# OPERATING MANUAL

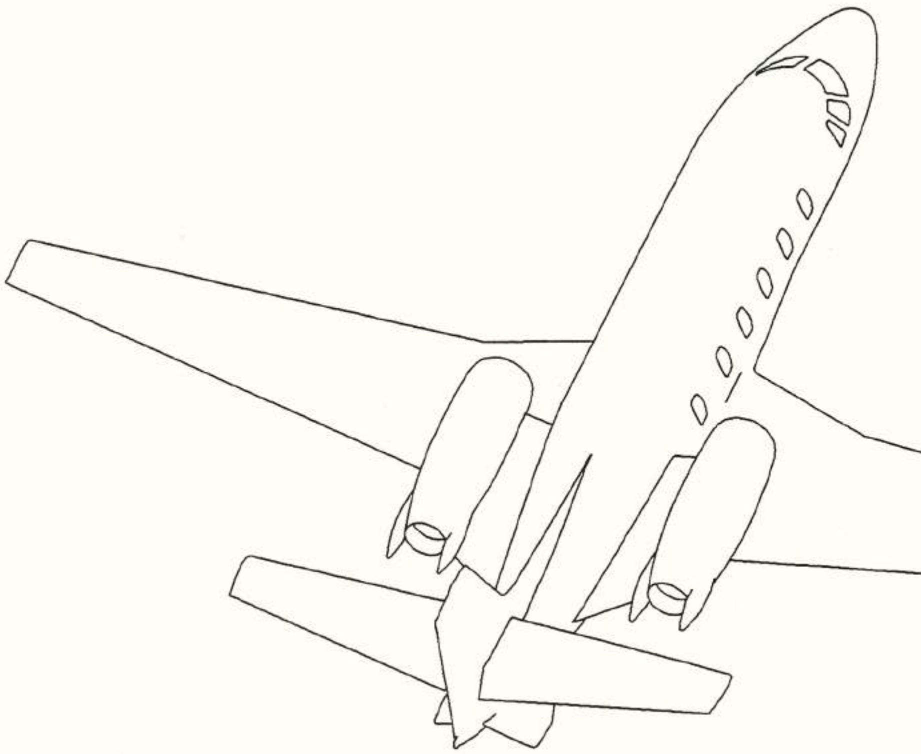
cessna/CITATION

Cessna
A Textron Company

# Operating Manual

# Citation Excel

**MODEL 560XL**
**560-5001 AND ON**



**Member of GAMA**



56XOM-04

**13 JULY 1998**

REVISION 4 22 AUGUST 2000

# LOG OF EFFECTIVE PAGES

Use this page to determine the currency and applicability of your Operating Manual. Determine which pages are applicable to your airplane by checking effectivity of each page, which is listed after each page entry where an airplane serialization is required. Only the pages applicable to your airplane should be retained in the Operating Manual. This manual pertains to Model 560 Excel airplanes, serial number 560-5001 and On.

In addition to the serialization shown on the effectivity pages, pages that apply to certain airplanes have the applicable airplane configuration code on the bottom of the pages. Pages not serialized apply to all airplanes.

Refer to page Introduction-4 for an explanation of airplane configuration codes.

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

Revision Number - Indicates the revision number of the applicable manual.
Date - Indicates the date on which the manual (or revisions to the manual) were issued.
Page - Describes the page (or pages) in question. Page numbers with a slash (/) indicates text or illustration on the first page and a blank backup on the second page.
Rev Level - Indicates the revision level of the page (or pages).
Configuration Code - When required for effectivity, the applicable configuration code is listed below the page. (Refer to pages Introduction-3 and Introduction-4 for an explanation of Configuration Codes).

| | REVISION NUMBER | DATE |
|---|---|---|
| Original | 0 | 13 July 1998 |
| Revision | 1 | 1 September 1998 |
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| Revision | 3 | 15 March 2000 |
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| 2-33 | 3 |
| 2-34 | 0 |
| 2-35 | 3 |
| 2-36 thru 2-37 | 0 |
| 2-38 | 2 |
| 2-38A/2-38B | 4 |
| 2-39 | 0 |
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| 2-40.1 | 3 |
| Configuration AC | |
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| 3-11 thru 3-12 | 0 |
| 3-13 | 4 |
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| 5-24 thru 5-25 | 0 |
| 5-26 thru 5-27 | 1 |
| 5-28 | 0 |

# CONTENTS

# INTRODUCTION

## SERIAL NUMBER

On all Model 560 Citation Excel airplanes, the unit and serial number is stamped into the airplane identification nameplate. This manual uses serial numbers to describe airplane effectivities.

## OPERATING MANUAL PART NUMBER

Each page in the Operating Manual contains the part number of the manual and the page status of each page; Refer to the following example:

56X - OM - 00

Page Status (Original)

Manual (Operating Manual)

Airplane Model (560XL)

## AIRPLANE CONFIGURATION CODES

The following is a list of airplane configuration codes which may appear at the bottom of the page of the Operating Manual, and which indicates page effectivity by serial number. If no configuration code appears on the page, the page is for all configurations. This list contains only the configurations which have been incorporated into this Operating Manual.

| Configuration Code | Effectivity by Serial Number |
|---|---|
| AA | Airplanes 560-5001 and On. |
| AB | Airplanes equipped with Rudder Bias System. |
| AC | Airplanes not equipped with Rudder Bias System. |

## COVERAGE

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

While the Operating Manual covers and expands upon FAA Approved Airplane Flight Manual information, the FAA approved document shall take precedence should a difference be noted.

## REVISIONS

As new information becomes available, the Operating Manual will be revised. Throughout this manual, revised material is identified by use of change bars or pointing hands.

### TEXT CHANGES

#### In The Main Body

A change bar located in the left margin adjacent to the applicable text will extend the full length of new material on new pages. On presently existing pages, a change bar will extend the length of new or revised text. Deleted text will be indicated with a change bar near the beginning of its previous location.

#### In Footers

A change bar in the footer will indicate one of the following conditions:

- A configuration code change.
- Unedited text has slid on or off of the page.
- There is slippage of text as well as a change in text on the same page (in this case, a change bar would appear adjacent to the edited text and in the footer).

### ILLUSTRATION CHANGES

A pointing hand or a change bar may be used to indicate changes to an existing illustration. If changes are minor, a change bar or pointing hand will appear adjacent to the changed portion of the illustration. If changes are extensive, a pointing hand or change bar will appear adjacent to the figure number. New figures will use only a pointing hand adjacent to the figure number.

## SERVICE BULLETIN CONFIGURATION LIST

| Number | Title | Airplane Serial Effectivity | Revision Incorporated | Incorporated In Airplane |
|---|---|---|---|---|
| SB560XL-27-06 | Rudder Bias | 560-5001 thru -5051, -5053 thru -5084, -5086 thru -5087 | 3 | |

## DEFINITIONS AND ABBREVIATIONS

| | |
|---|---|
| AC: | Alternating Current |
| Accelerate-Stop Distance: | The distance required to accelerate the aircraft and then abort the takeoff due to a failed engine, or other emergency, occurring just prior to $V_1$ with brake application commencing at $V_1$ |
| ADF: | Automatic Direction Finding |
| AHRS: | Attitude Heading Reference System |
| ADI: | Attitude Director Indicator |
| AIA: | Anti-icing Additive |
| Altitude: | All altitudes used in this manual are pressure altitudes unless otherwise stated. |
| AM or AME: | Amplitude Modulation. |
| Anti-Ice/Deice Systems: | The following systems comprise the anti-ice/deice systems:<br>a. Windshield Electric Anti-ice.<br>b. Wing Bleed Air Anti-Ice.<br>c. Engine Bleed Air Anti-Ice.<br>d. Pitot-Static system Anti-ice (includes electrical anti-ice for AOA vane).<br>e. Horizontal Stabilizer Pneumatic Deice.<br>Performance, when referred to ANTI-ICE ON, is based on the wing and engine anti-ice systems being operated at the same time. |
| ARM: | The horizontal distance from the reference datum to the center-of-gravity (C.G.) of an item. |
| ATC: | Air Traffic Control |
| Basic Empty Weight: | Standard empty weight plus installed optional equipment. |
| °C: | Temperature in degrees Celsius. |
| CAT II: | Category II Operation. A straight-in ILS approach to the runway of an airport under a Category II ILS instrument approach procedure. |
| CB: | Circuit Breaker |
| CDI: | Course Deviation Indicator |
| Center-of-Gravity (C.G.): | The point at which an airplane would balance if suspended. |

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|---|---|
| C.G. Arm: | The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight. |
| C.G. Limits: | The extreme center-of-gravity locations within which the airplane must be operated at a given weight. |
| Climb Gradient: | The ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval. |
| DC: | Direct Current |
| Demonstrated Crosswind: | The demonstrated crosswind velocity of 24 knots (measured at 10 meters above the runway surface) is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. This is not limiting. |
| DG: | Directional Gyro |
| DH: | Decision Height |
| DME: | Distance Measuring Equipment |
| Engine Cycle: | Any operational sequence involving engine start, power to 80 percent $N_1$ or above and engine shutdown. |
| Engine Out Accelerate-Go Distance: | The horizontal distance from brake release to the point at which the airplane attains a height of 35 feet above the runway surface on a takeoff during which an engine is recognized to have failed at $V_1$ and the takeoff is continued. |
| °F: | Temperature in degrees Fahrenheit |
| FAA: | Federal Aviation Administration |
| Flameout: | Unintentional loss of engine during operation. |
| FM: | Frequency Modulation |
| FMS: | Flight Management System |
| G: | Acceleration due to gravity. One G equals the pull of gravity with no acceleration. |
| Gross Climb Gradient: | The climb gradient that the airplane can actually achieve with ideal ambient conditions (smooth air). |
| HF: | High Frequency |

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| Hot Start: | An engine start, or attempted start, which results in an interstage turbine temperature exceeding 720°C or which otherwise exceeds the engine starting temperature envelope limits. |
| Hr: | Hour |
| HSI: | Horizontal Situation Indicator |
| Hz: | Hertz |
| In. Hg: | Inches of Mercury |
| IOAT: | The indicated outside air temperature as read from the indicator on the instrument panel. It is the same as RAT. |
| IFR: | Instrument Flight Rules |
| ISA: | International Standard Atmosphere in which:<br>a. The air is a dry perfect gas;<br>b. The temperature at sea level is 15°C (59°F);<br>c. The pressure at sea level (standard datum plane) is 29.92 inches Hg. (1013.2 Mb);<br>d. The temperature gradient from sea level to the altitude at which the temperature is -56.5°C will be -1.98°C per 1000 feet. |
| ITT: | Interstage Turbine Temperature. Engine operating temperature taken between the high and low pressure turbine sections. |
| Jack Point: | One of three points on the airplane designed to rest on a jack. |
| KCAS: | Indicated airspeed (knots) corrected for position error (instrument error is assumed to be zero). |
| kHz: | Kilohertz |
| KIAS: | Airspeed indicator reading (knots). Zero instrument error is assumed. |
| KTAS: | True airspeed expressed in knots |
| Landing Distance: | The distance from a point 50 feet above the runway surface to the point at which the airplane would come to a full stop on the runway. |
| Lb: | Pound |
| Lb/hr: | Pounds-per-hour |
| LH: | Left Hand |
| LSB: | Lower Side Band |

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| M or Mach: | Mach Number. The ratio of true airspeed to the speed of sound. |
| MAC: | Mean Aerodynamic Chord. The chord of an imaginary airfoil which, throughout the flight range, will have the same force vectors as those of the wing. |
| MFD: | Multi Function Display |
| Maximum Brake Energy Speed: | The maximum speed from which a stop can be accomplished within the energy capabilities of the brakes. |
| Maximum Continuous Power: | The power developed at 720°C ITT or 100.0 percent $N_1$ RPM, which is the maximum power setting without a time limit. |
| Maximum Cruise Thrust Setting | Maximum power setting recommended for cruise thrust. |
| Maximum Landing Weight: | Maximum weight approved for landing touchdown. |
| Maximum Ramp Weight: | Maximum weight approved for ground maneuver. It includes engine start and taxi fuel. |
| Maximum Zero Fuel Weight: | Maximum weight exclusive of usable fuel. |
| Mb: | Millibars |
| Moment: | The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.) |
| MHz: | Megahertz |
| Multiengine Normal Climb Thrust Setting | Maximum power setting recommended for normal multiengine climb. |
| $N_1$: | Low pressure turbine speed. The fan is attached to the low pressure turbine. |
| $N_2$: | High pressure turbine speed. |
| Net Climb Gradient: | The gross climb gradient reduced by 0.8 percent during the takeoff phase and 1.1 percent during enroute. This conservatism is required by FAR Part 25 for terrain clearance determination to account for variables encountered in service. |
| OAT or TEMP: | Outside Air Temperature or Ambient Air Temperature. The free air static temperature, obtained either from ground meteorological sources or from in flight temperature indications adjusted for instrument error and compressibility effects. |

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| Payload: | Weight of occupants, cargo and baggage. |
| PFD: | Primary Flight Display |
| Position Correction: | A correction applied to indicated airspeed or altitude to eliminate the effect of the location of the static pressure source on the instrument reading. No position corrections are required when using performance section charts in Section VII since all airspeeds and altitudes in this section are presented as "indicated" values except for stall speeds which are presented as "calibrated" values. |
| Power Lever: | Engine power control; synonymous with throttle in same terminology. |
| Pressure Altitude: | Altitude measured from standard sea level pressure (29.92 inches Hg) (standard datum plane) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this manual, altimeter instrument errors are assumed to be zero. |
| PSI: | Pounds-per-Square Inch |
| PSIG: | Pounds-per-Square Inch Gage |
| RAT: | Ram Air Temperature. The indicated outside air temperature as read from the indicator on the instrument panel. |
| REF: | Reference |
| Reference Datum: | An imaginary vertical plane from which all horizontal distances are measured for center-of-gravity purposes. |
| Reference Zero: | The point in the takeoff flight path at which the airplane is 35 feet (dry runway) or 15 feet (wet runway) above the takeoff surface and at the end of the takeoff distance required. |
| Residual Fuel: | The undrainable fuel remaining when the airplane is defueled in a specific attitude by the normal means and procedures specified for draining the tanks. |
| Residual Ice: | The ice which is not completely removed from the leading edge stagnation areas of the wing and horizontal stabilizer by the surface anti-ice/deice system during operation in icing conditions. |
| Reverse Thrust: | The thrust produced when the thrust reverser deflectors are deployed into the engine exhaust stream. |

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| RH: | Right Hand |
| RMI: | Radio Magnetic Indicator |
| RNAV: | Area Navigation |
| RPM: | Revolutions-per-Minute. |
| R/T: | Receiver Transmitter |
| SAT: | Static Air Temperature. The temperature of the air undisturbed by the presence or motion of the airplane. SAT and OAT are similar terms. |
| SRC: | Standby Radio Control |
| SSB: | Single Side Band |
| Standard Empty Weight: | Weight of a standard airplane including unusable fuel, full oil and full operating fluids. |
| Station: | A location along the airplane fuselage given in terms of distance from the reference datum plane. |
| STD: | Standard |
| Tachometer: | Indicates the speed of the engine in percent of a specific reference RPM. Tachometers are provided for $N_1$ (fan RPM) and $N_2$ (turbine RPM).<br>$N_1$ (fan) RPM; 100% = 13,034.<br>$N_2$ (turbine) RPM; 100% = 32,700. |
| Takeoff Field Length: | The Takeoff Field Length given for each combination of gross weight, ambient temperature, altitude, wind and runway gradients is the greatest of the following:<br>a. 115 percent of the two-engine horizontal takeoff distance from start to a height of 35 feet above runway surface.<br>b. Accelerate-stop distance.<br>c. The engine-out accelerate-go distance to 35 feet for dry runways and 15 feet for wet runways.<br>No specific identification is made on the charts as to which of these distances governs a specific case. |
| Takeoff Power: | Power setting used for takeoff, limited to 5 minutes duration, not to exceed 720°C ITT or 100.0 percent $N_1$ RPM. |
| TAS: | True Airspeed. The airspeed relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility factor. |

| | |
|---|---|
| TAT: | Total Air Temperature. Air which has had its temperature increased due to adiabatic compression caused by the speed of the airplane. TAT and RAT are similar terms. |
| Temperature Compressibility Effects: | An error in the indication of temperature caused by airflow over the temperature probe. The error varies depending on altitude and airspeed. |
| Tower Wind: | Wind reported by the tower or from an FAA source, usually measured at a height of 10 meters above the runway, used for computation of takeoff and landing data. |
| True Airspeed (KTAS): | The airspeed (knots) of an airplane relative to undisturbed air. |
| True Mach Number: | The displayed Mach number with position error removed. |
| UHF: | Ultra High Frequency |
| Unusable Fuel: | Fuel remaining after fuel runout tests have been completed in accordance with governmental regulations. |
| U.S.: | United States |
| Usable Fuel: | Fuel available for flight planning. |
| USB: | Upper Side Band |
| $V_1$: | Takeoff decision speed. The distance to continue the takeoff to 35 feet (dry runway) or 15 feet (wet runway) will not exceed the scheduled takeoff field length if recognition occurred at $V_1$ (accelerate-go). The distance to bring the airplane to a full stop (accelerate-stop) will not exceed the scheduled takeoff field length provided that the brakes are applied at $V_1$. |
| $V_2$: | Takeoff safety speed. This climb speed is the actual speed at 35 feet above the runway surface as demonstrated in flight during takeoff with one engine inoperative. |
| $V_{35}$: | This climb speed is the actual speed at 35 feet above the runway surface as demonstrated in flight during takeoff with both engines operating. |
| $V_A$: | The maneuvering speed is the maximum speed at which application of full available aerodynamic control will not over stress the airplane. |
| $V_{APP}$: | The approach climb airspeed (1.3 $VS_1$) with 15-degree flap position, landing gear UP. |

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| $V_{ENR}$: | Single-engine enroute climb speed. |
| $V_{FE}$: | Maximum flap extended speed. The highest speed permissible with wing flaps in a prescribed extended position. |
| $V_{LE}$: | Maximum landing gear extended speed. The maximum speed at which an airplane can be safely flown with the landing gear extended. |
| $V_{LO}$: | Maximum landing gear operating speed. The maximum speed at which the landing gear can be safely extended or retracted. |
| $V_{MC_A}$: | Minimum airspeed in flight at which directional control can be maintained, when one engine is suddenly made inoperative. $V_{MC_A}$ is a function of engine thrust which varies with altitude and temperature. The $V_{MC_A}$ presented in Section I was determined for maximum thrust. |
| $V_{MC_G}$: | Minimum airspeed on the ground at which directional control can be maintained, when one engine is suddenly made inoperative, using only aerodynamic controls. $V_{MC_G}$ is a function of engine thrust which varies with altitude and temperature. The $V_{MC_G}$ presented in Section II was determined for maximum thrust. |
| $V_{MCL}$: | Minimum airspeed in the air, in the landing configuration, at which directional control can be maintained, when one engine is suddenly made inoperative. $V_{MCL}$ is a function of engine thrust which varies with altitude and temperature. $V_{MCL}$ is 92 KIAS at maximum takeoff thrust. |
| $V_{MO}/M_{MO}$: | Maximum Operating Limit Speed is the calibrated speed limit that may not be deliberately exceeded in normal flight operations. V is expressed in knots and M in Mach number. |
| $V_R$: | The rotation speed is the speed at which rotation is initiated during takeoff to attain the $V_2$ climb speed at or before a height of 35 feet above runway surface has been reached. |
| $V_{REF}$: | The landing approach airspeed at the 50-foot point with flaps in landing position and landing gear extended (1.3 $V_{SO}$). |
| $V_{SO}$: | The stalling speed or minimum steady flight speed in the landing configuration. |
| $V_{S1}$: | The stalling speed or minimum steady flight speed obtained in a specified configuration. |

| | |
|---|---|
| VA: | Volt Amperes |
| VAC: | Volts Alternating Current |
| VHF: | Very High Frequency |
| VLF: | Very Low Frequency |
| VNAV: | Vertical Navigation |
| VOR: | Very High Frequency Omnidirectional Radio Range |
| VOT: | Very High Frequency Omnidirectional Test |
| Visible Moisture: | Visible moisture includes, but is not limited to the following conditions: fog or clouds with visibility less than 1 mile, wet snow and rain. |
| Wet Runway | A runway is considered wet when there is sufficient moisture on the surface to appear reflective, but without significant areas of standing water. |
| Wind: | The wind velocities recorded as variables on the charts of this manual are to be understood to refer to the headwind or tailwind components of the actual winds at 10 meters above the runway surface (tower winds). |
| Windmill: | Engine turbine rotation from airstream inputs. |
| WPT: | Waypoint |

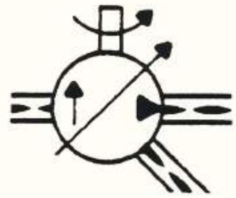
# STANDARD SYSTEM SYMBOLS

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

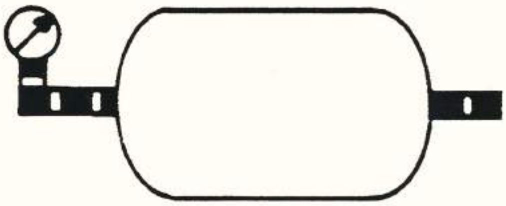
Symbols utilized in electrical schematics follow the Standard System Symbols.

## HYDRAULIC/PNEUMATIC SYSTEM SYMBOLS

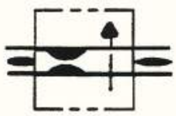
HYDRAULIC PUMP
ENGINE DRIVEN OR
ELECTRIC MOTOR
DRIVEN



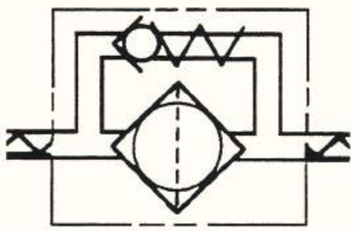
PNEUMATIC RESERVOIR
(BOTTLE) WITH
PRESSURE GAGE



FLOW
REGULATOR



FILTER WITH
BYPASS



HYDROPNEUMATIC
ACCUMULATOR WITH
PRESSURE GAGE

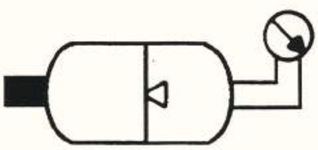
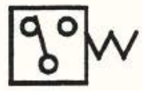


Figure 1-1

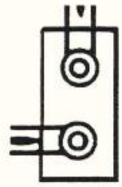
## HYDRAULIC/PNEUMATIC SYSTEM SYMBOLS (Continued)

PRESSURE SWITCH

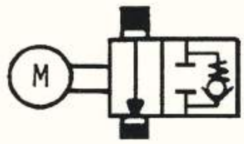


RESTRICTOR

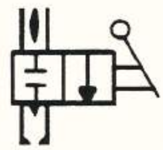
GROUND SERVICE, EXTERNAL
QUICK DISCONNECTS



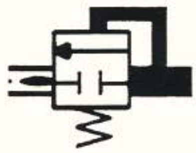
SHUTOFF VALVE WITH
PRESSURE RELIEF
TWO-POSITION - 2-WAY
(MOTOR ACTUATED)



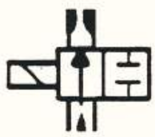

SHUTOFF VALVE WITH
TWO-POSITION - 2-WAY
(MANUALLY ACTUATED)



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



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



VALVE
TWO-POSITION - 3-WAY
(SOLENOID OPERATED)

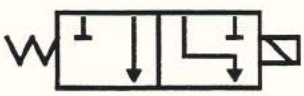


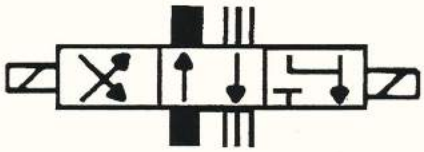
Figure 1-2

## HYDRAULIC/PNEUMATIC SYSTEM SYMBOLS (Continued)

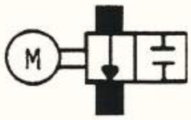
SHUTTLE VALVE

CHECK VALVE

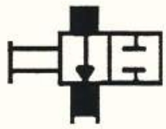
LANDING GEAR CONTROL
MODULE MANIFOLD VALVE
THREE-POSITION - 4-WAY
(SOLENOID OPERATED)



VALVE
TWO-POSITION - 2-WAY
(MOTOR (M) DRIVEN)




VALVE
TWO-POSITION - 2 - WAY
(MECHANICALLY ACTUATED)



ACTUATOR

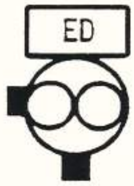
## FUEL SYSTEM SYMBOLS

PUMP
(EJECTOR)

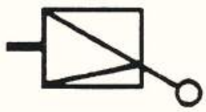
PUMP
(FUEL PRESSURE (FP) DRIVEN)


PUMP
(DC MOTOR (DCM) DRIVEN)


PUMP
(ENGINE DRIVEN (ED)

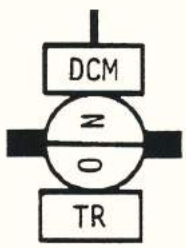



FLOAT SWITCH



FILTER WITH
BYPASS RELIEF VALVE

SHUTOFF VALVE - NORMAL OPEN
(THERMAL RELIEF (TR) -
DC MOTOR (DCM) DRIVEN)

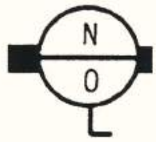


## FUEL SYSTEM SYMBOLS (Continued)

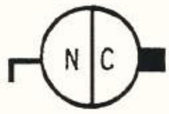
CHECK VALVE

RELIEF VALVE

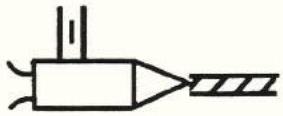
SHUTOFF VALVE - NORMAL OPEN
(MANUALLY OPERATED)




SHUTOFF VALVE - NORMAL CLOSED
(MANUALLY OPERATED)

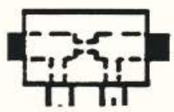



LEVEL CONTROL VALVE

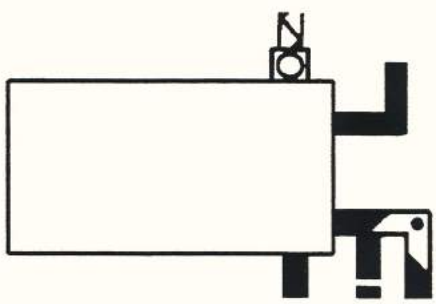


QUICK COUPLER

ORIFICE - FLOW
SENSE UNIT

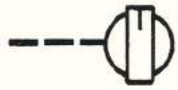


STORAGE TANK

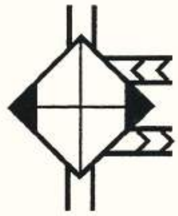


## BLEED AIR/DEICE AND VACUUM SYSTEM SYMBOLS

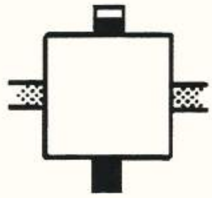
CONTROL



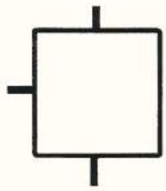
HEAT
EXCHANGER



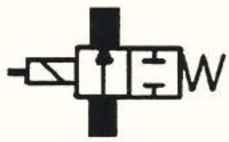
OR



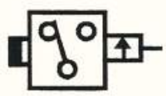
TEMPERATURE
CONTROL
UNIT



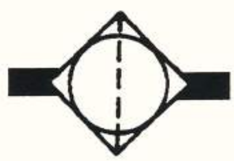
PRESSURE REGULATING
AND SHUTOFF VALVE
TWO-POSITION - 2-WAY
(SOLENOID OPERATED)



PRESSURE
SWITCH



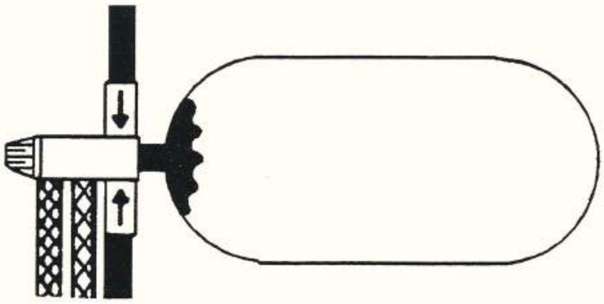
FILTER



DEICE CONTROL
VALVE

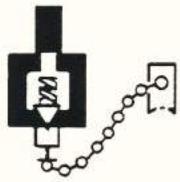
## OXYGEN SYSTEM SYMBOLS

OXYGEN CYLINDER



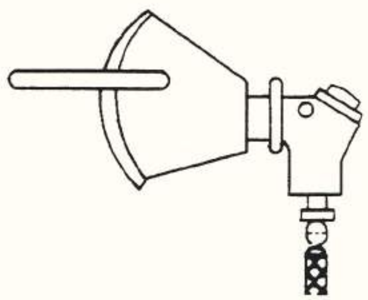
GAGE

FILLER VALVE
AND PROTECTIVE CAP



OVERBOARD DISCHARGE
INDICATOR
(VENT PORT)

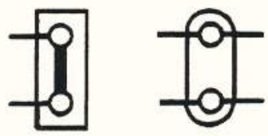
MASK (CREW)



## ELECTRICAL SYMBOLS

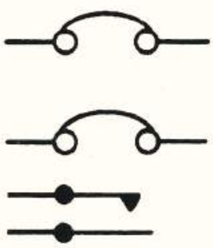
BATTERY


BUS



CAPACITOR

CIRCUIT BREAKER



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

CURRENT TRANSFORMER

Current flowing in wire produces a voltage in coil.

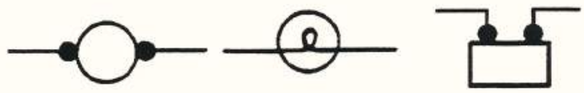
DIODE

## ELECTRICAL SYMBOLS (Continued)

FUSE/LIMITER

GROUND

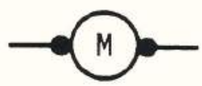
LAMP



METER/INDICATOR

MICROPHONE

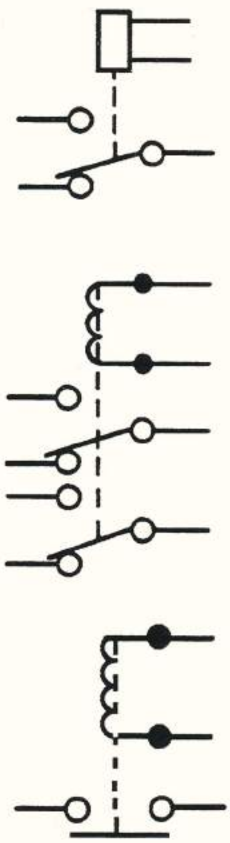
MOTOR



## ELECTRICAL SYMBOLS (Continued)

RELAY

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



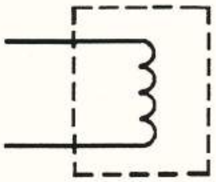
RESISTOR

REGULAR - resistance does not change.


TEMPERATURE CONTROLLED - resistance changes with the temperature.

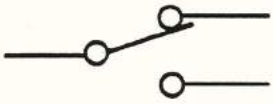
## ELECTRICAL SYMBOLS (Continued)

SOLENOID/SOLENOID VALVE

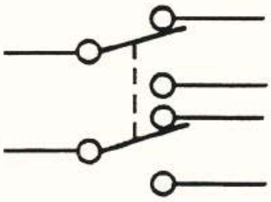


NO (normally open) or NC (normally closed) by a solenoid operated valve indicates the position of the valve with no power applied to the solenoid.

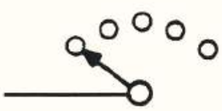
SINGLE POLE/SINGLE THROW (SPST)



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



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



ROTARY OR MULTI POSITION

# SECTION 1

# DESCRIPTION AND SPECIFICATIONS



(Continued Next Page)

# DESCRIPTION AND SPECIFICATIONS (Continued)

OPERATING LIMITATIONS (Continued)

# GENERAL DESCRIPTION

The Cessna Model 560 Excel is certified in accordance with FAR Part 25 airworthiness standards and utilizes the fail-safe construction concept. It combines systems simplicity with ease of access to reduce maintenance requirements. Low takeoff and landing speeds permit operation at small and unimproved airports. Front fan type turbofan engines contribute to overall operating efficiency and performance.

## FLIGHT CONTROLS

Primary flight control is accomplished through conventional cable-operated surfaces. Trimming is provided by aileron, elevator and rudder tabs. Hydraulically operated speed brakes are installed on the upper and lower surface of both wings. The horizontal stabilizer with a two-position angle-of-incidence setting (cruise verses takeoff/landing) is hydraulically actuated. Trailing edge flaps are powered hydraulically. Nose wheel steering is mechanically controlled by the rudder pedals.

## ENGINES

Two Pratt & Whitney Canada Inc. PW545A turbofans installed on the rear fuselage produce 3804 pounds of thrust each for takeoff, up to an ambient temperature of 83°F, and 3767 pounds of thrust at maximum continuous thrust setting. The engines have electronic fuel controls with hydromechanical backup. Ice protection and fire detection and extinguishing systems are incorporated. Fuel is carried in two integral wing tanks with each engine normally supplied from its respective side. Cross-feeding can be selected. Target-type thrust reversers are individually operated by conventional "piggy back" controls mounted on the throttles. Fueling is done through a single point pressure refueling system on the right side of the fuselage forward of the wing or through an overwing filler port in each tank.

## FUSELAGE

Sequentially from front to rear are the avionics bay with the radar antenna, the nose avionics area, forward pressure bulkhead; flight deck, passenger and aft cabin compartments; rear pressure bulkhead and aft compartment (including tailcone/equipment and aft baggage compartments).

The flight deck is equipped with dual controls and both crew seats can be moved vertically, horizontally, and tilted.

The passenger compartment provides seating, an air outlet, a light and an oxygen mask for each occupant. The rear seats may be moved laterally away from the sidewall, tracked fore and aft, or reclined. The tailcone compartment contains equipment and systems components.

## ELECTRICAL SYSTEM

The main Direct Current (DC) buses are supplied from two 28-volt DC, 300 ampere, engine driven starter/generators. Engine starting and secondary DC power is available from either a 44-ampere-hour battery or an external source. An optional 43-ampere-hour battery is available. Two engine-driven 30 kVA AC Alternators, one on each engine, are dedicated to the windshield anti-ice system.

## HYDRAULIC SYSTEM

Engine-driven pumps supply pressure for operation of the landing gear, flaps, thrust reversers, horizontyal tail, angle-of-incidence actuator and speedbrakes through an open center system. The main gear is equipped with wheel brakes actuated hydraulically from a separate, closed system. Pneumatic backup is available for landing gear extension and braking.

## ENVIRONMENTAL CONTROL

Cabin pressurization utilizes bleed air from the engines which is conditioned by an air cycle machine (ACM). Temperature is controllable over a wide range and the system provides sufficient pressure to maintain a 6770-foot cabin at a cruise altitude of 45,000 feet. The oxygen system automatically supplies oxygen to the cockpit quick-donning masks and to the cabin dropout type masks in the event of excessive cabin altitude.

## AVIONICS

The standard, factory-installed avionics package includes dual altitude reporting mode S transponders, and a Primus 1000 integrated flight director system which incorporates the autopilot as well as a dual attitude and heading reference system (AHRS). Air traffic control and other communication is provided by two VHF transceivers, and dual audio amplifiers. Navigation equipment includes a digitally tuned ADF, dual DMEs, and dual VOR/localizer/glideslope/marker beacon receivers, all controlled by dual radio management units (RMU). A Universal UNS-1Csp flight management system with internal GPS sensor is installed on the center pedestal. Weather radar capability is provided by a Primus 880 Color Radar. The pilot's and copilot's positions are equipped with a dual electronic flight instrument system (EFIS), which has primary flight displays (PFD) for each pilot and a multifunction display (MFD) in the center instrument panel. A radio altimeter is provided, which presents its information on the EFIS PFD displays. An emergency locator beacon and a solid state cockpit voice recorder, which is equipped with an underwater locator beacon, and an airborne telephone are also installed as standard equipment.

A standby attitude/altitude/airspeed indicator (secondary flight display) and a mechanical horizontal situation indicator (HSI) are provided. The HSI provides redundant course deviation indicator/localizer and glideslope capability as well as standby heading capability. The secondary flight display also has a short range navigation and approach capability.

A high frequency communications radio, an airborne flight information system (AFIS), a B & D cabin display, a Magnastar phone and a Digital Flitefone are also available as options.

## CABIN DOOR

The passenger/crew entry door is located on the left side of the fuselage at the forward end of the passenger compartment. An inflatable rubber seal around the door opening provides pressure sealing. A secondary seal is installed to provide a backup in case of failure of the primary seal. If the primary seal should deflate, the cabin altitude may rise, but should stabilize at a slightly higher altitude. If the door seal should deflate, an amber annunciator DOOR SEAL on the annunciator panel will illuminate. The door can be opened from either the inside or the outside of the airplane. The air stair door, when opened, serves as steps into the interior of the airplane. An amber CABIN DOOR indicating light on the annunciator panel will illuminate at any time the door is not closed and/or the locking pins are not properly engaged.

## EMERGENCY EXIT DOOR

A removable emergency exit door is located on the right side of the fuselage at the aft end of the passenger compartment. The aft most right passenger compartment window is located in the door. The door is of the plug type and is installed or removed from inside the airplane. This exit is an alternate to the cabin door in the event of a crash landing and is the primary exit in a ditching situation.

During emergency evacuation, the emergency exit door should be completely removed and thrown outside the airplane through its own open exit, to keep the escape route clear inside the cabin.

# INSTRUMENT PANEL (TYPICAL)

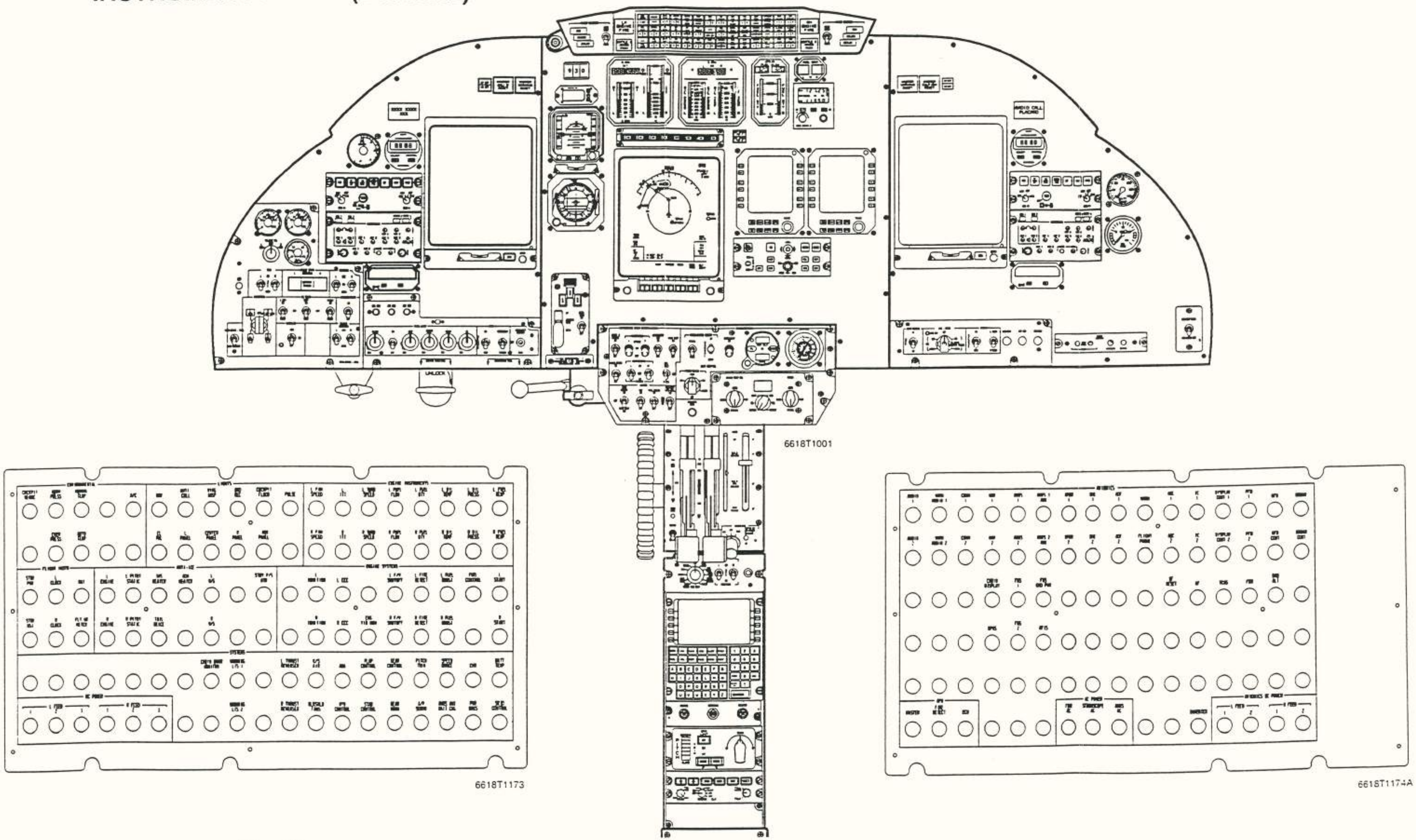



Figure 1-1

# SPECIFICATIONS

## DIMENSIONS

| | |
|---|---|
| Length | 52.10 Feet |
| Height | 17.20 Feet |
| Wingspan | 55.70 Feet |
| Horizontal Stabilizer Span | 21.07 Feet |
| Wheelbase (Main to Nose Gear) | 21.90 Feet |
| Stance (Distance Between Main Gear) | 14.90 Feet |
| Cabin: | |
| Length (Pressure Vessel) | 23.00 Feet |
| Height | 5.66 Feet |
| Width | 5.56Feet |

## CAPACITIES

| | |
|---|---|
| Oil Tank | 1.53 Gallons Per Engine (2.14 Quarts Usable) |
| Fuel (Maximum Usable) | Approximately 3395 Pounds Per Tank (503 Gallons) |
| Oxygen (Full 49-cubic foot bottle) | 1234 Liters Usable |
| Optional (76-cubic foot bottle) | 1923 Liters Usable |
| Oxygen quantities based on usable regulated pressure of 70 PSI | |
| Hydraulic Fluid Reservoir | 0.65 Gallon |
| Hydraulic Brake Fluid Reservoir | 0.25 Gallon |

## ENGINES

| | |
|---|---|
| Type | PW 545A Turbofan |
| Manufacturer | Pratt & Whitney Canada Inc. |
| Maximum Dry Weight | 805 Pounds |
| Static Thrust (Takeoff, Standard Day at Sea Level) | 3804 Pounds |
| Bypass Ratio | 4.10 to 1 |

## AVIONICS (STANDARD PACKAGE)

| Equipment | Quantity | Type Equipment |
|---|---|---|
| Communication (VHF) | 2 | Honeywell Primus II (SRZ-850) |
| Clearance Delivery Unit (VHF) | 1 | Honeywell Primus II (SRZ-850) |
| VOR Navigation/ILS/Marker Beacon | 2 | Honeywell (SRZ-850) |
| Standby Horizontal Situation Indicator (HSI) | 1 | Aeronetics HSI-315B |
| Secondary Flight Display System | 1 | Meggit Avionics |
| Distance Measuring Equipment (DME) | 2 | Honeywell Primus II (SRZ-850) |
| Transponder | 2 | Honeywell Primus II (Mode S, Diversity) |
| Weather Radar | 1 | Honeywell Primus 880 |
| Automatic Direction Finder | 1 | Honeywell Primus II (SRZ-850) |
| Digital Autopilot/Flight Director/Dual Electronic Instrument System (EFIS) | 1 | Honeywell Primus-1000 |
| Radio Altimeter | 1 | Collins ALT-55B |
| Flight Management System with GPS | 1 | Universal UNS-1Csp |
| Cockpit Voice Recorder | 1 | Loral A200S |
| Dual Audio System | 1 | Honeywell Primus II (SRZ-850) |

(Continued on Page 1-12)

# AIRPLANE THREE VIEW

| | |
|---|---|
| AIRFOILS | INCIDENCE |
| WING | WING |
| CESSNA MODIFIED | WS 34.00 +3° 33' |
| VERTICAL TAIL | WS 335.023 -1.22' |
| WL 138.90 NACA 0012 | 2 POSITION HORIZONTAL TAIL |
| WL 254.75 NACA 0008 | NOSE UP 1° |
| HORIZONTAL TAIL | NOSE DOWN 2° |
| SS 0.00 NACA 0010 | DIHEDRAL |
| SS 126.42 NACA 0008 | WING 4° |
| | HORIZONTAL TAIL 9° |

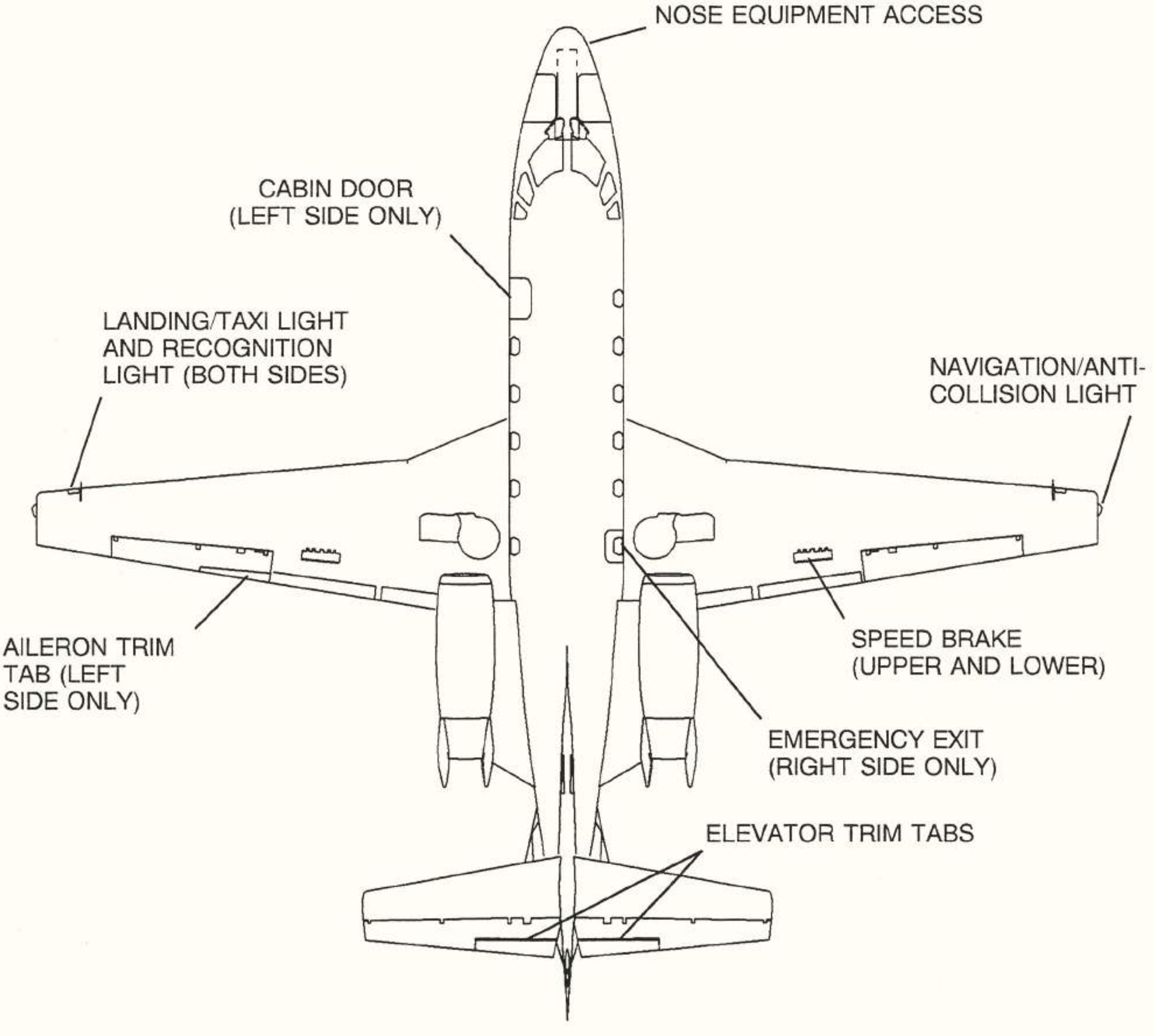
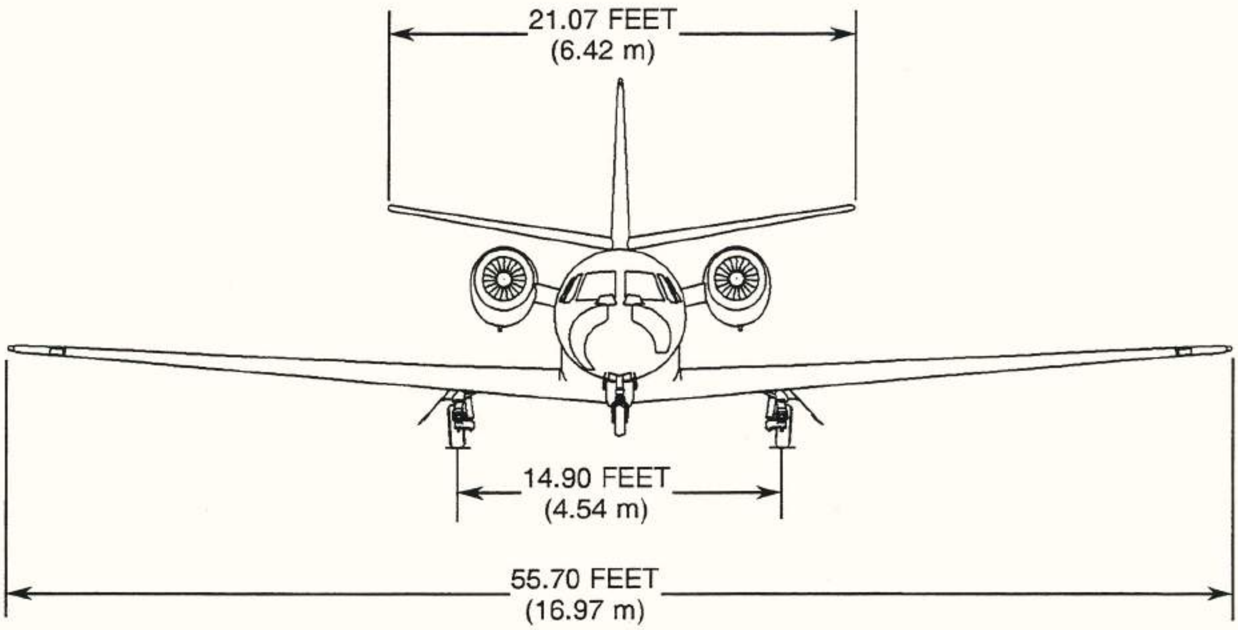
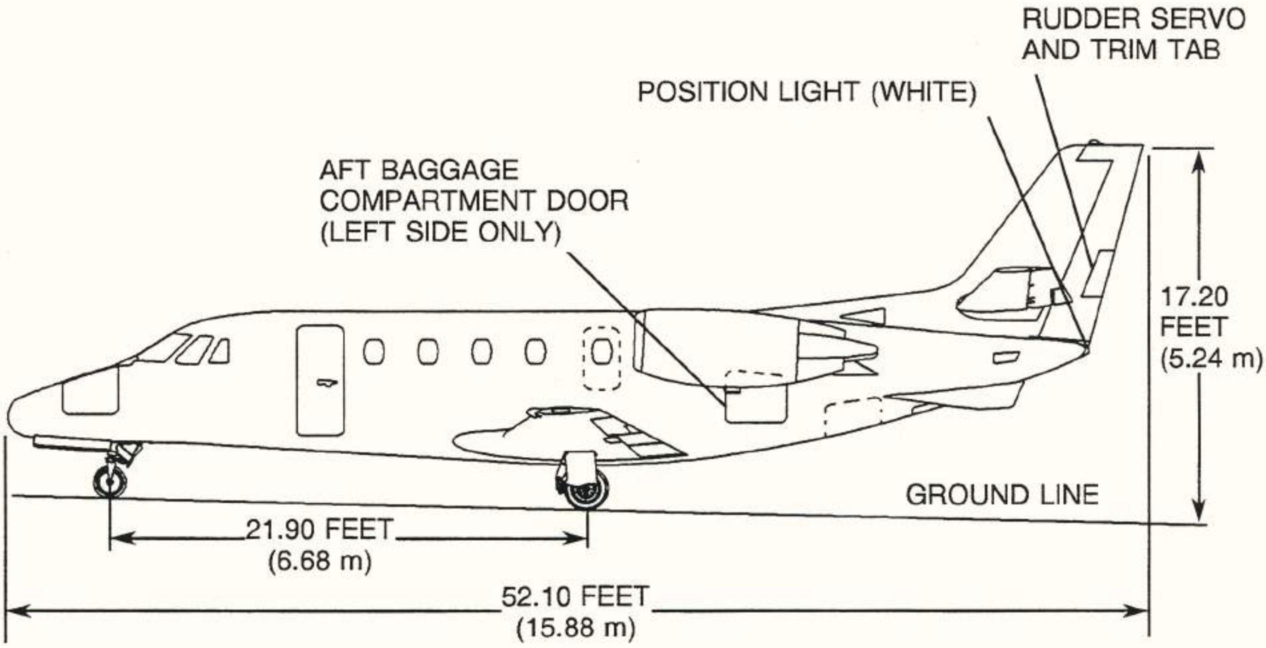



Figure 1-2 (Sheet 1 of 2)

# AIRPLANE THREE VIEW




6610T1002
6610T1002

Figure 1-2 (Sheet 2)

## AVIONICS (STANDARD PACKAGE) (Continued from Page 1-9)

| Equipment | Quantity | Type Equipment |
|---|---|---|
| Flitefone 800 | 1 | Global-Wulfsberg |
| Attitude/Heading Reference System (AHRS) | 2 | Litef GmbH LCR-93 |
| Emergency Locator Beacon | 1 | Artex ELT-110-4 |

# OPERATING LIMITATIONS

**NOTICE**

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

## CERTIFICATION STATUS

This airplane is certified in accordance with FAR 25.

## WEIGHT LIMITATIONS

| | |
|---|---|
| Maximum Design Ramp Weight | 20,200 Pounds |
| Maximum Design Takeoff Weight | 20,000 Pounds |
| Maximum Design Landing Weight | 18,700 Pounds |
| Maximum Design Zero Fuel Weight | 15,000 Pounds |
| Minimum Flight Weight | 12,400 Pounds |
| Maximum Tailcone Baggage Weight | 700 Pounds |

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

| | |
|---|---|
| Maximum Certified Takeoff Weight | 20,000 Pounds |
| Maximum Takeoff Weight Permitted by Climb Requirements | Refer to Procedures for Use of Takeoff Performance Tables in Section IV of the AFM |
| Takeoff Field Length | Refer to Procedures for Use of Takeoff Performance Tables in Section IV of the AFM |

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

| | |
|---|---|
| Maximum Certified Landing Weight | 18,700 Pounds |
| Maximum Landing Weight Permitted by Climb Requirements or Brake Energy Limit | Refer to Procedures for Use of Approach and Landing Performance Tables in Section IV of the AFM |
| Landing Distance | Refer to Procedures for Use of Approach and Landing Performance Tables in Section IV of the AFM |

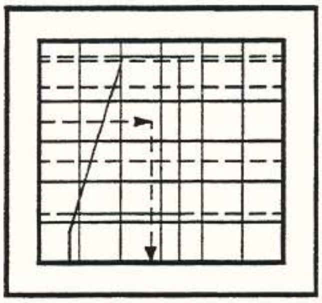
## CENTER-OF-GRAVITY LIMITS

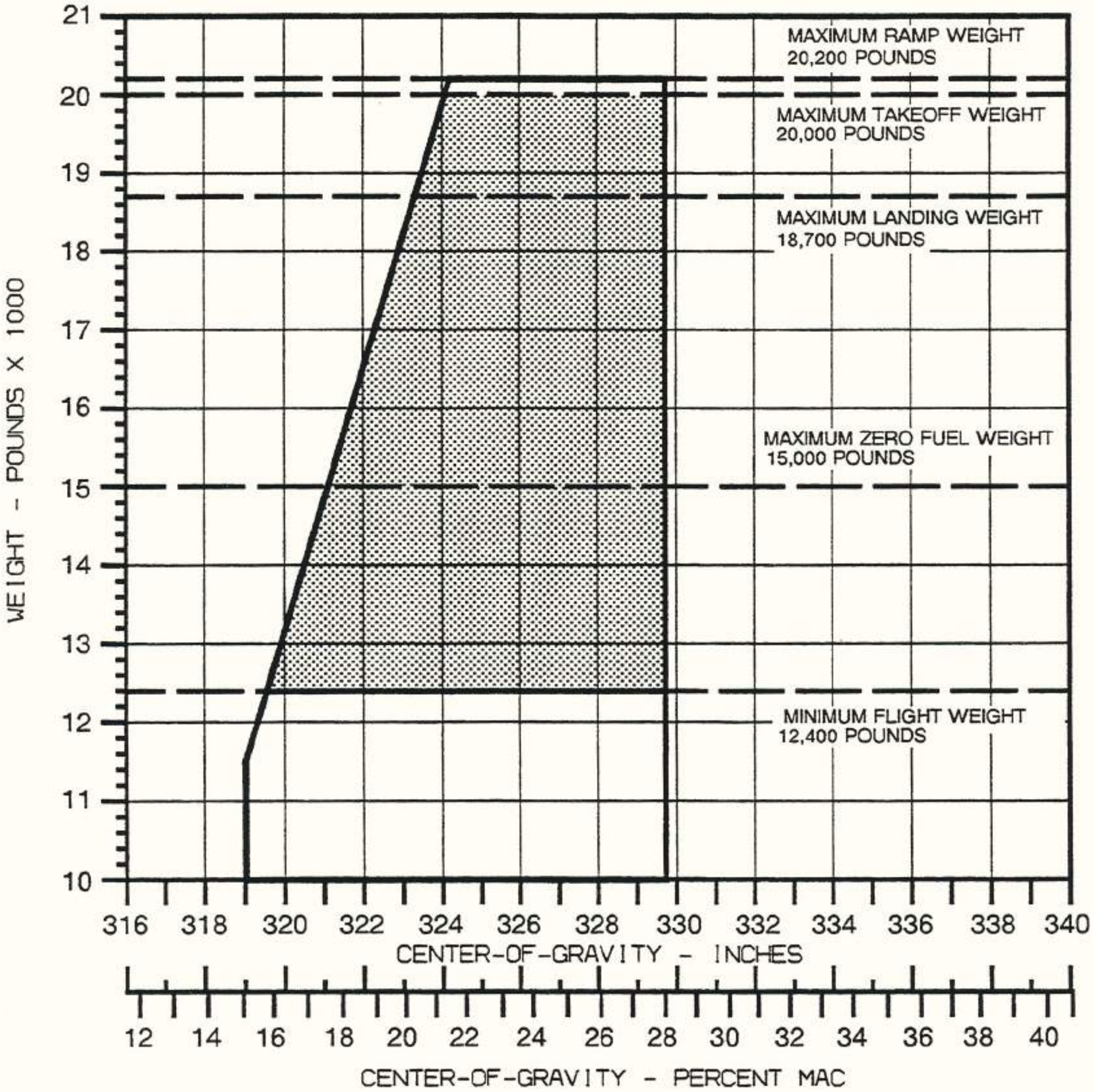
Center-of-Gravity Moment Envelope .......... Refer to Figure 1-3

## WEIGHT AND BALANCE DATA

The airplane must be operated in accordance with the approved loading schedule. Refer to Weight and Balance Data Sheet and Model 560XL Weight and Balance Manual.

# CENTER-OF-GRAVITY LIMITS ENVELOPE GRAPH






FORM NUMBER 2008, 17 April 1998
REVISED 14 August 1998

Figure 1-3

## POWERPLANT LIMITATIONS

Engine Type .................. Pratt and Whitney Canada Inc. PW545A Turbofan
Engine Operating Limits .................................... Refer to Figure 1-4
Inter-Turbine Temperature Limits ........................ Refer to Figure 1-5
Engine Overspeed Limits .................................... Refer to Figure 1-6
Takeoff/Go Around Thrust Setting (TO Detent) ....... Refer to Figure 4-8 of the AFM
Maximum Continuous Thrust Setting (CLB Detent) .... Refer to Figure 4-9 of the AFM
Minimum Ambient Temperature For Ground Engine Starting ............. –30°C

# ENGINE OPERATING LIMITS

| OPERATING CONDITION | | OPERATING LIMITS | | | | |
|---|---|---|---|---|---|---|
| THRUST SETTING | TIME LIMIT (MINUTES) | MAX OBSERVED ITT °C | $N_2$ % | $N_1$ % | OIL PRESSURE (NOTE 1) PSI | OIL TEMP °C |
| TAKE-OFF | 5 (NOTE 4) | 720 | 101 | 100 | 45 TO 140 | 10 TO 121.1 |
| MAXIMUM CONTINUOUS | CONTINUOUS | 720 | 101 | 100 | 45 TO 140 | 10 TO 121.1 |
| GROUND IDLE | CONTINUOUS | N/A | 47 (MIN) (NOTE 2) | -- | 45 (MIN) | -40 TO 121.1 |
| FLIGHT IDLE | | | 51.5 (MIN) (NOTE 3) | -- | | |
| STARTING | N/A | 720** | -- | -- | -- | -40 MIN |
| TRANSIENT | 20 SECONDS | 760** | 103* | 102* | NOTE 1 | 121.1 TO 135 |
| TRANSIENT | 120 SECONDS | -- | -- | -- | NOTE 1 | 121.1 TO 135 |

* Refer to Figure 1-6.
** Refer to Figure 1-5.

**NOTES**

1. Oil Pressure

   - Normal oil pressure is 45 to 140 PSI at $N_2$ speeds above 60%. Oil pressure below 45 PSI is undesirable and should be tolerated only for the completion of the flight, preferably at reduced power setting.

   - Oil pressure at takeoff and maximum thrust setting may exceed 140 PSI (not to exceed 250 PSI) for up to 120 seconds.

2. Ground Idle is available in EEC mode only.

3. Flight idle is available in EEC or Manual modes.

4. Take-off ratings that are nominally limited to 5 minutes duration may be used for up to 10 minutes for One Engine Inoperative operations without adverse effects upon engine airworthiness.

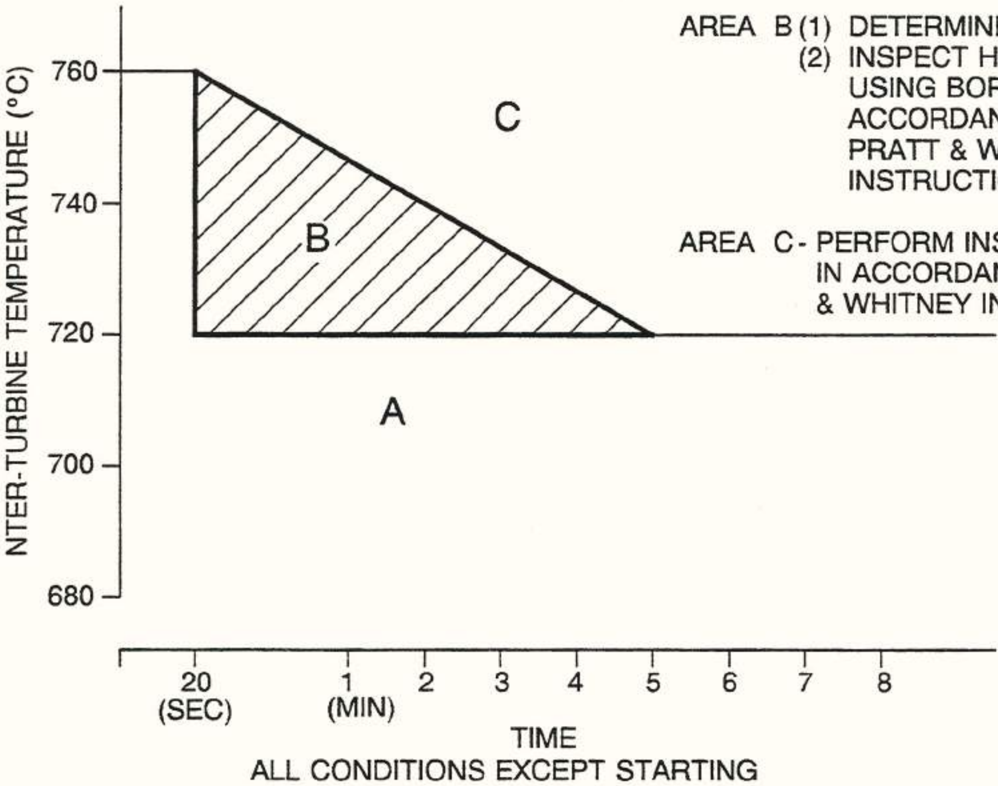
Figure 1-4

# INTER-TURBINE TEMPERATURE LIMITS

AREA A - NO ACTION REQUIRED

AREA B (1) DETERMINE CAUSE AND CORRECT
(2) INSPECT HOT SECTION USING BORESCOPE IN ACCORDANCE WITH PRATT & WHITNEY INSTRUCTIONS

AREA C - PERFORM INSPECTION/REPAIRS IN ACCORDANCE WITH PRATT & WHITNEY INSTRUCTIONS.




AREA A - NO ACTION REQUIRED

AREA B (1) DETERMINE CAUSE AND CORRECT
(2) INSPECT HOT SECTION USING BORESCOPE IN ACCORDANCE WITH PRATT & WHITNEY INSTRUCTIONS

AREA C - PERFORM INSPECTION/REPAIRS IN ACCORDANCE WITH PRATT & WHITNEY INSTRUCTIONS.

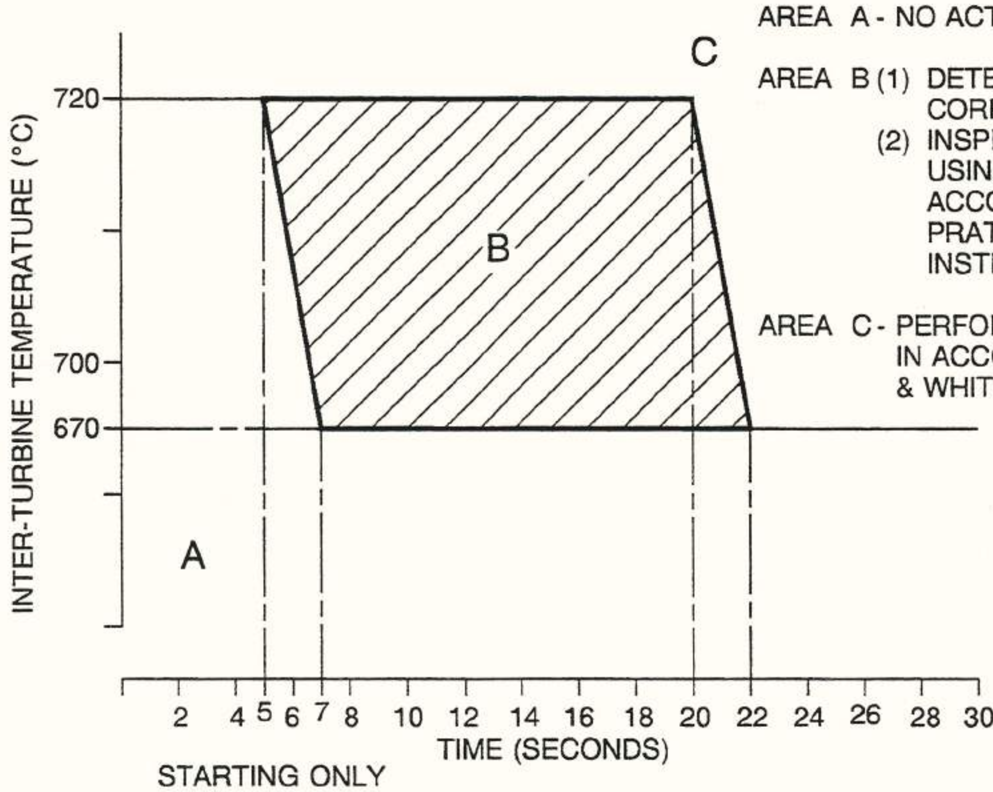



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Figure 1-5

# ENGINE OVERSPEED LIMITS

AREA A - NO ACTION REQUIRED
AREA B - RECORD IN ENGINE LOG BOOK
AREA C - PERFORM INSPECTION/REPAIRS IN ACCORDANCE WITH PRATT & WHITNEY INSTRUCTIONS

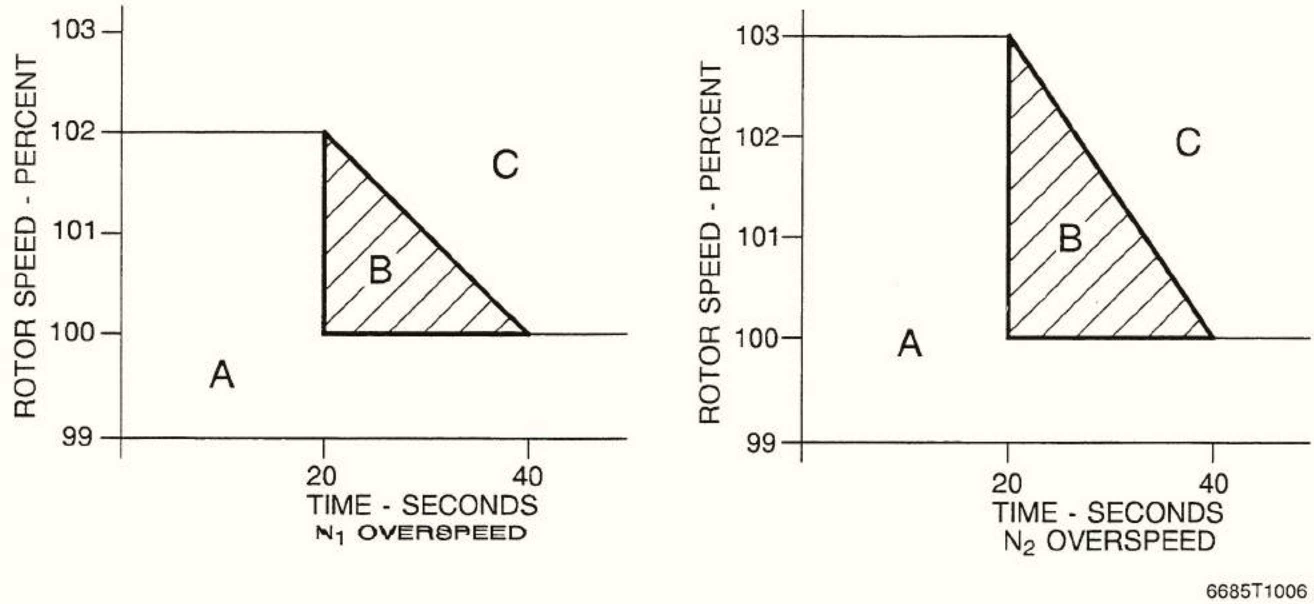



Figure 1-6

## ENGINE FAN INSPECTION

To assure accurate fan speed thrust indication, inspect the fan for damage prior to each flight in accordance with the exterior inspection in the Normal Procedures Section of the manual.

## ELECTRONIC ENGINE COMPUTER

Dispatch with either, or both, engines operating in manual mode is prohibited, except when conducted in accordance with limitations and procedures contained in Supplement 9 of the FAA Approved Airplane Flight Manual, Dispatch With Electronic Engine Computer(s) Inoperative.

## BATTERY AND STARTER CYCLE LIMITATIONS

Starter Limitation ................ Three engine starts per 30 minutes. Three cycles of operation with a 90-second rest period between cycles is permitted.

Battery Limitation ................ Three engine starts per hour. Refer to notes 2 and 3.

(Continued Next Page)

## BATTERY AND STARTER CYCLE LIMITATIONS (Continued)

**NOTE**

1. If battery limitation is exceeded, a deep cycle including a capacity check must be accomplished to detect possible cell damage. Refer to Chapter 24 of the Maintenance Manual for procedure.
2. Three generator assisted cross starts are equal to one battery start.
3. If an external power unit is used for start, no battery cycle is counted.
4. Use of an external power source with voltage in excess of 28 VDC or current in excess of 1000 amps may damage the starter. Minimum 800 amps for start.

## GROUND OPERATION

Continuous engine ground static operation up to and including five minutes at takeoff thrust is limited to ambient temperatures not to exceed 39°C above ISA. (Refer to Figure 1-8).

Limit ground operation of pitot/static heat to two minutes to preclude damage to the pitot tubes and angle-of-attack vane.

### AVIONICS AMBIENT TEMPERATURE LIMIT VS POWER ON TIME PRIOR TO TAKEOFF

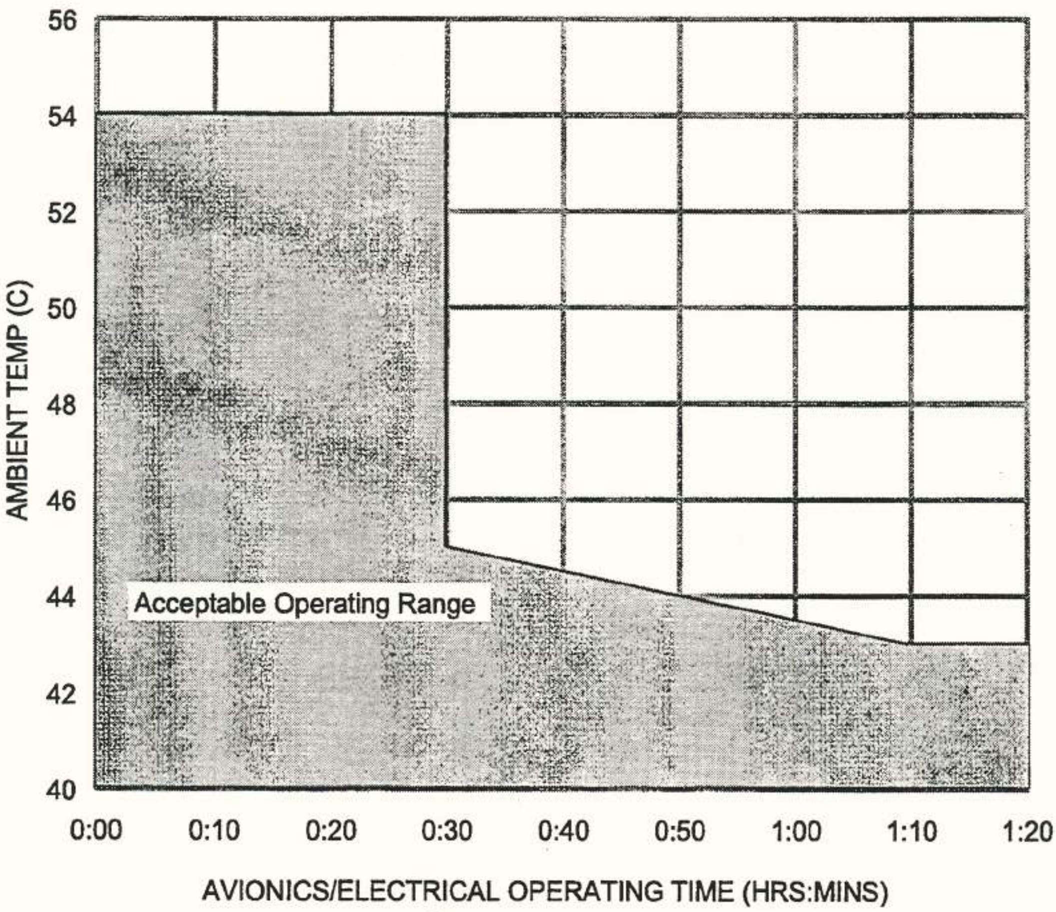



Figure 1-6A

(Continued Next Page)

## GROUND OPERATION (Continued)

Electrical load is limited to 200 amps per generator during ground operations (transients up to 250 amps are permissible for up to 4 minutes).

## HYDRAULIC FLUID

Use Skydrol 500A, B, B-4, C, or LD-4; or Hyjet, Hyjet W, III, IV, IVA or IVA Plus only.

## APPROVED OILS

The following oils are approved for use:

| | | |
|---|---|---|
| MOBIL JET OIL II | EXXON TURBO OIL 2380 | AEROSHELL TURBINE OIL 500 |
| MOBIL JET OIL 254* | ROYCO TURBINE OIL 500 | AEROSHELL TURBINE OIL 560* |
| CASTROL 5000 | | |

Oils denoted with an asterisk are "THIRD GENERATION" lubricants.

In addition, oils listed for the engine in the latest revision to Pratt and Whitney Canada Inc. Service Bulletin Number 7001 are approved.

**CAUTION**

WHEN CHANGING FROM AN EXISTING LUBRICANT FORMULATION TO A "THIRD GENERATION" LUBRICANT FORMULATION (AEROSHELL TURBINE OIL 560 OR MOBIL JET 254), THE ENGINE MANUFACTURER STRONGLY RECOMMENDS THAT SUCH A CHANGE SHOULD ONLY BE MADE WHEN AN ENGINE IS NEW OR FRESHLY OVERHAULED. FOR ADDITIONAL INFORMATION ON USE OF THIRD GENERATION OILS, REFER TO ENGINE MANUFACTURER'S PERTINENT OIL SERVICE BULLETINS.

Should it be necessary to replenish oil consumption losses when oil of the same brand (as tank contents) is unavailable, then the following requirements apply:

For contingency purposes, oil replenishment using any other approved oil brand listed is acceptable provided:

1. The total quantity of added oil does not exceed two U.S. quarts in any 400-hour period.
2. If it is required to add more than two U.S. quarts of dissimilar oil brands, drain and flush complete oil system and refill with an approved oil in accordance with Engine Maintenance Manual instructions.

Should oils of nonapproved brands or of different viscosities become intermixed, drain and flush complete oil system and refill with an approved oil in accordance with Engine Maintenance Manual instructions.

## SINGLE POINT REFUELING LIMITATION

Single point refueling operations must be accomplished per the procedures contained on the placard installed on the single point refueling access door. Refueling pressure range is 10 to 55 PSI, maximum defueling pressure is -10 PSI.

## FUEL LIMITATIONS

Anti-icing additive must be added to all approved fuels not presently containing the additive.

FUEL BOOST Pumps - ON; when low fuel lights illuminate or at 400 pounds or less indicated fuel.

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

COMMERCIAL KEROSENE JET A, JET A-1, JET B, JP-4, JP-5 and JP-8 per CPW 204 specification.

**CAUTION**

THESE FUELS, EXCEPT MILITARY JP-5 and JP-8, REQUIRE THE ADDITION OF ANTI-ICING ADDITIVE (PER MIL-I-27686 OR MIL-I-85470 OR PFA 55 MB). REFER TO SECTION IV, FUEL ANTI-ICING ADDITIVES, FOR PROCEDURES TO FOLLOW WHEN BLENDING AND CHECKING FUEL ANTI-ICING ADDITIVE.

## FUEL LIMITATIONS

| | JET A, A-1, JP-5 & JP-8 | JET B & JP-4 |
|---|---|---|
| MINIMUM FUEL TEMPERATURE (TAKEOFF) | -40°C | -45°C |
| MINIMUM FUEL TEMPERATURE (STARTING) | -40°C | -45°C |
| MAXIMUM FUEL TEMPERATURE | +57°C | ** |
| MAXIMUM ALTITUDE | 45,000 FEET | ** |
| MAXIMUM ASYMMETRIC FUEL DIFFERENTIAL FOR NORMAL OPERATIONS | 400 POUNDS | 400 POUNDS |
| EMERGENCY ASYMMETRIC FUEL DIFFERENTIAL * | 800 POUNDS | 800 POUNDS |

* MAXIMUM LATERAL FUEL IMBALANCE IS 400 POUNDS. A LATERAL FUEL IMBALANCE OF 800 POUNDS HAS BEEN DEMONSTRATED FOR EMERGENCY RETURN.

** REFER TO FIGURE 2-5A

Figure 1-7

## UNUSABLE FUEL

Fuel remaining in the fuel tanks when the fuel quantity indicator reads zero is not usable in flight.

## JET B/JP-4 FUEL OPERATING LIMITATIONS

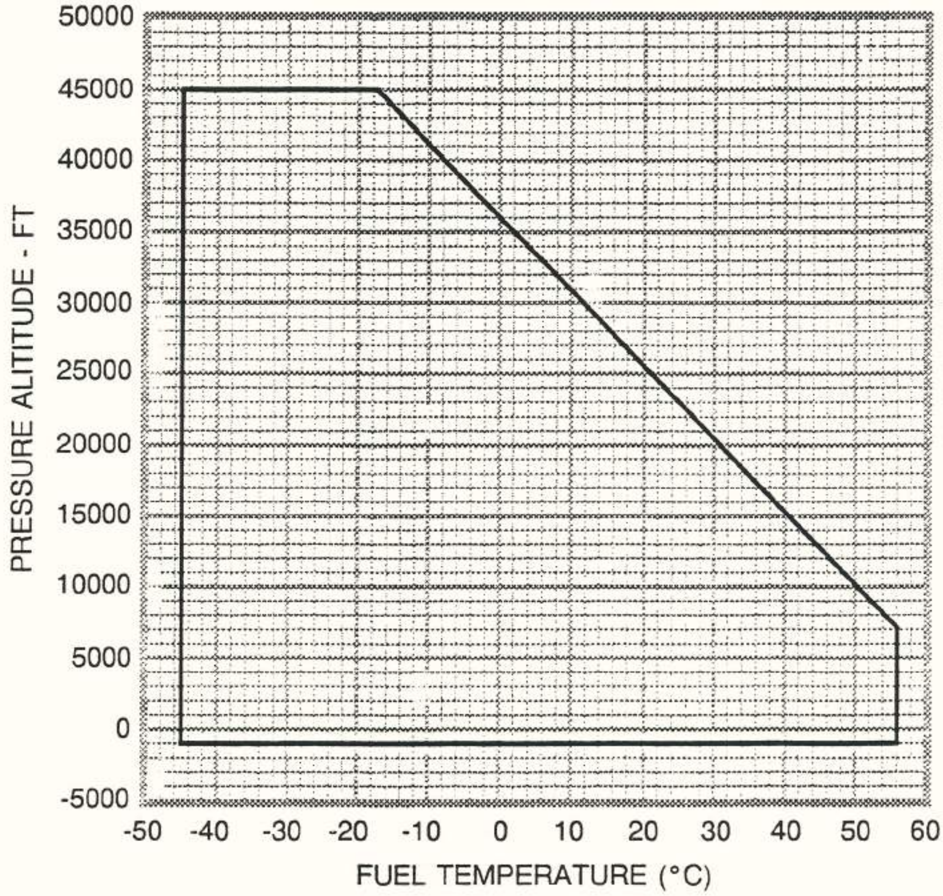



Figure 1-7A

## SPEED LIMITATIONS

Maximum Operating Limit Speeds

| | |
|---|---|
| $M_{MO}$ (Above 26,515 Feet) | 0.75 Mach (Indicated) |
| $V_{MO}$ (Between 8000 and 26,515 Feet) | 305 KIAS |
| $V_{MO}$ (Below 8000 Feet) | 260 KIAS |

The maximum operating limit speeds may not be deliberately exceeded in any phase of flight (climb, cruise or descent) unless a higher speed is authorized for flight test or pilot training.

Maximum Maneuvering Speeds - $V_A$ ........ Refer to Figure 1-9

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

Maximum Flap Extended Speed - $V_{FE}$

| | |
|---|---|
| Full Flaps - LAND Position (35°) | 175 KIAS |
| Partial Flaps - T.O (7°). and TO & APPR Position (15°) | 200 KIAS |
| Maximum Landing Gear Extended Speed - $V_{LE}$ | 250 KIAS |
| Maximum Landing Gear Operating Speed - $V_{LO}$ (Extending) | 250 KIAS |
| - $V_{LO}$ (Retracting) | 200 KIAS |
| Maximum Speed Brake Operation Speed - $V_{SB}$ | No Limit |

Minimum Control Speeds ($V_{MCA}$ and $V_{MCG}$) Refer to Section IV, Performance General in the AFM.

Autopilot Operation ........ 305 KIAS or 0.75 MACH

## TAKEOFF AND LANDING OPERATIONAL LIMITS

| | |
|---|---|
| Maximum Altitude Limit | 14,000 Feet |
| Maximum Tailwind Components | 10 Knots |
| Maximum Ambient Temperature | ISA +39°C (Refer to Figure 1-8) |
| Minimum Ambient Temperature | –30°C |

The autopilot and yaw damper must be OFF for takeoff and landing.

Michelin part number 031-613-8 nose tire and OM13701 main tire are the only tires approved. The nose tire must be inflated to 130 ± 5 PSI with the weight on the wheels.

| | |
|---|---|
| Maximum Tire Ground Speed | 165 Knots |

The lavatory doors must be latched open for takeoff and landing.

Engine Sync must be off for takeoff and landing.

Takeoff and landings are limited to paved runway surfaces.

Antiskid must be operational for takeoff.

## PERFORMANCE CONFIGURATION

The airplane configuration must be as presented under Standard Performance Conditions, Section IV, Performance of the AFM.

## ENROUTE OPERATIONAL LIMITS

| | |
|---|---|
| Minimum airspeed for sustained flight in icing (except approach and landing) | 160 KIAS |
| Maximum Operating Altitude | 45,000 Feet |
| Maximum Ambient Temperature | Refer to Figure 1-8 |
| Minimum Ambient Temperature | Refer to Figure 1-8 |
| Generator Load | 300 Amperes in Flight |

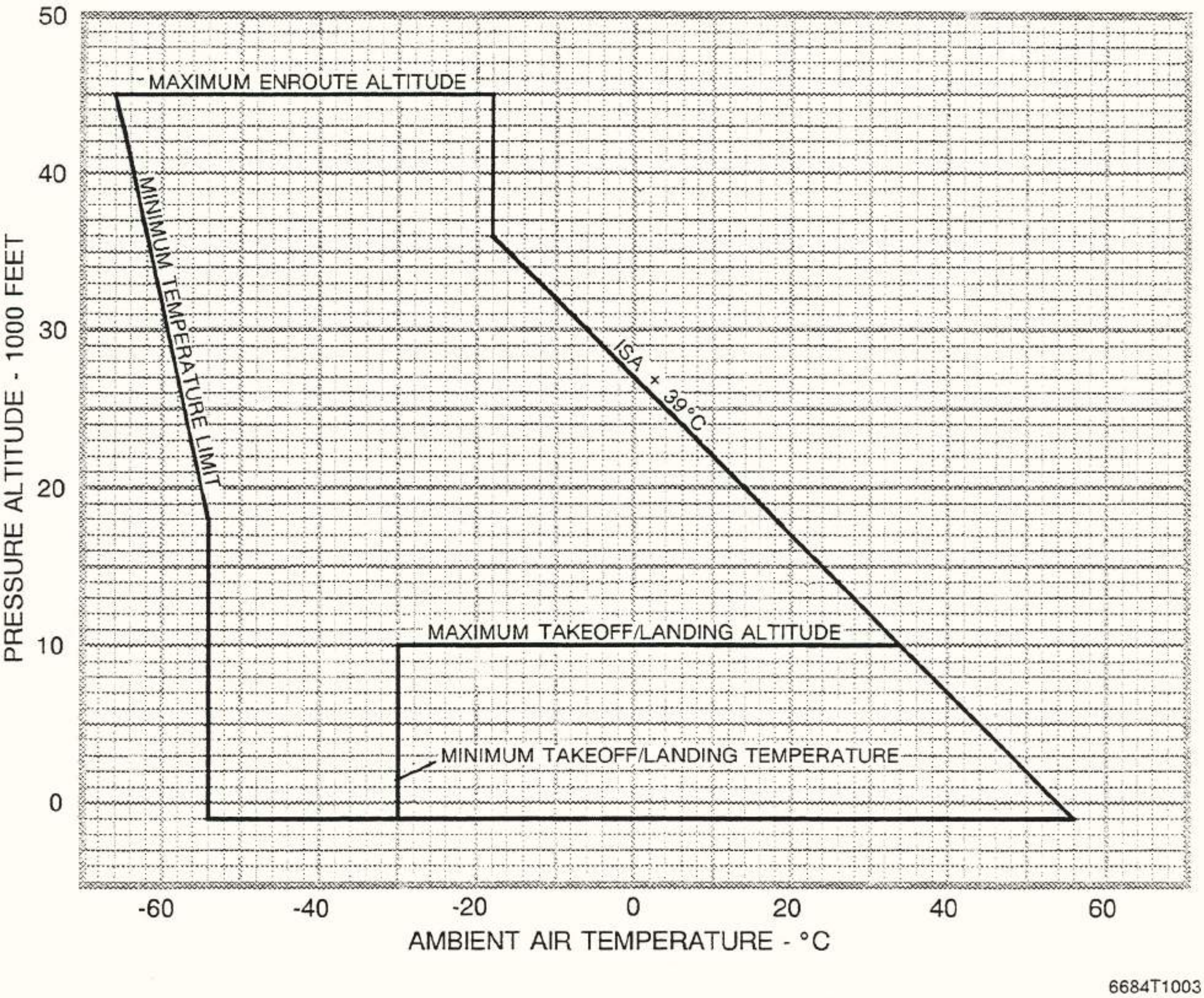
## OPERATIONS AUTHORIZED

This airplane is approved for day and night, VFR, IFR flight and flight into known icing conditions. This airplane is not approved for ditching under FAR 25.801.

## VORTEX GENERATORS/BOUNDARY LAYER ENERGIZERS

Up to three vortex generatrs may be missing for dispatch provided the aircraft is limited to FL410 for enroute operations. There are typically a total of 52 vortex generators installed, 26 per wing. All boundary layer energizers must be present for dispatch (11 per wing).

# TAKEOFF/LANDING/ENROUTE TEMPERATURE LIMITATIONS




**NOTE:** Ambient Air Temperature Limit is indicated Ram Air Temperature (RAT) adjusted for Ram rise.

Figure 1-8 (Sheet 1)

# MAXIMUM MANEUVERING SPEEDS

EXAMPLE:
PRESSURE ALTITUDE - 37,000 FEET
WEIGHT - 13,500 POUNDS
MAXIMUM MANEUVERING SPEED - 200 KNOTS

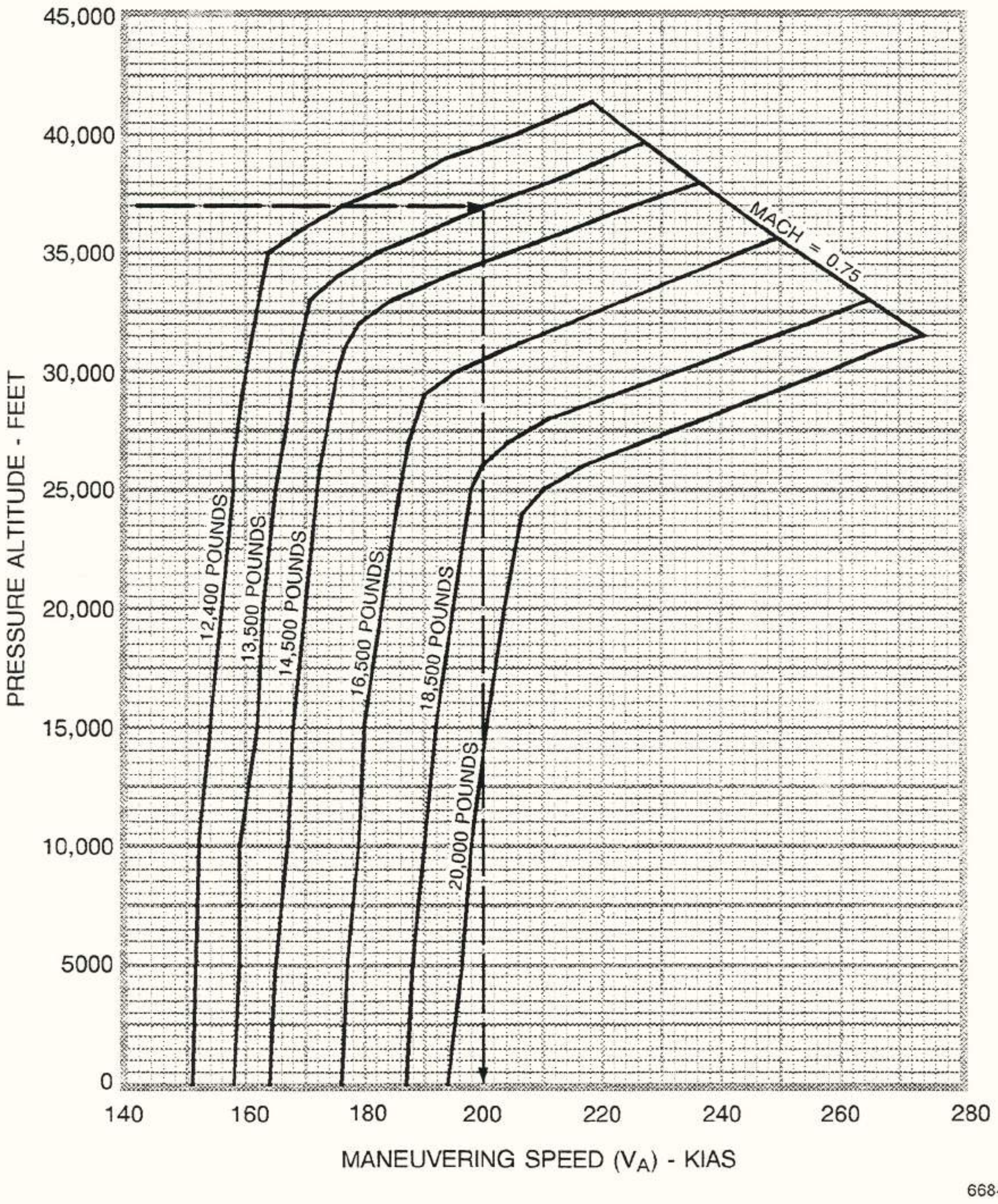



Figure 1-9

## MINIMUM CREW

Minimum Flight Crew for All Operations .................... 1 Pilot and 1 Copilot

## LOAD FACTOR

In Flight
Flaps UP Position (0°) ..................... –1.2 to + 3.0G at 20,000 Pounds
Flaps T.O., T.O. & APPR to LAND Position
(7° To 35°) ........................... 0.0 to + 2.0G at 20,000 Pounds

**NOTE**

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

Landing ..................................... 0.0 to + 2.0G at 18,700 Pounds

**NOTE**

These accelerations limit the airplane to landing sink rate of 600 feet-per-minute.

## CABIN PRESSURIZATION LIMITATIONS

Normal Cabin Pressurization Limitations .. 0.0 to 9.3 PSI, + 0.1 or –0.1 PSI Differential
Pressure Relief Valve ..................... 9.5 PSI, + 0.1 or –0.1 PSI Differential
Pressure Gauge Redline ................... 9.7 PSI, + 0.0 or –0.1 PSI Differential

## MANEUVERS

No acrobatic maneuvers, including spins, are approved. No intentional stalls permitted above 25,000 feet.

## PASSENGER COMPARTMENT

For all takeoff and landings, seats must be fully upright and outboard, and passenger seat belts and shoulder harnesses must be fastened. Maximum number of passenger seats is 12. The lavatory door must be latched open for taxi, takeoff, and landing.

## ANGLE-OF-ATTACK/STICK SHAKER SYSTEM

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

The angle-of-attack system can be used as a reference for approach speed (1.3 $V_{S1}$) at all airplane weights and center-of-gravity locations at zero, takeoff/approach and landing flap positions. 1.3 $V_{S1}$ is indicated by approximately .6 on the AOA gage and by the top of the white tape on the pilot's and copilot's airspeed indicators.

The angle-of-attack and stall warning system must be operable and a satisfactory preflight test must be performed in accordance with Section IV, Normal Procedures.

## AIRPLANE BATTERY

If the BATT O'TEMP light illuminates during ground operation, do not take off until after the proper maintenance procedures have been accomplished.

## INSTRUMENT MARKINGS

Left and Right Oil Pressure Indicators . . . . . . . . . . . . . . . . . . . Red Line (Min) - 20 PSI
Yellow Band - 20 to 45 PSI
Green Band - 45 to 140 PSI
Red Line - 140 PSI
Red Triangle (Max) - 250 PSI

Left and Right Turbine ($N_2$) RPM
Indicators . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Flashing Red Light > 101% RPM
Normal Operating - 47 to 101% RPM

Left and Right Oil Temperature Indicators . . . . . . . . . . . . . . . . . . . Red Line - 121°C
Green Band - 10 to 121°C

Airspeed Indicator . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Red Bands - 260 KIAS
- 305 KIAS
- 0.75 Mach

Standby Airspeed Indicator . . . . . . . . . . . . . . . . . . . . . . . . . . Red Bands - 305 KIAS
- 260 KIAS
- 0.750 MACH

Left and Right Inter-Turbine Temperature Indicators . . . . . . . . . . . . Red Line - 720°C
Green Band - 0 to 720°C

Left and Right Fan ($N_1$) RPM Indicators . . . . . . . . . . . . . . . . . . . . . Red Line - 100.0%
(Refer to Section IV for thrust setting limits) Green Band - 20 to 100.0%

Left and Right Ammeter Indicators . . . . . . . . . . . . . . . . . . . . . . . Red Line - 300 Amps
Red Triangle - 200 Amps

Cabin Differential Pressure Indicator . . . . . . . . . . . . . . . . . . . . . . . Red Line - 9.7 PSI
Green Arc - 0.0 to 9.3 PSI

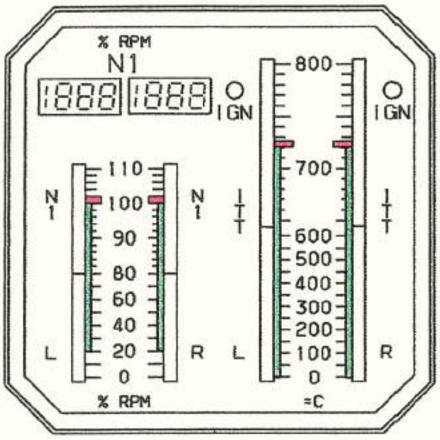
Oxygen Pressure Indicator . . . . . . . . . . . . . . . . . . . . . . . . . . . . Red Line - 2000 PSI
Yellow Arc - 0.0 to 400 PSI
Green Arc - 1600 to 1800 PSI

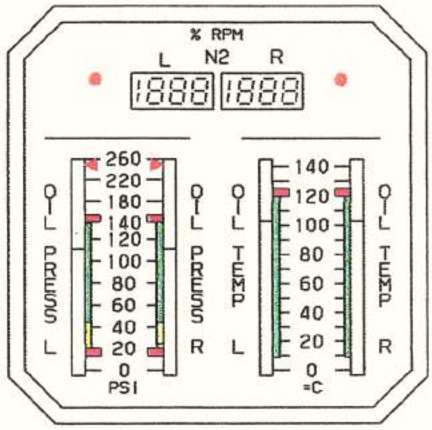
Brake and Gear Pneumatic Pressure Indicator
(In Nose Compartment) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Per Placard

Brake Hydraulic Accumulator Pressure
Indicator (In Nose Compartment) . . . . . . . . . . . . . . . . . . . . . . . . . . . Per Placard

# INSTRUMENT MARKINGS

## ENGINE $N_1$% RPM AND INTER-TURBINE TEMPERATURE




$N_1$ (FAN) % RPM

- 100% RPM (red)
- 20% TO 100% RPM (green)

INTER-TURBINE TEMPERATURES (ITT)

- 720° (red)
- 150°C TO 720°C (green)

## OXYGEN


- 2000 PSI (red)
- 1600 PSI TO 1800 PSI (green)
- 0 PSI TO 400 PSI (yellow)

$N_2$ (TURBINE) % RPM

- 101% RPM AND ABOVE (FLASHING DISPLAY) (red)

OIL PRESSURE

- REDLINE (MIN) 20 PSID (red)
- 20 PSID TO 45 PSID (yellow)
- 45 PSID TO 140 PSID (green)
- REDLINE (MAX) 140 PSID (red)
- 250 PSID (red)

OIL TEMPERATURE

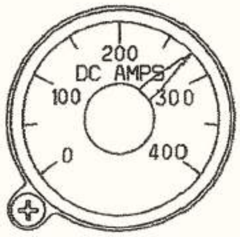
- 121° (red)
- 10°C TO 121°C (green)

9912497-5
9912497-6
C668512-0101

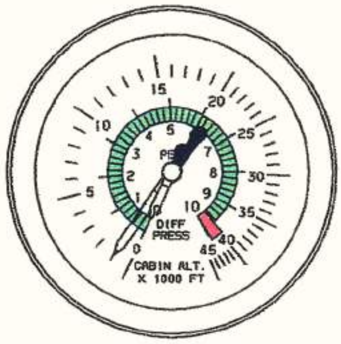
Figure 1-10 (Sheet 1 of 2)

# INSTRUMENT MARKINGS

## AMMETER



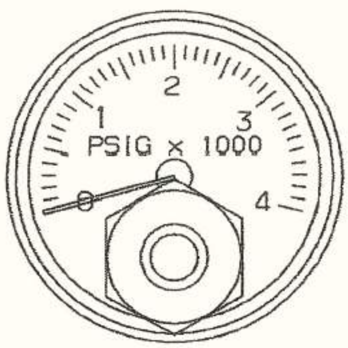

## DIFFERENTIAL PRESSURE



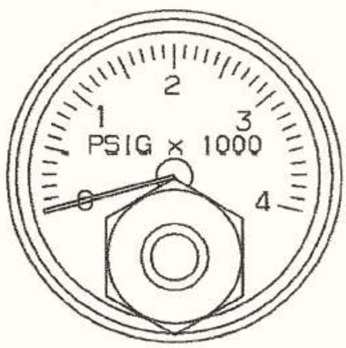

9.7 PSI

0.0 TO 9.3 PSI

## BRAKE ACCUMULATOR INDICATOR




## GEAR AND BRAKE PNEUMATIC BOTTLE




**BRAKE SYSTEM ACCUMULATOR**

PRE-CHARGE ± 25 PSI VS. AMBIENT AIR TEMP

| TEMP | °F | -65 | 10 | 50 | 70 | 95 | 130 |
|---|---|---|---|---|---|---|---|
| PRESS | PSI | 500 | 600 | 650 | 675 | 700 | 750 |

6605101-3

**GEAR & BRAKE PNEUMATIC BOTTLE**

SERVICE TO PRESSURE SHOWN ± 100 PSI FOR APPROX AMBIENT AIR TEMP WITH DRY NITROGEN GAS ONLY

| TEMP | °F | -40 | 0 | 70 | 100 | 130 |
|---|---|---|---|---|---|---|
| PRESS | PSI | 1500 | 1650 | 1950 | 2000 | 2060 |

6605101-2

S3439-1
3001-J72
19940929-1
19940929-1
6605101-3
6605101-2

Figure 1-10 (Sheet 2)

## AUTOPILOT

1. One pilot must remain in his seat with the seat belt fastened during all autopilot operations.
2. Autopilot operation is prohibited if any comparison monitor annunciator illuminates inflight.
3. Minimum autopilot use height for enroute is 1000 feet AGL. Minimum autopilot use height for approaches is 180 feet AGL.

## HONEYWELL PRIMUS-1000 FLIGHT GUIDANCE SYSTEM

1. The Pilot's Manual for the Honeywell P-1000 Integrated Avionics System for the Cessna Citation Excel, part number A28-1146-120-00, revision 0, or later applicable revision, must be immediately available to the flight crew.
2. Category II approaches are not approved.
3. EFIS ground operation with the pilot's RADOME FAN FAIL annunciator light illuminated is limited to 30 minutes or until either IC-1 HOT or IC-2 HOT annunciator light illuminates, whichever occurs first.
4. Dispatch is prohibited if either the IC-1 HOT or IC-2 HOT annunciator light is illuminated.
5. Dispatch in instrument meteorological conditions is prohibited with the RADOME FAN annunciator light illuminated. Dispatch in visual meteorological conditions is allowed with the RADOME FAN annunciator illuminated, provided the DISPLAY GUIDANCE COMPUTER COOLING FAN FAILURE abnormal procedures are followed.
6. Dispatch is prohibited following a flight where either a IC-1 HOT or IC-2 HOT annunciator light was illuminated, until the condition is identified and corrected.
7. The pilot's and copilot's PFD's must be installed and operational in the normal (non-reversionary) mode for takeoff.
8. The P-1000 system must be verified to be operational by a satisfactory preflight test as contained in Section III, Normal Procedures.
9. Reversion of both PFD's to the MFD is prohibited.
10. VOR approaches without a valid DME signal are prohibited with autopilot coupled or with flight director only.

**NOTE**

Enroute VOR navigation without a valid co-located DME signal may result in significantly degraded course tracking when utilizing the flight director or autopilot. The flight crew should monitor the CDI for excessive deviation and select HDG mode as required to manually track the desired course.

## STANDBY FLIGHT DISPLAY

1. A satisfactory preflight test must be accomplished on the STBY PWR system in accordance with Section IV, Normal Procedures.
2. The standby flight display (including ATT, ALT and ASI) and HSI must be functioning prior to takeoff.

## SUPPLEMENTAL OXYGEN SYSTEM

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

Crew and passenger oxygen masks are not approved for use above 40,000 feet cabin altitude. Prolonged operation of passenger masks above 25,000 feet cabin altitudes is not recommended.

### WARNING

**PASSENGER MASKS ARE INTENDED FOR USE DURING AN EMERGENCY DESCENT TO AN ALTITUDE NOT REQUIRING SUPPLEMENTAL OXYGEN.**

The pressure demand crew oxygen masks must be properly stowed in their containers to qualify as a quick-donning oxygen mask.

### NOTE

Headsets, eyeglasses or hats worn by the crew will interfere with the quick-donning capabilities of the oxygen masks.

## THRUST REVERSERS

Reverse thrust power must be reduced to the idle reverse detent position at 60 KIAS on landing roll.

Maximum reverse thrust setting is limited to 75% of takeoff thrust.

Maximum allowable thrust reverser deployed time is 3 minutes in any 10 minute period.

Engine static ground operation is limited to idle power (if thrust reversers are deployed).

Use of thrust reversers is prohibited during touch and go landings.

The thrust reverser(s) must be verified to be operational. An operational test is provided in Section IV, Normal Procedures, Taxi.

The use of thrust reversers to back the airplane is prohibited.

## TRIM

Prior to takeoff the elevator trim check in Section IV, Normal Procedures, must be satisfactorily completed.

## AHRS SLAVING

Within certain latitudes, the AHRS system must be operated in the DG switch position to provide reliable readings. Refer to the Airplane Flight Manual, Figure 2-8, for an illustration of these limitations.

## AHRS SLAVING

Within certain latitudes, the AHRS system must be operated in the DG switch position to provide reliable readings. Refer to the Airplane Flight Manual, Figure 2-8, for an illustration of these limitations.

II. AIRPLANE
& SYSTEMS

# SECTION II

# AIRPLANE AND SYSTEMS

## CONTENTS

# ENGINE

## GENERAL

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

In a turbojet engine, incoming air is compressed, mixed with fuel, combusted and exhausted at a high velocity. In a turbofan engine, only a portion of incoming air is combusted. The hot air then drives the fan which accelerates a large volume of air at a lower velocity. This air is bypassed around the engine and is not mixed with fuel or combusted. The relation of the total mass of bypassed air, to the amount of air going through the combustion section, is known as the bypass ratio. The bypass ratio of the Citation Excel engine is 4.1 to 1.

The PW545A, developed by Pratt and Whitney Canada Inc., is a turbofan engine rated at 3804 pounds static thrust. A concentric shaft system supports the fan and turbine rotors. The inner shaft connects the fan ($N_1$) and the axial boost stage of the low pressure compressor at the front of the engine to the three rear low pressure turbines. The outer shaft connects the centrifugal compressor ($N_2$) and the forward high pressure turbine.

All intake air passes through the fan. Immediately aft of the fan the airflow is divided by a concentric duct. More than four-fifths of the total airflow is bypassed around the engine through the outer duct and is exhausted at the rear. Air entering the inner duct passes through guide vanes to the axial boost compressor stage, then through a second set of guide vanes and is compressed by the centrifugal compressor. The high pressure air then passes through a diffuser assembly and moves aft to the combustion section.

The combustion chamber is of a reverse flow design to save space and reduce engine size. A portion of the air entering the chamber is mixed with fuel and ignited. The remainder enters the chamber liner downstream for cooling.

Fuel is introduced by eleven hybrid nozzles supplied by a dual manifold. The mixture is ignited initially by two spark igniters which extend into the combustion chamber at the four and eight o'clock positions. After start, combustion becomes self-sustaining. The hot gases expand, reverse direction and pass through a set of turbine guide vanes to the high pressure turbine. The power generated by this turbine is transmitted by the outer shaft to turn the $N_2$ compressor.

Only a small part of the energy available in the hot, high pressure air is absorbed by the high pressure turbine. As the expanding gases move rearward, they pass through another set of guide vanes and enter the three-stage, low-pressure turbine. A greater portion of the remaining energy is extracted there and transmitted by the inner shaft to the forward-mounted fan. The hot gases then exhaust into the atmosphere.

The turbofan is in effect two interrelated power plants. One section is designed to produce energy in the form of high velocity, hot air. The other utilizes some of this air to provide the power to drive the fan. The fan of the PW545A, pumping a high volume of cool low-velocity air, produces over one-half of the total thrust.

# ENGINE AIRFLOW AND CROSS SECTION

## FLANGES

A NACELLE TO FAN CASE
B FAN CASE TO INTERMEDIATE CASE
C INTERMEDIATE CASE TO OUTER BYPASS DUCT
D OUTER BYPASS DUCT TO REAR BYPASS DUCT
E REAR BYPASS DUCT TO AIRFRAME SUPPLIED BYPASS DUCT

CORE AIR FLOW
BYPASS AIR FLOW

## STATIONS

0 AMBIENT
1 FAN CASE INLET (ID)
1.1 FAN CASE INLET (OD)
1.2 FAN BYPASS INLET
1.3 FAN BYPASS OUTLET
1.6 BYPASS EXHAUST
2 FAN CORE INLET
2.1 FAN CORE OUTLET
2.2 HP COMRESSOR AXIAL INLET
2.5 HP COMPRESSOR INTERSTAGE
2.8 HP COMPRESSOR IMPELLER INLET
3 COMBUSTION CHAMBER INLET
4 HP TURBINE INLET
4.5 INTERTUBINE
5 LP TURBINE OUTLET
6 CORE EXHAUST

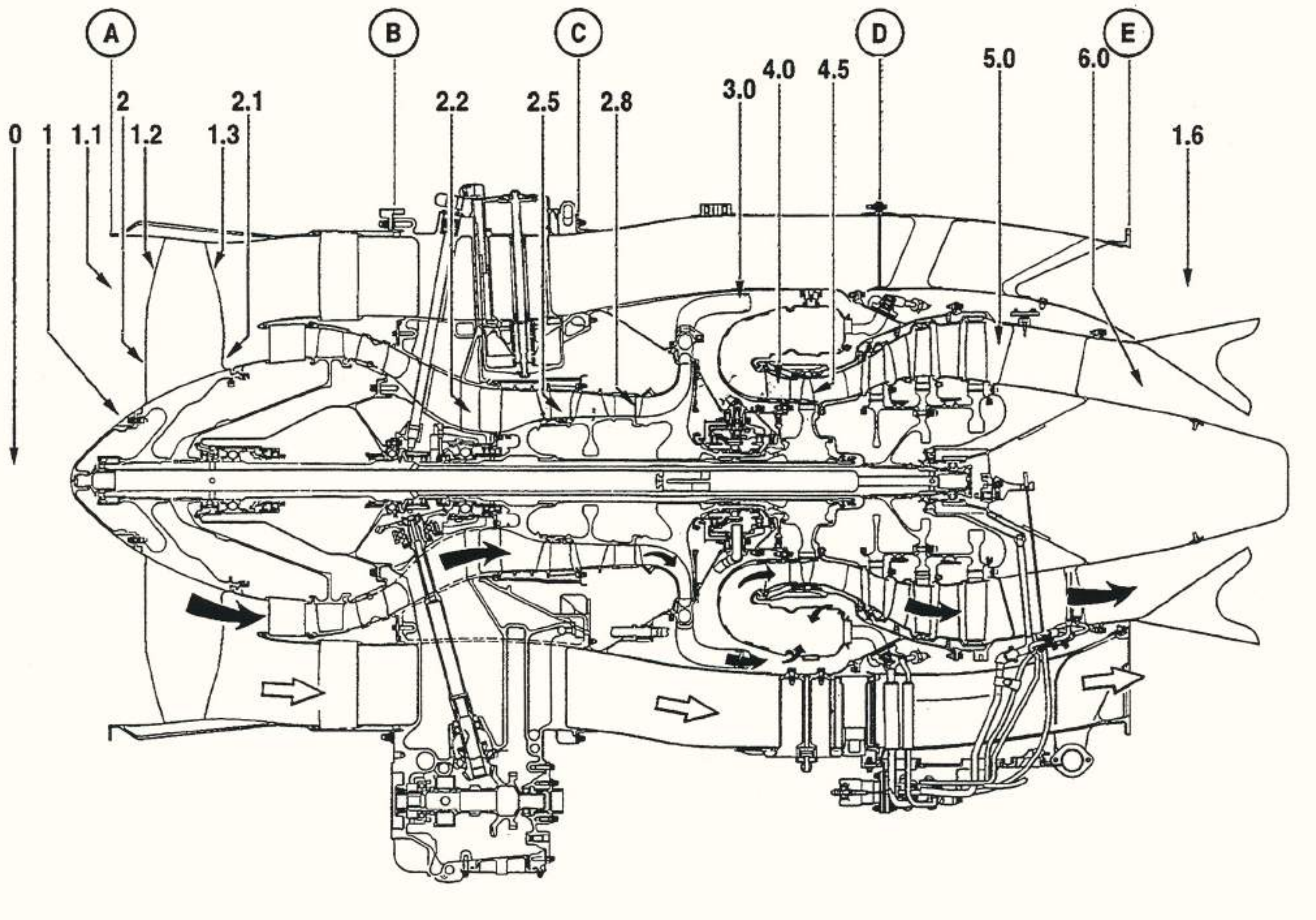



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Figure 2-1

## ENGINE CONTROL SYSTEM

The primary function of the Electronic Engine Control (EEC) system is to control the engine low rotor speed ($N_1$) and thereby the engine thrust as requested by the pilot's throttle position and the existing ambient conditions. The engine control system, which is a single channel, microprocessor based controller, provides two main modes of operation: AUTO mode and MANUAL (MAN) mode. MANUAL mode will automatically be entered in the case of an EEC major fault or may be selected by the pilot by placing the EEC switch, located on the lower left of the instrument panel, in the MAN position.

In AUTO mode the EEC provides the following functions in response to the Thrust Lever Angle (TLA) signal:

Detented throttle, automatic thrust setting ($N_1$ governing).
Idle governing ($N_2$ governing) at ground idle and flight idle.
Acceleration and deceleration limiting.
$N_1$ and $N_2$ speed limiting.
Closed loop bleed valve (BOV) control.
Engine diagnostic system (EDS) functions.
Overspeed protection ($N_2$).
$N_1$ or $N_2$ synchronization.

In MANUAL mode, the Fuel Control Unit (FCU) takes over full control of the engine speed in response to the throttle position. In MANUAL mode the throttle directly controls the FCU by means of a mechanical linkage. MANUAL mode provide the following functions:

Pilot adjustable power setting ($N_2$ governing).
Idle governing ($N_2$ governing) at flight idle and anti-ice idle.
Acceleration and deceleration limiting (ratio unit control).
$N_2$ speed limiting.
Closed Loop Bleed Valve (BOV) control.
Limited engine diagnostic system functions (EDS)

The Engine Diagnostic System (EDS) provides troubleshooting tools to resolve engine and airframe related EEC system problems.

# CONTROL SYSTEM SCHEMATIC

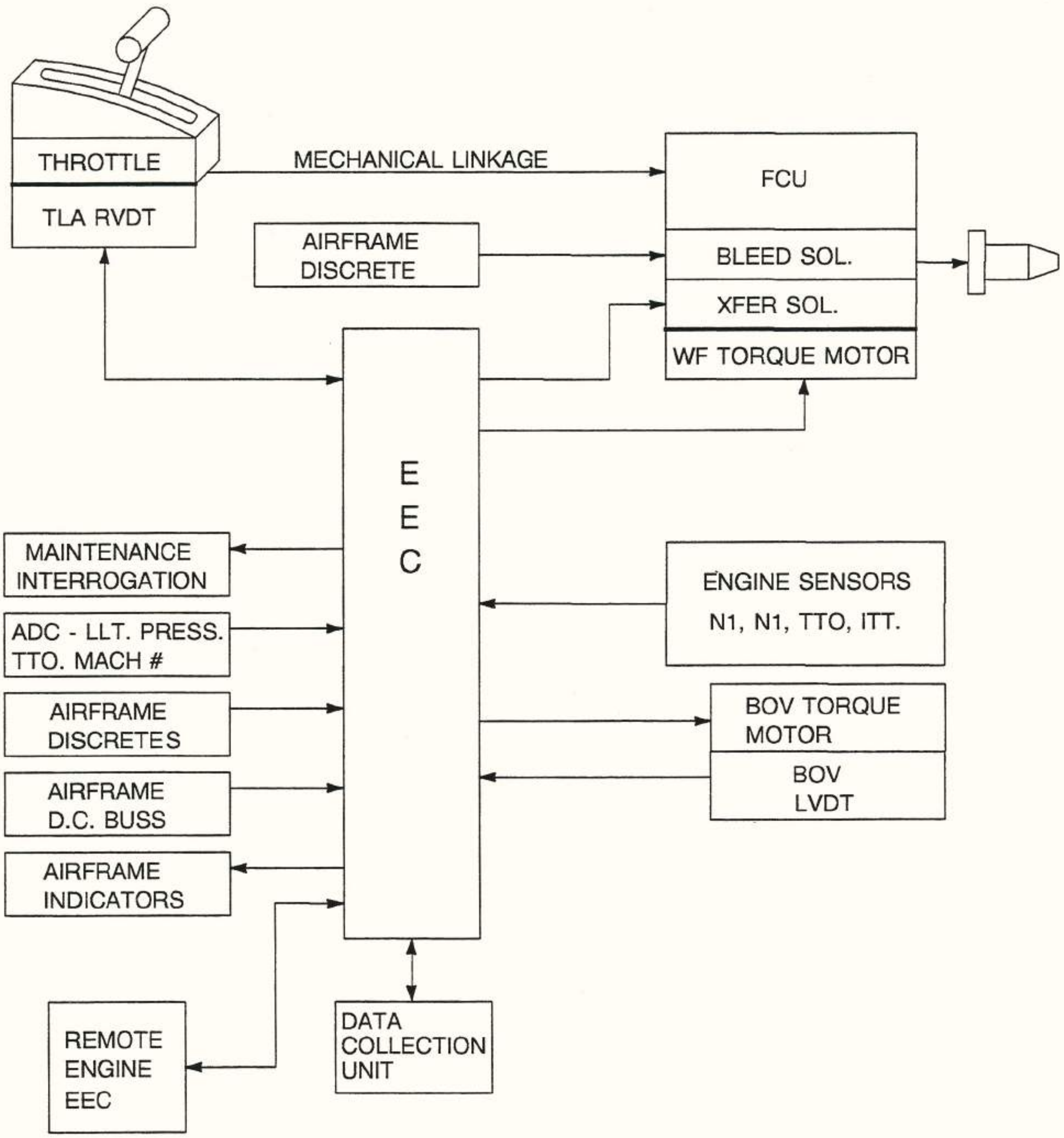



Figure 2-2

## GROUND IDLE

The 560 Excel is equipped with a ground idle system which automatically allows the engines to decelerate to an idle speed eight seconds after the landing gear squat switches have sensed a landing. The slower idle speed allows better taxiing control at lighter weights and in very cold temperatures, when the normal flight idle speed of 56.5% (at sea level) would require more use of the brakes, resulting in reduced brake life. The ground idle function is controlled automatically by the (EEC). A GND IDLE annunciator is located on the annunciator panel. The annunciator will illuminate when the airplane is on the ground and the engine has assumed the slower idle speed, or will assume it when the throttle is reduced to idle.

## ENGINE SYNCHRONIZER

An engine synchronizer system provides automatic $N_1$ fan or $N_2$ turbine RPM matching of the right (slave) engine to the left (master) engine. The synchronizer will continuously monitor the engine speeds and adjust the slave engine speed setting as required. The actuator has a range capability of 4.75 percent of fan RPM.

A rotary FAN-OFF-TURB switch on the pedestal actuates the engine synchronizer system. The FAN position synchronizes $N_1$ RPMs. The TURB position synchronizes $N_2$ RPMs. The OFF position deactivates the system and drives the actuator to the center of its range before stopping. An indicator light adjacent to the synchronizer switch comes on when the system is turned on. A turbine out-of-sync condition is generally more noticeable in the cockpit and a fan out-of-sync condition is usually more noticeable in the area of the rear seats. Engine synchroniztion is inoperative below approximatley 45% $N_1$.

## IGNITION SYSTEM

Each engine incorporates dual exciter units and two igniters. The exciter units convert battery or generator input to high voltage Direct Current (DC), store it momentarily until a given energy level is reached, and allow it to discharge in spark form through the igniters. System wiring is such that malfunction of one igniter or exciter will not affect normal operation of the other.

Cockpit control consists of two-position R and L ignition switches. In NORM, function is automatic during start and with engine anti-ice selected. Moving the throttle to IDLE after depressing the start button activates ignition until it is terminated automatically at approximately 38 percent turbine RPM ($N_2$). Continuous ignition occurs any time the respective engine anti-ice or ignition switch is ON.

A small green light adjacent to the ITT graph illuminates when both exciters are receiving electrical power. If one ignitor should fail, ignition will still be available from the remaining ignitor. If the ignition light does not illuminate when ignition is selected, or should be automatically provided, check the applicable ignition system circuit breaker on the left circuit breaker panel, or fuse in the aft power junction box.

## ACCESSORY GEARBOX

The starter/generator, fuel pump, fuel control, hydraulic pump, oil pump, $N_2$ monopole speed sensor and an AC generator for the windshield anti-ice are driven by the accessory gearbox mounted below the engine. Power to drive the gearbox is transmitted from the $N_2$ section through the tower shaft and a series of bevel gears. Lubrication is provided by the engine oil system.

# OIL SYSTEM

The oil system is a self-contained fuel-cooled oil cooler, which is incorporated as part of the engine. Each engine has a nominal capacity of 6.13 U.S. quarts, of which 2.14 quarts are usable.

Oil passes through a check valve, which prevents gravity flow when the engine is not running, and past a pressure relief valve enroute to the oil cooler. If system pressure becomes excessive, the relief valve reduces it by unseating and allowing oil to return to the pump inlet via a bypass line.

From the cooler, oil passes through a filter before being routed to the engine bearings and accessory gearbox. Should the filter become clogged, a bypass valve opens, allowing lubrication to continue.

Cockpit indicators receive inputs from the pressure transmitter just upstream of the oil cooler and the temperature bulb immediately downstream of the cooler.

# THRUST REVERSER SYSTEM

## DESCRIPTION AND OPERATION

The thrust reversers are of the external target type employing two vertically oriented doors or buckets, which, when deployed, direct exhaust gases forward to provide a deceleration force for ground braking. When stowed, the reversers fair into external airplane contours to form the aft portion of the nacelle. The reversers are mounted to the engine fan nozzle through an aluminum support casting and four interconnecting links per door.

## NORMAL OPERATION

The reverser system is designed for two-position operation: stowed during takeoff and flight and deployed during landing ground roll. The reversers are activated by pilot operation of the thrust reverser throttle levers and deployed by hydraulic pressure supplied by an engine-driven pump and directed to the drive actuators. The actuators are connected to a slider mechanism which is in turn connected to the reverser doors by a four-bar linkage system. The system, by design, incorporates an overcenter feature in the linkage which locks the reverser in the stowed position.

Hydraulic actuators are mounted to the support casting on each side of the reverser. The airplane hydraulic system provides pressure to these actuators which in turn operate the linkage system along a sliding track in the support casting to deploy and stow the reversers.

# ENGINE OIL SYSTEM SCHEMATIC

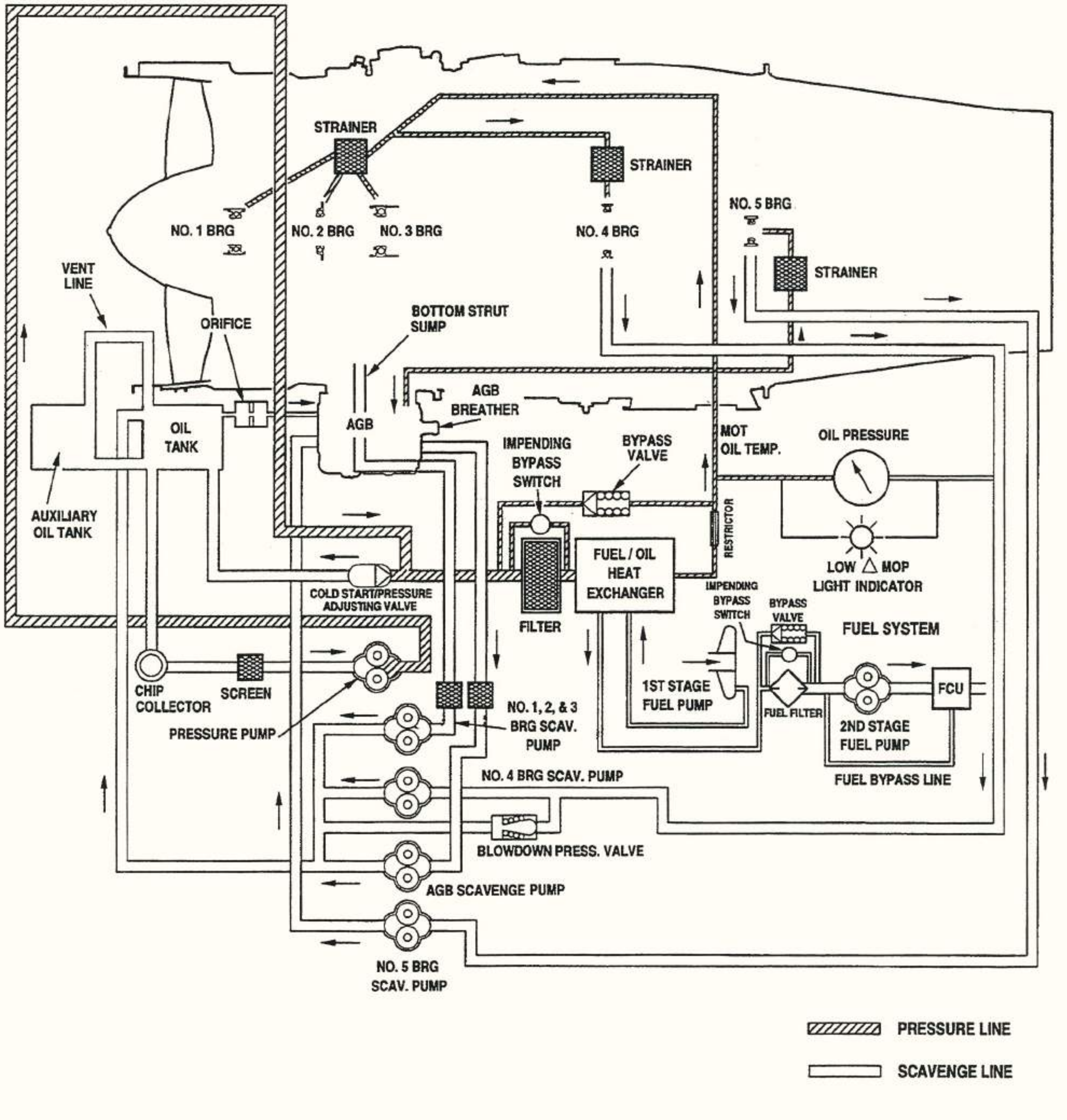



Figure 2-3

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

An automatic system is incorporated in the installation to reduce engine power approximately to idle if an inadvertent deployment, or stowage, of the thrust reverser should occur.

In the event of an inadvertent thrust reverser deployment, an automatic throttle retarding device will bring the throttle to approximately idle thrust depending on the amount of throttle friction that has been applied. After this device has activated, the throttle lever can be advanced resulting in corresponding reverse thrust. It is possible for a pilot, with hand on the throttle levers, to override the retraction mechanism resulting in corresponding reverse thrust should inadvertent deployment occur. Subsequent reduction of the throttle lever to idle will not result in engine flameout unless mechanical damage has resulted from the deployment.

## WARNING

- **DO NOT USE THROTTLE FRICTION OR MANUALLY RESTRAIN THE THROTTLE LEVERS DURING TAKEOFF. SHOULD AN INADVERTENT THRUST REVERSER DEPLOYMENT OCCUR, THIS COULD RESULT IN A DANGEROUS ASYMMETRICAL THRUST CONDITION.**

- **SHOULD AN INADVERTENT THRUST REVERSER DEPLOYMENT OCCUR, THE PILOT MUST ENSURE THAT THE THROTTLE LEVER IS IN THE IDLE POSITION.**

Moving the reverse thrust lever from the STOWED to the IDLE REVERSE position actuates the deploy cycle. This electrically opens the isolation valve, moves the reverser control to deploy and pressurizes the airplane hydraulic system. The isolation valve allows the airplane hydraulic system to pressurize the thrust reverser system. The amber ARM light indicates hydraulic pressure to the reverser control valve as sensed by a pressure switch.

During thrust reverser deployment, the initial movement of the actuators activates the unlocked switches. Either switch will cause the amber UNLOCK light to illuminate. Further movement of the actuator unlocks the reverser through the overcenter linkage. The remaining travel of the actuators deploys the reverser doors.

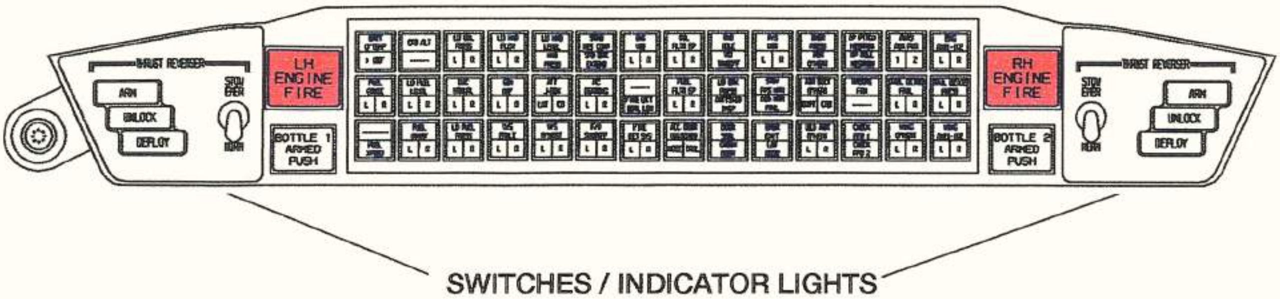
At full deployment of the reverser, the deploy switch is activated which in turn illuminates the white DEPLOY light and unlocks the pedestal-mounted throttle lock-out cam. The purpose of the lock-out cam is to prevent increasing engine thrust, once reverser deployment has been selected, until the reversers have fully deployed.

Three reverser indicator lights for each reverser are mounted on the cockpit glareshield for monitoring reverse functions: ARM, UNLOCK and DEPLOY.

## NOTE

The DEPLOY light shall illuminate in less than 1.5 seconds after the hydraulic UNLOCK light illuminates. An erroneous sequencing or a delay in the illumination of the thrust reverser lights indicates a failure in the thrust reverser system. Either or both conditions requires a maintenance check.

# THRUST REVERSER STOW SWITCHES / LIGHTS




9912504-4

Figure 2-4

## WARNING

**DO NOT ATTEMPT TO FLY THE AIRPLANE IF THE THRUST REVERSER PREFLIGHT CHECK IS UNSUCCESSFUL.**

As previously mentioned, either of the landing gear squat switches must be activated to complete the electrical circuit necessary to initiate deployment of the thrust reversers.

The thrust reverser lever(s) should not be placed in the idle reverse detent position in flight since a single failure of either squat switch could permit deployment of the thrust reverser(s). If the thrust reverser lever is placed in the idle reverse detent position while airborne, the airplane MASTER WARNING light will flash along with illumination of the ARM and HYD PRESS annunciator lights. A MASTER WARNING light, when thrust reversers are moved to deploy on the ground, means that neither landing gear squat switch has activated. To ensure actuation of the squat switches and to eliminate any delay in the deployment of the thrust reversers, it is recommended that the speed brakes be extended immediately following touchdown.

After deployment, power may be increased by moving the thrust reverser throttle levers aft for maximum reverse thrust. Thrust reverser throttle stops are set for approximately 75% $N_2$ (turbine) RPM of takeoff thrust. These stops will allow the pilot to keep his/her attention on the landing rollout instead of diverting attention to the reverse power settings.

For increased aerodynamic drag on landing roll, it is suggested that the thrust reversers remain in the deployed idle reverse power position after reverse thrust power has been terminated at 60 KIAS unless loose pavement, dirt or gravel is present on the runway. Idle reverse thrust is capable of causing ingestion of small grit at very low ground speed.

To stow the thrust reversers, move the reverse thrust lever through the idle reverse detent to the stow position. This actuates a switch in the pedestal which moves the thrust reverser control valve to the stow position. Hydraulic pressure is directed by the valve to the two actuators in the reverser which move the thrust reverser doors to the stowed position. Initial movement of the linkage toward the stowed position deactivates the deploy switch extinguishing the DEPLOY light. As each actuator moves to the fully stowed and locked position, they deactivate a thrust reverser unlocked switch. When both switches in a reverser have been deactivated, the UNLOCK light is extinguished, the airplane hydraulic system is depressurized and the affected thrust reverser isolation valve closes. This puts the ARM light out as the pressure in the line downstream of the isolation valve drops.

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

Landings with a crosswind component of 20 knots at 30 feet above runway were demonstrated. Adequate control of the airplane was maintained during and after thrust reverser deployment. Single-engine reversing has been demonstrated during normal landings and is easily controllable.

### EMERGENCY STOW OPERATION

An emergency stow switch for each thrust reverser is located on the cockpit glare shield and will provide the same stow sequence (using the alternate 28 volt thrust reverser power source) as the thrust reverser throttle levers, in the event of a failure of the pedestal-mounted deploy and stow switch, or of the respective 28 volt direct current (VDC) bus.

Each emergency stow switch receives its electrical power through the opposite thrust reverser circuit breaker. The emergency stow function can be checked on the ground by deploying the reversers normally and then actuating each emergency stow switch. The DEPLOY and UNLOCK lights shall extinguish. The ARM and HYD PRESS lights remain illuminated. Return the thrust reverser lever to stowed position, then turn each emergency stow switch off. All lights shall be extinguished.

## FIRE PROTECTION

Engine fire detection consists of a closed-loop sensing system and detector control unit which illuminates the respective red ENGINE FIRE warning light on the cockpit glare shield if a fire or overheat condition is present. The warning light, under a transparent, spring-loaded guard, also serves as a firewall shutoff switch.

## FIRE DETECTION INDICATING LIGHTS

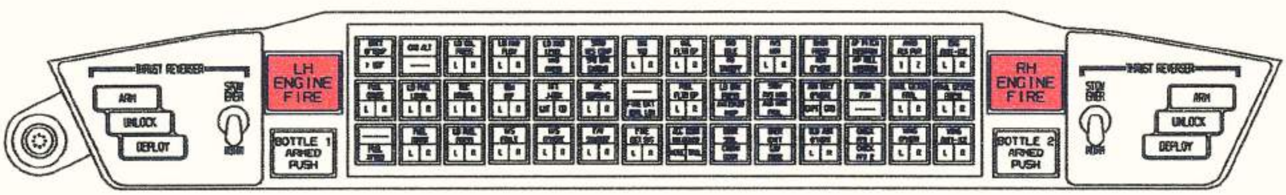



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Figure 2-5

# ENGINE FIRE EXTINGUISHING SYSTEM

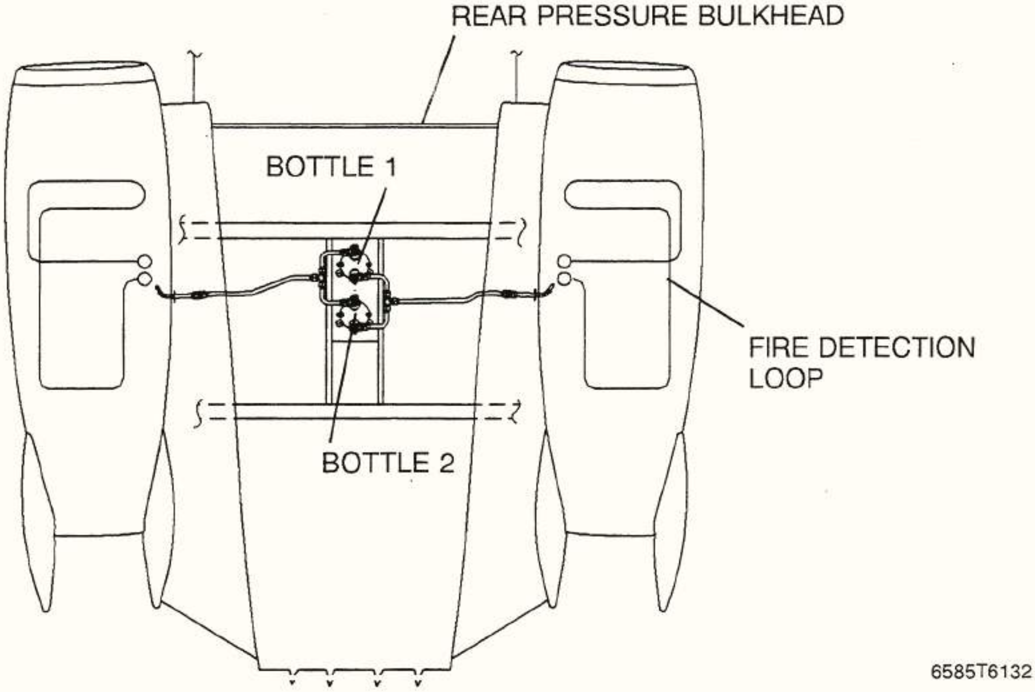



Figure 2-6

Lifting the guard and depressing the warning light simultaneously closes the respective firewall fuel and hydraulic valves, deenergizes the starter/generator and arms the two freon extinguishing bottles. Firewall shutoff and extinguisher arming are indicated by illumination of the respective LO FUEL PRESS, HYD PRESS, F/W SHUTOFF and GEN OFF annunciator panel lights and both white BOTTLE ARMED lights.

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

Function of the lights and continuity of the sensor and detector control units is checked by placing the rotary TEST selector in the FIRE WARN position and observing illumination of both red lights and the FIRE DET SYS L R annunciator. Depressing either fire light will then illuminate both BOTTLE ARMED lights.

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

## FUEL

### GENERAL

The Excel utilizes a wet wing with fuel functionally divided into two separate tanks by a fuel rib in the center of the wing (BL 0.00). Normal operation supplies fuel to the engine from its respective integral wing tank. Each half of the system holds approximately 503 U.S. gallons for a total airplane capacity of 1006 gallons of usable fuel (approximately 6790 pounds).

# FUEL SYSTEM SCHEMATIC

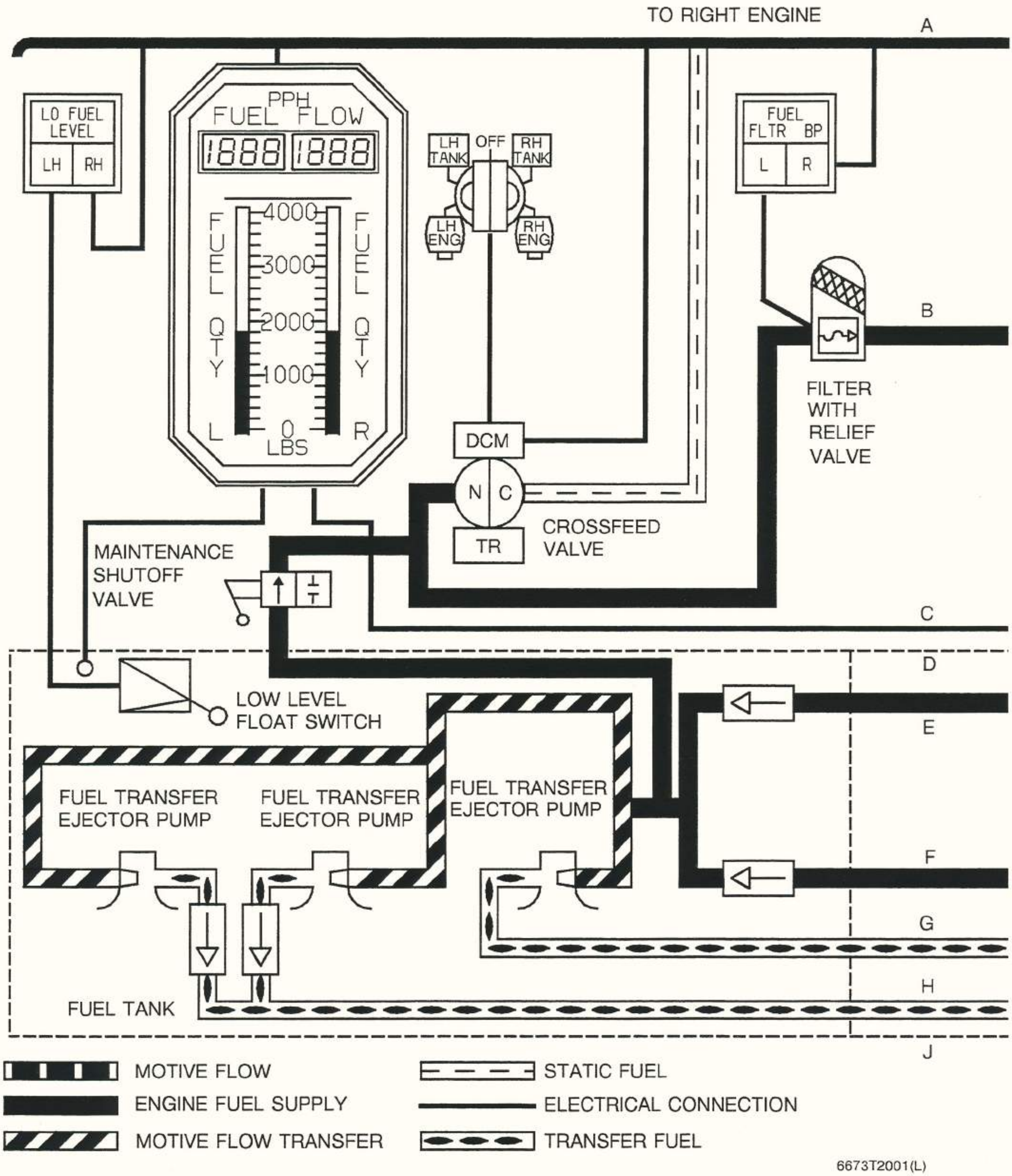
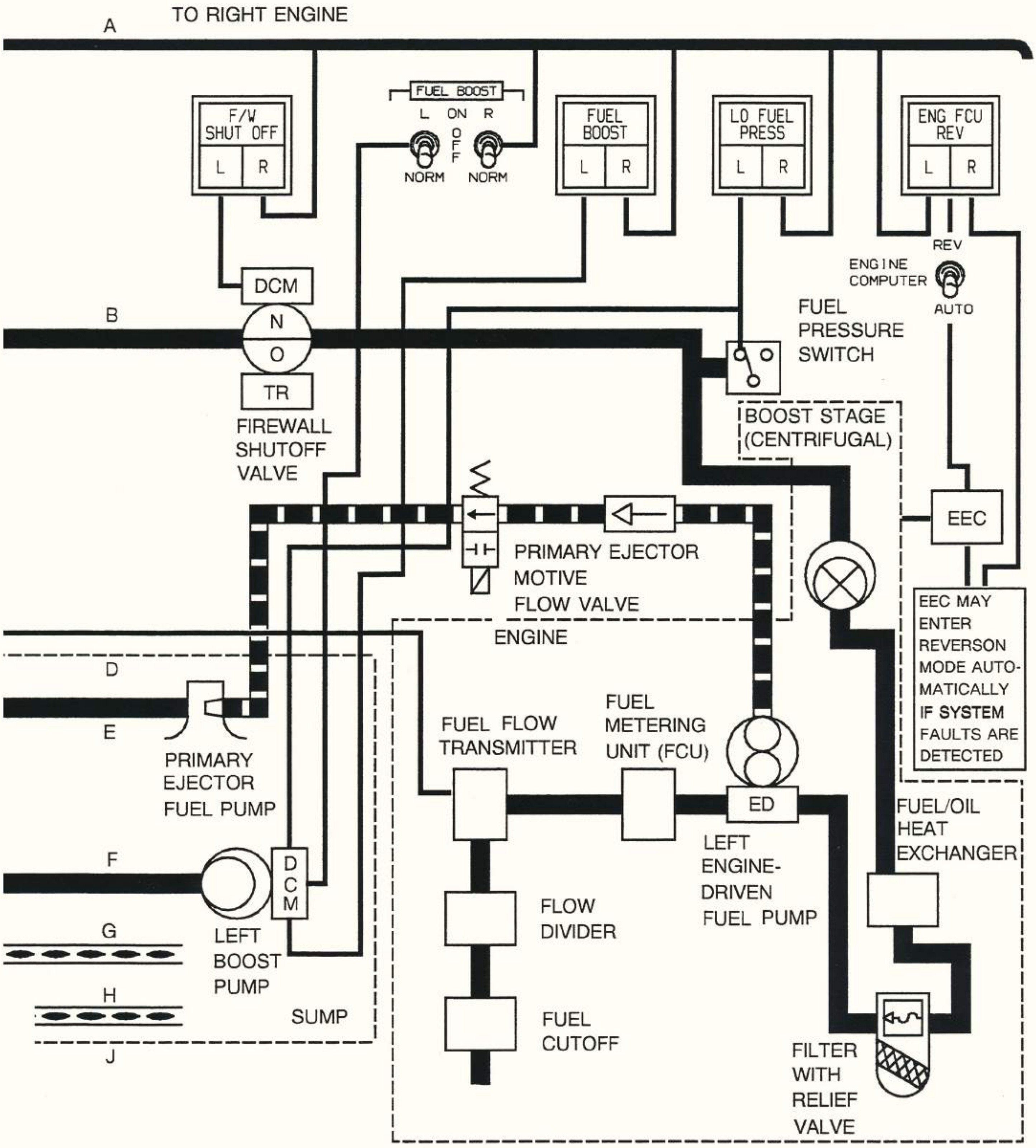



Figure 2-7 (Sheet 1 of 2)

# FUEL SYSTEM SCHEMATIC




6673T2001 (R)

Figure 2-7 (Sheet 2)

Crossfeed capability is incorporated, and when selected, enables both engines to receive fuel from a single tank. A single-point pressure refueling receptacle is located on the right side of the fuselage, just forward of the wing. It permits simultaneous servicing of both sides of the fuel system. Refer to the Maintenance Manual, Chapter 12 for fuel servicing procedures.

System operation is fully automatic throughout the normal flight profile. Fuel system control and monitoring is available through the boost pump switches, crossfeed switch, fuel quantity and flow indicators, and annunciator panel lights which warn of abnormal system operation. A low fuel level warning system functions independently of the normal fuel quantity indicating system.

## WING FUEL TANKS

Fuel for each tank is contained between the fore and aft spars, and from the center point of the wing (BL 0.00) outboard to the wing tip (WS 284.52) with necessary deviations in the wheel well area. Fuel flows freely inward across the ribs through lightening holes and stringer cutouts, but is restricted from flowing outward by flapper vales located in three different wing ribs.

The engine feed hopper is located forward of the rear spar and extends outward approximately 11.5 inches from each side of centerline. It is sealed except for vent openings at the top (in order to maintain a full hopper under low fuel conditions). It is equipped with flapper valves that allow for gravity fuel flow into the hopper. Components which supply fuel to the engine are located within the hopper.

A vent system ensures ambient pressure within the tank and fuel expansion overflow capability. A float-type valve restricts flow through the vent during inflight maneuvering. Design features of the vent prevent it from becoming blocked by inflight ice accumulation.

## DRAIN VALVES

Five fuel tank drains (push to drain, turn to lock) are located underneath each wing Four of the drains are located near the wing center line (from fore to aft) and one drain is located outboard of the wheel well.

## VENT SYSTEM

The left and right tanks have separate yet similar vent systems, with each tank containing pressure/vacuum relief provisions separate from the vent system. Components of the vent system are as follows:

### CLIMB VENT LINE

This is a series of tubes which extend from the outboard surge tank to the forward upper corner of the wing tank, just inboard of WS 34.00. The climb vent line serves as the primary vent during climb and descent at normal fuel levels and attitudes.

### VENT SURGE TANKS

The vent surge tanks are located near each wing tip in a semi-isolated location, and normally do not contain fuel. These surge tanks function as a fuel collector for relatively small amounts of fuel which may be trapped in the climb vent line during flight maneuvers and climb attitudes, or during thermal expansion of the fuel. Each surge tank is vented to atmosphere by a flush, non-icing NACA scoop located on the lower wing surface. The vent scoop is connected to the surge tank with an open-ended tube located at a high point in the surge tank, preventing fuel from siphoning overboard. This also prevents fuel from spilling overboard during wing-low conditions of flight, or in uncoordinated turns.

Additionally, each surge tank also contains a vent valve which allows air to either enter or leave the fuel cell through the surge tank. It is the primary vent used during level attitudes, including refueling and defueling. The valve is float actuated so that whenever fuel moves to the wing tip for any reason, the valve closes, preventing fuel flow into the surge tank. Each surge tank also contains an inboard mounted flapper valve which allows fuel to drain back to the wing tank and prohibit it from flowing into the surge tank.

## RELIEF VALVES

Each wing tank incorporates a relief valve which prevents excessive positive or negative tank pressures during single point refueling, or during other conditions if the the normal vent system is blocked. The valve automatically reseats itself once system pressure has returned to normal pressure levels.

## EJECTOR PUMP

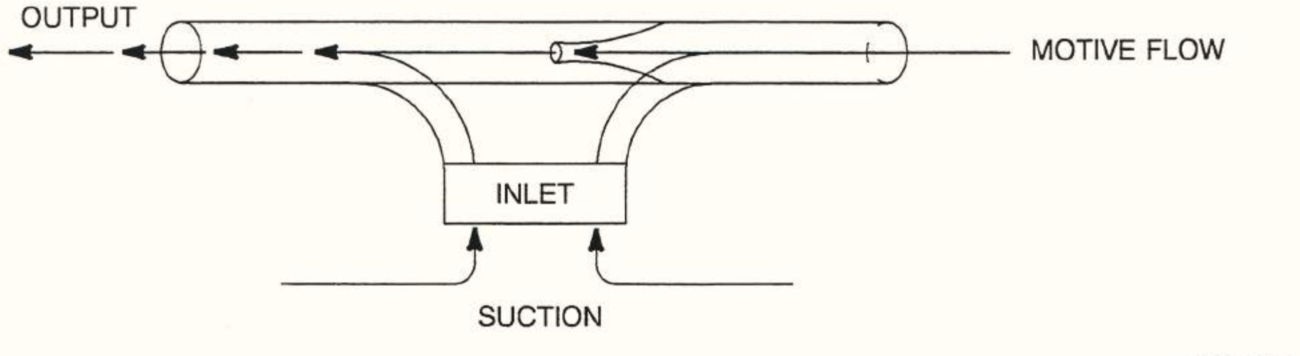



Figure 2-8

## ENGINE FUEL SUPPLY COMPONENTS

Each engine is supplied with fuel primarily by the motive flow-powered ejector pump and secondarily by the electric boost pump. Both components for each engine are located in the engine feed hopper.

The primary ejector pump is powered by high pressure motive flow from the engine fuel control unit, and it supplies low pressure fuel to its respective engine during normal fuel operation and operates only when that engine is operating. It also supplies the scavenge ejectors with low pressure motive flow. A check valve is installed in the pump discharge fitting to prevent backflow through the pump.The 28 VDC wet electric motor pump is used for engine starting, fuel crossfeed, APU only operation (when so equipped), and in the event of primary ejector pump failure. The pump includes a cartridge element for the motor and impeller which allows motor replacement without the need for airplane defueling.

A pressure switch is located in the engine nacelle area and actuates between 5.3 and 5.8 PSIG with decreasing pressure, and deactivates by 7.5 PSIG with increasing pressure. Actuation of the switch is indicated by the LO FUEL PRESS L or R light on the annunciator panel, and will cause the boost pump to operate.

Each fuel supply line (left engine and right engine) also contains a firewall shutoff valve. These valves are located behind the rear spar in an access panel area, and are actuated by the fire tray annunciator/switches.

## FUEL SCAVENGE COMPONENTS

Fuel for the engine feed hopper is supplied by the fuel scavenge system (and to a much lesser extent by gravity flow). This system uses ejector pumps to pick up fuel at three distinct points in the inner portion of each wing tank and deliver it to the hopper area. The scavenge ejectors are powered by low pressure motive flow from the primary ejector pump. The scavenge system also contains wire mesh screens which minimize contamination reaching the hopper and fuel system components.

## CROSSFEED COMPONENTS

The crossfeed system allows either or both engines and the auxiliary power unit (if equipped) to be fed from the primary ejector and/or auxiliary boost pumps in either tank. The system consists of the following components:

### CROSSFEED VALVE

This is a normally closed, motor-operated ball valve. This valve is installed in the rear spar area of the engine feed hopper, and connects left and right engine supply manifolds. The motor portion of this valve is installed outside of the engine feed hopper to allow motor removal/installation without removing the ball valve.

### MOTIVE FLOW SHUTOFF VALVE

These normally-open valves are installed aft of the rear spar area. Each motive flow shutoff valve is installed in-line to allow normal left engine/left tank and right engine/right tank feeding operation. In crossfeed operation, one of the valves will be closed (dependent on switch position).

## CROSSFEED OPERATION

Crossfeed operation is controlled by a selector on the left switch panel labeled L TANK - OFF - R TANK and allows both engines to be supplied from one fuel cell.

Selecting either tank automatically turns on the electric boost pump in that cell, opens the crossfeed valve, illuminates the XFEED annunciator on the annunciator panel, and three seconds later closes the motive flow shutoff valve on the engine receiving crossfeed. Returning the selector to OFF reverses the sequence.

**NOTE**

When selecting crossfeed, it is important to allow sufficient time for the cycle of events to be completed before returning the switch to OFF. Not allowing sufficient time can interfere with the normal operation of the time delay relays resulting in loss of control of the crossfeed system. If experienced, this condition can be corrected by placing the battery switch in EMER and turning both generators off. After several seconds, electrical power can be restored and crossfeed will function normally.

## SINGLE POINT REFUEL/DEFUEL SYSTEM

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

The refueling/defueling system is independent of the airplane system. It is designed for refueling with a truck or refueling hydrant (pit) having single point provisions. The system allows for fuel to be delivered to both wings, or to each wing independently. Major components of the system include the refueling/defueling adapter (receptacle), the precheck control panel, refuel/defuel shutoff valve, the pilot (precheck) valve, the low level pilot vale, the high level pilot valve and associated system plumbing.

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

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

Precheck is accomplished by lifting the precheck handle and applying fuel pressure. Flow should stop within approximately thirty seconds. During the precheck operation fuel is pumped into a small bowl at the high level pilot valve, which will operate the refuel shutoff valve, stopping the flow of fuel just as it does when the tank is full.

When one wing tank reaches the full level and flow is discontinued, the opposite wing (if not yet full) will receive the full refueling flow until it also reaches the full level. When both wings have been filled, the system will stop the flow of fuel just downstream of the refuel adaptor. A check valve in the adaptor will ensure no fuel is spilled when the hose is removed from the panel. When refueling the wings to less than full, small differences in fuel flow within the single point distribution system may result in slightly more fuel entering one wing tank than the other.

### DEFUELING OPERATION

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

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

## ENGINE FUEL SYSTEM

The two-stage, engine-driven pump, mounted on the accessory gearbox, supplies high pressure flow to the fuel control unit. Fuel enters the pump at low pressure from the primary ejector pump and exits at high pressure. Part of the pump output is bypassed through the motive flow valve to drive the primary ejector pump and the remainder is directed downstream to the fuel control. This positive pressure to the fuel control must be maintained by the engine-driven pump for the engine to continue to operate.

The fuel control unit is mounted on the engine-driven fuel pump and determines the proper fuel schedule for all phases of engine operation.

A flow divider downstream of the fuel control unit provides proper fuel distribution to the combustion chamber by dividing the flow from the fuel control between the primary and secondary fuel manifolds. It also acts as a fuel shutoff valve, bypassing fuel back to the pump. When the throttle is closed, fuel flow is terminated at the flow divider and the fuel manifold is drained. A fuel canister assembly collects the fuel at engine shutdown and returns it to the main tanks during the next flight.

### FLOW INDICATORS

Fuel flow rate is measured downstream of the fuel control and presented on a digital format gauge in pounds per hour per engine.

## FILTER

Each engine-driven pump incorporates a filter. A pressure differential sensing switch and a bypass valve alert the pilot and allow flow to continue should the filter become obstructed. The switch closes and illuminates the FUEL FLTR BP annunciator panel light if the difference between filter inlet and outlet pressure reaches 6 to 8 PSI. The bypass valve will open at 9 to 12 PSI differential. Illumination of the annunciator panel light indicates impending or actual bypass of fuel around the filter.

## QUANTITY INDICATORS

Seven capacitance-type probes and one temperature compensator in each cell supply information to the vertical scale quantity gauge. The indicator converts these signals into fuel weight and displays it in pounds per cell.

## LOW LEVEL WARNING

Low level warning functions independently of the normal quantity indicating system and provides a visual warning to the crew when a minimum amount of usable fuel remains in either tank. The system consists of a float switch in each fuel cell and L and R LO FUEL LEVEL annunciator panel lights. A minimum usable fuel quantity of 360 pounds in either tank will illuminate the associated light. When operating with light fuel loads, it is possible for the lights to illuminate momentarily in turbulent flight conditions or while taxiing on rough surfaces. The system is calibrated to give an accurate indication in level unaccelerated flight.

## FUEL SHUTOFF

Electrically operated firewall shutoff valves can be individually closed by depressing the LH or RH ENGINE FIRE button. Actuation of a shutoff valve will be indicated by illumination of the respective LH or RH F/W SHUTOFF annunciator panel light.

Protection against severe overspeed or explosive structural failure of the engine is provided by an automatic fuel shutoff. It is actuated through mechanical linkage should a predetermined amount of rearward displacement take place on the turbine shaft. Fuel flow to the manifold is terminated, automatically shutting down the engine.

# HYDRAULIC

## GENERAL

The Excel utilizes a phosphate ester-based open center concept to operate the landing gear, flaps, speedbrakes, two-position horizontal stabilizer and the thrust reversers. A separate independent system is used for the main wheel antiskid/power brake system.

In the open center system, fluid continually circulates between the hydraulic lines and the reservoir at a pressure of approximately 60 PSI. This very low pressure greatly reduces the quantity of hydraulic fluid required in the reservoir because there is minimum fluid heat buildup. Low pump wear and low system leakage rates are additional benefits of the open center system.

## RESERVOIR

The fluid for the system is contained in an hydraulic bootstrap reservoir located in the aft tailcone area. The reservoir contains an external tapered-piston rod and housing, and the piston extends or retracts based on fluid level in the system. Markings on the piston rod housing indicate refill, full and overfill levels. Any time the fluid level drops below the refill position, the taped rod will activate a microswitch and cause the amber LO HYD LEVEL annunciator to illuminate. Servicing requires equipment capable of delivering hydraulic fluid under pressure. Bleeding or relieving an overfill condition is accomplished by opening a relief valve located on the reservoir (right hand wing root area). Relieved excessive fluid is drained overboard through the underbelly vent mast. Any internal leakage is collected and drained through an overboard vent line into the underbelly vent mast.

## PUMPS

Hydraulic pressure is provided by two positive displacement engine-driven pumps, each mounted on the engine accessory case. Either pump is capable of supplying enough pressure to operate the gear, flaps, speedbrakes, two-position horizontal stabilizer and reversers. From each pump, hydraulic fluid is routed through filters and flow switch check valve assemblies to the bypass valve and relief valve. In the event that either pump output should drop to less than 0.45 gallons-per-minute, +0.10 or -0.10 gallons-per-minute (GPM), the respective LO HYD FLOW annunciator panel light will illuminate. The light will extinguish when pump output reaches a minimum of 1.33 GPM.

## NORMAL OPERATION

When either the landing gear, flaps, speedbrakes, two-position horizontal stabilizer or thrust reversers are actuated, a bypass valve in the return line closes enabling the system to pressurize to 1500 PSI. At the same time, the respective control valve opens, allowing flow to go to the selected system. A relief valve which maintains system pressure at 1500 PSI is in parallel with the bypass valve. The relief valve cracks at 1350 PSI and is fully open at 1500 PSI. The HYD PRESS light illuminates on the annunciator panel any time the system is pressurized. Once the selected cycle is complete, the respective control valve closes, the bypass valve opens and the system reverts to the low pressure, open center state.

# HYDRAULIC RESERVOIR REFILL LEVEL

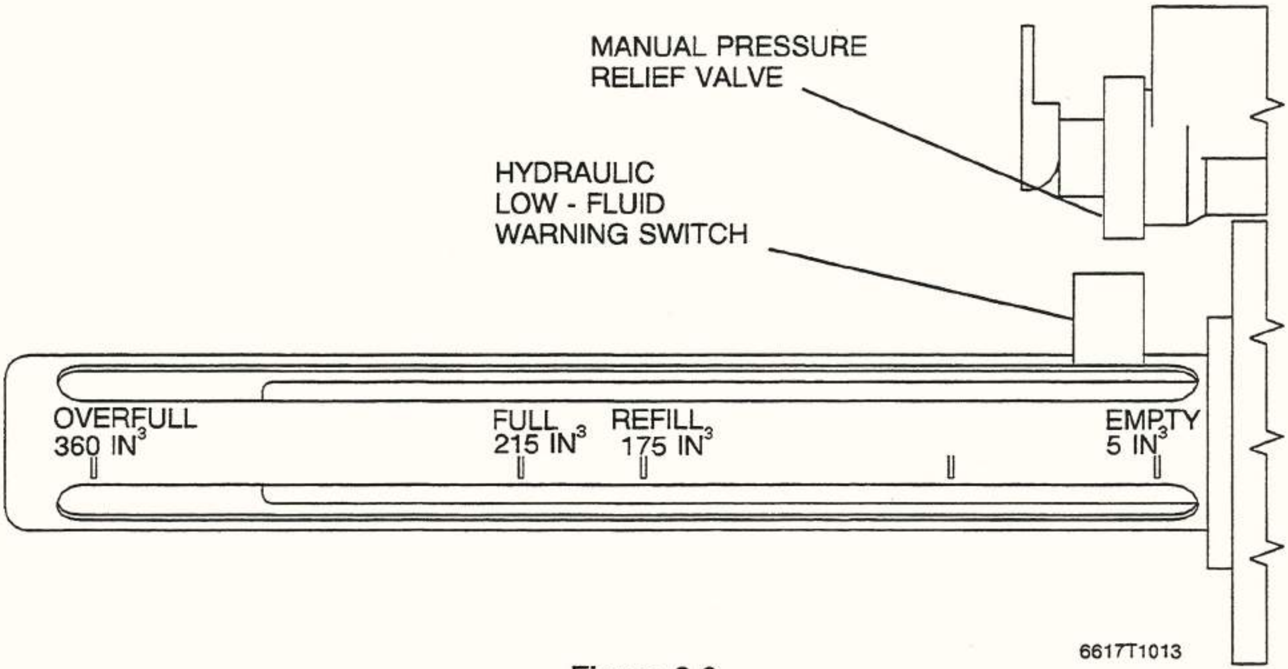



Figure 2-9

## WHEEL BRAKES

The power brake and anti-skid system are designed independent of the main hydraulic system. Refer to the following topic for a complete description.

## POWER BRAKE AND ANTI-SKID SYSTEM

## GENERAL

The power brake and anti-skid installation is a closed center, phosphate-ester based system with its its own separate independent powerpack assembly, accumulator and reservoir. These components provide pressurized hydraulic fluid to the power brake and anti-skid servo valve, which in turn regulates a maximum of 1000 PSI, +20 or -20 PSI pressure to the brakes. This pressure is based upon pilot/co-pilot input through the brake master cylinders, and electronic inputs from the anti-skid control box.

RPM transducers at each wheel sense the beginning of a skid and transmit this information to the anti-skid control. A hand-controllable pneumatic emergency brake valve is provided in the event of a power brake failure. Pneumatic pressure is transmitted to brakes through a shuttle valve integral to each brake assembly. Additionally, a parking brake is included in the basic hydraulic brake system. Specific components are described below.

(Continued Next Page)

# POWER BRAKE AND ANTI-SKID SYSTEM (continued)

### POWER PACK

The powerpack is located on the left side of the nose avionics compartment. The powerpack assembly contains the pump, electric motor, filter and associated plumbing. The motor is of fixed displacement, delivering approximately 0.3 gallons per minute at 7000 RPM. The motor runs only when the gear lever in in the down position and a pressure switch mounted at the accumulator outlet is closed. The switch contacts are normally closed, and open on increasing pressure at 1500 PSI. The contacts close after pressure decreases a minimum of 300 PSI and above 1100 PSI.

If the gear is extended and pressure drops below 900 PSI, a pressure switch installed on the pump manifold will activate the LO BRK PRESS light on the annunciator. Thermal relief is provided by a manifold mounted valve at 1700 PSI.

### ACCUMULATOR AND RESERVOIR

The accumulator is located on the left side of the nose avionics compartment. It is precharged to 675 PSI, with all hydraulic fluid bled out to the reservoir. The reservoir is located on the forward side of the forward pressure bulkhead, and contains sight gauges to indicate fill levels.

## BRAKE MASTER CYLINDERS

The pilot and copilot brake master cylinders are plumbed in series, but a check valve from input to output allows fluid to pass above 3 PSID, sot he input signal at the control valve is the greater of either the pilot or the copilot's effort.

## WHEEL BRAKES

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

### PARKING BRAKE VALVE

The parking brake is a part of the normal brake system and employs controllable check valves that can prevent the return of fluid after the brakes have been set. Parking brakes are set by depressing the toe brakes and pulling out the black parking brake handle located under the lower left side of the instrument panel. The parking brake should not be set if the brakes are very hot. This increases brake cool-down time due to decreased airflow, and may result in sufficient heat transfer from the brakes to cause the parking brake thermal relief valves to open or to melt the thermal relief plugs in the wheel, causing deflation of the tire.

## DIGITAL ANTISKID SYSTEM

The antiskid system provides power assisted braking with skid protection. It is designed to provide maximum braking efficiency on all runway surfaces. The system consists of two wheel speed generators, power brake relay/antiskid valve, a digital control box, pressure and control switches and two indicator lights.

System operation is conventional with power braking available at all speeds while antiskid protection is available at speeds between 10 and 175 knots. The antiskid protection feature is designed to operate with maximum pilot brake applied pressure.

The wheel speed generator is bolted in the main gear axle with the drive shaft connected through a drive cap to the main wheel. As the wheel turns, the generator generates a signal for each wheel revolution that is sent to the control module as a variable frequency. The control module accepts the output of the left and right wheel speed generators independently and converts these signals to a direct current (DC) voltage directly proportional to wheel speed. Any significant variation between either wheel speed voltage produces an error signal that activates the power brake and antiskid valve which controls the amount of braking being applied against each wheel. At touchdown, the generator voltage reaches maximum as soon as the wheel spins up. As long as no skid occurs, the generator voltage follows wheel speed and the reference voltage follows the voltage of the generator. When excessive deceleration of a wheel occurs, generator voltage suddenly drops. An error signal is generated which energizes the servo valve segment of the power brake and antiskid valve. The servo valve controls the movement of spools within the main body of the power brake and antiskid valve which modulate the braking effort being applied by the pilot as required to maintain generator voltage and reference voltage within the skid limits, preventing the skid condition. When the airplane speed drops below approximately 10 knots, the antiskid function disengages.

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

A switch on the instrument panel allows the pilot to select antiskid ON or OFF. When the switch is in the ON position, the antiskid function is operational. With the control switch in the OFF position, the ANTISKID INOP light on the annunciator panel will illuminate and the pilot will have power braking available without the antiskid function. If the power system should fail, braking will only be available through the back-up pneumatic system. The antiskid control module incorporates test circuitry which continually monitors the antiskid system. If a fault is detected, the ANTISKID INOP light will illuminate on the annunciator panel. Certain faults in the system are displayed on a "BITE" indicator (fault display unit), which is located under the removable panel at the aft of the left nose compartment.

### EMERGENCY BRAKING

In the event of normal hydraulic braking system failure, a pneumatic system is available. The pneumatic pressure required is contained in the emergency air bottle and is controlled by a lever with red knob located to the left of the AUX GEAR CONTROL T-handle. Pulling the lever aft will apply equal pressure to both main landing gear brake assemblies. Releasing the back pressure on the lever and allowing it to move forward will relieve the pressure. The air pressure to the brakes may be modulated to provide any braking rate desired, but differential braking and antiskid will not be available. The emergency air bottle, when fully charged, contains sufficient pressure for ten or more full brake applications. For the most efficient use of the system, apply sufficient air pressure to the brakes to obtain the desired deceleration rate. Maintain that pressure until airplane is stopped. When the handle is released, residual air pressure from the brakes is exhausted overboard. Normal braking should not be applied while using the pneumatic brakes. Depressing the pedals will reposition the shuttle valves in the brake lines to open, allowing high pressure air from the brake housing to enter the brake hydraulic reservoir, which might possibly rupture it. Adequate emergency braking for most conditions will be available from a properly serviced air bottle, even if the landing gear have been extended pneumatically. After stopping and clearing the runway, it is probably best to shut down the engines and have the airplane towed to the ramp, as there is no warning in the cockpit when the air bottle is depleted.

## BRAKE SYSTEM ELECTRICAL POWER

The brake system receives electrical power through two 20-ampere circuit breakers on the left circuit breaker panel. The SKID CONTROL circuit breaker provides power to the brake antiskid system and the PWR BRKS circuit breaker provides power to the power brake motor/pump.

**CAUTION**

DO NOT PULL THE PWR BRKS CIRCUIT BREAKER TO PREVENT THE POWER BRAKE PUMP FROM CYCLING. WITH THE CIRCUIT BREAKER DISENGAGED, THE POWER BRAKE SYSTEM IS INOPERATIVE AND THE RUDDER PEDAL TOE BRAKES ARE DISABLED. BRAKING IS THEN AVAILABLE ONLY BY USE OF THE PNEUMATIC BRAKE SYSTEM.

# LANDING GEAR

## GENERAL

The landing gear is electrically controlled and hydraulically actuated. Each landing gear assembly uses a single wheel assembly and an oil over air strut. The nose gear has a chined tire for water and slush deflection. The main landing gear doors are mechanically connected to the main gear struts and extend and retract with the individual gear assemblies. The nose gear utilizes three doors. The rear door is mechanically connected to the nose gear strut and extends aft, or retracts forward with the nose gear assembly. The two forward double-action doors are mechanically linked to the nose gear. These doors remain open with the nose gear fully extended.

The gear actuators incorporate an internal lock to hold the gear in the extended position. They are held retracted by mechanical uplocks that are normally released hydraulically. The landing gear completes a retraction or extension cycle in less than 6 seconds. The gear can be extended at airspeeds up to 250 KIAS (VLO extend). It can be retracted at speeds up to 200 KIAS (VLO retract). With the landing gear extended, the maximum speed is 250 KIAS (VLE).

## CONTROL

The landing gear control panel contains the landing gear handle, an audible warning system, three gear safe indicators and a red gear unlocked indicator. The landing gear handle has two positions: full down and full up. The gear handle must be pulled out to clear a detent before it can be repositioned. Operation of the gear and doors will not begin until the handle has been positioned in one of the two detents. A gear handle locking solenoid activated by the left main gear squat switch, physically prevents inadvertent movement of the gear handle while on the ground.

### EXTENSION AND RETRACTION

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

1. With weight off the left landing gear squat switch, power is applied to the solenoid lock, allowing the landing gear handle to be placed in the UP position.
2. Actuation of the gear handle to the UP position:
   a. Lights the GEAR UNLOCK warning light when a gear unlocks.
   b. Closes the bypass valve in the hydraulic return line, pressurizing the system as required.
   c. Positions the landing gear control valve to route hydraulic fluid to the retract side of the hydraulic cylinders.
3. The landing gear are mechanically snatched and held in place by the uplatches.
4. Actuation of the three gear up microswitches:
   a. Opens the bypass valve in the hydraulic system returning it to open center operation and low pressure.
   b. Removes power from the landing gear control valve.
   c. Extinguishes GEAR UNLOCKED indicator light.

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

1. Solenoid lock on landing gear handle is not in use.
2. Gear handle to the DOWN position causes fluid to be routed by the control valve through the uplocks to release them, and then to the extend side of the actuating cylinders. The green LH, RH and NOSE gear indicating lights illuminate as each gear locks down. After all gear are down-and-locked, the gear down microswitches return the hydraulic system to open center operation.

### POSITION AND WARNING SYSTEM

The landing gear position and warning system provides visual and audible indication of landing gear position. Three green safe lights and a red GEAR UNLOCK light are located in a group adjacent to the gear control handle. Each green light corresponds to one gear, NOSE, LH or RH and indicates that it is in the down and locked position. The red light indicates an unsafe gear position (in transit or not locked). The landing gear warning system sounds an audible warning when one of the following three conditions exist:

1.) Gear not down and locked, both throttles retarded below approximately 70 percent $N_2$, and flaps greater than 15 degrees.

2.) Gear not down and locked, both throttles retarded below approximately 70 percent $N_2$, and valid radio altimeter signal indicates less than 500 feet AGL.

3.) Gear not down and locked, both throttles retarded below approximately 70 percent $N_2$, and, a non-valid radio altimeter signal and airspeed below 150 KIAS.

The audible warning system cannot be silenced until the conditions which initiated warning system activation are corrected.

## LANDING GEAR POSITION WARNING

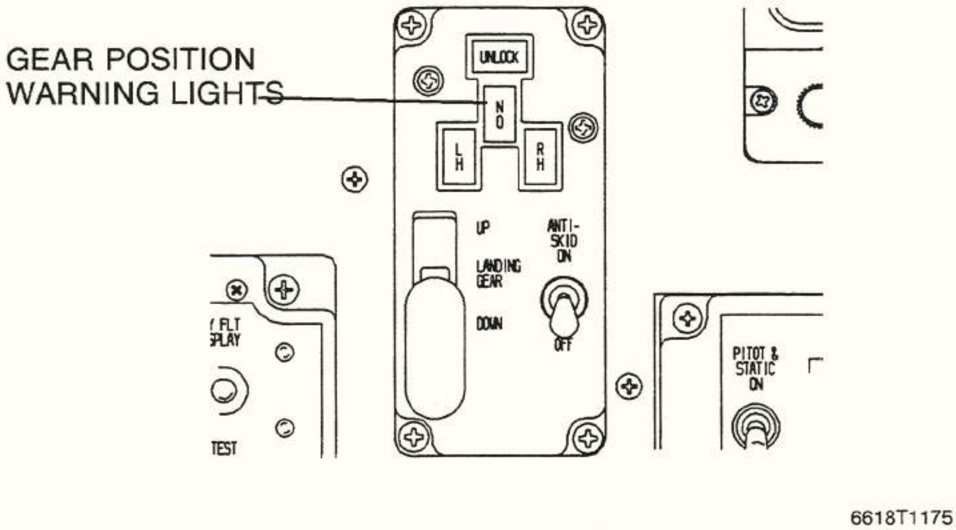



Figure 2-10

## EMERGENCY EXTENSION

In the event of normal system malfunction, a manually operated system is provided to release the landing gear for free-fall extension.

The manual system is actuated by the red AUX GEAR CONTROL T-handle located under the pilot's instrument panel. The handle is pulled and rotated clockwise to lock. This action mechanically disengages the landing gear uplocks, allowing the landing gear to free-fall to the down and locked position and also unlocks the red, collar-type, blow down knob. Lowering the landing gear by the free fall method is not advisable at speeds above 200 KIAS, as the gear may not fully extend above that speed. Approximately 150 KIAS with flaps up is the optimum speed/configuration for free fall extension. Yawing the airplane may be required to achieve green light indications and the pneumatic system should always be used to assure positive locking of all three gear actuators. If the landing gear down and locked lights are not illuminated, verify that the gear is out of the up and locked position before utilizing the blow-down system.

Pulling the red, collar-type knob on the T-handle shaft mechanically ports the emergency air bottle into the extend side of all three landing gear actuators. The gear is driven to the down and locked position and normal indications will appear in the cockpit providing the gear handle is down. After actuation of the pneumatic system, the knob and T-handle should be reset. After each use, the system must be reserviced.

# PNEUMATIC

## GENERAL

An air bottle which provides for emergency extension of the landing gear and/or emergency braking is located on the left side of the forward pressure bulkhead. The bottle is properly serviced at 1500-2000 PSI and can be checked on preflight by a gauge visible in the left side of the nose avionics compartment. A relief valve on the bottle will rupture at 4000 PSI if the bottle becomes overpressurized.

The bottle has outlets to the vent line, the gear auxiliary extension line, and the brake air pressure line. In normal system configuration the landing gear auxiliary extension line is connected to the vent line through the position of the control valve.

## EMERGENCY GEAR EXTENSION

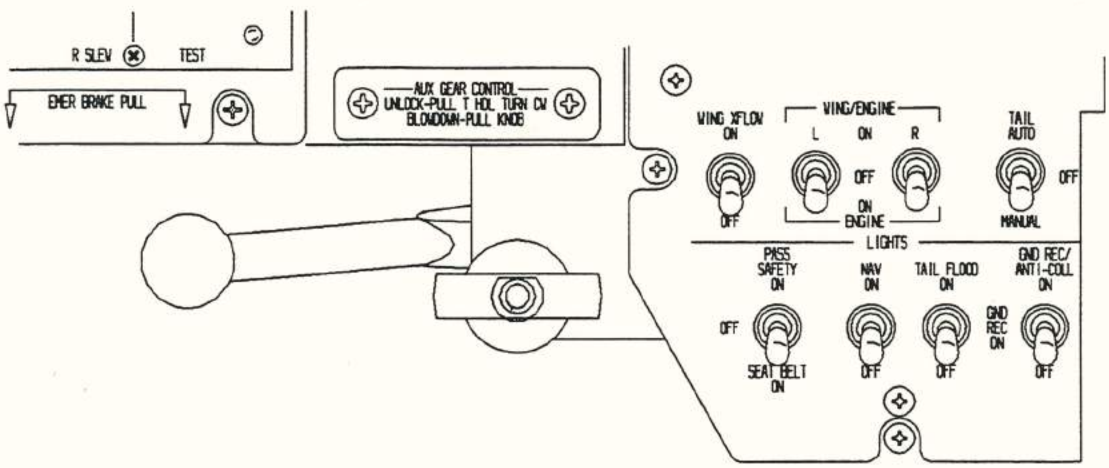



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Figure 2-11

Emergency braking is controlled through a manually operated three-way pressure regulating valve. Air from the bottle is connected directly to the inlet port of the valve by the brake air pressure line. The outlet port is connected to the brakes and, when the emergency brake handle is in NORMAL position, is vented to an exhaust line. When the emergency brakes are applied, the vent is closed, the inlet port opens and high pressure air is applied to the brakes. Releasing the emergency brake handle opens the vent, relieving pressure. This allows modulation of the system to obtain the desired braking force. Each time the handle is cycled some air pressure is vented overboard, reducing the emergency bottle supply.

# FLIGHT CONTROLS

## GENERAL

All aerodynamic controls, with the exception of the flaps, speed brakes and two-position stabilizer are mechanically actuated by cables. The ailerons, elevator and rudder have trimmed control surfaces and cockpit trim position indicators.

Flaps are hydraulically powered and can be operated to 15 degrees at 200 KIAS or below and 35 degrees (full travel) at 175 KIAS or below. Spoiler-type speed brakes are hydraulically actuated and electrically controlled and can be extended throughout the flight envelope.

## AILERONS AND TRIM TAB

The ailerons provide excellent lateral control throughout the entire operating envelope. Full range of travel is 19 degrees, +1 or -1 degree up and 15 degrees, +1 or -1 degree down. One trim tab, located on the left aileron, is mechanically controlled by a knob on the center pedestal. An indicator on the pedestal shows the amount of trim selected in relation to a neutral position. Full travel of the tab is 20 degrees, +2 or -2 degree up and down.

## ELEVATORS AND TRIM TABS

Elevator control is mechanical through four cable assemblies. Full elevator travel is through a range of 19 degrees, +1 or -0 degree up, to 15 degrees, +1 or -1 degree down. Elevator trim tabs installed on each elevator can be positioned electrically or mechanically through cockpit trim tab actuators. Full travel of the tabs is 5 degrees, +1 or -1 degrees up and 15 degrees, +1 or -1 degrees down. An elevator trim wheel on the pedestal provides manual trim control. A trim switch, located on the left side of the pilot's control wheel, controls an electric trim motor which in turn positions the elevator tabs. The copilot's trim switch is located on the right side of the copilot's control wheel. The pilot's trim switch has priority and will interrupt and override the copilot's control. If the electric trim malfunctions, it can be overridden by the manual trim system, or momentarily disabled by pressing the AP/TRIM DISC switch on the pilot's or copilot's yoke.

# FLIGHT CONTROLS

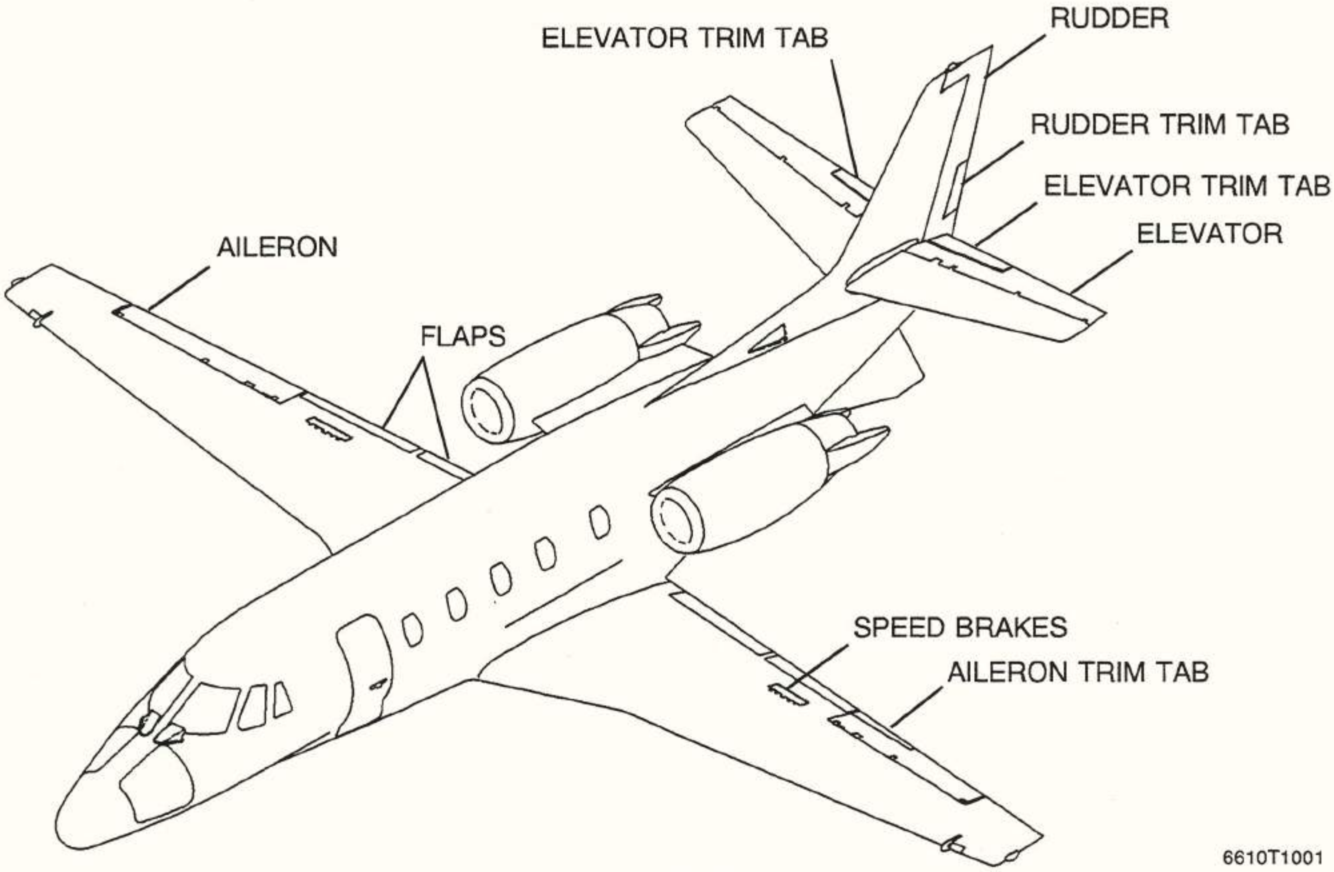



Figure 2-12

## RUDDER AND TRIM TAB

The rudder is activated by dual left and right rudder pedals located just aft of the forward pressure bulkhead. Full rudder deflection is 22 degrees, +1 or -0 degrees either side of center. A single rudder trim is provided at the trailing edge. With the rudder in the trail position, the trim tab will deflect 11.5 degrees, +1 or -1 degrees left and right. The rudder trim is mechanically operated by the rudder trim wheel on the center pedestal. An indicator on the pedestal shows trim tab position relative to neutral. In addition to mechanical actuation, the rudder trim is servo-connected to follow assist in rudder movement. When the trailing edge of the rudder moves to the left, the rudder trim tab trailing edge will servo to the right, assisting in pushing the rudder trailing edge to the left. When the trailing edge of the rudder moves to the right, the rudder trim tab trailing edge will servo to the left, assisting in pushing the rudder trailing edge to the right.

## RUDDER/AILERON INTERCONNECT

The interconnect operates in conjunction with the primary controls. When the pilot inputs a left rudder command through the pedals, the torsion bungee imposes a left roll torque to the aileron system. A left roll input likewise produces a left yaw response. Right inputs produce right responses.

## NOSE GEAR STEERING

The nose gear is mechanically steered by the rudder pedals to 20 degrees either side of center. Steering is accomplished through mechanical linkage with a bungee that allows the nose gear to center before entering the wheel well on retraction. Additional castering of the nose wheel can be achieved against the bungee by application of differential power and braking. For ground handling and towing, maximum deflection of the nose wheel is 90 degrees either side of center.

## SPEED BRAKES

The speed brakes are installed on the upper and lower surfaces of each wing to permit rapid rates of descent without exceeding $V_{MO}/M_{MO}$ and to spoil lift during landing roll. The speed brakes are electrically controlled and hydraulically actuated by a switch located on the throttle quadrant and may be selected to the fully extended or fully retracted positions. The angular travel for the upper speed brake panels is 65 degrees, +2 or -2 degrees. The lower speed brake panels extend and retract through interconnecting linkage with the upper panels.

When the speed brakes switch is positioned to EXTEND, electrical power is applied to close the bypass valve in the hydraulic system return line and open the speed brake control valve. This allows hydraulic fluid at 1500 PSI to flow to the extend side of the speed brake actuators. Once the speed brakes are extended, the speed brake control valve closes to create a hydraulic lock and hold the speed brakes extended. The bypass valve opens and the hydraulic system returns to an open center condition. Moving the speed brakes switch to RETRACT again pressurizes the system, and the speed brake control valve allows fluid to go to the retract side of the speed brake actuators.

When the speed brakes are fully retracted, the control valve closes, the hydraulic system bypass valve opens and open center operation resumes.

Microswitches in the tailcone prevent speed brakes extension at engine power settings above approximately 85 percent $N_2$. If the speed brakes are extended at lower power settings and the throttles are subsequently advanced above 85 percent, the speed brakes will retract and the switch will return to the RETRACT position.

In the event of an electrical failure while the speed brakes are extended, the control valve fails to the open position and the speed brakes will trail. If a dual hydraulic pump failure or fluid loss should occur with the speed brakes extended, moving the switch to RETRACT will deenergize the speed brake control valve and the speed brakes will trail.

## FLAPS

The trailing edge flaps are constructed of graphite composite laminates and consist of two segments on each wing. They are electrically controlled and hydraulically actuated and operate through a range of 0 to 35 degrees of travel. A mechanical detent is installed at the T.O. (7-degree) and T.O. & APPR (15-degree) positions of the flaps lever. The FULL or UP flaps positions are reached by pushing down on the flaps lever when passing through the T.O. and/or T.O. & APPR detents. Any intermediate position can be selected throughout the range of travel.

A gear warning horn will sound any time the flaps are selected past the T.O. & APPR position with the gear not down and locked and both throttles set at less than 70% $N_2$. The horn cannot be silenced until the condition which caused the horn to activate are removed.

## TWO-POSITION STABILIZER

The two-position stabilizer utilizes a hydraulic pump coupled to a jack screw to provide takeoff/landing setting (nose down 2 degrees) or cruise setting (nose up 1 degree) for the horizontal stabilizer. The pump and jack screw assembly are located at the horizontal/vertical stabilizer intersection, and drive the leading edge of the horizontal stabilizer up or down based on flap handle position. Cycle time for the stabilizer to move from one position to another is approximately 25 seconds.

With the flap handle in the 0 degree position, the leading edge of the horizontal stabilizer assumes a 1 degree nose up position. When the flap handle is moved out of the 0 degree position, a microswitch inside the pedestal commands a hydraulic valve to open, allowing fluid to actuate the pump and jack screw assembly. The jack screw drives the leading edge of the horizontal stabilizer to the 2 degree nose down position. This nose down position will remain as long as the flap handle is out of the 0 degree position.

After takeoff, when the flap handle is moved back to the 0 degree position, the microswitch will activate and allow the jack screw to move the horizontal stabilizer to the 1 degree nose up (cruise) position.

**NOTE**

A pneumatic switch installed in the backup pitot-static line prevents inadvertent movement of the actuator anytime airspeed is above 205 KIAS regardless of flap handle position.

When the airplane is configured for landing and the flap handle is moved out of the 0 degree position, the microswitch will again activate and allow the jack screw to move the horizontal stabilizer to the takeoff/landing setting (nose down 2 degrees).

## CONTROL LOCK

The control lock is mechanically operated and, when engaged, locks the ailerons, elevators and rudder in the neutral position and the throttles in the OFF position. The control lock handle, located below the instrument panel on the left side, controls the system. When the handle is pulled straight aft to the detent, the flight controls and throttles are locked. To release the control lock system, rotate the T-handle 45 degrees clockwise and push it in. With the control lock engaged, the maximum deflection of the nosewheel is restricted to 60 degrees either side of center. Exceeding the degree of turn will cause excessive force to be placed on the control lock mechanism and rudder control cables. Towing the airplane with the control lock engaged should be avoided. The controls should be neutralized before engaging the lock.

## STALL WARNING - STICK SHAKER

Stall warning is achieved by the use of a stick shaker mounted on the forward side of the pilot's and co-pilot's control column. An electric motor with rotating weights induces a vibration feel to the control column. The pilot is alerted to impending stall by the vibration of the control column which occurs approximately 8% to 10% above the actual stall speed. Stick shaker activation will occur before stall buffet. The stick shaker is energized by inputs from the angle-of-attack system. The rotary test switch located on the center pedestal provides a means of checking the shaker prior to flight.

# ELECTRICAL

## GENERAL

Electrical power for the Excel comes primarily from DC sources originating with the starter/generators or the battery. A receptacle below the left engine pylon is provided for connection of a 28 VDC external power unit.

## ALTERNATING CURRENT (AC) POWER

The Excel utilizes a single alternating current (AC) inverter to power the electroluminescent panel lighting. In addition, AC power from engine-driven alternators is used to power the electrically-heated windshield. For a complete system description, refer to Anti-Ice/Deice description in this section.

**NOTE**

Avionics equipment in the Excel is DC-powered, and therefore does not require the use of AC inverters.

## DIRECT CURRENT (DC) POWER

The direct current (DC) power distribution system contains of two separate and independent DC power sources which supply the system. In the event these DC power sources fail, the battery system will supply emergency power to selected systems. The direct current (DC) power distribution system consists of a battery system, two 300 amp starter/generators, two Generator Control Units (GCUs), a distribution system, a battery switch, an avionics switch, two generator control switches, two ammeters and a voltmeter with a selector switch. A description of various components follows.

## BATTERY SYSTEM

The battery system consists of the battery, the battery disconnect relay and associated switches. The 40-amp battery is used to provide power for engine starting, and to provide power to the emergency battery bus in the event of a dual generator failure.

The battery is located in the left hand aft fairing and has an overboard vent. A battery disconnect relay is provided for the battery. During normal operation, the relay remains in a de-energized position. During a battery overtemp condition, the battery may be disconnected by operating the BATTERY DISCONNECT switch on the pilot's circuit breaker sub-panel. The switch is also intended for ground operation in the event a starter relay becomes welded closed.

The battery condition may be continuously monitored using the cockpit temperature gauge. Battery temperatures should remain well below 63°C (145°F) during all operations. Anytime battery temperature exceeds 63°C (145°F), the red BATT O'TEMP annunciator illuminates. If temperature continues to climb and exceeds 71°C (160°F), the red BATT O'TEMP > 160° annunciator will flash and trigger the MASTER WARNING annunciator.

**NOTE**

The battery must be serviced per the Maintenance Manual when the battery temperature exceeds 63°C (145°F).

The three-position control switch for the battery is normally located on pilot's switch panel, and is labeled BATT, OFF and EMER. Placing the switch to the BATT position closes the battery and emergency relays and powers the battery bus, emergency bus and both main DC buses. This position also enables external power to supply the entire system.

In the OFF position, battery or external power is isolated from all but the hot battery bus.

With the battery switch in the EMER (emergency) position and both generators OFF, a properly charged battery will supply power for approximately 30 minutes to the following equipment:

- LH AND RH Ignition
- COMM 1
- NAV 1
- AHRS 2
- LH and RH $N_1$ Indicator
- RMU I
- Flap Control
- Two-Position Stabilizer
- Standby Pitot and Static Heaters
- Pilot's and Copilot's Audio Panels
- Glareshield and Overhead Floodlights
- Standby HSI
- Standby Radio Control Head
- Interior Entry Lights
- Landing Gear Control and Indication

The standby flight display unit will continue to operate on its own emergency battery pack. This battery pack also provides 5 volt emergency instrument lighting.

**NOTE**

In some cases, it may be prudent to turn OFF unneeded systems in order to conserve the airplane's battery.

## STARTER/GENERATORS

A starter/generator is located on each engine and is wired directly to the power Junction Box. The starter/generator is driven by engine rotation through the accessory gear box, and is air cooled using engine bypass air. In ground operations (ground idle) each starter/generator is rated at 200 amps (which may be exceeded momentarily for start). At maximum operating altitude, each starter/generator is rated at 300 amps.

# DIRECT CURRENT SIMPLIFIED SCHEMATIC

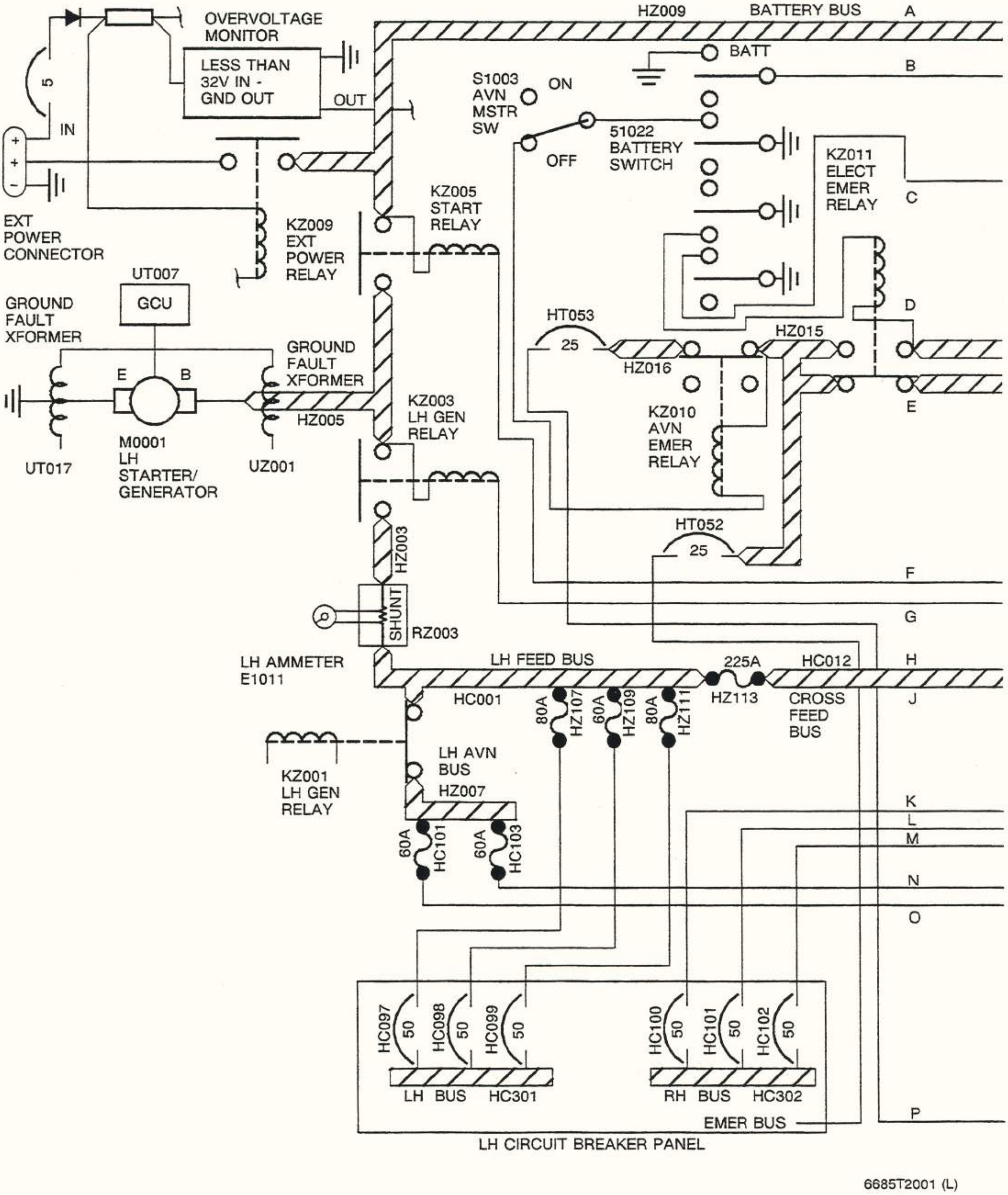



Figure 2-13 (Sheet 1 of 2)

# DIRECT CURRENT SIMPLIFIED SCHEMATIC

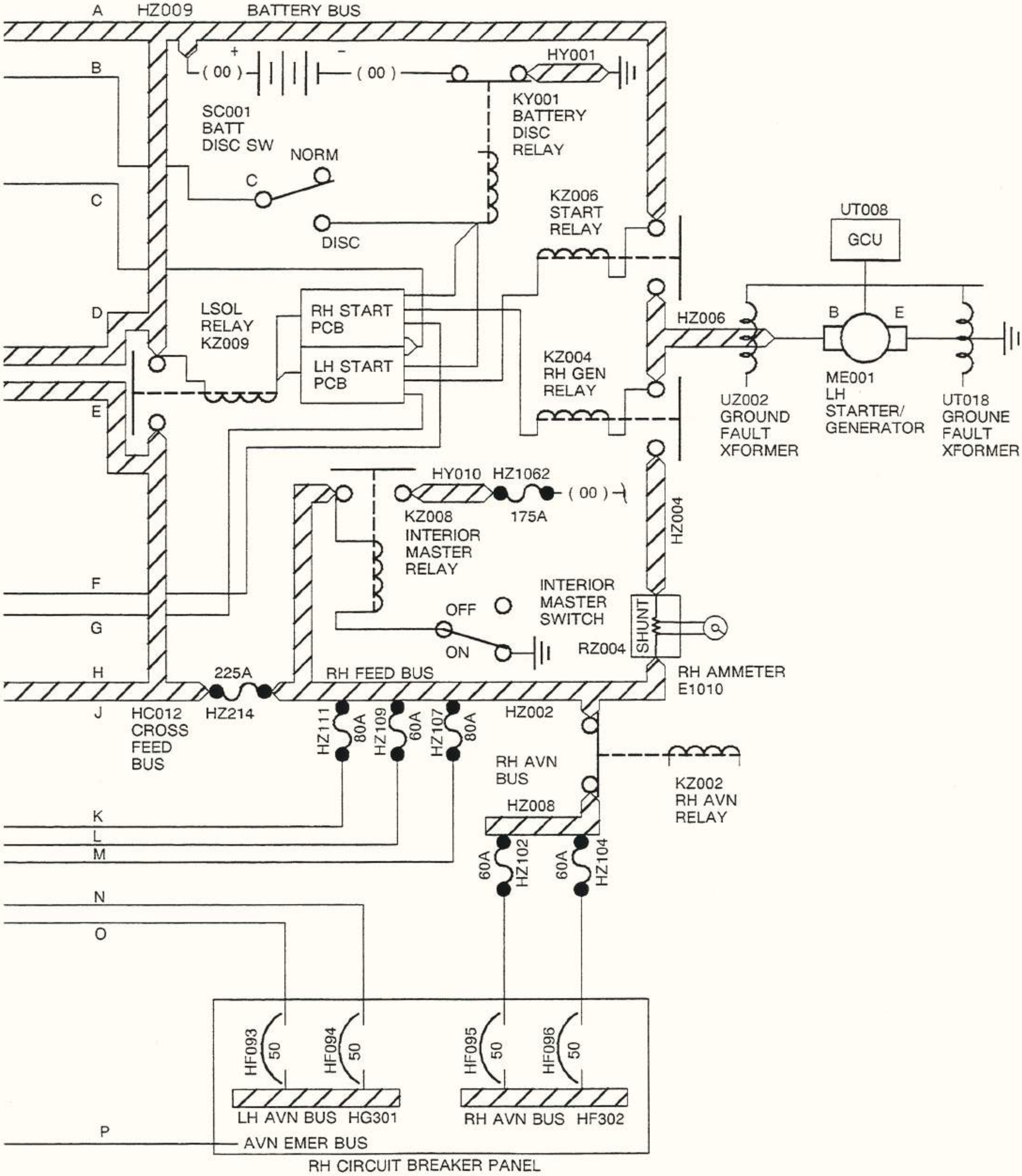



Figure 2-13 (Sheet 2)

## GENERATOR CONTROL UNIT (GCU)

Two GCUs, one for each starter/generator, are installed in the tailcone area above the aft power junction box. The GCU is used to control the operation of the starter/generator and provides the following control features:

1.) Voltage regulation at 28.5 VDC.
2.) Load sharing to within 40 amps in parallel operation.
3.) Overvoltage protection at 35.0 VDC.
4.) Reverse current control of the line contactor.
5.) Generator feeder ground fault protection.
6.) Start contactor control and field-weakening during start.
7.) Overspeed sensing and protection resulting from sheared starter shaft.
8.) Generator self-excitation and subsequent regulation without an external source of power (such as a battery).
9.) Generator deactivation when the firewall shut-off is activated.

## EXTERNAL POWER

External direct current (DC) power can be connected to the airplane through a receptacle located on the left side of the fuselage. When external power is connected, the external power relay energizes and connects the power source to the hot battery bus. Positioning the battery switch to BATT energizes the battery and emergency relays allowing external power to be connected to the entire DC system. Ground power requirements dictate a 28-volt unit, with a nominal capability of 1000 amperes current. If an adjustable power unit is used, it should be adjusted to provide a setting of 1000 amperes. A ground power unit with a soft start capability if preferable. The battery should be disconnected if the airplane is to be on a ground power unit for a prolonged period of time.

## DIRECT CURRENT (DC) POWER INDICATORS

The indicators consist of two ammeters, a voltmeter and two amber generator failure lights. The ammeters function as load meters indicating the load being carried by each generator.

The voltmeter is wired through the battery switch and will indicate the voltage of the hot battery bus any time the battery switch is in the BATT or EMER position. The voltmeter selector switch can be rotated to the LH or RH GEN positions to check generator voltage output. Since the voltmeter reads the highest voltage on the bus, an accurate check of one generator is obtained only with the opposite one off the line.

Should either generator fail, the associated power relay will open, removing the generator from the system and illuminating the appropriate L or R GEN OFF annunciator panel light. Should both generators fail, the master warning light will also illuminate. This is the only condition under which amber annunciator light illumination will trigger the master warning.

# ELECTRICAL BUSSES

## EMERGENCY BUS

LH FAN SPEED
RH FAN SPEED
STANDBY HSI
STANDBY P/S HEATER
LH IGNITION
RH IGNITION
HYD CONTROL
STAB CONTROL
FLAP CONTROL
GEAR CONTROL
GEAR WARNING
FLOOD LIGHTS
AHRS 2
AUDIO 2
COMM 1
NAV 1
AUDIO 1 (only when EMER is selected, otherwise this is on the Avionics Bus)

## BATTERY BUS

INTERIORS
FWD EMERG LTS
CABIN DOOR
LH START CONTROL PCB
BATTERY VOLTAGE
RH START CONTROL PCB
ELT (AVN)
AFT EMERG LTS
AFT/FWD COMP LTS

## FEED BUS

LH PRECOOLER CONTROL
LH BUS SENSE
LH LANDING/RECOG LTS
OXY/SEAT BELT
RH PRECOOLER CONTROL
RH LANDING/RECOG LTS
TAIL FLOOD LTS

## AVIONICS BUS

AUDIO 1
AHRS 1
XPDR 1
DME 1
ADF 1
WARN
ADC 1
IC 1
DISPLAY 1
PFD 1
TCAS
RAD ALT
HF
MFD
RADAR
AUDIO 2 (WARN)
COMM 2
MNAV 2
XPDR 2
DME 2
ADF 2
FLIGHT PHONE
ADC 2
IC 2
DISPLAY CONTRL 2
PFD 2
MFD CONTROL
RADAR CONTROL
CABIN DISPLAY
GPWS
AFIS

## CROSSFEED BUS

COCKPIT WEMAC FAN
FWD EVAP FAN
AFT EVAP FAN
RH IGNITOR SOURCE
LH LANDING/RECOG LTS
LH IGNITOR SOURCE
LH LANDING LTS

## GENERATOR BUS

RH START CONTROL PCB
RH VOLTMETER
RH GENERATOR
LH START CONTROL PCB
LH VOLTMETER
LH GENERATOR

## ELECTRICAL BUS

LH PANEL LTS
STBY FLT DISPLAY
LH CLOCK
RAT
LH ENGINE ANTI-ICE
LH PITOT/STATIC
TAS HEATER
AOA HEATER
NORM PRESS
LH ITT
LH TURB SPEED
LH FUEL FLOW
LH FUEL QTY
LH OIL TEMP
LH FUEL TEMP
AUTO TEMP
FUEL CONTROL
LH START
RH ENG COMP
ENGINE VIB MON
WARNING LTS
PITCH TRIM
SPEED BRAKES
CVR
CABIN DOOR MONITOR
LH W/S ANT-ICE
RH F/W SHUTOFF
RH FIR DETECT
RH BOOST PUMP
LH THRUST REVERSER

## ELECTRICAL BUS
(continued)

W/S AIR
AOA
BATT EMP
SKID CONTROL
PWR BRAKES
PH PANEL LTS & MAP LTS
NAV
ANTI-COLLISION LTS
GND RECOG LIGHT
RH ENGINE ANTI-ICE
RH PITOT/STATIC
EL PNL/PNL FLD
FREON AC
CABIN ALT SWITCH
RH ITT
RH TURB SPEED
RH FUEL FLOW
RH OIL TEMP
RH OIL PRESS
RH FUEL TEMP
MANUAL TEMP
WING INSPECTION LT
CENTER PNL LTS
LH ENG COMP
EMERG PRESS
LH F/W SHUTOFF
LH BOOST
RH CLOCK
FLT HOUR METER
TAIL DEICE
RH W/S ANTI-ICE
RH START
WARNING LTS 2
RH THRUST REVERSER
GLARESHIELD FANS
A/P SERVO
AHRS AUX BATT

Figure 2-13A

## ENGINE STARTING

Depressing either engine start button closes the respective start relay and provides DC power to the engine starter. Power to close the solenoid start relays and energize ignition comes from the battery bus, requiring the battery switch to be in the BATT position. Automatic ignition sequencing takes place with both engine ignition switches in the NORM position.

A white light in each starter button indicates power on the contacts of the respective start relay. The starter operation is terminated when the speed sensor in the generator control unit removes power from the start relay at approximately 38 percent $N_2$ RPM. The automatic start sequence can be terminated at any time by pushing the cockpit START DISG switch located between the start buttons, which will open the start relay and halt the start sequence. During engine start, when the generator output exceeds battery voltage and/or is in parallel with the other generator (within 40 amperes), the starter/generator reverts to generator operation. The power relay closes and supplies power to the respective DC bus. Current will then flow from either main DC bus through the battery bus, battery relay and hot battery bus, providing battery charging.

The airplane is equipped with a cross start capability which utilizes the generator of an operating engine to assist starting the second. This is accomplished by both start relays closing when the second start is initiated routing power through the hot battery bus to the other engine. On all cross starts, the operating engine should be set at 52 to 53 percent $N_2$ to ensure proper torque on the generator shaft. Cross generator start capability is disabled with weight off the left main gear squat switch in order to prevent cross starts in flight.

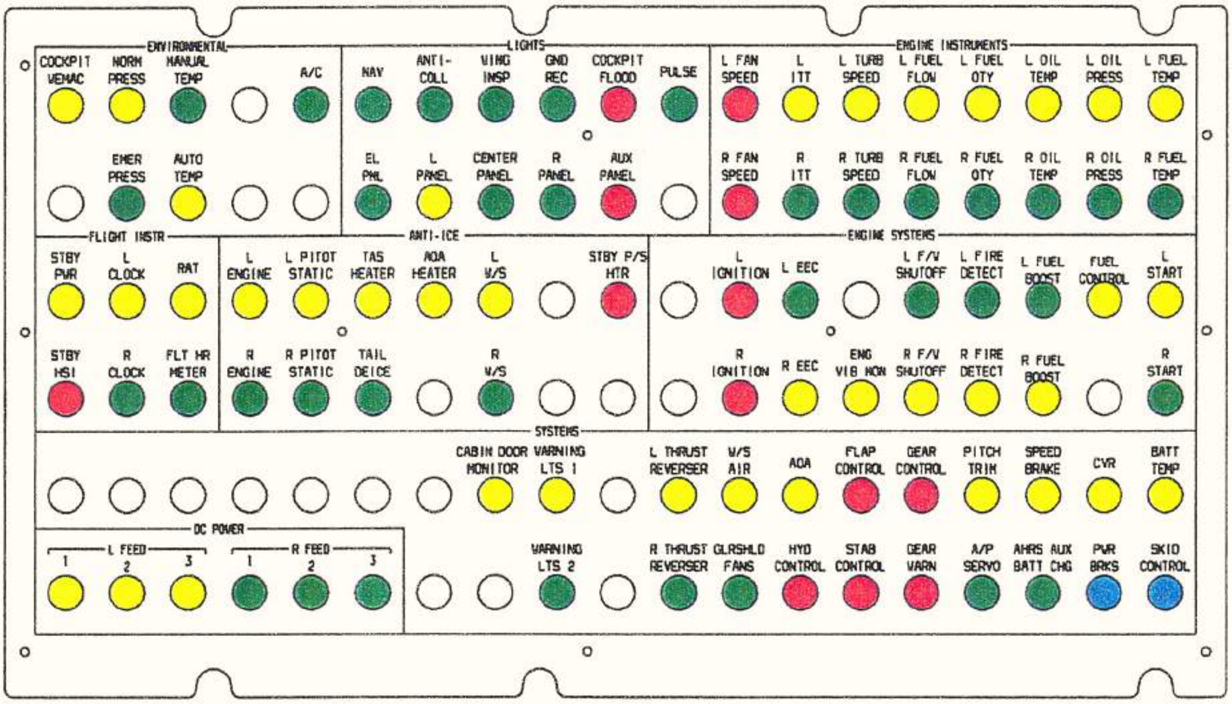
Starts being made on external power may be accomplished with the generator switches in either the ON or OFF position; however, it is recommended that they be turned OFF during the start. If the generator switch is placed in the ON position the generator control unit will automatically initiate the generator mode after engine start. If the generator switch is placed in the OFF position, the generator mode will be initiated by manually placing the generator switch to the ON position. External power is automatically disconnected when either generator is supplying power to the bus. In order to start the second engine by auxiliary power unit, the generator supplying voltage to the bus must be disconnected by placing the generator switch to the OFF position.

An overvoltage protection system is provided during use of an auxiliary power unit. The control unit monitors the external power unit voltage and will deenergize the external power relay if the voltage is above 32.5 volts. External power cannot be reapplied to the airplane until the voltage has been interrupted, after a start termination which has been caused by an overvoltage condition.

For battery starts and under all normal flight conditions, the generators are left in the GEN position.

# LEFT CIRCUIT BREAKER PANEL

A4439



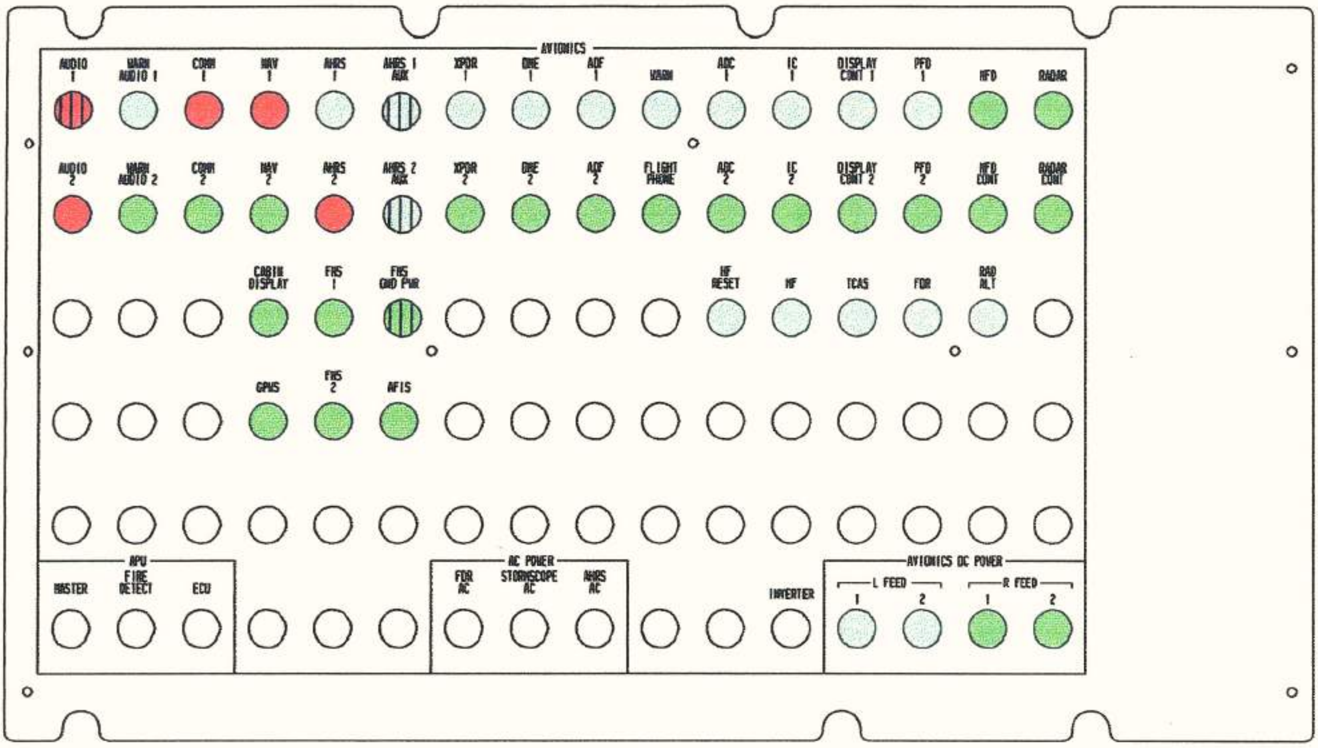

6618T1173

DC POWER

- LH BUS
- RH BUS
- EMER BUS
- LH SUB BUS

Figure 2-14 (Sheet 1 of 2)

# RIGHT CIRCUIT BREAKER PANEL




DC POWER

- AHRS AUX PWR BUS (HF304)
- LH AVN BUS (HF301)
- RH AVN BUS (HF302)
- AVN EMER BUS (HF303)
- LH AVN BUS (HF301) SWITCHES TO AVN EMER BUS (HF003) WHEN BATT IS SWITCHED TO EMER
- SWITCHES BETWEEN AHRS AUX PWR BUS (HF304) AND LH AVN BUS (HF301) BASED ON BATT SWITCH AND AVIONICS SWITCH POSITION

6618T1174A

Figure 2-14 (Sheet 2)

## CIRCUIT BREAKERS

Push-to-reset, pull-off type circuit breakers, with the amperage rating marked on each breaker, are installed in panels located on both sides of the cockpit. The panels are readily accessible to the flight crew during flight. The panels shown are typical installations for the Excel.

