TECHNICAL MANUAL

OPERATOR'S MANUAL
FOR
ARMY RC-12D AIRCRAFT

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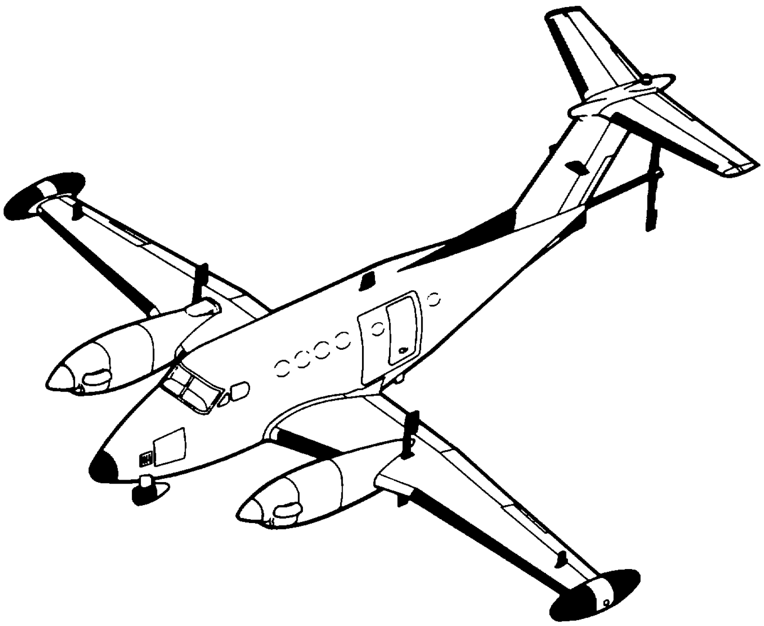

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***This TM 55-1510-219-10 supersedes TM 55-1510-219-10 dated 25 May 1985 including all changes.**

HEADQUARTERS, DEPARTMENT OF THE ARMY
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TM 55-1510-219-10
C3

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OPERATOR'S MANUAL FOR ARMY RC-12D AIRCRAFT

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Operator's Manual

For

ARMY RC-12D AIRCRAFT

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Operator's Manual
For
ARMY RC-12D AIRCRAFT

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WARNING PAGE

Personnel performing operations, procedures and practices which are included or implied in this technical manual shall observe the following warnings. Disregard of these warnings and precautionary information can cause serious injury or loss of life.

NOISE LEVELS

Sound pressure levels in this aircraft during some operating conditions exceed the Surgeon General's hearing conservation criteria, as defined in TM MED 501. Hearing protection devices, such as the aviator helmet or ear plugs shall be worn by all personnel in and around the aircraft during its operation.

STARTING ENGINES

Operating procedures or practices defined in this Technical Manual must be followed correctly. Failure to do so may result in personal injury or loss of life.

Exposure to exhaust gases shall be avoided since exhaust gases are an irritant to eyes, skin and respiratory system.

HIGH VOLTAGE

High voltage is a possible hazard around AC inverters, ignition exciter units, and strobe beacons.

USE OF FIRE EXTINGUISHERS IN CONFINED AREAS

Monobromotrifluoromethane (CF_3Br) is very volatile, but is not easily detected by its odor. Although non toxic, it must be considered to be about the same as other freons and carbon dioxide, causing danger to personnel primarily by reduction of oxygen available for proper breathing. During operation of the fire extinguisher, ventilate personnel areas with fresh air. The liquid shall not be allowed to come into contact with the skin, as it may cause frostbite or low temperature burns because of its very low boiling point.

VERTIGO

The strobe/beacon lights should be turned off during flight through clouds to prevent sensations of vertigo, as a result of reflections of the light on the clouds.

CARBON MONOXIDE

When smoke, suspected carbon monoxide fumes, or symptoms of lack of oxygen (hypoxia) exist, all personnel shall immediately don oxygen masks, and activate the oxygen system.

FUEL AND OIL HANDLING

Turbine fuels and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin.

SERVICING AIRCRAFT

When conditions permit, the aircraft shall be positioned so that the wind will carry fuel vapors away from all possible sources of ignition. The fueling unit shall maintain a distance of 20 feet between unit and filler point. A minimum of 10 feet shall be maintained between fueling unit and aircraft.

Prior to refueling, the hose nozzle static ground wire shall be attached to the grounding lugs that are located adjacent to filler openings.

SERVICING BATTERY

Improper service of the nickel-cadmium battery is dangerous and may result in both bodily injury and equipment damage. The battery shall be serviced in accordance with applicable manuals by qualified personnel only.

Wear rubber gloves, apron, and face shield when handling batteries. If corrosive battery electrolyte (potassium hydroxide) is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.

JET BLAST

Occasionally, during starting, excess fuel accumulation in the combustion chamber causes flames to be blown from the exhausts. This area shall be clear of personnel and flammable materials.

RADIOACTIVE MATERIAL

Instruments contained in this aircraft may contain radioactive material (TB 55-1500-314-25). These items present no radiation hazard to personnel unless seal has been broken due to aging or has accidentally been broken. If seal is suspected to have been broken, notify Radioactive Protective Officer.

RF BURNS

Do not stand near the antennas when they are transmitting.

OPERATION OF AIRCRAFT ON GROUND

At all times during a towing operation, be sure there is a man in the cockpit to operate the brakes.

Personnel should take every precaution against slipping or falling. Make sure guard rails are installed when using maintenance stands.

Engines shall be started and operated only by authorized personnel. Reference AR 95-1.

Insure that landing gear control handle is in the DN position.

TECHNICAL MANUAL

NO. 55-1510-219-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 May 1991

Operator's Manual

ARMY MODEL RC-12D AIRCRAFT

REPORTING OR ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of any way to improve the procedures, please let use know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-LS-LP, Redstone Arsenal, AL 35898-5230. A reply will be furnished directly to you. You may also send in your comments electronically to our E-mail address at <ls-lp@redstone.army.mil>, or by fax at (205) 842-6546 or DSN 788-6546. Instructions for sending an Electronic DA Form 2028 may be found at the back of this manual immediately preceding the hard copy DA Forms 2028.

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

1-1. GENERAL.

These instructions are for use by the operator(s). They apply to the RC-12D aircraft.

1-2. WARNINGS, CAUTIONS, AND NOTES.

Warnings, cautions, and notes are used to emphasize important and critical instructions and are used for the following conditions:

WARNING

An operating procedure, practice, etc. , which if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc. , which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc. , which is essential to highlight.

1-3. DESCRIPTION.

This manual contains the best operating instructions and procedures for the RC-12D aircraft under most circumstances. The observance of limitations, performance, and weight/balance data provided is mandatory. The observance of procedures is mandatory except when modification is required because of multiple emergencies, adverse weather, terrain, etc. Your flying experience is recognized, and therefore basic flight principles are not included. **THIS MANUAL SHALL BE CARRIED IN THE AIRCRAFT AT ALL TIMES.**

1-4. APPENDIX A, REFERENCES.

Appendix A is a listing of official publications cited within the manual applicable to and available for flight crews.

1-5. APPENDIX B, ABBREVIATIONS AND TERMS.

Appendix B is a listing of abbreviations and terms used throughout the manual.

1-6. INDEX.

The index lists, in alphabetical order, every titled paragraph, figure, and table contained in this manual. Chapter 7, Performance Data, has an additional index within the chapter.

1-7. ARMY AVIATION SAFETY PROGRAM.

Reports necessary to comply with the safety program are prescribed in AR 385-40.

1-8. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

For information concerning destruction of Army materiel to prevent enemy use, refer to TM 750-2441-5.

1-9. FORMS AND RECORDS.

Army aviators flight record and aircraft maintenance records which are to be used by crew members are prescribed in DA PAM 738-751 and TM 55-1500-342-23.

1-10. EXPLANATION OF CHANGE SYMBOLS.

Changes, except as noted below, to the text and tables, including new material on added pages, are indicated by a vertical line in the outer margin extending close to the entire area of the material affected; exception: pages with emergency markings, which consist of black diagonal lines around three edges, may have the vertical line or change symbol placed along the inner margins. Symbols show current changes only. A miniature pointing hand symbol is used to denote a change to an illustration. However, a vertical line in the outer margin, rather than miniature pointing hands, is utilized when there have been extensive changes made to an illustration. Change symbols are not utilized to indicate changes in the following:

a. Introductory material.

b. Indexes and tabular data where the change cannot be identified.

c. Blank space resulting from the deletion of text, an illustration or a table.

d. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc. , unless correction changes the meaning of instructive information and procedures.

1-11. AIRCRAFT DESIGNATION SYSTEM.

The designation system prescribed by AR 70-50 is used in aircraft designations as follows: EXAMPLE RC-12D

R - Modified mission symbol (reconnaissance)
C - Basic mission and type symbol (cargo)
12 - Design number
D - Series symbol

1-12. USE OF WORDS SHALL, WILL, SHOULD, AND MAY.

Within this technical manual the word "shall" is used to indicate a mandatory requirement. The word "should" is used to indicate a nonmandatory but preferred method of accomplishment. The word "may" is used to indicate an acceptable method of accomplishment. The word "will" is used to express a declaration of purpose and may also be used where simple futurity is required.

1-13. PLACARD ITEMS.

All placard items (switches, controls, etc.) are shown throughout this manual in capital letters.

CHAPTER 2

AIRCRAFT AND SYSTEMS DESCRIPTION AND OPERATION

Section I. AIRCRAFT

2-1. INTRODUCTION.

The purpose of this chapter is to describe the aircraft and its systems and controls which contribute to the physical act of operating the aircraft. It does not contain descriptions of avionics or mission equipment, covered elsewhere in this manual. This chapter contains descriptive information and does not describe procedures for operation of the aircraft. These procedures are contained within appropriate chapters in the manual. This chapter also contains the emergency equipment installed. This chapter is not designed to provide instructions on the complete mechanical and electrical workings of the various systems; therefore, each is described only in enough detail to make comprehension of that system sufficiently complete to allow for its safe and efficient operation.

2-2. GENERAL.

The RC-12D is a pressurized, low wing, all metal aircraft (figs. 2-1 and 2-2) powered by two PT6A41 turboprop engines, and has all weather capability. Distinguishable features of the aircraft are the slender, streamlined engine nacelles, an aft rotating boom antenna, mission antennas, antenna pods, wing tip pods, a T-tail and a ventral fin below the empennage. The basic mission of the aircraft is radio reconnaissance. Cabin entrance is made through a stair-type door on the left side of the fuselage.

2-3. DIMENSIONS.

Overall aircraft dimensions are shown in Figure 2-3.

2-4. GROUND TURNING RADIUS.

Minimum ground turning radius of the aircraft is shown in Figure 2-4.

2-5. MAXIMUM WEIGHTS.

Maximum takeoff gross weight is 14,200 pounds. Maximum landing weight is 13,500 pounds. Maximum ramp weight is 14,290 pounds.

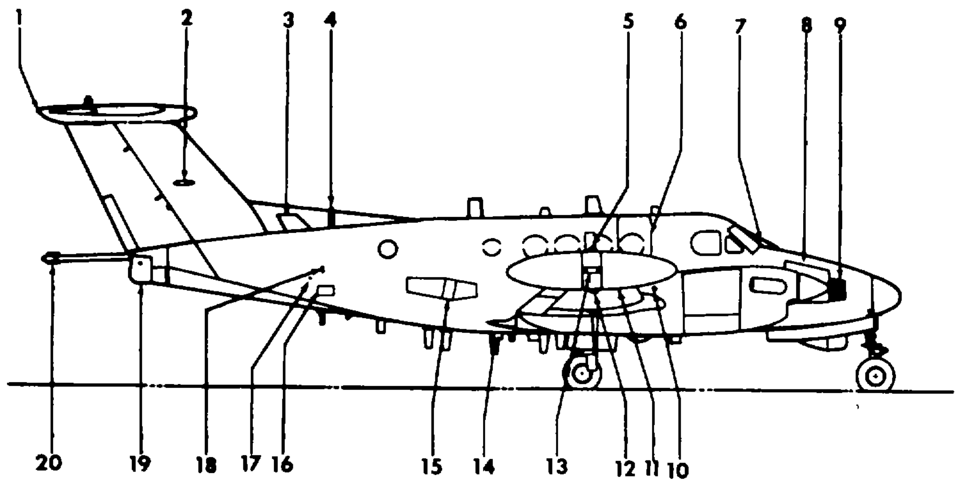
2-6. EXHAUST DANGER AREA.

Danger areas to be avoided by personnel while aircraft engines are being operated on the ground are depicted in Figure 2-5. Distance to be maintained with engines operating at idle are shown. Temperature and velocity of exhaust gases at varying locations aft of the exhaust stacks are shown for maximum power. The danger area extends to 40 feet aft of the exhaust stack outlets. Propeller danger areas are also shown.

2-7. LANDING GEAR SYSTEM.

The landing gear is a retractable, tricycle type, electrically operated by a single DC motor. This motor drives the main landing gear actuators through a gear box and torque tube arrangement, and also drives a chain mechanism which controls the position of the nose gear. Positive down-locks are installed to hold the drag brace in the extended and locked position. The down-locks are actuated by overtravel of the linear jackscrews and are held in position by a spring-loaded overcenter mechanism. The jackscrew in each actuator holds all three gears in the UP position, when the gear is retracted. A friction clutch between the gearbox and the torque shafts protects the motor from electrical overload in the event of a mechanical malfunction. A 150ampere current limiter, located on the DC distribution bus under the center floorboard, protects against electrical overload. Rotation of the dipole antenna is controlled through the actuation of the right main gear up limit switch. Gear doors are opened and closed through a mechanical linkage connected to the landing gear. The nose wheel steering mechanism is automatically centered and the rudder pedals relieved of the steering load when the landing gear is retracted. Air-oil type shock struts, filled with compressed air and hydraulic fluid, are incorporated with the landing gear. Gear retraction or extension time is approximately six seconds.

a. Landing Gear Control Switch. Landing gear system operation is controlled by a manually actuated, wheel-shaped switch placarded LDG GEAR CONTR, UP and DN, on the left subpanel. The control switch and associated relay circuits are protected by a 5-ampere circuit breaker, placarded



1. Tail navigation light
2. VOR/localizer antenna
3. ELT antenna
4. Radar warning receiver antenna (top)
5. Navigation light
6. Emergency entrance/exit hatch
7. Windshield wipers
8. Avionics compartment access door (right side)
9. Air conditioner condenser air inlet
10. Right wing ice light
11. VHF DF antenna pod
12. Navigation light
13. Radar signal detecting set antenna
14. TACAN/INS antenna
15. Flare dispenser
16. Oxygen system servicing door
17. ELT control switch access door
18. Static air source
19. Aft wide band data link antenna pod
20. Rotatable VHF dipole antenna

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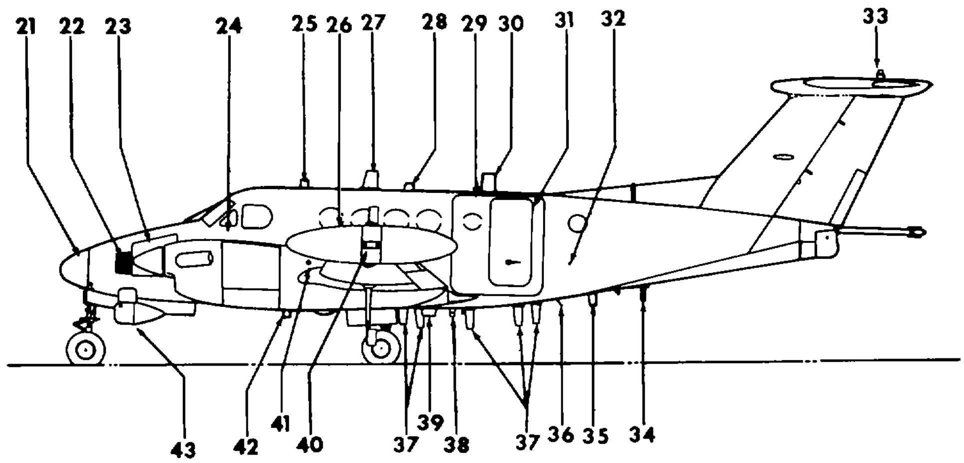
Figure 2-1. General Exterior Arrangement (Sheet 1 of 7)



21. Radome
22. Air conditioner condenser air outlet
23. Avionics compartment access door (left side)
24. Free air temperature gage probe
25. TACAN antenna
26. VHF DF Antenna pod
27. VHF/AM/FM command antenna
28. Transponder antenna
29. Cargo door
30. VHF/UHF command antenna
31. Cabin Door
32. Emergency light
33. Strobe beacon
34. Radar warning receiver antenna (bottom
35. Transponder / backup VOW antenna
36. Relief tube drain
37. UHF DF monopole antennas (6 places)
38. Strobe beacon
39. Strobe beacon shield
40. Radar signal detecting set antenna
41. Left wing ice light
42. Radar signal detecting set blade antenna
43. Forward wide band data link antenna pod

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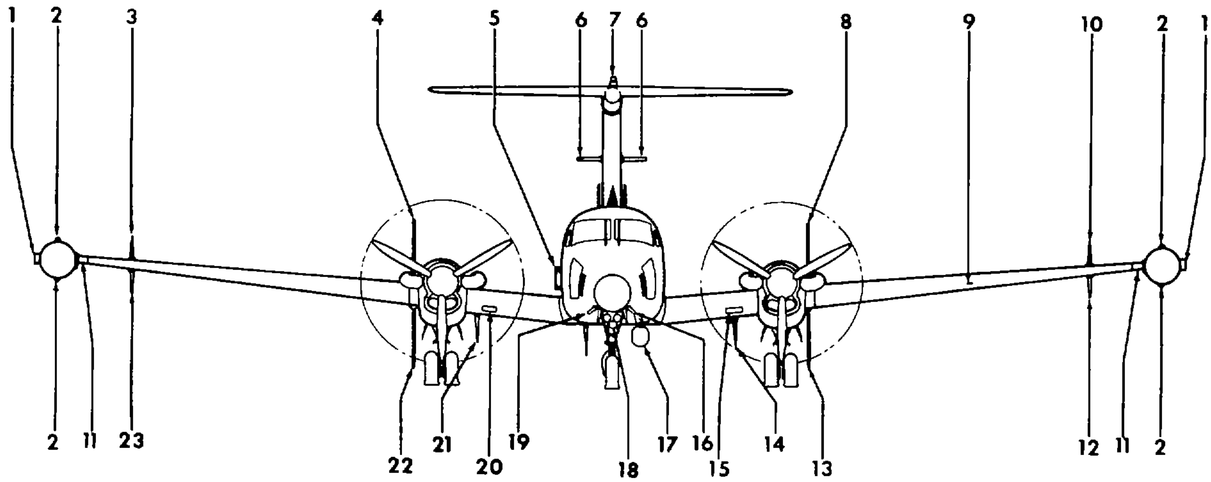
Figure 2-1. General Exterior Arrangement (Sheet 2 of 7)



1. Radar signal detecting set antenna
2. Navigation light
3. UHF dipole antenna (top)
$. VHF dipole antenna (top)
5. Flare dispenser
6. VOR/localizer antenna
7. Strobe beacon
8. VHF dipole antenna (top)
9. Stall warning vane
10. TTY/TCT transmit dipole (top)
11. Recognition light
12. TTY/TCT transmit dipole (bottom)
13. VHF dipole antenna (bottom)
14. UHF DF monopole antenna
15. Bleed air heat exchanger air inlet
16. Pitot tube (left)
17. Forward wide band data link antenna pod
18. Taxi and landing lights
19. Pitot tube (right)
20. Bleed air heat exchanger air inlet
21. UHF DF monopole antenna
22. VHF dipole antenna (bottom)
23. UHF dipole antenna (bottom)

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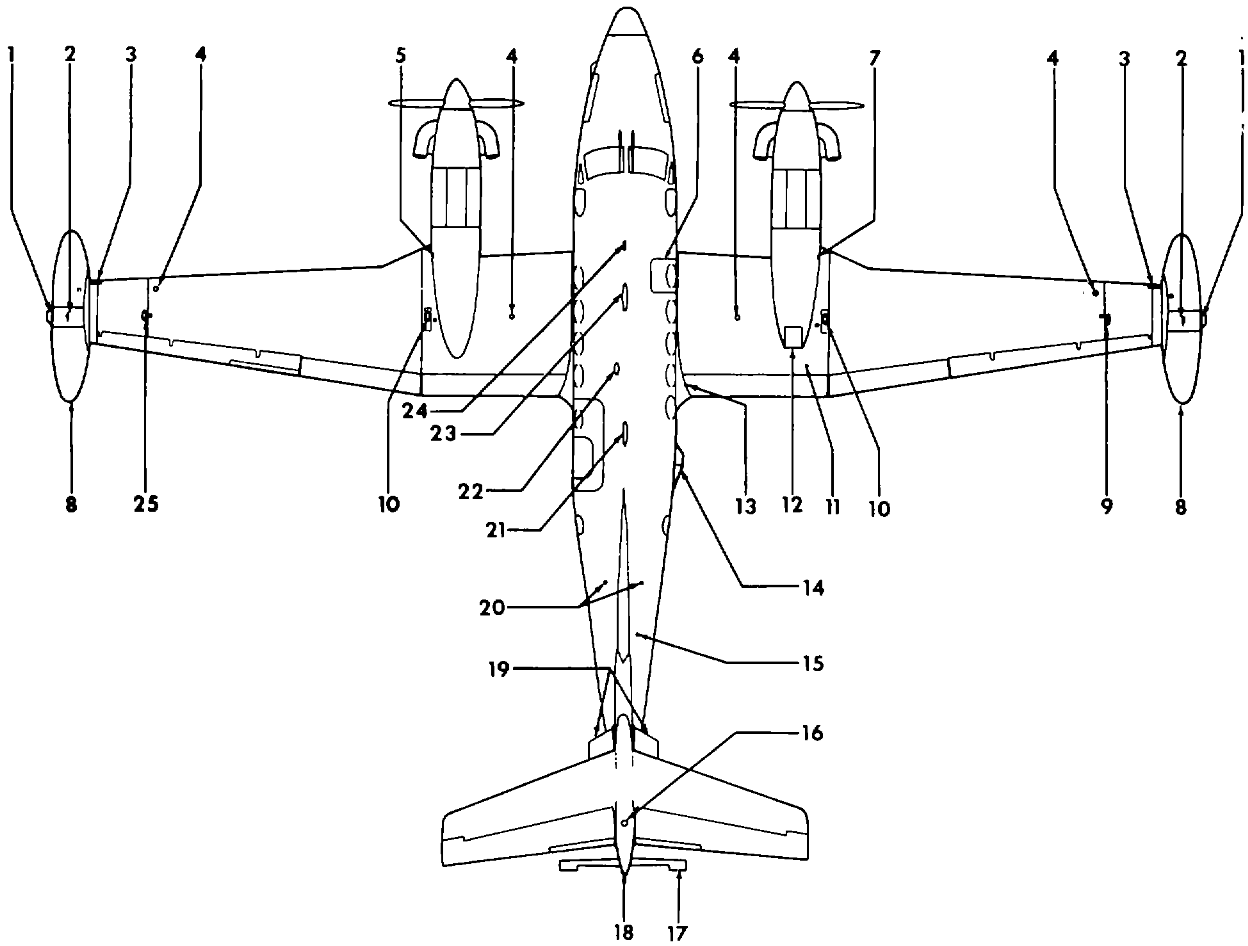
Figure 2-1. General Exterior Arrangement (Sheet 3 of 7)



1. Radar signal detecting set antenna
2. Navigation light
3. Recognition light
4. Fuel filler cap
5. Left wing ice light
6. Emergency entrance/exit hatch
7. Right wing ice light
8. VHF DF antenna pod
9. UHF dipole antenna (top)
10. VHF dipole antenna (top)
11. Flare/chaff dispenser safety switch
12. Chaff dispenser
13. Flare/chaff test connector jack
14. Flare dispenser
15. ELT antenna
16. Strobe beacon
17. Rotatable VHF dipole antenna
18. Tail navigation light
19. VOR/localizer antenna
20. Radar warning receiver antennas (top)
21. VHF/UHF command antenna
22. TACAN/INS antenna
23. VHF/AM/FM command antenna
24. TACAN antenna
25. TTY/TCT transmit dipole (top)

