PILOT'S MANUAL

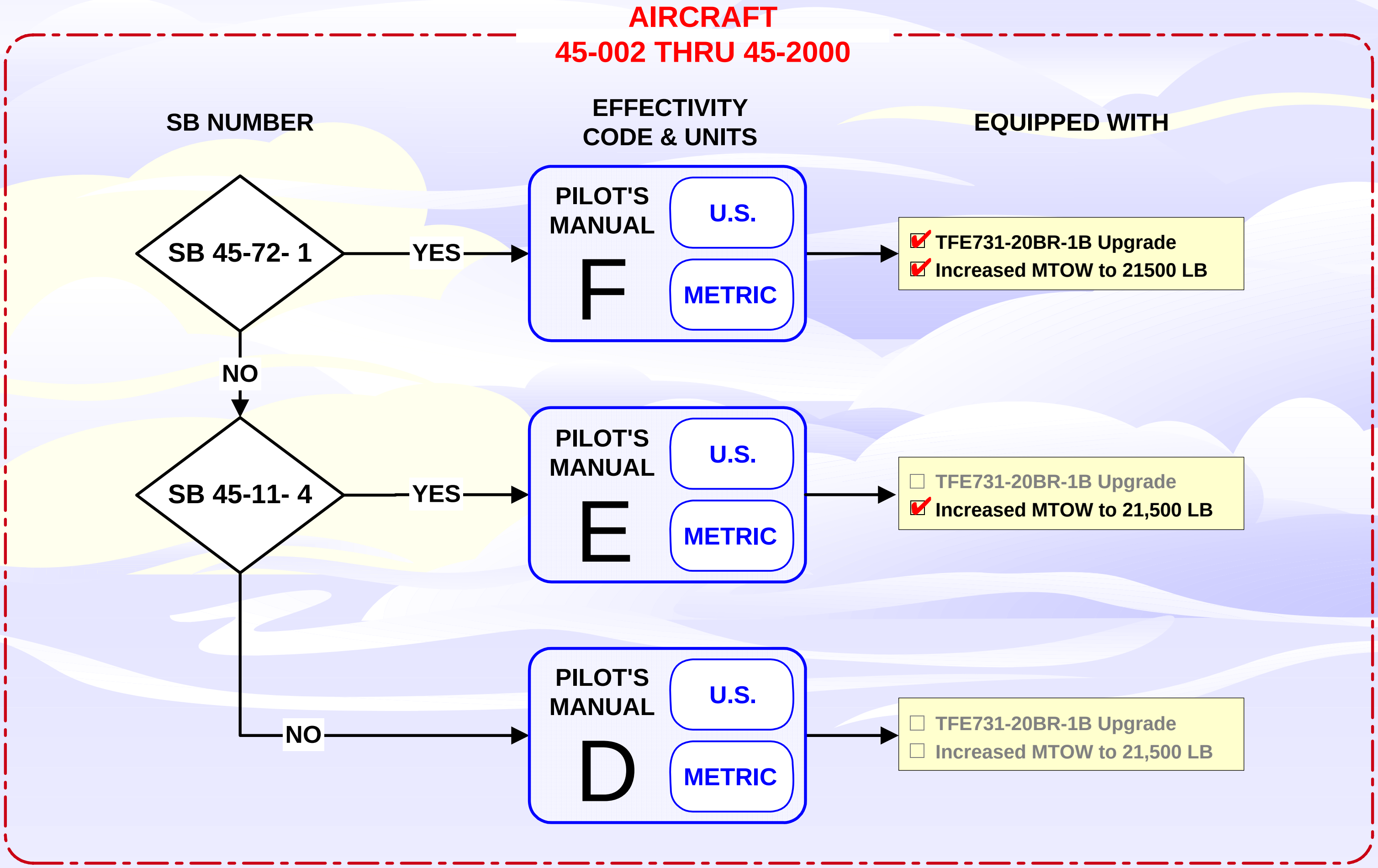
BOMBARDIER LEARJET 45

This Pilot's Manual provides information supplemental to the Learjet 45 FAA Approved Airplane Flight Manual. In the event any information herein conflicts with information in the FAA Approved Airplane Flight Manual, the FAA Approved Airplane Flight Manual shall take precedence.

BOMBARDIER

PM-126A **March 2005**

PILOT'S MANUAL



AIRCRAFT
45-002 THRU 45-2000

SB NUMBER

EFFECTIVITY CODE & UNITS

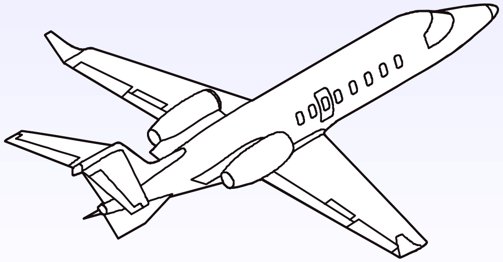
EQUIPPED WITH

SB 45-72- 1 — YES → PILOT'S MANUAL **F** (U.S. / METRIC) →
- ☑ TFE731-20BR-1B Upgrade
- ☑ Increased MTOW to 21500 LB

NO ↓

SB 45-11- 4 — YES → PILOT'S MANUAL **E** (U.S. / METRIC) →
- ☐ TFE731-20BR-1B Upgrade
- ☑ Increased MTOW to 21,500 LB

NO → PILOT'S MANUAL **D** (U.S. / METRIC) →
- ☐ TFE731-20BR-1B Upgrade
- ☐ Increased MTOW to 21,500 LB



Use the flowchart above to determine which performance code applies to a specific aircraft. *Click in the effectivity code box to open the desired manual*.

BOMBARDIER
LEARJET 45

Pilot's Manual

D E

U.S. UNITS

This electronic Pilot's Manual was compiled based upon data relevant to D & E coded aircraft using U.S. Units.

The content of this electronic collection in no way supersedes the current content outlined in the approved Airplane Flight Manual and any revisions thereto. In case of conflict, the hardcopy Airplane Flight Manual takes precedence. Revisions may be published without notice. Verification that copies are the latest version is the responsibility of the user.

(Return to Selection Screen)

Subject: Learjet 45 Pilot's Manual (U.S. Units) — Change 3

The following summary describes the changes that are incorporated with this change.

SECTION VIII — FLIGHT CHARACTERISTICS & OPERATIONAL PLANNING

STANDARD INSTRUMENT DEPARTURE (SID) CLIMB PERFORMANCE	This Section is new and provides SID climb requirements data for one and two engine operations and for takeoff flap settings of 8 and 20 degrees. Separate tables are provided for airport pressure altitudes from Sea Level through 14,000 feet.

PILOT'S MANUAL

BOMBARDIER LEARJET 45

This Pilot's Manual provides information supplemental to the Learjet 45 FAA Approved Airplane Flight Manual. In the event any information herein conflicts with information in the FAA Approved Airplane Flight Manual, the FAA Approved Airplane Flight Manual shall take precedence.

BOMBARDIER

PM-126A **March 2005**

LOG OF TEMPORARY PILOT'S MANUAL CHANGES

This list is intended to assist the flight crew in determining the applicable temporary pilot's manual changes for Learjet 45 aircraft. It is the responsibility of the aircraft owner and operator to maintain their basic pilot's manual with the temporary changes applicable to their aircraft. Insert this list after the title page.

TPM # Dated	Section or Page	Description	Status
2006-05 12-4-2006	5-56	Tuning the KHF 1050 with the RMU	Removed by Change 1

LIST OF EFFECTIVE PAGES

Use this List of Effective Pages to determine the current status of the Pilot's Manual. Pages affected by the current change are indicated by an asterisk (*) immediately preceding the page number.

Dates of issue for Original and Changed pages are:

Original	O	December 1997
Reissue	A	March 2005
Change	1	May 2008
Change	2	April 2010
Change	3	August 2010

Page	Change	Aircraft Affected
Title	A	All
* A thru E	3	All
i thru iv	A	All
General Description		
I-1 and I-2	A	All
1-1	A	All
1-2	1	All
1-3 thru 1-32	A	All
Engines & Fuel		
II-1	A	All
II-2	2	All
2-1 thru 2-26	A	All
2-27	1	All
2-28 thru 2-34	A	All
2-35 and 2-36	2	All
2-36A and 2-36B	2	All
2-37 thru 2-45	A	All
2-46	2	All
2-47 and 2-48	A	All
Hydraulics & Landing Gear		
III-1	A	All
3-1 thru 3-22	A	All
Electrical & Lighting		
IV-1 and IV-2	2	All
4-1 and 4-2	A	All
4-3	1	All
4-4 thru 4-18	A	All
4-19	2	All
4-20 thru 4-25	A	All
4-26 thru 4-29	2	All
4-30 thru 4-37	A	All

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected
Flight Control Systems & Avionics		
V-1	A	All
V-2	2	All
V-3 and V-4	1	All
5-1 thru 5-13	A	All
5-14	1	All
5-15 thru 5-19	A	All
5-20	2	All
5-21 thru 5-32	A	All
5-33	2	All
5-33A (Added)	2	All
5-34	2	All
5-35 and 5-36	A	All
5-37	2	All
5-38 thru 5-55	A	All
5-56	1	All
5-56A thru 5-56J	1	All
5-57 thru 5-74	A	All
5-75	2	All
5-76 thru 5-84	A	All
Anti-Ice & Environmental		
VI-1 and VI-2	2	All
6-1 thru 6-11	A	All
6-12	2	All
6-13 thru 6-18	A	All
6-19 and 6-20	2	All
6-20A thru 6-20D	2	All
6-21 thru 6-24	2	All
6-25 thru 6-33	A	All
Interior Equipment		
VII-1 and VII-2	A	All
VII-3	2	All
7-1 and 7-2	A	All
7-3	2	All
7-4 thru 7-8	A	All
7-9	2	All
7-10 thru 7-35	A	All
7-36 thru 7-38	2	All
7-38A	2	All
7-39	2	All
7-40 thru 7-45	A	All

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected/Effectivity Code
Flight Characteristics & Operational Planning		
VIII-1	A	All
* VIII-2	3	All
8-1 thru 8-11	A	All
8-12	1	♦ D and E
8-12.1	1	♦ F
8-13	1	♦ D and E
8-13.1	1	♦ F
8-14	1	♦ D and E
8-14.1	1	♦ F
8-15	1	♦ D and E
8-15.1	1	♦ F
8-16	1	♦ D and E
8-16.1	1	♦ F
8-17	1	♦ D and E
8-17.1	1	♦ F
8-18	1	♦ D and E
8-18.1	1	♦ F
8-19	1	♦ D and E
8-19.1	1	♦ F
8-20	1	♦ D and E
8-20.1	1	♦ F
8-21 and 8-22	A	♦ All
8-23	1	♦ D and E
8-23.1	1	♦ F
8-24	1	♦ D and E
8-24.1	1	♦ F
8-25	1	♦ D and E
8-25.1	1	♦ F
8-26	1	♦ D and E
8-26.1	1	♦ F
8-27	1	♦ D and E
8-27.1	1	♦ F
8-28	1	♦ D and E
8-28.1	1	♦ F
8-29	1	♦ D and E
8-29.1	1	♦ F
8-30	A	All
8-31	1	♦ D and E
8-31.1	1	♦ F
8-32	1	♦ D and E
8-32.1	1	♦ F
8-33	1	♦ D and E
8-33.1	1	♦ F
8-34	1	♦ D and E

♦ Denotes pages presented in either U.S. or metric units.

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected/Effectivity Code
8-34.1	1	♦ F
8-35	1	♦ D and E
8-35.1	1	♦ F
8-36	1	♦ D and E
8-36.1	1	♦ F
8-37	1	♦ D and E
8-37.1	1	♦ F
8-38	1	♦ D and E
8-38.1	1	♦ F
8-39	1	♦ D and E
8-39.1	1	♦ F
8-40	1	♦ D and E
8-40.1	1	♦ F
8-41	1	♦ D and E
8-41.1	1	♦ F
8-42	1	♦ D and E
8-42.1	1	♦ F
8-43	1	♦ D and E
8-43.1	1	♦ F
8-44	1	♦ D and E
8-44.1	1	♦ F
8-45	1	♦ D and E
8-45.1	1	♦ F
8-46	1	♦ D and E
8-46.1	1	♦ F
8-47	1	♦ D and E
8-47.1	1	♦ F
8-48	1	♦ D and E
8-48.1	1	♦ F
8-49	1	♦ D and E
8-49.1	1	♦ F
8-50	1	♦ D and E
8-50.1	1	♦ F
8-51	1	♦ D and E
8-51.1	1	♦ F
8-52	1	♦ D and E
8-52.1	1	♦ F
8-53	1	♦ D and E
8-53.1	1	♦ F
8-54	1	♦ D and E
8-54.1	1	♦ F
8-55	1	♦ D and E
8-55.1	1	♦ F
8-56	1	♦ D and E

♦ Denotes pages presented in either U.S. or metric units.

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected/Effectivity Code
8-56.1	1	♦ F
8-57	1	♦ D and E
8-57.1	1	♦ F
8-58	1	♦ D and E
8-58.1	1	♦ F
8-59	1	♦ D and E
8-59.1	1	♦ F
8-60	1	♦ D and E
8-60.1	1	♦ F
8-61	1	♦ D and E
8-61.1	1	♦ F
8-62	1	♦ D and E
8-62.1	1	♦ F
8-63	1	♦ D and E
8-63.1	1	♦ F
8-64	1	♦ D and E
8-64.1	1	♦ F
8-65	1	♦ D and E
8-65.1	1	♦ F
8-66	A	All
8-67	A	Aircraft 45-002 thru 45-169 *without* Altitude Compensated Oxygen System
8-67.1	A	Aircraft 45-170 & Subsequent and prior aircraft *with* Altitude Compensated Oxygen System
8-68 and 8-69	A	All
8-70 and 8-71	A	♦ All
8-72	A	All
8-73	A	♦ All
*8-74 (Blank) (Added)	3	♦ All
*8-75 (Added)	3	D and E
* 8-75.1 thru 8-79.1 (Added)	3	F
*8-80.1 and 8-81.1 (Added)	3	♦ F
*8-82.1 (Added)	3	F
*8-83.1 thru 8-146.1 (Added)	3	♦ F

♦ Denotes pages presented in either U.S. or metric units.

INTRODUCTION

The information in this manual is intended to augment the information in the Learjet 45 FAA Approved Airplane Flight Manual (AFM) and in no manner supersedes any Flight Manual limitations, procedures, or performance data. In the event that any information in this manual should conflict with that in the FAA Approved Airplane Flight Manual, the FAA Approved Airplane Flight Manual shall take precedence.

THE MANUAL

This manual describes Learjet 45 airplanes configured with the Performance enhancement package. Airplanes not configured with this package will have slightly different indications in some situations. The AFM describes these situations and should be referenced as required to verify configuration.

Sections I through VII of this manual are intended to provide the operator of the Learjet 45 with a basic description of the airplane operating systems from the cockpit controls and indicators to the actuating mechanisms in the systems. No attempt has been made to establish a specific standard airplane due to the numerous customer options. Therefore, the illustrations and descriptions within this manual are for a "typical" airplane and may not match a specific airplane. Specific serialization is shown only when more than one version of the same system is incorporated into production on a nonretrofit basis.

Section VIII of this manual contains tabular performance and fuel consumption data derived from the AFM and flight testing. This data may be used by the operator for flight planning.

This section has been designed so that pages not applicable to a particular airplane may be removed. Removing such pages allows the operator to construct a flight planning section applicable to a particular airplane.

Flight planning data of this section contains an effectivity block located at the top of the page. To remove pages not applicable to your airplane, examine the effectivity block to determine if the page is applicable to your airplane. If the page is not applicable, remove the page from the section and discard. If the page is applicable, retain the page.

The effectivity codes used in this section are identical to the effectivity codes used in the basic AFM. For an explanation of the effectivity codes, refer to FLIGHT MANUAL PERFORMANCE DATA in the AFM introduction.

REVISING THE MANUAL

Periodically, Numbered Changes may be issued against this manual. Pages included in Numbered Changes supersede like numbered pages in the Pilot's Manual. Each page of a Numbered Change contains a "Change" number located at the lower inside margin of the page. Portions of the text affected by the change are indicated by a vertical bar at the outer margin of the page. The vertical bars may not appear on pages that contain graphs or tables. Additionally, when a "changed" page occurs as the result of a rearrangement of material due to a change on a previous page, no vertical bar appears.

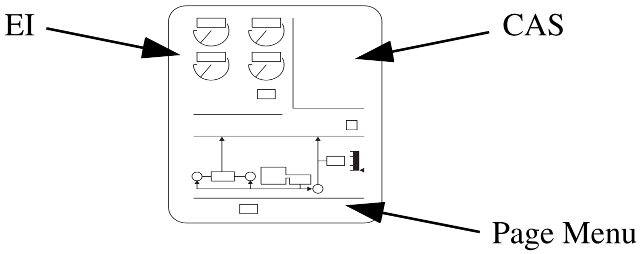
The List of Effective Pages provides the user with a guide to establish the current effective date of each page in the Pilot's Manual and may be used as an instruction sheet for incorporating the latest Numbered Change into the Pilot's Manual. Information included in the List of Effective Pages states the current "Change" number for each page and the dates of Original issue and Numbered Changes. An asterisk (*) next to a page number indicates the page was changed, added, or deleted by the current change.

MANUAL CONVENTIONS

ENGINE INDICATING AND CREW ALERTING SYSTEM (EICAS)

EICAS indications will be presented by all capital letters within their appropriate display fields. The following table lists samples of EICAS text and illustrates terms used in this manual:

Sample Text	Definition
EICAS — Select HYD or SUMRY page.	EICAS is an acronym for Engine Indicating and Crew Alerting System. HYD or SUMRY is illuminated on the system page menu (lower display of EICAS) for applicable page selection.
An APR green EI indicates that the APR has activated.	EI is an acronym for Engine Indicating and will represent illuminated indications within the engine instruments field in the upper left display of EICAS. APR is illuminated green.
The MAIN HYD QTY LO white CAS indicates that the main hydraulic quantity is low.	CAS is an acronym for Crew Alerting System and will represent illuminated indications within the CAS window in the upper right display of EICAS. MAIN HYD QTY LO is illuminated white.



EICAS Display

SWITCH INDICATIONS

Normal switch condition will be assumed not illuminated on the "quiet-dark-normal" instrument panel and pedestal. Illuminated switch indications will be noted in all capital letters. (e.g. PACK Switch — OFF).

Switch conditions that are not illuminated will be lead capped (e.g. PACK Switch — On), unless they are part of a longer description. The following table lists samples of text and definitions used in this Manual:

Sample Text	**Definition**
AUX HYD Switch — ON.	The switch labeled AUX HYD is illuminated ON.
L or R STBY Switch — Off.	The applicable switch labeled L STBY or R STBY is not illuminated and switch condition is off.

VOICE AND CREW WARNING PANEL (CWP) ANNUNCIATIONS

Voice annunciations will be presented by all capital letters and within quotes. CWP annunciations will be presented by all capital letters and are usually accompanied by a CAS. The following table lists samples of EICAS text and illustrates terms used in this Manual:

Sample Text	**Definition**
"GEAR" Voice.	A "GEAR" voice message will sound.
GEAR red CAS and CWP.	CWP is an acronym for Crew Warning Panel and will represent illuminated indications of the annunciator panel located in the center of the instrument panel. The GEAR warning light and CAS are illuminated red.

ADDRESSES

Your comments and suggestions concerning this manual are solicited and should be forwarded to:

Learjet, Inc.
P.O. Box 7707
Wichita, Kansas 67277-7707

Attn: Manager Technical Publications MS#53

SECTION I
GENERAL DESCRIPTION

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

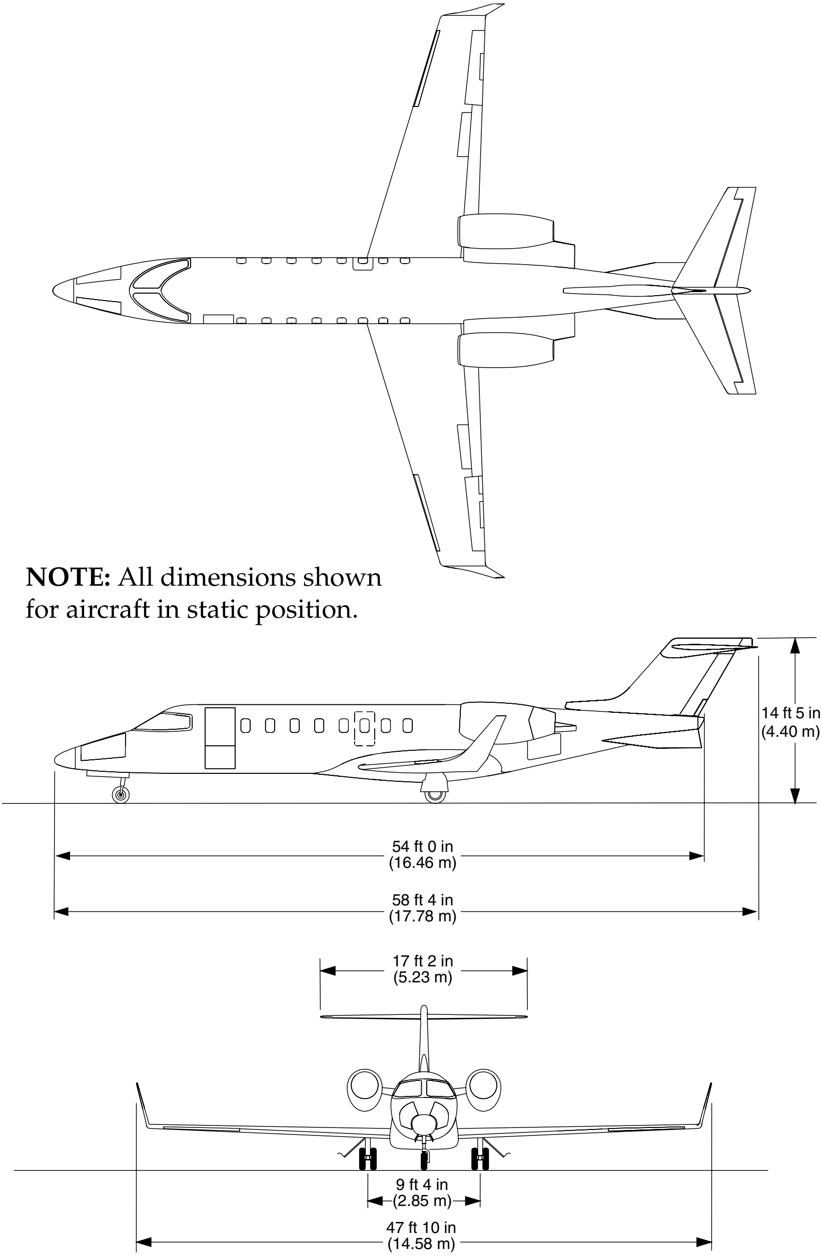
SECTION I
GENERAL DESCRIPTION

AIRCRAFT GENERAL DESCRIPTION

The Learjet 45 aircraft, manufactured by Learjet Inc., is an all metal, pressurized, low-wing, turbofan-powered monoplane. The high-aspect ratio, fully cantilevered, swept-back wings with winglets are of conventional riveted construction except for the upper section of the winglets, which utilize full-depth honeycomb core bonded to the outer skin. The fuselage is of semimonocoque construction and utilizes a constant circular cross sectional shape across the upper fuselage half and an elongated cross sectional shape in the lower fuselage. The constant upper circular section extends back to the aft pressure bulkhead where it is faired into the tailcone. Two inverted "V" ventral fins (delta fins) are fitted to the aft section of the tailcone to provide the aircraft with favorable stall recovery characteristics and additional lateral/ directional stability.

Thrust is provided by two pod-mounted TFE-731-20 turbofan engines manufactured by Honeywell. Independent fuel systems supply fuel to the engines with fuel storage provided in wing and fuselage tanks. Engine-driven hydraulic pumps provide hydraulic power for braking, extending or retracting the landing gear, wing flaps, spoilers, and thrust reversers. The landing gear system is a fully retractable tricycle-type trailing link landing gear with dual main gear wheels, nose-wheel steering, and a brake-by-wire brake control/anti-skid braking system.

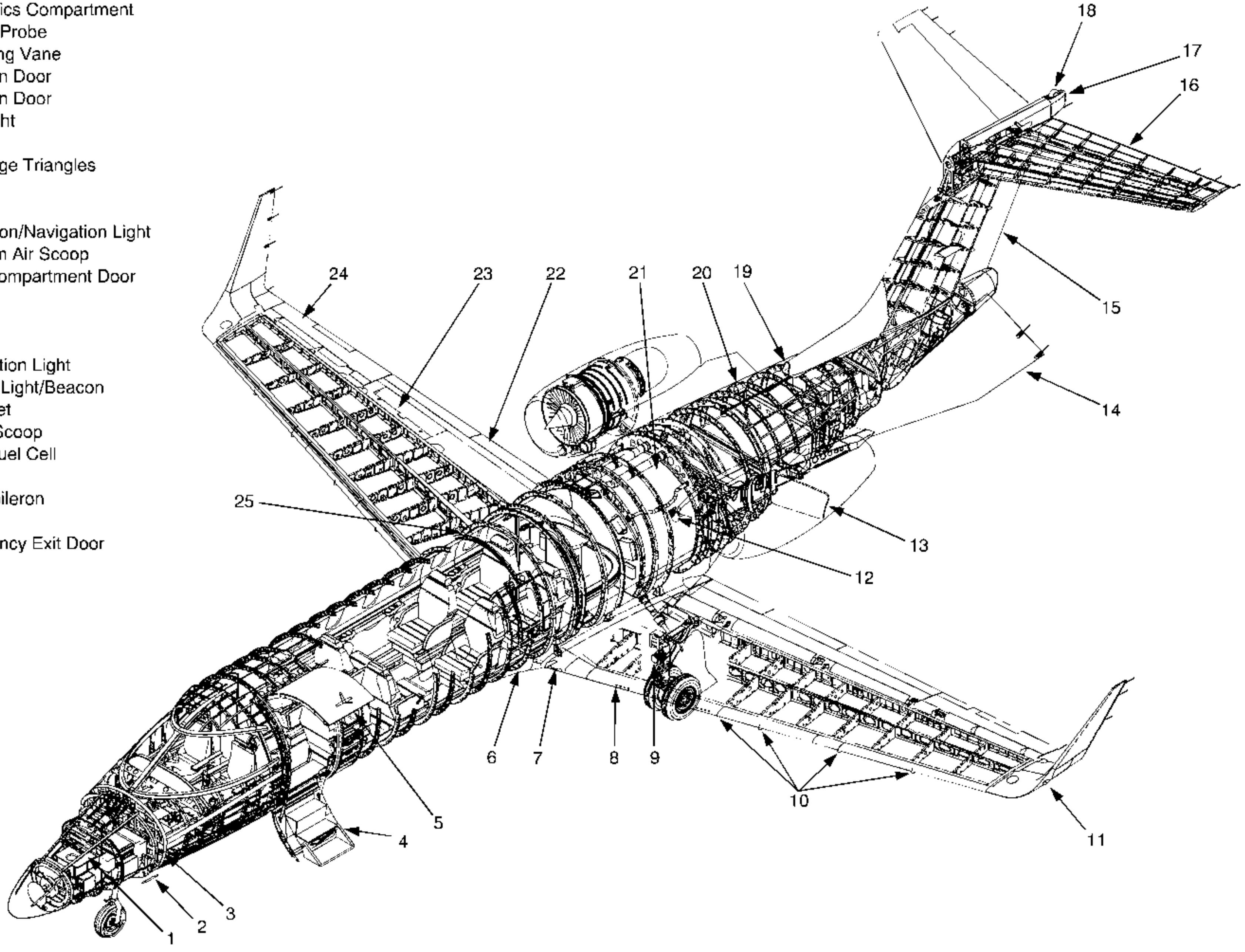
The ailerons, rudder, and elevator are manually controlled through cables, bellcranks, pulleys, and push-pull tubes. An electrically-actuated trim tab is installed on the left aileron and on the rudder to provide lateral and directional trim. Longitudinal trim is accomplished by changing the incidence of the horizontal stabilizer with an electrically-operated linear actuator. Aircraft air conditioning systems which include an air cycle machine, provide heating, cooling, and pressurization for the cockpit, passenger compartment and aft lavatory.



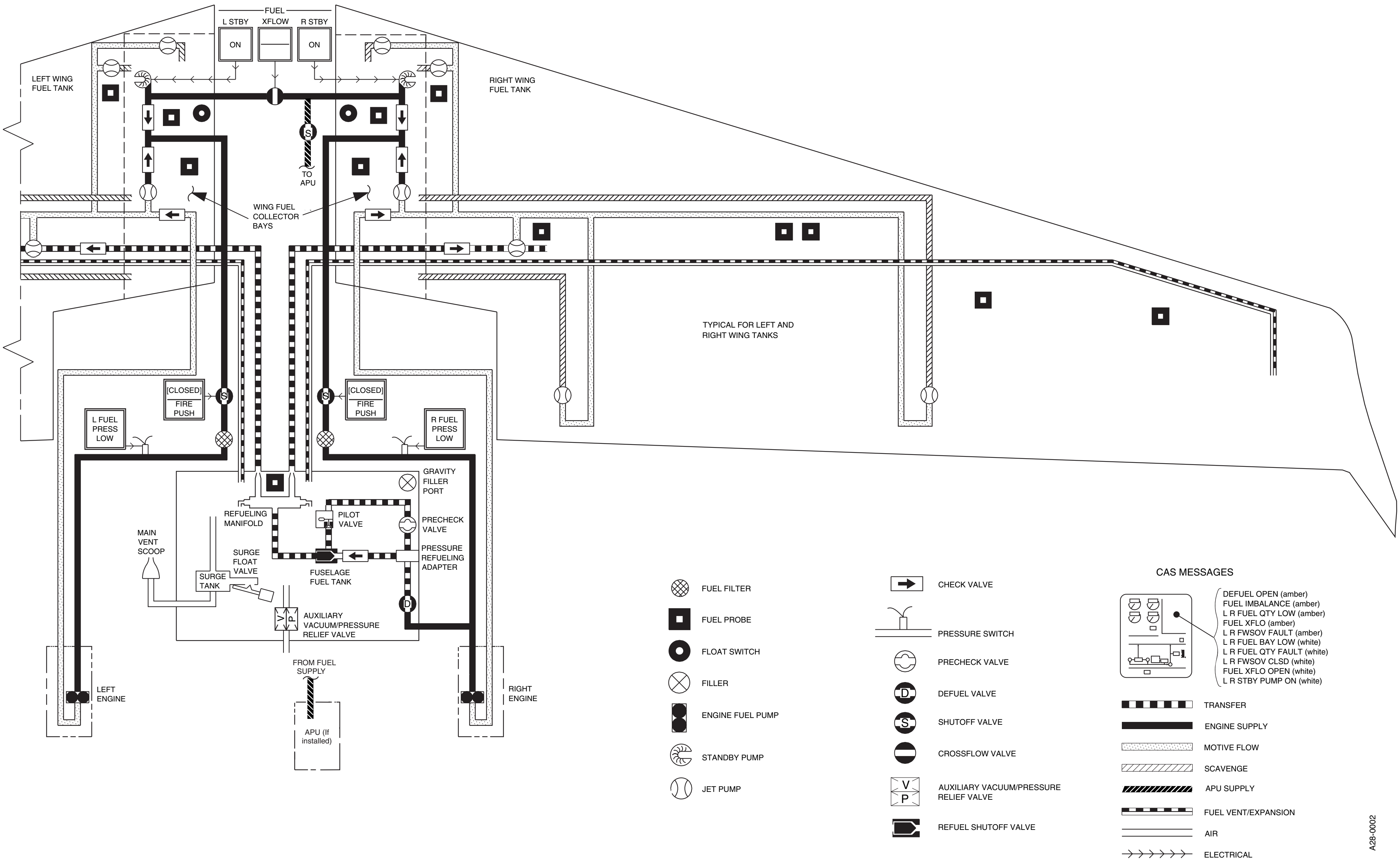
NOTE: All dimensions shown for aircraft in static position.

AIRPLANE THREE-VIEW
Figure 1-1

1. Nose Avionics Compartment
2. Pitot Static Probe
3. Stall Warning Vane
4. Lower Cabin Door
5. Upper Cabin Door
6. Landing Light
7. Stall Strip
8. Leading Edge Triangles
9. Taxi Light
10. Vortilons
11. Wing Position/Navigation Light
12. Fuel System Air Scoop
13. Baggage Compartment Door
14. Delta Fin
15. Rudder
16. Elevator
17. Tail Navigation Light
18. Tail Strobe Light/Beacon
19. Ram Air Inlet
20. Pack Inlet Scoop
21. Fuselage Fuel Cell
22. Flap
23. Spoiler/Spoileron
24. Aileron
25. Aft Emergency Exit Door



GENERAL ARRANGEMENT —EXTERIOR
Figure 1-2



FUEL SYSTEM SCHEMATIC
Figure 2-6

CABIN ENTRY DOOR

The cabin door is located in the forward left side of the fuselage. The cabin door is a clamshell style design which consists of an upper door section which opens upward to form a canopy while open, and a lower door section with integral steps which opens downward. A retractable flip step is installed on the lower cabin door which is rotated down to form the lowest entry step. The cabin door is 30 inches (76 centimeters) wide and provides normal entrance to and egress from the aircraft. The upper cabin door also doubles as the left forward emergency exit.

The upper cabin door features handles on both the inside and outside of the door. The outside upper door handle is recessed and protrudes slightly from the door skin. Before operating the outside handle the security keylock must be unlocked and the handle must be first lifted out from the door, then rotated clockwise into the open position. The inside upper door handle is readily accessible and can be rotated to lock or unlock the upper door mechanism. The upper door is equipped with a pair of gas struts which aid when raising the door. The gas struts will maintain the door in the open position after it is raised. A key lock is installed on the outside of the upper door to secure the aircraft from the outside. Rotating the key lock will prevent the outer upper door handle mechanism from moving into the open position. The security lock can be easily overridden from inside the aircraft.

A vent door and locking mechanism is incorporated into the upper cabin door. If the upper cabin door is not closed with the locking pins engaged, the vent door will remain open to prevent the airplane from pressurizing. The vent door is connected to the upper door handle mechanism through a series of bell cranks and link rods which will keep the vent door closed while the upper door handle is in the closed position. As the upper door handle is rotated out of the closed position the vent door will open and remain open while the handle is in transition. When the handle is in the fully open position the vent door will close. The vent door will remain closed while the upper cabin door is open to prevent ice and moisture contamination.

The lower cabin door is equipped with a single locking handle which is installed in the upper edge of the door as it is viewed in the closed position. The handle can be lifted out of the recess and rotated forward to latch the door, or aft to unlatch the lower cabin door. Gas struts are installed on the forward lower door structure to aid in closing and prevent damage if the door is inadvertently allowed to drop open.

CABIN ENTRY DOOR (CONT)

A cable and knob assembly is attached to the forward side of the lower door frame.The cable and knob assembly is used to raise and lower the lower door from inside the cabin. When closing the lower cabin door, a secondary latch will automatically engage and hold the lower door in position against the door seal until the lower door handle is rotated forward to the locked position. If the handle is not rotated to latch the door and the door is left in position by the secondary latch, the upper door will be prevented from closing due to a pin which extends outboard from the lower door just below the handle.

When the locking handle on the lower door is rotated forward, the latching mechanism drives four pins into the fuselage frame, securing the lower door. The inside and outside handles on the upper cabin door are secured to a common shaft within the door. When either upper door handle is rotated to the closed position, six latching pins are driven into the fuselage structure and two pins are driven from the upper door into overlapping halves in the lower door. There are a total of eight pins installed in the upper door. Two of the six upper door latching pins are driven through both the fuselage structure and through interlocking arms on the lower door, which secure the doors together.

When the cabin entry door pins are engaged (there are twelve pins total, eight in the upper door, four in the lower door), the door becomes a rigid structural member. Correct pin engagement may be checked using the small sight windows installed in the upper and lower inner door panels. Sight windows are provided to check pin engagement for ten of the latch pin locations, for two middle lock pins and for the lower lock (pawl).

ENTRY DOOR ANNUNCIATIONS

All of the twelve cabin door latching pins are installed so they contact a microswitch when the pin is fully engaged. If any of these pins do not make contact when the upper door handle is closed, a red ENTRY DOOR warning light is displayed on the Crew Warning Panel (CWP) and a red ENTRY DOOR message on the Engine Indicating and Crew Alerting System (EICAS) illuminates to provide the crew with visual indication of cabin door security.

ENTRY DOOR ANNUNCIATIONS (Cont)

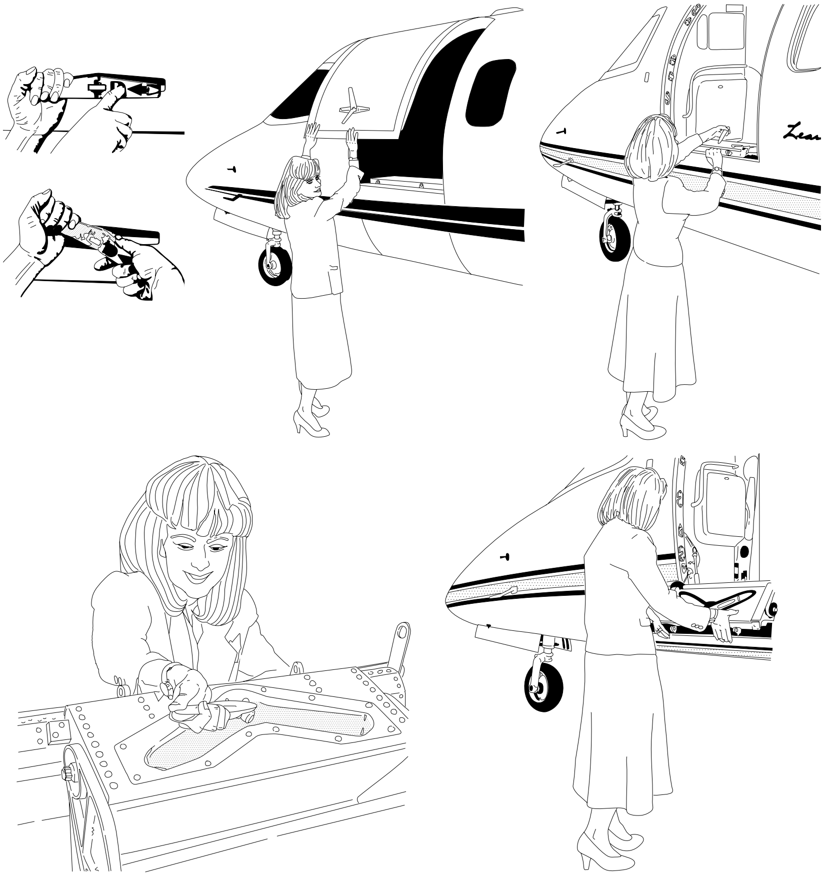
A white ENTRY DOOR PIN message will illuminate on the CAS whenever the aircraft is on the ground and the cabin door pins are not all fully engaged or all not fully disengaged. The ENTRY DOOR CWP message will be simultaneously displayed with the ENTRY DOOR PIN CAS message. If the keylock on the upper cabin entry (forward emergency exit) door is locked and electrical power is applied to the aircraft the red ENTRY DOOR light on the CWP will illuminate steady to prevent operations with the emergency exit locked. The red ENTRY DOOR and white ENTRY DOOR PIN CAS messages will also be displayed on the EICAS when the aircraft is in this configuration.

If the DOOR circuit breaker on the pilot's circuit breaker panel is out, the red ENTRY DOOR CWP annunciator and the red ENTRY DOOR and white ENTRY DOOR PIN CAS messages will all be displayed at the same time.

CABIN DOOR OPERATION

To open the cabin door from the outside:

1. Insert the key in the key lock and rotate to unlock.
2. Lift the upper door handle out and rotate the handle clockwise with both hands to the stop, releasing the door latch pins.
3. Raise the upper door by hand until the gas struts automatically raise the door up and hold it fully open.
4. While holding the lower door, reach inside and rotate the lower door locking handle aft (clockwise) to the OPEN position.
5. Lift the lower door secondary latch lever, located on the forward side of the door frame, to release the lower door.
6. Gently lower the door to the open position, the flip-down step will self deploy into the extended position.



OPENING CABIN DOOR (FROM OUTSIDE)
Figure 1-3

A52-1032

CABIN DOOR OPERATION (CONT)

To close cabin door from the inside:

WARNING The flip-down step could cause injury to the hand or fingers if it is allowed to suddenly swing down into the stowed position. The flip-down step must be grasped firmly as the door is raised, and lowered by hand before the step nears the vertical position.

1. Raise the lower door using the cable and knob until the lower door is within reach. Immediately grasp the flip-down step, before it falls inward and lower it by hand into the stowed position against the inside of the lower door.
2. Pull the lower door against the door seal until the secondary latch engages, the secondary latch will hold the door in place. Release the cable and knob and allow the cable to retract, stowing the knob on forward side of the door frame.
3. Rotate the lower door handle forward (counterclockwise) to the locked position.

CLOSING CABIN DOOR
(LOWER DOOR FROM INSIDE)
Figure 1-4

A52-1037

CABIN DOOR OPERATION (CONT)

4. Pull the upper door down until the upper door handle is within reach.
5. With the upper door handle in the OPEN position (with the handle pointing up), pull the door tightly against the door seal and rotate the locking handle forward (clockwise) to the locked position. (If preparing for flight, check that the ENTRY DOOR warning annunciator light on the CWP is extinguished and the ENTRY DOOR and ENTRY DOOR PIN messages on the CAS are extinguished.)
6. Inspect the cabin door sight windows, located on the inside of the upper and lower door panels, to ensure that all of the latches and locks are properly engaged. The sight windows should appear in the safe condition as shown in Figure 1-6 CABIN DOOR LATCH PIN SIGHT WINDOWS.

CLOSING CABIN DOOR
(UPPER DOOR FROM INSIDE)
Figure 1-5

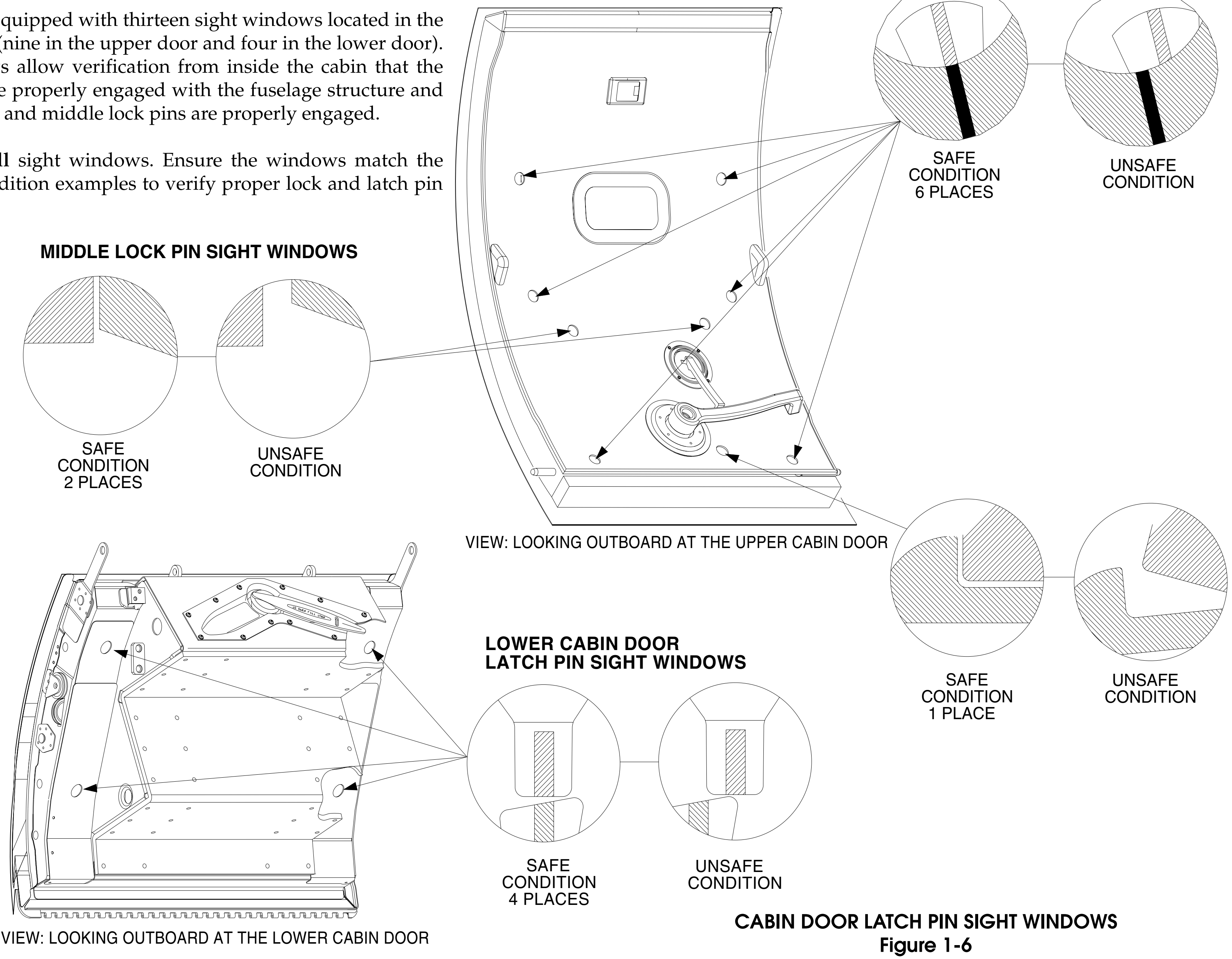
A52-1037

CABIN DOOR OPERATION (CONT)

Cabin Door Closed and Latched Verification:

The cabin door is equipped with thirteen sight windows located in the cabin door panels (nine in the upper door and four in the lower door). The sight windows allow verification from inside the cabin that the cabin door pins are properly engaged with the fuselage structure and that the lower lock and middle lock pins are properly engaged.

Visually inspect **all** sight windows. Ensure the windows match the following safe condition examples to verify proper lock and latch pin engagement.



CABIN DOOR LATCH PIN SIGHT WINDOWS
Figure 1-6

CABIN DOOR OPERATION (CONT)

To open cabin door from the inside:

1. Lift the upper door locking handle into the OPEN position.
2. Push the upper door outward and up allowing the door struts to raise the upper door to the fully open position.
3. Rotate the lower door locking handle aft (clockwise) to the OPEN position.
4. Grasp the cable knob, pull out any slack in the cable and while holding tension on the cable, release the secondary latch located on the forward side of the door frame.
5. Lower the lower door into the fully open position with the cable and knob, the flip-down step will pivot out into the deployed position as the door is lowered. Stow the knob on the forward side of the door frame.

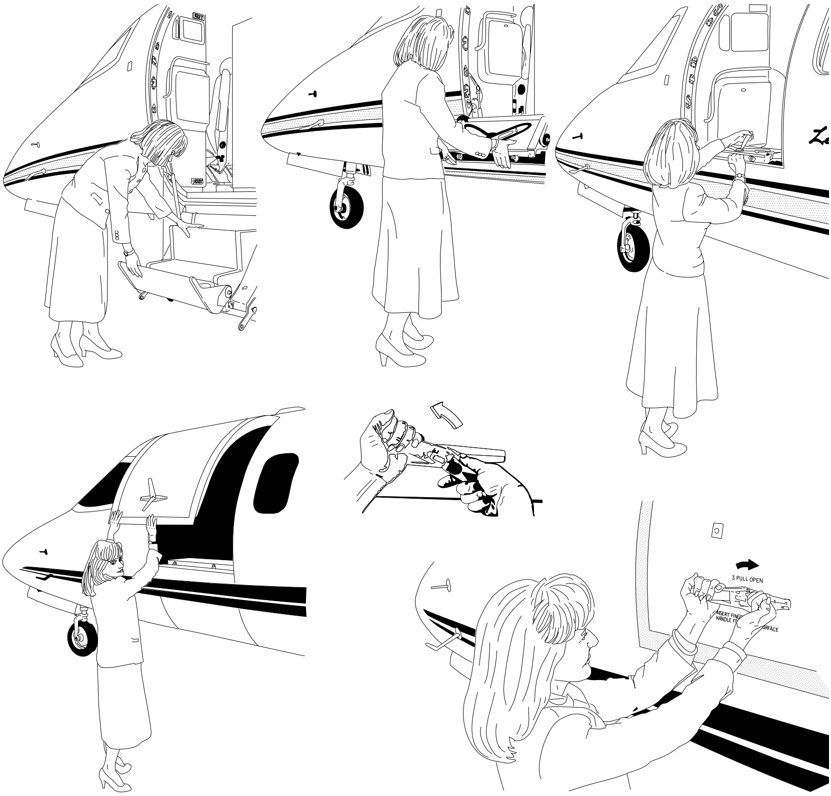
A52-1036

OPENING CABIN DOOR (FROM INSIDE)
Figure 1-7

CABIN DOOR OPERATION (CONT)

To close the cabin door from the outside:

1. Pivot the flip-down step upward until the step rests against the lower door.
2. Raise the lower door until it is against the door seal and secondary latch engages.
3. Reach inside and rotate the lower door handle forward (counterclockwise) to the locked position.
4. With the upper door handle in the OPEN position, pull the upper door down and hold it tightly against the door frame.
5. While holding the upper door closed, rotate the upper door handle counterclockwise to the stop with both hands.
6. Release the upper door handle and ensure the handle retracts into position against the door skin.



CLOSING CABIN DOOR (FROM THE OUTSIDE)
Figure 1-8

A52-1038

EMERGENCY EXITS

LEFT FORWARD EMERGENCY EXIT

The upper portion of the cabin entry door serves as the left forward emergency exit. The upper cabin entry door/left forward emergency exit is secured to the fuselage by six latching pins which extend from the left forward emergency exit into the fuselage structure and by two latching pins which are driven from the left forward emergency exit into an overlapping section in the lower cabin entry door. The pins are extended and retracted by the upper cabin door handles (on the inside and outside of the cabin door) which operate a common shaft.

Because the upper door is equipped with a keylock, it must be unlocked before flight to ensure optimum operation as an emergency exit. However, in the event that the keylock is locked, an override bar is installed on the inside of the door, above the door handle. When depressed outboard, the override bar will disable the locking function and allow the inboard handle to unlatch the left forward emergency exit. To open the left forward emergency exit from inside, the upper cabin door handle is rotated up (counterclockwise) into the OPEN position and the upper door is pushed open. The lower cabin door is kept closed. Keeping the lower door closed will also provide a greater safety factor in the event of ditching.

LEFT FORWARD EMERGENCY EXIT OPERATION

To open from the inside:

1. Lift the upper cabin door handle (rotate counterclockwise) into the OPEN position.
2. Push the upper door outward and up allowing the door struts to raise the upper door to the fully open position.
3. Leave the lower cabin door in place and exit through the open upper cabin door.

LEFT FORWARD EMERGENCY EXIT OPERATION
Figure 1-9

To open from the outside:

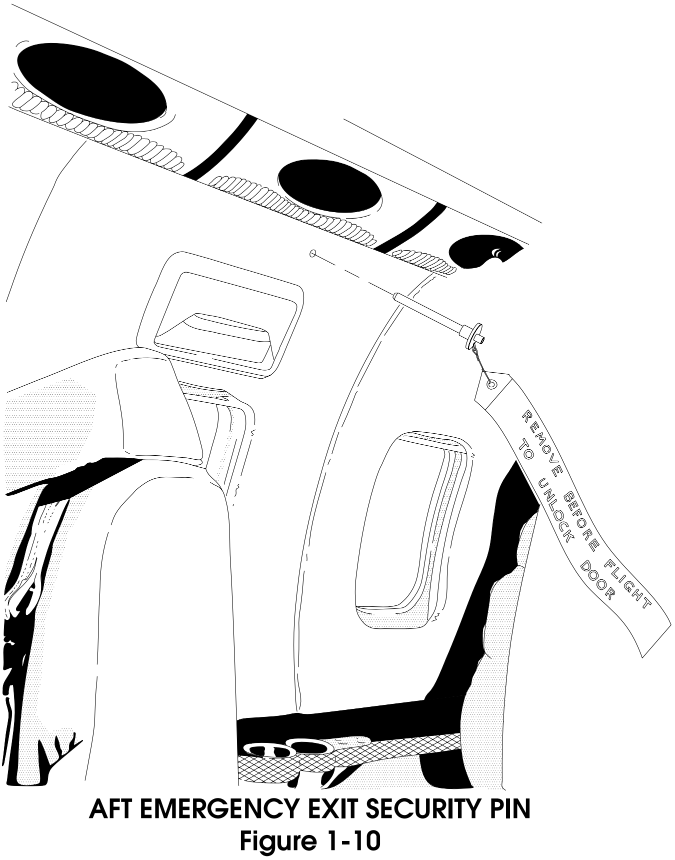
1. Lift the upper cabin door handle out and rotate the handle clockwise with both hands to the stop, releasing the upper door locking pins.
2. Raise the upper door by hand until the gas struts automatically raise the door up and hold it fully open.
3. Leave the lower cabin door in place and gain access through the open upper cabin door.

A52-1036

RIGHT AFT EMERGENCY EXIT HATCH

The emergency exit hatch is located on the right aft side of the cabin near the leading edge of the wing, adjacent to the right aft passenger seat. It provides egress from the cabin in the event of an emergency. The hatch is secured to the airframe by two spring-loaded pins which extend from the top of the hatch into the fuselage structure. The hatch is designed as a plug type hatch which **opens inward only**, and is held in the closed position by pressurization forces and the spring loaded pins. The emergency exit hatch is 20 inches (51 centimeters) wide by 36 inches (91 centimeters) high and functions as a Type III escape hatch.

A security pin can be installed on the inside of the emergency exit hatch to prevent unauthorized entry from the outside. The security pin is inserted from the inside to lock one of the spring loaded hatch pins in place. The security pin has a small flag attached which states REMOVE BEFORE FLIGHT.



AFT EMERGENCY EXIT SECURITY PIN
Figure 1-10

A52-1033

RIGHT AFT EMERGENCY EXIT HATCH OPERATION

To open/remove the right aft emergency exit from the inside:

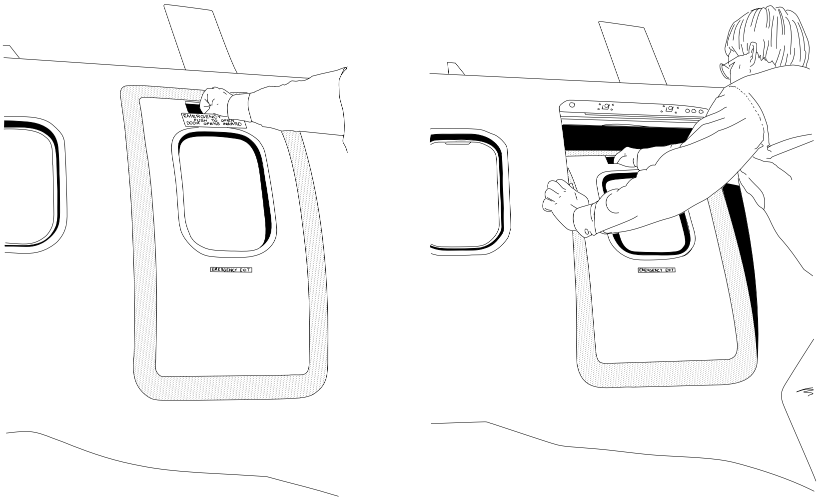
1. Remove the handle cover from the emergency exit hatch to fully expose the emergency exit handle. The cover is attached with hook and loop fasteners and can be easily pulled from the hatch.
2. Grasp the emergency exit handle placarded EXIT-PULL and pull it fully toward you and up, retracting the hatch pins.
3. While holding the emergency exit handle in the retracted position, tilt the top edge of the hatch inward.
4. Grasp the hatch in the armrest recess with the opposite hand and lift the hatch inward and up from the fuselage structure.
5. Lean the top of the hatch inward and rotate the hatch onto its edge.
6. Pass the hatch through the emergency exit opening to the outside of the aircraft.

EMERGENCY EXIT HATCH OPERATION (FROM INSIDE)
Figure 1-11

EMERGENCY EXIT HATCH OPERATION (CONT)

To open/remove the emergency exit hatch from the outside:

1. Locate the emergency exit hatch latch. The latch is located above the window in the emergency exit door, immediately above the placard that reads "EMERGENCY DOOR PUSH TO OPEN DOOR OPENS INWARD".
2. Push fully inward on the latch. This will retract the pins into the top of the hatch.
3. While holding the latch open, push the upper edge of the hatch inward.
4. Lift the hatch upward from the fuselage structure, inward into the cabin.
5. Rotate the hatch onto its edge and remove it by pulling it back through the emergency exit opening.



EMERGENCY EXIT HATCH OPERATION (FROM OUTSIDE)
Figure 1-12

A52-1039

Installing the right aft emergency exit hatch from the inside:

NOTE The emergency exit hatch is designed to be installed from inside the cabin only. Ensure the seat next to the emergency exit hatch is positioned in the fully inboard position before installing the hatch.

1. Position the emergency exit hatch next to the emergency exit opening on the inside of the cabin.
2. Tilt the upper end of the emergency exit hatch down and inward (several inches).
3. Position the lower edge of the hatch so that the fittings on the lower edge of the hatch align with and engage the fittings on the lower side of the emergency exit opening.
4. Set the hatch in place on the lower fittings and grasp the emergency exit handle and pull it fully inward and down. This will retract the latch pins into the top of the hatch.
5. While keeping the latch pins retracted push the upper edge of the emergency exit hatch into the cabin structure (hatch frame). Ensure the emergency exit hatch seal fits into the hatch frame evenly and does not become caught or bound.
6. Release the emergency exit handle and ensure the latch pins extend into the cabin structure. The handle is spring loaded and should fully retract when released.
7. Attach the handle cover to the inner panel with the hook and loop fasteners.

RIGHT AFT EMERGENCY EXIT ANNUNCIATIONS

A hatch warning system microswitch is installed on one of the latch pins above the right aft emergency exit hatch frame. If this microswitch senses that the latch pin is not in the fully extended position, the switch will cause an amber caution EMERGENCY EXIT message to be displayed on the EICAS.

EXTERNAL DOORS

BAGGAGE COMPARTMENT DOOR

The baggage compartment door provides access to the baggage compartment and is located on the left side of the fuselage below the left engine nacelle. The door is 33 inches (84 centimeters) wide and is hinged on the forward side. The baggage door has two latches and an optional security lock installed on the aft side. The door is equipped with a strut and opens to the forward side for unobstructed loading.

TAILCONE ACCESS DOOR

The tailcone access door is located on the lower side of the fuselage aft of the right engine and provides access to the aft equipment bay. The aft equipment bay contains many of the electrical, environmental, hydraulic and engine fire extinguishing system components. The door is hinged at the lower edge and is secured at the upper side with two latches. It opens downward for access to the listed components.

EXTERNAL DOORS ANNUNCIATIONS

Illumination of the EXTERNAL DOORS amber CAS message indicates that either the baggage compartment door or the tailcone access door switches have not signaled that the door is closed. There are two switches on each door. The switches are designed to indicate a door open condition if it exists, prior to takeoff. If the doors were properly latched prior to takeoff and the light illuminates in flight, the most probable cause is a switch failure.

EXTERNAL SERVICE DOORS

OXYGEN SERVICE DOOR

The nose oxygen servicing door is located on the lower right side of the nose, below the right side nose avionics access panel. The nose access door is hinged at the lower edge and is secured at the upper edge with two latches.

On aircraft modified by SB 45-12-1 (Installation of Remote Oxygen Servicing Provisions), an optional remote mounted oxygen filler port and electrically-driven oxygen temperature/pressure gauge are installed behind this service door.

If applicable, an oxygen servicing door located on the right wing root may also be installed. An oxygen filler port and electrically-driven oxygen temperature/pressure gauge are installed behind this service door. The door is hinged on the forward edge and latched at the trailing edge with two latches.

EXTERNAL SERVICE DOORS (CONT)

FUSELAGE FUEL GRAVITY FILL ACCESS DOOR

The fuselage fuel gravity fill access door is located on the right side of the fuselage. This door is hinged at the top, has a spring-loaded latch at the bottom edge, and opens upward. The fuselage fuel gravity filler port is installed behind the door. The fuselage fuel gravity filler cap is tethered to the airplane with a lanyard to prevent dropping or misplacing it.

SINGLE-POINT PRESSURE REFUELING ACCESS DOOR

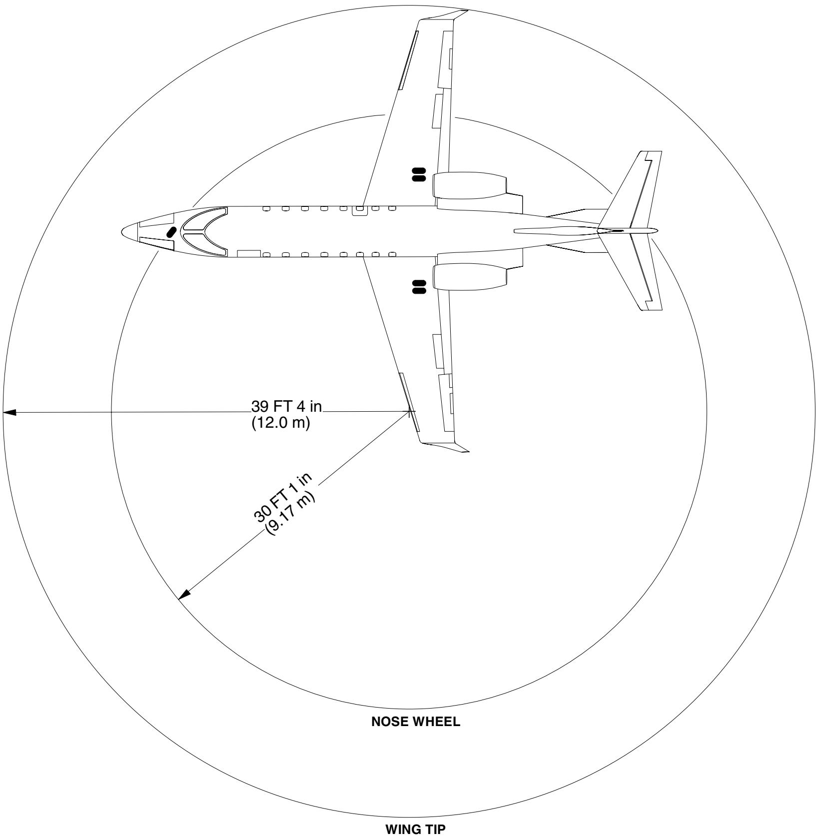
The Single-Point Pressure Refueling (SPPR) access door is located on the fuselage below the right engine pylon. The SPPR adapter and precheck valve lever are installed behind this door. The door is hinged at the bottom and is secured with two spring-loaded latches near the top of the door.

SINGLE-POINT PRESSURE REFUELING CONTROL PANEL ACCESS DOOR

The Single-Point Pressure Refueling (SPPR) control panel access door is located aft of the SPPR access door on the right side of the fuselage. The refueling control panel access door is hinged at the lower edge and opens down from the top.

OIL SERVICING DOORS

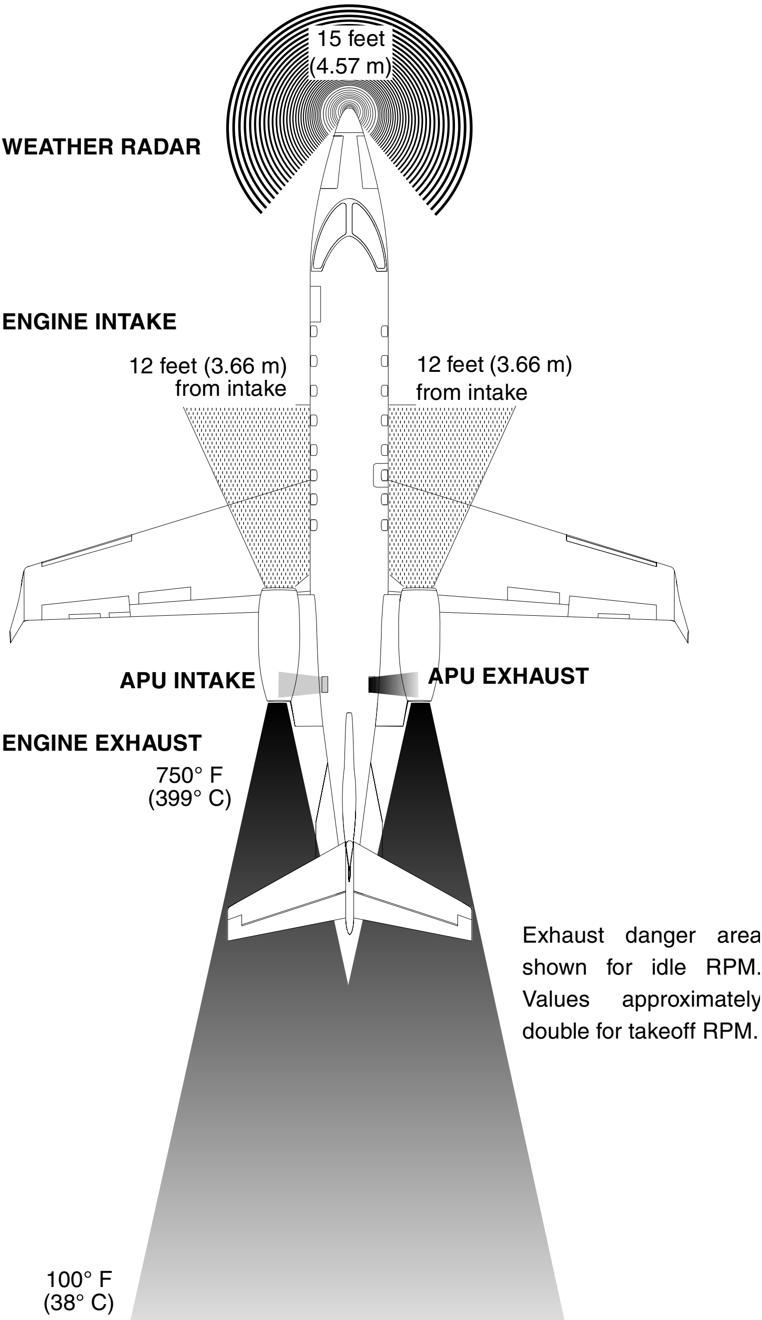
The oil servicing doors are located on the forward outboard side of each engine nacelle. The oil quantity sight gauge (on the right nacelle) and dipstick (on the left nacelle) are accessed through the oil servicing doors. The doors are hinged at the bottom and are secured by two spring-loaded latches at the top of each door.



NOTE: Turning radius expressed above is based upon 60° nose-wheel deflection.

TURNING RADIUS
Figure 1-13

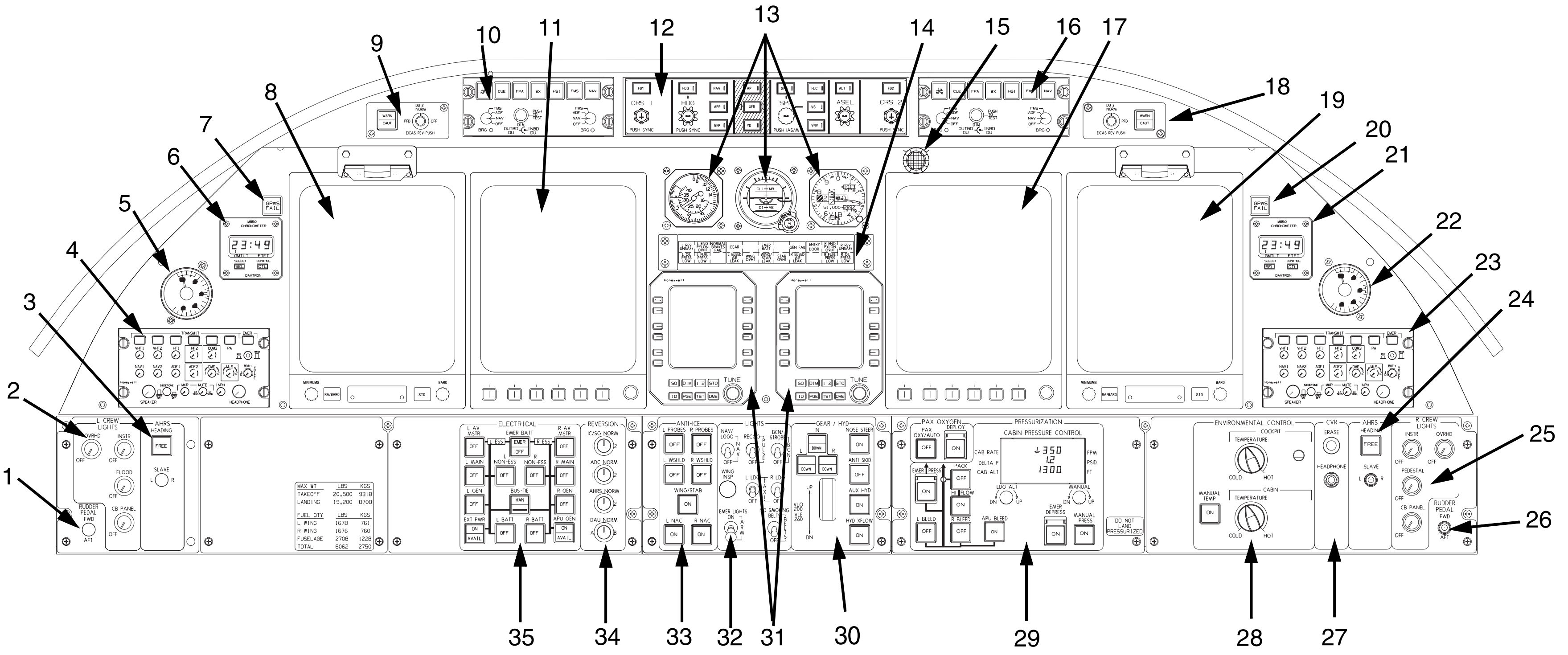
A09-2001



Exhaust danger area shown for idle RPM. Values approximately double for takeoff RPM.

DANGER AREAS
Figure 1-14

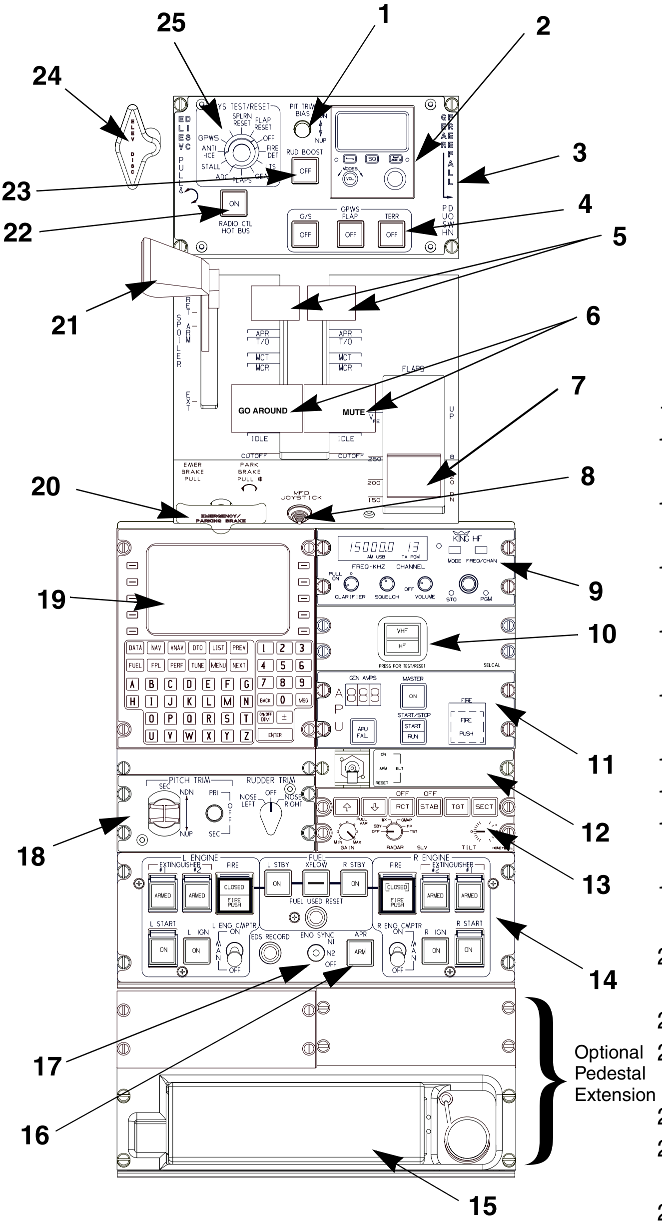
A06-7001



1. Pilot's Rudder Pedal Adjustment
2. Pilot's Crew Lighting Panel
3. #1 AHRS Mode Control
4. Pilot's Audio Control Panel
5. Pilot's Angle of Attack Indicator (opt)
6. Pilot's Digital Chronometer
7. Pilot's GPWS Fail Annunciator
8. Pilot's Primary Flight Display (DU-1)
9. DU-2 Reversion Panel / Master Warning Flashers
10. Pilot's Display Controller
11. EICAS Display (DU-2)
12. Flight Guidance Controller
13. Standby Instruments
14. Crew Warning Panel
15. Cockpit Voice Recorder Microphone
16. Copilot's Display Controller
17. Multi-Function Display (DU-3)
18. DU-3 Reversion Panel / Master Warning Flashers
19. Copilot's Primary Flight Display (DU-4)
20. Copilot's GPWS Fail Annunciator
21. Copilot's Digital Chronometer
22. Copilot's Angle of Attack Indicator (opt)
23. Copilot's Audio Control Panel
24. #2 AHRS Mode Control
25. Copilot's Crew Lighting Panel
26. Copilot's Rudder Pedal Adjustment
27. Cockpit Voice Recorder Panel
28. Environmental Control Panel
29. Cabin Pressurization / Oxygen Control Panel
30. Landing Gear / Hydraulic Control Panel
31. Radio Management Units
32. Aircraft Light Control Panel
33. Anti-Ice Panel
34. Reversion Control Panel
35. Electrical Control Panel

INSTRUMENT PANEL (TYPICAL)
Figure 1-15

A31-1001

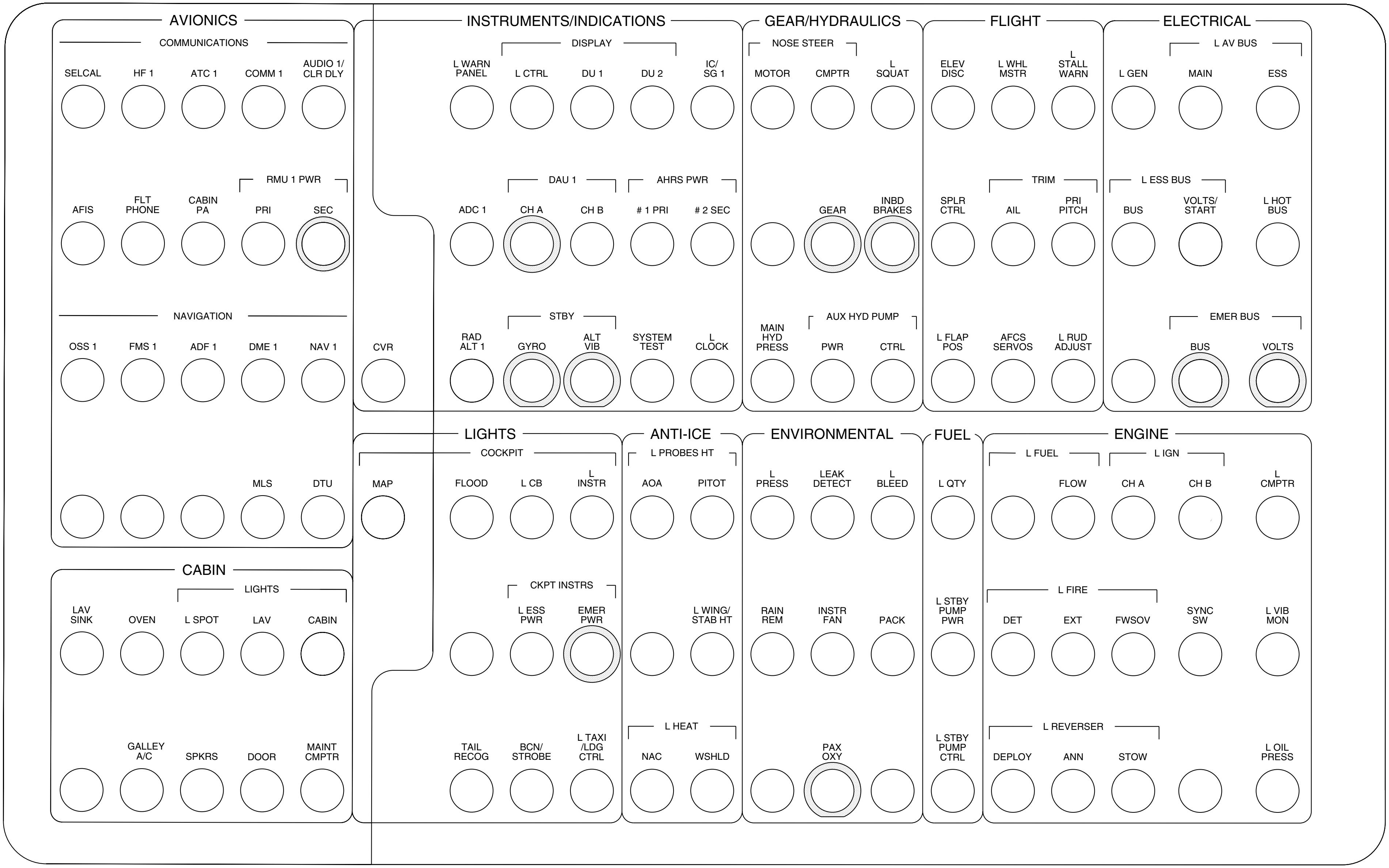


1. Pitch Trim Bias
   Switch
2. Clearance Delivery
   Radio (CDR)
3. Gear Freefall Lever
4. Ground Proximity
   Warning System
   Switches (opt)
5. Thrust Reverser
   Levers
6. Thrust Levers
7. Flap Lever
8. MFD Joystick
9. HF Control Panel
10. SELCAL Panel (opt)
11. APU Control
    Panel (opt)
12. ELT Switch
    Panel (opt)
13. Weather Radar
    Control Panel
14. Engine/Fuel
    Control Panel
15. Flight Phone
    Handset (opt)
16. APR Arm Switch
17. Engine Sync Switch
18. Pitch Trim and Rudder
    Trim Control Panel
19. FMS Control Display
    Unit
20. Emergency/Parking
    Brake Handle
21. Spoiler Lever
22. Radio Control Hot
    Bus Switch
23. Rudder Boost Switch
24. Elevator Disconnect
    Handle
25. System Test Panel

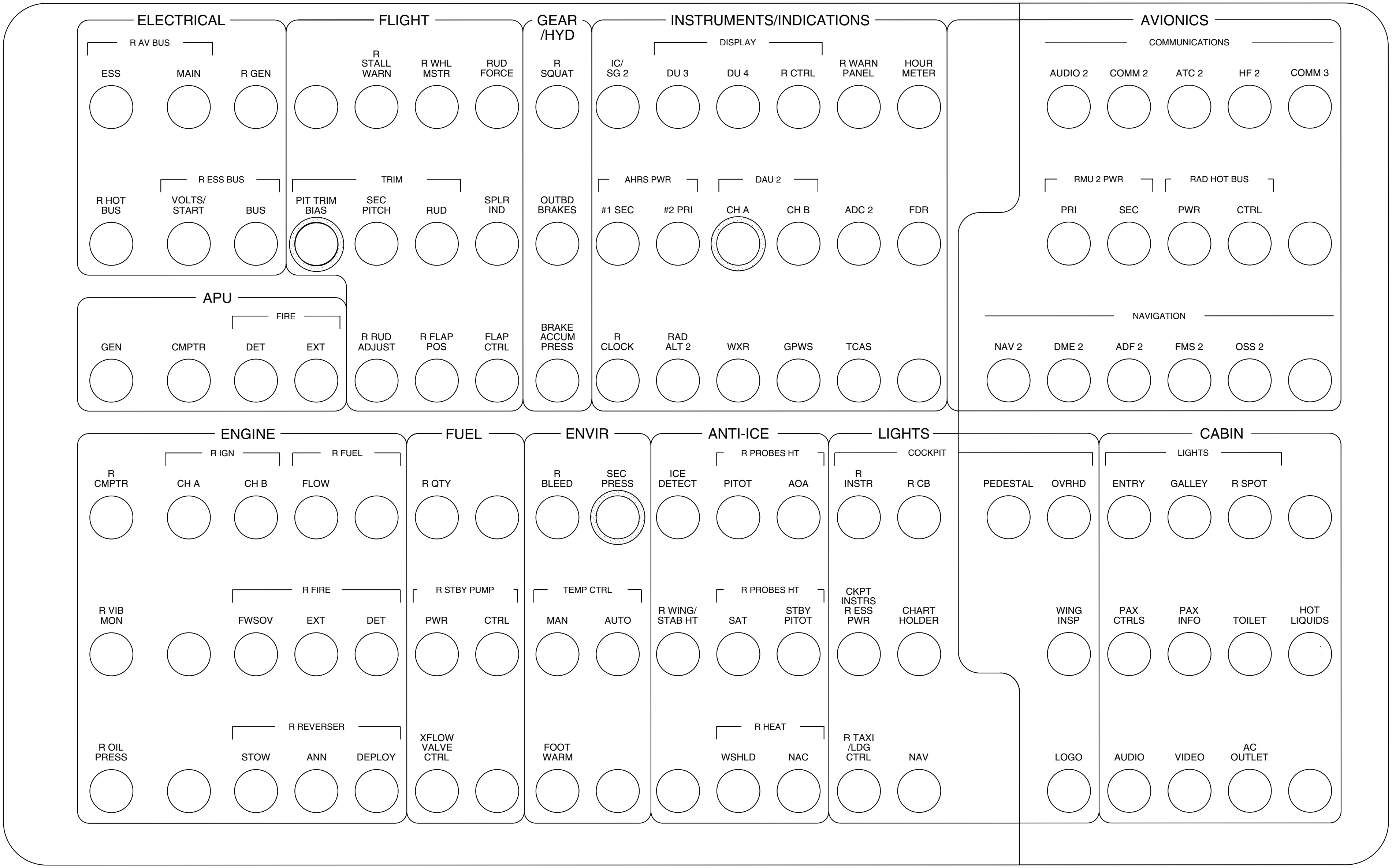
A31-1001a

PEDESTAL (TYPICAL)
Figure 1-16

INTENTIONALLY LEFT BLANK



PILOT'S CIRCUIT BREAKER PANEL (TYPICAL)
Figure 1-17



A25-1025

COPILOT'S CIRCUIT BREAKER PANEL (TYPICAL)
Figure 1-18

SECTION II
ENGINES & FUEL

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

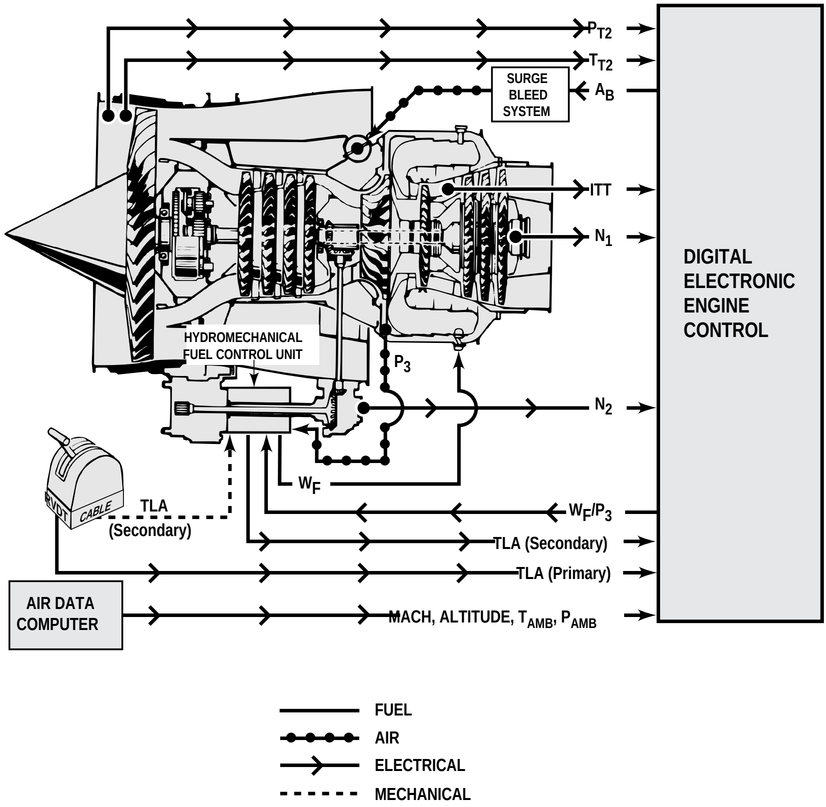
SECTION II
ENGINES & FUEL

ENGINES

The aircraft is powered by two TFE731-20 turbofan engines manufactured by Honeywell. These engines are two-spool, geared transonic-stage, front-fan, jet-propulsion engines. Each engine is rated at 3500 pounds (15.56 kN) thrust at sea level.

A spinner and an axial-flow fan are located at the forward end of the engine and are gear driven by the low-pressure (N1) rotor. The fan gearbox output-to-input speed ratio is 0.556. The low-pressure rotor consists of a four-stage low-pressure axial compressor and a three-stage low-pressure axial turbine, mounted on a common shaft. The high-pressure (N2) rotor consists of a single-stage centrifugal compressor and a single-stage air-cooled axial turbine, mounted on a common shaft. The high-pressure rotor drives the accessory gearbox through a transfer gearbox. The rotor shafts are concentric, so that the low-pressure rotor shaft passes through the high-pressure rotor shaft.

An annular duct serves to bypass fan air for direct thrust and also diverts a portion of the fan air to the low-pressure compressor. Air from the low-pressure compressor flows through the high-pressure compressor and is discharged into the annular combustor. Combustion products flow through the high- and low-pressure turbines and are discharged axially through the exhaust duct to provide additional thrust.



A_B — AREA BLEED
N_1 — LOW PRESSURE ROTOR (FAN) SPEED
N_2 — HIGH PRESSURE ROTOR (TURBINE) SPEED
P_3 — COMPRESSOR DISCHARGE PRESSURE
P_{T2} — ENGINE INLET TOTAL PRESSURE
T_{T2} — ENGINE INLET TOTAL TEMPERATURE
ITT — INTERSTAGE TURBINE TEMPERATURE
W_F — FUEL FLOW
T_{AMB} — AMBIENT TEMPERATURE
P_{AMB} — AMBIENT PRESSURE
TLA — THRUST LEVER ANGLE

FUEL CONTROL LOGIC DIAGRAM
Figure 2-1

ENGINE FUEL AND CONTROL SYSTEM

The engine fuel and control system pressurizes fuel routed to the engine from the aircraft fuel system, meters fuel flow, filters the fuel, heats it as necessary to prevent filter icing, and delivers atomized fuel to the combustion section of the engine. The system also supplies high-pressure motive-flow fuel to the aircraft fuel system for jet pump operation. The major components of the system are the thrust levers, the engine-driven fuel pump, the hydromechanical fuel control unit, the Digital Electronic Engine Control (DEEC), surge bleed control valve and the fuel heater/oil cooler.

THRUST LEVERS

Two thrust levers, located on the upper portion of the pedestal, are operated in a conventional manner with the full forward position being maximum power. Stops at the IDLE position prevent inadvertent reduction of the thrust levers to CUTOFF. The IDLE stops can be released by lifting a finger lift on the outboard side of each thrust lever. Detents are provided for CUTOFF, IDLE, Maximum Cruise (MCR), Maximum Continuous Thrust (MCT), Takeoff (T/O) and Automatic Performance Reserve (APR).

Primary Thrust Lever Angle (TLA) input to each DEEC is provided through Rotary Variable Differential Transformers (RVDTs) located within the thrust lever quadrant. Secondary TLA input is provided by a control cable connecting each thrust lever to the corresponding engine's hydromechanical fuel control unit.

A flight director go-around button is installed in the left thrust lever handle. An aural warning horn/voice mute button is installed in the right thrust lever handle. A thrust reverser control lever is mounted piggyback fashion on each thrust lever. Refer to THRUST REVERSERS in this Section for a functional description of the thrust reverser levers.

The Engine Indicating (EI) display will illuminate a green MCR, MCT, T/O or APR for the corresponding thrust lever detents.

ENGINE-DRIVEN FUEL PUMP

The engine-driven fuel pump provides high-pressure fuel to the engine fuel control system as well as motive-flow fuel for operation of the aircraft jet pumps. The pump consists of a low-pressure pump element, high-pressure pump element, high-pressure relief valve, filter, filter bypass valve, and motive-flow provisions.

The fuel pump is mounted to the accessory drive gearbox of the engine. Fuel entering the first stage low-pressure element is pressurized to flow through the fuel heater/oil cooler and filter. A second flow path for this fuel is to the Auxiliary Motive Flow Pump (AMFP). The fuel from the AMFP is used to operate the various jet pumps in the wing tanks. Fuel that is supplied to the fuel heater/oil cooler and filter is passed on to the pump high-pressure element. The high-pressure element provides fuel at the fuel pressures required by the hydromechanical fuel control unit. The high-pressure relief valve protects the fuel pump and hydromechanical fuel control unit from extreme fuel pressure surges. A fuel filter bypass valve begins to open at a pressure differential of 9 to 12 psi (62 to 82 kPa) and allows flow of unfiltered fuel to the inlet of the high-pressure pump.

The following CAS illuminations are specific to the fuel pumps:

CAS	Color	Description
FUEL PRESS LOW	Red	Fuel pressure is low at the associated (L or R) engine's fuel pump inlet.
FUEL FILTER	White	The engine or wing fuel filter, on the associated (L or R) side, is becoming clogged.

HYDROMECHANICAL FUEL CONTROL UNIT

The hydromechanical fuel control unit meters the required amount of fuel to the engine combustor that corresponds to TLA, atmospheric and engine operating conditions. The unit is mounted on the fuel pump and contains the hydromechanical fuel metering section, thrust lever input and position potentiometer, shutoff valve, and a mechanical governor. The mechanical governor functions as an overspeed governor for the high-pressure rotor. In addition, the mechanical governor provides manual control when the DEEC is deactivated. When activated, the DEEC controls fuel scheduling by means of a torque motor located within the hydromechanical fuel control unit. The torque motor controls the metering section of the hydromechanical fuel control unit.

DIGITAL ELECTRONIC ENGINE CONTROL (DEEC)

A DEEC is provided for each engine. The DEEC is basically an N1 governor with provisions for fuel limits during acceleration and deceleration. The DEEC performs governing, limiting, and fuel scheduling functions for engine start and continuous operation.

Input parameters utilized by the DEEC for controlling functions are: engine inlet pressure (PT2), engine inlet temperature (TT2), interstage turbine temperature (ITT), low-pressure rotor speed (N1), high-pressure rotor speed (N2), and Thrust Lever Angle (TLA).

Output signals from the DEEC to control engine operation go to the hydromechanical fuel control unit, surge bleed valves and ignitors.

The crew is able to control the engine through the DEEC by changing the TLA input to change desired thrust level. Primary TLA is received from the RVDT. Secondary TLA is sensed by the DEEC from a potentiometer within the hydromechanical fuel control unit during manual mode operation.

TT2 and PT2 input is provided by a temperature/pressure sensor integrated into the inlet duct. The sensor contains an electrical element for sensing temperature (TT2). Inlet pressure (PT2) is applied directly to the DEEC through a flexible line. An electrical heating element on the sensor provides protection against icing. The PT2 line from the sensor shall be treated as an aircraft pitot line with a drain trap located at the low point for draining possible moisture accumulation. In the normal operating mode, the DEEC analyzes the TT2 and PT2 inputs and produces output signals which are sent to a torque motor in the hydromechanical fuel control unit for fuel flow control and to the control solenoids of the surge bleed valves.

ITT is measured by thermocouple probes that extend into the gas path between the high-pressure (N2) and low-pressure (N1) turbines.

The N1 speed signals are produced by a dual element monopole located in the rear bearing housing and are the primary thrust indicating instruments. The N2 speed signal is produced by a dual element monopole located in the transfer gearbox. Both dual element monopoles provide outputs to the DEEC and EICAS for flight deck display. Output signals from the DEEC for engine control are also directed to a torque motor in the hydromechanical fuel control unit and to the control solenoids of the surge bleed valves.

The DEEC has an extensive self-monitoring and fault analysis system. In the event a minor fault is detected in the system, the DEEC will initiate an ENGCMPTR FAULT white CAS when ENG CMPTR switch is in the ON position. If electrical power to the computer is lost, the manual mode solenoid valve is deenergized closed, engine control reverts to manual mode, and an ENGCMPTR FAULT amber CAS illuminates.

If a major fault occurs in the DEEC, it may remain in the auto mode or it may revert to manual mode depending on the fault. In either case, the ENGCMPTR FAULT amber CAS will illuminate. A MAN amber EI will also illuminate if DEEC has reverted to manual mode.

When engine control automatically reverts to manual mode, it will not go back to normal mode until the pilot cycles the ENG CMPTR switch. If the CAS doesn't clear, the fault condition still exists. At this point, the pilot may select the MAN position which will result in the ENGCMPTR FAULT amber CAS changing to white.

Whenever engine control is in the manual mode of operation, a MAN amber or white EI will illuminate. If engine control has reverted to manual because of a DEEC fault or failure, MAN will illuminate amber. If manual mode was selected by the pilot, MAN will illuminate white.

Engine operation during manual mode is maintained through the secondary TLA and mechanical linkage to the hydromechanical fuel control unit.

Power to the DEEC is 28-vdc supplied from the L and R ESS buses through the 7.5-amp L and R CMPTR circuit breakers located within the ENGINE groups of the respective pilot's and copilot's circuit breaker panels.

The following CAS illuminations are specific to the DEEC:

CAS	Color	Description
ENGCMPTR FAULT	Amber	There is a major fault in the associated (L or R) engine computer system.
ENGCMPTR FAULT	White	There is a minor fault in the associated (L or R) engine computer system.

The DEEC also functions to provide the crew with automatic performance reserve and engine synchronization.

AUTOMATIC PERFORMANCE RESERVE (APR)

Automatic Performance Reserve (APR) provides a change in thrust on the operating engine in the event of opposite engine thrust loss during takeoff and missed approach conditions. The APR is controlled by the APR switch located on the aft portion of the pedestal. Depressing the switch illuminates the white ARM on the switch and the DEEC performs a software verification. If the APR circuits are active for both engines, an APR white EI will then appear at the top of the EICAS once the system is armed by the DEECs. When armed, each DEEC monitors the opposite engine in order to automatically increase the maximum available thrust if the opposite engine fails. An APR ON green EI will illuminate during automatic APR activity or manual activation. APR may be manually activated by advancing the thrust lever to the APR detent. The engine synchronizer will not function during APR operation.

The following CAS illumination is specific to the APR:

CAS	Color	Description
APR FAULT	White	APR fault is detected in the associated (L or R) DEEC.

ENGINE SYNCHRONIZER

The engine synchronizer system consists of a three position ENG SYNC N1/N2/OFF switch (located on the aft pedestal), engine synchronizer circuits, and data crosslink communication lines integrated within the DEECs. The synchronizer will function from flight idle to the maximum power rating as long as the engines are operating within the system authority limits. The authority limits are: ± 5% N1 during midrange operation, 0% at takeoff TLA, and -2% to +5% at flight idle. During flight, the engine synchronizer, if selected, will maintain the two engines' N1 or N2 in sync with each other. The engine synchronizer must not be used during takeoff, landing, or single-engine operations.

If N1 is selected, SYNC green or amber EI will illuminate between the N1 indicators. If N2 is selected, SYNC green or amber EI will illuminate between the N2 indicators. The light will be green if the landing gear is up and amber if the gear is down. ENG SYNC should be OFF for takeoff and landing; therefore, the amber color is to alert the crew to turn the synchronization system off if the landing gear is down.

Synchronization is accomplished by maintaining the speed of the slave engine in sync with the speed of the master engine. The master engine is determined and so designated during installation.

The following criteria must be satisfied before the system will operate:

- The ENG SYNC switch is set to N1 or N2.
- The difference between the N1 speed of each engine is no more than 5%.
- Thrust reversers are stowed.
- APR is disarmed.

Deviating from any of these criteria will cancel engine synchronization.

Electrical power for the ENG SYNC switch is 28-vdc supplied through the 1-amp SYNC SW circuit breaker located within the ENGINE group of the pilot's circuit breaker panel.

ENG CMPTR SWITCHES

The DEECs are controlled by the L and R ENG CMPTR switches located in the respective L and R ENGINE panels. Normally, the switches are left in the ON position. The ON position allows full DEEC authority of engine operation through inputs with the pilot's primary TLA. If normal engine control is not satisfactory, the engine can be operated in the manual mode.

The manual mode can be activated by placing the ENG CMPTR switch to either MAN or OFF. If the ENG CMPTR switch is placed in the MAN position, the manual mode solenoid (within the hydromechanical fuel control unit) is deenergized closed, the engine fuel control is in the manual mode and the DEEC is no longer controlling the engine. However, if electrical power is still available, the DEEC will monitor N1 and N2 and provide ultimate overspeed protection. If the ENG CMPTR switch is placed to OFF or electrical power is lost, operation is the same, except the ultimate overspeed protection is no longer available. The OFF position of the ENG CMPTR switch disconnects power to the DEEC.

SURGE BLEED CONTROL

A surge bleed control system for each engine is installed to prevent low-pressure compressor surge. Each system consists of two externally mounted surge valve control solenoids and an internally mounted surge bleed valve. During normal operation, surge bleed valve position is controlled by the DEEC via the solenoid control valves. Once the DEEC transfers to manual mode, the surge bleed valve will go to the 1/3-open position.

FUEL HEATER /OIL COOLER

Each engine is equipped with a fuel heater/oil cooler. The fuel heater/oil cooler is provided for the purpose of heating the fuel sufficiently to prevent ice formation in the engine system, and to provide oil cooling to the planetary gearbox. The fuel heater/oil cooler is of a liquid-to-liquid design utilizing the engine lubricating oil as a source of heat to warm the fuel. This heat transfer conversely cools the oil.

Fuel heater/oil cooler faults are detected by the Data Acquisition Unit (DAU). The DAU interprets the temperature as a function of engine oil temperature and uses the result to illuminate a CAS message.

The following CAS illuminations are specific to the fuel heater/oil cooler:

CAS	Color	Description
FUEL HEATER	Amber	The fuel heater, on the associated (L or R) engine, is not keeping the fuel warm enough.
FUEL HEATER	White	The fuel heater, on the associated (L or R) engine, is heating the fuel too much.

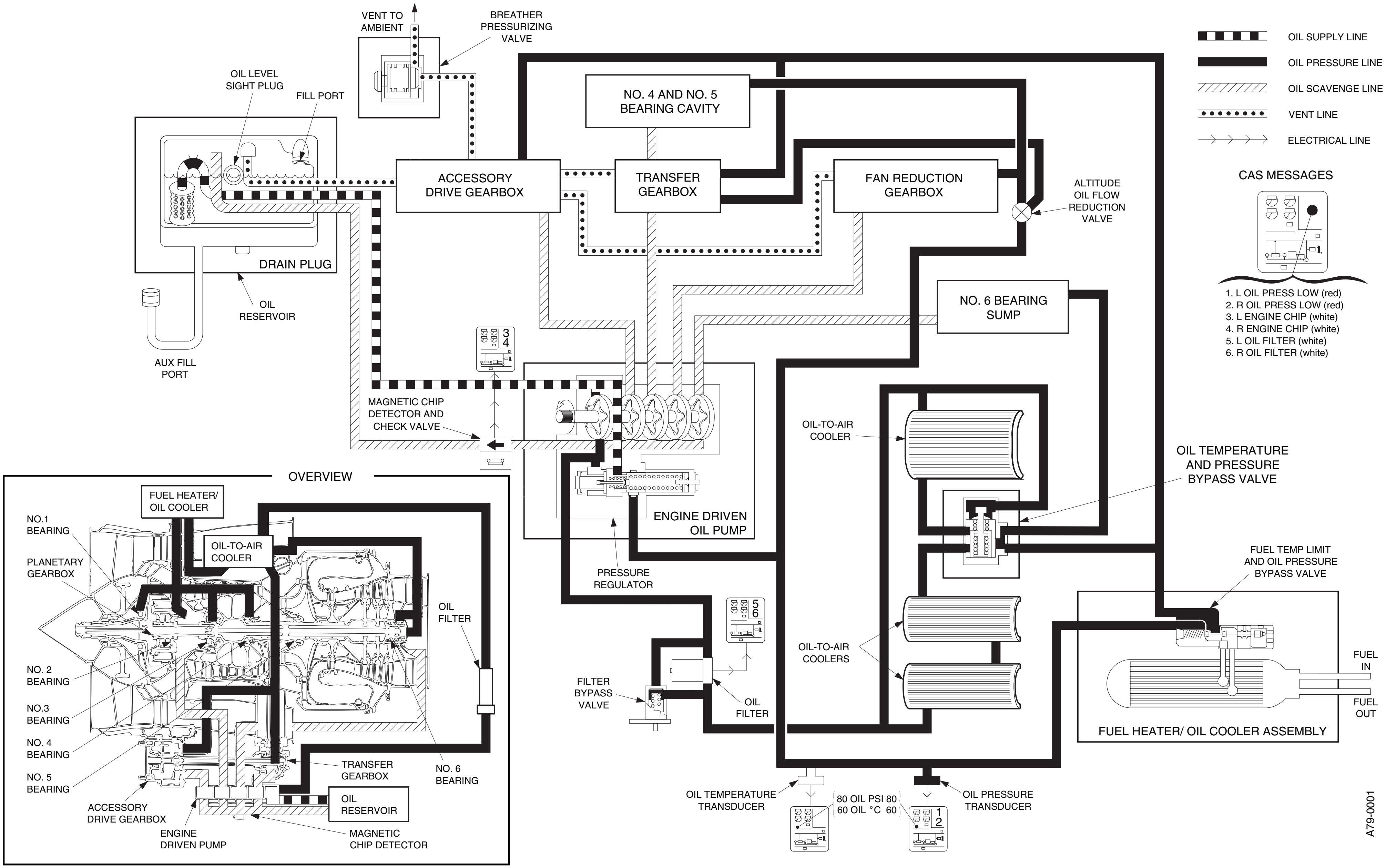
ENGINE OIL SYSTEM

Oil for engine lubrication is drawn from the engine oil tank by the oil pump. The oil is output from the pump through a filter, a pressure regulator valve, an oil-to-air cooler, and a fuel heater/oil cooler. The oil-to-air cooler is a three-segment, finned cooler that forms the inner surface of the fan duct. From the oil-to-air cooler, the oil flow is divided so that part of the oil is directed to the accessory drive and transfer gearboxes, and the engine shaft bearings. The remaining oil is diverted to a fuel heater/oil cooler and then to the planetary gearbox.

The oil filter assembly incorporates a bypass valve and an electrical switch to indicate when the oil filter is clogged or clogging. In the event of an impending bypass, an L or R OIL FILTER white CAS will illuminate. The bypass valve will open when the pressure differential across the filter reaches 35 psi (241 kPa) allowing oil to bypass the filter. Under cold oil conditions, such as engine start, the bypass indication is inhibited when the oil temperature is less than approximately 100° F (38° C); however, the bypass valve will still open. This function prevents nuisance indications during engine start due to high oil viscosity at cold temperatures.

The following CAS illumination is specific to the engine oil system:

CAS	Color	Description
OIL FILTER	White	The associated (L or R) engine oil filter is becoming plugged.



ENGINE OIL SYSTEM SCHEMATIC
Figure 2-2

ENGINE IGNITION AND START SYSTEMS

IGNITION SYSTEM

The engine ignition system is an integral sub-system of the engine. Each engine consists of an ignition unit, two ignitor plugs, two shielded high-voltage output cables and associated aircraft wiring. During normal engine operation the system is controlled by the DEEC and is capable of continuous operation. The DEEC powers the ignition system for three modes of operation. The first is for normal engine start. During normal engine start the DEEC commands ignition at >6.0% N2 and turns ignition off when N1 = 0.7 of idle N1. The second mode is for uncommanded deceleration, and the third mode prevents engine flameout during rapid deceleration.

The ignition unit is a solid-state, high-voltage, capacitor-discharge unit mounted on the fan bypass duct of each engine. The unit provides a spark rate of 2 sparks per second at an output of 18,000 to 24,000 volts through the ignitor plugs. The ignitor plugs are located on the combustor plenum at the 4 and 8 o'clock positions. These iridium plugs are linked to the ignition unit by separate high-voltage cables and spark when pulsed by the ignition unit.

The ignition system is powered by 28-vdc from the L and R ESS buses through the CH A and CH B circuit breakers located within the ENGINE groups (respective L and R IGN) of the pilot's and copilot's circuit breaker panels.

IGN SWITCHES

The L and R IGN switches, located in the respective ENGINE panel of the pedestal, are used to obtain continuous engine ignition. The switch controlling the left engine ignition system is labeled L IGN. The switch controlling the right engine ignition system is labeled R IGN. When an IGN switch is placed in the ON position, 28-vdc is applied to the engine ignition unit.

IGN INDICATIONS

The EI will display a green, white, and amber IGN. The green EI represents normal ignition activity. A white EI is generated if one ignitor plug is not firing. The amber EI alerts the pilot of dual ignitor plug failure.

ENGINE START SYSTEM

A combined starter/generator is mounted on the front of the accessory gearbox. For normal starts, the DEEC provides for automatic starting which allows the thrust lever to be moved into the IDLE position before activating the starter. When the respective L or R START switch is momentarily depressed, the DEEC begins the start sequence by activating the corresponding standby fuel pump and energizing the starter relay closed. The starter relay connects electrical power to the starter from the respective L or R GEN bus. Power to the GEN buses is supplied from the aircraft batteries, an external power source, or an Auxiliary Power Unit (APU) (if installed).

An external power source or APU is recommended for starts when ambient temperature is 32° F (0° C) or below. Ensure an external power source supply is regulated to 28-vdc, has adequate capacity for engine starting and is limited to 1500 amps maximum. Allow the operating generator amperage to decrease below 300 amps prior to a generator cross-start. Refer to Cold Weather Operation, AFM, for additional information when operating in extremely cold weather.

START SWITCHES

The L and R START switches, located in the respective ENGINE panel of the pedestal, are guarded momentary action switches that illuminate ON when depressed indicating the starter relay is energized.

START INDICATIONS

During engine starts, a vertical START green or amber EI will appear. The green EI represents normal starter activity. The amber EI represents an engine starter engaged with N_2 greater than 51%.

ENGINE INDICATING (EI)

ENGINE VIBRATION MONITOR

The engine vibration monitor system consists of an accelerometer mounted on each engine and a tailcone-mounted engine vibration monitor signal conditioner. The vibration monitor signal conditioner consists of two identical independent channels.

Each channel is powered by the corresponding 3-amp L or R VIB MON circuit breaker located within the ENGINE group of the respective pilot's or copilot's circuit breaker panels.

The following CAS illumination is specific to the engine vibration monitor system:

CAS	Color	Description
ENG VIB MON	White	Vibration level, in the associated (L or R) engine, is higher than normal.

OIL TEMPERATURE INDICATOR

Oil temperature is displayed for each engine as a white digital readout. The display consists of an OIL ° C legend with temperature readouts to the left and right. An engine-mounted transducer transmits oil temperature signals to the DAU. The DAU then provides an oil temperature value for EICAS. Refer to the following table for temperature ranges and corresponding color displays during normal engine operation:

ALTITUDE FT	WHITE °C	AMBER °C	RED °C
≤30,000	30 to 127	-53 to 29	-60 to -54 and 128 to 175
>30,000	30 to 140	-53 to 29	-60 to -54 and 141 to 175

OIL PRESSURE INDICATOR

Oil pressure is displayed for each engine as a digital readout on EICAS. The display consists of an OIL PSI legend with pressure readouts to the left and right.

Refer to the following table for pressure ranges and corresponding color display during normal engine operation:

(% N_2)	WHITE PSIG	AMBER PSIG	RED PSIG
≤80% and up to 3 minutes after engine start	65 to 80	50 to 64	0 to 49 and 126 to 150
>80% or more than 3 minutes after engine start	65 to 80	50 to 64	0 to 49 and 101 to 150

FUEL FLOW INDICATOR

Fuel flow is displayed for each engine as a white digital readout on EICAS. The display consists of a FF PPH legend with flow rates to the left and right. The fuel flow rates are presented in Pounds-Per-Hour (PPH). A fuel flow transmitter located in the main fuel line of each engine supplies fuel flow signals to the DAU via a fuel flow converter. The DAU then provides a fuel flow rate value for EICAS presentation.

N1 INDICATORS

The fan speed (N_1) analog EI for each engine consists of a needle, arc, and N_1 bug with integral digital readouts for N_1 and N_1 setting. The N_1 sensor is mounted in the engine's rear bearing support housing and senses low-pressure fan speed. The sensor provides signals to the DEEC and DAU. Refer to the following table for N_1 speeds and corresponding color display.

WHITE % N_1	AMBER % N_1	RED % N_1
0 to 100.0	N/A	100.1 to 115*

*Above 115% the digits are invalid.

N2 INDICATORS

N2 is displayed for each engine as a digital readout. The display consists of an N2 legend with digital readouts to the left and right. Refer to the following table for N2 speeds and corresponding color display for various conditions.

% N2	WHITE % N2	AMBER % N2	RED % N2
Except APR Mode	0 to 100	100.1 to 102.5	102.6 to 115*
APR Mode	0 to 101	101.1 to 102.5	102.6 to 115*

*Above 115% the digits are invalid.

ITT INDICATORS

Interstage Turbine Temperature (ITT) is displayed for each engine as a needle and arc with an integral digital readout for ITT. The arc is scaled to start at 100° C. Interstage turbine temperature for each engine is sensed by Chromel-Alumel parallel wired thermocouples positioned between the high- and low-pressure turbine sections. The signal from the averaging circuit of the thermocouples is carried to the DEEC and DAU for EI display. Refer to the following table for ITT and corresponding color display for various conditions.

Aircraft 45-002 & Subsequent ***not*** *modified by SB 45-72-1:*

OPERATING MODE	WHITE °C	AMBER °C	RED °C
Start	0 to 941	N/A	942 to 1014
Takeoff (≤5 minutes)	0 to 941	N/A	942 to 1014
Takeoff or APR (>5 minutes)	0 to 916	917 to 941	942 to 1014
APR (≤5 minutes)	0 to 963	N/A	964 to 1014
Up To MCR	0 to 900	N/A	901 to 1014
MCT (no anti-ice)	0 to 916	N/A	917 to 1014
MCT (any anti-ice)	0 to 941	N/A	942 to 1014

Aircraft 45-002 & Subsequent modified by SB 45-72-1:

OPERATING MODE	WHITE °C	AMBER °C	RED °C
Start	0 to 991	N/A	992 to 1014
Takeoff (no anti-ice) (≤5 minutes)	0 to 991	N/A	992 to 1014
Takeoff (any anti-ice) (≤5 minutes)	0 to 991	N/A	992 to 1014
Takeoff or APR (>5 minutes)	0 to 1013	N/A	1014
APR (≤5 minutes)	0 to 1013	N/A	1014
Up To MCR	0 to 974	N/A	975 to 1014
MCT (no anti-ice)	0 to 991	N/A	992 to 1014
MCT (any anti-ice)	0 to 991	N/A	992 to 1014

ENGINE DIAGNOSTIC SYSTEM (EDS)

An Engine Diagnostic System (EDS) is installed to provide engine fault recording and condition trend monitoring. The system periodically records engine parameters and allows the crew to request that conditions be recorded at any time. Normal use of the system entails downloading data from the DEEC and submitting to the engine manufacturer for timely analysis. The data may be downloaded at any time to assist in diagnosing engine problems which may be encountered. The EDS is intended for maintenance functions only and not for in-flight monitoring or diagnosis by the flight crew. The system is integrated into the DEEC of each engine.

EDS RECORD SWITCH

The EDS RECORD switch is located on the aft pedestal. The purpose of the switch is to allow the flight crew to initiate data collection by the EDS. When the switch is actuated, the engine parameters existing four minutes prior to and one minute after switch actuation will be recorded in the EDS memory.

The following CAS illuminations are specific to the engine diagnostic system:

CAS	Color	Description
CHECK EDS	White	Indicates one of the following about the associated (L or R) engine diagnostic system (EDS): • The EDS has lost power. • The EDS built-in test equipment (BITE) has detected a system failure. • The EDS memory is 80% full. • The system has detected an engine condition which is out of acceptable parameters.

ENGINE FIRE DETECTION SYSTEM

Three heat-sensing elements connected in series are located in each engine nacelle to detect an engine fire. One element is located around the accessory gearbox; one is located around the engine tailcone; and another around the engine firewall. The fire detection system is controlled by two fire detect control boxes located in the tailcone. In the event of an engine fire, the applicable control box will sense a resistance change in the sensing elements and flash the master WARN lights in the glareshield and applicable FIRE switch located within the L or R ENGINE panel of the aft pedestal.

The FIRE red EI will flash within the arc of the ITT dial. Warning is given if the firewall or accessory gearbox area exceeds approximately 410° F (210° C), or the engine tailcone area exceeds approximately 890° F (477° C).

Whenever an engine fire is detected a "LEFT" or "RIGHT ENGINE FIRE" voice message will sound to both pilots' headphones and flight deck speakers. This voice message is continuous, but can be silenced by depressing the mute switch located on the right thrust lever or the master WARN light.

Electrical power for the system is 28-vdc supplied through the 1-amp L and R FIRE DET circuit breakers located within the ENGINE group of the pilot's and copilot's circuit breaker panels respectively. Fire detect systems are powered from the respective L and R ESS buses.

SYS TEST/RESET SWITCH

FIRE DETECTION FUNCTION

The rotary-type SYS TEST/RESET switch on the forward pedestal is used to test the fire detection system. Rotating the switch to FIRE DET and depressing the switch (PRESS TEST) button will connect a resistance into both fire detect system circuits. This resistance, simulating an engine fire, will test system indications as follows:

- Master WARN tone and light will activate followed by a "LEFT ENGINE FIRE . . . RIGHT ENGINE FIRE" voice.
- Both red FIRE and all white EXTINGUISHER #1 and #2 ARMED switches (ENGINE panel) will illuminate. Illumination of the FIRE switch indicates continuity of the fire detect systems and illumination of the EXTINGUISHER #1 and #2 ARMED switches indicate continuity of the fire extinguisher squibs.
- Red FIRE messages in ITTs will flash.

NOTE

> Both red FIRE messages on RMU ENGINE PGE 1 will flash next to the N_1 display.

- L and R BLEED AIR LEAK red CAS and CWP. This indicates continuity of the bleed air overheat sensor system.
- WING/STAB LEAK red CAS and CWP. This indicates continuity of the anti-ice bleed air overheat sensor system.
- APU FIRE Switch (if installed) and a red CAS will illuminate with the APU MASTER Switch ON. The red CAS only will illuminate if the APU MASTER Switch is Off.

NOTE

> Depressing and holding the SYS TEST/RESET Switch in the FIRE DET position for 15 seconds will result in the APU fire horn sounding. Holding the switch for 30 seconds will result in an APU FAIL indication and APU shutdown.

ENGINE FIRE EXTINGUISHING SYSTEM

The engine fire extinguishing system components include: two spherical extinguishing agent containers, a red FIRE PUSH light/switch for each engine, two white EXTINGUISHER #1 and #2 ARMED light/ switches for each engine, one hydraulic shutoff valve for each engine, one fuel shutoff valve for each engine, a thermal discharge indicator, a manual discharge indicator, and associated wiring and plumbing. The system also utilizes the pneumatic system bleed air shutoff valves. The system is plumbed to provide the contents of either or both extinguishing agent containers to either engine nacelle. Shuttle valves are installed to prevent extinguishing agent flow between containers. The extinguishing agent, Halon 1301 (Bromotrifluromethane [CF_3Br]), is stored under pressure (600 psi) in the extinguisher containers and a pressure gauge on each container is visible from inside the tailcone. Halon 1301 is non-toxic at normal temperatures and is non-corrosive. As Halon 1301 is non-corrosive, no special cleaning of the engine or nacelle area is required in the event the system has been used. The system operates on 28-vdc supplied through the 5-amp L and R FIRE EXT circuit breakers located within the respective ENGINE group of the pilot's and copilot's circuit breaker panels. Fire extinguishing systems are powered from the EMER BATT hot bus.

L AND R ENGINE FIRE AND EXTINGUISHER #1/#2 SWITCHES

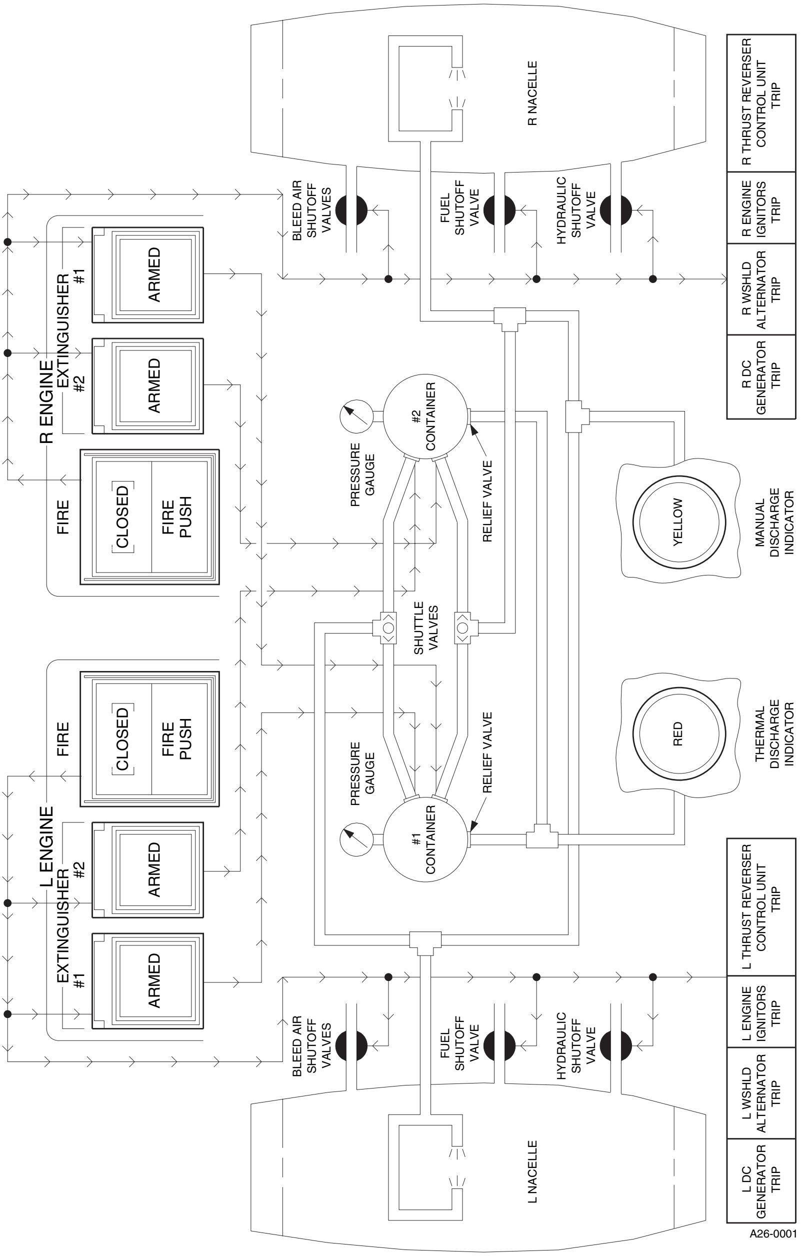
The engine fire extinguishing system is operated through the L and R FIRE switches and the EXTINGUISHER #1 and #2 switches located in the respective L and R ENGINE panel on the aft pedestal. Activating the applicable FIRE switch will cause the following events:

- Close the respective shutoff valves. (Refer to Figure 2-3.)
- CLOSED indication will appear on respective FIRE switch. Flashing FIRE PUSH illumination goes to steady.
- Arm the extinguishing agent containers.
- EXTINGUISHER #1 and #2 light illuminated.
- Trip respective DC generator and alternator off-line.
- Trip respective engine ignitors off-line.
- Trip respective thrust reverser control unit off-line and prevent the thrust reverser isolation valve from opening.

Illumination of the EXTINGUISHER #1/#2 ARMED light(s) indicates that the fire extinguishing system is armed and the squibs are good. Depressing an illuminated EXTINGUISHER #1 ARMED light will discharge the contents of the first extinguisher bottle into the associated nacelle. Depressing the EXTINGUISHER #2 ARMED light will discharge the contents of the second bottle. Either or both EXTINGUISHER #1/#2 ARMED lights may be depressed to extinguish the fire. Should the first container control the fire, the other container is available to either engine.

FIRE EXTINGUISHER DISCHARGE INDICATORS

Two disk-type indicators are flush-mounted in the fuselage under the right engine pylon. If the contents of either or both containers have been discharged into the engine nacelles, the yellow disk will be ruptured. If the contents of either or both containers have been discharged overboard as the result of an overheat condition causing excessive pressure within the containers, the red disk will be ruptured. If both disks are intact, the system has not been discharged.



FIRE EXTINGUISHING SYSTEM
Figure 2-3

THRUST REVERSERS

Each engine is equipped with an independent, electrically controlled, hydraulically actuated, clamshell-type thrust reverser. The thrust reverser system consists of a thrust reverser control unit, an engine nacelle afterbody on each engine, a piggy-back thrust reverser lever on each main thrust lever, associated hydraulic plumbing, and associated electrical wiring.

The thrust reverser control unit integrates all deploy, stow, and indication functions of the thrust reverser system. Input signals indicating the status of each of these functions are analyzed by the thrust reverser control unit. Different combinations of these signals will generate the applicable output command from the thrust reverser control unit.

Each nacelle afterbody consists of an upper and lower blocker door, an inboard and outboard primary deploy/stow actuator, unlatch actuator, unlatch switch, unlock switch, full deploy switch, and a throttle retard mechanism. Hydraulic power for thrust reverser operation is supplied by the aircraft hydraulic system. A selector valve for each thrust reverser is installed in the tailcone. The selector valves control hydraulic flow to the associated system actuators in response to electrical inputs from the associated thrust reverser lever and position switches via the thrust reverser control unit.

The thrust reverser levers and the system circuit breakers are the only controls used by the crew to operate the system. Electrical power for thrust reverser control and indication circuits is 28-vdc supplied by the L and R ESS buses through the L and R REVERSER circuit breakers. The L REVERSER circuit breakers located in the ENGINE group of the pilot's circuit breaker panel include the 5-amp DEPLOY, the 3-amp ANN, and the 3-amp STOW. The R REVERSER circuit breakers located within the ENGINE group of the copilot's circuit breaker panel also include a 5-amp DEPLOY, a 3-amp ANN, and a 3-amp STOW.

In order to arm the thrust reversers, both main gear weight-on-wheels switches must be in the ground mode (aircraft weight on the main gear) and the thrust levers must be in the IDLE position. When fully armed (reverser system relays and switches are properly sequenced), the associated isolation valve is open and the system is ready for deploy/stow commands by operation of the thrust reverser levers.

The clam-shell type blocker doors are held in the stowed position by latch hooks. The latch hooks are hinged to the unlatch actuator, and are rotated away from the blocker doors for thrust reverser deployment. When the deploy cycle is initiated, hydraulic pressure is applied to the stow side of the primary actuators which move the doors into an overstowed condition. Overstowing the thrust reversers allows the unlatch actuators to rotate the latch hooks. As the latch hooks begin to rotate, the unlock switch signals the thrust reverser control unit of the unlocked condition. As the latch hooks clear the blocker door receptacles, an unlatch switch signals the thrust reverser control unit that the blocker doors are unlatched. After the latch hooks are unlatched, hydraulic pressure is applied to the deploy side of the primary actuators which push the doors open.

Stow is initiated automatically whenever an unlock condition is detected and the thrust reverser lever is forward of the thrust reverser deploy detent. This occurs during the normal stow cycle and also to correct an abnormal condition in flight. During autostow, hydraulic pressure is applied to the stow side of the primary actuators and the blocker doors move towards the overstow position. As the doors reach overstow, the spring-loaded latches close. When the latches close, the unlock switches are deactivated. The selector valve then releases stow pressure on the primary stow/deploy actuator. Exhaust gas pressure and springs return the doors to the normal stowed position.

An automatic throttle retard mechanism is installed on each thrust reverser to ensure that thrust reverser stow and deploy does not occur with an engine thrust setting above idle. The throttle retard mechanism consists of an actuator, crank, and lever. Whenever hydraulic stow pressure is applied to the thrust reverser actuators, the throttle retard mechanism will position thrust lever to the IDLE position. When hydraulic stow pressure is removed, the mechanism will return to a neutral position and release retard pressure to the thrust lever.

THRUST REVERSER LEVERS

A thrust reverser control lever for each thrust reverser is mounted piggy-back fashion on each main thrust lever. The thrust reverser levers are inoperable and cannot be moved unless the associated main thrust levers are at the IDLE stop. Similarly, the main thrust levers cannot be moved from the IDLE position until the associated thrust reverser lever is in the stow (full down) position. When fully armed, a thrust reverser may be independently deployed by lifting the corresponding thrust reverser lever to the first (idle/deploy) stop. A throttle release will activate and the thrust reverser lever may be pulled beyond the idle/deploy stop to increase reverse thrust. If both thrust reversers are deployed, a detent limits thrust reverser lever travel to approximately MCR.

The thrust reverser is stowed by first returning the thrust reverser lever to the idle/deploy stop and then moving the lever to the stow (full down) position at engine idle speed.

THRUST REVERSER INDICATIONS

Thrust reverser control is automatic and status indications are displayed on the EICAS and CWP. The following EICAS illuminations are specific to the thrust reversers:

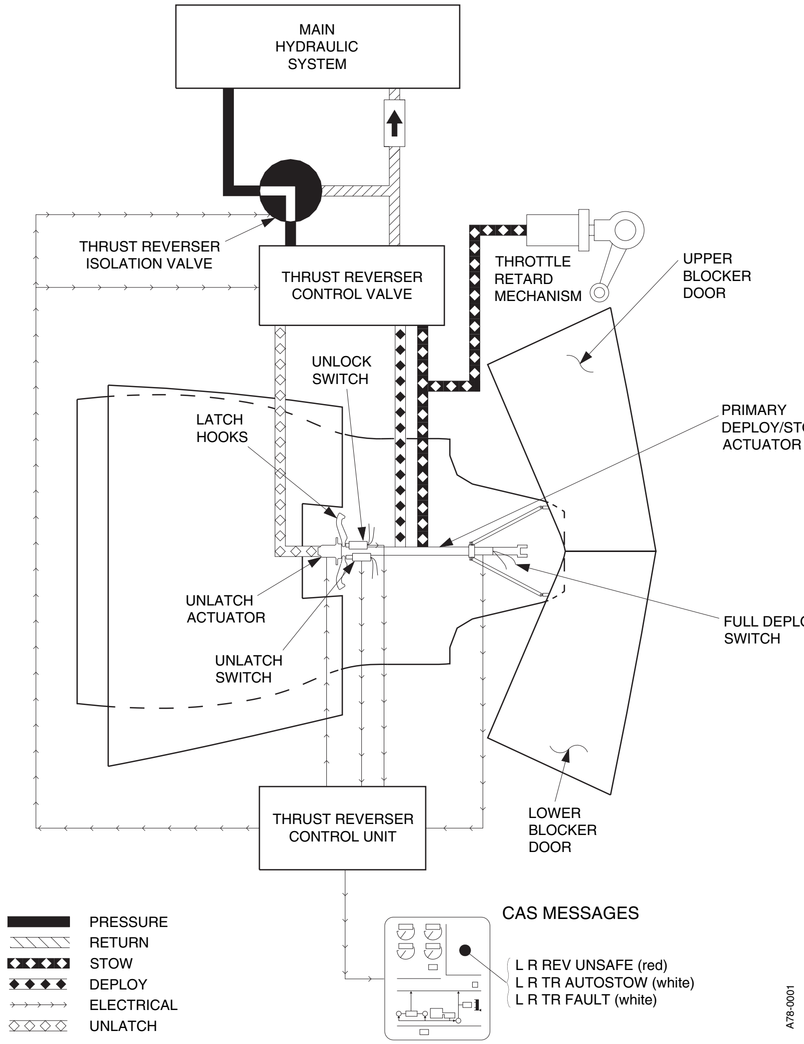
EICAS	Color	Description
DEP (EI)	Red	Uncommanded deployment of the associated (L or R) thrust reverser.
DEP (EI)	Green	Normal thrust reverser deployment on the ground.
REV (EI)	Amber	The associated (L or R) thrust reverser system is armed in flight OR armed on the ground with thrust lever greater than MCR.
REV (EI)	White	The associated (L or R) thrust reverser system is armed on the ground with thrust lever in IDLE.
REV AUTOSTOW	White	The associated (L or R) thrust reverser autostow function is activated.
REV FAULT	White	A fault is detected in the associated (L or R) thrust reverser system.
UNL (EI)	Red	The associated thrust reverser system is not armed, but an unlock condition is detected.
UNL (EI)	Amber	On the ground, the thrust reverser is in transition between stow and deploy. It will temporarily illuminate during normal thrust reverser deployment. If illumination continues for more than several seconds, an abnormal condition exists and the master caution is tripped.

During normal thrust reverser deployment the following illuminations will occur:

1. REV white EI.
2. UNL amber EI.
3. DEP green EI.

During normal thrust reverser stowage the above illuminations will be reversed.

The CWP contains red L and R REV UNSAFE lights which will illuminate in conjunction with a UNL or DEP red EI above the N1 indicator. Whenever this illumination occurs, a continuous "LEFT" or "RIGHT REVERSER UNSAFE" voice message will sound. This voice message can be silenced by depressing the mute switch located on the right thrust lever or depressing the master CAUT/WARN light.



THRUST REVERSER SYSTEM SCHEMATIC
Figure 2-4

AIRCRAFT FUEL SYSTEM

The aircraft fuel system consists of two wing tanks, a fuselage tank, a fuel flow indicating system, a fuel quantity indicating system, a fuel transfer system, a fuel vent/expansion system and a single-point pressure refueling system.

WING TANKS

The wing is divided into two separate fuel-tight compartments which serve as fuel tanks. Each tank extends from the wing root to a point just short of the winglets, thus providing a separate fuel supply for each engine. A crossflow shutoff valve is installed to permit fuel transfer between wing tanks. Wing tank over-pressurization is prevented by vent/expansion lines between the wing tanks and fuselage tank. This allows access to the main fuel vent/expansion system of the fuselage tank. Flapper-type check valves, located in the various wing ribs, allowing free fuel flow inboard but restricted outboard fuel flow. A main jet pump is mounted in each wing tank near the center bulkhead to supply fuel under pressure to the respective engine fuel system. A standby pump also located at this location can be utilized as a back-up for the main jet pump, or be used to transfer fuel from wing tank to wing tank or defuel the aircraft. Three scavenge jet pumps, located throughout each wing tank, are used to transfer fuel to the inboard collector bay containing the main fuel jet pump. A fourth scavenge jet pump, located in the forward end of the collector tank, is used to transfer fuel to the inlet of the main fuel pumps. A fifth scavenge jet pump, located in the outlet of the fuselage to wing transfer line, is used to assist gravity in the transfer of fuel from fuselage to wing during normal aircraft operation. The wings are filled from the fuselage tank through the refueling manifold or the gravity filler port.

FUSELAGE TANK

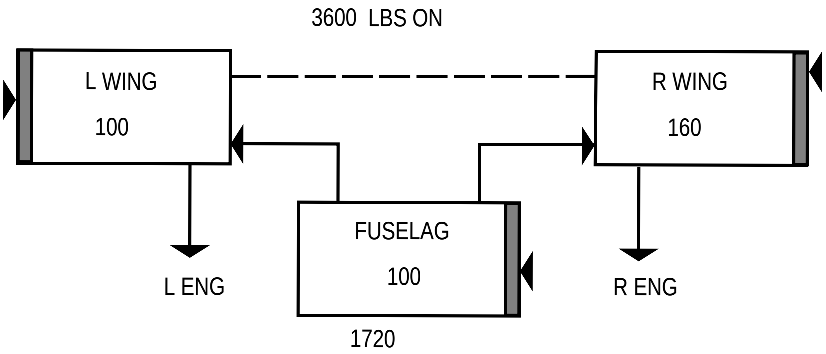
The fuselage tank consists of a single bladder-type cell located in the aft fuselage. The tank is equipped with a pressure refueling adapter, a gravity filler port, a fuel probe, a refueling manifold/nozzle, and a fuel vent/expansion system with an auxiliary vacuum/pressure relief valve. The tank allows the entire fuel system to be serviced through a pressure refueling adapter located on the right side of the aircraft below the engine pylon, or a gravity filler port located on the right side of the aircraft above the engine pylon. The gravity transfer system is boosted by motive flow through the refueling manifold/nozzle during refueling operations. Fuel will flow to both wing tanks through two transfer lines.

FUEL FLOW INDICATING SYSTEM

The fuel flow indicating system consists of a Dual Fuel Flow Converter (DFFC) and a fuel flow transmitter located in the main fuel line of each engine. There is no fuel flow transmitter for the APU. The fuel flow transmitters sense flow rate and fuel temperature, and provide these parameters to the DFFC. The DFFC processes these signals and sends a flow rate, along with the total fuel burned (APU fuel not included), to a Data Acquisition Unit (DAU). The DAU transfers the information to the flight management system for fuel monitoring and to EICAS for flight deck display to show Fuel Flow (FF) left and right engine, and total fuel used (refer to Figure 2-5 for the EICAS Fuel Page).

A TOTALIZER RESET switch, located within the FUEL group of the pedestal control panel, will reset the fuel burned information held in the DFFC's nonvolatile memory after fuel servicing. The fuel used can be zeroed out by depressing and holding the TOTALIZER RESET button for a minimum of two seconds.

The DFFC is powered by 28-vdc supplied by the 1-amp L and R FUEL FLOW circuit breakers located within the ENGINE groups of the pilot's and copilot's circuit breaker panels respectively.



FUEL PAGE
Figure 2-5

STBY SWITCHES

The L and R STBY switches, within the FUEL group of the aft pedestal, manually control the operation of the electric standby pumps. These momentary switches normally remain off. In the event of a main jet pump failure or during fuel crossflow, the L and R STBY switches must be manually selected to ON by the flight crew. The standby pumps are automatically energized during engine start (begins when the L or R START switch is depressed, and stops at 50% N2). The right standby pump is automatically energized during APU start and run. When the standby pumps are operating, the L and/or R STBY switches will illuminate ON.

The standby pumps operate on 28-vdc supplied through the 15-amp L and R STBY PUMP PWR circuit breakers within the FUEL groups of the pilot's and copilot's circuit breaker panels respectively. The automatic and manual pump controls are powered by 28-vdc through the 3-amp L and R STBY PUMP CTRL circuit breakers located within the FUEL groups of the pilot's and copilot's circuit breaker panels respectively.

The following CAS illuminations are specific to the standby fuel pumps:

CAS	Color	Description
FUEL PRESS LOW	Red	Fuel pressure is low at the associated (L or R) engine's fuel pump inlet.
STBY PUMP ON	White	The associated (L or R) standby fuel pump is receiving electrical power.

XFLOW SWITCH AND CROSSFLOW SHUTOFF VALVE

The XFLOW switch, within the FUEL group of the aft pedestal, controls the crossflow shutoff valve. The valve is normally in the closed position. Depressing the XFLOW switch illuminates a white bar and power is applied to open the motorized crossflow shutoff valve allowing fuel to flow between the wing tanks.

To balance wing fuel, the XFLOW switch should be set to open (white bar illuminated) and the heavy side L or R STBY switch set to ON. The standby pump will continue to operate until the L or R STBY switch is deselected. The crossflow shutoff valve allows all usable fuel aboard the aircraft to be available to either engine. The switch should not be selected except when correcting an out-of-balance condition.

The crossflow shutoff valve operates on 28-vdc supplied from the rear hot bus through the 5-amp XFLOW VALVE CTRL circuit breaker located within the FUEL group of the copilot's circuit breaker panel. Loss of power to the crossflow shutoff valve causes the valve to remain in its last commanded position.

The following CAS illuminations are specific to the XFLOW switch and crossflow shutoff valve:

CAS	Color	Description
FUEL PRESS LOW	Red	Fuel pressure is low at the associated (L or R) engine's fuel pump inlet.
FUEL XFLO	Amber	The fuel crossflow valve is not fully opened or closed as commanded.
FUEL XFLO OPEN	White	The fuel crossflow valve is open.
STBY PUMP ON	White	The associated (L or R) standby fuel pump is receiving electrical power.

FUEL INDICATING SYSTEM

The fuel indicating system consists of a refueling control panel, a fuel quantity signal conditioner, 16 wing tank fuel quantity probes (8 each wing), and a fuselage tank fuel quantity probe. The system provides fuel quantity accuracy which indicates zero at zero fuel and is corrected for pitch and roll through the AHRS system.

Power for the fuel indicating system is 28-vdc supplied through the 1-amp L and R QTY circuit breakers located within the FUEL groups of the pilot and copilot circuit breaker panels respectively.

REFUELING CONTROL PANEL

The refueling control panel is located on the exterior of the aircraft below the right engine pylon. The panel is energized by the FUEL PNL ON/OFF switch. This switch also activates a floodlight when placed in the ON/FLD LT position. This floodlight is installed below the right engine pylon and is energized from the EMER BATT hot bus to allow refueling without accessing the aircraft. The DEFUEL/READY/OFF switch opens the defuel shutoff valve and the crossflow shutoff valve when selected to READY for defueling operations. An amber LED indicator above the READY will illuminate when both valves are open. A green LED indicator below the OFF will illuminate when both valves are closed. A four-digit LED labeled TOTAL FUEL QTY will indicate total usable fuel in LB or KG depending on aircraft configuration.

FUEL QUANTITY SIGNAL CONDITIONER AND PROBES

The fuel quantity signal conditioner is based on two independently powered left and right wing channels. Each channel receives DC inputs from their respective wing probes. Both channels independently monitor the fuselage probe and receive aircraft pitch information from the AHRS #1 unit. This data significantly increases the accuracy of the fuel indicating system during climb and descent. Each channel monitors the data output of the other for calculating total fuel quantity for transmittal to the DAUs. Although each channel outputs the same fuel quantity information, the DAUs will only read specific information. DAU #1 reads left quantity and total quantity. DAU #2 reads right quantity and fuselage quantity. A weight-on-wheels input allows for separate calculation software to operate "on the ground" or "in the air", making the system more accurate in both environments.

Aircraft 45-002 thru 45-258 and 45-260 ***not*** *modified by SB 45-28-8 (Modification of Fuel Imbalance CAS Logic)*:

A wing fuel imbalance greater than 500 lb (227 kg) with flaps up or greater than 200 lb (91 kg) with flaps greater than 3° will generate the FUEL IMBALANCE amber CAS.

Aircraft 45-259, 45-261 thru 45-397 and prior aircraft modified by SB 45-28-8 (Modification of Fuel Imbalance CAS Logic), but not modified by SB 45-22-10 (Honeywell Phase VI Avionics Upgrade):

A wing fuel imbalance greater than or equal to 200 lb (91 kg) will generate the FUEL IMBALANCE amber CAS.

Aircraft 45-398 & subsequent and prior aircraft modified by SB 45-22-10 (Honeywell Phase VI Avionics Upgrade):

The system monitors the left and right wing fuel quantities, and generates a FUEL IMBALANCE amber CAS if the difference exceeds 200 pounds (91 kg). Nuisance messages are minimized by inhibiting this message under certain conditions. These conditions are described below.

- CAS is inhibited for 30 seconds after liftoff.
- When landing gear is up, CAS is inhibited if pitch angle deviates from zero (level) by +5° (nose up) or -2° (nose down). The inhibit remains in effect for 30 seconds after the aircraft returns to level (between +5° and -2°).

There are several cases when the inhibit logic is overridden. After the 30-second liftoff inhibit expires, if any of following conditions exists, the FUEL IMBALANCE amber CAS will appear.

- Indicated Mach is greater than 0.78 MI, and monitored fuel imbalance exceeds 200 pounds (91 kg).

- The landing gear is extended, and monitored fuel imbalance exceeds 200 pounds (91 kg).
- Monitored fuel imbalance is 500 pounds (227 kg) or greater.

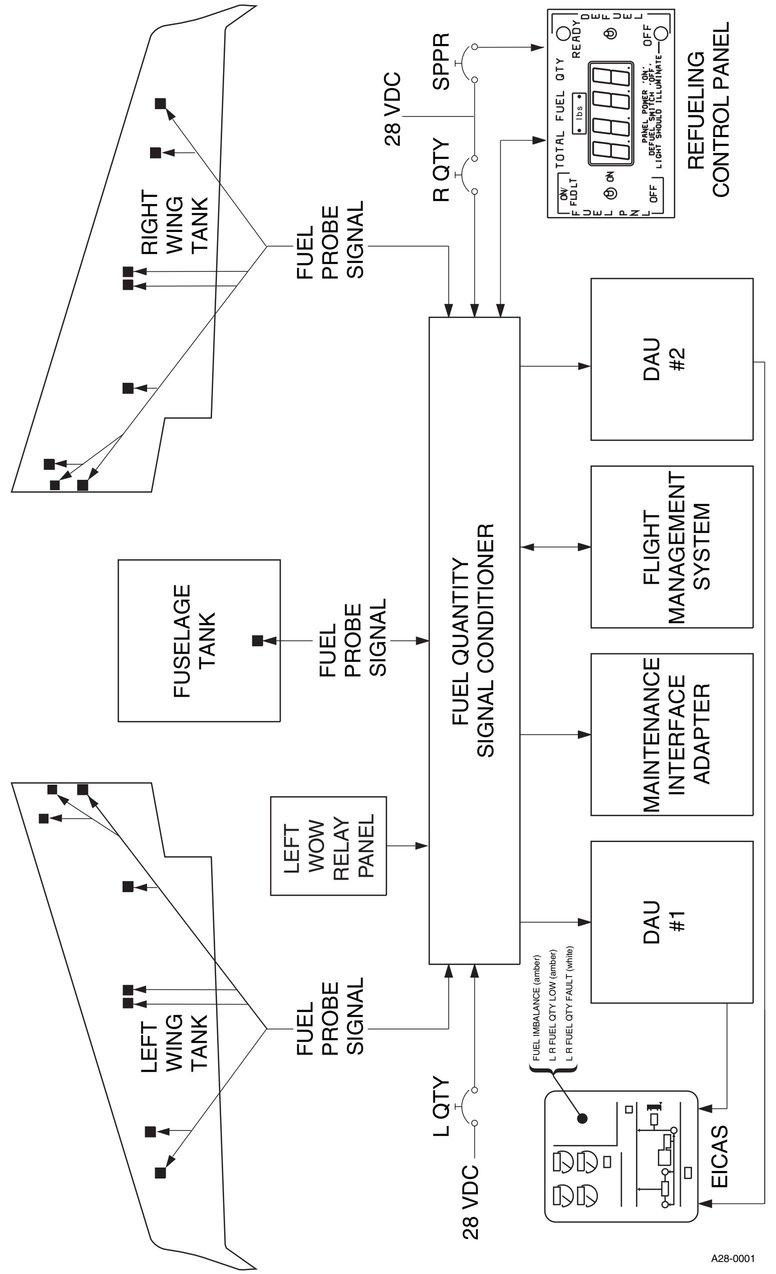
When the aircraft is on the ground, a FUEL IMBALANCE amber CAS will appear anytime the monitored fuel imbalance exceeds 200 pounds (91 kg).

In summary, the crew is generally alerted when fuel imbalance exceeds 200 pounds (91 kg). However, certain conditions tend to create nuisance alerts. The nuisance alerts are minimized by inhibiting the alerts when these conditions exist. In all cases, a fuel imbalance of 500 pounds (227 kg) or more will be annunciated.

CONDITION 1	**CONDITION 2**	**CONDITION 3**	**FUEL IMBALANCE amber CAS displayed by imbalance of:**	
			200 lb	**500lb**
On Ground	▨	▨	X	▨
Airborne for at least 30 seconds	Pitch Angle between +5° and -2° (i.e., level flight attitude) for at least 30 seconds	▨	X	
	Pitch Angle **NOT** between +5° and -2° (i.e., climb or descent attitude)	Mach 0.78 or less	▨	X
		Mach greater than 0.78	X	
	Landing Gear is down	▨	X	▨

The fuel quantity signal conditioner software determines low fuel conditions from the filtered fuel quantity. The L or R FUEL QTY LOW amber CAS is generated when fuel quantity is less than 350 pounds. The following CAS illuminations are specific to the fuel quantity indicating system:

CAS	**Color**	**Description**
FUEL QTY LOW	Amber	The fuel quantity in the associated (L or R) wing tank is approaching a minimum desired level for flight.
FUEL QTY FAULT	White	- **When message preceded by L or R:** A fault is detected in the associated channel of the fuel quantity indicating system. - **When message <u>not</u> preceded by L or R:** The fuselage fuel probe is invalid or attitude input from the AHRS to the fuel quantity indicating system is invalid.



FUEL INDICATING SYSTEM SCHEMATIC
Figure 2-7

RAM AIR FUEL VENT SYSTEM

The fuel vent system provides ram air pressure to all interconnected components of the fuel system to ensure positive pressure during all flight conditions. A flush-mounted ram air scoop (NACA vent scoop) located on the left side of the fuselage (forward of the engine) admits pressure to the fuselage tank main vent system. The main vent system pressurizes the wing tanks through the fuel vent/expansion lines. The fuselage fuel vent/expansion lines are each connected to a separate sump that has a moisture drain valve. Overpressurization due to thermal expansion in the wing tanks is relieved through the left and right expansion lines to the fuselage tank. Overpressurization of the fuselage tank is relieved overboard through the NACA vent scoop. The vacuum/pressure relief valve is a backup for the NACA vent scoop.

SINGLE-POINT PRESSURE REFUELING (SPPR) SYSTEM

The Single-Point Pressure Refueling (SPPR) system allows the entire fuel system to be serviced through a SPPR adapter located on the right side of the aircraft below the engine pylon. The SPPR incorporates a precheck system which allows the operator to check the operation of the system shutoff valves before commencing refuel operations. The major system components are the refueling adapter, refueling panel, refuel shutoff valve, pilot valve, precheck valve, and associated plumbing and wiring.

Electrical power to operate the system indicator lights, solenoid valves and fuel quantity signal conditioner is 28-vdc supplied from the EMER BATT hot bus through the PWR ON switch on the refuel control panel.

The refuel shutoff valve is controlled by the pilot valve located at the high point in the fuselage tank. When refueling pressure is applied to the system through the pressure refueling adapter, pressurized fuel is applied to the refuel shutoff valve. This pressure is applied to both sides of the valve poppet. If the pilot valve is open, some of the pressure acting to hold the valve closed will be vented through the pilot valve and the pressure acting to unseat the poppet will drive the valve open against the spring tension. When the tank fills, the pilot valve will close, fuel pressure on both sides of the refuel shutoff valve poppet will equalize, and spring tension will drive the valve closed. If the refuel shutoff valve malfunctions, fuel will vent out of the NACA vent scoop to prevent overpressurization of the fuselage tank.

PRECHECK VALVE

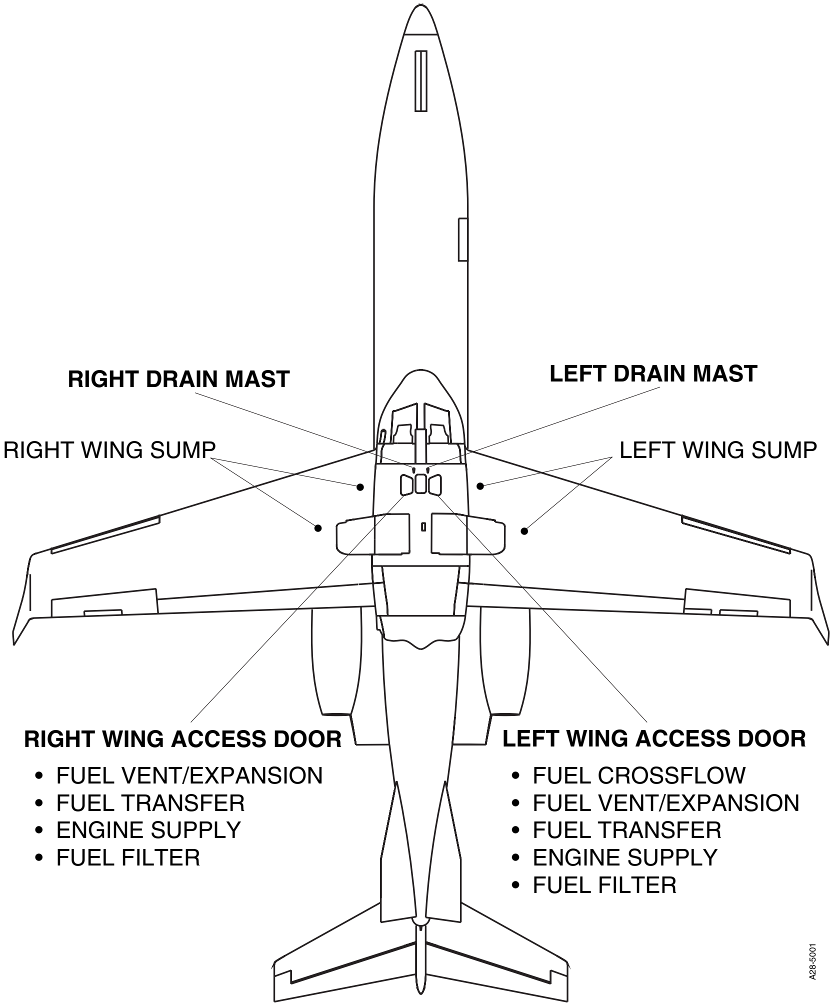
The precheck valve is used to check operation of the system shutoff valve before full refueling procedures are commenced. When the precheck valve is set to PRECHECK OPEN and refuel pressure is applied to the refuel adapter, fuel will be admitted to the precheck line. The shutoff valve will open and fuel will flow into the fuselage tank. The fuel in the precheck line will empty into a float basin at the pilot valve. When the basin fills, the pilot valve float will close the pilot valve, which causes the shutoff valve to close, terminating fuel flow. Fuel flow should stop within 20 seconds.

FUEL ADDITIVES

Refer to Airplane Flight Manual Addendum I Fuel Servicing for recommended concentrations and the proper blending methods of approved fuel additives.

REFUELING

The aircraft is refueled through a gravity filler cap located on the right side of the fuselage above the engine pylon or through the single-point pressure refueling (SPPR) adapter located on the right side of the fuselage below the engine pylon. A refueling panel access door is located next to the SPPR adapter access door. Refer to Airplane Flight Manual Addendum I Fuel Servicing for a list of approved fuels and refueling procedures.



FUEL DRAINS
Figure 2-8

AUXILIARY POWER UNIT (APU)

The Auxiliary Power Unit (APU), located in a special enclosure above the baggage compartment and tailcone equipment bay, is a self-contained, single-stage gas turbine unit that can be operated continuously up to an ambient temperature of 125° F (52° C). The APU provides pneumatic and electric power for ground operations of the aircraft Environmental Control System and aircraft electrical systems, independent of the aircraft main engines. It is restricted to ground operations only. The starting, acceleration and operation of the engine is controlled by an integral system of automatic and coordinated pneumatic and electromechanical controls.

The APU engine is comprised of three major sections: the accessory section, compressor section and turbine section. Engine power for the auxiliary power unit is developed through compression of ambient air by a single entry, radial, outward-flow, centrifugal compressor. The compressed air, when mixed with fuel and ignited, drives a radial inward-flow turbine rotor.

The APU control panel (located on the center pedestal) contains all of the primary controls to operate the APU. There is also a Maintenance Control Panel in the tailcone equipment bay (primarily for maintenance use). There is an EMER SHUTDOWN switch on this panel.

The engine is controlled and serviced by four systems: the engine fuel system, lubrication system, electrical system and indicating system. Fuel for the APU flows from the right wing fuel tank through the right standby pump and shutoff valve prior to reaching the APU. The APU uses approximately 150 pounds of fuel per hour. The APU should not be started and run in excess of 1 hour with less than 200 pounds in the right wing tank. Running out of fuel in the right wing tank will introduce air in the APU fuel lines which will cavitate the APU and prevent it from restarting immediately. The APU gearbox serves as an oil sump for the APU self-contained lubrication system. The APU Electronic Control Unit (ECU) is a fully automatic system that directs delivery of the correct amount of fuel regardless of ambient conditions and load requirements, as well as properly sequencing control of fuel and ignition during starting. The ECU is also used for trend monitoring (in lieu of a start counter or hour meter, etc.), which is accessed through the RS 232 maintenance port on the Maintenance Control Panel.

A warning horn is installed in the nose avionics bay. The audible alert can be heard out of the nose gear wheel well to alert personnel outside of the aircraft of an APU fire.

There are cooling fans installed in the tailcone equipment bay — one on the tailcone access door, the other on the opposite side of the fuselage. These fans are installed to improve cooling in the tailcone when the APU is operating. They are controlled by a 60° C thermostat located in the area of the tailcone most likely to exceed 70° C. If the temperature falls below 55° C the fans go off. Power for the fans is provided through the APU CMPTR circuit breaker.

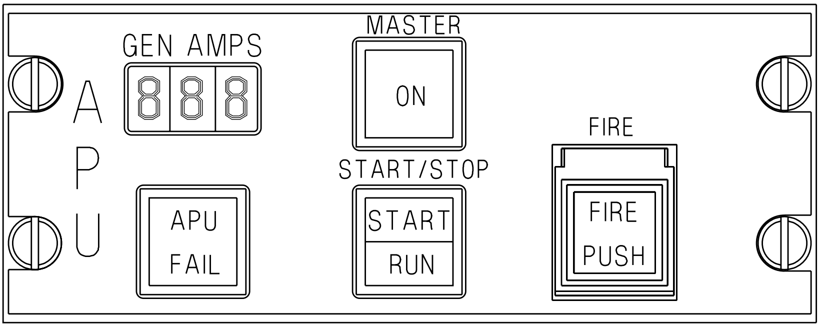
If the temperature in the tailcone reaches 70° C, the APU FAN FAIL indicator, in the tailcone, will activate (amber). The indicator is magnetically latched and will remain in the amber position until manually reset using the adjacent RESET switch. The APU FAN FAIL indicator should be checked prior to each start of the APU. If the indicator is activated, fan operation is suspect and maintenance should be obtained as required prior to running the APU. The APU may be operated at ambient temperatures up to 38° C with an amber APU FAN FAIL indication.

The following CAS illuminations are specific to the APU:

CAS	Color	Description
APU FAIL	Amber	- A start inhibit signal has been detected by the APU ECU. or - An APU protective shutdown signal has been detected by the APU ECU. or - The APU aircraft fuel valve is not closed and the APU is not running.

APU COCKPIT CONTROL PANEL

The APU cockpit control panel, located on the center pedestal, houses the necessary controls for operation and monitoring. APU fire detection/extinguishing controls are also located on the APU cockpit control panel.



F45-A00000-209-01

APU COCKPIT CONTROL PANEL
Figure 2-9

APU FAIL — The APU FAIL (amber) indicator shows a failure in the APU control or indication system. The indicator will also show if the aircraft fuel valve is not closed and the APU is not running.

APU MASTER — The APU MASTER switch/indicator is an alternate-action push-button switch. When selected ON, the ECU is powered and a bit test is started. If the test fails the APU FAIL indicator will come on.

APU FIRE — This switch/indicator is used to show an APU system fire and activate the APU fire extinguishing system. Should there be a fire in the APU, as detected by the fire loop, the FIRE switch/indicator will indicate FIRE PUSH (red), the aircraft Master WARN lights will illuminate, and the APU fire warning horn will sound. The fire detection/extinguishing system will automatically shut down the APU and activate the fire extinguisher within 10 seconds.

Depressing the FIRE switch/indicator will also shut down the APU and discharge the APU fire extinguishing bottle. After shutdown, the start inhibit circuit (within the ECU) is latched, not allowing restart.

NOTE The FIRE switch/indicator is wired directly to the R EMER HOT BUS and will activate the APU fire extinguisher even with the batteries OFF.

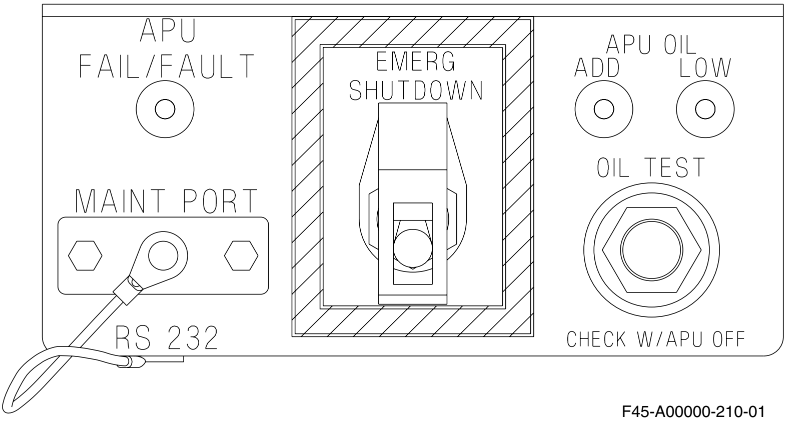
APU GEN AMPS — The GEN AMPS indicator is a digital display indicating the amperage output of the APU Generator (shows zero during start).

APU START/STOP — This switch/indicator is a momentary, two-cell, lighted switch. The top portion is labeled START (white) and is on only while the APU is starting. The lower portion is labeled RUN (green) and is illuminated when the APU is running.

Depressing this switch initiates the APU start sequence. If the APU is running, depressing this switch initiates the APU shutdown sequence.

APU MAINTENANCE PANEL

The APU maintenance panel is located in the tailcone equipment bay. It houses the necessary controls, indicators and interfaces for operation of the APU for maintenance, or to shut down the APU in an emergency.



APU MAINTENENCE PANEL
Figure 2-10

APU FAIL/FAULT — The blue APU FAIL/FAULT indicator shows that a fault has been registered by the ECU. The fault will be stored in the ECU.

APU OIL ADD / LOW — The APU OIL indicators show whether the APU oil level switch indicates an "ADD" or "LOW" (both amber) condition. These indicators are operative only when the right aircraft battery is on and the OIL TEST switch is held.

OIL TEST — The OIL TEST push button switch is used to check the oil level in the APU. Pushing the switch, with the R BATT Switch on, allows the "ADD" or "LOW" indicators to come on as required.

EMERG SHUTDOWN — This switch, when toggled, removes power from the APU ECU and causes the APU to shut down. This function is separate from the APU control panel in the cockpit. On the next ECU power up, a loss of DC power fault is logged.

MAINT PORT— The RS 232 maintenance port provides the interface between the APU ECU and the field service monitor. The PC and ECU communicate through this port to provide maintenance personnel with fault isolation information stored in the APU ECU.

APU FIRE WARNING SYSTEM

The APU fire detection system consists of a sealed gas line inside the shroud surrounding the APU itself. In the event of a fire external to the APU proper the increase in pressure in the sealed line activates the system:

- The APU FIRE PUSH and aircraft master WARN lights will illuminate, the APU fire warning horn sounds and the APU shuts down.
- Ten seconds after illumination of the APU FIRE PUSH annunciator, the fire bottle will release a charge of Halon into the APU compartment.
- The fire extinguisher may also be activated manually by depressing the APU FIRE switch.

The following CAS illuminations are specific to the APU fire warning system:

CAS	Color	Description
APU FIRE	Red	A fire has been detected in the APU compartment.

APU BLEED AIR

Refer to Section VI, ANTI-ICE & ENVIRONMENTAL, for information on APU bleed air.

APU GENERATOR

Refer to Section IV, ELECTRICAL & LIGHTING, for information on the APU generator.

OPERATING PROCEDURES

APU PRE-START CHECK

This check should be accomplished if the APU is to be started without accomplishing the standard aircraft preflight.

NOTE The APU maintenance panel is located in the tailcone. Access is gained through the tailcone access door.

1. L and R BATT Switches — On, simultaneously.
2. EMER BATT Switch — EMER.
3. APU MASTER Switch — ON.
4. Tailcone Interior Check:
   a. OIL TEST Switch (on the APU maintenance panel) — Select. If the LOW indicator comes on, have oil serviced prior to starting the APU.
   b. APU FAN FAIL indicator (in the tailcone) — Check. If indicator shows amber, obtain maintenance as required prior to running APU (temperatures above 100° F [38° C]).

NOTE APU may be operated at ambient temperatures up to 100° F (38° C) with an amber APU FAN FAIL indication.

   c. APU Fire Bottle Pressure — Check.
5. APU Exhaust — Clear of obstructions.
6. APU Inlet — Clear of obstructions.
7. Check APU firebox drains for indications of oil or fuel leaks.
8. Fuel Quantity (right wing) — Check.
9. PACK Circuit Breaker (pilot's ENVIRONMENTAL group) — Set.
10. APU Circuit Breakers (copilot's APU group) — Set.
11. L and R BLEED Circuit Breakers (pilot's and copilot's ENVIRONMENTAL and ENVIR group) — Set.
12. MAN and AUTO Circuit Breakers (copilot's ENVIR group [TEMP CTRL]) — Set.
13. L and R BLEED Switches — OFF.
14. PACK Switch — OFF.
15. HI FLOW Switch — Off.
16. MANUAL TEMP Switch — Off.
17. COCKPIT and CABIN TEMPERATURE COLD-HOT Knobs — Rotate to the mid (12 o'clock) position.

APU START UP

To start the APU:

1. L INSTR Lights Switch — On.
2. BCN/STROBE Switch — BCN.
3. APU Fire Detection System — Test:

CAUTION

Ensure personnel are clear of the nose wheel well/avionics bay area during the APU fire warning system test. The APU fire warning horn is located in this area.

   a. SYSTEM TEST Switch — Rotate to FIRE DET. Press and hold.
   b. Verify:
      - The APU FIRE red CAS activates.
      - The Master WARN tone and lights activate.
      - The APU FIRE switch/indicator illuminates.
      - After 13 to 18 seconds the APU fire warning horn will sound.
   c. SYSTEM TEST Switch — Release.
4. APU START/STOP Switch — Press (momentarily) and release. An automatic start sequence is initiated and the following events will occur:
   - The white START light will illuminate.
   - The APU fuel shutoff valve opens. The right fuel standby pump begins operation (an R STBY PUMP ON white CAS is displayed and ON will illuminate on the R STBY PUMP switch/indicator).
   - As the starter is energized, it provides a rotational input to the gear train. The gear train drives the compressor and turbine components, the oil pump and the fuel control unit.
   - When the engine reaches the specified RPM, the ECU permits fuel flow to the fuel nozzle assemblies, and the ignition unit causes the igniter plug to fire and ignite the fuel-air mixture in the combustion chamber.
   - The starter assists acceleration up to the starter cutout speed.

- At approximately 60% RPM, compressor discharge pressure opens the surge control valve, dumping a small percentage of compressor discharge air overboard preventing engine surge.
- As acceleration continues and engine speed reaches approximately 95% RPM plus 4 seconds, the ECU deactivates ignition.
- On the START/STOP switch/indicator, the START light goes off and the green RUN light comes on. On the APU GEN switch, on the electrical control panel, the green AVAIL light comes on (a delay of 3 seconds or less between the RUN light and the AVAIL light coming on is not abnormal). An APU AVAILABLE white CAS will be displayed.

5. APU GEN Switch — ON.
6. APU BLEED Switch — ON.
7. PACK Switch — On.

APU SHUTDOWN

To shut down the APU:

1. APU START/STOP Switch — Press (momentarily) and release. An automatic shutdown sequence is initiated. Verify that the green RUN light goes off and R STBY PUMP white CAS goes out.
2. APU MASTER Switch (after 30-second delay) — Off.
3. BCN/STROBE Switch — OFF.
4. EMER BATT Switch — OFF.
5. L and R BATT Switches — OFF.

APU SHUTDOWN FEATURES (Automatic)

During APU operation, the ECU monitors engine speed, temperature, oil pressure and electrical surge conditions. The ECU contains circuitry which will automatically remove power from the APU's internal fuel solenoid valve and shut down the APU under the following conditions:

- Overspeed
- Electrical surge in ECU driven circuits
- Low oil pressure
- Over temperature
- Failure of EGT thermocouple
- High oil temperature

APU CIRCUIT BREAKERS

All APU circuit breakers are located on the copilot's circuit breaker panel.

CIRCUIT BREAKER	SUPPLIES POWER TO
APU CMPTR	APU Ammeter, APU Electronic Control Unit, APU Fans, APU FIRE PUSH Control, APU Fuel Shutoff Valve, APU Maintenance Control Panel, APU MASTER Switch, Generator Reset Control
APU FIRE DET	APU Fire Detection Circuit
APU FIRE EXT	APU Fire Bottle
APU GEN	APU Generator Control Unit

SECTION III
HYDRAULICS & LANDING GEAR

TABLE OF CONTENTS

SECTION III HYDRAULICS & LANDING GEAR

HYDRAULIC SYSTEM

The aircraft hydraulic system supplies hydraulic pressure for operation of the aircraft landing gear, brake, flap, spoiler/spoileron and thrust reverser systems. Hydraulic fluid flows from the main hydraulic reservoir through two firewall shutoff valves to the main engine-driven hydraulic pumps for distribution to the required systems upon demand.

The hydraulic system has both a main and auxiliary source of hydraulic power. These sources are totally separate up to the source selector valve. An auxiliary dc motor-driven hydraulic pump is installed to provide auxiliary hydraulic pressure to the brake system through the brake source shuttle valve and to the landing gear and flap system through the source selector valve in the event of a malfunction. The auxiliary hydraulic system only provides pressure for the brake system while the aircraft is on the ground.

A 260 cu. in. (4261 cc) reservoir supplies hydraulic fluid to the main and auxiliary hydraulic systems. The reservoir is designed with a separation wall (partition) to contain fluid for either the main or auxiliary system. Reservoir pressure is maintained at approximately 20 psi (138 kPa) by bleed air supplied through a pressure regulator. A bleed air pressure relief valve releases pressure in excess of 20 psi (138 kPa), and a vacuum relief valve prevents negative pressure in the reservoir. A thermal shutoff valve prevents high energy bleed air (>390° F [199° C]) from entering the reservoir in the event of a hydraulic line failure.

The main and auxiliary hydraulic pumps will each maintain a nominal pressure of 3000 psi (20,685 kPa) for their applicable systems. A precharged (1500 psi [10,343 kPa]) hydraulic accumulator is installed to dampen and absorb pressure surges within the main hydraulic system. A separate brake accumulator, fed by the auxiliary system, maintains pressure for the emergency/parking brakes. Two high-pressure filters and two return filters prevent hydraulic fluid contamination within the main and auxiliary systems. These filters incorporate bypass valves which will open in the event they become clogged. A hydraulic pressure relief valve, installed between the high-pressure and return lines in both the main and auxiliary system filters, will open to relieve pressure in excess of 3700 psi (25,511 kPa).

FIREWALL SHUTOFF VALVES

Two motor-driven firewall shutoff valves can stop hydraulic fluid flow to the main engine-driven hydraulic pumps in the event of an emergency or engine fire. These valves will also shut off fuel supply to the engine and close the engine bleed air valves. Each shutoff valve is operated by the corresponding FIRE switch on the pedestal (ENGINE panel). (Refer to Engine Fire Extinguishing System, Section II). The valves operate on 28-vdc supplied through the 3-amp L and R FWSOV circuit breakers located on the pilot's and copilot's circuit breaker panels (ENGINE group), respectively. Loss of power causes the shutoff valves to remain in their last position. The firewall shutoff valves are powered from the hot bus.

SOURCE SELECTOR VALVE

A source selector valve controls the source (main or auxiliary) of hydraulic pressure to the landing gear and flap systems. To initiate the hydraulic cross flow function, the auxiliary hydraulic pump must be running. This is achieved by pressing the AUX PUMP switch (GEAR/HYD panel). Manual activation of the valve during flight is accomplished by depressing the alternate-action push button HYD XFLOW switch (GEAR/HYD panel) which connects the landing gear and flap systems to the auxiliary hydraulic system. The switch will illuminate ON to indicate the valve is energized. If the auxiliary fluid level becomes low, the valve will automatically be deactivated in order to conserve fluid for the brake system.

The following CAS illumination is specific to the source selector valve:

CAS	Color	Description
HYD XFLOW ON	White	Hydraulic crossflow function is selected.

AUX HYD PUMP CONTROL

The auxiliary dc motor-driven hydraulic pump is automatically controlled by landing gear position, and manually controlled by the momentary-action push button AUX HYD switch (GEAR/HYD panel). The ON legend will illuminate when the pump is activated either manually or automatically. Normal auxiliary pump operation is based on the following aircraft configurations:

(1) Pump off when aircraft is powered up.
(2) Manual control prior to gear retraction. AUX HYD switch should be ON during normal taxi and takeoff.
(3) Automatically off when gear is transitioned up.
(4) Manual control in flight.
(5) Automatically ON when gear is transitioned down.
(6) Manual control after gear extension.
(7) Automatically off when aircraft is powered down.

The auxiliary pump operates on 28-vdc supplied from the L ESS bus. Power for the auxiliary pump is provided by the 1-amp PWR circuit breaker located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group [AUX HYD PUMP]). Power for the auxiliary pump control circuit is provided by 2-amp CTRL circuit breaker located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group [AUX HYD PUMP]). Refer to Airplane Flight Manual for hydraulic pump limitations.

The following CAS illumination is specific to the auxiliary hydraulic pump:

CAS	Color	Description
AUX HYD PMP LO	Amber	Auxiliary hydraulic pump is on and pressure is less than 1900 psi.

MAIN/AUXILIARY SYSTEM PRESSURE

The HYD system page on EICAS contains a schematic display of fluid flow in the main and auxiliary hydraulic systems. Main system pressure is sensed by a pressure transducer which provides an analog signal to the EICAS. Pressure is displayed as a digital readout on the HYD system page with a range of 0 to 4000 psi (27,580 kPa) and a display resolution of 10 psi (69 kPa). Low-pressure switches relay information to CAS for low-pressure indications for the left or right side of the main hydraulic system, or in the auxiliary system.

The following CAS illuminations are specific to hydraulic system pressure:

CAS	Color	Description
AUX HYD PMP LO	Amber	Auxiliary hydraulic pump is on and pressure is less than 1900 psi.
MAIN HYD PRESS	Amber	Hydraulic pressure (main system) is not within the acceptable range (either too high or too low).
HYD PUMP LOW	White	Pressure from the associated (L or R) engine-driven hydraulic pump is low.

BRAKE ACCUMULATOR PRESSURE

The brake accumulator provides reserve hydraulic pressure of 3000 psi (20,685 kPa) for emergency brake operation and for parking brake operation. The accumulator is designed to provide at least six emergency brake applications or parking brake pressure for approximately 48 hours. The brake accumulator incorporates a pressure transducer which provides a signal to CAS. The following CAS illumination is specific to the brake accumulator:

CAS	Color	Description
BRK ACUM PRESS	Amber	Emergency brake accumulator pressure is not within the acceptable range (either too high or too low).

HYDRAULIC GROUND SERVICE

The hydraulic system is serviced through a ground service access located below the right engine pylon. A ground service panel within this access monitors hydraulic system condition for the auxiliary dc motor brushes, main/auxiliary system filters, status of the ground service valve, and main/auxiliary reservoir fluid levels. If the BRUSH indicator illuminates, the dc motor brushes are 90% worn (refer to Chapter 29 in the maintenance manual for corrective actions). A ground service switch allows system pressurization by either main or auxiliary pumps. The ground service access also includes quick-disconnect ports for pressure, return and fill lines, and an air bleed valve for the reservoir.

The following CAS illuminations are specific to the hydraulic system:

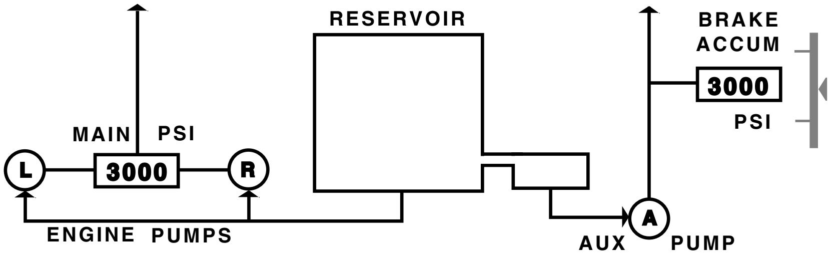
CAS	Color	Description
AUX HYD QTY LO	Amber	Auxiliary hydraulic reservoir quantity is low. Auxiliary hydraulic pressure is not available to operate the landing gear and flaps. Auxiliary hydraulic pressure is still available to the brakes and brake accumulator.
MAIN HYDQTY LO	White	- The fluid level in the hydraulic reservoir (main system) is either low or overfull. or - One or more of the hydraulic system (main or auxiliary) filters is becoming clogged.

HYDRAULIC SYSTEM PAGE

The HYD system page can be selected for display from the System Page Menu. This page includes a system schematic that presents both a graphic and a digital display of system pressures, quantities and faults.

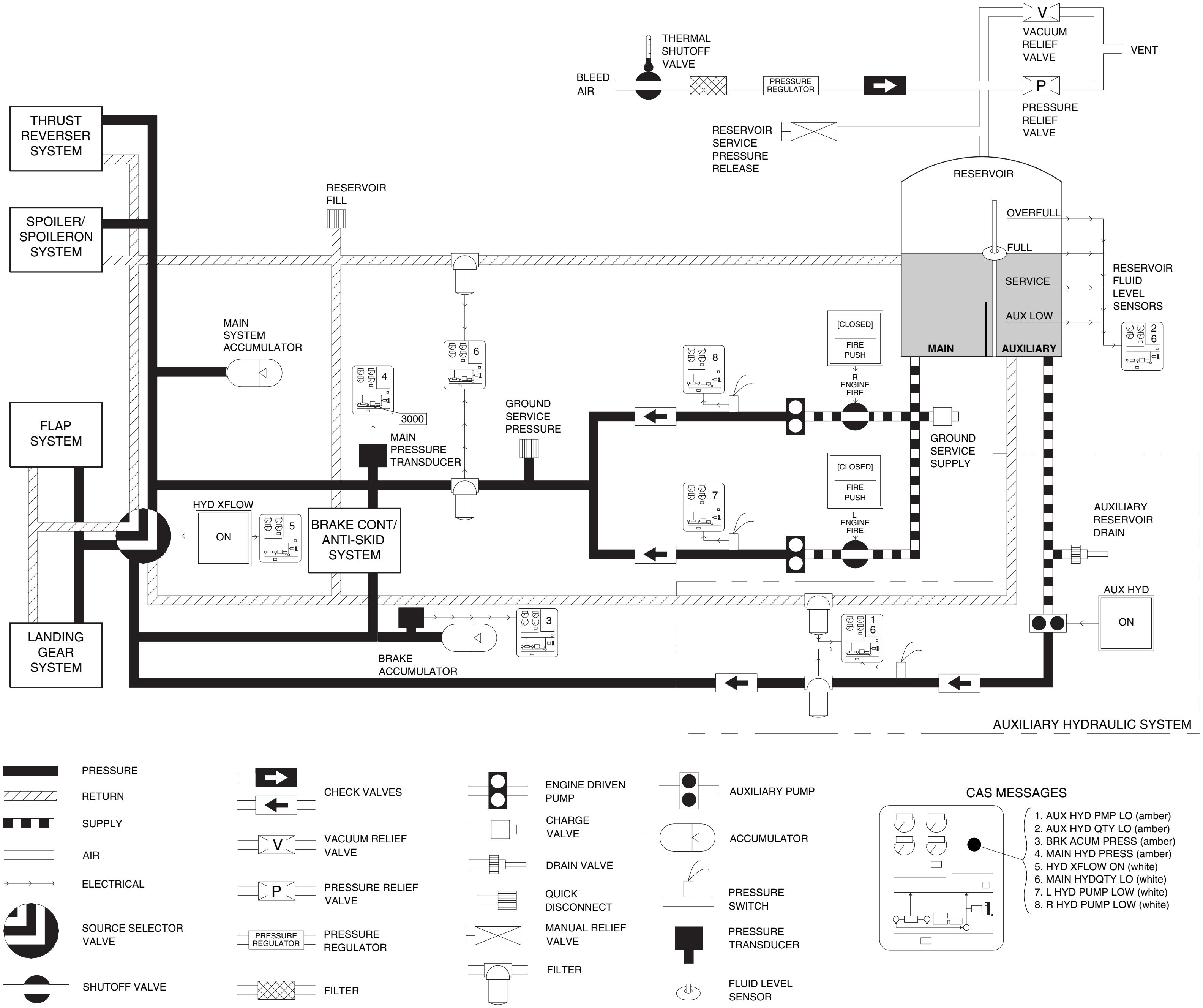
These indications include a digital readout of main hydraulic system pressure, a digital and analog indication of brake accumulator pressure, and a LOW indication for the auxiliary reservoir fluid level. These indications will change color when operating limits are exceeded.

A circled L, R, and A on the HYD page schematic represent the three hydraulic pumps. These pump symbols will turn amber if the corresponding pump output pressure switch in the hydraulic manifold does not detect normal output pressure.



HYD SYSTEM PAGE
Figure 3-1

INTENTIONALLY LEFT BLANK



HYDRAULIC SYSTEM SCHEMATIC
Figure 3-2

LANDING GEAR SYSTEM

The landing gear is hydraulically retractable, tricycle gear with air-hydraulic shock strut-type nose and main gear. The main gear struts are of a trailing-link design. The main gear has dual wheels and brakes on each strut. Each main gear wheel is equipped with three fusible plugs which will melt and release tire pressure in the event wheel temperature reaches 390° F (199° C). The brake system incorporates four hydraulically-actuated multi-disc carbon brakes with an integral anti-skid system. The nose gear utilizes a chined tire to prevent splashing into the engine inlet. Nose wheel steering is electrically powered and controlled by the nose wheel steering controller. Hydraulic pressure for gear retraction and extension is transmitted by a system of tubing, hoses, and actuating cylinders, and is electrically controlled by switches, relays, and solenoid valves. Emergency extension can be accomplished by mechanical landing gear "free-fall" in case of hydraulic or electrical system failure. Two doors enclose each main gear after retraction. The inboard doors are hydraulically operated and the outboard doors are mechanically operated by linkage connected to the main gear struts. The nose gear doors operate mechanically with linkage attached to the nose gear shock strut.

LANDING GEAR CONTROL SWITCH

The Landing Gear Control switch (GEAR/HYD panel) is a lever-lock type switch and must be pulled aft before selecting the UP or DN position. The switch controls the position of the gear selector valve and the door selector valve through gear and door position-sensing switches. Electrical power for the control circuits is 28-vdc supplied through the 3-amp GEAR circuit breaker on the pilot's circuit breaker panel (GEAR/HAYDRAULICS group). The landing gear control circuits are powered from the EMER BATT.

Landing gear retraction cycle: When the Landing Gear Control switch is placed in the UP position and the main gear weight-on-wheels switches are in the air mode, the following sequence of events will occur:

1. 28-vdc will be applied to the "open" solenoid of the door selector valve and hydraulic pressure will be applied to both inboard main gear door actuators and the inboard door uplocks.

2. When the inboard main gear doors open, door open switches will complete a circuit from the Landing Gear Control switch to the "up" solenoid of the gear selector valve. Hydraulic pressure will be applied to the main and nose gear actuators and the gear will retract.

3. When the main gear retract, gear up switches will complete a circuit from the Landing Gear Control switch to the "close" solenoid of the door selector valves. Hydraulic pressure will be applied to the inboard main gear door actuators to raise the gear doors. Pressure will remain on the main gear actuators until the doors are in the locked position.

4. The gear doors are locked into position by a hook/roller locking mechanism.

The normal retraction cycle takes approximately 11 seconds to complete with one or two main pumps. The auxiliary pump cycle will take about 18 seconds to complete.

Landing gear extension cycle: When the Landing Gear Control switch is placed in the DN position the following sequence of events will occur:

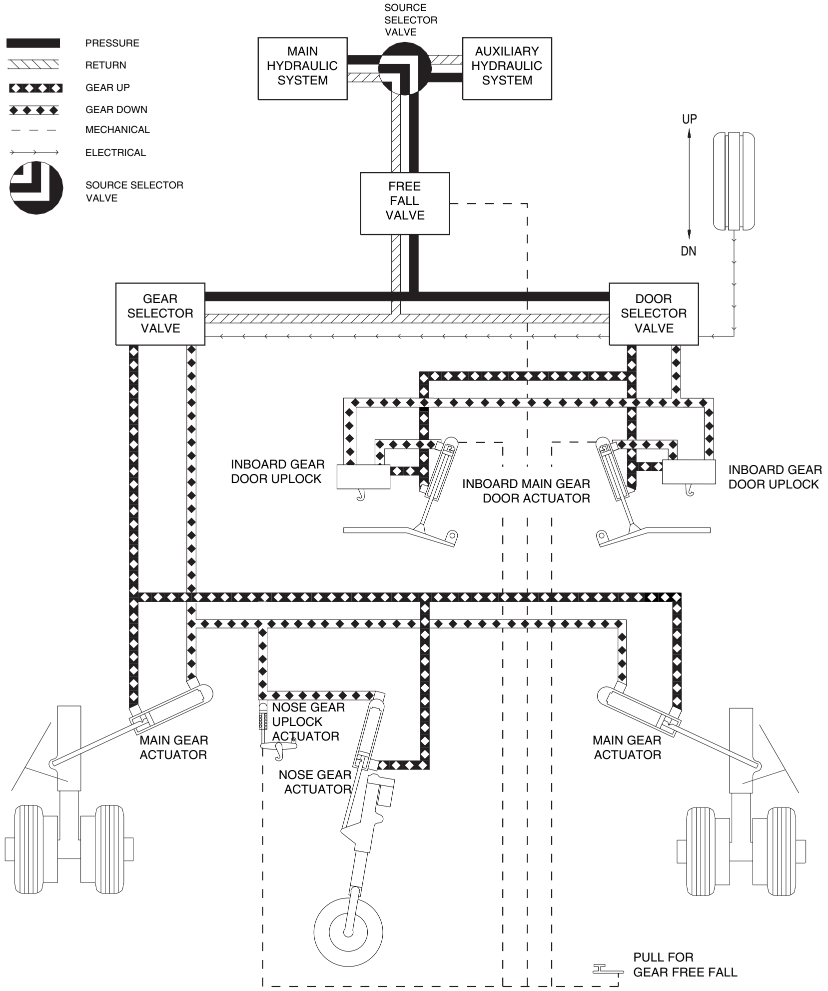
1. 28-vdc will be applied to the "open" solenoid of the door selector valve and hydraulic pressure will be applied to both inboard main gear door uplock actuators. Simultaneously, pressure is applied to the gear up actuator to hold gear in up position while main landing gear inboard doors open.

2. When the main gear doors open, door open switches will complete a circuit from the Landing Gear Control switch to the "down" solenoid of the gear selector valve. Hydraulic pressure will simultaneously be applied to release the nose gear uplock, apply pressure to the main and nose gear actuators, and extend all three landing gear.

3. When the main gear are full down, gear down switches will complete a circuit from the Landing Gear Control switch to the "close" solenoid of the door selector valve. Hydraulic pressure will be applied to the inboard main gear door actuators to raise the gear doors.

4. The main gear doors are locked into the retracted position by a hook/roller locking mechanism.

The normal extension cycle takes approximately 11 seconds to complete with one or two main pumps. The auxiliary pump cycle will take about 35 seconds to complete.



LANDING GEAR EXTENSION/RETRACTION SCHEMATIC
Figure 3-3

LANDING GEAR POSITION LIGHTS

The landing gear position lights, consisting of three Advisory/DOWN lights arranged in a triangular pattern, are located on the panel GEAR/HYD panel. The Advisory portion of each light is white in color with a black hash background and equipped with dual bulbs. The DOWN portion of each light is green in color and is also equipped with dual bulbs.

The location of each light in the triangular arrangement corresponds to the location of the gear on the aircraft. A white/hash (advisory) indication signifies that the corresponding gear position does not agree with the position of the Landing Gear Control switch, or that the inboard door is not up and locked. A DOWN (green) indication signifies the corresponding gear is down and locked.

During the gear retraction sequence, the three Advisory lights will illuminate when the sequence is initiated, remain illuminated throughout the retraction cycle, and then extinguish when the nose gear is up and locked, and the main gear inboard doors close.

During the gear extension sequence, the three Advisory lights will illuminate when the sequence is initiated, remain illuminated throughout the extension cycle, and then extinguish when the nose gear is down and locked and the main gear inboard doors close.

The lights are operated by the same switches that control the landing gear extension and retraction cycles. The lights are dimmed when the navigation lights are on, and may be tested at any time by setting the SYSTEM TEST switch to the GEAR position and depressing.

The landing gear position indicator lights operate on 5-vdc provided by the lighting control unit. The position indicator lights are powered by the EMER BATT. In the event of a complete dc electrical failure, the landing gear position lights will be powered by the emergency power system when the EMER BATT switch is in the ON position.

LANDING GEAR WARNING SYSTEM

Landing gear indications are installed to alert the operator of potentially unsafe flight conditions with the landing gear retracted or in transition. The system provides outputs to the CAS and CWP which activate aural and visual annunciation during such conditions. Depending upon the flight condition encountered, a distinct warning or caution will be indicated.

Gear Warning Indications

- **Master Warning Light Illuminated**
- **Aural Warning Master Warning Tone and Voice Message, "GEAR . . . GEAR . . . GEAR".**
- **GEAR red CWP**
- **GEAR red CAS**

The aforementioned warning indications will be activated by either of the following conditions:

- One or more landing gear are not down and locked, and flaps lowered beyond 25°.
- One or more landing gear are not down and locked, both thrust levers are set less than MCR, and radio altimeter (valid) is less than 500 feet.

The "GEAR" warning function cannot be muted.

Gear Caution Indications

- **Master Caution Light Illuminated**
- **Aural Caution Master Caution Tone and Voice Message, "GEAR . . . GEAR . . . GEAR".**
- **GEAR amber CAS**

The aforementioned caution indications will be activated by either of the following conditions:

- One or more landing gear are not down and locked, both thrust levers are set less than 70%, airspeed is below approximately 170 KIAS, altitude is below approximately 14,500 feet, and radio altimeter is invalid.
- One or more landing gear are in transition, or either main gear door is not up and locked, and airspeed is 210 KIAS or above.

The "GEAR" caution function can be muted by depressing either the Master Caution light on the glareshield or the Mute switch on the right thrust lever handle.

The following CAS illuminations are specific to the landing gear warning system:

CAS	Color	Description
GEAR	Red	The landing gear is not down and locked and other conditions indicate a landing is imminent.
GEAR	Amber	• The landing gear is not down and locked and other conditions indicate the flight is transitioning into the landing phase. or • The landing gear is being operated with an airspeed in excess of the maximum landing gear operating speed.

LANDING GEAR FREE FALL

In the event of a main/auxiliary hydraulic system failure or an electrical system malfunction, the landing gear can be extended using gravity to allow the gear to "free fall". Whenever free fall gear extension is to be accomplished, the Landing Gear Control switch should be placed in the DN position and the GEAR circuit breaker on the copilot's circuit breaker panel should be pulled after gear extension. This will prevent inadvertent gear retraction in the event electrical power to the system is regained.

Landing gear free fall extension is activated by the GEAR FREE FALL lever located on the copilot side of the forward pedestal. Pushing this lever mechanically unlocks the uplock actuators of the nose gear and main gear doors. This action also actuates an emergency valve allowing the hydraulic pressure and return lines of the door selector and gear selector valves to connect; thus, isolating them from the main and auxiliary hydraulic systems. Hydraulic resistance is minimized and the landing gear "free fall" to the extended and locked position. All three Advisory lights illuminate when gear control switches are placed in the down position. Each gear down light illuminates as the respective gear is down and locked. The main gear door Advisory lights will remain illuminated since the inboard doors are still extended.

NOSE WHEEL STEERING SYSTEM

The nose wheel steering system is controlled by the nose wheel steering computer. This steer-by-wire system receives pilot and copilot inputs through two rudder pedal position sensors and two dual pedal force sensors. A steering command based upon pedal position and force, nose strut position, and aircraft speed is calculated by the computer. This command is relayed to a dc motor which positions the nose wheel via a nose wheel strut gearbox.

The nose wheel steering system is powered by 28-vdc through the 25-amp MOTOR and 2-amp CMPTR circuit breakers located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group [NOSE STEER]). Arming of the system is initiated by depressing the momentary-action NOSE STEER switch (GEAR/HYD panel). The NOSE STEER switch will illuminate ON when the following conditions occur:

- Both system dc power sources are on and available to the computer.
- The nose gear is down and locked.
- No system faults or failures are detected.
- Main gear and nose gear weight-on-wheels switches are in the ground mode.

Once the system is armed, computer steering commands will be transmitted to the nose wheel during ground operation.

For low speed ground operations, 60° of steering authority either side of center is available. At low speed and large rudder pedal deflection, the nose wheel displacement will be large for high maneuverability. Once a rudder pedal has reached its stop, further nose wheel displacement is generated by additional force being applied to that rudder pedal. As ground speed increases, the maximum wheel deflection is reduced to zero. The nose wheel steering system remains active through liftoff.

The NOSE STEER switch will illuminate ON when the system is armed. When the nose gear is no longer in the down and locked position, the ON annunciator on the NOSE STEER switch will extinguish; however, the computer is still powered and system monitor circuitry remains active.

For landing, the nose wheel steering system becomes active only after all weight-on-wheels switches are in the ground mode. The ON annunciator on the NOSE STEER switch will illuminate provided no faults have been detected. The nose wheel steering system has a fade-in feature that allows several seconds to transition from rudder steering to nose wheel steering, to avoid an initial oversteer condition.

The nose wheel steering system can be disarmed at anytime by depressing the NOSE STEER switch, or either Control Wheel Master (MSW) switch during ground operations.

NOSE STEER SWITCH

The NOSE STEER switch is used to activate nose steering circuits for taxi operations. Momentarily depressing the NOSE STEER switch will activate the system and the ON annunciator will illuminate. When nose steering has been activated, the system can be disengaged by depressing either the pilot's or copilot's MSW or by depressing the NOSE STEER switch a second time. A disconnect tone will sound.

The following CAS illuminations are specific to the nose steering system:

CAS	Color	Description
NWS FAIL	Amber	The nose wheel steering system has failed.
NWS FAULT	White	A fault is detected in the nose wheel steering system. The system will operate in degraded mode.

WHEEL BRAKE CONTROL /ANTI-SKID SYSTEM

The wheel brake control /anti-skid system is a brake-by-wire system that electronically controls hydraulic brake pressure. The system is designed to maximize braking efficiency and reduce tire wear by modulating brake pressure to each of the four wheels at the time of an impending skid. Major components of the system include: a brake control unit, four wheel-speed transducers, two hydraulic shutoff valves, four two-channel pedal transducers, five hydraulic fuses, a pressure switch, an emergency/parking brake valve assembly, an emergency/ parking brake accumulator, four brake control valves, four brake pressure transducers, four brake shuttle valves, a source shuttle valve, and four brake assemblies.

The brake control unit is divided into two independent channels for the inboard and outboard wheels. Each channel applies brake pressure commands to the respective left or right brake control valves. The brake control valves regulate actual brake pressure to each corresponding brake. Brake pressure commands from the brake control unit are determined from the combination of pilot/copilot pedal commands, and anti-skid, locked-wheel protection and touchdown protection functions. Hydraulic fuses, located in the main gear wheel wells, will close to prevent pressure loss if fluid flow exceeds normal brake actuation rate.

Power is supplied by 28-vdc provided through the 3-amp INBD BRAKES circuit breaker located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group) and the 3-amp OUTBD BRAKES circuit breaker located on the copilot's circuit breaker panel (GEAR/HYD group). The wheel brake control /anti-skid system is active whenever power is present on the right essential bus and the emergency battery bus, the circuit breakers are engaged, and hydraulic pressure is present at the source shuttle valve.

TOUCHDOWN PROTECTION

Braking is enabled after touchdown when wheel spin-up is achieved (≥50 knots) or after the main gear weight-on-wheels switches are in the ground mode and time-out has elapsed. This prevents landing with the brakes engaged and allows spin-up time for traction to be established. The time-out function is a safety feature in the event of a wheel-speed transducer failure. Locked-wheel protection is provided by the brake control unit so that brake pressure is removed from a wheel if that wheel's velocity is less than or equal to 30% of the velocity of the fastest wheel. Removal of brake pressure from the slow wheel allows traction to be re-established.

The following CAS illuminations are specific to the brake system:

CAS	Color	Description
NORM BRK FAIL	Red	All four brakes (normal system) have failed.
CPLT BRK FAULT	Amber	One or more of the copilot's brake LVDTs has failed.
INBD BRK FAIL	Amber	The associated (L and/or R) inboard brake (normal system) has failed.
OUTBD BRK FAIL	Amber	The associated (L and/or R) outboard brake (normal system) has failed.
PLT BRK FAULT	Amber	One or more of the pilot's brake LVDTs has failed.
BRAKE FAULT	White	A minor brake system fault is detected. Minor faults will not significantly degrade brake performance. Reduced performance may be experienced during maximum braking.

EMERGENCY/PARKING BRAKE

The emergency/parking brake component of the brake system utilizes the emergency/parking brake valve assembly, emergency/parking brake accumulator. An EMERGENCY/PARKING BRAKE handle and cable system is used to apply emergency braking or to set the parking brakes. Emergency braking works independently of the main braking system and the brake accumulator is charged from the auxiliary hydraulic system.The EMERGENCY/PARKING BRAKE handle is located on the pedestal below the thrust levers. The handle is mechanically connected to the emergency/parking brake valve assembly. A switch within this assembly senses on/off condition and provides the signal for illumination of the EMER/PARK BRK red and white CAS. The parking brake is engaged by pulling the EMERGENCY/PARKING BRAKE handle and rotating clockwise or counterclockwise to the locking position. Rotating back to center position and releasing park brake handle disengages the parking brake. Emergency braking is controlled by pulling the EMERGENCY/PARKING BRAKE handle with a force proportional to the amount of emergency braking desired. Releasing the handle to the off position will disengage the emergency brake.

The following CAS illuminations are specific to the EMERGENCY/PARKING BRAKE system:

CAS	Color	Description
EMER/PARK BRK	Red	Parking brake valve (lever) is not fully released and thrust levers are advanced to MCR or above.
EMER/PARK BRK	White	Parking brake valve (lever) is not fully released.

ANTI-SKID SWITCH

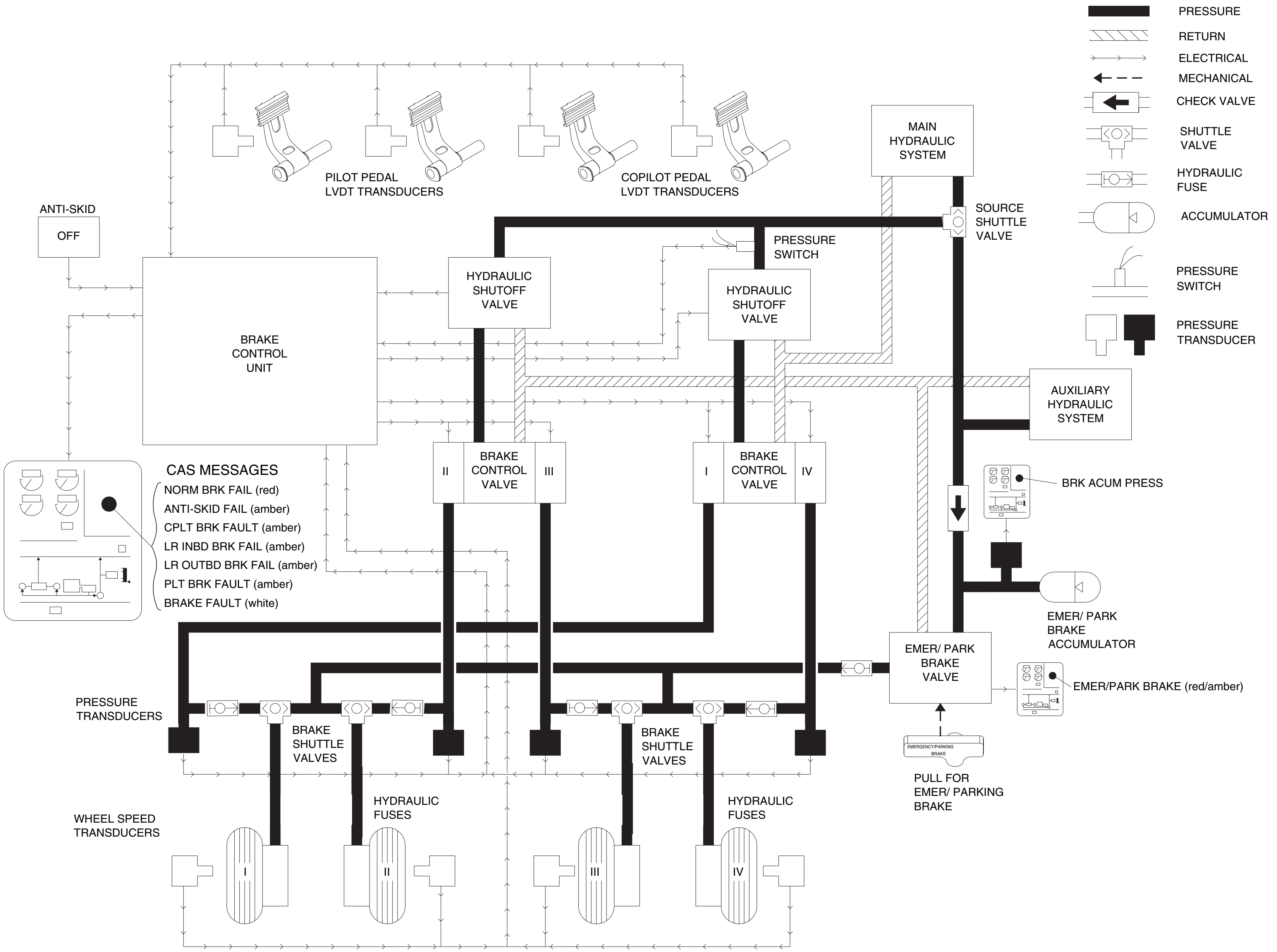
The anti-skid function can be disabled by depressing the ANTI-SKID switch (GEAR/HYD panel). This alternate-action switch will illuminate OFF to indicate the anti-skid function is disabled. The switch indicator lamps can be tested by placing the SYSTEM TEST switch in the LTS position and depressing.

The following CAS illumination is specific to the anti-skid system:

CAS	Color	Description
ANTI-SKID FAIL	Amber	Failure of anti-skid function to one or more brakes, or ANTI-SKID switch is OFF.

.

INTENTIONALLY LEFT BLANK



WHEEL BRAKE CONTROL/ANTI-SKID
SYSTEM SCHEMATIC
Figure 3-4

SECTION IV
ELECTRICAL & LIGHTING

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

SECTION IV
ELECTRICAL & LIGHTING

ELECTRICAL POWER SYSTEMS

INTRODUCTION

Primary dc electrical power is provided by two engine-driven starter/ generator units supplying 28-vdc power to a split bus electrical system. The generators are limited to 300 amps. An automatic electrical load shedding system has been incorporated to prevent generator overloading and prolong battery duration in the event of a single or dual generator failure. Secondary dc electrical power is supplied by two main airplane batteries that will power essential avionics, communication and instrumentation. A single emergency battery is provided to power standby equipment in case of airplane electrical system failure and to power certain equipment that must remain powered during engine start.

A ground power unit can provide electrical power for system operation prior to engine start, to assist in engine start and to charge airplane batteries. Additionally, an optional APU may be installed to provide for systems operation on the ground and for engine start.

The ac electrical power is provided by two engine-driven alternators for the sole purpose of powering the windshield ice and fog protection system. The alternators are rated at 200-vac, 200-400 Hz, 5kva.

GENERAL

The electrical system incorporates a split, multiple bus system for power distribution interconnected by contactors, fuses, and circuit breakers which react automatically to isolate a malfunctioning circuit. Manual isolation is also possible by turning off power to an affected bus via the electrical control panel or by opening the appropriate circuit breakers.

In the event of a dual generator failure, the main airplane batteries may be used to power the essential, essential avionics and hot bus components for a limited period of time. An emergency battery is also provided to operate equipment connected to the emergency battery bus and emergency hot bus.

It is possible to power the dc electrical systems from the airplane batteries, engine driven generators, a Ground Power Unit (GPU) or an auxiliary power unit (APU), if installed.

MAIN BATTERIES

Two main electrical system batteries are located, one above the other, in the tailcone. The upper battery is connected to the left generator bus when selected On via the L BATT switch and the lower battery is connected to the right generator bus when selected On via the R BATT switch. The main batteries provide a source of electrical power for engine starting and for emergency operation in the event of dual generator failure. They also provide power to three hot buses and two emergency hot buses even when the batteries are selected off.

The standard batteries installed are 24-vdc nickel-cadmium (NICAD) rated at 27-amp-hours. Optional 38-amp-hours NICAD batteries or 28-amp-hour lead-acid batteries may also be installed.

Gases produced by the main batteries are vented overboard through two tubes. The end of the tubes are cut at an angle so that one tube takes air in and the other exhausts the gases from the battery cases.

Electrical power from each battery is used to close the corresponding battery contactor when the L and R BATT switches are selected On. When the battery contactors are closed, the main batteries are connected to the respective generator bus. When the airplane is on the ground, the battery contactors are controlled by voltage sensors to prevent discharge below 14 volts. If a battery is below 14 volts, the contactor will not close when the BATT switch is selected On. If the battery voltage falls below 14 volts for more than 10 seconds while on the ground, the contactor will open. Battery depletion protection is inhibited when airborne and during engine starting on the ground. If the batteries are above 14 volts, they can be connected and recharged from a GPU, APU or aircraft generator.

Individual battery voltages can be read on the SUMRY or ELEC schematic displays which are selectable on the EICAS or MFD display units.

Battery temperature monitoring and overtemperature warning for NICAD batteries are provided via the EICAS/MFD displays and the Crew Warning Panel (CWP). The above is described further under ELECTRICAL SYSTEM INDICATORS in this section and under BATTERY OVERHEAT.

In the event of a dual generator failure, the aircraft batteries, in conjunction with the emergency battery, will provide power for the necessary essential equipment for a limited duration. For more information, see DUAL GENERATOR FAILURE in this section.

EMERGENCY BATTERY

The emergency battery installed is one 24-vdc lead-acid battery located in the nose section of the airplane. The emergency battery is connected to the emergency battery bus when selected On, but only provides power to that bus when the electrical system is not being powered by a GPU, APU or airplane generator. The emergency battery also provides power to both emergency hot buses even with the emergency battery selected OFF. The emergency battery provides power to the emergency battery bus in the event of a dual generator failure or an inflight electrical fire. The installation also enables the essential and essential avionics buses to be powered by the emergency battery in isolation from the main system during the engine start sequence, thus preventing problems caused by engine start voltage fluctuations. This is described further under DISTRIBUTION in this section.

The emergency battery is charged by the airplane electrical system and provides power to the emergency bus for a limited time if the airplane dc generators fail. See DUAL GENERATOR FAILURE in this section for more information.

A shunt, located between the emergency battery and the emergency battery contactor allows for monitoring of battery recharge and discharge current. If the emergency battery is selected to On and a battery discharge current is sensed by the shunt, the white EMER caption on the EMER BATT switch will illuminate, indicating emergency battery discharge. A white EMER BATT annunciator on the

CWP will also illuminate for this condition. Battery charging from the airplane generators precludes these indications under normal operation. The emergency battery has the same battery depletion protection on the ground as the main batteries.

The shunt also monitors emergency battery charging. If it exceeds 10 amps for 1 minute, an amber EMER BATT LOW will be displayed on the CAS alerting the crew to an emergency battery recharging condition.

The emergency battery voltage can be checked by observing the EMER-V or EMER BUS VOLTS on the EICAS/MFD SUMRY or ELEC systems schematic displays prior to applying GPU, APU or airplane generator power to the electrical system.

Eleven different components are connected directly to the emergency battery bus and will be available when that bus is being powered by the emergency battery, aircraft generator, GPU or APU. Main airplane batteries alone will not power the emergency battery bus because the isolation contactors will both be open if both generators are off-line.

The EMER BATT is selected On before engine start and remains on throughout the flight. When the EMER BATT switch on the electrical control panel is depressed, current from the emergency battery closes the emergency battery contactor and the OFF indication on the switch extinguishes.

When the emergency battery is selected OFF, the contactor will open and the OFF indication on the switch will illuminate, assuming at least one essential bus is still powered by another power source.

GENERATORS

Two engine-driven starter/generators, one on each engine accessory section, provide the normal source of 28-vdc power to the airplane. Each starter/generator is equipped with a "quick attach/detach" mounting to facilitate maintenance. Unless a GPU is powering the airplane electrical system, the generator will automatically come on line when the DEEC determines the engine is up to speed (approximately 95% of N_1 idle). If a GPU is used for engine start, the generators will automatically come on line after the engines are running when the GPU is disconnected, or when the EXT PWR switch on the electrical control panel is depressed, changing the annunciation from ON to AVAIL.

In flight, cooling air is routed from a scoop on the associated engine nacelle to the starter/generator. Cooling while on the ground is provided by a fan mounted on the generator shaft.