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

# ANTI-ICE/DEICE SYSTEMS

The airplane utilizes a combination of engine bleed air, electrical heating elements and pneumatic boots to accomplish anti-ice/deice functions. The anti-ice system consists of bleed air heated engine inlets, wing leading edges, and fan spinner and stators. Electric heating elements are used for pitot tubes, static ports, a true airspeed (TAS) probe and an angle-of-attack probe. The horizontal stabilizer is deiced by pneumatic boots. Windshield anti-ice is provided by electrical heating.

All anti-ice systems should be turned on when operating in visible moisture and the indicated RAT is +10°C or below.

**NOTE**

- Icing conditions exist when the indicated RAT on the ground and for takeoff is +10°C or below; the indicated RAT in flight is +10°C or below; and visible moisture in any form is present (such as clouds, fog with visibility of one mile or less, rain, snow, sleet or ice crystals.)
- Icing conditions also exist when the indicated RAT on the ground and for takeoff is +10°C or below when operating on ramps, taxiways or runways where snow, ice, standing water, or slush may be ingested by the engines or freeze on engine nacelles or engine sensor probes.

## ENGINE AND WING ANTI-ICE SYSTEM

Bleed air flows continuously through the fan spinner whether the anti-ice system is activated or not. When the wing/engine anti-ice switches (one for each engine) are positioned to ENGINE ON, bleed air flows through the applicable engine inlet and engine stators. If sufficient bleed air flow is not available to maintain the proper wing temperature, the wing anti-ice annunciator will illuminate. The light may be extinguished by increasing engine RPM. Operation of the system may be checked by observing engine ITT rise when the engine anti-ice is turned on. If the check is made on the ground, it may require up to two minutes to extinguish the wing anti-ice light with $N_1$ set at approximately 70%. Maximum engine power setting values are reduced when using anti-ice, as shown in Section IV. Loss of electrical power to the valve supplying flow to the inlets results in the valve opening; thus, assuring anti-ice capability. The WING XFLOW switch is designed to provide wing anti-ice protection to both wings in the event of an inoperative engine. WING XFLOW position disables the selected engine inlet temperature and stator valve inputs to the anti-ice failure annunciators.

# AIRPLANE ANTI-ICE / DEICE SYSTEMS

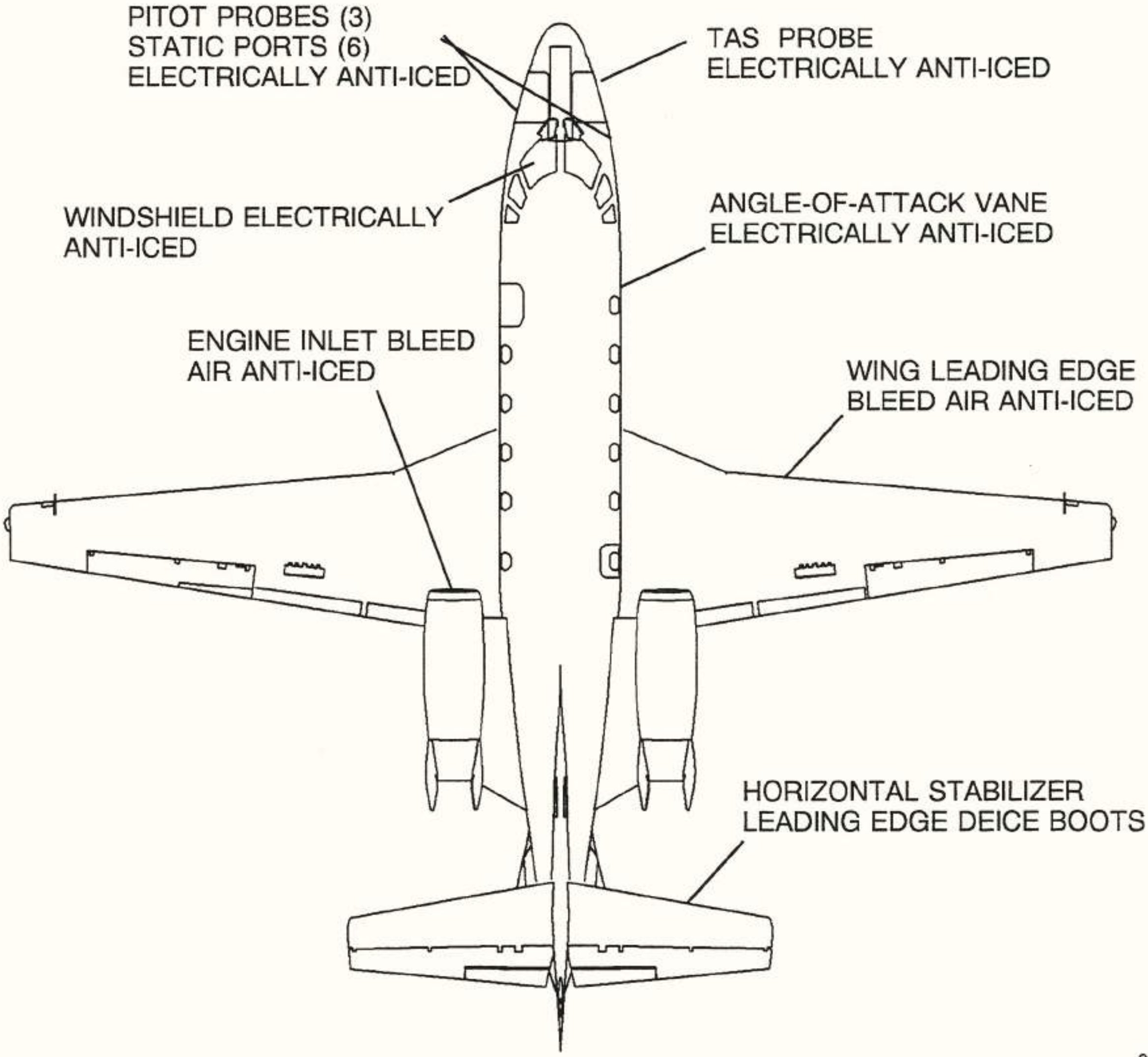



Figure 2-15

## TAIL DEICE

The horizontal tail is deiced by pneumatic boots controlled by the tail deice AUTO/OFF MANUAL switch. Selecting the switch to AUTO will activate a controller which will inflate the boots one side at a time and then repeat this cycle after 3 minutes, continuously, providing automatic deice of the stabilizer. Selecting the momentary MANUAL position will inflate both boots as long as the pilot holds the switch in the MANUAL position. Vacuum is supplied to deflate the boots after each cycle and keep them deflated between cycles and when OFF.

Proper activation of the deice boots is annunciated by a white TL DEICE PRESS L or R advisory light on the annunciator panel which illuminates when proper inflation pressure is reached in each deice boot.

**CAUTION**

THE TAIL DEICE BOOTS SHOULD NOT BE ACTIVATED AT INDICATED RAT BELOW -40°C (-40°F). BOOT CRACKING MAY RESULT.

# WING ANTI-ICE FLOW DIAGRAM

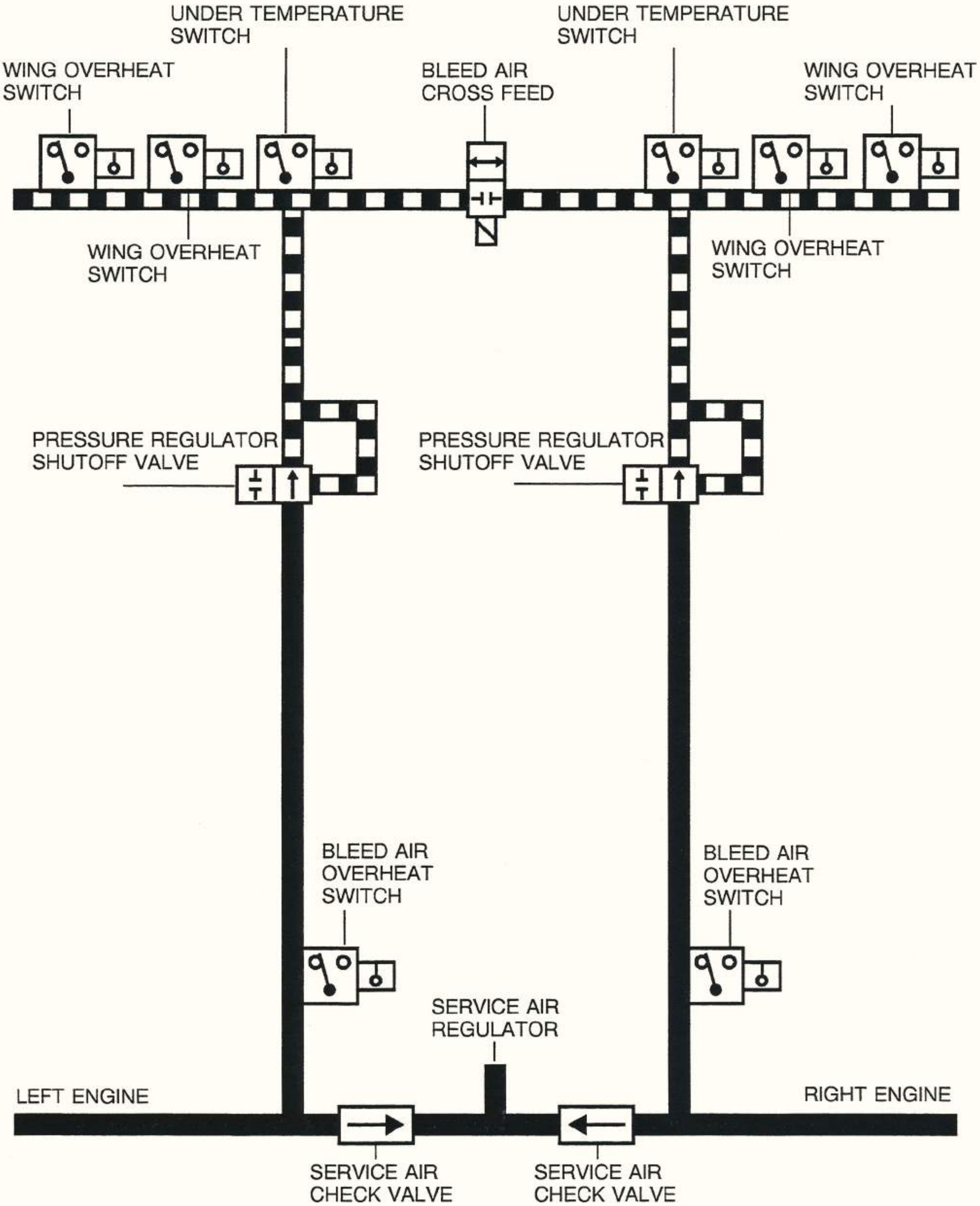



Figure 2-16

Failure of the deice boots to activate properly when in the AUTO mode is annunciated by an amber TL DEICE FAIL L or R advisory light on the annunciator panel which illuminates when tail deice pressure is not sequenced correctly to either deice boot.

If the switch is placed in MANUAL during a cycle of automatic operation, MANUAL will override the AUTO function and all the tubes will simultaneously inflate.

**NOTE**

Airflow perturbations during manual boot cycle or during AUTO boot cycle with significant ice on the stabilizer may cause a minor pitch upset.

If icing conditions are anticipated after takeoff, operation of the tail deice system should be functionally checked prior to takeoff. The pilot should also check the system for proper operation prior to entering areas in which icing may be encountered.

## WINDSHIELD ANTI-ICE

The left and right windshields and the left and right forward cockpit side windows are AC electrically heated. Windshield anti-ice is controlled by the WINDSHIELD L and R O'RIDE/ON/OFF switches on the anti-ice switch panel. Windshield anti-ice must be turned on anytime icing is detected. It may be operated full time from engine start to shutdown and will improve cockpit comfort at high altitude, particularly at night. It is also required for windshield defog.

The windshield anti-ice system may be operated in the ON position throughout the flight. This position gradually ramps power to warm the windshield slowly. If icing is encountered with the windshield OFF, an O'RIDE switch position will override this ramp to warm the windshield more quickly.

The left and right windshields each have three heating element areas. Power from the left engine driven alternator is supplied to the left windshield outboard and center section, the right windshield inboard section and the right side window. Power from the right alternator is identically supplied to the opposite sections.

The windshield anti-ice is monitored by W/S FAULT L or R and W/S O'HEAT L or R annunciators. The W/S FAULT annunciator indicates a fault or failure of the controller to supply power to the windshield. The W/S O'HEAT annunciator indicates that the controller has detected an overheat condition which automatically shuts the affected windshield off until the overheat condition clears.

Self-test of the temperature monitor system is normally accomplished after engine start by turning the windshield heat switches ON and selecting the W/S TEMP position on the rotary test switch.

## PITOT-STATIC , TAS AND ANGLE-OF-ATTACK ANTI-ICE

Electric heating elements are provided in the pilot's, copilot's and standby pitot tubes; pilot's, copilot's and standby static ports, TAS probe, and the angle-of-attack probe. The pitot static anti-ice switch actuates all of these elements, with the exception of the TAS probe, which is activated via the landing gear squat switch.

# AIRPLANE ANTI-ICE SWITCH PANEL

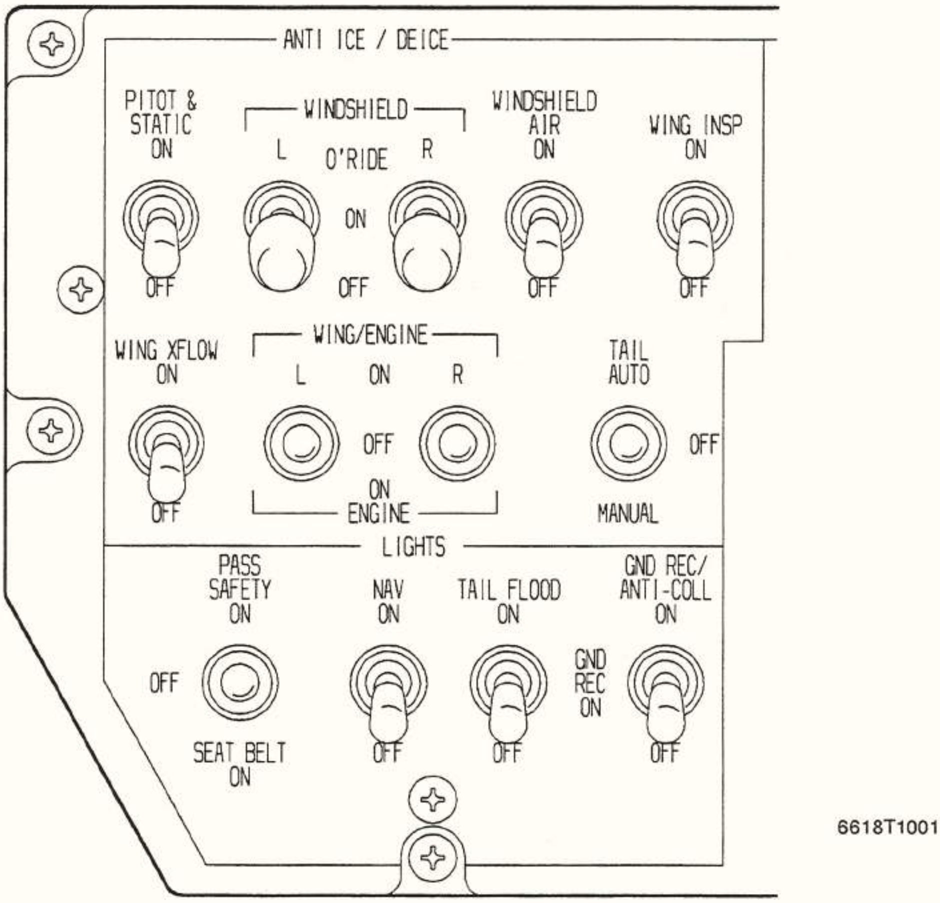



Figure 2-17.

Operation may be checked on preflight by turning the switch ON for approximately 30 seconds, then OFF; then feel each element during the external inspection. Ground operation of the pitot-static heat should be limited to less than two minutes to avoid damage to the pitot tubes and angle-of-attack vane, except as required during icing conditions. Failures of pitot and static heating elements and of the angle-of-attack vane element are annunciated by P/S HTR L or R, STBY P/S HTR and AOA HTR FAIL lights, respectively, in the annunciator panel.

**NOTE**

Although the nose-mounted TAS probe measures outside ram air temperature, this measurement is fed only to the Air Data Computers (ADCs). The Ram Air Temperature display, located above the secondary flight display, receives its input from the right engine $T_{TO}$ probe. Ram air temperature is accurate only after the right engine has been started. This probe also provides temperature data to the right engine EEC, and is electrically anti-iced anytime the engine anti-ice is turned on. The left engine $T_{TO}$ probe provides temperature only to the left engine EEC. In the event of RAT failure, the EEC's will revert to the Air Data Computers for temperature data.

# TAIL DEICE FLOW DIAGRAM

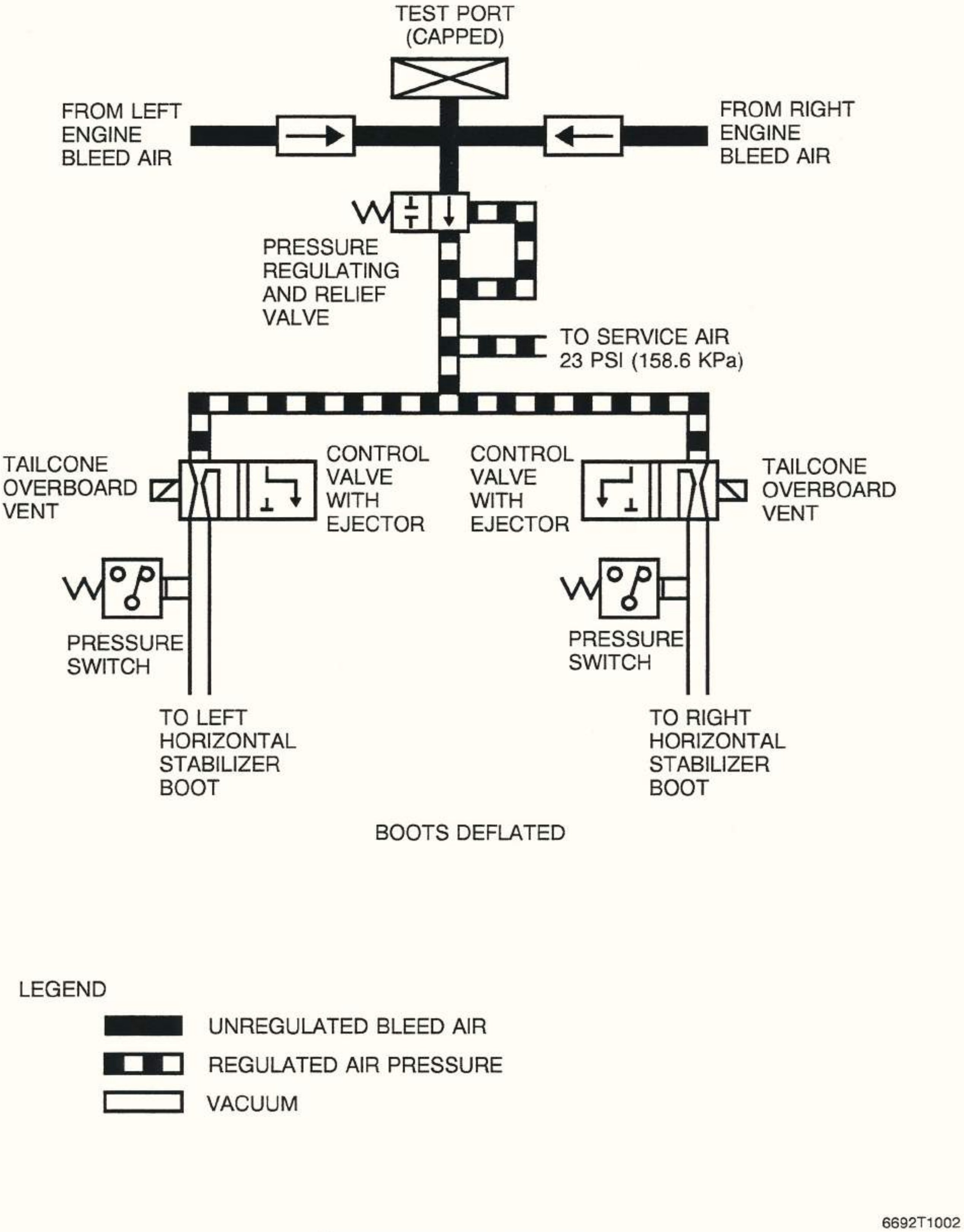



Figure 2-18 (Sheet 1 of 2)

# TAIL DEICE FLOW DIAGRAM

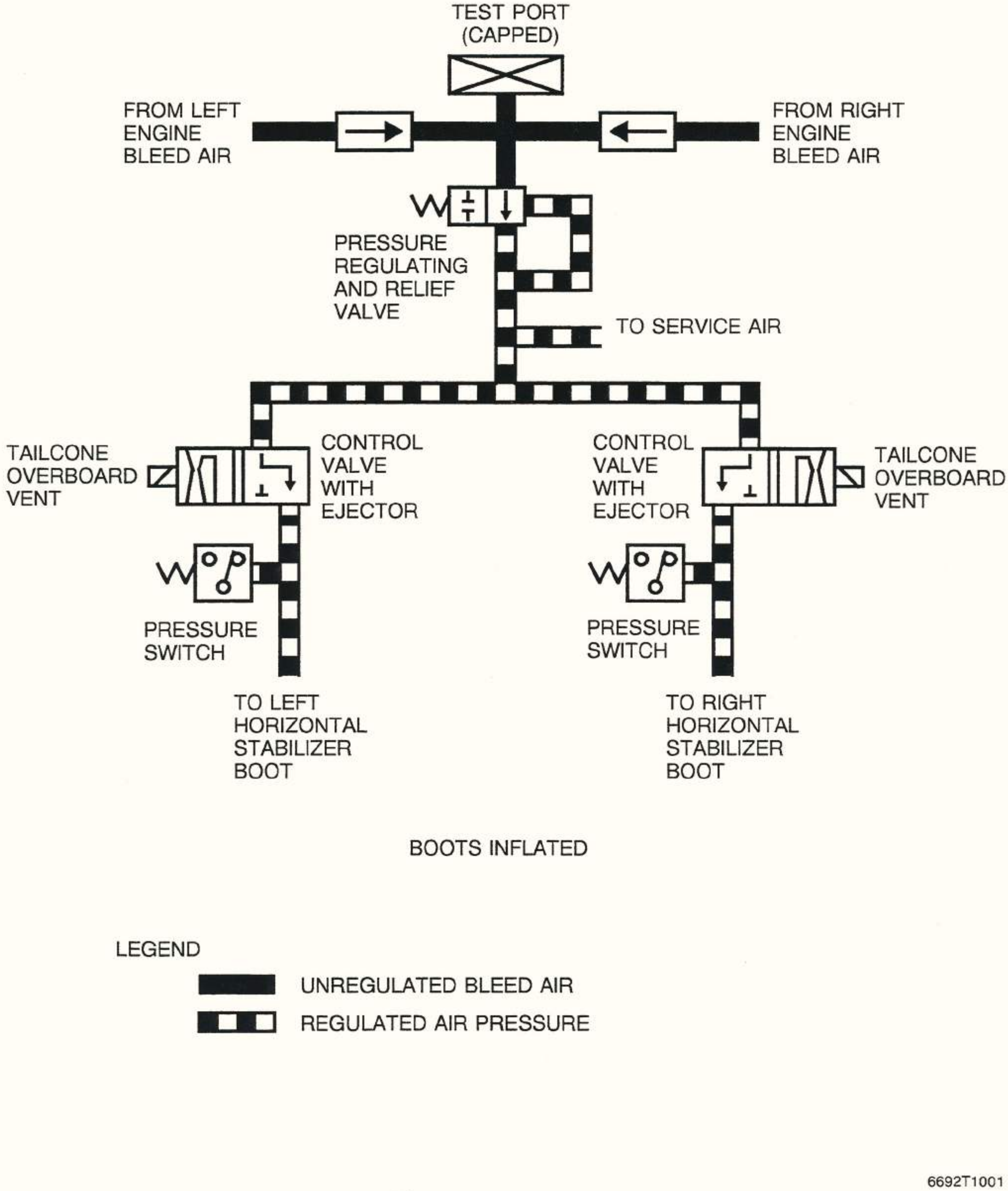



Figure 2-18 (Sheet 2)

## WINDSHIELD RAIN REMOVAL

The windshield rain removal system utilizes a two speed blower fan located in the nose avionics compartment that is routed to the windshield through a dual duct. Placing the WINDSHIELD AIR switch in the ON position will operate the fan at high speed. With the windshield air ON, the blower will direct high velocity air onto the windshield to assist in clearing rain. The system is primarily for ground use, but does provide some benefit in flight. The primary rain removal in flight is provide by airflow in conjunction with a windshield treatment. In the OFF position, a nose avionics bay temperature of more than 95°F will automatically switch the blower fan to low speed to assist in cooling of the nose avionics compartment.

# PRESSURIZATION

## GENERAL

The cabin is pressurized by engine bleed air which has been conditioned (cooled) by the environmental control system. This inflow of conditioned air remains constant through a wide range of engine power settings. The level of pressurization (cabin altitude) and rate of cabin change is then controlled by the Cabin Pressure Control System, a microprocessor-controlled pneumatic/electrical system linked to outflow valves. Under most conditions, the controller will increase cabin altitude at a 600 feet/minute rate and decrease cabin altitude at a 500 feet/minute rate. When in the high altitude mode, these rates may increase to a climb rate of 2,500 feet/minute and a dive rate of 1,500 feet/minute. Ultimately, cabin pressurization is also controlled by limiters installed on the outflow valves. These limiters prevent the cabin altitude from exceeding 9.5 PSI, +0.1 or -0.1 PSI, higher than ambient (Max Delta-P Limiters) and prevent cabin altitude from exceeding 14,500 feet (Max Altitude Limiters). Primary components of the system include the digital cabin pressure controller, the primary and secondary outflow valves, a MANUAL TOGGLE VALVE, an AUTO/MANUAL switch and an EMER DUMP switch.

## AUTOMATIC OPERATION

The system has two methods of automatic operation. The primary (and default) method is the Auto Schedule Control Mode, which is used during all normal flight operations. This method of operation schedules the cabin altitude as a function of airplane altitude, cabin altitude, throttle position and whether the airplane is on the ground or in flight. In the auto schedule mode, the cabin will be depressurized by an altitude of 1500 feet above the set destination field elevation before landing.

A secondary method of automatic operation is called the Isobaric mode. This is a reversionary mode which can be used only if the Air Data Computer (ADC) altitude signal becomes invalid.

**NOTE**

> Neither Auto Schedule nor Isobaric modes are available in case of DC electrical power failure, since the controller does not receive power from the emergency bus. The manual control system functions without electrical power and is used to directly control the outflow valves in case of electrical failure or failure of the automatic controller.

### AUTO SCHEDULE

In Auto Schedule, the controller maintains the lowest practical cabin altitude for the airplane throughout its flight envelope. This is done by electrical signals sent from the microprocessor to solenoids located on the primary outflow valve. These solenoid valves add or remove air in the outflow valve chambers, thusly affecting the rate at which conditioned air is allowed to exit the pressure vessel. The controller has five sub-level modes of operation when in auto schedule: Ground Mode, Take-off (pre-pressurization) Mode, Flight Mode, Descent Mode and High Altitude Mode. When in auto schedule, the only crew action is to program in the Set Landing Altitude (SLA) prior to landing. The following parameters and conditions exist in the various modes:

**GROUND MODE** - In the Ground Mode, either throttle will be set below 62% Throttle Lever Angle (TLA) and the squat switch will indicate weight-on-wheels. Both outflow valves will be in the wide open position to minimize positive pressure in the cabin.

**TAKE-OFF MODE** - When both throttles are advanced to the take-off setting (above 62% TLA), throttle position switches will signal the controller. When the controller receives the signal, it will switch from ground mode to take-off mode. The controller will begin to close the outflow valves until cabin pressure descends to a maximum of 200 feet below take-off altitude after approximately 2 minutes. This mode is seen in varying degrees as most flights do not stay on the ground for 2 minutes after the throttles are positioned to takeoff power. From this point on, the controller is actively scheduling cabin altitude.

**FLIGHT MODE** - When the airplane leaves the ground (as determined by the weight-on-wheels switch), the cabin altitude and cabin pressure rate of change are determined by the auto schedule parameters. The controller looks at the airplane altitude (received via the ARINC 429 data bus), cabin pressure (detected by an internal sensor) and the SLA position to determine what the control system should be doing.

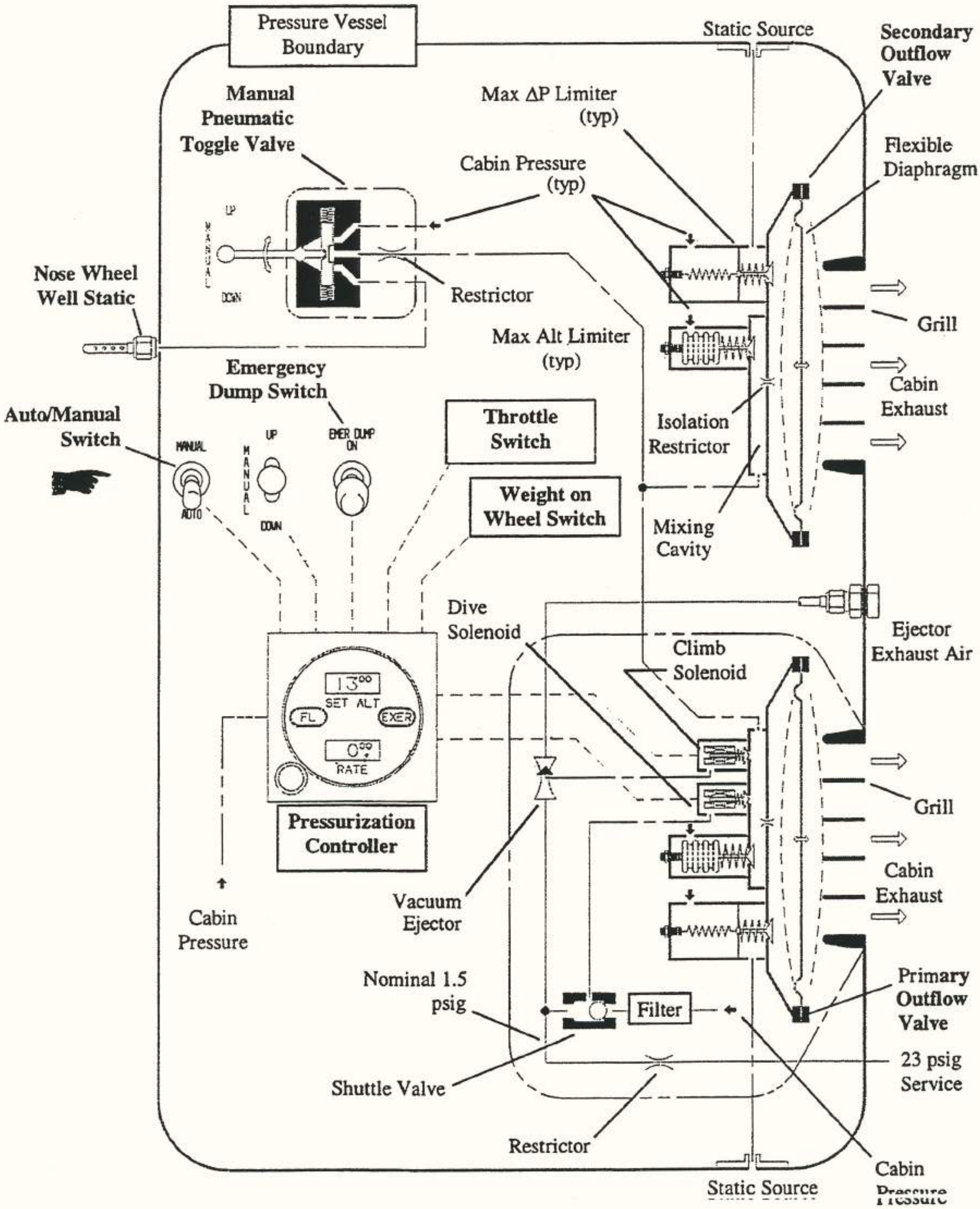
**DESCENT MODE** - When airplane descends more than 500 feet below its cruise altitude, the controller enters the descent mode. During descent, cabin altitude and descent rate are determined by the descent schedule. The descent rate will not be permitted to exceed the selected descent rate limit. Upon landing, the squat switch will cause the controller to return to ground mode and dump any remaining pressure in the cabin.

**HIGH ALTITUDE AIRPORT OPERATION** - The controller will go into High Altitude Airport Mode when the airplane is landing into or departing from airports with elevations between 8,000 and 14,000 feet MSL. The primary function of the high altitude mode is to prevent nuisance CAB ALT annunciations and to minimize the amount of time the cabin altitude spends above 8000 feet while the airplane is above FL 250. This is accomplished by increasing rates the cabin is allowed to climb and dive. When the controller is operated in the high altitude mode, the CAB ALT annunciator will be delayed from its normal 10,000 foot trip point to a modified 14,500 foot trip point (the new signal will occur simultaneous with the cabin oxygen drop box deployment and Emergency Pressurization). The following parameters apply to high altitude landings and takeoffs:

**HIGH ALTITUDE LANDINGS** - When the airplane is landing at airports between 8,000 and 14,000 ft MSL, the SLA must be greater than 8,000 feet, and the airplane altitude (as detected by the ADC) must be between 8,000 and 25,000 feet before the high altitude mode is activated. When activated, cabin pressure altitude will remain at 8,000 feet (maximum) until the airplane descends past FL 245. Below FL 245, the controller will enter the High Altitude Mode and allow an increased outflow rate (up to 2,500 feet/minute). This outflow rate will continue until the Set Landing Altitude has been achieved (approximately 1,500 feet above the ground).

**HIGH ALTITUDE DEPARTURES** - When the airplane is departing from an airport with field elevation between 8,000 and 14,000 MSL, the high altitude mode will occur if there is weight on wheels, the air data computer indicates altitude greater than 8,000 feet and cabin altitude is greater than 8,000 feet. Upon takeoff the cabin altitude begins to dive towards an 8,000 feet cabin at 1,500 feet/minute. During a typical flight the cabin will reach 8,000 feet by the time the airplane is at FL 250 and intercept the auto schedule as the plane continues to climb. If the airplane climbs faster than a typical flight, the cabin will remain above 8,000 feet after FL 250, but the amount of time spent with the cabin above 8,000 feet will be minimized.

# PRESSURIZATION SCHEMATIC




6685X1002

Figure 2-19

## ISOBARIC MODE

The isobaric mode is a standby mode that can not be entered directly while in flight. The controller will switch from auto schedule to isobaric mode anytime the altitude signal (generated through the ADC) becomes disabled. Isobaric mode is indicated by a yellow warning indicator on the pressurization controller display face. If the air data sensor information resumes, the controller will automatically switch back to the auto schedule mode and the yellow warning indicator will extinguish.

If the controller switches to isobaric mode, the SLA on the controller display is replaced with the selected Flight Level, allowing the pilot to set the desired airplane cruising altitude. This altitude is selected by rotating the SET ALT knob to the desired flight level. The controller then uses the selected flight level to control the cabin pressure rate of change and the cabin pressure altitude to maintain near-maximum differential pressure.

During descent, the pilot can view the selected landing field altitude by pressing the FL button on the controller. The display will show cabin altitude, allowing the pilot to set the desired cabin altitude prior to landing. The controller then controls the cabin pressure rate of change to maintain the displayed cabin altitude.

# PRESSURIZATION CONTROL PANEL

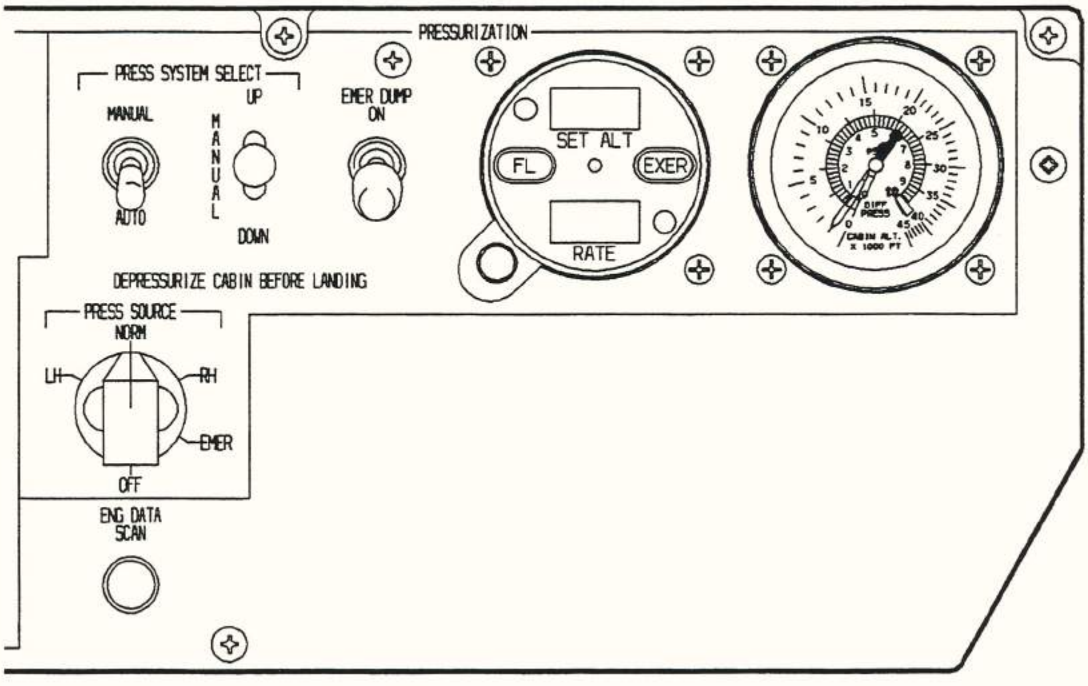



Figure 2-20

## MANUAL OPERATION

In the event of a controller failure, cabin pressure can be controlled manually (pneumatically). Manual control is activated when the AUTO/MANUAL switch is selected to the MANUAL position.

In this position, electric power is removed from the controller (and subsequently the climb and dive solenoids associated with the primary outflow valve). All changes to the outflow valves are now commanded using differential pressure from cabin and ambient sources. Placing the MANUAL valve in the UP position will increase cabin altitude, and placing the valve in the DOWN position will decrease cabin altitude.

The amount of cabin altitude change and the cabin altitude rate of change is controlled by the amount of time the MANUAL valve is held in the UP or DOWN position. Because the manual valve uses cabin pressure to open and close the outflow valves, reaction time will increase at low cabin Delta-P. Safety features in the manual toggle valve will not allow rate selections beyond Delta-P limits.

## EMERGENCY DUMP

The EMER DUMP ON switch is stowed in the de-activation position. The EMER DUMP ON switch may be used for rapid equalization of the cabin and ambient pressures. When activated, the primary outflow valve climb solenoid is electrically commanded to vent air out of the control chambers, causing the primary and secondary outflow valves to open and dump cabin pressure. However, limiters in the solenoid will not allow cabin altitude to exceed 14,500 feet regardless of commands from the EMER DUMP ON switch.

## BUILT IN TEST FUNCTIONS

The controller incorporates two sets of built-in diagnostics tests. The first test is an internal check of the controller and is performed continuously during operation. If an internal fault is detected, power is removed form the primary outflow valve climb and dive solenoids. The RATE and SET ALT displays will go blank, providing the pilot with immediate indication of the controller failure. The system is now in the manual mode of operation, with the outflow valves remaining in the last commanded position. If this failure occurs in flight, the cabin pressure altitude may then be controlled using the MANUAL TOGGLE VALVE.

If the controllers detects a loss of the air data computer signal, a yellow warning indicator will illuminate and the controller will automatically switch to the Isobaric Mode of operation. The controller will continue to operate in Isobaric Mode until the signal is restored. If the signal is restored in flight, the controller will switch back to the auto schedule mode of operation.

While on the ground, the integrity of the system may be checked by pressing and holding the EXER button for approximately 2 minutes. The controller will command the outflow valves to the closed position and pressurize the cabin to 200 feet below current field elevation. Upon release of the button, the controller will perform a display test and gradually re-open the outflow valves to their full open position, depressurizing the cabin.

**NOTE**

In flight, the EXER button provides only a lamp test.

A second test is provided to assist maintenance personnel in isolating system faults. This on-ground BITE test is activated by pressing a recessed push button between the FL and EXER buttons. For further description of this test procedure, refer to appropriate maintenance manuals.

## PRESSURIZATION SOURCE

Engine bleed air is used as the source of high pressure air to provide cabin pressurization. During normal operations, some of the bleed air passes through the air cycle machine for cooling before entering the cabin.

Each engine has two ports from which compressor discharge air (bleed air) is bled off from the engines. Two control valves, one mounted in each pressurization bleed air line, control the bleed air flow from the respective engine through the air conditioning system and into the cabin.

The emergency pressurization control valve installed on the left bleed air line is used to route orifice controlled bleed air directly to the cabin for emergency pressurization.

The pressurization source selector switch is a five-position switch labeled NORM, LH, RH, EMER AND OFF. In the OFF position, both bleed air control valves are closed allowing no bleed air to enter the cabin. In the NORMAL position, the left and right flow control valves will open, allowing both left and right conditioned bleed air (12 pounds/minute) to enter the cabin. In the LH position, the left flow control valve will open, allowing the left engine conditioned bleed air (6 pounds/minute) to enter the cabin. In the RH position, the right flow control valve will open, allowing right engine conditioned bleed air (6 pounds/minute) to enter the cabin.

## EMERGENCY PRESSURIZATION

In the EMER position, the emergency pressurization valve opens in flight only, allowing hot bleed air from the left engine to enter the cabin directly and the EMER PRESS annunciator light will illuminate. The air cycle machine is bypassed with emergency pressurization selected, cabin temperature will rise, and AUTOMATIC or MANUAL temperature control will be disabled. Cabin temperature can be controlled to some extent with the left throttle. Retarding the left throttle will lower bleed air temperature, but excessive reduction will allow the cabin altitude to climb.

Emergency pressurization will also automatically activate at 14,500 foot cabin altitude regardless of the bleed air control valve switch position, and will deactivate by 11,000 foot (descending).

# ENVIRONMENTAL AND TEMPERATURE CONTROL

## GENERAL

Environmental and temperature control on the Excel is provided by a combination of engine bleed air, air cooled through air-to-air heat exchangers and a refrigerent-based air conditioning system. These components are combined to provide temperature controlled air throughout the cabin which is distributed in a series of ducts and vents. The primary means of altering temperatures in this system involves changing the amount of warm bleed air allowed to mix with cold air. Additional velocity is available through the use of electric blowers placed in the ductwork.

The environmental control system consists of the Environmental Control Unit (ECU), the Air Distribution System, and the Temperature Control System. The various systems and their components are listed as follows:

## ENVIRONMENTAL CONTROL UNIT

The tailcone-mounted ECU is designed to take hot engine bleed air from both engines and produce cold air for use in the temperature and distribution system. This conditioned air also serves as the source of pressurization for the entire pressure vessel. The ECU consists of a primary heat exchanger, a secondary heat exchanger, an Air Cycle Machine (ACM), a water separator and an over-temperature switch.

Initially, hot engine bleed air is extracted from both engines and run through a pylon-mounted air-to-air heat exchanger. This exchanger lowers the temperature of the air to approximately 475°F (405°F on the ground). This pre-cooled air from each pylon is then routed together and plumbed into the primary heat exchanger, where temperature drops from 200°F to 300°F. Air is then routed into (and out of) the ACM, through the secondary heat exchanger and back into the ACM where air eventually exits at a temperature which may be well below freezing. An in-line temperature sensor constantly measures this air temperature, and automatically mixes hot bleed air to provide a constant 32°F to 35°F temperature output. This controlled-temperature cold air is then run through a water separator to remove entrapped moisture.

After exiting the water separator, the cold is ducted overhead to provide cool air distribution, or mixed with bleed air and ducted toward floor and armrests to provide warm air distribution.

**NOTE**

Overtemp protection for the ACM is provided by a temperature sensor mounted in the compressor discharge section of the ACM. When the switch senses an overheat condition in flight (temperature above 420°F), it closes the mass flow regulating shut-off valves in the tailcone, opens the emergency pressurization valve and annunciates both the EMERG PRESS ON and ACM O'HEAT lights.

## AIR DISTRIBUTION SYSTEM

When conditioned air leaves the water separator at between 32°F to 35°F, it is ducted forward to a four-outlet wye near the rear pressure bulkhead. Two of the wye ducts are plumbed into the overhead distribution system, terminating at the cockpit overhead wemacs. This overhead system contains only cold air, and this supply of cold air may be further augmented by blower motors and/or additional cooling from the aft mounted freon air conditioning system evaporator. The remaining two wye ducts are plumbed into the cabin/cockpit warm air distribution system, and temperature in this ductwork is controlled by mixing cold air with hot bleed air. The distribution sub-systems are described in greater detail below.

**OVERHEAD COLD AIR DISTRIBUTION** - The overhead cold air distribution ductwork originates at the tailcone-mounted ECU. On the aft side of the aft pressure bulkhead, this single line splits into the four-outlet wye. After penetrating the pressure vessel, the cold air lines (left and right) feed into left and right overhead ducts which run the length of the cabin and terminate in the cockpit. An outlet (wemac) is provided at each passenger and flight crew location. These outlets are operated individually, and may be rotated from a full open to a full closed position. This overhead distribution duct is continuously pressurized with cold air when the engines are running and bleed air is being supplied. Velocity of this air may be increased by selected WEMAC BOOST LO or WEMAC BOOST HIGH on the A/C - FANS control panel.

### A/C - WEMAC BOOT CONTROLS

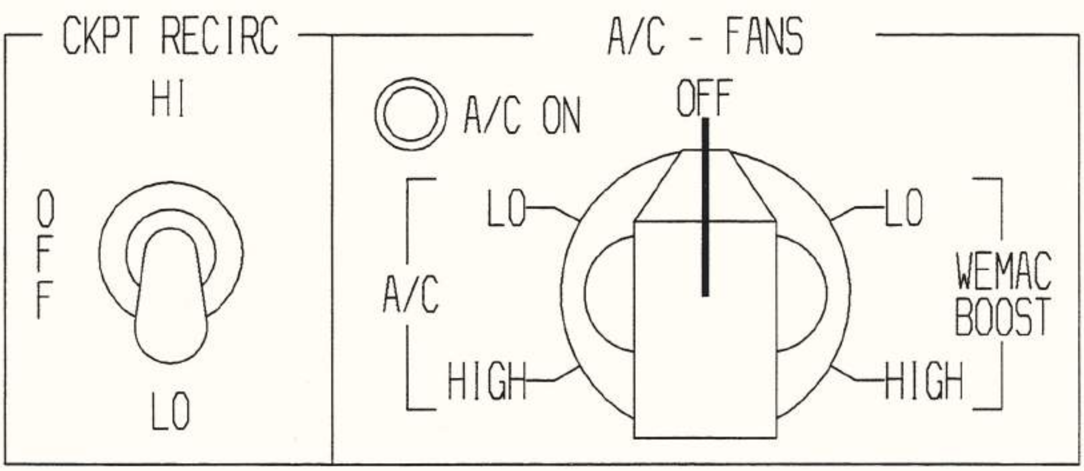



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Figure 2-21

**FREON AIR CONDITIONING** - Additional cooling of the entire cabin is available through two electrically-powered freon air conditioners, with evaporators mounted near the rear bulkhead and near the cabin entrance. The aft evaporator has ducting which ties into the overhead cold air distribution system. The forward evaporator is not tied into any ductwork and blows cold air directly into the cabin area through a floorboard grate. Controls for the air conditioning system are located below the co-pilot's primary flight display. Selecting the rotary switch to the A/C LO position will illuminate the A/C ON light and power both evaporator fans at low speed.

Selecting the rotary switch to the A/C HIGH position will illuminate the A/C ON light and power both evaporator fans at high speed. A barometric switch incorporated in the A/C system removes electrical power to the system above 18,000 feet. In addition, automatic load shedding limits are built in. In flight, both generators must be operating in order for the compressor drive motor to operate. In the event of a generator failure, the compressor is automatically disconnected from the power source. On the ground, the system may be powered either by an auxiliary ground cart or by operating either engine.

**CABIN AIR DISTRIBUTION** - The lower cabin air distribution system supplies conditioned air through the left hand lower supply duct. When air enters the cabin, it is split into several paths; the left hand armrest and footwarmer ducts, the dropped aisle ducts located on the left hand side of the dropped aisle, and to the right hand armrest and footwarmer ducts. The footwarmer and armrest ducts are of a piccolo tube design that allows the air to flow evenly over the length of the cabin.

**COCKPIT AIR DISTRIBUTION** - The cockpit air distribution system supplies with conditioned air through the right hand lower supply duct. The air enters in the aft cabin and is ducted underneath the right hand seats towards the cockpit. After reaching the cockpit, the air is split off into side wall diffusers, side window defog and forward bulkhead diffusers.

**COCKPIT VENT SYSTEM** - The cockpit vent system consists of side console air outlets, foot warmers and console wemacs which are supplied by a fan located in the foot warmer ducting. The side console air outlets are installed on the top surface of the pilot's and copilot's side consoles. The right console air outlet is connected to the cockpit air duct inside the console. The left console air outlet is supplied air through a crossover duct which extends from the co-pilot's side console to the pilot's side console and follows the lower fuselage contour. The side console air outlets are opened and closed by rotating the nozzles. The left and right foot warmer outlets are mounted in the forward crossover ducting. the side console wemacs are supplied with air pulled in from the foot warmer ducts. Air is supplied through flex ducts connected to a center outlet, between the left and right foot warmers on the forward ducting. The console wemac fan is mounted in the center of the forward foot warmer duct. The console wemac fan is controlled electrically by a fan switch on the co-pilot's instrument panel.

Condensation on the cockpit side windows is prevented by using frost panels to prevent moist cockpit air from coming in contact with the cold outer window surface. Conditioned air from the cockpit supply is fed between the panels from the bottom of the window. there is a small vent hole placed in the upper corner of the frost pane to allow the air to flow over the pane and into the cockpit.

## WINDSHIELD DEFOG

Windshield defog is accomplished by electric windshields powered by engine driven AC alternators. The windshield heat should be turned on prior to descent from altitude to provide adequate clearing for descent into high humidity conditions. The window vent controls must be positioned to the closed position for descent to prevent internal side window defogging. If the outside windshield fogs over after landing the electric windshield anti-ice system may be turned to the O'RIDE position.

## TEMPERATURE CONTROL SYSTEM

The basic principle of operation in the temperature control system is to mix a stream of cold air from the ECU (32°F to 35°F) with a stream of warm bleed air (approximately 475°F) from the engines. This mixed air passes through the aft pressure bulkhead and is then distributed throughout the cockpit and cabin area via a series of under floor ducts and distribution points.

Once inside the cabin, this air may further mix with overhead cold air to create a composite temperature conducive to passenger comfort. Two sensors measure this composite temperature and convey data to the cockpit-mounted display and controller. Individual zone controls allow the flight crew to set different temperatures in the cockpit and in the cabin area (typically between 65°F to 85°F).

The temperature control system consists of three temperature control valves (cabin, cockpit and ECU low limit), two mixing muffs, three duct temperature sensors, two zone temperature sensors, two duct overheat temperature switches, and the temperature controller (which is integral with the selector/indicator).

**TEMPERATURE CONTROL VALVES** - Three temperature control valves are utilized to regulate the amount of hot bleed air mixed in with the cold air out of the ECU. Two of the valves are located just aft of the aft pressure bulkhead, and the third is located near the ECU. The ECU valve receives commands from the cockpit temperature controller, but its operation is automatic. The other two valves also receive commands from the cockpit temperature controller in response to either manual or automatic temperature change requests from the flight crew.

**MIXING MUFFS** - The mixing muffs are devices that mix the hot and cold air streams. The mixing muff surrounds the conditioned air duct and injects hot bleed air into the conditioned air duct. The quantity of bleed air to be mixed in controlled upstream by the by the temperature control valves. The mixed air becomes temperature controlled conditioned air and is routed to the cabin and cockpit.

**DUCT TEMPERATURE SENSORS** - The duct temperature sensors monitor the air temperature at three points in the system. Sensors are located near the aft pressure bulkhead (left and right lower duct locations) and downstream of the water separator in the tailcone area.

**ZONE SENSORS** - Two zone sensors sample representative air temperature and display temperature data on the controller. Each sensor contains a small fan which pulls cabin air across the sensor to provide a more representative zone temperature. The cockpit zone sensor is located in the right hand side console. The cabin zone sensor is located in the aft cabin in the passenger service unit.

**DUCT OVERHEAT TEMPERATURE SWITCHES** - Two switches are located near the aft bulkhead (left and right lower duct) to provide an over-temperature indication. If either switch detects an over-temperature condition (temperature exceeds 300°F), the switch will close, causing the DUCT O'HEAT CKPT or the DUCT O'HEAT CAB annunciator to illuminate in conjunction with the MASTER CAUTION warning.

**TEMPERATURE CONTROLLER** - The temperature controller is mounted on the center tilt panel and provides dual zone adjustments and monitoring of both the cockpit and cabin systems. The TEMP SEL knobs provide for automatic and manual settings of the temperature (both zones), and a center knob allows the cockpit or cabin selected temperature and the cockpit or cabin duct temperature to be monitored. A digital display in the center of the controller shows temperature readout (in Fahrenheit) of the selected sensor.

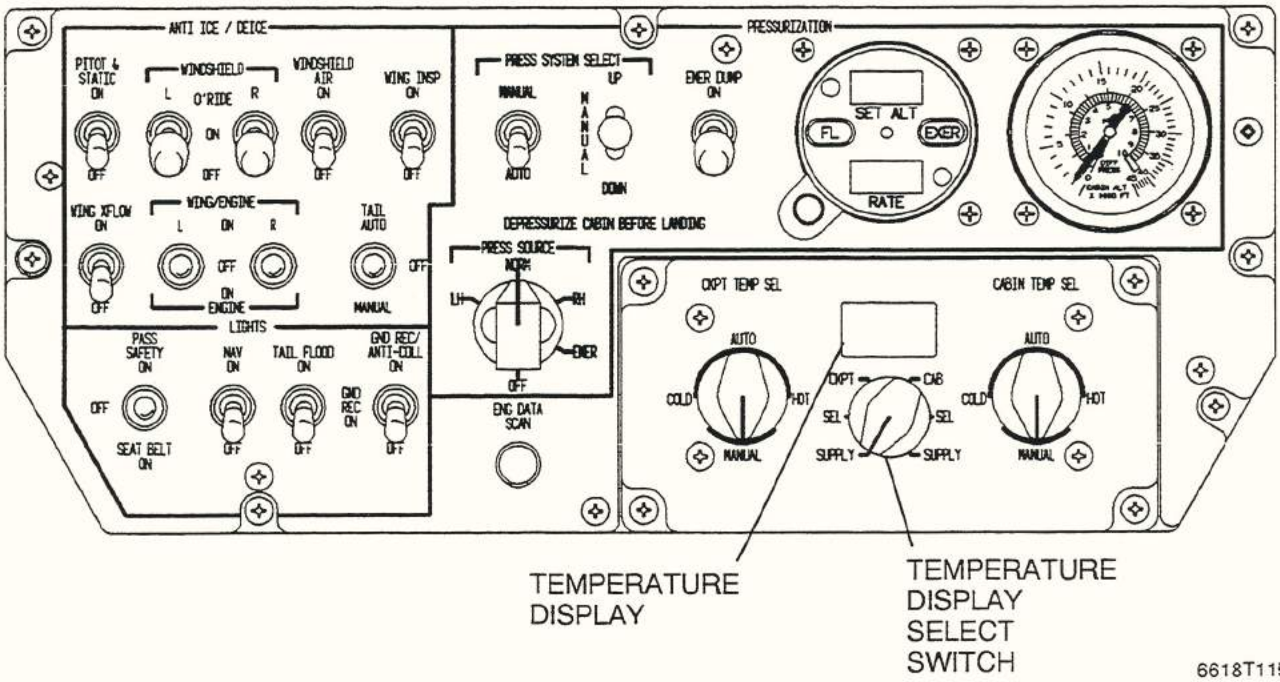


Figure 2-21A TEMPERATURE CONTROLLER

# ENVIRONMENTAL CONTROL SYSTEM

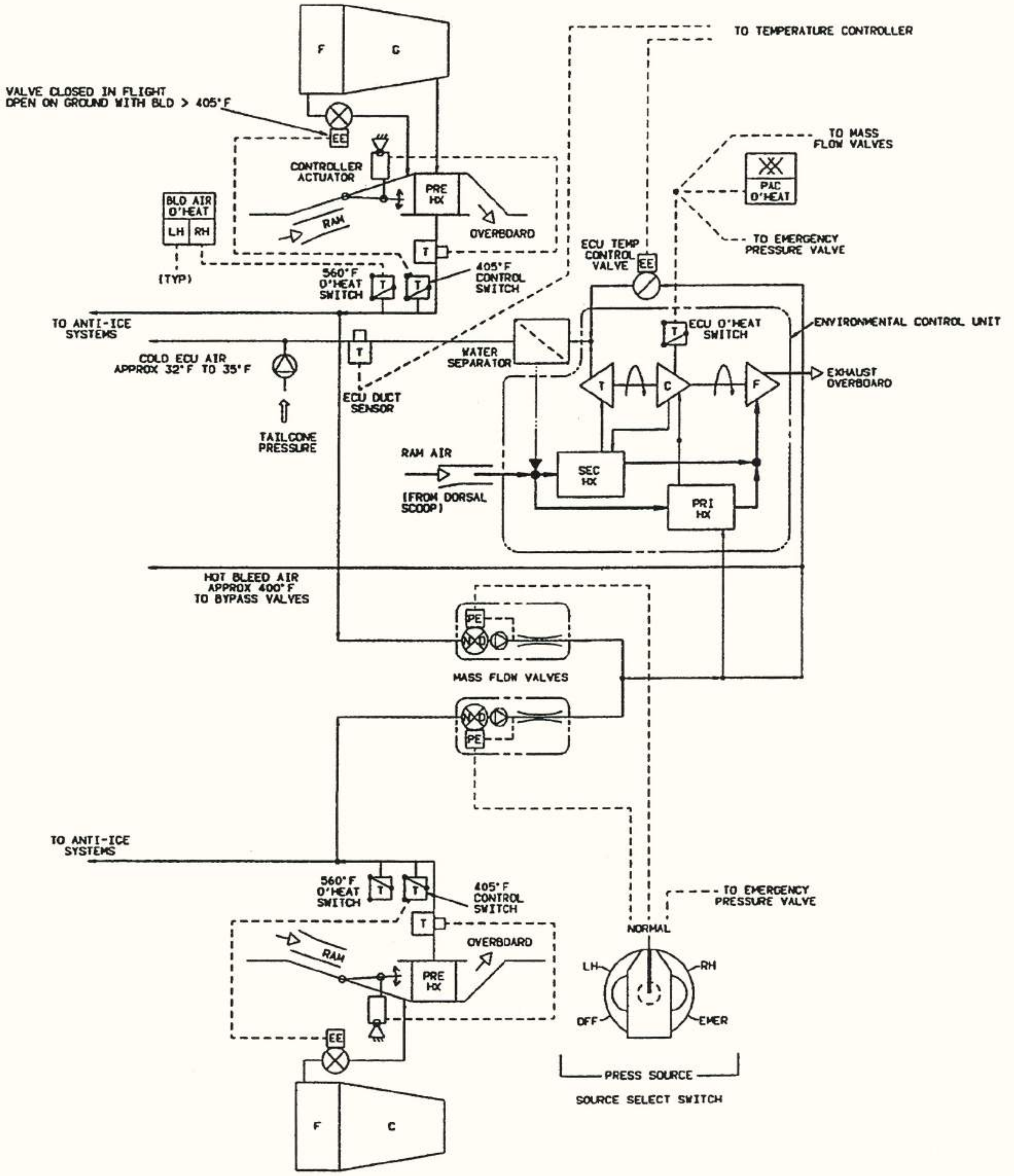


Figure 2-22 (Sheet 1 of 2)

# ENVIRONMENTAL CONTROL SYSTEM

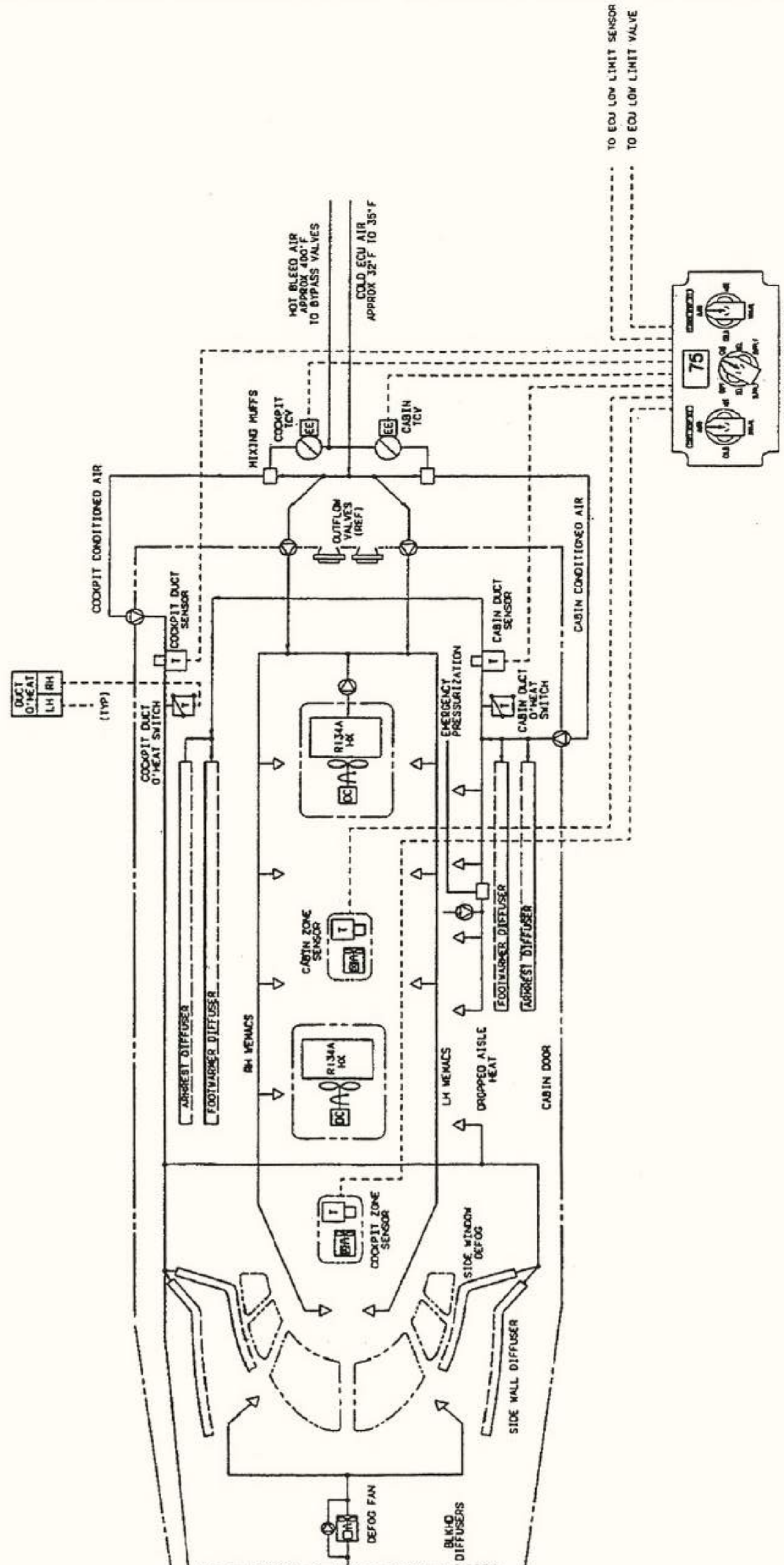


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Figure 2-22 (Sheet 2)

# OXYGEN

## GENERAL

Oxygen for flight crew and passengers is supplied from a 49 or 76-cubic foot oxygen cylinder. The oxygen cylinder pressure gauge is located on the instrument panel. Refer to the oxygen utilization chart for duration of oxygen supply (Figure 3-3).

A three-position oxygen control switch (oxygen control valve) is located on the pilot's left console. The three positions are OFF / PASS OXY AUTO / ON. In the PASS OXY AUTO position, if the cabin altitude exceeds approximately 14,500 feet, the passenger masks will automatically drop. Oxygen will flow to these masks when the lanyard is pulled as the mask is donned. Therapeutic oxygen may be supplied to the passengers at any cabin altitude by placing the selector valve in the ON position. This will cause all masks in the cabin to deploy. Oxygen flow may be shut off from passenger masks by positioning the oxygen priority valve to the OFF (crew only) position.

### PILOT'S SIDE CONSOLE OXYGEN CONTROL AND OUTLETS

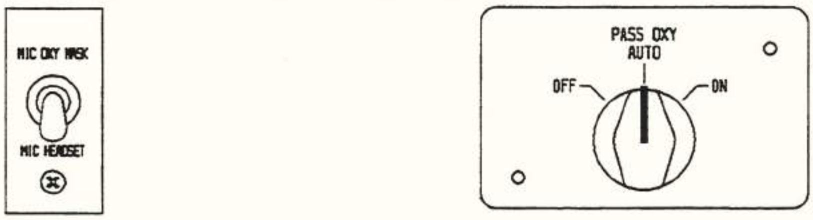


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Figure 2-23

## OXYGEN MASKS

The crew oxygen mask is a quick donning mask with a microphone and regulator attachment. The mask is a diluter demand with pressure breathing available by selecting the EMER position. The crew member is assured that oxygen is being received when no restriction to breathing is present with the mask donned and in the 100% position. Selection of the EMER position will provide a steady flow of pressurized oxygen in the face cone. To qualify as a quick donning mask, the mask must be properly stowed in the receptacle located in the cockpit side console. To conserve oxygen when using the mask, the regulator may be set to normal if the cabin altitude is below 20,000 feet.

When using an oxygen mask for smoke protection, 100% position should be selected. The emergency position may be used with the oxygen mask.

> The high altitude airport mode is automatically selected when a field elevation above 8000 feet is set into the cabin pressurization controller. In this mode, the automatic passenger oxygen mask drop is inhibited below cabin altitudes of approximately 14,500 feet.

## OXYGEN MASK MIC AND HEADSET MIC

A two-position toggle switch is provided on the pilot's and copilot's instrument panels. The switch is marked MIC OXY MASK and MIC HEADSET. Depressing the microphone button on the appropriate control wheel allows a crew member to transmit through the headset microphone or oxygen mask microphone, whichever is selected.

**NOTE**

Cockpit masks are assumed to be at the normal setting below 20,000 feet cabin altitude with a respiratory rate of 10 liters per minute - body temperature pressure saturated and at 100% setting at and above 25,000 feet.

### EROS CREW MASK AND 49-CUBIC FOOT CYLINDER

| AVAILABLE TIME IN MINUTES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CABIN ALTITUDE | 1 COCKPIT | 2 COCKPIT | 2 COCKPIT 2 CABIN | 2 COCKPIT 4 CABIN | 2 COCKPIT 6 CABIN | 2 COCKPIT 8 CABIN | 2 COCKPIT 10 CABIN | 2 COCKPIT 11 CABIN | 2 COCKPIT 12 CABIN |
| 8,000 | 839 | 420 | 106 | 61 | 42 | 33 | 27 | 24 | 22 |
| 10,000 | 964 | 482 | 110 | 62 | 43 | 33 | 27 | 25 | 23 |
| 15,000 | 964 | 482 | 112 | 63 | 44 | 34 | 28 | 25 | 23 |
| 20,000 | 757 | 379 | 107 | 62 | 44 | 34 | 28 | 25 | 23 |
| 25,000 | 405 | 202 | 87 | 55 | 41 | 32 | 27 | 24 | 22 |
| 27,000 | 475 | 237 | | | | | | | |
| 29,000 | 523 | 261 | | | | | | | |
| 31,000 | 588 | 294 | | | | | | | |
| 33,000 | 663 | 332 | | | | | | | |
| 35,000 | 748 | 374 | | | | | | | |
| 37,000 | 851 | 426 | | | | | | | |
| 39,000 | 1037 | 518 | | | | | | | |

### EROS CREW MASK AND 76-CUBIC FOOT CYLINDER

| AVAILABLE TIME IN MINUTES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CABIN ALTITUDE | 1 COCKPIT | 2 COCKPIT | 2 COCKPIT 2 CABIN | 2 COCKPIT 4 CABIN | 2 COCKPIT 6 CABIN | 2 COCKPIT 8 CABIN | 2 COCKPIT 10 CABIN | 2 COCKPIT 11 CABIN | 2 COCKPIT 12 CABIN |
| 8,000 | 1308 | 654 | 165 | 94 | 66 | 51 | 41 | 38 | 34 |
| 10,000 | 1502 | 751 | 172 | 97 | 68 | 52 | 42 | 38 | 35 |
| 15,000 | 1502 | 751 | 175 | 99 | 69 | 53 | 43 | 39 | 36 |
| 20,000 | 1180 | 590 | 167 | 97 | 69 | 53 | 43 | 39 | 36 |
| 25,000 | 630 | 315 | 136 | 86 | 63 | 50 | 41 | 38 | 35 |
| 27,000 | 740 | 370 | | | | | | | |
| 29,000 | 815 | 407 | | | | | | | |
| 31,000 | 916 | 458 | | | | | | | |
| 33,000 | 1034 | 517 | | | | | | | |
| 35,000 | 1165 | 583 | | | | | | | |
| 37,000 | 1326 | 663 | | | | | | | |
| 39,000 | 1616 | 808 | | | | | | | |

## CREW OXYGEN SCHEMATIC

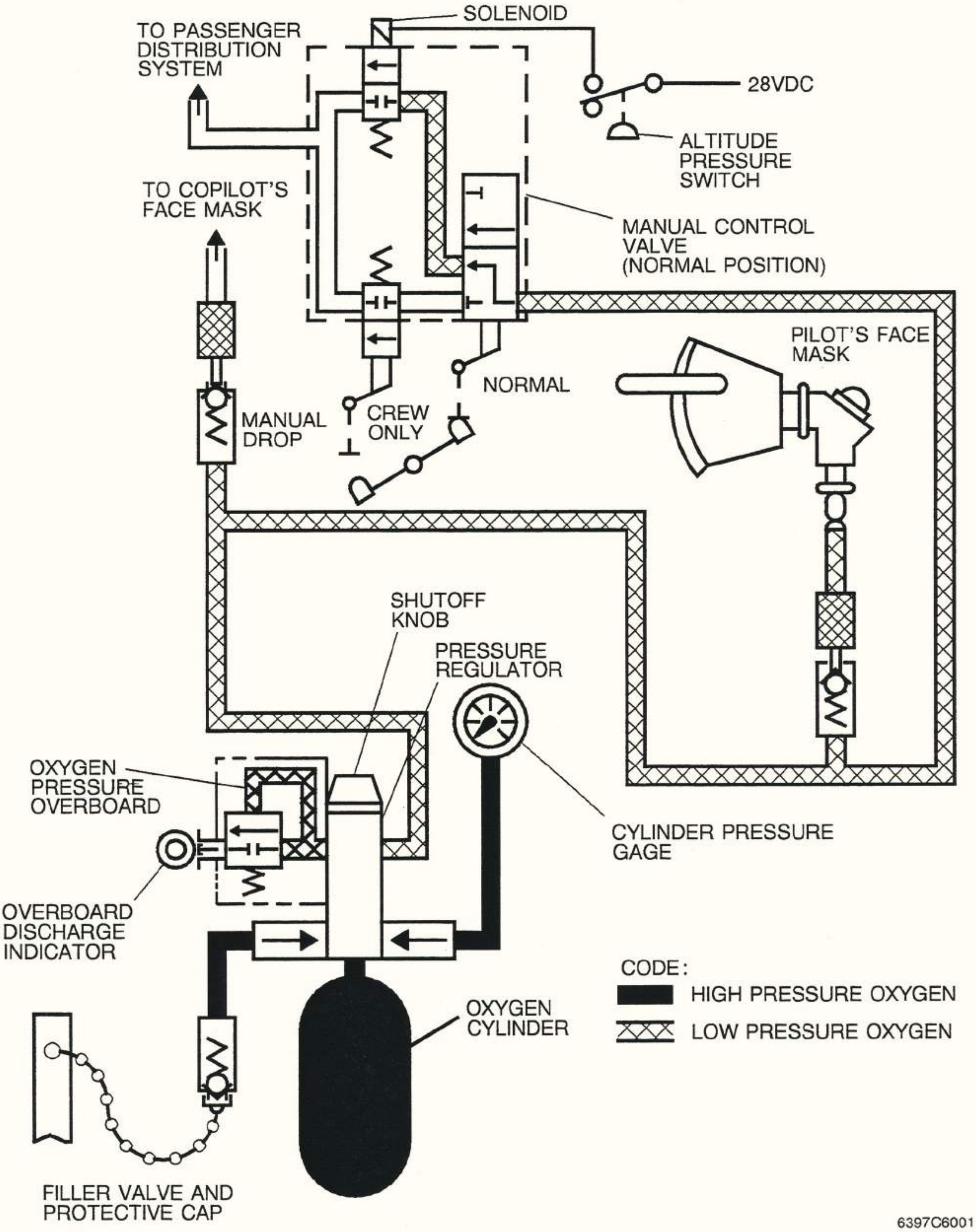



Figure 2-24

# LIGHTING

## INTERIOR LIGHTING

Interior lighting is provided for the flight compartment and cabin through a series of direct, indirect, fluorescent and incandescent lighting arrangements.

Cockpit lighting includes electroluminescent panels, glareshield lighting, flood lighting and back lit instrument lighting. Most cockpit lights are controlled from the PANEL LIGHT sub panel, located below the pilot's primary flight display. It contains rheostats for the left, right and center instrument panel (LEFT, CTR PNL and RIGHT), the electroluminescent panels (EL) ,and the cockpit flood lights (FLOOD). In addition, the sub-panel contains the ON / OFF switch for panel lighting.

Two individually controlled map lights are located in the overhead panel above the pilot and copilot. Intensity controls are located at the forward end of each side console.

Cabin lighting includes overhead fluorescent lighting, individually controlled overhead reading lights for each passenger and in the aft lavatory area, and two additional lights in the aft compartment. An illuminated switch on the forward door post turns on exit lights over the main and emergency doors and one aft baggage compartment light. These lights are powered by the hot battery bus and are available any time the battery is installed and serviceable.

In addition to this cabin lighting, a passenger advisory message light is installed in the cabin. This advisory is controlled by a three-position switch on the tilt panel labeled PASS SAFETY ON / OFF / SEAT BELT ON.

Provisions are made to power certain lighting systems in emergency conditions. Refer to Emergency Lighting for a description.

## EXTERIOR LIGHTING

Exterior lighting consists of landing lights, position/anti-collision lights, wing inspection lights, tail flood lights and a ground recognition beacon.

The landing lights are located under the belly fairing (2) and in the outer left and right wingtips (4). The landing light are controlled by separate left and right LANDING LIGHT toggle switches located on the pedestal. When set to the ON position, all six lights are powered. When set to REC (which also serves as the taxi position), both belly lights and a single light at each wing tip are powered.

The position lights are located in each wingtip and on the aft end of the vertical tail. The position system includes red and green wingtip lights, and a white vertical tail light. Selecting the nav switch to the NAV ON position powers the position lights.

The wing inspection lights are mounted on each side of the fuselage just above each wing's leading edge and are used to detect the presence of ice on the wing. Selecting the tilt-panel mounted switch to the WING INSP ON position powers both lights.

The tail flood lights are installed on the upper surface of the horizontal stabilizer. Selecting the tilt-panel mounted switch to the TAIL FLOOD position powers lights which illuminate both sides of the vertical stabilizer.

A ground recognition light is mounted on top of the vertical tail for optimum line of sight visibility and is used during ground taxi operation. The anti-collosion light system includes strobes at each wingtip. Selecting the tilt panel-mounted switch to the GND REC ON position powers the beacon. Selecting the switch in the GND REC / ANTI-COLL ON position powers the ground recognition and anti-collision lights.

## TAILCONE LIGHTING

Detachable lights located in the tailcone inspection and baggage areas provide interior lighting for tailcone inspection. Power is from the hot battery bus. The OFF/ON switch is mounted on the access doorframe and is wired through the door-closed microswitch. Closing the tailcone compartment door will extinguish the respective light, regardless of OFF/ON switch position.

## EMERGENCY LIGHTING

Emergency lighting is a separate and independent system used to provide illumination in case of a primary electrical power failure or in a hard landing situation. The emergency lighting system consists of two emergency battery packs (with 5G inertia switch control), five illuminated emergency exit marking and locating signs, four overhead lights for illumination of exit areas, two strips of floor proximity escape path lighting along the cabin dropped aisle, six cabin door step lights, and two exterior lights for external overwing illumination during night evacuation.

The emergency lights are normally powered from the main DC power system, with the emergency battery packs being trickle charged by the DC power system. In the event of power failure, the 2.5 amp, 17 cell battery powers the following items:

**FORWARD BATTERY** - The forward battery provides power to illuminate the exit indicators on either side of the cabin door, an exit sign over the cabin door, six lights on the cabin door steps, an overhead light opposite the cabin door, an overhead light aft of the cabin door, and floor proximity lights along one side of the cabin's dropped aisle.

**AFT BATTERY** - The aft emergency battery pack provides power to illuminate an exit sign above the rear escape hatch, an exit sign on the cabin's aft divider, an overhead light above the escape hatch, an overhead light forward of the cabin's aft divider, two exterior light for overwing escape, and floor proximity lights along the other side of the cabin's dropped aisle.

The lights are controlled by a three position EMER LTS switch located at the bottom of the left instrument panel. When the switch is in the OFF position, none of the emergency lights are illuminated. With normal DC power on and the switch in the OFF position, an amber light adjacent to the switch is illuminated to remind the pilot to place the switch to either the ON or ARM position before flight.

In the ARM position (normal flight mode), the amber light next to the switch extinguishes, but the emergency lights do not illuminate unless either the passenger safety switch is placed in the PASS SAFETY ON position, normal airplane power is lost, or a 5G impact is sustained to the airplane.

In the ON position, the amber light adjacent to the switch extinguishes and all emergency lights are illuminated. These lights will be powered from either the main power bus or, if not available, from the emergency battery packs.

# WARNING AND TEST

## ANNUNCIATOR PANEL

The annunciator panel is designed to provide the pilot with an easily interpreted display of both normal and abnormal system conditions. Two flashing master warning lights (MASTER WARNING RESET) are used in conjunction with the panel to ensure rapid recognition of any red annunciator light. In addition, the master warning light will flash if both amber GEN OFF lights should illuminate.

The master warning lights can be reset by pressing either light. Resetting the master warning light rearms the system so that it will function should another failure occur.

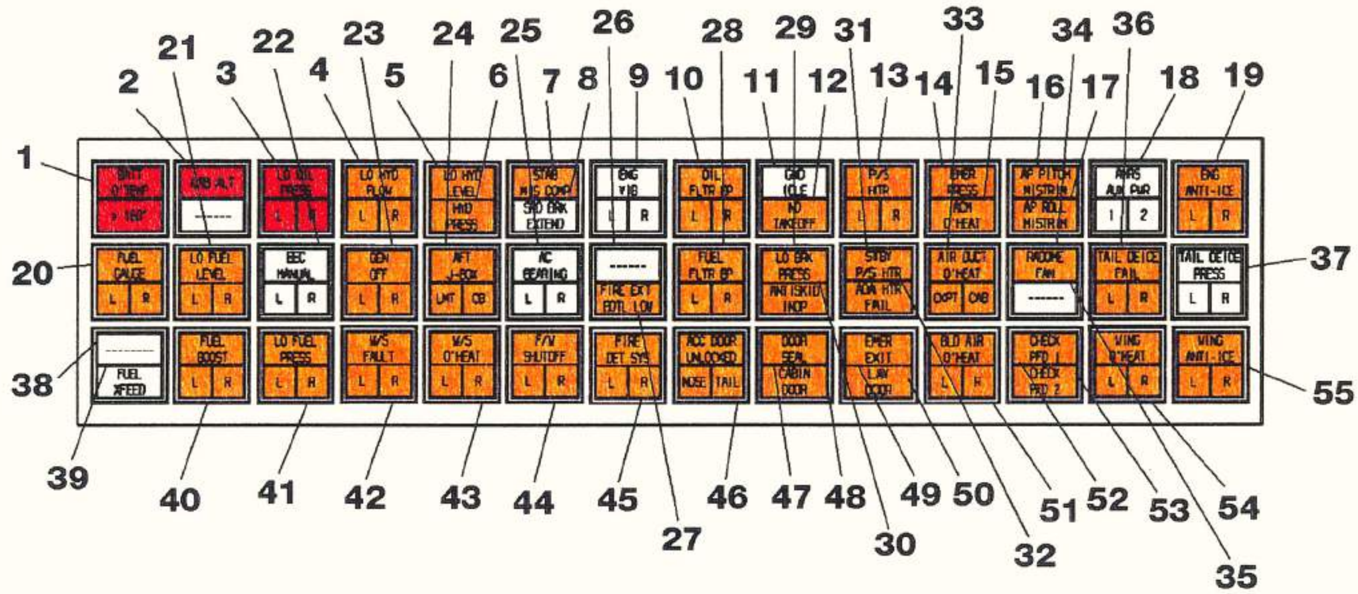
The annunciator system is powered from the main direct current (DC) buses through the WARN LTS 1 and 2 circuit breakers on the left cockpit panel.

All system light bulbs can be tested by placing the rotary TEST selector on the center pedestal to the ANNU position. This will illuminate all lights and cause the master warning lights to flash.

Burned out bulbs can be replaced by pushing in the light assemblies to the left and right of the failed bulb; then use a tool to remove the assembly with the burned out lamp.

If the MASTER WARNING light illuminates in a steady mode, it indicates that there has been a loss of power to the annunciator panel from either the left or right DC electrical bus.

# ANNUNCIATOR PANEL



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1. **BATT O'TEMP** — The red battery overtemperature light will flash and the master warning will flash if battery temperature exceeds 145°F. Pressing the master warning will cause the flashing annunciator to change to steady on and the master warning to extinguish.

   **BATT O'TEMP >160°** — The red battery overtemperature light and the >160° light will flash and the master warning will flash if battery temperature continues to climb above 160°. Pressing the master warning will cause the flashing annunciator to change to steady on and the master warning to extinguish.

2. **CAB ALT** — Normal Altitude Mode - The red cabin altitude light will flash and the master warning will flash to advise that the cabin pressure altitude is above 10,000 feet (+350 feet or -350 feet) during operation out of low altitude airports (8.000 feet or less), and anytime airplane altitude is greater than 24,500 feet. Pressing the master warning will cause the flashing annunciator to change to steady on and the master warning to extinguish.

   High Altitude Mode - The red cabin altitude light will flash and the master warning will flash to advise that the cabin pressure altitude is above 14,500 feet (+500 feet or -500 feet) during operation out of high elevation airports (greater than 8,000 feet), with an airplane altitude less than 24,500 feet. Pressing the master warning will cause the flashing annunciator to change to steady on and the master warning to extinguish.

3. **LO OIL PRESS L R** — The red oil pressure warning light will flash and the master warning flash if oil pressure is below safe limits (20 PSI) in left or right engine. Pressing the master warning will cause the flashing annunciator to change to steady on and the master warning to extinguish.

Figure 2-25 (Sheet 1 of 8)

| | | |
|---|---|---|
| 4. | LO HYD FLOW L R | The amber hydraulic flow low light illuminates steady to advise that left and/or right hydraulic system flow is below approximately 0.35 to 0.55 gallons per minute. If conditions continue for more than five seconds, the amber annunciator will begin to flash steady and illuminate the master caution. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 5. | LO HYD LEVEL | The amber hydraulic low light flashes and the master caution illuminates if the hydraulic system level is below approximately 74 to 76 cubic inches. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 6. | HYD PRESS | On the ground, the amber hydraulic pressure light will illuminate when hydraulic pressure rises above 185 PSIG. The light will extinguish when pressure falls below 150-160 PSIG.<br><br>In the air the amber annunciator, if on for more than 40 seconds, will flash and illuminate the master caution light. Pressing the master caution will cause the master caution to extinguish. |
| 7. | STAB MIS COMP | The amber stabilizer miscompare light and the master caution illuminates steady to advise that a miscompare exists between flap handle position and the horizontal stabilizer position. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 8. | SPD BRK EXTEND | The white speed brake extend light advises that the left and right speed brakes are fully extended. |
| 9. | ENG VIB L R | The white engine vibration light advises that the left and/or right engine vibration has exceeded prescribed limits. |
| 10. | OIL FLTR BP L R | The amber oil filter bypass light flashes and the master caution illuminates to advice that bypass of the left and/or right oil filter is impending. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 11. | GND IDLE | On the ground, the white ground idle light indicates the EEC is in ground idle mode (46%$N_2$).<br><br>In the air, the white annunciator flashes and the master caution illuminates when the EEC is in ground idle mode. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguis<br><br>Once the airplane has transitioned from flight to ground mode, the annunciator will illuminate steady 8 seconds after throttles are positioned to idle. |

Figure 2-25 (Sheet 2 of 8)

| | | |
|---|---|---|
| 12. | NO TAKEOFF | On the ground, the amber no takeoff annunciator will illuminate steadily if one or more of the following conditions exist: Flaps not within takeoff range (less than 7 degrees or more than 15 degrees), elevator out of trim for takeoff, horizontal stabilizer is out of takeoff position, or speed brakes are out of takeoff position. |
| | | As the throttles are advanced beyond climb setting, the no takeoff annunciator will flash and the master caution illuminate if one or more the following conditions exist: Flaps not within takeoff range (less than 7 degrees or more than 15 degrees), elevator out of trim for takeoff or horizontal stabilizer is out of takeoff position. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 13. | P/S HTR | On the ground, the amber pitot/static heater failure annunciator illuminates steady to indicate an inoperative heating element in the pitot-static system. |
| | L R | In the air, the amber light flashes and the master caution illuminates steady to advises of an inoperative heating element. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 14. | EMER PRESS | The amber emergency pressurization light flashes and the master caution illuminates to advise that emergency pressurization has been manually selected or automatically activated by an air cycle machine overheat. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 15. | ACM O'HEAT | The amber ACM overheat light flashes and the master caution illuminates to advise of an overtemperature condition of air cycle machine (in excess of 420°F). This light will trip in conjunction with the EMER PRESS light. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 16. | AP PITCH MISTRIM | The amber autopilot pitch mistrim light flashes and the master caution illuminates steady to advise that the autopilot is in an out-of-trim condition, and that a sustained input is being applied to the elevator servo. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 17. | AP ROLL MISTRIM | The amber autopilot roll mistrim light flashes and the master caution illuminates steady to advise that the autopilot is in an out-of-trim condition, and that a sustained input is being applied to the aileron servo. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |

Figure 2-25 (Sheet 3)

| | | |
|---|---|---|
| 18. | AHRS AUX PWR<br>1 2 | The white attitude heading reference system light illuminates steady, advising that primary DC power has been lost on the respective AHRS and is operating on secondary power from the AHRS auxiliary battery. |
| 19. | ENG ANTI-ICE<br>L R | On the ground, with left and/or right anti-ice switches selected to the WING/ENGINE position, the amber engine anti-ice light will illuminate steady with no illumination of master caution to advise of low temperature in the respective engine inlet. The light will extinguish after respective engines reach normal operating temperature.<br><br>After normal operating temperature has been reached, an under-temperature condition will cause the respective annunciator to flash and the mater caution light to illuminate. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>In the air, with left and/or right anti-ice switches selected to the WING/ENGINE position, the amber engine anti-ice light will flash and the mater caution light will illuminate if normal operating temperatures are not reached within 4 minutes and 45 seconds. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>Nuisance trips (less than 5 seconds between resumption of normal temperature and the detection of a new under-temperature condition) are inhibited by circuit logic.<br><br>If the respective left and/or right WING/ENGINE anti-ice switches are selected to the OFF position and the respective engine anti-ice fan stator valve is open, the annunciator will flash and illuminate the master caution. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 20. | FUEL GAUGE<br>L R | The amber fuel gauge light flashes and the mater caution illuminates to advises that a fault has been detected in the respective fuel gauging system. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 21. | LO FUEL LEVEL<br>L R | The amber low fuel level light flashes and the master caution illuminates to advises that a minimum of 360 pounds of fuel remain the respective tank. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 22. | EEC MANUAL<br>L R | The white electronic engine control light advises that the EEC is in the manual mode ( a fault has been detected in the system). |
| 23. | GEN OFF<br>L R | The amber generator off light flashes and the mater caution illuminates to advises that left and/or right generator is not connected to the airplane bus. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>Failure of the remaining generator will trigger the concurrent and synchronous flashing of L and R annunciator and master warning, and the master caution will change to steady illuminating. Pressing the master warning along will extinguish master and warning and master caution when both generators have been tripped. |

Figure 2-25 (Sheet 4)

| | | |
|---|---|---|
| 24. | AFT J-BOX LMT CB | The amber aft j-box LMT light flashes and the master caution illuminates to advise that the left and/or right crossfeed limiters have blown, disabling crossfeed of electrical power from left but to right bus or visa versa. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>The amber aft j-box CB light flashes and the master caution illuminates to advises that the left and/or right start control PCB circuit breaker has popped,disabling the electrical start system. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 25. | AC BEARING L R | The white AC bearing light advises the alternator's primary bearing has failed and the secondary bearing has picked up the load. |
| 26. | - - - - - - - | Reserved. |
| 27. | FIRE EXT BOTL LOW | The amber lights flashes and the master caution illuminates steady to advises one or both fire extinguisher bottles have low pressure or may have discharged. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 28. | FUEL FLTR BP L R | The amber fuel filter bypass light flashes and the master caution illuminates steady to advise that bypass of the left and/or right fuel filter is impending. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 29. | LO BRK PRESS | On the ground, the amber low brake pressure light flashes and the master caution illuminates to advise of low system pressure. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>In the air, the light will illuminate steady for 20 seconds before it flashes and the master caution illuminates to advise that system pressure is low. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 30. | ANTISKID INOP | On the ground, the amber antiskid inop light flashes and the master caution illuminates to advise that the antiskid system is inoperative. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>In the air, the light will illuminate steady for 20 seconds before it flashes and the master caution illuminates to advise that the antiskid system is inoperative. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 31. | STBY P/S HTR | In the air, the amber standby pitot/static heater light flashes and the master caution illuminates steady to advise that the pitot/static heater has failed. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. On the ground, the light will illuminate steady with no master caution illumination to show the pitot-static heater has failed. |

Figure 2-25 (Sheet 5)

| | | |
|---|---|---|
| 32. | AOA HTR FAIL | On the ground, the amber AOA heater failure annunciator illuminates steady to indicate an inoperative heating element in the angle-of-attack vane.<br><br>In the air, the amber AOA heater fail light flashes and the master caution illuminates steady to advises of an inoperative heating element in the angle-of-attack vane. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 33. | AIR DUCT O'HEAT CKPT CAB | The amber air duct overheat light flashes and the master caution illuminates steady to advise that the temperature in either the cockpit or cabin warm air duct has exceeded 300°F. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 34. | RADOME FAN | The amber radome fan light flashes and the master caution illuminates steady to advise that the nose cone mounted radome fan has failed. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 35. | - - - - - - | Reserved |
| 36. | TAIL DEICE FAIL L R | The amber light flashes and the master caution illuminates steady if, after the system is selected on, the respective tail deice valve has a loss of voltage and/or the respective tail deice system has a loss of pressure during the 6 second on cycle time. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 37. | TAIL DEICE PRESS L R | The white light illuminates steady to indicate the tail deice system is operating (pressure greater than 12 PSI). |
| 38. | - - - - - - | Reserved |
| 39. | FUEL XFEED | The white light illuminates steady to indicate the fuel crossfeed has been selected and the fuel crossfeed valve is in the open position.<br><br>If the fuel crossfeed is selected off and the fuel crossfeed valve is not closed, the white annunciator will flash and the master caution illuminate steady on. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 40. | FUEL BOOST L R | Under most conditions, the amber fuel boost on light will illuminate steady to advise that electric power has been applied to the left and/or right fuel boost pump.<br><br>In the air, the amber fuel boost will initially illuminate steady. After 10 seconds, the annunciator will flash and the master caution illuminate steady if the fuel system has low pressure, the airplane is in the air, and the respective throttle is out of cutoff position. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |

Figure 2-25 (Sheet 6)

| | | |
|---|---|---|
| 41. | LOW FUEL PRESS<br>L R | On the ground and prior to both left and right engine start, the amber low fuel pressure light will illuminate steady to indicate that fuel pressure is below 5.3 to 5.8 PSI in left and/or right systems.<br><br>After both engine have been started, the amber low fuel pressure light flashes and the master caution illuminates steady to indicate that fuel pressure is below 5.3 to 5.8 PSI in left and/or right systems. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 42. | W/S FAULT<br>L R | On the ground and prior to either engine start, the annunciator will illuminate steady for 8 seconds to advises of a controller failure, and may illuminate in conjunction with the windshield overheat light. After 8 seconds, the fault light flashes and the master caution illuminates steady.<br><br>After both engines have been started, the amber fault light flashes and the master caution illuminates steady to indicate a controller failure. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 43. | W/S O'HEAT<br>L R | The amber overheat light flashes and the master caution illuminates steady to indicate an overtemperature condition in the left or right electrically-heated windows. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 44. | F/W SHUTOFF<br>L R | The amber firewall shutoff light flashes and the master caution illuminates steady to indicate that the left and/or right fuel and hydraulic shutoff valves are closed. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 45. | FIRE DET SYS<br>L R | The amber light flashes and the master caution illuminates steady to indicate a failure in the left or right fire detection warning system. Extinguishing bottles and firewall shutoff valves are still operative. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 46. | ACC DOOR UNLOCKED<br>NOSE TAIL | The amber light flashes and the master caution illuminates steady to indicate that the nose or tail accessory doors are not in the latched position. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 47. | DOOR SEAL | The amber light flashes and the master caution illuminates steady to indicate door seal pressure has dropped below 5.5 PSIG. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 48. | CABIN DOOR | The amber light flashes and the master caution illuminates steady to indicate failure or improper position of door switch(es), and/or possible disengagement of the cabin door pin. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |

Figure 2-25 (Sheet 7)

| | | |
|---|---|---|
| 49. | EMER EXIT | The amber light flashes and the master caution illuminates steady indicating potential failure of emergency exit door hinges, or improper position of the emergency door handle. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 50. | LAV DOOR | The amber light flashes and the master caution illuminates steady if the lavatory doors are not in the latched open position with flaps not up or with the airplane on the ground. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 51. | BLD AIR O'HEAT L R | The amber bleed air overheat light flashes and the master caution illuminates steady if left or right engine bleed air temperature is greater than 560°F as measured downstream of the pylon-mounted air-to-air heat exchanger. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 52. | CHECK PFD 1 | The amber check PFD 1 light flashes and the master caution illuminates steady if the pilot's primary flight display (PFD) has a malfunction. Check the pilot's PFD against the standby instruments or the copilot's PFD. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 53. | CHECK PFD 2 | The amber check PFD 2 light flashes and the master caution illuminates steady if the copilot's primary flight display (PFD) has a malfunction. Check the copilot's PFD against the standby instruments or the pilot's PFD. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 54. | WING O'HEAT L R | The amber wing overheat light flashes and the master caution illuminates steady if left or right forward wing spar temperature has exceeded 160°F. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish. |
| 55. | WING ANTI-ICE L R | On the ground, with left and/or right anti-ice switches selected to the WING/ENGINE position, the amber wing anti-ice light will illuminate steady with no illumination of master caution to advise of low temperature (less than 220°F) in the respective wing. The light will extinguish after respective wings reach normal operating temperature.<br><br>After normal operating temperature has been reached, an under-temperature condition will cause the respective annunciator to flash and the mater caution light to illuminate. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>In the air, with left and/or right anti-ice switches selected to the WING/ENGINE position, the amber wing anti-ice light will flash and the mater caution light will illuminate if normal operating temperatures are not reached within 4 minutes and 45 seconds. Pressing the master caution will cause the flashing annunciator to change to steady on and the master caution to extinguish.<br><br>Nuisance trips (less than 5 seconds between resumption of normal temperature and the detection of a new under-temperature condition) are inhibited by circuit logic. |

Figure 2-25 (Sheet 8)

# TEST SYSTEM

The test selector is located in the upper left corner of the pilot's switch panel and offers several positions of test. It will function only when the BATT switch is ON. A red light above the test selector switch illuminates whenever the test selector switch is in any position but OFF.

## ROTARY TEST SWITCH

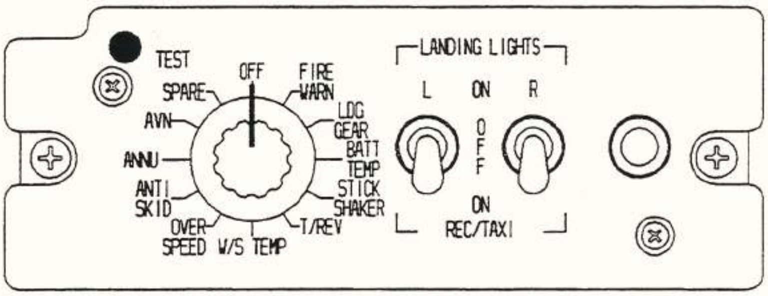


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Figure 2-26

**OFF** • The red light will be off and the test system inoperative.

**NOTE**

The red light above the rotary test switch should illuminate for all the other test positions, including the spare position.

**FIRE WARN** • The LH ENG FIRE and RH ENG FIRE lights should illuminate.

**LDG GEAR**
- The green LH, RH and NOSE lights should illuminate.
- The red GEAR UNLOCK light should illuminate.
- The gear warning horn should sound.

**BATT TEMP**
- The red BATT O'TEMP > 160° annunciator should flash.
- The battery temperature gage should indicate 160°F.
- The Master Warning should flash (cancelable).

**STICK SHAKER**
- Stick shaker should activate immediately on both control columns.
- The AOA gage needle should swing to the top of the red band.
- The red chevron in the AOA indexer should flash.

**THRUST REVERSER**

- The ARM, UNLOCK, and DEPLOY thrust reverser indicator lights should illuminate steady.
- The master warning should flash (cancelable).

**W/S TEMP**

- With windshield heat selected on, the W/S O'HT annunciator should illuminate steady for 3 to 4 seconds then extinguish.

**NOTE**

If windshield heat is selected on with the engines shut down, W/S FAULT should annunciate because the AC alternator is not supplying power.

**OVERSPEED**

**NOTE**

The avionics switch must be on for the check of overspeed warning and related EFIS display information.

- The MADC output reverts to Functional Test Mode and PFD1/PFD 2 should indicate 265 KIAS, Mach 0.4, 5,000 feet altitude and a vertical speed of 2,000 feet per minute.
- The audible overspeed warning should sound.

**ANTISKID**

- With the antiskid switch on, the ANTISKID INOP annunciator should flash for 3 to 4 seconds, then extinguish.
- The Master Caution should illuminate steady during the self-test.

**ANNUNCIATOR**

**NOTE**

The avionics switch must be on for the annunciator check.

- All lights on the annunciator panel should illuminate.
- Master Warning should flash and Master Caution should illuminate steady (non Cancelable)
- Both red turbine overspeed lights should flash.
- Engine instrument LCDs should show steady 8s.

(Continued Next Page)

**ANNUNCIATOR** (Continued)

- The AP OFF annunciators should illuminate steady.
- The Flight Director Mode Selector (FDMS) buttons should illuminate left to right and then remain on steady.
- The annunciators to the right of the Mode Selector panel should illuminate steady. They are as follows, but may vary depending on installed options:
  1. AP XFER FD1/AP XFER FD2
  2. TERR NORM, TERR INHIB (optional system)
  3. GPWS FLAP NORM, GPWS FLAP OVRD (optional system)
  4. GPWS G/S, CANCELLED (optional system)
  5. GPWS TEST (optional system)
  6. PHONE CALL

- All A/P control panel lights should illuminate steady.
- The green A/C ON light above the A/C switch should illuminate steady.
- A pulsating aural horn, which is a combination of the following 2 inputs should sound:
  1. Altitude alert tone (steady).
  2. Phone call tone (pulsating and becomes steady when the PHONE CALL button is depressed).

**AVIONICS**

**NOTE**

The avionics switch must be on for the avionics check.

- Master caution should illuminate steady (cancelable)
- The Flight Director Mode Selector buttons should illuminate left to right and then remain on steady.
- All A/P control panel lights should illuminate steady.
- After a short delay the following annunciators on the annunciator panel should flash, indicating a successful self-test:
  1. AP PITCH MISTRIM
  2. AP ROLL MISTRIM
  3. RADOME FAN
  4. CHECK PFD 1
  5. CHECK PFD 2

(Continued Next Page)

**AVIONICS** (Continued)

- The annunciators to the right of the mode selector panel should illuminate steady. They are as follows, but may vary depending on which options are installed.
  1. AP XFER FD1/AP XFER FD2
  2. TERR NORM, TERR INHIB
  3. GPWS FLAP NORM, GPWS FLAP OVRD
  4. GPWS G/S, CANCELLED
  5. GPWS TEST
  6. PHONE CALL
- The AP OFF and YD OFF annunciators should illuminate steady.
- A pulsating aural horn, which is a combination of the following 2 inputs should sound:
  1. Altitude alert tone (steady).
  2. Phone call tone (pulsating and becomes steady when the PHONE CALL button is depressed).

**SPARE**

- This is an unused position, and should not activate any system.

# III. INSTRUMENTATION & AVIONICS

# SECTION III
# INSTRUMENTATION AND AVIONICS
## CONTENTS



(Continued Next Page)

# CONTENTS (Continued)

# INSTRUMENTATION

The Model 560 Excel is equipped with a Primus 1000 Integrated Avionics System which includes display, flight director guidance, autopilot, yaw damper and pitch trim functions. The system consists of the following components:

- IC-600 Integrated Avionics Computer (IAC) that includes:
  - Flight Guidance System (FGS)
  - Electronic Flight Instrument System (EFIS)
- AZ-850 Air Data System (ADS)
- Primus 880 Weather Radar
- Attitude and Heading Reference System

The IAC system is a fail-passive autopilot/flight director and display system that has full complement of horizontal and vertical flight guidance modes. These include all radio guidance modes, long range navigation system tracking modes, and air data vertical modes. Either pilot's flight director (FD) can be coupled to control the airplane.

The IAC is the focal point of information flow in the system. It converts input data and information to the pilot-selected formats, and displays then on the attitude director indicator (ADI) and the horizontal situation indicator (HSI) within the confines of the primary flight display tube(s). The IAC also generates information that is displayed on the multifunction display (MFD), and it computes the flight director steering information for the autopilot function.

The two IACs are connected with high level data link control lines. This and other interconnects are used so that the flight guidance functions and symbol generator functions share, compare, and communicate blocks of information.

When engaged and coupled to the flight director commands, the system's autopilot controls the aircraft using the same commands that are displayed on the attitude director indicator. When the autopilot is engaged and uncoupled from the flight director commands, manual pitch and roll commands can be entered using the touch control steering (TCS) button or the autopilot PITCH wheel and TURN knob.

A secondary flight display is installed, which displays the airplane attitude, altitude, and airspeed, as well as Mach number. All of this information is displayed in one DC powered cathode ray tube instrument, which is powered by its own battery. It receives its data from a small standby air data computer connected to the standby pitot-static system.

A mechanical standby HSI is also installed to provide heading, short range navigation and approach information. It is comprised of a course deviation indicator (CDI or localizer) and a glide slope indicator.

# PITOT-STATIC SYSTEMS

The airplane is equipped with three separate and independent pitot-static systems. The two primary systems serve the pilot's and copilot's systems. The third (backup) system provides pitot and static air pressure to the backup airspeed indicator and altimeter indicators in the secondary flight display, and provides a source of static pressure for the cabin pressure differential pressure gauge.

Pitot pressure from the tube on the left side of nose of the airplane supplies pressure to the pilot's AZ-850 micro air data computer which, after converting the data into digital information, forwards the data through the system to the pilot's primary flight display via the IC-600s. Pitot pressure from the tube of the right side of the nose of the airplane serves the same function in the copilot's system.

The pitot tube on the right side of the fuselage, approximately below the copilot's aft window, provides pitot pressure to the backup airspeed indicator/altimeter in the secondary flight display. Three static ports are located on each side of the airplane, approximately at fuselage station 153. The lower port on the left side and the upper port on the right side provide the static source for the pilot's system. The upper port on the left side and the lower port on the right side provide the static source for the copilot's system. The center ports on each side provide static pressure for the backup pitot-static system.

The two pitot tubes and four static ports of the primary pitot-static systems, as well as the two static ports and single pitot tube of the backup system, are electrically heated for ice protection.

## AIRSPEED AND ALTIMETER INDICATIONS

Altitude and airspeed data to the primary flight displays (PFDs) is provided by information generated through the AZ-850 micro air data computers, which is transmitted in digital form through the IC-600 Display Guidance Computers to the PFDs. This information is then presented in color on the display in the PFDs. The micro air data computers also generate the altitude information which is used by the mode S (altitude) function of the transponders.

## AIRSPEED INDICATION

The indicated airspeed display is to the left of the attitude display on the primary flight display. The display consists of a "rolling digit" window in the center of an airspeed vertical tape. The resolution of the rolling digits is one knot. The moving vertical tape moves behind the window and displays digital airspeed at 20 knot intervals, with the larger numbers at the top of the scale. The range of the airspeed scale is 40 to 450 knots with tick marks at ten knot intervals.

An airspeed trend vector, which displays an indication of the direction and rate of airspeed change, extends vertically from the apex of the current airspeed value display window. It extends upward for acceleration and downward for deceleration. The trend vector represents a prediction of what the airspeed will be in ten seconds if the current change in airspeed is maintained.

# PITOT-STATIC SYSTEM SCHEMATIC

A26599

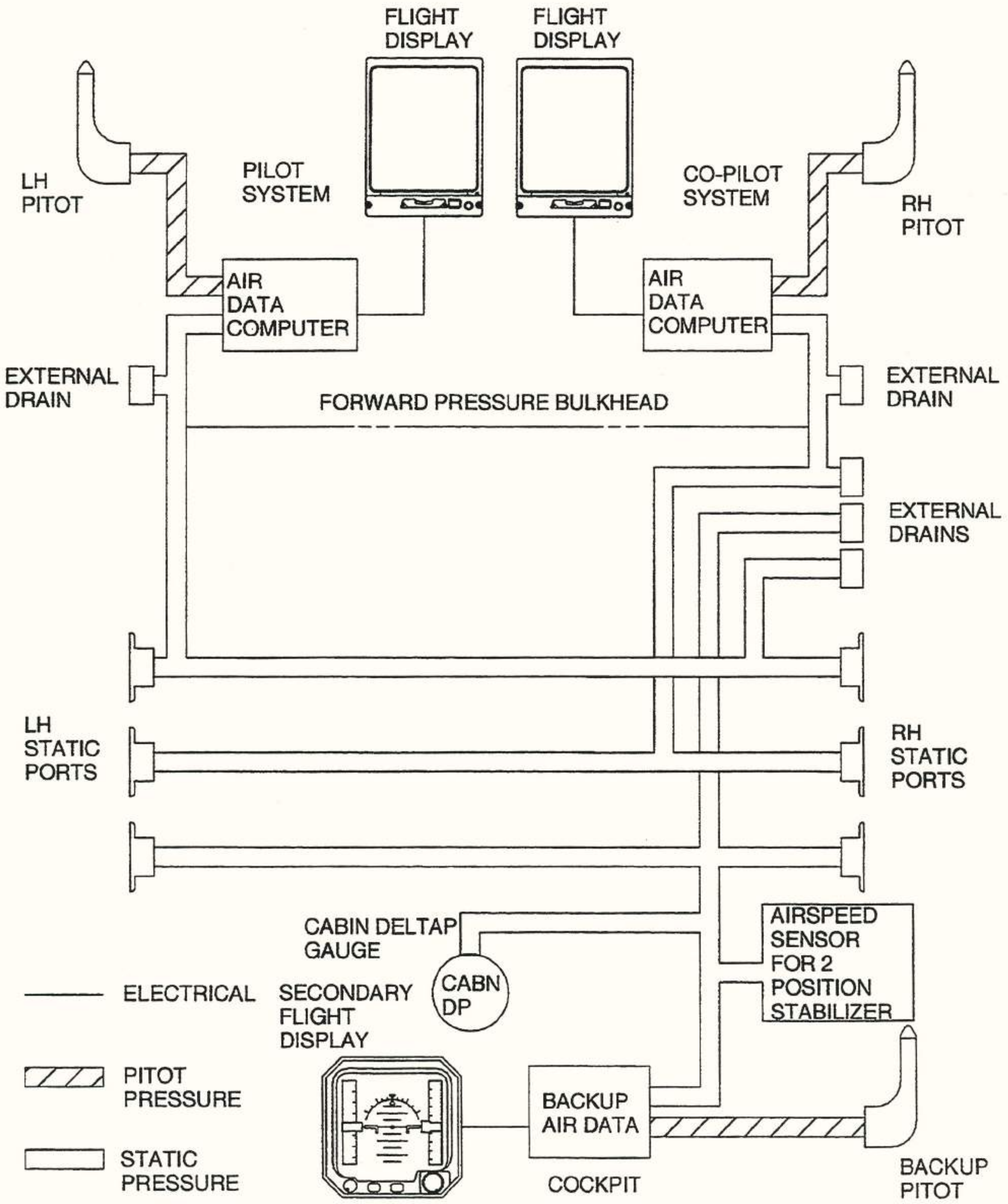


Figure 3-1

"Bugs" for six V-speeds are provided to allow pilots selection of key airspeeds by means of the PFD SET button and bezel knobs. The bugs are labeled 1, ($V_1$) R ($V_R$), 2, ($V_2$) and E ($V_{ENR}$) (this airspeed is automatically displayed whenever $V_1$, $V_R$, or $V_2$ is selected for display; $V_{ENR}$ is permanently selected to 160 knots) and RF ($V_{REF}$) and AP ($V_{APP}$). When the speeds are selected digital indications appear at the bottom of the PFD display as well as the bugs being placed into position. The bugs are positioned on the right outside edge of the airspeed tape. They consist of a horizontal T-shaped symbol with its respective label positioned to the right of the symbol. All the takeoff set bugs will be removed from the display when the airplane airspeed exceeds 230 knots and the landing speed bugs are removed upon touchdown.

When the airspeed is below 40 knots, $V_1$, $V_R$, $V_2$, and $V_E$ are displayed in the bottom portion of the airspeed tape in the form of a digital readout. The digital readout of the set value is displayed along with the bug symbol and are labeled in ascending order, starting with $V_1$. Upon power up, the digital readouts for the set bugs will be amber dashes. As the V speeds are set, the digital readouts will follow the readout on the PFD and set accordingly. The digital readouts are removed from the display when the first V speed value comes into view on the airspeed tape.

Standby altitude and airspeed are available, in case of main electrical system failure, from the standby altimeter and the standby airspeed indicator, which are located in the secondary flight display. These indicators receive their data from a standby micro air data computer (MADC). The standby MADC, powered by its own battery source, obtains its pneumatic data from the standby pitot-static system and converts it to digital electrical outputs for the indicators.

## OVERSPEED INDICATIONS

Below 8000 feet altitude the limiting airspeed ($V_{MO}$) is 260 KIAS; between 8000 feet and 28,907 feet the limiting airspeed is 305 KIAS. When one of these limits is exceeded, the airspeed indication in the window to the left of the attitude display in the PFD will be changed to red and an amber annunciation, also to the left of the attitude sphere, will announce MAX SPEED. A red thermometer type tape is also presented on the inside of the airspeed scale. The thermometer extends from $V_{MO}/M_{MO}$ to larger airspeeds on the tape and appears in the indication as the airspeed reaches into the range near $V_{MO}/M_{MO}$. When the limiting airspeed is exceeded the overspeed warning aural alert will sound, and will continue to sound until the airspeed is reduced below the limit speed.

**NOTE**

The aural warning system consists of two separate units which receive input from airplane anomalies of overspeed, autopilot off and altitude alert. The units will output aural signals to both the headphones and speakers.

# TYPICAL AIRSPEED DISPLAY

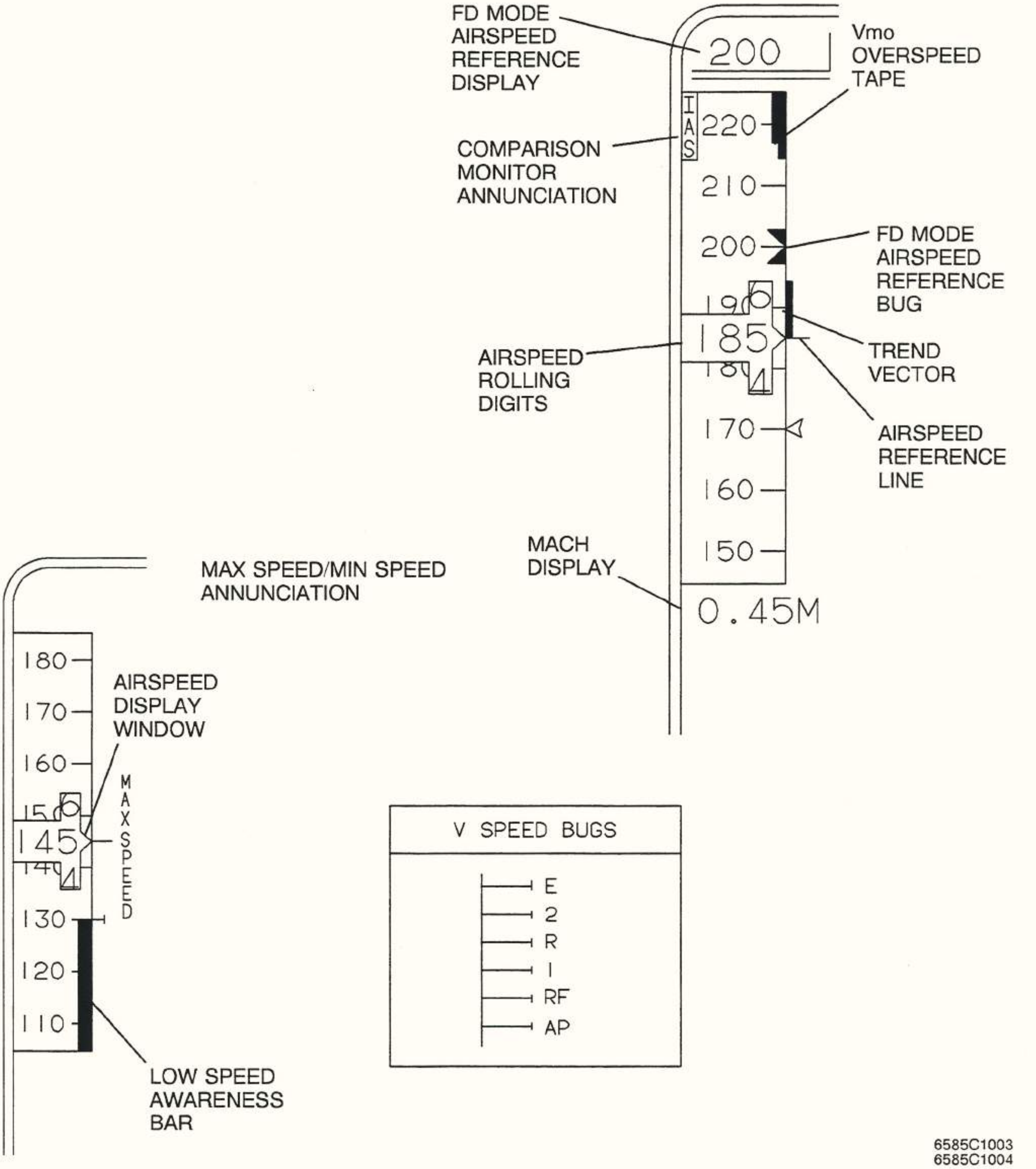


Figure 3-2

## LOW AIRSPEED AWARENESS

A red, amber, and white thermometer type display located on the inside of the airspeed scale gives indication of low airspeed. The white extends from 1.3 $V_{S1}$ to 1.2 $V_{S1}$, the amber band extends from 1.2 $V_{S1}$ to 1.1 $V_{S1}$ (approximately stick shaker speed), and the red extends from stick shaker speed to the smaller airspeeds on the tape.

## MACH NUMBER DISPLAY

A digital readout of indicated Mach number is displayed below the airspeed dial. The Mach number will come up on the display when Mach exceeds 0.390, and is removed when it is falls below 0.380 Mach. Resolution of the Mach display is 0.01 Mach. The secondary flight display has a Mach indication which begins to read out when the Mach reaches a minimum of 0.35.

## ALTITUDE INDICATION

The altitude display is located to the right of the attitude display on the primary flight display. The altitude is indicated by means of a vertical tape display which has a “rolling digit” window in the center of an altitude vertical tape. The resolution of the digits to 20 feet. The hundreds, thousands, and ten thousands digits are larger digit numerals than the others. The vertical tape moves behind the window and displays a tape 550 feet both above and below the present indicated altitude, with the larger numbers at the top of the scale. The range of the altitude window is from 1,000 to 60,000 feet with tick marks located at 500 foot increments. The scale is labeled in 500 foot intervals, and single line chevrons are located at each 500 foot increment. Double line chevrons are located at each 1000 foot increment. The chevrons extend back to the approximate midpoint of the altitude tape and are connected with each other by a vertical line. The left side of the “rolling digit” window will has the same angle as the chevrons.

The barometric pressure setting is controlled by a BARO knob at the bottom right of the primary flight display. A STD button, located next to the BARO knob, allows a change to a baro setting of 29.92 in. Hg. (or 1013 millibars) by simply pressing it. The baro correction setting display is located just below the altitude dial. The BARO knob will change the altitude correction by 0.01 in. Hg. per click.

An altitude trend vector is displayed on the left edge of the altitude tape and provides an indication of the rate of altitude change. The trend vector extends vertically from the apex of the current altitude display window. The vector extends up for positive vertical trends and down for negative values. The vector represents a prediction of what the altitude will be in six seconds if the current vertical speed is maintained.

Standby altitude indications are available from the secondary flight display (standby airspeed/altitude/attitude indicator) which is discussed under Secondary Flight Display System below in this section.

# TYPICAL ALTITUDE DISPLAY

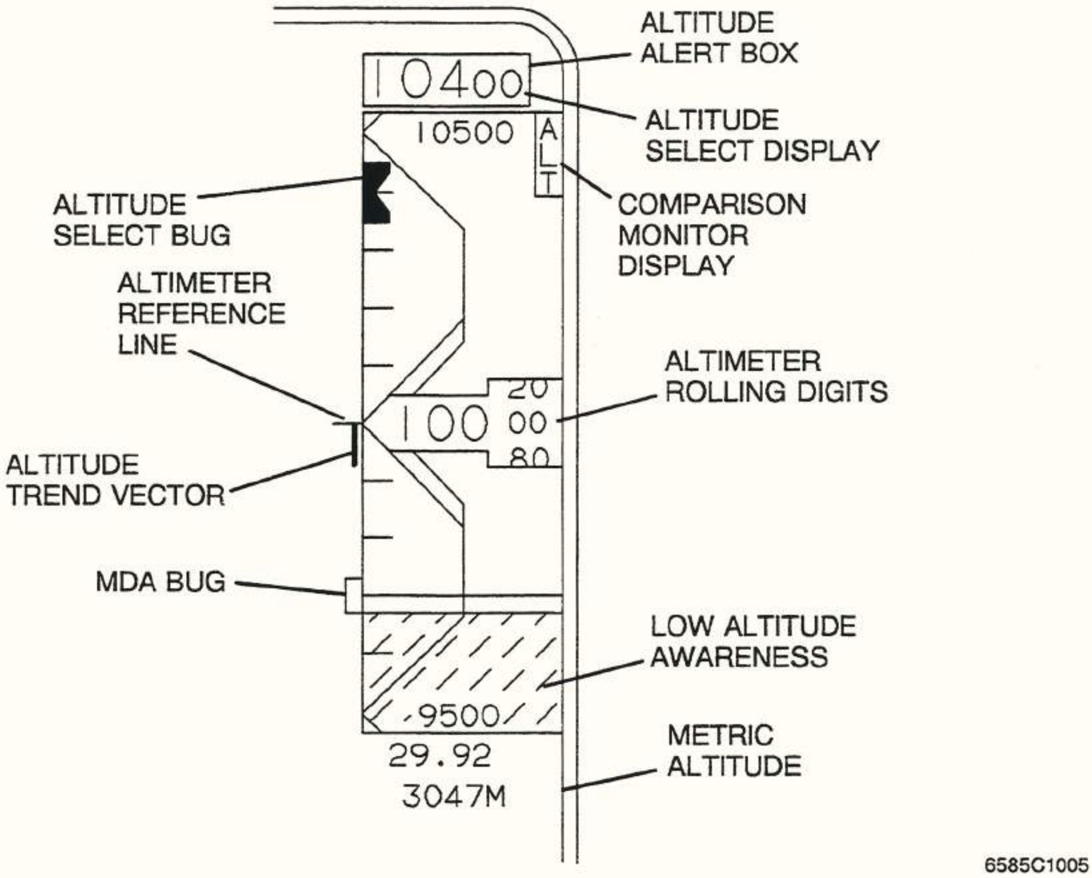


Figure 3-3

## VERTICAL SPEED INDICATION

Vertical speed data is developed in the AZ-850 Micro Air Data Computers, which sense the rate-of-change of altitude from inputs of the static system. The computers convert the data into digital form and transmit it through the digital data bus system to the IC-600 Display Guidance Computers, which forward it to the DU-870 Primary Flight Displays where it is generated into a visual display.

The vertical speed display is a fixed scale meter movement type display; a pointer rotates about a point which is outside of the actual display. The scale is non-linear, which provides increased resolution around zero vertical speed. In the center of the scale a digital readout of the actual vertical speed is displayed. The digital display has a resolution of 50 feet per minute and can accommodate rates of climb or descent of 6600 feet per minute. On the display scale tick marks are located at the positive and negative values of 500, 1000, 1500, 2000, 2500, and 3000 feet per minute. The pointer will continue to move up to plus or minus 6600 feet per minute but will have a reduced sensitivity.The digital display and the digital readout box will be removed from the display for vertical speeds of plus or minus 550 feet per minute, leaving only the meter type display.

# VERTICAL SPEED DISPLAY

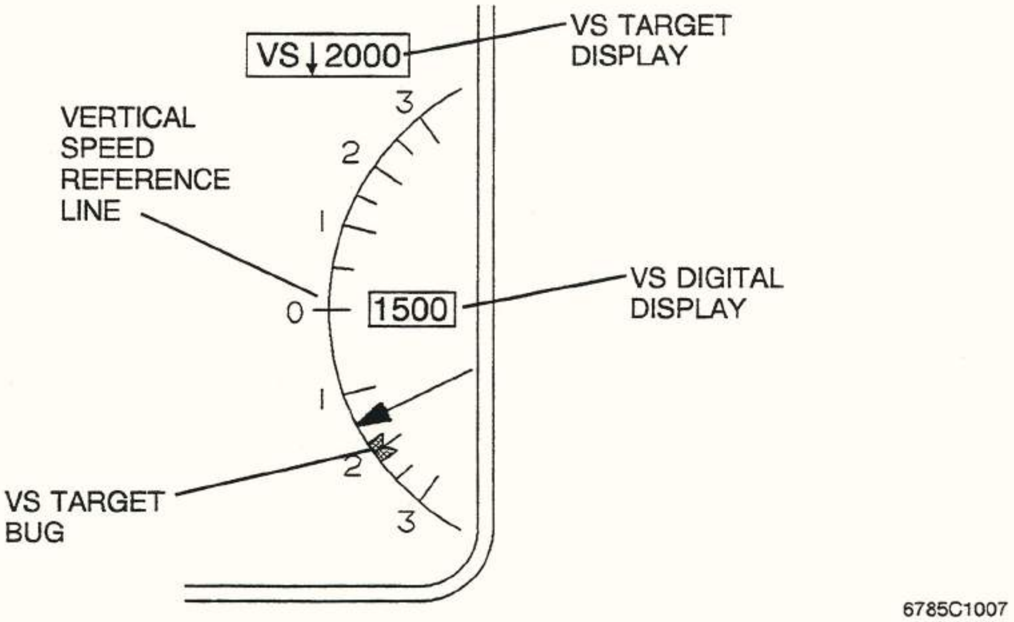


Figure 3-4

## INCLINOMETER

Conventional inclinometers (slip indicators) are fixed to the bezel of each PFD and to the standby flight display. In addition, the primary flight displays also show split sky pointers.

## MAGNETIC COMPASS

A standard liquid filled magnetic compass is mounted above the glareshield.

## RAM AIR TEMPERATURE INDICATOR

A ram air temperature (RAT) indicator, located high and to the left on the center instrument panel, displays air temperature uncorrected for ram rise. Either Celsius or Fahrenheit readings may be selected by a switch on the face of the instrument. The indicator receives temperature signals from the right engine-mounted $T_{T0}$ probe.

## TRUE AIRSPEED PROBE

A true airspeed probe is located below the windshield on the fuselage right side. This temperature reading is fed directly into the Air Data Computers for computation purposes only and does not provide a viewable readout.

# ENGINE INSTRUMENTS

Each engine is equipped with the following instruments located on the center instrument panel:

- Fan RPM
- Inter-Turbine Temperature (ITT)
- Turbine RPM
- Fuel Flow
- Oil Temperature
- Oil Pressure
- Fuel Temperature

All engine instruments are of the vertical tape readout design except for the turbine RPM, fuel flow, and fuel temperature which are digital readout only The gauges are powered by 28 VDC through circuit breakers on both cockpit circuit breaker panels. The fan tachometer also has a digital RPM display as well as the vertical tape. The digital display is provided above the $N_1$ tape for a more accurate readout. The loss of DC power or instrument failure is indicated by OFF flags in each instrument, except the fan ($N_1$) and turbine ($N_2$), digital tachometers and the digital fuel temperature indicator.

The fan RPM (% RPM $N_1$) and turbine RPM (% RPM $N_2$) are calibrated in percent from 0-110% (100% Fan RPM = 13,034; 100% Turbine RPM = 32,700) (maximum takeoff and maximum continuous turbine RPM is 100%). The fan ($N_1$) tachometers are powered from the emergency bus and are thus available in case of electrical system failure. They are powered by engine monopoles (magnetic speed sensors) mounted on the applicable engine shaft and require airplane electrical power for operation. The $N_2$ gauge will illuminate the small red lights just below the digits and flash the display if a turbine overspeed occurs.

The ITT indicator is calibrated from 150°C to 800°C. The temperature displayed is a synthetic inter-turbine temperature which is computed by measuring the exhaust gas temperature and then adding to it three times the temperature rise across the bypass duct.

The FUEL FLOW indicator displays fuel flow in pounds per hour. Readings are accurate at stabilized power settings.

The FUEL QUANTITY indicator is calibrated in pounds of fuel and accurately displays fuel remaining in the left and right tanks.

The OIL TEMPERATURE indicator, in degrees Celsius and the OIL PRESSURE indicator in pounds per square inch (PSI), show system limitations with red, yellow and green markings.

# FLIGHT HOUR METER

The quartz hour meter, on a panel next to the right circuit breaker panel, displays the total flight time on the airplane in hours and tenths. The landing gear squat switch activates the meter when the weight is off the gear. A small indicator on the face of the instrument rotates when the hour meter is in operation. It receives DC power from a circuit breaker (FLT HR METER) on the left circuit breaker panel.

# SECONDARY FLIGHT DISPLAY

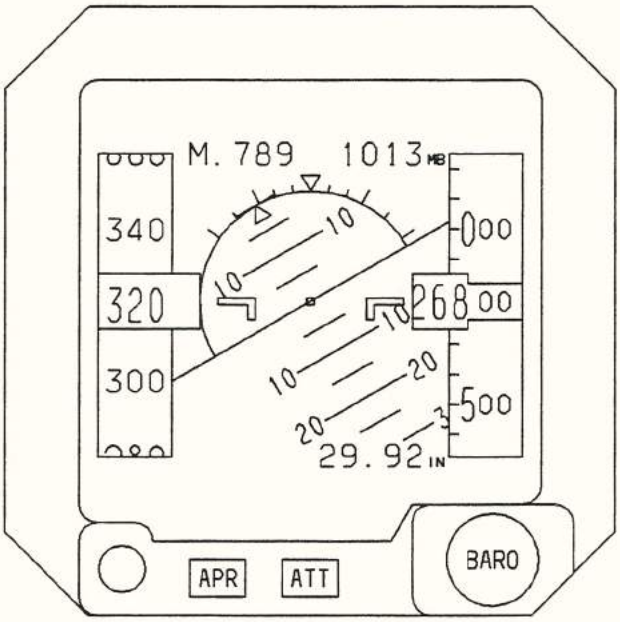


Figure 3-5

A Meggitt Avionics Secondary Flight Display (SFD) System indicator is located on the left side of the center instrument panel. This DC-powered cathode ray tube indicator combines standby attitude indicator, and altimeter, and airspeed indications into one composite instrument. A Mach indication is also included in the instrument. Pneumatics inputs, which are received from the standby pitot-static system, are fed into a standby micro air data computer (MADC) which is powered from the DC emergency bus. The MADC converts the data to digital information and forwards it to the indicator.

The SFD contains a gyro solid state inertial sensors for the measurement and presentation of aircraft pitch and bank attitudes. Application of 28-volt DC power to the display system initiates the attitude initialization process, which is identified by the display of the message "attitude initializing" in yellow on the SFD. The duration of the initialization process is normally less than 180 seconds.

The attitude display has an instantaneous display range of 360° of bank and 50° of pitch. A moving tape on the right side of the display includes a "rolling digit" depiction of altitude; the tape is calibrated in 100 foot increments. Baro data is set in the altitude display by a knob on the bottom right of the bezel; clockwise rotation increases the pressure setting and counterclockwise decreases it. The setting is displayed simultaneously in millibars at the top right of the display and in inches of mercury at the bottom right. On the left side of the display is a moving tape showing airspeed. The tape is marked in ten knot increments with a "rolling digit" display in the center. The airspeed display becomes active at 40 knots. The Mach number is displayed in the upper left corner of the display. The Mach display range is 0.30 to 0.999 Mach.

Failure flag indications for airspeed and altitude are red crosses covering the appropriate tape box, with all indications removed from within the box. The failure flags for the Mach indication and Baro Setting are a series of four red dashes in the appropriate display area.

A light sensor is located on the bottom left side of the instrument case. It provides ambient light level data to the backlight control system to ensure optimum display brightness. The lighting level can still be controlled manually from the center instrument panel light rheostat control.

The navigation display is selected by the APR button on the bottom of the display bezel. Pressing the button results in display of ILS localizer and glideslope information from NAV 1 receiver. The ILS can be flown by reference to the ILS localizer and glideslope display on the standby horizontal situation indicator.

Power to the SFD is controlled by a switch marked STDBY PWR ON/OFF/TEST located on the lower right of the pilot's instrument panel. The SFD has an emergency source of power from an emergency battery pack located in the nose avionics compartment of the airplane. This battery pack also provides emergency instrument lighting for the secondary flight display system, the dual fan ($N_1$) tachometers, and the interturbine temperature (ITT) indicators.

The battery pack is constantly charged by the airplane's electrical system, and should therefore be fully charged in the event of an electrical power failure. The STDBY PWR switch must be ON for automatic transfer to battery power to occur. The SFD will operate for a minimum of 30 minutes on battery power. An amber POWER ON light next to the STDBY PWR switch illuminates when the SFD is turned ON and the airplane's electrical system is not charging the emergency power supply batteries. When the SFD switch is held to the spring-loaded TEST position, a self-test of the battery and circuits is accomplished. The green GYRO TEST light, also next to the STDBY GYRO switch, will illuminate if the test is satisfactory and the battery is sufficiently charged.

When NAV 1 is tuned for ILS operation, pressing the APR button will select ILS localizer and glideslope display. Pressing the button a second time will provide back course display, and pressing it a third time will revert the display to non-ILS format.

Maximum allowable airspeed ($V_{MO}$) is displayed in analog form by a red warning strip on the airspeed tape. When $V_{MO}$ is reached, the numerals on the numeric airspeed display change from white to red. When the maximum allowable Mach number ($M_{MO}$) is reached, the numeric Mach number display will also change from white to red.

A built-in test system (BIT) will automatically detect any failure of the display at power up or during continuous operation. If the pilot desires to test the system after it is powered up, pressing the ATT button will initiate a self-test. If a failure is detected, the appropriate part of the display is replaced with a message indicating the failure. Where it is not possible to display an appropriate message, the display backlight is switched off.

# DIGITAL CLOCK

One model M877 digital clock is mounted on the left side of the pilot's instrument panel and one on the right side of the copilot's panel. The clock can be made to display four time functions: local time, GMT, flight time and elapsed time. Two versions of the elapsed time function may be selected: count up or count down.

The clock has two control buttons: SEL (select) and CTL (control). The SEL button is used to select the desired function, and the CTL button to start and reset the selected mode.

For normal operation, either local time or Greenwich Mean Time (GMT) may be selected. GMT is displayed only in 24-hour format, and local time is 12-hour format. Pressing the SEL button sequentially displays GMT, local time, flight time and elapsed time. The displayed mode is annunciated GMT, LT, FT and ET, as applicable, under the time display window.

To set GMT or local time, select the desired function by pressing the SEL button. Simultaneously press both the SEL and the CTL buttons to enter the set mode. The tens of ours digit will start flashing and may be incremented by pressing the CTL button. The next digit is then selected by pressing the SEL button, and similarly set by means of the CTL button. When the last digit has been set, press the SEL button to exit the set mode. At that time the clock will start running and the lighted annunciator will resume flashing. When no airplane power is applied to the clock, the SEL and CTL buttons will not operate.

To use the clock as a stop watch to time approaches, etc., select ET with the SEL button and press the CTL button to start the timing. The clock will start counting elapsed time in minutes and seconds up to 59 minutes and 59 seconds. It will then switch to hours and minutes and continue up to 99 hours and 59 minutes. Pressing the CTL button will reset the elapsed time to zero.

## DIGITAL CLOCK


5685P6065

Figure 3-6

To use the clock for an elapsed time "count down" display, select ET for display and enter set mode by pressing both buttons simultaneously. A maximum count down time of 59 minutes and 59 seconds can be set. The time from which it is desired to count is entered in the same manner as setting GMT or local time. When the last digit is set, press the SEL button to exit the set mode. Pressing the CTL button will start the countdown. The display will flash when the time reaches zero. After reaching zero, the ET counter will count up. Pressing the CTL button again resets ET to zero.

The flight time mode of the clock is enabled by a ground-in-air landing gear squat switch which causes the clock to operate any time the airplane weight is off the landing gear. The flight time may be reset to zero by selecting FT mode with the SEL button and holding down the CTL button for three seconds. Flight time is zeroed when the CTL button is released. A total of 99 hours and 59 minutes can be shown.

A flight time alarm mode is provided which will flash the clock display when the desired flight time is reached. To set the alarm function, select FT with the SEL button and enter the set mode by pressing both buttons simultaneously. Enter the desired alarm time in the identical manner that GMT or local time is set. When flight time equals the alarm time, the display will flash. If FT is not being displayed when the alarm time is reached, the clock will automatically select FT for display. Pressing either the SEL or CTL button will turn off the alarm and reset the alarm time to zero. Flight time is unchanged and continues counting.

The clock display may be tested when power is on the airplane by holding the SEL button down for three seconds. The display will show 88:88 and activate all four annunciators.

# STALL WARNING AND ANGLE-OF-ATTACK SYSTEM

The angle-of-attack system is powered by 28 volts direct current (DC) from the left main DC bus through a circuit breaker on the left circuit breaker panel and incorporates an angle-of-airflow sensor, a signal summing unit, a vane heater monitor, an angle-of-attack indicator, and a stick shaker on each control column.

The vane type angle-of-airflow sensor, which is located on the forward right side of the fuselage, detects the angle of airflow and deflects accordingly. The wedge-shaped vane streamlines with the relative airflow and causes a transducer, at which it is mounted, to send signals to the signal summing unit (computer) located in the left nose avionics compartment. Signal inputs concerning flap position are also received by the signal summing unit. It then compensates for that variable and transmits the information to the angle-of-attack indicator. Indications are accurate throughout the weight and CG range of the airplane.

The full range type indicator is calibrated from 0.1 to 1.0., and marked with red, yellow and white arcs. Lift information is displayed on the indicator with 0.1 representing near zero lift and 1.0 representing stall. Lift being produced is displayed as a percentage and, with flap position information, is valid for all airplane configurations and weights. At 1.0 where full stall occurs, 100 percent of the available lift coefficient is being achieved. At the bottom of the scale (0.1) near zero lift is being produced.

# ANGLE-OF-ATTACK INDICATOR AND INDEXER

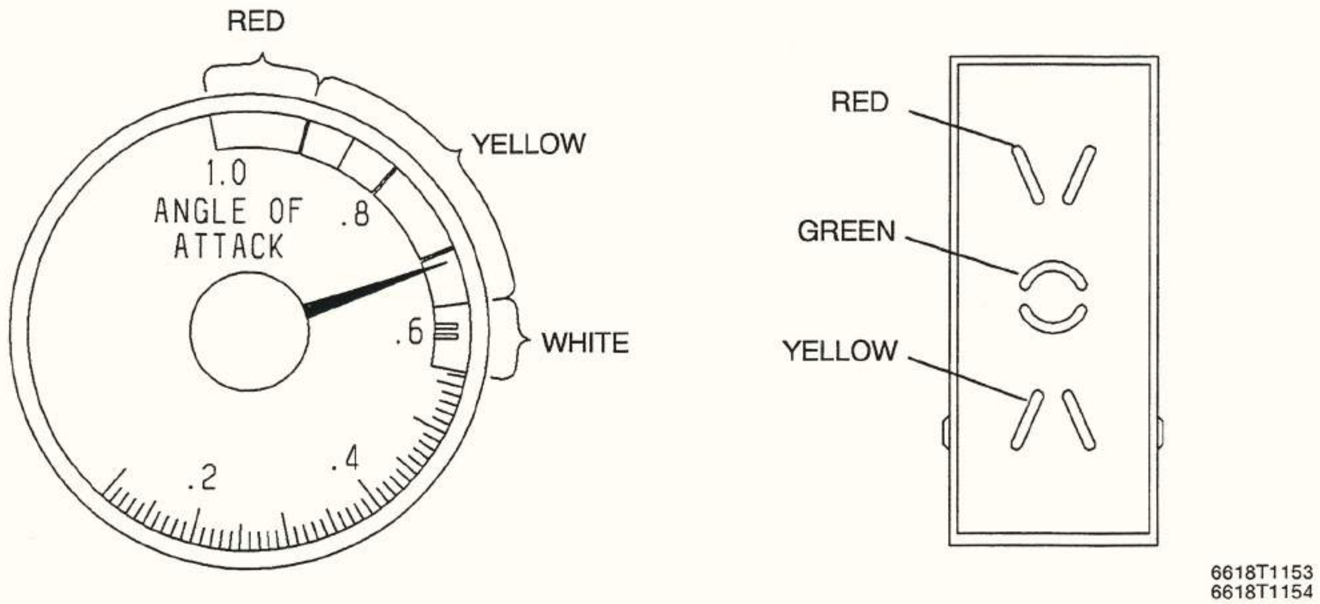


Figure 3-7

The area at the lower part of the scale (0.57 to 0.1) represents the normal operating range of the airplane, except for approach and landing. The narrow white arc (0.57 to 0.63) covers the approach and landing range and the middle of the white arc, 0.6, represents the optimum landing approach ($V_{APP}$ or $V_{REF}$). The yellow range (0.63 to 0.85) represents a caution area where the airplane is approaching a critical angle-of-attack. The red arc (0.85 to 1.0) is a warning zone that represents the area just prior to stick shaker activation and continuing to full stall. At an indication of approximately 0.79 to 0.88 (depending on flap setting and rate of deceleration) in the warning range, the stick shaker will activate.

If the angle-of-attack system loses power or becomes inoperative for other reasons the needle will deflect to the top of the scale and stow at a 1.0 indication. A red X will also appear at the ADI slow/fast indication. The airplane may not be flown if the stick shaker is found to be inoperative on the preflight check, or if the angle-of-attack system is otherwise inoperative.

A stick shaker is located on both the pilots' control columns, approximately 9 inches down from the control wheel and on the forward side. The stick shaker provides tactile warning of impending stall. The angle-of-attack transmitter causes the stick shaker to be powered when the proper threshold is reached.

**WARNING**

**IF THE ANGLE-OF-ATTACK VANE HEATER FAILS AND THE VANE BECOMES ICED, THE STICK SHAKER MAY NOT OPERATE OR MAY ACTIVATE AT NORMAL APPROACH SPEEDS.**

# AVIONICS

The standard airplane avionics package for the Model 560 Excel is the Primus 1000 Display and Flight Guidance System. In addition, standard equipment includes two audio control panels, dual VHF COMM transceivers, dual NAVs incorporating marker beacon receivers, dual DMEs with dual indicators, dual Mode S transponders, an ADF, a flight guidance system which includes dual attitude/heading reference systems (AHRS), electronic flight instrument system (EFIS, which is part of the flight guidance system), a Universal UNS-1Csp flight management system with GPS capability, color weather radar, a radio altimeter, a cockpit voice recorder, a Flitefone VI radio telephone, a secondary flight display system (combination attitude indicator/altimeter/airspeed indicator) with approach capability, a standby horizontal situation indicator, a Primus 880 weather radar, and an emergency locator transmitter. Included as part of the flight guidance system is altitude preselect, altitude alerting, altitude reporting and vertical navigation.

An Allied Signal KHF-950 high frequency radio, or provisions for that radio, is optional. An Enhanced capability Ground Proximity Warning System (EGPWS) is also available, as is a traffic collision avoidance system (TCAS II) and a second ADF.

Possible choices of a second Universal UNS-1Csp FMS, a flight data recorder, an airborne flight information system (AFIS),Magnastar or Flitefone 800 telephones, and a B & D cabin information display complete the list of optional avionics equipment.

# VHF COMM TRANSCEIVERS

### HONEYWELL PRIMUS II REMOTE RADIO SYSTEM

The RCZ-850 integrated communications unit normally operates in the frequency range of 118 to 136.975 (or 137) MHz. The RCZ-850 unit is the communications component of the SRZ-850 integrated radio system. The COM radios are controlled from the RM-850 radio management unit (RMU), two of which are mounted on the right side of the center instrument panel. COM 1, NAV 1, ADF 1, etc. are controlled by the left RMU and COM 2, NAV 2, and ADF 2 are controlled by the right RMU. The unit being controlled is annunciated on the control display unit of the RMU. The four radio functions: COM, NAV, ATC (Transponder), and ADF which are controlled by the RMU are all displayed on page one (main frequency select page) of the RMU. Tuning control for the desired function/parameter is obtained by pressing the line select key next to that function/parameter. The COM radio has a memory capacity for up to 12 frequencies to be selected and stored for later use.

### CONTROLS AND INDICATORS

Control of the COMM radios is normally through the controls and display located in the upper left corner of the radio management unit (RMU). Any selectable parameter is changed by pressing the corresponding line key next to the displayed parameter which brings an yellow box (cursor) to surround that position, which allows it to be tuned by the concentric controller tuning knobs on the bottom of the RMU.

Tuning of the COM radios is accomplished by three methods. The first method, discussed below, also provides methods to store frequencies in the memory locations. This is considered the "normal" method. Storing of the frequencies while tuning is not required, however, and is discussed there only because it may be convenient to store the frequencies as they are used for possible later use. The second method is "direct tuning", and the third is remote tuning through the Standby COM 1/NAV 1 control display unit control head which may be used when only battery power is available or desired, or in case of emergency. Operation of the standby radio control (SRC) unit is discussed at the end of the VHF COM section.

Normal, or preselect tuning of the COM radios is accomplished in the following manner: Press the line key next to the second COM frequency line displayed on the RMU. The yellow box will move to that position if it is not already there; set the desired frequency by means of the concentric tuning knobs at the bottom of the RMU; press the upper left button on the RMU bezel (the one with vertical arrows), which will switch the pretuned frequency with the active frequency. When a frequency is preselected (set in the second line), it may result in the changing of a frequency which was identified by MEMORY, plus a number from 1 to 12, below the active frequency. The prior number has been stored in memory and the imposition of the second frequency over it is only temporary (which is identified TEMP) and will not result in the new frequency being stored in the memory unless the STO button is pressed before the frequency is transferred to the active location (top line). In this case, the word TEMP will be replaced by the word MEMORY plus the memory position number. The pilot may progress through all 12 of the memory locations by pressing the line key near the line identified by TEMP or MEMORY in the COM box (upper left hand corner), which will move the yellow box to surround that line. Turning either the large or small tuning knob will then select each memory space sequentially, showing the frequency stored there in blue on the line above the MEMORY annunciator line. Vacant memory locations will not appear. When the last occupied memory location is selected, the frequency shown on the second line, which was a temporary frequency in memory, will again be shown to occupy that space, plus the word TEMP, indicating that it is not stored in MEMORY.

When progressing through the stored memory locations, the frequency in the memory location being displayed can be transferred into the active position (tuned) simply by pressing the upper button (the one with the vertical arrows).

If the pilot desires to view all of the stored frequencies at once, he may press the PGE (page) button at the bottom of the RMU and the active frequency, with a maximum of six stored frequencies, will be displayed along with the number of their memory location. Pressing the line key adjacent to the MORE annunciator will advance the page to show the remaining frequencies with their location numbers of 7 through 12. If it is desired to insert a frequency in any particular location on these pages, move the cursor to that location by pressing the line key next to the desired memory location and the tuning knob will control that selection. The memory locations must be filled sequentially, i.e., blanks cannot be left open. If memory location eleven is vacant, for instance, and an attempt is made to store a frequency in location twelve, the word CAN'T will appear in yellow at the bottom of the page. It is not necessary to push STO to store the frequency. If deletion of a stored frequency is desired, press the line key adjacent to that memory location and press the line key adjacent to the DELETE ANNUNCIATOR. Higher memory locations will move down to fill the vacant space. If the pilot desires to place a frequency in a particular memory location, press the line key at that location to move the yellow box there; press the line key at the INSERT location. The frequencies at the selected location and at higher location numbers will move up one location. The frequency in the selected location may then be modified and it will be stored.

If all the memory locations on the first memory page are not filled, the second memory page cannot be accessed.

Direct tuning of the COM radio is accomplished by selecting the cursor (yellow box) to the COM preset location (second frequency line) and pressing the line key at that position for a minimum of three seconds. The preset frequency will disappear and the cursor will move and enclose the active frequency. Direct tuning is then available. Preset tuning may be restored by pressing the same button again.

An additional feature provided by the SRZ-850 integrated system is stuck microphone protection. The COM transmitter has a two-minute timer which cuts off transmission after that time has elapsed if the MIC key has not be released. A short warning tone is sounded a few seconds before the automatic shutoff. When the microphone cutoff has been activated at the two-minute limit, a MIC STK warning in red will be annunciated in the upper left corner of the RMU.

A TX annunciation at the top of the COM frequency window will annunciate whenever the transmitter is active.

When the second (first memory location) page of the display is selected, a "NARROW BANDWIDTH SELECT" annunciation will appear in the upper right corner of the display. Narrow bandwidth is the normal selection, however, a wider bandwidth may be selected for use in areas where slightly off-channel transmitters are used. Its selection will result in improved reception in such areas. The selection is made by pressing the double arrow selector next to the annunciation. Another press of the selector will return the selection to the original.

If any of the components of the radio system fail to respond to tuning or operating commands of the RMU, the frequency or operating command associated with that particular function will be dashed out. This alerts the crew to a failure or abnormal system operation.

"Cross-side" operation of the RMU is possible by pressing the 1/2 button on the bottom of the RMU. This allows the operator to tune the opposite side radio system from that RMU. The tuning will be followed on the other RMU and so indicated. The system banners will be indicated in magenta color to serve as a reminder of the cross tuning condition.

Each time the integrated radio system is powered up with the landing gear squat switches activated, a power on self-test (POST) will be activated. If any radio or bus fails any test parameter, an error message will be displayed on a test results page. If no errors are detected, the main tuning page will be displayed.

# PRIMUS II RADIO MANAGEMENT UNIT

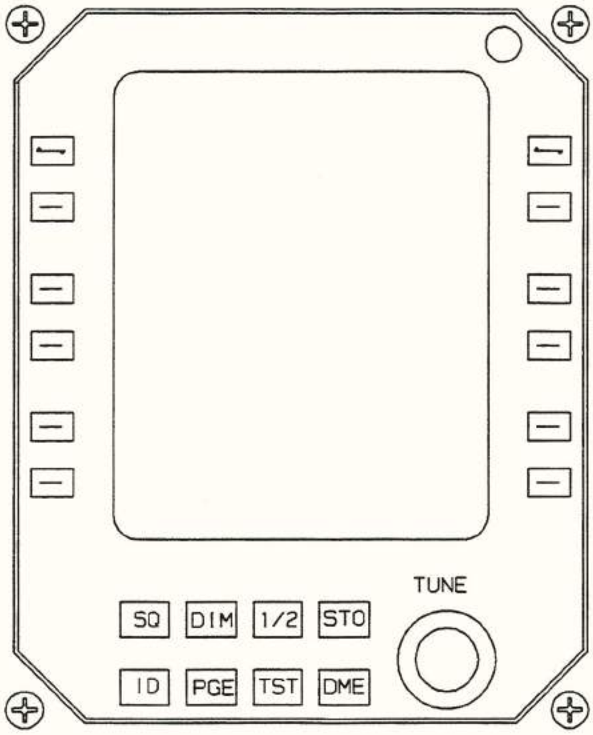


Figure 3-8

A pilot activated self-test (PAST) may be initiated by pressing the TST button on the RMU. A complete test will then be accomplished on the component represented by the window at which the yellow cursor is located. At the completion of the test, a legend will appear in the window for a short time to indicate successful completion. If the test is not successful, an error message will appear to indicate which circuit area has failed.

By pressing the DIM button on a bottom of the RMU, the tuning button may be used to dim the display. Exit from the dim mode is accomplished by pressing the DIM button again. Variations in ambient light will be automatically sensed, within limits, and automatically adjusted to maintain a desired setting.

# STANDBY RADIO CONTROL UNIT

The CD-850 standby radio control (SRC) unit is located on the center instrument panel above the right RMU. It may be used in two modes: normal and emergency. The modes are selected by means of the mode switch on the SRC. The mode selections cycle as the switch is turned. In the emergency mode, EMRG is displayed vertically along the top right edge of the display. The SRC is powered from a circuit breaker (NAV1) on the emergency DC bus.

# STANDBY RADIO CONTROL UNIT

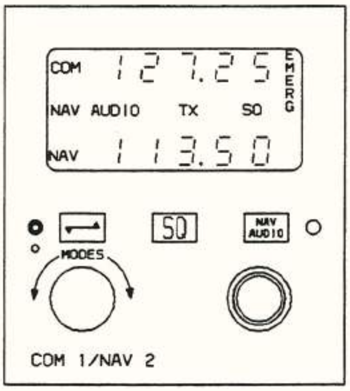


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Figure 3-9

In normal mode the SRC acts as an additional tuning source for the radio system. COM 1 and NAV 1 may be tuned by the SRC in this mode. The SRC verifies that the COM 1 RCZ-850 or the NAV 1 RNZ-850 (integrated COM and NAV units, respectively) are tuned to the correct frequency by checking the frequency echoed on the radio service bus (RSB). If the tuned frequency is incorrect, the frequency displayed on the SRC will be dashed out. If the appropriate RMU is illuminated, the frequency change will be seen to appear in the active display. In normal mode, the radios which are tuneable by the SRC (COM 1 and NAV 1) may be also tuned from the applicable RMU. If tuned from the RMU, the frequency will also be tuned on the SRC.

In emergency mode, operation of the SRC is identical on the part of the operator. The internal tuning of the system differs in that it does not read and compare frequencies on the RSB; whatever frequencies are set in the SRC are transmitted to the appropriate NAV or COM unit and that frequency is tuned.

When tuning the standby radio control, COM frequencies are displayed on the top line and NAV frequencies on the bottom. An arrow cursor, which appears to the left of the displayed frequencies may be toggled between the NAV and COM frequencies by pressing the double arrow (transfer) switch. The line on the which the arrow appears is then tuneable by the tuning knobs on the SRC.

The SQ push button toggles the COM squelch open and closed. When the squelch is open, SQ is annunciated in the right center part of the display.

When the EMER button is selected on the audio panel, the NAV AUDIO push button toggles the NAV AUDIO off and on. When NAV AUDIO is on, it is summed in with the COM audio. NAV AUDIO will be annunciated at the center left of the display.

Any time the COM transmitter is being keyed, the TX annunciator in the center of the display will appear.

# VHF NAVIGATION

The RNZ-850 integrated navigation unit operates in the frequency range of 108.00 to 117.95 MHz. The RNZ-850 system encompasses the functions of VHF NAV, localizer and glideslope receiver, and marker beacon receiver, as well as the addition of functions to ADF and DME which, in conventional systems, are separate units. Operation of the marker beacon system is discussed under "Marker Beacon" above.

Glideslope paired frequencies are tuned with the published ILS frequencies as in standard VHF NAV practice. The RNZ-850 is the navigation component of the SRZ-850 integrated radio system. The two NAV integrated receivers are controlled and tuned in a similar manner to the RCZ-850 COM units discussed under VHF COMM, above.

The NAV frequency window on the main tuning (first) page has an additional function called the "DME Split Tuning Mode". This function involves "DME hold" plus some additional features, and is discussed under Distance Measuring Equipment in the Pulse Equipment part of this section.

NAV 1 can be tuned by the standby radio control unit (SRC) as well as by the RM-850. Tuning by means of the SRC is discussed under Standby Radio Control Unit, above.

Both NAV 1 and NAV 2 are selectable on the pilot's and copilot's DC-550 display controller to be displayed on either HSI (within the PFD). NAV 1 is displayed by the BRG "**O**" knob and NAV 2 is displayed by the BRG "◇" knob. Either NAV 1 or NAV 2 may be selected by the NAV pushbutton to provide guidance to the flight director system. The NAV 1 or NAV 2 selection switches with each press of the button. If NAV 1 or NAV 2 is selected on both sides (by pilot and copilot) the annunciation in the HSI will be in yellow instead of green.

Operation of the NAV displays on the standby horizontal situation indicator (HSI) and the electronic horizontal situation indicators (EHSI) is discussed under Standby Horizontal Situation Indicator and Electronic Horizontal Situation Indicators, in this section.

# AUTOMATIC DIRECTION FINDER

The automatic direction finder (ADF) function of the Primus II integrated radio system is provided by the DF-850 ADF receiver module which is a component of the RNZ-850 integrated navigation unit. As discussed in the COM section above, the tuning of the complete system, which includes the ADF, is accomplished by means of the radio management unit (RMU), the RM-850.

The receiver has a frequency range of 100.00 to 1799.5 KHz in 0.5 KHz increments. A strap selectable option is available which allows tuning of marine emergency frequency of 2181 thru 2183 KHz.

Four modes of operation are available on the DF-850 ADF: ANT (Antenna), ADF (Automatic Direction Finder), BFO (Beat Frequency Oscillator), and VOICE. In ANT mode, the ADF receives only and does not compute bearing information. In ADF mode, the system receives signals and computes relative bearing to station. In BFO mode, a beat frequency oscillator is added to the signal for reception of CW signals. In VOICE mode, the reception bandwidth is widened for improved voice audio on the frequency. The VOICE mode is not used for navigation. Bearing information is available only in ADF and BFO modes. If ANT is used for tuning, random ADF needle searching is prevented. The modes are selected by pressing the lower line key adjacent to the ADF window. Progression is: ANT; ADF; BFO; and VOICE. The mode changes each time the line key is pressed. When the tuning cursor (yellow box) surrounds the lower ADF Line, the ANT, ADF, BFO, and VOICE Progression may also be selected by turning the tuning knob.

When the line select key adjacent to the frequency window of the ADF is pressed, the cursor will move to the ADF frequency window and the ADF may be tuned by the tuning knobs. Tuning will increment in steps of 0.5 KHz with the small knob and 10 KHz with the large knob. If the knobs are turned faster, larger increments are selected for each turn enabling large changes to be made in much less time. The rate of increased tuning speed is proportional to the rate the knobs are turned.

The ADF has a "scratch pad" memory which will store one frequency. This is accomplished by selecting the desired frequency and pressing the STO button for two seconds. To retrieve the frequency from memory, press the line select key adjacent to the ADF frequency window for two seconds.

The "**O**" bearing needle on the DC-550 display controller is dedicated to number one sources. ADF 1 bearing information may be selected on the "**O**" bearing needle of the pilot's and copilot's electronic horizontal situation indicators (EHSI). The "◇" bearing needle is dedicated to number two sources. The "◇" bearing pointer displays ADF 2 (if installed), when selected; if ADF 2 is not installed, ADF 1 will be displayed on both needles when selected. Selection is controlled by the BRG "**O**" knob and the BRG "◇" knob on the respective DC-550 controller.

On the radio magnetic indicators (RMIs), the single bar needle displays ADF 1 (when ADF is selected) and the double bar needle displays ADF 2.

# TRANSPONDER

The ATC (transponder) function of the SRZ-850 Integrated Radio System is provided by the XS-850 transponder module, which is a sub-unit of the RCZ-850 Integrated Communication Unit. It functions as a 4096 code mode A transponder, as well as providing mode C (altitude) and mode S (collision avoidance) information.

General tuning information concerning the SRZ-850 system is discussed under PRIMUS II REMOTE RADIO SYSTEM - COM in this section. Specifically, tuning of the transponder is accomplished by pressing the line key adjacent to the desired ATC function of the left side of the main tuning page which is displayed on the RMU. The ATC window has two lines. The top line represents the tuneable transponder codes and the second line represents transponder modes. When the line key adjacent to the transponder code line is pressed, the yellow box (cursor) will surround the code digits, which are then tuneable by the tuning knobs. The large knob controls the left two digits and the small knob controls the right two digits.

Pressing the mode select line button moves the cursor box to the mode select annunciator which connects the tuning knobs to the window. Either knob may then be used to select modes in the following sequence:

Only one transponder is in operation at one time; the opposite one is held in STANDBY for instantaneous operation, if required. The system in operation is controlled by the mode select line key. Pressing the mode select line key (once the cursor is moved to that line) cycles the transponders as follows:

STANDBY - Both units in STANDBY.
SYSTEM No. 1 in operation.
STANDBY - Both units in STANDBY.
SYSTEM No. 2 in operation.
STANDBY - (Sequence will repeat)

If S ONLY or S+ALT is selected and Mode S is not active at the ground station, the transponder will appear to the ground station to be inoperative. Make sure that Mode S capability exists at the ground station before selecting any Mode S function.

The system in operation is indicated by a "1" or "2" in front of the selected mode.

A transponder code may be stored in memory. To accomplish that, select the desired codes and press the STO button for two seconds. To retrieve the code from memory, press the line select button for two seconds.

The IDENT function of the transponder may be activated by pressing the ID button on the RMU or by pressing the ID button on the inboard side of either the pilot's or copilot's control wheel. Pressing any ID button will activate the ID mode for approximately 18 seconds. An yellow ID annunciation will appear along the top edge of the transponder window during ID mode activation.

# DISTANCE MEASURING EQUIPMENT

The Primus II DME system is comprised of two RNZ-850 integrated navigation units, two NV-850 VHF NAV receivers and two DME-850 distance measuring modules. The DME transmitters of the DME-850s work in the L frequency band, and the receiver frequency range is from 962 to 1213 MHz. DME tuning normally follows the VHF NAV receiver tuning which selects the DME frequencies paired to the VHF VORTAC published frequencies.

The PRIMUS II has a special "hold" function which is annunciated by splitting the NAV window. While in hold, the actual DME can be tuned independent of the active VOR or ILS.

In normal VOR/ILS/DME operations, one of the six DME channels is paired with the active frequency and another with the preset frequency. Pressing the DME function key will split the NAV box on the main tuning page, allowing the active DME channel to be selected from the active VOR/ILS frequency. Cycling the DME select button sequences the NAV window from normal; to VOR/ILS, and DME split tuning; to VOR/ILS and TACAN channel split tuning; back to normal. When the NAV window is split, an amber H (hold) appears in the lower DME window. This H indicates that the distance display (DME or TACAN) is not paired with the VOR/ILS navigation data. When the H is displayed, the other aircraft systems HOLD annunciators will also illuminate. Display of the DME (or TACAN) channel being held provides a more positive identification of the navigation channel. In addition, the DME station identifier is also displayed.

Two DI-850 indicators are installed; one on the pilot's instrument panel and one on the copilot's instrument panel. DME information is presented on the indicators and on the pilot's and copilot's HSIs. VOR 1 or VOR 2 may be selected on either indicator. A selection on one indicator will not affect the selection on the opposite indicator. The source of the NAV/DME data is annunciated on the respective HSI.

Each DME has the capability to scan six channels, simultaneously tracking four selected DME channels for distance, ground speed and time to station, as well as tracking two stations for identification (IDENT) functions. Of the four channels of which it can track three functions (DIST, GS and TTG), two are dedicated to the flight management system(s) (FMS).

## PRIMUS DME

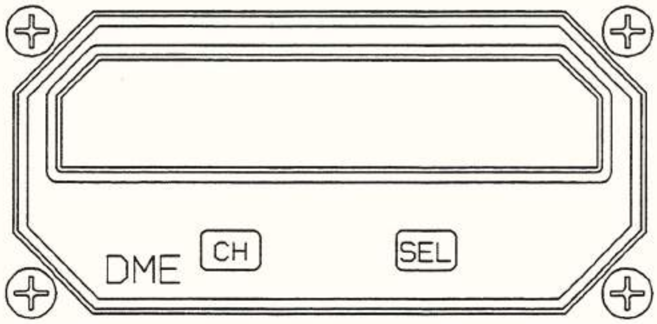


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Figure 3-10

Normally, one DME station will be tuned to an active VOR frequency, which is annunciated on the top line of the NAV tuning window of the radio management unit (RMU). Another (preset) VOR frequency may be selected in the preset frequency window. When a frequency is set in the preselect window, the system will already be tracking the preselected station so that there will be no delay when that frequency is transferred to active.

NAV tuning, which normally also selects the associated DME frequencies, is discussed under VHF NAV in this section. Special tuning procedures applicable to DME, which are in addition to the NAV tuning, are discussed below.

The select (SEL) button on the indicator is used to cycle the display on the right side of the readout through ground speed, time-to-station, and IDENT functions. If HOLD is selected on the DME, the function will return to IDENT in 15 seconds if any other function is selected.

The channel (CH) button on the indicator selects either NAV 1 or NAV 2 VOR receiver for display on the indicator. NAV 1 or NAV 2 will be annunciated on the top line of the indicator to indicate which NAV is being displayed and computed. If the DME is being held, HLD is annunciated on the top line along with NAV 1 or NAV 2 to indicate which channel the DME is holding. When a station is being held, the regular functions are selectable on the DI-850 indicator and information will be computed from the station identified by "H" on the DME line of the RMU; however, after 15 seconds, the DI-850 annunciation will revert to identifier.

The DME has a "split tuning" mode which operates somewhat like conventional HOLD functions, but provides other options. Pressing the DME button on the bottom of the RMU will divide the NAV window into two windows. The top window will remain the active VOR frequency. H will be annunciated on the bottom line, indicating that the DME frequency is holding with the active frequency which is displayed on the top line. The bottom line will be labeled DME and will have in it the active frequency displayed in VHF (VOR) format. The DME may then be tuned by pressing the line select key and changing it to a new channel. Pressing the DME button again will cause the DME (lower) window to change to a TACAN channel presentation. TACAN channels, along with their related W, X, Y, and Z channelization nomenclature will then be tunable with the tuning knobs. The DME function of all 126 TACAN channels may be tuned. No azimuth information is received in this mode. A third press of the DME button causes the NAV window to return to its normal active/preset presentation and the DME will resume tuning with the active frequency.

DME information is selected for display on the pilot's and copilot's HSIs by pressing the NAV button on the respective DC-550 EFIS display controller. Pressing the NAV button alternately selects NAV 1 and NAV 2 for display. If both NAV receivers are selected to the same NAV source, the NAV annunciations (VOR 1, VOR 2) on the HSI will be in yellow. The selected DME will always be the same as the NAV source (VOR).

# AUDIO CONTROL PANELS

Two identical Honeywell Primus II digital audio control units are installed. Digital transmission of audio from remote units to the audio panels differs from conventional audio systems in that it requires one twisted pair of wires rather than many twisted pairs to achieve the same performance. The control units are mounted on the pilot's switch panel and the copilot's meter panel respectively.

## AUDIO CONTROL PANEL

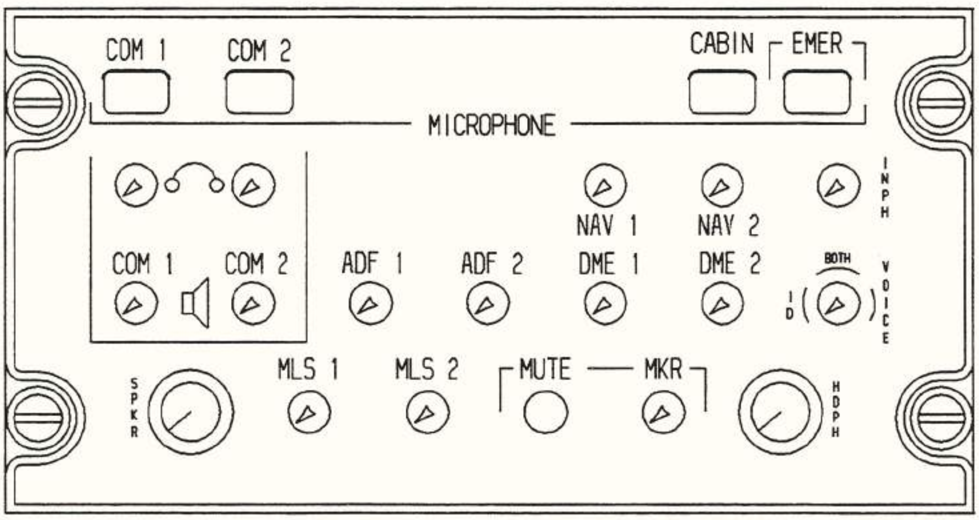


Figure 3-11

The panels have three rows of combination audio ON/OFF switches and volume controls. The small round knobs serve as audio on/off switches when pressed. When the switch is latched in, the audio for the particular receiver it serves will be off. When pressed again, the switch will move outward turning the audio on. When the audio is on, the knob of the switch may be used as a volume control. Turning it clockwise will increase the volume; counterclockwise will decrease it.

Two larger knobs on the lower part of the control panel serve as volume controls for the speaker and headset respectively, of the pilot and copilot. These knobs are in series with the smaller individual volume controls. This allows a volume selection to be made on the individual radio volume control, and then a final overall selection to be made by means of the speaker or headphone control, resulting in a more flexible individual control of all available audio signals.

A row of microphone selector buttons (push-push latching switches) is located across the top of the control panel. These buttons connect the pilot's or copilot's microphone to the selected transmitter. The receiver for the selected radio or interphone will also be selected regardless of the selection of the audio on/off switches. For night operation, a light above the microphone selector button is illuminated.

The emergency COM (EMER) microphone switch, located at the upper right corner of the audio panel, when depressed connects COM 1 transceiver directly to the aircraft microphone and headphone. All electronic circuitry is eliminated and all other audio panel modes are disabled in this mode. NAV 1 audio will also be directed into the headset controlled by the panel on which EMER is activated, if NAV AUDIO is selected on the SRC unit.

An ID/VOICE selector is located on the right center of the audio panel. It is not a latching switch, but is active whenever NAV 1 or 2 and/or ADF 1 or 2 (if installed) is selected. If BOTH is selected, both ID and voice will be heard; if ID is selected, voice signals will be filtered out and coded identification signals will be heard. If VOICE is selected, coded signals will be filtered out and voice will be heard.

The marker mute and marker aural on/off/volume control are located on the bottom row of switches on the panel. The marker mute is used to temporarily silence the marker beacon audio. Momentarily pressing the MUTE button will mute the beacon signal as long as it remains above a minimum threshold level. When it drops below that level, a time-out sequence will begin, which will mute it for a fixed period of time. The MKR button may be pressed in to disable the aural signal. When the button is out (pressed again) the marker beacon volume can be controlled with the knob, however, maximum counterclockwise rotation will not totally turn down the volume since a minimum signal is automatically retained in order not to miss the aural marker signal if it has been selected on.

# STANDBY HORIZONTAL SITUATION INDICATOR (HSI)

The HSI-315B standby horizontal situation indicator is a three-inch instrument located on the left side of the center instrument panel. It provides short range navigational guidance in case of PFD/flight director failure, or in case of primary electrical system failure. The HSI is "hard-wired" to the NAV 1 receiver and is powered by the emergency DC bus.

The standby HSI displays compass heading, glideslope and localizer deviation and airplane position relative to VOR radials. The compass card is graduated in 5-degree increments and a lubber line is fixed at the fore and aft positions. Azimuth markings are fixed at 45, 135, 225, 270, and 315 degrees on the compass face. A fixed reference airplane is in the center of the HSI, aligned longitudinally with the lubber line markings.

The course cursor is set by a knob on the instrument. Once set, the cursor rotates in its set position with the compass card. The course deviation bar, which forms the inner segment of the course cursor, rotates with the course cursor.

A blue ADF needle, which displays ADF 1 bearings, rotates around the outer portion of the dial.

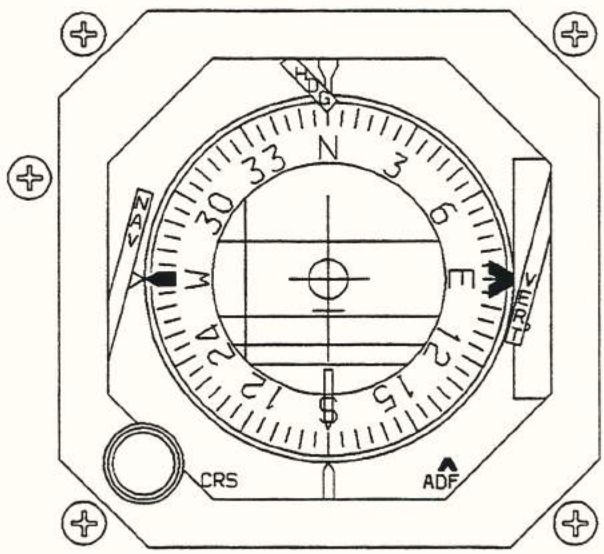


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Figure 3-12

A heading (HDG) flag will appear in the instrument when the compass system is OFF, the heading signal from the AHRS 2 becomes invalid, primary power to the indicator is lost, or the error between the displayed heading and the received signal becomes excessive.

The course deviation bar moves laterally in the HSI, in relation to the course cursor. Course deviation dots in the HSI act as a displacement reference for the course deviation bar. When tracking a VOR, the outer dot represents 10 degrees, while on an ILS localizer it represents 2-1/2 degrees. White TO-FROM flags point to or from a station along the VOR radial when operating on a VOR. A red warning flag comes into view when power is OFF, when NAV information is unreliable, or when signals from the NAV receiver are not valid. The standby HSI displays only NAV 1 information.

The glideslope deviation pointer is located to the right side of the display. When receiving glideslope information during an ILS approach, the green deviation pointer will be uncovered by the red VERT warning flag which will otherwise be in evidence. If an ILS frequency is not tuned and being received, or the ILS signal is unusable or unreliable, the deviation pointer will be covered by the red warning flag.

# COCKPIT VOICE RECORDER

The A-200S cockpit voice recorder system provides a continuous recording of the last 30 minutes of all voice communications and aural warnings originating in the cockpit, as well as sounds from warning horns and bells. The system is protected by a 5-ampere circuit breaker located on the left circuit breaker panel in the cockpit.

The sensitive cockpit microphone is located to the left of the fire tray. The recorder is energized any time the battery switch is in the BATT position. The control panel, located low on the right side of the copilot's instrument panel, contains a TEST button and an ERASE button. System operation is checked by pressing the TEST button. When the TEST button is held down for five seconds, illumination of the green light on the control panel indicates correct functioning of the voice recorder system. To erase the cockpit voice recorder the airplane must be on the ground with the landing gear squat switch compressed and the cabin door open. Pressing the ERASE button for approximately 2 seconds will cause the entire record to be erased.

## COCKPIT VOICE RECORDER

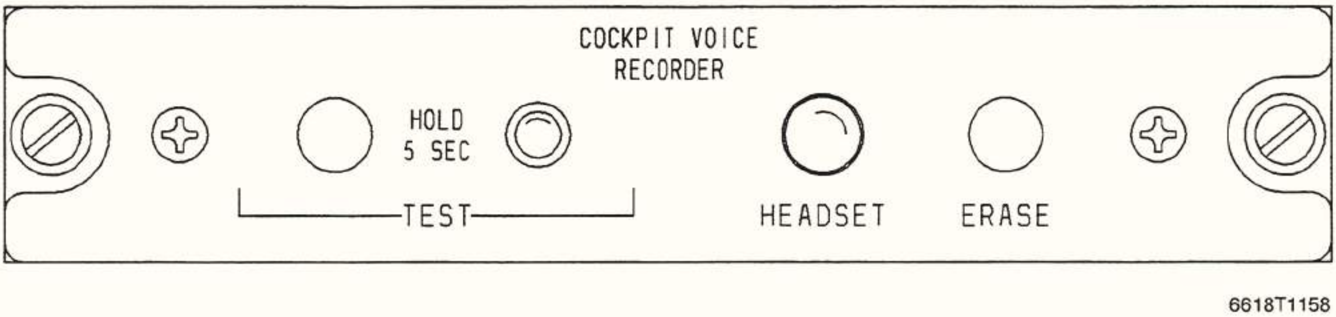


Figure 3-13

The installation is equipped with a five-G switch which will activate any time the airplane is subjected to a five-G force; this will disable the system's erasure mechanism until a reset button on the G-switch is pressed. The switch is located in the tailcone.

# EMERGENCY LOCATOR BEACON

The ELT 110-4 emergency locator beacon (ELT) system is an emergency transmitter designed to assist in locating a downed airplane. The system is comprised of a cockpit mounted remote switch (with indicator), a dorsal mounted transmitter/bracket assembly, and a fuselage mounted rod antenna.

The transmitter has a self-contained battery pack which must be changed every three years or after a cumulative total of one hour of operation. The system is activated automatically by an impact of 5.0 G, +2 or -0 along the flight axis of the airplane. The ELT can also be activated manually by the cockpit ON/ARM switch (located forward of the left circuit breaker panel). When activated, a modulated omni-directional signal is transmitted simultaneously on emergency frequencies 121.5 and 243.00 MHz.

The dorsal mounted transmitter/bracket assembly can be accessed by removing access panel 340AR (this panel is located just forward of the horizontal stabilizer on the left side). The transmitter itself has an integral ON-OFF switch which is set to OFF (down) upon final inspection/installation. This switch setting will allow the system to transmit either by an impact ("G") Switch or by the cockpit ON/ARM switch.

The transmitter may be turned off (reset) by placing the transmitter switch to ON (up) and back to OFF (down). This turns off the transmitter and resets (rearms) the unit.

**NOTE**

The transmitter must be correctly placed and properly secured in its bracket to function. The transmitter will not transmit if removed from its bracket.

The cockpit ON/ARM switch provides manual activation of the system (ON position) as well as a means of testing the system operation. In ARM (down) position, the system is armed for activation by the impact switch. In ON position, the impact switch is bypassed and the emergency signal is transmitted. Signal transmission is indicated by a blinking red light located directly above the cockpit switch.

The ELT system also incorporates a complete self-analysis program with test routines transmitted at reduced power over the emergency frequencies. The test sequence checks the microprocessor, antennas, and transmitter. To test, perform the following sequence:

1.) Turn on applicable airplane and avionics switches.
2.) Tune radio to 121.5 MHz.
3.) Place the ARM/ON switch to ON for three sweeps of the receiver (approximately one second) and then back to ARM. Ensure the indicator light comes on immediately and begins flashing.

**NOTE**

If the indicator light does not come on immediately, the unit has failed its test.

# DIGITAL FLIGHT DATA RECORDER (Parts 91 and 135)

On airplanes which are equipped with more than 9 passenger seats and are operated under FAR Part 91 or FAR Part 135, a digital flight data recorder (FDR), which continuously records at least 17 parameters of airplane and systems operation, is required. A continuous recording of 8 hours is also required. The optional recorder installed in the Citation Excel records the information digitally by a solid state method. Recorder operation begins upon airplane power-up and continues until electrical power is shut off. Recorder operation requires no attention from crew members. An annunciator light (FDR FAIL) in the annunciator panel will illuminate if the flight data recorder malfunctions or if power to the system fails. The flight data recorder receives 28-volt DC power through a 5-ampere circuit breaker (FDR) on the right circuit breaker panel powered by the right avionics bus.

# FLITEFONE 800 (Optional)

The Flitefone 800 is a fully digital wireless multichannel airborne telephone system which provides continuous coverage throughout the United States including Hawaii and Alaska, with additional coverage in Canada and Mexico.

To place a call to a party on the ground: remove the handset by pressing the release key and press the "ON" button. Wait for the beep and/or green light which indicates ready for use. A dial tone should now be present (10 to 45 seconds on the average to receive a dial tone). Dial "1" + "Area Code" + number for all direct bill calls. (If direct billing is not activated a message will appear on the display reminding that the caller must use a credit card.) Volume may be adjusted by pressing and holding the volume control on the side of the handset until the desired level is reached. To end the call press "END" on the handset or press "NEW" to end the current call and to place another call. After completing the call(s), tug gently on the cord to retract. Reinsert the handset into the cradle cord end first, pressing firmly to lock.

To receive an incoming call when the phone rings, remove the handset from the cradle and press "ON" to begin talking. Press the "END" key to end billing.

The Flitefone 800 has many features not included here. For more detailed information refer to the Allied Signal Flitefone 800 Operating Instructions.

# MAGNASTAR C-2000 DIGITAL AIRBORNE TELEPHONE (Optional)

The MagnaStar C-2000 can be used to place and receive voice telephone calls, send data transmissions via modem, as well as to send and receive facsimile transmissions. A central processor on board each MagnaStar equipped airplane controls and coordinates the (s) for all voice calls, data and fax modem transmissions, and in-cabin intercom functions. The MagnaStar continually scans and monitors ground based radio cells for the clearest usable communications channel while in flight. The LCD on the handset indicate the clearest usable communications channel while in flight. The LCD on the handset indicates the availability of a channel. The system searches for the optimum channel when a call is initiated and connects the calling and receiving parties. The system allows for multiple handsets and two simultaneous calls may be placed (voice, fax, or data). Reliable and clear connections are ensured at all times through digital technology. Coverage is provided throughout North America above 17,000 feet (much of the United States is covered at lower altitudes) and additional coverage is available on the ground at many major domestic airports.

All operations are performed via the handset. The handset features adjustable volume and a telephone system numerical keypad. the two-button volume control is located on the side of the handset and should be used to adjust the volume to the users desired level. Two additional keys are also included: " + " and "END CALL". The LCD on the handset displays information and "menu" style selections, reducing the need for separate instruction. A credit card reader is also provided in the handset, allowing optional billing to individual user accounts.

**NOTE**

> The standard handset has a magnetically activated hook switch in the holder and therefore operates in a typical "on-hook" and "off-hook" manner. Additional (optional) handsets, custom mounted or portable (which plug into jacks), do not provide the hook switch. To place these handsets "off-hook", depress the " + " key; to return the phone to "on-hook", depress the " + " key again.

While the handset is "on-hook", available services will be displayed on the LCD. To place a call, remove the handset from its holder and select the type of call you wish to make ("1" for a voice call). In the case of a voice call to someone on the ground, the following would be keyed; "1" + "Area Code" + "Number". To terminate any dialing sequence and return to the main menu, press "END CALL".

Calls to the airplane may be made in three ways:

**AIRPLANE AIRCALL NUMBER**

The Aircraft Aircall number is permanently assigned to the aircraft and is stored by the C-2000 upon registration. The Aircraft Aircall number will ring at all handset locations.

**STATION AIRCALL NUMBERS**

Station Aircall numbers are assigned to each handset and are permanently stored by the C-2000 upon registration. The Station Aircall number will ring at the assigned handset location.

### GTE AIRFONE CALLING CARD/"PERSONAL" NUMBERS

These numbers are encoded into GTE Airfone Calling cards and can be used on any MagnaStar or GenStar equipped aircraft, and must be registered on each flight. Up to nine GTE Airfone calling card numbers may be registered on a C-2000 equipped aircraft.

To initiate an Aircall, the ground part must dial 1-800-AIRFONE. When prompted, enter the Aircall number of the aircraft, a station handset, or of an individual traveler, then enter the callback telephone number of the ground party. To return a call to the displayed callback number, take the handset off-hook and press either "1" or "2". Pressing "1" will charge the call to the aircraft account and automatically dial the number. Pressing "2" will allow you to charge the call to a credit card; after pressing "2" wait for the tone and then swipe the card or manually input the card number.

The C-2000 has many features not included in this manual. For more detailed information, refer to the MagnaStar C-2000 System Digital Airborne Telephone User's Guide.

# FLIGHT GUIDANCE

## PRIMUS 1000 INTEGRATED AVIONICS SYSTEM

The Primus 1000 Integrated Avionics system is an autopilot/flight director and electronic flight instrument system (EFIS) which is integrated into one complete automatic flight control system. The primary component of the system is the IC-600 Integrated Avionics computer (IAC) which contains the symbol generator, the flight director, and the autopilot computer (autopilot computer in pilot's IC-600 only). The entire system is comprised of the flight director, automatic pilot, pilot's and copilot's electronic attitude director indicators (ADIs) and electronic horizontal situation indicators (HSIs) located in one single primary flight display (PFD) for each pilot, dual air data computers with associated outputs, autopilot controller, altitude alert and altitude preselect, touch control steering, and the autopilot servos. The air data system provides pressure altitude, true airspeed and overspeed warning. The system may be flown manually or automatically.

The IC-600s are cooled by individual cooling fans. Failure of the fan(s) are annunciated in the upper left hand corner of the multi function display (IC1 FAN or IC2 FAN). Continued operation of the IC-600s without a fan may produce even greater heat (especially on the ground or in hot ambient conditions). If temperature rises to between 110°C and 140°C, the message IC1 HOT or IC2 HOT will appear on the Primary Flight Display. If temperatures exceed 140°C, the respective IC-600(s) will shut down.

Specific procedures for dealing with fan failure and computer overheat conditions can be found the Abnormal Procedures portion of this manual.

## LCR-93 ATTITUDE AND HEADING REFERENCE SYSTEM (AHRS)

The dual AHRS is the primary source of attitude and heading information on the Excel. The LCR-93 is a strapdown AHRS which uses fiber optic rate gyros and three micromechanical accelerometers to provide a composite source of pitch, roll and heading information for the Electronic Flight Information System (EFIS) and the Automatic Flight Control System (AFCS). Attitude data is also supplied to the weather radar antenna and heading data to the standby horizontal situation indicator (HSI). A flux valve provides long term heading references for the system. A digital computer mathematically integrates the rate data to obtain the heading, pitch and roll information. The micro air data computers provide true airspeed and barometric altitude inputs to the AHRS. The key component of the AHRS is the attitude and heading reference unit (AHRU). It comprises the inertial sensors and the computer boards for data processing and interfacing.

## MODES OF OPERATION

After the system is powered on and completes its alignment, it begins to provide system information from the Normal, Basic, Slaved, and DG modes. The attitude loop is controlled by the normal/basic modes, and the heading loop is controlled by the slaved/DG modes.

In normal mode the AHRS uses valid true airspeed (TAS) from the air data computers, to improve attitude accuracy. If the true airspeed data are not available or are invalid, the system will automatically revert to the basic mode to operate autonomously. If true airspeed becomes valid again during basic mode operation, the system will revert to normal mode. Transition between normal and basic modes is controlled by the availability and validity of true airspeed data, and the transition is performed automatically in both directions.

In slaved mode, the heading loop of the LCR-93 attitude and heading reference unit (AHRU) is supplied with magnetic heading data from the magnetic sensor unit (flux valve). The heading output is magnetic heading referenced to local magnetic north. The earth rate and gyro drift correction factors are updated continuously during slaved operation.

A dot/cross type of heading sync indicator is displayed at the top left of the horizontal situation indicator (HSI) display in the primary flight display (PFD). The scale is green and the pointer is white. During straight and level flight the indicator will be stabilized between the dot "o" and the cross " + ". and may temporarily drift to one side or the other. This indicates normal operation in the slaved mode. After a turn, the indicator should return to a centered indication within two minutes. The heading sync indicator can be quickly re-synchronized by cycling the DG/SLAVE/TEST switch to DG and back to SLAVE. The heading sync indicator is removed from the HSI when DG mode is selected, when there is an invalid flux valve heading, and when there is an invalid magnetic heading.

In DG (directional gyro) mode, the heading may be set as desired by the L SLEW and R SLEW (right) switch of either AHRS system, after DG is selected on the appropriate system switch (DG/SLAVE/TEST). In DG mode the system acts as a free gyro; there is no magnetic input, and no update of earth rate and gyro drift estimation will be performed.

The AHRS basic mode is annunciated in the upper left corner of the MFD (i.e., AHRS BASIC-1-2), in white, if the AHRS is not in a normal mode.

## SYSTEM ALIGNMENT

When power is supplied to the AHRS system (automatically upon power-up) it automatically enters the alignment mode. Upon completion of the alignment the appropriate modes of slaved heading or DG, and Normal or Basic (depending upon switch selection and availability of data), will be entered. Alignment takes approximately 30 seconds; if no internal failures are detected during the alignment self-test and all values are within accuracy limits, heading attitude angular rates and accelerations are output and system flags are withdrawn. A pilot initiated self-test is available by pressing the DG/SLAVE/TEST switch to the TEST position. While the system is testing, failure flags and invalid data annunciations (amber dashes) will be in evidence, and TEST will be annunciated in magenta at the top left of the attitude display in the primary flight display (PFD). When the system is tested, the heading of the HSI will slew to 015 degrees, and the attitude sphere will show 45 degrees of right bank and 5 degrees nose up.

Wind buffeting, cargo loading, and movements caused by running engines will not affect the duration of alignment on the ground. In case of excessive movement of the airplane on the ground the alignment may be compromised. It may take longer or alignment may not be completed. If alignment is not completed the warning flags will not be withdrawn and it may be necessary to restart alignment by removing power from the system by shutting down airplane system power or by pulling the affected AHRS circuit breakers (AHRS 1, AHRS 1 AUX or AHRS 2, AHRS 2 AUX), in order to cause the system to restart alignment. An AHRS battery supplies power to AHRS 1 AUX and AHRS 2 AUX circuit breakers when the STBY PWR switch is in the ON position. Due to the fact that a system battery will prevent an in-flight power interruption for periods of up to 30 minutes, an in-flight power interruption is unlikely. However, if an in-flight power interruption is experienced or attitude and heading reference is lost during flight, an in-flight alignment can be performed. The same system circuit breakers must be pulled, as on a ground alignment, above, to ensure that all power has been removed from the system; by re-setting, the system will then start an in-flight alignment, which normally takes 45 seconds to 2 minutes. An in-flight alignment requires that the airplane be flown straight and level for the duration of the alignment.

## HDG REV and ATT REV

The opposite attitude source may be selected, if desired, by pressing the applicable ATT REV (attitude reversion) button on the pilot's or copilot's instrument panel. The opposite heading source may be selected by pressing the applicable HDG REV (heading reversion) button, also on the pilot's or copilot's panel. Pressing either of these buttons adds the opposite system to the desired source. If both systems are selected to the same source, or if a "cross-selection" has been made, it will be annunciated on the EFIS displays in amber.

Takeoff with one AHRS in BASIC and/or in DG mode is not recommended.

# MODE ANNUNCIATION

Flight director mode annunciations are integral to the primary flight displays. The vertical and lateral modes are annunciated along the top of the display. Armed vertical and lateral modes are annunciated in white and appear slightly to the left of the position of the captured vertical and lateral mode annunciations, which are presented in green. Lateral mode annunciations are located to the left of top center and vertical modes are annunciated to the right of top center. A white box appears around a capture or hold mode for five seconds after mode transition. Lateral and vertical mode annunciations and transitions are listed below:

| | |
|---|---|
| VOR | A NAV mode (VOR) is armed or has been captured and is being tracked. |
| HDG | Heading select mode engaged. |
| LOC | Localizer has been armed or captured. |
| APR | VOR approach selected or course capture has occurred. |
| GS | Glideslope armed or captured. |
| ASEL | Altitude preselect armed. |
| ALT | Altitude hold mode engaged. |
| BC | Back course armed or captured. |
| VS | Vertical speed hold has been selected and captured. |
| IAS or MACH* | Indicated airspeed (or Mach) hold has been selected and captured. |
| LNAV | Long range NAV (FMS) mode has been selected. |
| VNAV | Vertical navigation mode has been either armed or captured. |
| GA | Go-around mode has been selected. |
| TEST | System is in test mode (annunciated in magenta) Annunciation is automatic immediately after power up. |

*IAS or MACH will be annunciated automatically, depending upon airplane altitude and airspeed. Transition from IAS to Mach is automatic as the airplane climbs through 29,000 feet altitude or exceeds 0.620 Mach, and Mach to airspeed occurs automatically as the airplane descends through 28,800 and decreases below 0.610 Mach.

(Continued Next Page)

## MODE ANNUNCIATION (Continued)

| Lateral Transitions | Vertical Transitions |
|---|---|
| VOR arm to VOR cap | VNAV armed to VNAV cap |
| LOC arm to LOC cap | VNAV cap to ALT |
| BC arm to BC cap | ASEL arm to ASEL cap |
| APR arm to APR cap | ASEL cap to ALT |
| ASEL arm to ALT | GS arm to GS cap |

### MISCELLANEOUS ANNUNCIATIONS

ATT1 (or ATT2) — Attitude Source (amber for "cross-selection").

MIN — Illuminates when the airplane reaches the preset minimum radio altitude. (Annunciated in amber letters on white background with black border in the upper left side of the ADI attitude sphere.) A white box is drawn around the indication when DH is reached. When the airplane reaches the selected minimums, MIN will flash for 10 seconds and then remain steady.

AP ENG — Illuminates when the autopilot is engaged.

GREEN ARROW — A green arrow will point either left or right, indicating to which flight director (pilot's or copilot's) the flight director is coupled.

TCS ENG — Illuminates in white to Indicate touch control steering is engaged.

TRN KNB — Illuminates in amber when the autopilot turn knob is out of center. The autopilot will not engage when the turn knob is out of center.

AP FAIL — Illuminates in amber to indicate autopilot failure.

MAG1 (MAG2) — Heading Source, in mid left-center of PFD. MAG annunciation if SLAVE is selected on the applicable AHRS DG/SLAVE/TEST switch.

DG1 (DG2) — Gyro slave switch; DG annunciation if DG is selected on the applicable AHRS DG/SLAVE/TEST switch. Annunciation is in amber. No annunciation if normal selections are made.

SG1 (SG2) — Amber, in upper left side of primary flight display (PFD) (annunciated only in case of reversion selection). Symbol generator 1 (or No. 2) is providing symbol generator for both PFD displays. Selection is made on the SG1/NORM/SG2 switch on the MFD controller. In SG1 position SG2 will be a duplicate of SG1; in SG2 position SG1 will be a duplicate of SG2.

(Continued Next Page)

**MISCELLANEOUS ANNUNCIATIONS** (Continued)

| | |
|---|---|
| ADC1 (ADC2) | Amber, in upper left side of PFD (annunciated only in case of reversion selection). ADC1 (ADC2) is the source of air data information for both displays, or a cross-selection of both systems (ADC2/ADC1) has been made. Selection is by the small ADC REV buttons on the bottom of the respective pilot's and copilot's instrument panels. |
| WPT | FMS waypoint annunciation (amber), (DR [dead reckoning] - amber, DGR [degrade] - amber, INTG [FMS integrity problem] - amber.) |
| AOA | Invalid angle-of-attack input - amber. |
| APP, HDG SEL | Typical FMS lateral submodes; indicated in magenta near center-left of display. |
| MAX (MIN) SPD | Maximum (Minimum) speed has been reached. Indicated to the left side of the attitude sphere. |
| CRS (DTRK) XXX (digits) | FMS course selected (desired track) digital display. Color depends upon FMS/NAV pilot/copilot selections. |
| WIND SHEAR | Annunciation of WINDSHEAR mode; caution - amber, warning - red. In boxed annunciator at upper right side of attitude sphere. |
| GND PROX | Ground proximity warning system mode annunciator; caution - amber. |
| MSG | FMS message flag (amber). Appears in order to indicate message is present on the FMS control display unit (CDU). |
| BELOW GLIDE | Amber message in box in upper right side of attitude sphere. |
| VNV | VNAV source annunciation. FMS (white); VNV (white). Annunciation located above vertical deviation scale. |

# FLIGHT DIRECTOR MODE SELECTOR

The flight director mode selector consists of eight push-on, push-off switches that select various flight director/autopilot modes of operation. The green mode activation light in the switch (button) will be illuminated if the corresponding mode is in the arm or capture state.

The status of the selected mode is displayed in white letters (annunciations) in the primary flight display (PFD) when armed, and in green when capture has occurred (or when selected on, for those modes where capture occurs immediately).

## MS-560 MODE SELECTOR PANEL

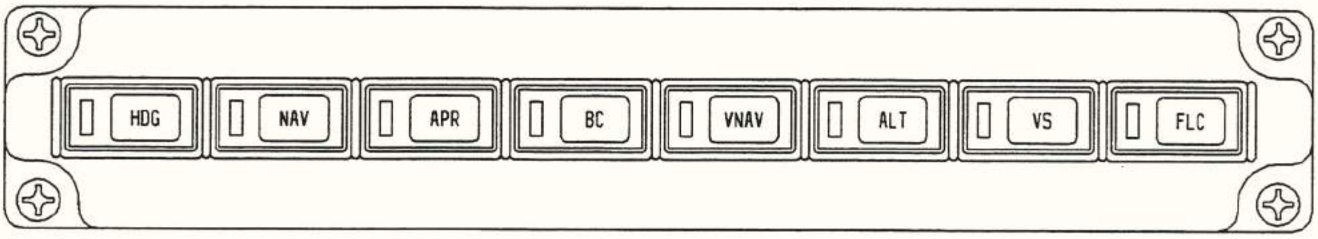


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Figure 3-14

The flight director can be selected off by deselecting all of the modes on the MS-560 Flight Director Mode Selector. The command bars will bias out of view. If no modes are selected on the MS-560 mode selector the autopilot will engage in a basic heading hold/pitch hold mode which will be annunciated (PIT and ROL) in the primary flight display (PFD).

Operation of the various modes is explained under Primus 1000 System Operation below. The pilot and copilot may select either NAV 1 or NAV 2 for display on the course deviation indicator (CDI) of their respective primary flight display (PFD), by means of the NAV button on the DC-550 display controller. The respective NAV will be automatically selected upon power up; the sequence of selection will then be NAV2/NAV1/NAV2 etc. for the pilot and NAV1/NAV2/NAV1 etc. for the copilot. If both sides have been selected to the same source, the annunciation of VOR 1, etc., in the PFD will be in amber. The selection of NAV 1, NAV 2 or FMS is annunciated above and to the right of the HSI display in the PFD as VOR 1, VOR 2 and FMS respectively.

The selection of NAV 1, NAV 2 or FMS on the DC-550 display controller push-buttons controls the source of navigation information to the flight director, as well as selects the source of navigation information displayed on the EFIS course deviation indicator of the PFD. A switch (AP XFER FD1/AP XFER FD2) is installed (on the center instrument panel) to determine which flight director controls the autopilot. The position of this switch can be changed with the autopilot engaged or disengaged, however, the flight director modes will drop out. The autopilot will remain engaged, if it is already engaged, but will revert to basic autopilot modes of pitch and heading hold.

# AUTOPILOT CONTROL PANEL

The autopilot control panel, mounted at the aft end of the pedestal, provides the means of engaging the autopilot and yaw damper, as well as manually controlling the autopilot through the turn knob and pitch wheel.

The autopilot (AP) engage switch is used to engage the autopilot and yaw damper. The yaw damper (YD) switch is used to engage and disengage the yaw damper without the autopilot. Use of the yaw damper while manually controlling the airplane aids in airplane stability and passenger comfort. The push-on push-off AP and YD switches are illuminated green when engaged. Pressing the AP switch when the autopilot is engaged will disengage the autopilot but leave the yaw damper engaged. Pressing the YD switch when both YD and AP are engaged will turn off both the yaw damper and the autopilot. The yaw damper and autopilot may also be disengaged with the red AP TRIM DISC button on the pilot's and copilot's control wheels. Pressing the go around (GA) button on either throttle will disconnect the autopilot and force the flight director into go around mode; the yaw damper will remain engaged. Additionally, the stick shaker will disengage the autopilot and yaw damper.

The pitch wheel allows manual pitch control of the airplane proportional to the rotation of the wheel and in the direction of wheel movement. Movement of the wheel also cancels any other previously selected vertical mode. The turn knob allows manual bank control of the airplane proportional to and in the direction of knob movement. Turns with a maximum bank angle of 30 degrees can be performed with the turn knob. The turn knob must be in the center detent position before the autopilot can be engaged. Rotation of the turn knob out of detent cancels any other previously selected lateral mode.

## AUTOPILOT CONTROL PANEL

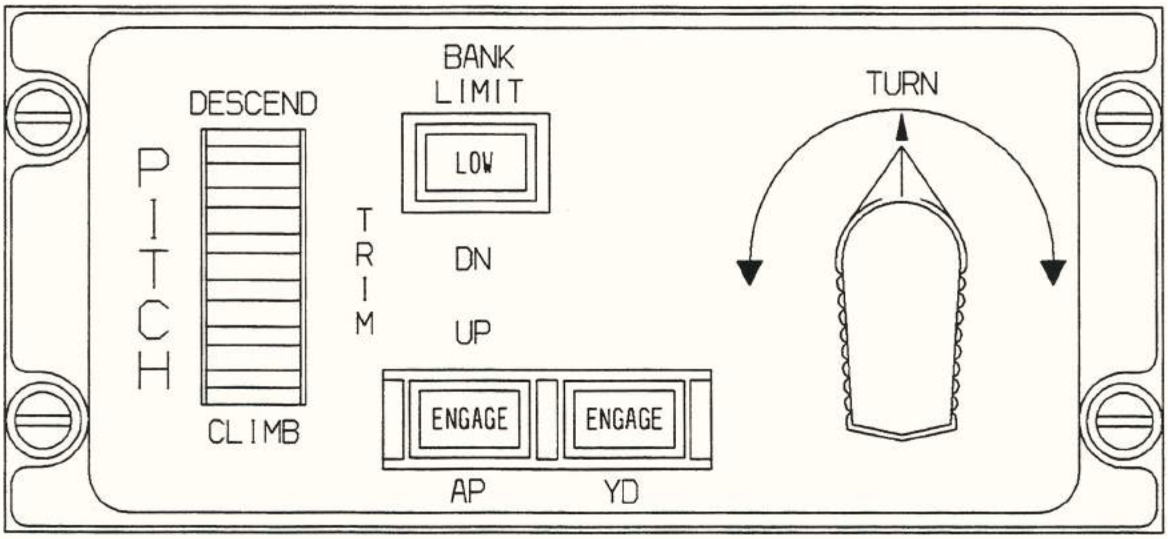


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Figure 3-15

The elevator trim indicator shows an out of trim condition, in the direction indicated by illumination of UP or DN in the TRIM annunciator, when a sustained trim input is being applied to the elevator servo. The indicator should be OFF before engaging the autopilot. If the TRIM annunciator is illuminated and the autopilot must be disengaged, the pilot must be prepared for an out-of-trim condition in the annunciated direction.

A separate additional AP PITCH MISTRIM/AP ROLL MISTRIM annunciator is located on the annunciator panel where it is more readily visible to the pilots. The AP PITCH MISTRIM annunciator is a repeat of the TRIM annunciator on the autopilot control panel. The AP ROLL MISTRIM annunciator indicates to the pilot that a sufficient level of roll mistrim is present that the pilot must be prepared for an out-of-trim roll condition if the autopilot is disconnected. The bank limit (LOW) mode may be selected if it is desired to limit the maximum bank angle during autopilot operation. The mode is limited to use in conjunction with heading (HDG) mode only. When the bank limit mode is engaged, the autopilot maximum bank angle is limited to 14 degrees. When the mode is engaged, LOW will annunciate in the pushbutton. Low bank mode will be automatically selected when climbing through 34,000 feet altitude, and automatically cancelled when descending through 33,750 feet. If heading mode is selected and then deselected while low bank is engaged low bank mode will be disengaged and the engage light will extinguish during the time heading mode is disengaged, but low bank mode will reengage and the LOW annunciator will re-illuminate when heading mode is reengaged. When low bank mode is engaged, a green low bank limit mark will appear on each side of the vertical index at the top of the attitude sphere.

The autopilot is normally disengaged in one of three ways: (1) depressing the AP/TRIM DISC switch on either yoke, (2) electrically trimming the elevator trim system, or (3) depressing the go-around button on either throttle. Actuation of the touch control steering button on the yoke will interrupt the pitch and roll servos until the switch is released; the yaw damper will remain engaged. If the autopilot is disengaged by any of the above three ways, a warning tone will sound for one second and the amber AUTOPILOT OFF light will illuminate for one second. Any other disconnect will cause the warning tone to sound for one second and the amber AUTOPILOT OFF light to stay illuminated. The amber light can be turned off by holding the AP/TRIM DISC switch for two seconds, or by pressing the electric trim switch or the go-around (GA) button on either throttle. The autopilot will also disengage if an overriding force (sustained torque) is applied to the vertical or horizontal axis for a minimum preset time. Disconnect will be annunciated by the one-second disconnect tone and illumination of the autopilot disconnect light, until the light is extinguished by one of the above methods.

# ALTITUDE ALERTING SYSTEM

An altitude alerting system provides a visual indication of when the airplane is within 1000 feet of a preselected altitude and normalizes when the airplane is within 200 feet of the preselected altitude. After capture, the system will reactivate if the airplane departs more than 200 feet from the selected altitude. As the airplane approaches within 1000 feet of the preselected altitude, the color of the altitude display will change to amber and the altitude alert warning tone will sound for one second. As the airplane approaches to within 200 feet of the selected altitude, the display will change back to blue. If the airplane again deviates from the selected altitude by more than 200 feet, the altitude display will change to amber and the altitude alert tone will sound for one second. The display will remain amber until the airplane returns to within 200 feet of the altitude, or until the altitude selection is reset. The altitude selection is set into the upper right corner of the primary flight display (PFD) by means of the ALT SEL knob on the lower right side of the multifunction display (MFD). The selected altitude setting is also visible, in the same color codes, above the ALT SET knob on the MFD.

The altitude alert function works in conjunction with altitude preselect (ASEL) mode, which is described below. The only difference in operation of altitude alert function alone is that the flight director and/or autopilot need not be engaged for altitude alert to function. The altitude alert annunciations are controlled by the pertinent flight director, which is selected by the autopilot couple switch (AP XFER FD1/AP XFER FD2), and are therefore based on the barometrically corrected altitude displayed on the same side of the cockpit. If the altitude set knob is moved or the glide slope capture mode is active, the annunciations of altitude alert will be cancelled.

# PRIMUS 1000 SYSTEM OPERATION

The Primus 1000 system incorporates a wide variety of capabilities that produces one of the most precise, flexible and easy to use systems in airplanes today. The flight director and autopilot can be used independently or together. The airplane may be flown manually, using the guidance provided by the modes selected on the flight director, or when the autopilot is engaged and coupled to the flight director it will control the airplane using the commands generated by the flight director computer. Disengagement of the autopilot will have no effect on the FD modes in operation at the moment of disengagement, except when using the go-around button, in which case a wings level 10-degree nose up attitude will be commanded and all other FD modes will be reset. When the autopilot is engaged without any mode selected, manual pitch and roll commands may be made by means of the turn knob and pitch wheel on the autopilot controller. Touch control steering (TCS) can be used to maneuver the airplane or to modify the commands to the FD and AP. If the autopilot is not engaged, the TCS button can be used to synchronize the command bars to the airplane attitude. If HDG mode has been selected, BANK LIMIT mode may be engaged and the maximum bank angle will be limited to approximately 14 degrees.

The Primus 1000 system in the Citation Excel Model 560 operates through displays of the pilot's (or copilot's) electronic flight instrument system (EFIS). The systems of autopilot and EFIS are integrated, and unnecessary system redundancy has thereby been eliminated. The result is an overall simplification over previous systems, and greatly simplified interface requirements for the flight director function. If a particular EFIS unit is operational, the flight director will also be operational, and conversely if the EFIS has failed, the flight director will also be failed. The display is available as a single-cue or a double-cue (cross-pointer) presentation, the selection of which is made by means of the SC/CP button on the DC-550 Display Controller. The presentation upon power-up is single-cue. Glideslope information is presented on the right side of the electronic attitude director indicator (ADI) section of the primary flight display (PFD). The pertinent command bar(s) of the flight director can be brought into view, when double cue display is selected, by selecting any mode. If single cue mode is selected, selection of only a vertical mode will not bring the command bars into view.

The autopilot may be switched to the pilot's flight director (FD 1) or the copilot's flight director (FD 2) by means of an illuminated selector switch (AP XFER FD1/AP XFER FD2) located on the center instrument panel. This switch determines only which flight director system provides guidance to the autopilot.

## BASIC AUTOPILOT

The basic autopilot, without any inputs from the flight director system, can be used for pitch, roll and heading hold. The autopilot will hold the pitch attitude existing at the moment of AP engagement and the pitch attitude existing at the moment of disengagement of a vertical mode. PIT and ROL will be annunciated for the basic modes.

The autopilot can be engaged in any reasonable attitude; however, unless touch control steering (TCS) is used in conjunction with autopilot engagement, the autopilot will roll wings level if engaged while in a bank. If the bank is less than six degrees at engagement, the autopilot will hold the heading indicated when the autopilot is engaged. If the bank is over six degrees at engagement, it will hold the heading indicated when the airplane rolls through six degrees of bank on the way to wings level. If a lateral mode is disengaged, the autopilot will hold the heading existing at the moment of disengagement. If the turn controller is out of the center detent position, the autopilot will not engage.

## ALTITUDE ALERTING SYSTEM

The altitude alerting system is automatically engaged in conjunction with the altitude preselect mode (ASEL). The desired altitude is set into the system for use of the ASEL mode. The altitude is set into the lower right corner of the MFD and on top of the PFD altitude tape scales with the ALT Sel knob on the right hand side of the MFD bezel. The desired flight director mode which is to be used to reach the designated altitude is then selected on the flight director/autopilot mode control panel. Refer to Altitude Hold and Altitude Preselect, below. If the pilot does not desire to select a flight director mode, the airplane can be flown manually and the altitude alerting system will still provide the appropriate annunciations.

## TOUCH CONTROL STEERING

Touch control steering (TCS) enables the airplane to be maneuvered manually during autopilot operation without cancellation of any selected flight director modes. To use touch control steering, press the TCS button, maneuver the airplane and release the TCS button. TCS is operable with all autopilot modes. During TCS operation the yaw damper will remain engaged.

If the autopilot is engaged in a bank and it is desired to hold the bank, press the TCS button, engage the autopilot and release the TCS button. The bank will be maintained if it is in excess of six degrees. The airplane may be rolled level with the turn knob. The memory function holding the autopilot in a bank will be canceled when the turn knob is moved out of detent.

In the case of Flight Level Change (FLC) (IAS or MACH annunciated) mode, vertical speed (VS) mode or altitude hold (ALT) mode, the TCS button may be depressed and the airplane maneuvered to a new reference. When the TCS button is released, the flight director/autopilot will maintain the new reference.

## HEADING MODE (HDG)

The heading mode (HDG - annunciated in green letters in the top left of the ADI) can be used with the flight director (FD) only, or in conjunction with the autopilot. When the heading (HDG) mode is selected on the MS-560 Mode Selector, the command bars will come into view and display a steering command that is controlled by the HDG cursor (bug) on the HSI. The heading bug is set by means of the RI-553 Remote Instrument Controller located on the pilot's pedestal. The command bars will synchronize vertically to the pitch attitude at the time of HDG selection. Heading mode will be engaged automatically if another lateral mode is selected and the airplane is outside the capture parameters of that mode. In this case, HDG mode will remain ON until the airplane arrives at a point where capture can occur. The selected mode will then capture and be annunciated in the mode selector and in green letters at the top left side of the HSI, and HDG will cancel. If the autopilot is also engaged, the autopilot will receive steering commands according to the selected mode(s). NAV and APR modes can be armed with the HDG mode ON. When intercepting a VOR radial or localizer course with the NAV or APR modes selected, the system will switch from ARM to CAP when within the capture limits and the armed mode will be captured.

# RI-553 REMOTE INSTRUMENT CONTROLLER

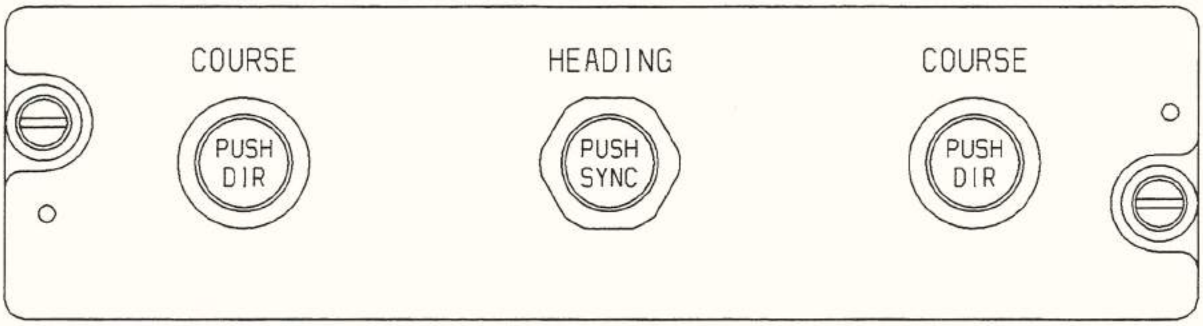



Figure 3-16

## NAV (VOR) AND NAV APR (APR) MODES

Two different modes of capture and tracking a VOR signal are used in the Primus 1000 system. One method is used for normal enroute navigation (VOR) and the other for a VOR approach (APR).

For enroute navigation, the desired VOR frequency is selected on a NAV receiver, the course bearing set on the HSI, and NAV mode is selected on the MS-560 Flight Director Mode Selector. The small green light in the mode selector will illuminate, and if the airplane is outside the NAV capture limits, VOR will be annunciated in white at the top left of the ADI and HDG will be annunciated in green also at the top left of the ADI. As the airplane is maneuvered within the capture limits, HDG will extinguish and VOR will illuminate in the green at the top left of the ADI. When the mode is transitioning to capture, a white box will be drawn around the mode for five seconds.

For a VOR approach (APR mode), the desired VOR frequency is selected on the NAV receiver, the course bearing set on the HSI, and the APR mode is selected on the flight director mode selector. The green light will illuminate in the APR button and, if outside the capture limits, APR will illuminate in white on the top left side of the ADI. HDG will annunciate in green also in the top left side of the ADI. When the airplane maneuvers into capture range, HDG mode will cancel and APR will annunciate in green in the top left side of the ADI. A white box will be drawn around the capturing mode for five seconds.

In both NAV and APP modes, a station passage feature is provided that incorporates bank angle limits and a course hold (plus wind drift) mode. The station passage mode for enroute tracking (NAV mode) is of long enough duration to provide smooth transition of a VOR station at any altitude. The station passage mode for APP mode is of short duration to provide approach accuracy. This does not provide the degree of ride smoothing that is present in the enroute case.

With a localizer frequency selected in a NAV receiver, operation is similar to capturing and tracking a VOR radial. Selecting APR on the mode control panel with a localizer frequency tuned, arms both the LOC and GS modes and engages HDG, if not previously selected and the airplane is outside the capture parameters of the mode. HDG will be displayed in green at the top left of the ADI and the green light in the APR button of the mode selector will illuminate; LOC and GS will be illuminated in white on the upper left and right, respectively, of the ADI. When inside the LOC capture limits, LOC will illuminate in green at the top left of the ADI and HDG will extinguish. At glideslope capture (approximately 1/2 dot), GS will illuminate in green on the ADI. During transition to both the LOC and GS capture modes a white box will be drawn around the respective mode annunciations. During ILS approaches, the FD gain is progressively adjusted during the approach using GS deviation, radio altitude, and middle marker passage for gain programming. If the radio altimeter is not operational, this function is performed as a function of glideslope capture and middle marker passage.

The capture limits for VOR and LOC captures are variable depending on DME distance, speed and intercept angle. Glideslope capture is locked out until localizer capture occurs. If the localizer mode becomes invalid for any reason, the glideslope mode will also be cancelled.

The glide slope indicator, located on the right side of the ADI presentation, is green unless there is a cross-side selection, in which case it will be yellow.

## BACK COURSE LOCALIZER APPROACH (BC)

A back course localizer approach capability is provided using either flight director or autopilot or both.

With a localizer frequency set in the selected NAV, selecting BC on the mode selector arms the system for a back course localizer approach. The front course of the ILS must be set into the HSI to give proper indications on the course deviation bar and for the flight director computer to compute correct back course corrections during the approach. If the the back course is set on the HSI the command bars and autopilot will be given incorrect steering commands. When BC is selected on the mode selector, the green light in the button will illuminate and BC will be annunciated in white on the left top side of the HSI. HDG may illuminate in the top right side of the ADI if the airplane is outside of capture parameters for the mode and heading select mode engages in order to effect capture. When the back course is captured, BC will be illuminated in green on the top left side of the ADI and HDG will extinguish if heading mode was engaged to accomplish intercept.

## ALTITUDE HOLD (ALT) AND ALTITUDE PRESELECT (ASEL)

Selecting altitude hold (ALT) provides steering commands to maintain the altitude at the moment of engagement. An altitude preselect (ASEL) mode is also incorporated which provides a preprogramming capability. To use altitude preselect, the desired altitude is set into the ALT window in the lower right side of the MFD (and at the upper right corner of the primary flight display [PFD] at the same time) by means of the ALT SEL knob on the lower right side of the MFD. ASEL will illuminate in white in the top right side of the ADI to indicate that the altitude preselect mode is armed. The airplane may be maneuvered toward the desired altitude using any of several methods: the autopilot pitch wheel, touch control steering, FD pitch sync, speed hold, or vertical speed hold. If the airplane is flown manually, the flight director will guide the pilot onto the selected altitude. As the airplane approaches the desired altitude, the altitude preselect will capture at an altitude corresponding to approximately 1/5 the rate-of-climb/descent; i.e., at 2000 feet/minute climb rate, the system will capture approximately 400 feet prior to the selected altitude.

At capture, the mode ASEL will illuminate in green on the ADI. The flight director will perform a smooth level-off at the selected altitude. At level-off altitude, ALT mode will be automatically selected and displayed in green on the ADI. Once altitude hold is captured, the touch control steering (TCS) button on the control wheel can be used to change or trim the selected altitude. TCS operates in conjunction with the flight director or the autopilot or both. Once ALT mode is engaged, resetting the BARO setting on the pilot's altimeter will cause the airplane to climb or descend to recapture the same indicated altitude. Moving the autopilot pitch wheel will cause ALT or ASEL CAP modes to be canceled if either is selected.

Selection of a vertical mode without a lateral mode will provide autopilot tracking of the mode but the FD command bars will not be in view.

## FLIGHT LEVEL CHANGE HOLD AND VERTICAL SPEED HOLD

Flight Level Change (FLC) hold (IAS or MACH - mode selectable depends upon altitude) and vertical speed (VS) hold are selected by pressing the appropriate mode button (FLC or VS) on the MS-560 Flight Director Mode Control Selector. The flight director, autopilot, or both will hold the airspeed, (Mach if appropriate), or vertical speed indicated at the moment of engagement. The green light in the respective mode selector button will illuminate and VS or IAS (or Mach), as appropriate, will illuminate in green on the ADI. When initially selecting speed mode, the speed target will synchronize to the existing indicated airspeed for altitudes below 29,000 feet or at speeds less than 0.560 Mach, and will synchronize to the existing Mach number for altitudes above 29,000 feet or at speeds greater than 0.620 Mach. The target will automatically switch from indicated airspeed to the equivalent Mach number as the airplane climbs through 29,000 feet or exceeds 0.620 Mach. It will automatically switch from Mach number to the equivalent indicated airspeed as the airplane descends through 28,800 feet and decreases below 0.610 Mach. Upon initially selecting vertical speed hold mode, the vertical speed will synchronize to the existing vertical speed. Once the vertical speed mode is selected with the autopilot engaged, the pilot can select a different vertical speed with the pitch wheel on the autopilot controller (within the minimum/maximum limits). If the autopilot is engaged after VS mode is selected, the vertical speed must be resynchronized.