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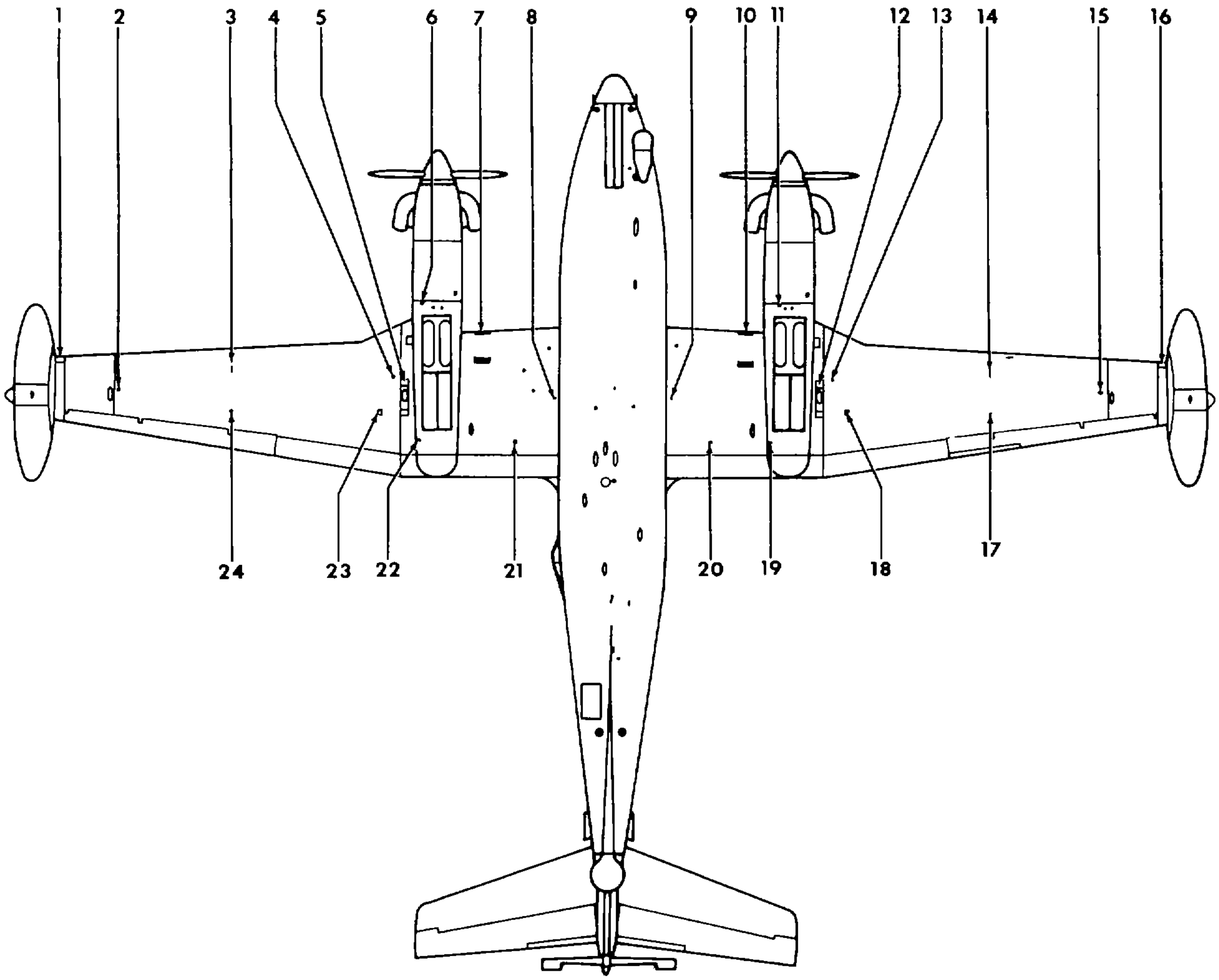
Figure 2-1. General Exterior Arrangement (Sheet 4 of 7)



1. Recognition light
2. Siphon fuel vent
3. Tiedown ring
4. Main tank drain (right wing)
5. Three phase inverter cooling air intake
6. Firewall fuel filter drain
7. Bleed air heat exchanger air intake
8. Extended range fuel tank drain (right wing)
9. Extended range fuel tank drain (left wing)
10. Bleed air heat exchanger air intake
11. Firewall fuel filter drain
12. Three phase inverter cooling air intake
13. Main tank drain (left wing)
14. Tiedown ring
15. Siphon fuel vent
16. Recognition light
17. Outboard fuel sump drain (left wing)
18. Ram scoop fuel vent
19. Oil vent (left engine)
20. Jack pad
21. Jack pad
22. Oil vent (left engine)
23. Ram scoop fuel vent
24. Outboard fuel sump drain (left wing)

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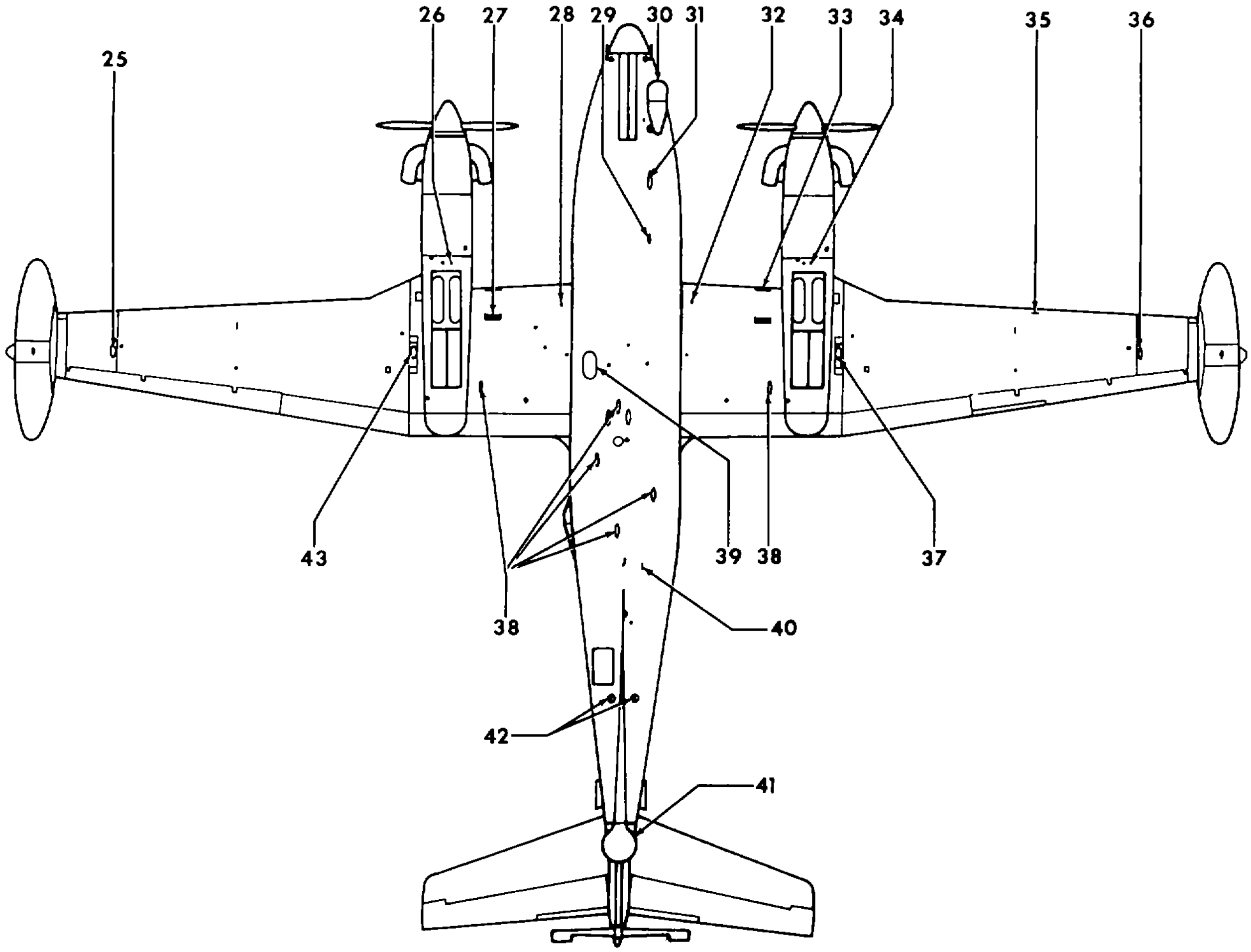
Figure 2-1. General Exterior Arrangement (Sheet 5 of 7)



25. UHF dipole antenna (bottom)
26. Fuel strainer drain
27. Bleed air heat exchanger air exhaust
28. Fuel line drain
29. Radar signal detecting blade antenna
30. Forward wide band data link antenna pod
31. Marker beacon antenna
32. Fuel line drain
33. Bleed air heat exchanger air exhaust
34. Fuel strainer drain
35. Stall warning vane
36. TTY/TCT transmit dipole antenna (bottom)
37. VHF DF dipole antenna (bottom)
38. UHF monopole blade antennas (six places)
39. ADF loop antenna
40. Transponder/backup VOW antenna
41. Aft wide band data link antenna pod
42. Radar warning receiver antennas (bottom)
43. VHF DF dipole antenna (bottom)

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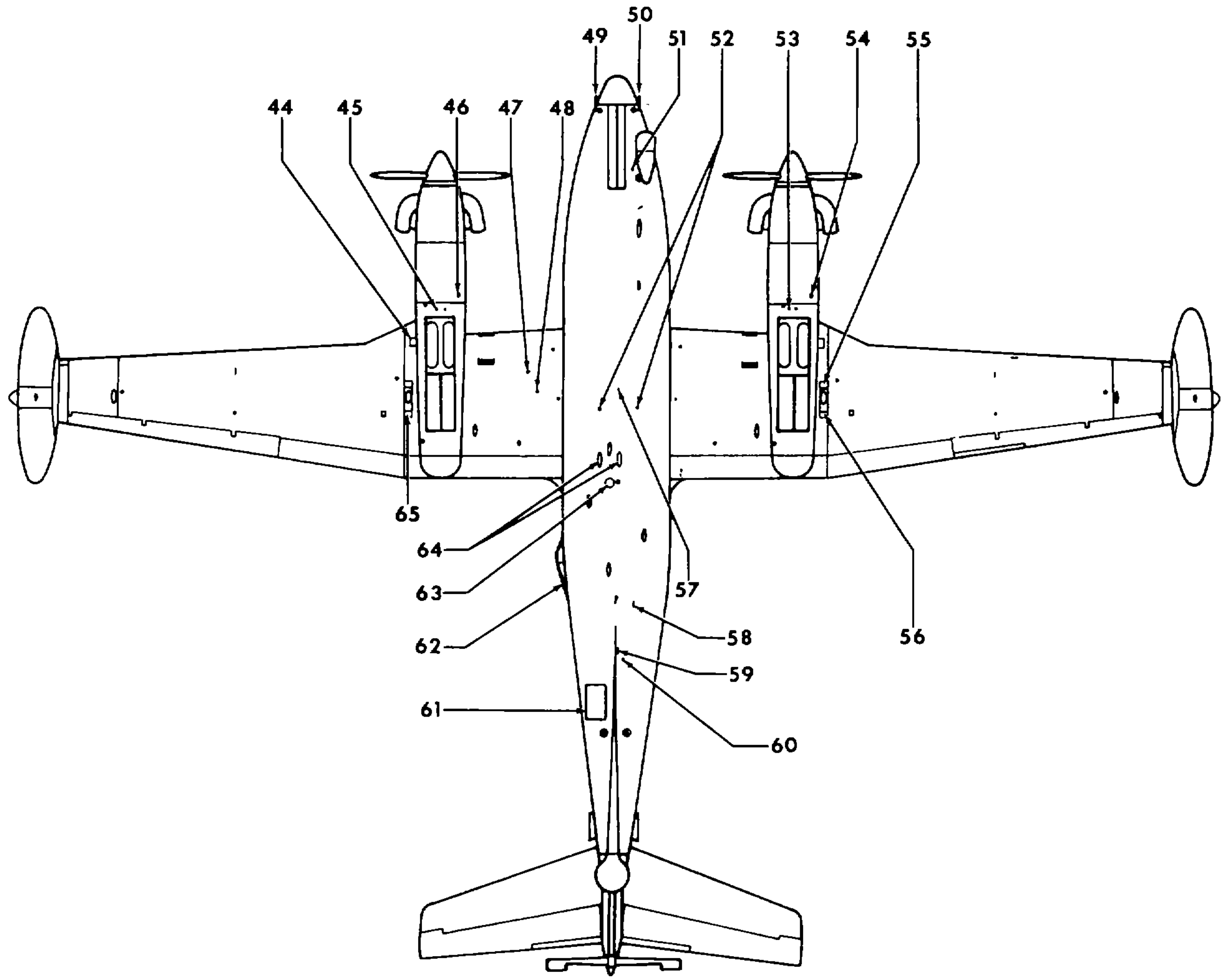
Figure 2-1. General Exterior Arrangement (Sheet 6 of 7)



44. DC external power receptacle
45. Standby fuel boost pump drain (right engine)
46. Gang drain (right engine)
47. INS TAS probe
48. Battery drain
49. Pitot tube (right)
50. Pitot tube (left)
51. Jack pad
52. Surface deice system ejector exhaust
53. Standby fuel boost pump drain (left engine)
54. Gang drain (left engine)
55. AC external power receptacle
56. Three phase inverter cooling air outlet
57. Antenna deice system ejector tube
58. Relief tube drain
59. Oxygen regulator vent
60. Aft compartment drain
61. Tailcone access door
62. Flare dispenser
63. Strobe beacon
64. Strobe beacon shield
65. Three phase inverter cooling air outlet

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Figure 2-1. General Exterior Arrangement (Sheet 7 of 7)

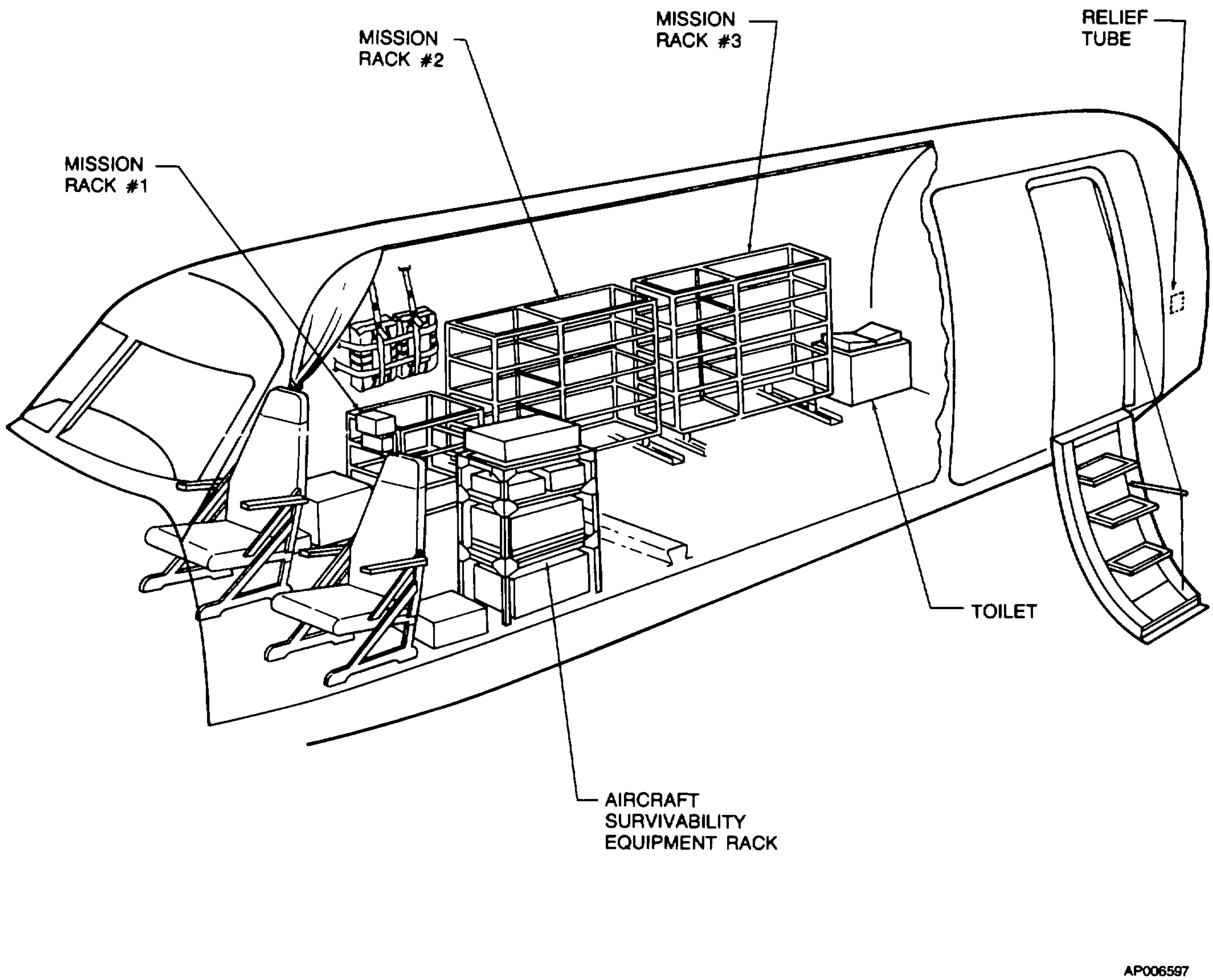


Figure 2-2. General Interior Arrangement

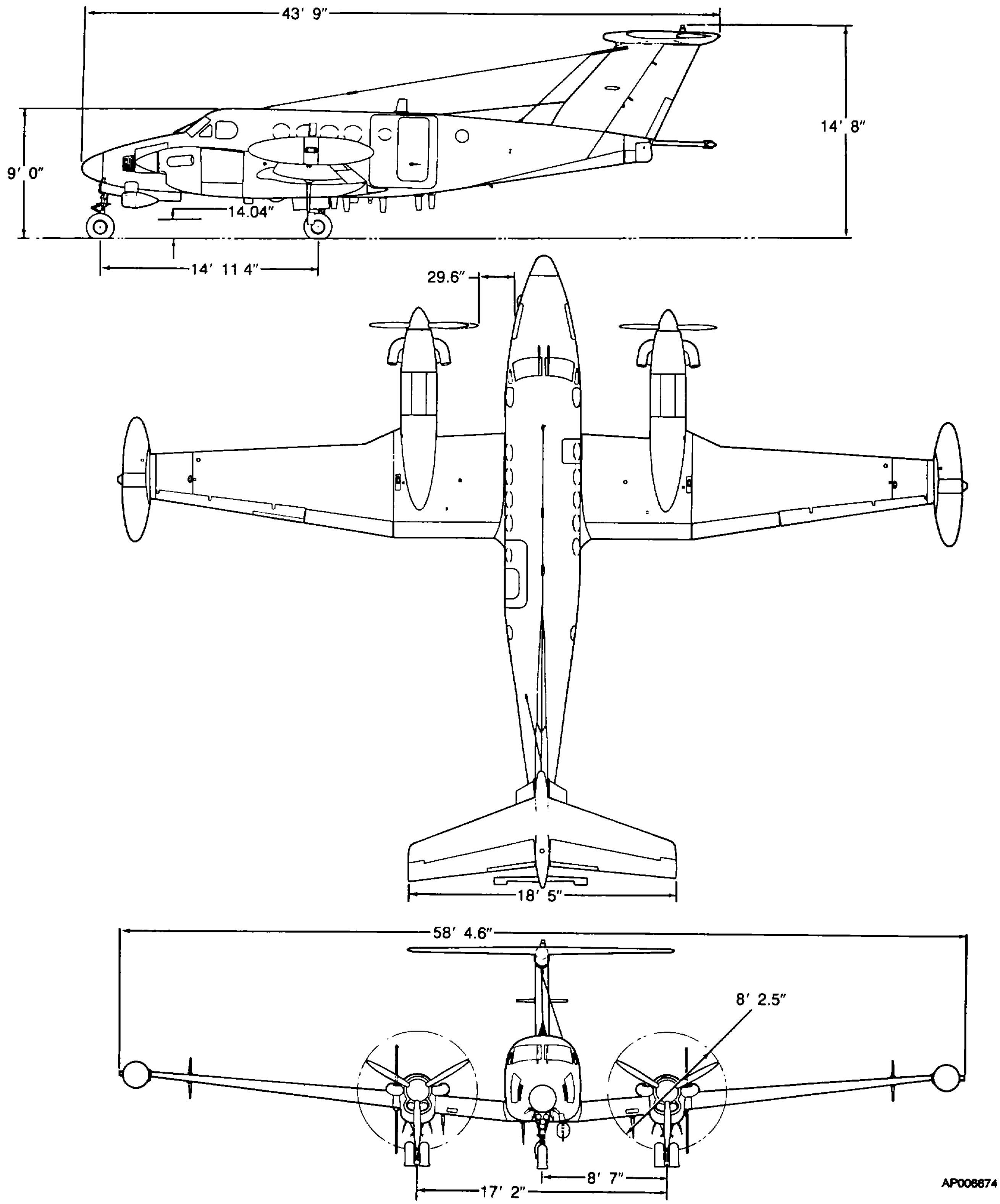
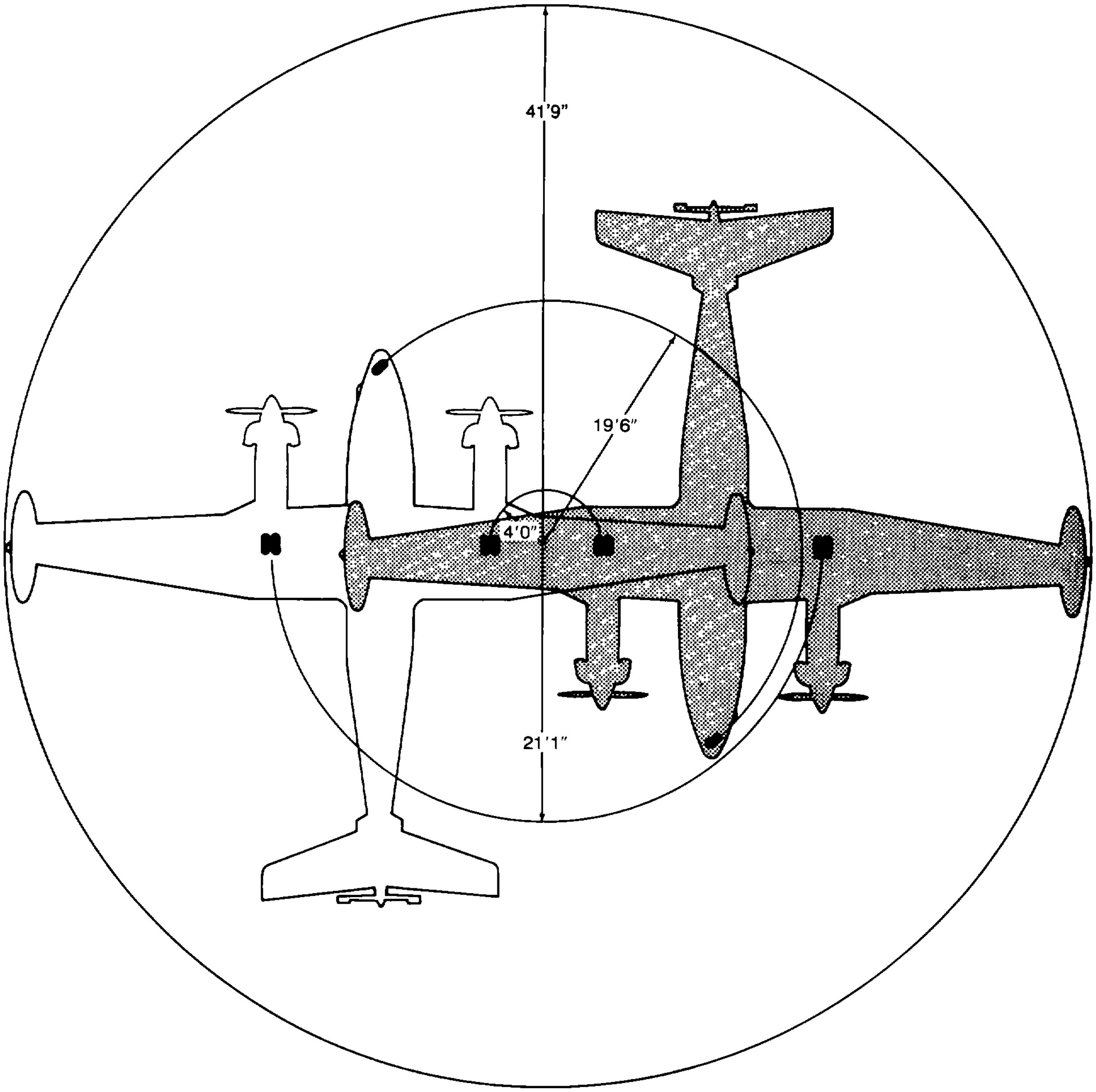