During normal operation, both generators operate independently unless the bus tie is closed. When both generators are on line, the bus-tie will normally be open and the left generator will recharge the left main battery and the right generator will recharge the right main battery and the emergency battery. If the bus-tie is closed, both generators will recharge the main batteries and the emergency battery. The generators supply dc power to all dc powered equipment on the airplane under normal conditions.

GENERATOR CONTROL UNITS

Left and right Generator Control Units (GCUs) are provided to monitor and control the engine driven starter/generators. They regulate the voltage of the generators to approximately 28-vdc and limit the output on the ground and for in-flight cross starting. The GCUs will automatically disconnect the generators from the electrical system if a generator malfunction is detected. If the generator fault was momentary or has cleared, generator operation may be restored by depressing the generator switch for one second. If the fault has cleared, this will reset the field relay allowing the generator to be energized and the line contactor to close. The field flashing relay and associated circuitry ensures that the generator can be built up from residual voltage without any other power source required. The GCUs also provide several engine starting functions.

GCU functions are as follows:

VOLTAGE REGULATION — To maintain a preset constant voltage at the generator output terminal, the GCU controls the shunt field current when the generator is rotating within its normal speed range. With both generators on line, the GCUs also perform a paralleling function in the unlikely event of an inadvertent bus-tie condition between the generator buses.

GENERATOR CURRENT LIMITING — When activated by a main gear weight-on-wheels switch/starter selection, the generator output is restricted by appropriate suppression of generator voltage. This action prevents excessive generator heating when charging depleted batteries and when assisting opposite engine starting.

AUTOMATIC STARTER CUTOFF — As the engine start cycle progresses, the starter/generator shunt field is weakened to enhance torque performance. At 50% N2, the start cycle is terminated automatically when starter cutoff speed is sensed by a magnetic pickup in the starter. This is a back-up starter cutoff to the normal cutoff at 50% N2 input to the GCU from the DEEC.

LINE CONTACTOR CONTROL — In the generating mode, power is automatically provided to the line contactor in order to connect the generator to the generator bus when the output voltage is at an adequate level. During an engine shutdown, as the generator runs down, reverse current is sensed and signals the line contactor to open, disconnecting the starter/generator from its bus.

OVERVOLTAGE PROTECTION — In the event of a failure of normal voltage regulation, and with due allowances for surges and transients, an independent circuit causes the line contactor to open, disconnecting the starter/generator from the generator bus if the voltage exceeds approximately 32 volts.

OVERSPEED (RUNAWAY) PROTECTION — Should a starter shaft shear during the starting mode, the starter/generator is de-energized as the speed passes the starter/cutoff point, preventing further damage by the overspeed condition. It is the starter speed, rather than engine speed that is sensed to provide this function.

STARTER ABORT OPERATION — If during a start cycle, the corresponding thrust lever is selected to CUTOFF, the starter will automatically disengage.

UNDERVOLTAGE PROTECTION — Should voltage regulation fail, causing a generator undervoltage condition (less than 10 volts for 5 seconds), the generator will disconnect from the system by de-energizing the field relay, causing the line contactor to open.

DIFFERENTIAL CURRENT PROTECTION — Should the output current at the generator differ significantly from the sensed load within the power distribution panel (due to a generator feeder line fault) the generator will be deenergized and disconnected from the system by the differential current protection circuit.

GROUND POWER UNIT (GPU)

Ground power can be connected to the airplane through a receptacle located on the lower left side of the fuselage just aft of the tailcone baggage door. The anti-flash contactor that connects the output of the GPU to the aircraft electrical system will only close if the voltage and polarity are within acceptable limits. The acceptable voltage limits are approximately 24 to 32 volts. The GPU should be regulated to 28-vdc and limited to 1,500 amps.

The EXT PWR switch is located on the cockpit electrical control panel . The green AVAIL caption on the EXT PWR switch will illuminate if the plugged-in GPU is within acceptable parameters. Depressing the EXT PWR switch when the green AVAIL light is illuminated will close the GPU anti-flash contactor, connecting the GPU output to the left generator bus. The ON caption will illuminate and the green AVAIL caption will extinguish. The GPU may be deselected with the same switch.

The bus-tie contactor automatically closes when a GPU is connected to the airplane electrical system. The entire dc system is powered, assuming the AV MSTR and BATT switches are on and no buses have been deselected via the electrical control panel.

Neither the airplane generators nor the APU will come on line with the GPU selected ON; and if they are on when the GPU is selected, they will drop off line. Airplane generators will automatically come on line after engine start, but not if the GPU is selected ON. The aircraft main batteries do not have to be on to close the GPU anti-flash contactor; however, only the bus-tie and non-essential bus contactors will close if neither battery is selected On. In this case GPU power would only be available to the left and right generator buses, the left and right non-essential buses, and the hot buses.

GPU output voltage is indicated on the EICAS/MFD SUMRY page and on the ELEC system schematic under "L/R ESS VOLTS." The EMER BUS VOLTS will also show GPU voltage. No indication of amps drawn from the GPU is provided.

The CAS will provide an EXTERNAL POWER message when an external power cable is connected and EXT PWR will also be annunciated on the EICAS/MFD ELEC system schematic. These indications will appear whenever a GPU cable is connected to the airplane, and a voltage of greater than 5 volts is sensed by the power monitor. It is not an indication that the GPU meets acceptable parameters nor does it indicate that the GPU is powering the airplane electrical system.

Operation of the EXT PWR switch on the electrical control panel is also described under ELECTRICAL SWITCHES in this section.

AUXILIARY POWER UNIT (APU)

The optional APU generator can provide the same service as an airplane engine generator and can be operated in conjunction with one or both airplane generators. The APU is only certified for ground use. After starting the APU using the APU control panel on the center pedestal, the green APU RUN annunciator on the APU control panel will illuminate and at the same time, the green AVAIL caption on the APU GEN switch, located on the electrical control panel, will also illuminate. After depressing the APU GEN switch on the electrical control panel, the ON caption will illuminate and the AVAIL caption will extinguish to indicate that the APU contactor has closed, connecting the APU generator output to the right generator bus. The APU GEN switch is also used to reset the APU generator when a failure has been detected and cleared. Operation may be restored by depressing the APU GEN switch for one second. If the AVAIL caption illuminates, depressing the switch again will bring the generator on line.

The bus-tie contactor automatically closes with the APU generator on line. A GPU and APU generator cannot provide airplane electrical power simultaneously. The APU generator will automatically drop off line if the GPU is selected on line.

The following CAS illuminations are specific to the APU generator:

CAS	Color	Description
APU AMPS HIGH	Amber	APU generator amperage exceeds upper limit.
APU AVAILABLE	White	APU is operating and available for bleed air and electrical power.

ELECTRICAL CONTROL PANEL

The dc power system electrical control panel is designed to provide ease of operation and dark cockpit integration. The automatic load shedding design for operation with single or dual generator failure relieves the pilot of manual deselection of electrical buses to prevent an overload. The control panel reflects and displays batteries, generators, or buses that have been isolated (automatically shed) in the event of a fault. The pilot has a manual override option of selecting, recycling or deselecting some of the buses on the dc system. During engine start, the generator autostart feature reduces engine start switch selections and pilot workload.

The electrical control panel consists of an illuminated panel with 13 (14 when an APU is installed) switches. Each switch incorporates lighted captions showing system status (i.e. OFF/ON). All captions have white letters on a black background except for AVAIL on the GPU and APU switches, which are green on a black background. For normal flight conditions, none of the switch captions should be illuminated.

ELECTRICAL SWITCHES

Following is a description of the switches on the electrical control panel:

L/R BATT — The battery switches are momentary action switches. If the aircraft electrical system is powered (one BATT, EXT PWR, APU GEN or GEN on), the OFF caption will be illuminated in the L/R BATT switch whenever the corresponding battery contactor is open. If the battery meets satisfactory voltage and temperature conditions, the OFF caption will extinguish when the switch is momentarily depressed and the battery contactor will close, connecting the battery to the respective generator bus. The switch will be blank when the battery is on. It will also be dark (with no OFF annunciations illuminated) when there is no electrical power applied to the airplane even though the contactor would be open in this case. The battery contactor will open and the OFF caption will illuminate if the battery switch is depressed a second time or if the battery is automatically turned off due to an overheat or an undervoltage condition.

BUS-TIE — Normal automatic operation of this momentary action switch displays a horizontal bar when the generator buses are tied and no indication will be illuminated when the buses are split. Automatic bus-tie operation is described under DISTRIBUTION in this section.

If required, this switch may be depressed to manually override an automatic bus-tie operation to provide a split system or to tie the electrical system together. One exception is that it cannot be used to open the bus-tie when it has been closed automatically due to GPU operation. The bus-tie manual selection may also be used, in accordance with AFM procedures, to close the bus-tie if it fails to automatically close within five seconds after an inflight generator failure. When the bus-tie switch is depressed, a MAN (manual) caption is illuminated to show that the automatic operation is disabled and the bus-tie will be held in the existing position until deselected by the crew. The CAS also provides a BUS TIE CLSD and BUS TIE MANUAL message.

EXT PWR — The external power switch is a momentary action switch. The green AVAIL caption will illuminate only when a supply of correct voltage and polarity is sensed on a connected GPU. When the EXT PWR switch is pressed to provide external power to the aircraft, AVAIL extinguishes and the white ON is illuminated. The ON caption indicates that the contactor is closed, connecting the GPU to the left generator bus.

APU GEN—The APU GEN switch is a momentary action switch. The green "AVAIL" illuminates when the APU generator is in generating mode and ready to be connected to the aircraft electrical system. When pressed, the AVAIL caption extinguishes and the white "ON" is illuminated. If the switch is depressed again, ON is extinguished and AVAIL is re-illuminated until the APU falls below 92% normal running rpm.

L/R GEN—These are momentary action switches. Normal generator operation is automatic and the OFF indication changes with the on/off-line operation of the generator. If a battery or APU engine start is made, the generator will automatically come on line after start and the OFF caption will extinguish. If the start is made with GPU power connected, the generators will not come on line until the GPU is deselected or disconnected. With the generator on line, the pilot may select to override the automatic operation and select it off line by pressing the generator switch. Depressing the switch when the generator is off line also initiates a reset signal to the GCU which eliminates the need for a separate momentary generator reset switch.

If a generator trips off line, the switch displays OFF and the CAS displays an amber L or R GEN FAIL message. In accordance with AFM procedures, the GEN switch should be depressed once to attempt a reset. If the generator does not reset, the switch again illuminates OFF. If both generators are off or failed, a red L R GEN FAIL message will be displayed by the CAS and a red GEN FAIL annunciator on the CWP will also illuminate. The L R GEN FAIL messages on the CAS will not display if the corresponding thrust lever(s) is/are in the cutoff position; instead a white L R ENG SHUTDOWN collector message will be displayed.

L/R NON-ESS & L/R MAIN — These momentary action switches are only depressed if the crew needs to override the automatic operation of these buses during generator failure. The OFF indication changes automatically to indicate bus condition. Selection of the switch in normal operation (both generators on line) will isolate the corresponding bus and display OFF. Reselection resumes normal operation. The non-essential buses will automatically be OFF whenever the electrical system is being powered strictly by battery power and also in flight if one generator fails. The main and non-essential buses will automatically be shed in-flight if both generators have failed.

L/R AV MSTR — These switches are alternate action and allow the crew to connect or disconnect both main avionics and essential avionics buses by manual selection. The main avionics bus contactors automatically open during engine start on the ground and during starter-assisted airstart.

EMER BATT — The bottom half of this alternate action switch displays OFF when manually selected to OFF (i.e. emergency battery contactor de-energized). This switch is selected on before engine start and will normally remain on during flight. The OFF caption will extinguish when the switch is selected on.

The top half of the EMER BATT switch displays EMER when the emergency battery is powering the emergency battery bus and an airplane generator, GPU or APU is not providing power to the emergency battery bus. This provides advisory information that the battery is discharging and should not be left on for an extended period while on the ground. In flight, this is an indication that generator power to the emergency battery bus has been lost and that the emergency battery is powering the emergency battery bus. It is normal for this annunciator to be illuminated during start and for a short period before start when generator, GPU or APU power is not available. A white EMER BATT annunciator on the Crew Warning Panel (CWP) also illuminates when the emergency battery is discharging.

ELECTRICAL SYSTEM INDICATORS

Monitoring of the dc electrical system is menu selectable on the EICAS or MFD displays. Electrical system parameters are usually monitored on the EICAS SUMRY page while the MFD is usually used for navigation display, TCAS, WX Radar, Checklists, etc. The SUMRY display is the power-up default display on the EICAS and MFD. Electrical system parameters in the form of a system schematic may also be monitored on the ELEC system schematic on the EICAS or MFD.

The EICAS/MFD system SUMRY page displays VOLTS, left and right. These two digital displays are an indication of the voltage on the left and right essential buses. Depending on what is powering the airplane electrical system, this can be an indication of airplane main battery volts, GPU volts, APU volts or airplane generator volts.

An indication of EMER-V (emergency bus voltage) is displayed on the SUMRY page immediately below VOLTS, left and right. Emergency bus voltage can be monitored on the EICAS/MFD displays. The CAS also monitors the emergency bus volts and will generate an amber EMER BUS VOLTS message if emergency bus voltage is less than 22 volts or more than 29.5 volts.

The left and right generator AMPS are displayed below the emergency bus voltage. There is no display for the amperage being drawn from a GPU. APU amps are displayed on an indicator located on the APU control panel.

The last electrical parameter displayed on the SUMRY page is left and right battery TEMP in degrees Celsius. Battery temperature is displayed only for airplanes equipped with NICAD batteries.

All of the electrical system information presented on the SUMRY page is also displayed in a schematic format on the EICAS/MFD ELEC system schematic page. Additionally, the ELEC system schematic display shows whether EXT PWR is connected to the airplane and, if the APU generator is connected, APU amps are also displayed.

Electrical system volts and amps may also be selected for display on either RMU. Under some conditions, the #1 RMU will automatically display the first of two backup engine pages which provide engine operating indications and other system data. The electrical system volts and amps appear on page 2 of the RMU backup engine displays, which is selectable with the PGE button on the RMU. After 20 seconds, the display returns to page 1. Returning the RMU to the communication and navigation function is accomplished with the RMU PGE button. However, if the #1 RMU is displaying engine information due to an automatic selection, that RMU will return to page 1 of the backup engine display 20 seconds after the last pilot selection on the RMU.

The display of volts, amps and battery temperature on the EICAS/MFD are color coded. As limits are exceeded, the digital data changes color (amber or red). When the data is in its normal operating range, the data is displayed in white. If any of the data exceeds a limit, the data changes to the appropriate color and is boxed in that same color. The exception to the display is when the actual battery temperature is below -23° C (-9.4° F). Below this temperature, the EICAS/MFD will display a flashing amber numeric display. If the actual battery temperature falls below -25° C (-13° F), the numeric digits will be replaced by amber dashes in a cyan box. This indicates the battery temperature(s) is/are below the valid indicating system range, it is not a system failure.

In certain cases, to alert the operator to a parameter exceedance or malfunction, a color coded message will be presented in the upper right corner of the EICAS. This section of the EICAS is known as the Crew Alerting System (CAS). Warning messages will be in red and caution messages will be in amber. A red or amber message will be accompanied by flashing Master Warning (red) or Caution (amber) light, while advisory messages will only flash in white lettering for 5 seconds and then go steady.

The crew is also alerted to certain malfunctions or conditions with illumination of a red or white annunciator on the Crew Warning Panel (CWP). The following annunciators relating to the electrical system are located on the CWP:

L & R BATT OVHT (red) — Illuminates if the corresponding battery temperature exceeds 70 degrees Celsius (160 degrees Fahrenheit).

GEN FAIL (red) — Illuminates if both generators are inoperative or off line.

EMER BATT (white) — Illuminates when the emergency battery is on and is discharging.

DISTRIBUTION

Basic dc power distribution is illustrated in Figure 4-1. With the main airplane batteries installed, power from the left and right batteries, through two 40-amp fuses, is always available to the "hot wired" items connected to the rear hot bus, the left and right hot buses, and the left and right emergency hot buses. Battery power to the left and right hot buses also passes through a single 20-amp fuse and 15-amp circuit breakers for each bus.

The left and right fire extinguishers and the left and right Firewall Shut-off Valves (FWSOVs) receive power through the left and right emergency hot buses, respectively. These items can also receive power from the emergency battery, either engine generator, or external power source. The tailcone utility light, Single-Point Pressure Refueling (SPPR) and baggage compartment lights are powered through the rear hot bus. Additional hot bus items include the cockpit overhead lights and entry lights. The hot buses are connected directly to both of the main batteries and to the external power connector through the left generator bus.

Power to the radio control hot bus is controlled with a momentary action switch on the center pedestal, just forward of the throttle quadrant. The radio control hot bus can only be selected ON when the airplane batteries are OFF. If the radio control hot bus is selected ON and the batteries are subsequently selected ON, the radio control hot bus will automatically be turned off and the ON annunciator on the switch will extinguish. The switch is labeled RADIO CONTROL HOT BUS. When this switch is depressed, the ON annunciator on the switch will illuminate and main battery power through the right forward hot bus will power the following (normal power source shown in parenthesis):

- Left audio control unit (L ESS)

- Clearance delivery radio (L ESS)

- Comm sections of the integrated communication unit #1 (L ESS)

- Nav section of the integrated navigation unit #1 (L ESS)

Ground power can be connected to the airplane as previously described in this section under GROUND POWER UNIT. With ground power connected, the bus-tie will automatically close and the output of the GPU is applied to the left and right generator buses and non-essential buses. With the main and emergency batteries selected On, external power is distributed to the rest of the dc electrical system. The airplane batteries (main and emergency) will then be charged from the power supplied by the GPU.

The external power supplied to the dc electrical system can then be monitored as described under ELECTRICAL SYSTEM INDICATORS in this section.

The APU (if installed) can supply power to the electrical system through the right generator bus. When the APU generator is on line, the bus-tie will automatically close, providing power to the left generator bus as well. Electrical power is then distributed from the generator buses to the rest of the electrical system in the same way as if a GPU was providing electrical power with airplane batteries selected On.

The APU generator output voltage can be monitored on the EICAS in the same manner that GPU or airplane generator voltage is monitored. Additionally, APU amperage draw can be monitored on an indicator located on the APU control panel on the center pedestal or on the ELEC schematic page of the EICAS/MFD.

Various-sized fuses are installed throughout the electrical system to provide circuit protection. Each fuse will carry more than its rated capacity for a short period of time. Extreme or prolonged overloading will cause a fuse to blow, isolating a particular circuit and precluding progressive failure of other electrical components. Fuses cannot be reset. When a fuse has blown, it must be replaced. Fuses are located within the aft and forward left and right Power Distribution Panels (PDPs).

Contactors which are particularly suited for circuits with heavy electrical loads are used throughout the electrical system. Contactors function as remote switches to make or break power circuits. Most of the contactors in the electrical system automatically close and open for given conditions. Some, such as the Battery, GPU and APU, are manually selected open and closed with the respective switches on the electrical control panel, but can also open automatically if monitored faults are detected.

A circuit breaker is designed to open, and interrupt current flow in the event of a malfunction. Once opened, it may be reset by pushing it back in. An open circuit breaker may be identified by a white base which can only be seen when it is in the open or tripped position.

Most of the airplane's circuit breakers are located on two circuit breaker panels in the cockpit, one on the pilot's left side panel and one on the copilot's right side panel.

The circuit breakers are thermal type mechanisms and the amperage ratings are stamped on the top of each circuit breaker.

The circuit breakers are grouped by systems rather than by buses.

Emergency bus circuit breakers have red rings around them to easily distinguish them from the other circuit breakers.

The individual circuit breaker labels, grouping labels and dividing lines are illuminated with electroluminescent lighting. There are no bulbs in the panels, but the panels glow when current is flowing through wires imbedded in them. The silk-screened panels allow light to shine through the lettering on the panels. The intensity of the lighting is controlled with the CB PANEL rheostat located on the pilot's and copilot's CREW LIGHTS panels.

SPLIT BUS SYSTEM

The split bus electrical system has a left and right generator bus (GEN BUS) located in a left and right Power Distribution Panel (PDP) in the tailcone. The generator buses supply power to the respective left and right essential, left and right main and left and right non-essential buses located on the left and right circuit breaker panels in the cockpit. Under normal flight conditions, the generator buses are split (bus-tie open), increasing safety in that any major electrical system fault will only affect one side of the system.

GENERATOR BUSES

The generator buses are the central distribution point for the split bus system. The left generator bus powers the left side buses and the right generator bus powers the right side buses. Some services including landing lights, taxi lights, navigation lights, recognition lights and baggage heat are connected through fuses and circuit breakers directly to the generator buses. Each generator bus is connected to a starter/

generator and a main battery. The GPU connects to the left generator bus and the APU (if installed) connects to the right generator bus. Normally, the two buses operate independently; however, they are automatically "tied" through a bus-tie contactor when a GPU or APU is connected to the electrical system, during engine starting and in flight following a single generator failure. The generator buses can be tied or split manually using the BUS-TIE switch on the electrical control panel, except the bus-tie cannot be manually opened when a GPU is being used.

The CAS presents a BUS TIE CLSD message when the bus-tie is closed and a BUS TIE MANUAL message when closed manually. Also, the bar on the BUS-TIE switch illuminates any time the BUS-TIE is closed and it extinguishes when the bus-tie is open.

MAIN BUSES

The left and right main buses are fed by the respective left and right generator buses through fuses and contactors. The main buses, in turn, supply power to the left and right main avionics buses through circuit breakers and contactors. Both of the main buses are automatically disconnected in the unlikely event of a dual generator failure and the OFF caption will illuminate on the MAIN bus switches. The main avionics buses will also be depowered in this case, but the OFF caption does not illuminate on the AV MSTR switches since the essential avionics buses will still be powered. The main and main avionics buses may be reconnected by manual selection after reducing the bus load.

MAIN AVIONICS BUSES

The left and right main avionics buses are supplied by the respective main buses through contactors and circuit breakers. The essential and main avionics bus contactors are closed and opened by manual selection of the left and right AV MSTR switches. If the AV MSTR switches are on, the main avionics buses are automatically depowered during engine starting to prevent possible equipment damage from voltage spikes.

The essential avionics buses remain powered during engine start since they power flight critical display units. The AV MSTR switches need not be on during ground starts since the primary flight displays are not needed and DU2 (EICAS) is still powered with the AV MSTR switches OFF.

ESSENTIAL BUSES

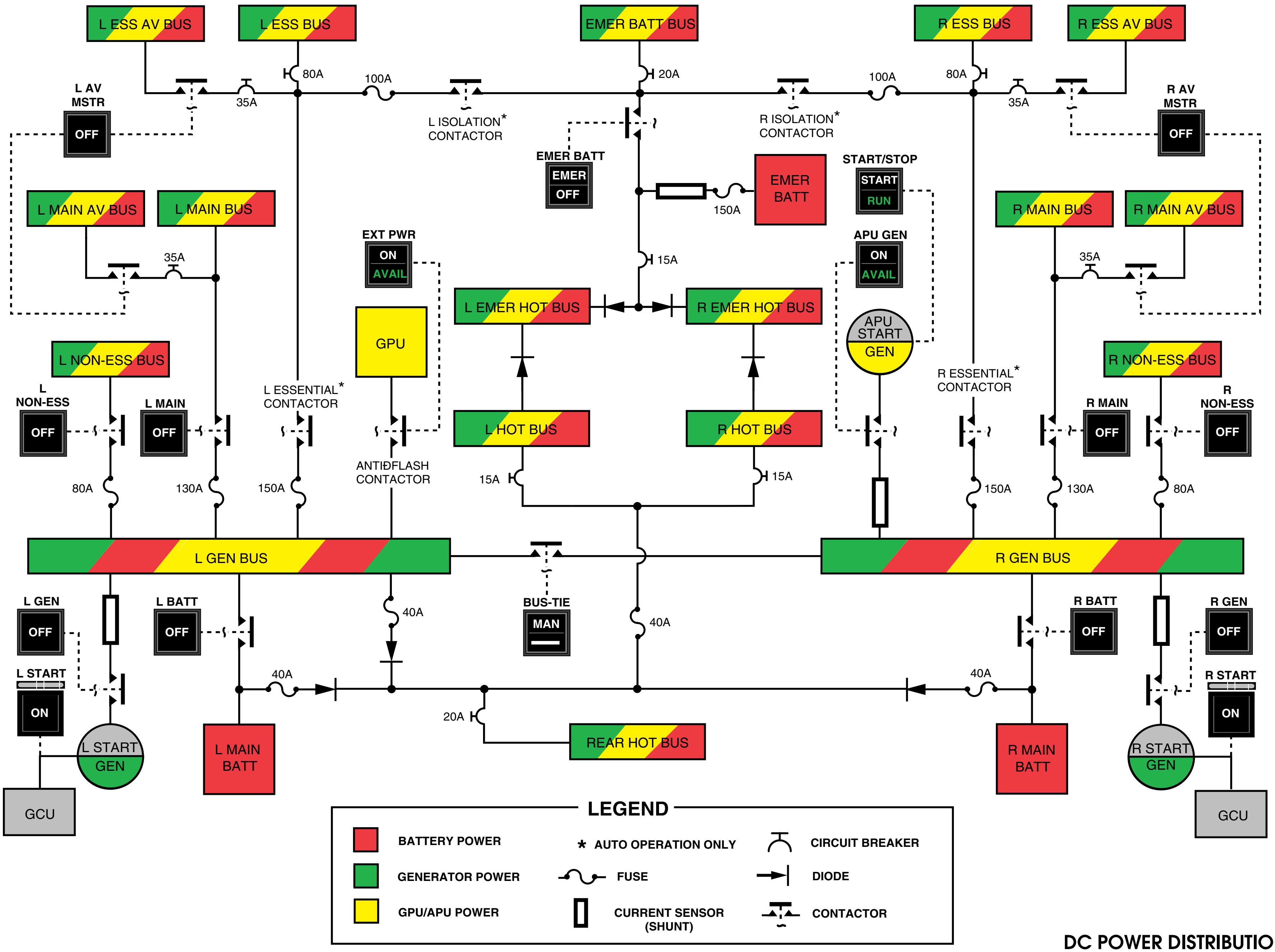
All essential power loads are connected to the left and right essential buses, including cockpit warning systems and the engine, flap, hydraulic, pressurization, and spoiler controls. Normally, the essential buses are fed by the left and right generator buses respectively through 150-amp fuses, essential bus contactors and 80-amp circuit breakers. The left and right essential bus contactors automatically close when the respective left and right BATT switches are turned on and they automatically open during starter operation. The essential buses are tied together by a left and right isolation contactor so that they are both powered by the emergency battery during engine start and they will be powered by either generator bus if an essential bus contactor should fail in flight.

ISOLATION CONTACTORS

There are two isolation contactors located within the electrical system. The right isolation contactor is located between the right essential contactor and the emergency battery bus, and the left isolation contactor is located between the left essential contactor and the emergency battery bus. The isolation contactors are automatically controlled and there are no provisions for the crew to manually override their operation.

Except during starter-assisted engine start, the left isolation contactor is normally open and the right isolation contactor is normally closed. With the right isolation contactor closed, the right generator bus powers the emergency battery bus and charges the emergency battery.

During ground engine starting and for starter-assisted airstarts, the isolation contactors close and the left and right essential contactors automatically open. This allows the emergency battery to power the emergency battery bus, essential buses, and essential avionics buses and isolates these buses from voltage fluctuations caused by starter operation. After starter drop-out, the left isolation contactor opens and the essential contactors close.



DC POWER DISTRIBUTION
Figure 4-1

ISOLATION CONTACTORS (CONT)

There are two abnormal conditions that will cause the left isolation contactor to automatically close. If either essential contactor fails (opens), the left isolation contactor will close. Since the right isolation contactor is normally closed, either generator bus can then provide generator power through the essential contactor that is closed to the left and right essential buses and to essential avionics buses, the emergency battery bus and to charge the emergency battery. This failure will be displayed as a white L/R ESS BUS FAULT message on the CAS.

The left isolation contactor will also close in the event that the right isolation contactor fails (open). This will allow the emergency battery bus and emergency battery to receive power from the left generator bus. There is no apparent indication of this condition to alert the crew.

ESSENTIAL AVIONICS BUSES

The left and right essential avionics buses are powered from the left and right generator buses respectively through the left and right essential contactors and left and right essential avionics contactors. In addition to the 150-amp fuses protecting the essential bus feeders, the essential avionics buses are also protected with 35-amp circuit breakers. Under normal conditions, the essential contactors will automatically be closed, providing power to the essential avionics contactors. The essential and main avionics contactors are closed and opened by manual selection of the left and right AV MSTR switches. These essential avionics buses, like the essential buses, are powered by the emergency battery during starter-assisted airstarts while the main avionics buses are depowered.

EMERGENCY BATTERY BUS

The emergency battery bus is normally powered from the right generator bus through the right essential contactor and right isolation contactor, but for engine starting and in the event of dual generator failure, it is powered directly from the emergency battery. Emergency battery bus services include landing gear control and indication, inboard brakes/anti-skid, standby instruments, and the #1 RMU for a backup EICAS display.

In the event of a dual generator failure, the right isolation contactor opens (left one already open), leaving the main aircraft batteries to power the respective essential buses and the emergency battery to power the emergency battery bus. Hence, three independent battery channels are operating following a dual generator failure. The standard 10-ampere-hour emergency battery will power the emergency battery bus for at least one hour after being isolated from the rest of the electrical system. The optional 18 ampere hour emergency battery will last for approximately two (2) hours.

NON-ESSENTIAL BUSES

The left and right non-essential buses, normally connected to the respective generator buses, are used to supply noncritical loads, including certain cabin lighting and domestic loads. When the airplane electrical system is powered with airplane batteries only, the non-essential buses are not powered and the OFF captions will be illuminated on both NON-ESS switches. If a GPU or APU is selected ON, but the main batteries are OFF, only the non-essential buses are powered. When a GPU, APU, or airplane generator is powering the electrical system, and the main batteries are On, the non-essential bus contactors will automatically close and the OFF captions will extinguish if the airplane is on the ground. However, if either generator fails in flight, the non-essential buses are both automatically disconnected to reduce the electrical load. One or both non-essential buses may be subsequently reconnected by depressing the NON-ESS switches on the electrical control panel.

DISTRIBUTION SUMMARY

When only main and emergency battery power is On (and the AV MSTR switches are On), the non-essential buses are not powered and cannot be selected On.

When external power (GPU) is connected and the emergency battery is selected On, the bus-tie connecting the two generator buses is automatically closed. When the AV MSTR switches are selected to On the contactors to the left and right essential avionics buses and the left and right main avionics buses will close. Note that the EMER BATT switch caption EMER will no longer illuminate as the emergency battery will no longer be discharging. The same conditions would exist with a APU powering the electrical system except the contactor between the GPU and the left generator bus would be open and the APU contactor would be closed.

During an engine start (using airplane batteries) the essential buses and emergency battery bus are isolated and are powered from the emergency battery. The non-essential buses and main avionics buses are also automatically depowered for engine start.

When one engine-driven generator comes on line, the essential bus contactors will close and the left isolation contactor will open. Also, the contactors to the non-essential buses will close. The bus-tie contactor remains closed at this point so that both generator buses are powered by the single generator.

During normal flight conditions (two engine-driven generators on line), the bus-tie opens and will remain open as long as both generators remain on line and the bus-tie is not manually selected closed.

ABNORMAL MODES OF OPERATION

SINGLE GENERATOR FAILURE

In the event of a single generator failure in flight, the operating generator must supply the load for both sides of the dc electrical power system. To prevent shock loading of the remaining generator, load shedding of the non-essential buses automatically occurs. After a 5 second voltage check delay, to see that there is no fault on the generator bus associated with the failed generator, the bus-tie automatically closes. The CAS will display an amber L or R GEN FAIL message and a white BUS TIE CLSD message after the bus-tie automatically closes. Indications on the electrical control panel would be illuminated OFF captions on the left and right NON-ESS bus switches, an illuminated OFF caption on the GEN switch of the failed generator and an illuminated bar on the BUS-TIE switch. All other systems will continue to operate normally. If necessary, the crew should reduce the load further and if conditions warrant, attempt to reset the failed generator. Non-essential buses may be regained by selecting the appropriate NON-ESS switch. No aircraft electrical system power is required to reset a generator, however, the corresponding L GEN or R GEN circuit breaker must be in to sustain generator operation.

DUAL GENERATOR FAILURE

Dual generator failure would become most apparent with illumination of the red GEN FAIL annunciator on the CWP and the accompanying flashing Master Warning lights. Also the CAS would display a red L R GEN FAIL message. Generator failure can be verified by noting zero left and right amps on the EICAS/MFD SUMRY or ELEC system schematic display and OFF illuminated in each GEN switch.

With a dual generator failure, main airplane batteries and the emergency battery powers the dc electrical systems. Both main buses, both main avionics buses and both non-essential buses will be automatically depowered to immediately shed the electrical load. Also, the right isolation contactor automatically opens leaving the emergency battery to power the emergency battery bus. The bus-tie remains open, so the left battery will power the left essential bus and left essential avionics bus, and the right battery will power the right essential bus and the right essential avionics bus. The AFM procedure for L and R GEN FAIL is to turn off the AV MSTR switches which will also cause the loss of the left and right essential avionics buses.

The duration of the standard main batteries (27-amp-hour) is a minimum of 30 minutes and the optional main batteries (38-amp-hour) is a minimum of 60 minutes. The duration of the standard emergency battery (10-amp-hour) is approximately 1 hour and the optional emergency battery (18-amp-hour) is approximately 2 hours. Expected duration assumes the electrical load is reduced in accordance with the L R GEN FAIL procedure in the Emergency Section of the AFM.

Indications of a dual generator failure would be OFF captions on the left and right MAIN bus switches, NON-ESS bus switches and GEN switches. Also, the EMER captions on the EMER BATT switch would be illuminated indicating the emergency battery is powering the emergency battery bus. The OFF captions in the L and R AV MSTR will also be illuminated when the AV MSTR switches are selected OFF per the AFM procedure.

During a dual generator failure, both essential avionics buses, both main buses and both main avionics buses are available by manual selection if desired; however, this will significantly reduce the main battery duration.

BATTERY OVERHEAT

If either nickel-cadmium main battery exceeds the established temperature values, the crew is alerted in several different ways. First, the Master Caution or Master Warning annunciators, depending on battery temperature, is activated. A corresponding CAS message is generated for a battery overheat. An amber L or R BATT OVHT message is displayed for battery temperature exceeding 60° C and a red message is displayed if the battery temperature exceeds 70° C. Also, if battery temperature exceeds 70° C, a red L or R BATT OVHT annunciator on the CWP will illuminate and the corresponding battery is automatically switched OFF if not already switched OFF by the crew. The battery temperature must be less than 60° C before it can again be turned on.

If the SUMRY or ELEC system schematic is being displayed on the EICAS or MFD displays, the digital readout of the battery temperature for the affected battery will change color and flash. If the battery temperature exceeds 60° C (140° F) the digital battery temperature display will change from white to a boxed amber and if the temperature exceeds 70° C (160° F) it will change to boxed red.

AC POWER

As part of the anti-ice protection system, left and right windshield heaters are powered by two, left and right engine-driven alternators. The alternators are mounted to the front of the engine accessory section, next to the starter/generator, and operate from 6,000 to 12,000 rpm.

These alternators will supply 200-vac, 200-400 Hz at a maximum of 5kva single phase output. The alternator output is controlled by a separate control unit that contains the monitor circuitry for the windshield. There are no provisions for directly monitoring alternator output on the EICAS displays, but loss of ac power from an alternator would be detected by failure of windshield anti-ice.

The output of the alternators is only used by the windshield anti-ice. See Section VI, ANTI-ICE & ENVIRONMENTAL for additional information.

110-VAC GROUND POWER SYSTEM (OPTIONAL)

The optional 110-vac/60-Hz ground power inlet is located in the right hand side of the nose wheel well. When an extension cord is connected from an existing 110-vac/60-Hz source to the ground power inlet, power is available to an outlet located on the side wall just aft of the cabin entry door and two outlets in the tail, just aft of the lower main battery.

Power distribution is through two 15-amp circuit breakers located in the right nose bay.

LIGHTING

INTRODUCTION

Lighting is used to illuminate the cockpit area and all flight instruments. The majority of the instruments are internally lighted. For general illumination, floodlights, of the fluorescent, incandescent or Light Emitting Diodes (LEDs) type, are used. Rheostatic controlled goose-neck map lights are installed on both the left and right side panels. The standard warning lights are available for the cabin area, and emergency lights are provided to illuminate the exits in the event of an emergency. Exterior lighting consists of landing, taxi, recognition, strobe, navigation, beacon, and a wing inspection light. Optional exterior lighting consists of tail logo lights and exterior convenience lights that illuminate the single-point pressure refueling and baggage door areas.

GENERAL

Cockpit lighting consists of map lights, glareshield floodlights, instrument/indicator lights, panel lights, dome lights and two cockpit switch panels to control the lights.

Cabin lighting consists of entry, overhead, passenger table and reading lights, galley, and lavatory lights.

Tailcone baggage lighting is provided within the baggage compartment.

Tailcone maintenance lighting consists of lighting within the tailcone equipment compartment.

Additional interior lighting consists of an emergency cabin lighting package and optional illuminated lavatory mirror. The emergency cabin lighting package utilizes existing overhead lights, additional exit lights and seat base mounted floor proximity lights. The optional illuminated lavatory mirror utilizes additional lights installed behind the mirror.

Optional exterior lighting is available to illuminate the general areas around the baggage compartment and the Single-point Pressure Refueling (SPPR) area.

COCKPIT LIGHTING

Cockpit lighting is controlled through two cockpit control panels and two Light Control Units (LCUs) that are located within the forward avionics bay. Each LCU (pilot LCU and copilot LCU) has four separate channels that distribute power resources to lighting groups.

LEFT CREW LIGHTS PANEL

The L CREW LIGHTS panel is 28-vdc powered from the left essential bus and protected by a circuit breaker labeled CKPT INSTRS L ESS PWR, located within the LIGHTS group of circuit breakers on the pilot's circuit breaker panel. The four pilot LCU channels control:

- Channels 1 and 2 — Pilot's instrument panel, overlays, and instruments.

- Channel 3 — Pilot's circuit breaker panel.

- Channel 4 — Left side bulbs for switch lighting.

Following is a description of each of the potentiometer controls located on the L CREW LIGHTS panel.

OVRHD — The pilot's overhead swivel light is controlled by the OVRHD potentiometer. The pilot overhead light can also be turned on with the COCKPIT switch on the entryway switch panel assembly when the cabin door is open and the OVRHD control is off. When the upper cabin door is closed, cockpit overhead light control from the entryway switch panel assembly is disabled. The overhead light is powered by the right main bus and is protected by the OVRHD circuit breaker within the CABIN group on the copilot's circuit breaker panel. When the pilot's overhead light is controlled via the entryway switch panel assembly, it receives power from the airplane hot bus system.

INSTR — The pilot's instrument panel lighting is controlled via the INSTR potentiometer. Display units and the radio management units have internal lighting, and the intensity is controlled through sensors and controls. The bezel controller backlighting for these units are controlled by the INSTR control, however. The pilot's instrument panel lights receive 28-vdc power from the left main bus and are protected by a circuit breaker labeled L INSTR located within the LIGHTS group on the pilot's circuit breaker panel.

FLOOD — The entire instrument panel can be illuminated by a floodlight located beneath the glareshield. Dimming is controlled via this potentiometer. Power to the floodlight is from the left essential bus and is protected by the FLOOD circuit breaker within the LIGHTS group on the pilot's circuit breaker panel.

CB PANEL — This potentiometer controls the intensity of overlay lighting on the pilot's circuit breaker panel. The panel receives 28-vdc power from the left main bus and is protected by a circuit breaker labeled L CB located within the LIGHTS group on the pilot's circuit breaker panel.

RIGHT CREW LIGHTS PANEL

The R CREW LIGHTS panel is 28-vdc powered from the right main bus and protected by a circuit breaker labeled CKPT INSTRS R ESS PWR, located within the LIGHTS group of circuit breakers on the copilot's circuit breaker panel. The four copilot LCU channels control:

- Channels 1 and 2 — Copilot's instrument panel and glareshield overlays, instruments, and pedestal overlays.

- Channel 3 — Copilot's circuit breaker panel.

- Channel 4 — Right side bulbs for switch lighting.

Following is a description of each of the potentiometer controls located on the R CREW LIGHTS panel.

INSTR — The copilot's instrument panel lighting is controlled via the INSTR potentiometer. Display units and the radio management units have internal lighting, and the intensity is controlled through sensors and controls. The bezel controller backlighting for these units is controlled by the INSTR control, however. The copilot's instrument panel lights receive 28-vdc power from the right main bus and is protected by a circuit breaker labeled R INSTR located within the LIGHTS group on the copilot's circuit breaker panel.

OVRHD — The copilot's overhead swivel light is controlled by the OVRHD potentiometer. When the upper cabin door is closed, cockpit overhead light control from the entryway switch panel assembly is disabled. The overhead light is powered by the right main bus and is protected by the OVRHD circuit breaker within the CABIN group on the copilot's circuit breaker panel. When the copilot's overhead light is controlled via the entryway switch panel assembly, it receives power from the airplane hot bus system.

PEDESTAL — This potentiometer controls the lighting intensity of equipment installed in the pedestal. The FMS display intensity is regulated by the dim button on FMS control panel. Pedestal lighting receives power from the right main bus and is protected by a circuit breaker labeled PEDESTAL located within the LIGHTS group on the copilot's circuit breaker panel.

CB PANEL — This potentiometer controls the intensity of overlay lighting to the copilot's circuit breaker panel. The panel receives 28-vdc power from the right main bus and is protected by a circuit breaker labeled R CB located within the LIGHTS group on the copilot's circuit breaker panel.

SWITCH LIGHTING

A majority of the switches in the cockpit are push button switches with lighted indicators. They are designed so that none of the indicators are illuminated under normal conditions, which supports the "quiet or dark cockpit" concept. For example, the GEN switches are black (blank) when the generators are On and OFF illuminates when the generators are off.

For redundancy, each of the switches contain four bulbs and receive power from two different sources. The pilot's Lighting Control Unit (LCU) supplies power to the two left bulbs and the copilot's LCU supplies power to the two right bulbs in most cases. Exceptions to this are the RAD HOT BUS switch, which receives power from the hot bus, and the master WARN/CAUT and engine FIRE PUSH switches which receive power through the Crew Warning Panel (CWP).

A bulb test may be initiated by selecting LTS on the system test knob (center pedestal) and depressing the PRESS-TO-TEST button.

MAP LIGHTS

Two multi-directional, goose-neck map lights are located in the cockpit, one on each side. Power is provided to each light by the left essential bus and is protected by a circuit breaker labeled MAP located on the pilot's circuit breaker panel in the LIGHTS group. Dimming is controlled by a rheostat located at the base of each light assembly.

CABIN LIGHTING

Cabin (passenger compartment) lighting consists of entry/exit, overhead, passenger reading/table, galley cabinet, lavatory (read/vanity) and NO SMOKING/FASTEN SEAT BELT lights.

Primary cabin lighting control is through the entryway switch panel assembly which is located on the left storage cabinet just above the main cabin door entry hand rail. Additional lighting controls are located in the individual seat passenger lighting control unit (for reading and table lights), master control panel and the lavatory passenger control panel assembly.

The master control panel is located in the right mid aft seat storage box (in the standard configuration). When the menu item indicated by the Liquid Crystal Display (LCD) is cabin lights, for example, operation of the SELECT switch provides ON/VARIABLE/OFF control.

Cabin lighting (except entry/exit light and overhead lights) is powered by the LEFT and RIGHT NON-ESSENTIAL Buses. This arrangement allows cabin lighting to be used with a GPU powering the non-essential buses, but with the rest of the electrical system not powered. See GPU and the non-essential bus system in ELECTRICAL, this section for more information.

ENTRY/EXIT LIGHTS

The cabin entry/exit door light is installed in the upper door to provide illumination of the lower door steps and/or ground when both doors are open. This light is controlled by the ENTRY light switch on the entryway switch panel assembly and is powered by the hot bus regardless of the BATT switch position. The light is inoperative when the upper entry door is closed. The entry/exit light is protected by a circuit breaker labeled ENTRY, located within the CABIN light group on the copilot's circuit breaker panel.

OVERHEAD LIGHTS

The overhead lights consist of indirect downwash lighting located within the convenience panel. Covered by lenses, the overhead lights are controlled by the CABIN switch on the entryway switch panel assembly and the master control panel. The cabin overhead lights are powered by the left main bus and are protected by the CABIN circuit breaker within the CABIN group on the pilot's circuit breaker panel.

PASSENGER READING AND TABLE LIGHTS

Reading and table lighting consists of lights installed in the convenience panels above the seats on each side of the cabin. The seats have only one light, while the table lights consist of a two-light assembly, installed above each table. Control for the reading lights is by the passenger lighting control unit mounted near each passenger seat and by the SPOTLIGHT switch on the entryway switch panel assembly. Power for the reading lights is provided by the left and right non-essential bus and they are protected by the L and R SPOT circuit breakers located within the CABIN group on the pilot's and copilot's circuit breaker panels.

GALLEY LIGHTS

Lighting (LEDs) for the passenger refreshment area is powered by the right non-essential bus and protected by the GALLEY circuit breaker within the CABIN group on the copilot's circuit breaker panel.

LAVATORY LIGHTS

Lighting of the lavatory area consists of spotlights and downwash lights.

The spotlights (one located on the left side above the toilet and one located on the right side above the aft cabin stowage compartment) are controlled using the READ, BAGGAGE, MIRROR LIGHTS switch on the lavatory passenger control panel assembly.

The downwash lights run lengthwise on the left and right convenience panels and are controlled using either the LAV LIGHTS switch on the lavatory passenger control panel assembly or the LAVATORY switch on the entryway switch panel assembly located near the main cabin door.

All the lavatory lights are powered by the left and right non-essential bus and are protected by the CABIN group LAV LIGHTS and L and R SPOT LIGHT circuit breakers on the pilot's and copilot's circuit breaker panels.

If installed, the optional lavatory mirror provides additional indirect lighting of the lavatory area. The indirect lighting is controlled using the same switch as the spotlights. Depressing the READ, BAGGAGE, MIRROR LIGHTS switch on the lavatory passenger control panel assembly will either illuminate or extinguish the optional mirror indirect lighting.

Control of the NO SMOKING/FASTEN SEAT BELT signs is through a switch located on the LIGHTS control panel in the cockpit. This switch is a three-position switch labeled OFF, BELTS and NO SMOKING/BELTS.

BAGGAGE/TAILCONE LIGHTING

Lighting for the baggage compartment consists of two overhead dome lights. The lights are controlled by the LIGHTS toggle switch located on the ceiling near the baggage compartment door. The baggage compartment lights are powered by the airplane's hot bus system. If inadvertently left on, it will automatically extinguish when the access door is closed.

The tailcone equipment bay internal light is also powered by the hot bus system. The switch is located near the access door and if inadvertently left on, the light automatically extinguishes when the door is closed.

EMERGENCY LIGHTING SYSTEM

The emergency lighting system is standard and consists of cabin discrete overhead, floor proximity lights (seat-base mounted lighting units), and emergency exit area lights that illuminate in the event of a failure of the normal electrical system. Control of the emergency lighting system is through a three-position switch located on the LIGHTS control panel.

The emergency lighting group consists of:

- 5 exit signs (2 per door, 1 on forward face of lavatory partition)
- 4 PSU lights
- 8 floor proximity lights (6 white lens, 2 red lens on each side of the aft RH emergency exit)
- Main door egress light (when upper door open)
- Emergency exit egress light
- Lavatory light

The cockpit EMER LIGHTS switch is lever-locked and labeled OFF, ARM and ON. When the cockpit switch is in the OFF position, the emergency lights are inhibited. When the cockpit switch is in the ON position, the emergency lighting group illuminates.

Activation periods are limited by a timing circuit to a minimum of 10 minutes and a maximum of 12 minutes.

To function automatically, the cockpit switch must be in the ARM position. Once armed, the emergency lighting system automatically illuminates when normal electrical power is lost (dual generator failure) or when the passenger oxygen mask deployment occurs. When the emergency lights are activated automatically, they may be deactivated by placing the EMER LIGHTS switch to the OFF position. The crew is alerted when airplane power is on and the emergency lights are not armed. To indicate this condition, a white EMER LTS CAS message is illuminated.

The emergency lights receive power from the left main battery and the emergency battery. The emergency lights are divided into four lighting zones (forward, mid-forward, mid-aft, and aft), and each zone is powered in parallel from both electrical sources. The emergency battery is inhibited from supplying power to the emergency lights in the air, conserving power for ground egress illumination. If activated while on the ground, the emergency lights operate for approximately 10 minutes to adequately allow for safe egress. Circuit breaker protection for the emergency lights is located in the tailcone on the power distribution panel.

LANDING and TAXI LIGHTS

The landing lights consist of two dual bulb light assemblies mounted just forward of the wing fuselage fairing. The taxi lights consist of a single filament light mounted on each main landing gear strut.

The landing lights are controlled from two toggle switches located on the LIGHTS control panel. When these switches are positioned to the LDG (landing) position, all four bulbs (two in each light assembly) illuminate. Control of the taxi lights is via the same switch, but positioned to the TAXI position. The taxi lights also illuminate whenever the main landing gear is down and locked, the gear doors are up and locked and the landing light switches are in the LDG position. For ground operations, selecting the TAXI position illuminates only the taxi lights.

The landing and taxi lights are powered from the left and right main buses, respectively and are protected by circuit breakers labeled L and R TAXI/LDG CTRL located on the pilot's and copilot's circuit breaker panels in the LIGHTS group.

RECOGNITION LIGHTS

The standard recognition lights consist of the outboard bulbs on each of the two landing light assemblies. Moving the RECOG switch to the RECOG position illuminates both outboard landing lights (recognition lights). The recognition lights are protected by the 5-amp R and L TAXI/LDG CTRL circuit breakers located on the pilot's and copilot's circuit breaker panels.

An optional tail recognition light may be installed in the upper leading edge of the vertical stabilizer. The tail recognition light is controlled by the RECOG switch. When RECOG is selected, the standard and tail recognition lights illuminate. It is protected by the 1-amp TAIL RECOG circuit breaker, located on the pilot's circuit breaker panel.

An optional pulsating recognition light system is available which consists of a three-position recognition light switch and a pulse controller unit. The pulsating recognition light switch is labeled RECOG/PULSE/OFF. Moving the RECOG switch to the RECOG position will illuminate both wing recognition lights (outboard landing lights) and the tail recognition light, if installed. Moving the RECOG switch to the PULSE position will cause the recognition lights to pulse at a rate of approximately 45 cycles per minute.

NAVIGATION LIGHTS

The navigation lights system consists of three lights, two wing-tip (winglet) position lights that are viewable from each side and one tail mounted position light that is viewable from the rear. The left and right position lights are located on the outboard side of the left winglet (aviation red) and the outboard side of the right winglet (aviation green). The aft position light (aviation white) is located on the top trailing edge of the vertical stabilizer.

All three navigation lights are controlled by the NAV light switch. Additionally, setting the NAV light switch to NAV (or to NAV/LOGO) automatically dims all cockpit switch lights on the instrument panel and the center pedestal. The NAV switch is a two-position (OFF-NAV) switch on airplanes not equipped with the optional LOGO lights. When an airplane is equipped with the LOGO lights, a third position (NAV/LOGO) is added to the NAV light switch.

The navigation lights receive 28-vdc power from the right main bus and are protected by the NAV circuit breaker located on the copilot's circuit breaker panel within the LIGHTS group.

TAIL LOGO LIGHTS (OPTIONAL)

Optional tail logo lights consist of two lights installed on the bottom of the horizontal stabilizer, that illuminates both sides of the vertical stabilizer. Controlled by a NAV/LOGO position on the NAV light switch, they are powered by the right non-essential bus. The logo lights are protected by the LOGO circuit breaker located on the copilot's circuit breaker panel within the CABIN group.

ANTI-COLLISION LIGHTS (BEACON/STROBE)

The anti-collision light system consists of two beacon/strobe light units. The upper anti-collision light is located on the top of the vertical stabilizer, and the lower light is mounted on the bottom of the wing/ fuselage fairing.

Each light unit incorporates two flash tubes, one with an aviation red filter and one with a clear filter. Control over both anti-collision lights is via the three-position BCN/STROBE-BCN/OFF light switch on the LIGHTS control panel. When the switch is placed in the BCN/STROBE position, the red light in each unit flashes if the airplane is on the ground, or if airborne the clear flashtube flashes. When the switch is placed in the BCN position, the red flashtube in each light unit flashes whether the airplane is on the ground or airborne.

The combined anti-collision light system, with each light unit pulsed independently, has a flash rate of approximately 100 pulses per minute. The system receives power from the left main bus and is protected by the BCN/STROBE circuit breaker located within the LIGHTS group on the pilot's circuit breaker panel.

WING INSPECTION LIGHT

The wing inspection light system provides the copilot with a means to visually detect ice buildup on the airplane wings during night operations. The system consists of a WING INSP light pushbutton, located on the LIGHTS control panel; a halogen spotlight assembly, flush-mounted in the right side of the fuselage aft of the cockpit; and a black spot located on the right wing leading edge. The black spot enhances visual detection of ice accumulation; however, clear ice may not be detectable by visual inspection alone.

The WING INSP pushbutton is a momentary action switch, meaning that the inspection spotlight illuminates the wing area only when the switch is held depressed. The system is powered by the right main bus and is protected by the WING INSP circuit breaker located within the LIGHTS group on the copilot's circuit breaker panel.

EXTERIOR CONVENIENCE LIGHTS (OPTIONAL)

When installed, the optional convenience lighting group consists of an area light mounted beneath each engine pylon to illuminate the baggage compartment area on the left side of the airplane, and the single-point pressure refueling (SPPR) access door area on the right side of the airplane.

Selection of the baggage area light is by an additional switch mounted inside the baggage compartment. The switch is automatically switched OFF whenever the baggage compartment door is closed. The SPPR area light is controlled via the SPPR panel power switch. This means that the light will illuminate whenever power has been applied to the refueling panel. Both area lights are powered from the hot bus system.

SECTION V
FLIGHT CONTROL SYSTEMS & AVIONICS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

SECTION V
FLIGHT CONTROL SYSTEMS & AVIONICS

FLIGHT CONTROL SYSTEMS

The primary flight controls (ailerons, elevator, and rudder) are mechanically operated through the control columns, control wheels, and rudder pedals. The flaps and spoilers are hydraulically actuated and electronically controlled. Airplane trim systems (pitch, roll, and yaw) are electronically controlled.

AILERON

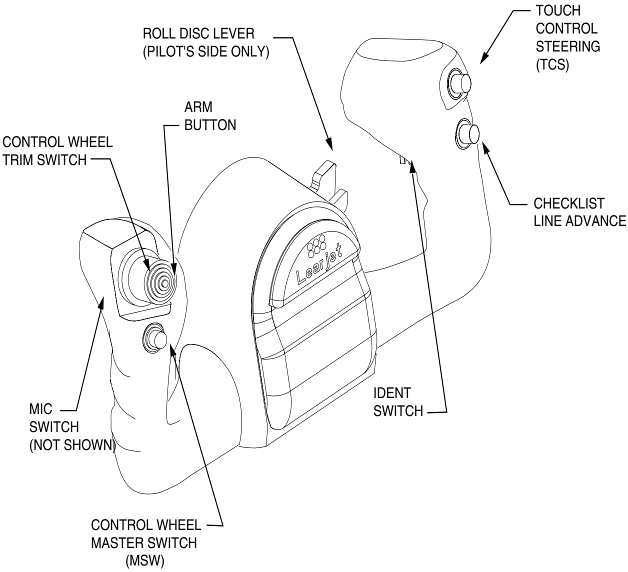
The aileron control system consists mainly of three control circuits, one in the fuselage area and one in each of the left and right wing area. In addition, a disconnect mechanism is incorporated into the pilot's control wheel which allows the disconnection of the aileron control system (in the event of a jam) and switching to spoileron system for roll control. The fuselage control circuit connects both pilot's and copilot's control wheels together, and each wing control circuit is connected to the aileron drive mechanism. The three control circuits are connected together via a common sector assembly. In normal operation, whether by an input from the autopilot or by manual input to one of the two control wheels, the two control circuits will move in unison to drive the two aileron panels. The aileron control system is considered the primary system for roll control and is interfaced with the spoileron system for roll augmentation.

ROLL DISCONNECT

If ailerons become jammed, the aileron control system can be disconnected and the spoileron system can be used for roll control. The pilot's control wheel is disconnected from the aileron cables and copilot's control wheel by the red lever labeled ROLL DISC located on the hub of the pilot's control wheel. This will also disconnect and prevent engagement of the autopilot. Safe flight can continue on spoilerons alone. For more information on roll disconnect, see Spoileron (ROLL DISCONNECT) system.

CONTROL WHEEL

Each flight station is equipped with a U-shaped control wheel. The pilot's control wheel is equipped with a disconnect assembly which employs a red lever labeled ROLL DISC located on the inboard side of the control wheel hub (Figure 5-1). Each control wheel contains the following switches: Control Wheel Trim, Control Wheel Master (MSW), MIC, IDENT, Touch Control Steering (TCS), and Checklist Line Advance.



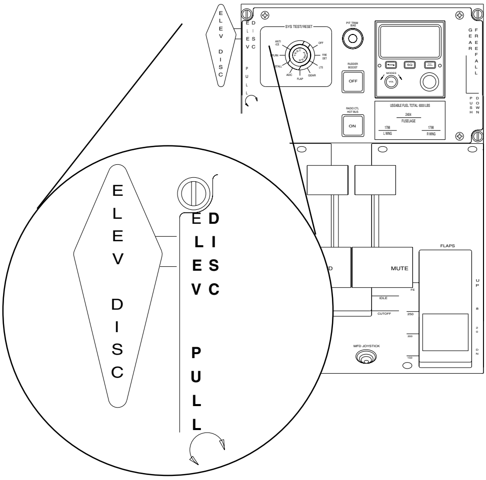
CONTROL WHEEL
Figure 5-1

ELEVATOR

Movement of the control columns is mechanically translated into elevator surface movement through levers, bellcranks, sectors, cables, and pushrods. The elevator control system consists of two parallel control circuits. The two control circuits are normally connected together via forward and aft disconnect assemblies in which either control column moves both the left and right elevator surfaces in union. A mechanical up/down spring is also used in the system to augment high and low speed trim ability of the airplane. If a jam occurs in either mechanical control circuit, an elevator disconnect feature is incorporated into the system.

ELEVATOR DISCONNECT

In the event of an elevator jam, the two cable circuits can be disconnected by pulling the red ELEV DISC T-handle (Figure 5-2) located at the left-forward edge of the pedestal. The airplane will then be controlled with the unjammed elevator. The forward and aft disconnect assemblies are dog clutch devices that are operated simultaneous by the handle being pulled. When the ELEV DISC T-handle is pulled, a cable connected to the handle shaft is pulled which disengages the forward clutch thereby disengaging the two control columns. Electrical switches sense the movement of the shaft and signal the aft disconnect to disengage.



ELEVATOR DISCONNECT
Figure 5-2

When the handle is pulled to full extension, it must be rotated 90°, either clockwise or counterclockwise, to lock it in the disconnect position. The elevator forward disconnect is a mechanical clutch mechanism located on the torque tube between the control columns. The clutch is held open when the ELEV DISC T-handle is pulled and locked in the extended position. This will disconnect and prevent engagement of the autopilot.

The elevator aft disconnect is an electro-mechanical device located in the top of the vertical stabilizer. When the ELEV DISC T-handle is pulled, a two-position linear actuator on the elevator aft disconnect assembly is energized to the extended position (disconnected position), separating operation of the two elevators. The linear actuator will remain in the extended position. When the elevator aft disconnect is actuated, the elevator disconnect sensor will send a signal to display a message on the Crew Alerting System (CAS). **Do not** reconnect. Obtain maintenance prior to next flight. Electrical power used by the elevator disconnect system is through the ELEV DISC circuit breaker located on the pilot's circuit breaker panel (FLIGHT group).

The following CAS illuminations are specific to the elevator disconnect:

CAS	Color	Description
ELEVATOR DISC	Amber	Elevator disconnect has split the elevator controls on the ground. Obtain maintenance prior to flight.
ELEVATOR DISC	White	Elevator disconnect has split the elevator controls during flight. **Do not** reconnect.

RUDDER

Directional control is provided by a dual closed-loop cable system with separate parallel paths in the engine area for rotor burst considerations. Rudder pedal movement is mechanically translated into rudder control surface movement through cables, pulleys, and bellcranks. There is an electrically driven rudder boost system to provide additional rudder control power in the event of an engine-out on takeoff.

RUDDER PEDAL ADJUSTMENT SWITCHES

The pilot's and copilot's rudder pedals are individually adjustable with a spring-loaded toggle switch to accommodate differences in crew size. The pilot operated toggle switch controls a linear actuator which provides forward and aft pedal adjustment. This toggle switch is labeled RUDDER PEDAL, and located on the lower outboard corner of the pilot's and copilot's switch panel. Each switch has three positions: FWD, Off, and AFT. Only the FWD and AFT positions are labeled. The rudder pedal adjustment is powered by 28-vdc supplied through two 3-amp circuit breakers, L RUD ADJUST and R RUD ADJUST, on the pilot's and copilot's circuit breaker panels (FLIGHTgroup).

RUDDER BOOST

The rudder boost system is provided to reduce rudder forces. Signals from force sensors in both sets of rudder pedal mechanisms are read by the ICs. The ICs then send rudder boost signals to the yaw damper servo. Rudder boost provides yaw servo torque proportional to rudder pedal force, when either the pilot's or copilot's rudder pedal force or the sum of their forces reaches 50 pounds. The rudder boost will override the yaw damper (if engaged) when this threshold is reached. When the force on the rudder pedals is released, the yaw damper will resume operation. The rudder boost system is armed when flap extension is greater than 3° and the RUD BOOST switch is selected to On. The RUD BOOST switch is located on the forward pedestal. When selected On, the switch is dark and when selected OFF, OFF will be displayed in the center of the switch. A white CAS illuminates when the switch is OFF or the system is disabled by the IC or the yaw force interface box. An amber CAS illuminates when the system is inoperative and not selected OFF.

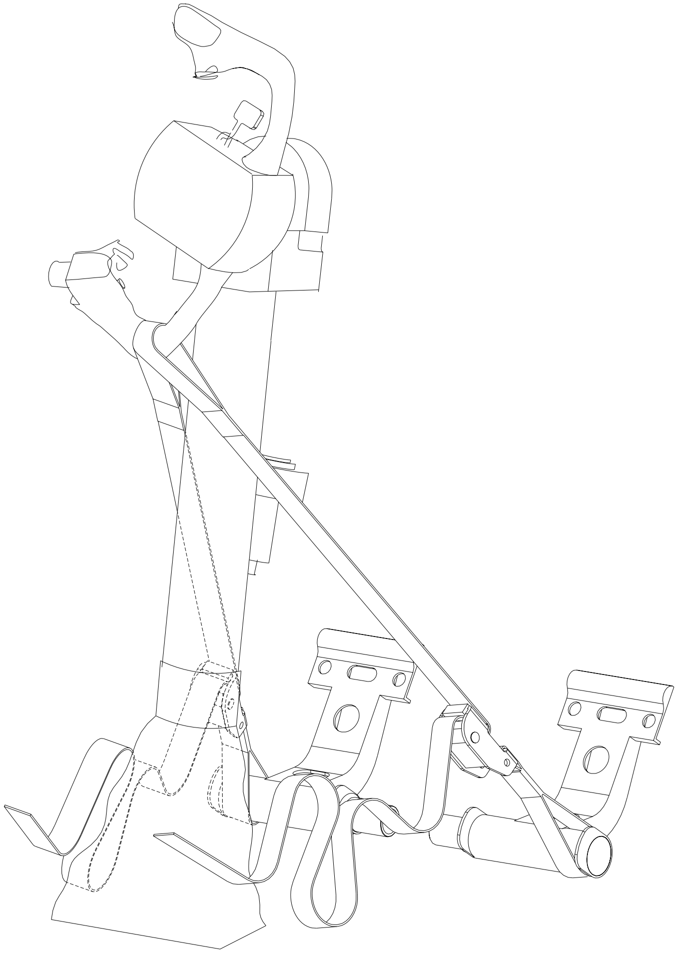
Dual, redundant power inputs are provided via the RUD FORCE circuit breaker on the right essential bus and the NOSE STEER COMPUTER circuit breaker on the left essential bus. If both these power sources should fail, the #2 IC-600 will disable rudder boost and provide appropriate annunciation.

The following CAS illuminations are specific to the rudder boost system:

CAS	Color	Description
RUD BOOST INOP	Amber	Rudder boost is inoperative and not selected OFF. Do not takeoff.
RUD BOOST INOP	White	Rudder boost is selected OFF. Do not takeoff.

CONTROLS GUST LOCK

A gust lock is provided to help prevent wind gust damage to moveable control surfaces. The gust lock is installed on the pilot's side only, with control wheel rotated counterclockwise until the bend in the handle aligns with the column, and the rudder pedals are centered. Loop straps around bottom heel, and draw both left and right pedal straps taut to seat control column against the primary stop. When installed, the gust lock secures the flight controls in the rudder centered, full aileron, and full down elevator position.



CONTROLS GUST LOCK
Figure 5-3

FLAPS

The airplane's single-slotted Fowler flaps are electronically controlled and operated by a hydraulic motor (flap power unit). Each flap panel, one on each wing, has three safe-life flap tracks and is driven by two screw jack actuators. A flexible drive shaft transfers power from the hydraulic motor to each flap actuator. The flap control lever is located on the center pedestal and is recessed to prevent inadvertent operation. The flap control lever has settings at 0° (up), 8°, 20° and 40° (down). To select a new flap position, the flap control lever is moved directly to the desired setting. Flap position is controlled by a microprocessor based controller (Flap Control Unit). The Flap Control Unit receives position command information and an arming signal from the flap control lever in the cockpit. It then provides the electrical arming and control signal to the arming solenoid valve located in the flap power unit and receives a feed-back signal from sensors mounted on the outboard actuator of each flap panel. When flaps are extended or retracted in flight, the configuration trim system automatically applies the appropriate amount of pitch trim to compensate for the pitching moment caused by flap repositioning.

The Flap Power Unit (FPU) is located under the center wing and contains the hydraulic motor, a servo control valve, an arming solenoid valve and a pressure switch. The servo valve responds to electrical signals from the flap control unit and meters hydraulic pressure to the extend or retract side of the bidirectional hydraulic motor. The arming solenoid valve must be energized open by the flap control unit before hydraulic pressure is available to the servo valve. The pressure switch, located upstream of the servo valve, monitors system pressure between the arming solenoid valve and the servo valve. If pressure is not available on flap selection, flaps will be inoperative, but if pressure is available without a selection command, the FPU will show a fault and the flaps will operate in a degraded mode, i. e. the flaps may deploy at a reduced speed when selected. These will cause the following CAS illuminations in order described above.

The following CAS illuminations are specific to the Flap System:

CAS	Color	Description
FLAPS FAIL	Amber	The flap system has failed and the flaps are inoperative.
FLAPS FAULT	Amber	The flap system is operating in a degraded mode.

Flexible drive shafts routed along the rear wing spar transmit the rotary motion of the flap power unit to the input shaft of each of the flap actuators. Two Rotary Variable Differential Transformers (RVDTs) mounted on the outboard side of each outboard flap actuator provide position information to the flap control unit and the flap position indicating unit. The flap actuators incorporate a screw jack and are attached to the rear spar. These actuators convert the rotary input motion into linear output motion through these screw jacks thus driving the flaps. Each actuator has overtravel end stops. Uncommanded retraction due to airloads, vibration, etc., is prevented by the screw jack design of the flap actuators. The flap control system operates on 28-vdc supplied through a 3- amp FLAP CTRL breaker located on the copilot's circuit breaker panel (FLIGHT group).

FLAP CONTROL LEVER

The FLAP control lever will operate in one of four positions (UP, 8°, 20°, and DN) with detents at the 8° and 20° positions. When retracting flaps, there is a gate at the 8° position; therefore, the lever must be pulled out slightly when raising the flaps above 8°. The lever is attached to dual RVDTs co-located with a flap lever detent switch within the throttle quadrant. These dual RVDTs transmit the selected position to a flap control unit. Moving the lever between positions actuates the flap lever detent switch and energizes a 75-second timing circuit within the flap control unit. This circuit allows the arming solenoid valve within the flap power unit to energize open for 75 seconds and then de-energizes. Normal flap extension from 0° to 40° will not exceed 10 seconds with engine-driven hydraulic pumps operating. However, this time will extend up to 60 seconds when using HYD XFLOW while lowering flaps from 0° to 20° in flight.

FLAP POSITION INDICATION

The flap position indicating unit has two separate and independent channels. Channel 1 provides left side equipment and Channel 2 provides right side equipment. Both channels are housed in a common chassis. Flap position is shown full time in a digital display on the Engine Indicating and Crew Alerting System (EICAS). The EICAS display is framed with a white box when the flaps are not in the selected position in flight, or on the ground with flaps not set for takeoff. The EICAS display turns red if power is advanced for takeoff and flaps are not properly set. The display turns amber if there is a fault or failure in the flap system. Flap selection and position are also displayed on the right side of the FLT (flight) system schematic page. The FLT system schematic display can be displayed on the EICAS or Multi-Function Display (MFD).

Selected flap position is indicated by a horizontal magenta line across the vertical scale. Actual left and right flap position is indicated by flap position pointers on each side of the vertical scale. When flaps have moved to their selected position, the pointers will overlay the magenta line. Flap position pointers turn red on the ground when power is advanced for takeoff and flaps are not properly set. Pointers turn amber when there is a fault or failure in the flap system. A digital indication of flap position is provided on the backup engine/systems page of the Radio Management Unit (RMU).

SPOILER SYSTEMS

Spoilers, one on the upper surface of each wing forward of the flaps, are provided for deceleration. The spoilers are electrically controlled and hydraulically operated. The spoilers are extended symmetrically for use as spoilers/speed brakes or asymmetrically for aileron augmentation. Each spoiler is hinged at four points and is extended or retracted with a single hydraulic actuator. The spoiler control lever, located on the left side of the throttle quadrant, is linked to two RVDTs. There are three labeled settings for the spoiler lever that correspond to detent positions: RET (retract), ARM (autospoilers), and EXT (full extension) - approximately 60° at slower airspeeds. The range between the ARM and EXT detents allow for variable spoiler positions in flight. There are also two unmarked detent positions between ARM and EXT which correspond to intermediate spoiler extension positions of approximately 15° and 30°. At high airspeeds the actuators cannot extend the spoilers fully; therefore, spoileron computer commands to the actuator servos are limited by airspeed inputs from the Air Data Computers (ADCs). At speeds below 175 knots, spoilers will extend to 60° when the spoiler control lever is placed to EXT; however, at higher speeds full extension is not possible.

NORMAL SPOILER MODE

The spoilers can be extended symmetrically on the ground or in flight by moving the spoiler lever aft of the ARM position. Placing the lever to any position aft of ARM while on the ground will cause full extension (60°) of the spoilers. Spoiler extension on the ground requires approximately 1 second and in flight, approximately 5 to 7 seconds. When the spoiler control lever is placed aft of the ARM position, the RVDTs will signal the spoileron computer. The computer, in turn, energizes torque motors on the servo valves to meter hydraulic pressure to the extend side of the actuators. The computer receives spoiler extension feedback from the RVDTs attached to the spoiler surfaces, and neutralizes the servo valves when the spoilers reach their selected position. In flight, the amount of spoiler extension will depend on spoiler control lever position and airspeed.

AUTOSPOILERS

Autospoiler mode is used to automatically extend spoilers on landing or in an aborted takeoff. When the SPOILER lever is set to ARM, the system will arm and CAS will illuminate. This will automatically extend spoilers when the main gear weight-on-wheels switch circuits indicate an "on ground" condition, thrust levers are in the IDLE position and the airplane has attained 60 knots ground speed. This mode fully extends spoilers at maximum rate (one second or less) when spoiler control lever is in the ARM position and autospoiler deploy logic is met. An autospoiler system is installed to automatically extend both spoilers in order to spoil lift after landing or during an aborted takeoff.

The following CAS illumination is specific to the autospoiler system:

CAS	Color	Description
AUTOSPLR ARMED	White	Autospoilers have been armed.

The main gear weight-on-wheels switch circuits are electronically latched in the "on ground" state once the initial weight-on-wheels signal is received. This prevents inadvertent spoiler retraction in the event the airplane should bounce during the ground roll. If either thrust lever is moved above IDLE while autospoilers are extended, the spoilers will immediately retract. Flap position has no effect on autospoiler operation and autospoilers are not operational when EXT or RET is selected.

The spoileron computer receives power from the L ESS BUS for operation and the spoiler indicating system receives power from the R ESS BUS. The circuits are protected by "SPLR CTRL" circuit breaker on the pilot's circuit breaker panel (FLIGHT group) and the "SPLR IND" circuit breaker on the copilot's circuit breaker panel (FLIGHT group).

When spoilers are extended or retracted in flight, depending on the mach number, the configuration trim system automatically applies the appropriate amount of pitch trim to compensate for the pitching moment caused by spoiler repositioning.

SPOILERON OPERATION

Spoilerons operate automatically on the ground and in flight to augment the ailerons whenever either control wheel is turned more than 5°. Rotation of either control wheel provides a roll input to the spoileron computer via dual RVDTs inside of the pilot's control wheel. The appropriate spoiler, left or right, extends to the commanded angle for the current conditions (Mach number, airspeed, AP engage and flap setting) while the other spoiler is commanded stowed. When in the mixed spoiler and spoileron mode, the spoiler command derived from the spoiler lever and spoileron command derived from the control wheel are added to form a composite position command for each spoiler panel. The spoiler command provides a bias position command common to both panels while the control wheel RVDTs generate a differential command. The control wheel inputs command the angular displacement that exists between the two spoilers regardless of the amount of spoilers command. Spoileron commands have priority over spoiler commands.

If the spoilers are extended, and the control wheel is turned right, the computer mix logic retracts the left spoiler first to give differential necessary for the roll commanded. If that is not enough differential for the roll commanded, the computer then extends the right spoiler as required.

SPOILERON (ROLL DISCONNECT MODE OF OPERATION)

Spoilerons provide automatic roll augmentation and backup roll control. The spoilerons are electrically controlled and hydraulically actuated. Artificial friction is introduced into the pilot control wheel upon disconnection from the mechanical aileron system to provide pilot feel and to preclude the control wheel from free-wheeling. If ailerons become jammed, the pilot's control wheel can be disconnected from the aileron control cables and the copilot's control wheel. Roll disconnect is activated with a red lever labeled (ROLL DISC) located on the hub of the pilot's control wheel. In addition to mechanically disconnecting the pilot's control wheel from the ailerons, activation of the ROLL DISC lever trips two disconnect switches within the control wheel hub. When the roll disconnect mode is activated within the spoileron computer, it outputs a signal for a CAS message to illuminate. When roll disconnect mode is activated, the autopilot will disengage.

The following CAS illuminations are specific to the spoileron computer:

CAS	Color	Description
ROLL DISC	Amber	Roll disconnect has occurred on the ground.
ROLL DISC	White	Roll disconnect has occurred in flight.

The roll disconnect mode provides roll control through RVDT signals from the pilot's control wheel to the spoileron computer. This mode is much the same as the normal spoileron mode but has a different gain curve relating to control wheel input and panel deflection begins at 1° movement instead of 5°. Spoileron operation is full time. Anytime either control wheel is turned more than 5°, there is a differential displacement of the spoiler surfaces to augment roll control. Spoilers can be operated in conjunction with the roll disconnect mode the same as they are with normal spoileron mode. The roll disconnect mode may be deselected in flight by returning the ROLL DISC lever to its normal position.

SPOILER INDICATIONS

Spoiler extension is indicated at the base of either the SUMRY or FLT system schematic page on either EICAS or MFD. On the FLT system schematic display, spoiler extension is presented as a digital display and as a vertical analog scale with dual points (one for each spoiler). The digital displays on the SUMRY and FLT pages only show spoiler extension commanded by autospoilers or with the spoiler lever. They do not reflect differential extension resulting from operation in spoileron mode. When the airplane is on the ground with spoilers extended, a white box will overlay the digital spoiler display. If power is advanced for takeoff with either or both spoilers extended, this digital display and box will turn red along with the pointers on the analog scale. In addition, a red CAS and "CONFIGURATION" voice message will activate. Spoilers should not be extended at the same time flaps are extended while in flight except as specified in the Airplane Flight Manual, or the following CAS message will be posted.

The following CAS illuminations are specific to the spoilers:

CAS	Color	Description
SPOILERS EXT	Red	The spoilers have moved from the stowed position, with aircraft on the ground, and either thrust lever is advanced to MCR or above.
SPOILERS EXT	Amber	The airplane is in flight and spoilers are extended with flaps extended more than 3°.
SPOILERS EXT	White	Spoilers are not fully retracted. Spoileron extension will not activate this CAS (flight and ground).

The analog scale and pointers are real time showing actual spoiler position for all conditions. When spoilers are extended as result of spoileron operation, pointers will indicate their differential on the analog scale. Digital spoiler indicators and analog scale pointers will turn amber when flaps are extended 3° or more with spoilers extended.

SPOILER MONITOR SYSTEM

The spoileron computer contains a monitor system to prevent electrical or mechanical faults from causing uncommanded extension or retraction of the spoilers. The spoileron computer uses electrical power from the L ESS BUS for operation and the spoiler indicating system uses power from the R ESS BUS. The circuits are protected by the SPLR CTRL and SPLR IND circuit breaker, respectively, located in the FLIGHT group on the pilot's and copilot's circuit breaker panels. If power to the spoileron computer is lost through the SPLR CTRL or SPLR IND circuit breaker, the spoilers will retract and be inoperative in all modes. The spoileron computer performs a self-test (BIT) at powerup. A test failure will trip the spoileron monitor. If the monitor detects a self-test failure or a fault during normal operation, hydraulic pressure is removed from the system by closing the spoiler shutoff valve. A hydraulic return is provided to blow the spoilers closed. During normal operation, the shutoff valve is held open by an electrical solenoid. A power failure will cause this valve to close. *On aircraft 45-002 thru 45-294* ***not*** *modified by SB 45-27-20 (Modification of the Spoiler System Control Wheel Master Input)*, when either Control Wheel Master Switch (MSW) is held depressed, the spoiler shutoff valve is depowered closed and the spoilers will blow down, however, they may not fully retract.

A system malfunction will cause the spoileron monitor to trip and an amber CAS display. If the malfunction clears, the system may be reset using the "SPLRN RESET" position on the system test knob. If the monitor detects a jammed spoiler, the spoileron computer continues to operate using the spoiler that is not jammed and it applies a full retract input to the effected actuator for 5 to 7 seconds. This will also illuminate on the CAS.

The following CAS illuminations are specific to the spoileron monitor:

CAS	Color	Description
SPOILERS FAIL	Amber	A failure in the spoiler system is detected.
SPOILER JAM	Amber	The associated (L or R) spoiler is jammed.

PITCH TRIM

Pitch trim is provided by a moveable horizontal stabilizer. Operational structural redundancy has been incorporated by using primary and secondary sections that are independent. Primary and secondary each have electrically and mechanically independent motors (separated for rotor burst considerations), gear trains, and control inputs. Position sensors in each section of the actuator, geared directly off of the main drive screw, are monitored by both IC-600s. The computers compare the primary position sensors to the secondary position sensors in the actuator to annunciate to the pilot when the display position may not be accurate. The secondary section structure, construction, and operation is the same as the primary and both sections drive a common screwjack-type actuator to move the leading edge of the horizontal stabilizer up or down. The primary motor is actuated by manual primary pitch trim (control wheel trim switch), configuration trim, and Mach trim systems. The secondary motor is provided as a backup for primary trim and is operated by the secondary pitch trim and the autopilot.

The following CAS illuminations are specific to the pitch trim system:

CAS	Color	Description
PIT TRIM MISCMP	Red	Miscompare between the primary and secondary pitch trim on the ground and either thrust lever is advanced to MCR or above.
PIT TRIM MISCMP	White	Miscompare between the primary and secondary pitch trim in flight.

PITCH TRIM SELECTOR SWITCH

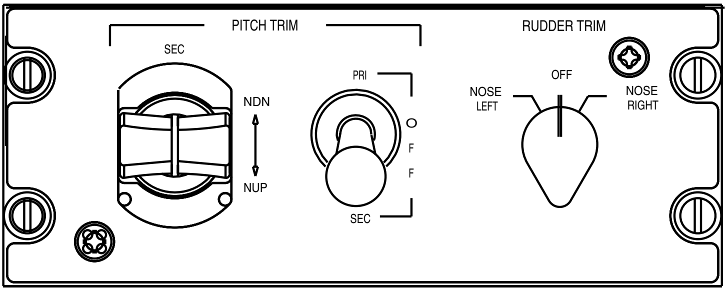
This switch, as shown in Figure 5-4, is located on the trim switch panel (pedestal) and is used to select which trim system will be used. The PRI position enables the primary trim switches in the control wheels, while the SEC position will enable the secondary trim switches in the panel. Selecting OFF or SEC will disable all #1 IC-600 trim functions. When set to OFF position, the power and ground circuits for the motor command functions in the actuator control box are disconnected and a CAS is posted.

The following CAS illumination is specific to the pitch trim system:

CAS	Color	Description
PITCH TRIM OFF	White	Pitch trim is selected to OFF.

PRIMARY PITCH TRIM

Each control wheel has a control wheel trim switch located on the outboard horn of each control wheel (Figure 5-1). Each switch is a four position (LWD, RWD, NOSEDOWN & NOSEUP) barrel switch with a momentary-action push button switch in the center of the barrel. This switch is used to input trim commands for pitch and roll and autopilot functions. Normally, the pitch trim control switch (Figure 5-4) is positioned to PRI. This position enables the control wheel trim switches and causes commands from either of these switches to be processed by the #1 IC. To complete the trim command circuit, the arming switch (button) on the top of the barrel must be depressed simultaneously with movement of the barrel. Trim commands from the pilot's control wheel trim switch will override commands from the copilot's. Primary trim speed is variable and is automatically controlled by the #1 IC based on indicated airspeed. The IC uses airspeed information from both ADCs to schedule trim speed and Mach trim. The #1 IC sends the primary trim commands to the primary trim actuator. The trim actuator and the IC both monitor the trim operation. The primary trim actuator performs a power-up circuit check. If the actuator detects a fault during the power-up check, a fault is posted on the CAS. Primary trim will still be available with the fault displayed, however, operation may be at a low trim rate and configuration trim and Mach trim may be inoperative depending on the malfunction. The primary trim actuator and #1 IC both monitor primary trim operations for a number of possible malfunctions including uncommanded trim and trim in the wrong direction. If either of these malfunctions is detected by the trim actuator, a fail is displayed on the CAS and primary trim is disabled.



TRIM SWITCH PANEL
Figure 5-4

Electrical power for primary pitch trim is provided by the L ESS BUS and is protected by the TRIM-PRI PITCH circuit breaker located on the pilot's circuit breaker panel (FLIGHT group). The dc electrical power to the #1 IC is also required for primary pitch trim, except for primary bypass trim. The power for #1 IC is provided by the L ESS BUS and protected by IC/SG 1 circuit breaker located on the pilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).

Bypass Trim

Primary trim reverts to bypass as a result of a detected malfunction or #1 IC failure and cannot be selected by the crew. When in bypass trim a fault is displayed on CAS and control wheel trim switch commands go directly to the primary trim actuator, bypassing the IC circuits. The #1 IC trim functions (IC controller/monitored primary trim, configuration trim, and Mach trim) are all disabled in this case. When in bypass trim, the primary trim actuator operates at only two speeds (high or low). The speed depends on flap position. Dual flap position inputs are provided to the actuator electrical box to maintain redundancy. If the flap signals do not agree, the rate of trim function is limited to slow speed. Both flap signals must agree and must indicate flaps are greater than 3° for the actuator to operate at a high rate. When the flaps are up (<3°), primary bypass trim will be at a slow rate. The primary trim actuator continues to monitor for uncommanded trim and incorrect trim direction in the bypass trim mode. It also monitors for the correct trim speed based on flap position. If it detects a failure in any of these areas, primary trim is disabled and a fail CAS is displayed.

The following CAS illuminations are specific to the primary pitch trim:

CAS	Color	Description
PRI TRIM FAIL	Amber	The primary pitch trim system has failed.
PRI TRIM FAULT	White	The Integrated avionics Computer (IC) detects a fault in the primary pitch trim system.

SECONDARY PITCH TRIM

Secondary pitch trim is electrically independent of the primary trim, configuration trim, and Mach trim. In the event of primary trim failure, secondary pitch trim is available as a backup means of trimming the airplane in the pitch axis. The autopilot also uses the secondary trim actuator as a normal means of trimming in the pitch axis. The autopilot can use the secondary trim actuator with the trim selector in the PRI or SEC position.

The dual-segment SEC trim switch (Figure 5-4) is located on the center pedestal. Manual activation of secondary trim requires that the pitch trim selector be in the SEC position and that both segments of the spring-loaded SEC switch be moved at the same time. When SEC position is selected, a CAS is displayed.

The secondary pitch trim actuator has a monitor function similar to the primary actuator. It performs a power-up check and if any faults are detected, a fault is displayed on the CAS, however, secondary trim operates normally. The secondary trim actuator also monitors for uncommanded trim, trim in wrong direction, and incorrect trim rate. If any of these malfunctions are detected, a fail annunciation is posted on CAS and the secondary actuator is disabled. The IC has no control or monitor functions for manual secondary trim.

The following CAS illuminations are specific to the secondary pitch trim:

CAS	Color	Description
SEC TRIM FAIL	Amber	Secondary pitch trim has failed.
SEC PITCH TRIM	White	Secondary pitch trim is selected by the crew.
SEC TRIM FAULT	White	A pitch trim actuator (secondary) fault is detected.

Electrical power for the secondary pitch trim system is provided from the R ESS BUS and is protected by the TRIM-SEC PITCH circuit breaker located on the copilot's circuit breaker panel (FLIGHT group).

AUTOPILOT PITCH TRIM

When the autopilot is engaged, it can drive the horizontal stabilizer trim to alleviate elevator servo loading. The autopilot pitch trim function is contained in the #2 IC autopilot processor. When elevator servo current exceeds a predetermined threshold for a given period of time, this is considered to be a steady state error and trim will run. As the trim runs, the horizontal stabilizer is re-positioned and the air load on the elevator primary servo is reduced. When this load falls below the threshold level, trim stops running.

Whenever the autopilot is engaged, #1 IC trim functions, which includes config/Mach trim, drop off-line. The autopilot commands pitch trim based on elevator servo current demand and airspeed. Autopilot pitch trim engagement is controlled by the autopilot engage logic. An autopilot engage signal is provided to the horizontal trim actuator. If the autopilot is disengaged as a result of a monitor trip, the aural tone alert will sound until the MSW switch is pushed. A red AP will also be displayed on the PFDs and flash for five seconds and then go steady. The #2 IC monitors for uncommanded trim, trim direction, and incorrect trim rate. If the actuator detects one of the above faults, a CAS is displayed.

The following CAS illumination is specific to the autopilot pitch trim:

CAS	Color	Description
AP ELEV MISTRIM	Amber	Autopilot elevator servo holding excessive torque.

TRIM-IN-MOTION INDICATION

A trim-in-motion potentiometer is installed on the secondary trim actuator. When the autopilot energizes the secondary trim actuator for more than 2 to 3 seconds, a series of audible clacker sounds is transmitted through the audio system. A built-in time delay allows trim operation for approximately 2 to 3 seconds before the clacker sounds which prevents a nuisance alarm on the clacker. For longer periods of continuous trim, the clacker will alert the crew. Unusual long periods of autopilot trimming may indicate trim runaway. There is no trim-in-motion clacker for any trim operation other than autopilot trim.

PITCH TRIM BIAS

The pitch trim bias system works in conjunction with the up/down spring assembly. Its function is to assist the pilot by providing added spring pressure against the elevator in the event the horizontal stabilizer is jammed in an out-of-trim position. Pitch trim bias is actuated by the crew using the three-position (spring loaded to the center position) PIT TRIM BIAS switch located at the front of the throttle quadrant. Power for the system is provided through the PIT TRIM BIAS circuit breaker on the copilot's circuit breaker panel (FLIGHT group).

The following CAS illuminations are specific to the pitch trim bias.

CAS	Color	Description
PIT TRIM BIAS	Red	Abnormal PIT TRIM BIAS configuration with the aircraft on the ground and either thrust lever is advanced to MCR or above.
PIT TRIM BIAS	White	The pitch trim bias system is moved from the normal position. PIT TRIM BIAS should only be used for jammed stabilizer conditions in flight.

CONFIGURATION TRIM

The configuration trim functions aid the pilot by providing automatic relief of control column loads via the #1 IC control of horizontal stabilizer position. The configuration trim system control and monitoring functions are provided by software contained in the #1 IC using inputs from spoiler lever position sensors or when flap position is greater than 3° . Through these interfaces, the configuration trim provides automatic pitch control for changes in airplane configuration. This mode is only functional when the trim selector switch is in the PRI position and the autopilot is not engaged. Trim commands from either control wheel trim switch will have priority over the configuration trim commands.

AILERON TRIM

The aileron trim system provides manual aileron trim tab control. The manual trim tab control system enables the pilot, with authority, and the copilot to eliminate out-of-trim forces which may be present in the aileron control circuit, preventing smooth operation of the control column. This enables the airplane to be flown without either pilot having to apply constant forces to the hand wheel to maintain the wing level. The aileron trim system is controlled by a control wheel trim switch mounted on the pilot and copilot's control wheels (Figure 5-1) and incorporates two switches, trim, and trim arm. To manually trim, the pilot or copilot must press and hold the ARM button while pushing the trim switch to the LWD or RWD position. The control wheel trim switch induce inputs into the roll trim control electrical system which translates commands to a rotary actuator mounted in the left aileron. The actuator moves the aileron trim tab through dual push rods to the command position. A trim tab position sensor is attached to the rotary actuator shaft and provides input to the Data Acquisition Units (DAUs) for display of aileron trim position on the cockpit Engine Indicating and Crew Alerting System (EICAS). Driving the actuator clockwise causes the trim tab to rise. This results in left aileron moving down and the right aileron moving up. This results in the airplane performing a Right Wing Down (RWD) movement. Conversely, driving the actuator counterclockwise causes the trim tab to lower. This causes the left aileron to move up and the right aileron to move down, resulting in the airplane performing a Left Wing Down (LWD) movement.

Aileron trim is powered from the L ESS BUS and is protected by TRIM-AIL 5-amp circuit breaker on the pilot's circuit breaker panel (FLIGHT group).

RUDDER TRIM

The rudder trim system provides manual rudder trim tab control. The manual trim control system enables the pilot and copilot to eliminate out-of trim forces which may be present in the rudder control circuit. This enables the airplane to be flown without either pilot having to apply a constant force to the rudder pedals.

Rudder trim changes are effected through an electronically driven rotary actuator mounted in the rudder and connected to the rudder trim tab with dual pushrods. The actuator is controlled manually by a double-pole, double-throw, center-off, momentary-action, rotary switch located on the trim switch panel (Figure 5-4) in the center pedestal. This switch is constructed in two sections with poles that are not mechanically linked. One pole of the switch is used to provide control of the rudder trim ARM circuit and is referred to as the ARM switch. The other pole of this switch is used to provide either nose left or nose right trim commands and is called the rudder trim switch. These poles are independent of each other except of the fact that they are both rotated by the same shaft. The failure of one pole will not affect the other. Since one pole provides ARM control and the other provides the trim command inputs, the failure of one pole will not result in a trim runaway. Setting and holding the switch to the NOSE LEFT or NOSE RIGHT position energizes the trim tab actuator, resulting in the rudder rotating either clockwise or counterclockwise. A trim tab position sensor is attached to the rotary actuator shaft and provides input via the #2 data acquisition unit for display of rudder trim position on the cockpit engine indicating and crew alerting system.

Electrical power for rudder trim is provided from the R ESS BUS and protected by TRIM-RUD 5-amp circuit breaker located on the copilot's circuit breaker panel (FLIGHT group). Rudder trim can be stopped by depressing and holding either control wheel master switch.

TRIM INDICATIONS

Pitch, aileron, and rudder trim indications are provided on the EICAS and the MFD. A digital display of pitch trim position (PIT TRIM) is always in view below the CAS window, on the right side of the EICAS. Pitch (PIT), aileron (AIL), and rudder (RUD) trim are digitally displayed on the SUMRY page. They are arranged in a vertical column labeled FLT on the right side of the SUMRY page. The SUMRY page is the power-up default display on the EICAS. The SUMRY page is displayed at the base of the MFD. Trim indications are correspondingly displayed on the left side of the FLT system schematic page.

The following CAS illuminations are specific to the trim indications:

CAS	Color	Description
TAKE OFF TRIM	Red	The aircraft is on the ground and either thrust lever is advanced to MCR or above, and aircraft trim (pitch, aileron, or rudder) is not set for takeoff.
TAKE OFF TRIM	White	The aircraft is on the ground and aircraft trim (pitch, aileron, or rudder) is not set for takeoff.

PITCH TRIM INDICATIONS

Pitch trim tab position is presented as both analog and digital display. The label PITCH, in cyan, is positioned above the pitch trim tab position digital readout. The range of pitch trim is from 0 to 10, and with 0 being maximum nose down trim and 10 being maximum nose up trim. The analog scale consists of a white vertical line with three horizontal tick marks on the right side. The labels NDN and NUP are displayed at the left top and bottom of the scale, respectively. The digits 0 and 10 are displayed at the right top and bottom of the scale, respectively. The analog scale has a white takeoff band located between 5.5 units and 8.7 units. There is a pointer which moves up and down the left side of the scale in accordance with the digital readout of the pitch trim tab position. If the pitch trim is not within the takeoff band, and the airplane is on the ground, the digital display of trim will have a white box around it and a message posted to CAS. If power is advanced for takeoff (MCR or greater) and pitch trim is not within the takeoff band, the "CONFIGURATION" voice warning will sound and the CAS message turns red along with the digits, pointer and box in the trim position display. Invalid data will replace the digits with amber dashes, and the pointer and box are removed.

AILERON TRIM INDICATIONS

Aileron trim tab position is presented as both analog and digital display. The label AILERON, in cyan, is positioned above the aileron trim tab position digital readout. The range of aileron trim position is from L12 to R12 and with L being left wing down, and R being right wing down. The analog scale consists of a white arc with three tic marks on the outside of the arc. The digits 10, in white, are displayed at the left and right ends of the scale, respectively. A white takeoff trim band is located on the outside of the scale between the values of +5 and -5. A pointer moves along the inside of the scale in accordance with the digital readout of the aileron trim tab position. If the aileron trim is not within the takeoff band while the airplane is on the ground the digital display will have a white box around it. CAS messages and alerting are the same as those described above in pitch trim.

RUDDER TRIM INDICATIONS

Rudder trim tab position is presented in both analog and digital display. The label RUDDER, in cyan, is positioned above the rudder trim tab position digital readout. The range of rudder trim position is from L12 to R12, and with L being nose left and R being nose right. The analog scale consists of a horizontal white bar with three tic marks on the top of the bar. The digits 10, in white, are displayed at the left and right ends of the scale, respectively. A white takeoff trim band is located on the top of the horizontal scale between +5 and -5. There is a pointer which moves along the bottom of the scale in accordance with the digital readout of the rudder trim tab position. If the rudder trim is not within the takeoff band while the airplane is on the ground the digital display will have a white box around it. CAS messages and crew alerting are the same as described in pitch trim. Pitch, aileron, and rudder trim indications are available on page 2 of the backup engine/system pages on the RMU.

MACH TRIM

Mach trim is a fully automatic system installed to increase longitudinal stability and counteract nose-down tendency at high Mach numbers. A circuit card in the #1 IC performs all the computational aspects for Mach trim and signals the primary trim actuator to apply trim as necessary. Airspeed information provided by the ADCs is used by the IC in computing the trim requirement.

The pitch trim selector (Figure 5-4), located on the center pedestal, must be in the PRI position for Mach trim to be functional and the autopilot must be disengaged for the Mach trim to become active. If the autopilot is engaged, it performs the pitch trim function using the secondary trim actuator and the Mach trim is in a passive mode. Mach trim automatically becomes active at 0.725 MI. Nose up trim will be applied as Mach increases and nose down as Mach decreases. When the horizontal stabilizer position changes, two Mach trim position sensors apply feedback signals to the IC. Mach trim is interrupted whenever the manual trim is activated. The system resynchronizes to function about the new horizontal stabilizer position when manual trim is released. If the IC detects a fault within the Mach trim system function, a fail is posted on the CAS and the overspeed cue on the airspeed indicator will also adjust to indicate a Mach limit of 0.76 to 0.78 MI.

The following CAS illuminations are specific to the Mach trim:

CAS	Color	Description
MACH TRIM FAIL	Amber	Mach trim function has failed and aircraft speed is greater than 0.76 to 0.78MI.
MACH TRIM FAIL	White	Mach trim function has failed and aircraft speed is equal to or less than 0.76 to 0.78MI.

STALL WARNING SYSTEM

The stall warning system, also referred to as the Angle-of-Attack (AOA) system, is installed to provide the crew with an indication of impending airplane stall. The stall warning system consists of two independent systems which use a dual channel computer.

Other system components include two AOA sensors, control column shaker motors and an interface with the PFDs. Left and right AOA indicators are available as an option. Each channel of the computer generates a reference signal to the corresponding stall vane and, in return, receives AOA information. The computer then processes this information with airspeed, altitude, flap setting, and weight-on-wheels inputs to determine the stall warning indications. The left and right stall warning systems are powered from the left and right essential buses respectively. The circuits are protected by the L STALL WARN and R STALL WARN circuit breakers located on the pilot's and copilot's circuit breaker panels (FLIGHT group).

STALL WARNING INDICATIONS

As the airplane approaches stall speed, stall warning indications are activated. The shaker speed will be above the stall speed at the most critical weight and Center of Gravity (CG). The stall warning computer sums inputs of AOA and altitude shift along with flap position from the flap position indication unit. Stall warning is biased for each flap setting. The stall warning system provides the following aural, tactile, and visual indications when the predetermined conditions have been reached:

(1) The left and right channels of the computer drive low-speed cues on the pilot's and copilot's PFDs respectively. The low-speed cue is a vertical red bar on the inside of the airspeed tape which rises from the bottom of the tape as the airplane AOA increases. The point at which the red bar reaches the airspeed pointer will coincide with the point at which other stall warning indications are activated.

(2) The left and right channels of the stall computer will activate the control column shaker motors.

(3) The non-cancelable voice message "STALL" will repeat until the AOA is decreased.

(4) The AOA indicators (if installed) will enter the red band on the indicator.

STALL WARNING OPERATION

The stall warning system is powered when the circuit breakers are in. The shakers, along with other visual and aural stall indications, are inhibited until the airplane is airborne. If installed, the AOA indicators will operate in both the air and ground modes. The stall warning system performs a power-up self-test (BIT) and monitors for a number of possible system faults. Detection of a fault appears on CAS.

The following CAS illumination is specific to the stall warning system:

CAS	Color	Description
STALLWARN FAIL	Amber	The associated (L or R) stall warning system has failed.

STALL VANE ANTI-ICE

The stall vanes are equipped with a 28-vdc heater to anti-ice the vane surfaces during icing conditions. The AOA vane heater of the angle-of-attack transmitter is monitored for open circuit when the vane heater power is applied. Detection of an open circuit will result in the appropriate CAS message as well as being logged into the stall computer as a fault for that flight. The vane heaters are controlled by the L and R PROBE anti-ice switches located on the anti-ice section of the center switch panel. Each vane heater is supplied power from the left and right main bus respectively and protected by the AOA 15-amp circuit breakers on the pilot's and copilot's circuit breaker panel (ANTI-ICE group).

The following CAS illumination is specific to the stall vane anti-ice system:

CAS	Color	Description
AOA HT FAIL	Amber	Associated (L or R) angle-of-attack vane heater has failed.

STALL SYSTEM TEST

A self-test mode is available when the weight-on-wheels signal indicates that the airplane is on the ground and no system failure is detected. When the system test switch is rotated to the STALL position and held down for approximately 7 to 10 seconds, the stall warning computer shall demonstrate that the stall warning system is fully operational by performing the following events in the order listed:

(1) L AOA HT FAIL message appears in CAS.

(2) Low Speed Awareness (LSA) bar will begin to sweep up the pilot side airspeed tape, the left (pilot's) column will shake when the LSA bar approximately reaches the indicated airspeed pointer, and the aural voice warning "STALL" will be repeated through the cockpit speakers and crew headphones.

(3) L AOA HT FAIL message extinguishes from the CAS window, the LSA bar scrolls down the airspeed tape, the left column stops shaking and the aural warning stops.

(4) R AOA HT FAIL message appears in CAS. (Note: Master caution tone may not sound when the R AOA HT FAIL is annunciated. If the master caution tone is not heard, then the STALL aural warning will be heard as called out in the next step below).

(5) The LSA bar will begin to sweep up the copilot side airspeed tape, the right (copilot's) column will shake when the LSA bar approximately reaches the indicated airspeed pointer, and the aural voice warning "STALL" will be repeated through the cockpit speakers and crew headphones (if the master caution tone was not heard in the previous step).

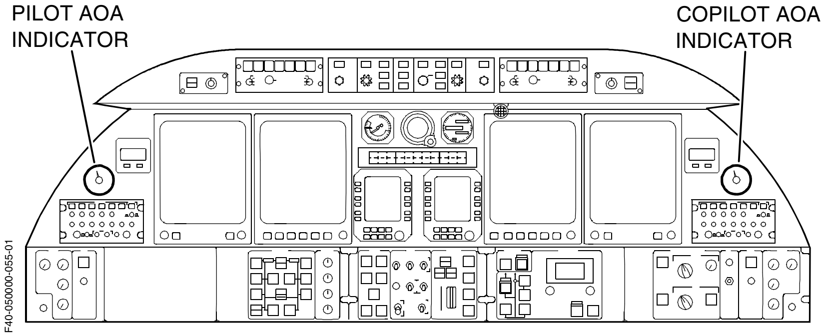
(6) R AOA HT FAIL message extinguishes from the CAS, the LSA bar scrolls down the airspeed tape, the right column stops shaking and the aural warning stops (if the aural warning was present in the previous step).

The left and right stall warning failure discretes are not checked during self-test. It was necessary to inhibit the output of the left and right failure discretes in order to permit display of the LSA bar on the PFDs during test.

ANGLE-OF-ATTACK INDICATORS (OPTIONAL)

The optional Angle-of-Attack (AOA) indicators system consists of two angle-of-attack indicators mounted in the instrument panel, one outboard of the pilot PFD and one outboard of the copilot PFD, Figure 5-5.

The angle-of-attack indicators display continuous angle-of-attack position to the flight crew. The AOA indicators are driven by the stall warning computer. The dual channel computer provides buffered outputs to the indicators for protection. The pilot AOA indicator receives data from the left channel of the stall warning computer and the copilot AOA indicator receives data from the right channel of the stall warning computer. The AOA indicator is adequately marked displaying .10, .20, .30, .40, .50, .60, .70, .80, .90, 1.0 with unnumbered marks half way between each. The beginning of the red band at .80 represents shaker activation and an imminent stall condition. The AOA indicators front plate markings are consistent with the stall warning information shown on the PFDs, a tape type presentation at the end of the airspeed tape. The AOA indicators are powered via the L STALL WARN and R STALL WARN circuit breakers located on the pilot's and copilot's circuit breaker panels (FLIGHT group).



INSTRUMENT PANEL LAYOUT AND AOA INDICATOR POSITION
Figure 5-5

AVIONICS

HONEYWELL PRIMUS 1000 AVIONICS SYSTEM

The Learjet 45 is equipped with a Honeywell Primus 1000 Avionics system. The primary component of the Primus 1000 system is the display flight guidance computer, or more simply, the IC-600. This computer, together with the appropriate controllers and sensors, comprises the Primus 1000 system. It consists of dual IC-600 (single autopilot is contained in the copilot's IC-600), dual air data computers, PRIMUS weather radar system and appropriate controllers. The radio sensor package is the Honeywell PRIMUS II integrated radio system.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The PRIMUS 1000 EFIS System consists of four, 8 x 7 inch, Display Units (DUs) driven by two Symbol Generators (SGs) resident in the two IC-600s. The EFIS presents information to the crew in an uncluttered format, simplifying cockpit scan, and reducing pilot workload and fatigue. The flight instruments, engine instruments, system status, navigation, TCAS, RADAR, and electronic checklist are all displayed on these high resolution DUs. The EFIS is integrated with the Engine Indicating and Crew Alerting System (EICAS) and Crew Warning Panel (CWP) to provide the crew with not only flight monitoring indications but also with engine data, warning, cautionary and advisory alerts (visual and aural). Dual Primary Flight Displays (PFDs) combine attitude and HSI formats with airspeed, vertical speed and other essential information, such as resolution advisories for the optional TCAS system. A Multi-Function Display (MFD) offers a full spectrum of operational capabilities, from weather radar and mapping displays, to a custom programmable checklist. A digital audio control system and dual Radio Management Units (RMUs) support the communications and navigation functions.

The display information provided on EFIS is generated by two IC-600 computers located in the nose. Each of the IC-600s contains circuitry that performs the symbol generation function for the EFIS. Along with interfacing with the display units, the ICs receive data from the Data Acquisition Units (DAUs), Air Data Computers (ADCs), Attitude Heading Reference System (AHRS), navigation system, flight management system, autopilot and other various display controllers. The CAS monitors the IC-600 bus interconnect, the temperature of each IC-600, the IC cooling fans and Weight-On-Wheels (WOW). A CAS will also illuminate if communications between the left and right ICs are invalid.

The following CAS illuminations are specific to the IC-600:

CAS	Color	Description
IC 1-2 OVHT	Amber	#1 and/or #2 Integrated avionics Computer (IC) are/is overheated.
IC BUS FAIL	Amber	-The off-side IC has failed. or - IC bus invalid
IC1-2 FAN FAIL	White	#1 and/or #2 Integrated avionics Computer (IC) cooling fan has failed.
IC1-2 WOW INOP	White	The associated (#1 or #2) Integrated avionics Computer (IC) has tripped the weight-on-wheels validity monitor.

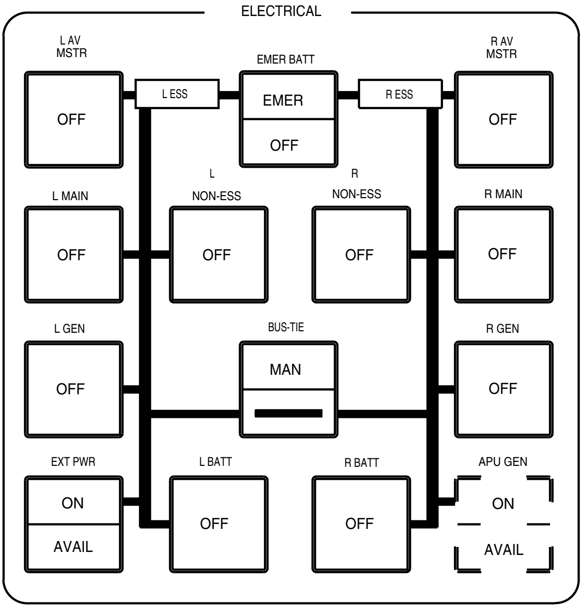
IC-600 POWER SOURCE

The #1 and #2 IC-600s are powered from the left and right essential buses respectively. The circuits are protected by the 7.5-amp IC/SG 1 and IC/SG 2 circuit breakers on the pilot's and copilot's circuit breaker panels (INSTRUMENT/INDICATIONS group).

AVIONICS MASTER SWITCHES

Left and right avionics master switches are located on the electrical control panel below DU 2 (Figure 5-6). When the alternate action avionics master switches are selected to On (OFF annunciator extinguished), contactors are closed that connect the left and right essential avionics buses and left and right main avionics buses to the respective generator buses.

The associated essential contactors and main bus contactors must be closed for the avionics buses to be powered. If the avionics master switches are on during ground start or for a starter assisted airstart, the essential avionics buses will continue to be powered, but the contactors for the main avionics buses will automatically open until the start is complete. The essential avionics buses must remain powered during an airstart since they power the critical flight display units. The emergency bus, essential buses and essential avionics buses are all powered by the emergency battery during a starter assisted start. The avionics equipment that must be on during a ground start is powered from the essential buses and the emergency battery bus.



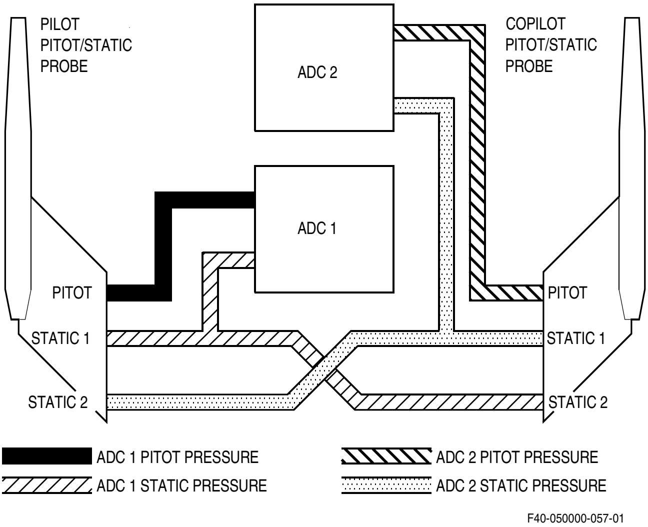
ELECTRICAL CONTROL PANEL
Figure 5-6

AIR DATA SYSTEM (ADS)

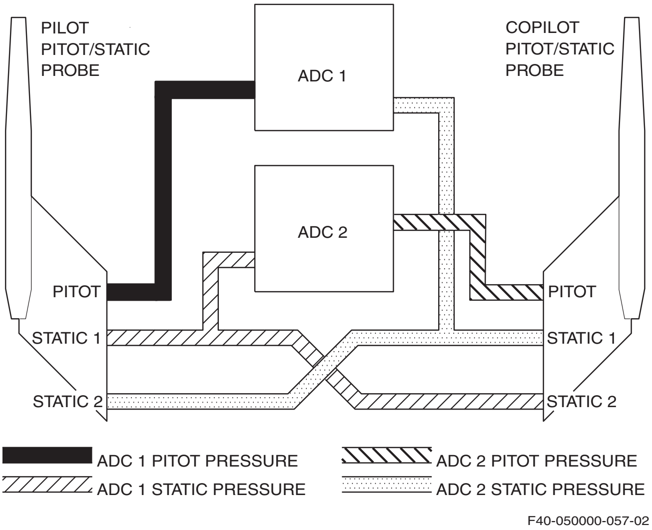
The air data system and air data instruments depend upon pitot pressure and static pressure sensing, as well as air temperature sensing. Air data is provided to the flight instruments and airplane systems by two Air Data Computers (ADCs) which receive pitot and static information from the main pitot static system. The ADCs receive total air temperature from a dual element temperature probe and barometric correction inputs via the BARO set knobs on the corresponding PFDs.

PITOT-STATIC SYSTEM

The primary pitot-static system consists of two pitot-static probes, located one on each side of the airplane's nose section. The pilot's pitot-static probe supplies the pilot's ADC with total pressure and the copilot's pitot-static probe supplies the copilot's ADC with total pressure. Each pitot-static probe has two isolated static ports. The pilot's ADC receives static pressure from coupled static ports off the pilot's and copilot's pitot-static probes (Figure 5-7). The copilot's ADC receives static pressure from separate coupled static ports off the pilot's and copilot's pitot-static probes which are isolated from the static ports used by the pilot's ADC. This crossover arrangement reduces system errors.

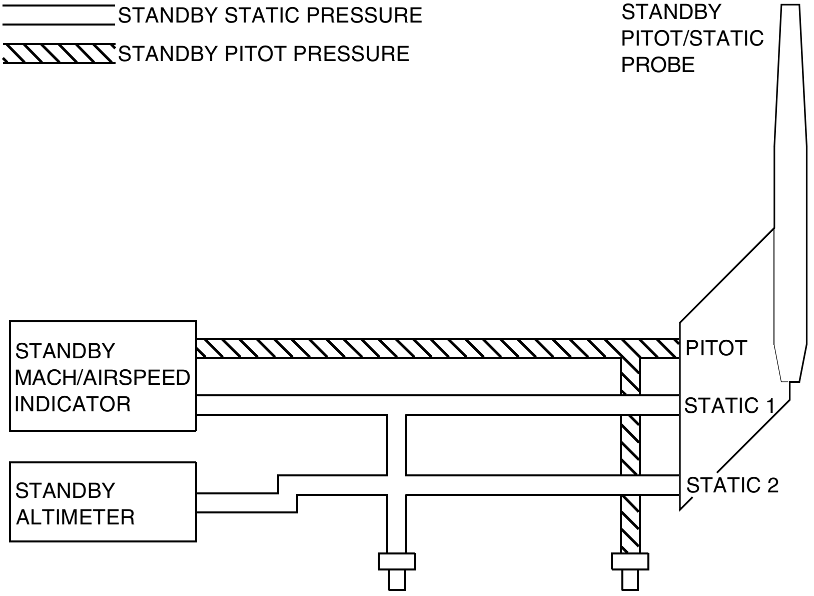


PITOT-STATIC SYSTEM SCHEMATIC
Aircraft 45-005 thru 45-079
Figure 5-7



PITOT-STATIC SYSTEM SCHEMATIC
Aircraft 45-080 & Subsequent
Figure 5-7A

A third pitot-static probe, mounted above the main probe on the right side of the airplane, provides total and static pressure inputs to the standby instrument group. Moisture drains are provided for the standby pitot-static lines. The two drains for the standby pitot-static system are flush mounted on the right side of the airplane just aft of the nose wheel door. The main pitot-static probes are physically located at the lowest point of the primary pitot-static system plumbing and therefore, do not require moisture drains. The pitot source on the standby probe provides total pressure to the standby Mach/airspeed indicator. There are two static sources on the standby probe, one provides static information to the standby altimeter and the other provides data to the standby Mach/airspeed indicator (Figure 5-8).



STANDBY PITOT-STATIC SYSTEM SCHEMATIC
Figure 5-8

AIR DATA COMPUTERS (ADCs)

The Learjet 45 utilizes two, independent micro air data computers as the primary source for air data. The is a self contained unit incorporating pressure sensing modules and all required processing and input/output functions in a single unit. Each computer is independent of the other and has independent circuit breakers.

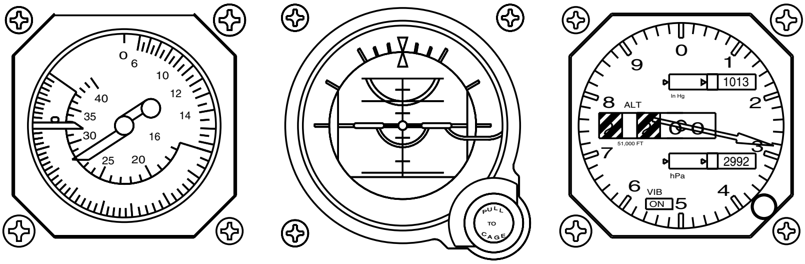
The air data system provides the required airplane airspeed, air temperature, altitude and vertical speed data for the Electronic Flight Instrument System (EFIS) displays, Attitude and Heading Reference System (AHRS), dual stall warning system, autopilot, transponders, spoileron computer, cabin pressurization, Digital Electronic Engine Control (DEEC) and landing gear warning system as required. The Air Data System (ADS) accepts static air pressure, total air pressure, total air temperature, various discrete signals and baro set inputs. The #1 and #2 ADCs receive power from the L and R ESS BUS respectively, through ADC 1 and ADC 2 circuit breakers. The circuit breakers are located on the pilot's and copilot's circuit breaker panels (INSTRUMENT/INDICATIONS group).

ADC REVERSION

Display of the ADS data on the EFIS display is controlled by the pilot or copilot via the ADC reversionary control switch (Figure 5-14). The reversionary control panel, located below the EICAS display (DU#2), incorporates an ADC reversion switch which has three positions, 1 - ADC NORM - 2. In the ADC NORM position, the IC-600s receive air data from their on-side ADC. In the "1 or 2" position both IC-600s receive air data from the selected source. If the switch is not in the NORM position, an annunciator of the selected source is displayed above and to the left of the ADI on both PFDs.

STANDBY INSTRUMENTS

The standby instrument group (Figure 5-9) includes a barometric altimeter, a airspeed/Mach indicator, an attitude indicator, mounted on the center instrument panel above the CWP and RMUs. The standby instruments have their own pitot-static probe to provide air data information. The instruments are of traditional mechanical design. If a fault occurs which causes one of the ADCs to output misleading information to the PFDs, the standby instruments act as a useful comparison to indicate which of the three displays is incorrect.



STANDBY INSTRUMENT GROUP
Figure 5-9

STANDBY ALTIMETER

The standby altimeter displays baro corrected altitude in a pointer/counter drum display. The dial graduations are marked every 20 feet. Above sea level the counter displays every 100 feet up to 55,000 feet of operational range. The indicator has dual barometric correction, from 27.9 to 31 inches of mercury and 946 to 1050 hectoPascals. Back lighting is provided by 5-vdc to illuminate the standby altimeter indicator at night.

STANDBY AIRSPEED/MACH INDICATOR

The standby airspeed/Mach indicator provides indicated airspeed by means of a pointer indicating against a 50- to 400-knot dial and a Mach sub-dial ranging from 0.3 to 1.0 Mach. Maximum allowable airspeed (Vmo) is indicated at 325 knots by a red radial mark on the airspeed dial. Maximum allowable Mach (Mmo) is indicated at 0.75 Mach by a red and white striped radial mark on the Mach sub-dial. Back lighting is provided by 5-vdc to illuminate the standby airspeed/Mach indicator at night.

STANDBY ATTITUDE INDICATOR

The standby attitude indicator provides a visual indication of the airplane flight attitude. It is located in the center of the standby instrument group (Figure 5-9) where it can be viewed easily by both pilots. It is powered from the emergency battery bus so that it will remain powered for at least one hour after the loss of airplane generator power. The standby attitude indicator will continue to provide an accurate display of aircraft attitude for nine minutes after the loss of all airplane power.

The indicator is an electrically-driven gyro whose vertical attitude is maintained by a mechanical erection system. The power warning flag is pulled from view after the gyro has spun up to valid operating speed and reappears if there is any interruption of source power or the unit is in caged mode.

Insure the indicator is caged (locked) prior to application of power. After approximately one minute after power has been applied, a smooth quick motion of the caging knob, yet without a "snap" release will uncage the gyro. Allow an additional two minutes for stabilization.

Horizontal accelerations experienced during takeoff, climb-out descent and landing exert forces on the gyro which can cause precession and indicator display errors. Errors that do develop are corrected at a nominal 2.5° per minute when attitude changes cease and the aircraft is stable in flight. If the unit does not erect to the proper attitude, cage and hold the unit caging mechanism until the display obtains normal attitudes.

To reduce maintenance and extend the service life of the standby attitude indicator, it should be caged only after the chocks and/or EMERGENCY/PARKING BRAKE has been set. If the indicator is caged immediately after landing, it is still functioning and normal taxiing procedures and tarmac irregularities may contribute to excess wear and tear on the bearings of the gyroscope.

Back lighting is provided by 5-vdc to illuminate the standby attitude indicator at night.

STANDBY COMPASS

The standby compass is located at the top of the windshield center post. It is a magnetic compass that does not require any electrical power to provide the crew with a continuous standby heading display. The only electrical input to the compass is 5-vdc to illuminate the compass at night.

ATTITUDE HEADING REFERENCE SYSTEM (AHRS)

Due to the design of the Honeywell Primus 1000 Avionics System, the various avionics systems are very integrated. The AHRS uses the PFDs as its primary display and the MFD in the event of PFD failure. The display units, display controllers and appropriate reversion switches are considered part of the electronic display system and are covered later in this section.

The Learjet 45 is equipped with either a dual Honeywell (AH-800) or dual LITEF (LCR-93) Attitude Heading Reference Units (AHRUs). Both units contain a memory module and are located in the aircraft's nose section.

Each system (#1 and #2 AHRS) incorporates a flux valve located in their respective wing tips. The AHRUs contain three Fiber Optic Gyros (FOGs) which sense angular rotation about the three principle axis (pitch, roll, and yaw) thus, computing the airplane's attitude and heading. When slaved to magnetic, the flux valves provide a magnetic heading reference. The memory module stores calibration data. This data is used to compensate AHRU inaccuracies caused from installation errors and local disturbances to the earth's magnetic field created by the aircraft's structure.

The AHRUs receive true airspeed (TAS) information from the on-side ADC. However, if a single ADC failure occurs, they will receive TAS from the operating ADC. True airspeed information is used to compute pitch and roll attitude. If TAS inputs to #1 AHRS or #2 AHRS are lost, a CAS will illuminate. Although system operation will be degraded, the AHRS still retains the same accuracy as a conventional spinning mass type gyro. AHRU's data output is received through their corresponding IC for attitude and heading displays on the PFDs/MFD. Attitude and/or heading information from the AHRS is used by the Flight Guidance System (FGS), Flight Management System (FMS), weather radar system, and the fuel quantity indicating system. In addition, AHRS #2 provides heading information through DAU #2 for the backup navigation display on the RMU.

The following CAS illumination is specific to the AHRUs:

CAS	Color	Description
AHRS 1-2 BASIC	White	Attitude Heading Reference System (AHRS 1 or 2) has reverted to basic mode due to a loss of true airspeed from both air data computers.

ATTITUDE AND HEADING COMPARISON MONITORS

The attitude and heading comparison monitors are functions within the IC-600s that compare the displayed data with the cross-side or secondary source data, depending on system reversionary status. Annunciations are provided to the crew if the attitude or heading on both sides differ.

The attitude comparison function is made of two monitors, the roll comparison monitor and the pitch comparison monitor. If the pitch data displayed on each side differ, the pitch comparison monitor trips and the PIT annunciation is displayed. The comparison threshold figure for the pitch monitor is 5°. Similarly, if the roll data on both sides differ, the ROL annunciation is displayed. The comparison threshold figure for the roll monitor is 6°. If both the roll and pitch comparison monitors trip, the ATT annunciation is displayed. If the heading comparison monitor trips, HDG is displayed. The normal comparison threshold figure for the heading monitor is 6°. However, if the displayed roll information is > 6°, the heading comparison threshold figure is increased to 12°.

All comparison monitor annunciations flash for 10 seconds on activation and then remain steady. These comparison monitors provide an extra safeguard to alert the cockpit crew in the event of any failures affecting the attitude or heading data displayed.

Other annunciations for attitude and heading which are displayed on the PFDs, not associated with the comparison monitors, are:

ATT FAIL and HDG FAIL. These red annunciations are displayed on the affected side's PFD whenever the heading or attitude display from that AHRS has failed. If an AHRS fails or both primary and auxiliary power supplies to an AHRS fail, both the red ATT FAIL and HDG FAIL annunciations are displayed.

ATT1/2 and DG1/2. These annunciations are displayed on the PFDs and indicate to the crew which AHRS is the source for the attitude and heading data on the display. If the onside AHRS is the source of display, the annunciation is white. If AHRS reversion has been performed, the cross-side PFD annunciation is amber. There are no crew actions required for these annunciations.

AHRU POWER SOURCE & COOLING

Each AHRU has a primary and a secondary dc electrical power source. The pilot's AHRU receives primary power from the left essential bus and a secondary or backup power from the right essential bus. The copilot's AHRU receives primary power from the right essential bus and secondary power from the left essential bus. Should either essential bus fail in flight, power to both AHRUs is uninterrupted. Separate circuit breakers for each system, primary and secondary, are provided in the INSTRUMENT/INDICATIONS group on the pilot's and copilot's circuit breaker panels. The AHRS #1 PRI and #2 SEC circuit breakers are located on the pilot's side, and the AHRS #2 PRI and #1 SEC circuit breakers are located on the copilot's side. The AHRUs are equipped with cooling fans which operate automatically to keep the AHRU within proper temperature limits. *On aircraft 45-002 thru 45-174 (Honeywell AH-800),* a CAS illuminates if the temperature exceeds predefined limits.

The following CAS illumination is specific to AHRU cooling:

CAS	Color	Description
AHRS 1-2 OVHT (Aircraft 45-002 thru 45-174)	Amber	Attitude Heading Reference System (AHRS 1 or 2) has reached an overheat condition.

AHRS REVERSION

Failure of an AHRS is apparent when the on-side horizon and pitch lines are removed from the ADI and a red ATT FAIL annunciator appears in the upper center of the ADI. The heading compass rose will display a HDG FAIL annunciator on the HSI. If either AHRS fail, the AHRS reversion switch on the reversionary control panel (Figure 5-14) will allow the pilot to select the remaining AHRS to provide attitude and heading information to both displays. The three-position switch is labeled 1 - AHRS NORM - 2.

ELECTRONIC DISPLAY SYSTEM (EDS)

Four electronic displays are used to provide the display formats for the Primary Flight Displays (PFDs), the Multi-Function Display (MFD) and the EICAS display in the electronic flight instrument system. The four display units are large format 8 x 7 inch, 16 color high resolution display tubes. The display units are identical and interchangeable, except for the bezel controllers attached to the front of the units. The bezel controllers for the outboard DUs are the same and the bezel controllers for the inboard DUs are the same. A display controller (two) provides the means for each pilot to control the display of the on-side PFD and to activate the EFIS test function. A display unit reversion panel, located above the PFDs, provides reversion control capability.

The display unit configuration powers up with the following displays:

DU#1 - Pilot's Primary Flight Display (PFD #1)
DU#2 - EICAS Display
DU#3 - Multi-Function Display (MFD)
DU#4 - Copilot's Primary Flight Display (PFD #2)

The above configuration can be changed using the EICAS reversion switch. This provides the ability to swap the DU #2 and DU #3 displays between EICAS and MFD as the pilots desire.

The display units require forced air circulation for cooling which is provided by two fans mounted on the rear of each DU. If a DU fan fails, a CAS will illuminate indicating DU 1, 2, 3, or DU 4 fail. If the temperature of the DU reaches approximately 120° F, a CAS will illuminate.

The following CAS illuminations are specific to the DUs:

CAS	Color	Description
DU 1-2 OVHT	Amber	#1 and/or #2 Display Unit (DU) is overheated.
DU 3-4 OVHT	Amber	#3 and/or #4 Display Unit (DU) is overheated.
DU1-2 FAN FAIL	White	#1 and/or #2 Display Unit (DU) cooling fan has failed.
DU3-4 FAN FAIL	White	#3 and/or #4 Display Unit (DU) cooling fan has failed.

PRIMARY FLIGHT DISPLAY (PFD)

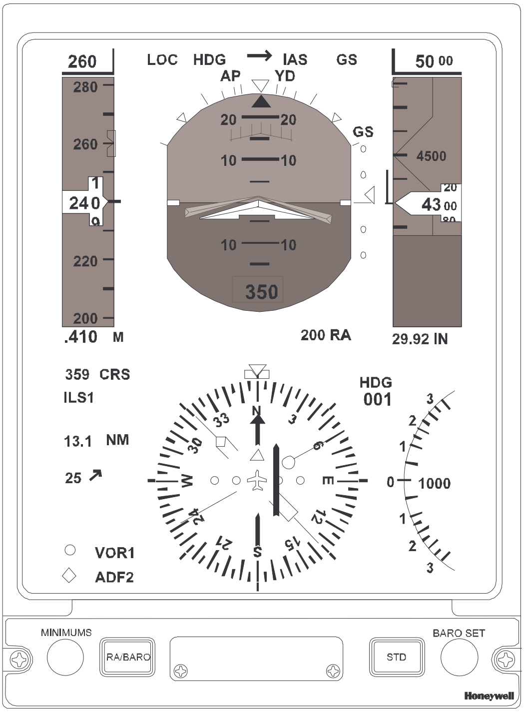
The PFD (DU #1 and DU #4) is a single display in which all of the required flight and navigation data is displayed for each pilot. The PFD (Figure 5-10) format is divided into two main sections. The top half displays an Attitude Director Indicator (ADI) with an airspeed tape to the left, and a barometric altitude tape to the right. A Horizontal Situation Indicator (HSI) is located on the lower half of the PFD. The HSI can be displayed in three different formats. The three options are full 360° compass rose (HSI), a 120° compass arc display (ARC), and a 120° map display (MAP). The MAP cannot be displayed on the PFD if the adjacent display (DU #2 or DU #3) is already displaying an MFD MAP format. Weather information can be displayed on the PFD ARC or MAP format. To the right of the HSI, a Vertical Speed Indicator (VSI) is displayed, and to the left, navigation information is annunciated.

Comparison monitors provide indications to the pilots that there is a difference between the data displayed on each PFD. This monitoring is a function within the IC-600s that compares what is being displayed on one side with either the cross-side displayed data or the secondary source data. Should data be out of tolerance between what is being reported from the source, and what is being sent to the display units, or if avionics related exceedances are detected, CAS will illuminate.

The following CAS illumination is specific to the PFDs:

CAS	Color	Description
PFD CHECK	Amber	The associated (L or R) Primary Flight Display (PFD) is displaying invalid data.

The brightness of each PFD is controlled by the DIM control on each respective display controller. Pilot's PFD (DU #1) receives 28-vdc power from the left essential avionics bus by a 15-amp circuit breaker DU 1 located in the INSTRUMENT/INDICATIONS group of the pilot's circuit breaker panel. Copilot's PFD (DU #4) receives 28-vdc from the right essential avionics bus by a 15-amp circuit breaker DU #4 located in the INSTRUMENT/INDICATIONS group of the copilot's circuit breaker panel.



PRIMARY FLIGHT DISPLAY AND BEZEL CONTROLLER
Figure 5-10

BEZEL CONTROLLERS

Many of the display control functions are controlled by the DU bezel controllers and by the menus displayed on the MFD and EICAS displays. The PFDs both use the BL-870 bezel controller located at the bottom of the PFDs. Each has two push buttons and two rotary knobs (Figure 5-10). The push buttons and rotary knobs have functions dedicated to decision height, minimum descent altitude and barometric correction.

The MFD and EICAS displays use the BL-871 bezel controllers which have six push buttons, menu keys, and a rotary knob for menu manipulation. The push buttons allow selection of functions displayed in the menus on the MFD. There are three functions that the MFD bezel push buttons provide - (1) selection of a submenu, (2) toggling the selection of a menu item and (3) selection of a variable parameter for setting. The MFD rotary knob is dedicated to the control of the map/plan range.

With weather radar selected for display, the MFD rotary knob will have no function. The EICAS bezel controller provides dedicated buttons for the displayed EICAS menu. These buttons toggle the selection of the EICAS system page displays. The EICAS rotary knob allows for scrolling of the CAS messages on the EICAS display.

MULTI-FUNCTION DISPLAY (MFD)

The MFD (normally DU #3) provides the flight crew with a means of displaying a variety of information. In its normal mode it can serve as a full time weather radar display superimposed on a 120° compass arc. There are two basic formats available on the MFD, a partial arc (Map) display, and a plan mode (North up). Like the PFD, the MFD may have flight plans composed of up to ten connected waypoints imposed on a compass card. True airspeed (TAS) provided from the ADC and ground speed (GSPD) provided from the FMS, are displayed on the MFD. Other information displayed full time include: FMS source, "TO" waypoint, distance to "TO" waypoint, time-to-go to "TO" waypoint, wind speed and direction, Static Air Temperature (SAT), and weather radar (WX) modes.

The MFD also provides a second source for access to EICAS systems pages as well as providing joystick functions. The MFD (DU #3) may serve as a backup for any other DU through pilot initiated reversionary modes.

Other information available on the MFD includes:

- TCAS mode (optional) — Controls the display of TCAS on the map presentation.
- MFD MENU — Activation of this key will enable the MFD SUB-MENU to appear.
- CHECKLIST PAGE — This key provides entry into the normal checklist procedure index page.
- SYSTEM PAGE — Selection of this key will access the systems sub-menu pages which are duplicates of the EICAS system pages.

28-vdc is provided from the right essential avionics bus by a 15-amp circuit breaker DU #3, located on the copilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).

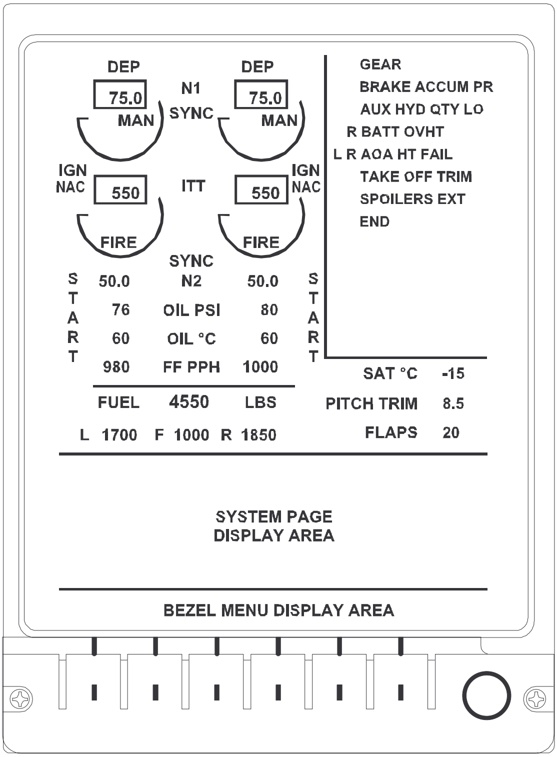
EICAS DISPLAY

The Engine Indicating and Crew Alerting System (EICAS) is an integrated digital computer/display system that replaces the majority of the traditional gauges and warning lights located throughout the cockpit. The EICAS display (Figure 5-11) is divided into four designated areas: engine instruments, CAS messages, system display pages and menu items. The EICAS also incorporates the Crew Warning Panel (CWP) which provides crew alerting by visual representation while the cockpit audio system provides the aural alerting. The Crew Alerting System (CAS) provides the crew with a visual attention getting means to alert them to a warning that requires immediate action, a caution alert that requires subsequent pilot or maintenance action, or an advisory indication that may require pilot or maintenance action at some point in time. Other airplane system parameters are displayed on the lower portion of the display via system pages and are selectable by the bezel controller at the bottom of the DU. Normally, the airplane system summary page (SUMRY on the menu) is in view, which provides brief status reports of all sub-systems. Menu selectable, a system schematic of airplane electrical, hydraulic, environmental control, flight control, and fuel systems can be individually selected for more detailed monitoring by the flight crew.

The following CAS illumination is specific to the EICAS display:

CAS	Color	Description
EICAS CHK	Amber	Available on MFD display only. EICAS wrap-around monitor.

28-vdc power is provided from the left essential bus by a 15-amp circuit breaker DU 2, located on the pilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).



EICAS DISPLAY AND BL-871 BEZEL CONTROLLER
Figure 5-11

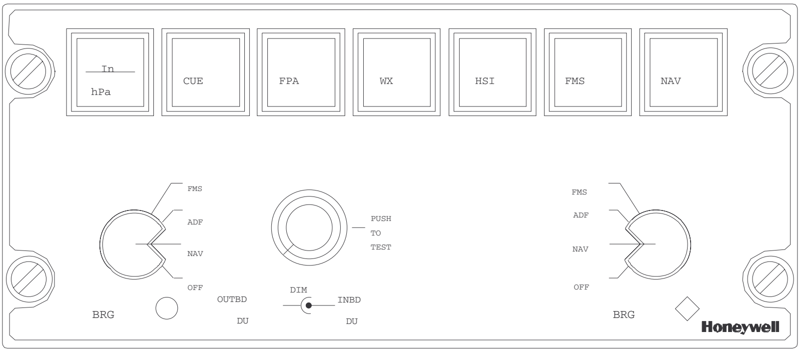
DISPLAY CONTROLLERS

The display controllers (two DC-550s), located on the glareshield, provide immediate access to and control of the objects on the PFDs. Each controller is configured with seven push buttons located on the front panel along with two rotary knobs used for reference selection for bearing source, two concentric knobs for DU dimming and a momentary push button (located inside concentric DU knob) used to initiate a system test (Figure 5-12).

The display controllers also provide a data acquisition function, collecting inputs from sources such as the bezel controllers, guidance controller, joystick, etc. The controllers pass these inputs to the corresponding IC-600 for processing.

The display controller buttons are as follows:

1. **IN/HPA** — Inches of mercury or hectopascals.
2. **CUE** — Selection of single cue or cross pointer command bars.
3. **FPA** — Controls selection and deselection of the flight path angle symbol and flight path acceleration display.
4. **WX** — Select or deselect weather radar display on the PFD.
5. **HSI** — Provides up to three different display options on the HSI.
6. **FMS** — Allows a navigation display of FMS information (alternately FMS 1 or FMS 2 if dual) to be selected for display on the PFD.
7. **NAV** — Alternately selects NAV 1 or NAV 2 as the source of NAV data on the HSI.



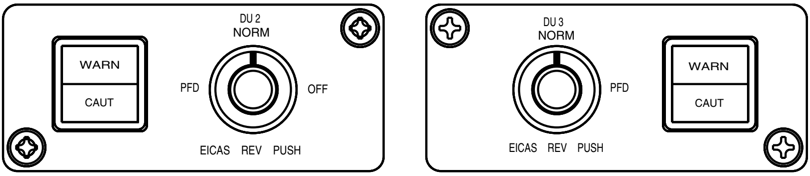
DISPLAY CONTROLLER
Figure 5-12

Each controller contains two rotary bearing source selector knobs that are used to assign the respective bearing pointers on the HSI or ARC displays to a particular navigation source.

Power for the display controllers, and the IC-600s, are from the left and right essential buses and are labeled IC/SG 1 and IC/SG 2 on the pilot's and copilot's circuit breaker panels in the INSTRUMENT/INDICATIONS group respectively.

DISPLAY UNIT REVERSION PANELS

A display unit reversion panel is located on the glareshield above the PFDs on each side of the cockpit. The panel on the pilot's side is for controlling the display on DU #2 and the panel on the copilot's side is for controlling the display on DU #3. The reversion selector knob on these panels plus the push function of the knobs allow the operators to switch the inboard DUs (DU #2 and DU #3) to display either PFD, MFD, or EICAS formats. With both reversion selector switches in NORM, an EICAS format is displayed on DU #2 and an MFD format on DU #3. Depressing the selector knob on either reversion panel flip-flops the DU #2 and DU #3 displays, reversing the MFD and EICAS display locations. Placing the reversion selector to the PFD position on either side causes the PFD format to move to the inboard display tube on that side and the outboard display to blank.



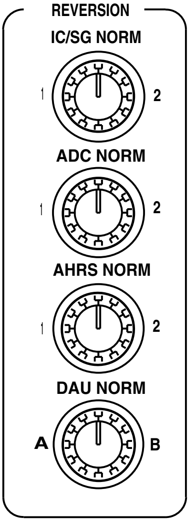
DISPLAY UNIT REVERSION PANEL
Figure 5-13

It is important to note that when selecting display unit reversion, the bezel controllers on DU #1 and DU #4 continue to work with the PFD display when it is transferred to an inboard display unit. The airplane master warning/caution lights are also located on the display unit reversion panels.

DATA ACQUISITION UNITS (DAUs)

There are two dual channel data acquisition units (DAUs) installed in the tailcone equipment area of the airplane. The DAUs receive engine and airplane systems sensor information and pass it, primarily, to the IC-600 computers. Both channels of DAU #1 provide left engine data and both channels of DAU #2 provide right engine data. For redundancy, both channels of each DAU independently convert on-side engine information to a common ARINC 429 data bus format and send it to both IC-600s. The IC-600s process the information and send it to the selected display unit (normally DU #2) for EICAS display. In addition to engine information, the DAUs also collect analog data from other airplane systems such as fuel, hydraulic and accumulator pressure, dc electrical power, flight control settings, cabin pressure settings/indications, and oxygen temperature/pressure.

A three-position DAU reversionary switch is provided on the reversionary control panel located below DU #2 (Figure 5-14). The switch positions are labeled A, DAU NORM, and B. With the switch in DAU NORM, both IC-600s use Channel A from the left DAU and Channel B from the right DAU for engine/systems displays. In the reversionary positions (A or B), each IC-600 uses only the selected channel from both DAUs.



REVERSIONARY CONTROL PANEL
Figure 5-14

If either channel of either DAU should fail, if either A or B reversion is selected, if an engine or system miscompare is detected, an appropriate CAS will illuminate.

The following CAS illuminations are specific to the DAUs:

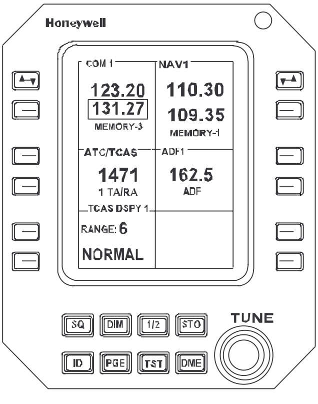
CAS	Color	Description
DAU 1A-1B FAIL	Amber	Channel A and/or B of the #1 Data Acquisition Unit (DAU) has failed.
DAU 2A-2B FAIL	Amber	Channel A and/or B of the #2 Data Acquisition Unit (DAU) has failed.
DAU A REV	White	Reversion of both Data Acquisition Units (DAUs) to Channel A is selected by the crew.
DAU B REV	White	Reversion of both Data Acquisition Units (DAUs) to Channel B is selected by the crew.
DAU ENG MISCMP	Amber	The associated (L or R) Data Acquisition Unit (DAU) has detected a miscompare between channel A and B involving an engine parameter (N_1,N_2,ITT).
DAU SYS MISCMP	Amber	The associated (L or R) Data Acquisition Unit (DAU) has detected a miscompare between channel A and B involving a system parameter (dc voltage, Emergency Bus voltage, dc amperage, Battery temperature, Main Hydraulic pressure, Brake Accumulator pressure, Oxygen temperature and pressure).
LBS/KGS CONFIG	Amber	The configuration of the integrated avionics computer is not compatible with that of the data acquisition unit (i.e., one is configured for pounds while the other for kilograms) on the ground.
LBS/KGS CONFIG	White	The configuration of the integrated avionics computer is not compatible with that of the data acquisition unit (i.e., one is configured for pounds while the other for kilograms) in flight.

The DAU circuit breakers are located in the INSTRUMENT/INDICATIONS group on each circuit breaker panel. On the left side is DAU 1 CH A and CH B, and on the right side is DAU 2 CH A and CH B. DAU 1 CH A and DAU 2 CH A are powered by the EMER BATT bus. DAU 1 CH B and DAU 2 CH B are powered by the L and R essential buses respectively.

RADIO MANAGEMENT UNITS (RMUs)

The two RM-855B Radio Management Units (RMUs) provide the central controlling functions for the entire basic radio system. Each RMU is a color, active matrix, Liquid Crystal Display (LCD) based unit. The primary function of each RMU is to select and control the frequencies and operational modes of each radio. Each RMU also provides access and storage for up to twelve pre-set channels for the VHF COM and VHF NAV functions. Cross-side operation, maintenance display, power on self-test and pilot activated self-test and optional FMS radio tuning features are also available on each RMU. Each RMU also provides backup engine and navigation display facilities in the event of EFIS/EICAS failure. Automatic presentation of engine data occurs on RMU #1 if neither IC-600 is providing EICAS data.

There are six line select keys on each side of the RMUs (Figure 5-15). The top key is referred to as a transfer button and has directional arrows on them. The remaining keys are referred to as line select keys. There are also eight function keys located at the bottom of the RMUs. The RMU main tuning page is divided into six dedicated windows. Each window groups the data associated with a particular function. The windows (COM, NAV, ATC/TCAS, ADF, and TCAS DSPY) each provide for control of both frequency and operational mode of the associated function. The RMU also has other display modes, called pages, which provide additional features and functions for the control of the radio system. The PGE function at the bottom of the RMU is used to access additional RMU pages. RMU display brightness is adjustable using the tuning knob after the DIM function key is depressed. To return the tuning knob to normal operation select any other key.



RADIO MANAGEMENT UNIT
Figure 5-15

RMUs each have a primary and a secondary power source. If the primary source is not available, the RMU will automatically switch to the secondary power source. RMU #1 primary is powered from the L essential bus, and RMU #1 secondary is powered from EMER BATT bus. RMU #2 primary is powered from R main avionics bus and the secondary from the R essential bus. RMU #1 and RMU #2 primary and secondary circuit breakers are located in the COMMUNICATIONS group on the pilot's and copilot's circuit breaker panels. RMU #2 primary is the only power source affected by the avionics master.

RMU CROSS-SIDE OPERATION

Should the pilot decide to tune the copilot's set of radios, he can push the 1/2 function key and transfer his entire RMU display and operation to the copilot's #2 system. Both RMU displays will be identical; however the pilot's RMU will show the function legends on the main tuning and memory pages in magenta to indicate that cross-control is being exercised. In addition to having access to the #2 system, the pilot still has the memory frequencies in their #1 RMU available for recall for use with the #2 system. Both pilots have this control transfer function available. It provides flexibility in crew coordinated tuning as well as a back up mode in the event one RMU becomes inoperative. The pilot may change any frequency or mode on the copilot's system using the pilot side RMU. Any changed frequency is annunciated in yellow on the copilot's RMU. The frequency will be white on the pilot's RMU. If the pilot should push the 1/2 button again, the pilot's side RMU will revert to the original display.

RMU BACKUP PAGES

Either RMU can provide two pages of backup engine and systems indication and one page for a backup navigation display. These backup displays can be selected on the PAGE MENU page of either RMU. The backup engine and systems pages can be selected by depressing the line select key adjacent to "ENGINE PG1" or "ENGINE PG2" on the PAGE MENU page. The backup navigation display is accessed by depressing the line select key adjacent to "NAVIGATION" on the PAGE MENU page.

The ENGINE PG1 and ENGINE PG2 contain information such as: ITT, O/P (oil pressure, left and right), FUEL, HYDM-B (hydraulic pressure), N_1, N_2, OIL ° C, FF PPH (fuel flow pounds per hour), VOLTS, EMER VOLTS, AMPS, OXY, SAT (oxygen quantity and static air temp), TRIM-PIT, AIL, and RUD (pitch, aileron and rudder trim).

The NAVIGATION page provides the following data, when valid data is available: NAV, ADF, CRS (selected course), DME (distance to tuned station), bearing pointers for VOR and ADF, TO/FROM indication, MARKER BEACONS, HEADING, lateral deviation (VOR and ILS), and vertical deviation (GS only). The navigation displays on both RMUs use AHRS#2 heading information and NAV information from NAV 1 and ADF 1.

VHF COM TUNING

Normal operation of the RMU is with the radio tuning page displayed. A section for COM is located in the upper left corner. The COM window displays two frequencies. The top line displays the active frequency of the COM, while the line below will display the preset frequency. When pressing the line select key (preset frequency) adjacent to the lower frequency, a yellow cursor encloses that frequency. This step is not always necessary since the cursor normally "parks" over the preset frequency box. Anytime the cursor has been moved to another area on the main radio tuning page, it will automatically return to the COM preset frequency after twenty seconds of inactivity on that page. When the yellow cursor is enclosing the preset frequency, that frequency can be changed by adjusting the tuning knobs. The preset frequency can then be changed (flip-flopped) with the active frequency by depressing the transfer key.

The storage function can be accomplished by pressing the STO (store) key located at the bottom of the RMU. When the STO key is depressed, the nomenclature below the preset COM frequency will change back to MEMORY, and the digit following MEMORY will indicate in which memory location the frequency is stored. With the main tuning page displayed, the rotary tuning knob can be used to scroll through the frequencies stored in memory. As each memory location (channel) is selected, the stored frequency will be shown on the COM preset line which can then be moved to the active position by depressing the transfer key.

A TX will appear at the top of the COM window when the associated radio is transmitting. Its purpose is to show that the transmitter is on and to alert the pilot in case of a stuck microphone key. If not attended to for approximately two minutes, a beep will sound on the audio and a MIC STK annunciation will appear at the top of the COM window until the mic button is released. Ten seconds after the MIC STK annunciation appears, the selected transmitter will automatically turn off. Depressing the SQ (squelch) function button at the bottom of the RMU causes the COM radio to open its squelch and allows any noise or signal present in the receiver to be heard. When selected, an SQ will appear at the top of the COM window. Pressing the button a second time closes the squelch.

FMS TUNING

The FMS interfaces with the RMUs for radio tuning. The FMS has a radio tuning page that can be used to control VHF COM, NAV, ADF and transponder codes. If it is suspected that the FMS is interfering with com/nav radio tuning, an FMS ENABLE/DISABLE selection on the RMU NAV memory page can be toggled with the adjacent line select key. The DISABLE selection will prevent tuning any of the radios through the FMS CDU.

NAV TUNING

The format of the NAV window (top right corner of the RMU) is identical to the COM window in that the top frequency is active and the bottom frequency is the preset frequency. Pressing the line select key alongside the NAV preselect window moves the cursor to that window. This connects the tuning knobs to the NAV preset frequency. By pressing the NAV transfer key (top right) the preset and active frequencies are exchanged. The preset frequency may be changed to a different frequency by using the tuning knobs or by pressing the line select key to bring up the next frequency from memory. Selection of stored frequencies can be accomplished by pressing the line select key by the NAV preset window until the tuning box encloses the memory mnemonic. Rotating the tuning knob scrolls through the stored frequencies displaying them in the preset area.

The memory functions and direct tuning operate the same as described under COM operation, except the NAV window has an added function called DME split tuning mode. Its operation is similar to the function called DME hold. Depressing the DME function key on the RMU allows the DME frequency to be tuned independent of the NAV frequency. Depressing the DME once causes the NAV window to split into two sections, the top one being the active VOR frequency and the lower one, now labeled "DME", containing the active DME frequency in VHF format. In this condition, the DME may be tuned directly by simply pressing the line select key to place the cursor box around the frequency and retuning using the tuning knobs. The DME digital station identifier will appear adjacent to the DME nomenclature on the top edge of the DME window. An amber H (hold) appears in the lower DME window. This indicates that the distance display (DME or TACAN) is not paired with the VOR/ILS navigation data. When the H is displayed on the RMU, it will also be displayed following the DME read-out on the PFD.

ADF TUNING

ADF operation is the same as COM and NAV tuning in that depressing the line select key beside the ADF frequency will place the cursor over the frequency to be changed. Rotating the small tuning knob slowly will advance the frequency in 0.5 kHz steps. This change will increase to 10 kHz steps when the large knob is used. The RMU has the capacity to store one ADF frequency in memory. This is done by selecting the desired frequency, then depressing the STO function key at the bottom of the RMU. To retrieve the stored frequency from memory, the frequency line select key must be depressed for two seconds. ADF modes are also controlled within the ADF window. Repetitively depressing the line select key adjacent to the ADF mode annunciator will step through the available ADF modes of operation. This can also be accomplished by placing the cursor over the mode annunciation, and using the tuning knobs to step up or down through the available modes.

The ADF operating modes are as follows:

1. ANT (Antenna) — ADF audio signal only.
2. ADF — ADF receives signal and calculates the relative bearing to the station.
3. BFO (Beat Frequency Oscillator) — ADF adds a beat frequency oscillator to detect continuous wave (CW) signals.
4. Voice — ADF has maximum audio clarity and fidelity, but no bearing information.

TRANSPONDER/TCAS TUNING

Transponder operation is similar to COM and NAV operation in that depressing a line select key beside the function desired will move the cursor to that location. Those aircraft without TCAS installed will have an ATC legend at the top of the transponder window, and those equipped with TCAS will have ATC/TCAS labeled above the window. Either transponder 1 or 2 can be selected for use and controlled by either RMU. A number 1 or 2 will appear in front of the transponder mode in the ATC window on both RMUs indicating which transponder has been selected. Transponder side selection is toggled by depressing the 1/2 key on either RMU with the cursor anywhere within the ATC window.

The transponder is switched from standby to an operating mode by depressing the line select key adjacent to the mode line. Once the cursor has been selected, the mode line select key acts as a toggle to switch the transponder between the standby mode and the active mode. Once the transponder is in the ALT ON mode, the mode of operation is changed using the tuning knobs. The active mode of operation can now be changed by rotating the concentric tuning knobs. Depressing the ID button of the RMU will initiate an approximate 18 second IDENT mode on the transponder. This will also illuminate an ID annunciation along the top edge of the transponder window. A reply annunciator is located in the upper right corner of the ATC window.

HF TUNING (KHF 1050 Only)

The format of the HF window (bottom right corner of the RMU) when in simplex preset tune mode is similar to the COM window, in that the top frequency is the active frequency and the bottom frequency is the preset frequency. By pressing the line select key alongside the HF active frequency, the preset and active frequencies are exchanged. Pressing the line select key alongside the HF preset frequency places the cursor around the preset frequency. The preset frequency may be changed to a different frequency using the tuning knobs.

There are 12 memory locations for preset frequencies. The preset frequencies are stored and recalled from the HF Memory or Control pages.

To change to simplex direct tune mode, press and hold the line select key alongside the HF preset frequency until the cursor is around the HF active frequency and the HF preset frequency is removed. The active frequency may be changed to a different frequency using the tuning knobs. To change to simplex preset tune mode, press and hold the line select key alongside the blank HF preset frequency display until the preset frequency appears.

The HF window has the following additional modes: Split Mode (Half-Duplex), Emergency Mode, and ITU Mode. These modes are accessed from the HF Control page along with the Squelch, Emission Mode and Transmit Power Level Controls.

The Split Mode (Half-Duplex) displays a separate frequency for receive (RX) and transmit (TX). Pressing the RX or TX line select key places the cursor around that frequency, and the TUNE knobs are used to change the frequency.

The Emergency Mode displays the emergency channel or an emergency channel frequency preview. Pressing the either HF line select key places the cursor around the emergency channel, and the TUNE knobs are used to change the channel. Pressing and holding either HF line select key will shift to the preview display. When the line select key is released, the HF window reverts back to the emergency channel display.

The ITU Mode displays the active ITU channel or an ITU channel frequency preview. Pressing either HF line select key places the cursor around the ITU channel, and the TUNE knobs are used to change the channel. Pressing and holding either HF line select key will shift to the preview display. When the line select key is released, the HF window reverts back to the ITU channel display.

HF Operation (KHF 1050 Only)

There are three pages that control the HF system functions. They are accessed from the page menu.

Radio Tuning Page — Controls HF channel/frequency.
HF Control Page — Expanded control of HF functions.
HF Memory Page — Manages the 12-channel non-volatile memory.

Page Menu

Radio Tuning Page

The HF window is the lower right-hand corner of the radio tuning page.

Radio Tuning Page

TUNE Knobs Function

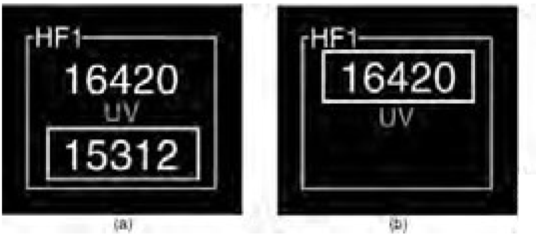
The function of the TUNE knobs varies, depending on the information that is inside the cursor.

- **FREQUENCY** — The inner knob controls the last two digits of the frequency readout. The outer knob controls the remaining digits.
- **ITU CHANNEL** — The inner knob controls the last two digits of the ITU channel. The outer knob controls the remaining.
- **EMERGENCY CHANNEL** — Both knobs control the emergency channel.

HF Window - Simplex Mode

The HF window simplex mode has two displays as follows:

- The preset (a)
- The direct tune (b).



(a) (b)

Simplex Mode Displays

Preset Tune Mode

- When the cursor is not in the HF window, pushing the line select key adjacent to the preset frequency positions the cursor around the preset frequency, and the TUNE knobs can be used to change the frequency.
- Pushing the line select key adjacent to the active frequency switches the active frequency and the preset frequency.
- Pushing and holding the line select key adjacent to the preset frequency for more than 2 seconds switches the HF window to direct tune mode and removes the preset readout.

Direct Tune Mode

- When the cursor is not in the HF window, momentarily pushing either of the line select keys adjacent to the HF window positions the cursor around the active frequency so it can be tuned using the TUNE knobs.
- Pushing and holding the line select key adjacent to the blank preset frequency display for more than 2 seconds switches the HF window back to preset tune mode with the cursor around the preset frequency.

HF Window - Split Mode (Half-Duplex)

The split mode HF window has the following annunciators:

- Receive label (RX), frequency, and mode
- Transmit label (TX), frequency, and mode.

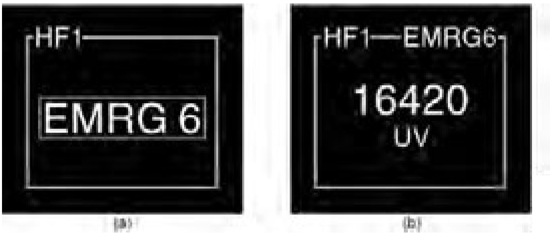
Split Mode (Half Duplex) Display

Both channels are tuned in a similar manner. Pushing the RX line select key or the TX line select key places the cursor around the associated frequency, and the TUNE knobs are used to change the frequency.

HF Window - Emergency Mode

The HF window emergency mode has two displays as follows:

- The active emergency channel (a)
- The emergency channel frequency preview (b).



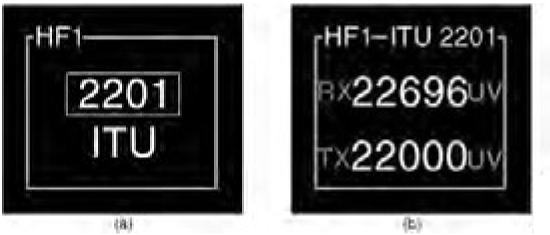
Emergency Mode Displays

When the cursor is not in the HF window, the first push of either HF line select keys positions the cursor around the emergency channel so the TUNE knobs can be used to tune the channel. When the cursor is in the HF window, pushing and holding either of the HF line select keys changes the HF window to the emergency preview mode. In the preview mode, the emergency channel annunciator replaces the HF status annunciator, and the HF window displays the emergency channel frequency and transmit mode. When the line select key is released, the HF window reverts back to the emergency mode display with the cursor around the emergency channel.

HF Window - ITU Mode

The HF window ITU mode has two displays as follows:

- The active ITU channel (a)
- The ITU channel frequency preview (b).



ITU Mode Displays

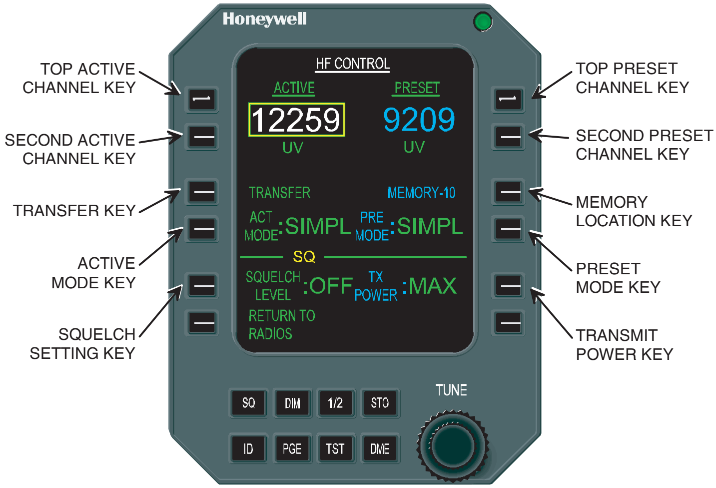
When the cursor is not in the HF window, the first push of either HF line select key positions the cursor around the ITU channel so the TUNE knobs can be used to tune the channel. When the cursor is in the HF window, pushing and holding either HF line select key changes the HF window to the ITU preview mode. In the preview mode, the ITU channel annunciator replaces the HF status annunciator, and the HF window displays the ITU channel frequencies and transmit mode. When the line select key is released, the HF window reverts back to the ITU mode display with the cursor box around the ITU channel.

HF Control Page

The HF control page is accessed from the page menu. The active channel window is on the left side of the page, and the preset channel window is on the right side of the page.

The HF control page is used to control the following functions:

- Active and preset channel tuning
- Memory channel recall and store
- HF squelch control and adjustment
- Transmitter power level adjustment.



HF Control Page

STO (Store) Function Key — Stores the information in the preset channel into the selected memory location.

TUNE Knobs Function

The function of the TUNE knobs is the same as on the Radio tuning Page with the following additional functions:

- **Cursor around memory location**— Scrolls thru memory locations.
- **Cursor around emission mode**— Scrolls thru emission modes.

Left Line Select Keys

Top Active Channel Key:

- SIMPLEX MODE — Positions the cursor box around the active frequency.
- SPLIT MODE — If the cursor box is elsewhere, the first push of this key positions the cursor box around the active RX frequency.
  When the cursor box is around the active RX frequency, each push of this key toggles the cursor box between the active RX frequency and the active RX emission mode.
- EMERGENCY MODE — Functions same as on Radio Tuning Page.
- ITU MODE — Functions same as on Radio Tuning Page.

Second Active Channel Key:

- SIMPLEX MODE — If the cursor box is elsewhere, the first push positions the cursor box around the active emission mode.
  When the cursor box is around the active emission mode, subsequent pushes scroll thru the different emission modes.
- SPLIT MODE — If the cursor box is elsewhere, the first push positions the cursor box around the active TX frequency.
  When the cursor box is around the active TX frequency, subsequent pushes toggle the cursor box between the active TX frequency and the active TX emission mode.
- EMERGENCY MODE — Functions same as on Radio Tuning Page.
- ITU MODE — Functions same as on Radio Tuning Page.

Transfer Key — Switches active frequency and preset frequency. After information has been switched, the memory location annunciator will show TEMP. To save the information in the preset field to a memory location, push the STO function key.

Active Mode Key — Changes active mode in the following sequence: SIMPL, SPLIT, EMRG, ITU, SIMPL. The tune mode selection is green after a local tune and yellow after a remote tune.

Squelch Setting Key — Opens and Closes the squelch and changes the available settings (MIN, MED, MAX).

Return to Radios Key — Changes to the Radio Tuning Page.

Right Line Select Keys

Top Preset Channel Key — Operates the same as the top active channel key except on the preset channel.

Second Preset Channel Key — Operates the same as the second active channel key except on the preset channel.

Memory Location Key — Positions the cursor box around the Memory location Annunciator. To scroll thru the memory locations, rotate either tuning knob. When any change has been made to the preset channel the memory location annunciator shows TEMP.

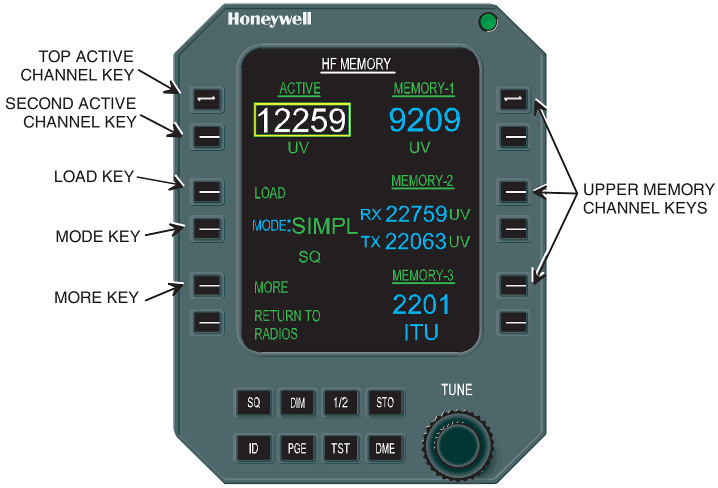
Preset Mode Key — Changes the preset channel mode.

Transmit Power Key — Changes the transmit power level settings (MIN is 50 W, MED is 100 W, MAX is 200 W).

Bottom Right Key — Not used.

HF Memory Page

The HF memory page is accessed from the page menu. The active channel window is on the left side of the page, and the memory channel window is on the right side of the page.



HF Memory Page

Line Select Keys

Top Active Channel Key — Operates the same as the top active channel key on the HF control page.

Second Active Channel Key — Operates the same as the second active channel key on the HF control page.

Load Key — Loads the information from the memory location selected by the cursor box into the active channel.

Mode Key — Changes the mode for the channel that is selected by the cursor box.

More Key — Toggles the memory window through the 12 memory locations, displaying three memory locations at one time.

Return to Radios Key — Changes to the Radio Tuning Page.

Upper Memory Channel Keys — Operates the same as the top active channel key on the HF control page.

Lower Memory Channel Keys — Operates the same as the second active channel key on the HF control page.

HF System Operating Practices (KHF 1050 Only)

Preflight Checks

As power is applied to the system the HF system conducts a brief automatic self-test. A more thorough pilot-activated self-test can be conducted on the HF system at any time except when transmitting.

Dual HF System Operation

In dual HF system installations, both HF radios operate independently except that they share a common antenna. When one radio is keyed, the other radio is completely disconnected from the antenna and both reception and transmission is inhibited. The radio that is not transmitting annunciates **TX INH** to indicate that transmission is not possible. At the completion of the transmission, reception and transmission on the other system is possible.

Antenna Coupler Tuning

When a new frequency is selected, momentarily press the push-to-talk button to tune the antenna coupler. During the tuning process a steady 1000Hz tune tone will be heard. Typically the antenna coupler will find a tune in less than 10 seconds. When tune tone ends, the antenna tuning is complete.

When the antenna coupler is unable to tune to the selected frequency within 30 seconds, the tune tone will sound intermittently. Press the push-to-talk button once to clear the tune fault. Press the push-to-talk button again to initiate another tune attempt. (Up to three tuning attempts should be made to tune the antenna.) Failure of a third tuning cycle usually indicates a system problem. (The tune fault may also be cleared by selecting a different frequency.)

TCAS

The Traffic Alert and Collision Avoidance System (TCAS) provides the crew with aural and visual indications of potentially dangerous flight paths relative to other aircraft in the vicinity. The system uses the transponder to interrogate other transponder-equipped aircraft and determine their bearing, range, and altitude, if the intruder has an altitude encoding transponder in operation. Advisories are issued to the crew via the airplane Primary Flight Displays (PFDs), audio system and Multi-Function Displays (MFDs) (traffic map). Two levels of TCAS are in use today, TCAS I and TCAS II. TCAS II is the same as TCAS I with the exception of providing Resolution Advisories (RAs) integrated with the vertical speed indicator on the PFDs and additional aural commands through the audio system. There is no RA display on TCAS I equipped aircraft. The TCAS system consists of a processor, two bearing antennas, and associated airplane wiring. System control is through the radio management units. Power for the TCAS system operation is 28-vdc supplied through the 5-amp TCAS circuit breaker located on the copilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).

TCAS OPERATION

The Learjet 45 may be equipped with either the optional TCAS I or TCAS II system. The controls and displays are integrated with the Honeywell Primus 1000 system. Controls are through the RMUs and TCAS/annunciator displays are on the MFD and PFDs. On airplanes equipped with TCAS II, the Resolution Advisories (RA) are integrated with the vertical speed indicator display on the PFDs. The TCAS interrogates other aircraft transponders and analyzes the replies to determine range and bearing of the intruder. In addition, if the intruder's transponder is reporting altitude, the relative altitude is also determined. If the system predicts that safe boundaries may be violated, the system issues a Traffic Advisory (TA) which is displayed on the MFD. Should the TCAS II processor determine that a possible collision exists, it issues visual and audio advisories to the crew to initiate appropriate vertical avoidance maneuvers.

If an aircraft has a transponder, but does not have altitude reporting, the TCAS will depict it on the TA display, but without the altitude information tag, and without the capability of providing evasive commands. TCAS II is capable of generating a TA display of traffic from Mode A transponder-equipped aircraft, and it is also capable of generating RA signals to avoid Mode C-equipped aircraft. For similar Mode S-equipped aircraft, the airplane's TCAS II system coordinates evasive maneuvers for both aircraft. TCAS I can process transponder information from other aircraft equipped with Mode A, C, or S transponders, but does not receive altitude information to compute or coordinate a Resolution Advisory (RA). If the depicted traffic is reporting altitude and is climbing or descending at a rate of at least 500 feet per minute, a trend arrow is displayed beside the traffic symbol indicating that the aircraft is climbing or descending. If the intruder is not reporting altitude, the traffic symbol appears without an altitude tag or trend arrow. The RA displays are incorporated into the vertical speed indicator on the PFDs. Green FLY-TO zones and red NO-FLY zones are placed on the vertical speed arc by the TCAS for collision avoidance. The zones are not displayed on the arc until the TCAS detects an RA intruder and computes the collision avoidance data. Synthesized voice commands and announcements are issued by the TCAS over the airplane audio system.

SYSTEM CONTROLS AND DISPLAYS

Selection of the TA or TA/RA (TCAS II) modes is accomplished through the transponder window on either RMU main radio tuning page. After the cursor is placed over the transponder mode line, the desired mode is selected with the RMU tuning knob. The transponder selection options for TCAS I equipped aircraft will be STANDBY, ATC ON, ATC ALT and TA. Selections available with TCAS II include the same as TCAS I plus TA/RA. The selected TCAS mode will be annunciated in the top left corner of the TCAS display. The auto or manual mode can be selected on the ATC/TCAS CONTROL PAGE of the RMU. This page is accessed through the RMU PAGE MENU page. When AUTO is selected, traffic targets display only when a TA or RA target condition exists. When manual is selected, all traffic targets within the viewing airspace are displayed. In either the MAP or PLAN format display, the TCAS TA display is selected by pushing the TCAS menu key on the MFD Main Menu bezel controller. If the TCAS triggers an RA, and TCAS display is selected OFF, the main menu is activated on the MFD. This allows flight crew selection of TA displays with a single button push. This display is in addition to the resolution advisory on the VSI display on the PFD (TCAS II only).

TRAFFIC DISPLAY SYMBOLS

TCAS I will display three different traffic symbols and TCAS II four with the addition of Resolution Advisories (RA). The type of symbol selected by TCAS is based on the intruder's location and closing rate. The symbols change shape and color to represent increasing levels of urgency. The traffic symbols may also have an associated altitude tag which shows relative altitude in hundreds of feet, indicating whether the intruder is climbing, flying level or descending. A + sign and number above the symbol means the intruder is above your altitude. A - sign and number beneath indicates it is below your altitude. A trend arrow appears when the intruder's vertical rate is 500 feet per minute or greater. The symbology displayed on the PFDs and MFD is as follows:

(1) **NON-THREAT ADVISORY (OA) TRAFFIC** — An open cyan diamond indicates that an intruder's relative altitude is greater than ± 1200 feet, or its distance is beyond 6 nm range. It is not yet considered a threat.

(2) **PROXIMITY INTRUDER (PA) TRAFFIC** — A filled cyan diamond indicates that the intruding aircraft is within ± 1200 feet and within 6 nm range, but is still not considered a threat.

(0) **TRAFFIC ADVISORY (TA) TRAFFIC —** A symbol change to a filled amber circle indicates that the intruding aircraft is considered to be potentially hazardous. Depending on your own altitude TCAS II will display a TA when time to closest point of approach (CPA) is between 20 and 48 seconds. An advisory voice message "TRAFFIC, TRAFFIC" may be heard through the audio system.

(1) **RESOLUTION ADVISORY (RA) (TCAS II only) —** A solid red square indicates that the intruding aircraft is projected to be a collision threat. TCAS II calculates that the intruder has reached a point where a resolution advisory is necessary. The time to closest approach with the intruder is now between 15 and 35 seconds, depending on your altitude. The symbol appears with an audio warning and a vertical maneuver indication on the PFD VSI.

ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS)

EGPWS is shown on the MFD by pushing the EGPWS menu button on the MFD main menu. When TERRAIN is selected for display, the EGPWS sends the terrain data directly to the MFD display unit via the WX picture bus and replaces the WX display with terrain information.

If a potential terrain hazard is sensed by the EGPWS, terrain data automatically pops up on the MAP. This "pop-up" mode defaults to the 10 NM range. EGPWS annunciators are described in the table below and are displayed in the upper left corner of the MFD.

Annunciator	Description
TERR INHB or TERR INHIB (inhibit)	TERRAIN displays and aurals associated with terrain are inhibited (annunciation in white)
TERR FAIL	The TAWS is inoperative.
TERR TEST	EGPWS is in test mode.
TERR N/A	TERRAIN map not available.
TERR	TERRAIN map selected for display.

The terrain data is displayed above the airplane symbol on the MFD in green, yellow, and red colors that define the elevation of the terrain relative to the airplane's current altitude. Terrain that is more than 2000 feet below the airplane is not included in the display.

A moving marker scrolls across the bottom of the EGPWS display as an indication that the terrain is display is operational.

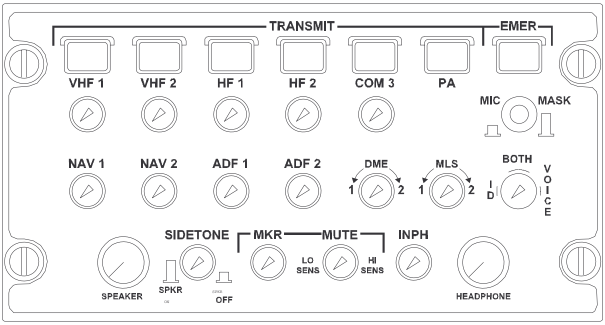
AUDIO CONTROL SYSTEM

The pilot's and copilot's digital audio control panels are located outboard of the PFDs on each side of the flight deck. Microphone transmit selector buttons are located in a row along the top edge of this panel (Figure 5-16). For night flying operations, the microphone selector buttons are annunciated with a lighted bar on the switch indicating the selected microphone. When these latching buttons are pushed, they connect the microphone (hand-held microphone, boom microphone, or oxygen mask microphone) to the selected radio. They simultaneously enable the audio associated with that radio, regardless of the setting on the audio on/off buttons located below these microphone transmit selector buttons. The microphones selector buttons are mechanically interlocked so that each new selection automatically deselects the previous selection. Depressing the PA button connects the on-side microphone to the passenger address amplifier. The audio level for the PA is automatically adjusted for conditions and cannot be adjusted by the crew. The pilot will use either a hand-held microphone or boom microphone for transmissions. Oxygen mask microphones are used when the MIC/MASK selector is in the extended (unlatched) position.

An EMER switch is located in the upper right corner of each audio control panel. When the EMER switch is depressed, the microphone and audio reception is connected directly to VHF 1 and NAV 1 and all functions of the audio control panel are bypassed except the headphone volume. In order to receive NAV 1 audio with EMER selected, the NAV AUDIO switch on the clearance delivery radio must be selected ON. When EMER is selected on the audio control panel and power is available to the control units, COM and NAV frequencies are set using either RMU or the clearance delivery radio. If EMER is selected and electrical power is still available to the audio panel, system warning audios will still be available through the cockpit speaker and audio will be routed to the cockpit voice recorder. Regardless of whether power is lost to the audio control panel, the EMER switch is operational, however, system warning audio and audio to the cockpit voice recorder are inoperative.

The audio source selector controls are located on the lower rows of the audio control panel. When these push-on/push-off switches are latched (in position) audio is turned off from that receiver. When unlatched (out position), the audio associated with that button is connected to the headphone and also to the speaker, if it is selected on. The audio level can be adjusted by rotating the button, counterclockwise to decrease, and clockwise to increase the volume.

One knob, labeled DME, controls the audio reception for both DME 1 and DME 2. When the DME knob is unlatched (out position) and the arrow on the knob is centered straight up, the audio level is at a minimum. Rotating the control knob in either direction toward 1 or 2 will increase the volume for that corresponding channel only. The audio level pointers on the knobs are displayed for night flight. There are separate controls for speaker volume and headphone volume which adjust the volume level for all audio buttons selected. The speaker push-on/push-off selector is combined with the sidetone knob. When the speaker switch is extended, it turns on audio to the on-side speaker. The speaker sidetone audio is controlled by the speaker SIDETONE volume control and the SPEAKER volume control for both on-side and off-side transmit conditions.



DIGITAL AUDIO CONTROL PANEL
Figure 5-16

The ID/BOTH/VOICE switch is located on the right side of the audio panel. In the ID position, the VOR and ADF audio is filtered to enhance the Morse Code identification and eliminate the voice signal. In the VOICE position, the ident audio is filtered to pass the voice content only and in the BOTH position, voice and ident signals will be heard simultaneously.

The controls for the marker beacon receiver are located at the bottom of the audio panel. They include the marker audio volume control (MKR), marker sensitivity control (LO SENS/HI SENS) and marker mute control (MUTE). The sensitivity is controlled by the rotation of the MUTE control. If either audio panel MKR sensitivity control is set LO, then both MKR receivers are set to LO, regardless of the position of the other audio panel controls. Either pilot can temporarily mute the marker beaconreceiver by depressing the MUTE/HI/LO switch.

The INPH (interphone) volume control adjusts the on-side headset audio level when the interphone function is used. The interphone operates on a "hot microphone" basis. The interphone is not available over the cockpit speaker except when the oxygen mask audio is selected. The MIC/MASK control allows for microphone audio switching between the boom/hand-held microphone (MIC) and the oxygen mask microphone (MASK). When the switch is latched (depressed position), MIC is selected and when the switch is unlatched (out position), MASK is selected.

The MASK intercom feature provides interphone audio to the on-side cockpit speaker. Audio is available regardless of the SPKR ON/OFF button position. Selecting INPH allows adjustable volume control of the off-side MASK intercom on the speaker.

Warning system audio signals are input to the audio panel for dissemination to the flight crew over the headphones and speaker. The audio output from the headphone, speaker, and microphone are recorded by the Cockpit Voice Recorder (CVR). The CVR microphone is the input for the AGC circuit and if the CVR microphone becomes disabled, or the CVR circuit breaker is pulled, then the aural warnings will be at the fixed HIGH volume level. If the Crew Warning Panel (CWP) has detected a fault in any one of the audio output channels, or in the Automatic Gain Control (AGC) input, a CAS annunciation will be posted.

The following CAS illuminations are specific to the Crew Warning Panel audio:

CAS	Color	Description
WARN AUDIO	Amber	The audio function of the Crew Warning Panel (CWP) has failed.
WARN AUDIO	White	• A Crew Warning Panel (CWP) audio output channel fault is detected. or • A problem exists with the Automatic Gain Control (AGC).

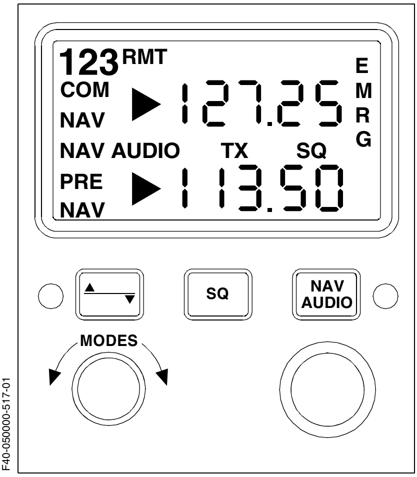
The pilot's audio panel receives 28-vdc from the left essential bus and is protected by a 3-amp circuit breaker labeled AUDIO 1/CLR DLY on the pilot's circuit breaker panel (AVIONICS [COMMUNICATIONS] group). The copilot's audio panel receives 28-vdc from the right essential bus and is protected by a 3-amp circuit breaker labeled AUDIO 2 on the copilot's circuit breaker panel (AVIONICS [COMMUNICATIONS] group). The passenger address amplifier receives power from the left essential bus and is protected by the CABIN PA 5-amp circuit breaker on the pilot's circuit breaker panel (AVIONICS [COMMUNICAIONS] group).

CLEARANCE DELIVERY RADIO (CDR)

The Clearance Delivery Radio (CDR), Figure 5-17, is located on the right, front corner of the center pedestal. The CDR provides an alternative capability for tuning the VHF COM 1 transceiver and the VHF NAV 1 radio. The CDR will tune the VHF COM radio prior to applying electrical power to the airplane. The CDR control head is normally powered by the left essential bus through the AUDIO 1 circuit breaker; however, it and other communication related equipment can be powered from the right forward hot bus, prior to applying electrical power to the aircraft.

With airplane batteries OFF, depressing the momentary action RADIO CTL HOT BUS switch on the center pedestal applies power from the right hot bus to the left audio control panel, CDR control panel, COM section of the integrated communications unit, and NAV section of the integrated navigation unit. The display on the CDR is liquid crystal type with white letters on a black background. The push button, display, and control identifier legend are on a black background displayed with electroluminescent lighting.

In the emergency mode, RMU and FMS tuning capabilities are inhibited and the COM and NAV units are tuned exclusively by the CDR. An AUX ON caption replaces the NB or WB annunciators on the RMUs to indicate that tuning through the RMUs is inhibited. Tuning through the CDR is no different when EMRG is selected, but the CDR does not look at the radio bus data to check the echoed frequency.



CLEARANCE DELIVERY RADIO
Figure 5-17

The CDR controls are as follows:

- **Transfer Key —** Alternately selects either the COM (top) or NAV (bottom) frequency to be connected to the tuning knobs.
- **Tuning Knobs —** Used to change the frequency indicated by the tuning cursor.
- **Normal/Emergency Mode Switch —** This rotary knob provides alternate selection of Normal and Emergency modes.
- **NAV AUDIO On/Off Switch —** This alternate action push button switch is used to toggle NAV audio ON or OFF when in the EMER audio mode on the audio control panel.
- **Squelch (SQ) Switch —** Used to toggle COM squelch on or off.

FLIGHT GUIDANCE CONTROL SYSTEM

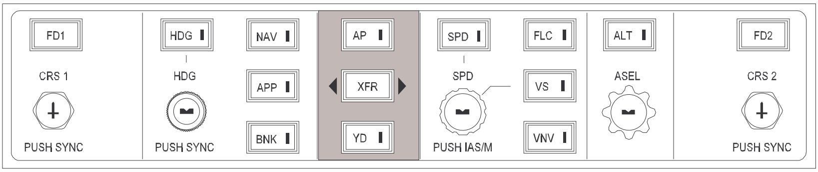
The Primus 1000 system includes an autopilot, yaw damper and dual synchronized flight directors. These are all co-located in two IC-600 display flight guidance computers located in the nose avionics bay. Each IC-600 houses a flight director; however, only the copilot IC-600 is connected to the pitch, roll and yaw servos for the autopilot/yaw damper and rudder boost functions. A flight guidance controller, located in the center of the glareshield, provides the means of engaging the autopilot/yaw damper and controlling both Flight Director (FD) systems. It also contains a transfer (XFR) switch that allows the crew to select either the left or right flight director as master and for autopilot coupling. The autopilot is a single channel with a fail passive design. The monitor system provides for automatic disconnect in the event of a malfunction in autopilot, yaw damper, or rudder boost. All automatic disconnects, which result from monitor trips, will be stored in a non-volatile memory for later recall by technicians.

FLIGHT DIRECTOR

The flight director system, utilizing two separate IC-600 computers, provides dual flight director computations, either of which can be coupled to the autopilot. Only one flight director can be coupled to the autopilot at a time. In this case the coupled flight director is classified as the master flight director, and the other flight director is classified as the slave flight director. The flight director can couple to Short Range Navigation (SRN) units (e.g. VOR, ILS), dependent upon which SRN is being displayed as a NAV data source on the Primary Flight Display (PFD). The flight director will use the displayed SRN data on the associated PFD for command-bar control computations. The flight director can be coupled to optional Long-Range Navigation (LRN) units (e.g. flight management system) if it is installed and selected as the NAV data source and displayed on the associated PFD. The flight director utilizes the lateral and/or vertical steering commands from the LRN in the command control computations. Each flight director uses the displayed on-side Air Data Computer (ADC) data for all vertical modes and gain programing. The flight director modes are synchronized in a manner that allows selection of the modes to be accomplished by the single set of FD mode select buttons on the flight guidance controller (FGC), see Figure 5-18. The FD mode select buttons on the FGC panel are momentary action and each has a vertical green bar that illuminates whenever the mode is selected.

FLIGHT GUIDANCE CONTROLLER (FGC)

The Flight Guidance Controller (Figure 5-18) is the prime controller for the flight director and the autopilot/yaw damper. Located on the center glareshield, the FGC provides the means, via push button switches, for flight director mode selection, couple status and autopilot/yaw damper engage selection. Flight director modes engage status is indicated to the crew via a green light on the right edge of each mode switch, which is illuminated when the mode is active and extinguished when the mode is inactive or dropped. The controller also has several rotary controls enabling selection of IAS, MACH, and VS targets, altitude, course and heading. All push button selections are signaled to both IC-600s via a discrete output from the FGC. The IC-600s then provide the drive to illuminate the appropriate light on the FGC.



FLIGHT GUIDANCE CONTROLLER
Figure 5-18

The FGC annunciations and controls are as follows;

FD 1/2 buttons — The flight director buttons (FD 1 and FD 2) are located on the upper left/right corners of the flight guidance controller. Depressing these buttons alone will not bring the FD command bars into view. Any FD mode selection causes the FD command bars to appear on both PFDs. When the FD command bars are in view on both PFDs and the autopilot is not engaged, depressing the master side FD button will disengage all FD modes and remove the command bars from both sides. Pressing the slave side FD button will remove the command bars from the PFD on that side acting as a flight director clear function.With the autopilot engaged, the FD command bars will be in view at all times on the coupled side and cannot be removed from the PFD. The opposite side FD command bars can be removed from view by depressing the appropriate FD 1 or FD 2 button.

Course set knobs — A course set knob (CRS 1 and CRS 2) is located at each end of the FGC. These knobs are used to individually set the courses on the left and right PFD HSI displays. They are used primarily to set the course for a VOR radial or LOC course. The course knobs have a push button in the center to synchronize the display to the aircraft's "direct-to" course.

Heading set knobs — Heading is selected via a rotary knob, with a "Heading Bug" symbol on the face of the knob. The heading knob controls the heading bug and digital display on both PFDs and the bug on the MFD MAP display. Depressing the HDG knob will synchronize the HDG bug on all display units to the aircraft's current heading.

HDG (heading) button — Depressing the HDG button engages the heading mode and displays a green HDG annunciation on the PFDs. The flight director command bars will command a turn in the direction the heading bug was moved to achieve the set heading. Heading select is used to maintain a magnetic heading. The heading bug is positioned to the desired heading on the HSI using the HDG knob on the FGC. The heading select mode is canceled when any armed lateral mode captures or if GA is selected.

NAV (navigation) button — Pressing the NAV button alternately selects and deselects the navigation mode. The NAV mode is normally used to intercept route segments identified with VOR radials and to intercept and fly desired FMS tracks (SIDs, routes, holding and STARS).

APP (approach) button — The intended function of the APP mode is that APP be used for all approaches, regardless of nav source or whether a vertical mode is also associated with the approach. The APP mode is normally used to select lateral and vertical steering for ILS and FMS. The VOR approach mode is selected by pressing the APP mode button with the navigation receiver tuned to a VOR frequency and selected as the active nav source. Pressing the APP button arms both localizer and glideslope modes when the navigation receiver is tuned to an ILS frequency and ILS is selected as the active navigation source. Selection of APP mode when the nav source is FMS engages the FMS lateral mode the same as described for NAV and also arms VNAV for approach.

BNK (bank) button — Pressing this button alternately selects or deselects a reduced maximum bank angle of 14° (for all lateral modes, except roll) on both FDs. When selected, a green low bank arc appears on the top of the ADIs and BNK is annunciated on the PFD.

AP (autopilot) button — Depressing this button engages the autopilot. Depressing a second time disengages the autopilot.

XFR (transfer) button — Located in the center section of the FGC. The XFR button is used to select the desired flight director (left or right) to command the autopilot.

YD (yaw damper) button — Depressing this button engages yaw damper. The YD can be engaged independent of the AP, but the autopilot system will not engage, or remain engaged, without the YD.

SPD (speed) knob — The rotary SPD knob is used to change the IAS/ Mach speed reference (SPD mode) and the vertical speed reference (VS mode). The speed knob changes the bug airspeed at any time, as long as VS is not selected. When VS mode is engaged, rotation of the SPD knob changes the digital vertical speed reference and the vertical speed bug position. The integral PUSH IAS/M button within the SPD knob is used to toggle the airspeed tape between IAS and Mach. The master flight director computes the airspeed reference, and the slave flight director synchronizes to this reference.

SPD (speed) button — Depressing the SPD button engages the speed hold mode (IAS or Mach) on both FDs. The speed select mode is used to fly to a selected airspeed or Mach number, and to provide limited overspeed/underspeed protection during climbs and descents. When speed select mode is active, a green IAS or Mach annunciation is displayed in the captured vertical mode field on the PFDs.

FLC (Flight Level Change) button — Depressing the FLC button once engages the normal climb/descent profile on both PFDs. Depressing it a second time selects the high speed climb/descent schedule. A third depression deselects the mode. The FD chooses between the climb and descent schedule based upon the aircraft's present altitude and preselected target altitude. The FD annunciation on the PFD is FLC for the normal profile and FLCH for the high speed profile.

VS (Vertical Speed) button — Depressing the VS button engages the vertical speed hold mode on both FDs. When VS is selected, the speed bug disappears and reference goes to dashes.The FD commands pitch changes to hold the vertical speed that existed at the time of engagement. Once engaged, the vertical speed bug positions on the inner side of the vertical speed scale and a digital readout appears above the vertical speed indicator.

VNV (Vertical Navigation) button — Depressing the VNV button arms, then captures the FMS pitch steering commands of the FDs if FMS is selected as the NAV source, the FMS is programmed for a vertical navigation profile, the altitude preselector is set below existing altitude and the aircraft is within the TOD (top of descent) window. When the VNAV mode is armed, a white VNAV is annunciated on the PFDs in the FD vertical mode annunciation field and will turn green upon capture.

ASEL (Altitude Select) knob — The preselected altitude is set via the ASEL rotary knob on the FGC. The altitude preselect mode provides a means for FD/AP to climb or descend to a preselected altitude and then level off and maintain the preselected altitude. The ASEL knob is used to set the altitude preselect function, and also provides the altitude reference for the altitude alerter function.

ALT (Altitude Hold) button — Altitude hold may be engaged by depressing the ALT button on the FGC. When ALT is engaged, the FD commands pitch to hold the existing altitude at the time the ALT button was depressed, or at the ASEL reference altitude if ALT automatically engages.

AUTOPILOT/YAW DAMPER

The autopilot is a single-channel autopilot which may be coupled to either flight director. The autopilot function is contained within the #2 IC-600 located in the nose. The IC-600 will fly the aircraft based on the selected control mode and guidance inputs from the coupled flight director, via servo control of the elevator, aileron and rudder. When engaged, the autopilot will also automatically command trim changes as required to alleviate the aerodynamic loading on the elevator (pitch trim), and will allow control surface commands to be entered via the control wheel trim switches for the ailerons and elevator. There is also a Touch Control Steering (TCS) feature which allows the cockpit crew to manually maneuver the aircraft with the autopilot engaged when the TCS switch is pressed. The autopilot provides aircraft control in response to pitch and roll steering commands from either flight director.

The yaw damper software computes servo commands based on sensor input data only. the yaw damper control software provides yaw rate damping that holds rudder force to zero. The servo position reference is synchronized to zero at engagement and is constantly washed out to ensure that the steady-state rudder forces are zero. The yaw damper can be engaged independent of the autopilot but the autopilot cannot be engaged without the yaw damper.

AP/YD Annunciation

At the very top, center section of the PFDs is an area dedicated to flight director and autopilot annunciations. A horizontal arrow appears at the top center of each PFD between the flight director vertical and lateral mode annunciators. This arrow points left or right, as selected on the FGC XFR switch, to indicate which flight director the autopilot will couple to when engaged. It also indicates which flight director has priority. Just below the arrow is a line reserved for autopilot and yaw damper annunciation. A green AP and YD appear in this area when the autopilot and/or the yaw damper is /are engaged.

Control Wheel Trim Switch

Manual primary pitch trim or roll trim commands are initiated by pressing and holding of the arm switch and actuation of the control wheel trim switch. Pressing and holding of the arm switch with control wheel trim switch input will result in immediate autopilot disengagement.

The yaw damper and flight director modes are not affected by manual pitch or roll trim commands. Actuation of the control wheel trim switch without pressing the arm switch allows manual autopilot commands. During autopilot engagement, basic attitude commands (pitch and roll) can be entered through either the pilot's or copilot's control wheel trim switch (dependent upon which flight director is coupled to the autopilot). With the autopilot engaged, activation of the control wheel trim switch (without arm switch depressed), on the side coupled to the autopilot, causes the flight director roll and/or pitch hold mode to be activated.

Control Wheel Master Switch (MSW)

The MSW switch immediately disconnects all autopilot and yaw damper servo drives. The selected flight director modes are not affected. In normal operation, a 28-vdc signal is routed through the normally closed contacts of each MSW and then to the onside IC-600. This input to the IC-600s is the autopilot disengage discrete, and if 28-vdc is removed from this discrete on either IC-600, the autopilot will disengage.

Touch Control Steering (TCS)

TCS allows the pilot to manually fly and retrim the aircraft without disengaging the autopilot. To use the TCS function, the pilot will press the TCS button on the control wheel, maneuver the aircraft to the desired condition, and release the TCS. Operation of the TCS button has no effect on flight director mode of operation. While the TCS button is held depressed (AP engaged), a white "TCS ENG" annunciator appears in the autopilot display area at the top of the PFDs.

Autopilot Engagement/Disengagement

Engagement of the autopilot is achieved via the AP push button on the FGC. Each button has a vertical green bar that illuminates when engaged. Engagement of the autopilot will cause the yaw damper to automatically engage. When engaged, the autopilot will couple to the master flight director, and will follow the guidance commands from the master FD. If no flight director is active, engagement of the autopilot will cause the master FD to default to the basic PIT and ROL modes. When engaged, the appropriate annunciation will be provided on both PFDs, and the green bar on the AP push button will be illuminated. Disengagement of the autopilot via the AP switch will cause the AP annunciation to be removed from both PFDs and the green bar on the AP push button will extinguish. Other actions that will cause autopilot disengagement include:

(1) Control wheel master switch activation.
(2) Pilot initiated trim commands with control wheel trim switch depressed.
(3) Yaw damper disengagement.
(4) AP switch on the FGC disengaged.
(5) Autopilot primary or secondary monitor trip.

For a normal disconnect, AP flashes red for 5 seconds, then is removed. For a monitored disconnect, it flashes red for 5 seconds, then steady, and the aural alert is continuous until the crew cancels it with the MSW.

Yaw Damper Engagement/Disengagement

Selection of the autopilot via the AP push-button will automatically engage the yaw damper. Alternatively the yaw damper may be selected via the YD push button on the FGC. When engaged, the green YD annunciation will be provided on both PFDs, and the green bar on the YD push button will illuminate. Manual disengagement of the yaw damper via the YD button will cause the YD annunciation to flash amber then be removed from both PFDs and the green bar on the YD push button will extinguish. In the case of a monitored disconnect, the YD annunciation will turn amber and flash for five seconds and then remain steady. Other actions that will disengage yaw damper include:

1. Control wheel master switch activation.
2. YD Switch on the FGC disengaged.
3. Yaw damper monitor trip.

Mistrim Annunciation

When the autopilot is engaged and the roll or pitch servo remains energized for a longer than normal period, this condition will be annunciated with a CAS. The autopilot does not have a capability to trim in the roll axis; therefore, if there is a mistrim in the roll axis, this will also display a CAS.

The following CAS illuminations are specific to the autopilot:

CAS	Color	Description
AP AIL MISTRIM	Amber	Autopilot is engaged and autopilot aileron servo is holding excessive torque. Disengage autopilot.
AP ELEV MISTRIM	Amber	Autopilot is engaged and autopilot elevator servo is holding excessive torque. Disengage autopilot.
AP ELEV MISTRIM	White	Autopilot is engaged and autopilot elevator servo is holding torque. Disengage autopilot.

Power Supply Configuration

The power supply for all the AFCS servos is supplied from the L MAIN bus, and is routed through the #2 IC-600 to the servos. The system is designed so that power failure to any major component in the system will result in the system reverting to the safe, disconnect mode. The AFCS SERVOS circuit breaker is located in the FLIGHT group of the pilot's circuit breaker panel.

GO-AROUND (GA) BUTTON

The GA button is located on the outboard side of the left thrust lever. Selection of the GA button disconnects the autopilot (but not the yaw damper) and cancels all other vertical and lateral modes except automatic altitude preselect arm. The flight director provides a wings level command bar display in the lateral axis and a fixed pitch-up vertical command. The pitch command does not guarantee that the go around airspeed will be achieved. If used on takeoff, the pitch attitude will not guarantee achieving the V_2.

FLIGHT MANAGEMENT SYSTEM (FMS)

The UNS-1E is a fully integrated Flight Management System (FMS). The FMS provides centralized navigation sensor control, flight planning, lateral and vertical flight guidance, steering enroute, terminal and approach modes of operation. Database management, fuel management, and maintenance functions are also provided by the FMS.

The UNS-1E accepts position information from up to five long-range navigation sensors as well as DME, VOR, or TACAN sensors. The data from these sensors is used to determine the best computed position. The UNS-1E incorporates an internal GPS sensor with Receiver Autonomous Integrity Monitoring (RAIM) as a standard part of the FMS configuration. The FMS interfaces with the IC-600s for a transfer of information to the FMS and lateral and vertical steering commands back to the EFIS and FD/AP.

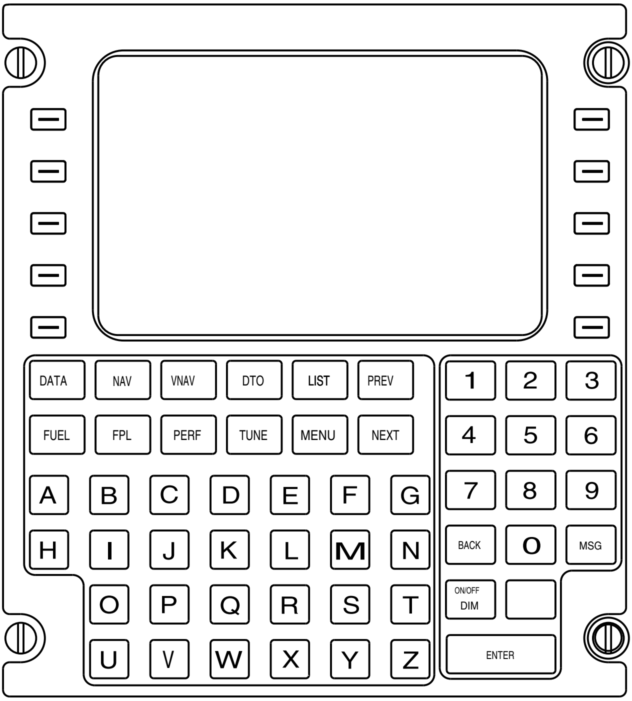
If a single FMS is installed, it can receive ADC, AHRS, EFIS, and AP data from either IC-600 but will use the #1 IC-600 as the primary source. If dual FMSes are installed, FMS 1 will use the #1 IC-600 as the primary source and FMS 2 will use #2 IC-600 as its primary source. With dual FMS installation, the pilots can use either FMS as the navigation source on their PFDs/MFD. In the material that follows, the FMS unit will be referred to as the Control Display Unit (CDU). The CDU contains a color, flat panel display, ten Line Select Keys (LSK) and dedicated function keys.

The FMS is powered from the left essential bus by a 5-amp circuit breaker labeled FMS located on the pilot's circuit breaker panel (AVIONICS [NAVIGATION] group).

CONTROL DISPLAY UNIT (CDU)

The CDU (Figure 5-19) is the primary interface to the pilot. It provides keypad input for selection of NAV modes and entering of waypoints and a display to indicate current operational modes. The CDU contains all the components required for the FMS functions. Other functions that are provided include:

- **Radio tuning and RMU interface** — The CDU allows remote tuning of the VHF COMM, VOR/ILS, ADF and ATC radios.
- **Flight planning** — The CDU can store a fixed number of flight plans into the FMS database.



UNS-1E FMS CDU
Figure 5-19

DATA TRANSFER UNIT (DTU)

The DTU allows updating of the FMS database, storing of pilot data and can also be used to record flight data. Database updates can be obtained on a subscription basis. The data transfer unit utilizes removable medium (e.g. 3.5-inch floppy, zip disk, USB memory, SD card) and is designed for mounting in the aircraft.

CONFIGURATION MODULE

The configuration module is used to store configuration data that is specific to the aircraft in which the FMS is installed.

At start-up, the CDU checks the version number stored in FMS memory against the version number stored in the configuration module. Any discrepancy between version numbers results in an FMS message, "CONFIG UPDATE REQUIRED", on the CDU.

FMS FUNCTIONS

FLP (flight plan) — Before using the FMS for navigation, an active flight plan must be defined within the FMS. The operator may select a previously stored route or create a new one to load as the active flight plan. A route or active flight plan can be created on the FMS as well. Once the departure airport is identified, the UNS-1E will present tailored lists from which the current runway, SID and transition can be selected. Also, both low and high altitude airways can be accessed for route or flight plan creation using the LIST function. Routes or the flight plan may also be constructed waypoint by waypoint, or by combining stored route segments. When en route and nearing the destination, a progression of smart prompts similar to those used on departure may be utilized to input a STAR, the approach and landing runway.

Upon selection of NAV on the MFD (FMS MENU), the IC-600 will display the closest eight navaids (VORs or NDBs) received from the FMS on the MFD MAP as background data. Selection of APT on the MFD, will result in the IC-600 displaying the first four airports received from the FMS on the MFD MAP as background data.

FUEL — Before takeoff, the fuel quantity signal conditioner provides the FMS with fuel quantity on-board. The pilot must accept or change the transmitted fuel quantity on the CDU fuel page. After engine start, the FMS receives real time fuel flow information independent of the aircraft indicating system. APU fuel is not included in fuel flow. Specific range and endurance are provided along with fuel, time and distance predictions for the destination.

PERF (performance) — A performance program in the FMS can compute takeoff speeds, takeoff N1 , takeoff distance and landing speed. The operator enters pertinent data such as takeoff configuration and environmental conditions mostly through menu selections. V Speeds and balanced field data is calculated and displayed. For landing, Vref is calculated along with approach speeds for different flap settings.

NAV (navigation) — All pertinent en route navigation data is displayed on the first NAV page of the CDU. This page along with the PFD/MFD displays provide complete integrated real time information on flight progress.

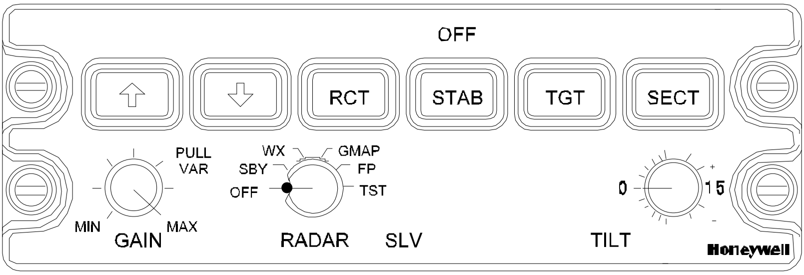
DTO (direct to) — A dedicated function key can be used to navigate from present position directly to any point on or off the present flight plan.

VNAV (vertical navigation) — Vertical navigation pages allow the operator to define waypoints with altitudes or flight levels. Features such as computed top-of-descent, target vertical speed and vertical direct-to are included. The FMS outputs vertical commands to the flight director when selected.

HOLDING PATTERNS — Holding patterns may be programmed at any waypoint on or off the flight plan or stored in the navigation data base as part of a SID, STAR or approach procedure. The holding pattern page provides a graphic depiction of the holding pattern. The pattern is defined with some crew inputs, and when the ACTIVATE line select key is pressed, the aircraft will proceed from its present position directly to the fix and make the appropriate entry (direct, parallel or teardrop), all automatically calculated and flown by the FMS.

WEATHER RADAR

The Primus 650 is the standard radar installed in the Learjet 45. It is an X-band radar system designed for weather detection and analysis. The radar can also be used for ground mapping. The WU-650 is an integrated unit which incorporates the receiver, transmitter and antenna (RTA) into a single unit, located in the nose of the aircraft. The only remaining radar component is the cockpit control panel which is mounted on the center pedestal. The antenna is a 12-inch flat plate that is stabilized with inputs from the #1 AHRS. Weather patterns can be displayed on both PFDs, on the ARC or MAP format, and on the MFD MAP format. The radar generates high-level RF pulses and should be operated with caution while on the ground. When operating on the ground, position the nose of the airplane so that the antenna scan sector is free of large metallic objects such as hangers or other aircraft for a distance of at least 100 feet.



WU-650 WEATHER RADAR CONTROL PANEL
Figure 5-20

The weather radar is controlled from the WC-650 weather radar controller, Figure 5-20. WX is selected for display on the PFDs by selecting the WX button on the display controller, the HSI automatically switches to the ARC mode. WX is selected for display on the MFD MAP by depressing the WX bezel button on the MFD main menu.

A six-position rotary switch is provided on the radar control panel for selecting the different radar modes. They are:

- **OFF** — removes electrical power from the system.
- **SBY (standby)** — in this position the RTA is powered up but does not radiate any RF energy nor does the antenna scan.

- **WX (weather)** — selects the weather radar main operating mode.
- **GMAP (ground map)** — in the ground mapping mode, the system internal parameters are set to enhance returns from ground targets.
- **FP (flight plan)** — selecting this position places the radar in the flight plan mode.
- **TST (test)** — when this mode is selected the weather depiction will be a special colored test pattern to allow verification of system operation.

Power is provided to the RTA and cockpit controller from the right avionics main bus with a 7.5-amp circuit breaker located in the INSTRUMENT/INDICATIONS group of the copilot's circuit breaker panel.