The autopilot pitch wheel may be used to change the reference speeds for both the speed mode and the vertical speed mode. The touch control steering (TCS) button may also be used to temporarily release the autopilot clutches and maneuver the airplane to a new reference. The airspeed, Mach, or vertical speed established when the (TCS) button is released will become the new reference.

A predetermined lower limit has been established, below which the FLC mode will not engage. At the opposite end of the speed spectrum, $V_{MO}$ or $M_{MO}$, as appropriate, will not be exceeded. If an upper limiting speed is attained the system will maintain the limiting speed, thus speed hold mode can be used to fly $V_{MO}$ or $M_{MO}$ descents.

Selection of the flight level change mode will cancel all other vertical modes except altitude preselect arm (ASEL - green annunciation) and glide slope arm (GS - green annunciation).

## GO-AROUND MODE

A go-around mode (GA) is available through buttons on the left and right throttles. Depressing one of the buttons will drop all other FD modes and disconnect the autopilot except for the yaw damper. The FD command bars will command a wings level and a ten-degree nose up climb attitude. GA will illuminate in green on the ADI. After go-around has been selected, the selection of any lateral mode will cancel the wings level roll command but the pitch-up command will remain. The go-around mode is canceled by selecting and entering a vertical mode, pressing the TCS button, transitioning to altitude preselect capture mode, engaging the autopilot, or by changing the autopilot flight director coupling status (only the side that becomes the new flight director master will cancel the go-around mode).

## PITCH SYNCHRONIZATION

When flying the airplane manually and using the flight director, the command bars may be matched to the existing pitch attitude, or if a vertical mode has been selected the mode reference may be changed, by pressing the touch control steering (TCS) button. When the TCS button is released, the command bars will synchronize to the airplane attitude existing at the moment of release. If a vertical mode is selected (ALT, VS, FLC), the flight director/autopilot will hold the vertical reference existing at the time of release.

# ELECTRONIC FLIGHT INSTRUMENT SYSTEM

The electronic flight instrument system (EFIS) is an integral part of the Primus 1000 Flight Guidance System. The EFIS system consists of three DU-870 electronic Primary Flight Displays (PFD) (excluding bezels, the three displays are interchangeable), and the center instrument panel mounted DU-870 Multi Function Display (MFD), a DC-550 Display Controller for each pilot, a single MS-560 Mode Selector, an MC-800 Multifunction Display Controller, and an RI-553 Remote Instrument Controller. An AZ-850 micro air data computer in each system also provides inputs which are used and displayed by the EFIS system; cross selection, or reversion, (ADC1/ADC2 annunciation) of micro air data computers is possible, which provides system redundancy. The heart of each pilot's system is an IC-600 Integrated Avionics Computer. It contains the flight director computer; the pilot's IC-600 also contains the autopilot computer. The symbol generator receives and processes airplane sensor inputs and transmits the data to the electronic primary flight displays (PFD) or multifunction display (MFD) in its system. In case of malfunction of a symbol generator, which is located in each IC-600, reversion is possible through a selection on the three-position SG REV selector (SG1/NORM/SG2) located on the multifunction display controller located on the center instrument panel.

Other parts of the system are discussed under different headings, since some of the sub-systems must be covered individually, and components of the EFIS system also comprise parts of those systems. The dual LCR-93 attitude and heading reference system (AHRS) for example, is also an important part of the integrated system, however, it is discussed under its own heading.

A conventional slip/skid indicator is attached to the bottom of each PFD, and a third is located under the Secondary Flight Display. Also, the bottom third of the roll attitude pointer in the attitude director indicator (ADI) portion of the PFD acts as slip-skid indicator. For zero lateral acceleration the bottom section of the triangular pointer aligns with the top part and forms a complete triangle; when lateral acceleration is detected, to the right for instance, the bottom part of the triangle moves to the left, as the ball in the conventional inclinometer will move. For left lateral acceleration the bottom of the triangle will move right. Both primary flight displays and the multifunction display can be dimmed manually by means of knobs on the respective controllers and the relative brightness will then be maintained photoelectrically.

Selections for navigation sources and bearing needle presentations are controlled by means of buttons and knobs on the DC-550 display controller (DC). The selected sources are annunciated on the primary flight displays. Each pilot may choose full or arc mode for compass display (pressing the HSI button on the display controller cycles the display), single cue or cross pointer flight director display, a display of ground speed (GS) or time-to-go (TTG), and elapsed time (ET). NAV 1 or NAV 2, or FMS may be selected for navigation display and control of the flight director. These functions are explained under Display Controller below. Additional knobs which select various navigation equipment for display (only) on the EFIS are also discussed below.

Operation of the EFIS is similar to a standard flight director system except for the presentation of additional information on the small format of two electronic display units. More information is available in a more compact arrangement and the format is variable as desired. Presentations that are not necessary or desired at any one time can be removed and replaced with more appropriate data for the existing flight conditions. The units of the system are discussed below.

## DISPLAY CONTROLLER

The display controller, located near the respective PFD on the pilot's and copilot's instrument panels, allows selection of the different display formats and provides for selection of required navigation sources and bearing data.

### DISPLAY CONTROLLER

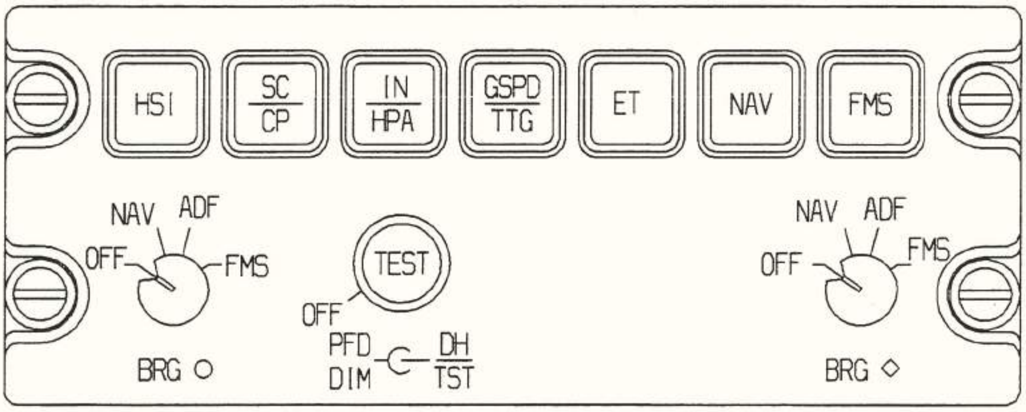



Figure 3-17

The individual controls are:

| | |
|---|---|
| HSI Button | Controls FULL or ARC (partial compass display). Displays 360 degrees in FULL mode and 90 degrees in ARC mode. Successive pushes change the mode back and forth. |
| SC/CP Button | Selects flight director command mode. Alternate action toggling between single cue and cross pointer flight director display. Power up state is single cue. Some European configurations have no CP option. |
| IN/HPA Button | Selects inches-of-mercury or hectopascals (millibars) for display and setting of baro information on the respective PFD. When HPA is selected, altitude digits near the BARO display show altitude in meters. |
| GSPD/TTG Button | Ground speed (GS) or time-to-go (TTG) is displayed in the lower right center of the HSI. Pressing the GSPD/TTG button provides alternating selection of GS or TTG to next station or waypoint. GSPD is the power up mode. |
| ET Button | Controls elapsed timer that appears in the HSI location dedicated to GSPD/TTG. Initial actuation enters the mode at the previous position. If elapsed time is being displayed, stops the display. Sequence of the ET button is: Reset - Elapsed Time - Stop - Repeat. |
| NAV Button | Pressing the NAV button selects the VOR for display on the HSI course deviation indicator (CDI). Pressing the button alternately selects NAV 1 and NAV 2 (annunciated VOR 1 and VOR 2 on the center right side of the HSI; ILS 1 and ILS 2, if ILS frequency is tuned in NAV). The flight director interfaces with the NAV that is selected and displayed on the HSI. |

| | |
|---|---|
| FMS Button | Selects flight management system (FMS) for display on the HSI; the flight director will interface with the FMS. The HSI course needle represents FMS course information on the bearing pointer. If two FMSs are installed the switch will toggle between the two. |
| Bearing " **O** " | This knob has four positions. The OFF position removes the bearing pointer from the display. In NAV 1 position, VOR 1 bearing information is displayed. In ADF 1 position, ADF 1 bearing is displayed. Selecting FMS displays FMS information. If two FMSs installed, selects FMS 1. |
| PFD DIM (Outer Concentric) | The DIM knob sets the overall brightness of the PFD. When a reference level is set, photoelectric sensors will maintain the relative brightness level in various lighting conditions. Full counterclockwise OFF position blanks the PFD and the PFD information is displayed on the MFD. |
| Radio Altitude | Rotation of the DH inner concentric knob adjusts the radio altitude decision height display on the ADI. Rotating the inner knob fully counterclockwise removes decision height information from the display. |
| Test Function (TEST) | Pressing and holding the TEST button causes the displays to enter the test mode. Flags, cautions, and all flight director and mode annunciations are tested and presented on the display. As the test button is held down an autopilot (left display only) and flight director system checks will be accomplished. Satisfactory or unsatisfactory test results will be annunciated on the display. The test will also result in a self-test of the radio altimeter system; 50 feet will be indicated in green at the bottom of the ADI display. The TEST button is wired through a squat switch and is completely active only when the airplane is on the ground. The Primus 1000 test is not active in flight, but a self-test of the radio altimeter system may be made in flight if the APR mode is not selected. The EFIS system will also automatically self-test when it is powered up. If the test is not satisfactory it will be so annunciated. |
| Bearing " ◇ " | This knob has four positions. The OFF position removes the bearing pointer from the display. In NAV 2, NAV 2 bearing is displayed. In ADF 2 position (if installed), ADF 2 bearing is displayed. In FMS position, FMS is displayed. Decal will be OFF/NAV/ADF/FMS, if FMS 2 is installed. |

## HEADING REVERSION SWITCH (HDG REV)

The heading reversion switch is an auxiliary push button switch (HDG REV) on the respective pilot's and copilot's instrument panels which allows selection of the opposite side attitude and heading reference system (AHRS) as an alternate (reversion) heading source for the pilot's or copilot's flight director. MAG 2 (MAG 1) or DG 2 (DG 1) will be annunciated in amber in the center-left of the PFD. The annunciation of MAG or DG will be controlled by the position of the respective AHRS DG/SLAVE/TEST switch on the pilot's or copilot's instrument panel. If there is no reversion selection and both systems are selected to their own respective sources, there will be no annunciation. If there is a cross-selection (reversion) on both sides, the annunciation will be in white. If the same AHRS is selected as a heading source on both sides, the heading source annunciation will be in amber, to apprise the pilots that both indicators are selected to the same heading source.

## ATTITUDE REVERSION SWITCH (ATT REV)

The attitude reversion switch (ATT REV) is an auxiliary push button switch on the respective pilot's and copilot's instrument panels which allows selection of the opposite side attitude and heading reference system (AHRS) as an alternate (reversion) attitude source for the pilot's or copilot's attitude indicator (ADI) in their respective PFD. ATT 2 or ATT 1 will be annunciated in amber in the upper left of the PFD. If the same AHRS is selected as an attitude source for the attitude indicators on both sides, the attitude source annunciation will be in amber; if both systems are selected to their respective sources there will be no annunciation. If there is a cross-selection (reversion) on both sides the annunciation will be in white. In case of a reversion selection, the annunciation is in amber to apprise the pilots that both indicators are selected to the same attitude source.

## RADOME COOLING FAN

An avionics cooling fan is mounted well forward in the right side of the nose compartment to provide circulation of cooling air to the radar set and other nose mounted avionics while on the ground. An amber RADOME FAN annunciator on the annunciator panel monitors the condition of the cooling fan. If the RADOME FAN annunciator illuminates, indicating failure of the fan, procedures in the Abnormal Procedures Section should be followed. In flight, no abnormal conditions should be experienced, however, ground operation is time limited.

## EFIS BACKUP MODES

In case of a symbol generator (SG) failure, the side having the failure may be selected to the opposite side SG by means of the SG REV selector (SG 1/NORM/SG 2) on the multifunction display controller on the center instrument panel. If SG1 is selected it means that the symbol generator in the pilot's IC-600 is driving both PFDs. SG2 means the symbol generator in the copilot's IC-600 is driving both PFD displays. In these cases both PFD displays will have the same format. The annunciation (SG 1 or SG 2) will be in amber.

## AUXILIARY EFIS ANNUNCIATORS

Various amber annunciators, located on the airplane annunciator panel and in the upper left corner of the multifunction display (MFD), are used to monitor the condition of the various components of the EFIS system. Procedures in the Abnormal Procedures Section of this manual and the FAA Approved Airplane Flight Manual must be followed in the event of illumination of one or more of the annunciators. Their function is to warn of overtemperature and failure conditions in the respective primary flight displays or other EFIS components as follows:

| | |
|---|---|
| IC-1 HOT | Indicates Pilot IC-600 Integrated Avionics Computer Overtemperature Condition. |
| IC-2 HOT | Indicates Copilot IC-600 Integrated Avionics Computer Overtemperature Condition. |
| IC-1-2 HOT | Indicates Overtemperature Condition of Both IC-600 Integrated Avionics Computers. |
| IC-1 FAN | Indicates Failure of Pilot's IC-600 Cooling Fan. |
| IC-2 FAN | Indicates Failure of Copilot's IC-600 Cooling Fan. |
| IC-1-2 FAN | Indicates Failure of Both Pilot's and Copilot's IC-600 Cooling Fans. |

| | |
|---|---|
| CHK PFD1 | IC-600 Display Guidance Computer Detects a Wrap-around Failure in PFD 1. This annunciator appears in the MFD and is also found on the annunciator panel. |
| CHK PFD2 | IC-600 Display Guidance Computer Detects a Wrap-around Failure in PFD 2. This annunciator appears in the MFD and is also found on the annunciator panel. |
| CHK PFD1-2 | IC-600 Display Guidance Computers Detect a Wrap-around Failure in Both PFDs. |
| AHRS BASIC-1 | Indicates AHRS 1 is in basic mode. |
| AHRS BASIC-2 | Indicates AHRS 2 is in basic mode. |
| AHRS BASIC-1-2 | Indicates that both AHRS are in basic mode. |
| AHRS AUX PWR-1-2 | Indicates AHRS 1 or 2 has transferred to the auxiliary battery due to loss of DC power. |

## ATTITUDE DIRECTOR INDICATOR (ADI)

Certain displays form a permanent part of the attitude director indicator (ADI) portion of the Primary Flight Display (PFD). The displays are: the blue and brown sphere, the pitch and roll attitude reference marks, the airplane symbol, the conventional inclinometer which is fixed to the lower part of the PFD, and the electronic slip-skid indicator. Some annunciations which are presented in the ADI display are annunciations for other systems which are discussed under the headings of those systems, since they are not associated with ADI information. The flight director command bars will be in view on power up unless there is no lateral mode selected. The single-cue flight director presentation is the power-up mode.

Other displays are present when selected or during certain phases of a flight. When not in use, the displays are removed from view. The displays are:

| | |
|---|---|
| Decision Height (Radio Alt) Minimums | The radio altitude minimums readout is a three-digit display identified RA (white) located below and right of the attitude sphere.. The value of the decision height is identified in cyan numbers. It is set by rotating the DH set knob on the display controller. Full counterclockwise rotation removes the display from view. A decision height annunciation (MIN in amber inside a black box with white background) appears in the upper left of the attitude sphere at radio altitudes less than or equal to the decision height setting and flashes for ten seconds. Decision height will not be annunciated until it is armed. Arming occurs when the “weight on wheels” switch senses “in air” and a radio altitude of 100 feet greater than the selected decision height exists for at least five seconds. |
| Flight Director Mode Annunciators | Armed mode annunciations appear in white at the top left (lateral modes) and the top right (vertical modes) of the ADI presentation. Captured mode annunciations appear in green. When a mode is not selected, the annunciation is not present. As a mode transitions from armed to captured, a white box is drawn around the annunciation for five seconds. |

| | |
|---|---|
| Marker Beacon | Marker beacon information appears below the glideslope indicator when ILS is tuned. A white box, in which the appropriate letter will flash when a marker beacon is passed, will be located in that position. Outer marker is identified with a cyan "O", middle marker by an amber "M" and inner marker by a white "I". |
| Comparison Monitors | Amber attitude comparison monitor warnings (ROL, PIT, ATT), and localizer and glideslope comparison monitor warning (LOC, GS and ILS) are located at the lower left side of the attitude sphere. Parameters for the illumination of comparator warnings are discussed under Comparison Monitor, below in this section. |
| Flight Director Couple Arrow | The green flight director couple arrow is positioned at the top center of the PFD. The arrow is left pointing or right pointing to indicate which flight director the autopilot is coupled to. (This display is always present.) |
| Low Altitude Awareness | A “Low altitude awareness” indication of a solid brown raster band will appear on the altitude tape as the radio altitude drops below 550 feet. When the airplane is on the ground the brown band will cover the lower half of the altitude tape. A yellow line will be drawn at the intersection of the brown and grey band of the altitude tape, until radio altitude drops below 60 feet. There will be no written information displayed in the brown raster tape. |
| Glideslope | When an ILS frequency is tuned, glideslope information will appear. Indication is conventional in appearance. Green color of the vertical scale pointer identifies the information as glide slope information (pilot tuned to ILS 1 and copilot to ILS 2) (yellow if same NAV is selected on both sides or “cross-selected”.) When tuned to other than an ILS frequency, the glideslope disappears. |

**NOTE**

When the back course (BC) mode is selected on the flight director the glide slope indication will not be present.

# PRIMARY FLIGHT DISPLAY


6585M6129

Figure 3-18

**Flight Director Command Cue**

The magenta flight director command cues can be selected in single cue or cross pointer format be pressing the SC/CP button on the DC-550 Display Controller. In the single cue format, if a lateral mode is not selected, the command bars will remain biased out of view. Power up default selection is single cue.

**Radio Altitude**

When at an altitude within operational range of the radio altimeter, the radio altitude display appears in green in the lower section of the ADI sphere.

| | |
|---|---|
| Source Annunciations | Source annunciations (ADC1 and ADC2, ATT1 and ATT2, SG1 and SG2) will be displayed to indicate the sources of air data, attitude and symbol generator information, respectively. If the pilot and copilot are using their normal sources, there is no source annunciated. "Cross-selections" will be annunciated in white, and when both displays are selected to the same source the annunciation will be in amber, to remind the pilots of the single source selection. Annunciation is in the upper left section of the ADI display. |

## ADI CAUTION OR FAILURE ANNUNCIATIONS

| | |
|---|---|
| Flight Director Failure | If the flight director fails, the flight director command bars disappear and an amber FD FAIL warning appears in the top left center of the display. All FD mode annunciators will be removed. |
| Internal Failures | A large red X will cover the face of the primary flight display. |
| Radio Altimeter Failure | If the radio altimeter fails, the radio altitude readout will be replaced by an amber RA. If the low altitude awareness indication is present, it will be removed. |
| Pointer/Scale Failures (Glide Slope [Vertical Deviation], Altitude, Airspeed, and Vertical Speed) | Failure of pointers/scales is indicated by: Replacing the digital readouts with dashes, drawing a red X through the scale (IAS, ALT, GS only), and removing the pointer (GS and VS only). The digital readout inside the vertical speed scale will be replaced by amber dashes. |
| Attitude Failure | Attitude failure is annunciated by appearance of ATT FAIL in red in the middle of the attitude sphere. The sphere will change to solid blue, and the pitch scale and roll pointer will disappear. |

## EXCESSIVE ATTITUDE DECLUTTER

When roll or pitch attitude becomes excessive, certain symbology is removed from the PFD in order to declutter the display. A roll attitude of greater than 65 degrees in either direction, a pitch attitude of greater than 30 degrees nose up or 20 degrees nose down will trigger the declutter mode, removing many of the digital readouts, failure flags, comparison monitor annunciations, and mode annunciations from the ADI display.

When the roll attitude becomes less the 63 degrees, the nose up pitch attitude less than 28 degrees, and the nose down attitude less than 18 degrees, the removed symbology will be restored.

# HORIZONTAL SITUATION INDICATOR (HSI)

The displays in the HSI portion of the PFD are discussed below in three categories: FULL TIME which are always present, PART TIME which are sometimes present, and the arc mode.

## FULL TIME DISPLAYS

Certain displays are always present on the HSI or are always present when certain navigation equipment is in operation. The airplane symbol is always present and provides a quick visual cue of airplane position relative to a selected course or heading.

The other full time displays are discussed serially below. The angular presentations are all similar to those seen on a mechanical HSI.

| | |
|---|---|
| Heading Dial and Digital Heading Readout | Heading information is presented on standard type compass dial format and digital heading readout is shown above the heading dial when in the ARC mode. |
| Heading Select Bug and Heading Select Readout | The heading bug is positioned around a compass dial with HDG knob on the remote instrument controller. The bug then retains its position in relation to the dial. A digital heading select readout is provided at the lower left of the display (cyan digits, white HDG label). The heading bug provides a heading error signal to the flight director. |
| Course Deviation Indicator | Navigation or localizer course. Course deviation and airplane position relationships are depicted as on a mechanical HSI instrument. The course deviation indicator also operates in conjunction with the long range NAV system. Refer to Part Time Displays, below, for Desired Track information. The CDI is positioned by the course knob on the remote instrument controller. The course knob is not functional when FMS mode is selected. The CDI is magenta when FMS course information is presented, green when on-side NAV information is being presented, and yellow when off-side NAV information is being presented. |
| TO/FROM Annunciator | Indicator points along selected course depicting whether the course will generally take the airplane to or from the selected station or waypoint. Indicator does not appear during localizer operation. |
| Distance Display | Indicates nautical miles to selected station or waypoint. Distance display is in 0-512 NM for selection of short range navigation equipment and 0-4095 NM format for long range equipment. DME HOLD is indicated by an amber H next to the readout. |

Navigation Source Annunciators

NAV source annunciations are displayed in the upper right corner of the HSI presentation. Long range sources are in magenta and short range sources are in green or yellow. A yellow indication means an "offside" selection or that both sources are the same. The label identification will always be white. A yellow annunciation of FMS indicates that both pilots are selected to the FMS.

## PART TIME DISPLAYS

Part time displays are present when selected on the display controller or the flight director mode selector panel. The mode and bearing pointers available depend upon optional equipment installed and may not be present in all installations. Some annunciations also concern other systems, which will be discussed under headings pertaining to those systems.

Bearing Pointer and Source Annunciation

The bearing pointers indicate relative bearing to the selected navaid and can be selected as desired on the display controller. Bearing pointers appear on the compass rose when they are selected by means of the knobs on the display controller, and the bearing pointer source annunciations are in the lower left of the HSI display. If NAV source is invalid or LOC frequency is tuned, the NAV bearing pointer and the annunciation will disappear. The "**O**" bearing displays NAV 1, ADF 1, or FMS. The "◇" bearing pointer displays NAV 2, ADF 2 (if installed), or FMS. In dual FMS installations the " **O** " bearing pointer displays FMS 1 and the "◇" bearing pointer displays FMS 2. In standard single ADF installations, ADF can be selected on either bearing pointer.

Elapsed Time Annunciation

Shows elapsed time in hours and minutes or minutes and seconds. Selection is made on display controller. Display is green with white label.

Time-to-Go and Ground Speed

Pressing the GS/TTG button on the display controller alternates time-to-go (to next waypoint or navaid) and ground speed displays. Display is in color determined by navaid selection/cross selection; label is white.

Desired Track

When long range navigation is selected, the course pointer becomes a desired track pointer. The long range nav system will position the desired track pointer. A desired track (DTRK) digital display will appear in the upper left corner of the HSI display. When FMS is selected, the course selection knob on the remote instrument controller is inactive. Color of the course deviation indicator (CDI) and digits will depend upon combination of short range and long range navigation sources selected.

| | |
|---|---|
| NAV Source Annunciation | Appears in the upper right side on the HSI presentation when a NAV (NAV), ILS (ILS), or FMS (FMS) source is selected as a navigation source. Distance to next waypoint or to selected VORTAC appears below the annunciation. Source will be annunciated by the color code of the annunciations and HSI course deviation indicator (CDI). Yellow means "same side" or "cross side" selection of both sources, and green means normal "on side" selection. Labels will be white. |
| Wind Display | The wind display (magenta direction and arrow) is located at the lower left-center of the display when FMS is selected for navigation. In single FMS installations, the wind display will be in magenta unless both sides are selected to FMS, in which case the display will be yellow. |

## ARC MODE (PARTIAL COMPASS FORMAT)

During operation in the arc mode, 90 degrees of arc presentation is visible on the HSI. Pressing the HSI button on the display controller toggles the display between the full and partial compass display.

| | |
|---|---|
| Range Rings | Display of the range rings aids in the use of radar returns when WX mode is selected. Center half-range ring represents half the value of the selected radar range. Range is controlled by the weather radar controller. Power up default is 50 nautical range. |
| Weather | Weather radar returns are displayed on the HSI when WX mode (HSI Button pressed) is selected on the display controller. WX mode forces the PFD into arc display if it was not already selected. Radar mode annunciations are presented on the left side of the HSI presentation and on the lower left side of the multifunction display (MFD). |

## HSI CAUTION OR FAILURE ANNUNCIATIONS

Amber caution annunciations will appear to indicate the following situations:

| | |
|---|---|
| DME Hold | When the DME is selected to HOLD, an amber H will appear to the left of the DME readout on the HSI. |
| FMS Alert Messages | Waypoint (WPT), dead reckoning (DR), GPS Integrity (INTG), or Degrade (DGR) messages appear in amber at the upper center-left of the HSI presentation to indicate, respectively, that a waypoint is being passed, the FMS is in dead reckoning, the GPS has an invalid receiver condition, or the FMS navigation has become degraded for any of various reasons. Amber MSG annunciated (flashing) in amber at the top center-right of the HSI display indicates that the FMS has a message on the FMS CDU. |
| Digital Display Cautions | When DME, ground speed (GSPD), time-to-go (TTG), or elapsed time (ET), digital readouts fail, the digital display will be replaced by amber dashes. |

| | |
|---|---|
| Target Alerts | An amber TGT on the left of the HSI indicates weather radar target alert. A green TGT annunciation indicates that target mode has been selected (enabled) on the weather radar. An amber annunciation means that a level three weather return has been detected in the forward 15 degrees of the forward antenna scan. |
| Digital Readouts | Failure of the course or heading select signals will cause these displays to be replaced by amber dashes. They are also dashed when the heading display is invalid. |
| Heading Source and Navigation Source | When the pilot and copilot select to the same heading source or NAV source, the source annunciators will be amber. If the NAV or heading sources are cross-switched, i.e., pilot to copilot and vice versa, the annunciation will also be in amber. Normal selections are not annunciated. |
| Heading Comparator Warning | HDG is annunciated in amber at the top left center of the HSI display to indicate that the comparator system has detected an excessive difference between the two heading indicators. |

Red failure annunciations will appear in the following instances and locations:

| | |
|---|---|
| Heading Failure | A heading failure will result in the following indications: heading and bearing annunciations and bearing pointers will disappear; HDG FAIL appears at top of heading dial. HDG, CRS SEL, and DTRK will dash. |
| Deviation Indicator Failures | A failure in the vertical deviation or glideslope system will result in removal of the applicable pointer and a red **X** being drawn through the scale. |
| Vertical Speed Display | A failure in the vertical speed indicator or invalid information to the indicator will result in the needle being removed from the display. The digital information will be removed and replaced with amber dashes. For an invalid vertical speed target display, the target bug shall be removed from the display and the vertical speed digital display shall be removed from the display. |
| Navigation Indicator Failures | A red **X** will be drawn through the lateral deviation scale and the bearing pointer shall be removed from the display. |

## COMPARISON MONITOR

Selected pilot and copilot input data are compared in the symbol generator. If the difference between the data exceeds predetermined levels, the out-of-tolerance symbol will be displayed in amber. A list of the compared signals and the displayed cautionary symbols is given below. When the compared pitch and roll attitude or glideslope and localizer signals are out of tolerance, a combined level (ATT or ILS) will be displayed.

| Compared Parameter | Annunciation | Triggering Difference |
|---|---|---|
| 1. Pitch Attitude | "PIT" | 5° |
| 2. Roll Attitude | "ROL" | 6° |
| 3. Heading | "HDG" * | 6° |
| 4. Localizer | "LOC"** | Approximately $\frac{1}{2}$ dot |
| 5. Glideslope | "GS"** | Approximately $\frac{3}{4}$ dot |
| 6. Pitch and Roll Attitude | "ATT" | 5° & 6° respectively |
| 7. Localizer and Glideslope | "ILS"** | $\frac{1}{2}$ & $\frac{3}{4}$ dot respectively |
| 8. Indicated Airspeed | "IAS"*** | 5 Knots |
| 9. Altitude | "ALT"*** | 200 Feet |

* If the compared heading sources are not the same (both MAG or TRU) the comparison monitor is disabled. Twelve degree triggering difference if roll attitude is greater than 6 degrees.

** These comparisons are only active during flight director, localizer, and glideslope capture with both NAV receivers tuned to a LOC frequency.

*** Airspeed and altitude displays will flash for ten seconds and then go steady.

# EFIS EQUIPMENT FAILURE CHECKLIST

Failure of equipment feeding information to EFIS will be annunciated by flags or dashes. Failure effects of EFIS equipment are listed in Figure 3-19 below.

For detailed information concerning operation of the Primus 1000 system, consult the P-1000 Integrated Avionics System Pilot's Manual for the Citation Excel. For detailed emergency/abnormal procedures refer to the Emergency and Abnormal procedures in Section Three of the FAA Approved Airplane Flight Manual and Sections Four and Five of this manual.

| FAILURE | ANNUNCIATION | FLIGHT DIRECTOR | PILOT ACTION |
|---|---|---|---|
| Symbol Generator Failure | Red **X** on PFD or display blank | All modes cancel | Select opposite symbol generator on MFD controller SG1/NORM/SG2 switch, to drive all displays. |
| Display Controller Failure | Display cannot be changed | N/A | Select opposite symbol generator on MFD controller SG1/NORM/SG2 switch, to drive all displays. |
| Display Failure | Display goes blank | None | Rotate dim knob - PFD on MFD. Opposite pilot flies airplane, or fly from standby instruments. |
| Heading Failure | Red HDG FAIL on HSI, map, bearing pointers etc. removed | Command Bars out of view | Select opposite heading AHRS source by pressing appropriate HDG REV button. |
| Attitude Failure | ATT FAIL annunciation; No pitch scale or roll pointer, sphere all blue | None | Select opposite vertical AHRS source by pressing appropriate ATT REV button. |
| Flight Director Failure | FD FAIL on PFD in upper left of ADI display | FD Cues and Mode Annunciations Removed | Select opposite flight director on AP XFER FD1/AP XFER FD2 Switch and select opposite SG on instrument panel SG1/NORM/SG2 switch. Mode and display selections must be made on opposite Mode Selector and Display Controller respectively. |

Figure 3-19

## MULTIFUNCTION DISPLAY SYSTEM

The Multifunction Display (MFD), the center DU-870 cathode ray tube, serves as the weather radar indicator. It can be used to display the horizontal navigation situation, either short range (VORTAC) or long range (FMS), and to display electronic checklists. It also provides backup capability to the EFIS systems, with a major sub-function. If a symbol generator on one side fails the pilot can, through the SG1/NORM/SG2 control on the MFD controller (MC-800), select the opposite side symbol generator to take over the failed side's display, and operation of the EFIS in that position will continue as before, with the selected symbol generator powering all three displays.

The multifunction display system expands on the navigation mapping capability of the EFIS, especially in conjunction with the flight management system (FMS). The MFD display may be used independently for navigation and mapping information without disturbing the HSIs, which may be then used without additional displays which would result in more "clutter" on the PFD HSI. The weather radar display may be selected independently (by selecting off all of the navigation functions) or overlaid on the navigation display provided by the flight management system, in order to show the airplane route with respect to the displayed weather returns.

## MULTIFUNCTION DISPLAY CONTROLLER (MC-800)

The EFIS multifunction display (MFD) controller, located on the center instrument panel, allows mode selections, display control, and symbol generator reversion control of the pilot's and copilot's systems. In addition to its navigation, reversion, and checklist functions the MFD control also provides for control of the display of the optional Traffic Collision Avoidance System (TCAS) when installed.

## MULTI-FUNCTION DISPLAY CONTROLLER

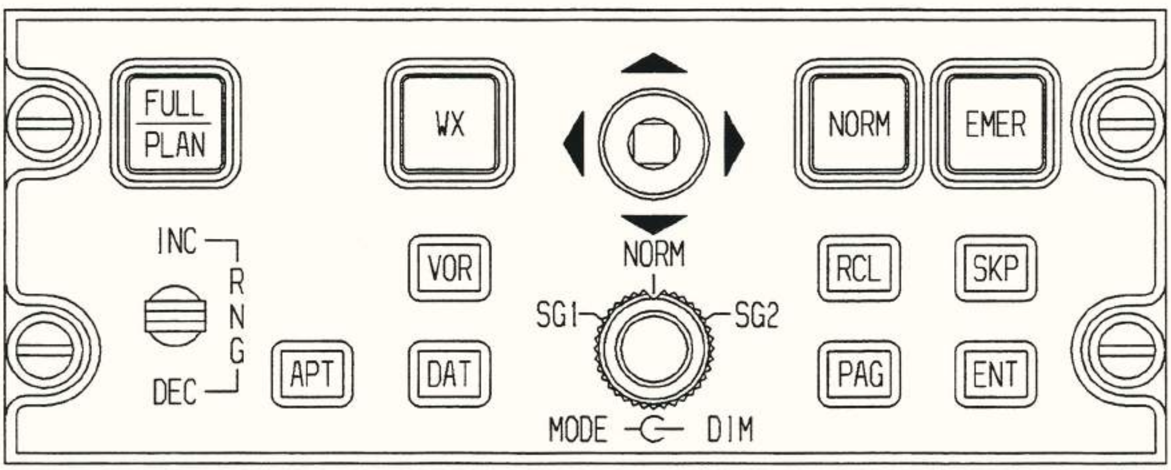



Figure 3-20

## MFD MODES OF OPERATION

The different modes of operation available to the multifunction display system are discussed below. The modes are: MAP/PLAN; WX; Checklist, with Normal and Emergency Procedures; and backup symbol generator modes for either of the primary flight displays (PFDs). The optional enhanced ground proximity warning system (EGPWS) and the optional Traffic Collision Avoidance System (TCAS) also operate through displays presented on the multifunction display. If the TCAS system is installed, the MFD controller will have an additional (TCAS) button located to the right of the MAP/PLAN button.

## MAP MODE

The MAP function is a partial arc airplane heading up display which is selected by the alternate action MAP/PLAN push button. The MFD display cycles from MAP to PLAN as the MAP/PLAN button is pressed. The MAP format allows totally independent use of the MFD display for navigation mapping and allows increasing the maximum range, beyond normal radar range, on the display which normally serves as the radar indicator. Power up mode is the MAP mode. To add weather to the display, press the WX button on the MFD controller. The MAP format is always oriented to the airplane heading and the airplane symbol is located at the center of the display. When coupled to the FMS, the NAV route, with up to ten waypoints, can be displayed to the range limit. When weather returns are selected, range control defaults to the WC-880 Weather Radar Controller.

## PLAN MODE

In PLAN mode the top of the display is oriented to North; a three-inch range ring is displayed and centered horizontally on the display area. An aircraft symbol is plotted at present position (if present position is on the display) and is oriented with respect to heading. The PLAN mode display encompasses 360°. Weather radar returns cannot be presented in the PLAN mode.

# TRAFFIC COLLISION AVOIDANCE SYSTEM (TCAS II) (OPTIONAL)

The TCAS mode allows the TCAS window to be displayed when TCAS is installed in the airplane. If TCAS II is installed, TCAS resolution advisories (on PFD) and traffic advisories (on MFD) and general TCAS operating modes and failure annunciations will be displayed on the respective display; the TCAS display is selected by the TCAS button found to the right of the MAP/PLAN button on the display controller. The button operates as a "push-on, push-off" switch for the display, which will appear at the lower part of the MFD display. The TCAS display is the same field that is used for the checklist display, with the checklist having higher priority. TCAS traffic displays will not overlay the normal flight plan display information. The TCAS window will display a 2-mile ring made up of twelve small circles, and an outer ring up to 20-mile range display, at which time the 2-mile ring will be replaced with a half-arc ring. TCAS mode annunciations are displayed in the upper left corner of the TCAS window. Traffic advisory (TA) and resolution advisory (RA) annunciations will be identified in the upper right corner of the TCAS window.

## WEATHER (WX) MODE

The WX mode allows the MFD display to be used as a weather radar indicator. In WX mode, weather data is presented on the MFD and is superimposed upon the normal navigation display. Weather radar can only be selected for display on the MFD if MAP mode is selected. If the MFD is in PLAN mode, selection of WX mode will force the display into MAP mode. Range selection is controlled by the weather radar control on the center pedestal (arrow up and arrow down). When the WX button is toggled, the progression of selection is: WX on - WX off. Annunciation of weather mode, warnings, and antenna tilt angle are provided at the lower middle-left of the MFD display. Annunciations are color coded in magenta, green, and amber according to the importance of the display. Operation of the weather radar with the weather radar control is discussed in this section. The MFD has a dedicated box in the lower left corner of the display, with four lines of display which include related WX mode annunciations plus antenna tilt angle and stabilization annunciation.

## EFIS BACKUP MODES

In case of a symbol generator (SG) failure, the side having the failure may be selected to the opposite side SG. If SG1 is selected, it means that the pilot's symbol generator in his IC-600 is driving all three displays. SG2 means the symbol generator in the copilot's IC-600 is driving all three PFD displays. In these cases the MFD will be normal and both PFD displays will have the same format. The multifunction display (MFD) has no complete symbol generator function of its own and its symbol generator is therefore not selectable. The MFD operates from IC-600 number one or number two.

## CHECKLIST MODE

The NORM button on the MC-800 provides entry into the normal checklist display function. The normal checklists are arranged in the order of standard flight operations. Button actuations cause presentation of the normal checklist index page that contains the lowest order incomplete and unskipped checklist with the active selection at that checklist.

The RCL, SKP, PAG, and ENT buttons and the joystick on the MC-800 provide control of this function and are discussed under "MFD Controls" below.

The EMER button on the MC-800 provides entry into the emergency checklist display function. Actuation of EMER results in the presentation of the first page of the emergency checklist index with the active selection at the first checklist. The RCL, SKP, PAG, and ENT buttons and the joystick provide control of this function and are described in "MFD Controls" below. These controls perform as described for NORM with the exception of the action taken upon completion of the checklist. All checklist items are removed from the page and "EMERGENCY PROCEDURE COMPLETE" is written below the amber checklist title. This will be cleared when the index is selected. The SKP, PAG and ENT buttons will be inoperative.

## MFD CONTROLS

Dim — This concentric knob controls overall MFD CRT dimming in addition to the automatic dimming feature accomplished by CRT mounted photodiodes. Counterclockwise dims display. The WX display is dimmed at the same time.

Joystick — The function of the joystick depends upon the type of MFD display:

MAP or PLAN: In MAP mode it moves the designator in the directions shown. In PLAN mode movement of the designator causes the flight plan to move while the designator remains fixed in the center of the PLAN circle.

TEXT:

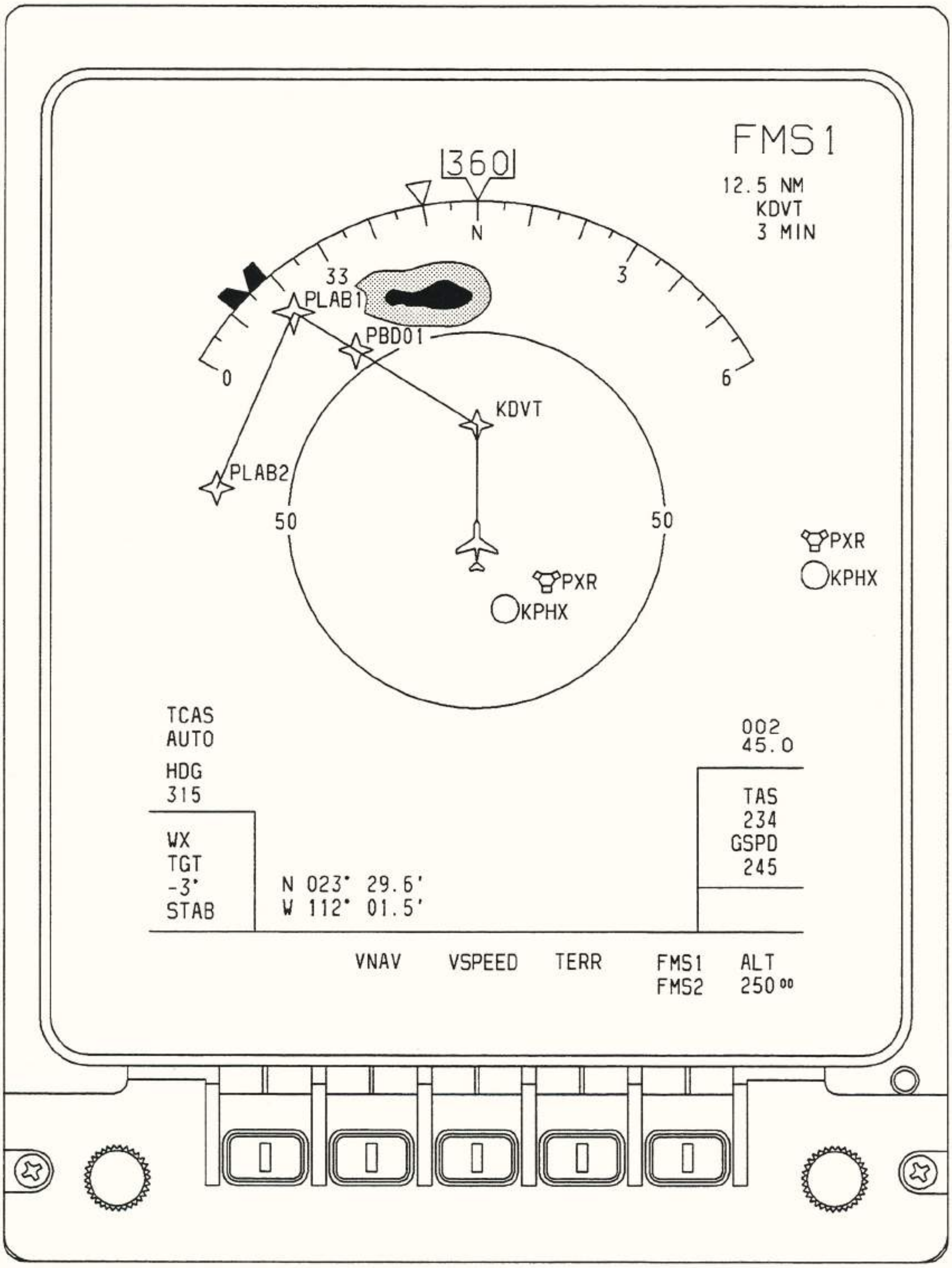
a. Vertical actuations of the joystick act as a cursor control by changing the active line. This provides an additional means of skipping lines or returning to a previously skipped line.

b. Horizontal actuations of the joystick control paging. Actuation to the right increases the page number, and actuation to the left decreases the page number.

| | |
|---|---|
| MAP/PLAN | Pressing the MAP/PLAN button selects the MAP MFD display mode. Pressing it again selects North-up PLAN mode. |
| WX | Weather radar data may be displayed with the MAP mode. The toggling sequence of this button is: WX on WX off. If PLAN mode is selected, selection of MAP mode will be forced when WX mode is selected. The WX and the MAP/PLAN buttons interact, the selection becoming PLAN, MAP with WX, or MAP without weather, depending upon which button was pressed last. |
| VOR | This button is used to display the four closest VORs, that are not on the active flight plan list, on the MFD MAP and PLAN displays. The first push of the button inserts the VORs with identifications. The second push removes the identification, and the third push removes the VORs from the display. |
| APT | The APT button is used to display the four closest airports, that are not on the active flight plan list, to the MFD MAP and PLAN displays. The first push of the APT button adds the airports with their identifiers. The next push of the button removes the airport identifiers . A third push of the button removes the airports from the MFD display. |
| DAT | This button is used to add long range NAV information to the MFD MAP and PLAN displays. The first push adds waypoint identifications and the second push removes them. |
| Range Controls | The MFD range controls are active only when WX is not selected for display. |
| (INC and DEC) | Selectable ranges (in the MAP mode) are 2.5, 5, 12.5, 25, 50, 100, 150, 300, and 600 NM. The switch position labeled INC increases the selected range, and DEC decreases the selected range. In PLAN mode the ranges are 5, 10, 25, 100, 200, 300, 600, and 1200 nautical miles. In WX mode this selector is inactive. Default mode is 100-nautical mile range with MAP selected. |
| NORM | When this button is pressed, the MFD will display the index page containing the lowest numbered uncompleted or unskipped normal checklist with the active line at that checklist. |
| | While operating in this mode, as a checklist is completed, the system will automatically step to the next uncompleted procedure of the index. |
| EMER | Actuation results in the display of the first page of the emergency checklist index. |
| RCL | The function of this button depends upon the type of MFD display: |
| MAP or PLAN: | Recalls the designator to its home position, or if the is the designator is at its home position, it moves it to present position. |
| TEXT: | Recalls the lowest numbered skipped line in a checklist by changing the active page and/or line. |

(Continued)

# TYPICAL MULTIFUNCTION DISPLAY

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## MAP MODE WITH WEATHER DISPLAYED

Figure 3-21

## MFD CONTROLS (Continued)

SKP — The function of this button depends upon the type of MFD display:

- MAP or PLAN: Skips the designator to the next waypoint. If the designator is not at the home position, the displacement line will be moved to the next waypoint.
- TEXT: Actuation skips the active line in a checklist or index and advances the active selection to the subsequent line. If the line skipped is the last line, the active selection will revert to the lowest numbered skipped line.

PAG — Actuation advances the page count and places the active line selection at the first line of the page. Actuation with the last page displayed will result in display of the lowest numbered page containing a skipped line with the active line selection at the lowest numbered skipped line.

ENT — The function of this button depends upon the type of MFD display:

- MAP or PLAN: With the designator moved from its home position, actuation of these buttons will enter the designator LAT/LON as a waypoint in place of the TO waypoint.
- TEXT: Actuation checks off a line in a checklist or selects an index line item for display.

## WAYPOINT LISTING MODE

The waypoint listing mode is a display showing the user the airplane's current position, the FROM waypoint, the TO waypoint, and any additional FMS waypoints on the flight plan up to a maximum of eight. If the waypoint listing is selected from the normal index mode, the display system will display data for the FROM waypoint, TO waypoint, present position, and up to eight additional waypoints from the current flight plan.

Information provided on the waypoint page will be the waypoint identifier, the latitude and longitude information, and the FMS distance.

# ENHANCED GROUND PROXIMITY WARNING SYSTEM

The enhanced ground proximity warning system monitors the airplane's flight path with respect to the terrain at radio altitudes from 50 to 2450 feet. If projected flight paths could result in impact with the terrain, unique aural and visual warnings are issued to the flight crew. The system is powered whenever power is applied to the airplane and it operates automatically in any one of six flight modes. If the airplane flies into an envelope which is protected by the warning system, the warning advisory will begin and will continue over the earphones and speakers until it is cleared by a positive pull up or the airplane flight path is no longer in the danger zone.

The EGPWS warning computer utilizes airspeed, altitude, and vertical speed signals from the micro air data computers as well as signals from the radio altimeter, glideslope indicators, landing gear position, flap position, angle-of-attack system, attitude AHRS, a world wide terrain elevation data base, and the selected radio altitude decision height to output the various aural and visual warnings.

There are four switch-annunciators in the system, (TERR NORM/TERR INHIB, GPWS FLAP NORM/GPWS FLAP OVRD, GPWS G/S//CANCELLED and GPWS TEST). The normal selection for the flap norm/override switch is for GPWS FLAP OVRD not to be illuminated. If it is desired to make approaches or landings with no flaps, nuisance warnings may be avoided by placing the switch to the GPWS FLAP OVRD position. If the pilot desires to purposely descend below the glideslope, the mode can be inhibited if the BELOW G/S annunciator/switch is pressed below 1000 feet above ground level.

The warnings for the different system flight modes are listed and described below:

Mode 1 - Excessive Descent Rate (SINK RATE Envelope)

The sink rate is measured barometrically and registers in a flight envelope beginning at approximately 4500 feet-per-minute at 2450 feet above ground level, decreasing progressively as the absolute altitude decreases. If the GPWS computer calculates that ground impact will occur in less then thirty seconds the red PULL UP light will illuminate and SINK RATE will be announced every three seconds. If the airplane enters a situation in which ground impact will occur within ten seconds or less, the red PULL UP light will illuminate and an aural warning PULL UP will be announced continually until the airplane is recovered by a positive pull up from the danger area.

Mode 2A - Excessive Closure Rate to Terrain

This mode protects the airplane from rising terrain after takeoff. The GPWS uses radio altitude, airspeed, and vertical speed to compute an excessive closure rate. At less than 2,000 feet AGL if the radio altitude begins to decrease rapidly and there is no excessive rate of descent. then the terrain must be rising rapidly beneath the airplane. The GPWS compares the airplane parameters to a programmed curve that varies with altitude AGL, terrain closure, and airspeed. In most cases, if ground impact is within 15 seconds the aural warning TERRAIN - TERRAIN will be heard once and the red PULL UP box in the PFD attitude sphere will illuminate. This is followed almost immediately by the continuous warning PULL UP until the airplane has exited the warning envelope. The red PULL UP box in the PFD attitude sphere will remain illuminated until the airplane has climbed approximately 300 feet above the last pull up message. If the flaps are in the landing configuration (out of the up position) or the flap override switch (GPWS FLAP OVRD ON has been activated, the warnings will not occur.

Mode 2B - Excessive Closure Rate to Terrain During Landing

The warning envelope for this mode is much smaller, in order to allow flight paths closer to terrain without nuisance warnings. During an approach to a landing this mode is armed when the flaps are in the landing configuration or the flap override mode has been selected, and the airplane is on a glide slope not more than 1.3 dots below the glide slope and the G/S CANCEL function has not been selected. Terrain closure rates between 2,500 and 10,000 feet per minute at less than 750 feet altitude AGL will result in a red PULL UP light and the message TERRAIN - TERRAIN followed by a continuous PULL UP warning. If this mode is entered with the landing gear down and the flaps in landing configuration, the red PULL UP light will illuminate and the message TERRAIN - TERRAIN will be heard. There will be no PULL UP warning.

Mode 3 - Descent after Takeoff

After takeoff, or go around from an altitude below 245 feet AGL, a negative rate-of-climb for a specific altitude loss will trigger an aural warning of DON'T SINK. The mode becomes active when the airplane leaves the ground or begins a go-around and the GPWS senses the airspeed increasing, no weight on wheels, the radio altitude increasing, and the landing gear and flaps retracted, etc. Above an altitude of 50 feet AGL the GPWS monitors both radio and barometric altitudes.
If the airplane begins to descend toward toward the surface, a comparison of radio altitude gained to that point is made with the barometric altitude being lost in the descent. When the barometric altitude loss becomes approximately ten percent of the radio altitude gained, the red PULL UP light will illuminate and the alert message DON'T SINK will be announced every three seconds. Once a positive rate of climb is re-established, the alert message will cease and the red PULL UP light will extinguish. In order to reduce nuisance warnings above 700 feet AGL, the alert envelope is shifted by five feet per second to allow greater loss of altitude before the alert is activated.

Mode 4A - Proximity to Terrain with the Landing Gear Up

This mode is intended to give protection against flying into terrain in cruise configuration. If an airplane has slowly descended toward relatively flat terrain or the terrain has risen slowly under the airplane, there will be no excessive descent rate warning as in Modes 1 or 2. This mode will also guard against making a wheels up landing.

With the wheels up and the flaps not out of the up position, the GPWS monitors the radio altitude and airspeed. At speeds above 178 knots indicated the GPWS will illuminate the red PULL UP light and provide the aural warning TOO LOW, TERRAIN every three seconds between 750 and 500 feet altitude AGL. The purpose of this warning is to alert the pilot to proximity to terrain at high airspeed. By climbing above the altitude at which the alert began a safe terrain clearance will be re-established and the warning will be canceled.

At airspeeds below 178 knots IAS the GPWS becomes concerned with aircraft configuration, since at lower airspeeds the crew is more likely to be configuring the airplane for landing. If the gear are not down before the airplane is less than 500 feet altitude AGL the warning TOO LOW, GEAR will be repeated every three seconds and the red PULL UP light will illuminate. Lowering the landing gear or climbing above 500 feet AGL will silence the warning. No warning will be heard if the wheels are down before the airplane descends through 500 feet altitude AGL.

Mode 4B -Proximity to Terrain with Flaps Up

Modes 4A and 4B are similar, however, mode 4B becomes active when the landing gear has been lowered. At airspeeds greater than 250 knots IAS , if the flaps are not out of the up position, the GPWS will illuminate the red PULL UP light and announce TOO LOW, TERRAIN every three seconds between 750 and 170 feet altitude AGL. Below 170 feet AGL the warning message changes to TOO LOW, FLAPS. Lowering the flaps to the landing configuration will cancel this warning.

In case specific conditions require a flaps up landing, or the pilot wishes to practice flaps up landings, mode 4B warnings can be eliminated by pressing the amber GPS FLAP OVRD switch on the instrument panel. The switch may be engaged any time the altitude is at least fifty feet altitude AGL. The yellow GPWS FLAP OVRD ON will illuminate; this will prevent flap warnings or will cancel flaps warnings which have occurred. Illumination of the amber GPWS FLAP OVRD ON portion of the switch/annunciator indicates that the warning has been disabled.

The flaps override function may be selected off by pressing the switch/annunciator again or by descending below 50 feet AGL upon landing, when it is automatically reset.

Mode 4C - Proximity to Terrain after Takeoff

This mode alerts pilots to the fact that the terrain is rising at a steeper gradient than the airplane is climbing. It does this by monitoring and noting a decreasing radio altitude even if the barometric altitude is increasing. A "minimum terrain clearance floor" is created by the GPWS when a takeoff is made, or when a go around is made from below 200 feet altitude AGL. This floor is generated starting at 100 feet AGL during a takeoff and 200 feet AGL during a go around. As the airplane climbs, the GPWS monitors the radio altimeter and records the highest point reached above ground level. If the radio altitude decreases to 75% of that maximum, the red PULL UP light will illuminate and TOO LOW, TERRAIN will be repeated every three seconds until the airplane climbs above the altitude at which the alert started.

Above 750 feet AGL the mode becomes inactive until the system detects another takeoff, or a go around from below 200 feet AGL.

Mode 5 - Descent Below Glide slope

Excessive descent below glide slope on an ILS approach will result in an alert from this mode. For the mode to become active the following conditions must be met:

1. A valid glide slope signal must be in reception from the NAV receiver selected for the approach.
2. The landing gear must be down.
3. The airplane must be below 925 feet altitude AGL.
4. The glide slope cancelled function (BELOW G/S//G/S CANCLED) must not have been selected.

If the above conditions have been met, the voice message GLIDE SLOPE will be heard between 925 and 300 feet AGL when the airplane is greater than 1.3 dots below the glide slope. The initial warning will be at a reduced volume, which is referred to as a "soft warning". Repetition of the voice warning varies with radio altitude. As the radio altitude decreases, the warning will be repeated more and more frequently.

If the airplane deviates more than 2.0 dots below the glide slope, or passes through 300 feet altitude AGL, the aural warning will increase to the normal warning message level. This is referred to as the "hard warning". All of the alerts cancel when the airplane returns to less than 1.0 dots below the glide slope.

If the pilot wishes to intentionally descend below the glide slope, the mode 5 warning can be canceled by pressing the G/S CANCLED button on the instrument panel The amber G/S CANCLED light will illuminate to indicate this condition. The mode will be cancelled and reset when the airplane descends below 50 feet altitude AGL, climbs above 1900 feet altitude AGL, or when a VOR frequency is tuned on the selected NAV radio.

Mode 6 - Altitude Callouts and Excessive Bank Angle

This mode is designed to enhance the pilot's situational awareness. During altitude or bank angle warnings no annunciators are illuminated. When the airplane descends through 500 feet altitude AGL on an approach to landing, the system will announce FIVE HUNDRED. This will only happen if the airplane is not on an ILS approach or is more than 2.0 dots below the glide slope. This warning will be silent if the airplane is near the glide slope on a properly executed ILS precision approach.

The electronic flight instrument system (EFIS) makes one input to the GPWS. As the airplane descends through the decision height selected on the DC-550 display controller (using the RA knob) will be announced as MINIMUMS - MINIMUMS. This announcement will be made only once per approach. If the decision height is set at 200 feet altitude AGL, the minimums warning will be heard instead of the 200 FEET warning. The minimums warning can be disabled by setting the decision height to less than 50 feet.

The GPWS monitors the bank angle of the airplane and compares it to the airplane's current altitude. The bank angle inputs are received from the pilot's and copilot's AHRS units. At ground level a bank angle of 15 degrees will produce a BANK ANGLE warning every three seconds. As altitude AGL increases the alert is shifted to progressively steeper angles of bank up to 50 degrees of bank at 150 feet altitude AGL; it remains at that maximum point as the altitude increases. When the bank angle is reduced below the warning point the warning will cease.

Self-Test

The system is self-tested by placing the rotary test switch on the center pedestal to the ANNUN position or by selecting GPWS TEST on the switch/annunciator on the center instrument panel, and holding it down for the duration of the test - approximately seven seconds. During system self-test by selecting GPWS TEST, MK VI warnings will be evidenced by the voice message PULL UP followed by GLIDE SLOPE and at least two more PULL UP MESSAGES.

When the GPWS system is tested by placing the rotary test switch to the ANNUN position, the following GPWS annunciations will occur:

1. GPWS TEST, GPWS G/S//CANCELLED, GPWS FLAP NORM/GPWS FLAP OVRD, and TERR NORM/TERR INHIB will come on immediately.

When the GPWS system is tested by selecting GPWS TEST, the following GPWS annunciations will occur:

1. GPWS FAIL and GPWS/WSHR FAIL annunciations on PFDs.
2. Glide slope callout.
3. GND PROX annunciation on PFD.
4. PULL UP annunciation on PFD.
5. WIND SHEAR annunciation on PFD.
6. Wind shear callout.
7. Terrain inop callout (with FMS off).

# TRAFFIC AND COLLISION AVOIDANCE SYSTEM II (TCAS-II) (OPTIONAL)

The TCAS II system visually presents traffic advisories on the multifunction displays to the flight crew. The system interrogates every transponder equipped airplane within the selected range for bearing and altitude data. It uses this data to establish a track for collision avoidance predictions.

The TCAS computer performs functions that determine range, bearing, and altitude of intruder aircraft based on information computed from or contained in the reply messages. Bearing can only be determined for intruder replies received on the system directional antenna. Altitude can only be determined if the intruder is reporting altitude in its transponder's reply message.

Based on the information that can be extracted from or computed from the reply, the TCAS computer evaluates the threat potential of the intruder by calculating intruder closing rate and position relative to own aircraft. Based on this evaluation the TCAS computer categorizes the intruder as a nonthreat, proximity or traffic advisory.

For traffic advisory category aircraft, the TCAS computer outputs traffic advisory symbol position and alert data to the EFIS. The TCAS computer also outputs traffic advisory alert voice messages to the cockpit audio system.

For proximity and nonthreat aircraft, the TCAS computer outputs proximity or nonthreat traffic symbol position data to the EFIS. Voice alerts are not generated for proximity or nonthreat category aircraft. Intruders which are not reporting altitude are also detected and tracked. By using the interrogation reply, the TCAS can accomplish the following:

(1) Compute range between own airplane and an intruder.
(2) Compute relative bearing to the intruder.
(3) Compute altitude and vertical speed of an intruder (if reporting altitude).
(4) Compute closing rate between an intruder and own airplane.
(5) Issue a traffic advisory (TA) when the closing traffic is in the vicinity.
(6) Issue a resolution advisory (RA) in order to maintain safe vertical separation.
(7) Track 45 aircraft at once, displaying up to 30, and can coordinate a resolution advisory for up to three intruders at once.

Certain functions of the traffic and collision avoidance system (TCAS) are tuned through the radio management unit (RMU). Other selections are made with controls on the multifunction display (MFD). For information on the MFD, refer to Flight Guidance System in this section. The ATC/TCAS control page display provides displays and controls for the TCAS modes. To access the page, the page (PGE) button is pressed, and the ATC/TCAS line key is then pressed.

On the ATC/TCAS control page the additional selections which follow may be made. System selection (INTRUDER ALTITUDE) is possible between two altitude modes; relative altitude or absolute altitude modes. In relative altitude (REL) (green) mode, the difference between the intruder airplane's altitude and own airplane altitude is displayed. In absolute altitude mode (FL), the flight level (cyan) of the intruder airplane is displayed. If FL is selected on the Honeywell system, the selection will return to REL in 20 seconds.

A TCAS selection may be made to display only traffic that constitutes a potential threat or all traffic. The TA DISPLAY line key is used to select AUTO, whereupon traffic will be displayed on the multifunction display (MFD) only if it is a TA (traffic advisory) or RA (resolution advisory) target. MANUAL on the same key selects an MFD display in which all TCAS traffic within the viewing airspace will be shown.

In the STANDBY (green) mode the TCAS computer shows no traffic displays and does not reply to other airplane interrogations. The standby mode is selected by pressing the STANDBY line key on the main tuning page, thereby causing the transponder not to transmit and disabling the TCAS system.

The primary TCAS selection is displayed in the lower left window of the RMU main tuning page. Control of those displayed functions is possible by means of the line keys and/or the tuning knobs, once the tuning box is moved to the desired function with the line key. Range and altitude bands are selectable. The following are included:

Altitude band select - With the NORMAL altitude band selected (green) the altitude display encompasses a range of ±2700 feet; with ABOVE (cyan) selected the altitude display changes to a range of -2700 feet to +7000 feet from own airplane altitude. If BELOW (cyan) is selected, the range becomes from, -7000 feet to +2700 feet from own airplane altitude.

Range (green) - Selectable at ranges of 6, 12, 20, and 40 NM. Selection is made by pressing the RANGE line key or by turning the tuning knobs once the tuning box is transferred to the RANGE function by pressing the line key.

TCAS Display 1/2 - This is the annunciation of which side's (pilot or copilot) TCAS display features the RMU is controlling. When the cursor is in the window, the 1/2 button is used for the selection. At power down the selections store.

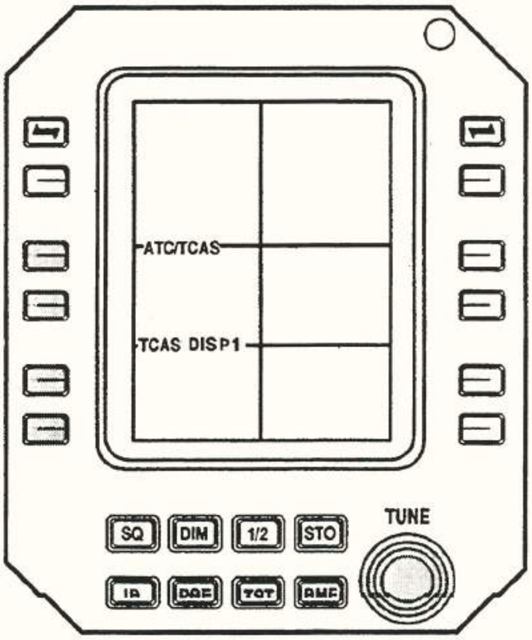
Flight ID is a mode S coding which reflects the current flight's call sign. The outer tuning knob moves the character position designator and the inner tuning knob selects the desired alphanumeric character.

The flight level 1/2 selection on the ATC/TCAS control page displays the transponder's encoded altitude and the air data source (digital air data computer 1 or 2) for that altitude (i.e., DADC 1 and DADC 2).

The TCAS system has a self-test which may be activated when the yellow cursor is in the ATC/TCAS window and the TST key is pressed on the RMU control. "TEST" will be displayed when the test is active. During the test the TCAS traffic displays will show test pattern traffic symbols, red and green resolution advisories, during the test sequence. The sequence takes approximately ten seconds. If the test is completed successfully the system will return to the set operating modes and aurally annunciate TCAS SYSTEM TEST OK on the cockpit audio system. For a failure in the TCAS system "TCAS FAIL" will be displayed in yellow on the TCAS display and the audio system aurally annunciates TCAS SYSTEM FAIL. TEST will operate either on the ground or airborne.

The TCAS system requires an operating mode S transponder with encoded altitude data included in the interrogation replies. When the transponder is set to STBY, the receiver transmitter may automatically change to standby mode or turn itself off.

# TCAS II CONTROL PANEL




**NOTE:** The shaded items represent the main controls for the TCAS II.

Figure 3-22

## DISPLAY INFORMATION

Messages concerning bearing information are displayed on two lines of text in the upper right side of the TCAS window whenever the system encounters an RA or TA target that has range but no bearing information for display. The color of each line is based on the type intruder. The first line contains the message RA NO BRG in red for an RA without bearing and the second line contains the message TA NO BRG in amber for a TA without bearing information.

The TCAS range ring boundary is a white full arc shown at the limits of the display window. The distance between the arc and the aircraft symbol is displayed in NM to the right of the arc.

The range ring is proportional to the selected range on the MFD, since the MC-800 MFD controller controls the map/plan mode range.

TCAS uses four color-coded symbols to map traffic and to locate aircraft which present a potential threat on the MFD. These symbols are a red solid square, an amber solid circle, a cyan solid diamond, and a hollow cyan diamond. These symbols represent traffic which has been identified and determined to pose a level of threat as, respectively, resolution advisory (RA), traffic advisory (TA), proximate traffic, and other traffic.

Red represents an immediate threat to TCAS equipped aircraft, and prompt action is necessary to maneuver for avoidance. Red color is used only in conjunction with a resolution advisory (RA). Amber represents a moderate threat (traffic advisory or TA) to TCAS equipped aircraft and a visual search is recommended to prepare for avoidance of the intruder. Amber is only used in conjunction with traffic advisory (TA) traffic. Other traffic is represented by cyan color.

# RADIO ALTIMETER

## COLLINS ALT-55B

The Collins ALT-55B radio altimeter displays radio altitude at all times up to an absolute altitude of 2500 feet. The system becomes operational when the airplane electrical system is powered up and it remains operational throughout the flight. Radio altitude is displayed in green digits located in the bottom center of the attitude sphere in the ADI displays.

The altitude display in the ADIs operates from -20 to 2500 feet. Between 200 and 2500 feet, the display is in ten feet increments. Below 200 feet, it is in 5-foot increments. Above 2500 feet, the display will disappear.

The radio altitude minimums (RA) selection is displayed digitally in the lower right side of the ADI display. It is selected by means of the DH/TST knob on the DC-550 display controller. The ADI radio altitude decision height range is from 200 to 999 feet in 10-foot increments and in 5-foot increments from 5 to 200 feet. Full counterclockwise rotation of the DH/TST knob on the DC-550 display controller removes the radio altitude DH display. A decision height warning tone will sound when the airplane reaches the decision height set on the pilot's ADI.

The decision height warning tone is controlled only by the DH setting in the pilot's ADI. The copilot's attitude sphere decision height selection has no effect on the sounding of the DH warning horn.

When the airplane descends below an altitude of 100 feet above the selected radio altitude decision height, a black box with a white background appears in the upper left side of the ADI. When the decision height is reached, an amber MIN appears inside the box. The display flashes for ten seconds and then goes steady.

A "low altitude awareness display", which is a brown strip along the right side of the DU-870 primary flight display, is used as a visual annunciation of the airplane's nearness to the ground. The low altitude awareness display is inside the bottom part of the altitude display and begins to appear when a radio altitude of less than 550 feet is reached. At touchdown, the low altitude awareness display reaches the horizon line. The yellow line, which divides the brown area from the rest of the display will disappear at a radio altitude below 60 feet.

If radio altimeter information is invalid, the radio altitude display will be amber dashes, and the low altitude awareness display will not appear.

Functional testing of the radio altimeter system and the ADI display digital readout is accomplished on the ground by depressing the TEST button on the DC-550 Display Controller. The following displays will occur: a radio altitude of 50, +5, -5 feet will be indicated until the button is released, at which time the actual altitude will be displayed. The radio altitude decision height display shows dashes when the TEST button is held down, and then displays the current set altitude for the remainder of the test. The radio altimeter TEST cannot be accomplished when APR CAP function of the flight director is selected. The radio altitude decision height tone check will depend on the radio altitude selection (RA) set on the pilot's ADI display. Testing the radio altimeter system with the TEST button on the DC-550 display controller will also test the EFIS failure flags and annunciators (lamps) in the MS-560 Flight Director Mode Selector.

**NOTE**

The test function activated by the TEST button is disabled after the glideslope has been captured during an ILS approach using the autopilot or flight director.

While taxiing over ice or snow, the radio altimeter may fluctuate by as much as fifty feet.

Outputs from the radio altimeter system are used to desensitize the flight director and autopilot as the airplane passes 1100 feet AGL with the glideslope engaged during an ILS approach. If the radio altitude is invalid, gain programming becomes a function of glideslope capture, time, and airspeed.

# PULSE EQUIPMENT

## PRIMUS 880 WEATHER RADAR

**WARNING**

**THE AREA WITHIN THE SCAN AREA AND WITHIN 15 FEET OF AN OPERATING WEATHER RADAR SYSTEM CONSTITUTES A HAZARDOUS AREA. DO NOT OPERATE THE RADAR SYSTEM WITHIN 15 FEET OF PERSONNEL OR FLAMMABLE OR EXPLOSIVE MATERIAL OR DURING FUELING OPERATIONS. FOR GROUND OPERATION OF A RADAR SYSTEM, POSITION THE AIRPLANE FACING AWAY FROM BUILDINGS OR LARGE METAL STRUCTURES THAT ARE LIKELY TO REFLECT RADAR ENERGY BACK TO THE AIRPLANE.**

The Primus 880 Weather Radar System is an X-band alphanumeric digital radar with display designed for weather location and analysis and for ground mapping. The radar system can also be operated in conjunction with Electronic Flight Instrument Systems (EFIS) and the Multifunction Display (MFD) to provide radar video to the EFIS HSI display and the MFD. The MFD display serves as the primary indicator for the weather radar display, which is controlled by the WC-880 Remote Radar Controller. The system detects storms along the flight path and gives the pilot a visual indication, in color, of storm intensity. Storm intensity is displayed at five color video levels with black representing weak or no returns and green, yellow, red and magenta showing progressively stronger returns. In ground mapping mode, video levels of increasing reflectivity are displayed as black, cyan, yellow and magenta.

**WARNING**

**THE SYSTEM PERFORMS ONLY THE FUNCTIONS OF WEATHER DETECTION AND GROUND MAPPING. IT SHOULD NOT BE USED OR RELIED UPON FOR PROXIMITY WARNING, ANTI-COLLISION OR TERRAIN AVOIDANCE.**

The system consists of a receiver-transmitter-antenna and a remote operating control panel mounted on the center pedestal.

The multifunction display controller (MC-800) is installed in the center instrument panel. Some functions of the multifunction display interface with the radar; these are also discussed under Electronic Flight Instrument System in this section.

# MULTIFUNCTION DISPLAY/PRIMUS 880 WEATHER RADAR

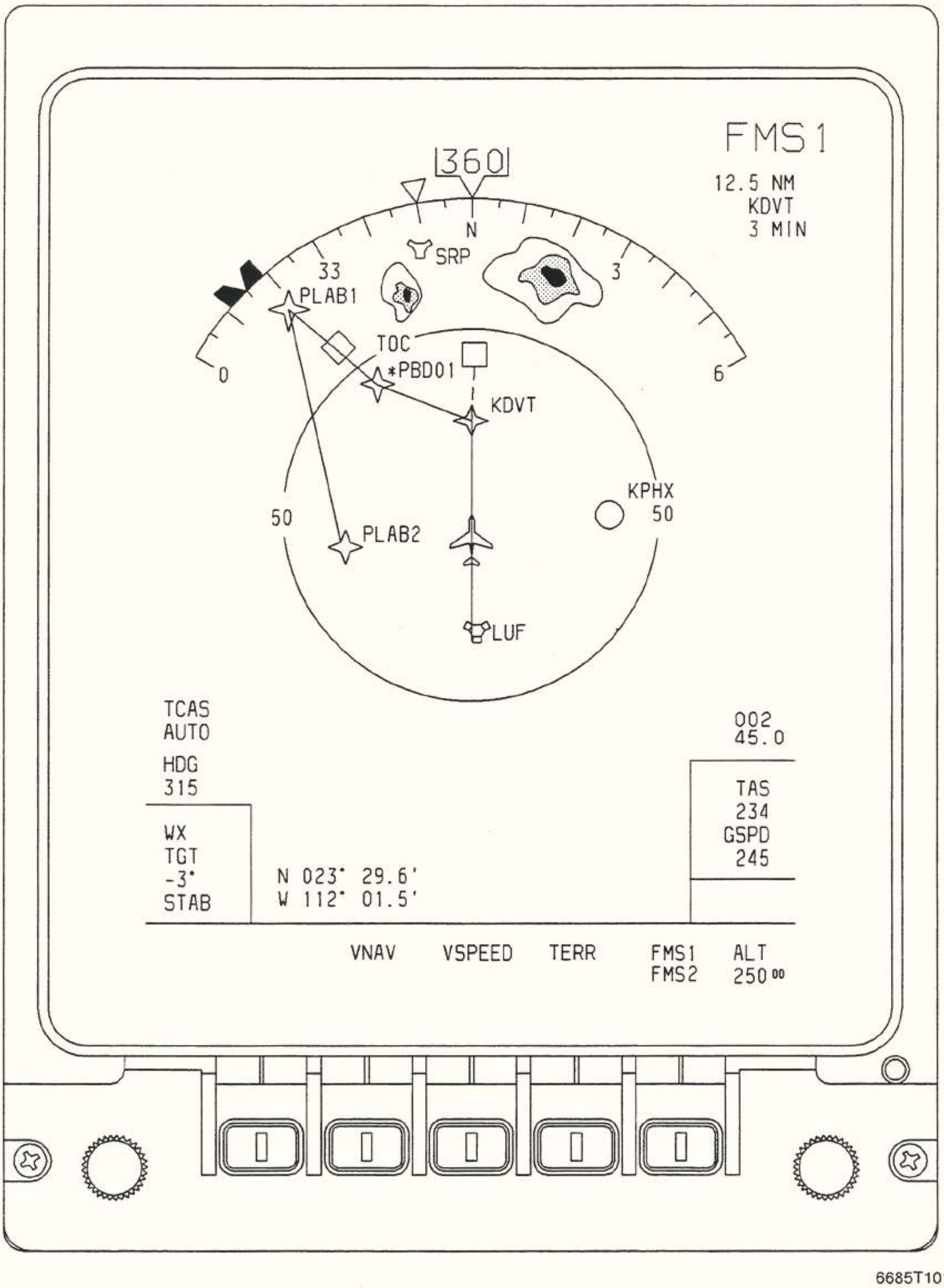



Figure 3-23

# PRIMUS 880 RADAR CONTROLLER

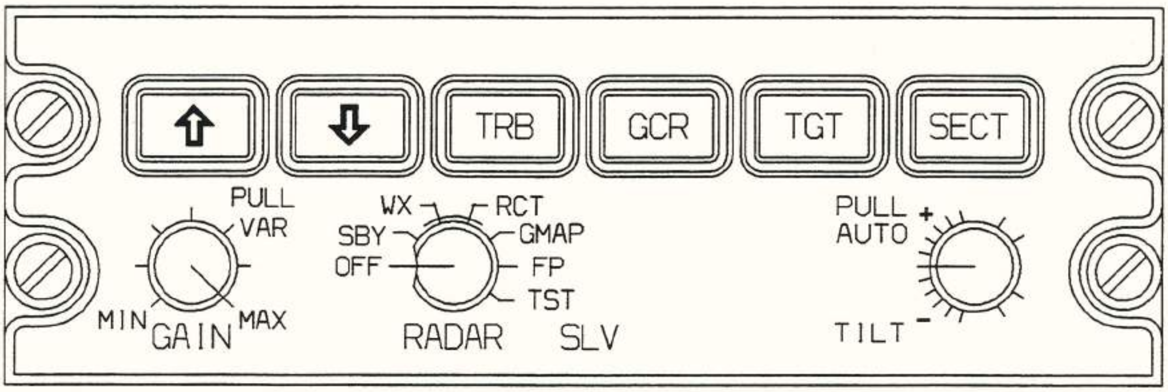



Figure 3-24

6618T1170

## CONTROLS

| | |
|---|---|
| TILT | Rotary control used to select tilt angle of antenna beam with relation to earth plane. Tilt range is 15 degrees upward to 15 degrees downward. |
| HSI | On DC-550 EFIS display controller. HSI button selects weather or map display on either primary flight display (PFD). WX selects arc mode as well as adds weather to the display. |
| WX | On MC-800 multifunction display controller. Selects radar weather mode for display on the multifunction display (MFD). If MFD is in PLAN mode, selecting WX mode will force the display into the MAP mode for weather display. |

MODE SWITCH Six-Position Rotary Switch

| | |
|---|---|
| OFF | Removes power from the system. |
| SBY | Standby. System will warm up but antenna is stowed and transmitter is disabled. |
| WX | Places system in the operational mode selected by HSI switch on the DC-550 EFIS display controller. |
| GMAP | Places system in ground mapping mode. Ground targets are enhanced. Do not use GMAP for weather detection, because weather type targets are not calibrated in GMAP mode. |
| FP | Flight Plan. Provides extended range display of navigational data. No radar data is presented; the system is put into standby mode. |
| TST | Activates the self-test mode and displays a test pattern. Transmitter is on and radiating. |

(Continued Next Page)

**CONTROLS** (Continued)

| | |
|---|---|
| TRB | Momentary alternate-action push button which enables and disables the Turbulence Detection mode of operation. TRB mode can only be selected when WX mode is selected and the selected range is 50 nautical miles or less. Areas of moderate or greater turbulence are shown in soft white (grey-white). WX/T is annunciated in the mode field. The radar cannot detect clear air turbulence. Undetected turbulence may exist within any storm cell. Selecting the 100, 200, or 300-mile range turns off the turbulence detection. The "/T" is deleted from the mode annunciation and variable gain is engaged if it was previously selected. Subsequent selection of ranges of 50 miles or less will re-engage the turbulence detection. |
| GAIN | Rotary control used to adjust sensitivity of radar receiver. Receiver gain is fixed and calibrated in the PRESET position. Selection of REACT (RCT) overrides the gain control setting causing the receiver gain to be fixed and calibrated. |
| RANGE | A two-pushbutton range selection system permits range selection from 5 to 300 nautical miles full scale in the WX mode, or 5 to 1200 nautical miles in the Flight Plan mode. The UP arrow button selects increasing ranges while the DOWN arrow selects decreasing ranges. 100-nautical mile range is presented when system is initially turned on. The last range selected will be remembered when switching between WX and FP. WX range overrides the RNG/INC/DEC switch on the MC-800 multifunction display controller when WX mode is selected on that controller. |
| GCR | Momentary alternate-action push button which enables and disables the Ground Clutter Reduction mode. Selectable only when WX mode selected and the range selection is 50 nautical miles or less. Ground clutter returns are reduced, making it easier to discern the remaining targets which are more likely to be weather. "GCR" is annunciated above the mode field. |
| TGT | Alternate action pushbutton enables the target alert function. |
| SECT | Alternate action pushbutton selects either full azimuth scan angle (120 degrees) or sector scan (60 degrees). Fourteen looks per minute versus 28 looks per minute. |

## DISPLAY ANNUNCIATIONS

The different mode annunciations shown below in Figure 3-25 are annunciated in the mode field. The mode field is on the lower left side of the PFD display. Below the mode field is the antenna tilt angle display which is preceded by a blank for positive values and a "- " for negative values. Directly below the tilt display are the target mode annunciation or the variable gain indicator. When target mode is selected, a green TGT annunciation appears on this line. When the receiver/transmitter (R/T) detects an alert condition the TGT turns to amber as long as the alert condition persists. Variable gain indication is annunciated by an amber VAR in the same field as the target alert, however, target mode/alert has the higher priority. When full compass mode and WX are turned on, a magenta TX will be displayed in the mode field. Also, if WX is failed and in test mode, an amber FAIL will be displayed in the mode field, and a failure code in the tilt field. If more than one code is associated with the failure, the numbers toggle between different fault codes.

# PFD WX RADAR OPERATING MODE ANNUNCIATIONS

| OPERATING MODE | FEATURE SELECTED | DISPLAY | |
|---|---|---|---|
| | | MODE ANNUNCIATION | "TGT" AREA |
| WAIT | ANY SELECTION | WAIT (Green) | --- |
| STANDBY | --- | STBY (Green) | --- |
| FORCED STANDBY | --- | FSBY (Green) | --- |
| TEST | --- | TEST (Green) or FAIL (Amber) | --- |
| WX | NONE<br>VAR<br>TGT<br>RCT<br>RCT/TGT | WX (Green)<br>WX (Green)<br>WX (Green)<br>RCT (Green)<br>RCT (Green) | ---<br>VAR (Amber)<br>TGT<br>---<br>TGT |
| FLIGHT PLAN | NONE<br>FPLN/TGT | FPLN (Green)<br>FPLN (Green) | ---<br>--- |
| GMAP | NONE<br>VAR | GMAP (Green)<br>GMAP (Green) | ---<br>VAR (Amber) |

Figure 3-25

# AREA NAVIGATION

## UNIVERSAL UNS-1Csp FLIGHT MANAGEMENT SYSTEM

The Universal UNS-1Csp is a fully integrated navigation management system designed to provide the pilot with centralized control for the airplanes navigation sensors, computer based flight planning, and fuel management. The FMS accepts primary position information from short and long-range navigation sensors. The primary position data received from the sensors is filtered within the FMS to derive a 'Best Computed Position' (BCP). It accomplishes these computations and advises the flight crew of components or systems requiring attention, as well as other irregularities, such as loss of enough sensors to compute a valid position. In the latter situation, if sensor loss endures over a set length of time, the system will enter Dead Reckoning (DR) mode and so inform the pilot through a message on the control display unit (CDU).

The UNS-1Csp provides lateral steering information to the pilot through the flight director and primary flight display (PFD). When connected to the autopilot, it provides roll steering commands. The VNAV function provides vertical steering information via the vertical deviation needle. The FMS may be coupled to the Autopilot/Flight Director for VNAV operation if the FMS option under the VNAV menu on the MFD bezel has been selected. VNAV guidance is not provided to the flight director or autopilot when in approach mode. The NAV computer additionally computes fuel flow information, providing a current fuel status and airplane gross weight throughout the flight if the fuel and gross weight are updated prior to takeoff.

In the dual installation of the Universal UNS-1Csp, the system may be configured as independent or with crossfill capability.

The system provides best computed position from the scanning DME and long range navigation sensors. This position is used for navigating the airplane along the programmed flight plan and during approved instrument approach procedures.

The UNS-1Csp provides advisory VNAV information for up to nine waypoints on the flight plan. Vertical guidance is displayed on the EFIS.

**NOTE**

- Selecting HSI or SG reversion returns the navigation display to basic NAV mode. FMS may be reselected.
- On airplanes equipped with TCAS, the map will not display on the cross side EHSI.

# DESCRIPTION (Continued)

The UNS-1C$_{SP}$ database incorporates SIDs, STARs, and approaches including GPS approaches. These procedures may be flown coupled to the autopilot or flight director.

**NOTE**

The MFD map display may be incorrect for the procedures described above. The pilot should refer to the appropriate published SID, STAR or approach procedure for correct navigational guidance. For SIDs and STARs containing floating waypoints (heading to altitude and/or course to intercept), the CDI needle will be set to the correct sensing for the first active non floating waypoint on that procedure. This waypoint will always be annunciated on the HSI and appear as the magenta colored waypoint on the MFD map. If LNAV is selected as the lateral mode, the flight director will command headings and course to intercept per the published procedure but these will not appear on the MFD or HSI map, nor will the CDI give any guidance to these floating waypoints.

**NOTE**

Curved flight path portions of the search pattern may not display on the MFD or may display as straight line segments. The center point of the orbit pattern may also not display on the MFD. CDI steering information will be accurately displayed.

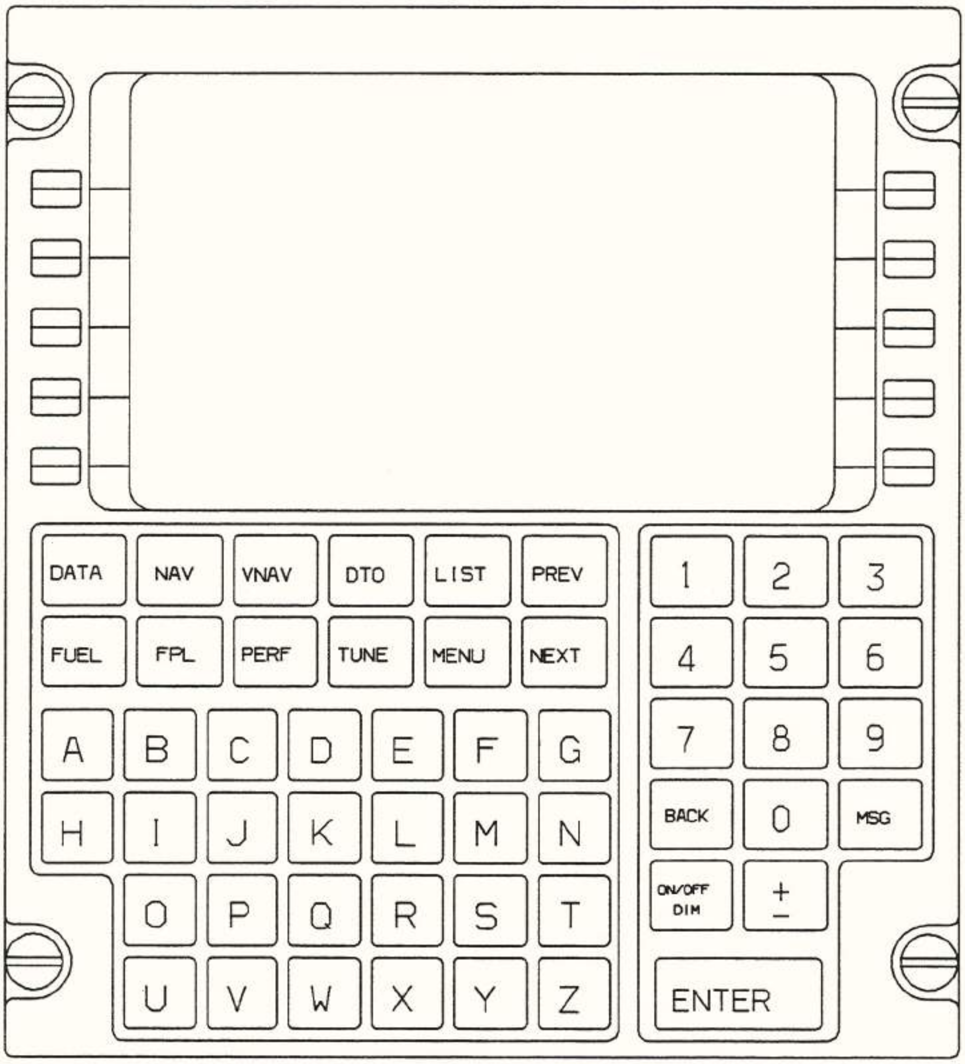
## SINGLE DME OPERATION

If one DME is inoperative and the crew elects to tune both NAVs to the ILS frequency during approach they should be aware that the VPU may go into DR. This does not affect the accuracy of other Universal UNS-1Csp sensors. This situation should not occur unless the remaining operational DME roving channel is unable to receive at least two valid DME signals.

## OPERATOR'S MANUAL

For detailed operating information, consult the Universal UNS-1Csp Pilot's Operating Manual, Universal Systems report number 2423sv603.X, latest revision.

# UNIVERSAL US-1Csp FLIGHT MANAGEMENT SYSTEM




6618T1129

Figure 3-26

IV. OPERATING INFORMATION

# SECTION IV
# OPERATING INFORMATION

## CONTENTS



(Continued Next Page)

## CONTENTS (Continued)

# PREFLIGHT

This section presents the abbreviated cockpit checklist provided with each Model 560 Excel in expanded form. Should any conflict exist between this information and the checklist in the FAA Approved Airplane Flight Manual, the Flight Manual shall take precedence. Any implied technique presented assumes that proper pilot skill and judgment are exercised.

## PREFLIGHT INSPECTION

Accomplish the following steps before continuing with the Cockpit and Exterior Inspection:

1. Battery - CONNECTED.
2. Engine Covers (4) - REMOVED.
3. Pitot Covers (3) - REMOVED.

## PRELIMINARY COCKPIT INSPECTION

A preliminary cockpit inspection should be made on the first flight of the day. Ensure that the Airworthiness and Registration Certificates and radio license are displayed in the airplane and that the FAA Approved Airplane Flight Manual is on board. FAA regulations also require a flashlight and a first aid kit to be carried on transport category airplanes. Check that oxygen masks, headsets, microphones and the pilot's checklist are on board.

**NOTE**

Prior to cockpit inspection, check tailcone to ensure battery is connected.

1. Documents - CHECK ABOARD.
   a. To be displayed in airplane at all times:
      (1) Airworthiness and Registration Certificates.
      (2) Radio Station License(s).
   b. To be carried in the airplane at all times:
      (1) FAA Approved Airplane Flight Manual.
      (2) Honeywell Primus 1000 Pilot's Manual.
      (3) Applicable FMS Pilot's Manual.
2. Flashlight - ABOARD.
3. Portable Fire Extinguisher - SERVICED and SECURE (under copilot's seat).
4. Microphones, Headsets, Oxygen Masks and Smoke Goggles - ABOARD and PROPERLY STOWED.
5. Oxygen Quantity - CHECK in Green arc..
   Check quantity gauge at 1600-1800 PSI.
6. CONTROL LOCK - UNLOCKED.
   Control surfaces should be free for exterior inspection.
7. Gear Handle - DOWN.

8. Rudder, Aileron and Elevator Trim - POSITION Elevator trim tab indicator within takeoff trim range and aileron and rudder trim tabs in neutral.
9. Flap Handle - AGREES with Flap position.
10. Circuit Breakers - IN.
11. GEN Switches - ON (OFF if external power is to be used for start).
12. All other switches - OFF/NORM/AUTO.
13. Throttles - CUT OFF.
14. BATT Switch - ON (24 volts minimum).
15. Fuel Quantity and Balance - CHECK.

**NOTE**

Maximum lateral fuel imbalance is 400 pounds. If imbalance exceeds 400 pounds, correct prior to flight

16. EMER Lights - ON, check illumination, then OFF
17. BATT Switch - EMER. Check $N_1$ indicators, RMU 1, Standby HSI and Landing Gear Indicator receiving power.

**NOTE**

STDBY Flight Display will be blank.

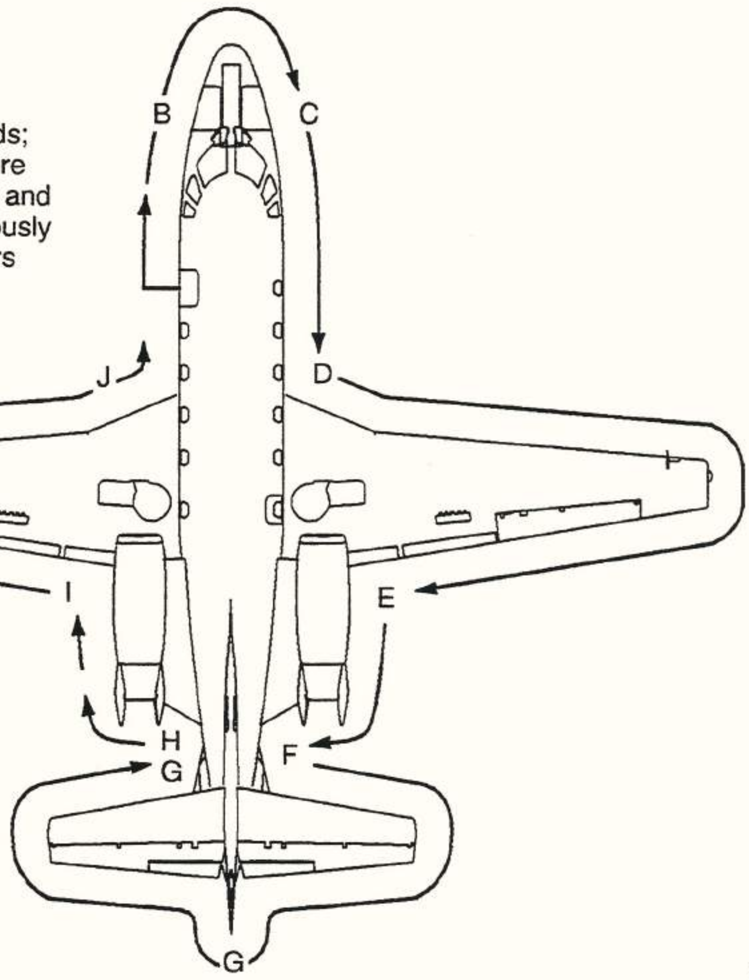
18. BATT Switch - ON

## EXTERIOR INSPECTION

During the inspection, make a general check for security, condition and cleanliness of the airplane and components. Check particularly for damage, fuel, oil and hydraulic fluid leakage, security of access panels and removal of keys from locks.

# EXTERIOR INSPECTION

***A.** Turn on hot items for 30 seconds; then OFF. Expedite check before items cool. The check of lights and hot items can be most expeditiously performed by two crew members coordinating with hand signals.




6610T1032

Figure 4-1

**1. Hot Items/Lights - (AREA A*).**

1. Hot Items/Lights - ON and CHECK.
   a. Left, Right and Standby Static Ports - CLEAR and WARM.
      At high outside temperatures, it is difficult to feel heat from the static port. Running the back of a finger from the airplane skin over the static port and onto the skin again is the easiest way to feel the higher temperature of the port.

(Continued Next Page)

## EXTERIOR INSPECTION (Continued)

b. Left, Right and Standby Pitot Tubes - CLEAR and HOT.
   Do not grasp pitot tube firmly, as severe burns can result.
c. True Airspeed Temperature Probe - CLEAR and HOT.
d. Landing Lights - ALL ON (if not observed from cockpit).
e. Recognition Lights - ALL ON (if not observed from cockpit).
f. Angle-of-attack Vane - FREE and HOT.
g. Ground Recognition Light - ON and FLASHING (if not observed from cockpit).
h. Right Wing Inspection, Navigation, and Anti-collision Lights - ON (if not observed from cockpit).
i. Tail Navigation Light - ON.
j. Left Wing Inspection, Navigation, and Anti-collision Lights - ON (if not observed from cockpit).
k. Hot Items/Lights and Battery Switches - OFF.

**NOTE**

- Expedite all checks with electrical power on and ensure that the air conditioner switch is OFF, if external power is not used.
- Landing and nav lights may be omitted if night flight is not anticipated.

2. **Left Nose - (AREA B)**

a. Brake Fluid Reservoir Sight Gages - FLUID VISIBLE.
b. Brake and Gear Pneumatic Pressure Gage - PER PLACARD.

| TEMP | °F | -40 | 0 | 70 | 100 | 130 |
|---|---|---|---|---|---|---|
| PRESS | PSI | 1500 | 1650 | 1950 | 2000 | 2050 |

c. Power Brake Accumulator Charge - PER PLACARD.

| TEMP | °F | -65 | 10 | 50 | 70 | 95 | 130 |
|---|---|---|---|---|---|---|---|
| PRESS | PSI | 500 | 600 | 650 | 675 | 700 | 750 |

d. Anti-skid Fault Display Unit (BITE indicator) - CHECK and RESET if required. Verify Amber ANTISKID INOP annunciator extinguished during BEFORE STARTING ENGINES checklist.
e. Accessory Door - SECURE and LOCKED.
f. Overboard Vent Lines - CLEAR.
g. Nose Gear, Doors, Wheel and Tire - CONDITION.

(Continued Next Page)

## EXTERIOR INSPECTION (Continued)

### 3. Right Nose and Fuselage Right Side - (AREA C, D)

a. Accessory Door - SECURE and LOCKED.
   Check latches firmly closed. The accessory door must be latched to actuate door locked microswitches. The ACC DOOR UNLOCKED NOSE annunciator will not extinguish if the accessory door is not locked.
b. Oxygen Blowout Disc - GREEN.
c. Top and Bottom Antennas - CONDITION and SECURE.
d. Dorsal Fin Air Inlet - Clear.

### 4. Right Wing - (AREA D, E).

a. $T_1$ and $T_{T0}$ Sensors (in right engine inlet) - CONDITION.
b. Engine Fan Duct and Fan - CONDITION.
c. Wing Inspection Light - CONDITION.
   Check the lens for cracks and security.
d. Emergency Exit Exterior Lights - CONDITION.
   The lights are located above the wing near mid-chord and slightly below the root leading edge on the fuselage.
e. Anti-Ice Bleed Air Cooling Air Inlet - CLEAR.
f. Heated Leading Edge - CONDITION and VENTS CLEAR.
g. Fuel Quick Drains (5) - DRAIN and CHECK for contamination.
   Push straight up on the drains when taking fuel samples. The drain may lock open if it is turned.
h. Main Gear Door, Wheel, Tire and Brake - CONDITION and SECURE.
   Check tire for wear and inflation to 210, +5 or -5 PSI; door for security. Check gear strut, wheel and brake for general security, fluid leakage and an approximate oleo strut extension of slightly more than 2 inches if the airplane is fully fueled.
i. Vortex Generators (26) - CHECK (no more than 3 may be missing on entire airplane).
j. Boundary Layer Energizers (11) - CHECK (none may be missing).
k. Fuel Filler Cap - SECURE.
l. Fuel Tank Vent - CLEAR.
   If the NACA inlet vent is blocked, a negative pressure may build up in the wing. Check wing bleed air exit louver, located underneath landing/recognition light, to ensure no blockage exists.
m. Navigation, Strobe, Landing and Recognition Lights - CONDITION.
n. Static Wicks (6) - CHECK (one on tip may be missing).
   There should be one static wick on the wing tip, four on the wing tip trailing edge area, and one on the trailing edge of the aileron.
o. Aileron, Speed Brakes and Flaps - CONDITION and SECURE.
   Check ailerons for freedom and hinge points for security. Check flaps and speed brakes for security. Check that flaps position matches cockpit indicator.

(Continued Next Page)

## EXTERIOR INSPECTION (Continued)

### 5. Right Nacelle - (AREA E, F).

a. Oil Level - CHECK; Filler Cap and Access Door - SECURE.
   Check for correct level by reading the engine sight gauge. The engine hs two Oil Sight Glasses, one on either side of the engine to allow for visual inspection of the engine oile level. The engine Oil filler is always mounted on the outboard side of the installed engine. It is recommended that the engine Oil Level in the sight glass be maintained at the midpoint between the MIN and MAX marks, when viewed on the outboard oil sight glass. Oil level should be checked after a minimum wait of 10 minutes after engine shutdown. 'Topping-off' by adding oil should only be performed after the 10 minute period has elapsed (Make certain filler cap is on securely and fasten access door.)
b. Generator and Alternator Cooling Air Exhaust - CLEAR.
c. Engine Fluid Drain Mast - CLEAR.
   It is normal to find some residual fluid on the drain lines.
d. Engine Exhaust and Bypass Ducts - CONDITION and CLEAR.
   Check for bent blades, nicks and blockage of fan stators.

**NOTE**

If fan is windmilling, place hand on bullet nose or install nozzle cover to stop. If any damage is observed, refer to Chapter 72 of the Engine Maintenance Manual.

e. Thrust Reverser Buckets - CONDITION AND STOWED.
   Check for cracks, damage and general security.
f. Pylon Heat Exchanger Door - CLOSED and AREA CLEAR.
   Lower door, visible in bottom of pylon-mounted NACA duct, should be closed on the ground. Exit louver should be clear.

### 6. Tailcone Compartment (AREA F).

a. Hydraulic Fluid Quantity - CHECK.
   The hydraulic fluid level may be visually checked using the metering pin and external markings on the metering pin housing. A hydraulic mule must be used to service the system.
b. Aft Junction Box Circuit Breakers - IN.
   Check all visible circuit breakers. Breakers for each wing heater are located on the J-box mounted on the aft pressure bulkhead.
c. External Power Receptacle Circuit Breaker - IN.
d. ECS Indicators - CHECK and RESET if required. Verify engine(s) operate in AUTO MODE after engine start.
e. Tailcone Light - OFF.
f. Tailcone Access Door - SECURE and LOCKED.

(Continued Next Page)

## EXTERIOR INSPECTION (Continued)

7. **Right Empennage - (AREA F, G).**

   a. Air Conditioning Overboard Exhaust - CLEAR.
   b. Hydraulic Service Door - SECURE, drain mast clear.
   c. Right Horizontal Stabilizer Deice Boot - CONDITION and SECURE.
   d. Right Elevator and Trim Tab - CONDITION.
      Visually check hinge points for security. Check two static wicks in place on each elevator. If static wick is missing, it should be replaced prior to flight to ensure proper control surface balance. Ensure trim tab position matches elevator trim tab position indicator.
   e. Rudder and Trim Tab - CONDITION.
      Visually check hinge points for security. Check two static wicks in place on trailing edge of rudder and one static wick on top of rudder. If static wick is missing, it should be replaced prior to flight to ensure proper control surface balance. Ensure trim tab position matches rudder trim tab position indicator.
   f. Static Wicks (Rudder, Vertical Stabilizer and Both Elevators) (6) - CHECK (static wick on the stinger may be missing).
   g. Tail Strakes - CONDITION and SECURE.

8. **Left Empennage - (AREA G, H).**

   a. Left Elevator and Trim Tab - CONDITION.
      Visually check hinge points for security. Check two static wicks in place on each elevator. If static wick is missing, it should be replaced prior to flight to ensure proper control surface balance. Ensure trim tab position matches elevator trim tab position indicator.
   b. Left Horizontal Stabilizer Deice Boot - CONDITION and SECURE.
      Check boots for cuts that might prevent inflation and any indication of delamination.
   c. Horizontal Stabilizer Position Index - CHECK; agrees with flap position.
   d. External Power Service Door - SECURE.
   e. Battery Cooling Intake and Vent Lines - CLEAR.
   f. Battery - CHECK CONNECTED.
   g. Battery Compartment Access Door - SECURE and LOCKED.

9. **Baggage Compartment - (AREA H).**

   a. Baggage Compartment - SECURE.
      Ensure baggage and engine covers are SECURED.
   b. Baggage Compartment Light - OFF.
   c. Baggage Compartment Access Door - SECURE and LOCKED.
      Check latches are firmly closed and ensure door locked microswitch is seated. The aft compartment access door should be key locked for flight in order to enhance door security.

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## EXTERIOR INSPECTION (Continued)

### 10. Left Nacelle - (AREA I).

a. Pylon Heat Exchanger Door - CLOSED and AREA CLEAR.
   Lower door, visible in bottom of pylon-mounted NACA duct, should be closed on the ground. Exit louver should be clear.
b. Thrust Reverser Buckets - CONDITION AND STOWED.
   Check for cracks, damage and general security.
c. Engine Exhaust and Bypass Ducts - CONDITION and CLEAR.
   Check for fuel leakage, damage to turbine blades, cracks, general security.
d. Engine Fluid Drain Mast - CLEAR.
   It is normal to find some residual fluid on the drain lines.
e. Generator and Alternator Cooling Air Exhaust - CLEAR.
f. Oil Level - CHECK; Filler Cap and Access Door - SECURE.
   Check for correct level by reading the engine sight gauge. The engine hs two Oil Sight Glasses, one on either side of the engine to allow for visual inspection of the engine oile level. The engine Oil filler is always mounted on the outboard side of the installed engine. It is recommended that the engine Oil Level in the sight glass be maintained at the midpoint between the MIN and MAX marks, when viewed on the outboard oil sight glass. Oil level should be checked after a minimum wait of 10 minutes after engine shutdown. 'Topping-off' by adding oil should only be performed after the 10 minute period has elapsed (Make certain filler cap is on securely and fasten access door.)

### 11. Left Wing - (AREA I, J).

a. Flap, Speed Brakes, Aileron and Trim Tab - CONDITION and SECURE.
   Check ailerons for freedom and hinge points for security. Check flaps and speed brakes for security. Check that flaps position matches the cockpit indicator.
b. Static Wicks (6) - CHECK (one on tip may be missing).
   There should be one static wick on the wing tip, four on the wing tip trailing edge area, and one on the trailing edge of the aileron.
c. Navigation, Strobe, Landing and Recognition Lights - CONDITION.
d. Fuel Tank Vent - CLEAR.
   If the NACA inlet vent is blocked, a negative pressure may build up in the wing.
e. Fuel Filler Cap - SECURE.
f. Vortex Generators (26) - CHECK (no more than 3 may be missing on entire airplane).
g. Boundary Layer Energizers (11) - CHECK (none may be missing).
h. Main Gear Door, Wheel, Tire and Brake - CONDITION.
   Check tire for wear and inflation to 210, +5 or -5 PSI; door for security. Check gear strut, wheel and brake for general security, fluid leakage and an approximate oleo strut extension of slightly more than 2 inches if the airplane is fully fueled.

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## EXTERIOR INSPECTION (Continued)

i. Fuel Quick Drains (5) - DRAIN and CHECK for contamination.
   Push straight up on the drains when taking fuel samples. The drain may lock open if it is turned.

j. Heated Leading Edge - CONDITION and VENT CLEAR.

k. Anti-Ice Bleed Air Cooling Air Inlet/Exits - CLEAR.
   If the NACA inlet vent is blocked, a negative pressure may build up in the wing. Check wing bleed air exit louver, located underneath landing/recognition light, to ensure no blockage exists.

l. Wing Inspection Light - CONDITION.
   Check the lens for cracks and security.

m. Engine Fan Duct and Fan - CONDITION.
   Check for bent blades, nicks and blockage of fan stators.

**NOTE**

If fan is windmilling, place hand on bullet nose or install nozzle cover to stop. If any damage is observed, refer to Chapter 72 of the Engine Maintenance Manual.

n. $T_1$ and $T_{T0}$ Sensors - CONDITION (located in left engine inlet).

**12. Cabin Entry - (AREA J).**

a. Dorsal Fin Air Inlet - CLEAR.
b. Secondary Cabin Door Seal - CHECK for RIPS, TEARS and FOLDING.

## CABIN INSPECTION

1. Emergency Exit - SECURE; Handle Lock Pin - REMOVE.
   Check fit of door, handle stowed, guard in place and locking pin removed (if applicable).
2. Passenger Seats - UPRIGHT, OUTBOARD and POSITIONED AFT or FORWARD as required to clear exit doors.
3. Door Entry Lights - OFF.
   Switch located on entry door post.
4. Portable Fire Extinguishers - SERVICED and SECURE (if installed).
5. Water Barrier - STOWED (if required).

## COCKPIT PREPARATION

**NOTE**

The BATT Switch must be ON prior to closing the cabin door to perform a self test of the cabin door locking mechanism.

1. Preflight Inspection - COMPLETE.
2. Oxygen - CHECK
   a. PASS OXY VALVE - AUTO.
      The AUTO position will allow passengers to receive oxygen when either the cabin altitude exceeds approximately 14,000 feet or the oxygen control switch is set to manual drop.
   b. Crew oxygen masks - CHECK and SET to 100%.
      Check mask at 100% and in EMER with crew masks connected to side console outlets; check mic. With regulator set at 100% and EMER verify green band visible in $0_2$ supply line. The crew can verify oxygen flow by donning the mask with the regulator in the 100% position and ensuring that no restrictions to breathing are present. The crew masks must be stowed in the quick donning hook and set on 100% for flight above FL 250.
3. Circuit Breakers - CHECK IN.
   Circuit breakers on both panels IN.

4. Cockpit Switches - SET.
   a. LH Microphone switch - MIC HEADSET.
   b. Fuel CROSSFEED - OFF.
   c. FUEL BOOST pumps - NORMAL.
   d. IGNITION - NORMAL.
   e. GEN Switches - ON (OFF if GPU start).
   f. AVIONIC POWER - OFF.
   g. EMER LTS - ARM.
   h. EEC - AUTO.
   i. DAY/NIGHT Switch - AS REQUIRED.
   j. AHRS 1 - SLV.
   k. STBY PWR - TEST, verify GREEN light, then ON.
   l. Gear Handle - DOWN.
   m. ANTISKID - ON.
   n. Anti-Ice/Deice - OFF.
   o. WINDSHIELD Anti-Ice - BOTH ON.
   p. Exterior Lights - OFF.
   q. PRESS SYSTEM SELECT - AUTO.
   r. EMER DUMP - NORM.
   s. PRESS SOURCE Select - NORM.
   t. Temperature Control - AS DESIRED.

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## COCKPIT PREPARATION (Continued)

   u. ENGINE SYNC - OFF.
   v. LANDING LIGHTS/REC/TAXI - OFF.
   w. Radar - OFF or STANDBY.
   x. CKPT RECIRC Fan - AS DESIRED.
   y. A/C-FANS - WEMAC BOOST or OFF (or AS DESIRED with GPU connected).
   z. AHRS 2 - SLV.
   aa. RH Microphone Switch - MIC HEADSET.

5. BATT Switch - ON.
6. Battery Voltage - CHECK (24 volts minimum).
7. AVIONIC POWER - ON.
8. Engine Instruments - NO FLAGS.
9. Gear Position Indicator - 3 GREEN LIGHTS.
10. Warning Systems Rotary Test Switch - CHECK, then OFF.

**NOTE**

- The W/S FAULT annunciator may not test after cold soak at extremely cold temperatures. If this occurs, repeat the test after the cabin has warmed up. The test must be completed prior to flight.
- If the windshield is heat soaked above 56°C (134°F), the test will result in a W/S FAULT annunciator.
- Rotary test switch functions are more fully described on page 2-77 of this manual.

11. Pitch Trim - CHECK/SET for Takeoff.
   a. LH - Push both trim switches down and verify elevator trim movement, and push autopilot/trim disconnect, verify no elevator trim movement.
   b. LH - Push both trim switches up, and push autopilot/trim disconnect.
   c. LH - Push left half of trim switch up and down, verify no elevator trim movement.
   d. LH - Push right half trim switch up and down, verify no elevator trim movement.
   e. Verify manual trim wheel can move elevator trim.
   f. RH - Push both trim switches down, and push autopilot/trim disconnect.
   g. RH - Push left half trim switch up and down, verify no elevator trim movement.
   h. RH - Push right half trim switch up and down, verify no elevator trim.
12. AVIONIC POWER - OFF.

## DELAY BEFORE FLIGHT W/O GPU

1. STBY PWR - OFF.
2. EMER LTS - OFF.
3. BATT Switch - OFF.

# NORMAL PROCEDURES

## BEFORE STARTING ENGINES

1. Passenger Briefing - COMPLETED.
   a. Emergency exit location and operation.
   b. Use of emergency oxygen.
   c. Smoking.
   d. Seat adjustment - Verify passenger seats are full upright and outboard, and passengers are wearing seat belts and shoulder harnesses.
   e. Lavatory door latched open for takeoff, landing, and taxi.
2. BATT Switch - ON.
3. GEN Switches - ON (OFF if GPU start).
4. EMER LTS - ARM.
5. PARK BRAKE - SET.
6. FLOOD Lights - FULL BRIGHT (night only).
7. STBY PWR - ON.
8. Exterior Lights - AS REQUIRED.
   a. GND REC - ON.
   b. NAV Lights - ON (during night operations).
9. Annunciators - CHECKED.

## STARTING ENGINES

**NOTE**

- Either engine may be started first. If the door is secured prior to battery start initiation, it is recommended that the left engine be started first. Spool up will be slightly faster due to less line loss because the battery is mounted on the left side of the tailcone compartment. Due to foreign object ingestion hazard, the left engine should not be running during boarding or deplaning. If last minute boarding is anticipated, start right engine first.

- If the aircraft has been cold soaked at temperatures below -10°C (14°F) and the engines have not been preheated, the use of external power or warming the battery to -10°C (14°F) or warmer is recommended. This temperature may be checked with the battery temperature gauge. Proper battery warmup may require extended application of heat to the battery. Refer to Normal Procedures, Cold Weather Operations.

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## STARTING ENGINES (Continued)

1. Engine - START.

   Momentarily depressing an ENGINE START button causes the button and engine instrument floodlights to illuminate, activates the fuel boost pump and the associated FUEL BOOST annunciator light, and commences engine rotation.

   a. At 8% $N_2$ - THROTTLE TO IDLE.

      At 8-10% turbine RPM, lifting the cutoff latch and advancing the throttle to idle activates the ignition and the associated igniter light, and initiates fuel flow.

   b. Abort start if no ITT rise within 10 seconds.

**NOTE**

The temperatures during ground start should not exceed 720°C. Temperatures exceeding this value should be investigated in accordance with the Engine Maintenance Manual.

   c. Abort start if ITT rapidly approaches 720°.
   d Abort start if no indication of $N_1$ rotation by 25% $N_2$.
   e. Engine instruments - CHECK NORMAL.

      Check engine instruments within limits. Check that starter has disengaged and that all annunciator lights are out except GND IDLE.

   f. Fuel, Oil, Generator and Hydraulic Annunciators - EXTINGUISHED.

      Check the LO FUEL PRESS, FUEL BOOST, and LO FUEL LEVEL lights extinguished. After light-off occurs, at approximately 30 to 44% turbine RPM, the starter relay opens, terminates ignition and fuel boost and turns off the start button and the instrument floodlights. During a battery start with the GEN switch ON, the generator will come on the line, extinguishing the GEN OFF light, at approximately 38 percent turbine RPM.
      With external power in use, the GEN switches can be off until starting is complete. It may not be possible to bring the generators on the line until the external power unit is removed. In any case, electrical equipment should not be turned on until both GEN OFF lights are extinguished.

      Should automatic start sequencing not terminate, the boost pump, ignition and associated lights will remain on. The starter, however, will discontinue cranking due to speed sensing which governs at approximately 38 percent $N_2$. Depressing the STARTER DISENGAGE button will terminate the automatic start sequence. This button is illuminated any time the PANEL LIGHT CONTROL master switch is ON.

      An overvoltage protection system is provided during use of an external power unit (EPU). The control unit monitors the external power unit voltage and will deenergize the external power relay if the voltage goes above 32 to 34 volts. External power cannot be reapplied to the airplane after an overvoltage condition has occurred until the EPU power has been cycled off and back on with the power output supplying the nominal 28.5 VDC.

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## STARTING ENGINES (Continued)

2. Other Engine - START.
   a. Repeat procedures in item 1.

**CAUTION**

THE OPERATING ENGINE MUST BE AT IDLE FOR A CROSS GENERATOR START.

3. Engine Annunciators - EXTINGUISHED (except GND IDLE).
4. GPU - DISCONNECTED (if used).
5. GEN Switch - ON/CHECK DC AMPS/VOLTS.
   a. Left generator - Off, right generator - GEN, check left generator voltage, check right generator AMPS.
   b. Left generator - GEN, right generator - Off, check left generator AMPS, check right generator voltage.
   c. Left generator - GEN, right generator - GEN, check left generator AMPS, check right generator AMPS, check system voltage

**NOTE**

When operating in visible moisture and ambient air temperature is +10°C or below, turn pitot and static heat ON and engine LH and RH anti-ice systems ON.

## BEFORE TAXI

1. AVIONIC POWER - ON.

**NOTE**

The avionics will require warmup after cold soak. Over 20 minutes may be required at temperatures below -25°C (-13°F). Proper warmup is indicated by normal illumination of frequency/code displays with pilot control of brightness and by audio reception on all applicable avionics. In the absence of a suitable station, background static is an acceptable demonstration of reception. Refer to Normal Procedures, Cold Weather Operations.

2. Flight Controls/Speed Brake/Flaps - CHECKED/SET.
   Check flight controls for full travel of all controls. The ailerons can be observed from the cockpit. Extend speed brakes. HYD PRESS light should be on until speed brakes are extended, then go out. SPD BRK EXTEND light should be on. Observe speed brakes on top of wing. Retract speed brakes. Note HYD PRESS light on, then off, SPD BRK EXTEND light out, and speed brakes retracted. Set flaps to T.O. & APPR. or T.O. - as required - for particular field elevation and takeoff conditions.

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## BEFORE TAXI (continued)

3. Anti-Ice/Deice - CHECKED/SET AS REQUIRED.

**NOTE**

If ambient temperature is approximately 15°C or warmer, the ENG ANTI-ICE L/R annunciators may not illuminate when anti-ice is selected ON. To ensure that bleed air is flowing to the engine inlet, the crew should observe a momentary small decrease in $N_2$ when ENGINE ON is selected.

4. Environmental Control System (ECS) - AS REQUIRED (to set the Temperature Controllers and the A/C and Wemac Boost controls to comfortable levels).
5. PRESSURIZATION Controller - SET Landing Field Elevation.
6. ATIS/Clearance/FMS - AS REQUIRED.
7. Avionics/Flight Instruments - SET.
   a. EFIS test switch - push, verify:
      i) Pilot and copilot radio altimeters display 50 feet.
      ii) Red X displayed in barometric altimeters, airspeed, and CDI.
      iii) All digits replaced with dashes (except radio altimeter).
      iv) All error messages are displayed.
      v) Test message is displayed in upper left corner of PFD.
   b. Radio altimeter - SET.
   c. Communication frequencies - SET.
   d. Navigation frequencies - SET.
   e. Course - SET.
   f. Cockpit Voice Recorder Test Button - PUSH for 5 seconds, verify test light illuminated.
   g. Autopilot (At pilot's discretion) - ENGAGE, PUSH LH AP TRIM DISC switch, verify autopilot disconnects and chime sounds. Repeat using RH AP TRIM DISC switch.

8. Lavatory Door - LATCHED OPEN.

**NOTE**

The lavatory doors must be latched open for takeoff, landing, and taxi.

9. Annunciator Panel - CHECKED.

**NOTE**

The antiskid system must be turned on and the self-test sequence completed (antiskid annunciator light out) while the airplane is stationary. If the airplane is taxiing when the antiskid system is actuated, the antiskid test sequence will not be completed successfully and the antiskid will not be operational during takeoff.

## TAXI

Gradually apply just enough thrust to break inertia. Reduce power to the amount necessary to achieve desired taxi speed. Avoid riding the brakes and always place the throttles to idle before commencing braking. Caution should be exercised in congested areas to reduce the possibility of blast damage to equipment and personnel.

Taxiing on one engine may be advisable at light weights to reduce brake wear, particularly in very cold weather when idle thrust is relatively high. Turning capability into the live engine is reduced however, and consideration should be given to the direction of anticipated turns in deciding which engine to operate. Peak exhaust velocity to generate the necessary thrust will be higher on one engine. Maneuvering in close quarters may dictate the use of both engines.

During ground operations in freezing precipitation, engine anti-ice may be required if ram air temperature reads between -30°C to +10°C. In these cases, the ENGINE ANTI-ICE switches should be selected to ON and the engines run at or above 65% $N_2$ for at least 15 seconds every four minutes.

1. Brakes - CHECK.
   Check operation of the pilot's and copilot's brakes early in the taxi.

**CAUTION**

IF DURING TAXIING, A HARD BRAKE PEDAL - NO BRAKING CONDITION IS ENCOUNTERED, OPERATE THE EMERGENCY BRAKE SYSTEM. CORRECT PRIOR TO FLIGHT.

2. Steering - CHECK.

**NOTE**

When taxiing in strong crosswinds, differential braking may be required to supplement nosewheel steering.

3. Thrust Reversers - CHECK.
   a. Deploy Thrust Reversers, check sequencing and timing of lights.
   b. Select EMER STOW, check sequencing and timing of lights.
   c. Stow Thrust Reversers, check sequencing and timing of lights.
   d. Deselect EMER STOW, verify all Thrust Reverser lights extinguished.
4. Takeoff Speeds - SET.
   a. Confirm $V_1$, $V_R$ and $V_2$ displayed on PFD.
5. Takeoff $N_1$ - SET.
   a. Obtain takeoff $N_1$ from AFM Section IV, Performance, or abbreviated checklist.

## BEFORE TAKEOFF

1. Flaps - SET.
2. Speed Brake - RETRACTED.
3. Trims - (3) SET.
4. Anti-Ice/Deice - AS REQUIRED. Check anti-ice and deice systems when icing conditions are anticipated.

**CAUTION**

- DO NOT OPERATE DEICE BOOTS WHEN AMBIENT AIR TEMPERATURE IS BELOW -40°C (-40°F).
- LIMIT GROUND OPERATION OF PITOT/STATIC HEAT TO TWO MINUTES TO PRECLUDE DAMAGE TO THE ANGLE-OF-ATTACK SYSTEM EXCEPT AS REQUIRED IN ICING CONDITIONS.

5. Crew Briefing - COMPLETE.
6. CKPT and CABIN Temperature SEL - AS DESIRED.

-----------------------------------------------**CLEARED FOR TAKEOFF**-----------------------------------------------

7. IGNITION - ON.
8. PITOT & STATIC Heat - ON.
9. Exterior Lights - AS REQUIRED.

**NOTE**

Do not operate the anti-collision lights in conditions of fog, clouds or haze as the reflection of the light beam can cause disorientation or vertigo.

10. Transponder/TCAS - ON/TA/RA.
11. Engine Instruments - CHECK.
12. Annunciator Panel - CHECK.

**NOTE**

All annunciators should be extinguished except ground idle.

## TAKEOFF

1. Throttles - To Detent, Check to $N_1$s.
2. Engine Instruments - CHECK.
3. Brakes - RELEASE.

   Apply power while monitoring the engine instruments. Very rapid thrust application should be avoided. A rolling takeoff may be used with sufficient runway available, but it should be remembered that Flight Manual takeoff field length data and takeoff $N_1$ settings assume a static run-up.

   Directional control is normally maintained with nosewheel steering and rudder, and upwind (wing down) aileron in crosswind conditions. It is suggested that the copilot perform the engine instrument monitoring function, enabling the pilot to direct his full attention to airplane control. $N_1$ should be closely observed to verify takeoff thrust has been set and to ensure symmetrical thrust application. Large differential power changes, particularly at the higher thrust settings, can induce significant yaw.

   It is recommended that the copilot verbally state when takeoff thrust is set, a cross-check of airspeed indicators at 70 knots is made, and when reaching $V_1$ and $V_R$. Positive back pressure is required to rotate the Citation Excel and it should be accomplished precisely at $V_R$. Early or late rotation will degrade takeoff performance. It should be done smoothly, however, so that a decrease in airspeed does not occur.

   Should a serious irregularity become evident before reaching $V_1$, the takeoff should be aborted. With a problem after $V_1$, the takeoff should normally be continued. Procedures for abort and single engine takeoff are outlined in the EMERGENCY section. Normal rotation angle is approximately 12 degrees nose up with both engines operating and degrees with a single engine.

## AFTER TAKEOFF - CLIMB

1. Landing Gear - UP.
   When a positive rate of climb is indicated, pulling the gear handle out and moving UP initiates the retraction cycle, illuminating the GEAR UNLOCKED and HYD PRESS lights. Check both lights extinguished indicating the gear are up and locked.
2. Flaps - UP.
   At a comfortable altitude with wings level and a minimum airspeed of $V_2$ +10 KIAS, push the flap handle in (to clear the T.O. T.O. & APPR detents) and full forward. Observe the position indicator to the left of the handle move to FLAP UP.
3. Throttle - CLB DETENT, Check CLB $N_1$'s.
4. Engine Synchronizer - ON.
   Turn engine synchronizer selector switch to FAN or TURB as desired. Cross-check the remaining engine instruments within limits.

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## AFTER TAKEOFF - CLIMB (continued)

5. Yaw Damper - ENGAGED.
   With the yaw damper engaged, airplane control is improved and passenger comfort is enhanced.
6. Ignition - NORM (ON when flying in heavy rain).
   When clear of any bird hazard and cockpit workload permits, return the IGNITION switches to NORM.
7. Passenger Advisory Lights - AS REQUIRED.
   Placing the switch to SEAT BELT leaves that cabin advisory light illuminated and extinguishes the NO SMOKING and emergency exit lights. If no turbulence is anticipated, placing the switch to OFF extinguishes both the advisory and emergency exit lights.
8. Pressurization - CHECK.
   During climb, observe the differential pressure/cabin altitude for correct cabin pressurization. The rate of cabin pressurization is automatically controlled.
9. CKPT and CABIN Temperature SEL - AS DESIRED.
10. Altimeters - SET (Transition altitude).
11. REC Lights - OFF (Transition altitude).
12. A/C-FANS - OFF or WEMAC BOOST.
    Turn off the optional vapor cycle air conditioner above 18,000 feet.
13. Anti-Ice/Deice Systems - AS REQUIRED.
    Use of engine anti-ice reduces allowable fan speed and dictates close monitoring of Inter-Turbine Temperature (ITT) and RPM limits.

**NOTE**

During a Maximum Continuous Thrust Climb above FL350, with airspeed approximately 0.59 Mach or below, indications of engine $N_2$ overspeed may occur. These indications may be eliminated by retarding the throttle or, alternatively, increasing airspeed.

## CRUISE

1. Throttles - CRU DETENT or AS DESIRED.
   Climb thrust is normally maintained upon level off until acceleration to the desired cruise mode takes place. When operating at maximum range cruise, thrust necessary to maintain optimum angle-of-attack diminishes with fuel burn-off, because of increased performance and lower airspeed requirements as weight decreases.

   Although the airplane is not operationally restricted in rough air, flight in severe turbulence should be avoided. If severe turbulence is encountered, it is recommended that the igniters be turned ON and airspeed maintained at approximately 180 KIAS. Maintain a constant attitude, avoid abrupt or large control inputs, and do not chase airspeed and altitude indications.
2. Pressurization - CHECK.
3. Anti-Ice/Deice - AS REQUIRED.

**CAUTION**

DO NOT OPERATE DEICE BOOTS WHEN INDICATED RAT IS BELOW -40°C (-40°F).

(Continued Next Page)

## CRUISE (continued)

**NOTE**

- Ignition switches should be selected to ON when flying through heavy rain.
- Check deice system for proper operation prior to entering areas in which icing might be encountered.

4. Fuel CROSSFEED - AS REQUIRED (maximum imbalance 400 lbs.)

## DESCENT

1. Windshield Anti-Ice - BOTH ON.
2. Anti-Ice/Deice - AS REQUIRED.
   a. Maintain sufficient power for anti-ice, advance throttles to extinguish wing anti-ice lights.

**CAUTION**

DO NOT OPERATE DEICE BOOTS WHEN INDICATED RAT IS BELOW -40°C (-40°F).

**NOTE**

- Check deice system for proper operation prior to entering areas in which icing might be encountered.
- Engine anti-ice is provided at all throttle settings, including idle.

3. IGNITION - ON when flying through heavy rain.
4. Pressurization - CHECK/SET Landing Elevation.
5. A/C-FANS - AS DESIRED (Transition Altitude).
6. REC Lights - ON (Transition Altitude).
7. Altimeter - SET at Transition Altitude and CROSSCHECK.
   Set landing field barometric pressure in both altimeters when cleared below, or when passing, transition altitude (18,000 feet in U.S.A.). Cross-check altimeters for agreement.

# APPROACH

1. Avionics/Flight Instruments - CHECK/SET.
   Check NAV receivers on proper frequency and required heading and course information set. Cross check flight instruments for correct indications.
2. Crew Briefing - COMPLETE.
   a. Landing Speeds - ($V_{APP}$ and $V_{REF}$) - Look up, Set, and Confirm.
      Refer to performance tables for $V_{REF}$ based on arrival gross weight.
   b. Landing Data ($N_1$, Landing Distance, Weight, and Factors) - CONFIRM.
      Check runway requirements based on gross weight and destination field information. Ascertain $N_1$ and $V_2$ for use in the event of a missed approach.
3. Pass Advisory Lights - PASS SAFETY ON.
   Turn on SEAT BELT/NO SMOKING signs and emergency exit lights.
4. Passengers - BRIEF.
   a. Verify passenger seats are full upright and outboard, passengers are wearing seat belts and shoulder harnesses, and the lavatory door is latched open.

**NOTE**

The LAV DOOR annunciator must be off for landing and the lavatory doors must be latched open.

5. Flaps - AS REQUIRED (below 200 KIAS - 7°/15°).

**NOTE**

When reconfiguring for approach and landing (i.e. flaps extended and gear down), and any ice accretion is visible on the wing leading edge, regardless of thickness, activate the wing and tail deice system. Continue to monitor the wing leading edge for any reaccumulation.

6. IGNITION - ON.
7. Exterior Lights - AS REQUIRED.
8. Fuel Crossfeed - OFF.
   Check CROSSFEED knob OFF, FUEL XFFED and FUEL BOOST lights extinguished.
9. ENGINE SYNC - OFF.
10. Annunciator Panel - CHECK.

## BEFORE LANDING

1. Pressurization - ZERO DIFFERENTIAL PRIOR TO LANDING.
   Passing approximately 500 feet above ground level (AGL), check the cabin differential pressure indicates zero prior to landing. If the differential is in excess of about one half PSI, select a higher landing field elevation to ascend the cabin. Differential pressure should be at zero for landing. Any pressure existing at touchdown will be dumped by the outflow valves (actuated by the main gear squat switch) and may cause discomfort.
2. Landing Gear - DOWN ($V_{LE}$ 250 KIAS).
   Pulling gear handle out and moving it DOWN illuminates the HYD PRESS and GEAR UNLOCKED lights while gear is extending. Check three green lights on and GEAR UNLOCKED and HYD PRESS lights extinguished. Antiskid and power brake lights will also momentarily illuminate. Maximum landing gear extension ($V_{LO}$ Extend) and landing gear extended ($V_{LE}$) airspeed is 250 KIAS. Maximum landing gear speed for retraction ($V_{LO}$ Retract) is 200 KIAS.
3. ANTI-SKID - CHECK ON.
4. Flaps - FULL (175 KIAS - 35°).
   Flaps may be extended to LAND below 175 KIAS. Flaps should be in the LAND position for all normal landings. Check indicator to verify position. Handle must be pushed in to clear T.O. & APPR detent when LAND flaps are desired.
5. Airspeed - $V_{REF}$ Minimum.
   Consistently comfortable and safe landings are best achieved from a stabilized approach. The point at which the airplane should be stabilized with airspeed at $V_{REF}$ to $V_{REF}$ +10, full flaps, and the desired descent rate is normally coincident with commencing the final descent to landing. Under instrument conditions, this usually occurs at the final approach fix inbound.

   After passing the instrument approach fix outbound or nearing the airport traffic area, airspeed should be reduced below 200 KIAS and the flaps extended to the T.O. & APPR (15-degree) position. Approaching the final instrument fix inbound (one dot from glideslope intercept on an ILS), or a downwind abeam position, extend the landing gear. At the point where final descent to landing is begun, extend flaps to LAND, establish the desired vertical rate, and adjust power to maintain at $V_{REF}$ to $V_{REF}$ +10 indicated airspeed.

   Power management during the approach/landing phase is relatively easy in the Citation Excel because an $N_1$ setting in the 55-60 percent range will normally result in desired indicated airspeeds for the various configurations. Depending on air traffic control requirements, thrust necessary for the entire approach can often be set during descent keeping in mind that fan ($N_1$) RPM will decrease slightly for a fixed throttle setting with a decrease in altitude or indicated airspeed. Using a sea level airport with zero wind at a typical landing weight (17,000 pounds), a throttle setting that results in about 55 percent $N_1$ in close will give approximate level flight indicated airspeeds of 160 knots clean and 140 with flaps T.O. & APPR. Gear extended, flaps LAND, and commencing an average descent (500 feet per minute) will result in approximately $V_{REF}$ airspeed. Higher field elevations, landing gross weights and/or headwind component will require a greater power setting.

(Continued Next Page)

## BEFORE LANDING (Continued)

For maneuvering prior to final approach, minimum airspeeds of $V_{REF}$ +30, $V_{REF}$ +20 and $V_{REF}$ +10 should be maintained clean, flaps T.O. & APPR and flaps LAND respectively to provide an adequate margin above stall.

Speed control on final should be precise for optimum landing performance and this is best accomplished by establishing $V_{REF}$ airspeed well before crossing the threshold. In gusty wind conditions, it is recommended that one half the gust factor in excess of 5 knots be added to $V_{REF}$.

Approaching within approximately 50 feet of airport elevation, power should be gradually reduced to counter the acceleration induced by ground effect. Wind velocity and direction will dictate the rate at which the throttles are retarded. In very high surface headwind conditions, as an example, it may be necessary to maintain at or near approach power until close to touchdown. With a tailwind, a fairly rapid power reduction may be necessary in the final descent to landing phase for accurate speed control. In ground effect, where induced drag is reduced, leaving approach power on will cause the airplane to float to a longer touchdown than desired. Retarding the throttles gradually in the final descent will normally result in idle thrust being reached just before touchdown.

6. Speed Brake - RETRACT (above 50 feet AGL).
   Extended Speed Brakes are not approved for landing
7. Autopilot and Yaw Damper - OFF (Autopilot must be disconnected above 180 feet AGL).
   Yaw damper OFF to give complete rudder authority to the pilot for landing. If the YAW DAMPER is not turned off it will attempt to override pilot rudder input during touchdown and roll out. Utilize the AP/TRIM DISC button on either control wheel.

## ALL ENGINE GO-AROUND

1. Throttles - TO DETENT, Check TO $N_1$'S.
2. Airplane Pitch attitude - POSITIVE ROTATION TO +10 degrees (use flight director go-around mode).
3. Flaps - TAKEOFF/APPROACH (15 degrees).
4. Climb Speed - $V_{APP}$.
5. Landing Gear - UP.
   Raise the gear when a positive rate of climb is established.
6. Flaps - UP.
   At approximately 400 feet with wings level and a minimum airspeed of $V_2$ +10 KIAS, raise the flaps. Observe the position indicator to the left of the handle move to FLAP UP. While the minimum retraction airspeed should be attained, excessive speed will accentuate the pitch change
7. Throttles - CLB DETENT, Check CLB $N_1$'S or AS REQUIRED

## LANDING

1. Throttles - IDLE.

**NOTE**

- The NO TAKEOFF Caution annunciator will illuminate on landing with flaps FULL (35°).

- Eight seconds after touchdown, engines will spool down from flight idle to ground idle.

2. Brakes - APPLY (after touchdown).

**CAUTION**

IF, DURING LANDING, A HARD BRAKE PEDAL - NO BRAKING CONDITION IS ENCOUNTERED, OPERATE THE EMERGENCY BRAKE SYSTEM. CORRECT PRIOR TO NEXT FLIGHT.

**NOTE**

To obtain maximum braking performance from the antiskid system, the pilot must apply continuous maximum effort (no modulation) to the brake pedals.

3. Speed Brake - EXTEND (after touchdown).
4. Thrust Reversers - DEPLOY (after touchdown).

**WARNING**

**DO NOT ATTEMPT TO RESTOW REVERSERS AND TAKE OFF ONCE REVERSERS HAVE STARTED TO DEPLOY.**

**NOTE**

- To prevent any possible nose up pitch during thrust reverser deployment, maintain forward pressure on the control column after the nose wheel is on the ground.

- To avoid possible jamming of the throttle lockout cams, do not exceed approximately 15 pounds force on the thrust reverser levers.

5. Reverser Indicator Lights - CHECK ILLUMINATION OF ARM, UNLOCK AND DEPLOY LIGHTS.
6. Reverse Power - AS REQUIRED (do not exceed 75% of takeoff thrust).
7. Thrust Reversers - REVERSER LEVERS TO IDLE REVERSE AT 60 KIAS.

## AFTER LANDING

It is recommended that use of the checklist be delayed until the airplane is clear of the runway. Turn off the anti-collision lights.

1. Thrust Reversers - STOW.

**CAUTION**

DO NOT ADVANCE THROTTLES UNTIL THE THRUST REVERSER UNLOCK LIGHTS ARE OUT.

Do not advance the throttles while the thrust reversers are being stowed. There is danger of the throttle being rapidly returned to idle position, which could cause injury. To avoid activating the automatic retard system, do not advance the throttle after moving the reverse thrust lever to stow until the UNLOCK light is out.

2. Speed Brake - RETRACT.
   Check HYD PRESS and SPD BRK EXTEND lights extinguished.
3. Flaps - UP.
   Check that the HYD PRESS light extinguishes after the flaps are up. Taxiing with flaps in any position except up on a snow or slush covered taxiway may result in obstruction of the flaps. Setting flaps to T.O. & APPR may facilitate the next preflight inspection. If the airplane is to be unattended for a lengthy period or severe weather is expected, leave flaps up.
4. Ignition - NORM.
   Both IGNITION switches to NORM position.
5. Transponder/TCAS - STANDBY.
6. PITOT & STATIC Heat - OFF.
7. Anti-Ice/Deice - WING and TAIL OFF, ENGINE As Required.
8. Exterior Lights - AS REQUIRED.
   a. ANTI-COLL Lights - OFF.
   b. REC/TAXI Lights - AS REQUIRED.
9. Radar - STANDBY.
   Do not operate the radar within 15 feet of personnel or flammable or explosive material.

## SHUTDOWN

1. Parking Brake - SET or Wheels - CHOCK.

   Parking brakes should not be set if the brakes are very hot. Heat transfer to the wheels and tires is increased with parking brakes set. This can cause the fusible plugs to melt, deflating the tires. Do not leave the airplane unattended without chocks unless the parking brake is set. Do not set the parking brake if the anticipated cold soak temperature is -15°C (5°F) or below.

   Always check cabin differential pressure at zero before opening the door. Any pressure existing due to malfunction of the left main gear squat switch or outflow valves could cause the door to open rapidly presenting a hazard to personnel in the vicinity.
2. AVIONICS POWER - OFF.
3. STBY PWR - OFF.
4. Anti-Ice Systems - OFF.
5. Exterior Lights - OFF.

   Turn off the navigation lights.
6. A/C-FANS - OFF.
7. Throttles - CUT OFF after allowing Inter-Turbine Temperature (ITT) to stabilize at minimum value for one minute.

   Lifting the latch and placing the throttles full aft terminates fuel flow to the engine. A canister collects manifold fuel on shutdown. During the next flight, this fuel is returned to the fuel cell. Repeated starts for ground operation will cause the canister to overflow through the lower nacelle after the third shutdown.
8. EMER LTS - OFF.
9. Passenger Advisory Lights - OFF.
10. Battery Switch - OFF.

    BATT switch to the center OFF position. Care should be exercised that it is not placed in EMER. Although most emergency bus items (COMM 1, NAV 1, floodlights, and standby pitot/static heat) are normally off, the pilot's directional gyro and the standby horizontal situation indicator (HSI) would drain the battery over a period of time.

    For deplaning at night, the battery switch may be left in BATT to make available all cabin lighting until passengers and cabin baggage are deplaned. Turning the WING INSP lights switch ON provides additional illumination in front of the cabin door. An illuminated courtesy light switch located on the forward door post is wired to the hot battery bus and turns on the emergency exit lights and one aft baggage compartment light.
11. Engine Covers - INSTALL (after engines have cooled).

    In conditions of blowing or drifting snow, install engine covers after shutdown as soon as engines cool sufficiently. These intake and exhaust covers should be installed to prevent long periods of windmilling.
12. Airplane - SECURE.

    When securing the airplane, install the engine and pitot tube covers. Check the BATT, passenger advisory and courtesy light switches off. Closing the door extinguishes integral courtesy light switch illumination. All doors and the nose avionics compartment can be key locked. A locking pin can be installed in the internal emergency exit door handle to prevent access from the outside. This pin must be removed prior to flight.

## QUICK TURN

1. Return to BEFORE START checklist.

# SPECIAL PROCEDURES

## SHORT FIELD OPERATION

For takeoff, taxi into position as close to the approach end as possible and apply takeoff thrust while holding the brakes. Airplane Flight Manual takeoff field length data assumes a static run-up and use of all available runway. When specified thrust is set, release the brakes. Rotate smoothly right at $V_R$ as a delay will result in degradation of takeoff performance. Retract the gear when positively climbing and climb at $V_2$ ($V_2$ +10 KIAS Multi-engine) with T.O. (7 degree) or T.O. & APPR. (15-degree) flaps until clear of any obstacles.

Landing field length data in the FAA Approved Airplane Flight Manual assumes a steady 3-degree approach angle and a threshold crossing speed of $V_{REF}$ at an altitude of 50 feet, with thrust reduced to idle at that point. In practice, it is suggested that for minimum field operations the threshold be crossed at a comfortable obstacle clearance altitude allowing some deceleration to take place approaching the runway. Touchdown should occur with maximum available runway remaining at minimum safe speed.

The energy to be dissipated during rollout is directly related to airplane weight and velocity at touchdown. Although weight is normally dictated by cabin loading and reserves required, flight planning into short fields should include avoiding carrying excessive weight in stored fuel. This consideration offers the side benefit of improved enroute performance. Velocity is something that can be controlled in nearly every case. Precise speed control is important in the short field environment. A one percent increase in speed will require approximately two percent more rollout distance. Excessive speed and late throttle reduction will also increase "float" prior to touchdown.

In general, short field landings are accomplished the same as normal landings except for heavier braking and closer attention to touchdown point and speed. A stabilized approach at $V_{REF}$ provides the best possible starting point because any corrections necessary will be small. Establish a glide angle that will safely clear any obstacles and result in touchdown as comfortably close to the approach end as feasible.

Avoid a very flat approach as they generally result in excessive power being required in close and the vertical gust protection margin is reduced. At approximately 50 feet AGL, power reduction is normally begun to cross the threshold at a speed not in excess of $V_{REF}$. Check the throttles at idle and avoid an excessive flare that may cause the airplane to float. Deceleration will take place much more rapidly on the runway than it will airborne.

If thrust reversers are not used, extend the speed brakes while lowering the nose and commence braking with steady maximum pressure. Once braking has begun, back pressure on the yoke will create elevator drag without affecting weight on the gear provided the nose wheel is not lifted off the runway.

For landings utilizing thrust reversers, after touchdown on the mains, lower the nose, extend speed brakes, apply wheel brakes, and deploy the thrust reversers. Forward pressure on the yoke should be applied during reverser deployment. Check illumination of the ARM, UNLOCK and DEPLOY lights. Once the thrust reversers are deployed, apply maximum reverse thrust power. Once braking has begun and maximum reverse power is reached, back pressure on the yoke will provide additional weight on the main gear provided the nose is not raised. At 60 KIAS return the thrust reverser levers to the idle reverse detent position. Leave the thrust reversers deployed for aerodynamic drag and idle reverse thrust.

## ADVERSE FIELD CONDITIONS

The Airplane Flight Manual presents takeoff field length data for dry, and wet, hard surface runways. The AFM landing data assumes a dry, hard surface runway. Precipitation-covered runway conditions will degrade braking effectiveness and will require significantly greater actual takeoff and landing field lengths.

Considerations for landing on a precipitation-covered runway are similar to those for short field operations where speed is minimized and maximum roll out distance is made available. Runway composition, condition and construction, the amount of precipitation and the depth of main landing gear tire tread remaining affect the magnitude of braking degradation, so it is impossible to apply a fixed factor to cover all conditions. Again, maximizing rollout runway available and touching down at minimum safe speed will provide the greatest possible margin.

Use of the thrust reversers on precipitation-covered runways is the same as that for a landing on a normal or dry runway. Cockpit visibility is not hampered by blowing rain, snow, or ice thrown forward by the thrust reversers except at low speed with idle reverse. Single-engine reversing during crosswind landings on precipitation-covered runways should be used with discretion.

Precipitation covered and icy runways present particular hazards which must be understood in order to achieve effective braking. Under normal braking conditions the antiskid system is very effective in preventing skids and in producing minimum stopping distances, with the pilot applying and maintaining steady maximum pressure. However, on a precipitation or ice covered runway, the phenomenon of dynamic hydroplaning may greatly reduce the antiskid effectiveness, because the wheels either do not spin up equally or do not spin up to the antiskid threshold speed. It is important to maintain properly inflated tires with good tread depth, and because ground speed is critical, to avoid tailwinds when operating in these conditions. When braking on precipitation covered runways, ensure that the wheels are down and tracking prior to applying brakes. This will give the wheels time to spin up. Ensure that maximum weight is on the wheels, i.e., deploy speed brakes and retract flaps. If runway permits, utilize maximum aerodynamic braking and thrust reversers to slow the airplane prior to braking. When braking is commenced, gradually apply steady pressure until antiskid cycling begins. As long as the antiskid is cycling, maintain that pressure. If long antiskid pressure dumps occur due to hydroplaning, release the brakes to allow the wheels to spin up again and then gradually reapply pressure until antiskid cycling resumes.

After landing on ice or slush, a complete check of the airplane, including overboard vents and control surfaces, should be conducted.

## ENGINE ANTI-ICE

The importance of proper system use cannot be overemphasized as serious engine damage can result from ice ingestion. Its function is preventative in nature and flight into visible moisture with an outside air temperature below +10°C indicated RAT should be anticipated so that the system is on and operating when icing conditions are encountered. Turning it on after ice has accumulated could result in ice from the inlet being freed and ingested by the engine.

Bleed air anti-icing of the engine inlet alone is available at idle power and above, however, approximately 70 percent $N_2$ RPM is required to maintain the ENG ANTI-ICE annunciator extinguished when operated in conjunction with WING ANTI-ICE. In descent, it should be turned on well before entering an icing environment to ensure that sufficient time is available for all system parameters to be met.

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## ENGINE ANTI-ICE (continued)

Engine icing may occur before ice formation is observed on the wings; therefore, surface icing should not be used to verify possible engine icing. The ENGINE ANTI-ICE system must be operating any time the airplane is operated in visible moisture below +10°C indicated ram air temperature (RAT) or when airframe icing is occurring. Refer to Section II of this manual for an explanation of the ice protection systems.

**NOTE**

- If ambient temperature is approximately 15°C or warmer, the ENG ANTI-ICE L/R annunciators may not illumiinate when anti-ice is selected ON. To ensure that bleed air is flowing to the engine inlet, the crew should observe a momentary small decrease in $N_2$ when ENGINE ON is selected.
- During sustained ground operations in freezing precipitation the engines should be operated for 15 seconds out of every 4 minutes at 60% $N_2$ or above to preclude ice forming on engine probes or internal components.

**CAUTION**

DURING SUSTAINED GROUND OPERATIONS IN FREEZING PRECIPITATION, IF THE ENGINES ARE OPERATED AT IDLE, ICE MAY FORM ON ENGINE PROBES AND INTERNAL COMPONENTS. THIS MAY CAUSE ENGINE VIBRATION AND ERRONEOUS RAT INDICATIONS. BY INCREASING THE ENGINE SPEED TO 60% $N_2$ OR HIGHER, THE ENGINE VIBRATION WILL BE ELIMINATED AND THE RAT INDICATION WILL READ CORRECTLY. THE PILOT SHOULD ACCOMPLISH THIS PROCEDURE PRIOR TO READING RAT TO COMPUTE TAKEOFF $N_1$ SETTINGS.

## PASSENGER COMFORT

Passenger comfort can be broadly delineated into two categories of environmental/pressurization and pilot technique. Some pointers are as follows:

- When parked during daylight in hot weather, it is suggested that the cabin window shades be closed to reduce solar heat transfer. An optional exterior windshield cover performs the same function for the cockpit and is very effective.
- The interior temperature can be controlled on the ground by use of the vapor cycle air conditioning (operating from generator or GPU power) and/or Air Cycle Machine. In flight, the vapor cycle air-conditioning system can be used up to 18,000 feet to augment ACM cooling capabilities. Refer to Section 2 of this manual, Environmental and Temperature Control, for a complete description and operation of system components.

- To warm the interior, a combination of hot engine bleed air is mixed with cold air from the air cycle machine. This temperature can be controlled through a wide range of settings. Refer to Section 2 of this manual, Environmental and Temperature Control, for a complete description and operation of system components.

- Increasing or decreasing engine bleed air extraction can cause a slight momentary bump in cabin pressure. Always check power stabilized at idle when changing the PRESS SOURCE SELECT on the ground.

- The abbreviated checklist is designed to enable the cockpit crew to perform all prestart functions in advance. This permits items such as the Warning Test to be complete before cabin crew and passenger boarding and accelerates the ramp departure without compromising safety or thoroughness.

- Leaving the chocks, brake checks can be done lightly and smoothly. If heavy braking is required on landing roll, using up elevator to create drag also counters the nose down pitching moment so that deceleration feel in the cabin is less abrupt. Do not apply excessive back pressure, as weight may be lifted from the main wheels decreasing braking effectiveness and increasing the possibility of a blown tire.

- The pressurization system procedures outlined in this chapter, coupled with a thorough understanding of the automatic controller and indicators greatly simplifies operation Optimum system performance in terms of passenger comfort is best achieved by proper selection of landing field elevation and by not making power changes simultaneously.

- Although it is not mandatory, use of the yaw damper is recommended when hand flying the airplane. It reduces pilot rudder input required and the airplane rides better in rough air. The yaw damper must be off for takeoff and landing.

- Power management has an impact on cabin comfort and changes should be made smoothly and symmetrically. An approximate estimate of synchronization can be made by observing the RPM gages and exact adjustments made audibly or with the engine synchronizer. Although the higher pitched turbine sound is generally more noticeable in the cockpit, the lower, fan out-of-synchronization sound is usually more pronounced in the area of the rear seats.

- Good crew coordination and smooth operation of the controls and systems serves the best interests of safety, economy and passenger comfort.

## WHEEL FUSIBLE PLUG CONSIDERATIONS

Brake application reduces the speed of an airplane by means of friction between the brake stack components. This friction generates heat, which increases the temperature of the brake and wheel assembly, resulting in an increased tire pressure. Each main wheel incorporates fuse plugs, which melt at a predetermined temperature, to prevent a possible tire explosion due to excessively high tire pressure. Flight crews must take precautions when conducting repetitive traffic circuits, including multiple landings and/or multiple rejected takeoffs, to prevent overheating the brakes, which could melt the fuse plugs and cause loss of all tire pressure and possible tire and wheel damage. During such operations, available runway permitting, minimize brake useage and consider cooling the brakes in flight with the landing gear extended. Maximizing use of reverse thrust and extending speed brakes will assist in bringing the airplane to a stop.

## BIRD INGESTION PRECAUTIONS

Studies have indicated that bird strikes are more likely to occur from the surface to approximately 4000 feet AGL. As a precaution against engine flameout due to bird ingestion, it is recommended that the engine ignitors be ON when flying at or below 4000 feet AGL, or anytime the crew has reason to suspect that the potential for a bird strike exists.

## TURBULENT AIR PENETRATION

Flight through severe turbulence should be avoided if possible. The following procedures are recommended for flight in severe turbulence.

1. Ignition - ON.
2. Airspeed approximately 180 KIAS. Do not chase airspeed.
3. Maintain a constant attitude without chasing the altitude. Avoid sudden large control movements.
4. Operation of autopilot is recommended using basic pitch and lateral mode only.

## COLD WEATHER OPERATION

Operation of the airplane has been demonstrated after prolonged exposure to ground ambient temperature of -30°C (-22°F). This was the minimum temperature achieved in cold weather testing. The operational procedures in this section are recommended for operations where prolonged exposure to temperatures below -10°C (+14°F) is anticipated or has occurred.

1. If the aircraft has been cold soaked at temperatures below -10°C (+14°F) it is recommended that the battery and crew oxygen masks be removed and stored at a temperature above -10°C (+14°F). If the battery has been cold soaked at temperatures below -10°C (+14°F) battery warmup to at least -10°C (+14°F) is required. This temperature may be checked with the battery temperature gage. Proper battery warmup may require extended application of heat to the battery.
2. The use of engine preheat should not be required at temperatures down to -25°C (-13°F). However, it should be verified after engine start and before flight that there are no visible oil leaks.
3. The avionics may require warmup after cold soak. This may require as long as 30 minutes. All avionics and must be operating properly before flight as indicated by the following:
   a. RAT indication stable and correct.
   b. Standby Flight Display aligned and indicating correctly.
   c. PFDs and MFD including air data displays indicating correctly.
   d. FMS CDUs and Radio Management Units (RMUs) indicating and operating correctly with no visible waviness or distortion.
   e. Audio reception is available on all applicable avionics.
4. It is recommended that the cockpit be warmed to at least 50°F as indicated on the cockpit temperature indicator before flight. This can be accomplished by taxiing the airplane to a suitable area and increasing power above idle (approximately 60% $N_2$) to obtain duct supply temperatures of approximately 200°F.

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## COLD WEATHER OPERATION (continued)

Engine preheating is best accomplished by installing the engine covers and directing hot air through the oil filler access door. A heater hose can be placed in the tail cone with the door propped as far closed as possible to minimize heat loss. With sufficient hose length, the cabin and cockpit area can be warmed through the pilot's side window.

The W/S TEMP annunciator may not test after cold soak at extremely cold temperatures. If this occurs, repeat the test after the cabin has warmed up. The test must be completed prior to flight.

If a start is attempted and the starter will not motor to 8 percent $N_2$ minimum, terminate the sequence. Advancing the throttle to idle below 8 percent $N_2$ can be damaging to the engine and battery. Battery voltage below 11 volts after the start button is pressed indicates a potential for an unsuccessful start.

Do not set the parking brake if the anticipated cold soak temperature is -15°C (5°F) or below.

Maximum heat from the air conditioning system is obtained with the right engine operating and the PRESS SOURCE SELECT in NORM. Switching the Temperature control selector to MANUAL and selecting MANUAL HOT for 10 seconds ensures that the temperature mixing valve is in the full hot position. Turning on the CKPT RECIRC fan to HI will increase air circulation in the cockpit. Operating the right engine above idle RPM increases temperature and airflow.

Because the airplane utilizes two separate controls for the cockpit and the cabin, comfortable temperature ranges can be obtained at both locations. Separate zone sensors for both the cockpit and cabin ensure accurate readings throughout the comfort range.

Use of MANUAL mode of the AUTO TEMP SELECT should be restricted to below 31,000 feet altitude in order to prevent possible overheating of the air cycle machine, which would result in automatic actuation of the emergency pressurization system.

Operating in extremely cold temperatures reduces the solubility and super cools any water particles in the fuel, increasing the possibility of fuel system icing. The five tank, and one fuel filter drains under each wing should be drained frequently and thoroughly. It is possible for water to settle in the sump and freeze, blocking the drain, in which case heat should be applied until fuel flows freely. Maintain heat after flow begins to ensure that all particles have melted and collect the drainage in a clear, clean container to inspect for water globules.

# GROUND DEICE/ANTI-ICE OPERATIONS

During cold weather operations, flight crews are responsible for ensuring the airplane is free of ice contaminants.

Ground icing may occur whenever there is high humidity with temperatures of +10°C or colder. Type I deice, and Type II or Type IV anti-ice fluids may be used sequentially to ensure compliance with FAA regulations (clean wing concept) requiring critical component airframe deicing and anti-icing.

**NOTE**

It is recommended that flight crews refamiliarize themselves seasonally with the following publications for expanded deice and anti-ice procedures:

- Cessna Maintenance Manual Chapter 12.
- FAA Advisory Circular AC 120-58 (large aircraft), dated September 30, 1992 or later.
- FAA Advisory Circular AC 135-17 (small aircraft), dated December 14, 1994 or later.
- Cessna Citation Service Letter SL560XL-30-01

## DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS)

ONE STEP DEICING - Type I fluid is used to remove ice, slush and snow from the airplane prior to departure, and to provide minimal anti-icing protection, as provided in the Type I holdover timetable (refer to applicable service letter).

TWO STEP DEICE/ANTI-ICE - May be used to ensure the airplane remains clean after deicing. Type II or Type IV fluid is used to provide longer term anti-icing protection, as provided in the Type II or Type IV holdover timetable (refer to applicable service letter).

**CAUTION**

TYPE I, TYPE II, AND TYPE IV FLUIDS ARE NOT COMPATIBLE AND MAY NOT BE MIXED. ADDITIONALLY, MOST MANUFACTURERS PROHIBIT MIXING OF BRANDS WITHIN A TYPE.

Line personnel should be supervised by the PIC or SIC to ensure proper application of deice or anti-ice, fluids. Refer to Figures 4-2 and 4-3.

**NOTE**

The first area to be deiced/anti-iced should be easily visible from the cabin/cockpit and should be used to provide a conservative estimate for unseen areas of the airplane before initiating takeoff roll.

Holdover timetables (refer to applicable service letter) are only estimates and vary depending on many factors which include temperature, precipitation type, wind and airplane skin temperature. Holdover times are based on mixture ratio. Times start when the last application begins.

## DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS) (Continued)

Guidelines for holdover times anticipated by SAE Type I, Type II, or Type IV, and ISO Type I, Type II, or TYPE IV fluid mixtures are a function of weather conditions and outside air temperature (OAT).

**CAUTION**

- AIRPLANE OPERATORS ARE SOLELY RESPONSIBLE FOR ENSURING HOLDOVER TIMETABLES CONTAIN CURRENT DATA.
- TABLES ARE FOR USE IN DEPARTURE PLANNING ONLY AND THEY SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CONTAMINATION CHECK PROCEDURES.

**NOTE**

- Tables do not apply to other than SAE or ISO Type I, Type II or Type IV FPD fluids.
- The responsibility for the application of this data remains with the user.
- The freezing point of Type I, Type II, and Type IV fluid mixture must be at least 10°C (18°F) below the current OAT.

### SPRAYING TECHNIQUE - TYPE I FLUID

Type I fluid should be sprayed on the airplane (with engines off) in a manner which minimizes heat loss to the air. If possible, fluid should be sprayed in a solid cone pattern of large coarse droplets at a temperature of 160° to 180°F. The fluid should be sprayed as close as possible to the airplane surfaces, but not closer than 10 feet if a high pressure nozzle is used. Refer to Figures 4-2 and 4-3 for essential areas to be deiced and anti-iced.

### SPRAYING TECHNIQUE - TYPE II FLUID

Application techniques for Type II fluid are the same as for Type I, except that since the airplane is already clean, the application should last only long enough to properly coat the airplane surfaces. Refer to Figure 4-2 and 4-3 for essential areas to be deiced/anti-iced.

Type II, fluid should be applied cold to a "clean" airplane. It is, however, sometimes heated and sprayed as a deicing fluid. For this case, it should be considered a Type I fluid, as the heat may change the characteristics of the thickening agents in the fluid. Type II fluid, therefore, applied in this manner, will not be as effective as if it were applied cold.

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## DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS) (Continued)

### SPRAYING TECHNIQUE - TYPE IV FLUID

Application techniques for Type IV fluid are the same as for Type I, except that since the airplane is already clean, the application should last only long enough to properly coat the airplane surfaces. Refer to Figure 4-2 and 4-3 for essential areas to be deiced/anti-iced.

Type IV, fluid should be applied cold to a "clean" airplane. It is, however, sometimes heated and sprayed as a deicing fluid. For this case, it should be considered a Type I fluid, as the heat may change the characteristics of the thickening agents in the fluid. Type IV fluid, therefore, applied in this manner, will not be as effective as if it were applied cold.

**NOTE**

- Holdover time starts when last application has begun.
- Some Type IV fluids could form a thick or high-strength gel during "dry-out" and when rehydrated form a slippery film.
- Some Type IV fluids exhibit poor aerodynamic elimination (flow-off) qualities at colder temperatures.
- Heated areas of aircraft (i.e.; heated leading edge) should be avoided due to the fact that fluid may "dry-out" into hard globular nodules.
- Type IV fluid should not be used undiluted below -24°C (-11°F).

## PRETAKEOFF CONTAMINATION CHECK - GROUND ICING CONDITIONS

When ground icing conditions are present, a pretakeoff contamination check should be conducted by the PIC/SIC within 5 minutes prior to takeoff, preferably just prior to taxiing onto the active runway. Critical areas of the airplane such as empennage, wing, windshield and control surfaces should be checked to ensure they are free of ice, slush and snow or that the deice/anti-ice fluids are still protecting the airplane. Refer to Figure 4-2 and 4-3 for essential areas to be deiced/anti-iced.

# AIRPLANE DEICING INFORMATION

| | |
|---|---|
| **MINIMUM DIRECT SPRAY AREAS:** | ENGINE INLETS, ENGINE EXHAUST, RAM AIR INLETS, BRAKES, PITOT HEADS, STATIC PORTS, WINDSHIELD, CABIN WINDOWS, AND AOA VANES. |

**NOTE:** SHADED AREAS INDICATE ESSENTIAL AREAS TO BE DEICED.

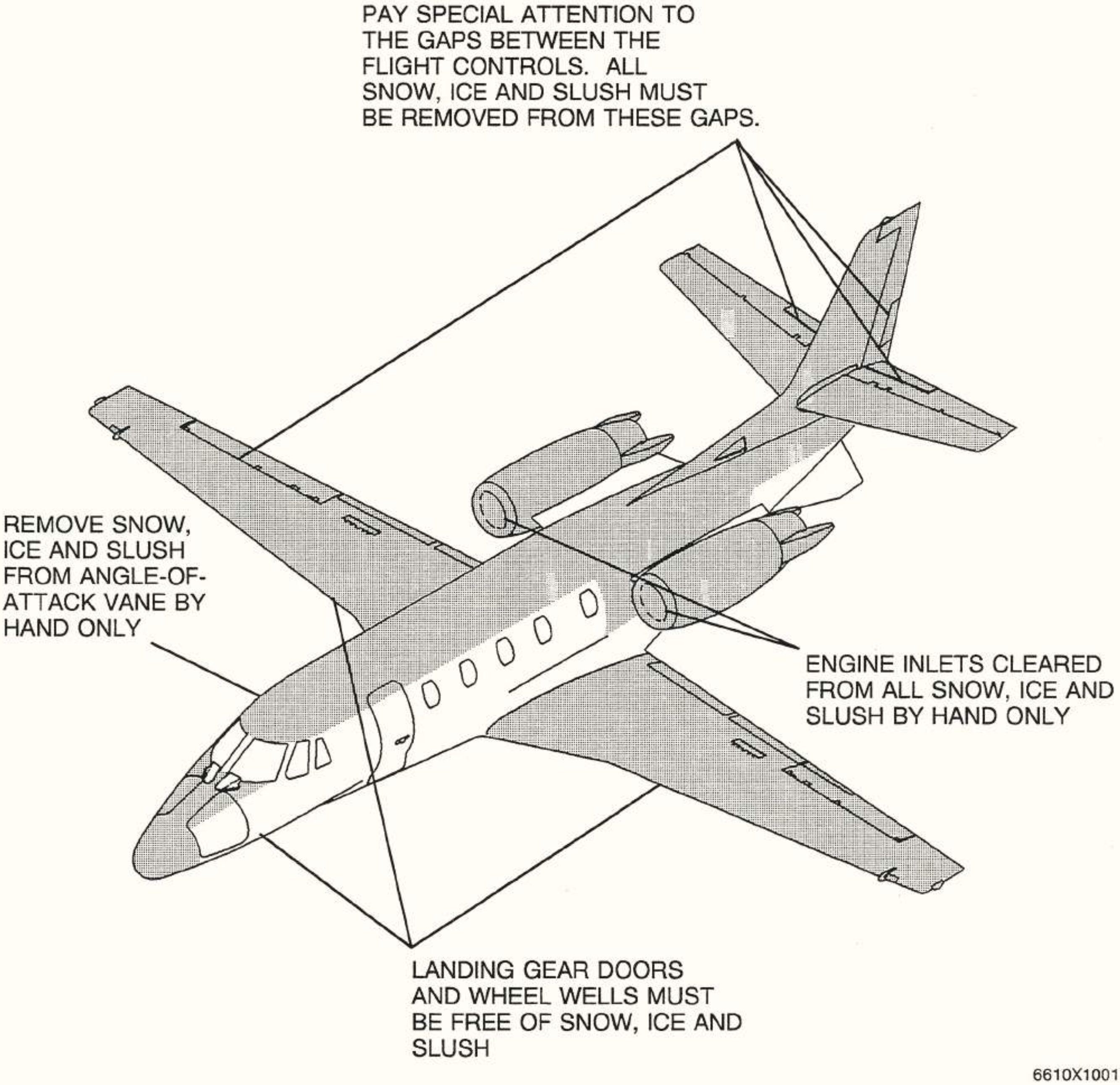


Figure 4-2

# AIRPLANE ANTI-ICING INFORMATION

| | |
|---|---|
| **MINIMUM DIRECT SPRAY AREAS:** | ENGINE INLETS, ENGINE EXHAUST, RAM AIR INLETS, BRAKES, PITOT HEADS, STATIC PORTS, WINDSHIELD, CABIN WINDOWS, AND AOA VANES. |

**NOTE:** THE SHADED AREAS INDICATE AREAS WHERE ANTI-ICE FLUID IS APPLIED. UPPER FUSELAGE IS ANTI-ICED TO PRECLUDE ICE FORMATION WHICH COULD BE INGESTED INTO ENGINE INLETS.

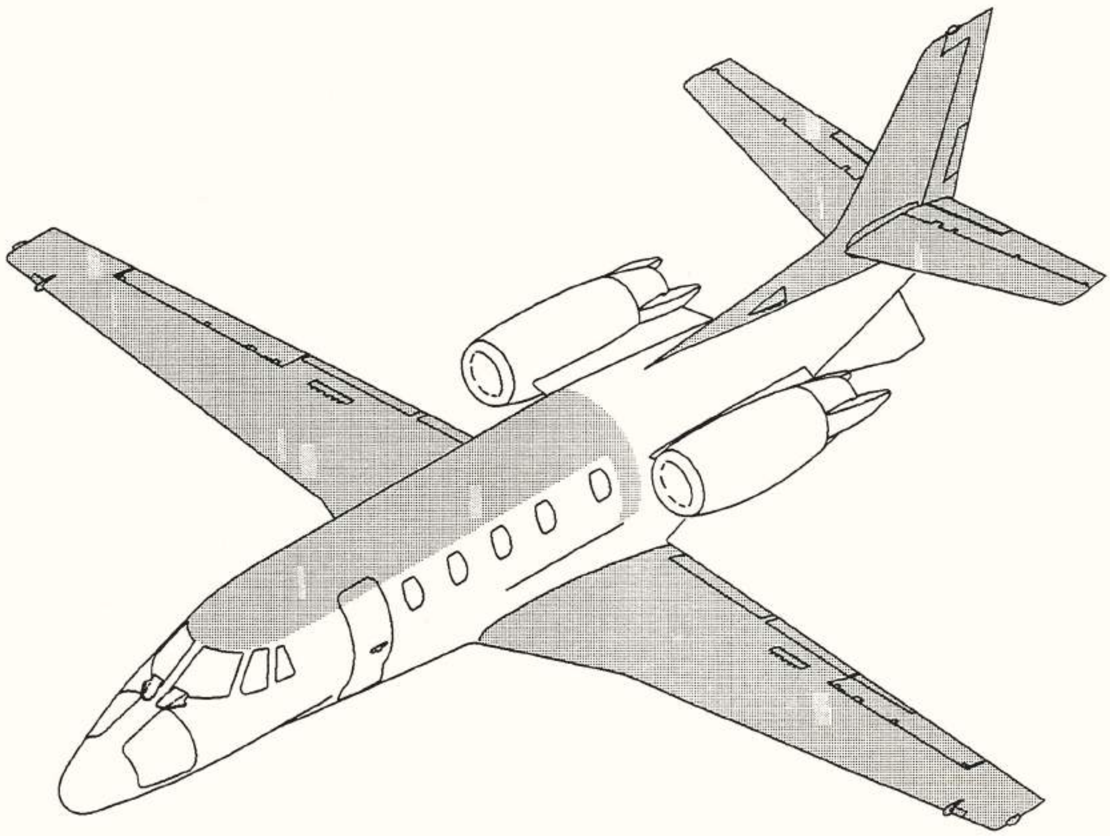

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Figure 4-3

# SERVICING

## FUEL

A variety of fuels can be used in the airplane, but each must have anti-icing additive incorporated or added to the fuel during refueling. Commercial kerosene Jet A, Jet A-1, JP-5, and JP-8 are approved fuels.

Additives meeting the specifications of MIL-I-27686, MIL-I-85470 (DIEGME) or PFA 55 MB can be used with fuel that does not contain an anti-icing additive. Ethylene glycol monomethyl ether (EGME) and diethylene glycol monomethyl ether (DIEGME) are approved anti-icing additives which meet these specifications, respectively.

Refer to the Normal Procedures Section of the FAA Approved Airplane flight Manual for instructions concerning procedures, quantities, and equipment to be used in treating the airplane fuel with anti-icing additive.

### WARNING

**ANTI-ICING ADDITIVES CONTAINING ETHYLENE GLYCOL MONOMETHYL ETHER (EGME) ARE HARMFUL IF INHALED, SWALLOWED, OR ABSORBED THROUGH THE SKIN, AND WILL CAUSE EYE IRRITATION. ALSO, COMBUSTIBLE. BEFORE USING THESE MATERIALS, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.**

### CAUTION

- DIETHYLENE GLYCOL MONOMETHYL ETHER (DIEGME) IS SLIGHTLY TOXIC IF SWALLOWED AND MAY CAUSE EYE REDNESS, SWELLING AND IRRITATION. IT IS ALSO COMBUSTIBLE. BEFORE USING THIS MATERIAL, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.

- ASSURE THAT THE ADDITIVE, EGME OR DIEGME IS DIRECTED INTO THE FLOWING FUEL STREAM AND THAT THE ADDITIVE FLOW IS STARTED AFTER THE FUEL FLOW STARTS AND IS STOPPED BEFORE FUEL FLOW STOPS. DO NOT ALLOW CONCENTRATED ADDITIVE TO CONTACT COATED INTERIOR OF FUEL TANK OR AIRPLANE PAINTED SURFACE.

Insufficient additive concentration may result in fuel system icing. Excessive additive may cause fuel tank damage or erroneous fuel quantity indications.

When refueling, do not operate radios, radar or other electronic equipment and ensure the fuel truck is grounded and a ground is connected to the airplane. A fuel ground plug attachment point is located under each wing tip.

It is not necessary to maintain fuel balance during refueling; however, maximum asymmetric fuel differential for flight is 400 pounds. In an emergency, 800 pounds of fuel unbalance may be tolerated.

The single-point pressure refueling receptacle is located on the right side of the fuselage, forward of the wing. It permits simultaneous servicing of both sides of the fuel system. Refer to the Maintenance Manual, Chapter 12 for fuel servicing procedures. Single point refueling operations must be accomplished per the procedures stated on the placard installed on the single point refueling access door.

## OIL

Each engine oil tank has an oil filler neck with a dipstick and cap assembly. Oil is added to each engine directly through the filler neck and quantity is measured on the dipstick in U.S. quarts. An accurate check of oil quantity can only be made when the engine is hot, within approximately 10 minutes after engine shutdown.

**CAUTION**

PERSONS WHO HANDLE ENGINE OIL ARE ADVISED TO MINIMIZE SKIN CONTACT WITH USED OIL, AND PROMPTLY REMOVE ANY USED OIL FROM THEIR SKIN. A LABORATORY STUDY, WHILE NOT CONCLUSIVE, FOUND SUBSTANCES WHICH MAY CAUSE CANCER IN HUMANS. THOROUGHLY WASH USED OIL OFF SKIN AS SOON AS POSSIBLE WITH SOAP AND WATER. DO NOT USE KEROSENE, THINNERS OR SOLVENTS TO REMOVE USED ENGINE OIL. IF WATERLESS HAND CLEANER IS USED, ALWAYS APPLY SKIN CREAM AFTER USING.

EXXON TURBO OIL 2380, CASTROL 5000, AEROSHELL TURBINE OIL 500, AEROSHELL TURBINE OIL 560, ROYCO TURBINE OIL 500, ROYCO TURBINE OIL 560, MOBIL JET OIL 254 and MOBIL JET OIL II are all approved oils. Normally different brands of oil should not be mixed; however, if oil replenishment is required and oil of the same brand as tank contents is not available, follow procedures set forth in Section I of this manual under OIL. The type of oil used in each airplane is noted in the engine logbook as well as on a placard inside the filler access door.

The latest revision of Pratt and Whitney Canada Inc. Service Bulletin 7001 may also be consulted for approved oils.

## HYDRAULIC

Servicing the main hydraulic reservoir requires equipment capable of delivering hydraulic fluid under pressure and is normally performed by maintenance personnel. The reservoir should be serviced with one of the approved fluids, SKYDROL 500A, B, B-4, C or LD-4; or Hyjet, Hyjet W, III, IV, IVA, or IVA Plus.

The hydraulic brake reservoir can be serviced by removing the left nose compartment lower liner to allow access to the reservoir. The filler plug can then be removed and the reservoir filled to within one-half inch of the opening. The brake reservoir should be serviced with one of the approved fluids, SKYDROL 500 B or equivalent.

## OXYGEN

The oxygen filler valve is located just inside the access door in the right forward avionics compartment, near the aft of the compartment. Oxygen servicing should be done by maintenance personnel using breathing oxygen conforming to MIL-O-27210, Type I. Refer to the cockpit gage while servicing to prevent overfill.

Oxygen pressure will vary with ambient temperature. In very cold ambient temperatures the oxygen pressure indication may appear low, but may in actuality be appropriate for the temperature condition.

**NOTE**

Refer to Chapter 12 of the Airplane Maintenance Manual, Oxygen Service Requirements, Pressure Variations Chart.

## FIRE BOTTLES

Under-serviced fire bottles must be exchanged by authorized maintenance facilities.

## LANDING GEAR AND BRAKES PNEUMATIC SYSTEM

The emergency gear and brake bottle should be serviced when the pressure gage reads below 1800 PSI. Maintenance personnel should perform the servicing with high pressure nitrogen and refill the bottle to 2050 PSI. Servicing is accomplished through a charging valve on the bottle which is located behind the right baggage compartment aft liner.

## TIRES

Main gear tire pressures should be maintained at 210 PSI and the nose tire at 130 PSI. Since tire pressure will decrease as the temperature drops, a slight over inflation can be used to compensate for cold weather. Main tires inflated at 21°C should be overinflated 1.5 PSI for each 6°C drop in temperature anticipated at the coldest airport of operation. Nose tires at 21°C should be overinflated only 0.5 PSI for each 6°C anticipated drop in temperature.

Worn tires and underinflation of tires both contribute to lowering the speed at which hydroplaning occurs on precipitation covered runways. Refer to Adverse Field Conditions in this section for a discussion of hydroplaning.

## TOILET

The airplane may be equipped with either an aft carry out flush toilet or an externally serviceable flush toilet. Both types requires servicing when the liquid level becomes too low or when liquid appears to have incorrect chemical balance. Instructions for servicing the toilets are found in Chapter 12 of the Airplane Maintenance Manual.

# AIRPLANE CLEANING AND CARE

## PAINTED SURFACES

The exterior of a new airplane is painted with a polyurethane two-component topcoat which, unlike early coatings, does not require exposure to air for complete cure to occur. The care required by the finish will not change as the paint ages.

The finish should be cleaned only by washing with clean water and mild soap, followed by rinse water and drying with a soft cloth or chamois.

Minimize flying through rain, hail or sleet.

To help prevent development of corrosion, particularly filiform corrosion, the airplane should be spray-washed at least every two or three weeks (especially in warm, damp, and salty environments) and waxed with a good grade of water repellent wax to help keep water from accumulating in skin joints and around countersinks. A heavier coating of wax on the leading edge, on the vertical tail and on the engine nose cones helps to reduce abrasions encountered in these areas.

Polyurethane topcoats are designed with UV inhibitors to slow the degradation caused by exposure. The inhibitors concentrate near the surface of the coating during the initial stages of cure. Care must be taken during any buffing, polishing, or power waxing so that this surface layer is disturbed only to the smallest extent necessary. With special care, however, buffing, polishing or power waxing is acceptable. Wax products containing silicones should be avoided as they contribute to the buildup of P-static, especially if the surface is well buffed to produce a shine.

## DEICE BOOTS

The deice boots on the horizontal stabilizer leading edges have a special electrically conductive coating to bleed off static charges which cause radio interference and may perforate the boots. Servicing operations should be done carefully, to avoid damaging this conductive coating or tearing the boots.

To prolong the life of surface deice boots, they should be washed and serviced on a regular basis. Keep the boots clean and free from oil, grease and other solvents which cause rubber to swell and deteriorate. Clean the boots with mild soap and water, then rinse thoroughly with clean water. Outlined below are recommended cleaning and servicing procedures.

**CAUTION**

USE ONLY THE FOLLOWING INSTRUCTIONS WHEN CLEANING BOOTS. DISREGARD INSTRUCTIONS WHICH RECOMMEND PETROLEUM BASE LIQUIDS (METHYL-ETHYL-KETONE, NONLEADED GASOLINE, ETC.) WHICH CAN HARM THE BOOT MATERIAL.

**NOTE**

Isopropyl alcohol can be used to remove grime which cannot be removed using soap. If isopropyl alcohol is used for cleaning, wash area with mild soap and water, then rinse thoroughly with clean water.

To possibly improve the service life of deice boots and to reduce the adhesion of ice, it is recommended that the deice boots be treated with AGE MASTER Number 1 and ICEX.

AGE MASTER Number 1, used to protect the rubber against deterioration from ozone, sunlight, weathering, oxidation and pollution, and ICEX, used to help retard ice adhesion and for keeping deice boots looking new longer, are both products of and recommended by B.F. Goodrich.

The application of both AGE MASTER Number 1 and ICEX should be in accordance with the manufacturer's recommended directions as outlined on the containers.

**CAUTION**

- PROTECT ADJACENT AREAS, CLOTHING, AND USE PLASTIC OR RUBBER GLOVES DURING APPLICATIONS, AS AGE MASTER NUMBER 1 STAINS AND ICEX CONTAINS SILICONE WHICH MAKES PAINT TOUCHUP ALMOST IMPOSSIBLE.
- ENSURE THAT THE MANUFACTURER'S WARNINGS AND CAUTIONS ARE ADHERED TO WHEN USING AGE MASTER NUMBER 1 AND ICEX.

If a high gloss finish is desired on the deice boots, ACROSEAL coating (available from Huber Janitorial Supplies, 114 North St. Francis Street, Wichita, KS 67202) may be used in lieu of AGE MASTER Number 1 and/or ICEX. Preparation for application of ACROSEAL is the same as required for AGE MASTER Number 1 and ICEX. Apply a thin layer of ACROSEAL on the clean and dry surface of the deice boot with a cloth swab. Let dry thoroughly and hand buff with a soft cloth.

Small tears and abrasions can be repaired temporarily without removing the boots and the conductive coating can be renewed.

## ENGINES

The engine compartments should be cleaned using a suitable solvent. Most efficient cleaning is done using a spray-type cleaner. Before spray cleaning, ensure protection is afforded for other components which might be adversely affected by the solvent. Refer to the Airplane Maintenance Manual for proper lubrication of components after engine cleaning.

## INTERIOR CARE

To remove dust and loose dirt from the upholstery, headliner and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

**WARNING**

- **USE ALL CLEANING AGENTS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.**
- **THE USE OF TOXIC OR FLAMMABLE CLEANING AGENTS IS DISCOURAGED. IF THESE CLEANING AGENTS ARE USED, ENSURE ADEQUATE VENTILATION IS PROVIDED TO PREVENT HARM TO THE USER AND/OR DAMAGE TO THE AIRPLANE.**

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

The plastic trim, instrument panel and control knobs need only be wiped with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with kerosene. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

## WINDOWS AND WINDSHIELDS

The glass windshields and forward (fixed) cockpit side windows, and the acrylic aft (openable) cockpit windows, and the cabin windows should be kept clean at all times. Recommended products and materials for washing and protecting the windows and windshields are listed in Chapter 12 of the Airplane Maintenance Manual. The acrylic windows should be kept clean and waxed at all times. To prevent scratches and crazing, wash them carefully with plenty of soap and water, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used, but only to carry water to the surface. Rinse thoroughly, then dry with a clean, moist chamois. Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge which attracts dust particles in the air. Wiping with a moist chamois will remove both the dust and this charge.

Remove oil and grease with a cloth moistened with kerosene. Never use gasoline, benzine, acetone, carbon tetrachloride, fire extinguisher fluid, lacquer thinner or glass cleaner. These materials will soften the acrylic and may cause it to craze.

After removing dirt and grease, if the surface is not badly scratched, it should be waxed with a good grade of commercial wax. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry soft flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the acrylic. If the surface is badly scratched refer to the Airplane Maintenance Manual for approved repairs.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated. Canvas covers may scratch the acrylic surface.

## OXYGEN MASKS

The crew masks are permanent-type masks which contain a microphone for radio transmissions. The passenger masks are oro-nasal type which forms around the mouth and nose area. All masks can be cleaned with alcohol. Do not allow solution to enter microphone or electrical connections. Apply talcum powder to external surfaces of passenger mask rubber face-piece.

# SECTION V

# ABNORMAL PROCEDURES

## CONTENTS

# ABNORMAL PROCEDURES

## ENGINE FAILURE/PRECAUTIONARY SHUTDOWN

1. AP TRIM DISC - PRESS and RELEASE.
2. Rudder and Aileron Trim - Trim toward operating engine as required.
3. Throttle (affected engine) - CUT OFF.
4. Autopilot/Yaw Damper - ON as desired.
5. IGNITION Switch (affected engine) - NORM.
6. ENGINE SYNC - OFF.
7. GEN Switch (affected engine) - OFF.
8. Electrical Load - REDUCE as required.
9. Fuel CROSSFEED - AS REQUIRED to maintain fuel balance within 400 pounds.
10. Affected ENGINE Anti-ice - CHECK OFF.
11. WING XFLOW - ON as required.
12. If no fire, Firewall Shutoff - LEAVE OPEN and FUEL BOOST Pump - ON.

**NOTE**

- If no fire hazard or engine damage exists, leave firewall shutoff OPEN, turn fuel boost pump ON to prevent damage to engine-driven fuel pump.
- If engine windmills with firewall shutoff CLOSED or with no indication of oil pressure, after landing refer to Engine Maintenance Manual for required inspections.

13. Refer to Abnormal Procedures, IN-FLIGHT RESTART - ONE ENGINE or Abnormal Procedures, SINGLE-ENGINE APPROACH and LANDING.

## IN-FLIGHT RESTART - ONE ENGINE (Refer to Figure 5-1 for Airstart Envelope)

### FOLLOWING SHUTDOWN - WITH STARTER ASSIST

1. Throttle - CUT OFF.
2. GEN Switch - ON.
3. Firewall Shutoff - CHECK OPEN.
4. IGNITION Switch - NORM.
5. ENGINE START Button - PRESS momentarily.
6. Throttle - IDLE at 8% $N_2$ minimum.
7. Engine Instruments - MONITOR.
8. FUEL BOOST Pump - NORM.

### IF START DOES NOT OCCUR

9. START DISG Button - PRESS.
10. Accomplish Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

### FOLLOWING SHUTDOWN - WINDMILLING WITH AIRSPEED ABOVE 200 KIAS AND $N_2$ ABOVE 8%. (Refer to Figure 5-1 for Airstart Envelope)

1. Throttle - CUT OFF.
2. Firewall Shutoff - CHECK OPEN.
3. IGNITION Switch - ON.
4. FUEL BOOST Pump - ON.
5. Throttle - IDLE.
6. Engine Instruments - MONITOR.
7. After engine stabilizes, FUEL BOOST Pump and IGNITION - NORM.
8. GEN Switch - ON.

# AIRSTART ENVELOPE

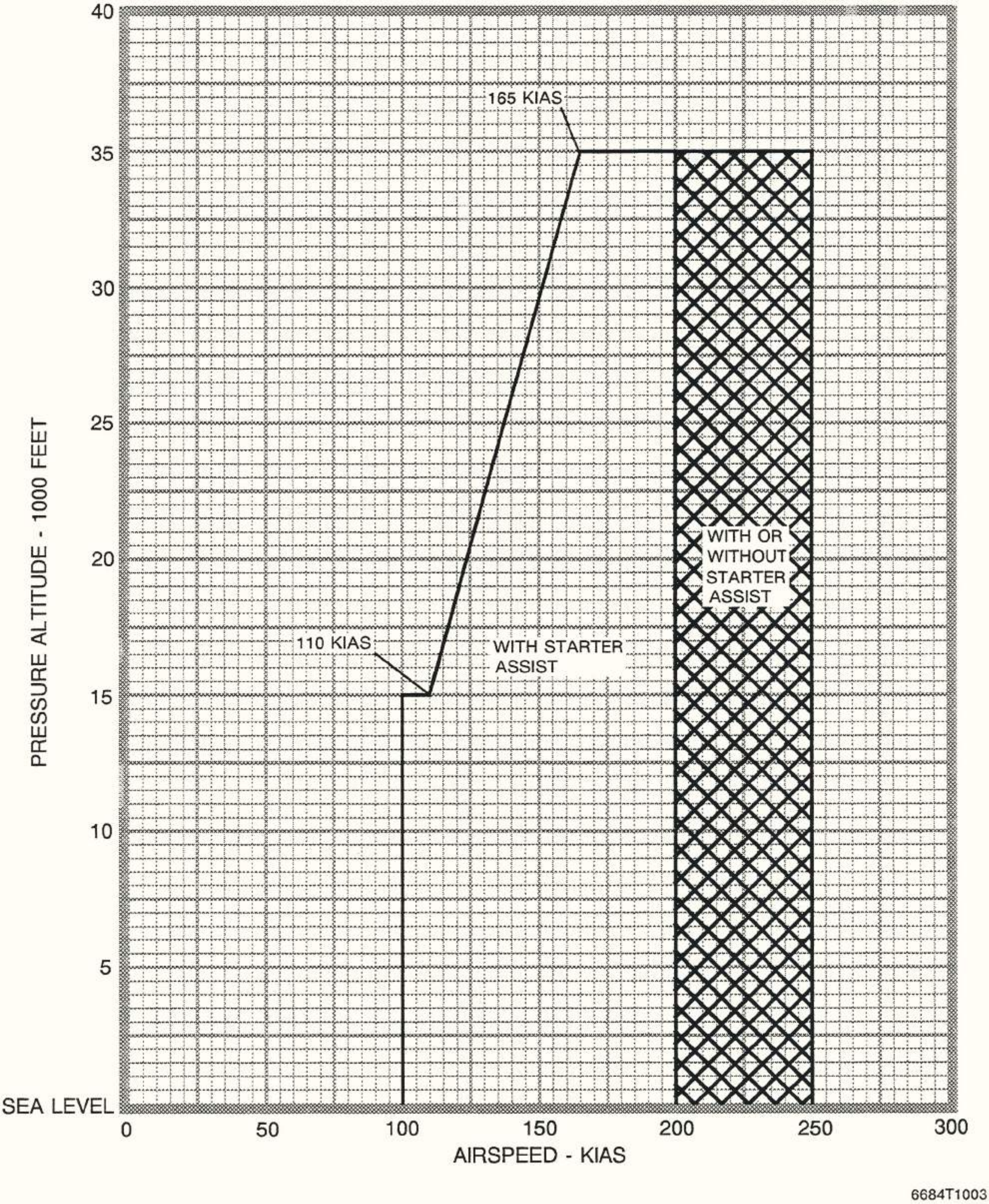


Figure 5-1. Airstart Envelope

## ENGINE START MALFUNCTION (ENGINE DOES NOT START)

1. Throttle - CUT OFF.
2. START DISG Button - PRESS 15 seconds after throttle OFF.

## ENGINE STARTER WILL NOT DISENGAGE (L OR R ENGINE START BUTTON LIGHT ON AFTER ENGINE START)

1. START DISG Button - PRESS.

**IF STARTER DOES NOT DISENGAGE AND ENGINE START BUTTON LIGHT REMAINS ILLUMINATED (START RELAY STUCK)**

2. GEN Switches - OFF.
3. BATTERY DISCONNECT Switch (LH panel) - LIFT GUARD AND DISCONNECT.

**NOTE**

Verify ground power is disconnected prior to engine shutdown or the starter will motor the engine.

4. Throttle(s) - CUT OFF.

**NOTE**

Disconnect the battery prior to turning the BATT Switch OFF.

## HIGH SUSTAINED ITT DURING GROUND SHUTDOWN

1. Throttle - CUT OFF.
2. ENGINE START Button - PRESS momentarily.
3. START DISG Button - PRESS after 15 seconds.

## DRY MOTORING

1. Throttle - CUT OFF.
2. IGNITION Switch - OFF.
3. FUEL BOOST Pump - ON.
4. ENGINE START Button - PRESS momentarily. Motor engine for the desired duration (observe starter limits).
5. START DISG Button - PRESS.
6. FUEL BOOST Pump - OFF.

## OIL FILTER BYPASS (OIL FLTR BP L OR R CAUTION LIGHT ON)

1. Land as soon as practical - Monitor affected engine oil pressure and temperature. Consider possibility of partial or total loss of affected engine thrust.
2. Perform inspection/maintenance after landing.

## HIGH OIL PRESSURE

### ABOVE 250 PSI

1. Throttle (affected engine) - REDUCE POWER.
2. Land as soon as practical.

## LOW FUEL PRESSURE (LO FUEL PRESS L OR R CAUTION LIGHT ON)

1. FUEL BOOST Pump - ON
2. L or R FUEL BOOST and CONTROL Circuit Breakers (LH Panel) - CHECK IN.
3. Fuel Quantity - CHECK.
4. Fuel CROSSFEED - AS REQUIRED.

## LOW FUEL QUANTITY (LO FUEL LEVEL L OR R CAUTION LIGHT ON)

The illumination of this light serves notice to the pilot that a minimum of 360 $\pm$20 pounds of fuel remains in either tank.

1. FUEL BOOST Pump - ON.
2. L or R FUEL BOOST and CONTROL Circuit Breakers (LH Panel) - CHECK IN.
3. Fuel CROSSFEED - AS REQUIRED.
4. Land as soon as possible.

## FUEL BOOST PUMP ON (FUEL BOOST L OR R CAUTION LIGHT ON)

Indicates that the respective fuel boost pump was either automatically or manually turned on.

1. FUEL BOOST Pump (affected pump) - ON; then NORM. CHECK for FUEL BOOST caution light to illuminate and extinguish.

During Fuel Crossfeed ON if boost pump latches ON to the side receiving crossfeed, cycle Boost Pump ON and back to NORM after 15 seconds. If boost pump latches ON again, do not cycle Boost Pump until after crossfeed operation is completed and Crossfeed is selected OFF.

If affected FUEL BOOST caution light does not extinguish, refer to Abnormal Procedure, LOW FUEL PRESSURE. If operating with Jet B or JP-4 fuel, verify operations are within the Jet B/JP-4 Fuel Operating Envelope. Refer to Figure 1-7A.

## FUEL FILTER BYPASS (FUEL FLTR BP L OR R CAUTION LIGHT ON)

1. Land as soon as practical - Consider possibility of partial or total loss of both engines thrust.
2. Inspect filter after landing.

## FUEL CROSSFEED (FUEL XFEED ADVISORY LIGHT ON)

1. Fuel crossfeed valve is open.

## GROUND IDLE (GND IDLE ADVISORY LIGHT ON)

Indicates EEC is in ground idle mode (47% $N_2$ minimum). Engine acceleration in flight from idle may be slow.

### ON GROUND

Indicates normal operation with EEC's in AUTO.

### IN FLIGHT

1. ENGINE SYNC - OFF.
2. Throttle(s) - MAINTAIN 51.5% $N_2$ minimum.

## ELECTRONIC ENGINE COMPUTER IN MANUAL MODE (EEC MANUAL L OR R ADVISORY LIGHT ON)

Indicates Electronic Engine Computer is in manual mode.

1. Throttle (affected engine) - Verify engine response to throttle movement.

**IF AFFECTED ENGINE RESPONDS TO THROTTLE**

2. Throttles - Ensure above idle and set matched $N_1$'s.
3. EEC Switches - L and R MAN.

**NOTE**

If originally unaffected engine does not respond to throttle movement in manual mode, reselect EEC mode. Throttles will not be matched for equal power.

4. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

**NOTE**

- In the manual mode, throttle detents will be inoperative. Set thrust by reference to AFM thrust charts.
- In the manual mode, engine response and throttle position will be different than normal mode.
- Multiply landing distance by 1.1 if WING/ENGINE or ENGINE anti-ice is on.

**IF AFFECTED ENGINE DOES NOT RESPOND TO THROTTLE**

2. Affected ENGINE Anti-Ice - ON (required sensing flow should resume, restoring engine response).
3. Throttle (affected engine) - Verify engine response to throttle inputs.

**IF AFFECTED ENGINE RESPONDS TO THROTTLE (WITH ENGINE ANTI-ICE ON)**

4. Throttles - Ensure above idle and set matched $N_1$'s.
5. EEC Switches - L AND R MAN.

**NOTE**

If originally unaffected engine does not respond to throttle movement in manual mode, reselect EEC mode. Throttles will not be matched for equal power.

6. ENGINE Anti-Ice Switches (Land R) - ON.
7. Land as soon as practical - Refer to Normal Procedures, BEFORE LANDING.

**NOTE**

- In the manual mode, throttle detents will be inoperative. Set thrust by reference to AFM thrust charts.
- In the manual mode, engine response and throttle position will be different than normal mode.
- Multiply landing distance by 1.1 if WING/ENGINE or ENGINE anti-ice is on.

**IF AFFECTED ENGINE STILL DOES NOT RESPOND TO THROTTLE**

4. Throttle (affected engine) - IDLE.
5. Affected ENGINE Anti-Ice - OFF or AS REQUIRED.
6. EEC Switches - Leave L and R in EEC.
7. Land as soon as practical. Refer to Abnormal Procedures, SINGLE ENGINE APPROACH AND LANDING.

## FIREWALL SHUTOFF VALVE CLOSED (F/W SHUTOFF L OR R CAUTION LIGHT ON)

Indicates the fuel and hydraulic firewall shutoff valves are closed and the generator field relay is tripped.

## ENGINE FIRE DETECTION SYSTEM FAILURE (FIRE DET SYS L OR R CAUTION LIGHT ON)

Indicates failure of the affected engine fire detection system.

**ON GROUND**

1. Correct prior to flight.

**IN FLIGHT**

1. FIRE DETECT Circuit Breaker (LH Panel) - CHECK IN.
2. Engine Instruments - MONITOR (for secondary indications of fire).
3. Land as soon as practical.

**NOTE**

The fire warning system is inoperative. The firewall shutoff and fire extinguisher bottles are still available if secondary indications of fire are present.

## FIRE EXTINGUISHER BOTTLE PRESSURE LOW (FIRE EXT BOTL LOW CAUTION LIGHT ON)

One or both fire extinguisher bottles have low pressure or may have discharged.

**ON GROUND**

1. Correct prior to flight.

## ENGINE VIBRATION (ENG VIB L OR R ADVISORY LIGHT ON)

Indicates engine vibration monitor has detected a higher than normal level of vibration.

1. Vibration - CONFIRM (audible and tactile indications).

**IF VIBRATION EXISTS**

2. Engine - MONITOR for other evidence of malfunction. Consider reducing RPM.
3. Land as soon as practical.

**IF VIBRATION INCREASES OR OTHER EVIDENCE OF ENGINE MALFUNCTION IS PRESENT**

4. Consider the possibility of shutting down the engine. Refer to Abnormal Procedures ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and Abnormal Procedures SINGLE-ENGINE APPROACH AND LANDING.

**CAUTION**

IF SIGNIFICANT VIBRATION CONTINUES WITH THE ENGINE RUNNING, ENGINE FAILURE MAY RESULT.

## FUEL GAUGING SYSTEM FAULT (FUEL GAUGE L OR R CAUTION LIGHT ON)

Indicates that a fault has been detected in the respective fuel gauging system. Monitor the respective fuel gauge for proper indication. Consider the possibility that the tank contains less fuel than the opposite tank. This fault may also be the result of improper fuel capacitance. Check fuel after landing.

**NOTE**

After landing, the B.I.T. status LED's on the fuel quantity signal conditioner, located in the LH wall of the cockpit, should be checked by appropriate personnel prior to battery switch OFF. Removal of power will reset the failure pattern displayed by the BIT status LED's. Record fuel quantity in each tank at time of fault to assist in maintenance troubleshooting.

## SINGLE GENERATOR FAILURE (GEN OFF L OR R CAUTION LIGHT ON)

1. Electrical Load - DECREASE if required.
2. Air Conditioner - OFF or WEMAC BOOST LO or HIGH.
3. Failed Generator - RESET and ON.

**NOTE**

The air conditioner compressor will not automatically load-shed on the ground.

**IF UNABLE TO RESET**

4. Failed GEN - OFF.

## AFT J-BOX CURRENT LIMITER OR CIRCUIT BREAKER (AFT J-BOX LMT OR CB CAUTION LIGHT ON)

Indicates either an open current limiter or circuit breaker in the aft junction box.

**ON GROUND**

1. Correct prior to flight.

**IN FLIGHT**

2. Electrical System - MONITOR (generator voltages may vary from 25 to 33 volts).

**CAUTION**

DO NOT TURN OFF THE GENERATORS BECAUSE PARTIAL ELECTRICAL SYSTEM FAILURE MAY OCCUR ON THE BUS ASSOCIATED WITH A GENERATOR WHICH IS TURNED OFF.

## ALTERNATOR BEARING FAILURE (AC BEARING L OR R ADVISORY LIGHT ON)

Indicates impending alternator bearing failure within approximately 20 hours of operation. Maintenance is required.

## ENGINE BLEED AIR OVERHEAT (BLD AIR O'HEAT L OR R CAUTION LIGHT ON)

1. PRESS SOURCE Selector - SELECT OPPOSITE SIDE.
2. Throttle (affected engine) - REDUCE if practical.

## ENVIRONMENTAL SYSTEM AIR DUCT OVERHEAT (AIR DUCT O'HEAT CKPT OR CAB CAUTION LIGHT ON)

1. AUTO and MANUAL TEMP Circuit Breakers (LH Panel) - CHECK IN.
2. TEMP SEL (affected system) - MANUAL COLD; hold in this position until overheat light goes out (30 seconds maximum).

**NOTE**

Operation above 31,000 feet in MANUAL full cold mode may result in air cycle machine overtemp and shutdown. Refer to Abnormal Procedures, AUTOMATIC TEMPERATURE CONTROLLER INOPERATIVE.

**IF LIGHT EXTINGUISHES**

3. TEMP SEL (affected system) - AUTO (select a cooler temperature)

**NOTE**

If the AIR DUCT O'HEAT light illuminates again, select MANUAL on the Temperature Selector and Control Temperature with the MANUAL TEMP SEL Switch.

**IF LIGHT DOES NOT EXTINGUISH**

3. PRESS SOURCE Selector - LH or RH; reduce power on selected engine, if necessary to control temperature.

## AUTOMATIC TEMPERATURE CONTROLLER INOPERATIVE

1. TEMP SEL (affected system) - MANUAL, ENSURE NOT MANUAL FULL COLD. Select full manual cold, at least 10 seconds then actuate at least 3 seconds toward MANUAL HOT.

**NOTE**

Operation in manual mode, full cold, above 31,000 feet, particularly at low (climb) airspeed may result in air cycle machine overtemperature and shutdown. In the event that this should occur, refer to Abnormal Procedures, EMERGENCY PRESSURIZATION ON.

## EMERGENCY PRESSURIZATION ON (AUTOMATIC ACTUATION) (EMER PRESS CAUTION LIGHT ON) AND CABIN ALTITUDE (CAB ALT) WARNING LIGHT NOT ON

Indicates air cycle machine shutdown or failure.

1. NORM PRESS Circuit Breakers (LH Panel) - CHECK IN.
2. TEMP SEL (CKPT and CABIN) - ADJUST TO WARMER SETTING (may require manual mode).
3. PRESS SOURCE Selector - RH, LH or NORM.

(Continued next page)

## EMERGENCY PRESSURIZATION ON (AUTOMATIC ACTUATION) (EMER PRESS CAUTION LIGHT ON) AND CABIN ALTITUDE (CAB ALT) WARNING LIGHT NOT ON (Continued)

**IF EMER PRESS CAUTION LIGHT REMAINS ON**

4. PRESS SOURCE Selector - EMER, then RH, LH or NORM.

**IF EMER PRESS CAUTION LIGHT STILL REMAINS ON**

5. Press Source Selector - EMER.
6. Control cabin temperature with LH throttle.
7. Overhead Wemacs - OPEN.
8. CKPT RECIRC - HI.

**NOTE**

Emergency pressurization utilizes precooled bleed air (475°F) from the left engine.

## CABIN PRESSURIZATION CONTROLLER FAILURE

**IF CABIN ALTITUDE IS NOT BEING MAINTAINED (CABIN RATE-OF-CLIMB INDICATOR SHOWS POSITIVE RATE)**

1. PRESS SYSTEM SELECT - MANUAL.
2. Manual Toggle Switch - UP/DOWN to control cabin altitude.

**CAUTION**

CABIN MUST BE MANUALLY DE-PRESSURIZED PRIOR TO LANDING.

**IF NOT ARRESTED BY 10,000 FEET CABIN ALTITUDE (CAB ALT WARNING LIGHT ON)**

3. Crew Oxygen Masks - DON.
4. Microphone Switches - MIC OXY MASK.

**IF NOT ARRESTED BY 14,000 FEET CABIN ALTITUDE**

5. Emergency Descent - INITIATE. Refer to Emergency Procedures, EMERGENCY DESCENT.
6. PASS OXY Valve - ON.
7. Passenger Oxygen - ENSURE passengers are receiving oxygen.

**NOTE**

The emergency pressurization will automatically activate when cabin altitude exceeds approximately 14,500 feet, and will automatically deactivate when cabin altitude descends below this altitude.

(Continued Next Page)

## CABIN PRESSURIZATION CONTROLLER FAILURE (Continued)

**IF CABIN PRESSURE IS MAINTAINED, BUT AMBER FAIL ANNUNCIATOR IN PRESSURE CONTROLLER IS ILLUMINATED**

Indicates probable loss of air data sensor input, controller auto-schedule function inoperative.

1. Pressurization Controller - SELECT CA or FL (cabin altitude or flight level).
2. Pressurization SET ALT Knob - SET DESIRED CA or FL.
3. Prior to Descent - SET ALT Knob - SET CA; DESTINATION AIRPORT ELEVATION.

## AIR CYCLE MACHINE OVERHEAT (ACM O'HEAT CAUTION LIGHT ON)

Indicates possible excess pressure in the bleed air supply to the ACM or overheating of the air cycle machine. The ACM will automatically turn off and the emergency pressurization will automatically come on.

**ON GROUND**

1. Correct prior to flight.

**IN FLIGHT**

1. TEMP SEL (CKPT and CABIN) - ADJUST to warmer setting (may require manual mode).
2. PRESS SOURCE Selector - RH, LH or NORM.

**IF ACM O'HEAT CAUTION LIGHT REMAINS ON**

3. PRESS SOURCE Selector - EMER.
4. Control cabin temperature with LH throttle.

**NOTE**

Emergency pressurization utilizes precooled bleed air (475°F) from the left engine.

## ELECTRIC ELEVATOR RUNAWAY TRIM

1. AP TRIM DISC Switch - PRESS and RELEASE.
2. Throttles - REDUCE as required to control airspeed.
3. Manual Elevator Trim - AS REQUIRED.
4. PITCH TRIM Circuit Breaker (LH Panel) - PULL.

**NOTE**

Do not attempt to use the autopilot if the electric trim is inoperative. The autopilot will not be able to trim out servo torque, and disengaging the autopilot in this condition could result in a significant pitch upset.

## RUDDER BIAS SYSTEM VALVE NOT IN COMMANDED POSITION (RUDDER BIAS CAUTION LIGHT ON)

### ON GROUND

1. Rudder Bias Circuit Breaker (LH panel) - Pull.
2. Correct prior to flight.

### IN FLIGHT

1. Rudder Bias Circuit Breaker (LH panel) - Pull.
2. Flight may be continued in a normal manner.

**NOTE**

With the rudder bias inoperative, rudder pedal force and/or directional trim required for single engine operation will be significantly increased.

## RUDDER BIAS UNCOMMANDED MOTION (LEFT OR RIGHT RUDDER PEDAL MOVED FORWARD)

### UNCOMMANDED MOTION DURING GROUND OPERATION

1. Rudder Pedal Deflection - Overpower as required to maintain directional control.
2. Rudder Bias Circuit Breaker (LH panel) - Pull.
3. Correct prior to flight.

**NOTE**

Uncommanded motion can only be detected with both engines at approximately the same power.

### UNCOMMANDED MOTION DURING TAKEOFF OR IN-FLIGHT

1. Rudder Pedal Deflection - Overpower as required to maintain directional control.
2. Climb to and/or maintain a safe altitude.
3. Rudder Bias Circuit Breaker (LH panel) - Pull.
4. Flight may be continued in a normal manner.

**NOTE**

- Uncommanded motion can only be detected with both engines at approximately the same power.
- With the rudder bias inoperative, rudder pedal force and/or directional trim required for single engine operation will be significantly increased.

## RUDDER BIAS HEATER FAILURE (BIAS HEATER FAIL CAUTION LIGHT ON)

**NOTE**

Press the annunciator to cancel flashing.

### ON GROUND

1. Correct prior to flight.

### IN FLIGHT

1. Flight may continue in a normal manner.

## ELECTRIC TRIM INOPERATIVE

1. PITCH TRIM Circuit Breaker (LH Panel) - CHECK IN.

**IF STILL INOPERATIVE**

2. Manual Elevator Trim - AS REQUIRED.

**NOTE**

Do not attempt to use the autopilot if the electric trim is inoperative. The autopilot will not be able to trim out servo torque, and disengaging the autopilot in this condition could result in a significant pitch upset.

## JAMMED ELEVATOR TRIM

**TRIM AT CRUISE SETTING**

1. Maintain trim speed as long as practical until speed reduction is required for approach.
2. Throttles - IDLE. Reduce airspeed to 200 KIAS.
3. Flaps - 7° (extend at 200 KIAS).
4. Landing Gear - DOWN.
5. Flaps - 15°.
6. Airspeed - $V_{APP}$ minimum.
7. Speed Brake - RETRACT (above 50 ft AGL).
8. Yaw Damper - OFF.

**NOTE**

At flaps 15° the trim speed will be approximately 175 KIAS if the elevator trim jam occurred at $V_{MO}/M_{MO}$.

**TRIM AT TAKEOFF SETTING**

1. Throttles - REDUCE as required to maintain 140 KIAS or less.
2. Flaps - 15°.
3. Landing Gear - DOWN.
4. Airspeed - $V_{APP}$ minimum.
5. Speed Brake - RETRACT (above 50 ft. AGL).
6. Yaw Damper - OFF.

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# JAMMED ELEVATOR TRIM (Continued)

## GO-AROUND WITH TRIM AT APPROACH/LANDING SETTING

1. Airspeed - 140 KIAS or less.
2. Flaps - RESET to previous setting when safely airborne and clear of obstacles.
3. Land as soon as practical.

**NOTE**

- Do not attempt to use the autopilot if the electric trim is inoperative. The autopilot will not be able to trim out servo torque, and disengaging the autopilot in this condition could result in a significant pitch upset.
- Use of thrust reversers in excess of idle may increase nose up pitching force on rollout.
- Multiply landing distance by 1.4 with flaps 15°.

# STABILIZER POSITION MIS-COMPARE (STAB MIS COMP CAUTION LIGHT ON)

## ON GROUND

1. Correct prior to flight.

## IN FLIGHT

### If Landing

1. Flap Handle - CHECK in desired detent.
2. Use Normal Procedures.
3. Touch and go landings are prohibited.

### If After Takeoff

1. Flap Handle - CHECK in full up (0°) detent.
2. Limit airspeed to 200 KIAS and M 0.62.
3. Maximum Altitude - 41,000 feet.

# AUTOPILOT OUT OF TRIM (AP ROLL MISTRIM OR AP PITCH MISTRIM CAUTION LIGHT ON)

1. AP TRIM DISC Switch - PRESS and RELEASE (if elevator trim not in motion).

**CAUTION**

BE PREPARED FOR MINOR CONTROL WHEEL FORCE REQUIRED TO MAINTAIN DESIRED FLIGHT PATH.

2. Elevator or Aileron trim - ADJUST as required.
3. Autopilot - ENGAGE as desired.

## AUTOPILOT FAIL/DISCONNECT (AP OFF CAUTION LIGHT ON AND AP FAIL ANNUNCIATION ON PFD)

### ON GROUND

1. IC 1 Circuit Breaker - PULL and RESET.

### IN FLIGHT

1. AP TRIM DISC Switch - PRESS and RELEASE.

If the autopilot will not reset, continue flight in accordance with operating rules.

## LANDING WITH FAILED PRIMARY FLIGHT CONTROL CABLE

### RUDDER

1. Utilize rudder trim.
2. After touchdown, lower the nose and deploy Speed Brakes as soon as possible.

**NOTE**

- Avoid the use of thrust reversers during landing rollout.
- Nose wheel steering may not be available, use differential braking.

### AILERON

1. Yaw Damper - OFF.
2. Use rudder for directional control limiting bank angle to 15 degrees maximum. Do not use aileron trim except for gross adjustments.
3. If possible, choose a runway with least possible crosswind. Maximum crosswind 10 knots.
4. Land with flaps 15°.
5. After touchdown, lower the nose and extend speed brakes as soon as possible.

### ELEVATOR

1. Use manual elevator trim wheel for primary pitch control. Do not use electric trim.
2. Make small pitch and power changes and set up landing configuration early.
3. After touchdown and nose wheel on ground, extend speed brakes and apply wheel brakes as soon as possible.

**WARNING**

**DO NOT DEPLOY THRUST REVERSERS DURING LANDING ROLLOUT.**

**NOTE**

Multiply landing distance by 1.4 for flaps 15°.

## WING ANTI-ICE FAILURE (WING ANTI-ICE L OR R CAUTION LIGHT ON)

1. Throttle - INCREASE POWER (as required above 70% $N_2$).
2. Respective ENGINE Anti-ice Circuit Breaker (LH Panel) - CHECK IN.

**IF WING ANTI-ICE LIGHT REMAINS ON (AFTER TWO MINUTES)**

3. Respective ENGINE Anti-ice Circuit Breaker (LH Panel) - PULL.
4. WING XFLOW - ON.

**NOTE**

Respective WING and ENGINE ANTI-ICE annunciators will be inoperative and the wing/engine anti-ice valves will open.

5. After leaving icing environment, reset ENGINE Aniti-ice Circuit Breaker (if applicable) and select anti-ice switches OFF.

## ENGINE ANTI-ICE FAILURE (ENG ANTI-ICE L OR R CAUTION LIGHT ON)

1. Respective ENGINE Anti-ice Circuit Breaker (LH Panel) - PULL.

**NOTE**

Respective WING and ENGINE ANTI-ICE annunciators will be inoperative and the wing/engine anti-ice valves will open.

2. Monitor engine inlet or leave icing environment as soon as possible.
3. After leaving icing environment, reset ENGINE Anti-ice Circuit Breaker (if applicable) and select anti-ice switches OFF.

## WING BLEED AIR OVERHEAT (WING O'HEAT L OR R CAUTION LIGHT ON)

**CONTINUOUS ILLUMINATION**

1. Affected Wing - DECREASE POWER (corresponding engine).

**IF LIGHT DOES NOT EXTINGUISH**

2. Affected WING/ENGINE Anti-Ice Switch - ENGINE ON.
3. WING XFLOW - ON.
4. Leave icing environment as soon as practical.

## TAIL DEICE FAILURE (TL DEICE FAIL L OR R CAUTION LIGHT ON)

1. Throttles - INCREASE POWER (as required above 70% $N_2$).
2. Tail Deice Switch - OFF, then AUTO or MANUAL.

**IF TL DEICE FAIL LIGHT REMAINS ON**

3. Leave icing environment as soon as possible.

**BEFORE LANDING**

1. Avionics and Flight Instruments - CHECK and SET.
2. Crew Briefing - COMPLETE.
3. Passenger Advisory Lights - PASS SAFETY ON.
4. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
5. Flaps - TAKEOFF and APPROACH (15°).
6. IGNITION - ON.
7. Exterior Lights - AS REQUIRED.
8. Fuel CROSSFEED - OFF.
9. ENGINE SYNC - OFF.
10. Annunciator Panel - CHECK.
11. Pressurization - CHECK ZERO DIFFERENTIAL.
12. Landing Gear - DOWN ($V_{LE}$ 250 KIAS).
13. ANTI-SKID - CHECK ON.
14. Speed Brake - RETRACT (above 50 feet AGL).
15. Autopilot and Yaw Damper - OFF.
16. Airspeed - $V_{APP}$ Minimum.

**NOTE**

Multiply landing distance by 1.4 for flaps 15°.

## TAIL DEICE TIMER FAILURE (TL DEICE PRESS L OR R ADVISORY LIGHT FAILS TO ILLUMINATE OR CONTINUES TO CYCLE)

**IF ADVISORY LIGHT(S) FAILS TO ILLUMINATE**

1. TAIL Deice Switch - CHECK AUTO.
2. TAIL DEICE Circuit Breaker (LH Panel) - CHECK IN.
3. TAIL Deice Switch - MANUAL (Repeat at 3 to 5 minute intervals).

**IF TL DEICE PRESS ADVISORY LIGHT REMAIN ILLUMINATED WITH SWITCH IN OFF POSITION**

1. TAIL DEICE Circuit Breaker (LH Panel) - PULL.
2. Reset circuit breaker as needed to actuate the system.
3. Leave icing environment as soon as practical.

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## TAIL DEICE TIMER FAILURE (TL DEICE PRESS L OR R ADVISORY LIGHT FAILS TO ILLUMINATE OR CONTINUES TO CYCLE) (Continued)

### BEFORE LANDING

1. Avionics and Flight Instruments - CHECK and SET.
2. Crew Briefing - COMPLETE.
3. Passenger Advisory Lights - PASS SAFETY ON.
4. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
5. Flaps - TAKEOFF and APPROACH (15°).
6. IGNITION - ON.
7. Exterior Lights - AS REQUIRED.
8. Fuel CROSSFEED - OFF.
9. ENGINE SYNC - OFF.
10. Annunciator Panel - CHECK.
11. Pressurization - CHECK ZERO DIFFERENTIAL.
12. Landing Gear - DOWN ($V_{LE}$ 250 KIAS).
13. ANTI-SKID - CHECK ON.
14. Speed Brake - RETRACT (above 50 feet AGL).
15. Autopilot and Yaw Damper - OFF.
16. Airspeed - $V_{APP}$ Minimum.

**NOTE**

Multiply landing distance by 1.4 for flaps 15°.

## WINDSHIELD FAULT (W/S FAULT L OR R CAUTION LIGHT ON)

### IF W/S O'HEAT L OR R CAUTION LIGHT IS ON, REFER TO ABNORMAL PROCEDURES, WINDSHIELD OVERHEAT

### ON GROUND

1. Correct prior to flight.

**NOTE**

Indicates the controller has detected a fault and shut off the windshield anti-ice. May also be accompanied by corresponding W/S O'HEAT Caution light.

### IN FLIGHT

1. WINDSHIELD Heat (affected side) - OFF, then ON.

### IF W/S FAULT L OR R CAUTION LIGHT REMAINS ILLUMINATED

2. WINDSHIELD Heat (affected side) - OFF.
3. Leave icing environment as soon as practical.

**NOTE**

Ice protection will be lost to the outboard and center sections of the affected windshield and the inboard sections of the opposite windshield.

## WINDSHIELD OVERHEAT (W/S O'HEAT L OR R CAUTION LIGHT ON)

### IF W/S FAULT L OR R AND W/S O'HEAT L OR R CAUTION LIGHTS CYCLE (CONTROLLER FAILURE, SYSTEM CYCLING ON OVERTEMP LIMIT)

1. WINDSHIELD Heat Switch (affected side) - OFF (unless needed for icing or defog).
2. Leave icing environment as soon as practical.

**NOTE**

Ice protection will be lost to the outboard and center sections of the affected windshield and the inboard sections of the opposite windshield.

### IF W/S FAULT L OR R AND W/S O'HEAT L OR R CAUTION LIGHTS ON STEADY (SYSTEM FAILURE)

1. WINDSHIELD Heat Switch (affected side) - OFF.
2. Leave icing environment as soon as practical.

**NOTE**

Ice protection will be lost to the outboard and center sections of the affected windshield and the inboard sections of the opposite windshield.

## PITOT-STATIC HEATER FAILURE (P/S HTR OFF L OR R, OR STBY P/S HTR CAUTION LIGHT ON)

1. PITOT & STATIC Heat Switch - CHECK ON.
2. L PITOT STATIC, R PITOT STATIC, and STBY P/S HTR Circuit Breakers (LH Panel) - CHECK IN.
3. Autopilot - SELECT side with operable pitot static heat.

**NOTE**

The autopilot references the pilot's (L) or co-pilot's (R) pitot-static system; therefore, the altitude hold and speed hold functions may be inoperative if the coupled side pitot-static system fails in icing conditions. Autopilot should be transferred to operative side.

## ANGLE-OF-ATTACK PROBE HEATER FAILURE (AOA HTR FAIL CAUTION LIGHT ON)

Indicates that the angle of attack probe heating element has failed.