Figure 2-3. Principal Dimensions

GROUND TURNING CLEARANCE



RADIUS FOR INSIDE GEAR...4 FEET
RADIUS FOR NOSE WHEEL..19 FEET 6 INCHES
RADIUS FOR OUTSIDE GEAR..21 FEET 1 INCH
RADIUS FOR WING TIP...41 FEET 9 INCHES

TURNING RADII ARE PREDICATED ON THE USE OF PARTIAL BRAKING ACTION AND DIFFERENTIAL POWER

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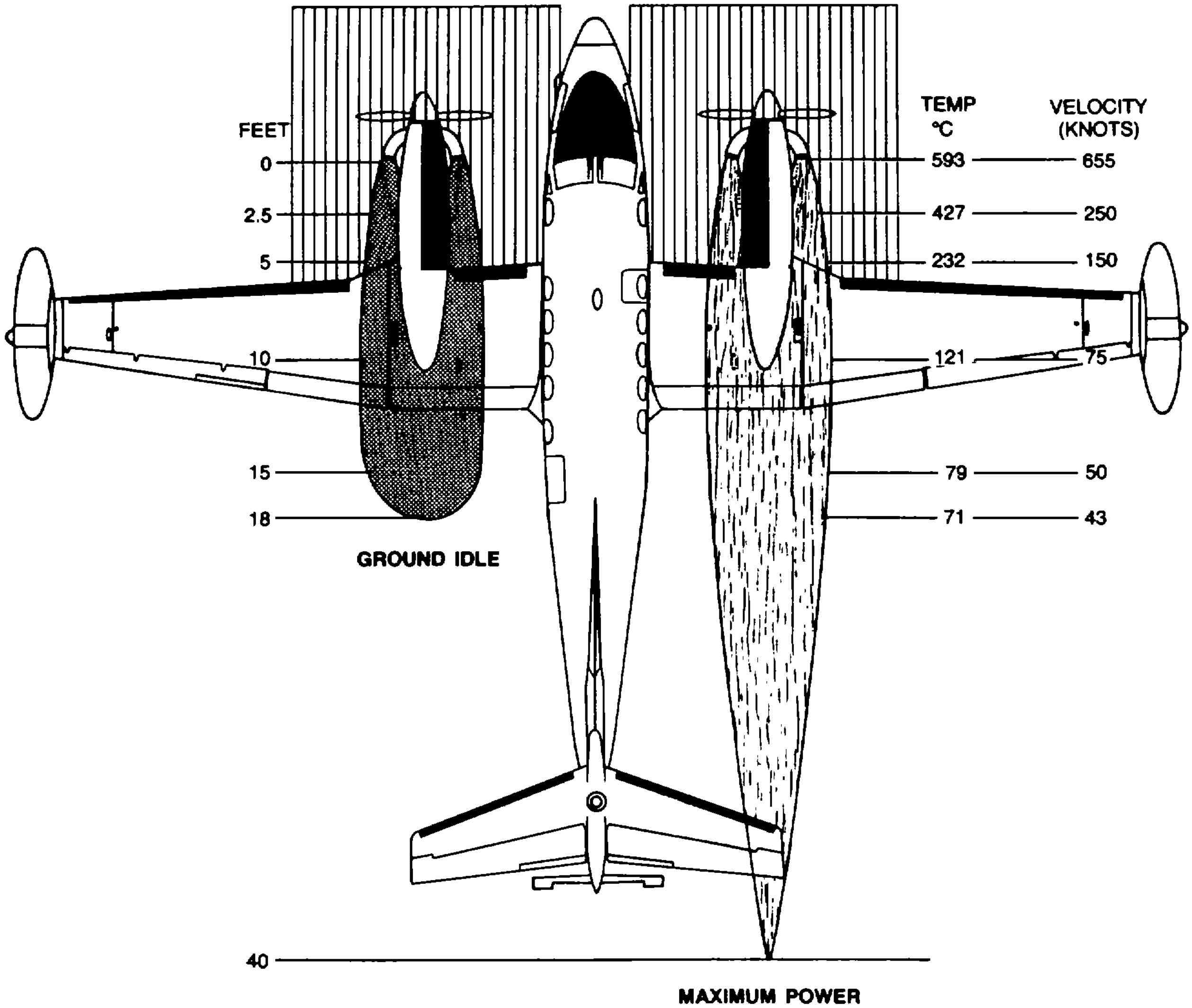
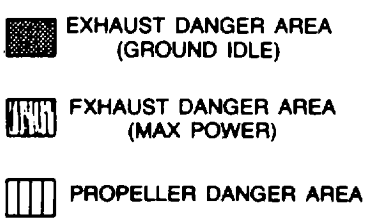
Figure 2-4. Ground Turning Radius





NOTE

- THE EXHAUST DANGER AREA DOES NOT INCLUDE PROPELLER WAKE WHICH INCREASES VELOCITY, AND SIGNIFICANTLY REDUCES TEMPERATURE.
- EXHAUST GAS TEMPERATURE AND VELOCITY AT GROUND IDLE IS VERY LOW, HOWEVER, THE IMMEDIATE AREA OF EXHAUST DISCHARGE SHOULD BE AVOIDED.

AP006440

Figure 2-5. Exhaust and Propeller Danger Areas

LANDING GEAR RELAY on the overhead circuit breaker panel (fig. 2-26).

b. Landing Gear Down Position Indicator Lights. Landing gear down position is indicated by three green lights on the left subpanel, placarded GEAR DOWN. These lights may be checked by operating the ANNUNCIATOR TEST switch. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR IND, on the overhead circuit breaker panel (fig. 2-26).

c. Landing Gear Position Warning Lights. Two red bulbs, wired in parallel and activated by microswitches independent of the GEAR DOWN position indicator lights, are positioned inside the clear plastic grip on the landing gear control switch. These lights illuminate whenever the landing gear switch is in either the UP or DN position and the gear is in transit. Both bulbs will also illuminate should either or both power levers be retarded below approximately 79 to 81% NI when the landing gear is not down and locked. To turn the switch lights OFF, during single-engine operation, the power lever for the inoperative engine must be advanced to a position which is higher than the setting of the warning horn microswitch. Extending the landing gear will also turn the lights off. Both red lights indicate the same warning conditions, but two are provided for a fail-safe indication in the event one bulb burns out. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR IND, on the overhead circuit breaker panel (fig. 2-26).

d. Landing Gear Warning Light Test Button. A test button, placarded HDL LT TEST, is located on the left subpanel. Failure of the landing gear switch to illuminate red, when this test button is pressed, indicates two defective bulbs or a circuit fault. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR RELAY CONTROL, on the overhead circuit breaker panel (fig. 2-26).

e. Landing Gear Warning Horn. When either power lever is retarded below approximately 80 ± 1% N 1 with the landing gear out of down and locked position and the flaps extended beyond 40%, a warning horn located in the overhead control panel will sound intermittently. To prevent actuation of the warning horn during long descents, a pressure differential "Q" switch is connected into the copilot's static air line to prevent the warning horn from sounding at airspeeds greater than 140 KIAS. An altitude sensing switch is installed in series with the "Q" switch to disable the warning horn at altitudes above approximately 12,500 feet MSL. The warning horn is enabled as the aircraft descends through approximately 10,500 feet MSL. The warning horn circuit is protected by a 5-ampere circuit breaker, placarded

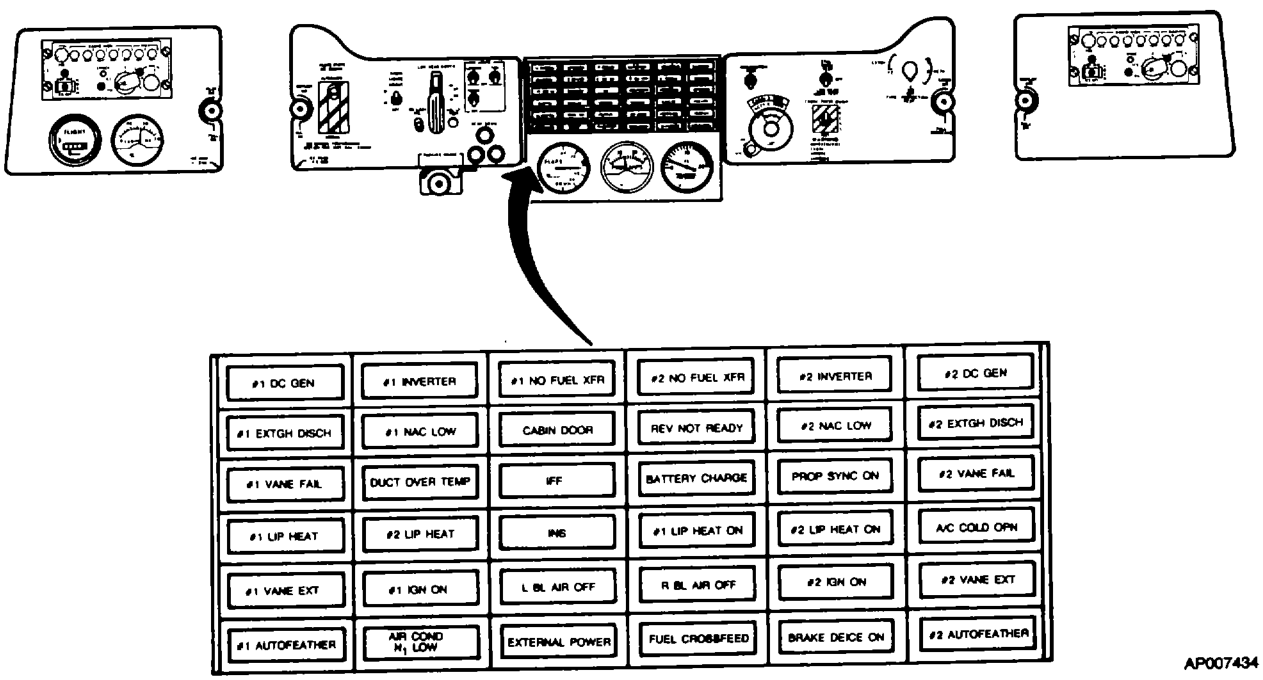


Figure 2-6. Subpanels

LANDING GEAR WARN, located on the overhead circuit breaker panel (fig. 2-26).

f. Landing Gear Warning Horn Test Switch.

The landing gear warning horn may be tested by the test switch on the right subpanel. The switch, placarded STALL WARN TEST OFF LDG GEAR WARN TEST, will sound the landing gear warning horn and illuminate the landing gear position warning lights when moved to the momentary LDG GEAR WARN TEST position. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR WARN, on the overhead circuit breaker panel (fig. 2-26).

g. Landing Gear Safety Switches. A safety switch on each main landing gear shock strut controls the operation of various aircraft systems that function only during flight or only during ground operation. These switches are mechanically actuated whenever the main landing gear shock struts are extended (normally after takeoff), or compressed (normally after landing). The safety switch on the right main landing gear strut activates the landing gear control circuits, cabin pressurization circuits and the flight hour meter when the strut is extended. This switch also activates a down-lock hook, preventing the landing gear from being raised while the aircraft is on the ground. The hook, which unlocks automatically after takeoff, can be manually over-ridden by pressing down on the red button, placarded DN LOCK REL located adjacent to the landing gear switch. If the over-ride is used and the landing gear control switch is raised, power will be supplied to the warning horn circuit and the horn will sound. The safety switch on the left main landing gear strut activates the left and right engine ambient air shutoff valves when the strut is extended.

CAUTION

Continued pumping of handle after GEAR DOWN position indicator lights (3) are illuminated could damage the drive mechanism, and prevent subsequent gear retraction.

h. Manual Landing Gear Extension System. Manual landing gear extension is provided through a manually powered system as a backup to the electrically operated system. Before manually extending the gear, make certain that the landing gear switch is in the down position with the LANDING GEAR RELAY circuit breaker pulled. During a manual landing gear extension, the landing gear motor must be disengaged from the landing gear drive mechanism. This is accomplished through use of an alternate engage handle located adjacent to the landing gear alternate extension handle. To disengage the landing gear motor, pull the alternate extension handle up and turn it clockwise. When this handle is pulled, the landing gear motor is disconnected from the system and the alternate drive system is locked to the gearbox and motor. With the alternate drive locked in, the landing gear may be manually extended by pumping the alternate extension handle until the three GEAR DOWN position indicator lamps are illuminated. Refer to Chapter 9 for additional information on emergency gear extension procedures.

i. Tires. The aircraft is equipped with dual 22 x 6. 75 x 10, 8 ply rated, tubeless, rim inflation tires on the main gear. The nose gear is equipped with a single 22 x 6. 75 x 10, 8 ply rated, tubeless, rim inflated tire.

j. Steerable Nose Wheel. The aircraft can be maneuvered on the ground by the steerable nose wheel system. Direct linkage from the rudder pedals (fig. 2-9) to the nose wheel steering linkage allows the nose wheel to be turned 12° to the left of center or 14° to the right. When rudder pedal steering is augmented by the main wheel braking action, the nose wheel can be deflected up to 48° either side of center. Shock loads which would normally be transmitted to the rudder pedals are absorbed by a spring mechanism in the steering linkage. Retraction of the landing gear automatically centers the nose wheel and disengages the steering linkage from the rudder pedals.

k. Wheel Brake System. The main wheels are equipped with multiple-disc hydraulic brakes actuated by master cylinders attached to the rudder pedals at the pilot's and copilot's position. Braking is permitted from either set of rudder pedals. Brake fluid is supplied to the system from the reservoir in the nose compartment. The toe brake sections of the rudder pedals are connected to the master cylinders which actuate the system for the or responding wheels. No emergency brake system is provided.

WARNING

Repeated and excessive application of brakes, without allowing sufficient cooling time between applications, will cause loss of braking efficiency, and may cause brake or wheel failure, tire blowout, or destruction of wheel assembly by fire.

2-8. PARKING BRAKE.

CAUTION

Parking brakes shall not be set during flight.

Dual parking brake valves are installed below the cockpit floor. Both valves can be closed simultaneously by pressing both brake pedals to build up pressure, then pulling out the handle placarded PARKING BRAKE, on the left subpanel. Pulling the handle full out sets the check valves in the system and any pressure being applied by the toe brakes is maintained. Parking brakes are released when the brake handle is pushed in. The parking brake may be set from either cockpit position. Parking brakes shall not be set during flight.

2-9. ENTRANCE AND EXIT PROVISIONS.

NOTE

Two keys are provided in the loose tools and equipment bag. Both keys will fit the locks on the cabin door, emergency hatch, tailcone access door and the right and left nose avionics doors.

a. Cabin Door.

CAUTION

Structural damage may be caused if more than one person is on the cabin door at a time. The door is weight limited to less than 300 pounds.

A swing-down door (fig. 2-7), hinged at the bottom, provides a stairway for normal and emergency entry and exit. Two of the steps are movable and fold flat against the door in the closed position. A step folds down over the door sill when the door opens to provide a platform (step) for door seal protection. A plastic encased cable provides support for the door in the open position, a handhold, and a convenience for closing the door from inside. A hydraulic damper permits the door to lower gradually during opening. A rubber seal around the door seals the pressure vessel while the aircraft is in flight. The door locking mechanism is operated by either of the two mechanically interconnected handles, one inside and the other outside the door. When either handle is rotated, three rotating-cam-type latches on either side of the door capture posts mounted on the cargo door. In the closed position, the door becomes an integral part of the cargo door. A button adjacent to the door handle must be depressed before the handle can be rotated to open the door. A bellows behind the button is inflated when the aircraft is pressurized to prevent accidental unlatching and/or opening of the door. A small round window just above the second step permits observation of the pressurization safety bellows. A placard adjacent to the window instructs the operator that the safety lock arm is in position around the bellows shaft which indicates a properly locked door. Pushing the red button adjacent to the window will illuminate the inside door mechanism. A CABIN DOOR annunciator light in the caution/advisory panel will illuminate if the door is not closed and all latches fully locked.

b. Cargo Door. A swing-up door (fig. 2-7), hinged at the top, provides cabin access for loading cargo or bulky items. After initial opening force is applied, gas springs will completely open the cargo door automatically. The door is counterbalanced and will remain in the open position. A door support rod is used to hold the door in the open position, and to aid in overcoming the pressure of the gas spring assemblies when closing the door. Once closed, the gas springs apply a closing force to assist in latching the door. A rubber seal around the door, seals the pressure vessel while in flight. The door locking mechanism is operated only from inside the aircraft, and is operated by two handles, one in the bottom forward portion of the door and the other in the upper aft portion of the door. When the upper aft handle is operated per placard instructions, two rotating cam-type latches on the forward side of the door and two on the aft side rotate, capturing posts mounted on the fuselage side of the door opening. The bottom handle, when operated per placard instructions, actuates four pin lug latches across the bottom of the door. A button on the upper aft handle must be pressed before the handle can be released to open the door. A latching lever on the bottom handle must be lifted to release the handle before the lower latches can be opened. These act as additional aids in preventing accidental opening or unlatching of the door. The cabin and cargo doors are equipped with dual sensing circuits to provide the crew remote indication of cabin/cargo door security. An annunciator light placarded CABIN DOOR will illuminate if the cabin or cargo door is open and the BATT switch is ON. If the battery switch is OFF, the annunciator will illuminate only if the cargo door is not securely closed and latched. The cargo door sensing circuit receives power from the hot battery bus.

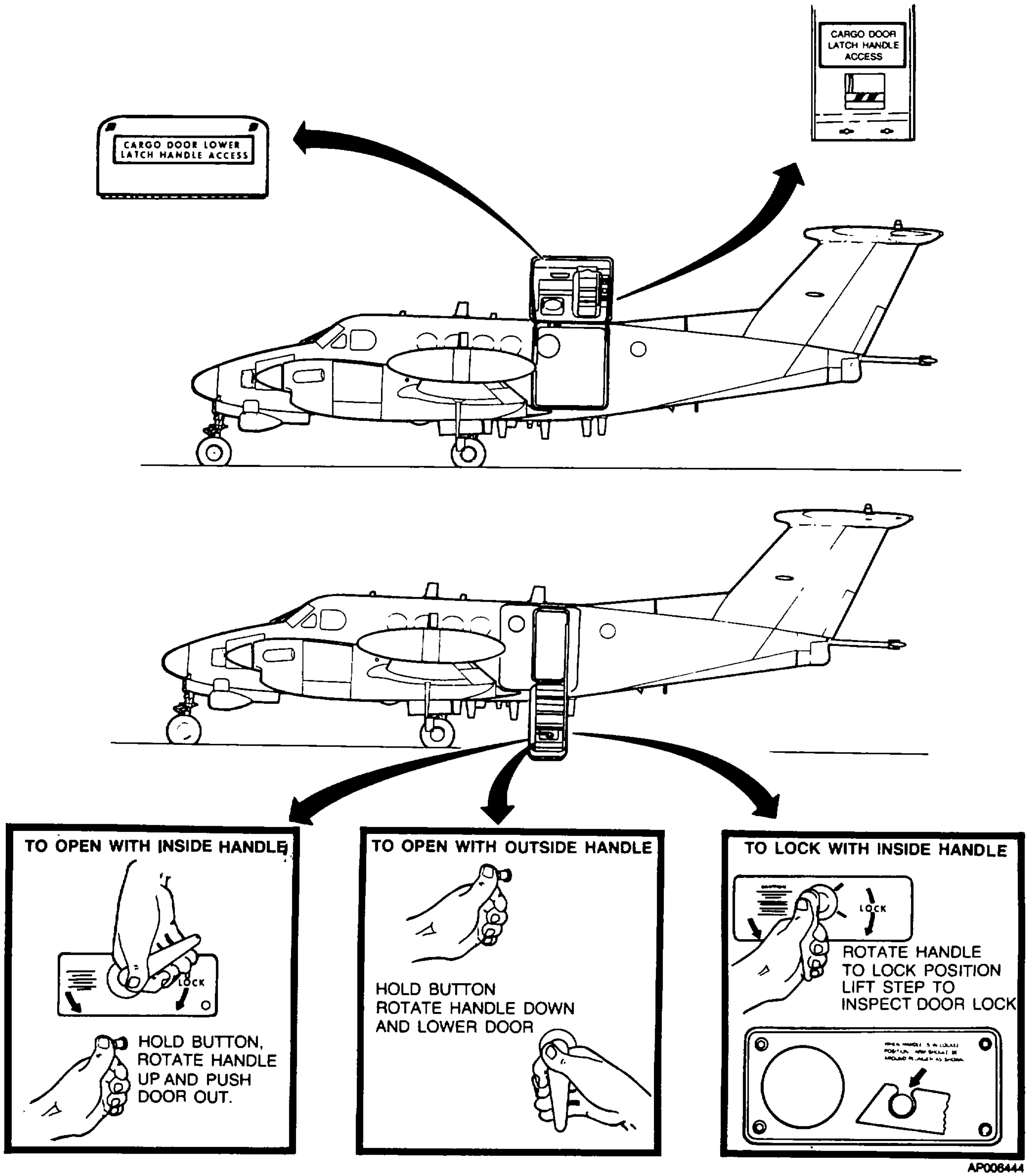


Figure 2-7. Cabin and Cargo Doors

CAUTION

Insure the cabin door is closed and locked. Operating the cargo door while the cabin door is open may damage the door hinge and adjacent structure.

(1) *Opening cargo door.*

CAUTION

Avoid side loading of the gas springs to prevent damage to the mechanism.

1. Handle access door (lower forward corner of door) -Unfasten and open.
2. Handle Lift hook and move to OPEN position.
3. Handle access door Secure.
4. Handle access door (upper aft corner of door) -Unfasten and open.
5. Handle Press button and lift to OPEN position then latch in place.
6. Handle access door Secure.
7. Door support rod Attach one end to cargo door ball stud (on forward side of door).
8. Support rod detent pin Check in place.
9. Cabin door sill step Push out on and allow cargo door to swing open. Gas springs will automatically open the door.
10. Door support rod Attach free end to ball stud on forward fuselage door frame.

(2) Closing cargo door.

CAUTION

Avoid side loading of the gas springs to prevent damage to the mechanism.