AVIONICS COOLING

INSTRUMENT PANEL COOLING

The instrument panel cooling system is located forward of the throttle quadrant and is provided to draw flight deck ambient air through the instrument panel and thus prevent overheating of avionics displays and instruments. The system consists of an avionics cooling fan, an on/off thermostat switch and an overtemperature thermostat circuit. The avionics cooling fan is activated when the temperature sensing switch reaches 90° F (32° C). The fan automatically turns off when the temperature has been reduced below 70° F (21° C). If the temperature reaches an extreme of 135° F (57° C) the overtemperature circuit is energized and an annunciation is posted on the CAS. The CAS remains displayed until the temperature has been reduced to 125° F (51.7° C).

The following CAS illumination is specific to the avionics cooling system:

CAS	Color	Description
INSTR PNL TEMP	White	The temperature at the instrument panel is higher than normal.

The instrument panel cooling system is powered from the L MAIN bus and protected by the INSTR FAN 3-amp circuit breaker located on the pilot's circuit breaker panel (ENVIRONMENTAL group).

MISCELLANEOUS

COCKPIT VOICE RECORDER (CVR)

A solid state Cockpit Voice Recorder (CVR) is installed in the Learjet 45. The standard CVR is a three-channel unit providing 30 minutes of recording. An optional unit is available which provides 120 minutes of recording. Two of the channels are used to record pilot and copilot audio. The third channel is used for the area microphone. Located in the tailcone, the CVR is painted international orange with reflective tape added to aid in recovery following a mishap. It also has an underwater locator beacon installed on one end of the unit. The recording is converted to a digital format and stored in crash protected memory. The area microphone is located in the upper center area of the instrument panel. An erase button and headphone jack are located on the CVR panel just beneath the copilot audio control panel. The CVR performs a self-test at power-up and has a continuous self monitor. If a fault is detected at any time, an annunciation is posted on CAS.

The following CAS illumination is specific to the CVR:

CAS	Color	Description
CVR FAIL	White	The cockpit voice recorder has failed.

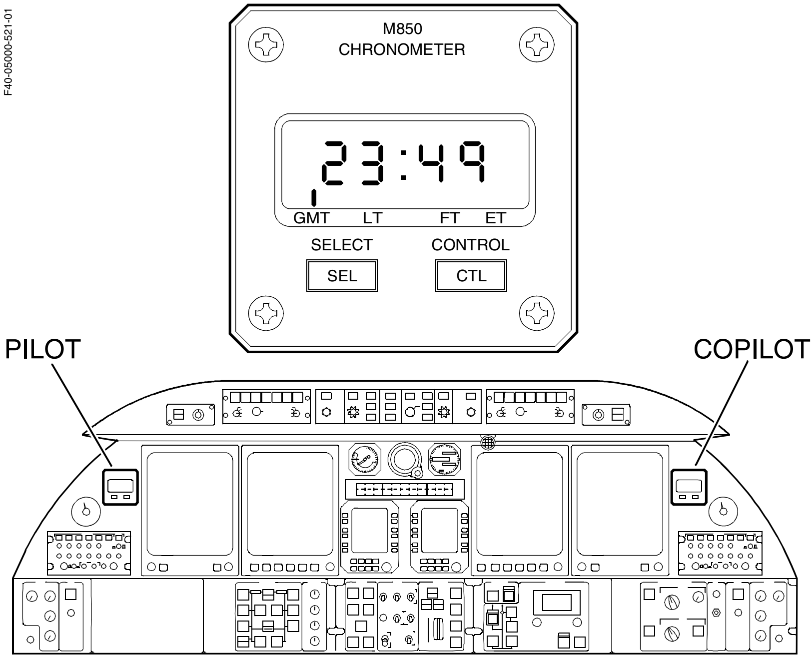
The erase function is initiated by pressing the erase button on the CVR panel. An interlocking device only allows this function to work when the airplane is on the ground and parking brake is set. When erase function is complete, a three-second tone is output to the headphone jack.

Voice recorder system power is 28-vdc supplied through a 3-amp CVR circuit breaker located on the pilot's circuit breaker panel (INSTRUMENTS/INDICATIONS group).

CLOCKS

Each instrument panel is equipped with a multi-function chronometer to display GMT, local time (LT), flight time (FT), and elapsed time (ET). The SEL button selects what is to be displayed and the CTL button controls what is being displayed (Figure 5-21). Pressing SEL sequentially selects GMT, LT, FT or ET for display. FT starts counting when the main gear weight-on-wheels switches transition to the air mode and stops counting when they transition back to ground mode. The CTL button resets FT back to zero when held down for three seconds. ET is started and reset when the CTL button is pushed momentarily. Depressing the SEL and CTL buttons simultaneously enters the set mode and GMT or LT can be set. The CTL button is then pressed to increment the flashing digit to the desired value. Pressing the SEL button enters that value and toggles to the next digit to be set.

Power for the chronometers is 28-vdc supplied through a 1-amp L and R CLOCK circuit breaker located on pilot's and copilot's circuit breaker panels respectively (INSTRUMENT/INDICATIONS group).



MULTI-FUNCTION CHRONOMETER AND INSTRUMENT LOCATION
Figure 5-21

HOURMETER-AIRCRAFT (OPTIONAL)

An optional hourmeter may be installed to measure aircraft accumulated time. The typical location for the hourmeter is on the RH side of the pedestal, just aft of the SELCAL decoder. It is wired to the right hand main gear weight-on-wheels switch, through a switch in the lower entry door frame. It will measure accumulated time as soon as the aircraft lifts off. The hourmeter receives 28-vdc from a 1-amp HOURMETER circuit breaker located in the INSTRUMENTS/INDICATIONS group of the copilot's circuit breaker panel.

FLIGHT DATA RECORDER (FDR) (OPTIONAL)

The flight data recorder, which may be installed, is a 25-hour Solid-State Flight Data Recorder (SSFDR) with Underwater Locator Beacon (ULB) and remote mounted tri-axial accelerometer.

The following CAS illumination is specific to the flight data recorder:

CAS	Color	Description
FDR FAIL	White	The flight data recorder has failed.

EMERGENCY LOCATOR TRANSMITTER (OPTIONAL)

Dorne & Margolin ELT14

The Dorne & Margolin ELT14 system simultaneously transmits distress signals on the frequencies of 121.5 and 243.0 MHz. The system will automatically activate under emergency conditions or may be manually activated with a cockpit-mounted switch. The system consists of a transmitter, antenna, remote control and monitor unit, and associated airplane wiring.

TRANSMITTER AND ANTENNA

The transmitter and antenna are installed in the airplane tail section. Power for the transmitter is provided by an internal battery pack. The transmitter incorporates a three-position switch (ARM/OFF/ON). Access to the transmitter is through an access cover placarded "ELT LOCATED HERE." The antenna is externally mounted and connects to the transmitter with antenna cable.

Transmitter Switch (ARM/OFF/ON)

Because of its location, this switch is not generally used by the crew. In the OFF position, the transmitter will not transmit distress signals. This position is normally used only while servicing the airplane. In the ON position, distress signals will be transmitted continuously. In the ARM position, the transmitter will automatically activate if the airplane stops abruptly. The switch should be in the ARM position for flight.

REMOTE CONTROL AND MONITOR UNIT

The remote control and monitor unit is installed in the cockpit. Power for this unit is provided by an internal coin cell. A three-position ON/ARM/RESET switch provides the remote control for the ELT transmitter. The ON and ARM positions function the same as described for the transmitter switch. Once activated, the transmitter may be returned to an armed status using the RESET function. The ELT can be reset but not switched off from this control unit.

A red LED, mounted in the end of the switch handle, provides the crew with the ELT status. The LED indicates ELT status as follows:

LED is:	**ELT Status:**
On continuously	The ELT is transmitting.
Flashing slowly (80 times per minute)	The ELT transmitter is switched OFF or the transmitter battery needs replacement.
Flashing quickly (5 times per second)	The remote control/monitor unit coin cell needs replacement.
Extinguished	The ELT is armed.

OPERATION

To arm the transmitter for automatic activation the ON/ARM/RESET Switch is placed in the ARM position. If the red LED flashes slowly, check that the transmitter switch is in the ARM position. If the transmitter switch is in the ARM position and the LED continues to flash, the transmitter battery needs replacement. To manually activate the transmitter, place the ON/ARM/RESET Switch to the ON position and check that the red LED is on continuously. To reset the transmitter, momentarily place the ON/ARM/RESET Switch to RESET and check that the red LED extinguishes.

ARTEX ELT 110-406

The ARTEX ELT 110-406 transmits on 121.5, 243.0 and 406.025 MHz. The ELT may be manually activated with a cockpit mounted switch or will automatically activate during an impact. Once activated, the ELT transmits the standard swept tone on 121.5 and 243.0 MHz. During that time the 406 MHz transmitter turns on and an encoded digital message is sent to the satellite. The information contained in the message includes:

- Serial number of the transmitter.
- Country code.
- Manufacturer.
- Position coordinates (optional).

The information sent to the satellite is programmed at the factory and contains a unique number that can be used to identify the beacon. The ELT 110-406 system consists of a transmitter, antenna, cockpit switch and indicator light, buzzer (aural monitor), and associated airplane wiring.

TRANSMITTER AND ANTENNA

The transmitter and antenna are installed in the airplane tail section. Power for the transmitter is provided by an internal battery pack which consists of 4 D size lithium manganese dioxide cells connected in series. The ELT unit incorporates an ON-OFF switch. Because of its location, this switch is not generally used by the crew. Access to the transmitter is through an access cover placarded "ELT LOCATED HERE." The antenna is externally mounted and is connected to the transmitter using antenna cable.

Transmitter Switch (ON-OFF)

In the ON position, the transmitter will transmit distress signals continuously. In the OFF position, the transmitter is armed to activate either automatically (impact) or manually (remote control from the cockpit switch). If removed from its mounting rack, the transmitter will be deactivated.

COCKPIT SWITCH AND INDICATOR LIGHT

The ELT 110-406 remote control (cockpit panel switch) provides manual On, Armed, and Reset modes. A 28-vdc indicator light, powered through the ELT WARN circuit breaker on the options circuit breaker panel in the tailcone, flashes continuously if the ELT has been activated and is transmitting.

BUZZER

The buzzer (aural monitor) provides a distinct signal (loud, siren-type sound) enabling a search and rescue team to locate an aircraft with a transmitting ELT in a confined area with a large number of aircraft (such as an airport). The buzzer is installed in the tail section and is powered by the ELT battery pack. The buzzer does not operate continuously, but sounds at predetermined intervals, and runs for shorter periods toward the end of battery life.

OPERATION

Under normal operation the cockpit switch is in the ARM position. The switch on the ELT unit will be positioned OFF. With these switch settings, the ELT will automatically activate on impact. To manually activate the ELT, set the cockpit switch to the ON position. When the ELT is activated, the presence of the emergency swept tone, a flashing cockpit indicator light, and the buzzer in the tail indicates a normally functioning unit. If the ELT is activated, it can be reset. This is done by moving the cockpit switch to ON and then immediately back to ARM.

The 406 MHz transmitter will operate for 24 hours and shut down automatically. The 121.5 and 243.0 MHz transmitter will continue to operate until the unit has exhausted the battery power. The 406 MHz transmitter transmits a digital message that allows search and rescue authorities to retrieve information from a database. Information contained in the database that may be useful include:

- Type of aircraft.
- Address of owner.
- Telephone number of owner.
- Aircraft registration number.
- Alternate emergency contact.

SECTION VI
ANTI-ICE & ENVIRONMENTAL

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

SECTION VI ANTI-ICE & ENVIRONMENTAL

BLEED AIR SUPPLY

Engine bleed air is used extensively for anti-icing and cabin environmental control. The source of this air is through low- and high-pressure ports on each engine compressor. High pressure (HP) or low pressure (LP) air is automatically supplied on an as-needed basis to meet pressurization requirements. The bleed air obtained from the engine's HP and LP ports is routed through shutoff and regulator valves. The bleed air is then ducted into either the anti-ice system or the Environmental Control Unit (ECU) or PACK. The PACK conditions the air for the cabin and cockpit distribution systems.

Shutoff valves and check valves are installed in the tailcone plumbing to control the bleed air from the left and right engines. In addition to the plumbing, the system includes control switches and incorporates an overheat, overpressurization and leak detection/warning system. A small amount of high-pressure bleed air is also used to pressurize the hydraulic reservoir described in Section 3, this manual.

The auxiliary power unit provides an additional bleed air source to operate the PACK when the aircraft engines are not running. The auxiliary power unit is designed for ground use only.

BLEED AIR SWITCHES

The L and R BLEED, and EMER PRESS switches, located on the PRESSURIZATION panel, control the respective left and right bleed-air shutoff valves, and the left and right emergency pressurization valves. The EMER PRESS switch is dependent on the L and R BLEED switches. Both L and R BLEED switches must be in the On position (OFF not illuminated) in order for both emergency pressurization valves to open with activation of the EMER PRESS switch. However, in the event of a L or R BLEED circuit breaker failure, it is possible to have bleed air supplied through an emergency pressurization valve of one engine and through the normal ducting of the other engine.

HP SHUTOFF VALVES

A pressure sensor within the HP ducting sends a signal to the ECS controller which drives the HP shutoff valves according to altitude and thrust lever angle.

The following CAS illumination is specific to the HP shutoff valves:

CAS	Color	Description
BLEED OVHT	Amber	Bleed air temperature in the associated (L or R) bleed air duct is excessive.

PYLON OVERHEAT

Four temperature sensors around the pylon structure provide for overheat indication.

The following CAS illumination is specific to pylon overheat detection:

CAS	Color	Description
ENG PYLON OVHT	Red	The associated (L or R) engine pylon area is overheated.

TAILCONE LEAK DETECTION

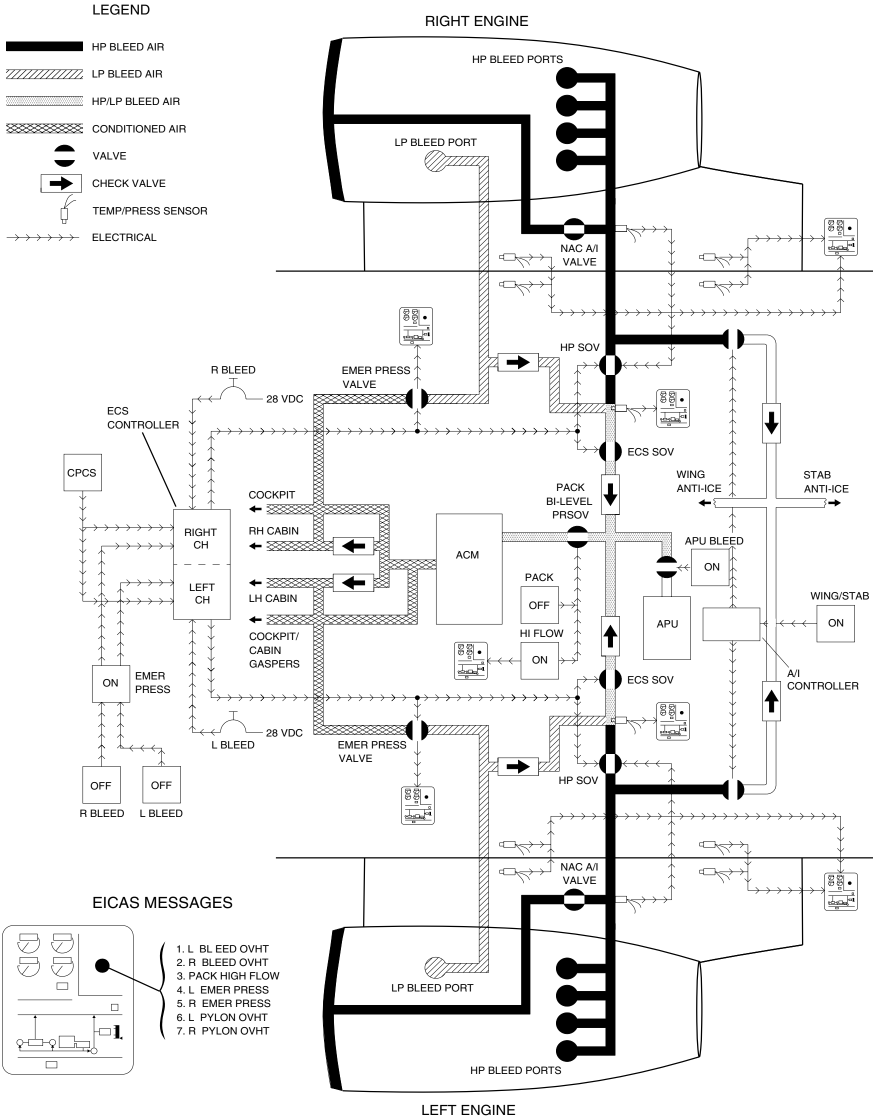
Tailcone sensing elements are installed along the ducting between the left and right high-pressure shutoff valves including the pack bi-level pressure shutoff valve, ECS pressure valves and ECS check valves. The loop-type elements detect elevated tailcone temperatures caused by a leak in the bleed-air ducting.

If a leak occurs between the high pressure shutoff valve and the ECS check valve, the corresponding BLEED AIR LEAK red CAS and CWP will illuminate. This CAS will also occur if a leak is detected between the ECS check valve and the pack bi-level pressure shutoff valve. The tailcone overheat detection system operates on 28-vdc supplied from the left essential bus.

The following CAS illumination is specific to tailcone overheat detection:

CAS	Color	Description
BLEED AIR LEAK	Red	A leak is detected in the associated (L or R) bleed air ducting (tailcone).

NOTE Illumination of the BLEED AIR LEAK red CAS will cause the APU to shut down.



BLEED AIR SYSTEM SCHEMATIC
Figure 6-1

ANTI-ICE SYSTEMS

Aircraft anti-ice protection is provided through the use of electrically heated and engine bleed-air heated anti-ice systems. Electrically heated systems include the pitot-static probes, total air temperature probe, engine inlet air temperature/pressure sensors, stall warning vanes, and windshields. Engine bleed air is utilized to provide anti-icing for the leading edge surfaces of the wings, horizontal stabilizer, and engine nacelle inlets. The engine fan spinners are unheated.

ICE DETECTOR SYSTEM

The ice detector system is installed to detect an icing condition and notifies the crew by illumination of the ICE DETECTED amber or white CAS described below. The ice detector system is always capable of detecting ice, provided aircraft electrical power is available. A self-test of the ice detector system is conducted every time aircraft power is turned on, and the ICE DETECT circuit breaker is engaged. The ice detector system receives 28-vdc power from the right essential bus through the 10-amp ICE DETECT circuit breaker on the copilot's circuit breaker panel (ANTI-ICE group).

The ICE DETECTED white CAS illuminates when ice is detected, the aircraft is airborne, and the following anti-icing systems are turned on:

- WING/STAB anti-ice selected ON.
- L and R NAC anti-ice selected ON and inlet pressure is present.

The ICE DETECTED amber CAS illuminates when ice is detected, the aircraft is airborne, and any of the following anti-icing systems are turned off:

- WING/STAB anti-ice selected Off,
  or
- L or R NAC anti-ice selected Off.

The following CAS illuminations are specific to the ice detection system:

CAS	Color	Description
ICE DET FAIL	Amber	The ice detection system has failed.
ICE DETECTED	Amber	Ice is detected and the appropriate (left and right nacelle heat, and wing/stab heat) anti-ice systems are **not** turned on.
ICE DETECTED	White	Ice is detected and the appropriate (L and R nacelle heat, and wing/stab heat) anti-ice systems are turned on.

WING INSPECTION LIGHT

The wing inspection light, located on the right forward fuselage, may be used to visually inspect the right wing leading edge for ice accumulation during night operations. The light is illuminated by depressing the WING INSP momentary switch located in the LIGHTS group of the center switch panel. The light illuminates a black dot on the outboard wing leading edge to enhance visual detection of ice accumulation. Power is supplied from the R MAIN bus through the 3-amp WING INSP circuit breaker on the copilot's circuit breaker panel (LIGHTS group).

ENGINE AND NACELLE INLET ANTI-ICE

The engine and nacelle inlet anti-ice system provides anti-ice protection for the nacelle inlets and the engine inlet air pressure/temperature sensors The engine inlets are anti-iced by directing engine bleed air through piccolo tubes to the inner surfaces of the nacelle inlet lip. After circulating around the inlet lip, excess bleed air is vented overboard through a hose at the bottom of the nacelle lip. The engine inlet air pressure/temperature sensors are anti-iced by integral heating elements whenever the respective L or R NAC anti-icing system is selected ON.

Each engine and nacelle anti-ice system consists of a bleed air duct, a nacelle anti-ice pressure switch, a nacelle anti-ice pressure regulating shutoff valve and a nacelle anti-ice switch. All anti-ice systems require electrical power to operate except the engine nacelle inlet heating systems which fail on when electrical power is not available to the respective nacelle anti-ice pressure regulating shutoff valve. Electrical power is provided from the L and R MAIN buses through the respective NAC circuit breakers located within the ANTI-ICE group [L and R HEAT] on the pilot's and copilot's circuit breaker panels.

System activation is indicated by a NAC green EI illuminated next to each engine ITT display. This illumination indicates that the respective L or R NAC switches are ON and that adequate bleed air pressure is being supplied to each nacelle lip.

An amber NAC illumination indicates that the respective L or R NAC switches are on with inadequate bleed air pressure being supplied to the nacelle lip or a circuitry fault to the pressure/temperature sensor. This EI will be accompanied by the L or R NAC HT amber CAS. If bleed air pressure of 6.5 psi or greater is sensed at the nacelle anti-ice shutoff valve with the L or R NAC switches off, the NAC amber EI will be accompanied by the respective L or R NAC HT FAIL ON amber CAS.

The following CAS illuminations are specific to the nacelle inlet anti-ice system:

CAS	Color	Description
NAC HT	Amber	- The associated (L or R) nacelle heat system is turned on, but the bleed air pressure to the nacelle is low. or - The associated (L or R) nacelle heat system is turned on, but the PT_2 heater is failed.
NAC HT FAIL ON	Amber	The associated nacelle heat system is turned off, but bleed air pressure is still present at the nacelle.

WING/STAB ANTI-ICE SYSTEM

The wing/stab anti-ice system utilizes high pressure (HP) bleed air directed through piccolo (diffuser) tubes in the leading edge of the wing and horizontal stabilizer. The bleed air used to warm the wing is then vented through the inboard wing boxes. The bleed air used to heat the stabilizer is vented overboard at the outboard ends of the stabilizer.

System components consist of the piccolo tubes, anti-ice Pressure Regulating Shutoff Valves (PRSOVs), anti-ice check valves, WING/STAB ON/off switch, wing temperature control and under/overheat sensors, electrical circuitry, and inputs from the integrated ECS temperature controller.

As the bleed air transfers to the piccolo tubes, it is routed through the pylon, into the tailcone, through a pressure regulating shutoff valve and modulating valve, a check valve, and into a common manifold. From the manifold, the wing supply duct branches forward and the horizontal stabilizer supply branches aft to the piccolo tubes. Check valves are provided to prevent bleed air cross flow from one source to the other, thus providing pneumatic isolation of the two bleed air sources.

The wing/stab anti-ice system is activated by selecting the WING/STAB switch located in the ANTI-ICE panel to ON. Electrical power is provided from the L and R MAIN buses through the respective circuit breakers located within the ANTI-ICE group [L or R WING/STAB HT] on the pilot's and copilot's circuit breaker panels. When activated, both anti-ice PRSOVs are energized open. The system controller then uses single control channels for each side to provide automatic control of the airplane wing and stabilizer leading edge skin temperature.

Each wing is continuously monitored by a wing temperature control sensor. The sensor supplies wing skin temperature information to a system controller. The controller then regulates the amount of HP bleed air allowed in the system by modulating the PRSOVs on each side to maintain the colder of the two wings at the established temperature. Under/overheat sensors also monitor wing and horizontal stabilizer temperatures and provide under/overheat signals to the controller.

Should the temperature exceed the established high value on any leading-edge surface, the sensors will trigger respective WING OVHT, STAB OVHT, or WING/STAB OVHT red CAS/CWP regardless of anti-ice systems being on or off. These CAS/CWP will extinguish once the leading edge temperature drops into the normal range.

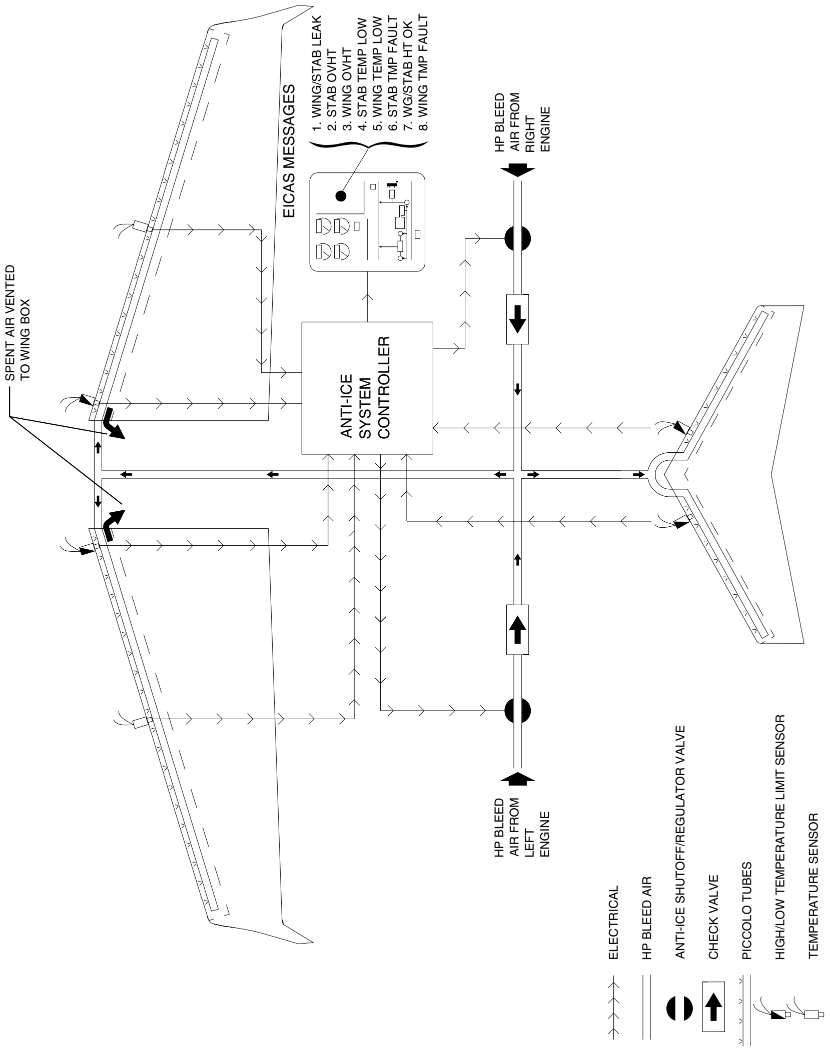
Should the temperature drop below the established low value on any leading-edge surface with anti-ice systems on, the sensors will trigger respective WING TEMP LOW or STAB TEMP LOW amber CAS. These CAS will extinguish once the leading edge temperature reaches the normal range.

Faults within the overheat/underheat sensors are indicated by illumination of the corresponding WING TMP FAULT and/or STAB TMP FAULT white CAS, and a WING and/or STAB TEMP LOW amber CAS with the system On.

The following CAS illuminations are specific to the wing/stab anti-ice system:

CAS	Color	Description
STAB OVHT	Red	The horizontal stabilizer leading edge is overheated.
WING/STAB LEAK	Red	A leak is detected in the ducting which supplies bleed air to the wing/stabilizer heat system.
WING OVHT	Red	The wing leading edge is overheated.
STAB TEMP LOW	Amber	Stabilizer heat is turned on, but the horizontal stabilizer leading edge temperature is too low for effective anti-icing.
WING TEMP LOW	Amber	Wing heat is turned on, but the wing leading edge temperature is too low for effective anti-icing.

CAS	Color	Description
STAB TMP FAULT	White	- A horizontal stabilizer temperature sensor has failed. or - The horizontal stabilizer high or low temperature sensor is invalid.
WING TMP FAULT	White	- A wing temperature sensor has failed. or - The wing high or low temperature sensor is invalid.
WG/STAB HT OK	White	The wing/stabilizer heat system checks OK.



WING/STAB ANTI-ICE SYSTEM SCHEMATIC
Figure 6-2

WINDSHIELD DEFOG AND ICE PROTECTION

Windshield defogging and ice protection is accomplished using electrically heated windshield panels. The system is designed so that if desired, it may be activated before takeoff and remain on until shutdown. The system is comprised of two windshield panels with integral heaters, dual-channel windshield heat control unit, system switches, engine driven alternators and associated aircraft wiring.

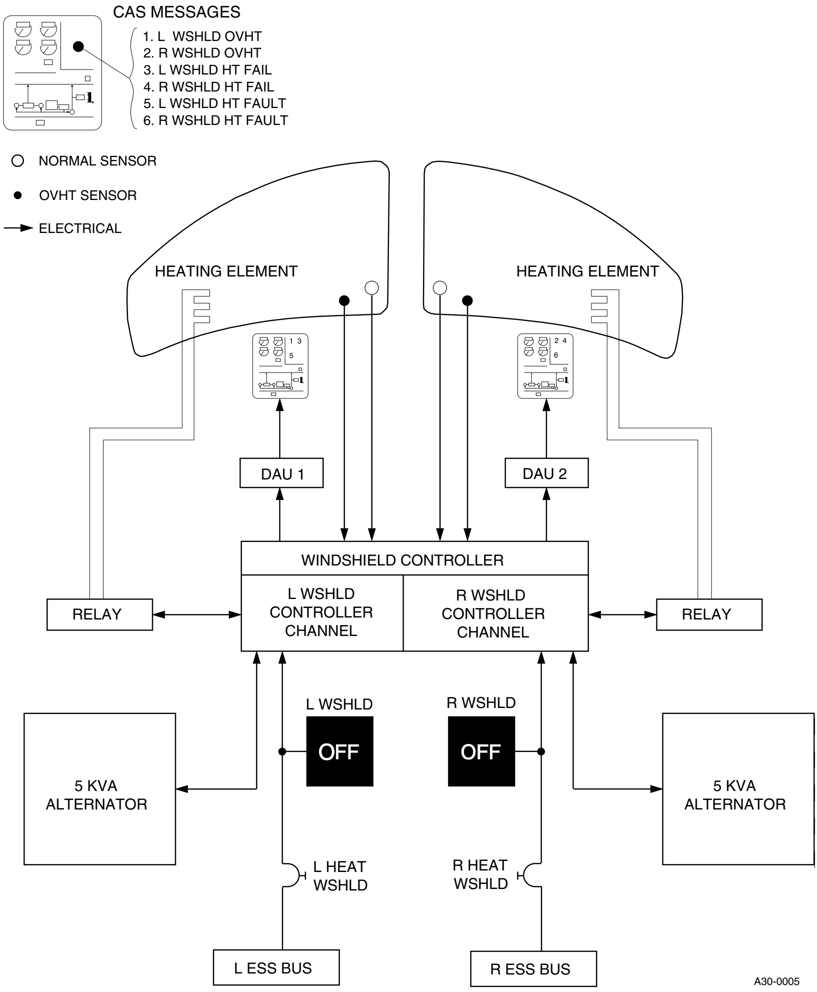
The same windshield panels are used for defogging and ice protection. The dual-channel windshield heat control unit automatically regulates windshield temperatures to preclude the formation of external ice and internal windshield surface condensation (fogging). Separate L and R WSHLD switches and power supplies provide for system redundancy.

Each system utilizes the 200-vac output from an alternator on its respective engine to power the integral heaters. The control circuit receives 28-vdc through the 5-amp WSHLD circuit breakers located within the ANTI-ICE group [L and R HEAT] on the pilot's and copilot's circuit breaker panels.

During normal operation the controller regulates the output of the alternators to maintain the desired windshield temperature. If there is a fault in the circuitry for normal operation, the system can continue to operate in a degraded mode. In the degraded mode the output of the alternator is no longer modulated and the controller cycles power full to the windshield. The controller continues to cycle power on and off to control operation when functioning in the degraded mode.

The following CAS illuminations are specific to the windshield defog and ice protection systems:

CAS	Color	Description
WSHLD HT FAIL	Amber	The associated (L or R) windshield heat system is on, but the windshield temperature is too low for effective anti-icing.
WSHLD OVHT	Amber	The associated (L or R) windshield is overheated.
WSHLD HT FAULT	White	The associated (L or R) windshield heat system is operating but in a degraded mode.



WINDSHIELD ANTI-ICE SCHEMATIC
Figure 6-3

BAGGAGE COMPARTMENT HEATING SYSTEM

The tailcone baggage compartment features a heating system to prevent the unpressurized compartment from freezing. Baggage compartment heat is available for both ground and inflight operations. *On aircraft 45-170 thru 45-2000 and prior aircraft modified by SB 45-21-3 (Air Conditioning-Relocation of Baggage Heater Switch)*, an ON/OFF switch for the heating system is located on the Environmental Control Panel. *On aircraft 45-169 and prior aircraft not modified by SB 45-21-3*, the ON/OFF switch is located in the ceiling of the baggage compartment. Once the system switch has been turned ON, operation of the system is fully automatic and requires no crew regulation or monitoring.

Heating is provided through electrical blanket heaters installed on the left, right and bottom sides of the tailcone baggage compartment. Two temperature sensors enable and disable the blanket heaters. The heaters will not activate unless the temperature falls below the established low value and will deactivate when the temperature reaches the established high value. The heaters are self-regulating whereby power consumption is reduced as temperature increases.

The baggage compartment heaters are powered by 28-vdc through the R NON-ESS bus. A baggage heat circuit breaker is located on the aft left power distribution panel within the tailcone.

ENVIRONMENTAL CONTROL SYSTEM (ECS)

The environmental control systems provide:

- conditioned air to the passenger and crew compartments for normal ventilation and pressurization,
- unconditioned air for emergency pressurization, and
- temperature control of passenger and crew compartments.

ECS CONTROLLER

A dual channel ECS controller provides the circuitry required to operate the ECS valves, HP shutoff valves and the emergency pressurization valves. The left and right channels independently control their respective shutoff valves. The controller receives and monitors signals from pressure sensors, the cabin pressurization controller, thrust lever angle, L and R BLEED switch positions and EMER PRESS switch position.

The ECS controller channels are powered by 28-vdc from the respective L and R essential buses through the L and R BLEED circuit breakers located in their respective pilot and copilot circuit breaker panels (ENVIRONMENTAL/ENVIR group).

ECS SHUTOFF VALVE

Normally during flight the ECS shutoff valves will be de-energized open. When a L or R BLEED switch is set to OFF, the respective ECS shutoff valve will be energized to the closed position. When the L and R BLEED switches are On and the EMER PRESS switch is activated, the bleed air shutoff valves will close and the emergency pressurization valves will be energized open and the HP bleed air will be shut off. The ECS shutoff valves will close automatically whenever emergency pressurization or a fire switch (respective ENGINE panel) is activated.

ENVIRONMENTAL CONTROL UNIT (ECU) OR PACK

The ECU or PACK consists of a precooler, primary and secondary heat exchangers, an Air Cycle Machine (ACM), and various pneumatic control valves and sensors. System control is accomplished by the Pressure Regulating Shutoff Valve (PRSOV). A water separator is installed to reduce humidity of the discharged air.

PRECOOLER AND HEAT EXCHANGERS

Ram air from a PACK airscoop is used to provide the cooling media for the precooler, primary and secondary heat exchangers. In the absence of ram air (ground operations), a fan wheel within the air cycle machine is used to create airflow across the precooler and heat exchangers.

AIR CYCLE MACHINE (ACM)

An Air Cycle Machine (ACM) is used to refrigerate bleed air, providing a source of cool air. The ACM is a three-wheel (fan, compressor, and cooling turbine) unit installed in the tailcone. Bleed air from the aircraft engines is first cooled by a precooler, then the amount of air is regulated by the PRSOV before being admitted into the ACM. The ACM then cools the bleed air further with the primary heat exchanger before compressing it in its compressor section. After the bleed air is compressed, heat is again extracted with a secondary heat exchanger before entering the turbine section of the machine. Additional heat is extracted from the compressed air by converting some of its heat energy to work (driving the cooling turbine) and rapid expansion of the air as it exits the turbine. This refrigerated air is passed through a water separator to remove the water before being supplied to the cabin and crew air distribution systems.

ACM BYPASS VALVE

When pressure at the compressor inlet exceeds the pressure at the compressor outlet, airflow is permitted around the compressor section through the ACM bypass check valve. This prevents the compressor from restricting airflow during operation of the ACM at low speeds.

LOW LIMIT TEMPERATURE SENSOR

A temperature sensor, at the water separator outlet, is used to modulate an anti-ice modulating valve. The anti-ice modulating valve is incorporated into the ACM to maintain a constant outlet temperature and prevent icing at the turbine outlet. To accomplish this, the anti-ice modulating valve mixes warm bleed air with the cooling turbine discharge air to produce the desired temperature.

PACK OVERTEMP SENSOR

Overheat conditions of the ACM are monitored by the pack overtemp sensor. The pack overtemp sensor, mounted downstream of the ACM compressor discharge, will illuminate the PACK OVHT amber CAS when the temperature has exceeded 450° F (212° C).

The following CAS illumination is specific to pack overheat detection:

CAS	Color	Description
PACK OVHT	Amber	Compressor discharge air temperature (air conditioning pack) is excessive.

AIR CYCLE MACHINE CONTROLS

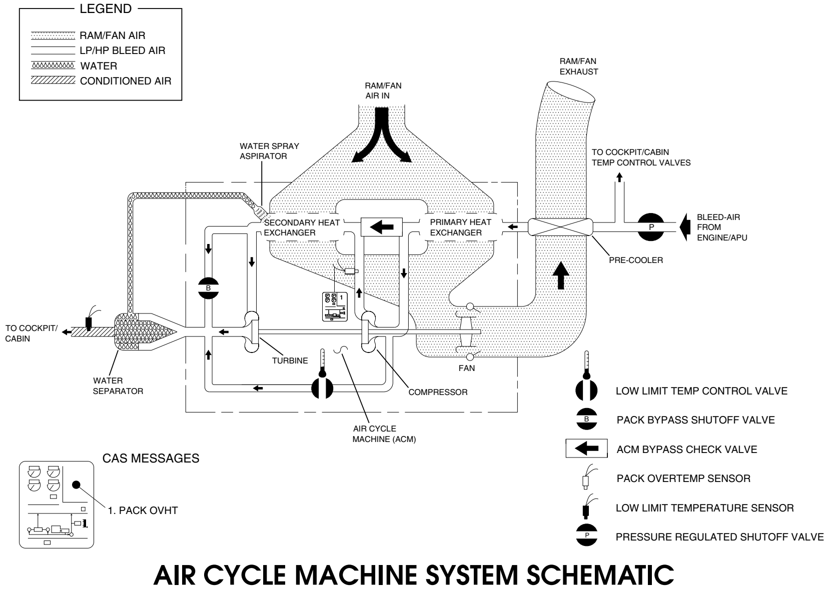
Control of the air cycle machine is through the use of the PACK and HI FLOW switches located on the PRESSURIZATION panel. These switches control the Pressure Regulating Shutoff Valve (PRSOV). The PRSOV controls inlet air to either 18 (normal) or 26 (HI FLOW) psig. The air cycle machine is always On (not illuminated) for normal operations.

PACK Switch — When set to OFF (illuminated), the bleed air supply to the ACM is shut off (PRSOV closed). When set to On (not illuminated), bleed air is allowed to pass through the ACM and enter the air distribution system at 18 psig.

HI FLOW Switch — When set to ON (illuminated), the bleed air coming out of the ACM compressor section must pass through the cooling turbine and enter the air distribution system at 26 psig.

The following CAS illuminations are specific to PACK control:

CAS	Color	Description
ECS FAIL	Amber	Both channels of the Pack has failed.
ECS FAULT	Amber or White	A fault has been detected in the appropriate (L or R ECS) channel of the ECS controller (Amber on the ground or White during flight.)
PACK HIGH FLOW	White	HI FLOW is selected on the air conditioning pack.



AIR CYCLE MACHINE SYSTEM SCHEMATIC
Figure 6-4

TEMPERATURE CONTROL SYSTEM

The temperature of the environmental air is controlled by mixing bleed air upstream of the air cycle machine with refrigerated air downstream of the air cycle machine. The resulting conditioned air is ducted into the cabin and cockpit. Separate controls are provided for the cockpit and cabin creating two temperature zones. Each temperature control system consists of a temperature control valve, torque motor, temperature controller, duct temperature sensor, air temperature sensor, and a COLD-HOT selector. A MANUAL TEMP switch allows the temperature control valves to be operated manually by rotation of the temperature selector knobs.

Temperature control valve position, thus, temperature regulation, is pneumatically controlled by the electrically operated temperature control system. During normal operation, the respective system temperature controller will automatically maintain the temperature set with the (COCKPIT or CABIN) COLD-HOT selector on the ENVIRONMENTAL CONTROL panel. The controllers maintain the selected temperature by comparing input signals from various temperature sensors and then electrically controlling the torque motors that provide pneumatic pressure (servo air) to the temperature control valves. The cockpit and cabin air temperature sensors have small blowers that draw air past the sensing elements to assure rapid sensing of temperature changes. Whenever the MANUAL TEMP switch is ON, the respective temperature control valve will respond directly to movement of the (COCKPIT or CABIN) COLD-HOT selector.

Each system has duct temperature sensors and limiters to provide for duct temperature indication and protection. The temperature sensors signal the ECS integrated controller of temperature information during normal operation. Temperature is displayed on the ECS page as digital CAB and CKPT indications.

If excessively high temperatures are reached in the cabin or cockpit supply duct, the overtemp limiter will signal the ECS integrated controller to close the respective cabin or cockpit temperature control valve. In this event, a CAB DUCT OVHT or CKPT DUCT OVHT amber CAS will illuminate. These CAS are primarily for protection during emergency pressurization (EMER PRESS) operation.

Electrical power for the temperature control system is 28-vdc supplied by the R MAIN bus for the automatic mode or the R essential bus for the manual mode. Power is supplied through the respective 1-amp AUTO or MAN circuit breaker located on the copilot's ENVIR panel (TEMP CTRL group). In the event power is lost to the right main and essential buses, the temperature control valves will fail to the full closed (cold) position.

The following CAS illuminations are specific to duct overheat detection:

CAS	Color	Description
CAB DUCT OVHT	Amber	Temperature of the cabin bleed air distribution duct has exceeded the system limit.
CKPT DUCT OVHT	Amber	Temperature of the cockpit bleed air distribution duct has exceeded the system limit.

TEMPERATURE CONTROL VALVES

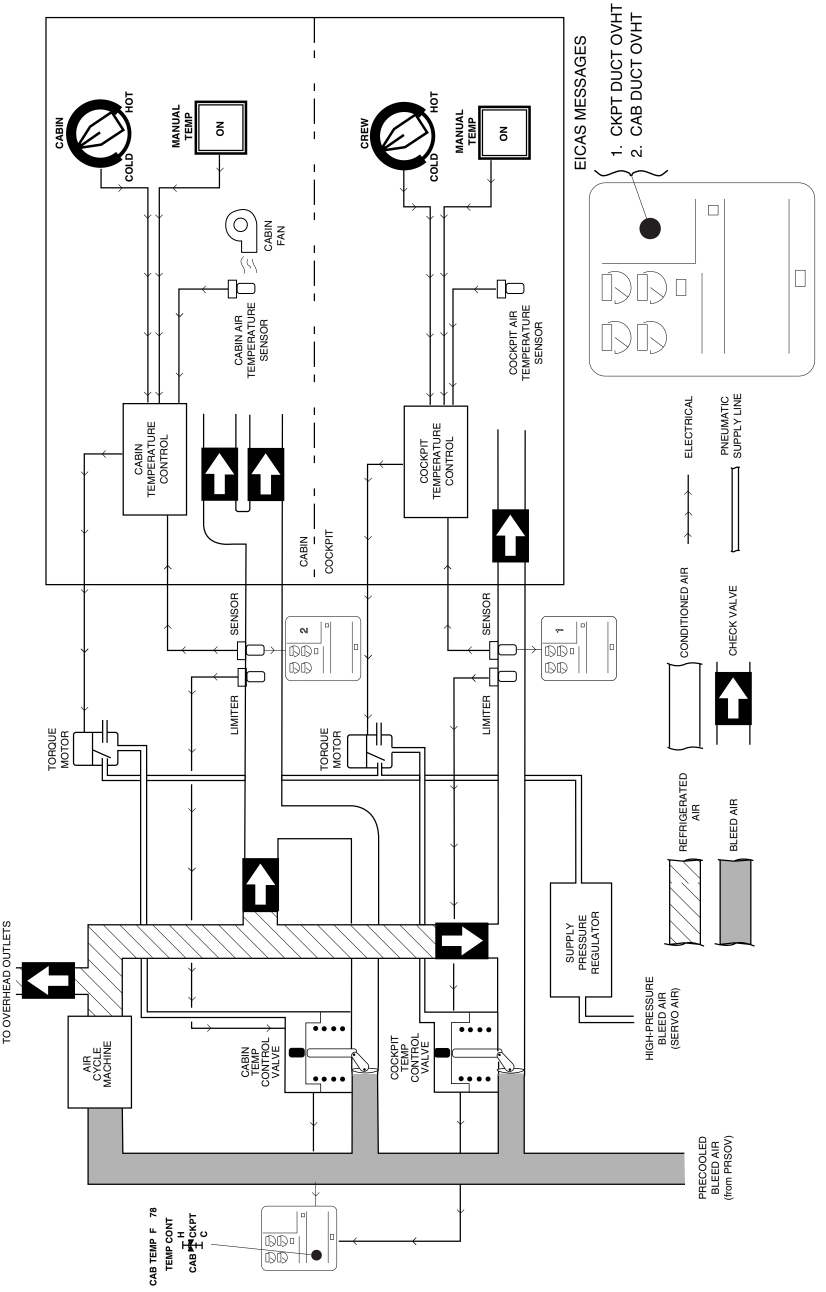
The temperature control valves are pneumatically operated. Regulated high-pressure bleed air is used to provide the required pneumatic pressure (servo air). The APU will provide servo air when it is being used to run the air cycle machine. The valves are spring-loaded closed and opened with pneumatic pressure. Valve position is controlled by varying the pneumatic pressure with a torque motor.

MANUAL TEMP SWITCH

The MANUAL TEMP switch allows the temperature control valves to be operated manually by rotation of the respective COLD-HOT temperature selector knob.

CREW AND CABIN COLD-HOT SELECTORS

A COCKPIT TEMPERATURE COLD-HOT and a CABIN TEMPERATURE COLD-HOT selector are located on the ENVIRONMENTAL CONTROL panel. During normal operation, these selectors are used to select the desired system temperature to be maintained automatically by the temperature controllers. In MANUAL TEMP mode (ON illuminated), these rheostat-type selectors directly vary the current input to the pneumatic torque motors which position the temperature control valves. Rotating the selectors clockwise from COLD to HOT is equivalent to selecting temperatures ranging from 60° F (16° C) to 90° F (32° C).

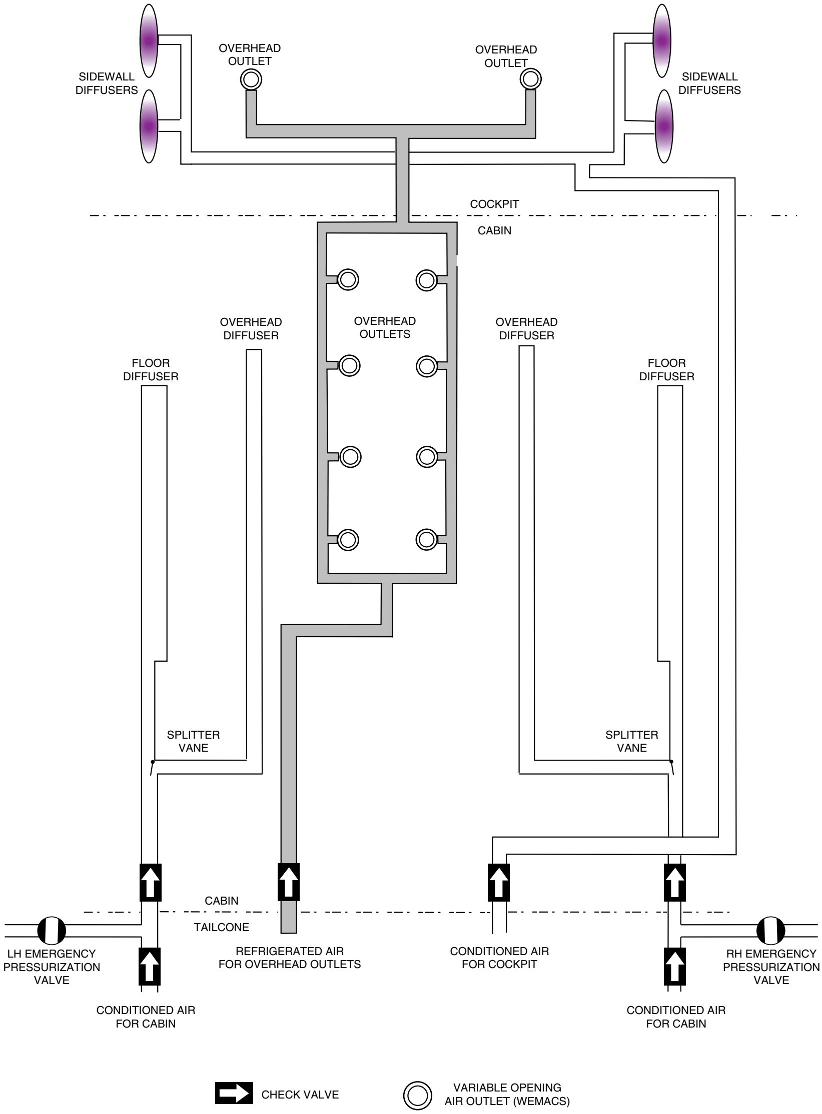


TEMPERATURE CONTROL SCHEMATIC
Figure 6-5

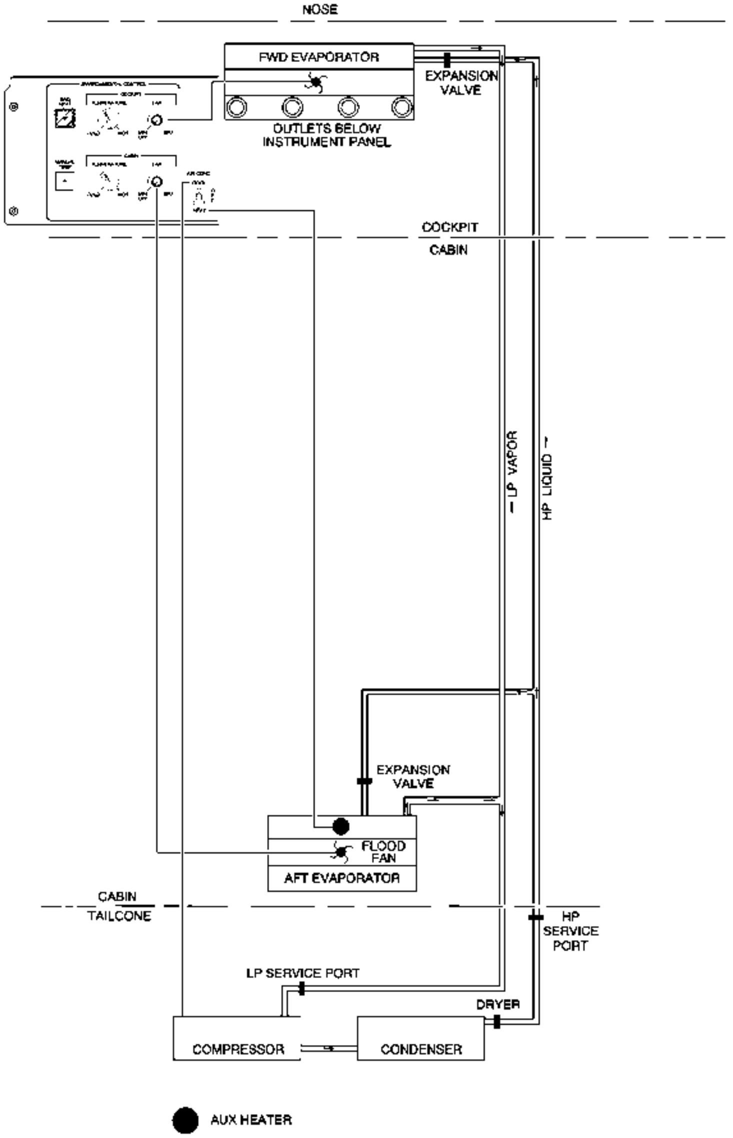
AIR DISTRIBUTION

Conditioned air enters the cabin through three separate ducts. Two ducts supply air to the floor and overhead diffusers. The third duct supplies air to the sidewall diffusers. Crew and passengers may regulate the gasper air by opening or closing the individual outlets.

The environmental control system will automatically divert some of the air from the overhead diffusers to the floor diffusers. This flow splitting is accomplished by a restrictor plate or an optional diverter door. The restrictor plate or diverter door diverts the majority of the flow to the floor diffusers during heating mode, and allows the majority of the flow to the overhead diffuser during cooling mode. This feature minimizes vertical air stratification in the cabin and provides for more efficient cabin heating.



COCKPIT/CABIN AIR DISTRIBUTION SCHEMATIC
WITHOUT OPTIONAL R-134A COOLING SYSTEM
Figure 6-6



COCKPIT/CABIN AIR DISTRIBUTION SCHEMATIC
WITH OPTIONAL R-134A COOLING SYSTEM
Figure 6-6A

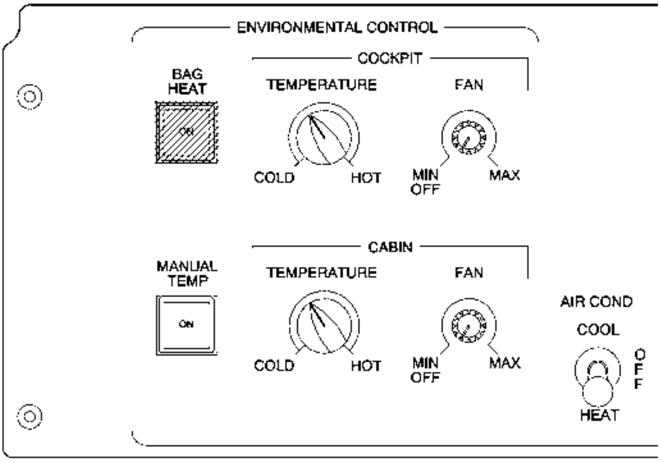
VAPOR CYCLE COOLING SYSTEM and AUXILIARY HEAT (OPTIONAL)

The R-134A vapor cycle cooling system is installed for cockpit and cabin cooling during ground operations, cabin dehumidification, and inflight cooling. In flight, the air conditioning system is powered by both engine generators. On the ground, power may be supplied by the APU, engine generators or ground power unit. Cabin and cockpit fan speeds are variable. Air conditioning can be selected by placing the AIR COND COOL, OFF, HEAT switch to the COOL position. A cockpit blower, located below the cockpit floor, and a cabin blower, located in the aft cabin overhead, circulate air through the system evaporators to provide cooling. Cabin and cockpit fans will automatically activate to the low speed setting if the fan speed selector is in the OFF position, or to the speed selected. A switch is installed in the lavatory door that decreases the cabin fan speed to a minimum setting when the lavatory is occupied.

The system is protected against overpressure conditions by two separate safety devices. The first is a binary high/low pressure switch located on the compressor discharge port. This switch will open at approximately 350 psig and will interrupt power to the compressor control circuit. The second overpressure safety device is a fuse plug located on the receiver-drier assembly. This plug will vent the system refrigerant safely overboard in the event of a system pressure is in excess of 425 psi.

The system incorporates an automatic load shed system that deactivates the compressor drive motor during starts or while the system is on battery power. It is recommended that the AIR COND switch be in the OFF position during engine starts to avoid large amperage surges after starter disengagement. The automatic load shed system requires both generators to be on line supplying 28 VDC to operate the air conditioning system. The failure of either generator activates the automatic load shed system.

System control circuits, including the cabin blowers, are powered by 28 VDC supplied through the 5-amp COOL/HEAT circuit breaker on the copilot's circuit breaker panel. The cabin blowers are powered by 28 VDC through a 50-amp current limiter. Speed control circuits for the cabin blowers are powered through the 5-amp CABIN FAN circuit breaker on the copilot's circuit breaker panel. The cockpit blower (including speed control circuit) is powered by 28 VDC through the 15-amp COCKPIT FAN circuit breaker on the copilot's circuit breaker panel.



ENVIRONMENTAL CONTROL PANEL
(R134A Cooling System)
Figure 6-6A

CABIN AUXILIARY HEAT

Cabin heating can be selected by placing the AIR COND switch in the HEAT position. The cabin auxiliary heat system consists of four heater elements, four thermal switches and two thermal fuses. The cabin auxiliary heater elements are located in the aft evaporator assembly. Two thermal switches are installed to regulate a specific temperature range by energizing and de-energizing the heater elements during normal operations. Power to operate the auxiliary heater can only be supplied by a GPU. Fixed high fan speed cabin air is blown across the heater elements and enters the cabin via the evaporator close out. A switch is installed to decrease the cabin fan speed to minimum setting and remove power to the heater elements when the lavatory door is closed. If either thermal switch fails to regulate the preset temperature range, the thermal fuses will melt and disable the heater.

The auxiliary heat system also incorporates two thermal switches that automatically enable the cabin blower into a cool-down mode at low speed. The cabin blower is powered through the rear hot bus and will continue to operate until the desired temperature is reached. This normal cooling cycling will occur automatically regardless of GPU availability, heater switch location or aircraft battery switch selection.

CABIN CLIMATE SWITCHES *(R-134A Cooling system)*

COOL-OFF-HEAT SWITCH

The COOL-OFF-HEAT switch, located in the ENVIRONMENTAL CONTROL group on the copilot's switch panel, controls the freon cooling system and the auxiliary heating system. When set to COOL, the switch allows power to the freon compressor motor and cabin and cockpit blower circuits. If either the COCKPIT or CABIN FAN switch is off when the switch is set to COOL, the respective blower, cockpit or cabin, will run at minimum speed. Blower speed may be increased by rotating the CABIN or COCKPIT FAN switch, as applicable, in a clockwise direction until the desired speed is reached.

CABIN FAN SWITCH

Cabin blower speed is controlled during cooling and supplemental air circulation modes by the rheostat-type CABIN FAN switch located in the ENVIRONMENTAL CONTROL group on the copilot's switch panel. Rotating the switch clockwise out of the off detent position will turn on the cabin blowers and blower speed will increase with further clockwise movement.

COCKPIT FAN SWITCH

The rheostat-type COCKPIT FAN switch is located in the ENVIRONMENTAL CONTROL group on the copilot's switch panel. The switch controls the cockpit blower which is available for all ground and inflight cooling or air circulation modes. When the cooling system is in operation, the blower will force air through the cockpit evaporator to provide cooling or circulate air when the air circulation mode is selected. Air circulated by the cockpit blower is exhausted through the cockpit and cabin overhead eyeball outlets when they are rotated to the open position.

COCKPIT FOOT WARMERS

The foot warmer heat system provides electrical heat from heel plate assemblies installed on the flight deck floorboard below each rudder pedal. The heel plate assemblies are provided as pilot and copilot foot warmers. The system control circuit operates on 28 VDC power supplied through the FOOT WARM circuit breaker on the copilot's circuit breaker panel. A thermostat located behind the copilot's aft kick panel regulates the heel plates between 40° F (4° C) and 80° F (27° C).

OXYGEN SYSTEM

The aircraft oxygen system provides oxygen service for the crew and passengers. The system consists of the crew and passenger distribution systems, and a high-pressure oxygen storage system. Electrical power to operate the passenger oxygen system is supplied by the EMER BATT bus through a 2-amp PAX OXY circuit breaker located on the pilot's circuit breaker panel (ENVIRONMENTAL group).

Oxygen is available to the crew at all times and can be made available to the passengers either automatically above 14,500 (±250) feet cabin altitude, or manually at all altitudes through the use of the DEPLOY switch located on the copilot's PAX OXYGEN panel. The oxygen system is designed for use during emergency descent to a cabin altitude not requiring oxygen, and is not to be used for extended periods of flight at cabin altitudes requiring oxygen (Refer to oxygen duration chart, Section IV of the AFM) or as a substitute for the normal pressurization system. *On aircraft 45-170 and subsequent,* an altitude compensating regulator is installed for extended oxygen duration. *On aircraft 45-169 and prior,* an altitude compensating regulator for extended oxygen duration is *optional*. Smoking is prohibited when oxygen is in use.

OXYGEN STORAGE AND PRESSURE REGULATION

The high-pressure oxygen storage system consists of a storage cylinder, a shutoff valve and regulating assembly, a direct reading pressure gauge and service valve attached to the regulator, an overpressure burst disk and indicator, a combined pressure/temperature transducer for EICAS display, and a solenoid operated passenger oxygen valve with an integral system pressure switch. *On aircraft modified by SB 45-12-1 (Installation of Remote Oxygen Servicing Provisions),* a remote service valve and gauge are installed allowing service through the nose access door.

The oxygen storage cylinder has a minimum storage capacity of 645 liters of oxygen at 70° F (21° C) when charged to 1850 psi. The cylinder is located in the nose compartment, or may be installed in the lavatory within a left closeout. The shutoff and pressure regulator assembly form an integral part of the storage cylinder and provide for pressure regulation, pressure/temperature indication, and servicing.

Oxygen pressure for the passenger and crew distribution systems is regulated to a pressure of 60 to 80 psi. The shutoff and pressure regulator assembly also incorporates a burst disc pressure relief valve to discharge the oxygen cylinder contents overboard in the event that cylinder pressure reaches 2500 to 2775 psi. Should the cylinder contents be discharged overboard, the green overboard discharge indicator on the outside surface of the aircraft near the storage cylinder will be ruptured or missing, and the EICAS pressure display will illuminate amber dashes.

The oxygen pressure gauge is located near the service port. The pressure/temperature transducer will provide pressure and temperature signals to the EICAS. *On aircraft modified by SB 45-12-1*, this transducer also provides information to the oxygen servicing pressure gauge. Temperature and pressure signals are input to the temperature compensated pressure warning system in EICAS to alert the crew of low or high oxygen quantity.

A pressure switch, integral with the oxygen control valve, will provide a signal to EICAS indicating when the regulator is off. The system pressure distribution line is vented when the regulator is in the OFF position, thus preventing trapped pressure in the line from giving an erroneous indication that oxygen is available.

The following CAS illuminations are specific to oxygen pressure:

CAS	Color	Description
OXYGEN OFF	Amber	The oxygen line pressure is low (i.e., bottle regulator is off or oxygen supply is depleted).
OXYGEN PRESS HI	Amber	Oxygen bottle quantity is not within the normal range (too high).
OXYGEN QTY LOW	Amber	Oxygen bottle quantity is not within the normal range (too low).

OXYGEN SYSTEM COCKPIT CONTROLS

The oxygen system cockpit controls consist of two switches located on the copilot's PAX OXYGEN panel. The PAX OXY /AUTO switch automatically controls oxygen availability to the passenger oxygen distribution system. The DEPLOY switch provides manual activation. Oxygen is available to the crew oxygen distribution system at all times when the oxygen cylinder shutoff valve is open. Control positions and system functions are as follows:

1. With the PAX OXY/AUTO switch On (OFF not illuminated), oxygen is available to the passenger distribution system and the passenger masks will deploy automatically in the event cabin altitude climbs to 14,500 feet. Should the cabin altitude reach 14,500 (±250) feet, an electrical signal from the pressurization indicator will cause the solenoid valve (integral with the passenger oxygen valve) to open, the passenger oxygen masks will

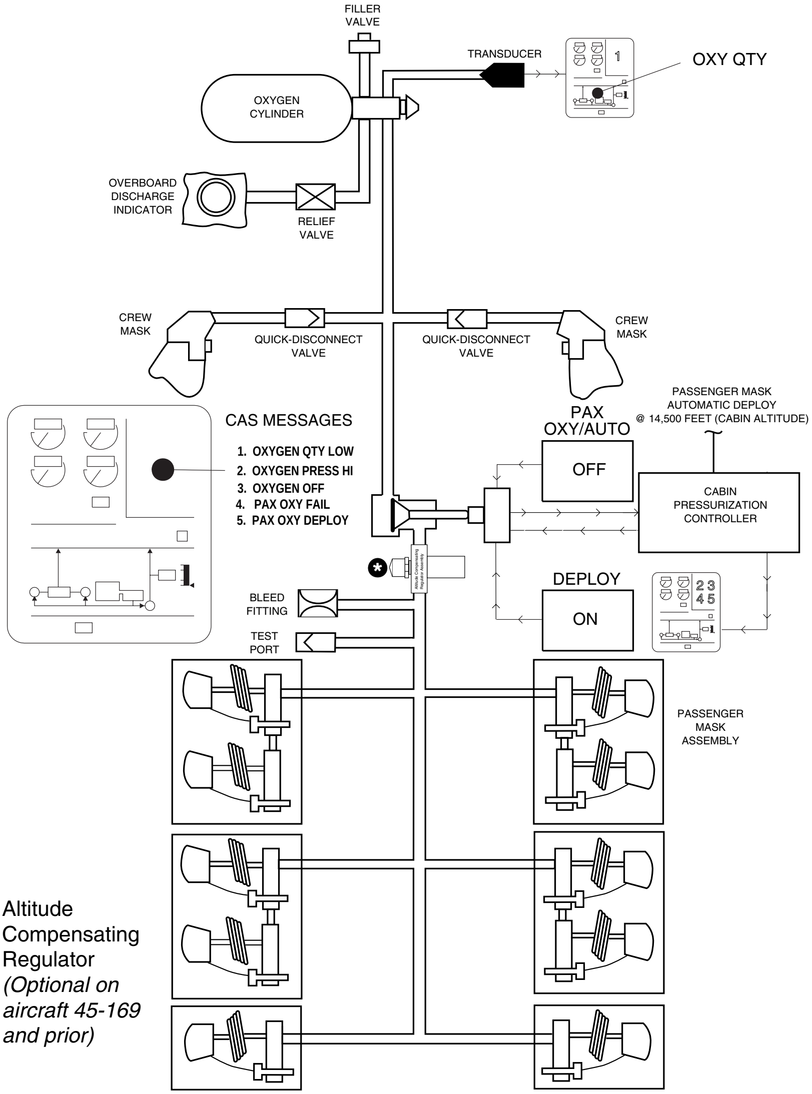
deploy, and the cabin overhead lights will illuminate to provide maximum visibility for donning masks. This is the normal position of the switch.

2. With the DEPLOY switch ON, oxygen is available to the passenger distribution system and the passenger masks will deploy. Activation of the DEPLOY switch will manually open the passenger oxygen valve and allow oxygen pressure to deploy the passenger masks. This position can be used to deploy the passenger masks at any cabin altitude. During automatic deployment of the masks, ON will illuminate.

3. With the PAX OXY/AUTO valve in the OFF position, oxygen will not be automatically made available to the passenger distribution system regardless of cabin altitude. This position can be used when oxygen is required for the crew members only.

The following CAS illuminations are specific to passenger oxygen valve operation:

CAS	Color	Description
PAX OXY FAIL	Amber	A failure of the passenger oxygen valve is detected. Passenger oxygen mask deployment may not be possible.
PAX OXY DEPLOY	White	The passenger oxygen valve is activated (auto or manual) causing the passenger oxygen masks to deploy.

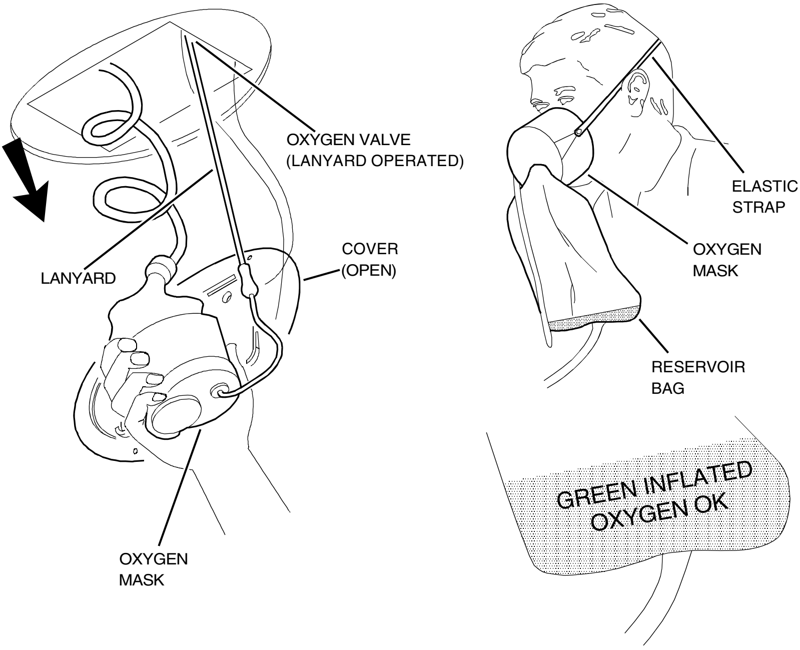


* Altitude Compensating Regulator *(Optional on aircraft 45-169 and prior)*

OXYGEN SYSTEM SCHEMATIC
Figure 6-7

PASSENGER MASKS

The passenger oxygen masks are stowed in the headliner above the passenger seats. Whenever the compartment doors open automatically or manually the passenger oxygen masks will fall free and oxygen will be available for passenger use. The reservoir bag incorporates a green-colored chamber which will inflate when oxygen is flowing to the mask. Passengers should don masks and pull the mask lanyard to initiate oxygen flow. An orifice incorporated in the mask tubing connections will provide a constant flow rate of 4.5 liters per minute. The compartment covers can be opened manually for mask cleaning and servicing per Maintenance Manual instructions.



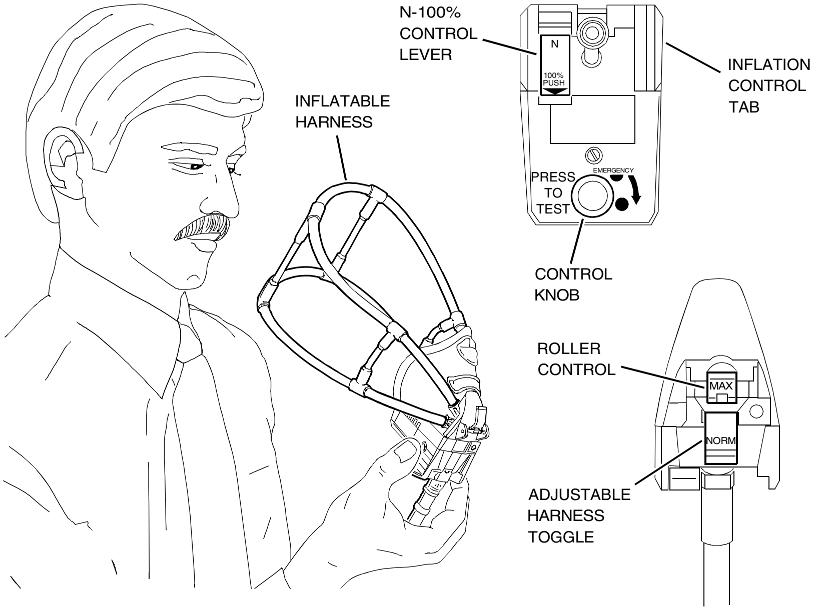
PASSENGER MASK
Figure 6-8

CREW MASKS

The flight crew oxygen masks are stowed in accessible stowage cups over each crew member's outboard shoulder, two models of pneumatic harness oxygen crew mask are available. The mask can be donned and functioning within 5 seconds by using one hand (refer to the Airplane Flight Manual for detailed operation procedures). The Puritan-Bennett model contains a mask mounted automatic diluter-demand regulator with single knob mode control (NORM - 100% - EMER). A purge valve will automatically bias open when the mask is used in conjunction with smoke goggles, the EMER position can be used to quickly purge the goggles of smoke. The EROS model, also with a mask mounted regulator, has the controls on the lower side of the regulator. A red control lever (N-100%) on the forward side and a red control knob with a normal (⯊) and an emergency (●) setting for controlling oxygen supply. The purge valve is manually opened on this model.

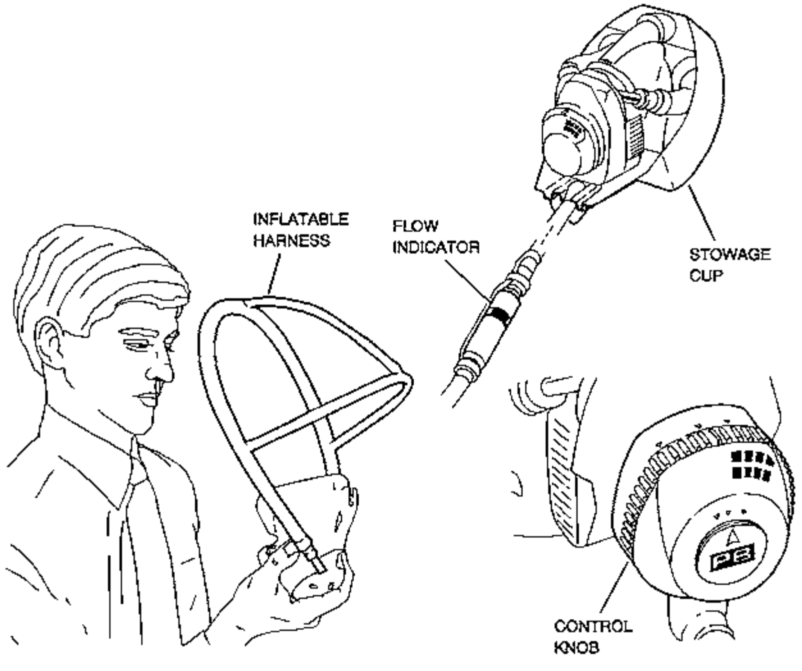
To use the mask, the crew member grasps the mask and pulls it from the stowage cup. Holding the mask harness inflated, don the mask, when the mask is in position release the inflation control to allow the mask to adjust into position. Adjust mask as necessary for comfort.

.



CREW MASKS (EROS)
Figure 6-9

A "comfort control" feature (if applicable) allows the tension in the harness to be adjusted by adding or reducing the amount of pressure in the harness. The EROS mask is manually controlled and in an emergency, the adjustable harness toggle must be switched to the NORM position to deflate the harness to full tension. On the Puritan-Bennett mask, a built-in altitude sensing aneroid automatically deflates the harness assembly (tightest setting), before cabin altitude reaches 15,000 feet.



CREW MASKS
(Puritan-Bennett)
Figure 6-10

PRESSURIZATION SYSTEM

Cabin pressurization is provided by conditioned air entering the cabin through the air distribution ducts and controlled by modulating the amount of air exhausted from the cabin. The Cabin Pressure Control System (CPCS) regulates the exhausted air at a rate that sets the cabin altitude.

CABIN PRESSURE CONTROL SYSTEM (CPCS)

The dual channel CPCS consists of a primary outflow valve, secondary outflow valve, jet pump, air filter, check valve and Cabin Pressurization Controller (CPC). The dual channel CPCS uses a primary and secondary channel. Both channels function the same and are capable of performing all operations required for automatic cabin pressurization.

The primary channel controls the primary outflow valve and the secondary channel controls the secondary outflow valve. A pressurization vacuum jet pump supplies servo pressure to both primary and secondary outflow valves during normal pressurization. An air filter and check valve prevent contaminated or overheated bleed air from entering the primary outflow valve.

GROUND MODE

To prevent possible injury resulting from closing or opening the cabin door with the aircraft partially pressurized, the outflow valves are fully open when the CPC is in ground mode. The CPC remains in ground mode until any of the following occurs:

- The left thrust lever is advanced for takeoff (T/O detent).
- The main gear weight-on-wheels switches indicate the aircraft is airborne.
- Airspeed is greater than 150 knots when transitioning to climb mode.
- Airspeed is less than 65 knots when transitioning from any mode but climb.

CABIN PRESSURE CONTROLLER (CPC)

The CPC is located on the copilot's PRESSURIZATION panel. This panel provides all the necessary crew interface with the pressurization system. The CPC contains two cabin pressure sensors (one for each channel), a liquid crystal display, LDG ALT selector and MANUAL rate control knobs.

Signals generated by the CPC are used to activate the altitude warning voice, the EICAS altitude warning, the emergency pressurization system, the oxygen system and the ACM (air cycle machine) bypass valve. Operating power for the primary (left) and secondary (right) channels of the cabin pressure controller is 28-vdc supplied through the 2-amp PRI and SEC circuit breakers on the respective pilot's and copilot's circuit breaker panels.

The following CAS illuminations are specific to cabin pressure controller system:

CAS	Color	Description
CAB DELTA P	Amber	Cabin differential pressure limit (either positive or negative) is exceeded.
CAB PRESS FAIL	Amber	Both channels (L and R) of the cabin pressurization control system have failed. System pressurization will go to maximum differential pressure and cabin pressurization displays will become amber dashes.
CAB PRESS MAN	Amber	Cabin pressurization has reverted to manual rate mode because of the loss of all air data input (dual ADC failure).
CAB PRESS FAIL	White	Associated channel (L or R) of the cabin pressurization control system has failed. System operation will automatically switch to the opposite channel.
CAB PRESS MAN	White	Cabin pressurization manual rate mode is selected by the crew.

EMERGENCY PRESSURIZATION

In the event of normal cabin airflow malfunction, emergency pressurization is provided by routing LP bleed air directly into the cabin through the emergency pressurization valves. The L and R BLEED switches need to be ON for automatic or manual activation of the emergency pressurization system to both sides. EMER PRESS can be selectively turned off on the left or right side by turning the respective L or R BLEED switch OFF.

Emergency pressurization is accomplished automatically by opening the emergency pressurization valves in response to signals from the cabin pressure controller or manually by pressing the EMER PRESS switch on the PRESSURIZATION panel. When the aircraft is below 25,000 feet pressure altitude and the system is in automatic mode with a takeoff or landing field elevation greater than 8000 feet specified, the cabin pressure controller will not trigger the emergency pressurization unless the cabin altitude increases to 14,500 (±250) feet.

Emergency pressurization is provided by two independent channels (primary and secondary) of the cabin pressure controller. If triggered automatically, the primary and secondary channels will activate approximately at the same time in response to the cabin pressure controller. If triggered manually, the primary and secondary channels may be activated separately. When automatic or manual emergency pressurization is triggered, the following events occur:

- EMER PRESS switch illuminates ON.
- EMER PRESS ON amber CAS illuminates.
- Emergency pressurization valves open.
- The HP bleed-air shutoff valves close.

Extended operation with emergency pressurization will increase cabin temperature, especially at higher thrust settings. Temperature control will only be possible by reducing thrust or turning an L or R BLEED switch OFF. At altitudes not requiring pressurization, both L and R BLEED switches can be selected OFF.

Once cabin pressure has been restored by EMER PRESS activation, or after descent, the cabin pressure controller will automatically reset the emergency pressurization system at 8300 or 13,300 feet, depending on the triggering altitude (9500 or 14,500 feet). Depressing the EMER PRESS switch when the cabin altitude is below 8000 feet will extinguish the switch and CAS, and restore normal pressurization.

The following CAS illumination is specific to the emergency pressurization system:

CAS	Color	Description
EMER PRESS ON	Amber	The associated (L or R) emergency pressurization valve is open (manually or automatically).

PRESSURIZATION CONTROLS AND INDICATORS

CABIN PRESSURIZATION CONTROL DISPLAY

The cabin pressurization control display on the PRESSURIZATION panel includes an LCD (liquid crystal display) for presenting CAB RATE (cabin rate), DELTA P (differential pressure), CAB ALT (cabin altitude), manual cabin, and landing field elevations.

LDG ALT KNOB

The LDG ALT rotary knob is used to select landing field elevation during automatic pressurization mode. Rotation of the knob illuminates an LA and displays the present landing field altitude for 5 seconds. The rotary knob adjusts the landing altitude DN or UP in 100-foot increments per detent.

MANUAL PRESS SWITCH AND MANUAL KNOB

Manual control of the pressurization system is initiated by pressing the MANUAL PRESS switch ON. In the event of a dual ADC failure, manual mode is automatically initiated.

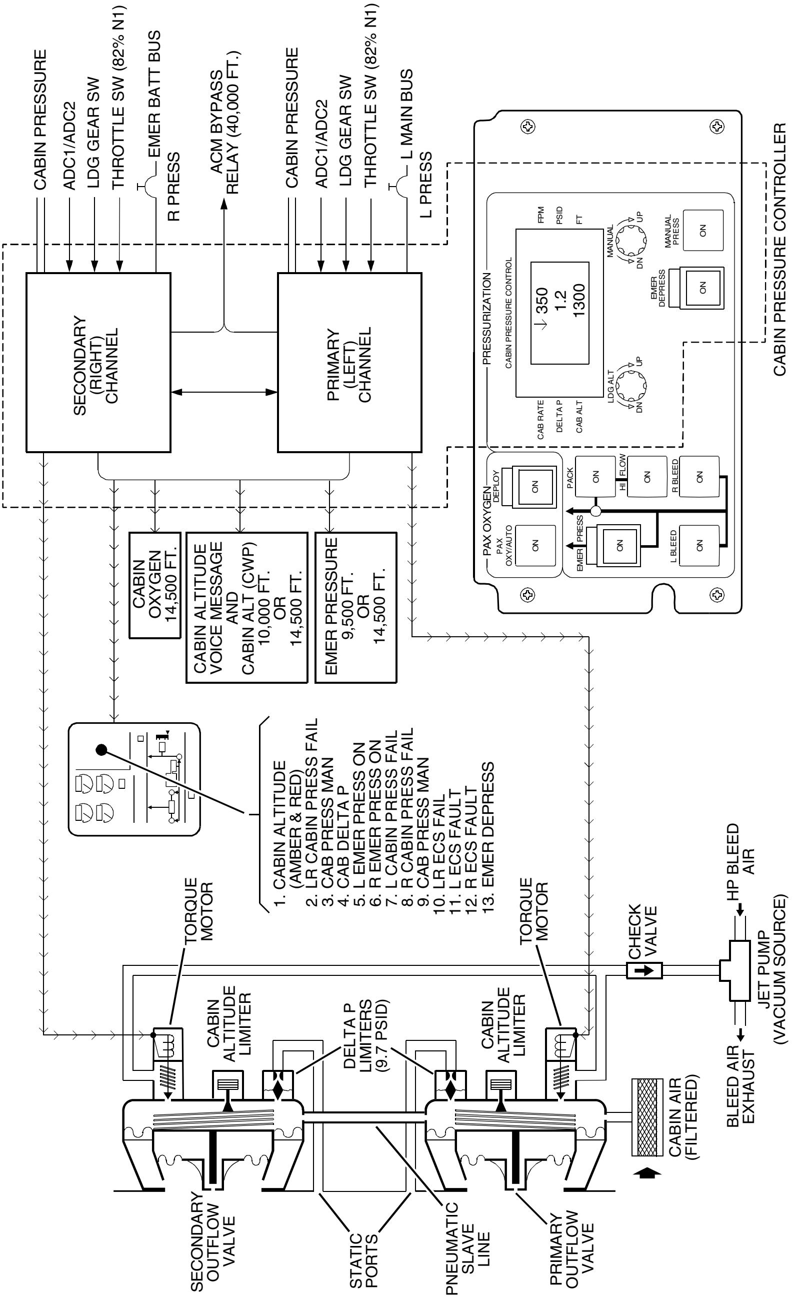
The MANUAL rate knob allows the crew to control how fast the cabin pressurization system reaches the desired cabin altitude. Rotation of the knob illuminates an MR and displays the present manual rate temporarily. The rotary knob adjusts the manual pressurization rate DN or UP in 100 foot-per-minute increments per detent. When the desired cabin altitude is approached, rotate the manual control knob in the appropriate direction until the manual cabin rate reaches zero.

EMER DEPRESS SWITCH

The EMER DEPRESS switch is an alternate-action switch located on the PRESSURIZATION panel. A guard is installed over the switch to prevent inadvertent actuation. The switch is used to depressurize the cabin and increase cabin airflow for smoke and fume evacuation. The EMER DEPRESS function is available in both automatic and manual modes. When EMER DEPRESS is selected ON, a EMER DEPRESS white CAS illuminates and the outflow valves receive a signal to move toward the full open position. The cabin altitude will ascend to the aircraft altitude or 13,700 (±500) feet (cabin altitude limiter), whichever is less. To de-select this mode, depress and release the EMER DEPRESS switch.

The following CAS illumination is specific to the emergency depressurization system:

CAS	Color	Description
EMER DEPRESS	White	Emergency depressurization is selected by the crew.



CABIN PRESSURE CONTROL DIAGRAM
Figure 6-11

PRESSURIZATION WARNING SYSTEM

The pressurization system provides the capability to operate at high altitude fields (8000 - 13,700 ft elevation) without triggering annunciations and emergency pressurization. The logic employed for this feature is as follows:

Conditions	Pressurization system will:
TAKEOFF	
Takeoff from field elevation less than 8000 ft	- Annunciate loss of cabin pressure if cabin altitude exceeds 8750 ft. - Activate emergency pressurization if cabin altitude exceeds 9500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 10,000 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 10,000 ft.
Takeoff from field elevation greater than 8000 ft	- Annunciate loss of cabin pressure if cabin altitude exceeds 14,500 ft. - Activate emergency pressurization if cabin altitude exceeds 14,500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 14,500 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 14,500 ft. **When the aircraft climbs above 24,500 ft:** Resume settings specified in "Takeoff from field elevation less than 8000 ft".
LANDING	
Landing at field elevation less than 8000 ft (as selected on LDG ALT)	- Annunciate loss of cabin pressure if cabin altitude exceeds 8750 ft. - Activate emergency pressurization if cabin altitude exceeds 9500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 10,000 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 10,000 ft.
Landing at field elevation greater than 8000 ft (as selected on LDG ALT)	Maintain the settings specified in "Landing at field elevation less than 8000 ft (as selected on LDG ALT)" until the aircraft descends below 24,500 ft. **When the aircraft descends below 24,500 ft:** - Annunciate loss of cabin pressure if cabin altitude exceeds 14,500 ft. - Activate emergency pressurization if cabin altitude exceeds 14,500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 14,500 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 14,500 ft.

Applicable operating rules, pertaining to the use of oxygen at high cabin altitude, must be observed.

The following CAS illuminations are specific to the pressurization warning system:

CAS	Color	Description
CABIN ALTITUDE *(Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5)*	Red	The cabin altitude exceeds 10,000 feet (pressurization system LDG ALT set below 8000) or 14,500 feet (pressurization system LDG ALT set above 8000).
CABIN ALTITUDE	Amber	The cabin altitude is higher than normal for the given conditions.

SECTION VII
INTERIOR EQUIPMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

SECTION VII
INTERIOR EQUIPMENT

COCKPIT DESCRIPTION

The cockpit (Figure 7-1) is configured in a standard side-by-side seating arrangement with a center pedestal mounted between the seats. The instrument panel is installed with an 18° forward cant which provides an ergonomic view of the panel by either crew member. The throttle quadrant is located between the center pedestal and the instrument panel. The instrument panel, center pedestal and throttle quadrant are easily accessible by both pilots.

The dual primary flight controls consist of a textured surface control wheel mounted to a control column and an adjustable set of rudder pedals. The control wheel and column operate with the normal push-pull (pitch) and left/right rotation (roll) input commands. The control wheels have a trim switch, microphone switch and a Control Wheel Master Switch (MSW) installed on the outboard side of the wheel. A checklist line advance switch, a transponder switch and a Touch Control Steering (TCS) switch are installed on the inboard side of the control wheels. The pilot's control wheel is equipped with an aileron (roll) disconnect lever. Each control column is equipped with an approach plate holder that will secure an entire approach plate booklet. An illuminated approach plate holder is available as an option. The left and right rudder pedals provide yaw control during flight and are electrically adjustable fore/aft for different sized pilots. The rudder pedals also control nose wheel steering and braking while the wheels are on the ground.

Secondary flight controls and thrust levers are mounted on the throttle quadrant at the forward side of the pedestal. The elevator disconnect handle, emergency gear freefall lever, flap control lever, emergency/parking brake handle and spoiler control handle are all located in the throttle quadrant. The system test control switch, pitch trim bias switch, radio control hot bus switch, rudder boost switch and clearance delivery radio are located at the forward end of the quadrant. Switches for the optional ground proximity warning system may be installed aft of the clearance delivery radio. The Multi-Function Display (MFD) joystick is located in the quadrant, aft of the thrust levers.

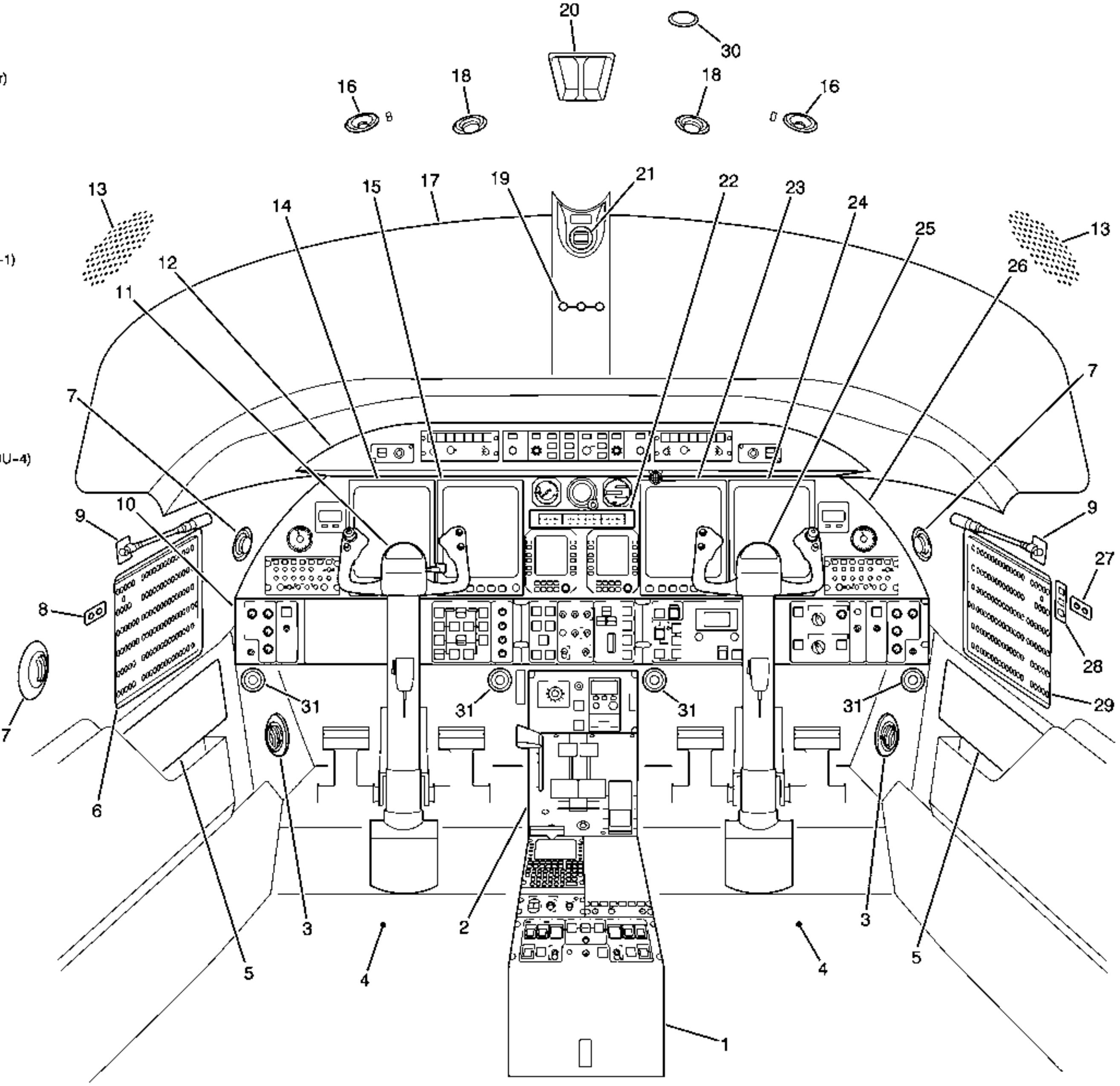
The instrument panel consists of three major horizontal tiers of instruments and controls. Within each tier, the controls for each system are grouped together on a separate panel and/or display. The glareshield panels (upper tier) provide controls for operating the flight director/autopilot and for managing information displayed on the Primary Flight Displays (PFDs), Multi-Function Display (MFD) and Multi-Function Display (MFD) and Engine Indicating and Crew Alerting System (EICAS) (EICAS) display. The main instrument panel (middle tier) provides visual displays and controls for communication/ navigation, engine management and electronic flight instrument systems management. The subpanel (lower tier) provides control for several aircraft systems and for control of the lights and landing gear.

The upper tier (glareshield panel) is located immediately below the glareshield. It consists of the integrated flight guidance controller and the pilot's and copilot's Electronic Flight Instrument System (EFIS) control panels. The glareshield panels also contain the pilot's and copilot's display unit reversion panels and master warning/caution annunciator/reset switch.

The main instrument panel, in the middle tier area, is identified by four 8 x 7 inch high resolution color Cathode Ray Tube (CRT) displays. Display Units (DUs) on the pilot's side include both a Primary Flight Display (PFD) and an Engine Indicating/Crew Alerting System (EICAS). DUs on the copilot's side include a multi-function display (MFD) and a second PFD. The standby instruments (Airspeed, Attitude Indicator and Altimeter) are located between the EICAS and copilot's MFD. The Crew Warning Panel (CWP) and Radio Management Unit (RMU) displays are located below the standby instruments and between the EICAS and copilot's MFD. The angle-of-attack indicators (if installed), digital chronometers and audio control panels for both the pilot's and copilot's side are located near the outboard ends of the main instrument panel.

The pilot's subpanel contains the reversion control panel, electrical control panel and the Attitude Heading Reference System (AHRS) control for AHRS 1. It also contains the pilot's side crew lighting panel and rudder pedal adjustment switch. The copilot's subpanel contains the cabin pressurization and oxygen control panel, the environmental control panel and cockpit voice recorder control panel. It also contains the AHRS control for AHRS 2, the crew lighting panel and the rudder pedal adjustment switch. The anti-ice panel, aircraft light control panel and landing gear/hydraulic panel are all installed near the center of the subpanel (center switch subpanel), directly above the forward side of the throttle quadrant.

1. Pedestal
2. Throttle Quadrant
3. Air Outlet (ankle)
4. Fire Extinguisher (mounted on crew chair)
5. Smoke Goggle Storage
6. Pilot's Circuit Breaker Panel
7. Air Outlet (armrest level)
8. Pilot's Mic/Phone Jack Panel
9. Map Light
10. Pilot's and Copilot's Subpanels
11. Pilot's Control Column & Wheel
12. Glareshield Panels
13. Cockpit Speakers
14. Pilot's Primary Flight Display (PFD) (DU-1)
15. Engine Indicating and Crew Alerting System (EICAS) (DU-2)
16. Dome Light
17. Sunvisor
18. Overhead Air Outlet
19. Eye Reference Locator
20. Assist Handle
21. Magnetic Compass
22. Crew Warning Panel
23. Multi-Function Display (MFD) (DU-3)
24. Copilot's Primary Flight Display (PFD) (DU-4)
25. Copilot's Control Column & Wheel
26. Instrument Panel
27. Copilot's Mic/Phone Jack Panel
28. Cabin Lighting Control
29. Copilot's Circuit Breaker Panel
30. Access for hanging plumb bob
31. 134A Air Outlet



F40-070000-001-02

GENERAL ARRANGEMENT — COCKPIT
Figure 7-1

The pedestal is typically equipped with a single flight management system (FMS), a trim control panel, a weather radar control panel and an engine/fuel control panel. Optional equipment in the pedestal may include a second (dual) FMS, a high frequency comm control head, a SELCAL control panel, an Auxiliary Power Unit (APU) control panel, an Emergency Locator Transmitter (ELT) switch, and a 12-vdc cigarette lighter.

An inflatable harness type oxygen mask with an integral microphone is stored on the outboard side of each crew seat. Smoke goggles are stored in the left and right lower sidewall storage compartments. Hand-held fire extinguishers are installed on the crew seats directly behind the pilot's and copilot's legs. Life vests are stowed inside plastic holders which are mounted to cabinets located directly behind each crew seat.

A magnetic compass is installed on the windshield center post near the top of the windshield. The headliner houses a dome light, air outlets, an assist handle and an access for a plumb bob location for leveling the aircraft. An optional sunvisor may also be attached to the headliner. No switches, instruments or placards are located overhead. Circuit breaker panels are located on the pilot and copilot upper sidewall panels. A flexible map light is attached to the upper sidewall above the circuit breaker panel on each side. Cabin and spot light control switches are located adjacent to the copilot's circuit breaker panel. Flashlights are installed on the cabinet behind each crew seat. Air outlets are installed in the cockpit sidewall panels and lower forward cockpit side panels. Storage compartments are built into the lower sidewall panels for charts and Jeppesen manuals. Drink holders are attached to the forward side of the storage compartments. Additional manual storage is provided in the left storage cabinet located behind the pilot's seat.

CREW SEATS

The crew seats (Figure 7-2) are comprised of three basic structures: the seat base, the seat bottom and the seat back. The seat base is attached to and travels on the seat tracks. The seat bottom is located above the seat base and provides controls for forward/aft movement, seat height adjustment and seat back reclining adjustment. The seat back contains the lumbar adjustment control, adjustable armrests and an adjustable headrest.

The crew seats are constructed of lightweight alloys covered with foam padding and sheepskin and are equipped with a five point restraint system. The lap belts and negative-G strap are mounted to the seat bottom. The rotary buckle is attached to the outboard lap belt. The manual lock/unlock handle for the shoulder harness belts is located on the inboard side of the seat back frame.

Seat height adjustment is accomplished by pulling up on the vertical adjustment control lever located under the forward edge of the seat bottom near the outboard side of the seat. When the lever is pulled, the mechanism is unlocked and the seat will move downward under the occupant's weight. To raise the seat, remove occupant weight from the seat while pulling up on the lever. Gas cylinders will cause the seat to automatically raise up. Release the lever at the desired height to lock the seat into place.

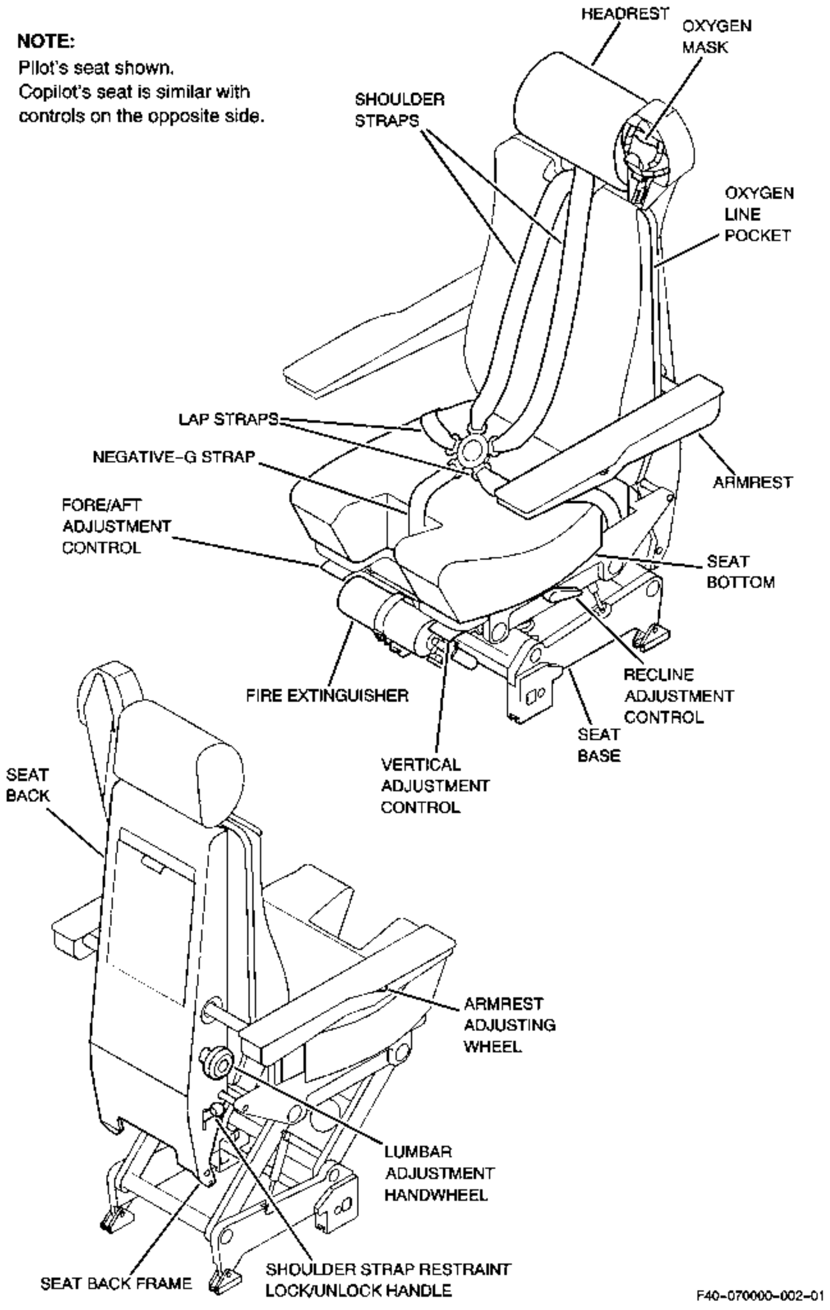
Forward and aft adjustment of the seat is accomplished by pulling up on the fore/aft adjustment control lever located under the forward edge of the seat bottom near the inboard side of the seat. The seat can be moved by holding the control lever up, and at the same time, sliding the seat forward or aft on the seat tracks. When the desired position is obtained, the control lever can be released to lock the seat to the seat track.

The headrest may be adjusted for both angle and height. The headrest can be tilted forward to an angle of up to 60° by tilting it by hand. The headrest can also be raised up to 2 inches by lifting the headrest. The headrest can be lowered by pushing it down to the desired height.

The back cushion/lumbar support is controlled by turning the fore/aft lumbar adjustment control handwheel located on the inboard side of the seat back frame. Turning the handwheel counterclockwise (as viewed looking outboard) extends the lumbar support forward. Turning the handwheel clockwise will retract the lumbar support.

The armrests are individually stowable and adjustable. Each armrest has an adjusting wheel on the underside of the armrest. To deploy the armrest, slide the armrest out from the seat back and rotate it down into position. To raise and lower the armrest position, turn the adjusting wheel on the underside of the armrest. The armrests will adjust 15 to 26°. To stow the armrests for entry and exit, lift the armrest until it is parallel with the seat back and push it in toward the seat spine.

The seat back recline angle is adjustable. The recline adjustment control lever is located on the outboard side of the crew seat bottom. Pull up on the recline control lever to release the seat back lock and lean the seat to the desired angle. The seat back can be reclined 25°. The seat back will lock in the selected position when the control lever is released.



NOTE:
Pilot's seat shown.
Copilot's seat is similar with controls on the opposite side.

COCKPIT SEAT
Figure 7-2

A flexible oxygen hose is routed between the oxygen outlets on the left and right cabin sidewalls and the lower outboard side of each crew seat bottom. This hose provides oxygen for the oxygen mask installation adjacent to each headrest. The crew mask microphone wiring is routed with the oxygen hose through the crew seat.

CABIN DESCRIPTION

The aircraft cabin is divided into three areas: the entryway galley, the passenger seating area and the lavatory/aft cabin stowage compartment. The entryway galley is located at the forward end of the cabin. The passenger seating area is located in the center of the cabin. The lavatory /aft cabin stowage compartment is located at the aft end of the cabin.

The entryway galley area begins at the cabin entry door area and extends forward to the cockpit. The entryway galley area is comprised of the left forward storage cabinet, the right forward storage closet and the right galley cabinet. The typical galley is equipped with a coffee warmer, a trash container, an ice chest and food / beverage storage and preparation equipment.

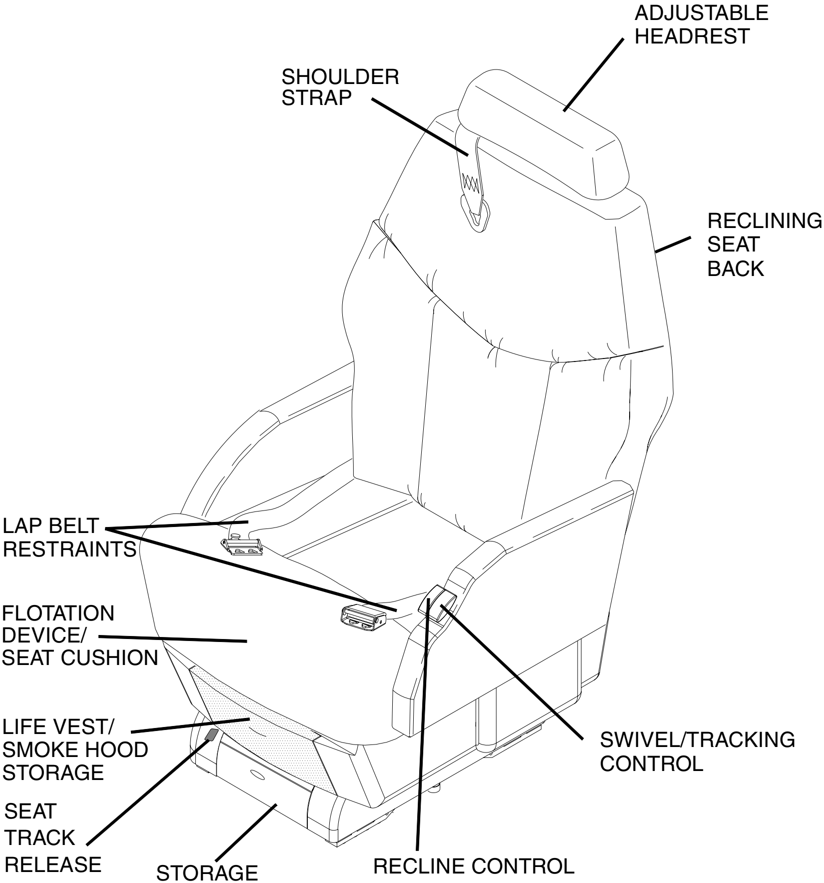
The passenger seating compartment is located aft of the cabin door entryway and extends aft to the lavatory. The typical passenger compartment has eight individual passenger seats in a two abreast configuration, with one seat on each side of a main center aisle. Individual reading lights, air outlets, and passenger oxygen masks are located in the overhead convenience panels and center headliner panels above the seats. Drinkholders, pull-out tables and lighting and entertainment control panels are built into the cabin sidewall adjacent to the seats. Optional 110-vac/60-Hz, 230-vac/50-Hz, or 115-vac electrical outlets may be available throughout the cabin or cockpit (Refer to AC ELECTRICAL OUTLETS this section).

The lavatory is located on the aft side of a partition at the aft end of the passenger compartment, adjacent to the aft cabin stowage compartment. The partition features sliding doors between the lavatory and passenger compartment. The lavatory consists of a toilet and vanity cabinet. The toilet is located on the forward RH side of the lavatory. The vanity is located aft of the toilet. An optional lavatory has a vanity which includes a warm water wash basin.

Access to the aft cabin stowage compartment is accomplished through the lavatory at the center aisle. The aft stowage compartment is equipped with a decorative coat rod and a baggage restraining net.

PASSENGER SEATS

The passenger seats have a standard lap and shoulder restraint built into each seat (Figure 7-3). Dual armrests which include an articulating inboard armrest and leather covering are standard equipment.



PASSENGER SEAT
Figure 7-3

The individual passenger seats are designed to be swiveled 360°. The seats are equipped with lateral tracking on the seat base which allows them to be located as far outboard as possible for takeoff and landing, thus maintaining maximum aisle clearance. After takeoff, the seats can be positioned inboard for increased comfort. The passenger seats can also be adjusted forward and aft on the seat base while the seat base remains stationary. These adjustments are accomplished by pulling up on the swivel control lever located at the end of the armrest. The swivel control lever is the larger of the two levers on the armrest.

Pulling up partially on the swivel/tracking control lever will release the seat to swivel, pulling the lever all the way up will allow the seat to be moved (in three directions) from side-to-side, forward/aft and in a swiveling motion. Releasing the swivel control lever will cause the seat locking mechanism to automatically lock the seat in the selected position.

The recline control lever is located at the end of the armrest, adjacent to the swivel control lever. The recline control lever is the smaller of the two levers on the end of the armrest. The seat will recline up to an 85° angle when the recline control lever is pulled up and the occupant applies weight against the seat back. The seat recline mechanism will lock in place when the recline control lever is released. To place the seat in an upright position, remove occupant weight from the seat back while pulling up on the recline lever. The mechanism will automatically raise the seat back into an upright position.

The passenger seat has an adjustable headrest installed in the seat back. The passenger headrest can be adjusted up and down by pulling it up or pushing it down with both hands. Life vests are stored in a pocket located on the forward side of each seat bottom. The seat base has proximity lights installed on the inboard side of the base.

Optional equipment may be installed on the passenger seats. An articulating outboard armrest is available that can be articulated for height. This armrest is standard equipment on the aft right passenger seat, which is situated adjacent to the right aft emergency exit. An underseat storage drawer may be incorporated into the forward end of the passenger seat. A seat track release mechanism is available which allows the entire passenger seat and seat base to be moved forward or aft along the seat tracks.

EMERGENCY EQUIPMENT

SMOKE GOGGLES

Smoke goggles are provided for each crew member and are stowed in the lower sidewall storage compartment. The goggles are donned if smoke or fumes are present in the aircraft.

HAND-HELD FIRE EXTINGUISHERS

Two hand-held fire extinguishers are mounted on the front of each crew seat. Each cockpit fire extinguisher contains 1.25 pounds of Halon 1211.

An additional hand-held fire extinguisher may be mounted in the aft cabin, near the lavatory. The cabin fire extinguisher contains 2.5 pounds of Halon 1211.

The extinguishers incorporate a pressure gauge which indicates the state of propellant charge. If properly charged, the indicator needle will be within the green segment. When an extinguisher has been manually discharged, the indicator will be in the red area. This provides the crew with visual indication that the bottle has been partially or totally discharged. The extinguishers are rechargeable.

FIRST AID KIT AND CRASH AXE (IF INSTALLED)

The first aid kit and crash axe are located in the forward right storage closet.

PROTECTIVE BREATHING EQUIPMENT (IF INSTALLED)

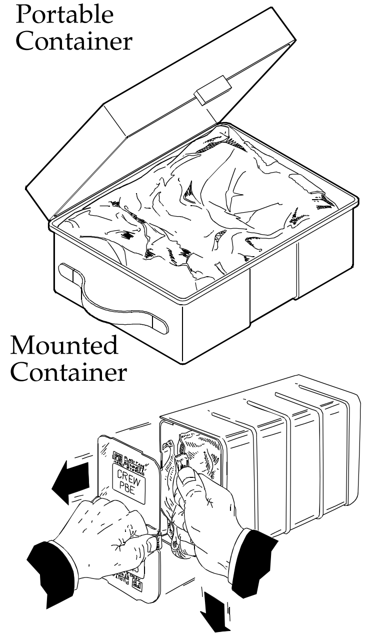
Protective Breathing Equipment (PBE) is available for a crew member to use in fighting cabin fires. The PBE is designed to protect the user's eyes and respiratory system from the harmful atmosphere which may be generated by a cabin fire. The PBE is a hood with a visor which is placed over the head and seals around the neck. An oxygen generating canister provides breathing oxygen for the user. The PBE is vacuum sealed in a bag and stored in a box accessible to the crew. The PBE is a throw-away unit that must be replaced whenever the vacuum seal is broken. It is imperative that the vacuum seal be maintained since the oxygen-generating chemicals react with moisture.

Duration of oxygen production is nominally 15 minutes depending upon the work rate and size of the user. Useful life of a sealed PBE is 10 years from the date of manufacture.

Donning the PBE:

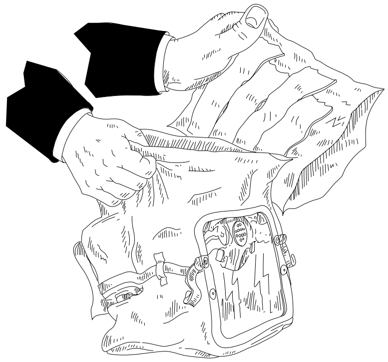
There are two available carriers for the PBE. A portable container stored in a cabinet behind the cockpit or a mounted container (normally mounted to the aft side of the pedestal).

1. Remove mask from container.
   a. To open the portable container, lift the single latch on the cover and lift. Remove sealed bag from the container.
   b. On the mounted container, grasp the red access handle on the protective container firmly and pull forcibly to disengage the cover. When the cover is removed from the container, immediately drop it. (The vacuum sealed bag does not need to be removed from the container to open.) The packaged unit may be removed from the stowage container prior to opening and carried to a remote location for use.



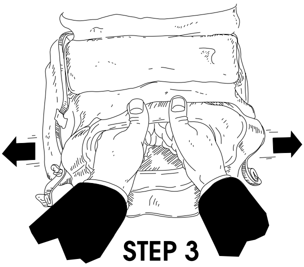
STEP 1

2. To remove the PBE from the vacuum sealed bag, locate the red I.D. tag and pull sharply to tear open the vacuum sealed bag. Reach into the opened vacuum-sealed bag and firmly grasp the PBE. Pull the PBE straight out of the bag. If necessary hold the bag with the opposite hand.



STEP 2

3. Place both hands inside the neckseal opening with palms facing each other and PBE visor facing downward with the oxygen generating canister resting on the tip of the hands.



STEP 3

4. With the top of the head bent forward, guide the PBE neckseal over the top of the head and down over the face using the hands to shield the face and glasses from the oronasal mask cone.

STEP 4

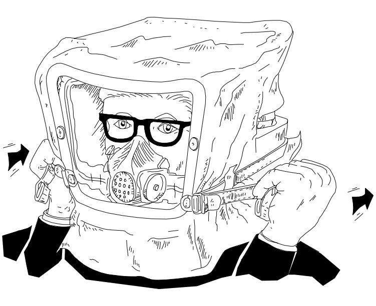
5. With both hands, grasp the adjustment straps at the lower corners of the visor and pull outward sharply to actuate the starter candle. Within 1 to 5 seconds, a rushing noise of oxygen entering the hood will be heard and inflation will be evident.

STEP 5

WARNING

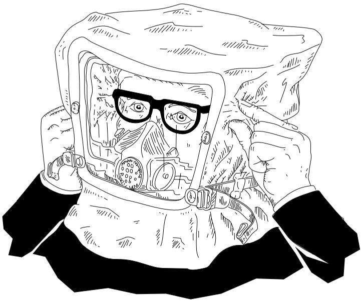
Human hair is highly flammable. Hair that protrudes through the neckseal could ignite if brought into direct contact with flame.

6. With the straps still in hand and head bent forward, pull backward to secure the oronasal mask cone high on the nose for a tight seal.



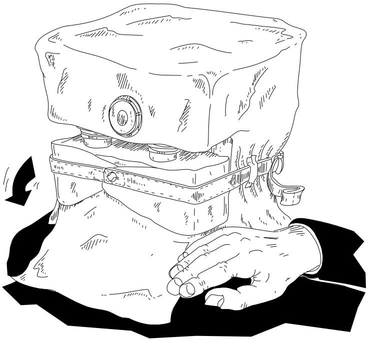
STEP 6

7. If wearing glasses, adjust their position to rest on the tip of the oronasal mask cone by moving the sides of the frame through the hood fabric. Do not attempt to adjust through the neckseal as this will result in infiltration of the surrounding atmosphere into the interior of the hood.



STEP 7

8. When the neckseal is positioned at the neck and the oxygen generating canister is resting on the nape of the neck, remove the hands, checking to see that clothing is not trapped in the seal and hair does not protrude between the seal and the neck. Pull the protective neck shield down to cover the collar and upper shoulder area.



STEP 8

Following actuation, the hood will inflate over a 15- to 20-second period. After this period, the starter candle will cease flowing and the only sound will be a slight rustling of the fabric on each inhalation and exhalation. Dependent upon breathing rate, there will be a slight exhalation resistance as the exhaled breath is forced through the oxygen generating canister. Inhalation resistance will be almost unrecognizable since inhalation is directly from the interior of the hood through a diaphragm type check valve located at the base of the oronasal mask. The visor should remain clear of fogging or misting. Heat is produced by both the chemical air regeneration process and transfer of body heat during the rebreathing cycle. Heat build-up within the hood is normal and is dependent upon the amount of work performed. There should be no irritating or strong unusual odors within the hood. Operational duration is variable dependent upon the amount of work performed by the user.

If the PBE is worn to exhaustion of the chemical regeneration system, this will be evidenced by a gradual reduction in the expended volume of the hood until the point that the hood is collapsed tightly around the head at the end of a full inhalation. Additionally, there will be a rapid buildup of heat and moisture in the hood as the canister loses its effectiveness. At this point, the wearer should immediately retire to a safe breathing area clear of flame and toxic fumes and remove the device.

Removing the PBE

1. Go to a safe area away from immediate contact with fire or open flame and/or toxic fumes.
2. With both hands, reach for the two lower corners of the visor area and push forward on the metal tabs of the adjustment strap buckles to release the strap tension.
3. Place both hands under the neckseal in the forward area and pull up, guiding the oronasal cone and neckseal over the face/glasses until the PBE is clear of the head.
4. Place the expended PBE in a safe place to cool away from fire or exposure to water.

Disposal

The expended PBE still contains unreacted oxidizing material and strong alkali materials. At the completion of flight, it must be turned over to maintenance for authorized disposal.

ABNORMAL CONDITION OF OPERATION

CAUTION

This device produces oxygen which will vigorously accelerate combustion. Do not intentionally expose the device to direct flame contact, or remove in the immediate presence of fire or flame. Due to oxygen saturation of the hair, do not smoke or become exposed to fire or flame immediately after removing.

Users should be trained to recognize abnormal conditions which could signify malfunction or failure of the equipment to properly operate as follows:

Failure of the Starter Candle

If the starter candle fails to actuate when the adjustment strap is pulled, an additional sharp pull on the strap may be sufficient to dislodge the lanyard pin and actuate the device. If the device still fails to actuate, the hood will continue to function, although the initial purge capability is lost. Sticking the fingers into the neckseal to allow a large lung inhalation may be required to enable sufficient breathing volume until the chemical regeneration system begins producing a surplus of oxygen.

Inadequate Oronasal Mask Seal

Absence of a tight seal of the oronasal cone to the face may result in excess leakage of the exhaled breath into the hood, short circuiting the oxygen-generating canister. This condition may result in a build-up of CO_2 within the rebreathing volume in the hood. Excessive CO_2 is normally indicated by breathing distress such as rapid and labored breathing accompanied by a general feeling of insufficient ability to get one's breath, although there is no restriction to breathing. Presence of moisture or fogging on the visor and the sensation of air escaping from the mask, particularly around the nose and eyes, are indications of a lack of proper fit. Adjustment of the mask straps and mask position to minimize leakage should rapidly alleviate the problem. If the perception of breathing distress persists, the user should quickly go to a safe area and remove the PBE and don alternate breathing equipment if required.

Loss of Infiltration Seal

The smoke and toxic fumes generated by the combustion of most aircraft cabin interior materials has many strong irritants. The continued presence of strong irritation odors inside the hood resulting in eye and respiratory tract discomfort is a good indicator of the lack of an effective infiltration seal. Verify that the seal is in contact with the skin or the neck and does not have clothing or jewelry trapped in the seal, or hair protruding between the seal and the neck. If the condition persists, or there is evidence of a tear in the neckseal, the user should go quickly to a safe area and don alternate breathing equipment if required.

FLOTATION EQUIPMENT

Life vests are stowed in plastic compartments located behind the pilot's and copilot's seats, and in the lavatory adjacent to the toilet seat (on toilet seats with seat belts). They also may be stowed in a compartment at the front of each passenger seat. The life vests are inflated by pulling the red CO_2 release tabs. *On aircraft 45-232, 45-236 thru 45-2000,* each passenger seat cushion has been designed to also be used as a personal flotation device.

MISCELLANEOUS EQUIPMENT

CREW COMPARTMENT

FLASHLIGHTS

Two flashlights are installed in the crew compartment. The flashlights are located behind each crew member's seat. The pilot's flashlight is secured to a bracket mounted to the forward side of the forward left storage cabinet. The copilot's flashlight is secured to a bracket mounted to the forward side of the forward right-hand storage cabinet.

Rechargeable flashlights are available as optional equipment. The rechargeable flashlights are mounted in a location similar to the standard flashlights. The rechargeable flashlights are waterproof, flotable and flame retardant.

APPROACH PLATE HOLDER

A spring loaded chart holder is installed on each control wheel. The holders are large enough to hold an entire approach plate.

LIGHTED APPROACH PLATE HOLDERS

Optional illuminated chart holders are available for each control wheel. The chart holders provide illumination of the approach plates.

SUNVISORS

Sunvisors may be installed as optional equipment. Two sunvisors are located at the upper edge of the windshield, one on each side. Each sunvisor is hinged so it can be folded down and will slide along its track as desired.

FORWARD POCKET DOORS

Optional solid sliding doors may be installed which separate the cockpit from the entryway galley and passenger compartment.

PASSENGER COMPARTMENT

CABINETS, DRAWERS & TABLES

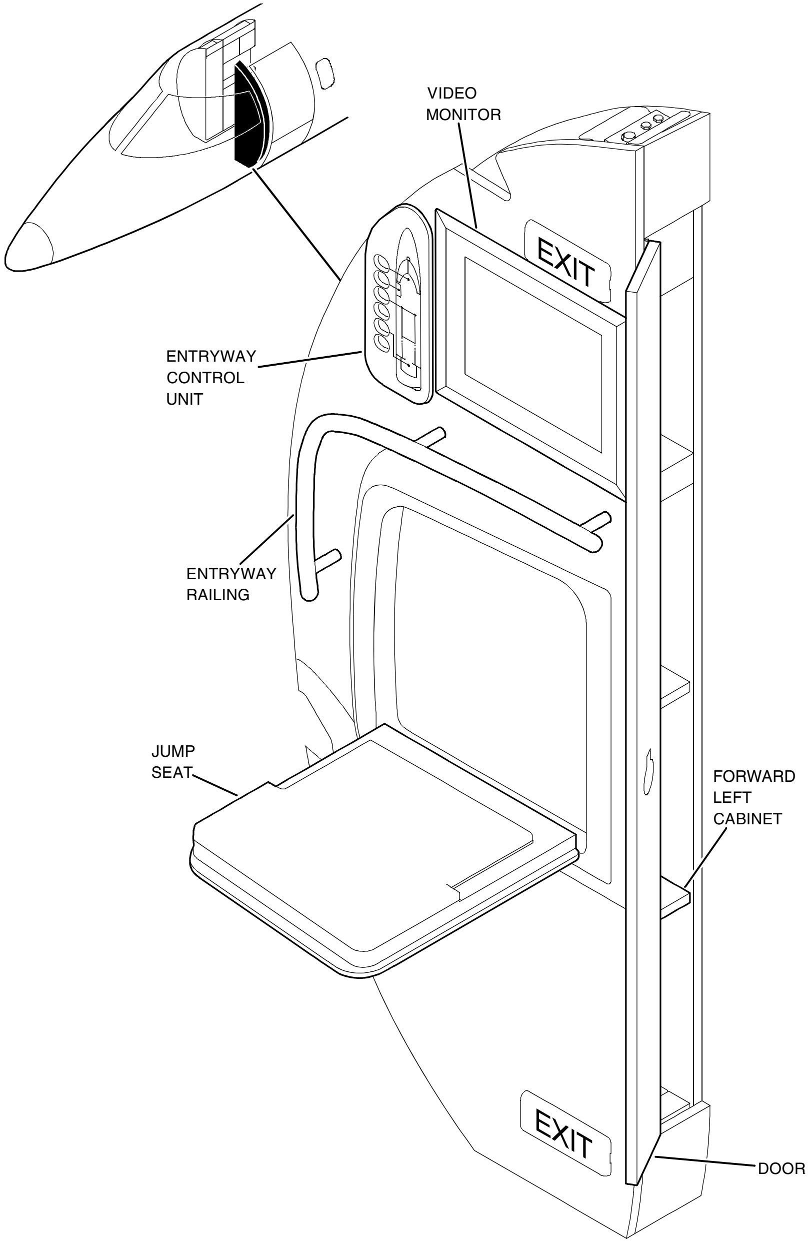
Standard and optional cabinets, drawers and tables may be built into the passenger compartment. The following descriptions and figures show the most common accessories:

Forward Left Cabinet

The forward left cabinet (Figure 7-4 or 7-5) is located immediately aft of the pilot's seat, on the forward side of the cabin entry door. The left cabinet has a hinged door and storage space built into the aisle side. An entryway railing is installed on the aft side of the cabinet adjacent to the entrance steps. A cabin entryway lighting control panel (Entryway Control Unit) is installed on the aft side of the cabinet above the railing. The entryway control unit contains switches for the pilot's overhead dome light, entry spotlight, cabin overhead lights, spotlights and lavatory overhead lights. An optional video monitor may be installed on the right side of the lighting control panel.

Jump Seat

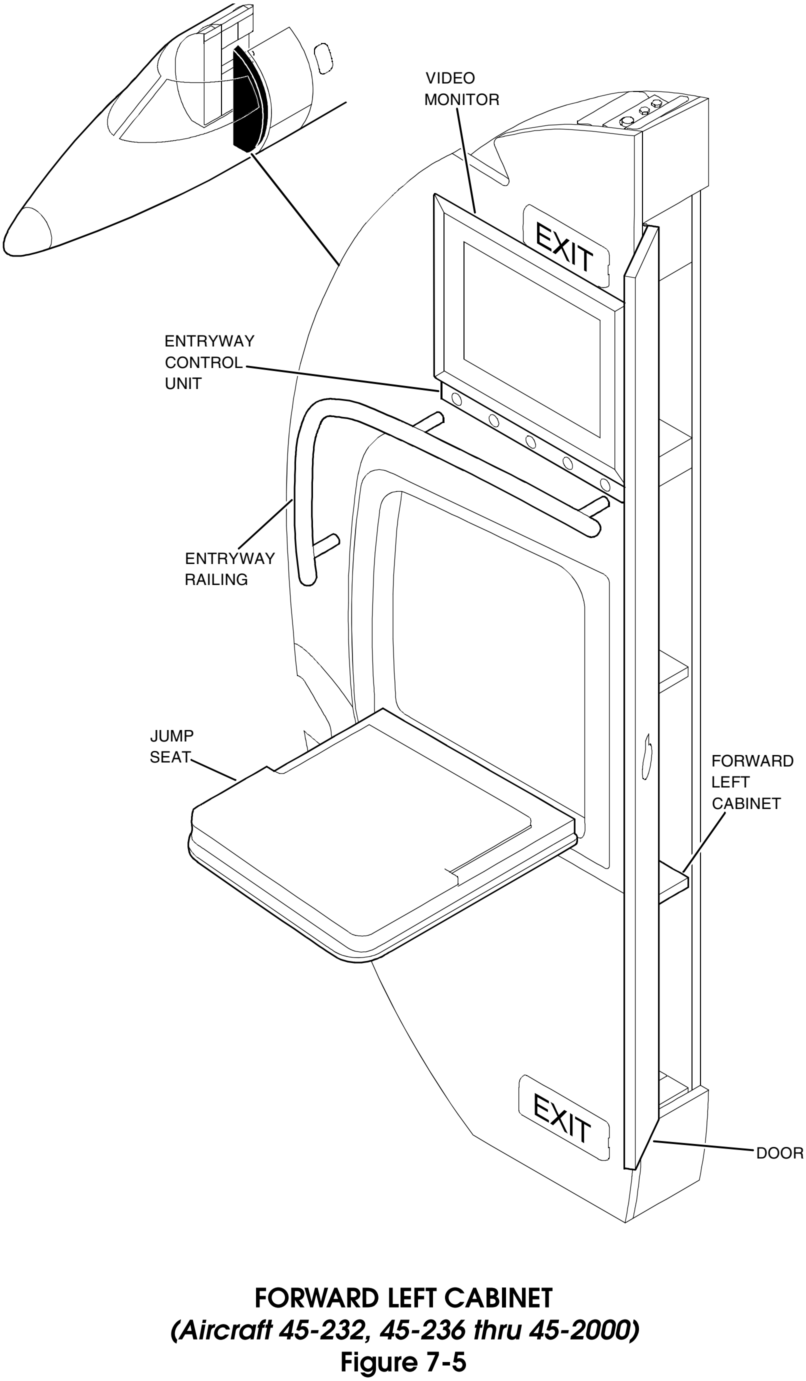
An optional jump seat may be installed on the aft side of the forward left cabinet. The jump seat unfolds down from the cabinet with the occupant situated in a side-facing position for access to the right forward galley. The jump seat cannot be occupied during takeoff or landing. It must be folded up against the aft side of the forward left cabinet for both takeoff and landing.



FORWARD LEFT CABINET

(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)

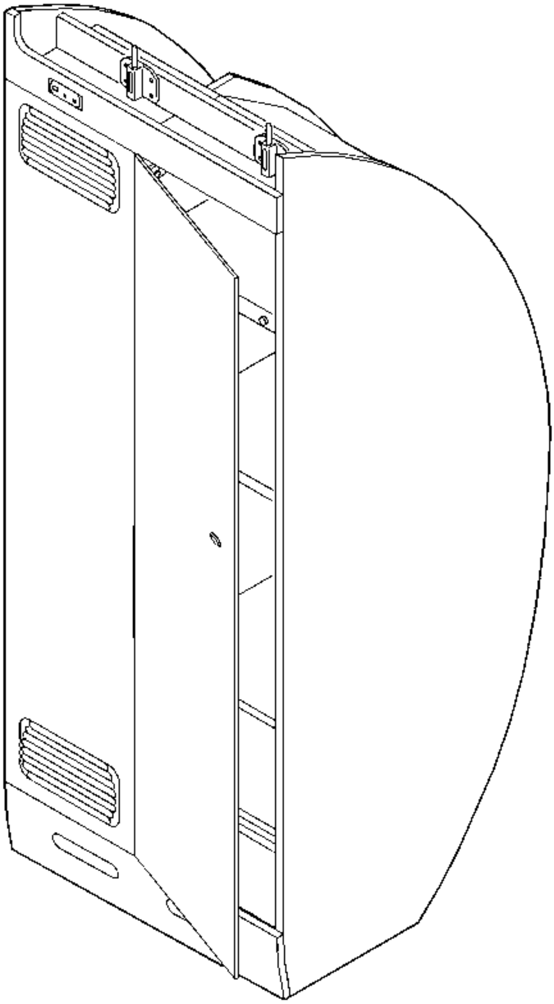
Figure 7-4



FORWARD LEFT CABINET
(Aircraft 45-232, 45-236 thru 45-2000)
Figure 7-5

Forward Right Storage Closet/Avionics Cabinet

The forward right storage closet/avionics cabinet is located in the forward right side of the cabin, aft of the copilot's seat. The closet is equipped with a door which is hinged at the forward side and shelves located in the main compartment. The avionics cabinet racks are located behind a panel and are not accessible by door.

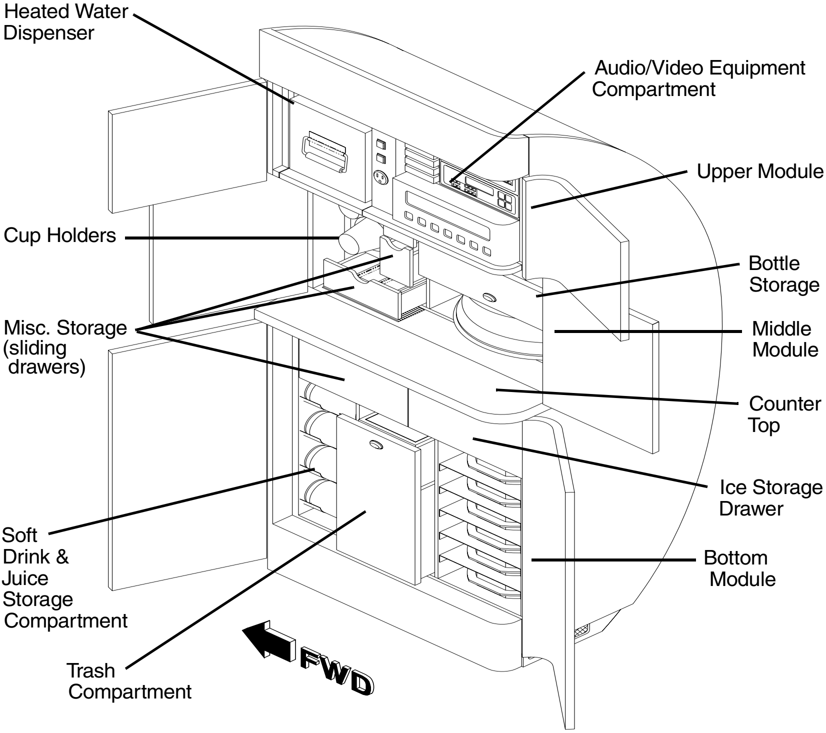


FORWARD RIGHT STORAGE CLOSET/AVIONICS CABINET
Figure 7-6

Galley Cabinet
(Aircraft 45-002 thru 45-231; 45-233 thru 45-235)

The galley cabinet (Figure 7-7) is located on the forward right side of the cabin next to and aft of the forward right storage closet. The galley cabinet consists of three customized insert modules inside the cabinet; the upper module, the middle module and the bottom module. Each module is configured according to the customer′s requests, so galley cabinet assemblies will vary.

Three pairs of self-facing doors are used to enclose the galley cabinet and ensconce the contents inside the three modules. A fluorescent light is installed inside the middle module. The cabinet doors can be opened by depressing the oval shaped press-to-open latches which are installed in each door, near the center of the cabinet.



NOTE: Galley Cabinets will vary in both equipment installation and arrangement.

GALLEY CABINET
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)
Figure 7-7

The upper module is equipped with a heated water dispenser, the audio amplifier and optional cassette player, CD player and video cassette player. Additional storage space for video tapes and compact discs is available inside the module.

The middle module may be equipped with a cup holder/dispenser, small misc. storage drawers, bottle storage and food storage.

The bottom module may be equipped with a soft drink & juice can storage compartment, a large misc. storage drawer, and a slide-out drawer with a built-in ice storage liner. The ice drawers are equipped with drains to the lower fuselage, where melted ice is drained overboard through a heated drain mast. The bottom module may also include a slide-out trash compartment and a set of food tray shelves.

The following equipment and features are standard and will be installed in the galley cabinet:

Water Dispenser

Soft Drink & Juice Can Storage

Liquor Decanter and Miniature Storage

Coffee Warmer

Ice Storage

Bottle Storage

Trash Compartment

The following equipment is optional and may be installed in the galley cabinet:

Cassette/CD Player

Microwave Oven

Catering Tray

Video Cassette Player

Convection Oven

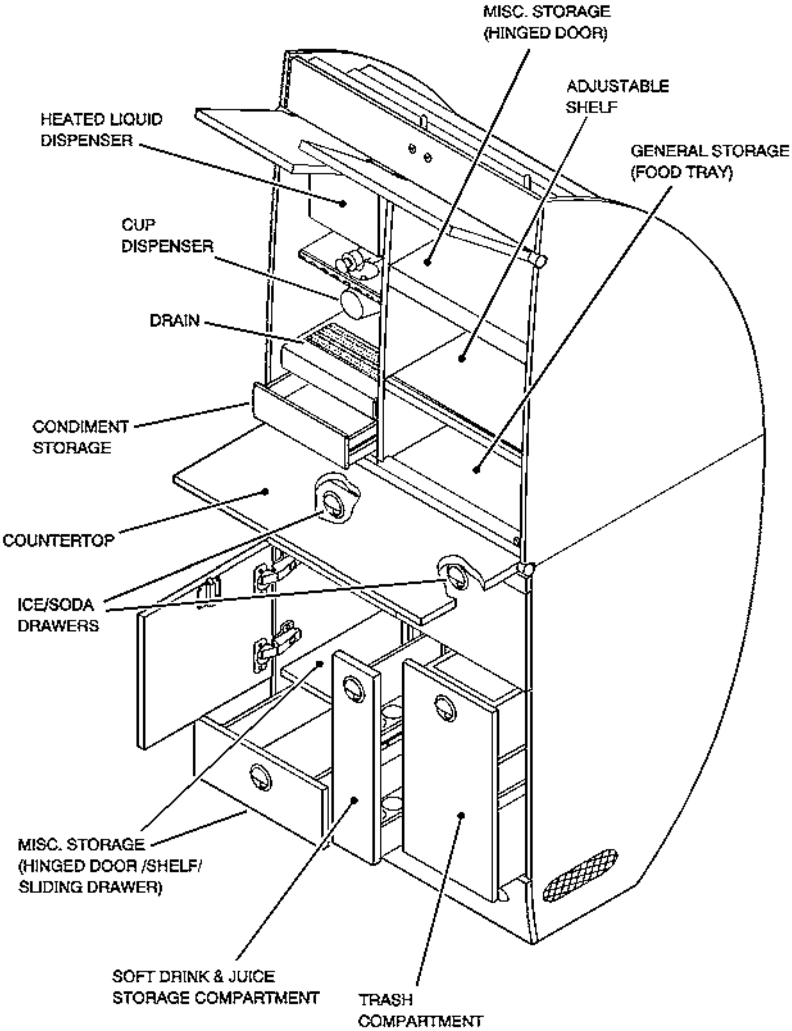
Crystal

Wine Storage

China

Galley Cabinet
(Aircraft 45-232, 45-236 thru 45-2000)

The galley cabinet (Figure 7-8) is located on the forward right side of the cabin next to and aft of the forward right storage closet/avionics cabinet. The galley cabinet consists of three customized insert modules inside the cabinet; the upper module, the middle module and the bottom module. Each module is configured according to the customer's requests, so galley cabinet assemblies will vary.



NOTE: Galley cabinets will vary in both equipment installation and arrangement.

GALLEY CABINET
(Aircraft 45-232, 45-236 thru 45-2000)
Figure 7-8

The following equipment and features are standard and will be installed in the galley cabinet:

- **Water/Coffee Warmer**
- **Soft Drink/Juice Can & Ice Storage**
- **Trash Compartment**

The following equipment is optional and may be installed in the galley or closet:

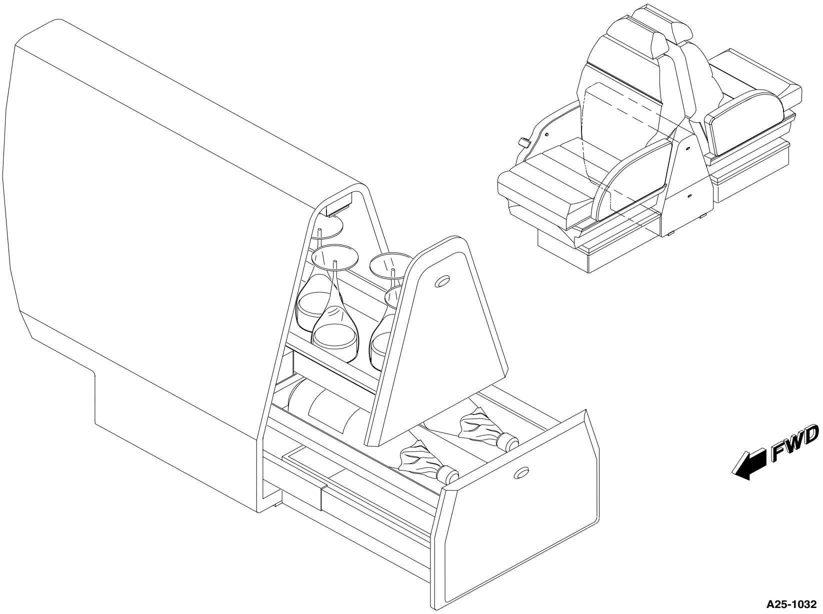
- **Warming Oven**
- **Catering Tray**
- **CD Player (closet)**
- **Microwave Oven**
- **Crystal**
- **DVD Player (closet)**
- **Wine Storage**
- **China**
- **Multi-DVD Player (closet)**

Sidewall Storage Boxes

Headphones, as well as other small items, may be stored in the outboard sidewall storage boxes located along the cabin armrests.

Mid-Ship Cabinets (Optional)

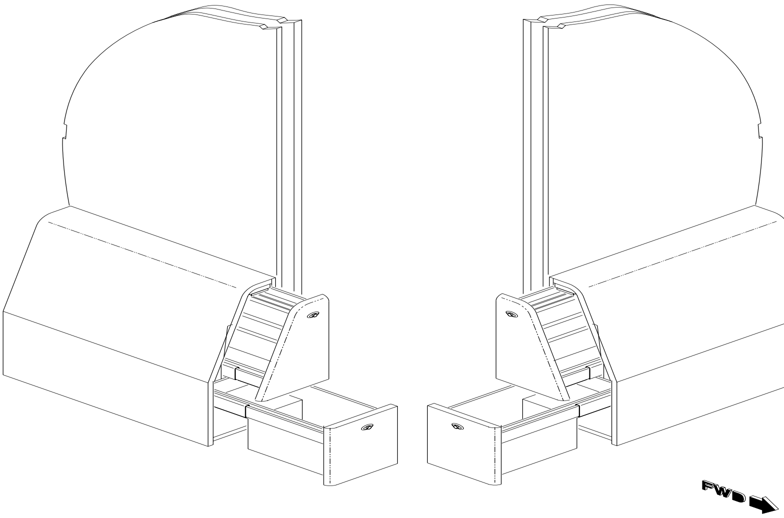
Optional mid-ship cabinets (Figure 7-9) may be located between the forward and aft-facing seats on both sides of the aisle. The mid-ship cabinet drawers may be configured for general storage, to securely store wine glasses and stemware, or to incorporate an optional ice liner to hold wine bottles. The drawers may be opened by pressing a button located near the top center of each front drawer panel.



MID-SHIP CABINETS
(Right Side with Wine & Stemware Shown)
Figure 7-9

Aft Pyramid Cabinets (Optional)

Optional aft pyramid cabinets (Figure 7-10) may be located behind the aft seats on both the right and left sides of the cabin. The pyramid cabinets can be opened by lifting and pulling latches near the top of each drawer panel. The pyramid cabinets may be configured for can storage, magazine and/or miscellaneous storage.

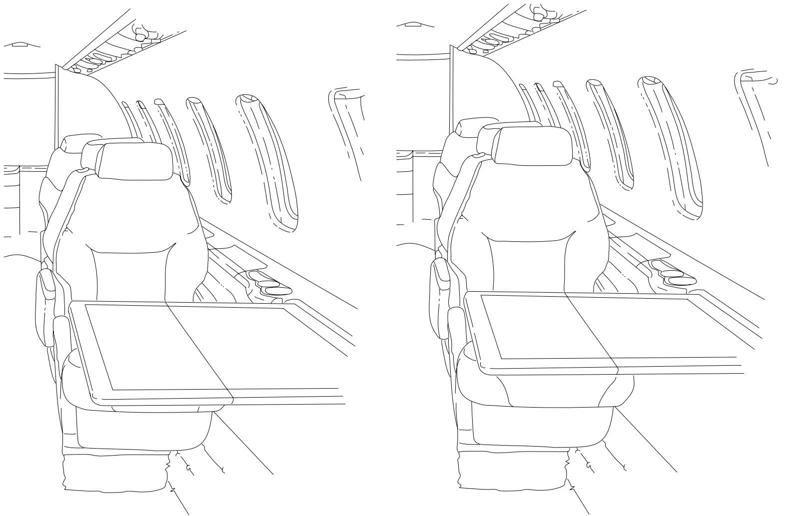


AFT PYRAMID CABINETS
Figure 7-10

Tables

Two pull-out bi-fold executive tables are located (one) on each side of the cabin and are stored inside the sidewall between the facing seats. The executive tables are 20 inches (50.8 centimeters) wide with folding leaves and a solid work surface. The table is extended for use by pulling it up from the cabin sidewall and then unfolding the leaves until they lock in place. The tables (Figure 7-11) can be stowed by folding the leaves together, raising them up until parallel with the cabin sidewall, and then sliding them down into the compartment inside the cabin sidewall.

An optional left side slimline table may be installed in the cabin sidewall adjacent to the aft forward-facing seat. The left side table unfolds and stows in the same manner as the larger tables. An optional right side table is stowed aft of the left side divider and plugs into the receptacles in the escape hatch armrest. Both tables are approximately 10 inches (25.4 centimeters) wide.



Executive Table

Slimline Table

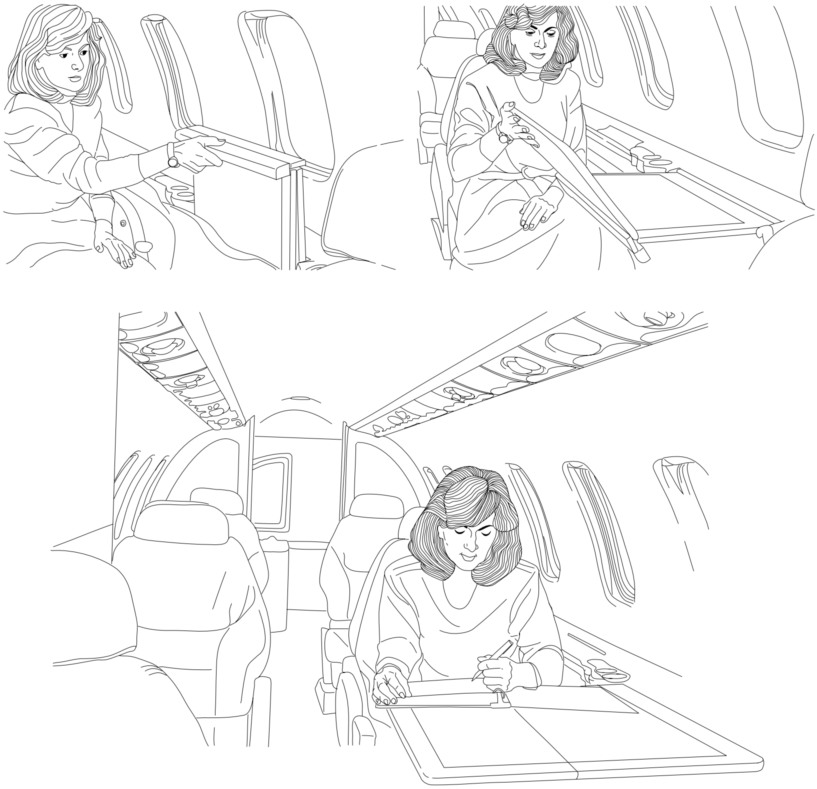


TABLE INSTALLATIONS (TYPICAL)
Figure 7-11

CABIN MANAGEMENT SYSTEM
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)

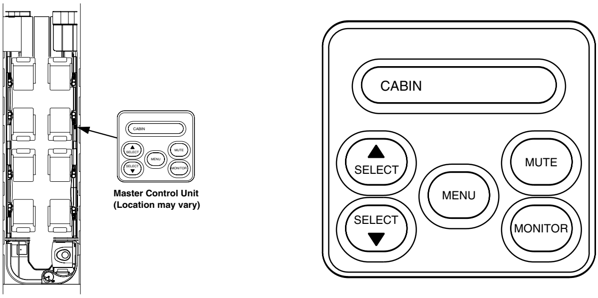
AUDIO/VIDEO SYSTEMS

The optional audio system consists of a 10 disc CD player, a cassette player, an audio amplifier, four cabin speakers, sub woofer speaker and a master control unit for cabin speaker control. The audio system also includes a passenger distribution system located in the outboard armrests with headphone jacks, output controls and an audio headphone set at each passenger seat location.

Power for the audio system is 28-vdc through the 20-amp AUDIO circuit breaker on the copilot's circuit breaker panel and through the 20-amp SPKRS circuit breaker on the pilot's circuit breaker panel. Electrical power for the optional video monitors is provided by the 5-amp VIDEO circuit breaker on the copilot's circuit breaker panel.

Cabin Speaker Audio Source

To select a listening source for the cabin speakers, first locate the master control unit. The master control unit (Figure 7-12) may be located on the outboard armrest panel at any of the cabin seat positions, but it is generally located on the right side at the second or third row from the front. Upon power-up the master control unit will display CABIN on the master control display.



MASTER CONTROL UNIT
Figure 7-12

Next, depress the MENU button on the master control unit until the display shows A̲| CD. When the A̲| CD symbol is displayed, the CD player will be selected as the active source for the cabin speakers. To select a different audio source for the cabin speakers, depress the

SELECT (down arrow) button on the master control unit, the next audio source A| CASS will be displayed. When A| CASS is displayed, the cassette player is selected as the active source for the cabin speakers.

For additional cabin speaker audio source choices, continue to depress the SELECT (down arrow) button or SELECT (up arrow) button until the desired source is displayed. The master control unit display will show the cabin speaker source selections as follows:

CABIN	(DISPLAYED UPON POWER-UP)
A| CD	(AUDIO SOURCE SELECTION)
- A|CD	(COMPACT DISC)
- A|VCP	(VIDEO CASSETTE PLAYER)
- A|CASS	(CASSETTE PLAYER)

Cabin Speaker Volume, Bass and Treble Adjustment

Cabin speaker volume is adjusted by first selecting the volume control by depressing the MENU button on the master control unit until VOL XX% is displayed (the XX represents a 2 digit number from 01 through 99, a percentage of maximum speaker volume). After VOL XX% is displayed, increase or decrease cabin speaker volume by depressing the SELECT up arrow or SELECT down arrow on the master control unit until the desired volume level is achieved. As the speaker volume level changes, the master control unit will display a corresponding VOL % value.

Cabin speaker treble and cabin speaker bass are adjusted in the same manner that cabin speaker volume is with the exception that BASS % or TREBLE % is selected with the MENU button, instead of VOL %.

Mute and Monitor Switches - Master Control Unit

To turn the cabin speaker sound OFF, depress the MUTE button on the master control unit. Depress the MUTE button again to turn the cabin speaker sound ON. To turn the optional video monitor ON, depress the MONITOR button on the master control unit. To turn the video OFF, depress the MONITOR button on the master control unit again.

Video Source Selection

Video signal for the video monitor is selected by depressing the MENU button on the master control unit until V| VCP is displayed. When V| VCP is displayed, the video cassette player will be selected as the active source for the video monitor. To select additional optional video sources, depress the SELECT down arrow or SELECT up arrow until the desired source (V| AIRSHOW 400, for example) is displayed.

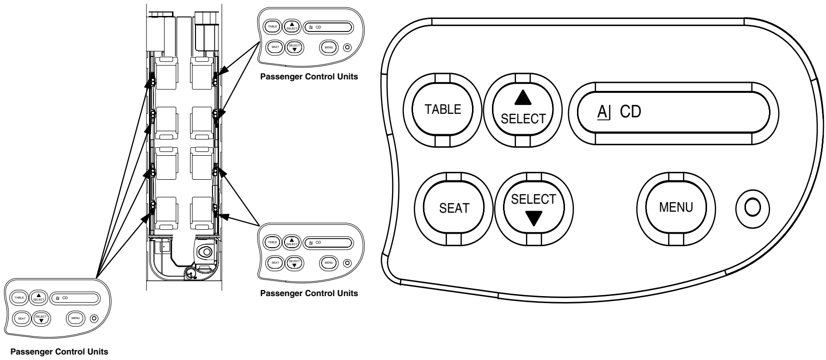
Headphone Audio Controls

Headphone audio is controlled by the passenger control units (Figure 7-14) which are located in the cabin sidewall adjacent to each passenger seat. To select a listening source for the passenger headphones, depress the MENU button on the passenger control unit until the A| CD symbol is displayed. When the A| CD symbol is displayed, the CD player will be selected as the active source for the headphones. After the A| CD is displayed, depress the SELECT up arrow or SELECT down arrow button on the passenger control unit until the desired source is displayed. The passenger control unit display will show the passenger headphone source selections as follows:

A| CD	(AUDIO SOURCE SELECTION)
- A CD	(COMPACT DISC)
- A|VCP	(VIDEO CASSETTE PLAYER)
- A|CASS	(CASSETTE PLAYER)

Headphone volume is adjusted by first depressing the MENU button on the passenger control unit until VOL XX% is displayed (the XX represents a 2 digit number from 01 through 99, a percentage of maximum headphone volume). After VOL XX% is displayed, increase or decrease headphone volume by depressing the SELECT up arrow or SELECT down arrow on the passenger control unit until the desired volume level is achieved. As the headphone volume level changes, the passenger control unit will display a corresponding VOL % value.

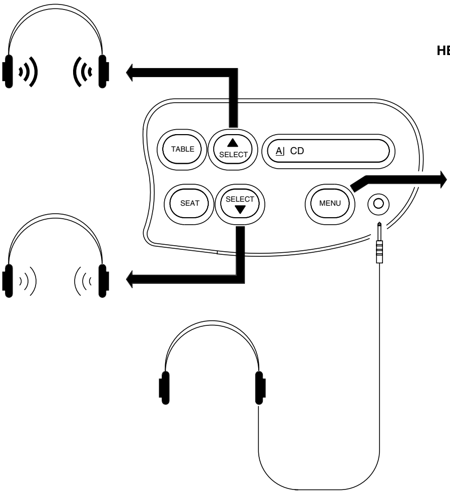
Headphone treble and headphone bass are adjusted in the same manner that headphone volume is with the exception that BASS % or TREBLE % is selected with the MENU button, instead of VOL %.



PASSENGER CONTROL UNIT
Figure 7-13

HEADPHONE CONTROL

PASSENGER CONTROL UNIT



HEADPHONE CONTROL -
Press MENU to select audio menu item.
Press SELECT ▲ or SELECT ▼ to
adjust sound or select audio/video source.

A| CD	(AUDIO SOURCE SELECTION)
- A|CD	(COMPACT DISC)
- A|VCP	(VIDEO CASSETTE PLAYER)
- A|CASS	(CASSETTE PLAYER)
VOL XX%	(HEADPHONE VOLUME %)
V| VCP	(VIDEO SOURCE)
- V|VCP	(VIDEO CASSETTE PLAYER)
- V|AIRSHOW	(AIRSHOW 400)
BASS XX%	(HEADPHONE BASS %)
TREB XX%	(HEADPHONE TREBLE %)
BRIGHT	(DISPLAY BRIGHTNESS)

PASSENGER HEADPHONE CONTROLS
Figure 7-14

Armrest Monitor Video Source Selection

Video signal for the 5.6 inch articulating armrest monitor is selected by depressing the MENU button on the appropriate passenger control unit until V| VCP is displayed. When V| VCP is displayed, the video cassette player will be selected as the active source for the articulating monitor. Additional video sources for the armrest monitor can be selected by depressing the SELECT up arrow or SELECT down arrow on the passenger control unit until the desired source (V| AIRSHOW 400, for example) is displayed.

Brightness Control - Master Control Unit and Passenger Control Unit Displays

To select the brightness on either the master control unit display or passenger control unit display, depress the MENU button on the respective display until the display brightness symbol (BRIGHT) is displayed. After BRIGHT is displayed, increase or decrease the master control unit or passenger control unit intensity by depressing the SELECT up arrow or SELECT down arrow on the master control unit until the desired brightness level is achieved.

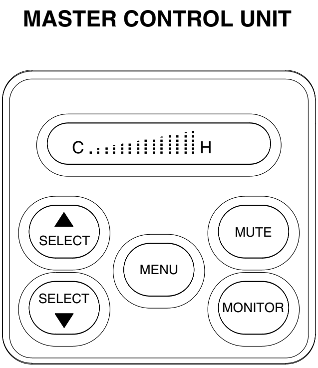
REMOTE CABIN TEMPERATURE CONTROLS

A remote cabin temperature control is incorporated into the master control unit located in the cabin armrest.

Cabin temperature adjustments can be made by pressing the MENU button on the master control unit until C .:: H symbols are displayed (Figure 7-15) in the display window. After the C .:: H symbols are displayed, the cabin temperature is adjusted by pressing the SELECT up arrow or SELECT down arrow buttons.

Each time the SELECT up arrow or SELECT down arrow button is pressed, the display will show a larger or smaller flashing segment which represents a corresponding higher or lower temperature.

The master control unit can only adjust the temperature within a 9° F range. The center of this range is determined by the setting on cabin temperature control located on the copilot's subpanel. The master control unit can adjust the cabin temperature in small increments up to a maximum of 4.5° F above, or down to 4.5° F below the current setting on the copilot's cabin temperature control. The copilot's cabin temperature control can be adjusted in a much wider range, between 60°F and 90° F.



REMOTE CABIN TEMPERATURE CONTROL PANEL
Figure 7-15

CABIN MANAGEMENT SYSTEM

(Aircraft 45-232, 45-236 thru 45-2000)

AUDIO INTERNATIONAL CABIN MANAGEMENT SYSTEM

The Audio International cabin management system manages various cabin systems and components. These systems and components include cabin lights, lavatory lights, cabin audio and video entertainment systems (if installed), cabin temperature, galley equipment, and water system (if installed). The cabin management system uses a two-wire, bidirectional data bus for communication between components.

This Audio International cabin management system consists of a cockpit switch panel, an entry switch panel, a galley switch panel, a lavatory switch panel, eight Lighting Control Unit (LCU) switches, seven Passenger Control Unit (PCU) switch panels, a Master Control Unit (MCU) switch panel, and a Power Switching Module. The following table lists the cabin management system components and locations.

Component	Location
Cockpit switch panel	Copilot's sidewall panel
Entry switch panel	Forward left cabinet aft face
Galley switch panel	Forward right cabinet header
Lavatory switch panel	Lavatory cabinet backsplash
Lighting Control Unit (LCU) (8)	Cabin side ledge (7) and PSU (1)
Master Control Unit (MCU)	VIP seat side ledge
Passenger Control Unit	Cabin side ledge
Power Switching Module	Forward left cabinet
PAX CTRLS circuit breaker	Copilot's circuit breaker panel

CABIN MANAGEMENT SYSTEM COMPONENTS/LOCATIONS
Figure 7-16

Galley Switch Panel

The galley switch panel controls the hot liquid container, second hot liquid container (if installed), and galley drain system (if installed).

Cockpit Switch Panel

The cockpit switch panel controls the cabin lights, entry light, and reading/table lights. This unit can also disable all cabin switch panels.

Entry Switch Panel

The entry switch panel controls the cabin wash lights, lavatory wash lights, cockpit lights, entry light, reading/table lights, and the optional exterior lighting system (if installed).

Lavatory Switch Panel

The lavatory switch panel controls the toilet flush, lavatory wash and spot lights. This unit includes an ordinance sign. This switch panel also controls the optional lavatory water pump and lavatory sink drain system (if installed).

Lighting Control Unit (LCU)

The LCU allows the passengers to control the reading and table lights for its seat location.

Passenger Control Unit (PCU)

The individual PCUs control the headphone audio source, volume, bass, and treble for its seat location.

Master Control Unit (MCU)

The MCU controls the cabin audio source, cabin video source, speaker audio source, volume, bass, and treble, in addition to the cabin lights and cabin temperature. The MCU will show one of two power-up screens (see Figure 7-16A) depending on the configuration of the aircraft. If the aircraft is not equipped with audio and video systems, the standard power-up screen will be shown on the MCU. If the aircraft is equipped with audio and video systems, the optional power-up screen will be shown. The MCU also functions as a PCU for its seat location.

OPERATION

The Audio International cabin management system utilizes a bidirectional data bus and discrete outputs to control a device. Actuation of a control switch sends a data word on the bidirectional data bus to the device being controlled. Each data word is addressed to a particular device. The addressed device decodes the data word, activates the appropriate control or function, and sends a feedback response to the control switch to change the display (if applicable).

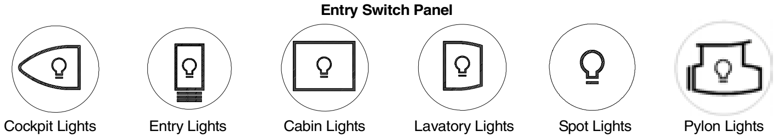
The MCU and the PCUs do not have individual switches, they are touch screen control panels. Each screen has five lines that are used to show different selections for items to be controlled. Selections are made when a line, symbol, or item that is shown on the screen is pushed. When power is first applied to the system, the MCU and the PCU will show a power-up screen. Selections are made from menus on each unit.

Consult the manufacturer's documentation for complete programming and operating instructions.

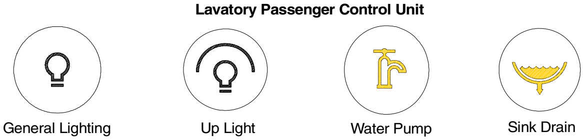
Standard Power-up Screen

Optional Power-up Screen

MASTER CONTROL UNIT
Figure 7-16A



ENTRY SWITCH PANEL
Figure 7-16B



LAVATORY PASSENGER CONTROL UNIT
Figure 7-16C

Equipment	Location	Control Circuit Breaker/s
Cabin Audio Amplifier	Aft Lavatory	SPKRS (Pilot's CB Panel) CABIN PA (Pilot's CB Panel)
Master Control Unit (MCU)	LH or RH Side Ledge	PAX CTRLS (Copilot's CB Panel)
Power Switching Module	Forward LH Cabinet	PAX CTRLS (Copilot's CB Panel)
Passenger Control Units (PCU)	LH/RH Side Ledge	PAX CTRLS (Copilot's CB Panel)
A/V Distribution Unit	Forward RH Cabin Sidewall	AUDIO (Copilot's CB Panel)
IR Receiver	Forward LH Cabinet	PAX CTRLS (Copilot's CB Panel)
CD Changer, Control Head	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
CD Changer, Remote Unit	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Single CD Player (SCD)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Cassette Tape Player (CTP)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Digital Video Disc Player (DVD)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Dual Digital Video Disc Player (Dual DVD)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Video Cassette Player (VCP)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
10.4" Monitor	Forward LH Cabinet and/ or Aft Bulkhead	VIDEO (Copilot's CB Panel)
Lavatory Switch Panel	Lavatory Backsplash	PAX CTRLS (Copilot's CB Panel)
Cockpit Switch Panel	Cockpit Sidewall	N/A
Galley Switch Panel	Forward RH Cabinet	N/A
Entry Switch Panel	Forward LH Cabinet	PAX CTRLS (Copilot's CB Panel) CABIN (Pilot's CB Panel)
Lighting Control Units (LCU)	LH Side Ledge	PAX CTRLS (Copilot's CB Panel) L SPOT (Pilot's CB Panel)
Lighting Control Units (LCU)	RH Side Ledge	PAX CTRLS (Copilot's CB Panel) R SPOT (Copilot's CB Panel)
Speaker (Mid-range/tweeter)	Convenience Panels	N/A
Speaker (Subwoofer)	Cabin Floor	N/A

CABIN MANAGEMENT SYSTEM
EQUIPMENT AND CIRCUIT BREAKER LOCATION (TYPICAL)
Figure 7-17

FLIGHT PHONE

Digital Airborne Telephone (Optional)

The optional Magnastar C2000 is a two voice/data system that has direct dialing, multiple calls, fax/data modem, uplink calls, interfone, speed dialing and call charging features. Handsets are installed in both the cockpit and the passenger compartment.

The passenger compartment handset(s) can be located in any of the cabin armrest storage boxes. The handset in the cockpit is located on the aft end of the center pedestal.

Power for the flight phone is 28-vdc through the 10-amp FLT PHONE circuit breaker on the pilot's circuit breaker panel.

AC ELECTRICAL OUTLETS (OPTIONAL)

Optional 110-vac/60-Hz and/or 115-vac electrical outlets may be installed in the cabin and/or cockpit (typically on the aft pedestal). Typically there is an outlet located in the galley cabinet and an outlet located in the lavatory. There are also outlets located in the passenger compartment sidewall or kick panels (on the right side and/or left side) between the passenger seats. Some outlets may be equipped with a Ground Fault Interrupt (GFI) circuit. The GFI outlet can be reset by depressing the TEST/RESET button. The 1200-va capacity inverter powering these outlets will automatically shut down if the cabin altitude goes above 9500 feet. Power will be restored when the cabin altitude descends below 8300 feet.

A 230-vac/50-Hz circuit is available, as an option, for aircraft which will be used primarily overseas.

WINDOW SHADES

Each cabin window is equipped with a window shade. The shades are adjustable and can be raised and lowered to any desired level. The shades are made of pleated translucent material and may allow some light in.

GASPER OUTLETS

Individual gasper outlets (air outlets) are located in the cabin overhead convenience panels. The outlets are adjacent to the lights and can be turned to approximately 40° around its center to direct airflow as desired. Rotate the conical port counterclockwise to open the outlet and clockwise to close.

AFT CABIN STOWAGE COMPARTMENT

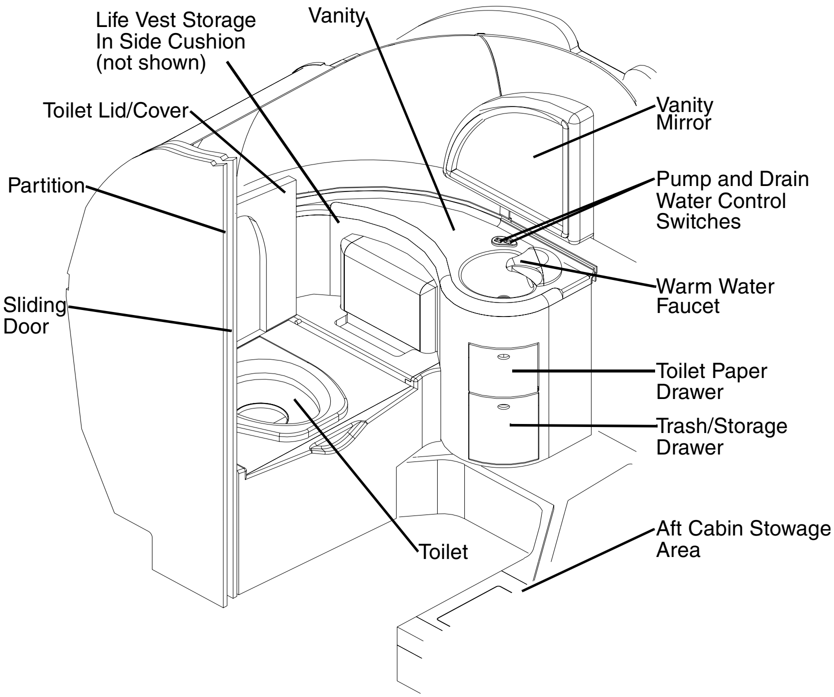
The aft cabin stowage compartment is located on the left side of the aircraft immediately aft of the passenger compartment. The stowage compartment is equipped with a coat rod for hanging garments and a restraining web. Some interiors are equipped with a fire extinguisher which is mounted to the left partition.

LAVATORY/VANITY
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)

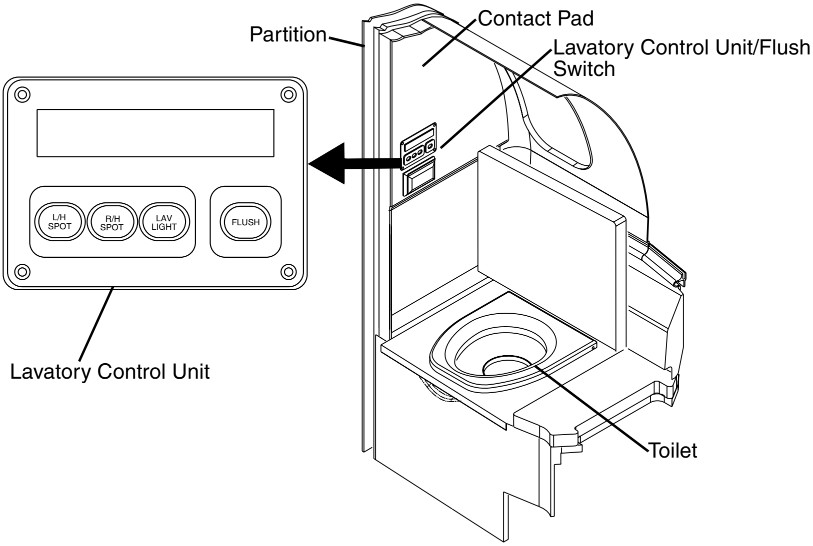
The standard lavatory/vanity (Figure 7-18) is equipped with a toilet, a vanity counter, a toilet tissue drawer and a trash/storage drawer. Optional equipment for the standard vanity includes a belted toilet with a life vest, a lighted vanity mirror and a wash basin with warm running water plumbed to an overboard heated drain.

The lavatory is separated from the passenger cabin by sliding doors which stow inside the left and right sides of the partition. The doors do not lock and are equipped with a magnetic strip which holds them together while closed. The toilet is located on the right side of the lavatory compartment. The toilet is flushed by depressing the toilet FLUSH switch, located in the contact pad on the forward side of the toilet. The optional sink is located at the aft end of the lavatory. The water faucet is operated by depressing the PUMP button located on the vanity adjacent to the basin to dispense running water. Water in the basin is drained by depressing the DRAIN button which is located next to the PUMP button.

If equipped with the optional sink, the lavatory/vanity will have a potable water tank and pump located under the vanity counter. The potable water tank (with an internal heater) holds approximately 1.5 gallons of 100° F heated water. The pump and tank (with heater) draw electrical power from the 15-amp LAV SINK circuit breaker located on the pilot's circuit breaker panel. The lavatory sink is drained through a heated drain mast on the bottom of the aircraft. The heater prevents ice from forming in the drain mast.



VIEW LOOKING AFT



VIEW LOOKING FORWARD

LAVATORY/VANITY (TYPICAL)
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)
Figure 7-18

Toilet

A flushing toilet is installed on the right side of the lavatory compartment. The unit features a two compartment design which isolates the flushing fluid from the waste. The toilet is flushed by depressing the FLUSH button located on the lavatory control unit in the contact pad immediately forward of the toilet (see Figure 7-18). The length of the flush cycle is controlled automatically. There are two electric pumps installed inside the unit. The flushing pump circulates the flushing fluid during the flush cycle. The macerator/pump is used to pump the waste from the toilet during servicing only.

This toilet is equipped with a macerator pump which has the capability to process regular toilet paper. It is not necessary to use the special biodegradable toilet paper in this toilet.

Servicing of the toilet is accomplished using servicing ports located on the aircraft exterior. The macerator/pump is used to pump the waste from the toilet while fresh flushing fluid is pumped into the toilet from the servicing equipment. Refer to Chapter 12 in the maintenance manual for servicing instructions.

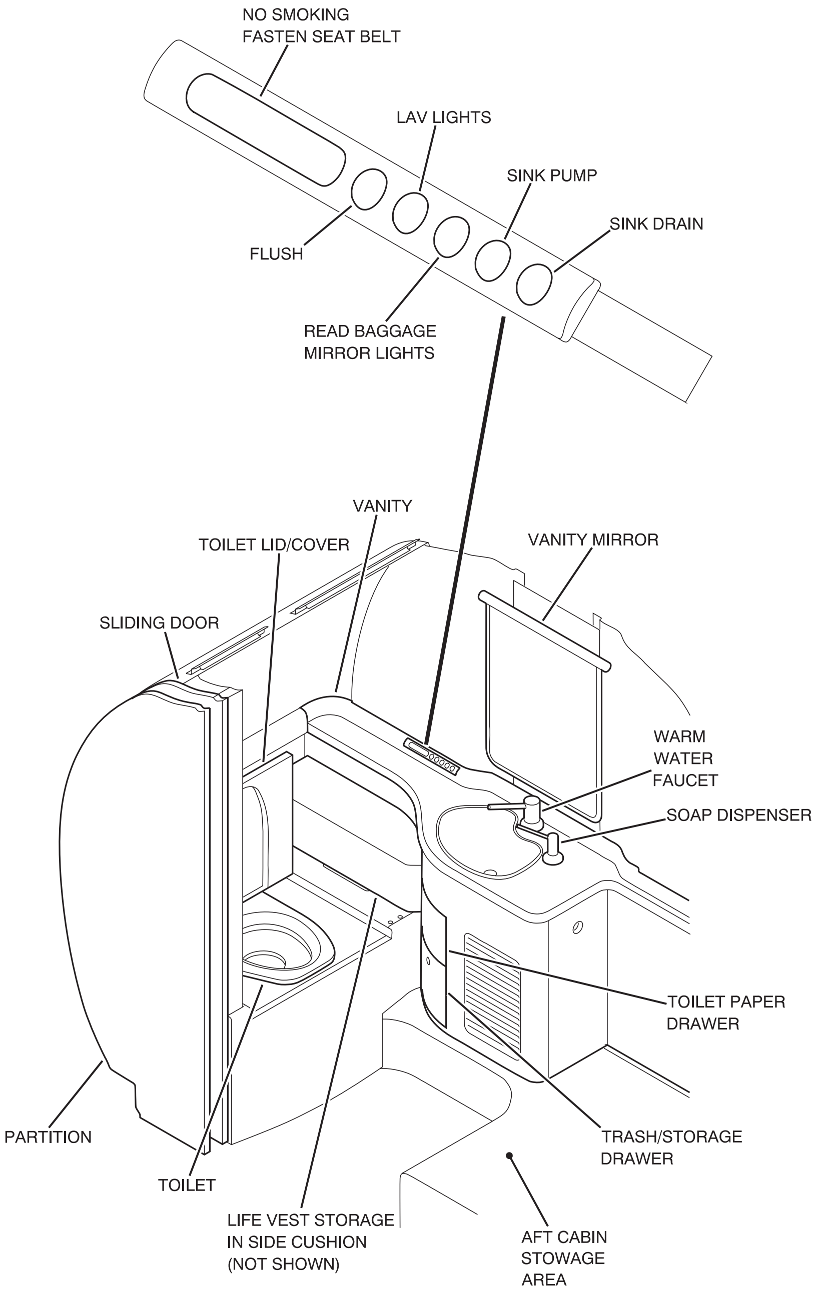
Electrical power to operate the flushing circuit is 28-vdc supplied through the 3-amp TOILET circuit breaker on the copilot's circuit breaker panel.

LAVATORY/VANITY
(Aircraft 45-232, 45-236 thru 45-2000)

The standard lavatory/vanity (Figure 7-19) is equipped with a toilet, a vanity counter, a toilet tissue drawer and a trash/storage drawer. Optional equipment for the standard vanity includes a belted toilet with a life vest, a lighted vanity mirror and a wash basin with warm running water plumbed to an overboard heated drain.

The lavatory is separated from the passenger cabin by sliding doors which stow inside the left and right sides of the partition. The doors do not lock and are equipped with a magnetic strip which holds them together while closed. The toilet is located on the right side of the lavatory compartment. The toilet is flushed by depressing the toilet FLUSH switch, located in the lavatory switch panel on the forward side of the toilet. The sink is located at the aft end of the lavatory. The water faucet is operated by depressing the PUMP switch located on the lavatory switch panel adjacent to the basin to dispense running water. Water in the basin is drained by depressing the DRAIN button which is also on the lavatory switch panel.

If equipped with the optional sink, the lavatory/vanity will have a potable water tank and pump located under the vanity counter. The potable water tank (with an internal heater) holds approximately 1.5 gallons of 100° F heated water. The pump and tank (with heater) draw electrical power from the 15-amp LAV SINK circuit breaker located on the pilot's circuit breaker panel. The lavatory sink is drained through a heated drain mast on the bottom of the aircraft. The heater prevents ice from forming in the drain mast.



LAVATORY/VANITY (TYPICAL)
(Aircraft 45-232, 45-236 thru 45-2000)
Figure 7-19

Toilet

A flushing toilet is installed on the right side of the lavatory compartment. The unit features a two compartment design which isolates the flushing fluid from the waste. The toilet is located on the right side of the lavatory compartment. The toilet is flushed by depressing the toilet FLUSH switch, located in the lavatory switch panel on the forward side of the toilet (see Figure 7-19). The length of the flush cycle is controlled automatically. There are two electric pumps installed inside the unit. The flushing pump circulates the flushing fluid during the flush cycle. The macerator/pump is used to pump the waste from the toilet during servicing only.

This toilet is equipped with a macerator pump which has the capability to process regular toilet paper. It is not necessary to use the special biodegradable toilet paper in this toilet.

Servicing of the toilet is accomplished using servicing ports located on the aircraft exterior. The macerator/pump is used to pump the waste from the toilet while fresh flushing fluid is pumped into the toilet from the servicing equipment. Refer to Chapter 12 in the maintenance manual for servicing instructions.

Electrical power to operate the flushing circuit is 28-vdc supplied through the 3-amp TOILET circuit breaker on the copilot's circuit breaker panel.

SECTION VIII
FLIGHT CHARACTERISTICS & OPERATIONAL PLANNING

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

SECTION VIII FLIGHT CHARACTERISTICS & OPERATIONAL PLANNING

GENERAL FLIGHT CHARACTERISTICS

Taxi operations can be conducted using one or both engines. If nosewheel steering is inoperative or when taxiing on a slick or icy surface, it is recommended that taxiing be conducted using both engines to preclude aggravating the problem with asymmetric thrust.

The steer-by-wire nose wheel steering system provides excellent taxi maneuverability. At low ground speeds, nose wheel travel is approximately 60° either side of neutral. Steering authority is diminished and is reduced to zero as ground speed increases. The system will automatically disengage when design speed is reached. The rudder is effective for directional control above 45 KIAS.

The two pod-mounted AlliedSignal TFE731-20 engines, are flat rated at 3500 pounds (15.56 kN) thrust at 87° F (30.5° C) at sea level. The time required to accelerate the engines from flight idle to takeoff N1 is approximately eight (8) seconds. The engine thrust and acceleration characteristics complement the Learjet 45 airframe so that outstanding performance, flexibility and safety margins are available in all flight regimes. Single-engine performance offers an example of these capabilities in that sea level single-engine rate of climb at 20,200 pounds (9163 kg) is approximately 620 feet per minute and the single-engine service ceiling is approximately 31,000 feet at a cruise weight of 17,000 pounds (7711 kg).

Although the flight control systems are manual, the stick forces are light to moderate throughout the flight envelope. Stability is good at all airspeeds and airplane configurations. Aircraft responsiveness and flight control authority are very good throughout the flight envelope. A yaw damper is employed to damp lateral oscillations caused by turbulent air; however, it is not required for takeoff. Trim changes due to the use of the landing gear, flaps and power are slight; however, a trim change is required when spoilers are extended and retracted.

The dual stall warning system provides an excellent indication of impending airplane stall. Additionally, the airplane exhibits an aerodynamic stall warning buffet in all configurations. A stick shaker actuates above the 1G stall speed published in the Airplane Flight Manual. The shaker system produces a high-frequency, low-amplitude vibration transmitted to the control columns. As the shakers actuate, an aural stall warning will also begin. Recovery is easily accomplished by lowering the nose of the airplane while simultaneously advancing power as necessary to accelerate out of the stall regime. Good aircraft response, to elevator inputs, occurs throughout the aircraft operating envelope.

The spoiler system provides an effective means of the increasing normal rates of descent and may be used as a drag device to achieve rapid airspeed deceleration. The spoilers may also be extended just after touchdown to spoil the lift for more effective braking action and to increase drag for minimum landing roll. Aileron augmentation is supplied automatically by the spoiler system whenever a control wheel is moved more than 5°. The spoiler system also provides backup roll control in the event the ailerons become inoperative.

OPERATIONAL PLANNING

The charts and tables on the following pages contain performance data for climb, cruise, descent and holding. Takeoff and landing performance data is presented in a tabular form in the FAA Approved Flight Manual. Fuel consumption information is presented based on flight test data and average engine characteristics. The following conditions are to be assumed when extracting data from this section:

WEIGHT	All weights presented in this section are the gross weight of the airplane at the start of the climb; the cruise weight used is the mid-weight between the start cruise weight and the end cruise weight; and the descent weight used is assumed to be 15,000 pounds (6804 kg).
ALTITUDE	All altitudes presented in this section are pressure altitude in feet.
TEMPERATURE	OAT — Outside Air Temperature (normally obtained from ground reporting stations). For presentation in this section, Temperature is OAT °C unless otherwise specified. SAT — Static Air Temperature obtained from in-flight indications in °C.
FUEL FLOW	The fuel flows presented are for two engines except where single engine performance is specified.
FLAPS	The flap position for various conditions are as follows : En route Climb .... UP-0° En route .... UP-0° Holding .... UP-0°

OPERATIONAL PLANNING FORM

	WEIGHT	TIME	DISTANCE	FUEL
ZERO FUEL WEIGHT				
FUEL LOAD				
RAMP WEIGHT				
WARM UP, APU & TAKEOFF				
Altitude=				
START CLIMB WEIGHT				
CLIMB				
END CLIMB WEIGHT				
Altitude=				
START CRUISE WEIGHT				
CRUISE				
END CRUISE WEIGHT				
Altitude=				
START CLIMB WEIGHT				
CLIMB				
END CLIMB WEIGHT				
Altitude=				
START CRUISE WEIGHT				
CRUISE				
END CRUISE WEIGHT				
Altitude=				
START CLIMB WEIGHT				
CLIMB				
END CLIMB WEIGHT				
Altitude=				
START CRUISE WEIGHT				
CRUISE				
END CRUISE WEIGHT				
Altitude=				
START DESCENT WEIGHT				
DESCENT				
END DESCENT WEIGHT				
Altitude=				
RESERVES				
ZERO FUEL WEIGHT				
	Total			

Figure 8-1

TEMPERATURE CONVERSION

- To convert from Celsius to Fahrenheit, find, in bold face columns, the number representing the Celsius temperature to be converted. The equivalent Fahrenheit temperature is read in the adjacent column headed °F.
- To convert from Fahrenheit to Celsius, find, in bold face columns, the number representing the Fahrenheit temperature to be converted. The equivalent Celsius temperature is read in the adjacent column headed °C.

°F	◄►	°C	°F	◄►	°C	°F	◄►	°C	°F	◄►	°C	°F	◄►	°C
-148.0	**-100**	-73.3	-58.0	**-50**	-45.6	32.0	**0**	-17.8	122.0	**50**	10.0	212.0	**100**	37.8
-146.2	**-99**	-72.8	-56.2	**-49**	-45.0	33.8	**1**	-17.2	123.8	**51**	10.6	213.8	**101**	38.3
-144.4	**-98**	-72.2	-54.4	**-48**	-44.4	35.6	**2**	-16.7	125.6	**52**	11.1	215.6	**102**	38.9
-142.6	**-97**	-71.7	-52.6	**-47**	-43.9	37.4	**3**	-16.1	127.4	**53**	11.7	217.4	**103**	39.4
-140.8	**-96**	-71.1	-50.8	**-46**	-43.3	39.2	**4**	-15.6	129.2	**54**	12.2	219.2	**104**	40.0
-139.0	**-95**	-70.6	-49.0	**-45**	-42.8	41.0	**5**	-15.0	131.0	**55**	12.8	221.0	**105**	40.6
-137.2	**-94**	-70.0	-47.2	**-44**	-42.2	42.8	**6**	-14.4	132.8	**56**	13.3	222.8	**106**	41.1
-135.4	**-93**	-69.4	-45.4	**-43**	-41.7	44.6	**7**	-13.9	134.6	**57**	13.9	224.6	**107**	41.7
-133.6	**-92**	-68.9	-43.6	**-42**	-41.1	46.4	**8**	-13.3	136.4	**58**	14.4	226.4	**108**	42.2
-131.8	**-91**	-68.3	-41.8	**-41**	-40.6	48.2	**9**	-12.8	138.2	**59**	15.0	228.2	**109**	42.8
-130.0	**-90**	-67.8	-40.0	**-40**	-40.0	50.0	**10**	-12.2	140.0	**60**	15.6	230.0	**110**	43.3
-128.2	**-89**	-67.2	-38.2	**-39**	-39.4	51.8	**11**	-11.7	141.8	**61**	16.1	231.8	**111**	43.9
-126.4	**-88**	-66.7	-36.4	**-38**	-38.9	53.6	**12**	-11.1	143.6	**62**	16.7	233.6	**112**	44.4
-124.6	**-87**	-66.1	-34.6	**-37**	-38.3	55.4	**13**	-10.6	145.4	**63**	17.2	235.4	**113**	45.0
-122.8	**-86**	-65.6	-32.8	**-36**	-37.8	57.2	**14**	-10.0	147.2	**64**	17.8	237.2	**114**	45.6
-121.0	**-85**	-65.0	-31.0	**-35**	-37.2	59.0	**15**	-9.4	149.0	**65**	18.3	239.0	**115**	46.1
-119.2	**-84**	-64.4	-29.2	**-34**	-36.7	60.8	**16**	-8.9	150.8	**66**	18.9	240.8	**116**	46.7
-117.4	**-83**	-63.9	-27.4	**-33**	-36.1	62.6	**17**	-8.3	152.6	**67**	19.4	242.6	**117**	47.2
-115.6	**-82**	-63.3	-25.6	**-32**	-35.6	64.4	**18**	-7.8	154.4	**68**	20.0	244.4	**118**	47.8
-113.8	**-81**	-62.8	-23.8	**-31**	-35.0	66.2	**19**	-7.2	156.2	**69**	20.6	246.2	**119**	48.3
-112.0	**-80**	-62.2	-22.0	**-30**	-34.4	68.0	**20**	-6.7	158.0	**70**	21.1	248.0	**120**	48.9
-110.2	**-79**	-61.7	-20.2	**-29**	-33.9	69.8	**21**	-6.1	159.8	**71**	21.7	249.8	**121**	49.4
-108.4	**-78**	-61.1	-18.4	**-28**	-33.3	71.6	**22**	-5.6	161.6	**72**	22.2	251.6	**122**	50.0
-106.6	**-77**	-60.6	-16.6	**-27**	-32.8	73.4	**23**	-5.0	163.4	**73**	22.8	253.4	**123**	50.6
-104.8	**-76**	-60.0	-14.8	**-26**	-32.2	75.2	**24**	-4.4	165.2	**74**	23.3	255.2	**124**	51.1
-103.0	**-75**	-59.4	-13.0	**-25**	-31.7	77.0	**25**	-3.9	167.0	**75**	23.9	257.0	**125**	51.7
-101.2	**-74**	-58.9	-11.2	**-24**	-31.1	78.8	**26**	-3.3	168.8	**76**	24.4	258.8	**126**	52.2
-99.4	**-73**	-58.3	-9.4	**-23**	-30.6	80.6	**27**	-2.8	170.6	**77**	25.0	260.6	**127**	52.8
-97.6	**-72**	-57.8	-7.6	**-22**	-30.0	82.4	**28**	-2.2	172.4	**78**	25.6	262.4	**128**	53.3
-95.8	**-71**	-57.2	-5.8	**-21**	-29.4	84.2	**29**	-1.7	174.2	**79**	26.1	264.2	**129**	53.9
-94.0	**-70**	-56.7	-4.0	**-20**	-28.9	86.0	**30**	-1.1	176.0	**80**	26.7	266.0	**130**	54.4
-92.2	**-69**	-56.1	-2.2	**-19**	-28.3	87.8	**31**	-0.6	177.8	**81**	27.2	267.8	**131**	55.0
-90.4	**-68**	-55.6	-0.4	**-18**	-27.8	89.6	**32**	0.0	179.6	**82**	27.8	269.6	**132**	55.6
-88.6	**-67**	-55.0	1.4	**-17**	-27.2	91.4	**33**	0.6	181.4	**83**	28.3	271.4	**133**	56.1
-86.8	**-66**	-54.4	3.2	**-16**	-26.7	93.2	**34**	1.1	183.2	**84**	28.9	273.2	**134**	56.7
-85.0	**-65**	-53.9	5.0	**-15**	-26.1	95.0	**35**	1.7	185.0	**85**	29.4	275.0	**135**	57.2
-83.2	**-64**	-53.3	6.8	**-14**	-25.6	96.8	**36**	2.2	186.8	**86**	30.0	276.8	**136**	57.8
-81.4	**-63**	-52.8	8.6	**-13**	-25.0	98.6	**37**	2.8	188.6	**87**	30.6	278.6	**137**	58.3
-79.6	**-62**	-52.2	10.4	**-12**	-24.4	100.4	**38**	3.3	190.4	**88**	31.1	280.4	**138**	58.9
-77.8	**-61**	-51.7	12.2	**-11**	-23.9	102.2	**39**	3.9	192.2	**89**	31.7	282.2	**139**	59.4
-76.0	**-60**	-51.1	14.0	**-10**	-23.3	104.0	**40**	4.4	194.0	**90**	32.2	284.0	**140**	60.0
-74.2	**-59**	-50.6	15.8	**-9**	-22.8	105.8	**41**	5.0	195.8	**91**	32.8	285.8	**141**	60.6
-72.4	**-58**	-50.0	17.6	**-8**	-22.2	107.6	**42**	5.6	197.6	**92**	33.3	287.6	**142**	61.1
-70.6	**-57**	-49.4	19.4	**-7**	-21.7	109.4	**43**	6.1	199.4	**93**	33.9	289.4	**143**	61.7
-68.8	**-56**	-48.9	21.2	**-6**	-21.1	111.2	**44**	6.7	201.2	**94**	34.4	291.2	**144**	62.2
-67.0	**-55**	-48.3	23.0	**-5**	-20.6	113.0	**45**	7.2	203.0	**95**	35.0	293.0	**145**	62.8
-65.2	**-54**	-47.8	24.8	**-4**	-20.0	114.8	**46**	7.8	204.8	**96**	35.6	294.8	**146**	63.3
-63.4	**-53**	-47.2	26.6	**-3**	-19.4	116.6	**47**	8.3	206.6	**97**	36.1	296.6	**147**	63.9
-61.6	**-52**	-46.7	28.4	**-2**	-18.9	118.4	**48**	8.9	208.4	**98**	36.7	298.4	**148**	64.4
-59.8	**-51**	-46.1	30.2	**-1**	-18.3	120.2	**49**	9.4	210.2	**99**	37.2	300.2	**149**	65.0

Figure 8-2

LINEAR CONVERSIONS

- To convert from meters to feet, find, in the bold face columns, the number of meters to be converted. The equivalent number of feet is read in the adjacent column headed FEET.
- To convert from feet to meters, find, in the bold face columns, the number of feet to be converted. The equivalent number of meters is read in the adjacent column headed METERS.

METERS	◀ ▶	FEET	METERS	◀ ▶	FEET	METERS	◀ ▶	FEET
304.8	**1000**	3280.8	1341.1	**4400**	14435.5	2377.5	**7800**	25590.2
335.3	**1100**	3608.9	1371.6	**4500**	14763.6	2407.9	**7900**	25918.3
365.8	**1200**	3937.0	1402.1	**4600**	15091.7	2438.4	**8000**	26246.4
396.2	**1300**	4265.0	1432.6	**4700**	15419.8	2468.9	**8100**	26574.5
426.7	**1400**	4593.1	1463.1	**4800**	15747.8	2499.4	**8200**	26902.6
457.2	**1500**	4921.2	1493.5	**4900**	16075.9	2529.9	**8300**	27230.6
487.7	**1600**	5249.3	1524.0	**5000**	16404.0	2560.4	**8400**	27558.7
518.2	**1700**	5577.4	1554.5	**5100**	16732.1	2590.8	**8500**	27886.8
548.6	**1800**	5905.4	1585.0	**5200**	17060.2	2621.3	**8600**	28214.9
579.1	**1900**	6233.5	1615.5	**5300**	17388.2	2651.8	**8700**	28543.0
609.6	**2000**	6561.6	1645.9	**5400**	17716.3	2682.3	**8800**	28871.0
640.1	**2100**	6889.7	1676.4	**5500**	18044.4	2712.8	**8900**	29199.1
670.6	**2200**	7217.8	1706.9	**5600**	18372.5	2743.2	**9000**	29527.2
701.0	**2300**	7545.8	1737.4	**5700**	18700.6	2773.7	**9100**	29855.3
731.5	**2400**	7873.9	1767.9	**5800**	19028.6	2804.2	**9200**	30183.4
762.0	**2500**	8202.0	1798.3	**5900**	19356.7	2834.7	**9300**	30511.4
792.5	**2600**	8530.1	1828.8	**6000**	19684.8	2865.2	**9400**	30839.5
823.0	**2700**	8858.2	1859.3	**6100**	20012.9	2895.6	**9500**	31167.6
853.5	**2800**	9186.2	1889.8	**6200**	20341.0	2926.1	**9600**	31495.7
883.9	**2900**	9514.3	1920.3	**6300**	20669.0	2956.6	**9700**	31823.8
914.4	**3000**	9842.4	1950.7	**6400**	20997.1	2987.1	**9800**	32151.8
944.9	**3100**	10170.5	1981.2	**6500**	21325.2	3017.6	**9900**	32479.9
975.4	**3200**	10498.6	2011.7	**6600**	21653.3	3048.0	**10000**	32808.0
1005.9	**3300**	10826.6	2042.2	**6700**	21981.4	3352.8	**11000**	36088.8
1036.3	**3400**	11154.7	2072.7	**6800**	22309.4	3657.6	**12000**	39369.6
1066.8	**3500**	11482.8	2103.1	**6900**	22637.5	3962.4	**13000**	42650.4
1097.3	**3600**	11810.9	2133.6	**7000**	22965.6	4267.3	**14000**	45931.2
1127.8	**3700**	12139.0	2164.1	**7100**	23293.7	4572.1	**15000**	49212.0
1158.3	**3800**	12467.0	2194.6	**7200**	23621.8	4876.9	**16000**	52492.8
1188.7	**3900**	12795.1	2225.1	**7300**	23949.8	5181.7	**17000**	55773.6
1219.2	**4000**	13123.2	2255.5	**7400**	24277.9	5486.5	**18000**	59054.4
1249.7	**4100**	13451.3	2286.0	**7500**	24606.0	5791.3	**19000**	62335.2
1280.2	**4200**	13779.4	2316.5	**7600**	24934.1	6096.1	**20000**	65616.0
1310.7	**4300**	14107.4	2347.0	**7700**	25262.2	6400.9	**21000**	68896.8

Figure 8-3

VOLUME CONVERSIONS

- To convert from liters to gallons, find, in the bold face columns, the number of liters to be converted. The equivalent number of gallons is read in the adjacent column headed GALLONS.
- To convert from gallons to liters, find, in the bold face columns, the number of gallons to be converted. The equivalent number of liters is read in the adjacent column headed LITERS.

LITERS	◀ ▶	GALLONS	LITERS	◀ ▶	GALLONS	LITERS	◀ ▶	GALLONS
18.9	**5**	1.3	1476.2	**390**	103.0	2952.3	**780**	206.1
37.9	**10**	2.6	1514.0	**400**	105.7	2990.2	**790**	208.7
75.7	**20**	5.3	1551.9	**410**	108.3	3028.0	**800**	211.4
113.6	**30**	7.9	1589.7	**420**	111.0	3065.9	**810**	214.0
151.4	**40**	10.6	1627.6	**430**	113.6	3103.7	**820**	216.6
189.3	**50**	13.2	1665.4	**440**	116.2	3141.6	**830**	219.3
227.1	**60**	15.9	1703.3	**450**	118.9	3179.4	**840**	221.9
265.0	**70**	18.5	1741.1	**460**	121.5	3217.3	**850**	224.6
302.8	**80**	21.1	1779.0	**470**	124.2	3255.1	**860**	227.2
340.7	**90**	23.8	1816.8	**480**	126.8	3293.0	**870**	229.9
378.5	**100**	26.4	1854.7	**490**	129.5	3330.8	**880**	232.5
416.4	**110**	29.1	1892.5	**500**	132.1	3368.7	**890**	235.1
454.2	**120**	31.7	1930.4	**510**	134.7	3406.5	**900**	237.8
492.1	**130**	34.3	1968.2	**520**	137.4	3444.4	**910**	240.4
529.9	**140**	37.0	2006.1	**530**	140.0	3482.2	**920**	243.1
567.8	**150**	39.6	2043.9	**540**	142.7	3520.1	**930**	245.7
605.6	**160**	42.3	2081.8	**550**	145.3	3557.9	**940**	248.3
643.5	**170**	44.9	2119.6	**560**	148.0	3595.8	**950**	251.0
681.3	**180**	47.6	2157.5	**570**	150.6	3633.6	**960**	253.6
719.2	**190**	50.2	2195.3	**580**	153.2	3671.5	**970**	256.3
757.0	**200**	52.8	2233.2	**590**	155.9	3709.3	**980**	258.9
794.9	**210**	55.5	2271.0	**600**	158.5	3747.2	**990**	261.6
832.7	**220**	58.1	2308.9	**610**	161.2	3785.0	**1000**	264.2
870.6	**230**	60.8	2346.7	**620**	163.8	4163.5	**1100**	290.6
908.4	**240**	63.4	2384.6	**630**	166.4	4542.0	**1200**	317.0
946.3	**250**	66.1	2422.4	**640**	169.1	4920.5	**1300**	343.5
984.1	**260**	68.7	2460.3	**650**	171.7	5299.0	**1400**	369.9
1022.0	**270**	71.3	2498.1	**660**	174.4	5677.5	**1500**	396.3
1059.8	**280**	74.0	2536.0	**670**	177.0	6056.0	**1600**	422.7
1097.7	**290**	76.6	2573.8	**680**	179.7	6434.5	**1700**	449.1
1135.5	**300**	79.3	2611.7	**690**	182.3	6813.0	**1800**	475.6
1173.4	**310**	81.9	2649.5	**700**	184.9	7191.5	**1900**	502.0
1211.2	**320**	84.5	2687.4	**710**	187.6	7570.0	**2000**	528.4
1249.1	**330**	87.2	2725.2	**720**	190.2	7948.5	**2100**	554.8
1286.9	**340**	89.8	2763.1	**730**	192.9	8327.0	**2200**	581.2
1324.8	**350**	92.5	2800.9	**740**	195.5	8705.5	**2300**	607.7
1362.6	**360**	95.1	2838.8	**750**	198.2	9084.0	**2400**	634.1
1400.5	**370**	97.8	2876.6	**760**	200.8	9462.5	**2500**	660.5
1438.3	**380**	100.4	2914.5	**770**	203.4	9841.0	**2600**	686.9

Figure 8-4

WEIGHT CONVERSIONS

- To convert from kilograms to pounds, find, in the bold face columns, the number of kilograms to be converted. The equivalent number of pounds is read in the adjacent column headed POUNDS.
- To convert from pounds to kilograms, find, in the bold face columns, the number of pounds to be converted. The equivalent number of kilograms is read in the adjacent column headed KILOGRAMS.

KILOGRAMS	◀ ▶	POUNDS	KILOGRAMS	◀ ▶	POUNDS	KILOGRAMS	◀ ▶	POUNDS
4.5	**10**	22.0	208.7	**460**	1014.1	412.8	**910**	2006.2
9.1	**20**	44.1	213.2	**470**	1036.2	417.3	**920**	2028.2
13.6	**30**	66.1	217.7	**480**	1058.2	421.8	**930**	2050.3
18.1	**40**	88.2	222.3	**490**	1080.3	426.4	**940**	2072.3
22.7	**50**	110.2	226.8	**500**	1102.3	430.9	**950**	2094.4
27.2	**60**	132.3	231.3	**510**	1124.3	435.5	**960**	2116.4
31.8	**70**	154.3	235.9	**520**	1146.4	440.0	**970**	2138.5
36.3	**80**	176.4	240.4	**530**	1168.4	444.5	**980**	2160.5
40.8	**90**	198.4	244.9	**540**	1190.5	449.1	**990**	2182.6
45.4	**100**	220.5	249.5	**550**	1212.5	453.6	**1000**	2204.6
49.9	**110**	242.5	254.0	**560**	1234.6	499.0	**1100**	2425.1
54.4	**120**	264.6	258.6	**570**	1256.6	544.3	**1200**	2645.5
59.0	**130**	286.6	263.1	**580**	1278.7	589.7	**1300**	2866.0
63.5	**140**	308.6	267.6	**590**	1300.7	635.0	**1400**	3086.4
68.0	**150**	330.7	272.2	**600**	1322.8	680.4	**1500**	3306.9
72.6	**160**	352.7	276.7	**610**	1344.8	907.2	**2000**	4409.2
77.1	**170**	374.8	281.2	**620**	1366.9	1134.0	**2500**	5511.5
81.6	**180**	396.8	285.8	**630**	1388.9	1360.8	**3000**	6613.8
86.2	**190**	418.9	290.3	**640**	1410.9	1587.6	**3500**	7716.1
90.7	**200**	440.9	294.8	**650**	1433.0	1814.4	**4000**	8818.4
95.3	**210**	463.0	299.4	**660**	1455.0	2041.2	**4500**	9920.7
99.8	**220**	485.0	303.9	**670**	1477.1	2268.0	**5000**	11023.0
104.3	**230**	507.1	308.4	**680**	1499.1	2494.8	**5500**	12125.3
108.9	**240**	529.1	313.0	**690**	1521.2	2721.6	**6000**	13227.6
113.4	**250**	551.1	317.5	**700**	1543.2	2948.4	**6500**	14329.9
117.9	**260**	573.2	322.1	**710**	1565.3	3175.2	**7000**	15432.2
122.5	**270**	595.2	326.6	**720**	1587.3	3402.0	**7500**	16534.5
127.0	**280**	617.3	331.1	**730**	1609.4	3628.8	**8000**	17636.8
131.5	**290**	639.3	335.7	**740**	1631.4	3855.6	**8500**	18739.1
136.1	**300**	661.4	340.2	**750**	1653.4	4082.4	**9000**	19841.4
140.6	**310**	683.4	344.7	**760**	1675.5	4309.2	**9500**	20943.7
145.2	**320**	705.5	349.3	**770**	1697.5	4536.0	**10000**	22046.0
149.7	**330**	727.5	353.8	**780**	1719.6	4989.6	**11000**	24250.6
154.2	**340**	749.6	358.3	**790**	1741.6	5443.2	**12000**	26455.2
158.8	**350**	771.6	362.9	**800**	1763.7	5896.8	**13000**	28659.8
163.3	**360**	793.7	367.4	**810**	1785.7	6350.4	**14000**	30864.4
167.8	**370**	815.7	371.9	**820**	1807.8	6804.0	**15000**	33069.0
172.4	**380**	837.7	376.5	**830**	1829.8	7257.6	**16000**	35273.6
176.9	**390**	859.8	381.0	**840**	1851.9	7711.1	**17000**	37478.2
181.4	**400**	881.8	385.6	**850**	1873.9	8164.7	**18000**	39682.8
186.0	**410**	903.9	390.1	**860**	1896.0	8618.3	**19000**	41887.4
190.5	**420**	925.9	394.6	**870**	1918.0	9071.9	**20000**	44092.0
195.0	**430**	948.0	399.2	**880**	1940.0	9525.5	**21000**	46296.6
199.6	**440**	970.0	403.7	**890**	1962.1	9979.1	**22000**	48501.2
204.1	**450**	992.1	408.2	**900**	1984.1	10432.7	**23000**	50705.8

Figure 8-5

RELATION OF TEMPERATURE (°C) TO ISA

ALTITUDE ~ 1000 FT	-50°C	-40°C	-30°C	-20°C	-10°C	ISA	+10°C	+20°C	+30°C
51	-106.5	-96.5	-86.5	-76.5	-66.5	**-56.5**	-46.5	-36.5	-26.5
┃	┃	┃	┃	┃	┃	┃	┃	┃	┃
37	-106.5	-96.5	-86.5	-76.5	-66.5	**-56.5**	-46.5	-36.5	-26.5
35	-104.2	-94.2	-84.2	-74.2	-64.2	**-54.2**	-44.2	-34.2	-24.2
33	-100.3	-90.3	-80.3	-70.3	-60.3	**-50.3**	-40.3	-30.3	-20.3
31	-96.3	-86.3	-76.3	-66.3	-56.3	**-46.3**	-36.3	-26.3	-16.3
30	-94.4	-84.4	-74.4	-64.4	-54.4	**-44.4**	-34.4	-24.4	-14.4
29	-92.4	-82.4	-72.4	-62.4	-52.4	**-42.4**	-32.4	-22.4	-12.4
28	-90.4	-80.4	-70.4	-60.4	-50.4	**-40.4**	-30.4	-20.4	-10.4
27	-88.4	-78.4	-68.4	-58.4	-48.4	**-38.4**	-28.4	-18.4	-8.4
26	-86.5	-76.5	-66.5	-56.5	-46.5	**-36.5**	-26.5	-16.5	-6.5
25	-84.5	-74.5	-64.5	-54.5	-44.5	**-34.5**	-24.5	-14.5	-4.5
24	-82.5	-72.5	-62.5	-52.5	-42.5	**-32.5**	-22.5	-12.5	-2.5
23	-80.5	-70.5	-60.5	-50.5	-40.5	**-30.5**	-20.5	-10.5	-0.5
22	-78.6	-68.6	-58.6	-48.6	-38.6	**-28.6**	-18.6	-8.6	1.4
21	-76.6	-66.6	-56.6	-46.6	-36.6	**-26.6**	-16.6	-6.6	3.4
20	-74.6	-64.6	-54.6	-44.6	-34.6	**-24.6**	-14.6	-4.6	5.4
19	-72.6	-62.6	-52.6	-42.6	-32.6	**-22.6**	-12.6	-2.6	7.4
18	-70.6	-60.6	-50.6	-40.6	-30.6	**-20.6**	-10.6	-0.6	9.4
16	-66.7	-56.7	-46.7	-36.7	-26.7	**-16.7**	-6.7	3.3	13.3
14	-62.7	-52.7	-42.7	-32.7	-22.7	**-12.7**	-2.7	7.3	17.3
12	-58.8	-48.8	-38.8	-28.8	-18.8	**-8.8**	1.2	11.2	21.2
10	-54.8	-44.8	-34.8	-24.8	-14.8	**-4.8**	5.2	15.2	25.2
8	-50.8	-40.8	-30.8	-20.8	-10.8	**-0.8**	9.2	19.2	29.2
6	-46.9	-36.9	-26.9	-16.9	-6.9	**3.1**	13.1	23.1	33.1
4	-42.9	-32.9	-22.9	-12.9	-2.9	**7.1**	17.1	27.1	37.1
2	-39.0	-29.0	-19.0	-9.0	1.0	**11.0**	21.0	31.0	41.0
S.L.	-35.0	-25.0	-15.0	-5.0	5.0	**15.0**	25.0	35.0	45.0
	-50°C	-40°C	-30°C	-20°C	-10°C	ISA	+10°C	+20°C	+30°C

Figure 8-6

CLIMB PERFORMANCE

Figure 8-7 shows time, distance, and fuel used to climb from sea level to altitude for standard and off-standard days at various weights. The climb weight used is the start of climb weight. Subtraction of performance values for two altitudes results in the time, distance and fuel required for climb between the two altitudes.