1. AOA HEATER Circuit Breaker (LH Panel) - CHECK IN.
2. Leave icing environment as soon as practical.

**NOTE**

If the AOA probe heater fails and the AOA probe becomes iced, the stick shaker may not function and the PFD low airspeed awareness display may not be reliable.

## PFD ATTITUDE FAILURE-SINGLE (RED ATT FAIL ON PFD ATTITUDE SPHERE)

1. ATT REV Button - PUSH (applicable display). Verify that amber ATT2 or ATT1 is displayed in pilot's and copilot's PFD.

## PFD HEADING FAILURE-SINGLE (RED HDG FAIL ON PFD HSI)

1. HDG REV Button - PUSH (applicable display). Verify that amber MAG2 or MAG1 is displayed in pilot's and copilot's PFD.

**NOTE**

The HDG REV button may require more than one push to select heading reversion mode. Reversion is verified by observing an amber MAG1 or MAG2, as appropriate, in each PFD.

## AIR DATA COMPUTER FAILURE-SINGLE (RED "X" ON PFD AIRSPEED / ALTITUDE TAPES)

1. ADC Button - PUSH (applicable display). Verify that amber, ADC2 or ADC1 is displayed in pilot's and copilot's PFD.

**NOTE**

- If normal operation of the MADC is restored all flight director modes and autopilot must be seleccted OFF and then back ON.
- The FMS on the side corresponding to the reverted ADC will display a FMS OVERSPEED INVALID message.

## IAC - PFD WRAP AROUND TEST FAIL (CHECK PFD I, CHECK PFD 2 CAUTION LIGHT ON)

Indicates IAC to PFD communication wraparound test has failed.

1. AP TRIM DISC Switch - PRESS and RELEASE.

**NOTE**

If normal operations of the MADC is restored all flight director modes and autopilot must be selected off and then back on.

## COMPARISON MONITOR ALERT (MESSAGE DISPLAYED ON PILOT'S OR COPILOT'S PFD)

Indicates one or more of the following parameters has exceeded its predetermined tolerance level:

| PFD ANNUNCIATOR | PARAMETER |
|---|---|
| PIT | Pitch Attitude |
| ROL | Roll Attitude |
| HDG | Heading |
| LOC | Localizer |
| ATT | Roll and Pitch Attitude |
| GS | Glideslope |
| ILS | Glideslope and Localizer |
| IAS | Airspeed |
| ALT | Altitude |

1. AP TRIM DISC Switch - PRESS and RELEASE.

**NOTE**

The autopilot must remain OFF. Yaw Damper may be utilized.

## SYMBOL GENERATOR FAILURE - SINGLE (RED "X" OR BLANK PFD)

1. MFD Controller Mode Select Knob - SELECT opposite side symbol generator (either SG1 or SG2).

2. PFD display - VERIFY amber SG1 or SG2 (as appropriate) annunciated in both PFDs and AP XFER has transferred to the selected side.

**NOTE**

Selected flight director modes will drop to basic attitude hold (ROL and PIT). Lateral and vertical FD modes may be reselected after SG reversion.

- If failure occurs on the pilot's side, the autopilot will disconnect and will not reengage after SG reversion.

- If failure occurs on the co-pilot's side, the autopilot will remain engaged.

## PRIMARY FLIGHT DISPLAY FAILURE (PILOT'S OR COPILOT'S PFD BLANK)

### ON GROUND

1. Correct prior to flight.

**NOTE**

A failed display unit in either pilot's or co-pilot's PFD position may be interchanged with the MFD display unit to allow dispatch with two functioning PFDs. Access to the removal screw is gained by removing the lower bezels.

**CAUTION**

WHEN THE MFD DISPLAY UNIT IS INOPERATIVE, THE FOLLOWING AVIONICS EQUIPMENT WILL NOT BE AVAILABLE:

- TAKEOFF V SPEED DISPLAY
- LANDING V SPEED DISPLAY
- FMS VNAV
- TCAS DISPLAY (OPTIONAL)
- SINGLE POINT VNAV

### IN FLIGHT

1. Dim Control (applicable display) - OFF.

**NOTE**

Turning off the applicable DIM knob on the DC-550 display controller will cause the PFD information to be displayed on the MFD.

## DISPLAY GUIDANCE COMPUTER COOLING FAN FAILURE (IC1 OR IC2 FAN MESSAGE ON MFD)

### ON GROUND

Indicates failure of the display guidance computer cooling fan.

1. Ground Operating Time - DO NOT EXCEED 10 MINUTES.

### IF GROUND OPERATING TIME EXCEEDS 10 MINUTES

2. PFD 1, PFD 2, IC 1, IC 2 and/or MFD Circuit Breakers (RH Panel) - PULL as appropriate.

**CAUTION**

ELECTRICAL POWER MUST BE REMOVED FROM EFIS SYSTEM TO PREVENT OVERHEATING DURING GROUND OPERATIONS.

3. PFD 1, PFD 2, IC 1, IC 2 and/or MFD Circuit Breakers (RH Panel) - RESET prior to takeoff.

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## DISPLAY GUIDANCE COMPUTER COOLING FAN FAILURE (IC1 OR IC2 FAN MESSAGE ON MFD) (Continued)

4. IC1 and IC2 HOT Annunciators - MONITOR.
5. Return to Normal Procedures.

**IN FLIGHT**

Indicates failure of the display guidance computer cooling fan.

1. IC1 and IC2 HOT Annunciators - MONITOR.

## DISPLAY GUIDANCE COMPUTER OVERTEMPERATURE (IC1 OR IC2 HOT MESSAGE ON PFD)

**ON GROUND**

1. Correct prior to flight.

**IN FLIGHT**

1. IC 1 or IC 2 Circuit Breaker (RH Panel) - PULL.
2. Land as soon as practical.

**NOTE**

The output of the unaffected display guidance computer may be used to drive all three displays by placing the SG reversion knob located on the MFD controller to SG1 or SG2 as appropriate.

## RADOME FAN FAILURE (RADOME FAN CAUTION LIGHT ON)

### ON GROUND

1. Ground Operation - LIMIT to 30 minutes.

### IN FLIGHT

1. Flight may be continued in a normal manner.

## AHRS ON BATTERY POWER (AHRS AUX PWR 1 OR 2 ADVISORY LIGHT ON)

AHRS 1 or 2 has transferred to the auxiliary battery due to loss of DC power.

## LANDING GEAR WILL NOT EXTEND

1. Landing Gear Handle - CHECK DOWN (airspeed below 200 KIAS).
2. GEAR CONTROL Circuit Breaker (LH Panel) - CHECK IN.
3. AUX GEAR CONTROL - PULL T-HANDLE and ROTATE TO LOCK.
4. Rudder - YAW AIRPLANE if necessary to achieve downlock light.
5. AUX GEAR CONTROL - PULL KNOB TO BLOW DOWN (for positive lock).

**NOTE**

Pneumatic pressure should be used to assure positive locking of all three gear actuators.

6. AUX GEAR CONTROL - RESET KNOB AND T-HANDLE (after gear down and locked).

## LOW HYDRAULIC FLOW (LO HYD FLOW L OR R CAUTION LIGHT ON)

Indicates inoperative left or right hydraulic pump.

### IF BOTH LO HYD FLOW L OR R CAUTION LIGHT ON

1. Land as soon as practical.

**NOTE**

The speed brakes, thrust reversers, horizontal stabilizer, and flaps may not operate. If the flaps lever is moved, the flaps may tend to float in a trail position. The landing gear may not operate using normal procedures.

## HYDRAULIC SYSTEM REMAINS PRESSURIZED (HYD PRESS CAUTION LIGHT REMAINS ON AFTER SYSTEM CYCLE IS COMPLETED)

1. HYD CONTROL Circuit Breaker (LH Panel) - PULL.

**IF SYSTEM DEPRESSURIZED**

2. HYD CONTROL Circuit Breaker - RESET prior to approach.

**IF SYSTEM REMAINS PRESSURIZED (Indicates bypass valve failed)**

2. HYD CONTROL Circuit Breaker (LH Panel) - RESET.
3. Airspeed - Maintain 200 KIAS or below.
4. Altitude - FL310 or below.
5. Land as soon as practical.

## LOW HYDRAULIC FLUID LEVEL (LO HYD LEVEL CAUTION LIGHT ON)

1. Land as soon as practical.

**NOTE**

The speed brakes, thrust reversers, horizontal stabilizer, and flaps may not operate. If the flaps lever is moved, the flaps may tend to float in a trail position. The landing gear may not operate using normal procedures.

## WHEEL BRAKE FAILURE

1. Brake Pedals - REMOVE FEET from BRAKE PEDALS.
2. EMER BRAKE Handle - PULL as required.

**CAUTION**

ANTISKID SYSTEM DOES NOT FUNCTION DURING EMERGENCY BRAKING. EXCESSIVE PRESSURE ON EMERGENCY BRAKE HANDLE CAN CAUSE BOTH WHEEL BRAKES TO LOCK, RESULTING IN BLOWOUT OF BOTH TIRES.

**NOTE**

Use Nosewheel Steering for directional control.

3. Multiply the landing distance by 1.4.

## POWER BRAKE SYSTEM FAILURE (LO BRK PRESS AND ANTISKID INOP CAUTION LIGHT ON)

1. PWR BRKS Circuit Breaker (LH Panel) - CHECK IN.

**IF LIGHT REMAINS ILLUMINATED**

2. Use the emergency brake system for landing.
3. Brake Pedals - REMOVE FEET FROM BRAKE PEDALS.
4. Emergency Brake Handle - PULL as required.

**CAUTION**

ANTISKID SYSTEM DOES NOT FUNCTION DURING EMERGENCY BRAKING. EXCESSIVE PRESSURE ON EMERGENCY BRAKE HANDLE CAN CAUSE BOTH WHEEL BRAKES TO LOCK, RESULTING IN BLOWOUT OF BOTH TIRES.

**NOTE**

Use Nosewheel Steering for directional control.

5. Multiply the landing distance by 1.4.

## ANTISKID SYSTEM FAILURE (ANTISKID INOP CAUTION LIGHT ON AND LO BRK PRESS CAUTION LIGHT EXTINGUISHED)

1. SKID CONTROL Circuit Breaker (LH Panel) - CHECK IN.
2. ANTISKID Switch - OFF then ON.

**IF LIGHT REMAINS ILLUMINATED**

3. ANTISKID Switch - OFF.
4. Multiply landing distance by 1.6.
5. Thrust Reverser - Maximum Reverse Thrust.
6. Wheel Brakes - Lightly apply.

**CAUTION**

DIFFERENTIAL POWER BRAKING IS AVAILABLE. HOWEVER, SINCE THE ANTISKID IS INOPERATIVE, EXCESSIVE PRESSURE ON THE BRAKE PEDALS MAY CAUSE WHEEL BRAKES TO LOCK, RESULTING IN TIRE BLOWOUT.

7. Be prepared to use the emergency brake system.

**NOTE**

If the antiskid hydraulic pump fails after the accumulator pressure exceeds 850 psi, the LO BRK PRESS light may not illuminate until normal brakes are used.

## SINGLE-ENGINE APPROACH AND LANDING

1. Avionics and Flight Instruments - CHECK and SET.
2. Crew Briefing - COMPLETE.
3. Passenger Advisory Lights - PASS SAFETY ON.
4. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
5. Flaps - TAKEOFF and APPROACH (15°).
6. IGNITION (operating engine) - ON.
7. Exterior Lights - AS REQUIRED.
8. Fuel CROSSFEED - CHECK.
9. ENGINE SYNC - OFF.
10. Annunciator Panel - CHECK.
11. Pressurization - CHECK ZERO DIFFERENTIAL.
12. Landing Gear - DOWN ($V_{LE}$ 250 KIAS).
13. ANTI-SKID - CHECK ON.
14. Speed Brake - RETRACT (above 50 feet AGL).
14. Autopilot and Yaw Damper - OFF.
16. Airspeed - $V_{APP}$ +10 KIAS.
17. Flaps - LAND (when landing assured).
18. Airspeed - $V_{REF}$.

**NOTE**

When reconfiguring for approach and landing (i.e., flaps extended and gear down), and any ice accretion is visible on the wing leading edge, regardless of thickness, activate the wing and tail deice system. Continue to monitor the wing leading edge for any reaccumulation.

## SINGLE-ENGINE REVERSING

1. Throttle - IDLE.
2. Brakes - APPLY.
3. Speed Brake - EXTEND.
4. Thrust Reverser - DEPLOY (after nose wheel on ground).
5. Thrust Reverser Indicator Lights - CHECK ILLUMINATION of ARM, UNLOCK and DEPLOY LIGHTS.
6. Reverser Power - AS REQUIRED.
7. Thrust Reverser - REVERSER LEVER TO IDLE REVERSE AT 60 KIAS.

**NOTE**

Reverse thrust may need to be reduced during crosswind landings on wet or icy runways.

## SINGLE-ENGINE GO-AROUND

1. Throttle (operating engine) - TO DETENT, check TO $N_1$.
2. Airplane Pitch Attitude - 10° (Go-around mode on flight director for reference).
3. Flaps - TAKEOFF and APPROACH (15°).
4. Climb Speed - $V_{APP}$ Minimum.
5. Landing Gear - UP (when positive rate-of-climb is established).
6. Flaps (when clear of obstacle) - RETRACT at 1500 feet and accelerate to $V_{ENR}$.
7. Throttle (operating engine) - CLB DETENT, check CLB $N_1$.

## FLAPS INOPERATIVE APPROACH AND LANDING (NOT IN LANDING POSITION)

1. Avionics and Flight Instruments - CHECK and SET.
2. Crew Briefing - COMPLETE.
3. Passenger Advisory Lights - PASS SAFETY ON.
4. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
5. FLAPS CONTROL Circuit Breaker (LH Panel) - CHECK IN.
6. IGNITION - ON.
7. Exterior Lights - AS REQUIRED.
8. Fuel CROSSFEED - OFF.
9. ENGINE SYNC - OFF.
10. Annunciator Panel - CLEAR.
11. Pressurization - CHECK ZERO DIFFERENTIAL.
12. Landing Gear - DOWN ($V_{LE}$ 250 KIAS).
13. ANTI-SKID - CHECK ON.
14. Speed Brake - RETRACT (above 50 feet AGL).
15. Autopilot and Yaw Damper - OFF.
16. Airspeed - Flaps 15°, $V_{APP}$.
    Flaps 7°, $V_{REF}$ + 10 KIAS.
    Flaps 0° or unknown, $V_{REF}$ + 15 KIAS.

**NOTE**

Multiply the landing distance by 1.4.

**CAUTION**

AVOID LANDINGS WITH TAILWINDS OR DOWNHILL RUNWAY GRADIENTS OR AT FIELD ELEVATIONS ABOVE 6,000 FEET MSL.

## CABIN DOOR NOT LOCKED (CABIN DOOR CAUTION LIGHT ON)

Indicates failure or improper position of door switch(es), vent door and/or possible disengagement of the cabin door pin.

**ON GROUND**

1. Cabin Door - OPEN; then CLOSE.
2. Visual Door Pin Indicators - CHECK PROPER INDICATION.

**IF MESSAGE IS STILL ILLUMINATED**

1. Cabin Vent Door - CLOSE MANUALLY
2. Cabin Door Light - VERIFY EXTINGUISHED.

**NOTE**

The cabin door can be manually closed using a lever located inside the door assembly. The lever is accessible through a plug in the aft side of the stair assembly.

**IN FLIGHT.**

1. PRESS SYSTEM SELECT - MANUAL.
2. Cabin Altitude - SELECT to 9500 feet.
3. Airspeed - REDUCE to 200 KIAS.
4. Passenger Advisory Lights - PASS SAFETY ON.
5. Cabin Door - KEEP CLEAR.
6. Altitude - DESCEND to 41,000 feet or lower.
7. Land as soon as practical.

## CABIN DOOR PRESSURE SEAL FAILURE (DOOR SEAL CAUTION LIGHT ON)

**ON GROUND**

1. Correct prior to flight.

**IN FLIGHT**

1. Altitude - DESCEND to 41,000 feet or lower.
2. Passenger Advisory Lights - PASS SAFETY ON.
3. Monitor cabin pressure. Land as soon as practical.

**NOTE**

Secondary door seal will maintain cabin pressurization.

## ACCESSORY DOOR NOT LOCKED (ACC DOOR UNLOCKD NOSE OR TAIL CAUTION LIGHT ON)

Indicates unlatched nose or tailcone door.

**ON GROUND**

1. Correct prior to flight.

**IN FLIGHT**

1. Airspeed - REDUCE to 200 KIAS.

## LAVATORY DOORS NOT OPEN (LAV DOOR CAUTION LIGHT ON)

Indicates that the lavatory doors are not latched open in taxi, takeoff, approach, or landing configurations.

1. Lavatory Door - VERIFY LATCHED OPEN for takeoff and landing.

## ANGLE-OF-ATTACK SYSTEM FAILURE (AMBER AOA ANNUNCIATION ON PFD)

1. Airspeed - Flaps 0 ° = $V_{REF}$ + 15
   Flaps 7° = $V_{REF}$ + 10
   Flaps 15° = $V_{APP}$

**NOTE**

The following systems will be inoperative:

- Stall warning (stick shaker)
- Low speed awareness

## USE OF SUPPLEMENTAL OXYGEN (UNPRESSURIZED)

1. Oxygen Masks - NORMAL below 25,000 cabin altitude.
   - 100% at or above 25,000 feet.
   - Ensure crew and passengers are receiving oxygen.
2. Cabin Altitude - MAX 25,000 FEET with passengers.
   - MAX 40,000 FEET crew only.
3. Oxygen - CHECK ENDURANCE (refer to Figure 3-3).
4. Range - COMPUTE, (based on oxygen endurance and revised fuel flow and ground speed).

## NO TAKEOFF WARNING (NO TAKEOFF CAUTION LIGHT ON AND AURAL WARNING)

1. Takeoff - ABORT.
2. Flap Position - CHECK.
3. Speed Brake - RETRACT.
4. Elevator Trim - CHECK.
5. STAB MIS COMP light - CHECK.

## MASTER WARNING LIGHT ON STEADY

1. MASTER WARNING RESET - PRESS TO RESET.
2. WARNING LTS 1 and 2 Circuit Breaker (LH Panel) - CHECK IN.
3. Instruments (Fuel, Electrical, and Engine) - MONITOR.

## MASTER CAUTION LIGHT ON STEADY, NO CAUTION LIGHTS ON

1. MASTER CAUTION RESET - PRESS TO RESET.
2. WARNING LTS 1 and 2 Circuit Breaker (LH Panel) - CHECK IN.
3. Instruments (Fuel, Electrical, and Engine) - MONITOR.

## MASTER WARNING LIGHT FLASHING, NO WARNING LIGHTS ILLUMINATED

1. MASTER WARNING RESET - PRESS to reset.
2. WARNING LTS 1 and 2 Circuit Breaker (LH Panel) - CHECK IN.
3. Instruments (fuel, electrical and engine) - MONITOR.

## SPEED BRAKE (SPD BRK EXTEND ADVISORY LIGHT ON)

Normal indication if speed brake is extended.

### IF SPEEDBRAKE FAILS TO STOW

1. Speed Break Circuit Breaker (LH Panel) - PULL.

## EMERGENGY EXIT (EMER EXIT CAUTION LIGHT ON)

### ON GROUND

1. Correct prior to flight.

### IN FLIGHT

1. PRESS SYSTEM SELECT - MANUAL.
2. Cabin Altitude - SELECT to 9500 feet.
3. Airspeed - REDUCE to 200 KIAS.
4. Passenger Advisory Lights - PASS SAFETY ON.
5. Emergency Exit Door - KEEP CLEAR.
6. Altitude - DESCEND to 41,000 feet or lower.
7. Land as soon as practical.

## COCKPIT FORWARD OR SIDE WINDSHIELD CRACKED OR SHATTERED

1. Cabin Pressurization - ALT SEL/SET CABIN ALTITUDE TO 9500 FEET.
2. Altitude - AS REQUIRED.

**NOTE**

- Descend to the lowest practical altitude consistent with fuel range requirements; 41,000 feet or lower is recommended.
- Either windshield ply is structurally capable of maintaining cabin pressure.

3. Oxygen Masks - ONE PILOT (minimum) DON OXYGEN MASK (set regulator to normal).
4. Remain clear of or leave icing conditions.

**IF EITHER FORWARD WINDSHIELD FAILED**

5. WINDSHIELD ANTI-ICE - BOTH SWITCHES OFF.
6. Land as soon as practical.

**IF A SIDE WINDSHIELD FAILED**

5. WINDSHIELD ANTI-ICE - TURN OPPOSITE SWITCH OFF.
6. Land as soon as practical.

# VI. EMERGENCY PROCEDURES

# SECTION VI

# EMERGENCY PROCEDURES

## CONTENTS

# EMERGENCY PROCEDURES

## ENGINE FAILURE OR FIRE, OR MASTER WARNING DURING TAKEOFF

**SPEED BELOW $V_1$** - TAKEOFF SHOULD BE ABORTED.

1. Brakes - MAXIMUM PILOT EFFORT.
2. Throttles - IDLE.
3. Thrust Reverser - DEPLOY ON UNAFFECTED ENGINE.
4. Thrust Reverser Indicator Lights - CHECK ILLUMINATION of ARM, UNLOCK AND DEPLOY LIGHTS.
5. Thrust Reverser - REVERSE POWER ON THE UNAFFECTED ENGINE.
6. Speed Brake - EXTEND.

**NOTE**

- To obtain maximum braking performance from the antiskid system, the pilot must apply continuous maximum effort (no modulation) to the brake pedals.
- The Takeoff Field Lengths assume that the pilot has maximum effort applied to the brakes at the scheduled $V_1$ speed during the aborted takeoff.

**SPEED ABOVE $V_1$** - TAKEOFF SHOULD NORMALLY BE CONTINUED.

1. Rotate - $V_R$.
2. Landing Gear - UP (after positive rate-of-climb).
3. Climb - $V_2$ until 1500 feet AGL.

**IF ENGINE FIRE**

4. At or above 400 feet AGL, accomplish Emergency Procedures, ENGINE FIRE.
5. Flaps - RETRACT (at 1500 feet and $V_2$ + 10, accelerate to $V_{ENR}$).
6. Throttle (operating engine) - CLB Detent, check CLB $N_1$.

**IF ENGINE FAILURE**

4. At or above 400 feet AGL, accomplish Abnormal Procedures, IN-FLIGHT RESTART - ONE ENGINE or Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.
5. Flaps - RETRACT (at 1500 feet and $V_2$ + 10, accelerate to $V_{ENR}$).
6. Throttle (operating engine) - CLB Detent, check CLB $N_1$.

## ENGINE FIRE (LH OR RH ENGINE FIRE WARNING LIGHT ON)

1. Throttle (affected engine) - IDLE.

**IF LIGHT REMAINS ON**

2. ENGINE FIRE Switch (affected engine) - LIFT COVER and PUSH.
3. Either Illuminated Bottle Armed Light - PUSH.
4. IGNITION Switch (affected engine) - NORM.
5. Throttle (affected engine) - CUT OFF.
6. Electrical Load - REDUCE as required.
7. Affected ENGINE Anti-ice - CHECK OFF.
8. WING XFLOW - ON as required.
9. Land as soon as practical.

**IF FIRE WARNING LIGHT REMAINS ON AFTER 30 SECONDS**

10. Remaining Illuminated Bottle Armed Light - PUSH.
11. Land as soon as possible.

**IF LIGHT GOES OUT AND SECONDARY INDICATIONS ARE NOT PRESENT**

2. Land as soon as practical.

## ENGINE FAILURE DURING FINAL APPROACH

1. AP TRIM DISC - PRESS and RELEASE.
2. Power (operating engine) - INCREASE as required.
3. Airspeed - $V_{APP}$ +10.
4. Flaps - TAKEOFF and APPROACH (15°).
5. Rudder and Aileron Trim - TRIM toward operating engine as required.
6. Throttle (affected engine) - CUT OFF.
7. Autopilot/Yaw Damper - ON as desired.
8. If engine fire, accomplish Emergency Procedures, ENGINE FIRE.
9. Passenger Advisory Lights - PASS SAFETY ON.
10. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
11. IGNITION (operating engine) - ON.
12. Exterior Lights - AS REQUIRED.
13. Fuel CROSSFEED - CHECK.
14. ENGINE SYNC - OFF.
15. Annunciator Panel - CHECK.
16. Pressurization - CHECK ZERO DIFFERENTIAL.
17. Landing Gear - DOWN ($V_{LE}$ 250 KIAS).
18. ANTI-SKID - CHECK ON.
19. Speed Brake - RETRACT (above 50 feet AGL).
20. Autopilot and Yaw Damper - OFF.
21. Airspeed - $V_{APP}$ +10 KIAS.
22. Flaps - LAND (when landing assured).
23. Airspeed - $V_{REF}$.

## THRUST REVERSER INADVERTENT DEPLOYMENT DURING TAKEOFF
(Continued)

**SPEED ABOVE $V_1$ - TAKEOFF SHOULD NORMALLY BE CONTINUED.**

1. Emergency STOW Switch - EMER (affected engine).
2. Throttle (affected engine) - CHECK IDLE.
3. Rotate - $V_R$.
4. Landing Gear - UP (after positive rate of climb). Do not exceed 140 KIAS until thrust reverser stows.
5. Climb - $V_2$.
6. Throttle (affected engine) - AS REQUIRED after the thrust reverser stows.
7. Flaps - RETRACT at $V_2$ +10 and accelerate.
8. Airspeed - MAINTAIN 200 KIAS OR BELOW (after T/R stows).
9. Altitude - FL310 OR BELOW.
10. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

**IF THRUST REVERSER WILL NOT STOW**

11. THRUST REVERSER Circuit Breaker (LH Panel) - CHECK IN.
12. Throttle (affected engine) - CUT OFF.
13. Airspeed - MAINTAIN 140 KIAS OR BELOW.
14. Land as soon as possible.

**BEFORE LANDING (WITH THRUST REVERSER DEPLOYED)**

15. Avionics and Flight Instruments - CHECK and SET.
16. Crew Briefing - COMPLETE.
17. Passenger Advisory Lights - PASS SAFETY ON.
18. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
19. Flaps - TAKEOFF and APPROACH (15°).
20. IGNITION (operating engine) - ON.
21. Exterior Lights - AS REQUIRED.
22. Fuel CROSSFEED - CHECK.
23. ENGINE SYNC - OFF.
24. Annunciator Panel - CHECK.
25. Pressurization - CHECK ZERO DIFFERENTIAL.

(Continued Next Page)

## THRUST REVERSER INADVERTENT DEPLOYMENT DURING TAKEOFF
(Continued)

**SPEED ABOVE $V_1$ - TAKEOFF SHOULD NORMALLY BE CONTINUED.**

1. Emergency STOW Switch - EMER (affected engine).
2. Throttle (affected engine) - CHECK IDLE.
3. Rotate - $V_R$.
4. Landing Gear - UP (after positive rate of climb). Do not exceed 140 KIAS until thrust reverser stows.
5. Climb - $V_2$.
6. Throttle (affected engine) - AS REQUIRED after the thrust reverser stows.
7. Flaps - RETRACT at $V_2$ +10 and accelerate.
8. Airspeed - MAINTAIN 200 KIAS OR BELOW (after T/R stows).
9. Altitude - FL310 OR BELOW.
10. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

**NOTE**

- Rudder bias is inoperative with either emergency stow switch in the EMER STOW position. The amber RUDDER BIAS annunciator will not be illuminated.
- With the rudder bias inoperative, rudder pedal force and/or directional trim required for single engine operation will be signficantly increased.

**IF THRUST REVERSER WILL NOT STOW**

11. THRUST REVERSER Circuit Breaker (LH Panel) - CHECK IN.
12. Throttle (affected engine) - CUT OFF.
13. Airspeed - MAINTAIN 140 KIAS OR BELOW.
14. Land as soon as possible.

**NOTE**

- Rudder bias is inoperative with either emergency stow switch in the EMER STOW position. The amber RUDDER BIAS annunciator will not be illuminated.
- With the rudder bias inoperative, rudder pedal force and/or directional trim required for single engine operation will be signficantly increased.

**BEFORE LANDING (WITH THRUST REVERSER DEPLOYED)**

15. Avionics and Flight Instruments - CHECK and SET.
16. Crew Briefing - COMPLETE.
17. Passenger Advisory Lights - PASS SAFETY ON.
18. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
19. Flaps - TAKEOFF and APPROACH (15°).
20. IGNITION (operating engine) - ON.
21. Exterior Lights - AS REQUIRED.
22. Fuel CROSSFEED - CHECK.
23. ENGINE SYNC - OFF.
24. Annunciator Panel - CHECK.
25. Pressurization - CHECK ZERO DIFFERENTIAL.

(Continued Next Page)

## THRUST REVERSER INADVERTENT DEPLOYMENT DURING TAKEOFF
(Continued)

26. Landing Gear - DOWN.
27. ANTI-SKID - CHECK ON.
28. Speed Brake - RETRACT.
29. Autopilot and Yaw Damper - OFF.
30. Airspeed - $V_{APP}$ Minimum.

**WARNING**

**DO NOT INITIATE GO-AROUND BELOW 600 FEET AGL WITH A THRUST REVERSER DEPLOYED.**

**NOTE**

Multiply landing distances by 1.4 for flaps 15°.

## THRUST REVERSER INADVERTENT INFLIGHT DEPLOYMENT

1. Control Wheel/AP TRIM DISG - GRIP/PRESS AND RELEASE.
2. Emergency STOW Switch - EMER (affected engine).
3. Throttle (affected engine) - CHECK IDLE.
4. Airspeed - REDUCE TO 140 KIAS OR BELOW.
5. Thrust Reverser Indicator Lights - UNLOCK and DEPLOY LIGHT EXTINGUISHED.
   - ARM LIGHT ILLUMINATED.
6. Throttle (affected engine) - NORMAL OPERATION (After thrust reverser stows, do not exceed 200 KIAS).
7. Altitude - FL310 or below.
8. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

**IF THRUST REVERSER WILL NOT STOW**

9. THRUST REVERSER Circuit Breaker (LH Panel) - CHECK IN.

**IF THRUST REVERSER STILL WILL NOT STOW**

10. Throttle (affected engine) - CUT OFF.
11. Airspeed - MAINTAIN 140 KIAS OR BELOW.
12. Land As Soon As Possible.

(Continued Next Page)

## THRUST REVERSER INADVERTENT INFLIGHT DEPLOYMENT (Continued)

### BEFORE LANDING (WITH THRUST REVERSER DEPLOYED)

13. Avionics and Flight Instruments - CHECK and SET.
14. Crew Briefing - COMPLETE.
15. Passenger Advisory Lights - PASS SAFETY ON.
16. Passenger Briefing - CHECK passenger seats upright, outboard, lavatory door latched open, seat belts and shoulder harnesses secure.
17. Flaps - TAKEOFF and APPROACH (15°).
18. IGNITION (operating engine) - ON.
19. Exterior Lights - AS REQUIRED.
20. Fuel CROSSFEED - CHECK.
21. ENGINE SYNC - OFF.
22. Annunciator Panel - CHECK.
23. Pressurization - CHECK ZERO DIFFERENTIAL.
24. Landing Gear - DOWN.
25. Anti-Skid - CHECK ON.
26. Speed Brake - RETRACT.
27. Autopilot and Yaw Damper - OFF.
28. Airspeed = $V_{APP}$ Minimum.

**WARNING**

**DO NOT INITIATE GO-AROUND BELOW 600 FEET AGL WITH A THRUST REVERSER DEPLOYED.**

**NOTE**

Multiply the landing distance by 1.4 for flaps 15°.

## THRUST REVERSER UNLOCK LIGHT ON IN FLIGHT

1. Emergency STOW Switch - EMER (affected engine).
2. Thrust Reverser Levers - CHECK THRUST REVERSER LEVERS AT STOWED (FULL FORWARD) POSITION.

### IF LIGHT WILL NOT EXTINGUISH

3. THRUST REVERSER Circuit Breaker (LH Panel) - CHECK IN.
4. Airpseed - MAINTAIN 200 KIAS OR BELOW.
5. Altitude - MAINTAIN FL310 OR BELOW.
6. Land as soon as practical.

## THRUST REVERSER ARM LIGHT ON IN FLIGHT

1. Thrust Reverser Levers - CHECK STOWED (full forward).
2. Emergency STOW Switch - Verify NORM.

**IF ARM LIGHT IS STILL ILLUMINATED**

3. HYD PRESS caution light - CHECK.

**IF HYD PRESS CAUTION LIGHT IS NOT ILLUMINATED**

4. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

**IF HYD PRESS CAUTION LIGHT IS ILLUMINATED (THRUST REVERSER ISOLATION VALVE IS OPEN)**

4. Emergency STOW Switch - EMER (affected engine).
5. Airspeed - MAINTAIN 200 KIAS OR BELOW.
6. Altitude - FL310 OR BELOW.
7. Land as soon as Practical. Refer to Normal Procedures, BEFORE LANDING.

## OVERPRESSURIZATION

1. PRESS SYSTEM SELECT - MANUAL. Control pressurization with the manual toggle switch,

**IF STILL OVERPRESSURIZED**

2. PRESS SOURCE Selector - LH or RH; control cabin pressure with throttle corresponding to the selected source.

**IF UNABLE TO CONTROL**

3. Oxygen Masks - DON and 100% OXYGEN.
4. Microphone Switches - MIC OXY MASK.
5. PASS OXY Valve - ON.
6. Passenger Oxygen - ENSURE passengers are receiving oxygen.
7. Passenger Advisory Light - PASS SAFETY ON.
8. PRESS SOURCE Selector - OFF.
9. Descend.

**IF STILL OVERPRESSURIZED**

10. EMER DUMP Switch - ON.

## RAPID DECOMPRESSION (CAB ALT WARNING LIGHT ON)

1. Oxygen Masks - DON and 100% Oxygen.
2. Microphone Switches - MIC OXY MASK.
3. Emergency Decent - AS REQUIRED.
4. Passenger Oxygen - ENSURE passengers are receiving oxygen.
5. Transponder - EMERGENCY.
6. Refer to Emergency Procedures, EMERGENCY DESCENT and Abnormal Procedures, USE OF SUPPLEMENTAL OXYGEN.

**NOTE**

- If a high altitude airport is selected on the cabin pressurization controller, the cabin altitude warning will illuminate at 14,500 feet.
- The emergency pressurization system will automatically activate when cabin altitude exceeds approximately 14,500 feet and will automatically deactivate when cabin altitude descends below this altitude.

## EMERGENCY DESCENT

1. AP TRIM DISC - PRESS and RELEASE.
2. Throttles - IDLE.
3. Speed Brake - EXTEND.
4. Airplane Pitch Attitude - APPROXIMATELY 15 DEGREES NOSE DOWN.
5. Maximum Airspeed - $V_{MO}/M_{MO}$ (use reduced speed if structural damage has occurred).
6. Transponder - EMERGENCY.
7. Passenger Advisory Lights - PASS SAFETY ON.
8. Descend to 15,000 MSL or Minimum Safe Altitude, whichever is higher.

**NOTE**

The emergency pressurization will automatically activate when cabin altitude exceeds approximately 14,500 feet, and will automatically deactivate when cabin altitude descends below this altitude.

### IF DESCENT INTO ICING CONDITIONS IS REQUIRED

9. Anti-Ice/Deice - AS REQUIRED.

## ENVIRONMENTAL SYSTEM SMOKE OR ODOR

1. Oxygen Masks - DON and EMER.
2. Microphone Switches - MIC OXY MASK.
3. Smoke Goggles - DON (if required).
4. A/C-FANS Selector - OFF.
5. CKPT RECIRC - LO.
6. PRESS SOURCE Selector - ISOLATE SOURCE by first selecting LH.

**NOTE**

Pressurization source selector must remain in each position long enough to allow adequate system purging to determine the source of smoke (approximately 1 minute).

**IF SMOKE CONTINUES**

7. PRESS SOURCE Selector - RH (allow time for smoke to dissipate).

**IF SMOKE STILL CONTINUES**

8. PRESS SOURCE Selector - EMER (control cabin temperature with LH throttle).

## SMOKE REMOVAL

**NOTE**

No action is normally required; however, if smoke is intense:

1. Oxygen Masks - DON and EMER.
2. Microphone Switches - MIC OXY MASK.
3. Smoke Goggles - DON (if required).
4. PASS OXY Valve - ON.
5. Cockpit Divider Door - OPEN.
6. Passenger Oxygen - ENSURE passengers are receiving oxygen.
7. Passenger Advisory Light - PASS SAFETY ON.
8. EMER DUMP Switch - ON (cabin altitude will not exceed approximately 14,000 feet).
9. Refer to Abnormal Procedures, USE OF SUPPLEMENTAL OXYGEN.

**IF SMOKE PERSISTS OR IT CANNOT BE VERIFIED THAT THERE IS NO FIRE**

10. Land as soon as possible.

**CAUTION**

WHETHER OR NOT SMOKE HAS DISSIPATED, IF IT CAN NOT BE VISIBLY CONFIRMED THAT ANY FIRE HAS BEEN EXTINGUISHED FOLLOWING FIRE SUPPRESSION AND/OR SMOKE EVACUATION PROCEDURE, LAND IMMEDIATELY AT THE NEAREST SUITABLE AIRPORT.

# ELECTRICAL FIRE OR SMOKE

1. Oxygen Masks - DON and EMER.
2. Microphone Switches - MIC OXY MASK.
3. Smoke Goggles - DON (if required).
4. PRESS SOURCE Selector - NORMAL.

**KNOWN SOURCE**

5. Faulty Circuit(s) - PULL CIRCUIT BREAKER(s) to isolate.

**UNKNOWN SOURCE**

5. Glareshield and FLOOD Lights - FULL BRIGHT.
6. BATT Switch - EMER.
7. GEN Switches - OFF - With the battery switch in EMER and the generators OFF, a properly charged battery will supply power for approximately 30 minutes to the following equipment:

| | | |
|---|---|---|
| COMM 1 | LH and RH $N_1$ Indicators | Glareshield And Flood Lights |
| NAV 1 | Standby Pitot and Static Heaters | Pilot's and Copilot's Audio Panels |
| AHRS 2 | LH and RH Secondary Ignition | Standby HSI |
| RMU 1 | Landing Gear Control & Indication | Standby Radio Control Head |
| | Flap Control | Interior Entry Lights |
| | | Two-Position Stabilizer |

The stabilizer will operate normally. The standby flight display will continue to operate on its own emergency battery pack. This battery pack also provides 5 volt emergency instrument lighting.

**CAUTION**

WHEN LANDING WITH EMERGENCY POWER (BATTERY SWITCH-EMER AND BOTH GENERATORS OFF), THE FOLLOWING ARE NOT AVAILABLE:

- THE ANTISKID/POWER BRAKE SYSTEM IS INOPERATIVE; ONLY THE EMERGENCY BRAKE SYSTEM IS AVAILABLE.
- THE ENGINE ANTI-ICE VALVES WILL BE OPEN. REFER TO ANTI-ICE ON THRUST CHARTS.
- THE RAM AIR TEMPERATURE GAGE IS INOPERATIVE; USE CAUTION WHEN APPLYING POWER (EXCEPT FOR GO-AROUND WHERE GROUND TEMPERATURES CAN BE USED).
- ALL ENGINE INSTRUMENTS EXCEPT THE $N_1$ INDICATORS WILL BE INOPERATIVE.
- THE EEC's WILL REVERT TO MANUAL MODE.

(Continued Next Page)

## ELECTRICAL FIRE OR SMOKE (Continued)

8. Land as soon as practical (within 30 minutes).

**IF SEVERITY OF SMOKE WARRANTS**

9. Initiate Emergency Procedures, SMOKE REMOVAL and/or EMERGENCY DESCENT. Land as soon as possible.

**COCKPIT FIRE**

10. Fire Extinguisher - UNSTOW and REMOVE SAFETY PIN (under copilot's seat).
11. Fire - LOCATE and EXTINGUISH.
12. Land as soon as possible.

**CABIN FIRE**

**NOTE**

A portable fire extinguisher is stowed in the aft cabin behind the aft, left seat.

10. Land as soon as possible.

### CAUTION

WHETHER OR NOT SMOKE HAS DISSIPATED, IF IT CANNOT BE VISIBLY CONFIRMED THAT ANY FIRE HAS BEEN EXTINGUISHED FOLLOWING FIRE SUPPRESSION AND/OR SMOKE EVACUATION, LAND IMMEDIATELY AT THE NEAREST SUITABLE AIRPORT.

**WHEN LANDING ASSURED**

11. Landing Gear - DOWN.
12. Flaps - LAND.
13. Airspeed - $V_{REF}$.
14. Landing - Use emergency brake system. Refer to Abnormal Procedures, WHEEL BRAKE FAILURE.

**NOTE**

For emergency braking, multiply landing distance by 1.4.

## BATTERY OVERTEMPERATURE (BATT O'TEMP WARNING LIGHT ON)

1. Amperage - NOTE.
2. BATT Switch - EMER.
3. Amperage - NOTE DECREASE.

**NOTE**

If current decreases and battery voltage is 1 volt less than generator voltage in 30 seconds to 2 minutes, monitor battery overheat annunciator for possible change.

**IF VOLT/AMP DECREASE**

4. BATT Switch - OFF (voltmeter will be inoperative).

**IF BATT O'TEMP WARNING LIGHT GOES OUT**

5. BATT Switch - ON.

**IF NO VOLT/AMP DECREASE** (Battery Relay Stuck)

4. BATT Switch - ON.
5. BATTERY DISCONNECT Switch (LH panel) - LIFT GUARD AND DISCONNECT.
6. Amperage - NOTE DECREASE.

**IF BATT O'TEMP WARNING LIGHT DOES NOT GO OUT OR >160 WARNING LIGHT ILLUMINATES**

7. Land As Soon As Possible.

**IF BATT O'TEMP WARNING LIGHT GOES OUT**

7. BATTERY DISCONNECT Switch (LH panel) - CLOSE GUARD.
8. BATT Switch - ON.
9. Land as soon as practical.

**CAUTION**

- PROLONGED OPERATION WITH THE BATTERY DISCONNECT SWITCH DISCONNECTED AND THE BATT SWITCH ON WILL GRADUALLY DEPLETE THE BATTERY THROUGH THE BATTERY DISCONNECT RELAY.

- AFTER LANDING, REFER TO AIRPLANE MAINTENANCE MANUAL FOR PROPER MAINTENANCE PROCEDURES, AS DAMAGE TO THE BATTERY MAY HAVE OCCURRED.

## LOSS OF BOTH GENERATORS (GEN OFF L AND R CAUTION LIGHTS ON AND MASTER WARNING)

1. GEN Switches - RESET THEN ON.

**IF ONLY ONE GENERATOR COMES ON**

2. Electrical Load - REDUCE as required.

**NOTE**

The Interior Master Switch, located on the LH Panel, will shed all non-essential passenger cabin electrical loads.

**IF NEITHER GENERATOR COMES ON**

2. Glareshield and FLOOD Lights - FULL BRIGHT.
3. BATT Switch - EMER. With the battery switch in EMER and the generators OFF, a properly charged battery will supply power for approximately 30 minutes to the following equipment:

| | | |
|---|---|---|
| COMM 1 | LH and RH $N_1$ Indicators | Glareshield and Flood Lights |
| NAV 1 | Standby Pitot and Static Heaters | Pilot's and Copilot's Audio Panels |
| AHRS 2 | LH and RH Secondary Ignition | Standby HSI |
| RMU 1 | Landing Gear Control & Indication | Standby Radio Control Head |
| Flap Control | Interior Entry Lights | Two-Position Stabilizer |

The standby flight display will continue to operate on its own emergency battery pack. This battery pack also provides 5 volt emergency instrument lighting. While operating in EMER, power is not available to the electric windshield, aural warnings, and annunciator panel, including the Master Warning, Master Caution and Fire annunciators.

**CAUTION**

WHEN LANDING WITH EMERGENCY POWER (BATTERY SWITCH-EMER AND BOTH GENERATORS OFF), THE FOLLOWING ARE NOT AVAILABLE:

- THE ANTISKID/POWER BRAKE SYSTEM IS INOPERATIVE; ONLY THE EMERGENCY BRAKE SYSTEM IS AVAILABLE.
- THE ENGINE ANTI-ICE VALVES WILL BE OPEN. REFER TO ANTI-ICE ON THRUST CHARTS.
- THE RAM AIR TEMPERATURE GAGE IS INOPERATIVE, SO USE CAUTION WHEN APPLYING POWER (EXCEPT FOR GO-AROUND WHERE GROUND TEMPERATURES CAN BE USED).
- ALL ENGINE INSTRUMENTS EXCEPT THE $N_1$ INDICATORS WILL BE INOPERATIVE.
- THE EEC'S WILL REVERT TO MANUAL MODE.

4. Land as soon as practical (within 30 minutes).

(Continued Next Page)

## LOSS OF BOTH GENERATORS (GEN OFF L AND R CAUTION LIGHTS ON AND MASTER WARNING) (Continued)

5. EMER LTS - AS DESIRED.

**NOTE**

Emergency cabin lights battery pack will be depleted in 10 minutes if lights remain on.

**WHEN LANDING ASSURED**

6. Battery Switch - BATT.
7. Landing Gear - DOWN.
8. Flaps - LAND.
9. Emergency Lights Switch - ARM or ON.
10. Airspeed - $V_{REF}$.

## PFD/MFD RED GUN FAILURE

The failure of a red gun in an electronic display indicator results in the following presentations:

PFD - Sky turns from dark blue to a dull dark blue.
Ground turns from brown to green hue.
Compass rose turns from white to blue.

1. Use display with caution - MONITOR remaining displays for any red annunciators.

**WARNING**

**FOLLOWING A FAILURE OF A RED GUN IN A DISPLAY UNIT, THE RED WARNING ANNUNCIATORS WILL NOT BE VISIBLE.**

## PFD ATTITUDE FAILURE - DUAL (RED ATT FAIL ON PFD ATTITUDE SPHERE)

1. Airplane attitude - CONTROL by reference to standby flight display.

## PFD HEADING FAILURE - DUAL (RED HDG FAIL ON PFD HSI)

1. Airplane heading - CONTROL by reference to magnetic compass.

## AIR DATA COMPUTER FAILURE - DUAL (RED "X" ON PFD AIRSPEED/ALTITUDE TAPES)

1. Airplane airspeed and altitude - MONITOR by reference to standby flight display.

## DISPLAY GUIDANCE COMPUTER FAILURE - DUAL (RED "X" OR BLANK PFD'S/MFD)

1. Airplane - CONTROL by reference to standby flight display.

## AUTOPILOT MALFUNCTION

1. AP TRIM DISC Switch - PRESS and RELEASE.

**NOTE**

- The autopilot monitor normally detects failures and automatically disengages the autopilot.
- Minimum Altitude for autopilot operation:

| | |
|---|---|
| Enroute | 1000 feet AGL |
| Precision/Non-precision Approach | 180 feet AGL |

## EMERGENCY EVACUATION

1. Throttles - BOTH CUT OFF.
2. LH/RH ENGINE FIRE Switches - BOTH PRESS.
3. LH/RH Fire Bottle Armed Switches - BOTH PRESS (if fire suspected).
4. BATT Switch - OFF.
5. Airplane and Immediate Area - CHECK for BEST ESCAPE ROUTE.

**IF THRU CABIN DOOR**

6. Cabin Door - OPEN.
7. Move away from airplane.

**IF THRU EMERGENCY EXIT**

6. Emergency Exit - REMOVE and THROW OUT of airplane.
7. Move away from airplane.

## DITCHING

Ditching is not approved under FAR 25.801 and was not conducted during certification testing of the airplane. Should ditching be required, the following procedures are recommended:

### PRELIMINARY

1. PRESS SOURCE Select - OFF.
2. Radio - MAYDAY.
3. Transponder - EMERGENCY.
4. Emergency Locator Beacon - EMER.
5. Passenger Advisory Lights - PASS SAFETY ON.
6. Water Barrier - IN POSITION. Locate and install the water barrier over the cabin door opening.

**CAUTION**

THE WATER BARRIER MUST BE IN POSITION PRIOR TO DITCHING.

7. Prepare Passengers for Ditching.
8. Rate of Descent - 200/300 feet/minute.
9. Ditching Heading - Parallel to Major Swell System.

### APPROACH

1. Landing Gear - UP.
2. Flaps - LAND.
3. Approach Speed - $V_{REF}$.

**NOTE**

Plan approach to parallel any uniform swell pattern and attempt to touch down along a wave crest or just behind it. If the surface wind is very strong or the water surface rough and irregular, ditch into the wind on the back side of a wave.

### WATER CONTACT

1. Aircraft Pitch Attitude - Slightly higher than Normal Landing Attitude.
2. Reduce airspeed and rate of descent to a minimum, but do not stall the airplane.
3. Throttles - CUT OFF just prior to water contact and contact water on a crest of a swell, parallel to the major swell.

### AFTER WATER CONTACT

Under reasonable ditching conditions, the aircraft should remain afloat an adequate time to launch and board life rafts in an orderly manner.

**WARNING**

**THE MAIN CABIN DOOR SHOULD REMAIN CLOSED AND EVACUATION MADE THROUGH THE EMERGENCY EXIT.**

**NOTE**

If situation warrants the use of the cabin door for egress, the water barrier will allow use of the cabin door as an additional egress route. The water barrier must be in position and must be installed before the cabin door is opened.

# VII. PLANNING & PERFORMANCE

# SECTION VII

# FLIGHT PLANNING AND PERFORMANCE

## CONTENTS

# WEIGHT AND BALANCE

The center-of-gravity (CG) of an airplane can be defined as the point on the longitudinal axis about which the airplane would balance. The force of weight always acts through the center-of-gravity. The forces of lift attempt to rotate the airplane about the center-of-gravity.

In flight, the forces of gravity and lift from the wing and horizontal stabilizer must balance about the center-of-gravity so that stability is achieved.

## CENTER-OF-GRAVITY FORCES

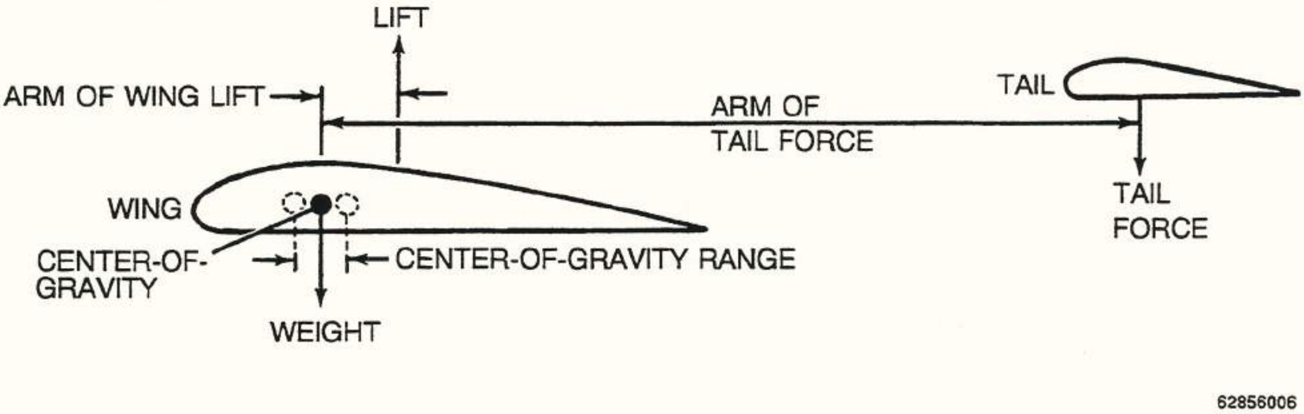


Figure 7-1

As the center-of-gravity changes forward or aft due to airplane loading, the lever or moment arm of the wing and tail lifting surfaces changes.

The horizontal stabilizer must be capable of providing an equalizing moment to that which is produced by the remainder of the airplane. Since the amount of lift produced by the horizontal stabilizer is limited, the range of movement of the center-of-gravity is restricted so that equilibrium can be maintained. Loading must be calculated as being within the allowable envelope to achieve proper stability and control.

The center-of-gravity of an empty airplane is found by accurate weighing to determine the balance point. This point is then defined by labeling it in inches aft of a fixed reference line located forward of the airplane nose. This line is called the Reference Datum Line. Selection of the Reference Datum line is arbitrary, but it does provide a standard from which center-of-gravity movement along the longitudinal axis can be measured.

# AIRPLANE WEIGHING INFORMATION

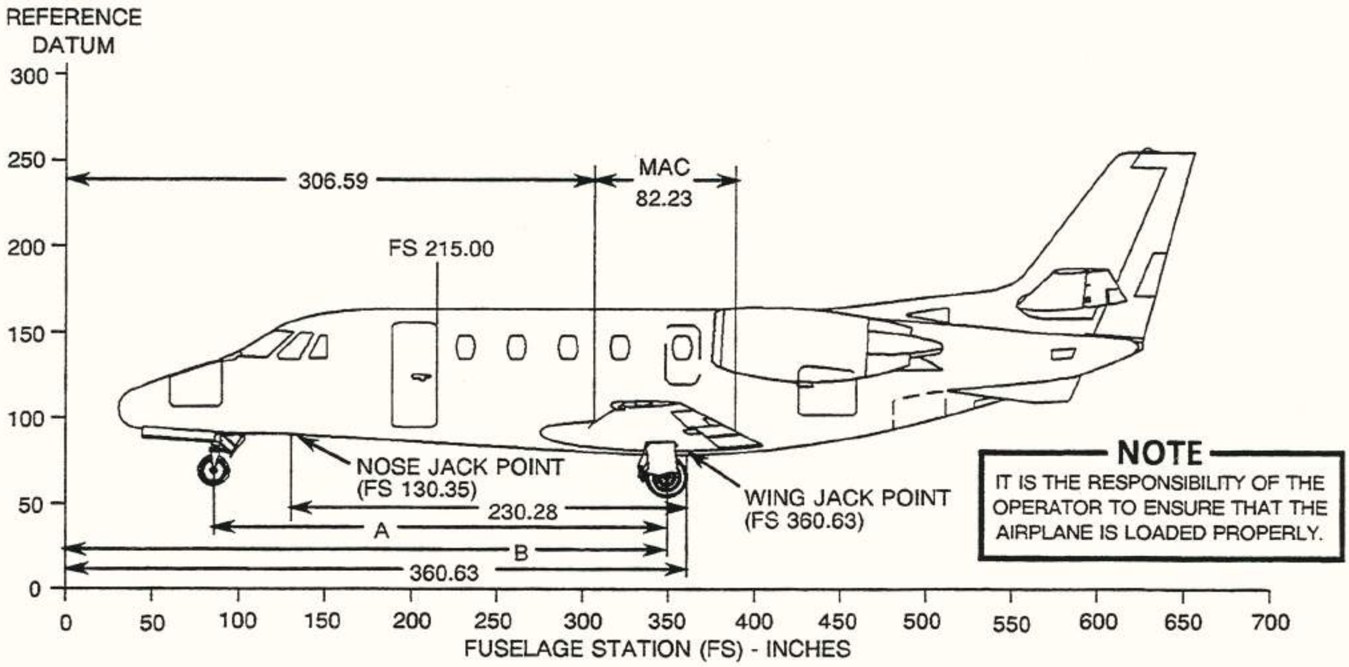


Figure 7-2

At maximum gross weight, the center-of-gravity of a loaded airplane can move from 324.18 inches to 329.62 inches aft of Datum and remain within limits.

As the airplane is loaded, the center-of-gravity will shift. The amount of shift is dependent on not only the weight added, but the distance the weight is placed from the original center-of-gravity. Both of these factors can be considered by multiplying the weight added by the distance from the Reference Datum Line to produce the loading moment. This information is presented in table form in the Crew and Passenger, Cabinet, Baggage and Fuel Loading Moments tables, which are found on the Weight and Balance Data Sheets supplied with each airplane.

The contribution each load station makes to center-of-gravity shift can be seen by comparing the respective center-of-gravity arm lengths given in the Weight and Moment Table. Any weight placed in the aft baggage bay will shift the center-of-gravity aft since it is aft of the typical standard empty weight center-of-gravity.

Adding fuel, passengers or baggage (in the nose compartment) will shift the center-of-gravity forward since all of them are loaded forward of the typical standard empty weight center-of-gravity. The magnitude of the shift for any given weight is proportional to the length of the moment arm.

# SAMPLE LOADING PROBLEM

## STANDARD AIRPLANE

Basic Empty Weight - 11,910 pounds.*
Crew of 170 and 170 pounds in Seats 1 and 2.
One 170-pound Passenger in Seat 3.
One 170-pound Passenger in Seat 4.
One 170-pound Passenger in Seat 5.
One 170-pound Passenger in Seat 6.
One 170-pound Passenger in Seat 7.
One 170-pound Passenger in Seat 8.
One 170-pound Passenger in Seat 10
270 pounds of baggage at station 431 in tailcone.
40 pounds of charts at station 158.
6,350 pounds of fuel.
200 pound fuel burn during taxi
2000-pound fuel burnoff during trip.

*Includes all undrainable fluids and a full service of oil.

Determine the operational takeoff weight and center-of-gravity. Loading tables are found in this manual and in the Weight and Balance Data Sheets. The following step-by-step procedure illustrates a logical manner in which to approach the loading problem.

**NOTE**

During computation of the following sample problem, weights are rounded to nearest whole number (pound) for entry on the Weight and Balance Computation Form.

1. Use the Crew and Passenger Loading Table obtained from Weight and Balance Data Sheets to determine the moment for each load station. Enter the figures for each load station in the Weight and Balance Computation Form.

2. Use the Cabinet Loading Table obtained from Weight and Balance Data Sheet to determine the moment for any cabinet contents and enter the figures in the Weight and Balance Computation Form.

3. Use the Baggage Loading Table obtained from Weight and Balance Data Sheet to determine the moment for baggage loading in the tailcone compartment. Enter the weight and moments for each load station in the Weight and Balance Computation Form.

4. Total the payload items and enter the totals on the Weight and Balance Computation Form (two places).

5. Enter the Airplane Basic Empty Weight and Moment from the Airplane Weighing Form on the Weight and Balance Computation Form.

6. Total the Basic Empty Weight and Payload and check the zero fuel weight.

(Continued Next Page)

## SAMPLE LOADING PROBLEM (Continued)

**NOTE**

To check approved limits, locate the weight on the Center-of-Gravity Limits Envelope Graph (refer to Figure 1-3). Approved points are points located below the Zero Fuel Weight Line.

7. Determine the zero fuel weight center-of-gravity on the Weight and Balance Computation Form; divide moment by weight and multiply by 100 (1000).

8. Use the Fuel Loading Table to determine the moment for the amount of fuel being loaded for the flight. Enter the weight and moment of the fuel in the Weight and Balance Computation Form.

9. Total zero fuel weight and fuel loading to obtain ramp weight.

**NOTE**

To check approved limits, locate the weight on the Center-of-Gravity Limits Envelope Graph (refer to Figure 1-3). Approved points are points located below the Maximum Ramp Weight line.

10. Subtract the fuel and moment used for taxi. A standard 200-pounds burnoff is assumed. The moment for the taxi fuel is determined by the difference in moments of the fuel loaded and the fuel remaining on board after taxi. Check takeoff weight and moment for approved limits.

**NOTE**

To check approved limits, divide moment by weight and multiply by 100 and obtain center-of-gravity. Locate the weight versus center-of-gravity point on the Center-of-Gravity Limits Envelope Graph (refer to Figure 1-3). Approved points are points located inside the shaded area.

11. Determine the estimated weight of the fuel to be used to arrive at the destination. The moment is determined by the difference in moments of the fuel remaining after taxi and the fuel remaining after reaching destination. Enter the weight of the remaining fuel and the moment in the Weight and Balance Computation Form.

(Continued Next Page)

## SAMPLE LOADING PROBLEM (Continued)

12. Subtract the weight and moment of the fuel used to arrive at the destination from the weight and moment at takeoff to determine the landing and moment. Check landing weight and moment for approved limits.

**NOTE**

To check approved limits, divide moment by weight and multiply by 100 and obtain center-of-gravity. Locate the weight versus center-of-gravity point on the Center-of-Gravity Limits Envelope Graph (refer to Figure 1-3). Approved points are points located inside the shaded area below the maximum landing weight line.

# WEIGHT AND BALANCE COMPUTATION FORM

| PAYLOAD COMPUTATIONS | | | |
|---|---|---|---|
| ITEM | ARM (INCHES) | WEIGHT (POUNDS) | MOMENT/ 100 |
| OCCUPANTS | | | |
| PILOT | 143.90 | 170 | 244.63 |
| COPILOT | 143.90 | 170 | 244.63 |
| SEAT 3 | 229.46 | 170 | 390.08 |
| SEAT 4 | 229.46 | 170 | 390.08 |
| SEAT 5 | 283.65 | 170 | 482.21 |
| SEAT 6 | 283.65 | 170 | 482.21 |
| SEAT 7 | 327.18 | 170 | 556.21 |
| SEAT 8 | 327.18 | 170 | 556.21 |
| SEAT 9 | | | |
| SEAT 10 | 176.05 | 170 | 299.29 |
| TOILET | 357.50 | | |
| TAILCONE BAGGAGE | 431.0 | 270 | 1,163.70 |
| LH FWD REFRESH CENTER | 172.09 | | |
| AFT CLOSET | 375.41 | | |
| NAV CHART CASE | 158.10 | 40 | 63.24 |
| CABINET CONTENTS | | | |
| PAYLOAD (Sub-total) | | 1,840 | 4,872 |

| ITEM | WEIGHT (POUNDS) | MOMENT/ 100 |
|---|---|---|
| 1. BASIC EMPTY WEIGHT<br>* Airplane CG = _______ | 11,910 | 40,005.69 |
| 2. PAYLOAD | 1,840 | 4,872.47 |
| 3. ZERO FUEL WEIGHT<br>(sub-total)<br>Do not exceed maximum zero fuel weight of 15,000 pounds.<br>* Airplane CG = _______ | 13,750 | 44,878.16 |
| 4. FUEL LOADING | 6,450 | 21,228.66 |
| 5. RAMP WEIGHT<br>(sub-total) Do not exceed maximum ramp weight of 20,200 pounds.<br>* Airplane CG = _______ | 20,200 | 66,106.82 |
| 6. LESS FUEL FOR TAXIING | 200 | 671.00 |
| 7. TAKEOFF WEIGHT **<br>Do not exceed maximum takeoff weight of 20,000 pounds.<br>* Airplane CG = 327.18 inches *** | ***<br>20,000 | 65,435.82 |
| 8. LESS FUEL TO DESTINATION | 2,000 | 6,687.20 |
| 9. LANDING WEIGHT **<br>Do not exceed maximum landing weight of 18,700 pounds.<br>* Airplane CG = 326.38 inches *** | ***<br>18,000 | 58,749 |

$$* \text{ Airplane CG} = \frac{\text{MOMENT/100}}{\text{WEIGHT}} \times 100$$

** Totals must be within approved weight and center-of-gravity limits. It is the responsibility of the operator to ensure that the airplane is loaded properly. The Basic Empty Weight CG is noted on the Airplane Weighing Form. If the airplane has been altered, refer to the Weight and Balance Record for information.

*** Enter the Center-of-Gravity Limits Envelope Graph to verify airplane is loaded within approved limits.

FORM NUMBER 2021, 17 April 1998

Figure 7-3. Weight and Balance Computation Form

Figure 7-3

# FUEL LOADING WEIGHT AND MOMENT TABLE

| WEIGHT (POUNDS) | MOMENT/100 ARM VARIES (INCH-POUNDS) |
|---|---|
| 100 | 347.51 |
| 200 | 695.02 |
| 300 | 1030.04 |
| 400 | 1356.72 |
| 500 | 1687.35 |
| 600 | 2014.57 |
| 700 | 2338.36 |
| 800 | 2658.73 |
| 900 | 2983.62 |
| 1000 | 3306.85 |
| 1100 | 3628.42 |
| 1200 | 3948.34 |
| 1300 | 4272.49 |
| 1400 | 4595.89 |
| 1500 | 4918.53 |
| 1600 | 5240.43 |
| 1700 | 5565.39 |
| 1800 | 5890.05 |
| 1900 | 6214.40 |
| 2000 | 6538.46 |
| 2100 | 6864.94 |
| 2200 | 7191.38 |
| 2300 | 7517.77 |
| 2400 | 7844.12 |
| 2500 | 8170.98 |
| 2600 | 8497.84 |
| 2700 | 8824.70 |
| 2800 | 9151.56 |
| 2900 | 9478.60 |
| 3000 | 9805.65 |
| 3100 | 10132.72 |
| 3200 | 10459.80 |
| 3300 | 10787.22 |
| 3400 | 11114.67 |

| WEIGHT (POUNDS) | MOMENT/100 ARM VARIES (INCH-POUNDS) |
|---|---|
| 3500 | 11442.15 |
| 3600 | 11769.66 |
| 3700 | 12097.61 |
| 3800 | 12425.61 |
| 3900 | 12753.67 |
| 4000 | 13081.78 |
| 4100 | 13410.41 |
| 4200 | 13739.12 |
| 4300 | 14067.91 |
| 4400 | 14396.77 |
| 4500 | 14726.26 |
| 4600 | 15055.84 |
| 4700 | 15385.53 |
| 4800 | 15715.32 |
| 4900 | 16046.52 |
| 5000 | 16377.88 |
| 5100 | 16709.40 |
| 5200 | 17041.07 |
| 5300 | 17374.80 |
| 5400 | 17708.76 |
| 5500 | 18042.94 |
| 5600 | 18377.36 |
| 5700 | 18712.41 |
| 5800 | 19047.71 |
| 5900 | 19383.26 |
| 6000 | 19719.04 |
| 6100 | 20054.19 |
| 6200 | 20389.55 |
| 6300 | 20725.12 |
| 6400 | 21060.91 |
| 6500 | 21396.48 |
| 6600 | 21732.25 |
| 6700 | 22067.29 |
| 6790 | 22369.55 |

**NOTE**

FUEL WEIGHT BASED ON
6.75 POUNDS PER GALLON

Figure 7-4

# MAXIMUM CONTINUOUS THRUST SETTING
# MULTI-ENGINE ENROUTE CLIMB
## ANTI-ICE SYSTEMS - OFF
## ENGINE FAN SPEED - (%RPM)

| PA | RAM AIR TEMPERATURE - Deg C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT | -60 | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 |
| 0 | 71.5 | 72.3 | 73.1 | 73.9 | 74.7 | 75.5 | 76.3 | 77.0 | 77.8 | 78.6 | 79.3 | 80.0 |
| 5000 | 76.7 | 77.6 | 78.5 | 79.3 | 80.2 | 81.0 | 81.9 | 82.7 | 83.5 | 84.3 | 85.1 | 85.8 |
| 10000 | 82.6 | 83.5 | 84.4 | 85.3 | 86.2 | 87.1 | 88.0 | 88.8 | 89.7 | 90.5 | 91.4 | 91.7 |
| 15000 | 92.8 | 93.8 | 94.7 | 95.7 | 96.7 | 96.9 | 96.3 | 95.5 | 94.6 | 93.8 | 93.1 | 92.3 |
| 20000 | 98.0 | 98.0 | 98.1 | 98.1 | 98.0 | 97.4 | 96.8 | 96.0 | 95.1 | 94.2 | 93.5 | 92.8 |
| 25000 | 98.0 | 98.0 | 98.0 | 97.8 | 97.6 | 97.0 | 96.3 | 95.4 | 94.4 | 93.4 | 92.6 | 91.8 |
| 30000 | 98.0 | 98.0 | 98.0 | 97.6 | 97.2 | 96.5 | 95.8 | 94.6 | 93.5 | 92.6 | 91.6 | 90.8 |
| 35000 | 98.0 | 98.0 | 97.9 | 97.3 | 96.7 | 96.0 | 95.3 | 94.0 | 92.7 | 91.6 | 90.6 | 89.6 |
| 37000 | 98.0 | 98.1 | 97.9 | 97.4 | 96.8 | 96.0 | 95.2 | 93.8 | 92.5 | 91.4 | 90.4 | 89.4 |
| 39000 | 98.1 | 98.2 | 98.0 | 97.5 | 96.9 | 96.0 | 95.0 | 93.5 | 92.2 | 91.1 | 90.2 | 89.1 |
| 41000 | 98.2 | 98.2 | 98.1 | 97.7 | 97.3 | 96.1 | 94.7 | 93.2 | 91.9 | 90.8 | 89.9 | 88.7 |
| 43000 | 98.2 | 98.2 | 98.1 | 97.4 | 96.6 | 95.2 | 93.5 | 92.3 | 90.9 | 89.7 | 88.6 | 87.3 |
| 45000 | 98.2 | 98.3 | 98.1 | 97.2 | 95.7 | 94.0 | 92.6 | 91.3 | 90.0 | 88.7 | 87.3 | 85.9 |

| PA | RAM AIR TEMPERATURE - Deg C | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FT | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 0 | 80.8 | 81.5 | 82.3 | 83.0 | 83.8 | 84.5 | 85.3 | 86.0 | 84.7 | 82.6 | 80.6 |
| 5000 | 86.6 | 87.4 | 88.2 | 89.0 | 88.7 | 87.7 | 86.5 | 85.3 | 83.8 | 82.0 | 80.1 |
| 10000 | 90.9 | 90.1 | 89.2 | 88.3 | 87.3 | 86.3 | 85.2 | 84.1 | 82.8 | 81.0 | 79.1 |
| 15000 | 91.3 | 90.3 | 89.2 | 88.2 | 87.1 | 85.9 | 84.7 | 83.4 | 81.8 | 80.0 | 78.2 |
| 20000 | 91.9 | 91.0 | 90.1 | 89.2 | 88.2 | 87.3 | 85.7 | 84.0 | 82.1 | ---- | ---- |
| 25000 | 90.8 | 89.8 | 88.8 | 87.9 | 86.6 | 85.4 | 83.7 | 81.8 | 79.8 | ---- | ---- |
| 30000 | 89.6 | 88.6 | 87.5 | 86.4 | 85.0 | 83.5 | 81.7 | ---- | ---- | ---- | ---- |
| 35000 | 88.5 | 87.4 | 86.3 | 85.1 | 83.4 | 81.6 | 79.6 | ---- | ---- | ---- | ---- |
| 37000 | 88.3 | 87.2 | 86.0 | 84.6 | 82.8 | ---- | ---- | ---- | ---- | ---- | ---- |
| 39000 | 88.1 | 87.1 | 85.7 | 84.2 | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 41000 | 87.8 | 86.9 | 85.3 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 43000 | 86.2 | 84.9 | 83.0 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 45000 | 84.5 | 83.0 | 80.7 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

Figure 7-5. (Sheet 1 of 2)

# MAXIMUM CONTINUOUS THRUST SETTING
# MULTI-ENGINE ENROUTE CLIMB
## ANTI-ICE SYSTEMS - ON

### ENGINE FAN SPEED - (%RPM)

| PA | RAM AIR TEMPERATURE - Deg C | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT | -60 | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 |
| 0 | 71.5 | 72.3 | 73.1 | 73.9 | 74.7 | 75.5 | 76.3 | 77.0 | 77.8 | 78.6 | 79.3 | 80.0 | 80.8 | 81.5 | 82.3 |
| 5000 | 76.7 | 77.6 | 78.5 | 79.3 | 80.2 | 81.0 | 81.9 | 82.7 | 83.5 | 84.3 | 85.1 | 85.8 | 86.6 | 87.4 | 87.4 |
| 10000 | 82.6 | 83.5 | 84.4 | 85.3 | 86.2 | 87.1 | 88.0 | 88.8 | 89.7 | 90.5 | 90.1 | 89.1 | 88.1 | 87.1 | 85.9 |
| 15000 | 92.8 | 93.8 | 94.7 | 95.7 | 96.0 | 95.2 | 94.5 | 93.5 | 92.5 | 91.6 | 90.8 | 89.8 | 88.8 | 87.6 | 85.9 |
| 20000 | 96.7 | 96.7 | 96.6 | 96.5 | 96.4 | 95.6 | 95.0 | 94.0 | 92.9 | 92.1 | 91.4 | 90.6 | 89.6 | 88.6 | 86.8 |
| 25000 | 97.7 | 97.8 | 97.7 | 97.5 | 97.3 | 96.6 | 95.8 | 94.8 | 93.4 | 92.5 | 91.7 | 90.7 | 89.6 | 88.5 | 86.8 |
| 30000 | 97.5 | 97.5 | 97.4 | 97.0 | 96.5 | 95.7 | 94.8 | 93.6 | 92.3 | 91.0 | 90.1 | 88.9 | 87.7 | 86.5 | 84.8 |
| 35000 | 97.1 | 97.1 | 97.0 | 96.3 | 95.6 | 94.8 | 93.8 | 92.4 | 91.0 | 89.6 | 88.4 | 87.2 | 85.8 | 84.5 | 82.9 |
| 37000 | 96.7 | 96.7 | 96.5 | 95.8 | 95.2 | 94.5 | 93.5 | 92.0 | 90.5 | 89.2 | 87.8 | 86.6 | 85.4 | 84.0 | 82.3 |
| 39000 | 96.3 | 96.3 | 96.1 | 95.4 | 94.8 | 94.0 | 93.1 | 91.6 | 90.0 | 88.7 | 87.3 | 86.1 | 84.9 | 83.5 | 81.7 |
| 41000 | 95.7 | 95.7 | 95.5 | 95.1 | 94.6 | 93.2 | 92.1 | 90.6 | 88.8 | 87.1 | 85.8 | 84.6 | 83.3 | 81.8 | 79.8 |
| 43000 | 95.1 | 95.1 | 94.9 | 93.8 | 92.7 | 91.3 | 90.0 | 88.2 | 86.3 | 84.5 | 82.7 | 80.9 | 79.2 | 77.3 | 74.8 |
| 45000 | 94.6 | 94.6 | 94.0 | 92.4 | 90.9 | 89.4 | 87.7 | 85.9 | 83.9 | 81.8 | 79.5 | 77.3 | 75.0 | 72.7 | 69.6 |

Figure 7-5 (Sheet 2)

# MAXIMUM CRUISE THRUST SETTING

## ANTI-ICE SYSTEMS - OFF

### ENGINE FAN SPEED - (%RPM)

| PA | RAM AIR TEMPERATURE - Deg C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT | -60 | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 |
| 0 | 71.5 | 72.3 | 73.1 | 73.9 | 74.7 | 75.5 | 76.3 | 77.0 | 77.8 | 78.6 | 79.3 | 80.0 |
| 5000 | 76.8 | 77.6 | 78.5 | 79.3 | 80.2 | 81.0 | 81.9 | 82.7 | 83.5 | 84.3 | 85.1 | 85.8 |
| 10000 | 82.6 | 83.5 | 84.4 | 85.3 | 86.2 | 87.1 | 88.0 | 88.9 | 89.7 | 90.6 | 91.4 | 90.6 |
| 15000 | 92.8 | 93.8 | 94.8 | 95.7 | 95.9 | 95.1 | 94.3 | 93.4 | 92.6 | 91.9 | 91.0 | 90.2 |
| 20000 | 98.0 | 97.7 | 97.2 | 96.3 | 95.4 | 94.6 | 93.8 | 92.9 | 92.1 | 91.3 | 90.5 | 89.7 |
| 25000 | 97.6 | 97.4 | 96.9 | 96.0 | 95.1 | 94.2 | 93.3 | 92.3 | 91.6 | 90.8 | 90.0 | 89.3 |
| 30000 | 97.4 | 97.0 | 96.6 | 95.6 | 94.6 | 93.5 | 92.5 | 91.6 | 90.5 | 90.1 | 89.6 | 88.7 |
| 35000 | 97.3 | 96.9 | 96.4 | 95.6 | 94.7 | 92.8 | 92.3 | 91.9 | 91.3 | 90.5 | 89.6 | 88.8 |
| 37000 | 97.7 | 97.5 | 97.0 | 96.1 | 95.1 | 92.5 | 92.3 | 92.2 | 91.6 | 90.7 | 89.8 | 88.7 |
| 39000 | 97.9 | 97.7 | 97.3 | 96.3 | 95.3 | 92.5 | 92.4 | 92.5 | 91.9 | 90.9 | 89.8 | 88.6 |
| 41000 | 97.9 | 97.7 | 97.3 | 96.2 | 95.2 | 92.8 | 92.7 | 92.7 | 91.8 | 90.7 | 89.8 | 88.5 |
| 43000 | 96.4 | 95.4 | 94.4 | 93.8 | 93.3 | 93.0 | 92.6 | 92.1 | 90.9 | 89.7 | 88.5 | 87.3 |
| 45000 | 96.2 | 95.0 | 93.7 | 93.5 | 93.5 | 93.4 | 92.4 | 91.3 | 90.0 | 88.6 | 87.2 | 85.9 |

| PA | RAM AIR TEMPERATURE - Deg C | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FT | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 0 | 80.8 | 81.5 | 82.3 | 83.0 | 83.8 | 84.5 | 83.0 | 81.3 | 79.4 | 77.4 | 75.3 |
| 5000 | 86.6 | 87.4 | 88.2 | 87.4 | 86.5 | 84.9 | 83.1 | 81.3 | 79.4 | 77.4 | 75.3 |
| 10000 | 89.8 | 89.0 | 88.2 | 87.4 | 86.5 | 84.9 | 83.1 | 81.3 | 79.5 | 77.4 | 75.2 |
| 15000 | 89.3 | 88.6 | 87.8 | 86.8 | 85.8 | 84.2 | 82.6 | 81.0 | 79.1 | 77.1 | 74.8 |
| 20000 | 88.9 | 88.2 | 87.4 | 86.2 | 85.0 | 83.6 | 82.1 | 80.6 | 78.8 | ---- | ---- |
| 25000 | 88.5 | 87.7 | 87.0 | 85.6 | 84.2 | 82.9 | 81.6 | 80.2 | 78.5 | ---- | ---- |
| 30000 | 87.9 | 86.9 | 85.9 | 84.4 | 82.8 | 81.3 | 79.6 | ---- | ---- | ---- | ---- |
| 35000 | 87.9 | 87.0 | 86.0 | 84.4 | 82.9 | ---- | ---- | ---- | ---- | ---- | ---- |
| 37000 | 87.7 | 86.8 | 85.7 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 39000 | 87.5 | 86.5 | 85.4 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 41000 | 87.4 | 86.3 | 85.2 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 43000 | 86.2 | 84.9 | 82.9 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 45000 | 84.5 | 82.9 | 80.7 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

Figure 7-6 (Sheet 1 of 2)

# MAXIMUM CRUISE THRUST SETTING

## ANTI-ICE SYSTEMS - ON

### ENGINE FAN SPEED - (%RPM)

| PA | RAM AIR TEMPERATURE - Deg C | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT | -60 | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 |
| 0 | 71.5 | 72.3 | 73.1 | 73.9 | 74.7 | 75.5 | 76.3 | 77.0 | 77.8 | 78.6 | 79.3 | 80.0 | 80.8 | 81.5 | 82.3 |
| 5000 | 76.8 | 77.6 | 78.5 | 79.3 | 80.2 | 81.0 | 81.9 | 82.7 | 83.5 | 84.3 | 85.1 | 85.8 | 86.6 | 86.3 | 85.1 |
| 10000 | 82.6 | 83.5 | 84.4 | 85.3 | 86.2 | 87.1 | 88.0 | 88.9 | 89.7 | 90.2 | 89.1 | 88.0 | 87.0 | 86.0 | 84.9 |
| 15000 | 92.8 | 93.8 | 94.8 | 95.1 | 94.3 | 93.4 | 92.5 | 91.4 | 90.6 | 89.6 | 88.7 | 87.7 | 86.8 | 85.9 | 84.5 |
| 20000 | 96.7 | 96.3 | 95.8 | 94.8 | 93.9 | 92.9 | 91.8 | 90.9 | 90.0 | 89.1 | 88.2 | 87.5 | 86.7 | 85.8 | 84.1 |
| 25000 | 97.3 | 97.1 | 96.7 | 95.8 | 94.8 | 93.8 | 92.8 | 91.7 | 90.8 | 89.9 | 89.0 | 88.2 | 87.4 | 86.5 | 85.0 |
| 30000 | 96.8 | 96.5 | 96.0 | 95.0 | 93.9 | 92.7 | 91.6 | 90.5 | 89.3 | 88.7 | 87.9 | 87.0 | 86.0 | 84.8 | 83.2 |
| 35000 | 96.5 | 96.1 | 95.5 | 94.6 | 93.6 | 91.5 | 90.9 | 90.4 | 89.6 | 88.5 | 87.4 | 86.4 | 85.3 | 84.0 | 82.6 |
| 37000 | 96.3 | 96.1 | 95.6 | 94.6 | 93.6 | 90.9 | 90.7 | 90.5 | 89.6 | 88.5 | 87.2 | 86.0 | 84.8 | 83.5 | 82.0 |
| 39000 | 96.0 | 95.8 | 95.4 | 94.3 | 93.2 | 90.6 | 90.7 | 90.6 | 89.7 | 88.4 | 86.9 | 85.6 | 84.3 | 82.9 | 81.5 |
| 41000 | 95.4 | 95.2 | 94.7 | 93.6 | 92.1 | 90.3 | 90.3 | 90.0 | 88.8 | 87.1 | 85.8 | 84.3 | 82.8 | 81.2 | 79.7 |
| 43000 | 93.3 | 92.0 | 90.9 | 90.1 | 89.5 | 89.5 | 89.0 | 88.1 | 86.2 | 84.4 | 82.7 | 80.9 | 79.1 | 77.2 | 74.7 |
| 45000 | 92.3 | 90.5 | 89.3 | 89.2 | 89.1 | 88.9 | 87.6 | 85.8 | 83.8 | 81.7 | 79.5 | 77.3 | 75.0 | 72.6 | 69.5 |

Figure 7-6 (Sheet 2)

# NOISE CHARACTERISTICS

## CERTIFICATED NOISE LEVELS

The following noise levels were established using test data obtained and analyzed under procedures of FAR Part 36, Amendment 21. This aircraft complies with FAR Part 36, Stage 3 requirements.

| NOISE REFERENCE | EPNdB |
|---|---|
| TAKEOFF | 72.4 |
| SIDELINE | 85.3 |
| APPROACH | 93.1 |

Takeoff and sideline noise levels were determined at a takeoff weight of 20,000 pounds with 7 degrees flaps, climb speed of 136 KIAS, and anti-ice systems off. For takeoff at sea level and 25°C, thrust was reduced at 2817 feet AGL to an $N_1$ that in the event of an engine failure, level flight would be maintained.

Approach data was determined with landing gear down, approach speed 127 KIAS and 35° Flaps. No special noise abatement procedures were used.

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

### SUPPLEMENTAL ICAO ANNEX 16, CHAPTER 3 NOISE LEVEL INFORMATION

The ICAO Annex 16, Chapter 3, noise values are the same as those for FAR Part 36, Amendment 21, and were obtained with the procedures used to establish compliance with FAR Part 36, Amendment 21. The ICAO Annex 16, Chapter 3, noise levels were obtained by analysis of approved data used to demonstrate compliance with FAR Part 36, Amendment 21, Noise Standards. This data is applicable only after approval of the Civil Aviation Approving Authority of the country of airplane registration, including approval of the equivalent procedures used to establish compliance with FAR Part 36, Amendment 21.

### SUPPLEMENTAL A-WEIGHTED NOISE LEVELS

The following A-weighted noise levels were established for FAR Part 36 (stage 3) reference conditions used in CERTIFICATED NOISE LEVELS.

| NOISE REFERENCE | dBA |
|---|---|
| TAKEOFF | 60.6 |
| SIDELINE | 71.8 |
| APPROACH | 85.0 |

Takeoff and sideline noise levels were determined at a takeoff weight of 20,000 pounds with 7 degrees flaps, climb speed of 136 KIAS, and anti-ice systems off. For takeoff at sea level and 25°C, thrust was reduced at 2817 feet AGL to an $N_1$ that in the event of an engine failure, level flight would be maintained.

Approach data was determined with landing gear down, approach speed 127 KIAS and 35° Flaps. No special noise abatement procedures were used.

# FLIGHT PLANNING

**NOTE**

Refer to Section I, TAKEOFF AND LANDING OPERATIONAL LIMITS and ENROUTE OPERATIONAL LIMITS for any serial number specific altitude restrictions.

Thorough flight planning suggests establishing a preflight goal such as maximum range, minimum time enroute, or maximum fuel reserve within the parameters defined by the FAA Approved Airplane Flight Manual takeoff, climb and landing requirements. Tables for Maximum Cruise Thrust, Normal Cruise Thrust, and Long Range Cruise are presented in this chapter to aid the crew in determining how best to achieve that goal. Maximum cruise thrust results in minimum time, long range cruise in optimum fuel consumption, and Normal Cruise represents a balance between the two.

Maximum range at a given altitude is dependent upon airframe efficiency and can be defined in still air as that point on the total drag curve where the relationship of velocity to total airplane drag is most favorable. The cruise angle-of-attack necessary to achieve that point is constant, but airspeed required is affected by airplane weight. The higher the weight, the higher the airspeed necessary to achieve optimum cruise angle-of-attack. This is in evidence when the long range cruise FLIGHT PLANNING tables are used and result in longer block times for the lighter weights. Enroute, as fuel burnoff occurs, thrust and airspeed required for best range will decrease as specific range increases due to improved performance at the lower operating weights. This should be considered when planning short stage lengths to avoid carrying excessive weight in stored fuel not operationally necessary.

Wind existing at cruise altitudes requires a more involved planning process to realize best range, because it requires a true airspeed faster or slower than that at which optimum range angle-of-attack is achieved in still air. This minimizes the effects of a headwind, or takes maximum advantage of a tailwind. The airplane's broad altitude capability also brings into consideration engine efficiency. Since the fuel flow necessary for a given true airspeed decreases with an increase in altitude, a higher headwind component may be tolerated at the upper flight level with best results in terms of ground distance covered to fuel consumed. Conversely, large increases in headwind velocity with altitude may dictate a lower cruise level to obtain the best fuel to distance relationship.

To assist altitude selection taking into account upper winds, Cruise Tables in the Performance Section present specific range as nautical miles per 100 pounds of fuel for different winds.

In comparative calculations, the highest number always represents best specific range. The Maximum Range mode will generally result in optimum specific range, but high headwinds may suggest an increased power setting to realize a shorter trip time without affecting total fuel burn appreciably. At 35,000 feet and 17,000 pounds gross weight with a 100-knot headwind, as an example, Maximum Range and Maximum Cruise Thrust give 25.2 and 20.5 nautical miles/100 pounds, respectively. In that case, Maximum Range will produce only 4.7 nautical miles more distance per 100 pounds of fuel while the ground speed at Maximum Cruise Thrust would be approximately 115 knots faster. For the absolute best range or maximum fuel reserve goal however, cruising at the altitude/wind/thrust combination with the highest specific range number will produce optimum results.

Climb and descent at maximum speed available to achieve desired vertical rate can be used in conjunction with Maximum Cruise Thrust for the minimum time goal. Fuel economy, however, is better served by using the climb and descent schedules presented in the PERFORMANCE chapter of this section.

Once the cruise mode and altitude has been determined, enroute time and fuel required can be approximated from the appropriate FLIGHT PLANNING tables.

The following criteria are used:

1. 200 pounds of taxi fuel.
2. 250 Knot / .62 Mach climb schedule for maximum cruise thrust and normal cruise tables, sea level through 35,000 feet. 230 Knot / .60 Mach climb schedule for long range cruise, sea level through 45,000 feet, and maximum cruise thrust and normal cruise tables, 37,000 feet through 45,000 feet.
3. 60 percent of the cruise wind factor applied to climb; 40 percent to descent.
4. Descent to 10,000 feet from cruise altitude using normal descent profile.
5. Thirty nautical miles from destination at 10,000 feet and long range cruise airspeed.
6. Ten minutes approach fuel at 944 pounds per hour total fuel flow.
7. No reserve fuel.

## FUEL RANGE TABLE USAGE

Entering the table at the planned stage length, read the fuel and time required per the conditions. If the fuel required is in excess of fuel available or if fuel reserves are inadequate, it may be advantageous to utilize one of the more economical cruise airspeed profiles and repeat the flight planning process. Specific data are presented in the PERFORMANCE chapter for separate computation of the climb, cruise and descent phases. If taxi time is known, 10 pounds per minute fuel flow can be used in lieu of the 200-pound figure.

After airplane loading and flight plan fuel requirements are determined, takeoff, climb and landing gross weights should be rechecked for compliance with Flight Manual criteria.

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 86.4% N1)

**STANDARD DAY** **CRUISE ALTITUDE 19000 FEET**

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1296. | 0.65 | 1386. | 0.69 | 1440. | 0.70 | 1500. | 0.73 | 1568. | 0.77 | 1646. | 0.80 | 1845. | 0.88 |
| | 16500 | 1268. | 0.64 | 1358. | 0.68 | 1412. | 0.70 | 1472. | 0.73 | 1540. | 0.76 | 1618. | 0.79 | 1816. | 0.87 |
| | 12500 | 1239. | 0.63 | 1330. | 0.68 | 1384. | 0.69 | 1443. | 0.72 | 1511. | 0.75 | 1589. | 0.79 | 1786. | 0.87 |
| 300 | 20000 | 1719. | 0.85 | 1856. | 0.91 | 1938. | 0.94 | 2029. | 0.98 | 2132. | 1.03 | 2250. | 1.08 | 2549. | 1.21 |
| | 16500 | 1690. | 0.84 | 1827. | 0.90 | 1909. | 0.93 | 1999. | 0.97 | 2101. | 1.02 | 2219. | 1.07 | 2515. | 1.20 |
| | 12500 | 1661. | 0.83 | 1797. | 0.90 | 1878. | 0.92 | 1969. | 0.96 | 2071. | 1.01 | 2188. | 1.07 | 2482. | 1.19 |
| 400 | 20000 | 2143. | 1.04 | 2327. | 1.13 | 2436. | 1.17 | 2558. | 1.23 | 2696. | 1.29 | 2854. | 1.36 | 3253. | 1.54 |
| | 16500 | 2113. | 1.03 | 2296. | 1.12 | 2405. | 1.16 | 2526. | 1.22 | 2663. | 1.28 | 2820. | 1.36 | 3215. | 1.53 |
| | 12500 | 2082. | 1.03 | 2265. | 1.11 | 2373. | 1.15 | 2494. | 1.21 | 2630. | 1.27 | 2786. | 1.34 | 3179. | 1.52 |
| 500 | 20000 | 2567. | 1.24 | 2798. | 1.35 | 2935. | 1.40 | 3087. | 1.47 | 3260. | 1.56 | 3458. | 1.65 | 3957. | 1.87 |
| | 16500 | 2536. | 1.23 | 2765. | 1.34 | 2901. | 1.39 | 3053. | 1.47 | 3224. | 1.54 | 3421. | 1.64 | 3915. | 1.85 |
| | 12500 | 2504. | 1.22 | 2733. | 1.33 | 2868. | 1.38 | 3019. | 1.45 | 3190. | 1.53 | 3385. | 1.62 | 3875. | 1.84 |
| 600 | 20000 | 2990. | 1.44 | 3268. | 1.57 | 3433. | 1.64 | 3616. | 1.72 | 3824. | 1.82 | 4063. | 1.93 | 4661. | 2.20 |
| | 16500 | 2958. | 1.43 | 3234. | 1.56 | 3398. | 1.62 | 3580. | 1.71 | 3786. | 1.81 | 4022. | 1.92 | 4614. | 2.18 |
| | 12500 | 2926. | 1.42 | 3200. | 1.55 | 3363. | 1.61 | 3544. | 1.70 | 3749. | 1.79 | 3984. | 1.90 | 4571. | 2.17 |
| 700 | 20000 | 3414. | 1.64 | 3739. | 1.79 | 3931. | 1.87 | 4146. | 1.97 | 4388. | 2.09 | 4667. | 2.21 | 5365. | 2.53 |
| | 16500 | 3381. | 1.63 | 3703. | 1.78 | 3894. | 1.86 | 4106. | 1.96 | 4348. | 2.07 | 4623. | 2.20 | 5314. | 2.50 |
| | 12500 | 3347. | 1.62 | 3668. | 1.77 | 3857. | 1.84 | 4069. | 1.94 | 4309. | 2.05 | 4582. | 2.18 | | |
| 800 | 20000 | 3838. | 1.84 | 4209. | 2.01 | 4429. | 2.10 | 4675. | 2.21 | 4952. | 2.35 | 5271. | 2.49 | 6069. | 2.86 |
| | 16500 | 3803. | 1.83 | 4172. | 2.00 | 4390. | 2.09 | 4633. | 2.21 | 4909. | 2.33 | 5224. | 2.48 | 6014. | 2.83 |
| | 12500 | 3769. | 1.81 | 4136. | 1.99 | 4352. | 2.07 | 4594. | 2.19 | 4868. | 2.31 | | | | |
| 900 | 20000 | 4262. | 2.04 | 4680. | 2.23 | 4927. | 2.34 | 5204. | 2.46 | 5516. | 2.61 | 5875. | 2.77 | 6773. | 3.19 |
| | 16500 | 4226. | 2.02 | 4641. | 2.21 | 4886. | 2.32 | 5160. | 2.45 | 5471. | 2.59 | 5825. | 2.76 | 6713. | 3.16 |
| | 12500 | 4190. | 2.01 | 4604. | 2.21 | 4847. | 2.30 | | | | | | | | |
| 1000 | 20000 | 4685. | 2.24 | 5150. | 2.45 | 5425. | 2.57 | 5733. | 2.71 | 6080. | 2.88 | 6479. | 3.06 | 7477. | 3.52 |
| | 16500 | 4648. | 2.22 | 5110. | 2.43 | 5383. | 2.55 | 5687. | 2.70 | 6032. | 2.85 | 6426. | 3.04 | 7413. | 3.48 |
| | 12500 | 4612. | 2.20 | | | | | | | | | | | | |
| 1100 | 20000 | 5109. | 2.44 | 5621. | 2.67 | 5923. | 2.80 | 6262. | 2.95 | 6644. | 3.14 | 7083. | 3.34 | | |
| | 16500 | 5071. | 2.42 | 5579. | 2.65 | 5879. | 2.78 | 6214. | 2.95 | 6594. | 3.12 | 7027. | 3.33 | | |
| | 12500 | 5033. | 2.40 | | | | | | | | | | | | |
| 1200 | 20000 | 5533. | 2.63 | 6092. | 2.89 | 6421. | 3.04 | 6791. | 3.20 | 7208. | 3.41 | | | | |
| | 16500 | 5493. | 2.62 | 6048. | 2.87 | 6375. | 3.01 | 6741. | 3.19 | 7156. | 3.38 | | | | |
| | 12500 | 5455. | 2.60 | | | | | | | | | | | | |
| 1300 | 20000 | 5957. | 2.83 | 6562. | 3.11 | 6919. | 3.27 | 7320. | 3.45 | | | | | | |
| | 16500 | 5916. | 2.81 | 6517. | 3.09 | 6872. | 3.25 | 7268. | 3.44 | | | | | | |
| | 12500 | 5877. | 2.79 | | | | | | | | | | | | |
| 1400 | 20000 | 6380. | 3.03 | 7033. | 3.33 | | | | | | | | | | |
| | 16500 | 6338. | 3.01 | 6986. | 3.31 | | | | | | | | | | |
| | 12500 | 6298. | 2.99 | | | | | | | | | | | | |
| 1500 | 20000 | 6804. | 3.23 | 7503. | 3.55 | | | | | | | | | | |
| | 16500 | 6761. | 3.21 | 7455. | 3.53 | | | | | | | | | | |
| | 12500 | 6720. | 3.19 | | | | | | | | | | | | |

Figure 7-7 (Sheet 1 of 11)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 89.7% N1)

**STANDARD DAY** **CRUISE ALTITUDE 23000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| STAGE LENGTH NM. | T.O. WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1299. | 0.65 | 1381. | 0.69 | 1430. | 0.70 | 1484. | 0.72 | 1545. | 0.75 | 1615. | 0.79 | 1791. | 0.86 |
| | 16500 | 1267. | 0.64 | 1349. | 0.68 | 1399. | 0.69 | 1453. | 0.72 | 1513. | 0.75 | 1583. | 0.78 | 1759. | 0.85 |
| | 12500 | 1234. | 0.63 | 1317. | 0.67 | 1366. | 0.68 | 1420. | 0.71 | 1481. | 0.74 | 1551. | 0.77 | 1726. | 0.84 |
| 300 | 20000 | 1712. | 0.84 | 1837. | 0.90 | 1912. | 0.92 | 1994. | 0.96 | 2087. | 1.00 | 2193. | 1.05 | 2458. | 1.16 |
| | 16500 | 1679. | 0.83 | 1804. | 0.89 | 1879. | 0.91 | 1961. | 0.95 | 2053. | 1.00 | 2159. | 1.04 | 2423. | 1.15 |
| | 12500 | 1645. | 0.82 | 1771. | 0.88 | 1845. | 0.90 | 1927. | 0.94 | 2019. | 0.99 | 2124. | 1.03 | 2388. | 1.14 |
| 400 | 20000 | 2124. | 1.03 | 2293. | 1.11 | 2393. | 1.14 | 2504. | 1.20 | 2629. | 1.25 | 2771. | 1.32 | 3126. | 1.47 |
| | 16500 | 2090. | 1.02 | 2259. | 1.10 | 2359. | 1.13 | 2469. | 1.18 | 2593. | 1.24 | 2735. | 1.31 | 3087. | 1.46 |
| | 12500 | 2056. | 1.01 | 2224. | 1.09 | 2324. | 1.12 | 2434. | 1.17 | 2557. | 1.23 | 2698. | 1.30 | 3049. | 1.45 |
| 500 | 20000 | 2537. | 1.22 | 2749. | 1.32 | 2875. | 1.36 | 3014. | 1.43 | 3171. | 1.50 | 3349. | 1.59 | 3793. | 1.78 |
| | 16500 | 2502. | 1.21 | 2714. | 1.31 | 2839. | 1.35 | 2977. | 1.42 | 3133. | 1.49 | 3310. | 1.57 | 3751. | 1.76 |
| | 12500 | 2467. | 1.20 | 2678. | 1.30 | 2802. | 1.34 | 2940. | 1.41 | 3096. | 1.48 | 3272. | 1.56 | 3710. | 1.75 |
| 600 | 20000 | 2949. | 1.41 | 3206. | 1.53 | 3356. | 1.59 | 3524. | 1.67 | 3713. | 1.75 | 3927. | 1.85 | 4461. | 2.09 |
| | 16500 | 2914. | 1.40 | 3168. | 1.52 | 3318. | 1.58 | 3485. | 1.65 | 3673. | 1.74 | 3886. | 1.83 | 4415. | 2.07 |
| | 12500 | 2878. | 1.39 | 3132. | 1.51 | 3281. | 1.56 | 3447. | 1.64 | 3634. | 1.73 | 3846. | 1.82 | 4372. | 2.06 |
| 700 | 20000 | 3362. | 1.60 | 3662. | 1.74 | 3838. | 1.81 | 4034. | 1.90 | 4254. | 2.00 | 4505. | 2.12 | 5128. | 2.40 |
| | 16500 | 3325. | 1.59 | 3623. | 1.73 | 3798. | 1.80 | 3993. | 1.88 | 4213. | 1.99 | 4462. | 2.10 | 5079. | 2.37 |
| | 12500 | 3288. | 1.58 | 3586. | 1.72 | 3760. | 1.78 | 3954. | 1.87 | 4172. | 1.98 | 4420. | 2.09 | 5033. | 2.36 |
| 800 | 20000 | 3774. | 1.79 | 4118. | 1.96 | 4319. | 2.03 | 4544. | 2.14 | 4796. | 2.25 | 5084. | 2.39 | 5796. | 2.71 |
| | 16500 | 3737. | 1.78 | 4078. | 1.94 | 4278. | 2.02 | 4502. | 2.12 | 4753. | 2.24 | 5037. | 2.36 | 5743. | 2.68 |
| | 12500 | 3699. | 1.76 | 4039. | 1.93 | 4239. | 2.00 | 4461. | 2.11 | 4710. | 2.23 | 4994. | 2.35 | | |
| 900 | 20000 | 4187. | 1.98 | 4574. | 2.17 | 4800. | 2.25 | 5054. | 2.37 | 5338. | 2.50 | 5662. | 2.65 | 6463. | 3.02 |
| | 16500 | 4148. | 1.97 | 4533. | 2.15 | 4758. | 2.24 | 5010. | 2.35 | 5293. | 2.49 | 5613. | 2.63 | 6408. | 2.99 |
| | 12500 | 4110. | 1.95 | 4493. | 2.14 | 4717. | 2.22 | 4967. | 2.34 | | | | | | |
| 1000 | 20000 | 4599. | 2.17 | 5030. | 2.38 | 5282. | 2.47 | 5563. | 2.61 | 5880. | 2.75 | 6240. | 2.92 | 7131. | 3.33 |
| | 16500 | 4560. | 2.16 | 4987. | 2.36 | 5238. | 2.46 | 5518. | 2.58 | 5832. | 2.74 | 6189. | 2.89 | 7072. | 3.29 |
| | 12500 | 4521. | 2.14 | 4947. | 2.34 | | | | | | | | | | |
| 1100 | 20000 | 5012. | 2.36 | 5486. | 2.59 | 5763. | 2.69 | 6073. | 2.84 | 6422. | 3.00 | 6818. | 3.19 | 7798. | 3.64 |
| | 16500 | 4971. | 2.35 | 5442. | 2.56 | 5718. | 2.68 | 6026. | 2.82 | 6372. | 2.98 | 6765. | 3.15 | 7736. | 3.60 |
| | 12500 | 4931. | 2.33 | | | | | | | | | | | | |
| 1200 | 20000 | 5424. | 2.55 | 5942. | 2.80 | 6245. | 2.92 | 6583. | 3.08 | 6964. | 3.25 | 7396. | 3.45 | | |
| | 16500 | 5383. | 2.54 | 5897. | 2.77 | 6198. | 2.90 | 6534. | 3.05 | 6912. | 3.23 | 7340. | 3.42 | | |
| | 12500 | 5342. | 2.52 | | | | | | | | | | | | |
| 1300 | 20000 | 5837. | 2.74 | 6398. | 3.01 | 6726. | 3.14 | 7093. | 3.31 | | | | | | |
| | 16500 | 5795. | 2.73 | 6352. | 2.98 | 6678. | 3.13 | 7042. | 3.28 | | | | | | |
| | 12500 | 5753. | 2.71 | | | | | | | | | | | | |
| 1400 | 20000 | 6250. | 2.93 | 6854. | 3.22 | 7208. | 3.36 | | | | | | | | |
| | 16500 | 6206. | 2.92 | 6806. | 3.19 | 7158. | 3.35 | | | | | | | | |
| | 12500 | 6164. | 2.89 | | | | | | | | | | | | |
| 1500 | 20000 | 6662. | 3.12 | 7310. | 3.43 | | | | | | | | | | |
| | 16500 | 6618. | 3.11 | 7261. | 3.40 | | | | | | | | | | |
| | 12500 | 6575. | 3.08 | | | | | | | | | | | | |
| 1600 | 20000 | 7075. | 3.31 | | | | | | | | | | | | |
| | 16500 | 7029. | 3.30 | | | | | | | | | | | | |
| | 12500 | 6985. | 3.27 | | | | | | | | | | | | |

Figure 7-7 (Sheet 2)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 90.4% N1)

**STANDARD DAY** **CRUISE ALTITUDE 27000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| STAGE LENGTH NM. | T.O. WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1287. | 0.66 | 1358. | 0.70 | 1401. | 0.70 | 1448. | 0.73 | 1501. | 0.76 | 1561. | 0.78 | 1714. | 0.85 |
| | 16500 | 1248. | 0.65 | 1320. | 0.69 | 1363. | 0.69 | 1410. | 0.72 | 1462. | 0.75 | 1523. | 0.78 | 1677. | 0.84 |
| | 12500 | 1207. | 0.64 | 1280. | 0.68 | 1323. | 0.69 | 1370. | 0.71 | 1423. | 0.74 | 1484. | 0.77 | 1638. | 0.83 |
| 300 | 20000 | 1660. | 0.85 | 1770. | 0.91 | 1836. | 0.92 | 1908. | 0.96 | 1989. | 1.00 | 2082. | 1.05 | 2315. | 1.15 |
| | 16500 | 1620. | 0.84 | 1730. | 0.90 | 1796. | 0.91 | 1868. | 0.95 | 1949. | 0.99 | 2042. | 1.04 | 2274. | 1.14 |
| | 12500 | 1579. | 0.83 | 1689. | 0.88 | 1755. | 0.90 | 1827. | 0.94 | 1908. | 0.98 | 2001. | 1.03 | 2232. | 1.13 |
| 400 | 20000 | 2033. | 1.04 | 2182. | 1.11 | 2270. | 1.14 | 2368. | 1.19 | 2478. | 1.25 | 2603. | 1.31 | 2915. | 1.46 |
| | 16500 | 1992. | 1.02 | 2141. | 1.10 | 2229. | 1.13 | 2326. | 1.18 | 2435. | 1.24 | 2560. | 1.30 | 2871. | 1.44 |
| | 12500 | 1950. | 1.02 | 2099. | 1.09 | 2187. | 1.12 | 2284. | 1.17 | 2393. | 1.23 | 2517. | 1.29 | 2827. | 1.43 |
| 500 | 20000 | 2406. | 1.23 | 2594. | 1.32 | 2705. | 1.36 | 2828. | 1.43 | 2966. | 1.50 | 3124. | 1.58 | 3516. | 1.76 |
| | 16500 | 2364. | 1.21 | 2551. | 1.31 | 2662. | 1.35 | 2784. | 1.41 | 2922. | 1.48 | 3079. | 1.56 | 3468. | 1.74 |
| | 12500 | 2321. | 1.20 | 2508. | 1.30 | 2619. | 1.34 | 2741. | 1.40 | 2878. | 1.47 | 3034. | 1.55 | 3421. | 1.73 |
| 600 | 20000 | 2778. | 1.41 | 3006. | 1.53 | 3139. | 1.58 | 3288. | 1.66 | 3455. | 1.74 | 3645. | 1.84 | 4116. | 2.06 |
| | 16500 | 2735. | 1.40 | 2962. | 1.52 | 3095. | 1.57 | 3242. | 1.65 | 3409. | 1.73 | 3598. | 1.82 | 4064. | 2.04 |
| | 12500 | 2692. | 1.39 | 2918. | 1.50 | 3051. | 1.56 | 3198. | 1.63 | 3363. | 1.72 | 3551. | 1.81 | 4015. | 2.03 |
| 700 | 20000 | 3151. | 1.60 | 3417. | 1.74 | 3574. | 1.80 | 3748. | 1.89 | 3943. | 1.99 | 4166. | 2.11 | 4716. | 2.37 |
| | 16500 | 3107. | 1.59 | 3372. | 1.73 | 3528. | 1.79 | 3701. | 1.88 | 3895. | 1.97 | 4116. | 2.09 | 4661. | 2.34 |
| | 12500 | 3063. | 1.58 | 3327. | 1.71 | 3482. | 1.78 | 3655. | 1.86 | 3847. | 1.96 | 4067. | 2.07 | 4609. | 2.33 |
| 800 | 20000 | 3524. | 1.79 | 3829. | 1.95 | 4009. | 2.02 | 4208. | 2.13 | 4432. | 2.24 | 4687. | 2.37 | 5317. | 2.67 |
| | 16500 | 3479. | 1.77 | 3783. | 1.93 | 3961. | 2.01 | 4159. | 2.11 | 4382. | 2.22 | 4635. | 2.35 | 5258. | 2.64 |
| | 12500 | 3435. | 1.77 | 3737. | 1.92 | 3914. | 2.00 | 4112. | 2.09 | 4332. | 2.21 | 4584. | 2.33 | | |
| 900 | 20000 | 3897. | 1.98 | 4241. | 2.16 | 4443. | 2.24 | 4668. | 2.36 | 4920. | 2.48 | 5207. | 2.63 | 5917. | 2.97 |
| | 16500 | 3851. | 1.96 | 4194. | 2.14 | 4395. | 2.22 | 4617. | 2.34 | 4868. | 2.46 | 5153. | 2.61 | 5855. | 2.94 |
| | 12500 | 3806. | 1.95 | 4146. | 2.12 | 4346. | 2.21 | 4568. | 2.32 | 4817. | 2.45 | | | | |
| 1000 | 20000 | 4269. | 2.17 | 4653. | 2.37 | 4878. | 2.46 | 5128. | 2.59 | 5408. | 2.73 | 5728. | 2.90 | 6518. | 3.28 |
| | 16500 | 4223. | 2.15 | 4604. | 2.35 | 4828. | 2.44 | 5075. | 2.57 | 5355. | 2.71 | 5672. | 2.87 | 6452. | 3.25 |
| | 12500 | 4177. | 2.14 | 4556. | 2.33 | 4778. | 2.43 | | | | | | | | |
| 1100 | 20000 | 4642. | 2.36 | 5064. | 2.58 | 5312. | 2.68 | 5588. | 2.83 | 5897. | 2.98 | 6249. | 3.16 | 7118. | 3.58 |
| | 16500 | 4595. | 2.34 | 5015. | 2.56 | 5261. | 2.66 | 5534. | 2.80 | 5841. | 2.95 | 6190. | 3.13 | 7049. | 3.55 |
| | 12500 | 4548. | 2.33 | | | | | | | | | | | | |
| 1200 | 20000 | 5015. | 2.54 | 5476. | 2.79 | 5747. | 2.90 | 6048. | 3.06 | 6385. | 3.22 | 6770. | 3.43 | 7718. | 3.88 |
| | 16500 | 4967. | 2.53 | 5425. | 2.76 | 5694. | 2.88 | 5992. | 3.04 | 6328. | 3.20 | 6709. | 3.40 | 7646. | 3.85 |
| | 12500 | 4919. | 2.52 | | | | | | | | | | | | |
| 1300 | 20000 | 5387. | 2.73 | 5888. | 3.00 | 6181. | 3.12 | 6508. | 3.29 | 6874. | 3.47 | 7291. | 3.69 | | |
| | 16500 | 5338. | 2.71 | 5836. | 2.97 | 6127. | 3.10 | 6450. | 3.27 | 6814. | 3.44 | 7227. | 3.66 | | |
| | 12500 | 5290. | 2.70 | | | | | | | | | | | | |
| 1400 | 20000 | 5760. | 2.92 | 6300. | 3.21 | 6616. | 3.34 | 6968. | 3.53 | | | | | | |
| | 16500 | 5710. | 2.90 | 6247. | 3.18 | 6560. | 3.32 | 6908. | 3.50 | | | | | | |
| | 12500 | 5662. | 2.89 | | | | | | | | | | | | |
| 1500 | 20000 | 6133. | 3.11 | 6712. | 3.41 | 7050. | 3.56 | | | | | | | | |
| | 16500 | 6082. | 3.09 | 6657. | 3.39 | 6993. | 3.53 | | | | | | | | |
| | 12500 | 6033. | 3.08 | | | | | | | | | | | | |
| 1600 | 20000 | 6506. | 3.30 | 7123. | 3.62 | | | | | | | | | | |
| | 16500 | 6454. | 3.28 | 7068. | 3.60 | | | | | | | | | | |
| | 12500 | 6404. | 3.27 | | | | | | | | | | | | |
| 1700 | 20000 | 6878. | 3.49 | | | | | | | | | | | | |
| | 16500 | 6826. | 3.46 | | | | | | | | | | | | |
| | 12500 | 6775. | 3.45 | | | | | | | | | | | | |

Figure 7-7 (Sheet 3)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 91.2% N1)

**STANDARD DAY** **CRUISE ALTITUDE 31000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE LENGTH NM. | T.O. WEIGHT LBS. | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| | | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1288. | 0.67 | 1350. | 0.70 | 1388. | 0.71 | 1429. | 0.73 | 1475. | 0.76 | 1528. | 0.78 | 1662. | 0.84 |
| | 16500 | 1240. | 0.66 | 1303. | 0.69 | 1341. | 0.70 | 1383. | 0.72 | 1429. | 0.75 | 1483. | 0.77 | 1618. | 0.83 |
| | 12500 | 1192. | 0.65 | 1256. | 0.68 | 1294. | 0.69 | 1336. | 0.71 | 1382. | 0.74 | 1436. | 0.77 | 1572. | 0.82 |
| 300 | 20000 | 1626. | 0.86 | 1723. | 0.91 | 1781. | 0.93 | 1845. | 0.96 | 1917. | 1.00 | 1999. | 1.05 | 2204. | 1.14 |
| | 16500 | 1577. | 0.85 | 1675. | 0.90 | 1733. | 0.92 | 1797. | 0.95 | 1869. | 0.99 | 1951. | 1.03 | 2156. | 1.13 |
| | 12500 | 1528. | 0.83 | 1626. | 0.89 | 1685. | 0.91 | 1748. | 0.94 | 1820. | 0.98 | 1903. | 1.02 | 2108. | 1.12 |
| 400 | 20000 | 1964. | 1.04 | 2096. | 1.12 | 2175. | 1.15 | 2261. | 1.20 | 2359. | 1.25 | 2470. | 1.31 | 2746. | 1.45 |
| | 16500 | 1914. | 1.03 | 2047. | 1.10 | 2125. | 1.13 | 2211. | 1.18 | 2309. | 1.24 | 2419. | 1.29 | 2695. | 1.43 |
| | 12500 | 1864. | 1.02 | 1997. | 1.09 | 2075. | 1.12 | 2161. | 1.17 | 2258. | 1.22 | 2369. | 1.28 | 2644. | 1.42 |
| 500 | 20000 | 2301. | 1.23 | 2469. | 1.33 | 2568. | 1.37 | 2677. | 1.43 | 2800. | 1.49 | 2941. | 1.57 | 3288. | 1.75 |
| | 16500 | 2251. | 1.22 | 2418. | 1.31 | 2517. | 1.35 | 2626. | 1.41 | 2748. | 1.48 | 2888. | 1.55 | 3233. | 1.73 |
| | 12500 | 2200. | 1.21 | 2367. | 1.30 | 2466. | 1.34 | 2574. | 1.40 | 2697. | 1.47 | 2836. | 1.54 | 3179. | 1.71 |
| 600 | 20000 | 2639. | 1.42 | 2842. | 1.53 | 2961. | 1.58 | 3094. | 1.66 | 3242. | 1.74 | 3412. | 1.83 | 3830. | 2.05 |
| | 16500 | 2588. | 1.40 | 2790. | 1.52 | 2909. | 1.57 | 3040. | 1.64 | 3188. | 1.72 | 3356. | 1.81 | 3772. | 2.03 |
| | 12500 | 2536. | 1.39 | 2738. | 1.50 | 2857. | 1.55 | 2987. | 1.62 | 3135. | 1.71 | 3302. | 1.79 | 3715. | 2.01 |
| 700 | 20000 | 2977. | 1.61 | 3215. | 1.74 | 3355. | 1.80 | 3510. | 1.89 | 3684. | 1.99 | 3883. | 2.10 | 4372. | 2.35 |
| | 16500 | 2925. | 1.59 | 3162. | 1.72 | 3301. | 1.79 | 3455. | 1.87 | 3628. | 1.97 | 3825. | 2.07 | 4310. | 2.33 |
| | 12500 | 2872. | 1.58 | 3108. | 1.71 | 3247. | 1.77 | 3400. | 1.85 | 3573. | 1.95 | 3769. | 2.05 | 4251. | 2.31 |
| 800 | 20000 | 3315. | 1.79 | 3588. | 1.95 | 3748. | 2.02 | 3926. | 2.12 | 4126. | 2.23 | 4354. | 2.36 | 4914. | 2.65 |
| | 16500 | 3262. | 1.78 | 3533. | 1.93 | 3693. | 2.00 | 3869. | 2.10 | 4068. | 2.21 | 4293. | 2.33 | 4849. | 2.63 |
| | 12500 | 3208. | 1.76 | 3479. | 1.91 | 3638. | 1.99 | 3813. | 2.08 | 4011. | 2.19 | 4235. | 2.31 | 4786. | 2.61 |
| 900 | 20000 | 3653. | 1.98 | 3961. | 2.16 | 4141. | 2.24 | 4342. | 2.35 | 4568. | 2.48 | 4825. | 2.62 | 5457. | 2.95 |
| | 16500 | 3598. | 1.96 | 3905. | 2.13 | 4085. | 2.22 | 4284. | 2.33 | 4508. | 2.45 | 4762. | 2.59 | 5387. | 2.93 |
| | 12500 | 3544. | 1.95 | 3850. | 2.11 | 4028. | 2.20 | 4226. | 2.31 | 4449. | 2.44 | 4701. | 2.57 | | |
| 1000 | 20000 | 3990. | 2.17 | 4334. | 2.36 | 4535. | 2.46 | 4759. | 2.59 | 5010. | 2.72 | 5295. | 2.88 | 5999. | 3.25 |
| | 16500 | 3935. | 2.15 | 4277. | 2.34 | 4477. | 2.44 | 4698. | 2.56 | 4947. | 2.70 | 5230. | 2.85 | 5926. | 3.22 |
| | 12500 | 3880. | 2.13 | 4220. | 2.32 | 4419. | 2.42 | 4639. | 2.53 | 4887. | 2.68 | | | | |
| 1100 | 20000 | 4328. | 2.36 | 4706. | 2.57 | 4928. | 2.67 | 5175. | 2.82 | 5452. | 2.97 | 5766. | 3.14 | 6541. | 3.55 |
| | 16500 | 4272. | 2.34 | 4648. | 2.54 | 4868. | 2.65 | 5112. | 2.79 | 5387. | 2.94 | 5699. | 3.11 | 6464. | 3.52 |
| | 12500 | 4216. | 2.32 | 4591. | 2.52 | 4810. | 2.63 | | | | | | | | |
| 1200 | 20000 | 4666. | 2.54 | 5079. | 2.78 | 5321. | 2.89 | 5591. | 3.05 | 5894. | 3.21 | 6237. | 3.41 | 7083. | 3.86 |
| | 16500 | 4609. | 2.52 | 5020. | 2.75 | 5260. | 2.87 | 5527. | 3.03 | 5827. | 3.19 | 6167. | 3.36 | 7003. | 3.82 |
| | 12500 | 4552. | 2.51 | | | | | | | | | | | | |
| 1300 | 20000 | 5004. | 2.73 | 5452. | 2.99 | 5715. | 3.11 | 6007. | 3.28 | 6336. | 3.46 | 6708. | 3.67 | 7625. | 4.16 |
| | 16500 | 4946. | 2.71 | 5392. | 2.95 | 5652. | 3.09 | 5941. | 3.26 | 6267. | 3.43 | 6636. | 3.62 | 7541. | 4.12 |
| | 12500 | 4889. | 2.69 | | | | | | | | | | | | |
| 1400 | 20000 | 5342. | 2.92 | 5825. | 3.20 | 6108. | 3.33 | 6424. | 3.51 | 6778. | 3.70 | 7179. | 3.93 | | |
| | 16500 | 5283. | 2.90 | 5763. | 3.16 | 6044. | 3.31 | 6356. | 3.49 | 6706. | 3.67 | 7104. | 3.88 | | |
| | 12500 | 5225. | 2.88 | | | | | | | | | | | | |
| 1500 | 20000 | 5679. | 3.11 | 6198. | 3.40 | 6502. | 3.55 | 6840. | 3.74 | 7220. | 3.95 | | | | |
| | 16500 | 5620. | 3.08 | 6135. | 3.36 | 6436. | 3.52 | 6770. | 3.72 | 7146. | 3.92 | | | | |
| | 12500 | 5561. | 3.06 | | | | | | | | | | | | |
| 1600 | 20000 | 6017. | 3.29 | 6571. | 3.61 | 6895. | 3.77 | 7256. | 3.98 | | | | | | |
| | 16500 | 5956. | 3.27 | 6507. | 3.57 | 6828. | 3.74 | 7185. | 3.95 | | | | | | |
| | 12500 | 5897. | 3.25 | | | | | | | | | | | | |
| 1700 | 20000 | 6355. | 3.48 | 6944. | 3.82 | | | | | | | | | | |
| | 16500 | 6293. | 3.46 | 6878. | 3.78 | | | | | | | | | | |
| | 12500 | 6233. | 3.44 | | | | | | | | | | | | |
| 1800 | 20000 | 6693. | 3.67 | 7317. | 4.03 | | | | | | | | | | |
| | 16500 | 6630. | 3.64 | 7250. | 3.98 | | | | | | | | | | |
| | 12500 | 6569. | 3.62 | | | | | | | | | | | | |
| 1900 | 20000 | 7031. | 3.85 | | | | | | | | | | | | |
| | 16500 | 6967. | 3.83 | | | | | | | | | | | | |
| | 12500 | 6905. | 3.81 | | | | | | | | | | | | |

Figure 7-7 (Sheet 4)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 91.9% N1)

**STANDARD DAY** **CRUISE ALTITUDE 33000 FEET**

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1289. | 0.68 | 1347. | 0.71 | 1383. | 0.71 | 1421. | 0.74 | 1464. | 0.76 | 1514. | 0.79 | 1640. | 0.84 |
| | 16500 | 1237. | 0.66 | 1296. | 0.70 | 1332. | 0.70 | 1371. | 0.73 | 1414. | 0.75 | 1465. | 0.78 | 1592. | 0.83 |
| | 12500 | 1185. | 0.65 | 1245. | 0.69 | 1281. | 0.69 | 1320. | 0.71 | 1364. | 0.74 | 1415. | 0.77 | 1543. | 0.82 |
| 300 | 20000 | 1611. | 0.86 | 1702. | 0.92 | 1757. | 0.93 | 1817. | 0.97 | 1885. | 1.01 | 1962. | 1.05 | 2156. | 1.14 |
| | 16500 | 1558. | 0.85 | 1650. | 0.90 | 1705. | 0.92 | 1765. | 0.95 | 1833. | 0.99 | 1911. | 1.03 | 2105. | 1.13 |
| | 12500 | 1505. | 0.84 | 1598. | 0.89 | 1653. | 0.91 | 1713. | 0.94 | 1781. | 0.98 | 1859. | 1.02 | 2053. | 1.12 |
| 400 | 20000 | 1932. | 1.05 | 2058. | 1.12 | 2132. | 1.15 | 2213. | 1.20 | 2305. | 1.25 | 2410. | 1.31 | 2672. | 1.45 |
| | 16500 | 1879. | 1.04 | 2004. | 1.11 | 2078. | 1.14 | 2160. | 1.18 | 2252. | 1.24 | 2356. | 1.29 | 2617. | 1.43 |
| | 12500 | 1825. | 1.02 | 1951. | 1.09 | 2025. | 1.12 | 2106. | 1.17 | 2198. | 1.22 | 2303. | 1.28 | 2562. | 1.41 |
| 500 | 20000 | 2254. | 1.24 | 2413. | 1.33 | 2506. | 1.37 | 2610. | 1.43 | 2726. | 1.50 | 2858. | 1.57 | 3188. | 1.75 |
| | 16500 | 2200. | 1.22 | 2358. | 1.31 | 2452. | 1.35 | 2555. | 1.41 | 2670. | 1.48 | 2802. | 1.55 | 3129. | 1.73 |
| | 12500 | 2145. | 1.21 | 2304. | 1.30 | 2397. | 1.34 | 2500. | 1.40 | 2615. | 1.46 | 2747. | 1.53 | 3072. | 1.71 |
| 600 | 20000 | 2576. | 1.42 | 2768. | 1.54 | 2881. | 1.59 | 3006. | 1.66 | 3147. | 1.74 | 3307. | 1.83 | 3703. | 2.05 |
| | 16500 | 2521. | 1.41 | 2712. | 1.52 | 2825. | 1.57 | 2949. | 1.64 | 3089. | 1.72 | 3248. | 1.81 | 3642. | 2.03 |
| | 12500 | 2466. | 1.39 | 2657. | 1.50 | 2769. | 1.55 | 2893. | 1.63 | 3032. | 1.71 | 3190. | 1.79 | 3582. | 2.00 |
| 700 | 20000 | 2898. | 1.61 | 3123. | 1.75 | 3255. | 1.81 | 3402. | 1.89 | 3567. | 1.99 | 3755. | 2.09 | 4219. | 2.35 |
| | 16500 | 2842. | 1.59 | 3066. | 1.72 | 3198. | 1.79 | 3344. | 1.87 | 3508. | 1.97 | 3694. | 2.07 | 4154. | 2.32 |
| | 12500 | 2786. | 1.58 | 3010. | 1.71 | 3141. | 1.77 | 3286. | 1.85 | 3449. | 1.95 | 3634. | 2.05 | 4091. | 2.30 |
| 800 | 20000 | 3219. | 1.80 | 3478. | 1.95 | 3630. | 2.02 | 3799. | 2.13 | 3988. | 2.23 | 4203. | 2.35 | 4735. | 2.65 |
| | 16500 | 3163. | 1.78 | 3420. | 1.93 | 3571. | 2.00 | 3739. | 2.10 | 3927. | 2.21 | 4140. | 2.33 | 4667. | 2.62 |
| | 12500 | 3106. | 1.76 | 3363. | 1.91 | 3513. | 1.98 | 3680. | 2.08 | 3867. | 2.19 | 4078. | 2.30 | 4601. | 2.60 |
| 900 | 20000 | 3541. | 1.99 | 3833. | 2.16 | 4004. | 2.24 | 4195. | 2.36 | 4409. | 2.48 | 4651. | 2.61 | 5251. | 2.95 |
| | 16500 | 3484. | 1.97 | 3774. | 2.13 | 3945. | 2.22 | 4133. | 2.33 | 4345. | 2.45 | 4586. | 2.59 | 5179. | 2.92 |
| | 12500 | 3426. | 1.95 | 3716. | 2.11 | 3885. | 2.20 | 4073. | 2.31 | 4284. | 2.43 | 4522. | 2.56 | | |
| 1000 | 20000 | 3863. | 2.17 | 4188. | 2.37 | 4379. | 2.46 | 4591. | 2.59 | 4829. | 2.72 | 5099. | 2.87 | 5767. | 3.25 |
| | 16500 | 3804. | 2.15 | 4128. | 2.34 | 4318. | 2.44 | 4528. | 2.55 | 4764. | 2.70 | 5031. | 2.84 | 5691. | 3.22 |
| | 12500 | 3746. | 2.13 | 4069. | 2.32 | 4257. | 2.41 | 4466. | 2.54 | 4701. | 2.67 | | | | |
| 1100 | 20000 | 4185. | 2.36 | 4544. | 2.58 | 4754. | 2.68 | 4987. | 2.82 | 5250. | 2.97 | 5548. | 3.13 | 6282. | 3.55 |
| | 16500 | 4125. | 2.34 | 4482. | 2.54 | 4691. | 2.65 | 4922. | 2.78 | 5183. | 2.94 | 5477. | 3.10 | 6204. | 3.52 |
| | 12500 | 4067. | 2.32 | 4422. | 2.52 | 4629. | 2.63 | 4859. | 2.77 | | | | | | |
| 1200 | 20000 | 4506. | 2.55 | 4899. | 2.78 | 5128. | 2.90 | 5384. | 3.05 | 5671. | 3.21 | 5996. | 3.39 | 6798. | 3.86 |
| | 16500 | 4446. | 2.53 | 4836. | 2.75 | 5064. | 2.87 | 5317. | 3.01 | 5602. | 3.18 | 5923. | 3.36 | 6716. | 3.81 |
| | 12500 | 4387. | 2.50 | 4775. | 2.72 | | | | | | | | | | |
| 1300 | 20000 | 4828. | 2.74 | 5254. | 2.99 | 5503. | 3.12 | 5780. | 3.28 | 6091. | 3.46 | 6444. | 3.66 | 7314. | 4.16 |
| | 16500 | 4767. | 2.71 | 5190. | 2.95 | 5438. | 3.09 | 5712. | 3.24 | 6020. | 3.43 | 6369. | 3.62 | 7228. | 4.11 |
| | 12500 | 4707. | 2.69 | | | | | | | | | | | | |
| 1400 | 20000 | 5150. | 2.92 | 5609. | 3.20 | 5877. | 3.33 | 6176. | 3.52 | 6512. | 3.70 | 6892. | 3.92 | | |
| | 16500 | 5088. | 2.90 | 5544. | 3.16 | 5811. | 3.30 | 6106. | 3.47 | 6439. | 3.67 | 6815. | 3.88 | | |
| | 12500 | 5027. | 2.87 | | | | | | | | | | | | |
| 1500 | 20000 | 5472. | 3.11 | 5964. | 3.41 | 6252. | 3.55 | 6572. | 3.75 | 6933. | 3.95 | | | | |
| | 16500 | 5409. | 3.08 | 5898. | 3.36 | 6184. | 3.52 | 6501. | 3.70 | 6858. | 3.91 | | | | |
| | 12500 | 5348. | 3.06 | | | | | | | | | | | | |
| 1600 | 20000 | 5793. | 3.30 | 6319. | 3.62 | 6626. | 3.77 | 6969. | 3.98 | | | | | | |
| | 16500 | 5730. | 3.27 | 6252. | 3.57 | 6557. | 3.74 | 6896. | 3.92 | | | | | | |
| | 12500 | 5668. | 3.24 | | | | | | | | | | | | |
| 1700 | 20000 | 6115. | 3.49 | 6675. | 3.82 | 7001. | 3.99 | | | | | | | | |
| | 16500 | 6051. | 3.46 | 6606. | 3.77 | 6931. | 3.95 | | | | | | | | |
| | 12500 | 5988. | 3.43 | | | | | | | | | | | | |
| 1800 | 20000 | 6437. | 3.67 | 7030. | 4.03 | | | | | | | | | | |
| | 16500 | 6372. | 3.64 | 6960. | 3.98 | | | | | | | | | | |
| | 12500 | 6308. | 3.61 | | | | | | | | | | | | |
| 1900 | 20000 | 6758. | 3.86 | 7385. | 4.24 | | | | | | | | | | |
| | 16500 | 6693. | 3.83 | 7314. | 4.18 | | | | | | | | | | |
| | 12500 | 6628. | 3.80 | | | | | | | | | | | | |
| 2000 | 20000 | 7080. | 4.05 | | | | | | | | | | | | |
| | 16500 | 7014. | 4.02 | | | | | | | | | | | | |
| | 12500 | 6949. | 3.98 | | | | | | | | | | | | |

Figure 7-7 (Sheet 5)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 92.3% N1)

**STANDARD DAY** **CRUISE ALTITUDE 35000 FEET**

| STAGE LENGTH NM. | T.O. WEIGHT LBS. | TAILWIND 100 KT. FUEL LBS. | TAILWIND 100 KT. TIME HRS. | TAILWIND 50 KT. FUEL LBS. | TAILWIND 50 KT. TIME HRS. | TAILWIND 25 KT. FUEL LBS. | TAILWIND 25 KT. TIME HRS. | ZERO WIND FUEL LBS. | ZERO WIND TIME HRS. | HEADWIND 25 KT. FUEL LBS. | HEADWIND 25 KT. TIME HRS. | HEADWIND 50 KT. FUEL LBS. | HEADWIND 50 KT. TIME HRS. | HEADWIND 100 KT. FUEL LBS. | HEADWIND 100 KT. TIME HRS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 20000 | 1293. | 0.68 | 1347. | 0.71 | 1380. | 0.72 | 1416. | 0.74 | 1456. | 0.77 | 1503. | 0.79 | 1621. | 0.84 |
| | 16500 | 1236. | 0.67 | 1291. | 0.70 | 1325. | 0.71 | 1361. | 0.73 | 1402. | 0.75 | 1449. | 0.78 | 1569. | 0.83 |
| | 12500 | 1179. | 0.66 | 1235. | 0.69 | 1269. | 0.69 | 1306. | 0.72 | 1347. | 0.74 | 1395. | 0.77 | 1516. | 0.82 |
| 300 | 20000 | 1597. | 0.87 | 1683. | 0.92 | 1734. | 0.94 | 1791. | 0.97 | 1854. | 1.01 | 1927. | 1.05 | 2110. | 1.15 |
| | 16500 | 1539. | 0.86 | 1626. | 0.91 | 1677. | 0.92 | 1734. | 0.96 | 1797. | 1.00 | 1870. | 1.04 | 2053. | 1.13 |
| | 12500 | 1481. | 0.84 | 1568. | 0.89 | 1620. | 0.91 | 1677. | 0.94 | 1741. | 0.98 | 1815. | 1.02 | 1998. | 1.12 |
| 400 | 20000 | 1901. | 1.06 | 2018. | 1.13 | 2088. | 1.16 | 2165. | 1.20 | 2252. | 1.26 | 2351. | 1.32 | 2598. | 1.45 |
| | 16500 | 1842. | 1.04 | 1960. | 1.11 | 2030. | 1.14 | 2107. | 1.19 | 2193. | 1.24 | 2292. | 1.30 | 2538. | 1.43 |
| | 12500 | 1784. | 1.03 | 1902. | 1.10 | 1972. | 1.13 | 2049. | 1.17 | 2135. | 1.23 | 2234. | 1.28 | 2480. | 1.41 |
| 500 | 20000 | 2205. | 1.25 | 2354. | 1.34 | 2442. | 1.38 | 2540. | 1.44 | 2649. | 1.50 | 2775. | 1.58 | 3086. | 1.75 |
| | 16500 | 2145. | 1.23 | 2294. | 1.32 | 2382. | 1.36 | 2479. | 1.42 | 2589. | 1.48 | 2713. | 1.56 | 3022. | 1.73 |
| | 12500 | 2086. | 1.21 | 2235. | 1.30 | 2324. | 1.34 | 2420. | 1.40 | 2530. | 1.47 | 2654. | 1.54 | 2962. | 1.71 |
| 600 | 20000 | 2508. | 1.44 | 2689. | 1.55 | 2796. | 1.59 | 2914. | 1.67 | 3047. | 1.75 | 3199. | 1.84 | 3574. | 2.05 |
| | 16500 | 2448. | 1.42 | 2629. | 1.53 | 2735. | 1.58 | 2852. | 1.65 | 2984. | 1.73 | 3134. | 1.82 | 3506. | 2.03 |
| | 12500 | 2389. | 1.40 | 2569. | 1.51 | 2675. | 1.56 | 2792. | 1.63 | 2924. | 1.71 | 3074. | 1.80 | 3444. | 2.00 |
| 700 | 20000 | 2812. | 1.62 | 3025. | 1.75 | 3150. | 1.81 | 3289. | 1.90 | 3444. | 1.99 | 3623. | 2.10 | 4062. | 2.36 |
| | 16500 | 2751. | 1.60 | 2963. | 1.73 | 3088. | 1.79 | 3225. | 1.88 | 3380. | 1.97 | 3556. | 2.08 | 3991. | 2.32 |
| | 12500 | 2691. | 1.58 | 2903. | 1.71 | 3027. | 1.77 | 3164. | 1.85 | 3318. | 1.95 | 3493. | 2.05 | 3925. | 2.30 |
| 800 | 20000 | 3116. | 1.81 | 3360. | 1.96 | 3504. | 2.03 | 3663. | 2.13 | 3842. | 2.24 | 4047. | 2.37 | 4550. | 2.66 |
| | 16500 | 3054. | 1.79 | 3297. | 1.94 | 3440. | 2.01 | 3598. | 2.11 | 3776. | 2.21 | 3977. | 2.34 | 4475. | 2.62 |
| | 12500 | 2994. | 1.77 | 3236. | 1.92 | 3378. | 1.99 | 3535. | 2.08 | 3712. | 2.19 | 3913. | 2.31 | 4407. | 2.59 |
| 900 | 20000 | 3420. | 2.00 | 3696. | 2.17 | 3858. | 2.25 | 4038. | 2.37 | 4240. | 2.49 | 4471. | 2.63 | 5038. | 2.96 |
| | 16500 | 3357. | 1.98 | 3632. | 2.14 | 3793. | 2.23 | 3971. | 2.34 | 4171. | 2.45 | 4398. | 2.60 | 4959. | 2.92 |
| | 12500 | 3296. | 1.95 | 3570. | 2.12 | 3730. | 2.21 | 3907. | 2.31 | 4107. | 2.44 | 4333. | 2.57 | 4889. | 2.89 |
| 1000 | 20000 | 3724. | 2.19 | 4031. | 2.38 | 4212. | 2.47 | 4412. | 2.60 | 4637. | 2.73 | 4895. | 2.89 | 5526. | 3.26 |
| | 16500 | 3660. | 2.16 | 3966. | 2.35 | 4145. | 2.45 | 4344. | 2.56 | 4567. | 2.70 | 4820. | 2.86 | 5444. | 3.22 |
| | 12500 | 3598. | 2.14 | 3903. | 2.32 | 4082. | 2.42 | 4278. | 2.54 | 4501. | 2.68 | 4753. | 2.82 | | |
| 1100 | 20000 | 4028. | 2.38 | 4367. | 2.59 | 4566. | 2.69 | 4787. | 2.83 | 5035. | 2.98 | 5319. | 3.16 | 6014. | 3.57 |
| | 16500 | 3964. | 2.35 | 4300. | 2.55 | 4498. | 2.67 | 4716. | 2.79 | 4962. | 2.94 | 5241. | 3.12 | 5928. | 3.52 |
| | 12500 | 3901. | 2.33 | 4237. | 2.53 | 4433. | 2.64 | 4650. | 2.76 | | | | | | |
| 1200 | 20000 | 4332. | 2.57 | 4702. | 2.79 | 4919. | 2.91 | 5161. | 3.06 | 5432. | 3.22 | 5743. | 3.42 | 6502. | 3.87 |
| | 16500 | 4267. | 2.54 | 4635. | 2.76 | 4850. | 2.88 | 5089. | 3.02 | 5358. | 3.18 | 5662. | 3.38 | 6412. | 3.82 |
| | 12500 | 4203. | 2.51 | 4570. | 2.73 | 4785. | 2.85 | | | | | | | | |
| 1300 | 20000 | 4635. | 2.76 | 5037. | 3.00 | 5273. | 3.13 | 5536. | 3.29 | 5830. | 3.47 | 6167. | 3.68 | 6991. | 4.17 |
| | 16500 | 4570. | 2.72 | 4969. | 2.97 | 5203. | 3.10 | 5462. | 3.25 | 5754. | 3.43 | 6083. | 3.63 | 6897. | 4.11 |
| | 12500 | 4506. | 2.70 | | | | | | | | | | | | |
| 1400 | 20000 | 4939. | 2.94 | 5373. | 3.21 | 5627. | 3.34 | 5910. | 3.53 | 6228. | 3.72 | 6591. | 3.95 | 7479. | 4.47 |
| | 16500 | 4873. | 2.91 | 5304. | 3.17 | 5556. | 3.32 | 5835. | 3.48 | 6149. | 3.67 | 6505. | 3.89 | 7381. | 4.41 |
| | 12500 | 4808. | 2.88 | | | | | | | | | | | | |
| 1500 | 20000 | 5243. | 3.13 | 5708. | 3.42 | 5981. | 3.56 | 6285. | 3.76 | 6625. | 3.96 | 7015. | 4.21 | | |
| | 16500 | 5176. | 3.10 | 5638. | 3.38 | 5908. | 3.54 | 6208. | 3.71 | 6545. | 3.91 | 6926. | 4.15 | | |
| | 12500 | 5111. | 3.07 | | | | | | | | | | | | |
| 1600 | 20000 | 5547. | 3.32 | 6044. | 3.62 | 6335. | 3.78 | 6659. | 3.99 | 7023. | 4.21 | | | | |
| | 16500 | 5479. | 3.28 | 5972. | 3.58 | 6261. | 3.75 | 6581. | 3.94 | 6940. | 4.16 | | | | |
| | 12500 | 5413. | 3.25 | | | | | | | | | | | | |
| 1700 | 20000 | 5851. | 3.51 | 6379. | 3.83 | 6689. | 4.00 | 7034. | 4.22 | | | | | | |
| | 16500 | 5782. | 3.47 | 6307. | 3.79 | 6613. | 3.97 | 6953. | 4.17 | | | | | | |
| | 12500 | 5716. | 3.44 | | | | | | | | | | | | |
| 1800 | 20000 | 6155. | 3.70 | 6715. | 4.04 | 7043. | 4.22 | | | | | | | | |
| | 16500 | 6085. | 3.66 | 6641. | 4.00 | 6966. | 4.19 | | | | | | | | |
| | 12500 | 6018. | 3.62 | | | | | | | | | | | | |
| 1900 | 20000 | 6459. | 3.89 | 7050. | 4.25 | | | | | | | | | | |
| | 16500 | 6388. | 3.85 | 6975. | 4.20 | | | | | | | | | | |
| | 12500 | 6321. | 3.81 | | | | | | | | | | | | |
| 2000 | 20000 | 6762. | 4.08 | 7386. | 4.46 | | | | | | | | | | |
| | 16500 | 6691. | 4.03 | 7310. | 4.41 | | | | | | | | | | |
| | 12500 | 6623. | 3.99 | | | | | | | | | | | | |
| 2100 | 20000 | 7066. | 4.26 | | | | | | | | | | | | |
| | 16500 | 6994. | 4.22 | | | | | | | | | | | | |
| | 12500 | 6926. | 4.18 | | | | | | | | | | | | |

Figure 7-7 (Sheet 6)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 92.3% N1)

**STANDARD DAY** **CRUISE ALTITUDE 37000 FEET**

| | | TRAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE LENGTH | T.O. WEIGHT | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| NM. | LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1293. | 0.70 | 1345. | 0.73 | 1376. | 0.73 | 1410. | 0.75 | 1449. | 0.78 | 1493. | 0.80 | 1607. | 0.86 |
| | 16500 | 1230. | 0.68 | 1282. | 0.71 | 1314. | 0.72 | 1348. | 0.74 | 1387. | 0.76 | 1431. | 0.79 | 1545. | 0.84 |
| | 12500 | 1167. | 0.66 | 1220. | 0.70 | 1252. | 0.70 | 1286. | 0.72 | 1325. | 0.75 | 1371. | 0.77 | 1485. | 0.83 |
| 400 | 20000 | 1854. | 1.07 | 1965. | 1.15 | 2030. | 1.17 | 2103. | 1.22 | 2184. | 1.28 | 2277. | 1.33 | 2511. | 1.47 |
| | 16500 | 1788. | 1.05 | 1898. | 1.13 | 1964. | 1.15 | 2036. | 1.20 | 2117. | 1.25 | 2209. | 1.31 | 2440. | 1.44 |
| | 12500 | 1724. | 1.04 | 1834. | 1.11 | 1900. | 1.14 | 1972. | 1.18 | 2052. | 1.24 | 2145. | 1.29 | 2374. | 1.42 |
| 600 | 20000 | 2415. | 1.45 | 2584. | 1.56 | 2684. | 1.62 | 2795. | 1.69 | 2919. | 1.77 | 3061. | 1.86 | 3415. | 2.08 |
| | 16500 | 2347. | 1.43 | 2515. | 1.54 | 2614. | 1.59 | 2724. | 1.66 | 2847. | 1.74 | 2987. | 1.83 | 3336. | 2.05 |
| | 12500 | 2281. | 1.41 | 2449. | 1.52 | 2548. | 1.57 | 2657. | 1.64 | 2779. | 1.72 | 2919. | 1.81 | 3263. | 2.02 |
| 700 | 20000 | 2696. | 1.64 | 2894. | 1.77 | 3011. | 1.84 | 3141. | 1.92 | 3287. | 2.02 | 3453. | 2.13 | 3867. | 2.38 |
| | 16500 | 2626. | 1.62 | 2823. | 1.75 | 2939. | 1.81 | 3067. | 1.89 | 3212. | 1.99 | 3376. | 2.10 | 3783. | 2.35 |
| | 12500 | 2560. | 1.59 | 2756. | 1.73 | 2872. | 1.78 | 2999. | 1.87 | 3142. | 1.96 | 3306. | 2.07 | 3708. | 2.31 |
| 800 | 20000 | 2976. | 1.83 | 3204. | 1.98 | 3338. | 2.06 | 3487. | 2.15 | 3655. | 2.27 | 3845. | 2.39 | 4319. | 2.69 |
| | 16500 | 2905. | 1.81 | 3131. | 1.95 | 3264. | 2.03 | 3411. | 2.12 | 3577. | 2.23 | 3765. | 2.36 | 4231. | 2.65 |
| | 12500 | 2838. | 1.78 | 3063. | 1.93 | 3196. | 2.00 | 3342. | 2.10 | 3505. | 2.21 | 3693. | 2.32 | 4152. | 2.61 |
| 900 | 20000 | 3256. | 2.02 | 3514. | 2.19 | 3665. | 2.28 | 3833. | 2.39 | 4022. | 2.52 | 4237. | 2.66 | 4771. | 2.99 |
| | 16500 | 3184. | 1.99 | 3440. | 2.16 | 3589. | 2.25 | 3755. | 2.36 | 3942. | 2.48 | 4154. | 2.62 | 4678. | 2.95 |
| | 12500 | 3117. | 1.97 | 3371. | 2.14 | 3520. | 2.22 | 3684. | 2.33 | 3869. | 2.45 | 4080. | 2.58 | 4597. | 2.91 |
| 1000 | 20000 | 3537. | 2.21 | 3824. | 2.40 | 3992. | 2.50 | 4179. | 2.62 | 4390. | 2.77 | 4629. | 2.92 | 5223. | 3.30 |
| | 16500 | 3464. | 2.18 | 3748. | 2.37 | 3914. | 2.47 | 4099. | 2.59 | 4307. | 2.72 | 4543. | 2.88 | 5126. | 3.25 |
| | 12500 | 3395. | 2.15 | 3678. | 2.34 | 3844. | 2.43 | 4027. | 2.56 | 4232. | 2.69 | 4467. | 2.84 | 5041. | 3.20 |
| 1100 | 20000 | 3817. | 2.40 | 4134. | 2.61 | 4319. | 2.72 | 4525. | 2.86 | 4758. | 3.02 | 5021. | 3.19 | 5675. | 3.61 |
| | 16500 | 3743. | 2.37 | 4056. | 2.57 | 4239. | 2.69 | 4443. | 2.82 | 4672. | 2.97 | 4932. | 3.14 | 5574. | 3.55 |
| | 12500 | 3674. | 2.34 | 3985. | 2.55 | 4168. | 2.65 | 4369. | 2.79 | 4595. | 2.94 | 4854. | 3.10 | | |
| 1200 | 20000 | 4098. | 2.59 | 4443. | 2.82 | 4646. | 2.94 | 4872. | 3.09 | 5125. | 3.27 | 5413. | 3.45 | 6127. | 3.91 |
| | 16500 | 4022. | 2.56 | 4364. | 2.78 | 4564. | 2.91 | 4787. | 3.05 | 5037. | 3.21 | 5321. | 3.40 | 6021. | 3.85 |
| | 12500 | 3952. | 2.52 | 4292. | 2.75 | 4491. | 2.87 | 4712. | 3.02 | | | | | | |
| 1300 | 20000 | 4378. | 2.78 | 4753. | 3.03 | 4973. | 3.16 | 5218. | 3.32 | 5493. | 3.51 | 5805. | 3.72 | 6579. | 4.22 |
| | 16500 | 4301. | 2.74 | 4673. | 2.99 | 4889. | 3.12 | 5131. | 3.28 | 5402. | 3.46 | 5710. | 3.67 | 6469. | 4.15 |
| | 12500 | 4231. | 2.71 | 4600. | 2.96 | 4815. | 3.08 | | | | | | | | |
| 1400 | 20000 | 4659. | 2.97 | 5063. | 3.23 | 5300. | 3.38 | 5564. | 3.56 | 5861. | 3.76 | 6197. | 3.98 | 7031. | 4.52 |
| | 16500 | 4581. | 2.93 | 4981. | 3.20 | 5214. | 3.34 | 5475. | 3.51 | 5767. | 3.70 | 6099. | 3.93 | 6916. | 4.46 |
| | 12500 | 4510. | 2.89 | | | | | | | | | | | | |
| 1500 | 20000 | 4939. | 3.16 | 5373. | 3.44 | 5627. | 3.61 | 5910. | 3.79 | 6228. | 4.01 | 6589. | 4.25 | 7483. | 4.83 |
| | 16500 | 4860. | 3.12 | 5289. | 3.40 | 5539. | 3.56 | 5819. | 3.74 | 6133. | 3.95 | 6488. | 4.19 | 7364. | 4.76 |
| | 12500 | 4788. | 3.08 | | | | | | | | | | | | |
| 1600 | 20000 | 5219. | 3.34 | 5683. | 3.65 | 5954. | 3.83 | 6256. | 4.02 | 6596. | 4.26 | 6981. | 4.51 | | |
| | 16500 | 5139. | 3.31 | 5597. | 3.61 | 5865. | 3.78 | 6163. | 3.97 | 6498. | 4.19 | 6876. | 4.45 | | |
| | 12500 | 5067. | 3.27 | | | | | | | | | | | | |
| 1700 | 20000 | 5500. | 3.53 | 5993. | 3.86 | 6281. | 4.05 | 6602. | 4.26 | 6964. | 4.51 | | | | |
| | 16500 | 5419. | 3.49 | 5906. | 3.82 | 6190. | 4.00 | 6507. | 4.20 | 6863. | 4.43 | | | | |
| | 12500 | 5345. | 3.45 | | | | | | | | | | | | |
| 1800 | 20000 | 5780. | 3.72 | 6302. | 4.07 | 6608. | 4.27 | 6948. | 4.49 | | | | | | |
| | 16500 | 5698. | 3.68 | 6214. | 4.02 | 6515. | 4.22 | 6850. | 4.43 | | | | | | |
| | 12500 | 5624. | 3.64 | | | | | | | | | | | | |
| 1900 | 20000 | 6061. | 3.91 | 6612. | 4.28 | 6935. | 4.49 | | | | | | | | |
| | 16500 | 5977. | 3.87 | 6522. | 4.23 | 6840. | 4.44 | | | | | | | | |
| | 12500 | 5902. | 3.82 | | | | | | | | | | | | |
| 2000 | 20000 | 6341. | 4.10 | 6922. | 4.49 | | | | | | | | | | |
| | 16500 | 6256. | 4.06 | 6830. | 4.44 | | | | | | | | | | |
| | 12500 | 6181. | 4.01 | | | | | | | | | | | | |
| 2100 | 20000 | 6621. | 4.29 | 7232. | 4.70 | | | | | | | | | | |
| | 16500 | 6536. | 4.24 | 7139. | 4.64 | | | | | | | | | | |
| | 12500 | 6459. | 4.20 | | | | | | | | | | | | |
| 2200 | 20000 | 6902. | 4.48 | | | | | | | | | | | | |
| | 16500 | 6815. | 4.43 | | | | | | | | | | | | |
| | 12500 | 6738. | 4.38 | | | | | | | | | | | | |

Figure 7-7 (Sheet 7)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 92.4% N1)

**STANDARD DAY** | **CRUISE ALTITUDE 39000 FEET**

| STAGE LENGTH NM. | T.O. WEIGHT LBS. | TAILWIND 100 KT. FUEL LBS. | TAILWIND 100 KT. TIME HRS. | TAILWIND 50 KT. FUEL LBS. | TAILWIND 50 KT. TIME HRS. | TAILWIND 25 KT. FUEL LBS. | TAILWIND 25 KT. TIME HRS. | ZERO WIND FUEL LBS. | ZERO WIND TIME HRS. | HEADWIND 25 KT. FUEL LBS. | HEADWIND 25 KT. TIME HRS. | HEADWIND 50 KT. FUEL LBS. | HEADWIND 50 KT. TIME HRS. | HEADWIND 100 KT. FUEL LBS. | HEADWIND 100 KT. TIME HRS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 20000 | 1305. | 0.71 | 1352. | 0.74 | 1381. | 0.74 | 1413. | 0.76 | 1448. | 0.79 | 1489. | 0.81 | 1594. | 0.86 |
| | 16500 | 1231. | 0.69 | 1280. | 0.72 | 1309. | 0.72 | 1341. | 0.74 | 1376. | 0.77 | 1418. | 0.79 | 1524. | 0.84 |
| | 12500 | 1162. | 0.67 | 1211. | 0.70 | 1241. | 0.71 | 1273. | 0.73 | 1309. | 0.75 | 1351. | 0.78 | 1457. | 0.83 |
| 400 | 20000 | 1820. | 1.09 | 1922. | 1.16 | 1983. | 1.19 | 2050. | 1.23 | 2125. | 1.29 | 2211. | 1.34 | 2428. | 1.48 |
| | 16500 | 1744. | 1.06 | 1845. | 1.13 | 1906. | 1.16 | 1972. | 1.21 | 2047. | 1.26 | 2133. | 1.32 | 2347. | 1.45 |
| | 12500 | 1673. | 1.04 | 1774. | 1.11 | 1835. | 1.14 | 1901. | 1.19 | 1975. | 1.24 | 2060. | 1.29 | 2273. | 1.42 |
| 600 | 20000 | 2336. | 1.47 | 2492. | 1.58 | 2585. | 1.63 | 2687. | 1.70 | 2802. | 1.79 | 2934. | 1.88 | 3262. | 2.10 |
| | 16500 | 2257. | 1.44 | 2411. | 1.55 | 2503. | 1.60 | 2604. | 1.67 | 2718. | 1.75 | 2847. | 1.84 | 3169. | 2.05 |
| | 12500 | 2184. | 1.42 | 2338. | 1.52 | 2429. | 1.57 | 2529. | 1.64 | 2642. | 1.72 | 2770. | 1.81 | 3088. | 2.02 |
| 800 | 20000 | 2851. | 1.85 | 3062. | 2.00 | 3186. | 2.08 | 3324. | 2.17 | 3479. | 2.29 | 3656. | 2.41 | 4096. | 2.71 |
| | 16500 | 2770. | 1.82 | 2977. | 1.96 | 3100. | 2.04 | 3236. | 2.14 | 3388. | 2.24 | 3562. | 2.36 | 3992. | 2.65 |
| | 12500 | 2695. | 1.79 | 2901. | 1.94 | 3023. | 2.01 | 3157. | 2.10 | 3308. | 2.21 | 3480. | 2.33 | 3903. | 2.61 |
| 900 | 20000 | 3109. | 2.04 | 3347. | 2.21 | 3487. | 2.30 | 3643. | 2.41 | 3818. | 2.54 | 4017. | 2.68 | 4514. | 3.02 |
| | 16500 | 3026. | 2.00 | 3260. | 2.17 | 3399. | 2.25 | 3552. | 2.37 | 3723. | 2.49 | 3919. | 2.62 | 4404. | 2.96 |
| | 12500 | 2950. | 1.98 | 3183. | 2.14 | 3320. | 2.22 | 3471. | 2.33 | 3642. | 2.45 | 3834. | 2.59 | 4311. | 2.91 |
| 1000 | 20000 | 3367. | 2.23 | 3632. | 2.42 | 3788. | 2.52 | 3961. | 2.64 | 4156. | 2.79 | 4379. | 2.95 | 4931. | 3.33 |
| | 16500 | 3282. | 2.19 | 3543. | 2.38 | 3697. | 2.47 | 3868. | 2.60 | 4059. | 2.74 | 4277. | 2.89 | 4815. | 3.26 |
| | 12500 | 3205. | 2.16 | 3464. | 2.35 | 3617. | 2.44 | 3785. | 2.56 | 3975. | 2.70 | 4189. | 2.84 | 4719. | 3.21 |
| 1100 | 20000 | 3625. | 2.42 | 3917. | 2.63 | 4089. | 2.74 | 4280. | 2.88 | 4495. | 3.04 | 4740. | 3.21 | 5348. | 3.64 |
| | 16500 | 3539. | 2.38 | 3826. | 2.59 | 3996. | 2.69 | 4183. | 2.83 | 4394. | 2.98 | 4634. | 3.15 | 5226. | 3.56 |
| | 12500 | 3461. | 2.35 | 3746. | 2.55 | 3914. | 2.65 | 4099. | 2.79 | 4308. | 2.94 | 4544. | 3.10 | | |
| 1200 | 20000 | 3883. | 2.61 | 4202. | 2.84 | 4389. | 2.97 | 4599. | 3.11 | 4833. | 3.29 | 5101. | 3.48 | 5765. | 3.95 |
| | 16500 | 3795. | 2.57 | 4109. | 2.80 | 4294. | 2.91 | 4499. | 3.06 | 4729. | 3.23 | 4991. | 3.41 | 5638. | 3.86 |
| | 12500 | 3716. | 2.53 | 4028. | 2.76 | 4211. | 2.87 | 4413. | 3.02 | 4641. | 3.18 | | | | |
| 1300 | 20000 | 4140. | 2.80 | 4487. | 3.05 | 4690. | 3.19 | 4917. | 3.35 | 5172. | 3.54 | 5462. | 3.75 | 6182. | 4.26 |
| | 16500 | 4051. | 2.76 | 4392. | 3.00 | 4593. | 3.13 | 4815. | 3.30 | 5065. | 3.47 | 5349. | 3.67 | 6049. | 4.16 |
| | 12500 | 3972. | 2.72 | 4310. | 2.96 | 4508. | 3.09 | 4727. | 3.25 | | | | | | |
| 1400 | 20000 | 4398. | 2.99 | 4772. | 3.26 | 4991. | 3.41 | 5236. | 3.58 | 5510. | 3.79 | 5823. | 4.01 | 6599. | 4.57 |
| | 16500 | 4308. | 2.95 | 4675. | 3.21 | 4891. | 3.35 | 5131. | 3.53 | 5400. | 3.72 | 5706. | 3.93 | 6461. | 4.47 |
| | 12500 | 4227. | 2.91 | 4591. | 3.17 | | | | | | | | | | |
| 1500 | 20000 | 4656. | 3.18 | 5056. | 3.47 | 5292. | 3.63 | 5554. | 3.82 | 5849. | 4.04 | 6185. | 4.28 | 7016. | 4.87 |
| | 16500 | 4564. | 3.13 | 4958. | 3.42 | 5190. | 3.57 | 5447. | 3.76 | 5735. | 3.97 | 6063. | 4.20 | 6872. | 4.77 |
| | 12500 | 4483. | 3.09 | 4873. | 3.37 | | | | | | | | | | |
| 1600 | 20000 | 4914. | 3.37 | 5341. | 3.68 | 5593. | 3.86 | 5873. | 4.05 | 6187. | 4.29 | 6546. | 4.55 | 7433. | 5.18 |
| | 16500 | 4820. | 3.32 | 5241. | 3.63 | 5488. | 3.79 | 5763. | 3.99 | 6070. | 4.21 | 6421. | 4.46 | 7283. | 5.07 |
| | 12500 | 4738. | 3.28 | | | | | | | | | | | | |
| 1700 | 20000 | 5171. | 3.56 | 5626. | 3.89 | 5894. | 4.08 | 6192. | 4.29 | 6526. | 4.54 | 6907. | 4.82 | 7850. | 5.49 |
| | 16500 | 5077. | 3.51 | 5524. | 3.83 | 5787. | 4.00 | 6079. | 4.22 | 6406. | 4.46 | 6778. | 4.72 | 7695. | 5.37 |
| | 12500 | 4993. | 3.47 | | | | | | | | | | | | |
| 1800 | 20000 | 5429. | 3.75 | 5911. | 4.10 | 6194. | 4.30 | 6510. | 4.52 | 6864. | 4.79 | 7268. | 5.08 | | |
| | 16500 | 5333. | 3.70 | 5807. | 4.04 | 6085. | 4.22 | 6394. | 4.46 | 6741. | 4.70 | 7135. | 4.98 | | |
| | 12500 | 5249. | 3.65 | | | | | | | | | | | | |
| 1900 | 20000 | 5687. | 3.94 | 6196. | 4.31 | 6495. | 4.52 | 6829. | 4.76 | 7203. | 5.05 | | | | |
| | 16500 | 5590. | 3.89 | 6090. | 4.25 | 6384. | 4.44 | 6710. | 4.69 | 7076. | 4.95 | | | | |
| | 12500 | 5504. | 3.84 | | | | | | | | | | | | |
| 2000 | 20000 | 5945. | 4.13 | 6481. | 4.52 | 6796. | 4.74 | 7147. | 4.99 | | | | | | |
| | 16500 | 5846. | 4.08 | 6373. | 4.46 | 6682. | 4.66 | 7026. | 4.92 | | | | | | |
| | 12500 | 5760. | 4.03 | | | | | | | | | | | | |
| 2100 | 20000 | 6203. | 4.32 | 6766. | 4.73 | 7097. | 4.97 | | | | | | | | |
| | 16500 | 6102. | 4.26 | 6656. | 4.67 | 6981. | 4.88 | | | | | | | | |
| | 12500 | 6015. | 4.21 | | | | | | | | | | | | |
| 2200 | 20000 | 6460. | 4.51 | 7051. | 4.94 | | | | | | | | | | |
| | 16500 | 6359. | 4.45 | 6939. | 4.87 | | | | | | | | | | |
| | 12500 | 6271. | 4.40 | | | | | | | | | | | | |
| 2300 | 20000 | 6718. | 4.70 | 7336. | 5.15 | | | | | | | | | | |
| | 16500 | 6615. | 4.64 | 7222. | 5.08 | | | | | | | | | | |
| | 12500 | 6526. | 4.59 | | | | | | | | | | | | |
| 2400 | 20000 | 6976. | 4.89 | | | | | | | | | | | | |
| | 16500 | 6871. | 4.83 | | | | | | | | | | | | |
| | 12500 | 6781. | 4.77 | | | | | | | | | | | | |

Figure 7-7 (Sheet 8)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 92.7% N1)

**STANDARD DAY** — **CRUISE ALTITUDE 41000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1322. | 0.72 | 1366. | 0.75 | 1393. | 0.75 | 1422. | 0.77 | 1455. | 0.80 | 1494. | 0.82 | 1592. | 0.87 |
| | 16500 | 1238. | 0.70 | 1283. | 0.73 | 1310. | 0.73 | 1340. | 0.75 | 1373. | 0.77 | 1412. | 0.80 | 1511. | 0.85 |
| | 12500 | 1161. | 0.68 | 1207. | 0.71 | 1235. | 0.71 | 1264. | 0.73 | 1298. | 0.75 | 1337. | 0.78 | 1437. | 0.83 |
| 400 | 20000 | 1803. | 1.10 | 1898. | 1.17 | 1955. | 1.20 | 2018. | 1.25 | 2088. | 1.30 | 2169. | 1.36 | 2374. | 1.49 |
| | 16500 | 1714. | 1.07 | 1809. | 1.14 | 1865. | 1.17 | 1927. | 1.21 | 1996. | 1.26 | 2076. | 1.32 | 2276. | 1.45 |
| | 12500 | 1635. | 1.05 | 1730. | 1.12 | 1786. | 1.14 | 1847. | 1.19 | 1917. | 1.24 | 1996. | 1.29 | 2194. | 1.42 |
| 600 | 20000 | 2284. | 1.49 | 2430. | 1.60 | 2517. | 1.65 | 2613. | 1.72 | 2721. | 1.81 | 2845. | 1.90 | 3155. | 2.12 |
| | 16500 | 2190. | 1.45 | 2334. | 1.56 | 2420. | 1.61 | 2514. | 1.68 | 2619. | 1.76 | 2740. | 1.84 | 3041. | 2.05 |
| | 12500 | 2110. | 1.42 | 2253. | 1.53 | 2337. | 1.58 | 2430. | 1.65 | 2535. | 1.73 | 2655. | 1.81 | 2951. | 2.02 |
| 800 | 20000 | 2764. | 1.87 | 2962. | 2.02 | 3079. | 2.10 | 3208. | 2.20 | 3354. | 2.31 | 3521. | 2.44 | 3936. | 2.74 |
| | 16500 | 2667. | 1.82 | 2860. | 1.97 | 2975. | 2.05 | 3101. | 2.14 | 3243. | 2.25 | 3404. | 2.37 | 3805. | 2.66 |
| | 12500 | 2584. | 1.79 | 2776. | 1.94 | 2889. | 2.01 | 3014. | 2.10 | 3154. | 2.21 | 3314. | 2.33 | 3708. | 2.61 |
| 1000 | 20000 | 3245. | 2.25 | 3494. | 2.45 | 3640. | 2.55 | 3803. | 2.67 | 3987. | 2.81 | 4197. | 2.98 | 4718. | 3.36 |
| | 16500 | 3143. | 2.20 | 3386. | 2.39 | 3529. | 2.48 | 3688. | 2.60 | 3866. | 2.74 | 4069. | 2.89 | 4570. | 3.26 |
| | 12500 | 3059. | 2.16 | 3299. | 2.35 | 3440. | 2.44 | 3597. | 2.56 | 3773. | 2.70 | 3972. | 2.84 | 4465. | 3.21 |
| 1200 | 20000 | 3726. | 2.64 | 4026. | 2.87 | 4202. | 3.00 | 4398. | 3.15 | 4620. | 3.32 | 4873. | 3.52 | 5499. | 3.99 |
| | 16500 | 3619. | 2.57 | 3912. | 2.80 | 4084. | 2.92 | 4275. | 3.07 | 4489. | 3.23 | 4733. | 3.41 | 5335. | 3.86 |
| | 12500 | 3533. | 2.54 | 3822. | 2.76 | 3991. | 2.88 | 4180. | 3.02 | 4391. | 3.18 | 4631. | 3.36 | | |
| 1300 | 20000 | 3966. | 2.83 | 4292. | 3.08 | 4483. | 3.22 | 4696. | 3.38 | 4936. | 3.57 | 5211. | 3.79 | 5890. | 4.30 |
| | 16500 | 3858. | 2.76 | 4175. | 3.01 | 4362. | 3.14 | 4568. | 3.30 | 4801. | 3.48 | 5065. | 3.68 | 5717. | 4.17 |
| | 12500 | 3770. | 2.72 | 4084. | 2.96 | 4267. | 3.10 | 4471. | 3.25 | 4701. | 3.42 | | | | |
| 1400 | 20000 | 4206. | 3.02 | 4558. | 3.29 | 4764. | 3.45 | 4994. | 3.62 | 5253. | 3.82 | 5548. | 4.06 | 6281. | 4.61 |
| | 16500 | 4096. | 2.95 | 4438. | 3.21 | 4639. | 3.36 | 4862. | 3.53 | 5112. | 3.72 | 5397. | 3.94 | 6100. | 4.47 |
| | 12500 | 4007. | 2.91 | 4345. | 3.17 | 4543. | 3.31 | 4763. | 3.48 | | | | | | |
| 1500 | 20000 | 4447. | 3.21 | 4823. | 3.50 | 5045. | 3.67 | 5291. | 3.86 | 5569. | 4.07 | 5886. | 4.33 | 6671. | 4.92 |
| | 16500 | 4334. | 3.14 | 4701. | 3.42 | 4916. | 3.58 | 5156. | 3.76 | 5424. | 3.97 | 5729. | 4.20 | 6482. | 4.77 |
| | 12500 | 4244. | 3.09 | 4607. | 3.37 | | | | | | | | | | |
| 1600 | 20000 | 4687. | 3.40 | 5089. | 3.72 | 5326. | 3.89 | 5589. | 4.10 | 5886. | 4.33 | 6224. | 4.60 | 7062. | 5.23 |
| | 16500 | 4572. | 3.33 | 4964. | 3.63 | 5194. | 3.80 | 5449. | 3.99 | 5735. | 4.21 | 6061. | 4.46 | 6864. | 5.07 |
| | 12500 | 4482. | 3.28 | 4868. | 3.58 | | | | | | | | | | |
| 1700 | 20000 | 4928. | 3.59 | 5355. | 3.93 | 5607. | 4.12 | 5886. | 4.33 | 6202. | 4.58 | 6562. | 4.87 | 7453. | 5.54 |
| | 16500 | 4810. | 3.51 | 5227. | 3.84 | 5471. | 4.02 | 5743. | 4.23 | 6047. | 4.46 | 6393. | 4.72 | 7247. | 5.37 |
| | 12500 | 4719. | 3.47 | | | | | | | | | | | | |
| 1800 | 20000 | 5168. | 3.78 | 5621. | 4.14 | 5888. | 4.34 | 6184. | 4.57 | 6519. | 4.83 | 6900. | 5.14 | 7844. | 5.86 |
| | 16500 | 5048. | 3.70 | 5490. | 4.04 | 5748. | 4.24 | 6036. | 4.46 | 6359. | 4.70 | 6725. | 4.98 | 7629. | 5.68 |
| | 12500 | 4956. | 3.65 | | | | | | | | | | | | |
| 1900 | 20000 | 5408. | 3.98 | 5887. | 4.35 | 6169. | 4.57 | 6482. | 4.81 | 6835. | 5.08 | 7238. | 5.41 | | |
| | 16500 | 5287. | 3.89 | 5753. | 4.25 | 6026. | 4.46 | 6330. | 4.69 | 6670. | 4.95 | 7058. | 5.25 | | |
| | 12500 | 5193. | 3.84 | | | | | | | | | | | | |
| 2000 | 20000 | 5649. | 4.17 | 6153. | 4.56 | 6450. | 4.79 | 6779. | 5.05 | 7152. | 5.34 | | | | |
| | 16500 | 5525. | 4.08 | 6016. | 4.46 | 6303. | 4.68 | 6623. | 4.92 | 6982. | 5.20 | | | | |
| | 12500 | 5430. | 4.03 | | | | | | | | | | | | |
| 2100 | 20000 | 5889. | 4.36 | 6419. | 4.78 | 6730. | 5.02 | 7077. | 5.28 | | | | | | |
| | 16500 | 5763. | 4.26 | 6279. | 4.67 | 6581. | 4.90 | 6917. | 5.15 | | | | | | |
| | 12500 | 5668. | 4.21 | | | | | | | | | | | | |
| 2200 | 20000 | 6129. | 4.55 | 6685. | 4.99 | 7011. | 5.24 | | | | | | | | |
| | 16500 | 6001. | 4.45 | 6542. | 4.87 | 6858. | 5.12 | | | | | | | | |
| | 12500 | 5905. | 4.40 | | | | | | | | | | | | |
| 2300 | 20000 | 6370. | 4.74 | 6951. | 5.20 | | | | | | | | | | |
| | 16500 | 6239. | 4.64 | 6805. | 5.08 | | | | | | | | | | |
| | 12500 | 6142. | 4.58 | | | | | | | | | | | | |
| 2400 | 20000 | 6610. | 4.93 | 7217. | 5.41 | | | | | | | | | | |
| | 16500 | 6477. | 4.83 | 7068. | 5.29 | | | | | | | | | | |
| | 12500 | 6379. | 4.77 | | | | | | | | | | | | |
| 2500 | 20000 | 6850. | 5.12 | 7483. | 5.62 | | | | | | | | | | |
| | 16500 | 6715. | 5.02 | 7330. | 5.50 | | | | | | | | | | |
| | 12500 | 6616. | 4.96 | | | | | | | | | | | | |

Figure 7-7 (Sheet 9)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE ( 92.9% N1)

**STANDARD DAY** **CRUISE ALTITUDE 43000 FEET**

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| STAGE LENGTH NM. | T.O. WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1352. | 0.74 | 1392. | 0.77 | 1418. | 0.77 | 1445. | 0.79 | 1475. | 0.82 | 1511. | 0.84 | 1603. | 0.88 |
| | 16500 | 1248. | 0.71 | 1289. | 0.74 | 1315. | 0.74 | 1343. | 0.76 | 1374. | 0.78 | 1410. | 0.80 | 1503. | 0.85 |
| | 12500 | 1162. | 0.68 | 1204. | 0.71 | 1230. | 0.72 | 1258. | 0.74 | 1289. | 0.76 | 1326. | 0.78 | 1420. | 0.83 |
| 400 | 20000 | 1799. | 1.13 | 1888. | 1.20 | 1941. | 1.23 | 2000. | 1.28 | 2066. | 1.33 | 2143. | 1.39 | 2336. | 1.52 |
| | 16500 | 1688. | 1.08 | 1776. | 1.15 | 1829. | 1.18 | 1886. | 1.22 | 1951. | 1.28 | 2025. | 1.33 | 2212. | 1.46 |
| | 12500 | 1599. | 1.05 | 1687. | 1.12 | 1739. | 1.15 | 1796. | 1.19 | 1861. | 1.25 | 1934. | 1.30 | 2119. | 1.42 |
| 600 | 20000 | 2246. | 1.52 | 2383. | 1.63 | 2465. | 1.69 | 2555. | 1.76 | 2658. | 1.84 | 2775. | 1.94 | 3069. | 2.16 |
| | 16500 | 2129. | 1.46 | 2262. | 1.57 | 2342. | 1.62 | 2429. | 1.69 | 2528. | 1.77 | 2640. | 1.86 | 2921. | 2.07 |
| | 12500 | 2037. | 1.43 | 2170. | 1.53 | 2248. | 1.58 | 2335. | 1.65 | 2432. | 1.73 | 2543. | 1.82 | 2818. | 2.02 |
| 800 | 20000 | 2693. | 1.91 | 2879. | 2.06 | 2989. | 2.14 | 3111. | 2.24 | 3249. | 2.36 | 3407. | 2.49 | 3803. | 2.80 |
| | 16500 | 2569. | 1.84 | 2749. | 1.99 | 2855. | 2.06 | 2972. | 2.15 | 3105. | 2.27 | 3255. | 2.39 | 3629. | 2.67 |
| | 12500 | 2475. | 1.80 | 2653. | 1.95 | 2758. | 2.02 | 2873. | 2.11 | 3003. | 2.22 | 3151. | 2.34 | 3517. | 2.61 |
| 1000 | 20000 | 3140. | 2.30 | 3374. | 2.49 | 3512. | 2.60 | 3666. | 2.73 | 3840. | 2.87 | 4039. | 3.03 | 4536. | 3.44 |
| | 16500 | 3010. | 2.22 | 3236. | 2.40 | 3369. | 2.50 | 3516. | 2.62 | 3681. | 2.76 | 3870. | 2.91 | 4338. | 3.28 |
| | 12500 | 2913. | 2.17 | 3136. | 2.36 | 3267. | 2.45 | 3412. | 2.57 | 3575. | 2.71 | 3759. | 2.85 | 4216. | 3.21 |
| 1200 | 20000 | 3587. | 2.68 | 3870. | 2.92 | 4036. | 3.05 | 4222. | 3.21 | 4432. | 3.39 | 4671. | 3.58 | 5269. | 4.08 |
| | 16500 | 3451. | 2.59 | 3722. | 2.82 | 3882. | 2.94 | 4059. | 3.08 | 4258. | 3.26 | 4485. | 3.44 | 5046. | 3.88 |
| | 12500 | 3351. | 2.55 | 3619. | 2.77 | 3776. | 2.88 | 3950. | 3.02 | 4146. | 3.19 | 4368. | 3.37 | 4915. | 3.80 |
| 1400 | 20000 | 4035. | 3.07 | 4365. | 3.35 | 4560. | 3.51 | 4777. | 3.69 | 5023. | 3.90 | 5303. | 4.13 | 6002. | 4.72 |
| | 16500 | 3891. | 2.97 | 4209. | 3.24 | 4395. | 3.38 | 4602. | 3.55 | 4835. | 3.75 | 5100. | 3.97 | 5755. | 4.49 |
| | 12500 | 3789. | 2.92 | 4102. | 3.18 | 4285. | 3.32 | 4489. | 3.48 | 4717. | 3.68 | 4976. | 3.89 | | |
| 1500 | 20000 | 4258. | 3.27 | 4613. | 3.57 | 4822. | 3.74 | 5055. | 3.93 | 5319. | 4.16 | 5619. | 4.41 | 6369. | 5.04 |
| | 16500 | 4111. | 3.16 | 4452. | 3.45 | 4652. | 3.60 | 4873. | 3.78 | 5124. | 4.00 | 5408. | 4.23 | 6109. | 4.79 |
| | 12500 | 4008. | 3.11 | 4344. | 3.39 | 4540. | 3.53 | 4758. | 3.71 | | | | | | |
| 1600 | 20000 | 4482. | 3.46 | 4861. | 3.78 | 5083. | 3.97 | 5333. | 4.18 | 5614. | 4.41 | 5935. | 4.68 | 6736. | 5.36 |
| | 16500 | 4332. | 3.35 | 4695. | 3.66 | 4909. | 3.82 | 5145. | 4.01 | 5412. | 4.24 | 5715. | 4.49 | 6464. | 5.10 |
| | 12500 | 4227. | 3.29 | 4585. | 3.59 | | | | | | | | | | |
| 1700 | 20000 | 4705. | 3.65 | 5109. | 4.00 | 5345. | 4.19 | 5610. | 4.42 | 5910. | 4.67 | 6251. | 4.96 | 7102. | 5.68 |
| | 16500 | 4552. | 3.54 | 4938. | 3.86 | 5165. | 4.04 | 5417. | 4.24 | 5701. | 4.49 | 6023. | 4.76 | 6818. | 5.40 |
| | 12500 | 4446. | 3.48 | 4827. | 3.80 | | | | | | | | | | |
| 1800 | 20000 | 4929. | 3.85 | 5356. | 4.21 | 5607. | 4.42 | 5888. | 4.66 | 6206. | 4.93 | 6567. | 5.23 | 7469. | 6.00 |
| | 16500 | 4772. | 3.73 | 5182. | 4.07 | 5422. | 4.26 | 5688. | 4.47 | 5989. | 4.74 | 6330. | 5.02 | 7172. | 5.70 |
| | 12500 | 4665. | 3.67 | | | | | | | | | | | | |
| 1900 | 20000 | 5152. | 4.04 | 5604. | 4.43 | 5869. | 4.65 | 6166. | 4.90 | 6501. | 5.18 | 6883. | 5.51 | 7836. | 6.31 |
| | 16500 | 4993. | 3.92 | 5425. | 4.28 | 5679. | 4.48 | 5960. | 4.71 | 6278. | 4.99 | 6638. | 5.29 | 7527. | 6.01 |
| | 12500 | 4884. | 3.85 | | | | | | | | | | | | |
| 2000 | 20000 | 5376. | 4.24 | 5852. | 4.64 | 6131. | 4.88 | 6444. | 5.14 | 6797. | 5.44 | 7199. | 5.78 | | |
| | 16500 | 5213. | 4.10 | 5668. | 4.49 | 5935. | 4.70 | 6231. | 4.94 | 6566. | 5.23 | 6945. | 5.55 | | |
| | 12500 | 5103. | 4.04 | | | | | | | | | | | | |
| 2100 | 20000 | 5600. | 4.43 | 6099. | 4.86 | 6393. | 5.11 | 6721. | 5.38 | 7093. | 5.70 | | | | |
| | 16500 | 5433. | 4.29 | 5911. | 4.70 | 6192. | 4.91 | 6503. | 5.17 | 6854. | 5.48 | | | | |
| | 12500 | 5322. | 4.23 | | | | | | | | | | | | |
| 2200 | 20000 | 5823. | 4.63 | 6347. | 5.08 | 6655. | 5.34 | 6999. | 5.63 | 7388. | 5.96 | | | | |
| | 16500 | 5654. | 4.48 | 6155. | 4.91 | 6449. | 5.13 | 6775. | 5.40 | 7143. | 5.73 | | | | |
| | 12500 | 5541. | 4.41 | | | | | | | | | | | | |
| 2300 | 20000 | 6047. | 4.82 | 6595. | 5.29 | 6916. | 5.56 | 7277. | 5.87 | | | | | | |
| | 16500 | 5874. | 4.67 | 6398. | 5.11 | 6705. | 5.35 | 7046. | 5.64 | | | | | | |
| | 12500 | 5760. | 4.60 | | | | | | | | | | | | |
| 2400 | 20000 | 6270. | 5.01 | 6843. | 5.51 | 7178. | 5.79 | | | | | | | | |
| | 16500 | 6094. | 4.86 | 6641. | 5.32 | 6962. | 5.57 | | | | | | | | |
| | 12500 | 5979. | 4.79 | | | | | | | | | | | | |
| 2500 | 20000 | 6494. | 5.21 | 7090. | 5.72 | | | | | | | | | | |
| | 16500 | 6314. | 5.05 | 6884. | 5.53 | | | | | | | | | | |
| | 12500 | 6198. | 4.97 | | | | | | | | | | | | |
| 2600 | 20000 | 6718. | 5.40 | 7338. | 5.94 | | | | | | | | | | |
| | 16500 | 6535. | 5.24 | 7128. | 5.74 | | | | | | | | | | |
| | 12500 | 6417. | 5.16 | | | | | | | | | | | | |
| 2700 | 20000 | 6941. | 5.60 | 7586. | 6.15 | | | | | | | | | | |
| | 16500 | 6755. | 5.43 | 7371. | 5.95 | | | | | | | | | | |
| | 12500 | 6636. | 5.34 | | | | | | | | | | | | |

Figure 7-7 (Sheet 10)

# FLIGHT PLANNING
## MAXIMUM CRUISE THRUST
## CRUISE [ 93.4% N1]

STANDARD DAY — CRUISE ALTITUDE 45000 FEET

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1495. | 0.81 | 1535. | 0.83 | 1559. | 0.84 | 1585. | 0.86 | 1615. | 0.88 | 1649. | 0.90 | 1738. | 0.95 |
| | 16500 | 1264. | 0.72 | 1303. | 0.75 | 1327. | 0.75 | 1353. | 0.77 | 1382. | 0.79 | 1416. | 0.81 | 1503. | 0.86 |
| | 12500 | 1166. | 0.69 | 1205. | 0.72 | 1230. | 0.72 | 1256. | 0.74 | 1285. | 0.76 | 1319. | 0.78 | 1407. | 0.83 |
| 400 | 20000 | 1909. | 1.20 | 1994. | 1.27 | 2045. | 1.30 | 2100. | 1.35 | 2164. | 1.40 | 2237. | 1.46 | 2422. | 1.60 |
| | 16500 | 1670. | 1.10 | 1751. | 1.17 | 1800. | 1.19 | 1853. | 1.24 | 1914. | 1.29 | 1983. | 1.34 | 2157. | 1.47 |
| | 12500 | 1568. | 1.06 | 1649. | 1.13 | 1697. | 1.15 | 1750. | 1.20 | 1810. | 1.25 | 1878. | 1.30 | 2049. | 1.43 |
| 600 | 20000 | 2323. | 1.59 | 2453. | 1.71 | 2530. | 1.76 | 2616. | 1.84 | 2713. | 1.92 | 2824. | 2.02 | 3105. | 2.25 |
| | 16500 | 2075. | 1.48 | 2199. | 1.59 | 2273. | 1.64 | 2354. | 1.71 | 2445. | 1.79 | 2550. | 1.87 | 2811. | 2.08 |
| | 12500 | 1970. | 1.43 | 2092. | 1.54 | 2165. | 1.59 | 2245. | 1.66 | 2334. | 1.73 | 2436. | 1.82 | 2691. | 2.02 |
| 800 | 20000 | 2737. | 1.98 | 2912. | 2.14 | 3016. | 2.22 | 3131. | 2.33 | 3262. | 2.44 | 3412. | 2.57 | 3789. | 2.90 |
| | 16500 | 2481. | 1.86 | 2647. | 2.01 | 2746. | 2.08 | 2855. | 2.17 | 2977. | 2.28 | 3117. | 2.40 | 3465. | 2.69 |
| | 12500 | 2372. | 1.81 | 2536. | 1.95 | 2632. | 2.02 | 2739. | 2.11 | 2859. | 2.22 | 2995. | 2.33 | 3332. | 2.62 |
| 1000 | 20000 | 3150. | 2.38 | 3371. | 2.58 | 3501. | 2.68 | 3647. | 2.81 | 3811. | 2.96 | 3999. | 3.13 | 4472. | 3.55 |
| | 16500 | 2886. | 2.24 | 3095. | 2.42 | 3219. | 2.52 | 3355. | 2.64 | 3509. | 2.78 | 3684. | 2.93 | 4119. | 3.30 |
| | 12500 | 2774. | 2.18 | 2979. | 2.36 | 3100. | 2.45 | 3234. | 2.57 | 3383. | 2.70 | 3553. | 2.85 | 3974. | 3.21 |
| 1200 | 20000 | 3564. | 2.77 | 3830. | 3.01 | 3987. | 3.14 | 4162. | 3.30 | 4360. | 3.48 | 4587. | 3.69 | 5156. | 4.20 |
| | 16500 | 3292. | 2.62 | 3544. | 2.84 | 3692. | 2.96 | 3856. | 3.11 | 4041. | 3.27 | 4251. | 3.46 | 4773. | 3.91 |
| | 12500 | 3177. | 2.55 | 3423. | 2.77 | 3568. | 2.89 | 3728. | 3.03 | 3908. | 3.19 | 4112. | 3.37 | 4616. | 3.81 |
| 1400 | 20000 | 3978. | 3.16 | 4289. | 3.45 | 4472. | 3.60 | 4677. | 3.79 | 4909. | 4.00 | 5175. | 4.25 | 5839. | 4.85 |
| | 16500 | 3698. | 2.99 | 3992. | 3.26 | 4165. | 3.40 | 4357. | 3.57 | 4573. | 3.77 | 4819. | 3.99 | 5427. | 4.52 |
| | 12500 | 3579. | 2.92 | 3867. | 3.19 | 4035. | 3.32 | 4223. | 3.49 | 4432. | 3.67 | 4670. | 3.88 | | |
| 1600 | 20000 | 4392. | 3.56 | 4748. | 3.89 | 4958. | 4.07 | 5193. | 4.28 | 5458. | 4.53 | 5762. | 4.80 | 6523. | 5.50 |
| | 16500 | 4103. | 3.37 | 4440. | 3.68 | 4638. | 3.84 | 4858. | 4.04 | 5104. | 4.27 | 5386. | 4.52 | 6081. | 5.13 |
| | 12500 | 3981. | 3.30 | 4310. | 3.60 | 4503. | 3.75 | 4717. | 3.94 | 4957. | 4.16 | | | | |
| 1800 | 20000 | 4806. | 3.95 | 5207. | 4.32 | 5443. | 4.53 | 5708. | 4.77 | 6007. | 5.05 | 6350. | 5.36 | 7206. | 6.15 |
| | 16500 | 4509. | 3.75 | 4888. | 4.10 | 5111. | 4.29 | 5358. | 4.51 | 5636. | 4.76 | 5953. | 5.05 | 6735. | 5.74 |
| | 12500 | 4383. | 3.67 | 4754. | 4.01 | | | | | | | | | | |
| 1900 | 20000 | 5013. | 4.15 | 5436. | 4.54 | 5686. | 4.76 | 5966. | 5.01 | 6282. | 5.31 | 6643. | 5.64 | 7548. | 6.48 |
| | 16500 | 4712. | 3.94 | 5112. | 4.31 | 5347. | 4.51 | 5609. | 4.74 | 5902. | 5.01 | 6236. | 5.31 | 7063. | 6.04 |
| | 12500 | 4584. | 3.86 | | | | | | | | | | | | |
| 2000 | 20000 | 5220. | 4.34 | 5666. | 4.76 | 5929. | 4.99 | 6224. | 5.26 | 6556. | 5.57 | 6937. | 5.92 | 7890. | 6.80 |
| | 16500 | 4915. | 4.13 | 5336. | 4.52 | 5584. | 4.73 | 5859. | 4.98 | 6168. | 5.26 | 6520. | 5.58 | 7390. | 6.35 |
| | 12500 | 4785. | 4.04 | | | | | | | | | | | | |
| 2100 | 20000 | 5427. | 4.54 | 5895. | 4.98 | 6172. | 5.22 | 6481. | 5.50 | 6831. | 5.83 | 7231. | 6.20 | | |
| | 16500 | 5117. | 4.32 | 5560. | 4.73 | 5820. | 4.95 | 6109. | 5.21 | 6434. | 5.51 | 6804. | 5.84 | | |
| | 12500 | 4986. | 4.23 | | | | | | | | | | | | |
| 2200 | 20000 | 5633. | 4.74 | 6124. | 5.20 | 6414. | 5.45 | 6739. | 5.75 | 7105. | 6.09 | 7525. | 6.47 | | |
| | 16500 | 5320. | 4.51 | 5784. | 4.94 | 6057. | 5.17 | 6360. | 5.44 | 6700. | 5.75 | 7087. | 6.11 | | |
| | 12500 | 5188. | 4.42 | | | | | | | | | | | | |
| 2300 | 20000 | 5840. | 4.93 | 6354. | 5.41 | 6657. | 5.68 | 6997. | 5.99 | 7380. | 6.35 | | | | |
| | 16500 | 5523. | 4.70 | 6008. | 5.15 | 6293. | 5.39 | 6610. | 5.68 | 6966. | 6.00 | | | | |
| | 12500 | 5389. | 4.60 | | | | | | | | | | | | |
| 2400 | 20000 | 6047. | 5.13 | 6583. | 5.63 | 6900. | 5.91 | 7254. | 6.24 | | | | | | |
| | 16500 | 5726. | 4.89 | 6233. | 5.36 | 6530. | 5.61 | 6860. | 5.91 | | | | | | |
| | 12500 | 5590. | 4.79 | | | | | | | | | | | | |
| 2500 | 20000 | 6254. | 5.32 | 6813. | 5.85 | 7143. | 6.14 | 7512. | 6.48 | | | | | | |
| | 16500 | 5929. | 5.08 | 6457. | 5.57 | 6766. | 5.83 | 7111. | 6.14 | | | | | | |
| | 12500 | 5791. | 4.97 | | | | | | | | | | | | |
| 2600 | 20000 | 6461. | 5.52 | 7042. | 6.07 | 7385. | 6.37 | | | | | | | | |
| | 16500 | 6131. | 5.27 | 6681. | 5.78 | 7002. | 6.05 | | | | | | | | |
| | 12500 | 5992. | 5.16 | | | | | | | | | | | | |
| 2700 | 20000 | 6668. | 5.72 | 7272. | 6.29 | | | | | | | | | | |
| | 16500 | 6334. | 5.46 | 6905. | 5.99 | | | | | | | | | | |
| | 12500 | 6193. | 5.35 | | | | | | | | | | | | |
| 2800 | 20000 | 6875. | 5.91 | 7501. | 6.50 | | | | | | | | | | |
| | 16500 | 6537. | 5.65 | 7129. | 6.20 | | | | | | | | | | |
| | 12500 | 6394. | 5.53 | | | | | | | | | | | | |

Figure 7-7 (Sheet 11)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** — **CRUISE ALTITUDE 23000 FEET**

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1263. | 0.66 | 1340. | 0.70 | 1386. | 0.71 | 1437. | 0.74 | 1495. | 0.77 | 1562. | 0.81 | 1733. | 0.89 |
| | 16500 | 1221. | 0.65 | 1297. | 0.69 | 1343. | 0.71 | 1394. | 0.73 | 1451. | 0.77 | 1518. | 0.80 | 1688. | 0.88 |
| | 12500 | 1177. | 0.65 | 1252. | 0.69 | 1298. | 0.70 | 1349. | 0.73 | 1406. | 0.76 | 1472. | 0.80 | 1642. | 0.88 |
| 300 | 20000 | 1626. | 0.86 | 1744. | 0.92 | 1814. | 0.95 | 1892. | 0.99 | 1981. | 1.04 | 2083. | 1.09 | 2342. | 1.22 |
| | 16500 | 1577. | 0.85 | 1693. | 0.92 | 1763. | 0.94 | 1840. | 0.99 | 1928. | 1.04 | 2029. | 1.09 | 2285. | 1.22 |
| | 12500 | 1527. | 0.85 | 1642. | 0.91 | 1711. | 0.94 | 1787. | 0.98 | 1874. | 1.03 | 1974. | 1.09 | 2229. | 1.21 |
| 400 | 20000 | 1990. | 1.06 | 2148. | 1.15 | 2242. | 1.19 | 2347. | 1.24 | 2467. | 1.31 | 2604. | 1.38 | 2952. | 1.56 |
| | 16500 | 1933. | 1.05 | 2089. | 1.14 | 2182. | 1.18 | 2286. | 1.24 | 2404. | 1.31 | 2539. | 1.38 | 2883. | 1.55 |
| | 12500 | 1877. | 1.05 | 2031. | 1.14 | 2123. | 1.17 | 2226. | 1.23 | 2342. | 1.30 | 2476. | 1.37 | 2816. | 1.55 |
| 500 | 20000 | 2353. | 1.26 | 2552. | 1.37 | 2670. | 1.42 | 2802. | 1.49 | 2952. | 1.58 | 3125. | 1.67 | 3561. | 1.90 |
| | 16500 | 2289. | 1.26 | 2485. | 1.37 | 2602. | 1.42 | 2732. | 1.49 | 2880. | 1.58 | 3050. | 1.67 | 3480. | 1.89 |
| | 12500 | 2227. | 1.25 | 2420. | 1.36 | 2536. | 1.41 | 2664. | 1.49 | 2811. | 1.57 | 2978. | 1.66 | 3403. | 1.89 |
| 600 | 20000 | 2716. | 1.46 | 2956. | 1.59 | 3098. | 1.66 | 3257. | 1.75 | 3438. | 1.85 | 3646. | 1.96 | 4170. | 2.24 |
| | 16500 | 2645. | 1.46 | 2881. | 1.59 | 3021. | 1.66 | 3178. | 1.74 | 3357. | 1.85 | 3561. | 1.95 | 4077. | 2.23 |
| | 12500 | 2577. | 1.45 | 2810. | 1.58 | 2948. | 1.65 | 3103. | 1.74 | 3279. | 1.84 | 3481. | 1.95 | 3990. | 2.23 |
| 700 | 20000 | 3079. | 1.66 | 3360. | 1.82 | 3526. | 1.90 | 3712. | 2.00 | 3924. | 2.12 | 4166. | 2.25 | 4779. | 2.58 |
| | 16500 | 3001. | 1.66 | 3277. | 1.81 | 3441. | 1.89 | 3625. | 1.99 | 3833. | 2.12 | 4072. | 2.24 | 4674. | 2.56 |
| | 12500 | 2927. | 1.65 | 3199. | 1.81 | 3361. | 1.88 | 3542. | 1.99 | 3747. | 2.10 | 3983. | 2.24 | 4577. | 2.56 |
| 800 | 20000 | 3442. | 1.87 | 3764. | 2.04 | 3954. | 2.14 | 4167. | 2.25 | 4410. | 2.39 | 4687. | 2.54 | 5388. | 2.91 |
| | 16500 | 3357. | 1.86 | 3673. | 2.04 | 3861. | 2.13 | 4071. | 2.24 | 4309. | 2.38 | 4582. | 2.53 | 5272. | 2.90 |
| | 12500 | 3277. | 1.86 | 3588. | 2.03 | 3773. | 2.12 | 3980. | 2.24 | 4215. | 2.37 | 4485. | 2.53 | 5164. | 2.90 |
| 900 | 20000 | 3805. | 2.07 | 4168. | 2.26 | 4382. | 2.37 | 4622. | 2.50 | 4895. | 2.66 | 5208. | 2.82 | 5997. | 3.25 |
| | 16500 | 3714. | 2.06 | 4069. | 2.26 | 4280. | 2.37 | 4517. | 2.50 | 4785. | 2.65 | 5093. | 2.82 | 5869. | 3.24 |
| | 12500 | 3627. | 2.06 | 3978. | 2.26 | 4185. | 2.36 | 4419. | 2.49 | 4683. | 2.64 | 4987. | 2.82 | | |
| 1000 | 20000 | 4169. | 2.27 | 4571. | 2.49 | 4810. | 2.61 | 5077. | 2.75 | 5381. | 2.93 | 5729. | 3.11 | 6606. | 3.59 |
| | 16500 | 4070. | 2.26 | 4465. | 2.48 | 4700. | 2.61 | 4963. | 2.75 | 5262. | 2.92 | 5604. | 3.11 | 6466. | 3.57 |
| | 12500 | 3977. | 2.26 | 4367. | 2.48 | 4598. | 2.59 | 4857. | 2.75 | | | | | | |
| 1100 | 20000 | 4532. | 2.47 | 4975. | 2.71 | 5237. | 2.85 | 5532. | 3.00 | 5867. | 3.20 | 6250. | 3.40 | 7215. | 3.93 |
| | 16500 | 4426. | 2.46 | 4861. | 2.71 | 5119. | 2.84 | 5409. | 3.00 | 5738. | 3.19 | 6115. | 3.40 | 7063. | 3.91 |
| | 12500 | 4327. | 2.46 | 4756. | 2.71 | | | | | | | | | | |
| 1200 | 20000 | 4895. | 2.67 | 5379. | 2.94 | 5665. | 3.09 | 5987. | 3.26 | 6353. | 3.47 | 6771. | 3.69 | 7824. | 4.27 |
| | 16500 | 4782. | 2.67 | 5257. | 2.93 | 5539. | 3.08 | 5855. | 3.25 | 6214. | 3.46 | 6625. | 3.69 | 7661. | 4.25 |
| | 12500 | 4677. | 2.66 | | | | | | | | | | | | |
| 1300 | 20000 | 5258. | 2.87 | 5783. | 3.16 | 6093. | 3.32 | 6442. | 3.51 | 6838. | 3.73 | 7292. | 3.98 | | |
| | 16500 | 5138. | 2.87 | 5653. | 3.15 | 5959. | 3.32 | 6302. | 3.50 | 6691. | 3.73 | 7136. | 3.97 | | |
| | 12500 | 5027. | 2.86 | | | | | | | | | | | | |
| 1400 | 20000 | 5621. | 3.07 | 6187. | 3.38 | 6521. | 3.56 | 6897. | 3.76 | 7324. | 4.00 | | | | |
| | 16500 | 5494. | 3.07 | 6049. | 3.38 | 6378. | 3.56 | 6748. | 3.76 | 7167. | 4.00 | | | | |
| | 12500 | 5377. | 3.07 | | | | | | | | | | | | |
| 1500 | 20000 | 5984. | 3.27 | 6591. | 3.61 | 6949. | 3.80 | 7352. | 4.01 | | | | | | |
| | 16500 | 5850. | 3.27 | 6445. | 3.60 | 6798. | 3.79 | 7194. | 4.01 | | | | | | |
| | 12500 | 5727. | 3.27 | | | | | | | | | | | | |
| 1600 | 20000 | 6347. | 3.48 | 6995. | 3.83 | | | | | | | | | | |
| | 16500 | 6206. | 3.47 | 6841. | 3.83 | | | | | | | | | | |
| | 12500 | 6077. | 3.47 | | | | | | | | | | | | |
| 1700 | 20000 | 6711. | 3.68 | 7399. | 4.05 | | | | | | | | | | |
| | 16500 | 6562. | 3.67 | 7237. | 4.05 | | | | | | | | | | |
| | 12500 | 6427. | 3.67 | | | | | | | | | | | | |
| 1800 | 20000 | 7074. | 3.88 | | | | | | | | | | | | |
| | 16500 | 6919. | 3.87 | | | | | | | | | | | | |
| | 12500 | 6777. | 3.87 | | | | | | | | | | | | |

Figure 7-8 (Sheet 1 of 9)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 27000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1262. | 0.67 | 1326. | 0.71 | 1366. | 0.72 | 1409. | 0.74 | 1458. | 0.77 | 1515. | 0.81 | 1661. | 0.88 |
| | 16500 | 1209. | 0.66 | 1274. | 0.70 | 1313. | 0.71 | 1356. | 0.74 | 1404. | 0.77 | 1461. | 0.80 | 1607. | 0.88 |
| | 12500 | 1154. | 0.65 | 1218. | 0.69 | 1258. | 0.70 | 1300. | 0.73 | 1349. | 0.76 | 1406. | 0.80 | 1551. | 0.87 |
| 300 | 20000 | 1574. | 0.87 | 1674. | 0.93 | 1735. | 0.96 | 1802. | 1.00 | 1877. | 1.05 | 1965. | 1.10 | 2190. | 1.23 |
| | 16500 | 1513. | 0.86 | 1612. | 0.93 | 1672. | 0.95 | 1738. | 0.99 | 1813. | 1.04 | 1900. | 1.10 | 2122. | 1.22 |
| | 12500 | 1451. | 0.86 | 1549. | 0.92 | 1608. | 0.95 | 1674. | 0.99 | 1748. | 1.04 | 1834. | 1.09 | 2054. | 1.22 |
| 400 | 20000 | 1887. | 1.08 | 2022. | 1.16 | 2104. | 1.20 | 2194. | 1.26 | 2297. | 1.32 | 2416. | 1.40 | 2719. | 1.57 |
| | 16500 | 1817. | 1.07 | 1951. | 1.16 | 2031. | 1.19 | 2120. | 1.25 | 2222. | 1.32 | 2339. | 1.39 | 2636. | 1.57 |
| | 12500 | 1748. | 1.06 | 1880. | 1.15 | 1959. | 1.19 | 2047. | 1.25 | 2147. | 1.31 | 2262. | 1.38 | 2556. | 1.56 |
| 500 | 20000 | 2199. | 1.28 | 2370. | 1.39 | 2473. | 1.44 | 2587. | 1.51 | 2717. | 1.60 | 2867. | 1.69 | 3248. | 1.92 |
| | 16500 | 2121. | 1.27 | 2290. | 1.38 | 2390. | 1.44 | 2502. | 1.51 | 2630. | 1.59 | 2777. | 1.69 | 3151. | 1.92 |
| | 12500 | 2045. | 1.27 | 2210. | 1.38 | 2309. | 1.43 | 2420. | 1.50 | 2545. | 1.59 | 2690. | 1.68 | 3058. | 1.91 |
| 600 | 20000 | 2511. | 1.48 | 2718. | 1.62 | 2842. | 1.68 | 2980. | 1.77 | 3137. | 1.87 | 3318. | 1.99 | 3777. | 2.26 |
| | 16500 | 2425. | 1.48 | 2628. | 1.61 | 2750. | 1.68 | 2885. | 1.76 | 3039. | 1.86 | 3216. | 1.98 | 3666. | 2.26 |
| | 12500 | 2342. | 1.47 | 2541. | 1.60 | 2660. | 1.67 | 2793. | 1.76 | 2944. | 1.86 | 3119. | 1.97 | 3561. | 2.25 |
| 700 | 20000 | 2824. | 1.69 | 3066. | 1.84 | 3211. | 1.92 | 3373. | 2.03 | 3557. | 2.14 | 3769. | 2.28 | 4306. | 2.61 |
| | 16500 | 2730. | 1.68 | 2967. | 1.84 | 3109. | 1.92 | 3267. | 2.02 | 3447. | 2.14 | 3655. | 2.28 | 4180. | 2.61 |
| | 12500 | 2639. | 1.67 | 2872. | 1.83 | 3011. | 1.91 | 3166. | 2.02 | 3343. | 2.13 | 3547. | 2.27 | 4063. | 2.60 |
| 800 | 20000 | 3136. | 1.89 | 3414. | 2.07 | 3580. | 2.16 | 3766. | 2.28 | 3976. | 2.42 | 4220. | 2.58 | 4835. | 2.96 |
| | 16500 | 3034. | 1.88 | 3306. | 2.06 | 3468. | 2.16 | 3649. | 2.28 | 3856. | 2.41 | 4094. | 2.57 | 4695. | 2.95 |
| | 12500 | 2935. | 1.88 | 3202. | 2.06 | 3361. | 2.15 | 3539. | 2.27 | 3742. | 2.41 | 3975. | 2.56 | 4566. | 2.94 |
| 900 | 20000 | 3448. | 2.10 | 3762. | 2.30 | 3949. | 2.40 | 4158. | 2.54 | 4396. | 2.69 | 4670. | 2.87 | 5364. | 3.30 |
| | 16500 | 3338. | 2.09 | 3645. | 2.29 | 3827. | 2.40 | 4031. | 2.53 | 4264. | 2.68 | 4532. | 2.87 | 5210. | 3.30 |
| | 12500 | 3232. | 2.08 | 3533. | 2.29 | 3712. | 2.39 | 3913. | 2.53 | 4141. | 2.68 | 4403. | 2.85 | 5068. | 3.29 |
| 1000 | 20000 | 3761. | 2.30 | 4110. | 2.53 | 4318. | 2.64 | 4551. | 2.80 | 4816. | 2.96 | 5121. | 3.17 | 5893. | 3.65 |
| | 16500 | 3642. | 2.29 | 3983. | 2.52 | 4186. | 2.64 | 4414. | 2.79 | 4673. | 2.96 | 4971. | 3.16 | 5724. | 3.64 |
| | 12500 | 3529. | 2.29 | 3863. | 2.51 | 4062. | 2.63 | 4286. | 2.79 | 4539. | 2.96 | 4832. | 3.15 | | |
| 1100 | 20000 | 4073. | 2.50 | 4458. | 2.75 | 4687. | 2.88 | 4944. | 3.05 | 5236. | 3.24 | 5572. | 3.46 | 6421. | 3.99 |
| | 16500 | 3946. | 2.50 | 4322. | 2.75 | 4545. | 2.88 | 4796. | 3.05 | 5081. | 3.23 | 5410. | 3.46 | 6239. | 3.99 |
| | 12500 | 3826. | 2.49 | 4194. | 2.74 | 4413. | 2.87 | 4659. | 3.04 | | | | | | |
| 1200 | 20000 | 4386. | 2.71 | 4806. | 2.98 | 5056. | 3.12 | 5337. | 3.31 | 5656. | 3.51 | 6023. | 3.76 | 6950. | 4.34 |
| | 16500 | 4250. | 2.70 | 4661. | 2.97 | 4905. | 3.13 | 5178. | 3.30 | 5490. | 3.51 | 5849. | 3.75 | 6754. | 4.34 |
| | 12500 | 4123. | 2.70 | 4525. | 2.97 | 4764. | 3.11 | | | | | | | | |
| 1300 | 20000 | 4698. | 2.91 | 5154. | 3.21 | 5425. | 3.36 | 5730. | 3.57 | 6075. | 3.79 | 6474. | 4.05 | 7479. | 4.69 |
| | 16500 | 4554. | 2.90 | 4999. | 3.20 | 5264. | 3.37 | 5560. | 3.56 | 5899. | 3.78 | 6287. | 4.04 | 7268. | 4.68 |
| | 12500 | 4420. | 2.90 | 4855. | 3.19 | | | | | | | | | | |
| 1400 | 20000 | 5010. | 3.12 | 5502. | 3.43 | 5794. | 3.60 | 6123. | 3.82 | 6495. | 4.06 | 6924. | 4.35 | 8008. | 5.03 |
| | 16500 | 4858. | 3.11 | 5338. | 3.43 | 5623. | 3.61 | 5943. | 3.82 | 6307. | 4.05 | 6726. | 4.34 | 7783. | 5.03 |
| | 12500 | 4717. | 3.10 | | | | | | | | | | | | |
| 1500 | 20000 | 5323. | 3.32 | 5850. | 3.66 | 6163. | 3.84 | 6516. | 4.08 | 6915. | 4.33 | 7375. | 4.64 | | |
| | 16500 | 5162. | 3.31 | 5677. | 3.65 | 5982. | 3.85 | 6325. | 4.07 | 6716. | 4.33 | 7165. | 4.63 | | |
| | 12500 | 5013. | 3.31 | | | | | | | | | | | | |
| 1600 | 20000 | 5635. | 3.53 | 6198. | 3.89 | 6532. | 4.08 | 6908. | 4.34 | 7335. | 4.61 | | | | |
| | 16500 | 5466. | 3.52 | 6016. | 3.88 | 6341. | 4.09 | 6707. | 4.33 | 7124. | 4.60 | | | | |
| | 12500 | 5310. | 3.51 | | | | | | | | | | | | |
| 1700 | 20000 | 5948. | 3.73 | 6547. | 4.12 | 6901. | 4.32 | 7301. | 4.59 | | | | | | |
| | 16500 | 5770. | 3.72 | 6354. | 4.11 | 6701. | 4.33 | 7090. | 4.59 | | | | | | |
| | 12500 | 5607. | 3.72 | | | | | | | | | | | | |
| 1800 | 20000 | 6260. | 3.93 | 6895. | 4.34 | 7271. | 4.56 | | | | | | | | |
| | 16500 | 6074. | 3.93 | 6693. | 4.34 | 7060. | 4.57 | | | | | | | | |
| | 12500 | 5904. | 3.92 | | | | | | | | | | | | |
| 1900 | 20000 | 6572. | 4.14 | 7243. | 4.57 | | | | | | | | | | |
| | 16500 | 6378. | 4.13 | 7032. | 4.56 | | | | | | | | | | |
| | 12500 | 6201. | 4.12 | | | | | | | | | | | | |
| 2000 | 20000 | 6885. | 4.34 | 7591. | 4.80 | | | | | | | | | | |
| | 16500 | 6682. | 4.33 | 7370. | 4.79 | | | | | | | | | | |
| | 12500 | 6498. | 4.33 | | | | | | | | | | | | |

Figure 7-8 (Sheet 2)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 31000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1280. | 0.67 | 1335. | 0.71 | 1369. | 0.72 | 1405. | 0.74 | 1447. | 0.77 | 1496. | 0.80 | 1622. | 0.87 |
| | 16500 | 1218. | 0.67 | 1272. | 0.70 | 1306. | 0.71 | 1342. | 0.74 | 1384. | 0.77 | 1432. | 0.80 | 1558. | 0.87 |
| | 12500 | 1152. | 0.66 | 1206. | 0.70 | 1240. | 0.71 | 1276. | 0.73 | 1318. | 0.76 | 1366. | 0.80 | 1492. | 0.87 |
| 400 | 20000 | 1821. | 1.09 | 1938. | 1.17 | 2008. | 1.21 | 2087. | 1.27 | 2176. | 1.33 | 2280. | 1.40 | 2545. | 1.58 |
| | 16500 | 1738. | 1.08 | 1853. | 1.17 | 1922. | 1.20 | 1999. | 1.26 | 2086. | 1.33 | 2188. | 1.40 | 2447. | 1.58 |
| | 12500 | 1654. | 1.07 | 1767. | 1.16 | 1835. | 1.20 | 1911. | 1.26 | 1997. | 1.32 | 2096. | 1.40 | 2351. | 1.58 |
| 600 | 20000 | 2361. | 1.50 | 2541. | 1.63 | 2648. | 1.70 | 2769. | 1.79 | 2906. | 1.89 | 3065. | 2.00 | 3469. | 2.29 |
| | 16500 | 2258. | 1.49 | 2433. | 1.63 | 2538. | 1.69 | 2655. | 1.78 | 2789. | 1.89 | 2943. | 2.00 | 3336. | 2.29 |
| | 12500 | 2157. | 1.49 | 2328. | 1.62 | 2431. | 1.69 | 2545. | 1.78 | 2676. | 1.88 | 2826. | 2.00 | 3211. | 2.28 |
| 700 | 20000 | 2631. | 1.71 | 2842. | 1.86 | 2968. | 1.94 | 3109. | 2.05 | 3271. | 2.17 | 3457. | 2.30 | 3930. | 2.64 |
| | 16500 | 2518. | 1.70 | 2723. | 1.86 | 2846. | 1.94 | 2983. | 2.05 | 3140. | 2.17 | 3321. | 2.30 | 3781. | 2.64 |
| | 12500 | 2409. | 1.69 | 2609. | 1.85 | 2729. | 1.93 | 2862. | 2.04 | 3015. | 2.16 | 3192. | 2.30 | 3640. | 2.64 |
| 800 | 20000 | 2901. | 1.91 | 3143. | 2.10 | 3288. | 2.19 | 3450. | 2.31 | 3635. | 2.45 | 3849. | 2.60 | 4392. | 2.99 |
| | 16500 | 2778. | 1.91 | 3013. | 2.09 | 3154. | 2.18 | 3311. | 2.31 | 3491. | 2.44 | 3698. | 2.60 | 4226. | 2.99 |
| | 12500 | 2660. | 1.90 | 2889. | 2.08 | 3026. | 2.18 | 3180. | 2.30 | 3355. | 2.44 | 3557. | 2.60 | 4070. | 2.99 |
| 900 | 20000 | 3171. | 2.12 | 3445. | 2.33 | 3608. | 2.43 | 3791. | 2.57 | 4000. | 2.73 | 4241. | 2.90 | 4854. | 3.35 |
| | 16500 | 3038. | 2.11 | 3304. | 2.32 | 3462. | 2.43 | 3640. | 2.57 | 3842. | 2.72 | 4076. | 2.90 | 4670. | 3.35 |
| | 12500 | 2912. | 2.11 | 3170. | 2.32 | 3324. | 2.42 | 3497. | 2.56 | 3694. | 2.72 | 3922. | 2.90 | 4500. | 3.34 |
| 1000 | 20000 | 3441. | 2.33 | 3746. | 2.56 | 3928. | 2.68 | 4132. | 2.83 | 4365. | 3.01 | 4634. | 3.20 | 5316. | 3.70 |
| | 16500 | 3298. | 2.32 | 3594. | 2.55 | 3770. | 2.67 | 3968. | 2.83 | 4193. | 3.00 | 4454. | 3.20 | 5115. | 3.70 |
| | 12500 | 3163. | 2.32 | 3450. | 2.55 | 3622. | 2.67 | 3814. | 2.82 | 4033. | 3.00 | 4287. | 3.20 | 4930. | 3.69 |
| 1100 | 20000 | 3711. | 2.54 | 4048. | 2.79 | 4248. | 2.92 | 4473. | 3.09 | 4729. | 3.29 | 5026. | 3.50 | 5777. | 4.06 |
| | 16500 | 3558. | 2.53 | 3884. | 2.78 | 4078. | 2.91 | 4296. | 3.09 | 4545. | 3.28 | 4831. | 3.50 | 5559. | 4.06 |
| | 12500 | 3415. | 2.52 | 3731. | 2.78 | 3920. | 2.91 | 4131. | 3.08 | 4373. | 3.28 | 4652. | 3.50 | | |
| 1200 | 20000 | 3981. | 2.74 | 4349. | 3.02 | 4568. | 3.16 | 4814. | 3.36 | 5094. | 3.56 | 5418. | 3.80 | 6239. | 4.41 |
| | 16500 | 3819. | 2.73 | 4174. | 3.01 | 4386. | 3.16 | 4624. | 3.35 | 4896. | 3.56 | 5209. | 3.80 | 6004. | 4.41 |
| | 12500 | 3666. | 2.73 | 4012. | 3.01 | 4218. | 3.16 | 4449. | 3.34 | 4712. | 3.56 | | | | |
| 1300 | 20000 | 4252. | 2.95 | 4650. | 3.25 | 4888. | 3.41 | 5154. | 3.62 | 5459. | 3.84 | 5810. | 4.10 | 6701. | 4.76 |
| | 16500 | 4079. | 2.94 | 4465. | 3.24 | 4694. | 3.40 | 4952. | 3.61 | 5247. | 3.84 | 5587. | 4.10 | 6449. | 4.76 |
| | 12500 | 3917. | 2.94 | 4292. | 3.24 | 4515. | 3.40 | 4766. | 3.60 | | | | | | |
| 1400 | 20000 | 4522. | 3.16 | 4952. | 3.48 | 5208. | 3.65 | 5495. | 3.88 | 5824. | 4.12 | 6202. | 4.40 | 7163. | 5.12 |
| | 16500 | 4339. | 3.15 | 4755. | 3.47 | 5002. | 3.65 | 5280. | 3.87 | 5598. | 4.12 | 5964. | 4.40 | 6893. | 5.12 |
| | 12500 | 4169. | 3.14 | 4573. | 3.47 | | | | | | | | | | |
| 1500 | 20000 | 4792. | 3.36 | 5253. | 3.71 | 5528. | 3.90 | 5836. | 4.14 | 6188. | 4.40 | 6595. | 4.70 | 7624. | 5.47 |
| | 16500 | 4599. | 3.35 | 5045. | 3.70 | 5310. | 3.89 | 5609. | 4.13 | 5949. | 4.40 | 6342. | 4.70 | 7338. | 5.47 |
| | 12500 | 4420. | 3.35 | 4853. | 3.70 | | | | | | | | | | |
| 1600 | 20000 | 5062. | 3.57 | 5555. | 3.94 | 5848. | 4.14 | 6177. | 4.40 | 6553. | 4.68 | 6987. | 5.00 | 8086. | 5.82 |
| | 16500 | 4859. | 3.56 | 5335. | 3.93 | 5618. | 4.14 | 5937. | 4.40 | 6301. | 4.68 | 6720. | 5.00 | 7782. | 5.83 |
| | 12500 | 4672. | 3.56 | | | | | | | | | | | | |
| 1700 | 20000 | 5332. | 3.78 | 5856. | 4.17 | 6167. | 4.39 | 6518. | 4.66 | 6918. | 4.96 | 7379. | 5.30 | | |
| | 16500 | 5119. | 3.77 | 5625. | 4.17 | 5927. | 4.38 | 6265. | 4.66 | 6652. | 4.96 | 7097. | 5.30 | | |
| | 12500 | 4923. | 3.76 | | | | | | | | | | | | |
| 1800 | 20000 | 5602. | 3.98 | 6157. | 4.40 | 6487. | 4.63 | 6859. | 4.92 | 7283. | 5.24 | | | | |
| | 16500 | 5379. | 3.98 | 5916. | 4.40 | 6235. | 4.63 | 6593. | 4.92 | 7003. | 5.24 | | | | |
| | 12500 | 5175. | 3.97 | | | | | | | | | | | | |
| 1900 | 20000 | 5872. | 4.19 | 6459. | 4.63 | 6807. | 4.88 | 7199. | 5.18 | | | | | | |
| | 16500 | 5639. | 4.18 | 6206. | 4.63 | 6543. | 4.87 | 6921. | 5.18 | | | | | | |
| | 12500 | 5426. | 4.18 | | | | | | | | | | | | |
| 2000 | 20000 | 6142. | 4.40 | 6760. | 4.86 | 7127. | 5.12 | | | | | | | | |
| | 16500 | 5899. | 4.39 | 6496. | 4.86 | 6851. | 5.12 | | | | | | | | |
| | 12500 | 5678. | 4.39 | | | | | | | | | | | | |
| 2100 | 20000 | 6412. | 4.60 | 7062. | 5.09 | 7447. | 5.36 | | | | | | | | |
| | 16500 | 6160. | 4.60 | 6786. | 5.09 | 7159. | 5.36 | | | | | | | | |
| | 12500 | 5929. | 4.59 | | | | | | | | | | | | |
| 2200 | 20000 | 6683. | 4.81 | 7363. | 5.33 | | | | | | | | | | |
| | 16500 | 6420. | 4.80 | 7077. | 5.32 | | | | | | | | | | |
| | 12500 | 6180. | 4.80 | | | | | | | | | | | | |
| 2300 | 20000 | 6953. | 5.02 | 7664. | 5.56 | | | | | | | | | | |
| | 16500 | 6680. | 5.01 | 7367. | 5.55 | | | | | | | | | | |
| | 12500 | 6432. | 5.01 | | | | | | | | | | | | |