1. Door support rod Detach from fuselage door frame ball stud, then firmly grasp free end of rod while exerting downward force to overcome the pressure of gas spring assemblies, Then remove support rod from door as gas spring assemblies pass over-center position.
2. Cargo door Pull closed, using finger hold cavity in fixed cabin door step.
3. Handle access door (upper aft corner of door) -Unfasten and open.
4. Handle Pull handle down until it latches in closed position.
5. Handle access door Secure.
6. Handle access door (lower forward corner of door) -Unfasten and open.
7. Handle Move to full forward position.
8. Safety hook Check locked in position by pulling aft on handle.
9. Handle access door Secure.

c. Cabin Emergency Hatch. The cabin emergency hatch, placarded EXIT-PULL, is located on the right cabin sidewall just aft of the copilot's seat. The hatch may be released, from the inside with a pull-down handle. A flush mounted pull out handle allows the hatch to be released from the outside. The hatch is of the non-hinged, plug type which removes completely from the frame when the latches are released. The hatch can be key locked, from the inside, to prevent opening from the outside. The inside handle will unlatch the hatch whether or not it is locked, by overriding the locking mechanism. The keylock should be unlocked prior to flight to allow removal of the hatch from the outside in the event of an emergency. The key remains in the lock when the hatch is locked and can be removed only when the hatch is unlocked. The key slot is in the vertical position when the hatch is unlocked. Removal of the key from the lock before flight assures the pilot that the hatch can be removed from the outside if necessary.

2-10. CABIN DOOR CAUTION LIGHT.

As a safety precaution, two illuminated MASTER CAUTION lights on the glare shield and a steadily illuminated CABIN DOOR yellow caution light on the annunciator panel indicates the cabin door is not closed and locked. This circuit is protected by 5-ampere circuit breakers placarded ANN PWR and ANN IND, located on the overhead circuit breaker panel (fig. 2-26).

2-11. WINDOWS.

a. Cockpit Windows. The pilot and copilot have side windows, a windshield and storm windows, which provide visibility from the cockpit. The storm windows may be opened on the ground or during unpressurized flight.

b. Cabin Windows. The outer cabin windows, of two-ply construction, are the pressure type and are integral parts of the pressure vessel. All cabin windows are painted over except for the two small aft windows (movable curtains are provided to cover these windows when it is desited to seal out light).

2-12. SEATS.

a. Pilot and Copilot Seats. The pilot and copilot seats (fig. 2-8) are separated from the cabin by movable curtains. The controls for vertical height adjustment and fore and aft travel are located under each seat. The fore and aft adjustment handle is located beneath the bottom front inboard corner of each seat. Pulling up on the handle allows the seat to move fore or aft. The height adjustment handle is located beneath the bottom front outboard corner of each seat. Pulling up on the handle, allows the seat to move up and down. Both seats have adjustable headrests and armrests which will raise and lower for access to the cockpit. Handholds on either side of the overhead panels and a fold-away protective pedestal step are provided for pilot and copilot entry into the cockpit (fig. 2-9). For the storage of maps and the operator's manual, pilot and copilot seats have an inboard-slanted, expandable pocket affixed to the lower portion of the seat back. Pocket openings are held closed by shock cord tension.

b. Pilot and Copilot Seat Belts and Shoulder Harnesses. Each pilot and copilot seat is equipped with a lap-type seat belt and shoulder harness connected to an inertia reel. The shoulder harness belt is of the "Y" configuration with the single strap being contained in an inertia reel attached to the base of the seatback. The two straps are worn with one strap over each shoulder and fastened by metal loops into the seat belt buckle. The spring loading at the inertia reel keeps the harness snug but will allow normal movement required during flight operations.

The inertia reel is designed with a locking device that will secure the harness in the event of sudden forward movement or an impact action.

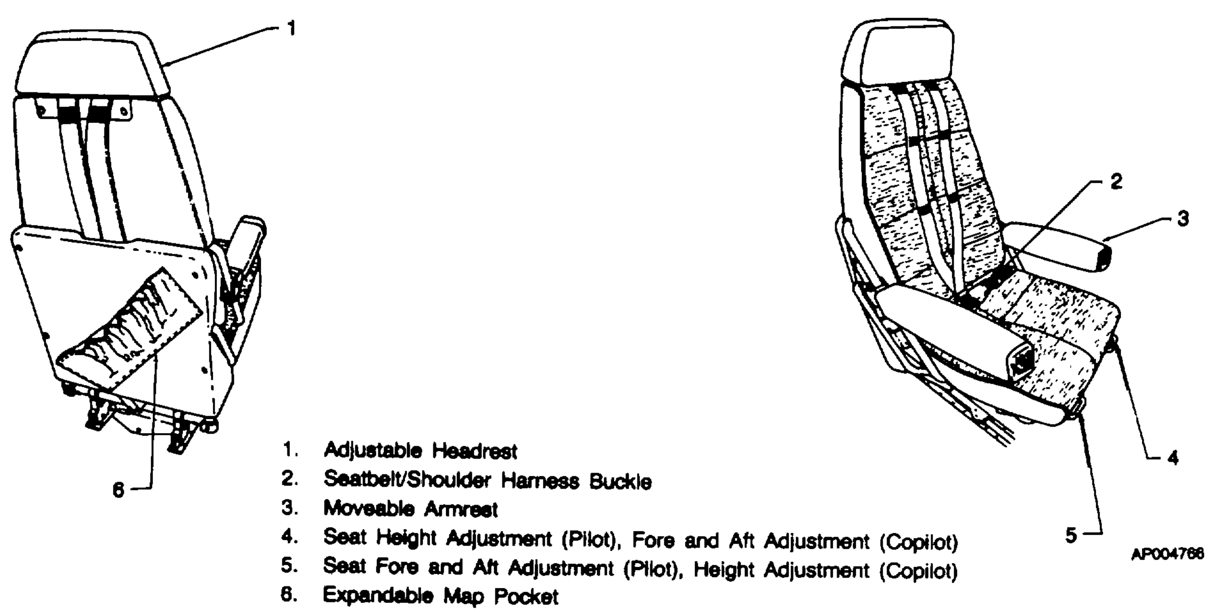
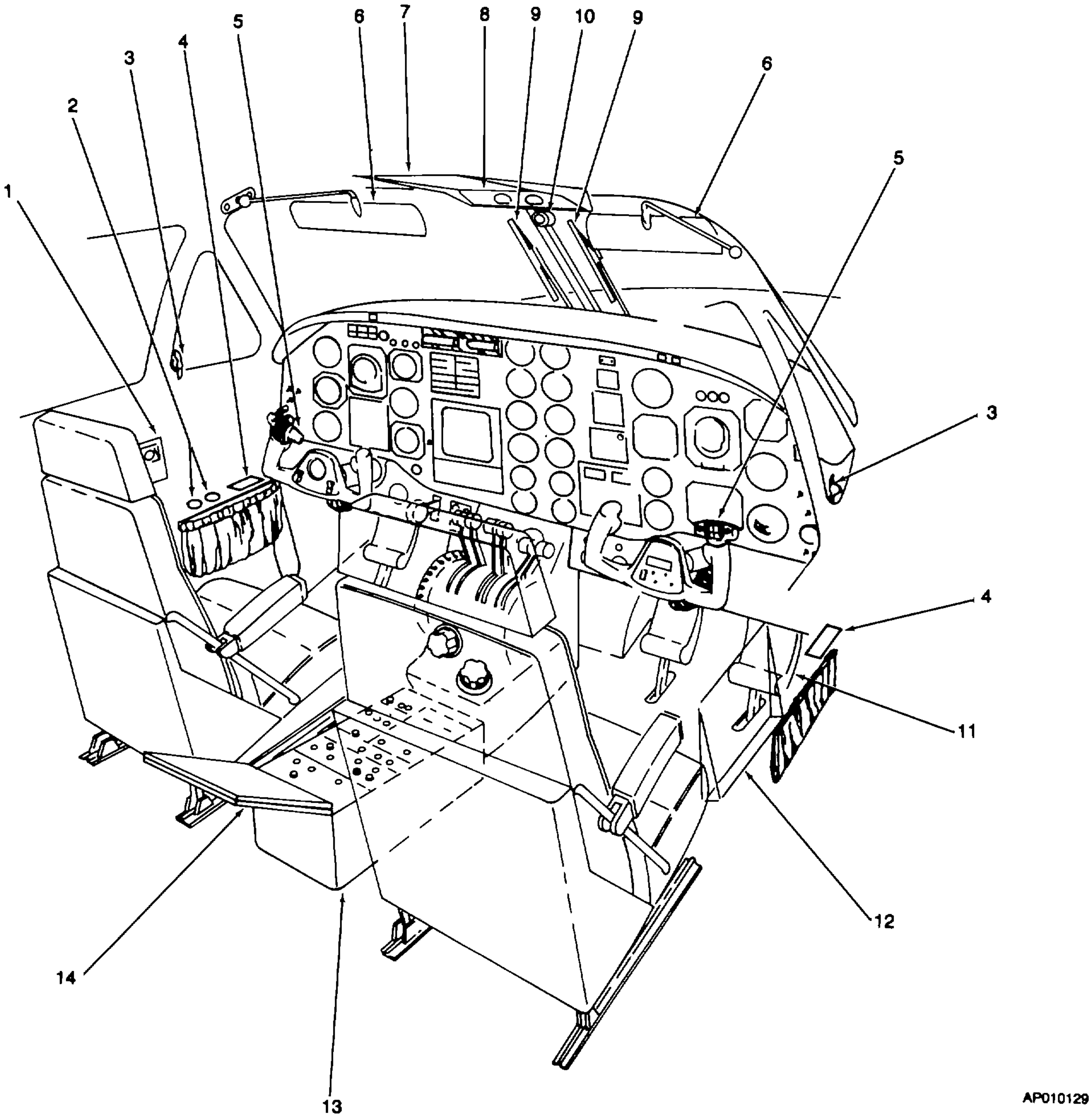
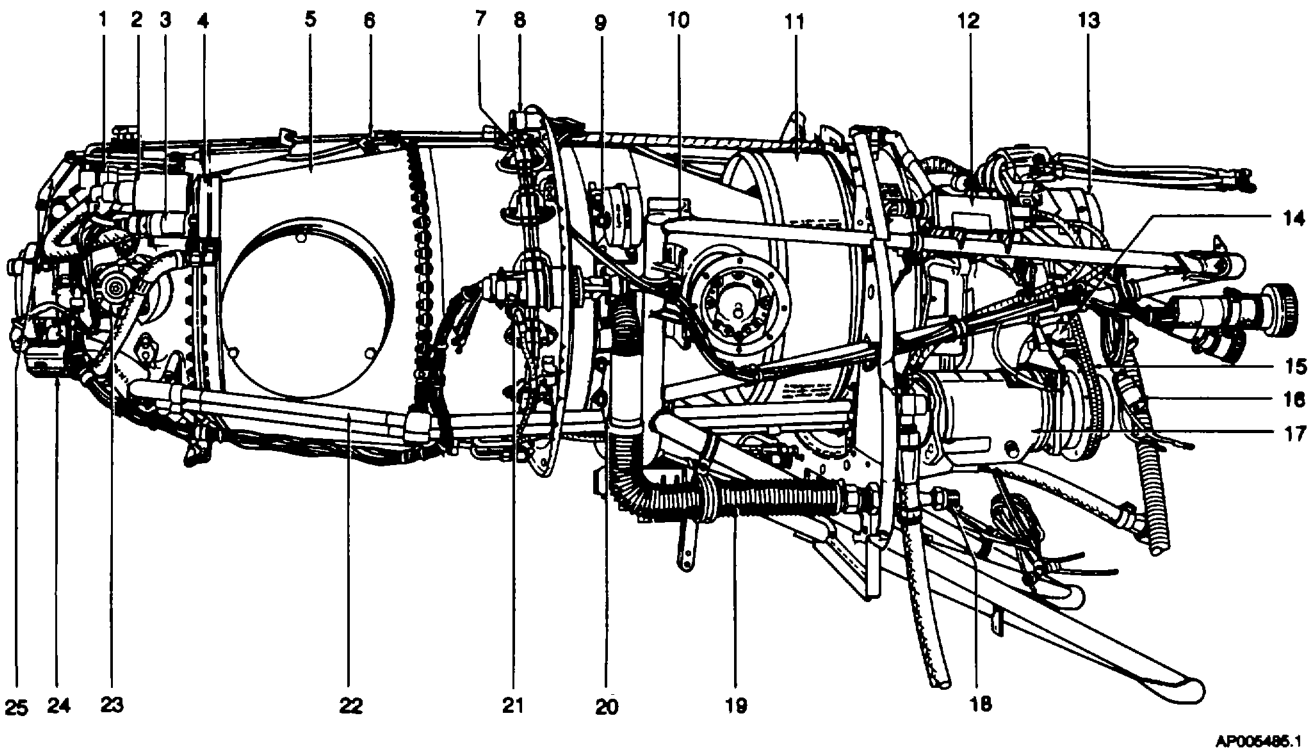


Figure 2-8. Pilot and Copilot Seats



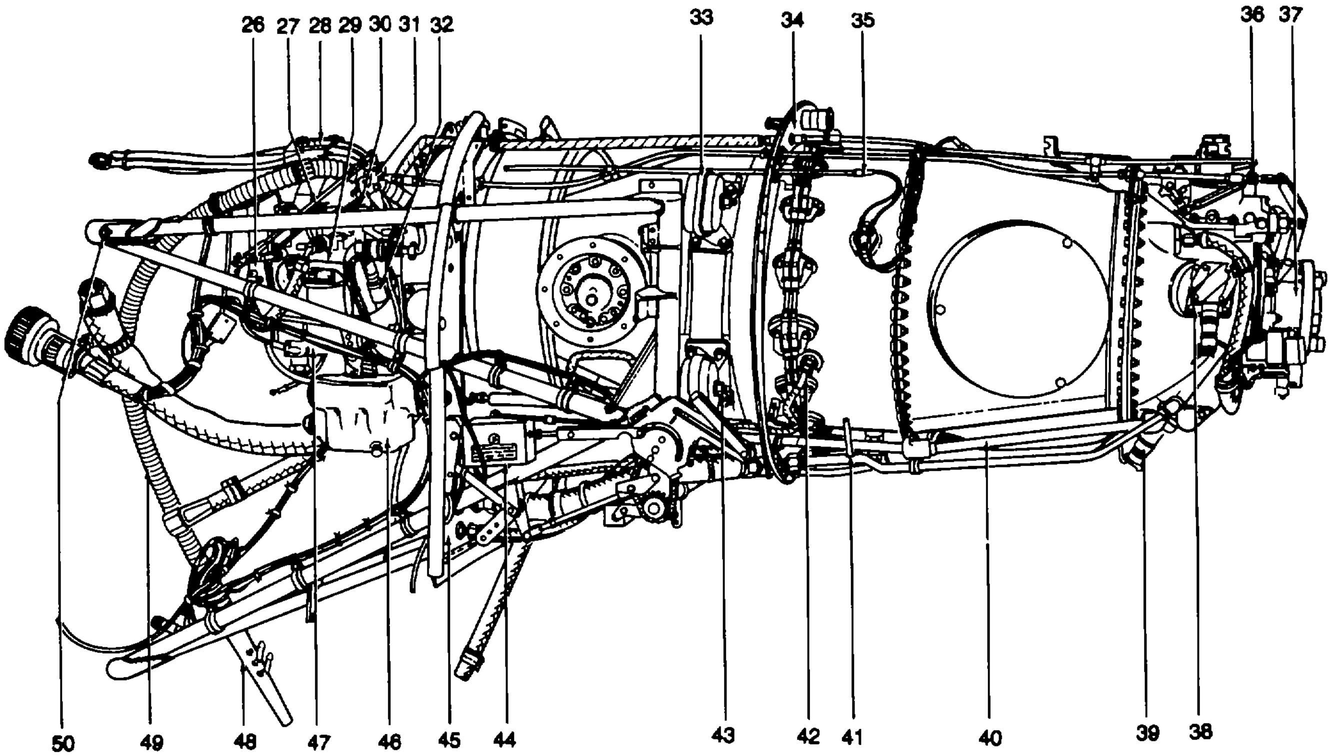
1. Free air temperature gage
2. Oxygen system pressure gages
3. Storm window lock
4. Oxygen regulator control panel
5. Control wheel
6. Sun visor
7. Overhead circuit breaker and control panel
8. Fuel management panel
9. Windshield wiper
10. Magnetic compass
11. Rudder pedals
12. Mission control panel
13. Pedestal extension
14. Assist step

Figure 2-9. Cockpit



1. Primary Prop Governor
2. Torque Pressure Transmitter
3. Torque Pressure Switch
4. Torque Pressure Manifold
5. Exhaust Duct
6. ITT Temperature Probe
7. Fuel Flow Divider Manifold
8. Fire Detector
9. Engine Mount Bolt
10. Engine Mount Truss Assembly
11. Engine Air Intake Screen
12. Ignition Exciter
13. Starter-Generator
14. Fuel Boost Pump
15. Air Conditioner Compressor Drive Belt (#2 Engine Only)
16. Fire Detector
17. Air Conditioner Compressor (#2 Engine Only)
18. Bleed Air Adapter
19. Bleed Air Line
20. Engine Mount
21. Ignition Exciter Plug
22. Oil Scavenge Tubes
23. Overspeed Governor
24. Prop Deice Brush Block Bracket
25. Prop Reverse Linkage Lever

Figure 2-10. PT6A-41 Engine (Sheet 1 of 2)



26. Fuel control unit
27. Fuel control unit control rod
28. Starter generator leads
29. Engine driven fuel pump
30. Power control lever
31. Prop interconnect linkage (aft)
32. Oil pressure transducer
33. Engine mount
34. Fireshield
35. Trim resistor thermocouple
36. Prop interconnect linkage (fore)
37. Prop shaft
38. Tach generator
39. Chip detector
40. Oil pressure tube
41. Fire extinguisher line
42. Ignition exciter plug
43. Engine mount bolt
44. Linear actuator
45. Engine baffle and seal assy
46. Fuel/oil heater
47. Tach-generator (aft)
48. Drain manifold
49. Overhead breather tube
50. Engine truss mounting bolt

Figure 2-10. PT6A-41 Engine (Sheet 2 of 2)

Section II: EMERGENCY EQUIPMENT

2-13. DESCRIPTION.

The equipment covered in this section includes all emergency equipment, except that which forms part of a complete system. For example, landing gear system, etc. Chapter 9 describes the operation of emergency exits and location of all emergency equipment.

2-14. FIRST AID KITS.

Four first aid kits are included in the survival kit.

2-15. HAND-OPERATED FIRE EXTINGUISHER.

WARNING

Repeated or prolonged exposure to high concentrations of monobromotrifluoromethane (CF_3Br) or decomposition products should be avoided. The liquid shall not be allowed to come into contact with the skin, as it may cause frost bite or low temperature burns because of its very low boiling point.

One hand-operated fire extinguisher is mounted below the pilot's seat and a second extinguisher, located on the left cabin sidewall, aft of the cabin door. They are of the monobromotrifluoromethane (CF_3Br) type. The extinguisher is charged to a pressure of 150 to 170 PSI and emits a forceful stream. Use an extinguisher with care within the limited area of the cabin to avoid severe splashing.

NOTE

Engine fire extinguisher systems are described in Section III.

Section III. ENGINES AND RELATED SYSTEMS

2-16. DESCRIPTION.

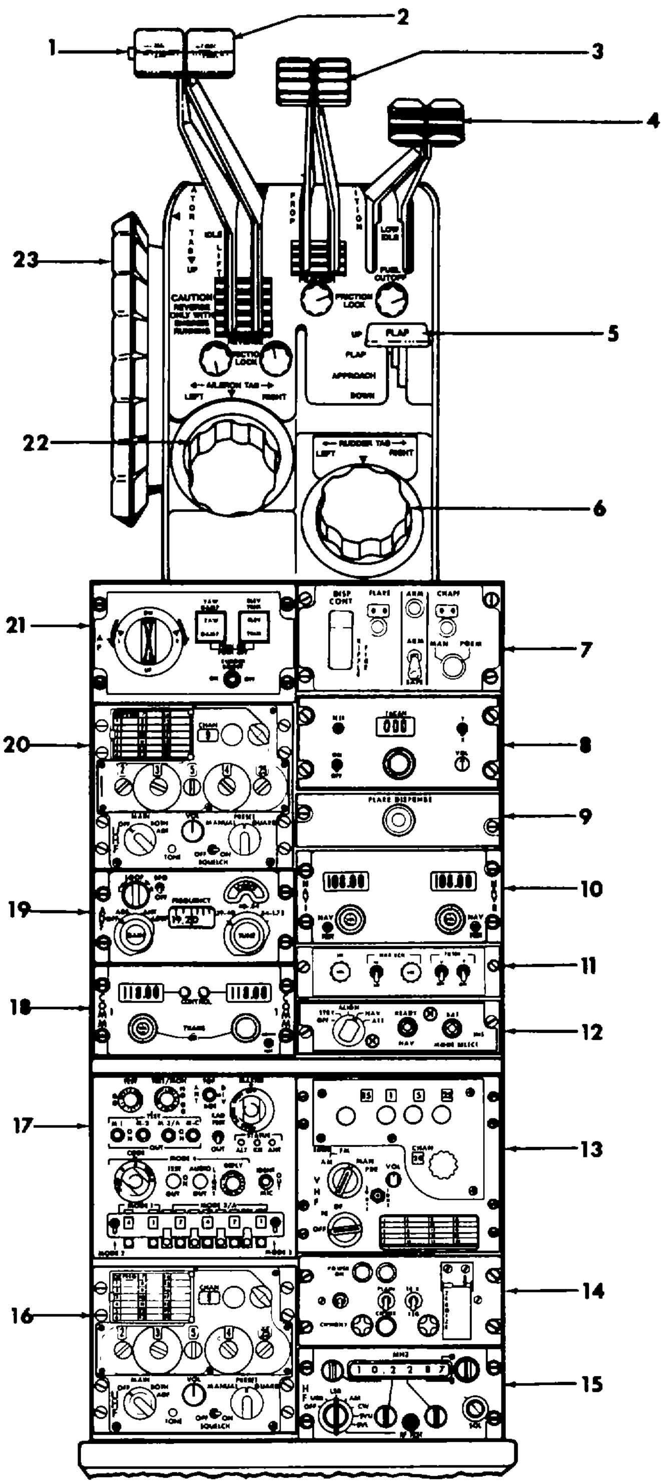
The aircraft is powered by two PT6A-41 turboprop engines (fig. 2-10). The engine has a three stage axial, single stage centrifugal compressor, driven by a single stage reaction turbine. The power turbine, a two stage reaction turbine, counter-rotating with the compressor turbine, drives the output shaft. Both the compressor turbine and the power turbine are located in the approximate center of the engine with their shafts extending in opposite directions. Being a reverse flow engine, the ram air supply enters the lower portion of the nacelle and is drawn in through the aft protective screens. The air is then routed into the compressor. After it is compressed, it is forced into the annular combustion chamber, and mixed with fuel that is sprayed in through 14 nozzles mounted around the gas generator case. A capacitance discharge ignition unit and two spark igniter plugs are used to start combustion. After combustion, the exhaust passes through the compressor turbine and two stages of power turbine and is routed through two exhaust ports near the front of the engine. A pneumatic fuel control system schedules fuel flow to maintain the power set by the gas generator power lever. The accessory drive at the aft end of the engine provides power to drive the fuel pumps, fuel control, the oil pumps, the refrigerant compressor (right engine), the starter/generator, and the turbine tachometer transmitter. The reduction gearbox forward of the power turbine provides gearing for the propeller and drives the propeller tachometer transmitter, the propeller overspeed governor, and the propeller governor. A torque limiter is incorporated on the front case of the propeller reduction gearbox to maintain developed engine torque within design limits.

2-17. ENGINE COMPARTMENT COOLING.

The forward engine compartment including the accessory section is cooled by air entering around the exhaust stack cutouts, the gap between the propeller spinner and forward cowling, and exhausting through ducts in the upper and lower aft cowling.

2-18. AIR INDUCTION SYSTEMS GENERAL.

Each engine and oil cooler receives ram air ducted from an air scoop located within the lower section of the forward nacelle. Special components of the engine induction system protect the power plant from icing and foreign object damage.