The climb speed schedule presented with each table is based on an operational climb schedule to optimize fuel consumption and approximates the best rate of climb speeds. The climb speeds given are 250 KIAS up to 32,000 feet and 0.70 MI above 32,000 feet. Climb thrust is maximum continuous thrust (MCT). The MCT rating is the maximum thrust certified for continuous operation within established engine operating limits. However, to maintain predicted engine durability and to achieve FAA approved maintenance intervals, use of MCT power setting should be minimized.

CLIMB PERFORMANCE — TWO ENGINE

45-901a

WEIGHT 15,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**	25.4	157.5	631.0	27.4	173.8	684.7									
	49	19.7	120.7	553.9	21.0	131.2	596.4	38.9	254.1	859.5						
	47	16.5	99.6	505.7	17.7	109.1	545.6	25.5	162.2	682.0	39.9	262.2	903.8			
	45	14.2	84.7	468.8	15.4	93.8	507.0	20.7	130.0	612.0	27.0	172.4	726.1			
	43	12.5	73.4	438.0	13.7	82.0	474.6	17.9	110.4	564.8	22.3	140.3	654.3	31.1	199.9	820.3
	41	11.1	64.3	410.9	12.2	72.5	446.1	15.8	96.4	527.2	19.4	120.3	604.6	25.8	162.7	735.1
	39	9.9	56.7	386.4	11.1	64.6	420.3	14.3	85.6	495.1	17.4	105.8	564.6	22.5	139.8	676.7
	37	9.0	50.3	363.6	10.1	57.9	396.3	13.0	76.9	466.6	15.8	94.7	530.6	20.2	123.8	631.3
	35	8.2	45.1	343.3	9.3	52.5	374.9	12.0	70.0	441.7	14.5	86.2	501.6	18.5	112.0	594.3
	33	7.5	40.6	324.0	8.5	47.5	354.0	11.1	63.7	416.9	13.4	78.3	472.6	17.0	101.1	557.2
	31	6.7	35.7	301.4	7.7	42.0	329.0	10.0	56.2	385.9	12.0	68.6	435.4	15.0	87.4	508.2
	29	6.1	31.5	279.3	7.0	37.1	304.5	8.9	49.2	355.0	10.7	59.6	398.2	13.2	74.7	460.0
	27	5.5	27.9	258.6	6.3	32.8	281.3	8.0	43.1	326.1	9.5	51.8	363.9	11.6	64.1	417.0
	25	5.0	24.8	239.0	5.7	29.0	259.1	7.2	37.7	298.8	8.5	45.1	331.9	10.2	55.3	377.7
	23	4.6	22.2	220.1	5.1	25.7	237.7	6.4	33.0	272.6	7.5	39.2	301.6	9.0	47.6	341.2
	21	4.1	19.8	201.7	4.6	22.6	217.0	5.7	28.8	247.3	6.6	33.9	272.5	7.9	40.9	306.8
	19	3.7	17.6	183.7	4.1	19.9	196.8	5.0	24.9	222.7	5.8	29.2	244.5	6.9	35.0	273.9
	17	3.4	15.7	166.2	3.7	17.3	177.0	4.4	21.4	198.7	5.1	24.9	217.3	6.0	29.7	242.4
	15	3.0	13.9	148.9	3.2	15.0	157.4	3.8	18.2	175.0	4.3	21.0	190.7	5.1	25.0	211.9
	13	2.7	12.2	131.4	2.8	12.9	137.9	3.2	15.2	151.7	3.7	17.5	164.6	4.3	20.7	182.4
	11	2.3	10.4	113.3	2.4	10.9	118.5	2.7	12.5	128.6	3.0	14.2	138.9	3.5	16.8	153.5
	9	2.0	8.7	94.6	2.0	9.0	99.0	2.2	9.9	105.6	2.4	11.2	113.5	2.8	13.2	125.2
	7	1.6	6.8	75.2	1.6	7.1	78.8	1.7	7.5	82.6	1.9	8.4	88.3	2.2	9.9	97.1
	5	1.2	4.9	54.9	1.2	5.1	57.4	1.2	5.3	59.7	1.3	5.8	63.1	1.5	6.8	69.2
	3	0.7	3.0	33.6	0.7	3.1	35.1	0.7	3.2	36.5	0.8	3.4	38.0	0.9	3.9	41.4
	1	0.2	1.0	11.4	0.2	1.0	11.9	0.2	1.1	12.4	0.3	1.1	12.7	0.3	1.3	13.8

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 1 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-902a

WEIGHT 16,000 LB	ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
PRESSURE ALTITUDE — 1000 FEET	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
51	34.9	219.3	788.2												
49	23.1	142.0	626.9	24.5	153.8	674.5									
47	18.6	112.6	559.9	19.9	123.0	603.9	30.5	195.6	784.8						
45	15.8	94.1	513.9	17.1	104.0	555.9	23.4	147.2	680.2	31.6	203.5	827.8			
43	13.7	80.7	477.4	15.0	90.1	517.7	19.8	122.6	620.7	25.1	158.0	726.5	36.5	236.3	939.6
41	12.1	70.2	446.4	13.4	79.2	485.1	17.4	106.1	576.5	21.5	133.5	665.4	29.0	184.1	820.4
39	10.8	61.7	418.8	12.0	70.3	456.0	15.6	93.7	539.7	19.1	116.6	618.7	25.0	155.9	748.7
37	9.7	54.6	393.5	10.9	62.9	429.4	14.2	84.0	507.8	17.3	104.0	580.0	22.3	137.2	695.6
35	8.8	48.8	371.1	10.0	56.9	405.7	13.0	76.3	480.0	15.9	94.4	547.5	20.4	123.8	653.5
33	8.1	43.9	349.9	9.2	51.5	382.8	12.0	69.3	452.7	14.6	85.6	515.2	18.7	111.5	611.5
31	7.3	38.6	325.2	8.3	45.5	355.5	10.8	61.1	418.6	13.1	74.9	473.9	16.5	96.0	556.3
29	6.6	34.0	301.2	7.5	40.1	328.8	9.7	53.3	384.6	11.6	64.9	432.7	14.4	81.8	502.3
27	5.9	30.1	278.7	6.8	35.4	303.5	8.7	46.7	353.0	10.3	56.3	395.0	12.7	70.0	454.3
25	5.4	26.8	257.5	6.1	31.3	279.4	7.8	40.9	323.1	9.2	48.9	359.8	11.1	60.2	410.9
23	4.9	23.9	237.0	5.5	27.7	256.3	6.9	35.7	294.6	8.1	42.5	326.7	9.8	51.8	370.7
21	4.5	21.3	217.2	5.0	24.4	233.9	6.1	31.1	267.2	7.2	36.7	295.0	8.6	44.5	332.9
19	4.0	19.0	197.9	4.4	21.4	212.1	5.4	26.9	240.5	6.3	31.6	264.5	7.5	38.0	297.0
17	3.6	16.9	178.9	3.9	18.7	190.7	4.7	23.1	214.4	5.5	27.0	234.9	6.5	32.2	262.6
15	3.3	14.9	160.3	3.5	16.2	169.5	4.1	19.6	188.8	4.7	22.7	206.0	5.5	27.0	229.5
13	2.9	13.1	141.5	3.0	13.9	148.5	3.5	16.4	163.6	4.0	18.9	177.8	4.7	22.4	197.4
11	2.5	11.3	122.1	2.6	11.7	127.6	2.9	13.4	138.6	3.3	15.4	150.0	3.8	18.1	166.1
9	2.1	9.3	101.9	2.2	9.7	106.6	2.3	10.7	113.8	2.6	12.1	122.5	3.1	14.3	135.3
7	1.7	7.4	81.0	1.7	7.6	84.8	1.8	8.1	89.0	2.0	9.1	95.2	2.3	10.7	104.9
5	1.2	5.3	59.1	1.3	5.5	61.9	1.3	5.7	64.4	1.4	6.3	68.1	1.6	7.3	74.7
3	0.8	3.2	36.2	0.8	3.3	37.8	0.8	3.4	39.3	0.8	3.7	40.9	1.0	4.2	44.7
1	0.3	1.1	12.3	0.3	1.1	12.8	0.3	1.1	13.4	0.3	1.2	13.7	0.3	1.4	14.8

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 2 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-903a

WEIGHT 17,000 LB	ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
PRESSURE ALTITUDE — 1000 FEET	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
51															
49	28.4	176.4	731.5	30.0	189.9	785.3									
47	21.2	128.9	623.3	22.6	140.3	671.8	40.1	260.6	958.3						
45	17.5	104.9	563.5	18.9	115.7	609.8	26.7	169.0	760.8	39.2	254.6	976.6			
43	15.0	88.7	519.6	16.4	98.9	563.8	22.0	136.5	682.4	28.4	179.6	809.6	45.0	294.2	1111.4
41	13.2	76.6	483.7	14.5	86.4	526.1	19.1	116.6	629.2	23.8	148.3	731.9	32.9	209.8	919.0
39	11.7	67.0	452.6	13.1	76.4	493.4	17.0	102.4	587.0	21.0	128.3	676.6	27.8	174.0	828.0
37	10.5	59.1	424.5	11.8	68.2	463.8	15.4	91.4	551.0	18.9	113.9	632.5	24.7	152.0	765.6
35	9.5	52.7	399.8	10.8	61.5	437.7	14.2	83.0	520.2	17.3	103.2	596.1	22.5	136.8	717.5
33	8.7	47.3	376.6	9.9	55.6	412.6	13.0	75.2	490.1	15.9	93.4	560.1	20.5	122.7	669.9
31	7.8	41.5	349.7	9.0	49.0	382.8	11.7	66.1	452.5	14.2	81.5	514.3	18.0	105.3	607.6
29	7.1	36.5	323.6	8.1	43.2	353.7	10.5	57.7	415.3	12.6	70.4	468.8	15.7	89.3	547.0
27	6.4	32.3	299.3	7.3	38.1	326.4	9.4	50.4	380.8	11.2	61.0	427.3	13.8	76.3	493.7
25	5.8	28.7	276.4	6.6	33.7	300.3	8.4	44.1	348.3	9.9	52.9	388.8	12.1	65.4	445.7
23	5.3	25.6	254.4	5.9	29.7	275.4	7.5	38.5	317.4	8.8	45.9	352.7	10.6	56.2	401.5
21	4.8	22.8	233.0	5.3	26.2	251.2	6.6	33.5	287.6	7.7	39.7	318.2	9.3	48.1	360.2
19	4.3	20.3	212.3	4.8	23.0	227.7	5.8	29.0	258.7	6.8	34.1	285.1	8.1	41.1	321.0
17	3.9	18.1	192.0	4.2	20.1	204.7	5.1	24.9	230.6	5.9	29.1	253.0	7.0	34.8	283.6
15	3.5	16.0	172.0	3.7	17.4	181.9	4.4	21.1	202.9	5.1	24.5	221.8	6.0	29.2	247.6
13	3.1	14.1	151.8	3.2	14.9	159.4	3.7	17.6	175.8	4.3	20.3	191.3	5.0	24.1	212.9
11	2.7	12.1	131.0	2.8	12.6	137.0	3.1	14.4	148.9	3.5	16.5	161.3	4.1	19.5	179.0
9	2.3	10.0	109.4	2.3	10.4	114.4	2.5	11.5	122.2	2.8	13.0	131.7	3.3	15.4	145.8
7	1.8	7.9	87.0	1.9	8.2	91.1	1.9	8.7	95.6	2.2	9.8	102.4	2.5	11.5	113.0
5	1.3	5.7	63.5	1.4	5.9	66.4	1.4	6.1	69.1	1.5	6.8	73.2	1.8	7.9	80.5
3	0.8	3.4	38.8	0.8	3.6	40.6	0.8	3.7	42.2	0.9	3.9	44.0	1.0	4.6	48.1
1	0.3	1.2	13.2	0.3	1.2	13.8	0.3	1.2	14.4	0.3	1.3	14.7	0.3	1.5	16.0

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 3 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-904a

WEIGHT 18,000 LB	ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
PRESSURE ALTITUDE — 1000 FEET	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
51															
49															
47	24.7	151.3	703.2	26.2	163.7	756.4									
45	19.6	117.6	619.5	21.1	129.5	670.4	31.3	199.4	864.2						
43	16.5	97.6	565.3	18.0	108.8	613.7	24.5	152.8	751.7	32.6	207.4	910.6			
41	14.3	83.5	523.3	15.8	94.1	569.7	20.9	128.3	686.3	26.5	165.3	805.8	37.9	242.6	1038.2
39	12.7	72.6	487.9	14.1	82.8	532.5	18.5	111.7	637.1	23.0	141.2	739.2	31.0	194.8	916.8
37	11.3	63.8	456.6	12.8	73.7	499.7	16.7	99.4	596.6	20.6	124.7	688.6	27.3	168.5	842.2
35	10.2	56.8	429.4	11.7	66.3	470.9	15.3	90.0	562.5	18.9	112.7	647.8	24.8	151.0	787.1
33	9.3	50.8	404.1	10.7	59.9	443.5	14.1	81.5	529.2	17.3	101.7	607.7	22.5	135.1	733.1
31	8.4	44.6	374.9	9.6	52.7	410.9	12.7	71.5	488.0	15.4	88.5	556.9	19.7	115.3	662.5
29	7.6	39.1	346.6	8.7	46.4	379.4	11.3	62.2	447.2	13.6	76.3	506.7	17.1	97.4	594.4
27	6.8	34.6	320.4	7.8	40.9	349.9	10.1	54.3	409.6	12.1	65.9	461.1	15.0	82.9	535.1
25	6.2	30.8	295.8	7.1	36.1	321.8	9.0	47.4	374.4	10.7	57.1	419.0	13.1	70.9	482.2
23	5.6	27.4	272.1	6.4	31.8	294.9	8.0	41.4	340.9	9.5	49.4	379.7	11.5	60.8	433.8
21	5.1	24.4	249.2	5.7	28.0	269.0	7.1	36.0	308.7	8.3	42.7	342.3	10.0	52.0	388.7
19	4.6	21.8	227.0	5.1	24.6	243.7	6.3	31.1	277.6	7.3	36.7	306.4	8.7	44.3	346.0
17	4.2	19.3	205.3	4.5	21.5	219.0	5.5	26.7	247.2	6.3	31.2	271.8	7.5	37.5	305.4
15	3.8	17.1	184.0	4.0	18.6	194.7	4.7	22.6	217.5	5.4	26.3	238.1	6.4	31.4	266.5
13	3.3	15.0	162.4	3.5	15.9	170.5	4.0	18.9	188.3	4.6	21.8	205.3	5.4	26.0	228.9
11	2.9	12.9	140.2	3.0	13.4	146.5	3.3	15.5	159.5	3.8	17.7	173.0	4.4	21.0	192.3
9	2.4	10.7	117.1	2.5	11.1	122.4	2.7	12.3	130.8	3.0	14.0	141.2	3.5	16.5	156.6
7	2.0	8.5	93.1	2.0	8.8	97.5	2.1	9.3	102.4	2.3	10.5	109.7	2.7	12.3	121.3
5	1.4	6.1	68.0	1.5	6.4	71.1	1.5	6.6	74.0	1.6	7.3	78.4	1.9	8.5	86.3
3	0.9	3.7	41.6	0.9	3.8	43.5	0.9	3.9	45.2	1.0	4.2	47.1	1.1	4.9	51.6
1	0.3	1.2	14.1	0.3	1.3	14.8	0.3	1.3	15.4	0.3	1.4	15.7	0.4	1.6	17.1

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 4 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-905a

WEIGHT 19,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	51															
	49															
	47	30.7	189.7	824.5	32.1	202.0	880.4									
	45	22.1	133.6	685.4	23.8	146.5	741.1	39.3	252.9	1024.9						
	43	18.2	107.8	615.5	19.8	120.0	668.5	27.6	172.8	832.6	38.7	248.6	1046.9			
	41	15.6	91.0	565.5	17.2	102.6	616.2	23.0	141.4	748.8	29.6	185.3	889.9	44.8	289.4	1196.3
	39	13.7	78.5	525.0	15.3	89.7	573.8	20.2	121.9	690.8	25.3	155.5	807.5	34.8	219.2	1018.2
	37	12.2	68.7	490.1	13.7	79.4	537.1	18.1	107.9	644.8	22.5	136.3	748.9	30.2	187.0	927.0
	35	11.0	61.0	460.2	12.5	71.4	505.5	16.6	97.4	606.9	20.5	122.8	702.9	27.3	166.8	863.4
	33	10.0	54.5	432.5	11.5	64.3	475.5	15.2	88.0	570.3	18.8	110.6	658.4	24.7	148.7	801.9
	31	9.0	47.7	400.8	10.3	56.5	440.1	13.6	77.1	524.9	16.7	96.0	601.8	21.5	126.2	721.6
	29	8.1	41.8	370.3	9.3	49.6	406.0	12.1	67.0	480.5	14.7	82.4	546.4	18.6	106.0	645.0
	27	7.3	36.9	342.0	8.4	43.8	374.1	10.8	58.3	439.5	13.0	71.1	496.4	16.2	89.9	579.0
	25	6.6	32.8	315.7	7.6	38.6	343.9	9.7	50.9	401.3	11.5	61.5	450.5	14.2	76.7	520.7
	23	6.0	29.3	290.3	6.8	34.0	315.0	8.6	44.3	365.1	10.2	53.2	407.8	12.4	65.6	467.6
	21	5.5	26.1	265.9	6.1	29.9	287.2	7.6	38.5	330.4	8.9	45.8	367.3	10.8	56.0	418.5
	19	4.9	23.2	242.1	5.4	26.3	260.2	6.7	33.3	296.9	7.8	39.3	328.6	9.4	47.7	372.1
	17	4.5	20.6	219.0	4.8	22.9	233.7	5.8	28.5	264.3	6.8	33.5	291.2	8.1	40.3	328.1
	15	4.0	18.3	196.2	4.2	19.8	207.7	5.0	24.2	232.5	5.8	28.2	255.0	6.9	33.7	286.0
	13	3.6	16.0	173.3	3.7	17.0	181.9	4.3	20.2	201.2	4.9	23.4	219.7	5.8	27.8	245.5
	11	3.1	13.8	149.6	3.2	14.3	156.3	3.6	16.5	170.3	4.1	19.0	185.1	4.8	22.5	206.2
	9	2.6	11.4	124.9	2.7	11.8	130.6	2.9	13.1	139.7	3.2	15.0	151.0	3.8	17.7	167.7
	7	2.1	9.0	99.4	2.1	9.4	104.0	2.2	10.0	109.2	2.5	11.2	117.2	2.9	13.2	129.9
	5	1.5	6.5	72.5	1.6	6.8	75.9	1.6	7.0	78.9	1.7	7.8	83.7	2.0	9.1	92.4
	3	0.9	3.9	44.4	1.0	4.1	46.4	1.0	4.2	48.2	1.0	4.5	50.3	1.2	5.2	55.2
	1	0.3	1.3	15.1	0.3	1.4	15.8	0.3	1.4	16.4	0.3	1.5	16.8	0.4	1.7	18.3

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 5 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-906a

WEIGHT 20,000 LB	ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
PRESSURE ALTITUDE — 1000 FEET	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
51															
49															
47															
45	25.6	155.6	768.9	27.3	169.5	829.6									
43	20.1	119.9	672.0	21.9	133.1	730.0	31.6	199.3	932.8						
41	17.0	99.3	611.2	18.7	112.0	666.5	25.4	156.6	818.6	33.4	210.3	989.6			
39	14.8	84.9	564.4	16.5	97.0	617.6	22.0	133.0	748.8	27.8	171.7	883.1	39.3	249.0	1137.4
37	13.1	73.9	525.1	14.8	85.6	576.4	19.6	117.0	696.2	24.6	149.2	814.2	33.5	208.2	1022.2
35	11.8	65.4	492.1	13.5	76.7	541.5	17.9	105.4	654.0	22.3	133.9	762.2	30.1	184.7	947.9
33	10.7	58.3	461.9	12.3	68.9	508.8	16.4	95.0	613.6	20.4	120.3	712.5	27.2	163.9	877.5
31	9.6	51.0	427.6	11.1	60.5	470.3	14.7	83.0	563.8	18.1	104.0	649.6	23.5	138.3	785.9
29	8.6	44.6	394.6	9.9	53.0	433.4	13.0	71.9	515.2	15.9	89.0	588.3	20.2	115.4	699.2
27	7.8	39.4	364.3	8.9	46.7	399.1	11.6	62.5	470.6	14.0	76.6	533.4	17.5	97.4	625.7
25	7.0	34.9	336.0	8.1	41.2	366.6	10.3	54.5	429.3	12.4	66.1	483.5	15.3	82.9	561.3
23	6.4	31.1	309.0	7.2	36.3	335.6	9.2	47.4	390.3	10.9	57.0	437.1	13.3	70.7	503.2
21	5.8	27.7	282.9	6.5	31.9	305.9	8.1	41.2	353.0	9.6	49.1	393.3	11.6	60.3	449.7
19	5.3	24.7	257.6	5.8	28.0	277.0	7.2	35.5	317.0	8.4	42.1	351.5	10.1	51.2	399.4
17	4.7	21.9	233.0	5.1	24.4	248.8	6.2	30.4	282.0	7.3	35.8	311.3	8.7	43.2	351.8
15	4.3	19.4	208.8	4.5	21.1	221.1	5.4	25.8	247.9	6.2	30.1	272.4	7.4	36.1	306.4
13	3.8	17.1	184.4	3.9	18.1	193.6	4.6	21.5	214.4	5.2	25.0	234.6	6.2	29.8	262.8
11	3.3	14.7	159.2	3.4	15.3	166.4	3.8	17.6	181.5	4.3	20.3	197.5	5.1	24.1	220.5
9	2.8	12.2	133.0	2.8	12.6	139.1	3.1	14.0	148.8	3.5	16.0	161.1	4.1	18.9	179.3
7	2.2	9.6	105.8	2.3	10.0	110.8	2.4	10.6	116.3	2.6	12.0	125.0	3.1	14.1	138.8
5	1.6	6.9	77.3	1.7	7.2	80.9	1.7	7.5	84.1	1.9	8.3	89.2	2.2	9.7	98.7
3	1.0	4.2	47.3	1.0	4.4	49.4	1.0	4.5	51.3	1.1	4.8	53.6	1.3	5.6	58.9
1	0.3	1.4	16.1	0.3	1.5	16.8	0.3	1.5	17.5	0.4	1.6	17.9	0.4	1.8	19.5

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 6 of 9)

EFFECTIVITY
D E

CLIMB PERFORMANCE — TWO ENGINE

45-964a

WEIGHT 20,500 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	51															
	49															
	47															
	45	28.0	171.2	823.5	29.8	185.3	886.4									
	43	21.2	126.9	703.5	23.1	140.7	764.1	34.3	217.1	995.5						
	41	17.7	103.9	635.5	19.6	117.1	693.4	26.7	165.2	857.0	35.7	225.6	1048.2			
	39	15.3	88.3	585.0	17.1	100.9	640.5	22.9	139.1	779.7	29.2	180.7	924.3	42.0	266.8	1206.6
	37	13.5	76.6	543.3	15.3	88.8	596.8	20.4	121.9	723.3	25.7	156.1	849.0	35.3	220.1	1074.5
	35	12.2	67.7	508.6	13.9	79.4	560.2	18.6	109.6	678.6	23.3	139.8	793.6	31.7	194.5	993.9
	33	11.1	60.3	477.1	12.7	71.3	525.9	17.0	98.7	636.1	21.2	125.4	741.0	28.5	172.3	918.4
	31	9.9	52.6	441.3	11.4	62.5	485.8	15.2	86.1	584.0	18.8	108.2	674.7	24.6	144.8	820.2
	29	8.9	46.1	407.1	10.3	54.8	447.5	13.5	74.5	533.1	16.5	92.4	610.2	21.1	120.4	727.9
	27	8.0	40.6	375.7	9.2	48.2	411.9	12.0	64.7	486.7	14.5	79.4	552.7	18.2	101.4	650.1
	25	7.3	36.0	346.5	8.3	42.5	378.2	10.7	56.3	443.7	12.8	68.4	500.5	15.9	86.1	582.5
	23	6.6	32.1	318.5	7.5	37.4	346.2	9.5	49.0	403.2	11.3	59.0	452.2	13.8	73.4	521.7
	21	6.0	28.6	291.6	6.7	32.9	315.4	8.4	42.5	364.5	9.9	50.8	406.7	12.0	62.5	465.8
	19	5.4	25.4	265.5	6.0	28.8	285.6	7.4	36.7	327.2	8.7	43.5	363.3	10.4	53.0	413.5
	17	4.9	22.6	240.1	5.3	25.1	256.5	6.4	31.4	291.1	7.5	37.0	321.7	9.0	44.7	364.0
	15	4.4	20.0	215.2	4.7	21.8	227.9	5.5	26.6	255.8	6.4	31.1	281.4	7.6	37.4	316.9
	13	3.9	17.6	190.0	4.1	18.6	199.6	4.7	22.2	221.2	5.4	25.8	242.2	6.4	30.8	271.7
	11	3.4	15.1	164.1	3.5	15.7	171.5	3.9	18.1	187.2	4.5	20.9	203.9	5.3	24.9	227.9
	9	2.9	12.6	137.1	2.9	13.0	143.4	3.2	14.4	153.4	3.6	16.5	166.2	4.2	19.5	185.3
	7	2.3	9.9	109.1	2.3	10.3	114.2	2.4	10.9	120.0	2.7	12.3	129.0	3.2	14.6	143.3
	5	1.7	7.2	79.7	1.7	7.5	83.4	1.7	7.7	86.7	1.9	8.5	92.1	2.2	10.0	101.9
	3	1.0	4.3	48.7	1.0	4.5	51.0	1.1	4.6	52.9	1.1	5.0	55.3	1.3	5.8	60.8
	1	0.3	1.4	16.5	0.4	1.5	17.3	0.4	1.5	18.0	0.4	1.6	18.4	0.4	1.8	20.1

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 7 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-971

WEIGHT 21,000 LB	ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
PRESSURE ALTITUDE — 1000 FEET	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
51															
49															
47															
45	31.4	193.2	896.0	33.1	207.1	959.8									
43	22.5	134.7	738.0	24.4	149.1	801.3	37.8	240.4	1073.6						
41	18.5	108.8	661.2	20.4	122.5	721.6	28.2	174.7	898.6	38.5	244.0	1115.7			
39	15.9	91.9	606.3	17.8	105.0	664.3	23.9	145.5	812.1	30.7	190.4	968.2	45.1	287.5	1284.9
37	14.0	79.4	561.9	15.9	92.1	617.8	21.2	126.9	751.3	26.8	163.4	885.5	37.3	232.9	1130.7
35	12.6	70.0	525.4	14.4	82.3	579.2	19.3	113.9	704.0	24.3	146.0	826.4	33.3	205.0	1042.9
33	11.4	62.3	492.5	13.2	73.8	543.4	17.7	102.5	659.4	22.1	130.7	770.6	29.9	181.1	961.7
31	10.2	54.3	455.3	11.8	64.6	501.7	15.8	89.3	604.7	19.5	112.6	700.6	25.7	151.6	856.3
29	9.2	47.5	419.8	10.6	56.6	461.8	14.0	77.2	551.5	17.1	96.0	632.6	22.0	125.6	757.7
27	8.3	41.9	387.2	9.5	49.8	424.8	12.4	67.0	503.1	15.0	82.3	572.4	19.0	105.5	675.4
25	7.5	37.1	357.0	8.6	43.8	390.0	11.0	58.2	458.4	13.2	70.9	517.9	16.5	89.4	604.4
23	6.8	33.1	328.2	7.7	38.6	356.9	9.8	50.6	416.3	11.7	61.1	467.7	14.3	76.1	540.8
21	6.2	29.5	300.4	6.9	33.9	325.1	8.7	43.9	376.2	10.2	52.6	420.4	12.5	64.8	482.4
19	5.6	26.2	273.5	6.2	29.7	294.3	7.6	37.9	337.7	8.9	45.0	375.4	10.8	54.9	427.9
17	5.0	23.3	247.3	5.5	25.9	264.3	6.6	32.4	300.3	7.7	38.2	332.2	9.3	46.3	376.5
15	4.5	20.6	221.7	4.8	22.4	234.8	5.7	27.4	263.8	6.6	32.1	290.5	7.9	38.7	327.6
13	4.0	18.1	195.8	4.2	19.2	205.7	4.9	22.9	228.1	5.6	26.6	250.0	6.6	31.9	280.7
11	3.5	15.6	169.1	3.6	16.2	176.7	4.0	18.7	193.0	4.6	21.6	210.4	5.4	25.7	235.4
9	2.9	12.9	141.3	3.0	13.4	147.7	3.3	14.8	158.2	3.7	17.0	171.5	4.3	20.2	191.3
7	2.4	10.2	112.4	2.4	10.6	117.7	2.5	11.3	123.6	2.8	12.7	133.0	3.3	15.1	148.0
5	1.7	7.4	82.1	1.8	7.7	85.9	1.8	7.9	89.3	2.0	8.8	94.9	2.3	10.3	105.2
3	1.1	4.5	50.2	1.1	4.6	52.5	1.1	4.7	54.5	1.2	5.1	57.0	1.3	6.0	62.8
1	0.4	1.5	17.1	0.4	1.5	17.8	0.4	1.6	18.6	0.4	1.7	19.0	0.4	1.9	20.8

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 8 of 9)

CLIMB PERFORMIANCE — TWO ENGINE

45-972

WEIGHT 21,500 LB	ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
PRESSURE ALTITUDE — 1000 FEET	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
51															
49															
47															
45	36.9	228.5	1004.6	38.2	240.8	1066.3									
43	23.9	143.8	776.3	25.9	158.8	842.4	42.8	274.2	1180.5						
41	19.4	114.1	688.2	21.4	128.4	751.3	29.9	185.4	943.9	41.9	267.0	1196.8			
39	16.6	95.7	628.4	18.5	109.3	688.9	25.0	152.3	846.1	32.4	201.0	1015.4	48.8	312.2	1375.6
37	14.5	82.3	581.1	16.5	95.5	639.4	22.1	132.2	780.4	28.1	171.1	923.9	39.4	247.0	1191.4
35	13.0	72.4	542.6	14.9	85.2	598.8	20.1	118.4	730.2	25.4	152.5	860.5	35.1	216.4	1095.1
33	11.8	64.3	508.2	13.6	76.3	561.3	18.3	106.4	683.3	23.0	136.3	801.4	31.4	190.6	1007.5
31	10.5	56.1	469.5	12.2	66.7	517.8	16.3	92.5	626.0	20.3	117.1	727.4	26.9	158.9	894.2
29	9.4	49.0	432.6	10.9	58.4	476.4	14.5	79.9	570.3	17.7	99.6	655.8	22.9	131.1	788.7
27	8.5	43.1	398.9	9.8	51.3	438.0	12.8	69.2	519.8	15.6	85.3	592.6	19.7	109.8	701.6
25	7.7	38.3	367.7	8.8	45.2	402.0	11.4	60.2	473.3	13.7	73.4	535.8	17.1	92.9	626.9
23	7.0	34.1	337.9	7.9	39.8	367.7	10.1	52.3	429.7	12.1	63.2	483.5	14.9	78.9	560.3
21	6.3	30.3	309.3	7.1	34.9	334.9	8.9	45.3	388.2	10.6	54.3	434.4	12.9	67.1	499.4
19	5.7	27.0	281.6	6.3	30.6	303.2	7.9	39.1	348.3	9.2	46.5	387.7	11.2	56.8	442.7
17	5.2	24.0	254.7	5.6	26.7	272.2	6.9	33.4	309.6	8.0	39.5	342.9	9.6	47.9	389.2
15	4.7	21.3	228.2	4.9	23.1	241.8	5.9	28.3	271.9	6.8	33.2	299.8	8.2	40.0	338.5
13	4.1	18.7	201.6	4.3	19.8	211.8	5.0	23.6	235.1	5.8	27.5	257.9	6.8	32.9	290.0
11	3.6	16.0	174.1	3.7	16.7	182.0	4.2	19.3	198.8	4.8	22.3	216.9	5.6	26.6	243.1
9	3.0	13.3	145.5	3.1	13.8	152.1	3.4	15.3	162.9	3.8	17.5	176.8	4.5	20.8	197.5
7	2.4	10.5	115.8	2.5	10.9	121.2	2.6	11.6	127.4	2.9	13.1	137.1	3.4	15.5	152.7
5	1.8	7.6	84.6	1.8	7.9	88.5	1.8	8.2	92.0	2.0	9.1	97.8	2.4	10.7	108.5
3	1.1	4.6	51.8	1.1	4.8	54.1	1.1	4.9	56.2	1.2	5.3	58.7	1.4	6.2	64.8
1	0.4	1.5	17.6	0.4	1.6	18.4	0.4	1.6	19.1	0.4	1.7	19.6	0.4	2.0	21.4

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7 (Sheet 9 of 9)

CRUISE PERFORMANCE

The cruise performance on the following pages is based on flight test data and represents the average delivered aircraft.

CONSTANT MACH

The Constant Mach tables (Figure 8-8) provide fuel flows and true airspeed for constant 0.76 MI cruise at weights from 14,500 to 21,000 pounds. Engine power is adjusted to maintain constant Mach as weight decreases. Standard and off-standard day temperatures provide interpolation factors.

SPECIFIC RANGE

Figure 8-9 presents a graphic description of the range capability at ISA as a function of weight and altitude. The data is based on two engine, long-range cruise at ISA. In general, the cruise altitude selected should be near the maximum nautical miles per pound of fuel for a given aircraft weight.

LONG RANGE CRUISE — TWO ENGINES

The Long-Range Cruise — Two-Engine tables (Figure 8-10) provide fuel flow, indicated Mach or airspeed, and true airspeed for 99% maximum range cruise at weights from 14,500 to 21,000 pounds. Standard and off-standard day temperatures provide interpolation factors.

HIGH-SPEED CRUISE

The High Speed Cruise tables (Figure 8-11) provide fuel flows, indicated Mach or airspeed, and true airspeed for a MMO/VMO or VMAX cruise at weights from 14,500 to 21,000 pounds. The cruise speed is MMO/VMO or that resulting from maximum cruise power (MCR) whichever is lower. Standard and off-standard day temperatures provide interpolation factors.

LONG-RANGE CRUISE — ONE ENGINE

The Long-Range Cruise — One Engine tables (Figure 8-12) provide fuel flows, indicated Mach or airspeed and true airspeed for 99% maximum range cruise at weights from 14,500 to 21,000 pounds. Standard and off-standard day temperatures provide interpolation factors.

OXYGEN QUANTITY MISSION PLANNING

The Oxygen Quantity Mission Planning table (Figure 8-13) provides oxygen quantity requirements based on the mission profile. Two profiles are presented — one crew member using oxygen in the normal mode while at altitudes above 35,000 feet and one crew member using oxygen in the normal mode while at altitudes above 41,000 feet.

CONSTANT MACH CRUISE

45-909a

WEIGHT — 14,500 LB Mach — .76 M_I		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS	426				
	Fuel - Lb/Hr	796				
49	KTAS	426	436			
	Fuel - Lb/Hr	814	833			
47	KTAS	426	436			
	Fuel - Lb/Hr	842	862			
45	KTAS	426	436			
	Fuel - Lb/Hr	882	903			
43	KTAS	426	436			
	Fuel - Lb/Hr	933	956			
41	KTAS	426	436	446		
	Fuel - Lb/Hr	994	1017	1041		
39	KTAS	426	436	446		
	Fuel - Lb/Hr	1063	1088	1113		
37	KTAS	426	436	446	451	
	Fuel - Lb/Hr	1141	1168	1195	1208	
35	KTAS	428	438	448	453	
	Fuel - Lb/Hr	1237	1266	1295	1309	
30	KTAS	438	448	457		
	Fuel - Lb/Hr	1538	1573	1607		
25	KTAS	448	457			
	Fuel - Lb/Hr	1901	1942			

45-910a

WEIGHT — 15,000 LB Mach — .76 M_I		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS	426				
	Fuel - Lb/Hr	819				
49	KTAS	426	436			
	Fuel - Lb/Hr	832	852			
47	KTAS	426	436			
	Fuel - Lb/Hr	857	877			
45	KTAS	426	436			
	Fuel - Lb/Hr	894	915			
43	KTAS	426	436			
	Fuel - Lb/Hr	942	964			
41	KTAS	426	436	446		
	Fuel - Lb/Hr	1001	1025	1049		
39	KTAS	426	436	446		
	Fuel - Lb/Hr	1070	1095	1120		
37	KTAS	426	436	446	451	
	Fuel - Lb/Hr	1147	1175	1202	1215	
35	KTAS	428	438	448	453	
	Fuel - Lb/Hr	1243	1272	1301	1315	
30	KTAS	438	448	457		
	Fuel - Lb/Hr	1543	1578	1612		
25	KTAS	448	457			
	Fuel - Lb/Hr	1905	1946			

Figure 8-8 (Sheet 1 of 7)

CONSTANT MACH CRUISE

45-911a

WEIGHT — 15,500 LB Mach — .76 MI			TEMPERATURE — °C				
			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS	426				
		Fuel - Lb/Hr	845				
	49	KTAS	426				
		Fuel - Lb/Hr	845				
	47	KTAS	426	436			
		Fuel - Lb/Hr	872	893			
	45	KTAS	426	436			
		Fuel - Lb/Hr	906	928			
	43	KTAS	426	436			
		Fuel - Lb/Hr	951	974			
	41	KTAS	426	436	446		
		Fuel - Lb/Hr	1009	1033	1057		
	39	KTAS	426	436	446		
		Fuel - Lb/Hr	1077	1103	1128		
	37	KTAS	426	436	446	451	
		Fuel - Lb/Hr	1154	1182	1209	1222	
	35	KTAS	428	438	448	453	
		Fuel - Lb/Hr	1249	1279	1308	1322	
	30	KTAS	438	448	457		
		Fuel - Lb/Hr	1548	1583	1618		
	25	KTAS	448	457			
		Fuel - Lb/Hr	1910	1951			

45-912a

WEIGHT — 16,000 LB Mach — .76 MI			TEMPERATURE — °C				
			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS	426				
		Fuel - Lb/Hr	866				
	47	KTAS	426	436			
		Fuel - Lb/Hr	888	909			
	45	KTAS	426	436			
		Fuel - Lb/Hr	920	942			
	43	KTAS	426	436			
		Fuel - Lb/Hr	963	986			
	41	KTAS	426	436	446		
		Fuel - Lb/Hr	1017	1042	1065		
	39	KTAS	426	436	446		
		Fuel - Lb/Hr	1085	1111	1136		
	37	KTAS	426	436	446	451	
		Fuel - Lb/Hr	1161	1189	1216	1230	
	35	KTAS	428	438	448	453	
		Fuel - Lb/Hr	1256	1286	1315	1329	
	30	KTAS	438	448	457		
		Fuel - Lb/Hr	1554	1589	1623		
	25	KTAS	448	457			
		Fuel - Lb/Hr	1914	1955			

Figure 8-8 (Sheet 2 of 7)

CONSTANT MACH CRUISE

45-913a

WEIGHT — 16,500 LB Mach — .76 MI		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS	426				
	Fuel - Lb/Hr	889				
47	KTAS	426	436			
	Fuel - Lb/Hr	906	928			
45	KTAS	426	436			
	Fuel - Lb/Hr	934	957			
43	KTAS	426	436			
	Fuel - Lb/Hr	974	998			
41	KTAS	426	436			
	Fuel - Lb/Hr	1026	1051			
39	KTAS	426	436	446		
	Fuel - Lb/Hr	1092	1118	1144		
37	KTAS	426	436	446	451	
	Fuel - Lb/Hr	1169	1197	1224	1237	
35	KTAS	428	438	448	453	
	Fuel - Lb/Hr	1263	1293	1322	1336	
30	KTAS	438	448	457		
	Fuel - Lb/Hr	1560	1595	1629		
25	KTAS	448	457			
	Fuel - Lb/Hr	1918	1960			

45-914a

WEIGHT — 17,000 LB Mach — .76 MI		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS	426				
	Fuel - Lb/Hr	914				
47	KTAS	426				
	Fuel - Lb/Hr	919				
45	KTAS	426	436			
	Fuel - Lb/Hr	949	972			
43	KTAS	426	436			
	Fuel - Lb/Hr	986	1010			
41	KTAS	426	436			
	Fuel - Lb/Hr	1037	1062			
39	KTAS	426	436	446		
	Fuel - Lb/Hr	1100	1126	1152		
37	KTAS	426	436	446		
	Fuel - Lb/Hr	1176	1204	1232		
35	KTAS	428	438	448	453	
	Fuel - Lb/Hr	1270	1300	1329	1344	
30	KTAS	438	448	457		
	Fuel - Lb/Hr	1565	1601	1635		
25	KTAS	448	457			
	Fuel - Lb/Hr	1923	1965			

Figure 8-8 (Sheet 3 of 7)

CONSTANT MACH CRUISE

45-915a

WEIGHT — 17,500 LB			TEMPERATURE — °C				
Mach — .76 MI			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS	426				
		Fuel - Lb/Hr	939				
	45	KTAS	426	436			
		Fuel - Lb/Hr	964	987			
	43	KTAS	426	436			
		Fuel - Lb/Hr	1000	1024			
	41	KTAS	426	436			
		Fuel - Lb/Hr	1048	1073			
	39	KTAS	426	436	446		
		Fuel - Lb/Hr	1108	1135	1161		
	37	KTAS	426	436	446		
		Fuel - Lb/Hr	1184	1212	1240		
	35	KTAS	428	438	448	453	
		Fuel - Lb/Hr	1277	1307	1337	1351	
	30	KTAS	438	448	457		
		Fuel - Lb/Hr	1571	1607	1642		
	25	KTAS	448	457			
		Fuel - Lb/Hr	1928	1970			

45-916a

WEIGHT — 18,000 LB			TEMPERATURE — °C				
Mach — .76 MI			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS	426				
		Fuel - Lb/Hr	961				
	45	KTAS	426	436			
		Fuel - Lb/Hr	982	1005			
	43	KTAS	426	436			
		Fuel - Lb/Hr	1013	1038			
	41	KTAS	426	436			
		Fuel - Lb/Hr	1060	1085			
	39	KTAS	426	436	446		
		Fuel - Lb/Hr	1118	1144	1170		
	37	KTAS	426	436	446		
		Fuel - Lb/Hr	1191	1220	1248		
	35	KTAS	428	438	448		
		Fuel - Lb/Hr	1284	1315	1344		
	30	KTAS	438	448	457		
		Fuel - Lb/Hr	1577	1613	1648		
	25	KTAS	448	457			
		Fuel - Lb/Hr	1933	1975			

Figure 8-8 (Sheet 4 of 7)

CONSTANT MACH CRUISE

45-917a

WEIGHT — 18,500 LB Mach — .76 MI		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS	426				
	Fuel - Lb/Hr	985				
45	KTAS	426				
	Fuel - Lb/Hr	992				
43	KTAS	426	436			
	Fuel - Lb/Hr	1028	1052			
41	KTAS	426	436			
	Fuel - Lb/Hr	1072	1097			
39	KTAS	426	436			
	Fuel - Lb/Hr	1128	1155			
37	KTAS	426	436	446		
	Fuel - Lb/Hr	1199	1228	1256		
35	KTAS	428	438	448		
	Fuel - Lb/Hr	1292	1322	1352		
30	KTAS	438	448	457		
	Fuel - Lb/Hr	1584	1619	1654		
25	KTAS	448	457			
	Fuel - Lb/Hr	1938	1980			

45-918a

WEIGHT — 19,000 LB Mach — .76 MI		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS	426				
	Fuel - Lb/Hr	1012				
45	KTAS	426				
	Fuel - Lb/Hr	1012				
43	KTAS	426	436			
	Fuel - Lb/Hr	1042	1067			
41	KTAS	426	436			
	Fuel - Lb/Hr	1084	1110			
39	KTAS	426	436			
	Fuel - Lb/Hr	1139	1166			
37	KTAS	426	436	446		
	Fuel - Lb/Hr	1207	1236	1264		
35	KTAS	428	438	448		
	Fuel - Lb/Hr	1299	1330	1360		
30	KTAS	438	448	457		
	Fuel - Lb/Hr	1590	1626	1661		
25	KTAS	448	457			
	Fuel - Lb/Hr	1944	1986			

Figure 8-8 (Sheet 5 of 7)

CONSTANT MACH CRUISE

45-919a

WEIGHT — 19,500 LB			TEMPERATURE — °C				
Mach — .76 MI			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS					
		Fuel - Lb/Hr					
	45	KTAS	426				
		Fuel - Lb/Hr	1032				
	43	KTAS	426	436			
		Fuel - Lb/Hr	1058	1083			
	41	KTAS	426	436			
		Fuel - Lb/Hr	1097	1124			
	39	KTAS	426	436			
		Fuel - Lb/Hr	1150	1178			
	37	KTAS	426	436	446		
		Fuel - Lb/Hr	1215	1244	1273		
	35	KTAS	428	438	448		
		Fuel - Lb/Hr	1307	1338	1368		
	30	KTAS	438	448			
		Fuel - Lb/Hr	1597	1633			
	25	KTAS	448	457			
		Fuel - Lb/Hr	1950	1992			

45-920a

WEIGHT — 20,000 LB			TEMPERATURE — °C				
Mach — .76 MI			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS					
		Fuel - Lb/Hr					
	45	KTAS	426				
		Fuel - Lb/Hr	1054				
	43	KTAS	426	436			
		Fuel - Lb/Hr	1075	1101			
	41	KTAS	426	436			
		Fuel - Lb/Hr	1111	1138			
	39	KTAS	426	436			
		Fuel - Lb/Hr	1162	1189			
	37	KTAS	426	436	446		
		Fuel - Lb/Hr	1225	1254	1283		
	35	KTAS	428	438	448		
		Fuel - Lb/Hr	1316	1347	1378		
	30	KTAS	438	448			
		Fuel - Lb/Hr	1603	1640			
	25	KTAS	448	457			
		Fuel - Lb/Hr	1956	1998			

Figure 8-8 (Sheet 6 of 7)

CONSTANT MACH CRUISE

45-965

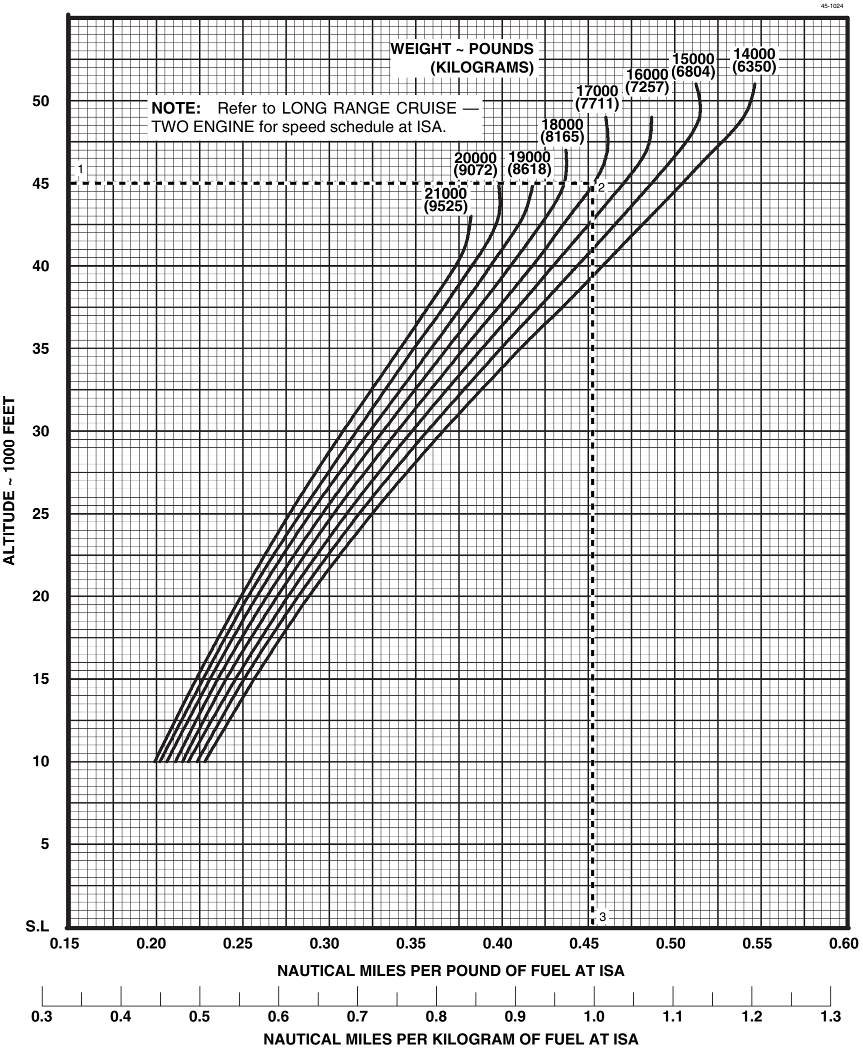
WEIGHT — 20,500 LB	Mach — .76 MI		TEMPERATURE — °C				
ALTITUDE — 1000 FEET			ISA -10	ISA	ISA +10	ISA +15	ISA +20
	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS					
		Fuel - Lb/Hr					
	45	KTAS	426				
		Fuel - Lb/Hr	1078				
	43	KTAS	426	436			
		Fuel - Lb/Hr	1093	1120			
	41	KTAS	426	436			
		Fuel - Lb/Hr	1125	1152			
	39	KTAS	426	436			
		Fuel - Lb/Hr	1173	1201			
	37	KTAS	426	436	446		
		Fuel - Lb/Hr	1235	1265	1294		
	35	KTAS	428	438	448		
		Fuel - Lb/Hr	1325	1356	1387		
	30	KTAS	438	448			
		Fuel - Lb/Hr	1610	1647			
	25	KTAS	448	457			
		Fuel - Lb/Hr	1962	2004			

45-966

WEIGHT — 21,000 LB	Mach — .76 MI		TEMPERATURE — °C				
ALTITUDE — 1000 FEET			ISA -10	ISA	ISA +10	ISA +15	ISA +20
	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS					
		Fuel - Lb/Hr					
	45	KTAS	426				
		Fuel - Lb/Hr	1105				
	43	KTAS	426				
		Fuel - Lb/Hr	1105				
	41	KTAS	426	436			
		Fuel - Lb/Hr	1139	1167			
	39	KTAS	426	436			
		Fuel - Lb/Hr	1186	1214			
	37	KTAS	426	436	446		
		Fuel - Lb/Hr	1246	1276	1305		
	35	KTAS	428	438	448		
		Fuel - Lb/Hr	1334	1366	1397		
	30	KTAS	438	448			
		Fuel - Lb/Hr	1617	1654			
	25	KTAS	448	457			
		Fuel - Lb/Hr	1968	2010			

Figure 8-8 (Sheet 7 of 7)

SPECIFIC RANGE



EXAMPLE:

1. Altitude .... 45,000 ft
2. Weight .... 17,000 lb (7711 kg)
3. Specific Range .... 0.453 NM/lb (0.99 NM/kg)

Figure 8-9

LONG RANGE CRUISE

45-923a

WEIGHT — 14,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind	.719				
	KTAS	403				
	Fuel - Lb/Hr	756				
49	Mach Ind	.748	.748			
	KTAS	419	429			
	Fuel - Lb/Hr	792	811			
47	Mach Ind	.750	.750			
	KTAS	420	430			
	Fuel - Lb/Hr	820	839			
45	Mach Ind	.731	.731	.731		
	KTAS	409	419	429		
	Fuel - Lb/Hr	830	849	869		
43	Mach Ind	.692	.692	.692	.692	
	KTAS	388	397	406	411	
	Fuel - Lb/Hr	813	833	852	861	
41	Mach Ind	.660	.660	.660	.660	.660
	KTAS	370	379	387	392	396
	Fuel - Lb/Hr	805	824	843	852	861
39	Mach Ind	.634	.634	.634	.634	.634
	KTAS	355	364	372	376	380
	Fuel - Lb/Hr	803	822	841	850	859
37	Mach Ind	.613	.613	.613	.613	.613
	KTAS	344	352	360	364	368
	Fuel - Lb/Hr	810	830	849	858	867
35	Mach Ind	.591	.591	.591	.591	.591
	KTAS	333	341	349	352	356
	Fuel - Lb/Hr	822	841	860	870	879
30	Mach Ind	.541	.541	.541	.541	.541
	KTAS	312	319	326	329	332
	Fuel - Lb/Hr	864	884	903	913	922
25	KIAS	201	201	201	201	201
	KTAS	288	294	300	303	306
	Fuel - Lb/Hr	898	917	936	946	955
20	KIAS	204	204	204	204	204
	KTAS	270	276	281	284	287
	Fuel - Lb/Hr	949	968	988	997	1007
15	KIAS	202	202	202	202	202
	KTAS	248	253	258	260	262
	Fuel - Lb/Hr	977	997	1016	1025	1034
10	KIAS	204	204	204	204	204
	KTAS	232	236	241	243	245
	Fuel - Lb/Hr	1028	1047	1067	1076	1086
5	KIAS	207	207	207	207	207
	KTAS	218	222	226	228	230
	Fuel - Lb/Hr	1098	1119	1139	1148	1158
S.L.	KIAS	206	206	206	206	206
	KTAS	202	206	210	211	213
	Fuel - Lb/Hr	1161	1182	1202	1212	1222

Figure 8-10 (Sheet 1 of 14)

LONG RANGE CRUISE

45-924a

WEIGHT — 15,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.753	.753			
	KTAS	422	432			
	Fuel - Lb/Hr	819	838			
47	Mach Ind	.746	.746			
	KTAS	418	428			
	Fuel - Lb/Hr	829	849			
45	Mach Ind	.743	.743			
	KTAS	416	426			
	Fuel - Lb/Hr	859	879			
43	Mach Ind	.706	.706	.706	.706	
	KTAS	395	405	414	418	
	Fuel - Lb/Hr	843	864	883	893	
41	Mach Ind	.670	.670	.670	.670	.670
	KTAS	375	384	393	397	401
	Fuel - Lb/Hr	830	850	869	878	888
39	Mach Ind	.642	.642	.642	.642	.642
	KTAS	360	368	377	381	385
	Fuel - Lb/Hr	826	846	865	875	884
37	Mach Ind	.617	.617	.617	.617	.617
	KTAS	346	354	362	366	370
	Fuel - Lb/Hr	827	847	866	876	885
35	Mach Ind	.596	.596	.596	.596	.596
	KTAS	336	344	351	355	359
	Fuel - Lb/Hr	840	860	879	889	898
30	Mach Ind	.545	.545	.545	.545	.545
	KTAS	314	321	328	332	335
	Fuel - Lb/Hr	883	902	922	932	941
25	KIAS	203	203	203	203	203
	KTAS	291	298	304	307	310
	Fuel - Lb/Hr	919	939	958	968	977
20	KIAS	206	206	206	206	206
	KTAS	273	279	284	287	290
	Fuel - Lb/Hr	969	989	1009	1018	1028
15	KIAS	205	205	205	205	205
	KTAS	251	256	261	264	266
	Fuel - Lb/Hr	1002	1021	1041	1051	1060
10	KIAS	206	206	206	206	206
	KTAS	234	239	243	245	248
	Fuel - Lb/Hr	1049	1069	1089	1098	1108
5	KIAS	209	209	209	209	209
	KTAS	220	224	228	230	232
	Fuel - Lb/Hr	1120	1141	1161	1171	1181
S.L.	KIAS	208	208	208	208	208
	KTAS	205	208	212	214	216
	Fuel - Lb/Hr	1187	1208	1229	1239	1249

Figure 8-10 (Sheet 2 of 14)

LONG RANGE CRUISE

45-925a

ALTITUDE — 1000 FEET	WEIGHT — 15,500 LB	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.751				
	KTAS	421				
	Fuel - Lb/Hr	836				
47	Mach Ind	.741	.741			
	KTAS	415	425			
	Fuel - Lb/Hr	837	857			
45	Mach Ind	.749	.749			
	KTAS	420	430			
	Fuel - Lb/Hr	880	901			
43	Mach Ind	.717	.717	.717		
	KTAS	402	411	421		
	Fuel - Lb/Hr	871	892	912		
41	Mach Ind	.681	.681	.681	.681	.681
	KTAS	382	391	400	404	408
	Fuel - Lb/Hr	858	878	898	908	918
39	Mach Ind	.650	.650	.650	.650	.650
	KTAS	364	373	381	385	389
	Fuel - Lb/Hr	849	869	889	899	909
37	Mach Ind	.625	.625	.625	.625	.625
	KTAS	350	358	366	370	374
	Fuel - Lb/Hr	849	870	889	899	909
35	Mach Ind	.600	.600	.600	.600	.600
	KTAS	338	346	354	358	362
	Fuel - Lb/Hr	857	878	897	907	917
30	Mach Ind	.549	.549	.549	.549	.549
	KTAS	316	324	331	334	338
	Fuel - Lb/Hr	900	920	940	950	959
25	KIAS	205	205	205	205	205
	KTAS	295	301	307	310	313
	Fuel - Lb/Hr	940	960	980	990	1000
20	KIAS	209	209	209	209	209
	KTAS	276	282	287	290	293
	Fuel - Lb/Hr	990	1011	1031	1041	1051
15	KIAS	208	208	208	208	208
	KTAS	255	260	265	267	270
	Fuel - Lb/Hr	1026	1047	1067	1076	1086
10	KIAS	208	208	208	208	208
	KTAS	237	241	246	248	250
	Fuel - Lb/Hr	1070	1090	1111	1120	1130
5	KIAS	211	211	211	211	211
	KTAS	222	227	231	233	235
	Fuel - Lb/Hr	1141	1163	1183	1193	1204
S.L.	KIAS	211	211	211	211	211
	KTAS	207	211	215	216	218
	Fuel - Lb/Hr	1212	1234	1255	1266	1276

Figure 8-10 (Sheet 3 of 14)

LONG RANGE CRUISE

45-926a

	WEIGHT — 16,000 LB	TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.733				
	KTAS	411				
	Fuel - Lb/Hr	835				
47	Mach Ind	.748	.748			
	KTAS	419	429			
	Fuel - Lb/Hr	866	887			
45	Mach Ind	.748	.748			
	KTAS	419	429			
	Fuel - Lb/Hr	892	914			
43	Mach Ind	.730	.730	.730		
	KTAS	409	418	428		
	Fuel - Lb/Hr	902	923	944		
41	Mach Ind	.694	.694	.694	.694	
	KTAS	389	398	407	412	
	Fuel - Lb/Hr	888	909	930	940	
39	Mach Ind	.659	.659	.659	.659	.659
	KTAS	369	378	386	391	395
	Fuel - Lb/Hr	874	895	916	926	936
37	Mach Ind	.632	.632	.632	.632	.632
	KTAS	354	362	371	375	379
	Fuel - Lb/Hr	872	893	914	924	933
35	Mach Ind	.608	.608	.608	.608	.608
	KTAS	342	350	358	362	366
	Fuel - Lb/Hr	880	901	921	931	941
30	Mach Ind	.553	.553	.553	.553	.553
	KTAS	319	326	333	336	340
	Fuel - Lb/Hr	917	938	958	968	978
25	KIAS	207	207	207	207	207
	KTAS	298	304	310	313	316
	Fuel - Lb/Hr	961	981	1002	1012	1022
20	KIAS	211	211	211	211	211
	KTAS	279	285	290	293	296
	Fuel - Lb/Hr	1010	1031	1052	1062	1072
15	KIAS	211	211	211	211	211
	KTAS	258	263	268	271	273
	Fuel - Lb/Hr	1051	1072	1092	1102	1113
10	KIAS	210	210	210	210	210
	KTAS	239	243	248	250	252
	Fuel - Lb/Hr	1091	1112	1132	1143	1153
5	KIAS	213	213	213	213	213
	KTAS	225	229	233	235	237
	Fuel - Lb/Hr	1163	1185	1206	1216	1226
S.L.	KIAS	213	213	213	213	213
	KTAS	210	213	217	219	221
	Fuel - Lb/Hr	1238	1260	1282	1292	1303

Figure 8-10 (Sheet 4 of 14)

LONG RANGE CRUISE

45-927a

WEIGHT — 16,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.753	.753			
	KTAS	422	432			
	Fuel - Lb/Hr	892	914			
45	Mach Ind	.745	.745			
	KTAS	417	427			
	Fuel - Lb/Hr	902	924			
43	Mach Ind	.740	.740	.740		
	KTAS	414	424	434		
	Fuel - Lb/Hr	929	951	973		
41	Mach Ind	.706	.706	.706	.706	
	KTAS	395	405	414	419	
	Fuel - Lb/Hr	917	939	960	971	
39	Mach Ind	.668	.668	.668	.668	.668
	KTAS	374	383	392	396	400
	Fuel - Lb/Hr	900	921	942	953	963
37	Mach Ind	.639	.639	.639	.639	.639
	KTAS	358	366	375	379	383
	Fuel - Lb/Hr	895	916	937	947	958
35	Mach Ind	.615	.615	.615	.615	.615
	KTAS	346	354	362	366	370
	Fuel - Lb/Hr	904	925	946	956	966
30	Mach Ind	.557	.557	.557	.557	.557
	KTAS	321	328	335	339	342
	Fuel - Lb/Hr	935	956	977	987	997
25	KIAS	209	209	209	209	209
	KTAS	300	307	313	316	320
	Fuel - Lb/Hr	981	1002	1023	1033	1044
20	KIAS	213	213	213	213	213
	KTAS	282	288	293	296	299
	Fuel - Lb/Hr	1032	1053	1074	1085	1095
15	KIAS	214	214	214	214	214
	KTAS	261	267	272	274	277
	Fuel - Lb/Hr	1076	1097	1118	1129	1139
10	KIAS	212	212	212	212	212
	KTAS	241	246	250	252	255
	Fuel - Lb/Hr	1112	1134	1154	1165	1175
5	KIAS	215	215	215	215	215
	KTAS	227	231	235	237	239
	Fuel - Lb/Hr	1185	1207	1228	1239	1249
S.L.	KIAS	220	220	220	220	220
	KTAS	216	220	223	225	227
	Fuel - Lb/Hr	1287	1309	1332	1343	1354

Figure 8-10 (Sheet 5 of 14)

EFFECTIVITY
D E

LONG RANGE CRUISE

45-928a

		TEMPERATURE — °C				
ALTITUDE — 1000 FEET	WEIGHT — 17,000 LB	ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.754				
	KTAS	422				
	Fuel - Lb/Hr	914				
45	Mach Ind	.742	.742			
	KTAS	415	425			
	Fuel - Lb/Hr	913	935			
43	Mach Ind	.746	.746			
	KTAS	418	428			
	Fuel - Lb/Hr	951	974			
41	Mach Ind	.715	.715	.715	.715	
	KTAS	400	410	419	424	
	Fuel - Lb/Hr	943	966	988	998	
39	Mach Ind	.679	.679	.679	.679	.679
	KTAS	380	389	398	402	407
	Fuel - Lb/Hr	928	951	972	983	993
37	Mach Ind	.646	.646	.646	.646	.646
	KTAS	362	370	379	383	387
	Fuel - Lb/Hr	917	939	961	971	982
35	Mach Ind	.622	.622	.622	.622	.622
	KTAS	350	359	367	371	375
	Fuel - Lb/Hr	927	949	971	981	992
30	Mach Ind	.563	.563	.563	.563	.563
	KTAS	324	332	339	342	346
	Fuel - Lb/Hr	957	978	1000	1010	1020
25	KIAS	211	211	211	211	211
	KTAS	303	310	316	319	322
	Fuel - Lb/Hr	1001	1023	1044	1054	1065
20	KIAS	215	215	215	215	215
	KTAS	284	290	295	298	301
	Fuel - Lb/Hr	1051	1072	1094	1104	1115
15	KIAS	216	216	216	216	216
	KTAS	265	270	275	278	280
	Fuel - Lb/Hr	1100	1122	1143	1154	1164
10	KIAS	214	214	214	214	214
	KTAS	243	248	253	255	257
	Fuel - Lb/Hr	1135	1156	1178	1188	1199
5	KIAS	217	217	217	217	217
	KTAS	229	233	237	239	241
	Fuel - Lb/Hr	1206	1229	1251	1261	1272
S.L.	KIAS	226	226	226	226	226
	KTAS	222	226	230	231	233
	Fuel - Lb/Hr	1335	1358	1382	1393	1405

Figure 8-10 (Sheet 6 of 14)

LONG RANGE CRUISE

45-929a

WEIGHT — 17,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.741				
	KTAS	415				
	Fuel - Lb/Hr	914				
45	Mach Ind	.748	.748			
	KTAS	419	429			
	Fuel - Lb/Hr	941	963			
43	Mach Ind	.746	.746			
	KTAS	418	428			
	Fuel - Lb/Hr	965	988			
41	Mach Ind	.725	.725	.725		
	KTAS	406	416	425		
	Fuel - Lb/Hr	971	994	1017		
39	Mach Ind	.690	.690	.690	.690	.690
	KTAS	387	396	405	409	414
	Fuel - Lb/Hr	958	981	1003	1014	1025
37	Mach Ind	.653	.653	.653	.653	.653
	KTAS	366	375	383	387	392
	Fuel - Lb/Hr	941	964	986	997	1007
35	Mach Ind	.629	.629	.629	.629	.629
	KTAS	354	363	371	375	379
	Fuel - Lb/Hr	950	973	995	1006	1016
30	Mach Ind	.571	.571	.571	.571	.571
	KTAS	329	336	343	347	351
	Fuel - Lb/Hr	982	1005	1026	1037	1048
25	KIAS	213	213	213	213	213
	KTAS	306	312	319	322	325
	Fuel - Lb/Hr	1022	1044	1065	1076	1087
20	KIAS	216	216	216	216	216
	KTAS	286	292	298	301	304
	Fuel - Lb/Hr	1070	1093	1114	1125	1136
15	KIAS	219	219	219	219	219
	KTAS	268	273	278	281	283
	Fuel - Lb/Hr	1125	1147	1169	1180	1191
10	KIAS	216	216	216	216	216
	KTAS	246	250	255	257	259
	Fuel - Lb/Hr	1156	1178	1200	1211	1221
5	KIAS	218	218	218	218	218
	KTAS	231	235	239	241	243
	Fuel - Lb/Hr	1228	1251	1273	1284	1295
S.L.	KIAS	231	231	231	231	231
	KTAS	227	231	235	237	239
	Fuel - Lb/Hr	1377	1401	1426	1437	1449

Figure 8-10 (Sheet 7 of 14)

LONG RANGE CRUISE

45-930a

WEIGHT — 18,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.715				
	KTAS	400				
	Fuel - Lb/Hr	912				
45	Mach Ind	.753	.753			
	KTAS	422	432			
	Fuel - Lb/Hr	967	990			
43	Mach Ind	.744	.744			
	KTAS	417	427			
	Fuel - Lb/Hr	976	1000			
41	Mach Ind	.735	.735	.735		
	KTAS	411	421	431		
	Fuel - Lb/Hr	998	1022	1046		
39	Mach Ind	.702	.702	.702	.702	
	KTAS	393	402	412	416	
	Fuel - Lb/Hr	988	1012	1035	1046	
37	Mach Ind	.662	.662	.662	.662	.662
	KTAS	371	380	388	393	397
	Fuel - Lb/Hr	967	990	1013	1024	1035
35	Mach Ind	.636	.636	.636	.636	.636
	KTAS	358	366	375	379	383
	Fuel - Lb/Hr	973	997	1019	1030	1041
30	Mach Ind	.578	.578	.578	.578	.578
	KTAS	333	340	348	351	355
	Fuel - Lb/Hr	1007	1030	1052	1063	1074
25	KIAS	216	216	216	216	216
	KTAS	309	316	323	326	329
	Fuel - Lb/Hr	1045	1068	1090	1101	1111
20	KIAS	218	218	218	218	218
	KTAS	288	294	300	303	306
	Fuel - Lb/Hr	1090	1113	1135	1146	1157
15	KIAS	221	221	221	221	221
	KTAS	271	276	282	284	287
	Fuel - Lb/Hr	1150	1173	1196	1207	1218
10	KIAS	218	218	218	218	218
	KTAS	248	253	257	260	262
	Fuel - Lb/Hr	1179	1201	1223	1234	1245
5	KIAS	221	221	221	221	221
	KTAS	233	237	241	244	246
	Fuel - Lb/Hr	1253	1276	1298	1310	1321
S.L.	KIAS	235	235	235	235	235
	KTAS	231	235	239	241	243
	Fuel - Lb/Hr	1415	1440	1465	1477	1489

Figure 8-10 (Sheet 8 of 14)

LONG RANGE CRUISE

45-931a

		TEMPERATURE — °C				
ALTITUDE — 1000 FEET	WEIGHT — 18,500 LB	ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.755	.755			
	KTAS	423	433			
	Fuel - Lb/Hr	990	1014			
43	Mach Ind	.741	.741			
	KTAS	415	425			
	Fuel - Lb/Hr	986	1010			
41	Mach Ind	.741	.741			
	KTAS	415	425			
	Fuel - Lb/Hr	1023	1047			
39	Mach Ind	.709	.709	.709	.709	
	KTAS	397	407	416	421	
	Fuel - Lb/Hr	1013	1037	1061	1072	
37	Mach Ind	.671	.671	.671	.671	.671
	KTAS	376	385	394	398	402
	Fuel - Lb/Hr	994	1018	1041	1053	1064
35	Mach Ind	.642	.642	.642	.642	.642
	KTAS	362	370	378	383	387
	Fuel - Lb/Hr	996	1020	1043	1054	1065
30	Mach Ind	.585	.585	.585	.585	.585
	KTAS	337	345	352	356	359
	Fuel - Lb/Hr	1032	1056	1079	1090	1101
25	KIAS	219	219	219	219	219
	KTAS	313	320	326	330	333
	Fuel - Lb/Hr	1069	1092	1115	1126	1137
20	KIAS	220	220	220	220	220
	KTAS	291	297	303	306	308
	Fuel - Lb/Hr	1110	1133	1156	1167	1178
15	KIAS	224	224	224	224	224
	KTAS	274	279	285	287	290
	Fuel - Lb/Hr	1174	1198	1221	1232	1243
10	KIAS	220	220	220	220	220
	KTAS	250	255	260	262	264
	Fuel - Lb/Hr	1201	1224	1247	1258	1269
5	KIAS	224	224	224	224	224
	KTAS	237	241	245	247	250
	Fuel - Lb/Hr	1285	1308	1332	1343	1355
S.L.	KIAS	237	237	237	237	237
	KTAS	233	237	241	243	245
	Fuel - Lb/Hr	1439	1464	1490	1502	1514

Figure 8-10 (Sheet 9 of 14)

LONG RANGE CRUISE

45-932a

ALTITUDE — 1000 FEET

		TEMPERATURE — °C				
WEIGHT — 19,000 LB		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.750				
	KTAS	420				
	Fuel - Lb/Hr	999				
43	Mach Ind	.746	.746			
	KTAS	418	428			
	Fuel - Lb/Hr	1011	1035			
41	Mach Ind	.742	.742			
	KTAS	415	425			
	Fuel - Lb/Hr	1037	1062			
39	Mach Ind	.717	.717	.717	.717	
	KTAS	402	411	421	425	
	Fuel - Lb/Hr	1038	1063	1087	1099	
37	Mach Ind	.681	.681	.681	.681	.681
	KTAS	381	390	399	404	408
	Fuel - Lb/Hr	1023	1047	1071	1083	1094
35	Mach Ind	.648	.648	.648	.648	.648
	KTAS	365	374	382	386	390
	Fuel - Lb/Hr	1019	1043	1066	1078	1089
30	Mach Ind	.591	.591	.591	.591	.591
	KTAS	341	348	356	360	363
	Fuel - Lb/Hr	1057	1081	1104	1115	1127
25	KIAS	221	221	221	221	221
	KTAS	317	324	330	334	337
	Fuel - Lb/Hr	1095	1118	1142	1153	1164
20	KIAS	222	222	222	222	222
	KTAS	293	299	305	308	311
	Fuel - Lb/Hr	1131	1154	1177	1189	1200
15	KIAS	226	226	226	226	226
	KTAS	277	282	288	290	293
	Fuel - Lb/Hr	1197	1221	1244	1256	1267
10	KIAS	223	223	223	223	223
	KTAS	253	258	263	265	267
	Fuel - Lb/Hr	1227	1251	1274	1285	1297
5	KIAS	228	228	228	228	228
	KTAS	240	245	249	251	254
	Fuel - Lb/Hr	1317	1341	1365	1377	1389
S.L.	KIAS	239	239	239	239	239
	KTAS	235	239	243	245	247
	Fuel - Lb/Hr	1461	1487	1513	1525	1538

Figure 8-10 (Sheet 10 of 14)

LONG RANGE CRUISE

45-933a

WEIGHT — 19,500 LB			TEMPERATURE — °C				
			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	49	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	47	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	45	Mach Ind	.736				
		KTAS	412				
		Fuel - Lb/Hr	999				
	43	Mach Ind	.751	.751			
		KTAS	421	431			
		Fuel - Lb/Hr	1038	1062			
	41	Mach Ind	.740	.740			
		KTAS	415	425			
		Fuel - Lb/Hr	1049	1074			
	39	Mach Ind	.726	.726	.726		
		KTAS	407	416	426		
		Fuel - Lb/Hr	1066	1091	1116		
	37	Mach Ind	.691	.691	.691	.691	.691
		KTAS	387	397	406	410	414
		Fuel - Lb/Hr	1052	1077	1102	1114	1126
	35	Mach Ind	.656	.656	.656	.656	.656
		KTAS	369	378	387	391	395
		Fuel - Lb/Hr	1044	1069	1093	1105	1116
	30	Mach Ind	.598	.598	.598	.598	.598
		KTAS	345	353	360	364	368
		Fuel - Lb/Hr	1082	1106	1130	1142	1154
	25	KIAS	224	224	224	224	224
		KTAS	320	327	334	337	341
		Fuel - Lb/Hr	1120	1145	1168	1180	1191
	20	KIAS	224	224	224	224	224
		KTAS	296	302	308	311	314
		Fuel - Lb/Hr	1153	1177	1200	1212	1223
	15	KIAS	229	229	229	229	229
		KTAS	280	285	291	293	296
		Fuel - Lb/Hr	1221	1246	1270	1281	1293
	10	KIAS	227	227	227	227	227
		KTAS	257	262	267	270	272
		Fuel - Lb/Hr	1260	1285	1308	1320	1332
	5	KIAS	231	231	231	231	231
		KTAS	244	249	253	255	257
		Fuel - Lb/Hr	1350	1375	1399	1411	1423
	S.L.	KIAS	241	241	241	241	241
		KTAS	237	241	245	247	249
		Fuel - Lb/Hr	1483	1510	1536	1549	1561

Figure 8-10 (Sheet 11 of 14)

LONG RANGE CRUISE

45-934a

WEIGHT — 20,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.708				
	KTAS	397				
	Fuel - Lb/Hr	998				
43	Mach Ind	.754	.754			
	KTAS	422	433			
	Fuel - Lb/Hr	1062	1087			
41	Mach Ind	.739	.739			
	KTAS	414	424			
	Fuel - Lb/Hr	1060	1086			
39	Mach Ind	.734	.734	.734		
	KTAS	411	421	431		
	Fuel - Lb/Hr	1093	1119	1144		
37	Mach Ind	.701	.701	.701	.701	
	KTAS	393	402	411	416	
	Fuel - Lb/Hr	1081	1107	1132	1144	
35	Mach Ind	.664	.664	.664	.664	.664
	KTAS	374	383	391	396	400
	Fuel - Lb/Hr	1071	1096	1121	1133	1145
30	Mach Ind	.604	.604	.604	.604	.604
	KTAS	348	356	364	367	371
	Fuel - Lb/Hr	1105	1130	1155	1167	1179
25	KIAS	227	227	227	227	227
	KTAS	324	331	338	341	345
	Fuel - Lb/Hr	1146	1171	1195	1207	1219
20	KIAS	226	226	226	226	226
	KTAS	298	305	311	314	317
	Fuel - Lb/Hr	1175	1199	1223	1235	1247
15	KIAS	231	231	231	231	231
	KTAS	282	288	293	296	299
	Fuel - Lb/Hr	1246	1270	1295	1307	1319
10	KIAS	230	230	230	230	230
	KTAS	261	266	271	274	276
	Fuel - Lb/Hr	1291	1316	1340	1352	1364
5	KIAS	235	235	235	235	235
	KTAS	248	252	257	259	261
	Fuel - Lb/Hr	1383	1409	1434	1446	1458
S.L.	KIAS	243	243	243	243	243
	KTAS	239	243	247	249	251
	Fuel - Lb/Hr	1506	1533	1559	1572	1585

Figure 8-10 (Sheet 12 of 14)

LONG RANGE CRUISE

45-967

WEIGHT — 20,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
43	Mach Ind	.756	.756			
	KTAS	423	434			
	Fuel - Lb/Hr	1084	1110			
41	Mach Ind	.741	.741			
	KTAS	415	425			
	Fuel - Lb/Hr	1080	1106			
39	Mach Ind	.739	.739	.739		
	KTAS	414	424	433		
	Fuel - Lb/Hr	1114	1141	1167		
37	Mach Ind	.708	.708	.708	.708	
	KTAS	397	406	415	420	
	Fuel - Lb/Hr	1106	1132	1158	1171	
35	Mach Ind	.673	.673	.673	.673	.673
	KTAS	379	388	396	401	405
	Fuel - Lb/Hr	1098	1124	1150	1162	1175
30	Mach Ind	.609	.609	.609	.609	.609
	KTAS	351	359	367	371	374
	Fuel - Lb/Hr	1128	1153	1178	1191	1203
25	KIAS	229	229	229	229	229
	KTAS	327	334	341	345	348
	Fuel - Lb/Hr	1169	1194	1219	1231	1243
20	KIAS	228	228	228	228	228
	KTAS	301	307	313	316	319
	Fuel - Lb/Hr	1197	1222	1246	1258	1270
15	KIAS	233	233	233	233	233
	KTAS	285	291	296	299	302
	Fuel - Lb/Hr	1269	1294	1319	1331	1343
10	KIAS	234	234	234	234	234
	KTAS	265	270	275	278	280
	Fuel - Lb/Hr	1324	1349	1374	1386	1399
5	KIAS	238	238	238	238	238
	KTAS	251	255	260	262	264
	Fuel - Lb/Hr	1410	1436	1462	1474	1487
S.L.	KIAS	245	245	245	245	245
	KTAS	241	245	249	251	253
	Fuel - Lb/Hr	1528	1555	1582	1595	1608

Figure 8-10 (Sheet 13 of 14)

LONG RANGE CRUISE

45-968

WEIGHT — 21,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
43	Mach Ind	.752				
	KTAS	421				
	Fuel - Lb/Hr	1094				
41	Mach Ind	.747	.747			
	KTAS	418	428			
	Fuel - Lb/Hr	1108	1135			
39	Mach Ind	.739	.739			
	KTAS	414	424			
	Fuel - Lb/Hr	1128	1155			
37	Mach Ind	.715	.715	.715	.715	
	KTAS	400	410	419	424	
	Fuel - Lb/Hr	1131	1158	1184	1197	
35	Mach Ind	.682	.682	.682	.682	.682
	KTAS	384	393	402	406	410
	Fuel - Lb/Hr	1127	1153	1179	1192	1205
30	Mach Ind	.615	.615	.615	.615	.615
	KTAS	354	362	370	374	378
	Fuel - Lb/Hr	1150	1176	1202	1214	1227
25	KIAS	231	231	231	231	231
	KTAS	330	337	344	348	351
	Fuel - Lb/Hr	1192	1218	1243	1256	1268
20	KIAS	231	231	231	231	231
	KTAS	304	311	317	320	323
	Fuel - Lb/Hr	1223	1249	1274	1286	1298
15	KIAS	235	235	235	235	235
	KTAS	287	293	299	301	304
	Fuel - Lb/Hr	1291	1317	1342	1354	1367
10	KIAS	237	237	237	237	237
	KTAS	269	274	279	282	284
	Fuel - Lb/Hr	1355	1381	1407	1419	1432
5	KIAS	240	240	240	240	240
	KTAS	253	257	262	264	266
	Fuel - Lb/Hr	1433	1459	1485	1498	1511
S.L.	KIAS	247	247	247	247	247
	KTAS	243	247	251	253	255
	Fuel - Lb/Hr	1550	1578	1605	1619	1632

Figure 8-10 (Sheet 14 of 14)

HIGH SPEED CRUISE

45-936a

			TEMPERATURE — °C				
WEIGHT — 14,500 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	Mach Ind	.784	.719			
		KTAS	439	412			
		Fuel - Lb/Hr	873	774			
	49	Mach Ind	.801	.771			
		KTAS	449	442			
		Fuel - Lb/Hr	974	857			
	47	Mach Ind	.810	.785	.712	.638	
		KTAS	454	450	418	378	
		Fuel - Lb/Hr	1033	938	808	745	
	45	Mach Ind	.810	.794	.743	.696	.632
		KTAS	454	455	436	413	379
		Fuel - Lb/Hr	1068	1025	890	825	760
	43	Mach Ind	.810	.801	.760	.727	.681
		KTAS	454	460	446	431	408
		Fuel - Lb/Hr	1125	1128	982	916	850
	41	Mach Ind	.810	.805	.769	.744	.709
		KTAS	454	461	451	441	425
		Fuel - Lb/Hr	1205	1232	1077	1011	945
	39	Mach Ind	.810	.809	.779	.758	.734
		KTAS	454	464	457	450	440
		Fuel - Lb/Hr	1294	1358	1194	1126	1062
	37	Mach Ind	.810	.810	.786	.770	.751
		KTAS	454	465	461	457	450
		Fuel - Lb/Hr	1394	1470	1332	1258	1193
	35	Mach Ind	.810	.810	.786	.771	.753
		KTAS	456	467	463	459	454
		Fuel - Lb/Hr	1523	1603	1446	1370	1302
	30	Mach Ind	.810	.797	.771	.756	.740
		KTAS	467	469	464	460	454
		Fuel - Lb/Hr	1906	1854	1676	1604	1530
	25	KIAS	330	328	315	308	300
		KTAS	462	468	461	456	450
		Fuel - Lb/Hr	2060	2102	1917	1835	1752
	20	KIAS	330	330	330	328	319
		KTAS	429	438	447	449	441
		Fuel - Lb/Hr	1940	2025	2110	2073	1982
	15	KIAS	330	330	330	330	330
		KTAS	399	407	415	419	423
		Fuel - Lb/Hr	1966	2061	2145	2184	2229
	10	KIAS	330	330	330	330	330
		KTAS	372	379	386	390	393
		Fuel - Lb/Hr	2028	2121	2211	2253	2295
	5	KIAS	330	330	330	330	330
		KTAS	347	354	360	363	366
		Fuel - Lb/Hr	2090	2183	2276	2323	2365
	S.L.	KIAS	330	330	330	330	330
		KTAS	324	330	336	339	341
		Fuel - Lb/Hr	2168	2262	2357	2405	2454

Figure 8-11 (Sheet 1 of 14)

HIGH SPEED CRUISE

45-937a

WEIGHT — 15,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		**ISA -10**	**ISA**	**ISA +10**	**ISA +15**	**ISA +20**
51	**Mach Ind**	.778				
	KTAS	436				
	Fuel - Lb/Hr	868				
49	**Mach Ind**	.796	.762			
	KTAS	446	437			
	Fuel - Lb/Hr	970	857			
47	**Mach Ind**	.807	.781	.698		
	KTAS	452	448	409		
	Fuel - Lb/Hr	1064	938	807		
45	**Mach Ind**	.810	.791	.736	.685	
	KTAS	454	454	432	406	
	Fuel - Lb/Hr	1083	1025	890	825	
43	**Mach Ind**	.810	.799	.756	.720	.671
	KTAS	454	458	443	427	402
	Fuel - Lb/Hr	1137	1128	982	914	849
41	**Mach Ind**	.810	.804	.767	.740	.702
	KTAS	454	461	450	439	421
	Fuel - Lb/Hr	1213	1232	1076	1010	942
39	**Mach Ind**	.810	.808	.777	.756	.730
	KTAS	454	463	456	448	437
	Fuel - Lb/Hr	1302	1358	1193	1125	1060
37	**Mach Ind**	.810	.810	.785	.768	.748
	KTAS	454	465	461	456	448
	Fuel - Lb/Hr	1401	1477	1332	1257	1192
35	**Mach Ind**	.810	.810	.785	.770	.751
	KTAS	456	467	462	458	452
	Fuel - Lb/Hr	1529	1609	1445	1369	1301
30	**Mach Ind**	.810	.796	.770	.755	.738
	KTAS	467	469	463	459	453
	Fuel - Lb/Hr	1911	1854	1675	1603	1529
25	**KIAS**	330	327	315	308	299
	KTAS	462	468	461	456	449
	Fuel - Lb/Hr	2066	2102	1917	1834	1751
20	**KIAS**	330	330	330	328	318
	KTAS	429	438	447	448	440
	Fuel - Lb/Hr	1945	2030	2115	2073	1981
15	**KIAS**	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	1973	2068	2151	2191	2237
10	**KIAS**	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2035	2127	2217	2260	2302
5	**KIAS**	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2096	2189	2282	2330	2371
S.L.	**KIAS**	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2173	2268	2363	2411	2460

Figure 8-11 (Sheet 2 of 14)

HIGH SPEED CRUISE

45-938a

			TEMPERATURE — °C				
WEIGHT — 15,500 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	Mach Ind	.770				
		KTAS	431				
		Fuel - Lb/Hr	862				
	49	Mach Ind	.792	.751			
		KTAS	444	431			
		Fuel - Lb/Hr	967	856			
	47	Mach Ind	.804	.776	.678		
		KTAS	450	445	398		
		Fuel - Lb/Hr	1063	937	807		
	45	Mach Ind	.810	.788	.727	.671	
		KTAS	454	452	426	398	
		Fuel - Lb/Hr	1100	1025	890	824	
	43	Mach Ind	.810	.797	.752	.712	.661
		KTAS	454	457	441	422	396
		Fuel - Lb/Hr	1150	1127	981	913	848
	41	Mach Ind	.810	.802	.764	.735	.695
		KTAS	454	460	448	436	417
		Fuel - Lb/Hr	1221	1231	1076	1008	940
	39	Mach Ind	.810	.807	.775	.753	.725
		KTAS	454	463	455	447	434
		Fuel - Lb/Hr	1309	1357	1193	1123	1057
	37	Mach Ind	.810	.810	.784	.766	.745
		KTAS	454	465	460	454	447
		Fuel - Lb/Hr	1408	1484	1331	1256	1190
	35	Mach Ind	.810	.810	.784	.768	.749
		KTAS	456	467	462	458	451
		Fuel - Lb/Hr	1536	1615	1445	1368	1299
	30	Mach Ind	.810	.796	.769	.754	.736
		KTAS	467	469	463	459	452
		Fuel - Lb/Hr	1916	1854	1674	1603	1528
	25	KIAS	330	327	314	307	299
		KTAS	462	468	460	455	448
		Fuel - Lb/Hr	2071	2101	1916	1833	1750
	20	KIAS	330	330	330	327	318
		KTAS	429	438	447	448	439
		Fuel - Lb/Hr	1950	2035	2121	2072	1980
	15	KIAS	330	330	330	330	330
		KTAS	399	407	415	419	423
		Fuel - Lb/Hr	1979	2074	2158	2198	2244
	10	KIAS	330	330	330	330	330
		KTAS	372	379	386	390	393
		Fuel - Lb/Hr	2041	2134	2224	2267	2309
	5	KIAS	330	330	330	330	330
		KTAS	347	354	360	363	366
		Fuel - Lb/Hr	2102	2195	2289	2336	2378
	S.L.	KIAS	330	330	330	330	330
		KTAS	324	330	336	339	341
		Fuel - Lb/Hr	2179	2274	2369	2418	2466

Figure 8-11 (Sheet 3 of 14)

HIGH SPEED CRUISE

45-939a

WEIGHT — 16,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.786	.733			
	KTAS	440	420			
	Fuel - Lb/Hr	961	855			
47	Mach Ind	.801	.771			
	KTAS	448	442			
	Fuel - Lb/Hr	1062	937			
45	Mach Ind	.810	.785	.717	.653	
	KTAS	454	450	421	387	
	Fuel - Lb/Hr	1127	1024	890	823	
43	Mach Ind	.810	.796	.747	.703	.648
	KTAS	454	456	438	417	388
	Fuel - Lb/Hr	1164	1127	980	911	846
41	Mach Ind	.810	.801	.761	.730	.687
	KTAS	454	459	446	433	412
	Fuel - Lb/Hr	1229	1231	1075	1006	939
39	Mach Ind	.810	.806	.773	.750	.719
	KTAS	454	462	453	445	431
	Fuel - Lb/Hr	1317	1357	1192	1122	1054
37	Mach Ind	.810	.810	.782	.764	.742
	KTAS	454	465	459	453	445
	Fuel - Lb/Hr	1416	1492	1330	1255	1188
35	Mach Ind	.810	.810	.783	.766	.747
	KTAS	456	467	461	457	450
	Fuel - Lb/Hr	1542	1623	1444	1367	1298
30	Mach Ind	.810	.795	.768	.753	.735
	KTAS	467	468	462	458	451
	Fuel - Lb/Hr	1922	1853	1674	1602	1526
25	KIAS	330	327	314	307	298
	KTAS	462	467	460	454	447
	Fuel - Lb/Hr	2076	2101	1915	1832	1749
20	KIAS	330	330	330	327	317
	KTAS	429	438	447	447	438
	Fuel - Lb/Hr	1955	2041	2127	2072	1979
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	1986	2081	2165	2205	2169
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2048	2141	2231	2274	2316
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2108	2201	2295	2343	2385
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2185	2280	2376	2424	2473

Figure 8-11 (Sheet 4 of 14)

HIGH SPEED CRUISE

45-940a

WEIGHT — 16,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.781				
	KTAS	437				
	Fuel - Lb/Hr	956				
47	Mach Ind	.796	.764			
	KTAS	446	438			
	Fuel - Lb/Hr	1058	937			
45	Mach Ind	.807	.782	.706		
	KTAS	452	448	414		
	Fuel - Lb/Hr	1162	1024	890		
43	Mach Ind	.810	.793	.741	.693	.628
	KTAS	454	455	435	411	376
	Fuel - Lb/Hr	1178	1127	980	910	844
41	Mach Ind	.810	.799	.757	.723	.678
	KTAS	454	458	444	429	407
	Fuel - Lb/Hr	1241	1230	1074	1004	937
39	Mach Ind	.810	.805	.771	.746	.713
	KTAS	454	462	452	443	427
	Fuel - Lb/Hr	1325	1356	1191	1120	1051
37	Mach Ind	.810	.810	.781	.762	.739
	KTAS	454	465	458	452	443
	Fuel - Lb/Hr	1423	1499	1330	1254	1185
35	Mach Ind	.810	.809	.782	.765	.744
	KTAS	456	466	461	456	448
	Fuel - Lb/Hr	1549	1622	1443	1366	1296
30	Mach Ind	.810	.794	.767	.752	.733
	KTAS	467	468	462	457	450
	Fuel - Lb/Hr	1927	1853	1673	1601	1525
25	KIAS	330	326	314	306	297
	KTAS	462	467	459	454	446
	Fuel - Lb/Hr	2080	2100	1915	1832	1748
20	KIAS	330	330	330	326	316
	KTAS	429	438	447	446	437
	Fuel - Lb/Hr	1961	2046	2133	2071	1978
15	KIAS	330	330	330	330	329
	KTAS	399	407	415	419	422
	Fuel - Lb/Hr	1993	2088	2172	2212	2168
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2054	2148	2238	2281	2323
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2114	2208	2302	2350	2392
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2192	2287	2382	2431	2480

Figure 8-11 (Sheet 5 of 14)

HIGH SPEED CRUISE

45-941a

WEIGHT — 17,000 LB

ALTITUDE — 1000 FEET		TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.774				
	KTAS	433				
	Fuel - Lb/Hr	950				
47	Mach Ind	.792	.754			
	KTAS	444	432			
	Fuel - Lb/Hr	1054	936			
45	Mach Ind	.805	.778	.690		
	KTAS	451	446	405		
	Fuel - Lb/Hr	1161	1024	889		
43	Mach Ind	.810	.790	.733	.682	
	KTAS	454	453	430	404	
	Fuel - Lb/Hr	1193	1126	978	909	
41	Mach Ind	.810	.798	.753	.716	.669
	KTAS	454	457	442	425	401
	Fuel - Lb/Hr	1254	1230	1073	1001	936
39	Mach Ind	.810	.804	.768	.742	.706
	KTAS	454	461	450	440	423
	Fuel - Lb/Hr	1333	1356	1190	1119	1047
37	Mach Ind	.810	.810	.780	.760	.735
	KTAS	454	464	457	450	441
	Fuel - Lb/Hr	1430	1504	1329	1252	1183
35	Mach Ind	.810	.808	.780	.763	.742
	KTAS	456	466	460	454	446
	Fuel - Lb/Hr	1556	1622	1443	1365	1294
30	Mach Ind	.810	.794	.766	.751	.731
	KTAS	467	468	461	457	449
	Fuel - Lb/Hr	1933	1853	1672	1600	1524
25	KIAS	330	326	313	306	297
	KTAS	462	467	458	453	445
	Fuel - Lb/Hr	2085	2100	1914	1831	1747
20	KIAS	330	330	330	326	316
	KTAS	429	438	447	446	436
	Fuel - Lb/Hr	1967	2052	2139	2070	1976
15	KIAS	330	330	330	330	328
	KTAS	399	407	415	419	421
	Fuel - Lb/Hr	1999	2094	2178	2218	2168
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2061	2155	2245	2288	2331
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2121	2215	2309	2358	2400
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2198	2293	2389	2438	2487

Figure 8-11 (Sheet 6 of 14)

HIGH SPEED CRUISE

45-942a

			TEMPERATURE — °C				
WEIGHT — 17,500 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	49	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	47	Mach Ind	.787	.741			
		KTAS	441	425			
		Fuel - Lb/Hr	1049	935			
	45	Mach Ind	.802	.773	.663		
		KTAS	449	443	389		
		Fuel - Lb/Hr	1161	1024	887		
	43	Mach Ind	.810	.788	.724	.668	
		KTAS	454	452	425	396	
		Fuel - Lb/Hr	1219	1126	977	909	
	41	Mach Ind	.810	.796	.749	.708	.659
		KTAS	454	456	440	420	395
		Fuel - Lb/Hr	1268	1229	1072	999	934
	39	Mach Ind	.810	.803	.765	.738	.699
		KTAS	454	460	449	437	419
		Fuel - Lb/Hr	1341	1355	1189	1116	1044
	37	Mach Ind	.810	.809	.778	.757	.731
		KTAS	454	464	456	449	438
		Fuel - Lb/Hr	1438	1503	1328	1251	1181
	35	Mach Ind	.810	.808	.779	.761	.739
		KTAS	456	465	459	453	445
		Fuel - Lb/Hr	1564	1621	1442	1364	1292
	30	Mach Ind	.810	.793	.765	.749	.729
		KTAS	467	467	461	456	448
		Fuel - Lb/Hr	1939	1852	1671	1599	1523
	25	KIAS	330	326	313	305	296
		KTAS	462	466	458	452	443
		Fuel - Lb/Hr	2089	2099	1913	1829	1745
	20	KIAS	330	330	330	325	315
		KTAS	429	438	447	445	436
		Fuel - Lb/Hr	1972	2058	2146	2070	1975
	15	KIAS	330	330	330	330	328
		KTAS	399	407	415	419	420
		Fuel - Lb/Hr	2005	2100	2184	2225	2167
	10	KIAS	330	330	330	330	330
		KTAS	372	379	386	390	393
		Fuel - Lb/Hr	2066	2161	2251	2295	2337
	5	KIAS	330	330	330	330	330
		KTAS	347	354	360	363	366
		Fuel - Lb/Hr	2127	2221	2316	2364	2406
	S.L.	KIAS	330	330	330	330	330
		KTAS	324	330	336	339	341
		Fuel - Lb/Hr	2204	2300	2396	2445	2494

Figure 8-11 (Sheet 7 of 14)

HIGH SPEED CRUISE

45-943a

ALTITUDE — 1000 FEET		TEMPERATURE — °C				
WEIGHT — 18,000 LB		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.782	.715			
	KTAS	438	410			
	Fuel - Lb/Hr	1043	934			
45	Mach Ind	.798	.768			
	KTAS	447	440			
	Fuel - Lb/Hr	1158	1024			
43	Mach Ind	.810	.785	.714	.645	
	KTAS	453	450	419	383	
	Fuel - Lb/Hr	1276	1126	976	907	
41	Mach Ind	.810	.794	.743	.698	.644
	KTAS	454	455	436	414	386
	Fuel - Lb/Hr	1281	1229	1070	996	931
39	Mach Ind	.810	.801	.762	.733	.691
	KTAS	454	460	447	435	414
	Fuel - Lb/Hr	1352	1355	1188	1114	1042
37	Mach Ind	.810	.808	.776	.755	.726
	KTAS	454	463	455	447	435
	Fuel - Lb/Hr	1446	1503	1327	1250	1177
35	Mach Ind	.810	.807	.778	.759	.735
	KTAS	456	465	458	452	443
	Fuel - Lb/Hr	1571	1621	1441	1362	1290
30	Mach Ind	.810	.792	.764	.747	.727
	KTAS	467	467	460	455	447
	Fuel - Lb/Hr	1945	1852	1670	1597	1521
25	KIAS	330	326	312	304	295
	KTAS	462	466	457	451	442
	Fuel - Lb/Hr	2094	2099	1912	1828	1744
20	KIAS	330	330	330	325	314
	KTAS	429	438	447	444	434
	Fuel - Lb/Hr	1978	2064	2153	2069	1974
15	KIAS	330	330	330	330	327
	KTAS	399	407	415	419	420
	Fuel - Lb/Hr	2011	2106	2190	2232	2167
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2073	2167	2258	2302	2344
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2133	2227	2322	2371	2413
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2210	2306	2402	2451	2501

Figure 8-11 (Sheet 8 of 14)

HIGH SPEED CRUISE

45-944a

WEIGHT — 18,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.777				
	KTAS	435				
	Fuel - Lb/Hr	1038				
45	Mach Ind	.794	.759			
	KTAS	445	435			
	Fuel - Lb/Hr	1153	1023			
43	Mach Ind	.807	.781	.700		
	KTAS	452	448	411		
	Fuel - Lb/Hr	1275	1125	974		
41	Mach Ind	.810	.791	.736	.688	.620
	KTAS	454	454	432	408	371
	Fuel - Lb/Hr	1295	1228	1068	995	927
39	Mach Ind	.810	.800	.759	.727	.683
	KTAS	454	459	445	431	409
	Fuel - Lb/Hr	1365	1354	1186	1112	1039
37	Mach Ind	.810	.807	.774	.752	.720
	KTAS	454	463	454	446	432
	Fuel - Lb/Hr	1454	1502	1326	1248	1174
35	Mach Ind	.810	.806	.776	.757	.732
	KTAS	456	464	457	451	441
	Fuel - Lb/Hr	1578	1620	1440	1361	1288
30	Mach Ind	.810	.791	.763	.746	.724
	KTAS	467	466	459	453	445
	Fuel - Lb/Hr	1950	1852	1669	1596	1520
25	KIAS	330	326	312	303	294
	KTAS	462	466	457	450	441
	Fuel - Lb/Hr	2099	2099	1911	1827	1743
20	KIAS	330	330	330	324	313
	KTAS	429	438	447	443	433
	Fuel - Lb/Hr	1985	2070	2159	2068	1973
15	KIAS	330	330	330	330	327
	KTAS	399	407	415	419	419
	Fuel - Lb/Hr	2017	2112	2196	2239	2166
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2079	2174	2265	2309	2351
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2139	2234	2329	2377	2420
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2216	2312	2408	2458	2508

Figure 8-11 (Sheet 9 of 14)

HIGH SPEED CRUISE

45-945a

WEIGHT — 19,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.770				
	KTAS	431				
	Fuel - Lb/Hr	1030				
45	Mach Ind	.790	.750			
	KTAS	443	430			
	Fuel - Lb/Hr	1149	1023			
43	Mach Ind	.804	.777	.685		
	KTAS	451	446	402		
	Fuel - Lb/Hr	1274	1124	973		
41	Mach Ind	.810	.789	.728	.677	
	KTAS	454	452	427	401	
	Fuel - Lb/Hr	1317	1228	1066	994	
39	Mach Ind	.810	.798	.755	.720	.674
	KTAS	454	458	443	427	404
	Fuel - Lb/Hr	1378	1353	1185	1108	1037
37	Mach Ind	.810	.806	.772	.748	.715
	KTAS	454	462	453	444	428
	Fuel - Lb/Hr	1462	1502	1325	1246	1170
35	Mach Ind	.810	.805	.775	.754	.728
	KTAS	456	464	457	449	439
	Fuel - Lb/Hr	1585	1620	1439	1360	1285
30	Mach Ind	.810	.791	.761	.744	.722
	KTAS	467	466	458	452	444
	Fuel - Lb/Hr	1957	1851	1668	1595	1518
25	KIAS	330	325	311	303	294
	KTAS	462	465	456	449	440
	Fuel - Lb/Hr	2104	2098	1910	1826	1742
20	KIAS	330	330	330	323	312
	KTAS	429	438	447	443	432
	Fuel - Lb/Hr	1991	2076	2166	2068	1972
15	KIAS	330	330	330	330	326
	KTAS	399	407	415	419	418
	Fuel - Lb/Hr	2024	2118	2203	2246	2165
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2085	2180	2272	2316	2359
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2145	2240	2336	2384	2427
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2222	2318	2415	2464	2514

Figure 8-11 (Sheet 10 of 14)

HIGH SPEED CRUISE

45-946a

WEIGHT — 19,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.785	.736			
	KTAS	440	422			
	Fuel - Lb/Hr	1143	1023			
43	Mach Ind	.801	.773			
	KTAS	449	443			
	Fuel - Lb/Hr	1273	1124			
41	Mach Ind	.810	.786	.719	.662	
	KTAS	454	451	422	393	
	Fuel - Lb/Hr	1343	1227	1063	993	
39	Mach Ind	.810	.796	.752	.712	.664
	KTAS	454	457	441	422	398
	Fuel - Lb/Hr	1391	1353	1183	1105	1034
37	Mach Ind	.810	.804	.770	.744	.708
	KTAS	454	461	452	441	424
	Fuel - Lb/Hr	1471	1501	1324	1244	1166
35	Mach Ind	.810	.804	.773	.752	.724
	KTAS	456	463	456	448	436
	Fuel - Lb/Hr	1592	1619	1438	1358	1282
30	Mach Ind	.810	.790	.760	.742	.719
	KTAS	467	466	457	451	442
	Fuel - Lb/Hr	1963	1851	1667	1593	1516
25	KIAS	330	325	311	302	293
	KTAS	462	465	455	448	439
	Fuel - Lb/Hr	2110	2097	1909	1825	1741
20	KIAS	330	330	330	323	311
	KTAS	429	438	447	442	431
	Fuel - Lb/Hr	1998	2083	2174	2066	1970
15	KIAS	330	330	330	330	325
	KTAS	399	407	415	419	417
	Fuel - Lb/Hr	2030	2125	2210	2253	2165
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2092	2187	2279	2323	2367
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2152	2247	2343	2392	2435
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2228	2325	2422	2471	2522

Figure 8-11 (Sheet 11 of 14)

HIGH SPEED CRUISE

45-947a

WEIGHT — 20,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.781	.708			
	KTAS	437	406			
	Fuel - Lb/Hr	1138	1021			
43	Mach Ind	.798	.769			
	KTAS	447	441			
	Fuel - Lb/Hr	1270	1123			
41	Mach Ind	.809	.783	.707		
	KTAS	453	449	415		
	Fuel - Lb/Hr	1389	1226	1060		
39	Mach Ind	.810	.794	.747	.703	.650
	KTAS	454	456	438	417	390
	Fuel - Lb/Hr	1405	1352	1181	1101	1030
37	Mach Ind	.810	.803	.767	.740	.701
	KTAS	454	460	450	439	420
	Fuel - Lb/Hr	1483	1500	1322	1242	1161
35	Mach Ind	.810	.803	.771	.749	.719
	KTAS	456	463	455	446	433
	Fuel - Lb/Hr	1600	1619	1437	1357	1278
30	Mach Ind	.810	.789	.758	.740	.717
	KTAS	467	465	456	450	440
	Fuel - Lb/Hr	1970	1850	1666	1592	1514
25	KIAS	330	325	310	301	292
	KTAS	462	464	454	447	438
	Fuel - Lb/Hr	2115	2097	1908	1824	1740
20	KIAS	330	330	330	322	311
	KTAS	429	438	447	441	430
	Fuel - Lb/Hr	2004	2089	2181	2065	1969
15	KIAS	330	330	330	330	324
	KTAS	399	407	415	419	416
	Fuel - Lb/Hr	2037	2131	2216	2260	2164
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2099	2194	2287	2331	2375
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2158	2254	2350	2399	2442
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2235	2331	2429	2478	2529

Figure 8-11 (Sheet 12 of 14)

HIGH SPEED CRUISE

45-969

WEIGHT — 20,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.775				
	KTAS	434				
	Fuel - Lb/Hr	1131				
43	Mach Ind	.795	.761			
	KTAS	445	436			
	Fuel - Lb/Hr	1266	1122			
41	Mach Ind	.806	.780	.694		
	KTAS	451	447	407		
	Fuel - Lb/Hr	1387	1225	1058		
39	Mach Ind	.810	.792	.740	.693	.628
	KTAS	454	454	434	411	376
	Fuel - Lb/Hr	1419	1351	1179	1098	1024
37	Mach Ind	.810	.802	.764	.735	.693
	KTAS	454	460	448	436	415
	Fuel - Lb/Hr	1496	1499	1321	1239	1157
35	Mach Ind	.810	.802	.769	.746	.713
	KTAS	456	462	453	444	430
	Fuel - Lb/Hr	1608	1618	1436	1355	1275
30	Mach Ind	.810	.789	.757	.738	.713
	KTAS	467	465	456	449	438
	Fuel - Lb/Hr	1976	1850	1665	1590	1512
25	KIAS	330	324	309	301	291
	KTAS	462	464	454	446	436
	Fuel - Lb/Hr	2120	2096	1907	1823	1738
20	KIAS	330	330	330	321	310
	KTAS	429	438	447	439	429
	Fuel - Lb/Hr	2011	2096	2189	2064	1967
15	KIAS	330	330	330	330	324
	KTAS	399	407	415	419	415
	Fuel - Lb/Hr	2044	2138	2223	2268	2164
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2106	2201	2294	2339	2383
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2165	2261	2358	2407	2450
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2242	2338	2436	2486	2536

Figure 8-11 (Sheet 13 of 14)

HIGH SPEED CRUISE

45-970

		TEMPERATURE — °C				
ALTITUDE — 1000 FEET	WEIGHT — 21,000 LB	ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.768				
	KTAS	430				
	Fuel - Lb/Hr	1122				
43	Mach Ind	.791	.752			
	KTAS	443	431			
	Fuel - Lb/Hr	1261	1121			
41	Mach Ind	.804	.776	.678		
	KTAS	450	445	398		
	Fuel - Lb/Hr	1386	1224	1057		
39	Mach Ind	.810	.790	.733	.682	
	KTAS	454	453	430	405	
	Fuel - Lb/Hr	1443	1350	1176	1096	
37	Mach Ind	.810	.801	.761	.730	.684
	KTAS	454	459	447	433	410
	Fuel - Lb/Hr	1509	1499	1319	1237	1154
35	Mach Ind	.810	.802	.767	.742	.708
	KTAS	456	462	452	442	426
	Fuel - Lb/Hr	1616	1617	1434	1353	1271
30	Mach Ind	.810	.788	.755	.736	.710
	KTAS	467	464	455	448	436
	Fuel - Lb/Hr	1983	1850	1663	1589	1510
25	KIAS	330	324	309	300	290
	KTAS	462	464	453	445	435
	Fuel - Lb/Hr	2126	2096	1906	1821	1737
20	KIAS	330	330	330	320	309
	KTAS	429	438	447	438	428
	Fuel - Lb/Hr	2018	2103	2196	2063	1966
15	KIAS	330	330	330	330	323
	KTAS	399	407	415	419	414
	Fuel - Lb/Hr	2051	2145	2231	2276	2163
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2113	2209	2302	2347	2391
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2172	2268	2365	2414	2458
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2248	2345	2443	2493	2544

Figure 8-11 (Sheet 14 of 14)

EFFECTIVITY
D E

LONG RANGE CRUISE — ONE ENGINE

45-949a

WEIGHT — 14,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind	.528	.528			
	KTAS	297	304			
	Fuel - Lb/Hr	711	728			
30	Mach Ind	.492	.492	.492	.492	
	KTAS	284	290	296	299	
	Fuel - Lb/Hr	721	738	754	762	
25	KIAS	184	184	184	184	184
	KTAS	266	271	277	280	282
	Fuel - Lb/Hr	740	756	772	780	787
20	KIAS	185	185	185	185	185
	KTAS	245	251	255	258	260
	Fuel - Lb/Hr	756	772	787	795	802
15	KIAS	186	186	186	186	186
	KTAS	229	233	238	240	242
	Fuel - Lb/Hr	781	796	812	819	826
10	KIAS	190	190	190	190	190
	KTAS	215	220	224	226	228
	Fuel - Lb/Hr	817	832	848	855	863
5	KIAS	192	192	192	192	192
	KTAS	203	206	210	212	214
	Fuel - Lb/Hr	856	872	887	895	903
S.L.	KIAS	195	195	195	195	195
	KTAS	192	195	198	200	202
	Fuel - Lb/Hr	903	919	935	943	950

45-950a

WEIGHT — 15,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind	.513	.513			
	KTAS	289	296			
	Fuel - Lb/Hr	706	723			
30	Mach Ind	.496	.496	.496	.496	
	KTAS	286	292	299	302	
	Fuel - Lb/Hr	741	757	774	782	
25	KIAS	187	187	187	187	187
	KTAS	270	275	281	284	287
	Fuel - Lb/Hr	764	780	797	805	813
20	KIAS	188	188	188	188	188
	KTAS	249	254	260	262	265
	Fuel - Lb/Hr	781	797	813	820	828
15	KIAS	189	189	189	189	189
	KTAS	232	237	241	244	246
	Fuel - Lb/Hr	805	821	836	844	852
10	KIAS	192	192	192	192	192
	KTAS	218	222	226	228	230
	Fuel - Lb/Hr	838	854	869	877	885
5	KIAS	195	195	195	195	195
	KTAS	206	210	213	215	217
	Fuel - Lb/Hr	881	897	913	921	928
S.L.	KIAS	197	197	197	197	197
	KTAS	194	197	201	203	204
	Fuel - Lb/Hr	925	942	958	966	974

Figure 8-12 (Sheet 1 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-951a

WEIGHT — 15,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.506	.506	.506		
	KTAS	292	298	305		
	Fuel - Lb/Hr	771	788	805		
25	KIAS	189	189	189	189	189
	KTAS	273	278	284	287	290
	Fuel - Lb/Hr	785	802	819	827	835
20	KIAS	191	191	191	191	191
	KTAS	253	259	264	266	269
	Fuel - Lb/Hr	806	823	839	847	855
15	KIAS	192	192	192	192	192
	KTAS	235	240	245	247	249
	Fuel - Lb/Hr	828	844	861	869	876
10	KIAS	194	194	194	194	194
	KTAS	221	225	229	231	233
	Fuel - Lb/Hr	860	876	893	901	909
5	KIAS	198	198	198	198	198
	KTAS	209	213	217	219	220
	Fuel - Lb/Hr	906	923	940	948	956
S.L.	KIAS	200	200	200	200	200
	KTAS	197	200	204	205	207
	Fuel - Lb/Hr	949	966	983	991	999

45-952a

WEIGHT — 16,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.514	.514	.514		
	KTAS	296	303	309		
	Fuel - Lb/Hr	798	816	834		
25	KIAS	191	191	191	191	191
	KTAS	275	281	287	290	293
	Fuel - Lb/Hr	806	823	840	849	857
20	KIAS	194	194	194	194	194
	KTAS	257	263	268	270	273
	Fuel - Lb/Hr	831	848	865	873	882
15	KIAS	195	195	195	195	195
	KTAS	239	243	248	250	253
	Fuel - Lb/Hr	851	868	885	893	901
10	KIAS	197	197	197	197	197
	KTAS	224	228	232	234	236
	Fuel - Lb/Hr	883	900	917	925	933
5	KIAS	201	201	201	201	201
	KTAS	212	216	220	222	224
	Fuel - Lb/Hr	932	950	967	975	983
S.L.	KIAS	203	203	203	203	203
	KTAS	200	203	207	208	210
	Fuel - Lb/Hr	974	991	1008	1017	1025

Figure 8-12 (Sheet 2 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-953a

		TEMPERATURE — °C				
WEIGHT — 16,500 LB		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET 35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.514	.514	.514		
	KTAS	296	303	310		
	Fuel - Lb/Hr	814	832	850		
25	KIAS	193	193	193	193	
	KTAS	278	284	290	293	
	Fuel - Lb/Hr	826	844	861	870	
20	KIAS	197	197	197	197	197
	KTAS	261	267	272	275	277
	Fuel - Lb/Hr	857	875	892	901	909
15	KIAS	197	197	197	197	197
	KTAS	242	247	251	254	256
	Fuel - Lb/Hr	874	892	909	917	926
10	KIAS	199	199	199	199	199
	KTAS	226	231	235	237	239
	Fuel - Lb/Hr	906	923	940	949	957
5	KIAS	203	203	203	203	203
	KTAS	215	219	223	225	226
	Fuel - Lb/Hr	955	972	990	998	1007
S.L.	KIAS	206	206	206	206	206
	KTAS	202	206	209	211	213
	Fuel - Lb/Hr	999	1017	1034	1043	1052

45-954a

		TEMPERATURE — °C				
WEIGHT — 17,000 LB		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET 35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.514	.514			
	KTAS	296	303			
	Fuel - Lb/Hr	828	846			
25	KIAS	196	196	196	196	
	KTAS	282	288	294	297	
	Fuel - Lb/Hr	851	870	888	897	
20	KIAS	200	200	200	200	200
	KTAS	265	271	276	279	282
	Fuel - Lb/Hr	883	901	919	928	937
15	KIAS	200	200	200	200	200
	KTAS	245	250	254	257	259
	Fuel - Lb/Hr	898	916	933	942	951
10	KIAS	202	202	202	202	202
	KTAS	229	234	238	240	242
	Fuel - Lb/Hr	929	947	965	973	982
5	KIAS	206	206	206	206	206
	KTAS	217	221	225	227	229
	Fuel - Lb/Hr	978	997	1014	1023	1032
S.L.	KIAS	209	209	209	209	209
	KTAS	206	209	213	215	216
	Fuel - Lb/Hr	1027	1045	1063	1072	1081

Figure 8-12 (Sheet 3 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-955a

WEIGHT — 17,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.517	.517			
	KTAS	298	305			
	Fuel - Lb/Hr	854	873			
25	KIAS	199	199	199		
	KTAS	286	292	298		
	Fuel - Lb/Hr	879	898	916		
20	KIAS	203	203	203	203	203
	KTAS	269	275	281	283	286
	Fuel - Lb/Hr	910	928	947	956	965
15	KIAS	203	203	203	203	203
	KTAS	248	253	258	260	263
	Fuel - Lb/Hr	923	942	960	969	977
10	KIAS	204	204	204	204	204
	KTAS	232	236	241	243	245
	Fuel - Lb/Hr	952	970	988	997	1006
5	KIAS	209	209	209	209	209
	KTAS	221	225	229	231	233
	Fuel - Lb/Hr	1004	1023	1041	1050	1059
S.L.	KIAS	213	213	213	213	213
	KTAS	210	214	217	219	221
	Fuel - Lb/Hr	1059	1078	1097	1106	1115

45-956a

WEIGHT — 18,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.521	.521			
	KTAS	300	307			
	Fuel - Lb/Hr	881	901			
25	KIAS	202	202	202		
	KTAS	290	296	302		
	Fuel - Lb/Hr	905	924	943		
20	KIAS	207	207	207	207	
	KTAS	274	279	285	288	
	Fuel - Lb/Hr	937	957	976	985	
15	KIAS	205	205	205	205	205
	KTAS	252	257	262	264	266
	Fuel - Lb/Hr	949	967	986	995	1004
10	KIAS	207	207	207	207	207
	KTAS	235	239	244	246	248
	Fuel - Lb/Hr	976	995	1013	1022	1031
5	KIAS	212	212	212	212	212
	KTAS	224	228	232	234	236
	Fuel - Lb/Hr	1032	1051	1070	1079	1088
S.L.	KIAS	218	218	218	218	218
	KTAS	214	218	222	223	225
	Fuel - Lb/Hr	1092	1112	1131	1140	1150

Figure 8-12 (Sheet 4 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-957a

WEIGHT — 18,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.525	.525			
	KTAS	303	309			
	Fuel - Lb/Hr	909	929			
25	KIAS	203	203	203		
	KTAS	291	297	304		
	Fuel - Lb/Hr	922	942	962		
20	KIAS	210	210	210	210	
	KTAS	278	283	289	292	
	Fuel - Lb/Hr	963	983	1003	1012	
15	KIAS	210	210	210	210	210
	KTAS	257	262	267	269	272
	Fuel - Lb/Hr	981	1001	1020	1029	1039
10	KIAS	209	209	209	209	209
	KTAS	237	242	246	248	251
	Fuel - Lb/Hr	999	1018	1037	1046	1055
5	KIAS	216	216	216	216	216
	KTAS	228	232	236	238	240
	Fuel - Lb/Hr	1061	1080	1099	1109	1118
S.L.	KIAS	221	221	221	221	221
	KTAS	218	222	225	227	229
	Fuel - Lb/Hr	1123	1143	1162	1172	1182

45-958a

WEIGHT — 19,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.509	.509			
	KTAS	293	300			
	Fuel - Lb/Hr	899	919			
25	KIAS	203	203	203		
	KTAS	292	298	305		
	Fuel - Lb/Hr	939	959	979		
20	KIAS	212	212	212		
	KTAS	281	287	293		
	Fuel - Lb/Hr	988	1008	1028		
15	KIAS	214	214	214	214	214
	KTAS	262	267	272	275	277
	Fuel - Lb/Hr	1013	1033	1053	1063	1072
10	KIAS	211	211	211	211	211
	KTAS	240	245	249	251	253
	Fuel - Lb/Hr	1023	1042	1062	1071	1080
5	KIAS	219	219	219	219	219
	KTAS	231	236	240	242	244
	Fuel - Lb/Hr	1089	1109	1129	1139	1148
S.L.	KIAS	224	224	224	224	224
	KTAS	221	224	228	230	232
	Fuel - Lb/Hr	1149	1170	1190	1200	1210

Figure 8-12 (Sheet 5 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-959a

WEIGHT — 19,500 LB		TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET 35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
25	KIAS	204	204			
	KTAS	293	299			
	Fuel - Lb/Hr	957	977			
20	KIAS	214	214	214		
	KTAS	284	290	295		
	Fuel - Lb/Hr	1010	1031	1051		
15	KIAS	218	218	218	218	
	KTAS	267	272	277	280	
	Fuel - Lb/Hr	1045	1066	1087	1097	
10	KIAS	215	215	215	215	215
	KTAS	244	249	253	256	258
	Fuel - Lb/Hr	1053	1073	1093	1102	1112
5	KIAS	222	222	222	222	222
	KTAS	234	238	243	245	247
	Fuel - Lb/Hr	1114	1134	1155	1165	1175
S.L.	KIAS	226	226	226	226	226
	KTAS	222	226	230	232	234
	Fuel - Lb/Hr	1169	1189	1210	1220	1230

45-960a

WEIGHT — 20,000 LB		TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET 35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
25	KIAS	205	205			
	KTAS	294	301			
	Fuel - Lb/Hr	978	999			
20	KIAS	215	215	215		
	KTAS	285	291	296		
	Fuel - Lb/Hr	1026	1047	1068		
15	KIAS	221	221	221	221	
	KTAS	271	276	282	284	
	Fuel - Lb/Hr	1075	1096	1117	1128	
10	KIAS	219	219	219	219	219
	KTAS	248	253	258	260	262
	Fuel - Lb/Hr	1084	1105	1125	1135	1145
5	KIAS	224	224	224	224	224
	KTAS	236	241	245	247	249
	Fuel - Lb/Hr	1136	1157	1178	1188	1198
S.L.	KIAS	227	227	227	227	227
	KTAS	223	227	231	233	235
	Fuel - Lb/Hr	1185	1206	1227	1237	1248

Figure 8-12 (Sheet 6 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-973

			TEMPERATURE — °C				
WEIGHT — 20,500 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	30	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	25	KIAS	206	206			
		KTAS	296	303			
		Fuel - Lb/Hr	1002	1023			
	20	KIAS	216	216	216		
		KTAS	286	291	297		
		Fuel - Lb/Hr	1041	1063	1084		
	15	KIAS	224	224	224	224	
		KTAS	274	279	284	287	
		Fuel - Lb/Hr	1097	1119	1140	1151	
	10	KIAS	223	223	223	223	223
		KTAS	253	258	262	265	267
		Fuel - Lb/Hr	1116	1138	1159	1169	1179
	5	KIAS	226	226	226	226	226
		KTAS	239	243	247	249	252
		Fuel - Lb/Hr	1158	1180	1201	1211	1221
	S.L.	KIAS	229	229	229	229	229
		KTAS	225	229	233	234	236
		Fuel - Lb/Hr	1202	1223	1244	1255	1265

45-974

			TEMPERATURE — °C				
WEIGHT — 21,000 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	30	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	25	KIAS	210	210			
		KTAS	301	308			
		Fuel - Lb/Hr	1040	1062			
	20	KIAS	216	216	216		
		KTAS	286	292	298		
		Fuel - Lb/Hr	1055	1077	1099		
	15	KIAS	226	226	226	226	
		KTAS	276	282	287	290	
		Fuel - Lb/Hr	1119	1141	1163	1174	
	10	KIAS	227	227	227	227	227
		KTAS	258	262	267	270	272
		Fuel - Lb/Hr	1150	1172	1194	1205	1215
	5	KIAS	228	228	228	228	228
		KTAS	240	245	249	251	253
		Fuel - Lb/Hr	1177	1198	1220	1230	1241
	S.L.	KIAS	230	230	230	230	230
		KTAS	226	230	234	236	238
		Fuel - Lb/Hr	1219	1240	1262	1272	1283

Figure 8-12 (Sheet 7 of 7)

INTENTIONALLY LEFT BLANK

OXYGEN QUANTITY MISSION PLANNING

EFFECTIVITY
Aircraft 45-002 thru 45-169 *without* Altitude Compensated Oxygen System

MINIMUM OXYGEN QUANTITY — LITERS
(as required by regulations)

Number of Passengers									
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
228	269	311	353	395	437	479	520	562	604

TIME (hours:minutes)
Light face numbers indicate one crew member using oxygen above FL410
Bold face numbers indicate one crew member using oxygen above FL350

OXY QTY LTR	**Number of Passengers**								
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
670	8:11	7:25	6:38	5:52	5:05	4:19	3:32	2:46	1:59	1:13
	6:42	**6:03**	**5:26**	**4:48**	**4:10**	**3:32**	**2:54**	**2:16**	**1:38**	**1:00**
623	7:19	6:33	5:46	5:00	4:13	3:27	2:40	1:54	1:07	0:21
	6:00	**5:22**	**4:44**	**4:05**	**3:28**	**2:50**	**2:12**	**1:34**	**0:56**	**0:17**
604	6:58	6:12	5:25	4:39	3:52	3:06	2:19	1:33	0:46	0:00
	5:42	**5:03**	**4:26**	**3:48**	**3:09**	**2:32**	**1:54**	**1:16**	**0:38**	**0:00**
562	6:12	5:25	4:39	3:52	3:06	2:19	1:33	0:46	0:00	
	5:03	**4:26**	**3:48**	**3:09**	**2:32**	**1:54**	**1:16**	**0:38**	**0:00**	
520	5:25	4:39	3:52	3:06	2:19	1:33	0:46	0:00		
	4:26	**3:48**	**3:09**	**2:32**	**1:54**	**1:16**	**0:38**	**0:00**		
479	4:39	3:52	3:06	2:19	1:33	0:46	0:00			
	3:48	**3:09**	**2:32**	**1:54**	**1:16**	**0:38**	**0:00**			
437	3:52	3:06	2:19	1:33	0:46	0:00				
	3:09	**2:32**	**1:54**	**1:16**	**0:38**	**0:00**				
395	3:06	2:19	1:33	0:46	0:00					
	2:32	**1:54**	**1:16**	**0:38**	**0:00**					
353	2:19	1:33	0:46	0:00						
	1:54	**1:16**	**0:38**	**0:00**						
311	1:33	0:46	0:00							
	1:16	**0:38**	**0:00**							
269	0:46	0:00								
	0:38	**0:00**								
228	0:00									
	0:00									

NOTE: The time obtained from this table may exceed the fuel endurance available.

Conditions:
- Cabin Pressure — Normal
- One crew member using oxygen (crew mask in normal mode)

Figure 8-13

OXYGEN QUANTITY MISSION PLANNING

EFFECTIVITY
Aircraft 45-170 & Subsequent and prior aircraft
with Altitude Compensated Oxygen System

MINIMUM OXYGEN QUANTITY — LITERS
(as required by regulations)

Number of Passengers									
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
228	248	267	287	307	327	347	367	387	407

TIME (hours:minutes)
Light face numbers indicate one crew member using oxygen above FL410
Bold face numbers indicate one crew member using oxygen above FL350

OXY QTY LTR	Number of Passengers								
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
670	8:11 **6:42**	7:49 **6:24**	7:27 **6:05**	7:05 **5:48**	6:42 **5:30**	6:20 **5:11**	5:58 **4:53**	5:36 **4:35**	5:14 **4:17**	4:51 **3:59**
623	7:19 **5:59**	6:57 **5:41**	6:34 **5:23**	6:12 **5:04**	5:50 **4:47**	5:28 **4:29**	5:06 **4:10**	4:43 **3:52**	4:21 **3:34**	4:00 **3:16**
569	6:19 **5:10**	5:57 **4:52**	5:34 **4:34**	5:12 **4:16**	4:50 **3:58**	4:28 **3:40**	4:06 **3:21**	3:43 **3:02**	3:21 **2:45**	3:00 **2:27**
515	5:19 **4:21**	4:57 **4:02**	4:34 **3:45**	4:12 **3:27**	3:50 **3:08**	3:28 **2:50**	3:06 **2:32**	2:43 **2:14**	2:21 **1:56**	2:00 **1:38**
407	3:19 **2:43**	2:57 **2:25**	2:35 **2:07**	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**
387	2:57 **2:25**	2:35 **2:07**	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**	
367	2:35 **2:07**	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**		
347	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**			
327	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**				
307	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**					
287	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**						
267	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**							
248	0:22 **0:18**	0:00 **0:00**								
228	0:00 **0:00**									

NOTE: The time obtained from this table may exceed the fuel endurance available.

Conditions:
- Cabin Pressure — Normal
- One crew member using oxygen (crew mask in normal mode)

Figure 8-13.1

INTENTIONALLY LEFT BLANK

DESCENT AND HOLDING PERFORMANCE

The descent and holding performance on the following pages is based on flight test data and represents the average delivered aircraft.

DESCENT PERFORMANCE SCHEDULE

Figures 8-14 and 8-15 show times, distance and fuel used, for normal and high speed descents respectively, from a given altitude to sea level. An average descent weight of 15,000 pounds (6804 kg) is assumed in the tables. Subtraction of performance values for two altitudes results in the time, distance and fuel required for descent between the two altitudes. The descent speed schedule is presented with each table. The power setting for descent is IDLE thrust. Data are shown without the use of spoilers. Descent performance is improved if spoilers are deployed.

MAXIMUM RANGE DESCENT — ONE ENGINE

Figure 8-16 shows the descent speed schedule for a maximum range descent to an altitude at or below the single-engine service ceiling for the aircraft gross weight.

HOLDING OPERATIONS

Figure 8-17 shows fuel flows and holding speed for various weights and altitude conditions. The holding speeds presented are sufficient to ensure a comfortable margin above shaker operation or low-speed buffet while maneuvering in a holding pattern.

DESCENT PERFORMANCE SCHEDULE
NORMAL DESCENT

45-961a

ALTITUDE 1000 Ft.	TIME Min.	DISTANCE N.M.	FUEL Lb.
51	15.7	100	117
49	14.6	92	108
47	13.5	85	100
45	12.5	78	92
43	11.7	71	86
41	10.9	66	80
39	10.2	61	75
37	9.6	56	70
35	9.1	53	66
33	8.7	49	63
31	8.3	47	60
29	8.0	44	58
27	7.7	42	55
25	7.2	39	52
23	6.8	36	49
21	6.4	33	46
19	6.0	30	44
17	5.5	27	41
15	5.1	24	38
13	4.7	22	36
11	4.3	19	33
9	3.4	15	27
7	2.7	12	21
5	1.9	8	16

DESCENT SPEED: 51,000 to 28,000 feet 0.76 MI
28,000 to 10,000 feet 300 KIAS
10,000 feet and below 250 KIAS

Figure 8-14

DESCENT PERFORMANCE SCHEDULE
HIGH SPEED DESCENT

45-962a

ALTITUDE 1000 Ft.	TIME Min.	DISTANCE N.M.	FUEL Lb.
51	12.1	79	87
49	11.4	74	81
47	10.7	68	76
45	10.0	63	71
43	9.4	58	66
41	8.9	54	62
39	8.5	51	59
37	8.0	48	56
35	7.7	45	53
33	7.4	42	51
31	7.1	40	49
29	6.9	39	47
27	6.7	37	46
25	6.5	35	44
23	6.2	33	43
21	5.9	30	41
19	5.5	28	39
17	5.2	26	38
15	4.9	24	36
13	4.6	21	34
11	4.2	19	33
9	3.4	15	27
7	2.7	12	21
5	1.9	8	16

DESCENT SPEED: 51,000 to 26,800 feet 0.81 M_I
26,800 to 10,000 feet 330 KIAS
10,000 feet and below 250 KIAS

Figure 8-15

MAXIMUM RANGE DESCENT — ONE ENGINE

ALTITUDE — FT	DESCENT SPEED
51,000 to 49,000	0.70 MI
49,000 to 29,000	170 KIAS
29,000 to 21,000	0.45 MI
21,000 and below	200 KIAS

NOTE: This table represents the minimum sink-rate speed above the single-engine service ceiling and approximates the best rate-of-climb speed below the single-engine service ceiling.

Figure 8-16

HOLDING OPERATIONS

45-976

		WEIGHT — 1000 LB							
ALTITUDE — 1000 FEET		14	15	16	17	18	19	20	21
41	Mach Ind	.607	.623	.639	.655	.671	.687	.703	.718
	Fuel - Lb/Hr	737	782	829	876	925	974	1024	1080
39	Mach Ind	.581	.596	.612	.627	.643	.658	.673	.688
	Fuel - Lb/Hr	735	777	823	869	918	966	1015	1065
37	Mach Ind	.556	.571	.585	.600	.615	.630	.644	.659
	Fuel - Lb/Hr	734	775	818	864	911	959	1007	1057
35	Mach Ind	.531	.546	.560	.574	.589	.603	.617	.631
	Fuel - Lb/Hr	738	780	822	867	914	960	1008	1057
33	Mach Ind	.508	.522	.536	.550	.563	.577	.591	.604
	Fuel - Lb/Hr	747	788	831	876	921	968	1016	1063
31	Mach Ind	.487	.500	.513	.526	.540	.553	.566	.579
	Fuel - Lb/Hr	757	798	839	882	930	976	1023	1071
29	Mach Ind	.466	.479	.492	.504	.517	.530	.543	.555
	Fuel - Lb/Hr	766	807	850	891	938	985	1033	1079
25	KIAS	150	155	160	165	170	175	180	185
	Fuel - Lb/Hr	711	752	793	835	877	919	962	1007
20	KIAS	150	155	160	165	170	175	180	185
	Fuel - Lb/Hr	737	778	819	861	903	946	990	1034
15	KIAS	150	155	160	165	170	175	180	185
	Fuel - Lb/Hr	767	808	849	891	934	978	1023	1068
10	KIAS	150	155	160	165	170	175	180	185
	Fuel - Lb/Hr	799	841	884	928	971	1015	1060	1106
5	KIAS	150	155	160	165	170	175	180	185
	Fuel - Lb/Hr	841	885	929	973	1018	1065	1112	1159

Figure 8-17

INTENTIONALLLY LEFT BLANK

STANDARD INSTRUMENT DEPARTURE (SID) CLIMB PERFORMANCE

INTRODUCTION

The Standard Instrument Departure (SID) Climb Performance data in this section are not provided for D and E effectivity aircraft.

BOMBARDIER
LEARJET 45

Pilot's Manual

F

U.S. UNITS

This electronic Pilot's Manual was compiled based upon data relevant to F coded aircraft using U.S. Units.

The content of this electronic collection in no way supersedes the current content outlined in the approved Airplane Flight Manual and any revisions thereto. In case of conflict, the hardcopy Airplane Flight Manual takes precedence. Revisions may be published without notice. Verification that copies are the latest version is the responsibility of the user.

(Return to Selection Screen)

Subject: Learjet 45 Pilot's Manual (U.S. Units) — Change 3

The following summary describes the changes that are incorporated with this change.

SECTION VIII — FLIGHT CHARACTERISTICS & OPERATIONAL PLANNING

STANDARD INSTRUMENT DEPARTURE (SID) CLIMB PERFORMANCE	This Section is new and provides SID climb requirements data for one and two engine operations and for takeoff flap settings of 8 and 20 degrees. Separate tables are provided for airport pressure altitudes from Sea Level through 14,000 feet.

PILOT'S MANUAL

BOMBARDIER LEARJET 45

This Pilot's Manual provides information supplemental to the Learjet 45 FAA Approved Airplane Flight Manual. In the event any information herein conflicts with information in the FAA Approved Airplane Flight Manual, the FAA Approved Airplane Flight Manual shall take precedence.

BOMBARDIER

PM-126A **March 2005**

LOG OF TEMPORARY PILOT'S MANUAL CHANGES

This list is intended to assist the flight crew in determining the applicable temporary pilot's manual changes for Learjet 45 aircraft. It is the responsibility of the aircraft owner and operator to maintain their basic pilot's manual with the temporary changes applicable to their aircraft. Insert this list after the title page.

TPM # Dated	Section or Page	Description	Status
2006-05 12-4-2006	5-56	Tuning the KHF 1050 with the RMU	Removed by Change 1

LIST OF EFFECTIVE PAGES

Use this List of Effective Pages to determine the current status of the Pilot's Manual. Pages affected by the current change are indicated by an asterisk (*) immediately preceding the page number.

Dates of issue for Original and Changed pages are:

Original	O	December 1997
Reissue	A	March 2005
Change	1	May 2008
Change	2	April 2010
Change	3	August 2010

Page	Change	Aircraft Affected
Title	A	All
* A thru E	3	All
i thru iv	A	All
General Description		
I-1 and I-2	A	All
1-1	A	All
1-2	1	All
1-3 thru 1-32	A	All
Engines & Fuel		
II-1	A	All
II-2	2	All
2-1 thru 2-26	A	All
2-27	1	All
2-28 thru 2-34	A	All
2-35 and 2-36	2	All
2-36A and 2-36B	2	All
2-37 thru 2-45	A	All
2-46	2	All
2-47 and 2-48	A	All
Hydraulics & Landing Gear		
III-1	A	All
3-1 thru 3-22	A	All
Electrical & Lighting		
IV-1 and IV-2	2	All
4-1 and 4-2	A	All
4-3	1	All
4-4 thru 4-18	A	All
4-19	2	All
4-20 thru 4-25	A	All
4-26 thru 4-29	2	All
4-30 thru 4-37	A	All

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected
Flight Control Systems & Avionics		
V-1	A	All
V-2	2	All
V-3 and V-4	1	All
5-1 thru 5-13	A	All
5-14	1	All
5-15 thru 5-19	A	All
5-20	2	All
5-21 thru 5-32	A	All
5-33	2	All
5-33A (Added)	2	All
5-34	2	All
5-35 and 5-36	A	All
5-37	2	All
5-38 thru 5-55	A	All
5-56	1	All
5-56A thru 5-56J	1	All
5-57 thru 5-74	A	All
5-75	2	All
5-76 thru 5-84	A	All
Anti-Ice & Environmental		
VI-1 and VI-2	2	All
6-1 thru 6-11	A	All
6-12	2	All
6-13 thru 6-18	A	All
6-19 and 6-20	2	All
6-20A thru 6-20D	2	All
6-21 thru 6-24	2	All
6-25 thru 6-33	A	All
Interior Equipment		
VII-1 and VII-2	A	All
VII-3	2	All
7-1 and 7-2	A	All
7-3	2	All
7-4 thru 7-8	A	All
7-9	2	All
7-10 thru 7-35	A	All
7-36 thru 7-38	2	All
7-38A	2	All
7-39	2	All
7-40 thru 7-45	A	All

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected/Effectivity Code
Flight Characteristics & Operational Planning		
VIII-1	A	All
* VIII-2	3	All
8-1 thru 8-11	A	All
8-12	1	♦ D and E
8-12.1	1	♦ F
8-13	1	♦ D and E
8-13.1	1	♦ F
8-14	1	♦ D and E
8-14.1	1	♦ F
8-15	1	♦ D and E
8-15.1	1	♦ F
8-16	1	♦ D and E
8-16.1	1	♦ F
8-17	1	♦ D and E
8-17.1	1	♦ F
8-18	1	♦ D and E
8-18.1	1	♦ F
8-19	1	♦ D and E
8-19.1	1	♦ F
8-20	1	♦ D and E
8-20.1	1	♦ F
8-21 and 8-22	A	♦ All
8-23	1	♦ D and E
8-23.1	1	♦ F
8-24	1	♦ D and E
8-24.1	1	♦ F
8-25	1	♦ D and E
8-25.1	1	♦ F
8-26	1	♦ D and E
8-26.1	1	♦ F
8-27	1	♦ D and E
8-27.1	1	♦ F
8-28	1	♦ D and E
8-28.1	1	♦ F
8-29	1	♦ D and E
8-29.1	1	♦ F
8-30	A	All
8-31	1	♦ D and E
8-31.1	1	♦ F
8-32	1	♦ D and E
8-32.1	1	♦ F
8-33	1	♦ D and E
8-33.1	1	♦ F
8-34	1	♦ D and E

♦ Denotes pages presented in either U.S. or metric units.

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected/Effectivity Code
8-34.1	1	♦ F
8-35	1	♦ D and E
8-35.1	1	♦ F
8-36	1	♦ D and E
8-36.1	1	♦ F
8-37	1	♦ D and E
8-37.1	1	♦ F
8-38	1	♦ D and E
8-38.1	1	♦ F
8-39	1	♦ D and E
8-39.1	1	♦ F
8-40	1	♦ D and E
8-40.1	1	♦ F
8-41	1	♦ D and E
8-41.1	1	♦ F
8-42	1	♦ D and E
8-42.1	1	♦ F
8-43	1	♦ D and E
8-43.1	1	♦ F
8-44	1	♦ D and E
8-44.1	1	♦ F
8-45	1	♦ D and E
8-45.1	1	♦ F
8-46	1	♦ D and E
8-46.1	1	♦ F
8-47	1	♦ D and E
8-47.1	1	♦ F
8-48	1	♦ D and E
8-48.1	1	♦ F
8-49	1	♦ D and E
8-49.1	1	♦ F
8-50	1	♦ D and E
8-50.1	1	♦ F
8-51	1	♦ D and E
8-51.1	1	♦ F
8-52	1	♦ D and E
8-52.1	1	♦ F
8-53	1	♦ D and E
8-53.1	1	♦ F
8-54	1	♦ D and E
8-54.1	1	♦ F
8-55	1	♦ D and E
8-55.1	1	♦ F
8-56	1	♦ D and E

♦ Denotes pages presented in either U.S. or metric units.

LIST OF EFFECTIVE PAGES (Cont)

Page	Change	Aircraft Affected/Effectivity Code
8-56.1	1	♦ F
8-57	1	♦ D and E
8-57.1	1	♦ F
8-58	1	♦ D and E
8-58.1	1	♦ F
8-59	1	♦ D and E
8-59.1	1	♦ F
8-60	1	♦ D and E
8-60.1	1	♦ F
8-61	1	♦ D and E
8-61.1	1	♦ F
8-62	1	♦ D and E
8-62.1	1	♦ F
8-63	1	♦ D and E
8-63.1	1	♦ F
8-64	1	♦ D and E
8-64.1	1	♦ F
8-65	1	♦ D and E
8-65.1	1	♦ F
8-66	A	All
8-67	A	Aircraft 45-002 thru 45-169 *without* Altitude Compensated Oxygen System
8-67.1	A	Aircraft 45-170 & Subsequent and prior aircraft *with* Altitude Compensated Oxygen System
8-68 and 8-69	A	All
8-70 and 8-71	A	♦ All
8-72	A	All
8-73	A	♦ All
*8-74 (Blank) (Added)	3	♦ All
*8-75 (Added)	3	D and E
* 8-75.1 thru 8-79.1 (Added)	3	F
*8-80.1 and 8-81.1 (Added)	3	♦ F
*8-82.1 (Added)	3	F
*8-83.1 thru 8-146.1 (Added)	3	♦ F

♦ Denotes pages presented in either U.S. or metric units.

INTRODUCTION

The information in this manual is intended to augment the information in the Learjet 45 FAA Approved Airplane Flight Manual (AFM) and in no manner supersedes any Flight Manual limitations, procedures, or performance data. In the event that any information in this manual should conflict with that in the FAA Approved Airplane Flight Manual, the FAA Approved Airplane Flight Manual shall take precedence.

THE MANUAL

This manual describes Learjet 45 airplanes configured with the Performance enhancement package. Airplanes not configured with this package will have slightly different indications in some situations. The AFM describes these situations and should be referenced as required to verify configuration.

Sections I through VII of this manual are intended to provide the operator of the Learjet 45 with a basic description of the airplane operating systems from the cockpit controls and indicators to the actuating mechanisms in the systems. No attempt has been made to establish a specific standard airplane due to the numerous customer options. Therefore, the illustrations and descriptions within this manual are for a "typical" airplane and may not match a specific airplane. Specific serialization is shown only when more than one version of the same system is incorporated into production on a nonretrofit basis.

Section VIII of this manual contains tabular performance and fuel consumption data derived from the AFM and flight testing. This data may be used by the operator for flight planning.

This section has been designed so that pages not applicable to a particular airplane may be removed. Removing such pages allows the operator to construct a flight planning section applicable to a particular airplane.

Flight planning data of this section contains an effectivity block located at the top of the page. To remove pages not applicable to your airplane, examine the effectivity block to determine if the page is applicable to your airplane. If the page is not applicable, remove the page from the section and discard. If the page is applicable, retain the page.

The effectivity codes used in this section are identical to the effectivity codes used in the basic AFM. For an explanation of the effectivity codes, refer to FLIGHT MANUAL PERFORMANCE DATA in the AFM introduction.

REVISING THE MANUAL

Periodically, Numbered Changes may be issued against this manual. Pages included in Numbered Changes supersede like numbered pages in the Pilot's Manual. Each page of a Numbered Change contains a "Change" number located at the lower inside margin of the page. Portions of the text affected by the change are indicated by a vertical bar at the outer margin of the page. The vertical bars may not appear on pages that contain graphs or tables. Additionally, when a "changed" page occurs as the result of a rearrangement of material due to a change on a previous page, no vertical bar appears.

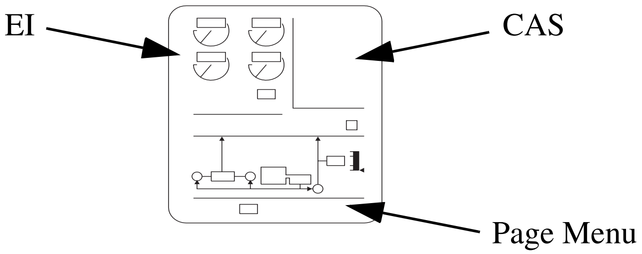
The List of Effective Pages provides the user with a guide to establish the current effective date of each page in the Pilot's Manual and may be used as an instruction sheet for incorporating the latest Numbered Change into the Pilot's Manual. Information included in the List of Effective Pages states the current "Change" number for each page and the dates of Original issue and Numbered Changes. An asterisk (*) next to a page number indicates the page was changed, added, or deleted by the current change.

MANUAL CONVENTIONS

ENGINE INDICATING AND CREW ALERTING SYSTEM (EICAS)

EICAS indications will be presented by all capital letters within their appropriate display fields. The following table lists samples of EICAS text and illustrates terms used in this manual:

Sample Text	Definition
EICAS — Select HYD or SUMRY page.	EICAS is an acronym for Engine Indicating and Crew Alerting System. HYD or SUMRY is illuminated on the system page menu (lower display of EICAS) for applicable page selection.
An APR green EI indicates that the APR has activated.	EI is an acronym for Engine Indicating and will represent illuminated indications within the engine instruments field in the upper left display of EICAS. APR is illuminated green.
The MAIN HYD QTY LO white CAS indicates that the main hydraulic quantity is low.	CAS is an acronym for Crew Alerting System and will represent illuminated indications within the CAS window in the upper right display of EICAS. MAIN HYD QTY LO is illuminated white.



EICAS Display

SWITCH INDICATIONS

Normal switch condition will be assumed not illuminated on the "quiet-dark-normal" instrument panel and pedestal. Illuminated switch indications will be noted in all capital letters. (e.g. PACK Switch — OFF).

Switch conditions that are not illuminated will be lead capped (e.g. PACK Switch — On), unless they are part of a longer description. The following table lists samples of text and definitions used in this Manual:

Sample Text	Definition
AUX HYD Switch — ON.	The switch labeled AUX HYD is illuminated ON.
L or R STBY Switch — Off.	The applicable switch labeled L STBY or R STBY is not illuminated and switch condition is off.

VOICE AND CREW WARNING PANEL (CWP) ANNUNCIATIONS

Voice annunciations will be presented by all capital letters and within quotes. CWP annunciations will be presented by all capital letters and are usually accompanied by a CAS. The following table lists samples of EICAS text and illustrates terms used in this Manual:

Sample Text	Definition
"GEAR" Voice.	A "GEAR" voice message will sound.
GEAR red CAS and CWP.	CWP is an acronym for Crew Warning Panel and will represent illuminated indications of the annunciator panel located in the center of the instrument panel. The GEAR warning light and CAS are illuminated red.

ADDRESSES

Your comments and suggestions concerning this manual are solicited and should be forwarded to:

Learjet, Inc.
P.O. Box 7707
Wichita, Kansas 67277-7707

Attn: Manager Technical Publications MS#53

SECTION I
GENERAL DESCRIPTION

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

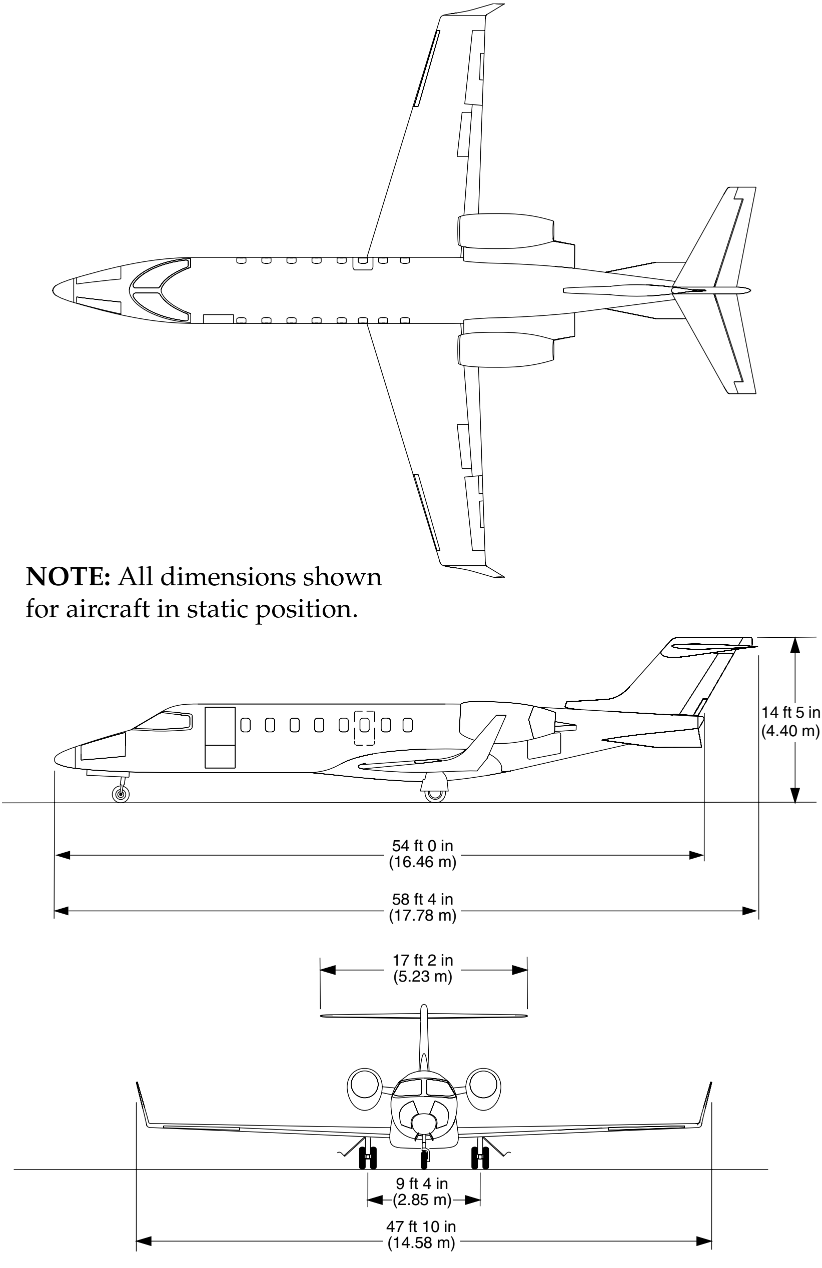
SECTION I
GENERAL DESCRIPTION

AIRCRAFT GENERAL DESCRIPTION

The Learjet 45 aircraft, manufactured by Learjet Inc., is an all metal, pressurized, low-wing, turbofan-powered monoplane. The high-aspect ratio, fully cantilevered, swept-back wings with winglets are of conventional riveted construction except for the upper section of the winglets, which utilize full-depth honeycomb core bonded to the outer skin. The fuselage is of semimonocoque construction and utilizes a constant circular cross sectional shape across the upper fuselage half and an elongated cross sectional shape in the lower fuselage. The constant upper circular section extends back to the aft pressure bulkhead where it is faired into the tailcone. Two inverted "V" ventral fins (delta fins) are fitted to the aft section of the tailcone to provide the aircraft with favorable stall recovery characteristics and additional lateral/ directional stability.

Thrust is provided by two pod-mounted TFE-731-20 turbofan engines manufactured by Honeywell. Independent fuel systems supply fuel to the engines with fuel storage provided in wing and fuselage tanks. Engine-driven hydraulic pumps provide hydraulic power for braking, extending or retracting the landing gear, wing flaps, spoilers, and thrust reversers. The landing gear system is a fully retractable tricycle-type trailing link landing gear with dual main gear wheels, nose-wheel steering, and a brake-by-wire brake control/anti-skid braking system.

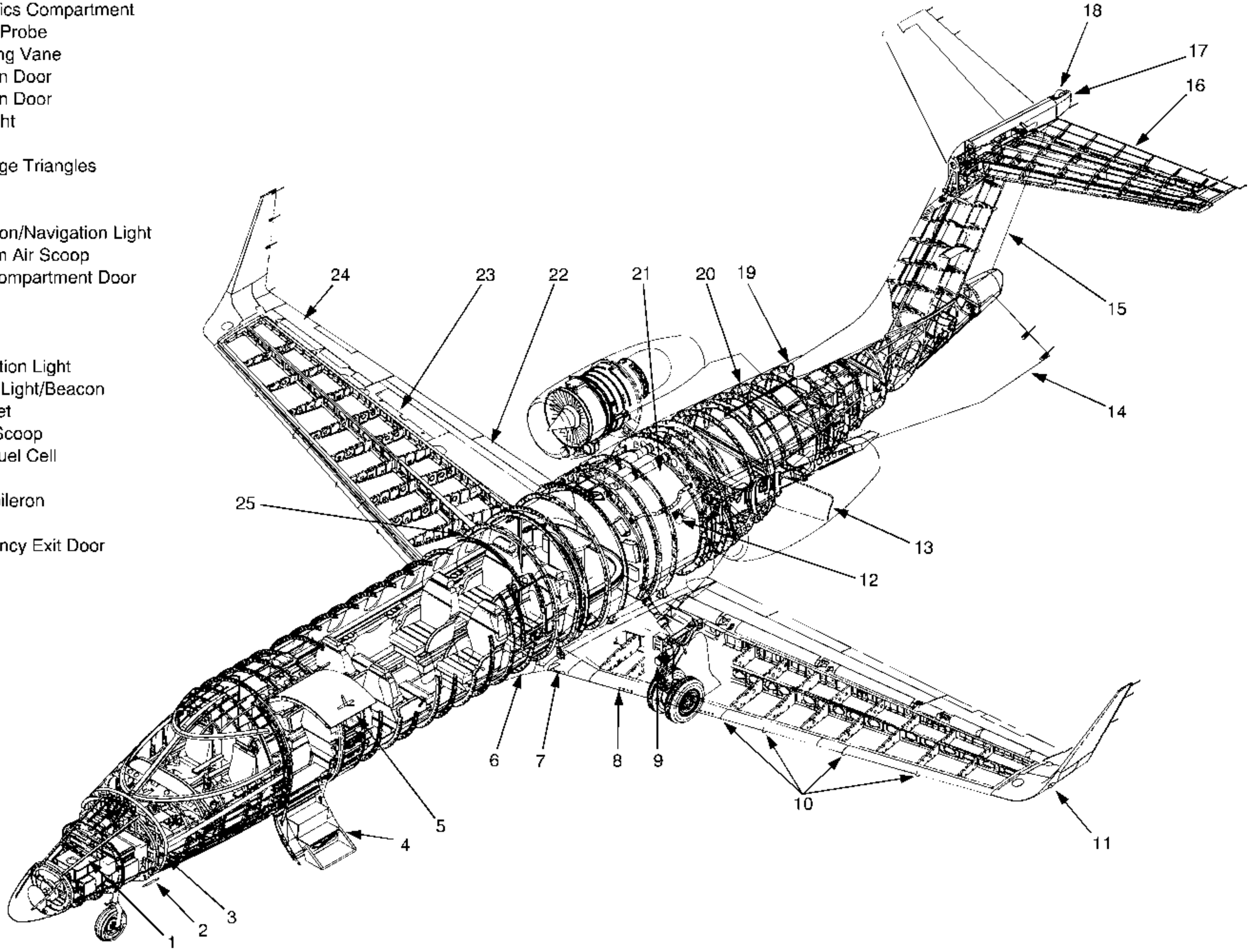
The ailerons, rudder, and elevator are manually controlled through cables, bellcranks, pulleys, and push-pull tubes. An electrically-actuated trim tab is installed on the left aileron and on the rudder to provide lateral and directional trim. Longitudinal trim is accomplished by changing the incidence of the horizontal stabilizer with an electrically-operated linear actuator. Aircraft air conditioning systems which include an air cycle machine, provide heating, cooling, and pressurization for the cockpit, passenger compartment and aft lavatory.



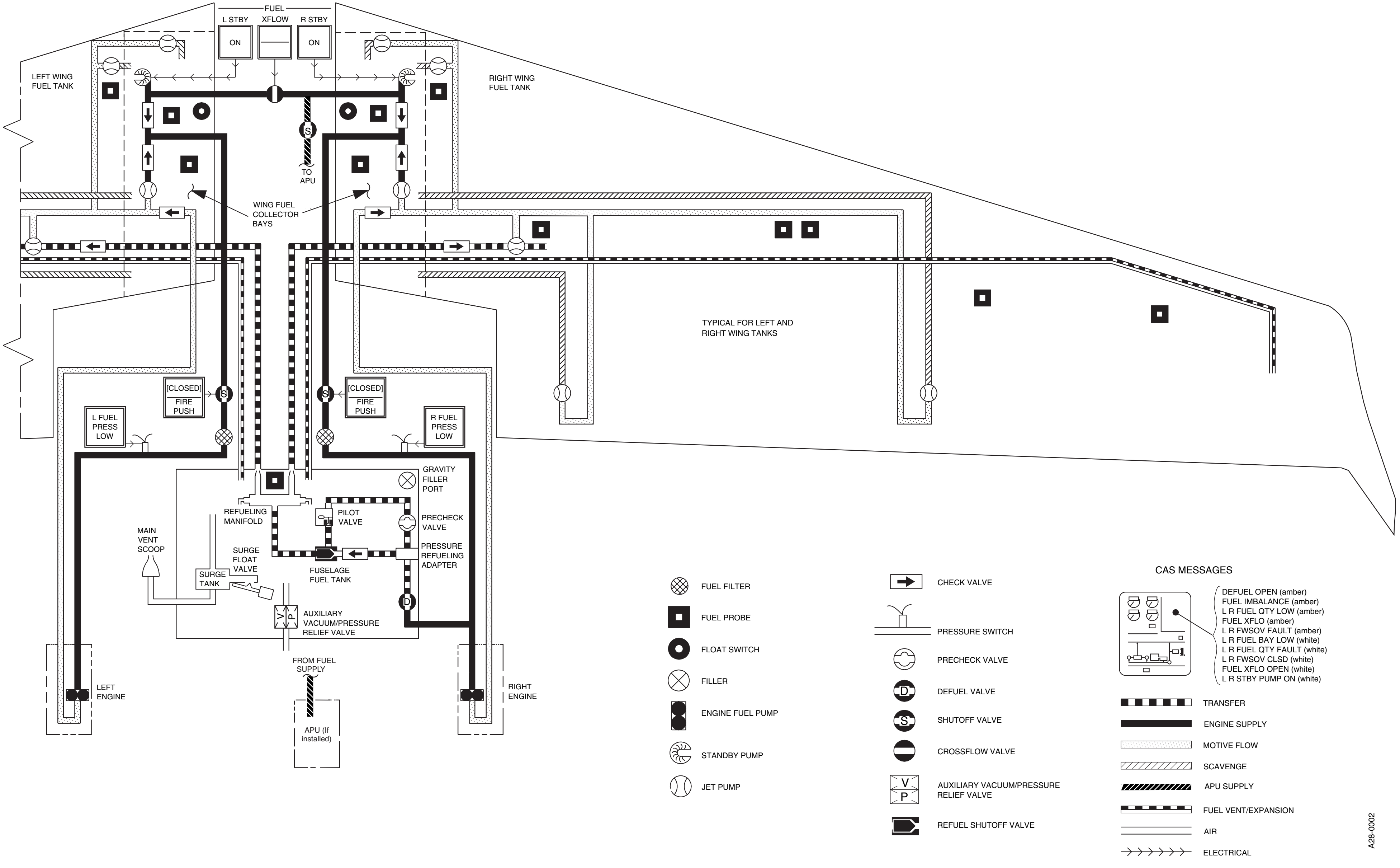
NOTE: All dimensions shown for aircraft in static position.

AIRPLANE THREE-VIEW
Figure 1-1

1. Nose Avionics Compartment
2. Pitot Static Probe
3. Stall Warning Vane
4. Lower Cabin Door
5. Upper Cabin Door
6. Landing Light
7. Stall Strip
8. Leading Edge Triangles
9. Taxi Light
10. Vortilons
11. Wing Position/Navigation Light
12. Fuel System Air Scoop
13. Baggage Compartment Door
14. Delta Fin
15. Rudder
16. Elevator
17. Tail Navigation Light
18. Tail Strobe Light/Beacon
19. Ram Air Inlet
20. Pack Inlet Scoop
21. Fuselage Fuel Cell
22. Flap
23. Spoiler/Spoileron
24. Aileron
25. Aft Emergency Exit Door



GENERAL ARRANGEMENT —EXTERIOR
Figure 1-2



FUEL SYSTEM SCHEMATIC
Figure 2-6

CABIN ENTRY DOOR

The cabin door is located in the forward left side of the fuselage. The cabin door is a clamshell style design which consists of an upper door section which opens upward to form a canopy while open, and a lower door section with integral steps which opens downward. A retractable flip step is installed on the lower cabin door which is rotated down to form the lowest entry step. The cabin door is 30 inches (76 centimeters) wide and provides normal entrance to and egress from the aircraft. The upper cabin door also doubles as the left forward emergency exit.

The upper cabin door features handles on both the inside and outside of the door. The outside upper door handle is recessed and protrudes slightly from the door skin. Before operating the outside handle the security keylock must be unlocked and the handle must be first lifted out from the door, then rotated clockwise into the open position. The inside upper door handle is readily accessible and can be rotated to lock or unlock the upper door mechanism. The upper door is equipped with a pair of gas struts which aid when raising the door. The gas struts will maintain the door in the open position after it is raised. A key lock is installed on the outside of the upper door to secure the aircraft from the outside. Rotating the key lock will prevent the outer upper door handle mechanism from moving into the open position. The security lock can be easily overridden from inside the aircraft.

A vent door and locking mechanism is incorporated into the upper cabin door. If the upper cabin door is not closed with the locking pins engaged, the vent door will remain open to prevent the airplane from pressurizing. The vent door is connected to the upper door handle mechanism through a series of bell cranks and link rods which will keep the vent door closed while the upper door handle is in the closed position. As the upper door handle is rotated out of the closed position the vent door will open and remain open while the handle is in transition. When the handle is in the fully open position the vent door will close. The vent door will remain closed while the upper cabin door is open to prevent ice and moisture contamination.

The lower cabin door is equipped with a single locking handle which is installed in the upper edge of the door as it is viewed in the closed position. The handle can be lifted out of the recess and rotated forward to latch the door, or aft to unlatch the lower cabin door. Gas struts are installed on the forward lower door structure to aid in closing and prevent damage if the door is inadvertently allowed to drop open.

CABIN ENTRY DOOR (CONT)

A cable and knob assembly is attached to the forward side of the lower door frame.The cable and knob assembly is used to raise and lower the lower door from inside the cabin. When closing the lower cabin door, a secondary latch will automatically engage and hold the lower door in position against the door seal until the lower door handle is rotated forward to the locked position. If the handle is not rotated to latch the door and the door is left in position by the secondary latch, the upper door will be prevented from closing due to a pin which extends outboard from the lower door just below the handle.

When the locking handle on the lower door is rotated forward, the latching mechanism drives four pins into the fuselage frame, securing the lower door. The inside and outside handles on the upper cabin door are secured to a common shaft within the door. When either upper door handle is rotated to the closed position, six latching pins are driven into the fuselage structure and two pins are driven from the upper door into overlapping halves in the lower door. There are a total of eight pins installed in the upper door. Two of the six upper door latching pins are driven through both the fuselage structure and through interlocking arms on the lower door, which secure the doors together.

When the cabin entry door pins are engaged (there are twelve pins total, eight in the upper door, four in the lower door), the door becomes a rigid structural member. Correct pin engagement may be checked using the small sight windows installed in the upper and lower inner door panels. Sight windows are provided to check pin engagement for ten of the latch pin locations, for two middle lock pins and for the lower lock (pawl).

ENTRY DOOR ANNUNCIATIONS

All of the twelve cabin door latching pins are installed so they contact a microswitch when the pin is fully engaged. If any of these pins do not make contact when the upper door handle is closed, a red ENTRY DOOR warning light is displayed on the Crew Warning Panel (CWP) and a red ENTRY DOOR message on the Engine Indicating and Crew Alerting System (EICAS) illuminates to provide the crew with visual indication of cabin door security.

ENTRY DOOR ANNUNCIATIONS (Cont)

A white ENTRY DOOR PIN message will illuminate on the CAS whenever the aircraft is on the ground and the cabin door pins are not all fully engaged or all not fully disengaged. The ENTRY DOOR CWP message will be simultaneously displayed with the ENTRY DOOR PIN CAS message. If the keylock on the upper cabin entry (forward emergency exit) door is locked and electrical power is applied to the aircraft the red ENTRY DOOR light on the CWP will illuminate steady to prevent operations with the emergency exit locked. The red ENTRY DOOR and white ENTRY DOOR PIN CAS messages will also be displayed on the EICAS when the aircraft is in this configuration.

If the DOOR circuit breaker on the pilot's circuit breaker panel is out, the red ENTRY DOOR CWP annunciator and the red ENTRY DOOR and white ENTRY DOOR PIN CAS messages will all be displayed at the same time.

CABIN DOOR OPERATION

To open the cabin door from the outside:

1. Insert the key in the key lock and rotate to unlock.
2. Lift the upper door handle out and rotate the handle clockwise with both hands to the stop, releasing the door latch pins.
3. Raise the upper door by hand until the gas struts automatically raise the door up and hold it fully open.
4. While holding the lower door, reach inside and rotate the lower door locking handle aft (clockwise) to the OPEN position.
5. Lift the lower door secondary latch lever, located on the forward side of the door frame, to release the lower door.
6. Gently lower the door to the open position, the flip-down step will self deploy into the extended position.

OPENING CABIN DOOR (FROM OUTSIDE)
Figure 1-3

A52-1032

CABIN DOOR OPERATION (CONT)

To close cabin door from the inside:

WARNING

The flip-down step could cause injury to the hand or fingers if it is allowed to suddenly swing down into the stowed position. The flip-down step must be grasped firmly as the door is raised, and lowered by hand before the step nears the vertical position.

1. Raise the lower door using the cable and knob until the lower door is within reach. Immediately grasp the flip-down step, before it falls inward and lower it by hand into the stowed position against the inside of the lower door.
2. Pull the lower door against the door seal until the secondary latch engages, the secondary latch will hold the door in place. Release the cable and knob and allow the cable to retract, stowing the knob on forward side of the door frame.
3. Rotate the lower door handle forward (counterclockwise) to the locked position.

CLOSING CABIN DOOR
(LOWER DOOR FROM INSIDE)
Figure 1-4

A52-1037

CABIN DOOR OPERATION (CONT)

4. Pull the upper door down until the upper door handle is within reach.
5. With the upper door handle in the OPEN position (with the handle pointing up), pull the door tightly against the door seal and rotate the locking handle forward (clockwise) to the locked position. (If preparing for flight, check that the ENTRY DOOR warning annunciator light on the CWP is extinguished and the ENTRY DOOR and ENTRY DOOR PIN messages on the CAS are extinguished.)
6. Inspect the cabin door sight windows, located on the inside of the upper and lower door panels, to ensure that all of the latches and locks are properly engaged. The sight windows should appear in the safe condition as shown in Figure 1-6 CABIN DOOR LATCH PIN SIGHT WINDOWS.

CLOSING CABIN DOOR
(UPPER DOOR FROM INSIDE)
Figure 1-5

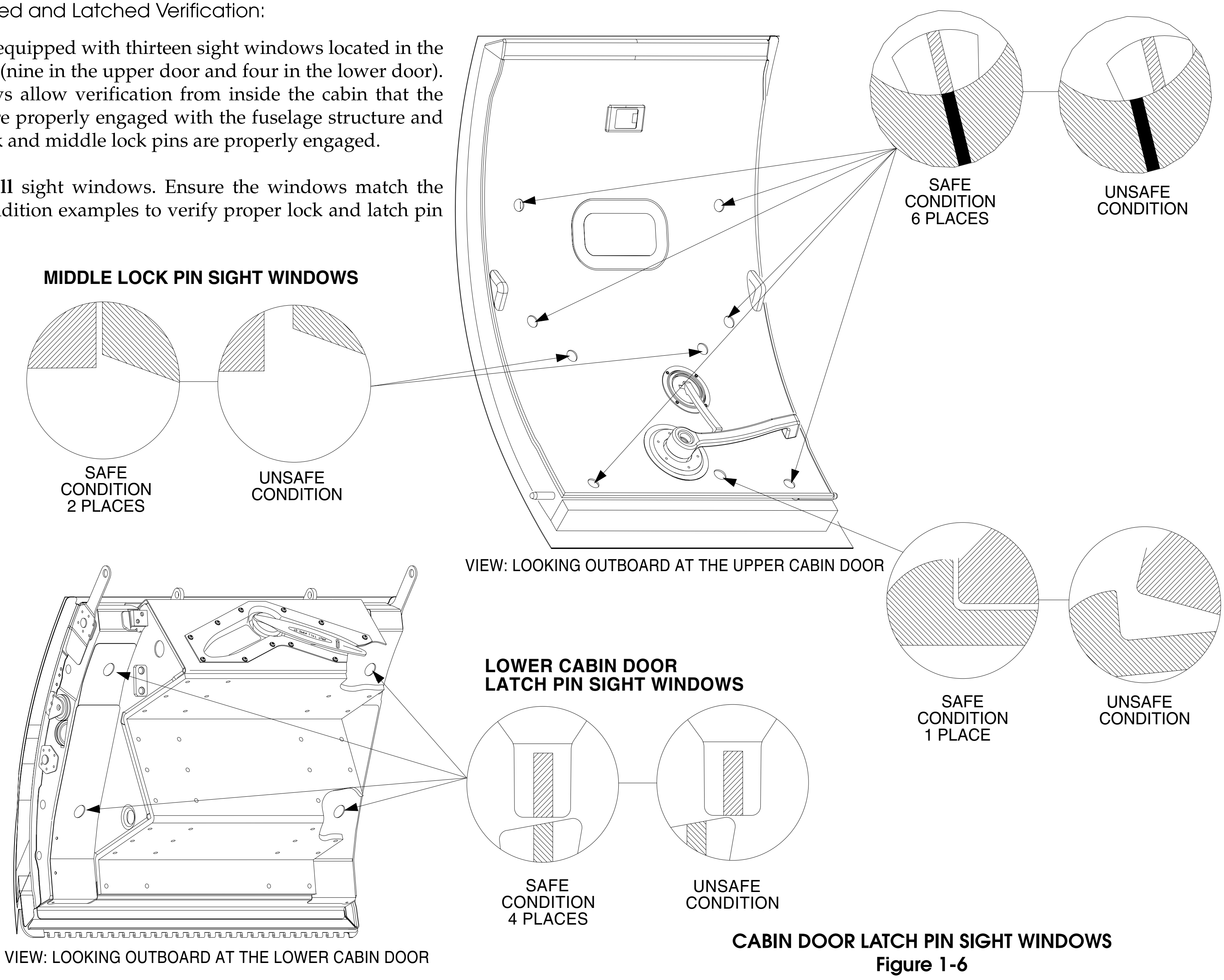
A52-1037

CABIN DOOR OPERATION (CONT)

Cabin Door Closed and Latched Verification:

The cabin door is equipped with thirteen sight windows located in the cabin door panels (nine in the upper door and four in the lower door). The sight windows allow verification from inside the cabin that the cabin door pins are properly engaged with the fuselage structure and that the lower lock and middle lock pins are properly engaged.

Visually inspect **all** sight windows. Ensure the windows match the following safe condition examples to verify proper lock and latch pin engagement.



CABIN DOOR LATCH PIN SIGHT WINDOWS
Figure 1-6

CABIN DOOR OPERATION (CONT)

To open cabin door from the inside:

1. Lift the upper door locking handle into the OPEN position.
2. Push the upper door outward and up allowing the door struts to raise the upper door to the fully open position.
3. Rotate the lower door locking handle aft (clockwise) to the OPEN position.
4. Grasp the cable knob, pull out any slack in the cable and while holding tension on the cable, release the secondary latch located on the forward side of the door frame.
5. Lower the lower door into the fully open position with the cable and knob, the flip-down step will pivot out into the deployed position as the door is lowered. Stow the knob on the forward side of the door frame.

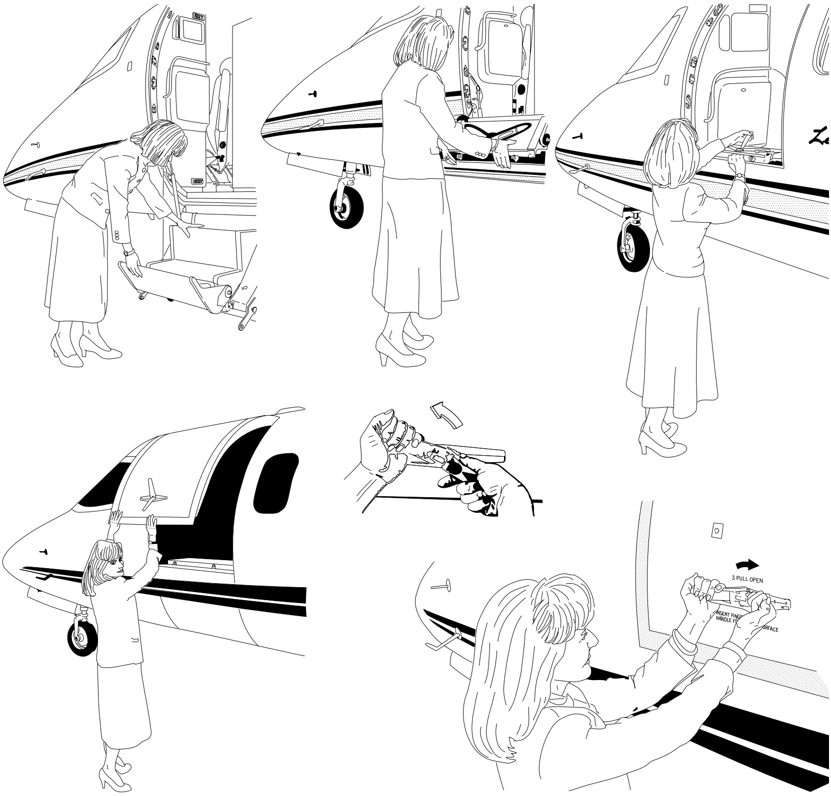
A52-1036

OPENING CABIN DOOR (FROM INSIDE)
Figure 1-7

CABIN DOOR OPERATION (CONT)

To close the cabin door from the outside:

1. Pivot the flip-down step upward until the step rests against the lower door.
2. Raise the lower door until it is against the door seal and secondary latch engages.
3. Reach inside and rotate the lower door handle forward (counterclockwise) to the locked position.
4. With the upper door handle in the OPEN position, pull the upper door down and hold it tightly against the door frame.
5. While holding the upper door closed, rotate the upper door handle counterclockwise to the stop with both hands.
6. Release the upper door handle and ensure the handle retracts into position against the door skin.



CLOSING CABIN DOOR (FROM THE OUTSIDE)
Figure 1-8

A52-1038

EMERGENCY EXITS

LEFT FORWARD EMERGENCY EXIT

The upper portion of the cabin entry door serves as the left forward emergency exit. The upper cabin entry door/left forward emergency exit is secured to the fuselage by six latching pins which extend from the left forward emergency exit into the fuselage structure and by two latching pins which are driven from the left forward emergency exit into an overlapping section in the lower cabin entry door. The pins are extended and retracted by the upper cabin door handles (on the inside and outside of the cabin door) which operate a common shaft.

Because the upper door is equipped with a keylock, it must be unlocked before flight to ensure optimum operation as an emergency exit. However, in the event that the keylock is locked, an override bar is installed on the inside of the door, above the door handle. When depressed outboard, the override bar will disable the locking function and allow the inboard handle to unlatch the left forward emergency exit. To open the left forward emergency exit from inside, the upper cabin door handle is rotated up (counterclockwise) into the OPEN position and the upper door is pushed open. The lower cabin door is kept closed. Keeping the lower door closed will also provide a greater safety factor in the event of ditching.

LEFT FORWARD EMERGENCY EXIT OPERATION

To open from the inside:

1. Lift the upper cabin door handle (rotate counterclockwise) into the OPEN position.
2. Push the upper door outward and up allowing the door struts to raise the upper door to the fully open position.
3. Leave the lower cabin door in place and exit through the open upper cabin door.

LEFT FORWARD EMERGENCY EXIT OPERATION
Figure 1-9

To open from the outside:

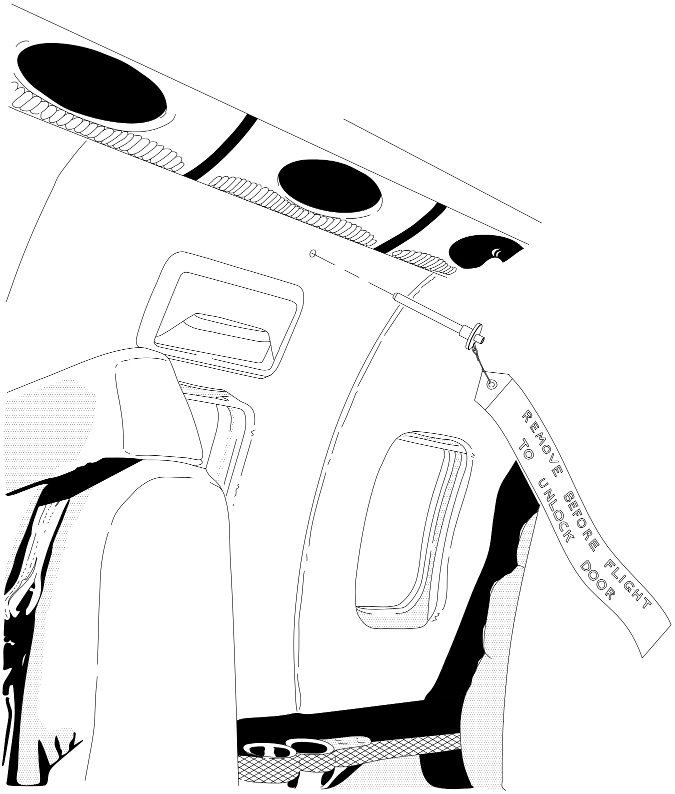
1. Lift the upper cabin door handle out and rotate the handle clockwise with both hands to the stop, releasing the upper door locking pins.
2. Raise the upper door by hand until the gas struts automatically raise the door up and hold it fully open.
3. Leave the lower cabin door in place and gain access through the open upper cabin door.

A52-1036

RIGHT AFT EMERGENCY EXIT HATCH

The emergency exit hatch is located on the right aft side of the cabin near the leading edge of the wing, adjacent to the right aft passenger seat. It provides egress from the cabin in the event of an emergency. The hatch is secured to the airframe by two spring-loaded pins which extend from the top of the hatch into the fuselage structure. The hatch is designed as a plug type hatch which **opens inward only**, and is held in the closed position by pressurization forces and the spring loaded pins. The emergency exit hatch is 20 inches (51 centimeters) wide by 36 inches (91 centimeters) high and functions as a Type III escape hatch.

A security pin can be installed on the inside of the emergency exit hatch to prevent unauthorized entry from the outside. The security pin is inserted from the inside to lock one of the spring loaded hatch pins in place. The security pin has a small flag attached which states REMOVE BEFORE FLIGHT.



A52-1033

AFT EMERGENCY EXIT SECURITY PIN
Figure 1-10

RIGHT AFT EMERGENCY EXIT HATCH OPERATION

To open/remove the right aft emergency exit from the inside:

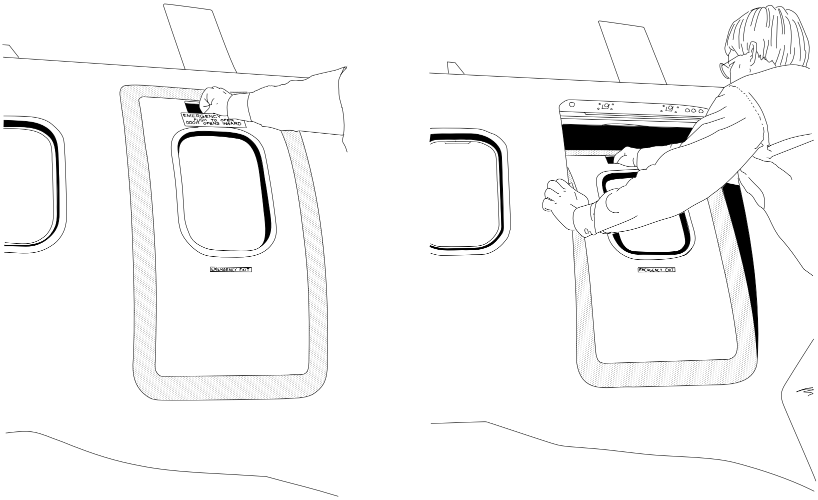
1. Remove the handle cover from the emergency exit hatch to fully expose the emergency exit handle. The cover is attached with hook and loop fasteners and can be easily pulled from the hatch.
2. Grasp the emergency exit handle placarded EXIT-PULL and pull it fully toward you and up, retracting the hatch pins.
3. While holding the emergency exit handle in the retracted position, tilt the top edge of the hatch inward.
4. Grasp the hatch in the armrest recess with the opposite hand and lift the hatch inward and up from the fuselage structure.
5. Lean the top of the hatch inward and rotate the hatch onto its edge.
6. Pass the hatch through the emergency exit opening to the outside of the aircraft.

EMERGENCY EXIT HATCH OPERATION (FROM INSIDE)
Figure 1-11

EMERGENCY EXIT HATCH OPERATION (CONT)

To open/remove the emergency exit hatch from the outside:

1. Locate the emergency exit hatch latch. The latch is located above the window in the emergency exit door, immediately above the placard that reads "EMERGENCY DOOR PUSH TO OPEN DOOR OPENS INWARD".
2. Push fully inward on the latch. This will retract the pins into the top of the hatch.
3. While holding the latch open, push the upper edge of the hatch inward.
4. Lift the hatch upward from the fuselage structure, inward into the cabin.
5. Rotate the hatch onto its edge and remove it by pulling it back through the emergency exit opening.



EMERGENCY EXIT HATCH OPERATION (FROM OUTSIDE)
Figure 1-12

A52-1039

Installing the right aft emergency exit hatch from the inside:

NOTE The emergency exit hatch is designed to be installed from inside the cabin only. Ensure the seat next to the emergency exit hatch is positioned in the fully inboard position before installing the hatch.

1. Position the emergency exit hatch next to the emergency exit opening on the inside of the cabin.
2. Tilt the upper end of the emergency exit hatch down and inward (several inches).
3. Position the lower edge of the hatch so that the fittings on the lower edge of the hatch align with and engage the fittings on the lower side of the emergency exit opening.
4. Set the hatch in place on the lower fittings and grasp the emergency exit handle and pull it fully inward and down. This will retract the latch pins into the top of the hatch.
5. While keeping the latch pins retracted push the upper edge of the emergency exit hatch into the cabin structure (hatch frame). Ensure the emergency exit hatch seal fits into the hatch frame evenly and does not become caught or bound.
6. Release the emergency exit handle and ensure the latch pins extend into the cabin structure. The handle is spring loaded and should fully retract when released.
7. Attach the handle cover to the inner panel with the hook and loop fasteners.

RIGHT AFT EMERGENCY EXIT ANNUNCIATIONS

A hatch warning system microswitch is installed on one of the latch pins above the right aft emergency exit hatch frame. If this microswitch senses that the latch pin is not in the fully extended position, the switch will cause an amber caution EMERGENCY EXIT message to be displayed on the EICAS.

EXTERNAL DOORS

BAGGAGE COMPARTMENT DOOR

The baggage compartment door provides access to the baggage compartment and is located on the left side of the fuselage below the left engine nacelle. The door is 33 inches (84 centimeters) wide and is hinged on the forward side. The baggage door has two latches and an optional security lock installed on the aft side. The door is equipped with a strut and opens to the forward side for unobstructed loading.

TAILCONE ACCESS DOOR

The tailcone access door is located on the lower side of the fuselage aft of the right engine and provides access to the aft equipment bay. The aft equipment bay contains many of the electrical, environmental, hydraulic and engine fire extinguishing system components. The door is hinged at the lower edge and is secured at the upper side with two latches. It opens downward for access to the listed components.

EXTERNAL DOORS ANNUNCIATIONS

Illumination of the EXTERNAL DOORS amber CAS message indicates that either the baggage compartment door or the tailcone access door switches have not signaled that the door is closed. There are two switches on each door. The switches are designed to indicate a door open condition if it exists, prior to takeoff. If the doors were properly latched prior to takeoff and the light illuminates in flight, the most probable cause is a switch failure.

EXTERNAL SERVICE DOORS

OXYGEN SERVICE DOOR

The nose oxygen servicing door is located on the lower right side of the nose, below the right side nose avionics access panel. The nose access door is hinged at the lower edge and is secured at the upper edge with two latches.

On aircraft modified by SB 45-12-1 (Installation of Remote Oxygen Servicing Provisions), an optional remote mounted oxygen filler port and electrically-driven oxygen temperature/pressure gauge are installed behind this service door.

If applicable, an oxygen servicing door located on the right wing root may also be installed. An oxygen filler port and electrically-driven oxygen temperature/pressure gauge are installed behind this service door. The door is hinged on the forward edge and latched at the trailing edge with two latches.

EXTERNAL SERVICE DOORS (CONT)

FUSELAGE FUEL GRAVITY FILL ACCESS DOOR

The fuselage fuel gravity fill access door is located on the right side of the fuselage. This door is hinged at the top, has a spring-loaded latch at the bottom edge, and opens upward. The fuselage fuel gravity filler port is installed behind the door. The fuselage fuel gravity filler cap is tethered to the airplane with a lanyard to prevent dropping or misplacing it.

SINGLE-POINT PRESSURE REFUELING ACCESS DOOR

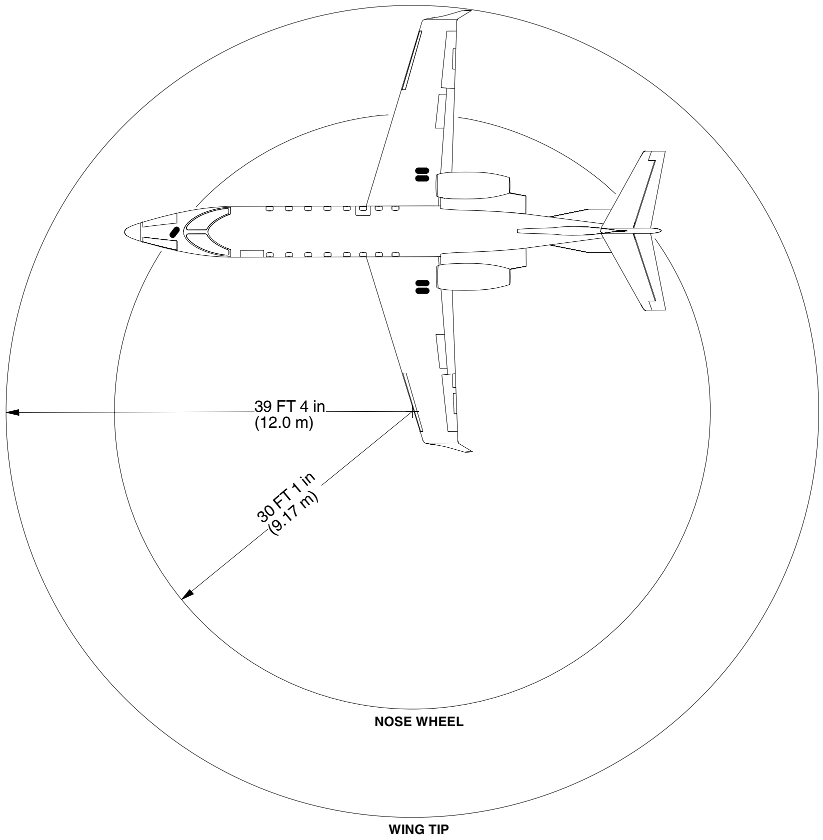
The Single-Point Pressure Refueling (SPPR) access door is located on the fuselage below the right engine pylon. The SPPR adapter and precheck valve lever are installed behind this door. The door is hinged at the bottom and is secured with two spring-loaded latches near the top of the door.

SINGLE-POINT PRESSURE REFUELING CONTROL PANEL ACCESS DOOR

The Single-Point Pressure Refueling (SPPR) control panel access door is located aft of the SPPR access door on the right side of the fuselage. The refueling control panel access door is hinged at the lower edge and opens down from the top.

OIL SERVICING DOORS

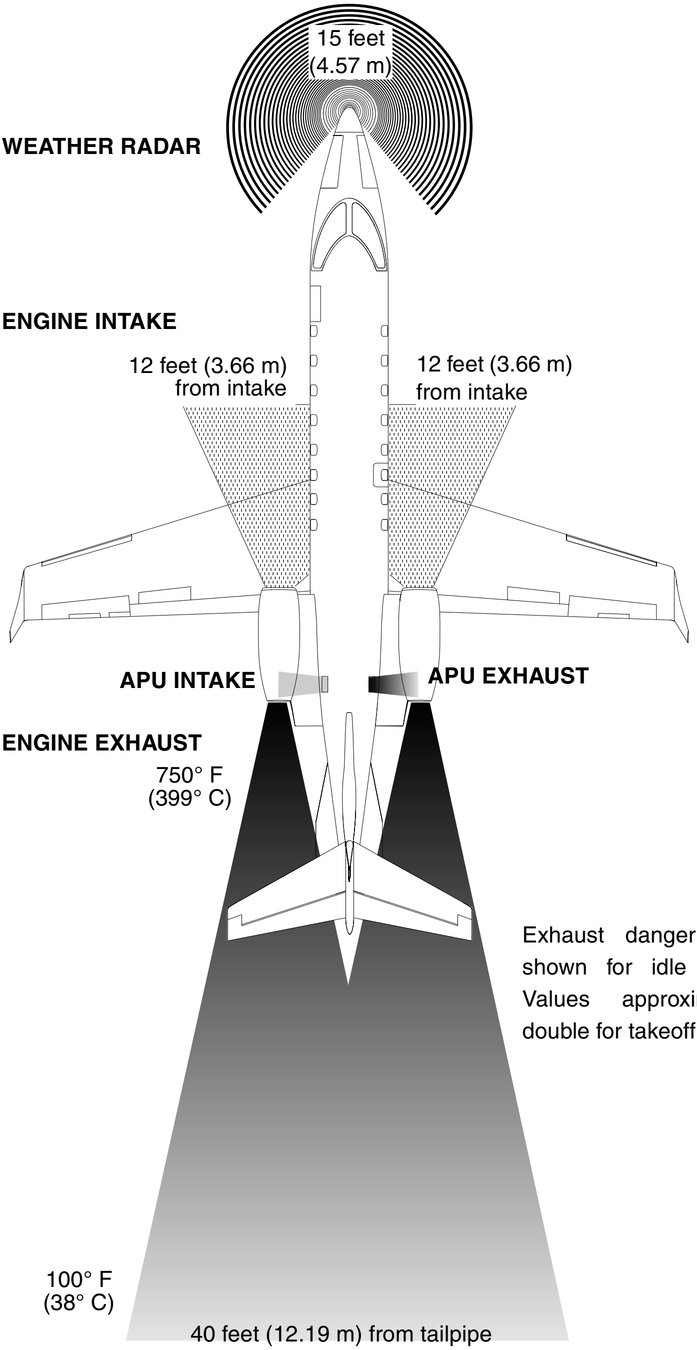
The oil servicing doors are located on the forward outboard side of each engine nacelle. The oil quantity sight gauge (on the right nacelle) and dipstick (on the left nacelle) are accessed through the oil servicing doors. The doors are hinged at the bottom and are secured by two spring-loaded latches at the top of each door.



NOTE: Turning radius expressed above is based upon 60° nose-wheel deflection.

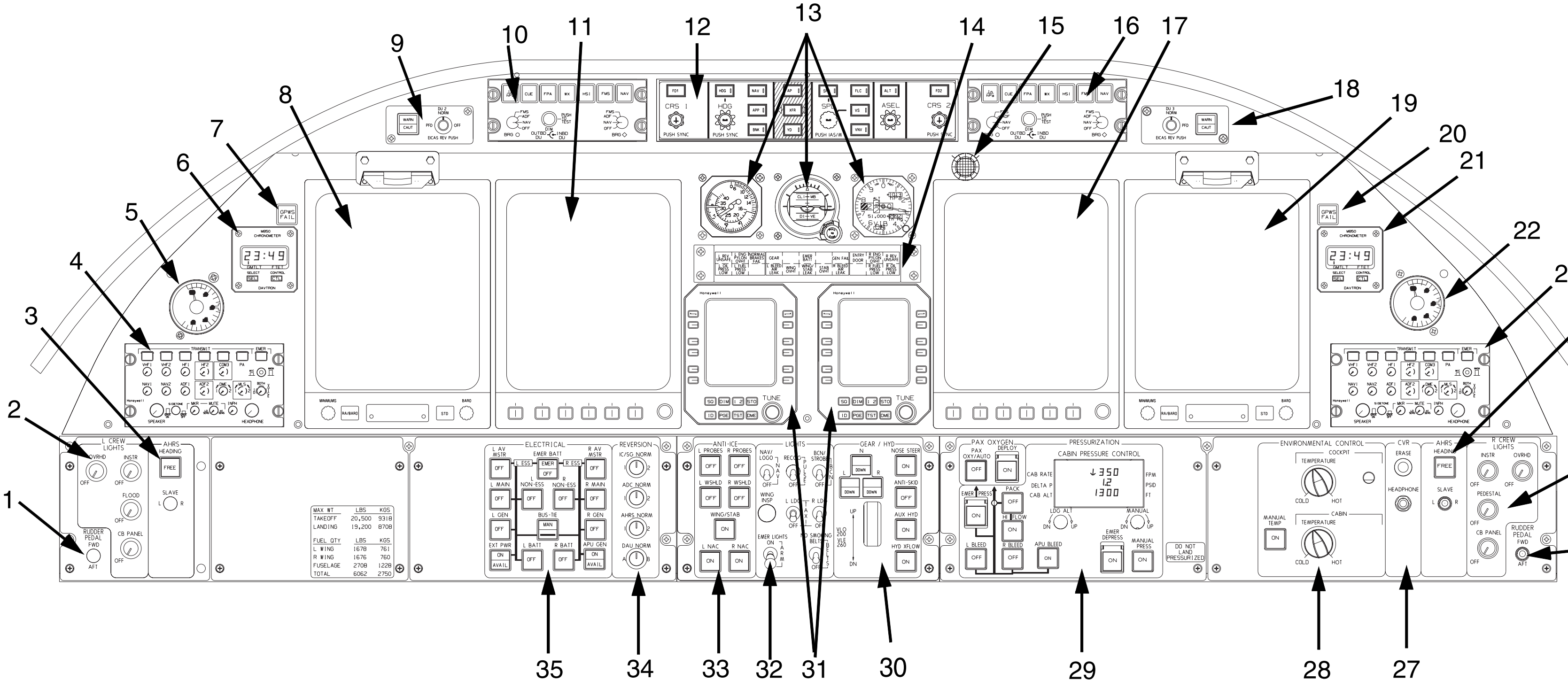
TURNING RADIUS
Figure 1-13

A09-2001



Exhaust danger area shown for idle RPM. Values approximately double for takeoff RPM.

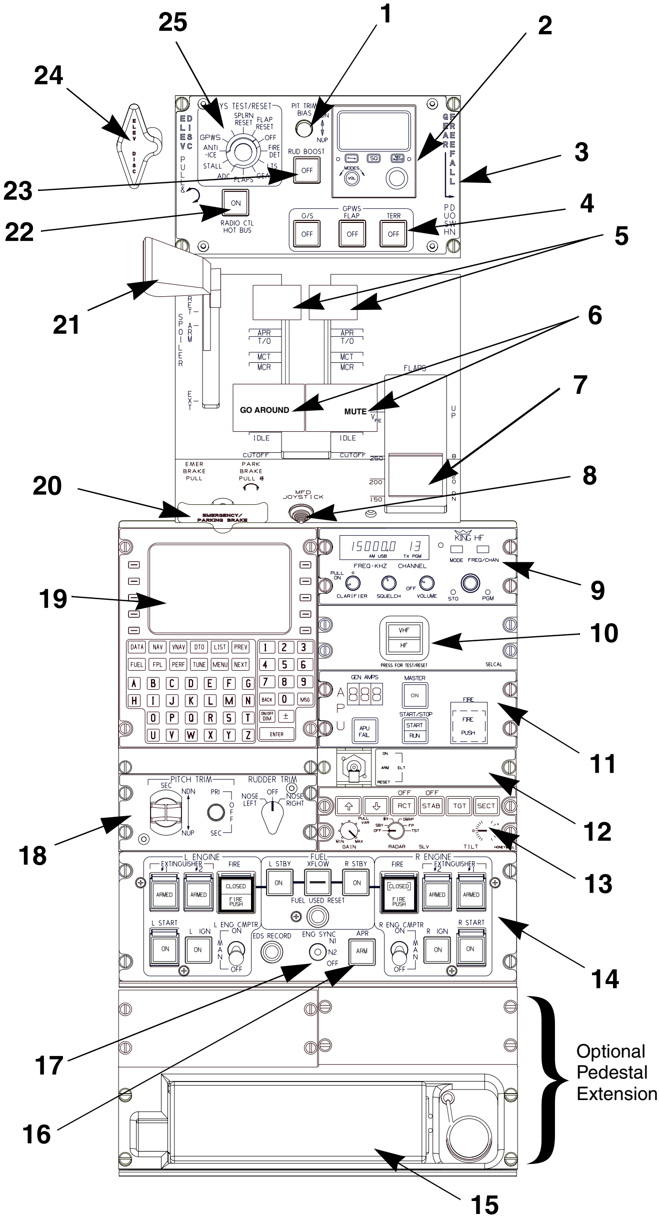
DANGER AREAS
Figure 1-14



1. Pilot's Rudder Pedal Adjustment
2. Pilot's Crew Lighting Panel
3. #1 AHRS Mode Control
4. Pilot's Audio Control Panel
5. Pilot's Angle of Attack Indicator (opt)
6. Pilot's Digital Chronometer
7. Pilot's GPWS Fail Annunciator
8. Pilot's Primary Flight Display (DU-1)
9. DU-2 Reversion Panel / Master Warning Flashers
10. Pilot's Display Controller
11. EICAS Display (DU-2)
12. Flight Guidance Controller
13. Standby Instruments
14. Crew Warning Panel
15. Cockpit Voice Recorder Microphone
16. Copilot's Display Controller
17. Multi-Function Display (DU-3)
18. DU-3 Reversion Panel / Master Warning Flashers
19. Copilot's Primary Flight Display (DU-4)
20. Copilot's GPWS Fail Annunciator
21. Copilot's Digital Chronometer
22. Copilot's Angle of Attack Indicator (opt)
23. Copilot's Audio Control Panel
24. #2 AHRS Mode Control
25. Copilot's Crew Lighting Panel
26. Copilot's Rudder Pedal Adjustment
27. Cockpit Voice Recorder Panel
28. Environmental Control Panel
29. Cabin Pressurization / Oxygen Control Panel
30. Landing Gear / Hydraulic Control Panel
31. Radio Management Units
32. Aircraft Light Control Panel
33. Anti-Ice Panel
34. Reversion Control Panel
35. Electrical Control Panel

INSTRUMENT PANEL (TYPICAL)
Figure 1-15

A31-1001

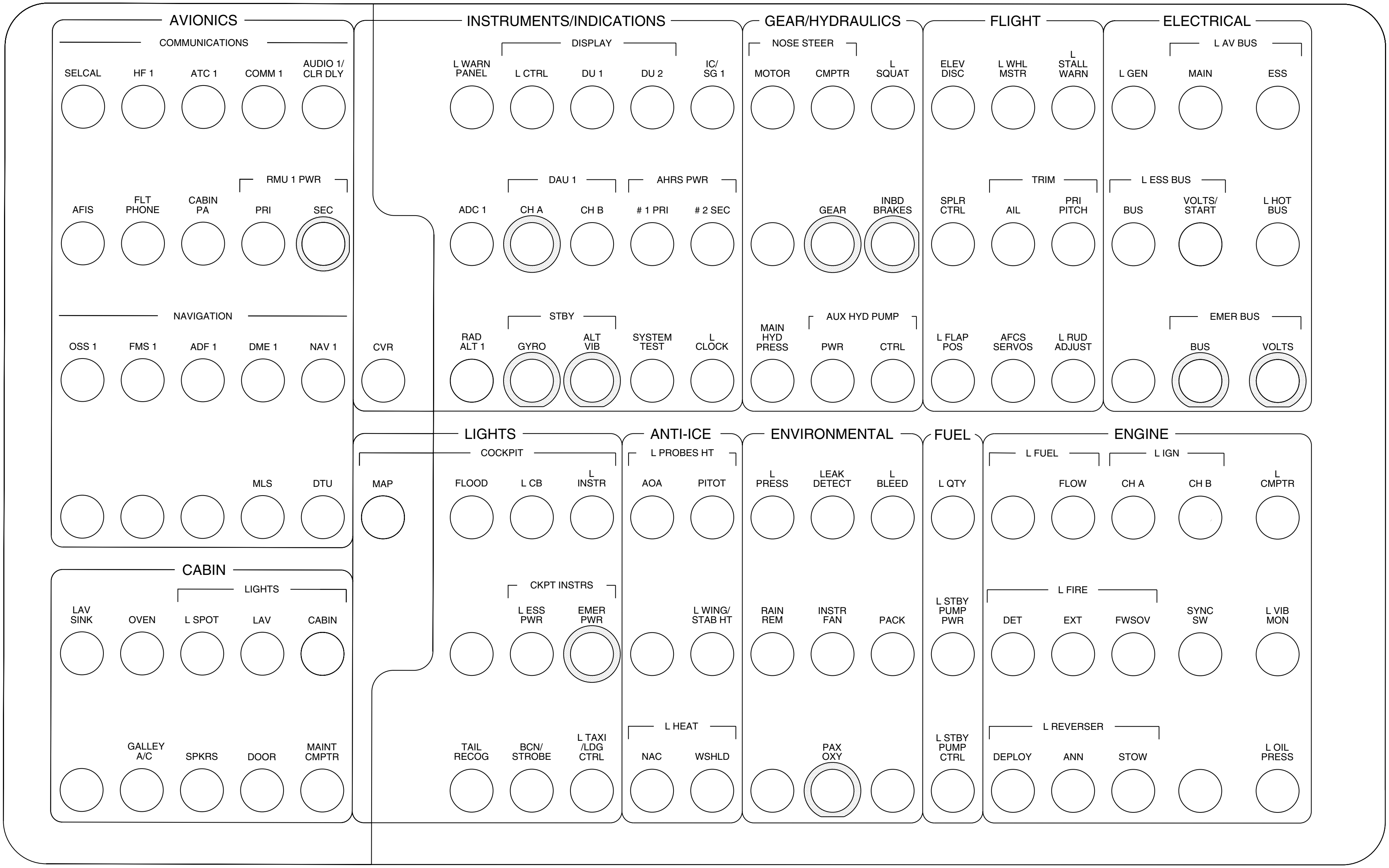


1. Pitch Trim Bias Switch
2. Clearance Delivery Radio (CDR)
3. Gear Freefall Lever
4. Ground Proximity Warning System Switches (opt)
5. Thrust Reverser Levers
6. Thrust Levers
7. Flap Lever
8. MFD Joystick
9. HF Control Panel
10. SELCAL Panel (opt)
11. APU Control Panel (opt)
12. ELT Switch Panel (opt)
13. Weather Radar Control Panel
14. Engine/Fuel Control Panel
15. Flight Phone Handset (opt)
16. APR Arm Switch
17. Engine Sync Switch
18. Pitch Trim and Rudder Trim Control Panel
19. FMS Control Display Unit
20. Emergency/Parking Brake Handle
21. Spoiler Lever
22. Radio Control Hot Bus Switch
23. Rudder Boost Switch
24. Elevator Disconnect Handle
25. System Test Panel

A31-1001a

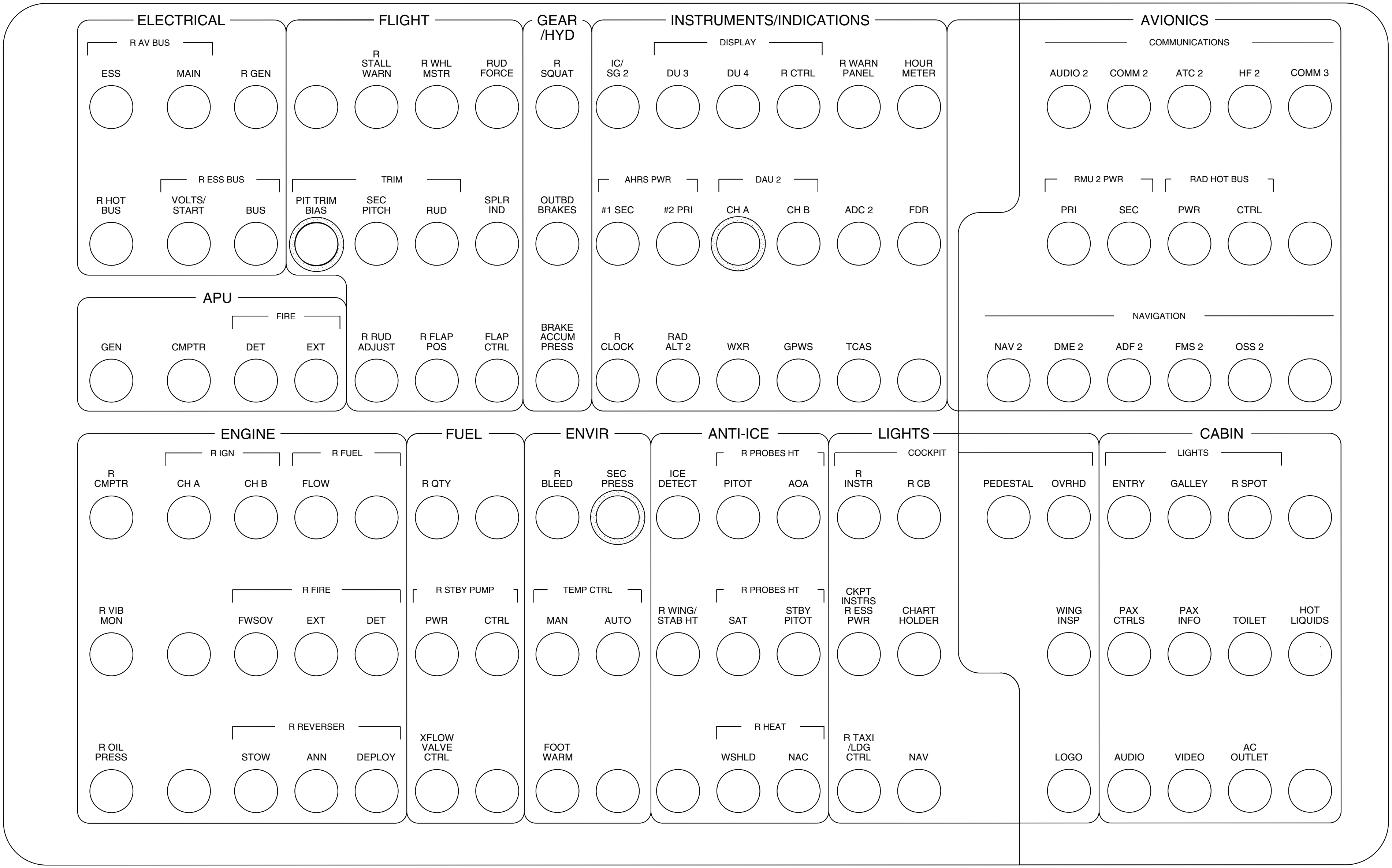
PEDESTAL (TYPICAL)
Figure 1-16

INTENTIONALLY LEFT BLANK



A25-1024

PILOT'S CIRCUIT BREAKER PANEL (TYPICAL)
Figure 1-17



A25-1025

COPILOT'S CIRCUIT BREAKER PANEL (TYPICAL)
Figure 1-18

SECTION II
ENGINES & FUEL

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

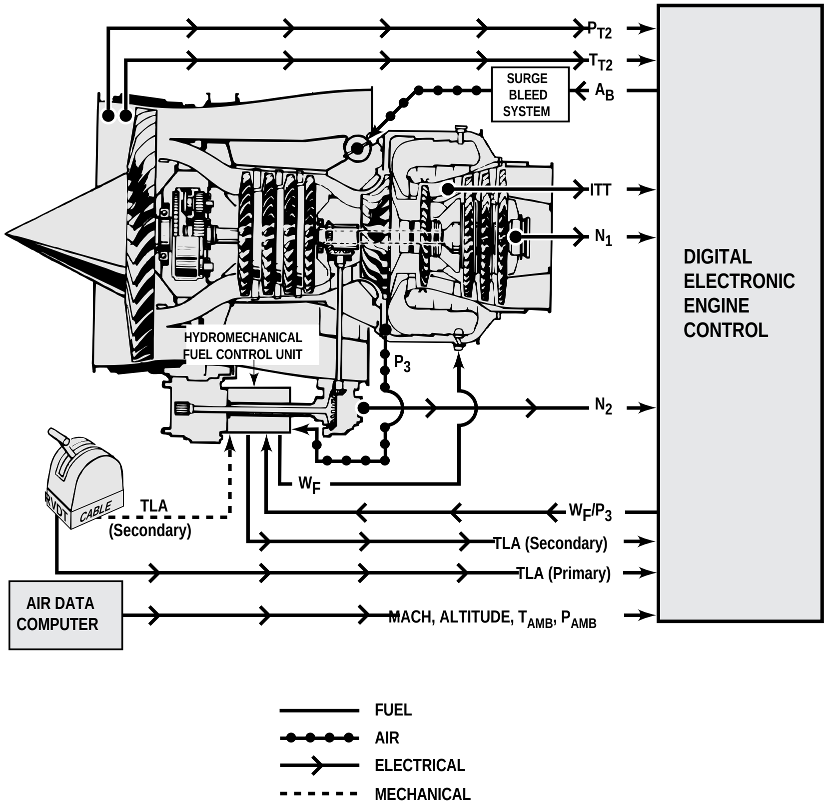
SECTION II
ENGINES & FUEL

ENGINES

The aircraft is powered by two TFE731-20 turbofan engines manufactured by Honeywell. These engines are two-spool, geared transonic-stage, front-fan, jet-propulsion engines. Each engine is rated at 3500 pounds (15.56 kN) thrust at sea level.