Figure 7-8 (Sheet 3)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 33000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1293. | 0.68 | 1344. | 0.71 | 1375. | 0.72 | 1409. | 0.74 | 1447. | 0.77 | 1492. | 0.80 | 1609. | 0.87 |
| | 16500 | 1225. | 0.67 | 1275. | 0.71 | 1306. | 0.71 | 1340. | 0.74 | 1379. | 0.77 | 1424. | 0.80 | 1541. | 0.87 |
| | 12500 | 1153. | 0.66 | 1204. | 0.70 | 1235. | 0.71 | 1269. | 0.73 | 1307. | 0.76 | 1352. | 0.79 | 1469. | 0.87 |
| 400 | 20000 | 1797. | 1.09 | 1906. | 1.18 | 1972. | 1.21 | 2045. | 1.27 | 2129. | 1.34 | 2226. | 1.41 | 2475. | 1.58 |
| | 16500 | 1707. | 1.09 | 1814. | 1.17 | 1878. | 1.21 | 1950. | 1.27 | 2031. | 1.33 | 2126. | 1.41 | 2369. | 1.58 |
| | 12500 | 1617. | 1.08 | 1721. | 1.17 | 1784. | 1.20 | 1854. | 1.26 | 1934. | 1.33 | 2027. | 1.40 | 2265. | 1.58 |
| 600 | 20000 | 2301. | 1.51 | 2469. | 1.64 | 2570. | 1.71 | 2682. | 1.80 | 2811. | 1.90 | 2960. | 2.02 | 3341. | 2.30 |
| | 16500 | 2189. | 1.50 | 2352. | 1.64 | 2450. | 1.70 | 2559. | 1.79 | 2684. | 1.90 | 2829. | 2.01 | 3198. | 2.30 |
| | 12500 | 2080. | 1.49 | 2238. | 1.63 | 2334. | 1.70 | 2440. | 1.79 | 2561. | 1.89 | 2702. | 2.01 | 3061. | 2.30 |
| 800 | 20000 | 2805. | 1.93 | 3031. | 2.11 | 3167. | 2.20 | 3319. | 2.32 | 3493. | 2.47 | 3694. | 2.62 | 4206. | 3.01 |
| | 16500 | 2672. | 1.92 | 2891. | 2.10 | 3022. | 2.20 | 3169. | 2.32 | 3337. | 2.46 | 3531. | 2.62 | 4027. | 3.01 |
| | 12500 | 2543. | 1.91 | 2756. | 2.10 | 2883. | 2.19 | 3026. | 2.31 | 3188. | 2.46 | 3376. | 2.62 | 3857. | 3.01 |
| 1000 | 20000 | 3308. | 2.34 | 3594. | 2.57 | 3764. | 2.69 | 3956. | 2.85 | 4175. | 3.03 | 4427. | 3.23 | 5072. | 3.73 |
| | 16500 | 3154. | 2.34 | 3430. | 2.57 | 3594. | 2.69 | 3779. | 2.84 | 3990. | 3.03 | 4234. | 3.23 | 4855. | 3.73 |
| | 12500 | 3007. | 2.33 | 3273. | 2.56 | 3432. | 2.68 | 3611. | 2.84 | 3816. | 3.02 | 4051. | 3.23 | 4653. | 3.73 |
| 1100 | 20000 | 3560. | 2.55 | 3875. | 2.81 | 4063. | 2.94 | 4274. | 3.11 | 4516. | 3.31 | 4794. | 3.53 | 5504. | 4.08 |
| | 16500 | 3395. | 2.54 | 3699. | 2.80 | 3880. | 2.94 | 4084. | 3.11 | 4316. | 3.31 | 4585. | 3.53 | 5270. | 4.09 |
| | 12500 | 3238. | 2.54 | 3532. | 2.79 | 3707. | 2.93 | 3904. | 3.10 | 4129. | 3.31 | 4389. | 3.53 | 5051. | 4.09 |
| 1200 | 20000 | 3812. | 2.76 | 4157. | 3.04 | 4362. | 3.19 | 4593. | 3.37 | 4857. | 3.59 | 5161. | 3.84 | 5937. | 4.44 |
| | 16500 | 3636. | 2.75 | 3968. | 3.03 | 4166. | 3.18 | 4389. | 3.37 | 4643. | 3.59 | 4936. | 3.84 | 5684. | 4.44 |
| | 12500 | 3470. | 2.74 | 3791. | 3.03 | 3982. | 3.18 | 4197. | 3.36 | 4443. | 3.59 | 4726. | 3.83 | | |
| 1300 | 20000 | 4064. | 2.97 | 4438. | 3.27 | 4660. | 3.44 | 4911. | 3.64 | 5198. | 3.88 | 5528. | 4.14 | 6370. | 4.80 |
| | 16500 | 3877. | 2.96 | 4237. | 3.27 | 4452. | 3.43 | 4693. | 3.63 | 4969. | 3.87 | 5287. | 4.14 | 6098. | 4.80 |
| | 12500 | 3702. | 2.95 | 4049. | 3.26 | 4256. | 3.42 | 4490. | 3.63 | 4756. | 3.87 | | | | |
| 1400 | 20000 | 4316. | 3.18 | 4719. | 3.51 | 4959. | 3.68 | 5230. | 3.90 | 5539. | 4.16 | 5895. | 4.44 | 6803. | 5.16 |
| | 16500 | 4119. | 3.17 | 4507. | 3.50 | 4738. | 3.68 | 4998. | 3.89 | 5296. | 4.16 | 5639. | 4.44 | 6512. | 5.16 |
| | 12500 | 3933. | 3.16 | 4308. | 3.49 | 4531. | 3.67 | 4783. | 3.89 | | | | | | |
| 1500 | 20000 | 4568. | 3.39 | 5000. | 3.74 | 5258. | 3.93 | 5548. | 4.16 | 5880. | 4.44 | 6262. | 4.75 | 7235. | 5.51 |
| | 16500 | 4360. | 3.38 | 4776. | 3.73 | 5024. | 3.92 | 5303. | 4.16 | 5622. | 4.44 | 5990. | 4.75 | 6927. | 5.52 |
| | 12500 | 4165. | 3.37 | 4567. | 3.73 | | | | | | | | | | |
| 1600 | 20000 | 4820. | 3.59 | 5282. | 3.97 | 5556. | 4.18 | 5867. | 4.42 | 6221. | 4.72 | 6629. | 5.05 | 7668. | 5.87 |
| | 16500 | 4601. | 3.59 | 5045. | 3.96 | 5310. | 4.17 | 5608. | 4.42 | 5949. | 4.72 | 6341. | 5.05 | 7341. | 5.88 |
| | 12500 | 4397. | 3.58 | 4826. | 3.96 | | | | | | | | | | |
| 1700 | 20000 | 5072. | 3.80 | 5563. | 4.20 | 5855. | 4.42 | 6185. | 4.69 | 6562. | 5.01 | 6995. | 5.36 | 8101. | 6.23 |
| | 16500 | 4842. | 3.79 | 5315. | 4.20 | 5596. | 4.42 | 5913. | 4.68 | 6275. | 5.00 | 6692. | 5.35 | 7755. | 6.23 |
| | 12500 | 4628. | 3.79 | | | | | | | | | | | | |
| 1800 | 20000 | 5323. | 4.01 | 5844. | 4.44 | 6154. | 4.67 | 6503. | 4.95 | 6903. | 5.29 | 7362. | 5.66 | | |
| | 16500 | 5083. | 4.00 | 5584. | 4.43 | 5882. | 4.66 | 6218. | 4.95 | 6601. | 5.28 | 7043. | 5.66 | | |
| | 12500 | 4860. | 4.00 | | | | | | | | | | | | |
| 1900 | 20000 | 5575. | 4.22 | 6126. | 4.67 | 6452. | 4.92 | 6822. | 5.21 | 7244. | 5.57 | | | | |
| | 16500 | 5324. | 4.21 | 5853. | 4.66 | 6168. | 4.91 | 6523. | 5.21 | 6928. | 5.57 | | | | |
| | 12500 | 5092. | 4.20 | | | | | | | | | | | | |
| 2000 | 20000 | 5827. | 4.43 | 6407. | 4.90 | 6751. | 5.16 | 7140. | 5.48 | | | | | | |
| | 16500 | 5566. | 4.42 | 6123. | 4.90 | 6454. | 5.16 | 6827. | 5.47 | | | | | | |
| | 12500 | 5323. | 4.41 | | | | | | | | | | | | |
| 2100 | 20000 | 6079. | 4.64 | 6688. | 5.13 | 7050. | 5.41 | 7459. | 5.74 | | | | | | |
| | 16500 | 5807. | 4.63 | 6392. | 5.13 | 6740. | 5.40 | 7132. | 5.73 | | | | | | |
| | 12500 | 5555. | 4.62 | | | | | | | | | | | | |
| 2200 | 20000 | 6331. | 4.84 | 6969. | 5.37 | 7348. | 5.66 | | | | | | | | |
| | 16500 | 6048. | 4.84 | 6661. | 5.36 | 7026. | 5.65 | | | | | | | | |
| | 12500 | 5787. | 4.83 | | | | | | | | | | | | |
| 2300 | 20000 | 6583. | 5.05 | 7251. | 5.60 | | | | | | | | | | |
| | 16500 | 6289. | 5.04 | 6931. | 5.59 | | | | | | | | | | |
| | 12500 | 6018. | 5.04 | | | | | | | | | | | | |
| 2400 | 20000 | 6835. | 5.26 | 7532. | 5.83 | | | | | | | | | | |
| | 16500 | 6530. | 5.25 | 7200. | 5.83 | | | | | | | | | | |
| | 12500 | 6250. | 5.25 | | | | | | | | | | | | |

Figure 7-8 (Sheet 4)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 35000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE LENGTH NM. | T.O. WEIGHT LBS. | 100 KT. FUEL LBS. | 100 KT. TIME HRS. | 50 KT. FUEL LBS. | 50 KT. TIME HRS. | 25 KT. FUEL LBS. | 25 KT. TIME HRS. | FUEL LBS. | TIME HRS. | 25 KT. FUEL LBS. | 25 KT. TIME HRS. | 50 KT. FUEL LBS. | 50 KT. TIME HRS. | 100 KT. FUEL LBS. | 100 KT. TIME HRS. |
| 200 | 20000 | 1310. | 0.68 | 1356. | 0.71 | 1385. | 0.72 | 1417. | 0.74 | 1452. | 0.77 | 1494. | 0.80 | 1603. | 0.86 |
| | 16500 | 1236. | 0.67 | 1282. | 0.71 | 1311. | 0.72 | 1342. | 0.74 | 1378. | 0.77 | 1420. | 0.80 | 1529. | 0.86 |
| | 12500 | 1159. | 0.66 | 1205. | 0.70 | 1234. | 0.71 | 1266. | 0.73 | 1301. | 0.76 | 1343. | 0.79 | 1453. | 0.86 |
| 400 | 20000 | 1781. | 1.10 | 1883. | 1.18 | 1945. | 1.22 | 2014. | 1.28 | 2092. | 1.34 | 2183. | 1.41 | 2418. | 1.59 |
| | 16500 | 1683. | 1.09 | 1783. | 1.18 | 1843. | 1.21 | 1910. | 1.27 | 1986. | 1.34 | 2074. | 1.41 | 2302. | 1.59 |
| | 12500 | 1586. | 1.08 | 1682. | 1.17 | 1741. | 1.21 | 1806. | 1.27 | 1881. | 1.33 | 1967. | 1.41 | 2190. | 1.59 |
| 600 | 20000 | 2253. | 1.52 | 2410. | 1.65 | 2505. | 1.72 | 2611. | 1.81 | 2732. | 1.91 | 2872. | 2.02 | 3232. | 2.31 |
| | 16500 | 2131. | 1.51 | 2283. | 1.65 | 2374. | 1.71 | 2477. | 1.80 | 2593. | 1.90 | 2729. | 2.02 | 3076. | 2.31 |
| | 12500 | 2012. | 1.50 | 2160. | 1.64 | 2248. | 1.71 | 2347. | 1.80 | 2460. | 1.90 | 2591. | 2.02 | 2927. | 2.31 |
| 800 | 20000 | 2724. | 1.94 | 2937. | 2.12 | 3065. | 2.22 | 3208. | 2.34 | 3372. | 2.48 | 3561. | 2.64 | 4047. | 3.04 |
| | 16500 | 2579. | 1.93 | 2783. | 2.12 | 2906. | 2.21 | 3044. | 2.33 | 3201. | 2.47 | 3383. | 2.63 | 3849. | 3.04 |
| | 12500 | 2439. | 1.92 | 2637. | 2.11 | 2755. | 2.20 | 2888. | 2.33 | 3039. | 2.47 | 3215. | 2.63 | 3664. | 3.03 |
| 1000 | 20000 | 3196. | 2.36 | 3464. | 2.59 | 3625. | 2.71 | 3806. | 2.87 | 4012. | 3.05 | 4251. | 3.25 | 4861. | 3.76 |
| | 16500 | 3026. | 2.35 | 3284. | 2.58 | 3438. | 2.71 | 3611. | 2.86 | 3808. | 3.04 | 4037. | 3.25 | 4622. | 3.76 |
| | 12500 | 2866. | 2.34 | 3114. | 2.58 | 3262. | 2.70 | 3428. | 2.86 | 3619. | 3.04 | 3839. | 3.24 | 4401. | 3.76 |
| 1200 | 20000 | 3667. | 2.78 | 3991. | 3.06 | 4185. | 3.21 | 4403. | 3.40 | 4651. | 3.61 | 4940. | 3.86 | 5676. | 4.49 |
| | 16500 | 3474. | 2.77 | 3784. | 3.05 | 3969. | 3.21 | 4178. | 3.39 | 4416. | 3.61 | 4691. | 3.86 | 5395. | 4.49 |
| | 12500 | 3293. | 2.76 | 3591. | 3.05 | 3769. | 3.20 | 3969. | 3.39 | 4198. | 3.61 | 4463. | 3.86 | 5138. | 4.48 |
| 1300 | 20000 | 3903. | 2.99 | 4255. | 3.30 | 4465. | 3.46 | 4701. | 3.66 | 4971. | 3.90 | 5284. | 4.17 | 6083. | 4.85 |
| | 16500 | 3698. | 2.98 | 4034. | 3.29 | 4235. | 3.45 | 4461. | 3.66 | 4720. | 3.89 | 5018. | 4.16 | 5782. | 4.85 |
| | 12500 | 3507. | 2.97 | 3830. | 3.28 | 4022. | 3.45 | 4239. | 3.65 | 4488. | 3.89 | 4775. | 4.16 | | |
| 1400 | 20000 | 4139. | 3.20 | 4518. | 3.53 | 4745. | 3.71 | 5000. | 3.93 | 5291. | 4.18 | 5629. | 4.47 | 6490. | 5.21 |
| | 16500 | 3922. | 3.19 | 4284. | 3.52 | 4501. | 3.70 | 4745. | 3.92 | 5024. | 4.18 | 5345. | 4.47 | 6168. | 5.22 |
| | 12500 | 3720. | 3.18 | 4068. | 3.52 | 4276. | 3.70 | 4510. | 3.92 | 4777. | 4.17 | | | | |
| 1500 | 20000 | 4375. | 3.41 | 4781. | 3.77 | 5024. | 3.96 | 5299. | 4.20 | 5611. | 4.47 | 5973. | 4.78 | 6897. | 5.58 |
| | 16500 | 4146. | 3.40 | 4535. | 3.76 | 4767. | 3.95 | 5028. | 4.19 | 5327. | 4.46 | 5672. | 4.78 | 6555. | 5.58 |
| | 12500 | 3934. | 3.39 | 4307. | 3.75 | 4529. | 3.95 | | | | | | | | |
| 1600 | 20000 | 4610. | 3.62 | 5045. | 4.00 | 5304. | 4.21 | 5597. | 4.46 | 5931. | 4.75 | 6318. | 5.08 | 7305. | 5.94 |
| | 16500 | 4369. | 3.61 | 4785. | 3.99 | 5033. | 4.20 | 5312. | 4.46 | 5631. | 4.75 | 6000. | 5.08 | 6941. | 5.94 |
| | 12500 | 4147. | 3.60 | 4545. | 3.98 | | | | | | | | | | |
| 1700 | 20000 | 4846. | 3.83 | 5308. | 4.24 | 5584. | 4.46 | 5896. | 4.73 | 6251. | 5.04 | 6663. | 5.39 | 7712. | 6.30 |
| | 16500 | 4593. | 3.82 | 5035. | 4.23 | 5299. | 4.45 | 5595. | 4.72 | 5935. | 5.03 | 6327. | 5.39 | 7328. | 6.30 |
| | 12500 | 4360. | 3.81 | 4784. | 4.22 | | | | | | | | | | |
| 1800 | 20000 | 5082. | 4.04 | 5572. | 4.47 | 5864. | 4.71 | 6195. | 4.99 | 6571. | 5.32 | 7007. | 5.70 | 8119. | 6.66 |
| | 16500 | 4817. | 4.03 | 5285. | 4.46 | 5564. | 4.70 | 5879. | 4.99 | 6239. | 5.32 | 6654. | 5.69 | 7715. | 6.67 |
| | 12500 | 4574. | 4.02 | | | | | | | | | | | | |
| 1900 | 20000 | 5318. | 4.25 | 5835. | 4.70 | 6144. | 4.96 | 6493. | 5.26 | 6891. | 5.60 | 7352. | 6.00 | | |
| | 16500 | 5041. | 4.24 | 5535. | 4.70 | 5830. | 4.95 | 6162. | 5.25 | 6542. | 5.60 | 6981. | 6.00 | | |
| | 12500 | 4787. | 4.23 | | | | | | | | | | | | |
| 2000 | 20000 | 5554. | 4.46 | 6099. | 4.94 | 6424. | 5.21 | 6792. | 5.52 | 7211. | 5.89 | | | | |
| | 16500 | 5265. | 4.45 | 5786. | 4.93 | 6096. | 5.20 | 6446. | 5.52 | 6846. | 5.88 | | | | |
| | 12500 | 5001. | 4.44 | | | | | | | | | | | | |
| 2100 | 20000 | 5789. | 4.67 | 6362. | 5.17 | 6704. | 5.45 | 7091. | 5.79 | 7531. | 6.17 | | | | |
| | 16500 | 5489. | 4.66 | 6036. | 5.16 | 6362. | 5.45 | 6729. | 5.78 | 7150. | 6.17 | | | | |
| | 12500 | 5214. | 4.65 | | | | | | | | | | | | |
| 2200 | 20000 | 6025. | 4.88 | 6626. | 5.41 | 6984. | 5.70 | 7389. | 6.05 | | | | | | |
| | 16500 | 5712. | 4.87 | 6286. | 5.40 | 6628. | 5.70 | 7013. | 6.05 | | | | | | |
| | 12500 | 5428. | 4.86 | | | | | | | | | | | | |
| 2300 | 20000 | 6261. | 5.09 | 6889. | 5.64 | 7264. | 5.95 | | | | | | | | |
| | 16500 | 5936. | 5.08 | 6536. | 5.63 | 6893. | 5.94 | | | | | | | | |
| | 12500 | 5641. | 5.07 | | | | | | | | | | | | |
| 2400 | 20000 | 6497. | 5.30 | 7153. | 5.88 | 7544. | 6.20 | | | | | | | | |
| | 16500 | 6160. | 5.29 | 6786. | 5.87 | 7159. | 6.19 | | | | | | | | |
| | 12500 | 5855. | 5.28 | | | | | | | | | | | | |
| 2500 | 20000 | 6732. | 5.51 | 7416. | 6.11 | | | | | | | | | | |
| | 16500 | 6384. | 5.50 | 7036. | 6.10 | | | | | | | | | | |
| | 12500 | 6068. | 5.49 | | | | | | | | | | | | |
| 2600 | 20000 | 6968. | 5.72 | 7680. | 6.35 | | | | | | | | | | |
| | 16500 | 6608. | 5.71 | 7287. | 6.34 | | | | | | | | | | |
| | 12500 | 6282. | 5.70 | | | | | | | | | | | | |

Figure 7-8 (Sheet 5)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 37000 FEET**

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1316. | 0.69 | 1361. | 0.72 | 1389. | 0.73 | 1419. | 0.75 | 1453. | 0.78 | 1493. | 0.81 | 1597. | 0.87 |
| | 16500 | 1238. | 0.68 | 1282. | 0.72 | 1310. | 0.72 | 1339. | 0.75 | 1373. | 0.77 | 1413. | 0.80 | 1517. | 0.87 |
| | 12500 | 1157. | 0.67 | 1201. | 0.71 | 1228. | 0.71 | 1258. | 0.74 | 1292. | 0.77 | 1331. | 0.80 | 1435. | 0.87 |
| 400 | 20000 | 1760. | 1.11 | 1857. | 1.20 | 1916. | 1.23 | 1981. | 1.29 | 2056. | 1.35 | 2142. | 1.42 | 2366. | 1.60 |
| | 16500 | 1654. | 1.10 | 1748. | 1.19 | 1805. | 1.22 | 1868. | 1.28 | 1940. | 1.35 | 2023. | 1.42 | 2239. | 1.60 |
| | 12500 | 1551. | 1.09 | 1642. | 1.18 | 1697. | 1.22 | 1758. | 1.27 | 1827. | 1.34 | 1909. | 1.41 | 2118. | 1.60 |
| 600 | 20000 | 2204. | 1.53 | 2353. | 1.67 | 2443. | 1.73 | 2544. | 1.82 | 2659. | 1.93 | 2792. | 2.04 | 3135. | 2.33 |
| | 16500 | 2071. | 1.52 | 2214. | 1.66 | 2300. | 1.72 | 2396. | 1.82 | 2506. | 1.92 | 2633. | 2.04 | 2961. | 2.33 |
| | 12500 | 1945. | 1.51 | 2083. | 1.65 | 2165. | 1.72 | 2258. | 1.81 | 2363. | 1.91 | 2486. | 2.03 | 2801. | 2.32 |
| 800 | 20000 | 2647. | 1.95 | 2849. | 2.14 | 2970. | 2.23 | 3106. | 2.35 | 3262. | 2.50 | 3442. | 2.66 | 3903. | 3.06 |
| | 16500 | 2488. | 1.95 | 2680. | 2.13 | 2795. | 2.22 | 2924. | 2.35 | 3072. | 2.49 | 3243. | 2.66 | 3683. | 3.05 |
| | 12500 | 2340. | 1.93 | 2524. | 2.12 | 2634. | 2.22 | 2758. | 2.34 | 2899. | 2.49 | 3063. | 2.65 | 3483. | 3.05 |
| 1000 | 20000 | 3091. | 2.37 | 3345. | 2.61 | 3498. | 2.73 | 3669. | 2.89 | 3865. | 3.07 | 4091. | 3.27 | 4672. | 3.78 |
| | 16500 | 2904. | 2.37 | 3146. | 2.60 | 3290. | 2.72 | 3453. | 2.89 | 3638. | 3.07 | 3853. | 3.27 | 4404. | 3.78 |
| | 12500 | 2734. | 2.36 | 2964. | 2.59 | 3103. | 2.72 | 3258. | 2.88 | 3435. | 3.06 | 3641. | 3.27 | 4166. | 3.78 |
| 1200 | 20000 | 3534. | 2.80 | 3841. | 3.08 | 4025. | 3.23 | 4231. | 3.42 | 4467. | 3.65 | 4741. | 3.89 | 5440. | 4.51 |
| | 16500 | 3321. | 2.79 | 3612. | 3.07 | 3785. | 3.22 | 3981. | 3.42 | 4205. | 3.64 | 4463. | 3.89 | 5126. | 4.51 |
| | 12500 | 3128. | 2.78 | 3405. | 3.06 | 3571. | 3.22 | 3758. | 3.41 | 3971. | 3.63 | 4218. | 3.88 | 4849. | 4.51 |
| 1400 | 20000 | 3978. | 3.22 | 4337. | 3.55 | 4552. | 3.73 | 4794. | 3.95 | 5070. | 4.22 | 5390. | 4.50 | 6209. | 5.24 |
| | 16500 | 3738. | 3.21 | 4078. | 3.54 | 4280. | 3.72 | 4509. | 3.96 | 4771. | 4.21 | 5073. | 4.51 | 5848. | 5.24 |
| | 12500 | 3523. | 3.20 | 3846. | 3.54 | 4040. | 3.72 | 4257. | 3.95 | 4507. | 4.20 | 4795. | 4.50 | | |
| 1600 | 20000 | 4422. | 3.64 | 4833. | 4.02 | 5079. | 4.23 | 5356. | 4.49 | 5673. | 4.79 | 6040. | 5.12 | 6977. | 5.97 |
| | 16500 | 4154. | 3.63 | 4544. | 4.01 | 4775. | 4.22 | 5038. | 4.49 | 5337. | 4.79 | 5684. | 5.13 | 6570. | 5.97 |
| | 12500 | 3917. | 3.62 | 4287. | 4.01 | 4508. | 4.22 | 4757. | 4.48 | | | | | | |
| 1700 | 20000 | 4643. | 3.85 | 5081. | 4.26 | 5343. | 4.48 | 5637. | 4.75 | 5975. | 5.08 | 6364. | 5.43 | 7362. | 6.33 |
| | 16500 | 4363. | 3.84 | 4777. | 4.25 | 5023. | 4.47 | 5302. | 4.76 | 5620. | 5.07 | 5989. | 5.43 | 6930. | 6.33 |
| | 12500 | 4114. | 3.83 | 4508. | 4.24 | | | | | | | | | | |
| 1800 | 20000 | 4865. | 4.06 | 5329. | 4.49 | 5606. | 4.73 | 5919. | 5.02 | 6276. | 5.37 | 6689. | 5.73 | 7746. | 6.70 |
| | 16500 | 4571. | 4.06 | 5009. | 4.48 | 5270. | 4.72 | 5566. | 5.02 | 5904. | 5.36 | 6294. | 5.74 | 7291. | 6.70 |
| | 12500 | 4311. | 4.04 | 4728. | 4.48 | | | | | | | | | | |
| 1900 | 20000 | 5087. | 4.27 | 5577. | 4.73 | 5870. | 4.98 | 6200. | 5.29 | 6578. | 5.65 | 7014. | 6.04 | 8130. | 7.06 |
| | 16500 | 4779. | 4.27 | 5242. | 4.72 | 5518. | 4.97 | 5830. | 5.29 | 6187. | 5.65 | 6599. | 6.05 | 7652. | 7.06 |
| | 12500 | 4508. | 4.25 | | | | | | | | | | | | |
| 2000 | 20000 | 5309. | 4.48 | 5825. | 4.96 | 6134. | 5.23 | 6481. | 5.55 | 6879. | 5.94 | 7339. | 6.35 | | |
| | 16500 | 4988. | 4.48 | 5475. | 4.95 | 5766. | 5.22 | 6094. | 5.56 | 6470. | 5.93 | 6904. | 6.36 | | |
| | 12500 | 4706. | 4.46 | | | | | | | | | | | | |
| 2100 | 20000 | 5531. | 4.69 | 6073. | 5.20 | 6397. | 5.48 | 6762. | 5.82 | 7181. | 6.23 | 7664. | 6.66 | | |
| | 16500 | 5196. | 4.69 | 5708. | 5.19 | 6013. | 5.47 | 6358. | 5.83 | 6753. | 6.22 | 7209. | 6.67 | | |
| | 12500 | 4903. | 4.67 | | | | | | | | | | | | |
| 2200 | 20000 | 5752. | 4.90 | 6321. | 5.43 | 6661. | 5.73 | 7044. | 6.09 | 7482. | 6.51 | | | | |
| | 16500 | 5404. | 4.90 | 5941. | 5.42 | 6261. | 5.72 | 6623. | 6.09 | 7036. | 6.50 | | | | |
| | 12500 | 5100. | 4.88 | | | | | | | | | | | | |
| 2300 | 20000 | 5974. | 5.11 | 6569. | 5.67 | 6925. | 5.98 | 7325. | 6.35 | | | | | | |
| | 16500 | 5613. | 5.11 | 6174. | 5.66 | 6508. | 5.97 | 6887. | 6.36 | | | | | | |
| | 12500 | 5297. | 5.09 | | | | | | | | | | | | |
| 2400 | 20000 | 6196. | 5.32 | 6818. | 5.91 | 7188. | 6.23 | 7606. | 6.62 | | | | | | |
| | 16500 | 5821. | 5.32 | 6407. | 5.89 | 6756. | 6.22 | 7151. | 6.63 | | | | | | |
| | 12500 | 5494. | 5.31 | | | | | | | | | | | | |
| 2500 | 20000 | 6418. | 5.53 | 7066. | 6.14 | 7452. | 6.48 | | | | | | | | |
| | 16500 | 6029. | 5.53 | 6640. | 6.13 | 7003. | 6.47 | | | | | | | | |
| | 12500 | 5691. | 5.52 | | | | | | | | | | | | |
| 2600 | 20000 | 6640. | 5.74 | 7314. | 6.38 | | | | | | | | | | |
| | 16500 | 6238. | 5.74 | 6873. | 6.36 | | | | | | | | | | |
| | 12500 | 5889. | 5.73 | | | | | | | | | | | | |
| 2700 | 20000 | 6861. | 5.95 | 7562. | 6.61 | | | | | | | | | | |
| | 16500 | 6446. | 5.95 | 7106. | 6.60 | | | | | | | | | | |
| | 12500 | 6086. | 5.94 | | | | | | | | | | | | |

Figure 7-8 (Sheet 6)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 39000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 KT. | | 50 KT. | | 25 KT. | | | | 25 KT. | | 50 KT. | | 100 KT. | |
| STAGE LENGTH NM. | T.O. WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1341. | 0.69 | 1383. | 0.73 | 1408. | 0.73 | 1436. | 0.75 | 1468. | 0.78 | 1505. | 0.81 | 1602. | 0.86 |
| | 16500 | 1251. | 0.68 | 1293. | 0.72 | 1318. | 0.72 | 1346. | 0.75 | 1378. | 0.77 | 1415. | 0.80 | 1512. | 0.86 |
| | 12500 | 1164. | 0.67 | 1205. | 0.71 | 1231. | 0.71 | 1258. | 0.74 | 1290. | 0.77 | 1327. | 0.79 | 1424. | 0.86 |
| 400 | 20000 | 1761. | 1.12 | 1851. | 1.20 | 1907. | 1.23 | 1968. | 1.29 | 2038. | 1.35 | 2119. | 1.42 | 2329. | 1.59 |
| | 16500 | 1642. | 1.10 | 1729. | 1.19 | 1782. | 1.22 | 1841. | 1.28 | 1908. | 1.35 | 1986. | 1.42 | 2188. | 1.59 |
| | 12500 | 1530. | 1.09 | 1614. | 1.18 | 1665. | 1.22 | 1722. | 1.27 | 1787. | 1.34 | 1862. | 1.41 | 2057. | 1.59 |
| 600 | 20000 | 2180. | 1.54 | 2320. | 1.67 | 2405. | 1.73 | 2500. | 1.82 | 2608. | 1.92 | 2733. | 2.04 | 3055. | 2.32 |
| | 16500 | 2032. | 1.53 | 2165. | 1.66 | 2246. | 1.73 | 2335. | 1.82 | 2438. | 1.92 | 2557. | 2.03 | 2864. | 2.32 |
| | 12500 | 1896. | 1.52 | 2023. | 1.65 | 2100. | 1.72 | 2186. | 1.81 | 2284. | 1.91 | 2398. | 2.03 | 2691. | 2.32 |
| 800 | 20000 | 2599. | 1.96 | 2789. | 2.14 | 2903. | 2.24 | 3031. | 2.36 | 3178. | 2.50 | 3347. | 2.66 | 3782. | 3.05 |
| | 16500 | 2422. | 1.95 | 2601. | 2.13 | 2709. | 2.23 | 2830. | 2.35 | 2968. | 2.49 | 3129. | 2.65 | 3540. | 3.05 |
| | 12500 | 2261. | 1.94 | 2432. | 2.12 | 2535. | 2.22 | 2650. | 2.34 | 2781. | 2.48 | 2933. | 2.64 | 3324. | 3.05 |
| 1000 | 20000 | 3019. | 2.38 | 3258. | 2.61 | 3402. | 2.74 | 3563. | 2.89 | 3747. | 3.07 | 3961. | 3.27 | 4509. | 3.78 |
| | 16500 | 2812. | 2.37 | 3037. | 2.60 | 3173. | 2.73 | 3325. | 2.88 | 3498. | 3.07 | 3700. | 3.26 | 4215. | 3.78 |
| | 12500 | 2627. | 2.36 | 2841. | 2.59 | 2969. | 2.72 | 3113. | 2.88 | 3278. | 3.05 | 3469. | 3.26 | 3958. | 3.78 |
| 1200 | 20000 | 3438. | 2.80 | 3727. | 3.09 | 3900. | 3.24 | 4095. | 3.43 | 4317. | 3.64 | 4576. | 3.89 | 5236. | 4.51 |
| | 16500 | 3202. | 2.79 | 3473. | 3.07 | 3636. | 3.23 | 3819. | 3.42 | 4028. | 3.64 | 4271. | 3.88 | 4891. | 4.51 |
| | 12500 | 2993. | 2.78 | 3250. | 3.07 | 3404. | 3.22 | 3577. | 3.41 | 3775. | 3.63 | 4004. | 3.88 | 4591. | 4.51 |
| 1400 | 20000 | 3858. | 3.22 | 4196. | 3.56 | 4399. | 3.74 | 4627. | 3.96 | 4887. | 4.21 | 5190. | 4.51 | 5962. | 5.25 |
| | 16500 | 3592. | 3.21 | 3910. | 3.54 | 4100. | 3.73 | 4314. | 3.95 | 4558. | 4.21 | 4842. | 4.50 | 5567. | 5.24 |
| | 12500 | 3358. | 3.20 | 3659. | 3.54 | 3839. | 3.72 | 4041. | 3.95 | 4272. | 4.20 | 4540. | 4.49 | | |
| 1600 | 20000 | 4277. | 3.65 | 4665. | 4.03 | 4897. | 4.24 | 5159. | 4.49 | 5457. | 4.79 | 5804. | 5.12 | 6689. | 5.98 |
| | 16500 | 3982. | 3.63 | 4346. | 4.01 | 4563. | 4.23 | 4809. | 4.49 | 5089. | 4.78 | 5413. | 5.11 | 6243. | 5.97 |
| | 12500 | 3724. | 3.62 | 4068. | 4.01 | 4273. | 4.22 | 4504. | 4.48 | 4769. | 4.77 | | | | |
| 1800 | 20000 | 4696. | 4.07 | 5134. | 4.50 | 5395. | 4.74 | 5691. | 5.03 | 6027. | 5.36 | 6418. | 5.74 | 7416. | 6.71 |
| | 16500 | 4372. | 4.06 | 4782. | 4.48 | 5027. | 4.73 | 5303. | 5.02 | 5619. | 5.36 | 5985. | 5.73 | 6919. | 6.70 |
| | 12500 | 4090. | 4.04 | 4477. | 4.48 | 4708. | 4.73 | | | | | | | | |
| 1900 | 20000 | 4906. | 4.28 | 5368. | 4.74 | 5644. | 4.99 | 5957. | 5.30 | 6312. | 5.65 | 6725. | 6.05 | 7779. | 7.07 |
| | 16500 | 4567. | 4.27 | 5000. | 4.72 | 5259. | 4.98 | 5551. | 5.29 | 5884. | 5.64 | 6270. | 6.04 | 7257. | 7.06 |
| | 12500 | 4273. | 4.26 | 4681. | 4.72 | | | | | | | | | | |
| 2000 | 20000 | 5116. | 4.49 | 5603. | 4.97 | 5894. | 5.24 | 6222. | 5.56 | 6597. | 5.93 | 7032. | 6.36 | 8142. | 7.44 |
| | 16500 | 4762. | 4.48 | 5218. | 4.95 | 5490. | 5.24 | 5798. | 5.56 | 6149. | 5.93 | 6556. | 6.34 | 7595. | 7.43 |
| | 12500 | 4456. | 4.47 | 4886. | 4.95 | | | | | | | | | | |
| 2100 | 20000 | 5325. | 4.70 | 5837. | 5.21 | 6143. | 5.49 | 6488. | 5.83 | 6882. | 6.22 | 7339. | 6.67 | | |
| | 16500 | 4957. | 4.69 | 5436. | 5.19 | 5722. | 5.49 | 6045. | 5.83 | 6414. | 6.22 | 6841. | 6.65 | | |
| | 12500 | 4638. | 4.68 | | | | | | | | | | | | |
| 2200 | 20000 | 5535. | 4.91 | 6072. | 5.44 | 6392. | 5.74 | 6754. | 6.10 | 7167. | 6.50 | 7646. | 6.98 | | |
| | 16500 | 5152. | 4.90 | 5654. | 5.42 | 5954. | 5.74 | 6293. | 6.09 | 6679. | 6.50 | 7127. | 6.96 | | |
| | 12500 | 4821. | 4.89 | | | | | | | | | | | | |
| 2300 | 20000 | 5745. | 5.12 | 6306. | 5.68 | 6641. | 5.99 | 7020. | 6.36 | 7452. | 6.79 | | | | |
| | 16500 | 5347. | 5.11 | 5872. | 5.66 | 6186. | 5.99 | 6540. | 6.36 | 6944. | 6.79 | | | | |
| | 12500 | 5004. | 5.10 | | | | | | | | | | | | |
| 2400 | 20000 | 5955. | 5.33 | 6540. | 5.92 | 6890. | 6.24 | 7286. | 6.63 | 7737. | 7.08 | | | | |
| | 16500 | 5542. | 5.32 | 6090. | 5.89 | 6417. | 6.24 | 6787. | 6.63 | 7209. | 7.08 | | | | |
| | 12500 | 5187. | 5.31 | | | | | | | | | | | | |
| 2500 | 20000 | 6164. | 5.54 | 6775. | 6.15 | 7140. | 6.49 | 7552. | 6.90 | | | | | | |
| | 16500 | 5737. | 5.53 | 6308. | 6.13 | 6649. | 6.49 | 7035. | 6.90 | | | | | | |
| | 12500 | 5370. | 5.52 | | | | | | | | | | | | |
| 2600 | 20000 | 6374. | 5.75 | 7009. | 6.39 | 7389. | 6.74 | | | | | | | | |
| | 16500 | 5933. | 5.74 | 6526. | 6.36 | 6881. | 6.74 | | | | | | | | |
| | 12500 | 5553. | 5.73 | | | | | | | | | | | | |
| 2700 | 20000 | 6584. | 5.96 | 7244. | 6.62 | 7638. | 7.00 | | | | | | | | |
| | 16500 | 6128. | 5.95 | 6744. | 6.60 | 7113. | 6.99 | | | | | | | | |
| | 12500 | 5736. | 5.94 | | | | | | | | | | | | |
| 2800 | 20000 | 6793. | 6.17 | 7478. | 6.86 | | | | | | | | | | |
| | 16500 | 6323. | 6.16 | 6963. | 6.84 | | | | | | | | | | |
| | 12500 | 5918. | 6.15 | | | | | | | | | | | | |

Figure 7-8 (Sheet 7)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 41000 FEET**

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1368. | 0.70 | 1406. | 0.73 | 1430. | 0.74 | 1455. | 0.76 | 1485. | 0.78 | 1519. | 0.80 | 1609. | 0.86 |
| | 16500 | 1269. | 0.69 | 1307. | 0.72 | 1331. | 0.72 | 1357. | 0.75 | 1387. | 0.77 | 1421. | 0.80 | 1512. | 0.86 |
| | 12500 | 1175. | 0.67 | 1213. | 0.71 | 1237. | 0.71 | 1263. | 0.74 | 1292. | 0.76 | 1327. | 0.79 | 1417. | 0.85 |
| 400 | 20000 | 1770. | 1.12 | 1856. | 1.20 | 1908. | 1.24 | 1966. | 1.29 | 2032. | 1.35 | 2109. | 1.42 | 2308. | 1.59 |
| | 16500 | 1635. | 1.11 | 1717. | 1.19 | 1767. | 1.23 | 1822. | 1.28 | 1884. | 1.34 | 1958. | 1.41 | 2147. | 1.58 |
| | 12500 | 1513. | 1.10 | 1592. | 1.18 | 1640. | 1.22 | 1692. | 1.27 | 1752. | 1.34 | 1823. | 1.41 | 2004. | 1.58 |
| 600 | 20000 | 2173. | 1.54 | 2306. | 1.67 | 2387. | 1.74 | 2477. | 1.82 | 2580. | 1.92 | 2699. | 2.04 | 3006. | 2.32 |
| | 16500 | 2001. | 1.53 | 2126. | 1.66 | 2202. | 1.73 | 2286. | 1.82 | 2382. | 1.92 | 2494. | 2.03 | 2781. | 2.31 |
| | 12500 | 1852. | 1.52 | 1971. | 1.65 | 2042. | 1.72 | 2122. | 1.81 | 2213. | 1.91 | 2319. | 2.02 | 2591. | 2.31 |
| 800 | 20000 | 2575. | 1.97 | 2757. | 2.14 | 2866. | 2.24 | 2988. | 2.36 | 3127. | 2.49 | 3289. | 2.65 | 3704. | 3.05 |
| | 16500 | 2368. | 1.95 | 2536. | 2.13 | 2637. | 2.23 | 2751. | 2.35 | 2880. | 2.49 | 3030. | 2.65 | 3416. | 3.04 |
| | 12500 | 2191. | 1.94 | 2349. | 2.12 | 2445. | 2.22 | 2551. | 2.34 | 2673. | 2.48 | 2815. | 2.64 | 3178. | 3.04 |
| 1000 | 20000 | 2978. | 2.39 | 3207. | 2.61 | 3344. | 2.74 | 3498. | 2.89 | 3675. | 3.07 | 3879. | 3.27 | 4402. | 3.78 |
| | 16500 | 2734. | 2.37 | 2945. | 2.61 | 3072. | 2.73 | 3215. | 2.88 | 3378. | 3.06 | 3567. | 3.26 | 4051. | 3.77 |
| | 12500 | 2530. | 2.36 | 2728. | 2.60 | 2847. | 2.72 | 2981. | 2.88 | 3134. | 3.05 | 3311. | 3.26 | 3765. | 3.77 |
| 1200 | 20000 | 3381. | 2.81 | 3657. | 3.09 | 3823. | 3.24 | 4009. | 3.42 | 4222. | 3.64 | 4469. | 3.89 | 5101. | 4.51 |
| | 16500 | 3100. | 2.79 | 3355. | 3.08 | 3508. | 3.23 | 3680. | 3.42 | 3876. | 3.63 | 4103. | 3.88 | 4686. | 4.50 |
| | 12500 | 2869. | 2.78 | 3107. | 3.07 | 3250. | 3.22 | 3411. | 3.41 | 3594. | 3.62 | 3807. | 3.88 | 4351. | 4.50 |
| 1400 | 20000 | 3783. | 3.23 | 4108. | 3.56 | 4302. | 3.74 | 4520. | 3.96 | 4770. | 4.21 | 5059. | 4.50 | 5799. | 5.24 |
| | 16500 | 3466. | 3.22 | 3765. | 3.55 | 3943. | 3.73 | 4144. | 3.95 | 4373. | 4.20 | 4640. | 4.50 | 5320. | 5.23 |
| | 12500 | 3207. | 3.20 | 3486. | 3.54 | 3652. | 3.72 | 3840. | 3.95 | 4054. | 4.20 | 4303. | 4.49 | 4938. | 5.23 |
| 1600 | 20000 | 4186. | 3.65 | 4558. | 4.03 | 4780. | 4.24 | 5030. | 4.49 | 5317. | 4.78 | 5649. | 5.12 | 6497. | 5.97 |
| | 16500 | 3832. | 3.64 | 4174. | 4.02 | 4378. | 4.23 | 4609. | 4.49 | 4871. | 4.77 | 5176. | 5.11 | 5955. | 5.95 |
| | 12500 | 3546. | 3.62 | 3864. | 4.01 | 4055. | 4.22 | 4270. | 4.48 | 4515. | 4.77 | 4799. | 5.11 | | |
| 1800 | 20000 | 4588. | 4.08 | 5008. | 4.50 | 5259. | 4.74 | 5541. | 5.02 | 5865. | 5.35 | 6239. | 5.73 | 7196. | 6.70 |
| | 16500 | 4199. | 4.06 | 4584. | 4.49 | 4814. | 4.73 | 5073. | 5.02 | 5369. | 5.35 | 5712. | 5.73 | 6590. | 6.68 |
| | 12500 | 3885. | 4.05 | 4243. | 4.48 | 4458. | 4.73 | 4699. | 5.02 | | | | | | |
| 2000 | 20000 | 4991. | 4.50 | 5458. | 4.97 | 5737. | 5.24 | 6052. | 5.56 | 6412. | 5.93 | 6829. | 6.35 | 7894. | 7.43 |
| | 16500 | 4565. | 4.48 | 4993. | 4.97 | 5249. | 5.24 | 5538. | 5.56 | 5867. | 5.92 | 6249. | 6.35 | 7225. | 7.41 |
| | 12500 | 4224. | 4.47 | 4622. | 4.95 | 4860. | 5.23 | | | | | | | | |
| 2100 | 20000 | 5192. | 4.71 | 5684. | 5.20 | 5977. | 5.49 | 6307. | 5.82 | 6686. | 6.21 | 7124. | 6.66 | 8243. | 7.79 |
| | 16500 | 4748. | 4.69 | 5198. | 5.20 | 5466. | 5.49 | 5770. | 5.83 | 6116. | 6.20 | 6517. | 6.65 | 7542. | 7.78 |
| | 12500 | 4393. | 4.68 | 4811. | 5.19 | | | | | | | | | | |
| 2200 | 20000 | 5394. | 4.92 | 5909. | 5.44 | 6216. | 5.74 | 6563. | 6.09 | 6960. | 6.50 | 7419. | 6.97 | 8592. | 8.16 |
| | 16500 | 4931. | 4.90 | 5403. | 5.44 | 5684. | 5.74 | 6002. | 6.09 | 6365. | 6.49 | 6785. | 6.96 | 7859. | 8.14 |
| | 12500 | 4563. | 4.89 | | | | | | | | | | | | |
| 2300 | 20000 | 5595. | 5.13 | 6134. | 5.68 | 6455. | 5.99 | 6818. | 6.36 | 7234. | 6.78 | 7714. | 7.28 | | |
| | 16500 | 5114. | 5.11 | 5607. | 5.67 | 5902. | 5.99 | 6234. | 6.36 | 6614. | 6.78 | 7054. | 7.27 | | |
| | 12500 | 4732. | 5.10 | | | | | | | | | | | | |
| 2400 | 20000 | 5796. | 5.34 | 6359. | 5.91 | 6695. | 6.24 | 7073. | 6.62 | 7507. | 7.07 | | | | |
| | 16500 | 5297. | 5.32 | 5812. | 5.91 | 6119. | 6.24 | 6467. | 6.63 | 6863. | 7.06 | | | | |
| | 12500 | 4901. | 5.31 | | | | | | | | | | | | |
| 2500 | 20000 | 5998. | 5.55 | 6584. | 6.15 | 6934. | 6.49 | 7329. | 6.89 | 7781. | 7.36 | | | | |
| | 16500 | 5480. | 5.53 | 6017. | 6.15 | 6337. | 6.49 | 6699. | 6.90 | 7111. | 7.35 | | | | |
| | 12500 | 5071. | 5.52 | | | | | | | | | | | | |
| 2600 | 20000 | 6199. | 5.76 | 6809. | 6.38 | 7173. | 6.74 | 7584. | 7.16 | | | | | | |
| | 16500 | 5663. | 5.74 | 6222. | 6.38 | 6555. | 6.74 | 6931. | 7.16 | | | | | | |
| | 12500 | 5240. | 5.73 | | | | | | | | | | | | |
| 2700 | 20000 | 6400. | 5.97 | 7034. | 6.62 | 7413. | 6.99 | 7839. | 7.42 | | | | | | |
| | 16500 | 5846. | 5.96 | 6426. | 6.62 | 6772. | 6.99 | 7163. | 7.43 | | | | | | |
| | 12500 | 5410. | 5.94 | | | | | | | | | | | | |
| 2800 | 20000 | 6601. | 6.19 | 7260. | 6.85 | 7652. | 7.24 | | | | | | | | |
| | 16500 | 6030. | 6.17 | 6631. | 6.85 | 6990. | 7.24 | | | | | | | | |
| | 12500 | 5579. | 6.15 | | | | | | | | | | | | |
| 2900 | 20000 | 6803. | 6.40 | 7485. | 7.09 | | | | | | | | | | |
| | 16500 | 6213. | 6.38 | 6836. | 7.09 | | | | | | | | | | |
| | 12500 | 5748. | 6.36 | | | | | | | | | | | | |

Figure 7-8 (Sheet 8)

# FLIGHT PLANNING
## NORMAL CRUISE THRUST
## CRUISE (0.65 MACH)

**STANDARD DAY** **CRUISE ALTITUDE 43000 FEET**

| | | TAILWIND | | | | | | ZERO WIND | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE LENGTH NM. | T.O. WEIGHT LBS. | 100 KT. FUEL LBS. | 100 KT. TIME HRS. | 50 KT. FUEL LBS. | 50 KT. TIME HRS. | 25 KT. FUEL LBS. | 25 KT. TIME HRS. | FUEL LBS. | TIME HRS. | 25 KT. FUEL LBS. | 25 KT. TIME HRS. | 50 KT. FUEL LBS. | 50 KT. TIME HRS. | 100 KT. FUEL LBS. | 100 KT. TIME HRS. |
| 200 | 20000 | 1407. | 0.71 | 1442. | 0.74 | 1464. | 0.74 | 1487. | 0.76 | 1514. | 0.78 | 1545. | 0.80 | 1628. | 0.85 |
| | 16500 | 1292. | 0.69 | 1328. | 0.72 | 1350. | 0.73 | 1374. | 0.75 | 1402. | 0.77 | 1434. | 0.79 | 1519. | 0.85 |
| | 12500 | 1187. | 0.68 | 1223. | 0.71 | 1245. | 0.71 | 1269. | 0.74 | 1296. | 0.76 | 1329. | 0.79 | 1414. | 0.85 |
| 400 | 20000 | 1799. | 1.13 | 1880. | 1.21 | 1929. | 1.24 | 1984. | 1.29 | 2046. | 1.35 | 2119. | 1.42 | 2307. | 1.58 |
| | 16500 | 1637. | 1.11 | 1714. | 1.19 | 1760. | 1.23 | 1812. | 1.28 | 1871. | 1.34 | 1939. | 1.41 | 2116. | 1.58 |
| | 12500 | 1500. | 1.10 | 1573. | 1.18 | 1618. | 1.22 | 1667. | 1.27 | 1723. | 1.33 | 1788. | 1.40 | 1957. | 1.58 |
| 600 | 20000 | 2190. | 1.55 | 2318. | 1.68 | 2395. | 1.74 | 2481. | 1.83 | 2579. | 1.92 | 2693. | 2.03 | 2987. | 2.31 |
| | 16500 | 1982. | 1.53 | 2099. | 1.66 | 2170. | 1.73 | 2249. | 1.81 | 2339. | 1.91 | 2444. | 2.03 | 2714. | 2.31 |
| | 12500 | 1814. | 1.52 | 1924. | 1.65 | 1991. | 1.72 | 2065. | 1.81 | 2149. | 1.91 | 2248. | 2.02 | 2501. | 2.31 |
| 800 | 20000 | 2582. | 1.98 | 2756. | 2.15 | 2861. | 2.24 | 2978. | 2.36 | 3112. | 2.50 | 3267. | 2.65 | 3666. | 3.03 |
| | 16500 | 2327. | 1.96 | 2485. | 2.13 | 2580. | 2.23 | 2686. | 2.35 | 2808. | 2.49 | 2949. | 2.64 | 3312. | 3.04 |
| | 12500 | 2128. | 1.94 | 2275. | 2.12 | 2363. | 2.22 | 2462. | 2.34 | 2576. | 2.48 | 2707. | 2.64 | 3044. | 3.04 |
| 1000 | 20000 | 2974. | 2.40 | 3194. | 2.62 | 3326. | 2.74 | 3475. | 2.89 | 3645. | 3.07 | 3841. | 3.27 | 4346. | 3.76 |
| | 16500 | 2671. | 2.38 | 2870. | 2.60 | 2990. | 2.73 | 3124. | 2.88 | 3277. | 3.06 | 3454. | 3.26 | 3909. | 3.77 |
| | 12500 | 2442. | 2.36 | 2626. | 2.60 | 2736. | 2.72 | 2860. | 2.88 | 3002. | 3.05 | 3166. | 3.26 | 3588. | 3.77 |
| 1200 | 20000 | 3365. | 2.82 | 3632. | 3.09 | 3792. | 3.24 | 3972. | 3.43 | 4177. | 3.64 | 4415. | 3.88 | 5026. | 4.49 |
| | 16500 | 3016. | 2.80 | 3256. | 3.08 | 3399. | 3.23 | 3561. | 3.41 | 3745. | 3.63 | 3959. | 3.88 | 4507. | 4.50 |
| | 12500 | 2755. | 2.79 | 2977. | 3.07 | 3109. | 3.22 | 3258. | 3.41 | 3428. | 3.62 | 3626. | 3.87 | 4131. | 4.50 |
| 1400 | 20000 | 3757. | 3.24 | 4070. | 3.56 | 4258. | 3.74 | 4468. | 3.96 | 4710. | 4.21 | 4989. | 4.50 | 5705. | 5.22 |
| | 16500 | 3361. | 3.22 | 3641. | 3.55 | 3809. | 3.73 | 3998. | 3.95 | 4214. | 4.20 | 4464. | 4.50 | 5105. | 5.23 |
| | 12500 | 3069. | 3.21 | 3327. | 3.54 | 3482. | 3.72 | 3656. | 3.95 | 3855. | 4.20 | 4085. | 4.49 | 4675. | 5.23 |
| 1600 | 20000 | 4148. | 3.66 | 4508. | 4.03 | 4723. | 4.24 | 4965. | 4.49 | 5243. | 4.78 | 5563. | 5.12 | 6385. | 5.95 |
| | 16500 | 3706. | 3.64 | 4027. | 4.02 | 4219. | 4.23 | 4436. | 4.48 | 4683. | 4.78 | 4969. | 5.11 | 5702. | 5.96 |
| | 12500 | 3383. | 3.63 | 3678. | 4.01 | 3855. | 4.22 | 4054. | 4.48 | 4281. | 4.77 | 4544. | 5.11 | | |
| 1800 | 20000 | 4540. | 4.09 | 4946. | 4.50 | 5189. | 4.74 | 5462. | 5.03 | 5775. | 5.36 | 6137. | 5.74 | 7064. | 6.67 |
| | 16500 | 4051. | 4.06 | 4412. | 4.49 | 4629. | 4.73 | 4873. | 5.02 | 5151. | 5.35 | 5474. | 5.73 | 6300. | 6.68 |
| | 12500 | 3696. | 4.05 | 4029. | 4.48 | 4227. | 4.72 | 4452. | 5.01 | 4708. | 5.34 | | | | |
| 2000 | 20000 | 4932. | 4.51 | 5384. | 4.98 | 5655. | 5.24 | 5959. | 5.56 | 6308. | 5.93 | 6711. | 6.35 | 7744. | 7.40 |
| | 16500 | 4395. | 4.48 | 4798. | 4.96 | 5038. | 5.23 | 5310. | 5.55 | 5620. | 5.92 | 5979. | 6.35 | 6898. | 7.41 |
| | 12500 | 4010. | 4.47 | 4380. | 4.95 | 4600. | 5.22 | 4849. | 5.55 | | | | | | |
| 2100 | 20000 | 5128. | 4.72 | 5603. | 5.21 | 5887. | 5.49 | 6208. | 5.83 | 6575. | 6.21 | 6998. | 6.66 | 8084. | 7.77 |
| | 16500 | 4568. | 4.69 | 4990. | 5.19 | 5243. | 5.48 | 5529. | 5.82 | 5854. | 6.21 | 6232. | 6.66 | 7197. | 7.78 |
| | 12500 | 4167. | 4.69 | 4555. | 5.19 | | | | | | | | | | |
| 2200 | 20000 | 5323. | 4.93 | 5822. | 5.45 | 6120. | 5.74 | 6456. | 6.10 | 6841. | 6.50 | 7285. | 6.97 | 8424. | 8.13 |
| | 16500 | 4740. | 4.91 | 5183. | 5.43 | 5448. | 5.73 | 5747. | 6.08 | 6089. | 6.49 | 6484. | 6.97 | 7495. | 8.14 |
| | 12500 | 4324. | 4.90 | 4731. | 5.42 | | | | | | | | | | |
| 2300 | 20000 | 5519. | 5.14 | 6041. | 5.68 | 6353. | 5.99 | 6704. | 6.36 | 7107. | 6.79 | 7572. | 7.28 | 8763. | 8.49 |
| | 16500 | 4913. | 5.12 | 5376. | 5.66 | 5653. | 5.98 | 5966. | 6.35 | 6323. | 6.78 | 6737. | 7.27 | 7794. | 8.51 |
| | 12500 | 4481. | 5.11 | 4906. | 5.66 | | | | | | | | | | |
| 2400 | 20000 | 5715. | 5.35 | 6260. | 5.92 | 6586. | 6.24 | 6953. | 6.63 | 7374. | 7.07 | 7859. | 7.59 | | |
| | 16500 | 5085. | 5.33 | 5569. | 5.90 | 5858. | 6.23 | 6185. | 6.62 | 6557. | 7.06 | 6989. | 7.58 | | |
| | 12500 | 4638. | 5.32 | | | | | | | | | | | | |
| 2500 | 20000 | 5911. | 5.56 | 6479. | 6.15 | 6819. | 6.49 | 7201. | 6.90 | 7640. | 7.36 | | | | |
| | 16500 | 5257. | 5.54 | 5762. | 6.13 | 6063. | 6.48 | 6403. | 6.88 | 6792. | 7.35 | | | | |
| | 12500 | 4794. | 5.53 | | | | | | | | | | | | |
| 2600 | 20000 | 6107. | 5.77 | 6698. | 6.39 | 7052. | 6.74 | 7450. | 7.16 | 7906. | 7.64 | | | | |
| | 16500 | 5430. | 5.75 | 5954. | 6.37 | 6268. | 6.73 | 6622. | 7.15 | 7026. | 7.64 | | | | |
| | 12500 | 4951. | 5.74 | | | | | | | | | | | | |
| 2700 | 20000 | 6302. | 5.98 | 6917. | 6.62 | 7284. | 6.99 | 7698. | 7.43 | | | | | | |
| | 16500 | 5602. | 5.96 | 6147. | 6.61 | 6473. | 6.98 | 6841. | 7.42 | | | | | | |
| | 12500 | 5108. | 5.95 | | | | | | | | | | | | |
| 2800 | 20000 | 6498. | 6.19 | 7136. | 6.86 | 7517. | 7.24 | 7947. | 7.70 | | | | | | |
| | 16500 | 5775. | 6.17 | 6340. | 6.84 | 6677. | 7.23 | 7059. | 7.68 | | | | | | |
| | 12500 | 5265. | 6.16 | | | | | | | | | | | | |
| 2900 | 20000 | 6694. | 6.41 | 7355. | 7.09 | 7750. | 7.49 | | | | | | | | |
| | 16500 | 5947. | 6.38 | 6533. | 7.08 | 6882. | 7.48 | | | | | | | | |
| | 12500 | 5422. | 6.37 | | | | | | | | | | | | |
| 3000 | 20000 | 6890. | 6.62 | 7574. | 7.33 | 7983. | 7.74 | | | | | | | | |
| | 16500 | 6119. | 6.59 | 6725. | 7.31 | 7087. | 7.73 | | | | | | | | |
| | 12500 | 5579. | 6.58 | | | | | | | | | | | | |

Figure 7-8 (Sheet 9)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 19000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| CRUISE WEIGHT LBS. | TAILWIND 100 KT. N1 PCT | TAILWIND 50 KT. N1 PCT | TAILWIND 25 KT. N1 PCT | ZERO WIND N1 PCT | HEADWIND 25 KT. N1 PCT | HEADWIND 50 KT. N1 PCT | HEADWIND 100 KT. N1 PCT |
|---|---|---|---|---|---|---|---|
| 20000 | 69.7 | 71.9 | 73.6 | 73.7 | 73.9 | 74.0 | 75.5 |
| 18000 | 68.5 | 69.8 | 70.3 | 71.3 | 72.5 | 73.0 | 74.3 |
| 16000 | 66.6 | 67.4 | 67.5 | 69.2 | 70.8 | 71.9 | 73.3 |
| 14000 | 63.7 | 64.7 | 65.5 | 67.2 | 69.0 | 70.5 | 72.3 |
| 12000 | 60.1 | 61.7 | 64.2 | 65.3 | 67.0 | 69.0 | 71.5 |

| STAGE LENGTH NM. | T.O. WEIGHT LBS. | TAILWIND 100 KT. FUEL LBS. | TAILWIND 100 KT. TIME HRS. | TAILWIND 50 KT. FUEL LBS. | TAILWIND 50 KT. TIME HRS. | TAILWIND 25 KT. FUEL LBS. | TAILWIND 25 KT. TIME HRS. | ZERO WIND FUEL LBS. | ZERO WIND TIME HRS. | HEADWIND 25 KT. FUEL LBS. | HEADWIND 25 KT. TIME HRS. | HEADWIND 50 KT. FUEL LBS. | HEADWIND 50 KT. TIME HRS. | HEADWIND 100 KT. FUEL LBS. | HEADWIND 100 KT. TIME HRS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 20000 | 1152. | 0.73 | 1236. | 0.79 | 1288. | 0.80 | 1348. | 0.84 | 1417. | 0.88 | 1498. | 0.93 | 1716. | 1.05 |
| | 16500 | 1089. | 0.74 | 1171. | 0.81 | 1224. | 0.83 | 1283. | 0.87 | 1354. | 0.91 | 1437. | 0.95 | 1654. | 1.07 |
| | 12500 | 1025. | 0.75 | 1105. | 0.84 | 1157. | 0.85 | 1216. | 0.90 | 1286. | 0.94 | 1371. | 0.98 | 1592. | 1.08 |
| 400 | 20000 | 1698. | 1.29 | 1877. | 1.42 | 1988. | 1.47 | 2116. | 1.54 | 2266. | 1.60 | 2439. | 1.71 | 2892. | 1.98 |
| | 16500 | 1590. | 1.33 | 1762. | 1.49 | 1873. | 1.55 | 2001. | 1.62 | 2152. | 1.69 | 2328. | 1.76 | 2783. | 2.02 |
| | 12500 | 1479. | 1.44 | 1658. | 1.58 | 1774. | 1.55 | 1890. | 1.67 | 2036. | 1.78 | 2215. | 1.85 | 2677. | 2.05 |
| 600 | 20000 | 2244. | 1.86 | 2517. | 2.05 | 2687. | 2.14 | 2885. | 2.24 | 3114. | 2.32 | 3380. | 2.49 | 4068. | 2.91 |
| | 16500 | 2090. | 1.93 | 2352. | 2.16 | 2521. | 2.26 | 2719. | 2.36 | 2950. | 2.47 | 3219. | 2.58 | 3912. | 2.97 |
| | 12500 | 1933. | 2.13 | 2212. | 2.32 | 2390. | 2.25 | 2564. | 2.44 | 2785. | 2.61 | 3059. | 2.71 | 3762. | 3.02 |
| 800 | 20000 | 2790. | 2.42 | 3158. | 2.68 | 3387. | 2.81 | 3653. | 2.93 | 3963. | 3.05 | 4321. | 3.27 | 5244. | 3.85 |
| | 16500 | 2590. | 2.52 | 2943. | 2.84 | 3170. | 2.97 | 3436. | 3.11 | 3748. | 3.25 | 4110. | 3.40 | 5041. | 3.93 |
| | 12500 | 2387. | 2.82 | 2766. | 3.06 | 3006. | 2.95 | 3239. | 3.21 | 3535. | 3.45 | 3903. | 3.58 | 4847. | 3.99 |
| 1000 | 20000 | 3336. | 2.98 | 3799. | 3.31 | 4086. | 3.48 | 4422. | 3.63 | 4811. | 3.77 | 5262. | 4.04 | 6420. | 4.78 |
| | 16500 | 3090. | 3.11 | 3533. | 3.51 | 3819. | 3.69 | 4154. | 3.86 | 4546. | 4.03 | 5000. | 4.21 | 6169. | 4.88 |
| | 12500 | 2841. | 3.51 | 3319. | 3.80 | 3623. | 3.65 | 3913. | 3.99 | 4285. | 4.29 | 4747. | 4.45 | | |
| 1200 | 20000 | 3882. | 3.55 | 4440. | 3.95 | 4786. | 4.15 | 5190. | 4.33 | 5660. | 4.49 | 6203. | 4.82 | 7596. | 5.71 |
| | 16500 | 3591. | 3.70 | 4123. | 4.19 | 4468. | 4.40 | 4871. | 4.61 | 5344. | 4.81 | 5891. | 5.03 | 7298. | 5.84 |
| | 12500 | 3294. | 4.20 | 3873. | 4.54 | 4239. | 4.35 | 4587. | 4.76 | 5034. | 5.12 | | | | |
| 1400 | 20000 | 4428. | 4.11 | 5081. | 4.58 | 5485. | 4.82 | 5959. | 5.03 | 6509. | 5.21 | 7144. | 5.60 | 8772. | 6.64 |
| | 16500 | 4091. | 4.29 | 4714. | 4.86 | 5117. | 5.12 | 5589. | 5.35 | 6142. | 5.59 | 6782. | 5.85 | 8427. | 6.79 |
| | 12500 | 3748. | 4.88 | 4427. | 5.28 | 4855. | 5.04 | | | | | | | | |
| 1600 | 20000 | 4974. | 4.68 | 5722. | 5.21 | 6185. | 5.49 | 6727. | 5.73 | 7357. | 5.94 | 8085. | 6.38 | | |
| | 16500 | 4591. | 4.88 | 5304. | 5.54 | 5765. | 5.83 | 6306. | 6.10 | 6940. | 6.38 | 7673. | 6.67 | | |
| | 12500 | 4202. | 5.57 | 4980. | 6.02 | | | | | | | | | | |
| 1800 | 20000 | 5520. | 5.24 | 6363. | 5.84 | 6885. | 6.16 | 7496. | 6.42 | | | | | | |
| | 16500 | 5091. | 5.47 | 5895. | 6.22 | 6414. | 6.54 | 7024. | 6.85 | | | | | | |
| | 12500 | 4656. | 6.26 | | | | | | | | | | | | |
| 2000 | 20000 | 6066. | 5.80 | 7004. | 6.48 | 7584. | 6.82 | | | | | | | | |
| | 16500 | 5591. | 6.06 | 6485. | 6.89 | 7063. | 7.26 | | | | | | | | |
| | 12500 | 5110. | 6.95 | | | | | | | | | | | | |
| 2200 | 20000 | 6612. | 6.37 | 7645. | 7.11 | | | | | | | | | | |
| | 16500 | 6092. | 6.65 | 7075. | 7.57 | | | | | | | | | | |
| | 12500 | 5564. | 7.64 | | | | | | | | | | | | |
| 2400 | 20000 | 7158. | 6.93 | 8286. | 7.74 | | | | | | | | | | |
| | 16500 | 6592. | 7.24 | 7666. | 8.24 | | | | | | | | | | |
| | 12500 | 6017. | 8.33 | | | | | | | | | | | | |

Figure 7-9 (Sheet 1 of 11)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 23000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| CRUISE WEIGHT LBS. | TAILWIND 100 KT. N1 PCT | TAILWIND 50 KT. N1 PCT | TAILWIND 25 KT. N1 PCT | ZERO WIND N1 PCT | HEADWIND 25 KT. N1 PCT | HEADWIND 50 KT. N1 PCT | HEADWIND 100 KT. N1 PCT |
|---|---|---|---|---|---|---|---|
| 20000 | 73.9 | 74.3 | 74.3 | 74.4 | 74.5 | 75.4 | 78.1 |
| 18000 | 70.7 | 71.8 | 72.5 | 73.0 | 73.4 | 73.9 | 75.9 |
| 16000 | 67.9 | 69.3 | 70.5 | 71.2 | 72.0 | 72.5 | 74.0 |
| 14000 | 65.3 | 66.9 | 68.2 | 69.1 | 70.3 | 71.0 | 72.4 |
| 12000 | 63.1 | 64.5 | 65.7 | 66.7 | 68.2 | 69.7 | 71.2 |

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1180. | 0.70 | 1250. | 0.76 | 1294. | 0.78 | 1343. | 0.82 | 1400. | 0.87 | 1469. | 0.91 | 1656. | 1.01 |
| | 16500 | 1116. | 0.72 | 1185. | 0.78 | 1229. | 0.79 | 1278. | 0.83 | 1336. | 0.87 | 1404. | 0.92 | 1588. | 1.04 |
| | 12500 | 1040. | 0.75 | 1110. | 0.81 | 1154. | 0.83 | 1203. | 0.87 | 1262. | 0.91 | 1332. | 0.94 | 1517. | 1.06 |
| 400 | 20000 | 1682. | 1.24 | 1835. | 1.36 | 1930. | 1.40 | 2038. | 1.49 | 2162. | 1.58 | 2308. | 1.69 | 2708. | 1.91 |
| | 16500 | 1568. | 1.30 | 1718. | 1.42 | 1812. | 1.48 | 1920. | 1.56 | 2047. | 1.63 | 2197. | 1.72 | 2586. | 2.00 |
| | 12500 | 1453. | 1.33 | 1596. | 1.48 | 1687. | 1.56 | 1793. | 1.65 | 1919. | 1.74 | 2072. | 1.80 | 2466. | 2.04 |
| 600 | 20000 | 2184. | 1.79 | 2421. | 1.95 | 2567. | 2.02 | 2733. | 2.15 | 2923. | 2.30 | 3146. | 2.48 | 3761. | 2.82 |
| | 16500 | 2020. | 1.88 | 2251. | 2.07 | 2395. | 2.17 | 2562. | 2.28 | 2759. | 2.38 | 2989. | 2.52 | 3583. | 2.95 |
| | 12500 | 1865. | 1.92 | 2083. | 2.15 | 2220. | 2.28 | 2382. | 2.43 | 2577. | 2.56 | 2812. | 2.65 | 3415. | 3.02 |
| 800 | 20000 | 2686. | 2.33 | 3006. | 2.55 | 3203. | 2.64 | 3428. | 2.81 | 3685. | 3.02 | 3985. | 3.26 | 4813. | 3.72 |
| | 16500 | 2471. | 2.46 | 2784. | 2.72 | 2979. | 2.85 | 3204. | 3.01 | 3470. | 3.14 | 3782. | 3.31 | 4580. | 3.91 |
| | 12500 | 2278. | 2.50 | 2570. | 2.83 | 2753. | 3.01 | 2971. | 3.21 | 3234. | 3.39 | 3552. | 3.51 | 4364. | 4.00 |
| 1000 | 20000 | 3189. | 2.87 | 3592. | 3.15 | 3840. | 3.26 | 4122. | 3.48 | 4446. | 3.73 | 4824. | 4.04 | 5865. | 4.63 |
| | 16500 | 2923. | 3.04 | 3317. | 3.37 | 3562. | 3.54 | 3846. | 3.74 | 4182. | 3.89 | 4574. | 4.11 | 5578. | 4.87 |
| | 12500 | 2690. | 3.09 | 3057. | 3.50 | 3286. | 3.74 | 3560. | 4.00 | 3891. | 4.22 | 4291. | 4.36 | 5313. | 4.98 |
| 1200 | 20000 | 3691. | 3.41 | 4177. | 3.74 | 4476. | 3.89 | 4817. | 4.14 | 5208. | 4.45 | 5662. | 4.82 | 6917. | 5.53 |
| | 16500 | 3375. | 3.62 | 3850. | 4.02 | 4146. | 4.23 | 4488. | 4.46 | 4893. | 4.64 | 5367. | 4.91 | 6575. | 5.83 |
| | 12500 | 3103. | 3.68 | 3544. | 4.17 | 3818. | 4.47 | 4149. | 4.78 | 4549. | 5.04 | 5031. | 5.21 | | |
| 1400 | 20000 | 4193. | 3.95 | 4762. | 4.34 | 5113. | 4.51 | 5512. | 4.81 | 5970. | 5.17 | 6501. | 5.60 | 7969. | 6.44 |
| | 16500 | 3827. | 4.20 | 4383. | 4.66 | 4729. | 4.91 | 5130. | 5.19 | 5605. | 5.40 | 6159. | 5.70 | 7573. | 6.78 |
| | 12500 | 3515. | 4.26 | 4031. | 4.84 | 4351. | 5.20 | 4739. | 5.56 | | | | | | |
| 1600 | 20000 | 4695. | 4.49 | 5348. | 4.93 | 5749. | 5.13 | 6207. | 5.47 | 6731. | 5.88 | 7340. | 6.38 | | |
| | 16500 | 4278. | 4.77 | 4916. | 5.31 | 5312. | 5.60 | 5772. | 5.91 | 6316. | 6.15 | 6952. | 6.50 | | |
| | 12500 | 3928. | 4.85 | 4517. | 5.51 | 4884. | 5.93 | | | | | | | | |
| 1800 | 20000 | 5197. | 5.03 | 5933. | 5.53 | 6386. | 5.75 | 6902. | 6.14 | 7493. | 6.60 | | | | |
| | 16500 | 4730. | 5.35 | 5449. | 5.96 | 5896. | 6.28 | 6414. | 6.64 | 7028. | 6.90 | | | | |
| | 12500 | 4340. | 5.43 | 5004. | 6.19 | | | | | | | | | | |
| 2000 | 20000 | 5699. | 5.57 | 6519. | 6.13 | 7022. | 6.37 | 7597. | 6.80 | | | | | | |
| | 16500 | 5182. | 5.93 | 5982. | 6.61 | 6479. | 6.97 | 7056. | 7.37 | | | | | | |
| | 12500 | 4752. | 6.02 | | | | | | | | | | | | |
| 2200 | 20000 | 6201. | 6.11 | 7104. | 6.72 | 7659. | 6.99 | | | | | | | | |
| | 16500 | 5633. | 6.51 | 6515. | 7.25 | 7062. | 7.66 | | | | | | | | |
| | 12500 | 5165. | 6.60 | | | | | | | | | | | | |
| 2400 | 20000 | 6703. | 6.65 | 7689. | 7.32 | | | | | | | | | | |
| | 16500 | 6085. | 7.09 | 7048. | 7.90 | | | | | | | | | | |
| | 12500 | 5577. | 7.19 | | | | | | | | | | | | |
| 2600 | 20000 | 7205. | 7.20 | 8275. | 7.91 | | | | | | | | | | |
| | 16500 | 6537. | 7.67 | 7581. | 8.55 | | | | | | | | | | |
| | 12500 | 5990. | 7.77 | | | | | | | | | | | | |

Figure 7-9 (Sheet 2)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 27000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| | TAILWIND | | | ZERO | HEADWIND | | |
|---|---|---|---|---|---|---|---|
| CRUISE | 100 KT. | 50 KT. | 25 KT. | WIND | 25 KT. | 50 KT. | 100 KT. |
| WEIGHT LBS. | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT |
| 20000 | 75.1 | 75.2 | 75.4 | 75.7 | 76.6 | 77.2 | 79.6 |
| 18000 | 73.1 | 73.7 | 74.1 | 74.3 | 74.9 | 75.4 | 77.6 |
| 16000 | 70.8 | 71.7 | 72.3 | 72.7 | 73.1 | 73.6 | 75.7 |
| 14000 | 68.2 | 69.3 | 70.1 | 70.7 | 71.2 | 71.8 | 73.8 |
| 12000 | 65.2 | 66.4 | 67.4 | 68.3 | 69.2 | 70.2 | 71.9 |

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1219. | 0.70 | 1278. | 0.75 | 1315. | 0.77 | 1358. | 0.80 | 1407. | 0.84 | 1465. | 0.88 | 1622. | 0.97 |
| | 16500 | 1155. | 0.69 | 1211. | 0.75 | 1248. | 0.77 | 1288. | 0.81 | 1335. | 0.85 | 1393. | 0.89 | 1550. | 0.99 |
| | 12500 | 1077. | 0.72 | 1134. | 0.77 | 1170. | 0.79 | 1211. | 0.82 | 1259. | 0.86 | 1317. | 0.91 | 1471. | 1.03 |
| 400 | 20000 | 1680. | 1.21 | 1810. | 1.33 | 1890. | 1.38 | 1982. | 1.46 | 2090. | 1.55 | 2218. | 1.65 | 2566. | 1.84 |
| | 16500 | 1568. | 1.25 | 1696. | 1.36 | 1775. | 1.41 | 1866. | 1.49 | 1972. | 1.58 | 2096. | 1.69 | 2436. | 1.93 |
| | 12500 | 1439. | 1.31 | 1562. | 1.45 | 1641. | 1.51 | 1732. | 1.59 | 1839. | 1.67 | 1966. | 1.75 | 2300. | 2.02 |
| 600 | 20000 | 2141. | 1.72 | 2342. | 1.90 | 2465. | 2.00 | 2606. | 2.13 | 2773. | 2.27 | 2972. | 2.42 | 3509. | 2.71 |
| | 16500 | 1981. | 1.81 | 2180. | 1.98 | 2303. | 2.06 | 2445. | 2.17 | 2608. | 2.32 | 2799. | 2.49 | 3323. | 2.87 |
| | 12500 | 1800. | 1.91 | 1989. | 2.13 | 2111. | 2.23 | 2252. | 2.35 | 2418. | 2.47 | 2616. | 2.59 | 3129. | 3.02 |
| 800 | 20000 | 2601. | 2.23 | 2874. | 2.48 | 3040. | 2.61 | 3231. | 2.79 | 3456. | 2.99 | 3725. | 3.19 | 4452. | 3.59 |
| | 16500 | 2394. | 2.36 | 2664. | 2.60 | 2831. | 2.71 | 3024. | 2.85 | 3245. | 3.05 | 3502. | 3.29 | 4209. | 3.81 |
| | 12500 | 2162. | 2.50 | 2417. | 2.81 | 2581. | 2.95 | 2772. | 3.11 | 2998. | 3.28 | 3265. | 3.43 | 3958. | 4.02 |
| 1000 | 20000 | 3062. | 2.73 | 3407. | 3.05 | 3615. | 3.23 | 3855. | 3.46 | 4139. | 3.70 | 4479. | 3.97 | 5396. | 4.46 |
| | 16500 | 2807. | 2.92 | 3148. | 3.22 | 3359. | 3.36 | 3603. | 3.53 | 3881. | 3.78 | 4205. | 4.09 | 5096. | 4.75 |
| | 12500 | 2524. | 3.10 | 2845. | 3.49 | 3052. | 3.67 | 3292. | 3.88 | 3578. | 4.08 | 3915. | 4.27 | 4787. | 5.02 |
| 1200 | 20000 | 3523. | 3.24 | 3939. | 3.63 | 4190. | 3.85 | 4480. | 4.12 | 4822. | 4.42 | 5232. | 4.74 | 6339. | 5.34 |
| | 16500 | 3220. | 3.48 | 3632. | 3.84 | 3887. | 4.00 | 4181. | 4.21 | 4518. | 4.51 | 4908. | 4.89 | 5983. | 5.70 |
| | 12500 | 2885. | 3.69 | 3272. | 4.17 | 3522. | 4.40 | 3812. | 4.64 | 4157. | 4.89 | 4565. | 5.11 | | |
| 1400 | 20000 | 3984. | 3.75 | 4471. | 4.20 | 4765. | 4.46 | 5104. | 4.79 | 5505. | 5.14 | 5985. | 5.51 | 7282. | 6.21 |
| | 16500 | 3632. | 4.04 | 4116. | 4.46 | 4415. | 4.65 | 4760. | 4.89 | 5155. | 5.24 | 5611. | 5.69 | 6869. | 6.64 |
| | 12500 | 3247. | 4.29 | 3700. | 4.84 | 3992. | 5.12 | 4332. | 5.40 | 4737. | 5.69 | | | | |
| 1600 | 20000 | 4445. | 4.26 | 5003. | 4.78 | 5340. | 5.08 | 5729. | 5.45 | 6188. | 5.85 | 6739. | 6.28 | 8226. | 7.09 |
| | 16500 | 4045. | 4.60 | 4600. | 5.08 | 4943. | 5.30 | 5339. | 5.56 | 5791. | 5.98 | 6314. | 6.49 | 7756. | 7.58 |
| | 12500 | 3608. | 4.88 | 4128. | 5.52 | 4462. | 5.84 | 4852. | 6.17 | | | | | | |
| 1800 | 20000 | 4906. | 4.77 | 5536. | 5.35 | 5915. | 5.69 | 6353. | 6.12 | 6871. | 6.57 | 7492. | 7.05 | | |
| | 16500 | 4458. | 5.16 | 5085. | 5.70 | 5471. | 5.95 | 5917. | 6.24 | 6428. | 6.71 | 7017. | 7.28 | | |
| | 12500 | 3970. | 5.48 | 4555. | 6.20 | 4933. | 6.56 | | | | | | | | |
| 2000 | 20000 | 5366. | 5.28 | 6068. | 5.93 | 6490. | 6.31 | 6977. | 6.78 | 7554. | 7.29 | | | | |
| | 16500 | 4871. | 5.71 | 5569. | 6.31 | 5999. | 6.59 | 6496. | 6.92 | 7064. | 7.44 | | | | |
| | 12500 | 4332. | 6.07 | 4983. | 6.88 | | | | | | | | | | |
| 2200 | 20000 | 5827. | 5.79 | 6600. | 6.50 | 7065. | 6.93 | 7602. | 7.45 | | | | | | |
| | 16500 | 5284. | 6.27 | 6053. | 6.93 | 6527. | 7.24 | 7075. | 7.60 | | | | | | |
| | 12500 | 4693. | 6.67 | | | | | | | | | | | | |
| 2400 | 20000 | 6288. | 6.30 | 7132. | 7.08 | 7640. | 7.54 | | | | | | | | |
| | 16500 | 5697. | 6.83 | 6537. | 7.55 | 7055. | 7.89 | | | | | | | | |
| | 12500 | 5055. | 7.26 | | | | | | | | | | | | |
| 2600 | 20000 | 6749. | 6.81 | 7664. | 7.65 | | | | | | | | | | |
| | 16500 | 6110. | 7.39 | 7021. | 8.17 | | | | | | | | | | |
| | 12500 | 5416. | 7.86 | | | | | | | | | | | | |
| 2800 | 20000 | 7210. | 7.32 | 8197. | 8.23 | | | | | | | | | | |
| | 16500 | 6523. | 7.95 | 7505. | 8.79 | | | | | | | | | | |
| | 12500 | 5778. | 8.46 | | | | | | | | | | | | |

Figure 7-9 (Sheet 3)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 31000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| | TRAILWIND | | | ZERO | HEADWIND | | |
|---|---|---|---|---|---|---|---|
| CRUISE | 100 KT. | 50 KT. | 25 KT. | WIND | 25 KT. | 50 KT. | 100 KT. |
| WEIGHT LBS. | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT |
| 20000 | 76.4 | 77.1 | 77.2 | 78.6 | 80.0 | 81.2 | 82.0 |
| 18000 | 74.9 | 75.6 | 75.9 | 76.5 | 77.2 | 78.1 | 79.9 |
| 16000 | 73.0 | 73.6 | 74.2 | 74.3 | 74.7 | 75.3 | 77.8 |
| 14000 | 70.6 | 71.3 | 72.0 | 72.1 | 72.4 | 73.0 | 75.7 |
| 12000 | 67.6 | 68.6 | 69.3 | 69.6 | 70.3 | 71.1 | 73.5 |

| | | TRAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1269. | 0.69 | 1320. | 0.74 | 1352. | 0.75 | 1388. | 0.78 | 1430. | 0.81 | 1479. | 0.84 | 1610. | 0.92 |
| | 16500 | 1194. | 0.69 | 1242. | 0.74 | 1273. | 0.75 | 1309. | 0.78 | 1350. | 0.82 | 1398. | 0.86 | 1530. | 0.94 |
| | 12500 | 1119. | 0.68 | 1165. | 0.73 | 1195. | 0.74 | 1228. | 0.78 | 1267. | 0.83 | 1314. | 0.88 | 1446. | 0.97 |
| 400 | 20000 | 1688. | 1.20 | 1803. | 1.32 | 1875. | 1.37 | 1957. | 1.43 | 2053. | 1.51 | 2166. | 1.59 | 2463. | 1.77 |
| | 16500 | 1573. | 1.21 | 1681. | 1.33 | 1749. | 1.38 | 1826. | 1.46 | 1917. | 1.55 | 2026. | 1.65 | 2321. | 1.84 |
| | 12500 | 1443. | 1.27 | 1548. | 1.39 | 1614. | 1.45 | 1691. | 1.53 | 1781. | 1.60 | 1888. | 1.71 | 2175. | 1.96 |
| 600 | 20000 | 2108. | 1.71 | 2286. | 1.89 | 2397. | 1.98 | 2526. | 2.09 | 2676. | 2.21 | 2853. | 2.33 | 3316. | 2.62 |
| | 16500 | 1951. | 1.73 | 2121. | 1.91 | 2225. | 2.01 | 2344. | 2.14 | 2485. | 2.29 | 2653. | 2.45 | 3112. | 2.74 |
| | 12500 | 1766. | 1.85 | 1931. | 2.05 | 2034. | 2.15 | 2153. | 2.27 | 2295. | 2.37 | 2461. | 2.53 | 2903. | 2.96 |
| 800 | 20000 | 2528. | 2.22 | 2769. | 2.47 | 2919. | 2.60 | 3094. | 2.75 | 3299. | 2.91 | 3540. | 3.08 | 4169. | 3.47 |
| | 16500 | 2330. | 2.26 | 2560. | 2.50 | 2701. | 2.64 | 2862. | 2.82 | 3052. | 3.02 | 3280. | 3.24 | 3903. | 3.63 |
| | 12500 | 2090. | 2.43 | 2313. | 2.71 | 2453. | 2.85 | 2615. | 3.01 | 2809. | 3.14 | 3034. | 3.36 | 3631. | 3.96 |
| 1000 | 20000 | 2947. | 2.74 | 3252. | 3.05 | 3441. | 3.22 | 3663. | 3.41 | 3922. | 3.61 | 4227. | 3.82 | 5022. | 4.32 |
| | 16500 | 2708. | 2.78 | 2999. | 3.09 | 3177. | 3.27 | 3379. | 3.49 | 3619. | 3.76 | 3907. | 4.04 | 4694. | 4.53 |
| | 12500 | 2414. | 3.02 | 2696. | 3.37 | 2872. | 3.56 | 3077. | 3.76 | 3322. | 3.90 | 3607. | 4.19 | 4359. | 4.95 |
| 1200 | 20000 | 3367. | 3.25 | 3735. | 3.63 | 3964. | 3.83 | 4232. | 4.07 | 4545. | 4.31 | 4914. | 4.57 | 5876. | 5.17 |
| | 16500 | 3087. | 3.30 | 3438. | 3.67 | 3653. | 3.90 | 3897. | 4.17 | 4187. | 4.49 | 4534. | 4.83 | 5485. | 5.43 |
| | 12500 | 2737. | 3.60 | 3078. | 4.03 | 3291. | 4.26 | 3540. | 4.50 | 3836. | 4.67 | 4180. | 5.01 | 5087. | 5.95 |
| 1400 | 20000 | 3787. | 3.76 | 4219. | 4.21 | 4486. | 4.45 | 4800. | 4.72 | 5168. | 5.01 | 5600. | 5.31 | 6729. | 6.02 |
| | 16500 | 3465. | 3.83 | 3877. | 4.26 | 4128. | 4.52 | 4415. | 4.85 | 4754. | 5.22 | 5161. | 5.63 | 6276. | 6.32 |
| | 12500 | 3061. | 4.19 | 3461. | 4.69 | 3710. | 4.97 | 4002. | 5.24 | 4350. | 5.44 | 4754. | 5.84 | | |
| 1600 | 20000 | 4206. | 4.27 | 4702. | 4.78 | 5008. | 5.07 | 5369. | 5.38 | 5791. | 5.72 | 6287. | 6.06 | 7582. | 6.87 |
| | 16500 | 3844. | 4.35 | 4316. | 4.85 | 4604. | 5.15 | 4932. | 5.53 | 5322. | 5.96 | 5789. | 6.42 | 7067. | 7.22 |
| | 12500 | 3385. | 4.77 | 3843. | 5.35 | 4129. | 5.67 | 4464. | 5.98 | 4864. | 6.20 | | | | |
| 1800 | 20000 | 4626. | 4.78 | 5185. | 5.36 | 5530. | 5.68 | 5938. | 6.04 | 6414. | 6.42 | 6974. | 6.81 | 8435. | 7.72 |
| | 16500 | 4222. | 4.88 | 4756. | 5.43 | 5080. | 5.78 | 5450. | 6.20 | 5889. | 6.69 | 6416. | 7.21 | 7858. | 8.12 |
| | 12500 | 3709. | 5.36 | 4226. | 6.01 | 4548. | 6.37 | 4926. | 6.73 | | | | | | |
| 2000 | 20000 | 5046. | 5.29 | 5668. | 5.94 | 6053. | 6.30 | 6506. | 6.70 | 7037. | 7.12 | 7661. | 7.55 | | |
| | 16500 | 4601. | 5.40 | 5195. | 6.02 | 5556. | 6.41 | 5968. | 6.88 | 6456. | 7.43 | 7043. | 8.01 | | |
| | 12500 | 4032. | 5.94 | 4608. | 6.67 | | | | | | | | | | |
| 2200 | 20000 | 5465. | 5.80 | 6151. | 6.52 | 6575. | 6.91 | 7075. | 7.36 | 7660. | 7.82 | | | | |
| | 16500 | 4979. | 5.92 | 5634. | 6.61 | 6032. | 7.04 | 6486. | 7.56 | 7024. | 8.16 | | | | |
| | 12500 | 4356. | 6.53 | 4991. | 7.33 | | | | | | | | | | |
| 2400 | 20000 | 5885. | 6.31 | 6634. | 7.09 | 7097. | 7.53 | 7644. | 8.02 | | | | | | |
| | 16500 | 5358. | 6.45 | 6073. | 7.19 | 6507. | 7.67 | 7003. | 8.24 | | | | | | |
| | 12500 | 4680. | 7.11 | | | | | | | | | | | | |
| 2600 | 20000 | 6305. | 6.82 | 7117. | 7.67 | 7619. | 8.15 | | | | | | | | |
| | 16500 | 5736. | 6.97 | 6512. | 7.78 | 6983. | 8.30 | | | | | | | | |
| | 12500 | 5004. | 7.70 | | | | | | | | | | | | |
| 2800 | 20000 | 6724. | 7.33 | 7600. | 8.25 | | | | | | | | | | |
| | 16500 | 6115. | 7.49 | 6952. | 8.37 | | | | | | | | | | |
| | 12500 | 5327. | 8.28 | | | | | | | | | | | | |
| 3000 | 20000 | 7144. | 7.84 | 8083. | 8.83 | | | | | | | | | | |
| | 16500 | 6493. | 8.02 | 7391. | 8.95 | | | | | | | | | | |
| | 12500 | 5651. | 8.86 | | | | | | | | | | | | |

Figure 7-9 (Sheet 4)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 33000 FEET**

**FAN SETTING FOR LONG RANGE CRUISE**

| CRUISE WEIGHT LBS. | TAILWIND 100 KT. N1 PCT | TAILWIND 50 KT. N1 PCT | TAILWIND 25 KT. N1 PCT | ZERO WIND N1 PCT | HEADWIND 25 KT. N1 PCT | HEADWIND 50 KT. N1 PCT | HEADWIND 100 KT. N1 PCT |
|---|---|---|---|---|---|---|---|
| 20000 | 78.1 | 78.5 | 79.1 | 79.7 | 81.3 | 82.3 | 83.8 |
| 18000 | 76.3 | 76.6 | 77.0 | 77.4 | 78.6 | 79.7 | 81.5 |
| 16000 | 74.1 | 74.4 | 74.7 | 75.1 | 76.0 | 77.1 | 79.1 |
| 14000 | 71.5 | 72.0 | 72.4 | 72.8 | 73.5 | 74.5 | 76.6 |
| 12000 | 68.6 | 69.4 | 69.9 | 70.5 | 71.1 | 72.0 | 74.1 |

| STAGE LENGTH NM. | T.O. WEIGHT LBS. | TAILWIND 100 KT. FUEL LBS. | TAILWIND 100 KT. TIME HRS. | TAILWIND 50 KT. FUEL LBS. | TAILWIND 50 KT. TIME HRS. | TAILWIND 25 KT. FUEL LBS. | TAILWIND 25 KT. TIME HRS. | ZERO WIND FUEL LBS. | ZERO WIND TIME HRS. | HEADWIND 25 KT. FUEL LBS. | HEADWIND 25 KT. TIME HRS. | HEADWIND 50 KT. FUEL LBS. | HEADWIND 50 KT. TIME HRS. | HEADWIND 100 KT. FUEL LBS. | HEADWIND 100 KT. TIME HRS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 20000 | 1292. | 0.68 | 1339. | 0.72 | 1369. | 0.74 | 1401. | 0.77 | 1439. | 0.80 | 1486. | 0.83 | 1607. | 0.89 |
| | 16500 | 1212. | 0.69 | 1258. | 0.74 | 1287. | 0.75 | 1320. | 0.78 | 1359. | 0.80 | 1404. | 0.84 | 1523. | 0.92 |
| | 12500 | 1135. | 0.66 | 1177. | 0.71 | 1204. | 0.73 | 1234. | 0.78 | 1269. | 0.82 | 1314. | 0.86 | 1436. | 0.95 |
| 400 | 20000 | 1696. | 1.20 | 1805. | 1.31 | 1873. | 1.36 | 1951. | 1.42 | 2042. | 1.48 | 2149. | 1.55 | 2424. | 1.73 |
| | 16500 | 1572. | 1.21 | 1674. | 1.32 | 1738. | 1.38 | 1811. | 1.45 | 1897. | 1.53 | 1999. | 1.62 | 2271. | 1.82 |
| | 12500 | 1443. | 1.24 | 1540. | 1.36 | 1602. | 1.42 | 1671. | 1.49 | 1754. | 1.58 | 1852. | 1.69 | 2120. | 1.93 |
| 600 | 20000 | 2100. | 1.71 | 2270. | 1.90 | 2377. | 1.98 | 2500. | 2.07 | 2645. | 2.16 | 2813. | 2.26 | 3241. | 2.57 |
| | 16500 | 1933. | 1.72 | 2091. | 1.91 | 2188. | 2.01 | 2301. | 2.13 | 2434. | 2.26 | 2594. | 2.40 | 3019. | 2.72 |
| | 12500 | 1751. | 1.82 | 1903. | 2.01 | 1999. | 2.10 | 2109. | 2.21 | 2238. | 2.34 | 2390. | 2.52 | 2804. | 2.91 |
| 800 | 20000 | 2504. | 2.23 | 2736. | 2.48 | 2882. | 2.60 | 3050. | 2.73 | 3248. | 2.84 | 3476. | 2.98 | 4059. | 3.41 |
| | 16500 | 2294. | 2.24 | 2508. | 2.49 | 2639. | 2.64 | 2791. | 2.81 | 2972. | 2.99 | 3190. | 3.18 | 3767. | 3.63 |
| | 12500 | 2059. | 2.40 | 2266. | 2.66 | 2397. | 2.78 | 2547. | 2.92 | 2723. | 3.10 | 2928. | 3.35 | 3489. | 3.90 |
| 1000 | 20000 | 2908. | 2.74 | 3202. | 3.07 | 3386. | 3.22 | 3599. | 3.38 | 3850. | 3.52 | 4140. | 3.70 | 4876. | 4.25 |
| | 16500 | 2655. | 2.76 | 2925. | 3.08 | 3089. | 3.27 | 3281. | 3.49 | 3510. | 3.72 | 3785. | 3.96 | 4515. | 4.53 |
| | 12500 | 2367. | 2.98 | 2629. | 3.31 | 2795. | 3.46 | 2984. | 3.63 | 3207. | 3.86 | 3466. | 4.18 | 4173. | 4.88 |
| 1200 | 20000 | 3313. | 3.26 | 3668. | 3.65 | 3890. | 3.85 | 4149. | 4.03 | 4453. | 4.20 | 4803. | 4.42 | 5693. | 5.08 |
| | 16500 | 3015. | 3.27 | 3342. | 3.66 | 3539. | 3.90 | 3771. | 4.16 | 4048. | 4.45 | 4380. | 4.74 | 5263. | 5.43 |
| | 12500 | 2675. | 3.56 | 2992. | 3.96 | 3192. | 4.15 | 3422. | 4.35 | 3691. | 4.62 | 4005. | 5.00 | 4857. | 5.86 |
| 1400 | 20000 | 3717. | 3.77 | 4133. | 4.24 | 4394. | 4.47 | 4698. | 4.68 | 5056. | 4.88 | 5467. | 5.14 | 6510. | 5.92 |
| | 16500 | 3376. | 3.79 | 3758. | 4.25 | 3990. | 4.52 | 4262. | 4.84 | 4586. | 5.18 | 4976. | 5.52 | 6010. | 6.33 |
| | 12500 | 2982. | 4.14 | 3355. | 4.61 | 3590. | 4.83 | 3860. | 5.06 | 4176. | 5.38 | 4543. | 5.83 | | |
| 1600 | 20000 | 4121. | 4.29 | 4599. | 4.83 | 4899. | 5.09 | 5248. | 5.33 | 5659. | 5.56 | 6131. | 5.86 | 7328. | 6.76 |
| | 16500 | 3737. | 4.31 | 4175. | 4.83 | 4440. | 5.15 | 4752. | 5.52 | 5124. | 5.90 | 5571. | 6.30 | 6758. | 7.24 |
| | 12500 | 3290. | 4.71 | 3718. | 5.25 | 3988. | 5.51 | 4297. | 5.78 | 4660. | 6.14 | | | | |
| 1800 | 20000 | 4525. | 4.80 | 5065. | 5.41 | 5403. | 5.71 | 5798. | 5.98 | 6262. | 6.24 | 6794. | 6.58 | 8145. | 7.60 |
| | 16500 | 4097. | 4.82 | 4592. | 5.42 | 4890. | 5.78 | 5242. | 6.20 | 5662. | 6.63 | 6166. | 7.08 | 7506. | 8.14 |
| | 12500 | 3598. | 5.29 | 4081. | 5.90 | 4385. | 6.19 | 4735. | 6.49 | | | | | | |
| 2000 | 20000 | 4929. | 5.32 | 5531. | 6.00 | 5907. | 6.33 | 6347. | 6.63 | 6864. | 6.92 | 7458. | 7.30 | 8962. | 8.44 |
| | 16500 | 4458. | 5.34 | 5009. | 6.00 | 5341. | 6.41 | 5732. | 6.87 | 6200. | 7.36 | 6762. | 7.87 | 8254. | 9.04 |
| | 12500 | 3906. | 5.87 | 4444. | 6.55 | 4783. | 6.87 | | | | | | | | |
| 2200 | 20000 | 5333. | 5.83 | 5997. | 6.58 | 6412. | 6.95 | 6897. | 7.28 | 7467. | 7.60 | 8121. | 8.02 | | |
| | 16500 | 4819. | 5.86 | 5426. | 6.59 | 5791. | 7.04 | 6222. | 7.55 | 6737. | 8.09 | 7357. | 8.65 | | |
| | 12500 | 4214. | 6.45 | 4807. | 7.20 | | | | | | | | | | |
| 2400 | 20000 | 5737. | 6.35 | 6462. | 7.17 | 6916. | 7.58 | 7446. | 7.93 | 8070. | 8.28 | | | | |
| | 16500 | 5179. | 6.37 | 5842. | 7.17 | 6242. | 7.67 | 6712. | 8.23 | 7275. | 8.82 | | | | |
| | 12500 | 4522. | 7.03 | | | | | | | | | | | | |
| 2600 | 20000 | 6141. | 6.87 | 6928. | 7.76 | 7420. | 8.20 | 7996. | 8.59 | | | | | | |
| | 16500 | 5540. | 6.89 | 6259. | 7.76 | 6692. | 8.30 | 7203. | 8.90 | | | | | | |
| | 12500 | 4830. | 7.61 | | | | | | | | | | | | |
| 2800 | 20000 | 6545. | 7.38 | 7394. | 8.34 | 7925. | 8.82 | | | | | | | | |
| | 16500 | 5901. | 7.40 | 6676. | 8.34 | 7142. | 8.93 | | | | | | | | |
| | 12500 | 5138. | 8.19 | | | | | | | | | | | | |
| 3000 | 20000 | 6949. | 7.90 | 7860. | 8.93 | | | | | | | | | | |
| | 16500 | 6262. | 7.92 | 7093. | 8.93 | | | | | | | | | | |
| | 12500 | 5445. | 8.77 | | | | | | | | | | | | |

Figure 7-9 (Sheet 5)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 35000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| | TAILWIND | | | ZERO | HEADWIND | | |
|---|---|---|---|---|---|---|---|
| CRUISE | 100 KT. | 50 KT. | 25 KT. | WIND | 25 KT. | 50 KT. | 100 KT. |
| WEIGHT LBS. | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT | N1 PCT |
| 20000 | 80.3 | 80.6 | 81.1 | 81.6 | 82.6 | 84.4 | 85.8 |
| 18000 | 77.8 | 78.3 | 78.5 | 79.1 | 80.2 | 81.4 | 83.0 |
| 16000 | 75.3 | 75.8 | 76.0 | 76.6 | 77.6 | 78.5 | 80.2 |
| 14000 | 72.6 | 73.2 | 73.5 | 74.0 | 75.0 | 75.7 | 77.5 |
| 12000 | 69.8 | 70.5 | 71.0 | 71.5 | 72.3 | 72.8 | 75.0 |

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1316. | 0.68 | 1359. | 0.72 | 1386. | 0.73 | 1416. | 0.76 | 1452. | 0.79 | 1494. | 0.81 | 1605. | 0.87 |
| | 16500 | 1234. | 0.69 | 1278. | 0.73 | 1305. | 0.73 | 1335. | 0.76 | 1370. | 0.78 | 1411. | 0.82 | 1521. | 0.90 |
| | 12500 | 1150. | 0.66 | 1188. | 0.71 | 1213. | 0.74 | 1242. | 0.77 | 1276. | 0.81 | 1317. | 0.84 | 1429. | 0.93 |
| 400 | 20000 | 1709. | 1.19 | 1812. | 1.29 | 1877. | 1.34 | 1950. | 1.40 | 2036. | 1.46 | 2137. | 1.51 | 2394. | 1.67 |
| | 16500 | 1578. | 1.20 | 1674. | 1.32 | 1734. | 1.36 | 1803. | 1.43 | 1884. | 1.51 | 1979. | 1.59 | 2233. | 1.78 |
| | 12500 | 1444. | 1.22 | 1534. | 1.34 | 1591. | 1.39 | 1656. | 1.47 | 1731. | 1.57 | 1822. | 1.67 | 2073. | 1.88 |
| 600 | 20000 | 2103. | 1.70 | 2266. | 1.87 | 2367. | 1.95 | 2484. | 2.04 | 2619. | 2.13 | 2780. | 2.22 | 3184. | 2.47 |
| | 16500 | 1922. | 1.72 | 2070. | 1.90 | 2163. | 1.99 | 2270. | 2.11 | 2397. | 2.23 | 2547. | 2.37 | 2945. | 2.66 |
| | 12500 | 1739. | 1.78 | 1880. | 1.96 | 1968. | 2.05 | 2069. | 2.17 | 2187. | 2.32 | 2327. | 2.50 | 2717. | 2.83 |
| 800 | 20000 | 2496. | 2.20 | 2719. | 2.44 | 2858. | 2.56 | 3017. | 2.68 | 3203. | 2.81 | 3423. | 2.93 | 3973. | 3.28 |
| | 16500 | 2266. | 2.24 | 2466. | 2.49 | 2592. | 2.62 | 2738. | 2.78 | 2911. | 2.95 | 3114. | 3.15 | 3657. | 3.54 |
| | 12500 | 2033. | 2.34 | 2225. | 2.59 | 2346. | 2.70 | 2483. | 2.87 | 2643. | 3.08 | 2832. | 3.33 | 3361. | 3.78 |
| 1000 | 20000 | 2890. | 2.71 | 3173. | 3.02 | 3348. | 3.17 | 3551. | 3.32 | 3787. | 3.48 | 4067. | 3.64 | 4762. | 4.08 |
| | 16500 | 2610. | 2.75 | 2863. | 3.08 | 3021. | 3.25 | 3205. | 3.46 | 3424. | 3.68 | 3682. | 3.92 | 4369. | 4.42 |
| | 12500 | 2328. | 2.91 | 2571. | 3.21 | 2723. | 3.35 | 2897. | 3.57 | 3099. | 3.84 | 3337. | 4.16 | 4005. | 4.73 |
| 1200 | 20000 | 3283. | 3.22 | 3626. | 3.59 | 3839. | 3.78 | 4084. | 3.96 | 4371. | 4.16 | 4710. | 4.35 | 5552. | 4.88 |
| | 16500 | 2953. | 3.27 | 3259. | 3.67 | 3450. | 3.88 | 3673. | 4.13 | 3938. | 4.40 | 4250. | 4.70 | 5081. | 5.30 |
| | 12500 | 2622. | 3.47 | 2917. | 3.84 | 3100. | 4.01 | 3311. | 4.27 | 3555. | 4.60 | 3842. | 4.99 | 4649. | 5.68 |
| 1400 | 20000 | 3676. | 3.73 | 4080. | 4.17 | 4329. | 4.39 | 4618. | 4.60 | 4955. | 4.83 | 5353. | 5.05 | 6341. | 5.68 |
| | 16500 | 3297. | 3.79 | 3655. | 4.26 | 3878. | 4.51 | 4140. | 4.81 | 4451. | 5.13 | 4818. | 5.47 | 5793. | 6.18 |
| | 12500 | 2917. | 4.03 | 3262. | 4.46 | 3478. | 4.66 | 3725. | 4.97 | 4011. | 5.35 | 4347. | 5.82 | 5293. | 6.63 |
| 1600 | 20000 | 4070. | 4.24 | 4533. | 4.74 | 4820. | 5.00 | 5151. | 5.24 | 5538. | 5.51 | 5996. | 5.76 | 7131. | 6.49 |
| | 16500 | 3641. | 4.30 | 4051. | 4.85 | 4307. | 5.14 | 4608. | 5.48 | 4965. | 5.85 | 5385. | 6.25 | 6506. | 7.06 |
| | 12500 | 3211. | 4.59 | 3608. | 5.08 | 3855. | 5.32 | 4138. | 5.67 | 4467. | 6.11 | 4852. | 6.65 | | |
| 1800 | 20000 | 4463. | 4.75 | 4987. | 5.32 | 5310. | 5.61 | 5685. | 5.88 | 6122. | 6.18 | 6639. | 6.47 | 7920. | 7.29 |
| | 16500 | 3985. | 4.82 | 4447. | 5.44 | 4736. | 5.77 | 5075. | 6.16 | 5478. | 6.57 | 5953. | 7.03 | 7218. | 7.94 |
| | 12500 | 3506. | 5.16 | 3954. | 5.71 | 4233. | 5.97 | 4552. | 6.37 | 4922. | 6.87 | | | | |
| 2000 | 20000 | 4857. | 5.26 | 5440. | 5.89 | 5801. | 6.23 | 6219. | 6.52 | 6706. | 6.85 | 7282. | 7.18 | 8709. | 8.09 |
| | 16500 | 4329. | 5.34 | 4843. | 6.03 | 5165. | 6.40 | 5543. | 6.83 | 5992. | 7.30 | 6521. | 7.80 | 7930. | 8.82 |
| | 12500 | 3800. | 5.72 | 4300. | 6.33 | 4610. | 6.62 | | | | | | | | |
| 2200 | 20000 | 5250. | 5.77 | 5894. | 6.47 | 6291. | 6.84 | 6752. | 7.16 | 7290. | 7.53 | 7925. | 7.88 | | |
| | 16500 | 4673. | 5.85 | 5240. | 6.62 | 5594. | 7.03 | 6010. | 7.50 | 6505. | 8.02 | 7088. | 8.58 | | |
| | 12500 | 4095. | 6.28 | 4645. | 6.96 | | | | | | | | | | |
| 2400 | 20000 | 5643. | 6.28 | 6347. | 7.04 | 6782. | 7.45 | 7286. | 7.80 | 7874. | 8.20 | | | | |
| | 16500 | 5016. | 6.37 | 5636. | 7.21 | 6023. | 7.66 | 6478. | 8.18 | 7019. | 8.75 | | | | |
| | 12500 | 4389. | 6.84 | 4991. | 7.58 | | | | | | | | | | |
| 2600 | 20000 | 6037. | 6.79 | 6801. | 7.61 | 7272. | 8.06 | 7819. | 8.44 | | | | | | |
| | 16500 | 5360. | 6.89 | 6032. | 7.79 | 6451. | 8.29 | 6945. | 8.85 | | | | | | |
| | 12500 | 4684. | 7.41 | | | | | | | | | | | | |
| 2800 | 20000 | 6430. | 7.30 | 7254. | 8.19 | 7763. | 8.67 | | | | | | | | |
| | 16500 | 5704. | 7.40 | 6428. | 8.38 | 6880. | 8.92 | | | | | | | | |
| | 12500 | 4978. | 7.97 | | | | | | | | | | | | |
| 3000 | 20000 | 6824. | 7.81 | 7708. | 8.76 | | | | | | | | | | |
| | 16500 | 6048. | 7.92 | 6824. | 8.97 | | | | | | | | | | |
| | 12500 | 5273. | 8.53 | | | | | | | | | | | | |

Figure 7-9 (Sheet 6)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 37000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| | TRAILWIND | | | ZERO | HEADWIND | | |
|---|---|---|---|---|---|---|---|
| CRUISE WEIGHT LBS. | 100 KT. N1 PCT | 50 KT. N1 PCT | 25 KT. N1 PCT | WIND N1 PCT | 25 KT. N1 PCT | 50 KT. N1 PCT | 100 KT. N1 PCT |
| 20000 | 82.7 | 83.4 | 83.8 | 84.3 | 85.6 | 86.6 | 87.9 |
| 18000 | 79.8 | 80.1 | 80.5 | 81.0 | 82.3 | 83.4 | 85.0 |
| 16000 | 76.9 | 77.0 | 77.4 | 77.9 | 79.1 | 80.3 | 82.2 |
| 14000 | 74.0 | 74.1 | 74.6 | 75.0 | 76.0 | 77.1 | 79.4 |
| 12000 | 71.1 | 71.5 | 71.9 | 72.3 | 73.1 | 73.9 | 76.6 |

| | | TRAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1338. | 0.67 | 1378. | 0.71 | 1403. | 0.71 | 1430. | 0.74 | 1462. | 0.76 | 1500. | 0.79 | 1601. | 0.86 |
| | 16500 | 1255. | 0.67 | 1294. | 0.71 | 1319. | 0.72 | 1347. | 0.75 | 1378. | 0.78 | 1417. | 0.80 | 1519. | 0.87 |
| | 12500 | 1163. | 0.67 | 1200. | 0.72 | 1224. | 0.73 | 1251. | 0.76 | 1283. | 0.79 | 1321. | 0.83 | 1424. | 0.90 |
| 400 | 20000 | 1723. | 1.17 | 1821. | 1.27 | 1881. | 1.31 | 1950. | 1.38 | 2031. | 1.42 | 2126. | 1.47 | 2363. | 1.61 |
| | 16500 | 1585. | 1.19 | 1676. | 1.30 | 1733. | 1.35 | 1798. | 1.42 | 1875. | 1.48 | 1965. | 1.54 | 2198. | 1.73 |
| | 12500 | 1445. | 1.21 | 1528. | 1.32 | 1581. | 1.38 | 1641. | 1.46 | 1712. | 1.55 | 1797. | 1.65 | 2029. | 1.84 |
| 600 | 20000 | 2109. | 1.67 | 2264. | 1.84 | 2360. | 1.92 | 2470. | 2.02 | 2599. | 2.09 | 2751. | 2.15 | 3125. | 2.36 |
| | 16500 | 1916. | 1.71 | 2057. | 1.90 | 2146. | 1.99 | 2249. | 2.09 | 2371. | 2.17 | 2513. | 2.29 | 2877. | 2.58 |
| | 12500 | 1727. | 1.75 | 1857. | 1.93 | 1938. | 2.02 | 2032. | 2.15 | 2140. | 2.30 | 2272. | 2.47 | 2634. | 2.78 |
| 800 | 20000 | 2494. | 2.18 | 2707. | 2.40 | 2838. | 2.52 | 2990. | 2.66 | 3167. | 2.75 | 3376. | 2.84 | 3887. | 3.11 |
| | 16500 | 2246. | 2.24 | 2439. | 2.49 | 2560. | 2.62 | 2701. | 2.76 | 2867. | 2.87 | 3060. | 3.03 | 3556. | 3.44 |
| | 12500 | 2009. | 2.29 | 2186. | 2.53 | 2296. | 2.67 | 2422. | 2.85 | 2569. | 3.06 | 2747. | 3.29 | 3238. | 3.72 |
| 1000 | 20000 | 2880. | 2.68 | 3150. | 2.97 | 3317. | 3.12 | 3510. | 3.30 | 3735. | 3.42 | 4001. | 3.52 | 4649. | 3.86 |
| | 16500 | 2576. | 2.76 | 2821. | 3.08 | 2973. | 3.25 | 3152. | 3.43 | 3364. | 3.56 | 3608. | 3.77 | 4235. | 4.30 |
| | 12500 | 2291. | 2.83 | 2514. | 3.13 | 2653. | 3.32 | 2813. | 3.54 | 2998. | 3.82 | 3223. | 4.12 | 3843. | 4.67 |
| 1200 | 20000 | 3265. | 3.18 | 3593. | 3.53 | 3795. | 3.73 | 4030. | 3.94 | 4304. | 4.08 | 4626. | 4.20 | 5412. | 4.61 |
| | 16500 | 2907. | 3.28 | 3202. | 3.68 | 3387. | 3.89 | 3603. | 4.11 | 3860. | 4.26 | 4156. | 4.51 | 4914. | 5.16 |
| | 12500 | 2573. | 3.37 | 2843. | 3.73 | 3010. | 3.96 | 3203. | 4.24 | 3426. | 4.57 | 3698. | 4.94 | 4448. | 5.61 |
| 1400 | 20000 | 3650. | 3.68 | 4036. | 4.10 | 4274. | 4.33 | 4550. | 4.58 | 4872. | 4.75 | 5251. | 4.88 | 6174. | 5.36 |
| | 16500 | 3237. | 3.81 | 3584. | 4.27 | 3800. | 4.52 | 4054. | 4.78 | 4357. | 4.96 | 4704. | 5.25 | 5592. | 6.02 |
| | 12500 | 2855. | 3.91 | 3172. | 4.33 | 3368. | 4.61 | 3593. | 4.94 | 3855. | 5.33 | 4174. | 5.76 | 5053. | 6.55 |
| 1600 | 20000 | 4036. | 4.19 | 4479. | 4.67 | 4753. | 4.93 | 5069. | 5.22 | 5440. | 5.41 | 5876. | 5.57 | 6936. | 6.11 |
| | 16500 | 3568. | 4.33 | 3965. | 4.86 | 4214. | 5.15 | 4506. | 5.45 | 4853. | 5.65 | 5251. | 5.99 | 6271. | 6.88 |
| | 12500 | 3137. | 4.45 | 3500. | 4.94 | 3725. | 5.26 | 3984. | 5.63 | 4283. | 6.09 | 4649. | 6.58 | | |
| 1800 | 20000 | 4421. | 4.69 | 4922. | 5.23 | 5231. | 5.54 | 5589. | 5.86 | 6008. | 6.08 | 6502. | 6.25 | 7698. | 6.85 |
| | 16500 | 3898. | 4.85 | 4347. | 5.46 | 4627. | 5.78 | 4957. | 6.12 | 5349. | 6.35 | 5799. | 6.73 | 6950. | 7.73 |
| | 12500 | 3419. | 4.99 | 3829. | 5.54 | 4082. | 5.90 | 4374. | 6.33 | 4712. | 6.84 | | | | |
| 2000 | 20000 | 4806. | 5.19 | 5365. | 5.80 | 5710. | 6.14 | 6109. | 6.50 | 6577. | 6.74 | 7127. | 6.93 | 8460. | 7.60 |
| | 16500 | 4228. | 5.38 | 4728. | 6.05 | 5041. | 6.42 | 5408. | 6.79 | 5846. | 7.04 | 6347. | 7.47 | 7629. | 8.59 |
| | 12500 | 3701. | 5.53 | 4158. | 6.14 | 4439. | 6.55 | 4765. | 7.02 | | | | | | |
| 2200 | 20000 | 5192. | 5.70 | 5808. | 6.36 | 6188. | 6.74 | 6629. | 7.14 | 7145. | 7.41 | 7752. | 7.62 | | |
| | 16500 | 4559. | 5.90 | 5110. | 6.64 | 5454. | 7.05 | 5860. | 7.46 | 6342. | 7.74 | 6895. | 8.21 | | |
| | 12500 | 3983. | 6.07 | 4487. | 6.74 | 4797. | 7.19 | | | | | | | | |
| 2400 | 20000 | 5577. | 6.20 | 6251. | 6.93 | 6667. | 7.35 | 7149. | 7.78 | 7713. | 8.07 | | | | |
| | 16500 | 4889. | 6.42 | 5492. | 7.24 | 5868. | 7.68 | 6311. | 8.13 | 6839. | 8.43 | | | | |
| | 12500 | 4265. | 6.61 | 4815. | 7.35 | | | | | | | | | | |
| 2600 | 20000 | 5962. | 6.70 | 6694. | 7.49 | 7145. | 7.95 | 7669. | 8.42 | 8281. | 8.74 | | | | |
| | 16500 | 5219. | 6.95 | 5873. | 7.83 | 6281. | 8.32 | 6762. | 8.80 | 7335. | 9.13 | | | | |
| | 12500 | 4547. | 7.15 | | | | | | | | | | | | |
| 2800 | 20000 | 6348. | 7.20 | 7137. | 8.06 | 7624. | 8.55 | 8189. | 9.06 | | | | | | |
| | 16500 | 5550. | 7.47 | 6255. | 8.42 | 6695. | 8.95 | 7214. | 9.47 | | | | | | |
| | 12500 | 4829. | 7.69 | | | | | | | | | | | | |
| 3000 | 20000 | 6733. | 7.71 | 7580. | 8.63 | 8102. | 9.16 | | | | | | | | |
| | 16500 | 5880. | 7.99 | 6636. | 9.02 | 7108. | 9.58 | | | | | | | | |
| | 12500 | 5111. | 8.23 | | | | | | | | | | | | |
| 3200 | 20000 | 7118. | 8.21 | 8023. | 9.19 | | | | | | | | | | |
| | 16500 | 6210. | 8.52 | 7018. | 9.61 | | | | | | | | | | |
| | 12500 | 5393. | 8.77 | | | | | | | | | | | | |

Figure 7-9 (Sheet 7)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 39000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| | TAILWIND | | | ZERO | HEADWIND | | |
|---|---|---|---|---|---|---|---|
| CRUISE WEIGHT LBS. | 100 KT. N1 PCT | 50 KT. N1 PCT | 25 KT. N1 PCT | WIND N1 PCT | 25 KT. N1 PCT | 50 KT. N1 PCT | 100 KT. N1 PCT |
| 20000 | 85.9 | 86.7 | 86.8 | 87.1 | 88.2 | 88.8 | 91.1 |
| 18000 | 82.4 | 83.0 | 83.3 | 83.8 | 85.1 | 86.1 | 87.8 |
| 16000 | 79.0 | 79.4 | 79.8 | 80.6 | 81.9 | 83.1 | 84.5 |
| 14000 | 75.8 | 76.1 | 76.6 | 77.4 | 78.6 | 79.8 | 81.2 |
| 12000 | 72.7 | 73.0 | 73.5 | 74.2 | 75.2 | 76.1 | 77.9 |

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1358. | 0.67 | 1395. | 0.70 | 1419. | 0.70 | 1444. | 0.73 | 1473. | 0.76 | 1508. | 0.79 | 1608. | 0.85 |
| | 16500 | 1275. | 0.66 | 1311. | 0.70 | 1334. | 0.71 | 1359. | 0.74 | 1389. | 0.77 | 1426. | 0.78 | 1518. | 0.84 |
| | 12500 | 1179. | 0.68 | 1215. | 0.72 | 1238. | 0.73 | 1265. | 0.75 | 1295. | 0.76 | 1329. | 0.79 | 1421. | 0.87 |
| 400 | 20000 | 1741. | 1.16 | 1833. | 1.25 | 1890. | 1.28 | 1955. | 1.34 | 2029. | 1.38 | 2116. | 1.43 | 2339. | 1.56 |
| | 16500 | 1597. | 1.18 | 1683. | 1.28 | 1737. | 1.33 | 1798. | 1.38 | 1870. | 1.44 | 1954. | 1.50 | 2169. | 1.66 |
| | 12500 | 1449. | 1.20 | 1528. | 1.31 | 1577. | 1.37 | 1633. | 1.44 | 1700. | 1.51 | 1779. | 1.60 | 1992. | 1.80 |
| 600 | 20000 | 2123. | 1.64 | 2271. | 1.79 | 2361. | 1.87 | 2465. | 1.95 | 2585. | 2.00 | 2725. | 2.07 | 3070. | 2.27 |
| | 16500 | 1920. | 1.69 | 2056. | 1.86 | 2140. | 1.94 | 2237. | 2.03 | 2351. | 2.11 | 2482. | 2.22 | 2820. | 2.49 |
| | 12500 | 1719. | 1.72 | 1840. | 1.91 | 1916. | 2.01 | 2002. | 2.13 | 2105. | 2.26 | 2228. | 2.42 | 2562. | 2.74 |
| 800 | 20000 | 2506. | 2.13 | 2708. | 2.34 | 2833. | 2.45 | 2975. | 2.56 | 3142. | 2.63 | 3334. | 2.70 | 3801. | 2.99 |
| | 16500 | 2242. | 2.21 | 2428. | 2.44 | 2544. | 2.55 | 2676. | 2.67 | 2832. | 2.79 | 3010. | 2.95 | 3472. | 3.31 |
| | 12500 | 1988. | 2.25 | 2153. | 2.50 | 2255. | 2.65 | 2371. | 2.82 | 2510. | 3.01 | 2678. | 3.23 | 3132. | 3.67 |
| 1000 | 20000 | 2888. | 2.62 | 3146. | 2.89 | 3304. | 3.03 | 3486. | 3.17 | 3698. | 3.25 | 3942. | 3.34 | 4531. | 3.70 |
| | 16500 | 2565. | 2.72 | 2800. | 3.03 | 2947. | 3.16 | 3115. | 3.31 | 3313. | 3.46 | 3538. | 3.67 | 4123. | 4.14 |
| | 12500 | 2258. | 2.77 | 2466. | 3.10 | 2594. | 3.28 | 2740. | 3.52 | 2916. | 3.77 | 3127. | 4.05 | 3702. | 4.60 |
| 1200 | 20000 | 3270. | 3.11 | 3583. | 3.44 | 3775. | 3.61 | 3996. | 3.78 | 4254. | 3.87 | 4551. | 3.97 | 5262. | 4.42 |
| | 16500 | 2888. | 3.24 | 3173. | 3.61 | 3350. | 3.77 | 3554. | 3.95 | 3794. | 4.13 | 4066. | 4.39 | 4774. | 4.96 |
| | 12500 | 2528. | 3.29 | 2778. | 3.69 | 2933. | 3.92 | 3109. | 4.21 | 3321. | 4.52 | 3576. | 4.86 | 4273. | 5.53 |
| 1400 | 20000 | 3653. | 3.60 | 4021. | 3.99 | 4246. | 4.19 | 4506. | 4.39 | 4811. | 4.49 | 5160. | 4.61 | 5993. | 5.13 |
| | 16500 | 3210. | 3.75 | 3545. | 4.19 | 3753. | 4.38 | 3993. | 4.59 | 4275. | 4.81 | 4594. | 5.11 | 5426. | 5.78 |
| | 12500 | 2798. | 3.82 | 3091. | 4.29 | 3271. | 4.56 | 3478. | 4.90 | 3726. | 5.27 | 4026. | 5.68 | 4843. | 6.46 |
| 1600 | 20000 | 4035. | 4.08 | 4459. | 4.54 | 4717. | 4.78 | 5017. | 5.00 | 5367. | 5.11 | 5768. | 5.24 | 6723. | 5.85 |
| | 16500 | 3533. | 4.27 | 3917. | 4.77 | 4157. | 5.00 | 4432. | 5.23 | 4756. | 5.48 | 5122. | 5.84 | 6077. | 6.61 |
| | 12500 | 3068. | 4.34 | 3404. | 4.88 | 3610. | 5.20 | 3846. | 5.59 | 4131. | 6.02 | 4475. | 6.49 | 5413. | 7.39 |
| 1800 | 20000 | 4418. | 4.57 | 4896. | 5.09 | 5188. | 5.36 | 5527. | 5.61 | 5923. | 5.73 | 6377. | 5.88 | 7454. | 6.56 |
| | 16500 | 3855. | 4.78 | 4290. | 5.35 | 4560. | 5.61 | 4871. | 5.87 | 5237. | 6.15 | 5650. | 6.56 | 6728. | 7.43 |
| | 12500 | 3338. | 4.86 | 3717. | 5.48 | 3949. | 5.84 | 4215. | 6.29 | 4536. | 6.77 | 4924. | 7.31 | | |
| 2000 | 20000 | 4800. | 5.06 | 5334. | 5.64 | 5659. | 5.94 | 6037. | 6.22 | 6480. | 6.35 | 6986. | 6.52 | 8185. | 7.28 |
| | 16500 | 4178. | 5.30 | 4662. | 5.93 | 4963. | 6.22 | 5310. | 6.51 | 5718. | 6.83 | 6178. | 7.28 | 7379. | 8.25 |
| | 12500 | 3607. | 5.39 | 4029. | 6.07 | 4288. | 6.48 | 4584. | 6.98 | | | | | | |
| 2200 | 20000 | 5182. | 5.55 | 5771. | 6.19 | 6131. | 6.52 | 6548. | 6.83 | 7036. | 6.97 | 7594. | 7.15 | 8916. | 7.99 |
| | 16500 | 4500. | 5.81 | 5035. | 6.51 | 5367. | 6.83 | 5749. | 7.15 | 6199. | 7.50 | 6706. | 8.01 | 8031. | 9.08 |
| | 12500 | 3877. | 5.91 | 4342. | 6.67 | 4627. | 7.12 | | | | | | | | |
| 2400 | 20000 | 5565. | 6.04 | 6209. | 6.74 | 6602. | 7.10 | 7058. | 7.44 | 7592. | 7.60 | 8203. | 7.79 | | |
| | 16500 | 4823. | 6.33 | 5407. | 7.09 | 5770. | 7.44 | 6188. | 7.79 | 6680. | 8.17 | 7234. | 8.73 | | |
| | 12500 | 4147. | 6.43 | 4655. | 7.26 | | | | | | | | | | |
| 2600 | 20000 | 5947. | 6.52 | 6647. | 7.29 | 7073. | 7.69 | 7568. | 8.05 | 8148. | 8.22 | | | | |
| | 16500 | 5146. | 6.84 | 5779. | 7.68 | 6173. | 8.05 | 6627. | 8.43 | 7161. | 8.85 | | | | |
| | 12500 | 4417. | 6.96 | 4968. | 7.86 | | | | | | | | | | |
| 2800 | 20000 | 6330. | 7.01 | 7084. | 7.84 | 7544. | 8.27 | 8079. | 8.66 | | | | | | |
| | 16500 | 5468. | 7.36 | 6152. | 8.26 | 6576. | 8.67 | 7066. | 9.07 | | | | | | |
| | 12500 | 4687. | 7.48 | | | | | | | | | | | | |
| 3000 | 20000 | 6712. | 7.50 | 7522. | 8.39 | 8015. | 8.85 | | | | | | | | |
| | 16500 | 5791. | 7.87 | 6524. | 8.84 | 6980. | 9.28 | | | | | | | | |
| | 12500 | 4956. | 8.00 | | | | | | | | | | | | |
| 3200 | 20000 | 7094. | 7.99 | 7959. | 8.93 | | | | | | | | | | |
| | 16500 | 6113. | 8.39 | 6896. | 9.42 | | | | | | | | | | |
| | 12500 | 5226. | 8.53 | | | | | | | | | | | | |

Figure 7-9 (Sheet 8)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 41000 FEET**

**FAN SETTING FOR LONG RANGE CRUISE**

| CRUISE WEIGHT LBS. | TAILWIND 100 KT. N1 PCT | TAILWIND 50 KT. N1 PCT | TAILWIND 25 KT. N1 PCT | ZERO WIND N1 PCT | HEADWIND 25 KT. N1 PCT | HEADWIND 50 KT. N1 PCT | HEADWIND 100 KT. N1 PCT |
|---|---|---|---|---|---|---|---|
| 20000 | 89.2 | 89.9 | 90.0 | 90.2 | 90.3 | 90.4 | 93.7 |
| 18000 | 85.4 | 86.0 | 86.3 | 86.7 | 87.5 | 88.1 | 90.5 |
| 16000 | 81.7 | 82.2 | 82.7 | 83.3 | 84.3 | 85.4 | 87.3 |
| 14000 | 78.1 | 78.6 | 79.1 | 79.7 | 80.9 | 82.1 | 83.8 |
| 12000 | 74.7 | 75.0 | 75.5 | 76.1 | 77.2 | 78.3 | 80.1 |

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1384. | 0.67 | 1417. | 0.70 | 1438. | 0.70 | 1461. | 0.73 | 1487. | 0.77 | 1520. | 0.80 | 1612. | 0.86 |
| | 16500 | 1296. | 0.66 | 1329. | 0.69 | 1351. | 0.69 | 1374. | 0.71 | 1401. | 0.73 | 1432. | 0.76 | 1517. | 0.83 |
| | 12500 | 1198. | 0.67 | 1232. | 0.70 | 1254. | 0.70 | 1278. | 0.72 | 1305. | 0.74 | 1336. | 0.77 | 1421. | 0.85 |
| 400 | 20000 | 1762. | 1.14 | 1849. | 1.22 | 1902. | 1.25 | 1962. | 1.31 | 2031. | 1.36 | 2111. | 1.41 | 2332. | 1.52 |
| | 16500 | 1611. | 1.16 | 1691. | 1.26 | 1742. | 1.30 | 1799. | 1.36 | 1866. | 1.41 | 1944. | 1.45 | 2143. | 1.60 |
| | 12500 | 1456. | 1.19 | 1530. | 1.30 | 1577. | 1.34 | 1629. | 1.40 | 1691. | 1.48 | 1764. | 1.56 | 1960. | 1.74 |
| 600 | 20000 | 2140. | 1.61 | 2281. | 1.74 | 2366. | 1.80 | 2463. | 1.88 | 2574. | 1.94 | 2702. | 2.03 | 3053. | 2.19 |
| | 16500 | 1925. | 1.66 | 2053. | 1.83 | 2133. | 1.91 | 2224. | 2.00 | 2330. | 2.08 | 2457. | 2.15 | 2769. | 2.36 |
| | 12500 | 1714. | 1.71 | 1828. | 1.89 | 1899. | 1.97 | 1981. | 2.09 | 2078. | 2.21 | 2193. | 2.35 | 2500. | 2.63 |
| 800 | 20000 | 2518. | 2.08 | 2713. | 2.27 | 2830. | 2.35 | 2963. | 2.46 | 3117. | 2.53 | 3293. | 2.64 | 3774. | 2.86 |
| | 16500 | 2240. | 2.17 | 2415. | 2.39 | 2524. | 2.51 | 2650. | 2.65 | 2795. | 2.75 | 2969. | 2.84 | 3395. | 3.13 |
| | 12500 | 1972. | 2.23 | 2126. | 2.48 | 2222. | 2.61 | 2333. | 2.77 | 2464. | 2.94 | 2621. | 3.13 | 3039. | 3.52 |
| 1000 | 20000 | 2897. | 2.56 | 3144. | 2.79 | 3294. | 2.90 | 3464. | 3.04 | 3660. | 3.12 | 3884. | 3.25 | 4494. | 3.53 |
| | 16500 | 2555. | 2.67 | 2777. | 2.96 | 2916. | 3.12 | 3075. | 3.30 | 3260. | 3.42 | 3481. | 3.53 | 4021. | 3.89 |
| | 12500 | 2230. | 2.75 | 2424. | 3.07 | 2544. | 3.24 | 2684. | 3.45 | 2851. | 3.67 | 3049. | 3.92 | 3578. | 4.41 |
| 1200 | 20000 | 3275. | 3.03 | 3576. | 3.31 | 3758. | 3.45 | 3965. | 3.61 | 4204. | 3.71 | 4475. | 3.87 | 5215. | 4.19 |
| | 16500 | 2870. | 3.18 | 3139. | 3.53 | 3307. | 3.73 | 3500. | 3.94 | 3724. | 4.09 | 3993. | 4.22 | 4647. | 4.66 |
| | 12500 | 2488. | 3.27 | 2722. | 3.67 | 2867. | 3.88 | 3036. | 4.13 | 3237. | 4.41 | 3478. | 4.71 | 4117. | 5.30 |
| 1400 | 20000 | 3653. | 3.50 | 4008. | 3.84 | 4222. | 4.00 | 4465. | 4.19 | 4747. | 4.29 | 5065. | 4.48 | 5936. | 4.86 |
| | 16500 | 3184. | 3.68 | 3501. | 4.10 | 3698. | 4.34 | 3925. | 4.59 | 4189. | 4.76 | 4505. | 4.91 | 5273. | 5.43 |
| | 12500 | 2746. | 3.79 | 3020. | 4.26 | 3190. | 4.51 | 3388. | 4.82 | 3624. | 5.14 | 3906. | 5.49 | 4656. | 6.19 |
| 1600 | 20000 | 4031. | 3.97 | 4440. | 4.36 | 4686. | 4.55 | 4966. | 4.76 | 5290. | 4.88 | 5656. | 5.09 | 6656. | 5.53 |
| | 16500 | 3499. | 4.18 | 3863. | 4.67 | 4090. | 4.94 | 4350. | 5.24 | 4654. | 5.43 | 5017. | 5.61 | 5899. | 6.19 |
| | 12500 | 3004. | 4.31 | 3317. | 4.85 | 3512. | 5.15 | 3739. | 5.50 | 4010. | 5.87 | 4334. | 6.28 | 5196. | 7.08 |
| 1800 | 20000 | 4409. | 4.45 | 4872. | 4.88 | 5150. | 5.10 | 5467. | 5.34 | 5834. | 5.47 | 6247. | 5.71 | 7377. | 6.20 |
| | 16500 | 3814. | 4.69 | 4225. | 5.24 | 4481. | 5.55 | 4776. | 5.88 | 5119. | 6.10 | 5529. | 6.30 | 6525. | 6.96 |
| | 12500 | 3262. | 4.83 | 3615. | 5.44 | 3835. | 5.78 | 4091. | 6.18 | 4397. | 6.61 | 4763. | 7.07 | | |
| 2000 | 20000 | 4788. | 4.92 | 5303. | 5.41 | 5614. | 5.65 | 5968. | 5.92 | 6377. | 6.06 | 6838. | 6.32 | 8098. | 6.87 |
| | 16500 | 4128. | 5.19 | 4587. | 5.81 | 4872. | 6.16 | 5201. | 6.53 | 5583. | 6.77 | 6041. | 6.99 | 7151. | 7.72 |
| | 12500 | 3520. | 5.35 | 3913. | 6.04 | 4157. | 6.42 | 4442. | 6.87 | 4783. | 7.34 | | | | |
| 2200 | 20000 | 5166. | 5.39 | 5735. | 5.93 | 6078. | 6.20 | 6468. | 6.49 | 6920. | 6.64 | 7429. | 6.93 | 8818. | 7.53 |
| | 16500 | 4443. | 5.69 | 4949. | 6.37 | 5263. | 6.76 | 5626. | 7.18 | 6048. | 7.45 | 6553. | 7.68 | 7777. | 8.49 |
| | 12500 | 3778. | 5.87 | 4211. | 6.63 | 4480. | 7.05 | 4794. | 7.55 | | | | | | |
| 2400 | 20000 | 5544. | 5.87 | 6167. | 6.45 | 6542. | 6.75 | 6969. | 7.07 | 7463. | 7.23 | 8020. | 7.55 | | |
| | 16500 | 4758. | 6.20 | 5311. | 6.94 | 5655. | 7.37 | 6051. | 7.82 | 6513. | 8.12 | 7065. | 8.37 | | |
| | 12500 | 4036. | 6.39 | 4509. | 7.22 | 4802. | 7.69 | | | | | | | | |
| 2600 | 20000 | 5922. | 6.34 | 6599. | 6.97 | 7006. | 7.30 | 7470. | 7.65 | 8007. | 7.82 | | | | |
| | 16500 | 5073. | 6.70 | 5673. | 7.51 | 6046. | 7.98 | 6477. | 8.47 | 6978. | 8.79 | | | | |
| | 12500 | 4295. | 6.91 | 4807. | 7.81 | | | | | | | | | | |
| 2800 | 20000 | 6300. | 6.81 | 7030. | 7.50 | 7469. | 7.85 | 7970. | 8.22 | | | | | | |
| | 16500 | 5387. | 7.20 | 6035. | 8.08 | 6437. | 8.59 | 6902. | 9.12 | | | | | | |
| | 12500 | 4553. | 7.43 | | | | | | | | | | | | |
| 3000 | 20000 | 6678. | 7.28 | 7462. | 8.02 | 7933. | 8.40 | | | | | | | | |
| | 16500 | 5702. | 7.71 | 6397. | 8.65 | 6828. | 9.19 | | | | | | | | |
| | 12500 | 4811. | 7.95 | | | | | | | | | | | | |
| 3200 | 20000 | 7057. | 7.76 | 7894. | 8.54 | 8397. | 8.95 | | | | | | | | |
| | 16500 | 6017. | 8.21 | 6759. | 9.22 | 7220. | 9.80 | | | | | | | | |
| | 12500 | 5069. | 8.47 | | | | | | | | | | | | |

Figure 7-9 (Sheet 9)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 43000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| CRUISE WEIGHT LBS. | TRAILWIND 100 KT. N1 PCT | TRAILWIND 50 KT. N1 PCT | TRAILWIND 25 KT. N1 PCT | ZERO WIND N1 PCT | HEADWIND 25 KT. N1 PCT | HEADWIND 50 KT. N1 PCT | HEADWIND 100 KT. N1 PCT |
|---|---|---|---|---|---|---|---|
| 20000 | 90.6 | 91.0 | 93.7 | 94.5 | 94.6 | 93.8 | 93.7 |
| 18000 | 87.3 | 87.9 | 89.4 | 90.1 | 90.6 | 91.0 | 91.3 |
| 16000 | 84.0 | 84.7 | 85.3 | 85.8 | 86.7 | 87.7 | 88.5 |
| 14000 | 80.6 | 81.2 | 81.3 | 81.8 | 82.9 | 84.2 | 85.5 |
| 12000 | 77.2 | 77.5 | 77.6 | 78.0 | 79.2 | 80.3 | 82.1 |

| STAGE LENGTH NM. | T.O. WEIGHT LBS. | TRAILWIND 100 KT. FUEL LBS. | TRAILWIND 100 KT. TIME HRS. | TRAILWIND 50 KT. FUEL LBS. | TRAILWIND 50 KT. TIME HRS. | TRAILWIND 25 KT. FUEL LBS. | TRAILWIND 25 KT. TIME HRS. | ZERO WIND FUEL LBS. | ZERO WIND TIME HRS. | HEADWIND 25 KT. FUEL LBS. | HEADWIND 25 KT. TIME HRS. | HEADWIND 50 KT. FUEL LBS. | HEADWIND 50 KT. TIME HRS. | HEADWIND 100 KT. FUEL LBS. | HEADWIND 100 KT. TIME HRS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 20000 | 1415. | 0.71 | 1448. | 0.75 | 1470. | 0.72 | 1493. | 0.74 | 1518. | 0.77 | 1547. | 0.80 | 1626. | 0.86 |
| | 16500 | 1315. | 0.65 | 1346. | 0.68 | 1366. | 0.68 | 1387. | 0.70 | 1411. | 0.74 | 1440. | 0.77 | 1521. | 0.83 |
| | 12500 | 1212. | 0.67 | 1245. | 0.70 | 1266. | 0.70 | 1288. | 0.72 | 1313. | 0.74 | 1344. | 0.76 | 1422. | 0.82 |
| 400 | 20000 | 1791. | 1.16 | 1876. | 1.24 | 1928. | 1.24 | 1986. | 1.29 | 2050. | 1.35 | 2123. | 1.41 | 2312. | 1.55 |
| | 16500 | 1624. | 1.15 | 1700. | 1.23 | 1748. | 1.27 | 1801. | 1.32 | 1863. | 1.37 | 1936. | 1.42 | 2119. | 1.56 |
| | 12500 | 1462. | 1.17 | 1532. | 1.28 | 1575. | 1.32 | 1625. | 1.39 | 1682. | 1.45 | 1751. | 1.51 | 1931. | 1.68 |
| 600 | 20000 | 2167. | 1.62 | 2303. | 1.74 | 2386. | 1.77 | 2479. | 1.84 | 2581. | 1.92 | 2699. | 2.02 | 2998. | 2.25 |
| | 16500 | 1933. | 1.64 | 2054. | 1.79 | 2130. | 1.86 | 2215. | 1.95 | 2314. | 2.01 | 2431. | 2.07 | 2718. | 2.28 |
| | 12500 | 1712. | 1.68 | 1818. | 1.85 | 1885. | 1.94 | 1962. | 2.05 | 2052. | 2.15 | 2159. | 2.27 | 2439. | 2.53 |
| 800 | 20000 | 2543. | 2.08 | 2730. | 2.24 | 2843. | 2.29 | 2972. | 2.39 | 3112. | 2.50 | 3276. | 2.63 | 3684. | 2.94 |
| | 16500 | 2242. | 2.13 | 2409. | 2.34 | 2512. | 2.45 | 2629. | 2.57 | 2766. | 2.65 | 2927. | 2.72 | 3316. | 3.01 |
| | 12500 | 1961. | 2.19 | 2105. | 2.43 | 2195. | 2.56 | 2298. | 2.71 | 2421. | 2.86 | 2567. | 3.03 | 2947. | 3.39 |
| 1000 | 20000 | 2919. | 2.53 | 3157. | 2.74 | 3301. | 2.82 | 3465. | 2.93 | 3644. | 3.07 | 3852. | 3.24 | 4370. | 3.64 |
| | 16500 | 2550. | 2.62 | 2763. | 2.90 | 2893. | 3.04 | 3044. | 3.19 | 3218. | 3.29 | 3422. | 3.37 | 3914. | 3.74 |
| | 12500 | 2211. | 2.70 | 2392. | 3.01 | 2505. | 3.18 | 2635. | 3.38 | 2790. | 3.57 | 2975. | 3.79 | 3455. | 4.25 |
| 1200 | 20000 | 3295. | 2.99 | 3585. | 3.24 | 3759. | 3.34 | 3957. | 3.48 | 4175. | 3.65 | 4428. | 3.85 | 5056. | 4.33 |
| | 16500 | 2859. | 3.12 | 3117. | 3.45 | 3275. | 3.63 | 3458. | 3.81 | 3670. | 3.92 | 3918. | 4.02 | 4512. | 4.46 |
| | 12500 | 2460. | 3.20 | 2679. | 3.59 | 2815. | 3.80 | 2972. | 4.04 | 3159. | 4.28 | 3382. | 4.54 | 3964. | 5.11 |
| 1400 | 20000 | 3671. | 3.45 | 4012. | 3.74 | 4217. | 3.87 | 4450. | 4.03 | 4707. | 4.23 | 5004. | 4.45 | 5742. | 5.03 |
| | 16500 | 3168. | 3.61 | 3471. | 4.01 | 3657. | 4.21 | 3872. | 4.43 | 4121. | 4.56 | 4413. | 4.67 | 5111. | 5.19 |
| | 12500 | 2710. | 3.71 | 2966. | 4.16 | 3124. | 4.42 | 3309. | 4.70 | 3528. | 4.98 | 3790. | 5.30 | 4472. | 5.97 |
| 1600 | 20000 | 4047. | 3.90 | 4439. | 4.23 | 4674. | 4.39 | 4943. | 4.58 | 5238. | 4.80 | 5580. | 5.06 | 6428. | 5.72 |
| | 16500 | 3477. | 4.10 | 3825. | 4.57 | 4039. | 4.80 | 4286. | 5.05 | 4573. | 5.20 | 4909. | 5.32 | 5709. | 5.92 |
| | 12500 | 2959. | 4.22 | 3252. | 4.74 | 3434. | 5.04 | 3646. | 5.37 | 3898. | 5.69 | 4198. | 6.06 | 4980. | 6.82 |
| 1800 | 20000 | 4423. | 4.36 | 4867. | 4.73 | 5132. | 4.92 | 5436. | 5.12 | 5769. | 5.38 | 6156. | 5.67 | 7114. | 6.42 |
| | 16500 | 3785. | 4.60 | 4179. | 5.12 | 4421. | 5.39 | 4700. | 5.68 | 5025. | 5.84 | 5405. | 5.97 | 6307. | 6.64 |
| | 12500 | 3209. | 4.73 | 3539. | 5.32 | 3744. | 5.66 | 3983. | 6.03 | 4267. | 6.40 | 4605. | 6.82 | | |
| 2000 | 20000 | 4799. | 4.82 | 5294. | 5.23 | 5590. | 5.44 | 5929. | 5.67 | 6301. | 5.96 | 6733. | 6.28 | 7800. | 7.11 |
| | 16500 | 4094. | 5.09 | 4534. | 5.68 | 4803. | 5.98 | 5114. | 6.30 | 5477. | 6.47 | 5900. | 6.62 | 6906. | 7.37 |
| | 12500 | 3458. | 5.23 | 3826. | 5.89 | 4054. | 6.28 | 4320. | 6.69 | 4636. | 7.10 | | | | |
| 2200 | 20000 | 5175. | 5.27 | 5721. | 5.73 | 6047. | 5.96 | 6422. | 6.22 | 6832. | 6.53 | 7309. | 6.89 | 8486. | 7.81 |
| | 16500 | 4403. | 5.58 | 4888. | 6.23 | 5184. | 6.57 | 5528. | 6.92 | 5928. | 7.11 | 6396. | 7.27 | 7504. | 8.10 |
| | 12500 | 3708. | 5.74 | 4113. | 6.47 | 4364. | 6.90 | 4657. | 7.36 | | | | | | |
| 2400 | 20000 | 5551. | 5.73 | 6148. | 6.23 | 6505. | 6.49 | 6914. | 6.77 | 7364. | 7.11 | 7885. | 7.50 | | |
| | 16500 | 4712. | 6.08 | 5242. | 6.79 | 5566. | 7.16 | 5942. | 7.54 | 6380. | 7.75 | 6891. | 7.92 | | |
| | 12500 | 3958. | 6.25 | 4400. | 7.05 | 4673. | 7.52 | | | | | | | | |
| 2600 | 20000 | 5927. | 6.19 | 6576. | 6.72 | 6963. | 7.01 | 7407. | 7.32 | 7895. | 7.68 | | | | |
| | 16500 | 5020. | 6.57 | 5596. | 7.34 | 5948. | 7.75 | 6356. | 8.16 | 6832. | 8.38 | | | | |
| | 12500 | 4207. | 6.75 | 4686. | 7.63 | | | | | | | | | | |
| 2800 | 20000 | 6303. | 6.65 | 7003. | 7.22 | 7421. | 7.54 | 7900. | 7.86 | 8426. | 8.26 | | | | |
| | 16500 | 5329. | 7.06 | 5950. | 7.90 | 6330. | 8.34 | 6770. | 8.78 | 7284. | 9.02 | | | | |
| | 12500 | 4457. | 7.26 | 4973. | 8.20 | | | | | | | | | | |
| 3000 | 20000 | 6679. | 7.10 | 7430. | 7.72 | 7878. | 8.06 | 8393. | 8.41 | | | | | | |
| | 16500 | 5638. | 7.56 | 6304. | 8.45 | 6712. | 8.93 | 7184. | 9.40 | | | | | | |
| | 12500 | 4706. | 7.77 | | | | | | | | | | | | |
| 3200 | 20000 | 7055. | 7.56 | 7857. | 8.22 | 8336. | 8.59 | | | | | | | | |
| | 16500 | 5947. | 8.05 | 6659. | 9.01 | 7094. | 9.52 | | | | | | | | |
| | 12500 | 4956. | 8.28 | | | | | | | | | | | | |

Figure 7-9 (Sheet 10)

# FLIGHT PLANNING
## LONG RANGE CRUISE

**STANDARD DAY** **CRUISE ALTITUDE 45000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

| CRUISE WEIGHT LBS. | TAILWIND 100 KT. N1 PCT | TAILWIND 50 KT. N1 PCT | TAILWIND 25 KT. N1 PCT | ZERO WIND N1 PCT | HEADWIND 25 KT. N1 PCT | HEADWIND 50 KT. N1 PCT | HEADWIND 100 KT. N1 PCT |
|---|---|---|---|---|---|---|---|
| 20000 | 92.7 | 92.8 | 92.9 | 93.0 | 96.8 | 95.8 | 95.1 |
| 18000 | 90.0 | 90.4 | 90.5 | 90.6 | 92.7 | 92.8 | 92.9 |
| 16000 | 86.9 | 87.4 | 87.6 | 87.9 | 89.1 | 89.7 | 90.4 |
| 14000 | 83.4 | 84.0 | 84.3 | 84.8 | 85.4 | 86.3 | 87.4 |
| 12000 | 79.6 | 80.2 | 80.5 | 81.2 | 81.8 | 82.7 | 84.1 |

| | | TAILWIND | | | | | | ZERO | | HEADWIND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | T.O. | 100 KT. | | 50 KT. | | 25 KT. | | WIND | | 25 KT. | | 50 KT. | | 100 KT. | |
| LENGTH NM. | WEIGHT LBS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. | FUEL LBS. | TIME HRS. |
| 200 | 20000 | 1593. | 0.77 | 1622. | 0.82 | 1651. | 0.80 | 1676. | 0.82 | 1705. | 0.79 | 1717. | 0.83 | 1790. | 0.87 |
| | 16500 | 1339. | 0.65 | 1367. | 0.67 | 1385. | 0.68 | 1404. | 0.70 | 1426. | 0.75 | 1452. | 0.78 | 1529. | 0.84 |
| | 12500 | 1228. | 0.66 | 1258. | 0.69 | 1277. | 0.70 | 1298. | 0.72 | 1322. | 0.73 | 1350. | 0.74 | 1423. | 0.79 |
| 400 | 20000 | 1956. | 1.21 | 2035. | 1.29 | 2089. | 1.30 | 2145. | 1.35 | 2210. | 1.35 | 2262. | 1.44 | 2437. | 1.57 |
| | 16500 | 1640. | 1.13 | 1712. | 1.21 | 1755. | 1.24 | 1804. | 1.29 | 1861. | 1.35 | 1927. | 1.40 | 2096. | 1.54 |
| | 12500 | 1469. | 1.16 | 1535. | 1.26 | 1576. | 1.29 | 1623. | 1.35 | 1676. | 1.40 | 1740. | 1.46 | 1903. | 1.62 |
| 600 | 20000 | 2319. | 1.64 | 2447. | 1.76 | 2526. | 1.81 | 2614. | 1.88 | 2714. | 1.92 | 2807. | 2.04 | 3085. | 2.28 |
| | 16500 | 1942. | 1.61 | 2056. | 1.74 | 2126. | 1.80 | 2205. | 1.88 | 2296. | 1.94 | 2402. | 2.02 | 2663. | 2.24 |
| | 12500 | 1710. | 1.66 | 1812. | 1.82 | 1875. | 1.89 | 1948. | 1.98 | 2031. | 2.07 | 2130. | 2.18 | 2383. | 2.45 |
| 800 | 20000 | 2681. | 2.07 | 2860. | 2.23 | 2963. | 2.31 | 3082. | 2.41 | 3219. | 2.48 | 3353. | 2.65 | 3732. | 2.98 |
| | 16500 | 2243. | 2.08 | 2400. | 2.27 | 2496. | 2.36 | 2605. | 2.47 | 2730. | 2.54 | 2876. | 2.63 | 3229. | 2.94 |
| | 12500 | 1951. | 2.16 | 2088. | 2.38 | 2174. | 2.49 | 2273. | 2.61 | 2386. | 2.75 | 2519. | 2.90 | 2862. | 3.28 |
| 1000 | 20000 | 3044. | 2.51 | 3272. | 2.70 | 3401. | 2.81 | 3551. | 2.94 | 3723. | 3.05 | 3898. | 3.26 | 4379. | 3.69 |
| | 16500 | 2544. | 2.56 | 2744. | 2.81 | 2867. | 2.93 | 3006. | 3.06 | 3165. | 3.14 | 3351. | 3.25 | 3796. | 3.64 |
| | 12500 | 2192. | 2.66 | 2365. | 2.95 | 2474. | 3.08 | 2598. | 3.24 | 2741. | 3.42 | 2909. | 3.62 | 3342. | 4.11 |
| 1200 | 20000 | 3407. | 2.94 | 3685. | 3.17 | 3838. | 3.31 | 4020. | 3.47 | 4228. | 3.62 | 4443. | 3.87 | 5027. | 4.39 |
| | 16500 | 2846. | 3.04 | 3089. | 3.34 | 3237. | 3.49 | 3406. | 3.64 | 3600. | 3.74 | 3826. | 3.87 | 4362. | 4.34 |
| | 12500 | 2433. | 3.17 | 2642. | 3.51 | 2773. | 3.68 | 2923. | 3.88 | 3096. | 4.09 | 3299. | 4.34 | 3822. | 4.94 |
| 1400 | 20000 | 3770. | 3.38 | 4097. | 3.64 | 4276. | 3.81 | 4489. | 4.00 | 4732. | 4.18 | 4988. | 4.48 | 5674. | 5.10 |
| | 16500 | 3147. | 3.52 | 3433. | 3.87 | 3608. | 4.05 | 3807. | 4.23 | 4035. | 4.34 | 4300. | 4.48 | 4929. | 5.04 |
| | 12500 | 2673. | 3.67 | 2919. | 4.08 | 3072. | 4.28 | 3248. | 4.51 | 3450. | 4.76 | 3688. | 5.06 | 4302. | 5.76 |
| 1600 | 20000 | 4133. | 3.81 | 4510. | 4.11 | 4713. | 4.32 | 4957. | 4.53 | 5237. | 4.75 | 5533. | 5.08 | 6321. | 5.80 |
| | 16500 | 3449. | 4.00 | 3777. | 4.41 | 3978. | 4.61 | 4208. | 4.82 | 4470. | 4.94 | 4775. | 5.10 | 5495. | 5.73 |
| | 12500 | 2914. | 4.17 | 3195. | 4.64 | 3371. | 4.87 | 3573. | 5.14 | 3805. | 5.43 | 4078. | 5.78 | 4781. | 6.59 |
| 1800 | 20000 | 4496. | 4.24 | 4922. | 4.58 | 5151. | 4.82 | 5426. | 5.06 | 5741. | 5.31 | 6079. | 5.69 | 6969. | 6.51 |
| | 16500 | 3750. | 4.48 | 4121. | 4.94 | 4349. | 5.17 | 4608. | 5.41 | 4905. | 5.54 | 5250. | 5.71 | 6062. | 6.43 |
| | 12500 | 3155. | 4.67 | 3472. | 5.21 | 3670. | 5.47 | 3898. | 5.77 | 4160. | 6.11 | 4468. | 6.50 | 5261. | 7.42 |
| 2000 | 20000 | 4859. | 4.68 | 5335. | 5.05 | 5588. | 5.32 | 5895. | 5.59 | 6246. | 5.88 | 6624. | 6.30 | 7616. | 7.22 |
| | 16500 | 4051. | 4.96 | 4466. | 5.47 | 4719. | 5.73 | 5009. | 6.00 | 5340. | 6.13 | 5724. | 6.33 | 6628. | 7.13 |
| | 12500 | 3396. | 5.17 | 3749. | 5.77 | 3969. | 6.07 | 4223. | 6.40 | 4515. | 6.78 | 4858. | 7.21 | | |
| 2200 | 20000 | 5221. | 5.11 | 5747. | 5.52 | 6026. | 5.82 | 6364. | 6.12 | 6750. | 6.45 | 7169. | 6.91 | 8263. | 7.92 |
| | 16500 | 4353. | 5.44 | 4810. | 6.00 | 5090. | 6.30 | 5409. | 6.58 | 5775. | 6.73 | 6199. | 6.95 | 7195. | 7.83 |
| | 12500 | 3637. | 5.68 | 4026. | 6.34 | 4268. | 6.66 | 4548. | 7.03 | | | | | | |
| 2400 | 20000 | 5584. | 5.55 | 6159. | 5.99 | 6463. | 6.33 | 6832. | 6.65 | 7255. | 7.01 | 7714. | 7.51 | 8911. | 8.63 |
| | 16500 | 4654. | 5.91 | 5154. | 6.54 | 5460. | 6.86 | 5810. | 7.17 | 6210. | 7.33 | 6674. | 7.56 | 7761. | 8.53 |
| | 12500 | 3878. | 6.18 | 4302. | 6.90 | 4567. | 7.26 | | | | | | | | |
| 2600 | 20000 | 5947. | 5.98 | 6572. | 6.46 | 6901. | 6.83 | 7301. | 7.18 | 7759. | 7.58 | 8259. | 8.12 | | |
| | 16500 | 4955. | 6.39 | 5498. | 7.07 | 5831. | 7.42 | 6210. | 7.76 | 6644. | 7.93 | 7149. | 8.18 | | |
| | 12500 | 4118. | 6.68 | 4579. | 7.47 | | | | | | | | | | |
| 2800 | 20000 | 6310. | 6.42 | 6984. | 6.93 | 7338. | 7.33 | 7770. | 7.71 | 8264. | 8.15 | | | | |
| | 16500 | 5257. | 6.87 | 5843. | 7.60 | 6201. | 7.98 | 6611. | 8.35 | 7079. | 8.53 | | | | |
| | 12500 | 4359. | 7.18 | 4856. | 8.03 | | | | | | | | | | |
| 3000 | 20000 | 6673. | 6.85 | 7397. | 7.40 | 7776. | 7.83 | 8239. | 8.24 | | | | | | |
| | 16500 | 5558. | 7.35 | 6187. | 8.14 | 6572. | 8.54 | 7011. | 8.93 | | | | | | |
| | 12500 | 4600. | 7.68 | | | | | | | | | | | | |
| 3200 | 20000 | 7036. | 7.28 | 7809. | 7.87 | 8213. | 8.33 | | | | | | | | |
| | 16500 | 5860. | 7.83 | 6531. | 8.67 | 6942. | 9.11 | | | | | | | | |
| | 12500 | 4841. | 8.19 | | | | | | | | | | | | |

Figure 7-9 (Sheet 11)

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# CLIMB

Climb performance for three multi-engine climb schedules is presented in tabular form on the following pages. The climbs are:

- 230 KIAS/0.60 Indicated Mach
- 250 KIAS/0.62 Indicated Mach
- 250 KIAS/0.65 Indicated Mach

This performance is based on maximum continuous climb thrust setting on both engines, gear and flaps up, speed brakes retracted, and anti-ice systems OFF. The performance is also presented for anti-ice systems ON.

The time, distance, fuel and rate-of-climb used to any given altitude is based on the climb starting at sea level. If the climb is initiated at some other altitude, it is necessary to go into the data twice, once at the initial altitude and once at the final altitude. The difference in time, distance, and fuel between these two altitudes provides the proper values for the climb. The data allows for fuel burnoff in the climb; therefore, the weight presented is at the start of the climb.

The climb data for the conditions requiring a step climb are based on climbing direct to the highest obtainable altitude as shown in the step climb weight table, cruising at the altitude until the desired weight is achieved, and then climbing to the desired altitude or the next step altitude per the step climb weight table.

Consult the buffet onset chart in Section IV, Performance, Standard Charts, of the FAA Approved Airplane Flight Manual to ensure adequate maneuver margin during the climb phase of flight.

# MULTI ENGINE CLIMB

## 230 KIAS/0.60 INDICATED MACH

**TIME, DISTANCE, FUEL, AND RATE OF CLIMB** **ANTI-ICE SYSTEMS OFF**

| T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | 5000 FEET ISA = 5°C = 41°F | | | | | 10000 FEET ISA = - 5°C = 23°F | | | | | 15000 FEET ISA = -15°C = 6°F | | | | | 17000 FEET ISA = -19°C = - 2°F | | | | |
| MIN | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 7 | 6 | 6 | 5 | 5 | 8 | 7 | 7 | 6 | 5 |
| ISA NM | 7 | 6 | 6 | 5 | 4 | 16 | 15 | 14 | 12 | 10 | 28 | 26 | 24 | 21 | 18 | 33 | 31 | 29 | 25 | 21 |
| +20°C LB | 89 | 84 | 79 | 68 | 59 | 181 | 170 | 159 | 138 | 118 | 276 | 258 | 241 | 209 | 179 | 313 | 293 | 273 | 236 | 202 |
| R/C | 2650 | 2828 | 3023 | 3480 | 4056 | 2246 | 2404 | 2578 | 2984 | 3494 | 1999 | 2147 | 2309 | 2686 | 3159 | 1983 | 2132 | 2292 | 2668 | 3140 |
| MIN | 2 | 2 | 2 | 2 | 1 | 4 | 3 | 3 | 3 | 2 | 5 | 5 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 4 |
| ISA NM | 5 | 5 | 5 | 4 | 3 | 12 | 11 | 11 | 9 | 8 | 21 | 19 | 18 | 16 | 13 | 24 | 23 | 21 | 18 | 16 |
| +10°C LB | 77 | 73 | 68 | 60 | 51 | 154 | 145 | 136 | 118 | 102 | 232 | 217 | 204 | 177 | 152 | 262 | 246 | 230 | 200 | 172 |
| R/C | 3430 | 3650 | 3891 | 4458 | 5176 | 2990 | 3188 | 3407 | 3918 | 4564 | 2704 | 2891 | 3095 | 3572 | 4174 | 2648 | 2832 | 3033 | 3505 | 4098 |
| MIN | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 4 | 4 |
| ISA NM | 5 | 4 | 4 | 3 | 3 | 10 | 10 | 9 | 8 | 7 | 17 | 16 | 15 | 13 | 11 | 20 | 18 | 17 | 15 | 13 |
| LB | 67 | 64 | 60 | 52 | 45 | 136 | 128 | 120 | 105 | 91 | 202 | 190 | 178 | 156 | 134 | 228 | 214 | 201 | 175 | 151 |
| R/C | 4014 | 4264 | 4541 | 5191 | 6016 | 3721 | 3959 | 4222 | 4836 | 5615 | 3508 | 3738 | 3990 | 4582 | 5330 | 3372 | 3596 | 3841 | 4415 | 5142 |
| MIN | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 3 |
| ISA NM | 4 | 4 | 4 | 3 | 3 | 9 | 9 | 8 | 7 | 6 | 14 | 13 | 13 | 11 | 9 | 17 | 16 | 15 | 13 | 11 |
| -10°C LB | 65 | 61 | 57 | 50 | 43 | 124 | 117 | 110 | 96 | 83 | 183 | 172 | 161 | 141 | 122 | 205 | 193 | 181 | 159 | 137 |
| R/C | 4081 | 4336 | 4617 | 5279 | 6117 | 4567 | 4850 | 5163 | 5898 | 6830 | 4250 | 4520 | 4817 | 5515 | 6399 | 4112 | 4376 | 4666 | 5346 | 6208 |
| PRESSURE ALTITUDE | 19000 FEET ISA = -23°C = - 9°F | | | | | 21000 FEET ISA = -27°C = -16°F | | | | | 23000 FEET ISA = -31°C = -23°F | | | | | 25000 FEET ISA = -35°C = -30°F | | | | |
| MIN | 9 | 8 | 8 | 7 | 6 | 10 | 9 | 9 | 8 | 7 | 11 | 11 | 10 | 9 | 7 | 13 | 12 | 11 | 10 | 8 |
| ISA NM | 39 | 36 | 33 | 29 | 24 | 45 | 42 | 39 | 33 | 28 | 52 | 48 | 45 | 38 | 33 | 61 | 57 | 52 | 45 | 38 |
| +20°C LB | 350 | 327 | 305 | 264 | 225 | 389 | 363 | 339 | 292 | 249 | 432 | 403 | 375 | 323 | 275 | 480 | 447 | 415 | 357 | 304 |
| R/C | 1908 | 2053 | 2211 | 2579 | 3040 | 1709 | 1844 | 1993 | 2336 | 2764 | 1442 | 1564 | 1697 | 2005 | 2389 | 1197 | 1309 | 1430 | 1707 | 2050 |
| MIN | 7 | 6 | 6 | 5 | 5 | 8 | 7 | 7 | 6 | 5 | 9 | 8 | 8 | 7 | 6 | 10 | 9 | 8 | 7 | 6 |
| ISA NM | 28 | 27 | 25 | 21 | 18 | 33 | 31 | 29 | 25 | 21 | 38 | 35 | 33 | 28 | 24 | 44 | 41 | 38 | 33 | 28 |
| +10°C LB | 292 | 274 | 256 | 223 | 191 | 323 | 303 | 283 | 246 | 211 | 356 | 333 | 312 | 271 | 232 | 391 | 366 | 342 | 296 | 254 |
| R/C | 2568 | 2748 | 2946 | 3409 | 3991 | 2373 | 2545 | 2733 | 3171 | 3722 | 2114 | 2274 | 2448 | 2853 | 3361 | 1861 | 2009 | 2170 | 2543 | 3009 |
| MIN | 6 | 5 | 5 | 4 | 4 | 6 | 6 | 6 | 5 | 4 | 7 | 7 | 6 | 5 | 5 | 8 | 7 | 7 | 6 | 5 |
| ISA NM | 23 | 21 | 20 | 17 | 15 | 26 | 24 | 23 | 20 | 17 | 30 | 28 | 26 | 23 | 19 | 34 | 32 | 30 | 26 | 22 |
| LB | 254 | 238 | 224 | 195 | 168 | 280 | 263 | 247 | 215 | 185 | 307 | 289 | 271 | 236 | 203 | 336 | 316 | 296 | 257 | 221 |
| R/C | 3223 | 3440 | 3678 | 4235 | 4937 | 3004 | 3210 | 3437 | 3966 | 4633 | 2753 | 2947 | 3161 | 3659 | 4284 | 2447 | 2628 | 2825 | 3283 | 3858 |
| MIN | 5 | 5 | 4 | 4 | 4 | 6 | 5 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 7 | 6 | 6 | 5 | 5 |
| ISA NM | 19 | 18 | 17 | 15 | 12 | 22 | 21 | 19 | 17 | 14 | 25 | 23 | 22 | 19 | 16 | 28 | 27 | 25 | 22 | 18 |
| -10°C LB | 228 | 215 | 202 | 176 | 152 | 252 | 237 | 223 | 195 | 168 | 277 | 260 | 244 | 213 | 184 | 303 | 284 | 267 | 233 | 201 |
| R/C | 3864 | 4114 | 4392 | 5041 | 5861 | 3581 | 3818 | 4081 | 4692 | 5468 | 3304 | 3528 | 3775 | 4353 | 5081 | 2999 | 3210 | 3442 | 3981 | 4659 |
| PRESSURE ALTITUDE | 27000 FEET ISA = -38°C = -37°F | | | | | 29000 FEET ISA = -42°C = -44°F | | | | | 31000 FEET ISA = -46°C = -52°F | | | | | 33000 FEET ISA = -50°C = -59°F | | | | |
| MIN | 15 | 14 | 13 | 11 | 9 | 17 | 16 | 15 | 12 | 11 | 19 | 18 | 16 | 14 | 12 | 21 | 19 | 18 | 15 | 13 |
| ISA NM | 72 | 67 | 62 | 53 | 44 | 86 | 79 | 73 | 62 | 52 | 99 | 91 | 83 | 70 | 58 | 111 | 102 | 93 | 78 | 65 |
| +20°C LB | 536 | 498 | 462 | 396 | 336 | 599 | 554 | 513 | 437 | 370 | 653 | 603 | 556 | 473 | 398 | 704 | 648 | 596 | 504 | 424 |
| R/C | 970 | 1073 | 1183 | 1432 | 1738 | 854 | 955 | 1065 | 1308 | 1606 | 1032 | 1160 | 1298 | 1610 | 1984 | 961 | 1093 | 1233 | 1552 | 1935 |
| MIN | 11 | 10 | 9 | 8 | 7 | 12 | 11 | 11 | 9 | 8 | 13 | 12 | 12 | 10 | 9 | 15 | 14 | 13 | 11 | 9 |
| ISA NM | 50 | 47 | 44 | 38 | 32 | 58 | 54 | 50 | 43 | 37 | 66 | 61 | 57 | 48 | 41 | 73 | 68 | 63 | 53 | 45 |
| +10°C LB | 429 | 401 | 375 | 324 | 277 | 470 | 438 | 408 | 353 | 301 | 506 | 471 | 438 | 378 | 322 | 540 | 502 | 467 | 401 | 341 |
| R/C | 1614 | 1752 | 1903 | 2245 | 2671 | 1497 | 1634 | 1783 | 2121 | 2539 | 1694 | 1859 | 2038 | 2449 | 2947 | 1573 | 1741 | 1921 | 2331 | 2833 |
| MIN | 9 | 8 | 8 | 7 | 6 | 10 | 9 | 9 | 7 | 6 | 11 | 10 | 9 | 8 | 7 | 12 | 11 | 10 | 9 | 8 |
| ISA NM | 39 | 37 | 34 | 30 | 25 | 45 | 42 | 39 | 34 | 29 | 50 | 47 | 44 | 37 | 32 | 56 | 52 | 48 | 41 | 35 |
| LB | 368 | 345 | 323 | 281 | 241 | 400 | 375 | 351 | 304 | 261 | 430 | 402 | 376 | 326 | 279 | 459 | 429 | 400 | 346 | 296 |
| R/C | 2166 | 2335 | 2520 | 2943 | 3472 | 2039 | 2207 | 2390 | 2808 | 3327 | 2277 | 2475 | 2691 | 3188 | 3795 | 2022 | 2217 | 2426 | 2905 | 3493 |
| MIN | 8 | 7 | 7 | 6 | 5 | 8 | 8 | 7 | 6 | 6 | 9 | 9 | 8 | 7 | 6 | 10 | 9 | 9 | 8 | 7 |
| ISA NM | 32 | 30 | 28 | 25 | 21 | 37 | 35 | 32 | 28 | 24 | 41 | 39 | 36 | 31 | 26 | 46 | 43 | 40 | 34 | 29 |
| -10°C LB | 330 | 310 | 291 | 254 | 218 | 359 | 337 | 315 | 275 | 236 | 385 | 361 | 338 | 294 | 253 | 411 | 385 | 360 | 312 | 268 |
| R/C | 2683 | 2881 | 3098 | 3596 | 4222 | 2515 | 2710 | 2923 | 3412 | 4021 | 2699 | 2921 | 3164 | 3725 | 4413 | 2352 | 2567 | 2798 | 3328 | 3981 |

Figure 7-10 (Sheet 1 of 2)

# MULTI ENGINE CLIMB

## 230 KIAS/0.60 INDICATED MACH

**TIME, DISTANCE, FUEL, AND RATE OF CLIMB**

**ANTI-ICE SYSTEMS OFF**

**PRESSURE ALTITUDE 35000 FEET — ISA = -54°C = -66°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 23 | 21 | 19 | 16 | 14 |
| | NM | 125 | 113 | 103 | 86 | 71 |
| | LB | 757 | 693 | 636 | 536 | 449 |
| | R/C | 868 | 1011 | 1163 | 1488 | 1882 |
| ISA +10°C | MIN | 16 | 15 | 14 | 12 | 10 |
| | NM | 81 | 75 | 69 | 59 | 49 |
| | LB | 576 | 534 | 496 | 425 | 361 |
| | R/C | 1429 | 1607 | 1798 | 2209 | 2712 |
| ISA | MIN | 13 | 12 | 11 | 10 | 8 |
| | NM | 62 | 58 | 53 | 46 | 39 |
| | LB | 490 | 456 | 425 | 367 | 313 |
| | R/C | 1730 | 1928 | 2139 | 2599 | 3164 |
| ISA -10°C | MIN | 11 | 10 | 9 | 8 | 7 |
| | NM | 51 | 48 | 44 | 38 | 32 |
| | LB | 439 | 410 | 382 | 331 | 284 |
| | R/C | 2008 | 2223 | 2454 | 2960 | 3581 |

**PRESSURE ALTITUDE 37000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 26 | 23 | 21 | 18 | 15 |
| | NM | 140 | 126 | 114 | 94 | 78 |
| | LB | 815 | 742 | 678 | 567 | 474 |
| | R/C | 707 | 853 | 1007 | 1344 | 1730 |
| ISA +10°C | MIN | 17 | 16 | 15 | 13 | 11 |
| | NM | 91 | 83 | 76 | 64 | 54 |
| | LB | 615 | 569 | 526 | 449 | 380 |
| | R/C | 1154 | 1329 | 1515 | 1926 | 2403 |
| ISA | MIN | 14 | 13 | 12 | 10 | 9 |
| | NM | 70 | 64 | 59 | 50 | 43 |
| | LB | 524 | 487 | 452 | 389 | 331 |
| | R/C | 1425 | 1619 | 1825 | 2282 | 2816 |
| ISA -10°C | MIN | 12 | 11 | 10 | 9 | 8 |
| | NM | 58 | 53 | 49 | 42 | 36 |
| | LB | 469 | 437 | 407 | 351 | 300 |
| | R/C | 1634 | 1842 | 2064 | 2559 | 3137 |

**PRESSURE ALTITUDE 39000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 30 | 27 | 24 | 20 | 16 |
| | NM | 166 | 146 | 130 | 105 | 86 |
| | LB | 899 | 807 | 730 | 604 | 501 |
| | R/C | 358 | 490 | 636 | 956 | 1314 |
| ISA +10°C | MIN | 20 | 18 | 16 | 14 | 12 |
| | NM | 103 | 94 | 86 | 71 | 60 |
| | LB | 663 | 610 | 561 | 476 | 401 |
| | R/C | 823 | 986 | 1164 | 1560 | 2015 |
| ISA | MIN | 16 | 14 | 13 | 11 | 10 |
| | NM | 79 | 73 | 67 | 56 | 47 |
| | LB | 564 | 522 | 483 | 412 | 350 |
| | R/C | 1070 | 1250 | 1446 | 1886 | 2395 |
| ISA -10°C | MIN | 13 | 12 | 11 | 10 | 8 |
| | NM | 66 | 61 | 56 | 47 | 40 |
| | LB | 505 | 469 | 435 | 373 | 318 |
| | R/C | 1251 | 1444 | 1655 | 2128 | 2680 |

**PRESSURE ALTITUDE 41000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | * 41 | 33 | 28 | 22 | 18 |
| | NM | 234 | 184 | 156 | 121 | 97 |
| | LB | 1104 | 921 | 808 | 651 | 533 |
| | R/C | 101 | 230 | 370 | 683 | 1044 |
| ISA +10°C | MIN | 23 | 20 | 19 | 15 | 13 |
| | NM | 122 | 109 | 98 | 80 | 66 |
| | LB | 729 | 662 | 604 | 506 | 424 |
| | R/C | 522 | 685 | 857 | 1242 | 1695 |
| ISA | MIN | 18 | 16 | 15 | 13 | 11 |
| | NM | 92 | 83 | 76 | 63 | 52 |
| | LB | 614 | 563 | 518 | 439 | 370 |
| | R/C | 780 | 961 | 1153 | 1584 | 2094 |
| ISA -10°C | MIN | 15 | 14 | 13 | 11 | 9 |
| | NM | 77 | 70 | 64 | 53 | 44 |
| | LB | 550 | 506 | 467 | 397 | 336 |
| | R/C | 917 | 1110 | 1315 | 1774 | 2319 |

**PRESSURE ALTITUDE 43000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | * 171 | * 114 | * 58 | 27 | 20 |
| | NM | 1054 | 703 | 347 | 147 | 112 |
| | LB | 3315 | 2307 | 1315 | 722 | 573 |
| | R/C | 101 | 100 | 101 | 341 | 688 |
| ISA +10°C | MIN | 31 | 25 | 22 | 17 | 14 |
| | NM | 169 | 136 | 117 | 92 | 74 |
| | LB | 876 | 746 | 664 | 544 | 450 |
| | R/C | 117 | 316 | 492 | 859 | 1292 |
| ISA | MIN | 22 | 19 | 17 | 14 | 12 |
| | NM | 114 | 99 | 88 | 71 | 58 |
| | LB | 693 | 619 | 562 | 469 | 392 |
| | R/C | 392 | 620 | 821 | 1240 | 1736 |
| ISA -10°C | MIN | 18 | 16 | 15 | 12 | 10 |
| | NM | 94 | 82 | 74 | 60 | 50 |
| | LB | 615 | 554 | 506 | 425 | 357 |
| | R/C | 517 | 762 | 977 | 1426 | 1957 |

**PRESSURE ALTITUDE 45000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | * 294 | * 238 | * 181 | * 60 | 25 |
| | NM | 1846 | 1499 | 1140 | 365 | 137 |
| | LB | 5241 | 4242 | 3243 | 1242 | 634 |
| | R/C | 101 | 101 | 101 | 101 | 363 |
| ISA +10°C | MIN | * 143 | * 86 | 30 | 21 | 16 |
| | NM | 878 | 528 | 168 | 111 | 86 |
| | LB | 2803 | 1803 | 805 | 597 | 481 |
| | R/C | 100 | 100 | 100 | 494 | 900 |
| ISA | MIN | * 73 | 26 | 21 | 16 | 13 |
| | NM | 440 | 138 | 109 | 83 | 66 |
| | LB | 1648 | 743 | 627 | 505 | 417 |
| | R/C | 101 | 139 | 435 | 894 | 1369 |
| ISA -10°C | MIN | * 51 | 21 | 17 | 14 | 11 |
| | NM | 300 | 108 | 89 | 70 | 56 |
| | LB | 1261 | 642 | 559 | 457 | 379 |
| | R/C | 100 | 278 | 596 | 1093 | 1606 |

* INDICATES STEP CLIMB REQUIRED

NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION. BASED ON MAXIMUM CRUISE THRUST.

**CRUISE CLIMB SPEED - KIAS**

| PRESSURE ALTITUDE-FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 | 40000 | 45000 |
| 230 | 230 | 230 | 230 | 230 | 230 | 223 | 199 | 177 | 157 |

**WIND EFFECT ON CLIMB DISTANCE - NM**
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

| CLIMB TIME (MIN) | WIND 25KTS | 50KTS | 100KTS |
|---|---|---|---|
| 5 | 2 | 4 | 8 |
| 10 | 4 | 8 | 16 |
| 15 | 6 | 12 | 25 |
| 20 | 8 | 16 | 33 |
| 25 | 10 | 20 | 41 |
| 30 | 12 | 25 | 50 |

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

| STEP CLIMB ALT IN FEET | TEMPERATURE ISA -10°C | ISA + 0°C | ISA +10°C | ISA +20°C |
|---|---|---|---|---|
| 39000 | ---- | ---- | ---- | 19089 |
| 41000 | ---- | ---- | ---- | 16840 |
| 43000 | 18874 | 18492 | 17339 | 14900 |

Figure 7-10 (Sheet 2)

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# MULTI ENGINE CLIMB

## 230 KIAS/0.60 INDICATED MACH

**TIME, DISTANCE, FUEL, AND RATE OF CLIMB** **ANTI-ICE SYSTEMS ON**

| T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | 5000 FEET ISA = 5°C = 41°F | | | | | 10000 FEET ISA = - 5°C = 23°F | | | | | 15000 FEET ISA = -15°C = 6°F | | | | | 17000 FEET ISA = -19°C = - 2°F | | | | |
| MIN | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 7 | 6 | 6 | 5 | 4 | 7 | 7 | 7 | 6 | 5 |
| ISA NM | 6 | 6 | 6 | 5 | 4 | 16 | 15 | 14 | 12 | 10 | 26 | 25 | 23 | 20 | 17 | 31 | 29 | 27 | 23 | 20 |
| +10°C LB | 86 | 81 | 76 | 66 | 57 | 177 | 166 | 155 | 135 | 116 | 269 | 252 | 235 | 204 | 174 | 304 | 284 | 265 | 230 | 196 |
| R/C | 2720 | 2902 | 3103 | 3571 | 4162 | 2265 | 2425 | 2601 | 3011 | 3528 | 2207 | 2366 | 2542 | 2950 | 3462 | 2218 | 2379 | 2556 | 2967 | 3484 |
| MIN | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 5 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 5 | 4 |
| ISA NM | 5 | 5 | 4 | 4 | 3 | 12 | 11 | 10 | 9 | 7 | 19 | 18 | 17 | 15 | 12 | 23 | 21 | 20 | 17 | 15 |
| LB | 76 | 71 | 67 | 58 | 50 | 151 | 142 | 133 | 116 | 100 | 225 | 211 | 198 | 172 | 148 | 253 | 238 | 222 | 194 | 167 |
| R/C | 3516 | 3741 | 3988 | 4569 | 5304 | 3124 | 3330 | 3557 | 4089 | 4761 | 3005 | 3208 | 3431 | 3953 | 4611 | 2963 | 3164 | 3385 | 3904 | 4556 |
| MIN | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 5 | 5 | 4 | 4 | 3 |
| ISA NM | 4 | 4 | 4 | 3 | 3 | 10 | 9 | 8 | 7 | 6 | 16 | 15 | 14 | 12 | 10 | 18 | 17 | 16 | 14 | 12 |
| -10°C LB | 67 | 63 | 59 | 51 | 44 | 134 | 126 | 118 | 103 | 89 | 197 | 185 | 174 | 152 | 131 | 222 | 208 | 196 | 171 | 147 |
| R/C | 4075 | 4330 | 4611 | 5271 | 6109 | 3956 | 4207 | 4484 | 5133 | 5957 | 3790 | 4035 | 4305 | 4939 | 5741 | 3670 | 3909 | 4174 | 4792 | 5575 |
| PRESSURE ALTITUDE | 19000 FEET ISA = -23°C = - 9°F | | | | | 21000 FEET ISA = -27°C = -16°F | | | | | 23000 FEET ISA = -31°C = -23°F | | | | | 25000 FEET ISA = -35°C = -30°F | | | | |
| MIN | 8 | 8 | 7 | 6 | 6 | 9 | 9 | 8 | 7 | 6 | 10 | 10 | 9 | 8 | 7 | 11 | 11 | 10 | 9 | 8 |
| ISA NM | 36 | 33 | 31 | 27 | 23 | 41 | 38 | 35 | 30 | 26 | 46 | 43 | 40 | 35 | 29 | 53 | 49 | 46 | 39 | 33 |
| +10°C LB | 338 | 316 | 295 | 255 | 218 | 374 | 349 | 326 | 282 | 241 | 411 | 383 | 357 | 309 | 264 | 449 | 419 | 390 | 337 | 287 |
| R/C | 2149 | 2308 | 2481 | 2885 | 3392 | 2013 | 2165 | 2332 | 2719 | 3205 | 1874 | 2021 | 2180 | 2551 | 3016 | 1710 | 1850 | 2002 | 2353 | 2792 |
| MIN | 6 | 6 | 6 | 5 | 4 | 7 | 7 | 6 | 6 | 5 | 8 | 7 | 7 | 6 | 5 | 9 | 8 | 8 | 7 | 6 |
| ISA NM | 26 | 24 | 23 | 20 | 17 | 30 | 28 | 26 | 23 | 19 | 34 | 32 | 30 | 26 | 22 | 39 | 36 | 34 | 29 | 25 |
| LB | 281 | 264 | 247 | 215 | 185 | 310 | 291 | 272 | 237 | 204 | 340 | 319 | 298 | 259 | 223 | 371 | 348 | 325 | 282 | 242 |
| R/C | 2845 | 3041 | 3257 | 3761 | 4396 | 2663 | 2851 | 3058 | 3539 | 4145 | 2507 | 2688 | 2887 | 3350 | 3931 | 2361 | 2536 | 2728 | 3174 | 3733 |
| MIN | 5 | 5 | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 7 | 6 | 6 | 5 | 5 | 7 | 7 | 6 | 6 | 5 |
| ISA NM | 21 | 20 | 18 | 16 | 13 | 24 | 22 | 21 | 18 | 15 | 27 | 25 | 24 | 21 | 17 | 31 | 29 | 27 | 23 | 20 |
| -10°C LB | 246 | 232 | 217 | 190 | 163 | 271 | 255 | 239 | 209 | 180 | 297 | 279 | 262 | 228 | 196 | 324 | 304 | 285 | 248 | 214 |
| R/C | 3574 | 3811 | 4071 | 4679 | 5448 | 3364 | 3590 | 3839 | 4421 | 5156 | 3159 | 3376 | 3615 | 4172 | 4874 | 2952 | 3160 | 3389 | 3921 | 4590 |
| PRESSURE ALTITUDE | 27000 FEET ISA = -38°C = -37°F | | | | | 29000 FEET ISA = -42°C = -44°F | | | | | 31000 FEET ISA = -46°C = -52°F | | | | | 33000 FEET ISA = -50°C = -59°F | | | | |
| MIN | 13 | 12 | 11 | 10 | 8 | 14 | 13 | 12 | 11 | 9 | 16 | 15 | 14 | 12 | 10 | 17 | 16 | 15 | 13 | 11 |
| ISA NM | 61 | 56 | 52 | 45 | 38 | 70 | 65 | 60 | 51 | 43 | 78 | 72 | 67 | 57 | 48 | 86 | 80 | 74 | 62 | 53 |
| +10°C LB | 492 | 458 | 427 | 368 | 313 | 539 | 501 | 466 | 400 | 340 | 580 | 539 | 500 | 428 | 364 | 618 | 573 | 531 | 454 | 385 |
| R/C | 1419 | 1546 | 1685 | 1999 | 2390 | 1276 | 1402 | 1538 | 1844 | 2221 | 1493 | 1647 | 1814 | 2195 | 2656 | 1433 | 1592 | 1762 | 2152 | 2626 |
| MIN | 10 | 9 | 9 | 7 | 6 | 11 | 10 | 9 | 8 | 7 | 12 | 11 | 10 | 9 | 8 | 13 | 12 | 11 | 10 | 8 |
| ISA NM | 44 | 41 | 38 | 33 | 28 | 50 | 47 | 43 | 37 | 32 | 56 | 52 | 48 | 41 | 35 | 61 | 57 | 53 | 45 | 39 |
| LB | 404 | 378 | 353 | 307 | 263 | 439 | 410 | 383 | 332 | 284 | 470 | 439 | 410 | 354 | 303 | 501 | 467 | 435 | 376 | 321 |
| R/C | 2060 | 2223 | 2401 | 2809 | 3319 | 1910 | 2071 | 2247 | 2646 | 3142 | 2167 | 2359 | 2568 | 3049 | 3636 | 1936 | 2126 | 2329 | 2795 | 3366 |
| MIN | 8 | 8 | 7 | 6 | 5 | 9 | 8 | 8 | 7 | 6 | 10 | 9 | 8 | 7 | 6 | 10 | 10 | 9 | 8 | 7 |
| ISA NM | 35 | 33 | 30 | 26 | 22 | 39 | 37 | 34 | 30 | 25 | 44 | 41 | 38 | 33 | 28 | 49 | 45 | 42 | 36 | 31 |
| -10°C LB | 352 | 331 | 310 | 270 | 232 | 382 | 358 | 335 | 292 | 251 | 410 | 384 | 359 | 312 | 268 | 436 | 408 | 381 | 331 | 283 |
| R/C | 2626 | 2821 | 3034 | 3525 | 4141 | 2444 | 2635 | 2844 | 3322 | 3918 | 2641 | 2860 | 3099 | 3651 | 4329 | 2312 | 2524 | 2752 | 3276 | 3922 |
| PRESSURE ALTITUDE | 35000 FEET ISA = -54°C = -66°F | | | | | 37000 FEET ISA = -57°C = -70°F | | | | | 39000 FEET ISA = -57°C = -70°F | | | | | 41000 FEET ISA = -57°C = -70°F | | | | |
| MIN | 19 | 17 | 16 | 14 | 12 | 20 | 19 | 17 | 15 | 12 | 23 | 21 | 19 | 16 | 13 | 27 | 24 | 22 | 18 | 15 |
| ISA NM | 95 | 88 | 81 | 68 | 57 | 106 | 97 | 89 | 74 | 62 | 120 | 109 | 99 | 82 | 68 | 147 | 129 | 114 | 93 | 76 |
| +10°C LB | 657 | 608 | 562 | 479 | 405 | 701 | 646 | 596 | 506 | 426 | 757 | 693 | 635 | 535 | 449 | 846 | 760 | 688 | 571 | 475 |
| R/C | 1297 | 1467 | 1648 | 2039 | 2517 | 1023 | 1190 | 1368 | 1757 | 2208 | 683 | 837 | 1007 | 1381 | 1808 | 334 | 485 | 645 | 1002 | 1417 |
| MIN | 14 | 13 | 12 | 10 | 9 | 15 | 14 | 13 | 11 | 10 | 17 | 16 | 14 | 12 | 10 | 20 | 18 | 16 | 14 | 11 |
| ISA NM | 68 | 63 | 58 | 50 | 42 | 76 | 70 | 65 | 55 | 46 | 87 | 80 | 73 | 61 | 51 | 103 | 92 | 83 | 69 | 57 |
| LB | 533 | 496 | 462 | 398 | 339 | 570 | 529 | 491 | 421 | 358 | 615 | 567 | 524 | 446 | 378 | 674 | 615 | 564 | 475 | 400 |
| R/C | 1646 | 1839 | 2045 | 2493 | 3041 | 1312 | 1499 | 1698 | 2138 | 2650 | 937 | 1109 | 1298 | 1718 | 2202 | 628 | 801 | 984 | 1393 | 1873 |
| MIN | 11 | 11 | 10 | 9 | 7 | 13 | 12 | 11 | 9 | 8 | 14 | 13 | 12 | 10 | 9 | 16 | 15 | 14 | 11 | 10 |
| ISA NM | 54 | 50 | 47 | 40 | 34 | 61 | 56 | 52 | 44 | 37 | 69 | 64 | 58 | 49 | 42 | 81 | 74 | 67 | 56 | 46 |
| -10°C LB | 465 | 434 | 405 | 351 | 300 | 497 | 463 | 431 | 372 | 317 | 536 | 497 | 460 | 395 | 335 | 585 | 538 | 495 | 421 | 355 |
| R/C | 1969 | 2182 | 2411 | 2910 | 3524 | 1569 | 1774 | 1991 | 2476 | 3042 | 1161 | 1350 | 1555 | 2015 | 2550 | 807 | 995 | 1192 | 1636 | 2161 |

CRUISE CLIMB SPEED - KIAS

| PRESSURE ALTITUDE-FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 | 40000 | 41000 |
| 230 | 230 | 230 | 230 | 230 | 230 | 223 | 199 | 177 | 173 |

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND. ADD FOR TAILWIND)

| CLIMB TIME (MIN) | WIND 25KTS | 50KTS | 100KTS |
|---|---|---|---|
| 5 | 2 | 4 | 8 |
| 10 | 4 | 8 | 16 |
| 15 | 6 | 12 | 25 |
| 20 | 8 | 16 | 33 |
| 25 | 10 | 20 | 41 |
| 30 | 12 | 25 | 50 |

Figure 7-11

# CRUISE CLIMB

## 250 KIAS/0.62 INDICATED MACH

## TIME, DISTANCE, FUEL, AND RATE OF CLIMB — ANTI-ICE SYSTEMS OFF

| T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | 5000 FEET ISA = 5°C = 41°F | | | | | 10000 FEET ISA = - 5°C = 23°F | | | | | 15000 FEET ISA = -15°C = 6°F | | | | | 17000 FEET ISA = -19°C = - 2°F | | | | |
| ISA +20°C MIN | 2 | 2 | 2 | 2 | 2 | 5 | 4 | 4 | 4 | 3 | 8 | 7 | 7 | 6 | 5 | 9 | 8 | 8 | 7 | 6 |
| NM | 8 | 8 | 7 | 6 | 5 | 20 | 18 | 17 | 15 | 13 | 34 | 32 | 30 | 26 | 22 | 41 | 38 | 36 | 31 | 26 |
| LB | 96 | 91 | 85 | 74 | 63 | 198 | 185 | 173 | 150 | 129 | 308 | 288 | 268 | 232 | 199 | 352 | 329 | 307 | 265 | 227 |
| R/C | 2429 | 2592 | 2770 | 3188 | 3716 | 2000 | 2142 | 2298 | 2660 | 3117 | 1685 | 1813 | 1952 | 2276 | 2682 | 1631 | 1755 | 1892 | 2209 | 2607 |
| ISA +10°C MIN | 2 | 2 | 2 | 2 | 1 | 4 | 3 | 3 | 3 | 3 | 6 | 5 | 5 | 4 | 4 | 6 | 6 | 6 | 5 | 4 |
| NM | 6 | 6 | 5 | 4 | 4 | 14 | 13 | 12 | 11 | 9 | 24 | 23 | 21 | 18 | 16 | 29 | 27 | 25 | 22 | 19 |
| LB | 80 | 76 | 71 | 62 | 54 | 163 | 153 | 143 | 125 | 108 | 248 | 233 | 218 | 190 | 163 | 282 | 265 | 248 | 216 | 185 |
| R/C | 3252 | 3459 | 3686 | 4220 | 4897 | 2774 | 2958 | 3160 | 3632 | 4229 | 2449 | 2618 | 2803 | 3235 | 3780 | 2324 | 2485 | 2664 | 3080 | 3604 |
| ISA MIN | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 5 | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 4 | 4 |
| NM | 5 | 5 | 4 | 4 | 3 | 11 | 11 | 10 | 9 | 7 | 19 | 18 | 16 | 14 | 12 | 22 | 21 | 19 | 17 | 14 |
| LB | 69 | 65 | 61 | 53 | 46 | 139 | 131 | 123 | 108 | 93 | 209 | 197 | 185 | 161 | 139 | 237 | 223 | 209 | 183 | 158 |
| R/C | 4000 | 4247 | 4519 | 5159 | 5971 | 3573 | 3799 | 4049 | 4634 | 5376 | 3316 | 3532 | 3769 | 4324 | 5028 | 3135 | 3341 | 3568 | 4100 | 4772 |
| ISA -10°C MIN | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 3 |
| NM | 5 | 5 | 4 | 4 | 3 | 10 | 9 | 9 | 8 | 6 | 16 | 15 | 14 | 12 | 10 | 18 | 17 | 16 | 14 | 12 |
| LB | 66 | 62 | 58 | 51 | 44 | 127 | 120 | 113 | 99 | 85 | 187 | 177 | 166 | 145 | 126 | 211 | 199 | 187 | 164 | 142 |
| R/C | 4065 | 4315 | 4593 | 5243 | 6069 | 4497 | 4773 | 5077 | 5793 | 6702 | 4128 | 4388 | 4673 | 5344 | 6194 | 3943 | 4193 | 4469 | 5115 | 5935 |

| PRESSURE ALTITUDE | 19000 FEET ISA = -23°C = - 9°F | | | | | 21000 FEET ISA = -27°C = -16°F | | | | | 23000 FEET ISA = -31°C = -23°F | | | | | 25000 FEET ISA = -35°C = -30°F | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISA +20°C MIN | 10 | 9 | 9 | 8 | 7 | 12 | 11 | 10 | 9 | 8 | 13 | 12 | 12 | 10 | 9 | 16 | 15 | 14 | 12 | 10 |
| NM | 48 | 45 | 42 | 36 | 31 | 57 | 53 | 49 | 42 | 36 | 68 | 63 | 59 | 50 | 42 | 84 | 78 | 72 | 61 | 51 |
| LB | 399 | 372 | 347 | 299 | 255 | 450 | 419 | 390 | 336 | 286 | 510 | 475 | 441 | 379 | 322 | 588 | 545 | 505 | 431 | 365 |
| R/C | 1506 | 1625 | 1755 | 2057 | 2435 | 1280 | 1388 | 1506 | 1779 | 2118 | 982 | 1076 | 1177 | 1411 | 1700 | 696 | 775 | 861 | 1057 | 1297 |
| ISA +10°C MIN | 7 | 7 | 7 | 6 | 5 | 8 | 8 | 7 | 6 | 6 | 9 | 9 | 8 | 7 | 6 | 11 | 10 | 9 | 8 | 7 |
| NM | 34 | 32 | 30 | 26 | 22 | 39 | 37 | 34 | 30 | 25 | 46 | 43 | 40 | 35 | 29 | 54 | 50 | 47 | 40 | 34 |
| LB | 317 | 297 | 278 | 242 | 208 | 354 | 332 | 311 | 270 | 232 | 394 | 369 | 345 | 299 | 257 | 440 | 411 | 384 | 332 | 284 |
| R/C | 2193 | 2349 | 2521 | 2922 | 3425 | 1987 | 2134 | 2295 | 2669 | 3138 | 1718 | 1852 | 1998 | 2337 | 2761 | 1429 | 1549 | 1679 | 1981 | 2357 |
| ISA MIN | 6 | 6 | 5 | 5 | 4 | 7 | 6 | 6 | 5 | 5 | 7 | 7 | 7 | 6 | 5 | 8 | 8 | 7 | 6 | 6 |
| NM | 26 | 24 | 23 | 20 | 17 | 30 | 28 | 26 | 23 | 19 | 34 | 32 | 30 | 26 | 22 | 40 | 37 | 35 | 30 | 26 |
| LB | 265 | 249 | 234 | 204 | 176 | 295 | 277 | 260 | 227 | 196 | 327 | 307 | 288 | 251 | 216 | 361 | 339 | 317 | 276 | 238 |
| R/C | 2933 | 3130 | 3346 | 3853 | 4492 | 2671 | 2856 | 3058 | 3530 | 4126 | 2380 | 2550 | 2737 | 3171 | 3718 | 2094 | 2250 | 2421 | 2818 | 3317 |
| ISA -10°C MIN | 5 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 5 | 4 | 6 | 6 | 6 | 5 | 4 | 7 | 7 | 6 | 6 | 5 |
| NM | 21 | 20 | 19 | 16 | 14 | 25 | 23 | 22 | 19 | 16 | 28 | 26 | 25 | 22 | 18 | 32 | 30 | 28 | 25 | 21 |
| LB | 236 | 222 | 209 | 183 | 158 | 262 | 246 | 231 | 202 | 175 | 289 | 272 | 255 | 223 | 193 | 318 | 299 | 281 | 245 | 211 |
| R/C | 3648 | 3884 | 4143 | 4751 | 5522 | 3315 | 3534 | 3776 | 4341 | 5055 | 2998 | 3202 | 3426 | 3950 | 4611 | 2691 | 2880 | 3088 | 3572 | 4181 |

| PRESSURE ALTITUDE | 27000 FEET ISA = -38°C = -37°F | | | | | 29000 FEET ISA = -42°C = -44°F | | | | | 31000 FEET ISA = -46°C = -52°F | | | | | 33000 FEET ISA = -50°C = -59°F | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISA +20°C MIN | 19 | 18 | 16 | 14 | 12 | 22 | 20 | 18 | 16 | 13 | 24 | 22 | 20 | 17 | 14 | 27 | 24 | 22 | 18 | 15 |
| NM | 105 | 96 | 88 | 74 | 62 | 122 | 112 | 102 | 85 | 71 | 138 | 125 | 114 | 95 | 78 | 153 | 138 | 125 | 104 | 86 |
| LB | 682 | 629 | 579 | 491 | 413 | 760 | 697 | 640 | 540 | 452 | 824 | 753 | 690 | 580 | 484 | 885 | 807 | 737 | 617 | 514 |
| R/C | 587 | 666 | 750 | 944 | 1179 | 786 | 893 | 1003 | 1255 | 1562 | 858 | 974 | 1100 | 1376 | 1710 | 812 | 932 | 1061 | 1354 | 1696 |
| ISA +10°C MIN | 12 | 11 | 11 | 9 | 8 | 14 | 13 | 12 | 10 | 9 | 15 | 14 | 13 | 11 | 9 | 16 | 15 | 14 | 12 | 10 |
| NM | 63 | 59 | 55 | 47 | 40 | 71 | 66 | 62 | 53 | 45 | 79 | 73 | 68 | 58 | 49 | 88 | 81 | 75 | 64 | 54 |
| LB | 488 | 455 | 424 | 367 | 313 | 529 | 493 | 459 | 395 | 337 | 566 | 527 | 490 | 421 | 358 | 603 | 561 | 520 | 446 | 379 |
| R/C | 1338 | 1458 | 1589 | 1891 | 2265 | 1614 | 1768 | 1929 | 2301 | 2762 | 1561 | 1718 | 1888 | 2271 | 2738 | 1452 | 1610 | 1781 | 2173 | 2640 |
| ISA MIN | 9 | 9 | 8 | 7 | 6 | 10 | 10 | 9 | 8 | 7 | 11 | 10 | 10 | 9 | 7 | 12 | 11 | 11 | 9 | 8 |
| NM | 46 | 43 | 40 | 35 | 30 | 52 | 48 | 45 | 39 | 33 | 57 | 53 | 50 | 43 | 36 | 63 | 59 | 55 | 47 | 40 |
| LB | 396 | 372 | 348 | 302 | 260 | 428 | 401 | 375 | 325 | 279 | 457 | 428 | 400 | 347 | 297 | 488 | 456 | 425 | 368 | 315 |
| R/C | 1990 | 2147 | 2317 | 2714 | 3209 | 2256 | 2447 | 2649 | 3114 | 3695 | 2171 | 2363 | 2572 | 3045 | 3628 | 1939 | 2125 | 2328 | 2792 | 3354 |
| ISA -10°C MIN | 8 | 7 | 7 | 6 | 5 | 9 | 8 | 8 | 7 | 6 | 9 | 9 | 8 | 7 | 6 | 10 | 9 | 9 | 8 | 7 |
| NM | 37 | 35 | 32 | 28 | 24 | 41 | 39 | 36 | 31 | 27 | 46 | 43 | 40 | 34 | 29 | 51 | 47 | 44 | 38 | 32 |
| LB | 348 | 327 | 307 | 268 | 230 | 375 | 352 | 330 | 287 | 247 | 401 | 376 | 352 | 306 | 263 | 428 | 401 | 375 | 325 | 279 |
| R/C | 2606 | 2796 | 3005 | 3490 | 4100 | 2850 | 3073 | 3312 | 3864 | 4557 | 2628 | 2845 | 3083 | 3625 | 4294 | 2295 | 2502 | 2728 | 3249 | 3880 |

Figure 7-12 (Sheet 1 of 2)

# CRUISE CLIMB

## 250 KIAS/0.62 INDICATED MACH

## TIME, DISTANCE, FUEL, AND RATE OF CLIMB — ANTI-ICE SYSTEMS OFF

**PRESSURE ALTITUDE 35000 FEET — ISA = -54°C = -66°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 29 | 27 | 24 | 20 | 17 |
| | NM | 169 | 152 | 138 | 113 | 93 |
| | LB | 946 | 859 | 783 | 652 | 542 |
| | R/C | 747 | 874 | 1006 | 1306 | 1666 |
| ISA +10°C | MIN | 18 | 16 | 15 | 13 | 11 |
| | NM | 96 | 89 | 82 | 70 | 58 |
| | LB | 642 | 595 | 551 | 472 | 400 |
| | R/C | 1342 | 1509 | 1682 | 2075 | 2554 |
| ISA | MIN | 13 | 12 | 12 | 10 | 9 |
| | NM | 70 | 65 | 60 | 52 | 44 |
| | LB | 520 | 485 | 452 | 390 | 333 |
| | R/C | 1671 | 1861 | 2056 | 2503 | 3050 |
| ISA -10°C | MIN | 11 | 10 | 10 | 8 | 7 |
| | NM | 56 | 52 | 49 | 42 | 36 |
| | LB | 456 | 426 | 398 | 345 | 296 |
| | R/C | 1971 | 2181 | 2396 | 2891 | 3499 |

**PRESSURE ALTITUDE 37000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 32 | 29 | 26 | 22 | 18 |
| | NM | 189 | 168 | 151 | 124 | 101 |
| | LB | 1015 | 916 | 832 | 689 | 570 |
| | R/C | 583 | 716 | 857 | 1153 | 1507 |
| ISA +10°C | MIN | 19 | 18 | 16 | 14 | 12 |
| | NM | 107 | 98 | 90 | 76 | 64 |
| | LB | 684 | 632 | 584 | 498 | 421 |
| | R/C | 1096 | 1265 | 1444 | 1826 | 2285 |
| ISA | MIN | 15 | 14 | 13 | 11 | 9 |
| | NM | 78 | 72 | 67 | 57 | 48 |
| | LB | 556 | 517 | 480 | 413 | 351 |
| | R/C | 1378 | 1567 | 1766 | 2198 | 2716 |
| ISA -10°C | MIN | 12 | 11 | 11 | 9 | 8 |
| | NM | 63 | 58 | 54 | 46 | 39 |
| | LB | 488 | 455 | 424 | 366 | 313 |
| | R/C | 1606 | 1811 | 2028 | 2500 | 3067 |

**PRESSURE ALTITUDE 39000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 38 | 33 | 29 | 24 | 19 |
| | NM | 223 | 194 | 171 | 137 | 111 |
| | LB | 1125 | 997 | 894 | 732 | 602 |
| | R/C | 249 | 382 | 518 | 809 | 1127 |
| ISA +10°C | MIN | 22 | 20 | 18 | 15 | 13 |
| | NM | 121 | 110 | 100 | 84 | 70 |
| | LB | 736 | 675 | 621 | 526 | 443 |
| | R/C | 755 | 924 | 1100 | 1480 | 1904 |
| ISA | MIN | 16 | 15 | 14 | 12 | 10 |
| | NM | 89 | 81 | 74 | 63 | 53 |
| | LB | 598 | 553 | 512 | 437 | 371 |
| | R/C | 1013 | 1199 | 1395 | 1821 | 2302 |
| ISA -10°C | MIN | 14 | 13 | 12 | 10 | 9 |
| | NM | 72 | 66 | 61 | 51 | 43 |
| | LB | 525 | 487 | 452 | 388 | 331 |
| | R/C | 1214 | 1413 | 1626 | 2089 | 2615 |

**PRESSURE ALTITUDE 41000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | * 84 | * 43 | 35 | 27 | 22 |
| | NM | 521 | 252 | 207 | 156 | 124 |
| | LB | 1982 | 1165 | 998 | 787 | 639 |
| | R/C | 100 | 129 | 261 | 561 | 885 |
| ISA +10°C | MIN | 25 | 22 | 20 | 17 | 14 |
| | NM | 142 | 127 | 114 | 93 | 77 |
| | LB | 809 | 732 | 667 | 558 | 467 |
| | R/C | 463 | 618 | 782 | 1167 | 1593 |
| ISA | MIN | 19 | 17 | 16 | 13 | 11 |
| | NM | 103 | 93 | 84 | 70 | 58 |
| | LB | 652 | 597 | 549 | 465 | 392 |
| | R/C | 750 | 927 | 1111 | 1548 | 2039 |
| ISA -10°C | MIN | 16 | 14 | 13 | 11 | 9 |
| | NM | 83 | 76 | 69 | 58 | 48 |
| | LB | 571 | 526 | 485 | 413 | 350 |
| | R/C | 893 | 1082 | 1279 | 1747 | 2275 |

**PRESSURE ALTITUDE 43000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | * 208 | * 155 | * 100 | 33 | 25 |
| | NM | 1330 | 990 | 633 | 192 | 142 |
| | LB | 4119 | 3111 | 2112 | 881 | 687 |
| | R/C | 101 | 100 | 100 | 239 | 565 |
| ISA +10°C | MIN | * 43 | 28 | 24 | 19 | 16 |
| | NM | 259 | 159 | 136 | 107 | 86 |
| | LB | 1157 | 831 | 736 | 599 | 495 |
| | R/C | 101 | 252 | 421 | 775 | 1197 |
| ISA | MIN | 23 | 20 | 18 | 15 | 12 |
| | NM | 127 | 110 | 98 | 79 | 65 |
| | LB | 735 | 655 | 595 | 496 | 415 |
| | R/C | 367 | 593 | 788 | 1199 | 1694 |
| ISA -10°C | MIN | 19 | 17 | 15 | 13 | 10 |
| | NM | 102 | 89 | 80 | 65 | 54 |
| | LB | 639 | 576 | 526 | 442 | 371 |
| | R/C | 497 | 740 | 951 | 1391 | 1923 |

**PRESSURE ALTITUDE 45000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | ---- | * 272 | * 216 | * 101 | 30 |
| | NM | ---- | 1761 | 1402 | 643 | 176 |
| | LB | ---- | 4948 | 3945 | 1948 | 766 |
| | R/C | ---- | 100 | 100 | 100 | 263 |
| ISA +10°C | MIN | * 158 | * 104 | * 48 | 23 | 18 |
| | NM | 1000 | 654 | 292 | 129 | 99 |
| | LB | 3148 | 2153 | 1150 | 660 | 530 |
| | R/C | 100 | 101 | 100 | 416 | 817 |
| ISA | MIN | * 76 | 27 | 22 | 17 | 14 |
| | NM | 467 | 152 | 120 | 91 | 73 |
| | LB | 1728 | 789 | 666 | 535 | 441 |
| | R/C | 100 | 122 | 391 | 844 | 1317 |
| ISA -10°C | MIN | * 49 | 21 | 18 | 14 | 12 |
| | NM | 292 | 116 | 97 | 75 | 61 |
| | LB | 1237 | 666 | 582 | 475 | 394 |
| | R/C | 100 | 279 | 572 | 1065 | 1579 |

* INDICATES STEP CLIMB REQUIRED

NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION. BASED ON MAXIMUM CRUISE THRUST.