1. Go-around switch
2. Power levers
3. Propeller levers
4. Condition levers
5. Flap lever
6. Rudder trim
7. Flare dispenser control panel
8. TACAN control panel
9. Flare dispenser switch
10. NAV1/NAV2 control panel
11. Radio control panel
12. Mode selector unit
13. VHF AM/FM control panel
14. Voice security control
15. HF control panel
16. No. 2 UHF command set
17. Transponder control panel
18. VHF-AM control panel
19. ADF control panel
20. No. 1 UHF command set
21. Autopilot pitch-turn control panel
22. Aileron trim
23. Elevator trim

Figure 2-11. Pedestal

2-19. FOREIGN OBJECT DAMAGE CONTROL.

The engine has an integral air inlet screen designed to obstruct objects large enough to damage the compressor.

2-20. ENGINE ICE PROTECTION SYSTEMS.

a. Inertial Separator.

CAUTION

After the ice vanes have been manually extended, they may be mechanically actuated only. No electrical extension or retraction shall be attempted as damage to the actuator may result. Linkage in the nacelle area must be reset prior to operation of the electric system.

An inertial separation system is built into each engine air inlet to prevent moisture particles from entering the engine inlet plenum under icing conditions. A movable vane and a bypass door are lowered into the airstream when operating in visible moisture at 5'C or colder, by energizing electrical actuators with the switches, placarded ICE VANE RETRACT EXTEND, located on the overhead control panel. A mechanical backup system is provided, and is actuated by pulling the T-handles just below the pilot's subpanel placarded ICE VANE #1 ENG #2 ENG. Decrease airspeed to 160 knots or less to reduce forces for manual extension. Normal airspeed may then be resumed.

(1) The vane deflects the ram airstream slightly downward to introduce a sudden turn in the airstream to the engine, causing the moisture particles to continue on undeflected, because of their greater momentum, and to be discharged overboard.

(2) While in the icing flight mode, the extended position of the vane and bypass door is indicated by green annunciator lights, #1 VANE EXT and #2 VANE EXT.

(3) In the non-ice protection mode, the vane and bypass door are retracted out of the airstream by placing the ice vane switches in the RETRACT position. The green annunciator lights will extinguish. Retraction should be accomplished at 15°C and above to assure adequate oil cooling. The vanes should be either extended or retracted; there are no intermediate positions.

(4) If for any reason the vane does not attain the selected position within approximately 15 seconds, a yellow #1 VANE FAIL or #2 VANE FAIL light illuminates on the caution/advisory panel. In this event, the manual backup system should be used. When the vane is successfully positioned with the manual system, the yellow annunciator lights will extinguish.

b. Engine Air Inlet Deice System.

(1) Description. Hot engine exhaust gas is utilized for heating the air inlet lips to prevent the formation of ice. Hot exhaust gas is picked up inside each engine exhaust stack and carried by plumbing to the inlet lip. The gas flows through the inside of the lip to the bottom where it is allowed to escape.

(2) Engine air inlet deice system switches. (Provisions only system not installed.) Two switches placarded ENG INLET LIP HEAT #1, #2 OFF/ ON, located on the overhead control panel, operate solenoid valves in the exhaust system of each engine. These valves control the flow of hot exhaust gases to the inlet air lip assemblies.

(3) Fuel heater. A oil-to-fuel heat exchanger, located on the engine accessory case, operates continuously and automatically to heat the fuel sufficiently to prevent ice from collecting in the fuel control unit. Each pneumatic fuel control line is protected against ice. Power is supplied to each fuel control air line jacket heater by two switches actuated by moving the condition levers in the pedestal out of the fuel cutoff range. Fuel control heat is automatically turned on for all engine operations.

2-21. ENGINE FUEL CONTROL SYSTEM.

a. Description. The basic engine fuel system consists of an engine driven fuel pump, a fuel control unit, a fuel flow divider, a dual fuel manifold and fourteen fuel nozzles.

b. Fuel Control Unit. One fuel control unit is mounted on the accessory case of each engine. This unit is a hydro-mechanical metering device which determines the proper fuel schedule for the engine to produce the amount of power requested by the relative position of its power lever. The control of developed engine power is accomplished by adjusting the engine compressor turbine (N1) speed. N speed controlled by varying the amount of fuel injected into the combustion chamber through the fuel nozzles. Engine shutdown is accomplished by moving the appropriate condition lever to the full aft, FUEL CUT-OFF position, which shuts off the fuel supply.

2-22. POWER LEVERS.

CAUTION

Moving the power levers into reverse range without the engines running may result in damage to the reverse linkage mechanism.

Two power levers are located on the control pedestal (fig. 2-11). These levers regulate power in the reverse, idle, and forward range, and operate so that forward movement increases engine power. Power control is accomplished through adjustment of the N1 speed governor in the fuel control unit. Power is increased when Ni RPM is increased. The power levers also control propeller reverse pitch. Distinct movement (pulling up and then aft on the power lever) by the pilot is required for reverse thrust. Placarding beside the lever travel slots reads POWER. Upper lever travel range is designated INCR (increase), supplemented by an arrow pointing forward. Lower travel range is marked IDLE, LIFT and REVERSE. A placard below the lever slots reads: CAUTION REVERSE ONLY WITH ENGINES RUNNING.

2-23. CONDITION LEVERS.

Two condition levers are located on the control pedestal (fig. 2-11). Each lever starts and stops the fuel supply, and controls the idle speed for its engine. The levers have three placarded positions: FUEL CUTOFF, LO IDLE, and HIGH IDLE. In the FUEL CUTOFF position, the condition lever controls the cutoff function of its engine-mounted fuel control unit. From LO IDLE to HIGH IDLE, they control the governors of the fuel control units to establish minimum fuel flow levels. LO IDLE position sets the fuel flow rate to attain 52 to 55% (at sea level) minimum NI and HIGH IDLE position sets the rate to attain 70% minimum NI. The power lever for the corresponding engine can select NI from the respective idle setting to maximum power. An increase in low idle Ni will be experienced at high field elevation.

2-24. FRICTION LOCK KNOBS.

Four friction lock knobs, placarded FRICTION LOCK, are provided on the control pedestal (fig. 211) to adjust friction drag against the engine power, propeller RPM, and fuel condition levers. These knobs prevent the levers from creeping. When rotated clockwise, each knob increases the friction that opposes movement of the affected lever. Counterclockwise movement of the knob decreases friction.

2-25. ENGINE FIRE DETECTION SYSTEM.

a. Description. A flame surveillance system is installed on each engine to detect external engine fire and provide alarm to the pilot. Both nacelles are monitored, each having a control amplifier and three detectors. Electrical wiring connects all sensors and control amplifiers to DC power and to the cockpit visual alarm units. In each nacelle, one detector monitors the forward nacelle, a second monitors the upper accessory area, and a third the lower accessory area. Fire emits an infrared radiation that will be sensed by the detector which monitors the area of origin. Radiation exposure activates the relay circuit of a control amplifier which causes signal power to be sent to cockpit warning systems. An activated surveillance system will return to the standby state after the fire is out. The system includes a functional test switch and has circuit protection through the FIRE DETR circuit breaker. Warning of internal nacelle fire is provided as follows: the red MASTER WARNING lights on the glareshield illuminate accompanied by the illumination of a red warning light in the appropriate fire control T-handle placarded FIRE PULL (fig. 2-28). Fire detector circuits are protected by a single 5-ampere circuit breaker, placarded FIRE DETR, located on the overhead circuit breaker panel (fig. 2-26).

b. Fire Detection System Test Switch. One rotary switch placarded FIRE PROTECTION TEST on the copilot's subpanel is provided to test the engine fire detection system. Before checkout, battery power must be on and the FIRE DETR circuit breaker must be closed. Switch position DETR 1, checks the area forward of the air intake of each nacelle, including circuits to the cockpit alarm and indication devices. Switch position DETR 2, checks the circuits for the upper accessory compartment of each nacelle. Switch position DETR 3, checks the circuits for the lower accessory compartment of each nacelle. Each numbered switch position will initiate the cockpit indications previously described.

c. Erroneous Fire Detection System Indications. During ground test of the engine fire detection system, an erroneous indication of system fault my be encountered if an engine cowling is not closed properly, or if the aircraft is headed toward a strong external light source. In this circumstance, change the aircraft heading to enable a valid system check.

2-26. ENGINE FIRE EXTINGUISHER SYSTEM.

a. Description. The fire extinguisher system utilizes an explosive squib and valve which, when opened, allows the distribution of the pressurized extinguishing agent through a plumbing network of spray nozzles strategically located in the fire zones of the engines.

b. Fire Pull Handles. The fire control handles, which are used to arm the extinguisher system are centrally located on the pilot's instrument panel (fig. 2-28), immediately below the glareshield. These controls receive power from the hot battery bus. The fire detection system will indicate an engine fire by illuminating the master fault warning light on the pilot's and copilot's glareshield and the respective #1 or #2 FIRE PULL lights in the fire control T-handles. Pulling the fire control T-handle will electrically arm the extinguisher system and close the fuel firewall shutoff valve for that particular engine. This will cause the red light in the PUSH TO EXTINGUISH switch and the respective red #1 and #2 FUEL PRESS light in the warning annunciator panel to illuminate. Pressing the lens of the PUSH TO EXTINGUISH switch (after lifting one side of its spring-loaded clear plastic guard) will fire the squib, expelling all the agent in the cylinder at one time. The respective yellow caution light, #1 or #2 EXTGH DISCH on the caution/advisory annunciator panel will illuminate and remain illuminated until the squib is replaced.

c. Fire Extinguisher System Test Switch. A rotary test switch, placarded FIRE PROTECTION TEST, is located on the copilot's subpanel. The test functions, placarded EXTGH #1 #2, are arranged on the left side of the switch and provide a test of the pyrotechnic cartridge circuitry. During Before Exterior Check, the pilot should rotate the test switch through the two positions and verify the illumination of the green SQUIB OK light on the PUSH TO EXTINGUISH switch and the corresponding yellow #1 or #2 EXTGH DISCH light on the caution/advisory annunciator panel.

d. Fire Extinguishing System Supply Cylinder Gages. A gage, calibrated in PSI, is mounted on each supply cylinder for determining the level of charge and should be checked during preflight (table 2-1).

2-27. OIL SUPPLY SYSTEM.

a. The engine oil tank is integral with the air-inlet casting located forward of the accessory gearbox. Oil for propeller operation, lubrication of the reduction gearbox and engine bearings is supplied by an external line from the high pressure pump. Two scavenge lines return oil to the tank from the propeller reduction gearbox. A non-congealing external oil cooler keeps the engine oil temperature within the operating limits. The capacity of each engine oil tank is 2. 3 U. S. gallons. The total system capacity for each engine, which includes the oil tank, oil cooler, lines, etc. , is 3. 5 U. S. gallons. The oil level is indicated by a dipstick attached to the oil filler cap. Oil grade, specification and servicing points, are described in Section XII, Servicing.

b. The oil system of each engine is coupled to a heat exchanger unit (radiator) of fin-and-tube design. These exchanger units are the only airframe mounted part of the oil system and are attached to the nacelles below the engine air intake. Each heat exchanger incorporates a thermal bypass which assists in maintaining oil at the proper temperature range for engine operation.

2-28. TORQUE LIMITER

A torque limiter is installed in the torquemeter pressure transmitter boss on the front case of the propeller reduction gearbox. The limiter incorporates a sealed bellows, connected directly to torquemeter oil pressure, which works against an externally adjustable torque-limit spring. Torquemeter oil pressure is sensed at the inside of the bellows assembly, and during normal operating conditions the torquemeter oil pressure is not high enough to compress the torque-limit spring. When high torque pressure is sensed, the bellows will stretch and compress the spring assembly. This will permit a limited amount of governing air pressure to be bled from the fuel control unit and will continue to do so until engine speed is reduced, resulting in a proportional reduction in engine torque pressure.

Table 2-1. Engine Fire Extinguisher Gage Pressure

Temp°C	-40	-29	-18	-06	+04	+16	+27	+38	+48
PSI	190 to 240	220 to 275	250 to 315	290 to 365	340 to 420	390 to 480	455 to 550	525 to 635	605 to 730
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2-29. ENGINE CHIP DETECTION SYSTEM.

A magnetic chip detector is installed in the bottom of each engine nose gearbox to warn the pilot of oil contamination and possible engine failure. The sensor is an electrically insulated gap immersed in the oil, functioning as a normally-open switch. If a large metal chip or a mass of small particles bridge the detector gap, a circuit is completed, sending a signal to illuminate a red annunciator panel indicator light placarded #1 or #2 CHIP DETR and the MASTER WARNING lights. Chip detector circuits are protected by two 5-ampere circuit breakers, placarded CHIP DETR #1 and #2 on the overhead circuit breaker panel (fig. 2-26).

2-30. ENGINE IGNITION SYSTEM.

a. The basic ignition system consists of a solid state ignition exciter unit, two igniter plugs, two shielded ignition cables, pilot controlled IGNITION AND ENGINE START switches and the ENG AUTO IGN switch. Placing an IGNITION AND ENGINE START switch to ON (forward) will cause the respective igniter plugs to spark, igniting the fuel/air mixture sprayed into the combustion chamber by the fuel nozzles. The ignition system is activated for ground and air starts, but is switched off after combustion light up.

b. One three-position toggle switch for each engine, located on the overhead control panel, will initiate starter motoring and ignition in the ON/ ENG START position, or will motor the engine in the STARTER ONLY (aft) position (fig. 2-18). The switches are placarded #1 ENG START or #2 ENG START to designate the appropriate engine. The ON switch position completes the starter circuit for engine rotation, energizes the igniter plugs for fuel combustion, and activates the IGN ON light on the annunciator panel. At center position the switch is OFF. Two 5-ampere circuit breakers on the overhead circuit breaker panel, placarded IGNITOR CONTR #1 and #2, protect ignition circuits. Two 5ampere circuit breakers on the overhead circuit breaker panel, placarded START CONTR #1 and #2, protect starter control circuits (fig. 2-26).

2-31. AUTO IGNITION SYSTEM.

If armed, the auto ignition system automatically provides combustion re-ignition of either engine should accidental flameout occur. The system is not essential to normal engine operation, but is used to reduce the possibility of power loss due to icing or other conditions. Each engine has a separate auto ignition control switch and a green indicator light placarded #1 or #2 IGN ON, on the annunciator panel. Auto ignition is accomplished by energizing the two igniter plugs in each engine.

NOTE

The system should be turned OFF during extended ground operation to prolong the life of the igniter plugs.

a. Auto Ignition Switches. Two switches placarded ENG AUTO IGN #1 or #2, control the auto ignition systems. The ARM position initiates a readiness mode for the auto ignition system of the corresponding engine. The OFF position disarms the system. Each switch is protected by a corresponding START CONTR #1 or #2 5-ampere circuit breaker on the overhead circuit breaker panel (fig. 2-26).

b. Auto Ignition Lights. If an armed auto ignition system changes from a ready condition to an operating condition (energizing the igniter plugs in the engine) a corresponding green annunciator panel light will illuminate. The annunciator panel light is placarded #1 or #2 IGN ON and indicates that the igniters are energized. The auto ignition system is triggered from a ready condition to an operating condition when engine torque drops below approximately 20%. Therefore, when an auto ignition system is armed, the igniters will be energized continuously during the time when an engine is operating at a level below approximately 20% torque. The auto ignition lights are protected by 5-ampere IGNITOR CONTR #1 or #2 circuit breakers, located on the overhead circuit breaker panel (fig. 2-26).

2-32. ENGINE STARTER-GENERATORS.

One start-generator is mounted on each engine accessory drive section. Each is able to function either as a starter or as a generator. In the starter function, 28 volts DC is required to power rotation. In the generator function, each unit is capable of 400 amperes DC output. Each starter circuit is protected by a 5-ampere circuit breaker placarded START CONTR, located on the overhead circuit breaker panel. An automatic starter cut-off is installed in each starter-generator to provide automatic termination of the start cycle at approximately 40% NI. This rotational speed is sensed by a magnetic sensor internal to the starter-generator. For additional information on the starter-generator system refer to Section IX.

2-33. ENGINE INSTRUMENTS.

The engine instruments are vertically mounted near the center of the instrument panel (fig. 2-28).

a. Turbine Gas Temperature Indicators. Two TGT gages on the instrument panel (fig. 2-28) are calibrated in degrees Celsius. Each gage is connected to thermocouple probes located in the hot gases between the turbine wheels. The gages register the temperature present between the compressor turbine and power turbine for the corresponding engine.

b. Engine Torquemeters. Two torquemeters on the instrument panel (fig. 2-28) indicate torque applied to the propeller shafts of the respective engines. Each gage shows torque in percent of maximum using 2 percent graduations and is actuated by an electrical signal from a pressure sensing system located in the respective propeller reduction gear case. Torquemeters are protected by individual 0. 5ampere circuit breakers placarded TORQUEMETER #1 or #2 on the overhead circuit breaker panel (fig. 2-26).

c. Turbine Tachometers. Two tachometers on the instrument panel (fig. 2-28) register compressor turbine RPM (N1) for the respective engine. These indicators register turbine RPM as a percentage of maximum gas generator RPM. Each instrument is slaved to a tachometer generator attached to the respective engine.

d. Oil Pressure/Oil Temperature Indicators. Two gages on the instrument panel (fig. 2-28) panel register oil pressure in PSI and oil temperature in °C. Oil pressure is taken from the delivery side of the main oil pressure pump. Oil temperature is transmitted by a thermal sensor unit which senses the temperature of the oil as it leaves the delivery side of the oil pressure pump. Each gage is connected to pressure transmitters installed on the respective engine. Both instruments are protected by 5ampere circuit breakers, placarded OIL PRESS and OIL TEMP #1 or #2, on the overhead circuit breaker panel (fig. 2-26).

e. Fuel Flow Indicators. Two gages on the instrument panel (fig. 2-28) register the rate of flow for consumed fuel as measured by sensing units coupled into the fuel supply lines of the respective engines. The fuel flow indicators are calibrated in increments of hundreds of pounds per hour. Both circuits are protected by 1/2 ampere circuit breakers placarded FUEL FLOW #1 or #2, on the overhead circuit breaker panel (fig. 2-26).

Section IV. FUEL SYSTEM

2-34. FUEL SUPPLY SYSTEM.

The engine fuel supply system (fig. 2-12) consists of two identical systems sharing a common fuel management panel and fuel crossfeed plumbing. Each fuel system consists of five interconnected wing tanks, a nacelle tank, an auxiliary inboard fuel tank. A fuel transfer pump is located within each auxiliary tank. Additionally, the system has an engine-driven boost pump, a standby fuel pump located within each nacelle tank, a fuel heater (engine oilto-fuel heat exchanger unit), a tank vent system, a tank vent heating system and interconnecting wiring and plumbing. Refer to Section IV for fuel grades and specifications. Fuel tank capacity is shown in Table 2-2.

a. Engine Driven Boost Pumps.

CAUTION

Engine operation using only the enginedriven primary (high pressure) fuel pump without standby pump or engine-driven boost pump fuel pressure is limited to 10 cumulative hours. This condition is indicated by illumination of either #1 or #2 FUEL PRESS lights and the simultaneous illumination of both MASTER WARNING lights. Refer to Chapter 9. All time in this category shall be entered on DA Form 2408-13 for the attention of maintenance personnel.

A gear driven boost pump, mounted on each engine supplies fuel under pressure to the inlet of the engine-driven primary high-pressure pump for engine starting and all normal operations. Either the engine-driven boost pump or standby pump is capable of supplying sufficient pressure to the enginedriven primary high-pressure pump and thus maintain normal engine operation.

b. Standby Fuel Pumps. A submerged, electrically-operated standby fuel pump, located within each nacelle tank, serves as a backup unit for the engine-driven boost pump. The standby pumps are switched off during normal system operations. A standby fuel pump will be operated during crossfeed to pump fuel from one system to the opposite engine. The correct pump is automatically selected when the CROSSFEED switch is activated. Each standby fuel pump has an inertia switch included in the power supply circuit. When subjected to a 5 to 6 G shock loading, as in a crash situation, the inertia switch will remove electrical power from the standby fuel pumps. The standby fuel pumps are protected

Table 2-2. Fuel Quantity Data

	TANKS	NUMBER	GALLONS	**POUNDS
LEFT ENGINE	Wing Tanks	5	135	884.0
	Nacelle Tank	1	57	370.5
	Auxiliary Tank	1	79	513.5
RIGHT ENGINE	Wing Tanks	5	135	884.0
	Nacelle Tank	1	57	370.5
	Auxiliary Tank	1	79	513.5
	*TOTALS	14	542	3536.0

* Unusable fuel quantity and weight (6.7 gallons, 44 pounds not included in totals).
** Fuel weight is based on standard day conditions at 6.5 pounds per U.S. gallon.
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by two 10-ampere circuit breakers placarded STANDBY PUMP #1 or #2, located on the overhead circuit breaker panel (fig. 2-26), and four 5ampere circuit breakers (2 each in parallel) on the hot battery bus.

c. Fuel Transfer Pumps. The auxiliary tank fuel transfer system automatically transfers the fuel from the auxiliary tank to the nacelle tank without pilot action. Motive flow to a jet pump mounted in the auxiliary tank sump is obtained from the engine fuel plumbing system downstream from the engine driven boost pump and routed through the transfer control motive flow valve. The motive flow valve is energized to the open position by the control system to transfer auxiliary fuel to the nacelle tank to be consumed by the engine during the initial portion of the flight. When an engine is started, pressure at the engine driven boost pump closes a pressure switch which, after a 30 to 50 second time delay to avoid depletion of fuel pressure during starting, energizes the motive flow valve. When auxiliary fuel is depleted, a low level float switch de-energizes the motive flow valve after a 30 to 60 second time delay provided to prevent cycling of the motive flow valve due to sloshing fuel. In the event of a failure of the motive flow valve or the associated control circuitry, the loss of motive flow pressure when there is still fuel remaining in the auxiliary fuel tank is sensed by a pressure switch and float switch, respectively, which illuminates a light placarded #1 or #2 NO FUEL XFR on the annunciator panel. During engine start, the pilot should note that the NO FUEL XFR lights extinguish 30 to 50 seconds after engine start. The NO FUEL XFR lights will not illuminate if auxiliary tanks are empty. A manual override is incorporated as a backup for the automatic transfer system. This is initiated by placing the AUX TRANSFER switch, located on the fuel management panel (fig. 2-13) to the OVERRIDE position. This will energize the transfer control motive flow valve. The transfer systems are protected by 5-ampere circuit breakers placarded AUXILIARY TRANSIEK #1 or #2, located on the overhead circuit breaker panel (fig. 2-26).

NOTE

In turbulence or during maneuvers, the NO FUEL XFR lights may momentarily illuminate after the auxiliary fuel has completed transfer.

d. Fuel Gaging System. The total fuel quantity in the left or right main system or left or right auxiliary tank is measured by a capacitance type fuel gaging system. Two fuel gages, one for the left and one for the right fuel system, read fuel quantity in pounds. Refer to Section XII for fuel capacities and weights. A maximum of 3% error may be encountered in each system. However, the system is compensated for fuel density changes due to temperature excursions. In addition to the fuel gages, yellow No. 1 or No. 2 NAC LOW lights on the caution/ advisory annunciator panel illuminate when there is approximately 20 minutes of fuel per engine remaining (on standard day, at Sea Level, Maximum Cruise Power consumption rate). The fuel gaging system is protected by individual 5 ampere circuit breakers placarded QTY IND and QTY WARN #1 or #2, located on the overhead circuit breaker panel (fig. 226). A mechanical spiral float gage (fig. 2-13) is installed in the auxiliary fuel tank to provide an indication of fuel level when servicing the tank. The gage is installed on the auxiliary fuel tank cover, adjacent to the filler neck. A small sight window in the upper wing skin permits observation of the gage.

e. Fuel Management Panel. The fuel management panel (fig. 2-13) is located on the cockpit overhead between the pilot and copilot. It contains the fuel gages, standby fuel pump switches, the crossfeed valve switch and a fuel gaging system control switch and transfer control switches are also installed.