A spinner and an axial-flow fan are located at the forward end of the engine and are gear driven by the low-pressure (N1) rotor. The fan gearbox output-to-input speed ratio is 0.556. The low-pressure rotor consists of a four-stage low-pressure axial compressor and a three-stage low-pressure axial turbine, mounted on a common shaft. The high-pressure (N2) rotor consists of a single-stage centrifugal compressor and a single-stage air-cooled axial turbine, mounted on a common shaft. The high-pressure rotor drives the accessory gearbox through a transfer gearbox. The rotor shafts are concentric, so that the low-pressure rotor shaft passes through the high-pressure rotor shaft.

An annular duct serves to bypass fan air for direct thrust and also diverts a portion of the fan air to the low-pressure compressor. Air from the low-pressure compressor flows through the high-pressure compressor and is discharged into the annular combustor. Combustion products flow through the high- and low-pressure turbines and are discharged axially through the exhaust duct to provide additional thrust.



A_B — AREA BLEED
N_1 — LOW PRESSURE ROTOR (FAN) SPEED
N_2 — HIGH PRESSURE ROTOR (TURBINE) SPEED
P_3 — COMPRESSOR DISCHARGE PRESSURE
P_{T2} — ENGINE INLET TOTAL PRESSURE
T_{T2} — ENGINE INLET TOTAL TEMPERATURE
ITT — INTERSTAGE TURBINE TEMPERATURE
W_F — FUEL FLOW
T_{AMB} — AMBIENT TEMPERATURE
P_{AMB} — AMBIENT PRESSURE
TLA — THRUST LEVER ANGLE

FUEL CONTROL LOGIC DIAGRAM
Figure 2-1

ENGINE FUEL AND CONTROL SYSTEM

The engine fuel and control system pressurizes fuel routed to the engine from the aircraft fuel system, meters fuel flow, filters the fuel, heats it as necessary to prevent filter icing, and delivers atomized fuel to the combustion section of the engine. The system also supplies high-pressure motive-flow fuel to the aircraft fuel system for jet pump operation. The major components of the system are the thrust levers, the engine-driven fuel pump, the hydromechanical fuel control unit, the Digital Electronic Engine Control (DEEC), surge bleed control valve and the fuel heater/oil cooler.

THRUST LEVERS

Two thrust levers, located on the upper portion of the pedestal, are operated in a conventional manner with the full forward position being maximum power. Stops at the IDLE position prevent inadvertent reduction of the thrust levers to CUTOFF. The IDLE stops can be released by lifting a finger lift on the outboard side of each thrust lever. Detents are provided for CUTOFF, IDLE, Maximum Cruise (MCR), Maximum Continuous Thrust (MCT), Takeoff (T/O) and Automatic Performance Reserve (APR).

Primary Thrust Lever Angle (TLA) input to each DEEC is provided through Rotary Variable Differential Transformers (RVDTs) located within the thrust lever quadrant. Secondary TLA input is provided by a control cable connecting each thrust lever to the corresponding engine's hydromechanical fuel control unit.

A flight director go-around button is installed in the left thrust lever handle. An aural warning horn/voice mute button is installed in the right thrust lever handle. A thrust reverser control lever is mounted piggyback fashion on each thrust lever. Refer to THRUST REVERSERS in this Section for a functional description of the thrust reverser levers.

The Engine Indicating (EI) display will illuminate a green MCR, MCT, T/O or APR for the corresponding thrust lever detents.

ENGINE-DRIVEN FUEL PUMP

The engine-driven fuel pump provides high-pressure fuel to the engine fuel control system as well as motive-flow fuel for operation of the aircraft jet pumps. The pump consists of a low-pressure pump element, high-pressure pump element, high-pressure relief valve, filter, filter bypass valve, and motive-flow provisions.

The fuel pump is mounted to the accessory drive gearbox of the engine. Fuel entering the first stage low-pressure element is pressurized to flow through the fuel heater/oil cooler and filter. A second flow path for this fuel is to the Auxiliary Motive Flow Pump (AMFP). The fuel from the AMFP is used to operate the various jet pumps in the wing tanks. Fuel that is supplied to the fuel heater/oil cooler and filter is passed on to the pump high-pressure element. The high-pressure element provides fuel at the fuel pressures required by the hydromechanical fuel control unit. The high-pressure relief valve protects the fuel pump and hydromechanical fuel control unit from extreme fuel pressure surges. A fuel filter bypass valve begins to open at a pressure differential of 9 to 12 psi (62 to 82 kPa) and allows flow of unfiltered fuel to the inlet of the high-pressure pump.

The following CAS illuminations are specific to the fuel pumps:

CAS	Color	Description
FUEL PRESS LOW	Red	Fuel pressure is low at the associated (L or R) engine's fuel pump inlet.
FUEL FILTER	White	The engine or wing fuel filter, on the associated (L or R) side, is becoming clogged.

HYDROMECHANICAL FUEL CONTROL UNIT

The hydromechanical fuel control unit meters the required amount of fuel to the engine combustor that corresponds to TLA, atmospheric and engine operating conditions. The unit is mounted on the fuel pump and contains the hydromechanical fuel metering section, thrust lever input and position potentiometer, shutoff valve, and a mechanical governor. The mechanical governor functions as an overspeed governor for the high-pressure rotor. In addition, the mechanical governor provides manual control when the DEEC is deactivated. When activated, the DEEC controls fuel scheduling by means of a torque motor located within the hydromechanical fuel control unit. The torque motor controls the metering section of the hydromechanical fuel control unit.

DIGITAL ELECTRONIC ENGINE CONTROL (DEEC)

A DEEC is provided for each engine. The DEEC is basically an N1 governor with provisions for fuel limits during acceleration and deceleration. The DEEC performs governing, limiting, and fuel scheduling functions for engine start and continuous operation.

Input parameters utilized by the DEEC for controlling functions are: engine inlet pressure (PT2), engine inlet temperature (TT2), interstage turbine temperature (ITT), low-pressure rotor speed (N1), high-pressure rotor speed (N2), and Thrust Lever Angle (TLA).

Output signals from the DEEC to control engine operation go to the hydromechanical fuel control unit, surge bleed valves and ignitors.

The crew is able to control the engine through the DEEC by changing the TLA input to change desired thrust level. Primary TLA is received from the RVDT. Secondary TLA is sensed by the DEEC from a potentiometer within the hydromechanical fuel control unit during manual mode operation.

TT2 and PT2 input is provided by a temperature/pressure sensor integrated into the inlet duct. The sensor contains an electrical element for sensing temperature (TT2). Inlet pressure (PT2) is applied directly to the DEEC through a flexible line. An electrical heating element on the sensor provides protection against icing. The PT2 line from the sensor shall be treated as an aircraft pitot line with a drain trap located at the low point for draining possible moisture accumulation. In the normal operating mode, the DEEC analyzes the TT2 and PT2 inputs and produces output signals which are sent to a torque motor in the hydromechanical fuel control unit for fuel flow control and to the control solenoids of the surge bleed valves.

ITT is measured by thermocouple probes that extend into the gas path between the high-pressure (N2) and low-pressure (N1) turbines.

The N1 speed signals are produced by a dual element monopole located in the rear bearing housing and are the primary thrust indicating instruments. The N2 speed signal is produced by a dual element monopole located in the transfer gearbox. Both dual element monopoles provide outputs to the DEEC and EICAS for flight deck display. Output signals from the DEEC for engine control are also directed to a torque motor in the hydromechanical fuel control unit and to the control solenoids of the surge bleed valves.

The DEEC has an extensive self-monitoring and fault analysis system. In the event a minor fault is detected in the system, the DEEC will initiate an ENGCMPTR FAULT white CAS when ENG CMPTR switch is in the ON position. If electrical power to the computer is lost, the manual mode solenoid valve is deenergized closed, engine control reverts to manual mode, and an ENGCMPTR FAULT amber CAS illuminates.

If a major fault occurs in the DEEC, it may remain in the auto mode or it may revert to manual mode depending on the fault. In either case, the ENGCMPTR FAULT amber CAS will illuminate. A MAN amber EI will also illuminate if DEEC has reverted to manual mode.

When engine control automatically reverts to manual mode, it will not go back to normal mode until the pilot cycles the ENG CMPTR switch. If the CAS doesn't clear, the fault condition still exists. At this point, the pilot may select the MAN position which will result in the ENGCMPTR FAULT amber CAS changing to white.

Whenever engine control is in the manual mode of operation, a MAN amber or white EI will illuminate. If engine control has reverted to manual because of a DEEC fault or failure, MAN will illuminate amber. If manual mode was selected by the pilot, MAN will illuminate white.

Engine operation during manual mode is maintained through the secondary TLA and mechanical linkage to the hydromechanical fuel control unit.

Power to the DEEC is 28-vdc supplied from the L and R ESS buses through the 7.5-amp L and R CMPTR circuit breakers located within the ENGINE groups of the respective pilot's and copilot's circuit breaker panels.

The following CAS illuminations are specific to the DEEC:

CAS	Color	Description
ENGCMPTR FAULT	Amber	There is a major fault in the associated (L or R) engine computer system.
ENGCMPTR FAULT	White	There is a minor fault in the associated (L or R) engine computer system.

The DEEC also functions to provide the crew with automatic performance reserve and engine synchronization.

AUTOMATIC PERFORMANCE RESERVE (APR)

Automatic Performance Reserve (APR) provides a change in thrust on the operating engine in the event of opposite engine thrust loss during takeoff and missed approach conditions. The APR is controlled by the APR switch located on the aft portion of the pedestal. Depressing the switch illuminates the white ARM on the switch and the DEEC performs a software verification. If the APR circuits are active for both engines, an APR white EI will then appear at the top of the EICAS once the system is armed by the DEECs. When armed, each DEEC monitors the opposite engine in order to automatically increase the maximum available thrust if the opposite engine fails. An APR ON green EI will illuminate during automatic APR activity or manual activation. APR may be manually activated by advancing the thrust lever to the APR detent. The engine synchronizer will not function during APR operation.

The following CAS illumination is specific to the APR:

CAS	Color	Description
APR FAULT	White	APR fault is detected in the associated (L or R) DEEC.

ENGINE SYNCHRONIZER

The engine synchronizer system consists of a three position ENG SYNC N1/N2/OFF switch (located on the aft pedestal), engine synchronizer circuits, and data crosslink communication lines integrated within the DEECs. The synchronizer will function from flight idle to the maximum power rating as long as the engines are operating within the system authority limits. The authority limits are: ± 5% N1 during midrange operation, 0% at takeoff TLA, and -2% to +5% at flight idle. During flight, the engine synchronizer, if selected, will maintain the two engines' N1 or N2 in sync with each other. The engine synchronizer must not be used during takeoff, landing, or single-engine operations.

If N1 is selected, SYNC green or amber EI will illuminate between the N1 indicators. If N2 is selected, SYNC green or amber EI will illuminate between the N2 indicators. The light will be green if the landing gear is up and amber if the gear is down. ENG SYNC should be OFF for takeoff and landing; therefore, the amber color is to alert the crew to turn the synchronization system off if the landing gear is down.

Synchronization is accomplished by maintaining the speed of the slave engine in sync with the speed of the master engine. The master engine is determined and so designated during installation.

The following criteria must be satisfied before the system will operate:

- The ENG SYNC switch is set to N1 or N2.
- The difference between the N1 speed of each engine is no more than 5%.
- Thrust reversers are stowed.
- APR is disarmed.

Deviating from any of these criteria will cancel engine synchronization.

Electrical power for the ENG SYNC switch is 28-vdc supplied through the 1-amp SYNC SW circuit breaker located within the ENGINE group of the pilot's circuit breaker panel.

ENG CMPTR SWITCHES

The DEECs are controlled by the L and R ENG CMPTR switches located in the respective L and R ENGINE panels. Normally, the switches are left in the ON position. The ON position allows full DEEC authority of engine operation through inputs with the pilot's primary TLA. If normal engine control is not satisfactory, the engine can be operated in the manual mode.

The manual mode can be activated by placing the ENG CMPTR switch to either MAN or OFF. If the ENG CMPTR switch is placed in the MAN position, the manual mode solenoid (within the hydromechanical fuel control unit) is deenergized closed, the engine fuel control is in the manual mode and the DEEC is no longer controlling the engine. However, if electrical power is still available, the DEEC will monitor N1 and N2 and provide ultimate overspeed protection. If the ENG CMPTR switch is placed to OFF or electrical power is lost, operation is the same, except the ultimate overspeed protection is no longer available. The OFF position of the ENG CMPTR switch disconnects power to the DEEC.

SURGE BLEED CONTROL

A surge bleed control system for each engine is installed to prevent low-pressure compressor surge. Each system consists of two externally mounted surge valve control solenoids and an internally mounted surge bleed valve. During normal operation, surge bleed valve position is controlled by the DEEC via the solenoid control valves. Once the DEEC transfers to manual mode, the surge bleed valve will go to the 1/3-open position.

FUEL HEATER /OIL COOLER

Each engine is equipped with a fuel heater/oil cooler. The fuel heater/oil cooler is provided for the purpose of heating the fuel sufficiently to prevent ice formation in the engine system, and to provide oil cooling to the planetary gearbox. The fuel heater/oil cooler is of a liquid-to-liquid design utilizing the engine lubricating oil as a source of heat to warm the fuel. This heat transfer conversely cools the oil.

Fuel heater/oil cooler faults are detected by the Data Acquisition Unit (DAU). The DAU interprets the temperature as a function of engine oil temperature and uses the result to illuminate a CAS message.

The following CAS illuminations are specific to the fuel heater/oil cooler:

CAS	Color	Description
FUEL HEATER	Amber	The fuel heater, on the associated (L or R) engine, is not keeping the fuel warm enough.
FUEL HEATER	White	The fuel heater, on the associated (L or R) engine, is heating the fuel too much.

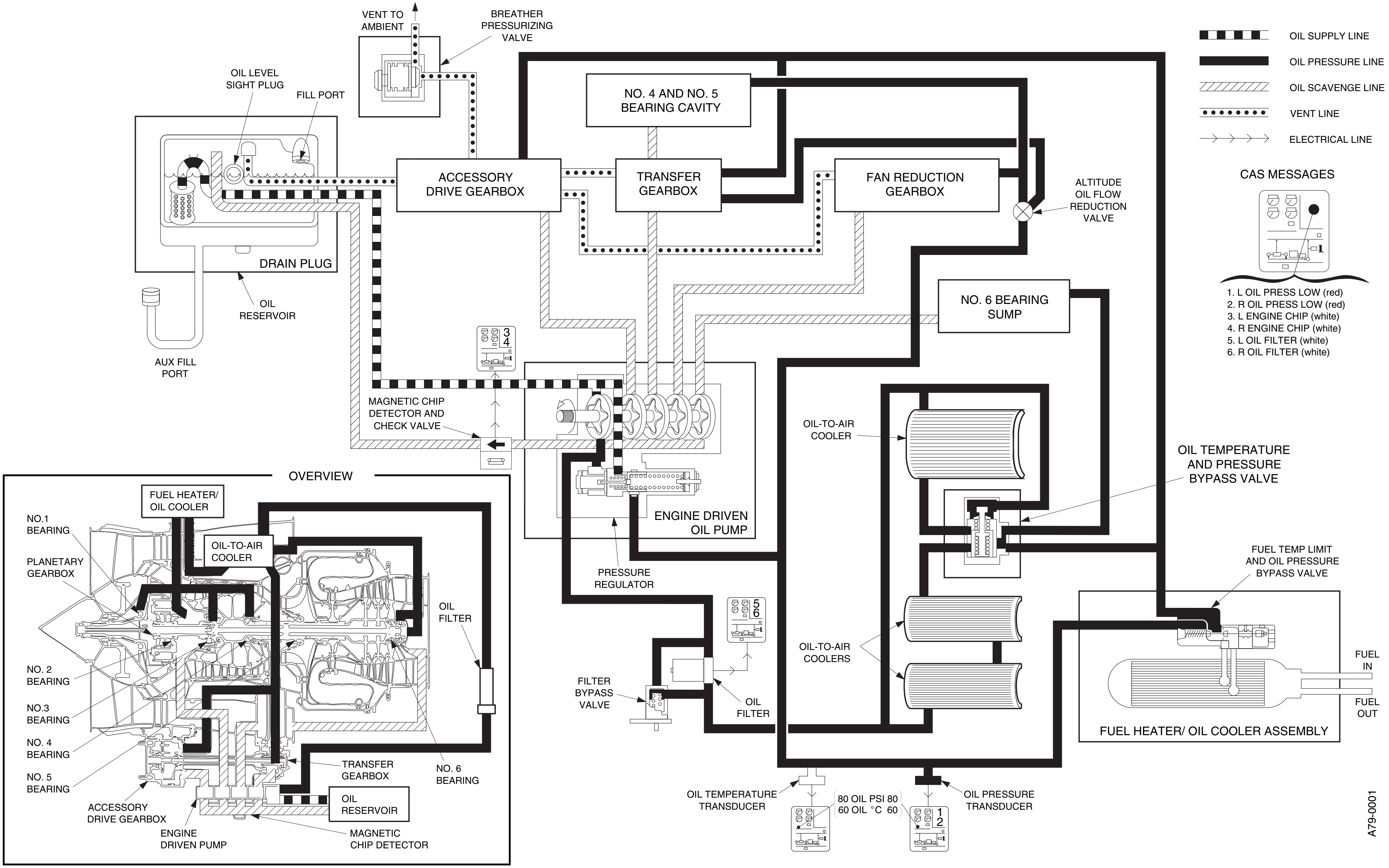
ENGINE OIL SYSTEM

Oil for engine lubrication is drawn from the engine oil tank by the oil pump. The oil is output from the pump through a filter, a pressure regulator valve, an oil-to-air cooler, and a fuel heater/oil cooler. The oil-to-air cooler is a three-segment, finned cooler that forms the inner surface of the fan duct. From the oil-to-air cooler, the oil flow is divided so that part of the oil is directed to the accessory drive and transfer gearboxes, and the engine shaft bearings. The remaining oil is diverted to a fuel heater/oil cooler and then to the planetary gearbox.

The oil filter assembly incorporates a bypass valve and an electrical switch to indicate when the oil filter is clogged or clogging. In the event of an impending bypass, an L or R OIL FILTER white CAS will illuminate. The bypass valve will open when the pressure differential across the filter reaches 35 psi (241 kPa) allowing oil to bypass the filter. Under cold oil conditions, such as engine start, the bypass indication is inhibited when the oil temperature is less than approximately 100° F (38° C); however, the bypass valve will still open. This function prevents nuisance indications during engine start due to high oil viscosity at cold temperatures.

The following CAS illumination is specific to the engine oil system:

CAS	Color	Description
OIL FILTER	White	The associated (L or R) engine oil filter is becoming plugged.



ENGINE OIL SYSTEM SCHEMATIC
Figure 2-2

ENGINE IGNITION AND START SYSTEMS

IGNITION SYSTEM

The engine ignition system is an integral sub-system of the engine. Each engine consists of an ignition unit, two ignitor plugs, two shielded high-voltage output cables and associated aircraft wiring. During normal engine operation the system is controlled by the DEEC and is capable of continuous operation. The DEEC powers the ignition system for three modes of operation. The first is for normal engine start. During normal engine start the DEEC commands ignition at >6.0% N_2 and turns ignition off when N_1 = 0.7 of idle N_1. The second mode is for uncommanded deceleration, and the third mode prevents engine flameout during rapid deceleration.

The ignition unit is a solid-state, high-voltage, capacitor-discharge unit mounted on the fan bypass duct of each engine. The unit provides a spark rate of 2 sparks per second at an output of 18,000 to 24,000 volts through the ignitor plugs. The ignitor plugs are located on the combustor plenum at the 4 and 8 o'clock positions. These iridium plugs are linked to the ignition unit by separate high-voltage cables and spark when pulsed by the ignition unit.

The ignition system is powered by 28-vdc from the L and R ESS buses through the CH A and CH B circuit breakers located within the ENGINE groups (respective L and R IGN) of the pilot's and copilot's circuit breaker panels.

IGN SWITCHES

The L and R IGN switches, located in the respective ENGINE panel of the pedestal, are used to obtain continuous engine ignition. The switch controlling the left engine ignition system is labeled L IGN. The switch controlling the right engine ignition system is labeled R IGN. When an IGN switch is placed in the ON position, 28-vdc is applied to the engine ignition unit.

IGN INDICATIONS

The EI will display a green, white, and amber IGN. The green EI represents normal ignition activity. A white EI is generated if one ignitor plug is not firing. The amber EI alerts the pilot of dual ignitor plug failure.

ENGINE START SYSTEM

A combined starter/generator is mounted on the front of the accessory gearbox. For normal starts, the DEEC provides for automatic starting which allows the thrust lever to be moved into the IDLE position before activating the starter. When the respective L or R START switch is momentarily depressed, the DEEC begins the start sequence by activating the corresponding standby fuel pump and energizing the starter relay closed. The starter relay connects electrical power to the starter from the respective L or R GEN bus. Power to the GEN buses is supplied from the aircraft batteries, an external power source, or an Auxiliary Power Unit (APU) (if installed).

An external power source or APU is recommended for starts when ambient temperature is 32° F (0° C) or below. Ensure an external power source supply is regulated to 28-vdc, has adequate capacity for engine starting and is limited to 1500 amps maximum. Allow the operating generator amperage to decrease below 300 amps prior to a generator cross-start. Refer to Cold Weather Operation, AFM, for additional information when operating in extremely cold weather.

START SWITCHES

The L and R START switches, located in the respective ENGINE panel of the pedestal, are guarded momentary action switches that illuminate ON when depressed indicating the starter relay is energized.

START INDICATIONS

During engine starts, a vertical START green or amber EI will appear. The green EI represents normal starter activity. The amber EI represents an engine starter engaged with N_2 greater than 51%.

ENGINE INDICATING (EI)

ENGINE VIBRATION MONITOR

The engine vibration monitor system consists of an accelerometer mounted on each engine and a tailcone-mounted engine vibration monitor signal conditioner. The vibration monitor signal conditioner consists of two identical independent channels.

Each channel is powered by the corresponding 3-amp L or R VIB MON circuit breaker located within the ENGINE group of the respective pilot's or copilot's circuit breaker panels.

The following CAS illumination is specific to the engine vibration monitor system:

CAS	Color	Description
ENG VIB MON	White	Vibration level, in the associated (L or R) engine, is higher than normal.

OIL TEMPERATURE INDICATOR

Oil temperature is displayed for each engine as a white digital readout. The display consists of an OIL ° C legend with temperature readouts to the left and right. An engine-mounted transducer transmits oil temperature signals to the DAU. The DAU then provides an oil temperature value for EICAS. Refer to the following table for temperature ranges and corresponding color displays during normal engine operation:

ALTITUDE FT	WHITE °C	AMBER °C	RED °C
≤30,000	30 to 127	-53 to 29	-60 to -54 and 128 to 175
>30,000	30 to 140	-53 to 29	-60 to -54 and 141 to 175

OIL PRESSURE INDICATOR

Oil pressure is displayed for each engine as a digital readout on EICAS. The display consists of an OIL PSI legend with pressure readouts to the left and right.

Refer to the following table for pressure ranges and corresponding color display during normal engine operation:

(% N_2)	WHITE PSIG	AMBER PSIG	RED PSIG
≤80% and up to 3 minutes after engine start	65 to 80	50 to 64	0 to 49 and 126 to 150
>80% or more than 3 minutes after engine start	65 to 80	50 to 64	0 to 49 and 101 to 150

FUEL FLOW INDICATOR

Fuel flow is displayed for each engine as a white digital readout on EICAS. The display consists of a FF PPH legend with flow rates to the left and right. The fuel flow rates are presented in Pounds-Per-Hour (PPH). A fuel flow transmitter located in the main fuel line of each engine supplies fuel flow signals to the DAU via a fuel flow converter. The DAU then provides a fuel flow rate value for EICAS presentation.

N1 INDICATORS

The fan speed (N_1) analog EI for each engine consists of a needle, arc, and N_1 bug with integral digital readouts for N_1 and N_1 setting. The N_1 sensor is mounted in the engine's rear bearing support housing and senses low-pressure fan speed. The sensor provides signals to the DEEC and DAU. Refer to the following table for N_1 speeds and corresponding color display.

WHITE % N_1	AMBER % N_1	RED % N_1
0 to 100.0	N/A	100.1 to 115*

*Above 115% the digits are invalid.

N2 INDICATORS

N2 is displayed for each engine as a digital readout. The display consists of an N2 legend with digital readouts to the left and right. Refer to the following table for N2 speeds and corresponding color display for various conditions.

% N2	WHITE % N2	AMBER % N2	RED % N2
Except APR Mode	0 to 100	100.1 to 102.5	102.6 to 115*
APR Mode	0 to 101	101.1 to 102.5	102.6 to 115*

*Above 115% the digits are invalid.

ITT INDICATORS

Interstage Turbine Temperature (ITT) is displayed for each engine as a needle and arc with an integral digital readout for ITT. The arc is scaled to start at 100° C. Interstage turbine temperature for each engine is sensed by Chromel-Alumel parallel wired thermocouples positioned between the high- and low-pressure turbine sections. The signal from the averaging circuit of the thermocouples is carried to the DEEC and DAU for EI display. Refer to the following table for ITT and corresponding color display for various conditions.

Aircraft 45-002 & Subsequent ***not*** *modified by SB 45-72-1:*

OPERATING MODE	WHITE °C	AMBER °C	RED °C
Start	0 to 941	N/A	942 to 1014
Takeoff (≤5 minutes)	0 to 941	N/A	942 to 1014
Takeoff or APR (>5 minutes)	0 to 916	917 to 941	942 to 1014
APR (≤5 minutes)	0 to 963	N/A	964 to 1014
Up To MCR	0 to 900	N/A	901 to 1014
MCT (no anti-ice)	0 to 916	N/A	917 to 1014
MCT (any anti-ice)	0 to 941	N/A	942 to 1014

Aircraft 45-002 & Subsequent modified by SB 45-72-1:

OPERATING MODE	WHITE °C	AMBER °C	RED °C
Start	0 to 991	N/A	992 to 1014
Takeoff (no anti-ice) (≤5 minutes)	0 to 991	N/A	992 to 1014
Takeoff (any anti-ice) (≤5 minutes)	0 to 991	N/A	992 to 1014
Takeoff or APR (>5 minutes)	0 to 1013	N/A	1014
APR (≤5 minutes)	0 to 1013	N/A	1014
Up To MCR	0 to 974	N/A	975 to 1014
MCT (no anti-ice)	0 to 991	N/A	992 to 1014
MCT (any anti-ice)	0 to 991	N/A	992 to 1014

ENGINE DIAGNOSTIC SYSTEM (EDS)

An Engine Diagnostic System (EDS) is installed to provide engine fault recording and condition trend monitoring. The system periodically records engine parameters and allows the crew to request that conditions be recorded at any time. Normal use of the system entails downloading data from the DEEC and submitting to the engine manufacturer for timely analysis. The data may be downloaded at any time to assist in diagnosing engine problems which may be encountered. The EDS is intended for maintenance functions only and not for in-flight monitoring or diagnosis by the flight crew. The system is integrated into the DEEC of each engine.

EDS RECORD SWITCH

The EDS RECORD switch is located on the aft pedestal. The purpose of the switch is to allow the flight crew to initiate data collection by the EDS. When the switch is actuated, the engine parameters existing four minutes prior to and one minute after switch actuation will be recorded in the EDS memory.

The following CAS illuminations are specific to the engine diagnostic system:

CAS	Color	Description
CHECK EDS	White	Indicates one of the following about the associated (L or R) engine diagnostic system (EDS): • The EDS has lost power. • The EDS built-in test equipment (BITE) has detected a system failure. • The EDS memory is 80% full. • The system has detected an engine condition which is out of acceptable parameters.

ENGINE FIRE DETECTION SYSTEM

Three heat-sensing elements connected in series are located in each engine nacelle to detect an engine fire. One element is located around the accessory gearbox; one is located around the engine tailcone; and another around the engine firewall. The fire detection system is controlled by two fire detect control boxes located in the tailcone. In the event of an engine fire, the applicable control box will sense a resistance change in the sensing elements and flash the master WARN lights in the glareshield and applicable FIRE switch located within the L or R ENGINE panel of the aft pedestal.

The FIRE red EI will flash within the arc of the ITT dial. Warning is given if the firewall or accessory gearbox area exceeds approximately 410° F (210° C), or the engine tailcone area exceeds approximately 890° F (477° C).

Whenever an engine fire is detected a "LEFT" or "RIGHT ENGINE FIRE" voice message will sound to both pilots' headphones and flight deck speakers. This voice message is continuous, but can be silenced by depressing the mute switch located on the right thrust lever or the master WARN light.

Electrical power for the system is 28-vdc supplied through the 1-amp L and R FIRE DET circuit breakers located within the ENGINE group of the pilot's and copilot's circuit breaker panels respectively. Fire detect systems are powered from the respective L and R ESS buses.

SYS TEST/RESET SWITCH

FIRE DETECTION FUNCTION

The rotary-type SYS TEST/RESET switch on the forward pedestal is used to test the fire detection system. Rotating the switch to FIRE DET and depressing the switch (PRESS TEST) button will connect a resistance into both fire detect system circuits. This resistance, simulating an engine fire, will test system indications as follows:

- Master WARN tone and light will activate followed by a "LEFT ENGINE FIRE . . . RIGHT ENGINE FIRE" voice.
- Both red FIRE and all white EXTINGUISHER #1 and #2 ARMED switches (ENGINE panel) will illuminate. Illumination of the FIRE switch indicates continuity of the fire detect systems and illumination of the EXTINGUISHER #1 and #2 ARMED switches indicate continuity of the fire extinguisher squibs.
- Red FIRE messages in ITTs will flash.

NOTE

Both red FIRE messages on RMU ENGINE PGE 1 will flash next to the N1 display.

- L and R BLEED AIR LEAK red CAS and CWP. This indicates continuity of the bleed air overheat sensor system.
- WING/STAB LEAK red CAS and CWP. This indicates continuity of the anti-ice bleed air overheat sensor system.
- APU FIRE Switch (if installed) and a red CAS will illuminate with the APU MASTER Switch ON. The red CAS only will illuminate if the APU MASTER Switch is Off.

NOTE

Depressing and holding the SYS TEST/RESET Switch in the FIRE DET position for 15 seconds will result in the APU fire horn sounding. Holding the switch for 30 seconds will result in an APU FAIL indication and APU shutdown.

ENGINE FIRE EXTINGUISHING SYSTEM

The engine fire extinguishing system components include: two spherical extinguishing agent containers, a red FIRE PUSH light/switch for each engine, two white EXTINGUISHER #1 and #2 ARMED light/switches for each engine, one hydraulic shutoff valve for each engine, one fuel shutoff valve for each engine, a thermal discharge indicator, a manual discharge indicator, and associated wiring and plumbing. The system also utilizes the pneumatic system bleed air shutoff valves. The system is plumbed to provide the contents of either or both extinguishing agent containers to either engine nacelle. Shuttle valves are installed to prevent extinguishing agent flow between containers. The extinguishing agent, Halon 1301 (Bromotrifluromethane [CF_3Br]), is stored under pressure (600 psi) in the extinguisher containers and a pressure gauge on each container is visible from inside the tailcone. Halon 1301 is non-toxic at normal temperatures and is non-corrosive. As Halon 1301 is non-corrosive, no special cleaning of the engine or nacelle area is required in the event the system has been used. The system operates on 28-vdc supplied through the 5-amp L and R FIRE EXT circuit breakers located within the respective ENGINE group of the pilot's and copilot's circuit breaker panels. Fire extinguishing systems are powered from the EMER BATT hot bus.

L AND R ENGINE FIRE AND EXTINGUISHER #1/#2 SWITCHES

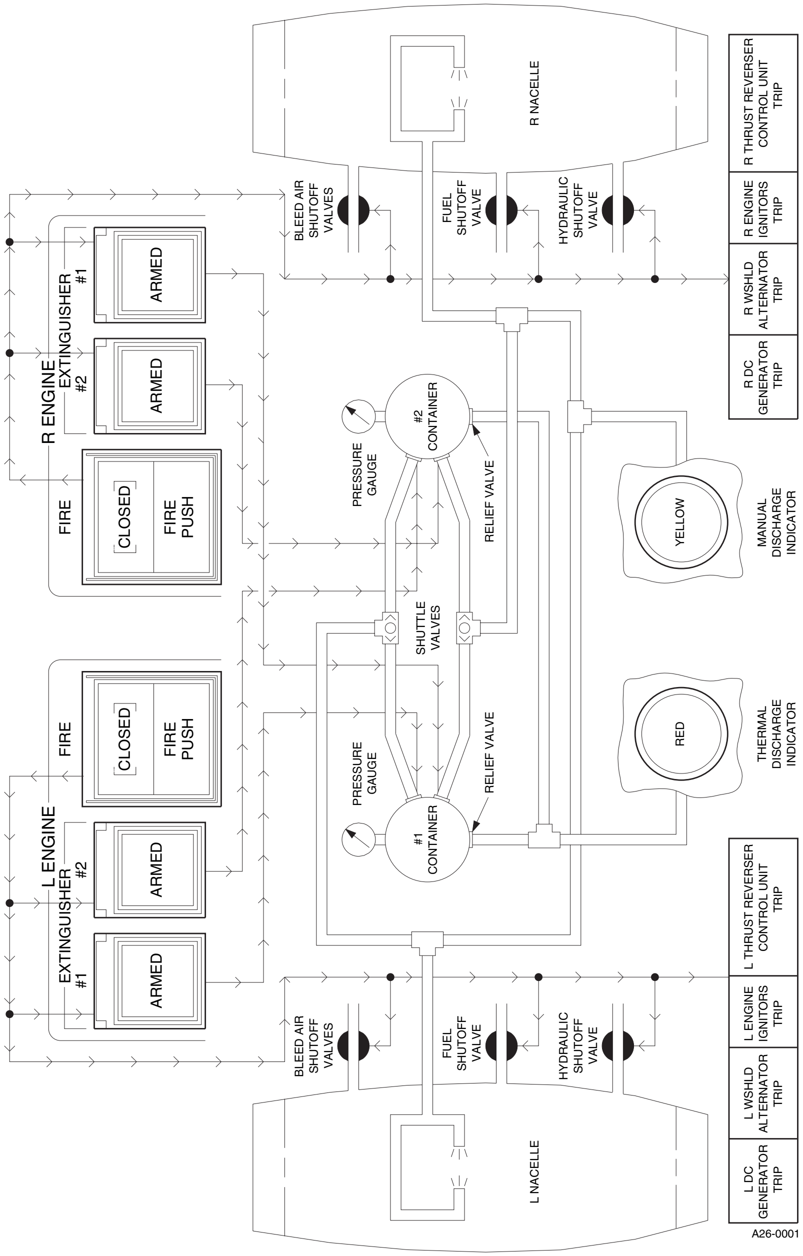
The engine fire extinguishing system is operated through the L and R FIRE switches and the EXTINGUISHER #1 and #2 switches located in the respective L and R ENGINE panel on the aft pedestal. Activating the applicable FIRE switch will cause the following events:

- Close the respective shutoff valves. (Refer to Figure 2-3.)
- CLOSED indication will appear on respective FIRE switch. Flashing FIRE PUSH illumination goes to steady.
- Arm the extinguishing agent containers.
- EXTINGUISHER #1 and #2 light illuminated.
- Trip respective DC generator and alternator off-line.
- Trip respective engine ignitors off-line.
- Trip respective thrust reverser control unit off-line and prevent the thrust reverser isolation valve from opening.

Illumination of the EXTINGUISHER #1/#2 ARMED light(s) indicates that the fire extinguishing system is armed and the squibs are good. Depressing an illuminated EXTINGUISHER #1 ARMED light will discharge the contents of the first extinguisher bottle into the associated nacelle. Depressing the EXTINGUISHER #2 ARMED light will discharge the contents of the second bottle. Either or both EXTINGUISHER #1/#2 ARMED lights may be depressed to extinguish the fire. Should the first container control the fire, the other container is available to either engine.

FIRE EXTINGUISHER DISCHARGE INDICATORS

Two disk-type indicators are flush-mounted in the fuselage under the right engine pylon. If the contents of either or both containers have been discharged into the engine nacelles, the yellow disk will be ruptured. If the contents of either or both containers have been discharged overboard as the result of an overheat condition causing excessive pressure within the containers, the red disk will be ruptured. If both disks are intact, the system has not been discharged.



FIRE EXTINGUISHING SYSTEM
Figure 2-3

THRUST REVERSERS

Each engine is equipped with an independent, electrically controlled, hydraulically actuated, clamshell-type thrust reverser. The thrust reverser system consists of a thrust reverser control unit, an engine nacelle afterbody on each engine, a piggy-back thrust reverser lever on each main thrust lever, associated hydraulic plumbing, and associated electrical wiring.

The thrust reverser control unit integrates all deploy, stow, and indication functions of the thrust reverser system. Input signals indicating the status of each of these functions are analyzed by the thrust reverser control unit. Different combinations of these signals will generate the applicable output command from the thrust reverser control unit.

Each nacelle afterbody consists of an upper and lower blocker door, an inboard and outboard primary deploy/stow actuator, unlatch actuator, unlatch switch, unlock switch, full deploy switch, and a throttle retard mechanism. Hydraulic power for thrust reverser operation is supplied by the aircraft hydraulic system. A selector valve for each thrust reverser is installed in the tailcone. The selector valves control hydraulic flow to the associated system actuators in response to electrical inputs from the associated thrust reverser lever and position switches via the thrust reverser control unit.

The thrust reverser levers and the system circuit breakers are the only controls used by the crew to operate the system. Electrical power for thrust reverser control and indication circuits is 28-vdc supplied by the L and R ESS buses through the L and R REVERSER circuit breakers. The L REVERSER circuit breakers located in the ENGINE group of the pilot's circuit breaker panel include the 5-amp DEPLOY, the 3-amp ANN, and the 3-amp STOW. The R REVERSER circuit breakers located within the ENGINE group of the copilot's circuit breaker panel also include a 5-amp DEPLOY, a 3-amp ANN, and a 3-amp STOW.

In order to arm the thrust reversers, both main gear weight-on-wheels switches must be in the ground mode (aircraft weight on the main gear) and the thrust levers must be in the IDLE position. When fully armed (reverser system relays and switches are properly sequenced), the associated isolation valve is open and the system is ready for deploy/stow commands by operation of the thrust reverser levers.

The clam-shell type blocker doors are held in the stowed position by latch hooks. The latch hooks are hinged to the unlatch actuator, and are rotated away from the blocker doors for thrust reverser deployment. When the deploy cycle is initiated, hydraulic pressure is applied to the stow side of the primary actuators which move the doors into an overstowed condition. Overstowing the thrust reversers allows the unlatch actuators to rotate the latch hooks. As the latch hooks begin to rotate, the unlock switch signals the thrust reverser control unit of the unlocked condition. As the latch hooks clear the blocker door receptacles, an unlatch switch signals the thrust reverser control unit that the blocker doors are unlatched. After the latch hooks are unlatched, hydraulic pressure is applied to the deploy side of the primary actuators which push the doors open.

Stow is initiated automatically whenever an unlock condition is detected and the thrust reverser lever is forward of the thrust reverser deploy detent. This occurs during the normal stow cycle and also to correct an abnormal condition in flight. During autostow, hydraulic pressure is applied to the stow side of the primary actuators and the blocker doors move towards the overstow position. As the doors reach overstow, the spring-loaded latches close. When the latches close, the unlock switches are deactivated. The selector valve then releases stow pressure on the primary stow/deploy actuator. Exhaust gas pressure and springs return the doors to the normal stowed position.

An automatic throttle retard mechanism is installed on each thrust reverser to ensure that thrust reverser stow and deploy does not occur with an engine thrust setting above idle. The throttle retard mechanism consists of an actuator, crank, and lever. Whenever hydraulic stow pressure is applied to the thrust reverser actuators, the throttle retard mechanism will position thrust lever to the IDLE position. When hydraulic stow pressure is removed, the mechanism will return to a neutral position and release retard pressure to the thrust lever.

THRUST REVERSER LEVERS

A thrust reverser control lever for each thrust reverser is mounted piggy-back fashion on each main thrust lever. The thrust reverser levers are inoperable and cannot be moved unless the associated main thrust levers are at the IDLE stop. Similarly, the main thrust levers cannot be moved from the IDLE position until the associated thrust reverser lever is in the stow (full down) position. When fully armed, a thrust reverser may be independently deployed by lifting the corresponding thrust reverser lever to the first (idle/deploy) stop. A throttle release will activate and the thrust reverser lever may be pulled beyond the idle/ deploy stop to increase reverse thrust. If both thrust reversers are deployed, a detent limits thrust reverser lever travel to approximately MCR.

The thrust reverser is stowed by first returning the thrust reverser lever to the idle/deploy stop and then moving the lever to the stow (full down) position at engine idle speed.

THRUST REVERSER INDICATIONS

Thrust reverser control is automatic and status indications are displayed on the EICAS and CWP. The following EICAS illuminations are specific to the thrust reversers:

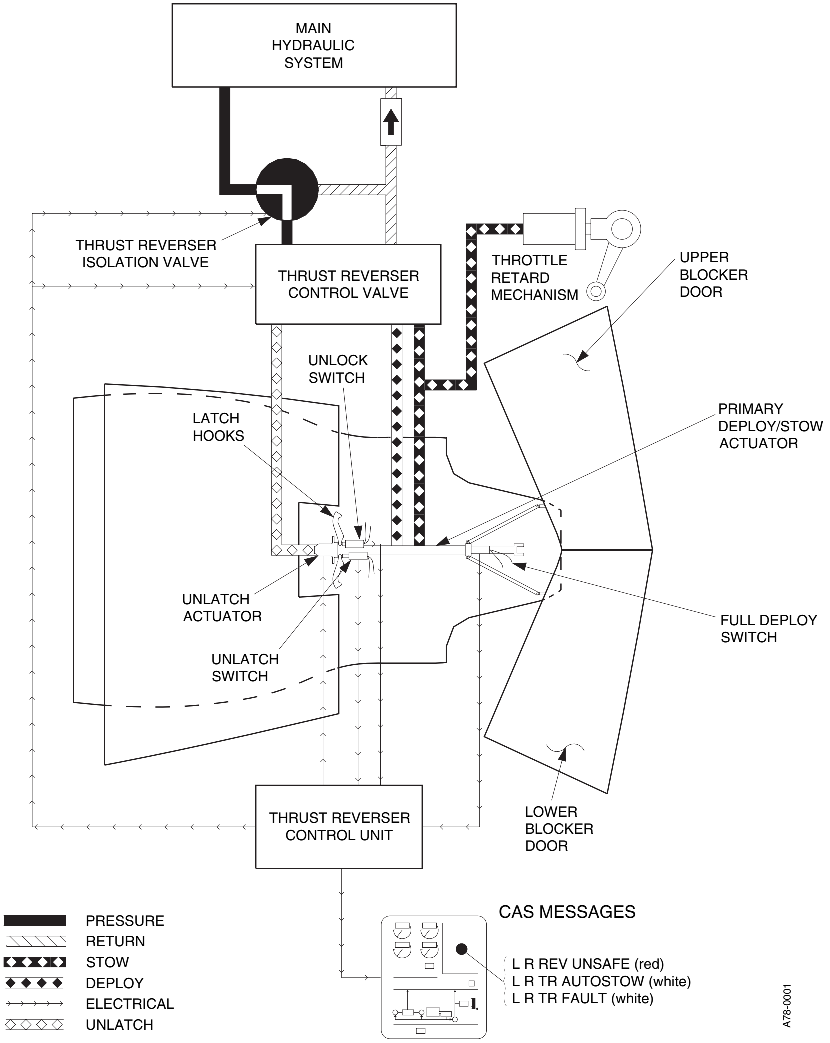
EICAS	Color	Description
DEP (EI)	Red	Uncommanded deployment of the associated (L or R) thrust reverser.
DEP (EI)	Green	Normal thrust reverser deployment on the ground.
REV (EI)	Amber	The associated (L or R) thrust reverser system is armed in flight OR armed on the ground with thrust lever greater than MCR.
REV (EI)	White	The associated (L or R) thrust reverser system is armed on the ground with thrust lever in IDLE.
REV AUTOSTOW	White	The associated (L or R) thrust reverser autostow function is activated.
REV FAULT	White	A fault is detected in the associated (L or R) thrust reverser system.
UNL (EI)	Red	The associated thrust reverser system is not armed, but an unlock condition is detected.
UNL (EI)	Amber	On the ground, the thrust reverser is in transition between stow and deploy. It will temporarily illuminate during normal thrust reverser deployment. If illumination continues for more than several seconds, an abnormal condition exists and the master caution is tripped.

During normal thrust reverser deployment the following illuminations will occur:

1. REV white EI.
2. UNL amber EI.
3. DEP green EI.

During normal thrust reverser stowage the above illuminations will be reversed.

The CWP contains red L and R REV UNSAFE lights which will illuminate in conjunction with a UNL or DEP red EI above the N1 indicator. Whenever this illumination occurs, a continuous "LEFT" or "RIGHT REVERSER UNSAFE" voice message will sound. This voice message can be silenced by depressing the mute switch located on the right thrust lever or depressing the master CAUT/WARN light.



THRUST REVERSER SYSTEM SCHEMATIC
Figure 2-4

AIRCRAFT FUEL SYSTEM

The aircraft fuel system consists of two wing tanks, a fuselage tank, a fuel flow indicating system, a fuel quantity indicating system, a fuel transfer system, a fuel vent/expansion system and a single-point pressure refueling system.

WING TANKS

The wing is divided into two separate fuel-tight compartments which serve as fuel tanks. Each tank extends from the wing root to a point just short of the winglets, thus providing a separate fuel supply for each engine. A crossflow shutoff valve is installed to permit fuel transfer between wing tanks. Wing tank over-pressurization is prevented by vent/expansion lines between the wing tanks and fuselage tank. This allows access to the main fuel vent/expansion system of the fuselage tank. Flapper-type check valves, located in the various wing ribs, allowing free fuel flow inboard but restricted outboard fuel flow. A main jet pump is mounted in each wing tank near the center bulkhead to supply fuel under pressure to the respective engine fuel system. A standby pump also located at this location can be utilized as a back-up for the main jet pump, or be used to transfer fuel from wing tank to wing tank or defuel the aircraft. Three scavenge jet pumps, located throughout each wing tank, are used to transfer fuel to the inboard collector bay containing the main fuel jet pump. A fourth scavenge jet pump, located in the forward end of the collector tank, is used to transfer fuel to the inlet of the main fuel pumps. A fifth scavenge jet pump, located in the outlet of the fuselage to wing transfer line, is used to assist gravity in the transfer of fuel from fuselage to wing during normal aircraft operation. The wings are filled from the fuselage tank through the refueling manifold or the gravity filler port.

FUSELAGE TANK

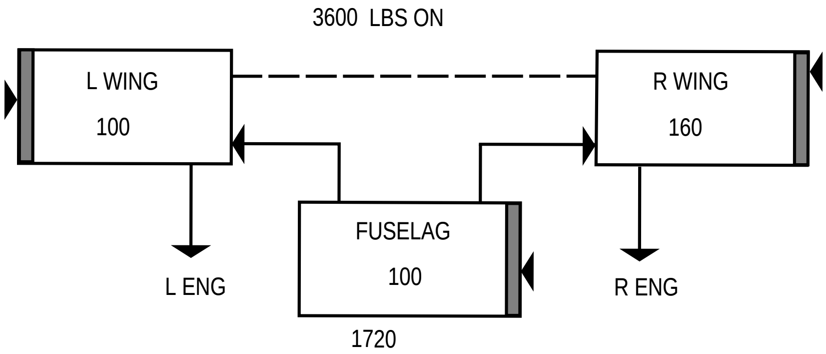
The fuselage tank consists of a single bladder-type cell located in the aft fuselage. The tank is equipped with a pressure refueling adapter, a gravity filler port, a fuel probe, a refueling manifold/nozzle, and a fuel vent/expansion system with an auxiliary vacuum/pressure relief valve. The tank allows the entire fuel system to be serviced through a pressure refueling adapter located on the right side of the aircraft below the engine pylon, or a gravity filler port located on the right side of the aircraft above the engine pylon. The gravity transfer system is boosted by motive flow through the refueling manifold/nozzle during refueling operations. Fuel will flow to both wing tanks through two transfer lines.

FUEL FLOW INDICATING SYSTEM

The fuel flow indicating system consists of a Dual Fuel Flow Converter (DFFC) and a fuel flow transmitter located in the main fuel line of each engine. There is no fuel flow transmitter for the APU. The fuel flow transmitters sense flow rate and fuel temperature, and provide these parameters to the DFFC. The DFFC processes these signals and sends a flow rate, along with the total fuel burned (APU fuel not included), to a Data Acquisition Unit (DAU). The DAU transfers the information to the flight management system for fuel monitoring and to EICAS for flight deck display to show Fuel Flow (FF) left and right engine, and total fuel used (refer to Figure 2-5 for the EICAS Fuel Page).

A TOTALIZER RESET switch, located within the FUEL group of the pedestal control panel, will reset the fuel burned information held in the DFFC's nonvolatile memory after fuel servicing. The fuel used can be zeroed out by depressing and holding the TOTALIZER RESET button for a minimum of two seconds.

The DFFC is powered by 28-vdc supplied by the 1-amp L and R FUEL FLOW circuit breakers located within the ENGINE groups of the pilot's and copilot's circuit breaker panels respectively.



FUEL PAGE
Figure 2-5

STBY SWITCHES

The L and R STBY switches, within the FUEL group of the aft pedestal, manually control the operation of the electric standby pumps. These momentary switches normally remain off. In the event of a main jet pump failure or during fuel crossflow, the L and R STBY switches must be manually selected to ON by the flight crew. The standby pumps are automatically energized during engine start (begins when the L or R START switch is depressed, and stops at 50% N_2). The right standby pump is automatically energized during APU start and run. When the standby pumps are operating, the L and/or R STBY switches will illuminate ON.

The standby pumps operate on 28-vdc supplied through the 15-amp L and R STBY PUMP PWR circuit breakers within the FUEL groups of the pilot's and copilot's circuit breaker panels respectively. The automatic and manual pump controls are powered by 28-vdc through the 3-amp L and R STBY PUMP CTRL circuit breakers located within the FUEL groups of the pilot's and copilot's circuit breaker panels respectively.

The following CAS illuminations are specific to the standby fuel pumps:

CAS	Color	Description
FUEL PRESS LOW	Red	Fuel pressure is low at the associated (L or R) engine's fuel pump inlet.
STBY PUMP ON	White	The associated (L or R) standby fuel pump is receiving electrical power.

XFLOW SWITCH AND CROSSFLOW SHUTOFF VALVE

The XFLOW switch, within the FUEL group of the aft pedestal, controls the crossflow shutoff valve. The valve is normally in the closed position. Depressing the XFLOW switch illuminates a white bar and power is applied to open the motorized crossflow shutoff valve allowing fuel to flow between the wing tanks.

To balance wing fuel, the XFLOW switch should be set to open (white bar illuminated) and the heavy side L or R STBY switch set to ON. The standby pump will continue to operate until the L or R STBY switch is deselected. The crossflow shutoff valve allows all usable fuel aboard the aircraft to be available to either engine. The switch should not be selected except when correcting an out-of-balance condition.

The crossflow shutoff valve operates on 28-vdc supplied from the rear hot bus through the 5-amp XFLOW VALVE CTRL circuit breaker located within the FUEL group of the copilot's circuit breaker panel. Loss of power to the crossflow shutoff valve causes the valve to remain in its last commanded position.

The following CAS illuminations are specific to the XFLOW switch and crossflow shutoff valve:

CAS	Color	Description
FUEL PRESS LOW	Red	Fuel pressure is low at the associated (L or R) engine's fuel pump inlet.
FUEL XFLO	Amber	The fuel crossflow valve is not fully opened or closed as commanded.
FUEL XFLO OPEN	White	The fuel crossflow valve is open.
STBY PUMP ON	White	The associated (L or R) standby fuel pump is receiving electrical power.

FUEL INDICATING SYSTEM

The fuel indicating system consists of a refueling control panel, a fuel quantity signal conditioner, 16 wing tank fuel quantity probes (8 each wing), and a fuselage tank fuel quantity probe. The system provides fuel quantity accuracy which indicates zero at zero fuel and is corrected for pitch and roll through the AHRS system.

Power for the fuel indicating system is 28-vdc supplied through the 1-amp L and R QTY circuit breakers located within the FUEL groups of the pilot and copilot circuit breaker panels respectively.

REFUELING CONTROL PANEL

The refueling control panel is located on the exterior of the aircraft below the right engine pylon. The panel is energized by the FUEL PNL ON/OFF switch. This switch also activates a floodlight when placed in the ON/FLD LT position. This floodlight is installed below the right engine pylon and is energized from the EMER BATT hot bus to allow refueling without accessing the aircraft. The DEFUEL/READY/OFF switch opens the defuel shutoff valve and the crossflow shutoff valve when selected to READY for defueling operations. An amber LED indicator above the READY will illuminate when both valves are open. A green LED indicator below the OFF will illuminate when both valves are closed. A four-digit LED labeled TOTAL FUEL QTY will indicate total usable fuel in LB or KG depending on aircraft configuration.

FUEL QUANTITY SIGNAL CONDITIONER AND PROBES

The fuel quantity signal conditioner is based on two independently powered left and right wing channels. Each channel receives DC inputs from their respective wing probes. Both channels independently monitor the fuselage probe and receive aircraft pitch information from the AHRS #1 unit. This data significantly increases the accuracy of the fuel indicating system during climb and descent. Each channel monitors the data output of the other for calculating total fuel quantity for transmittal to the DAUs. Although each channel outputs the same fuel quantity information, the DAUs will only read specific information. DAU #1 reads left quantity and total quantity. DAU #2 reads right quantity and fuselage quantity. A weight-on-wheels input allows for separate calculation software to operate "on the ground" or "in the air", making the system more accurate in both environments.

Aircraft 45-002 thru 45-258 and 45-260 ***not*** *modified by SB 45-28-8 (Modification of Fuel Imbalance CAS Logic)*:

A wing fuel imbalance greater than 500 lb (227 kg) with flaps up or greater than 200 lb (91 kg) with flaps greater than 3° will generate the FUEL IMBALANCE amber CAS.

Aircraft 45-259, 45-261 thru 45-397 and prior aircraft modified by SB 45-28-8 (Modification of Fuel Imbalance CAS Logic), but not modified by SB 45-22-10 (Honeywell Phase VI Avionics Upgrade):

A wing fuel imbalance greater than or equal to 200 lb (91 kg) will generate the FUEL IMBALANCE amber CAS.

Aircraft 45-398 & subsequent and prior aircraft modified by SB 45-22-10 (Honeywell Phase VI Avionics Upgrade):

The system monitors the left and right wing fuel quantities, and generates a FUEL IMBALANCE amber CAS if the difference exceeds 200 pounds (91 kg). Nuisance messages are minimized by inhibiting this message under certain conditions. These conditions are described below.

- CAS is inhibited for 30 seconds after liftoff.
- When landing gear is up, CAS is inhibited if pitch angle deviates from zero (level) by +5° (nose up) or -2° (nose down). The inhibit remains in effect for 30 seconds after the aircraft returns to level (between +5° and -2°).

There are several cases when the inhibit logic is overridden. After the 30-second liftoff inhibit expires, if any of following conditions exists, the FUEL IMBALANCE amber CAS will appear.

- Indicated Mach is greater than 0.78 MI, and monitored fuel imbalance exceeds 200 pounds (91 kg).

- The landing gear is extended, and monitored fuel imbalance exceeds 200 pounds (91 kg).
- Monitored fuel imbalance is 500 pounds (227 kg) or greater.

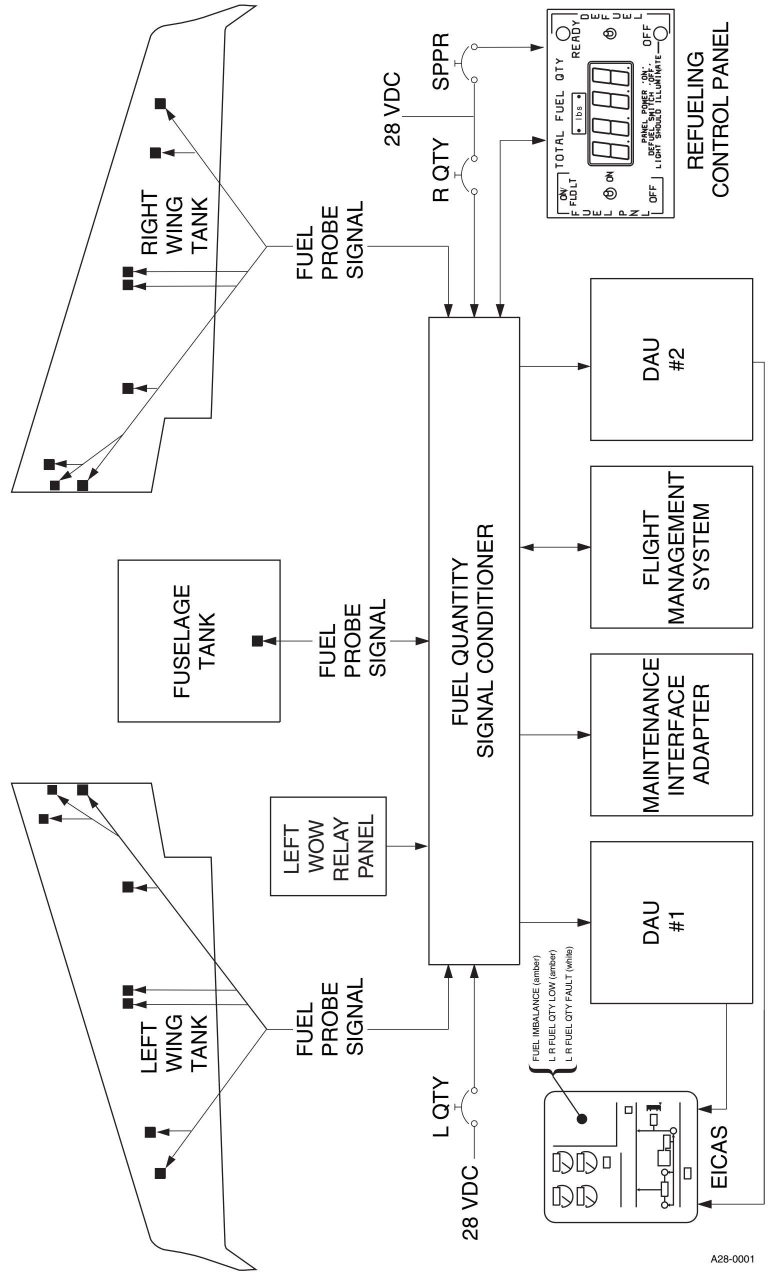
When the aircraft is on the ground, a FUEL IMBALANCE amber CAS will appear anytime the monitored fuel imbalance exceeds 200 pounds (91 kg).

In summary, the crew is generally alerted when fuel imbalance exceeds 200 pounds (91 kg). However, certain conditions tend to create nuisance alerts. The nuisance alerts are minimized by inhibiting the alerts when these conditions exist. In all cases, a fuel imbalance of 500 pounds (227 kg) or more will be annunciated.

CONDITION 1	**CONDITION 2**	**CONDITION 3**	**FUEL IMBALANCE amber CAS displayed by imbalance of:**	
			200 lb	**500lb**
On Ground			X	
Airborne for at least 30 seconds	Pitch Angle between +5° and -2° (i.e., level flight attitude) for at least 30 seconds		X	
	Pitch Angle **NOT** between +5° and -2° (i.e., climb or descent attitude)	Mach 0.78 or less		X
		Mach greater than 0.78	X	
	Landing Gear is down		X	

The fuel quantity signal conditioner software determines low fuel conditions from the filtered fuel quantity. The L or R FUEL QTY LOW amber CAS is generated when fuel quantity is less than 350 pounds. The following CAS illuminations are specific to the fuel quantity indicating system:

CAS	**Color**	**Description**
FUEL QTY LOW	Amber	The fuel quantity in the associated (L or R) wing tank is approaching a minimum desired level for flight.
FUEL QTY FAULT	White	- **When message preceded by L or R:** A fault is detected in the associated channel of the fuel quantity indicating system. - **When message <u>not</u> preceded by L or R:** The fuselage fuel probe is invalid or attitude input from the AHRS to the fuel quantity indicating system is invalid.



FUEL INDICATING SYSTEM SCHEMATIC
Figure 2-7

RAM AIR FUEL VENT SYSTEM

The fuel vent system provides ram air pressure to all interconnected components of the fuel system to ensure positive pressure during all flight conditions. A flush-mounted ram air scoop (NACA vent scoop) located on the left side of the fuselage (forward of the engine) admits pressure to the fuselage tank main vent system. The main vent system pressurizes the wing tanks through the fuel vent/expansion lines. The fuselage fuel vent/expansion lines are each connected to a separate sump that has a moisture drain valve. Overpressurization due to thermal expansion in the wing tanks is relieved through the left and right expansion lines to the fuselage tank. Overpressurization of the fuselage tank is relieved overboard through the NACA vent scoop. The vacuum/pressure relief valve is a backup for the NACA vent scoop.

SINGLE-POINT PRESSURE REFUELING (SPPR) SYSTEM

The Single-Point Pressure Refueling (SPPR) system allows the entire fuel system to be serviced through a SPPR adapter located on the right side of the aircraft below the engine pylon. The SPPR incorporates a precheck system which allows the operator to check the operation of the system shutoff valves before commencing refuel operations. The major system components are the refueling adapter, refueling panel, refuel shutoff valve, pilot valve, precheck valve, and associated plumbing and wiring.

Electrical power to operate the system indicator lights, solenoid valves and fuel quantity signal conditioner is 28-vdc supplied from the EMER BATT hot bus through the PWR ON switch on the refuel control panel.

The refuel shutoff valve is controlled by the pilot valve located at the high point in the fuselage tank. When refueling pressure is applied to the system through the pressure refueling adapter, pressurized fuel is applied to the refuel shutoff valve. This pressure is applied to both sides of the valve poppet. If the pilot valve is open, some of the pressure acting to hold the valve closed will be vented through the pilot valve and the pressure acting to unseat the poppet will drive the valve open against the spring tension. When the tank fills, the pilot valve will close, fuel pressure on both sides of the refuel shutoff valve poppet will equalize, and spring tension will drive the valve closed. If the refuel shutoff valve malfunctions, fuel will vent out of the NACA vent scoop to prevent overpressurization of the fuselage tank.

PRECHECK VALVE

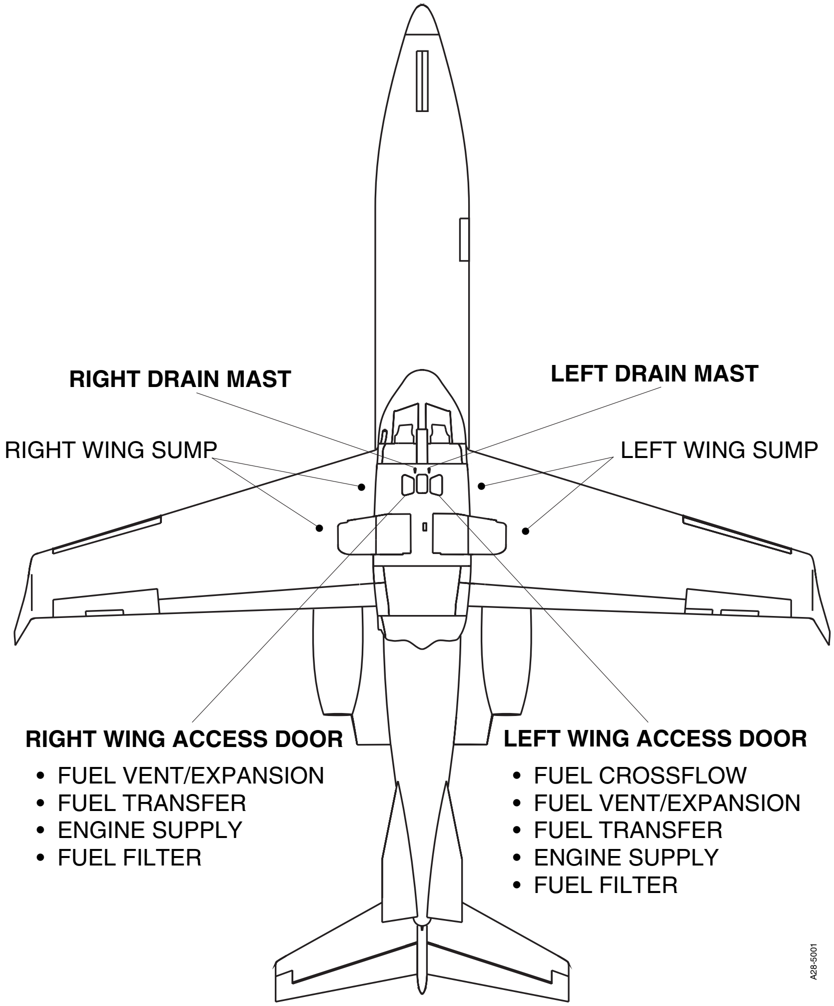
The precheck valve is used to check operation of the system shutoff valve before full refueling procedures are commenced. When the precheck valve is set to PRECHECK OPEN and refuel pressure is applied to the refuel adapter, fuel will be admitted to the precheck line. The shutoff valve will open and fuel will flow into the fuselage tank. The fuel in the precheck line will empty into a float basin at the pilot valve. When the basin fills, the pilot valve float will close the pilot valve, which causes the shutoff valve to close, terminating fuel flow. Fuel flow should stop within 20 seconds.

FUEL ADDITIVES

Refer to Airplane Flight Manual Addendum I Fuel Servicing for recommended concentrations and the proper blending methods of approved fuel additives.

REFUELING

The aircraft is refueled through a gravity filler cap located on the right side of the fuselage above the engine pylon or through the single-point pressure refueling (SPPR) adapter located on the right side of the fuselage below the engine pylon. A refueling panel access door is located next to the SPPR adapter access door. Refer to Airplane Flight Manual Addendum I Fuel Servicing for a list of approved fuels and refueling procedures.



FUEL DRAINS
Figure 2-8

AUXILIARY POWER UNIT (APU)

The Auxiliary Power Unit (APU), located in a special enclosure above the baggage compartment and tailcone equipment bay, is a self-contained, single-stage gas turbine unit that can be operated continuously up to an ambient temperature of 125° F (52° C). The APU provides pneumatic and electric power for ground operations of the aircraft Environmental Control System and aircraft electrical systems, independent of the aircraft main engines. It is restricted to ground operations only. The starting, acceleration and operation of the engine is controlled by an integral system of automatic and coordinated pneumatic and electromechanical controls.

The APU engine is comprised of three major sections: the accessory section, compressor section and turbine section. Engine power for the auxiliary power unit is developed through compression of ambient air by a single entry, radial, outward-flow, centrifugal compressor. The compressed air, when mixed with fuel and ignited, drives a radial inward-flow turbine rotor.

The APU control panel (located on the center pedestal) contains all of the primary controls to operate the APU. There is also a Maintenance Control Panel in the tailcone equipment bay (primarily for maintenance use). There is an EMER SHUTDOWN switch on this panel.

The engine is controlled and serviced by four systems: the engine fuel system, lubrication system, electrical system and indicating system. Fuel for the APU flows from the right wing fuel tank through the right standby pump and shutoff valve prior to reaching the APU. The APU uses approximately 150 pounds of fuel per hour. The APU should not be started and run in excess of 1 hour with less than 200 pounds in the right wing tank. Running out of fuel in the right wing tank will introduce air in the APU fuel lines which will cavitate the APU and prevent it from restarting immediately. The APU gearbox serves as an oil sump for the APU self-contained lubrication system. The APU Electronic Control Unit (ECU) is a fully automatic system that directs delivery of the correct amount of fuel regardless of ambient conditions and load requirements, as well as properly sequencing control of fuel and ignition during starting. The ECU is also used for trend monitoring (in lieu of a start counter or hour meter, etc.), which is accessed through the RS 232 maintenance port on the Maintenance Control Panel.

A warning horn is installed in the nose avionics bay. The audible alert can be heard out of the nose gear wheel well to alert personnel outside of the aircraft of an APU fire.

There are cooling fans installed in the tailcone equipment bay — one on the tailcone access door, the other on the opposite side of the fuselage. These fans are installed to improve cooling in the tailcone when the APU is operating. They are controlled by a 60° C thermostat located in the area of the tailcone most likely to exceed 70° C. If the temperature falls below 55° C the fans go off. Power for the fans is provided through the APU CMPTR circuit breaker.

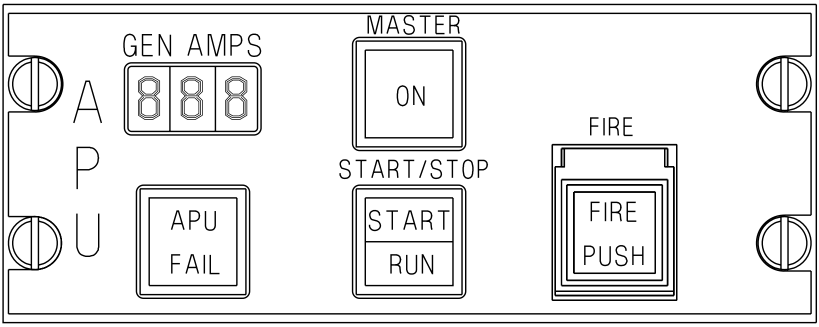
If the temperature in the tailcone reaches 70° C, the APU FAN FAIL indicator, in the tailcone, will activate (amber). The indicator is magnetically latched and will remain in the amber position until manually reset using the adjacent RESET switch. The APU FAN FAIL indicator should be checked prior to each start of the APU. If the indicator is activated, fan operation is suspect and maintenance should be obtained as required prior to running the APU. The APU may be operated at ambient temperatures up to 38° C with an amber APU FAN FAIL indication.

The following CAS illuminations are specific to the APU:

CAS	Color	Description
APU FAIL	Amber	- A start inhibit signal has been detected by the APU ECU. or - An APU protective shutdown signal has been detected by the APU ECU. or - The APU aircraft fuel valve is not closed and the APU is not running.

APU COCKPIT CONTROL PANEL

The APU cockpit control panel, located on the center pedestal, houses the necessary controls for operation and monitoring. APU fire detection/extinguishing controls are also located on the APU cockpit control panel.



F45-A00000-209-01

APU COCKPIT CONTROL PANEL
Figure 2-9

APU FAIL — The APU FAIL (amber) indicator shows a failure in the APU control or indication system. The indicator will also show if the aircraft fuel valve is not closed and the APU is not running.

APU MASTER — The APU MASTER switch/indicator is an alternate-action push-button switch. When selected ON, the ECU is powered and a bit test is started. If the test fails the APU FAIL indicator will come on.

APU FIRE — This switch/indicator is used to show an APU system fire and activate the APU fire extinguishing system. Should there be a fire in the APU, as detected by the fire loop, the FIRE switch/indicator will indicate FIRE PUSH (red), the aircraft Master WARN lights will illuminate, and the APU fire warning horn will sound. The fire detection/extinguishing system will automatically shut down the APU and activate the fire extinguisher within 10 seconds.

Depressing the FIRE switch/indicator will also shut down the APU and discharge the APU fire extinguishing bottle. After shutdown, the start inhibit circuit (within the ECU) is latched, not allowing restart.

NOTE The FIRE switch/indicator is wired directly to the R EMER HOT BUS and will activate the APU fire extinguisher even with the batteries OFF.

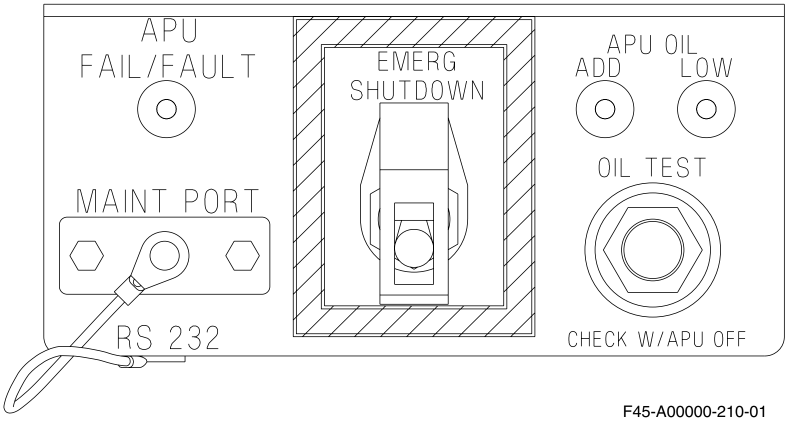
APU GEN AMPS — The GEN AMPS indicator is a digital display indicating the amperage output of the APU Generator (shows zero during start).

APU START/STOP — This switch/indicator is a momentary, two-cell, lighted switch. The top portion is labeled START (white) and is on only while the APU is starting. The lower portion is labeled RUN (green) and is illuminated when the APU is running.

Depressing this switch initiates the APU start sequence. If the APU is running, depressing this switch initiates the APU shutdown sequence.

APU MAINTENANCE PANEL

The APU maintenance panel is located in the tailcone equipment bay. It houses the necessary controls, indicators and interfaces for operation of the APU for maintenance, or to shut down the APU in an emergency.



APU MAINTENENCE PANEL
Figure 2-10

APU FAIL/FAULT — The blue APU FAIL/FAULT indicator shows that a fault has been registered by the ECU. The fault will be stored in the ECU.

APU OIL ADD / LOW — The APU OIL indicators show whether the APU oil level switch indicates an "ADD" or "LOW" (both amber) condition. These indicators are operative only when the right aircraft battery is on and the OIL TEST switch is held.

OIL TEST — The OIL TEST push button switch is used to check the oil level in the APU. Pushing the switch, with the R BATT Switch on, allows the "ADD" or "LOW" indicators to come on as required.

EMERG SHUTDOWN — This switch, when toggled, removes power from the APU ECU and causes the APU to shut down. This function is separate from the APU control panel in the cockpit. On the next ECU power up, a loss of DC power fault is logged.

MAINT PORT— The RS 232 maintenance port provides the interface between the APU ECU and the field service monitor. The PC and ECU communicate through this port to provide maintenance personnel with fault isolation information stored in the APU ECU.

APU FIRE WARNING SYSTEM

The APU fire detection system consists of a sealed gas line inside the shroud surrounding the APU itself. In the event of a fire external to the APU proper the increase in pressure in the sealed line activates the system:

- The APU FIRE PUSH and aircraft master WARN lights will illuminate, the APU fire warning horn sounds and the APU shuts down.
- Ten seconds after illumination of the APU FIRE PUSH annunciator, the fire bottle will release a charge of Halon into the APU compartment.
- The fire extinguisher may also be activated manually by depressing the APU FIRE switch.

The following CAS illuminations are specific to the APU fire warning system:

CAS	Color	Description
APU FIRE	Red	A fire has been detected in the APU compartment.

APU BLEED AIR

Refer to Section VI, ANTI-ICE & ENVIRONMENTAL, for information on APU bleed air.

APU GENERATOR

Refer to Section IV, ELECTRICAL & LIGHTING, for information on the APU generator.

OPERATING PROCEDURES

APU PRE-START CHECK

This check should be accomplished if the APU is to be started without accomplishing the standard aircraft preflight.

NOTE The APU maintenance panel is located in the tailcone. Access is gained through the tailcone access door.

1. L and R BATT Switches — On, simultaneously.
2. EMER BATT Switch — EMER.
3. APU MASTER Switch — ON.
4. Tailcone Interior Check:
   a. OIL TEST Switch (on the APU maintenance panel) — Select. If the LOW indicator comes on, have oil serviced prior to starting the APU.
   b. APU FAN FAIL indicator (in the tailcone) — Check. If indicator shows amber, obtain maintenance as required prior to running APU (temperatures above 100° F [38° C]).

NOTE APU may be operated at ambient temperatures up to 100° F (38° C) with an amber APU FAN FAIL indication.

   c. APU Fire Bottle Pressure — Check.
5. APU Exhaust — Clear of obstructions.
6. APU Inlet — Clear of obstructions.
7. Check APU firebox drains for indications of oil or fuel leaks.
8. Fuel Quantity (right wing) — Check.
9. PACK Circuit Breaker (pilot's ENVIRONMENTAL group) — Set.
10. APU Circuit Breakers (copilot's APU group) — Set.
11. L and R BLEED Circuit Breakers (pilot's and copilot's ENVIRONMENTAL and ENVIR group) — Set.
12. MAN and AUTO Circuit Breakers (copilot's ENVIR group [TEMP CTRL]) — Set.
13. L and R BLEED Switches — OFF.
14. PACK Switch — OFF.
15. HI FLOW Switch — Off.
16. MANUAL TEMP Switch — Off.
17. COCKPIT and CABIN TEMPERATURE COLD-HOT Knobs — Rotate to the mid (12 o'clock) position.

APU START UP

To start the APU:

1. L INSTR Lights Switch — On.
2. BCN/STROBE Switch — BCN.
3. APU Fire Detection System — Test:

CAUTION

Ensure personnel are clear of the nose wheel well/ avionics bay area during the APU fire warning system test. The APU fire warning horn is located in this area.

   a. SYSTEM TEST Switch — Rotate to FIRE DET. Press and hold.
   b. Verify:
      - The APU FIRE red CAS activates.
      - The Master WARN tone and lights activate.
      - The APU FIRE switch/indicator illuminates.
      - After 13 to 18 seconds the APU fire warning horn will sound.
   c. SYSTEM TEST Switch — Release.
4. APU START/STOP Switch — Press (momentarily) and release. An automatic start sequence is initiated and the following events will occur:
   - The white START light will illuminate.
   - The APU fuel shutoff valve opens. The right fuel standby pump begins operation (an R STBY PUMP ON white CAS is displayed and ON will illuminate on the R STBY PUMP switch/indicator).
   - As the starter is energized, it provides a rotational input to the gear train. The gear train drives the compressor and turbine components, the oil pump and the fuel control unit.
   - When the engine reaches the specified RPM, the ECU permits fuel flow to the fuel nozzle assemblies, and the ignition unit causes the igniter plug to fire and ignite the fuel-air mixture in the combustion chamber.
   - The starter assists acceleration up to the starter cutout speed.

  - At approximately 60% RPM, compressor discharge pressure opens the surge control valve, dumping a small percentage of compressor discharge air overboard preventing engine surge.
  - As acceleration continues and engine speed reaches approximately 95% RPM plus 4 seconds, the ECU deactivates ignition.
  - On the START/STOP switch/indicator, the START light goes off and the green RUN light comes on. On the APU GEN switch, on the electrical control panel, the green AVAIL light comes on (a delay of 3 seconds or less between the RUN light and the AVAIL light coming on is not abnormal). An APU AVAILABLE white CAS will be displayed.
5. APU GEN Switch — ON.
6. APU BLEED Switch — ON.
7. PACK Switch — On.

APU SHUTDOWN

To shut down the APU:
1. APU START/STOP Switch — Press (momentarily) and release. An automatic shutdown sequence is initiated. Verify that the green RUN light goes off and R STBY PUMP white CAS goes out.
2. APU MASTER Switch (after 30-second delay) — Off.
3. BCN/STROBE Switch — OFF.
4. EMER BATT Switch — OFF.
5. L and R BATT Switches — OFF.

APU SHUTDOWN FEATURES (Automatic)

During APU operation, the ECU monitors engine speed, temperature, oil pressure and electrical surge conditions. The ECU contains circuitry which will automatically remove power from the APU's internal fuel solenoid valve and shut down the APU under the following conditions:

- Overspeed
- Electrical surge in ECU driven circuits
- Low oil pressure
- Over temperature
- Failure of EGT thermocouple
- High oil temperature

APU CIRCUIT BREAKERS

All APU circuit breakers are located on the copilot's circuit breaker panel.

CIRCUIT BREAKER	SUPPLIES POWER TO
APU CMPTR	APU Ammeter, APU Electronic Control Unit, APU Fans, APU FIRE PUSH Control, APU Fuel Shutoff Valve, APU Maintenance Control Panel, APU MASTER Switch, Generator Reset Control
APU FIRE DET	APU Fire Detection Circuit
APU FIRE EXT	APU Fire Bottle
APU GEN	APU Generator Control Unit

SECTION III
HYDRAULICS & LANDING GEAR

TABLE OF CONTENTS

SECTION III HYDRAULICS & LANDING GEAR

HYDRAULIC SYSTEM

The aircraft hydraulic system supplies hydraulic pressure for operation of the aircraft landing gear, brake, flap, spoiler/spoileron and thrust reverser systems. Hydraulic fluid flows from the main hydraulic reservoir through two firewall shutoff valves to the main engine-driven hydraulic pumps for distribution to the required systems upon demand.

The hydraulic system has both a main and auxiliary source of hydraulic power. These sources are totally separate up to the source selector valve. An auxiliary dc motor-driven hydraulic pump is installed to provide auxiliary hydraulic pressure to the brake system through the brake source shuttle valve and to the landing gear and flap system through the source selector valve in the event of a malfunction. The auxiliary hydraulic system only provides pressure for the brake system while the aircraft is on the ground.

A 260 cu. in. (4261 cc) reservoir supplies hydraulic fluid to the main and auxiliary hydraulic systems. The reservoir is designed with a separation wall (partition) to contain fluid for either the main or auxiliary system. Reservoir pressure is maintained at approximately 20 psi (138 kPa) by bleed air supplied through a pressure regulator. A bleed air pressure relief valve releases pressure in excess of 20 psi (138 kPa), and a vacuum relief valve prevents negative pressure in the reservoir. A thermal shutoff valve prevents high energy bleed air (>390° F [199° C]) from entering the reservoir in the event of a hydraulic line failure.

The main and auxiliary hydraulic pumps will each maintain a nominal pressure of 3000 psi (20,685 kPa) for their applicable systems. A precharged (1500 psi [10,343 kPa]) hydraulic accumulator is installed to dampen and absorb pressure surges within the main hydraulic system. A separate brake accumulator, fed by the auxiliary system, maintains pressure for the emergency/parking brakes. Two high-pressure filters and two return filters prevent hydraulic fluid contamination within the main and auxiliary systems. These filters incorporate bypass valves which will open in the event they become clogged. A hydraulic pressure relief valve, installed between the high-pressure and return lines in both the main and auxiliary system filters, will open to relieve pressure in excess of 3700 psi (25,511 kPa).

FIREWALL SHUTOFF VALVES

Two motor-driven firewall shutoff valves can stop hydraulic fluid flow to the main engine-driven hydraulic pumps in the event of an emergency or engine fire. These valves will also shut off fuel supply to the engine and close the engine bleed air valves. Each shutoff valve is operated by the corresponding FIRE switch on the pedestal (ENGINE panel). (Refer to Engine Fire Extinguishing System, Section II). The valves operate on 28-vdc supplied through the 3-amp L and R FWSOV circuit breakers located on the pilot's and copilot's circuit breaker panels (ENGINE group), respectively. Loss of power causes the shutoff valves to remain in their last position. The firewall shutoff valves are powered from the hot bus.

SOURCE SELECTOR VALVE

A source selector valve controls the source (main or auxiliary) of hydraulic pressure to the landing gear and flap systems. To initiate the hydraulic cross flow function, the auxiliary hydraulic pump must be running. This is achieved by pressing the AUX PUMP switch (GEAR/HYD panel). Manual activation of the valve during flight is accomplished by depressing the alternate-action push button HYD XFLOW switch (GEAR/HYD panel) which connects the landing gear and flap systems to the auxiliary hydraulic system. The switch will illuminate ON to indicate the valve is energized. If the auxiliary fluid level becomes low, the valve will automatically be deactivated in order to conserve fluid for the brake system.

The following CAS illumination is specific to the source selector valve:

CAS	Color	Description
HYD XFLOW ON	White	Hydraulic crossflow function is selected.

AUX HYD PUMP CONTROL

The auxiliary dc motor-driven hydraulic pump is automatically controlled by landing gear position, and manually controlled by the momentary-action push button AUX HYD switch (GEAR/HYD panel). The ON legend will illuminate when the pump is activated either manually or automatically. Normal auxiliary pump operation is based on the following aircraft configurations:

(1) Pump off when aircraft is powered up.
(2) Manual control prior to gear retraction. AUX HYD switch should be ON during normal taxi and takeoff.
(3) Automatically off when gear is transitioned up.
(4) Manual control in flight.
(5) Automatically ON when gear is transitioned down.
(6) Manual control after gear extension.
(7) Automatically off when aircraft is powered down.

The auxiliary pump operates on 28-vdc supplied from the L ESS bus. Power for the auxiliary pump is provided by the 1-amp PWR circuit breaker located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group [AUX HYD PUMP]). Power for the auxiliary pump control circuit is provided by 2-amp CTRL circuit breaker located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group [AUX HYD PUMP]). Refer to Airplane Flight Manual for hydraulic pump limitations.

The following CAS illumination is specific to the auxiliary hydraulic pump:

CAS	Color	Description
AUX HYD PMP LO	Amber	Auxiliary hydraulic pump is on and pressure is less than 1900 psi.

MAIN/AUXILIARY SYSTEM PRESSURE

The HYD system page on EICAS contains a schematic display of fluid flow in the main and auxiliary hydraulic systems. Main system pressure is sensed by a pressure transducer which provides an analog signal to the EICAS. Pressure is displayed as a digital readout on the HYD system page with a range of 0 to 4000 psi (27,580 kPa) and a display resolution of 10 psi (69 kPa). Low-pressure switches relay information to CAS for low-pressure indications for the left or right side of the main hydraulic system, or in the auxiliary system.

The following CAS illuminations are specific to hydraulic system pressure:

CAS	Color	Description
AUX HYD PMP LO	Amber	Auxiliary hydraulic pump is on and pressure is less than 1900 psi.
MAIN HYD PRESS	Amber	Hydraulic pressure (main system) is not within the acceptable range (either too high or too low).
HYD PUMP LOW	White	Pressure from the associated (L or R) engine-driven hydraulic pump is low.

BRAKE ACCUMULATOR PRESSURE

The brake accumulator provides reserve hydraulic pressure of 3000 psi (20,685 kPa) for emergency brake operation and for parking brake operation. The accumulator is designed to provide at least six emergency brake applications or parking brake pressure for approximately 48 hours. The brake accumulator incorporates a pressure transducer which provides a signal to CAS. The following CAS illumination is specific to the brake accumulator:

CAS	Color	Description
BRK ACUM PRESS	Amber	Emergency brake accumulator pressure is not within the acceptable range (either too high or too low).

HYDRAULIC GROUND SERVICE

The hydraulic system is serviced through a ground service access located below the right engine pylon. A ground service panel within this access monitors hydraulic system condition for the auxiliary dc motor brushes, main/auxiliary system filters, status of the ground service valve, and main/auxiliary reservoir fluid levels. If the BRUSH indicator illuminates, the dc motor brushes are 90% worn (refer to Chapter 29 in the maintenance manual for corrective actions). A ground service switch allows system pressurization by either main or auxiliary pumps. The ground service access also includes quick-disconnect ports for pressure, return and fill lines, and an air bleed valve for the reservoir.

The following CAS illuminations are specific to the hydraulic system:

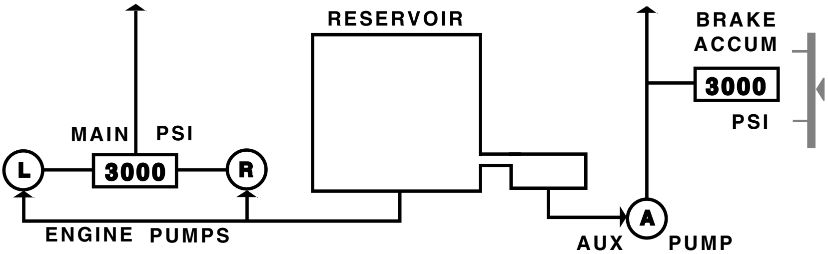
CAS	Color	Description
AUX HYD QTY LO	Amber	Auxiliary hydraulic reservoir quantity is low. Auxiliary hydraulic pressure is not available to operate the landing gear and flaps. Auxiliary hydraulic pressure is still available to the brakes and brake accumulator.
MAIN HYDQTY LO	White	- The fluid level in the hydraulic reservoir (main system) is either low or overfull. or - One or more of the hydraulic system (main or auxiliary) filters is becoming clogged.

HYDRAULIC SYSTEM PAGE

The HYD system page can be selected for display from the System Page Menu. This page includes a system schematic that presents both a graphic and a digital display of system pressures, quantities and faults.

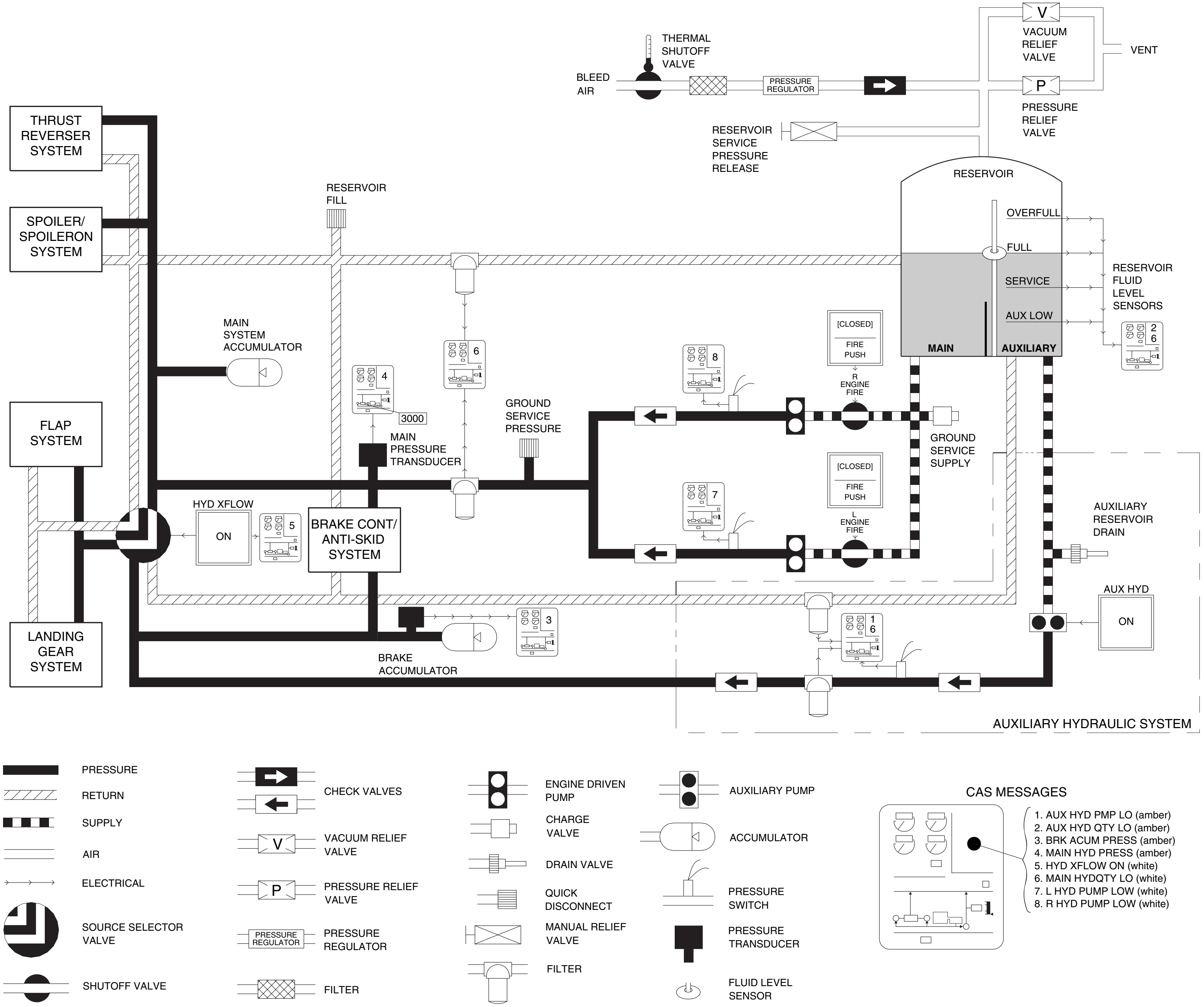
These indications include a digital readout of main hydraulic system pressure, a digital and analog indication of brake accumulator pressure, and a LOW indication for the auxiliary reservoir fluid level. These indications will change color when operating limits are exceeded.

A circled L, R, and A on the HYD page schematic represent the three hydraulic pumps. These pump symbols will turn amber if the corresponding pump output pressure switch in the hydraulic manifold does not detect normal output pressure.



HYD SYSTEM PAGE
Figure 3-1

INTENTIONALLY LEFT BLANK



HYDRAULIC SYSTEM SCHEMATIC
Figure 3-2

LANDING GEAR SYSTEM

The landing gear is hydraulically retractable, tricycle gear with air-hydraulic shock strut-type nose and main gear. The main gear struts are of a trailing-link design. The main gear has dual wheels and brakes on each strut. Each main gear wheel is equipped with three fusible plugs which will melt and release tire pressure in the event wheel temperature reaches 390° F (199° C). The brake system incorporates four hydraulically-actuated multi-disc carbon brakes with an integral anti-skid system. The nose gear utilizes a chined tire to prevent splashing into the engine inlet. Nose wheel steering is electrically powered and controlled by the nose wheel steering controller. Hydraulic pressure for gear retraction and extension is transmitted by a system of tubing, hoses, and actuating cylinders, and is electrically controlled by switches, relays, and solenoid valves. Emergency extension can be accomplished by mechanical landing gear "free-fall" in case of hydraulic or electrical system failure. Two doors enclose each main gear after retraction. The inboard doors are hydraulically operated and the outboard doors are mechanically operated by linkage connected to the main gear struts. The nose gear doors operate mechanically with linkage attached to the nose gear shock strut.

LANDING GEAR CONTROL SWITCH

The Landing Gear Control switch (GEAR/HYD panel) is a lever-lock type switch and must be pulled aft before selecting the UP or DN position. The switch controls the position of the gear selector valve and the door selector valve through gear and door position-sensing switches. Electrical power for the control circuits is 28-vdc supplied through the 3-amp GEAR circuit breaker on the pilot's circuit breaker panel (GEAR/HAYDRAULICS group). The landing gear control circuits are powered from the EMER BATT.

Landing gear retraction cycle: When the Landing Gear Control switch is placed in the UP position and the main gear weight-on-wheels switches are in the air mode, the following sequence of events will occur:

1. 28-vdc will be applied to the "open" solenoid of the door selector valve and hydraulic pressure will be applied to both inboard main gear door actuators and the inboard door uplocks.

2. When the inboard main gear doors open, door open switches will complete a circuit from the Landing Gear Control switch to the "up" solenoid of the gear selector valve. Hydraulic pressure will be applied to the main and nose gear actuators and the gear will retract.

3. When the main gear retract, gear up switches will complete a circuit from the Landing Gear Control switch to the "close" solenoid of the door selector valves. Hydraulic pressure will be applied to the inboard main gear door actuators to raise the gear doors. Pressure will remain on the main gear actuators until the doors are in the locked position.

4. The gear doors are locked into position by a hook/roller locking mechanism.

The normal retraction cycle takes approximately 11 seconds to complete with one or two main pumps. The auxiliary pump cycle will take about 18 seconds to complete.

Landing gear extension cycle: When the Landing Gear Control switch is placed in the DN position the following sequence of events will occur:

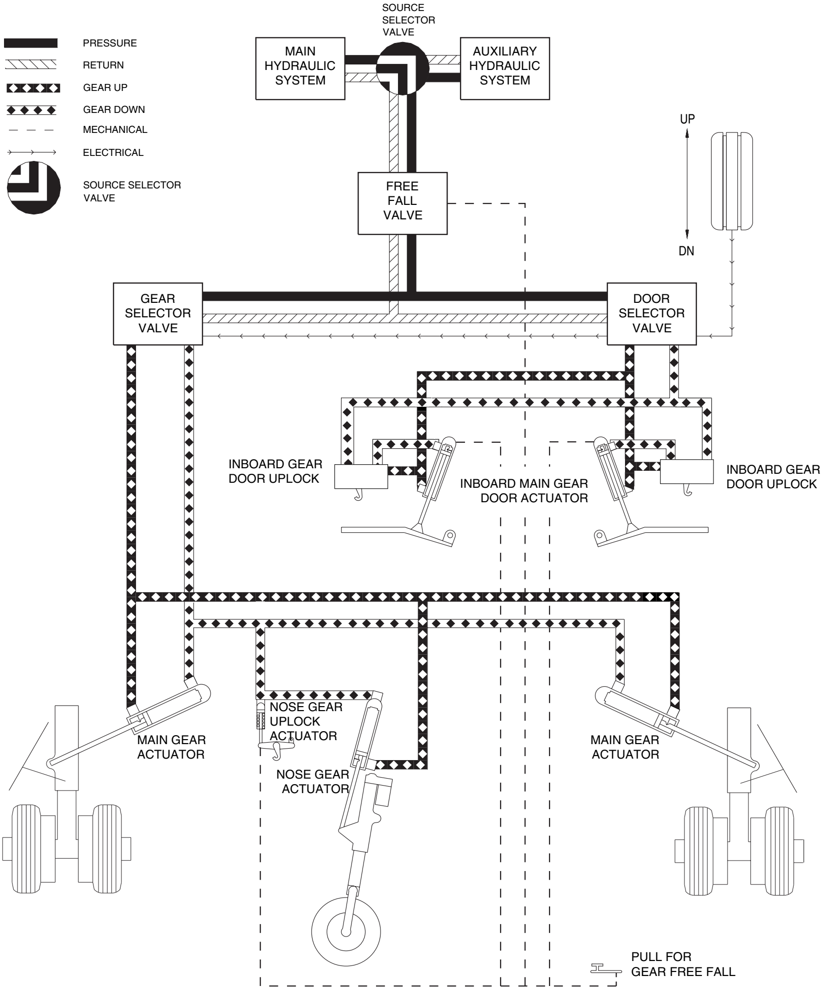
1. 28-vdc will be applied to the "open" solenoid of the door selector valve and hydraulic pressure will be applied to both inboard main gear door uplock actuators. Simultaneously, pressure is applied to the gear up actuator to hold gear in up position while main landing gear inboard doors open.

2. When the main gear doors open, door open switches will complete a circuit from the Landing Gear Control switch to the "down" solenoid of the gear selector valve. Hydraulic pressure will simultaneously be applied to release the nose gear uplock, apply pressure to the main and nose gear actuators, and extend all three landing gear.

3. When the main gear are full down, gear down switches will complete a circuit from the Landing Gear Control switch to the "close" solenoid of the door selector valve. Hydraulic pressure will be applied to the inboard main gear door actuators to raise the gear doors.

4. The main gear doors are locked into the retracted position by a hook/roller locking mechanism.

The normal extension cycle takes approximately 11 seconds to complete with one or two main pumps. The auxiliary pump cycle will take about 35 seconds to complete.



LANDING GEAR EXTENSION/RETRACTION SCHEMATIC
Figure 3-3

LANDING GEAR POSITION LIGHTS

The landing gear position lights, consisting of three Advisory/DOWN lights arranged in a triangular pattern, are located on the panel GEAR/HYD panel. The Advisory portion of each light is white in color with a black hash background and equipped with dual bulbs. The DOWN portion of each light is green in color and is also equipped with dual bulbs.

The location of each light in the triangular arrangement corresponds to the location of the gear on the aircraft. A white/hash (advisory) indication signifies that the corresponding gear position does not agree with the position of the Landing Gear Control switch, or that the inboard door is not up and locked. A DOWN (green) indication signifies the corresponding gear is down and locked.

During the gear retraction sequence, the three Advisory lights will illuminate when the sequence is initiated, remain illuminated throughout the retraction cycle, and then extinguish when the nose gear is up and locked, and the main gear inboard doors close.

During the gear extension sequence, the three Advisory lights will illuminate when the sequence is initiated, remain illuminated throughout the extension cycle, and then extinguish when the nose gear is down and locked and the main gear inboard doors close.

The lights are operated by the same switches that control the landing gear extension and retraction cycles. The lights are dimmed when the navigation lights are on, and may be tested at any time by setting the SYSTEM TEST switch to the GEAR position and depressing.

The landing gear position indicator lights operate on 5-vdc provided by the lighting control unit. The position indicator lights are powered by the EMER BATT. In the event of a complete dc electrical failure, the landing gear position lights will be powered by the emergency power system when the EMER BATT switch is in the ON position.

LANDING GEAR WARNING SYSTEM

Landing gear indications are installed to alert the operator of potentially unsafe flight conditions with the landing gear retracted or in transition. The system provides outputs to the CAS and CWP which activate aural and visual annunciation during such conditions. Depending upon the flight condition encountered, a distinct warning or caution will be indicated.

Gear Warning Indications

- **Master Warning Light Illuminated**
- **Aural Warning Master Warning Tone and Voice Message, "GEAR . . . GEAR . . . GEAR".**
- **GEAR red CWP**
- **GEAR red CAS**

The aforementioned warning indications will be activated by either of the following conditions:

- One or more landing gear are not down and locked, and flaps lowered beyond 25°.
- One or more landing gear are not down and locked, both thrust levers are set less than MCR, and radio altimeter (valid) is less than 500 feet.

The "GEAR" warning function cannot be muted.

Gear Caution Indications

- **Master Caution Light Illuminated**
- **Aural Caution Master Caution Tone and Voice Message, "GEAR . . . GEAR . . . GEAR".**
- **GEAR amber CAS**

The aforementioned caution indications will be activated by either of the following conditions:

- One or more landing gear are not down and locked, both thrust levers are set less than 70%, airspeed is below approximately 170 KIAS, altitude is below approximately 14,500 feet, and radio altimeter is invalid.
- One or more landing gear are in transition, or either main gear door is not up and locked, and airspeed is 210 KIAS or above.

The "GEAR" caution function can be muted by depressing either the Master Caution light on the glareshield or the Mute switch on the right thrust lever handle.

The following CAS illuminations are specific to the landing gear warning system:

CAS	Color	Description
GEAR	Red	The landing gear is not down and locked and other conditions indicate a landing is imminent.
GEAR	Amber	• The landing gear is not down and locked and other conditions indicate the flight is transitioning into the landing phase. or • The landing gear is being operated with an airspeed in excess of the maximum landing gear operating speed.

LANDING GEAR FREE FALL

In the event of a main/auxiliary hydraulic system failure or an electrical system malfunction, the landing gear can be extended using gravity to allow the gear to "free fall". Whenever free fall gear extension is to be accomplished, the Landing Gear Control switch should be placed in the DN position and the GEAR circuit breaker on the copilot's circuit breaker panel should be pulled after gear extension. This will prevent inadvertent gear retraction in the event electrical power to the system is regained.

Landing gear free fall extension is activated by the GEAR FREE FALL lever located on the copilot side of the forward pedestal. Pushing this lever mechanically unlocks the uplock actuators of the nose gear and main gear doors. This action also actuates an emergency valve allowing the hydraulic pressure and return lines of the door selector and gear selector valves to connect; thus, isolating them from the main and auxiliary hydraulic systems. Hydraulic resistance is minimized and the landing gear "free fall" to the extended and locked position. All three Advisory lights illuminate when gear control switches are placed in the down position. Each gear down light illuminates as the respective gear is down and locked. The main gear door Advisory lights will remain illuminated since the inboard doors are still extended.

NOSE WHEEL STEERING SYSTEM

The nose wheel steering system is controlled by the nose wheel steering computer. This steer-by-wire system receives pilot and copilot inputs through two rudder pedal position sensors and two dual pedal force sensors. A steering command based upon pedal position and force, nose strut position, and aircraft speed is calculated by the computer. This command is relayed to a dc motor which positions the nose wheel via a nose wheel strut gearbox.

The nose wheel steering system is powered by 28-vdc through the 25-amp MOTOR and 2-amp CMPTR circuit breakers located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group [NOSE STEER]). Arming of the system is initiated by depressing the momentary-action NOSE STEER switch (GEAR/HYD panel). The NOSE STEER switch will illuminate ON when the following conditions occur:

- Both system dc power sources are on and available to the computer.
- The nose gear is down and locked.
- No system faults or failures are detected.
- Main gear and nose gear weight-on-wheels switches are in the ground mode.

Once the system is armed, computer steering commands will be transmitted to the nose wheel during ground operation.

For low speed ground operations, 60° of steering authority either side of center is available. At low speed and large rudder pedal deflection, the nose wheel displacement will be large for high maneuverability. Once a rudder pedal has reached its stop, further nose wheel displacement is generated by additional force being applied to that rudder pedal. As ground speed increases, the maximum wheel deflection is reduced to zero. The nose wheel steering system remains active through liftoff.

The NOSE STEER switch will illuminate ON when the system is armed. When the nose gear is no longer in the down and locked position, the ON annunciator on the NOSE STEER switch will extinguish; however, the computer is still powered and system monitor circuitry remains active.

For landing, the nose wheel steering system becomes active only after all weight-on-wheels switches are in the ground mode. The ON annunciator on the NOSE STEER switch will illuminate provided no faults have been detected. The nose wheel steering system has a fade-in feature that allows several seconds to transition from rudder steering to nose wheel steering, to avoid an initial oversteer condition.

The nose wheel steering system can be disarmed at anytime by depressing the NOSE STEER switch, or either Control Wheel Master (MSW) switch during ground operations.

NOSE STEER SWITCH

The NOSE STEER switch is used to activate nose steering circuits for taxi operations. Momentarily depressing the NOSE STEER switch will activate the system and the ON annunciator will illuminate. When nose steering has been activated, the system can be disengaged by depressing either the pilot's or copilot's MSW or by depressing the NOSE STEER switch a second time. A disconnect tone will sound.

The following CAS illuminations are specific to the nose steering system:

CAS	Color	Description
NWS FAIL	Amber	The nose wheel steering system has failed.
NWS FAULT	White	A fault is detected in the nose wheel steering system. The system will operate in degraded mode.

WHEEL BRAKE CONTROL /ANTI-SKID SYSTEM

The wheel brake control /anti-skid system is a brake-by-wire system that electronically controls hydraulic brake pressure. The system is designed to maximize braking efficiency and reduce tire wear by modulating brake pressure to each of the four wheels at the time of an impending skid. Major components of the system include: a brake control unit, four wheel-speed transducers, two hydraulic shutoff valves, four two-channel pedal transducers, five hydraulic fuses, a pressure switch, an emergency/parking brake valve assembly, an emergency/parking brake accumulator, four brake control valves, four brake pressure transducers, four brake shuttle valves, a source shuttle valve, and four brake assemblies.

The brake control unit is divided into two independent channels for the inboard and outboard wheels. Each channel applies brake pressure commands to the respective left or right brake control valves. The brake control valves regulate actual brake pressure to each corresponding brake. Brake pressure commands from the brake control unit are determined from the combination of pilot/copilot pedal commands, and anti-skid, locked-wheel protection and touchdown protection functions. Hydraulic fuses, located in the main gear wheel wells, will close to prevent pressure loss if fluid flow exceeds normal brake actuation rate.

Power is supplied by 28-vdc provided through the 3-amp INBD BRAKES circuit breaker located on the pilot's circuit breaker panel (GEAR/HYDRAULICS group) and the 3-amp OUTBD BRAKES circuit breaker located on the copilot's circuit breaker panel (GEAR/HYD group). The wheel brake control /anti-skid system is active whenever power is present on the right essential bus and the emergency battery bus, the circuit breakers are engaged, and hydraulic pressure is present at the source shuttle valve.

TOUCHDOWN PROTECTION

Braking is enabled after touchdown when wheel spin-up is achieved (≥50 knots) or after the main gear weight-on-wheels switches are in the ground mode and time-out has elapsed. This prevents landing with the brakes engaged and allows spin-up time for traction to be established. The time-out function is a safety feature in the event of a wheel-speed transducer failure. Locked-wheel protection is provided by the brake control unit so that brake pressure is removed from a wheel if that wheel's velocity is less than or equal to 30% of the velocity of the fastest wheel. Removal of brake pressure from the slow wheel allows traction to be re-established.

The following CAS illuminations are specific to the brake system:

CAS	Color	Description
NORM BRK FAIL	Red	All four brakes (normal system) have failed.
CPLT BRK FAULT	Amber	One or more of the copilot's brake LVDTs has failed.
INBD BRK FAIL	Amber	The associated (L and/or R) inboard brake (normal system) has failed.
OUTBD BRK FAIL	Amber	The associated (L and/or R) outboard brake (normal system) has failed.
PLT BRK FAULT	Amber	One or more of the pilot's brake LVDTs has failed.
BRAKE FAULT	White	A minor brake system fault is detected. Minor faults will not significantly degrade brake performance. Reduced performance may be experienced during maximum braking.

EMERGENCY/PARKING BRAKE

The emergency/parking brake component of the brake system utilizes the emergency/parking brake valve assembly, emergency/parking brake accumulator. An EMERGENCY/PARKING BRAKE handle and cable system is used to apply emergency braking or to set the parking brakes. Emergency braking works independently of the main braking system and the brake accumulator is charged from the auxiliary hydraulic system.The EMERGENCY/PARKING BRAKE handle is located on the pedestal below the thrust levers. The handle is mechanically connected to the emergency/parking brake valve assembly. A switch within this assembly senses on/off condition and provides the signal for illumination of the EMER/PARK BRK red and white CAS. The parking brake is engaged by pulling the EMERGENCY/PARKING BRAKE handle and rotating clockwise or counterclockwise to the locking position. Rotating back to center position and releasing park brake handle disengages the parking brake. Emergency braking is controlled by pulling the EMERGENCY/PARKING BRAKE handle with a force proportional to the amount of emergency braking desired. Releasing the handle to the off position will disengage the emergency brake.

The following CAS illuminations are specific to the EMERGENCY/PARKING BRAKE system:

CAS	Color	Description
EMER/PARK BRK	Red	Parking brake valve (lever) is not fully released and thrust levers are advanced to MCR or above.
EMER/PARK BRK	White	Parking brake valve (lever) is not fully released.

ANTI-SKID SWITCH

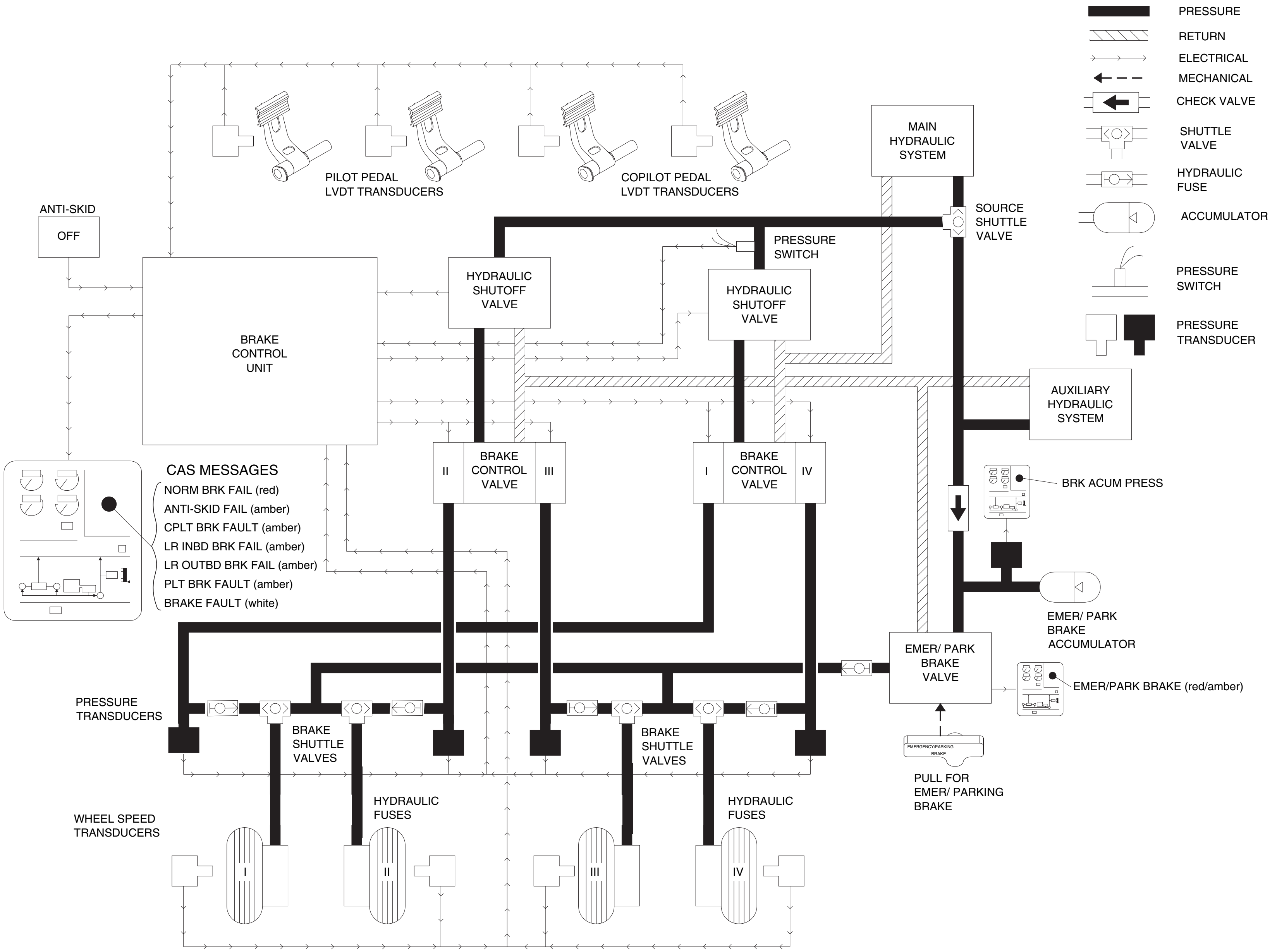
The anti-skid function can be disabled by depressing the ANTI-SKID switch (GEAR/HYD panel). This alternate-action switch will illuminate OFF to indicate the anti-skid function is disabled. The switch indicator lamps can be tested by placing the SYSTEM TEST switch in the LTS position and depressing.

The following CAS illumination is specific to the anti-skid system:

CAS	Color	Description
ANTI-SKID FAIL	Amber	Failure of anti-skid function to one or more brakes, or ANTI-SKID switch is OFF.

.

INTENTIONALLY LEFT BLANK



WHEEL BRAKE CONTROL/ANTI-SKID SYSTEM SCHEMATIC
Figure 3-4

SECTION IV
ELECTRICAL & LIGHTING

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

SECTION IV
ELECTRICAL & LIGHTING

ELECTRICAL POWER SYSTEMS

INTRODUCTION

Primary dc electrical power is provided by two engine-driven starter/generator units supplying 28-vdc power to a split bus electrical system. The generators are limited to 300 amps. An automatic electrical load shedding system has been incorporated to prevent generator overloading and prolong battery duration in the event of a single or dual generator failure. Secondary dc electrical power is supplied by two main airplane batteries that will power essential avionics, communication and instrumentation. A single emergency battery is provided to power standby equipment in case of airplane electrical system failure and to power certain equipment that must remain powered during engine start.

A ground power unit can provide electrical power for system operation prior to engine start, to assist in engine start and to charge airplane batteries. Additionally, an optional APU may be installed to provide for systems operation on the ground and for engine start.

The ac electrical power is provided by two engine-driven alternators for the sole purpose of powering the windshield ice and fog protection system. The alternators are rated at 200-vac, 200-400 Hz, 5kva.

GENERAL

The electrical system incorporates a split, multiple bus system for power distribution interconnected by contactors, fuses, and circuit breakers which react automatically to isolate a malfunctioning circuit. Manual isolation is also possible by turning off power to an affected bus via the electrical control panel or by opening the appropriate circuit breakers.

In the event of a dual generator failure, the main airplane batteries may be used to power the essential, essential avionics and hot bus components for a limited period of time. An emergency battery is also provided to operate equipment connected to the emergency battery bus and emergency hot bus.

It is possible to power the dc electrical systems from the airplane batteries, engine driven generators, a Ground Power Unit (GPU) or an auxiliary power unit (APU), if installed.

MAIN BATTERIES

Two main electrical system batteries are located, one above the other, in the tailcone. The upper battery is connected to the left generator bus when selected On via the L BATT switch and the lower battery is connected to the right generator bus when selected On via the R BATT switch. The main batteries provide a source of electrical power for engine starting and for emergency operation in the event of dual generator failure. They also provide power to three hot buses and two emergency hot buses even when the batteries are selected off.

The standard batteries installed are 24-vdc nickel-cadmium (NICAD) rated at 27-amp-hours. Optional 38-amp-hours NICAD batteries or 28-amp-hour lead-acid batteries may also be installed.

Gases produced by the main batteries are vented overboard through two tubes. The end of the tubes are cut at an angle so that one tube takes air in and the other exhausts the gases from the battery cases.

Electrical power from each battery is used to close the corresponding battery contactor when the L and R BATT switches are selected On. When the battery contactors are closed, the main batteries are connected to the respective generator bus. When the airplane is on the ground, the battery contactors are controlled by voltage sensors to prevent discharge below 14 volts. If a battery is below 14 volts, the contactor will not close when the BATT switch is selected On. If the battery voltage falls below 14 volts for more than 10 seconds while on the ground, the contactor will open. Battery depletion protection is inhibited when airborne and during engine starting on the ground. If the batteries are above 14 volts, they can be connected and recharged from a GPU, APU or aircraft generator.

Individual battery voltages can be read on the SUMRY or ELEC schematic displays which are selectable on the EICAS or MFD display units.

Battery temperature monitoring and overtemperature warning for NICAD batteries are provided via the EICAS/MFD displays and the Crew Warning Panel (CWP). The above is described further under ELECTRICAL SYSTEM INDICATORS in this section and under BATTERY OVERHEAT.

In the event of a dual generator failure, the aircraft batteries, in conjunction with the emergency battery, will provide power for the necessary essential equipment for a limited duration. For more information, see DUAL GENERATOR FAILURE in this section.

EMERGENCY BATTERY

The emergency battery installed is one 24-vdc lead-acid battery located in the nose section of the airplane. The emergency battery is connected to the emergency battery bus when selected On, but only provides power to that bus when the electrical system is not being powered by a GPU, APU or airplane generator. The emergency battery also provides power to both emergency hot buses even with the emergency battery selected OFF. The emergency battery provides power to the emergency battery bus in the event of a dual generator failure or an inflight electrical fire. The installation also enables the essential and essential avionics buses to be powered by the emergency battery in isolation from the main system during the engine start sequence, thus preventing problems caused by engine start voltage fluctuations. This is described further under DISTRIBUTION in this section.

The emergency battery is charged by the airplane electrical system and provides power to the emergency bus for a limited time if the airplane dc generators fail. See DUAL GENERATOR FAILURE in this section for more information.

A shunt, located between the emergency battery and the emergency battery contactor allows for monitoring of battery recharge and discharge current. If the emergency battery is selected to On and a battery discharge current is sensed by the shunt, the white EMER caption on the EMER BATT switch will illuminate, indicating emergency battery discharge. A white EMER BATT annunciator on the

CWP will also illuminate for this condition. Battery charging from the airplane generators precludes these indications under normal operation. The emergency battery has the same battery depletion protection on the ground as the main batteries.

The shunt also monitors emergency battery charging. If it exceeds 10 amps for 1 minute, an amber EMER BATT LOW will be displayed on the CAS alerting the crew to an emergency battery recharging condition.

The emergency battery voltage can be checked by observing the EMER-V or EMER BUS VOLTS on the EICAS/MFD SUMRY or ELEC systems schematic displays prior to applying GPU, APU or airplane generator power to the electrical system.

Eleven different components are connected directly to the emergency battery bus and will be available when that bus is being powered by the emergency battery, aircraft generator, GPU or APU. Main airplane batteries alone will not power the emergency battery bus because the isolation contactors will both be open if both generators are off-line.

The EMER BATT is selected On before engine start and remains on throughout the flight. When the EMER BATT switch on the electrical control panel is depressed, current from the emergency battery closes the emergency battery contactor and the OFF indication on the switch extinguishes.

When the emergency battery is selected OFF, the contactor will open and the OFF indication on the switch will illuminate, assuming at least one essential bus is still powered by another power source.

GENERATORS

Two engine-driven starter/generators, one on each engine accessory section, provide the normal source of 28-vdc power to the airplane. Each starter/generator is equipped with a "quick attach/detach" mounting to facilitate maintenance. Unless a GPU is powering the airplane electrical system, the generator will automatically come on line when the DEEC determines the engine is up to speed (approximately 95% of N_1 idle). If a GPU is used for engine start, the generators will automatically come on line after the engines are running when the GPU is disconnected, or when the EXT PWR switch on the electrical control panel is depressed, changing the annunciation from ON to AVAIL.

In flight, cooling air is routed from a scoop on the associated engine nacelle to the starter/generator. Cooling while on the ground is provided by a fan mounted on the generator shaft.

During normal operation, both generators operate independently unless the bus tie is closed. When both generators are on line, the bus-tie will normally be open and the left generator will recharge the left main battery and the right generator will recharge the right main battery and the emergency battery. If the bus-tie is closed, both generators will recharge the main batteries and the emergency battery. The generators supply dc power to all dc powered equipment on the airplane under normal conditions.

GENERATOR CONTROL UNITS

Left and right Generator Control Units (GCUs) are provided to monitor and control the engine driven starter/generators. They regulate the voltage of the generators to approximately 28-vdc and limit the output on the ground and for in-flight cross starting. The GCUs will automatically disconnect the generators from the electrical system if a generator malfunction is detected. If the generator fault was momentary or has cleared, generator operation may be restored by depressing the generator switch for one second. If the fault has cleared, this will reset the field relay allowing the generator to be energized and the line contactor to close. The field flashing relay and associated circuitry ensures that the generator can be built up from residual voltage without any other power source required. The GCUs also provide several engine starting functions.

GCU functions are as follows:

VOLTAGE REGULATION — To maintain a preset constant voltage at the generator output terminal, the GCU controls the shunt field current when the generator is rotating within its normal speed range. With both generators on line, the GCUs also perform a paralleling function in the unlikely event of an inadvertent bus-tie condition between the generator buses.

GENERATOR CURRENT LIMITING — When activated by a main gear weight-on-wheels switch/starter selection, the generator output is restricted by appropriate suppression of generator voltage. This action prevents excessive generator heating when charging depleted batteries and when assisting opposite engine starting.

AUTOMATIC STARTER CUTOFF — As the engine start cycle progresses, the starter/generator shunt field is weakened to enhance torque performance. At 50% N2, the start cycle is terminated automatically when starter cutoff speed is sensed by a magnetic pickup in the starter. This is a back-up starter cutoff to the normal cutoff at 50% N2 input to the GCU from the DEEC.

LINE CONTACTOR CONTROL — In the generating mode, power is automatically provided to the line contactor in order to connect the generator to the generator bus when the output voltage is at an adequate level. During an engine shutdown, as the generator runs down, reverse current is sensed and signals the line contactor to open, disconnecting the starter/generator from its bus.

OVERVOLTAGE PROTECTION — In the event of a failure of normal voltage regulation, and with due allowances for surges and transients, an independent circuit causes the line contactor to open, disconnecting the starter/generator from the generator bus if the voltage exceeds approximately 32 volts.

OVERSPEED (RUNAWAY) PROTECTION — Should a starter shaft shear during the starting mode, the starter/generator is de-energized as the speed passes the starter/cutoff point, preventing further damage by the overspeed condition. It is the starter speed, rather than engine speed that is sensed to provide this function.

STARTER ABORT OPERATION — If during a start cycle, the corresponding thrust lever is selected to CUTOFF, the starter will automatically disengage.

UNDERVOLTAGE PROTECTION — Should voltage regulation fail, causing a generator undervoltage condition (less than 10 volts for 5 seconds), the generator will disconnect from the system by de-energizing the field relay, causing the line contactor to open.

DIFFERENTIAL CURRENT PROTECTION — Should the output current at the generator differ significantly from the sensed load within the power distribution panel (due to a generator feeder line fault) the generator will be deenergized and disconnected from the system by the differential current protection circuit.

GROUND POWER UNIT (GPU)

Ground power can be connected to the airplane through a receptacle located on the lower left side of the fuselage just aft of the tailcone baggage door. The anti-flash contactor that connects the output of the GPU to the aircraft electrical system will only close if the voltage and polarity are within acceptable limits. The acceptable voltage limits are approximately 24 to 32 volts. The GPU should be regulated to 28-vdc and limited to 1,500 amps.

The EXT PWR switch is located on the cockpit electrical control panel . The green AVAIL caption on the EXT PWR switch will illuminate if the plugged-in GPU is within acceptable parameters. Depressing the EXT PWR switch when the green AVAIL light is illuminated will close the GPU anti-flash contactor, connecting the GPU output to the left generator bus. The ON caption will illuminate and the green AVAIL caption will extinguish. The GPU may be deselected with the same switch.

The bus-tie contactor automatically closes when a GPU is connected to the airplane electrical system. The entire dc system is powered, assuming the AV MSTR and BATT switches are on and no buses have been deselected via the electrical control panel.

Neither the airplane generators nor the APU will come on line with the GPU selected ON; and if they are on when the GPU is selected, they will drop off line. Airplane generators will automatically come on line after engine start, but not if the GPU is selected ON. The aircraft main batteries do not have to be on to close the GPU anti-flash contactor; however, only the bus-tie and non-essential bus contactors will close if neither battery is selected On. In this case GPU power would only be available to the left and right generator buses, the left and right non-essential buses, and the hot buses.

GPU output voltage is indicated on the EICAS/MFD SUMRY page and on the ELEC system schematic under "L/R ESS VOLTS." The EMER BUS VOLTS will also show GPU voltage. No indication of amps drawn from the GPU is provided.

The CAS will provide an EXTERNAL POWER message when an external power cable is connected and EXT PWR will also be annunciated on the EICAS/MFD ELEC system schematic. These indications will appear whenever a GPU cable is connected to the airplane, and a voltage of greater than 5 volts is sensed by the power monitor. It is not an indication that the GPU meets acceptable parameters nor does it indicate that the GPU is powering the airplane electrical system.

Operation of the EXT PWR switch on the electrical control panel is also described under ELECTRICAL SWITCHES in this section.

AUXILIARY POWER UNIT (APU)

The optional APU generator can provide the same service as an airplane engine generator and can be operated in conjunction with one or both airplane generators. The APU is only certified for ground use. After starting the APU using the APU control panel on the center pedestal, the green APU RUN annunciator on the APU control panel will illuminate and at the same time, the green AVAIL caption on the APU GEN switch, located on the electrical control panel, will also illuminate. After depressing the APU GEN switch on the electrical control panel, the ON caption will illuminate and the AVAIL caption will extinguish to indicate that the APU contactor has closed, connecting the APU generator output to the right generator bus. The APU GEN switch is also used to reset the APU generator when a failure has been detected and cleared. Operation may be restored by depressing the APU GEN switch for one second. If the AVAIL caption illuminates, depressing the switch again will bring the generator on line.

The bus-tie contactor automatically closes with the APU generator on line. A GPU and APU generator cannot provide airplane electrical power simultaneously. The APU generator will automatically drop off line if the GPU is selected on line.

The following CAS illuminations are specific to the APU generator:

CAS	Color	Description
APU AMPS HIGH	Amber	APU generator amperage exceeds upper limit.
APU AVAILABLE	White	APU is operating and available for bleed air and electrical power.

ELECTRICAL CONTROL PANEL

The dc power system electrical control panel is designed to provide ease of operation and dark cockpit integration. The automatic load shedding design for operation with single or dual generator failure relieves the pilot of manual deselection of electrical buses to prevent an overload. The control panel reflects and displays batteries, generators, or buses that have been isolated (automatically shed) in the event of a fault. The pilot has a manual override option of selecting, recycling or deselecting some of the buses on the dc system. During engine start, the generator autostart feature reduces engine start switch selections and pilot workload.

The electrical control panel consists of an illuminated panel with 13 (14 when an APU is installed) switches. Each switch incorporates lighted captions showing system status (i.e. OFF/ON). All captions have white letters on a black background except for AVAIL on the GPU and APU switches, which are green on a black background. For normal flight conditions, none of the switch captions should be illuminated.

ELECTRICAL SWITCHES

Following is a description of the switches on the electrical control panel:

L/R BATT — The battery switches are momentary action switches. If the aircraft electrical system is powered (one BATT, EXT PWR, APU GEN or GEN on), the OFF caption will be illuminated in the L/R BATT switch whenever the corresponding battery contactor is open. If the battery meets satisfactory voltage and temperature conditions, the OFF caption will extinguish when the switch is momentarily depressed and the battery contactor will close, connecting the battery to the respective generator bus. The switch will be blank when the battery is on. It will also be dark (with no OFF annunciations illuminated) when there is no electrical power applied to the airplane even though the contactor would be open in this case. The battery contactor will open and the OFF caption will illuminate if the battery switch is depressed a second time or if the battery is automatically turned off due to an overheat or an undervoltage condition.

BUS-TIE — Normal automatic operation of this momentary action switch displays a horizontal bar when the generator buses are tied and no indication will be illuminated when the buses are split. Automatic bus-tie operation is described under DISTRIBUTION in this section.

If required, this switch may be depressed to manually override an automatic bus-tie operation to provide a split system or to tie the electrical system together. One exception is that it cannot be used to open the bus-tie when it has been closed automatically due to GPU operation. The bus-tie manual selection may also be used, in accordance with AFM procedures, to close the bus-tie if it fails to automatically close within five seconds after an inflight generator failure. When the bus-tie switch is depressed, a MAN (manual) caption is illuminated to show that the automatic operation is disabled and the bus-tie will be held in the existing position until deselected by the crew. The CAS also provides a BUS TIE CLSD and BUS TIE MANUAL message.

EXT PWR — The external power switch is a momentary action switch. The green AVAIL caption will illuminate only when a supply of correct voltage and polarity is sensed on a connected GPU. When the EXT PWR switch is pressed to provide external power to the aircraft, AVAIL extinguishes and the white ON is illuminated. The ON caption indicates that the contactor is closed, connecting the GPU to the left generator bus.

APU GEN—The APU GEN switch is a momentary action switch. The green "AVAIL" illuminates when the APU generator is in generating mode and ready to be connected to the aircraft electrical system. When pressed, the AVAIL caption extinguishes and the white "ON" is illuminated. If the switch is depressed again, ON is extinguished and AVAIL is re-illuminated until the APU falls below 92% normal running rpm.

L/R GEN—These are momentary action switches. Normal generator operation is automatic and the OFF indication changes with the on/off-line operation of the generator. If a battery or APU engine start is made, the generator will automatically come on line after start and the OFF caption will extinguish. If the start is made with GPU power connected, the generators will not come on line until the GPU is deselected or disconnected. With the generator on line, the pilot may select to override the automatic operation and select it off line by pressing the generator switch. Depressing the switch when the generator is off line also initiates a reset signal to the GCU which eliminates the need for a separate momentary generator reset switch.

If a generator trips off line, the switch displays OFF and the CAS displays an amber L or R GEN FAIL message. In accordance with AFM procedures, the GEN switch should be depressed once to attempt a reset. If the generator does not reset, the switch again illuminates OFF. If both generators are off or failed, a red L R GEN FAIL message will be displayed by the CAS and a red GEN FAIL annunciator on the CWP will also illuminate. The L R GEN FAIL messages on the CAS will not display if the corresponding thrust lever(s) is/are in the cutoff position; instead a white L R ENG SHUTDOWN collector message will be displayed.

L/R NON-ESS & L/R MAIN — These momentary action switches are only depressed if the crew needs to override the automatic operation of these buses during generator failure. The OFF indication changes automatically to indicate bus condition. Selection of the switch in normal operation (both generators on line) will isolate the corresponding bus and display OFF. Reselection resumes normal operation. The non-essential buses will automatically be OFF whenever the electrical system is being powered strictly by battery power and also in flight if one generator fails. The main and non-essential buses will automatically be shed in-flight if both generators have failed.

L/R AV MSTR — These switches are alternate action and allow the crew to connect or disconnect both main avionics and essential avionics buses by manual selection. The main avionics bus contactors automatically open during engine start on the ground and during starter-assisted airstart.

EMER BATT — The bottom half of this alternate action switch displays OFF when manually selected to OFF (i.e. emergency battery contactor de-energized). This switch is selected on before engine start and will normally remain on during flight. The OFF caption will extinguish when the switch is selected on.

The top half of the EMER BATT switch displays EMER when the emergency battery is powering the emergency battery bus and an airplane generator, GPU or APU is not providing power to the emergency battery bus. This provides advisory information that the battery is discharging and should not be left on for an extended period while on the ground. In flight, this is an indication that generator power to the emergency battery bus has been lost and that the emergency battery is powering the emergency battery bus. It is normal for this annunciator to be illuminated during start and for a short period before start when generator, GPU or APU power is not available. A white EMER BATT annunciator on the Crew Warning Panel (CWP) also illuminates when the emergency battery is discharging.

ELECTRICAL SYSTEM INDICATORS

Monitoring of the dc electrical system is menu selectable on the EICAS or MFD displays. Electrical system parameters are usually monitored on the EICAS SUMRY page while the MFD is usually used for navigation display, TCAS, WX Radar, Checklists, etc. The SUMRY display is the power-up default display on the EICAS and MFD. Electrical system parameters in the form of a system schematic may also be monitored on the ELEC system schematic on the EICAS or MFD.

The EICAS/MFD system SUMRY page displays VOLTS, left and right. These two digital displays are an indication of the voltage on the left and right essential buses. Depending on what is powering the airplane electrical system, this can be an indication of airplane main battery volts, GPU volts, APU volts or airplane generator volts.

An indication of EMER-V (emergency bus voltage) is displayed on the SUMRY page immediately below VOLTS, left and right. Emergency bus voltage can be monitored on the EICAS/MFD displays. The CAS also monitors the emergency bus volts and will generate an amber EMER BUS VOLTS message if emergency bus voltage is less than 22 volts or more than 29.5 volts.

The left and right generator AMPS are displayed below the emergency bus voltage. There is no display for the amperage being drawn from a GPU. APU amps are displayed on an indicator located on the APU control panel.

The last electrical parameter displayed on the SUMRY page is left and right battery TEMP in degrees Celsius. Battery temperature is displayed only for airplanes equipped with NICAD batteries.

All of the electrical system information presented on the SUMRY page is also displayed in a schematic format on the EICAS/MFD ELEC system schematic page. Additionally, the ELEC system schematic display shows whether EXT PWR is connected to the airplane and, if the APU generator is connected, APU amps are also displayed.

Electrical system volts and amps may also be selected for display on either RMU. Under some conditions, the #1 RMU will automatically display the first of two backup engine pages which provide engine operating indications and other system data. The electrical system volts and amps appear on page 2 of the RMU backup engine displays, which is selectable with the PGE button on the RMU. After 20 seconds, the display returns to page 1. Returning the RMU to the communication and navigation function is accomplished with the RMU PGE button. However, if the #1 RMU is displaying engine information due to an automatic selection, that RMU will return to page 1 of the backup engine display 20 seconds after the last pilot selection on the RMU.

The display of volts, amps and battery temperature on the EICAS/MFD are color coded. As limits are exceeded, the digital data changes color (amber or red). When the data is in its normal operating range, the data is displayed in white. If any of the data exceeds a limit, the data changes to the appropriate color and is boxed in that same color. The exception to the display is when the actual battery temperature is below -23° C (-9.4° F). Below this temperature, the EICAS/MFD will display a flashing amber numeric display. If the actual battery temperature falls below -25° C (-13° F), the numeric digits will be replaced by amber dashes in a cyan box. This indicates the battery temperature(s) is/are below the valid indicating system range, it is not a system failure.

In certain cases, to alert the operator to a parameter exceedance or malfunction, a color coded message will be presented in the upper right corner of the EICAS. This section of the EICAS is known as the Crew Alerting System (CAS). Warning messages will be in red and caution messages will be in amber. A red or amber message will be accompanied by flashing Master Warning (red) or Caution (amber) light, while advisory messages will only flash in white lettering for 5 seconds and then go steady.

The crew is also alerted to certain malfunctions or conditions with illumination of a red or white annunciator on the Crew Warning Panel (CWP). The following annunciators relating to the electrical system are located on the CWP:

L & R BATT OVHT (red) — Illuminates if the corresponding battery temperature exceeds 70 degrees Celsius (160 degrees Fahrenheit).

GEN FAIL (red) — Illuminates if both generators are inoperative or off line.

EMER BATT (white) — Illuminates when the emergency battery is on and is discharging.

DISTRIBUTION

Basic dc power distribution is illustrated in Figure 4-1. With the main airplane batteries installed, power from the left and right batteries, through two 40-amp fuses, is always available to the "hot wired" items connected to the rear hot bus, the left and right hot buses, and the left and right emergency hot buses. Battery power to the left and right hot buses also passes through a single 20-amp fuse and 15-amp circuit breakers for each bus.

The left and right fire extinguishers and the left and right Firewall Shut-off Valves (FWSOVs) receive power through the left and right emergency hot buses, respectively. These items can also receive power from the emergency battery, either engine generator, or external power source. The tailcone utility light, Single-Point Pressure Refueling (SPPR) and baggage compartment lights are powered through the rear hot bus. Additional hot bus items include the cockpit overhead lights and entry lights. The hot buses are connected directly to both of the main batteries and to the external power connector through the left generator bus.

Power to the radio control hot bus is controlled with a momentary action switch on the center pedestal, just forward of the throttle quadrant. The radio control hot bus can only be selected ON when the airplane batteries are OFF. If the radio control hot bus is selected ON and the batteries are subsequently selected ON, the radio control hot bus will automatically be turned off and the ON annunciator on the switch will extinguish. The switch is labeled RADIO CONTROL HOT BUS. When this switch is depressed, the ON annunciator on the switch will illuminate and main battery power through the right forward hot bus will power the following (normal power source shown in parenthesis):

- Left audio control unit (L ESS)

- Clearance delivery radio (L ESS)

- Comm sections of the integrated communication unit #1 (L ESS)

- Nav section of the integrated navigation unit #1 (L ESS)

Ground power can be connected to the airplane as previously described in this section under GROUND POWER UNIT. With ground power connected, the bus-tie will automatically close and the output of the GPU is applied to the left and right generator buses and non-essential buses. With the main and emergency batteries selected On, external power is distributed to the rest of the dc electrical system. The airplane batteries (main and emergency) will then be charged from the power supplied by the GPU.

The external power supplied to the dc electrical system can then be monitored as described under ELECTRICAL SYSTEM INDICATORS in this section.

The APU (if installed) can supply power to the electrical system through the right generator bus. When the APU generator is on line, the bus-tie will automatically close, providing power to the left generator bus as well. Electrical power is then distributed from the generator buses to the rest of the electrical system in the same way as if a GPU was providing electrical power with airplane batteries selected On.

The APU generator output voltage can be monitored on the EICAS in the same manner that GPU or airplane generator voltage is monitored. Additionally, APU amperage draw can be monitored on an indicator located on the APU control panel on the center pedestal or on the ELEC schematic page of the EICAS/MFD.

Various-sized fuses are installed throughout the electrical system to provide circuit protection. Each fuse will carry more than its rated capacity for a short period of time. Extreme or prolonged overloading will cause a fuse to blow, isolating a particular circuit and precluding progressive failure of other electrical components. Fuses cannot be reset. When a fuse has blown, it must be replaced. Fuses are located within the aft and forward left and right Power Distribution Panels (PDPs).

Contactors which are particularly suited for circuits with heavy electrical loads are used throughout the electrical system. Contactors function as remote switches to make or break power circuits. Most of the contactors in the electrical system automatically close and open for given conditions. Some, such as the Battery, GPU and APU, are manually selected open and closed with the respective switches on the electrical control panel, but can also open automatically if monitored faults are detected.

A circuit breaker is designed to open, and interrupt current flow in the event of a malfunction. Once opened, it may be reset by pushing it back in. An open circuit breaker may be identified by a white base which can only be seen when it is in the open or tripped position.

Most of the airplane's circuit breakers are located on two circuit breaker panels in the cockpit, one on the pilot's left side panel and one on the copilot's right side panel.

The circuit breakers are thermal type mechanisms and the amperage ratings are stamped on the top of each circuit breaker.

The circuit breakers are grouped by systems rather than by buses.

Emergency bus circuit breakers have red rings around them to easily distinguish them from the other circuit breakers.

The individual circuit breaker labels, grouping labels and dividing lines are illuminated with electroluminescent lighting. There are no bulbs in the panels, but the panels glow when current is flowing through wires imbedded in them. The silk-screened panels allow light to shine through the lettering on the panels. The intensity of the lighting is controlled with the CB PANEL rheostat located on the pilot's and copilot's CREW LIGHTS panels.

SPLIT BUS SYSTEM

The split bus electrical system has a left and right generator bus (GEN BUS) located in a left and right Power Distribution Panel (PDP) in the tailcone. The generator buses supply power to the respective left and right essential, left and right main and left and right non-essential buses located on the left and right circuit breaker panels in the cockpit. Under normal flight conditions, the generator buses are split (bus-tie open), increasing safety in that any major electrical system fault will only affect one side of the system.

GENERATOR BUSES

The generator buses are the central distribution point for the split bus system. The left generator bus powers the left side buses and the right generator bus powers the right side buses. Some services including landing lights, taxi lights, navigation lights, recognition lights and baggage heat are connected through fuses and circuit breakers directly to the generator buses. Each generator bus is connected to a starter/

generator and a main battery. The GPU connects to the left generator bus and the APU (if installed) connects to the right generator bus. Normally, the two buses operate independently; however, they are automatically "tied" through a bus-tie contactor when a GPU or APU is connected to the electrical system, during engine starting and in flight following a single generator failure. The generator buses can be tied or split manually using the BUS-TIE switch on the electrical control panel, except the bus-tie cannot be manually opened when a GPU is being used.

The CAS presents a BUS TIE CLSD message when the bus-tie is closed and a BUS TIE MANUAL message when closed manually. Also, the bar on the BUS-TIE switch illuminates any time the BUS-TIE is closed and it extinguishes when the bus-tie is open.

MAIN BUSES

The left and right main buses are fed by the respective left and right generator buses through fuses and contactors. The main buses, in turn, supply power to the left and right main avionics buses through circuit breakers and contactors. Both of the main buses are automatically disconnected in the unlikely event of a dual generator failure and the OFF caption will illuminate on the MAIN bus switches. The main avionics buses will also be depowered in this case, but the OFF caption does not illuminate on the AV MSTR switches since the essential avionics buses will still be powered. The main and main avionics buses may be reconnected by manual selection after reducing the bus load.

MAIN AVIONICS BUSES

The left and right main avionics buses are supplied by the respective main buses through contactors and circuit breakers. The essential and main avionics bus contactors are closed and opened by manual selection of the left and right AV MSTR switches. If the AV MSTR switches are on, the main avionics buses are automatically depowered during engine starting to prevent possible equipment damage from voltage spikes.

The essential avionics buses remain powered during engine start since they power flight critical display units. The AV MSTR switches need not be on during ground starts since the primary flight displays are not needed and DU2 (EICAS) is still powered with the AV MSTR switches OFF.

ESSENTIAL BUSES

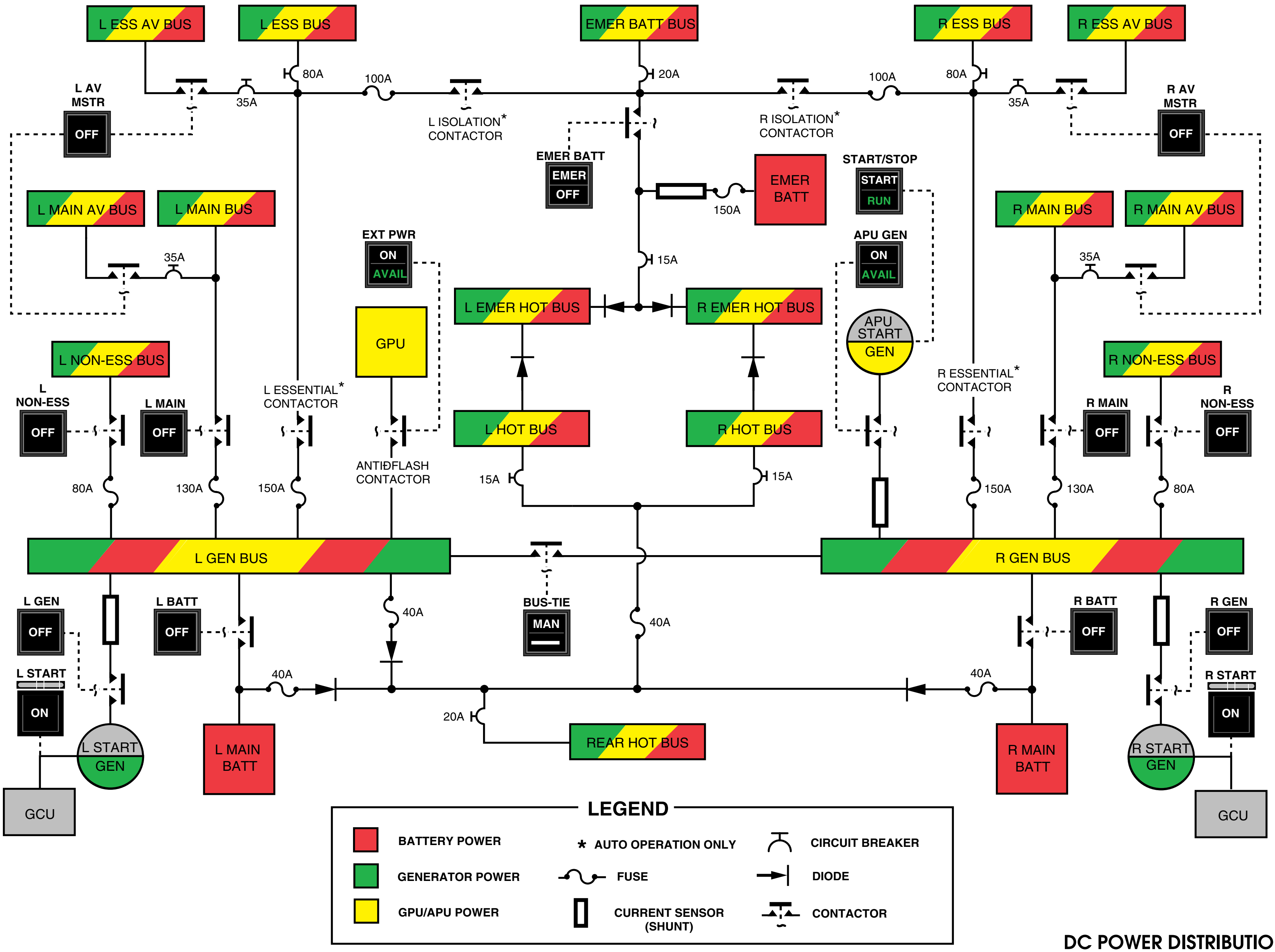
All essential power loads are connected to the left and right essential buses, including cockpit warning systems and the engine, flap, hydraulic, pressurization, and spoiler controls. Normally, the essential buses are fed by the left and right generator buses respectively through 150-amp fuses, essential bus contactors and 80-amp circuit breakers. The left and right essential bus contactors automatically close when the respective left and right BATT switches are turned on and they automatically open during starter operation. The essential buses are tied together by a left and right isolation contactor so that they are both powered by the emergency battery during engine start and they will be powered by either generator bus if an essential bus contactor should fail in flight.

ISOLATION CONTACTORS

There are two isolation contactors located within the electrical system. The right isolation contactor is located between the right essential contactor and the emergency battery bus, and the left isolation contactor is located between the left essential contactor and the emergency battery bus. The isolation contactors are automatically controlled and there are no provisions for the crew to manually override their operation.

Except during starter-assisted engine start, the left isolation contactor is normally open and the right isolation contactor is normally closed. With the right isolation contactor closed, the right generator bus powers the emergency battery bus and charges the emergency battery.

During ground engine starting and for starter-assisted airstarts, the isolation contactors close and the left and right essential contactors automatically open. This allows the emergency battery to power the emergency battery bus, essential buses, and essential avionics buses and isolates these buses from voltage fluctuations caused by starter operation. After starter drop-out, the left isolation contactor opens and the essential contactors close.



DC POWER DISTRIBUTION
Figure 4-1

ISOLATION CONTACTORS (CONT)

There are two abnormal conditions that will cause the left isolation contactor to automatically close. If either essential contactor fails (opens), the left isolation contactor will close. Since the right isolation contactor is normally closed, either generator bus can then provide generator power through the essential contactor that is closed to the left and right essential buses and to essential avionics buses, the emergency battery bus and to charge the emergency battery. This failure will be displayed as a white L/R ESS BUS FAULT message on the CAS.

The left isolation contactor will also close in the event that the right isolation contactor fails (open). This will allow the emergency battery bus and emergency battery to receive power from the left generator bus. There is no apparent indication of this condition to alert the crew.

ESSENTIAL AVIONICS BUSES

The left and right essential avionics buses are powered from the left and right generator buses respectively through the left and right essential contactors and left and right essential avionics contactors. In addition to the 150-amp fuses protecting the essential bus feeders, the essential avionics buses are also protected with 35-amp circuit breakers. Under normal conditions, the essential contactors will automatically be closed, providing power to the essential avionics contactors. The essential and main avionics contactors are closed and opened by manual selection of the left and right AV MSTR switches. These essential avionics buses, like the essential buses, are powered by the emergency battery during starter-assisted airstarts while the main avionics buses are depowered.

EMERGENCY BATTERY BUS

The emergency battery bus is normally powered from the right generator bus through the right essential contactor and right isolation contactor, but for engine starting and in the event of dual generator failure, it is powered directly from the emergency battery. Emergency battery bus services include landing gear control and indication, inboard brakes/anti-skid, standby instruments, and the #1 RMU for a backup EICAS display.

In the event of a dual generator failure, the right isolation contactor opens (left one already open), leaving the main aircraft batteries to power the respective essential buses and the emergency battery to power the emergency battery bus. Hence, three independent battery channels are operating following a dual generator failure. The standard 10-ampere-hour emergency battery will power the emergency battery bus for at least one hour after being isolated from the rest of the electrical system. The optional 18 ampere hour emergency battery will last for approximately two (2) hours.

NON-ESSENTIAL BUSES

The left and right non-essential buses, normally connected to the respective generator buses, are used to supply noncritical loads, including certain cabin lighting and domestic loads. When the airplane electrical system is powered with airplane batteries only, the non-essential buses are not powered and the OFF captions will be illuminated on both NON-ESS switches. If a GPU or APU is selected ON, but the main batteries are OFF, only the non-essential buses are powered. When a GPU, APU, or airplane generator is powering the electrical system, and the main batteries are On, the non-essential bus contactors will automatically close and the OFF captions will extinguish if the airplane is on the ground. However, if either generator fails in flight, the non-essential buses are both automatically disconnected to reduce the electrical load. One or both non-essential buses may be subsequently reconnected by depressing the NON-ESS switches on the electrical control panel.

DISTRIBUTION SUMMARY

When only main and emergency battery power is On (and the AV MSTR switches are On), the non-essential buses are not powered and cannot be selected On.

When external power (GPU) is connected and the emergency battery is selected On, the bus-tie connecting the two generator buses is automatically closed. When the AV MSTR switches are selected to On the contactors to the left and right essential avionics buses and the left and right main avionics buses will close. Note that the EMER BATT switch caption EMER will no longer illuminate as the emergency battery will no longer be discharging. The same conditions would exist with a APU powering the electrical system except the contactor between the GPU and the left generator bus would be open and the APU contactor would be closed.

During an engine start (using airplane batteries) the essential buses and emergency battery bus are isolated and are powered from the emergency battery. The non-essential buses and main avionics buses are also automatically depowered for engine start.

When one engine-driven generator comes on line, the essential bus contactors will close and the left isolation contactor will open. Also, the contactors to the non-essential buses will close. The bus-tie contactor remains closed at this point so that both generator buses are powered by the single generator.

During normal flight conditions (two engine-driven generators on line), the bus-tie opens and will remain open as long as both generators remain on line and the bus-tie is not manually selected closed.

ABNORMAL MODES OF OPERATION

SINGLE GENERATOR FAILURE

In the event of a single generator failure in flight, the operating generator must supply the load for both sides of the dc electrical power system. To prevent shock loading of the remaining generator, load shedding of the non-essential buses automatically occurs. After a 5 second voltage check delay, to see that there is no fault on the generator bus associated with the failed generator, the bus-tie automatically closes. The CAS will display an amber L or R GEN FAIL message and a white BUS TIE CLSD message after the bus-tie automatically closes. Indications on the electrical control panel would be illuminated OFF captions on the left and right NON-ESS bus switches, an illuminated OFF caption on the GEN switch of the failed generator and an illuminated bar on the BUS-TIE switch. All other systems will continue to operate normally. If necessary, the crew should reduce the load further and if conditions warrant, attempt to reset the failed generator. Non-essential buses may be regained by selecting the appropriate NON-ESS switch. No aircraft electrical system power is required to reset a generator, however, the corresponding L GEN or R GEN circuit breaker must be in to sustain generator operation.

DUAL GENERATOR FAILURE

Dual generator failure would become most apparent with illumination of the red GEN FAIL annunciator on the CWP and the accompanying flashing Master Warning lights. Also the CAS would display a red L R GEN FAIL message. Generator failure can be verified by noting zero left and right amps on the EICAS/MFD SUMRY or ELEC system schematic display and OFF illuminated in each GEN switch.

With a dual generator failure, main airplane batteries and the emergency battery powers the dc electrical systems. Both main buses, both main avionics buses and both non-essential buses will be automatically depowered to immediately shed the electrical load. Also, the right isolation contactor automatically opens leaving the emergency battery to power the emergency battery bus. The bus-tie remains open, so the left battery will power the left essential bus and left essential avionics bus, and the right battery will power the right essential bus and the right essential avionics bus. The AFM procedure for L and R GEN FAIL is to turn off the AV MSTR switches which will also cause the loss of the left and right essential avionics buses.

The duration of the standard main batteries (27-amp-hour) is a minimum of 30 minutes and the optional main batteries (38-amp-hour) is a minimum of 60 minutes. The duration of the standard emergency battery (10-amp-hour) is approximately 1 hour and the optional emergency battery (18-amp-hour) is approximately 2 hours. Expected duration assumes the electrical load is reduced in accordance with the L R GEN FAIL procedure in the Emergency Section of the AFM.

Indications of a dual generator failure would be OFF captions on the left and right MAIN bus switches, NON-ESS bus switches and GEN switches. Also, the EMER captions on the EMER BATT switch would be illuminated indicating the emergency battery is powering the emergency battery bus. The OFF captions in the L and R AV MSTR will also be illuminated when the AV MSTR switches are selected OFF per the AFM procedure.

During a dual generator failure, both essential avionics buses, both main buses and both main avionics buses are available by manual selection if desired; however, this will significantly reduce the main battery duration.

BATTERY OVERHEAT

If either nickel-cadmium main battery exceeds the established temperature values, the crew is alerted in several different ways. First, the Master Caution or Master Warning annunciators, depending on battery temperature, is activated. A corresponding CAS message is generated for a battery overheat. An amber L or R BATT OVHT message is displayed for battery temperature exceeding 60° C and a red message is displayed if the battery temperature exceeds 70° C. Also, if battery temperature exceeds 70° C, a red L or R BATT OVHT annunciator on the CWP will illuminate and the corresponding battery is automatically switched OFF if not already switched OFF by the crew. The battery temperature must be less than 60° C before it can again be turned on.

If the SUMRY or ELEC system schematic is being displayed on the EICAS or MFD displays, the digital readout of the battery temperature for the affected battery will change color and flash. If the battery temperature exceeds 60° C (140° F) the digital battery temperature display will change from white to a boxed amber and if the temperature exceeds 70° C (160° F) it will change to boxed red.

AC POWER

As part of the anti-ice protection system, left and right windshield heaters are powered by two, left and right engine-driven alternators. The alternators are mounted to the front of the engine accessory section, next to the starter/generator, and operate from 6,000 to 12,000 rpm.

These alternators will supply 200-vac, 200-400 Hz at a maximum of 5kva single phase output. The alternator output is controlled by a separate control unit that contains the monitor circuitry for the windshield. There are no provisions for directly monitoring alternator output on the EICAS displays, but loss of ac power from an alternator would be detected by failure of windshield anti-ice.

The output of the alternators is only used by the windshield anti-ice. See Section VI, ANTI-ICE & ENVIRONMENTAL for additional information.

110-VAC GROUND POWER SYSTEM (OPTIONAL)

The optional 110-vac/60-Hz ground power inlet is located in the right hand side of the nose wheel well. When an extension cord is connected from an existing 110-vac/60-Hz source to the ground power inlet, power is available to an outlet located on the side wall just aft of the cabin entry door and two outlets in the tail, just aft of the lower main battery.

Power distribution is through two 15-amp circuit breakers located in the right nose bay.

LIGHTING

INTRODUCTION

Lighting is used to illuminate the cockpit area and all flight instruments. The majority of the instruments are internally lighted. For general illumination, floodlights, of the fluorescent, incandescent or Light Emitting Diodes (LEDs) type, are used. Rheostatic controlled goose-neck map lights are installed on both the left and right side panels. The standard warning lights are available for the cabin area, and emergency lights are provided to illuminate the exits in the event of an emergency. Exterior lighting consists of landing, taxi, recognition, strobe, navigation, beacon, and a wing inspection light. Optional exterior lighting consists of tail logo lights and exterior convenience lights that illuminate the single-point pressure refueling and baggage door areas.

GENERAL

Cockpit lighting consists of map lights, glareshield floodlights, instrument/indicator lights, panel lights, dome lights and two cockpit switch panels to control the lights.

Cabin lighting consists of entry, overhead, passenger table and reading lights, galley, and lavatory lights.

Tailcone baggage lighting is provided within the baggage compartment.

Tailcone maintenance lighting consists of lighting within the tailcone equipment compartment.

Additional interior lighting consists of an emergency cabin lighting package and optional illuminated lavatory mirror. The emergency cabin lighting package utilizes existing overhead lights, additional exit lights and seat base mounted floor proximity lights. The optional illuminated lavatory mirror utilizes additional lights installed behind the mirror.

Optional exterior lighting is available to illuminate the general areas around the baggage compartment and the Single-point Pressure Refueling (SPPR) area.

COCKPIT LIGHTING

Cockpit lighting is controlled through two cockpit control panels and two Light Control Units (LCUs) that are located within the forward avionics bay. Each LCU (pilot LCU and copilot LCU) has four separate channels that distribute power resources to lighting groups.

LEFT CREW LIGHTS PANEL

The L CREW LIGHTS panel is 28-vdc powered from the left essential bus and protected by a circuit breaker labeled CKPT INSTRS L ESS PWR, located within the LIGHTS group of circuit breakers on the pilot's circuit breaker panel. The four pilot LCU channels control:

- Channels 1 and 2 — Pilot's instrument panel, overlays, and instruments.

- Channel 3 — Pilot's circuit breaker panel.

- Channel 4 — Left side bulbs for switch lighting.

Following is a description of each of the potentiometer controls located on the L CREW LIGHTS panel.

OVRHD — The pilot's overhead swivel light is controlled by the OVRHD potentiometer. The pilot overhead light can also be turned on with the COCKPIT switch on the entryway switch panel assembly when the cabin door is open and the OVRHD control is off. When the upper cabin door is closed, cockpit overhead light control from the entryway switch panel assembly is disabled. The overhead light is powered by the right main bus and is protected by the OVRHD circuit breaker within the CABIN group on the copilot's circuit breaker panel. When the pilot's overhead light is controlled via the entryway switch panel assembly, it receives power from the airplane hot bus system.

INSTR — The pilot's instrument panel lighting is controlled via the INSTR potentiometer. Display units and the radio management units have internal lighting, and the intensity is controlled through sensors and controls. The bezel controller backlighting for these units are controlled by the INSTR control, however. The pilot's instrument panel lights receive 28-vdc power from the left main bus and are protected by a circuit breaker labeled L INSTR located within the LIGHTS group on the pilot's circuit breaker panel.

FLOOD — The entire instrument panel can be illuminated by a floodlight located beneath the glareshield. Dimming is controlled via this potentiometer. Power to the floodlight is from the left essential bus and is protected by the FLOOD circuit breaker within the LIGHTS group on the pilot's circuit breaker panel.

CB PANEL — This potentiometer controls the intensity of overlay lighting on the pilot's circuit breaker panel. The panel receives 28-vdc power from the left main bus and is protected by a circuit breaker labeled L CB located within the LIGHTS group on the pilot's circuit breaker panel.

RIGHT CREW LIGHTS PANEL

The R CREW LIGHTS panel is 28-vdc powered from the right main bus and protected by a circuit breaker labeled CKPT INSTRS R ESS PWR, located within the LIGHTS group of circuit breakers on the copilot's circuit breaker panel. The four copilot LCU channels control:

- Channels 1 and 2 — Copilot's instrument panel and glareshield overlays, instruments, and pedestal overlays.

- Channel 3 — Copilot's circuit breaker panel.

- Channel 4 — Right side bulbs for switch lighting.

Following is a description of each of the potentiometer controls located on the R CREW LIGHTS panel.

INSTR — The copilot's instrument panel lighting is controlled via the INSTR potentiometer. Display units and the radio management units have internal lighting, and the intensity is controlled through sensors and controls. The bezel controller backlighting for these units is controlled by the INSTR control, however. The copilot's instrument panel lights receive 28-vdc power from the right main bus and is protected by a circuit breaker labeled R INSTR located within the LIGHTS group on the copilot's circuit breaker panel.

OVRHD — The copilot's overhead swivel light is controlled by the OVRHD potentiometer. When the upper cabin door is closed, cockpit overhead light control from the entryway switch panel assembly is disabled. The overhead light is powered by the right main bus and is protected by the OVRHD circuit breaker within the CABIN group on the copilot's circuit breaker panel. When the copilot's overhead light is controlled via the entryway switch panel assembly, it receives power from the airplane hot bus system.

PEDESTAL — This potentiometer controls the lighting intensity of equipment installed in the pedestal. The FMS display intensity is regulated by the dim button on FMS control panel. Pedestal lighting receives power from the right main bus and is protected by a circuit breaker labeled PEDESTAL located within the LIGHTS group on the copilot's circuit breaker panel.

CB PANEL — This potentiometer controls the intensity of overlay lighting to the copilot's circuit breaker panel. The panel receives 28-vdc power from the right main bus and is protected by a circuit breaker labeled R CB located within the LIGHTS group on the copilot's circuit breaker panel.

SWITCH LIGHTING

A majority of the switches in the cockpit are push button switches with lighted indicators. They are designed so that none of the indicators are illuminated under normal conditions, which supports the "quiet or dark cockpit" concept. For example, the GEN switches are black (blank) when the generators are On and OFF illuminates when the generators are off.

For redundancy, each of the switches contain four bulbs and receive power from two different sources. The pilot's Lighting Control Unit (LCU) supplies power to the two left bulbs and the copilot's LCU supplies power to the two right bulbs in most cases. Exceptions to this are the RAD HOT BUS switch, which receives power from the hot bus, and the master WARN/CAUT and engine FIRE PUSH switches which receive power through the Crew Warning Panel (CWP).

A bulb test may be initiated by selecting LTS on the system test knob (center pedestal) and depressing the PRESS-TO-TEST button.

MAP LIGHTS

Two multi-directional, goose-neck map lights are located in the cockpit, one on each side. Power is provided to each light by the left essential bus and is protected by a circuit breaker labeled MAP located on the pilot's circuit breaker panel in the LIGHTS group. Dimming is controlled by a rheostat located at the base of each light assembly.

CABIN LIGHTING

Cabin (passenger compartment) lighting consists of entry/exit, overhead, passenger reading/table, galley cabinet, lavatory (read/vanity) and NO SMOKING/FASTEN SEAT BELT lights.

Primary cabin lighting control is through the entryway switch panel assembly which is located on the left storage cabinet just above the main cabin door entry hand rail. Additional lighting controls are located in the individual seat passenger lighting control unit (for reading and table lights), master control panel and the lavatory passenger control panel assembly.

The master control panel is located in the right mid aft seat storage box (in the standard configuration). When the menu item indicated by the Liquid Crystal Display (LCD) is cabin lights, for example, operation of the SELECT switch provides ON/VARIABLE/OFF control.

Cabin lighting (except entry/exit light and overhead lights) is powered by the LEFT and RIGHT NON-ESSENTIAL Buses. This arrangement allows cabin lighting to be used with a GPU powering the non-essential buses, but with the rest of the electrical system not powered. See GPU and the non-essential bus system in ELECTRICAL, this section for more information.

ENTRY/EXIT LIGHTS

The cabin entry/exit door light is installed in the upper door to provide illumination of the lower door steps and/or ground when both doors are open. This light is controlled by the ENTRY light switch on the entryway switch panel assembly and is powered by the hot bus regardless of the BATT switch position. The light is inoperative when the upper entry door is closed. The entry/exit light is protected by a circuit breaker labeled ENTRY, located within the CABIN light group on the copilot's circuit breaker panel.

OVERHEAD LIGHTS

The overhead lights consist of indirect downwash lighting located within the convenience panel. Covered by lenses, the overhead lights are controlled by the CABIN switch on the entryway switch panel assembly and the master control panel. The cabin overhead lights are powered by the left main bus and are protected by the CABIN circuit breaker within the CABIN group on the pilot's circuit breaker panel.

PASSENGER READING AND TABLE LIGHTS

Reading and table lighting consists of lights installed in the convenience panels above the seats on each side of the cabin. The seats have only one light, while the table lights consist of a two-light assembly, installed above each table. Control for the reading lights is by the passenger lighting control unit mounted near each passenger seat and by the SPOTLIGHT switch on the entryway switch panel assembly. Power for the reading lights is provided by the left and right non-essential bus and they are protected by the L and R SPOT circuit breakers located within the CABIN group on the pilot's and copilot's circuit breaker panels.

GALLEY LIGHTS

Lighting (LEDs) for the passenger refreshment area is powered by the right non-essential bus and protected by the GALLEY circuit breaker within the CABIN group on the copilot's circuit breaker panel.

LAVATORY LIGHTS

Lighting of the lavatory area consists of spotlights and downwash lights.

The spotlights (one located on the left side above the toilet and one located on the right side above the aft cabin stowage compartment) are controlled using the READ, BAGGAGE, MIRROR LIGHTS switch on the lavatory passenger control panel assembly.

The downwash lights run lengthwise on the left and right convenience panels and are controlled using either the LAV LIGHTS switch on the lavatory passenger control panel assembly or the LAVATORY switch on the entryway switch panel assembly located near the main cabin door.

All the lavatory lights are powered by the left and right non-essential bus and are protected by the CABIN group LAV LIGHTS and L and R SPOT LIGHT circuit breakers on the pilot's and copilot's circuit breaker panels.

If installed, the optional lavatory mirror provides additional indirect lighting of the lavatory area. The indirect lighting is controlled using the same switch as the spotlights. Depressing the READ, BAGGAGE, MIRROR LIGHTS switch on the lavatory passenger control panel assembly will either illuminate or extinguish the optional mirror indirect lighting.

Control of the NO SMOKING/FASTEN SEAT BELT signs is through a switch located on the LIGHTS control panel in the cockpit. This switch is a three-position switch labeled OFF, BELTS and NO SMOKING/BELTS.

BAGGAGE/TAILCONE LIGHTING

Lighting for the baggage compartment consists of two overhead dome lights. The lights are controlled by the LIGHTS toggle switch located on the ceiling near the baggage compartment door. The baggage compartment lights are powered by the airplane's hot bus system. If inadvertently left on, it will automatically extinguish when the access door is closed.

The tailcone equipment bay internal light is also powered by the hot bus system. The switch is located near the access door and if inadvertently left on, the light automatically extinguishes when the door is closed.

EMERGENCY LIGHTING SYSTEM

The emergency lighting system is standard and consists of cabin discrete overhead, floor proximity lights (seat-base mounted lighting units), and emergency exit area lights that illuminate in the event of a failure of the normal electrical system. Control of the emergency lighting system is through a three-position switch located on the LIGHTS control panel.

The emergency lighting group consists of:

- 5 exit signs (2 per door, 1 on forward face of lavatory partition)
- 4 PSU lights
- 8 floor proximity lights (6 white lens, 2 red lens on each side of the aft RH emergency exit)
- Main door egress light (when upper door open)
- Emergency exit egress light
- Lavatory light

The cockpit EMER LIGHTS switch is lever-locked and labeled OFF, ARM and ON. When the cockpit switch is in the OFF position, the emergency lights are inhibited. When the cockpit switch is in the ON position, the emergency lighting group illuminates.

Activation periods are limited by a timing circuit to a minimum of 10 minutes and a maximum of 12 minutes.

To function automatically, the cockpit switch must be in the ARM position. Once armed, the emergency lighting system automatically illuminates when normal electrical power is lost (dual generator failure) or when the passenger oxygen mask deployment occurs. When the emergency lights are activated automatically, they may be deactivated by placing the EMER LIGHTS switch to the OFF position. The crew is alerted when airplane power is on and the emergency lights are not armed. To indicate this condition, a white EMER LTS CAS message is illuminated.

The emergency lights receive power from the left main battery and the emergency battery. The emergency lights are divided into four lighting zones (forward, mid-forward, mid-aft, and aft), and each zone is powered in parallel from both electrical sources. The emergency battery is inhibited from supplying power to the emergency lights in the air, conserving power for ground egress illumination. If activated while on the ground, the emergency lights operate for approximately 10 minutes to adequately allow for safe egress. Circuit breaker protection for the emergency lights is located in the tailcone on the power distribution panel.

LANDING and TAXI LIGHTS

The landing lights consist of two dual bulb light assemblies mounted just forward of the wing fuselage fairing. The taxi lights consist of a single filament light mounted on each main landing gear strut.

The landing lights are controlled from two toggle switches located on the LIGHTS control panel. When these switches are positioned to the LDG (landing) position, all four bulbs (two in each light assembly) illuminate. Control of the taxi lights is via the same switch, but positioned to the TAXI position. The taxi lights also illuminate whenever the main landing gear is down and locked, the gear doors are up and locked and the landing light switches are in the LDG position. For ground operations, selecting the TAXI position illuminates only the taxi lights.

The landing and taxi lights are powered from the left and right main buses, respectively and are protected by circuit breakers labeled L and R TAXI/LDG CTRL located on the pilot's and copilot's circuit breaker panels in the LIGHTS group.

RECOGNITION LIGHTS

The standard recognition lights consist of the outboard bulbs on each of the two landing light assemblies. Moving the RECOG switch to the RECOG position illuminates both outboard landing lights (recognition lights). The recognition lights are protected by the 5-amp R and L TAXI/LDG CTRL circuit breakers located on the pilot's and copilot's circuit breaker panels.

An optional tail recognition light may be installed in the upper leading edge of the vertical stabilizer. The tail recognition light is controlled by the RECOG switch. When RECOG is selected, the standard and tail recognition lights illuminate. It is protected by the 1-amp TAIL RECOG circuit breaker, located on the pilot's circuit breaker panel.

An optional pulsating recognition light system is available which consists of a three-position recognition light switch and a pulse controller unit. The pulsating recognition light switch is labeled RECOG/PULSE/OFF. Moving the RECOG switch to the RECOG position will illuminate both wing recognition lights (outboard landing lights) and the tail recognition light, if installed. Moving the RECOG switch to the PULSE position will cause the recognition lights to pulse at a rate of approximately 45 cycles per minute.

NAVIGATION LIGHTS

The navigation lights system consists of three lights, two wing-tip (winglet) position lights that are viewable from each side and one tail mounted position light that is viewable from the rear. The left and right position lights are located on the outboard side of the left winglet (aviation red) and the outboard side of the right winglet (aviation green). The aft position light (aviation white) is located on the top trailing edge of the vertical stabilizer.

All three navigation lights are controlled by the NAV light switch. Additionally, setting the NAV light switch to NAV (or to NAV/LOGO) automatically dims all cockpit switch lights on the instrument panel and the center pedestal. The NAV switch is a two-position (OFF-NAV) switch on airplanes not equipped with the optional LOGO lights. When an airplane is equipped with the LOGO lights, a third position (NAV/LOGO) is added to the NAV light switch.

The navigation lights receive 28-vdc power from the right main bus and are protected by the NAV circuit breaker located on the copilot's circuit breaker panel within the LIGHTS group.

TAIL LOGO LIGHTS (OPTIONAL)

Optional tail logo lights consist of two lights installed on the bottom of the horizontal stabilizer, that illuminates both sides of the vertical stabilizer. Controlled by a NAV/LOGO position on the NAV light switch, they are powered by the right non-essential bus. The logo lights are protected by the LOGO circuit breaker located on the copilot's circuit breaker panel within the CABIN group.

ANTI-COLLISION LIGHTS (BEACON/STROBE)

The anti-collision light system consists of two beacon/strobe light units. The upper anti-collision light is located on the top of the vertical stabilizer, and the lower light is mounted on the bottom of the wing/ fuselage fairing.

Each light unit incorporates two flash tubes, one with an aviation red filter and one with a clear filter. Control over both anti-collision lights is via the three-position BCN/STROBE-BCN/OFF light switch on the LIGHTS control panel. When the switch is placed in the BCN/STROBE position, the red light in each unit flashes if the airplane is on the ground, or if airborne the clear flashtube flashes. When the switch is placed in the BCN position, the red flashtube in each light unit flashes whether the airplane is on the ground or airborne.

The combined anti-collision light system, with each light unit pulsed independently, has a flash rate of approximately 100 pulses per minute. The system receives power from the left main bus and is protected by the BCN/STROBE circuit breaker located within the LIGHTS group on the pilot's circuit breaker panel.

WING INSPECTION LIGHT

The wing inspection light system provides the copilot with a means to visually detect ice buildup on the airplane wings during night operations. The system consists of a WING INSP light pushbutton, located on the LIGHTS control panel; a halogen spotlight assembly, flush-mounted in the right side of the fuselage aft of the cockpit; and a black spot located on the right wing leading edge. The black spot enhances visual detection of ice accumulation; however, clear ice may not be detectable by visual inspection alone.

The WING INSP pushbutton is a momentary action switch, meaning that the inspection spotlight illuminates the wing area only when the switch is held depressed. The system is powered by the right main bus and is protected by the WING INSP circuit breaker located within the LIGHTS group on the copilot's circuit breaker panel.

EXTERIOR CONVENIENCE LIGHTS (OPTIONAL)

When installed, the optional convenience lighting group consists of an area light mounted beneath each engine pylon to illuminate the baggage compartment area on the left side of the airplane, and the single-point pressure refueling (SPPR) access door area on the right side of the airplane.

Selection of the baggage area light is by an additional switch mounted inside the baggage compartment. The switch is automatically switched OFF whenever the baggage compartment door is closed. The SPPR area light is controlled via the SPPR panel power switch. This means that the light will illuminate whenever power has been applied to the refueling panel. Both area lights are powered from the hot bus system.

SECTION V
FLIGHT CONTROL SYSTEMS & AVIONICS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

SECTION V
FLIGHT CONTROL SYSTEMS & AVIONICS

FLIGHT CONTROL SYSTEMS

The primary flight controls (ailerons, elevator, and rudder) are mechanically operated through the control columns, control wheels, and rudder pedals. The flaps and spoilers are hydraulically actuated and electronically controlled. Airplane trim systems (pitch, roll, and yaw) are electronically controlled.

AILERON

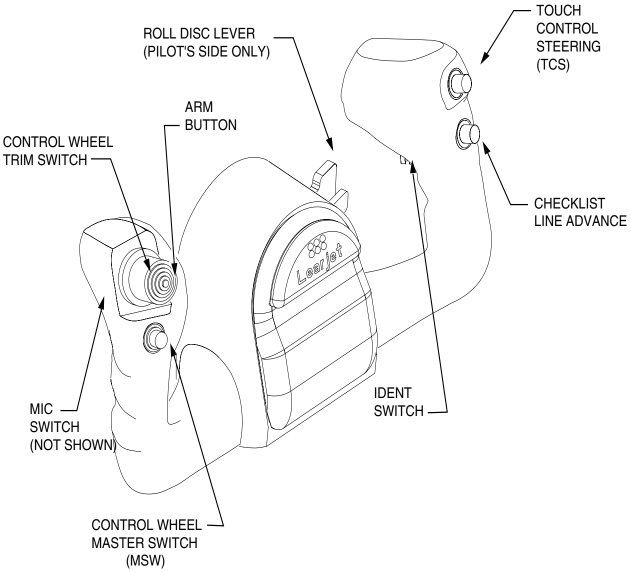
The aileron control system consists mainly of three control circuits, one in the fuselage area and one in each of the left and right wing area. In addition, a disconnect mechanism is incorporated into the pilot's control wheel which allows the disconnection of the aileron control system (in the event of a jam) and switching to spoileron system for roll control. The fuselage control circuit connects both pilot's and copilot's control wheels together, and each wing control circuit is connected to the aileron drive mechanism. The three control circuits are connected together via a common sector assembly. In normal operation, whether by an input from the autopilot or by manual input to one of the two control wheels, the two control circuits will move in unison to drive the two aileron panels. The aileron control system is considered the primary system for roll control and is interfaced with the spoileron system for roll augmentation.

ROLL DISCONNECT

If ailerons become jammed, the aileron control system can be disconnected and the spoileron system can be used for roll control. The pilot's control wheel is disconnected from the aileron cables and copilot's control wheel by the red lever labeled ROLL DISC located on the hub of the pilot's control wheel. This will also disconnect and prevent engagement of the autopilot. Safe flight can continue on spoilerons alone. For more information on roll disconnect, see Spoileron (ROLL DISCONNECT) system.

CONTROL WHEEL

Each flight station is equipped with a U-shaped control wheel. The pilot's control wheel is equipped with a disconnect assembly which employs a red lever labeled ROLL DISC located on the inboard side of the control wheel hub (Figure 5-1). Each control wheel contains the following switches: Control Wheel Trim, Control Wheel Master (MSW), MIC, IDENT, Touch Control Steering (TCS), and Checklist Line Advance.



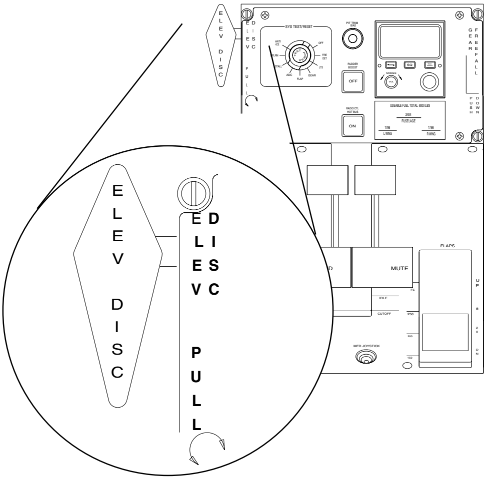
CONTROL WHEEL
Figure 5-1

ELEVATOR

Movement of the control columns is mechanically translated into elevator surface movement through levers, bellcranks, sectors, cables, and pushrods. The elevator control system consists of two parallel control circuits. The two control circuits are normally connected together via forward and aft disconnect assemblies in which either control column moves both the left and right elevator surfaces in union. A mechanical up/down spring is also used in the system to augment high and low speed trim ability of the airplane. If a jam occurs in either mechanical control circuit, an elevator disconnect feature is incorporated into the system.

ELEVATOR DISCONNECT

In the event of an elevator jam, the two cable circuits can be disconnected by pulling the red ELEV DISC T-handle (Figure 5-2) located at the left-forward edge of the pedestal. The airplane will then be controlled with the unjammed elevator. The forward and aft disconnect assemblies are dog clutch devices that are operated simultaneous by the handle being pulled. When the ELEV DISC T-handle is pulled, a cable connected to the handle shaft is pulled which disengages the forward clutch thereby disengaging the two control columns. Electrical switches sense the movement of the shaft and signal the aft disconnect to disengage.



ELEVATOR DISCONNECT
Figure 5-2

When the handle is pulled to full extension, it must be rotated 90°, either clockwise or counterclockwise, to lock it in the disconnect position. The elevator forward disconnect is a mechanical clutch mechanism located on the torque tube between the control columns. The clutch is held open when the ELEV DISC T-handle is pulled and locked in the extended position. This will disconnect and prevent engagement of the autopilot.

The elevator aft disconnect is an electro-mechanical device located in the top of the vertical stabilizer. When the ELEV DISC T-handle is pulled, a two-position linear actuator on the elevator aft disconnect assembly is energized to the extended position (disconnected position), separating operation of the two elevators. The linear actuator will remain in the extended position. When the elevator aft disconnect is actuated, the elevator disconnect sensor will send a signal to display a message on the Crew Alerting System (CAS). **Do not** reconnect. Obtain maintenance prior to next flight. Electrical power used by the elevator disconnect system is through the ELEV DISC circuit breaker located on the pilot's circuit breaker panel (FLIGHT group).

The following CAS illuminations are specific to the elevator disconnect:

CAS	Color	Description
ELEVATOR DISC	Amber	Elevator disconnect has split the elevator controls on the ground. Obtain maintenance prior to flight.
ELEVATOR DISC	White	Elevator disconnect has split the elevator controls during flight. **Do not** reconnect.

RUDDER

Directional control is provided by a dual closed-loop cable system with separate parallel paths in the engine area for rotor burst considerations. Rudder pedal movement is mechanically translated into rudder control surface movement through cables, pulleys, and bellcranks. There is an electrically driven rudder boost system to provide additional rudder control power in the event of an engine-out on takeoff.

RUDDER PEDAL ADJUSTMENT SWITCHES

The pilot's and copilot's rudder pedals are individually adjustable with a spring-loaded toggle switch to accommodate differences in crew size. The pilot operated toggle switch controls a linear actuator which provides forward and aft pedal adjustment. This toggle switch is labeled RUDDER PEDAL, and located on the lower outboard corner of the pilot's and copilot's switch panel. Each switch has three positions: FWD, Off, and AFT. Only the FWD and AFT positions are labeled. The rudder pedal adjustment is powered by 28-vdc supplied through two 3-amp circuit breakers, L RUD ADJUST and R RUD ADJUST, on the pilot's and copilot's circuit breaker panels (FLIGHTgroup).

RUDDER BOOST

The rudder boost system is provided to reduce rudder forces. Signals from force sensors in both sets of rudder pedal mechanisms are read by the ICs. The ICs then send rudder boost signals to the yaw damper servo. Rudder boost provides yaw servo torque proportional to rudder pedal force, when either the pilot's or copilot's rudder pedal force or the sum of their forces reaches 50 pounds. The rudder boost will override the yaw damper (if engaged) when this threshold is reached. When the force on the rudder pedals is released, the yaw damper will resume operation. The rudder boost system is armed when flap extension is greater than 3° and the RUD BOOST switch is selected to On. The RUD BOOST switch is located on the forward pedestal. When selected On, the switch is dark and when selected OFF, OFF will be displayed in the center of the switch. A white CAS illuminates when the switch is OFF or the system is disabled by the IC or the yaw force interface box. An amber CAS illuminates when the system is inoperative and not selected OFF.

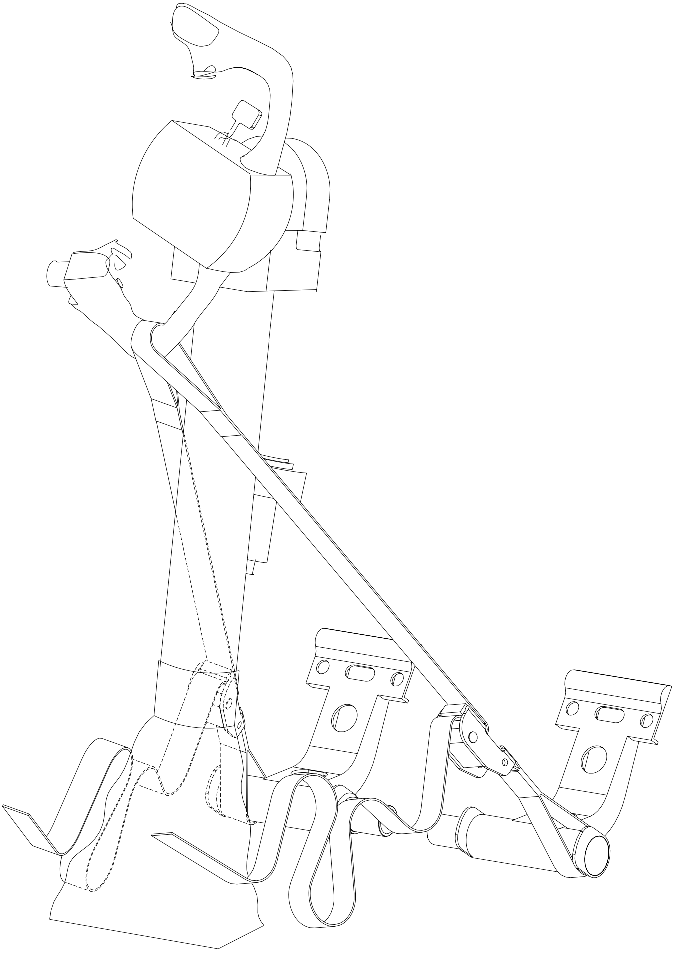
Dual, redundant power inputs are provided via the RUD FORCE circuit breaker on the right essential bus and the NOSE STEER COMPUTER circuit breaker on the left essential bus. If both these power sources should fail, the #2 IC-600 will disable rudder boost and provide appropriate annunciation.

The following CAS illuminations are specific to the rudder boost system:

CAS	Color	Description
RUD BOOST INOP	Amber	Rudder boost is inoperative and not selected OFF. Do not takeoff.
RUD BOOST INOP	White	Rudder boost is selected OFF. Do not takeoff.

CONTROLS GUST LOCK

A gust lock is provided to help prevent wind gust damage to moveable control surfaces. The gust lock is installed on the pilot's side only, with control wheel rotated counterclockwise until the bend in the handle aligns with the column, and the rudder pedals are centered. Loop straps around bottom heel, and draw both left and right pedal straps taut to seat control column against the primary stop. When installed, the gust lock secures the flight controls in the rudder centered, full aileron, and full down elevator position.



CONTROLS GUST LOCK
Figure 5-3

FLAPS

The airplane's single-slotted Fowler flaps are electronically controlled and operated by a hydraulic motor (flap power unit). Each flap panel, one on each wing, has three safe-life flap tracks and is driven by two screw jack actuators. A flexible drive shaft transfers power from the hydraulic motor to each flap actuator. The flap control lever is located on the center pedestal and is recessed to prevent inadvertent operation. The flap control lever has settings at 0° (up), 8°, 20° and 40° (down). To select a new flap position, the flap control lever is moved directly to the desired setting. Flap position is controlled by a microprocessor based controller (Flap Control Unit). The Flap Control Unit receives position command information and an arming signal from the flap control lever in the cockpit. It then provides the electrical arming and control signal to the arming solenoid valve located in the flap power unit and receives a feed-back signal from sensors mounted on the outboard actuator of each flap panel. When flaps are extended or retracted in flight, the configuration trim system automatically applies the appropriate amount of pitch trim to compensate for the pitching moment caused by flap repositioning.

The Flap Power Unit (FPU) is located under the center wing and contains the hydraulic motor, a servo control valve, an arming solenoid valve and a pressure switch. The servo valve responds to electrical signals from the flap control unit and meters hydraulic pressure to the extend or retract side of the bidirectional hydraulic motor. The arming solenoid valve must be energized open by the flap control unit before hydraulic pressure is available to the servo valve. The pressure switch, located upstream of the servo valve, monitors system pressure between the arming solenoid valve and the servo valve. If pressure is not available on flap selection, flaps will be inoperative, but if pressure is available without a selection command, the FPU will show a fault and the flaps will operate in a degraded mode, i. e. the flaps may deploy at a reduced speed when selected. These will cause the following CAS illuminations in order described above.

The following CAS illuminations are specific to the Flap System:

CAS	Color	Description
FLAPS FAIL	Amber	The flap system has failed and the flaps are inoperative.
FLAPS FAULT	Amber	The flap system is operating in a degraded mode.

Flexible drive shafts routed along the rear wing spar transmit the rotary motion of the flap power unit to the input shaft of each of the flap actuators. Two Rotary Variable Differential Transformers (RVDTs) mounted on the outboard side of each outboard flap actuator provide position information to the flap control unit and the flap position indicating unit. The flap actuators incorporate a screw jack and are attached to the rear spar. These actuators convert the rotary input motion into linear output motion through these screw jacks thus driving the flaps. Each actuator has overtravel end stops. Uncommanded retraction due to airloads, vibration, etc., is prevented by the screw jack design of the flap actuators. The flap control system operates on 28-vdc supplied through a 3- amp FLAP CTRL breaker located on the copilot's circuit breaker panel (FLIGHT group).

FLAP CONTROL LEVER

The FLAP control lever will operate in one of four positions (UP, 8°, 20°, and DN) with detents at the 8° and 20° positions. When retracting flaps, there is a gate at the 8° position; therefore, the lever must be pulled out slightly when raising the flaps above 8°. The lever is attached to dual RVDTs co-located with a flap lever detent switch within the throttle quadrant. These dual RVDTs transmit the selected position to a flap control unit. Moving the lever between positions actuates the flap lever detent switch and energizes a 75-second timing circuit within the flap control unit. This circuit allows the arming solenoid valve within the flap power unit to energize open for 75 seconds and then de-energizes. Normal flap extension from 0° to 40° will not exceed 10 seconds with engine-driven hydraulic pumps operating. However, this time will extend up to 60 seconds when using HYD XFLOW while lowering flaps from 0° to 20° in flight.

FLAP POSITION INDICATION

The flap position indicating unit has two separate and independent channels. Channel 1 provides left side equipment and Channel 2 provides right side equipment. Both channels are housed in a common chassis. Flap position is shown full time in a digital display on the Engine Indicating and Crew Alerting System (EICAS). The EICAS display is framed with a white box when the flaps are not in the selected position in flight, or on the ground with flaps not set for takeoff. The EICAS display turns red if power is advanced for takeoff and flaps are not properly set. The display turns amber if there is a fault or failure in the flap system. Flap selection and position are also displayed on the right side of the FLT (flight) system schematic page. The FLT system schematic display can be displayed on the EICAS or Multi-Function Display (MFD).

Selected flap position is indicated by a horizontal magenta line across the vertical scale. Actual left and right flap position is indicated by flap position pointers on each side of the vertical scale. When flaps have moved to their selected position, the pointers will overlay the magenta line. Flap position pointers turn red on the ground when power is advanced for takeoff and flaps are not properly set. Pointers turn amber when there is a fault or failure in the flap system. A digital indication of flap position is provided on the backup engine/systems page of the Radio Management Unit (RMU).

SPOILER SYSTEMS

Spoilers, one on the upper surface of each wing forward of the flaps, are provided for deceleration. The spoilers are electrically controlled and hydraulically operated. The spoilers are extended symmetrically for use as spoilers/speed brakes or asymmetrically for aileron augmentation. Each spoiler is hinged at four points and is extended or retracted with a single hydraulic actuator. The spoiler control lever, located on the left side of the throttle quadrant, is linked to two RVDTs. There are three labeled settings for the spoiler lever that correspond to detent positions: RET (retract), ARM (autospoilers), and EXT (full extension) - approximately 60° at slower airspeeds. The range between the ARM and EXT detents allow for variable spoiler positions in flight. There are also two unmarked detent positions between ARM and EXT which correspond to intermediate spoiler extension positions of approximately 15° and 30°. At high airspeeds the actuators cannot extend the spoilers fully; therefore, spoileron computer commands to the actuator servos are limited by airspeed inputs from the Air Data Computers (ADCs). At speeds below 175 knots, spoilers will extend to 60° when the spoiler control lever is placed to EXT; however, at higher speeds full extension is not possible.

NORMAL SPOILER MODE

The spoilers can be extended symmetrically on the ground or in flight by moving the spoiler lever aft of the ARM position. Placing the lever to any position aft of ARM while on the ground will cause full extension (60°) of the spoilers. Spoiler extension on the ground requires approximately 1 second and in flight, approximately 5 to 7 seconds. When the spoiler control lever is placed aft of the ARM position, the RVDTs will signal the spoileron computer. The computer, in turn, energizes torque motors on the servo valves to meter hydraulic pressure to the extend side of the actuators. The computer receives spoiler extension feedback from the RVDTs attached to the spoiler surfaces, and neutralizes the servo valves when the spoilers reach their selected position. In flight, the amount of spoiler extension will depend on spoiler control lever position and airspeed.

AUTOSPOILERS

Autospoiler mode is used to automatically extend spoilers on landing or in an aborted takeoff. When the SPOILER lever is set to ARM, the system will arm and CAS will illuminate. This will automatically extend spoilers when the main gear weight-on-wheels switch circuits indicate an "on ground" condition, thrust levers are in the IDLE position and the airplane has attained 60 knots ground speed. This mode fully extends spoilers at maximum rate (one second or less) when spoiler control lever is in the ARM position and autospoiler deploy logic is met. An autospoiler system is installed to automatically extend both spoilers in order to spoil lift after landing or during an aborted takeoff.

The following CAS illumination is specific to the autospoiler system:

CAS	Color	Description
AUTOSPLR ARMED	White	Autospoilers have been armed.

The main gear weight-on-wheels switch circuits are electronically latched in the "on ground" state once the initial weight-on-wheels signal is received. This prevents inadvertent spoiler retraction in the event the airplane should bounce during the ground roll. If either thrust lever is moved above IDLE while autospoilers are extended, the spoilers will immediately retract. Flap position has no effect on autospoiler operation and autospoilers are not operational when EXT or RET is selected.

The spoileron computer receives power from the L ESS BUS for operation and the spoiler indicating system receives power from the R ESS BUS. The circuits are protected by "SPLR CTRL" circuit breaker on the pilot's circuit breaker panel (FLIGHT group) and the "SPLR IND" circuit breaker on the copilot's circuit breaker panel (FLIGHT group).

When spoilers are extended or retracted in flight, depending on the mach number, the configuration trim system automatically applies the appropriate amount of pitch trim to compensate for the pitching moment caused by spoiler repositioning.

SPOILERON OPERATION

Spoilerons operate automatically on the ground and in flight to augment the ailerons whenever either control wheel is turned more than 5°. Rotation of either control wheel provides a roll input to the spoileron computer via dual RVDTs inside of the pilot's control wheel. The appropriate spoiler, left or right, extends to the commanded angle for the current conditions (Mach number, airspeed, AP engage and flap setting) while the other spoiler is commanded stowed. When in the mixed spoiler and spoileron mode, the spoiler command derived from the spoiler lever and spoileron command derived from the control wheel are added to form a composite position command for each spoiler panel. The spoiler command provides a bias position command common to both panels while the control wheel RVDTs generate a differential command. The control wheel inputs command the angular displacement that exists between the two spoilers regardless of the amount of spoilers command. Spoileron commands have priority over spoiler commands.

If the spoilers are extended, and the control wheel is turned right, the computer mix logic retracts the left spoiler first to give differential necessary for the roll commanded. If that is not enough differential for the roll commanded, the computer then extends the right spoiler as required.

SPOILERON (ROLL DISCONNECT MODE OF OPERATION)

Spoilerons provide automatic roll augmentation and backup roll control. The spoilerons are electrically controlled and hydraulically actuated. Artificial friction is introduced into the pilot control wheel upon disconnection from the mechanical aileron system to provide pilot feel and to preclude the control wheel from free-wheeling. If ailerons become jammed, the pilot's control wheel can be disconnected from the aileron control cables and the copilot's control wheel. Roll disconnect is activated with a red lever labeled (ROLL DISC) located on the hub of the pilot's control wheel. In addition to mechanically disconnecting the pilot's control wheel from the ailerons, activation of the ROLL DISC lever trips two disconnect switches within the control wheel hub. When the roll disconnect mode is activated within the spoileron computer, it outputs a signal for a CAS message to illuminate. When roll disconnect mode is activated, the autopilot will disengage.

The following CAS illuminations are specific to the spoileron computer:

CAS	Color	Description
ROLL DISC	Amber	Roll disconnect has occurred on the ground.
ROLL DISC	White	Roll disconnect has occurred in flight.

The roll disconnect mode provides roll control through RVDT signals from the pilot's control wheel to the spoileron computer. This mode is much the same as the normal spoileron mode but has a different gain curve relating to control wheel input and panel deflection begins at 1° movement instead of 5°. Spoileron operation is full time. Anytime either control wheel is turned more than 5°, there is a differential displacement of the spoiler surfaces to augment roll control. Spoilers can be operated in conjunction with the roll disconnect mode the same as they are with normal spoileron mode. The roll disconnect mode may be deselected in flight by returning the ROLL DISC lever to its normal position.

SPOILER INDICATIONS

Spoiler extension is indicated at the base of either the SUMRY or FLT system schematic page on either EICAS or MFD. On the FLT system schematic display, spoiler extension is presented as a digital display and as a vertical analog scale with dual points (one for each spoiler). The digital displays on the SUMRY and FLT pages only show spoiler extension commanded by autospoilers or with the spoiler lever. They do not reflect differential extension resulting from operation in spoileron mode. When the airplane is on the ground with spoilers extended, a white box will overlay the digital spoiler display. If power is advanced for takeoff with either or both spoilers extended, this digital display and box will turn red along with the pointers on the analog scale. In addition, a red CAS and "CONFIGURATION" voice message will activate. Spoilers should not be extended at the same time flaps are extended while in flight except as specified in the Airplane Flight Manual, or the following CAS message will be posted.

The following CAS illuminations are specific to the spoilers:

CAS	Color	Description
SPOILERS EXT	Red	The spoilers have moved from the stowed position, with aircraft on the ground, and either thrust lever is advanced to MCR or above.
SPOILERS EXT	Amber	The airplane is in flight and spoilers are extended with flaps extended more than 3°.
SPOILERS EXT	White	Spoilers are not fully retracted. Spoileron extension will not activate this CAS (flight and ground).

The analog scale and pointers are real time showing actual spoiler position for all conditions. When spoilers are extended as result of spoileron operation, pointers will indicate their differential on the analog scale. Digital spoiler indicators and analog scale pointers will turn amber when flaps are extended 3° or more with spoilers extended.

SPOILER MONITOR SYSTEM

The spoileron computer contains a monitor system to prevent electrical or mechanical faults from causing uncommanded extension or retraction of the spoilers. The spoileron computer uses electrical power from the L ESS BUS for operation and the spoiler indicating system uses power from the R ESS BUS. The circuits are protected by the SPLR CTRL and SPLR IND circuit breaker, respectively, located in the FLIGHT group on the pilot's and copilot's circuit breaker panels. If power to the spoileron computer is lost through the SPLR CTRL or SPLR IND circuit breaker, the spoilers will retract and be inoperative in all modes. The spoileron computer performs a self-test (BIT) at powerup. A test failure will trip the spoileron monitor. If the monitor detects a self-test failure or a fault during normal operation, hydraulic pressure is removed from the system by closing the spoiler shutoff valve. A hydraulic return is provided to blow the spoilers closed. During normal operation, the shutoff valve is held open by an electrical solenoid. A power failure will cause this valve to close. *On aircraft 45-002 thru 45-294* ***not*** *modified by SB 45-27-20 (Modification of the Spoiler System Control Wheel Master Input)*, when either Control Wheel Master Switch (MSW) is held depressed, the spoiler shutoff valve is depowered closed and the spoilers will blow down, however, they may not fully retract.

A system malfunction will cause the spoileron monitor to trip and an amber CAS display. If the malfunction clears, the system may be reset using the "SPLRN RESET" position on the system test knob. If the monitor detects a jammed spoiler, the spoileron computer continues to operate using the spoiler that is not jammed and it applies a full retract input to the effected actuator for 5 to 7 seconds. This will also illuminate on the CAS.

The following CAS illuminations are specific to the spoileron monitor:

CAS	Color	Description
SPOILERS FAIL	Amber	A failure in the spoiler system is detected.
SPOILER JAM	Amber	The associated (L or R) spoiler is jammed.

PITCH TRIM

Pitch trim is provided by a moveable horizontal stabilizer. Operational structural redundancy has been incorporated by using primary and secondary sections that are independent. Primary and secondary each have electrically and mechanically independent motors (separated for rotor burst considerations), gear trains, and control inputs. Position sensors in each section of the actuator, geared directly off of the main drive screw, are monitored by both IC-600s. The computers compare the primary position sensors to the secondary position sensors in the actuator to annunciate to the pilot when the display position may not be accurate. The secondary section structure, construction, and operation is the same as the primary and both sections drive a common screwjack-type actuator to move the leading edge of the horizontal stabilizer up or down. The primary motor is actuated by manual primary pitch trim (control wheel trim switch), configuration trim, and Mach trim systems. The secondary motor is provided as a backup for primary trim and is operated by the secondary pitch trim and the autopilot.

The following CAS illuminations are specific to the pitch trim system:

CAS	Color	Description
PIT TRIM MISCMP	Red	Miscompare between the primary and secondary pitch trim on the ground and either thrust lever is advanced to MCR or above.
PIT TRIM MISCMP	White	Miscompare between the primary and secondary pitch trim in flight.