CRUISE CLIMB SPEED - KIAS

| PRESSURE ALTITUDE-FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 | 40000 | 45000 |
| 250 | 250 | 250 | 250 | 250 | 250 | 231 | 206 | 183 | 163 |

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND. ADD FOR TAILWIND)

| CLIMB TIME (MIN) | WIND 25KTS | WIND 50KTS | WIND 100KTS |
|---|---|---|---|
| 5 | 2 | 4 | 8 |
| 10 | 4 | 8 | 16 |
| 15 | 6 | 12 | 25 |
| 20 | 8 | 16 | 33 |
| 25 | 10 | 20 | 41 |
| 30 | 12 | 25 | 50 |

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB. THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

| STEP CLIMB ALT IN FEET | TEMPERATURE ISA -10°C | ISA + 0°C | ISA +10°C | ISA +20°C |
|---|---|---|---|---|
| 39000 | ---- | ---- | ---- | 18214 |
| 41000 | ---- | ---- | 19003 | 16045 |
| 43000 | 18907 | 18416 | 16996 | 14195 |

Figure 7-12 (Sheet 2)

# CRUISE CLIMB

## 250 KIAS/0.62 INDICATED MACH

### TIME, DISTANCE, FUEL, AND RATE OF CLIMB — ANTI-ICE SYSTEMS ON

**PRESSURE ALTITUDE 5000 FEET — ISA = 5°C = 41°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 2 | 2 | 2 | 2 | 2 |
| | NM | 8 | 7 | 7 | 6 | 5 |
| | LB | 92 | 87 | 81 | 71 | 61 |
| | R/C | 2507 | 2674 | 2858 | 3289 | 3833 |
| ISA | MIN | 2 | 2 | 2 | 2 | 1 |
| | NM | 6 | 5 | 5 | 4 | 4 |
| | LB | 80 | 75 | 70 | 62 | 53 |
| | R/C | 3320 | 3531 | 3763 | 4308 | 4999 |
| ISA -10°C | MIN | 2 | 2 | 2 | 1 | 1 |
| | NM | 5 | 5 | 4 | 4 | 3 |
| | LB | 68 | 64 | 60 | 53 | 45 |
| | R/C | 4059 | 4309 | 4585 | 5235 | 6060 |

**PRESSURE ALTITUDE 10000 FEET — ISA = - 5°C = 23°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 5 | 4 | 4 | 4 | 3 |
| | NM | 19 | 17 | 16 | 14 | 12 |
| | LB | 193 | 181 | 169 | 147 | 126 |
| | R/C | 2009 | 2152 | 2309 | 2675 | 3136 |
| ISA | MIN | 4 | 3 | 3 | 3 | 3 |
| | NM | 13 | 13 | 12 | 10 | 9 |
| | LB | 160 | 150 | 141 | 123 | 106 |
| | R/C | 2909 | 3101 | 3311 | 3804 | 4428 |
| ISA -10°C | MIN | 3 | 3 | 3 | 2 | 2 |
| | NM | 11 | 10 | 9 | 8 | 7 |
| | LB | 137 | 129 | 121 | 106 | 92 |
| | R/C | 3797 | 4036 | 4300 | 4919 | 5703 |

**PRESSURE ALTITUDE 15000 FEET — ISA = -15°C = 6°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 7 | 7 | 6 | 6 | 5 |
| | NM | 32 | 30 | 28 | 24 | 20 |
| | LB | 299 | 280 | 261 | 226 | 194 |
| | R/C | 1853 | 1990 | 2141 | 2490 | 2928 |
| ISA | MIN | 5 | 5 | 5 | 4 | 4 |
| | NM | 22 | 21 | 20 | 17 | 15 |
| | LB | 240 | 225 | 211 | 184 | 158 |
| | R/C | 2754 | 2939 | 3143 | 3621 | 4223 |
| ISA -10°C | MIN | 4 | 4 | 4 | 4 | 3 |
| | NM | 17 | 16 | 15 | 13 | 11 |
| | LB | 203 | 191 | 180 | 157 | 136 |
| | R/C | 3640 | 3874 | 4131 | 4734 | 5497 |

**PRESSURE ALTITUDE 17000 FEET — ISA = -19°C = - 2°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 8 | 8 | 7 | 6 | 6 |
| | NM | 38 | 35 | 33 | 28 | 24 |
| | LB | 341 | 319 | 297 | 257 | 220 |
| | R/C | 1841 | 1978 | 2128 | 2477 | 2914 |
| ISA | MIN | 6 | 6 | 5 | 5 | 4 |
| | NM | 26 | 25 | 23 | 20 | 17 |
| | LB | 272 | 255 | 239 | 208 | 179 |
| | R/C | 2652 | 2832 | 3030 | 3494 | 4080 |
| ISA -10°C | MIN | 5 | 5 | 4 | 4 | 3 |
| | NM | 20 | 19 | 18 | 16 | 13 |
| | LB | 229 | 216 | 203 | 177 | 153 |
| | R/C | 3444 | 3667 | 3913 | 4491 | 5220 |

**PRESSURE ALTITUDE 19000 FEET — ISA = -23°C = - 9°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 9 | 9 | 8 | 7 | 6 |
| | NM | 44 | 41 | 38 | 33 | 28 |
| | LB | 383 | 358 | 334 | 288 | 246 |
| | R/C | 1749 | 1882 | 2027 | 2366 | 2789 |
| ISA | MIN | 7 | 6 | 6 | 5 | 5 |
| | NM | 31 | 29 | 27 | 23 | 20 |
| | LB | 304 | 285 | 267 | 232 | 200 |
| | R/C | 2534 | 2709 | 2902 | 3352 | 3919 |
| ISA -10°C | MIN | 6 | 5 | 5 | 4 | 4 |
| | NM | 24 | 22 | 21 | 18 | 15 |
| | LB | 256 | 241 | 226 | 198 | 171 |
| | R/C | 3246 | 3460 | 3696 | 4248 | 4946 |

**PRESSURE ALTITUDE 21000 FEET — ISA = -27°C = -16°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 11 | 10 | 9 | 8 | 7 |
| | NM | 51 | 48 | 45 | 38 | 32 |
| | LB | 428 | 399 | 372 | 321 | 274 |
| | R/C | 1580 | 1705 | 1842 | 2159 | 2555 |
| ISA | MIN | 8 | 7 | 7 | 6 | 5 |
| | NM | 35 | 33 | 31 | 27 | 23 |
| | LB | 337 | 316 | 296 | 258 | 221 |
| | R/C | 2315 | 2480 | 2661 | 3084 | 3615 |
| ISA -10°C | MIN | 6 | 6 | 6 | 5 | 4 |
| | NM | 27 | 25 | 24 | 21 | 18 |
| | LB | 284 | 267 | 251 | 219 | 189 |
| | R/C | 3083 | 3290 | 3517 | 4050 | 4722 |

**PRESSURE ALTITUDE 23000 FEET — ISA = -31°C = -23°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 12 | 11 | 11 | 9 | 8 |
| | NM | 59 | 55 | 51 | 44 | 37 |
| | LB | 476 | 444 | 413 | 356 | 304 |
| | R/C | 1409 | 1526 | 1653 | 1949 | 2317 |
| ISA | MIN | 9 | 8 | 8 | 7 | 6 |
| | NM | 41 | 38 | 36 | 31 | 26 |
| | LB | 372 | 349 | 327 | 284 | 244 |
| | R/C | 2129 | 2286 | 2457 | 2857 | 3357 |
| ISA -10°C | MIN | 7 | 7 | 6 | 5 | 5 |
| | NM | 31 | 29 | 27 | 24 | 20 |
| | LB | 313 | 294 | 276 | 241 | 207 |
| | R/C | 2831 | 3026 | 3240 | 3740 | 4370 |

**PRESSURE ALTITUDE 25000 FEET — ISA = -35°C = -30°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 14 | 13 | 12 | 10 | 9 |
| | NM | 69 | 64 | 59 | 51 | 43 |
| | LB | 529 | 492 | 458 | 394 | 335 |
| | R/C | 1262 | 1372 | 1492 | 1769 | 2114 |
| ISA | MIN | 10 | 9 | 8 | 7 | 6 |
| | NM | 47 | 44 | 41 | 35 | 30 |
| | LB | 410 | 384 | 359 | 312 | 267 |
| | R/C | 1940 | 2088 | 2250 | 2625 | 3096 |
| ISA -10°C | MIN | 8 | 7 | 7 | 6 | 5 |
| | NM | 35 | 33 | 31 | 27 | 23 |
| | LB | 343 | 322 | 302 | 264 | 227 |
| | R/C | 2623 | 2808 | 3011 | 3485 | 4082 |

**PRESSURE ALTITUDE 27000 FEET — ISA = -38°C = -37°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 15 | 14 | 13 | 11 | 10 |
| | NM | 80 | 74 | 68 | 58 | 49 |
| | LB | 584 | 543 | 505 | 433 | 368 |
| | R/C | 1127 | 1236 | 1354 | 1626 | 1962 |
| ISA | MIN | 11 | 10 | 9 | 8 | 7 |
| | NM | 53 | 50 | 46 | 40 | 34 |
| | LB | 447 | 419 | 391 | 339 | 291 |
| | R/C | 1878 | 2027 | 2191 | 2571 | 3045 |
| ISA -10°C | MIN | 8 | 8 | 7 | 7 | 6 |
| | NM | 40 | 38 | 35 | 30 | 26 |
| | LB | 374 | 351 | 329 | 287 | 247 |
| | R/C | 2536 | 2722 | 2927 | 3402 | 3999 |

**PRESSURE ALTITUDE 29000 FEET — ISA = -42°C = -44°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 17 | 16 | 15 | 13 | 11 |
| | NM | 90 | 83 | 77 | 65 | 55 |
| | LB | 634 | 588 | 545 | 467 | 396 |
| | R/C | 1314 | 1452 | 1595 | 1924 | 2330 |
| ISA | MIN | 12 | 11 | 10 | 9 | 8 |
| | NM | 59 | 55 | 51 | 44 | 38 |
| | LB | 481 | 450 | 420 | 364 | 311 |
| | R/C | 2094 | 2276 | 2467 | 2910 | 3461 |
| ISA -10°C | MIN | 9 | 9 | 8 | 7 | 6 |
| | NM | 45 | 42 | 39 | 34 | 29 |
| | LB | 402 | 377 | 353 | 308 | 264 |
| | R/C | 2759 | 2978 | 3211 | 3750 | 4425 |

**PRESSURE ALTITUDE 31000 FEET — ISA = -46°C = -52°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 18 | 17 | 16 | 14 | 12 |
| | NM | 99 | 91 | 84 | 72 | 60 |
| | LB | 679 | 629 | 582 | 497 | 421 |
| | R/C | 1301 | 1443 | 1598 | 1942 | 2361 |
| ISA | MIN | 13 | 12 | 11 | 10 | 8 |
| | NM | 65 | 61 | 56 | 49 | 41 |
| | LB | 513 | 479 | 447 | 386 | 330 |
| | R/C | 2034 | 2219 | 2419 | 2872 | 3429 |
| ISA -10°C | MIN | 10 | 9 | 9 | 8 | 7 |
| | NM | 49 | 46 | 43 | 37 | 32 |
| | LB | 429 | 402 | 377 | 327 | 281 |
| | R/C | 2541 | 2755 | 2987 | 3516 | 4170 |

**PRESSURE ALTITUDE 33000 FEET — ISA = -50°C = -59°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 20 | 18 | 17 | 15 | 12 |
| | NM | 109 | 100 | 92 | 78 | 65 |
| | LB | 721 | 667 | 617 | 526 | 444 |
| | R/C | 1308 | 1457 | 1618 | 1988 | 2426 |
| ISA | MIN | 14 | 13 | 12 | 10 | 9 |
| | NM | 71 | 66 | 62 | 53 | 45 |
| | LB | 545 | 509 | 474 | 409 | 349 |
| | R/C | 1848 | 2029 | 2225 | 2677 | 3221 |
| ISA -10°C | MIN | 11 | 10 | 9 | 8 | 7 |
| | NM | 54 | 51 | 47 | 41 | 35 |
| | LB | 457 | 428 | 400 | 347 | 298 |
| | R/C | 2251 | 2456 | 2679 | 3194 | 3817 |

**PRESSURE ALTITUDE 35000 FEET — ISA = -54°C = -66°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 22 | 20 | 18 | 16 | 13 |
| | NM | 118 | 109 | 100 | 84 | 71 |
| | LB | 764 | 705 | 651 | 553 | 466 |
| | R/C | 1206 | 1364 | 1527 | 1899 | 2350 |
| ISA | MIN | 15 | 14 | 13 | 11 | 10 |
| | NM | 79 | 73 | 68 | 58 | 49 |
| | LB | 580 | 540 | 502 | 432 | 368 |
| | R/C | 1586 | 1770 | 1959 | 2393 | 2923 |
| ISA -10°C | MIN | 12 | 11 | 10 | 9 | 8 |
| | NM | 60 | 56 | 52 | 44 | 38 |
| | LB | 487 | 455 | 425 | 368 | 315 |
| | R/C | 1929 | 2136 | 2349 | 2837 | 3437 |

**PRESSURE ALTITUDE 37000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 23 | 22 | 20 | 17 | 14 |
| | NM | 130 | 119 | 109 | 91 | 76 |
| | LB | 811 | 746 | 687 | 581 | 489 |
| | R/C | 961 | 1121 | 1290 | 1649 | 2081 |
| ISA | MIN | 16 | 15 | 14 | 12 | 10 |
| | NM | 87 | 81 | 74 | 63 | 53 |
| | LB | 618 | 574 | 532 | 456 | 388 |
| | R/C | 1265 | 1448 | 1640 | 2054 | 2551 |
| ISA -10°C | MIN | 13 | 12 | 11 | 10 | 8 |
| | NM | 67 | 62 | 57 | 49 | 41 |
| | LB | 520 | 485 | 451 | 389 | 332 |
| | R/C | 1539 | 1740 | 1952 | 2413 | 2968 |

**PRESSURE ALTITUDE 39000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 26 | 24 | 22 | 18 | 15 |
| | NM | 147 | 132 | 120 | 100 | 83 |
| | LB | 873 | 796 | 729 | 613 | 513 |
| | R/C | 616 | 776 | 941 | 1297 | 1692 |
| ISA | MIN | 18 | 17 | 16 | 13 | 11 |
| | NM | 99 | 91 | 83 | 70 | 59 |
| | LB | 665 | 614 | 567 | 483 | 409 |
| | R/C | 885 | 1064 | 1252 | 1658 | 2115 |
| ISA -10°C | MIN | 15 | 13 | 12 | 11 | 9 |
| | NM | 76 | 70 | 64 | 55 | 46 |
| | LB | 560 | 519 | 482 | 413 | 352 |
| | R/C | 1121 | 1315 | 1522 | 1971 | 2480 |

**PRESSURE ALTITUDE 41000 FEET — ISA = -57°C = -70°F**

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +10°C | MIN | 31 | 27 | 25 | 20 | 17 |
| | NM | 178 | 155 | 138 | 111 | 91 |
| | LB | 976 | 872 | 787 | 652 | 542 |
| | R/C | 275 | 417 | 570 | 923 | 1310 |
| ISA | MIN | 21 | 19 | 17 | 15 | 12 |
| | NM | 116 | 104 | 94 | 78 | 65 |
| | LB | 729 | 665 | 609 | 513 | 432 |
| | R/C | 589 | 756 | 930 | 1343 | 1803 |
| ISA -10°C | MIN | 17 | 15 | 14 | 12 | 10 |
| | NM | 89 | 81 | 73 | 61 | 51 |
| | LB | 612 | 562 | 518 | 440 | 372 |
| | R/C | 779 | 962 | 1151 | 1602 | 2109 |

**CRUISE CLIMB SPEED - KIAS**

| PRESSURE ALTITUDE-FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 | 40000 | 41000 |
| 250 | 250 | 250 | 250 | 250 | 250 | 231 | 206 | 183 | 179 |

**WIND EFFECT ON CLIMB DISTANCE - NM**
(SUBTRACT FOR HEADWIND. ADD FOR TAILWIND)

| CLIMB TIME (MIN) | WIND 25KTS | 50KTS | 100KTS |
|---|---|---|---|
| 5 | 2 | 4 | 8 |
| 10 | 4 | 8 | 16 |
| 15 | 6 | 12 | 25 |
| 20 | 8 | 16 | 33 |
| 25 | 10 | 20 | 41 |
| 30 | 12 | 25 | 50 |

Figure 7-13

# MULTI ENGINE CLIMB
## 250 KIAS/0.65 INDICATED MACH

**TIME, DISTANCE, FUEL, AND RATE OF CLIMB** **ANTI-ICE SYSTEMS OFF**

| T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | 5000 FEET ISA = 5°C = 41°F | | | | | 10000 FEET ISA = - 5°C = 23°F | | | | | 15000 FEET ISA = -15°C = 6°F | | | | | 17000 FEET ISA = -19°C = - 2°F | | | | |
| ISA +20°C MIN | 2 | 2 | 2 | 2 | 2 | 5 | 4 | 4 | 4 | 3 | 8 | 7 | 7 | 6 | 5 | 9 | 8 | 8 | 7 | 6 |
| NM | 8 | 8 | 7 | 6 | 5 | 20 | 18 | 17 | 15 | 13 | 34 | 32 | 30 | 26 | 22 | 41 | 38 | 36 | 31 | 26 |
| LB | 96 | 91 | 85 | 74 | 63 | 198 | 185 | 173 | 150 | 129 | 308 | 288 | 268 | 232 | 199 | 352 | 329 | 307 | 265 | 227 |
| R/C | 2429 | 2592 | 2770 | 3188 | 3716 | 2000 | 2142 | 2298 | 2661 | 3117 | 1685 | 1812 | 1952 | 2276 | 2682 | 1631 | 1755 | 1892 | 2209 | 2607 |
| ISA +10°C MIN | 2 | 2 | 2 | 2 | 1 | 4 | 3 | 3 | 3 | 3 | 6 | 5 | 5 | 4 | 4 | 6 | 6 | 6 | 5 | 4 |
| NM | 6 | 6 | 5 | 4 | 4 | 14 | 13 | 12 | 11 | 9 | 24 | 23 | 21 | 18 | 16 | 29 | 27 | 25 | 22 | 19 |
| LB | 80 | 76 | 71 | 62 | 54 | 163 | 153 | 143 | 125 | 108 | 248 | 232 | 218 | 190 | 163 | 282 | 264 | 248 | 216 | 185 |
| R/C | 3252 | 3459 | 3686 | 4220 | 4897 | 2775 | 2958 | 3160 | 3632 | 4229 | 2449 | 2617 | 2803 | 3235 | 3780 | 2323 | 2485 | 2664 | 3080 | 3604 |
| ISA MIN | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 5 | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 4 | 4 |
| NM | 5 | 5 | 4 | 4 | 3 | 11 | 11 | 10 | 9 | 7 | 19 | 18 | 16 | 14 | 12 | 22 | 21 | 19 | 17 | 14 |
| LB | 69 | 65 | 61 | 53 | 46 | 139 | 131 | 123 | 108 | 93 | 209 | 197 | 185 | 161 | 139 | 237 | 223 | 209 | 183 | 158 |
| R/C | 4000 | 4247 | 4519 | 5159 | 5971 | 3573 | 3799 | 4049 | 4634 | 5376 | 3317 | 3532 | 3770 | 4324 | 5027 | 3135 | 3341 | 3568 | 4100 | 4772 |
| ISA -10°C MIN | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 3 |
| NM | 5 | 5 | 4 | 4 | 3 | 10 | 9 | 9 | 8 | 6 | 16 | 15 | 14 | 12 | 10 | 18 | 17 | 16 | 14 | 12 |
| LB | 66 | 62 | 58 | 51 | 44 | 127 | 120 | 113 | 99 | 85 | 187 | 177 | 166 | 145 | 126 | 211 | 199 | 187 | 164 | 142 |
| R/C | 4065 | 4316 | 4592 | 5243 | 6069 | 4497 | 4773 | 5077 | 5793 | 6703 | 4128 | 4387 | 4673 | 5344 | 6194 | 3943 | 4193 | 4468 | 5115 | 5935 |
| PRESSURE ALTITUDE | 19000 FEET ISA = -23°C = - 9°F | | | | | 21000 FEET ISA = -27°C = -16°F | | | | | 23000 FEET ISA = -31°C = -23°F | | | | | 25000 FEET ISA = -35°C = -30°F | | | | |
| ISA +20°C MIN | 10 | 9 | 9 | 8 | 7 | 12 | 11 | 10 | 9 | 8 | 13 | 12 | 12 | 10 | 9 | 16 | 15 | 14 | 12 | 10 |
| NM | 48 | 45 | 42 | 36 | 31 | 57 | 53 | 49 | 42 | 36 | 68 | 63 | 59 | 50 | 42 | 84 | 78 | 72 | 61 | 51 |
| LB | 399 | 372 | 347 | 299 | 255 | 450 | 419 | 390 | 336 | 287 | 510 | 475 | 441 | 379 | 322 | 588 | 545 | 505 | 431 | 365 |
| R/C | 1506 | 1625 | 1755 | 2057 | 2435 | 1280 | 1388 | 1506 | 1778 | 2118 | 982 | 1076 | 1177 | 1411 | 1700 | 696 | 775 | 861 | 1057 | 1297 |
| ISA +10°C MIN | 7 | 7 | 7 | 6 | 5 | 8 | 8 | 7 | 6 | 6 | 9 | 9 | 8 | 7 | 6 | 11 | 10 | 9 | 8 | 7 |
| NM | 34 | 32 | 30 | 26 | 22 | 39 | 37 | 34 | 30 | 25 | 46 | 43 | 40 | 35 | 29 | 54 | 50 | 47 | 40 | 34 |
| LB | 317 | 297 | 278 | 242 | 208 | 354 | 332 | 311 | 270 | 232 | 394 | 369 | 345 | 299 | 257 | 440 | 411 | 384 | 332 | 284 |
| R/C | 2193 | 2349 | 2521 | 2922 | 3425 | 1987 | 2134 | 2295 | 2669 | 3139 | 1718 | 1852 | 1998 | 2337 | 2761 | 1429 | 1549 | 1679 | 1981 | 2357 |
| ISA MIN | 6 | 6 | 5 | 5 | 4 | 7 | 6 | 6 | 5 | 5 | 7 | 7 | 7 | 6 | 5 | 8 | 8 | 7 | 6 | 6 |
| NM | 26 | 24 | 23 | 20 | 17 | 30 | 28 | 26 | 23 | 19 | 34 | 32 | 30 | 26 | 22 | 40 | 37 | 35 | 30 | 26 |
| LB | 265 | 249 | 234 | 204 | 176 | 295 | 277 | 260 | 227 | 196 | 327 | 307 | 288 | 251 | 216 | 361 | 339 | 317 | 276 | 238 |
| R/C | 2933 | 3130 | 3346 | 3853 | 4492 | 2672 | 2856 | 3058 | 3530 | 4126 | 2381 | 2551 | 2737 | 3171 | 3718 | 2094 | 2250 | 2420 | 2818 | 3317 |
| ISA -10°C MIN | 5 | 5 | 5 | 4 | 4 | 6 | 5 | 5 | 5 | 4 | 6 | 6 | 6 | 5 | 4 | 7 | 7 | 6 | 6 | 5 |
| NM | 21 | 20 | 19 | 16 | 14 | 25 | 23 | 22 | 19 | 16 | 28 | 26 | 25 | 22 | 18 | 32 | 30 | 28 | 25 | 21 |
| LB | 236 | 222 | 209 | 183 | 158 | 262 | 246 | 231 | 202 | 175 | 289 | 272 | 255 | 223 | 193 | 318 | 299 | 281 | 245 | 211 |
| R/C | 3648 | 3884 | 4143 | 4751 | 5521 | 3315 | 3535 | 3776 | 4341 | 5055 | 2998 | 3202 | 3426 | 3950 | 4610 | 2691 | 2880 | 3088 | 3572 | 4181 |
| PRESSURE ALTITUDE | 27000 FEET ISA = -38°C = -37°F | | | | | 29000 FEET ISA = -42°C = -44°F | | | | | 31000 FEET ISA = -46°C = -52°F | | | | | 33000 FEET ISA = -50°C = -59°F | | | | |
| ISA +20°C MIN | 20 | 18 | 17 | 14 | 12 | 26 | 24 | 21 | 18 | 15 | 32 | 28 | 25 | 20 | 17 | 36 | 31 | 28 | 23 | 18 |
| NM | 109 | 100 | 91 | 76 | 64 | 153 | 136 | 122 | 99 | 81 | 188 | 165 | 147 | 118 | 95 | 214 | 188 | 166 | 132 | 106 |
| LB | 702 | 646 | 594 | 502 | 421 | 887 | 799 | 724 | 599 | 495 | 1026 | 915 | 822 | 672 | 551 | 1127 | 1000 | 895 | 727 | 594 |
| R/C | 423 | 488 | 559 | 719 | 914 | 240 | 299 | 363 | 505 | 676 | 454 | 541 | 633 | 840 | 1090 | 524 | 621 | 726 | 955 | 1231 |
| ISA +10°C MIN | 12 | 12 | 11 | 9 | 8 | 14 | 13 | 12 | 11 | 9 | 16 | 15 | 14 | 12 | 10 | 18 | 16 | 15 | 13 | 11 |
| NM | 64 | 60 | 56 | 48 | 40 | 77 | 71 | 66 | 56 | 48 | 88 | 82 | 75 | 64 | 54 | 99 | 91 | 84 | 71 | 60 |
| LB | 493 | 460 | 429 | 370 | 316 | 554 | 516 | 479 | 412 | 351 | 606 | 563 | 522 | 447 | 380 | 653 | 605 | 560 | 478 | 405 |
| R/C | 1136 | 1241 | 1355 | 1618 | 1945 | 967 | 1066 | 1175 | 1423 | 1729 | 1220 | 1356 | 1496 | 1819 | 2216 | 1198 | 1339 | 1491 | 1828 | 2237 |
| ISA MIN | 9 | 9 | 8 | 7 | 6 | 11 | 10 | 9 | 8 | 7 | 12 | 11 | 10 | 9 | 8 | 13 | 12 | 11 | 10 | 8 |
| NM | 47 | 44 | 41 | 35 | 30 | 54 | 51 | 47 | 41 | 35 | 62 | 57 | 53 | 46 | 39 | 69 | 64 | 59 | 51 | 43 |
| LB | 399 | 374 | 350 | 305 | 261 | 441 | 413 | 386 | 335 | 287 | 478 | 447 | 417 | 361 | 309 | 513 | 478 | 446 | 385 | 329 |
| R/C | 1757 | 1896 | 2049 | 2403 | 2844 | 1556 | 1688 | 1832 | 2166 | 2582 | 1896 | 2070 | 2253 | 2674 | 3198 | 1746 | 1918 | 2105 | 2525 | 3039 |
| ISA -10°C MIN | 8 | 7 | 7 | 6 | 5 | 9 | 8 | 8 | 7 | 6 | 10 | 9 | 9 | 7 | 6 | 11 | 10 | 9 | 8 | 7 |
| NM | 37 | 35 | 33 | 28 | 24 | 43 | 40 | 38 | 33 | 28 | 48 | 45 | 42 | 36 | 31 | 54 | 50 | 47 | 40 | 34 |
| LB | 350 | 329 | 308 | 269 | 232 | 384 | 361 | 338 | 294 | 253 | 415 | 389 | 364 | 317 | 272 | 444 | 416 | 389 | 338 | 290 |
| R/C | 2350 | 2522 | 2711 | 3151 | 3703 | 2120 | 2284 | 2463 | 2880 | 3402 | 2417 | 2621 | 2836 | 3335 | 3956 | 2147 | 2342 | 2555 | 3037 | 3628 |

Figure 7-13A (Sheet 1 of 3)

# MULTI ENGINE CLIMB
## 250 KIAS/0.65 INDICATED MACH

**TIME, DISTANCE, FUEL, AND RATE OF CLIMB** **ANTI-ICE SYSTEMS OFF**

PRESSURE ALTITUDE 35000 FEET, ISA = -54°C = -66°F

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 40 | 35 | 31 | 25 | 20 |
| | NM | 240 | 209 | 184 | 146 | 117 |
| | LB | 1221 | 1078 | 961 | 776 | 632 |
| | R/C | 498 | 598 | 707 | 955 | 1243 |
| ISA +10°C | MIN | 19 | 18 | 17 | 14 | 12 |
| | NM | 110 | 101 | 93 | 78 | 66 |
| | LB | 699 | 646 | 596 | 508 | 429 |
| | R/C | 1138 | 1281 | 1436 | 1790 | 2207 |
| ISA | MIN | 14 | 13 | 12 | 11 | 9 |
| | NM | 76 | 71 | 66 | 56 | 47 |
| | LB | 549 | 511 | 476 | 410 | 349 |
| | R/C | 1522 | 1688 | 1869 | 2284 | 2779 |
| ISA -10°C | MIN | 12 | 11 | 10 | 9 | 8 |
| | NM | 60 | 56 | 52 | 45 | 38 |
| | LB | 475 | 444 | 414 | 359 | 307 |
| | R/C | 1860 | 2046 | 2249 | 2717 | 3279 |

PRESSURE ALTITUDE 37000 FEET, ISA = -57°C = -70°F

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 44 | 39 | 34 | 27 | 22 |
| | NM | 271 | 234 | 205 | 161 | 128 |
| | LB | 1325 | 1162 | 1031 | 827 | 670 |
| | R/C | 382 | 482 | 588 | 831 | 1121 |
| ISA +10°C | MIN | 21 | 20 | 18 | 15 | 13 |
| | NM | 123 | 112 | 103 | 86 | 72 |
| | LB | 748 | 689 | 635 | 538 | 453 |
| | R/C | 937 | 1089 | 1238 | 1577 | 1987 |
| ISA | MIN | 16 | 14 | 13 | 12 | 10 |
| | NM | 86 | 79 | 73 | 62 | 52 |
| | LB | 588 | 546 | 507 | 435 | 370 |
| | R/C | 1265 | 1442 | 1614 | 2007 | 2486 |
| ISA -10°C | MIN | 13 | 12 | 11 | 10 | 8 |
| | NM | 68 | 63 | 58 | 50 | 42 |
| | LB | 509 | 474 | 442 | 381 | 326 |
| | R/C | 1527 | 1723 | 1914 | 2351 | 2885 |

PRESSURE ALTITUDE 39000 FEET, ISA = -57°C = -70°F

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | * 56 | * 45 | 39 | 30 | 24 |
| | NM | 344 | 278 | 236 | 181 | 142 |
| | LB | 1549 | 1295 | 1127 | 889 | 713 |
| | R/C | 100 | 209 | 327 | 548 | 814 |
| ISA +10°C | MIN | 24 | 22 | 20 | 17 | 14 |
| | NM | 141 | 127 | 115 | 95 | 79 |
| | LB | 811 | 740 | 678 | 571 | 479 |
| | R/C | 613 | 771 | 936 | 1258 | 1637 |
| ISA | MIN | 18 | 16 | 15 | 13 | 11 |
| | NM | 98 | 89 | 82 | 69 | 58 |
| | LB | 635 | 586 | 542 | 462 | 392 |
| | R/C | 911 | 1090 | 1278 | 1656 | 2099 |
| ISA -10°C | MIN | 14 | 13 | 12 | 11 | 9 |
| | NM | 77 | 71 | 65 | 55 | 47 |
| | LB | 549 | 509 | 472 | 406 | 345 |
| | R/C | 1142 | 1337 | 1543 | 1962 | 2455 |

PRESSURE ALTITUDE 41000 FEET, ISA = -57°C = -70°F

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | *157 | *108 | * 58 | 35 | 27 |
| | NM | 1025 | 699 | 363 | 213 | 162 |
| | LB | 3474 | 2483 | 1481 | 978 | 768 |
| | R/C | 100 | 101 | 101 | 330 | 581 |
| ISA +10°C | MIN | 29 | 26 | 23 | 19 | 15 |
| | NM | 172 | 149 | 132 | 107 | 88 |
| | LB | 911 | 813 | 734 | 609 | 507 |
| | R/C | 310 | 461 | 631 | 989 | 1349 |
| ISA | MIN | 20 | 18 | 17 | 14 | 12 |
| | NM | 115 | 103 | 93 | 77 | 64 |
| | LB | 697 | 636 | 583 | 492 | 415 |
| | R/C | 645 | 818 | 1014 | 1433 | 1866 |
| ISA -10°C | MIN | 17 | 15 | 14 | 12 | 10 |
| | NM | 90 | 82 | 75 | 62 | 52 |
| | LB | 600 | 551 | 508 | 432 | 366 |
| | R/C | 815 | 1003 | 1215 | 1669 | 2145 |

PRESSURE ALTITUDE 43000 FEET, ISA = -57°C = -70°F

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | *267 | *218 | *168 | * 60 | 32 |
| | NM | 1771 | 1442 | 1107 | 380 | 194 |
| | LB | 5403 | 4403 | 3403 | 1401 | 847 |
| | R/C | 100 | 100 | 100 | 100 | 325 |
| ISA +10°C | MIN | * 85 | * 35 | 28 | 21 | 17 |
| | NM | 545 | 211 | 165 | 124 | 99 |
| | LB | 1995 | 992 | 830 | 659 | 540 |
| | R/C | 100 | 100 | 263 | 616 | 995 |
| ISA | MIN | 25 | 22 | 19 | 16 | 13 |
| | NM | 146 | 124 | 109 | 88 | 72 |
| | LB | 802 | 706 | 636 | 527 | 440 |
| | R/C | 267 | 472 | 672 | 1088 | 1549 |
| ISA -10°C | MIN | 20 | 18 | 16 | 13 | 11 |
| | NM | 112 | 98 | 87 | 71 | 58 |
| | LB | 678 | 608 | 552 | 463 | 389 |
| | R/C | 428 | 652 | 871 | 1322 | 1828 |

PRESSURE ALTITUDE 45000 FEET, ISA = -57°C = -70°F

| T.O. WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | ---- | ---- | *286 | *178 | * 59 |
| | NM | ---- | ---- | 1907 | 1180 | 379 |
| | LB | ---- | ---- | 5276 | 3276 | 1272 |
| | R/C | ---- | ---- | 101 | 101 | 101 |
| ISA +10°C | MIN | *197 | *148 | * 93 | 27 | 20 |
| | NM | 1290 | 960 | 598 | 158 | 116 |
| | LB | 3961 | 2968 | 1964 | 746 | 583 |
| | R/C | 100 | 101 | 100 | 258 | 652 |
| ISA | MIN | *103 | * 51 | 24 | 18 | 15 |
| | NM | 653 | 317 | 142 | 103 | 82 |
| | LB | 2262 | 1263 | 733 | 573 | 469 |
| | R/C | 100 | 100 | 240 | 670 | 1137 |
| ISA -10°C | MIN | * 60 | 23 | 19 | 15 | 12 |
| | NM | 368 | 132 | 106 | 82 | 66 |
| | LB | 1470 | 719 | 616 | 499 | 413 |
| | R/C | 100 | 209 | 501 | 981 | 1503 |

* INDICATES STEP CLIMB REQUIRED
NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION. BASED ON MAXIMUM CRUISE THRUST.

CRUISE CLIMB SPEED - KIAS

| PRESSURE ALTITUDE-FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 | 40000 | 45000 |
| 250 | 250 | 250 | 250 | 250 | 250 | 242 | 217 | 193 | 171 |

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

| CLIMB TIME (MIN) | WIND 25KTS | 50KTS | 100KTS |
|---|---|---|---|
| 5 | 2 | 4 | 8 |
| 10 | 4 | 8 | 16 |
| 15 | 6 | 12 | 25 |
| 20 | 8 | 16 | 33 |
| 25 | 10 | 20 | 41 |
| 30 | 12 | 25 | 50 |

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

| STEP CLIMB ALT IN FEET | TEMPERATURE ISA -10°C | ISA + 0°C | ISA +10°C | ISA +20°C |
|---|---|---|---|---|
| 37000 | ---- | ---- | ---- | 18656 |
| 39000 | ---- | ---- | ---- | 16717 |
| 41000 | ---- | ---- | 18176 | 14772 |
| 43000 | 18682 | 17884 | 16188 | 12880 |

Figure 7-13A (Sheet 2)

# MULTI ENGINE CLIMB
## 250 KIAS/0.65 INDICATED MACH

**TIME, DISTANCE, FUEL, AND RATE OF CLIMB** — **ANTI-ICE SYSTEMS ON**

| PRESSURE ALTITUDE 5000 FEET (ISA = 5°C = 41°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 2 | 2 | 2 | 2 | 2 |
| ISA +10°C NM | 8 | 7 | 7 | 6 | 5 |
| ISA +10°C LB | 92 | 87 | 81 | 71 | 61 |
| ISA +10°C R/C | 2507 | 2674 | 2858 | 3289 | 3833 |
| ISA MIN | 2 | 2 | 2 | 2 | 1 |
| ISA NM | 6 | 5 | 5 | 4 | 4 |
| ISA LB | 80 | 75 | 70 | 62 | 53 |
| ISA R/C | 3320 | 3531 | 3763 | 4309 | 4999 |
| ISA -10°C MIN | 2 | 2 | 2 | 1 | 1 |
| ISA -10°C NM | 5 | 5 | 4 | 4 | 3 |
| ISA -10°C LB | 68 | 64 | 60 | 53 | 45 |
| ISA -10°C R/C | 4058 | 4309 | 4585 | 5235 | 6060 |

| PRESSURE ALTITUDE 10000 FEET (ISA = - 5°C = 23°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 5 | 4 | 4 | 4 | 3 |
| ISA +10°C NM | 19 | 17 | 16 | 14 | 12 |
| ISA +10°C LB | 193 | 181 | 169 | 147 | 126 |
| ISA +10°C R/C | 2009 | 2152 | 2309 | 2675 | 3136 |
| ISA MIN | 4 | 3 | 3 | 3 | 3 |
| ISA NM | 13 | 13 | 12 | 10 | 9 |
| ISA LB | 160 | 150 | 141 | 123 | 106 |
| ISA R/C | 2909 | 3100 | 3311 | 3804 | 4428 |
| ISA -10°C MIN | 3 | 3 | 3 | 2 | 2 |
| ISA -10°C NM | 11 | 10 | 9 | 8 | 7 |
| ISA -10°C LB | 137 | 129 | 121 | 106 | 92 |
| ISA -10°C R/C | 3797 | 4036 | 4300 | 4919 | 5703 |

| PRESSURE ALTITUDE 15000 FEET (ISA = -15°C = 6°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 7 | 7 | 6 | 6 | 5 |
| ISA +10°C NM | 32 | 30 | 28 | 24 | 20 |
| ISA +10°C LB | 299 | 280 | 261 | 226 | 194 |
| ISA +10°C R/C | 1853 | 1990 | 2141 | 2490 | 2928 |
| ISA MIN | 5 | 5 | 5 | 4 | 4 |
| ISA NM | 22 | 21 | 20 | 17 | 15 |
| ISA LB | 240 | 225 | 211 | 184 | 158 |
| ISA R/C | 2754 | 2940 | 3144 | 3621 | 4223 |
| ISA -10°C MIN | 4 | 4 | 4 | 4 | 3 |
| ISA -10°C NM | 17 | 16 | 15 | 13 | 11 |
| ISA -10°C LB | 203 | 191 | 180 | 157 | 136 |
| ISA -10°C R/C | 3641 | 3874 | 4131 | 4734 | 5497 |

| PRESSURE ALTITUDE 17000 FEET (ISA = -19°C = - 2°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 8 | 8 | 7 | 6 | 6 |
| ISA +10°C NM | 38 | 35 | 33 | 28 | 24 |
| ISA +10°C LB | 341 | 319 | 297 | 257 | 220 |
| ISA +10°C R/C | 1841 | 1978 | 2128 | 2477 | 2915 |
| ISA MIN | 6 | 6 | 5 | 5 | 4 |
| ISA NM | 26 | 25 | 23 | 20 | 17 |
| ISA LB | 272 | 255 | 239 | 208 | 179 |
| ISA R/C | 2652 | 2831 | 3031 | 3494 | 4081 |
| ISA -10°C MIN | 5 | 5 | 4 | 4 | 3 |
| ISA -10°C NM | 20 | 19 | 18 | 16 | 13 |
| ISA -10°C LB | 229 | 216 | 203 | 177 | 153 |
| ISA -10°C R/C | 3444 | 3667 | 3914 | 4490 | 5221 |

| PRESSURE ALTITUDE 19000 FEET (ISA = -23°C = - 9°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 9 | 9 | 8 | 7 | 6 |
| ISA +10°C NM | 44 | 41 | 38 | 33 | 28 |
| ISA +10°C LB | 383 | 358 | 334 | 288 | 246 |
| ISA +10°C R/C | 1749 | 1882 | 2028 | 2366 | 2790 |
| ISA MIN | 7 | 6 | 6 | 5 | 5 |
| ISA NM | 31 | 29 | 27 | 23 | 20 |
| ISA LB | 304 | 285 | 267 | 232 | 200 |
| ISA R/C | 2534 | 2709 | 2902 | 3352 | 3920 |
| ISA -10°C MIN | 6 | 5 | 5 | 4 | 4 |
| ISA -10°C NM | 24 | 22 | 21 | 18 | 15 |
| ISA -10°C LB | 256 | 241 | 226 | 198 | 171 |
| ISA -10°C R/C | 3245 | 3460 | 3696 | 4248 | 4946 |

| PRESSURE ALTITUDE 21000 FEET (ISA = -27°C = -16°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 11 | 10 | 9 | 8 | 7 |
| ISA +10°C NM | 51 | 48 | 45 | 38 | 32 |
| ISA +10°C LB | 428 | 399 | 372 | 321 | 274 |
| ISA +10°C R/C | 1580 | 1705 | 1842 | 2159 | 2555 |
| ISA MIN | 8 | 7 | 7 | 6 | 5 |
| ISA NM | 35 | 33 | 31 | 27 | 23 |
| ISA LB | 337 | 316 | 296 | 258 | 221 |
| ISA R/C | 2315 | 2480 | 2661 | 3084 | 3615 |
| ISA -10°C MIN | 6 | 6 | 6 | 5 | 4 |
| ISA -10°C NM | 27 | 25 | 24 | 21 | 18 |
| ISA -10°C LB | 284 | 267 | 250 | 219 | 189 |
| ISA -10°C R/C | 3083 | 3290 | 3518 | 4050 | 4722 |

| PRESSURE ALTITUDE 23000 FEET (ISA = -31°C = -23°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 12 | 11 | 11 | 9 | 8 |
| ISA +10°C NM | 59 | 55 | 51 | 44 | 37 |
| ISA +10°C LB | 476 | 444 | 413 | 356 | 304 |
| ISA +10°C R/C | 1409 | 1526 | 1653 | 1949 | 2317 |
| ISA MIN | 9 | 8 | 8 | 7 | 6 |
| ISA NM | 41 | 38 | 36 | 31 | 26 |
| ISA LB | 372 | 349 | 327 | 284 | 244 |
| ISA R/C | 2129 | 2286 | 2457 | 2856 | 3358 |
| ISA -10°C MIN | 7 | 7 | 6 | 5 | 5 |
| ISA -10°C NM | 31 | 29 | 27 | 24 | 20 |
| ISA -10°C LB | 313 | 294 | 276 | 241 | 207 |
| ISA -10°C R/C | 2831 | 3025 | 3240 | 3740 | 4370 |

| PRESSURE ALTITUDE 25000 FEET (ISA = -35°C = -30°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 14 | 13 | 12 | 10 | 9 |
| ISA +10°C NM | 69 | 64 | 59 | 51 | 43 |
| ISA +10°C LB | 529 | 492 | 458 | 394 | 335 |
| ISA +10°C R/C | 1262 | 1372 | 1492 | 1770 | 2115 |
| ISA MIN | 10 | 9 | 8 | 7 | 6 |
| ISA NM | 47 | 44 | 41 | 35 | 30 |
| ISA LB | 410 | 384 | 359 | 312 | 267 |
| ISA R/C | 1940 | 2088 | 2250 | 2625 | 3096 |
| ISA -10°C MIN | 8 | 7 | 7 | 6 | 5 |
| ISA -10°C NM | 35 | 33 | 31 | 27 | 23 |
| ISA -10°C LB | 343 | 322 | 302 | 264 | 227 |
| ISA -10°C R/C | 2623 | 2808 | 3011 | 3485 | 4082 |

| PRESSURE ALTITUDE 27000 FEET (ISA = -38°C = -37°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 15 | 14 | 13 | 12 | 10 |
| ISA +10°C NM | 81 | 75 | 69 | 59 | 50 |
| ISA +10°C LB | 591 | 549 | 510 | 437 | 371 |
| ISA +10°C R/C | 940 | 1034 | 1137 | 1372 | 1662 |
| ISA MIN | 11 | 10 | 9 | 8 | 7 |
| ISA NM | 54 | 50 | 47 | 40 | 34 |
| ISA LB | 451 | 422 | 394 | 342 | 293 |
| ISA R/C | 1658 | 1792 | 1938 | 2278 | 2700 |
| ISA -10°C MIN | 8 | 8 | 8 | 7 | 6 |
| ISA -10°C NM | 40 | 38 | 35 | 31 | 26 |
| ISA -10°C LB | 376 | 353 | 331 | 289 | 248 |
| ISA -10°C R/C | 2282 | 2451 | 2636 | 3066 | 3605 |

| PRESSURE ALTITUDE 29000 FEET (ISA = -42°C = -44°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 18 | 17 | 15 | 13 | 11 |
| ISA +10°C NM | 97 | 90 | 83 | 70 | 59 |
| ISA +10°C LB | 669 | 620 | 574 | 489 | 414 |
| ISA +10°C R/C | 717 | 803 | 896 | 1108 | 1369 |
| ISA MIN | 12 | 11 | 11 | 9 | 8 |
| ISA NM | 62 | 58 | 54 | 46 | 39 |
| ISA LB | 496 | 464 | 433 | 374 | 320 |
| ISA R/C | 1414 | 1539 | 1675 | 1989 | 2379 |
| ISA -10°C MIN | 9 | 9 | 8 | 7 | 6 |
| ISA -10°C NM | 46 | 43 | 40 | 35 | 30 |
| ISA -10°C LB | 412 | 387 | 362 | 315 | 271 |
| ISA -10°C R/C | 2040 | 2200 | 2375 | 2780 | 3287 |

| PRESSURE ALTITUDE 31000 FEET (ISA = -46°C = -52°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 20 | 19 | 17 | 15 | 12 |
| ISA +10°C NM | 113 | 103 | 95 | 80 | 67 |
| ISA +10°C LB | 739 | 681 | 629 | 534 | 449 |
| ISA +10°C R/C | 912 | 1029 | 1151 | 1429 | 1769 |
| ISA MIN | 13 | 12 | 12 | 10 | 9 |
| ISA NM | 70 | 65 | 61 | 52 | 44 |
| ISA LB | 537 | 501 | 467 | 403 | 344 |
| ISA R/C | 1721 | 1885 | 2057 | 2453 | 2945 |
| ISA -10°C MIN | 10 | 10 | 9 | 8 | 7 |
| ISA -10°C NM | 52 | 49 | 45 | 39 | 33 |
| ISA -10°C LB | 444 | 416 | 389 | 338 | 290 |
| ISA -10°C R/C | 2313 | 2510 | 2719 | 3203 | 3805 |

| PRESSURE ALTITUDE 33000 FEET (ISA = -50°C = -59°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 23 | 21 | 19 | 16 | 14 |
| ISA +10°C NM | 127 | 116 | 106 | 89 | 74 |
| ISA +10°C LB | 798 | 734 | 675 | 571 | 480 |
| ISA +10°C R/C | 946 | 1072 | 1208 | 1507 | 1869 |
| ISA MIN | 15 | 14 | 13 | 11 | 9 |
| ISA NM | 78 | 72 | 67 | 57 | 48 |
| ISA LB | 574 | 535 | 498 | 429 | 365 |
| ISA R/C | 1633 | 1799 | 1979 | 2382 | 2874 |
| ISA -10°C MIN | 11 | 11 | 10 | 9 | 7 |
| ISA -10°C NM | 58 | 54 | 50 | 43 | 37 |
| ISA -10°C LB | 475 | 445 | 415 | 360 | 309 |
| ISA -10°C R/C | 2076 | 2267 | 2476 | 2947 | 3525 |

| PRESSURE ALTITUDE 35000 FEET (ISA = -54°C = -66°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 25 | 22 | 21 | 17 | 15 |
| ISA +10°C NM | 140 | 127 | 116 | 97 | 81 |
| ISA +10°C LB | 853 | 782 | 718 | 605 | 507 |
| ISA +10°C R/C | 991 | 1124 | 1269 | 1599 | 1986 |
| ISA MIN | 16 | 15 | 14 | 12 | 10 |
| ISA NM | 86 | 80 | 74 | 63 | 53 |
| ISA LB | 613 | 570 | 529 | 455 | 387 |
| ISA R/C | 1429 | 1590 | 1764 | 2165 | 2642 |
| ISA -10°C MIN | 12 | 11 | 11 | 9 | 8 |
| ISA -10°C NM | 64 | 60 | 55 | 48 | 40 |
| ISA -10°C LB | 508 | 474 | 442 | 383 | 327 |
| ISA -10°C R/C | 1811 | 1995 | 2195 | 2655 | 3208 |

| PRESSURE ALTITUDE 37000 FEET (ISA = -57°C = -70°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 27 | 24 | 22 | 19 | 16 |
| ISA +10°C NM | 155 | 140 | 127 | 106 | 87 |
| ISA +10°C LB | 910 | 832 | 761 | 639 | 534 |
| ISA +10°C R/C | 791 | 928 | 1067 | 1382 | 1760 |
| ISA MIN | 17 | 16 | 15 | 13 | 11 |
| ISA NM | 96 | 89 | 82 | 69 | 58 |
| ISA LB | 656 | 608 | 563 | 482 | 409 |
| ISA R/C | 1152 | 1321 | 1485 | 1862 | 2318 |
| ISA -10°C MIN | 14 | 13 | 12 | 10 | 9 |
| ISA -10°C NM | 72 | 67 | 62 | 53 | 45 |
| ISA -10°C LB | 544 | 506 | 471 | 406 | 347 |
| ISA -10°C R/C | 1452 | 1643 | 1829 | 2254 | 2774 |

| PRESSURE ALTITUDE 39000 FEET (ISA = -57°C = -70°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 30 | 27 | 25 | 20 | 17 |
| ISA +10°C NM | 177 | 158 | 142 | 117 | 96 |
| ISA +10°C LB | 988 | 894 | 813 | 677 | 563 |
| ISA +10°C R/C | 466 | 612 | 765 | 1060 | 1408 |
| ISA MIN | 20 | 18 | 17 | 14 | 12 |
| ISA NM | 110 | 100 | 92 | 77 | 64 |
| ISA LB | 709 | 653 | 602 | 512 | 432 |
| ISA R/C | 788 | 959 | 1139 | 1496 | 1915 |
| ISA -10°C MIN | 15 | 14 | 13 | 11 | 10 |
| ISA -10°C NM | 82 | 75 | 69 | 59 | 49 |
| ISA -10°C LB | 587 | 544 | 504 | 432 | 367 |
| ISA -10°C R/C | 1042 | 1231 | 1431 | 1834 | 2309 |

| PRESSURE ALTITUDE 41000 FEET (ISA = -57°C = -70°F) / T.O. WEIGHT | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA +10°C MIN | 39 | 33 | 28 | 23 | 19 |
| ISA +10°C NM | 232 | 192 | 166 | 132 | 107 |
| ISA +10°C LB | 1164 | 1003 | 890 | 726 | 598 |
| ISA +10°C R/C | 112 | 252 | 407 | 729 | 1048 |
| ISA MIN | 23 | 21 | 19 | 16 | 13 |
| ISA NM | 131 | 117 | 105 | 86 | 72 |
| ISA LB | 786 | 712 | 650 | 546 | 458 |
| ISA R/C | 474 | 639 | 823 | 1216 | 1617 |
| ISA -10°C MIN | 18 | 16 | 15 | 12 | 10 |
| ISA -10°C NM | 97 | 88 | 80 | 66 | 55 |
| ISA -10°C LB | 645 | 591 | 543 | 461 | 390 |
| ISA -10°C R/C | 694 | 874 | 1078 | 1513 | 1966 |

CRUISE CLIMB SPEED - KIAS

| PRESSURE ALTITUDE-FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 | 40000 | 41000 |
| 250 | 250 | 250 | 250 | 250 | 250 | 242 | 217 | 193 | 188 |

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND. ADD FOR TAILWIND)

| CLIMB TIME (MIN) | WIND 25KTS | WIND 50KTS | WIND 100KTS |
|---|---|---|---|
| 5 | 2 | 4 | 8 |
| 10 | 4 | 8 | 16 |
| 15 | 6 | 12 | 25 |
| 20 | 8 | 16 | 33 |
| 25 | 10 | 20 | 41 |
| 30 | 12 | 25 | 50 |

Figure 7-13A (Sheet 3)

# CRUISE

Specific performance data are presented on the following pages for various combinations of fan speeds, weights, temperature, altitudes and winds to enable the calculation of the cruise portion of a range profile.

The various fan speeds presented provide the specific ranges between maximum cruise thrust (maximum TAS) and the approximate maximum range thrust. It should be noted that reducing thrust to maintain a constant indicated airspeed as the airplane weight decreases during cruise results in a significant increase in range. The best range, however, results from decreasing thrust to fly a constantly decreasing airspeed as airplane weight decreases per the values shown in the tabulated data.

When the anti-ice systems are ON, increase the fuel flows and decrease the specific ranges that are presented for each altitude by 7 percent. The cruise speeds will remain the same for a given fan RPM ($N_1$). The maximum allowable fan speeds with anti-ice systems ON are presented on each chart for each altitude. Only fan speeds equal to or lower than these values can be used.

The one engine specific range data is presented for use in the event of an enroute engine failure.

# CRUISE
# 5000 FEET

**ANTI-ICE SYSTEMS OFF** | **TWO ENGINES**

| | | | | | | | | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
| 20000. | ISA+20°C | 35 | (1) 70.4 | 1721 | 260 | .43 | 290 | 8.1 | 11.0 | 13.9 | 16.8 | 19.8 | 22.7 | 25.6 |
| | 25°C | 35 | 69.5 | 1674 | 254 | .420 | 284 | 8.0 | 11.0 | 14.0 | 17.0 | 20.0 | 22.9 | 25.9 |
| | | 34 | (2) 68.9 | 1647 | 251 | .41 | 280 | 7.9 | 10.9 | 14.0 | 17.0 | 20.1 | 23.1 | 26.1 |
| | ISA+10°C | 25 | (1) 69.2 | 1682 | 260 | .43 | 285 | 8.0 | 11.0 | 14.0 | 16.9 | 19.9 | 22.9 | 25.9 |
| | 15°C | 24 | 68.4 | 1636 | 254 | .420 | 279 | 7.9 | 10.9 | 14.0 | 17.1 | 20.1 | 23.2 | 26.2 |
| | | 24 | (2) 67.8 | 1607 | 251 | .41 | 275 | 7.8 | 10.9 | 14.0 | 17.1 | 20.2 | 23.3 | 26.4 |
| | ISA+ 0°C | 14 | (1) 68.1 | 1643 | 260 | .43 | 280 | 7.9 | 11.0 | 14.0 | 17.0 | 20.1 | 23.1 | 26.2 |
| | 5°C | 14 | 67.2 | 1598 | 254 | .420 | 274 | 7.8 | 10.9 | 14.0 | 17.2 | 20.3 | 23.4 | 26.5 |
| | | 14 | (2) 66.5 | 1564 | 250 | .41 | 269 | 7.6 | 10.8 | 14.0 | 17.2 | 20.4 | 23.6 | 26.8 |
| | ISA-10°C | 4 | (1) 66.9 | 1605 | 260 | .43 | 275 | 7.8 | 10.9 | 14.0 | 17.1 | 20.2 | 23.4 | 26.5 |
| | -5°C | 4 | 66.1 | 1561 | 254 | .420 | 269 | 7.6 | 10.8 | 14.0 | 17.2 | 20.4 | 23.6 | 26.9 |
| | | 3 | (2) 65.2 | 1517 | 249 | .41 | 263 | 7.5 | 10.8 | 14.0 | 17.3 | 20.6 | 23.9 | 27.2 |
| 19000. | ISA+20°C | 35 | (1) 70.1 | 1707 | 260 | .43 | 290 | 8.2 | 11.1 | 14.1 | 17.0 | 19.9 | 22.8 | 25.8 |
| | 25°C | 35 | 69.2 | 1659 | 254 | .420 | 284 | 8.1 | 11.1 | 14.1 | 17.1 | 20.1 | 23.1 | 26.2 |
| | | 35 | (2) 68.7 | 1636 | 252 | .42 | 281 | 8.0 | 11.0 | 14.1 | 17.2 | 20.2 | 23.3 | 26.3 |
| | ISA+10°C | 25 | (1) 68.9 | 1668 | 260 | .43 | 285 | 8.1 | 11.1 | 14.1 | 17.1 | 20.1 | 23.1 | 26.1 |
| | 15°C | 24 | 68.1 | 1622 | 254 | .420 | 279 | 8.0 | 11.0 | 14.1 | 17.2 | 20.3 | 23.4 | 26.5 |
| | | 24 | (2) 67.4 | 1591 | 250 | .41 | 275 | 7.8 | 11.0 | 14.1 | 17.3 | 20.4 | 23.6 | 26.7 |
| | ISA+ 0°C | 14 | (1) 67.8 | 1630 | 260 | .43 | 280 | 8.0 | 11.0 | 14.1 | 17.2 | 20.2 | 23.3 | 26.4 |
| | 5°C | 14 | 66.9 | 1585 | 254 | .420 | 274 | 7.8 | 11.0 | 14.1 | 17.3 | 20.5 | 23.6 | 26.8 |
| | | 14 | (2) 66.2 | 1550 | 250 | .41 | 269 | 7.7 | 10.9 | 14.2 | 17.4 | 20.6 | 23.8 | 27.1 |
| | ISA-10°C | 4 | (1) 66.6 | 1592 | 260 | .43 | 275 | 7.8 | 11.0 | 14.1 | 17.3 | 20.4 | 23.6 | 26.7 |
| | -5°C | 4 | 65.8 | 1548 | 254 | .420 | 269 | 7.7 | 10.9 | 14.2 | 17.4 | 20.6 | 23.9 | 27.1 |
| | | 3 | (2) 64.9 | 1506 | 249 | .41 | 263 | 7.5 | 10.9 | 14.2 | 17.5 | 20.8 | 24.1 | 27.5 |
| 18000. | ISA+20°C | 35 | (1) 69.8 | 1694 | 260 | .43 | 290 | 8.3 | 11.2 | 14.2 | 17.1 | 20.1 | 23.0 | 26.0 |
| | 25°C | 35 | 68.9 | 1645 | 254 | .420 | 284 | 8.1 | 11.2 | 14.2 | 17.3 | 20.3 | 23.3 | 26.4 |
| | | 35 | (2) 68.4 | 1620 | 251 | .41 | 280 | 8.0 | 11.1 | 14.2 | 17.3 | 20.4 | 23.5 | 26.6 |
| | ISA+10°C | 25 | (1) 68.7 | 1655 | 260 | .43 | 285 | 8.2 | 11.2 | 14.2 | 17.2 | 20.2 | 23.3 | 26.3 |
| | 15°C | 24 | 67.8 | 1608 | 254 | .420 | 279 | 8.0 | 11.1 | 14.2 | 17.4 | 20.5 | 23.6 | 26.7 |
| | | 24 | (2) 67.2 | 1578 | 251 | .41 | 275 | 7.9 | 11.1 | 14.3 | 17.4 | 20.6 | 23.8 | 26.9 |
| | ISA+ 0°C | 14 | (1) 67.5 | 1617 | 260 | .43 | 280 | 8.0 | 11.1 | 14.2 | 17.3 | 20.4 | 23.5 | 26.6 |
| | 5°C | 14 | 66.7 | 1572 | 254 | .420 | 274 | 7.9 | 11.1 | 14.3 | 17.4 | 20.6 | 23.8 | 27.0 |
| | | 14 | (2) 65.9 | 1536 | 250 | .41 | 269 | 7.8 | 11.0 | 14.3 | 17.5 | 20.8 | 24.0 | 27.3 |
| | ISA-10°C | 4 | (1) 66.4 | 1580 | 260 | .43 | 275 | 7.9 | 11.1 | 14.2 | 17.4 | 20.6 | 23.7 | 26.9 |
| | -5°C | 4 | 65.5 | 1535 | 254 | .420 | 269 | 7.8 | 11.0 | 14.3 | 17.5 | 20.8 | 24.0 | 27.3 |
| | | 3 | (2) 64.7 | 1496 | 249 | .41 | 264 | 7.6 | 11.0 | 14.3 | 17.6 | 21.0 | 24.3 | 27.7 |
| 17000. | ISA+20°C | 35 | (1) 69.6 | 1681 | 260 | .43 | 290 | 8.3 | 11.3 | 14.3 | 17.2 | 20.2 | 23.2 | 26.2 |
| | 25°C | 35 | 68.6 | 1632 | 254 | .420 | 284 | 8.2 | 11.3 | 14.3 | 17.4 | 20.5 | 23.5 | 26.6 |
| | | 35 | (2) 68.2 | 1612 | 252 | .42 | 281 | 8.1 | 11.2 | 14.3 | 17.4 | 20.5 | 23.6 | 26.7 |
| | ISA+10°C | 25 | (1) 68.4 | 1643 | 260 | .43 | 285 | 8.2 | 11.3 | 14.3 | 17.3 | 20.4 | 23.4 | 26.5 |
| | 15°C | 24 | 67.5 | 1596 | 254 | .420 | 279 | 8.1 | 11.2 | 14.4 | 17.5 | 20.6 | 23.8 | 26.9 |
| | | 24 | (2) 66.8 | 1562 | 250 | .41 | 275 | 8.0 | 11.2 | 14.4 | 17.6 | 20.8 | 24.0 | 27.2 |
| | ISA+ 0°C | 14 | (1) 67.3 | 1605 | 260 | .43 | 280 | 8.1 | 11.2 | 14.3 | 17.4 | 20.6 | 23.7 | 26.8 |
| | 5°C | 14 | 66.4 | 1559 | 254 | .420 | 274 | 8.0 | 11.2 | 14.4 | 17.6 | 20.8 | 24.0 | 27.2 |
| | | 14 | (2) 65.6 | 1522 | 250 | .41 | 269 | 7.8 | 11.1 | 14.4 | 17.7 | 21.0 | 24.3 | 27.5 |
| | ISA-10°C | 4 | (1) 66.1 | 1569 | 260 | .43 | 275 | 8.0 | 11.2 | 14.3 | 17.5 | 20.7 | 23.9 | 27.1 |
| | -5°C | 4 | 65.3 | 1523 | 254 | .420 | 269 | 7.8 | 11.1 | 14.4 | 17.7 | 21.0 | 24.2 | 27.5 |
| | | 3 | (2) 64.3 | 1479 | 249 | .41 | 263 | 7.7 | 11.0 | 14.4 | 17.8 | 21.2 | 24.6 | 27.9 |

Figure 7-14 (Sheet 1 of 35)

# CRUISE
# 5000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
| 16500. | ISA+20°C | 35 | (1) | 69.5 | 1675 | 260 | .43 | 290 | 8.4 | 11.3 | 14.3 | 17.3 | 20.3 | 23.3 | 26.3 |
| | 25°C | 35 | | 68.5 | 1626 | 254 | .420 | 284 | 8.2 | 11.3 | 14.4 | 17.5 | 20.5 | 23.6 | 26.7 |
| | | 35 | (2) | 68.1 | 1609 | 252 | .42 | 282 | 8.2 | 11.3 | 14.4 | 17.5 | 20.6 | 23.7 | 26.8 |
| | ISA+10°C | 25 | (1) | 68.3 | 1637 | 260 | .43 | 285 | 8.2 | 11.3 | 14.4 | 17.4 | 20.5 | 23.5 | 26.6 |
| | 15°C | 24 | | 67.4 | 1590 | 254 | .420 | 279 | 8.1 | 11.3 | 14.4 | 17.6 | 20.7 | 23.8 | 27.0 |
| | | 24 | (2) | 66.6 | 1552 | 250 | .41 | 274 | 8.0 | 11.2 | 14.4 | 17.7 | 20.9 | 24.1 | 27.3 |
| | ISA+ 0°C | 14 | (1) | 67.2 | 1600 | 260 | .43 | 280 | 8.1 | 11.3 | 14.4 | 17.5 | 20.6 | 23.8 | 26.9 |
| | 5°C | 14 | | 66.3 | 1554 | 254 | .420 | 274 | 8.0 | 11.2 | 14.4 | 17.6 | 20.9 | 24.1 | 27.3 |
| | | 14 | (2) | 65.4 | 1513 | 249 | .41 | 269 | 7.9 | 11.2 | 14.5 | 17.8 | 21.1 | 24.4 | 27.7 |
| | ISA-10°C | 4 | (1) | 66.0 | 1562 | 260 | .43 | 275 | 8.0 | 11.2 | 14.4 | 17.6 | 20.8 | 24.0 | 27.2 |
| | -5°C | 4 | | 65.1 | 1518 | 254 | .420 | 269 | 7.9 | 11.1 | 14.4 | 17.7 | 21.0 | 24.3 | 27.6 |
| | | 3 | (2) | 64.2 | 1472 | 249 | .41 | 263 | 7.7 | 11.1 | 14.5 | 17.9 | 21.3 | 24.7 | 28.1 |
| 16000. | ISA+20°C | 35 | (1) | 69.3 | 1669 | 260 | .43 | 290 | 8.4 | 11.4 | 14.4 | 17.4 | 20.4 | 23.4 | 26.4 |
| | 25°C | 35 | | 68.4 | 1620 | 254 | .420 | 284 | 8.3 | 11.3 | 14.4 | 17.5 | 20.6 | 23.7 | 26.8 |
| | | 34 | (2) | 67.5 | 1576 | 249 | .41 | 278 | 8.1 | 11.3 | 14.5 | 17.6 | 20.8 | 24.0 | 27.2 |
| | ISA+10°C | 25 | (1) | 68.2 | 1632 | 260 | .43 | 285 | 8.3 | 11.3 | 14.4 | 17.5 | 20.5 | 23.6 | 26.7 |
| | 15°C | 24 | | 67.3 | 1584 | 254 | .420 | 279 | 8.1 | 11.3 | 14.5 | 17.6 | 20.8 | 23.9 | 27.1 |
| | | 24 | (2) | 66.3 | 1540 | 249 | .41 | 273 | 8.0 | 11.2 | 14.5 | 17.7 | 21.0 | 24.2 | 27.5 |
| | ISA+ 0°C | 14 | (1) | 67.1 | 1594 | 260 | .43 | 280 | 8.2 | 11.3 | 14.4 | 17.6 | 20.7 | 23.8 | 27.0 |
| | 5°C | 14 | | 66.2 | 1548 | 254 | .420 | 274 | 8.0 | 11.3 | 14.5 | 17.7 | 20.9 | 24.2 | 27.4 |
| | | 14 | (2) | 65.2 | 1505 | 249 | .41 | 268 | 7.9 | 11.2 | 14.5 | 17.8 | 21.2 | 24.5 | 27.8 |
| | ISA-10°C | 4 | (1) | 65.9 | 1557 | 260 | .43 | 275 | 8.0 | 11.2 | 14.4 | 17.7 | 20.9 | 24.1 | 27.3 |
| | -5°C | 4 | | 65.0 | 1512 | 254 | .420 | 269 | 7.9 | 11.2 | 14.5 | 17.8 | 21.1 | 24.4 | 27.7 |
| | | 3 | (2) | 64.0 | 1467 | 249 | .41 | 263 | 7.7 | 11.1 | 14.5 | 17.9 | 21.4 | 24.8 | 28.2 |
| 14000. | ISA+20°C | 35 | (1) | 68.9 | 1648 | 260 | .43 | 290 | 8.5 | 11.5 | 14.6 | 17.6 | 20.6 | 23.7 | 26.7 |
| | 25°C | 34 | | 66.8 | 1550 | 248 | .410 | 277 | 8.2 | 11.4 | 14.7 | 17.9 | 21.1 | 24.3 | 27.6 |
| | | 33 | | 64.5 | 1463 | 236 | .390 | 264 | 7.8 | 11.2 | 14.6 | 18.0 | 21.4 | 24.9 | 28.3 |
| | | 33 | | 62.2 | 1382 | 224 | .370 | 250 | 7.3 | 10.9 | 14.5 | 18.1 | 21.7 | 25.3 | 29.0 |
| | | 32 | (2) | 59.2 | 1276 | 208 | .34 | 233 | 6.5 | 10.4 | 14.3 | 18.2 | 22.1 | 26.0 | 30.0 |
| | ISA+10°C | 25 | (1) | 67.8 | 1611 | 260 | .43 | 285 | 8.4 | 11.5 | 14.6 | 17.7 | 20.8 | 23.9 | 27.0 |
| | 15°C | 24 | | 65.7 | 1514 | 248 | .410 | 272 | 8.1 | 11.4 | 14.7 | 18.0 | 21.3 | 24.6 | 27.9 |
| | | 23 | | 63.4 | 1429 | 236 | .390 | 259 | 7.6 | 11.1 | 14.6 | 18.1 | 21.6 | 25.1 | 28.6 |
| | | 22 | | 61.2 | 1350 | 224 | .370 | 246 | 7.1 | 10.8 | 14.5 | 18.2 | 21.9 | 25.6 | 29.3 |
| | | 21 | (2) | 58.4 | 1252 | 209 | .34 | 229 | 6.3 | 10.3 | 14.3 | 18.3 | 22.3 | 26.3 | 30.3 |
| | ISA+ 0°C | 14 | (1) | 66.6 | 1574 | 260 | .43 | 280 | 8.3 | 11.4 | 14.6 | 17.8 | 21.0 | 24.1 | 27.3 |
| | 5°C | 14 | | 64.6 | 1478 | 248 | .410 | 268 | 8.0 | 11.3 | 14.7 | 18.1 | 21.5 | 24.9 | 28.3 |
| | | 13 | | 62.4 | 1395 | 236 | .390 | 255 | 7.5 | 11.1 | 14.7 | 18.3 | 21.8 | 25.4 | 29.0 |
| | | 12 | | 60.2 | 1317 | 224 | .370 | 242 | 7.0 | 10.8 | 14.6 | 18.3 | 22.1 | 25.9 | 29.7 |
| | | 11 | (2) | 57.8 | 1238 | 211 | .35 | 228 | 6.3 | 10.3 | 14.4 | 18.4 | 22.5 | 26.5 | 30.5 |
| | ISA-10°C | 4 | (1) | 65.5 | 1537 | 260 | .43 | 275 | 8.1 | 11.4 | 14.6 | 17.9 | 21.1 | 24.4 | 27.6 |
| | -5°C | 3 | | 63.5 | 1442 | 248 | .410 | 263 | 7.8 | 11.3 | 14.8 | 18.2 | 21.7 | 25.2 | 28.6 |
| | | 3 | | 61.3 | 1362 | 236 | .390 | 250 | 7.3 | 11.0 | 14.7 | 18.4 | 22.0 | 25.7 | 29.4 |
| | | 2 | | 59.1 | 1286 | 224 | .370 | 237 | 6.8 | 10.7 | 14.6 | 18.5 | 22.3 | 26.2 | 30.1 |
| | | 1 | (2) | 57.1 | 1219 | 213 | .35 | 226 | 6.2 | 10.3 | 14.4 | 18.5 | 22.6 | 26.7 | 30.8 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| 15°C | 5°C | -5°C |
| 68.4 | 67.2 | 66.1 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 2)

# CRUISE
# 10,000 FEET

**ANTI-ICE SYSTEMS OFF** | **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | 31 | (1) 82.2 | 2204 | 305 | .55 | 365 | 9.8 | 12.0 | 14.3 | 16.6 | 18.9 | 21.1 | 23.4 |
| | 15°C | 29 | 79.1 | 1973 | 288 | .520 | 345 | 9.9 | 12.4 | 15.0 | 17.5 | 20.0 | 22.6 | 25.1 |
| | | 28 | 77.1 | 1827 | 277 | .500 | 332 | 10.0 | 12.7 | 15.4 | 18.2 | 20.9 | 23.7 | 26.4 |
| | | 27 | 74.7 | 1655 | 260 | .470 | 312 | 9.8 | 12.8 | 15.8 | 18.9 | 21.9 | 24.9 | 27.9 |
| | | 25 | (2) 72.0 | 1513 | 242 | .44 | 291 | 9.4 | 12.7 | 16.0 | 19.3 | 22.6 | 25.9 | 29.2 |
| | ISA+10°C | 21 | (1) 80.8 | 2152 | 305 | .55 | 359 | 9.7 | 12.0 | 14.4 | 16.7 | 19.0 | 21.3 | 23.7 |
| | 5°C | 19 | 77.8 | 1927 | 288 | .520 | 339 | 9.8 | 12.4 | 15.0 | 17.6 | 20.2 | 22.8 | 25.4 |
| | | 18 | 75.8 | 1784 | 277 | .500 | 326 | 9.9 | 12.7 | 15.5 | 18.3 | 21.1 | 23.9 | 26.7 |
| | | 16 | 73.4 | 1617 | 260 | .470 | 307 | 9.7 | 12.8 | 15.9 | 19.0 | 22.1 | 25.2 | 28.2 |
| | | 15 | (2) 70.8 | 1476 | 242 | .44 | 286 | 9.2 | 12.6 | 16.0 | 19.4 | 22.8 | 26.2 | 29.5 |
| | ISA+ 0°C | 10 | (1) 79.4 | 2101 | 305 | .55 | 353 | 9.6 | 12.0 | 14.4 | 16.8 | 19.2 | 21.5 | 23.9 |
| | -5°C | 8 | 76.4 | 1881 | 288 | .520 | 333 | 9.7 | 12.4 | 15.0 | 17.7 | 20.4 | 23.0 | 25.7 |
| | | 7 | 74.5 | 1742 | 277 | .500 | 320 | 9.8 | 12.6 | 15.5 | 18.4 | 21.3 | 24.1 | 27.0 |
| | | 6 | 72.1 | 1579 | 260 | .470 | 301 | 9.6 | 12.7 | 15.9 | 19.1 | 22.2 | 25.4 | 28.6 |
| | | 5 | (2) 69.5 | 1440 | 242 | .44 | 281 | 9.1 | 12.6 | 16.0 | 19.5 | 23.0 | 26.4 | 29.9 |
| | ISA-10°C | 0 | (1) 78.0 | 2050 | 305 | .55 | 346 | 9.6 | 12.0 | 14.4 | 16.9 | 19.3 | 21.8 | 24.2 |
| | -15°C | -2 | 75.1 | 1835 | 288 | .520 | 327 | 9.6 | 12.4 | 15.1 | 17.8 | 20.5 | 23.3 | 26.0 |
| | | -3 | 73.2 | 1700 | 277 | .500 | 314 | 9.7 | 12.6 | 15.5 | 18.5 | 21.4 | 24.4 | 27.3 |
| | | -4 | 70.8 | 1541 | 260 | .470 | 296 | 9.4 | 12.7 | 15.9 | 19.2 | 22.4 | 25.7 | 28.9 |
| | | -6 | (2) 68.3 | 1406 | 242 | .44 | 276 | 8.9 | 12.5 | 16.1 | 19.6 | 23.2 | 26.7 | 30.3 |
| 19000. | ISA+20°C | 31 | (1) 82.1 | 2194 | 305 | .55 | 365 | 9.8 | 12.1 | 14.4 | 16.7 | 18.9 | 21.2 | 23.5 |
| | 15°C | 29 | 78.9 | 1961 | 288 | .520 | 345 | 10.0 | 12.5 | 15.1 | 17.6 | 20.2 | 22.7 | 25.3 |
| | | 28 | 76.0 | 1745 | 271 | .490 | 325 | 10.1 | 12.9 | 15.8 | 18.7 | 21.5 | 24.4 | 27.3 |
| | | 26 | 73.6 | 1592 | 254 | .460 | 306 | 9.8 | 12.9 | 16.1 | 19.2 | 22.3 | 25.5 | 28.6 |
| | | 25 | (2) 70.9 | 1464 | 238 | .43 | 286 | 9.3 | 12.7 | 16.1 | 19.5 | 23.0 | 26.4 | 29.8 |
| | ISA+10°C | 21 | (1) 80.7 | 2142 | 305 | .55 | 359 | 9.8 | 12.1 | 14.4 | 16.8 | 19.1 | 21.4 | 23.8 |
| | 5°C | 19 | 77.6 | 1916 | 288 | .520 | 339 | 9.9 | 12.5 | 15.1 | 17.7 | 20.3 | 22.9 | 25.5 |
| | | 17 | 74.7 | 1704 | 271 | .490 | 320 | 10.0 | 12.9 | 15.8 | 18.8 | 21.7 | 24.6 | 27.6 |
| | | 16 | 72.3 | 1555 | 254 | .460 | 300 | 9.7 | 12.9 | 16.1 | 19.3 | 22.5 | 25.7 | 29.0 |
| | | 15 | (2) 69.7 | 1431 | 238 | .43 | 281 | 9.2 | 12.7 | 16.2 | 19.7 | 23.2 | 26.6 | 30.1 |
| | ISA+ 0°C | 10 | (1) 79.3 | 2092 | 305 | .55 | 353 | 9.7 | 12.1 | 14.5 | 16.9 | 19.2 | 21.6 | 24.0 |
| | -5°C | 8 | 76.3 | 1870 | 288 | .520 | 333 | 9.8 | 12.5 | 15.1 | 17.8 | 20.5 | 23.2 | 25.8 |
| | | 7 | 73.4 | 1664 | 271 | .490 | 314 | 9.8 | 12.9 | 15.9 | 18.9 | 21.9 | 24.9 | 27.9 |
| | | 6 | 71.1 | 1519 | 254 | .460 | 295 | 9.5 | 12.8 | 16.1 | 19.4 | 22.7 | 26.0 | 29.3 |
| | | 4 | (2) 68.5 | 1394 | 238 | .43 | 276 | 9.0 | 12.6 | 16.2 | 19.8 | 23.4 | 26.9 | 30.5 |
| | ISA-10°C | 0 | (1) 77.9 | 2041 | 305 | .55 | 346 | 9.6 | 12.1 | 14.5 | 17.0 | 19.4 | 21.9 | 24.3 |
| | -15°C | -2 | 74.9 | 1825 | 288 | .520 | 327 | 9.7 | 12.4 | 15.2 | 17.9 | 20.7 | 23.4 | 26.1 |
| | | -3 | 72.1 | 1624 | 271 | .490 | 308 | 9.7 | 12.8 | 15.9 | 19.0 | 22.0 | 25.1 | 28.2 |
| | | -5 | 69.8 | 1482 | 254 | .460 | 289 | 9.4 | 12.8 | 16.1 | 19.5 | 22.9 | 26.3 | 29.6 |
| | | -6 | (2) 67.3 | 1363 | 238 | .43 | 271 | 8.9 | 12.5 | 16.2 | 19.9 | 23.5 | 27.2 | 30.9 |
| 18000. | ISA+20°C | 31 | (1) 81.9 | 2185 | 305 | .55 | 365 | 9.9 | 12.1 | 14.4 | 16.7 | 19.0 | 21.3 | 23.6 |
| | 15°C | 29 | 78.8 | 1950 | 288 | .520 | 345 | 10.0 | 12.6 | 15.1 | 17.7 | 20.3 | 22.8 | 25.4 |
| | | 28 | 75.8 | 1732 | 271 | .490 | 325 | 10.1 | 13.0 | 15.9 | 18.8 | 21.7 | 24.6 | 27.5 |
| | | 26 | 73.3 | 1577 | 254 | .460 | 306 | 9.9 | 13.0 | 16.2 | 19.4 | 22.6 | 25.7 | 28.9 |
| | | 25 | (2) 70.0 | 1427 | 235 | .43 | 283 | 9.3 | 12.8 | 16.3 | 19.8 | 23.3 | 26.8 | 30.3 |
| | ISA+10°C | 21 | (1) 80.6 | 2133 | 305 | .55 | 359 | 9.8 | 12.1 | 14.5 | 16.8 | 19.2 | 21.5 | 23.9 |
| | 5°C | 19 | 77.5 | 1905 | 288 | .520 | 339 | 9.9 | 12.6 | 15.2 | 17.8 | 20.4 | 23.1 | 25.7 |
| | | 17 | 74.5 | 1692 | 271 | .490 | 320 | 10.0 | 13.0 | 15.9 | 18.9 | 21.9 | 24.8 | 27.8 |
| | | 16 | 72.1 | 1541 | 254 | .460 | 300 | 9.8 | 13.0 | 16.2 | 19.5 | 22.7 | 26.0 | 29.2 |
| | | 14 | (2) 68.8 | 1392 | 235 | .42 | 277 | 9.1 | 12.7 | 16.3 | 19.9 | 23.5 | 27.1 | 30.7 |
| | ISA+ 0°C | 10 | (1) 79.2 | 2083 | 305 | .55 | 353 | 9.7 | 12.1 | 14.5 | 16.9 | 19.3 | 21.7 | 24.1 |
| | -5°C | 8 | 76.1 | 1860 | 288 | .520 | 333 | 9.8 | 12.5 | 15.2 | 17.9 | 20.6 | 23.3 | 26.0 |
| | | 7 | 73.2 | 1652 | 271 | .490 | 314 | 9.9 | 12.9 | 16.0 | 19.0 | 22.0 | 25.1 | 28.1 |
| | | 6 | 70.8 | 1505 | 254 | .460 | 295 | 9.6 | 12.9 | 16.3 | 19.6 | 22.9 | 26.2 | 29.6 |
| | | 4 | (2) 67.6 | 1358 | 235 | .42 | 272 | 9.0 | 12.7 | 16.4 | 20.0 | 23.7 | 27.4 | 31.1 |
| | ISA-10°C | 0 | (1) 77.8 | 2032 | 305 | .55 | 346 | 9.6 | 12.1 | 14.6 | 17.0 | 19.5 | 21.9 | 24.4 |
| | -15°C | -2 | 74.8 | 1815 | 288 | .520 | 327 | 9.7 | 12.5 | 15.3 | 18.0 | 20.8 | 23.5 | 26.3 |
| | | -3 | 71.9 | 1612 | 271 | .490 | 308 | 9.8 | 12.9 | 16.0 | 19.1 | 22.2 | 25.3 | 28.4 |
| | | -5 | 69.6 | 1469 | 254 | .460 | 289 | 9.5 | 12.9 | 16.3 | 19.7 | 23.1 | 26.5 | 29.9 |
| | | -6 | (2) 66.4 | 1324 | 234 | .42 | 267 | 8.8 | 12.6 | 16.4 | 20.2 | 23.9 | 27.7 | 31.5 |
| 17000. | ISA+20°C | 31 | (1) 81.8 | 2176 | 305 | .55 | 365 | 9.9 | 12.2 | 14.5 | 16.8 | 19.1 | 21.4 | 23.7 |
| | 15°C | 29 | 78.6 | 1940 | 288 | .520 | 345 | 10.1 | 12.6 | 15.2 | 17.8 | 20.4 | 23.0 | 25.5 |
| | | 28 | 75.6 | 1719 | 271 | .490 | 325 | 10.2 | 13.1 | 16.0 | 18.9 | 21.8 | 24.7 | 27.7 |
| | | 26 | 72.1 | 1517 | 249 | .450 | 299 | 9.8 | 13.1 | 16.4 | 19.7 | 23.0 | 26.3 | 29.6 |
| | | 24 | (2) 69.1 | 1386 | 231 | .42 | 278 | 9.2 | 12.9 | 16.5 | 20.1 | 23.7 | 27.3 | 30.9 |
| | ISA+10°C | 21 | (1) 80.4 | 2125 | 305 | .55 | 359 | 9.8 | 12.2 | 14.5 | 16.9 | 19.2 | 21.6 | 24.0 |
| | 5°C | 19 | 77.3 | 1895 | 288 | .520 | 339 | 10.0 | 12.6 | 15.3 | 17.9 | 20.5 | 23.2 | 25.8 |
| | | 17 | 74.3 | 1680 | 271 | .490 | 320 | 10.1 | 13.1 | 16.1 | 19.0 | 22.0 | 25.0 | 28.0 |
| | | 16 | 70.9 | 1482 | 249 | .450 | 294 | 9.7 | 13.1 | 16.4 | 19.8 | 23.2 | 26.6 | 29.9 |
| | | 14 | (2) 67.8 | 1351 | 231 | .42 | 273 | 9.1 | 12.8 | 16.5 | 20.2 | 23.9 | 27.6 | 31.3 |
| | ISA+ 0°C | 10 | (1) 79.1 | 2075 | 305 | .55 | 353 | 9.8 | 12.2 | 14.6 | 17.0 | 19.4 | 21.8 | 24.2 |
| | -5°C | 8 | 76.0 | 1850 | 288 | .520 | 333 | 9.9 | 12.6 | 15.3 | 18.0 | 20.7 | 23.4 | 26.1 |
| | | 7 | 73.1 | 1641 | 271 | .490 | 314 | 10.0 | 13.0 | 16.1 | 19.1 | 22.2 | 25.2 | 28.3 |
| | | 5 | 69.6 | 1447 | 249 | .450 | 288 | 9.6 | 13.0 | 16.5 | 19.9 | 23.4 | 26.8 | 30.3 |
| | | 4 | (2) 66.7 | 1320 | 231 | .42 | 268 | 8.9 | 12.7 | 16.5 | 20.3 | 24.1 | 27.9 | 31.7 |
| | ISA-10°C | 0 | (1) 77.6 | 2024 | 305 | .55 | 346 | 9.7 | 12.2 | 14.6 | 17.1 | 19.6 | 22.0 | 24.5 |
| | -15°C | -2 | 74.6 | 1805 | 288 | .520 | 327 | 9.8 | 12.6 | 15.3 | 18.1 | 20.9 | 23.6 | 26.4 |
| | | -3 | 71.7 | 1601 | 271 | .490 | 308 | 9.9 | 13.0 | 16.1 | 19.2 | 22.4 | 25.5 | 28.6 |
| | | -5 | 68.4 | 1412 | 249 | .450 | 283 | 9.4 | 13.0 | 16.5 | 20.0 | 23.6 | 27.1 | 30.7 |
| | | -6 | (2) 65.6 | 1292 | 232 | .42 | 264 | 8.8 | 12.7 | 16.5 | 20.4 | 24.3 | 28.2 | 32.0 |

Figure 7-14 (Sheet 3)

# CRUISE
# 10,000 FEET

**ANTI-ICE SYSTEMS OFF** — **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL: 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C 15°C | 31 | (1) 81.8 | 2172 | 305 | .55 | 365 | 9.9 | 12.2 | 14.5 | 16.8 | 19.1 | 21.4 | 23.7 |
| | | 29 | 78.6 | 1935 | 288 | .520 | 345 | 10.1 | 12.7 | 15.3 | 17.8 | 20.4 | 23.0 | 25.6 |
| | | 28 | 75.5 | 1713 | 271 | .490 | 325 | 10.2 | 13.2 | 16.1 | 19.0 | 21.9 | 24.8 | 27.7 |
| | | 26 | 71.9 | 1511 | 249 | .450 | 299 | 9.9 | 13.2 | 16.5 | 19.8 | 23.1 | 26.4 | 29.7 |
| | | 24 | (2) 68.9 | 1382 | 232 | .42 | 279 | 9.3 | 12.9 | 16.6 | 20.2 | 23.8 | 27.4 | 31.0 |
| | ISA+10°C 5°C | 21 | (1) 80.4 | 2121 | 305 | .55 | 359 | 9.9 | 12.2 | 14.6 | 16.9 | 19.3 | 21.6 | 24.0 |
| | | 19 | 77.3 | 1890 | 288 | .520 | 339 | 10.0 | 12.7 | 15.3 | 17.9 | 20.6 | 23.2 | 25.9 |
| | | 17 | 74.3 | 1674 | 271 | .490 | 320 | 10.1 | 13.1 | 16.1 | 19.1 | 22.1 | 25.1 | 28.1 |
| | | 16 | 70.7 | 1476 | 249 | .450 | 294 | 9.7 | 13.1 | 16.5 | 19.9 | 23.3 | 26.7 | 30.1 |
| | | 14 | (2) 67.6 | 1342 | 231 | .42 | 273 | 9.1 | 12.9 | 16.6 | 20.3 | 24.0 | 27.8 | 31.5 |
| | ISA+ 0°C -5°C | 10 | (1) 79.0 | 2071 | 305 | .55 | 353 | 9.8 | 12.2 | 14.6 | 17.0 | 19.4 | 21.9 | 24.3 |
| | | 8 | 75.9 | 1845 | 288 | .520 | 333 | 9.9 | 12.6 | 15.3 | 18.1 | 20.8 | 23.5 | 26.2 |
| | | 7 | 73.0 | 1635 | 271 | .490 | 314 | 10.0 | 13.1 | 16.1 | 19.2 | 22.3 | 25.3 | 28.4 |
| | | 5 | 69.5 | 1441 | 249 | .450 | 288 | 9.6 | 13.1 | 16.5 | 20.0 | 23.5 | 27.0 | 30.4 |
| | | 4 | (2) 66.3 | 1304 | 230 | .42 | 267 | 8.9 | 12.8 | 16.6 | 20.4 | 24.3 | 28.1 | 31.9 |
| | ISA-10°C -15°C | 0 | (1) 77.6 | 2020 | 305 | .55 | 346 | 9.7 | 12.2 | 14.6 | 17.1 | 19.6 | 22.1 | 24.6 |
| | | -2 | 74.6 | 1800 | 288 | .520 | 327 | 9.8 | 12.6 | 15.4 | 18.2 | 20.9 | 23.7 | 26.5 |
| | | -3 | 71.7 | 1595 | 271 | .490 | 308 | 9.9 | 13.0 | 16.2 | 19.3 | 22.4 | 25.6 | 28.7 |
| | | -5 | 68.3 | 1406 | 249 | .450 | 283 | 9.5 | 13.0 | 16.6 | 20.1 | 23.7 | 27.2 | 30.8 |
| | | -7 | (2) 65.1 | 1274 | 230 | .42 | 262 | 8.8 | 12.7 | 16.6 | 20.6 | 24.5 | 28.4 | 32.3 |
| 16000. | ISA+20°C 15°C | 31 | (1) 81.7 | 2168 | 305 | .55 | 365 | 9.9 | 12.2 | 14.5 | 16.9 | 19.2 | 21.5 | 23.8 |
| | | 29 | 78.5 | 1930 | 288 | .520 | 345 | 10.1 | 12.7 | 15.3 | 17.9 | 20.5 | 23.1 | 25.7 |
| | | 28 | 75.4 | 1708 | 271 | .490 | 325 | 10.3 | 13.2 | 16.1 | 19.1 | 22.0 | 24.9 | 27.8 |
| | | 26 | 71.8 | 1505 | 249 | .450 | 299 | 9.9 | 13.2 | 16.5 | 19.9 | 23.2 | 26.5 | 29.8 |
| | | 25 | (2) 68.8 | 1378 | 232 | .42 | 279 | 9.4 | 13.0 | 16.6 | 20.3 | 23.9 | 27.5 | 31.2 |
| | ISA+10°C 5°C | 21 | (1) 80.3 | 2117 | 305 | .55 | 359 | 9.9 | 12.2 | 14.6 | 17.0 | 19.3 | 21.7 | 24.0 |
| | | 19 | 77.2 | 1885 | 288 | .520 | 339 | 10.0 | 12.7 | 15.3 | 18.0 | 20.6 | 23.3 | 26.0 |
| | | 17 | 74.2 | 1669 | 271 | .490 | 320 | 10.2 | 13.2 | 16.2 | 19.2 | 22.2 | 25.2 | 28.1 |
| | | 16 | 70.6 | 1470 | 249 | .450 | 294 | 9.8 | 13.2 | 16.6 | 20.0 | 23.4 | 26.8 | 30.2 |
| | | 14 | (2) 67.6 | 1343 | 232 | .42 | 274 | 9.2 | 12.9 | 16.7 | 20.4 | 24.1 | 27.8 | 31.6 |
| | ISA+ 0°C -5°C | 10 | (1) 78.9 | 2067 | 305 | .55 | 353 | 9.8 | 12.2 | 14.6 | 17.1 | 19.5 | 21.9 | 24.3 |
| | | 8 | 75.9 | 1841 | 288 | .520 | 333 | 9.9 | 12.7 | 15.4 | 18.1 | 20.8 | 23.5 | 26.2 |
| | | 7 | 72.9 | 1630 | 271 | .490 | 314 | 10.1 | 13.1 | 16.2 | 19.3 | 22.3 | 25.4 | 28.5 |
| | | 5 | 69.4 | 1435 | 249 | .450 | 288 | 9.6 | 13.1 | 16.6 | 20.1 | 23.6 | 27.1 | 30.5 |
| | | 4 | (2) 66.4 | 1307 | 231 | .42 | 268 | 9.0 | 12.9 | 16.7 | 20.5 | 24.3 | 28.2 | 32.0 |
| | ISA-10°C -15°C | 0 | (1) 77.5 | 2016 | 305 | .55 | 346 | 9.7 | 12.2 | 14.7 | 17.2 | 19.6 | 22.1 | 24.6 |
| | | -2 | 74.5 | 1796 | 288 | .520 | 327 | 9.8 | 12.6 | 15.4 | 18.2 | 21.0 | 23.8 | 26.5 |
| | | -3 | 71.6 | 1590 | 271 | .490 | 308 | 9.9 | 13.1 | 16.2 | 19.4 | 22.5 | 25.7 | 28.8 |
| | | -5 | 68.1 | 1400 | 249 | .450 | 283 | 9.5 | 13.1 | 16.6 | 20.2 | 23.8 | 27.3 | 30.9 |
| | | -7 | (2) 65.2 | 1277 | 231 | .42 | 263 | 8.9 | 12.8 | 16.7 | 20.6 | 24.5 | 28.5 | 32.4 |
| 14000. | ISA+20°C 15°C | 31 | (1) 81.5 | 2153 | 305 | .55 | 365 | 10.0 | 12.3 | 14.6 | 17.0 | 19.3 | 21.6 | 23.9 |
| | | 29 | 78.2 | 1912 | 288 | .520 | 345 | 10.2 | 12.8 | 15.4 | 18.1 | 20.7 | 23.3 | 25.9 |
| | | 28 | 75.1 | 1686 | 271 | .490 | 325 | 10.4 | 13.4 | 16.3 | 19.3 | 22.3 | 25.2 | 28.2 |
| | | 26 | 72.3 | 1529 | 254 | .460 | 306 | 10.2 | 13.4 | 16.7 | 20.0 | 23.3 | 26.5 | 29.8 |
| | | 25 | (2) 68.6 | 1369 | 234 | .42 | 282 | 9.6 | 13.3 | 16.9 | 20.6 | 24.2 | 27.9 | 31.5 |
| | ISA+10°C 5°C | 21 | (1) 80.1 | 2103 | 305 | .55 | 359 | 9.9 | 12.3 | 14.7 | 17.1 | 19.5 | 21.8 | 24.2 |
| | | 19 | 76.9 | 1868 | 288 | .520 | 339 | 10.1 | 12.8 | 15.5 | 18.2 | 20.8 | 23.5 | 26.2 |
| | | 17 | 73.9 | 1648 | 271 | .490 | 320 | 10.3 | 13.3 | 16.4 | 19.4 | 22.4 | 25.5 | 28.5 |
| | | 16 | 71.1 | 1493 | 254 | .460 | 300 | 10.1 | 13.4 | 16.8 | 20.1 | 23.5 | 26.8 | 30.1 |
| | | 14 | (2) 67.2 | 1327 | 233 | .42 | 275 | 9.4 | 13.2 | 17.0 | 20.7 | 24.5 | 28.3 | 32.0 |
| | ISA+ 0°C -5°C | 10 | (1) 78.7 | 2052 | 305 | .55 | 353 | 9.9 | 12.3 | 14.7 | 17.2 | 19.6 | 22.1 | 24.5 |
| | | 8 | 75.6 | 1824 | 288 | .520 | 333 | 10.0 | 12.8 | 15.5 | 18.3 | 21.0 | 23.7 | 26.5 |
| | | 7 | 72.6 | 1609 | 271 | .490 | 314 | 10.2 | 13.3 | 16.4 | 19.5 | 22.6 | 25.7 | 28.8 |
| | | 5 | 68.9 | 1414 | 249 | .450 | 288 | 9.8 | 13.3 | 16.9 | 20.4 | 23.9 | 27.5 | 31.0 |
| | | 4 | (2) 65.8 | 1286 | 232 | .42 | 269 | 9.2 | 13.1 | 17.0 | 20.9 | 24.8 | 28.7 | 32.6 |
| | ISA-10°C -15°C | 0 | (1) 77.3 | 2002 | 305 | .55 | 346 | 9.8 | 12.3 | 14.8 | 17.3 | 19.8 | 22.3 | 24.8 |
| | | -2 | 74.3 | 1779 | 288 | .520 | 327 | 9.9 | 12.7 | 15.6 | 18.4 | 21.2 | 24.0 | 26.8 |
| | | -3 | 71.3 | 1570 | 271 | .490 | 308 | 10.1 | 13.2 | 16.4 | 19.6 | 22.8 | 26.0 | 29.2 |
| | | -5 | 67.6 | 1379 | 249 | .450 | 283 | 9.6 | 13.3 | 16.9 | 20.5 | 24.1 | 27.8 | 31.4 |
| | | -7 | (2) 64.6 | 1253 | 231 | .42 | 263 | 9.0 | 13.0 | 17.0 | 21.0 | 25.0 | 29.0 | 33.0 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| 5°C | -5°C | -15°C |
| 80.4 | 79.0 | 77.6 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 4)

# CRUISE
# 15,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | 23 | (1) | 84.5 | 2046 | 294 | .58 | 380 | 11.2 | 13.7 | 16.1 | 18.6 | 21.0 | 23.4 | 25.9 |
| | 5°C | 21 | | 81.4 | 1828 | 277 | .550 | 359 | 11.4 | 14.2 | 16.9 | 19.6 | 22.4 | 25.1 | 27.8 |
| | | 19 | | 78.5 | 1648 | 262 | .520 | 339 | 11.5 | 14.5 | 17.6 | 20.6 | 23.6 | 26.7 | 29.7 |
| | | 18 | | 75.8 | 1483 | 246 | .490 | 320 | 11.4 | 14.8 | 18.2 | 21.6 | 24.9 | 28.3 | 31.7 |
| | | 16 | (2) | 74.0 | 1378 | 233 | .46 | 302 | 11.0 | 14.7 | 18.3 | 21.9 | 25.6 | 29.2 | 32.8 |
| | ISA+10°C | 13 | (1) | 85.1 | 2166 | 305 | .60 | 386 | 10.9 | 13.2 | 15.5 | 17.8 | 20.1 | 22.4 | 24.8 |
| | -5°C | 11 | | 81.9 | 1910 | 288 | .570 | 365 | 11.3 | 13.9 | 16.5 | 19.1 | 21.7 | 24.3 | 27.0 |
| | | 10 | | 79.1 | 1722 | 272 | .540 | 346 | 11.4 | 14.3 | 17.2 | 20.1 | 23.0 | 25.9 | 28.8 |
| | | 8 | | 75.3 | 1499 | 252 | .500 | 320 | 11.4 | 14.7 | 18.0 | 21.4 | 24.7 | 28.0 | 31.4 |
| | | 6 | (2) | 72.7 | 1346 | 233 | .46 | 297 | 10.9 | 14.6 | 18.3 | 22.0 | 25.8 | 29.5 | 33.2 |
| | ISA+ 0°C | 2 | (1) | 83.6 | 2112 | 305 | .60 | 379 | 10.8 | 13.2 | 15.6 | 17.9 | 20.3 | 22.7 | 25.1 |
| | -15°C | 1 | | 80.5 | 1862 | 288 | .570 | 358 | 11.2 | 13.9 | 16.5 | 19.2 | 21.9 | 24.6 | 27.3 |
| | | -1 | | 77.6 | 1680 | 272 | .540 | 339 | 11.3 | 14.3 | 17.2 | 20.2 | 23.2 | 26.2 | 29.1 |
| | | -3 | | 74.0 | 1462 | 252 | .500 | 314 | 11.2 | 14.7 | 18.1 | 21.5 | 24.9 | 28.3 | 31.8 |
| | | -5 | (2) | 71.4 | 1315 | 233 | .46 | 292 | 10.8 | 14.6 | 18.4 | 22.2 | 26.0 | 29.8 | 33.6 |
| | ISA-10°C | -8 | (1) | 82.1 | 2058 | 305 | .60 | 372 | 10.8 | 13.2 | 15.6 | 18.1 | 20.5 | 22.9 | 25.3 |
| | -25°C | -10 | | 79.0 | 1815 | 288 | .570 | 351 | 11.1 | 13.8 | 16.6 | 19.3 | 22.1 | 24.9 | 27.6 |
| | | -11 | | 76.2 | 1636 | 272 | .540 | 333 | 11.2 | 14.2 | 17.3 | 20.3 | 23.4 | 26.5 | 29.5 |
| | | -13 | | 72.6 | 1425 | 252 | .500 | 308 | 11.1 | 14.6 | 18.1 | 21.6 | 25.1 | 28.6 | 32.2 |
| | | -15 | (2) | 70.2 | 1286 | 234 | .46 | 287 | 10.6 | 14.5 | 18.4 | 22.3 | 26.2 | 30.1 | 34.0 |
| 19000. | ISA+20°C | 23 | (1) | 84.5 | 2042 | 294 | .58 | 380 | 11.3 | 13.7 | 16.2 | 18.6 | 21.1 | 23.5 | 26.0 |
| | 5°C | 21 | | 81.2 | 1816 | 277 | .550 | 359 | 11.5 | 14.2 | 17.0 | 19.8 | 22.5 | 25.3 | 28.0 |
| | | 19 | | 78.3 | 1634 | 262 | .520 | 339 | 11.6 | 14.6 | 17.7 | 20.8 | 23.8 | 26.9 | 29.9 |
| | | 18 | | 75.5 | 1468 | 246 | .490 | 320 | 11.6 | 15.0 | 18.4 | 21.8 | 25.2 | 28.6 | 32.0 |
| | | 16 | (2) | 73.0 | 1330 | 228 | .45 | 296 | 11.0 | 14.8 | 18.5 | 22.3 | 26.0 | 29.8 | 33.6 |
| | ISA+10°C | 13 | (1) | 85.0 | 2155 | 305 | .60 | 386 | 11.0 | 13.3 | 15.6 | 17.9 | 20.2 | 22.6 | 24.9 |
| | -5°C | 11 | | 81.8 | 1899 | 288 | .570 | 365 | 11.3 | 14.0 | 16.6 | 19.2 | 21.9 | 24.5 | 27.1 |
| | | 9 | | 77.9 | 1651 | 267 | .530 | 340 | 11.5 | 14.5 | 17.5 | 20.6 | 23.6 | 26.6 | 29.6 |
| | | 7 | | 74.2 | 1433 | 246 | .490 | 314 | 11.4 | 14.9 | 18.4 | 21.9 | 25.4 | 28.9 | 32.4 |
| | | 5 | (2) | 71.7 | 1297 | 228 | .45 | 291 | 10.9 | 14.7 | 18.6 | 22.4 | 26.3 | 30.1 | 34.0 |
| | ISA+ 0°C | 2 | (1) | 83.5 | 2102 | 305 | .60 | 379 | 10.9 | 13.3 | 15.7 | 18.0 | 20.4 | 22.8 | 25.2 |
| | -15°C | 1 | | 80.3 | 1851 | 288 | .570 | 358 | 11.2 | 13.9 | 16.6 | 19.3 | 22.0 | 24.8 | 27.5 |
| | | -1 | | 76.5 | 1611 | 267 | .530 | 333 | 11.4 | 14.5 | 17.6 | 20.7 | 23.8 | 26.9 | 30.0 |
| | | -3 | | 72.8 | 1398 | 246 | .490 | 308 | 11.3 | 14.9 | 18.5 | 22.0 | 25.6 | 29.2 | 32.8 |
| | | -5 | (2) | 70.4 | 1263 | 228 | .45 | 285 | 10.7 | 14.6 | 18.6 | 22.6 | 26.5 | 30.5 | 34.4 |
| | ISA-10°C | -8 | (1) | 81.9 | 2048 | 305 | .60 | 372 | 10.8 | 13.3 | 15.7 | 18.1 | 20.6 | 23.0 | 25.5 |
| | -25°C | -10 | | 78.8 | 1804 | 288 | .570 | 351 | 11.2 | 13.9 | 16.7 | 19.5 | 22.2 | 25.0 | 27.8 |
| | | -12 | | 75.1 | 1570 | 267 | .530 | 327 | 11.3 | 14.4 | 17.6 | 20.8 | 24.0 | 27.2 | 30.4 |
| | | -14 | | 71.5 | 1362 | 246 | .490 | 302 | 11.2 | 14.8 | 18.5 | 22.2 | 25.8 | 29.5 | 33.2 |
| | | -15 | (2) | 69.0 | 1229 | 227 | .45 | 279 | 10.5 | 14.6 | 18.6 | 22.7 | 26.8 | 30.8 | 34.9 |
| 18000. | ISA+20°C | 23 | (1) | 84.4 | 2040 | 295 | .58 | 381 | 11.3 | 13.8 | 16.2 | 18.7 | 21.1 | 23.6 | 26.0 |
| | 5°C | 21 | | 81.0 | 1805 | 277 | .550 | 359 | 11.6 | 14.3 | 17.1 | 19.9 | 22.6 | 25.4 | 28.2 |
| | | 19 | | 78.1 | 1621 | 262 | .520 | 339 | 11.7 | 14.8 | 17.8 | 20.9 | 24.0 | 27.1 | 30.2 |
| | | 17 | | 74.5 | 1410 | 241 | .480 | 313 | 11.6 | 15.1 | 18.7 | 22.2 | 25.8 | 29.3 | 32.8 |
| | | 16 | (2) | 72.2 | 1293 | 225 | .45 | 293 | 11.0 | 14.9 | 18.8 | 22.6 | 26.5 | 30.4 | 34.2 |
| | ISA+10°C | 13 | (1) | 84.8 | 2145 | 305 | .60 | 386 | 11.0 | 13.4 | 15.7 | 18.0 | 20.3 | 22.7 | 25.0 |
| | -5°C | 11 | | 81.6 | 1888 | 288 | .570 | 365 | 11.4 | 14.0 | 16.7 | 19.3 | 22.0 | 24.6 | 27.3 |
| | | 9 | | 77.7 | 1640 | 267 | .530 | 340 | 11.6 | 14.6 | 17.7 | 20.7 | 23.8 | 26.8 | 29.9 |
| | | 7 | | 73.9 | 1418 | 246 | .490 | 314 | 11.6 | 15.1 | 18.6 | 22.1 | 25.7 | 29.2 | 32.7 |
| | | 5 | (2) | 70.9 | 1262 | 225 | .45 | 287 | 10.9 | 14.8 | 18.8 | 22.8 | 26.7 | 30.7 | 34.7 |
| | ISA+ 0°C | 2 | (1) | 83.3 | 2091 | 305 | .60 | 379 | 11.0 | 13.3 | 15.7 | 18.1 | 20.5 | 22.9 | 25.3 |
| | -15°C | 1 | | 80.1 | 1841 | 288 | .570 | 358 | 11.3 | 14.0 | 16.7 | 19.5 | 22.2 | 24.9 | 27.6 |
| | | -1 | | 76.3 | 1599 | 267 | .530 | 333 | 11.4 | 14.6 | 17.7 | 20.8 | 24.0 | 27.1 | 30.2 |
| | | -3 | | 72.6 | 1383 | 246 | .490 | 308 | 11.4 | 15.0 | 18.7 | 22.3 | 25.9 | 29.5 | 33.1 |
| | | -5 | (2) | 69.6 | 1229 | 225 | .45 | 282 | 10.7 | 14.8 | 18.8 | 22.9 | 27.0 | 31.0 | 35.1 |
| | ISA-10°C | -8 | (1) | 81.8 | 2037 | 305 | .60 | 372 | 10.9 | 13.3 | 15.8 | 18.2 | 20.7 | 23.2 | 25.6 |
| | -25°C | -10 | | 78.7 | 1794 | 288 | .570 | 351 | 11.2 | 14.0 | 16.8 | 19.6 | 22.4 | 25.2 | 27.9 |
| | | -12 | | 74.9 | 1559 | 267 | .530 | 327 | 11.3 | 14.5 | 17.7 | 21.0 | 24.2 | 27.4 | 30.6 |
| | | -14 | | 71.2 | 1348 | 246 | .490 | 302 | 11.3 | 15.0 | 18.7 | 22.4 | 26.1 | 29.8 | 33.5 |
| | | -16 | (2) | 68.3 | 1197 | 225 | .45 | 276 | 10.5 | 14.7 | 18.9 | 23.0 | 27.2 | 31.4 | 35.6 |
| 17000. | ISA+20°C | 23 | (1) | 84.4 | 2042 | 296 | .59 | 382 | 11.4 | 13.8 | 16.3 | 18.7 | 21.2 | 23.6 | 26.1 |
| | 5°C | 21 | | 80.8 | 1794 | 277 | .550 | 359 | 11.6 | 14.4 | 17.2 | 20.0 | 22.8 | 25.6 | 28.4 |
| | | 19 | | 77.8 | 1609 | 262 | .520 | 339 | 11.8 | 14.9 | 18.0 | 21.1 | 24.2 | 27.3 | 30.4 |
| | | 17 | | 74.2 | 1395 | 241 | .480 | 313 | 11.7 | 15.3 | 18.9 | 22.5 | 26.0 | 29.6 | 33.2 |
| | | 15 | (2) | 71.4 | 1258 | 223 | .44 | 289 | 11.1 | 15.1 | 19.0 | 23.0 | 27.0 | 31.0 | 34.9 |
| | ISA+10°C | 13 | (1) | 84.7 | 2134 | 305 | .60 | 386 | 11.1 | 13.4 | 15.8 | 18.1 | 20.4 | 22.8 | 25.1 |
| | -5°C | 11 | | 81.4 | 1878 | 288 | .570 | 365 | 11.4 | 14.1 | 16.8 | 19.4 | 22.1 | 24.8 | 27.4 |
| | | 9 | | 76.5 | 1571 | 262 | .520 | 333 | 11.7 | 14.8 | 18.0 | 21.2 | 24.4 | 27.6 | 30.8 |
| | | 7 | | 72.9 | 1362 | 241 | .480 | 308 | 11.6 | 15.2 | 18.9 | 22.6 | 26.2 | 29.9 | 33.6 |
| | | 5 | (2) | 70.1 | 1225 | 222 | .44 | 284 | 10.9 | 15.0 | 19.1 | 23.2 | 27.2 | 31.3 | 35.4 |
| | ISA+ 0°C | 2 | (1) | 83.2 | 2081 | 305 | .60 | 379 | 11.0 | 13.4 | 15.8 | 18.2 | 20.6 | 23.0 | 25.4 |
| | -15°C | 1 | | 80.0 | 1832 | 288 | .570 | 358 | 11.4 | 14.1 | 16.8 | 19.6 | 22.3 | 25.0 | 27.7 |
| | | -2 | | 75.1 | 1532 | 262 | .520 | 327 | 11.5 | 14.8 | 18.1 | 21.3 | 24.6 | 27.9 | 31.1 |
| | | -4 | | 71.6 | 1329 | 241 | .480 | 302 | 11.4 | 15.2 | 18.9 | 22.7 | 26.5 | 30.2 | 34.0 |
| | | -5 | (2) | 68.8 | 1195 | 222 | .44 | 278 | 10.7 | 14.9 | 19.1 | 23.3 | 27.5 | 31.7 | 35.8 |
| | ISA-10°C | -8 | (1) | 81.7 | 2028 | 305 | .60 | 372 | 10.9 | 13.4 | 15.9 | 18.3 | 20.8 | 23.3 | 25.7 |
| | -25°C | -10 | | 78.5 | 1785 | 288 | .570 | 351 | 11.3 | 14.1 | 16.9 | 19.7 | 22.5 | 25.3 | 28.1 |
| | | -12 | | 73.7 | 1493 | 262 | .520 | 320 | 11.4 | 14.8 | 18.1 | 21.5 | 24.8 | 28.2 | 31.5 |
| | | -14 | | 70.3 | 1296 | 241 | .480 | 296 | 11.3 | 15.1 | 19.0 | 22.8 | 26.7 | 30.6 | 34.4 |
| | | -16 | (2) | 67.5 | 1166 | 222 | .44 | 273 | 10.5 | 14.8 | 19.1 | 23.4 | 27.7 | 32.0 | 36.3 |

Figure 7-14 (Sheet 5 )

# CRUISE
# 15,000 FEET

**ANTI-ICE SYSTEMS OFF** | **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | 23 | (1) 84.5 | 2043 | 296 | .59 | 383 | 11.4 | 13.8 | 16.3 | 18.7 | 21.2 | 23.6 | 26.1 |
| | 5°C | 21 | 80.7 | 1789 | 277 | .550 | 359 | 11.7 | 14.5 | 17.3 | 20.1 | 22.8 | 25.6 | 28.4 |
| | | 19 | 77.7 | 1603 | 262 | .520 | 339 | 11.8 | 14.9 | 18.0 | 21.2 | 24.3 | 27.4 | 30.5 |
| | | 17 | 74.1 | 1388 | 241 | .480 | 313 | 11.8 | 15.4 | 19.0 | 22.6 | 26.2 | 29.8 | 33.4 |
| | | 15 | (2) 70.8 | 1237 | 221 | .44 | 287 | 11.1 | 15.1 | 19.2 | 23.2 | 27.3 | 31.3 | 35.3 |
| | ISA+10°C | 13 | (1) 84.6 | 2130 | 305 | .60 | 386 | 11.1 | 13.4 | 15.8 | 18.1 | 20.5 | 22.8 | 25.2 |
| | -5°C | 11 | 80.4 | 1809 | 282 | .560 | 359 | 11.5 | 14.3 | 17.1 | 19.8 | 22.6 | 25.3 | 28.1 |
| | | 9 | 76.4 | 1565 | 262 | .520 | 333 | 11.7 | 14.9 | 18.1 | 21.3 | 24.5 | 27.7 | 30.9 |
| | | 7 | 72.8 | 1355 | 241 | .480 | 308 | 11.6 | 15.3 | 19.0 | 22.7 | 26.4 | 30.1 | 33.8 |
| | | 5 | (2) 69.5 | 1204 | 220 | .44 | 281 | 10.9 | 15.1 | 19.2 | 23.4 | 27.5 | 31.7 | 35.8 |
| | ISA+ 0°C | 2 | (1) 83.1 | 2077 | 305 | .60 | 379 | 11.0 | 13.4 | 15.8 | 18.3 | 20.7 | 23.1 | 25.5 |
| | -15°C | 0 | 78.9 | 1764 | 282 | .560 | 352 | 11.4 | 14.3 | 17.1 | 19.9 | 22.8 | 25.6 | 28.4 |
| | | -2 | 75.0 | 1527 | 262 | .520 | 327 | 11.6 | 14.9 | 18.1 | 21.4 | 24.7 | 28.0 | 31.2 |
| | | -4 | 71.5 | 1322 | 241 | .480 | 302 | 11.5 | 15.3 | 19.0 | 22.8 | 26.6 | 30.4 | 34.2 |
| | | -6 | (2) 68.4 | 1180 | 221 | .44 | 277 | 10.8 | 15.0 | 19.2 | 23.5 | 27.7 | 32.0 | 36.2 |
| | ISA-10°C | -8 | (1) 81.6 | 2024 | 305 | .60 | 372 | 11.0 | 13.4 | 15.9 | 18.4 | 20.8 | 23.3 | 25.8 |
| | -25°C | -10 | 77.5 | 1719 | 282 | .560 | 345 | 11.3 | 14.3 | 17.2 | 20.1 | 23.0 | 25.9 | 28.8 |
| | | -12 | 73.6 | 1488 | 262 | .520 | 320 | 11.5 | 14.8 | 18.2 | 21.5 | 24.9 | 28.3 | 31.6 |
| | | -14 | 70.2 | 1289 | 241 | .480 | 296 | 11.3 | 15.2 | 19.1 | 23.0 | 26.8 | 30.7 | 34.6 |
| | | -16 | (2) 67.1 | 1149 | 221 | .44 | 271 | 10.6 | 14.9 | 19.3 | 23.6 | 28.0 | 32.3 | 36.7 |
| 16000. | ISA+20°C | 23 | (1) 84.4 | 2040 | 296 | .59 | 383 | 11.4 | 13.9 | 16.3 | 18.8 | 21.2 | 23.7 | 26.1 |
| | 5°C | 21 | 80.7 | 1784 | 277 | .550 | 359 | 11.7 | 14.5 | 17.3 | 20.1 | 22.9 | 25.7 | 28.5 |
| | | 19 | 76.6 | 1537 | 257 | .510 | 333 | 11.9 | 15.1 | 18.4 | 21.7 | 24.9 | 28.2 | 31.4 |
| | | 17 | 73.2 | 1341 | 236 | .470 | 307 | 11.7 | 15.4 | 19.1 | 22.9 | 26.6 | 30.3 | 34.1 |
| | | 15 | (2) 70.2 | 1213 | 218 | .43 | 284 | 11.0 | 15.2 | 19.3 | 23.4 | 27.5 | 31.7 | 35.8 |
| | ISA+10°C | 13 | (1) 84.6 | 2125 | 305 | .60 | 386 | 11.1 | 13.5 | 15.8 | 18.2 | 20.5 | 22.9 | 25.2 |
| | -5°C | 11 | 80.3 | 1805 | 282 | .560 | 359 | 11.6 | 14.3 | 17.1 | 19.9 | 22.6 | 25.4 | 28.2 |
| | | 9 | 76.3 | 1560 | 262 | .520 | 333 | 11.7 | 14.9 | 18.2 | 21.4 | 24.6 | 27.8 | 31.0 |
| | | 7 | 72.7 | 1348 | 241 | .480 | 308 | 11.7 | 15.4 | 19.1 | 22.8 | 26.5 | 30.2 | 33.9 |
| | | 5 | (2) 68.9 | 1182 | 218 | .43 | 278 | 10.9 | 15.1 | 19.3 | 23.6 | 27.8 | 32.0 | 36.3 |
| | ISA+ 0°C | 2 | (1) 83.1 | 2072 | 305 | .60 | 379 | 11.1 | 13.5 | 15.9 | 18.3 | 20.7 | 23.1 | 25.5 |
| | -15°C | 0 | 78.8 | 1760 | 282 | .560 | 352 | 11.5 | 14.3 | 17.2 | 20.0 | 22.8 | 25.7 | 28.5 |
| | | -2 | 74.9 | 1522 | 262 | .520 | 327 | 11.6 | 14.9 | 18.2 | 21.5 | 24.8 | 28.1 | 31.3 |
| | | -4 | 71.4 | 1315 | 241 | .480 | 302 | 11.5 | 15.3 | 19.1 | 22.9 | 26.7 | 30.5 | 34.3 |
| | | -6 | (2) 67.8 | 1157 | 219 | .44 | 274 | 10.7 | 15.0 | 19.4 | 23.7 | 28.0 | 32.3 | 36.6 |
| | ISA-10°C | -8 | (1) 81.6 | 2021 | 305 | .60 | 372 | 11.0 | 13.4 | 15.9 | 18.4 | 20.9 | 23.3 | 25.8 |
| | -25°C | -10 | 77.4 | 1714 | 282 | .560 | 345 | 11.4 | 14.3 | 17.2 | 20.1 | 23.0 | 26.0 | 28.9 |
| | | -12 | 73.5 | 1483 | 262 | .520 | 320 | 11.5 | 14.9 | 18.2 | 21.6 | 25.0 | 28.4 | 31.7 |
| | | -14 | 70.0 | 1282 | 241 | .480 | 296 | 11.4 | 15.3 | 19.2 | 23.1 | 27.0 | 30.9 | 34.8 |
| | | -16 | (2) 66.7 | 1131 | 219 | .44 | 269 | 10.6 | 15.0 | 19.4 | 23.8 | 28.2 | 32.6 | 37.1 |
| 14000. | ISA+20°C | 23 | (1) 84.4 | 2040 | 298 | .59 | 384 | 11.5 | 13.9 | 16.4 | 18.8 | 21.3 | 23.7 | 26.2 |
| | 5°C | 21 | 80.3 | 1766 | 277 | .550 | 359 | 11.8 | 14.7 | 17.5 | 20.3 | 23.1 | 26.0 | 28.8 |
| | | 19 | 76.2 | 1515 | 257 | .510 | 333 | 12.1 | 15.4 | 18.7 | 22.0 | 25.3 | 28.6 | 31.9 |
| | | 16 | 71.7 | 1274 | 231 | .460 | 300 | 11.8 | 15.7 | 19.7 | 23.6 | 27.5 | 31.4 | 35.4 |
| | | 14 | (2) 68.0 | 1136 | 211 | .42 | 275 | 11.0 | 15.4 | 19.8 | 24.2 | 28.6 | 33.0 | 37.4 |
| | ISA+10°C | 13 | (1) 84.4 | 2108 | 305 | .60 | 386 | 11.2 | 13.6 | 16.0 | 18.3 | 20.7 | 23.1 | 25.4 |
| | -5°C | 11 | 80.0 | 1788 | 282 | .560 | 359 | 11.7 | 14.5 | 17.3 | 20.1 | 22.9 | 25.7 | 28.5 |
| | | 8 | 74.9 | 1479 | 257 | .510 | 327 | 12.0 | 15.3 | 18.7 | 22.1 | 25.5 | 28.9 | 32.2 |
| | | 6 | 71.4 | 1283 | 236 | .470 | 301 | 11.8 | 15.7 | 19.6 | 23.5 | 27.4 | 31.3 | 35.2 |
| | | 4 | (2) 67.0 | 1111 | 212 | .42 | 270 | 10.8 | 15.3 | 19.8 | 24.3 | 28.8 | 33.3 | 37.8 |
| | ISA+ 0°C | 2 | (1) 82.9 | 2056 | 305 | .60 | 379 | 11.1 | 13.6 | 16.0 | 18.4 | 20.9 | 23.3 | 25.7 |
| | -15°C | 0 | 78.6 | 1743 | 282 | .560 | 352 | 11.6 | 14.5 | 17.3 | 20.2 | 23.1 | 25.9 | 28.8 |
| | | -2 | 73.6 | 1443 | 257 | .510 | 321 | 11.8 | 15.3 | 18.8 | 22.2 | 25.7 | 29.2 | 32.6 |
| | | -4 | 70.1 | 1251 | 236 | .470 | 296 | 11.6 | 15.6 | 19.6 | 23.6 | 27.6 | 31.6 | 35.6 |
| | | -6 | (2) 65.7 | 1084 | 211 | .42 | 265 | 10.6 | 15.2 | 19.8 | 24.5 | 29.1 | 33.7 | 38.3 |
| | ISA-10°C | -8 | (1) 81.3 | 2003 | 305 | .60 | 372 | 11.1 | 13.6 | 16.1 | 18.6 | 21.0 | 23.5 | 26.0 |
| | -25°C | -10 | 77.1 | 1698 | 282 | .560 | 345 | 11.5 | 14.4 | 17.4 | 20.3 | 23.3 | 26.2 | 29.2 |
| | | -13 | 72.2 | 1406 | 257 | .510 | 314 | 11.7 | 15.2 | 18.8 | 22.4 | 25.9 | 29.5 | 33.0 |
| | | -15 | 68.8 | 1220 | 236 | .470 | 290 | 11.5 | 15.6 | 19.7 | 23.8 | 27.8 | 31.9 | 36.0 |
| | | -17 | (2) 64.5 | 1057 | 212 | .42 | 260 | 10.4 | 15.1 | 19.9 | 24.6 | 29.3 | 34.1 | 38.8 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -5°C | -15°C | -25°C |
| 83.2 | 83.2 | 81.7 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 6)

# CRUISE
# 17,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | 19 | (1) 85.3 | 1986 | 289 | .59 | 385 | 11.8 | 14.3 | 16.8 | 19.4 | 21.9 | 24.4 | 26.9 |
| | 1°C | 18 | 83.1 | 1818 | 277 | .570 | 369 | 12.1 | 14.8 | 17.6 | 20.3 | 23.1 | 25.8 | 28.6 |
| | | 16 | 80.2 | 1641 | 262 | .540 | 350 | 12.2 | 15.2 | 18.3 | 21.3 | 24.4 | 27.4 | 30.5 |
| | | 14 | 77.5 | 1483 | 247 | .510 | 330 | 12.2 | 15.5 | 18.9 | 22.3 | 25.6 | 29.0 | 32.4 |
| | | 13 | (2) 75.3 | 1365 | 234 | .48 | 314 | 12.0 | 15.7 | 19.3 | 23.0 | 26.7 | 30.3 | 34.0 |
| | ISA+10°C | 10 | (1) 86.8 | 2184 | 305 | .63 | 398 | 11.4 | 13.6 | 15.9 | 18.2 | 20.5 | 22.8 | 25.1 |
| | -9°C | 8 | 83.5 | 1912 | 287 | .590 | 375 | 11.8 | 14.4 | 17.0 | 19.6 | 22.2 | 24.8 | 27.5 |
| | | 6 | 80.7 | 1713 | 272 | .560 | 356 | 12.0 | 14.9 | 17.9 | 20.8 | 23.7 | 26.6 | 29.5 |
| | | 4 | 77.0 | 1498 | 252 | .520 | 331 | 12.1 | 15.4 | 18.7 | 22.1 | 25.4 | 28.7 | 32.1 |
| | | 3 | (2) 74.0 | 1332 | 234 | .48 | 308 | 11.9 | 15.6 | 19.4 | 23.1 | 26.9 | 30.6 | 34.4 |
| | ISA+ 0°C | 0 | (1) 85.2 | 2130 | 305 | .63 | 390 | 11.3 | 13.6 | 16.0 | 18.3 | 20.7 | 23.0 | 25.4 |
| | -19°C | -2 | 82.0 | 1864 | 287 | .590 | 368 | 11.7 | 14.4 | 17.0 | 19.7 | 22.4 | 25.1 | 27.8 |
| | | -4 | 79.3 | 1670 | 272 | .560 | 349 | 11.9 | 14.9 | 17.9 | 20.9 | 23.9 | 26.9 | 29.9 |
| | | -6 | 75.6 | 1461 | 252 | .520 | 324 | 11.9 | 15.4 | 18.8 | 22.2 | 25.6 | 29.1 | 32.5 |
| | | -8 | (2) 72.7 | 1299 | 234 | .48 | 302 | 11.7 | 15.6 | 19.4 | 23.3 | 27.1 | 31.0 | 34.8 |
| | ISA-10°C | -11 | (1) 83.6 | 2076 | 305 | .63 | 383 | 11.2 | 13.6 | 16.0 | 18.4 | 20.8 | 23.3 | 25.7 |
| | -29°C | -13 | 80.5 | 1816 | 287 | .590 | 361 | 11.6 | 14.3 | 17.1 | 19.9 | 22.6 | 25.4 | 28.1 |
| | | -15 | 77.8 | 1625 | 272 | .560 | 342 | 11.8 | 14.9 | 18.0 | 21.1 | 24.1 | 27.2 | 30.3 |
| | | -17 | 74.2 | 1422 | 252 | .520 | 318 | 11.8 | 15.3 | 18.8 | 22.3 | 25.9 | 29.4 | 32.9 |
| | | -18 | (2) 71.3 | 1266 | 234 | .48 | 296 | 11.6 | 15.5 | 19.4 | 23.4 | 27.3 | 31.3 | 35.2 |
| 19000. | ISA+20°C | 19 | (1) 85.3 | 1986 | 290 | .60 | 386 | 11.9 | 14.4 | 16.9 | 19.4 | 21.9 | 24.5 | 27.0 |
| | 1°C | 18 | 82.9 | 1805 | 277 | .570 | 369 | 12.1 | 14.9 | 17.7 | 20.4 | 23.2 | 26.0 | 28.8 |
| | | 16 | 80.0 | 1628 | 262 | .540 | 350 | 12.3 | 15.3 | 18.4 | 21.5 | 24.6 | 27.6 | 30.7 |
| | | 14 | 76.3 | 1419 | 242 | .500 | 324 | 12.3 | 15.8 | 19.3 | 22.8 | 26.4 | 29.9 | 33.4 |
| | | 12 | (2) 74.2 | 1305 | 228 | .47 | 305 | 11.9 | 15.8 | 19.6 | 23.4 | 27.2 | 31.1 | 34.9 |
| | ISA+10°C | 10 | (1) 86.6 | 2173 | 305 | .63 | 398 | 11.4 | 13.7 | 16.0 | 18.3 | 20.6 | 22.9 | 25.2 |
| | -9°C | 8 | 83.3 | 1900 | 287 | .590 | 375 | 11.8 | 14.5 | 17.1 | 19.7 | 22.4 | 25.0 | 27.6 |
| | | 6 | 79.6 | 1644 | 267 | .550 | 350 | 12.1 | 15.2 | 18.2 | 21.3 | 24.3 | 27.4 | 30.4 |
| | | 4 | 75.8 | 1433 | 247 | .510 | 324 | 12.2 | 15.7 | 19.1 | 22.6 | 26.1 | 29.6 | 33.1 |
| | | 2 | (2) 72.9 | 1273 | 228 | .47 | 300 | 11.8 | 15.7 | 19.6 | 23.5 | 27.5 | 31.4 | 35.3 |
| | ISA+ 0°C | 0 | (1) 85.1 | 2119 | 305 | .63 | 390 | 11.3 | 13.7 | 16.1 | 18.4 | 20.8 | 23.1 | 25.5 |
| | -19°C | -2 | 81.8 | 1852 | 287 | .590 | 368 | 11.8 | 14.5 | 17.2 | 19.9 | 22.6 | 25.3 | 28.0 |
| | | -5 | 78.1 | 1602 | 267 | .550 | 343 | 12.0 | 15.2 | 18.3 | 21.4 | 24.5 | 27.6 | 30.8 |
| | | -7 | 74.4 | 1397 | 247 | .510 | 318 | 12.0 | 15.6 | 19.2 | 22.8 | 26.4 | 29.9 | 33.5 |
| | | -8 | (2) 71.5 | 1242 | 228 | .47 | 294 | 11.6 | 15.6 | 19.7 | 23.7 | 27.7 | 31.7 | 35.8 |
| | ISA-10°C | -11 | (1) 83.5 | 2065 | 305 | .63 | 383 | 11.3 | 13.7 | 16.1 | 18.5 | 21.0 | 23.4 | 25.8 |
| | -29°C | -13 | 80.3 | 1805 | 287 | .590 | 361 | 11.7 | 14.4 | 17.2 | 20.0 | 22.7 | 25.5 | 28.3 |
| | | -15 | 76.7 | 1560 | 267 | .550 | 336 | 11.9 | 15.1 | 18.3 | 21.5 | 24.7 | 28.0 | 31.2 |
| | | -17 | 73.0 | 1361 | 247 | .510 | 312 | 11.9 | 15.6 | 19.2 | 22.9 | 26.6 | 30.3 | 33.9 |
| | | -19 | (2) 70.2 | 1210 | 228 | .47 | 288 | 11.4 | 15.6 | 19.7 | 23.8 | 28.0 | 32.1 | 36.2 |
| 18000. | ISA+20°C | 19 | (1) 85.3 | 1986 | 290 | .60 | 387 | 11.9 | 14.4 | 17.0 | 19.5 | 22.0 | 24.5 | 27.0 |
| | 1°C | 17 | 81.7 | 1732 | 272 | .560 | 363 | 12.3 | 15.2 | 18.0 | 20.9 | 23.8 | 26.7 | 29.6 |
| | | 15 | 78.8 | 1561 | 257 | .530 | 343 | 12.4 | 15.6 | 18.8 | 22.0 | 25.2 | 28.4 | 31.6 |
| | | 13 | 75.1 | 1356 | 237 | .490 | 317 | 12.4 | 16.0 | 19.7 | 23.4 | 27.1 | 30.8 | 34.5 |
| | | 12 | (2) 73.0 | 1243 | 221 | .46 | 297 | 11.8 | 15.8 | 19.9 | 23.9 | 27.9 | 31.9 | 35.9 |
| | ISA+10°C | 10 | (1) 86.5 | 2163 | 305 | .63 | 398 | 11.5 | 13.8 | 16.1 | 18.4 | 20.7 | 23.0 | 25.3 |
| | -9°C | 8 | 83.1 | 1888 | 287 | .590 | 375 | 11.9 | 14.6 | 17.2 | 19.9 | 22.5 | 25.2 | 27.8 |
| | | 5 | 78.4 | 1576 | 262 | .540 | 343 | 12.3 | 15.4 | 18.6 | 21.8 | 25.0 | 28.1 | 31.3 |
| | | 3 | 74.6 | 1370 | 242 | .500 | 318 | 12.3 | 15.9 | 19.6 | 23.2 | 26.9 | 30.5 | 34.2 |
| | | 1 | (2) 71.7 | 1213 | 221 | .46 | 291 | 11.7 | 15.8 | 19.9 | 24.0 | 28.1 | 32.3 | 36.4 |
| | ISA+ 0°C | 0 | (1) 84.9 | 2109 | 305 | .63 | 390 | 11.4 | 13.8 | 16.1 | 18.5 | 20.9 | 23.3 | 25.6 |
| | -19°C | -2 | 81.6 | 1841 | 287 | .590 | 368 | 11.8 | 14.5 | 17.3 | 20.0 | 22.7 | 25.4 | 28.1 |
| | | -5 | 76.9 | 1537 | 262 | .540 | 337 | 12.2 | 15.4 | 18.7 | 21.9 | 25.2 | 28.4 | 31.7 |
| | | -7 | 73.3 | 1336 | 242 | .500 | 312 | 12.1 | 15.9 | 19.6 | 23.3 | 27.1 | 30.8 | 34.6 |
| | | -9 | (2) 70.4 | 1185 | 222 | .46 | 286 | 11.5 | 15.7 | 19.9 | 24.1 | 28.4 | 32.6 | 36.8 |
| | ISA-10°C | -11 | (1) 83.4 | 2054 | 305 | .63 | 383 | 11.3 | 13.8 | 16.2 | 18.6 | 21.1 | 23.5 | 25.9 |
| | -29°C | -13 | 80.1 | 1793 | 287 | .590 | 361 | 11.7 | 14.5 | 17.3 | 20.1 | 22.9 | 25.7 | 28.5 |
| | | -16 | 75.5 | 1496 | 262 | .540 | 330 | 12.0 | 15.4 | 18.7 | 22.1 | 25.4 | 28.7 | 32.1 |
| | | -17 | 71.9 | 1302 | 242 | .500 | 306 | 12.0 | 15.8 | 19.6 | 23.5 | 27.3 | 31.2 | 35.0 |
| | | -19 | (2) 69.1 | 1156 | 222 | .46 | 281 | 11.3 | 15.6 | 20.0 | 24.3 | 28.6 | 32.9 | 37.3 |
| 17000. | ISA+20°C | 19 | (1) 85.3 | 1986 | 291 | .60 | 388 | 12.0 | 14.5 | 17.0 | 19.5 | 22.0 | 24.6 | 27.1 |
| | 1°C | 17 | 81.5 | 1721 | 272 | .560 | 363 | 12.4 | 15.3 | 18.2 | 21.1 | 24.0 | 26.9 | 29.8 |
| | | 15 | 78.5 | 1548 | 257 | .530 | 343 | 12.5 | 15.7 | 18.9 | 22.2 | 25.4 | 28.6 | 31.9 |
| | | 13 | 74.8 | 1341 | 237 | .490 | 317 | 12.5 | 16.2 | 20.0 | 23.7 | 27.4 | 31.1 | 34.9 |
| | | 12 | (2) 72.1 | 1208 | 218 | .45 | 293 | 11.8 | 16.0 | 20.1 | 24.3 | 28.4 | 32.5 | 36.7 |
| | ISA+10°C | 10 | (1) 86.4 | 2152 | 305 | .63 | 398 | 11.5 | 13.8 | 16.2 | 18.5 | 20.8 | 23.1 | 25.5 |
| | -9°C | 8 | 82.0 | 1806 | 282 | .580 | 369 | 12.1 | 14.9 | 17.6 | 20.4 | 23.2 | 26.0 | 28.7 |
| | | 5 | 78.1 | 1565 | 262 | .540 | 343 | 12.4 | 15.6 | 18.7 | 21.9 | 25.1 | 28.3 | 31.5 |
| | | 3 | 74.4 | 1356 | 242 | .500 | 318 | 12.4 | 16.1 | 19.8 | 23.4 | 27.1 | 30.8 | 34.5 |
| | | 1 | (2) 70.8 | 1177 | 218 | .45 | 287 | 11.7 | 15.9 | 20.2 | 24.4 | 28.6 | 32.9 | 37.1 |
| | ISA+ 0°C | 0 | (1) 84.8 | 2098 | 305 | .63 | 390 | 11.5 | 13.8 | 16.2 | 18.6 | 21.0 | 23.4 | 25.8 |
| | -19°C | -3 | 80.5 | 1761 | 282 | .580 | 362 | 12.0 | 14.9 | 17.7 | 20.5 | 23.4 | 26.2 | 29.1 |
| | | -5 | 76.7 | 1525 | 262 | .540 | 337 | 12.2 | 15.5 | 18.8 | 22.1 | 25.4 | 28.6 | 31.9 |
| | | -7 | 73.0 | 1323 | 242 | .500 | 312 | 12.2 | 16.0 | 19.8 | 23.6 | 27.4 | 31.1 | 34.9 |
| | | -9 | (2) 69.5 | 1146 | 218 | .45 | 281 | 11.5 | 15.8 | 20.2 | 24.5 | 28.9 | 33.3 | 37.6 |
| | ISA-10°C | -11 | (1) 83.2 | 2045 | 305 | .63 | 383 | 11.4 | 13.8 | 16.3 | 18.7 | 21.2 | 23.6 | 26.0 |
| | -29°C | -14 | 79.0 | 1715 | 282 | .580 | 354 | 11.9 | 14.8 | 17.8 | 20.7 | 23.6 | 26.5 | 29.4 |
| | | -16 | 75.3 | 1485 | 262 | .540 | 330 | 12.1 | 15.5 | 18.9 | 22.2 | 25.6 | 29.0 | 32.3 |
| | | -17 | 71.6 | 1289 | 242 | .500 | 306 | 12.1 | 16.0 | 19.8 | 23.7 | 27.6 | 31.5 | 35.4 |
| | | -20 | (2) 68.1 | 1114 | 217 | .45 | 275 | 11.2 | 15.7 | 20.2 | 24.7 | 29.2 | 33.7 | 38.2 |

Figure 7-14 (Sheet 7)

# CRUISE
# 17,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C 1°C | 19 | (1) 85.2 | 1981 | 291 | .60 | 388 | 12.0 | 14.5 | 17.0 | 19.6 | 22.1 | 24.6 | 27.1 |
| | | 17 | 81.4 | 1716 | 272 | .560 | 363 | 12.4 | 15.3 | 18.2 | 21.1 | 24.1 | 27.0 | 29.9 |
| | | 15 | 78.4 | 1542 | 257 | .530 | 343 | 12.5 | 15.8 | 19.0 | 22.3 | 25.5 | 28.7 | 32.0 |
| | | 13 | 74.6 | 1333 | 237 | .490 | 317 | 12.6 | 16.3 | 20.1 | 23.8 | 27.6 | 31.3 | 35.1 |
| | | 11 | (2) 71.7 | 1189 | 217 | .45 | 291 | 11.9 | 16.1 | 20.3 | 24.5 | 28.7 | 32.9 | 37.1 |
| | ISA+10°C -9°C | 10 | (1) 86.3 | 2148 | 305 | .63 | 398 | 11.5 | 13.9 | 16.2 | 18.5 | 20.9 | 23.2 | 25.5 |
| | | 8 | 81.9 | 1800 | 282 | .580 | 369 | 12.1 | 14.9 | 17.7 | 20.5 | 23.3 | 26.0 | 28.8 |
| | | 5 | 78.0 | 1559 | 262 | .540 | 343 | 12.4 | 15.6 | 18.8 | 22.0 | 25.2 | 28.4 | 31.6 |
| | | 3 | 73.3 | 1302 | 237 | .490 | 312 | 12.4 | 16.3 | 20.1 | 23.9 | 27.8 | 31.6 | 35.5 |
| | | 1 | (2) 70.3 | 1157 | 216 | .45 | 285 | 11.7 | 16.0 | 20.3 | 24.6 | 28.9 | 33.3 | 37.6 |
| | ISA+ 0°C -19°C | 0 | (1) 84.8 | 2094 | 305 | .63 | 390 | 11.5 | 13.9 | 16.3 | 18.6 | 21.0 | 23.4 | 25.8 |
| | | -3 | 80.5 | 1756 | 282 | .580 | 362 | 12.1 | 14.9 | 17.8 | 20.6 | 23.4 | 26.3 | 29.1 |
| | | -5 | 76.6 | 1520 | 262 | .540 | 337 | 12.3 | 15.6 | 18.9 | 22.2 | 25.4 | 28.7 | 32.0 |
| | | -7 | 72.0 | 1269 | 237 | .490 | 306 | 12.3 | 16.2 | 20.1 | 24.1 | 28.0 | 32.0 | 35.9 |
| | | -9 | (2) 69.0 | 1127 | 216 | .45 | 279 | 11.5 | 15.9 | 20.3 | 24.8 | 29.2 | 33.6 | 38.1 |
| | ISA-10°C -29°C | -11 | (1) 83.2 | 2040 | 305 | .63 | 383 | 11.4 | 13.9 | 16.3 | 18.8 | 21.2 | 23.7 | 26.1 |
| | | -14 | 79.0 | 1710 | 282 | .580 | 354 | 12.0 | 14.9 | 17.8 | 20.7 | 23.7 | 26.6 | 29.5 |
| | | -16 | 75.2 | 1480 | 262 | .540 | 330 | 12.2 | 15.5 | 18.9 | 22.3 | 25.7 | 29.1 | 32.4 |
| | | -18 | 70.6 | 1237 | 237 | .490 | 300 | 12.1 | 16.1 | 20.2 | 24.2 | 28.3 | 32.3 | 36.4 |
| | | -20 | (2) 67.6 | 1095 | 216 | .45 | 273 | 11.2 | 15.8 | 20.4 | 24.9 | 29.5 | 34.1 | 38.6 |
| 16000. | ISA+20°C 1°C | 19 | (1) 85.2 | 1979 | 291 | .60 | 388 | 12.0 | 14.5 | 17.1 | 19.6 | 22.1 | 24.7 | 27.2 |
| | | 17 | 81.3 | 1710 | 272 | .560 | 363 | 12.4 | 15.4 | 18.3 | 21.2 | 24.1 | 27.0 | 30.0 |
| | | 15 | 77.4 | 1482 | 252 | .520 | 337 | 12.6 | 16.0 | 19.4 | 22.7 | 26.1 | 29.5 | 32.8 |
| | | 13 | 74.5 | 1326 | 237 | .490 | 317 | 12.6 | 16.4 | 20.2 | 23.9 | 27.7 | 31.5 | 35.2 |
| | | 11 | (2) 71.2 | 1172 | 215 | .45 | 289 | 11.9 | 16.2 | 20.4 | 24.7 | 29.0 | 33.2 | 37.5 |
| | ISA+10°C -9°C | 10 | (1) 86.3 | 2143 | 305 | .63 | 398 | 11.6 | 13.9 | 16.2 | 18.6 | 20.9 | 23.2 | 25.6 |
| | | 8 | 81.9 | 1795 | 282 | .580 | 369 | 12.2 | 15.0 | 17.8 | 20.5 | 23.3 | 26.1 | 28.9 |
| | | 5 | 77.9 | 1554 | 262 | .540 | 343 | 12.4 | 15.7 | 18.9 | 22.1 | 25.3 | 28.5 | 31.8 |
| | | 3 | 73.2 | 1295 | 237 | .490 | 312 | 12.5 | 16.4 | 20.2 | 24.1 | 27.9 | 31.8 | 35.7 |
| | | 1 | (2) 69.9 | 1140 | 215 | .45 | 283 | 11.7 | 16.1 | 20.5 | 24.8 | 29.2 | 33.6 | 38.0 |
| | ISA+ 0°C -19°C | 0 | (1) 84.7 | 2089 | 305 | .63 | 390 | 11.5 | 13.9 | 16.3 | 18.7 | 21.1 | 23.5 | 25.9 |
| | | -3 | 80.4 | 1750 | 282 | .580 | 362 | 12.1 | 14.9 | 17.8 | 20.7 | 23.5 | 26.4 | 29.2 |
| | | -5 | 76.5 | 1515 | 262 | .540 | 337 | 12.3 | 15.6 | 18.9 | 22.2 | 25.5 | 28.8 | 32.1 |
| | | -7 | 71.9 | 1262 | 237 | .490 | 306 | 12.3 | 16.3 | 20.3 | 24.2 | 28.2 | 32.1 | 36.1 |
| | | -9 | (2) 68.6 | 1110 | 215 | .44 | 277 | 11.5 | 16.0 | 20.5 | 25.0 | 29.5 | 34.0 | 38.5 |
| | ISA-10°C -29°C | -11 | (1) 83.1 | 2035 | 305 | .63 | 383 | 11.4 | 13.9 | 16.3 | 18.8 | 21.3 | 23.7 | 26.2 |
| | | -14 | 78.9 | 1705 | 282 | .580 | 354 | 12.0 | 14.9 | 17.9 | 20.8 | 23.7 | 26.7 | 29.6 |
| | | -16 | 75.1 | 1475 | 262 | .540 | 330 | 12.2 | 15.6 | 19.0 | 22.4 | 25.8 | 29.2 | 32.6 |
| | | -18 | 70.5 | 1230 | 237 | .490 | 300 | 12.2 | 16.2 | 20.3 | 24.4 | 28.4 | 32.5 | 36.6 |
| | | -20 | (2) 67.2 | 1078 | 214 | .44 | 271 | 11.2 | 15.9 | 20.5 | 25.1 | 29.8 | 34.4 | 39.1 |
| 14000. | ISA+20°C 1°C | 19 | (1) 85.2 | 1980 | 293 | .60 | 390 | 12.1 | 14.6 | 17.2 | 19.7 | 22.2 | 24.7 | 27.3 |
| | | 17 | 81.0 | 1691 | 272 | .560 | 363 | 12.6 | 15.5 | 18.5 | 21.4 | 24.4 | 27.4 | 30.3 |
| | | 15 | 76.9 | 1459 | 252 | .520 | 337 | 12.8 | 16.2 | 19.7 | 23.1 | 26.5 | 29.9 | 33.4 |
| | | 13 | 73.2 | 1259 | 232 | .480 | 311 | 12.8 | 16.8 | 20.7 | 24.7 | 28.7 | 32.6 | 36.6 |
| | | 11 | (2) 68.9 | 1090 | 208 | .43 | 279 | 11.8 | 16.4 | 21.0 | 25.6 | 30.2 | 34.8 | 39.4 |
| | ISA+10°C -9°C | 10 | (1) 86.0 | 2125 | 305 | .63 | 398 | 11.7 | 14.0 | 16.4 | 18.7 | 21.1 | 23.4 | 25.8 |
| | | 8 | 81.6 | 1776 | 282 | .580 | 369 | 12.3 | 15.1 | 17.9 | 20.8 | 23.6 | 26.4 | 29.2 |
| | | 5 | 76.6 | 1478 | 257 | .530 | 337 | 12.7 | 16.0 | 19.4 | 22.8 | 26.2 | 29.6 | 32.9 |
| | | 2 | 72.0 | 1229 | 232 | .480 | 305 | 12.6 | 16.7 | 20.8 | 24.8 | 28.9 | 33.0 | 37.0 |
| | | 0 | (2) 67.7 | 1062 | 207 | .43 | 274 | 11.6 | 16.3 | 21.0 | 25.8 | 30.5 | 35.2 | 39.9 |
| | ISA+ 0°C -19°C | 0 | (1) 84.5 | 2073 | 305 | .63 | 390 | 11.6 | 14.0 | 16.4 | 18.8 | 21.2 | 23.7 | 26.1 |
| | | -3 | 80.1 | 1731 | 282 | .580 | 362 | 12.2 | 15.1 | 18.0 | 20.9 | 23.8 | 26.7 | 29.6 |
| | | -6 | 75.2 | 1441 | 257 | .530 | 331 | 12.5 | 16.0 | 19.5 | 22.9 | 26.4 | 29.9 | 33.3 |
| | | -8 | 70.6 | 1199 | 232 | .480 | 299 | 12.5 | 16.6 | 20.8 | 25.0 | 29.2 | 33.3 | 37.5 |
| | | -10 | (2) 66.5 | 1037 | 208 | .43 | 269 | 11.4 | 16.3 | 21.1 | 25.9 | 30.7 | 35.5 | 40.4 |
| | ISA-10°C -29°C | -11 | (1) 82.9 | 2019 | 305 | .63 | 383 | 11.5 | 14.0 | 16.5 | 18.9 | 21.4 | 23.9 | 26.4 |
| | | -14 | 78.6 | 1686 | 282 | .580 | 354 | 12.1 | 15.1 | 18.1 | 21.0 | 24.0 | 27.0 | 29.9 |
| | | -16 | 73.7 | 1404 | 257 | .530 | 324 | 12.4 | 16.0 | 19.5 | 23.1 | 26.6 | 30.2 | 33.8 |
| | | -18 | 69.3 | 1168 | 232 | .480 | 294 | 12.3 | 16.6 | 20.8 | 25.1 | 29.4 | 33.7 | 38.0 |
| | | -20 | (2) 65.3 | 1013 | 208 | .43 | 264 | 11.2 | 16.2 | 21.1 | 26.0 | 31.0 | 35.9 | 40.9 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -9°C | -19°C | -29°C |
| 84.2 | 84.8 | 83.2 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 8)

# CRUISE
# 19,000 FEET

**ANTI-ICE SYSTEMS OFF** — **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
| 20000. | ISA+20°C | 15 | (1) 85.9 | 1903 | 282 | .60 | 388 | 12.5 | 15.1 | 17.7 | 20.4 | 23.0 | 25.6 | 28.3 |
| | -3°C | 14 | 83.8 | 1753 | 271 | .580 | 373 | 12.7 | 15.6 | 18.4 | 21.3 | 24.1 | 27.0 | 29.8 |
| | | 12 | 81.0 | 1579 | 256 | .550 | 354 | 12.9 | 16.1 | 19.2 | 22.4 | 25.6 | 28.7 | 31.9 |
| | | 11 | 78.3 | 1433 | 242 | .520 | 334 | 12.9 | 16.4 | 19.8 | 23.3 | 26.8 | 30.3 | 33.8 |
| | | 9 | (2) 76.1 | 1317 | 230 | .49 | 318 | 12.7 | 16.5 | 20.3 | 24.1 | 27.9 | 31.7 | 35.5 |
| | ISA+10°C | 7 | (1) 87.7 | 2145 | 301 | .64 | 405 | 11.9 | 14.2 | 16.5 | 18.9 | 21.2 | 23.5 | 25.9 |
| | -13°C | 5 | 85.0 | 1905 | 285 | .610 | 385 | 12.3 | 14.9 | 17.6 | 20.2 | 22.8 | 25.4 | 28.1 |
| | | 3 | 81.4 | 1649 | 266 | .570 | 360 | 12.7 | 15.7 | 18.8 | 21.8 | 24.8 | 27.9 | 30.9 |
| | | 1 | 77.8 | 1442 | 247 | .530 | 334 | 12.8 | 16.3 | 19.7 | 23.2 | 26.7 | 30.1 | 33.6 |
| | | -1 | (2) 74.7 | 1285 | 230 | .49 | 312 | 12.6 | 16.5 | 20.4 | 24.3 | 28.2 | 32.0 | 35.9 |
| | ISA+ 0°C | -3 | (1) 86.8 | 2163 | 305 | .65 | 402 | 11.7 | 14.0 | 16.3 | 18.6 | 20.9 | 23.2 | 25.5 |
| | -23°C | -6 | 83.4 | 1858 | 285 | .610 | 377 | 12.2 | 14.9 | 17.6 | 20.3 | 23.0 | 25.7 | 28.4 |
| | | -8 | 79.9 | 1608 | 266 | .570 | 353 | 12.6 | 15.7 | 18.8 | 21.9 | 25.0 | 28.2 | 31.3 |
| | | -9 | 77.3 | 1452 | 252 | .540 | 334 | 12.7 | 16.1 | 19.6 | 23.0 | 26.5 | 29.9 | 33.4 |
| | | -11 | (2) 73.4 | 1253 | 230 | .49 | 306 | 12.4 | 16.4 | 20.4 | 24.4 | 28.4 | 32.4 | 36.4 |
| | ISA-10°C | -14 | (1) 85.2 | 2108 | 305 | .65 | 394 | 11.6 | 13.9 | 16.3 | 18.7 | 21.1 | 23.4 | 25.8 |
| | -33°C | -16 | 81.8 | 1810 | 285 | .610 | 370 | 12.1 | 14.9 | 17.7 | 20.4 | 23.2 | 26.0 | 28.7 |
| | | -18 | 78.4 | 1566 | 266 | .570 | 346 | 12.5 | 15.7 | 18.9 | 22.1 | 25.3 | 28.5 | 31.7 |
| | | -20 | 75.8 | 1413 | 252 | .540 | 327 | 12.6 | 16.1 | 19.6 | 23.2 | 26.7 | 30.3 | 33.8 |
| | | -22 | (2) 72.0 | 1221 | 230 | .49 | 300 | 12.3 | 16.4 | 20.5 | 24.6 | 28.7 | 32.8 | 36.9 |
| 19000. | ISA+20°C | 15 | (1) 85.9 | 1905 | 283 | .61 | 389 | 12.5 | 15.2 | 17.8 | 20.4 | 23.0 | 25.7 | 28.3 |
| | -3°C | 14 | 83.5 | 1739 | 271 | .580 | 373 | 12.8 | 15.7 | 18.6 | 21.4 | 24.3 | 27.2 | 30.1 |
| | | 12 | 80.8 | 1566 | 256 | .550 | 354 | 13.0 | 16.2 | 19.4 | 22.6 | 25.8 | 29.0 | 32.2 |
| | | 11 | 78.0 | 1418 | 242 | .520 | 334 | 13.0 | 16.5 | 20.1 | 23.6 | 27.1 | 30.6 | 34.2 |
| | | 9 | (2) 75.4 | 1282 | 228 | .49 | 315 | 12.9 | 16.8 | 20.7 | 24.6 | 28.5 | 32.4 | 36.3 |
| | ISA+10°C | 7 | (1) 87.6 | 2144 | 302 | .64 | 406 | 11.9 | 14.3 | 16.6 | 18.9 | 21.3 | 23.6 | 25.9 |
| | -13°C | 5 | 84.8 | 1892 | 285 | .610 | 385 | 12.4 | 15.0 | 17.7 | 20.3 | 23.0 | 25.6 | 28.3 |
| | | 3 | 81.1 | 1635 | 266 | .570 | 360 | 12.8 | 15.9 | 18.9 | 22.0 | 25.1 | 28.1 | 31.2 |
| | | 1 | 77.5 | 1428 | 247 | .530 | 334 | 12.9 | 16.4 | 19.9 | 23.4 | 26.9 | 30.4 | 33.9 |
| | | -1 | (2) 74.0 | 1250 | 228 | .49 | 309 | 12.7 | 16.7 | 20.7 | 24.7 | 28.7 | 32.7 | 36.7 |
| | ISA+ 0°C | -3 | (1) 86.7 | 2153 | 305 | .65 | 402 | 11.7 | 14.0 | 16.4 | 18.7 | 21.0 | 23.3 | 25.6 |
| | -23°C | -6 | 83.2 | 1845 | 285 | .610 | 377 | 12.3 | 15.0 | 17.7 | 20.4 | 23.2 | 25.9 | 28.6 |
| | | -8 | 79.7 | 1594 | 266 | .570 | 353 | 12.7 | 15.9 | 19.0 | 22.1 | 25.3 | 28.4 | 31.5 |
| | | -10 | 76.1 | 1392 | 247 | .530 | 328 | 12.8 | 16.4 | 20.0 | 23.6 | 27.2 | 30.7 | 34.3 |
| | | -12 | (2) 72.7 | 1220 | 228 | .49 | 303 | 12.6 | 16.7 | 20.8 | 24.9 | 29.0 | 33.1 | 37.2 |
| | ISA-10°C | -14 | (1) 85.1 | 2097 | 305 | .65 | 394 | 11.6 | 14.0 | 16.4 | 18.8 | 21.2 | 23.6 | 25.9 |
| | -33°C | -16 | 81.7 | 1797 | 285 | .610 | 370 | 12.2 | 15.0 | 17.8 | 20.6 | 23.3 | 26.1 | 28.9 |
| | | -18 | 78.1 | 1552 | 266 | .570 | 346 | 12.6 | 15.8 | 19.0 | 22.3 | 25.5 | 28.7 | 31.9 |
| | | -20 | 74.6 | 1355 | 247 | .530 | 321 | 12.6 | 16.3 | 20.0 | 23.7 | 27.4 | 31.1 | 34.8 |
| | | -22 | (2) 71.3 | 1189 | 228 | .49 | 297 | 12.4 | 16.6 | 20.8 | 25.0 | 29.2 | 33.4 | 37.6 |
| 18000. | ISA+20°C | 16 | (1) 85.8 | 1900 | 283 | .61 | 390 | 12.6 | 15.2 | 17.9 | 20.5 | 23.1 | 25.8 | 28.4 |
| | -3°C | 14 | 83.3 | 1726 | 271 | .580 | 373 | 12.9 | 15.8 | 18.7 | 21.6 | 24.5 | 27.4 | 30.3 |
| | | 12 | 79.5 | 1500 | 252 | .540 | 347 | 13.1 | 16.5 | 19.8 | 23.1 | 26.5 | 29.8 | 33.2 |
| | | 10 | 76.8 | 1355 | 237 | .510 | 328 | 13.1 | 16.8 | 20.5 | 24.2 | 27.9 | 31.6 | 35.3 |
| | | 9 | (2) 74.3 | 1229 | 222 | .48 | 308 | 12.9 | 16.9 | 21.0 | 25.1 | 29.1 | 33.2 | 37.3 |
| | ISA+10°C | 7 | (1) 87.7 | 2149 | 302 | .65 | 407 | 12.0 | 14.3 | 16.6 | 18.9 | 21.3 | 23.6 | 25.9 |
| | -13°C | 5 | 84.6 | 1880 | 285 | .610 | 385 | 12.5 | 15.1 | 17.8 | 20.5 | 23.1 | 25.8 | 28.4 |
| | | 2 | 80.0 | 1566 | 261 | .560 | 353 | 13.0 | 16.2 | 19.4 | 22.6 | 25.8 | 28.9 | 32.1 |
| | | 0 | 76.3 | 1369 | 242 | .520 | 328 | 13.0 | 16.7 | 20.3 | 24.0 | 27.6 | 31.3 | 34.9 |
| | | -2 | (2) 73.0 | 1202 | 223 | .48 | 303 | 12.7 | 16.9 | 21.0 | 25.2 | 29.4 | 33.5 | 37.7 |
| | ISA+ 0°C | -3 | (1) 86.6 | 2142 | 305 | .65 | 402 | 11.8 | 14.1 | 16.4 | 18.8 | 21.1 | 23.4 | 25.8 |
| | -23°C | -6 | 83.1 | 1833 | 285 | .610 | 377 | 12.4 | 15.1 | 17.9 | 20.6 | 23.3 | 26.0 | 28.8 |
| | | -8 | 79.4 | 1581 | 266 | .570 | 353 | 12.8 | 16.0 | 19.1 | 22.3 | 25.5 | 28.6 | 31.8 |
| | | -10 | 74.9 | 1334 | 242 | .520 | 322 | 12.9 | 16.6 | 20.4 | 24.1 | 27.9 | 31.6 | 35.4 |
| | | -12 | (2) 71.7 | 1173 | 223 | .48 | 297 | 12.6 | 16.8 | 21.1 | 25.3 | 29.6 | 33.9 | 38.1 |
| | ISA-10°C | -14 | (1) 84.9 | 2086 | 305 | .65 | 394 | 11.7 | 14.1 | 16.5 | 18.9 | 21.3 | 23.7 | 26.1 |
| | -33°C | -16 | 81.5 | 1786 | 285 | .610 | 370 | 12.3 | 15.1 | 17.9 | 20.7 | 23.5 | 26.3 | 29.1 |
| | | -18 | 77.9 | 1539 | 266 | .570 | 346 | 12.7 | 16.0 | 19.2 | 22.4 | 25.7 | 28.9 | 32.2 |
| | | -21 | 73.5 | 1298 | 242 | .520 | 315 | 12.7 | 16.6 | 20.4 | 24.3 | 28.1 | 32.0 | 35.8 |
| | | -22 | (2) 70.3 | 1143 | 223 | .48 | 291 | 12.4 | 16.7 | 21.1 | 25.5 | 29.9 | 34.2 | 38.6 |
| 17000. | ISA+20°C | 16 | (1) 85.8 | 1899 | 284 | .61 | 391 | 12.7 | 15.3 | 17.9 | 20.6 | 23.2 | 25.8 | 28.5 |
| | -3°C | 13 | 82.2 | 1649 | 266 | .570 | 366 | 13.1 | 16.2 | 19.2 | 22.2 | 25.2 | 28.3 | 31.3 |
| | | 12 | 79.3 | 1487 | 252 | .540 | 347 | 13.3 | 16.6 | 20.0 | 23.3 | 26.7 | 30.1 | 33.4 |
| | | 10 | 75.6 | 1295 | 232 | .500 | 322 | 13.3 | 17.1 | 21.0 | 24.8 | 28.7 | 32.6 | 36.4 |
| | | 8 | (2) 73.0 | 1170 | 216 | .46 | 299 | 12.8 | 17.0 | 21.3 | 25.6 | 29.9 | 34.1 | 38.4 |
| | ISA+10°C | 7 | (1) 87.6 | 2147 | 303 | .65 | 408 | 12.0 | 14.3 | 16.7 | 19.0 | 21.3 | 23.6 | 26.0 |
| | -13°C | 5 | 83.5 | 1803 | 280 | .600 | 378 | 12.7 | 15.4 | 18.2 | 21.0 | 23.8 | 26.5 | 29.3 |
| | | 2 | 79.8 | 1554 | 261 | .560 | 353 | 13.1 | 16.3 | 19.5 | 22.7 | 25.9 | 29.2 | 32.4 |
| | | 0 | 75.1 | 1307 | 237 | .510 | 322 | 13.1 | 17.0 | 20.8 | 24.6 | 28.4 | 32.3 | 36.1 |
| | | -2 | (2) 71.8 | 1142 | 216 | .47 | 294 | 12.6 | 17.0 | 21.3 | 25.7 | 30.1 | 34.5 | 38.8 |
| | ISA+ 0°C | -3 | (1) 86.4 | 2132 | 305 | .65 | 402 | 11.8 | 14.2 | 16.5 | 18.9 | 21.2 | 23.6 | 25.9 |
| | -23°C | -6 | 82.9 | 1822 | 285 | .610 | 377 | 12.5 | 15.2 | 18.0 | 20.7 | 23.4 | 26.2 | 28.9 |
| | | -8 | 78.3 | 1514 | 261 | .560 | 346 | 13.0 | 16.3 | 19.6 | 22.9 | 26.2 | 29.5 | 32.8 |
| | | -11 | 73.7 | 1274 | 237 | .510 | 316 | 13.0 | 16.9 | 20.8 | 24.8 | 28.7 | 32.6 | 36.5 |
| | | -13 | (2) 70.5 | 1116 | 217 | .47 | 289 | 12.4 | 16.9 | 21.4 | 25.9 | 30.3 | 34.8 | 39.3 |
| | ISA-10°C | -14 | (1) 84.8 | 2077 | 305 | .65 | 394 | 11.8 | 14.2 | 16.6 | 19.0 | 21.4 | 23.8 | 26.2 |
| | -33°C | -16 | 81.3 | 1775 | 285 | .610 | 370 | 12.4 | 15.2 | 18.0 | 20.8 | 23.6 | 26.5 | 29.3 |
| | | -19 | 76.8 | 1473 | 261 | .560 | 339 | 12.9 | 16.3 | 19.6 | 23.0 | 26.4 | 29.8 | 33.2 |
| | | -21 | 72.3 | 1241 | 237 | .510 | 309 | 12.8 | 16.9 | 20.9 | 24.9 | 29.0 | 33.0 | 37.0 |
| | | -23 | (2) 69.1 | 1087 | 216 | .47 | 283 | 12.2 | 16.8 | 21.4 | 26.0 | 30.6 | 35.2 | 39.8 |

Figure 7-14 (Sheet 9)

# CRUISE
# 19,000 FEET

**ANTI-ICE SYSTEMS OFF** | **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | 16 | (1) | 85.8 | 1904 | 285 | .61 | 392 | 12.7 | 15.3 | 17.9 | 20.6 | 23.2 | 25.8 | 28.4 |
| | -3°C | 13 | | 82.1 | 1644 | 266 | .570 | 366 | 13.2 | 16.2 | 19.3 | 22.3 | 25.3 | 28.4 | 31.4 |
| | | 12 | | 79.1 | 1481 | 252 | .540 | 347 | 13.3 | 16.7 | 20.1 | 23.4 | 26.8 | 30.2 | 33.6 |
| | | 10 | | 75.4 | 1288 | 232 | .500 | 322 | 13.3 | 17.2 | 21.1 | 25.0 | 28.9 | 32.7 | 36.6 |
| | | 8 | (2) | 72.4 | 1140 | 213 | .46 | 295 | 12.7 | 17.1 | 21.5 | 25.9 | 30.2 | 34.6 | 39.0 |
| | ISA+10°C | 7 | (1) | 87.6 | 2147 | 303 | .65 | 408 | 12.0 | 14.3 | 16.7 | 19.0 | 21.3 | 23.7 | 26.0 |
| | -13°C | 5 | | 83.4 | 1797 | 280 | .600 | 378 | 12.7 | 15.5 | 18.3 | 21.1 | 23.8 | 26.6 | 29.4 |
| | | 2 | | 78.7 | 1496 | 256 | .550 | 347 | 13.2 | 16.5 | 19.9 | 23.2 | 26.5 | 29.9 | 33.2 |
| | | 0 | | 75.0 | 1301 | 237 | .510 | 322 | 13.2 | 17.1 | 20.9 | 24.7 | 28.6 | 32.4 | 36.3 |
| | | -3 | (2) | 71.1 | 1114 | 213 | .46 | 289 | 12.5 | 17.0 | 21.5 | 26.0 | 30.5 | 35.0 | 39.5 |
| | ISA+ 0°C | -3 | (1) | 86.4 | 2126 | 305 | .65 | 402 | 11.9 | 14.2 | 16.6 | 18.9 | 21.3 | 23.6 | 26.0 |
| | -23°C | -6 | | 81.9 | 1752 | 280 | .600 | 371 | 12.6 | 15.5 | 18.3 | 21.2 | 24.0 | 26.9 | 29.7 |
| | | -8 | | 78.2 | 1509 | 261 | .560 | 346 | 13.0 | 16.3 | 19.6 | 23.0 | 26.3 | 29.6 | 32.9 |
| | | -11 | | 73.6 | 1267 | 237 | .510 | 316 | 13.1 | 17.0 | 21.0 | 24.9 | 28.8 | 32.8 | 36.7 |
| | | -13 | (2) | 69.9 | 1088 | 213 | .46 | 284 | 12.4 | 16.9 | 21.5 | 26.1 | 30.7 | 35.3 | 39.9 |
| | ISA-10°C | -14 | (1) | 84.7 | 2072 | 305 | .65 | 394 | 11.8 | 14.2 | 16.6 | 19.0 | 21.4 | 23.8 | 26.3 |
| | -33°C | -17 | | 80.3 | 1706 | 280 | .600 | 364 | 12.5 | 15.5 | 18.4 | 21.3 | 24.2 | 27.2 | 30.1 |
| | | -19 | | 76.7 | 1468 | 261 | .560 | 339 | 12.9 | 16.3 | 19.7 | 23.1 | 26.5 | 29.9 | 33.3 |
| | | -21 | | 72.1 | 1234 | 237 | .510 | 309 | 12.9 | 17.0 | 21.0 | 25.1 | 29.1 | 33.2 | 37.2 |
| | | -23 | (2) | 68.5 | 1061 | 213 | .46 | 279 | 12.1 | 16.9 | 21.6 | 26.3 | 31.0 | 35.7 | 40.4 |
| 16000. | ISA+20°C | 16 | (1) | 85.8 | 1903 | 285 | .61 | 392 | 12.7 | 15.3 | 18.0 | 20.6 | 23.2 | 25.9 | 28.5 |
| | -3°C | 13 | | 81.9 | 1638 | 266 | .570 | 366 | 13.2 | 16.3 | 19.3 | 22.4 | 25.4 | 28.5 | 31.5 |
| | | 11 | | 78.1 | 1425 | 247 | .530 | 341 | 13.4 | 16.9 | 20.4 | 23.9 | 27.4 | 30.9 | 34.5 |
| | | 10 | | 75.2 | 1280 | 232 | .500 | 322 | 13.4 | 17.3 | 21.2 | 25.1 | 29.0 | 32.9 | 36.8 |
| | | 8 | (2) | 71.9 | 1122 | 211 | .45 | 292 | 12.7 | 17.2 | 21.6 | 26.1 | 30.5 | 35.0 | 39.4 |
| | ISA+10°C | 7 | (1) | 87.6 | 2150 | 304 | .65 | 409 | 12.0 | 14.3 | 16.7 | 19.0 | 21.3 | 23.6 | 26.0 |
| | -13°C | 5 | | 83.4 | 1792 | 280 | .600 | 378 | 12.8 | 15.5 | 18.3 | 21.1 | 23.9 | 26.7 | 29.5 |
| | | 2 | | 78.6 | 1490 | 256 | .550 | 347 | 13.2 | 16.6 | 19.9 | 23.3 | 26.6 | 30.0 | 33.4 |
| | | -1 | | 73.9 | 1249 | 232 | .500 | 316 | 13.3 | 17.3 | 21.3 | 25.3 | 29.3 | 33.3 | 37.3 |
| | | -3 | (2) | 70.6 | 1092 | 211 | .45 | 287 | 12.5 | 17.1 | 21.7 | 26.2 | 30.8 | 35.4 | 40.0 |
| | ISA+ 0°C | -3 | (1) | 86.3 | 2121 | 305 | .65 | 402 | 11.9 | 14.2 | 16.6 | 19.0 | 21.3 | 23.7 | 26.0 |
| | -23°C | -6 | | 81.8 | 1747 | 280 | .600 | 371 | 12.7 | 15.5 | 18.4 | 21.2 | 24.1 | 27.0 | 29.8 |
| | | -9 | | 77.2 | 1452 | 256 | .550 | 340 | 13.1 | 16.5 | 20.0 | 23.4 | 26.9 | 30.3 | 33.8 |
| | | -11 | | 72.5 | 1218 | 232 | .500 | 309 | 13.1 | 17.2 | 21.3 | 25.4 | 29.5 | 33.6 | 37.7 |
| | | -13 | (2) | 69.2 | 1063 | 210 | .45 | 281 | 12.3 | 17.0 | 21.7 | 26.4 | 31.1 | 35.8 | 40.5 |
| | ISA-10°C | -14 | (1) | 84.7 | 2067 | 305 | .65 | 394 | 11.8 | 14.2 | 16.6 | 19.1 | 21.5 | 23.9 | 26.3 |
| | -33°C | -17 | | 80.3 | 1701 | 280 | .600 | 364 | 12.6 | 15.5 | 18.4 | 21.4 | 24.3 | 27.3 | 30.2 |
| | | -19 | | 75.7 | 1414 | 256 | .550 | 333 | 13.0 | 16.5 | 20.0 | 23.6 | 27.1 | 30.7 | 34.2 |
| | | -22 | | 71.1 | 1186 | 232 | .500 | 303 | 12.9 | 17.1 | 21.4 | 25.6 | 29.8 | 34.0 | 38.2 |
| | | -24 | (2) | 67.9 | 1035 | 210 | .45 | 275 | 12.0 | 16.9 | 21.7 | 26.5 | 31.4 | 36.2 | 41.0 |
| 14000. | ISA+20°C | 16 | (1) | 85.7 | 1899 | 286 | .61 | 393 | 12.8 | 15.4 | 18.1 | 20.7 | 23.3 | 26.0 | 28.6 |
| | -3°C | 13 | | 81.6 | 1618 | 266 | .570 | 366 | 13.4 | 16.5 | 19.6 | 22.6 | 25.7 | 28.8 | 31.9 |
| | | 11 | | 77.6 | 1401 | 247 | .530 | 341 | 13.6 | 17.2 | 20.8 | 24.3 | 27.9 | 31.5 | 35.0 |
| | | 9 | | 73.8 | 1207 | 228 | .490 | 315 | 13.7 | 17.8 | 22.0 | 26.1 | 30.2 | 34.4 | 38.5 |
| | | 7 | (2) | 70.0 | 1050 | 205 | .44 | 284 | 12.8 | 17.6 | 22.3 | 27.1 | 31.8 | 36.6 | 41.3 |
| | ISA+10°C | 7 | (1) | 87.6 | 2151 | 305 | .65 | 410 | 12.1 | 14.4 | 16.7 | 19.1 | 21.4 | 23.7 | 26.0 |
| | -13°C | 5 | | 83.0 | 1772 | 280 | .600 | 378 | 12.9 | 15.7 | 18.5 | 21.4 | 24.2 | 27.0 | 29.8 |
| | | 2 | | 78.2 | 1470 | 256 | .550 | 347 | 13.4 | 16.8 | 20.2 | 23.6 | 27.0 | 30.4 | 33.8 |
| | | -1 | | 73.4 | 1223 | 232 | .500 | 316 | 13.5 | 17.6 | 21.7 | 25.8 | 29.9 | 34.0 | 38.1 |
| | | -3 | (2) | 68.7 | 1023 | 205 | .44 | 279 | 12.6 | 17.5 | 22.3 | 27.2 | 32.1 | 37.0 | 41.9 |
| | ISA+ 0°C | -3 | (1) | 86.1 | 2101 | 305 | .65 | 402 | 12.0 | 14.4 | 16.8 | 19.1 | 21.5 | 23.9 | 26.3 |
| | -23°C | -6 | | 81.5 | 1727 | 280 | .600 | 371 | 12.8 | 15.7 | 18.6 | 21.5 | 24.4 | 27.3 | 30.2 |
| | | -9 | | 76.7 | 1432 | 256 | .550 | 340 | 13.3 | 16.8 | 20.3 | 23.8 | 27.2 | 30.7 | 34.2 |
| | | -11 | | 72.0 | 1192 | 232 | .500 | 309 | 13.4 | 17.6 | 21.8 | 26.0 | 30.2 | 34.3 | 38.5 |
| | | -14 | (2) | 67.4 | 997 | 204 | .44 | 273 | 12.3 | 17.4 | 22.4 | 27.4 | 32.4 | 37.4 | 42.4 |
| | ISA-10°C | -14 | (1) | 84.5 | 2048 | 305 | .65 | 394 | 11.9 | 14.4 | 16.8 | 19.2 | 21.7 | 24.1 | 26.6 |
| | -33°C | -17 | | 80.0 | 1682 | 280 | .600 | 364 | 12.7 | 15.7 | 18.6 | 21.6 | 24.6 | 27.6 | 30.5 |
| | | -19 | | 75.3 | 1394 | 256 | .550 | 333 | 13.2 | 16.7 | 20.3 | 23.9 | 27.5 | 31.1 | 34.7 |
| | | -22 | | 69.7 | 1119 | 228 | .490 | 297 | 13.2 | 17.6 | 22.1 | 26.6 | 31.0 | 35.5 | 40.0 |
| | | -24 | (2) | 66.0 | 970 | 204 | .44 | 267 | 12.1 | 17.2 | 22.4 | 27.5 | 32.7 | 37.9 | 43.0 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -13°C | -23°C | -33°C |
| 85.1 | 86.4 | 84.8 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 10)

# CRUISE
# 21,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | 12 | [1] | 86.5 | 1830 | 276 | .61 | 391 | 13.2 | 15.9 | 18.7 | 21.4 | 24.1 | 26.8 | 29.6 |
| | -7°C | 10 | | 84.5 | 1689 | 265 | .590 | 376 | 13.4 | 16.4 | 19.3 | 22.3 | 25.3 | 28.2 | 31.2 |
| | | 9 | | 81.8 | 1520 | 251 | .560 | 357 | 13.6 | 16.9 | 20.2 | 23.5 | 26.8 | 30.1 | 33.4 |
| | | 7 | | 79.2 | 1381 | 237 | .530 | 338 | 13.6 | 17.3 | 20.9 | 24.5 | 28.1 | 31.7 | 35.4 |
| | | 6 | [2] | 76.7 | 1259 | 223 | .50 | 319 | 13.5 | 17.4 | 21.4 | 25.4 | 29.3 | 33.3 | 37.3 |
| | ISA+10°C | 3 | [1] | 88.1 | 2051 | 293 | .65 | 407 | 12.5 | 15.0 | 17.4 | 19.8 | 22.3 | 24.7 | 27.2 |
| | -17°C | 1 | | 84.7 | 1765 | 274 | .610 | 382 | 13.1 | 16.0 | 18.8 | 21.6 | 24.5 | 27.3 | 30.1 |
| | | -1 | | 82.1 | 1590 | 260 | .580 | 363 | 13.4 | 16.6 | 19.7 | 22.8 | 26.0 | 29.1 | 32.3 |
| | | -3 | | 78.6 | 1388 | 242 | .540 | 338 | 13.6 | 17.2 | 20.8 | 24.4 | 28.0 | 31.6 | 35.2 |
| | | -5 | [2] | 75.3 | 1228 | 223 | .50 | 313 | 13.3 | 17.4 | 21.4 | 25.5 | 29.6 | 33.7 | 37.7 |
| | ISA+ 0°C | -6 | [1] | 88.7 | 2199 | 305 | .68 | 414 | 12.0 | 14.3 | 16.6 | 18.8 | 21.1 | 23.4 | 25.7 |
| | -27°C | -9 | | 84.7 | 1850 | 284 | .630 | 387 | 12.8 | 15.5 | 18.2 | 20.9 | 23.6 | 26.3 | 29.0 |
| | | -11 | | 81.4 | 1605 | 265 | .590 | 362 | 13.2 | 16.3 | 19.4 | 22.6 | 25.7 | 28.8 | 31.9 |
| | | -13 | | 78.0 | 1397 | 246 | .550 | 338 | 13.4 | 17.0 | 20.6 | 24.2 | 27.8 | 31.3 | 34.9 |
| | | -15 | [2] | 73.9 | 1196 | 223 | .50 | 307 | 13.1 | 17.3 | 21.5 | 25.7 | 29.9 | 34.1 | 38.2 |
| | ISA-10°C | -17 | [1] | 87.1 | 2142 | 305 | .68 | 406 | 11.9 | 14.3 | 16.6 | 18.9 | 21.3 | 23.6 | 26.0 |
| | -37°C | -19 | | 83.1 | 1801 | 284 | .630 | 379 | 12.7 | 15.5 | 18.2 | 21.0 | 23.8 | 26.6 | 29.3 |
| | | -22 | | 79.8 | 1563 | 265 | .590 | 355 | 13.1 | 16.3 | 19.5 | 22.7 | 25.9 | 29.1 | 32.3 |
| | | -24 | | 76.5 | 1360 | 246 | .550 | 331 | 13.3 | 17.0 | 20.6 | 24.3 | 28.0 | 31.7 | 35.4 |
| | | -26 | [2] | 72.5 | 1165 | 223 | .50 | 301 | 13.0 | 17.3 | 21.5 | 25.8 | 30.1 | 34.4 | 38.7 |
| 19000. | ISA+20°C | 12 | [1] | 86.5 | 1831 | 277 | .62 | 393 | 13.3 | 16.0 | 18.7 | 21.5 | 24.2 | 26.9 | 29.6 |
| | -7°C | 10 | | 84.2 | 1674 | 265 | .590 | 376 | 13.5 | 16.5 | 19.5 | 22.5 | 25.5 | 28.5 | 31.5 |
| | | 9 | | 81.5 | 1504 | 251 | .560 | 357 | 13.8 | 17.1 | 20.4 | 23.8 | 27.1 | 30.4 | 33.7 |
| | | 7 | | 78.8 | 1365 | 237 | .530 | 338 | 13.8 | 17.5 | 21.1 | 24.8 | 28.5 | 32.1 | 35.8 |
| | | 5 | [2] | 76.0 | 1229 | 222 | .50 | 317 | 13.6 | 17.7 | 21.8 | 25.8 | 29.9 | 34.0 | 38.0 |
| | ISA+10°C | 3 | [1] | 88.0 | 2049 | 294 | .65 | 408 | 12.6 | 15.0 | 17.5 | 19.9 | 22.3 | 24.8 | 27.2 |
| | -17°C | 1 | | 84.5 | 1751 | 274 | .610 | 382 | 13.2 | 16.1 | 19.0 | 21.8 | 24.7 | 27.5 | 30.4 |
| | | -1 | | 81.8 | 1575 | 260 | .580 | 363 | 13.5 | 16.7 | 19.9 | 23.1 | 26.2 | 29.4 | 32.6 |
| | | -3 | | 78.3 | 1374 | 242 | .540 | 338 | 13.7 | 17.3 | 21.0 | 24.6 | 28.3 | 31.9 | 35.5 |
| | | -5 | [2] | 74.6 | 1197 | 222 | .50 | 311 | 13.5 | 17.6 | 21.8 | 26.0 | 30.2 | 34.3 | 38.5 |
| | ISA+ 0°C | -6 | [1] | 88.6 | 2188 | 305 | .68 | 414 | 12.1 | 14.4 | 16.6 | 18.9 | 21.2 | 23.5 | 25.8 |
| | -27°C | -9 | | 84.6 | 1837 | 284 | .630 | 387 | 12.9 | 15.6 | 18.3 | 21.0 | 23.8 | 26.5 | 29.2 |
| | | -11 | | 81.2 | 1591 | 265 | .590 | 362 | 13.3 | 16.5 | 19.6 | 22.8 | 25.9 | 29.0 | 32.2 |
| | | -13 | | 76.8 | 1338 | 242 | .540 | 331 | 13.6 | 17.3 | 21.0 | 24.8 | 28.5 | 32.3 | 36.0 |
| | | -15 | [2] | 73.2 | 1167 | 222 | .50 | 305 | 13.3 | 17.6 | 21.9 | 26.1 | 30.4 | 34.7 | 39.0 |
| | ISA-10°C | -17 | [1] | 86.9 | 2131 | 305 | .68 | 406 | 12.0 | 14.4 | 16.7 | 19.0 | 21.4 | 23.7 | 26.1 |
| | -37°C | -19 | | 82.9 | 1789 | 284 | .630 | 379 | 12.8 | 15.6 | 18.4 | 21.2 | 24.0 | 26.8 | 29.5 |
| | | -22 | | 79.6 | 1549 | 265 | .590 | 355 | 13.2 | 16.4 | 19.7 | 22.9 | 26.1 | 29.3 | 32.6 |
| | | -24 | | 75.3 | 1301 | 242 | .540 | 325 | 13.4 | 17.3 | 21.1 | 24.9 | 28.8 | 32.6 | 36.5 |
| | | -26 | [2] | 71.8 | 1137 | 222 | .50 | 299 | 13.1 | 17.5 | 21.9 | 26.3 | 30.7 | 35.1 | 39.5 |
| 18000. | ISA+20°C | 12 | [1] | 86.4 | 1829 | 278 | .62 | 394 | 13.3 | 16.1 | 18.8 | 21.5 | 24.3 | 27.0 | 29.7 |
| | -7°C | 10 | | 84.0 | 1660 | 265 | .590 | 376 | 13.6 | 16.7 | 19.7 | 22.7 | 25.7 | 28.7 | 31.7 |
| | | 9 | | 81.2 | 1489 | 251 | .560 | 357 | 13.9 | 17.3 | 20.6 | 24.0 | 27.4 | 30.7 | 34.1 |
| | | 7 | | 78.5 | 1350 | 237 | .530 | 338 | 14.0 | 17.7 | 21.4 | 25.1 | 28.8 | 32.5 | 36.2 |
| | | 5 | [2] | 75.3 | 1195 | 220 | .49 | 315 | 13.8 | 18.0 | 22.1 | 26.3 | 30.5 | 34.7 | 38.9 |
| | ISA+10°C | 3 | [1] | 88.0 | 2051 | 295 | .65 | 409 | 12.6 | 15.1 | 17.5 | 19.9 | 22.4 | 24.8 | 27.2 |
| | -17°C | 1 | | 85.1 | 1802 | 279 | .620 | 388 | 13.2 | 16.0 | 18.8 | 21.5 | 24.3 | 27.1 | 29.9 |
| | | -1 | | 80.7 | 1504 | 256 | .570 | 357 | 13.8 | 17.1 | 20.4 | 23.7 | 27.0 | 30.4 | 33.7 |
| | | -3 | | 77.1 | 1316 | 237 | .530 | 332 | 13.8 | 17.6 | 21.4 | 25.2 | 29.0 | 32.8 | 36.6 |
| | | -5 | [2] | 73.9 | 1165 | 220 | .49 | 308 | 13.6 | 17.9 | 22.2 | 26.5 | 30.8 | 35.1 | 39.4 |
| | ISA+ 0°C | -6 | [1] | 88.5 | 2177 | 305 | .68 | 414 | 12.1 | 14.4 | 16.7 | 19.0 | 21.3 | 23.6 | 25.9 |
| | -27°C | -9 | | 84.4 | 1825 | 284 | .630 | 387 | 13.0 | 15.7 | 18.4 | 21.2 | 23.9 | 26.7 | 29.4 |
| | | -11 | | 80.9 | 1578 | 265 | .590 | 362 | 13.4 | 16.6 | 19.8 | 22.9 | 26.1 | 29.3 | 32.5 |
| | | -13 | | 76.5 | 1324 | 242 | .540 | 331 | 13.7 | 17.5 | 21.3 | 25.0 | 28.8 | 32.6 | 36.4 |
| | | -16 | [2] | 72.5 | 1135 | 220 | .49 | 303 | 13.4 | 17.8 | 22.2 | 26.7 | 31.1 | 35.5 | 39.9 |
| | ISA-10°C | -17 | [1] | 86.8 | 2120 | 305 | .68 | 406 | 12.1 | 14.4 | 16.8 | 19.1 | 21.5 | 23.9 | 26.2 |
| | -37°C | -19 | | 82.8 | 1777 | 284 | .630 | 379 | 12.9 | 15.7 | 18.5 | 21.3 | 24.1 | 26.9 | 29.7 |
| | | -22 | | 79.4 | 1536 | 265 | .590 | 355 | 13.3 | 16.6 | 19.8 | 23.1 | 26.3 | 29.6 | 32.8 |
| | | -24 | | 75.0 | 1288 | 242 | .540 | 325 | 13.6 | 17.4 | 21.3 | 25.2 | 29.1 | 33.0 | 36.9 |
| | | -26 | [2] | 71.1 | 1108 | 220 | .49 | 297 | 13.2 | 17.8 | 22.3 | 26.8 | 31.3 | 35.8 | 40.3 |
| 17000. | ISA+20°C | 12 | [1] | 86.4 | 1827 | 278 | .62 | 395 | 13.4 | 16.1 | 18.9 | 21.6 | 24.4 | 27.1 | 29.8 |
| | -7°C | 10 | | 83.8 | 1646 | 265 | .590 | 376 | 13.8 | 16.8 | 19.8 | 22.9 | 25.9 | 28.9 | 32.0 |
| | | 8 | | 80.0 | 1428 | 246 | .550 | 351 | 14.1 | 17.6 | 21.1 | 24.6 | 28.1 | 31.6 | 35.1 |
| | | 7 | | 77.3 | 1292 | 232 | .520 | 332 | 14.1 | 18.0 | 21.8 | 25.7 | 29.6 | 33.4 | 37.3 |
| | | 5 | [2] | 74.4 | 1157 | 217 | .49 | 311 | 13.9 | 18.2 | 22.5 | 26.9 | 31.2 | 35.5 | 39.8 |
| | ISA+10°C | 3 | [1] | 88.0 | 2047 | 295 | .65 | 409 | 12.7 | 15.1 | 17.6 | 20.0 | 22.4 | 24.9 | 27.3 |
| | -17°C | 1 | | 84.1 | 1725 | 274 | .610 | 382 | 13.4 | 16.3 | 19.2 | 22.1 | 25.0 | 27.9 | 30.8 |
| | | -1 | | 80.4 | 1490 | 256 | .570 | 357 | 13.9 | 17.2 | 20.6 | 23.9 | 27.3 | 30.7 | 34.0 |
| | | -3 | | 76.8 | 1302 | 237 | .530 | 332 | 14.0 | 17.8 | 21.7 | 25.5 | 29.3 | 33.2 | 37.0 |
| | | -5 | [2] | 73.1 | 1129 | 217 | .49 | 305 | 13.7 | 18.2 | 22.6 | 27.0 | 31.5 | 35.9 | 40.3 |
| | ISA+ 0°C | -6 | [1] | 88.3 | 2167 | 305 | .68 | 414 | 12.2 | 14.5 | 16.8 | 19.1 | 21.4 | 23.7 | 26.0 |
| | -27°C | -9 | | 84.2 | 1813 | 284 | .630 | 387 | 13.0 | 15.8 | 18.6 | 21.3 | 24.1 | 26.8 | 29.6 |
| | | -11 | | 79.8 | 1508 | 260 | .580 | 356 | 13.7 | 17.0 | 20.3 | 23.6 | 26.9 | 30.2 | 33.5 |
| | | -13 | | 76.2 | 1311 | 242 | .540 | 331 | 13.8 | 17.7 | 21.5 | 25.3 | 29.1 | 32.9 | 36.7 |
| | | -16 | [2] | 71.7 | 1102 | 218 | .49 | 300 | 13.6 | 18.1 | 22.6 | 27.2 | 31.7 | 36.3 | 40.8 |
| | ISA-10°C | -17 | [1] | 86.6 | 2110 | 305 | .68 | 406 | 12.1 | 14.5 | 16.9 | 19.2 | 21.6 | 24.0 | 26.3 |
| | -37°C | -19 | | 82.6 | 1766 | 284 | .630 | 379 | 12.9 | 15.8 | 18.6 | 21.4 | 24.3 | 27.1 | 29.9 |
| | | -22 | | 78.3 | 1469 | 260 | .580 | 349 | 13.5 | 16.9 | 20.3 | 23.7 | 27.1 | 30.5 | 33.9 |
| | | -24 | | 74.7 | 1275 | 242 | .540 | 325 | 13.7 | 17.6 | 21.5 | 25.5 | 29.4 | 33.3 | 37.2 |
| | | -26 | [2] | 70.3 | 1074 | 218 | .49 | 294 | 13.4 | 18.0 | 22.7 | 27.3 | 32.0 | 36.6 | 41.3 |

Figure 7-14 (Sheet 11)

# CRUISE
# 21,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | 12 | (1) 86.4 | 1824 | 279 | .62 | 395 | 13.4 | 16.2 | 18.9 | 21.7 | 24.4 | 27.1 | 29.9 |
| | -7°C | 10 | 83.7 | 1640 | 265 | .590 | 376 | 13.8 | 16.9 | 19.9 | 23.0 | 26.0 | 29.1 | 32.1 |
| | | 8 | 79.9 | 1422 | 246 | .550 | 351 | 14.1 | 17.7 | 21.2 | 24.7 | 28.2 | 31.7 | 35.2 |
| | | 7 | 77.1 | 1285 | 232 | .520 | 332 | 14.2 | 18.1 | 21.9 | 25.8 | 29.7 | 33.6 | 37.5 |
| | | 5 | (2) 73.7 | 1128 | 214 | .48 | 306 | 13.8 | 18.3 | 22.7 | 27.2 | 31.6 | 36.0 | 40.5 |
| | ISA+10°C | 4 | (1) 88.0 | 2050 | 295 | .66 | 410 | 12.7 | 15.1 | 17.6 | 20.0 | 22.4 | 24.9 | 27.3 |
| | -17°C | 1 | 84.0 | 1719 | 274 | .610 | 382 | 13.5 | 16.4 | 19.3 | 22.2 | 25.1 | 28.0 | 30.9 |
| | | -1 | 80.3 | 1484 | 256 | .570 | 357 | 13.9 | 17.3 | 20.7 | 24.0 | 27.4 | 30.8 | 34.2 |
| | | -4 | 75.7 | 1253 | 232 | .520 | 326 | 14.0 | 18.0 | 22.0 | 26.0 | 30.0 | 34.0 | 38.0 |
| | | -6 | (2) 72.4 | 1098 | 214 | .48 | 300 | 13.7 | 18.2 | 22.8 | 27.3 | 31.9 | 36.4 | 41.0 |
| | ISA+ 0°C | -6 | (1) 88.3 | 2162 | 305 | .68 | 414 | 12.2 | 14.5 | 16.8 | 19.2 | 21.5 | 23.8 | 26.1 |
| | -27°C | -9 | 84.2 | 1808 | 284 | .630 | 387 | 13.1 | 15.8 | 18.6 | 21.4 | 24.1 | 26.9 | 29.7 |
| | | -11 | 79.7 | 1502 | 260 | .580 | 356 | 13.7 | 17.0 | 20.4 | 23.7 | 27.0 | 30.4 | 33.7 |
| | | -14 | 75.2 | 1262 | 237 | .530 | 325 | 13.9 | 17.9 | 21.8 | 25.8 | 29.8 | 33.7 | 37.7 |
| | | -16 | (2) 71.1 | 1074 | 214 | .48 | 295 | 13.5 | 18.2 | 22.8 | 27.5 | 32.1 | 36.8 | 41.4 |
| | ISA-10°C | -17 | (1) 86.6 | 2105 | 305 | .68 | 406 | 12.1 | 14.5 | 16.9 | 19.3 | 21.6 | 24.0 | 26.4 |
| | -37°C | -19 | 82.5 | 1761 | 284 | .630 | 379 | 13.0 | 15.8 | 18.7 | 21.5 | 24.3 | 27.2 | 30.0 |
| | | -22 | 78.2 | 1463 | 260 | .580 | 349 | 13.6 | 17.0 | 20.4 | 23.8 | 27.3 | 30.7 | 34.1 |
| | | -24 | 73.7 | 1228 | 237 | .530 | 319 | 13.7 | 17.8 | 21.9 | 26.0 | 30.0 | 34.1 | 38.2 |
| | | -27 | (2) 69.7 | 1046 | 214 | .48 | 289 | 13.3 | 18.1 | 22.8 | 27.6 | 32.4 | 37.2 | 42.0 |
| 16000. | ISA+20°C | 12 | (1) 86.4 | 1830 | 279 | .62 | 396 | 13.5 | 16.2 | 18.9 | 21.7 | 24.4 | 27.1 | 29.9 |
| | -7°C | 10 | 83.5 | 1634 | 265 | .590 | 376 | 13.9 | 16.9 | 20.0 | 23.0 | 26.1 | 29.2 | 32.2 |
| | | 8 | 79.8 | 1415 | 246 | .550 | 351 | 14.2 | 17.7 | 21.3 | 24.8 | 28.3 | 31.9 | 35.4 |
| | | 6 | 76.0 | 1234 | 228 | .510 | 326 | 14.2 | 18.3 | 22.3 | 26.4 | 30.4 | 34.5 | 38.5 |
| | | 4 | (2) 73.1 | 1098 | 210 | .47 | 301 | 13.8 | 18.3 | 22.9 | 27.4 | 32.0 | 36.5 | 41.1 |
| | ISA+10°C | 4 | (1) 88.0 | 2051 | 296 | .66 | 411 | 12.7 | 15.1 | 17.6 | 20.0 | 22.5 | 24.9 | 27.3 |
| | -17°C | 1 | 83.9 | 1714 | 274 | .610 | 382 | 13.5 | 16.4 | 19.4 | 22.3 | 25.2 | 28.1 | 31.0 |
| | | -1 | 80.2 | 1478 | 256 | .570 | 357 | 14.0 | 17.4 | 20.8 | 24.1 | 27.5 | 30.9 | 34.3 |
| | | -4 | 75.6 | 1246 | 232 | .520 | 326 | 14.1 | 18.1 | 22.1 | 26.1 | 30.1 | 34.2 | 38.2 |
| | | -6 | (2) 71.8 | 1071 | 210 | .47 | 296 | 13.6 | 18.3 | 22.9 | 27.6 | 32.3 | 36.9 | 41.6 |
| | ISA+ 0°C | -6 | (1) 88.2 | 2157 | 305 | .68 | 414 | 12.3 | 14.6 | 16.9 | 19.2 | 21.5 | 23.8 | 26.2 |
| | -27°C | -9 | 84.1 | 1803 | 284 | .630 | 387 | 13.1 | 15.9 | 18.7 | 21.4 | 24.2 | 27.0 | 29.8 |
| | | -11 | 79.6 | 1496 | 260 | .580 | 356 | 13.8 | 17.1 | 20.4 | 23.8 | 27.1 | 30.5 | 33.8 |
| | | -14 | 75.0 | 1255 | 237 | .530 | 325 | 14.0 | 18.0 | 21.9 | 25.9 | 29.9 | 33.9 | 37.9 |
| | | -16 | (2) 70.5 | 1048 | 211 | .47 | 291 | 13.4 | 18.2 | 23.0 | 27.8 | 32.5 | 37.3 | 42.1 |
| | ISA-10°C | -17 | (1) 86.5 | 2101 | 305 | .68 | 406 | 12.2 | 14.6 | 16.9 | 19.3 | 21.7 | 24.1 | 26.5 |
| | -37°C | -19 | 82.5 | 1756 | 284 | .630 | 379 | 13.0 | 15.9 | 18.7 | 21.6 | 24.4 | 27.3 | 30.1 |
| | | -22 | 78.1 | 1457 | 260 | .580 | 349 | 13.6 | 17.1 | 20.5 | 23.9 | 27.4 | 30.8 | 34.2 |
| | | -24 | 73.6 | 1222 | 237 | .530 | 319 | 13.8 | 17.9 | 22.0 | 26.1 | 30.2 | 34.3 | 38.4 |
| | | -27 | (2) 69.1 | 1020 | 211 | .47 | 285 | 13.2 | 18.1 | 23.0 | 27.9 | 32.8 | 37.7 | 42.6 |
| 14000. | ISA+20°C | 12 | (1) 86.3 | 1822 | 280 | .62 | 397 | 13.6 | 16.3 | 19.1 | 21.8 | 24.6 | 27.3 | 30.0 |
| | -7°C | 10 | 82.2 | 1550 | 260 | .580 | 370 | 14.2 | 17.4 | 20.7 | 23.9 | 27.1 | 30.3 | 33.6 |
| | | 8 | 78.3 | 1344 | 242 | .540 | 345 | 14.5 | 18.2 | 21.9 | 25.7 | 29.4 | 33.1 | 36.8 |
| | | 5 | 73.6 | 1123 | 219 | .490 | 313 | 14.5 | 19.0 | 23.4 | 27.9 | 32.3 | 36.8 | 41.2 |
| | | 3 | (2) 70.6 | 1003 | 200 | .45 | 287 | 13.6 | 18.6 | 23.6 | 28.6 | 33.6 | 38.6 | 43.6 |
| | ISA+10°C | 4 | (1) 88.0 | 2051 | 297 | .66 | 412 | 12.8 | 15.2 | 17.7 | 20.1 | 22.5 | 25.0 | 27.4 |
| | -17°C | 1 | 83.6 | 1695 | 274 | .610 | 382 | 13.7 | 16.6 | 19.6 | 22.5 | 25.5 | 28.4 | 31.4 |
| | | -2 | 78.8 | 1406 | 251 | .560 | 351 | 14.3 | 17.8 | 21.4 | 24.9 | 28.5 | 32.0 | 35.6 |
| | | -5 | 73.1 | 1135 | 223 | .500 | 313 | 14.4 | 18.8 | 23.2 | 27.6 | 32.0 | 36.4 | 40.8 |
| | | -7 | (2) 69.4 | 979 | 200 | .45 | 282 | 13.5 | 18.6 | 23.7 | 28.8 | 33.9 | 39.0 | 44.1 |
| | ISA+ 0°C | -6 | (1) 88.0 | 2140 | 305 | .68 | 414 | 12.4 | 14.7 | 17.0 | 19.4 | 21.7 | 24.0 | 26.4 |
| | -27°C | -9 | 82.9 | 1714 | 279 | .620 | 380 | 13.4 | 16.4 | 19.3 | 22.2 | 25.1 | 28.0 | 30.9 |
| | | -12 | 77.3 | 1370 | 251 | .560 | 344 | 14.1 | 17.8 | 21.4 | 25.1 | 28.7 | 32.4 | 36.1 |
| | | -15 | 72.6 | 1146 | 228 | .510 | 313 | 14.2 | 18.6 | 23.0 | 27.3 | 31.7 | 36.0 | 40.4 |
| | | -18 | (2) 68.0 | 953 | 200 | .45 | 276 | 13.2 | 18.4 | 23.7 | 28.9 | 34.2 | 39.4 | 44.7 |
| | ISA-10°C | -17 | (1) 86.3 | 2084 | 305 | .68 | 406 | 12.3 | 14.7 | 17.1 | 19.5 | 21.9 | 24.3 | 26.7 |
| | -37°C | -20 | 81.3 | 1669 | 279 | .620 | 373 | 13.3 | 16.3 | 19.3 | 22.3 | 25.3 | 28.3 | 31.3 |
| | | -23 | 75.8 | 1332 | 251 | .560 | 337 | 14.0 | 17.8 | 21.5 | 25.3 | 29.0 | 32.8 | 36.5 |
| | | -25 | 71.2 | 1116 | 228 | .510 | 307 | 14.0 | 18.5 | 23.0 | 27.5 | 32.0 | 36.4 | 40.9 |
| | | -28 | (2) 66.7 | 927 | 200 | .45 | 270 | 12.9 | 18.3 | 23.7 | 29.1 | 34.5 | 39.9 | 45.3 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -17°C | -27°C | -37°C |
| 86.2 | 87.5 | 86.6 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 12)

# CRUISE
# 23,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | 8 | (1) 87.2 | 1760 | 269 | .62 | 395 | 13.9 | 16.8 | 19.6 | 22.4 | 25.3 | 28.1 | 31.0 |
| | -11°C | 7 | 85.3 | 1621 | 259 | .600 | 380 | 14.2 | 17.3 | 20.4 | 23.4 | 26.5 | 29.6 | 32.7 |
| | | 5 | 82.6 | 1466 | 245 | .570 | 361 | 14.4 | 17.8 | 21.2 | 24.6 | 28.0 | 31.5 | 34.9 |
| | | 3 | 80.1 | 1329 | 232 | .540 | 342 | 14.5 | 18.2 | 22.0 | 25.7 | 29.5 | 33.3 | 37.0 |
| | | 2 | (2) 77.1 | 1193 | 216 | .50 | 319 | 14.1 | 18.3 | 22.5 | 26.7 | 30.9 | 35.1 | 39.3 |
| | ISA+10°C | -1 | (1) 88.5 | 1950 | 285 | .66 | 409 | 13.3 | 15.8 | 18.4 | 20.9 | 23.5 | 26.1 | 28.6 |
| | -21°C | -3 | 85.3 | 1694 | 268 | .620 | 385 | 13.9 | 16.8 | 19.8 | 22.7 | 25.7 | 28.6 | 31.6 |
| | | -5 | 82.0 | 1479 | 250 | .580 | 360 | 14.2 | 17.6 | 21.0 | 24.4 | 27.7 | 31.1 | 34.5 |
| | | -7 | 78.7 | 1295 | 232 | .540 | 336 | 14.3 | 18.2 | 22.0 | 25.9 | 29.8 | 33.6 | 37.5 |
| | | -9 | (2) 75.7 | 1163 | 216 | .50 | 313 | 14.0 | 18.3 | 22.6 | 26.9 | 31.2 | 35.5 | 39.8 |
| | ISA+ 0°C | -9 | (1) 89.8 | 2153 | 300 | .69 | 421 | 12.6 | 14.9 | 17.2 | 19.5 | 21.9 | 24.2 | 26.5 |
| | -31°C | -12 | 86.2 | 1842 | 281 | .650 | 396 | 13.3 | 16.0 | 18.8 | 21.5 | 24.2 | 26.9 | 29.6 |
| | | -15 | 82.1 | 1540 | 259 | .600 | 365 | 14.0 | 17.2 | 20.5 | 23.7 | 27.0 | 30.2 | 33.5 |
| | | -17 | 78.0 | 1304 | 236 | .550 | 335 | 14.2 | 18.0 | 21.8 | 25.7 | 29.5 | 33.3 | 37.2 |
| | | -19 | (2) 74.3 | 1134 | 216 | .50 | 307 | 13.8 | 18.2 | 22.6 | 27.1 | 31.5 | 35.9 | 40.3 |
| | ISA-10°C | -20 | (1) 88.9 | 2183 | 305 | .70 | 418 | 12.3 | 14.6 | 16.9 | 19.2 | 21.4 | 23.7 | 26.0 |
| | -41°C | -23 | 84.5 | 1793 | 281 | .650 | 387 | 13.2 | 16.0 | 18.8 | 21.6 | 24.4 | 27.2 | 30.0 |
| | | -25 | 81.3 | 1553 | 263 | .610 | 364 | 13.8 | 17.0 | 20.2 | 23.4 | 26.6 | 29.9 | 33.1 |
| | | -27 | 77.2 | 1312 | 241 | .560 | 334 | 14.0 | 17.8 | 21.6 | 25.4 | 29.3 | 33.1 | 36.9 |
| | | -30 | (2) 72.9 | 1106 | 216 | .50 | 301 | 13.7 | 18.2 | 22.7 | 27.2 | 31.7 | 36.3 | 40.8 |
| 19000. | ISA+20°C | 8 | (1) 87.2 | 1759 | 270 | .63 | 396 | 14.0 | 16.9 | 19.7 | 22.5 | 25.4 | 28.2 | 31.1 |
| | -11°C | 7 | 85.0 | 1605 | 259 | .600 | 380 | 14.3 | 17.4 | 20.6 | 23.7 | 26.8 | 29.9 | 33.0 |
| | | 5 | 82.3 | 1449 | 245 | .570 | 361 | 14.6 | 18.0 | 21.5 | 24.9 | 28.4 | 31.8 | 35.3 |
| | | 3 | 79.7 | 1312 | 232 | .540 | 342 | 14.6 | 18.4 | 22.3 | 26.1 | 29.9 | 33.7 | 37.5 |
| | | 2 | (2) 76.6 | 1171 | 215 | .50 | 318 | 14.4 | 18.6 | 22.9 | 27.2 | 31.5 | 35.7 | 40.0 |
| | ISA+10°C | 0 | (1) 88.5 | 1951 | 286 | .66 | 410 | 13.3 | 15.9 | 18.4 | 21.0 | 23.6 | 26.1 | 28.7 |
| | -21°C | -3 | 85.1 | 1680 | 268 | .620 | 385 | 14.0 | 17.0 | 19.9 | 22.9 | 25.9 | 28.9 | 31.9 |
| | | -5 | 81.7 | 1463 | 250 | .580 | 360 | 14.4 | 17.8 | 21.2 | 24.6 | 28.0 | 31.5 | 34.9 |
| | | -7 | 78.3 | 1279 | 232 | .540 | 336 | 14.5 | 18.4 | 22.3 | 26.2 | 30.1 | 34.0 | 38.0 |
| | | -9 | (2) 75.2 | 1142 | 215 | .50 | 312 | 14.2 | 18.6 | 23.0 | 27.3 | 31.7 | 36.1 | 40.5 |
| | ISA+ 0°C | -9 | (1) 89.8 | 2154 | 301 | .69 | 422 | 12.6 | 14.9 | 17.3 | 19.6 | 21.9 | 24.2 | 26.5 |
| | -31°C | -12 | 86.0 | 1829 | 281 | .650 | 396 | 13.4 | 16.2 | 18.9 | 21.6 | 24.4 | 27.1 | 29.8 |
| | | -15 | 81.9 | 1525 | 259 | .600 | 365 | 14.1 | 17.4 | 20.7 | 24.0 | 27.2 | 30.5 | 33.8 |
| | | -17 | 77.6 | 1287 | 236 | .550 | 335 | 14.4 | 18.3 | 22.1 | 26.0 | 29.9 | 33.8 | 37.7 |
| | | -19 | (2) 73.8 | 1113 | 215 | .50 | 306 | 14.0 | 18.5 | 23.0 | 27.5 | 32.0 | 36.5 | 41.0 |
| | ISA-10°C | -20 | (1) 88.8 | 2172 | 305 | .70 | 418 | 12.3 | 14.6 | 16.9 | 19.2 | 21.5 | 23.9 | 26.2 |
| | -41°C | -23 | 84.3 | 1780 | 281 | .650 | 387 | 13.3 | 16.1 | 18.9 | 21.8 | 24.6 | 27.4 | 30.2 |
| | | -25 | 80.2 | 1485 | 259 | .600 | 358 | 14.0 | 17.4 | 20.7 | 24.1 | 27.5 | 30.8 | 34.2 |
| | | -28 | 76.1 | 1253 | 236 | .550 | 328 | 14.2 | 18.2 | 22.2 | 26.2 | 30.2 | 34.2 | 38.2 |
| | | -30 | (2) 72.3 | 1084 | 216 | .50 | 300 | 13.8 | 18.5 | 23.1 | 27.7 | 32.3 | 36.9 | 41.5 |
| 18000. | ISA+20°C | 8 | (1) 87.1 | 1757 | 271 | .63 | 398 | 14.1 | 16.9 | 19.8 | 22.6 | 25.5 | 28.3 | 31.2 |
| | -11°C | 7 | 84.7 | 1591 | 259 | .600 | 380 | 14.5 | 17.6 | 20.7 | 23.9 | 27.0 | 30.2 | 33.3 |
| | | 5 | 82.0 | 1433 | 245 | .570 | 361 | 14.7 | 18.2 | 21.7 | 25.2 | 28.7 | 32.2 | 35.7 |
| | | 3 | 78.5 | 1257 | 227 | .530 | 336 | 14.8 | 18.8 | 22.7 | 26.7 | 30.7 | 34.7 | 38.6 |
| | | 1 | (2) 75.9 | 1143 | 214 | .50 | 316 | 14.6 | 18.9 | 23.3 | 27.7 | 32.1 | 36.4 | 40.8 |
| | ISA+10°C | 0 | (1) 88.5 | 1953 | 287 | .66 | 411 | 13.4 | 15.9 | 18.5 | 21.0 | 23.6 | 26.2 | 28.7 |
| | -21°C | -3 | 84.9 | 1666 | 268 | .620 | 385 | 14.1 | 17.1 | 20.1 | 23.1 | 26.1 | 29.1 | 32.1 |
| | | -5 | 81.4 | 1448 | 250 | .580 | 360 | 14.5 | 18.0 | 21.4 | 24.9 | 28.3 | 31.8 | 35.2 |
| | | -7 | 77.9 | 1264 | 232 | .540 | 336 | 14.7 | 18.6 | 22.6 | 26.5 | 30.5 | 34.4 | 38.4 |
| | | -9 | (2) 74.5 | 1113 | 214 | .50 | 310 | 14.4 | 18.9 | 23.4 | 27.9 | 32.4 | 36.9 | 41.3 |
| | ISA+ 0°C | -9 | (1) 89.8 | 2159 | 302 | .69 | 423 | 12.6 | 14.9 | 17.3 | 19.6 | 21.9 | 24.2 | 26.5 |
| | -31°C | -12 | 85.8 | 1816 | 281 | .650 | 396 | 13.5 | 16.3 | 19.0 | 21.8 | 24.5 | 27.3 | 30.0 |
| | | -15 | 81.6 | 1511 | 259 | .600 | 365 | 14.2 | 17.6 | 20.9 | 24.2 | 27.5 | 30.8 | 34.1 |
| | | -17 | 77.3 | 1271 | 236 | .550 | 335 | 14.5 | 18.5 | 22.4 | 26.3 | 30.3 | 34.2 | 38.1 |
| | | -19 | (2) 73.1 | 1086 | 214 | .50 | 304 | 14.2 | 18.8 | 23.4 | 28.0 | 32.6 | 37.2 | 41.9 |
| | ISA-10°C | -20 | (1) 88.7 | 2162 | 305 | .70 | 418 | 12.4 | 14.7 | 17.0 | 19.3 | 21.7 | 24.0 | 26.3 |
| | -41°C | -23 | 84.1 | 1768 | 281 | .650 | 387 | 13.4 | 16.3 | 19.1 | 21.9 | 24.7 | 27.6 | 30.4 |
| | | -25 | 80.0 | 1471 | 259 | .600 | 358 | 14.1 | 17.5 | 20.9 | 24.3 | 27.7 | 31.1 | 34.5 |
| | | -28 | 75.8 | 1237 | 236 | .550 | 328 | 14.4 | 18.4 | 22.5 | 26.5 | 30.5 | 34.6 | 38.6 |
| | | -30 | (2) 71.6 | 1056 | 214 | .50 | 298 | 14.0 | 18.7 | 23.5 | 28.2 | 32.9 | 37.7 | 42.4 |
| 17000. | ISA+20°C | 8 | (1) 87.1 | 1759 | 272 | .63 | 399 | 14.2 | 17.0 | 19.8 | 22.7 | 25.5 | 28.4 | 31.2 |
| | -11°C | 7 | 84.5 | 1578 | 259 | .600 | 380 | 14.6 | 17.7 | 20.9 | 24.1 | 27.2 | 30.4 | 33.6 |
| | | 4 | 80.8 | 1369 | 241 | .560 | 355 | 15.0 | 18.6 | 22.3 | 25.9 | 29.6 | 33.2 | 36.9 |
| | | 3 | 78.1 | 1242 | 227 | .530 | 336 | 15.0 | 19.0 | 23.0 | 27.0 | 31.1 | 35.1 | 39.1 |
| | | 1 | (2) 75.1 | 1111 | 212 | .50 | 314 | 14.7 | 19.2 | 23.7 | 28.2 | 32.7 | 37.2 | 41.7 |
| | ISA+10°C | 0 | (1) 88.4 | 1951 | 287 | .66 | 412 | 13.4 | 16.0 | 18.5 | 21.1 | 23.7 | 26.2 | 28.8 |
| | -21°C | -3 | 84.7 | 1653 | 268 | .620 | 385 | 14.2 | 17.2 | 20.3 | 23.3 | 26.3 | 29.3 | 32.4 |
| | | -5 | 81.1 | 1433 | 250 | .580 | 360 | 14.7 | 18.2 | 21.6 | 25.1 | 28.6 | 32.1 | 35.6 |
| | | -7 | 77.5 | 1250 | 232 | .540 | 336 | 14.8 | 18.8 | 22.8 | 26.8 | 30.8 | 34.8 | 38.8 |
| | | -9 | (2) 73.7 | 1083 | 212 | .50 | 308 | 14.6 | 19.2 | 23.8 | 28.4 | 33.0 | 37.6 | 42.3 |
| | ISA+ 0°C | -9 | (1) 89.7 | 2154 | 302 | .70 | 423 | 12.7 | 15.0 | 17.3 | 19.6 | 22.0 | 24.3 | 26.6 |
| | -31°C | -12 | 85.6 | 1804 | 281 | .650 | 396 | 13.6 | 16.4 | 19.2 | 21.9 | 24.7 | 27.5 | 30.2 |
| | | -15 | 81.4 | 1498 | 259 | .600 | 365 | 14.4 | 17.7 | 21.0 | 24.4 | 27.7 | 31.0 | 34.4 |
| | | -17 | 77.0 | 1257 | 236 | .550 | 335 | 14.7 | 18.7 | 22.7 | 26.6 | 30.6 | 34.6 | 38.6 |
| | | -20 | (2) 72.3 | 1055 | 212 | .50 | 302 | 14.4 | 19.1 | 23.9 | 28.6 | 33.3 | 38.1 | 42.8 |
| | ISA-10°C | -20 | (1) 88.5 | 2152 | 305 | .70 | 418 | 12.5 | 14.8 | 17.1 | 19.4 | 21.8 | 24.1 | 26.4 |
| | -41°C | -23 | 84.0 | 1756 | 281 | .650 | 387 | 13.5 | 16.4 | 19.2 | 22.1 | 24.9 | 27.7 | 30.6 |
| | | -25 | 79.8 | 1459 | 259 | .600 | 358 | 14.2 | 17.7 | 21.1 | 24.5 | 27.9 | 31.4 | 34.8 |
| | | -28 | 75.4 | 1223 | 236 | .550 | 328 | 14.5 | 18.6 | 22.7 | 26.8 | 30.9 | 35.0 | 39.1 |
| | | -30 | (2) 70.9 | 1027 | 212 | .50 | 295 | 14.2 | 19.0 | 23.9 | 28.8 | 33.6 | 38.5 | 43.4 |

Figure 7-14 (Sheet 13)

# CRUISE
# 23,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C -11°C | 9 | (1) 87.1 | 1763 | 273 | .63 | 400 | 14.2 | 17.0 | 19.9 | 22.7 | 25.5 | 28.4 | 31.2 |
| | | 7 | 84.3 | 1572 | 259 | .600 | 380 | 14.6 | 17.8 | 21.0 | 24.2 | 27.4 | 30.5 | 33.7 |
| | | 4 | 80.6 | 1362 | 241 | .560 | 355 | 15.0 | 18.7 | 22.4 | 26.0 | 29.7 | 33.4 | 37.1 |
| | | 3 | 77.9 | 1235 | 227 | .530 | 336 | 15.0 | 19.1 | 23.1 | 27.2 | 31.2 | 35.3 | 39.3 |
| | | 1 | (2) 74.7 | 1094 | 211 | .49 | 312 | 14.8 | 19.4 | 24.0 | 28.5 | 33.1 | 37.7 | 42.3 |
| | ISA+10°C -21°C | 0 | (1) 88.4 | 1949 | 288 | .66 | 412 | 13.4 | 16.0 | 18.6 | 21.1 | 23.7 | 26.3 | 28.8 |
| | | -3 | 84.6 | 1647 | 268 | .620 | 385 | 14.3 | 17.3 | 20.3 | 23.4 | 26.4 | 29.5 | 32.5 |
| | | -5 | 81.0 | 1426 | 250 | .580 | 360 | 14.7 | 18.2 | 21.8 | 25.3 | 28.8 | 32.3 | 35.8 |
| | | -7 | 77.4 | 1243 | 232 | .540 | 336 | 14.9 | 18.9 | 23.0 | 27.0 | 31.0 | 35.0 | 39.1 |
| | | -9 | (2) 73.3 | 1066 | 211 | .49 | 306 | 14.7 | 19.3 | 24.0 | 28.7 | 33.4 | 38.1 | 42.8 |
| | ISA+ 0°C -31°C | -9 | (1) 89.7 | 2154 | 302 | .70 | 423 | 12.7 | 15.0 | 17.3 | 19.7 | 22.0 | 24.3 | 26.6 |
| | | -12 | 85.5 | 1799 | 281 | .650 | 396 | 13.7 | 16.4 | 19.2 | 22.0 | 24.8 | 27.6 | 30.3 |
| | | -15 | 81.2 | 1492 | 259 | .600 | 365 | 14.4 | 17.8 | 21.1 | 24.5 | 27.8 | 31.2 | 34.5 |
| | | -17 | 76.8 | 1251 | 236 | .550 | 335 | 14.8 | 18.8 | 22.8 | 26.8 | 30.8 | 34.8 | 38.8 |
| | | -20 | (2) 71.9 | 1039 | 211 | .49 | 300 | 14.5 | 19.3 | 24.1 | 28.9 | 33.7 | 38.5 | 43.3 |
| | ISA-10°C -41°C | -20 | (1) 88.5 | 2147 | 305 | .70 | 418 | 12.5 | 14.8 | 17.1 | 19.5 | 21.8 | 24.1 | 26.5 |
| | | -23 | 83.9 | 1751 | 281 | .650 | 387 | 13.6 | 16.4 | 19.3 | 22.1 | 25.0 | 27.8 | 30.7 |
| | | -25 | 79.6 | 1453 | 259 | .600 | 358 | 14.3 | 17.7 | 21.2 | 24.6 | 28.1 | 31.5 | 34.9 |
| | | -28 | 75.3 | 1217 | 236 | .550 | 328 | 14.6 | 18.7 | 22.8 | 27.0 | 31.1 | 35.2 | 39.3 |
| | | -30 | (2) 70.5 | 1012 | 211 | .49 | 294 | 14.2 | 19.2 | 24.1 | 29.1 | 34.0 | 38.9 | 43.9 |
| 16000. | ISA+20°C -11°C | 9 | (1) 87.1 | 1758 | 273 | .63 | 400 | 14.2 | 17.1 | 19.9 | 22.8 | 25.6 | 28.4 | 31.3 |
| | | 7 | 84.2 | 1566 | 259 | .600 | 380 | 14.7 | 17.9 | 21.1 | 24.3 | 27.5 | 30.7 | 33.8 |
| | | 4 | 80.5 | 1355 | 241 | .560 | 355 | 15.1 | 18.8 | 22.5 | 26.2 | 29.9 | 33.6 | 37.2 |
| | | 3 | 77.7 | 1228 | 227 | .530 | 336 | 15.1 | 19.2 | 23.3 | 27.4 | 31.4 | 35.5 | 39.6 |
| | | 1 | (2) 74.3 | 1076 | 210 | .49 | 311 | 14.9 | 19.6 | 24.2 | 28.9 | 33.5 | 38.1 | 42.8 |
| | ISA+10°C -21°C | 0 | (1) 88.4 | 1954 | 288 | .67 | 413 | 13.5 | 16.0 | 18.6 | 21.1 | 23.7 | 26.2 | 28.8 |
| | | -3 | 84.5 | 1641 | 268 | .620 | 385 | 14.3 | 17.4 | 20.4 | 23.5 | 26.5 | 29.6 | 32.6 |
| | | -5 | 80.8 | 1420 | 250 | .580 | 360 | 14.8 | 18.3 | 21.9 | 25.4 | 28.9 | 32.4 | 35.9 |
| | | -7 | 77.2 | 1236 | 232 | .540 | 336 | 15.0 | 19.0 | 23.1 | 27.1 | 31.2 | 35.2 | 39.3 |
| | | -9 | (2) 72.9 | 1050 | 210 | .49 | 305 | 14.7 | 19.5 | 24.3 | 29.0 | 33.8 | 38.6 | 43.3 |
| | ISA+ 0°C -31°C | -9 | (1) 89.8 | 2161 | 303 | .70 | 424 | 12.7 | 15.0 | 17.3 | 19.6 | 21.9 | 24.3 | 26.6 |
| | | -12 | 85.5 | 1793 | 281 | .650 | 396 | 13.7 | 16.5 | 19.3 | 22.1 | 24.8 | 27.6 | 30.4 |
| | | -15 | 81.1 | 1487 | 259 | .600 | 365 | 14.5 | 17.8 | 21.2 | 24.6 | 27.9 | 31.3 | 34.7 |
| | | -18 | 75.7 | 1204 | 232 | .540 | 329 | 14.9 | 19.0 | 23.2 | 27.3 | 31.5 | 35.6 | 39.8 |
| | | -20 | (2) 71.5 | 1023 | 210 | .49 | 299 | 14.5 | 19.4 | 24.3 | 29.2 | 34.1 | 39.0 | 43.9 |
| | ISA-10°C -41°C | -20 | (1) 88.4 | 2142 | 305 | .70 | 418 | 12.5 | 14.8 | 17.2 | 19.5 | 21.8 | 24.2 | 26.5 |
| | | -23 | 83.8 | 1746 | 281 | .650 | 387 | 13.6 | 16.5 | 19.3 | 22.2 | 25.1 | 27.9 | 30.8 |
| | | -25 | 79.5 | 1447 | 259 | .600 | 358 | 14.3 | 17.8 | 21.3 | 24.7 | 28.2 | 31.6 | 35.1 |
| | | -28 | 75.1 | 1210 | 236 | .550 | 328 | 14.7 | 18.8 | 23.0 | 27.1 | 31.2 | 35.4 | 39.5 |
| | | -30 | (2) 70.1 | 996 | 210 | .49 | 293 | 14.3 | 19.3 | 24.4 | 29.4 | 34.4 | 39.4 | 44.4 |
| 14000. | ISA+20°C -11°C | 9 | (1) 87.0 | 1756 | 274 | .63 | 402 | 14.4 | 17.2 | 20.0 | 22.9 | 25.7 | 28.6 | 31.4 |
| | | 6 | 82.8 | 1486 | 254 | .590 | 374 | 15.1 | 18.4 | 21.8 | 25.1 | 28.5 | 31.9 | 35.2 |
| | | 4 | 79.0 | 1287 | 236 | .550 | 348 | 15.4 | 19.3 | 23.2 | 27.1 | 31.0 | 34.8 | 38.7 |
| | | 2 | 75.2 | 1120 | 219 | .510 | 323 | 15.5 | 19.9 | 24.4 | 28.9 | 33.3 | 37.8 | 42.3 |
| | | 0 | (2) 71.6 | 967 | 197 | .46 | 292 | 14.7 | 19.9 | 25.1 | 30.2 | 35.4 | 40.6 | 45.7 |
| | ISA+10°C -21°C | 0 | (1) 88.4 | 1954 | 289 | .67 | 415 | 13.5 | 16.1 | 18.7 | 21.2 | 23.8 | 26.3 | 28.9 |
| | | -3 | 84.1 | 1618 | 268 | .620 | 385 | 14.5 | 17.6 | 20.7 | 23.8 | 26.9 | 30.0 | 33.1 |
| | | -6 | 79.4 | 1343 | 245 | .570 | 354 | 15.2 | 18.9 | 22.6 | 26.4 | 30.1 | 33.8 | 37.5 |
| | | -8 | 74.8 | 1131 | 223 | .520 | 323 | 15.3 | 19.7 | 24.1 | 28.6 | 33.0 | 37.4 | 41.8 |
| | | -11 | (2) 70.3 | 945 | 198 | .46 | 287 | 14.5 | 19.8 | 25.1 | 30.4 | 35.7 | 41.0 | 46.3 |
| | ISA+ 0°C -31°C | -9 | (1) 89.7 | 2154 | 303 | .70 | 425 | 12.8 | 15.1 | 17.4 | 19.7 | 22.0 | 24.4 | 26.7 |
| | | -12 | 84.2 | 1704 | 277 | .640 | 389 | 14.1 | 17.0 | 19.9 | 22.9 | 25.8 | 28.7 | 31.7 |
| | | -16 | 78.8 | 1359 | 250 | .580 | 353 | 14.9 | 18.6 | 22.3 | 26.0 | 29.7 | 33.3 | 37.0 |
| | | -19 | 73.3 | 1102 | 223 | .520 | 317 | 15.1 | 19.7 | 24.2 | 28.7 | 33.3 | 37.8 | 42.4 |
| | | -21 | (2) 69.0 | 922 | 198 | .46 | 282 | 14.3 | 19.7 | 25.2 | 30.6 | 36.0 | 41.4 | 46.9 |
| | ISA-10°C -41°C | -20 | (1) 88.2 | 2126 | 305 | .70 | 418 | 12.6 | 15.0 | 17.3 | 19.7 | 22.0 | 24.4 | 26.7 |
| | | -23 | 82.6 | 1659 | 277 | .640 | 381 | 13.9 | 17.0 | 20.0 | 23.0 | 26.0 | 29.0 | 32.0 |
| | | -26 | 77.3 | 1323 | 250 | .580 | 346 | 14.8 | 18.6 | 22.3 | 26.1 | 29.9 | 33.7 | 37.5 |
| | | -29 | 71.9 | 1072 | 223 | .520 | 310 | 14.9 | 19.6 | 24.3 | 28.9 | 33.6 | 38.3 | 42.9 |
| | | -31 | (2) 67.6 | 896 | 198 | .46 | 276 | 14.0 | 19.6 | 25.2 | 30.8 | 36.3 | 41.9 | 47.5 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -21°C | -31°C | -41°C |
| 87.0 | 88.4 | 88.5 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 14)