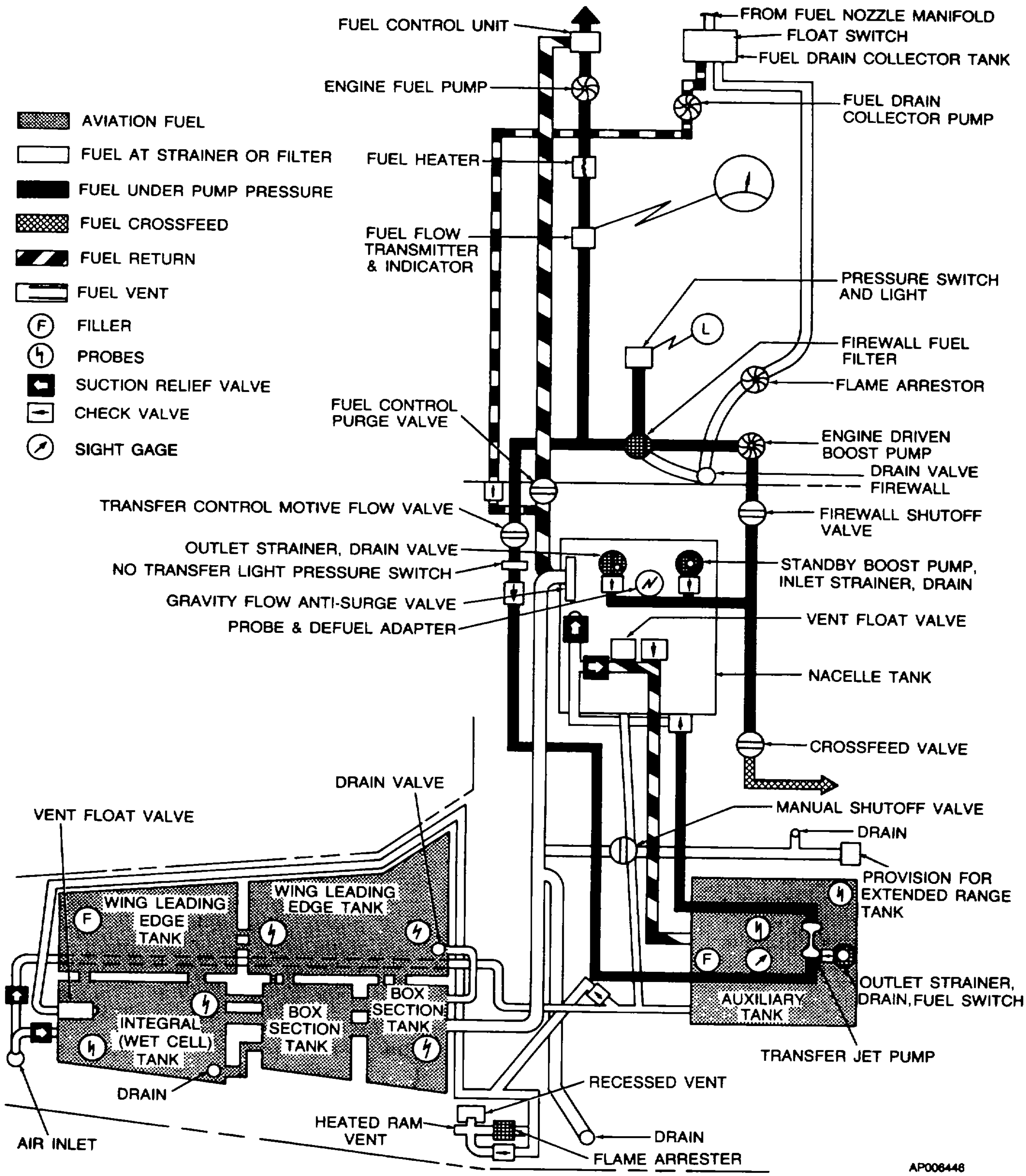


Figure 2-12. Fuel System Schematic

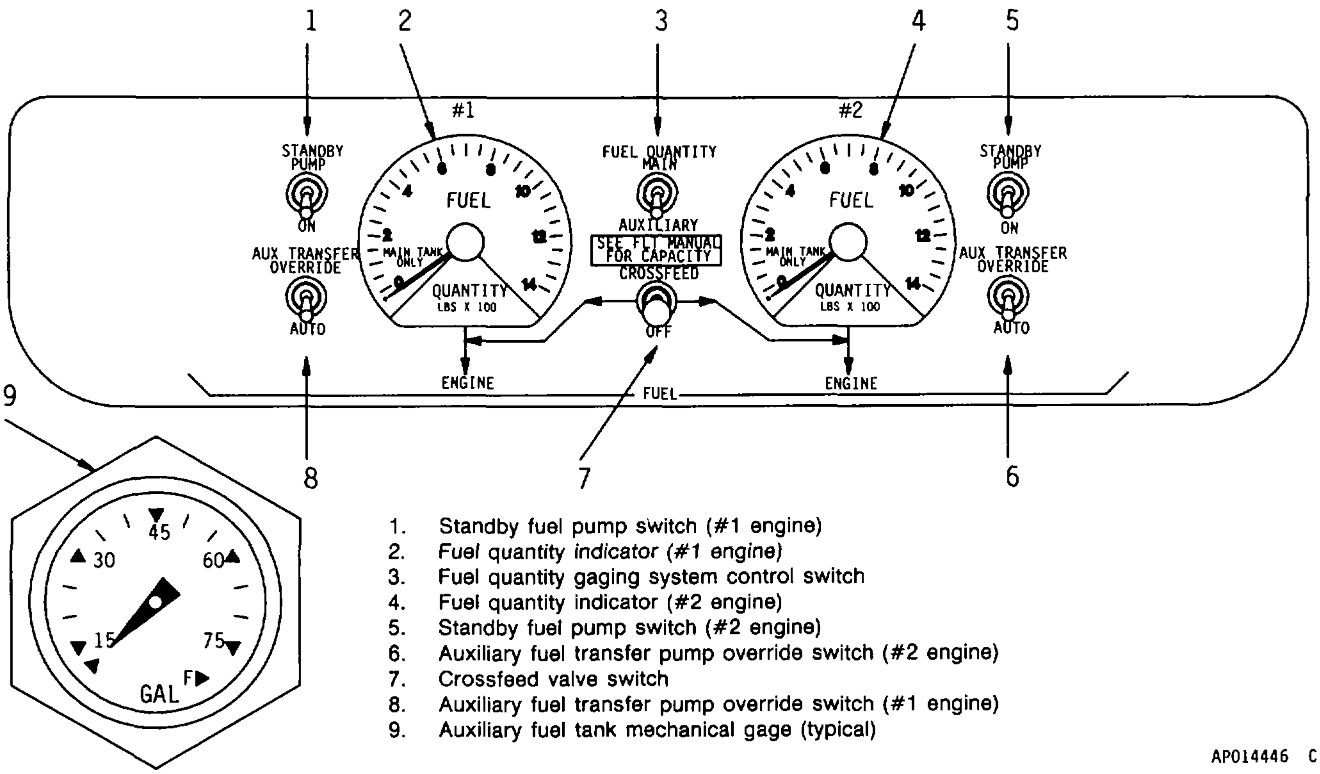


Figure 2-13. Fuel Management Panel and Auxiliary Tank Mechanical Gage

(1) Fuel gaging system control switch. A switch on the fuel management panel (fig. 2-13) placarded FUEL QUANTITY, MAIN AUXILIARY, controls the fuel gaging system. When in the MAIN position the fuel gages read the total fuel quantity in the left and right wing fuel system. When in the AUXILIARY position the fuel gages read the fuel quantity in the left and right auxiliary tanks only.

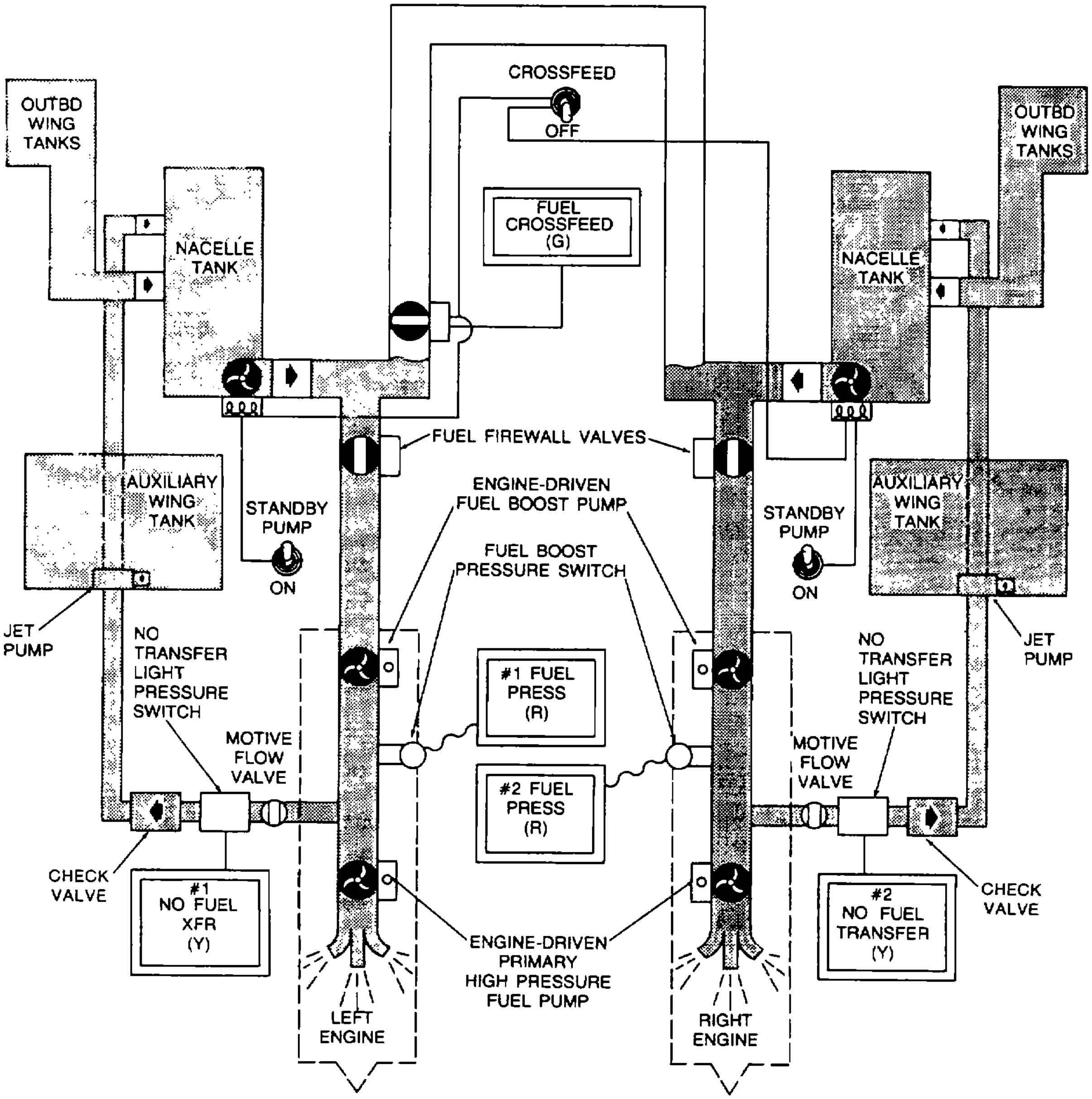
(2) Standby fuel pump switches. Two switches, placarded STANDBY PUMP ON located on the fuel management panel (fig. 2-13) control a submerged fuel pump located in the corresponding nacelle tank. During normal aircraft operation both switches are off so long as the engine-driven boost pumps function and during crossfeed operation. The loss of fuel pressure, due to failure of an engine driven boost pump will illuminate the MASTER WARNING lights on the glareshield and will illuminate the #1 FUEL PRESS or #2 FUEL PRESS on the warning annunciator panel. Turning ON the STANDBY PUMP will extinguish the FUEL PRESS lights. The MASTER WARNING lights must be manually cleared.

NOTE

Both standby pump switches shall be off during crossfeed operation.

(3) Fuel transfer control switches. Two switches on the fuel management panel (fig. 2-13), placarded AUX TRANSFER OVERRIDE AUTO control operation of the fuel transfer pumps. During normal operation both switches are in AUTO which allows the system to be automatically actuated by fuel flow to the engine. If either transfer system fails to operate, the fault condition is indicated by two illuminated MASTER CAUTION lights on the glareshield and a steadily illumihated yellow #1 or #2 NO FUEL XFR light on the caution annunciator panel.

(4) Fuel crossfeed switch. The fuel crossfeed valve is controlled by a 3-position switch (fig, 2-13), located on the fuel management panel, placarded CROSSFEED OFF. Under normal flight conditions the switch is left in the OFF position. During emergency single engine operation, it may become necessary to supply fuel to the operative engine from the fuel system on the opposite side. The crossfeed system (fig. 2-15) is placarded for fuel selection with a simplified diagram on the overhead fuel control panel. Place the standby fuel pump switches in the off position when crossfeeding. A lever lock switch, placarded CROSSFEED, is moved from the center OFF position to the left or to the right, depending on direction of fuel flow. This opens the crossfeed valve and energizes the standby



NOTE

IN THE EVENT THAT AN ENGINE DRIVEN BOOST PUMP FAILS, PRESSURE CAN BE MAINTAINED BY PLACING THE RESPECTIVE STANDBY PUMP SWITCH TO ON.

NOTE

THE ENGINE-DRIVEN PRIMARY (HIGH PRESSURE) FUEL PUMP IS LIMITED TO 10 HOURS OF OPERATION, THROUGHOUT ITS TBO PERIOD, WITHOUT STANDBY FUEL PUMP OR ENGINE-DRIVEN BOOST PUMP FUEL PRESSURE.

NOTE

THE SYSTEM WILL GRAVITY FEED FUEL ONLY TO ITS RESPECTIVE BOOST PUMP, I.E., LEFT OR RIGHT. FUEL WILL NOT GRAVITY FEED THROUGH THE CROSSFEED SYSTEM.

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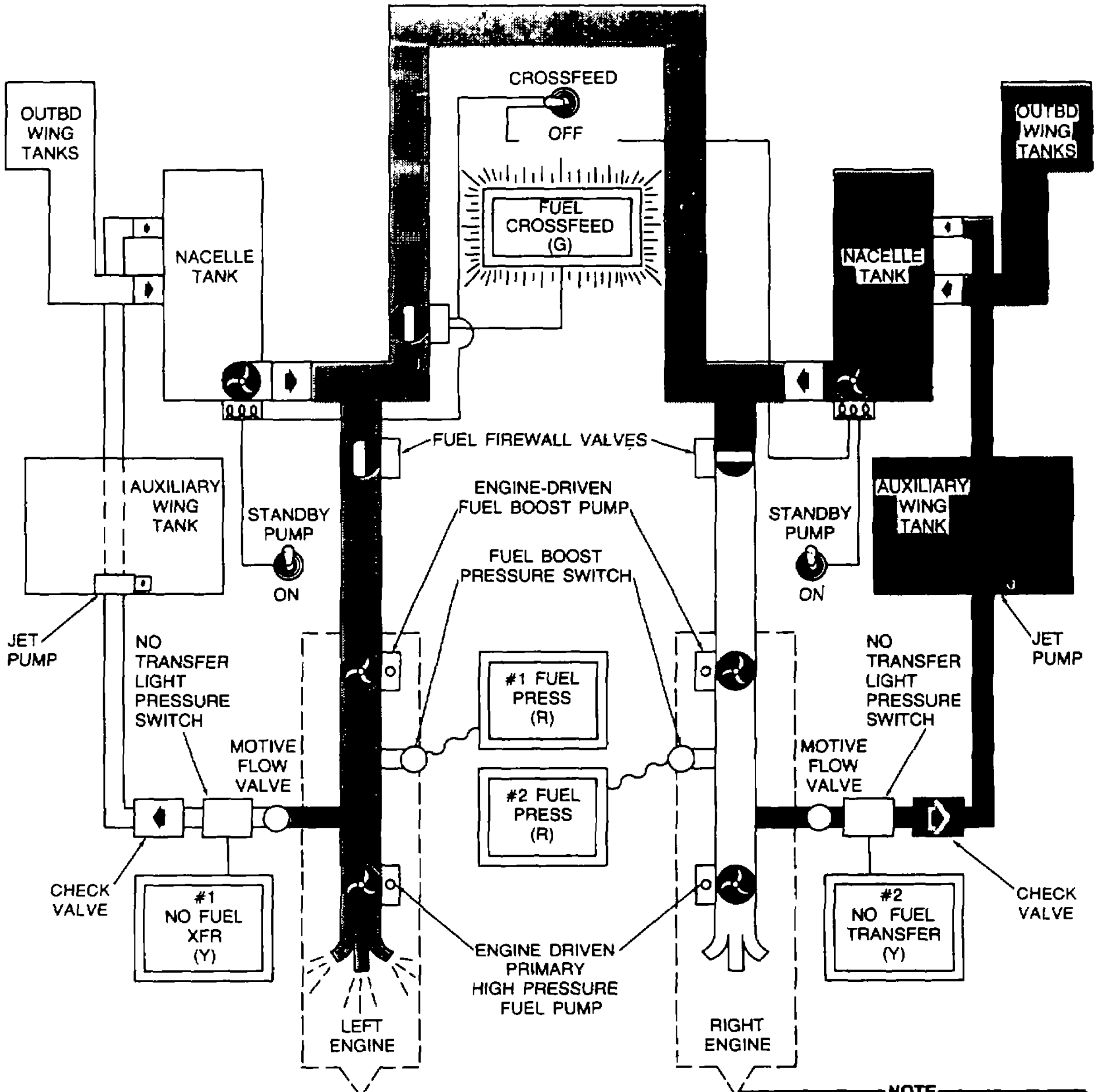
Figure 2-14. Gravity Feed Fuel Flow



NO FUEL FLOW FROM LEFT WING TANKS

NORMAL PRESSURIZED FUEL FLOW FROM RIGHT WING TANKS

NOTE

BOTH STANDBY PUMP SWITCHES WILL BE OFF DURING CROSSFEED OPERATION.

NOTE

THE ENGINE-DRIVEN PRIMARY (HIGH PRESSURE) FUEL PUMP IS LIMITED TO 10 HOURS OF OPERATION THROUGHOUT ITS TBO PERIOD WITHOUT STANDBY FUEL PUMP OR ENGINE-DRIVEN BOOST PUMP FUEL PRESSURE.

NOTE

DIAGRAM SHOWS TYPICAL FUEL CROSSFEED SITUATION WITH RIGHT WING FUEL SYSTEM SUPPLYING BOTH ENGINES (ALL BOOST AND STANDBY PUMPS OPERABLE). FOR SELECTION OF LEFT WING FUEL FOR CROSSFEED REVERSE CROSSFEED SWITCH POSITION. EITHER CONFIGURATION WILL SUPPLY EITHER ENGINE DURING SINGLE-ENGINE OPERATIONS. FUEL WILL NOT CROSSFEED BETWEEN TANK SYSTEMS.

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Figure 2-15. Crossfeed Fuel Flow

pump on the side from which crossfeed is desired. During crossfeed operation with firewall fuel valve closed, auxiliary tank fuel will not crossfeed. When the crossfeed mode is energized, a green FUEL CROSSFEED light on the caution/advisory panel will illuminate. Crossfeed system operation is described in Chapter 9. The crossfeed valve is protected by a 5-ampere circuit breaker placarded CROSSFEED VALVE located on the overhead circuit breaker panel (fig. 2-26).

f. Firewall Shutoff Valves.

CAUTION

Do not use the fuel firewall shutoff valve to shut down an engine, except in an emergency. The engine-driven highpressure fuel pump obtains essential lubrication from fuel flow. When an engine is operating, this pump may be severely damaged (while cavitating) if the firewall valve is closed before the condition lever is moved to the FUEL CUTOFF position.

The fuel system incorporates a fuel line shutoff valve mounted on each engine firewall. The firewall shutoff valves close automatically when the fire extinguisher T-handles on the instrument panel are pulled out. The firewall shutoff valves receive electrical power from the main buses and also from the hot battery bus which is connected directly to the battery. The valves are protected by circuit breakers placarded FIREWALL VALVE #1 or #2 on the overhead circuit breaker panel (fig. 2-26), and FIREWALL SHUTOFF #1 or #2 on the hot battery bus circuit breaker board.

g. Fuel Sump Drains. A sump drain wrench is provided in the aircraft loose tools to simplify draining a small amount of fuel from the sump drain. There are five sump drains and one filter drain in each wing (Table 2-3). An additional drain for the extended range fuel system line extends through the bottom of the wing center section adjacent to the fuselage. Anytime the extended range system is in use, a part of the preflight inspection would consist of draining a small amount of fuel from this drain to check for fuel contamination. Whenever the extended range system is removed from the aircraft and the fuel line is capped off in the fuselage, the remaining fuel in the line shall be drained.

h. Fuel Drain Collector System. Each engine is provided with a fuel drain collector system to return fuel dumped from the engine during clearing and shutdown operations back into its respective nacelle tank. The system draws power from the #4 feeder bus. Fuel transfer is completely automatic. Fuel from the engine flow divider drains into a collector tank mounted below the aft engine accessory section. An internal float switch actuates an electric scavenger pump which delivers the fuel to the fuel purge line just aft of the fuel purge shutoff valve. A check valve in the line prevents the backflow of fuel during engine purging. The circuit breaker for both pumps is located in the fuel section of the overhead circuit breaker panel; placarded SCAVENGER PUMP. A vent line, plumbed from the top of the collector tank, is routed through an inline flame arrestor and then downward to a drain manifold on the underside of the nacelle.

i. Fuel Vent System. Each fuel system is vented through two ram vents located on the underside of the wing adjacent to the nacelle. To prevent icing of the vent system, one vent is recessed into the wing and the backup vent protrudes out from the wing and contains a heating element. The vent line at the nacelle contains an inline flame arrestor.

j. Engine Oil-to-Fuel Heat Exchanger. An engine oil-to-fuel heat exchanger, located on each engine accessory case, operates continuously and automatically to heat the fuel delivered to the engine sufficiently to prevent the freezing of any water which it might contain. The temperature of the delivered fuel is thermostatically regulated to remain between 21°C and 32°C.

Table 2-3. Fuel Sump Drain Locations

NUMBER	DRAINS	LOCATION
1	Leading Edge Tank	Outboard of nacelle, underside of wing
1	Integral Tank	Underside of wing, forward of aileron
1	Firewall fuel filter	Underside of cowling forward of firewall
1	Sump Strainer	Bottom center of nacelle forward of wheel well
1	Gravity feed line	Aft of wheel well
1	Auxiliary Tank	At wing root, just forward of the flap
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2-35. FUEL SYSTEM MANAGEMENT.

a. Fuel Transfer System. When the auxiliary tanks are filled, they will be used first. During transfer of auxiliary fuel, which is automatically controlled, the nacelle tanks are maintained full. A check valve in the gravity feed line from the outboard wing prevents reverse fuel flow. Normal gravity transfer of the main wing fuel into the nacelle tanks will begin when auxiliary fuel is exhausted. The system will gravity feed fuel only to its respective nacelle tank, i. e. left or right. Fuel will not gravity feed through the crossfeed system.

b. Operation With Failed Engine-Driven Boost Pump or Standby Pump. Two pumps in each fuel system provide inlet head pressure to the engine driven primary high-pressure fuel pump. If crossfeed is used, a third pump, the standby fuel pump from the opposite system, will supply the required pressure. Operation under this condition will result in an unbalanced fuel load as fuel from one system will be supplied to both engines while all fuel from the system with the failed engine driven and standby boost pumps will remain unused. A triple failure, which is highly unlikely, would result in the engine driven primary pump operating without inlet head pressure. Should this situation occur, the affected engine can continue to operate from its own fuel supply on its engine-driven primary high-pressure fuel pump.

2-36. FERRY FUEL SYSTEM.

Provisions are installed for connection to long range fuel cells.

Section V. FLIGHT CONTROLS

2-37. DESCRIPTION.