PITCH TRIM SELECTOR SWITCH

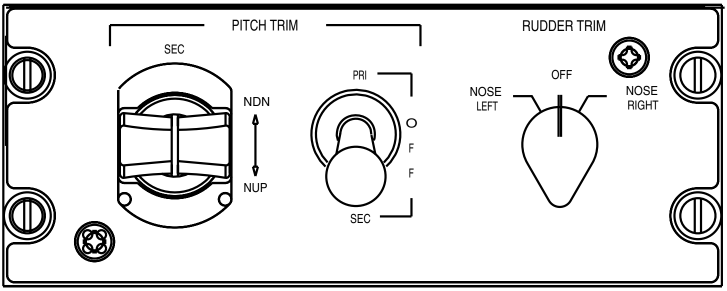
This switch, as shown in Figure 5-4, is located on the trim switch panel (pedestal) and is used to select which trim system will be used. The PRI position enables the primary trim switches in the control wheels, while the SEC position will enable the secondary trim switches in the panel. Selecting OFF or SEC will disable all #1 IC-600 trim functions. When set to OFF position, the power and ground circuits for the motor command functions in the actuator control box are disconnected and a CAS is posted.

The following CAS illumination is specific to the pitch trim system:

CAS	Color	Description
PITCH TRIM OFF	White	Pitch trim is selected to OFF.

PRIMARY PITCH TRIM

Each control wheel has a control wheel trim switch located on the outboard horn of each control wheel (Figure 5-1). Each switch is a four position (LWD, RWD, NOSEDOWN & NOSEUP) barrel switch with a momentary-action push button switch in the center of the barrel. This switch is used to input trim commands for pitch and roll and autopilot functions. Normally, the pitch trim control switch (Figure 5-4) is positioned to PRI. This position enables the control wheel trim switches and causes commands from either of these switches to be processed by the #1 IC. To complete the trim command circuit, the arming switch (button) on the top of the barrel must be depressed simultaneously with movement of the barrel. Trim commands from the pilot's control wheel trim switch will override commands from the copilot's. Primary trim speed is variable and is automatically controlled by the #1 IC based on indicated airspeed. The IC uses airspeed information from both ADCs to schedule trim speed and Mach trim. The #1 IC sends the primary trim commands to the primary trim actuator. The trim actuator and the IC both monitor the trim operation. The primary trim actuator performs a power-up circuit check. If the actuator detects a fault during the power-up check, a fault is posted on the CAS. Primary trim will still be available with the fault displayed, however, operation may be at a low trim rate and configuration trim and Mach trim may be inoperative depending on the malfunction. The primary trim actuator and #1 IC both monitor primary trim operations for a number of possible malfunctions including uncommanded trim and trim in the wrong direction. If either of these malfunctions is detected by the trim actuator, a fail is displayed on the CAS and primary trim is disabled.



TRIM SWITCH PANEL
Figure 5-4

Electrical power for primary pitch trim is provided by the L ESS BUS and is protected by the TRIM-PRI PITCH circuit breaker located on the pilot's circuit breaker panel (FLIGHT group). The dc electrical power to the #1 IC is also required for primary pitch trim, except for primary bypass trim. The power for #1 IC is provided by the L ESS BUS and protected by IC/SG 1 circuit breaker located on the pilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).

Bypass Trim

Primary trim reverts to bypass as a result of a detected malfunction or #1 IC failure and cannot be selected by the crew. When in bypass trim a fault is displayed on CAS and control wheel trim switch commands go directly to the primary trim actuator, bypassing the IC circuits. The #1 IC trim functions (IC controller/monitored primary trim, configuration trim, and Mach trim) are all disabled in this case. When in bypass trim, the primary trim actuator operates at only two speeds (high or low). The speed depends on flap position. Dual flap position inputs are provided to the actuator electrical box to maintain redundancy. If the flap signals do not agree, the rate of trim function is limited to slow speed. Both flap signals must agree and must indicate flaps are greater than 3° for the actuator to operate at a high rate. When the flaps are up (<3°), primary bypass trim will be at a slow rate. The primary trim actuator continues to monitor for uncommanded trim and incorrect trim direction in the bypass trim mode. It also monitors for the correct trim speed based on flap position. If it detects a failure in any of these areas, primary trim is disabled and a fail CAS is displayed.

The following CAS illuminations are specific to the primary pitch trim:

CAS	Color	Description
PRI TRIM FAIL	Amber	The primary pitch trim system has failed.
PRI TRIM FAULT	White	The Integrated avionics Computer (IC) detects a fault in the primary pitch trim system.

SECONDARY PITCH TRIM

Secondary pitch trim is electrically independent of the primary trim, configuration trim, and Mach trim. In the event of primary trim failure, secondary pitch trim is available as a backup means of trimming the airplane in the pitch axis. The autopilot also uses the secondary trim actuator as a normal means of trimming in the pitch axis. The autopilot can use the secondary trim actuator with the trim selector in the PRI or SEC position.

The dual-segment SEC trim switch (Figure 5-4) is located on the center pedestal. Manual activation of secondary trim requires that the pitch trim selector be in the SEC position and that both segments of the spring-loaded SEC switch be moved at the same time. When SEC position is selected, a CAS is displayed.

The secondary pitch trim actuator has a monitor function similar to the primary actuator. It performs a power-up check and if any faults are detected, a fault is displayed on the CAS, however, secondary trim operates normally. The secondary trim actuator also monitors for uncommanded trim, trim in wrong direction, and incorrect trim rate. If any of these malfunctions are detected, a fail annunciation is posted on CAS and the secondary actuator is disabled. The IC has no control or monitor functions for manual secondary trim.

The following CAS illuminations are specific to the secondary pitch trim:

CAS	Color	Description
SEC TRIM FAIL	Amber	Secondary pitch trim has failed.
SEC PITCH TRIM	White	Secondary pitch trim is selected by the crew.
SEC TRIM FAULT	White	A pitch trim actuator (secondary) fault is detected.

Electrical power for the secondary pitch trim system is provided from the R ESS BUS and is protected by the TRIM-SEC PITCH circuit breaker located on the copilot's circuit breaker panel (FLIGHT group).

AUTOPILOT PITCH TRIM

When the autopilot is engaged, it can drive the horizontal stabilizer trim to alleviate elevator servo loading. The autopilot pitch trim function is contained in the #2 IC autopilot processor. When elevator servo current exceeds a predetermined threshold for a given period of time, this is considered to be a steady state error and trim will run. As the trim runs, the horizontal stabilizer is re-positioned and the air load on the elevator primary servo is reduced. When this load falls below the threshold level, trim stops running.

Whenever the autopilot is engaged, #1 IC trim functions, which includes config/Mach trim, drop off-line. The autopilot commands pitch trim based on elevator servo current demand and airspeed. Autopilot pitch trim engagement is controlled by the autopilot engage logic. An autopilot engage signal is provided to the horizontal trim actuator. If the autopilot is disengaged as a result of a monitor trip, the aural tone alert will sound until the MSW switch is pushed. A red AP will also be displayed on the PFDs and flash for five seconds and then go steady. The #2 IC monitors for uncommanded trim, trim direction, and incorrect trim rate. If the actuator detects one of the above faults, a CAS is displayed.

The following CAS illumination is specific to the autopilot pitch trim:

CAS	Color	Description
AP ELEV MISTRIM	Amber	Autopilot elevator servo holding excessive torque.

TRIM-IN-MOTION INDICATION

A trim-in-motion potentiometer is installed on the secondary trim actuator. When the autopilot energizes the secondary trim actuator for more than 2 to 3 seconds, a series of audible clacker sounds is transmitted through the audio system. A built-in time delay allows trim operation for approximately 2 to 3 seconds before the clacker sounds which prevents a nuisance alarm on the clacker. For longer periods of continuous trim, the clacker will alert the crew. Unusual long periods of autopilot trimming may indicate trim runaway. There is no trim-in-motion clacker for any trim operation other than autopilot trim.

PITCH TRIM BIAS

The pitch trim bias system works in conjunction with the up/down spring assembly. Its function is to assist the pilot by providing added spring pressure against the elevator in the event the horizontal stabilizer is jammed in an out-of-trim position. Pitch trim bias is actuated by the crew using the three-position (spring loaded to the center position) PIT TRIM BIAS switch located at the front of the throttle quadrant. Power for the system is provided through the PIT TRIM BIAS circuit breaker on the copilot's circuit breaker panel (FLIGHT group).

The following CAS illuminations are specific to the pitch trim bias.

CAS	Color	Description
PIT TRIM BIAS	Red	Abnormal PIT TRIM BIAS configuration with the aircraft on the ground and either thrust lever is advanced to MCR or above.
PIT TRIM BIAS	White	The pitch trim bias system is moved from the normal position. PIT TRIM BIAS should only be used for jammed stabilizer conditions in flight.

CONFIGURATION TRIM

The configuration trim functions aid the pilot by providing automatic relief of control column loads via the #1 IC control of horizontal stabilizer position. The configuration trim system control and monitoring functions are provided by software contained in the #1 IC using inputs from spoiler lever position sensors or when flap position is greater than 3° . Through these interfaces, the configuration trim provides automatic pitch control for changes in airplane configuration. This mode is only functional when the trim selector switch is in the PRI position and the autopilot is not engaged. Trim commands from either control wheel trim switch will have priority over the configuration trim commands.

AILERON TRIM

The aileron trim system provides manual aileron trim tab control. The manual trim tab control system enables the pilot, with authority, and the copilot to eliminate out-of-trim forces which may be present in the aileron control circuit, preventing smooth operation of the control column. This enables the airplane to be flown without either pilot having to apply constant forces to the hand wheel to maintain the wing level. The aileron trim system is controlled by a control wheel trim switch mounted on the pilot and copilot's control wheels (Figure 5-1) and incorporates two switches, trim, and trim arm. To manually trim, the pilot or copilot must press and hold the ARM button while pushing the trim switch to the LWD or RWD position. The control wheel trim switch induce inputs into the roll trim control electrical system which translates commands to a rotary actuator mounted in the left aileron. The actuator moves the aileron trim tab through dual push rods to the command position. A trim tab position sensor is attached to the rotary actuator shaft and provides input to the Data Acquisition Units (DAUs) for display of aileron trim position on the cockpit Engine Indicating and Crew Alerting System (EICAS). Driving the actuator clockwise causes the trim tab to rise. This results in left aileron moving down and the right aileron moving up. This results in the airplane performing a Right Wing Down (RWD) movement. Conversely, driving the actuator counterclockwise causes the trim tab to lower. This causes the left aileron to move up and the right aileron to move down, resulting in the airplane performing a Left Wing Down (LWD) movement.

Aileron trim is powered from the L ESS BUS and is protected by TRIM-AIL 5-amp circuit breaker on the pilot's circuit breaker panel (FLIGHT group).

RUDDER TRIM

The rudder trim system provides manual rudder trim tab control. The manual trim control system enables the pilot and copilot to eliminate out-of trim forces which may be present in the rudder control circuit. This enables the airplane to be flown without either pilot having to apply a constant force to the rudder pedals.

Rudder trim changes are effected through an electronically driven rotary actuator mounted in the rudder and connected to the rudder trim tab with dual pushrods. The actuator is controlled manually by a double-pole, double-throw, center-off, momentary-action, rotary switch located on the trim switch panel (Figure 5-4) in the center pedestal. This switch is constructed in two sections with poles that are not mechanically linked. One pole of the switch is used to provide control of the rudder trim ARM circuit and is referred to as the ARM switch. The other pole of this switch is used to provide either nose left or nose right trim commands and is called the rudder trim switch. These poles are independent of each other except of the fact that they are both rotated by the same shaft. The failure of one pole will not affect the other. Since one pole provides ARM control and the other provides the trim command inputs, the failure of one pole will not result in a trim runaway. Setting and holding the switch to the NOSE LEFT or NOSE RIGHT position energizes the trim tab actuator, resulting in the rudder rotating either clockwise or counterclockwise. A trim tab position sensor is attached to the rotary actuator shaft and provides input via the #2 data acquisition unit for display of rudder trim position on the cockpit engine indicating and crew alerting system.

Electrical power for rudder trim is provided from the R ESS BUS and protected by TRIM-RUD 5-amp circuit breaker located on the copilot's circuit breaker panel (FLIGHT group). Rudder trim can be stopped by depressing and holding either control wheel master switch.

TRIM INDICATIONS

Pitch, aileron, and rudder trim indications are provided on the EICAS and the MFD. A digital display of pitch trim position (PIT TRIM) is always in view below the CAS window, on the right side of the EICAS. Pitch (PIT), aileron (AIL), and rudder (RUD) trim are digitally displayed on the SUMRY page. They are arranged in a vertical column labeled FLT on the right side of the SUMRY page. The SUMRY page is the power-up default display on the EICAS. The SUMRY page is displayed at the base of the MFD. Trim indications are correspondingly displayed on the left side of the FLT system schematic page.

The following CAS illuminations are specific to the trim indications:

CAS	Color	Description
TAKE OFF TRIM	Red	The aircraft is on the ground and either thrust lever is advanced to MCR or above, and aircraft trim (pitch, aileron, or rudder) is not set for takeoff.
TAKE OFF TRIM	White	The aircraft is on the ground and aircraft trim (pitch, aileron, or rudder) is not set for takeoff.

PITCH TRIM INDICATIONS

Pitch trim tab position is presented as both analog and digital display. The label PITCH, in cyan, is positioned above the pitch trim tab position digital readout. The range of pitch trim is from 0 to 10, and with 0 being maximum nose down trim and 10 being maximum nose up trim. The analog scale consists of a white vertical line with three horizontal tick marks on the right side. The labels NDN and NUP are displayed at the left top and bottom of the scale, respectively. The digits 0 and 10 are displayed at the right top and bottom of the scale, respectively. The analog scale has a white takeoff band located between 5.5 units and 8.7 units. There is a pointer which moves up and down the left side of the scale in accordance with the digital readout of the pitch trim tab position. If the pitch trim is not within the takeoff band, and the airplane is on the ground, the digital display of trim will have a white box around it and a message posted to CAS. If power is advanced for takeoff (MCR or greater) and pitch trim is not within the takeoff band, the "CONFIGURATION" voice warning will sound and the CAS message turns red along with the digits, pointer and box in the trim position display. Invalid data will replace the digits with amber dashes, and the pointer and box are removed.

AILERON TRIM INDICATIONS

Aileron trim tab position is presented as both analog and digital display. The label AILERON, in cyan, is positioned above the aileron trim tab position digital readout. The range of aileron trim position is from L12 to R12 and with L being left wing down, and R being right wing down. The analog scale consists of a white arc with three tic marks on the outside of the arc. The digits 10, in white, are displayed at the left and right ends of the scale, respectively. A white takeoff trim band is located on the outside of the scale between the values of +5 and -5. A pointer moves along the inside of the scale in accordance with the digital readout of the aileron trim tab position. If the aileron trim is not within the takeoff band while the airplane is on the ground the digital display will have a white box around it. CAS messages and alerting are the same as those described above in pitch trim.

RUDDER TRIM INDICATIONS

Rudder trim tab position is presented in both analog and digital display. The label RUDDER, in cyan, is positioned above the rudder trim tab position digital readout. The range of rudder trim position is from L12 to R12, and with L being nose left and R being nose right. The analog scale consists of a horizontal white bar with three tic marks on the top of the bar. The digits 10, in white, are displayed at the left and right ends of the scale, respectively. A white takeoff trim band is located on the top of the horizontal scale between +5 and -5. There is a pointer which moves along the bottom of the scale in accordance with the digital readout of the rudder trim tab position. If the rudder trim is not within the takeoff band while the airplane is on the ground the digital display will have a white box around it. CAS messages and crew alerting are the same as described in pitch trim. Pitch, aileron, and rudder trim indications are available on page 2 of the backup engine/system pages on the RMU.

MACH TRIM

Mach trim is a fully automatic system installed to increase longitudinal stability and counteract nose-down tendency at high Mach numbers. A circuit card in the #1 IC performs all the computational aspects for Mach trim and signals the primary trim actuator to apply trim as necessary. Airspeed information provided by the ADCs is used by the IC in computing the trim requirement.

The pitch trim selector (Figure 5-4), located on the center pedestal, must be in the PRI position for Mach trim to be functional and the autopilot must be disengaged for the Mach trim to become active. If the autopilot is engaged, it performs the pitch trim function using the secondary trim actuator and the Mach trim is in a passive mode. Mach trim automatically becomes active at 0.725 MI. Nose up trim will be applied as Mach increases and nose down as Mach decreases. When the horizontal stabilizer position changes, two Mach trim position sensors apply feedback signals to the IC. Mach trim is interrupted whenever the manual trim is activated. The system resynchronizes to function about the new horizontal stabilizer position when manual trim is released. If the IC detects a fault within the Mach trim system function, a fail is posted on the CAS and the overspeed cue on the airspeed indicator will also adjust to indicate a Mach limit of 0.76 to 0.78 MI.

The following CAS illuminations are specific to the Mach trim:

CAS	Color	Description
MACH TRIM FAIL	Amber	Mach trim function has failed and aircraft speed is greater than 0.76 to 0.78MI.
MACH TRIM FAIL	White	Mach trim function has failed and aircraft speed is equal to or less than 0.76 to 0.78MI.

STALL WARNING SYSTEM

The stall warning system, also referred to as the Angle-of-Attack (AOA) system, is installed to provide the crew with an indication of impending airplane stall. The stall warning system consists of two independent systems which use a dual channel computer.

Other system components include two AOA sensors, control column shaker motors and an interface with the PFDs. Left and right AOA indicators are available as an option. Each channel of the computer generates a reference signal to the corresponding stall vane and, in return, receives AOA information. The computer then processes this information with airspeed, altitude, flap setting, and weight-on-wheels inputs to determine the stall warning indications. The left and right stall warning systems are powered from the left and right essential buses respectively. The circuits are protected by the L STALL WARN and R STALL WARN circuit breakers located on the pilot's and copilot's circuit breaker panels (FLIGHT group).

STALL WARNING INDICATIONS

As the airplane approaches stall speed, stall warning indications are activated. The shaker speed will be above the stall speed at the most critical weight and Center of Gravity (CG). The stall warning computer sums inputs of AOA and altitude shift along with flap position from the flap position indication unit. Stall warning is biased for each flap setting. The stall warning system provides the following aural, tactile, and visual indications when the predetermined conditions have been reached:

(1) The left and right channels of the computer drive low-speed cues on the pilot's and copilot's PFDs respectively. The low-speed cue is a vertical red bar on the inside of the airspeed tape which rises from the bottom of the tape as the airplane AOA increases. The point at which the red bar reaches the airspeed pointer will coincide with the point at which other stall warning indications are activated.

(2) The left and right channels of the stall computer will activate the control column shaker motors.

(3) The non-cancelable voice message "STALL" will repeat until the AOA is decreased.

(4) The AOA indicators (if installed) will enter the red band on the indicator.

STALL WARNING OPERATION

The stall warning system is powered when the circuit breakers are in. The shakers, along with other visual and aural stall indications, are inhibited until the airplane is airborne. If installed, the AOA indicators will operate in both the air and ground modes. The stall warning system performs a power-up self-test (BIT) and monitors for a number of possible system faults. Detection of a fault appears on CAS.

The following CAS illumination is specific to the stall warning system:

CAS	Color	Description
STALLWARN FAIL	Amber	The associated (L or R) stall warning system has failed.

STALL VANE ANTI-ICE

The stall vanes are equipped with a 28-vdc heater to anti-ice the vane surfaces during icing conditions. The AOA vane heater of the angle-of-attack transmitter is monitored for open circuit when the vane heater power is applied. Detection of an open circuit will result in the appropriate CAS message as well as being logged into the stall computer as a fault for that flight. The vane heaters are controlled by the L and R PROBE anti-ice switches located on the anti-ice section of the center switch panel. Each vane heater is supplied power from the left and right main bus respectively and protected by the AOA 15-amp circuit breakers on the pilot's and copilot's circuit breaker panel (ANTI-ICE group).

The following CAS illumination is specific to the stall vane anti-ice system:

CAS	Color	Description
AOA HT FAIL	Amber	Associated (L or R) angle-of-attack vane heater has failed.

STALL SYSTEM TEST

A self-test mode is available when the weight-on-wheels signal indicates that the airplane is on the ground and no system failure is detected. When the system test switch is rotated to the STALL position and held down for approximately 7 to 10 seconds, the stall warning computer shall demonstrate that the stall warning system is fully operational by performing the following events in the order listed:

(1) L AOA HT FAIL message appears in CAS.

(2) Low Speed Awareness (LSA) bar will begin to sweep up the pilot side airspeed tape, the left (pilot's) column will shake when the LSA bar approximately reaches the indicated airspeed pointer, and the aural voice warning "STALL" will be repeated through the cockpit speakers and crew headphones.

(3) L AOA HT FAIL message extinguishes from the CAS window, the LSA bar scrolls down the airspeed tape, the left column stops shaking and the aural warning stops.

(4) R AOA HT FAIL message appears in CAS. (Note: Master caution tone may not sound when the R AOA HT FAIL is annunciated. If the master caution tone is not heard, then the STALL aural warning will be heard as called out in the next step below).

(5) The LSA bar will begin to sweep up the copilot side airspeed tape, the right (copilot's) column will shake when the LSA bar approximately reaches the indicated airspeed pointer, and the aural voice warning "STALL" will be repeated through the cockpit speakers and crew headphones (if the master caution tone was not heard in the previous step).

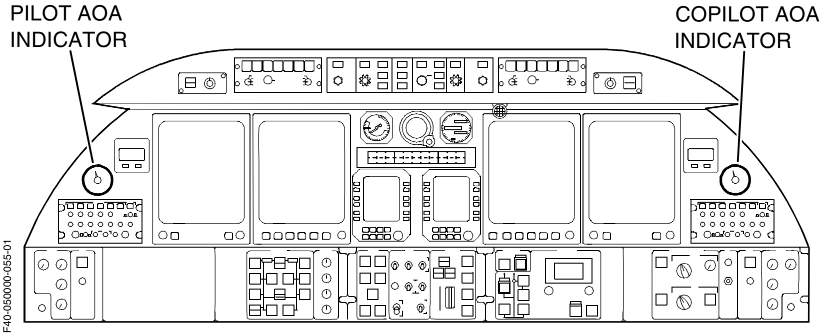
(6) R AOA HT FAIL message extinguishes from the CAS, the LSA bar scrolls down the airspeed tape, the right column stops shaking and the aural warning stops (if the aural warning was present in the previous step).

The left and right stall warning failure discretes are not checked during self-test. It was necessary to inhibit the output of the left and right failure discretes in order to permit display of the LSA bar on the PFDs during test.

ANGLE-OF-ATTACK INDICATORS (OPTIONAL)

The optional Angle-of-Attack (AOA) indicators system consists of two angle-of-attack indicators mounted in the instrument panel, one outboard of the pilot PFD and one outboard of the copilot PFD, Figure 5-5.

The angle-of-attack indicators display continuous angle-of-attack position to the flight crew. The AOA indicators are driven by the stall warning computer. The dual channel computer provides buffered outputs to the indicators for protection. The pilot AOA indicator receives data from the left channel of the stall warning computer and the copilot AOA indicator receives data from the right channel of the stall warning computer. The AOA indicator is adequately marked displaying .10, .20, .30, .40, .50, .60, .70, .80, .90, 1.0 with unnumbered marks half way between each. The beginning of the red band at .80 represents shaker activation and an imminent stall condition. The AOA indicators front plate markings are consistent with the stall warning information shown on the PFDs, a tape type presentation at the end of the airspeed tape. The AOA indicators are powered via the L STALL WARN and R STALL WARN circuit breakers located on the pilot's and copilot's circuit breaker panels (FLIGHT group).



INSTRUMENT PANEL LAYOUT AND AOA INDICATOR POSITION
Figure 5-5

AVIONICS

HONEYWELL PRIMUS 1000 AVIONICS SYSTEM

The Learjet 45 is equipped with a Honeywell Primus 1000 Avionics system. The primary component of the Primus 1000 system is the display flight guidance computer, or more simply, the IC-600. This computer, together with the appropriate controllers and sensors, comprises the Primus 1000 system. It consists of dual IC-600 (single autopilot is contained in the copilot's IC-600), dual air data computers, PRIMUS weather radar system and appropriate controllers. The radio sensor package is the Honeywell PRIMUS II integrated radio system.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The PRIMUS 1000 EFIS System consists of four, 8 x 7 inch, Display Units (DUs) driven by two Symbol Generators (SGs) resident in the two IC-600s. The EFIS presents information to the crew in an uncluttered format, simplifying cockpit scan, and reducing pilot workload and fatigue. The flight instruments, engine instruments, system status, navigation, TCAS, RADAR, and electronic checklist are all displayed on these high resolution DUs. The EFIS is integrated with the Engine Indicating and Crew Alerting System (EICAS) and Crew Warning Panel (CWP) to provide the crew with not only flight monitoring indications but also with engine data, warning, cautionary and advisory alerts (visual and aural). Dual Primary Flight Displays (PFDs) combine attitude and HSI formats with airspeed, vertical speed and other essential information, such as resolution advisories for the optional TCAS system. A Multi-Function Display (MFD) offers a full spectrum of operational capabilities, from weather radar and mapping displays, to a custom programmable checklist. A digital audio control system and dual Radio Management Units (RMUs) support the communications and navigation functions.

The display information provided on EFIS is generated by two IC-600 computers located in the nose. Each of the IC-600s contains circuitry that performs the symbol generation function for the EFIS. Along with interfacing with the display units, the ICs receive data from the Data Acquisition Units (DAUs), Air Data Computers (ADCs), Attitude Heading Reference System (AHRS), navigation system, flight management system, autopilot and other various display controllers. The CAS monitors the IC-600 bus interconnect, the temperature of each IC-600, the IC cooling fans and Weight-On-Wheels (WOW). A CAS will also illuminate if communications between the left and right ICs are invalid.

The following CAS illuminations are specific to the IC-600:

CAS	Color	Description
IC 1-2 OVHT	Amber	#1 and/or #2 Integrated avionics Computer (IC) are/is overheated.
IC BUS FAIL	Amber	-The off-side IC has failed. or - IC bus invalid
IC1-2 FAN FAIL	White	#1 and/or #2 Integrated avionics Computer (IC) cooling fan has failed.
IC1-2 WOW INOP	White	The associated (#1 or #2) Integrated avionics Computer (IC) has tripped the weight-on-wheels validity monitor.

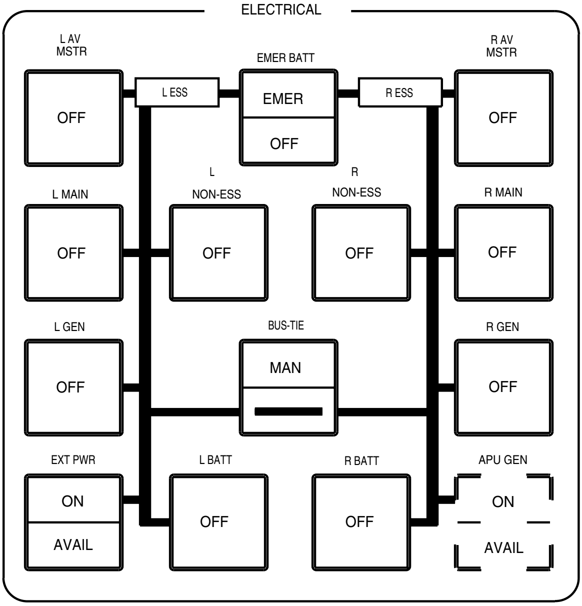
IC-600 POWER SOURCE

The #1 and #2 IC-600s are powered from the left and right essential buses respectively. The circuits are protected by the 7.5-amp IC/SG 1 and IC/SG 2 circuit breakers on the pilot's and copilot's circuit breaker panels (INSTRUMENT/INDICATIONS group).

AVIONICS MASTER SWITCHES

Left and right avionics master switches are located on the electrical control panel below DU 2 (Figure 5-6). When the alternate action avionics master switches are selected to On (OFF annunciator extinguished), contactors are closed that connect the left and right essential avionics buses and left and right main avionics buses to the respective generator buses.

The associated essential contactors and main bus contactors must be closed for the avionics buses to be powered. If the avionics master switches are on during ground start or for a starter assisted airstart, the essential avionics buses will continue to be powered, but the contactors for the main avionics buses will automatically open until the start is complete. The essential avionics buses must remain powered during an airstart since they power the critical flight display units. The emergency bus, essential buses and essential avionics buses are all powered by the emergency battery during a starter assisted start. The avionics equipment that must be on during a ground start is powered from the essential buses and the emergency battery bus.



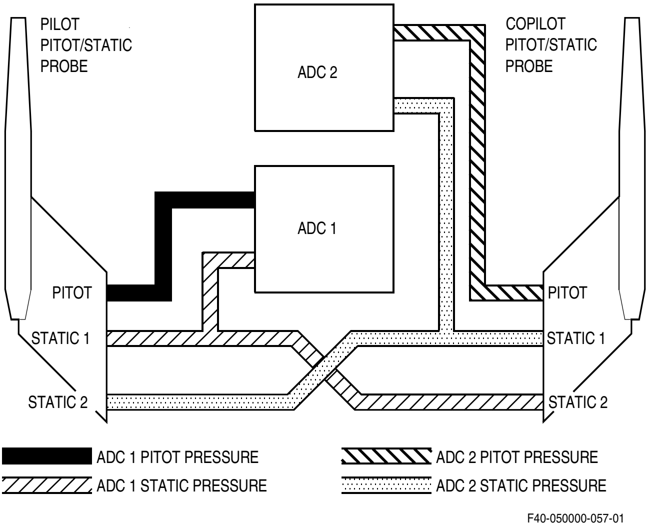
ELECTRICAL CONTROL PANEL
Figure 5-6

AIR DATA SYSTEM (ADS)

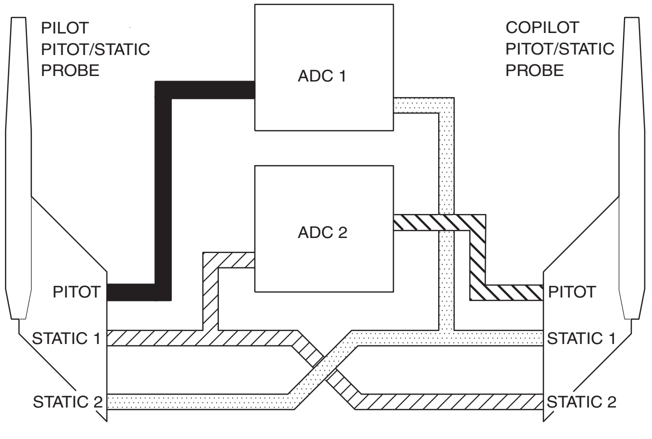
The air data system and air data instruments depend upon pitot pressure and static pressure sensing, as well as air temperature sensing. Air data is provided to the flight instruments and airplane systems by two Air Data Computers (ADCs) which receive pitot and static information from the main pitot static system. The ADCs receive total air temperature from a dual element temperature probe and barometric correction inputs via the BARO set knobs on the corresponding PFDs.

PITOT-STATIC SYSTEM

The primary pitot-static system consists of two pitot-static probes, located one on each side of the airplane's nose section. The pilot's pitot-static probe supplies the pilot's ADC with total pressure and the copilot's pitot-static probe supplies the copilot's ADC with total pressure. Each pitot-static probe has two isolated static ports. The pilot's ADC receives static pressure from coupled static ports off the pilot's and copilot's pitot-static probes (Figure 5-7). The copilot's ADC receives static pressure from separate coupled static ports off the pilot's and copilot's pitot-static probes which are isolated from the static ports used by the pilot's ADC. This crossover arrangement reduces system errors.

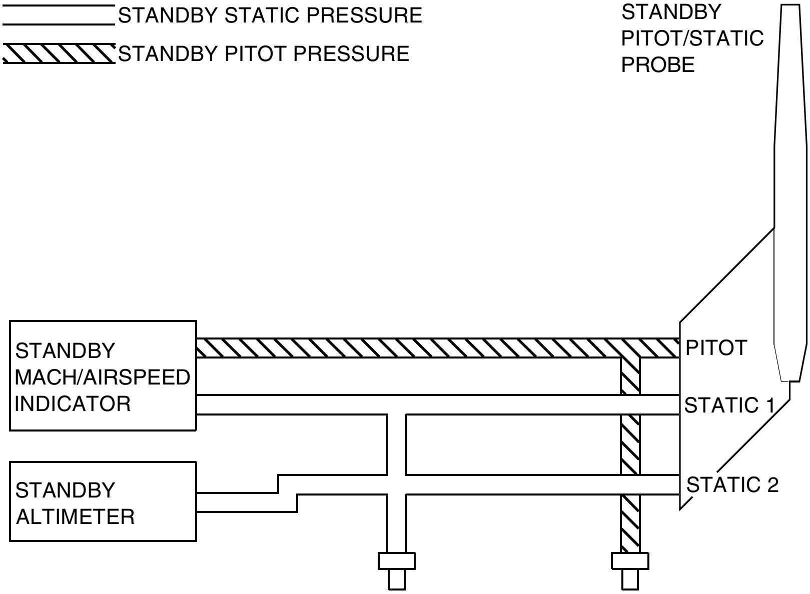


PITOT-STATIC SYSTEM SCHEMATIC
Aircraft 45-005 thru 45-079
Figure 5-7



PITOT-STATIC SYSTEM SCHEMATIC
Aircraft 45-080 & Subsequent
Figure 5-7A

A third pitot-static probe, mounted above the main probe on the right side of the airplane, provides total and static pressure inputs to the standby instrument group. Moisture drains are provided for the standby pitot-static lines. The two drains for the standby pitot-static system are flush mounted on the right side of the airplane just aft of the nose wheel door. The main pitot-static probes are physically located at the lowest point of the primary pitot-static system plumbing and therefore, do not require moisture drains. The pitot source on the standby probe provides total pressure to the standby Mach/airspeed indicator. There are two static sources on the standby probe, one provides static information to the standby altimeter and the other provides data to the standby Mach/airspeed indicator (Figure 5-8).



F40-050000-058-01

STANDBY PITOT-STATIC SYSTEM SCHEMATIC
Figure 5-8

AIR DATA COMPUTERS (ADCs)

The Learjet 45 utilizes two, independent micro air data computers as the primary source for air data. The is a self contained unit incorporating pressure sensing modules and all required processing and input/output functions in a single unit. Each computer is independent of the other and has independent circuit breakers.

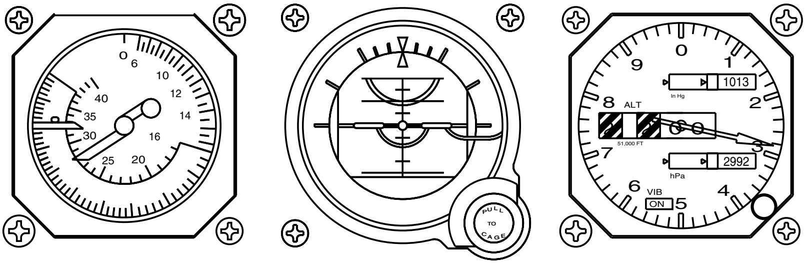
The air data system provides the required airplane airspeed, air temperature, altitude and vertical speed data for the Electronic Flight Instrument System (EFIS) displays, Attitude and Heading Reference System (AHRS), dual stall warning system, autopilot, transponders, spoileron computer, cabin pressurization, Digital Electronic Engine Control (DEEC) and landing gear warning system as required. The Air Data System (ADS) accepts static air pressure, total air pressure, total air temperature, various discrete signals and baro set inputs. The #1 and #2 ADCs receive power from the L and R ESS BUS respectively, through ADC 1 and ADC 2 circuit breakers. The circuit breakers are located on the pilot's and copilot's circuit breaker panels (INSTRUMENT/INDICATIONS group).

ADC REVERSION

Display of the ADS data on the EFIS display is controlled by the pilot or copilot via the ADC reversionary control switch (Figure 5-14). The reversionary control panel, located below the EICAS display (DU#2), incorporates an ADC reversion switch which has three positions, 1 - ADC NORM - 2. In the ADC NORM position, the IC-600s receive air data from their on-side ADC. In the "1 or 2" position both IC-600s receive air data from the selected source. If the switch is not in the NORM position, an annunciator of the selected source is displayed above and to the left of the ADI on both PFDs.

STANDBY INSTRUMENTS

The standby instrument group (Figure 5-9) includes a barometric altimeter, a airspeed/Mach indicator, an attitude indicator, mounted on the center instrument panel above the CWP and RMUs. The standby instruments have their own pitot-static probe to provide air data information. The instruments are of traditional mechanical design. If a fault occurs which causes one of the ADCs to output misleading information to the PFDs, the standby instruments act as a useful comparison to indicate which of the three displays is incorrect.



STANDBY INSTRUMENT GROUP
Figure 5-9

STANDBY ALTIMETER

The standby altimeter displays baro corrected altitude in a pointer/counter drum display. The dial graduations are marked every 20 feet. Above sea level the counter displays every 100 feet up to 55,000 feet of operational range. The indicator has dual barometric correction, from 27.9 to 31 inches of mercury and 946 to 1050 hectoPascals. Back lighting is provided by 5-vdc to illuminate the standby altimeter indicator at night.

STANDBY AIRSPEED/MACH INDICATOR

The standby airspeed/Mach indicator provides indicated airspeed by means of a pointer indicating against a 50- to 400-knot dial and a Mach sub-dial ranging from 0.3 to 1.0 Mach. Maximum allowable airspeed (Vmo) is indicated at 325 knots by a red radial mark on the airspeed dial. Maximum allowable Mach (Mmo) is indicated at 0.75 Mach by a red and white striped radial mark on the Mach sub-dial. Back lighting is provided by 5-vdc to illuminate the standby airspeed/Mach indicator at night.

STANDBY ATTITUDE INDICATOR

The standby attitude indicator provides a visual indication of the airplane flight attitude. It is located in the center of the standby instrument group (Figure 5-9) where it can be viewed easily by both pilots. It is powered from the emergency battery bus so that it will remain powered for at least one hour after the loss of airplane generator power. The standby attitude indicator will continue to provide an accurate display of aircraft attitude for nine minutes after the loss of all airplane power.

The indicator is an electrically-driven gyro whose vertical attitude is maintained by a mechanical erection system. The power warning flag is pulled from view after the gyro has spun up to valid operating speed and reappears if there is any interruption of source power or the unit is in caged mode.

Insure the indicator is caged (locked) prior to application of power. After approximately one minute after power has been applied, a smooth quick motion of the caging knob, yet without a "snap" release will uncage the gyro. Allow an additional two minutes for stabilization.

Horizontal accelerations experienced during takeoff, climb-out descent and landing exert forces on the gyro which can cause precession and indicator display errors. Errors that do develop are corrected at a nominal 2.5° per minute when attitude changes cease and the aircraft is stable in flight. If the unit does not erect to the proper attitude, cage and hold the unit caging mechanism until the display obtains normal attitudes.

To reduce maintenance and extend the service life of the standby attitude indicator, it should be caged only after the chocks and/or EMERGENCY/PARKING BRAKE has been set. If the indicator is caged immediately after landing, it is still functioning and normal taxiing procedures and tarmac irregularities may contribute to excess wear and tear on the bearings of the gyroscope.

Back lighting is provided by 5-vdc to illuminate the standby attitude indicator at night.

STANDBY COMPASS

The standby compass is located at the top of the windshield center post. It is a magnetic compass that does not require any electrical power to provide the crew with a continuous standby heading display. The only electrical input to the compass is 5-vdc to illuminate the compass at night.

ATTITUDE HEADING REFERENCE SYSTEM (AHRS)

Due to the design of the Honeywell Primus 1000 Avionics System, the various avionics systems are very integrated. The AHRS uses the PFDs as its primary display and the MFD in the event of PFD failure. The display units, display controllers and appropriate reversion switches are considered part of the electronic display system and are covered later in this section.

The Learjet 45 is equipped with either a dual Honeywell (AH-800) or dual LITEF (LCR-93) Attitude Heading Reference Units (AHRUs). Both units contain a memory module and are located in the aircraft's nose section.

Each system (#1 and #2 AHRS) incorporates a flux valve located in their respective wing tips. The AHRUs contain three Fiber Optic Gyros (FOGs) which sense angular rotation about the three principle axis (pitch, roll, and yaw) thus, computing the airplane's attitude and heading. When slaved to magnetic, the flux valves provide a magnetic heading reference. The memory module stores calibration data. This data is used to compensate AHRU inaccuracies caused from installation errors and local disturbances to the earth's magnetic field created by the aircraft's structure.

The AHRUs receive true airspeed (TAS) information from the on-side ADC. However, if a single ADC failure occurs, they will receive TAS from the operating ADC. True airspeed information is used to compute pitch and roll attitude. If TAS inputs to #1 AHRS or #2 AHRS are lost, a CAS will illuminate. Although system operation will be degraded, the AHRS still retains the same accuracy as a conventional spinning mass type gyro. AHRU's data output is received through their corresponding IC for attitude and heading displays on the PFDs/MFD. Attitude and/or heading information from the AHRS is used by the Flight Guidance System (FGS), Flight Management System (FMS), weather radar system, and the fuel quantity indicating system. In addition, AHRS #2 provides heading information through DAU #2 for the backup navigation display on the RMU.

The following CAS illumination is specific to the AHRUs:

CAS	Color	Description
AHRS 1-2 BASIC	White	Attitude Heading Reference System (AHRS 1 or 2) has reverted to basic mode due to a loss of true airspeed from both air data computers.

ATTITUDE AND HEADING COMPARISON MONITORS

The attitude and heading comparison monitors are functions within the IC-600s that compare the displayed data with the cross-side or secondary source data, depending on system reversionary status. Annunciations are provided to the crew if the attitude or heading on both sides differ.

The attitude comparison function is made of two monitors, the roll comparison monitor and the pitch comparison monitor. If the pitch data displayed on each side differ, the pitch comparison monitor trips and the PIT annunciation is displayed. The comparison threshold figure for the pitch monitor is 5°. Similarly, if the roll data on both sides differ, the ROL annunciation is displayed. The comparison threshold figure for the roll monitor is 6°. If both the roll and pitch comparison monitors trip, the ATT annunciation is displayed. If the heading comparison monitor trips, HDG is displayed. The normal comparison threshold figure for the heading monitor is 6°. However, if the displayed roll information is > 6°, the heading comparison threshold figure is increased to 12°.

All comparison monitor annunciations flash for 10 seconds on activation and then remain steady. These comparison monitors provide an extra safeguard to alert the cockpit crew in the event of any failures affecting the attitude or heading data displayed.

Other annunciations for attitude and heading which are displayed on the PFDs, not associated with the comparison monitors, are:

ATT FAIL and HDG FAIL. These red annunciations are displayed on the affected side's PFD whenever the heading or attitude display from that AHRS has failed. If an AHRS fails or both primary and auxiliary power supplies to an AHRS fail, both the red ATT FAIL and HDG FAIL annunciations are displayed.

ATT1/2 and DG1/2. These annunciations are displayed on the PFDs and indicate to the crew which AHRS is the source for the attitude and heading data on the display. If the onside AHRS is the source of display, the annunciation is white. If AHRS reversion has been performed, the cross-side PFD annunciation is amber. There are no crew actions required for these annunciations.

AHRU POWER SOURCE & COOLING

Each AHRU has a primary and a secondary dc electrical power source. The pilot's AHRU receives primary power from the left essential bus and a secondary or backup power from the right essential bus. The copilot's AHRU receives primary power from the right essential bus and secondary power from the left essential bus. Should either essential bus fail in flight, power to both AHRUs is uninterrupted. Separate circuit breakers for each system, primary and secondary, are provided in the INSTRUMENT/INDICATIONS group on the pilot's and copilot's circuit breaker panels. The AHRS #1 PRI and #2 SEC circuit breakers are located on the pilot's side, and the AHRS #2 PRI and #1 SEC circuit breakers are located on the copilot's side. The AHRUs are equipped with cooling fans which operate automatically to keep the AHRU within proper temperature limits. *On aircraft 45-002 thru 45-174 (Honeywell AH-800),* a CAS illuminates if the temperature exceeds predefined limits.

The following CAS illumination is specific to AHRU cooling:

CAS	Color	Description
AHRS 1-2 OVHT (Aircraft 45-002 thru 45-174)	Amber	Attitude Heading Reference System (AHRS 1 or 2) has reached an overheat condition.

AHRS REVERSION

Failure of an AHRS is apparent when the on-side horizon and pitch lines are removed from the ADI and a red ATT FAIL annunciator appears in the upper center of the ADI. The heading compass rose will display a HDG FAIL annunciator on the HSI. If either AHRS fail, the AHRS reversion switch on the reversionary control panel (Figure 5-14) will allow the pilot to select the remaining AHRS to provide attitude and heading information to both displays. The three-position switch is labeled 1 - AHRS NORM - 2.

ELECTRONIC DISPLAY SYSTEM (EDS)

Four electronic displays are used to provide the display formats for the Primary Flight Displays (PFDs), the Multi-Function Display (MFD) and the EICAS display in the electronic flight instrument system. The four display units are large format 8 x 7 inch, 16 color high resolution display tubes. The display units are identical and interchangeable, except for the bezel controllers attached to the front of the units. The bezel controllers for the outboard DUs are the same and the bezel controllers for the inboard DUs are the same. A display controller (two) provides the means for each pilot to control the display of the on-side PFD and to activate the EFIS test function. A display unit reversion panel, located above the PFDs, provides reversion control capability.

The display unit configuration powers up with the following displays:

DU#1 - Pilot's Primary Flight Display (PFD #1)
DU#2 - EICAS Display
DU#3 - Multi-Function Display (MFD)
DU#4 - Copilot's Primary Flight Display (PFD #2)

The above configuration can be changed using the EICAS reversion switch. This provides the ability to swap the DU #2 and DU #3 displays between EICAS and MFD as the pilots desire.

The display units require forced air circulation for cooling which is provided by two fans mounted on the rear of each DU. If a DU fan fails, a CAS will illuminate indicating DU 1, 2, 3, or DU 4 fail. If the temperature of the DU reaches approximately 120° F, a CAS will illuminate.

The following CAS illuminations are specific to the DUs:

CAS	Color	Description
DU 1-2 OVHT	Amber	#1 and/or #2 Display Unit (DU) is overheated.
DU 3-4 OVHT	Amber	#3 and/or #4 Display Unit (DU) is overheated.
DU1-2 FAN FAIL	White	#1 and/or #2 Display Unit (DU) cooling fan has failed.
DU3-4 FAN FAIL	White	#3 and/or #4 Display Unit (DU) cooling fan has failed.

PRIMARY FLIGHT DISPLAY (PFD)

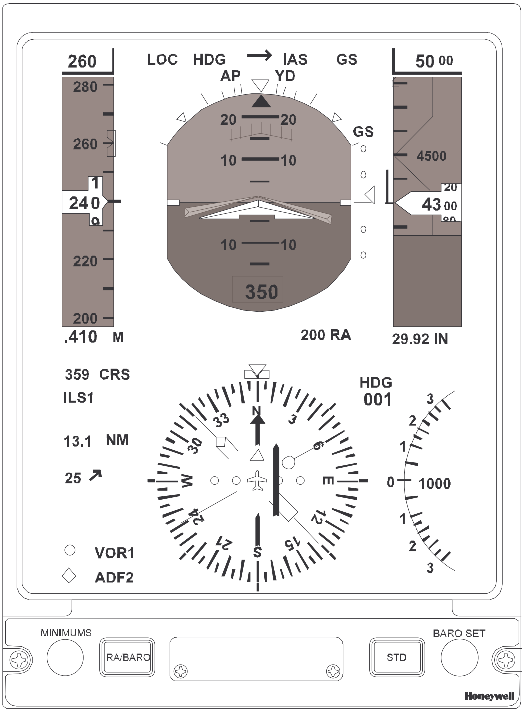
The PFD (DU #1 and DU #4) is a single display in which all of the required flight and navigation data is displayed for each pilot. The PFD (Figure 5-10) format is divided into two main sections. The top half displays an Attitude Director Indicator (ADI) with an airspeed tape to the left, and a barometric altitude tape to the right. A Horizontal Situation Indicator (HSI) is located on the lower half of the PFD. The HSI can be displayed in three different formats. The three options are full 360° compass rose (HSI), a 120° compass arc display (ARC), and a 120° map display (MAP). The MAP cannot be displayed on the PFD if the adjacent display (DU #2 or DU #3) is already displaying an MFD MAP format. Weather information can be displayed on the PFD ARC or MAP format. To the right of the HSI, a Vertical Speed Indicator (VSI) is displayed, and to the left, navigation information is annunciated.

Comparison monitors provide indications to the pilots that there is a difference between the data displayed on each PFD. This monitoring is a function within the IC-600s that compares what is being displayed on one side with either the cross-side displayed data or the secondary source data. Should data be out of tolerance between what is being reported from the source, and what is being sent to the display units, or if avionics related exceedances are detected, CAS will illuminate.

The following CAS illumination is specific to the PFDs:

CAS	Color	Description
PFD CHECK	Amber	The associated (L or R) Primary Flight Display (PFD) is displaying invalid data.

The brightness of each PFD is controlled by the DIM control on each respective display controller. Pilot's PFD (DU #1) receives 28-vdc power from the left essential avionics bus by a 15-amp circuit breaker DU 1 located in the INSTRUMENT/INDICATIONS group of the pilot's circuit breaker panel. Copilot's PFD (DU #4) receives 28-vdc from the right essential avionics bus by a 15-amp circuit breaker DU #4 located in the INSTRUMENT/INDICATIONS group of the copilot's circuit breaker panel.



PRIMARY FLIGHT DISPLAY AND BEZEL CONTROLLER
Figure 5-10

BEZEL CONTROLLERS

Many of the display control functions are controlled by the DU bezel controllers and by the menus displayed on the MFD and EICAS displays. The PFDs both use the BL-870 bezel controller located at the bottom of the PFDs. Each has two push buttons and two rotary knobs (Figure 5-10). The push buttons and rotary knobs have functions dedicated to decision height, minimum descent altitude and barometric correction.

The MFD and EICAS displays use the BL-871 bezel controllers which have six push buttons, menu keys, and a rotary knob for menu manipulation. The push buttons allow selection of functions displayed in the menus on the MFD. There are three functions that the MFD bezel push buttons provide - (1) selection of a submenu, (2) toggling the selection of a menu item and (3) selection of a variable parameter for setting. The MFD rotary knob is dedicated to the control of the map/plan range.

With weather radar selected for display, the MFD rotary knob will have no function. The EICAS bezel controller provides dedicated buttons for the displayed EICAS menu. These buttons toggle the selection of the EICAS system page displays. The EICAS rotary knob allows for scrolling of the CAS messages on the EICAS display.

MULTI-FUNCTION DISPLAY (MFD)

The MFD (normally DU #3) provides the flight crew with a means of displaying a variety of information. In its normal mode it can serve as a full time weather radar display superimposed on a 120° compass arc. There are two basic formats available on the MFD, a partial arc (Map) display, and a plan mode (North up). Like the PFD, the MFD may have flight plans composed of up to ten connected waypoints imposed on a compass card. True airspeed (TAS) provided from the ADC and ground speed (GSPD) provided from the FMS, are displayed on the MFD. Other information displayed full time include: FMS source, "TO" waypoint, distance to "TO" waypoint, time-to-go to "TO" waypoint, wind speed and direction, Static Air Temperature (SAT), and weather radar (WX) modes.

The MFD also provides a second source for access to EICAS systems pages as well as providing joystick functions. The MFD (DU #3) may serve as a backup for any other DU through pilot initiated reversionary modes.

Other information available on the MFD includes:

- TCAS mode (optional) — Controls the display of TCAS on the map presentation.
- MFD MENU — Activation of this key will enable the MFD SUB-MENU to appear.
- CHECKLIST PAGE — This key provides entry into the normal checklist procedure index page.
- SYSTEM PAGE — Selection of this key will access the systems sub-menu pages which are duplicates of the EICAS system pages.

28-vdc is provided from the right essential avionics bus by a 15-amp circuit breaker DU #3, located on the copilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).

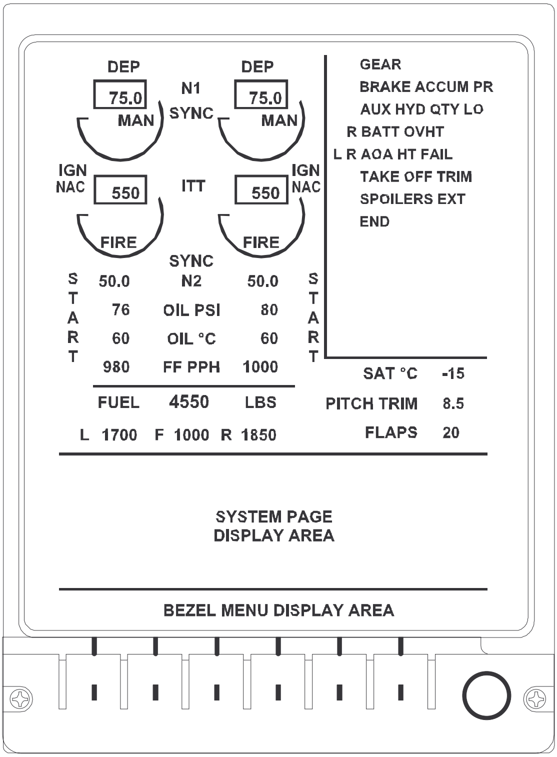
EICAS DISPLAY

The Engine Indicating and Crew Alerting System (EICAS) is an integrated digital computer/display system that replaces the majority of the traditional gauges and warning lights located throughout the cockpit. The EICAS display (Figure 5-11) is divided into four designated areas: engine instruments, CAS messages, system display pages and menu items. The EICAS also incorporates the Crew Warning Panel (CWP) which provides crew alerting by visual representation while the cockpit audio system provides the aural alerting. The Crew Alerting System (CAS) provides the crew with a visual attention getting means to alert them to a warning that requires immediate action, a caution alert that requires subsequent pilot or maintenance action, or an advisory indication that may require pilot or maintenance action at some point in time. Other airplane system parameters are displayed on the lower portion of the display via system pages and are selectable by the bezel controller at the bottom of the DU. Normally, the airplane system summary page (SUMRY on the menu) is in view, which provides brief status reports of all sub-systems. Menu selectable, a system schematic of airplane electrical, hydraulic, environmental control, flight control, and fuel systems can be individually selected for more detailed monitoring by the flight crew.

The following CAS illumination is specific to the EICAS display:

CAS	Color	Description
EICAS CHK	Amber	Available on MFD display only. EICAS wrap-around monitor.

28-vdc power is provided from the left essential bus by a 15-amp circuit breaker DU 2, located on the pilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).



EICAS DISPLAY AND BL-871 BEZEL CONTROLLER
Figure 5-11

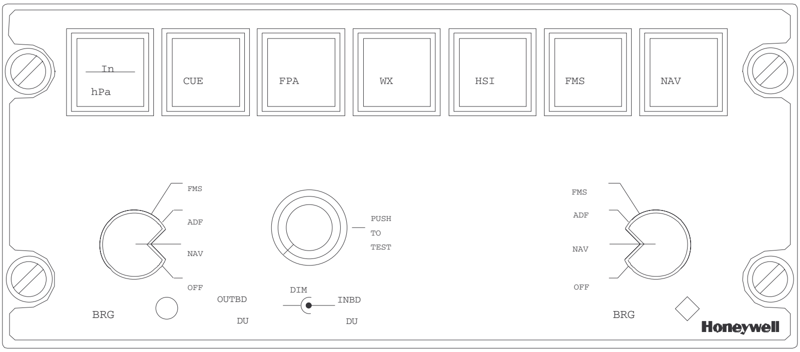
DISPLAY CONTROLLERS

The display controllers (two DC-550s), located on the glareshield, provide immediate access to and control of the objects on the PFDs. Each controller is configured with seven push buttons located on the front panel along with two rotary knobs used for reference selection for bearing source, two concentric knobs for DU dimming and a momentary push button (located inside concentric DU knob) used to initiate a system test (Figure 5-12).

The display controllers also provide a data acquisition function, collecting inputs from sources such as the bezel controllers, guidance controller, joystick, etc. The controllers pass these inputs to the corresponding IC-600 for processing.

The display controller buttons are as follows:

1. **IN/HPA** — Inches of mercury or hectopascals.
2. **CUE** — Selection of single cue or cross pointer command bars.
3. **FPA** — Controls selection and deselection of the flight path angle symbol and flight path acceleration display.
4. **WX** — Select or deselect weather radar display on the PFD.
5. **HSI** — Provides up to three different display options on the HSI.
6. **FMS** — Allows a navigation display of FMS information (alternately FMS 1 or FMS 2 if dual) to be selected for display on the PFD.
7. **NAV** — Alternately selects NAV 1 or NAV 2 as the source of NAV data on the HSI.



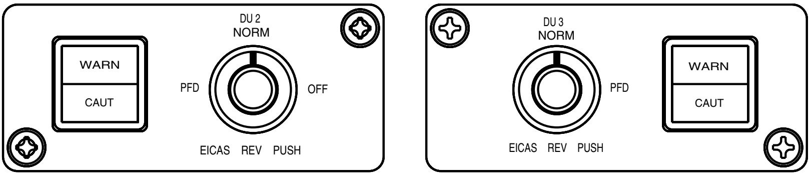
DISPLAY CONTROLLER
Figure 5-12

Each controller contains two rotary bearing source selector knobs that are used to assign the respective bearing pointers on the HSI or ARC displays to a particular navigation source.

Power for the display controllers, and the IC-600s, are from the left and right essential buses and are labeled IC/SG 1 and IC/SG 2 on the pilot's and copilot's circuit breaker panels in the INSTRUMENT/INDICATIONS group respectively.

DISPLAY UNIT REVERSION PANELS

A display unit reversion panel is located on the glareshield above the PFDs on each side of the cockpit. The panel on the pilot's side is for controlling the display on DU #2 and the panel on the copilot's side is for controlling the display on DU #3. The reversion selector knob on these panels plus the push function of the knobs allow the operators to switch the inboard DUs (DU #2 and DU #3) to display either PFD, MFD, or EICAS formats. With both reversion selector switches in NORM, an EICAS format is displayed on DU #2 and an MFD format on DU #3. Depressing the selector knob on either reversion panel flip-flops the DU #2 and DU #3 displays, reversing the MFD and EICAS display locations. Placing the reversion selector to the PFD position on either side causes the PFD format to move to the inboard display tube on that side and the outboard display to blank.



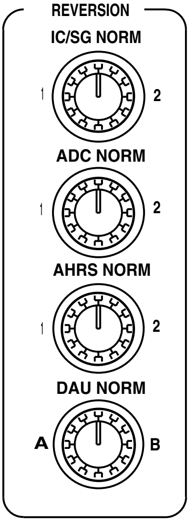
DISPLAY UNIT REVERSION PANEL
Figure 5-13

It is important to note that when selecting display unit reversion, the bezel controllers on DU #1 and DU #4 continue to work with the PFD display when it is transferred to an inboard display unit. The airplane master warning/caution lights are also located on the display unit reversion panels.

DATA ACQUISITION UNITS (DAUs)

There are two dual channel data acquisition units (DAUs) installed in the tailcone equipment area of the airplane. The DAUs receive engine and airplane systems sensor information and pass it, primarily, to the IC-600 computers. Both channels of DAU #1 provide left engine data and both channels of DAU #2 provide right engine data. For redundancy, both channels of each DAU independently convert on-side engine information to a common ARINC 429 data bus format and send it to both IC-600s. The IC-600s process the information and send it to the selected display unit (normally DU #2) for EICAS display. In addition to engine information, the DAUs also collect analog data from other airplane systems such as fuel, hydraulic and accumulator pressure, dc electrical power, flight control settings, cabin pressure settings/indications, and oxygen temperature/pressure.

A three-position DAU reversionary switch is provided on the reversionary control panel located below DU #2 (Figure 5-14). The switch positions are labeled A, DAU NORM, and B. With the switch in DAU NORM, both IC-600s use Channel A from the left DAU and Channel B from the right DAU for engine/systems displays. In the reversionary positions (A or B), each IC-600 uses only the selected channel from both DAUs.



REVERSIONARY CONTROL PANEL
Figure 5-14

If either channel of either DAU should fail, if either A or B reversion is selected, if an engine or system miscompare is detected, an appropriate CAS will illuminate.

The following CAS illuminations are specific to the DAUs:

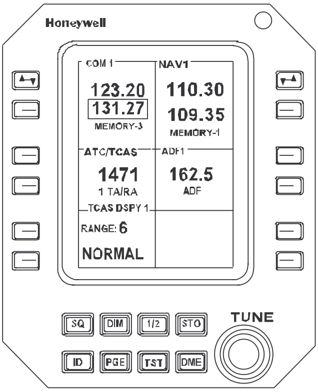
CAS	Color	Description
DAU 1A-1B FAIL	Amber	Channel A and/or B of the #1 Data Acquisition Unit (DAU) has failed.
DAU 2A-2B FAIL	Amber	Channel A and/or B of the #2 Data Acquisition Unit (DAU) has failed.
DAU A REV	White	Reversion of both Data Acquisition Units (DAUs) to Channel A is selected by the crew.
DAU B REV	White	Reversion of both Data Acquisition Units (DAUs) to Channel B is selected by the crew.
DAU ENG MISCMP	Amber	The associated (L or R) Data Acquisition Unit (DAU) has detected a miscompare between channel A and B involving an engine parameter (N_1,N_2,ITT).
DAU SYS MISCMP	Amber	The associated (L or R) Data Acquisition Unit (DAU) has detected a miscompare between channel A and B involving a system parameter (dc voltage, Emergency Bus voltage, dc amperage, Battery temperature, Main Hydraulic pressure, Brake Accumulator pressure, Oxygen temperature and pressure).
LBS/KGS CONFIG	Amber	The configuration of the integrated avionics computer is not compatible with that of the data acquisition unit (i.e., one is configured for pounds while the other for kilograms) on the ground.
LBS/KGS CONFIG	White	The configuration of the integrated avionics computer is not compatible with that of the data acquisition unit (i.e., one is configured for pounds while the other for kilograms) in flight.

The DAU circuit breakers are located in the INSTRUMENT/INDICATIONS group on each circuit breaker panel. On the left side is DAU 1 CH A and CH B, and on the right side is DAU 2 CH A and CH B. DAU 1 CH A and DAU 2 CH A are powered by the EMER BATT bus. DAU 1 CH B and DAU 2 CH B are powered by the L and R essential buses respectively.

RADIO MANAGEMENT UNITS (RMUs)

The two RM-855B Radio Management Units (RMUs) provide the central controlling functions for the entire basic radio system. Each RMU is a color, active matrix, Liquid Crystal Display (LCD) based unit. The primary function of each RMU is to select and control the frequencies and operational modes of each radio. Each RMU also provides access and storage for up to twelve pre-set channels for the VHF COM and VHF NAV functions. Cross-side operation, maintenance display, power on self-test and pilot activated self-test and optional FMS radio tuning features are also available on each RMU. Each RMU also provides backup engine and navigation display facilities in the event of EFIS/EICAS failure. Automatic presentation of engine data occurs on RMU #1 if neither IC-600 is providing EICAS data.

There are six line select keys on each side of the RMUs (Figure 5-15). The top key is referred to as a transfer button and has directional arrows on them. The remaining keys are referred to as line select keys. There are also eight function keys located at the bottom of the RMUs. The RMU main tuning page is divided into six dedicated windows. Each window groups the data associated with a particular function. The windows (COM, NAV, ATC/TCAS, ADF, and TCAS DSPY) each provide for control of both frequency and operational mode of the associated function. The RMU also has other display modes, called pages, which provide additional features and functions for the control of the radio system. The PGE function at the bottom of the RMU is used to access additional RMU pages. RMU display brightness is adjustable using the tuning knob after the DIM function key is depressed. To return the tuning knob to normal operation select any other key.



RADIO MANAGEMENT UNIT
Figure 5-15

RMUs each have a primary and a secondary power source. If the primary source is not available, the RMU will automatically switch to the secondary power source. RMU #1 primary is powered from the L essential bus, and RMU #1 secondary is powered from EMER BATT bus. RMU #2 primary is powered from R main avionics bus and the secondary from the R essential bus. RMU #1 and RMU #2 primary and secondary circuit breakers are located in the COMMUNICATIONS group on the pilot's and copilot's circuit breaker panels. RMU #2 primary is the only power source affected by the avionics master.

RMU CROSS-SIDE OPERATION

Should the pilot decide to tune the copilot's set of radios, he can push the 1/2 function key and transfer his entire RMU display and operation to the copilot's #2 system. Both RMU displays will be identical; however the pilot's RMU will show the function legends on the main tuning and memory pages in magenta to indicate that cross-control is being exercised. In addition to having access to the #2 system, the pilot still has the memory frequencies in their #1 RMU available for recall for use with the #2 system. Both pilots have this control transfer function available. It provides flexibility in crew coordinated tuning as well as a back up mode in the event one RMU becomes inoperative. The pilot may change any frequency or mode on the copilot's system using the pilot side RMU. Any changed frequency is annunciated in yellow on the copilot's RMU. The frequency will be white on the pilot's RMU. If the pilot should push the 1/2 button again, the pilot's side RMU will revert to the original display.

RMU BACKUP PAGES

Either RMU can provide two pages of backup engine and systems indication and one page for a backup navigation display. These backup displays can be selected on the PAGE MENU page of either RMU. The backup engine and systems pages can be selected by depressing the line select key adjacent to "ENGINE PG1" or "ENGINE PG2" on the PAGE MENU page. The backup navigation display is accessed by depressing the line select key adjacent to "NAVIGATION" on the PAGE MENU page.

The ENGINE PG1 and ENGINE PG2 contain information such as: ITT, O/P (oil pressure, left and right), FUEL, HYDM-B (hydraulic pressure), N1, N2, OIL ° C, FF PPH (fuel flow pounds per hour), VOLTS, EMER VOLTS, AMPS, OXY, SAT (oxygen quantity and static air temp), TRIM-PIT, AIL, and RUD (pitch, aileron and rudder trim).

The NAVIGATION page provides the following data, when valid data is available: NAV, ADF, CRS (selected course), DME (distance to tuned station), bearing pointers for VOR and ADF, TO/FROM indication, MARKER BEACONS, HEADING, lateral deviation (VOR and ILS), and vertical deviation (GS only). The navigation displays on both RMUs use AHRS#2 heading information and NAV information from NAV 1 and ADF 1.

VHF COM TUNING

Normal operation of the RMU is with the radio tuning page displayed. A section for COM is located in the upper left corner. The COM window displays two frequencies. The top line displays the active frequency of the COM, while the line below will display the preset frequency. When pressing the line select key (preset frequency) adjacent to the lower frequency, a yellow cursor encloses that frequency. This step is not always necessary since the cursor normally "parks" over the preset frequency box. Anytime the cursor has been moved to another area on the main radio tuning page, it will automatically return to the COM preset frequency after twenty seconds of inactivity on that page. When the yellow cursor is enclosing the preset frequency, that frequency can be changed by adjusting the tuning knobs. The preset frequency can then be changed (flip-flopped) with the active frequency by depressing the transfer key.

The storage function can be accomplished by pressing the STO (store) key located at the bottom of the RMU. When the STO key is depressed, the nomenclature below the preset COM frequency will change back to MEMORY, and the digit following MEMORY will indicate in which memory location the frequency is stored. With the main tuning page displayed, the rotary tuning knob can be used to scroll through the frequencies stored in memory. As each memory location (channel) is selected, the stored frequency will be shown on the COM preset line which can then be moved to the active position by depressing the transfer key.

A TX will appear at the top of the COM window when the associated radio is transmitting. Its purpose is to show that the transmitter is on and to alert the pilot in case of a stuck microphone key. If not attended to for approximately two minutes, a beep will sound on the audio and a MIC STK annunciation will appear at the top of the COM window until the mic button is released. Ten seconds after the MIC STK annunciation appears, the selected transmitter will automatically turn off. Depressing the SQ (squelch) function button at the bottom of the RMU causes the COM radio to open its squelch and allows any noise or signal present in the receiver to be heard. When selected, an SQ will appear at the top of the COM window. Pressing the button a second time closes the squelch.

FMS TUNING

The FMS interfaces with the RMUs for radio tuning. The FMS has a radio tuning page that can be used to control VHF COM, NAV, ADF and transponder codes. If it is suspected that the FMS is interfering with com/nav radio tuning, an FMS ENABLE/DISABLE selection on the RMU NAV memory page can be toggled with the adjacent line select key. The DISABLE selection will prevent tuning any of the radios through the FMS CDU.

NAV TUNING

The format of the NAV window (top right corner of the RMU) is identical to the COM window in that the top frequency is active and the bottom frequency is the preset frequency. Pressing the line select key alongside the NAV preselect window moves the cursor to that window. This connects the tuning knobs to the NAV preset frequency. By pressing the NAV transfer key (top right) the preset and active frequencies are exchanged. The preset frequency may be changed to a different frequency by using the tuning knobs or by pressing the line select key to bring up the next frequency from memory. Selection of stored frequencies can be accomplished by pressing the line select key by the NAV preset window until the tuning box encloses the memory mnemonic. Rotating the tuning knob scrolls through the stored frequencies displaying them in the preset area.

The memory functions and direct tuning operate the same as described under COM operation, except the NAV window has an added function called DME split tuning mode. Its operation is similar to the function called DME hold. Depressing the DME function key on the RMU allows the DME frequency to be tuned independent of the NAV frequency. Depressing the DME once causes the NAV window to split into two sections, the top one being the active VOR frequency and the lower one, now labeled "DME", containing the active DME frequency in VHF format. In this condition, the DME may be tuned directly by simply pressing the line select key to place the cursor box around the frequency and retuning using the tuning knobs. The DME digital station identifier will appear adjacent to the DME nomenclature on the top edge of the DME window. An amber H (hold) appears in the lower DME window. This indicates that the distance display (DME or TACAN) is not paired with the VOR/ILS navigation data. When the H is displayed on the RMU, it will also be displayed following the DME read-out on the PFD.

ADF TUNING

ADF operation is the same as COM and NAV tuning in that depressing the line select key beside the ADF frequency will place the cursor over the frequency to be changed. Rotating the small tuning knob slowly will advance the frequency in 0.5 kHz steps. This change will increase to 10 kHz steps when the large knob is used. The RMU has the capacity to store one ADF frequency in memory. This is done by selecting the desired frequency, then depressing the STO function key at the bottom of the RMU. To retrieve the stored frequency from memory, the frequency line select key must be depressed for two seconds. ADF modes are also controlled within the ADF window. Repetitively depressing the line select key adjacent to the ADF mode annunciator will step through the available ADF modes of operation. This can also be accomplished by placing the cursor over the mode annunciation, and using the tuning knobs to step up or down through the available modes.

The ADF operating modes are as follows:

(1) ANT (Antenna) — ADF audio signal only.
(2) ADF — ADF receives signal and calculates the relative bearing to the station.
(3) BFO (Beat Frequency Oscillator) — ADF adds a beat frequency oscillator to detect continuous wave (CW) signals.
(4) Voice — ADF has maximum audio clarity and fidelity, but no bearing information.

TRANSPONDER/TCAS TUNING

Transponder operation is similar to COM and NAV operation in that depressing a line select key beside the function desired will move the cursor to that location. Those aircraft without TCAS installed will have an ATC legend at the top of the transponder window, and those equipped with TCAS will have ATC/TCAS labeled above the window. Either transponder 1 or 2 can be selected for use and controlled by either RMU. A number 1 or 2 will appear in front of the transponder mode in the ATC window on both RMUs indicating which transponder has been selected. Transponder side selection is toggled by depressing the 1/2 key on either RMU with the cursor anywhere within the ATC window.

The transponder is switched from standby to an operating mode by depressing the line select key adjacent to the mode line. Once the cursor has been selected, the mode line select key acts as a toggle to switch the transponder between the standby mode and the active mode. Once the transponder is in the ALT ON mode, the mode of operation is changed using the tuning knobs. The active mode of operation can now be changed by rotating the concentric tuning knobs. Depressing the ID button of the RMU will initiate an approximate 18 second IDENT mode on the transponder. This will also illuminate an ID annunciation along the top edge of the transponder window. A reply annunciator is located in the upper right corner of the ATC window.

HF TUNING (KHF 1050 Only)

The format of the HF window (bottom right corner of the RMU) when in simplex preset tune mode is similar to the COM window, in that the top frequency is the active frequency and the bottom frequency is the preset frequency. By pressing the line select key alongside the HF active frequency, the preset and active frequencies are exchanged. Pressing the line select key alongside the HF preset frequency places the cursor around the preset frequency. The preset frequency may be changed to a different frequency using the tuning knobs.

There are 12 memory locations for preset frequencies. The preset frequencies are stored and recalled from the HF Memory or Control pages.

To change to simplex direct tune mode, press and hold the line select key alongside the HF preset frequency until the cursor is around the HF active frequency and the HF preset frequency is removed. The active frequency may be changed to a different frequency using the tuning knobs. To change to simplex preset tune mode, press and hold the line select key alongside the blank HF preset frequency display until the preset frequency appears.

The HF window has the following additional modes: Split Mode (Half-Duplex), Emergency Mode, and ITU Mode. These modes are accessed from the HF Control page along with the Squelch, Emission Mode and Transmit Power Level Controls.

The Split Mode (Half-Duplex) displays a separate frequency for receive (RX) and transmit (TX). Pressing the RX or TX line select key places the cursor around that frequency, and the TUNE knobs are used to change the frequency.

The Emergency Mode displays the emergency channel or an emergency channel frequency preview. Pressing the either HF line select key places the cursor around the emergency channel, and the TUNE knobs are used to change the channel. Pressing and holding either HF line select key will shift to the preview display. When the line select key is released, the HF window reverts back to the emergency channel display.

The ITU Mode displays the active ITU channel or an ITU channel frequency preview. Pressing either HF line select key places the cursor around the ITU channel, and the TUNE knobs are used to change the channel. Pressing and holding either HF line select key will shift to the preview display. When the line select key is released, the HF window reverts back to the ITU channel display.

HF Operation (KHF 1050 Only)

There are three pages that control the HF system functions. They are accessed from the page menu.

Radio Tuning Page — Controls HF channel/frequency.
HF Control Page — Expanded control of HF functions.
HF Memory Page — Manages the 12-channel non-volatile memory.

Page Menu

Radio Tuning Page

The HF window is the lower right-hand corner of the radio tuning page.

Radio Tuning Page

TUNE Knobs Function

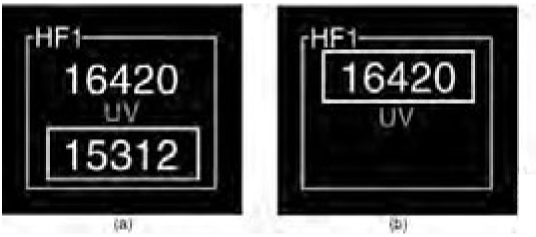
The function of the TUNE knobs varies, depending on the information that is inside the cursor.

- **FREQUENCY** — The inner knob controls the last two digits of the frequency readout. The outer knob controls the remaining digits.
- **ITU CHANNEL** — The inner knob controls the last two digits of the ITU channel. The outer knob controls the remaining.
- **EMERGENCY CHANNEL** — Both knobs control the emergency channel.

HF Window - Simplex Mode

The HF window simplex mode has two displays as follows:

- The preset (a)
- The direct tune (b).



Simplex Mode Displays

Preset Tune Mode

- When the cursor is not in the HF window, pushing the line select key adjacent to the preset frequency positions the cursor around the preset frequency, and the TUNE knobs can be used to change the frequency.
- Pushing the line select key adjacent to the active frequency switches the active frequency and the preset frequency.
- Pushing and holding the line select key adjacent to the preset frequency for more than 2 seconds switches the HF window to direct tune mode and removes the preset readout.

Direct Tune Mode

- When the cursor is not in the HF window, momentarily pushing either of the line select keys adjacent to the HF window positions the cursor around the active frequency so it can be tuned using the TUNE knobs.
- Pushing and holding the line select key adjacent to the blank preset frequency display for more than 2 seconds switches the HF window back to preset tune mode with the cursor around the preset frequency.

HF Window - Split Mode (Half-Duplex)

The split mode HF window has the following annunciators:

- Receive label (RX), frequency, and mode
- Transmit label (TX), frequency, and mode.

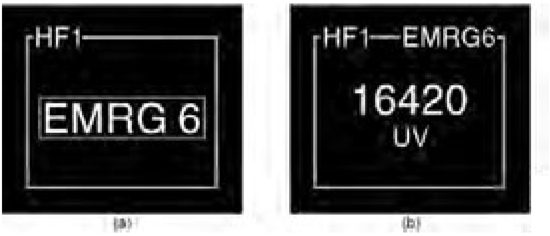
Split Mode (Half Duplex) Display

Both channels are tuned in a similar manner. Pushing the RX line select key or the TX line select key places the cursor around the associated frequency, and the TUNE knobs are used to change the frequency.

HF Window - Emergency Mode

The HF window emergency mode has two displays as follows:

- The active emergency channel (a)
- The emergency channel frequency preview (b).

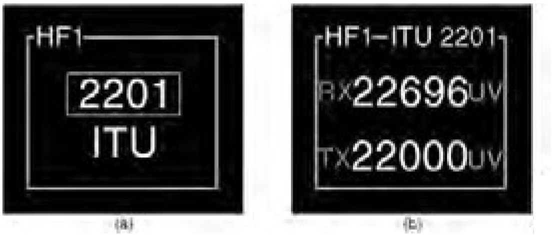


Emergency Mode Displays

When the cursor is not in the HF window, the first push of either HF line select keys positions the cursor around the emergency channel so the TUNE knobs can be used to tune the channel. When the cursor is in the HF window, pushing and holding either of the HF line select keys changes the HF window to the emergency preview mode. In the preview mode, the emergency channel annunciator replaces the HF status annunciator, and the HF window displays the emergency channel frequency and transmit mode. When the line select key is released, the HF window reverts back to the emergency mode display with the cursor around the emergency channel.

HF Window - ITU Mode

The HF window ITU mode has two displays as follows:
- The active ITU channel (a)
- The ITU channel frequency preview (b).



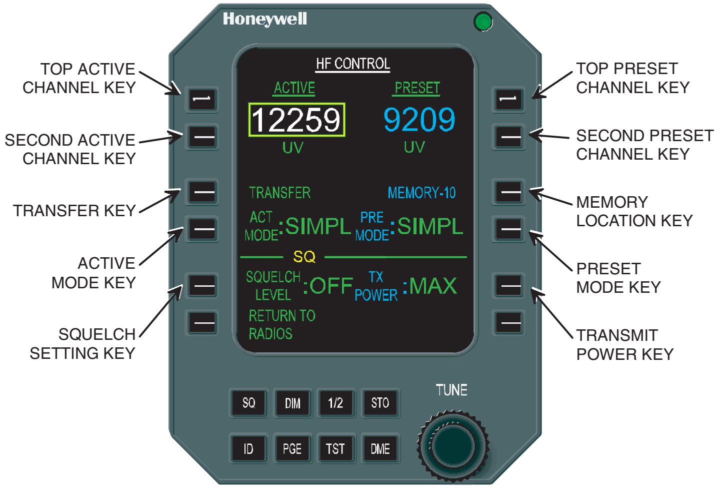
ITU Mode Displays

When the cursor is not in the HF window, the first push of either HF line select key positions the cursor around the ITU channel so the TUNE knobs can be used to tune the channel. When the cursor is in the HF window, pushing and holding either HF line select key changes the HF window to the ITU preview mode. In the preview mode, the ITU channel annunciator replaces the HF status annunciator, and the HF window displays the ITU channel frequencies and transmit mode. When the line select key is released, the HF window reverts back to the ITU mode display with the cursor box around the ITU channel.

HF Control Page

The HF control page is accessed from the page menu. The active channel window is on the left side of the page, and the preset channel window is on the right side of the page.

The HF control page is used to control the following functions:
- Active and preset channel tuning
- Memory channel recall and store
- HF squelch control and adjustment
- Transmitter power level adjustment.



HF Control Page

STO (Store) Function Key — Stores the information in the preset channel into the selected memory location.

TUNE Knobs Function

The function of the TUNE knobs is the same as on the Radio tuning Page with the following additional functions:

- **Cursor around memory location**— Scrolls thru memory locations.
- **Cursor around emission mode**— Scrolls thru emission modes.

Left Line Select Keys

Top Active Channel Key:

- SIMPLEX MODE — Positions the cursor box around the active frequency.
- SPLIT MODE — If the cursor box is elsewhere, the first push of this key positions the cursor box around the active RX frequency.
  When the cursor box is around the active RX frequency, each push of this key toggles the cursor box between the active RX frequency and the active RX emission mode.
- EMERGENCY MODE — Functions same as on Radio Tuning Page.
- ITU MODE — Functions same as on Radio Tuning Page.

Second Active Channel Key:

- SIMPLEX MODE — If the cursor box is elsewhere, the first push positions the cursor box around the active emission mode. When the cursor box is around the active emission mode, subsequent pushes scroll thru the different emission modes.
- SPLIT MODE — If the cursor box is elsewhere, the first push positions the cursor box around the active TX frequency. When the cursor box is around the active TX frequency, subsequent pushes toggle the cursor box between the active TX frequency and the active TX emission mode.
- EMERGENCY MODE — Functions same as on Radio Tuning Page.
- ITU MODE — Functions same as on Radio Tuning Page.

Transfer Key — Switches active frequency and preset frequency. After information has been switched, the memory location annunciator will show TEMP. To save the information in the preset field to a memory location, push the STO function key.

Active Mode Key — Changes active mode in the following sequence: SIMPL, SPLIT, EMRG, ITU, SIMPL. The tune mode selection is green after a local tune and yellow after a remote tune.

Squelch Setting Key — Opens and Closes the squelch and changes the available settings (MIN, MED, MAX).

Return to Radios Key — Changes to the Radio Tuning Page.

Right Line Select Keys

Top Preset Channel Key — Operates the same as the top active channel key except on the preset channel.

Second Preset Channel Key — Operates the same as the second active channel key except on the preset channel.

Memory Location Key — Positions the cursor box around the Memory location Annunciator. To scroll thru the memory locations, rotate either tuning knob. When any change has been made to the preset channel the memory location annunciator shows TEMP.

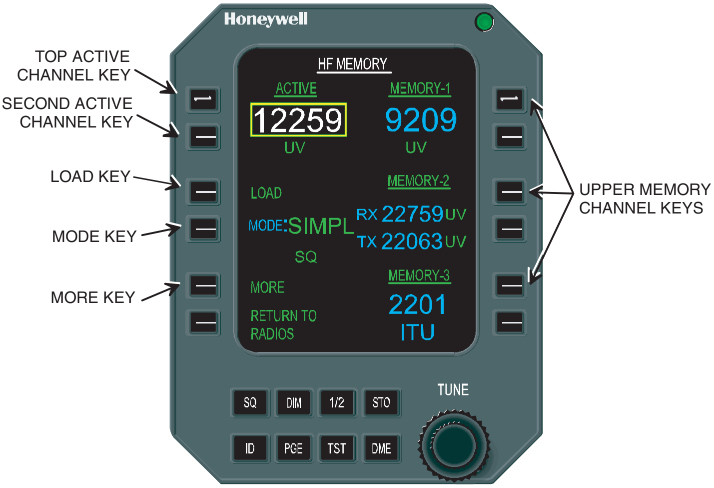
Preset Mode Key — Changes the preset channel mode.

Transmit Power Key — Changes the transmit power level settings (MIN is 50 W, MED is 100 W, MAX is 200 W).

Bottom Right Key — Not used.

HF Memory Page

The HF memory page is accessed from the page menu. The active channel window is on the left side of the page, and the memory channel window is on the right side of the page.



HF Memory Page

Line Select Keys

Top Active Channel Key — Operates the same as the top active channel key on the HF control page.

Second Active Channel Key — Operates the same as the second active channel key on the HF control page.

Load Key — Loads the information from the memory location selected by the cursor box into the active channel.

Mode Key — Changes the mode for the channel that is selected by the cursor box.

More Key — Toggles the memory window through the 12 memory locations, displaying three memory locations at one time.

Return to Radios Key — Changes to the Radio Tuning Page.

Upper Memory Channel Keys — Operates the same as the top active channel key on the HF control page.

Lower Memory Channel Keys — Operates the same as the second active channel key on the HF control page.

HF System Operating Practices (KHF 1050 Only)

Preflight Checks

As power is applied to the system the HF system conducts a brief automatic self-test. A more thorough pilot-activated self-test can be conducted on the HF system at any time except when transmitting.

Dual HF System Operation

In dual HF system installations, both HF radios operate independently except that they share a common antenna. When one radio is keyed, the other radio is completely disconnected from the antenna and both reception and transmission is inhibited. The radio that is not transmitting annunciates **TX INH** to indicate that transmission is not possible. At the completion of the transmission, reception and transmission on the other system is possible.

Antenna Coupler Tuning

When a new frequency is selected, momentarily press the push-to-talk button to tune the antenna coupler. During the tuning process a steady 1000Hz tune tone will be heard. Typically the antenna coupler will find a tune in less than 10 seconds. When tune tone ends, the antenna tuning is complete.

When the antenna coupler is unable to tune to the selected frequency within 30 seconds, the tune tone will sound intermittently. Press the push-to-talk button once to clear the tune fault. Press the push-to-talk button again to initiate another tune attempt. (Up to three tuning attempts should be made to tune the antenna.) Failure of a third tuning cycle usually indicates a system problem. (The tune fault may also be cleared by selecting a different frequency.)

TCAS

The Traffic Alert and Collision Avoidance System (TCAS) provides the crew with aural and visual indications of potentially dangerous flight paths relative to other aircraft in the vicinity. The system uses the transponder to interrogate other transponder-equipped aircraft and determine their bearing, range, and altitude, if the intruder has an altitude encoding transponder in operation. Advisories are issued to the crew via the airplane Primary Flight Displays (PFDs), audio system and Multi-Function Displays (MFDs) (traffic map). Two levels of TCAS are in use today, TCAS I and TCAS II. TCAS II is the same as TCAS I with the exception of providing Resolution Advisories (RAs) integrated with the vertical speed indicator on the PFDs and additional aural commands through the audio system. There is no RA display on TCAS I equipped aircraft. The TCAS system consists of a processor, two bearing antennas, and associated airplane wiring. System control is through the radio management units. Power for the TCAS system operation is 28-vdc supplied through the 5-amp TCAS circuit breaker located on the copilot's circuit breaker panel (INSTRUMENT/INDICATIONS group).

TCAS OPERATION

The Learjet 45 may be equipped with either the optional TCAS I or TCAS II system. The controls and displays are integrated with the Honeywell Primus 1000 system. Controls are through the RMUs and TCAS/annunciator displays are on the MFD and PFDs. On airplanes equipped with TCAS II, the Resolution Advisories (RA) are integrated with the vertical speed indicator display on the PFDs. The TCAS interrogates other aircraft transponders and analyzes the replies to determine range and bearing of the intruder. In addition, if the intruder's transponder is reporting altitude, the relative altitude is also determined. If the system predicts that safe boundaries may be violated, the system issues a Traffic Advisory (TA) which is displayed on the MFD. Should the TCAS II processor determine that a possible collision exists, it issues visual and audio advisories to the crew to initiate appropriate vertical avoidance maneuvers.

If an aircraft has a transponder, but does not have altitude reporting, the TCAS will depict it on the TA display, but without the altitude information tag, and without the capability of providing evasive commands. TCAS II is capable of generating a TA display of traffic from Mode A transponder-equipped aircraft, and it is also capable of generating RA signals to avoid Mode C-equipped aircraft. For similar Mode S-equipped aircraft, the airplane's TCAS II system coordinates evasive maneuvers for both aircraft. TCAS I can process transponder information from other aircraft equipped with Mode A, C, or S transponders, but does not receive altitude information to compute or coordinate a Resolution Advisory (RA). If the depicted traffic is reporting altitude and is climbing or descending at a rate of at least 500 feet per minute, a trend arrow is displayed beside the traffic symbol indicating that the aircraft is climbing or descending. If the intruder is not reporting altitude, the traffic symbol appears without an altitude tag or trend arrow. The RA displays are incorporated into the vertical speed indicator on the PFDs. Green FLY-TO zones and red NO-FLY zones are placed on the vertical speed arc by the TCAS for collision avoidance. The zones are not displayed on the arc until the TCAS detects an RA intruder and computes the collision avoidance data. Synthesized voice commands and announcements are issued by the TCAS over the airplane audio system.

SYSTEM CONTROLS AND DISPLAYS

Selection of the TA or TA/RA (TCAS II) modes is accomplished through the transponder window on either RMU main radio tuning page. After the cursor is placed over the transponder mode line, the desired mode is selected with the RMU tuning knob. The transponder selection options for TCAS I equipped aircraft will be STANDBY, ATC ON, ATC ALT and TA. Selections available with TCAS II include the same as TCAS I plus TA/RA. The selected TCAS mode will be annunciated in the top left corner of the TCAS display. The auto or manual mode can be selected on the ATC/TCAS CONTROL PAGE of the RMU. This page is accessed through the RMU PAGE MENU page. When AUTO is selected, traffic targets display only when a TA or RA target condition exists. When manual is selected, all traffic targets within the viewing airspace are displayed. In either the MAP or PLAN format display, the TCAS TA display is selected by pushing the TCAS menu key on the MFD Main Menu bezel controller. If the TCAS triggers an RA, and TCAS display is selected OFF, the main menu is activated on the MFD. This allows flight crew selection of TA displays with a single button push. This display is in addition to the resolution advisory on the VSI display on the PFD (TCAS II only).

TRAFFIC DISPLAY SYMBOLS

TCAS I will display three different traffic symbols and TCAS II four with the addition of Resolution Advisories (RA). The type of symbol selected by TCAS is based on the intruder's location and closing rate. The symbols change shape and color to represent increasing levels of urgency. The traffic symbols may also have an associated altitude tag which shows relative altitude in hundreds of feet, indicating whether the intruder is climbing, flying level or descending. A + sign and number above the symbol means the intruder is above your altitude. A - sign and number beneath indicates it is below your altitude. A trend arrow appears when the intruder's vertical rate is 500 feet per minute or greater. The symbology displayed on the PFDs and MFD is as follows:

(1) **NON-THREAT ADVISORY (OA) TRAFFIC** — An open cyan diamond indicates that an intruder's relative altitude is greater than ± 1200 feet, or its distance is beyond 6 nm range. It is not yet considered a threat.

(2) **PROXIMITY INTRUDER (PA) TRAFFIC** — A filled cyan diamond indicates that the intruding aircraft is within ± 1200 feet and within 6 nm range, but is still not considered a threat.

(0) **TRAFFIC ADVISORY (TA) TRAFFIC —** A symbol change to a filled amber circle indicates that the intruding aircraft is considered to be potentially hazardous. Depending on your own altitude TCAS II will display a TA when time to closest point of approach (CPA) is between 20 and 48 seconds. An advisory voice message "TRAFFIC, TRAFFIC" may be heard through the audio system.

(1) **RESOLUTION ADVISORY (RA) (TCAS II only) —** A solid red square indicates that the intruding aircraft is projected to be a collision threat. TCAS II calculates that the intruder has reached a point where a resolution advisory is necessary. The time to closest approach with the intruder is now between 15 and 35 seconds, depending on your altitude. The symbol appears with an audio warning and a vertical maneuver indication on the PFD VSI.

ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS)

EGPWS is shown on the MFD by pushing the EGPWS menu button on the MFD main menu. When TERRAIN is selected for display, the EGPWS sends the terrain data directly to the MFD display unit via the WX picture bus and replaces the WX display with terrain information.

If a potential terrain hazard is sensed by the EGPWS, terrain data automatically pops up on the MAP. This "pop-up" mode defaults to the 10 NM range. EGPWS annunciators are described in the table below and are displayed in the upper left corner of the MFD.

Annunciator	Description
TERR INHB or TERR INHIB (inhibit)	TERRAIN displays and aurals associated with terrain are inhibited (annunciation in white)
TERR FAIL	The TAWS is inoperative.
TERR TEST	EGPWS is in test mode.
TERR N/A	TERRAIN map not available.
TERR	TERRAIN map selected for display.

The terrain data is displayed above the airplane symbol on the MFD in green, yellow, and red colors that define the elevation of the terrain relative to the airplane's current altitude. Terrain that is more than 2000 feet below the airplane is not included in the display.

A moving marker scrolls across the bottom of the EGPWS display as an indication that the terrain is display is operational.

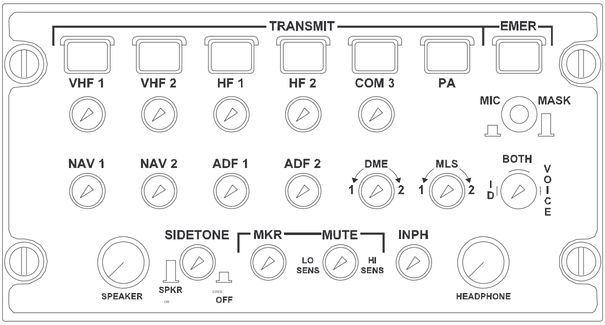
AUDIO CONTROL SYSTEM

The pilot's and copilot's digital audio control panels are located outboard of the PFDs on each side of the flight deck. Microphone transmit selector buttons are located in a row along the top edge of this panel (Figure 5-16). For night flying operations, the microphone selector buttons are annunciated with a lighted bar on the switch indicating the selected microphone. When these latching buttons are pushed, they connect the microphone (hand-held microphone, boom microphone, or oxygen mask microphone) to the selected radio. They simultaneously enable the audio associated with that radio, regardless of the setting on the audio on/off buttons located below these microphone transmit selector buttons. The microphones selector buttons are mechanically interlocked so that each new selection automatically deselects the previous selection. Depressing the PA button connects the on-side microphone to the passenger address amplifier. The audio level for the PA is automatically adjusted for conditions and cannot be adjusted by the crew. The pilot will use either a hand-held microphone or boom microphone for transmissions. Oxygen mask microphones are used when the MIC/MASK selector is in the extended (unlatched) position.

An EMER switch is located in the upper right corner of each audio control panel. When the EMER switch is depressed, the microphone and audio reception is connected directly to VHF 1 and NAV 1 and all functions of the audio control panel are bypassed except the headphone volume. In order to receive NAV 1 audio with EMER selected, the NAV AUDIO switch on the clearance delivery radio must be selected ON. When EMER is selected on the audio control panel and power is available to the control units, COM and NAV frequencies are set using either RMU or the clearance delivery radio. If EMER is selected and electrical power is still available to the audio panel, system warning audios will still be available through the cockpit speaker and audio will be routed to the cockpit voice recorder. Regardless of whether power is lost to the audio control panel, the EMER switch is operational, however, system warning audio and audio to the cockpit voice recorder are inoperative.

The audio source selector controls are located on the lower rows of the audio control panel. When these push-on/push-off switches are latched (in position) audio is turned off from that receiver. When unlatched (out position), the audio associated with that button is connected to the headphone and also to the speaker, if it is selected on. The audio level can be adjusted by rotating the button, counterclockwise to decrease, and clockwise to increase the volume.

One knob, labeled DME, controls the audio reception for both DME 1 and DME 2. When the DME knob is unlatched (out position) and the arrow on the knob is centered straight up, the audio level is at a minimum. Rotating the control knob in either direction toward 1 or 2 will increase the volume for that corresponding channel only. The audio level pointers on the knobs are displayed for night flight. There are separate controls for speaker volume and headphone volume which adjust the volume level for all audio buttons selected. The speaker push-on/push-off selector is combined with the sidetone knob. When the speaker switch is extended, it turns on audio to the on-side speaker. The speaker sidetone audio is controlled by the speaker SIDETONE volume control and the SPEAKER volume control for both on-side and off-side transmit conditions.



DIGITAL AUDIO CONTROL PANEL
Figure 5-16

The ID/BOTH/VOICE switch is located on the right side of the audio panel. In the ID position, the VOR and ADF audio is filtered to enhance the Morse Code identification and eliminate the voice signal. In the VOICE position, the ident audio is filtered to pass the voice content only and in the BOTH position, voice and ident signals will be heard simultaneously.

The controls for the marker beacon receiver are located at the bottom of the audio panel. They include the marker audio volume control (MKR), marker sensitivity control (LO SENS/HI SENS) and marker mute control (MUTE). The sensitivity is controlled by the rotation of the MUTE control. If either audio panel MKR sensitivity control is set LO, then both MKR receivers are set to LO, regardless of the position of the other audio panel controls. Either pilot can temporarily mute the marker beaconreceiver by depressing the MUTE/HI/LO switch.

The INPH (interphone) volume control adjusts the on-side headset audio level when the interphone function is used. The interphone operates on a "hot microphone" basis. The interphone is not available over the cockpit speaker except when the oxygen mask audio is selected. The MIC/MASK control allows for microphone audio switching between the boom/hand-held microphone (MIC) and the oxygen mask microphone (MASK). When the switch is latched (depressed position), MIC is selected and when the switch is unlatched (out position), MASK is selected.

The MASK intercom feature provides interphone audio to the on-side cockpit speaker. Audio is available regardless of the SPKR ON/OFF button position. Selecting INPH allows adjustable volume control of the off-side MASK intercom on the speaker.

Warning system audio signals are input to the audio panel for dissemination to the flight crew over the headphones and speaker. The audio output from the headphone, speaker, and microphone are recorded by the Cockpit Voice Recorder (CVR). The CVR microphone is the input for the AGC circuit and if the CVR microphone becomes disabled, or the CVR circuit breaker is pulled, then the aural warnings will be at the fixed HIGH volume level. If the Crew Warning Panel (CWP) has detected a fault in any one of the audio output channels, or in the Automatic Gain Control (AGC) input, a CAS annunciation will be posted.

The following CAS illuminations are specific to the Crew Warning Panel audio:

CAS	Color	Description
WARN AUDIO	Amber	The audio function of the Crew Warning Panel (CWP) has failed.
WARN AUDIO	White	• A Crew Warning Panel (CWP) audio output channel fault is detected. or • A problem exists with the Automatic Gain Control (AGC).

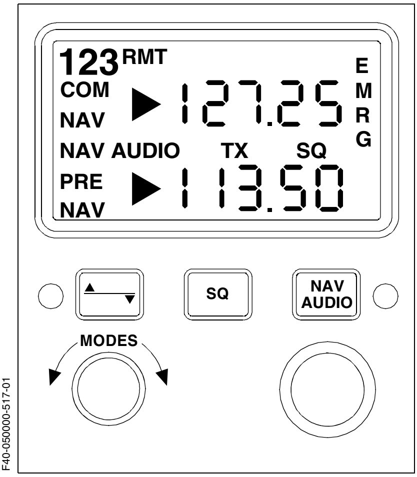
The pilot's audio panel receives 28-vdc from the left essential bus and is protected by a 3-amp circuit breaker labeled AUDIO 1/CLR DLY on the pilot's circuit breaker panel (AVIONICS [COMMUNICATIONS] group). The copilot's audio panel receives 28-vdc from the right essential bus and is protected by a 3-amp circuit breaker labeled AUDIO 2 on the copilot's circuit breaker panel (AVIONICS [COMMUNICATIONS] group). The passenger address amplifier receives power from the left essential bus and is protected by the CABIN PA 5-amp circuit breaker on the pilot's circuit breaker panel (AVIONICS [COMMUNICAIONS] group).

CLEARANCE DELIVERY RADIO (CDR)

The Clearance Delivery Radio (CDR), Figure 5-17, is located on the right, front corner of the center pedestal. The CDR provides an alternative capability for tuning the VHF COM 1 transceiver and the VHF NAV 1 radio. The CDR will tune the VHF COM radio prior to applying electrical power to the airplane. The CDR control head is normally powered by the left essential bus through the AUDIO 1 circuit breaker; however, it and other communication related equipment can be powered from the right forward hot bus, prior to applying electrical power to the aircraft.

With airplane batteries OFF, depressing the momentary action RADIO CTL HOT BUS switch on the center pedestal applies power from the right hot bus to the left audio control panel, CDR control panel, COM section of the integrated communications unit, and NAV section of the integrated navigation unit. The display on the CDR is liquid crystal type with white letters on a black background. The push button, display, and control identifier legend are on a black background displayed with electroluminescent lighting.

In the emergency mode, RMU and FMS tuning capabilities are inhibited and the COM and NAV units are tuned exclusively by the CDR. An AUX ON caption replaces the NB or WB annunciators on the RMUs to indicate that tuning through the RMUs is inhibited. Tuning through the CDR is no different when EMRG is selected, but the CDR does not look at the radio bus data to check the echoed frequency.



CLEARANCE DELIVERY RADIO
Figure 5-17

The CDR controls are as follows:

- **Transfer Key —** Alternately selects either the COM (top) or NAV (bottom) frequency to be connected to the tuning knobs.

- **Tuning Knobs —** Used to change the frequency indicated by the tuning cursor.

- **Normal/Emergency Mode Switch —** This rotary knob provides alternate selection of Normal and Emergency modes.

- **NAV AUDIO On/Off Switch —** This alternate action push button switch is used to toggle NAV audio ON or OFF when in the EMER audio mode on the audio control panel.

- **Squelch (SQ) Switch —** Used to toggle COM squelch on or off.

FLIGHT GUIDANCE CONTROL SYSTEM

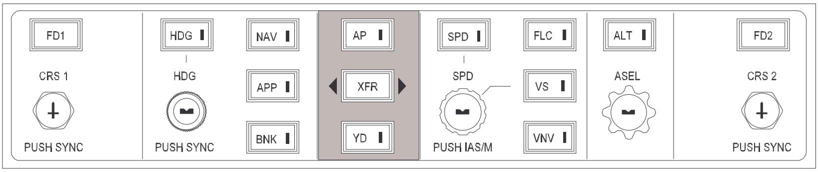
The Primus 1000 system includes an autopilot, yaw damper and dual synchronized flight directors. These are all co-located in two IC-600 display flight guidance computers located in the nose avionics bay. Each IC-600 houses a flight director; however, only the copilot IC-600 is connected to the pitch, roll and yaw servos for the autopilot/yaw damper and rudder boost functions. A flight guidance controller, located in the center of the glareshield, provides the means of engaging the autopilot/yaw damper and controlling both Flight Director (FD) systems. It also contains a transfer (XFR) switch that allows the crew to select either the left or right flight director as master and for autopilot coupling. The autopilot is a single channel with a fail passive design. The monitor system provides for automatic disconnect in the event of a malfunction in autopilot, yaw damper, or rudder boost. All automatic disconnects, which result from monitor trips, will be stored in a non-volatile memory for later recall by technicians.

FLIGHT DIRECTOR

The flight director system, utilizing two separate IC-600 computers, provides dual flight director computations, either of which can be coupled to the autopilot. Only one flight director can be coupled to the autopilot at a time. In this case the coupled flight director is classified as the master flight director, and the other flight director is classified as the slave flight director. The flight director can couple to Short Range Navigation (SRN) units (e.g. VOR, ILS), dependent upon which SRN is being displayed as a NAV data source on the Primary Flight Display (PFD). The flight director will use the displayed SRN data on the associated PFD for command-bar control computations. The flight director can be coupled to optional Long-Range Navigation (LRN) units (e.g. flight management system) if it is installed and selected as the NAV data source and displayed on the associated PFD. The flight director utilizes the lateral and/or vertical steering commands from the LRN in the command control computations. Each flight director uses the displayed on-side Air Data Computer (ADC) data for all vertical modes and gain programing. The flight director modes are synchronized in a manner that allows selection of the modes to be accomplished by the single set of FD mode select buttons on the flight guidance controller (FGC), see Figure 5-18. The FD mode select buttons on the FGC panel are momentary action and each has a vertical green bar that illuminates whenever the mode is selected.

FLIGHT GUIDANCE CONTROLLER (FGC)

The Flight Guidance Controller (Figure 5-18) is the prime controller for the flight director and the autopilot/yaw damper. Located on the center glareshield, the FGC provides the means, via push button switches, for flight director mode selection, couple status and autopilot/yaw damper engage selection. Flight director modes engage status is indicated to the crew via a green light on the right edge of each mode switch, which is illuminated when the mode is active and extinguished when the mode is inactive or dropped. The controller also has several rotary controls enabling selection of IAS, MACH, and VS targets, altitude, course and heading. All push button selections are signaled to both IC-600s via a discrete output from the FGC. The IC-600s then provide the drive to illuminate the appropriate light on the FGC.



FLIGHT GUIDANCE CONTROLLER
Figure 5-18

The FGC annunciations and controls are as follows;

FD 1/2 buttons — The flight director buttons (FD 1 and FD 2) are located on the upper left/right corners of the flight guidance controller. Depressing these buttons alone will not bring the FD command bars into view. Any FD mode selection causes the FD command bars to appear on both PFDs. When the FD command bars are in view on both PFDs and the autopilot is not engaged, depressing the master side FD button will disengage all FD modes and remove the command bars from both sides. Pressing the slave side FD button will remove the command bars from the PFD on that side acting as a flight director clear function.With the autopilot engaged, the FD command bars will be in view at all times on the coupled side and cannot be removed from the PFD. The opposite side FD command bars can be removed from view by depressing the appropriate FD 1 or FD 2 button.

Course set knobs — A course set knob (CRS 1 and CRS 2) is located at each end of the FGC. These knobs are used to individually set the courses on the left and right PFD HSI displays. They are used primarily to set the course for a VOR radial or LOC course. The course knobs have a push button in the center to synchronize the display to the aircraft's "direct-to" course.

Heading set knobs — Heading is selected via a rotary knob, with a "Heading Bug" symbol on the face of the knob. The heading knob controls the heading bug and digital display on both PFDs and the bug on the MFD MAP display. Depressing the HDG knob will synchronize the HDG bug on all display units to the aircraft's current heading.

HDG (heading) button — Depressing the HDG button engages the heading mode and displays a green HDG annunciation on the PFDs. The flight director command bars will command a turn in the direction the heading bug was moved to achieve the set heading. Heading select is used to maintain a magnetic heading. The heading bug is positioned to the desired heading on the HSI using the HDG knob on the FGC. The heading select mode is canceled when any armed lateral mode captures or if GA is selected.

NAV (navigation) button — Pressing the NAV button alternately selects and deselects the navigation mode. The NAV mode is normally used to intercept route segments identified with VOR radials and to intercept and fly desired FMS tracks (SIDs, routes, holding and STARS).

APP (approach) button — The intended function of the APP mode is that APP be used for all approaches, regardless of nav source or whether a vertical mode is also associated with the approach. The APP mode is normally used to select lateral and vertical steering for ILS and FMS. The VOR approach mode is selected by pressing the APP mode button with the navigation receiver tuned to a VOR frequency and selected as the active nav source. Pressing the APP button arms both localizer and glideslope modes when the navigation receiver is tuned to an ILS frequency and ILS is selected as the active navigation source. Selection of APP mode when the nav source is FMS engages the FMS lateral mode the same as described for NAV and also arms VNAV for approach.

BNK (bank) button — Pressing this button alternately selects or deselects a reduced maximum bank angle of 14° (for all lateral modes, except roll) on both FDs. When selected, a green low bank arc appears on the top of the ADIs and BNK is annunciated on the PFD.

AP (autopilot) button — Depressing this button engages the autopilot. Depressing a second time disengages the autopilot.

XFR (transfer) button — Located in the center section of the FGC. The XFR button is used to select the desired flight director (left or right) to command the autopilot.

YD (yaw damper) button — Depressing this button engages yaw damper. The YD can be engaged independent of the AP, but the autopilot system will not engage, or remain engaged, without the YD.

SPD (speed) knob — The rotary SPD knob is used to change the IAS/ Mach speed reference (SPD mode) and the vertical speed reference (VS mode). The speed knob changes the bug airspeed at any time, as long as VS is not selected. When VS mode is engaged, rotation of the SPD knob changes the digital vertical speed reference and the vertical speed bug position. The integral PUSH IAS/M button within the SPD knob is used to toggle the airspeed tape between IAS and Mach. The master flight director computes the airspeed reference, and the slave flight director synchronizes to this reference.

SPD (speed) button — Depressing the SPD button engages the speed hold mode (IAS or Mach) on both FDs. The speed select mode is used to fly to a selected airspeed or Mach number, and to provide limited overspeed/underspeed protection during climbs and descents. When speed select mode is active, a green IAS or Mach annunciation is displayed in the captured vertical mode field on the PFDs.

FLC (Flight Level Change) button — Depressing the FLC button once engages the normal climb/descent profile on both PFDs. Depressing it a second time selects the high speed climb/descent schedule. A third depression deselects the mode. The FD chooses between the climb and descent schedule based upon the aircraft's present altitude and preselected target altitude. The FD annunciation on the PFD is FLC for the normal profile and FLCH for the high speed profile.

VS (Vertical Speed) button — Depressing the VS button engages the vertical speed hold mode on both FDs. When VS is selected, the speed bug disappears and reference goes to dashes.The FD commands pitch changes to hold the vertical speed that existed at the time of engagement. Once engaged, the vertical speed bug positions on the inner side of the vertical speed scale and a digital readout appears above the vertical speed indicator.

VNV (Vertical Navigation) button — Depressing the VNV button arms, then captures the FMS pitch steering commands of the FDs if FMS is selected as the NAV source, the FMS is programmed for a vertical navigation profile, the altitude preselector is set below existing altitude and the aircraft is within the TOD (top of descent) window. When the VNAV mode is armed, a white VNAV is annunciated on the PFDs in the FD vertical mode annunciation field and will turn green upon capture.

ASEL (Altitude Select) knob — The preselected altitude is set via the ASEL rotary knob on the FGC. The altitude preselect mode provides a means for FD/AP to climb or descend to a preselected altitude and then level off and maintain the preselected altitude. The ASEL knob is used to set the altitude preselect function, and also provides the altitude reference for the altitude alerter function.

ALT (Altitude Hold) button — Altitude hold may be engaged by depressing the ALT button on the FGC. When ALT is engaged, the FD commands pitch to hold the existing altitude at the time the ALT button was depressed, or at the ASEL reference altitude if ALT automatically engages.

AUTOPILOT/YAW DAMPER

The autopilot is a single-channel autopilot which may be coupled to either flight director. The autopilot function is contained within the #2 IC-600 located in the nose. The IC-600 will fly the aircraft based on the selected control mode and guidance inputs from the coupled flight director, via servo control of the elevator, aileron and rudder. When engaged, the autopilot will also automatically command trim changes as required to alleviate the aerodynamic loading on the elevator (pitch trim), and will allow control surface commands to be entered via the control wheel trim switches for the ailerons and elevator. There is also a Touch Control Steering (TCS) feature which allows the cockpit crew to manually maneuver the aircraft with the autopilot engaged when the TCS switch is pressed. The autopilot provides aircraft control in response to pitch and roll steering commands from either flight director.

The yaw damper software computes servo commands based on sensor input data only. the yaw damper control software provides yaw rate damping that holds rudder force to zero. The servo position reference is synchronized to zero at engagement and is constantly washed out to ensure that the steady-state rudder forces are zero. The yaw damper can be engaged independent of the autopilot but the autopilot cannot be engaged without the yaw damper.

AP/YD Annunciation

At the very top, center section of the PFDs is an area dedicated to flight director and autopilot annunciations. A horizontal arrow appears at the top center of each PFD between the flight director vertical and lateral mode annunciators. This arrow points left or right, as selected on the FGC XFR switch, to indicate which flight director the autopilot will couple to when engaged. It also indicates which flight director has priority. Just below the arrow is a line reserved for autopilot and yaw damper annunciation. A green AP and YD appear in this area when the autopilot and/or the yaw damper is /are engaged.

Control Wheel Trim Switch

Manual primary pitch trim or roll trim commands are initiated by pressing and holding of the arm switch and actuation of the control wheel trim switch. Pressing and holding of the arm switch with control wheel trim switch input will result in immediate autopilot disengagement.

The yaw damper and flight director modes are not affected by manual pitch or roll trim commands. Actuation of the control wheel trim switch without pressing the arm switch allows manual autopilot commands. During autopilot engagement, basic attitude commands (pitch and roll) can be entered through either the pilot's or copilot's control wheel trim switch (dependent upon which flight director is coupled to the autopilot). With the autopilot engaged, activation of the control wheel trim switch (without arm switch depressed), on the side coupled to the autopilot, causes the flight director roll and/or pitch hold mode to be activated.

Control Wheel Master Switch (MSW)

The MSW switch immediately disconnects all autopilot and yaw damper servo drives. The selected flight director modes are not affected. In normal operation, a 28-vdc signal is routed through the normally closed contacts of each MSW and then to the onside IC-600. This input to the IC-600s is the autopilot disengage discrete, and if 28-vdc is removed from this discrete on either IC-600, the autopilot will disengage.

Touch Control Steering (TCS)

TCS allows the pilot to manually fly and retrim the aircraft without disengaging the autopilot. To use the TCS function, the pilot will press the TCS button on the control wheel, maneuver the aircraft to the desired condition, and release the TCS. Operation of the TCS button has no effect on flight director mode of operation. While the TCS button is held depressed (AP engaged), a white "TCS ENG" annunciator appears in the autopilot display area at the top of the PFDs.

Autopilot Engagement/Disengagement

Engagement of the autopilot is achieved via the AP push button on the FGC. Each button has a vertical green bar that illuminates when engaged. Engagement of the autopilot will cause the yaw damper to automatically engage. When engaged, the autopilot will couple to the master flight director, and will follow the guidance commands from the master FD. If no flight director is active, engagement of the autopilot will cause the master FD to default to the basic PIT and ROL modes. When engaged, the appropriate annunciation will be provided on both PFDs, and the green bar on the AP push button will be illuminated. Disengagement of the autopilot via the AP switch will cause the AP annunciation to be removed from both PFDs and the green bar on the AP push button will extinguish. Other actions that will cause autopilot disengagement include:

(1) Control wheel master switch activation.
(2) Pilot initiated trim commands with control wheel trim switch depressed.
(3) Yaw damper disengagement.
(4) AP switch on the FGC disengaged.
(5) Autopilot primary or secondary monitor trip.

For a normal disconnect, AP flashes red for 5 seconds, then is removed. For a monitored disconnect, it flashes red for 5 seconds, then steady, and the aural alert is continuous until the crew cancels it with the MSW.

Yaw Damper Engagement/Disengagement

Selection of the autopilot via the AP push-button will automatically engage the yaw damper. Alternatively the yaw damper may be selected via the YD push button on the FGC. When engaged, the green YD annunciation will be provided on both PFDs, and the green bar on the YD push button will illuminate. Manual disengagement of the yaw damper via the YD button will cause the YD annunciation to flash amber then be removed from both PFDs and the green bar on the YD push button will extinguish. In the case of a monitored disconnect, the YD annunciation will turn amber and flash for five seconds and then remain steady. Other actions that will disengage yaw damper include:

(1) Control wheel master switch activation.
(2) YD Switch on the FGC disengaged.
(3) Yaw damper monitor trip.

Mistrim Annunciation

When the autopilot is engaged and the roll or pitch servo remains energized for a longer than normal period, this condition will be annunciated with a CAS. The autopilot does not have a capability to trim in the roll axis; therefore, if there is a mistrim in the roll axis, this will also display a CAS.

The following CAS illuminations are specific to the autopilot:

CAS	Color	Description
AP AIL MISTRIM	Amber	Autopilot is engaged and autopilot aileron servo is holding excessive torque. Disengage autopilot.
AP ELEV MISTRIM	Amber	Autopilot is engaged and autopilot elevator servo is holding excessive torque. Disengage autopilot.
AP ELEV MISTRIM	White	Autopilot is engaged and autopilot elevator servo is holding torque. Disengage autopilot.

Power Supply Configuration

The power supply for all the AFCS servos is supplied from the L MAIN bus, and is routed through the #2 IC-600 to the servos. The system is designed so that power failure to any major component in the system will result in the system reverting to the safe, disconnect mode. The AFCS SERVOS circuit breaker is located in the FLIGHT group of the pilot's circuit breaker panel.

GO-AROUND (GA) BUTTON

The GA button is located on the outboard side of the left thrust lever. Selection of the GA button disconnects the autopilot (but not the yaw damper) and cancels all other vertical and lateral modes except automatic altitude preselect arm. The flight director provides a wings level command bar display in the lateral axis and a fixed pitch-up vertical command. The pitch command does not guarantee that the go around airspeed will be achieved. If used on takeoff, the pitch attitude will not guarantee achieving the V_2.

FLIGHT MANAGEMENT SYSTEM (FMS)

The UNS-1E is a fully integrated Flight Management System (FMS). The FMS provides centralized navigation sensor control, flight planning, lateral and vertical flight guidance, steering enroute, terminal and approach modes of operation. Database management, fuel management, and maintenance functions are also provided by the FMS.

The UNS-1E accepts position information from up to five long-range navigation sensors as well as DME, VOR, or TACAN sensors. The data from these sensors is used to determine the best computed position. The UNS-1E incorporates an internal GPS sensor with Receiver Autonomous Integrity Monitoring (RAIM) as a standard part of the FMS configuration. The FMS interfaces with the IC-600s for a transfer of information to the FMS and lateral and vertical steering commands back to the EFIS and FD/AP.

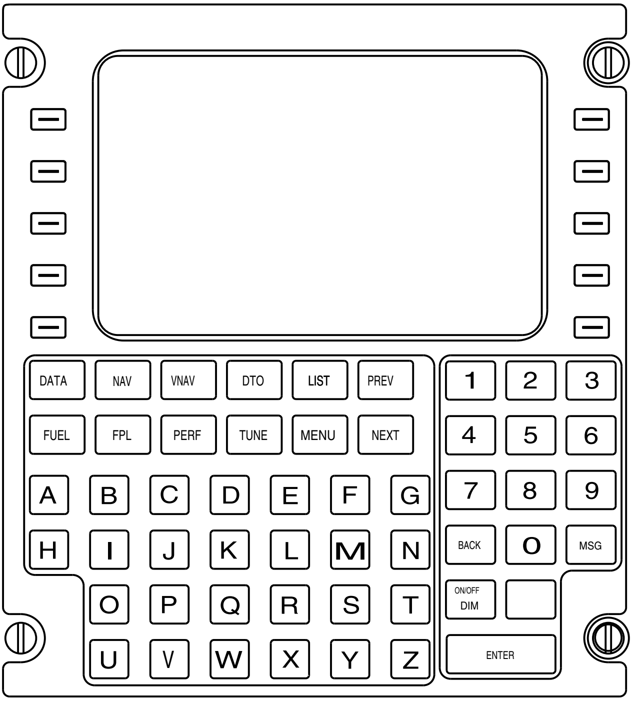
If a single FMS is installed, it can receive ADC, AHRS, EFIS, and AP data from either IC-600 but will use the #1 IC-600 as the primary source. If dual FMSes are installed, FMS 1 will use the #1 IC-600 as the primary source and FMS 2 will use #2 IC-600 as its primary source. With dual FMS installation, the pilots can use either FMS as the navigation source on their PFDs/MFD. In the material that follows, the FMS unit will be referred to as the Control Display Unit (CDU). The CDU contains a color, flat panel display, ten Line Select Keys (LSK) and dedicated function keys.

The FMS is powered from the left essential bus by a 5-amp circuit breaker labeled FMS located on the pilot's circuit breaker panel (AVIONICS [NAVIGATION] group).

CONTROL DISPLAY UNIT (CDU)

The CDU (Figure 5-19) is the primary interface to the pilot. It provides keypad input for selection of NAV modes and entering of waypoints and a display to indicate current operational modes. The CDU contains all the components required for the FMS functions. Other functions that are provided include:

- **Radio tuning and RMU interface** — The CDU allows remote tuning of the VHF COMM, VOR/ILS, ADF and ATC radios.
- **Flight planning** — The CDU can store a fixed number of flight plans into the FMS database.



UNS-1E FMS CDU
Figure 5-19

DATA TRANSFER UNIT (DTU)

The DTU allows updating of the FMS database, storing of pilot data and can also be used to record flight data. Database updates can be obtained on a subscription basis. The data transfer unit utilizes removable medium (e.g. 3.5-inch floppy, zip disk, USB memory, SD card) and is designed for mounting in the aircraft.

CONFIGURATION MODULE

The configuration module is used to store configuration data that is specific to the aircraft in which the FMS is installed.

At start-up, the CDU checks the version number stored in FMS memory against the version number stored in the configuration module. Any discrepancy between version numbers results in an FMS message, "CONFIG UPDATE REQUIRED", on the CDU.

FMS FUNCTIONS

FLP (flight plan) — Before using the FMS for navigation, an active flight plan must be defined within the FMS. The operator may select a previously stored route or create a new one to load as the active flight plan. A route or active flight plan can be created on the FMS as well. Once the departure airport is identified, the UNS-1E will present tailored lists from which the current runway, SID and transition can be selected. Also, both low and high altitude airways can be accessed for route or flight plan creation using the LIST function. Routes or the flight plan may also be constructed waypoint by waypoint, or by combining stored route segments. When en route and nearing the destination, a progression of smart prompts similar to those used on departure may be utilized to input a STAR, the approach and landing runway.

Upon selection of NAV on the MFD (FMS MENU), the IC-600 will display the closest eight navaids (VORs or NDBs) received from the FMS on the MFD MAP as background data. Selection of APT on the MFD, will result in the IC-600 displaying the first four airports received from the FMS on the MFD MAP as background data.

FUEL — Before takeoff, the fuel quantity signal conditioner provides the FMS with fuel quantity on-board. The pilot must accept or change the transmitted fuel quantity on the CDU fuel page. After engine start, the FMS receives real time fuel flow information independent of the aircraft indicating system. APU fuel is not included in fuel flow. Specific range and endurance are provided along with fuel, time and distance predictions for the destination.

PERF (performance) — A performance program in the FMS can compute takeoff speeds, takeoff N1 , takeoff distance and landing speed. The operator enters pertinent data such as takeoff configuration and environmental conditions mostly through menu selections. V Speeds and balanced field data is calculated and displayed. For landing, Vref is calculated along with approach speeds for different flap settings.

NAV (navigation) — All pertinent en route navigation data is displayed on the first NAV page of the CDU. This page along with the PFD/MFD displays provide complete integrated real time information on flight progress.

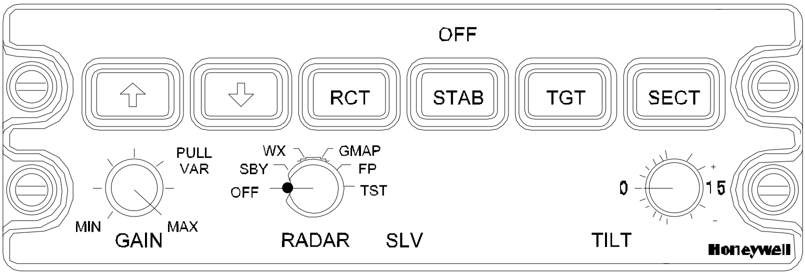
DTO (direct to) — A dedicated function key can be used to navigate from present position directly to any point on or off the present flight plan.

VNAV (vertical navigation) — Vertical navigation pages allow the operator to define waypoints with altitudes or flight levels. Features such as computed top-of-descent, target vertical speed and vertical direct-to are included. The FMS outputs vertical commands to the flight director when selected.

HOLDING PATTERNS — Holding patterns may be programmed at any waypoint on or off the flight plan or stored in the navigation data base as part of a SID, STAR or approach procedure. The holding pattern page provides a graphic depiction of the holding pattern. The pattern is defined with some crew inputs, and when the ACTIVATE line select key is pressed, the aircraft will proceed from its present position directly to the fix and make the appropriate entry (direct, parallel or teardrop), all automatically calculated and flown by the FMS.

WEATHER RADAR

The Primus 650 is the standard radar installed in the Learjet 45. It is an X-band radar system designed for weather detection and analysis. The radar can also be used for ground mapping. The WU-650 is an integrated unit which incorporates the receiver, transmitter and antenna (RTA) into a single unit, located in the nose of the aircraft. The only remaining radar component is the cockpit control panel which is mounted on the center pedestal. The antenna is a 12-inch flat plate that is stabilized with inputs from the #1 AHRS. Weather patterns can be displayed on both PFDs, on the ARC or MAP format, and on the MFD MAP format. The radar generates high-level RF pulses and should be operated with caution while on the ground. When operating on the ground, position the nose of the airplane so that the antenna scan sector is free of large metallic objects such as hangers or other aircraft for a distance of at least 100 feet.



WU-650 WEATHER RADAR CONTROL PANEL
Figure 5-20

The weather radar is controlled from the WC-650 weather radar controller, Figure 5-20. WX is selected for display on the PFDs by selecting the WX button on the display controller, the HSI automatically switches to the ARC mode. WX is selected for display on the MFD MAP by depressing the WX bezel button on the MFD main menu.

A six-position rotary switch is provided on the radar control panel for selecting the different radar modes. They are:

- **OFF** — removes electrical power from the system.
- **SBY (standby)** — in this position the RTA is powered up but does not radiate any RF energy nor does the antenna scan.

- **WX (weather)** — selects the weather radar main operating mode.
- **GMAP (ground map)** — in the ground mapping mode, the system internal parameters are set to enhance returns from ground targets.
- **FP (flight plan)** — selecting this position places the radar in the flight plan mode.
- **TST (test)** — when this mode is selected the weather depiction will be a special colored test pattern to allow verification of system operation.

Power is provided to the RTA and cockpit controller from the right avionics main bus with a 7.5-amp circuit breaker located in the INSTRUMENT/INDICATIONS group of the copilot's circuit breaker panel.

AVIONICS COOLING

INSTRUMENT PANEL COOLING

The instrument panel cooling system is located forward of the throttle quadrant and is provided to draw flight deck ambient air through the instrument panel and thus prevent overheating of avionics displays and instruments. The system consists of an avionics cooling fan, an on/off thermostat switch and an overtemperature thermostat circuit. The avionics cooling fan is activated when the temperature sensing switch reaches 90° F (32° C). The fan automatically turns off when the temperature has been reduced below 70° F (21° C). If the temperature reaches an extreme of 135° F (57° C) the overtemperature circuit is energized and an annunciation is posted on the CAS. The CAS remains displayed until the temperature has been reduced to 125° F (51.7° C).

The following CAS illumination is specific to the avionics cooling system:

CAS	Color	Description
INSTR PNL TEMP	White	The temperature at the instrument panel is higher than normal.

The instrument panel cooling system is powered from the L MAIN bus and protected by the INSTR FAN 3-amp circuit breaker located on the pilot's circuit breaker panel (ENVIRONMENTAL group).

MISCELLANEOUS

COCKPIT VOICE RECORDER (CVR)

A solid state Cockpit Voice Recorder (CVR) is installed in the Learjet 45. The standard CVR is a three-channel unit providing 30 minutes of recording. An optional unit is available which provides 120 minutes of recording. Two of the channels are used to record pilot and copilot audio. The third channel is used for the area microphone. Located in the tailcone, the CVR is painted international orange with reflective tape added to aid in recovery following a mishap. It also has an underwater locator beacon installed on one end of the unit. The recording is converted to a digital format and stored in crash protected memory. The area microphone is located in the upper center area of the instrument panel. An erase button and headphone jack are located on the CVR panel just beneath the copilot audio control panel. The CVR performs a self-test at power-up and has a continuous self monitor. If a fault is detected at any time, an annunciation is posted on CAS.

The following CAS illumination is specific to the CVR:

CAS	Color	Description
CVR FAIL	White	The cockpit voice recorder has failed.

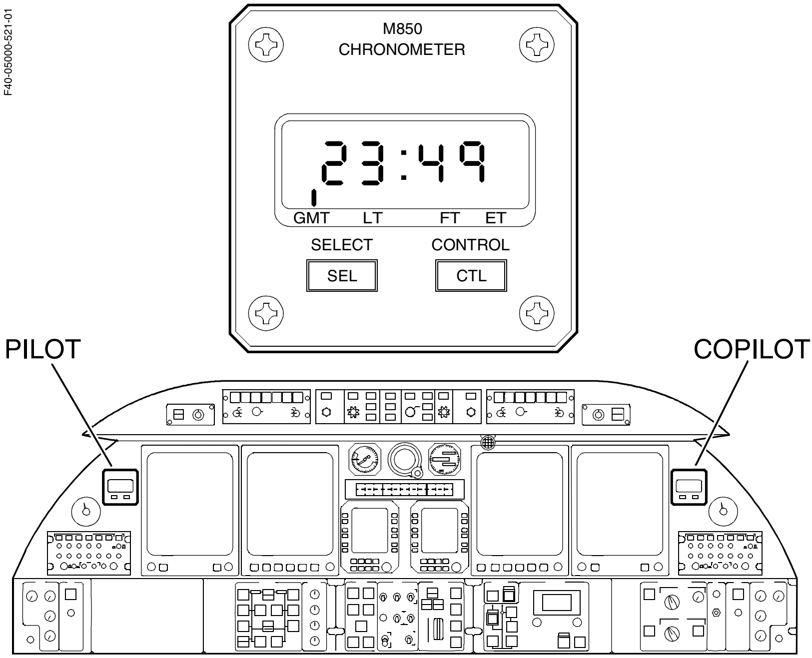
The erase function is initiated by pressing the erase button on the CVR panel. An interlocking device only allows this function to work when the airplane is on the ground and parking brake is set. When erase function is complete, a three-second tone is output to the headphone jack.

Voice recorder system power is 28-vdc supplied through a 3-amp CVR circuit breaker located on the pilot's circuit breaker panel (INSTRUMENTS/INDICATIONS group).

CLOCKS

Each instrument panel is equipped with a multi-function chronometer to display GMT, local time (LT), flight time (FT), and elapsed time (ET). The SEL button selects what is to be displayed and the CTL button controls what is being displayed (Figure 5-21). Pressing SEL sequentially selects GMT, LT, FT or ET for display. FT starts counting when the main gear weight-on-wheels switches transition to the air mode and stops counting when they transition back to ground mode. The CTL button resets FT back to zero when held down for three seconds. ET is started and reset when the CTL button is pushed momentarily. Depressing the SEL and CTL buttons simultaneously enters the set mode and GMT or LT can be set. The CTL button is then pressed to increment the flashing digit to the desired value. Pressing the SEL button enters that value and toggles to the next digit to be set.

Power for the chronometers is 28-vdc supplied through a 1-amp L and R CLOCK circuit breaker located on pilot's and copilot's circuit breaker panels respectively (INSTRUMENT/INDICATIONS group).



MULTI-FUNCTION CHRONOMETER AND INSTRUMENT LOCATION
Figure 5-21

HOURMETER-AIRCRAFT (OPTIONAL)

An optional hourmeter may be installed to measure aircraft accumulated time. The typical location for the hourmeter is on the RH side of the pedestal, just aft of the SELCAL decoder. It is wired to the right hand main gear weight-on-wheels switch, through a switch in the lower entry door frame. It will measure accumulated time as soon as the aircraft lifts off. The hourmeter receives 28-vdc from a 1-amp HOURMETER circuit breaker located in the INSTRUMENTS/INDICATIONS group of the copilot's circuit breaker panel.

FLIGHT DATA RECORDER (FDR) (OPTIONAL)

The flight data recorder, which may be installed, is a 25-hour Solid-State Flight Data Recorder (SSFDR) with Underwater Locator Beacon (ULB) and remote mounted tri-axial accelerometer.

The following CAS illumination is specific to the flight data recorder:

CAS	Color	Description
FDR FAIL	White	The flight data recorder has failed.

EMERGENCY LOCATOR TRANSMITTER (OPTIONAL)

Dorne & Margolin ELT14

The Dorne & Margolin ELT14 system simultaneously transmits distress signals on the frequencies of 121.5 and 243.0 MHz. The system will automatically activate under emergency conditions or may be manually activated with a cockpit-mounted switch. The system consists of a transmitter, antenna, remote control and monitor unit, and associated airplane wiring.

TRANSMITTER AND ANTENNA

The transmitter and antenna are installed in the airplane tail section. Power for the transmitter is provided by an internal battery pack. The transmitter incorporates a three-position switch (ARM/OFF/ON). Access to the transmitter is through an access cover placarded "ELT LOCATED HERE." The antenna is externally mounted and connects to the transmitter with antenna cable.

Transmitter Switch (ARM/OFF/ON)

Because of its location, this switch is not generally used by the crew. In the OFF position, the transmitter will not transmit distress signals. This position is normally used only while servicing the airplane. In the ON position, distress signals will be transmitted continuously. In the ARM position, the transmitter will automatically activate if the airplane stops abruptly. The switch should be in the ARM position for flight.

REMOTE CONTROL AND MONITOR UNIT

The remote control and monitor unit is installed in the cockpit. Power for this unit is provided by an internal coin cell. A three-position ON/ARM/RESET switch provides the remote control for the ELT transmitter. The ON and ARM positions function the same as described for the transmitter switch. Once activated, the transmitter may be returned to an armed status using the RESET function. The ELT can be reset but not switched off from this control unit.

A red LED, mounted in the end of the switch handle, provides the crew with the ELT status. The LED indicates ELT status as follows:

LED is:	**ELT Status:**
On continuously	The ELT is transmitting.
Flashing slowly (80 times per minute)	The ELT transmitter is switched OFF or the transmitter battery needs replacement.
Flashing quickly (5 times per second)	The remote control/monitor unit coin cell needs replacement.
Extinguished	The ELT is armed.

OPERATION

To arm the transmitter for automatic activation the ON/ARM/RESET Switch is placed in the ARM position. If the red LED flashes slowly, check that the transmitter switch is in the ARM position. If the transmitter switch is in the ARM position and the LED continues to flash, the transmitter battery needs replacement. To manually activate the transmitter, place the ON/ARM/RESET Switch to the ON position and check that the red LED is on continuously. To reset the transmitter, momentarily place the ON/ARM/RESET Switch to RESET and check that the red LED extinguishes.

ARTEX ELT 110-406

The ARTEX ELT 110-406 transmits on 121.5, 243.0 and 406.025 MHz. The ELT may be manually activated with a cockpit mounted switch or will automatically activate during an impact. Once activated, the ELT transmits the standard swept tone on 121.5 and 243.0 MHz. During that time the 406 MHz transmitter turns on and an encoded digital message is sent to the satellite. The information contained in the message includes:

- Serial number of the transmitter.
- Country code.
- Manufacturer.
- Position coordinates (optional).

The information sent to the satellite is programmed at the factory and contains a unique number that can be used to identify the beacon. The ELT 110-406 system consists of a transmitter, antenna, cockpit switch and indicator light, buzzer (aural monitor), and associated airplane wiring.

TRANSMITTER AND ANTENNA

The transmitter and antenna are installed in the airplane tail section. Power for the transmitter is provided by an internal battery pack which consists of 4 D size lithium manganese dioxide cells connected in series. The ELT unit incorporates an ON-OFF switch. Because of its location, this switch is not generally used by the crew. Access to the transmitter is through an access cover placarded "ELT LOCATED HERE." The antenna is externally mounted and is connected to the transmitter using antenna cable.

Transmitter Switch (ON-OFF)

In the ON position, the transmitter will transmit distress signals continuously. In the OFF position, the transmitter is armed to activate either automatically (impact) or manually (remote control from the cockpit switch). If removed from its mounting rack, the transmitter will be deactivated.

COCKPIT SWITCH AND INDICATOR LIGHT

The ELT 110-406 remote control (cockpit panel switch) provides manual On, Armed, and Reset modes. A 28-vdc indicator light, powered through the ELT WARN circuit breaker on the options circuit breaker panel in the tailcone, flashes continuously if the ELT has been activated and is transmitting.

BUZZER

The buzzer (aural monitor) provides a distinct signal (loud, siren-type sound) enabling a search and rescue team to locate an aircraft with a transmitting ELT in a confined area with a large number of aircraft (such as an airport). The buzzer is installed in the tail section and is powered by the ELT battery pack. The buzzer does not operate continuously, but sounds at predetermined intervals, and runs for shorter periods toward the end of battery life.

OPERATION

Under normal operation the cockpit switch is in the ARM position. The switch on the ELT unit will be positioned OFF. With these switch settings, the ELT will automatically activate on impact. To manually activate the ELT, set the cockpit switch to the ON position. When the ELT is activated, the presence of the emergency swept tone, a flashing cockpit indicator light, and the buzzer in the tail indicates a normally functioning unit. If the ELT is activated, it can be reset. This is done by moving the cockpit switch to ON and then immediately back to ARM.

The 406 MHz transmitter will operate for 24 hours and shut down automatically. The 121.5 and 243.0 MHz transmitter will continue to operate until the unit has exhausted the battery power. The 406 MHz transmitter transmits a digital message that allows search and rescue authorities to retrieve information from a database. Information contained in the database that may be useful include:

- Type of aircraft.
- Address of owner.
- Telephone number of owner.
- Aircraft registration number.
- Alternate emergency contact.

SECTION VI ANTI-ICE & ENVIRONMENTAL

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

SECTION VI
ANTI-ICE & ENVIRONMENTAL

BLEED AIR SUPPLY

Engine bleed air is used extensively for anti-icing and cabin environmental control. The source of this air is through low- and high-pressure ports on each engine compressor. High pressure (HP) or low pressure (LP) air is automatically supplied on an as-needed basis to meet pressurization requirements. The bleed air obtained from the engine's HP and LP ports is routed through shutoff and regulator valves. The bleed air is then ducted into either the anti-ice system or the Environmental Control Unit (ECU) or PACK. The PACK conditions the air for the cabin and cockpit distribution systems.

Shutoff valves and check valves are installed in the tailcone plumbing to control the bleed air from the left and right engines. In addition to the plumbing, the system includes control switches and incorporates an overheat, overpressurization and leak detection/warning system. A small amount of high-pressure bleed air is also used to pressurize the hydraulic reservoir described in Section 3, this manual.

The auxiliary power unit provides an additional bleed air source to operate the PACK when the aircraft engines are not running. The auxiliary power unit is designed for ground use only.

BLEED AIR SWITCHES

The L and R BLEED, and EMER PRESS switches, located on the PRESSURIZATION panel, control the respective left and right bleed-air shutoff valves, and the left and right emergency pressurization valves. The EMER PRESS switch is dependent on the L and R BLEED switches. Both L and R BLEED switches must be in the On position (OFF not illuminated) in order for both emergency pressurization valves to open with activation of the EMER PRESS switch. However, in the event of a L or R BLEED circuit breaker failure, it is possible to have bleed air supplied through an emergency pressurization valve of one engine and through the normal ducting of the other engine.

HP SHUTOFF VALVES

A pressure sensor within the HP ducting sends a signal to the ECS controller which drives the HP shutoff valves according to altitude and thrust lever angle.

The following CAS illumination is specific to the HP shutoff valves:

CAS	Color	Description
BLEED OVHT	Amber	Bleed air temperature in the associated (L or R) bleed air duct is excessive.

PYLON OVERHEAT

Four temperature sensors around the pylon structure provide for overheat indication.

The following CAS illumination is specific to pylon overheat detection:

CAS	Color	Description
ENG PYLON OVHT	Red	The associated (L or R) engine pylon area is overheated.

TAILCONE LEAK DETECTION

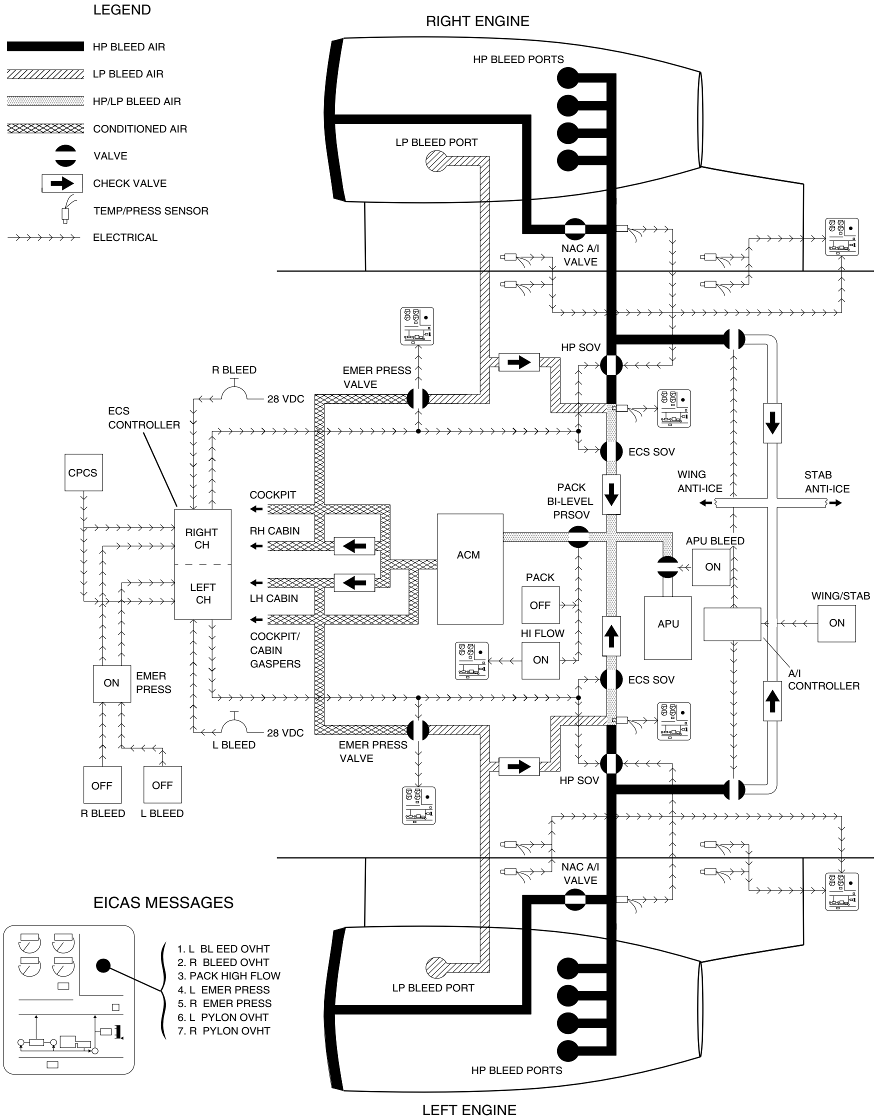
Tailcone sensing elements are installed along the ducting between the left and right high-pressure shutoff valves including the pack bi-level pressure shutoff valve, ECS pressure valves and ECS check valves. The loop-type elements detect elevated tailcone temperatures caused by a leak in the bleed-air ducting.

If a leak occurs between the high pressure shutoff valve and the ECS check valve, the corresponding BLEED AIR LEAK red CAS and CWP will illuminate. This CAS will also occur if a leak is detected between the ECS check valve and the pack bi-level pressure shutoff valve. The tailcone overheat detection system operates on 28-vdc supplied from the left essential bus.

The following CAS illumination is specific to tailcone overheat detection:

CAS	Color	Description
BLEED AIR LEAK	Red	A leak is detected in the associated (L or R) bleed air ducting (tailcone).

NOTE Illumination of the BLEED AIR LEAK red CAS will cause the APU to shut down.



BLEED AIR SYSTEM SCHEMATIC
Figure 6-1

ANTI-ICE SYSTEMS

Aircraft anti-ice protection is provided through the use of electrically heated and engine bleed-air heated anti-ice systems. Electrically heated systems include the pitot-static probes, total air temperature probe, engine inlet air temperature/pressure sensors, stall warning vanes, and windshields. Engine bleed air is utilized to provide anti-icing for the leading edge surfaces of the wings, horizontal stabilizer, and engine nacelle inlets. The engine fan spinners are unheated.

ICE DETECTOR SYSTEM

The ice detector system is installed to detect an icing condition and notifies the crew by illumination of the ICE DETECTED amber or white CAS described below. The ice detector system is always capable of detecting ice, provided aircraft electrical power is available. A self-test of the ice detector system is conducted every time aircraft power is turned on, and the ICE DETECT circuit breaker is engaged. The ice detector system receives 28-vdc power from the right essential bus through the 10-amp ICE DETECT circuit breaker on the copilot's circuit breaker panel (ANTI-ICE group).

The ICE DETECTED white CAS illuminates when ice is detected, the aircraft is airborne, and the following anti-icing systems are turned on:

- WING/STAB anti-ice selected ON.
- L and R NAC anti-ice selected ON and inlet pressure is present.

The ICE DETECTED amber CAS illuminates when ice is detected, the aircraft is airborne, and any of the following anti-icing systems are turned off:

- WING/STAB anti-ice selected Off,
  or
- L or R NAC anti-ice selected Off.

The following CAS illuminations are specific to the ice detection system:

CAS	Color	Description
ICE DET FAIL	Amber	The ice detection system has failed.
ICE DETECTED	Amber	Ice is detected and the appropriate (left and right nacelle heat, and wing/stab heat) anti-ice systems are **not** turned on.
ICE DETECTED	White	Ice is detected and the appropriate (L and R nacelle heat, and wing/stab heat) anti-ice systems are turned on.

WING INSPECTION LIGHT

The wing inspection light, located on the right forward fuselage, may be used to visually inspect the right wing leading edge for ice accumulation during night operations. The light is illuminated by depressing the WING INSP momentary switch located in the LIGHTS group of the center switch panel. The light illuminates a black dot on the outboard wing leading edge to enhance visual detection of ice accumulation. Power is supplied from the R MAIN bus through the 3-amp WING INSP circuit breaker on the copilot's circuit breaker panel (LIGHTS group).

ENGINE AND NACELLE INLET ANTI-ICE

The engine and nacelle inlet anti-ice system provides anti-ice protection for the nacelle inlets and the engine inlet air pressure/temperature sensors The engine inlets are anti-iced by directing engine bleed air through piccolo tubes to the inner surfaces of the nacelle inlet lip. After circulating around the inlet lip, excess bleed air is vented overboard through a hose at the bottom of the nacelle lip. The engine inlet air pressure/temperature sensors are anti-iced by integral heating elements whenever the respective L or R NAC anti-icing system is selected ON.

Each engine and nacelle anti-ice system consists of a bleed air duct, a nacelle anti-ice pressure switch, a nacelle anti-ice pressure regulating shutoff valve and a nacelle anti-ice switch. All anti-ice systems require electrical power to operate except the engine nacelle inlet heating systems which fail on when electrical power is not available to the respective nacelle anti-ice pressure regulating shutoff valve. Electrical power is provided from the L and R MAIN buses through the respective NAC circuit breakers located within the ANTI-ICE group [L and R HEAT] on the pilot's and copilot's circuit breaker panels.

System activation is indicated by a NAC green EI illuminated next to each engine ITT display. This illumination indicates that the respective L or R NAC switches are ON and that adequate bleed air pressure is being supplied to each nacelle lip.

An amber NAC illumination indicates that the respective L or R NAC switches are on with inadequate bleed air pressure being supplied to the nacelle lip or a circuitry fault to the pressure/temperature sensor. This EI will be accompanied by the L or R NAC HT amber CAS. If bleed air pressure of 6.5 psi or greater is sensed at the nacelle anti-ice shutoff valve with the L or R NAC switches off, the NAC amber EI will be accompanied by the respective L or R NAC HT FAIL ON amber CAS.

The following CAS illuminations are specific to the nacelle inlet anti-ice system:

CAS	Color	Description
NAC HT	Amber	- The associated (L or R) nacelle heat system is turned on, but the bleed air pressure to the nacelle is low. or - The associated (L or R) nacelle heat system is turned on, but the PT_2 heater is failed.
NAC HT FAIL ON	Amber	The associated nacelle heat system is turned off, but bleed air pressure is still present at the nacelle.

WING/STAB ANTI-ICE SYSTEM

The wing/stab anti-ice system utilizes high pressure (HP) bleed air directed through piccolo (diffuser) tubes in the leading edge of the wing and horizontal stabilizer. The bleed air used to warm the wing is then vented through the inboard wing boxes. The bleed air used to heat the stabilizer is vented overboard at the outboard ends of the stabilizer.

System components consist of the piccolo tubes, anti-ice Pressure Regulating Shutoff Valves (PRSOVs), anti-ice check valves, WING/STAB ON/off switch, wing temperature control and under/overheat sensors, electrical circuitry, and inputs from the integrated ECS temperature controller.

As the bleed air transfers to the piccolo tubes, it is routed through the pylon, into the tailcone, through a pressure regulating shutoff valve and modulating valve, a check valve, and into a common manifold. From the manifold, the wing supply duct branches forward and the horizontal stabilizer supply branches aft to the piccolo tubes. Check valves are provided to prevent bleed air cross flow from one source to the other, thus providing pneumatic isolation of the two bleed air sources.

The wing/stab anti-ice system is activated by selecting the WING/STAB switch located in the ANTI-ICE panel to ON. Electrical power is provided from the L and R MAIN buses through the respective circuit breakers located within the ANTI-ICE group [L or R WING/STAB HT] on the pilot's and copilot's circuit breaker panels. When activated, both anti-ice PRSOVs are energized open. The system controller then uses single control channels for each side to provide automatic control of the airplane wing and stabilizer leading edge skin temperature.

Each wing is continuously monitored by a wing temperature control sensor. The sensor supplies wing skin temperature information to a system controller. The controller then regulates the amount of HP bleed air allowed in the system by modulating the PRSOVs on each side to maintain the colder of the two wings at the established temperature. Under/overheat sensors also monitor wing and horizontal stabilizer temperatures and provide under/overheat signals to the controller.

Should the temperature exceed the established high value on any leading-edge surface, the sensors will trigger respective WING OVHT, STAB OVHT, or WING/STAB OVHT red CAS/CWP regardless of anti-ice systems being on or off. These CAS/CWP will extinguish once the leading edge temperature drops into the normal range.

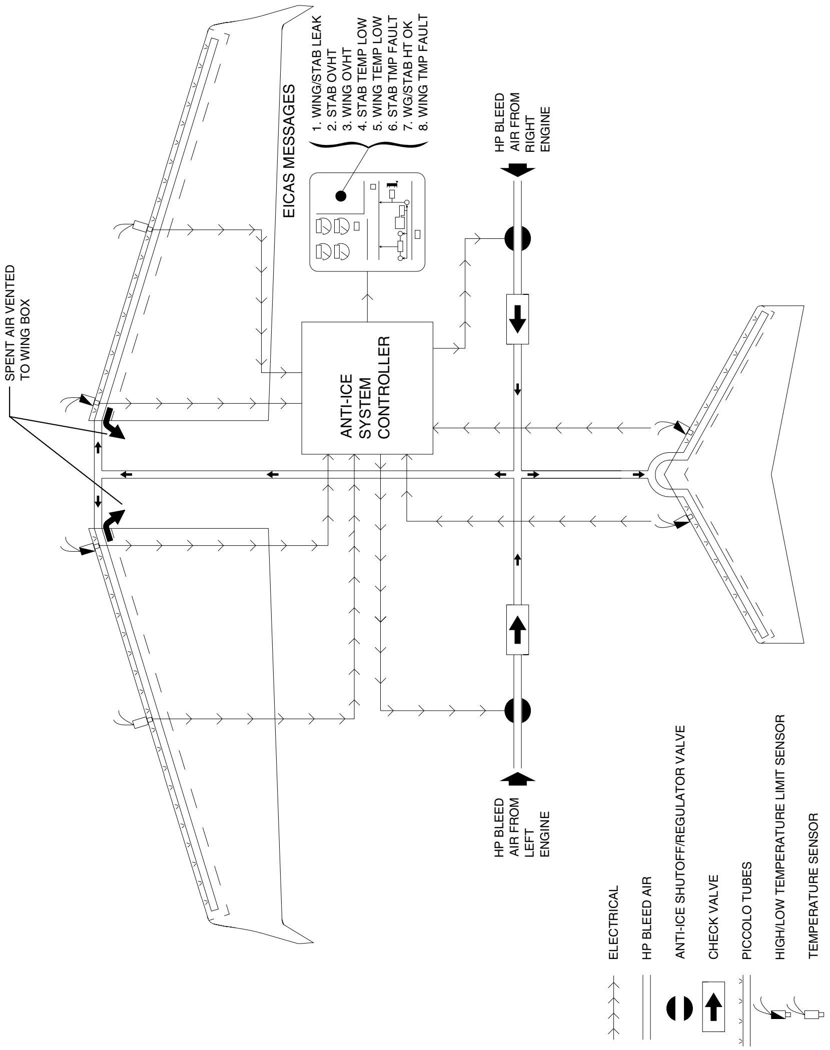
Should the temperature drop below the established low value on any leading-edge surface with anti-ice systems on, the sensors will trigger respective WING TEMP LOW or STAB TEMP LOW amber CAS. These CAS will extinguish once the leading edge temperature reaches the normal range.

Faults within the overheat/underheat sensors are indicated by illumination of the corresponding WING TMP FAULT and/or STAB TMP FAULT white CAS, and a WING and/or STAB TEMP LOW amber CAS with the system On.

The following CAS illuminations are specific to the wing/stab anti-ice system:

CAS	Color	Description
STAB OVHT	Red	The horizontal stabilizer leading edge is overheated.
WING/STAB LEAK	Red	A leak is detected in the ducting which supplies bleed air to the wing/stabilizer heat system.
WING OVHT	Red	The wing leading edge is overheated.
STAB TEMP LOW	Amber	Stabilizer heat is turned on, but the horizontal stabilizer leading edge temperature is too low for effective anti-icing.
WING TEMP LOW	Amber	Wing heat is turned on, but the wing leading edge temperature is too low for effective anti-icing.

CAS	Color	Description
STAB TMP FAULT	White	- A horizontal stabilizer temperature sensor has failed. or - The horizontal stabilizer high or low temperature sensor is invalid.
WING TMP FAULT	White	- A wing temperature sensor has failed. or - The wing high or low temperature sensor is invalid.
WG/STAB HT OK	White	The wing/stabilizer heat system checks OK.



WING/STAB ANTI-ICE SYSTEM SCHEMATIC
Figure 6-2

WINDSHIELD DEFOG AND ICE PROTECTION

Windshield defogging and ice protection is accomplished using electrically heated windshield panels. The system is designed so that if desired, it may be activated before takeoff and remain on until shutdown. The system is comprised of two windshield panels with integral heaters, dual-channel windshield heat control unit, system switches, engine driven alternators and associated aircraft wiring.

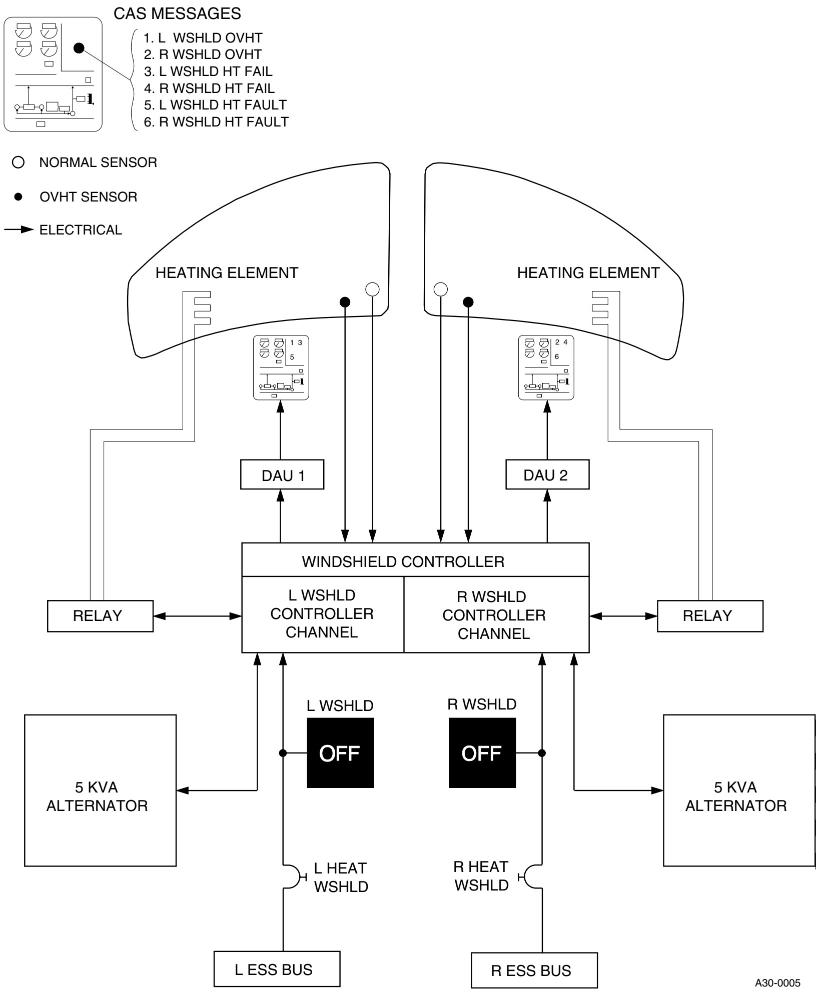
The same windshield panels are used for defogging and ice protection. The dual-channel windshield heat control unit automatically regulates windshield temperatures to preclude the formation of external ice and internal windshield surface condensation (fogging). Separate L and R WSHLD switches and power supplies provide for system redundancy.

Each system utilizes the 200-vac output from an alternator on its respective engine to power the integral heaters. The control circuit receives 28-vdc through the 5-amp WSHLD circuit breakers located within the ANTI-ICE group [L and R HEAT] on the pilot's and copilot's circuit breaker panels.

During normal operation the controller regulates the output of the alternators to maintain the desired windshield temperature. If there is a fault in the circuitry for normal operation, the system can continue to operate in a degraded mode. In the degraded mode the output of the alternator is no longer modulated and the controller cycles power full to the windshield. The controller continues to cycle power on and off to control operation when functioning in the degraded mode.

The following CAS illuminations are specific to the windshield defog and ice protection systems:

CAS	Color	Description
WSHLD HT FAIL	Amber	The associated (L or R) windshield heat system is on, but the windshield temperature is too low for effective anti-icing.
WSHLD OVHT	Amber	The associated (L or R) windshield is overheated.
WSHLD HT FAULT	White	The associated (L or R) windshield heat system is operating but in a degraded mode.



WINDSHIELD ANTI-ICE SCHEMATIC
Figure 6-3

BAGGAGE COMPARTMENT HEATING SYSTEM

The tailcone baggage compartment features a heating system to prevent the unpressurized compartment from freezing. Baggage compartment heat is available for both ground and inflight operations. *On aircraft 45-170 thru 45-2000 and prior aircraft modified by SB 45-21-3 (Air Conditioning-Relocation of Baggage Heater Switch)*, an ON/OFF switch for the heating system is located on the Environmental Control Panel. *On aircraft 45-169 and prior aircraft not modified by SB 45-21-3*, the ON/OFF switch is located in the ceiling of the baggage compartment. Once the system switch has been turned ON, operation of the system is fully automatic and requires no crew regulation or monitoring.

Heating is provided through electrical blanket heaters installed on the left, right and bottom sides of the tailcone baggage compartment. Two temperature sensors enable and disable the blanket heaters. The heaters will not activate unless the temperature falls below the established low value and will deactivate when the temperature reaches the established high value. The heaters are self-regulating whereby power consumption is reduced as temperature increases.

The baggage compartment heaters are powered by 28-vdc through the R NON-ESS bus. A baggage heat circuit breaker is located on the aft left power distribution panel within the tailcone.

ENVIRONMENTAL CONTROL SYSTEM (ECS)

The environmental control systems provide:

- conditioned air to the passenger and crew compartments for normal ventilation and pressurization,
- unconditioned air for emergency pressurization, and
- temperature control of passenger and crew compartments.

ECS CONTROLLER

A dual channel ECS controller provides the circuitry required to operate the ECS valves, HP shutoff valves and the emergency pressurization valves. The left and right channels independently control their respective shutoff valves. The controller receives and monitors signals from pressure sensors, the cabin pressurization controller, thrust lever angle, L and R BLEED switch positions and EMER PRESS switch position.

The ECS controller channels are powered by 28-vdc from the respective L and R essential buses through the L and R BLEED circuit breakers located in their respective pilot and copilot circuit breaker panels (ENVIRONMENTAL/ENVIR group).

ECS SHUTOFF VALVE

Normally during flight the ECS shutoff valves will be de-energized open. When a L or R BLEED switch is set to OFF, the respective ECS shutoff valve will be energized to the closed position. When the L and R BLEED switches are On and the EMER PRESS switch is activated, the bleed air shutoff valves will close and the emergency pressurization valves will be energized open and the HP bleed air will be shut off. The ECS shutoff valves will close automatically whenever emergency pressurization or a fire switch (respective ENGINE panel) is activated.

ENVIRONMENTAL CONTROL UNIT (ECU) OR PACK

The ECU or PACK consists of a precooler, primary and secondary heat exchangers, an Air Cycle Machine (ACM), and various pneumatic control valves and sensors. System control is accomplished by the Pressure Regulating Shutoff Valve (PRSOV). A water separator is installed to reduce humidity of the discharged air.

PRECOOLER AND HEAT EXCHANGERS

Ram air from a PACK airscoop is used to provide the cooling media for the precooler, primary and secondary heat exchangers. In the absence of ram air (ground operations), a fan wheel within the air cycle machine is used to create airflow across the precooler and heat exchangers.

AIR CYCLE MACHINE (ACM)

An Air Cycle Machine (ACM) is used to refrigerate bleed air, providing a source of cool air. The ACM is a three-wheel (fan, compressor, and cooling turbine) unit installed in the tailcone. Bleed air from the aircraft engines is first cooled by a precooler, then the amount of air is regulated by the PRSOV before being admitted into the ACM. The ACM then cools the bleed air further with the primary heat exchanger before compressing it in its compressor section. After the bleed air is compressed, heat is again extracted with a secondary heat exchanger before entering the turbine section of the machine. Additional heat is extracted from the compressed air by converting some of its heat energy to work (driving the cooling turbine) and rapid expansion of the air as it exits the turbine. This refrigerated air is passed through a water separator to remove the water before being supplied to the cabin and crew air distribution systems.

ACM BYPASS VALVE

When pressure at the compressor inlet exceeds the pressure at the compressor outlet, airflow is permitted around the compressor section through the ACM bypass check valve. This prevents the compressor from restricting airflow during operation of the ACM at low speeds.

LOW LIMIT TEMPERATURE SENSOR

A temperature sensor, at the water separator outlet, is used to modulate an anti-ice modulating valve. The anti-ice modulating valve is incorporated into the ACM to maintain a constant outlet temperature and prevent icing at the turbine outlet. To accomplish this, the anti-ice modulating valve mixes warm bleed air with the cooling turbine discharge air to produce the desired temperature.

PACK OVERTEMP SENSOR

Overheat conditions of the ACM are monitored by the pack overtemp sensor. The pack overtemp sensor, mounted downstream of the ACM compressor discharge, will illuminate the PACK OVHT amber CAS when the temperature has exceeded 450° F (212° C).

The following CAS illumination is specific to pack overheat detection:

CAS	Color	Description
PACK OVHT	Amber	Compressor discharge air temperature (air conditioning pack) is excessive.

AIR CYCLE MACHINE CONTROLS

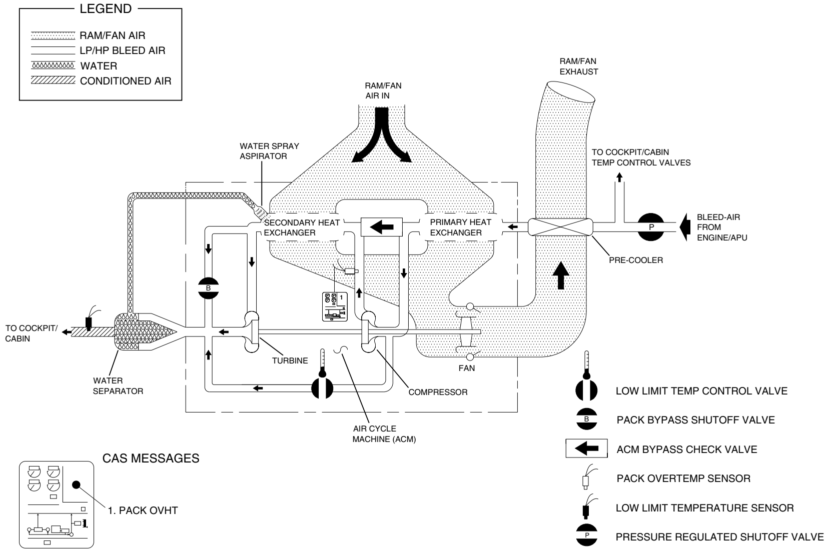
Control of the air cycle machine is through the use of the PACK and HI FLOW switches located on the PRESSURIZATION panel. These switches control the Pressure Regulating Shutoff Valve (PRSOV). The PRSOV controls inlet air to either 18 (normal) or 26 (HI FLOW) psig. The air cycle machine is always On (not illuminated) for normal operations.

PACK Switch — When set to OFF (illuminated), the bleed air supply to the ACM is shut off (PRSOV closed). When set to On (not illuminated), bleed air is allowed to pass through the ACM and enter the air distribution system at 18 psig.

HI FLOW Switch — When set to ON (illuminated), the bleed air coming out of the ACM compressor section must pass through the cooling turbine and enter the air distribution system at 26 psig.

The following CAS illuminations are specific to PACK control:

CAS	Color	Description
ECS FAIL	Amber	Both channels of the Pack has failed.
ECS FAULT	Amber or White	A fault has been detected in the appropriate (L or R ECS) channel of the ECS controller (Amber on the ground or White during flight.)
PACK HIGH FLOW	White	HI FLOW is selected on the air conditioning pack.



AIR CYCLE MACHINE SYSTEM SCHEMATIC
Figure 6-4

TEMPERATURE CONTROL SYSTEM

The temperature of the environmental air is controlled by mixing bleed air upstream of the air cycle machine with refrigerated air downstream of the air cycle machine. The resulting conditioned air is ducted into the cabin and cockpit. Separate controls are provided for the cockpit and cabin creating two temperature zones. Each temperature control system consists of a temperature control valve, torque motor, temperature controller, duct temperature sensor, air temperature sensor, and a COLD-HOT selector. A MANUAL TEMP switch allows the temperature control valves to be operated manually by rotation of the temperature selector knobs.

Temperature control valve position, thus, temperature regulation, is pneumatically controlled by the electrically operated temperature control system. During normal operation, the respective system temperature controller will automatically maintain the temperature set with the (COCKPIT or CABIN) COLD-HOT selector on the ENVIRONMENTAL CONTROL panel. The controllers maintain the selected temperature by comparing input signals from various temperature sensors and then electrically controlling the torque motors that provide pneumatic pressure (servo air) to the temperature control valves. The cockpit and cabin air temperature sensors have small blowers that draw air past the sensing elements to assure rapid sensing of temperature changes. Whenever the MANUAL TEMP switch is ON, the respective temperature control valve will respond directly to movement of the (COCKPIT or CABIN) COLD-HOT selector.

Each system has duct temperature sensors and limiters to provide for duct temperature indication and protection. The temperature sensors signal the ECS integrated controller of temperature information during normal operation. Temperature is displayed on the ECS page as digital CAB and CKPT indications.

If excessively high temperatures are reached in the cabin or cockpit supply duct, the overtemp limiter will signal the ECS integrated controller to close the respective cabin or cockpit temperature control valve. In this event, a CAB DUCT OVHT or CKPT DUCT OVHT amber CAS will illuminate. These CAS are primarily for protection during emergency pressurization (EMER PRESS) operation.

Electrical power for the temperature control system is 28-vdc supplied by the R MAIN bus for the automatic mode or the R essential bus for the manual mode. Power is supplied through the respective 1-amp AUTO or MAN circuit breaker located on the copilot's ENVIR panel (TEMP CTRL group). In the event power is lost to the right main and essential buses, the temperature control valves will fail to the full closed (cold) position.

The following CAS illuminations are specific to duct overheat detection:

CAS	Color	Description
CAB DUCT OVHT	Amber	Temperature of the cabin bleed air distribution duct has exceeded the system limit.
CKPT DUCT OVHT	Amber	Temperature of the cockpit bleed air distribution duct has exceeded the system limit.

TEMPERATURE CONTROL VALVES

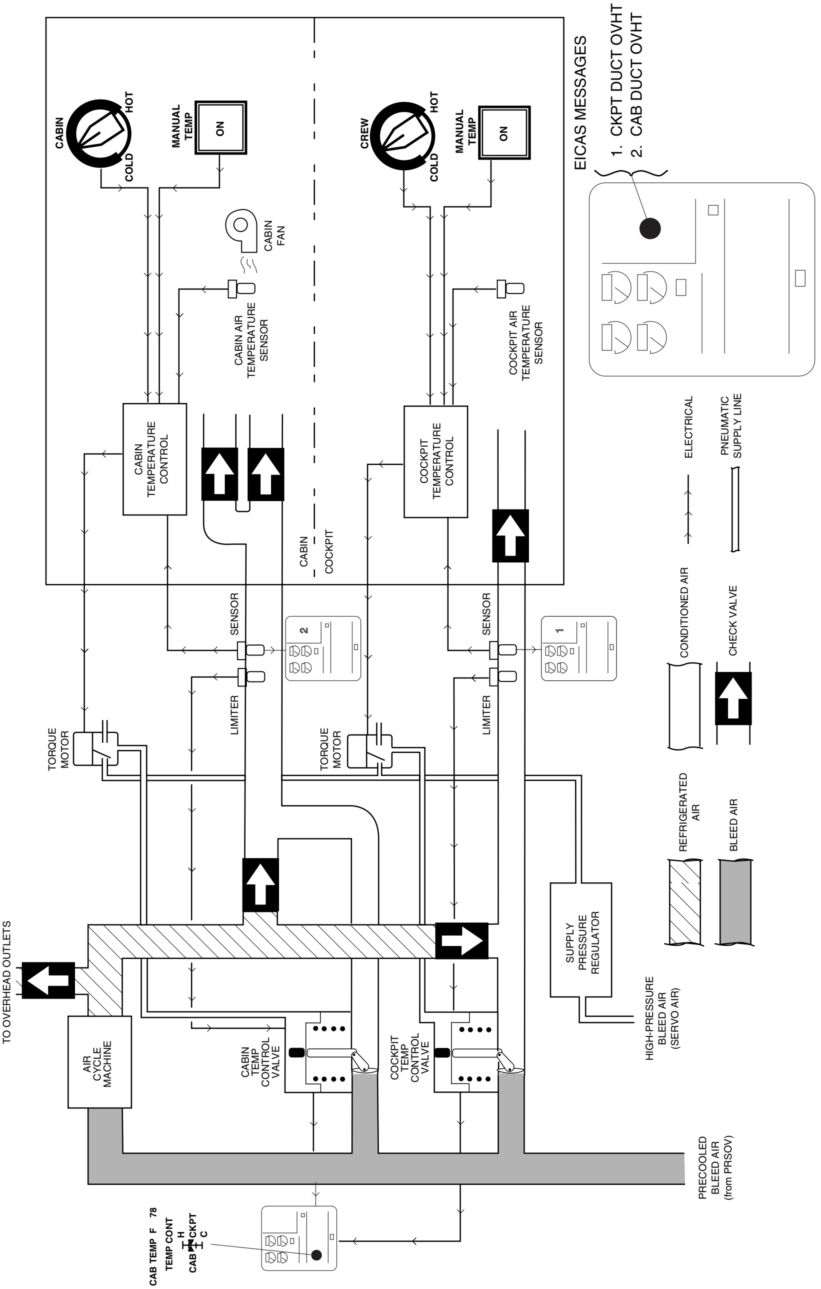
The temperature control valves are pneumatically operated. Regulated high-pressure bleed air is used to provide the required pneumatic pressure (servo air). The APU will provide servo air when it is being used to run the air cycle machine. The valves are spring-loaded closed and opened with pneumatic pressure. Valve position is controlled by varying the pneumatic pressure with a torque motor.

MANUAL TEMP SWITCH

The MANUAL TEMP switch allows the temperature control valves to be operated manually by rotation of the respective COLD-HOT temperature selector knob.

CREW AND CABIN COLD-HOT SELECTORS

A COCKPIT TEMPERATURE COLD-HOT and a CABIN TEMPERATURE COLD-HOT selector are located on the ENVIRONMENTAL CONTROL panel. During normal operation, these selectors are used to select the desired system temperature to be maintained automatically by the temperature controllers. In MANUAL TEMP mode (ON illuminated), these rheostat-type selectors directly vary the current input to the pneumatic torque motors which position the temperature control valves. Rotating the selectors clockwise from COLD to HOT is equivalent to selecting temperatures ranging from 60° F (16° C) to 90° F (32° C).

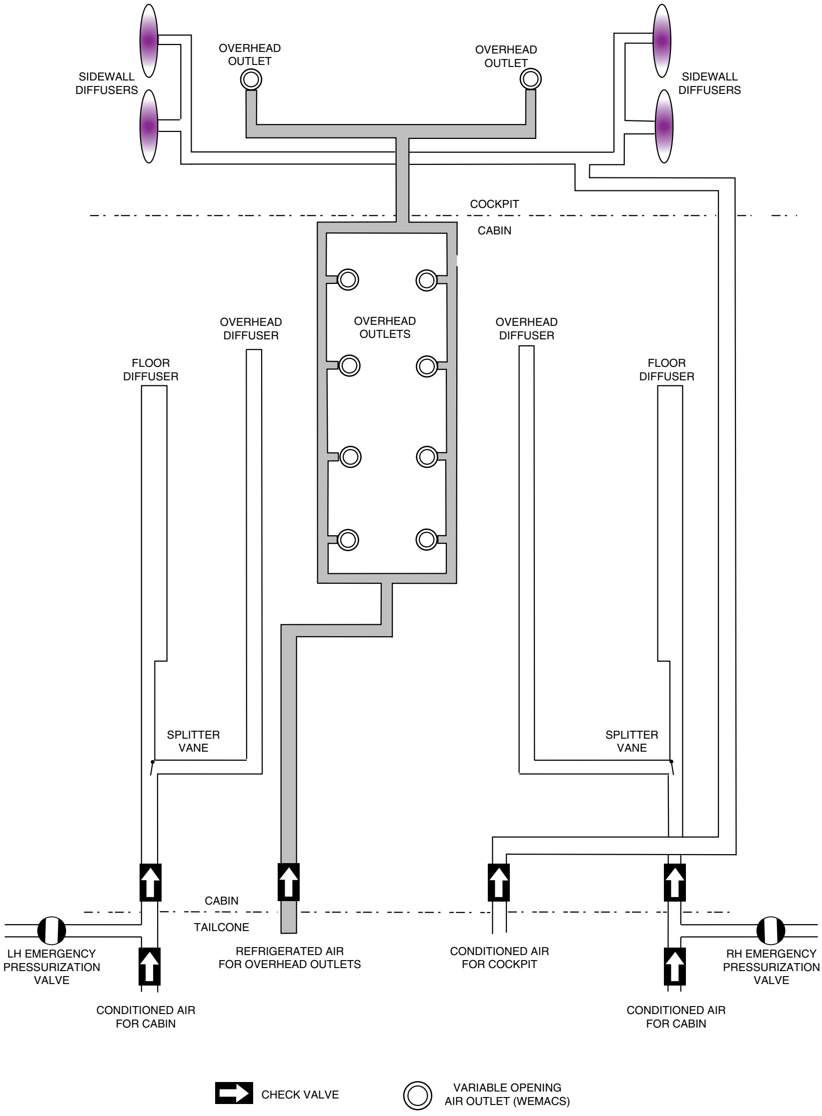


TEMPERATURE CONTROL SCHEMATIC
Figure 6-5

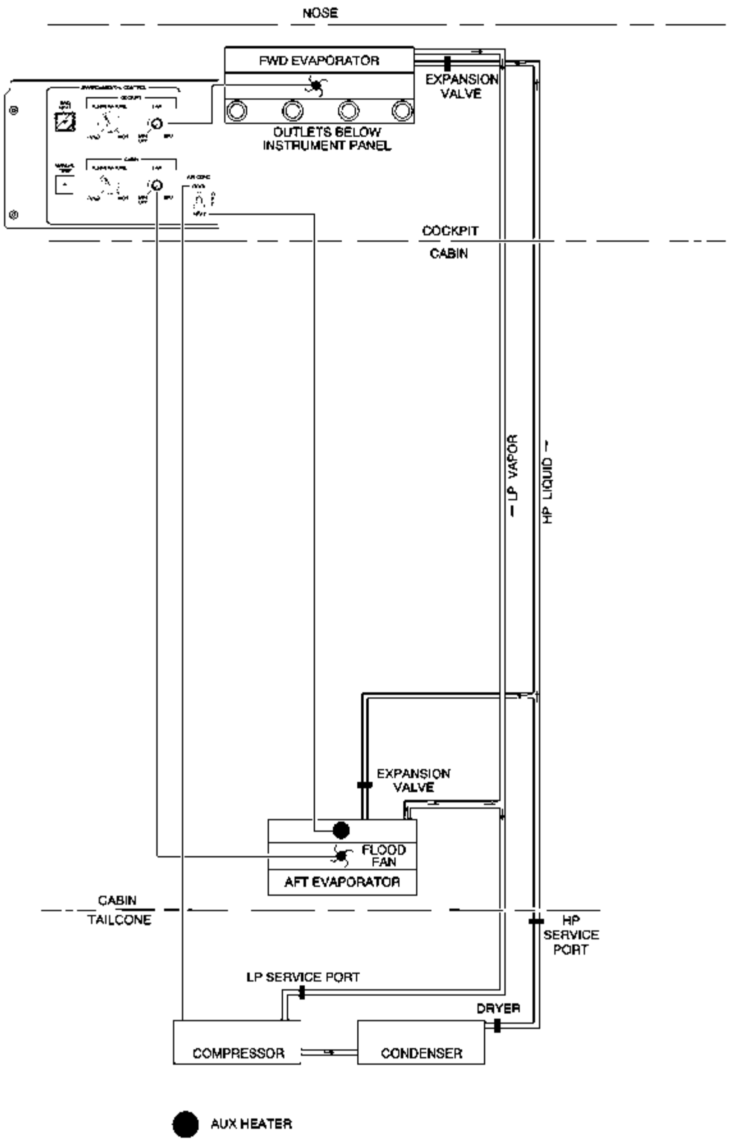
AIR DISTRIBUTION

Conditioned air enters the cabin through three separate ducts. Two ducts supply air to the floor and overhead diffusers. The third duct supplies air to the sidewall diffusers. Crew and passengers may regulate the gasper air by opening or closing the individual outlets.

The environmental control system will automatically divert some of the air from the overhead diffusers to the floor diffusers. This flow splitting is accomplished by a restrictor plate or an optional diverter door. The restrictor plate or diverter door diverts the majority of the flow to the floor diffusers during heating mode, and allows the majority of the flow to the overhead diffuser during cooling mode. This feature minimizes vertical air stratification in the cabin and provides for more efficient cabin heating.



COCKPIT/CABIN AIR DISTRIBUTION SCHEMATIC
WITHOUT OPTIONAL R-134A COOLING SYSTEM
Figure 6-6



COCKPIT/CABIN AIR DISTRIBUTION SCHEMATIC
WITH OPTIONAL R-134A COOLING SYSTEM
Figure 6-6A

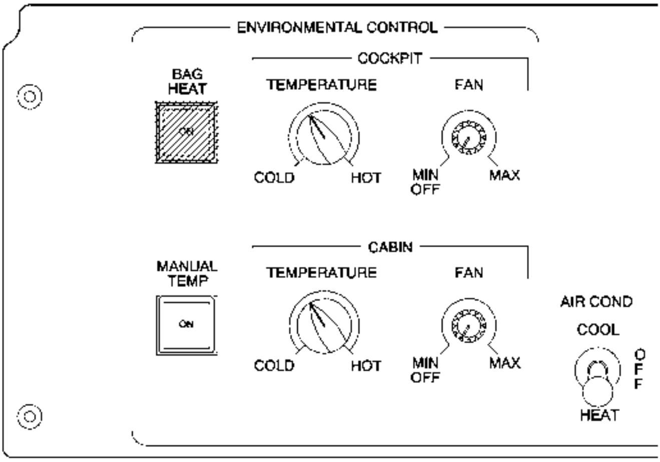
VAPOR CYCLE COOLING SYSTEM and AUXILIARY HEAT (OPTIONAL)

The R-134A vapor cycle cooling system is installed for cockpit and cabin cooling during ground operations, cabin dehumidification, and inflight cooling. In flight, the air conditioning system is powered by both engine generators. On the ground, power may be supplied by the APU, engine generators or ground power unit. Cabin and cockpit fan speeds are variable. Air conditioning can be selected by placing the AIR COND COOL, OFF, HEAT switch to the COOL position. A cockpit blower, located below the cockpit floor, and a cabin blower, located in the aft cabin overhead, circulate air through the system evaporators to provide cooling. Cabin and cockpit fans will automatically activate to the low speed setting if the fan speed selector is in the OFF position, or to the speed selected. A switch is installed in the lavatory door that decreases the cabin fan speed to a minimum setting when the lavatory is occupied.

The system is protected against overpressure conditions by two separate safety devices. The first is a binary high/low pressure switch located on the compressor discharge port. This switch will open at approximately 350 psig and will interrupt power to the compressor control circuit. The second overpressure safety device is a fuse plug located on the receiver-drier assembly. This plug will vent the system refrigerant safely overboard in the event of a system pressure is in excess of 425 psi.

The system incorporates an automatic load shed system that deactivates the compressor drive motor during starts or while the system is on battery power. It is recommended that the AIR COND switch be in the OFF position during engine starts to avoid large amperage surges after starter disengagement. The automatic load shed system requires both generators to be on line supplying 28 VDC to operate the air conditioning system. The failure of either generator activates the automatic load shed system.

System control circuits, including the cabin blowers, are powered by 28 VDC supplied through the 5-amp COOL/HEAT circuit breaker on the copilot's circuit breaker panel. The cabin blowers are powered by 28 VDC through a 50-amp current limiter. Speed control circuits for the cabin blowers are powered through the 5-amp CABIN FAN circuit breaker on the copilot's circuit breaker panel. The cockpit blower (including speed control circuit) is powered by 28 VDC through the 15-amp COCKPIT FAN circuit breaker on the copilot's circuit breaker panel.



ENVIRONMENTAL CONTROL PANEL
(R134A Cooling System)
Figure 6-6A

CABIN AUXILIARY HEAT

Cabin heating can be selected by placing the AIR COND switch in the HEAT position. The cabin auxiliary heat system consists of four heater elements, four thermal switches and two thermal fuses. The cabin auxiliary heater elements are located in the aft evaporator assembly. Two thermal switches are installed to regulate a specific temperature range by energizing and de-energizing the heater elements during normal operations. Power to operate the auxiliary heater can only be supplied by a GPU. Fixed high fan speed cabin air is blown across the heater elements and enters the cabin via the evaporator close out. A switch is installed to decrease the cabin fan speed to minimum setting and remove power to the heater elements when the lavatory door is closed. If either thermal switch fails to regulate the preset temperature range, the thermal fuses will melt and disable the heater.

The auxiliary heat system also incorporates two thermal switches that automatically enable the cabin blower into a cool-down mode at low speed. The cabin blower is powered through the rear hot bus and will continue to operate until the desired temperature is reached. This normal cooling cycling will occur automatically regardless of GPU availability, heater switch location or aircraft battery switch selection.

CABIN CLIMATE SWITCHES *(R-134A Cooling system)*

COOL-OFF-HEAT SWITCH

The COOL-OFF-HEAT switch, located in the ENVIRONMENTAL CONTROL group on the copilot's switch panel, controls the freon cooling system and the auxiliary heating system. When set to COOL, the switch allows power to the freon compressor motor and cabin and cockpit blower circuits. If either the COCKPIT or CABIN FAN switch is off when the switch is set to COOL, the respective blower, cockpit or cabin, will run at minimum speed. Blower speed may be increased by rotating the CABIN or COCKPIT FAN switch, as applicable, in a clockwise direction until the desired speed is reached.

CABIN FAN SWITCH

Cabin blower speed is controlled during cooling and supplemental air circulation modes by the rheostat-type CABIN FAN switch located in the ENVIRONMENTAL CONTROL group on the copilot's switch panel. Rotating the switch clockwise out of the off detent position will turn on the cabin blowers and blower speed will increase with further clockwise movement.

COCKPIT FAN SWITCH

The rheostat-type COCKPIT FAN switch is located in the ENVIRONMENTAL CONTROL group on the copilot's switch panel. The switch controls the cockpit blower which is available for all ground and inflight cooling or air circulation modes. When the cooling system is in operation, the blower will force air through the cockpit evaporator to provide cooling or circulate air when the air circulation mode is selected. Air circulated by the cockpit blower is exhausted through the cockpit and cabin overhead eyeball outlets when they are rotated to the open position.

COCKPIT FOOT WARMERS

The foot warmer heat system provides electrical heat from heel plate assemblies installed on the flight deck floorboard below each rudder pedal. The heel plate assemblies are provided as pilot and copilot foot warmers. The system control circuit operates on 28 VDC power supplied through the FOOT WARM circuit breaker on the copilot's circuit breaker panel. A thermostat located behind the copilot's aft kick panel regulates the heel plates between 40° F (4° C) and 80° F (27° C).

OXYGEN SYSTEM

The aircraft oxygen system provides oxygen service for the crew and passengers. The system consists of the crew and passenger distribution systems, and a high-pressure oxygen storage system. Electrical power to operate the passenger oxygen system is supplied by the EMER BATT bus through a 2-amp PAX OXY circuit breaker located on the pilot's circuit breaker panel (ENVIRONMENTAL group).

Oxygen is available to the crew at all times and can be made available to the passengers either automatically above 14,500 (±250) feet cabin altitude, or manually at all altitudes through the use of the DEPLOY switch located on the copilot's PAX OXYGEN panel. The oxygen system is designed for use during emergency descent to a cabin altitude not requiring oxygen, and is not to be used for extended periods of flight at cabin altitudes requiring oxygen (Refer to oxygen duration chart, Section IV of the AFM) or as a substitute for the normal pressurization system. *On aircraft 45-170 and subsequent,* an altitude compensating regulator is installed for extended oxygen duration. *On aircraft 45-169 and prior,* an altitude compensating regulator for extended oxygen duration is *optional*. Smoking is prohibited when oxygen is in use.

OXYGEN STORAGE AND PRESSURE REGULATION

The high-pressure oxygen storage system consists of a storage cylinder, a shutoff valve and regulating assembly, a direct reading pressure gauge and service valve attached to the regulator, an overpressure burst disk and indicator, a combined pressure/temperature transducer for EICAS display, and a solenoid operated passenger oxygen valve with an integral system pressure switch. *On aircraft modified by SB 45-12-1 (Installation of Remote Oxygen Servicing Provisions),* a remote service valve and gauge are installed allowing service through the nose access door.

The oxygen storage cylinder has a minimum storage capacity of 645 liters of oxygen at 70° F (21° C) when charged to 1850 psi. The cylinder is located in the nose compartment, or may be installed in the lavatory within a left closeout. The shutoff and pressure regulator assembly form an integral part of the storage cylinder and provide for pressure regulation, pressure/temperature indication, and servicing.

Oxygen pressure for the passenger and crew distribution systems is regulated to a pressure of 60 to 80 psi. The shutoff and pressure regulator assembly also incorporates a burst disc pressure relief valve to discharge the oxygen cylinder contents overboard in the event that cylinder pressure reaches 2500 to 2775 psi. Should the cylinder contents be discharged overboard, the green overboard discharge indicator on the outside surface of the aircraft near the storage cylinder will be ruptured or missing, and the EICAS pressure display will illuminate amber dashes.

The oxygen pressure gauge is located near the service port. The pressure/temperature transducer will provide pressure and temperature signals to the EICAS. *On aircraft modified by SB 45-12-1*, this transducer also provides information to the oxygen servicing pressure gauge. Temperature and pressure signals are input to the temperature compensated pressure warning system in EICAS to alert the crew of low or high oxygen quantity.

A pressure switch, integral with the oxygen control valve, will provide a signal to EICAS indicating when the regulator is off. The system pressure distribution line is vented when the regulator is in the OFF position, thus preventing trapped pressure in the line from giving an erroneous indication that oxygen is available.

The following CAS illuminations are specific to oxygen pressure:

CAS	Color	Description
OXYGEN OFF	Amber	The oxygen line pressure is low (i.e., bottle regulator is off or oxygen supply is depleted).
OXYGEN PRESS HI	Amber	Oxygen bottle quantity is not within the normal range (too high).
OXYGEN QTY LOW	Amber	Oxygen bottle quantity is not within the normal range (too low).

OXYGEN SYSTEM COCKPIT CONTROLS

The oxygen system cockpit controls consist of two switches located on the copilot's PAX OXYGEN panel. The PAX OXY /AUTO switch automatically controls oxygen availability to the passenger oxygen distribution system. The DEPLOY switch provides manual activation. Oxygen is available to the crew oxygen distribution system at all times when the oxygen cylinder shutoff valve is open. Control positions and system functions are as follows:

1. With the PAX OXY/AUTO switch On (OFF not illuminated), oxygen is available to the passenger distribution system and the passenger masks will deploy automatically in the event cabin altitude climbs to 14,500 feet. Should the cabin altitude reach 14,500 (±250) feet, an electrical signal from the pressurization indicator will cause the solenoid valve (integral with the passenger oxygen valve) to open, the passenger oxygen masks will

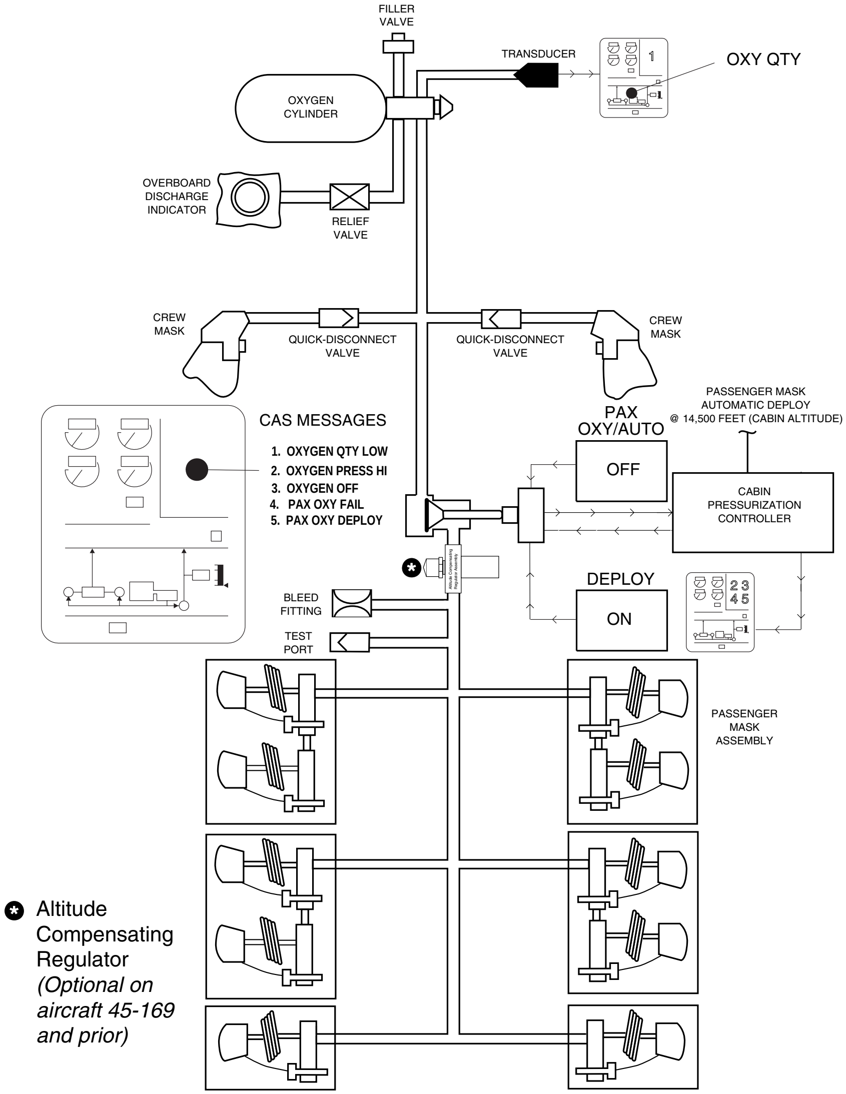
deploy, and the cabin overhead lights will illuminate to provide maximum visibility for donning masks. This is the normal position of the switch.

2. With the DEPLOY switch ON, oxygen is available to the passenger distribution system and the passenger masks will deploy. Activation of the DEPLOY switch will manually open the passenger oxygen valve and allow oxygen pressure to deploy the passenger masks. This position can be used to deploy the passenger masks at any cabin altitude. During automatic deployment of the masks, ON will illuminate.

3. With the PAX OXY/AUTO valve in the OFF position, oxygen will not be automatically made available to the passenger distribution system regardless of cabin altitude. This position can be used when oxygen is required for the crew members only.

The following CAS illuminations are specific to passenger oxygen valve operation:

CAS	Color	Description
PAX OXY FAIL	Amber	A failure of the passenger oxygen valve is detected. Passenger oxygen mask deployment may not be possible.
PAX OXY DEPLOY	White	The passenger oxygen valve is activated (auto or manual) causing the passenger oxygen masks to deploy.



CAS MESSAGES

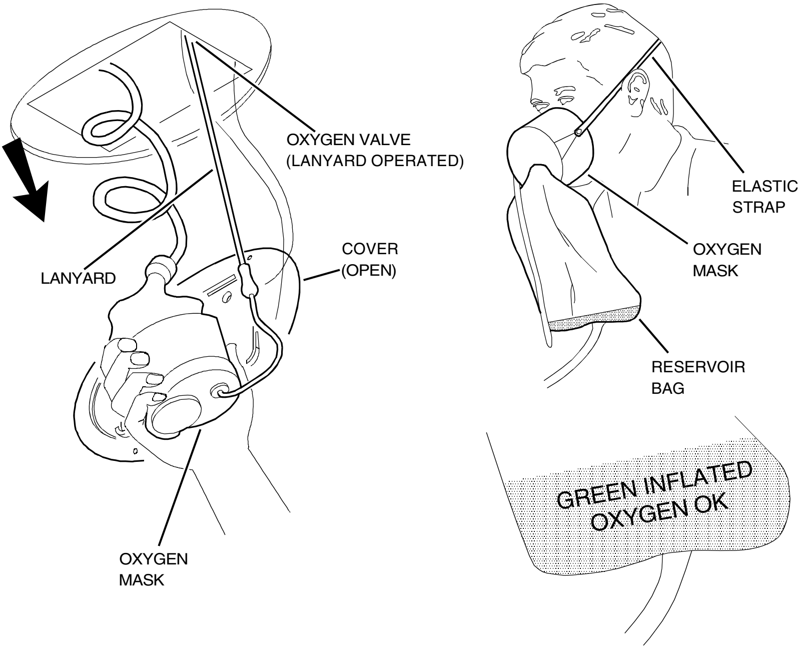
1. **OXYGEN QTY LOW**
2. **OXYGEN PRESS HI**
3. **OXYGEN OFF**
4. **PAX OXY FAIL**
5. **PAX OXY DEPLOY**

✱ Altitude Compensating Regulator *(Optional on aircraft 45-169 and prior)*

OXYGEN SYSTEM SCHEMATIC
Figure 6-7

PASSENGER MASKS

The passenger oxygen masks are stowed in the headliner above the passenger seats. Whenever the compartment doors open automatically or manually the passenger oxygen masks will fall free and oxygen will be available for passenger use. The reservoir bag incorporates a green-colored chamber which will inflate when oxygen is flowing to the mask. Passengers should don masks and pull the mask lanyard to initiate oxygen flow. An orifice incorporated in the mask tubing connections will provide a constant flow rate of 4.5 liters per minute. The compartment covers can be opened manually for mask cleaning and servicing per Maintenance Manual instructions.



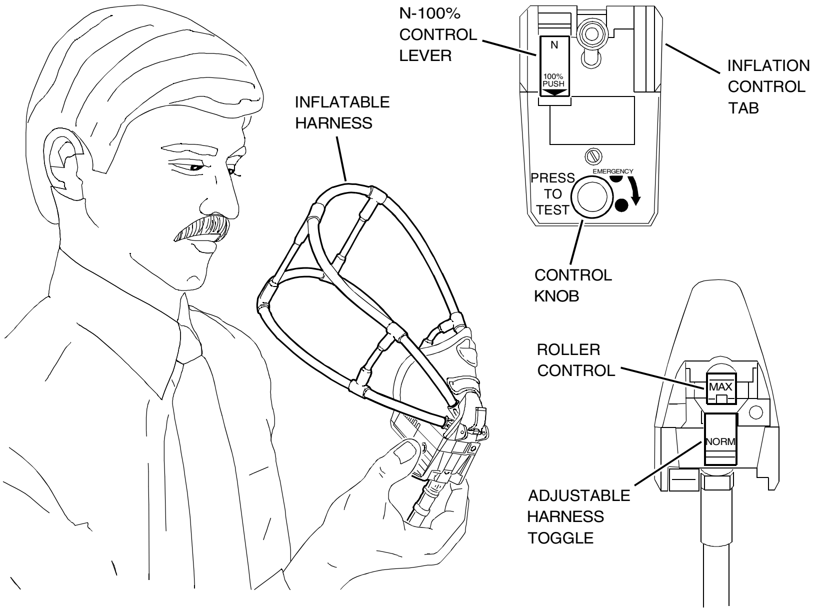
PASSENGER MASK
Figure 6-8

CREW MASKS

The flight crew oxygen masks are stowed in accessible stowage cups over each crew member's outboard shoulder, two models of pneumatic harness oxygen crew mask are available. The mask can be donned and functioning within 5 seconds by using one hand (refer to the Airplane Flight Manual for detailed operation procedures). The Puritan-Bennett model contains a mask mounted automatic diluter-demand regulator with single knob mode control (NORM - 100% - EMER). A purge valve will automatically bias open when the mask is used in conjunction with smoke goggles, the EMER position can be used to quickly purge the goggles of smoke. The EROS model, also with a mask mounted regulator, has the controls on the lower side of the regulator. A red control lever (N-100%) on the forward side and a red control knob with a normal (◒) and an emergency (●) setting for controlling oxygen supply. The purge valve is manually opened on this model.

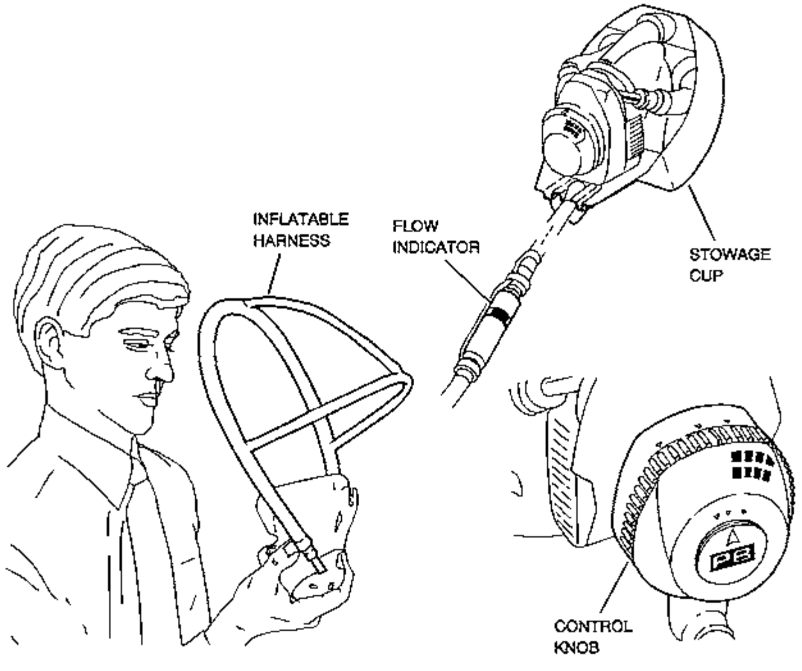
To use the mask, the crew member grasps the mask and pulls it from the stowage cup. Holding the mask harness inflated, don the mask, when the mask is in position release the inflation control to allow the mask to adjust into position. Adjust mask as necessary for comfort.

.



CREW MASKS (EROS)
Figure 6-9

A "comfort control" feature (if applicable) allows the tension in the harness to be adjusted by adding or reducing the amount of pressure in the harness. The EROS mask is manually controlled and in an emergency, the adjustable harness toggle must be switched to the NORM position to deflate the harness to full tension. On the Puritan-Bennett mask, a built-in altitude sensing aneroid automatically deflates the harness assembly (tightest setting), before cabin altitude reaches 15,000 feet.



CREW MASKS
(Puritan-Bennett)
Figure 6-10

PRESSURIZATION SYSTEM

Cabin pressurization is provided by conditioned air entering the cabin through the air distribution ducts and controlled by modulating the amount of air exhausted from the cabin. The Cabin Pressure Control System (CPCS) regulates the exhausted air at a rate that sets the cabin altitude.

CABIN PRESSURE CONTROL SYSTEM (CPCS)

The dual channel CPCS consists of a primary outflow valve, secondary outflow valve, jet pump, air filter, check valve and Cabin Pressurization Controller (CPC). The dual channel CPCS uses a primary and secondary channel. Both channels function the same and are capable of performing all operations required for automatic cabin pressurization.

The primary channel controls the primary outflow valve and the secondary channel controls the secondary outflow valve. A pressurization vacuum jet pump supplies servo pressure to both primary and secondary outflow valves during normal pressurization. An air filter and check valve prevent contaminated or overheated bleed air from entering the primary outflow valve.

GROUND MODE

To prevent possible injury resulting from closing or opening the cabin door with the aircraft partially pressurized, the outflow valves are fully open when the CPC is in ground mode. The CPC remains in ground mode until any of the following occurs:

- The left thrust lever is advanced for takeoff (T/O detent).
- The main gear weight-on-wheels switches indicate the aircraft is airborne.
- Airspeed is greater than 150 knots when transitioning to climb mode.
- Airspeed is less than 65 knots when transitioning from any mode but climb.

CABIN PRESSURE CONTROLLER (CPC)

The CPC is located on the copilot's PRESSURIZATION panel. This panel provides all the necessary crew interface with the pressurization system. The CPC contains two cabin pressure sensors (one for each channel), a liquid crystal display, LDG ALT selector and MANUAL rate control knobs.

Signals generated by the CPC are used to activate the altitude warning voice, the EICAS altitude warning, the emergency pressurization system, the oxygen system and the ACM (air cycle machine) bypass valve. Operating power for the primary (left) and secondary (right) channels of the cabin pressure controller is 28-vdc supplied through the 2-amp PRI and SEC circuit breakers on the respective pilot's and copilot's circuit breaker panels.

The following CAS illuminations are specific to cabin pressure controller system:

CAS	Color	Description
CAB DELTA P	Amber	Cabin differential pressure limit (either positive or negative) is exceeded.
CAB PRESS FAIL	Amber	Both channels (L and R) of the cabin pressurization control system have failed. System pressurization will go to maximum differential pressure and cabin pressurization displays will become amber dashes.
CAB PRESS MAN	Amber	Cabin pressurization has reverted to manual rate mode because of the loss of all air data input (dual ADC failure).
CAB PRESS FAIL	White	Associated channel (L or R) of the cabin pressurization control system has failed. System operation will automatically switch to the opposite channel.
CAB PRESS MAN	White	Cabin pressurization manual rate mode is selected by the crew.

EMERGENCY PRESSURIZATION

In the event of normal cabin airflow malfunction, emergency pressurization is provided by routing LP bleed air directly into the cabin through the emergency pressurization valves. The L and R BLEED switches need to be ON for automatic or manual activation of the emergency pressurization system to both sides. EMER PRESS can be selectively turned off on the left or right side by turning the respective L or R BLEED switch OFF.

Emergency pressurization is accomplished automatically by opening the emergency pressurization valves in response to signals from the cabin pressure controller or manually by pressing the EMER PRESS switch on the PRESSURIZATION panel. When the aircraft is below 25,000 feet pressure altitude and the system is in automatic mode with a takeoff or landing field elevation greater than 8000 feet specified, the cabin pressure controller will not trigger the emergency pressurization unless the cabin altitude increases to 14,500 (±250) feet.

Emergency pressurization is provided by two independent channels (primary and secondary) of the cabin pressure controller. If triggered automatically, the primary and secondary channels will activate approximately at the same time in response to the cabin pressure controller. If triggered manually, the primary and secondary channels may be activated separately. When automatic or manual emergency pressurization is triggered, the following events occur:

- EMER PRESS switch illuminates ON.
- EMER PRESS ON amber CAS illuminates.
- Emergency pressurization valves open.
- The HP bleed-air shutoff valves close.

Extended operation with emergency pressurization will increase cabin temperature, especially at higher thrust settings. Temperature control will only be possible by reducing thrust or turning an L or R BLEED switch OFF. At altitudes not requiring pressurization, both L and R BLEED switches can be selected OFF.

Once cabin pressure has been restored by EMER PRESS activation, or after descent, the cabin pressure controller will automatically reset the emergency pressurization system at 8300 or 13,300 feet, depending on the triggering altitude (9500 or 14,500 feet). Depressing the EMER PRESS switch when the cabin altitude is below 8000 feet will extinguish the switch and CAS, and restore normal pressurization.

The following CAS illumination is specific to the emergency pressurization system:

CAS	Color	Description
EMER PRESS ON	Amber	The associated (L or R) emergency pressurization valve is open (manually or automatically).

PRESSURIZATION CONTROLS AND INDICATORS

CABIN PRESSURIZATION CONTROL DISPLAY

The cabin pressurization control display on the PRESSURIZATION panel includes an LCD (liquid crystal display) for presenting CAB RATE (cabin rate), DELTA P (differential pressure), CAB ALT (cabin altitude), manual cabin, and landing field elevations.

LDG ALT KNOB

The LDG ALT rotary knob is used to select landing field elevation during automatic pressurization mode. Rotation of the knob illuminates an LA and displays the present landing field altitude for 5 seconds. The rotary knob adjusts the landing altitude DN or UP in 100-foot increments per detent.

MANUAL PRESS SWITCH AND MANUAL KNOB

Manual control of the pressurization system is initiated by pressing the MANUAL PRESS switch ON. In the event of a dual ADC failure, manual mode is automatically initiated.