# CRUISE
# 25,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | 4 | (1) 87.6 | 1677 | 262 | .63 | 397 | 14.7 | 17.7 | 20.7 | 23.6 | 26.6 | 29.6 | 32.6 |
| | -15°C | 2 | 85.2 | 1508 | 248 | .600 | 377 | 15.1 | 18.4 | 21.7 | 25.0 | 28.3 | 31.6 | 35.0 |
| | | 1 | 82.7 | 1369 | 235 | .570 | 358 | 15.2 | 18.9 | 22.5 | 26.2 | 29.8 | 33.5 | 37.1 |
| | | -1 | 80.3 | 1246 | 222 | .540 | 340 | 15.2 | 19.2 | 23.2 | 27.2 | 31.3 | 35.3 | 39.3 |
| | | -2 | (2) 78.1 | 1148 | 210 | .51 | 322 | 14.9 | 19.3 | 23.7 | 28.0 | 32.4 | 36.7 | 41.1 |
| | ISA+10°C | -4 | (1) 88.9 | 1855 | 277 | .67 | 410 | 14.0 | 16.7 | 19.4 | 22.1 | 24.8 | 27.5 | 30.2 |
| | -25°C | -6 | 86.0 | 1629 | 261 | .630 | 388 | 14.6 | 17.7 | 20.8 | 23.8 | 26.9 | 30.0 | 33.0 |
| | | -9 | 82.8 | 1421 | 244 | .590 | 364 | 15.0 | 18.6 | 22.1 | 25.6 | 29.1 | 32.6 | 36.1 |
| | | -11 | 79.6 | 1254 | 227 | .550 | 339 | 15.1 | 19.1 | 23.1 | 27.0 | 31.0 | 35.0 | 39.0 |
| | | -13 | (2) 76.7 | 1119 | 210 | .51 | 315 | 14.8 | 19.3 | 23.7 | 28.2 | 32.7 | 37.1 | 41.6 |
| | ISA+ 0°C | -13 | (1) 90.1 | 2056 | 292 | .70 | 423 | 13.3 | 15.7 | 18.1 | 20.6 | 23.0 | 25.4 | 27.9 |
| | -35°C | -16 | 86.7 | 1766 | 274 | .660 | 398 | 14.1 | 16.9 | 19.7 | 22.6 | 25.4 | 28.2 | 31.1 |
| | | -18 | 82.8 | 1481 | 252 | .610 | 368 | 14.7 | 18.1 | 21.5 | 24.9 | 28.2 | 31.6 | 35.0 |
| | | -21 | 78.8 | 1260 | 231 | .560 | 338 | 14.9 | 18.9 | 22.9 | 26.8 | 30.8 | 34.8 | 38.7 |
| | | -23 | (2) 75.2 | 1088 | 210 | .51 | 309 | 14.6 | 19.2 | 23.8 | 28.4 | 33.0 | 37.6 | 42.2 |
| | ISA-10°C | -22 | (1) 91.4 | 2265 | 305 | .73 | 431 | 12.4 | 14.6 | 16.8 | 19.0 | 21.2 | 23.4 | 25.6 |
| | -45°C | -25 | 86.7 | 1849 | 283 | .680 | 402 | 13.6 | 16.3 | 19.0 | 21.7 | 24.4 | 27.1 | 29.8 |
| | | -28 | 81.9 | 1491 | 257 | .620 | 366 | 14.5 | 17.9 | 21.2 | 24.6 | 27.9 | 31.3 | 34.6 |
| | | -31 | 78.0 | 1264 | 235 | .570 | 337 | 14.8 | 18.7 | 22.7 | 26.7 | 30.6 | 34.6 | 38.5 |
| | | -34 | (2) 73.7 | 1059 | 210 | .51 | 302 | 14.4 | 19.1 | 23.8 | 28.6 | 33.3 | 38.0 | 42.7 |
| 19000. | ISA+20°C | 5 | (1) 87.7 | 1686 | 263 | .64 | 399 | 14.8 | 17.7 | 20.7 | 23.7 | 26.6 | 29.6 | 32.6 |
| | -15°C | 2 | 84.9 | 1490 | 248 | .600 | 377 | 15.2 | 18.6 | 21.9 | 25.3 | 28.7 | 32.0 | 35.4 |
| | | 1 | 82.3 | 1350 | 235 | .570 | 358 | 15.4 | 19.1 | 22.8 | 26.5 | 30.2 | 33.9 | 37.6 |
| | | -1 | 79.8 | 1227 | 222 | .540 | 340 | 15.5 | 19.5 | 23.6 | 27.7 | 31.8 | 35.8 | 39.9 |
| | | -2 | (2) 77.2 | 1115 | 208 | .51 | 319 | 15.1 | 19.6 | 24.1 | 28.6 | 33.1 | 37.6 | 42.1 |
| | ISA+10°C | -4 | (1) 88.9 | 1853 | 278 | .67 | 411 | 14.1 | 16.8 | 19.5 | 22.2 | 24.9 | 27.6 | 30.3 |
| | -25°C | -6 | 85.7 | 1613 | 261 | .630 | 388 | 14.8 | 17.9 | 21.0 | 24.1 | 27.2 | 30.3 | 33.4 |
| | | -9 | 82.5 | 1404 | 244 | .590 | 364 | 15.2 | 18.8 | 22.3 | 25.9 | 29.5 | 33.0 | 36.6 |
| | | -11 | 79.2 | 1235 | 227 | .550 | 339 | 15.3 | 19.4 | 23.4 | 27.5 | 31.5 | 35.6 | 39.6 |
| | | -13 | (2) 75.8 | 1086 | 208 | .51 | 312 | 15.0 | 19.6 | 24.2 | 28.8 | 33.4 | 38.0 | 42.6 |
| | ISA+ 0°C | -13 | (1) 90.2 | 2064 | 293 | .70 | 424 | 13.3 | 15.7 | 18.1 | 20.6 | 23.0 | 25.4 | 27.8 |
| | -35°C | -16 | 86.5 | 1752 | 274 | .660 | 398 | 14.2 | 17.0 | 19.9 | 22.7 | 25.6 | 28.4 | 31.3 |
| | | -18 | 82.5 | 1465 | 252 | .610 | 368 | 14.9 | 18.3 | 21.7 | 25.1 | 28.6 | 32.0 | 35.4 |
| | | -21 | 78.4 | 1242 | 231 | .560 | 338 | 15.2 | 19.2 | 23.2 | 27.2 | 31.3 | 35.3 | 39.3 |
| | | -23 | (2) 74.3 | 1058 | 208 | .51 | 306 | 14.8 | 19.5 | 24.2 | 29.0 | 33.7 | 38.4 | 43.1 |
| | ISA-10°C | -22 | (1) 91.3 | 2252 | 305 | .73 | 431 | 12.5 | 14.7 | 16.9 | 19.1 | 21.3 | 23.6 | 25.8 |
| | -45°C | -25 | 86.5 | 1837 | 283 | .680 | 402 | 13.7 | 16.4 | 19.1 | 21.9 | 24.6 | 27.3 | 30.0 |
| | | -28 | 81.6 | 1475 | 257 | .620 | 366 | 14.7 | 18.1 | 21.4 | 24.8 | 28.2 | 31.6 | 35.0 |
| | | -31 | 76.9 | 1208 | 231 | .560 | 331 | 15.0 | 19.1 | 23.3 | 27.4 | 31.5 | 35.7 | 39.8 |
| | | -34 | (2) 72.8 | 1028 | 208 | .51 | 300 | 14.6 | 19.4 | 24.3 | 29.2 | 34.0 | 38.9 | 43.7 |
| 18000. | ISA+20°C | 5 | (1) 87.5 | 1676 | 264 | .64 | 400 | 14.9 | 17.9 | 20.9 | 23.8 | 26.8 | 29.8 | 32.8 |
| | -15°C | 2 | 84.6 | 1474 | 248 | .600 | 377 | 15.4 | 18.8 | 22.2 | 25.6 | 29.0 | 32.4 | 35.8 |
| | | 1 | 81.9 | 1333 | 235 | .570 | 358 | 15.6 | 19.4 | 23.1 | 26.9 | 30.6 | 34.4 | 38.1 |
| | | -1 | 79.4 | 1209 | 222 | .540 | 340 | 15.7 | 19.8 | 24.0 | 28.1 | 32.2 | 36.4 | 40.5 |
| | | -3 | (2) 76.3 | 1082 | 206 | .50 | 316 | 15.3 | 20.0 | 24.6 | 29.2 | 33.8 | 38.4 | 43.1 |
| | ISA+10°C | -4 | (1) 88.8 | 1853 | 278 | .67 | 412 | 14.2 | 16.9 | 19.6 | 22.3 | 24.9 | 27.6 | 30.3 |
| | -25°C | -6 | 85.5 | 1598 | 261 | .630 | 388 | 14.9 | 18.0 | 21.2 | 24.3 | 27.4 | 30.5 | 33.7 |
| | | -9 | 82.2 | 1389 | 244 | .590 | 364 | 15.4 | 19.0 | 22.6 | 26.2 | 29.8 | 33.4 | 37.0 |
| | | -11 | 78.7 | 1217 | 227 | .550 | 339 | 15.5 | 19.6 | 23.8 | 27.9 | 32.0 | 36.1 | 40.2 |
| | | -13 | (2) 74.9 | 1055 | 206 | .50 | 310 | 15.2 | 19.9 | 24.6 | 29.4 | 34.1 | 38.9 | 43.6 |
| | ISA+ 0°C | -13 | (1) 90.1 | 2062 | 294 | .70 | 425 | 13.3 | 15.8 | 18.2 | 20.6 | 23.0 | 25.5 | 27.9 |
| | -35°C | -16 | 86.3 | 1739 | 274 | .660 | 398 | 14.3 | 17.2 | 20.0 | 22.9 | 25.8 | 28.7 | 31.5 |
| | | -18 | 82.2 | 1450 | 252 | .610 | 368 | 15.1 | 18.5 | 22.0 | 25.4 | 28.8 | 32.3 | 35.7 |
| | | -21 | 78.0 | 1224 | 231 | .560 | 338 | 15.4 | 19.5 | 23.5 | 27.6 | 31.7 | 35.8 | 39.9 |
| | | -24 | (2) 73.5 | 1026 | 206 | .50 | 304 | 15.0 | 19.8 | 24.7 | 29.6 | 34.4 | 39.3 | 44.2 |
| | ISA-10°C | -22 | (1) 91.1 | 2241 | 305 | .73 | 431 | 12.5 | 14.8 | 17.0 | 19.2 | 21.5 | 23.7 | 25.9 |
| | -45°C | -26 | 85.5 | 1758 | 279 | .670 | 396 | 14.0 | 16.8 | 19.7 | 22.5 | 25.4 | 28.2 | 31.1 |
| | | -28 | 81.4 | 1461 | 257 | .620 | 366 | 14.8 | 18.2 | 21.7 | 25.1 | 28.5 | 31.9 | 35.3 |
| | | -31 | 76.5 | 1191 | 231 | .560 | 331 | 15.2 | 19.4 | 23.6 | 27.8 | 32.0 | 36.2 | 40.4 |
| | | -34 | (2) 72.0 | 999 | 207 | .50 | 297 | 14.7 | 19.7 | 24.8 | 29.8 | 34.8 | 39.8 | 44.8 |
| 17000. | ISA+20°C | 5 | (1) 87.5 | 1674 | 265 | .64 | 401 | 15.0 | 18.0 | 21.0 | 24.0 | 26.9 | 29.9 | 32.9 |
| | -15°C | 3 | 85.2 | 1512 | 252 | .610 | 383 | 15.4 | 18.7 | 22.1 | 25.4 | 28.7 | 32.0 | 35.3 |
| | | 1 | 81.6 | 1316 | 235 | .570 | 358 | 15.8 | 19.6 | 23.4 | 27.2 | 31.0 | 34.8 | 38.6 |
| | | -1 | 79.0 | 1192 | 222 | .540 | 340 | 15.9 | 20.1 | 24.3 | 28.5 | 32.7 | 36.9 | 41.1 |
| | | -3 | (2) 75.7 | 1059 | 206 | .50 | 315 | 15.6 | 20.3 | 25.0 | 29.7 | 34.5 | 39.2 | 43.9 |
| | ISA+10°C | -4 | (1) 88.8 | 1856 | 279 | .67 | 414 | 14.2 | 16.9 | 19.6 | 22.3 | 25.0 | 27.7 | 30.4 |
| | -25°C | -6 | 85.2 | 1584 | 261 | .630 | 388 | 15.0 | 18.2 | 21.3 | 24.5 | 27.7 | 30.8 | 34.0 |
| | | -9 | 81.8 | 1375 | 244 | .590 | 364 | 15.5 | 19.2 | 22.8 | 26.4 | 30.1 | 33.7 | 37.4 |
| | | -11 | 78.4 | 1200 | 227 | .550 | 339 | 15.8 | 19.9 | 24.1 | 28.3 | 32.4 | 36.6 | 40.8 |
| | | -13 | (2) 74.3 | 1033 | 206 | .50 | 309 | 15.4 | 20.2 | 25.1 | 29.9 | 34.8 | 39.6 | 44.4 |
| | ISA+ 0°C | -13 | (1) 90.1 | 2062 | 294 | .71 | 426 | 13.4 | 15.8 | 18.2 | 20.7 | 23.1 | 25.5 | 27.9 |
| | -35°C | -16 | 86.1 | 1727 | 274 | .660 | 398 | 14.4 | 17.3 | 20.2 | 23.1 | 26.0 | 28.9 | 31.8 |
| | | -18 | 82.0 | 1435 | 252 | .610 | 368 | 15.2 | 18.7 | 22.2 | 25.7 | 29.1 | 32.6 | 36.1 |
| | | -21 | 76.8 | 1168 | 227 | .550 | 332 | 15.6 | 19.9 | 24.2 | 28.4 | 32.7 | 37.0 | 41.3 |
| | | -24 | (2) 72.9 | 1007 | 206 | .50 | 303 | 15.2 | 20.2 | 25.2 | 30.1 | 35.1 | 40.1 | 45.0 |
| | ISA-10°C | -22 | (1) 91.0 | 2229 | 305 | .73 | 431 | 12.6 | 14.8 | 17.1 | 19.3 | 21.6 | 23.8 | 26.0 |
| | -45°C | -26 | 85.3 | 1746 | 279 | .670 | 396 | 14.1 | 16.9 | 19.8 | 22.7 | 25.5 | 28.4 | 31.3 |
| | | -28 | 81.1 | 1447 | 257 | .620 | 366 | 14.9 | 18.4 | 21.9 | 25.3 | 28.8 | 32.2 | 35.7 |
| | | -31 | 76.1 | 1176 | 231 | .560 | 331 | 15.4 | 19.6 | 23.9 | 28.2 | 32.4 | 36.7 | 40.9 |
| | | -34 | (2) 71.5 | 980 | 206 | .50 | 297 | 15.0 | 20.1 | 25.2 | 30.3 | 35.4 | 40.5 | 45.6 |

Figure 7-14 (Sheet 15)

# CRUISE
# 25,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | 5 | (1) | 87.5 | 1680 | 266 | .64 | 402 | 15.0 | 18.0 | 21.0 | 23.9 | 26.9 | 29.9 | 32.9 |
| | -15°C | 3 | | 85.0 | 1504 | 252 | .610 | 383 | 15.5 | 18.8 | 22.2 | 25.5 | 28.8 | 32.1 | 35.5 |
| | | 1 | | 81.4 | 1309 | 235 | .570 | 358 | 15.9 | 19.7 | 23.6 | 27.4 | 31.2 | 35.0 | 38.8 |
| | | -1 | | 78.8 | 1185 | 222 | .540 | 340 | 16.0 | 20.2 | 24.4 | 28.7 | 32.9 | 37.1 | 41.3 |
| | | -3 | (2) | 75.3 | 1046 | 205 | .50 | 314 | 15.7 | 20.5 | 25.3 | 30.0 | 34.8 | 39.6 | 44.4 |
| | ISA+10°C | -4 | (1) | 88.8 | 1855 | 280 | .67 | 414 | 14.2 | 16.9 | 19.6 | 22.3 | 25.0 | 27.7 | 30.4 |
| | -25°C | -6 | | 85.1 | 1578 | 261 | .630 | 388 | 15.1 | 18.3 | 21.4 | 24.6 | 27.8 | 30.9 | 34.1 |
| | | -9 | | 81.7 | 1368 | 244 | .590 | 364 | 15.6 | 19.3 | 22.9 | 26.6 | 30.2 | 33.9 | 37.5 |
| | | -11 | | 77.3 | 1154 | 222 | .540 | 333 | 15.8 | 20.2 | 24.5 | 28.8 | 33.2 | 37.5 | 41.8 |
| | | -13 | (2) | 73.9 | 1018 | 205 | .50 | 308 | 15.5 | 20.4 | 25.3 | 30.2 | 35.2 | 40.1 | 45.0 |
| | ISA+ 0°C | -13 | (1) | 90.1 | 2063 | 295 | .71 | 426 | 13.4 | 15.8 | 18.2 | 20.7 | 23.1 | 25.5 | 27.9 |
| | -35°C | -16 | | 86.0 | 1721 | 274 | .660 | 398 | 14.4 | 17.3 | 20.2 | 23.2 | 26.1 | 29.0 | 31.9 |
| | | -18 | | 81.9 | 1429 | 252 | .610 | 368 | 15.3 | 18.8 | 22.3 | 25.8 | 29.3 | 32.8 | 36.3 |
| | | -21 | | 76.7 | 1160 | 227 | .550 | 332 | 15.7 | 20.0 | 24.3 | 28.6 | 32.9 | 37.2 | 41.6 |
| | | -24 | (2) | 72.5 | 993 | 205 | .50 | 302 | 15.3 | 20.3 | 25.4 | 30.4 | 35.4 | 40.5 | 45.5 |
| | ISA-10°C | -22 | (1) | 90.9 | 2224 | 305 | .73 | 431 | 12.6 | 14.9 | 17.1 | 19.4 | 21.6 | 23.9 | 26.1 |
| | -45°C | -26 | | 85.2 | 1740 | 279 | .670 | 396 | 14.1 | 17.0 | 19.9 | 22.7 | 25.6 | 28.5 | 31.4 |
| | | -28 | | 81.0 | 1441 | 257 | .620 | 366 | 15.0 | 18.5 | 22.0 | 25.4 | 28.9 | 32.4 | 35.8 |
| | | -31 | | 75.9 | 1168 | 231 | .560 | 331 | 15.5 | 19.8 | 24.1 | 28.3 | 32.6 | 36.9 | 41.2 |
| | | -34 | (2) | 71.1 | 966 | 205 | .50 | 296 | 15.1 | 20.3 | 25.4 | 30.6 | 35.8 | 41.0 | 46.1 |
| 16000. | ISA+20°C | 5 | (1) | 87.5 | 1679 | 266 | .64 | 403 | 15.1 | 18.0 | 21.0 | 24.0 | 27.0 | 29.9 | 32.9 |
| | -15°C | 3 | | 84.9 | 1497 | 252 | .610 | 383 | 15.6 | 18.9 | 22.3 | 25.6 | 28.9 | 32.3 | 35.6 |
| | | 1 | | 81.2 | 1301 | 235 | .570 | 358 | 16.0 | 19.9 | 23.7 | 27.5 | 31.4 | 35.2 | 39.1 |
| | | -1 | | 78.6 | 1177 | 222 | .540 | 340 | 16.1 | 20.3 | 24.6 | 28.8 | 33.1 | 37.3 | 41.6 |
| | | -3 | (2) | 74.9 | 1030 | 204 | .50 | 313 | 15.8 | 20.7 | 25.5 | 30.4 | 35.2 | 40.1 | 44.9 |
| | ISA+10°C | -4 | (1) | 88.8 | 1853 | 280 | .67 | 414 | 14.3 | 17.0 | 19.7 | 22.4 | 25.1 | 27.8 | 30.5 |
| | -25°C | -6 | | 85.0 | 1571 | 261 | .630 | 388 | 15.2 | 18.3 | 21.5 | 24.7 | 27.9 | 31.1 | 34.3 |
| | | -9 | | 81.5 | 1362 | 244 | .590 | 364 | 15.7 | 19.4 | 23.0 | 26.7 | 30.4 | 34.0 | 37.7 |
| | | -11 | | 77.1 | 1147 | 222 | .540 | 333 | 15.9 | 20.3 | 24.7 | 29.0 | 33.4 | 37.7 | 42.1 |
| | | -13 | (2) | 73.5 | 1004 | 204 | .50 | 307 | 15.6 | 20.6 | 25.6 | 30.6 | 35.5 | 40.5 | 45.5 |
| | ISA+ 0°C | -13 | (1) | 90.1 | 2064 | 295 | .71 | 427 | 13.4 | 15.8 | 18.2 | 20.7 | 23.1 | 25.5 | 27.9 |
| | -35°C | -16 | | 86.0 | 1715 | 274 | .660 | 398 | 14.5 | 17.4 | 20.3 | 23.2 | 26.1 | 29.1 | 32.0 |
| | | -19 | | 80.9 | 1372 | 248 | .600 | 362 | 15.5 | 19.1 | 22.8 | 26.4 | 30.0 | 33.7 | 37.3 |
| | | -21 | | 76.5 | 1153 | 227 | .550 | 332 | 15.8 | 20.1 | 24.5 | 28.8 | 33.2 | 37.5 | 41.8 |
| | | -24 | (2) | 72.1 | 978 | 204 | .50 | 301 | 15.4 | 20.5 | 25.6 | 30.7 | 35.9 | 41.0 | 46.1 |
| | ISA-10°C | -22 | (1) | 90.8 | 2219 | 305 | .73 | 431 | 12.7 | 14.9 | 17.2 | 19.4 | 21.7 | 23.9 | 26.2 |
| | -45°C | -26 | | 85.1 | 1735 | 279 | .670 | 396 | 14.2 | 17.0 | 19.9 | 22.8 | 25.7 | 28.6 | 31.5 |
| | | -28 | | 80.9 | 1435 | 257 | .620 | 366 | 15.1 | 18.6 | 22.1 | 25.5 | 29.0 | 32.5 | 36.0 |
| | | -31 | | 75.8 | 1161 | 231 | .560 | 331 | 15.6 | 19.9 | 24.2 | 28.5 | 32.8 | 37.1 | 41.4 |
| | | -34 | (2) | 70.7 | 952 | 204 | .50 | 294 | 15.2 | 20.4 | 25.7 | 30.9 | 36.2 | 41.4 | 46.7 |
| 14000. | ISA+20°C | 5 | (1) | 87.5 | 1678 | 267 | .64 | 405 | 15.2 | 18.2 | 21.2 | 24.1 | 27.1 | 30.1 | 33.1 |
| | -15°C | 3 | | 84.4 | 1472 | 252 | .610 | 383 | 15.9 | 19.3 | 22.6 | 26.0 | 29.4 | 32.8 | 36.2 |
| | | 1 | | 80.6 | 1273 | 235 | .570 | 358 | 16.4 | 20.3 | 24.2 | 28.2 | 32.1 | 36.0 | 39.9 |
| | | -1 | | 76.9 | 1113 | 218 | .530 | 333 | 16.5 | 21.0 | 25.5 | 29.9 | 34.4 | 38.9 | 43.4 |
| | | -3 | (2) | 73.0 | 957 | 199 | .48 | 304 | 16.1 | 21.4 | 26.6 | 31.8 | 37.0 | 42.3 | 47.5 |
| | ISA+10°C | -4 | (1) | 88.8 | 1859 | 282 | .68 | 417 | 14.3 | 17.0 | 19.7 | 22.4 | 25.1 | 27.8 | 30.5 |
| | -25°C | -6 | | 84.6 | 1547 | 261 | .630 | 388 | 15.4 | 18.6 | 21.9 | 25.1 | 28.3 | 31.5 | 34.8 |
| | | -9 | | 80.1 | 1288 | 240 | .580 | 357 | 16.1 | 20.0 | 23.9 | 27.8 | 31.6 | 35.5 | 39.4 |
| | | -12 | | 75.5 | 1084 | 218 | .530 | 327 | 16.3 | 20.9 | 25.5 | 30.1 | 34.7 | 39.4 | 44.0 |
| | | -14 | (2) | 71.7 | 934 | 199 | .48 | 299 | 15.9 | 21.3 | 26.6 | 32.0 | 37.3 | 42.7 | 48.0 |
| | ISA+ 0°C | -13 | (1) | 90.1 | 2060 | 296 | .71 | 428 | 13.5 | 15.9 | 18.3 | 20.8 | 23.2 | 25.6 | 28.0 |
| | -35°C | -16 | | 84.7 | 1629 | 270 | .650 | 392 | 14.9 | 17.9 | 21.0 | 24.1 | 27.2 | 30.2 | 33.3 |
| | | -19 | | 80.4 | 1349 | 248 | .600 | 362 | 15.7 | 19.4 | 23.1 | 26.9 | 30.6 | 34.3 | 38.0 |
| | | -22 | | 74.9 | 1091 | 222 | .540 | 326 | 16.1 | 20.7 | 25.3 | 29.9 | 34.5 | 39.1 | 43.6 |
| | | -24 | (2) | 70.3 | 910 | 199 | .48 | 293 | 15.7 | 21.2 | 26.7 | 32.2 | 37.7 | 43.2 | 48.7 |
| | ISA-10°C | -22 | (1) | 90.6 | 2200 | 305 | .73 | 431 | 12.8 | 15.0 | 17.3 | 19.6 | 21.9 | 24.1 | 26.4 |
| | -45°C | -26 | | 84.8 | 1715 | 279 | .670 | 396 | 14.3 | 17.2 | 20.2 | 23.1 | 26.0 | 28.9 | 31.8 |
| | | -29 | | 79.7 | 1360 | 252 | .610 | 360 | 15.5 | 19.2 | 22.8 | 26.5 | 30.2 | 33.9 | 37.5 |
| | | -32 | | 74.3 | 1097 | 227 | .550 | 325 | 16.0 | 20.5 | 25.1 | 29.6 | 34.2 | 38.7 | 43.3 |
| | | -35 | (2) | 68.8 | 885 | 199 | .48 | 287 | 15.4 | 21.1 | 26.7 | 32.4 | 38.0 | 43.7 | 49.3 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -25°C | -35°C | -45°C |
| 87.8 | 89.3 | 90.9 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 16)

# CRUISE
# 27,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
| 20000. | ISA+20°C -18°C | 0 | (1) | 87.9 | 1580 | 253 | .64 | 396 | 15.6 | 18.7 | 21.9 | 25.1 | 28.2 | 31.4 | 34.6 |
| | | -1 | | 86.0 | 1453 | 242 | .610 | 380 | 15.9 | 19.3 | 22.7 | 26.2 | 29.6 | 33.1 | 36.5 |
| | | -3 | | 83.8 | 1320 | 230 | .580 | 362 | 16.0 | 19.8 | 23.6 | 27.4 | 31.2 | 35.0 | 38.8 |
| | | -4 | | 81.4 | 1208 | 217 | .550 | 343 | 16.0 | 20.1 | 24.3 | 28.4 | 32.5 | 36.7 | 40.8 |
| | | -6 | (2) | 79.1 | 1107 | 204 | .52 | 324 | 15.7 | 20.2 | 24.7 | 29.2 | 33.8 | 38.3 | 42.8 |
| | ISA+10°C -28°C | -8 | (1) | 89.3 | 1763 | 269 | .67 | 412 | 14.8 | 17.7 | 20.5 | 23.4 | 26.2 | 29.0 | 31.9 |
| | | -10 | | 86.6 | 1564 | 255 | .640 | 391 | 15.4 | 18.6 | 21.8 | 25.0 | 28.2 | 31.4 | 34.6 |
| | | -12 | | 83.7 | 1371 | 238 | .600 | 367 | 15.8 | 19.5 | 23.1 | 26.7 | 30.4 | 34.0 | 37.7 |
| | | -14 | | 80.6 | 1212 | 221 | .560 | 342 | 15.9 | 20.0 | 24.1 | 28.2 | 32.4 | 36.5 | 40.6 |
| | | -16 | (2) | 77.6 | 1076 | 204 | .52 | 317 | 15.5 | 20.1 | 24.8 | 29.4 | 34.1 | 38.7 | 43.4 |
| | ISA+ 0°C -38°C | -17 | (1) | 90.5 | 1960 | 284 | .71 | 424 | 14.0 | 16.6 | 19.1 | 21.7 | 24.2 | 26.8 | 29.3 |
| | | -20 | | 86.5 | 1633 | 263 | .660 | 395 | 15.0 | 18.1 | 21.1 | 24.2 | 27.2 | 30.3 | 33.4 |
| | | -22 | | 83.5 | 1424 | 246 | .620 | 371 | 15.5 | 19.0 | 22.6 | 26.1 | 29.6 | 33.1 | 36.6 |
| | | -25 | | 79.8 | 1215 | 225 | .570 | 341 | 15.7 | 19.9 | 24.0 | 28.1 | 32.2 | 36.3 | 40.4 |
| | | -27 | (2) | 76.0 | 1045 | 204 | .52 | 310 | 15.3 | 20.0 | 24.8 | 29.6 | 34.4 | 39.2 | 44.0 |
| | ISA-10°C -48°C | -26 | (1) | 91.8 | 2176 | 296 | .74 | 432 | 12.9 | 15.2 | 17.5 | 19.8 | 22.1 | 24.4 | 26.7 |
| | | -30 | | 86.2 | 1707 | 271 | .680 | 398 | 14.5 | 17.5 | 20.4 | 23.3 | 26.3 | 29.2 | 32.1 |
| | | -32 | | 82.5 | 1433 | 250 | .630 | 369 | 15.3 | 18.8 | 22.3 | 25.8 | 29.2 | 32.7 | 36.2 |
| | | -35 | | 78.2 | 1182 | 225 | .570 | 334 | 15.6 | 19.8 | 24.0 | 28.3 | 32.5 | 36.7 | 41.0 |
| | | -38 | (2) | 74.4 | 1014 | 203 | .52 | 302 | 15.0 | 19.9 | 24.9 | 29.8 | 34.7 | 39.7 | 44.6 |
| 19000. | ISA+20°C -18°C | 1 | (1) | 87.9 | 1584 | 254 | .64 | 398 | 15.7 | 18.8 | 22.0 | 25.2 | 28.3 | 31.5 | 34.6 |
| | | -1 | | 85.6 | 1434 | 242 | .610 | 380 | 16.1 | 19.6 | 23.0 | 26.5 | 30.0 | 33.5 | 37.0 |
| | | -3 | | 83.3 | 1300 | 230 | .580 | 362 | 16.3 | 20.1 | 24.0 | 27.8 | 31.7 | 35.5 | 39.4 |
| | | -4 | | 80.8 | 1187 | 217 | .550 | 343 | 16.3 | 20.5 | 24.7 | 28.9 | 33.1 | 37.3 | 41.5 |
| | | -6 | (2) | 78.3 | 1076 | 203 | .52 | 322 | 16.0 | 20.7 | 25.3 | 29.9 | 34.6 | 39.2 | 43.9 |
| | ISA+10°C -28°C | -8 | (1) | 89.3 | 1764 | 270 | .68 | 413 | 14.9 | 17.8 | 20.6 | 23.4 | 26.3 | 29.1 | 31.9 |
| | | -10 | | 86.4 | 1548 | 255 | .640 | 391 | 15.6 | 18.8 | 22.0 | 25.3 | 28.5 | 31.7 | 35.0 |
| | | -12 | | 83.3 | 1352 | 238 | .600 | 367 | 16.0 | 19.7 | 23.4 | 27.1 | 30.8 | 34.5 | 38.2 |
| | | -14 | | 80.1 | 1193 | 221 | .560 | 342 | 16.1 | 20.3 | 24.5 | 28.7 | 32.9 | 37.1 | 41.3 |
| | | -17 | (2) | 76.8 | 1047 | 203 | .52 | 316 | 15.8 | 20.6 | 25.4 | 30.1 | 34.9 | 39.7 | 44.5 |
| | ISA+ 0°C -38°C | -17 | (1) | 90.4 | 1959 | 285 | .71 | 425 | 14.1 | 16.6 | 19.2 | 21.7 | 24.3 | 26.8 | 29.4 |
| | | -20 | | 86.3 | 1618 | 263 | .660 | 395 | 15.1 | 18.2 | 21.3 | 24.4 | 27.5 | 30.6 | 33.7 |
| | | -22 | | 83.1 | 1407 | 246 | .620 | 371 | 15.7 | 19.3 | 22.8 | 26.4 | 29.9 | 33.5 | 37.0 |
| | | -25 | | 79.3 | 1196 | 225 | .570 | 341 | 16.0 | 20.2 | 24.4 | 28.5 | 32.7 | 36.9 | 41.1 |
| | | -27 | (2) | 75.3 | 1017 | 203 | .52 | 309 | 15.6 | 20.5 | 25.4 | 30.4 | 35.3 | 40.2 | 45.1 |
| | ISA-10°C -48°C | -26 | (1) | 91.8 | 2176 | 296 | .74 | 432 | 13.0 | 15.3 | 17.6 | 19.9 | 22.2 | 24.5 | 26.8 |
| | | -30 | | 86.1 | 1693 | 271 | .680 | 398 | 14.7 | 17.6 | 20.6 | 23.5 | 26.5 | 29.4 | 32.4 |
| | | -32 | | 82.2 | 1417 | 250 | .630 | 369 | 15.5 | 19.0 | 22.5 | 26.0 | 29.6 | 33.1 | 36.6 |
| | | -35 | | 77.7 | 1163 | 225 | .570 | 334 | 15.8 | 20.1 | 24.4 | 28.7 | 33.0 | 37.3 | 41.6 |
| | | -38 | (2) | 73.7 | 989 | 203 | .52 | 302 | 15.4 | 20.4 | 25.5 | 30.5 | 35.6 | 40.6 | 45.7 |
| 18000. | ISA+20°C -18°C | 1 | (1) | 87.8 | 1581 | 255 | .64 | 400 | 15.8 | 19.0 | 22.1 | 25.3 | 28.5 | 31.6 | 34.8 |
| | | -1 | | 85.3 | 1416 | 242 | .610 | 380 | 16.3 | 19.8 | 23.3 | 26.9 | 30.4 | 33.9 | 37.5 |
| | | -3 | | 82.8 | 1282 | 230 | .580 | 362 | 16.5 | 20.4 | 24.3 | 28.2 | 32.1 | 36.0 | 39.9 |
| | | -5 | | 79.5 | 1131 | 213 | .540 | 337 | 16.5 | 21.0 | 25.4 | 29.8 | 34.2 | 38.6 | 43.1 |
| | | -6 | (2) | 77.2 | 1038 | 201 | .51 | 318 | 16.2 | 21.0 | 25.9 | 30.7 | 35.5 | 40.3 | 45.1 |
| | ISA+10°C -28°C | -8 | (1) | 89.2 | 1761 | 271 | .68 | 414 | 15.0 | 17.8 | 20.7 | 23.5 | 26.4 | 29.2 | 32.0 |
| | | -10 | | 86.1 | 1533 | 255 | .640 | 391 | 15.7 | 19.0 | 22.3 | 25.5 | 28.8 | 32.0 | 35.3 |
| | | -12 | | 82.9 | 1334 | 238 | .600 | 367 | 16.2 | 20.0 | 23.7 | 27.5 | 31.2 | 35.0 | 38.7 |
| | | -15 | | 78.8 | 1137 | 217 | .550 | 336 | 16.4 | 20.8 | 25.2 | 29.6 | 34.0 | 38.4 | 42.8 |
| | | -17 | (2) | 75.9 | 1013 | 201 | .51 | 313 | 16.1 | 21.0 | 25.9 | 30.9 | 35.8 | 40.7 | 45.7 |
| | ISA+ 0°C -38°C | -17 | (1) | 90.4 | 1960 | 285 | .71 | 426 | 14.1 | 16.6 | 19.2 | 21.7 | 24.3 | 26.9 | 29.4 |
| | | -20 | | 86.0 | 1604 | 263 | .660 | 395 | 15.3 | 18.4 | 21.5 | 24.6 | 27.7 | 30.9 | 34.0 |
| | | -23 | | 82.1 | 1344 | 242 | .610 | 365 | 16.0 | 19.7 | 23.4 | 27.2 | 30.9 | 34.6 | 38.3 |
| | | -25 | | 78.1 | 1142 | 221 | .560 | 335 | 16.2 | 20.6 | 25.0 | 29.4 | 33.7 | 38.1 | 42.5 |
| | | -27 | (2) | 74.4 | 987 | 201 | .51 | 306 | 15.9 | 20.9 | 26.0 | 31.1 | 36.1 | 41.2 | 46.3 |
| | ISA-10°C -48°C | -26 | (1) | 91.8 | 2174 | 297 | .74 | 433 | 13.0 | 15.3 | 17.6 | 19.9 | 22.2 | 24.5 | 26.8 |
| | | -30 | | 85.9 | 1680 | 271 | .680 | 398 | 14.8 | 17.7 | 20.7 | 23.7 | 26.7 | 29.7 | 32.6 |
| | | -32 | | 82.0 | 1402 | 250 | .630 | 369 | 15.6 | 19.2 | 22.8 | 26.3 | 29.9 | 33.5 | 37.0 |
| | | -35 | | 77.3 | 1146 | 225 | .570 | 334 | 16.1 | 20.4 | 24.8 | 29.1 | 33.5 | 37.9 | 42.2 |
| | | -38 | (2) | 72.9 | 960 | 201 | .51 | 300 | 15.6 | 20.8 | 26.0 | 31.2 | 36.4 | 41.7 | 46.9 |
| 17000. | ISA+20°C -18°C | 1 | (1) | 87.8 | 1584 | 256 | .64 | 402 | 15.9 | 19.1 | 22.2 | 25.4 | 28.5 | 31.7 | 34.8 |
| | | -1 | | 85.0 | 1400 | 242 | .610 | 380 | 16.5 | 20.0 | 23.6 | 27.2 | 30.8 | 34.3 | 37.9 |
| | | -3 | | 82.4 | 1265 | 230 | .580 | 362 | 16.7 | 20.7 | 24.6 | 28.6 | 32.5 | 36.5 | 40.4 |
| | | -5 | | 79.0 | 1112 | 213 | .540 | 337 | 16.8 | 21.3 | 25.8 | 30.3 | 34.8 | 39.3 | 43.8 |
| | | -7 | (2) | 76.3 | 1007 | 199 | .51 | 316 | 16.5 | 21.4 | 26.4 | 31.4 | 36.3 | 41.3 | 46.2 |
| | ISA+10°C -28°C | -8 | (1) | 89.2 | 1763 | 272 | .68 | 416 | 15.1 | 17.9 | 20.7 | 23.6 | 26.4 | 29.2 | 32.1 |
| | | -10 | | 85.8 | 1518 | 255 | .640 | 391 | 15.9 | 19.2 | 22.5 | 25.8 | 29.1 | 32.4 | 35.7 |
| | | -12 | | 82.6 | 1318 | 238 | .600 | 367 | 16.5 | 20.2 | 24.0 | 27.8 | 31.6 | 35.4 | 39.2 |
| | | -15 | | 78.4 | 1119 | 217 | .550 | 336 | 16.7 | 21.1 | 25.6 | 30.1 | 34.5 | 39.0 | 43.5 |
| | | -17 | (2) | 74.9 | 981 | 199 | .51 | 309 | 16.3 | 21.4 | 26.5 | 31.5 | 36.6 | 41.7 | 46.8 |
| | ISA+ 0°C -38°C | -17 | (1) | 90.5 | 1963 | 286 | .71 | 427 | 14.1 | 16.7 | 19.2 | 21.8 | 24.3 | 26.9 | 29.4 |
| | | -20 | | 85.8 | 1591 | 263 | .660 | 395 | 15.4 | 18.5 | 21.7 | 24.8 | 28.0 | 31.1 | 34.3 |
| | | -23 | | 81.8 | 1328 | 242 | .610 | 365 | 16.2 | 20.0 | 23.7 | 27.5 | 31.3 | 35.0 | 38.8 |
| | | -25 | | 77.6 | 1125 | 221 | .560 | 335 | 16.5 | 20.9 | 25.4 | 29.8 | 34.3 | 38.7 | 43.2 |
| | | -28 | (2) | 73.4 | 955 | 199 | .51 | 303 | 16.0 | 21.3 | 26.5 | 31.7 | 37.0 | 42.2 | 47.5 |
| | ISA-10°C -48°C | -26 | (1) | 91.8 | 2175 | 297 | .74 | 434 | 13.0 | 15.3 | 17.6 | 19.9 | 22.2 | 24.5 | 26.8 |
| | | -30 | | 85.7 | 1668 | 271 | .680 | 398 | 14.9 | 17.9 | 20.9 | 23.9 | 26.9 | 29.9 | 32.9 |
| | | -32 | | 81.7 | 1387 | 250 | .630 | 369 | 15.8 | 19.4 | 23.0 | 26.6 | 30.2 | 33.8 | 37.4 |
| | | -35 | | 76.8 | 1129 | 225 | .570 | 334 | 16.3 | 20.7 | 25.1 | 29.6 | 34.0 | 38.4 | 42.8 |
| | | -38 | (2) | 71.9 | 927 | 199 | .51 | 296 | 15.8 | 21.2 | 26.6 | 32.0 | 37.3 | 42.7 | 48.1 |

Figure 7-14 (Sheet 17)

# CRUISE
# 27,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL: 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | 1 | (1) 87.8 | 1586 | 257 | .65 | 403 | 15.9 | 19.1 | 22.2 | 25.4 | 28.5 | 31.7 | 34.9 |
| | -18°C | -1 | 84.9 | 1392 | 242 | .610 | 380 | 16.6 | 20.1 | 23.7 | 27.3 | 30.9 | 34.5 | 38.1 |
| | | -3 | 82.2 | 1258 | 230 | .580 | 362 | 16.8 | 20.8 | 24.8 | 28.8 | 32.7 | 36.7 | 40.7 |
| | | -5 | 78.8 | 1103 | 213 | .540 | 337 | 16.9 | 21.5 | 26.0 | 30.5 | 35.1 | 39.6 | 44.1 |
| | | -7 | (2) 75.8 | 990 | 198 | .50 | 314 | 16.6 | 21.6 | 26.7 | 31.7 | 36.8 | 41.8 | 46.9 |
| | ISA+10°C | -8 | (1) 89.2 | 1761 | 272 | .68 | 416 | 15.1 | 17.9 | 20.8 | 23.6 | 26.5 | 29.3 | 32.1 |
| | -28°C | -10 | 85.7 | 1511 | 255 | .640 | 391 | 16.0 | 19.3 | 22.6 | 25.9 | 29.2 | 32.5 | 35.8 |
| | | -13 | 81.6 | 1266 | 234 | .590 | 361 | 16.6 | 20.6 | 24.5 | 28.5 | 32.4 | 36.4 | 40.3 |
| | | -15 | 78.1 | 1110 | 217 | .550 | 336 | 16.8 | 21.3 | 25.8 | 30.3 | 34.8 | 39.3 | 43.8 |
| | | -17 | (2) 74.4 | 963 | 198 | .50 | 308 | 16.4 | 21.5 | 26.7 | 31.9 | 37.1 | 42.3 | 47.5 |
| | ISA+ 0°C | -17 | (1) 90.4 | 1963 | 286 | .71 | 428 | 14.1 | 16.7 | 19.2 | 21.8 | 24.3 | 26.9 | 29.4 |
| | -38°C | -20 | 85.7 | 1584 | 263 | .660 | 395 | 15.5 | 18.6 | 21.8 | 24.9 | 28.1 | 31.2 | 34.4 |
| | | -23 | 81.6 | 1321 | 242 | .610 | 365 | 16.3 | 20.1 | 23.9 | 27.6 | 31.4 | 35.2 | 39.0 |
| | | -25 | 77.4 | 1116 | 221 | .560 | 335 | 16.6 | 21.1 | 25.6 | 30.0 | 34.5 | 39.0 | 43.5 |
| | | -28 | (2) 72.9 | 938 | 198 | .50 | 301 | 16.1 | 21.5 | 26.8 | 32.1 | 37.5 | 42.8 | 48.1 |
| | ISA-10°C | -26 | (1) 91.8 | 2175 | 298 | .74 | 434 | 13.1 | 15.3 | 17.6 | 19.9 | 22.2 | 24.5 | 26.8 |
| | -48°C | -30 | 85.7 | 1662 | 271 | .680 | 398 | 14.9 | 17.9 | 21.0 | 24.0 | 27.0 | 30.0 | 33.0 |
| | | -33 | 80.8 | 1331 | 246 | .620 | 363 | 16.0 | 19.8 | 23.5 | 27.3 | 31.0 | 34.8 | 38.6 |
| | | -36 | 75.8 | 1086 | 221 | .560 | 328 | 16.4 | 21.0 | 25.6 | 30.2 | 34.8 | 39.4 | 44.0 |
| | | -38 | (2) 71.4 | 912 | 198 | .50 | 295 | 15.9 | 21.4 | 26.8 | 32.3 | 37.8 | 43.3 | 48.8 |
| 16000. | ISA+20°C | 1 | (1) 87.8 | 1582 | 257 | .65 | 403 | 16.0 | 19.2 | 22.3 | 25.5 | 28.6 | 31.8 | 35.0 |
| | -18°C | -1 | 84.7 | 1384 | 242 | .610 | 380 | 16.6 | 20.3 | 23.9 | 27.5 | 31.1 | 34.7 | 38.3 |
| | | -3 | 82.0 | 1250 | 230 | .580 | 362 | 16.9 | 20.9 | 24.9 | 28.9 | 32.9 | 36.9 | 40.9 |
| | | -5 | 78.6 | 1095 | 213 | .540 | 337 | 17.1 | 21.6 | 26.2 | 30.8 | 35.3 | 39.9 | 44.5 |
| | | -7 | (2) 75.6 | 981 | 198 | .50 | 314 | 16.7 | 21.8 | 26.9 | 32.0 | 37.1 | 42.2 | 47.3 |
| | ISA+10°C | -8 | (1) 89.2 | 1765 | 272 | .68 | 417 | 15.1 | 18.0 | 20.8 | 23.6 | 26.5 | 29.3 | 32.1 |
| | -28°C | -10 | 85.6 | 1504 | 255 | .640 | 391 | 16.0 | 19.4 | 22.7 | 26.0 | 29.3 | 32.7 | 36.0 |
| | | -13 | 81.4 | 1259 | 234 | .590 | 361 | 16.7 | 20.7 | 24.7 | 28.6 | 32.6 | 36.6 | 40.6 |
| | | -15 | 77.9 | 1101 | 217 | .550 | 336 | 16.9 | 21.5 | 26.0 | 30.5 | 35.1 | 39.6 | 44.2 |
| | | -17 | (2) 74.1 | 956 | 198 | .50 | 308 | 16.5 | 21.7 | 27.0 | 32.2 | 37.4 | 42.7 | 47.9 |
| | ISA+ 0°C | -17 | (1) 90.4 | 1962 | 287 | .72 | 428 | 14.2 | 16.7 | 19.3 | 21.8 | 24.4 | 26.9 | 29.5 |
| | -38°C | -20 | 85.6 | 1578 | 263 | .660 | 395 | 15.5 | 18.7 | 21.9 | 25.0 | 28.2 | 31.4 | 34.5 |
| | | -23 | 81.5 | 1314 | 242 | .610 | 365 | 16.4 | 20.2 | 24.0 | 27.8 | 31.6 | 35.4 | 39.2 |
| | | -25 | 77.2 | 1108 | 221 | .560 | 335 | 16.7 | 21.2 | 25.7 | 30.3 | 34.8 | 39.3 | 43.8 |
| | | -28 | (2) 72.7 | 930 | 198 | .50 | 301 | 16.3 | 21.7 | 27.0 | 32.4 | 37.8 | 43.2 | 48.5 |
| | ISA-10°C | -26 | (1) 91.8 | 2176 | 298 | .74 | 434 | 13.1 | 15.4 | 17.7 | 20.0 | 22.3 | 24.6 | 26.9 |
| | -48°C | -30 | 85.6 | 1656 | 271 | .680 | 398 | 15.0 | 18.0 | 21.0 | 24.0 | 27.1 | 30.1 | 33.1 |
| | | -33 | 80.6 | 1324 | 246 | .620 | 363 | 16.1 | 19.9 | 23.6 | 27.4 | 31.2 | 35.0 | 38.8 |
| | | -36 | 75.6 | 1078 | 221 | .560 | 328 | 16.5 | 21.2 | 25.8 | 30.4 | 35.1 | 39.7 | 44.3 |
| | | -38 | (2) 71.0 | 899 | 197 | .50 | 294 | 16.0 | 21.5 | 27.1 | 32.7 | 38.2 | 43.8 | 49.4 |
| 14000. | ISA+20°C | 1 | (1) 87.8 | 1587 | 259 | .65 | 406 | 16.1 | 19.3 | 22.4 | 25.6 | 28.7 | 31.9 | 35.0 |
| | -18°C | -1 | 84.2 | 1356 | 242 | .610 | 380 | 17.0 | 20.7 | 24.4 | 28.1 | 31.7 | 35.4 | 39.1 |
| | | -3 | 80.4 | 1177 | 225 | .570 | 356 | 17.5 | 21.7 | 26.0 | 30.2 | 34.5 | 38.7 | 42.9 |
| | | -5 | 77.7 | 1065 | 213 | .540 | 337 | 17.5 | 22.2 | 26.9 | 31.6 | 36.3 | 41.0 | 45.7 |
| | | -7 | (2) 73.8 | 921 | 194 | .49 | 308 | 17.2 | 22.6 | 28.1 | 33.5 | 38.9 | 44.4 | 49.8 |
| | ISA+10°C | -7 | (1) 89.2 | 1765 | 274 | .69 | 419 | 15.2 | 18.1 | 20.9 | 23.7 | 26.6 | 29.4 | 32.2 |
| | -28°C | -10 | 85.1 | 1479 | 255 | .640 | 391 | 16.3 | 19.7 | 23.1 | 26.5 | 29.8 | 33.2 | 36.6 |
| | | -13 | 80.7 | 1232 | 234 | .590 | 361 | 17.1 | 21.2 | 25.2 | 29.3 | 33.3 | 37.4 | 41.4 |
| | | -15 | 76.2 | 1037 | 213 | .540 | 330 | 17.4 | 22.2 | 27.0 | 31.8 | 36.6 | 41.5 | 46.3 |
| | | -18 | (2) 72.4 | 897 | 195 | .49 | 302 | 17.0 | 22.6 | 28.1 | 33.7 | 39.3 | 44.9 | 50.4 |
| | ISA+ 0°C | -16 | (1) 90.4 | 1964 | 288 | .72 | 430 | 14.2 | 16.8 | 19.3 | 21.9 | 24.4 | 27.0 | 29.5 |
| | -38°C | -20 | 85.2 | 1555 | 263 | .660 | 395 | 15.8 | 19.0 | 22.2 | 25.4 | 28.6 | 31.8 | 35.0 |
| | | -23 | 81.0 | 1287 | 242 | .610 | 365 | 16.7 | 20.6 | 24.5 | 28.4 | 32.3 | 36.1 | 40.0 |
| | | -26 | 75.6 | 1043 | 217 | .550 | 329 | 17.2 | 22.0 | 26.8 | 31.6 | 36.4 | 41.2 | 46.0 |
| | | -28 | (2) 71.0 | 874 | 195 | .49 | 296 | 16.8 | 22.5 | 28.2 | 33.9 | 39.6 | 45.4 | 51.1 |
| | ISA-10°C | -26 | (1) 91.8 | 2180 | 299 | .74 | 436 | 13.1 | 15.4 | 17.7 | 20.0 | 22.3 | 24.6 | 26.9 |
| | -48°C | -30 | 85.2 | 1635 | 271 | .680 | 398 | 15.2 | 18.2 | 21.3 | 24.3 | 27.4 | 30.5 | 33.5 |
| | | -33 | 80.1 | 1299 | 246 | .620 | 363 | 16.4 | 20.3 | 24.1 | 28.0 | 31.8 | 35.7 | 39.5 |
| | | -36 | 74.9 | 1049 | 221 | .560 | 328 | 17.0 | 21.7 | 26.5 | 31.3 | 36.0 | 40.8 | 45.6 |
| | | -38 | (2) 69.5 | 850 | 195 | .49 | 290 | 16.5 | 22.3 | 28.2 | 34.1 | 40.0 | 45.9 | 51.8 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -28°C | -38°C | -48°C |
| 88.0 | 89.5 | 91.0 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 18)

# CRUISE
# 29,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
| 20000. | ISA+20°C -22°C | -4 | (1) | 88.4 | 1503 | 245 | .64 | 397 | 16.4 | 19.8 | 23.1 | 26.4 | 29.7 | 33.1 | 36.4 |
| | | -5 | | 86.8 | 1402 | 236 | .620 | 384 | 16.7 | 20.2 | 23.8 | 27.4 | 30.9 | 34.5 | 38.1 |
| | | -6 | | 84.8 | 1279 | 224 | .590 | 365 | 16.8 | 20.7 | 24.6 | 28.5 | 32.5 | 36.4 | 40.3 |
| | | -8 | | 82.6 | 1169 | 212 | .560 | 347 | 16.8 | 21.1 | 25.4 | 29.6 | 33.9 | 38.2 | 42.5 |
| | | -9 | (2) | 80.8 | 1094 | 201 | .53 | 330 | 16.5 | 21.0 | 25.6 | 30.2 | 34.7 | 39.3 | 43.9 |
| | ISA+10°C -32°C | -12 | (1) | 89.8 | 1686 | 262 | .68 | 415 | 15.7 | 18.7 | 21.6 | 24.6 | 27.6 | 30.5 | 33.5 |
| | | -14 | | 87.3 | 1503 | 248 | .650 | 394 | 16.2 | 19.6 | 22.9 | 26.2 | 29.5 | 32.9 | 36.2 |
| | | -16 | | 84.5 | 1324 | 232 | .610 | 370 | 16.6 | 20.4 | 24.2 | 27.9 | 31.7 | 35.5 | 39.3 |
| | | -18 | | 81.7 | 1173 | 216 | .570 | 346 | 16.7 | 20.9 | 25.2 | 29.5 | 33.7 | 38.0 | 42.3 |
| | | -20 | (2) | 79.2 | 1066 | 201 | .53 | 324 | 16.3 | 21.0 | 25.7 | 30.4 | 35.0 | 39.7 | 44.4 |
| | ISA+ 0°C -42°C | -21 | (1) | 90.6 | 1855 | 275 | .72 | 425 | 14.8 | 17.5 | 20.2 | 22.9 | 25.6 | 28.3 | 31.0 |
| | | -24 | | 87.0 | 1565 | 256 | .670 | 398 | 15.8 | 19.0 | 22.2 | 25.4 | 28.6 | 31.8 | 35.0 |
| | | -26 | | 84.2 | 1371 | 240 | .630 | 374 | 16.3 | 20.0 | 23.6 | 27.3 | 30.9 | 34.6 | 38.2 |
| | | -28 | | 80.8 | 1177 | 220 | .580 | 344 | 16.5 | 20.8 | 25.0 | 29.3 | 33.5 | 37.8 | 42.0 |
| | | -30 | (2) | 77.7 | 1039 | 202 | .53 | 317 | 16.1 | 20.9 | 25.7 | 30.5 | 35.3 | 40.2 | 45.0 |
| | ISA-10°C -52°C | -30 | (1) | 92.4 | 2048 | 285 | .74 | 430 | 13.7 | 16.1 | 18.6 | 21.0 | 23.5 | 25.9 | 28.3 |
| | | -33 | | 86.5 | 1634 | 264 | .690 | 400 | 15.3 | 18.4 | 21.4 | 24.5 | 27.6 | 30.6 | 33.7 |
| | | -36 | | 83.1 | 1377 | 244 | .640 | 371 | 16.1 | 19.7 | 23.4 | 27.0 | 30.6 | 34.2 | 37.9 |
| | | -38 | | 79.8 | 1180 | 224 | .590 | 343 | 16.3 | 20.6 | 24.8 | 29.0 | 33.3 | 37.5 | 41.8 |
| | | -41 | (2) | 76.1 | 1010 | 202 | .53 | 310 | 15.9 | 20.8 | 25.8 | 30.7 | 35.7 | 40.6 | 45.6 |
| 19000. | ISA+20°C -22°C | -3 | (1) | 88.3 | 1503 | 246 | .65 | 399 | 16.6 | 19.9 | 23.2 | 26.6 | 29.9 | 33.2 | 36.6 |
| | | -5 | | 86.4 | 1380 | 236 | .620 | 384 | 16.9 | 20.5 | 24.2 | 27.8 | 31.4 | 35.0 | 38.7 |
| | | -6 | | 84.3 | 1256 | 224 | .590 | 365 | 17.1 | 21.1 | 25.1 | 29.1 | 33.0 | 37.0 | 41.0 |
| | | -9 | | 81.2 | 1115 | 208 | .550 | 340 | 17.1 | 21.6 | 26.0 | 30.5 | 35.0 | 39.5 | 44.0 |
| | | -10 | (2) | 79.3 | 1038 | 197 | .52 | 323 | 16.7 | 21.5 | 26.3 | 31.1 | 36.0 | 40.8 | 45.6 |
| | ISA+10°C -32°C | -12 | (1) | 89.7 | 1680 | 262 | .69 | 416 | 15.8 | 18.8 | 21.8 | 24.7 | 27.7 | 30.7 | 33.7 |
| | | -14 | | 87.0 | 1486 | 248 | .650 | 394 | 16.4 | 19.8 | 23.1 | 26.5 | 29.9 | 33.2 | 36.6 |
| | | -16 | | 84.1 | 1303 | 232 | .610 | 370 | 16.9 | 20.7 | 24.5 | 28.4 | 32.2 | 36.1 | 39.9 |
| | | -19 | | 80.4 | 1118 | 212 | .560 | 340 | 17.0 | 21.4 | 25.9 | 30.4 | 34.9 | 39.3 | 43.8 |
| | | -20 | (2) | 77.8 | 1011 | 197 | .52 | 317 | 16.5 | 21.4 | 26.4 | 31.3 | 36.3 | 41.2 | 46.2 |
| | ISA+ 0°C -42°C | -21 | (1) | 90.5 | 1850 | 275 | .72 | 425 | 14.9 | 17.6 | 20.3 | 23.0 | 25.7 | 28.4 | 31.1 |
| | | -24 | | 86.8 | 1550 | 256 | .670 | 398 | 16.0 | 19.2 | 22.4 | 25.7 | 28.9 | 32.1 | 35.3 |
| | | -26 | | 83.1 | 1309 | 236 | .620 | 368 | 16.7 | 20.5 | 24.3 | 28.1 | 31.9 | 35.8 | 39.6 |
| | | -29 | | 79.6 | 1119 | 216 | .570 | 338 | 16.8 | 21.3 | 25.8 | 30.2 | 34.7 | 39.2 | 43.6 |
| | | -31 | (2) | 76.2 | 984 | 197 | .52 | 310 | 16.3 | 21.4 | 26.4 | 31.5 | 36.6 | 41.7 | 46.8 |
| | ISA-10°C -52°C | -30 | (1) | 92.3 | 2049 | 286 | .74 | 431 | 13.7 | 16.2 | 18.6 | 21.0 | 23.5 | 25.9 | 28.4 |
| | | -33 | | 86.3 | 1620 | 264 | .690 | 400 | 15.5 | 18.5 | 21.6 | 24.7 | 27.8 | 30.9 | 34.0 |
| | | -36 | | 82.1 | 1315 | 240 | .630 | 366 | 16.4 | 20.2 | 24.0 | 27.8 | 31.6 | 35.4 | 39.2 |
| | | -39 | | 78.6 | 1123 | 220 | .580 | 337 | 16.6 | 21.1 | 25.5 | 30.0 | 34.4 | 38.9 | 43.3 |
| | | -41 | (2) | 74.6 | 957 | 197 | .52 | 303 | 16.0 | 21.2 | 26.5 | 31.7 | 36.9 | 42.1 | 47.4 |
| 18000. | ISA+20°C -22°C | -3 | (1) | 88.3 | 1504 | 247 | .65 | 401 | 16.7 | 20.0 | 23.4 | 26.7 | 30.0 | 33.3 | 36.7 |
| | | -5 | | 86.1 | 1361 | 236 | .620 | 384 | 17.2 | 20.8 | 24.5 | 28.2 | 31.9 | 35.5 | 39.2 |
| | | -6 | | 83.8 | 1235 | 224 | .590 | 365 | 17.4 | 21.5 | 25.5 | 29.6 | 33.6 | 37.7 | 41.7 |
| | | -9 | | 80.6 | 1094 | 208 | .550 | 340 | 17.4 | 22.0 | 26.6 | 31.1 | 35.7 | 40.3 | 44.8 |
| | | -10 | (2) | 78.4 | 1002 | 196 | .52 | 321 | 17.1 | 22.1 | 27.1 | 32.1 | 37.0 | 42.0 | 47.0 |
| | ISA+10°C -32°C | -12 | (1) | 89.7 | 1686 | 264 | .69 | 418 | 15.9 | 18.8 | 21.8 | 24.8 | 27.7 | 30.7 | 33.7 |
| | | -14 | | 86.7 | 1470 | 248 | .650 | 394 | 16.6 | 20.0 | 23.4 | 26.8 | 30.2 | 33.6 | 37.0 |
| | | -16 | | 83.7 | 1283 | 232 | .610 | 370 | 17.1 | 21.0 | 24.9 | 28.8 | 32.7 | 36.6 | 40.5 |
| | | -19 | | 79.9 | 1098 | 212 | .560 | 340 | 17.3 | 21.8 | 26.4 | 30.9 | 35.5 | 40.1 | 44.6 |
| | | -21 | (2) | 76.8 | 974 | 195 | .52 | 314 | 16.9 | 22.0 | 27.1 | 32.3 | 37.4 | 42.5 | 47.7 |
| | ISA+ 0°C -42°C | -21 | (1) | 90.5 | 1850 | 276 | .72 | 426 | 14.9 | 17.6 | 20.3 | 23.0 | 25.7 | 28.4 | 31.1 |
| | | -24 | | 86.6 | 1535 | 256 | .670 | 398 | 16.1 | 19.4 | 22.6 | 25.9 | 29.2 | 32.4 | 35.7 |
| | | -26 | | 82.8 | 1290 | 236 | .620 | 368 | 16.9 | 20.8 | 24.6 | 28.5 | 32.4 | 36.3 | 40.1 |
| | | -29 | | 79.0 | 1100 | 216 | .570 | 338 | 17.1 | 21.7 | 26.2 | 30.8 | 35.3 | 39.9 | 44.4 |
| | | -31 | (2) | 75.2 | 945 | 195 | .52 | 307 | 16.6 | 21.9 | 27.2 | 32.5 | 37.8 | 43.1 | 48.4 |
| | ISA-10°C -52°C | -30 | (1) | 92.3 | 2050 | 287 | .74 | 432 | 13.8 | 16.2 | 18.6 | 21.1 | 23.5 | 25.9 | 28.4 |
| | | -33 | | 86.1 | 1606 | 264 | .690 | 400 | 15.6 | 18.7 | 21.8 | 24.9 | 28.0 | 31.2 | 34.3 |
| | | -36 | | 81.8 | 1299 | 240 | .630 | 366 | 16.6 | 20.5 | 24.3 | 28.2 | 32.0 | 35.9 | 39.7 |
| | | -39 | | 77.4 | 1069 | 216 | .570 | 331 | 16.9 | 21.6 | 26.3 | 30.9 | 35.6 | 40.3 | 45.0 |
| | | -42 | (2) | 73.5 | 916 | 194 | .52 | 300 | 16.3 | 21.8 | 27.2 | 32.7 | 38.2 | 43.6 | 49.1 |
| 17000. | ISA+20°C -22°C | -3 | (1) | 88.3 | 1506 | 249 | .65 | 404 | 16.8 | 20.1 | 23.5 | 26.8 | 30.1 | 33.4 | 36.7 |
| | | -5 | | 85.7 | 1343 | 236 | .620 | 384 | 17.4 | 21.1 | 24.8 | 28.6 | 32.3 | 36.0 | 39.7 |
| | | -6 | | 83.4 | 1214 | 224 | .590 | 365 | 17.7 | 21.8 | 25.9 | 30.1 | 34.2 | 38.3 | 42.4 |
| | | -9 | | 80.0 | 1074 | 208 | .550 | 340 | 17.7 | 22.4 | 27.1 | 31.7 | 36.4 | 41.0 | 45.7 |
| | | -10 | (2) | 77.3 | 968 | 194 | .51 | 319 | 17.4 | 22.6 | 27.7 | 32.9 | 38.1 | 43.2 | 48.4 |
| | ISA+10°C -32°C | -11 | (1) | 89.6 | 1683 | 264 | .69 | 419 | 16.0 | 18.9 | 21.9 | 24.9 | 27.8 | 30.8 | 33.8 |
| | | -14 | | 86.4 | 1454 | 248 | .650 | 394 | 16.8 | 20.2 | 23.7 | 27.1 | 30.5 | 34.0 | 37.4 |
| | | -17 | | 82.6 | 1223 | 228 | .600 | 364 | 17.5 | 21.6 | 25.6 | 29.7 | 33.8 | 37.9 | 42.0 |
| | | -19 | | 79.3 | 1078 | 212 | .560 | 340 | 17.6 | 22.2 | 26.9 | 31.5 | 36.1 | 40.8 | 45.4 |
| | | -21 | (2) | 75.8 | 941 | 194 | .51 | 312 | 17.2 | 22.5 | 27.8 | 33.1 | 38.5 | 43.8 | 49.1 |
| | ISA+ 0°C -42°C | -21 | (1) | 90.6 | 1856 | 277 | .72 | 428 | 15.0 | 17.7 | 20.4 | 23.0 | 25.7 | 28.4 | 31.1 |
| | | -24 | | 86.3 | 1521 | 256 | .670 | 398 | 16.3 | 19.6 | 22.8 | 26.1 | 29.4 | 32.7 | 36.0 |
| | | -26 | | 82.4 | 1274 | 236 | .620 | 368 | 17.1 | 21.0 | 25.0 | 28.9 | 32.8 | 36.7 | 40.7 |
| | | -29 | | 78.5 | 1082 | 216 | .570 | 338 | 17.4 | 22.0 | 26.7 | 31.3 | 35.9 | 40.5 | 45.2 |
| | | -31 | (2) | 74.3 | 915 | 194 | .51 | 305 | 17.0 | 22.4 | 27.9 | 33.4 | 38.8 | 44.3 | 49.8 |
| | ISA-10°C -52°C | -30 | (1) | 92.4 | 2055 | 287 | .75 | 433 | 13.8 | 16.2 | 18.6 | 21.1 | 23.5 | 25.9 | 28.4 |
| | | -33 | | 86.0 | 1594 | 264 | .690 | 400 | 15.7 | 18.9 | 22.0 | 25.1 | 28.3 | 31.4 | 34.5 |
| | | -36 | | 81.5 | 1283 | 240 | .630 | 366 | 16.8 | 20.7 | 24.6 | 28.5 | 32.4 | 36.3 | 40.2 |
| | | -39 | | 76.9 | 1052 | 216 | .570 | 331 | 17.2 | 22.0 | 26.7 | 31.5 | 36.2 | 41.0 | 45.7 |
| | | -42 | (2) | 72.8 | 891 | 194 | .51 | 299 | 16.7 | 22.3 | 27.9 | 33.6 | 39.2 | 44.8 | 50.4 |

Figure 7-14 (Sheet 19)

# CRUISE
# 29,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | -3 | (1) 88.2 | 1503 | 249 | .65 | 404 | 16.9 | 20.2 | 23.6 | 26.9 | 30.2 | 33.5 | 36.9 |
| | -22°C | -5 | 85.6 | 1335 | 236 | .620 | 384 | 17.5 | 21.2 | 25.0 | 28.7 | 32.5 | 36.2 | 40.0 |
| | | -7 | 82.3 | 1168 | 220 | .580 | 359 | 17.9 | 22.2 | 26.5 | 30.7 | 35.0 | 39.3 | 43.6 |
| | | -9 | 79.8 | 1064 | 208 | .550 | 340 | 17.9 | 22.6 | 27.3 | 32.0 | 36.7 | 41.4 | 46.1 |
| | | -10 | (2) 76.7 | 950 | 193 | .51 | 317 | 17.5 | 22.8 | 28.1 | 33.3 | 38.6 | 43.9 | 49.1 |
| | ISA+10°C | -11 | (1) 89.6 | 1681 | 265 | .69 | 419 | 16.0 | 19.0 | 22.0 | 24.9 | 27.9 | 30.9 | 33.9 |
| | -32°C | -14 | 86.3 | 1447 | 248 | .650 | 394 | 16.9 | 20.3 | 23.8 | 27.2 | 30.7 | 34.1 | 37.6 |
| | | -17 | 82.4 | 1215 | 228 | .600 | 364 | 17.6 | 21.7 | 25.8 | 29.9 | 34.1 | 38.2 | 42.3 |
| | | -19 | 79.0 | 1069 | 212 | .560 | 340 | 17.7 | 22.4 | 27.1 | 31.8 | 36.4 | 41.1 | 45.8 |
| | | -21 | (2) 75.3 | 924 | 193 | .51 | 310 | 17.3 | 22.7 | 28.1 | 33.5 | 39.0 | 44.4 | 49.8 |
| | ISA+ 0°C | -21 | (1) 90.5 | 1850 | 277 | .72 | 428 | 15.0 | 17.7 | 20.4 | 23.1 | 25.8 | 28.5 | 31.2 |
| | -42°C | -24 | 86.2 | 1515 | 256 | .670 | 398 | 16.3 | 19.6 | 22.9 | 26.2 | 29.6 | 32.9 | 36.2 |
| | | -26 | 82.3 | 1266 | 236 | .620 | 368 | 17.2 | 21.2 | 25.1 | 29.1 | 33.0 | 37.0 | 40.9 |
| | | -29 | 78.3 | 1073 | 216 | .570 | 338 | 17.6 | 22.2 | 26.9 | 31.5 | 36.2 | 40.9 | 45.5 |
| | | -31 | (2) 73.8 | 900 | 193 | .51 | 304 | 17.1 | 22.7 | 28.2 | 33.8 | 39.3 | 44.9 | 50.4 |
| | ISA-10°C | -30 | (1) 92.4 | 2056 | 288 | .75 | 433 | 13.8 | 16.2 | 18.6 | 21.1 | 23.5 | 25.9 | 28.4 |
| | -52°C | -33 | 85.9 | 1587 | 264 | .690 | 400 | 15.8 | 18.9 | 22.1 | 25.2 | 28.4 | 31.5 | 34.7 |
| | | -36 | 81.3 | 1275 | 240 | .630 | 366 | 16.9 | 20.8 | 24.8 | 28.7 | 32.6 | 36.5 | 40.4 |
| | | -39 | 76.6 | 1043 | 216 | .570 | 331 | 17.4 | 22.1 | 26.9 | 31.7 | 36.5 | 41.3 | 46.1 |
| | | -42 | (2) 72.3 | 875 | 193 | .51 | 297 | 16.8 | 22.6 | 28.3 | 34.0 | 39.7 | 45.4 | 51.1 |
| 16000. | ISA+20°C | -3 | (1) 88.2 | 1502 | 250 | .65 | 405 | 17.0 | 20.3 | 23.6 | 26.9 | 30.3 | 33.6 | 36.9 |
| | -22°C | -5 | 85.4 | 1327 | 236 | .620 | 384 | 17.6 | 21.4 | 25.1 | 28.9 | 32.7 | 36.5 | 40.2 |
| | | -7 | 82.0 | 1159 | 220 | .580 | 359 | 18.0 | 22.3 | 26.6 | 31.0 | 35.3 | 39.6 | 43.9 |
| | | -9 | 79.5 | 1054 | 208 | .550 | 340 | 18.1 | 22.8 | 27.5 | 32.3 | 37.0 | 41.8 | 46.5 |
| | | -11 | (2) 76.2 | 934 | 192 | .51 | 315 | 17.7 | 23.0 | 28.4 | 33.7 | 39.1 | 44.4 | 49.8 |
| | ISA+10°C | -11 | (1) 89.6 | 1683 | 265 | .69 | 420 | 16.0 | 19.0 | 22.0 | 24.9 | 27.9 | 30.9 | 33.9 |
| | -32°C | -14 | 86.2 | 1440 | 248 | .650 | 394 | 16.9 | 20.4 | 23.9 | 27.4 | 30.8 | 34.3 | 37.8 |
| | | -17 | 82.2 | 1206 | 228 | .600 | 364 | 17.7 | 21.9 | 26.0 | 30.2 | 34.3 | 38.4 | 42.6 |
| | | -19 | 78.8 | 1060 | 212 | .560 | 340 | 17.9 | 22.6 | 27.3 | 32.0 | 36.8 | 41.5 | 46.2 |
| | | -21 | (2) 74.7 | 907 | 191 | .51 | 308 | 17.4 | 22.9 | 28.5 | 34.0 | 39.5 | 45.0 | 50.5 |
| | ISA+ 0°C | -20 | (1) 90.5 | 1851 | 277 | .72 | 428 | 15.0 | 17.7 | 20.4 | 23.1 | 25.8 | 28.5 | 31.2 |
| | -42°C | -24 | 86.1 | 1508 | 256 | .670 | 398 | 16.4 | 19.7 | 23.0 | 26.4 | 29.7 | 33.0 | 36.3 |
| | | -26 | 82.1 | 1258 | 236 | .620 | 368 | 17.3 | 21.3 | 25.3 | 29.3 | 33.2 | 37.2 | 41.2 |
| | | -29 | 77.2 | 1032 | 212 | .560 | 332 | 17.7 | 22.5 | 27.4 | 32.2 | 37.1 | 41.9 | 46.8 |
| | | -32 | (2) 73.3 | 883 | 192 | .51 | 302 | 17.2 | 22.9 | 28.5 | 34.2 | 39.9 | 45.5 | 51.2 |
| | ISA-10°C | -30 | (1) 92.3 | 2055 | 288 | .75 | 434 | 13.8 | 16.2 | 18.7 | 21.1 | 23.5 | 26.0 | 28.4 |
| | -52°C | -33 | 85.8 | 1581 | 264 | .690 | 400 | 15.8 | 19.0 | 22.2 | 25.3 | 28.5 | 31.6 | 34.8 |
| | | -36 | 81.2 | 1268 | 240 | .630 | 366 | 17.0 | 21.0 | 24.9 | 28.8 | 32.8 | 36.7 | 40.7 |
| | | -39 | 76.4 | 1035 | 216 | .570 | 331 | 17.5 | 22.3 | 27.2 | 32.0 | 36.8 | 41.6 | 46.5 |
| | | -42 | (2) 71.7 | 859 | 192 | .51 | 296 | 16.9 | 22.8 | 28.6 | 34.4 | 40.2 | 46.0 | 51.8 |
| 14000. | ISA+20°C | -2 | (1) 88.3 | 1513 | 252 | .66 | 409 | 17.1 | 20.4 | 23.7 | 27.0 | 30.3 | 33.6 | 36.9 |
| | -22°C | -5 | 84.8 | 1296 | 236 | .620 | 384 | 18.0 | 21.9 | 25.7 | 29.6 | 33.4 | 37.3 | 41.2 |
| | | -7 | 81.2 | 1128 | 220 | .580 | 359 | 18.5 | 22.9 | 27.4 | 31.8 | 36.2 | 40.7 | 45.1 |
| | | -9 | 77.7 | 988 | 204 | .540 | 334 | 18.6 | 23.7 | 28.8 | 33.8 | 38.9 | 43.9 | 49.0 |
| | | -11 | (2) 74.4 | 879 | 189 | .50 | 310 | 18.3 | 23.9 | 29.6 | 35.3 | 41.0 | 46.7 | 52.4 |
| | ISA+10°C | -11 | (1) 89.6 | 1684 | 267 | .70 | 422 | 16.2 | 19.1 | 22.1 | 25.1 | 28.0 | 31.0 | 34.0 |
| | -32°C | -14 | 85.7 | 1413 | 248 | .650 | 394 | 17.3 | 20.8 | 24.3 | 27.9 | 31.4 | 35.0 | 38.5 |
| | | -17 | 81.5 | 1176 | 228 | .600 | 364 | 18.2 | 22.4 | 26.7 | 30.9 | 35.2 | 39.4 | 43.7 |
| | | -19 | 77.0 | 993 | 208 | .550 | 334 | 18.5 | 23.5 | 28.6 | 33.6 | 38.6 | 43.7 | 48.7 |
| | | -21 | (2) 73.0 | 855 | 189 | .50 | 304 | 18.0 | 23.9 | 29.7 | 35.6 | 41.4 | 47.3 | 53.1 |
| | ISA+ 0°C | -20 | (1) 90.5 | 1856 | 279 | .73 | 430 | 15.1 | 17.8 | 20.5 | 23.2 | 25.9 | 28.6 | 31.3 |
| | -42°C | -24 | 85.7 | 1484 | 256 | .670 | 398 | 16.7 | 20.0 | 23.4 | 26.8 | 30.2 | 33.5 | 36.9 |
| | | -26 | 81.5 | 1230 | 236 | .620 | 368 | 17.7 | 21.8 | 25.9 | 29.9 | 34.0 | 38.1 | 42.1 |
| | | -29 | 76.3 | 999 | 212 | .560 | 332 | 18.3 | 23.3 | 28.3 | 33.3 | 38.3 | 43.3 | 48.3 |
| | | -32 | (2) 71.5 | 832 | 189 | .50 | 298 | 17.7 | 23.8 | 29.8 | 35.8 | 41.8 | 47.8 | 53.8 |
| | ISA-10°C | -30 | (1) 92.3 | 2057 | 289 | .75 | 435 | 13.9 | 16.3 | 18.7 | 21.1 | 23.6 | 26.0 | 28.4 |
| | -52°C | -33 | 85.5 | 1559 | 264 | .690 | 400 | 16.1 | 19.3 | 22.5 | 25.7 | 28.9 | 32.1 | 35.3 |
| | | -36 | 80.7 | 1241 | 240 | .630 | 366 | 17.4 | 21.4 | 25.4 | 29.5 | 33.5 | 37.5 | 41.5 |
| | | -39 | 75.6 | 1005 | 216 | .570 | 331 | 18.0 | 23.0 | 28.0 | 32.9 | 37.9 | 42.9 | 47.9 |
| | | -42 | (2) 70.0 | 809 | 189 | .50 | 291 | 17.5 | 23.6 | 29.8 | 36.0 | 42.2 | 48.4 | 54.5 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -32°C | -42°C | -52°C |
| 88.3 | 89.5 | 91.0 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 20)

# CRUISE
## 31,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | -7 | (1) | 88.9 | 1436 | 237 | .65 | 399 | 17.3 | 20.8 | 24.3 | 27.7 | 31.2 | 34.7 | 38.2 |
| | -26°C | -9 | | 87.6 | 1355 | 229 | .630 | 387 | 17.5 | 21.2 | 24.8 | 28.5 | 32.2 | 35.9 | 39.6 |
| | | -10 | | 85.7 | 1242 | 218 | .600 | 368 | 17.6 | 21.6 | 25.6 | 29.7 | 33.7 | 37.7 | 41.7 |
| | | -12 | | 83.9 | 1144 | 206 | .570 | 350 | 17.5 | 21.8 | 26.2 | 30.6 | 35.0 | 39.3 | 43.7 |
| | | -13 | (2) | 82.4 | 1074 | 197 | .54 | 334 | 17.2 | 21.8 | 26.5 | 31.1 | 35.8 | 40.4 | 45.1 |
| | ISA+10°C | -16 | (1) | 90.1 | 1617 | 254 | .69 | 417 | 16.5 | 19.6 | 22.7 | 25.8 | 28.9 | 32.0 | 35.1 |
| | -36°C | -18 | | 87.9 | 1444 | 241 | .660 | 397 | 17.1 | 20.5 | 24.0 | 27.5 | 30.9 | 34.4 | 37.9 |
| | | -20 | | 85.3 | 1281 | 226 | .620 | 373 | 17.4 | 21.3 | 25.2 | 29.1 | 33.0 | 36.9 | 40.8 |
| | | -22 | | 82.8 | 1143 | 210 | .580 | 349 | 17.4 | 21.8 | 26.1 | 30.5 | 34.9 | 39.2 | 43.6 |
| | | -24 | (2) | 80.8 | 1044 | 197 | .54 | 327 | 17.0 | 21.8 | 26.5 | 31.3 | 36.1 | 40.9 | 45.7 |
| | ISA+ 0°C | -25 | (1) | 91.3 | 1790 | 267 | .73 | 427 | 15.4 | 18.2 | 21.0 | 23.8 | 26.6 | 29.4 | 32.2 |
| | -46°C | -27 | | 87.3 | 1500 | 249 | .680 | 400 | 16.7 | 20.0 | 23.3 | 26.7 | 30.0 | 33.3 | 36.7 |
| | | -29 | | 84.8 | 1322 | 233 | .640 | 377 | 17.1 | 20.9 | 24.7 | 28.5 | 32.3 | 36.1 | 39.8 |
| | | -32 | | 81.8 | 1143 | 214 | .590 | 347 | 17.2 | 21.6 | 26.0 | 30.4 | 34.7 | 39.1 | 43.5 |
| | | -34 | (2) | 79.1 | 1014 | 196 | .54 | 320 | 16.7 | 21.7 | 26.6 | 31.5 | 36.5 | 41.4 | 46.3 |
| | ISA-10°C | -34 | (1) | 92.8 | 1945 | 275 | .75 | 429 | 14.4 | 16.9 | 19.5 | 22.1 | 24.7 | 27.2 | 29.8 |
| | -56°C | -37 | | 87.0 | 1566 | 257 | .700 | 403 | 16.1 | 19.3 | 22.5 | 25.7 | 28.9 | 32.1 | 35.3 |
| | | -40 | | 83.7 | 1324 | 237 | .650 | 374 | 16.9 | 20.7 | 24.5 | 28.2 | 32.0 | 35.8 | 39.6 |
| | | -42 | | 80.7 | 1144 | 218 | .600 | 345 | 17.1 | 21.4 | 25.8 | 30.2 | 34.6 | 38.9 | 43.3 |
| | | -45 | (2) | 77.4 | 986 | 196 | .54 | 313 | 16.5 | 21.6 | 26.6 | 31.7 | 36.8 | 41.8 | 46.9 |
| 19000. | ISA+20°C | -8 | (1) | 88.8 | 1434 | 239 | .65 | 401 | 17.5 | 21.0 | 24.5 | 28.0 | 31.4 | 34.9 | 38.4 |
| | -26°C | -9 | | 87.2 | 1333 | 229 | .630 | 387 | 17.8 | 21.5 | 25.3 | 29.0 | 32.8 | 36.5 | 40.3 |
| | | -10 | | 85.2 | 1218 | 218 | .600 | 368 | 17.9 | 22.0 | 26.1 | 30.2 | 34.4 | 38.5 | 42.6 |
| | | -12 | | 83.2 | 1115 | 206 | .570 | 350 | 17.9 | 22.4 | 26.9 | 31.4 | 35.9 | 40.4 | 44.9 |
| | | -13 | (2) | 81.5 | 1042 | 197 | .54 | 334 | 17.6 | 22.4 | 27.2 | 32.0 | 36.8 | 41.6 | 46.4 |
| | ISA+10°C | -15 | (1) | 90.1 | 1618 | 256 | .70 | 419 | 16.6 | 19.7 | 22.8 | 25.9 | 29.0 | 32.1 | 35.2 |
| | -36°C | -18 | | 87.6 | 1425 | 241 | .660 | 397 | 17.3 | 20.8 | 24.3 | 27.8 | 31.3 | 34.9 | 38.4 |
| | | -20 | | 84.8 | 1258 | 226 | .620 | 373 | 17.7 | 21.7 | 25.7 | 29.6 | 33.6 | 37.6 | 41.6 |
| | | -22 | | 82.2 | 1118 | 210 | .580 | 349 | 17.8 | 22.3 | 26.7 | 31.2 | 35.7 | 40.1 | 44.6 |
| | | -24 | (2) | 79.9 | 1013 | 196 | .54 | 327 | 17.5 | 22.4 | 27.3 | 32.3 | 37.2 | 42.1 | 47.1 |
| | ISA+ 0°C | -25 | (1) | 91.2 | 1789 | 267 | .73 | 428 | 15.5 | 18.3 | 21.1 | 23.9 | 26.7 | 29.5 | 32.3 |
| | -46°C | -27 | | 87.1 | 1484 | 249 | .680 | 400 | 16.8 | 20.2 | 23.6 | 27.0 | 30.3 | 33.7 | 37.1 |
| | | -29 | | 84.4 | 1302 | 233 | .640 | 377 | 17.4 | 21.2 | 25.1 | 28.9 | 32.8 | 36.6 | 40.5 |
| | | -32 | | 81.2 | 1120 | 214 | .590 | 347 | 17.6 | 22.1 | 26.5 | 31.0 | 35.5 | 39.9 | 44.4 |
| | | -34 | (2) | 78.3 | 986 | 196 | .54 | 320 | 17.2 | 22.3 | 27.4 | 32.4 | 37.5 | 42.6 | 47.7 |
| | ISA-10°C | -34 | (1) | 92.8 | 1946 | 276 | .75 | 431 | 14.4 | 17.0 | 19.6 | 22.1 | 24.7 | 27.3 | 29.8 |
| | -56°C | -37 | | 86.7 | 1550 | 257 | .700 | 403 | 16.3 | 19.5 | 22.7 | 26.0 | 29.2 | 32.4 | 35.7 |
| | | -40 | | 83.3 | 1306 | 237 | .650 | 374 | 17.1 | 21.0 | 24.8 | 28.6 | 32.5 | 36.3 | 40.1 |
| | | -42 | | 80.2 | 1121 | 218 | .600 | 345 | 17.4 | 21.9 | 26.3 | 30.8 | 35.2 | 39.7 | 44.2 |
| | | -45 | (2) | 76.6 | 958 | 196 | .54 | 313 | 17.0 | 22.2 | 27.4 | 32.6 | 37.9 | 43.1 | 48.3 |
| 18000. | ISA+20°C | -7 | (1) | 88.7 | 1430 | 240 | .66 | 403 | 17.7 | 21.2 | 24.7 | 28.2 | 31.7 | 35.2 | 38.7 |
| | -26°C | -9 | | 86.8 | 1311 | 229 | .630 | 387 | 18.1 | 21.9 | 25.7 | 29.5 | 33.3 | 37.1 | 40.9 |
| | | -10 | | 84.7 | 1195 | 218 | .600 | 368 | 18.3 | 22.5 | 26.6 | 30.8 | 35.0 | 39.2 | 43.4 |
| | | -12 | | 81.8 | 1059 | 203 | .560 | 344 | 18.3 | 23.0 | 27.7 | 32.5 | 37.2 | 41.9 | 46.6 |
| | | -14 | (2) | 79.8 | 983 | 192 | .53 | 326 | 17.9 | 23.0 | 28.1 | 33.2 | 38.2 | 43.3 | 48.4 |
| | ISA+10°C | -15 | (1) | 90.0 | 1617 | 257 | .70 | 421 | 16.7 | 19.8 | 22.9 | 26.0 | 29.1 | 32.2 | 35.3 |
| | -36°C | -18 | | 87.2 | 1409 | 241 | .660 | 397 | 17.5 | 21.1 | 24.6 | 28.2 | 31.7 | 35.3 | 38.8 |
| | | -20 | | 84.4 | 1237 | 226 | .620 | 373 | 18.0 | 22.1 | 26.1 | 30.1 | 34.2 | 38.2 | 42.3 |
| | | -22 | | 81.0 | 1061 | 206 | .570 | 343 | 18.2 | 22.9 | 27.6 | 32.3 | 37.0 | 41.7 | 46.4 |
| | | -24 | (2) | 78.3 | 956 | 192 | .53 | 319 | 17.7 | 22.9 | 28.1 | 33.4 | 38.6 | 43.8 | 49.0 |
| | ISA+ 0°C | -24 | (1) | 91.2 | 1787 | 268 | .73 | 429 | 15.6 | 18.4 | 21.2 | 24.0 | 26.8 | 29.6 | 32.4 |
| | -46°C | -27 | | 86.8 | 1468 | 249 | .680 | 400 | 17.0 | 20.4 | 23.8 | 27.2 | 30.6 | 34.1 | 37.5 |
| | | -30 | | 83.4 | 1242 | 229 | .630 | 371 | 17.8 | 21.8 | 25.8 | 29.9 | 33.9 | 37.9 | 41.9 |
| | | -32 | | 80.0 | 1065 | 210 | .580 | 341 | 18.0 | 22.7 | 27.4 | 32.1 | 36.8 | 41.5 | 46.2 |
| | | -35 | (2) | 76.7 | 931 | 192 | .53 | 312 | 17.4 | 22.8 | 28.2 | 33.6 | 38.9 | 44.3 | 49.7 |
| | ISA-10°C | -34 | (1) | 92.7 | 1940 | 277 | .75 | 431 | 14.5 | 17.1 | 19.6 | 22.2 | 24.8 | 27.4 | 30.0 |
| | -56°C | -37 | | 86.4 | 1535 | 257 | .700 | 403 | 16.5 | 19.7 | 23.0 | 26.2 | 29.5 | 32.7 | 36.0 |
| | | -40 | | 82.3 | 1247 | 233 | .640 | 368 | 17.5 | 21.5 | 25.5 | 29.5 | 33.5 | 37.6 | 41.6 |
| | | -43 | | 79.0 | 1067 | 214 | .590 | 339 | 17.8 | 22.4 | 27.1 | 31.8 | 36.5 | 41.2 | 45.9 |
| | | -45 | (2) | 75.1 | 906 | 192 | .53 | 306 | 17.2 | 22.7 | 28.2 | 33.7 | 39.3 | 44.8 | 50.3 |
| 17000. | ISA+20°C | -7 | (1) | 88.8 | 1441 | 242 | .66 | 406 | 17.8 | 21.3 | 24.7 | 28.2 | 31.7 | 35.1 | 38.6 |
| | -26°C | -9 | | 86.4 | 1292 | 229 | .630 | 387 | 18.3 | 22.2 | 26.1 | 29.9 | 33.8 | 37.7 | 41.6 |
| | | -11 | | 83.5 | 1136 | 214 | .590 | 362 | 18.7 | 23.1 | 27.5 | 31.9 | 36.3 | 40.7 | 45.1 |
| | | -12 | | 81.2 | 1038 | 203 | .560 | 344 | 18.7 | 23.5 | 28.3 | 33.1 | 38.0 | 42.8 | 47.6 |
| | | -14 | (2) | 78.3 | 931 | 188 | .52 | 320 | 18.2 | 23.6 | 28.9 | 34.3 | 39.7 | 45.1 | 50.4 |
| | ISA+10°C | -15 | (1) | 90.0 | 1619 | 258 | .70 | 422 | 16.8 | 19.9 | 23.0 | 26.1 | 29.2 | 32.3 | 35.3 |
| | -36°C | -18 | | 86.9 | 1393 | 241 | .660 | 397 | 17.7 | 21.3 | 24.9 | 28.5 | 32.1 | 35.7 | 39.3 |
| | | -20 | | 83.3 | 1178 | 222 | .610 | 367 | 18.4 | 22.6 | 26.9 | 31.1 | 35.4 | 39.6 | 43.9 |
| | | -22 | | 80.4 | 1040 | 206 | .570 | 343 | 18.5 | 23.4 | 28.2 | 33.0 | 37.8 | 42.6 | 47.4 |
| | | -25 | (2) | 76.7 | 905 | 187 | .52 | 312 | 18.0 | 23.5 | 29.0 | 34.5 | 40.1 | 45.6 | 51.1 |
| | ISA+ 0°C | -24 | (1) | 91.2 | 1791 | 269 | .73 | 430 | 15.6 | 18.4 | 21.2 | 24.0 | 26.8 | 29.6 | 32.4 |
| | -46°C | -27 | | 86.6 | 1454 | 249 | .680 | 400 | 17.2 | 20.6 | 24.1 | 27.5 | 31.0 | 34.4 | 37.8 |
| | | -30 | | 83.0 | 1223 | 229 | .630 | 371 | 18.0 | 22.1 | 26.2 | 30.3 | 34.4 | 38.5 | 42.6 |
| | | -33 | | 78.7 | 1011 | 206 | .570 | 335 | 18.3 | 23.3 | 28.2 | 33.2 | 38.1 | 43.1 | 48.0 |
| | | -35 | (2) | 75.1 | 879 | 187 | .52 | 305 | 17.7 | 23.4 | 29.1 | 34.8 | 40.4 | 46.1 | 51.8 |
| | ISA-10°C | -34 | (1) | 92.4 | 1921 | 277 | .75 | 431 | 14.6 | 17.2 | 19.8 | 22.4 | 25.0 | 27.6 | 30.3 |
| | -56°C | -38 | | 85.5 | 1466 | 253 | .690 | 397 | 16.8 | 20.2 | 23.7 | 27.1 | 30.5 | 33.9 | 37.3 |
| | | -40 | | 82.0 | 1230 | 233 | .640 | 368 | 17.7 | 21.8 | 25.9 | 29.9 | 34.0 | 38.1 | 42.1 |
| | | -43 | | 77.8 | 1014 | 210 | .580 | 334 | 18.1 | 23.0 | 28.0 | 32.9 | 37.8 | 42.8 | 47.7 |
| | | -46 | (2) | 73.5 | 854 | 187 | .52 | 298 | 17.4 | 23.2 | 29.1 | 34.9 | 40.8 | 46.6 | 52.5 |

Figure 7-14 (Sheet 21)

# CRUISE
## 31,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | -7 | (1) 88.7 | 1439 | 242 | .66 | 407 | 17.9 | 21.3 | 24.8 | 28.3 | 31.8 | 35.2 | 38.7 |
| | -26°C | -9 | 86.2 | 1283 | 229 | .630 | 387 | 18.5 | 22.4 | 26.2 | 30.1 | 34.0 | 37.9 | 41.8 |
| | | -11 | 83.2 | 1125 | 214 | .590 | 362 | 18.9 | 23.3 | 27.7 | 32.2 | 36.6 | 41.1 | 45.5 |
| | | -12 | 80.9 | 1027 | 203 | .560 | 344 | 18.9 | 23.7 | 28.6 | 33.5 | 38.3 | 43.2 | 48.1 |
| | | -14 | (2) 77.8 | 914 | 187 | .52 | 318 | 18.4 | 23.9 | 29.4 | 34.9 | 40.3 | 45.8 | 51.3 |
| | ISA+10°C | -15 | (1) 90.0 | 1620 | 258 | .70 | 423 | 16.8 | 19.9 | 23.0 | 26.1 | 29.2 | 32.3 | 35.4 |
| | -36°C | -18 | 86.8 | 1385 | 241 | .660 | 397 | 17.8 | 21.4 | 25.0 | 28.6 | 32.2 | 35.9 | 39.5 |
| | | -20 | 83.1 | 1169 | 222 | .610 | 367 | 18.6 | 22.8 | 27.1 | 31.4 | 35.7 | 39.9 | 44.2 |
| | | -22 | 80.1 | 1030 | 206 | .570 | 343 | 18.7 | 23.6 | 28.4 | 33.3 | 38.1 | 43.0 | 47.9 |
| | | -25 | (2) 76.3 | 888 | 187 | .52 | 312 | 18.2 | 23.8 | 29.5 | 35.1 | 40.7 | 46.3 | 52.0 |
| | ISA+ 0°C | -24 | (1) 91.2 | 1792 | 270 | .73 | 431 | 15.7 | 18.5 | 21.3 | 24.0 | 26.8 | 29.6 | 32.4 |
| | -46°C | -27 | 86.5 | 1447 | 249 | .680 | 400 | 17.3 | 20.7 | 24.2 | 27.7 | 31.1 | 34.6 | 38.0 |
| | | -30 | 82.9 | 1215 | 229 | .630 | 371 | 18.2 | 22.3 | 26.4 | 30.5 | 34.6 | 38.7 | 42.8 |
| | | -33 | 78.5 | 1002 | 206 | .570 | 335 | 18.5 | 23.5 | 28.5 | 33.5 | 38.5 | 43.5 | 48.5 |
| | | -35 | (2) 74.6 | 862 | 186 | .52 | 304 | 17.9 | 23.7 | 29.5 | 35.3 | 41.1 | 46.9 | 52.7 |
| | ISA-10°C | -34 | (1) 92.3 | 1913 | 277 | .75 | 431 | 14.7 | 17.3 | 19.9 | 22.5 | 25.2 | 27.8 | 30.4 |
| | -56°C | -38 | 85.4 | 1459 | 253 | .690 | 397 | 16.9 | 20.3 | 23.8 | 27.2 | 30.6 | 34.0 | 37.5 |
| | | -41 | 81.1 | 1181 | 229 | .630 | 362 | 18.0 | 22.2 | 26.4 | 30.7 | 34.9 | 39.1 | 43.4 |
| | | -43 | 77.6 | 1004 | 210 | .580 | 334 | 18.3 | 23.3 | 28.3 | 33.2 | 38.2 | 43.2 | 48.2 |
| | | -46 | (2) 73.0 | 835 | 186 | .52 | 297 | 17.6 | 23.6 | 29.6 | 35.5 | 41.5 | 47.5 | 53.5 |
| 16000. | ISA+20°C | -6 | (1) 88.7 | 1441 | 243 | .67 | 408 | 17.9 | 21.4 | 24.9 | 28.3 | 31.8 | 35.3 | 38.7 |
| | -26°C | -9 | 86.0 | 1274 | 229 | .630 | 387 | 18.6 | 22.5 | 26.4 | 30.4 | 34.3 | 38.2 | 42.1 |
| | | -11 | 83.0 | 1115 | 214 | .590 | 362 | 19.0 | 23.5 | 28.0 | 32.5 | 37.0 | 41.4 | 45.9 |
| | | -12 | 80.6 | 1018 | 203 | .560 | 344 | 19.1 | 24.0 | 28.9 | 33.8 | 38.7 | 43.6 | 48.5 |
| | | -14 | (2) 77.4 | 899 | 187 | .52 | 318 | 18.7 | 24.2 | 29.8 | 35.4 | 40.9 | 46.5 | 52.0 |
| | ISA+10°C | -15 | (1) 90.0 | 1619 | 259 | .70 | 424 | 16.9 | 20.0 | 23.1 | 26.2 | 29.2 | 32.3 | 35.4 |
| | -36°C | -18 | 86.7 | 1378 | 241 | .660 | 397 | 17.9 | 21.5 | 25.2 | 28.8 | 32.4 | 36.0 | 39.7 |
| | | -20 | 82.9 | 1159 | 222 | .610 | 367 | 18.7 | 23.0 | 27.3 | 31.6 | 35.9 | 40.3 | 44.6 |
| | | -22 | 79.8 | 1020 | 206 | .570 | 343 | 18.9 | 23.8 | 28.7 | 33.6 | 38.5 | 43.4 | 48.3 |
| | | -25 | (2) 75.8 | 875 | 187 | .52 | 311 | 18.4 | 24.2 | 29.9 | 35.6 | 41.3 | 47.0 | 52.7 |
| | ISA+ 0°C | -24 | (1) 91.1 | 1788 | 270 | .73 | 431 | 15.7 | 18.5 | 21.3 | 24.1 | 26.9 | 29.7 | 32.5 |
| | -46°C | -27 | 86.4 | 1440 | 249 | .680 | 400 | 17.4 | 20.8 | 24.3 | 27.8 | 31.3 | 34.7 | 38.2 |
| | | -30 | 82.7 | 1207 | 229 | .630 | 371 | 18.3 | 22.4 | 26.6 | 30.7 | 34.9 | 39.0 | 43.1 |
| | | -33 | 78.2 | 993 | 206 | .570 | 335 | 18.7 | 23.7 | 28.8 | 33.8 | 38.8 | 43.9 | 48.9 |
| | | -35 | (2) 74.2 | 848 | 186 | .52 | 304 | 18.2 | 24.1 | 29.9 | 35.8 | 41.7 | 47.6 | 53.5 |
| | ISA-10°C | -34 | (1) 92.1 | 1904 | 277 | .75 | 431 | 14.8 | 17.4 | 20.0 | 22.6 | 25.3 | 27.9 | 30.5 |
| | -56°C | -38 | 85.3 | 1453 | 253 | .690 | 397 | 17.0 | 20.4 | 23.9 | 27.3 | 30.8 | 34.2 | 37.6 |
| | | -41 | 81.0 | 1173 | 229 | .630 | 362 | 18.1 | 22.4 | 26.6 | 30.9 | 35.1 | 39.4 | 43.7 |
| | | -43 | 77.3 | 995 | 210 | .580 | 334 | 18.5 | 23.5 | 28.5 | 33.5 | 38.6 | 43.6 | 48.6 |
| | | -46 | (2) 72.6 | 823 | 186 | .52 | 297 | 17.8 | 23.9 | 30.0 | 36.1 | 42.1 | 48.2 | 54.3 |
| 14000. | ISA+20°C | -6 | (1) 88.6 | 1439 | 245 | .67 | 411 | 18.1 | 21.6 | 25.1 | 28.6 | 32.0 | 35.5 | 39.0 |
| | -26°C | -9 | 85.4 | 1242 | 229 | .630 | 387 | 19.1 | 23.1 | 27.1 | 31.1 | 35.2 | 39.2 | 43.2 |
| | | -11 | 82.0 | 1081 | 214 | .590 | 362 | 19.6 | 24.3 | 28.9 | 33.5 | 38.1 | 42.8 | 47.4 |
| | | -13 | 78.6 | 949 | 199 | .550 | 338 | 19.8 | 25.1 | 30.3 | 35.6 | 40.9 | 46.1 | 51.4 |
| | | -15 | (2) 74.9 | 827 | 181 | .50 | 309 | 19.3 | 25.3 | 31.3 | 37.4 | 43.4 | 49.5 | 55.5 |
| | ISA+10°C | -15 | (1) 90.0 | 1620 | 260 | .71 | 426 | 17.0 | 20.1 | 23.2 | 26.3 | 29.4 | 32.5 | 35.5 |
| | -36°C | -18 | 86.1 | 1350 | 241 | .660 | 397 | 18.3 | 22.0 | 25.7 | 29.4 | 33.1 | 36.8 | 40.5 |
| | | -20 | 82.1 | 1127 | 222 | .610 | 367 | 19.2 | 23.7 | 28.1 | 32.6 | 37.0 | 41.4 | 45.9 |
| | | -23 | 77.9 | 954 | 203 | .560 | 337 | 19.6 | 24.8 | 30.1 | 35.3 | 40.5 | 45.8 | 51.0 |
| | | -25 | (2) 73.4 | 806 | 182 | .50 | 303 | 19.0 | 25.2 | 31.4 | 37.6 | 43.8 | 50.0 | 56.2 |
| | ISA+ 0°C | -24 | (1) 91.1 | 1793 | 271 | .74 | 433 | 15.8 | 18.6 | 21.4 | 24.2 | 26.9 | 29.7 | 32.5 |
| | -46°C | -27 | 86.0 | 1414 | 249 | .680 | 400 | 17.7 | 21.2 | 24.7 | 28.3 | 31.8 | 35.4 | 38.9 |
| | | -30 | 81.3 | 1135 | 226 | .620 | 365 | 18.9 | 23.3 | 27.7 | 32.1 | 36.5 | 40.9 | 45.4 |
| | | -33 | 76.3 | 928 | 203 | .560 | 330 | 19.3 | 24.7 | 30.1 | 35.5 | 40.9 | 46.3 | 51.7 |
| | | -36 | (2) 72.0 | 785 | 182 | .50 | 297 | 18.7 | 25.1 | 31.5 | 37.8 | 44.2 | 50.6 | 57.0 |
| | ISA-10°C | -34 | (1) 91.6 | 1876 | 277 | .75 | 431 | 15.0 | 17.7 | 20.3 | 23.0 | 25.7 | 28.3 | 31.0 |
| | -56°C | -38 | 84.9 | 1429 | 253 | .690 | 397 | 17.3 | 20.8 | 24.3 | 27.8 | 31.3 | 34.8 | 38.3 |
| | | -41 | 80.3 | 1144 | 229 | .630 | 362 | 18.6 | 22.9 | 27.3 | 31.7 | 36.0 | 40.4 | 44.8 |
| | | -44 | 75.5 | 932 | 206 | .570 | 328 | 19.1 | 24.5 | 29.8 | 35.2 | 40.6 | 45.9 | 51.3 |
| | | -46 | (2) 70.4 | 763 | 182 | .50 | 291 | 18.4 | 25.0 | 31.5 | 38.1 | 44.6 | 51.2 | 57.7 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -36°C | -46°C | -56°C |
| 88.6 | 89.9 | 91.9 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 22)

## CRUISE
## 33,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | -11 | (1) | 89.5 | 1386 | 231 | .66 | 402 | 18.2 | 21.8 | 25.4 | 29.0 | 32.6 | 36.2 | 39.9 |
| | -30°C | -13 | | 87.7 | 1273 | 219 | .630 | 384 | 18.4 | 22.3 | 26.2 | 30.1 | 34.1 | 38.0 | 41.9 |
| | | -14 | | 86.1 | 1178 | 208 | .600 | 365 | 18.3 | 22.5 | 26.8 | 31.0 | 35.3 | 39.5 | 43.8 |
| | | -16 | | 84.5 | 1097 | 197 | .570 | 347 | 18.0 | 22.5 | 27.1 | 31.7 | 36.2 | 40.8 | 45.3 |
| | | -17 | (2) | 83.2 | 1032 | 187 | .54 | 330 | 17.5 | 22.3 | 27.2 | 32.0 | 36.9 | 41.7 | 46.5 |
| | ISA+10°C | -19 | (1) | 90.7 | 1537 | 246 | .70 | 418 | 17.4 | 20.7 | 23.9 | 27.2 | 30.4 | 33.7 | 36.9 |
| | -40°C | -22 | | 87.7 | 1348 | 231 | .660 | 393 | 18.1 | 21.8 | 25.5 | 29.2 | 32.9 | 36.6 | 40.3 |
| | | -24 | | 85.4 | 1206 | 216 | .620 | 370 | 18.2 | 22.4 | 26.5 | 30.7 | 34.8 | 38.9 | 43.1 |
| | | -26 | | 83.4 | 1092 | 201 | .580 | 346 | 17.9 | 22.5 | 27.1 | 31.7 | 36.2 | 40.8 | 45.4 |
| | | -28 | (2) | 81.6 | 1004 | 187 | .54 | 323 | 17.3 | 22.2 | 27.2 | 32.2 | 37.2 | 42.2 | 47.1 |
| | ISA+ 0°C | -29 | (1) | 91.9 | 1703 | 258 | .73 | 427 | 16.3 | 19.2 | 22.2 | 25.1 | 28.0 | 31.0 | 33.9 |
| | -50°C | -31 | | 87.9 | 1442 | 242 | .690 | 402 | 17.5 | 21.0 | 24.4 | 27.9 | 31.4 | 34.8 | 38.3 |
| | | -34 | | 84.8 | 1238 | 223 | .640 | 373 | 18.0 | 22.1 | 26.1 | 30.2 | 34.2 | 38.2 | 42.3 |
| | | -36 | | 82.2 | 1088 | 205 | .590 | 344 | 17.8 | 22.4 | 27.0 | 31.6 | 36.2 | 40.8 | 45.4 |
| | | -38 | (2) | 79.9 | 976 | 187 | .54 | 316 | 17.0 | 22.2 | 27.3 | 32.4 | 37.5 | 42.7 | 47.8 |
| | ISA-10°C | -39 | (1) | 93.1 | 1836 | 265 | .75 | 427 | 15.1 | 17.8 | 20.6 | 23.3 | 26.0 | 28.7 | 31.4 |
| | -60°C | -41 | | 86.9 | 1450 | 246 | .700 | 399 | 17.2 | 20.6 | 24.1 | 27.5 | 30.9 | 34.4 | 37.8 |
| | | -44 | | 83.5 | 1237 | 227 | .650 | 370 | 17.8 | 21.9 | 25.9 | 29.9 | 34.0 | 38.0 | 42.1 |
| | | -46 | | 80.9 | 1083 | 208 | .600 | 342 | 17.7 | 22.4 | 27.0 | 31.6 | 36.2 | 40.8 | 45.4 |
| | | -49 | (2) | 78.1 | 948 | 187 | .54 | 309 | 16.8 | 22.0 | 27.3 | 32.6 | 37.9 | 43.1 | 48.4 |
| 19000. | ISA+20°C | -11 | (1) | 89.5 | 1386 | 233 | .67 | 405 | 18.4 | 22.0 | 25.6 | 29.3 | 32.9 | 36.5 | 40.1 |
| | -30°C | -12 | | 87.8 | 1285 | 223 | .640 | 390 | 18.6 | 22.5 | 26.4 | 30.3 | 34.2 | 38.1 | 42.0 |
| | | -14 | | 86.0 | 1181 | 212 | .610 | 371 | 18.7 | 23.0 | 27.2 | 31.4 | 35.7 | 39.9 | 44.2 |
| | | -16 | | 83.8 | 1065 | 197 | .570 | 347 | 18.5 | 23.2 | 27.9 | 32.6 | 37.3 | 42.0 | 46.7 |
| | | -17 | (2) | 82.3 | 994 | 187 | .54 | 329 | 18.0 | 23.1 | 28.1 | 33.1 | 38.2 | 43.2 | 48.2 |
| | ISA+10°C | -19 | (1) | 90.7 | 1541 | 247 | .70 | 420 | 17.5 | 20.8 | 24.0 | 27.3 | 30.5 | 33.7 | 37.0 |
| | -40°C | -21 | | 88.0 | 1369 | 234 | .670 | 399 | 18.2 | 21.9 | 25.5 | 29.2 | 32.8 | 36.5 | 40.1 |
| | | -24 | | 84.9 | 1182 | 216 | .620 | 370 | 18.6 | 22.8 | 27.0 | 31.3 | 35.5 | 39.7 | 44.0 |
| | | -26 | | 82.7 | 1062 | 201 | .580 | 346 | 18.4 | 23.1 | 27.9 | 32.6 | 37.3 | 42.0 | 46.7 |
| | | -28 | (2) | 80.6 | 965 | 186 | .54 | 322 | 17.8 | 23.0 | 28.2 | 33.3 | 38.5 | 43.7 | 48.9 |
| | ISA+ 0°C | -28 | (1) | 91.9 | 1706 | 259 | .74 | 429 | 16.3 | 19.3 | 22.2 | 25.1 | 28.1 | 31.0 | 33.9 |
| | -50°C | -31 | | 87.5 | 1421 | 242 | .690 | 402 | 17.8 | 21.3 | 24.8 | 28.3 | 31.8 | 35.4 | 38.9 |
| | | -34 | | 84.4 | 1216 | 223 | .640 | 373 | 18.4 | 22.5 | 26.6 | 30.7 | 34.8 | 38.9 | 43.0 |
| | | -36 | | 81.5 | 1059 | 205 | .590 | 344 | 18.3 | 23.0 | 27.8 | 32.5 | 37.2 | 41.9 | 46.7 |
| | | -39 | (2) | 78.9 | 936 | 186 | .54 | 314 | 17.5 | 22.9 | 28.2 | 33.5 | 38.9 | 44.2 | 49.6 |
| | ISA-10°C | -39 | (1) | 92.7 | 1813 | 265 | .75 | 427 | 15.3 | 18.1 | 20.8 | 23.6 | 26.3 | 29.1 | 31.8 |
| | -60°C | -41 | | 86.5 | 1432 | 246 | .700 | 399 | 17.4 | 20.9 | 24.4 | 27.9 | 31.3 | 34.8 | 38.3 |
| | | -44 | | 83.1 | 1217 | 227 | .650 | 370 | 18.1 | 22.2 | 26.3 | 30.4 | 34.5 | 38.7 | 42.8 |
| | | -47 | | 79.7 | 1029 | 205 | .590 | 336 | 18.1 | 23.0 | 27.8 | 32.7 | 37.5 | 42.4 | 47.3 |
| | | -49 | (2) | 77.1 | 909 | 186 | .54 | 307 | 17.2 | 22.7 | 28.2 | 33.7 | 39.2 | 44.7 | 50.2 |
| 18000. | ISA+20°C | -10 | (1) | 89.5 | 1391 | 235 | .67 | 409 | 18.6 | 22.2 | 25.8 | 29.4 | 33.0 | 36.6 | 40.2 |
| | -30°C | -12 | | 87.4 | 1264 | 223 | .640 | 390 | 19.0 | 22.9 | 26.9 | 30.8 | 34.8 | 38.7 | 42.7 |
| | | -14 | | 85.5 | 1157 | 212 | .610 | 371 | 19.1 | 23.5 | 27.8 | 32.1 | 36.4 | 40.8 | 45.1 |
| | | -15 | | 83.6 | 1062 | 201 | .580 | 353 | 19.1 | 23.8 | 28.6 | 33.3 | 38.0 | 42.7 | 47.4 |
| | | -17 | (2) | 81.7 | 974 | 189 | .55 | 333 | 18.8 | 23.9 | 29.0 | 34.2 | 39.3 | 44.4 | 49.6 |
| | ISA+10°C | -19 | (1) | 90.6 | 1539 | 248 | .71 | 422 | 17.6 | 20.9 | 24.1 | 27.4 | 30.6 | 33.9 | 37.1 |
| | -40°C | -21 | | 87.6 | 1350 | 234 | .670 | 399 | 18.5 | 22.2 | 25.9 | 29.6 | 33.3 | 37.0 | 40.7 |
| | | -23 | | 85.0 | 1194 | 219 | .630 | 376 | 18.9 | 23.1 | 27.3 | 31.5 | 35.6 | 39.8 | 44.0 |
| | | -26 | | 82.6 | 1063 | 205 | .590 | 352 | 19.0 | 23.7 | 28.4 | 33.1 | 37.8 | 42.5 | 47.2 |
| | | -28 | (2) | 80.1 | 947 | 189 | .55 | 326 | 18.6 | 23.8 | 29.1 | 34.4 | 39.7 | 45.0 | 50.2 |
| | ISA+ 0°C | -28 | (1) | 91.9 | 1707 | 260 | .74 | 430 | 16.4 | 19.3 | 22.3 | 25.2 | 28.1 | 31.0 | 34.0 |
| | -50°C | -31 | | 87.2 | 1405 | 242 | .690 | 402 | 18.0 | 21.5 | 25.1 | 28.6 | 32.2 | 35.8 | 39.3 |
| | | -34 | | 83.9 | 1196 | 223 | .640 | 373 | 18.7 | 22.8 | 27.0 | 31.2 | 35.4 | 39.6 | 43.8 |
| | | -36 | | 81.5 | 1064 | 208 | .600 | 350 | 18.8 | 23.5 | 28.2 | 32.9 | 37.6 | 42.3 | 47.0 |
| | | -38 | (2) | 78.4 | 920 | 189 | .55 | 318 | 18.3 | 23.7 | 29.2 | 34.6 | 40.0 | 45.5 | 50.9 |
| | ISA-10°C | -39 | (1) | 92.3 | 1790 | 265 | .75 | 427 | 15.5 | 18.3 | 21.1 | 23.9 | 26.7 | 29.5 | 32.3 |
| | -60°C | -41 | | 86.2 | 1416 | 246 | .700 | 399 | 17.6 | 21.1 | 24.6 | 28.2 | 31.7 | 35.2 | 38.8 |
| | | -44 | | 82.7 | 1198 | 227 | .650 | 370 | 18.4 | 22.6 | 26.8 | 30.9 | 35.1 | 39.3 | 43.5 |
| | | -46 | | 79.8 | 1034 | 208 | .600 | 342 | 18.6 | 23.4 | 28.3 | 33.1 | 37.9 | 42.8 | 47.6 |
| | | -49 | (2) | 76.7 | 894 | 188 | .55 | 311 | 18.0 | 23.6 | 29.2 | 34.8 | 40.4 | 46.0 | 51.6 |
| 17000. | ISA+20°C | -10 | (1) | 89.4 | 1389 | 236 | .67 | 411 | 18.8 | 22.4 | 26.0 | 29.6 | 33.2 | 36.8 | 40.4 |
| | -30°C | -12 | | 86.9 | 1243 | 223 | .640 | 390 | 19.3 | 23.3 | 27.3 | 31.4 | 35.4 | 39.4 | 43.4 |
| | | -14 | | 85.0 | 1133 | 212 | .610 | 371 | 19.5 | 23.9 | 28.4 | 32.8 | 37.2 | 41.6 | 46.0 |
| | | -15 | | 83.0 | 1037 | 201 | .580 | 353 | 19.6 | 24.4 | 29.2 | 34.1 | 38.9 | 43.7 | 48.5 |
| | | -17 | (2) | 80.4 | 932 | 187 | .54 | 329 | 19.2 | 24.6 | 30.0 | 35.3 | 40.7 | 46.1 | 51.4 |
| | ISA+10°C | -19 | (1) | 90.6 | 1544 | 250 | .71 | 423 | 17.7 | 20.9 | 24.2 | 27.4 | 30.7 | 33.9 | 37.1 |
| | -40°C | -21 | | 87.3 | 1333 | 234 | .670 | 399 | 18.7 | 22.5 | 26.2 | 30.0 | 33.7 | 37.5 | 41.2 |
| | | -23 | | 84.6 | 1172 | 219 | .630 | 376 | 19.2 | 23.5 | 27.8 | 32.0 | 36.3 | 40.6 | 44.8 |
| | | -26 | | 82.0 | 1039 | 205 | .590 | 352 | 19.4 | 24.2 | 29.0 | 33.8 | 38.7 | 43.5 | 48.3 |
| | | -28 | (2) | 78.8 | 907 | 187 | .54 | 322 | 19.0 | 24.5 | 30.0 | 35.5 | 41.0 | 46.6 | 52.1 |
| | ISA+ 0°C | -28 | (1) | 91.9 | 1709 | 261 | .74 | 431 | 16.5 | 19.4 | 22.3 | 25.2 | 28.2 | 31.1 | 34.0 |
| | -50°C | -31 | | 86.9 | 1389 | 242 | .690 | 402 | 18.2 | 21.8 | 25.4 | 29.0 | 32.6 | 36.2 | 39.8 |
| | | -34 | | 83.5 | 1176 | 223 | .640 | 373 | 19.0 | 23.2 | 27.5 | 31.7 | 36.0 | 40.2 | 44.5 |
| | | -36 | | 80.3 | 1011 | 205 | .590 | 344 | 19.2 | 24.2 | 29.1 | 34.0 | 39.0 | 43.9 | 48.9 |
| | | -38 | (2) | 77.2 | 882 | 187 | .54 | 315 | 18.8 | 24.4 | 30.1 | 35.8 | 41.4 | 47.1 | 52.8 |
| | ISA-10°C | -39 | (1) | 92.0 | 1769 | 265 | .75 | 427 | 15.7 | 18.5 | 21.3 | 24.1 | 27.0 | 29.8 | 32.6 |
| | -60°C | -41 | | 85.9 | 1400 | 246 | .700 | 399 | 17.8 | 21.3 | 24.9 | 28.5 | 32.1 | 35.6 | 39.2 |
| | | -44 | | 82.4 | 1179 | 227 | .650 | 370 | 18.7 | 22.9 | 27.2 | 31.4 | 35.7 | 39.9 | 44.1 |
| | | -46 | | 79.2 | 1012 | 208 | .600 | 342 | 19.0 | 23.9 | 28.9 | 33.8 | 38.7 | 43.7 | 48.6 |
| | | -49 | (2) | 75.5 | 858 | 187 | .54 | 309 | 18.5 | 24.3 | 30.1 | 36.0 | 41.8 | 47.6 | 53.4 |

Figure 7-14 (Sheet 23)

# CRUISE
# 33,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | -10 | (1) | 89.4 | 1388 | 237 | .68 | 412 | 18.8 | 22.4 | 26.1 | 29.7 | 33.3 | 36.9 | 40.5 |
| | -30°C | -12 | | 86.7 | 1232 | 223 | .640 | 390 | 19.4 | 23.5 | 27.6 | 31.6 | 35.7 | 39.7 | 43.8 |
| | | -14 | | 84.7 | 1122 | 212 | .610 | 371 | 19.7 | 24.2 | 28.6 | 33.1 | 37.5 | 42.0 | 46.5 |
| | | -16 | | 82.0 | 994 | 197 | .570 | 347 | 19.8 | 24.9 | 29.9 | 34.9 | 39.9 | 45.0 | 50.0 |
| | | -18 | (2) | 79.4 | 901 | 184 | .53 | 324 | 19.4 | 24.9 | 30.5 | 36.0 | 41.6 | 47.1 | 52.7 |
| | ISA+10°C | -19 | (1) | 90.6 | 1540 | 250 | .71 | 424 | 17.8 | 21.0 | 24.3 | 27.5 | 30.8 | 34.0 | 37.3 |
| | -40°C | -21 | | 87.2 | 1325 | 234 | .670 | 399 | 18.8 | 22.6 | 26.4 | 30.1 | 33.9 | 37.7 | 41.5 |
| | | -24 | | 83.7 | 1126 | 216 | .620 | 370 | 19.5 | 23.9 | 28.4 | 32.8 | 37.3 | 41.7 | 46.1 |
| | | -26 | | 81.1 | 998 | 201 | .580 | 346 | 19.6 | 24.6 | 29.7 | 34.7 | 39.7 | 44.7 | 49.7 |
| | | -28 | (2) | 77.9 | 878 | 184 | .53 | 318 | 19.1 | 24.8 | 30.5 | 36.2 | 41.9 | 47.6 | 53.3 |
| | ISA+ 0°C | -28 | (1) | 91.9 | 1710 | 261 | .74 | 432 | 16.5 | 19.4 | 22.3 | 25.3 | 28.2 | 31.1 | 34.0 |
| | -50°C | -31 | | 86.8 | 1382 | 242 | .690 | 402 | 18.3 | 21.9 | 25.5 | 29.1 | 32.7 | 36.3 | 40.0 |
| | | -34 | | 83.3 | 1167 | 223 | .640 | 373 | 19.1 | 23.4 | 27.7 | 32.0 | 36.3 | 40.6 | 44.8 |
| | | -36 | | 80.1 | 1000 | 205 | .590 | 344 | 19.4 | 24.4 | 29.4 | 34.4 | 39.4 | 44.4 | 49.4 |
| | | -39 | (2) | 76.3 | 854 | 184 | .53 | 311 | 18.9 | 24.7 | 30.6 | 36.4 | 42.3 | 48.2 | 54.0 |
| | ISA-10°C | -39 | (1) | 91.8 | 1758 | 265 | .75 | 427 | 15.8 | 18.6 | 21.5 | 24.3 | 27.1 | 30.0 | 32.8 |
| | -60°C | -41 | | 85.7 | 1393 | 246 | .700 | 399 | 17.9 | 21.5 | 25.1 | 28.6 | 32.2 | 35.8 | 39.4 |
| | | -44 | | 81.5 | 1134 | 223 | .640 | 365 | 18.9 | 23.4 | 27.8 | 32.2 | 36.6 | 41.0 | 45.4 |
| | | -47 | | 78.3 | 971 | 205 | .590 | 336 | 19.2 | 24.3 | 29.5 | 34.6 | 39.8 | 44.9 | 50.1 |
| | | -49 | (2) | 74.7 | 831 | 184 | .53 | 304 | 18.6 | 24.6 | 30.6 | 36.6 | 42.7 | 48.7 | 54.7 |
| 16000. | ISA+20°C | -10 | (1) | 89.4 | 1390 | 237 | .68 | 413 | 18.9 | 22.5 | 26.1 | 29.7 | 33.3 | 36.9 | 40.5 |
| | -30°C | -12 | | 86.5 | 1223 | 223 | .640 | 390 | 19.6 | 23.7 | 27.8 | 31.9 | 35.9 | 40.0 | 44.1 |
| | | -14 | | 83.8 | 1078 | 208 | .600 | 365 | 20.0 | 24.6 | 29.3 | 33.9 | 38.5 | 43.2 | 47.8 |
| | | -16 | | 81.7 | 983 | 197 | .570 | 347 | 20.1 | 25.1 | 30.2 | 35.3 | 40.4 | 45.5 | 50.6 |
| | | -18 | (2) | 78.5 | 872 | 181 | .53 | 320 | 19.5 | 25.2 | 30.9 | 36.7 | 42.4 | 48.1 | 53.9 |
| | ISA+10°C | -19 | (1) | 90.6 | 1543 | 250 | .71 | 425 | 17.8 | 21.0 | 24.3 | 27.5 | 30.8 | 34.0 | 37.2 |
| | -40°C | -21 | | 87.0 | 1317 | 234 | .670 | 399 | 18.9 | 22.7 | 26.5 | 30.3 | 34.1 | 37.9 | 41.7 |
| | | -24 | | 83.5 | 1116 | 216 | .620 | 370 | 19.7 | 24.2 | 28.6 | 33.1 | 37.6 | 42.1 | 46.6 |
| | | -27 | | 80.1 | 956 | 197 | .570 | 340 | 19.9 | 25.1 | 30.3 | 35.5 | 40.8 | 46.0 | 51.2 |
| | | -29 | (2) | 76.9 | 848 | 181 | .52 | 313 | 19.2 | 25.1 | 31.0 | 36.9 | 42.8 | 48.7 | 54.6 |
| | ISA+ 0°C | -28 | (1) | 91.9 | 1710 | 261 | .74 | 432 | 16.5 | 19.4 | 22.4 | 25.3 | 28.2 | 31.1 | 34.1 |
| | -50°C | -31 | | 86.7 | 1375 | 242 | .690 | 402 | 18.3 | 22.0 | 25.6 | 29.3 | 32.9 | 36.5 | 40.2 |
| | | -34 | | 83.1 | 1158 | 223 | .640 | 373 | 19.3 | 23.6 | 27.9 | 32.2 | 36.5 | 40.9 | 45.2 |
| | | -37 | | 79.1 | 959 | 201 | .580 | 338 | 19.6 | 24.8 | 30.1 | 35.3 | 40.5 | 45.7 | 50.9 |
| | | -39 | (2) | 75.4 | 824 | 181 | .52 | 306 | 18.9 | 25.0 | 31.1 | 37.1 | 43.2 | 49.3 | 55.3 |
| | ISA-10°C | -39 | (1) | 91.6 | 1749 | 265 | .75 | 427 | 15.9 | 18.7 | 21.6 | 24.4 | 27.3 | 30.1 | 33.0 |
| | -60°C | -41 | | 85.6 | 1386 | 246 | .700 | 399 | 18.0 | 21.6 | 25.2 | 28.8 | 32.4 | 36.0 | 39.6 |
| | | -44 | | 81.3 | 1125 | 223 | .640 | 365 | 19.1 | 23.5 | 28.0 | 32.4 | 36.9 | 41.3 | 45.8 |
| | | -47 | | 77.4 | 932 | 201 | .580 | 331 | 19.4 | 24.7 | 30.1 | 35.5 | 40.8 | 46.2 | 51.6 |
| | | -50 | (2) | 73.7 | 800 | 181 | .52 | 299 | 18.6 | 24.9 | 31.1 | 37.3 | 43.6 | 49.8 | 56.1 |
| 14000. | ISA+20°C | -10 | (1) | 89.3 | 1393 | 240 | .68 | 417 | 19.1 | 22.7 | 26.3 | 29.9 | 33.5 | 37.1 | 40.7 |
| | -30°C | -12 | | 85.8 | 1190 | 223 | .640 | 390 | 20.1 | 24.3 | 28.5 | 32.7 | 36.9 | 41.1 | 45.4 |
| | | -14 | | 82.8 | 1038 | 208 | .600 | 365 | 20.8 | 25.6 | 30.4 | 35.2 | 40.0 | 44.8 | 49.7 |
| | | -16 | | 79.6 | 915 | 194 | .560 | 341 | 20.9 | 26.3 | 31.8 | 37.3 | 42.7 | 48.2 | 53.7 |
| | | -19 | (2) | 75.9 | 794 | 177 | .51 | 312 | 20.4 | 26.7 | 33.0 | 39.3 | 45.6 | 51.9 | 58.2 |
| | ISA+10°C | -19 | (1) | 90.5 | 1544 | 252 | .72 | 427 | 18.0 | 21.2 | 24.4 | 27.7 | 30.9 | 34.1 | 37.4 |
| | -40°C | -21 | | 86.5 | 1289 | 234 | .670 | 399 | 19.3 | 23.2 | 27.1 | 31.0 | 34.9 | 38.7 | 42.6 |
| | | -24 | | 82.7 | 1080 | 216 | .620 | 370 | 20.3 | 25.0 | 29.6 | 34.2 | 38.8 | 43.5 | 48.1 |
| | | -27 | | 78.8 | 918 | 197 | .570 | 340 | 20.7 | 26.1 | 31.6 | 37.0 | 42.5 | 47.9 | 53.4 |
| | | -29 | (2) | 74.5 | 773 | 177 | .51 | 306 | 20.2 | 26.6 | 33.1 | 39.6 | 46.0 | 52.5 | 59.0 |
| | ISA+ 0°C | -28 | (1) | 91.9 | 1715 | 263 | .75 | 435 | 16.6 | 19.5 | 22.4 | 25.3 | 28.3 | 31.2 | 34.1 |
| | -50°C | -31 | | 86.2 | 1349 | 242 | .690 | 402 | 18.7 | 22.4 | 26.1 | 29.8 | 33.5 | 37.2 | 41.0 |
| | | -34 | | 81.7 | 1088 | 219 | .630 | 367 | 20.0 | 24.6 | 29.2 | 33.8 | 38.4 | 43.0 | 47.6 |
| | | -37 | | 77.2 | 892 | 197 | .570 | 333 | 20.5 | 26.1 | 31.7 | 37.3 | 42.9 | 48.5 | 54.1 |
| | | -40 | (2) | 72.9 | 752 | 177 | .51 | 299 | 19.9 | 26.5 | 33.1 | 39.8 | 46.4 | 53.1 | 59.7 |
| | ISA-10°C | -39 | (1) | 90.9 | 1715 | 265 | .75 | 427 | 16.2 | 19.1 | 22.0 | 24.9 | 27.8 | 30.8 | 33.7 |
| | -60°C | -42 | | 84.3 | 1311 | 242 | .690 | 393 | 18.6 | 22.4 | 26.2 | 30.0 | 33.8 | 37.6 | 41.4 |
| | | -45 | | 80.0 | 1057 | 219 | .630 | 359 | 19.8 | 24.5 | 29.2 | 34.0 | 38.7 | 43.4 | 48.2 |
| | | -48 | | 75.5 | 867 | 197 | .570 | 325 | 20.2 | 25.9 | 31.7 | 37.5 | 43.2 | 49.0 | 54.8 |
| | | -50 | (2) | 71.3 | 730 | 177 | .51 | 292 | 19.5 | 26.3 | 33.2 | 40.0 | 46.9 | 53.7 | 60.6 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -40°C | -50°C | -60°C |
| 89.1 | 90.7 | 91.8 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 24)

# CRUISE
# 35,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
| 20000. | ISA+20°C | -15 | (1) 90.1 | 1332 | 224 | .67 | 404 | 19.1 | 22.9 | 26.6 | 30.4 | 34.1 | 37.9 | 41.6 |
| | -34°C | -16 | 88.9 | 1262 | 217 | .650 | 392 | 19.2 | 23.2 | 27.1 | 31.1 | 35.1 | 39.0 | 43.0 |
| | | -18 | 87.5 | 1175 | 206 | .620 | 374 | 19.1 | 23.4 | 27.6 | 31.9 | 36.1 | 40.4 | 44.6 |
| | | -19 | 86.2 | 1102 | 195 | .590 | 356 | 18.7 | 23.3 | 27.8 | 32.3 | 36.9 | 41.4 | 46.0 |
| | | -20 | (2) 85.1 | 1047 | 187 | .57 | 342 | 18.3 | 23.1 | 27.9 | 32.6 | 37.4 | 42.2 | 47.0 |
| | ISA+10°C | -23 | (1) 91.5 | 1470 | 238 | .71 | 418 | 18.3 | 21.7 | 25.1 | 28.5 | 31.9 | 35.3 | 38.7 |
| | -44°C | -26 | 88.3 | 1298 | 224 | .670 | 396 | 18.9 | 22.8 | 26.7 | 30.5 | 34.4 | 38.2 | 42.1 |
| | | -27 | 86.6 | 1197 | 213 | .640 | 378 | 19.1 | 23.3 | 27.4 | 31.6 | 35.8 | 40.0 | 44.1 |
| | | -29 | 84.9 | 1094 | 199 | .600 | 355 | 18.7 | 23.3 | 27.8 | 32.4 | 37.0 | 41.5 | 46.1 |
| | | -31 | (2) 83.4 | 1017 | 187 | .57 | 334 | 18.1 | 23.0 | 27.9 | 32.8 | 37.8 | 42.7 | 47.6 |
| | ISA+ 0°C | -33 | (1) 92.4 | 1603 | 247 | .73 | 425 | 17.1 | 20.2 | 23.4 | 26.5 | 29.6 | 32.7 | 35.8 |
| | -54°C | -35 | 88.2 | 1346 | 231 | .690 | 399 | 18.5 | 22.2 | 25.9 | 29.6 | 33.3 | 37.0 | 40.8 |
| | | -37 | 85.3 | 1193 | 217 | .650 | 376 | 18.9 | 23.1 | 27.3 | 31.5 | 35.7 | 39.9 | 44.0 |
| | | -39 | 83.5 | 1087 | 202 | .610 | 353 | 18.6 | 23.2 | 27.8 | 32.4 | 37.0 | 41.6 | 46.2 |
| | | -42 | (2) 81.7 | 988 | 187 | .56 | 327 | 17.9 | 22.9 | 28.0 | 33.0 | 38.1 | 43.2 | 48.2 |
| | ISA-10°C | -43 | (1) 93.4 | 1713 | 253 | .75 | 423 | 16.0 | 18.9 | 21.8 | 24.7 | 27.6 | 30.5 | 33.5 |
| | -64°C | -45 | 87.8 | 1403 | 238 | .710 | 401 | 17.9 | 21.4 | 25.0 | 28.6 | 32.1 | 35.7 | 39.2 |
| | | -48 | 84.0 | 1191 | 220 | .660 | 373 | 18.7 | 22.9 | 27.1 | 31.3 | 35.5 | 39.7 | 43.9 |
| | | -50 | 81.7 | 1056 | 202 | .610 | 344 | 18.4 | 23.2 | 27.9 | 32.6 | 37.4 | 42.1 | 46.8 |
| | | -52 | (2) 79.9 | 961 | 187 | .57 | 319 | 17.6 | 22.8 | 28.0 | 33.2 | 38.4 | 43.6 | 48.8 |
| 19000. | ISA+20°C | -14 | (1) 90.1 | 1334 | 226 | .68 | 408 | 19.4 | 23.1 | 26.9 | 30.6 | 34.4 | 38.1 | 41.8 |
| | -34°C | -16 | 88.4 | 1238 | 217 | .650 | 392 | 19.6 | 23.6 | 27.7 | 31.7 | 35.7 | 39.8 | 43.8 |
| | | -18 | 86.8 | 1145 | 206 | .620 | 374 | 19.6 | 24.0 | 28.3 | 32.7 | 37.1 | 41.4 | 45.8 |
| | | -20 | 84.9 | 1045 | 192 | .580 | 350 | 19.2 | 23.9 | 28.7 | 33.5 | 38.3 | 43.1 | 47.9 |
| | | -21 | (2) 83.6 | 983 | 182 | .55 | 333 | 18.6 | 23.7 | 28.8 | 33.9 | 39.0 | 44.1 | 49.2 |
| | ISA+10°C | -23 | (1) 91.6 | 1476 | 240 | .71 | 422 | 18.4 | 21.8 | 25.2 | 28.6 | 32.0 | 35.3 | 38.7 |
| | -44°C | -25 | 88.6 | 1315 | 227 | .680 | 402 | 19.2 | 23.0 | 26.8 | 30.6 | 34.4 | 38.2 | 42.0 |
| | | -28 | 85.6 | 1142 | 210 | .630 | 372 | 19.5 | 23.8 | 28.2 | 32.6 | 37.0 | 41.4 | 45.7 |
| | | -30 | 83.7 | 1040 | 195 | .590 | 349 | 19.1 | 23.9 | 28.7 | 33.5 | 38.3 | 43.1 | 47.9 |
| | | -32 | (2) 82.0 | 956 | 182 | .55 | 326 | 18.4 | 23.6 | 28.9 | 34.1 | 39.3 | 44.6 | 49.8 |
| | ISA+ 0°C | -33 | (1) 92.3 | 1605 | 248 | .74 | 426 | 17.2 | 20.3 | 23.4 | 26.6 | 29.7 | 32.8 | 35.9 |
| | -54°C | -35 | 87.6 | 1323 | 231 | .690 | 399 | 18.8 | 22.6 | 26.4 | 30.1 | 33.9 | 37.7 | 41.5 |
| | | -37 | 84.9 | 1171 | 217 | .650 | 376 | 19.3 | 23.5 | 27.8 | 32.1 | 36.3 | 40.6 | 44.9 |
| | | -40 | 82.4 | 1034 | 199 | .600 | 347 | 19.0 | 23.9 | 28.7 | 33.5 | 38.4 | 43.2 | 48.0 |
| | | -42 | (2) 80.2 | 929 | 182 | .55 | 319 | 18.2 | 23.6 | 28.9 | 34.3 | 39.7 | 45.1 | 50.5 |
| | ISA-10°C | -43 | (1) 92.7 | 1682 | 253 | .75 | 423 | 16.2 | 19.2 | 22.2 | 25.2 | 28.1 | 31.1 | 34.1 |
| | -64°C | -46 | 86.6 | 1329 | 235 | .700 | 395 | 18.4 | 22.2 | 26.0 | 29.7 | 33.5 | 37.2 | 41.0 |
| | | -48 | 83.0 | 1138 | 217 | .650 | 367 | 19.1 | 23.5 | 27.9 | 32.3 | 36.7 | 41.1 | 45.4 |
| | | -51 | 80.6 | 1004 | 199 | .600 | 339 | 18.8 | 23.8 | 28.8 | 33.7 | 38.7 | 43.7 | 48.7 |
| | | -53 | (2) 78.5 | 902 | 182 | .55 | 312 | 17.9 | 23.5 | 29.0 | 34.5 | 40.1 | 45.6 | 51.2 |
| 18000. | ISA+20°C | -14 | (1) 90.0 | 1337 | 228 | .68 | 412 | 19.6 | 23.3 | 27.1 | 30.8 | 34.5 | 38.3 | 42.0 |
| | -34°C | -16 | 88.0 | 1216 | 217 | .650 | 392 | 19.9 | 24.1 | 28.2 | 32.3 | 36.4 | 40.5 | 44.6 |
| | | -18 | 85.7 | 1091 | 202 | .610 | 368 | 20.0 | 24.6 | 29.2 | 33.8 | 38.4 | 42.9 | 47.5 |
| | | -20 | 84.1 | 1013 | 192 | .580 | 350 | 19.8 | 24.7 | 29.6 | 34.6 | 39.5 | 44.4 | 49.4 |
| | | -22 | (2) 82.3 | 929 | 178 | .54 | 327 | 19.1 | 24.4 | 29.8 | 35.2 | 40.6 | 46.0 | 51.4 |
| | ISA+10°C | -23 | (1) 91.5 | 1479 | 241 | .72 | 424 | 18.5 | 21.9 | 25.3 | 28.7 | 32.0 | 35.4 | 38.8 |
| | -44°C | -25 | 88.1 | 1294 | 227 | .680 | 402 | 19.5 | 23.3 | 27.2 | 31.1 | 34.9 | 38.8 | 42.6 |
| | | -28 | 85.1 | 1119 | 210 | .630 | 372 | 19.9 | 24.3 | 28.8 | 33.3 | 37.8 | 42.2 | 46.7 |
| | | -30 | 83.0 | 1010 | 195 | .590 | 349 | 19.7 | 24.6 | 29.6 | 34.5 | 39.5 | 44.4 | 49.4 |
| | | -32 | (2) 80.6 | 904 | 179 | .54 | 320 | 18.8 | 24.3 | 29.9 | 35.4 | 40.9 | 46.5 | 52.0 |
| | ISA+ 0°C | -32 | (1) 92.4 | 1611 | 250 | .74 | 428 | 17.3 | 20.4 | 23.5 | 26.6 | 29.7 | 32.8 | 35.9 |
| | -54°C | -35 | 87.1 | 1301 | 231 | .690 | 399 | 19.1 | 23.0 | 26.8 | 30.6 | 34.5 | 38.3 | 42.2 |
| | | -38 | 83.8 | 1118 | 213 | .640 | 370 | 19.7 | 24.1 | 28.6 | 33.1 | 37.6 | 42.0 | 46.5 |
| | | -40 | 81.2 | 982 | 195 | .590 | 341 | 19.5 | 24.6 | 29.7 | 34.7 | 39.8 | 44.9 | 50.0 |
| | | -43 | (2) 78.9 | 878 | 178 | .54 | 313 | 18.5 | 24.2 | 29.9 | 35.6 | 41.3 | 47.0 | 52.7 |
| | ISA-10°C | -43 | (1) 92.2 | 1654 | 253 | .75 | 423 | 16.5 | 19.5 | 22.6 | 25.6 | 28.6 | 31.6 | 34.7 |
| | -64°C | -46 | 86.1 | 1308 | 235 | .700 | 395 | 18.7 | 22.6 | 26.4 | 30.2 | 34.0 | 37.9 | 41.7 |
| | | -48 | 82.6 | 1117 | 217 | .650 | 367 | 19.4 | 23.9 | 28.4 | 32.9 | 37.3 | 41.8 | 46.3 |
| | | -51 | 79.9 | 977 | 199 | .600 | 339 | 19.3 | 24.5 | 29.6 | 34.7 | 39.8 | 44.9 | 50.1 |
| | | -53 | (2) 77.2 | 852 | 178 | .54 | 306 | 18.3 | 24.1 | 30.0 | 35.9 | 41.7 | 47.6 | 53.5 |
| 17000. | ISA+20°C | -14 | (1) 89.9 | 1335 | 230 | .69 | 414 | 19.8 | 23.5 | 27.3 | 31.0 | 34.8 | 38.5 | 42.3 |
| | -34°C | -16 | 87.5 | 1194 | 217 | .650 | 392 | 20.3 | 24.5 | 28.7 | 32.9 | 37.0 | 41.2 | 45.4 |
| | | -18 | 85.7 | 1096 | 206 | .620 | 374 | 20.5 | 25.0 | 29.6 | 34.2 | 38.7 | 43.3 | 47.9 |
| | | -20 | 83.4 | 983 | 192 | .580 | 350 | 20.4 | 25.5 | 30.6 | 35.6 | 40.7 | 45.8 | 50.9 |
| | | -21 | (2) 81.5 | 902 | 180 | .54 | 329 | 19.9 | 25.4 | 31.0 | 36.5 | 42.0 | 47.6 | 53.1 |
| | ISA+10°C | -23 | (1) 91.5 | 1477 | 242 | .72 | 425 | 18.6 | 22.0 | 25.4 | 28.8 | 32.2 | 35.6 | 39.0 |
| | -44°C | -25 | 87.7 | 1275 | 227 | .680 | 402 | 19.8 | 23.7 | 27.6 | 31.5 | 35.4 | 39.4 | 43.3 |
| | | -28 | 84.6 | 1097 | 210 | .630 | 372 | 20.3 | 24.8 | 29.4 | 34.0 | 38.5 | 43.1 | 47.6 |
| | | -30 | 82.3 | 981 | 195 | .590 | 349 | 20.3 | 25.4 | 30.5 | 35.6 | 40.7 | 45.8 | 50.8 |
| | | -32 | (2) 79.9 | 876 | 180 | .54 | 322 | 19.6 | 25.3 | 31.0 | 36.7 | 42.4 | 48.1 | 53.8 |
| | ISA+ 0°C | -32 | (1) 92.3 | 1610 | 250 | .74 | 429 | 17.4 | 20.5 | 23.6 | 26.7 | 29.8 | 32.9 | 36.0 |
| | -54°C | -35 | 87.6 | 1329 | 235 | .700 | 404 | 19.1 | 22.9 | 26.7 | 30.4 | 34.2 | 37.9 | 41.7 |
| | | -37 | 84.0 | 1130 | 217 | .650 | 376 | 20.0 | 24.4 | 28.8 | 33.3 | 37.7 | 42.1 | 46.5 |
| | | -40 | 81.1 | 980 | 199 | .600 | 347 | 20.1 | 25.2 | 30.3 | 35.4 | 40.5 | 45.6 | 50.7 |
| | | -43 | (2) 78.2 | 850 | 179 | .54 | 314 | 19.3 | 25.2 | 31.1 | 37.0 | 42.8 | 48.7 | 54.6 |
| | ISA-10°C | -43 | (1) 91.7 | 1631 | 253 | .75 | 423 | 16.8 | 19.8 | 22.9 | 26.0 | 29.0 | 32.1 | 35.2 |
| | -64°C | -46 | 85.7 | 1291 | 235 | .700 | 395 | 19.0 | 22.9 | 26.7 | 30.6 | 34.5 | 38.4 | 42.2 |
| | | -48 | 82.1 | 1097 | 217 | .650 | 367 | 19.8 | 24.3 | 28.9 | 33.5 | 38.0 | 42.6 | 47.1 |
| | | -51 | 79.3 | 952 | 199 | .600 | 339 | 19.8 | 25.1 | 30.4 | 35.6 | 40.9 | 46.1 | 51.4 |
| | | -53 | (2) 76.4 | 825 | 179 | .54 | 307 | 19.0 | 25.1 | 31.1 | 37.2 | 43.3 | 49.3 | 55.4 |

Figure 7-14 (Sheet 25)

# CRUISE
# 35,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | -14 | (1) 90.0 | 1338 | 230 | .69 | 416 | 19.9 | 23.6 | 27.3 | 31.1 | 34.8 | 38.5 | 42.3 |
| | -34°C | -15 | 87.9 | 1221 | 220 | .660 | 398 | 20.4 | 24.5 | 28.5 | 32.6 | 36.7 | 40.8 | 44.9 |
| | | -18 | 85.4 | 1084 | 206 | .620 | 374 | 20.7 | 25.3 | 29.9 | 34.5 | 39.1 | 43.8 | 48.4 |
| | | -20 | 83.0 | 968 | 192 | .580 | 350 | 20.7 | 25.9 | 31.0 | 36.2 | 41.3 | 46.5 | 51.7 |
| | | -21 | (2) 81.2 | 892 | 181 | .55 | 331 | 20.3 | 25.9 | 31.5 | 37.1 | 42.7 | 48.3 | 53.9 |
| | ISA+10°C | -23 | (1) 91.5 | 1478 | 242 | .72 | 426 | 18.7 | 22.1 | 25.5 | 28.8 | 32.2 | 35.6 | 39.0 |
| | -44°C | -25 | 87.5 | 1266 | 227 | .680 | 402 | 19.9 | 23.8 | 27.8 | 31.7 | 35.7 | 39.6 | 43.6 |
| | | -27 | 84.9 | 1118 | 213 | .640 | 378 | 20.4 | 24.9 | 29.4 | 33.8 | 38.3 | 42.8 | 47.2 |
| | | -30 | 81.9 | 968 | 195 | .590 | 349 | 20.5 | 25.7 | 30.9 | 36.0 | 41.2 | 46.3 | 51.5 |
| | | -32 | (2) 79.5 | 866 | 180 | .55 | 323 | 20.0 | 25.8 | 31.6 | 37.3 | 43.1 | 48.9 | 54.7 |
| | ISA+ 0°C | -32 | (1) 92.3 | 1612 | 251 | .74 | 430 | 17.4 | 20.5 | 23.6 | 26.7 | 29.8 | 32.9 | 36.0 |
| | -54°C | -35 | 87.4 | 1321 | 235 | .700 | 404 | 19.3 | 23.0 | 26.8 | 30.6 | 34.4 | 38.2 | 42.0 |
| | | -37 | 83.8 | 1120 | 217 | .650 | 376 | 20.2 | 24.6 | 29.1 | 33.5 | 38.0 | 42.5 | 46.9 |
| | | -40 | 80.8 | 968 | 199 | .600 | 347 | 20.3 | 25.5 | 30.7 | 35.8 | 41.0 | 46.1 | 51.3 |
| | | -42 | (2) 77.8 | 840 | 180 | .55 | 316 | 19.7 | 25.7 | 31.7 | 37.6 | 43.6 | 49.5 | 55.5 |
| | ISA-10°C | -43 | (1) 91.5 | 1620 | 253 | .75 | 423 | 16.9 | 20.0 | 23.0 | 26.1 | 29.2 | 32.3 | 35.4 |
| | -64°C | -46 | 85.5 | 1283 | 235 | .700 | 395 | 19.1 | 23.0 | 26.9 | 30.8 | 34.7 | 38.6 | 42.5 |
| | | -48 | 81.9 | 1087 | 217 | .650 | 367 | 20.0 | 24.6 | 29.1 | 33.7 | 38.3 | 42.9 | 47.5 |
| | | -51 | 79.0 | 940 | 199 | .600 | 339 | 20.1 | 25.4 | 30.7 | 36.0 | 41.4 | 46.7 | 52.0 |
| | | -53 | (2) 76.1 | 815 | 180 | .55 | 308 | 19.4 | 25.6 | 31.7 | 37.8 | 44.0 | 50.1 | 56.2 |
| 16000. | ISA+20°C | -14 | (1) 89.9 | 1337 | 231 | .69 | 417 | 19.9 | 23.7 | 27.4 | 31.2 | 34.9 | 38.6 | 42.4 |
| | -34°C | -15 | 87.7 | 1211 | 220 | .660 | 398 | 20.5 | 24.6 | 28.8 | 32.9 | 37.0 | 41.2 | 45.3 |
| | | -18 | 85.1 | 1073 | 206 | .620 | 374 | 20.9 | 25.6 | 30.2 | 34.9 | 39.6 | 44.2 | 48.9 |
| | | -19 | 83.3 | 983 | 195 | .590 | 356 | 21.0 | 26.1 | 31.2 | 36.3 | 41.3 | 46.4 | 51.5 |
| | | -21 | (2) 80.7 | 876 | 181 | .55 | 331 | 20.6 | 26.3 | 32.0 | 37.8 | 43.5 | 49.2 | 54.9 |
| | ISA+10°C | -23 | (1) 91.5 | 1479 | 243 | .72 | 427 | 18.7 | 22.1 | 25.5 | 28.9 | 32.3 | 35.6 | 39.0 |
| | -44°C | -25 | 87.4 | 1258 | 227 | .680 | 402 | 20.0 | 24.0 | 28.0 | 31.9 | 35.9 | 39.9 | 43.9 |
| | | -27 | 84.7 | 1108 | 213 | .640 | 378 | 20.6 | 25.1 | 29.6 | 34.1 | 38.7 | 43.2 | 47.7 |
| | | -30 | 81.6 | 956 | 195 | .590 | 349 | 20.8 | 26.0 | 31.2 | 36.5 | 41.7 | 46.9 | 52.2 |
| | | -32 | (2) 79.1 | 851 | 181 | .55 | 324 | 20.4 | 26.3 | 32.1 | 38.0 | 43.9 | 49.7 | 55.6 |
| | ISA+ 0°C | -32 | (1) 92.3 | 1614 | 251 | .75 | 431 | 17.4 | 20.5 | 23.6 | 26.7 | 29.8 | 32.9 | 36.0 |
| | -54°C | -35 | 87.2 | 1313 | 235 | .700 | 404 | 19.4 | 23.2 | 27.0 | 30.8 | 34.6 | 38.4 | 42.2 |
| | | -37 | 83.6 | 1110 | 217 | .650 | 376 | 20.3 | 24.8 | 29.3 | 33.8 | 38.3 | 42.8 | 47.3 |
| | | -40 | 80.5 | 957 | 199 | .600 | 347 | 20.6 | 25.8 | 31.0 | 36.2 | 41.5 | 46.7 | 51.9 |
| | | -42 | (2) 77.4 | 828 | 181 | .55 | 316 | 20.1 | 26.1 | 32.2 | 38.2 | 44.3 | 50.3 | 56.3 |
| | ISA-10°C | -43 | (1) 91.2 | 1610 | 253 | .75 | 423 | 17.0 | 20.1 | 23.2 | 26.3 | 29.4 | 32.5 | 35.6 |
| | -64°C | -46 | 85.3 | 1275 | 235 | .700 | 395 | 19.2 | 23.1 | 27.1 | 31.0 | 34.9 | 38.8 | 42.8 |
| | | -48 | 81.7 | 1078 | 217 | .650 | 367 | 20.1 | 24.8 | 29.4 | 34.0 | 38.7 | 43.3 | 48.0 |
| | | -51 | 78.8 | 929 | 199 | .600 | 339 | 20.3 | 25.7 | 31.1 | 36.5 | 41.8 | 47.2 | 52.6 |
| | | -53 | (2) 75.7 | 803 | 181 | .55 | 309 | 19.8 | 26.0 | 32.2 | 38.5 | 44.7 | 50.9 | 57.1 |
| 14000. | ISA+20°C | -13 | (1) 89.9 | 1339 | 233 | .70 | 420 | 20.2 | 23.9 | 27.7 | 31.4 | 35.1 | 38.9 | 42.6 |
| | -34°C | -16 | 86.3 | 1139 | 217 | .650 | 392 | 21.3 | 25.7 | 30.1 | 34.4 | 38.8 | 43.2 | 47.6 |
| | | -18 | 83.5 | 998 | 202 | .610 | 368 | 21.9 | 26.9 | 31.9 | 36.9 | 41.9 | 46.9 | 51.9 |
| | | -21 | 79.9 | 857 | 185 | .560 | 338 | 22.0 | 27.8 | 33.6 | 39.5 | 45.3 | 51.1 | 57.0 |
| | | -23 | (2) 77.0 | 764 | 170 | .52 | 313 | 21.3 | 27.8 | 34.4 | 40.9 | 47.5 | 54.0 | 60.6 |
| | ISA+10°C | -22 | (1) 91.3 | 1477 | 244 | .73 | 430 | 18.9 | 22.3 | 25.7 | 29.1 | 32.5 | 35.9 | 39.2 |
| | -44°C | -25 | 86.8 | 1228 | 227 | .680 | 402 | 20.5 | 24.6 | 28.6 | 32.7 | 36.8 | 40.9 | 44.9 |
| | | -28 | 82.5 | 1002 | 206 | .620 | 366 | 21.6 | 26.6 | 31.6 | 36.6 | 41.6 | 46.5 | 51.5 |
| | | -31 | 79.0 | 858 | 189 | .570 | 337 | 21.8 | 27.6 | 33.5 | 39.3 | 45.1 | 50.9 | 56.8 |
| | | -33 | (2) 75.4 | 743 | 170 | .52 | 306 | 21.0 | 27.7 | 34.5 | 41.2 | 47.9 | 54.7 | 61.4 |
| | ISA+ 0°C | -32 | (1) 92.3 | 1616 | 253 | .75 | 433 | 17.5 | 20.6 | 23.7 | 26.8 | 29.9 | 33.0 | 36.1 |
| | -54°C | -35 | 85.7 | 1238 | 231 | .690 | 399 | 20.1 | 24.1 | 28.2 | 32.2 | 36.2 | 40.3 | 44.3 |
| | | -38 | 82.1 | 1042 | 213 | .640 | 370 | 21.1 | 25.9 | 30.7 | 35.5 | 40.3 | 45.1 | 49.9 |
| | | -41 | 78.1 | 859 | 192 | .580 | 335 | 21.6 | 27.4 | 33.2 | 39.0 | 44.8 | 50.7 | 56.5 |
| | | -44 | (2) 73.8 | 721 | 170 | .52 | 299 | 20.7 | 27.6 | 34.5 | 41.5 | 48.4 | 55.3 | 62.3 |
| | ISA-10°C | -43 | (1) 90.4 | 1571 | 253 | .75 | 423 | 17.4 | 20.6 | 23.8 | 26.9 | 30.1 | 33.3 | 36.5 |
| | -64°C | -46 | 83.8 | 1202 | 231 | .690 | 389 | 19.9 | 24.1 | 28.2 | 32.4 | 36.6 | 40.7 | 44.9 |
| | | -49 | 80.3 | 1011 | 213 | .640 | 361 | 20.9 | 25.8 | 30.8 | 35.7 | 40.7 | 45.6 | 50.6 |
| | | -51 | 76.4 | 835 | 192 | .580 | 328 | 21.3 | 27.3 | 33.3 | 39.2 | 45.2 | 51.2 | 57.2 |
| | | -54 | (2) 72.1 | 699 | 170 | .52 | 292 | 20.3 | 27.4 | 34.6 | 41.7 | 48.9 | 56.0 | 63.2 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -44°C | -54°C | -64°C |
| 89.9 | 90.9 | 91.5 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 26)

# CRUISE
# 37,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+20°C | -17 | (1) | 90.8 | 1249 | 212 | .67 | 400 | 20.1 | 24.1 | 28.1 | 32.1 | 36.1 | 40.1 | 44.1 |
| | -37°C | -18 | | 89.9 | 1205 | 207 | .650 | 391 | 20.0 | 24.1 | 28.3 | 32.4 | 36.6 | 40.7 | 44.9 |
| | | -19 | | 89.4 | 1178 | 203 | .640 | 385 | 19.9 | 24.2 | 28.4 | 32.7 | 36.9 | 41.1 | 45.4 |
| | | -20 | | 88.6 | 1130 | 197 | .620 | 373 | 19.7 | 24.1 | 28.6 | 33.0 | 37.4 | 41.8 | 46.2 |
| | | -21 | (2) | 87.9 | 1085 | 190 | .60 | 361 | 19.4 | 24.0 | 28.6 | 33.2 | 37.8 | 42.4 | 47.1 |
| | ISA+10°C | -26 | (1) | 92.2 | 1405 | 228 | .71 | 418 | 19.1 | 22.6 | 26.2 | 29.8 | 33.3 | 36.9 | 40.4 |
| | -47°C | -27 | | 90.7 | 1307 | 221 | .690 | 406 | 19.6 | 23.4 | 27.2 | 31.0 | 34.9 | 38.7 | 42.5 |
| | | -28 | | 88.7 | 1198 | 210 | .660 | 388 | 19.9 | 24.0 | 28.2 | 32.4 | 36.6 | 40.7 | 44.9 |
| | | -30 | | 87.2 | 1121 | 200 | .630 | 371 | 19.7 | 24.1 | 28.6 | 33.1 | 37.5 | 42.0 | 46.4 |
| | | -32 | (2) | 86.1 | 1055 | 190 | .60 | 353 | 19.2 | 24.0 | 28.7 | 33.4 | 38.2 | 42.9 | 47.7 |
| | ISA+ 0°C | -36 | (1) | 92.3 | 1463 | 233 | .73 | 417 | 18.3 | 21.7 | 25.1 | 28.5 | 31.9 | 35.4 | 38.8 |
| | -57°C | -37 | | 89.5 | 1315 | 224 | .700 | 402 | 19.2 | 23.0 | 26.8 | 30.6 | 34.4 | 38.2 | 42.0 |
| | | -39 | | 86.8 | 1165 | 210 | .660 | 380 | 19.7 | 24.0 | 28.3 | 32.6 | 36.9 | 41.2 | 45.5 |
| | | -41 | | 85.4 | 1090 | 200 | .630 | 362 | 19.5 | 24.1 | 28.7 | 33.3 | 37.8 | 42.4 | 47.0 |
| | | -42 | (2) | 84.3 | 1025 | 190 | .60 | 345 | 19.0 | 23.9 | 28.8 | 33.6 | 38.5 | 43.4 | 48.3 |
| | ISA-10°C | -45 | (1) | 95.8 | 1676 | 241 | .75 | 421 | 16.2 | 19.1 | 22.1 | 25.1 | 28.1 | 31.1 | 34.1 |
| | -67°C | -47 | | 88.3 | 1327 | 227 | .710 | 399 | 18.7 | 22.5 | 26.3 | 30.0 | 33.8 | 37.6 | 41.3 |
| | | -49 | | 86.1 | 1192 | 217 | .680 | 382 | 19.5 | 23.7 | 27.8 | 32.0 | 36.2 | 40.4 | 44.6 |
| | | -51 | | 83.9 | 1080 | 203 | .640 | 359 | 19.4 | 24.0 | 28.7 | 33.3 | 37.9 | 42.5 | 47.2 |
| | | -53 | (2) | 82.4 | 994 | 190 | .60 | 337 | 18.8 | 23.8 | 28.8 | 33.9 | 38.9 | 43.9 | 49.0 |
| 19000. | ISA+20°C | -17 | (1) | 90.7 | 1252 | 215 | .68 | 406 | 20.4 | 24.4 | 28.4 | 32.4 | 36.4 | 40.4 | 44.4 |
| | -37°C | -18 | | 89.6 | 1200 | 210 | .660 | 397 | 20.6 | 24.7 | 28.9 | 33.1 | 37.2 | 41.4 | 45.6 |
| | | -19 | | 88.2 | 1120 | 200 | .630 | 379 | 20.4 | 24.9 | 29.4 | 33.8 | 38.3 | 42.8 | 47.2 |
| | | -20 | | 87.4 | 1073 | 193 | .610 | 367 | 20.2 | 24.8 | 29.5 | 34.2 | 38.8 | 43.5 | 48.1 |
| | | -22 | (2) | 86.5 | 1025 | 185 | .59 | 353 | 19.8 | 24.6 | 29.5 | 34.4 | 39.3 | 44.1 | 49.0 |
| | ISA+10°C | -25 | (1) | 92.1 | 1403 | 230 | .72 | 422 | 19.4 | 22.9 | 26.5 | 30.1 | 33.6 | 37.2 | 40.8 |
| | -47°C | -27 | | 90.1 | 1280 | 221 | .690 | 406 | 20.0 | 23.9 | 27.8 | 31.7 | 35.6 | 39.5 | 43.4 |
| | | -29 | | 87.3 | 1138 | 207 | .650 | 382 | 20.4 | 24.8 | 29.2 | 33.6 | 38.0 | 42.4 | 46.8 |
| | | -31 | | 86.1 | 1066 | 197 | .620 | 365 | 20.1 | 24.8 | 29.5 | 34.2 | 38.9 | 43.6 | 48.3 |
| | | -32 | (2) | 84.7 | 997 | 185 | .59 | 345 | 19.6 | 24.6 | 29.6 | 34.6 | 39.6 | 44.6 | 49.6 |
| | ISA+ 0°C | -35 | (1) | 92.3 | 1469 | 235 | .73 | 421 | 18.5 | 21.9 | 25.3 | 28.7 | 32.1 | 35.5 | 38.9 |
| | -57°C | -37 | | 89.0 | 1287 | 224 | .700 | 402 | 19.6 | 23.5 | 27.4 | 31.3 | 35.2 | 39.0 | 42.9 |
| | | -39 | | 86.0 | 1134 | 210 | .660 | 380 | 20.2 | 24.7 | 29.1 | 33.5 | 37.9 | 42.3 | 46.7 |
| | | -41 | | 84.2 | 1036 | 197 | .620 | 357 | 19.9 | 24.8 | 29.6 | 34.4 | 39.2 | 44.1 | 48.9 |
| | | -43 | (2) | 82.9 | 968 | 185 | .59 | 337 | 19.3 | 24.5 | 29.6 | 34.8 | 40.0 | 45.1 | 50.3 |
| | ISA-10°C | -45 | (1) | 93.7 | 1587 | 241 | .75 | 421 | 17.1 | 20.2 | 23.4 | 26.5 | 29.7 | 32.8 | 36.0 |
| | -67°C | -47 | | 87.6 | 1295 | 227 | .710 | 399 | 19.2 | 23.1 | 26.9 | 30.8 | 34.7 | 38.5 | 42.4 |
| | | -50 | | 84.8 | 1132 | 214 | .670 | 376 | 20.0 | 24.4 | 28.8 | 33.2 | 37.6 | 42.1 | 46.5 |
| | | -52 | | 82.8 | 1028 | 200 | .630 | 354 | 19.8 | 24.7 | 29.6 | 34.4 | 39.3 | 44.2 | 49.0 |
| | | -54 | (2) | 81.1 | 939 | 185 | .59 | 329 | 19.0 | 24.4 | 29.7 | 35.0 | 40.4 | 45.7 | 51.0 |
| 18000. | ISA+20°C | -16 | (1) | 90.6 | 1253 | 218 | .68 | 410 | 20.7 | 24.7 | 28.7 | 32.7 | 36.7 | 40.7 | 44.7 |
| | -37°C | -18 | | 88.5 | 1144 | 207 | .650 | 391 | 21.0 | 25.4 | 29.8 | 34.1 | 38.5 | 42.9 | 47.3 |
| | | -20 | | 87.1 | 1064 | 197 | .620 | 373 | 20.9 | 25.6 | 30.3 | 35.0 | 39.7 | 44.4 | 49.1 |
| | | -21 | | 86.1 | 1019 | 190 | .600 | 361 | 20.7 | 25.6 | 30.5 | 35.4 | 40.3 | 45.2 | 50.1 |
| | | -23 | (2) | 84.5 | 946 | 178 | .56 | 339 | 20.0 | 25.3 | 30.6 | 35.8 | 41.1 | 46.4 | 51.7 |
| | ISA+10°C | -25 | (1) | 92.1 | 1406 | 232 | .72 | 426 | 19.6 | 23.2 | 26.7 | 30.3 | 33.8 | 37.4 | 40.9 |
| | -47°C | -27 | | 89.5 | 1254 | 221 | .690 | 406 | 20.4 | 24.4 | 28.4 | 32.3 | 36.3 | 40.3 | 44.3 |
| | | -29 | | 86.8 | 1113 | 207 | .650 | 382 | 20.9 | 25.4 | 29.9 | 34.4 | 38.9 | 43.4 | 47.8 |
| | | -31 | | 84.9 | 1013 | 193 | .610 | 359 | 20.6 | 25.6 | 30.5 | 35.4 | 40.4 | 45.3 | 50.3 |
| | | -33 | (2) | 82.8 | 920 | 178 | .56 | 332 | 19.8 | 25.2 | 30.6 | 36.1 | 41.5 | 46.9 | 52.4 |
| | ISA+ 0°C | -35 | (1) | 92.4 | 1476 | 237 | .74 | 425 | 18.6 | 22.0 | 25.4 | 28.8 | 32.1 | 35.5 | 38.9 |
| | -57°C | -37 | | 88.5 | 1261 | 224 | .700 | 402 | 20.0 | 24.0 | 27.9 | 31.9 | 35.9 | 39.8 | 43.8 |
| | | -40 | | 84.9 | 1081 | 207 | .650 | 374 | 20.7 | 25.3 | 29.9 | 34.6 | 39.2 | 43.8 | 48.4 |
| | | -42 | | 83.1 | 984 | 193 | .610 | 351 | 20.4 | 25.5 | 30.6 | 35.7 | 40.7 | 45.8 | 50.9 |
| | | -44 | (2) | 81.0 | 893 | 178 | .56 | 324 | 19.5 | 25.1 | 30.7 | 36.3 | 41.9 | 47.5 | 53.1 |
| | ISA-10°C | -45 | (1) | 92.7 | 1546 | 241 | .75 | 421 | 17.5 | 20.8 | 24.0 | 27.2 | 30.5 | 33.7 | 36.9 |
| | -67°C | -47 | | 87.3 | 1269 | 227 | .710 | 399 | 19.6 | 23.5 | 27.5 | 31.4 | 35.3 | 39.3 | 43.2 |
| | | -50 | | 83.6 | 1079 | 210 | .660 | 371 | 20.5 | 25.1 | 29.7 | 34.4 | 39.0 | 43.6 | 48.3 |
| | | -52 | | 81.2 | 955 | 193 | .610 | 343 | 20.2 | 25.4 | 30.6 | 35.9 | 41.1 | 46.3 | 51.6 |
| | | -55 | (2) | 79.2 | 867 | 178 | .56 | 317 | 19.2 | 25.0 | 30.7 | 36.5 | 42.3 | 48.0 | 53.8 |
| 17000. | ISA+20°C | -16 | (1) | 90.6 | 1255 | 220 | .69 | 413 | 21.0 | 25.0 | 29.0 | 32.9 | 36.9 | 40.9 | 44.9 |
| | -37°C | -18 | | 88.6 | 1153 | 210 | .660 | 397 | 21.4 | 25.7 | 30.1 | 34.4 | 38.7 | 43.1 | 47.4 |
| | | -20 | | 86.3 | 1035 | 197 | .620 | 373 | 21.5 | 26.3 | 31.2 | 36.0 | 40.8 | 45.7 | 50.5 |
| | | -21 | | 84.8 | 966 | 187 | .590 | 355 | 21.2 | 26.4 | 31.5 | 36.7 | 41.9 | 47.1 | 52.3 |
| | | -23 | (2) | 82.9 | 887 | 174 | .55 | 331 | 20.5 | 26.1 | 31.7 | 37.4 | 43.0 | 48.6 | 54.3 |
| | ISA+10°C | -25 | (1) | 92.0 | 1401 | 233 | .73 | 428 | 19.8 | 23.4 | 26.9 | 30.5 | 34.1 | 37.7 | 41.2 |
| | -47°C | -27 | | 88.1 | 1190 | 217 | .680 | 400 | 21.0 | 25.2 | 29.4 | 33.6 | 37.8 | 42.0 | 46.2 |
| | | -30 | | 85.7 | 1061 | 203 | .640 | 376 | 21.3 | 26.1 | 30.8 | 35.5 | 40.2 | 44.9 | 49.6 |
| | | -32 | | 83.6 | 961 | 190 | .600 | 353 | 21.1 | 26.3 | 31.5 | 36.7 | 41.9 | 47.1 | 52.3 |
| | | -34 | (2) | 81.2 | 861 | 173 | .55 | 324 | 20.2 | 26.0 | 31.8 | 37.6 | 43.4 | 49.2 | 55.0 |
| | ISA+ 0°C | -35 | (1) | 92.3 | 1477 | 238 | .74 | 426 | 18.7 | 22.1 | 25.5 | 28.9 | 32.2 | 35.6 | 39.0 |
| | -57°C | -37 | | 88.0 | 1238 | 224 | .700 | 402 | 20.4 | 24.4 | 28.5 | 32.5 | 36.6 | 40.6 | 44.6 |
| | | -40 | | 84.4 | 1060 | 207 | .650 | 374 | 21.1 | 25.8 | 30.6 | 35.3 | 40.0 | 44.7 | 49.4 |
| | | -42 | | 81.8 | 934 | 190 | .600 | 345 | 20.9 | 26.2 | 31.6 | 36.9 | 42.3 | 47.6 | 53.0 |
| | | -44 | (2) | 79.5 | 837 | 173 | .55 | 317 | 19.9 | 25.9 | 31.9 | 37.8 | 43.8 | 49.8 | 55.8 |
| | ISA-10°C | -45 | (1) | 91.9 | 1512 | 241 | .75 | 421 | 17.9 | 21.2 | 24.5 | 27.9 | 31.2 | 34.5 | 37.8 |
| | -67°C | -48 | | 86.0 | 1202 | 224 | .700 | 393 | 20.2 | 24.4 | 28.6 | 32.7 | 36.9 | 41.0 | 45.2 |
| | | -51 | | 82.5 | 1029 | 207 | .650 | 365 | 20.9 | 25.8 | 30.6 | 35.5 | 40.3 | 45.2 | 50.1 |
| | | -53 | | 80.0 | 907 | 190 | .600 | 337 | 20.6 | 26.1 | 31.7 | 37.2 | 42.7 | 48.2 | 53.7 |
| | | -55 | (2) | 77.7 | 812 | 173 | .55 | 309 | 19.6 | 25.8 | 31.9 | 38.1 | 44.2 | 50.4 | 56.6 |

Figure 7-14 (Sheet 27)

# CRUISE
# 37,000 FEET

**ANTI-ICE SYSTEMS OFF** | **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | -16 | (1) 90.5 | 1257 | 221 | .69 | 415 | 21.1 | 25.1 | 29.1 | 33.0 | 37.0 | 41.0 | 45.0 |
| | -37°C | -18 | 88.4 | 1142 | 210 | .660 | 397 | 21.6 | 26.0 | 30.4 | 34.7 | 39.1 | 43.5 | 47.9 |
| | | -20 | 86.0 | 1023 | 197 | .620 | 373 | 21.8 | 26.7 | 31.5 | 36.4 | 41.3 | 46.2 | 51.1 |
| | | -22 | 83.8 | 928 | 183 | .580 | 349 | 21.4 | 26.8 | 32.2 | 37.6 | 43.0 | 48.3 | 53.7 |
| | | -24 | (2) 82.1 | 857 | 171 | .54 | 327 | 20.7 | 26.5 | 32.3 | 38.2 | 44.0 | 49.8 | 55.7 |
| | ISA+10°C | -24 | (1) 92.0 | 1404 | 234 | .73 | 429 | 19.9 | 23.4 | 27.0 | 30.5 | 34.1 | 37.7 | 41.2 |
| | -47°C | -27 | 87.8 | 1179 | 217 | .680 | 400 | 21.2 | 25.4 | 29.7 | 33.9 | 38.2 | 42.4 | 46.6 |
| | | -30 | 85.4 | 1050 | 203 | .640 | 376 | 21.6 | 26.3 | 31.1 | 35.9 | 40.6 | 45.4 | 50.2 |
| | | -32 | 82.6 | 924 | 187 | .590 | 347 | 21.3 | 26.7 | 32.1 | 37.6 | 43.0 | 48.4 | 53.8 |
| | | -34 | (2) 80.4 | 833 | 171 | .54 | 320 | 20.4 | 26.4 | 32.4 | 38.4 | 44.4 | 50.4 | 56.4 |
| | ISA+ 0°C | -35 | (1) 92.3 | 1478 | 239 | .74 | 427 | 18.7 | 22.1 | 25.5 | 28.9 | 32.3 | 35.7 | 39.0 |
| | -57°C | -37 | 87.7 | 1227 | 224 | .700 | 402 | 20.6 | 24.7 | 28.7 | 32.8 | 36.9 | 41.0 | 45.0 |
| | | -40 | 84.2 | 1049 | 207 | .650 | 374 | 21.3 | 26.1 | 30.9 | 35.6 | 40.4 | 45.2 | 49.9 |
| | | -42 | 81.4 | 920 | 190 | .600 | 345 | 21.2 | 26.6 | 32.1 | 37.5 | 42.9 | 48.4 | 53.8 |
| | | -45 | (2) 78.7 | 810 | 171 | .54 | 313 | 20.1 | 26.3 | 32.5 | 38.6 | 44.8 | 51.0 | 57.1 |
| | ISA-10°C | -45 | (1) 91.6 | 1500 | 241 | .75 | 421 | 18.1 | 21.4 | 24.7 | 28.1 | 31.4 | 34.7 | 38.1 |
| | -67°C | -48 | 85.8 | 1191 | 224 | .700 | 393 | 20.4 | 24.6 | 28.8 | 33.0 | 37.2 | 41.4 | 45.6 |
| | | -51 | 82.3 | 1019 | 207 | .650 | 365 | 21.1 | 26.0 | 30.9 | 35.8 | 40.8 | 45.7 | 50.6 |
| | | -53 | 79.6 | 893 | 190 | .600 | 337 | 20.9 | 26.5 | 32.1 | 37.7 | 43.3 | 48.9 | 54.5 |
| | | -55 | (2) 76.9 | 786 | 171 | .54 | 306 | 19.8 | 26.2 | 32.5 | 38.9 | 45.3 | 51.6 | 58.0 |
| 16000. | ISA+20°C | -16 | (1) 90.5 | 1257 | 222 | .69 | 417 | 21.2 | 25.2 | 29.2 | 33.2 | 37.1 | 41.1 | 45.1 |
| | -37°C | -18 | 88.1 | 1132 | 210 | .660 | 397 | 21.8 | 26.2 | 30.6 | 35.1 | 39.5 | 43.9 | 48.3 |
| | | -20 | 85.6 | 1011 | 197 | .620 | 373 | 22.0 | 27.0 | 31.9 | 36.9 | 41.8 | 46.7 | 51.7 |
| | | -22 | 83.3 | 913 | 183 | .580 | 349 | 21.8 | 27.3 | 32.7 | 38.2 | 43.7 | 49.2 | 54.6 |
| | | -24 | (2) 81.5 | 835 | 170 | .54 | 326 | 21.0 | 27.0 | 33.0 | 39.0 | 45.0 | 50.9 | 56.9 |
| | ISA+10°C | -24 | (1) 91.9 | 1400 | 234 | .73 | 429 | 19.9 | 23.5 | 27.1 | 30.6 | 34.2 | 37.8 | 41.4 |
| | -47°C | -27 | 87.6 | 1170 | 217 | .680 | 400 | 21.4 | 25.6 | 29.9 | 34.2 | 38.5 | 42.7 | 47.0 |
| | | -30 | 85.1 | 1039 | 203 | .640 | 376 | 21.8 | 26.6 | 31.4 | 36.2 | 41.1 | 45.9 | 50.7 |
| | | -32 | 82.2 | 910 | 187 | .590 | 347 | 21.7 | 27.2 | 32.7 | 38.2 | 43.7 | 49.1 | 54.6 |
| | | -34 | (2) 79.7 | 810 | 170 | .54 | 317 | 20.7 | 26.9 | 33.0 | 39.2 | 45.4 | 51.6 | 57.7 |
| | ISA+ 0°C | -35 | (1) 92.3 | 1481 | 240 | .74 | 428 | 18.8 | 22.2 | 25.5 | 28.9 | 32.3 | 35.7 | 39.0 |
| | -57°C | -37 | 87.4 | 1217 | 224 | .700 | 402 | 20.7 | 24.8 | 29.0 | 33.1 | 37.2 | 41.3 | 45.4 |
| | | -40 | 83.3 | 1010 | 203 | .640 | 368 | 21.6 | 26.6 | 31.5 | 36.5 | 41.4 | 46.4 | 51.3 |
| | | -43 | 80.5 | 884 | 187 | .590 | 339 | 21.4 | 27.1 | 32.7 | 38.4 | 44.0 | 49.7 | 55.3 |
| | | -45 | (2) 78.0 | 786 | 170 | .54 | 310 | 20.4 | 26.7 | 33.1 | 39.5 | 45.8 | 52.2 | 58.5 |
| | ISA-10°C | -45 | (1) 91.4 | 1488 | 241 | .75 | 421 | 18.2 | 21.6 | 24.9 | 28.3 | 31.7 | 35.0 | 38.4 |
| | -67°C | -48 | 85.5 | 1182 | 224 | .700 | 393 | 20.6 | 24.8 | 29.0 | 33.3 | 37.5 | 41.7 | 46.0 |
| | | -51 | 82.1 | 1009 | 207 | .650 | 365 | 21.3 | 26.3 | 31.2 | 36.2 | 41.2 | 46.1 | 51.1 |
| | | -53 | 78.7 | 858 | 187 | .590 | 331 | 21.1 | 27.0 | 32.8 | 38.6 | 44.4 | 50.3 | 56.1 |
| | | -56 | (2) 76.3 | 763 | 170 | .54 | 303 | 20.0 | 26.6 | 33.1 | 39.7 | 46.3 | 52.8 | 59.4 |
| 14000. | ISA+20°C | -15 | (1) 90.3 | 1258 | 224 | .70 | 421 | 21.6 | 25.5 | 29.5 | 33.5 | 37.5 | 41.4 | 45.4 |
| | -37°C | -18 | 87.2 | 1093 | 210 | .660 | 397 | 22.6 | 27.1 | 31.7 | 36.3 | 40.9 | 45.4 | 50.0 |
| | | -20 | 84.4 | 966 | 197 | .620 | 373 | 23.1 | 28.2 | 33.4 | 38.6 | 43.8 | 49.0 | 54.1 |
| | | -22 | 81.8 | 858 | 183 | .580 | 349 | 23.2 | 29.0 | 34.8 | 40.6 | 46.5 | 52.3 | 58.1 |
| | | -24 | (2) 79.4 | 775 | 171 | .54 | 326 | 22.7 | 29.2 | 35.6 | 42.1 | 48.5 | 55.0 | 61.4 |
| | ISA+10°C | -24 | (1) 91.9 | 1401 | 236 | .74 | 432 | 20.1 | 23.7 | 27.3 | 30.8 | 34.4 | 38.0 | 41.6 |
| | -47°C | -27 | 87.6 | 1176 | 221 | .690 | 406 | 21.8 | 26.0 | 30.3 | 34.5 | 38.8 | 43.0 | 47.3 |
| | | -30 | 84.0 | 998 | 203 | .640 | 376 | 22.7 | 27.7 | 32.7 | 37.7 | 42.7 | 47.7 | 52.7 |
| | | -32 | 80.8 | 859 | 187 | .590 | 347 | 22.9 | 28.8 | 34.6 | 40.4 | 46.2 | 52.0 | 57.8 |
| | | -34 | (2) 77.8 | 753 | 171 | .54 | 319 | 22.4 | 29.1 | 35.7 | 42.4 | 49.0 | 55.6 | 62.3 |
| | ISA+ 0°C | -34 | (1) 92.3 | 1486 | 241 | .75 | 431 | 18.9 | 22.3 | 25.7 | 29.0 | 32.4 | 35.8 | 39.1 |
| | -57°C | -37 | 86.6 | 1185 | 224 | .700 | 402 | 21.3 | 25.5 | 29.7 | 34.0 | 38.2 | 42.4 | 46.6 |
| | | -40 | 83.0 | 1001 | 207 | .650 | 374 | 22.4 | 27.4 | 32.4 | 37.4 | 42.3 | 47.3 | 52.3 |
| | | -42 | 79.7 | 860 | 190 | .600 | 345 | 22.7 | 28.5 | 34.3 | 40.1 | 45.9 | 51.7 | 57.5 |
| | | -45 | (2) 76.1 | 732 | 171 | .54 | 312 | 22.1 | 29.0 | 35.8 | 42.6 | 49.5 | 56.3 | 63.1 |
| | ISA-10°C | -45 | (1) 90.4 | 1446 | 241 | .75 | 421 | 18.7 | 22.2 | 25.7 | 29.1 | 32.6 | 36.0 | 39.5 |
| | -67°C | -48 | 84.7 | 1150 | 224 | .700 | 393 | 21.1 | 25.5 | 29.8 | 34.2 | 38.5 | 42.9 | 47.2 |
| | | -51 | 81.1 | 971 | 207 | .650 | 365 | 22.1 | 27.3 | 32.4 | 37.6 | 42.7 | 47.9 | 53.0 |
| | | -53 | 77.9 | 835 | 190 | .600 | 337 | 22.4 | 28.4 | 34.4 | 40.4 | 46.3 | 52.3 | 58.3 |
| | | -55 | (2) 74.4 | 710 | 171 | .54 | 305 | 21.8 | 28.8 | 35.8 | 42.9 | 49.9 | 57.0 | 64.0 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -47°C | -57°C | -67°C |
| 90.4 | 90.7 | 91.6 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 28)

# CRUISE
# 39,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+10°C | -27 | (1) | 92.4 | 1281 | 212 | .69 | 409 | 20.2 | 24.1 | 28.0 | 31.9 | 35.8 | 39.7 | 43.6 |
| | -47°C | -27 | | 91.4 | 1229 | 207 | .680 | 400 | 20.3 | 24.4 | 28.5 | 32.5 | 36.6 | 40.7 | 44.7 |
| | | -28 | | 90.5 | 1169 | 201 | .660 | 388 | 20.4 | 24.6 | 28.9 | 33.2 | 37.5 | 41.7 | 46.0 |
| | | -29 | | 90.1 | 1142 | 197 | .650 | 382 | 20.3 | 24.7 | 29.1 | 33.5 | 37.9 | 42.2 | 46.6 |
| | | -30 | (2) | 89.2 | 1093 | 191 | .63 | 370 | 20.1 | 24.7 | 29.3 | 33.9 | 38.4 | 43.0 | 47.6 |
| | ISA+ 0°C | -36 | (1) | 92.4 | 1331 | 218 | .71 | 409 | 19.5 | 23.2 | 27.0 | 30.7 | 34.5 | 38.3 | 42.0 |
| | -57°C | -38 | | 90.2 | 1230 | 210 | .690 | 397 | 20.1 | 24.1 | 28.2 | 32.3 | 36.3 | 40.4 | 44.4 |
| | | -39 | | 89.1 | 1164 | 204 | .670 | 385 | 20.2 | 24.5 | 28.8 | 33.1 | 37.4 | 41.7 | 46.0 |
| | | -40 | | 88.2 | 1109 | 197 | .650 | 374 | 20.2 | 24.7 | 29.2 | 33.7 | 38.2 | 42.7 | 47.2 |
| | | -41 | (2) | 87.3 | 1062 | 191 | .63 | 362 | 20.0 | 24.7 | 29.4 | 34.1 | 38.8 | 43.5 | 48.2 |
| | ISA-10°C | -46 | (1) | 96.1 | 1533 | 227 | .74 | 415 | 17.3 | 20.5 | 23.8 | 27.1 | 30.3 | 33.6 | 36.9 |
| | -67°C | -47 | | 90.3 | 1287 | 217 | .710 | 399 | 19.3 | 23.2 | 27.1 | 31.0 | 34.9 | 38.7 | 42.6 |
| | | -49 | | 88.3 | 1196 | 210 | .690 | 387 | 19.9 | 24.0 | 28.2 | 32.4 | 36.6 | 40.8 | 45.0 |
| | | -50 | | 86.7 | 1102 | 201 | .660 | 371 | 20.0 | 24.6 | 29.1 | 33.6 | 38.2 | 42.7 | 47.2 |
| | | -52 | (2) | 85.4 | 1030 | 190 | .63 | 353 | 19.7 | 24.6 | 29.4 | 34.3 | 39.2 | 44.0 | 48.9 |
| 19000. | ISA+20°C | -18 | (1) | 91.1 | 1147 | 199 | .66 | 394 | 21.3 | 25.7 | 30.0 | 34.4 | 38.7 | 43.1 | 47.5 |
| | -37°C | -18 | | 90.8 | 1134 | 197 | .650 | 391 | 21.2 | 25.6 | 30.0 | 34.5 | 38.9 | 43.3 | 47.7 |
| | | -19 | | 90.3 | 1110 | 194 | .640 | 385 | 21.1 | 25.6 | 30.1 | 34.6 | 39.1 | 43.6 | 48.2 |
| | | -19 | | 89.9 | 1088 | 191 | .630 | 379 | 21.0 | 25.6 | 30.2 | 34.8 | 39.4 | 44.0 | 48.6 |
| | | -20 | (2) | 89.3 | 1054 | 186 | .61 | 369 | 20.8 | 25.6 | 30.3 | 35.1 | 39.8 | 44.5 | 49.3 |
| | ISA+10°C | -26 | (1) | 92.5 | 1291 | 216 | .71 | 415 | 20.5 | 24.4 | 28.3 | 32.2 | 36.0 | 39.9 | 43.8 |
| | -47°C | -27 | | 91.2 | 1221 | 210 | .690 | 406 | 21.0 | 25.0 | 29.1 | 33.2 | 37.3 | 41.4 | 45.5 |
| | | -28 | | 89.5 | 1126 | 201 | .660 | 388 | 21.2 | 25.6 | 30.0 | 34.5 | 38.9 | 43.4 | 47.8 |
| | | -30 | | 88.6 | 1079 | 194 | .640 | 376 | 21.0 | 25.6 | 30.3 | 34.9 | 39.5 | 44.1 | 48.8 |
| | | -31 | (2) | 87.5 | 1026 | 186 | .62 | 362 | 20.7 | 25.5 | 30.4 | 35.3 | 40.1 | 45.0 | 49.9 |
| | ISA+ 0°C | -36 | (1) | 92.5 | 1340 | 221 | .72 | 415 | 19.7 | 23.5 | 27.2 | 30.9 | 34.7 | 38.4 | 42.1 |
| | -57°C | -37 | | 89.9 | 1228 | 214 | .700 | 402 | 20.6 | 24.6 | 28.7 | 32.8 | 36.9 | 40.9 | 45.0 |
| | | -39 | | 88.2 | 1121 | 204 | .670 | 385 | 21.0 | 25.5 | 29.9 | 34.4 | 38.8 | 43.3 | 47.8 |
| | | -40 | | 86.7 | 1048 | 194 | .640 | 368 | 20.8 | 25.6 | 30.3 | 35.1 | 39.9 | 44.6 | 49.4 |
| | | -41 | (2) | 85.7 | 998 | 186 | .62 | 354 | 20.4 | 25.5 | 30.5 | 35.5 | 40.5 | 45.5 | 50.5 |
| | ISA-10°C | -46 | (1) | 96.0 | 1535 | 229 | .75 | 418 | 17.5 | 20.8 | 24.0 | 27.3 | 30.5 | 33.8 | 37.0 |
| | -67°C | -47 | | 90.4 | 1299 | 220 | .720 | 404 | 19.6 | 23.4 | 27.3 | 31.1 | 35.0 | 38.8 | 42.7 |
| | | -49 | | 86.8 | 1117 | 207 | .680 | 382 | 20.8 | 25.2 | 29.7 | 34.2 | 38.7 | 43.1 | 47.6 |
| | | -51 | | 85.3 | 1039 | 197 | .650 | 365 | 20.7 | 25.5 | 30.3 | 35.1 | 39.9 | 44.8 | 49.6 |
| | | -52 | (2) | 83.8 | 970 | 187 | .62 | 346 | 20.2 | 25.4 | 30.5 | 35.7 | 40.8 | 46.0 | 51.2 |
| 18000. | ISA+20°C | -17 | (1) | 91.0 | 1153 | 205 | .67 | 404 | 22.0 | 26.3 | 30.7 | 35.0 | 39.3 | 43.7 | 48.0 |
| | -37°C | -18 | | 90.3 | 1122 | 201 | .660 | 397 | 22.0 | 26.4 | 30.9 | 35.3 | 39.8 | 44.3 | 48.7 |
| | | -19 | | 89.3 | 1072 | 194 | .640 | 385 | 21.9 | 26.6 | 31.2 | 35.9 | 40.5 | 45.2 | 49.9 |
| | | -20 | | 88.5 | 1029 | 188 | .620 | 373 | 21.6 | 26.5 | 31.4 | 36.2 | 41.1 | 45.9 | 50.8 |
| | | -21 | (2) | 87.8 | 989 | 181 | .60 | 361 | 21.3 | 26.4 | 31.5 | 36.5 | 41.6 | 46.6 | 51.7 |
| | ISA+10°C | -25 | (1) | 92.4 | 1297 | 219 | .71 | 420 | 20.8 | 24.7 | 28.6 | 32.4 | 36.3 | 40.1 | 44.0 |
| | -47°C | -27 | | 90.6 | 1190 | 210 | .690 | 406 | 21.5 | 25.7 | 29.9 | 34.1 | 38.3 | 42.5 | 46.7 |
| | | -28 | | 88.5 | 1091 | 201 | .660 | 388 | 21.8 | 26.4 | 31.0 | 35.6 | 40.2 | 44.8 | 49.3 |
| | | -30 | | 87.1 | 1020 | 191 | .630 | 371 | 21.6 | 26.5 | 31.4 | 36.3 | 41.2 | 46.1 | 51.0 |
| | | -32 | (2) | 86.1 | 961 | 181 | .60 | 353 | 21.2 | 26.4 | 31.6 | 36.8 | 42.0 | 47.2 | 52.4 |
| | ISA+ 0°C | -36 | (1) | 92.4 | 1343 | 223 | .73 | 419 | 20.0 | 23.7 | 27.5 | 31.2 | 34.9 | 38.6 | 42.4 |
| | -57°C | -37 | | 89.4 | 1197 | 214 | .700 | 402 | 21.1 | 25.3 | 29.4 | 33.6 | 37.8 | 42.0 | 46.2 |
| | | -39 | | 87.2 | 1085 | 204 | .670 | 385 | 21.7 | 26.3 | 30.9 | 35.5 | 40.1 | 44.7 | 49.3 |
| | | -41 | | 85.3 | 991 | 191 | .630 | 362 | 21.4 | 26.5 | 31.5 | 36.6 | 41.6 | 46.6 | 51.7 |
| | | -42 | (2) | 84.2 | 932 | 181 | .60 | 345 | 20.9 | 26.3 | 31.6 | 37.0 | 42.4 | 47.7 | 53.1 |
| | ISA-10°C | -45 | (1) | 95.5 | 1519 | 230 | .75 | 421 | 17.8 | 21.1 | 24.4 | 27.7 | 31.0 | 34.3 | 37.6 |
| | -67°C | -47 | | 88.1 | 1205 | 217 | .710 | 399 | 20.6 | 24.8 | 28.9 | 33.1 | 37.2 | 41.4 | 45.5 |
| | | -49 | | 86.0 | 1085 | 207 | .680 | 382 | 21.4 | 26.0 | 30.6 | 35.2 | 39.8 | 44.4 | 49.0 |
| | | -51 | | 83.8 | 982 | 194 | .640 | 359 | 21.3 | 26.4 | 31.5 | 36.6 | 41.7 | 46.8 | 51.9 |
| | | -53 | (2) | 82.3 | 904 | 181 | .60 | 336 | 20.6 | 26.2 | 31.7 | 37.2 | 42.8 | 48.3 | 53.8 |
| 17000. | ISA+20°C | -17 | (1) | 90.8 | 1151 | 207 | .68 | 408 | 22.4 | 26.8 | 31.1 | 35.5 | 39.8 | 44.1 | 48.5 |
| | -37°C | -18 | | 89.5 | 1092 | 201 | .660 | 397 | 22.6 | 27.2 | 31.8 | 36.3 | 40.9 | 45.5 | 50.1 |
| | | -19 | | 88.1 | 1017 | 191 | .630 | 379 | 22.5 | 27.4 | 32.3 | 37.2 | 42.1 | 47.1 | 52.0 |
| | | -20 | | 87.3 | 975 | 184 | .610 | 367 | 22.2 | 27.4 | 32.5 | 37.6 | 42.8 | 47.9 | 53.0 |
| | | -22 | (2) | 86.2 | 933 | 177 | .59 | 353 | 21.7 | 27.1 | 32.5 | 37.8 | 43.2 | 48.5 | 53.9 |
| | ISA+10°C | -25 | (1) | 92.3 | 1299 | 221 | .72 | 425 | 21.1 | 25.0 | 28.8 | 32.7 | 36.5 | 40.4 | 44.2 |
| | -47°C | -27 | | 90.0 | 1164 | 210 | .690 | 406 | 22.0 | 26.3 | 30.6 | 34.9 | 39.2 | 43.5 | 47.8 |
| | | -28 | | 87.7 | 1061 | 201 | .660 | 388 | 22.4 | 27.2 | 31.9 | 36.6 | 41.3 | 46.0 | 50.7 |
| | | -31 | | 85.9 | 968 | 188 | .620 | 365 | 22.2 | 27.4 | 32.5 | 37.7 | 42.9 | 48.0 | 53.2 |
| | | -32 | (2) | 84.5 | 907 | 177 | .59 | 345 | 21.5 | 27.0 | 32.6 | 38.1 | 43.6 | 49.1 | 54.6 |
| | ISA+ 0°C | -35 | (1) | 92.4 | 1351 | 226 | .74 | 423 | 20.2 | 23.9 | 27.6 | 31.3 | 35.0 | 38.7 | 42.4 |
| | -57°C | -37 | | 88.9 | 1169 | 214 | .700 | 402 | 21.6 | 25.9 | 30.1 | 34.4 | 38.7 | 43.0 | 47.2 |
| | | -39 | | 85.9 | 1031 | 201 | .660 | 380 | 22.3 | 27.1 | 32.0 | 36.8 | 41.7 | 46.5 | 51.4 |
| | | -41 | | 84.5 | 961 | 191 | .630 | 362 | 22.1 | 27.3 | 32.5 | 37.7 | 42.9 | 48.1 | 53.3 |
| | | -43 | (2) | 82.7 | 879 | 177 | .59 | 337 | 21.3 | 27.0 | 32.6 | 38.3 | 44.0 | 49.7 | 55.4 |
| | ISA-10°C | -45 | (1) | 93.1 | 1428 | 230 | .75 | 421 | 19.0 | 22.5 | 26.0 | 29.5 | 33.0 | 36.5 | 40.0 |
| | -67°C | -47 | | 87.6 | 1176 | 217 | .710 | 399 | 21.1 | 25.4 | 29.7 | 33.9 | 38.2 | 42.4 | 46.7 |
| | | -50 | | 84.6 | 1029 | 204 | .670 | 376 | 22.0 | 26.8 | 31.7 | 36.6 | 41.4 | 46.3 | 51.1 |
| | | -52 | | 82.6 | 933 | 191 | .630 | 354 | 21.9 | 27.2 | 32.6 | 37.9 | 43.3 | 48.7 | 54.0 |
| | | -54 | (2) | 80.9 | 853 | 177 | .59 | 329 | 21.0 | 26.8 | 32.7 | 38.6 | 44.4 | 50.3 | 56.2 |

Figure 7-14 (Sheet 29)

# CRUISE
# 39,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL: 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+20°C | -16 | (1) 90.8 | 1152 | 208 | .68 | 410 | 22.6 | 26.9 | 31.3 | 35.6 | 39.9 | 44.3 | 48.6 |
| | -37°C | -18 | 89.2 | 1079 | 201 | .660 | 397 | 22.9 | 27.5 | 32.1 | 36.8 | 41.4 | 46.0 | 50.6 |
| | | -19 | 87.8 | 1002 | 191 | .630 | 379 | 22.8 | 27.8 | 32.8 | 37.8 | 42.8 | 47.8 | 52.8 |
| | | -21 | 86.3 | 939 | 181 | .600 | 361 | 22.5 | 27.8 | 33.1 | 38.4 | 43.8 | 49.1 | 54.4 |
| | | -22 | (2) 85.0 | 889 | 172 | .57 | 344 | 21.8 | 27.5 | 33.1 | 38.7 | 44.3 | 49.9 | 55.6 |
| | ISA+10°C | -25 | (1) 92.3 | 1299 | 222 | .73 | 426 | 21.3 | 25.1 | 29.0 | 32.8 | 36.7 | 40.5 | 44.4 |
| | -47°C | -27 | 89.6 | 1151 | 210 | .690 | 406 | 22.2 | 26.6 | 30.9 | 35.3 | 39.6 | 43.9 | 48.3 |
| | | -29 | 86.9 | 1022 | 197 | .650 | 382 | 22.7 | 27.6 | 32.5 | 37.4 | 42.3 | 47.2 | 52.1 |
| | | -31 | 85.0 | 932 | 184 | .610 | 359 | 22.4 | 27.8 | 33.1 | 38.5 | 43.9 | 49.2 | 54.6 |
| | | -33 | (2) 83.3 | 864 | 172 | .57 | 337 | 21.6 | 27.4 | 33.2 | 39.0 | 44.7 | 50.5 | 56.3 |
| | ISA+ 0°C | -35 | (1) 92.4 | 1351 | 227 | .74 | 425 | 20.3 | 24.0 | 27.7 | 31.4 | 35.1 | 38.8 | 42.5 |
| | -57°C | -37 | 88.6 | 1156 | 214 | .700 | 402 | 21.8 | 26.2 | 30.5 | 34.8 | 39.1 | 43.4 | 47.8 |
| | | -39 | 85.6 | 1020 | 201 | .660 | 380 | 22.5 | 27.4 | 32.3 | 37.2 | 42.1 | 47.0 | 51.9 |
| | | -41 | 83.7 | 926 | 188 | .620 | 357 | 22.3 | 27.7 | 33.1 | 38.5 | 43.9 | 49.3 | 54.7 |
| | | -44 | (2) 81.5 | 838 | 172 | .57 | 329 | 21.3 | 27.3 | 33.3 | 39.2 | 45.2 | 51.1 | 57.1 |
| | ISA-10°C | -45 | (1) 92.5 | 1412 | 230 | .75 | 421 | 19.2 | 22.7 | 26.3 | 29.8 | 33.4 | 36.9 | 40.5 |
| | -67°C | -47 | 87.3 | 1163 | 217 | .710 | 399 | 21.4 | 25.7 | 30.0 | 34.3 | 38.6 | 42.9 | 47.2 |
| | | -50 | 83.7 | 990 | 201 | .660 | 371 | 22.3 | 27.3 | 32.4 | 37.4 | 42.5 | 47.5 | 52.6 |
| | | -52 | 81.9 | 899 | 188 | .620 | 348 | 22.1 | 27.6 | 33.2 | 38.8 | 44.3 | 49.9 | 55.5 |
| | | -54 | (2) 79.7 | 814 | 172 | .57 | 321 | 21.0 | 27.2 | 33.3 | 39.5 | 45.6 | 51.8 | 57.9 |
| 16000. | ISA+20°C | -16 | (1) 90.8 | 1154 | 209 | .69 | 412 | 22.7 | 27.1 | 31.4 | 35.7 | 40.1 | 44.4 | 48.7 |
| | -37°C | -18 | 89.0 | 1068 | 201 | .660 | 397 | 23.1 | 27.8 | 32.5 | 37.1 | 41.8 | 46.5 | 51.2 |
| | | -19 | 87.3 | 987 | 191 | .630 | 379 | 23.2 | 28.2 | 33.3 | 38.4 | 43.4 | 48.5 | 53.6 |
| | | -21 | 85.3 | 903 | 178 | .590 | 355 | 22.7 | 28.2 | 33.7 | 39.3 | 44.8 | 50.3 | 55.9 |
| | | -23 | (2) 83.8 | 851 | 168 | .56 | 337 | 21.9 | 27.8 | 33.7 | 39.6 | 45.4 | 51.3 | 57.2 |
| | ISA+10°C | -25 | (1) 92.3 | 1300 | 223 | .73 | 428 | 21.4 | 25.3 | 29.1 | 32.9 | 36.8 | 40.6 | 44.5 |
| | -47°C | -27 | 89.3 | 1139 | 210 | .690 | 406 | 22.5 | 26.8 | 31.2 | 35.6 | 40.0 | 44.4 | 48.8 |
| | | -29 | 86.6 | 1010 | 197 | .650 | 382 | 23.0 | 27.9 | 32.9 | 37.8 | 42.8 | 47.7 | 52.7 |
| | | -32 | 84.1 | 897 | 181 | .600 | 353 | 22.6 | 28.2 | 33.8 | 39.3 | 44.9 | 50.5 | 56.1 |
| | | -34 | (2) 82.1 | 827 | 168 | .56 | 330 | 21.7 | 27.8 | 33.8 | 39.8 | 45.9 | 51.9 | 58.0 |
| | ISA+ 0°C | -35 | (1) 92.4 | 1355 | 227 | .74 | 426 | 20.4 | 24.1 | 27.8 | 31.4 | 35.1 | 38.8 | 42.5 |
| | -57°C | -37 | 88.3 | 1144 | 214 | .700 | 402 | 22.1 | 26.4 | 30.8 | 35.2 | 39.5 | 43.9 | 48.3 |
| | | -40 | 84.8 | 982 | 197 | .650 | 374 | 22.8 | 27.9 | 33.0 | 38.1 | 43.2 | 48.3 | 53.4 |
| | | -42 | 82.8 | 891 | 184 | .610 | 351 | 22.5 | 28.2 | 33.8 | 39.4 | 45.0 | 50.6 | 56.2 |
| | | -44 | (2) 80.4 | 802 | 168 | .56 | 322 | 21.4 | 27.6 | 33.9 | 40.1 | 46.3 | 52.6 | 58.8 |
| | ISA-10°C | -45 | (1) 92.1 | 1396 | 230 | .75 | 421 | 19.4 | 23.0 | 26.6 | 30.2 | 33.7 | 37.3 | 40.9 |
| | -67°C | -48 | 86.3 | 1111 | 214 | .700 | 393 | 21.9 | 26.4 | 30.9 | 35.4 | 39.9 | 44.4 | 48.9 |
| | | -50 | 83.4 | 980 | 201 | .660 | 371 | 22.5 | 27.6 | 32.7 | 37.8 | 42.9 | 48.1 | 53.2 |
| | | -52 | 81.0 | 865 | 184 | .610 | 343 | 22.3 | 28.1 | 33.8 | 39.6 | 45.4 | 51.2 | 57.0 |
| | | -55 | (2) 78.6 | 779 | 168 | .56 | 314 | 21.1 | 27.5 | 33.9 | 40.4 | 46.8 | 53.2 | 59.6 |
| 14000. | ISA+20°C | -16 | (1) 90.4 | 1148 | 212 | .70 | 418 | 23.3 | 27.7 | 32.0 | 36.3 | 40.7 | 45.1 | 49.4 |
| | -37°C | -17 | 89.2 | 1091 | 207 | .680 | 409 | 23.7 | 28.3 | 32.9 | 37.5 | 42.1 | 46.6 | 51.2 |
| | | -19 | 86.5 | 967 | 194 | .640 | 385 | 24.3 | 29.4 | 34.6 | 39.8 | 45.0 | 50.1 | 55.3 |
| | | -21 | 83.3 | 842 | 178 | .590 | 355 | 24.3 | 30.2 | 36.2 | 42.1 | 48.0 | 54.0 | 59.9 |
| | | -23 | (2) 81.1 | 763 | 165 | .55 | 331 | 23.7 | 30.2 | 36.8 | 43.3 | 49.9 | 56.4 | 63.0 |
| | ISA+10°C | -24 | (1) 92.2 | 1300 | 225 | .73 | 432 | 21.7 | 25.5 | 29.4 | 33.2 | 37.1 | 40.9 | 44.8 |
| | -47°C | -27 | 88.2 | 1096 | 210 | .690 | 406 | 23.3 | 27.9 | 32.5 | 37.0 | 41.6 | 46.1 | 50.7 |
| | | -30 | 84.8 | 940 | 194 | .640 | 376 | 24.1 | 29.4 | 34.7 | 40.0 | 45.4 | 50.7 | 56.0 |
| | | -32 | 82.2 | 842 | 181 | .600 | 353 | 24.1 | 30.1 | 36.0 | 41.9 | 47.9 | 53.8 | 59.8 |
| | | -34 | (2) 79.4 | 740 | 165 | .55 | 323 | 23.4 | 30.1 | 36.9 | 43.6 | 50.4 | 57.1 | 63.9 |
| | ISA+ 0°C | -34 | (1) 92.5 | 1362 | 230 | .75 | 430 | 20.5 | 24.2 | 27.9 | 31.6 | 35.2 | 38.9 | 42.6 |
| | -57°C | -37 | 87.2 | 1104 | 214 | .700 | 402 | 22.9 | 27.4 | 31.9 | 36.5 | 41.0 | 45.5 | 50.0 |
| | | -40 | 83.7 | 940 | 197 | .650 | 374 | 23.8 | 29.1 | 34.4 | 39.8 | 45.1 | 50.4 | 55.7 |
| | | -42 | 80.5 | 818 | 181 | .600 | 345 | 23.9 | 30.0 | 36.1 | 42.2 | 48.3 | 54.4 | 60.5 |
| | | -45 | (2) 77.7 | 717 | 164 | .55 | 315 | 23.0 | 30.0 | 37.0 | 43.9 | 50.9 | 57.9 | 64.9 |
| | ISA-10°C | -45 | (1) 90.9 | 1343 | 230 | .75 | 421 | 20.2 | 23.9 | 27.6 | 31.4 | 35.1 | 38.8 | 42.5 |
| | -67°C | -48 | 85.3 | 1072 | 214 | .700 | 393 | 22.7 | 27.3 | 32.0 | 36.7 | 41.3 | 46.0 | 50.7 |
| | | -51 | 81.9 | 913 | 197 | .650 | 365 | 23.6 | 29.0 | 34.5 | 40.0 | 45.5 | 50.9 | 56.4 |
| | | -53 | 78.7 | 794 | 181 | .600 | 337 | 23.6 | 29.9 | 36.2 | 42.4 | 48.7 | 55.0 | 61.3 |
| | | -55 | (2) 75.9 | 695 | 164 | .55 | 307 | 22.6 | 29.8 | 37.0 | 44.2 | 51.4 | 58.6 | 65.8 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -47°C | -57°C | -67°C |
| 90.5 | 90.5 | 92.5 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 30)