The aircraft's primary flight control systems consist of conventional rudder, elevator and aileron control surfaces. These surfaces are manually operated from the cockpit through mechanical linkage using a control wheel for the ailerons and elevators, and adjustable rudder/brake pedals for the rudder. Both the pilot and copilot have flight controls. Trim control for the rudder, elevator and ailerons is accomplished through a manually actuated cable-drum system for each set of control surfaces. The autopilot has provisions for controlling the position of the ailerons, elevators, and rudder. Chapter 3 describes the operation of the autopilot system.

2-38. CONTROL WHEELS.

Elevator and aileron control surfaces are operated by manually actuating either the pilot's or copilot's control wheel (fig. 2-16). Switches are installed in the grips of each control wheel for operation of pitch trim microphone, autopilot disconnect, transponder identification, and chaff dispenser. A manually wound 8-day clock is installed in the center of the pilot's control wheel, and a digital clock/timer is installed in the center of the copilot's control wheel. A map light switch is mounted adjacent to each clock. For information on operation of the digital clock/timer, refer to Section XI.

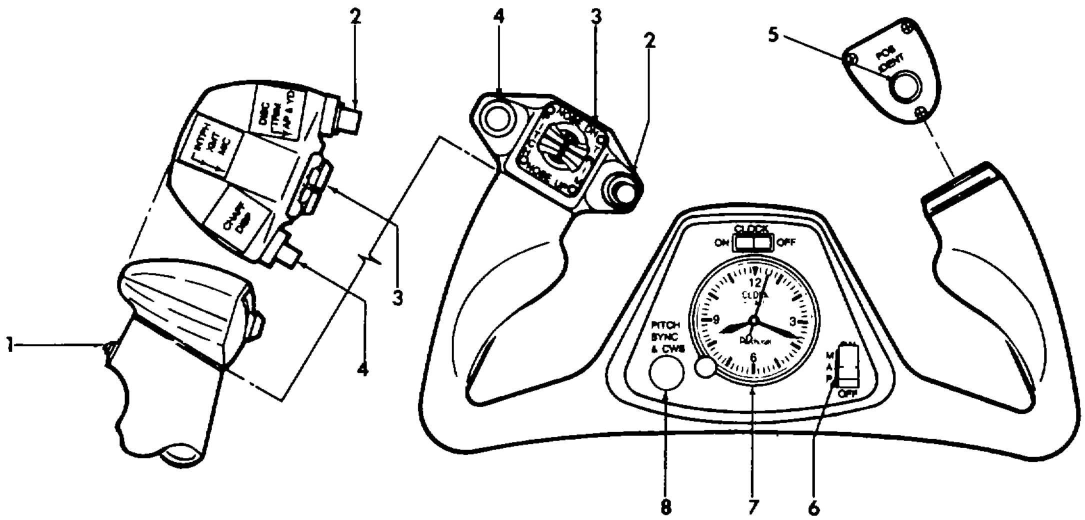
2-39. RUDDER SYSTEM.

a. Rudder Pedals. Aircraft rudder control and nose wheel steering is accomplished by actuation of the rudder pedals from either pilot's or copilot's station (fig. 2-9). The rudder pedals may be individually adjusted in either a forward or aft position to provide adequate leg room for the pilot and copilot. Adjustment is accomplished by depressing the lever alongside the rudder pedal arm and moving the pedal forward or aft until the locking pin engages in the selected position.

b. Yaw Damp System. A yaw damp system is provided to aid the pilot in maintaining directional stability and increase ride comfort. The system may be used at any altitude and is required for flight above 17,000 feet. It must be deactivated for takeoff and landing. The yaw damp system is a part of the autopilot. Operating instructions for this system are contained in Chapter 3. The system is controlled by a YAW DAMP switch adjacent to the ELEV TRIM switch on the pedestal extension.

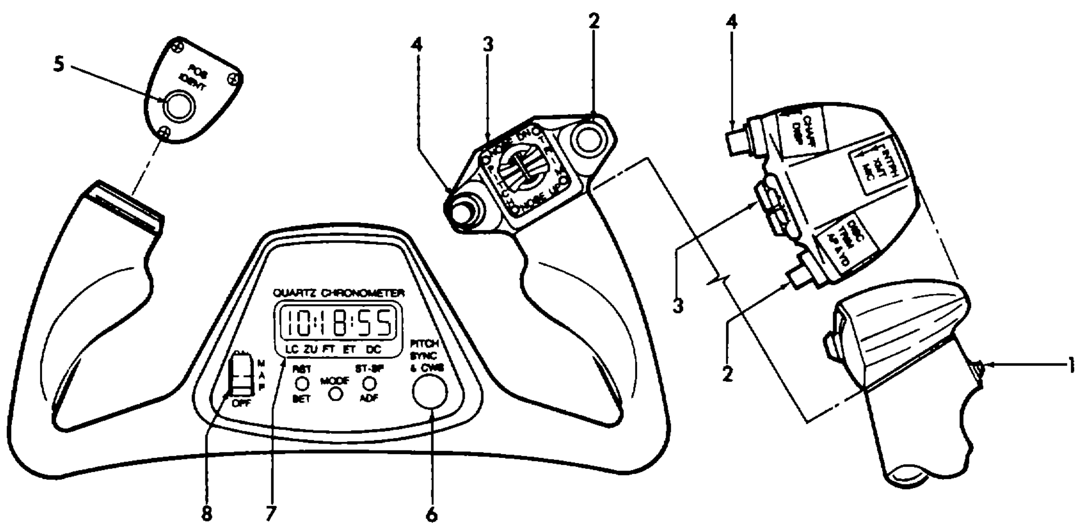
c. Rudder Boost System. A rudder boost system is provided to aid the pilot in maintaining directional stability resulting from an engine failure or a large variation of power between the engines. Incorporated in the rudder cable system are two pneumatic rudder boosting servos that actuates the cables to provide rudder pressure to help compensate for asymmetrical thrust.

(1) During operation, a differential pressure valve accepts bleed air pressure from each engine. When the pressure varies between the bleed air systems, the shuttle in the differential pressure valve moves toward the low pressure side. As the pressure difference reaches a preset tolerance, a switch closes on the low pressure side which activates the rudder boost system. This system is designed only to help compensate for asymmetrical thrust. Appropriate trimming is to be accomplished by the pilot. Moving



PILOT

1. MICROPHONE, INTERCOM, TRANSMIT SWITCH
2. TRIM, AUTOPILOT, YAW DAMP DISCONNECT SWITCH
3. PITCH-TRIM SWITCHES
4. CHAFF DISPENSE SWITCH
5. TRANSPONDER IDENT SWITCH
6. MAP LIGHT
7. EIGHT DAY CLOCK
8. PITCH SYNCHRONIZATION AND CONTROL WHEEL STEERING SWITCH



COPILOT

1. MICROPHONE, INTERCOM, TRANSMIT SWITCH
2 CHAFF DISPENSE SWITCH
3 PITCH-TRIM SWITCHES
4 TRIM, AUTOPILOT, YAW DAMP DISCONNECT SWITCH
5 TRANSPONDER IDENT SWITCH
6 PITCH SYNCHRONIZATION AND CONTROL WHEEL STEERING SWITCH
7 DIGITAL CLOCK
8 MAP LIGHT

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Figure 2-16. Control Wheels

either or both of the bleed air valve switches on the overhead control panel to PNEU & ENVIRO OFF position will disengage the rudder boost system.

NOTE

Condition levers must be in LOW IDLE position to perform rudder boost check.

(2) The system is controlled by a switch located on the extended pedestal placarded RUDDER BOOST ON OFF, and is to be turned on before flight. A preflight check of the system can be performed during the run-up by retarding the power on one engine to idle and advancing power on the opposite engine until the power difference between the engines is great enough to activate the switch to turn on the rudder boost system. Movement of the appropriate rudder pedal (left engine idling, right rudder pedal moves forward) will be noted when the switch closes, indicating the system is functioning properly for low engine power on that side. Repeat the check with opposite power settings to check for movement of the opposite rudder pedal. The system is protected by a 5-ampere circuit breaker placarded RUDDER BOOST, located on the overhead circuit breaker panel (fig. 2-26).

NOTE

With brake deice on, rudder boost may be inoperative.

2-40. FLIGHT CONTROLS LOCK.

CAUTION

Remove control locks before towing the aircraft or starting engines. Serious damage could result in the steering linkage if towed by a tug with the rudder lock installed.

Positive locking of the rudder, elevator and aileron control surfaces, and engine controls (power levers, propeller levers, and condition levers) is provided by a removable lock assembly (fig. 2-17) consisting of two pins, and an elongated U-shaped strap interconnected by a chain. Installation of the controls lock is accomplished by inserting the U-shaped strap around the aligned control levers from the copilot's side; then the aileron/elevator locking pin is inserted through a guide hole in the top of the pilot's control column assembly, thus locking the control wheel. The rudder is held in a neutral position by an L-shaped pin which is installed through a guide hole in the floor aft of the pilots rudder pedals. The rudder pedals must be centered to align the hole in the rudder bellcrank with the guide hole in the floor. Remove the locks in reverse order, i. e. , rudder pin, control column pin, and power control clamp.

2-41. TRIM TABS.

Trim tabs are provided for all flight control surfaces. These tabs are manually activated, and are mechanically controlled by a cable-drum and jackscrew actuator system, except the right aileron tab which is of the fixed bendable type. Elevator and aileron trim tabs incorporate neutral, anti-servo action, i. e. , as the elevators or ailerons are displaced from the neutral position, the trim tab maintains an "as adjusted" position. The rudder trim tab incorporates anti-servo action, i. e. , as the rudder is displaced from the neutral position the trim tab moves in the same direction as the control surface. This action increases control pressure as rudder is deflected from the neutral position.

a. Elevator Trim Tab Control. The elevator trim tab control wheel placarded ELEVATOR TAB DOWN, UP, is on the left side of the control pedestal and controls a trim tab on each elevator (fig. 210). The amount of elevator tab deflection in degrees from a neutral setting, is indicated by a position arrow.

b. Electric Elevator Trim. The electric elevator trim system is controlled by an ELEV TRIM PUSH ON PUSH OFF switch located on the pedestal, dual element thumb switches on the control wheels, a trim disconnect switch on each control wheel and a circuit breaker on the overhead circuit breaker panel. The PUSH ON -PUSH OFF switch must be in the ON position to operate the system. The dual element thumb switch is moved forward for trimming nose down, aft for nose up, and when released returns to the center (off) position. Any activation of the trim system through the copilot's trim switch can be cancelled by activation of the pilot's switch. Operating the pilot's and copilot's switches in opposing directions simultaneously results in no trim action. A preflight check of the switches should be accomplished before flight by moving the switches individually on both control wheels. No one switch alone should operate the system; operation of elevator trim should occur only by movement of pairs of switches. The trim system disconnect is a bi-level, push button, momentary type switch, located on the outboard grip of each control wheel. Depressing the switch to the first of two levels disconnects the autopilot and yaw damp system, and the second level disconnects the electric trim

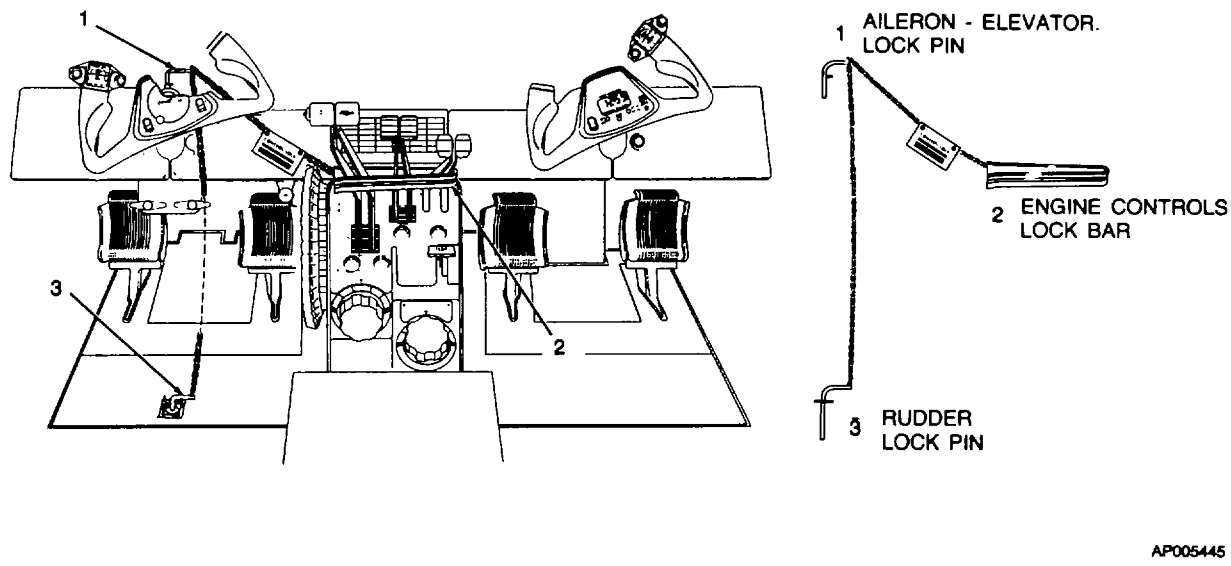

Figure 2-17. Control Locks

system. The system can be reset by pressing the ON OFF switch on the pedestal to ON again.

c. Aileron Trim Tab Control. The aileron trim tab control, placarded AILERON TAB -LEFT, RIGHT, is on the control pedestal and will adjust the left aileron trim tab only (fig. 2-10). The amount of aileron tab deflection, from a neutral setting, as indicted by a position arrow, is relative only and is not in degrees. Full travel of the tab control moves the trim tab 7-1/2 degrees up and down.

d. Rudder Trim Tab Control. The rudder trim tab control knob, placarded RUDDER TAB LEFT, RIGHT, is on the control pedestal, and controls adjustment of the rudder trim tab (fig. 2-10). The amount of rudder tab deflection, in degrees from a neutral setting, is indicated by a position arrow.

2-42. WING FLAPS.

The all-metal slot-type wing flaps are electrically operated and consist of two sections for each wing. These sections extend from the inboard end of each aileron to the junction of the wing and fuselage. During extension, or retraction, the flaps are operated as a single unit, each section being actuated by a separate jackscrew actuator. The actuators are driven through flexible shafts by a single, reversible electric motor. Wing flap movement is indicated in percent of travel by a flap position indicator on the forward control pedestal. Full flap extension and retraction time is approximately 11 seconds. The flap control switch is located on the control pedestal. No emergency wing flap actuation system is provided. With flaps extended beyond the APPROACH position, the landing gear warning horn will sound, unless the landing gear is down and locked. The circuit is protected by a 20-ampere circuit breaker, placarded FLAP MOTOR POWER, located on the overhead circuit breaker panel (fig. 2-26).

a. Wing Flap Control Switch. Flap operation is controlled by a three-position switch with a flapshaped handle on the control pedestal (fig. 2-10). The handle of this switch is placarded FLAP and switch positions are placarded: FLAP UP, APPROACH, and DOWN. The amount of downward extension of the flaps is established by position of the flap switch, and is as follows: UP 0%, APPROACH 40%, and DOWN 100%. Limit switches, mounted on the right inboard flap, control flap travel. The flap control switch, limit switch, and relay circuits are protected by a 5-ampere circuit breaker, placarded FLAP CONTR located on the overhead circuit breaker panel (fig. 2-26). Flap positions between UP and APPROACH cannot be selected. For intermediate flap positions between AP-

PROACH and DOWN, the APPROACH position acts as an off position. To return the flaps to any position between full DOWN and APPROACH, place the flap switch to UP and when desired flap position is obtained, return the switch to the APPROACH detent. In the event that any two adjacent flap sections extend 3 to 5 degrees out of phase with the other, a safety mechanism is provided to discontinue power to the flap motor.

b. Wing Flap Position Indicator. Flap position in percent of travel from "O" percent (UP) to 100 percent (DOWN), is shown on an indicator, placarded FLAPS, located on the subpanel (fig. 2-6). The approach and full down or extended flap position is 14 and 34 degrees, respectively. The flap position indicator is protected by a 5-ampere circuit breaker, placarded FLAP CONTR, located on the overhead circuit breaker panel (fig. 2-26).

Section VI. PROPELLERS

2-43. DESCRIPTION.

A three blade aluminum propeller is installed on each engine. The propeller is of the full feathering, constant speed, counter-weighted, reversible type, controlled by engine oil pressure through single action, engine driven propeller governors. The propeller is flange mounted to the engine shaft. Centrifugal counterweights, assisted by a feathering spring, move the blades toward the low RPM (high pitch) position and into the feathered position. Governor boosted engine oil pressure moves the propeller to the high RPM (low pitch) hydraulic stop and reverse position. The propellers have no low RPM (high pitch) stops; this allows the blades to feather after engine shutdown. Low pitch propeller position is determined by the low pitch stop which is a mechanically actuated, hydraulic stop. Beta and reverse blade angles are controlled by the power levers in the beta and reverse range.

2-44. FEATHERING PROVISIONS.

Both manual and automatic propeller feathering systems are provided. Manual feathering is accomplished by pulling the corresponding propeller lever aft past a friction detent. To unfeather, the propeller lever is pushed forward into the governing range. An automatic feathering system, will sense loss of torque and will feather an unpowered propeller. Feathering springs will feather the propeller when it is not turning.

a. Automatic Feathering. The automatic feathering system provides a means of immediately dumping oil from the propeller servo to enable the feathering spring and counterweights to start feathering action of the blades in the event of an engine failure. Although the system is armed by a switch on the overhead control panel, placarded AUTOFEATHER ARM OFF TEST, the completion of the arming phase occurs when both power levers are advanced above 90% Ni at which time both indicator lightson the caution/advisory annunciator panel indicate a fully armed system. The annunciator lights are green and are placarded #1 AUTOFEATHER (left engine) and #2 AUTOFEATHER (right engine). The system will remain inoperative as long as either power lever is retarded below 90% Ni position, unless TEST position of the AUTOFEATHER SWITCH is selected to disable the power lever limit switches. The system is designed for use only during takeoff and landing and should be turned off when establishing cruise climb. During takeoff or landing, should the torque for either engine drop to an indication between 16 21%, the autofeather system for the opposite engine will be disarmed. Disarming is confirmed when the AUTOFEATHER light of the opposite engine becomes extinguished. If torque drops further, to a reading between 9 and 14%, oil is dumped from the servo of the effected propeller allowing a feathering spring and counter-weights to move the blades into feathered position. Feathering also causes the AUTOFEATHER light of the feathered propeller to extinguish. At this time, both annunciator AUTOFEATHER lights are extinguished, the propeller of the defective engine has feathered, and the propeller of the operative engine has been disarmed from the autofeathering capability. Only manual feathering control remains for the second propeller.

b. Propeller Autofeather Switch. Autofeathering is controlled by an AUTOFEATHER switch on the overhead control panel (fig. 2-18). The threeposition switch is placarded ARM, OFF and TEST, and is spring-loaded from TEST to OFF. The ARM position is used only during takeoff and landing. The TEST position of the switch, enables the pilot to check readiness of the autofeather systems, below 88% to 92% N1, and is for ground checkout purposes only.

c. Autofeather Lights. Two green lights on the caution/advisory annunciator panel, placarded AUTOFEATHER #1 and #2. When illuminated, the lights indicate that the autofeather system is armed. Both lights will be extinguished if either propeller has been autofeathered or if the system is disarmed by retarding a power lever. Autofeather circuits are protected by one 5-ampere circuit breaker placarded

AUTO FEATHER, located on the overhead circuit breaker panel (fig. 2-26).

2-45. PROPELLER GOVERNORS.

Two governors (a constant speed governor, and an overspeed governor) control propeller RPM. The constant speed governor, mounted on top of the propeller reduction housing, controls the propeller through its entire range. The propeller control lever operates the propeller by means of this governor. If the constant speed governor should malfunction and request more than 2000 RPM, the overspeed governor cuts in at 2080 RPM and dumps oil from the propeller to limit RPM. A solenoid, actuated by the PROP GOV TEST switch located on the overhead control panel (fig. 2-18), is provided to reset the overspeed governor to approximately 1830 to 1910 RPM for test purposes. If the propeller sticks or moves too slowly to prevent an overspeed condition, the power turbine governor, contained within the constant speed governor housing, acts as a fuel topping governor. When the propeller reaches 2120 RPM, the fuel topping governor limits the fuel flow to the gas generator, thereby reducing the power driving the propeller. During operation in the reverse range, the power turbine governor is reset to approximately 95% propeller RPM before the propeller reaches a negative pitch angle. This insures that the engine power is limited to maintain a propeller RPM of somewhat less than that of the constant speed governor setting. The constant speed governor will, therefore, always sense an underspeed condition and direct oil pressure to the propeller servo piston to permit propeller operation in beta and reverse range.

2-46. PROPELLER TEST SWITCHES.

Two two-position switches on the overhead control panel (fig. 2-18), are provided for operational testing of the propeller systems. Placarding above the switches reads PROP GOV TEST. Each switch controls test circuits for the corresponding propeller. In the test position, the switches are used to test the function of the corresponding overspeed governor. Refer to Chapter 8, for test procedure. Propeller test circuits are protected by one 5-ampere circuit breaker placarded PROP GOV. located on the overhead circuit breaker panel (fig. 2-26).

2-47. PROPELLER SYNCHROPHASER.

a. Operation. The propeller synchrophaser automatically matches the RPM of the right propeller (slave propeller) to that of the left propeller (master propeller) and maintains the blades of one propeller at a predetermined relative position with the blades of the other propeller. To prevent the right propeller from losing excessive RPM if the left propeller is feathered while the synchrophaser is on, the synchrophaser has a limited range of control from the manual governor setting. Normal governor operation is unchanged but the synchrophaser will continuously monitor propeller RPM and reset the governor as required. A magnetic pickup mounted in each propeller overspeed governor and adjacent to each propeller deice brush block transmits electric pulses to a transistorized control box installed forward of the pedestal. The right propeller RPM and phase will automatically be adjusted to correspond to the left. To change RPM, adjust both propeller controls at the same time. This will keep the right governor setting within the limiting range of the left propeller. If the synchrophaser is on but is unable to adjust to the right propeller to match the left, the actuator has reached the end of its travel. To recenter, turn the switch off, synchronize the propellers manually, and turn the switch back on.

b. Control Box. The control box converts any pulse rate differences into correction commands, which are transmitted to a stepping type actuator motor mounted on the right engine cowl forward support ring. The motor then trims the right propeller governor through a flexible shaft and trimmer assembly to exactly match the left propeller. The trimmer, installed between the governor control arm and the control cable, screws in or out to adjust the governor while leaving the control lever setting constant. A toggle switch installed adjacent to the synchrophaser turns the system on. With the switch off, the actuator automatically runs to the center of its range of travel before stopping to assure normal function when used again. To operate the system, synchronize the propeller in the normal manner and turn the synchrophaser on. The system is designed for in-flight operations and is placarded to be off for take-off and landing. Therefore, with the system on and the landing gear extended, the master caution lights will illuminate and a yellow light on the caution/advisory annunciator panel, PROP SYNC ON, will illuminate.

c. Synchroscope. The propeller synchroscope, provides an indication of synchronization of the propellers. If the right propeller is operating at a higher RPM than the left, the face of the synchroscope, a black and white cross pattern, spins in a clockwise rotation. Left, or counterclockwise, rotation indicates a higher RPM of the left propeller. This instrument aids the pilot in obtaining complete synchronization of propellers. The system is protected by a 5-ampere circuit breaker placarded PROP SYNC, located on the overhead circuit breaker panel (fig. 2-26).

2-48. PROPELLER LEVERS.

Two propeller levers on the control pedestal (fig, 2-10), placarded PROP, are used to regulate propeller speeds. Each lever controls a primary governor, which acts to regulate propeller speeds within the normal operation range. The full forward position of the levers is placarded TAKEOFF, LANDING AND REVERSE and also HIGH RPM. The full aft position of the levers is placarded FEATHER. When a lever is placed at HIGH RPM, the propeller may attain a static RPM of 2,000 depending upon power lever position. As a lever is moved aft, passing through the propeller governing range, but stopping at the feathering detent, propeller RPM will correspondingly decrease to the lowest limit. Moving a propeller lever aft past the detent into FEATHER will feather the propeller.