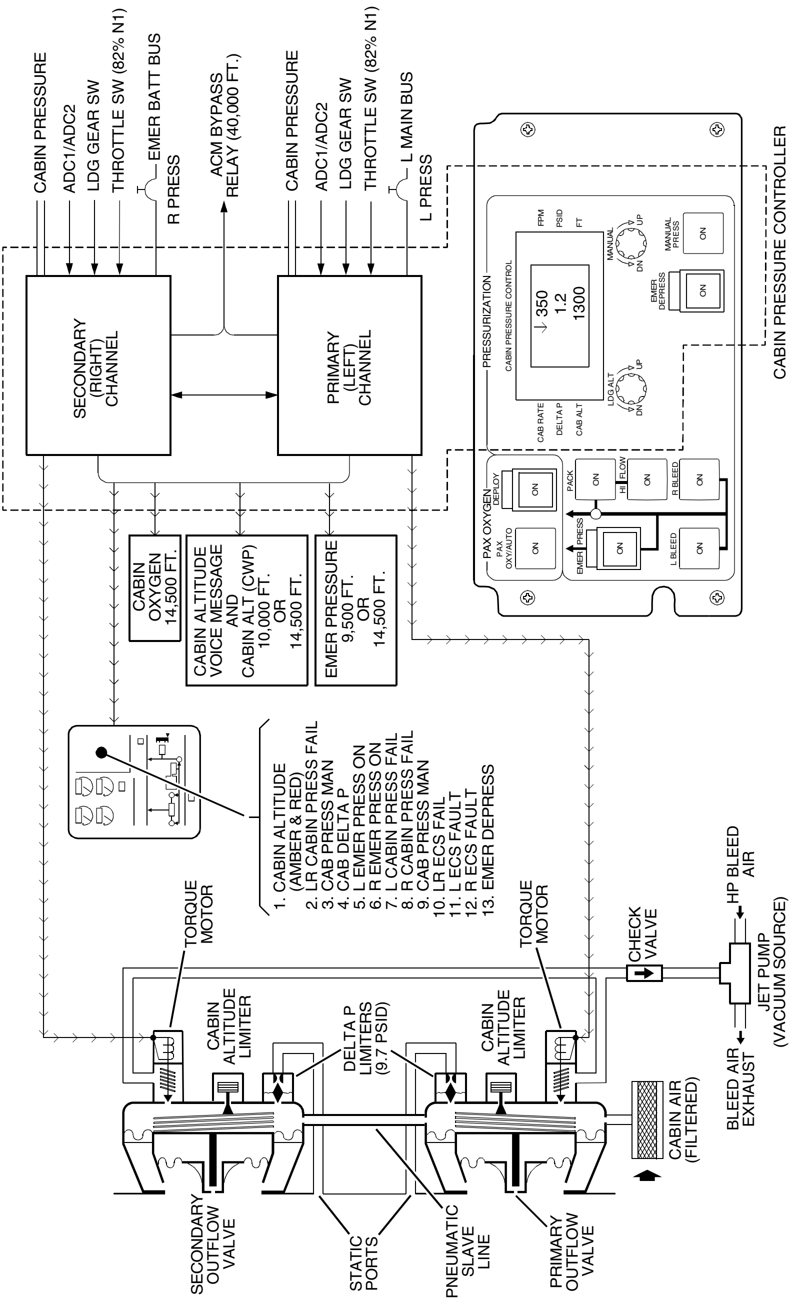
The MANUAL rate knob allows the crew to control how fast the cabin pressurization system reaches the desired cabin altitude. Rotation of the knob illuminates an MR and displays the present manual rate temporarily. The rotary knob adjusts the manual pressurization rate DN or UP in 100 foot-per-minute increments per detent. When the desired cabin altitude is approached, rotate the manual control knob in the appropriate direction until the manual cabin rate reaches zero.

EMER DEPRESS SWITCH

The EMER DEPRESS switch is an alternate-action switch located on the PRESSURIZATION panel. A guard is installed over the switch to prevent inadvertent actuation. The switch is used to depressurize the cabin and increase cabin airflow for smoke and fume evacuation. The EMER DEPRESS function is available in both automatic and manual modes. When EMER DEPRESS is selected ON, a EMER DEPRESS white CAS illuminates and the outflow valves receive a signal to move toward the full open position. The cabin altitude will ascend to the aircraft altitude or 13,700 (±500) feet (cabin altitude limiter), whichever is less. To de-select this mode, depress and release the EMER DEPRESS switch.

The following CAS illumination is specific to the emergency depressurization system:

CAS	Color	Description
EMER DEPRESS	White	Emergency depressurization is selected by the crew.



CABIN PRESSURE CONTROL DIAGRAM
Figure 6-11

PRESSURIZATION WARNING SYSTEM

The pressurization system provides the capability to operate at high altitude fields (8000 - 13,700 ft elevation) without triggering annunciations and emergency pressurization. The logic employed for this feature is as follows:

Conditions	Pressurization system will:
TAKEOFF	
Takeoff from field elevation less than 8000 ft	- Annunciate loss of cabin pressure if cabin altitude exceeds 8750 ft. - Activate emergency pressurization if cabin altitude exceeds 9500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 10,000 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 10,000 ft.
Takeoff from field elevation greater than 8000 ft	- Annunciate loss of cabin pressure if cabin altitude exceeds 14,500 ft. - Activate emergency pressurization if cabin altitude exceeds 14,500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 14,500 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 14,500 ft. **When the aircraft climbs above 24,500 ft:** Resume settings specified in "Takeoff from field elevation less than 8000 ft".
LANDING	
Landing at field elevation less than 8000 ft (as selected on LDG ALT)	- Annunciate loss of cabin pressure if cabin altitude exceeds 8750 ft. - Activate emergency pressurization if cabin altitude exceeds 9500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 10,000 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 10,000 ft.
Landing at field elevation greater than 8000 ft (as selected on LDG ALT)	Maintain the settings specified in "Landing at field elevation less than 8000 ft (as selected on LDG ALT)" until the aircraft descends below 24,500 ft. **When the aircraft descends below 24,500 ft:** - Annunciate loss of cabin pressure if cabin altitude exceeds 14,500 ft. - Activate emergency pressurization if cabin altitude exceeds 14,500 ft. - Activate cabin altitude warning voice if cabin altitude exceeds 14,500 ft. - *Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5,* activate CABIN ALTITUDE red CAS and CABIN ALT red CWP if cabin altitude exceeds 14,500 ft.

Applicable operating rules, pertaining to the use of oxygen at high cabin altitude, must be observed.

The following CAS illuminations are specific to the pressurization warning system:

CAS	Color	Description
CABIN ALTITUDE *(Aircraft 45-236 & subsequent and prior aircraft modified by SB 45-22-5)*	Red	The cabin altitude exceeds 10,000 feet (pressurization system LDG ALT set below 8000) or 14,500 feet (pressurization system LDG ALT set above 8000).
CABIN ALTITUDE	Amber	The cabin altitude is higher than normal for the given conditions.

SECTION VII
INTERIOR EQUIPMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

SECTION VII
INTERIOR EQUIPMENT

COCKPIT DESCRIPTION

The cockpit (Figure 7-1) is configured in a standard side-by-side seating arrangement with a center pedestal mounted between the seats. The instrument panel is installed with an 18° forward cant which provides an ergonomic view of the panel by either crew member. The throttle quadrant is located between the center pedestal and the instrument panel. The instrument panel, center pedestal and throttle quadrant are easily accessible by both pilots.

The dual primary flight controls consist of a textured surface control wheel mounted to a control column and an adjustable set of rudder pedals. The control wheel and column operate with the normal push-pull (pitch) and left/right rotation (roll) input commands. The control wheels have a trim switch, microphone switch and a Control Wheel Master Switch (MSW) installed on the outboard side of the wheel. A checklist line advance switch, a transponder switch and a Touch Control Steering (TCS) switch are installed on the inboard side of the control wheels. The pilot's control wheel is equipped with an aileron (roll) disconnect lever. Each control column is equipped with an approach plate holder that will secure an entire approach plate booklet. An illuminated approach plate holder is available as an option. The left and right rudder pedals provide yaw control during flight and are electrically adjustable fore/aft for different sized pilots. The rudder pedals also control nose wheel steering and braking while the wheels are on the ground.

Secondary flight controls and thrust levers are mounted on the throttle quadrant at the forward side of the pedestal. The elevator disconnect handle, emergency gear freefall lever, flap control lever, emergency/parking brake handle and spoiler control handle are all located in the throttle quadrant. The system test control switch, pitch trim bias switch, radio control hot bus switch, rudder boost switch and clearance delivery radio are located at the forward end of the quadrant. Switches for the optional ground proximity warning system may be installed aft of the clearance delivery radio. The Multi-Function Display (MFD) joystick is located in the quadrant, aft of the thrust levers.

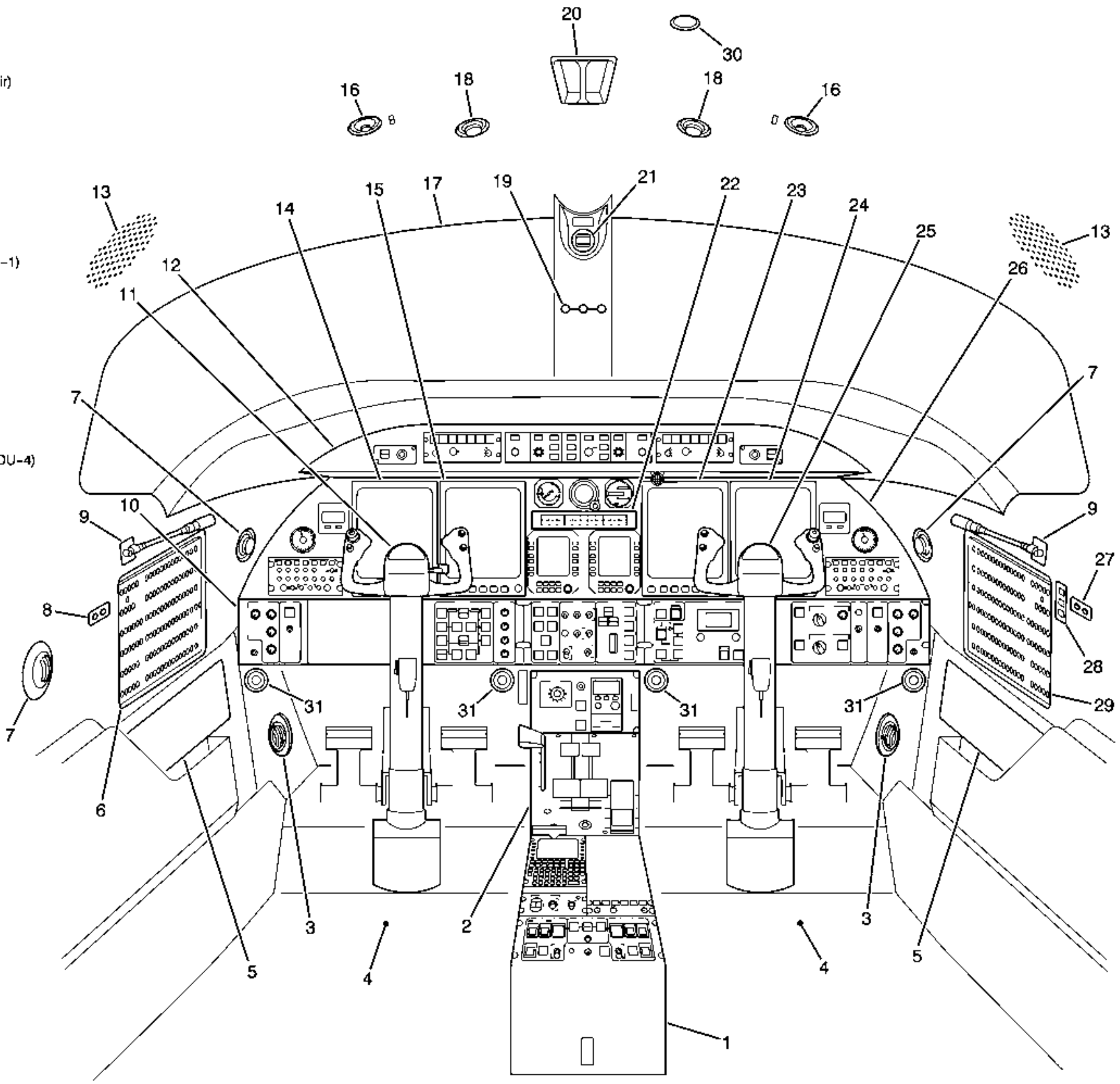
The instrument panel consists of three major horizontal tiers of instruments and controls. Within each tier, the controls for each system are grouped together on a separate panel and/or display. The glareshield panels (upper tier) provide controls for operating the flight director/autopilot and for managing information displayed on the Primary Flight Displays (PFDs), Multi-Function Display (MFD) and Multi-Function Display (MFD) and Engine Indicating and Crew Alerting System (EICAS) (EICAS) display. The main instrument panel (middle tier) provides visual displays and controls for communication/navigation, engine management and electronic flight instrument systems management. The subpanel (lower tier) provides control for several aircraft systems and for control of the lights and landing gear.

The upper tier (glareshield panel) is located immediately below the glareshield. It consists of the integrated flight guidance controller and the pilot's and copilot's Electronic Flight Instrument System (EFIS) control panels. The glareshield panels also contain the pilot's and copilot's display unit reversion panels and master warning/caution annunciator/reset switch.

The main instrument panel, in the middle tier area, is identified by four 8 x 7 inch high resolution color Cathode Ray Tube (CRT) displays. Display Units (DUs) on the pilot's side include both a Primary Flight Display (PFD) and an Engine Indicating/Crew Alerting System (EICAS). DUs on the copilot's side include a multi-function display (MFD) and a second PFD. The standby instruments (Airspeed, Attitude Indicator and Altimeter) are located between the EICAS and copilot's MFD. The Crew Warning Panel (CWP) and Radio Management Unit (RMU) displays are located below the standby instruments and between the EICAS and copilot's MFD. The angle-of-attack indicators (if installed), digital chronometers and audio control panels for both the pilot's and copilot's side are located near the outboard ends of the main instrument panel.

The pilot's subpanel contains the reversion control panel, electrical control panel and the Attitude Heading Reference System (AHRS) control for AHRS 1. It also contains the pilot's side crew lighting panel and rudder pedal adjustment switch. The copilot's subpanel contains the cabin pressurization and oxygen control panel, the environmental control panel and cockpit voice recorder control panel. It also contains the AHRS control for AHRS 2, the crew lighting panel and the rudder pedal adjustment switch. The anti-ice panel, aircraft light control panel and landing gear/hydraulic panel are all installed near the center of the subpanel (center switch subpanel), directly above the forward side of the throttle quadrant.

1. Pedestal
2. Throttle Quadrant
3. Air Outlet (ankle)
4. Fire Extinguisher (mounted on crew chair)
5. Smoke Goggle Storage
6. Pilot's Circuit Breaker Panel
7. Air Outlet (armrest level)
8. Pilot's Mic/Phone Jack Panel
9. Map Light
10. Pilot's and Copilot's Subpanels
11. Pilot's Control Column & Wheel
12. Glareshield Panels
13. Cockpit Speakers
14. Pilot's Primary Flight Display (PFD) (DU-1)
15. Engine Indicating and Crew Alerting System (EICAS) (DU-2)
16. Dome Light
17. Sunvisor
18. Overhead Air Outlet
19. Eye Reference Locator
20. Assist Handle
21. Magnetic Compass
22. Crew Warning Panel
23. Multi-Function Display (MFD) (DU-3)
24. Copilot's Primary Flight Display (PFD) (DU-4)
25. Copilot's Control Column & Wheel
26. Instrument Panel
27. Copilot's Mic/Phone Jack Panel
28. Cabin Lighting Control
29. Copilot's Circuit Breaker Panel
30. Access for hanging plumb bob
31. 134A Air Outlet



GENERAL ARRANGEMENT — COCKPIT
Figure 7-1

The pedestal is typically equipped with a single flight management system (FMS), a trim control panel, a weather radar control panel and an engine/fuel control panel. Optional equipment in the pedestal may include a second (dual) FMS, a high frequency comm control head, a SELCAL control panel, an Auxiliary Power Unit (APU) control panel, an Emergency Locator Transmitter (ELT) switch, and a 12-vdc cigarette lighter.

An inflatable harness type oxygen mask with an integral microphone is stored on the outboard side of each crew seat. Smoke goggles are stored in the left and right lower sidewall storage compartments. Hand-held fire extinguishers are installed on the crew seats directly behind the pilot's and copilot's legs. Life vests are stowed inside plastic holders which are mounted to cabinets located directly behind each crew seat.

A magnetic compass is installed on the windshield center post near the top of the windshield. The headliner houses a dome light, air outlets, an assist handle and an access for a plumb bob location for leveling the aircraft. An optional sunvisor may also be attached to the headliner. No switches, instruments or placards are located overhead. Circuit breaker panels are located on the pilot and copilot upper sidewall panels. A flexible map light is attached to the upper sidewall above the circuit breaker panel on each side. Cabin and spot light control switches are located adjacent to the copilot's circuit breaker panel. Flashlights are installed on the cabinet behind each crew seat. Air outlets are installed in the cockpit sidewall panels and lower forward cockpit side panels. Storage compartments are built into the lower sidewall panels for charts and Jeppesen manuals. Drink holders are attached to the forward side of the storage compartments. Additional manual storage is provided in the left storage cabinet located behind the pilot's seat.

CREW SEATS

The crew seats (Figure 7-2) are comprised of three basic structures: the seat base, the seat bottom and the seat back. The seat base is attached to and travels on the seat tracks. The seat bottom is located above the seat base and provides controls for forward/aft movement, seat height adjustment and seat back reclining adjustment. The seat back contains the lumbar adjustment control, adjustable armrests and an adjustable headrest.

The crew seats are constructed of lightweight alloys covered with foam padding and sheepskin and are equipped with a five point restraint system. The lap belts and negative-G strap are mounted to the seat bottom. The rotary buckle is attached to the outboard lap belt. The manual lock/unlock handle for the shoulder harness belts is located on the inboard side of the seat back frame.

Seat height adjustment is accomplished by pulling up on the vertical adjustment control lever located under the forward edge of the seat bottom near the outboard side of the seat. When the lever is pulled, the mechanism is unlocked and the seat will move downward under the occupant's weight. To raise the seat, remove occupant weight from the seat while pulling up on the lever. Gas cylinders will cause the seat to automatically raise up. Release the lever at the desired height to lock the seat into place.

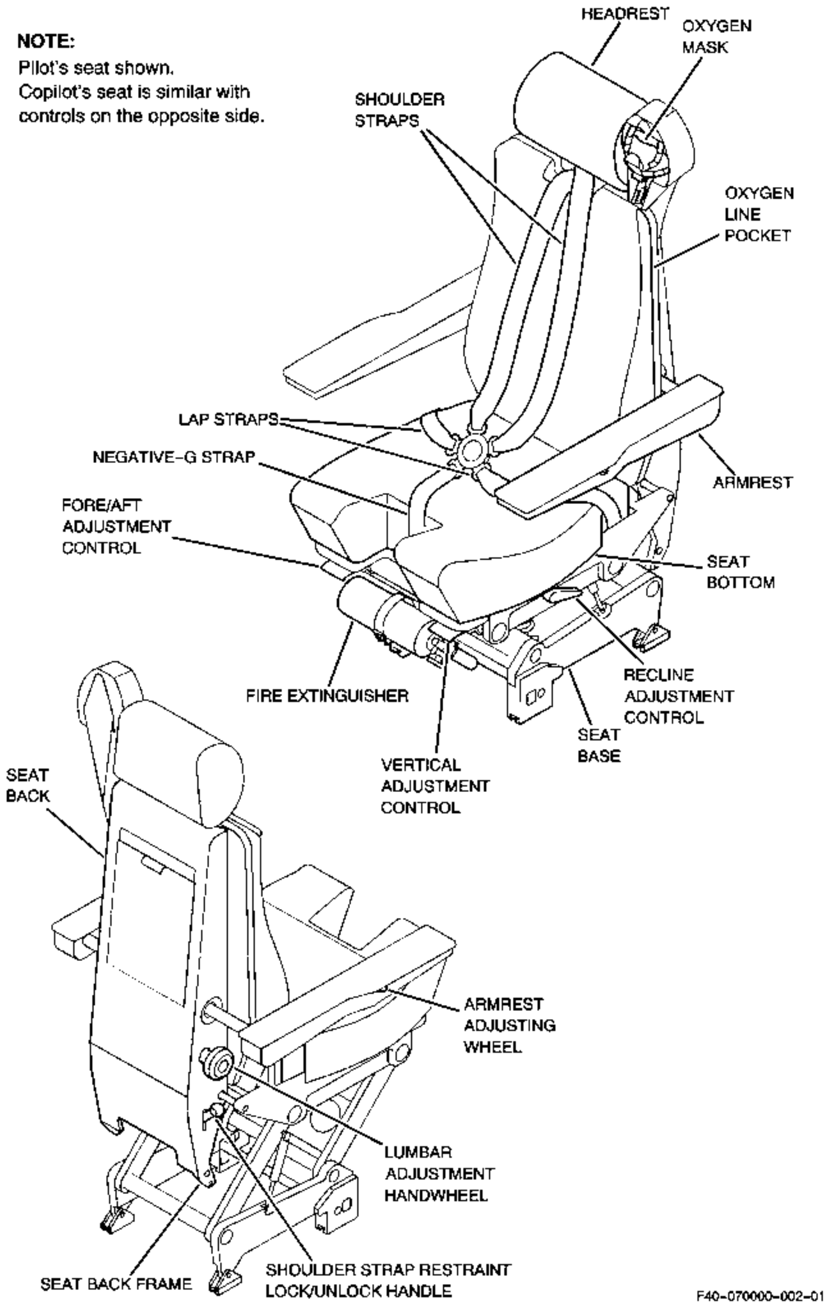
Forward and aft adjustment of the seat is accomplished by pulling up on the fore/aft adjustment control lever located under the forward edge of the seat bottom near the inboard side of the seat. The seat can be moved by holding the control lever up, and at the same time, sliding the seat forward or aft on the seat tracks. When the desired position is obtained, the control lever can be released to lock the seat to the seat track.

The headrest may be adjusted for both angle and height. The headrest can be tilted forward to an angle of up to 60° by tilting it by hand. The headrest can also be raised up to 2 inches by lifting the headrest. The headrest can be lowered by pushing it down to the desired height.

The back cushion/lumbar support is controlled by turning the fore/aft lumbar adjustment control handwheel located on the inboard side of the seat back frame. Turning the handwheel counterclockwise (as viewed looking outboard) extends the lumbar support forward. Turning the handwheel clockwise will retract the lumbar support.

The armrests are individually stowable and adjustable. Each armrest has an adjusting wheel on the underside of the armrest. To deploy the armrest, slide the armrest out from the seat back and rotate it down into position. To raise and lower the armrest position, turn the adjusting wheel on the underside of the armrest. The armrests will adjust 15 to 26°. To stow the armrests for entry and exit, lift the armrest until it is parallel with the seat back and push it in toward the seat spine.

The seat back recline angle is adjustable. The recline adjustment control lever is located on the outboard side of the crew seat bottom. Pull up on the recline control lever to release the seat back lock and lean the seat to the desired angle. The seat back can be reclined 25°. The seat back will lock in the selected position when the control lever is released.



COCKPIT SEAT
Figure 7-2

A flexible oxygen hose is routed between the oxygen outlets on the left and right cabin sidewalls and the lower outboard side of each crew seat bottom. This hose provides oxygen for the oxygen mask installation adjacent to each headrest. The crew mask microphone wiring is routed with the oxygen hose through the crew seat.

CABIN DESCRIPTION

The aircraft cabin is divided into three areas: the entryway galley, the passenger seating area and the lavatory/aft cabin stowage compartment. The entryway galley is located at the forward end of the cabin. The passenger seating area is located in the center of the cabin. The lavatory /aft cabin stowage compartment is located at the aft end of the cabin.

The entryway galley area begins at the cabin entry door area and extends forward to the cockpit. The entryway galley area is comprised of the left forward storage cabinet, the right forward storage closet and the right galley cabinet. The typical galley is equipped with a coffee warmer, a trash container, an ice chest and food / beverage storage and preparation equipment.

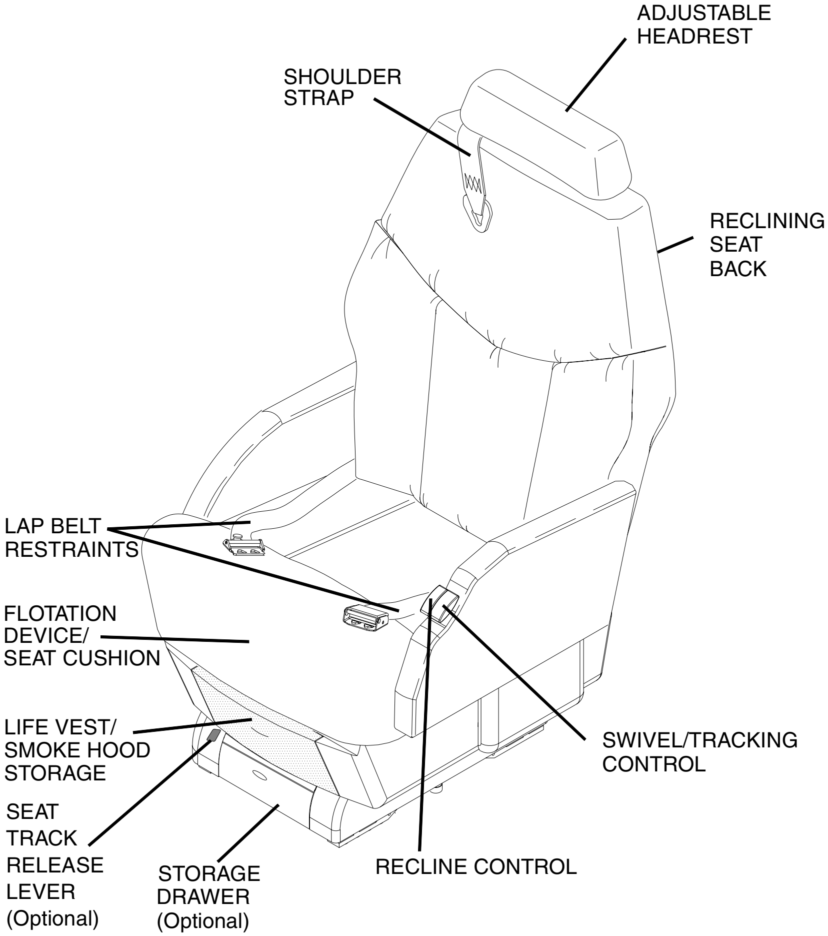
The passenger seating compartment is located aft of the cabin door entryway and extends aft to the lavatory. The typical passenger compartment has eight individual passenger seats in a two abreast configuration, with one seat on each side of a main center aisle. Individual reading lights, air outlets, and passenger oxygen masks are located in the overhead convenience panels and center headliner panels above the seats. Drinkholders, pull-out tables and lighting and entertainment control panels are built into the cabin sidewall adjacent to the seats. Optional 110-vac/60-Hz, 230-vac/50-Hz, or 115-vac electrical outlets may be available throughout the cabin or cockpit (Refer to AC ELECTRICAL OUTLETS this section).

The lavatory is located on the aft side of a partition at the aft end of the passenger compartment, adjacent to the aft cabin stowage compartment. The partition features sliding doors between the lavatory and passenger compartment. The lavatory consists of a toilet and vanity cabinet. The toilet is located on the forward RH side of the lavatory. The vanity is located aft of the toilet. An optional lavatory has a vanity which includes a warm water wash basin.

Access to the aft cabin stowage compartment is accomplished through the lavatory at the center aisle. The aft stowage compartment is equipped with a decorative coat rod and a baggage restraining net.

PASSENGER SEATS

The passenger seats have a standard lap and shoulder restraint built into each seat (Figure 7-3). Dual armrests which include an articulating inboard armrest and leather covering are standard equipment.



PASSENGER SEAT
Figure 7-3

The individual passenger seats are designed to be swiveled 360°. The seats are equipped with lateral tracking on the seat base which allows them to be located as far outboard as possible for takeoff and landing, thus maintaining maximum aisle clearance. After takeoff, the seats can be positioned inboard for increased comfort. The passenger seats can also be adjusted forward and aft on the seat base while the seat base remains stationary. These adjustments are accomplished by pulling up on the swivel control lever located at the end of the armrest. The swivel control lever is the larger of the two levers on the armrest.

Pulling up partially on the swivel/tracking control lever will release the seat to swivel, pulling the lever all the way up will allow the seat to be moved (in three directions) from side-to-side, forward/aft and in a swiveling motion. Releasing the swivel control lever will cause the seat locking mechanism to automatically lock the seat in the selected position.

The recline control lever is located at the end of the armrest, adjacent to the swivel control lever. The recline control lever is the smaller of the two levers on the end of the armrest. The seat will recline up to an 85° angle when the recline control lever is pulled up and the occupant applies weight against the seat back. The seat recline mechanism will lock in place when the recline control lever is released. To place the seat in an upright position, remove occupant weight from the seat back while pulling up on the recline lever. The mechanism will automatically raise the seat back into an upright position.

The passenger seat has an adjustable headrest installed in the seat back. The passenger headrest can be adjusted up and down by pulling it up or pushing it down with both hands. Life vests are stored in a pocket located on the forward side of each seat bottom. The seat base has proximity lights installed on the inboard side of the base.

Optional equipment may be installed on the passenger seats. An articulating outboard armrest is available that can be articulated for height. This armrest is standard equipment on the aft right passenger seat, which is situated adjacent to the right aft emergency exit. An underseat storage drawer may be incorporated into the forward end of the passenger seat. A seat track release mechanism is available which allows the entire passenger seat and seat base to be moved forward or aft along the seat tracks.

EMERGENCY EQUIPMENT

SMOKE GOGGLES

Smoke goggles are provided for each crew member and are stowed in the lower sidewall storage compartment. The goggles are donned if smoke or fumes are present in the aircraft.

HAND-HELD FIRE EXTINGUISHERS

Two hand-held fire extinguishers are mounted on the front of each crew seat. Each cockpit fire extinguisher contains 1.25 pounds of Halon 1211.

An additional hand-held fire extinguisher may be mounted in the aft cabin, near the lavatory. The cabin fire extinguisher contains 2.5 pounds of Halon 1211.

The extinguishers incorporate a pressure gauge which indicates the state of propellant charge. If properly charged, the indicator needle will be within the green segment. When an extinguisher has been manually discharged, the indicator will be in the red area. This provides the crew with visual indication that the bottle has been partially or totally discharged. The extinguishers are rechargeable.

FIRST AID KIT AND CRASH AXE (IF INSTALLED)

The first aid kit and crash axe are located in the forward right storage closet.

PROTECTIVE BREATHING EQUIPMENT (IF INSTALLED)

Protective Breathing Equipment (PBE) is available for a crew member to use in fighting cabin fires. The PBE is designed to protect the user's eyes and respiratory system from the harmful atmosphere which may be generated by a cabin fire. The PBE is a hood with a visor which is placed over the head and seals around the neck. An oxygen generating canister provides breathing oxygen for the user. The PBE is vacuum sealed in a bag and stored in a box accessible to the crew. The PBE is a throw-away unit that must be replaced whenever the vacuum seal is broken. It is imperative that the vacuum seal be maintained since the oxygen-generating chemicals react with moisture.

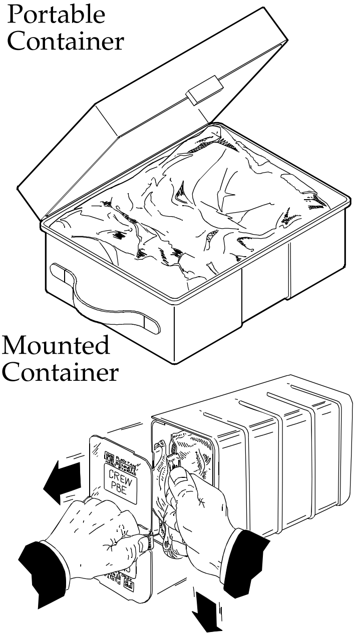
Duration of oxygen production is nominally 15 minutes depending upon the work rate and size of the user. Useful life of a sealed PBE is 10 years from the date of manufacture.

Donning the PBE:

There are two available carriers for the PBE. A portable container stored in a cabinet behind the cockpit or a mounted container (normally mounted to the aft side of the pedestal).

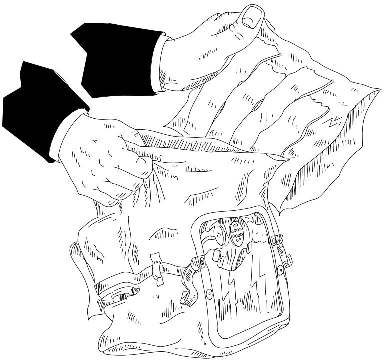
1. Remove mask from container.
   a. To open the portable container, lift the single latch on the cover and lift. Remove sealed bag from the container.

   b. On the mounted container, grasp the red access handle on the protective container firmly and pull forcibly to disengage the cover. When the cover is removed from the container, immediately drop it. (The vacuum sealed bag does not need to be removed from the container to open.) The packaged unit may be removed from the stowage container prior to opening and carried to a remote location for use.



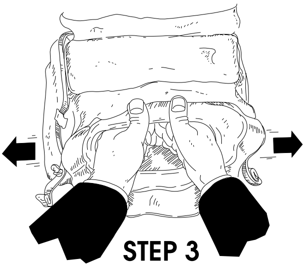
STEP 1

2. To remove the PBE from the vacuum sealed bag, locate the red I.D. tag and pull sharply to tear open the vacuum sealed bag. Reach into the opened vacuum-sealed bag and firmly grasp the PBE. Pull the PBE straight out of the bag. If necessary hold the bag with the opposite hand.



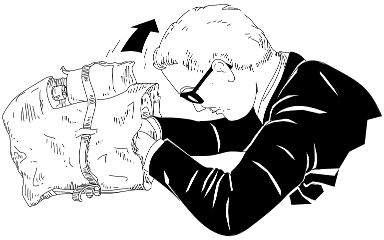
STEP 2

3. Place both hands inside the neckseal opening with palms facing each other and PBE visor facing downward with the oxygen generating canister resting on the tip of the hands.



STEP 3

4. With the top of the head bent forward, guide the PBE neckseal over the top of the head and down over the face using the hands to shield the face and glasses from the oronasal mask cone.



STEP 4

5. With both hands, grasp the adjustment straps at the lower corners of the visor and pull outward sharply to actuate the starter candle. Within 1 to 5 seconds, a rushing noise of oxygen entering the hood will be heard and inflation will be evident.

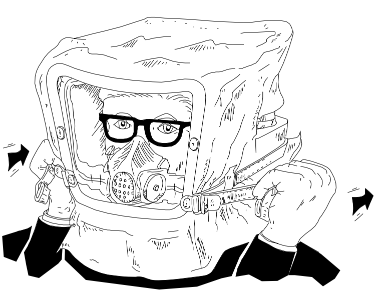
STEP 5

.

WARNING

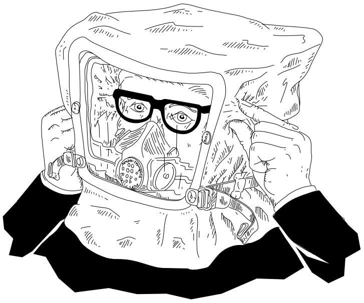
Human hair is highly flammable. Hair that protrudes through the neckseal could ignite if brought into direct contact with flame.

6. With the straps still in hand and head bent forward, pull backward to secure the oronasal mask cone high on the nose for a tight seal.



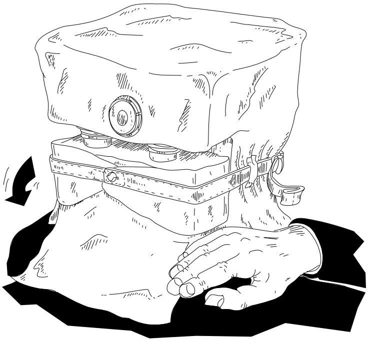
STEP 6

7. If wearing glasses, adjust their position to rest on the tip of the oronasal mask cone by moving the sides of the frame through the hood fabric. Do not attempt to adjust through the neckseal as this will result in infiltration of the surrounding atmosphere into the interior of the hood.



STEP 7

8. When the neckseal is positioned at the neck and the oxygen generating canister is resting on the nape of the neck, remove the hands, checking to see that clothing is not trapped in the seal and hair does not protrude between the seal and the neck. Pull the protective neck shield down to cover the collar and upper shoulder area.



STEP 8

Following actuation, the hood will inflate over a 15- to 20-second period. After this period, the starter candle will cease flowing and the only sound will be a slight rustling of the fabric on each inhalation and exhalation. Dependent upon breathing rate, there will be a slight exhalation resistance as the exhaled breath is forced through the oxygen generating canister. Inhalation resistance will be almost unrecognizable since inhalation is directly from the interior of the hood through a diaphragm type check valve located at the base of the oronasal mask. The visor should remain clear of fogging or misting. Heat is produced by both the chemical air regeneration process and transfer of body heat during the rebreathing cycle. Heat build-up within the hood is normal and is dependent upon the amount of work performed. There should be no irritating or strong unusual odors within the hood. Operational duration is variable dependent upon the amount of work performed by the user.

If the PBE is worn to exhaustion of the chemical regeneration system, this will be evidenced by a gradual reduction in the expended volume of the hood until the point that the hood is collapsed tightly around the head at the end of a full inhalation. Additionally, there will be a rapid buildup of heat and moisture in the hood as the canister loses its effectiveness. At this point, the wearer should immediately retire to a safe breathing area clear of flame and toxic fumes and remove the device.

Removing the PBE

1. Go to a safe area away from immediate contact with fire or open flame and/or toxic fumes.
2. With both hands, reach for the two lower corners of the visor area and push forward on the metal tabs of the adjustment strap buckles to release the strap tension.
3. Place both hands under the neckseal in the forward area and pull up, guiding the oronasal cone and neckseal over the face/glasses until the PBE is clear of the head.
4. Place the expended PBE in a safe place to cool away from fire or exposure to water.

Disposal

The expended PBE still contains unreacted oxidizing material and strong alkali materials. At the completion of flight, it must be turned over to maintenance for authorized disposal.

ABNORMAL CONDITION OF OPERATION

CAUTION This device produces oxygen which will vigorously accelerate combustion. Do not intentionally expose the device to direct flame contact, or remove in the immediate presence of fire or flame. Due to oxygen saturation of the hair, do not smoke or become exposed to fire or flame immediately after removing.

Users should be trained to recognize abnormal conditions which could signify malfunction or failure of the equipment to properly operate as follows:

Failure of the Starter Candle

If the starter candle fails to actuate when the adjustment strap is pulled, an additional sharp pull on the strap may be sufficient to dislodge the lanyard pin and actuate the device. If the device still fails to actuate, the hood will continue to function, although the initial purge capability is lost. Sticking the fingers into the neckseal to allow a large lung inhalation may be required to enable sufficient breathing volume until the chemical regeneration system begins producing a surplus of oxygen.

Inadequate Oronasal Mask Seal

Absence of a tight seal of the oronasal cone to the face may result in excess leakage of the exhaled breath into the hood, short circuiting the oxygen-generating canister. This condition may result in a build-up of CO_2 within the rebreathing volume in the hood. Excessive CO_2 is normally indicated by breathing distress such as rapid and labored breathing accompanied by a general feeling of insufficient ability to get one's breath, although there is no restriction to breathing. Presence of moisture or fogging on the visor and the sensation of air escaping from the mask, particularly around the nose and eyes, are indications of a lack of proper fit. Adjustment of the mask straps and mask position to minimize leakage should rapidly alleviate the problem. If the perception of breathing distress persists, the user should quickly go to a safe area and remove the PBE and don alternate breathing equipment if required.

Loss of Infiltration Seal

The smoke and toxic fumes generated by the combustion of most aircraft cabin interior materials has many strong irritants. The continued presence of strong irritation odors inside the hood resulting in eye and respiratory tract discomfort is a good indicator of the lack of an effective infiltration seal. Verify that the seal is in contact with the skin or the neck and does not have clothing or jewelry trapped in the seal, or hair protruding between the seal and the neck. If the condition persists, or there is evidence of a tear in the neckseal, the user should go quickly to a safe area and don alternate breathing equipment if required.

FLOTATION EQUIPMENT

Life vests are stowed in plastic compartments located behind the pilot's and copilot's seats, and in the lavatory adjacent to the toilet seat (on toilet seats with seat belts). They also may be stowed in a compartment at the front of each passenger seat. The life vests are inflated by pulling the red CO_2 release tabs. *On aircraft 45-232, 45-236 thru 45-2000,* each passenger seat cushion has been designed to also be used as a personal flotation device.

MISCELLANEOUS EQUIPMENT

CREW COMPARTMENT

FLASHLIGHTS

Two flashlights are installed in the crew compartment. The flashlights are located behind each crew member's seat. The pilot's flashlight is secured to a bracket mounted to the forward side of the forward left storage cabinet. The copilot's flashlight is secured to a bracket mounted to the forward side of the forward right-hand storage cabinet.

Rechargeable flashlights are available as optional equipment. The rechargeable flashlights are mounted in a location similar to the standard flashlights. The rechargeable flashlights are waterproof, flotable and flame retardant.

APPROACH PLATE HOLDER

A spring loaded chart holder is installed on each control wheel. The holders are large enough to hold an entire approach plate.

LIGHTED APPROACH PLATE HOLDERS

Optional illuminated chart holders are available for each control wheel. The chart holders provide illumination of the approach plates.

SUNVISORS

Sunvisors may be installed as optional equipment. Two sunvisors are located at the upper edge of the windshield, one on each side. Each sunvisor is hinged so it can be folded down and will slide along its track as desired.

FORWARD POCKET DOORS

Optional solid sliding doors may be installed which separate the cockpit from the entryway galley and passenger compartment.

PASSENGER COMPARTMENT

CABINETS, DRAWERS & TABLES

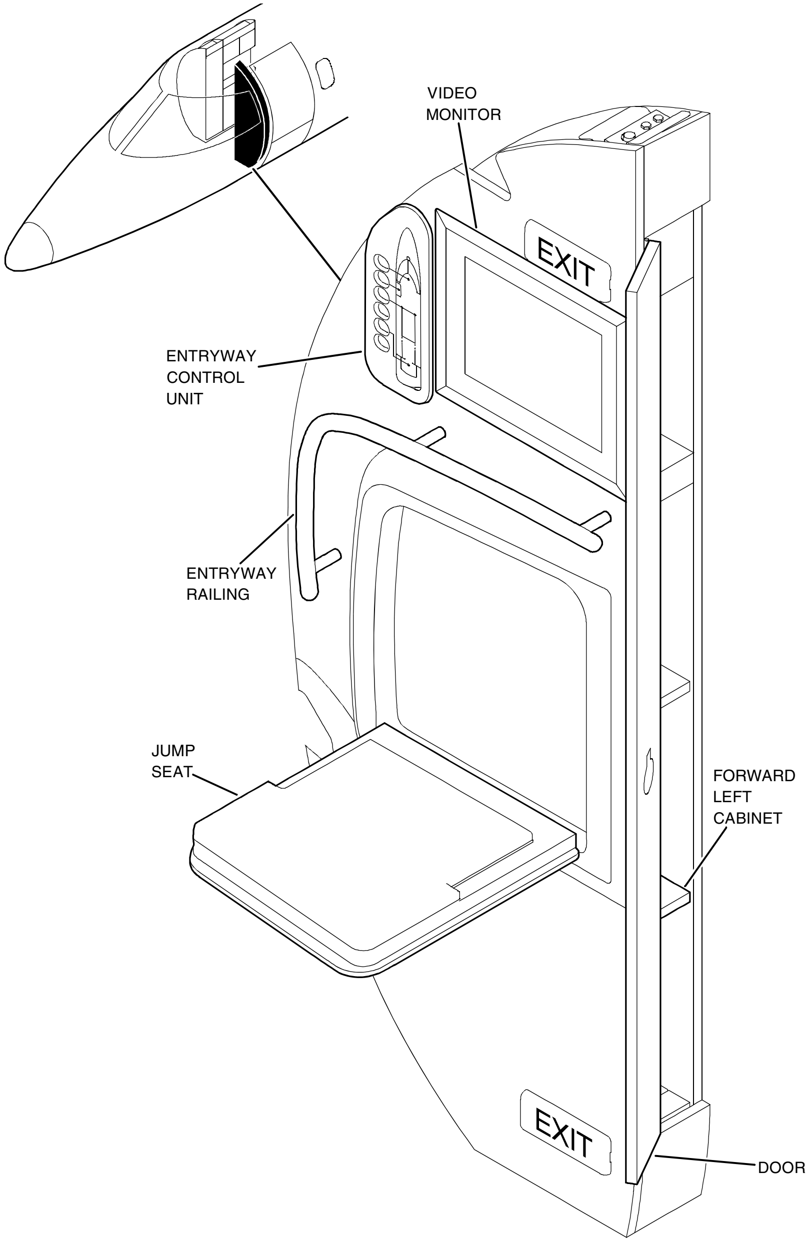
Standard and optional cabinets, drawers and tables may be built into the passenger compartment. The following descriptions and figures show the most common accessories:

Forward Left Cabinet

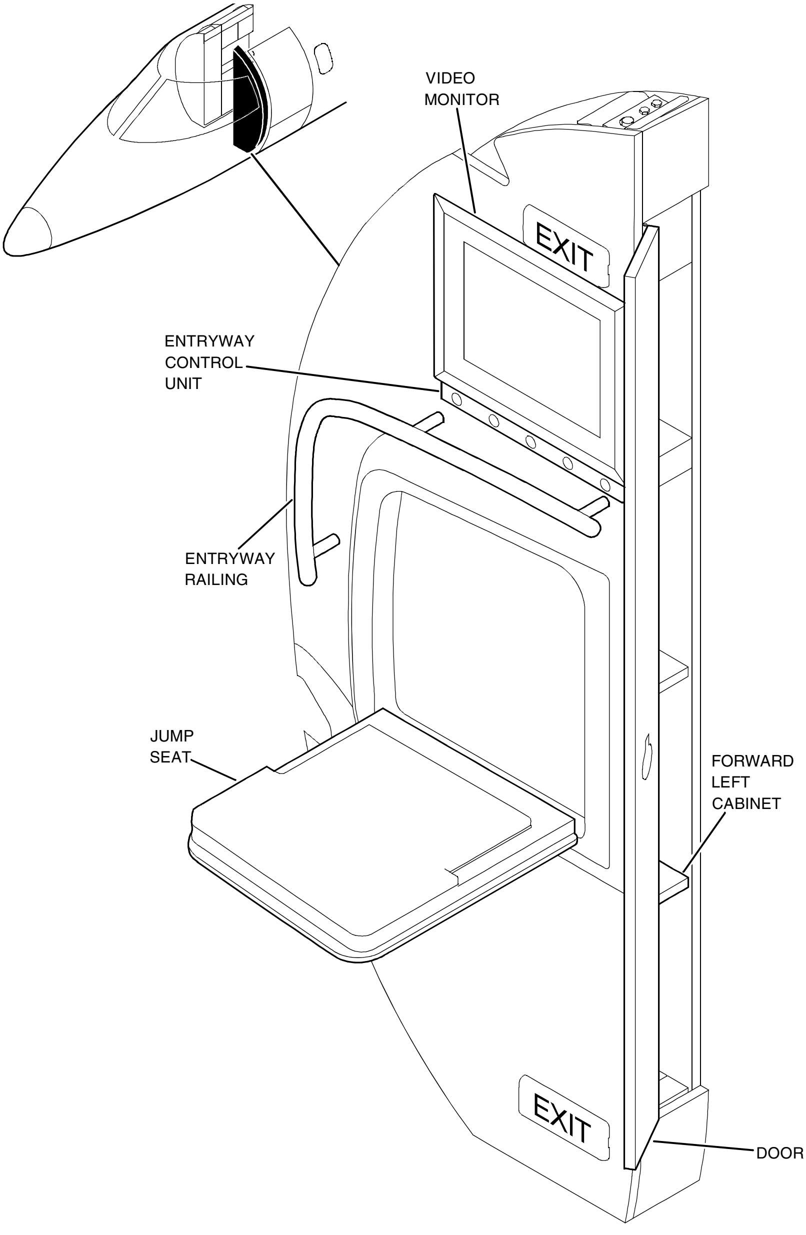
The forward left cabinet (Figure 7-4 or 7-5) is located immediately aft of the pilot's seat, on the forward side of the cabin entry door. The left cabinet has a hinged door and storage space built into the aisle side. An entryway railing is installed on the aft side of the cabinet adjacent to the entrance steps. A cabin entryway lighting control panel (Entryway Control Unit) is installed on the aft side of the cabinet above the railing. The entryway control unit contains switches for the pilot's overhead dome light, entry spotlight, cabin overhead lights, spotlights and lavatory overhead lights. An optional video monitor may be installed on the right side of the lighting control panel.

Jump Seat

An optional jump seat may be installed on the aft side of the forward left cabinet. The jump seat unfolds down from the cabinet with the occupant situated in a side-facing position for access to the right forward galley. The jump seat cannot be occupied during takeoff or landing. It must be folded up against the aft side of the forward left cabinet for both takeoff and landing.



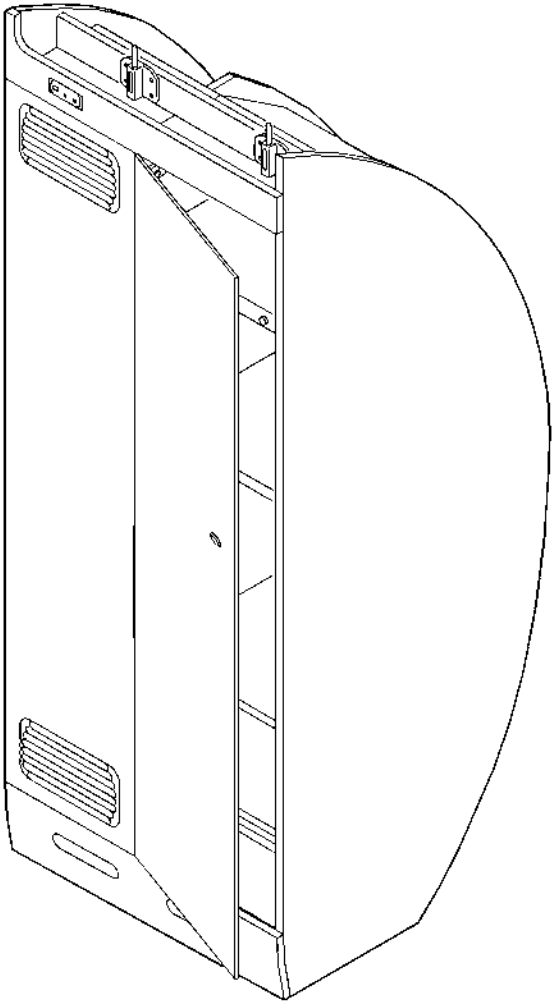
FORWARD LEFT CABINET
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)
Figure 7-4



FORWARD LEFT CABINET
(Aircraft 45-232, 45-236 thru 45-2000)
Figure 7-5

Forward Right Storage Closet/Avionics Cabinet

The forward right storage closet/avionics cabinet is located in the forward right side of the cabin, aft of the copilot's seat. The closet is equipped with a door which is hinged at the forward side and shelves located in the main compartment. The avionics cabinet racks are located behind a panel and are not accessible by door.



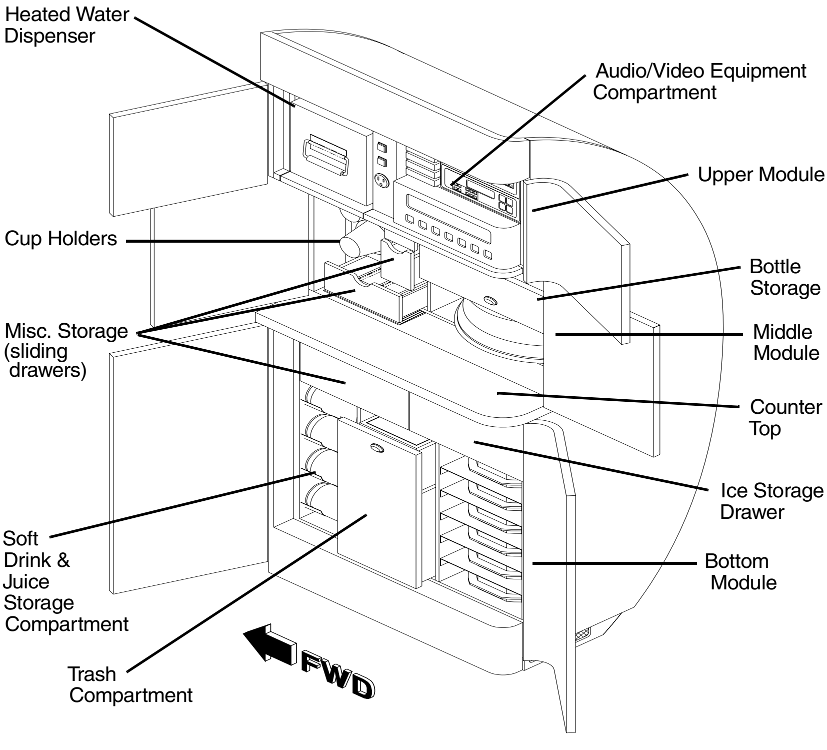
FORWARD RIGHT STORAGE CLOSET/AVIONICS CABINET
Figure 7-6

Galley Cabinet

(Aircraft 45-002 thru 45-231; 45-233 thru 45-235)

The galley cabinet (Figure 7-7) is located on the forward right side of the cabin next to and aft of the forward right storage closet. The galley cabinet consists of three customized insert modules inside the cabinet; the upper module, the middle module and the bottom module. Each module is configured according to the customer's requests, so galley cabinet assemblies will vary.

Three pairs of self-facing doors are used to enclose the galley cabinet and ensconce the contents inside the three modules. A fluorescent light is installed inside the middle module. The cabinet doors can be opened by depressing the oval shaped press-to-open latches which are installed in each door, near the center of the cabinet.



NOTE: Galley Cabinets will vary in both equipment installation and arrangement.

GALLEY CABINET
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)
Figure 7-7

The upper module is equipped with a heated water dispenser, the audio amplifier and optional cassette player, CD player and video cassette player. Additional storage space for video tapes and compact discs is available inside the module.

The middle module may be equipped with a cup holder/dispenser, small misc. storage drawers, bottle storage and food storage.

The bottom module may be equipped with a soft drink & juice can storage compartment, a large misc. storage drawer, and a slide-out drawer with a built-in ice storage liner. The ice drawers are equipped with drains to the lower fuselage, where melted ice is drained overboard through a heated drain mast. The bottom module may also include a slide-out trash compartment and a set of food tray shelves.

The following equipment and features are standard and will be installed in the galley cabinet:

Water Dispenser

Soft Drink & Juice Can Storage

Liquor Decanter and Miniature Storage

Coffee Warmer

Ice Storage

Bottle Storage

Trash Compartment

The following equipment is optional and may be installed in the galley cabinet:

Cassette/CD Player

Microwave Oven

Catering Tray

Video Cassette Player

Convection Oven

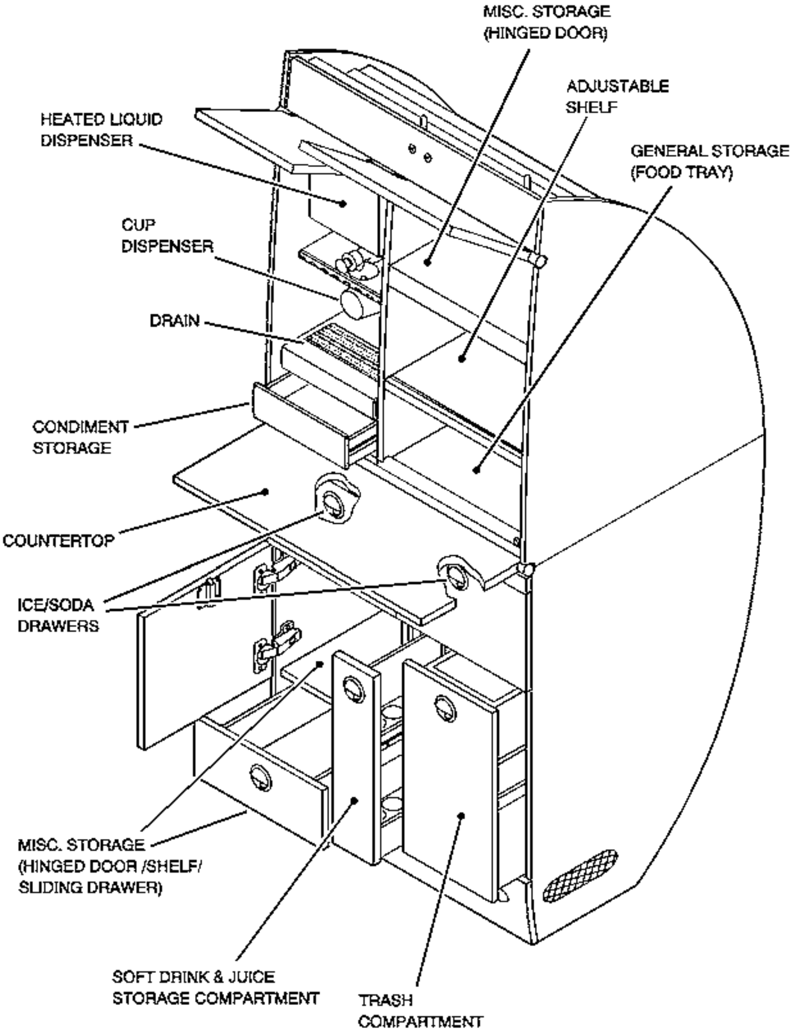
Crystal

Wine Storage

China

Galley Cabinet
(Aircraft 45-232, 45-236 thru 45-2000)

The galley cabinet (Figure 7-8) is located on the forward right side of the cabin next to and aft of the forward right storage closet/avionics cabinet. The galley cabinet consists of three customized insert modules inside the cabinet; the upper module, the middle module and the bottom module. Each module is configured according to the customer's requests, so galley cabinet assemblies will vary.



NOTE: Galley cabinets will vary in both equipment installation and arrangement.

GALLEY CABINET
(Aircraft 45-232, 45-236 thru 45-2000)
Figure 7-8

The following equipment and features are standard and will be installed in the galley cabinet:

Water/Coffee Warmer

Soft Drink/Juice Can & Ice Storage

Trash Compartment

The following equipment is optional and may be installed in the galley or closet:

Warming Oven

Catering Tray

CD Player (closet)

Microwave Oven

Crystal

DVD Player (closet)

Wine Storage

China

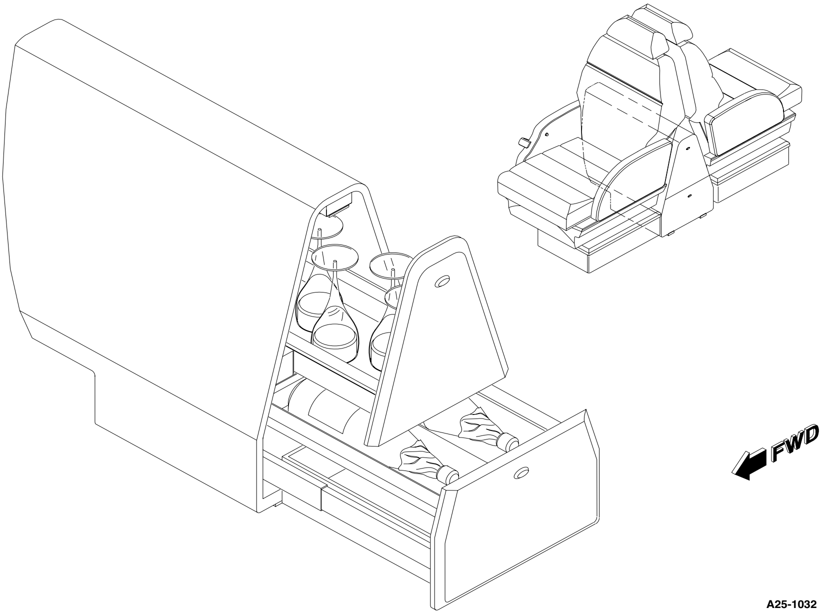
Multi-DVD Player (closet)

Sidewall Storage Boxes

Headphones, as well as other small items, may be stored in the outboard sidewall storage boxes located along the cabin armrests.

Mid-Ship Cabinets (Optional)

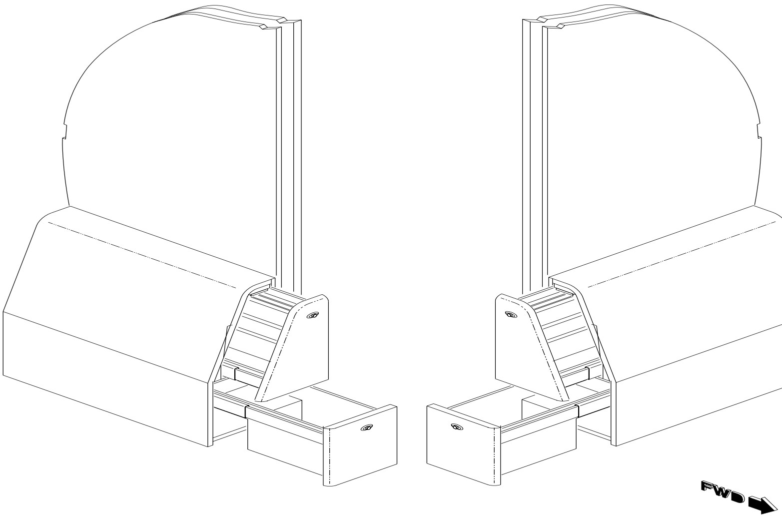
Optional mid-ship cabinets (Figure 7-9) may be located between the forward and aft-facing seats on both sides of the aisle. The mid-ship cabinet drawers may be configured for general storage, to securely store wine glasses and stemware, or to incorporate an optional ice liner to hold wine bottles. The drawers may be opened by pressing a button located near the top center of each front drawer panel.



MID-SHIP CABINETS
(Right Side with Wine & Stemware Shown)
Figure 7-9

Aft Pyramid Cabinets (Optional)

Optional aft pyramid cabinets (Figure 7-10) may be located behind the aft seats on both the right and left sides of the cabin. The pyramid cabinets can be opened by lifting and pulling latches near the top of each drawer panel. The pyramid cabinets may be configured for can storage, magazine and/or miscellaneous storage.

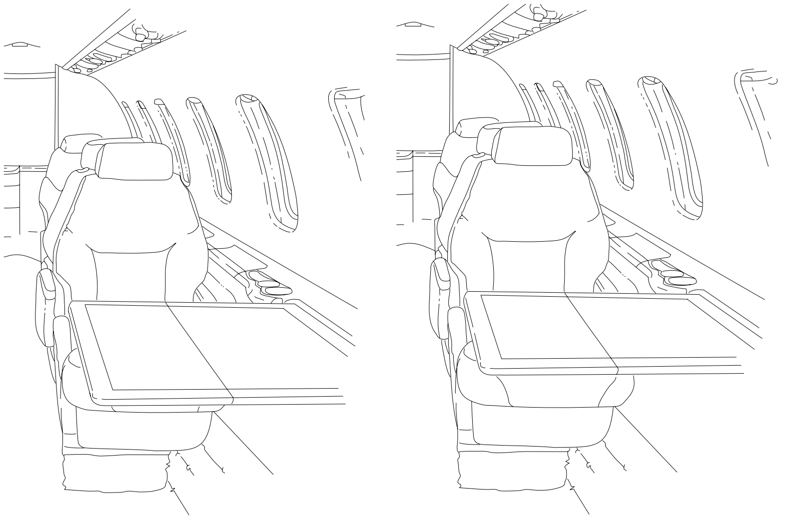


AFT PYRAMID CABINETS
Figure 7-10

Tables

Two pull-out bi-fold executive tables are located (one) on each side of the cabin and are stored inside the sidewall between the facing seats. The executive tables are 20 inches (50.8 centimeters) wide with folding leaves and a solid work surface. The table is extended for use by pulling it up from the cabin sidewall and then unfolding the leaves until they lock in place. The tables (Figure 7-11) can be stowed by folding the leaves together, raising them up until parallel with the cabin sidewall, and then sliding them down into the compartment inside the cabin sidewall.

An optional left side slimline table may be installed in the cabin sidewall adjacent to the aft forward-facing seat. The left side table unfolds and stows in the same manner as the larger tables. An optional right side table is stowed aft of the left side divider and plugs into the receptacles in the escape hatch armrest. Both tables are approximately 10 inches (25.4 centimeters) wide.



Executive Table

Slimline Table

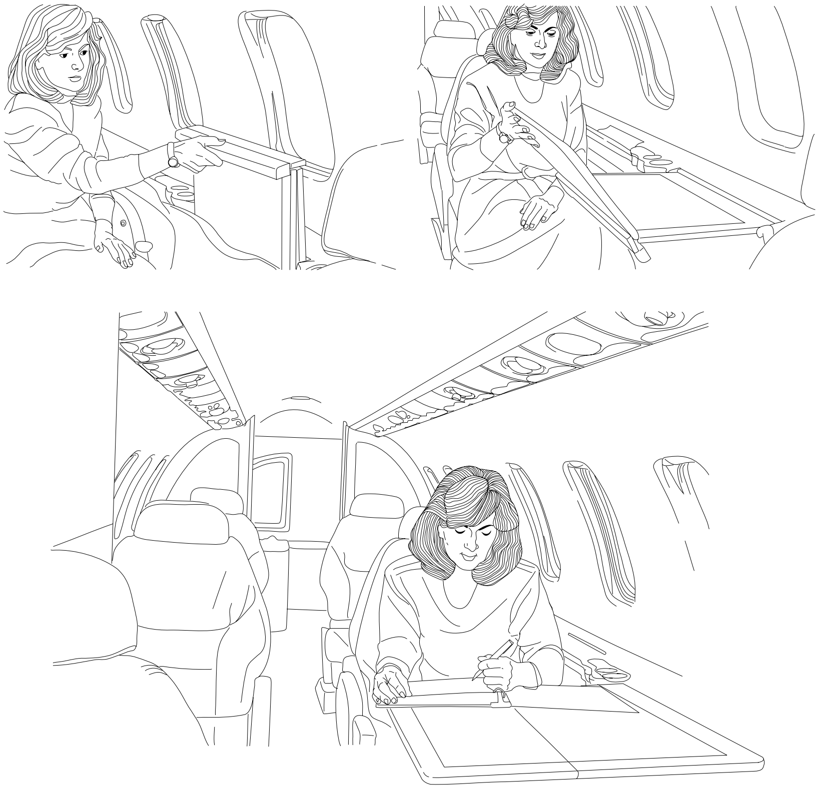


TABLE INSTALLATIONS (TYPICAL)
Figure 7-11

CABIN MANAGEMENT SYSTEM
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)

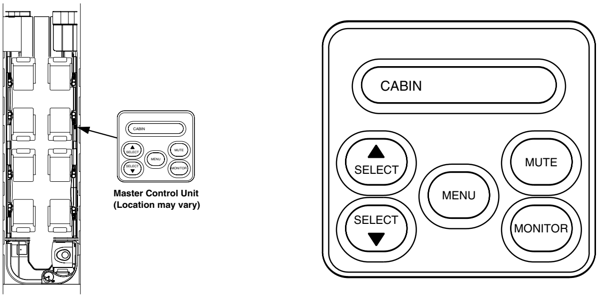
AUDIO/VIDEO SYSTEMS

The optional audio system consists of a 10 disc CD player, a cassette player, an audio amplifier, four cabin speakers, sub woofer speaker and a master control unit for cabin speaker control. The audio system also includes a passenger distribution system located in the outboard armrests with headphone jacks, output controls and an audio headphone set at each passenger seat location.

Power for the audio system is 28-vdc through the 20-amp AUDIO circuit breaker on the copilot's circuit breaker panel and through the 20-amp SPKRS circuit breaker on the pilot's circuit breaker panel. Electrical power for the optional video monitors is provided by the 5-amp VIDEO circuit breaker on the copilot's circuit breaker panel.

Cabin Speaker Audio Source

To select a listening source for the cabin speakers, first locate the master control unit. The master control unit (Figure 7-12) may be located on the outboard armrest panel at any of the cabin seat positions, but it is generally located on the right side at the second or third row from the front. Upon power-up the master control unit will display CABIN on the master control display.



MASTER CONTROL UNIT
Figure 7-12

Next, depress the MENU button on the master control unit until the display shows A| CD. When the A| CD symbol is displayed, the CD player will be selected as the active source for the cabin speakers. To select a different audio source for the cabin speakers, depress the

SELECT (down arrow) button on the master control unit, the next audio source A| CASS will be displayed. When A| CASS is displayed, the cassette player is selected as the active source for the cabin speakers.

For additional cabin speaker audio source choices, continue to depress the SELECT (down arrow) button or SELECT (up arrow) button until the desired source is displayed. The master control unit display will show the cabin speaker source selections as follows:

CABIN	(DISPLAYED UPON POWER-UP)
A| CD	(AUDIO SOURCE SELECTION)
- A|CD	(COMPACT DISC)
- A|VCP	(VIDEO CASSETTE PLAYER)
- A|CASS	(CASSETTE PLAYER)

Cabin Speaker Volume, Bass and Treble Adjustment

Cabin speaker volume is adjusted by first selecting the volume control by depressing the MENU button on the master control unit until VOL XX% is displayed (the XX represents a 2 digit number from 01 through 99, a percentage of maximum speaker volume). After VOL XX% is displayed, increase or decrease cabin speaker volume by depressing the SELECT up arrow or SELECT down arrow on the master control unit until the desired volume level is achieved. As the speaker volume level changes, the master control unit will display a corresponding VOL % value.

Cabin speaker treble and cabin speaker bass are adjusted in the same manner that cabin speaker volume is with the exception that BASS % or TREBLE % is selected with the MENU button, instead of VOL %.

Mute and Monitor Switches - Master Control Unit

To turn the cabin speaker sound OFF, depress the MUTE button on the master control unit. Depress the MUTE button again to turn the cabin speaker sound ON. To turn the optional video monitor ON, depress the MONITOR button on the master control unit. To turn the video OFF, depress the MONITOR button on the master control unit again.

Video Source Selection

Video signal for the video monitor is selected by depressing the MENU button on the master control unit until V| VCP is displayed. When V| VCP is displayed, the video cassette player will be selected as the active source for the video monitor. To select additional optional video sources, depress the SELECT down arrow or SELECT up arrow until the desired source (V| AIRSHOW 400, for example) is displayed.

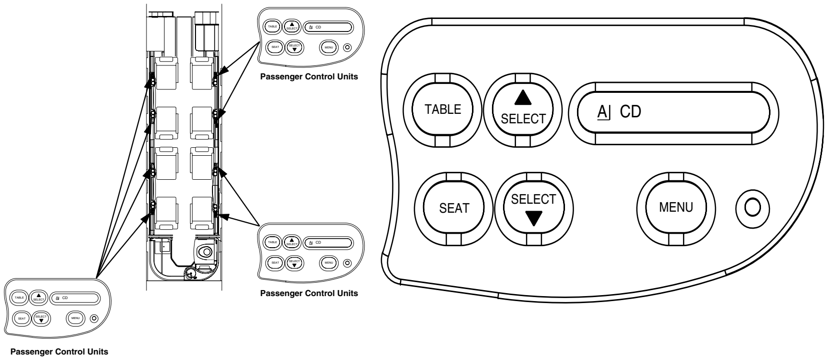
Headphone Audio Controls

Headphone audio is controlled by the passenger control units (Figure 7-14) which are located in the cabin sidewall adjacent to each passenger seat. To select a listening source for the passenger headphones, depress the MENU button on the passenger control unit until the A| CD symbol is displayed. When the A| CD symbol is displayed, the CD player will be selected as the active source for the headphones. After the A|CD is displayed, depress the SELECT up arrow or SELECT down arrow button on the passenger control unit until the desired source is displayed. The passenger control unit display will show the passenger headphone source selections as follows:

A| CD	(AUDIO SOURCE SELECTION)
- A CD	(COMPACT DISC)
- A|VCP	(VIDEO CASSETTE PLAYER)
- A|CASS	(CASSETTE PLAYER)

Headphone volume is adjusted by first depressing the MENU button on the passenger control unit until VOL XX% is displayed (the XX represents a 2 digit number from 01 through 99, a percentage of maximum headphone volume). After VOL XX% is displayed, increase or decrease headphone volume by depressing the SELECT up arrow or SELECT down arrow on the passenger control unit until the desired volume level is achieved. As the headphone volume level changes, the passenger control unit will display a corresponding VOL % value.

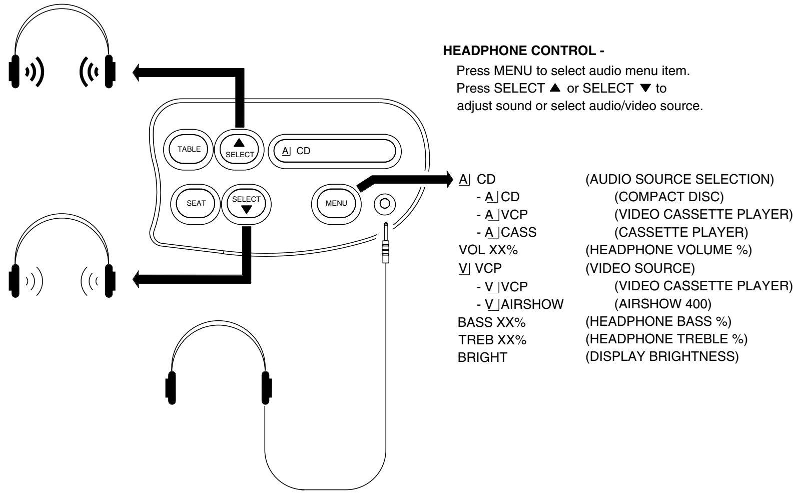
Headphone treble and headphone bass are adjusted in the same manner that headphone volume is with the exception that BASS % or TREBLE % is selected with the MENU button, instead of VOL %.



PASSENGER CONTROL UNIT
Figure 7-13

HEADPHONE CONTROL

PASSENGER CONTROL UNIT



HEADPHONE CONTROL -
Press MENU to select audio menu item.
Press SELECT ▲ or SELECT ▼ to
adjust sound or select audio/video source.

A| CD	(AUDIO SOURCE SELECTION)
- A|CD	(COMPACT DISC)
- A|VCP	(VIDEO CASSETTE PLAYER)
- A|CASS	(CASSETTE PLAYER)
VOL XX%	(HEADPHONE VOLUME %)
V| VCP	(VIDEO SOURCE)
- V|VCP	(VIDEO CASSETTE PLAYER)
- V|AIRSHOW	(AIRSHOW 400)
BASS XX%	(HEADPHONE BASS %)
TREB XX%	(HEADPHONE TREBLE %)
BRIGHT	(DISPLAY BRIGHTNESS)

PASSENGER HEADPHONE CONTROLS
Figure 7-14

Armrest Monitor Video Source Selection

Video signal for the 5.6 inch articulating armrest monitor is selected by depressing the MENU button on the appropriate passenger control unit until V| VCP is displayed. When V| VCP is displayed, the video cassette player will be selected as the active source for the articulating monitor. Additional video sources for the armrest monitor can be selected by depressing the SELECT up arrow or SELECT down arrow on the passenger control unit until the desired source (V| AIRSHOW 400, for example) is displayed.

Brightness Control - Master Control Unit and Passenger Control Unit Displays

To select the brightness on either the master control unit display or passenger control unit display, depress the MENU button on the respective display until the display brightness symbol (BRIGHT) is displayed. After BRIGHT is displayed, increase or decrease the master control unit or passenger control unit intensity by depressing the SELECT up arrow or SELECT down arrow on the master control unit until the desired brightness level is achieved.

REMOTE CABIN TEMPERATURE CONTROLS

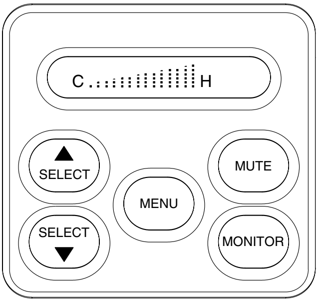
A remote cabin temperature control is incorporated into the master control unit located in the cabin armrest.

Cabin temperature adjustments can be made by pressing the MENU button on the master control unit until C .:: H symbols are displayed (Figure 7-15) in the display window. After the C .:: H symbols are displayed, the cabin temperature is adjusted by pressing the SELECT up arrow or SELECT down arrow buttons.

Each time the SELECT up arrow or SELECT down arrow button is pressed, the display will show a larger or smaller flashing segment which represents a corresponding higher or lower temperature.

The master control unit can only adjust the temperature within a 9° F range. The center of this range is determined by the setting on cabin temperature control located on the copilot's subpanel. The master control unit can adjust the cabin temperature in small increments up to a maximum of 4.5° F above, or down to 4.5° F below the current setting on the copilot's cabin temperature control. The copilot's cabin temperature control can be adjusted in a much wider range, between 60°F and 90° F.

MASTER CONTROL UNIT



REMOTE CABIN TEMPERATURE CONTROL PANEL
Figure 7-15

CABIN MANAGEMENT SYSTEM
(Aircraft 45-232, 45-236 thru 45-2000)

AUDIO INTERNATIONAL CABIN MANAGEMENT SYSTEM

The Audio International cabin management system manages various cabin systems and components. These systems and components include cabin lights, lavatory lights, cabin audio and video entertainment systems (if installed), cabin temperature, galley equipment, and water system (if installed). The cabin management system uses a two-wire, bidirectional data bus for communication between components.

This Audio International cabin management system consists of a cockpit switch panel, an entry switch panel, a galley switch panel, a lavatory switch panel, eight Lighting Control Unit (LCU) switches, seven Passenger Control Unit (PCU) switch panels, a Master Control Unit (MCU) switch panel, and a Power Switching Module. The following table lists the cabin management system components and locations.

Component	Location
Cockpit switch panel	Copilot's sidewall panel
Entry switch panel	Forward left cabinet aft face
Galley switch panel	Forward right cabinet header
Lavatory switch panel	Lavatory cabinet backsplash
Lighting Control Unit (LCU) (8)	Cabin side ledge (7) and PSU (1)
Master Control Unit (MCU)	VIP seat side ledge
Passenger Control Unit	Cabin side ledge
Power Switching Module	Forward left cabinet
PAX CTRLS circuit breaker	Copilot's circuit breaker panel

CABIN MANAGEMENT SYSTEM COMPONENTS/LOCATIONS
Figure 7-16

Galley Switch Panel

The galley switch panel controls the hot liquid container, second hot liquid container (if installed), and galley drain system (if installed).

Cockpit Switch Panel

The cockpit switch panel controls the cabin lights, entry light, and reading/table lights. This unit can also disable all cabin switch panels.

Entry Switch Panel

The entry switch panel controls the cabin wash lights, lavatory wash lights, cockpit lights, entry light, reading/table lights, and the optional exterior lighting system (if installed).

Lavatory Switch Panel

The lavatory switch panel controls the toilet flush, lavatory wash and spot lights. This unit includes an ordinance sign. This switch panel also controls the optional lavatory water pump and lavatory sink drain system (if installed).

Lighting Control Unit (LCU)

The LCU allows the passengers to control the reading and table lights for its seat location.

Passenger Control Unit (PCU)

The individual PCUs control the headphone audio source, volume, bass, and treble for its seat location.

Master Control Unit (MCU)

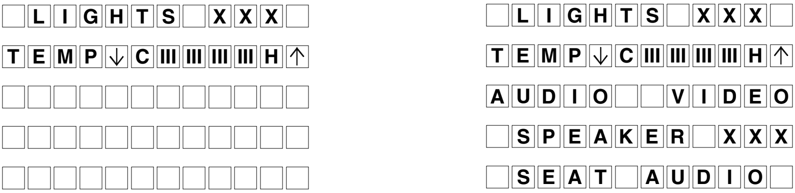
The MCU controls the cabin audio source, cabin video source, speaker audio source, volume, bass, and treble, in addition to the cabin lights and cabin temperature. The MCU will show one of two power-up screens (see Figure 7-16A) depending on the configuration of the aircraft. If the aircraft is not equipped with audio and video systems, the standard power-up screen will be shown on the MCU. If the aircraft is equipped with audio and video systems, the optional power-up screen will be shown. The MCU also functions as a PCU for its seat location.

OPERATION

The Audio International cabin management system utilizes a bidirectional data bus and discrete outputs to control a device. Actuation of a control switch sends a data word on the bidirectional data bus to the device being controlled. Each data word is addressed to a particular device. The addressed device decodes the data word, activates the appropriate control or function, and sends a feedback response to the control switch to change the display (if applicable).

The MCU and the PCUs do not have individual switches, they are touch screen control panels. Each screen has five lines that are used to show different selections for items to be controlled. Selections are made when a line, symbol, or item that is shown on the screen is pushed. When power is first applied to the system, the MCU and the PCU will show a power-up screen. Selections are made from menus on each unit.

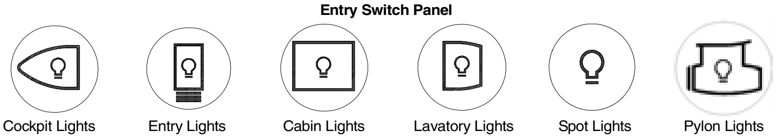
Consult the manufacturer's documentation for complete programming and operating instructions.



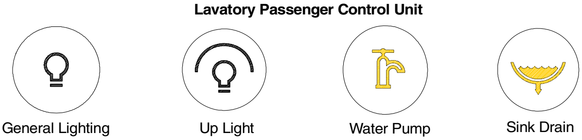
Standard Power-up Screen

Optional Power-up Screen

MASTER CONTROL UNIT
Figure 7-16A



ENTRY SWITCH PANEL
Figure 7-16B



LAVATORY PASSENGER CONTROL UNIT
Figure 7-16C

Equipment	Location	Control Circuit Breaker/s
Cabin Audio Amplifier	Aft Lavatory	SPKRS (Pilot's CB Panel) CABIN PA (Pilot's CB Panel)
Master Control Unit (MCU)	LH or RH Side Ledge	PAX CTRLS (Copilot's CB Panel)
Power Switching Module	Forward LH Cabinet	PAX CTRLS (Copilot's CB Panel)
Passenger Control Units (PCU)	LH/RH Side Ledge	PAX CTRLS (Copilot's CB Panel)
A/V Distribution Unit	Forward RH Cabin Sidewall	AUDIO (Copilot's CB Panel)
IR Receiver	Forward LH Cabinet	PAX CTRLS (Copilot's CB Panel)
CD Changer, Control Head	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
CD Changer, Remote Unit	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Single CD Player (SCD)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Cassette Tape Player (CTP)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Digital Video Disc Player (DVD)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Dual Digital Video Disc Player (Dual DVD)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
Video Cassette Player (VCP)	Forward RH Cabinet	AUDIO (Copilot's CB Panel)
10.4" Monitor	Forward LH Cabinet and/ or Aft Bulkhead	VIDEO (Copilot's CB Panel)
Lavatory Switch Panel	Lavatory Backsplash	PAX CTRLS (Copilot's CB Panel)
Cockpit Switch Panel	Cockpit Sidewall	N/A
Galley Switch Panel	Forward RH Cabinet	N/A
Entry Switch Panel	Forward LH Cabinet	PAX CTRLS (Copilot's CB Panel) CABIN (Pilot's CB Panel)
Lighting Control Units (LCU)	LH Side Ledge	PAX CTRLS (Copilot's CB Panel) L SPOT (Pilot's CB Panel)
Lighting Control Units (LCU)	RH Side Ledge	PAX CTRLS (Copilot's CB Panel) R SPOT (Copilot's CB Panel)
Speaker (Mid-range/tweeter)	Convenience Panels	N/A
Speaker (Subwoofer)	Cabin Floor	N/A

CABIN MANAGEMENT SYSTEM
EQUIPMENT AND CIRCUIT BREAKER LOCATION (TYPICAL)
Figure 7-17

FLIGHT PHONE

Digital Airborne Telephone (Optional)

The optional Magnastar C2000 is a two voice/data system that has direct dialing, multiple calls, fax/data modem, uplink calls, interfone, speed dialing and call charging features. Handsets are installed in both the cockpit and the passenger compartment.

The passenger compartment handset(s) can be located in any of the cabin armrest storage boxes. The handset in the cockpit is located on the aft end of the center pedestal.

Power for the flight phone is 28-vdc through the 10-amp FLT PHONE circuit breaker on the pilot's circuit breaker panel.

AC ELECTRICAL OUTLETS (OPTIONAL)

Optional 110-vac/60-Hz and/or 115-vac electrical outlets may be installed in the cabin and/or cockpit (typically on the aft pedestal). Typically there is an outlet located in the galley cabinet and an outlet located in the lavatory. There are also outlets located in the passenger compartment sidewall or kick panels (on the right side and/or left side) between the passenger seats. Some outlets may be equipped with a Ground Fault Interrupt (GFI) circuit. The GFI outlet can be reset by depressing the TEST/RESET button. The 1200-va capacity inverter powering these outlets will automatically shut down if the cabin altitude goes above 9500 feet. Power will be restored when the cabin altitude descends below 8300 feet.

A 230-vac/50-Hz circuit is available, as an option, for aircraft which will be used primarily overseas.

WINDOW SHADES

Each cabin window is equipped with a window shade. The shades are adjustable and can be raised and lowered to any desired level. The shades are made of pleated translucent material and may allow some light in.

GASPER OUTLETS

Individual gasper outlets (air outlets) are located in the cabin overhead convenience panels. The outlets are adjacent to the lights and can be turned to approximately 40° around its center to direct airflow as desired. Rotate the conical port counterclockwise to open the outlet and clockwise to close.

AFT CABIN STOWAGE COMPARTMENT

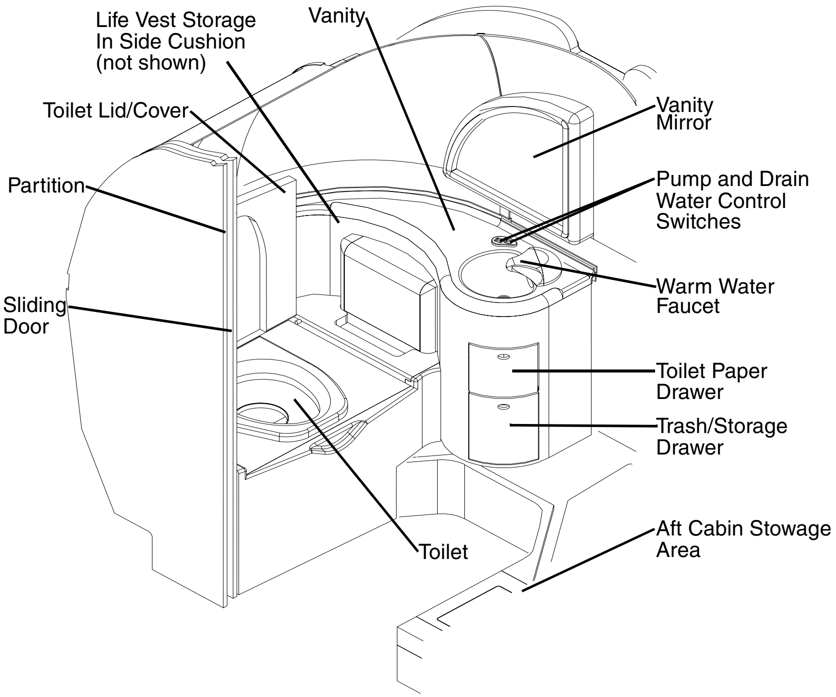
The aft cabin stowage compartment is located on the left side of the aircraft immediately aft of the passenger compartment. The stowage compartment is equipped with a coat rod for hanging garments and a restraining web. Some interiors are equipped with a fire extinguisher which is mounted to the left partition.

LAVATORY/VANITY
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)

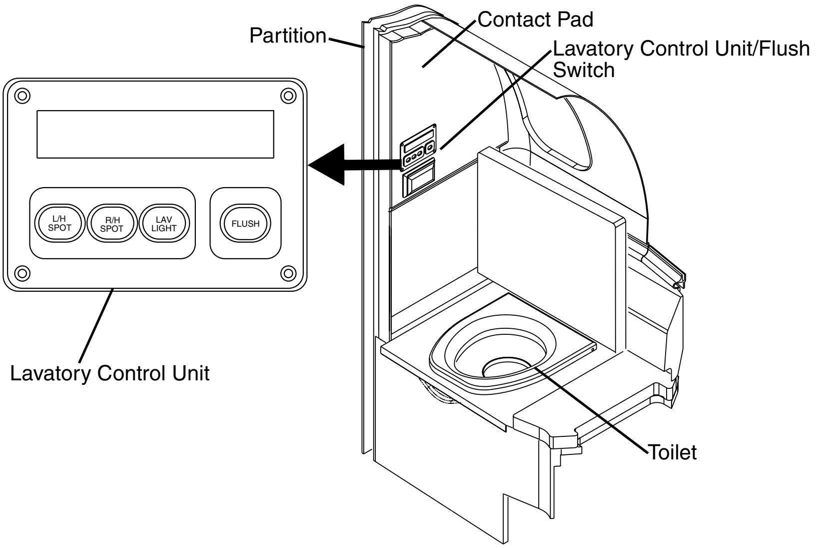
The standard lavatory/vanity (Figure 7-18) is equipped with a toilet, a vanity counter, a toilet tissue drawer and a trash/storage drawer. Optional equipment for the standard vanity includes a belted toilet with a life vest, a lighted vanity mirror and a wash basin with warm running water plumbed to an overboard heated drain.

The lavatory is separated from the passenger cabin by sliding doors which stow inside the left and right sides of the partition. The doors do not lock and are equipped with a magnetic strip which holds them together while closed. The toilet is located on the right side of the lavatory compartment. The toilet is flushed by depressing the toilet FLUSH switch, located in the contact pad on the forward side of the toilet. The optional sink is located at the aft end of the lavatory. The water faucet is operated by depressing the PUMP button located on the vanity adjacent to the basin to dispense running water. Water in the basin is drained by depressing the DRAIN button which is located next to the PUMP button.

If equipped with the optional sink, the lavatory/vanity will have a potable water tank and pump located under the vanity counter. The potable water tank (with an internal heater) holds approximately 1.5 gallons of 100° F heated water. The pump and tank (with heater) draw electrical power from the 15-amp LAV SINK circuit breaker located on the pilot's circuit breaker panel. The lavatory sink is drained through a heated drain mast on the bottom of the aircraft. The heater prevents ice from forming in the drain mast.



VIEW LOOKING AFT



VIEW LOOKING FORWARD

LAVATORY/VANITY (TYPICAL)
(Aircraft 45-002 thru 45-231, 45-233 thru 45-235)
Figure 7-18

Toilet

A flushing toilet is installed on the right side of the lavatory compartment. The unit features a two compartment design which isolates the flushing fluid from the waste. The toilet is flushed by depressing the FLUSH button located on the lavatory control unit in the contact pad immediately forward of the toilet (see Figure 7-18). The length of the flush cycle is controlled automatically. There are two electric pumps installed inside the unit. The flushing pump circulates the flushing fluid during the flush cycle. The macerator/pump is used to pump the waste from the toilet during servicing only.

This toilet is equipped with a macerator pump which has the capability to process regular toilet paper. It is not necessary to use the special biodegradable toilet paper in this toilet.

Servicing of the toilet is accomplished using servicing ports located on the aircraft exterior. The macerator/pump is used to pump the waste from the toilet while fresh flushing fluid is pumped into the toilet from the servicing equipment. Refer to Chapter 12 in the maintenance manual for servicing instructions.

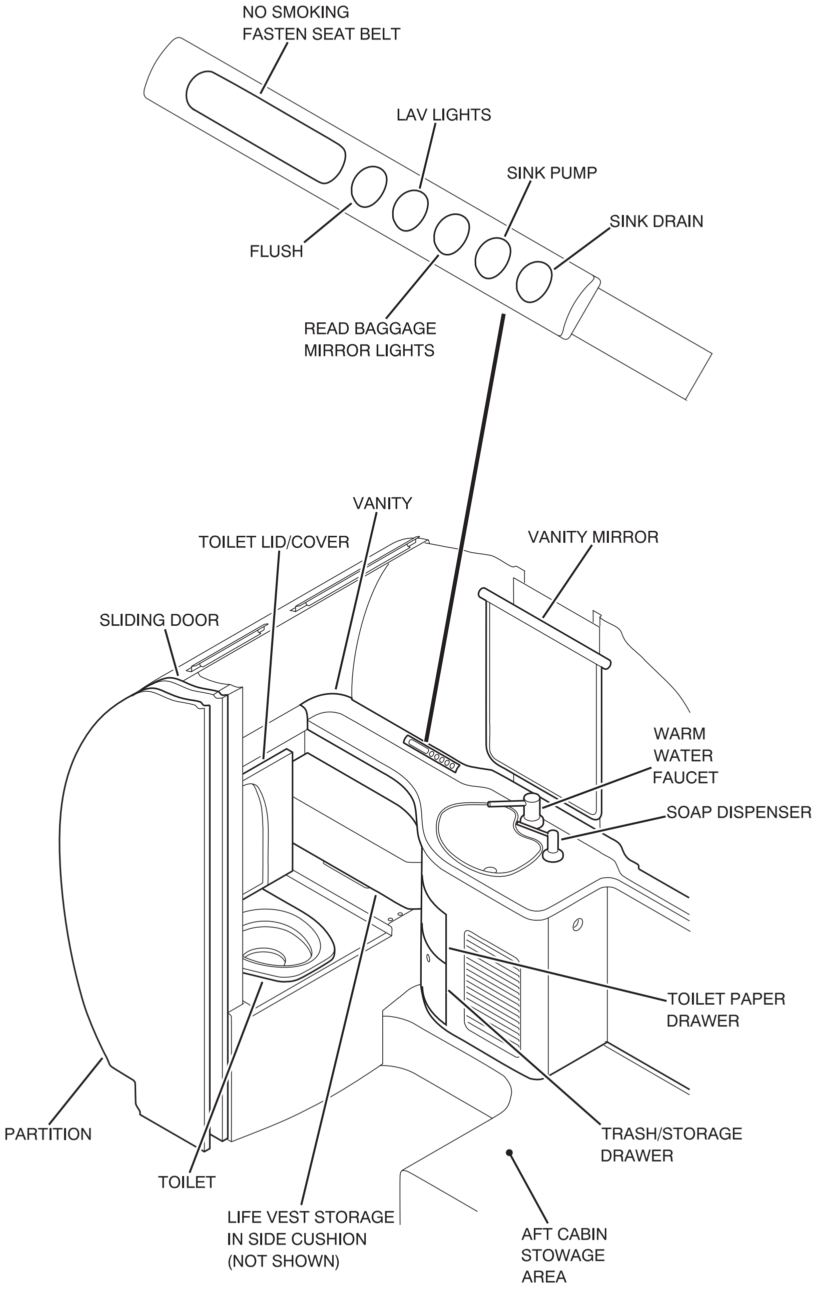
Electrical power to operate the flushing circuit is 28-vdc supplied through the 3-amp TOILET circuit breaker on the copilot's circuit breaker panel.

LAVATORY/VANITY (Aircraft 45-232, 45-236 thru 45-2000)

The standard lavatory/vanity (Figure 7-19) is equipped with a toilet, a vanity counter, a toilet tissue drawer and a trash/storage drawer. Optional equipment for the standard vanity includes a belted toilet with a life vest, a lighted vanity mirror and a wash basin with warm running water plumbed to an overboard heated drain.

The lavatory is separated from the passenger cabin by sliding doors which stow inside the left and right sides of the partition. The doors do not lock and are equipped with a magnetic strip which holds them together while closed. The toilet is located on the right side of the lavatory compartment. The toilet is flushed by depressing the toilet FLUSH switch, located in the lavatory switch panel on the forward side of the toilet. The sink is located at the aft end of the lavatory. The water faucet is operated by depressing the PUMP switch located on the lavatory switch panel adjacent to the basin to dispense running water. Water in the basin is drained by depressing the DRAIN button which is also on the lavatory switch panel.

If equipped with the optional sink, the lavatory/vanity will have a potable water tank and pump located under the vanity counter. The potable water tank (with an internal heater) holds approximately 1.5 gallons of 100° F heated water. The pump and tank (with heater) draw electrical power from the 15-amp LAV SINK circuit breaker located on the pilot's circuit breaker panel. The lavatory sink is drained through a heated drain mast on the bottom of the aircraft. The heater prevents ice from forming in the drain mast.



LAVATORY/VANITY (TYPICAL)
(Aircraft 45-232, 45-236 thru 45-2000)
Figure 7-19

Toilet

A flushing toilet is installed on the right side of the lavatory compartment. The unit features a two compartment design which isolates the flushing fluid from the waste. The toilet is located on the right side of the lavatory compartment. The toilet is flushed by depressing the toilet FLUSH switch, located in the lavatory switch panel on the forward side of the toilet (see Figure 7-19). The length of the flush cycle is controlled automatically. There are two electric pumps installed inside the unit. The flushing pump circulates the flushing fluid during the flush cycle. The macerator/pump is used to pump the waste from the toilet during servicing only.

This toilet is equipped with a macerator pump which has the capability to process regular toilet paper. It is not necessary to use the special biodegradable toilet paper in this toilet.

Servicing of the toilet is accomplished using servicing ports located on the aircraft exterior. The macerator/pump is used to pump the waste from the toilet while fresh flushing fluid is pumped into the toilet from the servicing equipment. Refer to Chapter 12 in the maintenance manual for servicing instructions.

Electrical power to operate the flushing circuit is 28-vdc supplied through the 3-amp TOILET circuit breaker on the copilot's circuit breaker panel.

SECTION VIII
FLIGHT CHARACTERISTICS & OPERATIONAL PLANNING

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

SECTION VIII
FLIGHT CHARACTERISTICS & OPERATIONAL PLANNING

GENERAL FLIGHT CHARACTERISTICS

Taxi operations can be conducted using one or both engines. If nosewheel steering is inoperative or when taxiing on a slick or icy surface, it is recommended that taxiing be conducted using both engines to preclude aggravating the problem with asymmetric thrust.

The steer-by-wire nose wheel steering system provides excellent taxi maneuverability. At low ground speeds, nose wheel travel is approximately 60° either side of neutral. Steering authority is diminished and is reduced to zero as ground speed increases. The system will automatically disengage when design speed is reached. The rudder is effective for directional control above 45 KIAS.

The two pod-mounted AlliedSignal TFE731-20 engines, are flat rated at 3500 pounds (15.56 kN) thrust at 87° F (30.5° C) at sea level. The time required to accelerate the engines from flight idle to takeoff N1 is approximately eight (8) seconds. The engine thrust and acceleration characteristics complement the Learjet 45 airframe so that outstanding performance, flexibility and safety margins are available in all flight regimes. Single-engine performance offers an example of these capabilities in that sea level single-engine rate of climb at 20,200 pounds (9163 kg) is approximately 620 feet per minute and the single-engine service ceiling is approximately 31,000 feet at a cruise weight of 17,000 pounds (7711 kg).

Although the flight control systems are manual, the stick forces are light to moderate throughout the flight envelope. Stability is good at all airspeeds and airplane configurations. Aircraft responsiveness and flight control authority are very good throughout the flight envelope. A yaw damper is employed to damp lateral oscillations caused by turbulent air; however, it is not required for takeoff. Trim changes due to the use of the landing gear, flaps and power are slight; however, a trim change is required when spoilers are extended and retracted.

The dual stall warning system provides an excellent indication of impending airplane stall. Additionally, the airplane exhibits an aerodynamic stall warning buffet in all configurations. A stick shaker actuates above the 1G stall speed published in the Airplane Flight Manual. The shaker system produces a high-frequency, low-amplitude vibration transmitted to the control columns. As the shakers actuate, an aural stall warning will also begin. Recovery is easily accomplished by lowering the nose of the airplane while simultaneously advancing power as necessary to accelerate out of the stall regime. Good aircraft response, to elevator inputs, occurs throughout the aircraft operating envelope.

The spoiler system provides an effective means of the increasing normal rates of descent and may be used as a drag device to achieve rapid airspeed deceleration. The spoilers may also be extended just after touchdown to spoil the lift for more effective braking action and to increase drag for minimum landing roll. Aileron augmentation is supplied automatically by the spoiler system whenever a control wheel is moved more than 5°. The spoiler system also provides backup roll control in the event the ailerons become inoperative.

OPERATIONAL PLANNING

The charts and tables on the following pages contain performance data for climb, cruise, descent and holding. Takeoff and landing performance data is presented in a tabular form in the FAA Approved Flight Manual. Fuel consumption information is presented based on flight test data and average engine characteristics. The following conditions are to be assumed when extracting data from this section:

WEIGHT

All weights presented in this section are the gross weight of the airplane at the start of the climb; the cruise weight used is the mid-weight between the start cruise weight and the end cruise weight; and the descent weight used is assumed to be 15,000 pounds (6804 kg).

ALTITUDE

All altitudes presented in this section are pressure altitude in feet.

TEMPERATURE

OAT — Outside Air Temperature (normally obtained from ground reporting stations). For presentation in this section, Temperature is OAT °C unless otherwise specified.

SAT — Static Air Temperature obtained from in-flight indications in °C.

FUEL FLOW

The fuel flows presented are for two engines except where single engine performance is specified.

FLAPS

The flap position for various conditions are as follows :

En route Climb .... UP-0°
En route .... UP-0°
Holding .... UP-0°

OPERATIONAL PLANNING FORM

	WEIGHT	TIME	DISTANCE	FUEL
ZERO FUEL WEIGHT				
FUEL LOAD				
RAMP WEIGHT				
WARM UP, APU & TAKEOFF				
Altitude=				
START CLIMB WEIGHT				
CLIMB				
END CLIMB WEIGHT				
Altitude=				
START CRUISE WEIGHT				
CRUISE				
END CRUISE WEIGHT				
Altitude=				
START CLIMB WEIGHT				
CLIMB				
END CLIMB WEIGHT				
Altitude=				
START CRUISE WEIGHT				
CRUISE				
END CRUISE WEIGHT				
Altitude=				
START CLIMB WEIGHT				
CLIMB				
END CLIMB WEIGHT				
Altitude=				
START CRUISE WEIGHT				
CRUISE				
END CRUISE WEIGHT				
Altitude=				
START DESCENT WEIGHT				
DESCENT				
END DESCENT WEIGHT				
Altitude=				
RESERVES				
ZERO FUEL WEIGHT				
	Total			

Figure 8-1

TEMPERATURE CONVERSION

- To convert from Celsius to Fahrenheit, find, in bold face columns, the number representing the Celsius temperature to be converted. The equivalent Fahrenheit temperature is read in the adjacent column headed °F.
- To convert from Fahrenheit to Celsius, find, in bold face columns, the number representing the Fahrenheit temperature to be converted. The equivalent Celsius temperature is read in the adjacent column headed °C.

°F	◄►	°C	°F	◄►	°C	°F	◄►	°C	°F	◄►	°C	°F	◄►	°C
-148.0	**-100**	-73.3	-58.0	**-50**	-45.6	32.0	**0**	-17.8	122.0	**50**	10.0	212.0	**100**	37.8
-146.2	**-99**	-72.8	-56.2	**-49**	-45.0	33.8	**1**	-17.2	123.8	**51**	10.6	213.8	**101**	38.3
-144.4	**-98**	-72.2	-54.4	**-48**	-44.4	35.6	**2**	-16.7	125.6	**52**	11.1	215.6	**102**	38.9
-142.6	**-97**	-71.7	-52.6	**-47**	-43.9	37.4	**3**	-16.1	127.4	**53**	11.7	217.4	**103**	39.4
-140.8	**-96**	-71.1	-50.8	**-46**	-43.3	39.2	**4**	-15.6	129.2	**54**	12.2	219.2	**104**	40.0
-139.0	**-95**	-70.6	-49.0	**-45**	-42.8	41.0	**5**	-15.0	131.0	**55**	12.8	221.0	**105**	40.6
-137.2	**-94**	-70.0	-47.2	**-44**	-42.2	42.8	**6**	-14.4	132.8	**56**	13.3	222.8	**106**	41.1
-135.4	**-93**	-69.4	-45.4	**-43**	-41.7	44.6	**7**	-13.9	134.6	**57**	13.9	224.6	**107**	41.7
-133.6	**-92**	-68.9	-43.6	**-42**	-41.1	46.4	**8**	-13.3	136.4	**58**	14.4	226.4	**108**	42.2
-131.8	**-91**	-68.3	-41.8	**-41**	-40.6	48.2	**9**	-12.8	138.2	**59**	15.0	228.2	**109**	42.8
-130.0	**-90**	-67.8	-40.0	**-40**	-40.0	50.0	**10**	-12.2	140.0	**60**	15.6	230.0	**110**	43.3
-128.2	**-89**	-67.2	-38.2	**-39**	-39.4	51.8	**11**	-11.7	141.8	**61**	16.1	231.8	**111**	43.9
-126.4	**-88**	-66.7	-36.4	**-38**	-38.9	53.6	**12**	-11.1	143.6	**62**	16.7	233.6	**112**	44.4
-124.6	**-87**	-66.1	-34.6	**-37**	-38.3	55.4	**13**	-10.6	145.4	**63**	17.2	235.4	**113**	45.0
-122.8	**-86**	-65.6	-32.8	**-36**	-37.8	57.2	**14**	-10.0	147.2	**64**	17.8	237.2	**114**	45.6
-121.0	**-85**	-65.0	-31.0	**-35**	-37.2	59.0	**15**	-9.4	149.0	**65**	18.3	239.0	**115**	46.1
-119.2	**-84**	-64.4	-29.2	**-34**	-36.7	60.8	**16**	-8.9	150.8	**66**	18.9	240.8	**116**	46.7
-117.4	**-83**	-63.9	-27.4	**-33**	-36.1	62.6	**17**	-8.3	152.6	**67**	19.4	242.6	**117**	47.2
-115.6	**-82**	-63.3	-25.6	**-32**	-35.6	64.4	**18**	-7.8	154.4	**68**	20.0	244.4	**118**	47.8
-113.8	**-81**	-62.8	-23.8	**-31**	-35.0	66.2	**19**	-7.2	156.2	**69**	20.6	246.2	**119**	48.3
-112.0	**-80**	-62.2	-22.0	**-30**	-34.4	68.0	**20**	-6.7	158.0	**70**	21.1	248.0	**120**	48.9
-110.2	**-79**	-61.7	-20.2	**-29**	-33.9	69.8	**21**	-6.1	159.8	**71**	21.7	249.8	**121**	49.4
-108.4	**-78**	-61.1	-18.4	**-28**	-33.3	71.6	**22**	-5.6	161.6	**72**	22.2	251.6	**122**	50.0
-106.6	**-77**	-60.6	-16.6	**-27**	-32.8	73.4	**23**	-5.0	163.4	**73**	22.8	253.4	**123**	50.6
-104.8	**-76**	-60.0	-14.8	**-26**	-32.2	75.2	**24**	-4.4	165.2	**74**	23.3	255.2	**124**	51.1
-103.0	**-75**	-59.4	-13.0	**-25**	-31.7	77.0	**25**	-3.9	167.0	**75**	23.9	257.0	**125**	51.7
-101.2	**-74**	-58.9	-11.2	**-24**	-31.1	78.8	**26**	-3.3	168.8	**76**	24.4	258.8	**126**	52.2
-99.4	**-73**	-58.3	-9.4	**-23**	-30.6	80.6	**27**	-2.8	170.6	**77**	25.0	260.6	**127**	52.8
-97.6	**-72**	-57.8	-7.6	**-22**	-30.0	82.4	**28**	-2.2	172.4	**78**	25.6	262.4	**128**	53.3
-95.8	**-71**	-57.2	-5.8	**-21**	-29.4	84.2	**29**	-1.7	174.2	**79**	26.1	264.2	**129**	53.9
-94.0	**-70**	-56.7	-4.0	**-20**	-28.9	86.0	**30**	-1.1	176.0	**80**	26.7	266.0	**130**	54.4
-92.2	**-69**	-56.1	-2.2	**-19**	-28.3	87.8	**31**	-0.6	177.8	**81**	27.2	267.8	**131**	55.0
-90.4	**-68**	-55.6	-0.4	**-18**	-27.8	89.6	**32**	0.0	179.6	**82**	27.8	269.6	**132**	55.6
-88.6	**-67**	-55.0	1.4	**-17**	-27.2	91.4	**33**	0.6	181.4	**83**	28.3	271.4	**133**	56.1
-86.8	**-66**	-54.4	3.2	**-16**	-26.7	93.2	**34**	1.1	183.2	**84**	28.9	273.2	**134**	56.7
-85.0	**-65**	-53.9	5.0	**-15**	-26.1	95.0	**35**	1.7	185.0	**85**	29.4	275.0	**135**	57.2
-83.2	**-64**	-53.3	6.8	**-14**	-25.6	96.8	**36**	2.2	186.8	**86**	30.0	276.8	**136**	57.8
-81.4	**-63**	-52.8	8.6	**-13**	-25.0	98.6	**37**	2.8	188.6	**87**	30.6	278.6	**137**	58.3
-79.6	**-62**	-52.2	10.4	**-12**	-24.4	100.4	**38**	3.3	190.4	**88**	31.1	280.4	**138**	58.9
-77.8	**-61**	-51.7	12.2	**-11**	-23.9	102.2	**39**	3.9	192.2	**89**	31.7	282.2	**139**	59.4
-76.0	**-60**	-51.1	14.0	**-10**	-23.3	104.0	**40**	4.4	194.0	**90**	32.2	284.0	**140**	60.0
-74.2	**-59**	-50.6	15.8	**-9**	-22.8	105.8	**41**	5.0	195.8	**91**	32.8	285.8	**141**	60.6
-72.4	**-58**	-50.0	17.6	**-8**	-22.2	107.6	**42**	5.6	197.6	**92**	33.3	287.6	**142**	61.1
-70.6	**-57**	-49.4	19.4	**-7**	-21.7	109.4	**43**	6.1	199.4	**93**	33.9	289.4	**143**	61.7
-68.8	**-56**	-48.9	21.2	**-6**	-21.1	111.2	**44**	6.7	201.2	**94**	34.4	291.2	**144**	62.2
-67.0	**-55**	-48.3	23.0	**-5**	-20.6	113.0	**45**	7.2	203.0	**95**	35.0	293.0	**145**	62.8
-65.2	**-54**	-47.8	24.8	**-4**	-20.0	114.8	**46**	7.8	204.8	**96**	35.6	294.8	**146**	63.3
-63.4	**-53**	-47.2	26.6	**-3**	-19.4	116.6	**47**	8.3	206.6	**97**	36.1	296.6	**147**	63.9
-61.6	**-52**	-46.7	28.4	**-2**	-18.9	118.4	**48**	8.9	208.4	**98**	36.7	298.4	**148**	64.4
-59.8	**-51**	-46.1	30.2	**-1**	-18.3	120.2	**49**	9.4	210.2	**99**	37.2	300.2	**149**	65.0

Figure 8-2

LINEAR CONVERSIONS

- To convert from meters to feet, find, in the bold face columns, the number of meters to be converted. The equivalent number of feet is read in the adjacent column headed FEET.
- To convert from feet to meters, find, in the bold face columns, the number of feet to be converted. The equivalent number of meters is read in the adjacent column headed METERS.

METERS	◀ ▶	FEET	METERS	◀ ▶	FEET	METERS	◀ ▶	FEET
304.8	**1000**	3280.8	1341.1	**4400**	14435.5	2377.5	**7800**	25590.2
335.3	**1100**	3608.9	1371.6	**4500**	14763.6	2407.9	**7900**	25918.3
365.8	**1200**	3937.0	1402.1	**4600**	15091.7	2438.4	**8000**	26246.4
396.2	**1300**	4265.0	1432.6	**4700**	15419.8	2468.9	**8100**	26574.5
426.7	**1400**	4593.1	1463.1	**4800**	15747.8	2499.4	**8200**	26902.6
457.2	**1500**	4921.2	1493.5	**4900**	16075.9	2529.9	**8300**	27230.6
487.7	**1600**	5249.3	1524.0	**5000**	16404.0	2560.4	**8400**	27558.7
518.2	**1700**	5577.4	1554.5	**5100**	16732.1	2590.8	**8500**	27886.8
548.6	**1800**	5905.4	1585.0	**5200**	17060.2	2621.3	**8600**	28214.9
579.1	**1900**	6233.5	1615.5	**5300**	17388.2	2651.8	**8700**	28543.0
609.6	**2000**	6561.6	1645.9	**5400**	17716.3	2682.3	**8800**	28871.0
640.1	**2100**	6889.7	1676.4	**5500**	18044.4	2712.8	**8900**	29199.1
670.6	**2200**	7217.8	1706.9	**5600**	18372.5	2743.2	**9000**	29527.2
701.0	**2300**	7545.8	1737.4	**5700**	18700.6	2773.7	**9100**	29855.3
731.5	**2400**	7873.9	1767.9	**5800**	19028.6	2804.2	**9200**	30183.4
762.0	**2500**	8202.0	1798.3	**5900**	19356.7	2834.7	**9300**	30511.4
792.5	**2600**	8530.1	1828.8	**6000**	19684.8	2865.2	**9400**	30839.5
823.0	**2700**	8858.2	1859.3	**6100**	20012.9	2895.6	**9500**	31167.6
853.5	**2800**	9186.2	1889.8	**6200**	20341.0	2926.1	**9600**	31495.7
883.9	**2900**	9514.3	1920.3	**6300**	20669.0	2956.6	**9700**	31823.8
914.4	**3000**	9842.4	1950.7	**6400**	20997.1	2987.1	**9800**	32151.8
944.9	**3100**	10170.5	1981.2	**6500**	21325.2	3017.6	**9900**	32479.9
975.4	**3200**	10498.6	2011.7	**6600**	21653.3	3048.0	**10000**	32808.0
1005.9	**3300**	10826.6	2042.2	**6700**	21981.4	3352.8	**11000**	36088.8
1036.3	**3400**	11154.7	2072.7	**6800**	22309.4	3657.6	**12000**	39369.6
1066.8	**3500**	11482.8	2103.1	**6900**	22637.5	3962.4	**13000**	42650.4
1097.3	**3600**	11810.9	2133.6	**7000**	22965.6	4267.3	**14000**	45931.2
1127.8	**3700**	12139.0	2164.1	**7100**	23293.7	4572.1	**15000**	49212.0
1158.3	**3800**	12467.0	2194.6	**7200**	23621.8	4876.9	**16000**	52492.8
1188.7	**3900**	12795.1	2225.1	**7300**	23949.8	5181.7	**17000**	55773.6
1219.2	**4000**	13123.2	2255.5	**7400**	24277.9	5486.5	**18000**	59054.4
1249.7	**4100**	13451.3	2286.0	**7500**	24606.0	5791.3	**19000**	62335.2
1280.2	**4200**	13779.4	2316.5	**7600**	24934.1	6096.1	**20000**	65616.0
1310.7	**4300**	14107.4	2347.0	**7700**	25262.2	6400.9	**21000**	68896.8

Figure 8-3

VOLUME CONVERSIONS

- To convert from liters to gallons, find, in the bold face columns, the number of liters to be converted. The equivalent number of gallons is read in the adjacent column headed GALLONS.
- To convert from gallons to liters, find, in the bold face columns, the number of gallons to be converted. The equivalent number of liters is read in the adjacent column headed LITERS.

LITERS	◀ ▶	GALLONS	LITERS	◀ ▶	GALLONS	LITERS	◀ ▶	GALLONS
18.9	**5**	1.3	1476.2	**390**	103.0	2952.3	**780**	206.1
37.9	**10**	2.6	1514.0	**400**	105.7	2990.2	**790**	208.7
75.7	**20**	5.3	1551.9	**410**	108.3	3028.0	**800**	211.4
113.6	**30**	7.9	1589.7	**420**	111.0	3065.9	**810**	214.0
151.4	**40**	10.6	1627.6	**430**	113.6	3103.7	**820**	216.6
189.3	**50**	13.2	1665.4	**440**	116.2	3141.6	**830**	219.3
227.1	**60**	15.9	1703.3	**450**	118.9	3179.4	**840**	221.9
265.0	**70**	18.5	1741.1	**460**	121.5	3217.3	**850**	224.6
302.8	**80**	21.1	1779.0	**470**	124.2	3255.1	**860**	227.2
340.7	**90**	23.8	1816.8	**480**	126.8	3293.0	**870**	229.9
378.5	**100**	26.4	1854.7	**490**	129.5	3330.8	**880**	232.5
416.4	**110**	29.1	1892.5	**500**	132.1	3368.7	**890**	235.1
454.2	**120**	31.7	1930.4	**510**	134.7	3406.5	**900**	237.8
492.1	**130**	34.3	1968.2	**520**	137.4	3444.4	**910**	240.4
529.9	**140**	37.0	2006.1	**530**	140.0	3482.2	**920**	243.1
567.8	**150**	39.6	2043.9	**540**	142.7	3520.1	**930**	245.7
605.6	**160**	42.3	2081.8	**550**	145.3	3557.9	**940**	248.3
643.5	**170**	44.9	2119.6	**560**	148.0	3595.8	**950**	251.0
681.3	**180**	47.6	2157.5	**570**	150.6	3633.6	**960**	253.6
719.2	**190**	50.2	2195.3	**580**	153.2	3671.5	**970**	256.3
757.0	**200**	52.8	2233.2	**590**	155.9	3709.3	**980**	258.9
794.9	**210**	55.5	2271.0	**600**	158.5	3747.2	**990**	261.6
832.7	**220**	58.1	2308.9	**610**	161.2	3785.0	**1000**	264.2
870.6	**230**	60.8	2346.7	**620**	163.8	4163.5	**1100**	290.6
908.4	**240**	63.4	2384.6	**630**	166.4	4542.0	**1200**	317.0
946.3	**250**	66.1	2422.4	**640**	169.1	4920.5	**1300**	343.5
984.1	**260**	68.7	2460.3	**650**	171.7	5299.0	**1400**	369.9
1022.0	**270**	71.3	2498.1	**660**	174.4	5677.5	**1500**	396.3
1059.8	**280**	74.0	2536.0	**670**	177.0	6056.0	**1600**	422.7
1097.7	**290**	76.6	2573.8	**680**	179.7	6434.5	**1700**	449.1
1135.5	**300**	79.3	2611.7	**690**	182.3	6813.0	**1800**	475.6
1173.4	**310**	81.9	2649.5	**700**	184.9	7191.5	**1900**	502.0
1211.2	**320**	84.5	2687.4	**710**	187.6	7570.0	**2000**	528.4
1249.1	**330**	87.2	2725.2	**720**	190.2	7948.5	**2100**	554.8
1286.9	**340**	89.8	2763.1	**730**	192.9	8327.0	**2200**	581.2
1324.8	**350**	92.5	2800.9	**740**	195.5	8705.5	**2300**	607.7
1362.6	**360**	95.1	2838.8	**750**	198.2	9084.0	**2400**	634.1
1400.5	**370**	97.8	2876.6	**760**	200.8	9462.5	**2500**	660.5
1438.3	**380**	100.4	2914.5	**770**	203.4	9841.0	**2600**	686.9

Figure 8-4

WEIGHT CONVERSIONS

- To convert from kilograms to pounds, find, in the bold face columns, the number of kilograms to be converted. The equivalent number of pounds is read in the adjacent column headed POUNDS.
- To convert from pounds to kilograms, find, in the bold face columns, the number of pounds to be converted. The equivalent number of kilograms is read in the adjacent column headed KILOGRAMS.

KILOGRAMS	◀ ▶	POUNDS	KILOGRAMS	◀ ▶	POUNDS	KILOGRAMS	◀ ▶	POUNDS
4.5	**10**	22.0	208.7	**460**	1014.1	412.8	**910**	2006.2
9.1	**20**	44.1	213.2	**470**	1036.2	417.3	**920**	2028.2
13.6	**30**	66.1	217.7	**480**	1058.2	421.8	**930**	2050.3
18.1	**40**	88.2	222.3	**490**	1080.3	426.4	**940**	2072.3
22.7	**50**	110.2	226.8	**500**	1102.3	430.9	**950**	2094.4
27.2	**60**	132.3	231.3	**510**	1124.3	435.5	**960**	2116.4
31.8	**70**	154.3	235.9	**520**	1146.4	440.0	**970**	2138.5
36.3	**80**	176.4	240.4	**530**	1168.4	444.5	**980**	2160.5
40.8	**90**	198.4	244.9	**540**	1190.5	449.1	**990**	2182.6
45.4	**100**	220.5	249.5	**550**	1212.5	453.6	**1000**	2204.6
49.9	**110**	242.5	254.0	**560**	1234.6	499.0	**1100**	2425.1
54.4	**120**	264.6	258.6	**570**	1256.6	544.3	**1200**	2645.5
59.0	**130**	286.6	263.1	**580**	1278.7	589.7	**1300**	2866.0
63.5	**140**	308.6	267.6	**590**	1300.7	635.0	**1400**	3086.4
68.0	**150**	330.7	272.2	**600**	1322.8	680.4	**1500**	3306.9
72.6	**160**	352.7	276.7	**610**	1344.8	907.2	**2000**	4409.2
77.1	**170**	374.8	281.2	**620**	1366.9	1134.0	**2500**	5511.5
81.6	**180**	396.8	285.8	**630**	1388.9	1360.8	**3000**	6613.8
86.2	**190**	418.9	290.3	**640**	1410.9	1587.6	**3500**	7716.1
90.7	**200**	440.9	294.8	**650**	1433.0	1814.4	**4000**	8818.4
95.3	**210**	463.0	299.4	**660**	1455.0	2041.2	**4500**	9920.7
99.8	**220**	485.0	303.9	**670**	1477.1	2268.0	**5000**	11023.0
104.3	**230**	507.1	308.4	**680**	1499.1	2494.8	**5500**	12125.3
108.9	**240**	529.1	313.0	**690**	1521.2	2721.6	**6000**	13227.6
113.4	**250**	551.1	317.5	**700**	1543.2	2948.4	**6500**	14329.9
117.9	**260**	573.2	322.1	**710**	1565.3	3175.2	**7000**	15432.2
122.5	**270**	595.2	326.6	**720**	1587.3	3402.0	**7500**	16534.5
127.0	**280**	617.3	331.1	**730**	1609.4	3628.8	**8000**	17636.8
131.5	**290**	639.3	335.7	**740**	1631.4	3855.6	**8500**	18739.1
136.1	**300**	661.4	340.2	**750**	1653.4	4082.4	**9000**	19841.4
140.6	**310**	683.4	344.7	**760**	1675.5	4309.2	**9500**	20943.7
145.2	**320**	705.5	349.3	**770**	1697.5	4536.0	**10000**	22046.0
149.7	**330**	727.5	353.8	**780**	1719.6	4989.6	**11000**	24250.6
154.2	**340**	749.6	358.3	**790**	1741.6	5443.2	**12000**	26455.2
158.8	**350**	771.6	362.9	**800**	1763.7	5896.8	**13000**	28659.8
163.3	**360**	793.7	367.4	**810**	1785.7	6350.4	**14000**	30864.4
167.8	**370**	815.7	371.9	**820**	1807.8	6804.0	**15000**	33069.0
172.4	**380**	837.7	376.5	**830**	1829.8	7257.6	**16000**	35273.6
176.9	**390**	859.8	381.0	**840**	1851.9	7711.1	**17000**	37478.2
181.4	**400**	881.8	385.6	**850**	1873.9	8164.7	**18000**	39682.8
186.0	**410**	903.9	390.1	**860**	1896.0	8618.3	**19000**	41887.4
190.5	**420**	925.9	394.6	**870**	1918.0	9071.9	**20000**	44092.0
195.0	**430**	948.0	399.2	**880**	1940.0	9525.5	**21000**	46296.6
199.6	**440**	970.0	403.7	**890**	1962.1	9979.1	**22000**	48501.2
204.1	**450**	992.1	408.2	**900**	1984.1	10432.7	**23000**	50705.8

Figure 8-5

RELATION OF TEMPERATURE (°C) TO ISA

ALTITUDE ~ 1000 FT	-50°C	-40°C	-30°C	-20°C	-10°C	ISA	+10°C	+20°C	+30°C
51	-106.5	-96.5	-86.5	-76.5	-66.5	**-56.5**	-46.5	-36.5	-26.5
┃	┃	┃	┃	┃	┃	┃	┃	┃	┃
37	-106.5	-96.5	-86.5	-76.5	-66.5	**-56.5**	-46.5	-36.5	-26.5
35	-104.2	-94.2	-84.2	-74.2	-64.2	**-54.2**	-44.2	-34.2	-24.2
33	-100.3	-90.3	-80.3	-70.3	-60.3	**-50.3**	-40.3	-30.3	-20.3
31	-96.3	-86.3	-76.3	-66.3	-56.3	**-46.3**	-36.3	-26.3	-16.3
30	-94.4	-84.4	-74.4	-64.4	-54.4	**-44.4**	-34.4	-24.4	-14.4
29	-92.4	-82.4	-72.4	-62.4	-52.4	**-42.4**	-32.4	-22.4	-12.4
28	-90.4	-80.4	-70.4	-60.4	-50.4	**-40.4**	-30.4	-20.4	-10.4
27	-88.4	-78.4	-68.4	-58.4	-48.4	**-38.4**	-28.4	-18.4	-8.4
26	-86.5	-76.5	-66.5	-56.5	-46.5	**-36.5**	-26.5	-16.5	-6.5
25	-84.5	-74.5	-64.5	-54.5	-44.5	**-34.5**	-24.5	-14.5	-4.5
24	-82.5	-72.5	-62.5	-52.5	-42.5	**-32.5**	-22.5	-12.5	-2.5
23	-80.5	-70.5	-60.5	-50.5	-40.5	**-30.5**	-20.5	-10.5	-0.5
22	-78.6	-68.6	-58.6	-48.6	-38.6	**-28.6**	-18.6	-8.6	1.4
21	-76.6	-66.6	-56.6	-46.6	-36.6	**-26.6**	-16.6	-6.6	3.4
20	-74.6	-64.6	-54.6	-44.6	-34.6	**-24.6**	-14.6	-4.6	5.4
19	-72.6	-62.6	-52.6	-42.6	-32.6	**-22.6**	-12.6	-2.6	7.4
18	-70.6	-60.6	-50.6	-40.6	-30.6	**-20.6**	-10.6	-0.6	9.4
16	-66.7	-56.7	-46.7	-36.7	-26.7	**-16.7**	-6.7	3.3	13.3
14	-62.7	-52.7	-42.7	-32.7	-22.7	**-12.7**	-2.7	7.3	17.3
12	-58.8	-48.8	-38.8	-28.8	-18.8	**-8.8**	1.2	11.2	21.2
10	-54.8	-44.8	-34.8	-24.8	-14.8	**-4.8**	5.2	15.2	25.2
8	-50.8	-40.8	-30.8	-20.8	-10.8	**-0.8**	9.2	19.2	29.2
6	-46.9	-36.9	-26.9	-16.9	-6.9	**3.1**	13.1	23.1	33.1
4	-42.9	-32.9	-22.9	-12.9	-2.9	**7.1**	17.1	27.1	37.1
2	-39.0	-29.0	-19.0	-9.0	1.0	**11.0**	21.0	31.0	41.0
S.L.	-35.0	-25.0	-15.0	-5.0	5.0	**15.0**	25.0	35.0	45.0
	-50°C	**-40°C**	**-30°C**	**-20°C**	**-10°C**	**ISA**	**+10°C**	**+20°C**	**+30°C**

Figure 8-6

CLIMB PERFORMANCE

Figure 8-7 shows time, distance, and fuel used to climb from sea level to altitude for standard and off-standard days at various weights. The climb weight used is the start of climb weight. Subtraction of performance values for two altitudes results in the time, distance and fuel required for climb between the two altitudes.

The climb speed schedule presented with each table is based on an operational climb schedule to optimize fuel consumption and approximates the best rate of climb speeds. The climb speeds given are 250 KIAS up to 32,000 feet and 0.70 MI above 32,000 feet. Climb thrust is maximum continuous thrust (MCT). The MCT rating is the maximum thrust certified for continuous operation within established engine operating limits. However, to maintain predicted engine durability and to achieve FAA approved maintenance intervals, use of MCT power setting should be minimized.

CLIMB PERFORMANCE — TWO ENGINE

45-1001

WEIGHT 15,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**	25.3	157.0	630.5	25.7	163.3	663.1	30.9	202.1	755.5	36.4	241.7	839.9			
	49	19.6	120.2	553.3	20.2	126.3	584.5	22.6	144.8	639.2	24.7	161.2	680.7	27.9	184.7	737.5
	47	16.4	99.0	505.0	17.0	104.7	534.3	18.5	117.1	577.3	19.9	127.8	608.2	21.7	141.4	646.4
	45	14.1	84.2	468.1	14.7	89.3	495.6	15.8	98.9	532.7	16.9	106.9	558.3	18.2	116.9	589.6
	43	12.4	72.9	437.3	12.9	77.5	463.2	13.9	85.4	496.5	14.7	91.8	518.8	15.8	99.8	545.9
	41	11.0	63.7	410.2	11.5	68.0	434.6	12.3	74.8	465.3	13.0	80.1	485.2	13.9	86.7	509.2
	39	9.8	56.2	385.6	10.3	60.1	408.7	11.1	66.2	437.3	11.7	70.6	455.2	12.4	76.1	476.9
	37	8.9	49.8	362.9	9.3	53.5	384.8	10.0	59.0	411.6	10.5	62.8	427.9	11.2	67.5	447.6
	35	8.1	44.6	342.6	8.5	48.0	363.3	9.2	53.1	388.8	9.6	56.4	403.7	10.2	60.5	421.8
	33	7.4	40.0	323.2	7.8	43.2	342.9	8.4	47.9	366.7	8.8	50.7	380.3	9.3	54.4	397.0
	31	6.6	35.2	300.6	7.0	38.1	318.6	7.6	42.1	340.0	7.9	44.4	352.1	8.3	47.4	366.9
	29	6.0	31.0	278.5	6.3	33.5	294.9	6.8	36.8	313.8	7.0	38.7	324.4	7.4	41.3	337.6
	27	5.4	27.4	257.8	5.7	29.6	272.7	6.1	32.3	289.3	6.3	33.9	298.6	6.6	36.1	310.6
	25	4.9	24.3	238.2	5.2	26.2	251.5	5.5	28.4	266.3	5.7	29.7	274.5	6.0	31.6	285.3
	23	4.5	21.7	219.4	4.7	23.3	231.3	4.9	25.1	244.3	5.1	26.1	251.6	5.3	27.8	261.2
	21	4.1	19.4	201.2	4.2	20.7	211.7	4.4	22.1	223.3	4.6	23.0	229.7	4.8	24.4	238.1
	19	3.7	17.3	183.4	3.8	18.3	192.8	4.0	19.5	202.9	4.1	20.2	208.5	4.3	21.4	215.8
	17	3.3	15.4	166.0	3.4	16.3	174.3	3.6	17.2	183.1	3.7	17.8	187.9	3.8	18.7	194.0
	15	3.0	13.7	148.9	3.1	14.4	156.2	3.2	15.2	163.8	3.3	15.6	167.7	3.4	16.2	172.5
	13	2.7	12.1	131.5	2.8	12.7	137.8	2.8	13.2	144.3	2.9	13.5	147.6	2.9	13.9	151.2
	11	2.4	10.5	113.5	2.4	10.9	118.9	2.5	11.3	124.3	2.5	11.5	127.0	2.5	11.8	129.8
	9	2.0	8.7	94.7	2.0	9.0	99.2	2.1	9.4	103.7	2.1	9.5	106.0	2.1	9.7	108.2
	7	1.6	6.8	75.2	1.6	7.1	78.8	1.6	7.4	82.4	1.7	7.5	84.2	1.7	7.6	86.0
	5	1.2	4.9	54.9	1.2	5.1	57.5	1.2	5.3	60.1	1.2	5.4	61.4	1.2	5.5	62.6
	3	0.7	3.0	33.6	0.7	3.1	35.1	0.7	3.2	36.7	0.7	3.3	37.5	0.7	3.3	38.2
	1	0.2	1.0	11.4	0.2	1.0	11.9	0.2	1.1	12.4	0.3	1.1	12.7	0.3	1.1	12.9

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 1 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1002

WEIGHT 16,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**	34.8	218.8	787.7	34.6	222.0	817.2									
	49	23.0	141.4	626.2	23.5	148.1	660.5	27.0	174.2	733.0	30.4	199.4	793.9	36.4	243.3	893.2
	47	18.5	112.0	559.1	19.1	118.2	591.4	21.0	133.2	641.7	22.8	146.7	679.7	25.1	164.2	727.6
	45	15.6	93.5	513.1	16.2	99.2	543.3	17.6	110.1	585.0	18.8	119.5	614.9	20.4	131.4	651.5
	43	13.6	80.1	476.6	14.1	85.2	504.9	15.2	94.0	542.0	16.2	101.3	567.3	17.4	110.4	598.0
	41	12.0	69.6	445.6	12.5	74.3	472.2	13.5	81.8	506.1	14.2	87.8	528.3	15.2	95.1	555.2
	39	10.7	61.1	417.9	11.2	65.4	443.1	12.0	72.1	474.5	12.7	77.0	494.4	13.5	83.2	518.5
	37	9.6	54.0	392.6	10.1	58.0	416.4	10.9	64.1	445.9	11.4	68.2	463.9	12.1	73.5	485.7
	35	8.7	48.3	370.2	9.2	52.0	392.8	9.9	57.6	420.6	10.4	61.2	437.1	11.0	65.7	457.0
	33	8.0	43.3	349.0	8.4	46.8	370.3	9.1	51.9	396.4	9.5	55.0	411.4	10.1	59.0	429.6
	31	7.2	38.0	324.3	7.6	41.1	343.9	8.2	45.5	367.2	8.5	48.0	380.4	9.0	51.4	396.7
	29	6.5	33.4	300.2	6.8	36.1	318.1	7.3	39.7	338.6	7.6	41.8	350.2	8.0	44.6	364.7
	27	5.8	29.5	277.8	6.2	31.9	293.9	6.6	34.9	312.0	6.8	36.5	322.2	7.2	39.0	335.2
	25	5.3	26.2	256.6	5.6	28.2	271.0	5.9	30.7	287.0	6.1	32.0	296.0	6.4	34.1	307.7
	23	4.8	23.4	236.2	5.0	25.0	249.1	5.3	27.0	263.2	5.5	28.2	271.2	5.8	30.0	281.6
	21	4.4	20.8	216.6	4.6	22.2	228.0	4.8	23.8	240.5	4.9	24.8	247.4	5.2	26.3	256.6
	19	4.0	18.6	197.5	4.1	19.7	207.6	4.3	21.0	218.5	4.4	21.8	224.6	4.6	23.1	232.6
	17	3.6	16.6	178.8	3.7	17.5	187.7	3.9	18.6	197.2	3.9	19.1	202.3	4.1	20.2	209.0
	15	3.2	14.8	160.4	3.3	15.5	168.2	3.4	16.3	176.4	3.5	16.8	180.7	3.6	17.5	185.8
	13	2.9	13.1	141.7	3.0	13.6	148.5	3.1	14.3	155.4	3.1	14.6	158.9	3.2	15.0	162.8
	11	2.5	11.3	122.2	2.6	11.7	128.1	2.6	12.2	133.9	2.7	12.4	136.8	2.7	12.7	139.8
	9	2.1	9.4	102.0	2.2	9.7	106.9	2.2	10.1	111.7	2.2	10.3	114.2	2.3	10.4	116.6
	7	1.7	7.4	81.1	1.7	7.7	84.9	1.8	8.0	88.8	1.8	8.1	90.7	1.8	8.2	92.6
	5	1.2	5.3	59.2	1.3	5.5	62.0	1.3	5.8	64.7	1.3	5.9	66.1	1.3	6.0	67.5
	3	0.8	3.2	36.2	0.8	3.3	37.9	0.8	3.5	39.5	0.8	3.5	40.4	0.8	3.6	41.2
	1	0.3	1.1	12.3	0.3	1.1	12.8	0.3	1.2	13.4	0.3	1.2	13.7	0.3	1.2	13.9

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 2 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1003

WEIGHT 17,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**															
	49	28.3	175.8	730.8	28.8	182.4	767.2	35.3	230.5	888.7						
	47	21.1	128.2	622.4	21.7	135.1	657.9	24.1	154.1	719.1	26.6	172.3	768.6	30.0	197.2	834.3
	45	17.4	104.2	562.6	18.0	110.4	595.6	19.6	123.1	643.2	21.1	134.5	678.5	23.1	149.0	722.4
	43	14.9	88.0	518.7	15.5	93.6	549.5	16.7	103.5	590.7	17.9	111.9	619.6	19.3	122.5	654.9
	41	13.1	75.9	482.8	13.6	81.0	511.7	14.7	89.4	549.0	15.6	96.0	573.9	16.7	104.3	604.2
	39	11.6	66.4	451.6	12.1	71.0	478.9	13.1	78.3	513.3	13.8	83.8	535.3	14.7	90.7	562.1
	37	10.4	58.4	423.5	10.9	62.8	449.3	11.8	69.4	481.5	12.4	74.0	501.3	13.2	79.8	525.4
	35	9.4	52.1	398.8	9.9	56.1	423.2	10.7	62.3	453.6	11.2	66.2	471.7	11.9	71.2	493.6
	33	8.6	46.6	375.5	9.1	50.4	398.6	9.8	56.0	427.0	10.3	59.4	443.4	10.9	63.7	463.5
	31	7.7	40.9	348.7	8.2	44.3	369.8	8.8	49.0	395.2	9.2	51.8	409.6	9.7	55.4	427.4
	29	6.9	35.9	322.5	7.3	38.9	341.8	7.9	42.8	364.1	8.2	45.0	376.6	8.6	48.1	392.5
	27	6.3	31.7	298.3	6.6	34.3	315.7	7.1	37.5	335.3	7.3	39.3	346.3	7.7	41.9	360.5
	25	5.7	28.1	275.4	6.0	30.3	290.9	6.4	32.9	308.3	6.6	34.4	317.9	6.9	36.7	330.7
	23	5.2	25.1	253.5	5.4	26.9	267.3	5.7	29.0	282.6	5.9	30.2	291.1	6.2	32.2	302.5
	21	4.7	22.4	232.4	4.9	23.9	244.7	5.1	25.6	258.1	5.3	26.6	265.6	5.5	28.3	275.6
	19	4.3	20.0	211.9	4.4	21.2	222.7	4.6	22.6	234.5	4.7	23.4	241.0	5.0	24.8	249.7
	17	3.9	17.8	191.8	4.0	18.8	201.3	4.1	19.9	211.6	4.2	20.5	217.1	4.4	21.6	224.3
	15	3.5	15.9	172.0	3.6	16.7	180.5	3.7	17.5	189.2	3.8	18.0	193.8	3.9	18.8	199.4
	13	3.1	14.0	152.0	3.2	14.6	159.3	3.3	15.3	166.7	3.3	15.6	170.6	3.4	16.1	174.7
	11	2.7	12.1	131.2	2.8	12.6	137.4	2.8	13.1	143.7	2.9	13.3	146.8	2.9	13.6	150.1
	9	2.3	10.0	109.5	2.3	10.5	114.7	2.4	10.8	119.9	2.4	11.0	122.5	2.4	11.2	125.1
	7	1.8	7.9	87.0	1.9	8.2	91.2	1.9	8.6	95.3	1.9	8.7	97.4	1.9	8.8	99.5
	5	1.3	5.7	63.5	1.4	6.0	66.5	1.4	6.2	69.5	1.4	6.3	71.0	1.4	6.4	72.5
	3	0.8	3.4	38.9	0.8	3.6	40.7	0.9	3.7	42.5	0.9	3.8	43.4	0.9	3.8	44.2
	1	0.3	1.2	13.2	0.3	1.2	13.8	0.3	1.2	14.4	0.3	1.3	14.7	0.3	1.3	15.0

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 3 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1004

WEIGHT 18,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	51															
	49															
	47	24.6	150.6	702.3	25.2	158.0	741.0	28.7	184.8	822.1	32.7	213.6	896.9	39.0	259.2	1010.2
	45	19.4	116.9	618.5	20.1	123.7	654.7	22.0	138.7	709.7	23.9	153.0	752.7	26.4	171.6	807.6
	43	16.4	96.9	564.2	17.0	103.0	597.8	18.4	114.2	643.8	19.7	124.0	677.0	21.4	136.3	718.0
	41	14.2	82.8	522.2	14.8	88.3	553.6	16.0	97.5	594.7	17.0	105.0	622.6	18.3	114.5	656.8
	39	12.5	71.9	486.8	13.1	76.9	516.4	14.2	85.0	554.0	15.0	91.1	578.5	16.0	98.7	608.3
	37	11.2	63.1	455.5	11.8	67.8	483.4	12.7	75.0	518.6	13.4	80.1	540.4	14.2	86.4	567.0
	35	10.1	56.1	428.3	10.7	60.5	454.7	11.5	67.2	487.9	12.1	71.5	507.6	12.9	77.0	531.8
	33	9.2	50.1	402.9	9.7	54.2	427.8	10.6	60.3	458.8	11.1	64.0	476.7	11.7	68.7	498.6
	31	8.3	43.9	373.7	8.7	47.5	396.5	9.5	52.7	424.1	9.9	55.7	439.7	10.4	59.7	459.1
	29	7.4	38.5	345.4	7.9	41.7	366.2	8.5	45.9	390.3	8.8	48.3	403.9	9.3	51.7	421.2
	27	6.7	33.9	319.2	7.1	36.7	338.0	7.6	40.2	359.2	7.9	42.1	371.1	8.3	45.0	386.5
	25	6.1	30.1	294.6	6.4	32.5	311.3	6.8	35.3	330.0	7.0	36.9	340.5	7.4	39.4	354.3
	23	5.5	26.8	271.1	5.8	28.8	286.0	6.1	31.1	302.5	6.3	32.4	311.7	6.6	34.5	324.0
	21	5.0	23.9	248.5	5.2	25.5	261.7	5.5	27.4	276.1	5.7	28.5	284.2	5.9	30.3	295.0
	19	4.6	21.4	226.5	4.7	22.7	238.2	4.9	24.2	250.8	5.1	25.0	257.8	5.3	26.5	267.2
	17	4.1	19.1	205.1	4.3	20.1	215.3	4.4	21.3	226.3	4.5	22.0	232.3	4.7	23.1	240.1
	15	3.7	17.0	184.0	3.8	17.8	193.0	4.0	18.7	202.4	4.0	19.2	207.4	4.1	20.1	213.4
	13	3.3	15.0	162.6	3.4	15.7	170.4	3.5	16.4	178.4	3.5	16.7	182.4	3.6	17.2	187.0
	11	2.9	12.9	140.4	3.0	13.5	147.1	3.0	14.0	153.8	3.1	14.3	157.1	3.1	14.6	160.5
	9	2.4	10.7	117.2	2.5	11.2	122.7	2.6	11.6	128.3	2.6	11.8	131.1	2.6	12.0	133.9
	7	2.0	8.5	93.2	2.0	8.8	97.6	2.0	9.2	102.0	2.1	9.3	104.3	2.1	9.5	106.4
	5	1.4	6.1	68.0	1.5	6.4	71.2	1.5	6.6	74.4	1.5	6.7	76.0	1.5	6.8	77.6
	3	0.9	3.7	41.6	0.9	3.8	43.5	0.9	4.0	45.4	0.9	4.1	46.4	0.9	4.1	47.4
	1	0.3	1.2	14.1	0.3	1.3	14.8	0.3	1.3	15.4	0.3	1.3	15.7	0.3	1.4	16.0

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 4 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1005

WEIGHT 19,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**															
	49															
	47	30.6	189.0	823.6	31.0	196.1	864.0	37.8	246.3	1002.2						
	45	22.0	132.9	684.2	22.7	140.3	723.8	25.1	158.9	789.5	27.6	177.8	845.1	31.2	204.1	919.8
	43	18.0	107.1	614.3	18.7	113.7	650.9	20.3	126.5	702.6	21.9	138.1	741.4	23.9	153.0	790.0
	41	15.4	90.2	564.3	16.1	96.2	598.4	17.4	106.4	643.6	18.5	115.0	675.1	20.0	125.8	714.0
	39	13.5	77.8	523.8	14.2	83.3	555.8	15.3	92.0	597.0	16.2	98.8	624.1	17.4	107.4	657.3
	37	12.0	67.9	488.8	12.6	73.0	519.0	13.7	80.9	557.3	14.4	86.5	581.3	15.4	93.5	610.6
	35	10.9	60.2	458.9	11.4	65.0	487.4	12.4	72.3	523.5	13.0	77.0	545.1	13.9	83.0	571.6
	33	9.9	53.7	431.2	10.4	58.1	458.1	11.3	64.7	491.6	11.9	68.8	511.2	12.6	74.0	535.2
	31	8.8	47.0	399.5	9.4	50.9	424.0	10.1	56.5	453.9	10.6	59.8	470.9	11.2	64.0	492.0
	29	7.9	41.1	368.9	8.4	44.5	391.3	9.0	49.1	417.4	9.4	51.7	432.1	9.9	55.3	450.8
	27	7.2	36.2	340.7	7.6	39.2	360.9	8.1	43.0	383.8	8.4	45.1	396.6	8.9	48.1	413.3
	25	6.5	32.1	314.4	6.8	34.7	332.3	7.3	37.7	352.4	7.5	39.4	363.7	7.9	42.1	378.6
	23	5.9	28.6	289.2	6.2	30.7	305.2	6.5	33.2	322.8	6.7	34.6	332.7	7.1	36.9	346.0
	21	5.3	25.5	265.0	5.6	27.2	279.1	5.9	29.2	294.6	6.0	30.4	303.3	6.3	32.3	315.0
	19	4.9	22.8	241.6	5.0	24.2	254.0	5.3	25.8	267.6	5.4	26.7	275.1	5.7	28.3	285.2
	17	4.4	20.3	218.7	4.5	21.4	229.6	4.7	22.7	241.4	4.8	23.4	247.8	5.0	24.7	256.2
	15	4.0	18.1	196.2	4.1	19.0	205.9	4.2	20.0	215.9	4.3	20.5	221.2	4.4	21.4	227.7
	13	3.5	16.0	173.4	3.6	16.7	181.8	3.7	17.5	190.3	3.8	17.8	194.6	3.9	18.4	199.5
	11	3.1	13.8	149.8	3.2	14.4	156.9	3.2	14.9	164.0	3.3	15.2	167.6	3.3	15.5	171.3
	9	2.6	11.5	125.0	2.7	11.9	131.0	2.7	12.4	136.9	2.7	12.6	139.9	2.8	12.8	142.9
	7	2.1	9.0	99.4	2.1	9.4	104.2	2.2	9.8	108.9	2.2	9.9	111.3	2.2	10.1	113.6
	5	1.5	6.5	72.6	1.6	6.8	76.0	1.6	7.1	79.4	1.6	7.2	81.1	1.6	7.3	82.8
	3	0.9	3.9	44.4	1.0	4.1	46.5	1.0	4.3	48.5	1.0	4.3	49.5	1.0	4.4	50.6
	1	0.3	1.3	15.1	0.3	1.4	15.8	0.3	1.4	16.4	0.3	1.4	16.8	0.3	1.5	17.1

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 5 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1006

WEIGHT 20,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	51															
	49															
	47															
	45	25.4	154.9	767.7	26.2	162.9	810.8	29.5	188.1	895.3	33.5	217.5	978.1	39.9	264.3	1104.4
	43	20.0	119.1	670.7	20.7	126.3	710.5	22.6	141.1	769.4	24.5	155.3	816.0	27.0	174.0	875.8
	41	16.8	98.5	609.8	17.5	105.0	646.7	19.0	116.4	696.7	20.3	126.3	732.6	22.0	138.8	777.2
	39	14.6	84.1	563.0	15.3	90.1	597.5	16.5	99.7	642.5	17.6	107.3	672.8	18.9	116.9	709.9
	37	12.9	73.1	523.7	13.6	78.6	556.2	14.7	87.2	597.9	15.5	93.3	624.4	16.6	101.1	656.8
	35	11.6	64.6	490.7	12.3	69.7	521.4	13.3	77.6	560.6	14.0	82.8	584.3	14.9	89.4	613.3
	33	10.5	57.5	460.5	11.2	62.2	489.4	12.1	69.4	525.8	12.7	73.8	547.1	13.5	79.5	573.3
	31	9.4	50.2	426.1	10.0	54.3	452.5	10.8	60.4	484.8	11.3	64.0	503.2	12.0	68.6	526.2
	29	8.5	43.8	393.1	9.0	47.5	417.2	9.7	52.5	445.3	10.0	55.3	461.2	10.6	59.2	481.4
	27	7.6	38.6	362.8	8.1	41.8	384.5	8.6	45.8	409.1	9.0	48.1	422.9	9.5	51.4	440.9
	25	6.9	34.2	334.6	7.3	36.9	353.8	7.7	40.2	375.4	8.0	42.0	387.5	8.4	44.9	403.7
	23	6.3	30.4	307.7	6.6	32.7	324.8	7.0	35.3	343.7	7.2	36.8	354.3	7.6	39.3	368.7
	21	5.7	27.1	281.9	5.9	29.0	297.0	6.2	31.1	313.6	6.4	32.3	322.9	6.8	34.4	335.5
	19	5.2	24.2	257.0	5.4	25.7	270.2	5.6	27.4	284.7	5.8	28.4	292.8	6.0	30.1	303.7
	17	4.7	21.6	232.6	4.8	22.8	244.3	5.0	24.2	256.8	5.1	25.0	263.7	5.3	26.3	272.7
	15	4.2	19.3	208.8	4.3	20.2	219.0	4.5	21.3	229.7	4.6	21.9	235.4	4.7	22.8	242.3
	13	3.8	17.0	184.6	3.9	17.8	193.5	4.0	18.6	202.5	4.0	19.0	207.1	4.1	19.6	212.3
	11	3.3	14.7	159.4	3.4	15.3	167.0	3.5	15.9	174.6	3.5	16.2	178.4	3.5	16.5	182.3
	9	2.8	12.2	133.1	2.8	12.7	139.4	2.9	13.2	145.8	2.9	13.4	148.9	2.9	13.6	152.1
	7	2.2	9.6	105.9	2.3	10.0	110.9	2.3	10.4	115.9	2.3	10.6	118.5	2.4	10.7	120.9
	5	1.6	6.9	77.3	1.7	7.2	80.9	1.7	7.5	84.6	1.7	7.7	86.4	1.7	7.8	88.2
	3	1.0	4.2	47.3	1.0	4.4	49.5	1.0	4.5	51.7	1.0	4.6	52.8	1.1	4.7	53.8
	1	0.3	1.4	16.1	0.3	1.5	16.8	0.4	1.5	17.5	0.4	1.5	17.8	0.4	1.6	18.2

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 6 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1007

WEIGHT 20,500 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**															
	49															
	47															
	45	27.9	170.4	822.2	28.6	178.6	867.0	32.8	210.4	969.2	38.5	251.8	1082.8			
	43	21.1	126.0	702.2	21.9	133.6	743.6	23.9	149.7	807.0	26.1	165.7	859.0	29.0	187.2	926.7
	41	17.6	103.1	634.1	18.3	109.8	672.5	19.8	121.9	725.2	21.3	132.5	763.7	23.1	146.1	811.8
	39	15.2	87.5	583.5	15.9	93.7	619.4	17.2	103.8	666.5	18.3	111.8	698.5	19.7	122.0	737.8
	37	13.4	75.8	541.8	14.1	81.5	575.5	15.2	90.4	619.0	16.1	96.9	646.8	17.2	105.1	680.9
	35	12.0	66.8	507.0	12.7	72.1	538.9	13.8	80.4	579.8	14.5	85.8	604.6	15.5	92.7	635.0
	33	10.9	59.4	475.5	11.5	64.3	505.5	12.5	71.8	543.4	13.2	76.4	565.6	14.0	82.3	593.0
	31	9.7	51.8	439.7	10.3	56.1	467.1	11.2	62.5	500.7	11.7	66.2	519.9	12.4	71.0	543.9
	29	8.7	45.2	405.5	9.3	49.1	430.4	10.0	54.2	459.5	10.4	57.1	476.1	11.0	61.2	497.2
	27	7.9	39.8	374.1	8.3	43.1	396.5	8.9	47.3	422.0	9.2	49.6	436.3	9.8	53.1	455.1
	25	7.1	35.2	344.9	7.5	38.1	364.8	8.0	41.4	387.1	8.3	43.4	399.7	8.7	46.3	416.5
	23	6.5	31.4	317.2	6.8	33.7	334.8	7.2	36.4	354.4	7.4	38.0	365.4	7.8	40.5	380.3
	21	5.9	28.0	290.5	6.1	29.9	306.1	6.4	32.1	323.3	6.6	33.4	332.9	7.0	35.5	345.9
	19	5.3	25.0	264.8	5.5	26.5	278.5	5.8	28.3	293.5	5.9	29.3	301.8	6.2	31.1	313.1
	17	4.8	22.3	239.7	5.0	23.5	251.8	5.2	24.9	264.7	5.3	25.7	271.8	5.5	27.1	281.1
	15	4.4	19.8	215.2	4.5	20.8	225.7	4.6	21.9	236.8	4.7	22.5	242.6	4.9	23.5	249.8
	13	3.9	17.5	190.2	4.0	18.3	199.4	4.1	19.2	208.7	4.1	19.6	213.5	4.2	20.2	218.8
	11	3.4	15.1	164.3	3.5	15.8	172.2	3.6	16.4	180.0	3.6	16.7	183.9	3.6	17.0	187.9
	9	2.9	12.6	137.2	2.9	13.1	143.8	3.0	13.6	150.3	3.0	13.8	153.5	3.0	14.0	156.8
	7	2.3	9.9	109.1	2.3	10.3	114.4	2.4	10.7	119.5	2.4	10.9	122.1	2.4	11.1	124.7
	5	1.7	7.2	79.7	1.7	7.5	83.5	1.8	7.8	87.2	1.8	7.9	89.1	1.8	8.0	90.9
	3	1.0	4.3	48.8	1.1	4.5	51.0	1.1	4.7	53.3	1.1	4.8	54.4	1.1	4.8	55.5
	1	0.3	1.4	16.6	0.4	1.5	17.3	0.4	1.6	18.0	0.4	1.6	18.4	0.4	1.6	18.8

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 7 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1008

WEIGHT 21,000 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**															
	49															
	47															
	45	31.3	192.4	894.8	31.9	200.4	940.3	37.8	244.3	1074.8						
	43	22.3	133.9	736.5	23.2	141.8	779.8	25.4	159.5	848.5	27.9	177.9	907.4	31.4	203.3	986.1
	41	18.4	108.0	659.6	19.1	115.0	699.5	20.8	127.8	755.2	22.3	139.3	796.7	24.3	154.1	848.8
	39	15.8	91.0	604.7	16.5	97.4	642.0	17.9	108.0	691.3	19.0	116.6	725.1	20.5	127.4	767.0
	37	13.9	78.6	560.3	14.6	84.4	595.3	15.8	93.8	640.7	16.7	100.7	669.9	17.9	109.3	705.8
	35	12.4	69.2	523.8	13.1	74.6	556.8	14.3	83.3	599.4	15.0	89.0	625.3	16.0	96.2	657.3
	33	11.3	61.4	490.8	11.9	66.5	521.9	13.0	74.3	561.4	13.6	79.1	584.6	14.5	85.3	613.2
	31	10.1	53.5	453.6	10.7	58.0	481.9	11.6	64.5	516.8	12.1	68.4	536.8	12.8	73.4	561.8
	29	9.0	46.6	418.1	9.5	50.6	443.8	10.3	55.9	474.1	10.7	59.0	491.2	11.3	63.2	513.2
	27	8.1	41.0	385.6	8.6	44.5	408.7	9.2	48.8	435.1	9.5	51.2	450.0	10.1	54.8	469.4
	25	7.3	36.3	355.4	7.7	39.2	375.9	8.2	42.7	399.0	8.5	44.7	412.0	9.0	47.8	429.5
	23	6.7	32.3	326.7	7.0	34.7	344.9	7.4	37.5	365.2	7.6	39.2	376.5	8.0	41.8	392.0
	21	6.0	28.8	299.3	6.3	30.8	315.4	6.6	33.0	333.1	6.8	34.4	343.0	7.2	36.6	356.5
	19	5.5	25.7	272.8	5.7	27.3	286.9	6.0	29.1	302.3	6.1	30.2	310.9	6.4	32.0	322.6
	17	5.0	22.9	246.9	5.1	24.2	259.3	5.3	25.7	272.7	5.5	26.5	280.0	5.7	27.9	289.6
	15	4.5	20.4	221.6	4.6	21.5	232.5	4.8	22.6	243.9	4.8	23.2	249.9	5.0	24.2	257.4
	13	4.0	18.1	196.0	4.1	18.9	205.4	4.2	19.7	215.0	4.3	20.2	220.0	4.4	20.8	225.5
	11	3.5	15.6	169.3	3.6	16.3	177.4	3.7	16.9	185.4	3.7	17.2	189.5	3.7	17.5	193.6
	9	3.0	13.0	141.4	3.0	13.5	148.1	3.1	14.0	154.9	3.1	14.2	158.2	3.1	14.5	161.6
	7	2.4	10.2	112.5	2.4	10.6	117.8	2.5	11.1	123.2	2.5	11.2	125.9	2.5	11.4	128.5
	5	1.7	7.4	82.1	1.8	7.7	86.0	1.8	8.0	89.9	1.8	8.1	91.8	1.8	8.3	93.7
	3	1.1	4.5	50.3	1.1	4.6	52.6	1.1	4.8	54.9	1.1	4.9	56.1	1.1	5.0	57.2
	1	0.4	1.5	17.1	0.4	1.5	17.8	0.4	1.6	18.6	0.4	1.6	19.0	0.4	1.7	19.3

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 8 of 9)

CLIMB PERFORMANCE — TWO ENGINE

45-1009

WEIGHT 21,500 LB		ISA -10°C			ISA			ISA +10°C			ISA +15°C			ISA +20°C		
		Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb	Time Min.	Dist N.M.	Fuel Lb
PRESSURE ALTITUDE — 1000 FEET	**51**															
	49															
	47															
	45	36.7	227.7	1003.4	37.1	234.5	1047.6									
	43	23.8	143.0	774.8	24.6	151.2	820.0	27.1	170.9	895.3	30.1	192.7	963.8	34.4	224.0	1059.1
	41	19.2	113.2	686.6	20.0	120.5	728.1	21.8	134.1	787.0	23.4	146.7	831.9	25.7	162.9	888.8
	39	16.4	94.8	626.7	17.2	101.4	665.4	18.6	112.5	717.1	19.8	121.6	753.0	21.4	133.2	797.5
	37	14.4	81.4	579.4	15.1	87.5	615.7	16.4	97.3	663.1	17.3	104.5	693.8	18.6	113.6	731.5
	35	12.9	71.5	540.9	13.6	77.2	575.1	14.8	86.2	619.6	15.6	92.2	646.7	16.6	99.7	680.1
	33	11.6	63.4	506.4	12.3	68.7	538.6	13.4	76.8	579.8	14.1	81.8	604.0	15.0	88.3	633.9
	31	10.4	55.2	467.7	11.0	59.8	497.0	11.9	66.7	533.3	12.5	70.7	554.1	13.2	75.9	580.2
	29	9.3	48.1	430.8	9.8	52.2	457.5	10.6	57.7	488.9	11.1	60.9	506.7	11.7	65.2	529.5
	27	8.4	42.3	397.2	8.8	45.8	421.1	9.5	50.3	448.4	9.8	52.8	463.8	10.4	56.5	484.1
	25	7.6	37.4	366.0	8.0	40.4	387.2	8.5	44.0	411.1	8.8	46.1	424.6	9.3	49.2	442.7
	23	6.8	33.3	336.4	7.2	35.7	355.2	7.6	38.7	376.1	7.9	40.3	387.9	8.3	43.1	404.0
	21	6.2	29.6	308.1	6.5	31.7	324.7	6.8	34.0	343.0	7.0	35.4	353.3	7.4	37.7	367.3
	19	5.6	26.5	280.8	5.9	28.1	295.4	6.1	30.0	311.3	6.3	31.1	320.2	6.6	33.0	332.3
	17	5.1	23.6	254.2	5.3	24.9	267.0	5.5	26.4	280.8	5.6	27.3	288.3	5.9	28.8	298.3
	15	4.6	21.0	228.2	4.8	22.1	239.4	4.9	23.3	251.2	5.0	23.9	257.4	5.2	24.9	265.0
	13	4.1	18.6	201.8	4.2	19.4	211.5	4.3	20.3	221.4	4.4	20.8	226.5	4.5	21.4	232.2
	11	3.6	16.1	174.4	3.7	16.7	182.7	3.8	17.4	191.0	3.8	17.7	195.1	3.9	18.1	199.4
	9	3.0	13.3	145.6	3.1	13.9	152.6	3.2	14.4	159.5	3.2	14.7	162.9	3.2	14.9	166.4
	7	2.4	10.5	115.9	2.5	11.0	121.4	2.5	11.4	126.9	2.6	11.6	129.6	2.6	11.8	132.4
	5	1.8	7.6	84.6	1.8	7.9	88.6	1.9	8.2	92.6	1.9	8.4	94.6	1.9	8.5	96.5
	3	1.1	4.6	51.8	1.1	4.8	54.2	1.1	5.0	56.6	1.1	5.0	57.8	1.2	5.1	58.9
	1	0.4	1.5	17.6	0.4	1.6	18.4	0.4	1.7	19.1	0.4	1.7	19.5	0.4	1.7	19.9

CLIMB SPEED: 250 KIAS up to 32,000 feet.
0.70 MI above 32,000 feet.

Figure 8-7.1 (Sheet 9 of 9)

CRUISE PERFORMANCE

The cruise performance on the following pages is based on flight test data and represents the average delivered aircraft.

CONSTANT MACH

The Constant Mach tables (Figure 8-8) provide fuel flows and true airspeed for constant 0.76 MI cruise at weights from 14,500 to 21,000 pounds. Engine power is adjusted to maintain constant Mach as weight decreases. Standard and off-standard day temperatures provide interpolation factors.

SPECIFIC RANGE

Figure 8-9 presents a graphic description of the range capability at ISA as a function of weight and altitude. The data is based on two engine, long-range cruise at ISA. In general, the cruise altitude selected should be near the maximum nautical miles per pound of fuel for a given aircraft weight.

LONG RANGE CRUISE — TWO ENGINES

The Long-Range Cruise — Two-Engine tables (Figure 8-10) provide fuel flow, indicated Mach or airspeed, and true airspeed for 99% maximum range cruise at weights from 14,500 to 21,000 pounds. Standard and off-standard day temperatures provide interpolation factors.

HIGH-SPEED CRUISE

The High Speed Cruise tables (Figure 8-11) provide fuel flows, indicated Mach or airspeed, and true airspeed for a MMO/VMO or VMAX cruise at weights from 14,500 to 21,000 pounds. The cruise speed is MMO/VMO or that resulting from maximum cruise power (MCR) whichever is lower. Standard and off-standard day temperatures provide interpolation factors.

LONG-RANGE CRUISE — ONE ENGINE

The Long-Range Cruise — One Engine tables (Figure 8-12) provide fuel flows, indicated Mach or airspeed and true airspeed for 99% maximum range cruise at weights from 14,500 to 21,000 pounds. Standard and off-standard day temperatures provide interpolation factors.

OXYGEN QUANTITY MISSION PLANNING

The Oxygen Quantity Mission Planning table (Figure 8-13) provides oxygen quantity requirements based on the mission profile. Two profiles are presented — one crew member using oxygen in the normal mode while at altitudes above 35,000 feet and one crew member using oxygen in the normal mode while at altitudes above 41,000 feet.

CONSTANT MACH CRUISE

45-1010

WEIGHT — 14,500 LB			TEMPERATURE — °C				
	Mach — .76 MI		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS	426	436	446		
		Fuel - Lb/Hr	804	823	842		
	49	KTAS	426	436	446	451	
		Fuel - Lb/Hr	814	834	853	862	
	47	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	843	863	883	893	902
	45	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	882	903	923	933	943
	43	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	934	956	978	989	999
	41	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	995	1018	1042	1053	1064
	39	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1064	1089	1114	1126	1138
	37	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1142	1169	1196	1209	1222
	35	KTAS	428	438	448	453	458
		Fuel - Lb/Hr	1238	1267	1296	1310	1324
	30	KTAS	438	448	457	462	467
		Fuel - Lb/Hr	1539	1574	1608	1624	1641
	25	KTAS	448	457	467	472	476
		Fuel - Lb/Hr	1902	1943	1983	2003	2022

45-1011

WEIGHT — 15,000 LB			TEMPERATURE — °C				
	Mach — .76 MI		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS	426	436			
		Fuel - Lb/Hr	828	848			
	49	KTAS	426	436	446	451	
		Fuel - Lb/Hr	833	853	872	882	
	47	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	858	878	898	908	918
	45	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	894	915	936	946	956
	43	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	942	965	987	997	1008
	41	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1002	1026	1050	1061	1072
	39	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1071	1097	1122	1134	1146
	37	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1148	1176	1203	1216	1229
	35	KTAS	428	438	448	453	458
		Fuel - Lb/Hr	1244	1273	1302	1316	1330
	30	KTAS	438	448	457	462	467
		Fuel - Lb/Hr	1544	1579	1613	1630	1647
	25	KTAS	448	457	467	472	476
		Fuel - Lb/Hr	1906	1948	1988	2008	2027

Figure 8-8.1 (Sheet 1 of 7)

CONSTANT MACH CRUISE

45-1012

WEIGHT — 15,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET	Mach — .76 M_I	ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS	426	436			
	Fuel - Lb/Hr	855	875			
49	KTAS	426	436	446	451	
	Fuel - Lb/Hr	853	873	893	903	
47	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	873	894	914	924	934
45	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	906	928	949	960	970
43	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	951	974	996	1007	1018
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1010	1034	1058	1069	1081
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1078	1104	1129	1142	1154
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1155	1183	1210	1223	1236
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1250	1280	1309	1323	1337
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1549	1584	1619	1636	1652
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1911	1952	1992	2012	2032

45-1013

WEIGHT — 16,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET	Mach — .76 M_I	ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS	426	436	446		
	Fuel - Lb/Hr	875	896	916		
47	KTAS	426	436	446	451	
	Fuel - Lb/Hr	889	910	931	941	
45	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	920	942	964	974	985
43	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	963	986	1008	1020	1030
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1018	1042	1066	1078	1089
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1086	1112	1137	1150	1162
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1162	1190	1217	1231	1244
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1257	1287	1316	1330	1344
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1555	1590	1624	1641	1658
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1915	1956	1997	2017	2037

Figure 8-8.1 (Sheet 2 of 7)

CONSTANT MACH CRUISE

45-1014

WEIGHT — 16,500 LB			TEMPERATURE — °C				
	Mach — .76 MI		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS	426	436			
		Fuel - Lb/Hr	898	920			
	47	KTAS	426	436	446	451	
		Fuel - Lb/Hr	908	929	951	961	
	45	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	935	957	979	990	1000
	43	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	975	998	1021	1032	1043
	41	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1027	1052	1076	1088	1099
	39	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1093	1120	1145	1158	1170
	37	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1170	1198	1225	1238	1252
	35	KTAS	428	438	448	453	458
		Fuel - Lb/Hr	1264	1294	1323	1337	1351
	30	KTAS	438	448	457	462	467
		Fuel - Lb/Hr	1560	1596	1630	1647	1664
	25	KTAS	448	457	467	472	476
		Fuel - Lb/Hr	1919	1961	2002	2022	2042

45-1015

WEIGHT — 17,000 LB			TEMPERATURE — °C				
	Mach — .76 MI		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS	426	436			
		Fuel - Lb/Hr	923	945			
	47	KTAS	426	436	446	451	
		Fuel - Lb/Hr	927	950	971	982	
	45	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	950	973	995	1006	1016
	43	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	987	1011	1034	1045	1056
	41	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1038	1063	1087	1099	1111
	39	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1101	1128	1153	1166	1178
	37	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1177	1205	1233	1246	1260
	35	KTAS	428	438	448	453	458
		Fuel - Lb/Hr	1271	1301	1330	1344	1359
	30	KTAS	438	448	457	462	467
		Fuel - Lb/Hr	1566	1602	1636	1653	1670
	25	KTAS	448	457	467	472	476
		Fuel - Lb/Hr	1924	1966	2007	2027	2046

Figure 8-8.1 (Sheet 3 of 7)

CONSTANT MACH CRUISE

45-1016

	WEIGHT — 17,500 LB Mach — .76 MI	TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS	426	436	446		
	Fuel - Lb/Hr	949	972	994		
45	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	965	988	1011	1022	1033
43	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1000	1024	1048	1059	1070
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1049	1074	1099	1111	1123
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1109	1136	1162	1174	1187
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1185	1213	1241	1254	1268
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1278	1308	1337	1352	1366
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1572	1608	1642	1659	1676
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1929	1971	2012	2032	2052

45-1017

	WEIGHT — 18,000 LB Mach — .76 MI	TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS	426	436			
	Fuel - Lb/Hr	972	995			
45	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	983	1007	1029	1041	1052
43	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1014	1038	1062	1074	1085
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1061	1086	1111	1123	1135
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1119	1145	1171	1184	1197
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1192	1221	1248	1262	1276
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1285	1315	1345	1360	1374
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1578	1614	1649	1666	1683
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1934	1976	2017	2037	2057

Figure 8-8.1 (Sheet 4 of 7)

CONSTANT MACH CRUISE

45-1018

WEIGHT — 18,500 LB			TEMPERATURE — °C				
Mach — .76 MI			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS	426	436			
		Fuel - Lb/Hr	995	1019			
	45	KTAS	426	436	446	451	
		Fuel - Lb/Hr	1001	1025	1049	1060	
	43	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1029	1053	1077	1089	1101
	41	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1073	1098	1123	1136	1148
	39	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1129	1156	1183	1195	1208
	37	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1200	1229	1257	1270	1284
	35	KTAS	428	438	448	453	458
		Fuel - Lb/Hr	1293	1323	1353	1368	1382
	30	KTAS	438	448	457	462	467
		Fuel - Lb/Hr	1584	1620	1655	1673	1690
	25	KTAS	448	457	467	472	476
		Fuel - Lb/Hr	1939	1981	2022	2042	2062

45-1019

WEIGHT — 19,000 LB			TEMPERATURE — °C				
Mach — .76 MI			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	KTAS					
		Fuel - Lb/Hr					
	49	KTAS					
		Fuel - Lb/Hr					
	47	KTAS	426	436			
		Fuel - Lb/Hr	1022	1047			
	45	KTAS	426	436	446	451	
		Fuel - Lb/Hr	1022	1047	1071	1082	
	43	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1043	1068	1093	1105	1116
	41	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1085	1111	1136	1149	1161
	39	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1140	1167	1194	1207	1220
	37	KTAS	426	436	446	451	456
		Fuel - Lb/Hr	1208	1237	1265	1279	1293
	35	KTAS	428	438	448	453	458
		Fuel - Lb/Hr	1300	1331	1361	1376	1390
	30	KTAS	438	448	457	462	467
		Fuel - Lb/Hr	1591	1627	1662	1679	1696
	25	KTAS	448	457	467	472	476
		Fuel - Lb/Hr	1945	1987	2028	2048	2068

Figure 8-8.1 (Sheet 5 of 7)

CONSTANT MACH CRUISE

45-1020

ALTITUDE — 1000 FEET	WEIGHT — 19,500 LB Mach — .76 MI	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS					
	Fuel - Lb/Hr					
45	KTAS	426	436	446		
	Fuel - Lb/Hr	1044	1069	1093		
43	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1059	1084	1109	1121	1133
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1098	1125	1150	1163	1175
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1151	1179	1206	1219	1232
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1216	1245	1274	1288	1301
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1308	1339	1369	1384	1399
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1597	1634	1669	1686	1703
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1951	1993	2034	2055	2075

45-1021

ALTITUDE — 1000 FEET	WEIGHT — 20,000 LB Mach — .76 MI	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS					
	Fuel - Lb/Hr					
45	KTAS	426	436			
	Fuel - Lb/Hr	1067	1092			
43	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1076	1102	1127	1140	1152
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1112	1139	1165	1177	1190
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1163	1190	1218	1231	1244
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1226	1255	1284	1298	1312
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1317	1348	1378	1393	1408
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1604	1640	1676	1693	1711
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1957	1999	2041	2061	2081

Figure 8-8.1 (Sheet 6 of 7)

CONSTANT MACH CRUISE

45-1022

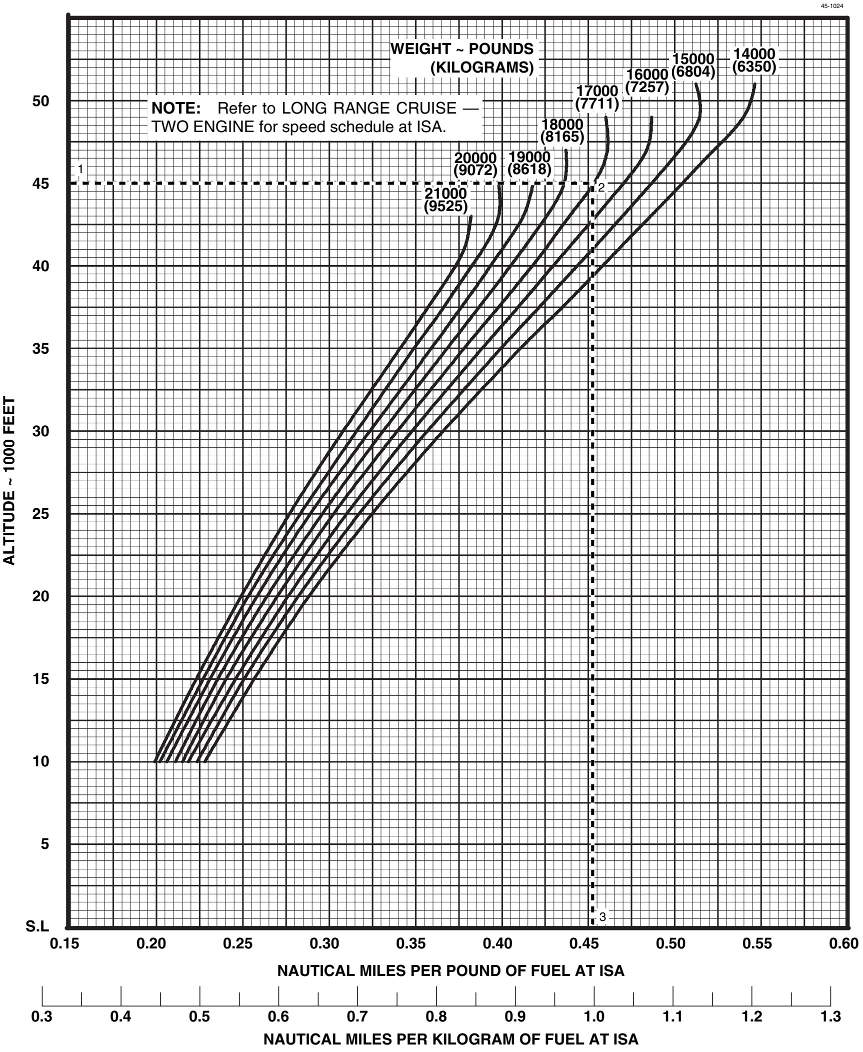
WEIGHT — 20,500 LB	Mach — .76 MI	TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS					
	Fuel - Lb/Hr					
45	KTAS	426	436			
	Fuel - Lb/Hr	1090	1116			
43	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1094	1120	1146	1159	1171
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1126	1153	1179	1192	1205
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1174	1202	1230	1243	1257
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1236	1266	1295	1309	1323
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1326	1357	1388	1403	1418
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1611	1647	1683	1701	1718
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1963	2006	2047	2068	2088

45-1023

WEIGHT — 21,000 LB	Mach — .76 MI	TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	KTAS					
	Fuel - Lb/Hr					
49	KTAS					
	Fuel - Lb/Hr					
47	KTAS					
	Fuel - Lb/Hr					
45	KTAS	426	436			
	Fuel - Lb/Hr	1117	1143			
43	KTAS	426	436	446	451	
	Fuel - Lb/Hr	1115	1141	1167	1180	
41	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1141	1168	1194	1208	1221
39	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1187	1215	1243	1257	1270
37	KTAS	426	436	446	451	456
	Fuel - Lb/Hr	1247	1277	1306	1320	1335
35	KTAS	428	438	448	453	458
	Fuel - Lb/Hr	1335	1367	1398	1413	1428
30	KTAS	438	448	457	462	467
	Fuel - Lb/Hr	1618	1654	1690	1708	1725
25	KTAS	448	457	467	472	476
	Fuel - Lb/Hr	1969	2012	2054	2074	2095

Figure 8-8.1 (Sheet 7 of 7)

SPECIFIC RANGE



EXAMPLE:

1. Altitude .... 45,000 ft
2. Weight .... 17,000 lb (7711 kg)
3. Specific Range .... 0.453 NM/lb (0.99 NM/kg)

Figure 8-9

LONG RANGE CRUISE

45-1025

WEIGHT — 14,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind	.759	.759	.759		
	KTAS	425	435	445		
	Fuel - Lb/Hr	803	822	841		
49	Mach Ind	.749	.749	.749	.749	
	KTAS	419	429	439	444	
	Fuel - Lb/Hr	795	814	832	842	
47	Mach Ind	.750	.750	.750	.750	.750
	KTAS	420	430	440	445	450
	Fuel - Lb/Hr	821	841	860	870	879
45	Mach Ind	.732	.732	.732	.732	.732
	KTAS	410	420	430	434	439
	Fuel - Lb/Hr	831	851	870	880	889
43	Mach Ind	.691	.691	.691	.691	.691
	KTAS	387	396	405	410	414
	Fuel - Lb/Hr	813	832	851	860	870
41	Mach Ind	.657	.657	.657	.657	.657
	KTAS	368	377	385	390	394
	Fuel - Lb/Hr	801	820	838	848	857
39	Mach Ind	.631	.631	.631	.631	.631
	KTAS	353	362	370	374	378
	Fuel - Lb/Hr	799	818	837	846	855
37	Mach Ind	.612	.612	.612	.612	.612
	KTAS	342	351	359	363	367
	Fuel - Lb/Hr	808	827	846	855	864
35	Mach Ind	.591	.591	.591	.591	.591
	KTAS	333	341	349	352	356
	Fuel - Lb/Hr	822	842	861	870	879
30	Mach Ind	.543	.543	.543	.543	.543
	KTAS	313	320	327	330	334
	Fuel - Lb/Hr	869	889	908	918	927
25	KIAS	200	200	200	200	200
	KTAS	287	293	299	302	305
	Fuel - Lb/Hr	896	916	935	944	953
20	KIAS	204	204	204	204	204
	KTAS	270	276	281	284	287
	Fuel - Lb/Hr	949	968	988	997	1007
15	KIAS	202	202	202	202	202
	KTAS	248	253	258	260	262
	Fuel - Lb/Hr	977	997	1016	1025	1034
10	KIAS	204	204	204	204	204
	KTAS	232	236	241	243	245
	Fuel - Lb/Hr	1028	1047	1067	1076	1086
5	KIAS	207	207	207	207	207
	KTAS	218	222	226	228	230
	Fuel - Lb/Hr	1098	1119	1139	1148	1158
S.L.	KIAS	206	206	206	206	206
	KTAS	202	206	210	211	213
	Fuel - Lb/Hr	1161	1182	1202	1212	1222

Figure 8-10.1 (Sheet 1 of 14)

LONG RANGE CRUISE

45-1026

WEIGHT — 15,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind	.764	.764			
	KTAS	428	438			
	Fuel - Lb/Hr	835	855			
49	Mach Ind	.753	.753	.753	.753	
	KTAS	422	432	442	447	
	Fuel - Lb/Hr	820	840	859	868	
47	Mach Ind	.747	.747	.747	.747	.747
	KTAS	418	428	438	443	448
	Fuel - Lb/Hr	831	851	871	880	890
45	Mach Ind	.745	.745	.745	.745	.745
	KTAS	417	427	437	442	446
	Fuel - Lb/Hr	860	881	901	911	920
43	Mach Ind	.706	.706	.706	.706	.706
	KTAS	395	405	414	419	423
	Fuel - Lb/Hr	844	864	884	894	903
41	Mach Ind	.667	.667	.667	.667	.667
	KTAS	374	382	391	395	400
	Fuel - Lb/Hr	826	846	866	875	884
39	Mach Ind	.639	.639	.639	.639	.639
	KTAS	358	367	375	379	383
	Fuel - Lb/Hr	823	842	862	871	880
37	Mach Ind	.615	.615	.615	.615	.615
	KTAS	345	353	361	365	369
	Fuel - Lb/Hr	824	844	863	872	882
35	Mach Ind	.595	.595	.595	.595	.595
	KTAS	335	343	351	355	359
	Fuel - Lb/Hr	839	859	878	888	897
30	Mach Ind	.548	.548	.548	.548	.548
	KTAS	316	323	330	333	337
	Fuel - Lb/Hr	889	909	929	938	948
25	KIAS	202	202	202	202	202
	KTAS	290	297	303	306	309
	Fuel - Lb/Hr	917	937	957	966	976
20	KIAS	206	206	206	206	206
	KTAS	273	279	284	287	290
	Fuel - Lb/Hr	969	989	1009	1018	1028
15	KIAS	205	205	205	205	205
	KTAS	251	256	261	264	266
	Fuel - Lb/Hr	1001	1021	1040	1050	1059
10	KIAS	206	206	206	206	206
	KTAS	234	239	243	245	248
	Fuel - Lb/Hr	1049	1069	1089	1098	1108
5	KIAS	209	209	209	209	209
	KTAS	220	224	228	230	232
	Fuel - Lb/Hr	1120	1141	1161	1171	1181
S.L.	KIAS	208	208	208	208	208
	KTAS	205	208	212	214	215
	Fuel - Lb/Hr	1185	1206	1227	1237	1247

Figure 8-10.1 (Sheet 2 of 14)

LONG RANGE CRUISE

45-1027

WEIGHT — 15,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind	.763				
	KTAS	427				
	Fuel - Lb/Hr	859				
49	Mach Ind	.756	.756	.756	.756	
	KTAS	423	434	443	448	
	Fuel - Lb/Hr	845	865	885	895	
47	Mach Ind	.742	.742	.742	.742	.742
	KTAS	416	426	435	440	445
	Fuel - Lb/Hr	840	860	880	890	899
45	Mach Ind	.749	.749	.749	.749	.749
	KTAS	420	430	439	444	449
	Fuel - Lb/Hr	879	901	921	931	941
43	Mach Ind	.718	.718	.718	.718	.718
	KTAS	402	412	421	426	431
	Fuel - Lb/Hr	874	895	915	925	935
41	Mach Ind	.679	.679	.679	.679	.679
	KTAS	380	389	398	403	407
	Fuel - Lb/Hr	855	876	896	906	915
39	Mach Ind	.647	.647	.647	.647	.647
	KTAS	362	371	380	384	388
	Fuel - Lb/Hr	846	866	886	896	905
37	Mach Ind	.622	.622	.622	.622	.622
	KTAS	349	357	365	369	373
	Fuel - Lb/Hr	846	867	886	896	906
35	Mach Ind	.599	.599	.599	.599	.599
	KTAS	337	345	353	357	361
	Fuel - Lb/Hr	856	876	896	906	915
30	Mach Ind	.552	.552	.552	.552	.552
	KTAS	318	325	332	336	339
	Fuel - Lb/Hr	906	926	946	956	966
25	KIAS	205	205	205	205	205
	KTAS	294	300	306	309	312
	Fuel - Lb/Hr	939	959	979	989	998
20	KIAS	209	209	209	209	209
	KTAS	276	282	287	290	293
	Fuel - Lb/Hr	990	1011	1031	1041	1051
15	KIAS	208	208	208	208	208
	KTAS	255	260	265	267	270
	Fuel - Lb/Hr	1025	1046	1066	1076	1085
10	KIAS	208	208	208	208	208
	KTAS	237	241	246	248	250
	Fuel - Lb/Hr	1070	1090	1111	1120	1130
5	KIAS	211	211	211	211	211
	KTAS	222	227	231	233	235
	Fuel - Lb/Hr	1141	1163	1183	1193	1204
S.L.	KIAS	211	211	211	211	211
	KTAS	207	211	214	216	218
	Fuel - Lb/Hr	1211	1232	1254	1264	1274

Figure 8-10.1 (Sheet 3 of 14)

LONG RANGE CRUISE

45-1028

		TEMPERATURE — °C				
ALTITUDE — 1000 FEET	WEIGHT — 16,000 LB	ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.760	.760	.760		
	KTAS	426	436	446		
	Fuel - Lb/Hr	875	896	916		
47	Mach Ind	.749	.749	.749	.749	.749
	KTAS	420	430	439	444	449
	Fuel - Lb/Hr	868	889	909	919	929
45	Mach Ind	.747	.747	.747	.747	.747
	KTAS	419	429	438	443	448
	Fuel - Lb/Hr	891	912	933	943	954
43	Mach Ind	.731	.731	.731	.731	.731
	KTAS	410	419	429	434	438
	Fuel - Lb/Hr	905	926	947	958	968
41	Mach Ind	.694	.694	.694	.694	.694
	KTAS	389	398	407	411	416
	Fuel - Lb/Hr	888	909	930	940	950
39	Mach Ind	.656	.656	.656	.656	.656
	KTAS	367	376	385	389	393
	Fuel - Lb/Hr	871	892	912	922	932
37	Mach Ind	.630	.630	.630	.630	.630
	KTAS	353	361	370	374	378
	Fuel - Lb/Hr	870	891	911	921	931
35	Mach Ind	.606	.606	.606	.606	.606
	KTAS	341	350	357	361	365
	Fuel - Lb/Hr	879	900	920	930	940
30	Mach Ind	.556	.556	.556	.556	.556
	KTAS	320	327	334	338	341
	Fuel - Lb/Hr	923	944	964	974	984
25	KIAS	207	207	207	207	207
	KTAS	297	303	310	313	316
	Fuel - Lb/Hr	960	981	1001	1011	1021
20	KIAS	211	211	211	211	211
	KTAS	279	285	290	293	296
	Fuel - Lb/Hr	1011	1032	1053	1063	1073
15	KIAS	210	210	210	210	210
	KTAS	258	263	268	270	273
	Fuel - Lb/Hr	1049	1070	1090	1101	1111
10	KIAS	210	210	210	210	210
	KTAS	239	243	248	250	252
	Fuel - Lb/Hr	1091	1112	1132	1143	1153
5	KIAS	213	213	213	213	213
	KTAS	225	229	233	235	237
	Fuel - Lb/Hr	1163	1185	1206	1216	1226
S.L.	KIAS	213	213	213	213	213
	KTAS	209	213	217	219	220
	Fuel - Lb/Hr	1237	1259	1280	1291	1302

Figure 8-10.1 (Sheet 4 of 14)

LONG RANGE CRUISE

45-1029

WEIGHT — 16,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.764	.764			
	KTAS	428	438			
	Fuel - Lb/Hr	906	927			
47	Mach Ind	.753	.753	.753	.753	
	KTAS	422	432	442	446	
	Fuel - Lb/Hr	893	914	935	945	
45	Mach Ind	.744	.744	.744	.744	.744
	KTAS	417	427	436	441	446
	Fuel - Lb/Hr	900	922	943	953	964
43	Mach Ind	.741	.741	.741	.741	.741
	KTAS	415	425	435	439	444
	Fuel - Lb/Hr	931	953	975	986	996
41	Mach Ind	.707	.707	.707	.707	.707
	KTAS	396	405	414	419	424
	Fuel - Lb/Hr	919	941	963	973	984
39	Mach Ind	.666	.666	.666	.666	.666
	KTAS	373	382	391	395	399
	Fuel - Lb/Hr	898	920	941	951	961
37	Mach Ind	.638	.638	.638	.638	.638
	KTAS	357	366	374	378	382
	Fuel - Lb/Hr	893	915	936	946	956
35	Mach Ind	.614	.614	.614	.614	.614
	KTAS	346	354	362	366	370
	Fuel - Lb/Hr	902	924	945	955	965
30	Mach Ind	.560	.560	.560	.560	.560
	KTAS	323	330	337	340	344
	Fuel - Lb/Hr	941	962	983	993	1003
25	KIAS	209	209	209	209	209
	KTAS	300	307	313	316	319
	Fuel - Lb/Hr	982	1003	1024	1034	1044
20	KIAS	213	213	213	213	213
	KTAS	282	288	293	296	299
	Fuel - Lb/Hr	1032	1053	1074	1085	1095
15	KIAS	213	213	213	213	213
	KTAS	261	266	271	274	276
	Fuel - Lb/Hr	1073	1094	1115	1126	1136
10	KIAS	212	212	212	212	212
	KTAS	241	246	250	252	255
	Fuel - Lb/Hr	1112	1134	1154	1165	1175
5	KIAS	215	215	215	215	215
	KTAS	227	231	235	237	239
	Fuel - Lb/Hr	1185	1207	1228	1239	1249
S.L.	KIAS	219	219	219	219	219
	KTAS	215	219	222	224	226
	Fuel - Lb/Hr	1281	1304	1326	1337	1348

Figure 8-10.1 (Sheet 5 of 14)

LONG RANGE CRUISE

45-1030

WEIGHT — 17,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.765	.765			
	KTAS	429	439			
	Fuel - Lb/Hr	933	955			
47	Mach Ind	.754	.754	.754	.754	
	KTAS	422	432	442	447	
	Fuel - Lb/Hr	915	937	959	969	
45	Mach Ind	.740	.740	.740	.740	.740
	KTAS	414	424	434	439	443
	Fuel - Lb/Hr	909	931	952	963	973
43	Mach Ind	.746	.746	.746	.746	.746
	KTAS	418	428	438	442	447
	Fuel - Lb/Hr	951	974	996	1007	1018
41	Mach Ind	.716	.716	.716	.716	.716
	KTAS	401	411	420	425	429
	Fuel - Lb/Hr	946	969	991	1002	1012
39	Mach Ind	.678	.678	.678	.678	.678
	KTAS	380	389	397	402	406
	Fuel - Lb/Hr	928	950	972	982	993
37	Mach Ind	.645	.645	.645	.645	.645
	KTAS	361	370	378	383	387
	Fuel - Lb/Hr	917	939	961	971	982
35	Mach Ind	.621	.621	.621	.621	.621
	KTAS	350	358	366	370	374
	Fuel - Lb/Hr	926	948	970	980	991
30	Mach Ind	.566	.566	.566	.566	.566
	KTAS	326	333	341	344	348
	Fuel - Lb/Hr	963	985	1007	1017	1027
25	KIAS	212	212	212	212	212
	KTAS	303	310	316	320	323
	Fuel - Lb/Hr	1004	1026	1047	1057	1068
20	KIAS	215	215	215	215	215
	KTAS	284	290	296	299	301
	Fuel - Lb/Hr	1052	1073	1095	1105	1116
15	KIAS	216	216	216	216	216
	KTAS	264	269	275	277	280
	Fuel - Lb/Hr	1098	1120	1141	1152	1162
10	KIAS	214	214	214	214	214
	KTAS	243	248	253	255	257
	Fuel - Lb/Hr	1135	1156	1178	1188	1199
5	KIAS	217	217	217	217	217
	KTAS	229	233	237	239	241
	Fuel - Lb/Hr	1206	1229	1251	1261	1272
S.L.	KIAS	224	224	224	224	224
	KTAS	221	224	228	230	232
	Fuel - Lb/Hr	1327	1351	1374	1386	1397

Figure 8-10.1 (Sheet 6 of 14)

LONG RANGE CRUISE

45-1031

		TEMPERATURE — °C				
WEIGHT — 17,500 LB		ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET						
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.758	.758	.758		
	KTAS	425	435	445		
	Fuel - Lb/Hr	945	968	990		
45	Mach Ind	.745	.745	.745	.745	.745
	KTAS	417	427	437	442	447
	Fuel - Lb/Hr	935	958	980	990	1001
43	Mach Ind	.745	.745	.745	.745	.745
	KTAS	417	427	437	442	447
	Fuel - Lb/Hr	964	987	1010	1021	1032
41	Mach Ind	.727	.727	.727	.727	.727
	KTAS	407	417	426	431	436
	Fuel - Lb/Hr	974	998	1021	1032	1043
39	Mach Ind	.690	.690	.690	.690	.690
	KTAS	387	396	405	409	414
	Fuel - Lb/Hr	959	982	1005	1016	1026
37	Mach Ind	.653	.653	.653	.653	.653
	KTAS	366	374	383	387	391
	Fuel - Lb/Hr	942	964	986	997	1008
35	Mach Ind	.628	.628	.628	.628	.628
	KTAS	354	362	370	374	378
	Fuel - Lb/Hr	950	973	994	1005	1016
30	Mach Ind	.573	.573	.573	.573	.573
	KTAS	330	338	345	348	352
	Fuel - Lb/Hr	988	1010	1032	1043	1053
25	KIAS	214	214	214	214	214
	KTAS	307	313	320	323	326
	Fuel - Lb/Hr	1026	1048	1070	1081	1092
20	KIAS	216	216	216	216	216
	KTAS	286	292	298	301	304
	Fuel - Lb/Hr	1071	1094	1115	1126	1137
15	KIAS	218	218	218	218	218
	KTAS	267	272	278	280	283
	Fuel - Lb/Hr	1122	1145	1167	1177	1188
10	KIAS	216	216	216	216	216
	KTAS	246	250	255	257	259
	Fuel - Lb/Hr	1156	1178	1200	1211	1221
5	KIAS	218	218	218	218	218
	KTAS	231	235	239	241	243
	Fuel - Lb/Hr	1228	1251	1273	1284	1295
S.L.	KIAS	229	229	229	229	229
	KTAS	225	229	233	235	237
	Fuel - Lb/Hr	1370	1394	1418	1430	1442

Figure 8-10.1 (Sheet 7 of 14)

LONG RANGE CRUISE

45-1032

		TEMPERATURE — °C				
ALTITUDE — 1000 FEET	WEIGHT — 18,000 LB	ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.763	.763			
	KTAS	427	437			
	Fuel - Lb/Hr	977	1000			
45	Mach Ind	.752	.752	.752	.752	.752
	KTAS	421	431	441	446	451
	Fuel - Lb/Hr	965	988	1010	1021	1032
43	Mach Ind	.743	.743	.743	.743	.743
	KTAS	416	426	436	441	445
	Fuel - Lb/Hr	975	998	1021	1032	1043
41	Mach Ind	.736	.736	.736	.736	.736
	KTAS	412	422	432	436	441
	Fuel - Lb/Hr	1002	1026	1049	1060	1072
39	Mach Ind	.702	.702	.702	.702	.702
	KTAS	393	403	412	417	421
	Fuel - Lb/Hr	990	1014	1037	1049	1060
37	Mach Ind	.663	.663	.663	.663	.663
	KTAS	371	380	389	393	397
	Fuel - Lb/Hr	969	993	1015	1026	1037
35	Mach Ind	.635	.635	.635	.635	.635
	KTAS	358	366	375	379	383
	Fuel - Lb/Hr	974	997	1020	1031	1042
30	Mach Ind	.579	.579	.579	.579	.579
	KTAS	334	341	349	352	356
	Fuel - Lb/Hr	1011	1034	1056	1067	1078
25	KIAS	216	216	216	216	216
	KTAS	310	317	323	326	330
	Fuel - Lb/Hr	1049	1071	1094	1105	1115
20	KIAS	218	218	218	218	218
	KTAS	288	294	300	303	306
	Fuel - Lb/Hr	1090	1113	1135	1146	1157
15	KIAS	221	221	221	221	221
	KTAS	270	275	281	283	286
	Fuel - Lb/Hr	1146	1169	1192	1203	1214
10	KIAS	218	218	218	218	218
	KTAS	248	253	257	260	262
	Fuel - Lb/Hr	1179	1201	1223	1234	1245
5	KIAS	221	221	221	221	221
	KTAS	233	237	241	244	246
	Fuel - Lb/Hr	1253	1276	1298	1310	1321
S.L.	KIAS	234	234	234	234	234
	KTAS	230	234	238	240	242
	Fuel - Lb/Hr	1409	1434	1459	1471	1483

Figure 8-10.1 (Sheet 8 of 14)

LONG RANGE CRUISE

45-1033

			TEMPERATURE — °C				
WEIGHT — 18,500 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	49	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	47	Mach Ind	.766	.766			
		KTAS	429	439			
		Fuel - Lb/Hr	1007	1031			
	45	Mach Ind	.754	.754	.754	.754	
		KTAS	422	432	442	447	
		Fuel - Lb/Hr	989	1012	1035	1047	
	43	Mach Ind	.740	.740	.740	.740	.740
		KTAS	414	424	434	439	443
		Fuel - Lb/Hr	984	1008	1031	1042	1054
	41	Mach Ind	.741	.741	.741	.741	.741
		KTAS	415	425	435	440	444
		Fuel - Lb/Hr	1023	1048	1072	1083	1095
	39	Mach Ind	.710	.710	.710	.710	.710
		KTAS	398	407	417	421	426
		Fuel - Lb/Hr	1015	1039	1063	1075	1086
	37	Mach Ind	.673	.673	.673	.673	.673
		KTAS	377	386	395	399	403
		Fuel - Lb/Hr	998	1022	1045	1057	1068
	35	Mach Ind	.643	.643	.643	.643	.643
		KTAS	362	370	379	383	387
		Fuel - Lb/Hr	998	1022	1045	1056	1067
	30	Mach Ind	.586	.586	.586	.586	.586
		KTAS	337	345	352	356	360
		Fuel - Lb/Hr	1035	1058	1081	1092	1103
	25	KIAS	219	219	219	219	219
		KTAS	314	321	327	331	334
		Fuel - Lb/Hr	1075	1098	1121	1132	1143
	20	KIAS	220	220	220	220	220
		KTAS	291	297	303	306	308
		Fuel - Lb/Hr	1110	1133	1156	1167	1178
	15	KIAS	223	223	223	223	223
		KTAS	273	278	284	286	289
		Fuel - Lb/Hr	1171	1194	1217	1228	1239
	10	KIAS	220	220	220	220	220
		KTAS	250	255	260	262	264
		Fuel - Lb/Hr	1201	1224	1247	1258	1269
	5	KIAS	224	224	224	224	224
		KTAS	237	241	245	247	250
		Fuel - Lb/Hr	1285	1308	1332	1343	1355
	S.L.	KIAS	236	236	236	236	236
		KTAS	232	236	241	243	245
		Fuel - Lb/Hr	1435	1461	1486	1498	1510

Figure 8-10.1 (Sheet 9 of 14)

LONG RANGE CRUISE

45-1034

			TEMPERATURE — °C				
WEIGHT — 19,000 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	51	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	49	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	47	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	45	Mach Ind	.756	.756	.756	.756	
		KTAS	424	434	444	449	
		Fuel - Lb/Hr	1014	1038	1062	1074	
	43	Mach Ind	.743	.743	.743	.743	.743
		KTAS	416	426	436	441	446
		Fuel - Lb/Hr	1007	1031	1055	1066	1078
	41	Mach Ind	.741	.741	.741	.741	.741
		KTAS	415	425	435	440	444
		Fuel - Lb/Hr	1037	1062	1086	1098	1109
	39	Mach Ind	.718	.718	.718	.718	.718
		KTAS	402	412	421	426	430
		Fuel - Lb/Hr	1041	1066	1090	1102	1114
	37	Mach Ind	.683	.683	.683	.683	.683
		KTAS	383	392	401	405	409
		Fuel - Lb/Hr	1027	1052	1076	1088	1099
	35	Mach Ind	.649	.649	.649	.649	.649
		KTAS	366	374	383	387	391
		Fuel - Lb/Hr	1022	1046	1070	1081	1093
	30	Mach Ind	.592	.592	.592	.592	.592
		KTAS	341	349	356	360	364
		Fuel - Lb/Hr	1059	1083	1106	1118	1129
	25	KIAS	222	222	222	222	222
		KTAS	318	324	331	334	338
		Fuel - Lb/Hr	1099	1123	1146	1158	1169
	20	KIAS	222	222	222	222	222
		KTAS	293	299	305	308	311
		Fuel - Lb/Hr	1131	1154	1177	1189	1200
	15	KIAS	225	225	225	225	225
		KTAS	276	281	287	289	292
		Fuel - Lb/Hr	1194	1217	1241	1252	1264
	10	KIAS	223	223	223	223	223
		KTAS	253	258	263	265	267
		Fuel - Lb/Hr	1226	1250	1273	1284	1295
	5	KIAS	228	228	228	228	228
		KTAS	240	245	249	251	254
		Fuel - Lb/Hr	1317	1341	1365	1377	1389
	S.L.	KIAS	238	238	238	238	238
		KTAS	234	238	243	245	247
		Fuel - Lb/Hr	1457	1483	1509	1521	1534

Figure 8-10.1 (Sheet 10 of 14)

LONG RANGE CRUISE

45-1035

WEIGHT — 19,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.760	.760	.760		
	KTAS	426	436	446		
	Fuel - Lb/Hr	1043	1068	1093		
43	Mach Ind	.750	.750	.750	.750	.750
	KTAS	420	430	440	445	450
	Fuel - Lb/Hr	1037	1061	1086	1098	1109
41	Mach Ind	.740	.740	.740	.740	.740
	KTAS	414	424	434	439	443
	Fuel - Lb/Hr	1048	1073	1098	1110	1122
39	Mach Ind	.727	.727	.727	.727	.727
	KTAS	407	417	426	431	436
	Fuel - Lb/Hr	1068	1094	1119	1131	1143
37	Mach Ind	.693	.693	.693	.693	.693
	KTAS	388	398	407	411	416
	Fuel - Lb/Hr	1056	1082	1106	1119	1131
35	Mach Ind	.658	.658	.658	.658	.658
	KTAS	370	379	388	392	396
	Fuel - Lb/Hr	1048	1073	1098	1109	1121
30	Mach Ind	.598	.598	.598	.598	.598
	KTAS	345	353	360	364	368
	Fuel - Lb/Hr	1083	1107	1131	1143	1155
25	KIAS	225	225	225	225	225
	KTAS	321	328	335	338	341
	Fuel - Lb/Hr	1124	1148	1172	1184	1195
20	KIAS	224	224	224	224	224
	KTAS	296	302	308	311	314
	Fuel - Lb/Hr	1153	1177	1200	1212	1223
15	KIAS	228	228	228	228	228
	KTAS	278	284	289	292	295
	Fuel - Lb/Hr	1217	1241	1265	1276	1288
10	KIAS	227	227	227	227	227
	KTAS	257	262	267	269	272
	Fuel - Lb/Hr	1259	1283	1307	1319	1330
5	KIAS	231	231	231	231	231
	KTAS	244	249	253	255	257
	Fuel - Lb/Hr	1350	1375	1399	1411	1423
S.L.	KIAS	241	241	241	241	241
	KTAS	236	241	245	247	249
	Fuel - Lb/Hr	1482	1508	1534	1547	1559

Figure 8-10.1 (Sheet 11 of 14)

LONG RANGE CRUISE

45-1036

ALTITUDE — 1000 FEET	WEIGHT — 20,000 LB	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.764	.764			
	KTAS	428	438			
	Fuel - Lb/Hr	1075	1101			
43	Mach Ind	.753	.753	.753	.753	.753
	KTAS	422	432	442	447	451
	Fuel - Lb/Hr	1060	1085	1110	1122	1134
41	Mach Ind	.738	.738	.738	.738	.738
	KTAS	413	423	433	437	442
	Fuel - Lb/Hr	1059	1085	1109	1121	1134
39	Mach Ind	.735	.735	.735	.735	.735
	KTAS	412	421	431	436	440
	Fuel - Lb/Hr	1094	1121	1146	1159	1171
37	Mach Ind	.702	.702	.702	.702	.702
	KTAS	393	403	412	416	421
	Fuel - Lb/Hr	1084	1110	1135	1148	1160
35	Mach Ind	.666	.666	.666	.666	.666
	KTAS	375	384	393	397	401
	Fuel - Lb/Hr	1076	1101	1126	1139	1151
30	Mach Ind	.604	.604	.604	.604	.604
	KTAS	348	356	363	367	371
	Fuel - Lb/Hr	1105	1130	1155	1167	1179
25	KIAS	227	227	227	227	227
	KTAS	324	331	338	342	345
	Fuel - Lb/Hr	1148	1173	1197	1209	1221
20	KIAS	226	226	226	226	226
	KTAS	298	305	311	314	317
	Fuel - Lb/Hr	1175	1199	1223	1235	1247
15	KIAS	230	230	230	230	230
	KTAS	281	287	292	295	298
	Fuel - Lb/Hr	1241	1266	1290	1302	1314
10	KIAS	230	230	230	230	230
	KTAS	261	266	271	273	276
	Fuel - Lb/Hr	1290	1315	1339	1351	1363
5	KIAS	235	235	235	235	235
	KTAS	248	252	257	259	261
	Fuel - Lb/Hr	1383	1409	1434	1446	1458
S.L.	KIAS	243	243	243	243	243
	KTAS	238	243	247	249	251
	Fuel - Lb/Hr	1504	1531	1557	1570	1583

Figure 8-10.1 (Sheet 12 of 14)