# CRUISE
# 41,000 FEET

**ANTI-ICE SYSTEMS OFF** | **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+10°C | -28 | (1) 92.7 | 1159 | 192 | .66 | 389 | 20.6 | 24.9 | 29.3 | 33.6 | 37.9 | 42.2 | 46.5 |
| | -47°C | -29 | 91.9 | 1128 | 188 | .650 | 382 | 20.6 | 25.0 | 29.5 | 33.9 | 38.3 | 42.8 | 47.2 |
| | | -29 | (2) 91.7 | 1115 | 187 | .65 | 380 | 20.7 | 25.1 | 29.6 | 34.1 | 38.6 | 43.1 | 47.5 |
| | ISA+ 0°C | -38 | (1) 93.2 | 1240 | 202 | .69 | 398 | 20.0 | 24.0 | 28.1 | 32.1 | 36.1 | 40.1 | 44.2 |
| | -57°C | -38 | 92.2 | 1193 | 198 | .680 | 391 | 20.2 | 24.4 | 28.6 | 32.8 | 37.0 | 41.2 | 45.4 |
| | | -39 | 91.5 | 1158 | 195 | .670 | 385 | 20.3 | 24.6 | 29.0 | 33.3 | 37.6 | 41.9 | 46.2 |
| | | -39 | 90.8 | 1126 | 191 | .660 | 380 | 20.4 | 24.8 | 29.3 | 33.7 | 38.2 | 42.6 | 47.0 |
| | | -40 | (2) 89.8 | 1082 | 187 | .65 | 371 | 20.4 | 25.1 | 29.7 | 34.3 | 38.9 | 43.5 | 48.2 |
| | ISA-10°C | -47 | (1) 96.2 | 1396 | 211 | .72 | 405 | 18.3 | 21.8 | 25.4 | 29.0 | 32.6 | 36.2 | 39.8 |
| | -67°C | -48 | 92.6 | 1251 | 204 | .700 | 393 | 19.4 | 23.4 | 27.4 | 31.4 | 35.4 | 39.4 | 43.4 |
| | | -49 | 90.2 | 1159 | 198 | .680 | 382 | 20.0 | 24.3 | 28.6 | 32.9 | 37.3 | 41.6 | 45.9 |
| | | -50 | 89.5 | 1126 | 195 | .670 | 376 | 20.1 | 24.5 | 29.0 | 33.4 | 37.9 | 42.3 | 46.8 |
| | | -51 | (2) 87.8 | 1048 | 187 | .64 | 362 | 20.2 | 25.0 | 29.8 | 34.5 | 39.3 | 44.1 | 48.9 |
| 19000. | ISA+10°C | -27 | (1) 92.7 | 1173 | 199 | .68 | 402 | 21.4 | 25.7 | 30.0 | 34.2 | 38.5 | 42.7 | 47.0 |
| | -47°C | -28 | 91.6 | 1133 | 195 | .670 | 394 | 21.5 | 26.0 | 30.4 | 34.8 | 39.2 | 43.6 | 48.0 |
| | | -28 | 91.1 | 1103 | 191 | .660 | 388 | 21.6 | 26.1 | 30.7 | 35.2 | 39.7 | 44.2 | 48.8 |
| | | -29 | 90.7 | 1079 | 188 | .650 | 382 | 21.5 | 26.2 | 30.8 | 35.5 | 40.1 | 44.7 | 49.4 |
| | | -29 | (2) 90.5 | 1063 | 187 | .64 | 379 | 21.6 | 26.3 | 31.0 | 35.7 | 40.4 | 45.1 | 49.8 |
| | ISA+ 0°C | -37 | (1) 92.8 | 1232 | 206 | .71 | 406 | 20.7 | 24.8 | 28.9 | 32.9 | 37.0 | 41.0 | 45.1 |
| | -57°C | -38 | 91.4 | 1170 | 201 | .690 | 397 | 21.1 | 25.4 | 29.6 | 33.9 | 38.2 | 42.5 | 46.7 |
| | | -38 | 90.6 | 1135 | 198 | .680 | 391 | 21.2 | 25.6 | 30.0 | 34.5 | 38.9 | 43.3 | 47.7 |
| | | -39 | 89.2 | 1071 | 191 | .660 | 380 | 21.4 | 26.1 | 30.8 | 35.4 | 40.1 | 44.8 | 49.4 |
| | | -40 | (2) 88.6 | 1032 | 187 | .64 | 371 | 21.4 | 26.2 | 31.1 | 35.9 | 40.8 | 45.6 | 50.5 |
| | ISA-10°C | -46 | (1) 96.1 | 1404 | 215 | .73 | 412 | 18.6 | 22.2 | 25.8 | 29.3 | 32.9 | 36.4 | 40.0 |
| | -67°C | -47 | 91.4 | 1227 | 207 | .710 | 399 | 20.3 | 24.3 | 28.4 | 32.5 | 36.6 | 40.7 | 44.7 |
| | | -49 | 89.5 | 1137 | 201 | .690 | 387 | 20.9 | 25.3 | 29.7 | 34.1 | 38.5 | 42.9 | 47.3 |
| | | -50 | 87.9 | 1070 | 195 | .670 | 376 | 21.2 | 25.8 | 30.5 | 35.2 | 39.8 | 44.5 | 49.2 |
| | | -51 | (2) 86.6 | 1001 | 187 | .64 | 362 | 21.2 | 26.2 | 31.2 | 36.2 | 41.1 | 46.1 | 51.1 |
| 18000. | ISA+20°C | -19 | (1) 91.1 | 1041 | 185 | .64 | 384 | 22.5 | 27.3 | 32.1 | 36.9 | 41.7 | 46.5 | 51.3 |
| | -37°C | -19 | 90.7 | 1026 | 182 | .630 | 379 | 22.3 | 27.2 | 32.0 | 36.9 | 41.8 | 46.7 | 51.5 |
| | | -20 | (2) 90.6 | 1017 | 181 | .63 | 377 | 22.3 | 27.2 | 32.1 | 37.0 | 42.0 | 46.9 | 51.8 |
| | ISA+10°C | -26 | (1) 92.7 | 1189 | 204 | .70 | 412 | 22.1 | 26.3 | 30.5 | 34.7 | 38.9 | 43.1 | 47.3 |
| | -47°C | -27 | 91.2 | 1116 | 198 | .680 | 400 | 22.4 | 26.9 | 31.3 | 35.8 | 40.3 | 44.8 | 49.3 |
| | | -28 | 90.7 | 1088 | 195 | .670 | 394 | 22.4 | 27.0 | 31.6 | 36.2 | 40.8 | 45.4 | 50.0 |
| | | -29 | 89.7 | 1038 | 188 | .650 | 382 | 22.4 | 27.2 | 32.0 | 36.9 | 41.7 | 46.5 | 51.3 |
| | | -30 | (2) 88.7 | 987 | 181 | .63 | 368 | 22.1 | 27.2 | 32.2 | 37.3 | 42.4 | 47.4 | 52.5 |
| | ISA+ 0°C | -36 | (1) 92.7 | 1238 | 210 | .72 | 413 | 21.2 | 25.2 | 29.3 | 33.3 | 37.4 | 41.4 | 45.4 |
| | -57°C | -37 | 90.8 | 1154 | 204 | .700 | 402 | 21.9 | 26.2 | 30.5 | 34.9 | 39.2 | 43.5 | 47.9 |
| | | -39 | 88.8 | 1057 | 195 | .670 | 385 | 22.3 | 27.0 | 31.7 | 36.5 | 41.2 | 45.9 | 50.6 |
| | | -40 | 87.9 | 1008 | 188 | .650 | 374 | 22.2 | 27.2 | 32.1 | 37.1 | 42.1 | 47.0 | 52.0 |
| | | -41 | (2) 86.9 | 959 | 181 | .63 | 360 | 21.9 | 27.1 | 32.3 | 37.6 | 42.8 | 48.0 | 53.2 |
| | ISA-10°C | -46 | (1) 96.0 | 1413 | 217 | .74 | 416 | 18.9 | 22.4 | 25.9 | 29.5 | 33.0 | 36.6 | 40.1 |
| | -67°C | -47 | 89.9 | 1167 | 207 | .710 | 399 | 21.3 | 25.6 | 29.9 | 34.2 | 38.4 | 42.7 | 47.0 |
| | | -49 | 87.9 | 1083 | 201 | .690 | 387 | 21.9 | 26.5 | 31.2 | 35.8 | 40.4 | 45.0 | 49.6 |
| | | -50 | 86.4 | 1001 | 191 | .660 | 371 | 22.0 | 27.0 | 32.0 | 37.0 | 42.0 | 47.0 | 52.0 |
| | | -52 | (2) 84.9 | 929 | 181 | .63 | 351 | 21.7 | 27.0 | 32.4 | 37.8 | 43.2 | 48.6 | 54.0 |
| 17000. | ISA+20°C | -18 | (1) 90.9 | 1047 | 191 | .66 | 397 | 23.6 | 28.3 | 33.1 | 37.9 | 42.6 | 47.4 | 52.2 |
| | -37°C | -18 | 90.4 | 1027 | 188 | .650 | 391 | 23.4 | 28.3 | 33.2 | 38.0 | 42.9 | 47.8 | 52.6 |
| | | -19 | 89.9 | 1005 | 185 | .640 | 385 | 23.3 | 28.3 | 33.3 | 38.3 | 43.2 | 48.2 | 53.2 |
| | | -19 | 89.4 | 985 | 182 | .630 | 379 | 23.2 | 28.3 | 33.4 | 38.5 | 43.5 | 48.6 | 53.7 |
| | | -20 | (2) 88.8 | 950 | 177 | .61 | 368 | 23.0 | 28.2 | 33.5 | 38.7 | 44.0 | 49.3 | 54.5 |
| | ISA+10°C | -26 | (1) 92.7 | 1196 | 208 | .71 | 419 | 22.5 | 26.6 | 30.8 | 35.0 | 39.2 | 43.4 | 47.5 |
| | -47°C | -27 | 90.9 | 1108 | 201 | .690 | 406 | 23.1 | 27.6 | 32.1 | 36.6 | 41.1 | 45.7 | 50.2 |
| | | -28 | 89.1 | 1020 | 191 | .660 | 388 | 23.4 | 28.3 | 33.2 | 38.1 | 43.0 | 47.9 | 52.8 |
| | | -30 | 88.1 | 977 | 185 | .640 | 376 | 23.2 | 28.3 | 33.4 | 38.5 | 43.6 | 48.8 | 53.9 |
| | | -31 | (2) 87.1 | 925 | 177 | .61 | 361 | 22.8 | 28.2 | 33.6 | 39.0 | 44.4 | 49.8 | 55.2 |
| | ISA+ 0°C | -36 | (1) 92.7 | 1243 | 212 | .73 | 418 | 21.5 | 25.6 | 29.6 | 33.6 | 37.6 | 41.6 | 45.7 |
| | -57°C | -37 | 89.7 | 1114 | 204 | .700 | 402 | 22.7 | 27.2 | 31.6 | 36.1 | 40.6 | 45.1 | 49.6 |
| | | -39 | 87.7 | 1014 | 195 | .670 | 385 | 23.2 | 28.1 | 33.1 | 38.0 | 42.9 | 47.9 | 52.8 |
| | | -40 | 86.3 | 949 | 185 | .640 | 368 | 23.0 | 28.2 | 33.5 | 38.8 | 44.1 | 49.3 | 54.6 |
| | | -42 | (2) 85.3 | 900 | 177 | .61 | 354 | 22.6 | 28.2 | 33.7 | 39.3 | 44.8 | 50.4 | 55.9 |
| | ISA-10°C | -45 | (1) 96.0 | 1415 | 219 | .75 | 420 | 19.1 | 22.6 | 26.1 | 29.7 | 33.2 | 36.7 | 40.3 |
| | -67°C | -47 | 89.9 | 1173 | 210 | .720 | 404 | 21.7 | 25.9 | 30.2 | 34.5 | 38.7 | 43.0 | 47.2 |
| | | -49 | 86.4 | 1011 | 198 | .680 | 382 | 22.9 | 27.9 | 32.8 | 37.8 | 42.7 | 47.7 | 52.6 |
| | | -51 | 84.9 | 941 | 188 | .650 | 365 | 22.9 | 28.2 | 33.5 | 38.8 | 44.1 | 49.4 | 54.8 |
| | | -52 | (2) 83.4 | 875 | 178 | .62 | 346 | 22.4 | 28.1 | 33.8 | 39.5 | 45.2 | 51.0 | 56.7 |

Figure 7-14 (Sheet 31)

# CRUISE
# 41,000 FEET

**ANTI-ICE SYSTEMS OFF** | **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
| 16500. | ISA+20°C | -17 | (1) 90.8 | 1049 | 194 | .67 | 402 | 24.0 | 28.8 | 33.5 | 38.3 | 43.0 | 47.8 | 52.6 |
| | -37°C | -18 | 89.8 | 1008 | 188 | .650 | 391 | 23.9 | 28.8 | 33.8 | 38.8 | 43.7 | 48.7 | 53.6 |
| | | -19 | 89.4 | 986 | 185 | .640 | 385 | 23.8 | 28.9 | 33.9 | 39.0 | 44.1 | 49.2 | 54.2 |
| | | -20 | 88.6 | 946 | 179 | .620 | 373 | 23.5 | 28.8 | 34.1 | 39.4 | 44.7 | 50.0 | 55.2 |
| | | -21 | (2) 88.0 | 916 | 174 | .60 | 363 | 23.3 | 28.7 | 34.2 | 39.6 | 45.1 | 50.6 | 56.0 |
| | ISA+10°C | -25 | (1) 92.6 | 1197 | 209 | .72 | 421 | 22.6 | 26.8 | 31.0 | 35.2 | 39.4 | 43.5 | 47.7 |
| | -47°C | -27 | 90.6 | 1093 | 201 | .690 | 406 | 23.4 | 28.0 | 32.6 | 37.1 | 41.7 | 46.3 | 50.9 |
| | | -28 | 88.5 | 1002 | 191 | .660 | 388 | 23.8 | 28.8 | 33.7 | 38.7 | 43.7 | 48.7 | 53.7 |
| | | -30 | 87.2 | 938 | 182 | .630 | 371 | 23.5 | 28.8 | 34.2 | 39.5 | 44.8 | 50.2 | 55.5 |
| | | -31 | (2) 86.2 | 891 | 174 | .60 | 355 | 23.1 | 28.7 | 34.3 | 39.9 | 45.5 | 51.1 | 56.8 |
| | ISA+ 0°C | -35 | (1) 92.7 | 1246 | 214 | .73 | 420 | 21.7 | 25.7 | 29.7 | 33.7 | 37.7 | 41.7 | 45.8 |
| | -57°C | -37 | 89.4 | 1099 | 204 | .700 | 402 | 23.0 | 27.5 | 32.1 | 36.6 | 41.2 | 45.7 | 50.3 |
| | | -39 | 87.2 | 996 | 195 | .670 | 385 | 23.6 | 28.6 | 33.6 | 38.7 | 43.7 | 48.7 | 53.7 |
| | | -40 | 85.7 | 931 | 185 | .640 | 368 | 23.4 | 28.8 | 34.2 | 39.6 | 44.9 | 50.3 | 55.7 |
| | | -42 | (2) 84.4 | 864 | 174 | .60 | 347 | 22.8 | 28.6 | 34.4 | 40.2 | 46.0 | 51.7 | 57.5 |
| | ISA-10°C | -45 | (1) 95.5 | 1398 | 220 | .75 | 421 | 19.4 | 23.0 | 26.5 | 30.1 | 33.7 | 37.3 | 40.9 |
| | -67°C | -47 | 89.4 | 1153 | 210 | .720 | 404 | 22.1 | 26.4 | 30.7 | 35.1 | 39.4 | 43.7 | 48.1 |
| | | -49 | 86.0 | 996 | 198 | .680 | 382 | 23.3 | 28.3 | 33.3 | 38.4 | 43.4 | 48.4 | 53.4 |
| | | -51 | 83.8 | 903 | 185 | .640 | 359 | 23.2 | 28.7 | 34.3 | 39.8 | 45.4 | 50.9 | 56.4 |
| | | -53 | (2) 82.5 | 836 | 173 | .60 | 338 | 22.5 | 28.5 | 34.5 | 40.4 | 46.4 | 52.4 | 58.4 |
| 16000. | ISA+20°C | -17 | (1) 90.7 | 1051 | 196 | .67 | 405 | 24.3 | 29.0 | 33.8 | 38.5 | 43.3 | 48.0 | 52.8 |
| | -37°C | -18 | 89.8 | 1014 | 191 | .660 | 397 | 24.3 | 29.3 | 34.2 | 39.1 | 44.1 | 49.0 | 53.9 |
| | | -19 | 88.9 | 968 | 185 | .640 | 385 | 24.2 | 29.4 | 34.6 | 39.7 | 44.9 | 50.1 | 55.2 |
| | | -20 | 88.1 | 929 | 179 | .620 | 373 | 24.0 | 29.4 | 34.7 | 40.1 | 45.5 | 50.9 | 56.3 |
| | | -21 | (2) 87.3 | 890 | 172 | .60 | 359 | 23.5 | 29.1 | 34.7 | 40.4 | 46.0 | 51.6 | 57.2 |
| | ISA+10°C | -25 | (1) 92.6 | 1198 | 210 | .72 | 424 | 22.8 | 27.0 | 31.2 | 35.3 | 39.5 | 43.7 | 47.9 |
| | -47°C | -27 | 90.2 | 1079 | 201 | .690 | 406 | 23.7 | 28.3 | 33.0 | 37.6 | 42.3 | 46.9 | 51.5 |
| | | -28 | 88.0 | 985 | 191 | .660 | 388 | 24.2 | 29.3 | 34.3 | 39.4 | 44.5 | 49.6 | 54.6 |
| | | -30 | 86.7 | 921 | 182 | .630 | 371 | 23.9 | 29.4 | 34.8 | 40.2 | 45.6 | 51.1 | 56.5 |
| | | -32 | (2) 85.5 | 864 | 172 | .60 | 351 | 23.3 | 29.1 | 34.9 | 40.7 | 46.4 | 52.2 | 58.0 |
| | ISA+ 0°C | -35 | (1) 92.7 | 1250 | 215 | .73 | 423 | 21.8 | 25.8 | 29.8 | 33.8 | 37.8 | 41.8 | 45.8 |
| | -57°C | -37 | 89.1 | 1084 | 204 | .700 | 402 | 23.3 | 27.9 | 32.5 | 37.1 | 41.7 | 46.3 | 51.0 |
| | | -39 | 86.8 | 983 | 195 | .670 | 385 | 23.9 | 29.0 | 34.1 | 39.2 | 44.3 | 49.4 | 54.4 |
| | | -41 | 84.9 | 895 | 182 | .630 | 362 | 23.7 | 29.3 | 34.9 | 40.5 | 46.1 | 51.6 | 57.2 |
| | | -42 | (2) 83.7 | 837 | 172 | .60 | 343 | 23.0 | 29.0 | 35.0 | 41.0 | 46.9 | 52.9 | 58.9 |
| | ISA-10°C | -45 | (1) 94.2 | 1348 | 220 | .75 | 421 | 20.1 | 23.8 | 27.5 | 31.2 | 34.9 | 38.7 | 42.4 |
| | -67°C | -47 | 87.8 | 1090 | 207 | .710 | 399 | 22.8 | 27.4 | 32.0 | 36.6 | 41.2 | 45.8 | 50.4 |
| | | -50 | 84.9 | 954 | 195 | .670 | 376 | 23.7 | 29.0 | 34.2 | 39.4 | 44.7 | 49.9 | 55.2 |
| | | -51 | 83.4 | 887 | 185 | .640 | 359 | 23.6 | 29.2 | 34.9 | 40.5 | 46.2 | 51.8 | 57.4 |
| | | -53 | (2) 81.7 | 810 | 171 | .59 | 334 | 22.7 | 28.9 | 35.1 | 41.2 | 47.4 | 53.6 | 59.8 |
| 14000. | ISA+20°C | -16 | (1) 90.5 | 1055 | 201 | .69 | 414 | 25.1 | 29.8 | 34.5 | 39.3 | 44.0 | 48.8 | 53.5 |
| | -37°C | -18 | 88.6 | 964 | 191 | .660 | 397 | 25.6 | 30.8 | 35.9 | 41.1 | 46.3 | 51.5 | 56.7 |
| | | -20 | 86.2 | 867 | 179 | .620 | 373 | 25.7 | 31.5 | 37.2 | 43.0 | 48.8 | 54.5 | 60.3 |
| | | -21 | 84.6 | 809 | 170 | .590 | 355 | 25.3 | 31.5 | 37.7 | 43.8 | 50.0 | 56.2 | 62.4 |
| | | -23 | (2) 82.7 | 748 | 159 | .55 | 333 | 24.4 | 31.1 | 37.8 | 44.5 | 51.2 | 57.9 | 64.6 |
| | ISA+10°C | -24 | (1) 92.4 | 1202 | 214 | .73 | 431 | 23.4 | 27.5 | 31.7 | 35.8 | 40.0 | 44.2 | 48.3 |
| | -47°C | -27 | 88.8 | 1029 | 201 | .690 | 406 | 24.9 | 29.7 | 34.6 | 39.4 | 44.3 | 49.2 | 54.0 |
| | | -29 | 86.2 | 912 | 188 | .650 | 382 | 25.5 | 31.0 | 36.5 | 41.9 | 47.4 | 52.9 | 58.4 |
| | | -32 | 83.4 | 805 | 173 | .600 | 353 | 25.2 | 31.4 | 37.7 | 43.9 | 50.1 | 56.3 | 62.5 |
| | | -34 | (2) 81.1 | 727 | 159 | .55 | 326 | 24.2 | 31.0 | 37.9 | 44.8 | 51.7 | 58.6 | 65.4 |
| | ISA+ 0°C | -34 | (1) 92.8 | 1260 | 219 | .75 | 429 | 22.1 | 26.1 | 30.1 | 34.0 | 38.0 | 42.0 | 45.9 |
| | -57°C | -37 | 87.8 | 1034 | 204 | .700 | 402 | 24.4 | 29.3 | 34.1 | 38.9 | 43.8 | 48.6 | 53.5 |
| | | -40 | 84.4 | 886 | 188 | .650 | 374 | 25.3 | 30.9 | 36.6 | 42.2 | 47.8 | 53.5 | 59.1 |
| | | -42 | 81.7 | 782 | 173 | .600 | 345 | 25.0 | 31.4 | 37.8 | 44.2 | 50.6 | 57.0 | 63.4 |
| | | -44 | (2) 79.3 | 705 | 159 | .55 | 318 | 23.8 | 30.9 | 38.0 | 45.1 | 52.2 | 59.3 | 66.4 |
| | ISA-10°C | -45 | (1) 91.4 | 1253 | 220 | .75 | 421 | 21.6 | 25.6 | 29.6 | 33.6 | 37.6 | 41.6 | 45.6 |
| | -67°C | -48 | 85.9 | 1003 | 204 | .700 | 393 | 24.2 | 29.2 | 34.2 | 39.2 | 44.2 | 49.2 | 54.1 |
| | | -51 | 82.5 | 860 | 188 | .650 | 365 | 25.0 | 30.8 | 36.7 | 42.5 | 48.3 | 54.1 | 59.9 |
| | | -53 | 79.9 | 758 | 173 | .600 | 337 | 24.7 | 31.3 | 37.9 | 44.5 | 51.0 | 57.6 | 64.2 |
| | | -55 | (2) 77.5 | 684 | 158 | .55 | 310 | 23.5 | 30.8 | 38.1 | 45.4 | 52.7 | 60.0 | 67.4 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

| ANTI-ICE SYSTEMS ON | | |
|---|---|---|
| MAX. FAN %RPM | | |
| -47°C | -57°C | -67°C |
| 90.1 | 90.2 | 93.3 |
| INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 7% | | |

Figure 7-14 (Sheet 32)

# CRUISE
# 43,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+ 0°C | -42 | (1) | 93.2 | 1093 | 169 | .61 | 354 | 18.6 | 23.2 | 27.8 | 32.4 | 36.9 | 41.5 | 46.1 |
| | -57°C | -42 | | 93.1 | 1085 | 168 | .610 | 351 | 18.5 | 23.1 | 27.7 | 32.3 | 36.9 | 41.6 | 46.2 |
| | | -43 | | 93.0 | 1071 | 162 | .590 | 339 | 17.7 | 22.4 | 27.0 | 31.7 | 36.4 | 41.0 | 45.7 |
| | | -43 | | 92.2 | 1042 | 159 | .580 | 334 | 17.6 | 22.4 | 27.2 | 32.0 | 36.8 | 41.6 | 46.4 |
| | | -44 | (2) | 91.3 | 1002 | 156 | .57 | 327 | 17.7 | 22.7 | 27.7 | 32.7 | 37.7 | 42.7 | 47.6 |
| | ISA-10°C | -50 | (1) | 94.2 | 1198 | 185 | .67 | 376 | 18.9 | 23.0 | 27.2 | 31.4 | 35.6 | 39.7 | 43.9 |
| | -67°C | -51 | | 93.0 | 1137 | 180 | .650 | 365 | 18.9 | 23.3 | 27.7 | 32.1 | 36.5 | 40.9 | 45.3 |
| | | -52 | | 91.5 | 1071 | 171 | .620 | 348 | 18.5 | 23.2 | 27.8 | 32.5 | 37.2 | 41.8 | 46.5 |
| | | -53 | | 91.1 | 1046 | 165 | .600 | 337 | 17.9 | 22.7 | 27.4 | 32.2 | 37.0 | 41.8 | 46.6 |
| | | -54 | (2) | 89.3 | 972 | 156 | .57 | 319 | 17.4 | 22.6 | 27.7 | 32.8 | 38.0 | 43.1 | 48.3 |
| 19000. | ISA+ 0°C | -39 | (1) | 93.0 | 1125 | 186 | .67 | 386 | 21.0 | 25.5 | 29.9 | 34.4 | 38.8 | 43.3 | 47.7 |
| | -57°C | -39 | | 92.1 | 1088 | 183 | .660 | 380 | 21.1 | 25.7 | 30.3 | 34.9 | 39.5 | 44.1 | 48.7 |
| | | -40 | | 91.6 | 1062 | 180 | .650 | 374 | 21.1 | 25.8 | 30.5 | 35.2 | 39.9 | 44.6 | 49.3 |
| | | -40 | (2) | 91.2 | 1036 | 177 | .64 | 369 | 21.1 | 25.9 | 30.8 | 35.6 | 40.4 | 45.2 | 50.1 |
| | ISA-10°C | -48 | (1) | 93.9 | 1207 | 194 | .70 | 392 | 20.0 | 24.2 | 28.3 | 32.5 | 36.6 | 40.7 | 44.9 |
| | -67°C | -49 | | 93.1 | 1171 | 192 | .690 | 387 | 20.3 | 24.6 | 28.8 | 33.1 | 37.4 | 41.6 | 45.9 |
| | | -50 | | 91.0 | 1089 | 186 | .670 | 376 | 20.8 | 25.4 | 30.0 | 34.6 | 39.2 | 43.7 | 48.3 |
| | | -50 | | 90.2 | 1057 | 183 | .660 | 371 | 20.9 | 25.6 | 30.3 | 35.1 | 39.8 | 44.5 | 49.2 |
| | | -51 | (2) | 89.2 | 1005 | 177 | .64 | 360 | 20.9 | 25.8 | 30.8 | 35.8 | 40.8 | 45.7 | 50.7 |
| 18000. | ISA+ 0°C | -37 | (1) | 93.0 | 1139 | 194 | .70 | 400 | 22.0 | 26.4 | 30.8 | 35.2 | 39.6 | 43.9 | 48.3 |
| | -57°C | -38 | | 92.4 | 1115 | 192 | .690 | 397 | 22.1 | 26.6 | 31.1 | 35.6 | 40.1 | 44.6 | 49.0 |
| | | -39 | | 91.0 | 1049 | 186 | .670 | 385 | 22.4 | 27.2 | 32.0 | 36.7 | 41.5 | 46.3 | 51.0 |
| | | -39 | | 90.3 | 1020 | 183 | .660 | 380 | 22.5 | 27.4 | 32.3 | 37.2 | 42.1 | 47.0 | 51.9 |
| | | -40 | (2) | 89.4 | 985 | 179 | .65 | 373 | 22.6 | 27.7 | 32.7 | 37.8 | 42.9 | 48.0 | 53.0 |
| | ISA-10°C | -47 | (1) | 93.8 | 1214 | 200 | .72 | 402 | 20.8 | 24.9 | 29.0 | 33.1 | 37.2 | 41.4 | 45.5 |
| | -67°C | -48 | | 91.6 | 1130 | 195 | .700 | 393 | 21.5 | 25.9 | 30.4 | 34.8 | 39.2 | 43.6 | 48.1 |
| | | -49 | | 89.7 | 1050 | 189 | .680 | 382 | 22.1 | 26.8 | 31.6 | 36.4 | 41.1 | 45.9 | 50.6 |
| | | -50 | | 89.0 | 1019 | 186 | .670 | 376 | 22.2 | 27.1 | 32.0 | 36.9 | 41.8 | 46.7 | 51.6 |
| | | -51 | (2) | 87.4 | 954 | 179 | .65 | 363 | 22.3 | 27.6 | 32.8 | 38.1 | 43.3 | 48.5 | 53.8 |
| 17000. | ISA+10°C | -27 | | 92.2 | 1069 | 190 | .69 | 403 | 23.7 | 28.3 | 33.0 | 37.7 | 42.4 | 47.1 | 51.7 |
| | -47°C | -27 | | 91.8 | 1053 | 189 | .680 | 400 | 23.7 | 28.5 | 33.2 | 38.0 | 42.7 | 47.5 | 52.2 |
| | | -28 | | 91.2 | 1025 | 186 | .670 | 394 | 23.8 | 28.7 | 33.6 | 38.4 | 43.3 | 48.2 | 53.1 |
| | | -29 | | 90.2 | 977 | 180 | .650 | 382 | 23.8 | 28.9 | 34.0 | 39.2 | 44.3 | 49.4 | 54.5 |
| | | -30 | (2) | 89.8 | 955 | 177 | .64 | 377 | 23.7 | 29.0 | 34.2 | 39.4 | 44.7 | 49.9 | 55.1 |
| | ISA+ 0°C | -36 | (1) | 93.0 | 1149 | 199 | .71 | 411 | 22.7 | 27.0 | 31.4 | 35.7 | 40.1 | 44.4 | 48.8 |
| | -57°C | -37 | | 91.6 | 1091 | 195 | .700 | 402 | 23.1 | 27.7 | 32.3 | 36.9 | 41.5 | 46.0 | 50.6 |
| | | -38 | | 90.0 | 1023 | 189 | .680 | 391 | 23.5 | 28.4 | 33.3 | 38.2 | 43.1 | 48.0 | 52.9 |
| | | -39 | | 88.8 | 970 | 183 | .660 | 380 | 23.7 | 28.8 | 34.0 | 39.1 | 44.3 | 49.5 | 54.6 |
| | | -40 | (2) | 88.0 | 928 | 177 | .64 | 368 | 23.5 | 28.9 | 34.3 | 39.7 | 45.1 | 50.5 | 55.9 |
| | ISA-10°C | -46 | (1) | 93.7 | 1221 | 204 | .73 | 410 | 21.3 | 25.4 | 29.5 | 33.6 | 37.7 | 41.8 | 45.9 |
| | -67°C | -47 | | 90.6 | 1103 | 198 | .710 | 399 | 22.5 | 27.1 | 31.6 | 36.1 | 40.7 | 45.2 | 49.7 |
| | | -49 | | 88.9 | 1025 | 192 | .690 | 387 | 23.2 | 28.0 | 32.9 | 37.8 | 42.7 | 47.5 | 52.4 |
| | | -50 | | 86.8 | 941 | 183 | .660 | 371 | 23.5 | 28.8 | 34.1 | 39.4 | 44.7 | 50.0 | 55.3 |
| | | -51 | (2) | 86.0 | 899 | 177 | .64 | 359 | 23.3 | 28.9 | 34.4 | 40.0 | 45.5 | 51.1 | 56.7 |
| 16500. | ISA+10°C | -27 | (1) | 92.0 | 1066 | 193 | .69 | 408 | 24.2 | 28.9 | 33.5 | 38.2 | 42.9 | 47.6 | 52.3 |
| | -47°C | -27 | | 91.2 | 1029 | 189 | .680 | 400 | 24.3 | 29.2 | 34.0 | 38.9 | 43.7 | 48.6 | 53.5 |
| | | -28 | | 90.2 | 978 | 183 | .660 | 388 | 24.3 | 29.5 | 34.6 | 39.7 | 44.8 | 49.9 | 55.0 |
| | | -29 | | 89.7 | 956 | 180 | .650 | 382 | 24.3 | 29.5 | 34.8 | 40.0 | 45.2 | 50.5 | 55.7 |
| | | -30 | (2) | 88.8 | 915 | 174 | .63 | 370 | 24.1 | 29.5 | 35.0 | 40.5 | 45.9 | 51.4 | 56.9 |
| | ISA+ 0°C | -36 | (1) | 92.9 | 1148 | 201 | .72 | 413 | 22.9 | 27.3 | 31.7 | 36.0 | 40.4 | 44.7 | 49.1 |
| | -57°C | -37 | | 90.9 | 1064 | 195 | .700 | 402 | 23.7 | 28.4 | 33.1 | 37.8 | 42.5 | 47.2 | 51.9 |
| | | -38 | | 89.3 | 999 | 189 | .680 | 391 | 24.1 | 29.1 | 34.2 | 39.2 | 44.2 | 49.2 | 54.2 |
| | | -40 | | 87.8 | 928 | 180 | .650 | 374 | 24.1 | 29.5 | 34.9 | 40.3 | 45.7 | 51.1 | 56.5 |
| | | -41 | (2) | 86.9 | 888 | 174 | .63 | 362 | 23.9 | 29.5 | 35.1 | 40.8 | 46.4 | 52.0 | 57.6 |
| | ISA-10°C | -46 | (1) | 93.7 | 1222 | 205 | .73 | 413 | 21.5 | 25.6 | 29.7 | 33.7 | 37.8 | 41.9 | 46.0 |
| | -67°C | -47 | | 89.9 | 1074 | 198 | .710 | 399 | 23.1 | 27.8 | 32.5 | 37.1 | 41.8 | 46.4 | 51.1 |
| | | -49 | | 87.3 | 969 | 189 | .680 | 382 | 23.9 | 29.1 | 34.3 | 39.4 | 44.6 | 49.7 | 54.9 |
| | | -50 | | 86.3 | 922 | 183 | .660 | 371 | 23.9 | 29.4 | 34.8 | 40.2 | 45.6 | 51.1 | 56.5 |
| | | -52 | (2) | 85.0 | 861 | 173 | .63 | 353 | 23.6 | 29.4 | 35.2 | 41.0 | 46.8 | 52.7 | 58.5 |

Figure 7-14 (Sheet 33)

# CRUISE
# 43,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16000. | ISA+20°C | -19 | (1) 90.2 | 933 | 176 | .64 | 383 | 24.9 | 30.3 | 35.6 | 41.0 | 46.4 | 51.7 | 57.1 |
| | -37°C | -19 | 89.9 | 924 | 174 | .630 | 379 | 24.8 | 30.2 | 35.6 | 41.0 | 46.4 | 51.8 | 57.2 |
| | | -20 | (2) 89.4 | 902 | 170 | .62 | 372 | 24.6 | 30.1 | 35.7 | 41.2 | 46.8 | 52.3 | 57.9 |
| | ISA+10°C | -26 | (1) 91.8 | 1066 | 195 | .70 | 412 | 24.5 | 29.2 | 33.9 | 38.6 | 43.3 | 48.0 | 52.7 |
| | -47°C | -27 | 90.6 | 1006 | 189 | .680 | 400 | 24.8 | 29.8 | 34.8 | 39.8 | 44.7 | 49.7 | 54.7 |
| | | -28 | 89.5 | 956 | 183 | .660 | 388 | 24.9 | 30.1 | 35.4 | 40.6 | 45.8 | 51.1 | 56.3 |
| | | -30 | 88.6 | 915 | 177 | .640 | 376 | 24.7 | 30.2 | 35.7 | 41.1 | 46.6 | 52.1 | 57.5 |
| | | -31 | (2) 87.6 | 875 | 170 | .62 | 364 | 24.4 | 30.1 | 35.8 | 41.5 | 47.3 | 53.0 | 58.7 |
| | ISA+ 0°C | -36 | (1) 92.9 | 1151 | 202 | .72 | 416 | 23.2 | 27.5 | 31.8 | 36.2 | 40.5 | 44.9 | 49.2 |
| | -57°C | -37 | 90.1 | 1039 | 195 | .700 | 402 | 24.3 | 29.1 | 33.9 | 38.7 | 43.5 | 48.4 | 53.2 |
| | | -39 | 88.2 | 951 | 186 | .670 | 385 | 24.7 | 30.0 | 35.3 | 40.5 | 45.8 | 51.0 | 56.3 |
| | | -40 | 87.2 | 907 | 180 | .650 | 374 | 24.7 | 30.2 | 35.7 | 41.2 | 46.7 | 52.2 | 57.7 |
| | | -41 | (2) 85.8 | 849 | 170 | .62 | 355 | 24.2 | 30.1 | 35.9 | 41.8 | 47.7 | 53.6 | 59.5 |
| | ISA-10°C | -46 | (1) 93.6 | 1225 | 207 | .74 | 415 | 21.6 | 25.7 | 29.8 | 33.9 | 37.9 | 42.0 | 46.1 |
| | -67°C | -47 | 89.3 | 1051 | 198 | .710 | 399 | 23.7 | 28.4 | 33.2 | 37.9 | 42.7 | 47.4 | 52.2 |
| | | -49 | 86.8 | 948 | 189 | .680 | 382 | 24.5 | 29.7 | 35.0 | 40.3 | 45.6 | 50.9 | 56.1 |
| | | -51 | 85.3 | 880 | 180 | .650 | 365 | 24.4 | 30.1 | 35.8 | 41.5 | 47.2 | 52.8 | 58.5 |
| | | -52 | (2) 84.0 | 825 | 170 | .62 | 347 | 23.9 | 30.0 | 36.0 | 42.1 | 48.2 | 54.2 | 60.3 |
| 14000. | ISA+20°C | -17 | (1) 89.8 | 939 | 186 | .67 | 403 | 27.0 | 32.3 | 37.6 | 42.9 | 48.3 | 53.6 | 58.9 |
| | -37°C | -18 | 88.6 | 888 | 180 | .650 | 391 | 27.1 | 32.8 | 38.4 | 44.0 | 49.7 | 55.3 | 60.9 |
| | | -19 | 87.7 | 849 | 174 | .630 | 379 | 26.9 | 32.8 | 38.7 | 44.6 | 50.5 | 56.4 | 62.3 |
| | | -20 | 86.9 | 813 | 168 | .610 | 367 | 26.6 | 32.8 | 38.9 | 45.1 | 51.2 | 57.4 | 63.5 |
| | | -22 | (2) 85.8 | 774 | 161 | .59 | 352 | 26.1 | 32.5 | 39.0 | 45.4 | 51.9 | 58.4 | 64.8 |
| | ISA+10°C | -25 | (1) 91.5 | 1059 | 199 | .71 | 420 | 25.5 | 30.3 | 35.0 | 39.7 | 44.4 | 49.2 | 53.9 |
| | -47°C | -27 | 88.7 | 939 | 189 | .680 | 400 | 26.6 | 31.9 | 37.3 | 42.6 | 47.9 | 53.2 | 58.5 |
| | | -29 | 86.8 | 862 | 180 | .650 | 382 | 26.9 | 32.7 | 38.5 | 44.3 | 50.1 | 55.9 | 61.7 |
| | | -31 | 85.6 | 807 | 171 | .620 | 365 | 26.6 | 32.8 | 39.0 | 45.2 | 51.4 | 57.6 | 63.8 |
| | | -32 | (2) 84.1 | 753 | 161 | .59 | 344 | 25.8 | 32.5 | 39.1 | 45.7 | 52.4 | 59.0 | 65.7 |
| | ISA+ 0°C | -35 | (1) 92.8 | 1158 | 207 | .74 | 426 | 23.9 | 28.2 | 32.5 | 36.8 | 41.1 | 45.4 | 49.8 |
| | -57°C | -37 | 88.5 | 977 | 195 | .700 | 402 | 25.8 | 31.0 | 36.1 | 41.2 | 46.3 | 51.4 | 56.6 |
| | | -39 | 86.1 | 885 | 186 | .670 | 385 | 25.6 | 32.2 | 37.9 | 43.5 | 49.2 | 54.8 | 60.5 |
| | | -41 | 84.2 | 801 | 174 | .630 | 362 | 26.5 | 32.7 | 39.0 | 45.2 | 51.5 | 57.7 | 64.0 |
| | | -43 | (2) 82.3 | 730 | 160 | .58 | 336 | 25.5 | 32.4 | 39.2 | 46.1 | 52.9 | 59.8 | 66.6 |
| | ISA-10°C | -45 | (1) 92.2 | 1188 | 210 | .75 | 421 | 22.8 | 27.0 | 31.2 | 35.5 | 39.7 | 43.9 | 48.1 |
| | -67°C | -47 | 87.3 | 983 | 198 | .710 | 399 | 25.3 | 30.4 | 35.5 | 40.6 | 45.7 | 50.8 | 55.8 |
| | | -50 | 84.2 | 859 | 186 | .670 | 376 | 26.3 | 32.2 | 38.0 | 43.8 | 49.6 | 55.5 | 61.3 |
| | | -52 | 82.3 | 777 | 174 | .630 | 354 | 26.2 | 32.7 | 39.1 | 45.5 | 52.0 | 58.4 | 64.8 |
| | | -54 | (2) 80.4 | 706 | 160 | .58 | 328 | 25.2 | 32.2 | 39.3 | 46.4 | 53.5 | 60.6 | 67.6 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-14 (Sheet 34)

# CRUISE
# 45,000 FEET

**ANTI-ICE SYSTEMS OFF** **TWO ENGINES**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
| 19000. | ISA+ 0°C | -44 | (1) | 93.5 | 975 | 148 | .57 | 325 | 18.0 | 23.1 | 28.2 | 33.4 | 38.5 | 43.6 | 48.8 |
| | -57°C | -44 | | 93.1 | 962 | 146 | .560 | 322 | 17.9 | 23.1 | 28.3 | 33.5 | 38.7 | 43.9 | 49.1 |
| | | -44 | (2) | 92.1 | 930 | 144 | .55 | 317 | 18.0 | 23.4 | 28.7 | 34.1 | 39.5 | 44.9 | 50.2 |
| | ISA-10°C | -53 | (1) | 94.2 | 1033 | 154 | .59 | 331 | 17.5 | 22.4 | 27.2 | 32.1 | 36.9 | 41.7 | 46.6 |
| | -67°C | -54 | | 92.5 | 992 | 152 | .580 | 326 | 17.7 | 22.8 | 27.8 | 32.9 | 37.9 | 42.9 | 48.0 |
| | | -54 | | 91.8 | 962 | 149 | .570 | 320 | 17.7 | 22.9 | 28.1 | 33.3 | 38.5 | 43.7 | 48.9 |
| | | -55 | | 91.2 | 936 | 146 | .560 | 315 | 17.6 | 22.9 | 28.3 | 33.6 | 38.9 | 44.3 | 49.6 |
| | | -55 | (2) | 90.2 | 904 | 144 | .55 | 310 | 17.7 | 23.2 | 28.7 | 34.3 | 39.8 | 45.3 | 50.9 |
| 18000. | ISA+ 0°C | -40 | (1) | 93.5 | 1020 | 171 | .65 | 372 | 21.8 | 26.7 | 31.6 | 36.5 | 41.4 | 46.3 | 51.2 |
| | -57°C | -41 | | 92.7 | 987 | 166 | .630 | 362 | 21.5 | 26.6 | 31.7 | 36.7 | 41.8 | 46.9 | 51.9 |
| | | -42 | | 91.8 | 952 | 160 | .610 | 351 | 21.1 | 26.4 | 31.6 | 36.9 | 42.1 | 47.4 | 52.6 |
| | | -42 | | 91.6 | 942 | 157 | .600 | 345 | 20.7 | 26.0 | 31.3 | 36.6 | 42.0 | 47.3 | 52.6 |
| | | -43 | (2) | 91.0 | 904 | 151 | .58 | 331 | 20.1 | 25.6 | 31.1 | 36.7 | 42.2 | 47.7 | 53.2 |
| | ISA-10°C | -49 | (1) | 93.6 | 1083 | 180 | .68 | 381 | 21.3 | 25.9 | 30.6 | 35.2 | 39.8 | 44.4 | 49.0 |
| | -67°C | -51 | | 91.7 | 1000 | 171 | .650 | 365 | 21.5 | 26.5 | 31.5 | 36.5 | 41.5 | 46.5 | 51.5 |
| | | -52 | | 90.8 | 960 | 166 | .630 | 354 | 21.2 | 26.4 | 31.7 | 36.9 | 42.1 | 47.3 | 52.5 |
| | | -53 | | 89.8 | 916 | 157 | .600 | 337 | 20.4 | 25.9 | 31.3 | 36.8 | 42.3 | 47.7 | 53.2 |
| | | -54 | (2) | 89.0 | 875 | 150 | .57 | 323 | 19.8 | 25.5 | 31.2 | 36.9 | 42.6 | 48.3 | 54.0 |
| 17000. | ISA+ 0°C | -38 | (1) | 93.4 | 1042 | 182 | .69 | 395 | 23.5 | 28.3 | 33.1 | 37.9 | 42.7 | 47.5 | 52.3 |
| | -57°C | -38 | | 92.6 | 1016 | 180 | .680 | 391 | 23.7 | 28.6 | 33.6 | 38.5 | 43.4 | 48.3 | 53.2 |
| | | -39 | | 91.4 | 959 | 174 | .660 | 380 | 23.9 | 29.1 | 34.4 | 39.6 | 44.8 | 50.0 | 55.2 |
| | | -40 | | 90.8 | 936 | 171 | .650 | 374 | 23.9 | 29.3 | 34.6 | 40.0 | 45.3 | 50.6 | 56.0 |
| | | -40 | (2) | 90.2 | 907 | 168 | .64 | 367 | 23.9 | 29.5 | 35.0 | 40.5 | 46.0 | 51.5 | 57.0 |
| | ISA-10°C | -48 | (1) | 93.5 | 1096 | 187 | .71 | 396 | 22.5 | 27.0 | 31.6 | 36.2 | 40.7 | 45.3 | 49.9 |
| | -67°C | -49 | | 91.8 | 1027 | 183 | .690 | 387 | 23.1 | 28.0 | 32.9 | 37.7 | 42.6 | 47.5 | 52.3 |
| | | -50 | | 90.0 | 957 | 177 | .670 | 376 | 23.7 | 28.9 | 34.1 | 39.3 | 44.6 | 49.8 | 55.0 |
| | | -50 | | 89.4 | 932 | 174 | .660 | 371 | 23.7 | 29.0 | 34.4 | 39.8 | 45.1 | 50.5 | 55.9 |
| | | -51 | (2) | 88.3 | 879 | 168 | .64 | 358 | 23.7 | 29.4 | 35.1 | 40.7 | 46.4 | 52.1 | 57.8 |
| 16500. | ISA+ 0°C | -37 | (1) | 93.4 | 1051 | 186 | .70 | 402 | 24.0 | 28.8 | 33.5 | 38.3 | 43.0 | 47.8 | 52.6 |
| | -57°C | -38 | | 92.4 | 1013 | 183 | .690 | 397 | 24.4 | 29.3 | 34.2 | 39.2 | 44.1 | 49.0 | 54.0 |
| | | -38 | | 91.7 | 980 | 180 | .680 | 391 | 24.6 | 29.7 | 34.8 | 39.9 | 45.0 | 50.1 | 55.2 |
| | | -39 | | 90.4 | 926 | 174 | .660 | 380 | 24.8 | 30.2 | 35.6 | 41.0 | 46.4 | 51.8 | 57.2 |
| | | -40 | (2) | 89.5 | 896 | 171 | .65 | 372 | 24.8 | 30.4 | 36.0 | 41.5 | 47.1 | 52.7 | 58.3 |
| | ISA-10°C | -47 | (1) | 93.5 | 1099 | 190 | .72 | 402 | 22.9 | 27.5 | 32.0 | 36.6 | 41.1 | 45.7 | 50.2 |
| | -67°C | -48 | | 91.6 | 1027 | 186 | .700 | 393 | 23.7 | 28.5 | 33.4 | 38.3 | 43.2 | 48.0 | 52.9 |
| | | -49 | | 89.7 | 953 | 180 | .680 | 382 | 24.3 | 29.6 | 34.8 | 40.1 | 45.3 | 50.6 | 55.8 |
| | | -50 | | 89.1 | 925 | 177 | .670 | 376 | 24.5 | 29.9 | 35.3 | 40.7 | 46.1 | 51.5 | 56.9 |
| | | -51 | (2) | 87.6 | 868 | 170 | .65 | 363 | 24.6 | 30.3 | 36.1 | 41.8 | 47.6 | 53.4 | 59.1 |
| 16000. | ISA+10°C | -28 | (1) | 91.7 | 946 | 177 | .67 | 393 | 25.7 | 31.0 | 36.3 | 41.6 | 46.9 | 52.2 | 57.5 |
| | -47°C | -28 | | 91.1 | 925 | 174 | .660 | 388 | 25.8 | 31.2 | 36.6 | 42.0 | 47.4 | 52.8 | 58.2 |
| | | -29 | (2) | 90.6 | 902 | 171 | .65 | 382 | 25.8 | 31.3 | 36.8 | 42.4 | 47.9 | 53.5 | 59.0 |
| | ISA+ 0°C | -37 | (1) | 93.4 | 1057 | 189 | .71 | 408 | 24.4 | 29.2 | 33.9 | 38.6 | 43.4 | 48.1 | 52.8 |
| | -57°C | -37 | | 92.3 | 1016 | 186 | .700 | 402 | 24.9 | 29.8 | 34.7 | 39.6 | 44.5 | 49.5 | 54.4 |
| | | -38 | | 90.8 | 951 | 180 | .680 | 391 | 25.3 | 30.6 | 35.8 | 41.1 | 46.4 | 51.6 | 56.9 |
| | | -39 | | 90.1 | 924 | 177 | .670 | 385 | 25.5 | 30.9 | 36.3 | 41.7 | 47.1 | 52.5 | 58.0 |
| | | -40 | (2) | 88.8 | 875 | 171 | .65 | 374 | 25.6 | 31.3 | 37.0 | 42.7 | 48.4 | 54.1 | 59.8 |
| | ISA-10°C | -47 | (1) | 93.5 | 1104 | 193 | .72 | 407 | 23.3 | 27.8 | 32.3 | 36.8 | 41.4 | 45.9 | 50.4 |
| | -67°C | -47 | | 91.6 | 1032 | 189 | .710 | 399 | 24.1 | 29.0 | 33.8 | 38.6 | 43.5 | 48.3 | 53.2 |
| | | -49 | | 89.6 | 953 | 183 | .690 | 387 | 24.9 | 30.2 | 35.4 | 40.7 | 45.9 | 51.1 | 56.4 |
| | | -50 | | 88.2 | 897 | 177 | .670 | 376 | 25.2 | 30.8 | 36.4 | 42.0 | 47.5 | 53.1 | 58.7 |
| | | -51 | (2) | 86.8 | 849 | 171 | .65 | 365 | 25.3 | 31.2 | 37.1 | 43.0 | 48.9 | 54.8 | 60.7 |
| 14000. | ISA+20°C | -19 | (1) | 89.3 | 827 | 169 | .64 | 385 | 28.4 | 34.5 | 40.5 | 46.6 | 52.6 | 58.7 | 64.7 |
| | -37°C | -19 | | 88.9 | 812 | 166 | .630 | 379 | 28.2 | 34.3 | 40.5 | 46.7 | 52.8 | 59.0 | 65.1 |
| | | -20 | | 88.5 | 796 | 163 | .620 | 373 | 28.0 | 34.3 | 40.5 | 46.8 | 53.1 | 59.4 | 65.6 |
| | | -20 | (2) | 88.2 | 780 | 160 | .61 | 367 | 27.8 | 34.2 | 40.6 | 47.0 | 53.4 | 59.8 | 66.2 |
| | ISA+10°C | -26 | (1) | 91.2 | 945 | 186 | .70 | 412 | 27.7 | 33.0 | 38.3 | 43.6 | 48.9 | 54.2 | 59.5 |
| | -47°C | -27 | | 89.6 | 883 | 180 | .680 | 400 | 28.3 | 34.0 | 39.6 | 45.3 | 50.9 | 56.6 | 62.3 |
| | | -28 | | 88.5 | 840 | 174 | .660 | 388 | 28.4 | 34.3 | 40.3 | 46.2 | 52.2 | 58.1 | 64.1 |
| | | -30 | | 87.5 | 805 | 169 | .640 | 376 | 28.1 | 34.4 | 40.6 | 46.8 | 53.0 | 59.2 | 65.4 |
| | | -31 | (2) | 86.5 | 761 | 161 | .61 | 360 | 27.7 | 34.2 | 40.8 | 47.4 | 53.9 | 60.5 | 67.1 |
| | ISA+ 0°C | -35 | (1) | 93.0 | 1051 | 195 | .73 | 422 | 25.8 | 30.6 | 35.3 | 40.1 | 44.8 | 49.6 | 54.4 |
| | -57°C | -37 | | 90.3 | 951 | 189 | .710 | 408 | 27.1 | 32.4 | 37.7 | 42.9 | 48.2 | 53.4 | 58.7 |
| | | -38 | | 87.8 | 857 | 180 | .680 | 391 | 28.1 | 34.0 | 39.8 | 45.6 | 51.5 | 57.3 | 63.1 |
| | | -40 | | 86.2 | 798 | 171 | .650 | 374 | 28.1 | 34.3 | 40.6 | 46.9 | 53.1 | 59.4 | 65.7 |
| | | -42 | (2) | 84.7 | 740 | 161 | .61 | 353 | 27.4 | 34.2 | 41.0 | 47.7 | 54.5 | 61.3 | 68.0 |
| | ISA-10°C | -46 | (1) | 93.5 | 1119 | 199 | .75 | 419 | 24.0 | 28.5 | 32.9 | 37.4 | 41.9 | 46.4 | 50.8 |
| | -67°C | -47 | | 88.4 | 924 | 189 | .710 | 399 | 26.9 | 32.3 | 37.7 | 43.2 | 48.6 | 54.0 | 59.4 |
| | | -49 | | 85.9 | 831 | 180 | .680 | 382 | 27.9 | 33.9 | 39.9 | 45.9 | 51.9 | 58.0 | 64.0 |
| | | -51 | | 84.3 | 774 | 171 | .650 | 365 | 27.8 | 34.3 | 40.7 | 47.2 | 53.6 | 60.1 | 66.6 |
| | | -52 | (2) | 82.9 | 720 | 162 | .62 | 346 | 27.2 | 34.2 | 41.1 | 48.1 | 55.0 | 62.0 | 68.9 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-14 (Sheet 35)

# CRUISE
# 5000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+10°C | 24 | (1) 84.9 | 1393 | 250 | .41 | 274 | 8.9 | 12.5 | 16.1 | 19.7 | 23.3 | 26.8 | 30.4 |
| | 15°C | 24 | 83.6 | 1335 | 242 | .400 | 266 | 8.7 | 12.4 | 16.2 | 19.9 | 23.7 | 27.4 | 31.2 |
| | | 23 | (2) 81.2 | 1231 | 228 | .38 | 251 | 8.2 | 12.2 | 16.3 | 20.4 | 24.4 | 28.5 | 32.5 |
| | ISA+ 0°C | 14 | (1) 85.2 | 1442 | 260 | .43 | 280 | 9.0 | 12.5 | 16.0 | 19.4 | 22.9 | 26.4 | 29.8 |
| | 5°C | 14 | 83.2 | 1350 | 248 | .410 | 268 | 8.7 | 12.4 | 16.1 | 19.8 | 23.5 | 27.2 | 30.9 |
| | | 12 | (2) 79.9 | 1204 | 229 | .38 | 247 | 8.0 | 12.2 | 16.3 | 20.5 | 24.6 | 28.8 | 32.9 |
| | ISA-10°C | 4 | (1) 83.7 | 1407 | 260 | .43 | 275 | 8.9 | 12.4 | 16.0 | 19.5 | 23.1 | 26.6 | 30.2 |
| | -5°C | 3 | 81.8 | 1317 | 248 | .410 | 263 | 8.6 | 12.4 | 16.2 | 20.0 | 23.8 | 27.6 | 31.3 |
| | | 2 | (2) 78.6 | 1176 | 229 | .38 | 243 | 7.9 | 12.1 | 16.4 | 20.6 | 24.9 | 29.1 | 33.4 |
| 19000. | ISA+20°C | 33 | (1) 81.8 | 1235 | 227 | .37 | 253 | 8.4 | 12.4 | 16.5 | 20.5 | 24.6 | 28.6 | 32.7 |
| | 25°C | 33 | 81.3 | 1217 | 224 | .370 | 250 | 8.2 | 12.3 | 16.5 | 20.6 | 24.7 | 28.8 | 32.9 |
| | | 32 | (2) 81.0 | 1203 | 222 | .37 | 248 | 8.1 | 12.3 | 16.5 | 20.6 | 24.8 | 28.9 | 33.1 |
| | ISA+10°C | 24 | (1) 84.9 | 1395 | 252 | .42 | 276 | 9.1 | 12.6 | 16.2 | 19.8 | 23.4 | 27.0 | 30.6 |
| | 15°C | 23 | 82.2 | 1272 | 236 | .390 | 259 | 8.6 | 12.5 | 16.4 | 20.4 | 24.3 | 28.2 | 32.2 |
| | | 22 | (2) 79.8 | 1180 | 223 | .37 | 245 | 8.0 | 12.3 | 16.5 | 20.7 | 25.0 | 29.2 | 33.5 |
| | ISA+ 0°C | 14 | (1) 84.9 | 1429 | 260 | .43 | 280 | 9.1 | 12.6 | 16.1 | 19.6 | 23.1 | 26.6 | 30.1 |
| | 5°C | 13 | 81.8 | 1288 | 242 | .400 | 261 | 8.6 | 12.5 | 16.4 | 20.3 | 24.2 | 28.1 | 31.9 |
| | | 12 | (2) 78.6 | 1156 | 224 | .37 | 241 | 7.9 | 12.2 | 16.5 | 20.9 | 25.2 | 29.5 | 33.8 |
| | ISA-10°C | 4 | (1) 83.4 | 1394 | 260 | .43 | 275 | 9.0 | 12.6 | 16.1 | 19.7 | 23.3 | 26.9 | 30.5 |
| | -5°C | 3 | 80.4 | 1256 | 242 | .400 | 256 | 8.5 | 12.5 | 16.4 | 20.4 | 24.4 | 28.4 | 32.4 |
| | | 2 | (2) 77.2 | 1128 | 224 | .37 | 237 | 7.7 | 12.1 | 16.6 | 21.0 | 25.4 | 29.9 | 34.3 |
| 18000. | ISA+20°C | 33 | (1) 81.8 | 1234 | 229 | .38 | 256 | 8.6 | 12.6 | 16.7 | 20.7 | 24.8 | 28.8 | 32.9 |
| | 25°C | 33 | 80.9 | 1200 | 224 | .370 | 250 | 8.4 | 12.5 | 16.7 | 20.8 | 25.0 | 29.2 | 33.3 |
| | | 32 | (2) 79.2 | 1139 | 215 | .35 | 240 | 7.9 | 12.3 | 16.7 | 21.1 | 25.4 | 29.8 | 34.2 |
| | ISA+10°C | 24 | (1) 84.9 | 1394 | 253 | .42 | 278 | 9.2 | 12.8 | 16.4 | 19.9 | 23.5 | 27.1 | 30.7 |
| | 15°C | 23 | 81.8 | 1256 | 236 | .390 | 259 | 8.7 | 12.7 | 16.7 | 20.6 | 24.6 | 28.6 | 32.6 |
| | | 22 | (2) 77.9 | 1113 | 215 | .35 | 236 | 7.7 | 12.2 | 16.7 | 21.2 | 25.7 | 30.2 | 34.7 |
| | ISA+ 0°C | 14 | (1) 84.6 | 1416 | 260 | .43 | 280 | 9.2 | 12.7 | 16.2 | 19.8 | 23.3 | 26.8 | 30.4 |
| | 5°C | 13 | 80.4 | 1226 | 236 | .390 | 255 | 8.5 | 12.6 | 16.7 | 20.8 | 24.9 | 28.9 | 33.0 |
| | | 12 | (2) 76.7 | 1090 | 215 | .36 | 232 | 7.5 | 12.1 | 16.7 | 21.3 | 25.9 | 30.5 | 35.1 |
| | ISA-10°C | 4 | (1) 83.1 | 1381 | 260 | .43 | 275 | 9.0 | 12.7 | 16.3 | 19.9 | 23.5 | 27.1 | 30.8 |
| | -5°C | 3 | 79.0 | 1196 | 236 | .390 | 250 | 8.4 | 12.5 | 16.7 | 20.9 | 25.1 | 29.3 | 33.5 |
| | | 1 | (2) 75.3 | 1063 | 215 | .36 | 228 | 7.3 | 12.0 | 16.7 | 21.4 | 26.1 | 30.8 | 35.5 |
| 17000. | ISA+20°C | 33 | (1) 81.7 | 1233 | 231 | .38 | 258 | 8.8 | 12.8 | 16.9 | 20.9 | 25.0 | 29.0 | 33.1 |
| | 25°C | 32 | 79.3 | 1144 | 218 | .360 | 244 | 8.2 | 12.5 | 16.9 | 21.3 | 25.6 | 30.0 | 34.4 |
| | | 31 | (2) 77.3 | 1072 | 207 | .34 | 231 | 7.5 | 12.2 | 16.9 | 21.5 | 26.2 | 30.9 | 35.5 |
| | ISA+10°C | 24 | (1) 84.8 | 1390 | 254 | .42 | 279 | 9.3 | 12.9 | 16.5 | 20.1 | 23.7 | 27.3 | 30.9 |
| | 15°C | 23 | 80.2 | 1198 | 230 | .380 | 253 | 8.6 | 12.7 | 16.9 | 21.1 | 25.3 | 29.4 | 33.6 |
| | | 21 | (2) 76.0 | 1047 | 207 | .34 | 227 | 7.4 | 12.1 | 16.9 | 21.7 | 26.4 | 31.2 | 36.0 |
| | ISA+ 0°C | 14 | (1) 84.3 | 1403 | 260 | .43 | 280 | 9.3 | 12.8 | 16.4 | 20.0 | 23.5 | 27.1 | 30.6 |
| | 5°C | 13 | 80.0 | 1211 | 236 | .390 | 255 | 8.6 | 12.8 | 16.9 | 21.0 | 25.2 | 29.3 | 33.4 |
| | | 11 | (2) 74.8 | 1025 | 207 | .34 | 223 | 7.2 | 12.0 | 16.9 | 21.8 | 26.7 | 31.6 | 36.4 |
| | ISA-10°C | 4 | (1) 82.9 | 1369 | 260 | .43 | 275 | 9.1 | 12.8 | 16.4 | 20.1 | 23.7 | 27.4 | 31.0 |
| | -5°C | 3 | 78.6 | 1182 | 236 | .390 | 250 | 8.5 | 12.7 | 16.9 | 21.2 | 25.4 | 29.6 | 33.9 |
| | | 1 | (2) 73.5 | 1002 | 208 | .34 | 220 | 7.0 | 11.9 | 16.9 | 21.9 | 26.9 | 31.9 | 36.9 |
| 16500. | ISA+20°C | 33 | (1) 81.7 | 1233 | 232 | .38 | 259 | 8.8 | 12.9 | 16.9 | 21.0 | 25.1 | 29.1 | 33.2 |
| | 25°C | 32 | 79.1 | 1137 | 218 | .360 | 244 | 8.2 | 12.6 | 17.0 | 21.4 | 25.8 | 30.2 | 34.6 |
| | | 31 | (2) 76.5 | 1043 | 204 | .34 | 227 | 7.4 | 12.2 | 17.0 | 21.8 | 26.6 | 31.4 | 36.2 |
| | ISA+10°C | 24 | (1) 84.8 | 1391 | 255 | .42 | 280 | 9.3 | 12.9 | 16.5 | 20.1 | 23.7 | 27.3 | 30.9 |
| | 15°C | 23 | 80.0 | 1191 | 230 | .380 | 253 | 8.6 | 12.8 | 17.0 | 21.2 | 25.4 | 29.6 | 33.8 |
| | | 21 | (2) 75.2 | 1019 | 204 | .34 | 223 | 7.2 | 12.1 | 17.0 | 21.9 | 26.8 | 31.7 | 36.6 |
| | ISA+ 0°C | 14 | (1) 84.2 | 1397 | 260 | .43 | 280 | 9.3 | 12.9 | 16.5 | 20.0 | 23.6 | 27.2 | 30.8 |
| | 5°C | 12 | 78.7 | 1163 | 230 | .380 | 248 | 8.4 | 12.7 | 17.0 | 21.3 | 25.6 | 29.9 | 34.2 |
| | | 11 | (2) 74.0 | 998 | 204 | .34 | 220 | 7.0 | 12.0 | 17.0 | 22.1 | 27.1 | 32.1 | 37.1 |
| | ISA-10°C | 4 | (1) 82.7 | 1363 | 260 | .43 | 275 | 9.2 | 12.8 | 16.5 | 20.2 | 23.8 | 27.5 | 31.2 |
| | -5°C | 2 | 77.3 | 1135 | 230 | .380 | 244 | 8.3 | 12.7 | 17.1 | 21.5 | 25.9 | 30.3 | 34.7 |
| | | 1 | (2) 72.7 | 975 | 204 | .34 | 216 | 6.8 | 11.9 | 17.0 | 22.2 | 27.3 | 32.4 | 37.6 |
| 16000. | ISA+20°C | 33 | (1) 81.7 | 1234 | 233 | .38 | 260 | 8.9 | 13.0 | 17.0 | 21.1 | 25.1 | 29.2 | 33.2 |
| | 25°C | 32 | 78.8 | 1129 | 218 | .360 | 244 | 8.3 | 12.7 | 17.1 | 21.6 | 26.0 | 30.4 | 34.9 |
| | | 31 | (2) 75.7 | 1015 | 201 | .33 | 224 | 7.3 | 12.2 | 17.1 | 22.1 | 27.0 | 31.9 | 36.8 |
| | ISA+10°C | 25 | (1) 84.7 | 1390 | 256 | .42 | 281 | 9.4 | 13.0 | 16.6 | 20.2 | 23.8 | 27.4 | 31.0 |
| | 15°C | 23 | 79.8 | 1185 | 230 | .380 | 253 | 8.7 | 12.9 | 17.1 | 21.3 | 25.5 | 29.8 | 34.0 |
| | | 21 | (2) 74.5 | 992 | 201 | .33 | 220 | 7.1 | 12.1 | 17.2 | 22.2 | 27.2 | 32.3 | 37.3 |
| | ISA+ 0°C | 14 | (1) 84.1 | 1391 | 260 | .43 | 280 | 9.3 | 12.9 | 16.5 | 20.1 | 23.7 | 27.3 | 30.9 |
| | 5°C | 12 | 78.5 | 1157 | 230 | .380 | 248 | 8.5 | 12.8 | 17.1 | 21.5 | 25.8 | 30.1 | 34.4 |
| | | 11 | (2) 73.2 | 970 | 201 | .33 | 216 | 6.9 | 12.0 | 17.2 | 22.3 | 27.5 | 32.6 | 37.8 |
| | ISA-10°C | 4 | (1) 82.6 | 1357 | 260 | .43 | 275 | 9.2 | 12.9 | 16.6 | 20.3 | 23.9 | 27.6 | 31.3 |
| | -5°C | 2 | 77.1 | 1129 | 230 | .380 | 244 | 8.3 | 12.7 | 17.2 | 21.6 | 26.0 | 30.4 | 34.9 |
| | | 1 | (2) 72.0 | 948 | 201 | .33 | 213 | 6.6 | 11.9 | 17.2 | 22.4 | 27.7 | 33.0 | 38.3 |
| 14000. | ISA+20°C | 33 | (1) 81.6 | 1230 | 236 | .39 | 263 | 9.2 | 13.3 | 17.3 | 21.4 | 25.5 | 29.5 | 33.6 |
| | 25°C | 32 | 76.8 | 1058 | 212 | .350 | 237 | 8.2 | 12.9 | 17.7 | 22.4 | 27.1 | 31.8 | 36.6 |
| | | 30 | (2) 72.1 | 903 | 188 | .31 | 210 | 6.6 | 12.2 | 17.7 | 23.2 | 28.8 | 34.3 | 39.9 |
| | ISA+10°C | 25 | (1) 84.7 | 1387 | 258 | .43 | 283 | 9.6 | 13.2 | 16.8 | 20.4 | 24.0 | 27.6 | 31.2 |
| | 15°C | 22 | 77.9 | 1118 | 224 | .370 | 246 | 8.6 | 13.1 | 17.5 | 22.0 | 26.5 | 31.0 | 35.4 |
| | | 20 | (2) 70.9 | 882 | 188 | .31 | 206 | 6.4 | 12.0 | 17.7 | 23.4 | 29.0 | 34.7 | 40.4 |
| | ISA+ 0°C | 14 | (1) 83.6 | 1371 | 260 | .43 | 280 | 9.5 | 13.1 | 16.8 | 20.4 | 24.1 | 27.7 | 31.4 |
| | 5°C | 12 | 76.6 | 1091 | 224 | .370 | 242 | 8.4 | 13.0 | 17.6 | 22.1 | 26.7 | 31.3 | 35.9 |
| | | 10 | (2) 69.6 | 859 | 187 | .31 | 202 | 6.1 | 11.9 | 17.7 | 23.5 | 29.3 | 35.2 | 41.0 |
| | ISA-10°C | 4 | (1) 82.2 | 1338 | 260 | .43 | 275 | 9.3 | 13.1 | 16.8 | 20.6 | 24.3 | 28.0 | 31.8 |
| | -5°C | 2 | 75.3 | 1065 | 224 | .370 | 237 | 8.2 | 12.9 | 17.6 | 22.3 | 27.0 | 31.7 | 36.4 |
| | | 0 | (2) 68.3 | 837 | 187 | .31 | 198 | 5.7 | 11.7 | 17.7 | 23.7 | 29.6 | 35.6 | 41.6 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 1 of 12)

## CRUISE
## 10,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
| 20000. | ISA+10°C | 15 | (1) | 87.2 | 1294 | 243 | .44 | 287 | 10.6 | 14.4 | 18.3 | 22.2 | 26.0 | 29.9 | 33.7 |
| | 5°C | 14 | | 85.6 | 1216 | 232 | .420 | 274 | 10.2 | 14.3 | 18.4 | 22.5 | 26.7 | 30.8 | 34.9 |
| | | 13 | (2) | 83.3 | 1122 | 218 | .39 | 258 | 9.6 | 14.0 | 18.5 | 23.0 | 27.4 | 31.9 | 36.3 |
| | ISA+ 0°C | 6 | (1) | 88.7 | 1420 | 261 | .47 | 303 | 10.8 | 14.3 | 17.8 | 21.3 | 24.9 | 28.4 | 31.9 |
| | -5°C | 5 | | 85.8 | 1268 | 243 | .440 | 282 | 10.4 | 14.4 | 18.3 | 22.2 | 26.2 | 30.1 | 34.1 |
| | | 3 | (2) | 81.8 | 1093 | 218 | .39 | 253 | 9.4 | 14.0 | 18.5 | 23.1 | 27.7 | 32.3 | 36.8 |
| | ISA-10°C | -3 | (1) | 90.1 | 1541 | 277 | .50 | 315 | 10.7 | 13.9 | 17.2 | 20.4 | 23.7 | 26.9 | 30.2 |
| | -15°C | -5 | | 85.1 | 1280 | 249 | .450 | 283 | 10.4 | 14.3 | 18.2 | 22.1 | 26.0 | 29.9 | 33.8 |
| | | -7 | (2) | 80.4 | 1067 | 218 | .39 | 248 | 9.2 | 13.9 | 18.6 | 23.3 | 28.0 | 32.6 | 37.3 |
| 19000. | ISA+20°C | 24 | (1) | 85.1 | 1166 | 223 | .40 | 269 | 10.2 | 14.5 | 18.8 | 23.0 | 27.3 | 31.6 | 35.9 |
| | 15°C | 24 | | 84.7 | 1151 | 221 | .400 | 266 | 10.1 | 14.4 | 18.8 | 23.1 | 27.4 | 31.8 | 36.1 |
| | | 23 | (2) | 83.4 | 1098 | 213 | .39 | 257 | 9.7 | 14.3 | 18.8 | 23.4 | 27.9 | 32.5 | 37.0 |
| | ISA+10°C | 15 | (1) | 87.1 | 1292 | 244 | .44 | 289 | 10.7 | 14.6 | 18.5 | 22.3 | 26.2 | 30.1 | 34.0 |
| | 5°C | 14 | | 85.1 | 1200 | 232 | .420 | 274 | 10.4 | 14.5 | 18.7 | 22.9 | 27.0 | 31.2 | 35.4 |
| | | 13 | (2) | 82.0 | 1072 | 213 | .39 | 252 | 9.5 | 14.2 | 18.8 | 23.5 | 28.2 | 32.8 | 37.5 |
| | ISA+ 0°C | 6 | (1) | 88.6 | 1418 | 263 | .48 | 304 | 10.9 | 14.4 | 17.9 | 21.5 | 25.0 | 28.5 | 32.0 |
| | -5°C | 4 | | 84.6 | 1209 | 238 | .430 | 276 | 10.4 | 14.5 | 18.7 | 22.8 | 26.9 | 31.1 | 35.2 |
| | | 3 | (2) | 80.6 | 1046 | 213 | .39 | 248 | 9.3 | 14.1 | 18.9 | 23.7 | 28.4 | 33.2 | 38.0 |
| | ISA-10°C | -3 | (1) | 90.0 | 1539 | 278 | .50 | 315 | 10.8 | 14.0 | 17.3 | 20.5 | 23.7 | 27.0 | 30.2 |
| | -15°C | -5 | | 84.7 | 1264 | 249 | .450 | 283 | 10.5 | 14.5 | 18.4 | 22.4 | 26.3 | 30.3 | 34.2 |
| | | -8 | (2) | 79.2 | 1020 | 213 | .39 | 243 | 9.1 | 14.0 | 18.9 | 23.8 | 28.7 | 33.6 | 38.5 |
| 18000. | ISA+20°C | 24 | (1) | 85.0 | 1162 | 225 | .41 | 271 | 10.4 | 14.7 | 19.0 | 23.3 | 27.6 | 31.9 | 36.2 |
| | 15°C | 24 | | 84.2 | 1132 | 221 | .400 | 266 | 10.2 | 14.7 | 19.1 | 23.5 | 27.9 | 32.3 | 36.7 |
| | | 23 | (2) | 82.6 | 1068 | 212 | .38 | 255 | 9.8 | 14.5 | 19.2 | 23.8 | 28.5 | 33.2 | 37.9 |
| | ISA+10°C | 15 | (1) | 87.1 | 1293 | 246 | .45 | 291 | 10.9 | 14.8 | 18.6 | 22.5 | 26.4 | 30.3 | 34.1 |
| | 5°C | 14 | | 84.7 | 1184 | 232 | .420 | 274 | 10.5 | 14.7 | 18.9 | 23.2 | 27.4 | 31.6 | 35.8 |
| | | 13 | (2) | 81.2 | 1041 | 211 | .38 | 250 | 9.6 | 14.4 | 19.2 | 24.0 | 28.8 | 33.6 | 38.4 |
| | ISA+ 0°C | 6 | (1) | 88.6 | 1419 | 264 | .48 | 306 | 11.0 | 14.5 | 18.1 | 21.6 | 25.1 | 28.6 | 32.1 |
| | -5°C | 4 | | 84.2 | 1193 | 238 | .430 | 276 | 10.5 | 14.7 | 18.9 | 23.1 | 27.3 | 31.5 | 35.7 |
| | | 2 | (2) | 79.8 | 1016 | 211 | .38 | 246 | 9.4 | 14.3 | 19.2 | 24.2 | 29.1 | 34.0 | 38.9 |
| | ISA-10°C | -3 | (1) | 90.1 | 1541 | 279 | .50 | 317 | 10.8 | 14.1 | 17.3 | 20.6 | 23.8 | 27.0 | 30.3 |
| | -15°C | -6 | | 83.6 | 1206 | 243 | .440 | 277 | 10.5 | 14.7 | 18.8 | 23.0 | 27.1 | 31.2 | 35.4 |
| | | -8 | (2) | 78.3 | 987 | 211 | .38 | 240 | 9.1 | 14.2 | 19.3 | 24.3 | 29.4 | 34.5 | 39.5 |
| 17000. | ISA+20°C | 24 | (1) | 84.9 | 1162 | 228 | .41 | 274 | 10.7 | 15.0 | 19.3 | 23.6 | 27.9 | 32.2 | 36.5 |
| | 15°C | 24 | | 83.7 | 1115 | 221 | .400 | 266 | 10.4 | 14.9 | 19.4 | 23.9 | 28.3 | 32.8 | 37.3 |
| | | 23 | (2) | 82.0 | 1045 | 211 | .38 | 254 | 10.0 | 14.7 | 19.5 | 24.3 | 29.1 | 33.9 | 38.6 |
| | ISA+10°C | 15 | (1) | 87.1 | 1293 | 248 | .45 | 293 | 11.1 | 14.9 | 18.8 | 22.7 | 26.5 | 30.4 | 34.3 |
| | 5°C | 14 | | 84.3 | 1168 | 232 | .420 | 274 | 10.6 | 14.9 | 19.2 | 23.5 | 27.8 | 32.0 | 36.3 |
| | | 13 | (2) | 80.6 | 1019 | 211 | .38 | 249 | 9.8 | 14.7 | 19.6 | 24.5 | 29.4 | 34.3 | 39.2 |
| | ISA+ 0°C | 7 | (1) | 88.6 | 1418 | 266 | .48 | 308 | 11.1 | 14.6 | 18.2 | 21.7 | 25.2 | 28.8 | 32.3 |
| | -5°C | 4 | | 83.8 | 1179 | 238 | .430 | 276 | 10.7 | 14.9 | 19.1 | 23.4 | 27.6 | 31.9 | 36.1 |
| | | 2 | (2) | 79.2 | 994 | 211 | .38 | 245 | 9.5 | 14.6 | 19.6 | 24.6 | 29.7 | 34.7 | 39.7 |
| | ISA-10°C | -3 | (1) | 90.0 | 1539 | 280 | .51 | 318 | 10.9 | 14.1 | 17.4 | 20.6 | 23.9 | 27.1 | 30.4 |
| | -15°C | -5 | | 84.2 | 1236 | 249 | .450 | 283 | 10.8 | 14.8 | 18.9 | 22.9 | 26.9 | 31.0 | 35.0 |
| | | -8 | (2) | 77.7 | 967 | 210 | .38 | 240 | 9.3 | 14.4 | 19.6 | 24.8 | 30.0 | 35.1 | 40.3 |
| 16500. | ISA+20°C | 24 | (1) | 84.9 | 1160 | 228 | .41 | 275 | 10.8 | 15.1 | 19.4 | 23.7 | 28.0 | 32.3 | 36.6 |
| | 15°C | 24 | | 83.5 | 1106 | 221 | .400 | 266 | 10.5 | 15.0 | 19.5 | 24.0 | 28.6 | 33.1 | 37.6 |
| | | 23 | (2) | 81.6 | 1030 | 210 | .38 | 253 | 10.0 | 14.8 | 19.7 | 24.5 | 29.4 | 34.3 | 39.1 |
| | ISA+10°C | 16 | (1) | 87.1 | 1294 | 249 | .45 | 294 | 11.1 | 15.0 | 18.9 | 22.7 | 26.6 | 30.5 | 34.3 |
| | 5°C | 14 | | 84.1 | 1160 | 232 | .420 | 274 | 10.7 | 15.0 | 19.3 | 23.6 | 28.0 | 32.3 | 36.6 |
| | | 13 | (2) | 80.2 | 1005 | 210 | .38 | 248 | 9.8 | 14.8 | 19.7 | 24.7 | 29.7 | 34.7 | 39.6 |
| | ISA+ 0°C | 7 | (1) | 88.6 | 1421 | 267 | .48 | 309 | 11.2 | 14.7 | 18.2 | 21.7 | 25.3 | 28.8 | 32.3 |
| | -5°C | 4 | | 83.7 | 1173 | 238 | .430 | 276 | 10.7 | 15.0 | 19.2 | 23.5 | 27.8 | 32.0 | 36.3 |
| | | 2 | (2) | 78.8 | 980 | 210 | .38 | 244 | 9.6 | 14.7 | 19.8 | 24.9 | 30.0 | 35.1 | 40.2 |
| | ISA-10°C | -3 | (1) | 90.0 | 1539 | 280 | .51 | 318 | 10.9 | 14.2 | 17.4 | 20.7 | 23.9 | 27.2 | 30.4 |
| | -15°C | -6 | | 83.1 | 1184 | 243 | .440 | 277 | 10.7 | 14.9 | 19.1 | 23.4 | 27.6 | 31.8 | 36.0 |
| | | -8 | (2) | 77.3 | 954 | 210 | .38 | 239 | 9.3 | 14.6 | 19.8 | 25.0 | 30.3 | 35.5 | 40.8 |
| 16000. | ISA+20°C | 24 | (1) | 84.9 | 1161 | 230 | .42 | 276 | 10.9 | 15.2 | 19.5 | 23.8 | 28.1 | 32.4 | 36.7 |
| | 15°C | 24 | | 83.3 | 1098 | 221 | .400 | 266 | 10.6 | 15.1 | 19.7 | 24.2 | 28.8 | 33.3 | 37.9 |
| | | 23 | (2) | 81.0 | 1010 | 208 | .38 | 250 | 9.9 | 14.9 | 19.8 | 24.8 | 29.8 | 34.7 | 39.7 |
| | ISA+10°C | 16 | (1) | 87.1 | 1291 | 250 | .45 | 295 | 11.2 | 15.1 | 19.0 | 22.8 | 26.7 | 30.6 | 34.4 |
| | 5°C | 14 | | 83.9 | 1153 | 232 | .420 | 274 | 10.8 | 15.1 | 19.5 | 23.8 | 28.1 | 32.5 | 36.8 |
| | | 12 | (2) | 79.7 | 987 | 208 | .38 | 247 | 9.8 | 14.8 | 19.9 | 25.0 | 30.0 | 35.1 | 40.2 |
| | ISA+ 0°C | 7 | (1) | 88.6 | 1420 | 267 | .48 | 309 | 11.2 | 14.7 | 18.3 | 21.8 | 25.3 | 28.8 | 32.3 |
| | -5°C | 4 | | 83.5 | 1166 | 238 | .430 | 276 | 10.8 | 15.1 | 19.3 | 23.6 | 27.9 | 32.2 | 36.5 |
| | | 2 | (2) | 78.4 | 965 | 209 | .38 | 242 | 9.6 | 14.8 | 19.9 | 25.1 | 30.3 | 35.5 | 40.7 |
| | ISA-10°C | -3 | (1) | 90.0 | 1543 | 281 | .51 | 319 | 10.9 | 14.2 | 17.4 | 20.7 | 23.9 | 27.1 | 30.4 |
| | -15°C | -6 | | 83.0 | 1178 | 243 | .440 | 277 | 10.8 | 15.0 | 19.2 | 23.5 | 27.7 | 32.0 | 36.2 |
| | | -8 | (2) | 77.0 | 941 | 209 | .38 | 238 | 9.3 | 14.7 | 20.0 | 25.3 | 30.6 | 35.9 | 41.2 |
| 14000. | ISA+20°C | 25 | (1) | 84.8 | 1157 | 233 | .42 | 280 | 11.2 | 15.5 | 19.9 | 24.2 | 28.5 | 32.8 | 37.1 |
| | 15°C | 23 | | 81.4 | 1028 | 215 | .390 | 259 | 10.6 | 15.5 | 20.4 | 25.2 | 30.1 | 34.9 | 39.8 |
| | | 22 | (2) | 77.4 | 900 | 194 | .35 | 234 | 9.3 | 14.9 | 20.4 | 26.0 | 31.5 | 37.1 | 42.6 |
| | ISA+10°C | 16 | (1) | 87.0 | 1290 | 252 | .46 | 298 | 11.5 | 15.3 | 19.2 | 23.1 | 27.0 | 30.8 | 34.7 |
| | 5°C | 14 | | 82.2 | 1083 | 226 | .410 | 268 | 10.9 | 15.5 | 20.1 | 24.7 | 29.3 | 34.0 | 38.6 |
| | | 12 | (2) | 76.2 | 883 | 195 | .35 | 230 | 9.1 | 14.8 | 20.4 | 26.1 | 31.8 | 37.4 | 43.1 |
| | ISA+ 0°C | 7 | (1) | 88.5 | 1418 | 269 | .49 | 312 | 11.4 | 14.9 | 18.5 | 22.0 | 25.5 | 29.0 | 32.6 |
| | -5°C | 4 | | 81.8 | 1098 | 232 | .420 | 269 | 10.9 | 15.4 | 20.0 | 24.5 | 29.1 | 33.6 | 38.2 |
| | | 1 | (2) | 74.9 | 860 | 195 | .35 | 226 | 8.8 | 14.7 | 20.5 | 26.3 | 32.1 | 37.9 | 43.7 |
| | ISA-10°C | -3 | (1) | 90.0 | 1541 | 282 | .51 | 320 | 11.0 | 14.3 | 17.5 | 20.8 | 24.0 | 27.3 | 30.5 |
| | -15°C | -6 | | 81.4 | 1113 | 238 | .430 | 270 | 10.8 | 15.3 | 19.8 | 24.3 | 28.8 | 33.3 | 37.8 |
| | | -9 | (2) | 73.6 | 840 | 195 | .35 | 222 | 8.6 | 14.5 | 20.5 | 26.4 | 32.4 | 38.3 | 44.3 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 2)

# CRUISE
# 15,000 FEET

**ANTI-ICE SYSTEMS OFF** | **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
| 20000. | ISA+10°C | 5 | (1) | 88.4 | 1164 | 227 | .45 | 290 | 12.0 | 16.3 | 20.6 | 24.9 | 29.2 | 33.5 | 37.8 |
| | -5°C | 5 | | 87.3 | 1120 | 221 | .440 | 282 | 11.8 | 16.3 | 20.7 | 25.2 | 29.6 | 34.1 | 38.6 |
| | | 4 | (2) | 86.6 | 1088 | 216 | .43 | 276 | 11.6 | 16.2 | 20.8 | 25.4 | 30.0 | 34.6 | 39.2 |
| | ISA+ 0°C | -3 | (1) | 89.7 | 1262 | 245 | .49 | 307 | 12.4 | 16.4 | 20.3 | 24.3 | 28.3 | 32.2 | 36.2 |
| | -15°C | -5 | | 87.4 | 1159 | 231 | .460 | 289 | 12.0 | 16.3 | 20.7 | 25.0 | 29.3 | 33.6 | 37.9 |
| | | -6 | (2) | 85.1 | 1060 | 216 | .43 | 271 | 11.4 | 16.1 | 20.8 | 25.5 | 30.2 | 35.0 | 39.7 |
| | ISA-10°C | -13 | (1) | 91.2 | 1377 | 260 | .52 | 318 | 12.2 | 15.8 | 19.4 | 23.1 | 26.7 | 30.3 | 34.0 |
| | -25°C | -15 | | 86.6 | 1164 | 236 | .470 | 290 | 12.0 | 16.3 | 20.6 | 24.9 | 29.2 | 33.5 | 37.8 |
| | | -16 | (2) | 83.4 | 1032 | 216 | .43 | 265 | 11.2 | 16.0 | 20.9 | 25.7 | 30.5 | 35.4 | 40.2 |
| 19000. | ISA+10°C | 6 | (1) | 88.3 | 1164 | 230 | .46 | 293 | 12.3 | 16.6 | 20.9 | 25.2 | 29.5 | 33.8 | 38.1 |
| | -5°C | 5 | | 86.8 | 1100 | 221 | .440 | 282 | 12.0 | 16.5 | 21.1 | 25.6 | 30.2 | 34.7 | 39.3 |
| | | 4 | (2) | 85.6 | 1047 | 213 | .42 | 272 | 11.6 | 16.4 | 21.2 | 26.0 | 30.7 | 35.5 | 40.3 |
| | ISA+ 0°C | -3 | (1) | 89.7 | 1262 | 247 | .49 | 309 | 12.6 | 16.5 | 20.5 | 24.5 | 28.4 | 32.4 | 36.3 |
| | -15°C | -5 | | 87.0 | 1141 | 231 | .460 | 289 | 12.2 | 16.6 | 21.0 | 25.4 | 29.7 | 34.1 | 38.5 |
| | | -6 | (2) | 84.0 | 1019 | 212 | .42 | 266 | 11.4 | 16.3 | 21.2 | 26.1 | 31.0 | 35.9 | 40.9 |
| | ISA-10°C | -13 | (1) | 91.2 | 1376 | 261 | .52 | 319 | 12.3 | 15.9 | 19.6 | 23.2 | 26.8 | 30.4 | 34.1 |
| | -25°C | -15 | | 86.2 | 1147 | 236 | .470 | 290 | 12.2 | 16.5 | 20.9 | 25.3 | 29.6 | 34.0 | 38.3 |
| | | -17 | (2) | 82.5 | 992 | 212 | .42 | 261 | 11.2 | 16.2 | 21.3 | 26.3 | 31.3 | 36.4 | 41.4 |
| 18000. | ISA+20°C | 15 | (1) | 86.8 | 1058 | 214 | .43 | 278 | 12.1 | 16.8 | 21.5 | 26.3 | 31.0 | 35.7 | 40.4 |
| | 5°C | 14 | | 86.3 | 1042 | 211 | .420 | 274 | 11.9 | 16.7 | 21.5 | 26.3 | 31.1 | 35.9 | 40.7 |
| | | 14 | (2) | 86.1 | 1031 | 209 | .42 | 272 | 11.9 | 16.7 | 21.6 | 26.4 | 31.3 | 36.1 | 41.0 |
| | ISA+10°C | 6 | (1) | 88.3 | 1165 | 233 | .46 | 297 | 12.6 | 16.9 | 21.2 | 25.5 | 29.7 | 34.0 | 38.3 |
| | -5°C | 5 | | 86.4 | 1082 | 221 | .440 | 282 | 12.2 | 16.8 | 21.5 | 26.1 | 30.7 | 35.3 | 39.9 |
| | | 4 | (2) | 84.6 | 1007 | 210 | .42 | 268 | 11.7 | 16.7 | 21.6 | 26.6 | 31.6 | 36.5 | 41.5 |
| | ISA+ 0°C | -3 | (1) | 89.7 | 1265 | 249 | .49 | 311 | 12.7 | 16.7 | 20.6 | 24.6 | 28.5 | 32.5 | 36.4 |
| | -15°C | -5 | | 86.5 | 1124 | 231 | .460 | 289 | 12.4 | 16.8 | 21.3 | 25.7 | 30.2 | 34.6 | 39.1 |
| | | -6 | (2) | 83.2 | 985 | 210 | .42 | 263 | 11.5 | 16.6 | 21.7 | 26.7 | 31.8 | 36.9 | 42.0 |
| | ISA-10°C | -12 | (1) | 91.2 | 1377 | 262 | .52 | 321 | 12.4 | 16.0 | 19.6 | 23.3 | 26.9 | 30.5 | 34.2 |
| | -25°C | -15 | | 85.8 | 1132 | 236 | .470 | 290 | 12.4 | 16.8 | 21.2 | 25.6 | 30.0 | 34.4 | 38.9 |
| | | -17 | (2) | 81.6 | 960 | 210 | .42 | 258 | 11.3 | 16.5 | 21.7 | 26.9 | 32.1 | 37.3 | 42.5 |
| 17000. | ISA+20°C | 15 | (1) | 86.6 | 1054 | 216 | .43 | 281 | 12.4 | 17.2 | 21.9 | 26.6 | 31.4 | 36.1 | 40.9 |
| | 5°C | 14 | | 85.8 | 1022 | 211 | .420 | 274 | 12.2 | 17.1 | 22.0 | 26.8 | 31.7 | 36.6 | 41.5 |
| | | 14 | (2) | 84.3 | 970 | 202 | .40 | 263 | 11.7 | 16.8 | 22.0 | 27.1 | 32.3 | 37.4 | 42.6 |
| | ISA+10°C | 6 | (1) | 88.3 | 1166 | 235 | .47 | 299 | 12.8 | 17.1 | 21.4 | 25.7 | 30.0 | 34.3 | 38.5 |
| | -5°C | 5 | | 85.9 | 1064 | 221 | .440 | 282 | 12.4 | 17.1 | 21.8 | 26.5 | 31.2 | 35.9 | 40.6 |
| | | 3 | (2) | 82.9 | 948 | 202 | .40 | 259 | 11.5 | 16.7 | 22.0 | 27.3 | 32.6 | 37.8 | 43.1 |
| | ISA+ 0°C | -3 | (1) | 89.6 | 1262 | 250 | .50 | 312 | 12.8 | 16.8 | 20.8 | 24.7 | 28.7 | 32.6 | 36.6 |
| | -15°C | -5 | | 85.2 | 1072 | 226 | .450 | 283 | 12.4 | 17.1 | 21.7 | 26.4 | 31.1 | 35.7 | 40.4 |
| | | -7 | (2) | 81.4 | 925 | 203 | .40 | 254 | 11.3 | 16.7 | 22.1 | 27.5 | 32.9 | 38.3 | 43.7 |
| | ISA-10°C | -12 | (1) | 91.1 | 1378 | 263 | .52 | 322 | 12.5 | 16.1 | 19.7 | 23.4 | 27.0 | 30.6 | 34.2 |
| | -25°C | -15 | | 85.4 | 1117 | 236 | .470 | 290 | 12.5 | 17.0 | 21.5 | 25.9 | 30.4 | 34.9 | 39.4 |
| | | -17 | (2) | 79.9 | 902 | 203 | .40 | 249 | 11.0 | 16.5 | 22.1 | 27.6 | 33.2 | 38.7 | 44.3 |
| 16500. | ISA+20°C | 15 | (1) | 86.6 | 1054 | 217 | .43 | 283 | 12.6 | 17.3 | 22.1 | 26.8 | 31.5 | 36.3 | 41.0 |
| | 5°C | 14 | | 85.6 | 1013 | 211 | .420 | 274 | 12.3 | 17.2 | 22.1 | 27.1 | 32.0 | 36.9 | 41.9 |
| | | 13 | (2) | 83.4 | 940 | 199 | .40 | 259 | 11.6 | 16.9 | 22.2 | 27.5 | 32.8 | 38.1 | 43.5 |
| | ISA+10°C | 6 | (1) | 88.2 | 1165 | 236 | .47 | 301 | 12.9 | 17.2 | 21.5 | 25.8 | 30.1 | 34.4 | 38.7 |
| | -5°C | 4 | | 84.9 | 1021 | 216 | .430 | 276 | 12.3 | 17.2 | 22.1 | 27.0 | 31.9 | 36.8 | 41.7 |
| | | 3 | (2) | 82.0 | 918 | 199 | .40 | 254 | 11.3 | 16.8 | 22.2 | 27.7 | 33.1 | 38.6 | 44.0 |
| | ISA+ 0°C | -3 | (1) | 89.6 | 1262 | 250 | .50 | 313 | 12.9 | 16.9 | 20.8 | 24.8 | 28.7 | 32.7 | 36.7 |
| | -15°C | -5 | | 85.0 | 1065 | 226 | .450 | 283 | 12.5 | 17.2 | 21.9 | 26.6 | 31.3 | 36.0 | 40.7 |
| | | -7 | (2) | 80.5 | 896 | 199 | .40 | 250 | 11.1 | 16.7 | 22.3 | 27.8 | 33.4 | 39.0 | 44.6 |
| | ISA-10°C | -12 | (1) | 91.2 | 1381 | 264 | .52 | 323 | 12.5 | 16.1 | 19.7 | 23.4 | 27.0 | 30.6 | 34.2 |
| | -25°C | -15 | | 84.3 | 1073 | 231 | .460 | 284 | 12.5 | 17.1 | 21.8 | 26.4 | 31.1 | 35.8 | 40.4 |
| | | -18 | (2) | 79.0 | 873 | 199 | .40 | 245 | 10.8 | 16.6 | 22.3 | 28.0 | 33.7 | 39.5 | 45.2 |
| 16000. | ISA+20°C | 15 | (1) | 86.7 | 1057 | 219 | .44 | 285 | 12.7 | 17.5 | 22.2 | 26.9 | 31.7 | 36.4 | 41.1 |
| | 5°C | 14 | | 85.3 | 1004 | 211 | .420 | 274 | 12.4 | 17.4 | 22.3 | 27.3 | 32.3 | 37.3 | 42.2 |
| | | 13 | (2) | 82.7 | 916 | 196 | .39 | 255 | 11.5 | 17.0 | 22.4 | 27.9 | 33.4 | 38.8 | 44.3 |
| | ISA+10°C | 6 | (1) | 88.2 | 1165 | 237 | .47 | 302 | 13.0 | 17.3 | 21.6 | 25.9 | 30.2 | 34.5 | 38.8 |
| | -5°C | 4 | | 84.7 | 1012 | 216 | .430 | 276 | 12.4 | 17.4 | 22.3 | 27.2 | 32.2 | 37.1 | 42.1 |
| | | 3 | (2) | 81.2 | 893 | 196 | .39 | 251 | 11.3 | 16.9 | 22.5 | 28.1 | 33.7 | 39.3 | 44.9 |
| | ISA+ 0°C | -3 | (1) | 89.6 | 1262 | 251 | .50 | 313 | 12.9 | 16.9 | 20.9 | 24.8 | 28.8 | 32.8 | 36.7 |
| | -15°C | -5 | | 84.8 | 1057 | 226 | .450 | 283 | 12.6 | 17.3 | 22.1 | 26.8 | 31.5 | 36.2 | 41.0 |
| | | -7 | (2) | 79.7 | 870 | 196 | .39 | 246 | 11.0 | 16.8 | 22.5 | 28.2 | 34.0 | 39.7 | 45.5 |
| | ISA-10°C | -12 | (1) | 91.2 | 1380 | 264 | .52 | 323 | 12.6 | 16.2 | 19.8 | 23.4 | 27.0 | 30.7 | 34.3 |
| | -25°C | -15 | | 84.1 | 1066 | 231 | .460 | 284 | 12.5 | 17.2 | 21.9 | 26.6 | 31.3 | 36.0 | 40.7 |
| | | -18 | (2) | 78.3 | 849 | 196 | .39 | 241 | 10.7 | 16.6 | 22.5 | 28.4 | 34.3 | 40.2 | 46.1 |
| 14000. | ISA+20°C | 15 | (1) | 86.6 | 1056 | 223 | .44 | 290 | 13.2 | 18.0 | 22.7 | 27.5 | 32.2 | 36.9 | 41.7 |
| | 5°C | 14 | | 84.3 | 973 | 211 | .420 | 274 | 12.8 | 17.9 | 23.1 | 28.2 | 33.3 | 38.5 | 43.6 |
| | | 13 | (2) | 80.6 | 852 | 192 | .38 | 250 | 11.7 | 17.6 | 23.4 | 29.3 | 35.2 | 41.0 | 46.9 |
| | ISA+10°C | 7 | (1) | 88.2 | 1167 | 240 | .48 | 306 | 13.4 | 17.7 | 22.0 | 26.2 | 30.5 | 34.8 | 39.1 |
| | -5°C | 4 | | 83.8 | 982 | 216 | .430 | 276 | 12.8 | 17.9 | 23.0 | 28.1 | 33.2 | 38.3 | 43.4 |
| | | 2 | (2) | 79.2 | 829 | 191 | .38 | 245 | 11.4 | 17.5 | 23.5 | 29.5 | 35.5 | 41.6 | 47.6 |
| | ISA+ 0°C | -3 | (1) | 89.6 | 1263 | 253 | .50 | 316 | 13.1 | 17.1 | 21.1 | 25.0 | 29.0 | 32.9 | 36.9 |
| | -15°C | -6 | | 83.2 | 991 | 221 | .440 | 277 | 12.8 | 17.8 | 22.9 | 27.9 | 33.0 | 38.0 | 43.0 |
| | | -8 | (2) | 77.6 | 806 | 191 | .38 | 240 | 11.1 | 17.3 | 23.5 | 29.7 | 35.9 | 42.1 | 48.3 |
| | ISA-10°C | -12 | (1) | 91.1 | 1380 | 266 | .53 | 325 | 12.7 | 16.3 | 20.0 | 23.6 | 27.2 | 30.8 | 34.4 |
| | -25°C | -15 | | 83.4 | 1039 | 231 | .460 | 284 | 12.9 | 17.7 | 22.5 | 27.3 | 32.1 | 36.9 | 41.7 |
| | | -18 | (2) | 76.1 | 784 | 191 | .38 | 235 | 10.8 | 17.2 | 23.5 | 29.9 | 36.3 | 42.7 | 49.0 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM
RANGE (APPROXIMATE)

Figure 7-15 (Sheet 3)

# CRUISE
# 17,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+10°C | 1 | (1) | 88.8 | 1107 | 220 | .46 | 290 | 12.6 | 17.1 | 21.7 | 26.2 | 30.7 | 35.2 | 39.7 |
| | | 1 | (2) | 88.4 | 1088 | 217 | .45 | 286 | 12.5 | 17.1 | 21.7 | 26.3 | 30.9 | 35.5 | 40.0 |
| | ISA+ 0°C | -7 | (1) | 90.2 | 1202 | 238 | .49 | 307 | 13.1 | 17.2 | 21.4 | 25.6 | 29.7 | 33.9 | 38.0 |
| | -19°C | -8 | | 88.4 | 1122 | 227 | .470 | 293 | 12.8 | 17.2 | 21.7 | 26.1 | 30.6 | 35.0 | 39.5 |
| | | -9 | (2) | 86.8 | 1062 | 217 | .45 | 281 | 12.3 | 17.0 | 21.7 | 26.4 | 31.1 | 35.8 | 40.5 |
| | ISA-10°C | -17 | (1) | 91.8 | 1313 | 252 | .52 | 318 | 12.8 | 16.6 | 20.4 | 24.2 | 28.0 | 31.8 | 35.7 |
| | -29°C | -18 | | 88.3 | 1160 | 237 | .490 | 300 | 12.9 | 17.2 | 21.5 | 25.8 | 30.1 | 34.4 | 38.7 |
| | | -20 | (2) | 85.2 | 1034 | 217 | .45 | 275 | 12.1 | 16.9 | 21.8 | 26.6 | 31.4 | 36.3 | 41.1 |
| 19000. | ISA+10°C | 2 | (1) | 88.8 | 1107 | 223 | .46 | 294 | 13.0 | 17.5 | 22.0 | 26.5 | 31.0 | 35.6 | 40.1 |
| | -9°C | 1 | | 87.8 | 1069 | 217 | .450 | 286 | 12.8 | 17.4 | 22.1 | 26.8 | 31.5 | 36.1 | 40.8 |
| | | 1 | (2) | 86.8 | 1033 | 211 | .44 | 278 | 12.4 | 17.3 | 22.1 | 27.0 | 31.8 | 36.6 | 41.5 |
| | ISA+ 0°C | -7 | (1) | 90.2 | 1204 | 240 | .50 | 310 | 13.3 | 17.4 | 21.6 | 25.7 | 29.9 | 34.0 | 38.2 |
| | -19°C | -8 | | 87.9 | 1104 | 227 | .470 | 293 | 13.0 | 17.5 | 22.0 | 26.6 | 31.1 | 35.6 | 40.1 |
| | | -10 | (2) | 85.3 | 1007 | 211 | .44 | 273 | 12.2 | 17.2 | 22.2 | 27.1 | 32.1 | 37.0 | 42.0 |
| | ISA-10°C | -16 | (1) | 91.7 | 1313 | 253 | .52 | 320 | 12.9 | 16.7 | 20.5 | 24.3 | 28.2 | 32.0 | 35.8 |
| | -29°C | -18 | | 87.0 | 1108 | 232 | .480 | 294 | 13.0 | 17.5 | 22.0 | 26.5 | 31.0 | 35.5 | 40.0 |
| | | -20 | (2) | 83.6 | 980 | 211 | .44 | 267 | 12.0 | 17.1 | 22.2 | 27.3 | 32.4 | 37.5 | 42.6 |
| 18000. | ISA+20°C | 11 | (1) | 87.3 | 1017 | 208 | .43 | 280 | 12.7 | 17.7 | 22.6 | 27.5 | 32.4 | 37.3 | 42.3 |
| | | 11 | (2) | 87.1 | 1007 | 206 | .43 | 277 | 12.7 | 17.6 | 22.6 | 27.6 | 32.5 | 37.5 | 42.5 |
| | ISA+10°C | 2 | (1) | 88.8 | 1109 | 226 | .47 | 298 | 13.3 | 17.8 | 22.3 | 26.8 | 31.3 | 35.8 | 40.4 |
| | -9°C | 1 | | 87.3 | 1050 | 217 | .450 | 286 | 13.0 | 17.8 | 22.5 | 27.3 | 32.0 | 36.8 | 41.6 |
| | | 0 | (2) | 85.5 | 980 | 206 | .43 | 272 | 12.4 | 17.5 | 22.6 | 27.7 | 32.8 | 37.9 | 43.0 |
| | ISA+ 0°C | -7 | (1) | 90.2 | 1206 | 242 | .50 | 312 | 13.4 | 17.6 | 21.7 | 25.8 | 30.0 | 34.1 | 38.3 |
| | -19°C | -8 | | 87.4 | 1087 | 227 | .470 | 293 | 13.2 | 17.8 | 22.4 | 27.0 | 31.6 | 36.2 | 40.8 |
| | | -10 | (2) | 84.0 | 957 | 207 | .43 | 267 | 12.2 | 17.5 | 22.7 | 27.9 | 33.1 | 38.4 | 43.6 |
| | ISA-10°C | -16 | (1) | 91.7 | 1311 | 254 | .53 | 321 | 13.1 | 16.9 | 20.7 | 24.5 | 28.3 | 32.1 | 35.9 |
| | -29°C | -18 | | 86.6 | 1092 | 232 | .480 | 294 | 13.1 | 17.7 | 22.3 | 26.9 | 31.5 | 36.0 | 40.6 |
| | | -20 | (2) | 82.4 | 933 | 207 | .43 | 262 | 12.0 | 17.4 | 22.7 | 28.1 | 33.4 | 38.8 | 44.2 |
| 17000. | ISA+20°C | 11 | (1) | 87.3 | 1018 | 212 | .44 | 284 | 13.2 | 18.1 | 23.0 | 27.9 | 32.8 | 37.7 | 42.6 |
| | 1°C | 11 | | 86.7 | 994 | 208 | .430 | 279 | 13.0 | 18.0 | 23.0 | 28.0 | 33.1 | 38.1 | 43.1 |
| | | 10 | (2) | 86.1 | 968 | 203 | .42 | 273 | 12.7 | 17.9 | 23.1 | 28.2 | 33.4 | 38.6 | 43.7 |
| | ISA+10°C | 2 | (1) | 88.7 | 1107 | 228 | .47 | 300 | 13.6 | 18.1 | 22.6 | 27.1 | 31.6 | 36.1 | 40.7 |
| | -9°C | 1 | | 86.7 | 1032 | 217 | .450 | 286 | 13.2 | 18.1 | 22.9 | 27.8 | 32.6 | 37.5 | 42.3 |
| | | 0 | (2) | 84.5 | 944 | 203 | .42 | 268 | 12.5 | 17.8 | 23.1 | 28.4 | 33.7 | 39.0 | 44.3 |
| | ISA+ 0°C | -7 | (1) | 90.1 | 1203 | 243 | .50 | 313 | 13.6 | 17.7 | 21.9 | 26.0 | 30.2 | 34.3 | 38.5 |
| | -19°C | -9 | | 86.0 | 1037 | 222 | .460 | 287 | 13.2 | 18.0 | 22.9 | 27.7 | 32.5 | 37.3 | 42.1 |
| | | -10 | (2) | 83.0 | 920 | 203 | .42 | 263 | 12.3 | 17.7 | 23.2 | 28.6 | 34.0 | 39.5 | 44.9 |
| | ISA-10°C | -16 | (1) | 91.6 | 1313 | 256 | .53 | 323 | 13.2 | 17.0 | 20.8 | 24.6 | 28.4 | 32.2 | 36.0 |
| | -29°C | -18 | | 86.1 | 1077 | 232 | .480 | 294 | 13.3 | 18.0 | 22.6 | 27.3 | 31.9 | 36.6 | 41.2 |
| | | -21 | (2) | 81.4 | 895 | 203 | .42 | 258 | 12.0 | 17.6 | 23.2 | 28.8 | 34.4 | 40.0 | 45.5 |
| 16500. | ISA+20°C | 11 | (1) | 87.2 | 1013 | 212 | .44 | 285 | 13.3 | 18.3 | 23.2 | 28.1 | 33.1 | 38.0 | 42.9 |
| | 1°C | 11 | | 86.4 | 984 | 208 | .430 | 279 | 13.1 | 18.2 | 23.2 | 28.3 | 33.4 | 38.5 | 43.6 |
| | | 10 | (2) | 85.5 | 946 | 201 | .42 | 271 | 12.8 | 18.1 | 23.3 | 28.6 | 33.9 | 39.2 | 44.5 |
| | ISA+10°C | 2 | (1) | 88.7 | 1108 | 229 | .47 | 302 | 13.7 | 18.2 | 22.7 | 27.2 | 31.8 | 36.3 | 40.8 |
| | -9°C | 1 | | 86.5 | 1023 | 217 | .450 | 286 | 13.3 | 18.2 | 23.1 | 28.0 | 32.9 | 37.8 | 42.7 |
| | | 0 | (2) | 84.0 | 922 | 201 | .42 | 266 | 12.6 | 18.0 | 23.4 | 28.8 | 34.2 | 39.7 | 45.1 |
| | ISA+ 0°C | -7 | (1) | 90.1 | 1203 | 244 | .50 | 314 | 13.6 | 17.8 | 21.9 | 26.1 | 30.3 | 34.4 | 38.6 |
| | -19°C | -9 | | 85.8 | 1029 | 222 | .460 | 287 | 13.3 | 18.2 | 23.0 | 27.9 | 32.7 | 37.6 | 42.5 |
| | | -11 | (2) | 82.5 | 900 | 202 | .42 | 261 | 12.3 | 17.9 | 23.4 | 29.0 | 34.5 | 40.1 | 45.6 |
| | ISA-10°C | -16 | (1) | 91.6 | 1313 | 256 | .53 | 324 | 13.2 | 17.0 | 20.8 | 24.6 | 28.4 | 32.3 | 36.1 |
| | -29°C | -18 | | 85.9 | 1069 | 232 | .480 | 294 | 13.4 | 18.1 | 22.8 | 27.4 | 32.1 | 36.8 | 41.5 |
| | | -21 | (2) | 80.9 | 876 | 202 | .42 | 256 | 12.0 | 17.8 | 23.5 | 29.2 | 34.9 | 40.6 | 46.3 |
| 16000. | ISA+20°C | 11 | (1) | 87.2 | 1016 | 214 | .44 | 287 | 13.5 | 18.4 | 23.4 | 28.3 | 33.2 | 38.1 | 43.0 |
| | 1°C | 11 | | 86.2 | 975 | 208 | .430 | 279 | 13.2 | 18.3 | 23.5 | 28.6 | 33.7 | 38.9 | 44.0 |
| | | 10 | (2) | 84.5 | 915 | 198 | .41 | 266 | 12.6 | 18.1 | 23.6 | 29.0 | 34.5 | 40.0 | 45.4 |
| | ISA+10°C | 2 | (1) | 88.7 | 1111 | 231 | .48 | 304 | 13.8 | 18.3 | 22.8 | 27.3 | 31.8 | 36.3 | 40.8 |
| | -9°C | 1 | | 86.2 | 1014 | 217 | .450 | 286 | 13.4 | 18.4 | 23.3 | 28.2 | 33.2 | 38.1 | 43.0 |
| | | -1 | (2) | 83.1 | 895 | 198 | .41 | 261 | 12.5 | 18.0 | 23.6 | 29.2 | 34.8 | 40.4 | 46.0 |
| | ISA+ 0°C | -7 | (1) | 90.1 | 1203 | 244 | .50 | 315 | 13.7 | 17.9 | 22.0 | 26.2 | 30.3 | 34.5 | 38.6 |
| | -19°C | -9 | | 85.5 | 1022 | 222 | .460 | 287 | 13.4 | 18.3 | 23.2 | 28.1 | 33.0 | 37.9 | 42.8 |
| | | -11 | (2) | 81.7 | 874 | 199 | .41 | 257 | 12.2 | 18.0 | 23.7 | 29.4 | 35.1 | 40.8 | 46.5 |
| | ISA-10°C | -16 | (1) | 91.7 | 1315 | 257 | .53 | 324 | 13.3 | 17.1 | 20.9 | 24.7 | 28.5 | 32.3 | 36.1 |
| | -29°C | -19 | | 84.8 | 1028 | 227 | .470 | 287 | 13.4 | 18.2 | 23.1 | 28.0 | 32.8 | 37.7 | 42.5 |
| | | -21 | (2) | 80.1 | 852 | 199 | .41 | 252 | 12.0 | 17.8 | 23.7 | 29.6 | 35.4 | 41.3 | 47.2 |
| 14000. | ISA+20°C | 12 | (1) | 87.2 | 1016 | 219 | .45 | 293 | 14.1 | 19.0 | 24.0 | 28.9 | 33.8 | 38.7 | 43.6 |
| | 1°C | 10 | | 84.2 | 910 | 203 | .420 | 272 | 13.4 | 18.9 | 24.4 | 29.9 | 35.4 | 40.9 | 46.4 |
| | | 9 | (2) | 81.1 | 812 | 186 | .39 | 250 | 12.3 | 18.5 | 24.6 | 30.8 | 36.9 | 43.1 | 49.3 |
| | ISA+10°C | 3 | (1) | 88.6 | 1110 | 234 | .48 | 308 | 14.3 | 18.8 | 23.3 | 27.8 | 32.3 | 36.8 | 41.3 |
| | -9°C | 1 | | 84.6 | 949 | 212 | .440 | 280 | 13.7 | 19.0 | 24.2 | 29.5 | 34.8 | 40.0 | 45.3 |
| | | -1 | (2) | 79.6 | 792 | 186 | .39 | 245 | 12.1 | 18.4 | 24.7 | 31.0 | 37.3 | 43.6 | 49.9 |
| | ISA+ 0°C | -7 | (1) | 90.0 | 1204 | 247 | .51 | 318 | 13.9 | 18.1 | 22.2 | 26.4 | 30.6 | 34.7 | 38.9 |
| | -19°C | -9 | | 83.8 | 958 | 217 | .450 | 281 | 13.7 | 18.9 | 24.1 | 29.3 | 34.5 | 39.8 | 45.0 |
| | | -12 | (2) | 78.1 | 770 | 185 | .38 | 240 | 11.7 | 18.2 | 24.7 | 31.2 | 37.7 | 44.2 | 50.7 |
| | ISA-10°C | -16 | (1) | 91.6 | 1315 | 259 | .53 | 327 | 13.4 | 17.2 | 21.0 | 24.8 | 28.6 | 32.4 | 36.3 |
| | -29°C | -19 | | 83.1 | 967 | 222 | .460 | 281 | 13.6 | 18.8 | 23.9 | 29.1 | 34.3 | 39.5 | 44.6 |
| | | -22 | (2) | 76.5 | 748 | 185 | .38 | 235 | 11.4 | 18.0 | 24.7 | 31.4 | 38.1 | 44.8 | 51.4 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM
RANGE (APPROXIMATE)

Figure 7-15 (Sheet 4)

# CRUISE
# 19,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL: 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+ 0°C | -11 | (1) 90.6 | 1147 | 231 | .50 | 308 | 13.7 | 18.1 | 22.5 | 26.8 | 31.2 | 35.5 | 39.9 |
| | -23°C | -12 | 89.2 | 1086 | 223 | .480 | 297 | 13.5 | 18.2 | 22.8 | 27.4 | 32.0 | 36.6 | 41.2 |
| | | -13 | (2) 88.4 | 1051 | 217 | .47 | 289 | 13.3 | 18.0 | 22.8 | 27.5 | 32.3 | 37.0 | 41.8 |
| | ISA-10°C | -21 | (1) 92.1 | 1245 | 244 | .52 | 318 | 13.5 | 17.5 | 21.5 | 25.5 | 29.5 | 33.6 | 37.6 |
| | -33°C | -22 | 89.3 | 1130 | 232 | .500 | 303 | 13.6 | 18.0 | 22.4 | 26.8 | 31.3 | 35.7 | 40.1 |
| | | -23 | (2) 86.7 | 1024 | 217 | .47 | 284 | 13.0 | 17.9 | 22.8 | 27.7 | 32.6 | 37.5 | 42.3 |
| 19000. | ISA+10°C | -2 | (1) 89.2 | 1053 | 216 | .47 | 294 | 13.6 | 18.4 | 23.1 | 27.9 | 32.6 | 37.4 | 42.1 |
| | -13°C | -3 | 88.9 | 1037 | 214 | .460 | 290 | 13.5 | 18.4 | 23.2 | 28.0 | 32.8 | 37.7 | 42.5 |
| | | -3 | (2) 88.6 | 1029 | 212 | .46 | 288 | 13.4 | 18.3 | 23.2 | 28.0 | 32.9 | 37.7 | 42.6 |
| | ISA+ 0°C | -11 | (1) 90.6 | 1148 | 233 | .50 | 310 | 14.0 | 18.3 | 22.7 | 27.0 | 31.4 | 35.7 | 40.1 |
| | -23°C | -12 | 88.7 | 1067 | 223 | .480 | 297 | 13.8 | 18.5 | 23.2 | 27.8 | 32.5 | 37.2 | 41.9 |
| | | -13 | (2) 87.0 | 1004 | 212 | .46 | 283 | 13.3 | 18.2 | 23.2 | 28.2 | 33.2 | 38.1 | 43.1 |
| | ISA-10°C | -20 | (1) 92.1 | 1249 | 246 | .53 | 320 | 13.6 | 17.6 | 21.6 | 25.6 | 29.6 | 33.7 | 37.7 |
| | -33°C | -22 | 87.8 | 1072 | 228 | .490 | 297 | 13.7 | 18.4 | 23.1 | 27.7 | 32.4 | 37.1 | 41.7 |
| | | -23 | (2) 85.4 | 978 | 212 | .46 | 277 | 13.0 | 18.1 | 23.2 | 28.4 | 33.5 | 38.6 | 43.7 |
| 18000. | ISA+10°C | -2 | (1) 89.2 | 1053 | 219 | .47 | 298 | 14.0 | 18.8 | 23.5 | 28.3 | 33.0 | 37.8 | 42.5 |
| | -13°C | -3 | 88.3 | 1017 | 214 | .460 | 290 | 13.8 | 18.7 | 23.6 | 28.6 | 33.5 | 38.4 | 43.3 |
| | | -3 | (2) 87.2 | 980 | 207 | .45 | 282 | 13.4 | 18.5 | 23.6 | 28.7 | 33.9 | 39.0 | 44.1 |
| | ISA+ 0°C | -11 | (1) 90.5 | 1147 | 235 | .50 | 312 | 14.1 | 18.5 | 22.9 | 27.2 | 31.6 | 35.9 | 40.3 |
| | -23°C | -12 | 88.2 | 1050 | 223 | .480 | 297 | 14.0 | 18.8 | 23.5 | 28.3 | 33.1 | 37.8 | 42.6 |
| | | -14 | (2) 85.6 | 955 | 207 | .45 | 276 | 13.2 | 18.5 | 23.7 | 28.9 | 34.2 | 39.4 | 44.6 |
| | ISA-10°C | -20 | (1) 92.0 | 1245 | 247 | .53 | 322 | 13.8 | 17.8 | 21.8 | 25.8 | 29.8 | 33.9 | 37.9 |
| | -33°C | -22 | 87.3 | 1055 | 228 | .490 | 297 | 14.0 | 18.7 | 23.4 | 28.2 | 32.9 | 37.6 | 42.4 |
| | | -24 | (2) 83.9 | 929 | 207 | .45 | 270 | 13.0 | 18.3 | 23.7 | 29.1 | 34.5 | 39.9 | 45.3 |
| 17000. | ISA+20°C | 7 | (1) 87.8 | 973 | 205 | .44 | 285 | 13.8 | 19.0 | 24.1 | 29.2 | 34.4 | 39.5 | 44.7 |
| | | 7 | (2) 87.0 | 944 | 200 | .43 | 278 | 13.6 | 18.9 | 24.2 | 29.5 | 34.8 | 40.1 | 45.4 |
| | ISA+10°C | -2 | (1) 89.1 | 1054 | 222 | .48 | 302 | 14.4 | 19.1 | 23.9 | 28.6 | 33.3 | 38.1 | 42.8 |
| | -13°C | -3 | 87.7 | 998 | 214 | .460 | 290 | 14.1 | 19.1 | 24.1 | 29.1 | 34.1 | 39.1 | 44.1 |
| | | -4 | (2) 85.4 | 920 | 200 | .43 | 273 | 13.4 | 18.8 | 24.2 | 29.7 | 35.1 | 40.6 | 46.0 |
| | ISA+ 0°C | -11 | (1) 90.5 | 1149 | 236 | .51 | 315 | 14.3 | 18.7 | 23.0 | 27.4 | 31.7 | 36.1 | 40.4 |
| | -23°C | -13 | 86.9 | 1002 | 218 | .470 | 291 | 14.1 | 19.1 | 24.0 | 29.0 | 34.0 | 39.0 | 44.0 |
| | | -14 | (2) 83.9 | 897 | 200 | .43 | 268 | 13.1 | 18.7 | 24.3 | 29.9 | 35.4 | 41.0 | 46.6 |
| | ISA-10°C | -20 | (1) 92.1 | 1249 | 249 | .53 | 324 | 13.9 | 17.9 | 21.9 | 25.9 | 29.9 | 33.9 | 37.9 |
| | -33°C | -22 | 86.1 | 1006 | 223 | .480 | 291 | 14.0 | 19.0 | 24.0 | 28.9 | 33.9 | 38.9 | 43.9 |
| | | -24 | (2) 82.2 | 872 | 200 | .43 | 262 | 12.8 | 18.6 | 24.3 | 30.1 | 35.8 | 41.5 | 47.3 |
| 16500. | ISA+20°C | 7 | (1) 87.8 | 975 | 207 | .45 | 287 | 14.1 | 19.2 | 24.3 | 29.5 | 34.6 | 39.7 | 44.9 |
| | -3°C | 7 | 87.3 | 956 | 204 | .440 | 283 | 13.9 | 19.2 | 24.4 | 29.6 | 34.9 | 40.1 | 45.3 |
| | | 6 | (2) 86.4 | 924 | 199 | .43 | 276 | 13.6 | 19.0 | 24.5 | 29.9 | 35.3 | 40.7 | 46.1 |
| | ISA+10°C | -2 | (1) 89.1 | 1054 | 223 | .48 | 303 | 14.5 | 19.3 | 24.0 | 28.8 | 33.5 | 38.2 | 43.0 |
| | -13°C | -3 | 87.4 | 989 | 214 | .460 | 290 | 14.2 | 19.2 | 24.3 | 29.4 | 34.4 | 39.5 | 44.5 |
| | | -4 | (2) 84.8 | 898 | 198 | .43 | 270 | 13.4 | 18.9 | 24.5 | 30.1 | 35.6 | 41.2 | 46.8 |
| | ISA+ 0°C | -11 | (1) 90.5 | 1149 | 237 | .51 | 315 | 14.4 | 18.8 | 23.1 | 27.5 | 31.8 | 36.2 | 40.5 |
| | -23°C | -13 | 86.6 | 994 | 218 | .470 | 291 | 14.2 | 19.2 | 24.2 | 29.3 | 34.3 | 39.3 | 44.4 |
| | | -14 | (2) 83.2 | 874 | 198 | .43 | 265 | 13.1 | 18.8 | 24.6 | 30.3 | 36.0 | 41.7 | 47.4 |
| | ISA-10°C | -20 | (1) 92.1 | 1250 | 249 | .54 | 325 | 14.0 | 18.0 | 22.0 | 26.0 | 30.0 | 34.0 | 38.0 |
| | -33°C | -22 | 85.8 | 998 | 223 | .480 | 291 | 14.1 | 19.2 | 24.2 | 29.2 | 34.2 | 39.2 | 44.2 |
| | | -25 | (2) 81.6 | 851 | 198 | .43 | 259 | 12.8 | 18.7 | 24.6 | 30.5 | 36.3 | 42.2 | 48.1 |
| 16000. | ISA+20°C | 7 | (1) 87.8 | 975 | 209 | .45 | 289 | 14.3 | 19.4 | 24.5 | 29.7 | 34.8 | 39.9 | 45.1 |
| | -3°C | 7 | 87.0 | 946 | 204 | .440 | 283 | 14.1 | 19.4 | 24.6 | 29.9 | 35.2 | 40.5 | 45.8 |
| | | 6 | (2) 85.8 | 902 | 197 | .42 | 273 | 13.7 | 19.2 | 24.7 | 30.3 | 35.8 | 41.4 | 46.9 |
| | ISA+10°C | -2 | (1) 89.1 | 1054 | 224 | .48 | 305 | 14.7 | 19.4 | 24.2 | 28.9 | 33.6 | 38.4 | 43.1 |
| | -13°C | -3 | 87.1 | 981 | 214 | .460 | 290 | 14.3 | 19.4 | 24.5 | 29.6 | 34.7 | 39.8 | 44.9 |
| | | -4 | (2) 84.3 | 880 | 197 | .42 | 268 | 13.4 | 19.1 | 24.8 | 30.5 | 36.2 | 41.8 | 47.5 |
| | ISA+ 0°C | -11 | (1) 90.5 | 1151 | 238 | .51 | 317 | 14.5 | 18.8 | 23.2 | 27.5 | 31.9 | 36.2 | 40.6 |
| | -23°C | -13 | 86.4 | 986 | 218 | .470 | 291 | 14.3 | 19.4 | 24.4 | 29.5 | 34.6 | 39.7 | 44.7 |
| | | -14 | (2) 82.7 | 856 | 196 | .42 | 263 | 13.1 | 19.0 | 24.8 | 30.7 | 36.5 | 42.3 | 48.2 |
| | ISA-10°C | -20 | (1) 92.0 | 1250 | 250 | .54 | 325 | 14.0 | 18.0 | 22.0 | 26.0 | 30.0 | 34.0 | 38.0 |
| | -33°C | -22 | 85.6 | 990 | 223 | .480 | 291 | 14.3 | 19.3 | 24.3 | 29.4 | 34.4 | 39.5 | 44.5 |
| | | -25 | (2) 81.1 | 833 | 196 | .42 | 257 | 12.9 | 18.9 | 24.9 | 30.9 | 36.9 | 42.9 | 48.9 |
| 14000. | ISA+20°C | 8 | (1) 87.7 | 975 | 214 | .46 | 296 | 15.0 | 20.1 | 25.3 | 30.4 | 35.5 | 40.7 | 45.8 |
| | -3°C | 7 | 85.1 | 880 | 199 | .430 | 277 | 14.4 | 20.1 | 25.8 | 31.4 | 37.1 | 42.8 | 48.5 |
| | | 5 | (2) 82.3 | 796 | 184 | .40 | 256 | 13.3 | 19.6 | 25.9 | 32.1 | 38.4 | 44.7 | 51.0 |
| | ISA+10°C | -1 | (1) 89.0 | 1054 | 228 | .49 | 310 | 15.1 | 19.9 | 24.6 | 29.4 | 34.1 | 38.9 | 43.6 |
| | -13°C | -3 | 85.2 | 918 | 209 | .450 | 284 | 14.6 | 20.1 | 25.5 | 31.0 | 36.4 | 41.9 | 47.3 |
| | | -5 | (2) 80.8 | 777 | 184 | .40 | 251 | 13.0 | 19.5 | 25.9 | 32.3 | 38.8 | 45.2 | 51.6 |
| | ISA+ 0°C | -10 | (1) 90.5 | 1151 | 240 | .52 | 320 | 14.7 | 19.1 | 23.4 | 27.8 | 32.1 | 36.5 | 40.8 |
| | -23°C | -13 | 84.5 | 925 | 214 | .460 | 285 | 14.6 | 20.0 | 25.4 | 30.8 | 36.2 | 41.6 | 47.0 |
| | | -15 | (2) 79.3 | 757 | 184 | .40 | 246 | 12.7 | 19.3 | 25.9 | 32.5 | 39.2 | 45.8 | 52.4 |
| | ISA-10°C | -20 | (1) 92.0 | 1250 | 252 | .54 | 328 | 14.2 | 18.2 | 22.2 | 26.2 | 30.2 | 34.2 | 38.2 |
| | -33°C | -23 | 83.8 | 931 | 218 | .470 | 285 | 14.5 | 19.9 | 25.3 | 30.6 | 36.0 | 41.4 | 46.7 |
| | | -26 | (2) 77.9 | 739 | 184 | .40 | 242 | 12.4 | 19.2 | 26.0 | 32.7 | 39.5 | 46.3 | 53.0 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 5)

# CRUISE
# 21,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+ 0°C | -15 | (1) | 91.1 | 1084 | 222 | .50 | 306 | 14.4 | 19.0 | 23.6 | 28.2 | 32.8 | 37.4 | 42.0 |
| | -27°C | -16 | | 90.2 | 1053 | 219 | .490 | 301 | 14.3 | 19.1 | 23.8 | 28.6 | 33.3 | 38.1 | 42.8 |
| | | -16 | (2) | 89.9 | 1046 | 218 | .49 | 300 | 14.3 | 19.1 | 23.9 | 28.7 | 33.4 | 38.2 | 43.0 |
| | ISA-10°C | -25 | (1) | 92.5 | 1191 | 236 | .53 | 318 | 14.1 | 18.3 | 22.5 | 26.7 | 30.9 | 35.1 | 39.3 |
| | -37°C | -25 | | 90.6 | 1104 | 228 | .510 | 307 | 14.2 | 18.7 | 23.3 | 27.8 | 32.3 | 36.9 | 41.4 |
| | | -26 | (2) | 88.2 | 1018 | 218 | .49 | 294 | 14.1 | 19.0 | 23.9 | 28.8 | 33.8 | 38.7 | 43.6 |
| 19000. | ISA+ 0°C | -15 | (1) | 91.0 | 1085 | 225 | .50 | 309 | 14.6 | 19.3 | 23.9 | 28.5 | 33.1 | 37.7 | 42.3 |
| | -27°C | -16 | | 89.6 | 1033 | 219 | .490 | 301 | 14.6 | 19.4 | 24.3 | 29.1 | 34.0 | 38.8 | 43.6 |
| | | -16 | (2) | 88.6 | 994 | 212 | .48 | 292 | 14.3 | 19.3 | 24.4 | 29.4 | 34.4 | 39.5 | 44.5 |
| | ISA-10°C | -24 | (1) | 92.5 | 1192 | 238 | .53 | 320 | 14.3 | 18.5 | 22.7 | 26.9 | 31.1 | 35.3 | 39.5 |
| | -37°C | -25 | | 90.0 | 1085 | 228 | .510 | 307 | 14.4 | 19.1 | 23.7 | 28.3 | 32.9 | 37.5 | 42.1 |
| | | -27 | (2) | 86.8 | 966 | 212 | .47 | 286 | 14.1 | 19.2 | 24.4 | 29.6 | 34.8 | 39.9 | 45.1 |
| 18000. | ISA+10°C | -6 | (1) | 89.6 | 999 | 212 | .47 | 297 | 14.8 | 19.8 | 24.8 | 29.8 | 34.8 | 39.8 | 44.8 |
| | -17°C | -6 | | 89.3 | 985 | 210 | .470 | 294 | 14.7 | 19.7 | 24.8 | 29.9 | 35.0 | 40.1 | 45.1 |
| | | -6 | (2) | 88.9 | 971 | 207 | .46 | 291 | 14.5 | 19.7 | 24.8 | 30.0 | 35.1 | 40.3 | 45.4 |
| | ISA+ 0°C | -15 | (1) | 91.0 | 1087 | 227 | .51 | 312 | 14.9 | 19.5 | 24.1 | 28.7 | 33.3 | 37.9 | 42.5 |
| | -27°C | -16 | | 89.0 | 1015 | 219 | .490 | 301 | 14.9 | 19.8 | 24.7 | 29.6 | 34.6 | 39.5 | 44.4 |
| | | -17 | (2) | 87.2 | 946 | 207 | .46 | 285 | 14.3 | 19.6 | 24.8 | 30.1 | 35.4 | 40.7 | 46.0 |
| | ISA-10°C | -24 | (1) | 92.5 | 1194 | 240 | .54 | 323 | 14.5 | 18.7 | 22.8 | 27.0 | 31.2 | 35.4 | 39.6 |
| | -37°C | -26 | | 88.3 | 1026 | 223 | .500 | 301 | 14.7 | 19.6 | 24.4 | 29.3 | 34.2 | 39.1 | 43.9 |
| | | -27 | (2) | 85.5 | 920 | 207 | .46 | 279 | 14.0 | 19.4 | 24.9 | 30.3 | 35.8 | 41.2 | 46.6 |
| 17000. | ISA+10°C | -6 | (1) | 89.6 | 1000 | 215 | .48 | 302 | 15.2 | 20.2 | 25.2 | 30.2 | 35.2 | 40.2 | 45.2 |
| | -17°C | -6 | | 88.7 | 965 | 210 | .470 | 294 | 15.0 | 20.1 | 25.3 | 30.5 | 35.7 | 40.9 | 46.0 |
| | | -7 | (2) | 87.3 | 920 | 201 | .45 | 283 | 14.5 | 19.9 | 25.3 | 30.8 | 36.2 | 41.7 | 47.1 |
| | ISA+ 0°C | -15 | (1) | 90.9 | 1088 | 229 | .51 | 314 | 15.1 | 19.7 | 24.3 | 28.9 | 33.5 | 38.1 | 42.7 |
| | -27°C | -16 | | 87.8 | 968 | 214 | .480 | 295 | 15.0 | 20.1 | 25.3 | 30.5 | 35.6 | 40.8 | 46.0 |
| | | -17 | (2) | 85.7 | 896 | 201 | .45 | 277 | 14.2 | 19.8 | 25.4 | 31.0 | 36.5 | 42.1 | 47.7 |
| | ISA-10°C | -24 | (1) | 92.4 | 1192 | 241 | .54 | 324 | 14.6 | 18.8 | 23.0 | 27.2 | 31.4 | 35.6 | 39.8 |
| | -37°C | -26 | | 87.8 | 1010 | 223 | .500 | 301 | 14.9 | 19.9 | 24.8 | 29.8 | 34.7 | 39.7 | 44.6 |
| | | -28 | (2) | 84.0 | 872 | 201 | .45 | 272 | 14.0 | 19.7 | 25.4 | 31.2 | 36.9 | 42.6 | 48.4 |
| 16500. | ISA+20°C | 3 | (1) | 88.2 | 923 | 199 | .45 | 286 | 14.7 | 20.2 | 25.6 | 31.0 | 36.4 | 41.8 | 47.2 |
| | | 3 | (2) | 87.9 | 914 | 198 | .44 | 284 | 14.6 | 20.1 | 25.6 | 31.0 | 36.5 | 42.0 | 47.5 |
| | ISA+10°C | -6 | (1) | 89.5 | 999 | 216 | .48 | 304 | 15.4 | 20.4 | 25.4 | 30.4 | 35.4 | 40.4 | 45.4 |
| | -17°C | -6 | | 88.4 | 956 | 210 | .470 | 294 | 15.1 | 20.3 | 25.6 | 30.8 | 36.0 | 41.2 | 46.5 |
| | | -7 | (2) | 86.5 | 896 | 199 | .45 | 280 | 14.5 | 20.1 | 25.6 | 31.2 | 36.8 | 42.4 | 48.0 |
| | ISA+ 0°C | -15 | (1) | 90.9 | 1088 | 230 | .51 | 316 | 15.2 | 19.8 | 24.4 | 29.0 | 33.6 | 38.2 | 42.8 |
| | -27°C | -16 | | 87.5 | 959 | 214 | .480 | 295 | 15.1 | 20.3 | 25.5 | 30.7 | 36.0 | 41.2 | 46.4 |
| | | -18 | (2) | 84.9 | 873 | 199 | .45 | 274 | 14.2 | 19.9 | 25.7 | 31.4 | 37.1 | 42.9 | 48.6 |
| | ISA-10°C | -24 | (1) | 92.4 | 1194 | 242 | .54 | 325 | 14.7 | 18.9 | 23.1 | 27.3 | 31.4 | 35.6 | 39.8 |
| | -37°C | -26 | | 87.6 | 1002 | 223 | .500 | 301 | 15.0 | 20.0 | 25.0 | 30.0 | 35.0 | 40.0 | 45.0 |
| | | -28 | (2) | 83.2 | 849 | 199 | .45 | 268 | 13.9 | 19.8 | 25.7 | 31.6 | 37.5 | 43.4 | 49.3 |
| 16000. | ISA+20°C | 3 | (1) | 88.2 | 923 | 201 | .45 | 289 | 15.0 | 20.4 | 25.8 | 31.3 | 36.7 | 42.1 | 47.5 |
| | -7°C | 3 | | 87.3 | 891 | 196 | .440 | 281 | 14.7 | 20.3 | 25.9 | 31.5 | 37.1 | 42.7 | 48.4 |
| | | 3 | (2) | 87.0 | 885 | 195 | .44 | 279 | 14.6 | 20.3 | 25.9 | 31.6 | 37.2 | 42.8 | 48.5 |
| | ISA+10°C | -5 | (1) | 89.6 | 1001 | 218 | .49 | 306 | 15.6 | 20.6 | 25.5 | 30.5 | 35.5 | 40.5 | 45.5 |
| | -17°C | -6 | | 88.1 | 947 | 210 | .470 | 294 | 15.2 | 20.5 | 25.8 | 31.1 | 36.4 | 41.6 | 46.9 |
| | | -8 | (2) | 85.5 | 865 | 195 | .44 | 274 | 14.4 | 20.2 | 25.9 | 31.7 | 37.5 | 43.3 | 49.1 |
| | ISA+ 0°C | -15 | (1) | 91.0 | 1091 | 231 | .52 | 317 | 15.3 | 19.9 | 24.4 | 29.0 | 33.6 | 38.2 | 42.8 |
| | -27°C | -16 | | 87.2 | 951 | 214 | .480 | 295 | 15.2 | 20.5 | 25.8 | 31.0 | 36.3 | 41.5 | 46.8 |
| | | -18 | (2) | 83.9 | 843 | 195 | .44 | 269 | 14.1 | 20.0 | 26.0 | 31.9 | 37.8 | 43.8 | 49.7 |
| | ISA-10°C | -24 | (1) | 92.4 | 1194 | 243 | .54 | 326 | 14.8 | 19.0 | 23.1 | 27.3 | 31.5 | 35.7 | 39.9 |
| | -37°C | -26 | | 86.4 | 956 | 219 | .490 | 295 | 15.1 | 20.4 | 25.6 | 30.8 | 36.1 | 41.3 | 46.5 |
| | | -28 | (2) | 82.3 | 820 | 195 | .44 | 263 | 13.8 | 19.9 | 26.0 | 32.1 | 38.2 | 44.3 | 50.4 |
| 14000. | ISA+20°C | 4 | (1) | 88.1 | 924 | 207 | .46 | 297 | 15.9 | 21.3 | 26.7 | 32.1 | 37.5 | 43.0 | 48.4 |
| | -7°C | 3 | | 86.0 | 853 | 196 | .440 | 281 | 15.4 | 21.2 | 27.1 | 33.0 | 38.8 | 44.7 | 50.5 |
| | | 2 | (2) | 84.5 | 802 | 187 | .42 | 269 | 14.8 | 21.0 | 27.3 | 33.5 | 39.7 | 46.0 | 52.2 |
| | ISA+10°C | -5 | (1) | 89.5 | 1002 | 221 | .50 | 310 | 16.0 | 21.0 | 26.0 | 31.0 | 36.0 | 41.0 | 46.0 |
| | -17°C | -7 | | 86.1 | 886 | 205 | .460 | 288 | 15.6 | 21.3 | 26.9 | 32.5 | 38.2 | 43.8 | 49.5 |
| | | -8 | (2) | 83.0 | 782 | 187 | .42 | 263 | 14.5 | 20.9 | 27.3 | 33.7 | 40.1 | 46.5 | 52.9 |
| | ISA+ 0°C | -14 | (1) | 90.8 | 1090 | 233 | .52 | 320 | 15.6 | 20.2 | 24.8 | 29.4 | 34.0 | 38.5 | 43.1 |
| | -27°C | -17 | | 85.4 | 891 | 210 | .470 | 289 | 15.6 | 21.2 | 26.8 | 32.4 | 38.0 | 43.6 | 49.2 |
| | | -19 | (2) | 81.4 | 761 | 187 | .42 | 258 | 14.2 | 20.8 | 27.4 | 33.9 | 40.5 | 47.1 | 53.6 |
| | ISA-10°C | -24 | (1) | 92.3 | 1193 | 245 | .55 | 329 | 15.0 | 19.2 | 23.4 | 27.6 | 31.8 | 36.0 | 40.2 |
| | -37°C | -26 | | 85.5 | 926 | 219 | .490 | 295 | 15.6 | 21.0 | 26.4 | 31.8 | 37.2 | 42.6 | 48.0 |
| | | -29 | (2) | 79.7 | 740 | 187 | .42 | 253 | 13.9 | 20.6 | 27.4 | 34.1 | 40.9 | 47.7 | 54.4 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 6)

# CRUISE
# 23,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+ 0°C | -19 | (1) 91.6 | 1037 | 215 | .50 | 306 | 15.0 | 19.8 | 24.6 | 29.5 | 34.3 | 39.1 | 43.9 |
| | | -20 | (2) 90.8 | 1005 | 211 | .49 | 300 | 14.9 | 19.9 | 24.9 | 29.9 | 34.8 | 39.8 | 44.8 |
| | ISA-10°C | -29 | (1) 93.1 | 1126 | 228 | .53 | 316 | 14.8 | 19.2 | 23.6 | 28.1 | 32.5 | 37.0 | 41.4 |
| | -41°C | -29 | 90.6 | 1039 | 219 | .510 | 304 | 14.8 | 19.6 | 24.5 | 29.3 | 34.1 | 38.9 | 43.7 |
| | | -30 | (2) 89.0 | 978 | 211 | .49 | 294 | 14.7 | 19.8 | 24.9 | 30.0 | 35.2 | 40.3 | 45.4 |
| 19000. | ISA+ 0°C | -19 | (1) 91.5 | 1037 | 217 | .51 | 309 | 15.3 | 20.2 | 25.0 | 29.8 | 34.6 | 39.5 | 44.3 |
| | -31°C | -19 | 90.8 | 1010 | 214 | .500 | 305 | 15.3 | 20.2 | 25.2 | 30.1 | 35.1 | 40.0 | 45.0 |
| | | -20 | (2) 89.8 | 974 | 210 | .49 | 298 | 15.2 | 20.4 | 25.5 | 30.6 | 35.8 | 40.9 | 46.0 |
| | ISA-10°C | -28 | (1) 93.0 | 1129 | 230 | .54 | 319 | 15.0 | 19.4 | 23.9 | 28.3 | 32.7 | 37.2 | 41.6 |
| | -41°C | -29 | 90.0 | 1019 | 219 | .510 | 304 | 15.1 | 20.0 | 24.9 | 29.8 | 34.7 | 39.7 | 44.6 |
| | | -30 | (2) 88.1 | 948 | 210 | .49 | 292 | 15.0 | 20.3 | 25.5 | 30.8 | 36.1 | 41.4 | 46.6 |
| 18000. | ISA+ 0°C | -19 | (1) 91.5 | 1037 | 220 | .51 | 312 | 15.6 | 20.5 | 25.3 | 30.1 | 34.9 | 39.7 | 44.6 |
| | -31°C | -19 | 90.2 | 990 | 214 | .500 | 305 | 15.6 | 20.7 | 25.7 | 30.8 | 35.8 | 40.9 | 45.9 |
| | | -20 | (2) 88.7 | 938 | 207 | .48 | 295 | 15.4 | 20.8 | 26.1 | 31.4 | 36.8 | 42.1 | 47.4 |
| | ISA-10°C | -28 | (1) 93.0 | 1132 | 232 | .54 | 322 | 15.2 | 19.6 | 24.0 | 28.4 | 32.9 | 37.3 | 41.7 |
| | -41°C | -29 | 89.4 | 1000 | 219 | .510 | 304 | 15.4 | 20.4 | 25.4 | 30.4 | 35.4 | 40.4 | 45.4 |
| | | -31 | (2) 86.9 | 912 | 207 | .48 | 289 | 15.2 | 20.7 | 26.1 | 31.6 | 37.1 | 42.6 | 48.1 |
| 17000. | ISA+10°C | -10 | (1) 90.0 | 949 | 208 | .49 | 302 | 16.1 | 21.3 | 26.6 | 31.9 | 37.1 | 42.4 | 47.7 |
| | -21°C | -10 | 89.6 | 934 | 205 | .480 | 298 | 15.9 | 21.2 | 26.6 | 32.0 | 37.3 | 42.7 | 48.0 |
| | | -10 | (2) 89.0 | 910 | 201 | .47 | 292 | 15.6 | 21.1 | 26.6 | 32.1 | 37.6 | 43.1 | 48.6 |
| | ISA+ 0°C | -19 | (1) 91.5 | 1039 | 222 | .52 | 315 | 15.9 | 20.7 | 25.5 | 30.3 | 35.1 | 39.9 | 44.8 |
| | -31°C | -19 | 89.5 | 971 | 214 | .500 | 305 | 15.9 | 21.1 | 26.2 | 31.4 | 36.5 | 41.7 | 46.8 |
| | | -21 | (2) 87.3 | 887 | 201 | .47 | 287 | 15.4 | 21.0 | 26.7 | 32.3 | 38.0 | 43.6 | 49.2 |
| | ISA-10°C | -28 | (1) 92.9 | 1133 | 234 | .54 | 324 | 15.4 | 19.8 | 24.2 | 28.6 | 33.0 | 37.5 | 41.9 |
| | -41°C | -29 | 88.9 | 982 | 219 | .510 | 304 | 15.7 | 20.8 | 25.9 | 31.0 | 36.0 | 41.1 | 46.2 |
| | | -31 | (2) 85.5 | 861 | 201 | .47 | 280 | 15.1 | 20.9 | 26.7 | 32.5 | 38.3 | 44.1 | 49.9 |
| 16500. | ISA+10°C | -9 | (1) 90.0 | 950 | 210 | .49 | 305 | 16.3 | 21.5 | 26.8 | 32.0 | 37.3 | 42.6 | 47.8 |
| | -21°C | -10 | 89.3 | 924 | 205 | .480 | 298 | 16.1 | 21.5 | 26.9 | 32.3 | 37.7 | 43.1 | 48.5 |
| | | -11 | (2) 88.2 | 887 | 198 | .46 | 289 | 15.6 | 21.3 | 26.9 | 32.5 | 38.2 | 43.8 | 49.4 |
| | ISA+ 0°C | -19 | (1) 91.5 | 1041 | 223 | .52 | 317 | 16.0 | 20.8 | 25.6 | 30.4 | 35.2 | 40.0 | 44.8 |
| | -31°C | -20 | 88.3 | 927 | 210 | .490 | 298 | 16.0 | 21.4 | 26.8 | 32.2 | 37.6 | 43.0 | 48.4 |
| | | -21 | (2) 86.6 | 864 | 199 | .46 | 283 | 15.4 | 21.2 | 26.9 | 32.7 | 38.5 | 44.3 | 50.1 |
| | ISA-10°C | -28 | (1) 92.9 | 1134 | 234 | .55 | 325 | 15.5 | 19.9 | 24.3 | 28.7 | 33.1 | 37.5 | 41.9 |
| | -41°C | -29 | 88.6 | 974 | 219 | .510 | 304 | 15.8 | 21.0 | 26.1 | 31.2 | 36.4 | 41.5 | 46.6 |
| | | -31 | (2) 84.8 | 840 | 198 | .46 | 276 | 15.1 | 21.0 | 27.0 | 32.9 | 38.9 | 44.8 | 50.8 |
| 16000. | ISA+10°C | -9 | (1) 90.0 | 950 | 211 | .49 | 306 | 16.4 | 21.7 | 26.9 | 32.2 | 37.5 | 42.7 | 48.0 |
| | -21°C | -10 | 89.0 | 915 | 205 | .480 | 298 | 16.2 | 21.7 | 27.1 | 32.6 | 38.1 | 43.5 | 49.0 |
| | | -11 | (2) 87.4 | 862 | 196 | .46 | 284 | 15.6 | 21.4 | 27.2 | 33.0 | 38.8 | 44.6 | 50.4 |
| | ISA+ 0°C | -18 | (1) 91.4 | 1039 | 224 | .52 | 318 | 16.1 | 20.9 | 25.7 | 30.5 | 35.4 | 40.2 | 45.0 |
| | -31°C | -20 | 88.1 | 918 | 210 | .490 | 298 | 16.2 | 21.6 | 27.1 | 32.5 | 37.9 | 43.4 | 48.8 |
| | | -21 | (2) 85.8 | 839 | 196 | .46 | 279 | 15.3 | 21.3 | 27.3 | 33.2 | 39.2 | 45.1 | 51.1 |
| | ISA-10°C | -28 | (1) 92.9 | 1134 | 235 | .55 | 326 | 15.6 | 20.0 | 24.4 | 28.8 | 33.2 | 37.6 | 42.0 |
| | -41°C | -30 | 87.2 | 928 | 214 | .500 | 298 | 16.0 | 21.4 | 26.7 | 32.1 | 37.5 | 42.9 | 48.3 |
| | | -32 | (2) 84.0 | 815 | 195 | .46 | 273 | 15.0 | 21.2 | 27.3 | 33.4 | 39.6 | 45.7 | 51.8 |
| 14000. | ISA+20°C | 0 | (1) 88.6 | 874 | 200 | .47 | 297 | 16.8 | 22.5 | 28.3 | 34.0 | 39.7 | 45.4 | 51.1 |
| | -11°C | -1 | 87.0 | 825 | 192 | .450 | 285 | 16.4 | 22.4 | 28.5 | 34.6 | 40.6 | 46.7 | 52.7 |
| | | -2 | (2) 85.4 | 775 | 183 | .43 | 272 | 15.7 | 22.2 | 28.6 | 35.1 | 41.6 | 48.0 | 54.5 |
| | ISA+10°C | -9 | (1) 89.9 | 951 | 215 | .50 | 311 | 17.0 | 22.2 | 27.5 | 32.8 | 38.0 | 43.3 | 48.5 |
| | -21°C | -10 | 87.1 | 854 | 201 | .470 | 292 | 16.6 | 22.5 | 28.4 | 34.2 | 40.1 | 45.9 | 51.8 |
| | | -12 | (2) 83.8 | 756 | 183 | .43 | 267 | 15.5 | 22.1 | 28.7 | 35.3 | 41.9 | 48.5 | 55.1 |
| | ISA+ 0°C | -18 | (1) 91.3 | 1040 | 227 | .53 | 322 | 16.5 | 21.3 | 26.1 | 31.0 | 35.8 | 40.6 | 45.4 |
| | -31°C | -20 | 86.2 | 858 | 205 | .480 | 292 | 16.6 | 22.4 | 28.3 | 34.1 | 39.9 | 45.8 | 51.6 |
| | | -22 | (2) 82.2 | 735 | 183 | .43 | 261 | 15.1 | 21.9 | 28.7 | 35.5 | 42.3 | 49.1 | 55.9 |
| | ISA-10°C | -28 | (1) 92.8 | 1137 | 238 | .55 | 330 | 15.9 | 20.2 | 24.6 | 29.0 | 33.4 | 37.8 | 42.2 |
| | -41°C | -30 | 85.4 | 863 | 210 | .490 | 292 | 16.5 | 22.3 | 28.1 | 33.9 | 39.7 | 45.5 | 51.3 |
| | | -33 | (2) 80.6 | 716 | 183 | .43 | 256 | 14.8 | 21.8 | 28.8 | 35.7 | 42.7 | 49.7 | 56.7 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 7)

# CRUISE
## 25,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+ 0°C | -24 | (1) 91.9 | 989 | 206 | .50 | 303 | 15.5 | 20.5 | 25.6 | 30.7 | 35.7 | 40.8 | 45.8 |
| | | -24 | (2) 91.6 | 974 | 204 | .50 | 300 | 15.4 | 20.6 | 25.7 | 30.8 | 36.0 | 41.1 | 46.2 |
| | ISA-10°C | -33 | (1) 93.7 | 1071 | 218 | .53 | 314 | 15.3 | 20.0 | 24.6 | 29.3 | 34.0 | 38.6 | 43.3 |
| | -45°C | -33 | 92.3 | 1024 | 214 | .520 | 307 | 15.4 | 20.2 | 25.1 | 30.0 | 34.9 | 39.8 | 44.7 |
| | | -34 | (2) 89.7 | 948 | 204 | .50 | 294 | 15.2 | 20.4 | 25.7 | 31.0 | 36.3 | 41.5 | 46.8 |
| 19000. | ISA+ 0°C | -23 | (1) 91.9 | 991 | 210 | .51 | 308 | 15.9 | 21.0 | 26.0 | 31.1 | 36.1 | 41.2 | 46.2 |
| | -35°C | -24 | 91.0 | 955 | 205 | .500 | 302 | 15.9 | 21.2 | 26.4 | 31.6 | 36.9 | 42.1 | 47.3 |
| | | -24 | (2) 90.6 | 938 | 203 | .50 | 299 | 15.9 | 21.2 | 26.6 | 31.9 | 37.2 | 42.5 | 47.9 |
| | ISA-10°C | -32 | (1) 93.6 | 1072 | 221 | .54 | 317 | 15.6 | 20.3 | 24.9 | 29.6 | 34.3 | 38.9 | 43.6 |
| | -45°C | -33 | 91.2 | 997 | 214 | .520 | 307 | 15.8 | 20.8 | 25.8 | 30.8 | 35.9 | 40.9 | 45.9 |
| | | -34 | (2) 88.8 | 913 | 203 | .49 | 293 | 15.6 | 21.1 | 26.6 | 32.1 | 37.5 | 43.0 | 48.5 |
| 18000. | ISA+ 0°C | -23 | (1) 91.9 | 993 | 212 | .52 | 312 | 16.3 | 21.3 | 26.4 | 31.4 | 36.4 | 41.5 | 46.5 |
| | -35°C | -23 | 91.2 | 966 | 210 | .510 | 308 | 16.4 | 21.5 | 26.7 | 31.9 | 37.1 | 42.2 | 47.4 |
| | | -24 | (2) 89.6 | 905 | 202 | .49 | 297 | 16.2 | 21.8 | 27.3 | 32.8 | 38.3 | 43.8 | 49.4 |
| | ISA-10°C | -32 | (1) 93.5 | 1073 | 223 | .54 | 320 | 15.9 | 20.5 | 25.2 | 29.9 | 34.5 | 39.2 | 43.8 |
| | -45°C | -33 | 90.4 | 976 | 214 | .520 | 307 | 16.1 | 21.3 | 26.4 | 31.5 | 36.6 | 41.8 | 46.9 |
| | | -34 | (2) 87.8 | 881 | 202 | .49 | 291 | 16.0 | 21.6 | 27.3 | 33.0 | 38.7 | 44.3 | 50.0 |
| 17000. | ISA+ 0°C | -23 | (1) 91.8 | 994 | 215 | .52 | 315 | 16.6 | 21.6 | 26.7 | 31.7 | 36.7 | 41.8 | 46.8 |
| | -35°C | -23 | 90.6 | 946 | 210 | .510 | 308 | 16.7 | 22.0 | 27.3 | 32.6 | 37.8 | 43.1 | 48.4 |
| | | -24 | (2) 88.6 | 876 | 201 | .49 | 295 | 16.6 | 22.3 | 28.0 | 33.7 | 39.4 | 45.1 | 50.9 |
| | ISA-10°C | -32 | (1) 93.5 | 1076 | 225 | .55 | 323 | 16.1 | 20.8 | 25.4 | 30.1 | 34.7 | 39.4 | 44.0 |
| | -45°C | -33 | 89.8 | 957 | 214 | .520 | 307 | 16.5 | 21.7 | 26.9 | 32.1 | 37.4 | 42.6 | 47.8 |
| | | -35 | (2) 86.8 | 853 | 201 | .49 | 289 | 16.3 | 22.2 | 28.1 | 33.9 | 39.8 | 45.6 | 51.5 |
| 16500. | ISA+10°C | -13 | (1) 90.4 | 904 | 203 | .49 | 304 | 17.1 | 22.6 | 28.1 | 33.7 | 39.2 | 44.7 | 50.3 |
| | -25°C | -14 | 90.1 | 895 | 201 | .490 | 302 | 17.0 | 22.6 | 28.2 | 33.8 | 39.4 | 45.0 | 50.5 |
| | | -14 | (2) 89.7 | 878 | 199 | .48 | 299 | 16.9 | 22.6 | 28.3 | 34.0 | 39.7 | 45.4 | 51.1 |
| | ISA+ 0°C | -23 | (1) 91.8 | 992 | 216 | .52 | 316 | 16.8 | 21.8 | 26.9 | 31.9 | 36.9 | 42.0 | 47.0 |
| | -35°C | -23 | 90.3 | 937 | 210 | .510 | 308 | 16.9 | 22.2 | 27.5 | 32.9 | 38.2 | 43.6 | 48.9 |
| | | -24 | (2) 88.0 | 857 | 199 | .49 | 293 | 16.7 | 22.5 | 28.4 | 34.2 | 40.0 | 45.9 | 51.7 |
| | ISA-10°C | -32 | (1) 93.4 | 1074 | 226 | .55 | 324 | 16.2 | 20.9 | 25.6 | 30.2 | 34.9 | 39.5 | 44.2 |
| | -45°C | -33 | 89.5 | 948 | 214 | .520 | 307 | 16.6 | 21.9 | 27.2 | 32.4 | 37.7 | 43.0 | 48.3 |
| | | -35 | (2) 86.2 | 833 | 199 | .48 | 287 | 16.4 | 22.4 | 28.4 | 34.4 | 40.4 | 46.4 | 52.4 |
| 16000. | ISA+10°C | -13 | (1) 90.4 | 905 | 204 | .50 | 306 | 17.3 | 22.8 | 28.3 | 33.8 | 39.4 | 44.9 | 50.4 |
| | -25°C | -14 | 89.8 | 884 | 201 | .490 | 302 | 17.2 | 22.9 | 28.5 | 34.2 | 39.8 | 45.5 | 51.1 |
| | | -14 | (2) 89.0 | 852 | 196 | .48 | 294 | 16.9 | 22.8 | 28.6 | 34.5 | 40.4 | 46.2 | 52.1 |
| | ISA+ 0°C | -22 | (1) 91.8 | 994 | 217 | .53 | 318 | 16.9 | 22.0 | 27.0 | 32.0 | 37.0 | 42.1 | 47.1 |
| | -35°C | -24 | 89.0 | 894 | 205 | .500 | 302 | 17.0 | 22.6 | 28.2 | 33.8 | 39.4 | 45.0 | 50.6 |
| | | -25 | (2) 87.3 | 830 | 196 | .48 | 288 | 16.6 | 22.7 | 28.7 | 34.7 | 40.7 | 46.8 | 52.8 |
| | ISA-10°C | -32 | (1) 93.4 | 1074 | 227 | .55 | 326 | 16.3 | 21.0 | 25.7 | 30.3 | 35.0 | 39.6 | 44.3 |
| | -45°C | -33 | 89.2 | 939 | 214 | .520 | 307 | 16.8 | 22.1 | 27.4 | 32.7 | 38.0 | 43.4 | 48.7 |
| | | -35 | (2) 85.5 | 806 | 195 | .48 | 282 | 16.3 | 22.5 | 28.7 | 34.9 | 41.1 | 47.3 | 53.5 |
| 14000. | ISA+20°C | -4 | (1) 89.0 | 826 | 193 | .47 | 297 | 17.8 | 23.8 | 29.9 | 36.0 | 42.0 | 48.1 | 54.1 |
| | -15°C | -5 | 88.1 | 799 | 189 | .460 | 289 | 17.5 | 23.7 | 30.0 | 36.2 | 42.5 | 48.8 | 55.0 |
| | | -5 | (2) 87.0 | 768 | 183 | .45 | 280 | 17.0 | 23.5 | 30.0 | 36.5 | 43.0 | 49.5 | 56.0 |
| | ISA+10°C | -13 | (1) 90.2 | 905 | 208 | .51 | 313 | 18.0 | 23.5 | 29.0 | 34.5 | 40.1 | 45.6 | 51.1 |
| | -25°C | -14 | 88.0 | 823 | 197 | .480 | 296 | 17.7 | 23.8 | 29.9 | 36.0 | 42.0 | 48.1 | 54.2 |
| | | -15 | (2) 85.4 | 749 | 183 | .45 | 275 | 16.7 | 23.4 | 30.1 | 36.7 | 43.4 | 50.1 | 56.8 |
| | ISA+ 0°C | -22 | (1) 91.7 | 994 | 220 | .54 | 323 | 17.4 | 22.5 | 27.5 | 32.5 | 37.6 | 42.6 | 47.6 |
| | -35°C | -24 | 87.0 | 827 | 201 | .490 | 296 | 17.7 | 23.7 | 29.8 | 35.8 | 41.9 | 47.9 | 54.0 |
| | | -26 | (2) 83.8 | 729 | 183 | .45 | 269 | 16.4 | 23.2 | 30.1 | 37.0 | 43.8 | 50.7 | 57.5 |
| | ISA-10°C | -31 | (1) 93.3 | 1076 | 230 | .56 | 330 | 16.7 | 21.4 | 26.0 | 30.7 | 35.3 | 40.0 | 44.6 |
| | -45°C | -34 | 86.1 | 836 | 205 | .500 | 296 | 17.4 | 23.4 | 29.4 | 35.4 | 41.3 | 47.3 | 53.3 |
| | | -36 | (2) 82.1 | 709 | 182 | .45 | 263 | 16.0 | 23.1 | 30.1 | 37.2 | 44.2 | 51.3 | 58.3 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM
RANGE (APPROXIMATE)

Figure 7-15 (Sheet 8)

# CRUISE
# 27,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20000. | ISA+ 0°C | -28 | (1) 92.5 | 931 | 195 | .50 | 297 | 15.8 | 21.1 | 26.5 | 31.9 | 37.2 | 42.6 | 48.0 |
| | | -28 | (2) 92.2 | 925 | 194 | .49 | 295 | 15.7 | 21.1 | 26.5 | 31.9 | 37.3 | 42.7 | 48.2 |
| | ISA-10°C | -37 | (1) 94.1 | 1025 | 209 | .53 | 311 | 15.7 | 20.5 | 25.4 | 30.3 | 35.2 | 40.1 | 44.9 |
| | -48°C | -38 | 92.2 | 951 | 201 | .510 | 299 | 15.7 | 20.9 | 26.2 | 31.4 | 36.7 | 41.9 | 47.2 |
| | | -39 | (2) 90.4 | 898 | 194 | .49 | 288 | 15.4 | 21.0 | 26.6 | 32.1 | 37.7 | 43.3 | 48.8 |
| 19000. | ISA+ 0°C | -27 | (1) 92.3 | 935 | 200 | .51 | 304 | 16.5 | 21.8 | 27.2 | 32.5 | 37.9 | 43.2 | 48.6 |
| | | -28 | (2) 91.4 | 911 | 196 | .50 | 299 | 16.4 | 21.8 | 27.3 | 32.8 | 38.3 | 43.8 | 49.3 |
| | ISA-10°C | -37 | (1) 94.1 | 1026 | 212 | .54 | 315 | 16.1 | 21.0 | 25.9 | 30.7 | 35.6 | 40.5 | 45.4 |
| | -48°C | -37 | 92.0 | 952 | 205 | .520 | 305 | 16.3 | 21.5 | 26.8 | 32.0 | 37.3 | 42.5 | 47.8 |
| | | -38 | (2) 89.6 | 887 | 196 | .50 | 293 | 16.1 | 21.7 | 27.4 | 33.0 | 38.6 | 44.3 | 49.9 |
| 18000. | ISA+ 0°C | -27 | (1) 92.1 | 937 | 203 | .52 | 309 | 17.0 | 22.4 | 27.7 | 33.0 | 38.4 | 43.7 | 49.1 |
| | -38°C | -27 | 91.4 | 912 | 201 | .510 | 305 | 17.1 | 22.5 | 28.0 | 33.5 | 39.0 | 44.5 | 50.0 |
| | | -28 | (2) 90.3 | 876 | 195 | .50 | 298 | 16.9 | 22.6 | 28.3 | 34.0 | 39.7 | 45.4 | 51.1 |
| | ISA-10°C | -36 | (1) 94.0 | 1025 | 215 | .54 | 319 | 16.5 | 21.3 | 26.2 | 31.1 | 36.0 | 40.9 | 45.7 |
| | -48°C | -37 | 91.0 | 923 | 205 | .520 | 305 | 16.8 | 22.2 | 27.6 | 33.0 | 38.4 | 43.8 | 49.2 |
| | | -38 | (2) 88.5 | 853 | 195 | .50 | 291 | 16.5 | 22.4 | 28.3 | 34.1 | 40.0 | 45.9 | 51.7 |
| 17000. | ISA+ 0°C | -27 | (1) 92.1 | 941 | 207 | .52 | 314 | 17.4 | 22.7 | 28.0 | 33.4 | 38.7 | 44.0 | 49.3 |
| | -38°C | -27 | 90.7 | 890 | 201 | .510 | 305 | 17.5 | 23.1 | 28.7 | 34.3 | 39.9 | 45.6 | 51.2 |
| | | -28 | (2) 89.3 | 843 | 194 | .49 | 296 | 17.3 | 23.3 | 29.2 | 35.1 | 41.1 | 47.0 | 52.9 |
| | ISA-10°C | -36 | (1) 93.9 | 1026 | 217 | .55 | 322 | 16.8 | 21.6 | 26.5 | 31.4 | 36.3 | 41.1 | 46.0 |
| | -48°C | -37 | 89.8 | 898 | 205 | .520 | 305 | 17.2 | 22.8 | 28.4 | 34.0 | 39.5 | 45.1 | 50.7 |
| | | -38 | (2) 87.5 | 819 | 194 | .49 | 290 | 17.0 | 23.1 | 29.3 | 35.4 | 41.5 | 47.6 | 53.7 |
| 16500. | ISA+10°C | -18 | (1) 90.7 | 854 | 194 | .49 | 302 | 17.8 | 23.7 | 29.5 | 35.4 | 41.2 | 47.1 | 52.9 |
| | | -18 | (2) 90.5 | 849 | 194 | .49 | 301 | 17.8 | 23.7 | 29.6 | 35.5 | 41.4 | 47.3 | 53.2 |
| | ISA+ 0°C | -27 | (1) 92.1 | 941 | 208 | .53 | 316 | 17.6 | 22.9 | 28.3 | 33.6 | 38.9 | 44.2 | 49.5 |
| | -38°C | -27 | 90.3 | 880 | 201 | .510 | 305 | 17.7 | 23.4 | 29.0 | 34.7 | 40.4 | 46.1 | 51.8 |
| | | -28 | (2) 88.8 | 825 | 194 | .49 | 295 | 17.5 | 23.6 | 29.7 | 35.7 | 41.8 | 47.8 | 53.9 |
| | ISA-10°C | -36 | (1) 93.9 | 1027 | 218 | .55 | 324 | 16.9 | 21.8 | 26.6 | 31.5 | 36.4 | 41.3 | 46.1 |
| | -48°C | -37 | 89.5 | 888 | 205 | .520 | 305 | 17.4 | 23.1 | 28.7 | 34.3 | 39.9 | 45.6 | 51.2 |
| | | -39 | (2) 87.0 | 803 | 193 | .49 | 288 | 17.2 | 23.5 | 29.7 | 35.9 | 42.1 | 48.4 | 54.6 |
| 16000. | ISA+10°C | -17 | (1) 90.7 | 855 | 196 | .50 | 305 | 18.1 | 23.9 | 29.8 | 35.6 | 41.5 | 47.3 | 53.2 |
| | | -18 | (2) 90.0 | 833 | 193 | .49 | 300 | 18.0 | 24.0 | 30.0 | 36.0 | 42.0 | 48.0 | 54.0 |
| | ISA+ 0°C | -26 | (1) 92.1 | 943 | 209 | .53 | 318 | 17.8 | 23.1 | 28.4 | 33.7 | 39.0 | 44.3 | 49.6 |
| | -38°C | -27 | 89.9 | 870 | 201 | .510 | 305 | 17.9 | 23.6 | 29.4 | 35.1 | 40.9 | 46.6 | 52.3 |
| | | -28 | (2) 88.2 | 810 | 193 | .49 | 294 | 17.7 | 23.9 | 30.1 | 36.2 | 42.4 | 48.6 | 54.8 |
| | ISA-10°C | -36 | (1) 93.9 | 1027 | 219 | .55 | 325 | 17.1 | 21.9 | 26.8 | 31.7 | 36.5 | 41.4 | 46.3 |
| | -48°C | -37 | 89.2 | 879 | 205 | .520 | 305 | 17.6 | 23.3 | 29.0 | 34.7 | 40.4 | 46.1 | 51.7 |
| | | -39 | (2) 86.5 | 789 | 193 | .49 | 287 | 17.4 | 23.8 | 30.1 | 36.5 | 42.8 | 49.1 | 55.5 |
| 14000. | ISA+20°C | -8 | (1) 89.4 | 781 | 187 | .47 | 296 | 18.7 | 25.2 | 31.6 | 38.0 | 44.4 | 50.8 | 57.2 |
| | -18°C | -8 | 89.2 | 772 | 185 | .470 | 293 | 18.6 | 25.1 | 31.5 | 38.0 | 44.5 | 51.0 | 57.5 |
| | | -8 | (2) 89.0 | 768 | 184 | .47 | 292 | 18.5 | 25.0 | 31.5 | 38.0 | 44.5 | 51.1 | 57.6 |
| | ISA+10°C | -17 | (1) 90.6 | 857 | 201 | .51 | 312 | 18.9 | 24.8 | 30.6 | 36.4 | 42.3 | 48.1 | 53.9 |
| | -28°C | -18 | 88.7 | 794 | 193 | .490 | 300 | 18.9 | 25.2 | 31.4 | 37.7 | 44.0 | 50.3 | 56.6 |
| | | -19 | (2) 87.4 | 748 | 184 | .47 | 286 | 18.2 | 24.9 | 31.6 | 38.3 | 45.0 | 51.6 | 58.3 |
| | ISA+ 0°C | -26 | (1) 92.0 | 946 | 213 | .54 | 324 | 18.4 | 23.7 | 28.9 | 34.2 | 39.5 | 44.8 | 50.1 |
| | -38°C | -27 | 88.8 | 834 | 201 | .510 | 305 | 18.6 | 24.6 | 30.6 | 36.6 | 42.6 | 48.6 | 54.6 |
| | | -29 | (2) 85.6 | 727 | 184 | .47 | 280 | 17.9 | 24.8 | 31.6 | 38.5 | 45.4 | 52.3 | 59.1 |
| | ISA-10°C | -35 | (1) 93.8 | 1029 | 223 | .56 | 330 | 17.5 | 22.4 | 27.2 | 32.1 | 37.0 | 41.8 | 46.7 |
| | -48°C | -37 | 87.9 | 844 | 205 | .520 | 305 | 18.3 | 24.2 | 30.2 | 36.1 | 42.0 | 47.9 | 53.8 |
| | | -40 | (2) 83.8 | 707 | 184 | .47 | 274 | 17.5 | 24.6 | 31.7 | 38.8 | 45.8 | 52.9 | 60.0 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 9)

# CRUISE
# 29,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19000. | ISA+ 0°C | -32 | (1) 92.9 | 877 | 188 | .50 | 296 | 16.6 | 22.4 | 28.1 | 33.8 | 39.5 | 45.2 | 50.9 |
| | | -32 | (2) 92.1 | 853 | 184 | .49 | 291 | 16.5 | 22.3 | 28.2 | 34.1 | 39.9 | 45.8 | 51.6 |
| | ISA-10°C | -41 | (1) 94.7 | 981 | 202 | .53 | 311 | 16.4 | 21.5 | 26.6 | 31.7 | 36.8 | 41.9 | 47.0 |
| | -52°C | -42 | 92.0 | 892 | 192 | .510 | 296 | 16.4 | 22.0 | 27.6 | 33.2 | 38.8 | 44.4 | 50.0 |
| | | -43 | (2) 90.3 | 831 | 184 | .49 | 284 | 16.2 | 22.2 | 28.2 | 34.2 | 40.2 | 46.2 | 52.3 |
| 18000. | ISA+ 0°C | -31 | (1) 92.8 | 881 | 193 | .51 | 304 | 17.5 | 23.2 | 28.9 | 34.5 | 40.2 | 45.9 | 51.6 |
| | | -32 | (2) 91.4 | 845 | 188 | .50 | 296 | 17.3 | 23.2 | 29.1 | 35.0 | 41.0 | 46.9 | 52.8 |
| | ISA-10°C | -41 | (1) 94.6 | 982 | 205 | .54 | 316 | 16.9 | 22.0 | 27.1 | 32.2 | 37.3 | 42.3 | 47.4 |
| | -52°C | -42 | 91.7 | 887 | 196 | .520 | 302 | 17.1 | 22.8 | 28.4 | 34.1 | 39.7 | 45.3 | 51.0 |
| | | -42 | (2) 89.6 | 821 | 187 | .50 | 289 | 16.9 | 23.0 | 29.1 | 35.2 | 41.3 | 47.4 | 53.5 |
| 17000. | ISA+ 0°C | -31 | (1) 92.7 | 881 | 197 | .52 | 310 | 18.2 | 23.8 | 29.5 | 35.2 | 40.9 | 46.5 | 52.2 |
| | -42°C | -31 | 91.0 | 842 | 192 | .510 | 303 | 18.2 | 24.1 | 30.0 | 36.0 | 41.9 | 47.8 | 53.8 |
| | | -32 | (2) 90.1 | 818 | 188 | .50 | 296 | 17.9 | 24.0 | 30.1 | 36.2 | 42.3 | 48.5 | 54.6 |
| | ISA-10°C | -40 | (1) 94.5 | 984 | 208 | .55 | 320 | 17.3 | 22.3 | 27.4 | 32.5 | 37.6 | 42.7 | 47.7 |
| | -52°C | -41 | 91.7 | 891 | 200 | .530 | 308 | 17.7 | 23.3 | 29.0 | 34.6 | 40.2 | 45.8 | 51.4 |
| | | -42 | (2) 88.2 | 794 | 188 | .50 | 289 | 17.6 | 23.9 | 30.2 | 36.4 | 42.7 | 49.0 | 55.3 |
| 16500. | ISA+ 0°C | -31 | (1) 92.7 | 884 | 199 | .53 | 313 | 18.4 | 24.1 | 29.7 | 35.4 | 41.0 | 46.7 | 52.3 |
| | -42°C | -31 | 90.5 | 830 | 192 | .510 | 303 | 18.4 | 24.5 | 30.5 | 36.5 | 42.5 | 48.6 | 54.6 |
| | | -32 | (2) 89.4 | 800 | 187 | .50 | 295 | 18.2 | 24.4 | 30.7 | 36.9 | 43.2 | 49.4 | 55.7 |
| | ISA-10°C | -40 | (1) 94.5 | 986 | 210 | .55 | 322 | 17.4 | 22.5 | 27.6 | 32.6 | 37.7 | 42.8 | 47.9 |
| | -52°C | -41 | 91.3 | 876 | 200 | .530 | 308 | 18.0 | 23.7 | 29.4 | 35.1 | 40.8 | 46.5 | 52.2 |
| | | -42 | (2) 87.6 | 778 | 187 | .50 | 289 | 17.8 | 24.3 | 30.7 | 37.1 | 43.5 | 50.0 | 56.4 |
| 16000. | ISA+10°C | -21 | (1) 90.9 | 810 | 188 | .50 | 303 | 18.9 | 25.1 | 31.2 | 37.4 | 43.6 | 49.7 | 55.9 |
| | | -22 | (2) 90.6 | 802 | 187 | .50 | 301 | 18.8 | 25.0 | 31.3 | 37.5 | 43.8 | 50.0 | 56.2 |
| | ISA+ 0°C | -31 | (1) 92.6 | 882 | 200 | .53 | 315 | 18.7 | 24.3 | 30.0 | 35.7 | 41.3 | 47.0 | 52.7 |
| | -42°C | -31 | 90.1 | 819 | 192 | .510 | 303 | 18.7 | 24.8 | 30.9 | 37.0 | 43.1 | 49.2 | 55.3 |
| | | -32 | (2) 88.9 | 781 | 187 | .50 | 295 | 18.5 | 24.9 | 31.4 | 37.8 | 44.2 | 50.6 | 57.0 |
| | ISA-10°C | -40 | (1) 94.5 | 987 | 211 | .56 | 324 | 17.6 | 22.7 | 27.7 | 32.8 | 37.9 | 42.9 | 48.0 |
| | -52°C | -41 | 90.8 | 863 | 200 | .530 | 308 | 18.3 | 24.1 | 29.9 | 35.7 | 41.5 | 47.3 | 53.1 |
| | | -43 | (2) 87.0 | 759 | 187 | .50 | 288 | 18.2 | 24.8 | 31.4 | 38.0 | 44.6 | 51.2 | 57.8 |
| 14000. | ISA+10°C | -21 | (1) 90.7 | 809 | 194 | .51 | 312 | 20.0 | 26.1 | 32.3 | 38.5 | 44.7 | 50.8 | 57.0 |
| | -32°C | -21 | 89.5 | 773 | 188 | .500 | 303 | 19.8 | 26.3 | 32.8 | 39.2 | 45.7 | 52.2 | 58.6 |
| | | -22 | (2) 88.5 | 739 | 184 | .49 | 296 | 19.8 | 26.6 | 33.3 | 40.1 | 46.9 | 53.6 | 60.4 |
| | ISA+ 0°C | -30 | (1) 92.5 | 885 | 205 | .54 | 322 | 19.4 | 25.1 | 30.7 | 36.4 | 42.0 | 47.7 | 53.3 |
| | -42°C | -31 | 89.5 | 810 | 196 | .520 | 309 | 19.6 | 25.8 | 32.0 | 38.1 | 44.3 | 50.5 | 56.7 |
| | | -32 | (2) 86.8 | 720 | 184 | .49 | 290 | 19.5 | 26.4 | 33.4 | 40.3 | 47.3 | 54.2 | 61.2 |
| | ISA-10°C | -39 | (1) 94.4 | 988 | 215 | .57 | 330 | 18.2 | 23.3 | 28.3 | 33.4 | 38.4 | 43.5 | 48.6 |
| | -52°C | -41 | 88.8 | 817 | 200 | .530 | 308 | 19.3 | 25.4 | 31.5 | 37.7 | 43.8 | 49.9 | 56.0 |
| | | -43 | (2) 85.0 | 700 | 184 | .49 | 284 | 19.1 | 26.3 | 33.4 | 40.6 | 47.7 | 54.8 | 62.0 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 10)

# CRUISE
# 31,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18000. | ISA+ 0°C | -36 | (1) 93.3 | 838 | 182 | .50 | 297 | 17.5 | 23.5 | 29.4 | 35.4 | 41.4 | 47.3 | 53.3 |
| | | -36 | (2) 92.1 | 799 | 176 | .49 | 288 | 17.3 | 23.5 | 29.8 | 36.1 | 42.3 | 48.6 | 54.8 |
| | ISA-10°C | -45 | (1) 95.5 | 938 | 195 | .54 | 311 | 17.1 | 22.5 | 27.8 | 33.1 | 38.5 | 43.8 | 49.1 |
| | -56°C | -46 | 93.2 | 867 | 188 | .520 | 299 | 17.2 | 23.0 | 28.7 | 34.5 | 40.3 | 46.0 | 51.8 |
| | | -47 | (2) 90.3 | 778 | 176 | .49 | 282 | 16.9 | 23.4 | 29.8 | 36.2 | 42.6 | 49.1 | 55.5 |
| 17000. | ISA+ 0°C | -35 | (1) 93.2 | 839 | 187 | .52 | 305 | 18.5 | 24.5 | 30.4 | 36.4 | 42.3 | 48.3 | 54.3 |
| | -46°C | -36 | 92.4 | 816 | 184 | .510 | 300 | 18.4 | 24.5 | 30.7 | 36.8 | 42.9 | 49.0 | 55.2 |
| | | -36 | (2) 91.0 | 773 | 178 | .49 | 291 | 18.2 | 24.7 | 31.2 | 37.6 | 44.1 | 50.6 | 57.1 |
| | ISA-10°C | -44 | (1) 95.3 | 938 | 199 | .55 | 317 | 17.8 | 23.1 | 28.4 | 33.7 | 39.1 | 44.4 | 49.7 |
| | -56°C | -46 | 91.4 | 825 | 188 | .520 | 299 | 18.1 | 24.2 | 30.2 | 36.3 | 42.4 | 48.4 | 54.5 |
| | | -47 | (2) 89.0 | 749 | 177 | .49 | 284 | 17.9 | 24.5 | 31.2 | 37.9 | 44.6 | 51.2 | 57.9 |
| 16500. | ISA+ 0°C | -35 | (1) 93.1 | 840 | 189 | .52 | 309 | 18.9 | 24.9 | 30.8 | 36.8 | 42.7 | 48.7 | 54.6 |
| | -46°C | -36 | 91.7 | 797 | 184 | .510 | 300 | 18.9 | 25.1 | 31.4 | 37.7 | 43.9 | 50.2 | 56.5 |
| | | -36 | (2) 90.6 | 769 | 180 | .50 | 294 | 18.7 | 25.2 | 31.7 | 38.2 | 44.7 | 51.2 | 57.7 |
| | ISA-10°C | -44 | (1) 95.3 | 938 | 200 | .55 | 319 | 18.0 | 23.3 | 28.7 | 34.0 | 39.3 | 44.6 | 50.0 |
| | -56°C | -45 | 91.7 | 837 | 191 | .530 | 305 | 18.5 | 24.5 | 30.5 | 36.5 | 42.4 | 48.4 | 54.4 |
| | | -47 | (2) 88.7 | 746 | 179 | .50 | 287 | 18.3 | 25.0 | 31.7 | 38.4 | 45.1 | 51.9 | 58.6 |
| 16000. | ISA+ 0°C | -35 | (1) 93.1 | 840 | 191 | .53 | 312 | 19.3 | 25.2 | 31.2 | 37.1 | 43.1 | 49.0 | 55.0 |
| | -46°C | -35 | 92.1 | 810 | 188 | .520 | 306 | 19.3 | 25.4 | 31.6 | 37.8 | 44.0 | 50.1 | 56.3 |
| | | -36 | (2) 89.8 | 757 | 180 | .50 | 295 | 19.1 | 25.7 | 32.3 | 39.0 | 45.6 | 52.2 | 58.8 |
| | ISA-10°C | -44 | (1) 95.2 | 940 | 202 | .56 | 321 | 18.2 | 23.5 | 28.9 | 34.2 | 39.5 | 44.8 | 50.1 |
| | -56°C | -45 | 91.2 | 821 | 191 | .530 | 305 | 18.9 | 25.0 | 31.0 | 37.1 | 43.2 | 49.3 | 55.4 |
| | | -46 | (2) 88.0 | 736 | 180 | .50 | 288 | 18.8 | 25.6 | 32.4 | 39.2 | 46.0 | 52.8 | 59.6 |
| 14000. | ISA+10°C | -25 | (1) 91.5 | 780 | 188 | .52 | 313 | 20.8 | 27.3 | 33.7 | 40.1 | 46.5 | 52.9 | 59.3 |
| | -36°C | -25 | 90.5 | 752 | 184 | .510 | 307 | 20.9 | 27.5 | 34.2 | 40.8 | 47.5 | 54.1 | 60.8 |
| | | -26 | (2) 89.3 | 710 | 178 | .49 | 297 | 20.7 | 27.8 | 34.8 | 41.8 | 48.9 | 55.9 | 63.0 |
| | ISA+ 0°C | -34 | (1) 93.0 | 843 | 197 | .55 | 321 | 20.3 | 26.2 | 32.1 | 38.1 | 44.0 | 49.9 | 55.9 |
| | -46°C | -35 | 89.7 | 758 | 188 | .520 | 306 | 20.6 | 27.2 | 33.8 | 40.4 | 47.0 | 53.6 | 60.2 |
| | | -36 | (2) 87.4 | 691 | 178 | .49 | 291 | 20.4 | 27.6 | 34.8 | 42.1 | 49.3 | 56.6 | 63.8 |
| | ISA-10°C | -43 | (1) 95.2 | 944 | 207 | .57 | 329 | 19.0 | 24.3 | 29.6 | 34.9 | 40.2 | 45.4 | 50.7 |
| | -56°C | -45 | 89.2 | 767 | 191 | .530 | 305 | 20.2 | 26.7 | 33.2 | 39.8 | 46.3 | 52.8 | 59.3 |
| | | -47 | (2) 85.6 | 671 | 178 | .49 | 284 | 20.0 | 27.4 | 34.9 | 42.4 | 49.8 | 57.3 | 64.7 |

# CRUISE
# 33,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17000. | ISA+ 0°C | -40 | (1) 94.4 | 804 | 175 | .51 | 297 | 18.3 | 24.5 | 30.7 | 37.0 | 43.2 | 49.4 | 55.6 |
| | -50°C | -40 | 93.3 | 777 | 172 | .500 | 292 | 18.3 | 24.7 | 31.1 | 37.6 | 44.0 | 50.4 | 56.9 |
| | | -41 | (2) 92.5 | 755 | 169 | .49 | 287 | 18.2 | 24.8 | 31.4 | 38.0 | 44.7 | 51.3 | 57.9 |
| | ISA-10°C | -49 | (1) 96.1 | 871 | 186 | .54 | 308 | 18.1 | 23.9 | 29.6 | 35.3 | 41.1 | 46.8 | 52.6 |
| | -60°C | -50 | 93.7 | 812 | 179 | .520 | 297 | 18.1 | 24.2 | 30.4 | 36.5 | 42.7 | 48.8 | 55.0 |
| | | -51 | (2) 90.6 | 735 | 169 | .49 | 281 | 17.8 | 24.6 | 31.4 | 38.2 | 45.0 | 51.8 | 58.6 |
| 16500. | ISA+ 0°C | -39 | (1) 94.2 | 804 | 179 | .52 | 302 | 18.9 | 25.2 | 31.4 | 37.6 | 43.8 | 50.0 | 56.3 |
| | -50°C | -40 | 93.3 | 781 | 176 | .510 | 298 | 18.9 | 25.3 | 31.7 | 38.1 | 44.5 | 50.9 | 57.3 |
| | | -41 | (2) 91.6 | 735 | 169 | .49 | 287 | 18.7 | 25.5 | 32.3 | 39.1 | 45.9 | 52.7 | 59.5 |
| | ISA-10°C | -49 | (1) 96.1 | 875 | 189 | .55 | 312 | 18.5 | 24.2 | 30.0 | 35.7 | 41.4 | 47.1 | 52.8 |
| | -60°C | -50 | 92.6 | 788 | 179 | .520 | 297 | 18.6 | 24.9 | 31.3 | 37.6 | 44.0 | 50.3 | 56.6 |
| | | -51 | (2) 89.7 | 714 | 169 | .49 | 281 | 18.3 | 25.3 | 32.3 | 39.3 | 46.3 | 53.3 | 60.3 |
| 16000. | ISA+ 0°C | -39 | (1) 94.2 | 806 | 182 | .53 | 307 | 19.5 | 25.7 | 31.9 | 38.1 | 44.3 | 50.5 | 56.7 |
| | -50°C | -40 | 92.3 | 759 | 176 | .510 | 298 | 19.5 | 26.0 | 32.6 | 39.2 | 45.8 | 52.4 | 59.0 |
| | | -41 | (2) 90.4 | 707 | 168 | .49 | 285 | 19.1 | 26.2 | 33.2 | 40.3 | 47.4 | 54.5 | 61.5 |
| | ISA-10°C | -48 | (1) 96.0 | 878 | 191 | .55 | 316 | 18.9 | 24.5 | 30.2 | 35.9 | 41.6 | 47.3 | 53.0 |
| | -60°C | -50 | 91.6 | 766 | 179 | .520 | 297 | 19.1 | 25.7 | 32.2 | 38.7 | 45.2 | 51.7 | 58.3 |
| | | -51 | (2) 88.7 | 691 | 168 | .49 | 279 | 18.7 | 25.9 | 33.2 | 40.4 | 47.7 | 54.9 | 62.1 |
| 15000. | ISA+10°C | -29 | (1) 92.2 | 734 | 175 | .51 | 303 | 20.9 | 27.7 | 34.5 | 41.3 | 48.1 | 54.9 | 61.7 |
| | | -30 | (2) 91.4 | 715 | 172 | .50 | 298 | 20.7 | 27.7 | 34.7 | 41.7 | 48.7 | 55.7 | 62.7 |
| | ISA+ 0°C | -39 | (1) 94.0 | 807 | 186 | .54 | 314 | 20.3 | 26.5 | 32.7 | 38.9 | 45.1 | 51.3 | 57.5 |
| | -50°C | -39 | 91.7 | 748 | 179 | .520 | 303 | 20.5 | 27.2 | 33.9 | 40.6 | 47.2 | 53.9 | 60.6 |
| | | -40 | (2) 89.6 | 695 | 172 | .50 | 292 | 20.4 | 27.6 | 34.8 | 42.0 | 49.2 | 56.4 | 63.5 |
| | ISA-10°C | -48 | (1) 96.0 | 883 | 195 | .56 | 321 | 19.4 | 25.0 | 30.7 | 36.3 | 42.0 | 47.7 | 53.3 |
| | -60°C | -49 | 90.8 | 756 | 183 | .530 | 302 | 20.1 | 26.8 | 33.4 | 40.0 | 46.6 | 53.2 | 59.8 |
| | | -51 | (2) 87.6 | 674 | 172 | .50 | 284 | 19.9 | 27.3 | 34.8 | 42.2 | 49.6 | 57.0 | 64.4 |
| 14000. | ISA+10°C | -29 | (1) 92.1 | 737 | 180 | .52 | 311 | 21.8 | 28.6 | 35.4 | 42.2 | 49.0 | 55.7 | 62.5 |
| | -40°C | -29 | 90.9 | 708 | 176 | .510 | 304 | 21.8 | 28.8 | 35.9 | 43.0 | 50.0 | 57.1 | 64.1 |
| | | -30 | (2) 90.2 | 686 | 172 | .50 | 298 | 21.6 | 28.9 | 36.2 | 43.4 | 50.7 | 58.0 | 65.3 |
| | ISA+ 0°C | -38 | (1) 93.8 | 809 | 189 | .55 | 319 | 20.9 | 27.1 | 33.3 | 39.5 | 45.7 | 51.8 | 58.0 |
| | -50°C | -39 | 91.5 | 746 | 183 | .530 | 309 | 21.3 | 28.0 | 34.7 | 41.5 | 48.2 | 54.9 | 61.6 |
| | | -40 | (2) 88.4 | 667 | 172 | .50 | 292 | 21.2 | 28.7 | 36.2 | 43.7 | 51.2 | 58.7 | 66.2 |
| | ISA-10°C | -48 | (1) 95.9 | 888 | 198 | .57 | 326 | 19.8 | 25.4 | 31.1 | 36.7 | 42.3 | 48.0 | 53.6 |
| | -60°C | -49 | 90.8 | 759 | 187 | .540 | 308 | 20.8 | 27.4 | 34.0 | 40.6 | 47.2 | 53.8 | 60.4 |
| | | -51 | (2) 86.5 | 648 | 172 | .50 | 285 | 20.8 | 28.5 | 36.3 | 44.0 | 51.7 | 59.4 | 67.1 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 11)

# CRUISE
# 35,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TRAILWIND | 100 KT. TRAILWIND | 150 KT. TRAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16500. | ISA+ 0°C | -44 | (1) 95.3 | 755 | 165 | .50 | 290 | 18.5 | 25.1 | 31.8 | 38.4 | 45.0 | 51.6 | 58.3 |
| | | -45 | (2) 94.4 | 733 | 162 | .49 | 284 | 18.4 | 25.2 | 32.0 | 38.8 | 45.6 | 52.5 | 59.3 |
| | ISA-10°C | -54 | (1) 96.8 | 799 | 173 | .52 | 297 | 18.3 | 24.6 | 30.9 | 37.1 | 43.4 | 49.6 | 55.9 |
| | -64°C | -54 | 94.3 | 756 | 168 | .510 | 288 | 18.3 | 24.9 | 31.5 | 38.1 | 44.7 | 51.3 | 58.0 |
| | | -55 | (2) 92.5 | 714 | 162 | .49 | 278 | 17.9 | 24.9 | 31.9 | 38.9 | 45.9 | 52.9 | 59.9 |
| 16000. | ISA+ 0°C | -44 | (1) 95.3 | 757 | 168 | .51 | 295 | 19.2 | 25.8 | 32.4 | 39.0 | 45.6 | 52.2 | 58.8 |
| | -54°C | -44 | 94.0 | 726 | 164 | .500 | 289 | 19.2 | 26.1 | 33.0 | 39.8 | 46.7 | 53.6 | 60.5 |
| | | -45 | (2) 92.9 | 706 | 161 | .49 | 284 | 19.0 | 26.1 | 33.1 | 40.2 | 47.3 | 54.4 | 61.5 |
| | ISA-10°C | -53 | (1) 96.7 | 802 | 177 | .54 | 303 | 19.0 | 25.3 | 31.5 | 37.7 | 44.0 | 50.2 | 56.4 |
| | -64°C | -54 | 94.3 | 759 | 171 | .520 | 294 | 18.9 | 25.5 | 32.1 | 38.7 | 45.3 | 51.9 | 58.5 |
| | | -55 | (2) 91.0 | 687 | 161 | .49 | 277 | 18.5 | 25.8 | 33.1 | 40.3 | 47.6 | 54.9 | 62.2 |
| 15000. | ISA+ 0°C | -43 | (1) 95.1 | 762 | 175 | .53 | 307 | 20.6 | 27.2 | 33.7 | 40.3 | 46.9 | 53.4 | 60.0 |
| | -54°C | -44 | 92.5 | 705 | 168 | .510 | 295 | 20.6 | 27.7 | 34.8 | 41.9 | 49.0 | 56.1 | 63.2 |
| | | -45 | (2) 90.7 | 665 | 162 | .49 | 285 | 20.3 | 27.8 | 35.3 | 42.8 | 50.4 | 57.9 | 65.4 |
| | ISA-10°C | -53 | (1) 96.6 | 810 | 183 | .55 | 313 | 20.1 | 26.3 | 32.4 | 38.6 | 44.8 | 50.9 | 57.1 |
| | -64°C | -54 | 91.9 | 711 | 171 | .520 | 294 | 20.2 | 27.3 | 34.3 | 41.3 | 48.3 | 55.4 | 62.4 |
| | | -55 | (2) 88.8 | 646 | 162 | .49 | 278 | 19.8 | 27.6 | 35.3 | 43.0 | 50.8 | 58.5 | 66.2 |
| 14000. | ISA+10°C | -33 | (1) 92.5 | 689 | 169 | .51 | 303 | 22.3 | 29.5 | 36.8 | 44.0 | 51.3 | 58.5 | 65.8 |
| | -44°C | -34 | 91.1 | 660 | 164 | .500 | 296 | 22.1 | 29.7 | 37.2 | 44.8 | 52.4 | 59.9 | 67.5 |
| | | -34 | (2) 90.8 | 653 | 164 | .50 | 294 | 22.1 | 29.7 | 37.4 | 45.1 | 52.7 | 60.4 | 68.0 |
| | ISA+ 0°C | -42 | (1) 95.0 | 766 | 180 | .55 | 315 | 21.6 | 28.1 | 34.7 | 41.2 | 47.7 | 54.3 | 60.8 |
| | -54°C | -44 | 91.5 | 689 | 171 | .520 | 301 | 21.9 | 29.2 | 36.4 | 43.7 | 50.9 | 58.2 | 65.5 |
| | | -44 | (2) 88.9 | 634 | 163 | .50 | 287 | 21.6 | 29.5 | 37.4 | 45.3 | 53.2 | 61.1 | 68.9 |
| | ISA-10°C | -52 | (1) 96.6 | 815 | 187 | .56 | 319 | 20.7 | 26.9 | 33.0 | 39.2 | 45.3 | 51.4 | 57.6 |
| | -64°C | -54 | 90.7 | 696 | 175 | .530 | 299 | 21.5 | 28.7 | 35.9 | 43.0 | 50.2 | 57.4 | 64.6 |
| | | -55 | (2) 87.0 | 615 | 163 | .50 | 280 | 21.1 | 29.2 | 37.4 | 45.5 | 53.6 | 61.7 | 69.9 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 12)

## CRUISE
## 37,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15000. | ISA+ 0°C | -46 | (1) 96.1 | 713 | 161 | .51 | 295 | 20.4 | 27.4 | 34.4 | 41.4 | 48.4 | 55.5 | 62.5 |
| | -57°C | -47 | 94.7 | 680 | 157 | .500 | 288 | 20.3 | 27.6 | 35.0 | 42.4 | 49.7 | 57.1 | 64.4 |
| | | -47 | (2) 93.9 | 666 | 154 | .49 | 284 | 20.1 | 27.6 | 35.1 | 42.6 | 50.1 | 57.6 | 65.1 |
| | ISA-10°C | -56 | (1) 97.5 | 750 | 168 | .53 | 300 | 20.0 | 26.7 | 33.4 | 40.0 | 46.7 | 53.4 | 60.1 |
| | -67°C | -56 | 95.4 | 711 | 163 | .520 | 292 | 20.0 | 27.1 | 34.1 | 41.1 | 48.2 | 55.2 | 62.2 |
| | | -57 | (2) 92.0 | 649 | 154 | .49 | 277 | 19.6 | 27.3 | 35.0 | 42.7 | 50.4 | 58.1 | 65.8 |
| 14000. | ISA+ 0°C | -45 | (1) 96.0 | 720 | 168 | .54 | 308 | 22.0 | 28.9 | 35.9 | 42.8 | 49.8 | 56.7 | 63.7 |
| | -57°C | -46 | 94.2 | 679 | 163 | .520 | 299 | 22.0 | 29.4 | 36.7 | 44.1 | 51.5 | 58.8 | 66.2 |
| | | -47 | (2) 91.0 | 618 | 155 | .49 | 284 | 21.7 | 29.7 | 37.8 | 45.9 | 54.0 | 62.1 | 70.2 |
| | ISA-10°C | -55 | (1) 97.4 | 757 | 175 | .55 | 312 | 21.4 | 28.0 | 34.6 | 41.2 | 47.8 | 54.4 | 61.0 |
| | -67°C | -56 | 92.3 | 661 | 163 | .520 | 292 | 21.5 | 29.1 | 36.7 | 44.2 | 51.8 | 59.4 | 66.9 |
| | | -57 | (2) 88.9 | 597 | 154 | .49 | 276 | 21.1 | 29.5 | 37.8 | 46.2 | 54.6 | 63.0 | 71.3 |

## CRUISE
## 39,000 FEET

**ANTI-ICE SYSTEMS OFF** **ONE ENGINE**

| WT. LBS. | TEMP | RAT DEG. C | FAN PERCENT RPM | FUEL FLOW LBS/HR | KIAS | IND. MACH | KTAS | NAUTICAL MILES/100 LBS. FUEL 150 KT. HEADWIND | 100 KT. HEADWIND | 50 KT. HEADWIND | ZERO WIND | 50 KT. TAILWIND | 100 KT. TAILWIND | 150 KT. TAILWIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14000. | ISA+ 0°C | -46 | (1) 96.4 | 652 | 152 | .51 | 292 | 21.7 | 29.4 | 37.1 | 44.7 | 52.4 | 60.1 | 67.7 |
| | -57°C | -47 | 95.7 | 637 | 150 | .500 | 288 | 21.6 | 29.5 | 37.3 | 45.2 | 53.0 | 60.8 | 68.7 |
| | | -47 | (2) 95.3 | 634 | 149 | .50 | 286 | 21.4 | 29.3 | 37.2 | 45.1 | 53.0 | 60.9 | 68.7 |
| | ISA-10°C | -56 | (1) 97.8 | 690 | 158 | .53 | 297 | 21.2 | 28.5 | 35.7 | 43.0 | 50.2 | 57.4 | 64.7 |
| | -67°C | -57 | 95.0 | 643 | 153 | .510 | 287 | 21.3 | 29.0 | 36.8 | 44.6 | 52.4 | 60.2 | 67.9 |
| | | -57 | (2) 93.4 | 617 | 149 | .50 | 279 | 21.0 | 29.1 | 37.2 | 45.3 | 53.4 | 61.5 | 69.6 |

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-15 (Sheet 13)

# DRIFT DOWN

Engine out drift down data is presented in the table on the following page, in the event of an enroute engine failure. The following criteria are used:

1. Set good engine to climb throttle position.
2. Hold drift down speed per weight at engine failure as presented in the table.
3. When final altitude as presented in the table is reached, set throttle to cruise position and consult single engine cruise tables.

# ENGINE OUT DRIFTDOWN

DRIFTDOWN SPEED - KIAS

| TEMPERATURE | WEIGHT AT ENGINE FAILURE - LBS 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|
| ISA+20°C | 217 | 212 | 207 | 195 | 184 |
| ISA+10°C | 217 | 213 | 207 | 176 | 156 |
| ISA+ 0°C | 188 | 179 | 172 | 159 | 149 |
| ISA-10°C | 179 | 174 | 168 | 157 | 147 |

## TIME, DISTANCE, FUEL, AND FINAL ALTITUDE

## ANTI-ICE SYSTEMS OFF

PRESSURE ALTITUDE 45000 FEET, ISA = -57°C = -70°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |
| ISA +10°C | MIN | 84 | 77 | 62 | 43 | 40 |
| | NM | 445 | 407 | 334 | 218 | 200 |
| | LB | 1376 | 1195 | 921 | 497 | 405 |
| | FT | 20350 | 22300 | 24750 | 33850 | 37450 |
| ISA | MIN | 50 | 47 | 42 | 33 | 29 |
| | NM | 256 | 237 | 211 | 162 | 144 |
| | LB | 706 | 624 | 528 | 365 | 296 |
| | FT | 29600 | 31700 | 33550 | 36800 | 39700 |
| ISA -10°C | MIN | 39 | 36 | 34 | 29 | 26 |
| | NM | 195 | 181 | 168 | 142 | 126 |
| | LB | 532 | 472 | 420 | 324 | 264 |
| | FT | 32100 | 33500 | 34900 | 37750 | 40650 |

PRESSURE ALTITUDE 43000 FEET, ISA = -57°C = -70°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 88 | 85 | 85 | 79 | 52 |
| | NM | 447 | 431 | 436 | 408 | 274 |
| | LB | 1481 | 1343 | 1276 | 1057 | 613 |
| | FT | 15450 | 18000 | 20250 | 24600 | 30250 |
| ISA +10°C | MIN | 84 | 76 | 63 | 39 | 37 |
| | NM | 441 | 403 | 335 | 198 | 185 |
| | LB | 1371 | 1189 | 929 | 456 | 381 |
| | FT | 20350 | 22300 | 24700 | 33800 | 37450 |
| ISA | MIN | 49 | 45 | 40 | 31 | 26 |
| | NM | 249 | 229 | 201 | 153 | 125 |
| | LB | 693 | 609 | 511 | 352 | 264 |
| | FT | 29600 | 31700 | 33550 | 36750 | 39650 |
| ISA -10°C | MIN | 38 | 35 | 33 | 27 | 22 |
| | NM | 187 | 171 | 161 | 130 | 105 |
| | LB | 517 | 454 | 412 | 305 | 228 |
| | FT | 32100 | 33500 | 34850 | 37700 | 40550 |

PRESSURE ALTITUDE 41000 FEET, ISA = -57°C = -70°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 88 | 84 | 85 | 78 | 51 |
| | NM | 443 | 426 | 430 | 405 | 270 |
| | LB | 1474 | 1337 | 1267 | 1056 | 610 |
| | FT | 15450 | 18000 | 20250 | 24650 | 30200 |
| ISA +10°C | MIN | 83 | 75 | 62 | 35 | 34 |
| | NM | 436 | 398 | 329 | 178 | 170 |
| | LB | 1363 | 1181 | 919 | 416 | 359 |
| | FT | 20350 | 22300 | 24700 | 33750 | 37350 |
| ISA | MIN | 48 | 42 | 39 | 28 | 19 |
| | NM | 244 | 212 | 193 | 138 | 90 |
| | LB | 688 | 571 | 497 | 324 | 194 |
| | FT | 29550 | 31650 | 33500 | 36700 | 39550 |
| ISA -10°C | MIN | 37 | 32 | 30 | 24 | 11 |
| | NM | 181 | 158 | 147 | 112 | 49 |
| | LB | 510 | 425 | 382 | 268 | 110 |
| | FT | 32050 | 33450 | 34850 | 37650 | 40400 |

PRESSURE ALTITUDE 39000 FEET, ISA = -57°C = -70°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 88 | 83 | 83 | 78 | 50 |
| | NM | 441 | 420 | 423 | 401 | 262 |
| | LB | 1481 | 1327 | 1255 | 1056 | 600 |
| | FT | 15400 | 18000 | 20250 | 24600 | 30150 |
| ISA +10°C | MIN | 83 | 74 | 61 | 29 | 27 |
| | NM | 435 | 390 | 325 | 148 | 133 |
| | LB | 1368 | 1168 | 918 | 350 | 288 |
| | FT | 20300 | 22300 | 24650 | 33600 | 37250 |
| ISA | MIN | 46 | 41 | 37 | 23 | ---- |
| | NM | 232 | 203 | 180 | 111 | ---- |
| | LB | 663 | 554 | 473 | 268 | ---- |
| | FT | 29550 | 31600 | 33450 | 36650 | ---- |
| ISA -10°C | MIN | 34 | 31 | 27 | 17 | ---- |
| | NM | 167 | 152 | 131 | 80 | ---- |
| | LB | 479 | 420 | 349 | 197 | ---- |
| | FT | 32050 | 33400 | 34800 | 37550 | ---- |

PRESSURE ALTITUDE 37000 FEET, ISA = -57°C = -70°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 87 | 83 | 83 | 76 | 49 |
| | NM | 434 | 418 | 419 | 391 | 254 |
| | LB | 1466 | 1329 | 1253 | 1037 | 590 |
| | FT | 15400 | 17950 | 20200 | 24600 | 30050 |
| ISA +10°C | MIN | 82 | 74 | 59 | 21 | 4 |
| | NM | 426 | 386 | 314 | 107 | 19 |
| | LB | 1352 | 1166 | 895 | 256 | 42 |
| | FT | 20300 | 22250 | 24650 | 33450 | 36750 |
| ISA | MIN | 45 | 40 | 33 | 11 | ---- |
| | NM | 226 | 197 | 159 | 53 | ---- |
| | LB | 655 | 551 | 426 | 132 | ---- |
| | FT | 29450 | 31550 | 33400 | 36400 | ---- |
| ISA -10°C | MIN | 32 | 27 | 23 | ---- | ---- |
| | NM | 154 | 128 | 108 | ---- | ---- |
| | LB | 448 | 360 | 295 | ---- | ---- |
| | FT | 32000 | 33350 | 34700 | ---- | ---- |

PRESSURE ALTITUDE 35000 FEET, ISA = -54°C = -66°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 86 | 81 | 81 | 75 | 46 |
| | NM | 430 | 408 | 408 | 381 | 236 |
| | LB | 1464 | 1310 | 1231 | 1023 | 556 |
| | FT | 15350 | 17950 | 20200 | 24550 | 29950 |
| ISA +10°C | MIN | 81 | 73 | 58 | 12 | ---- |
| | NM | 421 | 380 | 304 | 60 | ---- |
| | LB | 1346 | 1157 | 875 | 149 | ---- |
| | FT | 20250 | 22200 | 24500 | 33250 | ---- |
| ISA | MIN | 42 | 34 | 26 | ---- | ---- |
| | NM | 209 | 168 | 124 | ---- | ---- |
| | LB | 616 | 477 | 340 | ---- | ---- |
| | FT | 29400 | 31450 | 33250 | ---- | ---- |
| ISA -10°C | MIN | 28 | 21 | 10 | ---- | ---- |
| | NM | 135 | 101 | 47 | ---- | ---- |
| | LB | 403 | 294 | 133 | ---- | ---- |
| | FT | 31900 | 33250 | 34450 | ---- | ---- |

PRESSURE ALTITUDE 33000 FEET, ISA = -50°C = -59°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 84 | 80 | 80 | 73 | 42 |
| | NM | 419 | 402 | 400 | 369 | 214 |
| | LB | 1440 | 1303 | 1218 | 999 | 513 |
| | FT | 15350 | 17900 | 20150 | 24500 | 29750 |
| ISA +10°C | MIN | 79 | 71 | 57 | 9 | ---- |
| | NM | 408 | 371 | 298 | 44 | ---- |
| | LB | 1316 | 1141 | 869 | 115 | ---- |
| | FT | 20250 | 22150 | 24500 | 32400 | ---- |
| ISA | MIN | 39 | 29 | 5 | ---- | ---- |
| | NM | 192 | 138 | 24 | ---- | ---- |
| | LB | 575 | 402 | 66 | ---- | ---- |
| | FT | 29250 | 31250 | 32700 | ---- | ---- |
| ISA -10°C | MIN | 20 | 2 | ---- | ---- | ---- |
| | NM | 93 | 9 | ---- | ---- | ---- |
| | LB | 285 | 28 | ---- | ---- | ---- |
| | FT | 31750 | 32850 | ---- | ---- | ---- |

PRESSURE ALTITUDE 31000 FEET, ISA = -46°C = -52°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 83 | 79 | 78 | 70 | 33 |
| | NM | 412 | 394 | 388 | 355 | 168 |
| | LB | 1427 | 1289 | 1195 | 971 | 410 |
| | FT | 15300 | 17850 | 20100 | 24400 | 29300 |
| ISA +10°C | MIN | 77 | 69 | 54 | 8 | ---- |
| | NM | 398 | 359 | 280 | 40 | ---- |
| | LB | 1295 | 1116 | 827 | 104 | ---- |
| | FT | 20200 | 22100 | 24350 | 30550 | ---- |
| ISA | MIN | 33 | 8 | ---- | ---- | ---- |
| | NM | 161 | 38 | ---- | ---- | ---- |
| | LB | 492 | 112 | ---- | ---- | ---- |
| | FT | 29050 | 30550 | ---- | ---- | ---- |
| ISA -10°C | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |

PRESSURE ALTITUDE 29000 FEET, ISA = -42°C = -44°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 83 | 77 | 75 | 66 | 13 |
| | NM | 406 | 383 | 373 | 333 | 65 |
| | LB | 1424 | 1267 | 1160 | 923 | 164 |
| | FT | 15200 | 17800 | 20050 | 24250 | 28300 |
| ISA +10°C | MIN | 76 | 66 | 52 | ---- | ---- |
| | NM | 389 | 341 | 269 | ---- | ---- |
| | LB | 1277 | 1072 | 805 | ---- | ---- |
| | FT | 20100 | 22050 | 24250 | ---- | ---- |
| ISA | MIN | 13 | ---- | ---- | ---- | ---- |
| | NM | 63 | ---- | ---- | ---- | ---- |
| | LB | 194 | ---- | ---- | ---- | ---- |
| | FT | 28300 | ---- | ---- | ---- | ---- |
| ISA -10°C | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |

PRESSURE ALTITUDE 27000 FEET, ISA = -38°C = -37°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 80 | 75 | 72 | 58 | ---- |
| | NM | 393 | 369 | 356 | 289 | ---- |
| | LB | 1392 | 1233 | 1120 | 815 | ---- |
| | FT | 15150 | 17750 | 19950 | 23950 | ---- |
| ISA +10°C | MIN | 72 | 63 | 47 | ---- | ---- |
| | NM | 368 | 323 | 240 | ---- | ---- |
| | LB | 1222 | 1028 | 730 | ---- | ---- |
| | FT | 20050 | 21900 | 24000 | ---- | ---- |
| ISA | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |
| ISA -10°C | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |

PRESSURE ALTITUDE 25000 FEET, ISA = -35°C = -30°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 78 | 72 | 68 | 36 | ---- |
| | NM | 381 | 354 | 332 | 177 | ---- |
| | LB | 1364 | 1198 | 1060 | 515 | ---- |
| | FT | 15050 | 17650 | 19800 | 23150 | ---- |
| ISA +10°C | MIN | 68 | 57 | 33 | ---- | ---- |
| | NM | 346 | 291 | 168 | ---- | ---- |
| | LB | 1162 | 937 | 522 | ---- | ---- |
| | FT | 19900 | 21650 | 23300 | ---- | ---- |
| ISA | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |
| ISA -10°C | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |

PRESSURE ALTITUDE 20000 FEET, ISA = -25°C = -12°F

| START WEIGHT | | 20000 | 19000 | 18000 | 16000 | 14000 |
|---|---|---|---|---|---|---|
| ISA +20°C | MIN | 68 | 56 | 31 | ---- | ---- |
| | NM | 327 | 271 | 148 | ---- | ---- |
| | LB | 1219 | 961 | 507 | ---- | ---- |
| | FT | 14500 | 16950 | 18400 | ---- | ---- |
| ISA +10°C | MIN | 29 | 5 | ---- | ---- | ---- |
| | NM | 143 | 24 | ---- | ---- | ---- |
| | LB | 510 | 85 | ---- | ---- | ---- |
| | FT | 18500 | 19700 | ---- | ---- | ---- |
| ISA | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |
| ISA -10°C | MIN | ---- | ---- | ---- | ---- | ---- |
| | NM | ---- | ---- | ---- | ---- | ---- |
| | LB | ---- | ---- | ---- | ---- | ---- |
| | FT | ---- | ---- | ---- | ---- | ---- |

WIND EFFECT ON DISTANCE - NM
(SUBTRACT FOR HEADWIND. ADD FOR TAILWIND)

| TIME (MIN) | WIND 25KTS | 50KTS | 100KTS |
|---|---|---|---|
| 10 | 4 | 8 | 16 |
| 20 | 8 | 16 | 33 |
| 30 | 12 | 25 | 50 |
| 40 | 16 | 33 | 66 |
| 50 | 20 | 41 | 83 |
| 60 | 25 | 50 | 100 |

Figure 7-16

# DESCENT

Performance for two types of descent is presented on the following pages. Time, distance and fuel information are provided for a normal descent of 2000 feet per minute; and a high speed descent of 3000 feet per minute for maximum speed.

This performance is based on controlling the fan speed to obtain the fuel flows, airspeed and rates of descent presented with gear and flaps up, speed brakes retracted and anti-ice systems OFF or ON.

The time, distance and fuel used from a given altitude is based on descending to sea level. If the descent is to another altitude, the difference in time, distance and fuel used between the initial and the final altitude must be determined.

Begin descent at $M_{MO}$ – 10 KIAS, and maintain desired rate of descent when obtained.

The data is based on a gross weight of 14,000 pounds and standard day temperature. However, weight and temperature effects are minimal and the data can be used for all conditions.

# NORMAL DESCENT

**ANTI-ICE SYSTEMS OFF**

**SPEED BRAKES RETRACTED** **GEAR AND FLAPS UP**

2000 FEET PER MINUTE RATE OF DESCENT

| PRESSURE ALTITUDE FEET | KIAS | TIME MIN | FUEL USED LBS | DISTANCE - NAUTICAL MILES | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 KT HEADWIND | 50 KT HEADWIND | 25 KT HEADWIND | ZERO WIND | 25 KT TAILWIND | 50 KT TAILWIND | 100 KT TAILWIND |
| 45,000 | 190. | 22.5 | 494. | 103. | 121. | 131. | 140. | 149. | 159. | 177. |
| 43,000 | 200. | 21.5 | 482. | 97. | 115. | 124. | 133. | 142. | 151. | 169. |
| 41,000 | 210. | 20.5 | 470. | 92. | 109. | 118. | 126. | 135. | 143. | 160. |
| 39,000 | 221. | 19.5 | 455. | 87. | 103. | 111. | 119. | 127. | 136. | 152. |
| 37,000 | 232. | 18.5 | 439. | 82. | 97. | 105. | 112. | 120. | 128. | 143. |
| 35,000 | 243. | 17.5 | 422. | 76. | 91. | 98. | 105. | 113. | 120. | 135. |
| 33,000 | 255. | 16.5 | 401. | 71. | 85. | 92. | 98. | 105. | 112. | 126. |
| 31,000 | 267. | 15.5 | 379. | 66. | 79. | 85. | 91. | 98. | 104. | 117. |
| 29,000 | 279. | 14.5 | 353. | 60. | 72. | 78. | 84. | 90. | 96. | 108. |
| 27,000 | 291. | 13.5 | 325. | 55. | 66. | 71. | 77. | 83. | 88. | 100. |
| 25,000 | 295. | 12.5 | 295. | 49. | 59. | 65. | 70. | 75. | 80. | 91. |
| 23,000 | 295. | 11.5 | 266. | 44. | 53. | 58. | 63. | 68. | 72. | 82. |
| 21,000 | 295. | 10.5 | 238. | 39. | 47. | 52. | 56. | 61. | 65. | 74. |
| 19,000 | 295. | 9.5 | 210. | 34. | 42. | 46. | 50. | 54. | 58. | 65. |
| 17,000 | 295. | 8.5 | 183. | 29. | 36. | 40. | 43. | 47. | 50. | 57. |
| 15,000 | 295. | 7.5 | 155. | 25. | 31. | 34. | 37. | 40. | 43. | 50. |
| 10,000 | 295. | 5.0 | 89. | 14. | 18. | 20. | 22. | 24. | 27. | 31. |
| 5,000 | 249. | 2.5 | 44. | 7. | 9. | 10. | 11. | 12. | 13. | 15. |
| 0 | 249. | 0.0 | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |

WHEN THE ANTI-ICE SYSTEMS ARE ON, INCREASE THE FUEL USED BY 7%.
TIME AND DISTANCE REMAINS THE SAME.

Figure 7-17

# HIGH SPEED DESCENT

**ANTI-ICE SYSTEMS OFF**

**SPEED BRAKES RETRACTED** **GEAR AND FLAPS UP**

3000 FEET PER MINUTE RATE OF DESCENT

| PRESSURE ALTITUDE FEET | KIAS | TIME MIN | FUEL USED LBS | DISTANCE - NAUTICAL MILES | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 KT HEADWIND | 50 KT HEADWIND | 25 KT HEADWIND | ZERO WIND | 25 KT TAILWIND | 50 KT TAILWIND | 100 KT TAILWIND |
| 45.000 | 190. | 15.0 | 275. | 68. | 81. | 87. | 93. | 99. | 106. | 118. |
| 43.000 | 200. | 14.3 | 270. | 65. | 77. | 83. | 89. | 95. | 100. | 112. |
| 41.000 | 210. | 13.7 | 263. | 61. | 73. | 78. | 84. | 90. | 95. | 107. |
| 39.000 | 221. | 13.0 | 256. | 58. | 69. | 74. | 79. | 85. | 90. | 101. |
| 37.000 | 232. | 12.3 | 247. | 54. | 65. | 70. | 75. | 80. | 85. | 95. |
| 35.000 | 243. | 11.7 | 237. | 51. | 61. | 65. | 70. | 75. | 80. | 90. |
| 33.000 | 255. | 11.0 | 226. | 47. | 56. | 61. | 66. | 70. | 75. | 84. |
| 31.000 | 267. | 10.3 | 213. | 44. | 52. | 57. | 61. | 65. | 69. | 78. |
| 29.000 | 279. | 9.7 | 198. | 40. | 48. | 52. | 56. | 60. | 64. | 72. |
| 27.000 | 291. | 9.0 | 181. | 36. | 44. | 48. | 51. | 55. | 59. | 66. |
| 25.000 | 295. | 8.3 | 163. | 33. | 40. | 43. | 46. | 50. | 53. | 60. |
| 23.000 | 295. | 7.7 | 146. | 29. | 35. | 39. | 42. | 45. | 48. | 55. |
| 21.000 | 295. | 7.0 | 130. | 26. | 32. | 34. | 37. | 40. | 43. | 49. |
| 19.000 | 295. | 6.3 | 113. | 22. | 28. | 30. | 33. | 36. | 38. | 43. |
| 17.000 | 295. | 5.7 | 97. | 19. | 24. | 26. | 29. | 31. | 33. | 38. |
| 15.000 | 295. | 5.0 | 81. | 16. | 21. | 23. | 25. | 27. | 29. | 33. |
| 10.000 | 295. | 3.3 | 43. | 9. | 12. | 14. | 15. | 16. | 18. | 20. |
| 5.000 | 249. | 1.7 | 20. | 4. | 6. | 6. | 7. | 8. | 9. | 10. |
| 0 | 249. | 0.0 | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |

WHEN THE ANTI-ICE SYSTEMS ARE ON, INCREASE THE FUEL USED BY 7%.
TIME AND DISTANCE REMAINS THE SAME.

Figure 7-18

# HOLDING

Holding fuel in total pounds per hour is presented for various weights at several altitudes.

This data is based on a nominal holding speed with gear and flaps up and speed brakes retracted.

## HOLDING FUEL

**ANTI-ICE SYSTEMS OFF**

**SPEED BRAKES RETRACTED** **GEAR AND FLAPS UP**

| WEIGHT LBS | KIAS | TOTAL POUNDS PER HOUR / PRESSURE ALTITUDE - FEET SEA LEVEL | 5000 | 10,000 | 15,000 | 20,000 | 25,000 | 30,000 |
|---|---|---|---|---|---|---|---|---|
| 17,000 | 190. | 1175. | 1162. | 1101. | 1014. | 963. | 919. | 889. |
| 16,000 | 185. | 1135. | 1113. | 1067. | 972. | 918. | 878. | 840. |
| 15,000 | 180. | 1096. | 1064. | 1029. | 937. | 877. | 836. | 794. |
| 14,000 | 175. | 1058. | 1015. | 988. | 910. | 837. | 794. | 756. |
| 13,000 | 170. | 1025. | 979. | 944. | 878. | 797. | 752. | 717. |

WHEN THE ANTI-ICE SYSTEMS ARE ON, INCREASE THE FUEL FLOW BY 10 PERCENT.

Figure 7-19

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