LONG RANGE CRUISE

45-1037

WEIGHT — 20,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.766	.766			
	KTAS	429	440			
	Fuel - Lb/Hr	1104	1130			
43	Mach Ind	.756	.756	.756	.756	.756
	KTAS	423	433	443	448	453
	Fuel - Lb/Hr	1084	1110	1135	1148	1160
41	Mach Ind	.739	.739	.739	.739	.739
	KTAS	414	424	434	438	443
	Fuel - Lb/Hr	1077	1103	1128	1141	1153
39	Mach Ind	.739	.739	.739	.739	.739
	KTAS	414	424	434	438	443
	Fuel - Lb/Hr	1116	1142	1168	1181	1194
37	Mach Ind	.708	.708	.708	.708	.708
	KTAS	397	406	416	420	425
	Fuel - Lb/Hr	1108	1134	1160	1173	1185
35	Mach Ind	.675	.675	.675	.675	.675
	KTAS	380	389	398	402	406
	Fuel - Lb/Hr	1103	1129	1154	1167	1179
30	Mach Ind	.609	.609	.609	.609	.609
	KTAS	351	359	367	370	374
	Fuel - Lb/Hr	1128	1153	1178	1190	1203
25	KIAS	229	229	229	229	229
	KTAS	327	334	341	345	348
	Fuel - Lb/Hr	1170	1195	1220	1232	1244
20	KIAS	228	228	228	228	228
	KTAS	301	307	313	316	319
	Fuel - Lb/Hr	1197	1222	1246	1258	1270
15	KIAS	232	232	232	232	232
	KTAS	284	289	295	298	300
	Fuel - Lb/Hr	1264	1289	1314	1326	1338
10	KIAS	233	233	233	233	233
	KTAS	265	270	275	277	280
	Fuel - Lb/Hr	1321	1347	1372	1384	1396
5	KIAS	238	238	238	238	238
	KTAS	251	255	260	262	264
	Fuel - Lb/Hr	1410	1436	1462	1474	1487
S.L.	KIAS	244	244	244	244	244
	KTAS	240	244	249	251	253
	Fuel - Lb/Hr	1526	1553	1580	1593	1606

Figure 8-10.1 (Sheet 13 of 14)

LONG RANGE CRUISE

45-1038

WEIGHT — 21,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
43	Mach Ind	.758	.758	.758	.758	
	KTAS	424	434	444	449	
	Fuel - Lb/Hr	1109	1135	1161	1174	
41	Mach Ind	.746	.746	.746	.746	.746
	KTAS	418	428	438	442	447
	Fuel - Lb/Hr	1107	1133	1159	1172	1185
39	Mach Ind	.739	.739	.739	.739	.739
	KTAS	414	424	433	438	443
	Fuel - Lb/Hr	1129	1156	1183	1196	1208
37	Mach Ind	.715	.715	.715	.715	.715
	KTAS	400	410	419	424	429
	Fuel - Lb/Hr	1132	1159	1185	1198	1211
35	Mach Ind	.683	.683	.683	.683	.683
	KTAS	384	393	402	407	411
	Fuel - Lb/Hr	1130	1157	1183	1196	1208
30	Mach Ind	.614	.614	.614	.614	.614
	KTAS	354	362	370	374	377
	Fuel - Lb/Hr	1150	1176	1202	1214	1227
25	KIAS	231	231	231	231	231
	KTAS	330	337	344	347	351
	Fuel - Lb/Hr	1192	1218	1243	1256	1268
20	KIAS	231	231	231	231	231
	KTAS	304	311	317	320	323
	Fuel - Lb/Hr	1223	1249	1274	1286	1298
15	KIAS	234	234	234	234	234
	KTAS	286	292	298	300	303
	Fuel - Lb/Hr	1287	1313	1338	1351	1363
10	KIAS	237	237	237	237	237
	KTAS	269	274	279	281	284
	Fuel - Lb/Hr	1353	1379	1404	1417	1429
5	KIAS	240	240	240	240	240
	KTAS	253	257	262	264	266
	Fuel - Lb/Hr	1433	1459	1485	1498	1511
S.L.	KIAS	247	247	247	247	247
	KTAS	242	247	251	253	255
	Fuel - Lb/Hr	1551	1578	1605	1619	1632

Figure 8-10.1 (Sheet 14 of 14)

HIGH SPEED CRUISE

45-1039

WEIGHT — 14,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind	.785	.782	.763	.701	
	KTAS	440	449	447	415	
	Fuel - Lb/Hr	881	893	856	800	
49	Mach Ind	.801	.800	.789	.778	.746
	KTAS	449	459	463	462	447
	Fuel - Lb/Hr	979	997	959	926	862
47	Mach Ind	.810	.810	.801	.795	.777
	KTAS	454	465	470	471	466
	Fuel - Lb/Hr	1033	1097	1055	1035	969
45	Mach Ind	.810	.810	.810	.805	.793
	KTAS	454	465	475	477	475
	Fuel - Lb/Hr	1070	1136	1193	1144	1087
43	Mach Ind	.810	.810	.810	.810	.805
	KTAS	454	465	475	480	482
	Fuel - Lb/Hr	1126	1194	1256	1288	1226
41	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1205	1277	1344	1381	1412
39	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1295	1371	1443	1483	1518
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1395	1479	1554	1596	1636
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1524	1611	1692	1737	1780
30	Mach Ind	.810	.810	.810	.810	.810
	KTAS	467	477	488	493	498
	Fuel - Lb/Hr	1908	2015	2110	2160	2120
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2062	2158	2262	2318	2368
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1941	2026	2112	2160	2205
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	1968	2063	2146	2185	2230
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2030	2123	2213	2254	2295
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2096	2190	2284	2331	2366
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2175	2271	2366	2414	2462

Figure 8-11.1 (Sheet 1 of 14)

HIGH SPEED CRUISE

45-1040

	WEIGHT — 15,000 LB	TEMPERATURE — °C				
ALTITUDE — 1000 FEET		**ISA -10**	**ISA**	**ISA +10**	**ISA +15**	**ISA +20**
51	**Mach Ind**	.779	.775			
	KTAS	437	445			
	Fuel - Lb/Hr	876	889			
49	**Mach Ind**	.796	.795	.783	.772	.731
	KTAS	446	456	460	458	438
	Fuel - Lb/Hr	974	993	955	923	859
47	**Mach Ind**	.808	.807	.797	.791	.772
	KTAS	453	463	467	469	463
	Fuel - Lb/Hr	1071	1103	1052	1032	968
45	**Mach Ind**	.810	.810	.808	.802	.790
	KTAS	454	465	474	476	474
	Fuel - Lb/Hr	1084	1152	1166	1142	1085
43	**Mach Ind**	.810	.810	.810	.810	.803
	KTAS	454	465	475	480	481
	Fuel - Lb/Hr	1138	1208	1270	1301	1225
41	**Mach Ind**	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1213	1286	1353	1389	1421
39	**Mach Ind**	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1303	1379	1452	1491	1525
37	**Mach Ind**	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1402	1485	1562	1604	1643
35	**Mach Ind**	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1531	1617	1699	1744	1786
30	**Mach Ind**	.810	.810	.810	.810	.809
	KTAS	467	477	488	493	497
	Fuel - Lb/Hr	1913	2021	2116	2166	2120
25	**KIAS**	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2067	2164	2269	2324	2374
20	**KIAS**	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1946	2031	2117	2165	2211
15	**KIAS**	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	1974	2069	2152	2192	2238
10	**KIAS**	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2037	2129	2219	2261	2302
5	**KIAS**	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2102	2196	2290	2338	2373
S.L.	**KIAS**	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2181	2277	2372	2421	2469

Figure 8-11.1 (Sheet 2 of 14)

HIGH SPEED CRUISE

45-1041

WEIGHT — 15,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind	.771	.763			
	KTAS	432	437			
	Fuel - Lb/Hr	868	880			
49	Mach Ind	.792	.790	.777	.760	.702
	KTAS	444	453	456	451	420
	Fuel - Lb/Hr	969	990	951	916	855
47	Mach Ind	.804	.803	.793	.786	.766
	KTAS	450	461	465	466	459
	Fuel - Lb/Hr	1066	1096	1049	1029	966
45	Mach Ind	.810	.810	.805	.800	.787
	KTAS	454	465	472	474	471
	Fuel - Lb/Hr	1101	1169	1163	1140	1084
43	Mach Ind	.810	.810	.810	.810	.801
	KTAS	454	465	475	480	480
	Fuel - Lb/Hr	1152	1222	1285	1270	1224
41	Mach Ind	.810	.810	.810	.810	.809
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1222	1295	1362	1398	1363
39	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1310	1387	1460	1500	1533
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1409	1492	1570	1612	1651
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1537	1624	1706	1751	1793
30	Mach Ind	.810	.810	.810	.810	.809
	KTAS	467	477	488	493	497
	Fuel - Lb/Hr	1918	2027	2122	2172	2120
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2072	2170	2275	2330	2381
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1951	2036	2123	2171	2217
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	1981	2076	2159	2199	2245
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2043	2136	2226	2268	2309
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2109	2202	2297	2345	2379
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2187	2283	2379	2427	2476

Figure 8-11.1 (Sheet 3 of 14)

HIGH SPEED CRUISE

45-1042

WEIGHT — 16,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.786	.784	.770	.739	
	KTAS	440	450	452	438	
	Fuel - Lb/Hr	964	985	947	905	
47	Mach Ind	.801	.799	.789	.782	.758
	KTAS	448	458	463	464	454
	Fuel - Lb/Hr	1061	1089	1046	1026	964
45	Mach Ind	.810	.810	.802	.796	.783
	KTAS	454	465	470	472	470
	Fuel - Lb/Hr	1128	1196	1160	1138	1082
43	Mach Ind	.810	.810	.810	.807	.799
	KTAS	454	465	475	479	479
	Fuel - Lb/Hr	1165	1237	1300	1268	1223
41	Mach Ind	.810	.810	.810	.810	.808
	KTAS	454	465	475	480	484
	Fuel - Lb/Hr	1230	1305	1372	1408	1362
39	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1318	1395	1469	1508	1542
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1417	1500	1579	1620	1659
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1543	1630	1713	1759	1801
30	Mach Ind	.810	.810	.810	.810	.809
	KTAS	467	477	488	493	497
	Fuel - Lb/Hr	1923	2034	2129	2178	2120
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2077	2175	2281	2336	2387
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1956	2041	2129	2177	2223
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	1988	2082	2166	2206	2253
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2050	2143	2233	2275	2316
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2115	2209	2304	2352	2386
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2194	2290	2386	2434	2483

Figure 8-11.1 (Sheet 4 of 14)

HIGH SPEED CRUISE

45-1043

WEIGHT — 16,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.781	.779	.752		
	KTAS	437	447	441		
	Fuel - Lb/Hr	959	980	935		
47	Mach Ind	.796	.795	.784	.776	.747
	KTAS	446	456	460	460	447
	Fuel - Lb/Hr	1056	1085	1043	1022	962
45	Mach Ind	.808	.808	.798	.793	.780
	KTAS	453	464	468	470	467
	Fuel - Lb/Hr	1171	1213	1157	1135	1081
43	Mach Ind	.810	.810	.810	.805	.797
	KTAS	454	465	475	478	478
	Fuel - Lb/Hr	1180	1253	1316	1266	1222
41	Mach Ind	.810	.810	.810	.810	.806
	KTAS	454	465	475	480	483
	Fuel - Lb/Hr	1243	1318	1386	1421	1361
39	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1325	1404	1478	1517	1551
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1424	1507	1587	1628	1667
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1550	1637	1721	1766	1808
30	Mach Ind	.810	.810	.810	.810	.808
	KTAS	467	477	488	493	496
	Fuel - Lb/Hr	1929	2041	2135	2185	2119
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2081	2180	2287	2342	2393
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1962	2047	2135	2183	2230
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	1995	2089	2173	2213	2261
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2057	2150	2240	2282	2323
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2122	2216	2312	2360	2393
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2200	2297	2393	2442	2491

Figure 8-11.1 (Sheet 5 of 14)

HIGH SPEED CRUISE

45-1044

WEIGHT — 17,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind	.774	.772			
	KTAS	433	443			
	Fuel - Lb/Hr	952	974			
47	Mach Ind	.792	.791	.779	.770	.730
	KTAS	444	454	457	456	437
	Fuel - Lb/Hr	1052	1081	1039	1017	958
45	Mach Ind	.805	.805	.795	.790	.775
	KTAS	451	462	467	468	464
	Fuel - Lb/Hr	1166	1206	1155	1133	1078
43	Mach Ind	.810	.810	.808	.803	.794
	KTAS	454	465	474	476	476
	Fuel - Lb/Hr	1194	1269	1290	1264	1220
41	Mach Ind	.810	.810	.810	.810	.804
	KTAS	454	465	475	480	482
	Fuel - Lb/Hr	1256	1333	1401	1435	1360
39	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1334	1413	1487	1526	1560
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1431	1514	1595	1636	1675
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1557	1644	1729	1774	1816
30	Mach Ind	.810	.810	.810	.810	.807
	KTAS	467	477	488	493	496
	Fuel - Lb/Hr	1935	2048	2142	2191	2119
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2086	2185	2292	2347	2398
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1968	2053	2141	2190	2236
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2000	2095	2179	2220	2267
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2063	2157	2247	2289	2331
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2129	2223	2319	2367	2401
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2207	2304	2400	2449	2498

Figure 8-11.1 (Sheet 6 of 14)

HIGH SPEED CRUISE

45-1045

WEIGHT — 17,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.787	.786	.772	.755	
	KTAS	441	451	453	447	
	Fuel - Lb/Hr	1047	1076	1034	1007	
45	Mach Ind	.802	.801	.791	.785	.769
	KTAS	449	460	464	465	461
	Fuel - Lb/Hr	1161	1198	1151	1128	1076
43	Mach Ind	.810	.810	.805	.800	.791
	KTAS	454	465	472	474	474
	Fuel - Lb/Hr	1219	1293	1287	1262	1218
41	Mach Ind	.810	.810	.810	.809	.803
	KTAS	454	465	475	480	481
	Fuel - Lb/Hr	1269	1347	1416	1393	1359
39	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1342	1423	1496	1535	1570
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1439	1522	1603	1645	1683
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1565	1651	1737	1782	1824
30	Mach Ind	.810	.810	.810	.810	.807
	KTAS	467	477	488	493	496
	Fuel - Lb/Hr	1940	2055	2149	2198	2119
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2091	2191	2298	2353	2404
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1974	2058	2148	2196	2243
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2006	2101	2185	2226	2274
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2069	2164	2253	2296	2337
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2135	2230	2326	2374	2407
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2213	2310	2407	2456	2506

Figure 8-11.1 (Sheet 7 of 14)

HIGH SPEED CRUISE

45-1046

ALTITUDE — 1000 FEET	WEIGHT — 18,000 LB	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.782	.781	.759		
	KTAS	438	448	445		
	Fuel - Lb/Hr	1041	1071	1025		
45	Mach Ind	.798	.797	.787	.781	.761
	KTAS	447	457	462	463	456
	Fuel - Lb/Hr	1156	1192	1148	1125	1072
43	Mach Ind	.810	.810	.802	.797	.788
	KTAS	454	465	471	473	472
	Fuel - Lb/Hr	1246	1321	1284	1259	1216
41	Mach Ind	.810	.810	.810	.807	.801
	KTAS	454	465	475	478	480
	Fuel - Lb/Hr	1283	1362	1431	1390	1358
39	Mach Ind	.810	.810	.810	.810	.809
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1353	1435	1509	1548	1506
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1447	1530	1612	1653	1691
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1572	1658	1746	1790	1831
30	Mach Ind	.810	.810	.810	.810	.806
	KTAS	467	477	488	493	495
	Fuel - Lb/Hr	1946	2063	2157	2205	2119
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2096	2196	2304	2358	2410
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1980	2064	2155	2203	2250
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2012	2107	2191	2233	2281
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2076	2170	2260	2302	2344
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2141	2237	2333	2381	2414
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2218	2316	2413	2462	2512

Figure 8-11.1 (Sheet 8 of 14)

HIGH SPEED CRUISE

45-1047

WEIGHT — 18,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.776	.774			
	KTAS	435	444			
	Fuel - Lb/Hr	1035	1065			
45	Mach Ind	.794	.793	.783	.775	.750
	KTAS	445	455	459	459	450
	Fuel - Lb/Hr	1151	1188	1144	1120	1067
43	Mach Ind	.808	.809	.800	.794	.784
	KTAS	453	464	469	471	470
	Fuel - Lb/Hr	1289	1339	1281	1256	1213
41	Mach Ind	.810	.810	.810	.805	.799
	KTAS	454	465	475	477	479
	Fuel - Lb/Hr	1297	1378	1416	1388	1357
39	Mach Ind	.810	.810	.810	.810	.807
	KTAS	454	465	475	480	484
	Fuel - Lb/Hr	1366	1449	1523	1562	1504
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1455	1539	1621	1662	1700
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1579	1666	1754	1798	1839
30	Mach Ind	.810	.810	.810	.810	.806
	KTAS	467	477	488	493	495
	Fuel - Lb/Hr	1952	2069	2163	2212	2119
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2100	2202	2310	2364	2417
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1986	2071	2161	2210	2258
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2019	2113	2198	2240	2288
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2082	2177	2267	2309	2352
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2148	2243	2340	2388	2421
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2224	2321	2419	2468	2518

Figure 8-11.1 (Sheet 9 of 14)

HIGH SPEED CRUISE

45-1048

ALTITUDE — 1000 FEET	WEIGHT — 19,000 LB	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind	.768	.763			
	KTAS	430	438			
	Fuel - Lb/Hr	1027	1054			
45	Mach Ind	.790	.790	.778	.769	.733
	KTAS	443	453	456	456	439
	Fuel - Lb/Hr	1147	1184	1140	1116	1059
43	Mach Ind	.805	.806	.796	.791	.781
	KTAS	451	462	467	469	468
	Fuel - Lb/Hr	1284	1331	1278	1253	1210
41	Mach Ind	.810	.810	.807	.802	.796
	KTAS	454	465	473	476	477
	Fuel - Lb/Hr	1317	1399	1413	1385	1354
39	Mach Ind	.810	.810	.810	.810	.805
	KTAS	454	465	475	480	483
	Fuel - Lb/Hr	1379	1464	1538	1576	1503
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1463	1549	1630	1671	1709
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1586	1674	1762	1806	1847
30	Mach Ind	.810	.810	.810	.810	.805
	KTAS	467	477	488	493	495
	Fuel - Lb/Hr	1958	2076	2170	2218	2118
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2106	2207	2316	2370	2423
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1993	2077	2168	2217	2265
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2025	2120	2204	2247	2295
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2089	2184	2274	2317	2359
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2154	2250	2347	2396	2428
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2230	2327	2425	2475	2524

Figure 8-11.1 (Sheet 10 of 14)

HIGH SPEED CRUISE

45-1049

WEIGHT — 19,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.785	.785	.772	.754	
	KTAS	440	450	453	447	
	Fuel - Lb/Hr	1141	1178	1135	1104	
43	Mach Ind	.802	.802	.793	.787	.776
	KTAS	449	460	465	467	465
	Fuel - Lb/Hr	1278	1322	1275	1250	1207
41	Mach Ind	.810	.810	.805	.800	.793
	KTAS	454	465	472	474	475
	Fuel - Lb/Hr	1343	1424	1410	1382	1351
39	Mach Ind	.810	.810	.810	.809	.804
	KTAS	454	465	475	480	482
	Fuel - Lb/Hr	1392	1479	1553	1530	1502
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1472	1559	1640	1681	1719
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1593	1683	1770	1814	1856
30	Mach Ind	.810	.810	.810	.810	.805
	KTAS	467	477	488	493	494
	Fuel - Lb/Hr	1965	2083	2177	2225	2118
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2111	2213	2323	2377	2430
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	1999	2083	2176	2225	2273
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2031	2126	2211	2254	2303
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2096	2192	2281	2324	2367
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2160	2256	2354	2403	2435
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2235	2333	2432	2481	2531

Figure 8-11.1 (Sheet 11 of 14)

HIGH SPEED CRUISE

45-1050

WEIGHT — 20,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.781	.781	.760		
	KTAS	437	448	446		
	Fuel - Lb/Hr	1136	1173	1125		
43	Mach Ind	.798	.798	.790	.783	.771
	KTAS	447	458	463	464	462
	Fuel - Lb/Hr	1273	1316	1272	1246	1204
41	Mach Ind	.810	.810	.802	.797	.791
	KTAS	454	465	470	473	474
	Fuel - Lb/Hr	1370	1453	1407	1379	1349
39	Mach Ind	.810	.810	.810	.807	.802
	KTAS	454	465	475	479	481
	Fuel - Lb/Hr	1406	1494	1569	1527	1500
37	Mach Ind	.810	.810	.810	.810	.810
	KTAS	454	465	475	480	485
	Fuel - Lb/Hr	1484	1573	1654	1695	1657
35	Mach Ind	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1601	1692	1779	1823	1864
30	Mach Ind	.810	.810	.810	.810	.804
	KTAS	467	477	488	493	494
	Fuel - Lb/Hr	1971	2091	2184	2232	2118
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2116	2219	2329	2383	2436
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	2006	2090	2183	2232	2281
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2038	2133	2218	2262	2310
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2103	2199	2288	2331	2375
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2167	2263	2361	2410	2443
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2242	2339	2438	2488	2538

Figure 8-11.1 (Sheet 12 of 14)

HIGH SPEED CRUISE

45-1051

ALTITUDE — 1000 FEET		TEMPERATURE — °C				
WEIGHT — 20,500 LB		**ISA -10**	**ISA**	**ISA +10**	**ISA +15**	**ISA +20**
51	**Mach Ind**					
	KTAS					
	Fuel - Lb/Hr					
49	**Mach Ind**					
	KTAS					
	Fuel - Lb/Hr					
47	**Mach Ind**					
	KTAS					
	Fuel - Lb/Hr					
45	**Mach Ind**	.775	.775			
	KTAS	434	444			
	Fuel - Lb/Hr	1128	1166			
43	**Mach Ind**	.795	.795	.785	.779	.763
	KTAS	445	456	461	462	457
	Fuel - Lb/Hr	1269	1311	1268	1243	1198
41	**Mach Ind**	.808	.808	.800	.794	.787
	KTAS	452	463	469	471	472
	Fuel - Lb/Hr	1405	1462	1404	1377	1346
39	**Mach Ind**	.810	.810	.810	.805	.800
	KTAS	454	465	475	478	480
	Fuel - Lb/Hr	1420	1510	1585	1525	1499
37	**Mach Ind**	.810	.810	.810	.810	.808
	KTAS	454	465	475	480	484
	Fuel - Lb/Hr	1497	1587	1669	1709	1655
35	**Mach Ind**	.810	.810	.810	.810	.810
	KTAS	456	467	477	483	488
	Fuel - Lb/Hr	1608	1701	1788	1831	1873
30	**Mach Ind**	.810	.810	.810	.810	.803
	KTAS	467	477	488	493	494
	Fuel - Lb/Hr	1978	2098	2191	2240	2118
25	**KIAS**	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2122	2225	2336	2390	2443
20	**KIAS**	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	2013	2097	2191	2240	2289
15	**KIAS**	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2045	2140	2225	2269	2318
10	**KIAS**	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2111	2207	2296	2339	2383
5	**KIAS**	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2173	2270	2368	2417	2450
S.L.	**KIAS**	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2248	2346	2445	2494	2545

Figure 8-11.1 (Sheet 13 of 14)

HIGH SPEED CRUISE

45-1052

WEIGHT — 21,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
51	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
49	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
47	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
45	Mach Ind	.766	.765			
	KTAS	429	439			
	Fuel - Lb/Hr	1118	1156			
43	Mach Ind	.792	.791	.781	.773	.751
	KTAS	443	454	458	458	450
	Fuel - Lb/Hr	1264	1307	1264	1238	1190
41	Mach Ind	.805	.805	.796	.791	.784
	KTAS	451	462	467	469	470
	Fuel - Lb/Hr	1400	1454	1401	1374	1343
39	Mach Ind	.810	.810	.808	.803	.798
	KTAS	454	465	474	476	478
	Fuel - Lb/Hr	1443	1532	1552	1521	1496
37	Mach Ind	.810	.810	.810	.810	.806
	KTAS	454	465	475	480	483
	Fuel - Lb/Hr	1510	1602	1683	1723	1654
35	Mach Ind	.810	.810	.810	.810	.809
	KTAS	456	467	477	483	487
	Fuel - Lb/Hr	1616	1710	1797	1840	1796
30	Mach Ind	.810	.810	.810	.810	.803
	KTAS	467	477	488	493	493
	Fuel - Lb/Hr	1985	2106	2199	2247	2118
25	KIAS	330	330	330	330	330
	KTAS	462	472	481	486	491
	Fuel - Lb/Hr	2127	2231	2343	2397	2450
20	KIAS	330	330	330	330	330
	KTAS	429	438	447	451	455
	Fuel - Lb/Hr	2020	2104	2198	2248	2297
15	KIAS	330	330	330	330	330
	KTAS	399	407	415	419	423
	Fuel - Lb/Hr	2052	2147	2232	2277	2326
10	KIAS	330	330	330	330	330
	KTAS	372	379	386	390	393
	Fuel - Lb/Hr	2118	2215	2304	2347	2392
5	KIAS	330	330	330	330	330
	KTAS	347	354	360	363	366
	Fuel - Lb/Hr	2180	2277	2375	2424	2458
S.L.	KIAS	330	330	330	330	330
	KTAS	324	330	336	339	341
	Fuel - Lb/Hr	2254	2352	2452	2501	2552

Figure 8-11.1 (Sheet 14 of 14)

LONG RANGE CRUISE — ONE ENGINE

45-1053

WEIGHT — 14,500 LB			TEMPERATURE — °C				
			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind	.528	.528	.528	.523	.511
		KTAS	297	304	311	312	307
		Fuel - Lb/Hr	711	728	744	753	743
	30	Mach Ind	.491	.491	.491	.491	.491
		KTAS	283	289	296	299	302
		Fuel - Lb/Hr	720	736	752	760	767
	25	KIAS	184	184	184	184	184
		KTAS	266	271	277	280	282
		Fuel - Lb/Hr	741	757	773	780	788
	20	KIAS	184	184	184	184	184
		KTAS	245	250	255	257	260
		Fuel - Lb/Hr	755	771	786	793	801
	15	KIAS	186	186	186	186	186
		KTAS	228	233	237	240	242
		Fuel - Lb/Hr	780	795	810	818	825
	10	KIAS	189	189	189	189	189
		KTAS	215	219	223	225	227
		Fuel - Lb/Hr	816	831	847	854	862
	5	KIAS	191	191	191	191	191
		KTAS	202	206	210	211	213
		Fuel - Lb/Hr	854	870	885	893	900
	S.L.	KIAS	195	195	195	195	195
		KTAS	191	195	198	200	201
		Fuel - Lb/Hr	902	918	934	942	950

45-1054

WEIGHT — 15,000 LB			TEMPERATURE — °C				
			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind	.512	.513	.508	.502	.482
		KTAS	288	295	299	299	290
		Fuel - Lb/Hr	699	723	740	742	732
	30	Mach Ind	.494	.494	.494	.494	.494
		KTAS	285	291	298	301	304
		Fuel - Lb/Hr	738	754	771	779	787
	25	KIAS	187	187	187	187	187
		KTAS	269	275	281	284	286
		Fuel - Lb/Hr	764	780	797	805	813
	20	KIAS	188	188	188	188	188
		KTAS	249	254	259	262	264
		Fuel - Lb/Hr	780	796	812	820	828
	15	KIAS	189	189	189	189	189
		KTAS	232	236	241	243	245
		Fuel - Lb/Hr	804	820	835	843	851
	10	KIAS	192	192	192	192	192
		KTAS	218	222	226	228	230
		Fuel - Lb/Hr	837	853	869	876	884
	5	KIAS	195	195	195	195	195
		KTAS	206	209	213	215	217
		Fuel - Lb/Hr	880	896	912	920	928
	S.L.	KIAS	197	197	197	197	197
		KTAS	194	197	201	202	204
		Fuel - Lb/Hr	925	941	958	966	974

Figure 8-12.1 (Sheet 1 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-1055

WEIGHT — 15,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.504	.504	.504	.504	.504
	KTAS	290	297	303	307	310
	Fuel - Lb/Hr	768	785	802	811	819
25	KIAS	189	189	189	189	189
	KTAS	272	278	284	287	290
	Fuel - Lb/Hr	785	802	819	827	835
20	KIAS	191	191	191	191	191
	KTAS	253	258	264	266	269
	Fuel - Lb/Hr	806	822	839	847	855
15	KIAS	192	192	192	192	192
	KTAS	235	240	244	247	249
	Fuel - Lb/Hr	827	843	859	867	875
10	KIAS	194	194	194	194	194
	KTAS	221	225	229	231	233
	Fuel - Lb/Hr	860	877	893	901	909
5	KIAS	198	198	198	198	198
	KTAS	209	213	216	218	220
	Fuel - Lb/Hr	906	922	939	947	955
S.L.	KIAS	200	200	200	200	200
	KTAS	196	200	203	205	207
	Fuel - Lb/Hr	949	966	982	990	998

45-1056

WEIGHT — 16,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.513	.513	.513	.513	.513
	KTAS	296	303	309	312	315
	Fuel - Lb/Hr	798	816	834	842	851
25	KIAS	191	191	191	191	191
	KTAS	275	281	287	290	293
	Fuel - Lb/Hr	807	824	841	850	858
20	KIAS	194	194	194	194	194
	KTAS	257	263	268	270	273
	Fuel - Lb/Hr	831	849	866	874	882
15	KIAS	194	194	194	194	194
	KTAS	238	243	248	250	252
	Fuel - Lb/Hr	851	868	885	893	901
10	KIAS	197	197	197	197	197
	KTAS	224	228	232	234	236
	Fuel - Lb/Hr	884	901	917	925	933
5	KIAS	201	201	201	201	201
	KTAS	212	216	220	221	223
	Fuel - Lb/Hr	931	948	965	973	981
S.L.	KIAS	203	203	203	203	203
	KTAS	199	203	206	208	210
	Fuel - Lb/Hr	974	991	1008	1016	1025

Figure 8-12.1 (Sheet 2 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-1057

WEIGHT — 16,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.514	.514	.514	.514	.514
	KTAS	296	303	310	313	316
	Fuel - Lb/Hr	814	833	851	860	868
25	KIAS	193	193	193	193	193
	KTAS	278	284	290	293	296
	Fuel - Lb/Hr	827	845	863	871	880
20	KIAS	197	197	197	197	197
	KTAS	261	267	272	275	277
	Fuel - Lb/Hr	857	875	893	901	910
15	KIAS	197	197	197	197	197
	KTAS	241	246	251	253	256
	Fuel - Lb/Hr	874	892	909	917	926
10	KIAS	199	199	199	199	199
	KTAS	226	231	235	237	239
	Fuel - Lb/Hr	906	923	940	949	957
5	KIAS	203	203	203	203	203
	KTAS	215	218	222	224	226
	Fuel - Lb/Hr	954	972	989	998	1006
S.L.	KIAS	206	206	206	206	206
	KTAS	202	206	209	211	213
	Fuel - Lb/Hr	999	1016	1034	1043	1051

45-1058

WEIGHT — 17,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.514	.514	.514	.514	.514
	KTAS	296	303	310	313	316
	Fuel - Lb/Hr	830	849	867	876	885
25	KIAS	196	196	196	196	196
	KTAS	282	288	294	297	300
	Fuel - Lb/Hr	853	872	890	899	908
20	KIAS	200	200	200	200	200
	KTAS	266	271	276	279	282
	Fuel - Lb/Hr	885	903	921	930	939
15	KIAS	200	200	200	200	200
	KTAS	245	250	254	257	259
	Fuel - Lb/Hr	899	917	934	943	952
10	KIAS	202	202	202	202	202
	KTAS	229	234	238	240	242
	Fuel - Lb/Hr	930	948	965	974	982
5	KIAS	206	206	206	206	206
	KTAS	217	221	225	227	229
	Fuel - Lb/Hr	977	995	1013	1021	1030
S.L.	KIAS	208	208	208	208	208
	KTAS	205	209	212	214	216
	Fuel - Lb/Hr	1024	1042	1060	1069	1078

Figure 8-12.1 (Sheet 3 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-1059

WEIGHT — 17,500 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.518	.518	.518	.518	.508
	KTAS	298	305	312	315	312
	Fuel - Lb/Hr	855	874	893	903	901
25	KIAS	200	200	200	200	200
	KTAS	287	293	299	302	305
	Fuel - Lb/Hr	881	900	919	928	937
20	KIAS	204	204	204	204	204
	KTAS	270	275	281	283	286
	Fuel - Lb/Hr	911	930	949	958	967
15	KIAS	203	203	203	203	203
	KTAS	248	253	258	260	263
	Fuel - Lb/Hr	924	943	961	970	978
10	KIAS	204	204	204	204	204
	KTAS	232	237	241	243	245
	Fuel - Lb/Hr	953	972	990	999	1007
5	KIAS	208	208	208	208	208
	KTAS	220	224	228	230	232
	Fuel - Lb/Hr	1001	1019	1037	1046	1055
S.L.	KIAS	211	211	211	211	211
	KTAS	208	211	215	217	219
	Fuel - Lb/Hr	1049	1068	1086	1095	1104

45-1060

WEIGHT — 18,000 LB		TEMPERATURE — °C				
ALTITUDE — 1000 FEET		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind	.522	.522	.522	.511	.492
	KTAS	301	307	314	311	302
	Fuel - Lb/Hr	883	903	922	916	894
25	KIAS	202	202	202	202	202
	KTAS	290	297	303	306	309
	Fuel - Lb/Hr	906	926	945	955	964
20	KIAS	207	207	207	207	207
	KTAS	274	280	285	288	291
	Fuel - Lb/Hr	939	958	977	987	996
15	KIAS	205	205	205	205	205
	KTAS	252	257	262	264	266
	Fuel - Lb/Hr	950	968	987	996	1005
10	KIAS	207	207	207	207	207
	KTAS	235	239	244	246	248
	Fuel - Lb/Hr	976	995	1013	1022	1031
5	KIAS	210	210	210	210	210
	KTAS	222	226	230	232	234
	Fuel - Lb/Hr	1023	1042	1061	1070	1079
S.L.	KIAS	214	214	214	214	214
	KTAS	210	214	218	220	221
	Fuel - Lb/Hr	1075	1094	1113	1122	1131

Figure 8-12.1 (Sheet 4 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-1061

WEIGHT — 18,500 LB			TEMPERATURE — °C				
			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	30	Mach Ind	.527	.527	.514	.494	
		KTAS	304	311	309	300	
		Fuel - Lb/Hr	916	936	932	908	
	25	KIAS	203	203	203	203	203
		KTAS	291	298	304	307	310
		Fuel - Lb/Hr	924	944	964	973	983
	20	KIAS	210	210	210	210	210
		KTAS	278	283	289	292	295
		Fuel - Lb/Hr	964	984	1003	1013	1023
	15	KIAS	210	210	210	210	210
		KTAS	257	262	267	269	272
		Fuel - Lb/Hr	982	1002	1021	1030	1040
	10	KIAS	209	209	209	209	209
		KTAS	237	242	246	249	251
		Fuel - Lb/Hr	1000	1019	1038	1047	1056
	5	KIAS	213	213	213	213	213
		KTAS	224	229	233	235	237
		Fuel - Lb/Hr	1046	1065	1084	1094	1103
	S.L.	KIAS	218	218	218	218	218
		KTAS	215	218	222	224	226
		Fuel - Lb/Hr	1108	1127	1147	1156	1166

45-1062

WEIGHT — 19,000 LB			TEMPERATURE — °C				
			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	30	Mach Ind	.510	.510	.493		
		KTAS	294	300	297		
		Fuel - Lb/Hr	893	921	921		
	25	KIAS	204	204	204	204	204
		KTAS	292	299	305	308	311
		Fuel - Lb/Hr	941	961	981	991	1001
	20	KIAS	212	212	212	212	212
		KTAS	281	287	293	295	298
		Fuel - Lb/Hr	989	1009	1029	1039	1049
	15	KIAS	214	214	214	214	214
		KTAS	262	267	272	275	277
		Fuel - Lb/Hr	1015	1035	1055	1065	1075
	10	KIAS	211	211	211	211	211
		KTAS	240	245	249	251	253
		Fuel - Lb/Hr	1023	1042	1062	1071	1081
	5	KIAS	215	215	215	215	215
		KTAS	227	231	235	237	239
		Fuel - Lb/Hr	1070	1090	1109	1119	1128
	S.L.	KIAS	225	225	225	225	225
		KTAS	222	225	229	231	233
		Fuel - Lb/Hr	1156	1177	1197	1207	1217

Figure 8-12.1 (Sheet 5 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-1063

ALTITUDE — 1000 FEET	WEIGHT — 19,500 LB	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
25	KIAS	204	204	204	204	204
	KTAS	293	299	305	309	312
	Fuel - Lb/Hr	957	977	998	1008	1018
20	KIAS	214	214	214	214	214
	KTAS	284	289	295	298	301
	Fuel - Lb/Hr	1010	1031	1051	1061	1071
15	KIAS	218	218	218	218	218
	KTAS	267	272	278	280	283
	Fuel - Lb/Hr	1047	1068	1089	1099	1109
10	KIAS	214	214	214	214	214
	KTAS	243	248	252	254	257
	Fuel - Lb/Hr	1048	1068	1088	1098	1107
5	KIAS	220	220	220	220	220
	KTAS	232	236	240	242	244
	Fuel - Lb/Hr	1104	1125	1145	1155	1164
S.L.	KIAS	228	228	228	228	228
	KTAS	224	228	232	234	236
	Fuel - Lb/Hr	1180	1201	1222	1232	1242

45-1064

ALTITUDE — 1000 FEET	WEIGHT — 20,000 LB	TEMPERATURE — °C				
		ISA -10	ISA	ISA +10	ISA +15	ISA +20
35	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
30	Mach Ind					
	KTAS					
	Fuel - Lb/Hr					
25	KIAS	205	205	205	205	205
	KTAS	294	300	307	310	313
	Fuel - Lb/Hr	977	998	1019	1029	1039
20	KIAS	215	215	215	215	215
	KTAS	285	290	296	299	302
	Fuel - Lb/Hr	1026	1047	1068	1078	1089
15	KIAS	221	221	221	221	221
	KTAS	271	276	282	284	287
	Fuel - Lb/Hr	1076	1097	1118	1129	1139
10	KIAS	216	216	216	216	216
	KTAS	246	250	255	257	259
	Fuel - Lb/Hr	1072	1093	1113	1123	1132
5	KIAS	225	225	225	225	225
	KTAS	237	242	246	248	250
	Fuel - Lb/Hr	1144	1165	1186	1196	1207
S.L.	KIAS	230	230	230	230	230
	KTAS	226	230	234	236	238
	Fuel - Lb/Hr	1204	1225	1246	1256	1267

Figure 8-12.1 (Sheet 6 of 7)

LONG RANGE CRUISE — ONE ENGINE

45-1065

			TEMPERATURE — °C				
WEIGHT — 20,500 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	30	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	25	KIAS	206	206	206	206	206
		KTAS	295	302	308	311	314
		Fuel - Lb/Hr	999	1021	1042	1053	1063
	20	KIAS	216	216	216	216	216
		KTAS	285	291	297	300	303
		Fuel - Lb/Hr	1041	1063	1084	1095	1105
	15	KIAS	224	224	224	224	224
		KTAS	274	279	285	287	290
		Fuel - Lb/Hr	1099	1121	1142	1153	1163
	10	KIAS	219	219	219	219	219
		KTAS	248	253	258	260	262
		Fuel - Lb/Hr	1097	1118	1139	1149	1159
	5	KIAS	229	229	229	229	229
		KTAS	241	246	250	252	255
		Fuel - Lb/Hr	1176	1198	1219	1230	1240
	S.L.	KIAS	231	231	231	231	231
		KTAS	227	231	235	237	239
		Fuel - Lb/Hr	1220	1242	1263	1274	1284

45-1066

			TEMPERATURE — °C				
WEIGHT — 21,000 LB			ISA -10	ISA	ISA +10	ISA +15	ISA +20
ALTITUDE — 1000 FEET	35	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	30	Mach Ind					
		KTAS					
		Fuel - Lb/Hr					
	25	KIAS	209	209	209	209	206
		KTAS	300	306	313	316	315
		Fuel - Lb/Hr	1036	1058	1080	1091	1091
	20	KIAS	216	216	216	216	216
		KTAS	286	292	298	300	303
		Fuel - Lb/Hr	1056	1078	1099	1110	1120
	15	KIAS	226	226	226	226	226
		KTAS	276	282	287	290	293
		Fuel - Lb/Hr	1121	1143	1165	1176	1186
	10	KIAS	222	222	222	222	222
		KTAS	252	257	262	264	267
		Fuel - Lb/Hr	1128	1149	1171	1181	1191
	5	KIAS	231	231	231	231	231
		KTAS	244	248	253	255	257
		Fuel - Lb/Hr	1199	1222	1243	1254	1265
	S.L.	KIAS	230	230	230	230	230
		KTAS	226	230	234	236	238
		Fuel - Lb/Hr	1215	1243	1274	1290	1306

Figure 8-12.1 (Sheet 7 of 7)

INTENTIONALLY LEFT BLANK

OXYGEN QUANTITY MISSION PLANNING

EFFECTIVITY
Aircraft 45-002 thru 45-169 *without* Altitude
Compensated Oxygen System

MINIMUM OXYGEN QUANTITY — LITERS (as required by regulations)									
Number of Passengers									
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
228	269	311	353	395	437	479	520	562	604

TIME (hours:minutes)
Light face numbers indicate one crew member using oxygen above FL410
Bold face numbers indicate one crew member using oxygen above FL350

OXY QTY LTR	**Number of Passengers**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
670	8:11 **6:42**	7:25 **6:03**	6:38 **5:26**	5:52 **4:48**	5:05 **4:10**	4:19 **3:32**	3:32 **2:54**	2:46 **2:16**	1:59 **1:38**	1:13 **1:00**
623	7:19 **6:00**	6:33 **5:22**	5:46 **4:44**	5:00 **4:05**	4:13 **3:28**	3:27 **2:50**	2:40 **2:12**	1:54 **1:34**	1:07 **0:56**	0:21 **0:17**
604	6:58 **5:42**	6:12 **5:03**	5:25 **4:26**	4:39 **3:48**	3:52 **3:09**	3:06 **2:32**	2:19 **1:54**	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**
562	6:12 **5:03**	5:25 **4:26**	4:39 **3:48**	3:52 **3:09**	3:06 **2:32**	2:19 **1:54**	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**	
520	5:25 **4:26**	4:39 **3:48**	3:52 **3:09**	3:06 **2:32**	2:19 **1:54**	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**		
479	4:39 **3:48**	3:52 **3:09**	3:06 **2:32**	2:19 **1:54**	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**			
437	3:52 **3:09**	3:06 **2:32**	2:19 **1:54**	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**				
395	3:06 **2:32**	2:19 **1:54**	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**					
353	2:19 **1:54**	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**						
311	1:33 **1:16**	0:46 **0:38**	0:00 **0:00**							
269	0:46 **0:38**	0:00 **0:00**								
228	0:00 **0:00**									

NOTE: The time obtained from this table may exceed the fuel endurance available.

Conditions:
- Cabin Pressure — Normal
- One crew member using oxygen (crew mask in normal mode)

Figure 8-13

OXYGEN QUANTITY MISSION PLANNING

EFFECTIVITY
Aircraft 45-170 & Subsequent and prior aircraft
with Altitude Compensated Oxygen System

MINIMUM OXYGEN QUANTITY — LITERS **(as required by regulations)**									
Number of Passengers									
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
228	248	267	287	307	327	347	367	387	407

TIME (hours:minutes)
Light face numbers indicate one crew member using oxygen above FL410
Bold face numbers indicate one crew member using oxygen above FL350

OXY QTY	**Number of Passengers**									
LTR	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
670	8:11 **6:42**	7:49 **6:24**	7:27 **6:05**	7:05 **5:48**	6:42 **5:30**	6:20 **5:11**	5:58 **4:53**	5:36 **4:35**	5:14 **4:17**	4:51 **3:59**
623	7:19 **5:59**	6:57 **5:41**	6:34 **5:23**	6:12 **5:04**	5:50 **4:47**	5:28 **4:29**	5:06 **4:10**	4:43 **3:52**	4:21 **3:34**	4:00 **3:16**
569	6:19 **5:10**	5:57 **4:52**	5:34 **4:34**	5:12 **4:16**	4:50 **3:58**	4:28 **3:40**	4:06 **3:21**	3:43 **3:02**	3:21 **2:45**	3:00 **2:27**
515	5:19 **4:21**	4:57 **4:02**	4:34 **3:45**	4:12 **3:27**	3:50 **3:08**	3:28 **2:50**	3:06 **2:32**	2:43 **2:14**	2:21 **1:56**	2:00 **1:38**
407	3:19 **2:43**	2:57 **2:25**	2:35 **2:07**	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**
387	2:57 **2:25**	2:35 **2:07**	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**	
367	2:35 **2:07**	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**		
347	2:13 **1:49**	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**			
327	1:50 **1:31**	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**				
307	1:28 **1:13**	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**					
287	1:06 **0:54**	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**						
267	0:44 **0:36**	0:22 **0:18**	0:00 **0:00**							
248	0:22 **0:18**	0:00 **0:00**								
228	0:00 **0:00**									

NOTE: The time obtained from this table may exceed the fuel endurance available.

Conditions:
- Cabin Pressure — Normal
- One crew member using oxygen (crew mask in normal mode)

Figure 8-13.1

INTENTIONALLY LEFT BLANK

DESCENT AND HOLDING PERFORMANCE

The descent and holding performance on the following pages is based on flight test data and represents the average delivered aircraft.

DESCENT PERFORMANCE SCHEDULE

Figures 8-14 and 8-15 show times, distance and fuel used, for normal and high speed descents respectively, from a given altitude to sea level. An average descent weight of 15,000 pounds (6804 kg) is assumed in the tables. Subtraction of performance values for two altitudes results in the time, distance and fuel required for descent between the two altitudes. The descent speed schedule is presented with each table. The power setting for descent is IDLE thrust. Data are shown without the use of spoilers. Descent performance is improved if spoilers are deployed.

MAXIMUM RANGE DESCENT — ONE ENGINE

Figure 8-16 shows the descent speed schedule for a maximum range descent to an altitude at or below the single-engine service ceiling for the aircraft gross weight.

HOLDING OPERATIONS

Figure 8-17 shows fuel flows and holding speed for various weights and altitude conditions. The holding speeds presented are sufficient to ensure a comfortable margin above shaker operation or low-speed buffet while maneuvering in a holding pattern.

DESCENT PERFORMANCE SCHEDULE
NORMAL DESCENT

45-961a

ALTITUDE 1000 Ft.	TIME Min.	DISTANCE N.M.	FUEL Lb.
51	15.7	100	117
49	14.6	92	108
47	13.5	85	100
45	12.5	78	92
43	11.7	71	86
41	10.9	66	80
39	10.2	61	75
37	9.6	56	70
35	9.1	53	66
33	8.7	49	63
31	8.3	47	60
29	8.0	44	58
27	7.7	42	55
25	7.2	39	52
23	6.8	36	49
21	6.4	33	46
19	6.0	30	44
17	5.5	27	41
15	5.1	24	38
13	4.7	22	36
11	4.3	19	33
9	3.4	15	27
7	2.7	12	21
5	1.9	8	16

DESCENT SPEED: 51,000 to 28,000 feet 0.76 MI
28,000 to 10,000 feet 300 KIAS
10,000 feet and below 250 KIAS

Figure 8-14

DESCENT PERFORMANCE SCHEDULE
HIGH SPEED DESCENT

45-962a

ALTITUDE 1000 Ft.	TIME Min.	DISTANCE N.M.	FUEL Lb.
51	12.1	79	87
49	11.4	74	81
47	10.7	68	76
45	10.0	63	71
43	9.4	58	66
41	8.9	54	62
39	8.5	51	59
37	8.0	48	56
35	7.7	45	53
33	7.4	42	51
31	7.1	40	49
29	6.9	39	47
27	6.7	37	46
25	6.5	35	44
23	6.2	33	43
21	5.9	30	41
19	5.5	28	39
17	5.2	26	38
15	4.9	24	36
13	4.6	21	34
11	4.2	19	33
9	3.4	15	27
7	2.7	12	21
5	1.9	8	16

DESCENT SPEED: 51,000 to 26,800 feet 0.81 MI
26,800 to 10,000 feet 330 KIAS
10,000 feet and below 250 KIAS

Figure 8-15

MAXIMUM RANGE DESCENT — ONE ENGINE

ALTITUDE — FT	DESCENT SPEED
51,000 to 49,000	0.70 MI
49,000 to 29,000	170 KIAS
29,000 to 21,000	0.45 MI
21,000 and below	200 KIAS

NOTE: This table represents the minimum sink-rate speed above the single-engine service ceiling and approximates the best rate-of-climb speed below the single-engine service ceiling.

Figure 8-16

HOLDING OPERATIONS

45-976

			WEIGHT — 1000 LB							
			14	15	16	17	18	19	20	21
ALTITUDE — 1000 FEET	41	Mach Ind	.607	.623	.639	.655	.671	.687	.703	.718
		Fuel - Lb/Hr	737	782	829	876	925	974	1024	1080
	39	Mach Ind	.581	.596	.612	.627	.643	.658	.673	.688
		Fuel - Lb/Hr	735	777	823	869	918	966	1015	1065
	37	Mach Ind	.556	.571	.585	.600	.615	.630	.644	.659
		Fuel - Lb/Hr	734	775	818	864	911	959	1007	1057
	35	Mach Ind	.531	.546	.560	.574	.589	.603	.617	.631
		Fuel - Lb/Hr	738	780	822	867	914	960	1008	1057
	33	Mach Ind	.508	.522	.536	.550	.563	.577	.591	.604
		Fuel - Lb/Hr	747	788	831	876	921	968	1016	1063
	31	Mach Ind	.487	.500	.513	.526	.540	.553	.566	.579
		Fuel - Lb/Hr	757	798	839	882	930	976	1023	1071
	29	Mach Ind	.466	.479	.492	.504	.517	.530	.543	.555
		Fuel - Lb/Hr	766	807	850	891	938	985	1033	1079
	25	KIAS	150	155	160	165	170	175	180	185
		Fuel - Lb/Hr	711	752	793	835	877	919	962	1007
	20	KIAS	150	155	160	165	170	175	180	185
		Fuel - Lb/Hr	737	778	819	861	903	946	990	1034
	15	KIAS	150	155	160	165	170	175	180	185
		Fuel - Lb/Hr	767	808	849	891	934	978	1023	1068
	10	KIAS	150	155	160	165	170	175	180	185
		Fuel - Lb/Hr	799	841	884	928	971	1015	1060	1106
	5	KIAS	150	155	160	165	170	175	180	185
		Fuel - Lb/Hr	841	885	929	973	1018	1065	1112	1159

Figure 8-17

INTENTIONALLLY LEFT BLANK

STANDARD INSTRUMENT DEPARTURE (SID) CLIMB PERFORMANCE

INTRODUCTION

Standard Instrument Departure (SID) climb requirements were established to allow aircraft to maintain a safe clearance during departures over high terrain or obstacles which can be required for various airports. SID's can also be specified for noise considerations or air traffic control issues.

The information in this section shows one and two-engine climb data to allow the crew to determine whether the aircraft is capable of meeting various SID climb requirements. The tables in Figure 8-20 thru Figure 8-23 provide Takeoff Weight Limits for various SID climb requirements with one and two engine operations, anti-ice Off and On, and for takeoff flap settings of 8 and 20 degrees. Separate tables are provided for airport pressure altitudes from Sea Level through 14,000 feet. On each of these tables, Maximum Takeoff Gross Weight (MTOGW) is presented as a function of SID climb requirements (ft/nm), required SID altitude and airport ambient temperatures.

NOTE

The following information is provided as advisory only and is not FAA approved. The information is based solely on Bombardier-Learjet's interpretation of the operating rules pertaining to departure climb operations. This information is not meant to replace understandings and agreements between individual operators and regulatory personnel. Operators should discuss this information with their regulatory personnel and make their own interpretations.

If an obstacle is a specified vertical height and horizontal distance from the end of the runway and in the intended flight path, then the FAA approved obstacle clearance data in the approved Airplane Flight Manual (AFM) must be used. If separate SID and obstacle clearance requirements exist at the same airport, the more limiting takeoff gross weight associated with the respective climb criteria should be used.

INTRODUCTION (CONT)

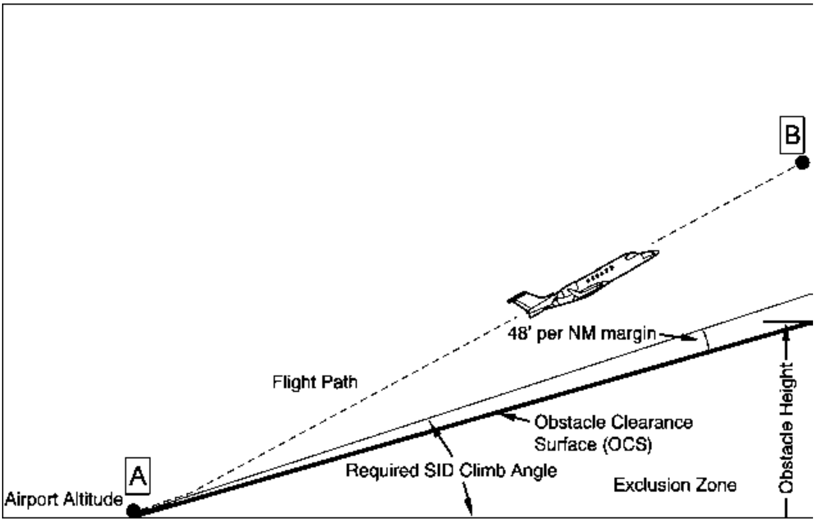
Single-engine climb performance assumes a direct climb to the specified AGL height at the engine-out V_2 safety speed with the flaps in the specified position and landing gear retracted. Two-engine climb performance assumes a direct climb in normal operations (all systems functioning normally including both engines operating) to the specified AGL height at V_2+25 KIAS with flaps in the specified position and landing gear retracted.

WARNING Two-engine SID climb criteria can be used at the operator's discretion. If two-engine SID climb criteria is used to determine a SID-limited takeoff weight and an engine failure occurs in the departure climb, continuation of the SID climb on one engine should not be attempted. Instead, the pilot should either land or enter a holding pattern to gain sufficient altitude to clear obstacles and high terrain and declare an emergency. Two engine SID climbs should only be used in VMC conditions where obstacles can be visually acquired and avoided.

At the higher AGL heights, a continued climb in the flaps down configuration may not be as beneficial as a flap retraction and acceleration at a lower altitude than a continued climb in the flaps up configuration. However, because of the complexity of analysis, it has not been considered in the SID table data presented in this section. All data are based on flaps in the takeoff position during the entire climb.

DETERMINATION OF SID REQUIREMENTS

Figure 8-18 illustrates an example of how the SID requirements are used to determine the MTOGW. SID climb requirements are stated in units of feet per nautical mile from the Departure End of the Runway (DER). The required SID climb angle allows the aircraft to clear any obstacles located in the exclusion zone from the end of the takeoff run at 35 feet above the runway to the obstacle height.

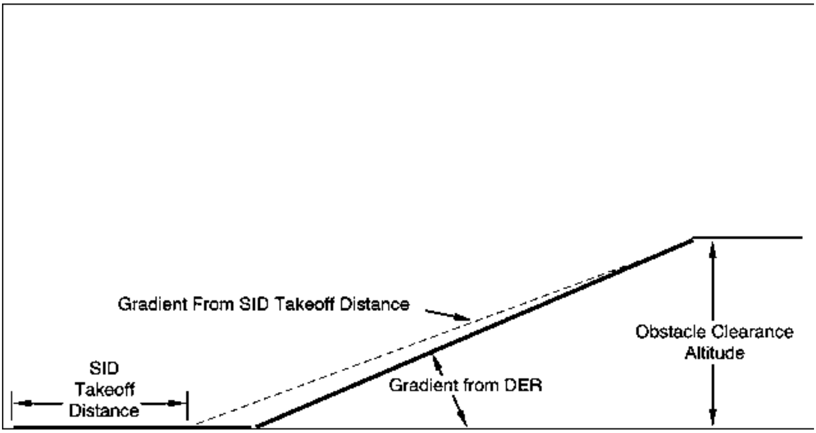


SID REQUIREMENTS
Figure 8-18

Takeoff gross weights shown in the SID climb tables are based on meeting an average climb gradient during the climb from lift-off to the specified AGL height. The AGL height is determined as the difference between the specified MSL SID height and the airport elevation. In Figure 8-18 the actual flight path from 35 feet above the runway (Point A, the end of the takeoff segment) to the obstacle height (Point B) maintains a conservative margin above the exclusion zone. The average climb gradient includes the first segment during which the landing gear is fully extended.

ADDITIONAL RUNWAY DISTANCE TO REDUCE REQUIRED SID CLIMB GRADIENT

Because the climb gradient is specified relative to the departure end of the runway (DER), the required gradient may be reduced when the SID takeoff distance and the DER provides additional horizontal distance to attain the specified AGL height. Figure 8-19 below shows an illustration of this condition. Example 2 shows a calculation of the MTOGW for the reduced SID climb gradient required when extra runway distance is available.



ADDITONAL RUNWAY DISTANCE TO REDUCE REQUIRED SID CLIMB GRADIENT
Figure 8-19

LIMITATIONS FOR USE OF SID TABLES

The allowable takeoff gross weights presented in the tables are for no-wind conditions. The takeoff gross weight can be increased by 100 pounds for each 10 knots of headwind up to a maximum of 30 knots. The takeoff gross weight must be reduced by 100 pounds for each 1 knot of tailwind up to a maximum of 10 knots.

The MTOGW determined from the tables is the weight at brake release.

Turns greater than 15 degrees bank angle invalidate the climb performance in the tables.

A 5-minute time limit for Takeoff power or APR ON has been applied and included in the SID tables. For higher AGL heights and lower SID climb gradients, the allowable takeoff weight has been reduced so that the specified AGL could be reached within 4 minutes from takeoff. This allows 1 minute from brake release to the runway DER.

BASIC DEPARTURE PROCEDURE TABLE USE

EXAMPLE 1: BASIC SID TABLE USE

Given:

- Airport pressure altitude = 5,000 ft
- Runway slope = 0%
- Airport ambient temperature = 37 degrees C
- Flaps 8 degrees, APR Armed, Anti-ice Off
- Wind = 0 knots
- SID climb gradient = 400 ft/nm to 13,000 ft MSL
- Assume Runway length is greater than SID takeoff distance.

Find:

Maximum allowable takeoff weight for two-engine operation.

Solution:

- Interpolate in the 4,000 ft airport pressure altitude table at required SID climb gradient of 400 ft/nm, SID altitude of 13,000 ft MSL and 37 Degrees C to obtain the maximum allowable takeoff weight at 37 degrees C (21,172 lb).
- Interpolate in the 6,000 ft airport pressure altitude table at required SID climb gradient of 400 ft/nm, SID altitude of 13,000 ft MSL and 37 degrees C to obtain the maximum allowable takeoff weight at 37 degrees C (21,500 lb).
- Interpolate between the takeoff weights at 4,000 ft and 6,000 ft airport pressure altitude to obtain the maximum allowable takeoff weight (21,336 lb).

EXAMPLE 2: USE OF EXTRA RUNWAY DISTANCE TO REDUCE REQUIRED SID CLIMB GRADIENT

Given:

- Airport pressure altitude = 6,000 ft.
- Airport ambient temperature = 15 degrees C
- Flaps 8 degrees, APR Armed, Anti-ice Off
- Runway available = 8,500 ft.
- Wind = 0 knots
- SID climb gradient = 400 ft/nm to 9,000 ft MSL

Find:

The maximum allowable takeoff weight for one-engine operation and use the extra runway available to reduce the required SID gradient because the takeoff distance is less than the runway length. See Figure 8-19 for an illustration.

Solution, by iteration:

Iteration 1 -

- Use the SID table for 6,000 ft MSL airport pressure altitude, Flaps 8 degrees, One engine operating, Anti-ice Off to determine the maximum takeoff weight.
- At airport pressure altitude = 6,000 ft, OAT = 15 degrees C and SID = 400 ft/nm, the maximum takeoff weight is 18,260 lb.
- The takeoff distance from the approved AFM at 18,260 lb takeoff weight is 4,504 ft.
- The additional runway distance available is 3,996 ft (8,500 - 4,504)
- Horizontal distance beyond DER to 3,000 ft AGL is 45,570 ft (6067 x 3000/400).
- Horizontal distance from end of SID takeoff to 3,000 ft AGL is 49,566 ft (45,570 + 3,996).
- Reduced SID is 368 ft/nm (3,000 x 6076/49,566).

Iteration 2 -

- Use the SID table for 6,000 ft MSL airport pressure altitude, Flaps 8 degrees, One engine operating, Anti-ice Off to determine the maximum takeoff weight.
- At airport pressure altitude = 6,000 ft, OAT = 15 degrees C and SID = 368 ft/nm, the maximum takeoff weight is 18,859 lb by interpolation.
- The takeoff distance from the approved AFM at 18,859 lb is 4,768 ft.
- The additional runway distance available = 3,732 ft (8,500 - 4,768).
- Horizontal distance beyond DER to 3,000 ft AGL is 45,570 ft (6076 x 3,000/400).
- Horizontal distance from end of SID takeoff distance to 3,000 ft AGL is 49,302 ft (45,570 + 3,732).
- Reduced SID is 370 ft/nm (3,000 x 6076/49,302).

Iteration 3 -

- Use the SID table for 6,000 ft MSL airport pressure altitude, Flaps 8 degrees, One engine operating, Anti-ice Off to determine the maximum takeoff weight.
- At airport pressure altitude = 6,000 ft, OAT = 15 degrees C and SID = 370 ft/nm, the maximum takeoff weight is 18,824 lb by interpolation.
- The takeoff distance from the approved AFM at 18,824 lb is 4,753 ft.
- The additional runway distance available = 3,747 ft (8,500 - 4,753).
- Horizontal distance beyond DER to 3,000 ft AGL is 45,570 ft (6076 x 3,000/400).
- Horizontal distance from end of SID takeoff distance to 3,000 ft AGL is 49,317 ft (45,570 + 3,747).
- Reduced SID is 370 ft/nm (3,000 x 6076/49,317).

Since the reduced SID climb gradient hasn't changed from the second iteration, the final maximum allowable take off weight is 18,824 lb.

By using the extra runway distance, the maximum takeoff weight has increased 564 lb (18,824 - 18,260).

TAKEOFF GROSS WEIGHT LIMITED BY REQUIRED SID CLIMB GRADIENT

The tables on the following pages present the information necessary to determine the maximum allowable takeoff weight as limited by SID climb requirements. This information is advisory only and is not FAA approved.

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200
300	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200
400	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200
500	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200
600	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200
700	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200
800	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20120
900	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20340	18880

45-1200

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — Sea Level
APR — Off
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 1 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20150
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18530
300	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20150
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18530
400	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20150
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18530
500	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20150
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18530
600	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20150
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18530
700	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450	19790
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18530
800	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20030	18480
900	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20290	18800	17340

45-1201

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 2000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 2 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB															
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20390	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20680	18750	
300	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20390	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20680	18750	
400	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20390	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20680	18750	
500	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20390	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20680	18750	
600	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20390	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20680	18750	
700	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21440	19800	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20680	18750	
800	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20020	18500	
900	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250	18800	17360	

45-1202

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 4000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 3 of 16)

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18510	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20740	18850	16960	
300	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18510	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20740	18850	16960	
400	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18510	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20740	18850	16960	
500	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21250	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21250	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21250	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21250	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21250	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21250	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18510	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20740	18850	16960	
600	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19610	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19610	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19610	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19610	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19610	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19610	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19610	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20500	18510	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20740	18850	16960	
700	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21360	19780	18210	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20740	18850	16960	
800	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	17020	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21410	19940	18480	16960	
900	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21480	20100	18730	17360	15780	

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

45-1203

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 6000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 4 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20450	18500		
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650	18770	16950		
300	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20450	18500		
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650	18770	16950		
400	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20450	18500		
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650	18770	16950		
500	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20250		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20450	18500		
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650	18770	16950		
600	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21140	19550		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21140	19550		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21140	19550		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21140	19550		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21140	19550		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21140	19550		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21140	19550		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20450	18500		
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650	18770	16950		
700	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21110	19630	18130		
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650	18770	16950		
800	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21090	19720	18330	16940		
900	9,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	10,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	11,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	12,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	13,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	14,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	15,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	16,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		
	17,000	21500	21500	21500	21500	21500	21500	21500	21090	19800	18500	17210	15740		

45-1204

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 8000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 5 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20100			
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	18360			
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20450	18620	16830			
300	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20100			
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	18360			
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20450	18620	16830			
400	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20100			
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	18360			
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20450	18620	16830			
500	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20760			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20760			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20760			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20760			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20760			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20760			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20100			
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	18360			
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20450	18620	16830			
600	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20720	19130			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20720	19130			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20720	19130			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20720	19130			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20720	19130			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20720	19130			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20720	19130			
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20280	18360			
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20450	18620	16830			
700	11,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	20690	19230	17760			
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20450	18620	16830			
800	11,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	12,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	13,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	14,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	15,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	16,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	17,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	18,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
	19,000	21500	21500	21500	21500	21500	21500	21500	20680	19320	17950	16570			
900	11,000	21500	21500	21500	21500	21500	21500	20670	19410	18130	16850	15400			
	12,000	21500	21500	21500	21500	21500	21500	20670	19410	18130	16850	15400			
	13,000	21500	21500	21500	21500	21500	21500	20670	19410	18130	16850	15400			
	14,000	21500	21500	21500	21500	21500	21500	20670	19410	18130	16850	15400			
	15,000	21500	21500	21500	21500	21500	21500	20670	19410	18130	16850	15400			
	16,000	21500	21500	21500	21500	21500	21500	20670	19410	18130	16850	15400			
	17,000	21500	21500	21500	21500	21500	21500	20670	19410	18130	16850	15400			
	18,000	21500	21500	21500	21500	21500	21210	20590	19410	18130	16850	15400			
	19,000	21500	21500	21500	21500	21500	20890	20300	19320	18110	16850	15400			

45-1205

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 10,000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 6 of 16)

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 12,000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870				
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	20030	18180				
	21,000	21500	21500	21500	21500	21500	21500	21500	20150	18400	16660				
300	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870				
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	20030	18180				
	21,000	21500	21500	21500	21500	21500	21500	21500	20150	18400	16660				
400	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870				
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	20030	18180				
	21,000	21500	21500	21500	21500	21500	21500	21500	20150	18400	16660				
500	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170				
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870				
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	20030	18180				
	21,000	21500	21500	21500	21500	21500	21500	21500	20150	18400	16660				
600	13,000	21500	21500	21500	21500	21500	21500	21500	21500	20160	18600				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	20160	18600				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	20160	18600				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	20160	18600				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	20160	18600				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	20160	18600				
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20160	18600				
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	20030	18180				
	21,000	21500	21500	21500	21500	21500	21500	21500	20150	18400	16660				
700	13,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	14,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	15,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	16,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	17,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	18,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	19,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	20,000	21500	21500	21500	21500	21500	21500	21500	20160	18720	17280				
	21,000	21500	21500	21500	21500	21500	21500	21370	20150	18400	16660				
800	13,000	21500	21500	21500	21500	21500	21440	20160	18830	17490	16120				
	14,000	21500	21500	21500	21500	21500	21440	20160	18830	17490	16120				
	15,000	21500	21500	21500	21500	21500	21440	20160	18830	17490	16120				
	16,000	21500	21500	21500	21500	21500	21440	20160	18830	17490	16120				
	17,000	21500	21500	21500	21500	21500	21440	20160	18830	17490	16120				
	18,000	21500	21500	21500	21500	21500	21440	20160	18830	17490	16120				
	19,000	21500	21500	21500	21500	21500	21230	20160	18830	17490	16120				
	20,000	21500	21500	21500	21500	21500	20900	20120	18830	17490	16120				
	21,000	21500	21500	21500	21500	21380	20580	19850	18730	17480	16120				
900	13,000	21500	21500	21500	21500	21160	20110	18920	17680	16410	14920				
	14,000	21500	21500	21500	21500	21160	20110	18920	17680	16410	14920				
	15,000	21500	21500	21500	21500	21160	20110	18920	17680	16410	14920				
	16,000	21500	21500	21500	21500	21160	20110	18920	17680	16410	14920				
	17,000	21500	21500	21500	21500	21160	20110	18920	17680	16410	14920				
	18,000	21500	21500	21500	21500	20890	20100	18920	17680	16410	14920				
	19,000	21500	21500	21500	21310	20580	19800	18920	17680	16410	14920				
	20,000	21500	21500	21500	20980	20260	19500	18800	17680	16410	14920				
	21,000	21360	21320	21200	20660	19930	19190	18540	17500	16320	14920				

45-1206

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

Figure 8-20.1
(Sheet 7 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	21,000	21500	21500	21500	21500	21500	21500	21500	21500	19600					
	22,000	21500	21500	21500	21500	21500	21500	21490	19710	17940					
	23,000	21500	21500	21500	21500	21500	20970	19730	18100	16440					
300	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	21,000	21500	21500	21500	21500	21500	21500	21500	21500	19600					
	22,000	21500	21500	21500	21500	21500	21500	21490	19710	17940					
	23,000	21500	21500	21500	21500	21500	20970	19730	18100	16440					
400	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21380					
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21380					
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21380					
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21380					
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	21380					
	20,000	21500	21500	21500	21500	21500	21500	21500	21500	21380					
	21,000	21500	21500	21500	21500	21500	21500	21500	21500	19600					
	22,000	21500	21500	21500	21500	21500	21500	21490	19710	17940					
	23,000	21500	21500	21500	21500	21500	20970	19730	18100	16440					
500	15,000	21500	21500	21500	21500	21500	21500	21500	21120	19550					
	16,000	21500	21500	21500	21500	21500	21500	21500	21120	19550					
	17,000	21500	21500	21500	21500	21500	21500	21500	21120	19550					
	18,000	21500	21500	21500	21500	21500	21500	21500	21120	19550					
	19,000	21500	21500	21500	21500	21500	21500	21500	21120	19550					
	20,000	21500	21500	21500	21500	21500	21500	21500	21120	19550					
	21,000	21500	21500	21500	21500	21500	21500	21500	21120	19550					
	22,000	21500	21500	21500	21500	21500	21500	21490	19710	17940					
	23,000	21500	21500	21500	21500	21500	20970	19730	18100	16440					
600	15,000	21500	21500	21500	21500	21500	21500	20930	19470	18000					
	16,000	21500	21500	21500	21500	21500	21500	20930	19470	18000					
	17,000	21500	21500	21500	21500	21500	21500	20930	19470	18000					
	18,000	21500	21500	21500	21500	21500	21500	20930	19470	18000					
	19,000	21500	21500	21500	21500	21500	21500	20930	19470	18000					
	20,000	21500	21500	21500	21500	21500	21500	20930	19470	18000					
	21,000	21500	21500	21500	21500	21500	21500	20930	19470	18000					
	22,000	21500	21500	21500	21500	21500	21500	20930	19470	17940					
	23,000	21500	21500	21500	21500	21500	20970	19730	18100	16440					
700	15,000	21500	21500	21500	21500	21500	20780	19430	18060	16750					
	16,000	21500	21500	21500	21500	21500	20780	19430	18060	16750					
	17,000	21500	21500	21500	21500	21500	20780	19430	18060	16750					
	18,000	21500	21500	21500	21500	21500	20780	19430	18060	16750					
	19,000	21500	21500	21500	21500	21500	20780	19430	18060	16750					
	20,000	21500	21500	21500	21500	21500	20780	19430	18060	16750					
	21,000	21500	21500	21500	21500	21500	20780	19430	18060	16750					
	22,000	21500	21500	21500	21500	21500	20590	19430	18060	16750					
	23,000	21500	21500	21500	21500	21150	20270	19370	18060	16440					
800	15,000	21500	21500	21500	21480	20690	19400	18130	16890	15590					
	16,000	21500	21500	21500	21480	20690	19400	18130	16890	15590					
	17,000	21500	21500	21500	21480	20690	19400	18130	16890	15590					
	18,000	21500	21500	21500	21480	20690	19400	18130	16890	15590					
	19,000	21500	21500	21500	21480	20690	19400	18130	16890	15590					
	20,000	21500	21500	21500	21350	20590	19400	18130	16890	15590					
	21,000	21500	21500	21500	21010	20270	19400	18130	16890	15590					
	22,000	21500	21500	21390	20670	19930	19100	18130	16890	15590					
	23,000	21330	21280	21000	20330	19610	18800	17970	16850	15590					
900	15,000	21080	21060	20860	20110	19380	18200	17030	15850	14420					
	16,000	21080	21060	20860	20110	19380	18200	17030	15850	14420					
	17,000	21080	21060	20860	20110	19380	18200	17030	15850	14420					
	18,000	21080	21060	20860	20110	19380	18200	17030	15850	14420					
	19,000	21080	21060	20860	20110	19380	18200	17030	15850	14420					
	20,000	21000	20940	20610	19890	19180	18200	17030	15850	14420					
	21,000	20630	20580	20270	19580	18870	18090	17030	15850	14420					
	22,000	20250	20210	19920	19270	18580	17820	17000	15850	14420					
	23,000	19860	19830	19590	18950	18280	17550	16790	15720	14420					

45-1207

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 14,000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 8 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
300	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
400	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
500	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
600	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
700	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
800	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
900	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500

45-1208

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — Sea Level
APR — Off
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 9 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
300	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
400	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
500	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
600	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
700	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
800	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
900	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500

45-1209

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 2000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 10 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
300	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
400	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
500	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
600	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
700	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
800	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
900	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500

45-1210

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 4000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 11 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
300	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
400	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
500	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
600	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
700	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
800	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
900	7,000	21500	21500	21500	21500	21500	21190
	8,000	21500	21500	21500	21500	21500	21190
	9,000	21500	21500	21500	21500	21500	21190
	10,000	21500	21500	21500	21500	21500	21190
	11,000	21500	21500	21500	21500	21500	21190
	12,000	21500	21500	21500	21500	21500	21190
	13,000	21500	21500	21500	21500	21500	21060
	14,000	21500	21500	21500	21500	21500	20850
	15,000	21500	21500	21500	21500	21500	20620

45-1211

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 6000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 12 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB							
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20300
300	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20300
400	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20300
500	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20300
600	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20300
700	9,000	21500	21500	21500	21500	21500	20520
	10,000	21500	21500	21500	21500	21500	20520
	11,000	21500	21500	21500	21500	21500	20520
	12,000	21500	21500	21500	21500	21500	20520
	13,000	21500	21500	21500	21500	21500	20520
	14,000	21500	21500	21500	21500	21500	20520
	15,000	21500	21500	21500	21500	21500	20520
	16,000	21500	21500	21500	21500	21500	20520
	17,000	21500	21500	21500	21500	21500	20300
800	9,000	21500	21500	21500	21500	21500	19150
	10,000	21500	21500	21500	21500	21500	19150
	11,000	21500	21500	21500	21500	21500	19150
	12,000	21500	21500	21500	21500	21500	19150
	13,000	21500	21500	21500	21500	21500	19150
	14,000	21500	21500	21500	21500	21500	19150
	15,000	21500	21500	21500	21500	21500	19150
	16,000	21500	21500	21500	21500	21500	19150
	17,000	21500	21500	21500	21500	21500	19150
900	9,000	21500	21500	21500	21500	21500	17960
	10,000	21500	21500	21500	21500	21500	17960
	11,000	21500	21500	21500	21500	21500	17960
	12,000	21500	21500	21500	21500	21500	17960
	13,000	21500	21500	21500	21500	21500	17960
	14,000	21500	21500	21500	21500	21500	17960
	15,000	21500	21500	21500	21500	21500	17960
	16,000	21500	21500	21500	21500	21500	17960
	17,000	21500	21500	21500	21500	21500	17960

45-1212

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 8000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE:
- -Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- -Maximum gross takeoff weight is 21,500 lb (9752 kg).
- -The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- -Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- -Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 13 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB							
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20870
	18,000	21500	21500	21500	21500	21500	19040
	19,000	21500	21500	21500	21500	21500	17440
300	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20870
	18,000	21500	21500	21500	21500	21500	19040
	19,000	21500	21500	21500	21500	21500	17440
400	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	20870
	18,000	21500	21500	21500	21500	21500	19040
	19,000	21500	21500	21500	21500	21500	17440
500	11,000	21500	21500	21500	21500	21500	21200
	12,000	21500	21500	21500	21500	21500	21200
	13,000	21500	21500	21500	21500	21500	21200
	14,000	21500	21500	21500	21500	21500	21200
	15,000	21500	21500	21500	21500	21500	21200
	16,000	21500	21500	21500	21500	21500	21200
	17,000	21500	21500	21500	21500	21500	20870
	18,000	21500	21500	21500	21500	21500	19040
	19,000	21500	21500	21500	21500	21500	17440
600	11,000	21500	21500	21500	21500	21500	19560
	12,000	21500	21500	21500	21500	21500	19560
	13,000	21500	21500	21500	21500	21500	19560
	14,000	21500	21500	21500	21500	21500	19560
	15,000	21500	21500	21500	21500	21500	19560
	16,000	21500	21500	21500	21500	21500	19560
	17,000	21500	21500	21500	21500	21500	19560
	18,000	21500	21500	21500	21500	21500	19040
	19,000	21500	21500	21500	21500	21500	17440
700	11,000	21500	21500	21500	21500	21500	18160
	12,000	21500	21500	21500	21500	21500	18160
	13,000	21500	21500	21500	21500	21500	18160
	14,000	21500	21500	21500	21500	21500	18160
	15,000	21500	21500	21500	21500	21500	18160
	16,000	21500	21500	21500	21500	21500	18160
	17,000	21500	21500	21500	21500	21500	18160
	18,000	21500	21500	21500	21500	21500	18160
	19,000	21500	21500	21500	21500	21500	17440
800	11,000	21500	21500	21500	21500	21210	16980
	12,000	21500	21500	21500	21500	21210	16980
	13,000	21500	21500	21500	21500	21210	16980
	14,000	21500	21500	21500	21500	21210	16980
	15,000	21500	21500	21500	21500	21210	16980
	16,000	21500	21500	21500	21500	21210	16980
	17,000	21500	21500	21500	21500	21210	16980
	18,000	21500	21500	21500	21500	21090	16980
	19,000	21500	21500	21500	21500	20840	16800
900	11,000	21500	21500	21500	21500	19920	15850
	12,000	21500	21500	21500	21500	19920	15850
	13,000	21500	21500	21500	21500	19920	15850
	14,000	21500	21500	21500	21500	19920	15850
	15,000	21500	21500	21500	21500	19920	15850
	16,000	21500	21500	21500	21500	19920	15850
	17,000	21500	21500	21500	21500	19920	15850
	18,000	21500	21500	21500	21500	19710	15830
	19,000	21500	21500	21500	21470	19470	15630

45-1213

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 10,000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).

- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.

- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.

-Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 14 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	21500
	18,000	21500	21500	21500	21500	21500	19890
	19,000	21500	21500	21500	21500	21500	18070
	20,000	21500	21500	21500	21500	21500	16520
	21,000	21500	21500	21500	21500	20120	15230
300	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	21500
	18,000	21500	21500	21500	21500	21500	19890
	19,000	21500	21500	21500	21500	21500	18070
	20,000	21500	21500	21500	21500	21500	16520
	21,000	21500	21500	21500	21500	20120	15230
400	13,000	21500	21500	21500	21500	21500	20150
	14,000	21500	21500	21500	21500	21500	20150
	15,000	21500	21500	21500	21500	21500	20150
	16,000	21500	21500	21500	21500	21500	20150
	17,000	21500	21500	21500	21500	21500	20150
	18,000	21500	21500	21500	21500	21500	19890
	19,000	21500	21500	21500	21500	21500	18070
	20,000	21500	21500	21500	21500	21500	16520
	21,000	21500	21500	21500	21500	20120	15230
500	13,000	21500	21500	21500	21500	21500	18420
	14,000	21500	21500	21500	21500	21500	18420
	15,000	21500	21500	21500	21500	21500	18420
	16,000	21500	21500	21500	21500	21500	18420
	17,000	21500	21500	21500	21500	21500	18420
	18,000	21500	21500	21500	21500	21500	18420
	19,000	21500	21500	21500	21500	21500	18070
	20,000	21500	21500	21500	21500	21500	16520
	21,000	21500	21500	21500	21500	20120	15230
600	13,000	21500	21500	21500	21500	21490	16990
	14,000	21500	21500	21500	21500	21490	16990
	15,000	21500	21500	21500	21500	21490	16990
	16,000	21500	21500	21500	21500	21490	16990
	17,000	21500	21500	21500	21500	21490	16990
	18,000	21500	21500	21500	21500	21490	16990
	19,000	21500	21500	21500	21500	21490	16990
	20,000	21500	21500	21500	21500	21490	16520
	21,000	21500	21500	21500	21500	20120	15230
700	13,000	21500	21500	21500	21500	19950	15690
	14,000	21500	21500	21500	21500	19950	15690
	15,000	21500	21500	21500	21500	19950	15690
	16,000	21500	21500	21500	21500	19950	15690
	17,000	21500	21500	21500	21500	19950	15690
	18,000	21500	21500	21500	21500	19950	15690
	19,000	21500	21500	21500	21500	19950	15690
	20,000	21500	21500	21500	21500	19940	15690
	21,000	21500	21500	21500	21500	19730	15230
800	13,000	21500	21500	21500	21500	18630	14390
	14,000	21500	21500	21500	21500	18630	14390
	15,000	21500	21500	21500	21500	18630	14390
	16,000	21500	21500	21500	21500	18630	14390
	17,000	21500	21500	21500	21500	18630	14390
	18,000	21500	21500	21500	21500	18630	14390
	19,000	21500	21500	21500	21500	18630	14390
	20,000	21500	21500	21500	21270	18510	14390
	21,000	21500	21500	21500	20950	18310	14390
900	13,000	21500	21500	21500	20820	17500	
	14,000	21500	21500	21500	20820	17500	
	15,000	21500	21500	21500	20820	17500	
	16,000	21500	21500	21500	20820	17500	
	17,000	21500	21500	21500	20800	17500	
	18,000	21500	21500	21500	20480	17500	
	19,000	21500	21500	21380	20160	17460	
	20,000	21320	21260	21040	19840	17290	
	21,000	20960	20900	20710	19550	17100	

45-1214

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 12,000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 15 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	21500
	17,000	21500	21500	21500	21500	21500	21500
	18,000	21500	21500	21500	21500	21500	21500
	19,000	21500	21500	21500	21500	21500	19510
	20,000	21500	21500	21500	21500	21500	17610
	21,000	21500	21500	21500	21500	20440	15960
	22,000	21500	21500	21500	21500	18780	14560
	23,000	21500	21500	21500	21500	17310	
300	15,000	21500	21500	21500	21500	21500	19330
	16,000	21500	21500	21500	21500	21500	19330
	17,000	21500	21500	21500	21500	21500	19330
	18,000	21500	21500	21500	21500	21500	19330
	19,000	21500	21500	21500	21500	21500	19330
	20,000	21500	21500	21500	21500	21500	17610
	21,000	21500	21500	21500	21500	20440	15960
	22,000	21500	21500	21500	21500	18780	14560
	23,000	21500	21500	21500	21500	17310	
400	15,000	21500	21500	21500	21500	21500	17510
	16,000	21500	21500	21500	21500	21500	17510
	17,000	21500	21500	21500	21500	21500	17510
	18,000	21500	21500	21500	21500	21500	17510
	19,000	21500	21500	21500	21500	21500	17510
	20,000	21500	21500	21500	21500	21500	17510
	21,000	21500	21500	21500	21500	20440	15960
	22,000	21500	21500	21500	21500	18780	14560
	23,000	21500	21500	21500	21500	17310	
500	15,000	21500	21500	21500	21500	19920	16020
	16,000	21500	21500	21500	21500	19920	16020
	17,000	21500	21500	21500	21500	19920	16020
	18,000	21500	21500	21500	21500	19920	16020
	19,000	21500	21500	21500	21500	19920	16020
	20,000	21500	21500	21500	21500	19920	16020
	21,000	21500	21500	21500	21500	19920	15960
	22,000	21500	21500	21500	21500	18780	14560
	23,000	21500	21500	21500	21500	17310	
600	15,000	21500	21500	21500	21500	18350	14480
	16,000	21500	21500	21500	21500	18350	14480
	17,000	21500	21500	21500	21500	18350	14480
	18,000	21500	21500	21500	21500	18350	14480
	19,000	21500	21500	21500	21500	18350	14480
	20,000	21500	21500	21500	21500	18350	14480
	21,000	21500	21500	21500	21500	18350	14480
	22,000	21500	21500	21500	21500	18350	14480
	23,000	21500	21500	21500	21500	17310	
700	15,000	21500	21500	21500	21090	17040	
	16,000	21500	21500	21500	21090	17040	
	17,000	21500	21500	21500	21090	17040	
	18,000	21500	21500	21500	21090	17040	
	19,000	21500	21500	21500	21090	17040	
	20,000	21500	21500	21500	21090	17040	
	21,000	21500	21500	21500	20940	17040	
	22,000	21500	21500	21500	20650	17040	
	23,000	21500	21500	21500	20340	17040	
800	15,000	21500	21500	21500	19670	15910	
	16,000	21500	21500	21500	19670	15910	
	17,000	21500	21500	21500	19670	15910	
	18,000	21500	21500	21500	19670	15910	
	19,000	21500	21500	21500	19670	15910	
	20,000	21500	21500	21320	19670	15910	
	21,000	21500	21500	21000	19440	15910	
	22,000	21290	21240	20690	19160	15910	
	23,000	20890	20850	20340	18860	15900	
900	15,000	20660	20600	20440	18440	14740	
	16,000	20660	20600	20440	18440	14740	
	17,000	20660	20600	20440	18440	14740	
	18,000	20660	20600	20440	18440	14740	
	19,000	20660	20600	20160	18440	14740	
	20,000	20580	20530	19870	18410	14740	
	21,000	20200	20150	19590	18120	14740	
	22,000	19820	19780	19280	17860	14740	
	23,000	19460	19420	18960	17600	14740	

45-1215

ALL ENGINES OPERATING
FLAPS — 8°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 14,000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-20.1
(Sheet 16 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB															
Required SID Climb Gradient (FT/NM)	**SID Altitude (ft, MSL)**	**Temperature - °C**													
		-40	**-30**	**-20**	**-10**	**0**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
200	**1,000**	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20910
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200	19270
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21420	19620	17840
300	**1,000**	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20910
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200	19270
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21420	19620	17840
400	**1,000**	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20910
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200	19270
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21420	19620	17840
500	**1,000**	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20910
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200	19270
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21420	19620	17840
600	**1,000**	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21450
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20910
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200	19270
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21420	19620	17840
700	**1,000**	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20010
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20010
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20010
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20010
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20010
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20010
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20010
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21200	19270
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21420	19620	17840
800	**1,000**	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20240	18770
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21420	19620	17840
900	**1,000**	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	2,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	3,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	4,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	5,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	6,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	7,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	8,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630
	9,000	20540	20560	20590	20580	20570	20550	20550	20540	20530	20520	20520	20460	19060	17630

45-1216

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — Sea Level
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 1 of 16)

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 2000 ft
APR — Off
Anti-Ice — Off
Zero Wind

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21030
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21240	19250
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21460	19550	17710
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870	18090	16410
300	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21030
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21240	19250
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21460	19550	17710
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870	18090	16410
400	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21030
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21240	19250
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21460	19550	17710
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870	18090	16410
500	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21030
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21240	19250
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21460	19550	17710
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870	18090	16410
600	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19670
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19670
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19670
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19670
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19670
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19670
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21240	19250
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21460	19550	17710
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870	18090	16410
700	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19930	18350
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19930	18350
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19930	18350
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19930	18350
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19930	18350
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19930	18350
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19930	18350
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21460	19550	17710
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870	18090	16410
800	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20200	18700	17070
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19870	18090	16410
900	3,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	4,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	5,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	6,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	7,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	8,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	9,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	10,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840
	11,000	20630	20650	20660	20640	20610	20580	20570	20560	20550	20530	20460	19020	17560	15840

45-1217

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 2 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21430	19480	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19730	17900	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19990	18220	16560	
300	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21430	19480	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19730	17900	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19990	18220	16560	
400	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21430	19480	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19730	17900	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19990	18220	16560	
500	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21230	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21230	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21230	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21230	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21230	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21230	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21430	19480	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19730	17900	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19990	18220	16560	
600	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19700	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19700	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19700	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19700	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19700	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19700	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21370	19480	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19730	17900	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19990	18220	16560	
700	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19940	18380	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19940	18380	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19940	18380	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19940	18380	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19940	18380	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19940	18380	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19940	18380	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19730	17900	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19990	18220	16560	
800	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20170	18710	17110	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19990	18220	16560	
900	5,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	6,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	7,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	8,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	9,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	10,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	11,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	12,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	
	13,000	20680	20690	20680	20630	20590	20560	20550	20540	20530	20380	18990	17570	15880	

45-1218

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 4000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 3 of 16)

EFFECTIVITY
F

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21400	19370	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21470	19540	17660	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19760	17970	16240	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19950	18230	16600	14980	
300	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21320	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21400	19370	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21470	19540	17660	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19760	17970	16240	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19950	18230	16600	14980	
400	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21150	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21150	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21150	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21150	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21150	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21400	19370	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21470	19540	17660	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19760	17970	16240	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19950	18230	16600	14980	
500	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210	19490	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210	19490	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210	19490	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210	19490	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210	19490	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21210	19370	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21470	19540	17660	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19760	17970	16240	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19950	18230	16600	14980	
600	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21280	19680	18080	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21280	19680	18080	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21280	19680	18080	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21280	19680	18080	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21280	19680	18080	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21280	19680	18080	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21280	19540	17660	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	19760	17970	16240	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19950	18230	16600	14980	
700	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19850	18370	16720	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19850	18370	16720	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19850	18370	16720	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19850	18370	16720	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19850	18370	16720	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19850	18370	16720	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19850	18370	16720	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19760	17970	16240	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	19950	18230	16600	14980	
800	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	20010	18630	17150	15390	
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21410	19950	18230	16600	14980	
900	7,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	8,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	9,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	10,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	11,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	12,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	13,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	14,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	
	15,000	20660	20670	20640	20570	20520	20500	20490	20460	20170	18850	17500	15920	14230	

45-1219

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 6000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 4 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21240		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19300		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19450	17600		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21430	19630	17870	16170		
	17,000	21500	21500	21500	21500	21500	21500	21500	21400	19790	18110	16490	14900		
300	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21240		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19300		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19450	17600		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21430	19630	17870	16170		
	17,000	21500	21500	21500	21500	21500	21500	21500	21400	19790	18110	16490	14900		
400	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21080		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21080		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21080		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21080		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21080		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21300	19300		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19450	17600		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21430	19630	17870	16170		
	17,000	21500	21500	21500	21500	21500	21500	21500	21400	19790	18110	16490	14900		
500	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19410		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19410		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19410		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19410		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19410		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19300		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21340	19450	17600		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21430	19630	17870	16170		
	17,000	21500	21500	21500	21500	21500	21500	21500	21400	19790	18110	16490	14900		
600	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21010	19510	17980		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21010	19510	17980		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21010	19510	17980		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21010	19510	17980		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21010	19510	17980		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21010	19510	17980		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21010	19450	17600		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21430	19630	17870	16170		
	17,000	21500	21500	21500	21500	21500	21500	21500	21400	19790	18110	16490	14900		
700	9,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	18200	16670		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	18200	16670		
	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	18200	16670		
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	18200	16670		
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	18200	16670		
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	18200	16670		
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	18200	16670		
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21010	19610	17870	16170		
	17,000	21500	21500	21500	21500	21500	21500	21500	21400	19790	18110	16490	14900		
800	9,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	10,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	11,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	12,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	13,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	14,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	15,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	16,000	21500	21500	21500	21500	21500	21500	21500	21010	19700	18390	17010	15340		
	17,000	21500	21500	21500	21500	21500	21500	21500	20880	19670	18110	16490	14900		
900	9,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	10,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	11,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	12,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	13,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	14,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	15,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	16,000	20770	20760	20710	20660	20610	20580	20550	19790	18560	17290	15780	14180		
	17,000	20770	20760	20710	20660	20610	20580	20350	19620	18480	17230	15780	14180		

45-1220

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 8000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 5 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21000			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19100			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21060	19220	17410			
	18,000	21500	21500	21500	21500	21500	21500	21500	21130	19380	17660	16000			
	19,000	21500	21500	21500	21500	21500	21500	20780	19490	17880	16300	14730			
300	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21000			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19100			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21060	19220	17410			
	18,000	21500	21500	21500	21500	21500	21500	21500	21130	19380	17660	16000			
	19,000	21500	21500	21500	21500	21500	21500	20780	19490	17880	16300	14730			
400	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20640			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20640			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20640			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20640			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20640			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21040	19100			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21060	19220	17410			
	18,000	21500	21500	21500	21500	21500	21500	21500	21130	19380	17660	16000			
	19,000	21500	21500	21500	21500	21500	21500	20780	19490	17880	16300	14730			
500	11,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20620	18990			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20620	18990			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20620	18990			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20620	18990			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20620	18990			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20620	18990			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21060	19220	17410			
	18,000	21500	21500	21500	21500	21500	21500	21500	21130	19380	17660	16000			
	19,000	21500	21500	21500	21500	21500	21500	20780	19490	17880	16300	14730			
600	11,000	21500	21500	21500	21500	21500	21500	21500	21500	20610	19110	17620			
	12,000	21500	21500	21500	21500	21500	21500	21500	21500	20610	19110	17620			
	13,000	21500	21500	21500	21500	21500	21500	21500	21500	20610	19110	17620			
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	20610	19110	17620			
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	20610	19110	17620			
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	20610	19110	17620			
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	20610	19110	17410			
	18,000	21500	21500	21500	21500	21500	21500	21500	21130	19380	17660	16000			
	19,000	21500	21500	21500	21500	21500	21500	20780	19490	17880	16300	14730			
700	11,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17830	16270			
	12,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17830	16270			
	13,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17830	16270			
	14,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17830	16270			
	15,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17830	16270			
	16,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17830	16270			
	17,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17830	16270			
	18,000	21500	21500	21500	21500	21500	21500	21500	20610	19220	17660	16000			
	19,000	21500	21500	21500	21500	21500	21500	20780	19490	17880	16300	14730			
800	11,000	21500	21500	21500	21500	21500	21500	20600	19320	18010	16650	14950			
	12,000	21500	21500	21500	21500	21500	21500	20600	19320	18010	16650	14950			
	13,000	21500	21500	21500	21500	21500	21500	20600	19320	18010	16650	14950			
	14,000	21500	21500	21500	21500	21500	21500	20600	19320	18010	16650	14950			
	15,000	21500	21500	21500	21500	21500	21500	20600	19320	18010	16650	14950			
	16,000	21500	21500	21500	21500	21500	21500	20600	19320	18010	16650	14950			
	17,000	21500	21500	21500	21500	21500	21240	20590	19320	18010	16650	14950			
	18,000	21500	21500	21500	21500	21500	20910	20300	19270	18000	16650	14950			
	19,000	21500	21500	21500	21500	21250	20590	19990	19030	17810	16300	14730			
900	11,000	20960	20940	20900	20860	20810	20590	19410	18200	16960	15430				
	12,000	20960	20940	20900	20860	20810	20590	19410	18200	16960	15430				
	13,000	20960	20940	20900	20860	20810	20590	19410	18200	16960	15430				
	14,000	20960	20940	20900	20860	20810	20590	19410	18200	16960	15430				
	15,000	20960	20940	20900	20860	20810	20570	19410	18200	16960	15430				
	16,000	20960	20940	20900	20860	20810	20250	19410	18200	16960	15430				
	17,000	20960	20940	20900	20860	20570	19930	19330	18200	16960	15430				
	18,000	20960	20940	20900	20800	20250	19630	19050	18090	16900	15430				
	19,000	20860	20840	20810	20500	19930	19310	18770	17880	16690	15310				

45-1221

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 10,000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 6 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	20670	18790				
	19,000	21500	21500	21500	21500	21500	21500	21500	20670	18900	17150				
	20,000	21500	21500	21500	21500	21500	21500	20570	19040	17370	15750				
	21,000	21500	21500	21500	21500	21020	19840	18930	17550	16040	14510				
300	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20650				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	20670	18790				
	19,000	21500	21500	21500	21500	21500	21500	21500	20670	18900	17150				
	20,000	21500	21500	21500	21500	21500	21500	20570	19040	17370	15750				
	21,000	21500	21500	21500	21500	21020	19840	18930	17550	16040	14510				
400	13,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20060				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20060				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20060				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20060				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20060				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	20670	18790				
	19,000	21500	21500	21500	21500	21500	21500	21500	20670	18900	17150				
	20,000	21500	21500	21500	21500	21500	21500	20570	19040	17370	15750				
	21,000	21500	21500	21500	21500	21020	19840	18930	17550	16040	14510				
500	13,000	21500	21500	21500	21500	21500	21500	21500	21500	20060	18480				
	14,000	21500	21500	21500	21500	21500	21500	21500	21500	20060	18480				
	15,000	21500	21500	21500	21500	21500	21500	21500	21500	20060	18480				
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	20060	18480				
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	20060	18480				
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	20060	18480				
	19,000	21500	21500	21500	21500	21500	21500	21500	20670	18900	17150				
	20,000	21500	21500	21500	21500	21500	21500	20570	19040	17370	15750				
	21,000	21500	21500	21500	21500	21020	19840	18930	17550	16040	14510				
600	13,000	21500	21500	21500	21500	21500	21500	21500	20080	18610	17150				
	14,000	21500	21500	21500	21500	21500	21500	21500	20080	18610	17150				
	15,000	21500	21500	21500	21500	21500	21500	21500	20080	18610	17150				
	16,000	21500	21500	21500	21500	21500	21500	21500	20080	18610	17150				
	17,000	21500	21500	21500	21500	21500	21500	21500	20080	18610	17150				
	18,000	21500	21500	21500	21500	21500	21500	21500	20080	18610	17150				
	19,000	21500	21500	21500	21500	21500	21500	21500	20080	18610	17150				
	20,000	21500	21500	21500	21500	21500	21500	20570	19040	17370	15750				
	21,000	21500	21500	21500	21500	21020	19840	18930	17550	16040	14510				
700	13,000	21500	21500	21500	21500	21500	21380	20090	18740	17380	15750				
	14,000	21500	21500	21500	21500	21500	21380	20090	18740	17380	15750				
	15,000	21500	21500	21500	21500	21500	21380	20090	18740	17380	15750				
	16,000	21500	21500	21500	21500	21500	21380	20090	18740	17380	15750				
	17,000	21500	21500	21500	21500	21500	21380	20090	18740	17380	15750				
	18,000	21500	21500	21500	21500	21500	21230	20090	18740	17380	15750				
	19,000	21500	21500	21500	21500	21500	20880	20090	18740	17380	15750				
	20,000	21500	21500	21500	21500	21350	20560	19820	18640	17370	15750				
	21,000	21500	21500	21500	21500	21000	19840	18930	17550	16040	14510				
800	13,000	21500	21500	21500	21500	21080	20040	18840	17580	16140	14470				
	14,000	21500	21500	21500	21500	21080	20040	18840	17580	16140	14470				
	15,000	21500	21500	21500	21500	21080	20040	18840	17580	16140	14470				
	16,000	21500	21500	21500	21500	21080	20040	18840	17580	16140	14470				
	17,000	21500	21500	21500	21500	20900	20040	18840	17580	16140	14470				
	18,000	21500	21500	21500	21310	20590	19810	18840	17580	16140	14470				
	19,000	21500	21500	21500	20970	20260	19500	18750	17580	16140	14470				
	20,000	21340	21310	21200	20650	19920	19190	18500	17410	16090	14470				
	21,000	20970	20940	20850	20310	19600	18870	18230	17210	15880	14460				
900	13,000	20650	20630	20600	20530	19850	18880	17760	16480	14940					
	14,000	20650	20630	20600	20530	19850	18880	17760	16480	14940					
	15,000	20650	20630	20600	20530	19850	18880	17760	16480	14940					
	16,000	20650	20630	20600	20530	19850	18880	17760	16480	14940					
	17,000	20650	20630	20600	20310	19620	18880	17760	16480	14940					
	18,000	20650	20630	20540	19990	19300	18590	17760	16480	14940					
	19,000	20350	20330	20220	19670	18980	18290	17610	16480	14940					
	20,000	20000	19980	19880	19350	18680	17980	17370	16260	14930					
	21,000	19660	19630	19540	19020	18380	17700	17100	16040	14720					

45-1222

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 12,000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 7 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21500					
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20240					
	20,000	21500	21500	21500	21500	21500	21500	21500	20230	18440					
	21,000	21500	21500	21500	21500	21500	21500	20190	18500	16840					
	22,000	21500	21500	21500	21500	20970	19720	18560	17020	15470					
	23,000	21500	21500	21420	20350	19240	18100	17090	15700	14250					
300	15,000	21500	21500	21500	21500	21500	21500	21500	21500	21300					
	16,000	21500	21500	21500	21500	21500	21500	21500	21500	21300					
	17,000	21500	21500	21500	21500	21500	21500	21500	21500	21300					
	18,000	21500	21500	21500	21500	21500	21500	21500	21500	21300					
	19,000	21500	21500	21500	21500	21500	21500	21500	21500	20240					
	20,000	21500	21500	21500	21500	21500	21500	21500	20230	18440					
	21,000	21500	21500	21500	21500	21500	21500	20190	18500	16840					
	22,000	21500	21500	21500	21500	20970	19720	18560	17020	15470					
	23,000	21500	21500	21420	20350	19240	18100	17090	15700	14250					
400	15,000	21500	21500	21500	21500	21500	21500	21500	21060	19450					
	16,000	21500	21500	21500	21500	21500	21500	21500	21060	19450					
	17,000	21500	21500	21500	21500	21500	21500	21500	21060	19450					
	18,000	21500	21500	21500	21500	21500	21500	21500	21060	19450					
	19,000	21500	21500	21500	21500	21500	21500	21500	21060	19450					
	20,000	21500	21500	21500	21500	21500	21500	21500	20230	18440					
	21,000	21500	21500	21500	21500	21500	21500	20190	18500	16840					
	22,000	21500	21500	21500	21500	20970	19720	18560	17020	15470					
	23,000	21500	21500	21420	20350	19240	18100	17090	15700	14250					
500	15,000	21500	21500	21500	21500	21500	21500	20870	19390	17900					
	16,000	21500	21500	21500	21500	21500	21500	20870	19390	17900					
	17,000	21500	21500	21500	21500	21500	21500	20870	19390	17900					
	18,000	21500	21500	21500	21500	21500	21500	20870	19390	17900					
	19,000	21500	21500	21500	21500	21500	21500	20870	19390	17900					
	20,000	21500	21500	21500	21500	21500	21500	20870	19390	17900					
	21,000	21500	21500	21500	21500	21500	21500	20190	18500	16840					
	22,000	21500	21500	21500	21500	20970	19720	18560	17020	15470					
	23,000	21500	21500	21420	20350	19240	18100	17090	15700	14250					
600	15,000	21500	21500	21500	21500	21500	20730	19360	17970	16570					
	16,000	21500	21500	21500	21500	21500	20730	19360	17970	16570					
	17,000	21500	21500	21500	21500	21500	20730	19360	17970	16570					
	18,000	21500	21500	21500	21500	21500	20730	19360	17970	16570					
	19,000	21500	21500	21500	21500	21500	20730	19360	17970	16570					
	20,000	21500	21500	21500	21500	21500	20730	19360	17970	16570					
	21,000	21500	21500	21500	21500	21460	20570	19360	17970	16570					
	22,000	21500	21500	21500	21500	20970	19720	18560	17020	15470					
	23,000	21500	21500	21420	20350	19240	18100	17090	15700	14250					
700	15,000	21500	21500	21500	21360	20580	19340	18050	16760	15170					
	16,000	21500	21500	21500	21360	20580	19340	18050	16760	15170					
	17,000	21500	21500	21500	21360	20580	19340	18050	16760	15170					
	18,000	21500	21500	21500	21360	20580	19340	18050	16760	15170					
	19,000	21500	21500	21500	21320	20560	19340	18050	16760	15170					
	20,000	21500	21500	21500	20960	20210	19340	18050	16760	15170					
	21,000	21500	21500	21350	20620	19880	19060	18050	16760	15170					
	22,000	21290	21260	20980	20280	19560	18760	17910	16720	15170					
	23,000	20890	20860	20610	19940	19230	18100	17090	15700	14250					
800	15,000	20970	20960	20750	20000	19280	18130	16940	15510						
	16,000	20970	20960	20750	20000	19280	18130	16940	15510						
	17,000	20970	20960	20750	20000	19280	18130	16940	15510						
	18,000	20970	20960	20750	20000	19280	18130	16940	15510						
	19,000	20970	20950	20590	19870	19160	18130	16940	15510						
	20,000	20610	20590	20260	19560	18850	18070	16940	15510						
	21,000	20230	20200	19910	19230	18550	17800	16940	15510						
	22,000	19850	19820	19570	18910	18240	17520	16700	15450						
	23,000	19470	19440	19210	18600	17930	17230	16450	15230						
900	15,000	19740	19730	19530	18840	18150	17100	15800	14340						
	16,000	19740	19730	19530	18840	18150	17100	15800	14340						
	17,000	19740	19730	19530	18840	18150	17100	15800	14340						
	18,000	19740	19730	19530	18840	18150	17100	15800	14340						
	19,000	19670	19650	19310	18630	17970	17100	15800	14340						
	20,000	19320	19290	18990	18330	17690	16960	15800	14340						
	21,000	18950	18930	18670	18010	17400	16680	15790	14340						
	22,000	18600	18570	18330	17730	17100	16380	15540	14300						
	23,000	18230	18200	17980	17440	16800	16070	15280	14080						

45-1223

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 14,000 ft
APR — Off
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 8 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
300	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
400	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
500	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
600	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
700	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
800	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
900	1,000	20370	20410	20430	20440	20420	20400
	2,000	20370	20410	20430	20440	20420	20400
	3,000	20370	20410	20430	20440	20420	20400
	4,000	20370	20410	20430	20440	20420	20400
	5,000	20370	20410	20430	20440	20420	20400
	6,000	20370	20410	20430	20440	20420	20400
	7,000	20370	20410	20430	20440	20420	20400
	8,000	20370	20410	20430	20440	20420	20400
	9,000	20370	20410	20430	20440	20420	20400

45-1224

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — Sea Level
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 9 of 16)

EFFECTIVITY
F

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 2000 ft
APR — Off
Anti-Ice — On
Zero Wind

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
300	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
400	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
500	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
600	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
700	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
800	3,000	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
900	3,000	20480	20520	20520	20500	20470	20430
	4,000	20480	20520	20520	20500	20470	20430
	5,000	20480	20520	20520	20500	20470	20430
	6,000	20480	20520	20520	20500	20470	20430
	7,000	20480	20520	20520	20500	20470	20430
	8,000	20480	20520	20520	20500	20470	20430
	9,000	20480	20520	20520	20500	20470	20430
	10,000	20480	20520	20520	20500	20470	20430
	11,000	20480	20520	20520	20500	20470	20430

45-1225

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 10 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
300	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
400	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
500	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
600	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
700	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
800	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
900	5,000	20530	20550	20540	20490	20440	20400
	6,000	20530	20550	20540	20490	20440	20400
	7,000	20530	20550	20540	20490	20440	20400
	8,000	20530	20550	20540	20490	20440	20400
	9,000	20530	20550	20540	20490	20440	20400
	10,000	20530	20550	20540	20490	20440	20400
	11,000	20530	20550	20540	20490	20440	20400
	12,000	20530	20550	20540	20490	20440	20400
	13,000	20530	20550	20540	20490	20440	20400

45-1226

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 4000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 11 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB							
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	20580
300	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	20580
400	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	20580
500	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	20580
600	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	20580
700	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	20580
800	7,000	21500	21500	21500	21500	21500	21100
	8,000	21500	21500	21500	21500	21500	21100
	9,000	21500	21500	21500	21500	21500	21100
	10,000	21500	21500	21500	21500	21500	21100
	11,000	21500	21500	21500	21500	21500	21100
	12,000	21500	21500	21500	21500	21500	21000
	13,000	21500	21500	21500	21500	21500	20810
	14,000	21500	21500	21500	21500	21500	20590
	15,000	21500	21500	21500	21500	21500	20350
900	7,000	20520	20530	20470	20410	20350	19880
	8,000	20520	20530	20470	20410	20350	19880
	9,000	20520	20530	20470	20410	20350	19880
	10,000	20520	20530	20470	20410	20350	19880
	11,000	20520	20530	20470	20410	20350	19870
	12,000	20520	20530	20470	20410	20350	19720
	13,000	20520	20530	20470	20410	20350	19540
	14,000	20520	20530	20470	20410	20350	19330
	15,000	20520	20530	20470	20410	20350	19100

45-1227

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 6000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 12 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21010
	16,000	21500	21500	21500	21500	21500	19260
	17,000	21500	21500	21500	21500	21500	17750
300	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21010
	16,000	21500	21500	21500	21500	21500	19260
	17,000	21500	21500	21500	21500	21500	17750
400	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21010
	16,000	21500	21500	21500	21500	21500	19260
	17,000	21500	21500	21500	21500	21500	17750
500	9,000	21500	21500	21500	21500	21500	21500
	10,000	21500	21500	21500	21500	21500	21500
	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21010
	16,000	21500	21500	21500	21500	21500	19260
	17,000	21500	21500	21500	21500	21500	17750
600	9,000	21500	21500	21500	21500	21500	20390
	10,000	21500	21500	21500	21500	21500	20390
	11,000	21500	21500	21500	21500	21500	20390
	12,000	21500	21500	21500	21500	21500	20390
	13,000	21500	21500	21500	21500	21500	20390
	14,000	21500	21500	21500	21500	21500	20390
	15,000	21500	21500	21500	21500	21500	20390
	16,000	21500	21500	21500	21500	21500	19260
	17,000	21500	21500	21500	21500	21500	17750
700	9,000	21500	21500	21500	21500	21500	19000
	10,000	21500	21500	21500	21500	21500	19000
	11,000	21500	21500	21500	21500	21500	19000
	12,000	21500	21500	21500	21500	21500	19000
	13,000	21500	21500	21500	21500	21500	19000
	14,000	21500	21500	21500	21500	21500	19000
	15,000	21500	21500	21500	21500	21500	19000
	16,000	21500	21500	21500	21500	21500	19000
	17,000	21500	21500	21500	21500	21500	17750
800	9,000	21500	21500	21500	21500	21500	17810
	10,000	21500	21500	21500	21500	21500	17810
	11,000	21500	21500	21500	21500	21500	17810
	12,000	21500	21500	21500	21500	21500	17810
	13,000	21500	21500	21500	21500	21500	17810
	14,000	21500	21500	21500	21500	21500	17810
	15,000	21500	21500	21500	21500	21500	17810
	16,000	21500	21500	21500	21500	21500	17810
	17,000	21500	21500	21500	21500	21350	17740
900	9,000	20540	20520	20460	20410	20330	16680
	10,000	20540	20520	20460	20410	20330	16680
	11,000	20540	20520	20460	20410	20330	16680
	12,000	20540	20520	20460	20410	20330	16680
	13,000	20540	20520	20460	20410	20330	16680
	14,000	20540	20520	20460	20410	20330	16680
	15,000	20540	20520	20460	20410	20330	16680
	16,000	20540	20520	20460	20410	20330	16680
	17,000	20540	20520	20460	20410	20050	16570

45-1228

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 8000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 13 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	19750
	17,000	21500	21500	21500	21500	21500	18000
	18,000	21500	21500	21500	21500	21500	16510
	19,000	21500	21500	21500	21500	20080	15220
300	11,000	21500	21500	21500	21500	21500	21500
	12,000	21500	21500	21500	21500	21500	21500
	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	19750
	17,000	21500	21500	21500	21500	21500	18000
	18,000	21500	21500	21500	21500	21500	16510
	19,000	21500	21500	21500	21500	20080	15220
400	11,000	21500	21500	21500	21500	21500	21100
	12,000	21500	21500	21500	21500	21500	21100
	13,000	21500	21500	21500	21500	21500	21100
	14,000	21500	21500	21500	21500	21500	21100
	15,000	21500	21500	21500	21500	21500	21100
	16,000	21500	21500	21500	21500	21500	19750
	17,000	21500	21500	21500	21500	21500	18000
	18,000	21500	21500	21500	21500	21500	16510
	19,000	21500	21500	21500	21500	20080	15220
500	11,000	21500	21500	21500	21500	21500	19450
	12,000	21500	21500	21500	21500	21500	19450
	13,000	21500	21500	21500	21500	21500	19450
	14,000	21500	21500	21500	21500	21500	19450
	15,000	21500	21500	21500	21500	21500	19450
	16,000	21500	21500	21500	21500	21500	19450
	17,000	21500	21500	21500	21500	21500	18000
	18,000	21500	21500	21500	21500	21500	16510
	19,000	21500	21500	21500	21500	20080	15220
600	11,000	21500	21500	21500	21500	21500	18030
	12,000	21500	21500	21500	21500	21500	18030
	13,000	21500	21500	21500	21500	21500	18030
	14,000	21500	21500	21500	21500	21500	18030
	15,000	21500	21500	21500	21500	21500	18030
	16,000	21500	21500	21500	21500	21500	18030
	17,000	21500	21500	21500	21500	21500	18000
	18,000	21500	21500	21500	21500	21500	16510
	19,000	21500	21500	21500	21500	20080	15220
700	11,000	21500	21500	21500	21500	21170	16790
	12,000	21500	21500	21500	21500	21170	16790
	13,000	21500	21500	21500	21500	21170	16790
	14,000	21500	21500	21500	21500	21170	16790
	15,000	21500	21500	21500	21500	21170	16790
	16,000	21500	21500	21500	21500	21170	16790
	17,000	21500	21500	21500	21500	21060	16790
	18,000	21500	21500	21500	21500	20790	16510
	19,000	21500	21500	21500	21500	20080	15220
800	11,000	21500	21500	21500	21500	19860	15460
	12,000	21500	21500	21500	21500	19860	15460
	13,000	21500	21500	21500	21500	19860	15460
	14,000	21500	21500	21500	21500	19860	15460
	15,000	21500	21500	21500	21500	19860	15460
	16,000	21500	21500	21500	21500	19860	15460
	17,000	21500	21500	21500	21500	19670	15460
	18,000	21500	21500	21500	21460	19410	15310
	19,000	21500	21500	21500	21130	19160	15070
900	11,000	20670	20640	20610	20560	18730	14300
	12,000	20670	20640	20610	20560	18730	14300
	13,000	20670	20640	20610	20560	18730	14300
	14,000	20670	20640	20610	20560	18730	14300
	15,000	20670	20640	20610	20560	18730	14300
	16,000	20670	20640	20610	20560	18730	14300
	17,000	20670	20640	20610	20460	18470	14300
	18,000	20670	20640	20610	20140	18230	14180
	19,000	20500	20470	20420	19830	17980	

45-1229

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 10,000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 14 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	13,000	21500	21500	21500	21500	21500	21500
	14,000	21500	21500	21500	21500	21500	21500
	15,000	21500	21500	21500	21500	21500	21500
	16,000	21500	21500	21500	21500	21500	20670
	17,000	21500	21500	21500	21500	21500	18660
	18,000	21500	21500	21500	21500	21500	17010
	19,000	21500	21500	21500	21500	20430	15520
	20,000	21500	21500	21500	21500	18860	14220
	21,000	21500	21500	21500	20750	17420	
300	13,000	21500	21500	21500	21500	21500	19990
	14,000	21500	21500	21500	21500	21500	19990
	15,000	21500	21500	21500	21500	21500	19990
	16,000	21500	21500	21500	21500	21500	19990
	17,000	21500	21500	21500	21500	21500	18660
	18,000	21500	21500	21500	21500	21500	17010
	19,000	21500	21500	21500	21500	20430	15520
	20,000	21500	21500	21500	21500	18860	14220
	21,000	21500	21500	21500	20750	17420	
400	13,000	21500	21500	21500	21500	21500	18250
	14,000	21500	21500	21500	21500	21500	18250
	15,000	21500	21500	21500	21500	21500	18250
	16,000	21500	21500	21500	21500	21500	18250
	17,000	21500	21500	21500	21500	21500	18250
	18,000	21500	21500	21500	21500	21500	17010
	19,000	21500	21500	21500	21500	20430	15520
	20,000	21500	21500	21500	21500	18860	14220
	21,000	21500	21500	21500	20750	17420	
500	13,000	21500	21500	21500	21500	21410	16780
	14,000	21500	21500	21500	21500	21410	16780
	15,000	21500	21500	21500	21500	21410	16780
	16,000	21500	21500	21500	21500	21410	16780
	17,000	21500	21500	21500	21500	21410	16780
	18,000	21500	21500	21500	21500	21410	16780
	19,000	21500	21500	21500	21500	20430	15520
	20,000	21500	21500	21500	21500	18860	14220
	21,000	21500	21500	21500	20750	17420	
600	13,000	21500	21500	21500	21500	19850	15200
	14,000	21500	21500	21500	21500	19850	15200
	15,000	21500	21500	21500	21500	19850	15200
	16,000	21500	21500	21500	21500	19850	15200
	17,000	21500	21500	21500	21500	19850	15200
	18,000	21500	21500	21500	21500	19850	15200
	19,000	21500	21500	21500	21500	19770	15200
	20,000	21500	21500	21500	21500	18860	14220
	21,000	21500	21500	21500	20750	17420	
700	13,000	21500	21500	21500	21500	18520	
	14,000	21500	21500	21500	21500	18520	
	15,000	21500	21500	21500	21500	18520	
	16,000	21500	21500	21500	21500	18520	
	17,000	21500	21500	21500	21500	18520	
	18,000	21500	21500	21500	21500	18520	
	19,000	21500	21500	21500	21250	18360	
	20,000	21500	21500	21500	20920	18170	
	21,000	21500	21500	21500	20600	17420	
800	13,000	21500	21500	21500	20750	17380	
	14,000	21500	21500	21500	20750	17380	
	15,000	21500	21500	21500	20750	17380	
	16,000	21500	21500	21500	20750	17380	
	17,000	21500	21500	21500	20490	17380	
	18,000	21500	21500	21350	20160	17340	
	19,000	21280	21250	21020	19850	17140	
	20,000	20920	20890	20700	19540	16960	
	21,000	20570	20530	20350	19220	16750	
900	13,000	20340	20300	20270	19550	16250	
	14,000	20340	20300	20270	19550	16250	
	15,000	20340	20300	20270	19550	16250	
	16,000	20340	20300	20270	19550	16250	
	17,000	20340	20300	20270	19230	16250	
	18,000	20290	20250	20020	18920	16180	
	19,000	19960	19920	19720	18620	15960	
	20,000	19620	19590	19400	18320	15780	
	21,000	19280	19240	19060	18020	15570	

45-1230

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 12,000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 15 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	15,000	21500	21500	21500	21500	21500	19150
	16,000	21500	21500	21500	21500	21500	19150
	17,000	21500	21500	21500	21500	21500	19150
	18,000	21500	21500	21500	21500	21500	18220
	19,000	21500	21500	21500	21500	20780	16470
	20,000	21500	21500	21500	21500	19030	14890
	21,000	21500	21500	21500	21500	17490	
	22,000	21500	21500	21500	20200	16150	
	23,000	21500	21460	20600	18590	14970	
300	15,000	21500	21500	21500	21500	21500	17330
	16,000	21500	21500	21500	21500	21500	17330
	17,000	21500	21500	21500	21500	21500	17330
	18,000	21500	21500	21500	21500	21500	17330
	19,000	21500	21500	21500	21500	20780	16470
	20,000	21500	21500	21500	21500	19030	14890
	21,000	21500	21500	21500	21500	17490	
	22,000	21500	21500	21500	20200	16150	
	23,000	21500	21460	20600	18590	14970	
400	15,000	21500	21500	21500	21500	19800	15530
	16,000	21500	21500	21500	21500	19800	15530
	17,000	21500	21500	21500	21500	19800	15530
	18,000	21500	21500	21500	21500	19800	15530
	19,000	21500	21500	21500	21500	19800	15530
	20,000	21500	21500	21500	21500	19030	14890
	21,000	21500	21500	21500	21500	17490	
	22,000	21500	21500	21500	20200	16150	
	23,000	21500	21460	20600	18590	14970	
500	15,000	21500	21500	21500	21500	18220	
	16,000	21500	21500	21500	21500	18220	
	17,000	21500	21500	21500	21500	18220	
	18,000	21500	21500	21500	21500	18220	
	19,000	21500	21500	21500	21500	18220	
	20,000	21500	21500	21500	21500	18220	
	21,000	21500	21500	21500	21500	17490	
	22,000	21500	21500	21500	20200	16150	
	23,000	21500	21460	20600	18590	14970	
600	15,000	21500	21500	21500	20980	16890	
	16,000	21500	21500	21500	20980	16890	
	17,000	21500	21500	21500	20980	16890	
	18,000	21500	21500	21500	20980	16890	
	19,000	21500	21500	21500	20980	16890	
	20,000	21500	21500	21500	20910	16890	
	21,000	21500	21500	21500	20590	16890	
	22,000	21500	21500	21500	20200	16150	
	23,000	21500	21460	20600	18590	14970	
700	15,000	21500	21500	21500	19580	15520	
	16,000	21500	21500	21500	19580	15520	
	17,000	21500	21500	21500	19580	15520	
	18,000	21500	21500	21500	19580	15520	
	19,000	21500	21500	21280	19580	15520	
	20,000	21500	21500	20950	19390	15520	
	21,000	21260	21220	20630	19070	15520	
	22,000	20840	20810	20300	18790	15520	
	23,000	20450	20410	19940	18500	14970	
800	15,000	20550	20490	20330	18360	14250	
	16,000	20550	20490	20330	18360	14250	
	17,000	20550	20490	20330	18360	14250	
	18,000	20550	20490	20130	18360	14250	
	19,000	20550	20490	19840	18360	14250	
	20,000	20180	20140	19560	18080	14250	
	21,000	19810	19770	19250	17810	14250	
	22,000	19430	19400	18930	17550	14250	
	23,000	19050	19010	18610	17280	14130	
900	15,000	19340	19280	19130	17300		
	16,000	19340	19280	19130	17300		
	17,000	19340	19280	19130	17300		
	18,000	19340	19280	18890	17300		
	19,000	19270	19230	18620	17240		
	20,000	18910	18880	18340	16970		
	21,000	18560	18520	18040	16690		
	22,000	18190	18160	17750	16410		
	23,000	17840	17810	17450	16120		

45-1231

ALL ENGINES OPERATING
FLAPS — 20°
APR — OFF
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 14,000 ft
APR — Off
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-21.1
(Sheet 16 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	1,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21020	19630
	2,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21020	19630
	3,000	21500	21500	21500	21400	21200	21010	20910	20820	20740	20660	20570	20120	18720	17200
	4,000	19600	19400	19210	19010	18770	18550	18450	18350	18270	18180	18090	17580	16440	15310
	5,000	17620	17410	17210	17000	16790	16610	16520	16450	16370	16300	16210	15800	14820	
	6,000	16170	16000	15830	15630	15440	15260	15180	15100	15030	14950	14850	14390		
	7,000	15040	14860	14680	14480	14290	14110	14030							
	8,000	14050													
	9,000														
300	1,000	20290	20290	20300	20280	20260	20240	20230	20220	20210	20200	20190	20150	18900	17650
	2,000	20290	20290	20300	20280	20260	20240	20230	20220	20210	20200	20190	20150	18900	17650
	3,000	20290	20290	20300	20280	20260	20240	20230	20220	20210	20200	20190	20120	18720	17200
	4,000	19600	19400	19210	19010	18770	18550	18450	18350	18270	18180	18090	17580	16440	15310
	5,000	17620	17410	17210	17000	16790	16610	16520	16450	16370	16300	16210	15800	14820	
	6,000	16170	16000	15830	15630	15440	15260	15180	15100	15030	14950	14850	14390		
	7,000	15040	14860	14680	14480	14290	14110	14030							
	8,000	14050													
	9,000														
400	1,000	18450	18450	18460	18440	18420	18400	18390	18380	18370	18360	18350	18320	17180	15970
	2,000	18450	18450	18460	18440	18420	18400	18390	18380	18370	18360	18350	18320	17180	15970
	3,000	18450	18450	18460	18440	18420	18400	18390	18380	18370	18360	18350	18320	17180	15970
	4,000	18450	18450	18460	18440	18420	18400	18390	18350	18270	18180	18090	17580	16440	15310
	5,000	17620	17410	17210	17000	16790	16610	16520	16450	16370	16300	16210	15800	14820	
	6,000	16170	16000	15830	15630	15440	15260	15180	15100	15030	14950	14850	14390		
	7,000	15040	14860	14680	14480	14290	14110	14030							
	8,000	14050													
	9,000														
500	1,000	16910	16920	16920	16900	16880	16860	16850	16850	16840	16830	16820	16790	15680	14520
	2,000	16910	16920	16920	16900	16880	16860	16850	16850	16840	16830	16820	16790	15680	14520
	3,000	16910	16920	16920	16900	16880	16860	16850	16850	16840	16830	16820	16790	15680	14520
	4,000	16910	16920	16920	16900	16880	16860	16850	16850	16840	16830	16820	16790	15680	14520
	5,000	16910	16920	16920	16900	16790	16610	16520	16450	16370	16300	16210	15800	14820	
	6,000	16170	16000	15830	15630	15440	15260	15180	15100	15030	14950	14850	14390		
	7,000	15040	14860	14680	14480	14290	14110	14030							
	8,000	14050													
	9,000														
600	1,000	15560	15560	15560	15550	15530	15510	15500	15490	15480	15470	15460	15430	14360	
	2,000	15560	15560	15560	15550	15530	15510	15500	15490	15480	15470	15460	15430	14360	
	3,000	15560	15560	15560	15550	15530	15510	15500	15490	15480	15470	15460	15430	14360	
	4,000	15560	15560	15560	15550	15530	15510	15500	15490	15480	15470	15460	15430	14360	
	5,000	15560	15560	15560	15550	15530	15510	15500	15490	15480	15470	15460	15430	14360	
	6,000	15560	15560	15560	15550	15440	15260	15180	15100	15030	14950	14850	14390		
	7,000	15040	14860	14680	14480	14290	14110	14030							
	8,000	14050													
	9,000														
700	1,000	14360	14370	14370	14350	14330	14310	14300	14290	14280	14270	14260	14240		
	2,000	14360	14370	14370	14350	14330	14310	14300	14290	14280	14270	14260	14240		
	3,000	14360	14370	14370	14350	14330	14310	14300	14290	14280	14270	14260	14240		
	4,000	14360	14370	14370	14350	14330	14310	14300	14290	14280	14270	14260	14240		
	5,000	14360	14370	14370	14350	14330	14310	14300	14290	14280	14270	14260	14240		
	6,000	14360	14370	14370	14350	14330	14310	14300	14290	14280	14270	14260	14240		
	7,000	14360	14370	14370	14350	14290	14110	14030							
	8,000	14050													
	9,000														
800	1,000														
	2,000														
	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
900	1,000														
	2,000														
	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														

45-1232

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — Sea Level
APR — On
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 1 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	3,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20960	19550	18110
	4,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20960	19550	18110
	5,000	21500	21500	21500	21500	21380	21180	21090	21010	20920	20810	20310	18920	17400	16120
	6,000	19840	19630	19430	19190	18950	18720	18620	18530	18430	18330	17770	16580	15480	14340
	7,000	17860	17640	17420	17180	16950	16760	16670	16580	16500	16390	15960	14990		
	8,000	16350	16170	16010	15800	15590	15410	15330	15250	15170	15030	14530			
	9,000	15220	15040	14860	14650	14450	14270	14190	14100	14010					
	10,000	14230	14050												
	11,000														
300	3,000	20300	20300	20290	20250	20200	20160	20160	20150	20150	20140	20120	18850	17570	16230
	4,000	20300	20300	20290	20250	20200	20160	20160	20150	20150	20140	20120	18850	17570	16230
	5,000	20300	20300	20290	20250	20200	20160	20160	20150	20150	20140	20120	18850	17400	16120
	6,000	19840	19630	19430	19190	18950	18720	18620	18530	18430	18330	17770	16580	15480	14340
	7,000	17860	17640	17420	17180	16950	16760	16670	16580	16500	16390	15960	14990		
	8,000	16350	16170	16010	15800	15590	15410	15330	15250	15170	15030	14530			
	9,000	15220	15040	14860	14650	14450	14270	14190	14100	14010					
	10,000	14230	14050												
	11,000														
400	3,000	18470	18470	18450	18410	18370	18330	18330	18320	18320	18310	18290	17130	15890	14610
	4,000	18470	18470	18450	18410	18370	18330	18330	18320	18320	18310	18290	17130	15890	14610
	5,000	18470	18470	18450	18410	18370	18330	18330	18320	18320	18310	18290	17130	15890	14610
	6,000	18470	18470	18450	18410	18370	18330	18330	18320	18320	18310	17770	16580	15480	14340
	7,000	17860	17640	17420	17180	16950	16760	16670	16580	16500	16390	15960	14990		
	8,000	16350	16170	16010	15800	15590	15410	15330	15250	15170	15030	14530			
	9,000	15220	15040	14860	14650	14450	14270	14190	14100	14010					
	10,000	14230	14050												
	11,000														
500	3,000	16930	16930	16910	16880	16840	16800	16800	16790	16790	16780	16760	15630	14440	
	4,000	16930	16930	16910	16880	16840	16800	16800	16790	16790	16780	16760	15630	14440	
	5,000	16930	16930	16910	16880	16840	16800	16800	16790	16790	16780	16760	15630	14440	
	6,000	16930	16930	16910	16880	16840	16800	16800	16790	16790	16780	16760	15630	14440	
	7,000	16930	16930	16910	16880	16840	16760	16670	16580	16500	16390	15960	14990		
	8,000	16350	16170	16010	15800	15590	15410	15330	15250	15170	15030	14530			
	9,000	15220	15040	14860	14650	14450	14270	14190	14100	14010					
	10,000	14230	14050												
	11,000														
600	3,000	15570	15570	15560	15520	15480	15450	15440	15440	15430	15430	15400	14310		
	4,000	15570	15570	15560	15520	15480	15450	15440	15440	15430	15430	15400	14310		
	5,000	15570	15570	15560	15520	15480	15450	15440	15440	15430	15430	15400	14310		
	6,000	15570	15570	15560	15520	15480	15450	15440	15440	15430	15430	15400	14310		
	7,000	15570	15570	15560	15520	15480	15450	15440	15440	15430	15430	15400	14310		
	8,000	15570	15570	15560	15520	15480	15410	15330	15250	15170	15030	14530			
	9,000	15220	15040	14860	14650	14450	14270	14190	14100	14010					
	10,000	14230	14050												
	11,000														
700	3,000	14380	14370	14360	14320	14290	14250	14240	14240	14230	14230	14210			
	4,000	14380	14370	14360	14320	14290	14250	14240	14240	14230	14230	14210			
	5,000	14380	14370	14360	14320	14290	14250	14240	14240	14230	14230	14210			
	6,000	14380	14370	14360	14320	14290	14250	14240	14240	14230	14230	14210			
	7,000	14380	14370	14360	14320	14290	14250	14240	14240	14230	14230	14210			
	8,000	14380	14370	14360	14320	14290	14250	14240	14240	14230	14230	14210			
	9,000	14380	14370	14360	14320	14290	14250	14190	14100	14010					
	10,000	14230	14050												
	11,000														
800	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
900	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														

45-1233

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 2000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 2 of 16)

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Takeoff Gross Weight Limited by Required SID Climb Gradient - LB Temperature - °C -40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	5,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20940	19560	18160	
	6,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	21500	20940	19560	18160	
	7,000	21500	21500	21500	21500	21500	21350	21260	21170	21030	20410	19040	17540	16250	
	8,000	20070	19850	19630	19370	19140	18930	18820	18720	18530	17870	16680	15600	14490	
	9,000	18080	17850	17620	17370	17110	16910	16810	16710	16550	16020	15080	14060		
	10,000	16510	16330	16150	15960	15760	15570	15470	15340	15170	14600				
	11,000	15360	15180	15010	14800	14590	14400	14290	14130						
	12,000	14340	14160												
	13,000														
300	5,000	20360	20360	20330	20270	20210	20180	20170	20150	20140	20050	18800	17570	16280	
	6,000	20360	20360	20330	20270	20210	20180	20170	20150	20140	20050	18800	17570	16280	
	7,000	20360	20360	20330	20270	20210	20180	20170	20150	20140	20050	18800	17540	16250	
	8,000	20070	19850	19630	19370	19140	18930	18820	18720	18530	17870	16680	15600	14490	
	9,000	18080	17850	17620	17370	17110	16910	16810	16710	16550	16020	15080	14060		
	10,000	16510	16330	16150	15960	15760	15570	15470	15340	15170	14600				
	11,000	15360	15180	15010	14800	14590	14400	14290	14130						
	12,000	14340	14160												
	13,000														
400	5,000	18500	18500	18470	18410	18360	18330	18320	18310	18290	18220	17080	15890	14650	
	6,000	18500	18500	18470	18410	18360	18330	18320	18310	18290	18220	17080	15890	14650	
	7,000	18500	18500	18470	18410	18360	18330	18320	18310	18290	18220	17080	15890	14650	
	8,000	18500	18500	18470	18410	18360	18330	18320	18310	18290	17870	16680	15600	14490	
	9,000	18080	17850	17620	17370	17110	16910	16810	16710	16550	16020	15080	14060		
	10,000	16510	16330	16150	15960	15760	15570	15470	15340	15170	14600				
	11,000	15360	15180	15010	14800	14590	14400	14290	14130						
	12,000	14340	14160												
	13,000														
500	5,000	16960	16950	16930	16880	16820	16800	16790	16780	16760	16690	15590	14440		
	6,000	16960	16950	16930	16880	16820	16800	16790	16780	16760	16690	15590	14440		
	7,000	16960	16950	16930	16880	16820	16800	16790	16780	16760	16690	15590	14440		
	8,000	16960	16950	16930	16880	16820	16800	16790	16780	16760	16690	15590	14440		
	9,000	16960	16950	16930	16880	16820	16800	16790	16710	16550	16020	15080	14060		
	10,000	16510	16330	16150	15960	15760	15570	15470	15340	15170	14600				
	11,000	15360	15180	15010	14800	14590	14400	14290	14130						
	12,000	14340	14160												
	13,000														
600	5,000	15600	15600	15580	15520	15470	15440	15430	15420	15410	15340	14280			
	6,000	15600	15600	15580	15520	15470	15440	15430	15420	15410	15340	14280			
	7,000	15600	15600	15580	15520	15470	15440	15430	15420	15410	15340	14280			
	8,000	15600	15600	15580	15520	15470	15440	15430	15420	15410	15340	14280			
	9,000	15600	15600	15580	15520	15470	15440	15430	15420	15410	15340	14280			
	10,000	15600	15600	15580	15520	15470	15440	15430	15340	15170	14600				
	11,000	15360	15180	15010	14800	14590	14400	14290	14130						
	12,000	14340	14160												
	13,000														
700	5,000	14400	14400	14380	14320	14270	14250	14230	14220	14210	14140				
	6,000	14400	14400	14380	14320	14270	14250	14230	14220	14210	14140				
	7,000	14400	14400	14380	14320	14270	14250	14230	14220	14210	14140				
	8,000	14400	14400	14380	14320	14270	14250	14230	14220	14210	14140				
	9,000	14400	14400	14380	14320	14270	14250	14230	14220	14210	14140				
	10,000	14400	14400	14380	14320	14270	14250	14230	14220	14210	14140				
	11,000	14400	14400	14380	14320	14270	14250	14230	14130						
	12,000	14340	14160												
	13,000														
800	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
900	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														

45-1234

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 4000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 3 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	7,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20770	19430	18070	16720	
	8,000	21500	21500	21500	21500	21500	21500	21500	21500	21500	20770	19430	18070	16720	
	9,000	21500	21500	21500	21500	21500	21500	21460	21270	20440	19100	17650	16330	15160	
	10,000	20320	20120	19890	19650	19410	19180	18980	18720	17920	16690	15650	14570		
	11,000	18300	18080	17830	17570	17290	17010	16810	16580	16020	15080	14100			
	12,000	16600	16420	16230	16050	15820	15550	15350	15120	14590					
	13,000	15410	15230	15050	14840	14580	14280	14070							
	14,000	14350	14170												
	15,000														
300	7,000	20340	20340	20280	20210	20150	20130	20120	20090	19830	18640	17430	16190	14880	
	8,000	20340	20340	20280	20210	20150	20130	20120	20090	19830	18640	17430	16190	14880	
	9,000	20340	20340	20280	20210	20150	20130	20120	20090	19830	18640	17430	16190	14880	
	10,000	20320	20120	19890	19650	19410	19180	18980	18720	17920	16690	15650	14570		
	11,000	18300	18080	17830	17570	17290	17010	16810	16580	16020	15080	14100			
	12,000	16600	16420	16230	16050	15820	15550	15350	15120	14590					
	13,000	15410	15230	15050	14840	14580	14280	14070							
	14,000	14350	14170												
	15,000														
400	7,000	18470	18460	18410	18350	18290	18270	18260	18240	17990	16900	15760	14560		
	8,000	18470	18460	18410	18350	18290	18270	18260	18240	17990	16900	15760	14560		
	9,000	18470	18460	18410	18350	18290	18270	18260	18240	17990	16900	15760	14560		
	10,000	18470	18460	18410	18350	18290	18270	18260	18240	17920	16690	15650	14560		
	11,000	18300	18080	17830	17570	17290	17010	16810	16580	16020	15080	14100			
	12,000	16600	16420	16230	16050	15820	15550	15350	15120	14590					
	13,000	15410	15230	15050	14840	14580	14280	14070							
	14,000	14350	14170												
	15,000														
500	7,000	16910	16910	16860	16800	16750	16730	16720	16700	16470	15410	14310			
	8,000	16910	16910	16860	16800	16750	16730	16720	16700	16470	15410	14310			
	9,000	16910	16910	16860	16800	16750	16730	16720	16700	16470	15410	14310			
	10,000	16910	16910	16860	16800	16750	16730	16720	16700	16470	15410	14310			
	11,000	16910	16910	16860	16800	16750	16730	16720	16580	16020	15080	14100			
	12,000	16600	16420	16230	16050	15820	15550	15350	15120	14590					
	13,000	15410	15230	15050	14840	14580	14280	14070							
	14,000	14350	14170												
	15,000														
600	7,000	15560	15550	15500	15450	15400	15370	15360	15340	15120	14100				
	8,000	15560	15550	15500	15450	15400	15370	15360	15340	15120	14100				
	9,000	15560	15550	15500	15450	15400	15370	15360	15340	15120	14100				
	10,000	15560	15550	15500	15450	15400	15370	15360	15340	15120	14100				
	11,000	15560	15550	15500	15450	15400	15370	15360	15340	15120	14100				
	12,000	15560	15550	15500	15450	15400	15370	15350	15120	14590					
	13,000	15410	15230	15050	14840	14580	14280	14070							
	14,000	14350	14170												
	15,000														
700	7,000	14360	14350	14300	14250	14200	14180	14160	14150						
	8,000	14360	14350	14300	14250	14200	14180	14160	14150						
	9,000	14360	14350	14300	14250	14200	14180	14160	14150						
	10,000	14360	14350	14300	14250	14200	14180	14160	14150						
	11,000	14360	14350	14300	14250	14200	14180	14160	14150						
	12,000	14360	14350	14300	14250	14200	14180	14160	14150						
	13,000	14360	14350	14300	14250	14200	14180	14070							
	14,000	14350	14170												
	15,000														
800	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
900	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														

45-1235

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 6000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- -Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- -Maximum gross takeoff weight is 21,500 lb (9752 kg).
- -The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- -Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- -Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 4 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	9,000	21500	21500	21500	21500	21500	21500	21500	21500	20510	19270	17940	16630		
	10,000	21500	21500	21500	21500	21500	21500	21500	21500	20510	19270	17940	16630		
	11,000	21500	21500	21500	21500	21500	21500	21130	20370	19030	17650	16360	15220		
	12,000	20450	20250	20040	19790	19410	18880	18470	17830	16650	15610	14590			
	13,000	18360	18140	17900	17590	17140	16620	16300	15850	15030	14080				
	14,000	16560	16360	16180	15920	15540	15100	14800	14380						
	15,000	15300	15120	14940	14630	14250									
	16,000	14200	14020												
	17,000														
300	9,000	20340	20330	20280	20240	20190	20130	20100	19470	18380	17270	16060	14780		
	10,000	20340	20330	20280	20240	20190	20130	20100	19470	18380	17270	16060	14780		
	11,000	20340	20330	20280	20240	20190	20130	20100	19470	18380	17270	16060	14780		
	12,000	20340	20250	20040	19790	19410	18880	18470	17830	16650	15610	14590			
	13,000	18360	18140	17900	17590	17140	16620	16300	15850	15030	14080				
	14,000	16560	16360	16180	15920	15540	15100	14800	14380						
	15,000	15300	15120	14940	14630	14250									
	16,000	14200	14020												
	17,000														
400	9,000	18470	18450	18410	18370	18330	18270	18250	17660	16660	15610	14440			
	10,000	18470	18450	18410	18370	18330	18270	18250	17660	16660	15610	14440			
	11,000	18470	18450	18410	18370	18330	18270	18250	17660	16660	15610	14440			
	12,000	18470	18450	18410	18370	18330	18270	18250	17660	16650	15610	14440			
	13,000	18360	18140	17900	17590	17140	16620	16300	15850	15030	14080				
	14,000	16560	16360	16180	15920	15540	15100	14800	14380						
	15,000	15300	15120	14940	14630	14250									
	16,000	14200	14020												
	17,000														
500	9,000	16910	16900	16860	16820	16780	16730	16710	16140	15170	14160				
	10,000	16910	16900	16860	16820	16780	16730	16710	16140	15170	14160				
	11,000	16910	16900	16860	16820	16780	16730	16710	16140	15170	14160				
	12,000	16910	16900	16860	16820	16780	16730	16710	16140	15170	14160				
	13,000	16910	16900	16860	16820	16780	16620	16300	15850	15030	14080				
	14,000	16560	16360	16180	15920	15540	15100	14800	14380						
	15,000	15300	15120	14940	14630	14250									
	16,000	14200	14020												
	17,000														
600	9,000	15570	15550	15510	15470	15430	15380	15360	14800						
	10,000	15570	15550	15510	15470	15430	15380	15360	14800						
	11,000	15570	15550	15510	15470	15430	15380	15360	14800						
	12,000	15570	15550	15510	15470	15430	15380	15360	14800						
	13,000	15570	15550	15510	15470	15430	15380	15360	14800						
	14,000	15570	15550	15510	15470	15430	15100	14800	14380						
	15,000	15300	15120	14940	14630	14250									
	16,000	14200	14020												
	17,000														
700	9,000	14370	14350	14310	14270	14230	14180	14160							
	10,000	14370	14350	14310	14270	14230	14180	14160							
	11,000	14370	14350	14310	14270	14230	14180	14160							
	12,000	14370	14350	14310	14270	14230	14180	14160							
	13,000	14370	14350	14310	14270	14230	14180	14160							
	14,000	14370	14350	14310	14270	14230	14180	14160							
	15,000	14370	14350	14310	14270	14230									
	16,000	14200	14020												
	17,000														
800	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
900	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														

45-1236

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 8000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).

- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.

- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.

-Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 5 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	11,000	21500	21500	21500	21500	21500	21500	21270	20080	18880	17680	16460			
	12,000	21500	21500	21500	21500	21500	21500	21270	20080	18880	17680	16460			
	13,000	21500	21500	21500	21500	21290	20390	19890	18900	17540	16280	15180			
	14,000	20290	20090	19800	19320	18630	17780	17260	16510	15480	14490				
	15,000	18120	17890	17550	17010	16390	15730	15380	14840						
	16,000	16260	16070	15790	15370	14860	14260								
	17,000	14970	14780	14500	14070										
	18,000														
	19,000														
300	11,000	20290	20270	20240	20200	20150	19560	19070	17990	16920	15810	14630			
	12,000	20290	20270	20240	20200	20150	19560	19070	17990	16920	15810	14630			
	13,000	20290	20270	20240	20200	20150	19560	19070	17990	16920	15810	14630			
	14,000	20290	20090	19800	19320	18630	17780	17260	16510	15480	14490				
	15,000	18120	17890	17550	17010	16390	15730	15380	14840						
	16,000	16260	16070	15790	15370	14860	14260								
	17,000	14970	14780	14500	14070										
	18,000														
	19,000														
400	11,000	18380	18370	18340	18300	18260	17720	17300	16320	15280	14190				
	12,000	18380	18370	18340	18300	18260	17720	17300	16320	15280	14190				
	13,000	18380	18370	18340	18300	18260	17720	17300	16320	15280	14190				
	14,000	18380	18370	18340	18300	18260	17720	17260	16320	15280	14190				
	15,000	18120	17890	17550	17010	16390	15730	15380	14840						
	16,000	16260	16070	15790	15370	14860	14260								
	17,000	14970	14780	14500	14070										
	18,000														
	19,000														
500	11,000	16810	16800	16770	16740	16700	16200	15810	14840						
	12,000	16810	16800	16770	16740	16700	16200	15810	14840						
	13,000	16810	16800	16770	16740	16700	16200	15810	14840						
	14,000	16810	16800	16770	16740	16700	16200	15810	14840						
	15,000	16810	16800	16770	16740	16390	15730	15380	14840						
	16,000	16260	16070	15790	15370	14860	14260								
	17,000	14970	14780	14500	14070										
	18,000														
	19,000														
600	11,000	15460	15450	15420	15390	15350	14860	14490							
	12,000	15460	15450	15420	15390	15350	14860	14490							
	13,000	15460	15450	15420	15390	15350	14860	14490							
	14,000	15460	15450	15420	15390	15350	14860	14490							
	15,000	15460	15450	15420	15390	15350	14860	14490							
	16,000	15460	15450	15420	15370	14860	14260								
	17,000	14970	14780	14500	14070										
	18,000														
	19,000														
700	11,000	14260	14250	14220	14190	14150									
	12,000	14260	14250	14220	14190	14150									
	13,000	14260	14250	14220	14190	14150									
	14,000	14260	14250	14220	14190	14150									
	15,000	14260	14250	14220	14190	14150									
	16,000	14260	14250	14220	14190	14010									
	17,000	14260	14250	14220	14070										
	18,000														
	19,000														
800	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
900	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														

45-1237

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 10,000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 6 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	13,000	21500	21500	21500	21500	20920	20170	19650	18500	17350	16190				
	14,000	21500	21500	21500	21500	20920	20170	19650	18500	17350	16190				
	15,000	21500	21500	21500	20700	19840	18940	18430	17330	16070	15020				
	16,000	19710	19480	18920	18150	17300	16440	16040	15300	14330					
	17,000	17480	17230	16640	15960	15340	14730	14390							
	18,000	15660	15480	15070	14500										
	19,000	14370	14200												
	20,000														
	21,000														
300	13,000	19820	19800	19780	19350	18730	18050	17600	16570	15500	14360				
	14,000	19820	19800	19780	19350	18730	18050	17600	16570	15500	14360				
	15,000	19820	19800	19780	19350	18730	18050	17600	16570	15500	14360				
	16,000	19710	19480	18920	18150	17300	16440	16040	15300	14330					
	17,000	17480	17230	16640	15960	15340	14730	14390							
	18,000	15660	15480	15070	14500										
	19,000	14370	14200												
	20,000														
	21,000														
400	13,000	17930	17910	17880	17530	16960	16360	15930	14930						
	14,000	17930	17910	17880	17530	16960	16360	15930	14930						
	15,000	17930	17910	17880	17530	16960	16360	15930	14930						
	16,000	17930	17910	17880	17530	16960	16360	15930	14930						
	17,000	17480	17230	16640	15960	15340	14730	14390							
	18,000	15660	15480	15070	14500										
	19,000	14370	14200												
	20,000														
	21,000														
500	13,000	16380	16370	16340	16010	15490	14880	14480							
	14,000	16380	16370	16340	16010	15490	14880	14480							
	15,000	16380	16370	16340	16010	15490	14880	14480							
	16,000	16380	16370	16340	16010	15490	14880	14480							
	17,000	16380	16370	16340	15960	15340	14730	14390							
	18,000	15660	15480	15070	14500										
	19,000	14370	14200												
	20,000														
	21,000														
600	13,000	15030	15010	14990	14690	14180									
	14,000	15030	15010	14990	14690	14180									
	15,000	15030	15010	14990	14690	14180									
	16,000	15030	15010	14990	14690	14180									
	17,000	15030	15010	14990	14690	14180									
	18,000	15030	15010	14910	14500										
	19,000	14370	14200												
	20,000														
	21,000														
700	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
800	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
900	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														

45-1238

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 12,000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 7 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	15,000	21300	21250	20610	19950	19320	18610	17930	16820	15680					
	16,000	21300	21250	20610	19950	19320	18610	17930	16820	15680					
	17,000	21280	20880	20060	19210	18380	17520	16990	15800	14750					
	18,000	18750	18380	17590	16770	16000	15310	14960	14110						
	19,000	16500	16160	15530	14940	14340									
	20,000	14890	14650	14120											
	21,000														
	22,000														
	23,000														
300	15,000	19040	19000	18440	17860	17290	16660	16060	14990						
	16,000	19040	19000	18440	17860	17290	16660	16060	14990						
	17,000	19040	19000	18440	17860	17290	16660	16060	14990						
	18,000	18750	18380	17590	16770	16000	15310	14960	14110						
	19,000	16500	16160	15530	14940	14340									
	20,000	14890	14650	14120											
	21,000														
	22,000														
	23,000														
400	15,000	17250	17210	16690	16180	15640	15030	14440							
	16,000	17250	17210	16690	16180	15640	15030	14440							
	17,000	17250	17210	16690	16180	15640	15030	14440							
	18,000	17250	17210	16690	16180	15640	15030	14440							
	19,000	16500	16160	15530	14940	14340									
	20,000	14890	14650	14120											
	21,000														
	22,000														
	23,000														
500	15,000	15760	15720	15220	14720	14190									
	16,000	15760	15720	15220	14720	14190									
	17,000	15760	15720	15220	14720	14190									
	18,000	15760	15720	15220	14720	14190									
	19,000	15760	15710	15220	14720	14190									
	20,000	14890	14650	14120											
	21,000														
	22,000														
	23,000														
600	15,000	14440	14410												
	16,000	14440	14410												
	17,000	14440	14410												
	18,000	14440	14410												
	19,000	14440	14410												
	20,000	14270	14190												
	21,000														
	22,000														
	23,000														
700	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
	22,000														
	23,000														
800	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
	22,000														
	23,000														
900	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
	22,000														
	23,000														

45-1239

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 14,000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 8 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB							
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	1,000	21500	21500	21500	21500	21500	21500
	2,000	21500	21500	21500	21500	21500	21500
	3,000	21500	21500	21460	21260	21060	20850
	4,000	19450	19270	19090	18870	18630	18410
	5,000	17490	17290	17100	16900	16700	16510
	6,000	16080	15900	15730	15540	15350	15160
	7,000	14940	14760	14580	14390	14200	14020
	8,000						
	9,000						
300	1,000	20150	20160	20170	20160	20120	20080
	2,000	20150	20160	20170	20160	20120	20080
	3,000	20150	20160	20170	20160	20120	20080
	4,000	19450	19270	19090	18870	18630	18410
	5,000	17490	17290	17100	16900	16700	16510
	6,000	16080	15900	15730	15540	15350	15160
	7,000	14940	14760	14580	14390	14200	14020
	8,000						
	9,000						
400	1,000	18330	18340	18350	18330	18300	18260
	2,000	18330	18340	18350	18330	18300	18260
	3,000	18330	18340	18350	18330	18300	18260
	4,000	18330	18340	18350	18330	18300	18260
	5,000	17490	17290	17100	16900	16700	16510
	6,000	16080	15900	15730	15540	15350	15160
	7,000	14940	14760	14580	14390	14200	14020
	8,000						
	9,000						
500	1,000	16800	16810	16820	16800	16770	16740
	2,000	16800	16810	16820	16800	16770	16740
	3,000	16800	16810	16820	16800	16770	16740
	4,000	16800	16810	16820	16800	16770	16740
	5,000	16800	16810	16820	16800	16700	16510
	6,000	16080	15900	15730	15540	15350	15160
	7,000	14940	14760	14580	14390	14200	14020
	8,000						
	9,000						
600	1,000	15450	15460	15460	15450	15420	15380
	2,000	15450	15460	15460	15450	15420	15380
	3,000	15450	15460	15460	15450	15420	15380
	4,000	15450	15460	15460	15450	15420	15380
	5,000	15450	15460	15460	15450	15420	15380
	6,000	15450	15460	15460	15450	15350	15160
	7,000	14940	14760	14580	14390	14200	14020
	8,000						
	9,000						
700	1,000	14250	14260	14270	14250	14220	14190
	2,000	14250	14260	14270	14250	14220	14190
	3,000	14250	14260	14270	14250	14220	14190
	4,000	14250	14260	14270	14250	14220	14190
	5,000	14250	14260	14270	14250	14220	14190
	6,000	14250	14260	14270	14250	14220	14190
	7,000	14250	14260	14270	14250	14200	14020
	8,000						
	9,000						
800	1,000						
	2,000						
	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
900	1,000						
	2,000						
	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						

45-1240

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — Sea Level
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).

- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.

- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.

-Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 9 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB							
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	**3,000**	21500	21500	21500	21500	21500	21500
	4,000	21500	21500	21500	21500	21500	21500
	5,000	21500	21500	21500	21460	21240	21030
	6,000	19680	19490	19290	19060	18810	18570
	7,000	17700	17500	17280	17050	16830	16630
	8,000	16230	16070	15880	15680	15480	15290
	9,000	15100	14930	14740	14530	14330	14130
	10,000	14110					
	11,000						
300	**3,000**	20170	20180	20170	20130	20090	20040
	4,000	20170	20180	20170	20130	20090	20040
	5,000	20170	20180	20170	20130	20090	20040
	6,000	19680	19490	19290	19060	18810	18570
	7,000	17700	17500	17280	17050	16830	16630
	8,000	16230	16070	15880	15680	15480	15290
	9,000	15100	14930	14740	14530	14330	14130
	10,000	14110					
	11,000						
400	**3,000**	18350	18360	18350	18310	18270	18230
	4,000	18350	18360	18350	18310	18270	18230
	5,000	18350	18360	18350	18310	18270	18230
	6,000	18350	18360	18350	18310	18270	18230
	7,000	17700	17500	17280	17050	16830	16630
	8,000	16230	16070	15880	15680	15480	15290
	9,000	15100	14930	14740	14530	14330	14130
	10,000	14110					
	11,000						
500	**3,000**	16820	16830	16820	16780	16740	16700
	4,000	16820	16830	16820	16780	16740	16700
	5,000	16820	16830	16820	16780	16740	16700
	6,000	16820	16830	16820	16780	16740	16700
	7,000	16820	16830	16820	16780	16740	16630
	8,000	16230	16070	15880	15680	15480	15290
	9,000	15100	14930	14740	14530	14330	14130
	10,000	14110					
	11,000						
600	**3,000**	15470	15470	15460	15430	15390	15350
	4,000	15470	15470	15460	15430	15390	15350
	5,000	15470	15470	15460	15430	15390	15350
	6,000	15470	15470	15460	15430	15390	15350
	7,000	15470	15470	15460	15430	15390	15350
	8,000	15470	15470	15460	15430	15390	15290
	9,000	15100	14930	14740	14530	14330	14130
	10,000	14110					
	11,000						
700	**3,000**	14270	14280	14270	14230	14190	14150
	4,000	14270	14280	14270	14230	14190	14150
	5,000	14270	14280	14270	14230	14190	14150
	6,000	14270	14280	14270	14230	14190	14150
	7,000	14270	14280	14270	14230	14190	14150
	8,000	14270	14280	14270	14230	14190	14150
	9,000	14270	14280	14270	14230	14190	14130
	10,000	14110					
	11,000						
800	**3,000**						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
900	**3,000**						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						

45-1241

ONE ENGINE INOPERATIVE
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

One Engine Inoperative
Flaps — 8°
Airport Pressure Altitude — 2000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 10 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	5,000	21500	21500	21500	21500	21500	21500
	6,000	21500	21500	21500	21500	21500	21500
	7,000	21500	21500	21500	21500	21360	21040
	8,000	19870	19660	19430	19190	18950	18560
	9,000	17890	17660	17430	17190	16950	16580
	10,000	16370	16190	16020	15810	15600	15200
	11,000	15230	15050	14860	14650	14440	14010
	12,000	14210	14030				
	13,000						
300	5,000	20240	20240	20210	20150	20090	20030
	6,000	20240	20240	20210	20150	20090	20030
	7,000	20240	20240	20210	20150	20090	20030
	8,000	19870	19660	19430	19190	18950	18560
	9,000	17890	17660	17430	17190	16950	16580
	10,000	16370	16190	16020	15810	15600	15200
	11,000	15230	15050	14860	14650	14440	14010
	12,000	14210	14030				
	13,000						
400	5,000	18390	18400	18360	18310	18260	18200
	6,000	18390	18400	18360	18310	18260	18200
	7,000	18390	18400	18360	18310	18260	18200
	8,000	18390	18400	18360	18310	18260	18200
	9,000	17890	17660	17430	17190	16950	16580
	10,000	16370	16190	16020	15810	15600	15200
	11,000	15230	15050	14860	14650	14440	14010
	12,000	14210	14030				
	13,000						
500	5,000	16860	16860	16830	16780	16730	16670
	6,000	16860	16860	16830	16780	16730	16670
	7,000	16860	16860	16830	16780	16730	16670
	8,000	16860	16860	16830	16780	16730	16670
	9,000	16860	16860	16830	16780	16730	16580
	10,000	16370	16190	16020	15810	15600	15200
	11,000	15230	15050	14860	14650	14440	14010
	12,000	14210	14030				
	13,000						
600	5,000	15500	15510	15480	15430	15380	15320
	6,000	15500	15510	15480	15430	15380	15320
	7,000	15500	15510	15480	15430	15380	15320
	8,000	15500	15510	15480	15430	15380	15320
	9,000	15500	15510	15480	15430	15380	15320
	10,000	15500	15510	15480	15430	15380	15200
	11,000	15230	15050	14860	14650	14440	14010
	12,000	14210	14030				
	13,000						
700	5,000	14310	14310	14280	14230	14180	14120
	6,000	14310	14310	14280	14230	14180	14120
	7,000	14310	14310	14280	14230	14180	14120
	8,000	14310	14310	14280	14230	14180	14120
	9,000	14310	14310	14280	14230	14180	14120
	10,000	14310	14310	14280	14230	14180	14120
	11,000	14310	14310	14280	14230	14180	14010
	12,000	14210	14030				
	13,000						
800	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
900	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						

45-1242

ONE ENGINE OPERATING
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 4000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 11 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	7,000	21500	21500	21500	21500	21500	21500
	8,000	21500	21500	21500	21500	21500	21500
	9,000	21500	21500	21500	21500	21500	19910
	10,000	20090	19880	19630	19390	19150	17400
	11,000	18080	17840	17590	17310	17030	15660
	12,000	16430	16250	16060	15870	15620	14290
	13,000	15240	15060	14870	14660	14400	
	14,000	14190	14010				
	15,000						
300	7,000	20180	20160	20110	20050	19980	19570
	8,000	20180	20160	20110	20050	19980	19570
	9,000	20180	20160	20110	20050	19980	19570
	10,000	20090	19880	19630	19390	19150	17400
	11,000	18080	17840	17590	17310	17030	15660
	12,000	16430	16250	16060	15870	15620	14290
	13,000	15240	15060	14870	14660	14400	
	14,000	14190	14010				
	15,000						
400	7,000	18320	18300	18260	18200	18140	17750
	8,000	18320	18300	18260	18200	18140	17750
	9,000	18320	18300	18260	18200	18140	17750
	10,000	18320	18300	18260	18200	18140	17400
	11,000	18080	17840	17590	17310	17030	15660
	12,000	16430	16250	16060	15870	15620	14290
	13,000	15240	15060	14870	14660	14400	
	14,000	14190	14010				
	15,000						
500	7,000	16780	16760	16720	16670	16610	16230
	8,000	16780	16760	16720	16670	16610	16230
	9,000	16780	16760	16720	16670	16610	16230
	10,000	16780	16760	16720	16670	16610	16230
	11,000	16780	16760	16720	16670	16610	15660
	12,000	16430	16250	16060	15870	15620	14290
	13,000	15240	15060	14870	14660	14400	
	14,000	14190	14010				
	15,000						
600	7,000	15430	15410	15370	15320	15260	14880
	8,000	15430	15410	15370	15320	15260	14880
	9,000	15430	15410	15370	15320	15260	14880
	10,000	15430	15410	15370	15320	15260	14880
	11,000	15430	15410	15370	15320	15260	14880
	12,000	15430	15410	15370	15320	15260	14290
	13,000	15240	15060	14870	14660	14400	
	14,000	14190	14010				
	15,000						
700	7,000	14230	14210	14180	14120	14060	
	8,000	14230	14210	14180	14120	14060	
	9,000	14230	14210	14180	14120	14060	
	10,000	14230	14210	14180	14120	14060	
	11,000	14230	14210	14180	14120	14060	
	12,000	14230	14210	14180	14120	14060	
	13,000	14230	14210	14180	14120	14060	
	14,000	14190	14010				
	15,000						
800	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
900	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						

45-1243

ONE ENGINE OPERATING
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 6000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 12 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	9,000	21500	21500	21500	21500	21500	19030
	10,000	21500	21500	21500	21500	21500	19030
	11,000	21500	21500	21500	21500	21330	17680
	12,000	20190	19980	19740	19490	18820	15730
	13,000	18100	17860	17590	17300	16660	14230
	14,000	16350	16160	15970	15700	15180	
	15,000	15110	14930	14720	14430		
	16,000	14010					
	17,000						
300	9,000	20120	20080	20040	19970	19880	17080
	10,000	20120	20080	20040	19970	19880	17080
	11,000	20120	20080	20040	19970	19880	17080
	12,000	20120	19980	19740	19490	18820	15730
	13,000	18100	17860	17590	17300	16660	14230
	14,000	16350	16160	15970	15700	15180	
	15,000	15110	14930	14720	14430		
	16,000	14010					
	17,000						
400	9,000	18270	18240	18190	18130	18040	15430
	10,000	18270	18240	18190	18130	18040	15430
	11,000	18270	18240	18190	18130	18040	15430
	12,000	18270	18240	18190	18130	18040	15430
	13,000	18100	17860	17590	17300	16660	14230
	14,000	16350	16160	15970	15700	15180	
	15,000	15110	14930	14720	14430		
	16,000	14010					
	17,000						
500	9,000	16730	16700	16660	16610	16530	
	10,000	16730	16700	16660	16610	16530	
	11,000	16730	16700	16660	16610	16530	
	12,000	16730	16700	16660	16610	16530	
	13,000	16730	16700	16660	16610	16530	
	14,000	16350	16160	15970	15700	15180	
	15,000	15110	14930	14720	14430		
	16,000	14010					
	17,000						
600	9,000	15380	15350	15320	15260	15180	
	10,000	15380	15350	15320	15260	15180	
	11,000	15380	15350	15320	15260	15180	
	12,000	15380	15350	15320	15260	15180	
	13,000	15380	15350	15320	15260	15180	
	14,000	15380	15350	15320	15260	15180	
	15,000	15110	14930	14720	14430		
	16,000	14010					
	17,000						
700	9,000	14190	14160	14120	14060		
	10,000	14190	14160	14120	14060		
	11,000	14190	14160	14120	14060		
	12,000	14190	14160	14120	14060		
	13,000	14190	14160	14120	14060		
	14,000	14190	14160	14120	14060		
	15,000	14190	14160	14120	14060		
	16,000	14010					
	17,000						
800	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
900	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						

45-1244

ONE ENGINE OPERATING
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 8000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 13 of 16)

ONE ENGINE OPERATING
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 10,000 ft
APR — On
Anti-Ice — On
Zero Wind

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	11,000	21500	21500	21500	21500	20640	16870
	12,000	21500	21500	21500	21500	20640	16870
	13,000	21500	21500	21500	21500	19770	15960
	14,000	19980	19750	19460	19010	17370	14290
	15,000	17800	17550	17220	16720	15490	
	16,000	16010	15820	15550	15150	14080	
	17,000	14730	14550	14280			
	18,000						
	19,000						
300	11,000	20050	20020	19990	19940	18530	15030
	12,000	20050	20020	19990	19940	18530	15030
	13,000	20050	20020	19990	19940	18530	15030
	14,000	19980	19750	19460	19010	17370	14290
	15,000	17800	17550	17220	16720	15490	
	16,000	16010	15820	15550	15150	14080	
	17,000	14730	14550	14280			
	18,000						
	19,000						
400	11,000	18170	18150	18110	18070	16810	
	12,000	18170	18150	18110	18070	16810	
	13,000	18170	18150	18110	18070	16810	
	14,000	18170	18150	18110	18070	16810	
	15,000	17800	17550	17220	16720	15490	
	16,000	16010	15820	15550	15150	14080	
	17,000	14730	14550	14280			
	18,000						
	19,000						
500	11,000	16620	16600	16570	16540	15340	
	12,000	16620	16600	16570	16540	15340	
	13,000	16620	16600	16570	16540	15340	
	14,000	16620	16600	16570	16540	15340	
	15,000	16620	16600	16570	16540	15340	
	16,000	16010	15820	15550	15150	14080	
	17,000	14730	14550	14280			
	18,000						
	19,000						
600	11,000	15280	15250	15220	15190	14020	
	12,000	15280	15250	15220	15190	14020	
	13,000	15280	15250	15220	15190	14020	
	14,000	15280	15250	15220	15190	14020	
	15,000	15280	15250	15220	15190	14020	
	16,000	15280	15250	15220	15150	14020	
	17,000	14730	14550	14280			
	18,000						
	19,000						
700	11,000	14080	14060	14030			
	12,000	14080	14060	14030			
	13,000	14080	14060	14030			
	14,000	14080	14060	14030			
	15,000	14080	14060	14030			
	16,000	14080	14060	14030			
	17,000	14080	14060	14030			
	18,000						
	19,000						
800	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
900	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						

45-1245

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 14 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	13,000	21500	21500	21500	21240	18660	15160
	14,000	21500	21500	21500	21240	18660	15160
	15,000	21500	21500	21120	20290	17890	14350
	16,000	19330	19110	18540	17770	15630	
	17,000	17100	16860	16310	15680	14040	
	18,000	15400	15220	14810	14260		
	19,000	14130					
	20,000						
	21,000						
300	13,000	19550	19530	19500	19020	16760	
	14,000	19550	19530	19500	19020	16760	
	15,000	19550	19530	19500	19020	16760	
	16,000	19330	19110	18540	17770	15630	
	17,000	17100	16860	16310	15680	14040	
	18,000	15400	15220	14810	14260		
	19,000	14130					
	20,000						
	21,000						
400	13,000	17680	17660	17640	17240	15140	
	14,000	17680	17660	17640	17240	15140	
	15,000	17680	17660	17640	17240	15140	
	16,000	17680	17660	17640	17240	15140	
	17,000	17100	16860	16310	15680	14040	
	18,000	15400	15220	14810	14260		
	19,000	14130					
	20,000						
	21,000						
500	13,000	16150	16130	16100	15750		
	14,000	16150	16130	16100	15750		
	15,000	16150	16130	16100	15750		
	16,000	16150	16130	16100	15750		
	17,000	16150	16130	16100	15680		
	18,000	15400	15220	14810	14260		
	19,000	14130					
	20,000						
	21,000						
600	13,000	14810	14800	14770	14430		
	14,000	14810	14800	14770	14430		
	15,000	14810	14800	14770	14430		
	16,000	14810	14800	14770	14430		
	17,000	14810	14800	14770	14430		
	18,000	14810	14800	14670	14260		
	19,000	14130					
	20,000						
	21,000						
700	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
800	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
900	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						

45-1246

ONE ENGINE OPERATING
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 12,000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 15 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	15,000	20930	20880	20250	19320	16730	
	16,000	20930	20880	20250	19320	16730	
	17,000	20830	20440	19640	18480	15530	
	18,000	18330	18000	17210	16190		
	19,000	16100	15820	15250	14520		
	20,000	14590	14370				
	21,000						
	22,000						
	23,000						
300	15,000	18730	18670	18110	17290	14900	
	16,000	18730	18670	18110	17290	14900	
	17,000	18730	18670	18110	17290	14900	
	18,000	18330	18000	17210	16190		
	19,000	16100	15820	15250	14520		
	20,000	14590	14370				
	21,000						
	22,000						
	23,000						
400	15,000	16950	16900	16410	15650		
	16,000	16950	16900	16410	15650		
	17,000	16950	16900	16410	15650		
	18,000	16950	16900	16410	15650		
	19,000	16100	15820	15250	14520		
	20,000	14590	14370				
	21,000						
	22,000						
	23,000						
500	15,000	15480	15430	14930	14200		
	16,000	15480	15430	14930	14200		
	17,000	15480	15430	14930	14200		
	18,000	15480	15430	14930	14200		
	19,000	15480	15430	14930	14200		
	20,000	14590	14370				
	21,000						
	22,000						
	23,000						
600	15,000	14170	14120				
	16,000	14170	14120				
	17,000	14170	14120				
	18,000	14170	14120				
	19,000	14170	14120				
	20,000						
	21,000						
	22,000						
	23,000						
700	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
	22,000						
	23,000						
800	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
	22,000						
	23,000						
900	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
	22,000						
	23,000						

45-1247

ONE ENGINE OPERATING
FLAPS — 8°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 8°
Airport Pressure Altitude — 14,000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-22.1
(Sheet 16 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	1,000	20490	20500	20510	20490	20470	20450	20440	20430	20420	20410	20400	20370	19090	17800
	2,000	20490	20500	20510	20490	20470	20450	20440	20430	20420	20410	20400	20190	18900	17500
	3,000	19170	19040	18900	18720	18540	18370	18300	18230	18170	18100	18040	17660	16570	15380
	4,000	17290	17160	17030	16860	16690	16530	16460	16390	16330	16270	16200	15820	14810	
	5,000	15890	15720	15570	15400	15220	15060	14990	14910	14830	14760	14670	14270		
	6,000	14650	14480	14330	14150										
	7,000														
	8,000														
	9,000														
300	1,000	18620	18620	18630	18610	18590	18570	18560	18550	18540	18540	18530	18500	17310	16020
	2,000	18620	18620	18630	18610	18590	18570	18560	18550	18540	18540	18530	18500	17310	16020
	3,000	18620	18620	18630	18610	18540	18370	18300	18230	18170	18100	18040	17660	16570	15380
	4,000	17290	17160	17030	16860	16690	16530	16460	16390	16330	16270	16200	15820	14810	
	5,000	15890	15720	15570	15400	15220	15060	14990	14910	14830	14760	14670	14270		
	6,000	14650	14480	14330	14150										
	7,000														
	8,000														
	9,000														
400	1,000	17010	17010	17010	17000	16980	16960	16950	16940	16930	16920	16910	16890	15710	14480
	2,000	17010	17010	17010	17000	16980	16960	16950	16940	16930	16920	16910	16890	15710	14480
	3,000	17010	17010	17010	17000	16980	16960	16950	16940	16930	16920	16910	16890	15710	14480
	4,000	17010	17010	17010	16860	16690	16530	16460	16390	16330	16270	16200	15820	14810	
	5,000	15890	15720	15570	15400	15220	15060	14990	14910	14830	14760	14670	14270		
	6,000	14650	14480	14330	14150										
	7,000														
	8,000														
	9,000														
500	1,000	15580	15580	15580	15570	15550	15530	15520	15510	15500	15490	15480	15450	14320	
	2,000	15580	15580	15580	15570	15550	15530	15520	15510	15500	15490	15480	15450	14320	
	3,000	15580	15580	15580	15570	15550	15530	15520	15510	15500	15490	15480	15450	14320	
	4,000	15580	15580	15580	15570	15550	15530	15520	15510	15500	15490	15480	15450	14320	
	5,000	15580	15580	15570	15400	15220	15060	14990	14910	14830	14760	14670	14270		
	6,000	14650	14480	14330	14150										
	7,000														
	8,000														
	9,000														
600	1,000	14310	14310	14320	14300	14280	14260	14250	14240	14230	14220	14210	14180		
	2,000	14310	14310	14320	14300	14280	14260	14250	14240	14230	14220	14210	14180		
	3,000	14310	14310	14320	14300	14280	14260	14250	14240	14230	14220	14210	14180		
	4,000	14310	14310	14320	14300	14280	14260	14250	14240	14230	14220	14210	14180		
	5,000	14310	14310	14320	14300	14280	14260	14250	14240	14230	14220	14210	14180		
	6,000	14310	14310	14320	14150										
	7,000														
	8,000														
	9,000														
700	1,000														
	2,000														
	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
800	1,000														
	2,000														
	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
900	1,000														
	2,000														
	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														

45-1248

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — Sea Level
APR — On
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).

- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
-Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 1 of 16)

EFFECTIVITY
F

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	3,000	20510	20520	20510	20460	20420	20380	20380	20380	20370	20370	20340	19040	17730	16310
	4,000	20510	20520	20510	20460	20420	20380	20380	20380	20370	20370	20320	19040	17640	16310
	5,000	19340	19210	19070	18880	18670	18500	18430	18360	18290	18210	17810	16720	15540	14320
	6,000	17450	17310	17170	17000	16810	16650	16580	16510	16450	16370	15970	14970		
	7,000	16050	15900	15730	15530	15350	15180	15110	15040	14970	14850	14390			
	8,000	14830	14660	14480	14290	14110									
	9,000														
	10,000														
	11,000														
300	3,000	18630	18640	18630	18590	18550	18510	18510	18500	18500	18490	18470	17260	15940	14570
	4,000	18630	18640	18630	18590	18550	18510	18510	18500	18500	18490	18470	17260	15940	14570
	5,000	18630	18640	18630	18590	18550	18500	18430	18360	18290	18210	17810	16720	15540	14320
	6,000	17450	17310	17170	17000	16810	16650	16580	16510	16450	16370	15970	14970		
	7,000	16050	15900	15730	15530	15350	15180	15110	15040	14970	14850	14390			
	8,000	14830	14660	14480	14290	14110									
	9,000														
	10,000														
	11,000														
400	3,000	17030	17030	17010	16970	16940	16900	16900	16890	16890	16880	16860	15660	14400	
	4,000	17030	17030	17010	16970	16940	16900	16900	16890	16890	16880	16860	15660	14400	
	5,000	17030	17030	17010	16970	16940	16900	16900	16890	16890	16880	16860	15660	14400	
	6,000	17030	17030	17010	16970	16810	16650	16580	16510	16450	16370	15970	14970		
	7,000	16050	15900	15730	15530	15350	15180	15110	15040	14970	14850	14390			
	8,000	14830	14660	14480	14290	14110									
	9,000														
	10,000														
	11,000														
500	3,000	15600	15600	15580	15540	15510	15470	15460	15460	15450	15450	15420	14270		
	4,000	15600	15600	15580	15540	15510	15470	15460	15460	15450	15450	15420	14270		
	5,000	15600	15600	15580	15540	15510	15470	15460	15460	15450	15450	15420	14270		
	6,000	15600	15600	15580	15540	15510	15470	15460	15460	15450	15450	15420	14270		
	7,000	15600	15600	15580	15530	15350	15180	15110	15040	14970	14850	14390			
	8,000	14830	14660	14480	14290	14110									
	9,000														
	10,000														
	11,000														
600	3,000	14330	14330	14320	14280	14240	14200	14190	14190	14180	14180	14150			
	4,000	14330	14330	14320	14280	14240	14200	14190	14190	14180	14180	14150			
	5,000	14330	14330	14320	14280	14240	14200	14190	14190	14180	14180	14150			
	6,000	14330	14330	14320	14280	14240	14200	14190	14190	14180	14180	14150			
	7,000	14330	14330	14320	14280	14240	14200	14190	14190	14180	14180	14150			
	8,000	14330	14330	14320	14280	14110									
	9,000														
	10,000														
	11,000														
700	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
800	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
900	3,000														
	4,000														
	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														

45-1249

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 2000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- -Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- -Maximum gross takeoff weight is 21,500 lb (9752 kg).
- -The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- -Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- -Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 2 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	5,000	20560	20560	20530	20470	20410	20390	20380	20360	20350	20260	19000	17730	16370	
	6,000	20560	20560	20530	20470	20410	20390	20380	20360	20350	20260	19000	17680	16370	
	7,000	19480	19340	19180	19000	18790	18620	18540	18470	18340	17860	16790	15640	14450	
	8,000	17600	17450	17290	17120	16940	16780	16710	16630	16500	16020	15040			
	9,000	16190	16040	15870	15670	15490	15320	15240	15150	15010	14440				
	10,000	14970	14790	14610	14420	14250	14090	14000							
	11,000														
	12,000														
	13,000														
300	5,000	18670	18670	18650	18590	18540	18510	18500	18490	18480	18400	17220	15950	14620	
	6,000	18670	18670	18650	18590	18540	18510	18500	18490	18480	18400	17220	15950	14620	
	7,000	18670	18670	18650	18590	18540	18510	18500	18470	18340	17860	16790	15640	14450	
	8,000	17600	17450	17290	17120	16940	16780	16710	16630	16500	16020	15040			
	9,000	16190	16040	15870	15670	15490	15320	15240	15150	15010	14440				
	10,000	14970	14790	14610	14420	14250	14090	14000							
	11,000														
	12,000														
	13,000														
400	5,000	17070	17060	17040	16980	16930	16900	16890	16880	16870	16790	15630	14400		
	6,000	17070	17060	17040	16980	16930	16900	16890	16880	16870	16790	15630	14400		
	7,000	17070	17060	17040	16980	16930	16900	16890	16880	16870	16790	15630	14400		
	8,000	17070	17060	17040	16980	16930	16780	16710	16630	16500	16020	15040			
	9,000	16190	16040	15870	15670	15490	15320	15240	15150	15010	14440				
	10,000	14970	14790	14610	14420	14250	14090	14000							
	11,000														
	12,000														
	13,000														
500	5,000	15630	15630	15610	15550	15490	15470	15460	15450	15430	15360	14230			
	6,000	15630	15630	15610	15550	15490	15470	15460	15450	15430	15360	14230			
	7,000	15630	15630	15610	15550	15490	15470	15460	15450	15430	15360	14230			
	8,000	15630	15630	15610	15550	15490	15470	15460	15450	15430	15360	14230			
	9,000	15630	15630	15610	15550	15490	15320	15240	15150	15010	14440				
	10,000	14970	14790	14610	14420	14250	14090	14000							
	11,000														
	12,000														
	13,000														
600	5,000	14360	14360	14340	14280	14220	14200	14190	14180	14160	14090				
	6,000	14360	14360	14340	14280	14220	14200	14190	14180	14160	14090				
	7,000	14360	14360	14340	14280	14220	14200	14190	14180	14160	14090				
	8,000	14360	14360	14340	14280	14220	14200	14190	14180	14160	14090				
	9,000	14360	14360	14340	14280	14220	14200	14190	14180	14160	14090				
	10,000	14360	14360	14340	14280	14220	14090	14000							
	11,000														
	12,000														
	13,000														
700	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
800	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
900	5,000														
	6,000														
	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														

45-1250

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 4000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 3 of 16)

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 6000 ft
APR — On
Anti-Ice — Off
Zero Wind

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	7,000	20520	20520	20460	20400	20340	20310	20300	20280	20010	18800	17590	16280	14870	
	8,000	20520	20520	20460	20400	20340	20310	20300	20280	20010	18800	17590	16280	14870	
	9,000	19680	19520	19350	19170	19000	18810	18690	18520	17820	16740	15660	14500		
	10,000	17750	17590	17410	17240	17070	16900	16740	16560	15980	15010				
	11,000	16270	16120	15970	15780	15580	15380	15200	15000	14410					
	12,000	15020	14850	14670	14490	14280	14040								
	13,000														
	14,000														
	15,000														
300	7,000	18620	18610	18560	18510	18450	18430	18420	18400	18160	17030	15820	14530		
	8,000	18620	18610	18560	18510	18450	18430	18420	18400	18160	17030	15820	14530		
	9,000	18620	18610	18560	18510	18450	18430	18420	18400	17820	16740	15660	14500		
	10,000	17750	17590	17410	17240	17070	16900	16740	16560	15980	15010				
	11,000	16270	16120	15970	15780	15580	15380	15200	15000	14410					
	12,000	15020	14850	14670	14490	14280	14040								
	13,000														
	14,000														
	15,000														
400	7,000	17020	17010	16960	16910	16850	16830	16820	16800	16570	15440	14270			
	8,000	17020	17010	16960	16910	16850	16830	16820	16800	16570	15440	14270			
	9,000	17020	17010	16960	16910	16850	16830	16820	16800	16570	15440	14270			
	10,000	17020	17010	16960	16910	16850	16830	16740	16560	15980	15010				
	11,000	16270	16120	15970	15780	15580	15380	15200	15000	14410					
	12,000	15020	14850	14670	14490	14280	14040								
	13,000														
	14,000														
	15,000														
500	7,000	15590	15580	15530	15470	15420	15400	15390	15370	15130	14040				
	8,000	15590	15580	15530	15470	15420	15400	15390	15370	15130	14040				
	9,000	15590	15580	15530	15470	15420	15400	15390	15370	15130	14040				
	10,000	15590	15580	15530	15470	15420	15400	15390	15370	15130	14040				
	11,000	15590	15580	15530	15470	15420	15380	15200	15000	14410					
	12,000	15020	14850	14670	14490	14280	14040								
	13,000														
	14,000														
	15,000														
600	7,000	14320	14310	14260	14200	14150	14130	14120	14100						
	8,000	14320	14310	14260	14200	14150	14130	14120	14100						
	9,000	14320	14310	14260	14200	14150	14130	14120	14100						
	10,000	14320	14310	14260	14200	14150	14130	14120	14100						
	11,000	14320	14310	14260	14200	14150	14130	14120	14100						
	12,000	14320	14310	14260	14200	14150	14040								
	13,000														
	14,000														
	15,000														
700	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
800	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
900	7,000														
	8,000														
	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														

45-1251

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 4 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	9,000	20520	20510	20470	20430	20380	20330	20300	19640	18530	17400	16110	14740		
	10,000	20520	20510	20470	20430	20380	20330	20300	19640	18530	17400	16110	14740		
	11,000	19790	19630	19460	19290	19080	18670	18330	17710	16610	15570	14480			
	12,000	17770	17600	17420	17250	16970	16570	16270	15830	14910					
	13,000	16210	16070	15900	15700	15380	14970	14660	14230						
	14,000	14930	14750	14570	14340	14010									
	15,000														
	16,000														
	17,000														
300	9,000	18610	18600	18560	18520	18480	18430	18400	17790	16750	15630	14370			
	10,000	18610	18600	18560	18520	18480	18430	18400	17790	16750	15630	14370			
	11,000	18610	18600	18560	18520	18480	18430	18330	17710	16610	15570	14370			
	12,000	17770	17600	17420	17250	16970	16570	16270	15830	14910					
	13,000	16210	16070	15900	15700	15380	14970	14660	14230						
	14,000	14930	14750	14570	14340	14010									
	15,000														
	16,000														
	17,000														
400	9,000	17010	17000	16960	16920	16880	16830	16810	16200	15160	14080				
	10,000	17010	17000	16960	16920	16880	16830	16810	16200	15160	14080				
	11,000	17010	17000	16960	16920	16880	16830	16810	16200	15160	14080				
	12,000	17010	17000	16960	16920	16880	16570	16270	15830	14910					
	13,000	16210	16070	15900	15700	15380	14970	14660	14230						
	14,000	14930	14750	14570	14340	14010									
	15,000														
	16,000														
	17,000														
500	9,000	15580	15570	15530	15490	15450	15400	15370	14780						
	10,000	15580	15570	15530	15490	15450	15400	15370	14780						
	11,000	15580	15570	15530	15490	15450	15400	15370	14780						
	12,000	15580	15570	15530	15490	15450	15400	15370	14780						
	13,000	15580	15570	15530	15490	15380	14970	14660	14230						
	14,000	14930	14750	14570	14340	14010									
	15,000														
	16,000														
	17,000														
600	9,000	14310	14300	14260	14220	14180	14130	14100							
	10,000	14310	14300	14260	14220	14180	14130	14100							
	11,000	14310	14300	14260	14220	14180	14130	14100							
	12,000	14310	14300	14260	14220	14180	14130	14100							
	13,000	14310	14300	14260	14220	14180	14130	14100							
	14,000	14310	14300	14260	14220	14010									
	15,000														
	16,000														
	17,000														
700	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
800	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
900	9,000														
	10,000														
	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														

45-1252

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 8000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 5 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	11,000	20430	20420	20390	20350	20310	19710	19240	18150	17040	15840	14560			
	12,000	20430	20420	20390	20350	20310	19710	19240	18150	17040	15840	14560			
	13,000	19590	19430	19250	18970	18380	17630	17190	16430	15410	14360				
	14,000	17510	17340	17120	16780	16270	15680	15310	14710						
	15,000	15950	15780	15560	15190	14670	14090								
	16,000	14590	14430	14190											
	17,000														
	18,000														
	19,000														
300	11,000	18490	18480	18450	18420	18380	17840	17440	16390	15280	14100				
	12,000	18490	18480	18450	18420	18380	17840	17440	16390	15280	14100				
	13,000	18490	18480	18450	18420	18380	17630	17190	16390	15280	14100				
	14,000	17510	17340	17120	16780	16270	15680	15310	14710						
	15,000	15950	15780	15560	15190	14670	14090								
	16,000	14590	14430	14190											
	17,000														
	18,000														
	19,000														
400	11,000	16890	16870	16850	16820	16780	16260	15840	14810						
	12,000	16890	16870	16850	16820	16780	16260	15840	14810						
	13,000	16890	16870	16850	16820	16780	16260	15840	14810						
	14,000	16890	16870	16850	16780	16270	15680	15310	14710						
	15,000	15950	15780	15560	15190	14670	14090								
	16,000	14590	14430	14190											
	17,000														
	18,000														
	19,000														
500	11,000	15450	15440	15410	15380	15340	14830	14440							
	12,000	15450	15440	15410	15380	15340	14830	14440							
	13,000	15450	15440	15410	15380	15340	14830	14440							
	14,000	15450	15440	15410	15380	15340	14830	14440							
	15,000	15450	15440	15410	15190	14670	14090								
	16,000	14590	14430	14190											
	17,000														
	18,000														
	19,000														
600	11,000	14180	14170	14140	14110	14070									
	12,000	14180	14170	14140	14110	14070									
	13,000	14180	14170	14140	14110	14070									
	14,000	14180	14170	14140	14110	14070									
	15,000	14180	14170	14140	14110	14050									
	16,000	14180	14170	14140											
	17,000														
	18,000														
	19,000														
700	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
800	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
900	11,000														
	12,000														
	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														

45-1253

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 10,000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 6 of 16)

EFFECTIVITY
F

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	13,000	19920	19900	19880	19490	18870	18190	17740	16670	15510	14270				
	14,000	19920	19900	19880	19490	18870	18190	17740	16670	15510	14270				
	15,000	19070	18910	18450	17810	17070	16360	16020	15180	14150					
	16,000	16960	16790	16380	15850	15220	14580	14230							
	17,000	15380	15220	14810	14260										
	18,000	14030													
	19,000														
	20,000														
	21,000														
300	13,000	18000	17980	17960	17630	17080	16430	15980	14900						
	14,000	18000	17980	17960	17630	17080	16430	15980	14900						
	15,000	18000	17980	17960	17630	17070	16360	15980	14900						
	16,000	16960	16790	16380	15850	15220	14580	14230							
	17,000	15380	15220	14810	14260										
	18,000	14030													
	19,000														
	20,000														
	21,000														
400	13,000	16410	16400	16370	16040	15500	14850	14420							
	14,000	16410	16400	16370	16040	15500	14850	14420							
	15,000	16410	16400	16370	16040	15500	14850	14420							
	16,000	16410	16400	16370	15850	15220	14580	14230							
	17,000	15380	15220	14810	14260										
	18,000	14030													
	19,000														
	20,000														
	21,000														
500	13,000	14980	14960	14940	14640	14100									
	14,000	14980	14960	14940	14640	14100									
	15,000	14980	14960	14940	14640	14100									
	16,000	14980	14960	14940	14640	14100									
	17,000	14980	14960	14810	14260										
	18,000	14030													
	19,000														
	20,000														
	21,000														
600	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
700	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
800	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														
900	13,000														
	14,000														
	15,000														
	16,000														
	17,000														
	18,000														
	19,000														
	20,000														
	21,000														

45-1254

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 12,000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 7 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB														
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
200	15,000	19160	19130	18560	17970	17410	16760	16130	14960					
	16,000	19160	19130	18560	17970	17410	16760	16130	14960					
	17,000	18150	17850	17140	16470	15860	15220	14810						
	18,000	16140	15900	15320	14730	14150								
	19,000	14560	14340											
	20,000													
	21,000													
	22,000													
	23,000													
300	15,000	17340	17310	16780	16230	15670	15000	14380						
	16,000	17340	17310	16780	16230	15670	15000	14380						
	17,000	17340	17310	16780	16230	15670	15000	14380						
	18,000	16140	15900	15320	14730	14150								
	19,000	14560	14340											
	20,000													
	21,000													
	22,000													
	23,000													
400	15,000	15770	15740	15210	14670	14110								
	16,000	15770	15740	15210	14670	14110								
	17,000	15770	15740	15210	14670	14110								
	18,000	15770	15740	15210	14670	14110								
	19,000	14560	14340											
	20,000													
	21,000													
	22,000													
	23,000													
500	15,000	14370	14340											
	16,000	14370	14340											
	17,000	14370	14340											
	18,000	14370	14340											
	19,000	14320	14230											
	20,000													
	21,000													
	22,000													
	23,000													
600	15,000													
	16,000													
	17,000													
	18,000													
	19,000													
	20,000													
	21,000													
	22,000													
	23,000													
700	15,000													
	16,000													
	17,000													
	18,000													
	19,000													
	20,000													
	21,000													
	22,000													
	23,000													
800	15,000													
	16,000													
	17,000													
	18,000													
	19,000													
	20,000													
	21,000													
	22,000													
	23,000													
900	15,000													
	16,000													
	17,000													
	18,000													
	19,000													
	20,000													
	21,000													
	22,000													
	23,000													

45-1255

NOTE: Figures in shaded area are above engine temperature limits and are provided for interpolation only.

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — OFF
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 14,000 ft
APR — On
Anti-Ice — Off
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 8 of 16)

EFFECTIVITY
F

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	1,000	20350	20370	20380	20370	20330	20300
	2,000	20350	20370	20380	20370	20330	20300
	3,000	19050	18910	18770	18590	18420	18250
	4,000	17180	17060	16930	16760	16590	16430
	5,000	15770	15620	15480	15310	15150	14990
	6,000	14540	14390	14230	14060		
	7,000						
	8,000						
	9,000						
300	1,000	18490	18510	18520	18500	18470	18430
	2,000	18490	18510	18520	18500	18470	18430
	3,000	18490	18510	18520	18500	18420	18250
	4,000	17180	17060	16930	16760	16590	16430
	5,000	15770	15620	15480	15310	15150	14990
	6,000	14540	14390	14230	14060		
	7,000						
	8,000						
	9,000						
400	1,000	16890	16900	16910	16900	16860	16830
	2,000	16890	16900	16910	16900	16860	16830
	3,000	16890	16900	16910	16900	16860	16830
	4,000	16890	16900	16910	16760	16590	16430
	5,000	15770	15620	15480	15310	15150	14990
	6,000	14540	14390	14230	14060		
	7,000						
	8,000						
	9,000						
500	1,000	15460	15470	15480	15470	15430	15400
	2,000	15460	15470	15480	15470	15430	15400
	3,000	15460	15470	15480	15470	15430	15400
	4,000	15460	15470	15480	15470	15430	15400
	5,000	15460	15470	15480	15310	15150	14990
	6,000	14540	14390	14230	14060		
	7,000						
	8,000						
	9,000						
600	1,000	14190	14210	14210	14200	14170	14130
	2,000	14190	14210	14210	14200	14170	14130
	3,000	14190	14210	14210	14200	14170	14130
	4,000	14190	14210	14210	14200	14170	14130
	5,000	14190	14210	14210	14200	14170	14130
	6,000	14190	14210	14210	14060		
	7,000						
	8,000						
	9,000						
700	1,000						
	2,000						
	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
800	1,000						
	2,000						
	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
900	1,000						
	2,000						
	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						

45-1256

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — SEA LEVEL

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — Sea Level
APR — On
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 9 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C -40	-30	-20	-10	0	10
200	3,000	20390	20400	20390	20350	20310	20260
	4,000	20390	20400	20390	20350	20310	20260
	5,000	19210	19090	18950	18740	18550	18370
	6,000	17340	17210	17070	16890	16710	16540
	7,000	15940	15780	15620	15420	15240	15070
	8,000	14700	14540	14370	14180	14010	
	9,000						
	10,000						
	11,000						
300	3,000	18520	18530	18520	18490	18440	18400
	4,000	18520	18530	18520	18490	18440	18400
	5,000	18520	18530	18520	18490	18440	18370
	6,000	17340	17210	17070	16890	16710	16540
	7,000	15940	15780	15620	15420	15240	15070
	8,000	14700	14540	14370	14180	14010	
	9,000						
	10,000						
	11,000						
400	3,000	16910	16920	16910	16880	16840	16800
	4,000	16910	16920	16910	16880	16840	16800
	5,000	16910	16920	16910	16880	16840	16800
	6,000	16910	16920	16910	16880	16710	16540
	7,000	15940	15780	15620	15420	15240	15070
	8,000	14700	14540	14370	14180	14010	
	9,000						
	10,000						
	11,000						
500	3,000	15480	15490	15480	15450	15410	15360
	4,000	15480	15490	15480	15450	15410	15360
	5,000	15480	15490	15480	15450	15410	15360
	6,000	15480	15490	15480	15450	15410	15360
	7,000	15480	15490	15480	15420	15240	15070
	8,000	14700	14540	14370	14180	14010	
	9,000						
	10,000						
	11,000						
600	3,000	14220	14220	14220	14180	14140	14100
	4,000	14220	14220	14220	14180	14140	14100
	5,000	14220	14220	14220	14180	14140	14100
	6,000	14220	14220	14220	14180	14140	14100
	7,000	14220	14220	14220	14180	14140	14100
	8,000	14220	14220	14220	14180	14010	
	9,000						
	10,000						
	11,000						
700	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
800	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
900	3,000						
	4,000						
	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						

45-1257

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 2000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 2000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE:
- -Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- -Maximum gross takeoff weight is 21,500 lb (9752 kg).
- -The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- -Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- -Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 10 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C -40	-30	-20	-10	0	10
200	5,000	20430	20450	20410	20360	20300	20240
	6,000	20430	20450	20410	20360	20300	20240
	7,000	19320	19190	19030	18830	18620	18340
	8,000	17450	17310	17150	16980	16790	16510
	9,000	16060	15900	15710	15520	15340	15020
	10,000	14830	14640	14460	14280	14110	
	11,000						
	12,000						
	13,000						
300	5,000	18560	18570	18540	18490	18440	18380
	6,000	18560	18570	18540	18490	18440	18380
	7,000	18560	18570	18540	18490	18440	18340
	8,000	17450	17310	17150	16980	16790	16510
	9,000	16060	15900	15710	15520	15340	15020
	10,000	14830	14640	14460	14280	14110	
	11,000						
	12,000						
	13,000						
400	5,000	16950	16960	16930	16880	16830	16770
	6,000	16950	16960	16930	16880	16830	16770
	7,000	16950	16960	16930	16880	16830	16770
	8,000	16950	16960	16930	16880	16790	16510
	9,000	16060	15900	15710	15520	15340	15020
	10,000	14830	14640	14460	14280	14110	
	11,000						
	12,000						
	13,000						
500	5,000	15520	15530	15500	15450	15400	15340
	6,000	15520	15530	15500	15450	15400	15340
	7,000	15520	15530	15500	15450	15400	15340
	8,000	15520	15530	15500	15450	15400	15340
	9,000	15520	15530	15500	15450	15340	15020
	10,000	14830	14640	14460	14280	14110	
	11,000						
	12,000						
	13,000						
600	5,000	14260	14260	14230	14180	14130	14070
	6,000	14260	14260	14230	14180	14130	14070
	7,000	14260	14260	14230	14180	14130	14070
	8,000	14260	14260	14230	14180	14130	14070
	9,000	14260	14260	14230	14180	14130	14070
	10,000	14260	14260	14230	14180	14110	
	11,000						
	12,000						
	13,000						
700	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
800	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
900	5,000						
	6,000						
	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						

45-1258

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 4000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 4000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).

- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.

- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.

-Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 11 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	7,000	20360	20340	20290	20230	20170	19730
	8,000	20360	20340	20290	20230	20170	19730
	9,000	19460	19300	19130	18950	18740	17370
	10,000	17560	17390	17220	17050	16870	15560
	11,000	16110	15960	15770	15590	15390	14070
	12,000	14850	14670	14490	14310	14100	
	13,000						
	14,000						
	15,000						
300	7,000	18470	18460	18420	18360	18300	17880
	8,000	18470	18460	18420	18360	18300	17880
	9,000	18470	18460	18420	18360	18300	17370
	10,000	17560	17390	17220	17050	16870	15560
	11,000	16110	15960	15770	15590	15390	14070
	12,000	14850	14670	14490	14310	14100	
	13,000						
	14,000						
	15,000						
400	7,000	16880	16860	16820	16770	16710	16290
	8,000	16880	16860	16820	16770	16710	16290
	9,000	16880	16860	16820	16770	16710	16290
	10,000	16880	16860	16820	16770	16710	15560
	11,000	16110	15960	15770	15590	15390	14070
	12,000	14850	14670	14490	14310	14100	
	13,000						
	14,000						
	15,000						
500	7,000	15450	15430	15390	15330	15270	14870
	8,000	15450	15430	15390	15330	15270	14870
	9,000	15450	15430	15390	15330	15270	14870
	10,000	15450	15430	15390	15330	15270	14870
	11,000	15450	15430	15390	15330	15270	14070
	12,000	14850	14670	14490	14310	14100	
	13,000						
	14,000						
	15,000						
600	7,000	14180	14160	14120	14060	14010	
	8,000	14180	14160	14120	14060	14010	
	9,000	14180	14160	14120	14060	14010	
	10,000	14180	14160	14120	14060	14010	
	11,000	14180	14160	14120	14060	14010	
	12,000	14180	14160	14120	14060	14010	
	13,000						
	14,000						
	15,000						
700	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
800	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
900	7,000						
	8,000						
	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						

45-1259

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 6000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 6000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 12 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB							
Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	9,000	20300	20270	20230	20160	20060	17210
	10,000	20300	20270	20230	20160	20060	17210
	11,000	19530	19370	19210	19040	18530	15600
	12,000	17540	17370	17190	17020	16530	14020
	13,000	16030	15860	15680	15480	15000	
	14,000	14720	14540	14370	14140		
	15,000						
	16,000						
	17,000						
300	9,000	18410	18380	18340	18280	18200	15440
	10,000	18410	18380	18340	18280	18200	15440
	11,000	18410	18380	18340	18280	18200	15440
	12,000	17540	17370	17190	17020	16530	14020
	13,000	16030	15860	15680	15480	15000	
	14,000	14720	14540	14370	14140		
	15,000						
	16,000						
	17,000						
400	9,000	16820	16790	16760	16700	16610	
	10,000	16820	16790	16760	16700	16610	
	11,000	16820	16790	16760	16700	16610	
	12,000	16820	16790	16760	16700	16530	
	13,000	16030	15860	15680	15480	15000	
	14,000	14720	14540	14370	14140		
	15,000						
	16,000						
	17,000						
500	9,000	15390	15360	15320	15260	15180	
	10,000	15390	15360	15320	15260	15180	
	11,000	15390	15360	15320	15260	15180	
	12,000	15390	15360	15320	15260	15180	
	13,000	15390	15360	15320	15260	15000	
	14,000	14720	14540	14370	14140		
	15,000						
	16,000						
	17,000						
600	9,000	14120	14090	14050			
	10,000	14120	14090	14050			
	11,000	14120	14090	14050			
	12,000	14120	14090	14050			
	13,000	14120	14090	14050			
	14,000	14120	14090	14050			
	15,000						
	16,000						
	17,000						
700	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
800	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
900	9,000						
	10,000						
	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						

45-1260

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 8000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 8000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 13 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C -40	-30	-20	-10	0	10
200	11,000	20190	20170	20140	20100	18690	15010
	12,000	20190	20170	20140	20100	18690	15010
	13,000	19300	19150	18980	18650	17150	14080
	14,000	17240	17070	16860	16540	15390	
	15,000	15700	15540	15320	14970		
	16,000	14360	14210				
	17,000						
	18,000						
	19,000						
300	11,000	18280	18260	18230	18190	16940	
	12,000	18280	18260	18230	18190	16940	
	13,000	18280	18260	18230	18190	16940	
	14,000	17240	17070	16860	16540	15390	
	15,000	15700	15540	15320	14970		
	16,000	14360	14210				
	17,000						
	18,000						
	19,000						
400	11,000	16690	16670	16640	16600	15350	
	12,000	16690	16670	16640	16600	15350	
	13,000	16690	16670	16640	16600	15350	
	14,000	16690	16670	16640	16540	15350	
	15,000	15700	15540	15320	14970		
	16,000	14360	14210				
	17,000						
	18,000						
	19,000						
500	11,000	15250	15230	15200	15170		
	12,000	15250	15230	15200	15170		
	13,000	15250	15230	15200	15170		
	14,000	15250	15230	15200	15170		
	15,000	15250	15230	15200	14970		
	16,000	14360	14210				
	17,000						
	18,000						
	19,000						
600	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
700	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
800	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
900	11,000						
	12,000						
	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						

45-1261

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 10,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 10,000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 14 of 16)

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	13,000	19650	19630	19600	19170	16920	
	14,000	19650	19630	19600	19170	16920	
	15,000	18710	18550	18130	17450	15600	
	16,000	16660	16500	16120	15550		
	17,000	15120	14970	14530	14020		
	18,000						
	19,000						
	20,000						
	21,000						
300	13,000	17760	17740	17710	17360	15160	
	14,000	17760	17740	17710	17360	15160	
	15,000	17760	17740	17710	17360	15160	
	16,000	16660	16500	16120	15550		
	17,000	15120	14970	14530	14020		
	18,000						
	19,000						
	20,000						
	21,000						
400	13,000	16160	16150	16120	15780		
	14,000	16160	16150	16120	15780		
	15,000	16160	16150	16120	15780		
	16,000	16160	16150	16120	15550		
	17,000	15120	14970	14530	14020		
	18,000						
	19,000						
	20,000						
	21,000						
500	13,000	14750	14730	14710	14370		
	14,000	14750	14730	14710	14370		
	15,000	14750	14730	14710	14370		
	16,000	14750	14730	14710	14370		
	17,000	14750	14730	14530	14020		
	18,000						
	19,000						
	20,000						
	21,000						
600	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
700	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
800	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
900	13,000						
	14,000						
	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						

45-1262

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 12,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 12,000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE:
- Takeoff gross weight limited by required departure procedure (DP) climb gradient.
- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Figure 8-23.1
(Sheet 15 of 16)

ONE ENGINE OPERATING
FLAPS — 20°
APR — ON
ANTI-ICE — ON
AIRPORT PRESSURE ALTITUDE — 14,000 FT

This table was prepared for the following conditions:

All Engines Operating
Flaps — 20°
Airport Pressure Altitude — 14,000 ft
APR — On
Anti-Ice — On
Zero Wind

NOTE: -Takeoff gross weight limited by required departure procedure (DP) climb gradient.

- Maximum gross takeoff weight is 21,500 lb (9752 kg).
- The value obtained from this chart may not be the limiting weight. The takeoff weight is also limited by takeoff weight for runway length available, obstacle clearance considerations, climb weight limit, or brake energy limits.
- Increase takeoff weight by 100 lb for each 10 kts of headwind up to a maximum of 30 kts.
- Decrease takeoff weight by 100 lb for each 1 kt of tailwind up to a maximum of 10 kts.

Takeoff Gross Weight Limited by Required SID Climb Gradient - LB

Required SID Climb Gradient (FT/NM)	SID Altitude (ft, MSL)	Temperature - °C					
		-40	-30	-20	-10	0	10
200	15,000	18840	18790	18230	17420	14870	
	16,000	18840	18790	18230	17420	14870	
	17,000	17760	17470	16810	15990		
	18,000	15820	15590	15060	14290		
	19,000	14270	14070				
	20,000						
	21,000						
	22,000						
	23,000						
300	15,000	17030	16980	16470	15670		
	16,000	17030	16980	16470	15670		
	17,000	17030	16980	16470	15670		
	18,000	15820	15590	15060	14290		
	19,000	14270	14070				
	20,000						
	21,000						
	22,000						
	23,000						
400	15,000	15470	15420	14900	14120		
	16,000	15470	15420	14900	14120		
	17,000	15470	15420	14900	14120		
	18,000	15470	15420	14900	14120		
	19,000	14270	14070				
	20,000						
	21,000						
	22,000						
	23,000						
500	15,000	14070	14020				
	16,000	14070	14020				
	17,000	14070	14020				
	18,000	14070	14020				
	19,000	14020					
	20,000						
	21,000						
	22,000						
	23,000						
600	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
	22,000						
	23,000						
700	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
	22,000						
	23,000						
800	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
	22,000						
	23,000						
900	15,000						
	16,000						
	17,000						
	18,000						
	19,000						
	20,000						
	21,000						
	22,000						
	23,000						

45-1263

Figure 8-23.1
(Sheet 16 of 16)

EFFECTIVITY
F