2-49. PROPELLER REVERSING.

CAUTION

Do not move the power levers into reverse range without the engine running. Damage to the reverse linkage mechanisms will occur.

CAUTION

Propeller reversing on unimproved surfaces should be accomplished carefully to prevent propeller erosion from reversed airflow and, in dusty conditions, to prevent obscuring the operator's vision.

CAUTION

To prevent an asymmetrical thrust condition, propeller levers must be in HIGH RPM position prior to propeller reversing.

The propeller blade angle may be reversed to shorten landing roll. To reverse, propeller levers must be positioned at HIGH RPM (full forward), and the power levers are lifted up to pass over the IDLE detent, then pulled aft into REVERSE setting. One yellow caution light, placarded REV NOT READY, on the caution/advisory annunciator panel, alerts the pilot not to reverse the propellers. This light illuminates only when the landing gear handle is down, and if propeller levers are not at HIGH RPM (full forward). This circuit is protected by a 5ampere circuit breaker, placarded LANDING GEAR RELAY, located on the overhead circuit breaker panel (fig. 2-26).

2-50. PROPELLER TACHOMETERS.

Two tachometers on the instrument panel register propeller speed in hundreds of RPM (fig. 2-28). Each indicator is slaved to a tachometer generator unit attached to the corresponding engine.

Section VII. UTILITY SYSTEMS

2-51. DEFROSTING/DEFOGGING SYSTEM.

a. Description. The defrosting/defogging system is an integral part of the heating and ventilation system. The system consists of two warm air outlets connected by ducts to the heating system. One outlet is just below the pilot's windshield and the other is below the copilot's windshield. A push-pull control, placarded DEFROST AIR, on the pilot's subpanel, manually controls airflow to the windshield. When pulled out, defrosting air is ducted to the windshield. As the control is pushed in, there is a corresponding decrease in airflow.

b. Automatic Operation.

1. Vent blower switches As required.

2. Cabin temperature mode selector switch AUTO

3. Cabin temperature control As required.

4. Cabin air, copilot air, pilot air, and defrost air controls As required.

c. Maximum Windshield Defrosting.

1. Pilot air, copilot air IN.

2. Cabin air and defrost air controls Out

3. Cabin temperature mode selector switch MAN HEAT.

4. Cold air outlets As required.

5. Manual temperature switch As required.

d. Manual Operation. If the automatic temperature control should fail to operate, the temperature (of defrost air and cabin air) may be controlled manually by manipulating the CABIN TEMP MODE control switch between the OFF and MAN HEAT positions.

2-52. SURFACE DEICER SYSTEM.

a. Description. Ice accumulation is removed from each inboard and outboard wing leading edge, and both horizontal stabilizers by the flexing of deicer boots which are pneumatically actuated. Engine bleed air, from the engine compressor, is used to supply air pressure to inflate the deicer boots, and to supply vacuum, through the ejector system, for boot hold down during flight. A pressure regulator protects the system from over inflation. When the system is not in operation, a distributor valve applies vacuum to the boots for hold down.

CAUTION

Operation of the surface deice system in ambient temperatures below -40°C can cause permanent damage to the deice boots.

b. Operation.

(1) Deice boots are intended to remove ice after it has formed rather than prevent its formation. For the most effective deicing operation, allow at least 1/2 inch of ice to form on the boots before attempting ice removal. Very thin ice may crack and cling to the boots instead of shedding.

NOTE

Never cycle the system rapidly, this may cause the ice to accumulate outside the contour of the inflated boots and prevent ice removal.

(2) A three position switch on the overhead control panel placarded DEICE MANUAL OFF SINGLE CYCLE AUTO, controls the deicing operation. The switch is spring loaded to return to the OFF position from SINGLE CYCLE AUTO or MANUAL. When the SINGLE CYCLE AUTO position is selected, the distributor valve opens to inflate the wing boots. After an inflation period of approximately 6 seconds, an electronic timer switches the distributor to deflate the wing boots and a 4 second inflation begins in the horizontal stabilizer boots. When these boots have inflated and deflated, the cycle is complete.

(3) If the switch is held in the MANUAL position, the boots will inflate simultaneously and remain inflated until the switch is released. The switch will return to the OFF position when released. After the cycle, the boots will remain in the vacuum hold down condition until again actuated by the switch.

(4) Either engine is capable of providing sufficient bleed air for all requirements of the surface deicer system. Check valves in the bleed air and vacuum lines prevent backflow through the system during single-engine operation. Regulated pressure is indicated on a gage, placarded PNEUMATIC PRESSURE, located on the copilots subpanel.

2-53. ANTENNA DEICE SYSTEM.

a. Description. The antenna deice system removes ice accumulation from the inboard wing dipole antennas and the aft rotating boom dipole antenna. Pressure regulated bleed air from the engines supplies pressure to inflate the boots. To assure operation of the system in the event of failure of one engine, a check valve is incorporated in the bleed air line from each engine to prevent loss of pressure through the compressor of the inoperative engine. Inflation and deflation phases are controlled by a distributor valve. Deice boots are intended to remove ice after is has formed rather than to prevent it's formation. For the most effective deicing operation, allow at least 1/8 to 1/4 inch of ice to form on the boots before attempting ice removal. Very thin ice may crack and cling to the boots instead of shedding.

NOTE

Never cycle the system rapidly. This may cause the ice to accumulate outside the contour of the inflated boots and prevent ice removal.

b. Antenna Deice System Switch. The antenna deice system is controlled by a switch placarded ANT DEICE, SINGLE-OFF-MANUAL located on the overhead control panel (fig. 2-18). The switch is spring loaded to return to the OFF position from the SINGLE or MANUAL position. When the switch is set to the single position, the system will run through one timed inflation-deflation cycle. When the switch is held in the MANUAL position the boots will inflate and remain inflated until the switch is released.

c. Forward Wide Band Data Link Antenna Radome Anti-Ice. The forward wide band data link antenna radome anti-ice system utilizes engine bleed air to prevent the formation of ice on the radome.

The system is controlled by a switch placarded RADOME ANTI-ICE-ON located on the overhead control panel. A temperature sensing element installed in the discharge duct measures the hot air temperature as it leaves the mixing chamber. When the hot air temperature reaches 130 degrees Fahrenheit, the green RADOME HEAT light in the mission caution/ advisory panel will illuminate. If the air temperature exceeds 200 degrees Fahrenheit, a heat detection switch, located adjacent to the temperature sensing element, will close the solenoid shutoff valves, and the yellow RADOME HOT light located on the mission caution/advisory panel will illuminate. The shutoff valves will automatically open after the air temperature cools to approximately 130 degrees Fahrenheit. The system is protected by a 7. 5 ampere circuit breaker placarded RADOME ANTI-ICE located on the overhead control panel.

2-54. PROPELLER ELECTROTHERMAL ANTI-ICE SYSTEM.

a. Description. Electrothermal anti-ice boots are cemented to each propeller blade to prevent ice formation or to remove the ice from the propellers. Each thermal boot consists of one outboard and one inboard heating element, and receives electrical power from the deice timer. This timer sends current to all propeller deice boots and prevents the boots from overheating by limiting the time each element is energized. Four intervals of approximately 30 seconds each complete one cycle. Current consumption is monitored by a propeller ammeter on the copilot's subpanel. Two 20-ampere circuit breakers placarded PROP ANTI ICE LEFT and RIGHT and 5-ampere propeller control circuit breaker placarded PROP ANTI-ICE CONTR on the overhead circuit breaker panel (fig. 2-26), protect the propeller electrothermal deice system during manual operation. A 25 ampere circuit breaker placarded PROP ANTI-ICE AUTO, protects the system in automatic operation.

b. Automatic Operation. A control switch on the overhead control panel placarded PROP OFF AUTO is provided to activate the automatic system. A deice ammeter on the center subpanel registers the amount of current (14 to 18 amperes) passing through the system being used. During AUTO operation, power to the timer will be cut off if the current rises above 25 amperes. Current flows from the timer to the brush assembly and then to the slip rings installed on the spinner backing plate. The slip rings carry the current to the deice boots on the propeller blades. Heat from the boots reduces the grip of the ice which is then thrown off by centrifugal force, aided by the air blast over the propeller surfaces. Power to the two heating elements on each blade, the inner and outer element, is cycled by the timer in the following sequence: right propeller outer element, right propeller inner element, left propeller outer element, left propeller inner element. Loss of one heating element circuit on one side does not mean that the entire system must be turned off. Proper operation can be checked by noting the correct level of current usage on the ammeter. An intermittent flicker of the needle approximately each 30 seconds indicates switching to the next group of heating elements by the timer.

c. Manual Operation. The manual propeller deice system is provided as a backup to the automatic system. A control switch located on the overhead control panel, placarded PROP INNER OUTER, controls the manual override relays. When the switch is in the OUTER position, the automatic timer is overridden and power is supplied to the outer heating elements of both propellers simultaneously. The switch is of the momentary type and must be held in position until the ice has been dislodged from the propeller surface. After deicing with the outer elements, the switch is to be held in the INNER position to perform the same function for the inner elements of both propellers. The loadmeters will indicate approximately a 5% increase of load per meter when manual prop deice is operating. The prop deice ammeter will not indicate any load in the manual mode of operation.

2-55. PITOT AND STALL WARNING HEAT SYSTEM.

CAUTION

Pitot heat should not be used for more than 15 minutes while the aircraft is on the ground. Overheating may damage the heating elements.

a. Pitot Heat. Heating elements are installed in the pitot masts located on the nose. Each heating element is controlled by an individual switch placarded PITOT ON LEFT or RIGHT, located on the overhead control panel (fig. 2-18). It is not advisable to operate the pitot heat system on the ground except for testing or for short intervals of time to remove ice or snow from the mast. Circuit protection is provided by two 7. 5 amperes circuit breakers, placarded PITOT HEAT, on the overhead circuit breaker panel (fig. 2-26).

CAUTION

The heating elements protect the stall warning lift transducer vane and face plate from ice, however, a buildup of ice on the wing may change or disrupt the airflow and prevent the system from accurately indicating an imminent stall.

b. Stall Warning Heat. The lift transducer is equipped with anti-icing capability on both the mounting plate and the vane. The heat is controlled by a switch located on the overhead control panel placarded STALL WARN. The level of heat is minimal for ground operation but is automatically increased for flight operation through the left landing gear saety switch. Circuit protection is provided by a 15-ampere circuit breaker, placarded STALL WARN, on the overhead circuit breaker panel (fig. 2-26).

2-56. PITOT AND STATIC SYSTEM.

a. Description. The pitot and static system supplies static pressure to two airspeed indicators, two altimeters, two vertical velocity indicators, and ram air to the airspeed indicators. This system consists of two pitot masts (one located on each side of the lower position of the nose), static air pressure ports in the aircraft's exterior skin on each side of the aft fuselage, and associated system plumbing. The pitot head is protected from ice formation by internal electric heating elements.

b. Alternate Static Air Source. An alternate static air line, which terminates just aft of the rear pressure bulkhead, provides a source of static air for the pilot's instruments in the event of source failure from the pilot's static air line. A control on the pilot's subpanel placarded PILOTS STATIC AIR SOURCE, may be actuated to select either the NORMAL or ALTERNATE air source by a two position selector valve. The valve is secured in the NORMAL position by a spring clip. Refer to Chapter 7 for airspeed indicator and altimeter calibration information when using the alternate air source.

c. Stall Warning System. The stall warning system consists of a transducer, a lift computer, a warning horn, and a test switch. Angle of attack is sensed by aerodynamic pressure on the lift transducer vane located on the left wing leading edge. When a stall is imminent, the output of the transducer activates a stall warning horn. The system has preflight test capability through the use of a switch placarded STALL WARN TEST OFFLDG GEAR WARN TEST on the right subpanel. Holding this switch in the STALL WARN TEST position actuates the warning horn by moving the transducer vane. The circuit is protected by a 5-ampere circuit breaker, placarded STALL WARN, on the overhead circuit breaker panel.

2-57. BRAKE DEICE SYSTEM.

a. Description. A heated-air brake deice system may be used on the ground or in flight with gear retracted or extended. When activated, hot air is diffused by means of a manifold assembly over the brake discs in each wheel. Manual and automatic controls are provided. There are two primary occasions which require brake deicing. The first is when an aircraft has been parked in a freezing atmosphere allowing the brake systems to become contaminated by freezing rain, snow, or ice, and the aircraft must be moved or taxied. The second occasion is during flight through icing conditions with wet brake assemblies presumed to be frozen, which must be thawed prior to landing to avoid possible tire damage and loss of directional control. Hot air for the brake deice system comes from the compressor stage of both engines obtained by means of a solenoid valve attached to the bleed air system which serves both the surface deice system and the pneumatic systems operation.

b. Operation. A switch on the overhead control panel, placarded BRAKE DEICE, controls the solenoid valve by routing power through a control module box under the aisleway floorboards. When the switch is on, power from a 5-ampere circuit breaker on the overhead circuit breaker panel is applied to the control module. A 10-minute timer limits operation and avoids excessive wheel well temperatures when the landing gear is retracted. The control module also contains a circuit to the green BRAKE DEICE ON annunciator light, and has a resetting circuit interlocked with the gear uplock switch. When the system is activated, the BRAKE DEICE ON light should be monitored and the control switch selected OFF after the light extinguishes otherwise, on the next gear extension the system will restart without pilot action. The control switch should also be selected OFF, if deice operation fails to self-terminate after 10 minutes. If the automatic timer has terminated brake deicer operation after the last retraction of the landing gear, the landing gear must be extended in order to obtain further operation of the system.

(1) The BLEED AIR FAIL lights may momentarily illuminate during simultaneous operation of the surface deice and brake deice systems at low N1 speeds. If the lights immediately extinguish. this may be disregarded.

(2) During certain ambient conditions, use of the brake deice system may reduce available engine power, and during flight will result in a TGT rise of approximately 20°C. Appropriate performance charts should be consulted before brake deice system use. If specified power cannot be obtained without exceeding limits, the brake deice system must be selected off until after takeoff is completed. TGT limitations must also be observed when setting climb and cruise power. The brake deice system is not to be operated above 15°C ambient temperature except to test the system. The system is not to be operated for longer than 10 minutes (one deicer cycle) with the landing gear retracted. If operation does not automatically terminate after approximately 10 minutes following gear retraction, the system must be manually selected off. During periods of simultaneous brake deice and surface deice operation, maintain 85% Nl or higher. If inadequate pneumatic pressure is developed for proper surface deicer boot inflation, select the brake deice system off. Both sources of pneumatic bleed air must be in operation during brake deice system use. Select the brake deice system off during single-engine operation. Circuit protection is provided by a 5-ampere circuit breaker, placarded BRAKE DEICE, on the overhead circuit breaker panel (fig. 2-26).

2-58. FUEL SYSTEM ANTI-ICING.

a. Description. An oil-to-fuel heat exchanger, located on each engine accessory case, operates continuously and automatically to heat the fuel sufficiently to prevent freezing of any water in the fuel. No controls are involved. Two external fuel vents are provided on each wing. One is recessed to prevent ice formation; the other is electrically heated and is controlled by two toggle switches on the overhead control panel placarded FUEL VENT ON, LEFT or RIGHT (fig. 2-18). They are protected by two 5-ampere circuit breakers, placarded FUEL VENT HEAT, RIGHT or LEFT, located on the overhead circuit breaker panel (fig. 2-26). Each fuel control unit's pneumatic line is protected against ice by an electrically heated jacket protected by a 7. 5ampere circuit breaker located on the overhead circuit breaker panel placarded FUEL CONTR HEAT, LEFT or RIGHT (fig. 2-26).

CAUTION

To prevent overheat damage to electrically heated anti-ice jackets, the FUEL VENT heat switches should not be turned ON unless cooling air will soon pass over the jackets.

b. Normal Operation. For normal operation, switches for the FUEL VENTS anti-ice circuits are turned ON as required during the BEFORE TAKEOFF procedures (Chapter 8).

2-59. WINDSHIELD ELECTROTHERMAL ANTIICE SYSTEM.

a. Description. Both pilot and copilot windshields are provided with an electrothermal anti-ice system. Each windshield is part of an independent electrothermal anti-ice system. Each system is comprised of the windshield assembly with heating wires sandwiched between glass panels, a temperature sensor attached to the glass, an electrothermal controller, two relays, a control switch, and two circuit breakers. Two switches, placarded WSHLD ANTIICE NORMAL -OFF HI PILOT, COPILOT, located on the overhead control panel (fig. 2-18) control system operation. Each switch controls one electrothermal windshield system. The circuits of each system are protected by a 5-ampere circuit breaker and a 50-ampere circuit breaker which are not accessible to the flight crew. The 50-ampere circuit breakers are located in the power distribution panel under the floor ahead of the main spar. The 5-ampere circuit breakers are located on panels forward of the instrument panel.

b. Normal Operation. Two levels of heat are provided through the three position switches placarded NORMAL in the aft position, OFF in the center position, and HI after lifting the switch over a detent and moving it to the forward position. In the NORMAL position, heat is provided for the major portion of each windshield. In the HI position, heat is provided at a higher watt density to a smaller portion of the windshield. The lever lock feature prevents inadvertent switching to the HI position during system shutdown.

2-60. PRESSURIZATION SYSTEM.

a. Pressure Differential. The pressure vessel is designed for a normal working pressure differential of 6. 0 PSI, which will provide a cabin pressure altitude of 3870 feet at an aircraft altitude of 20,000 feet, and a nominal cabin altitude of 9840 feet at an aircraft altitude of 31,000 feet.

b. Description. A mixture of bleed air from the engines, and ambient air, is available for pressurization to the cabin at a rate of approximately 10 to 17 pounds per minute. Approximately 85% NI is required when operating with one engine. The flow control unit of each engine controls the bleed air from the engine to make it usable for pressurization by mixing ambient air with the bleed air depending upon aircraft altitude and ambient temperature. On takeoff, excessive pressure bumps are prevented by landing gear safety switch actuated solenoids incorporated in the flow control units. These solenoids, through a time delay, stage the input of ambient air flow by allowing ambient air flow introduction through the left flow control unit first, ten seconds later, air flow through the right flow control unit. The Bleed Air Switches, located on the overhead control panel (fig. 2-1 8) operate an integral electric solenoid which controls the bleed air to the firewall shutoff valves.

c. Cabin Altitude and Rate-of-Climb Controller. A control panel is installed on the copilot's inboard subpanel for operation of the system. A knob (fig. 2-6), placarded INC RATE controls the rate of change of pressurization. A control, placarded CABIN CONTROLLER is used to set the desired cabin altitude. For proper cabin pressurization, the CABIN CONTROLLER should be set 500 feet above cruise altitude. For landing select 500 feet above field pressure altitude. The selected altitude is displayed on a mechanically coupled dial above the control, placarded CABIN ALT-FT. Mechanically coupled to the cabin altitude dial, placarded ACFTX1000. This dial indicates the maximum altitude the aircraft may be flown at to maintain the desired cabin altitude without exceeding the design pressure differential. A switch, placarded CABIN PRESS DUMP-PRESS-TEST, is provided to control pressurization. The switch is spring loaded to the PRESS position. In the DUMP position, the safety valve will be opened and the cabin will be depressurized to the aircraft altitude. In the PRESS position, cabin altitude is controlled by the CABIN CONTROLLER control. In the TEST position, the landing gear safety switch is bypassed to enable testing of the pressurization system on the ground. Operating instructions are contained in Chapter 8.

d. Cabin Rate-of-Climb Indicator. An indicator, placarded CABIN CLIMB, is installed on the copilot's side of the instrument panel (fig. 2-28). The cabin rate-of-climb controller is calibrated in thousands-of-feet per-minute change in cabin altitude.

e. Cabin Altitude Indicator. An indicator, placarded CABIN ALT, is installed in the instrument panel (fig. 2-28) above the cabin rate-of-climb indicator. The longer needle indicates aircraft altitude in thousands-of-feet on the outside dial. The shorter needle indicates pressure differential in PSI on the inner dial. Maximum differential is 6. 1 PSI.

f Outflow Valve. A pneumatically operated outflow valve, located on the aft pressure bulkhead, maintains the selected cabin altitude and rate-of-climb commanded by the cabin rate-of-climb and altitude controller on the copilot's instrument panel.

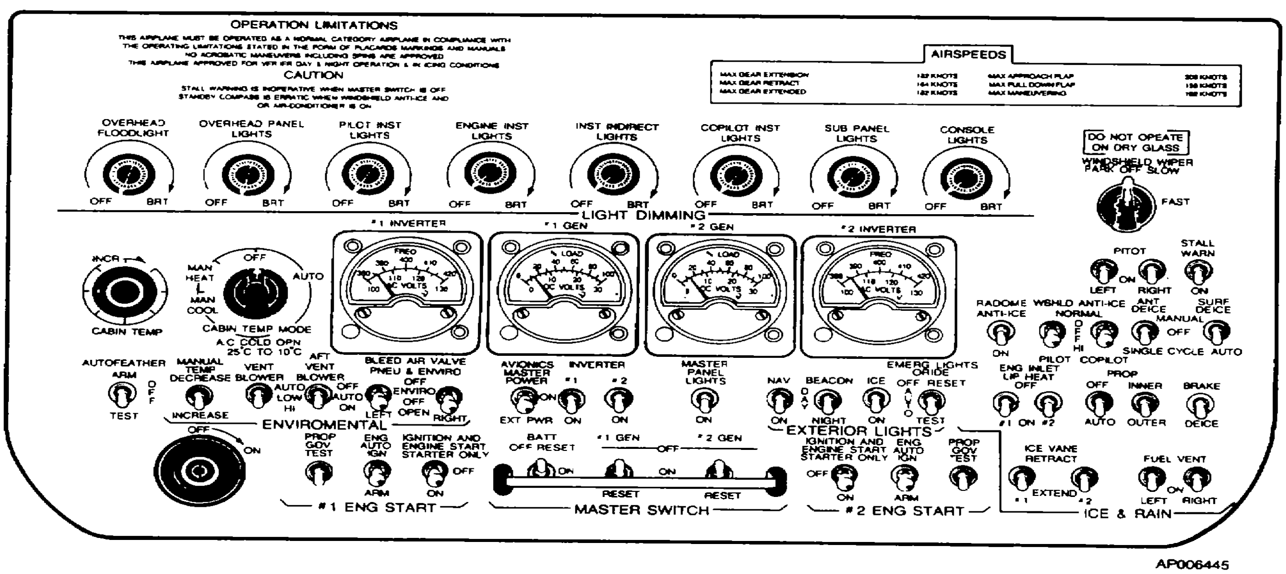

Figure 2-78. Overhead Control Panel

As the aircraft climbs, the controller modulates the outflow valve to maintain a selected cabin rate of climb and increases the cabin differential pressure until the maximum cabin pressure differential is reached. At a cabin altitude of 12,500 feet a pressure switch mounted on the back of the overhead control panel completes a circuit to illuminate a red warning annunciator light, ALT WARN, to warn of operation requiring oxygen. This light is protected by a 5ampere breaker, placarded PRESS CONTR.

g. Pressurization Safety Valve. Before takeoff, the safety valve is open with equal pressure between the cabin and the outside air. The safety valve closes on liftoff if the CABIN PRESS CONTR switch on the copilots subpanel is in the PRESS mode. The safety valve adjacent to the outflow valve provides pressure relief in the event of failure of the outflow valve. This valve is also used as a dump valve and is opened by vacuum which is controlled by a solenoid valve operated by the cabin pressure dump switch adjacent to the controller. It is also wired through the right landing gear safety switch. If either of these switches is open, or the vacuum source or electrical power is lost, the safety valve will close to atmosphere except at maximum differential pressure of 6. 1 PSI. A negative pressure relief diaphragm is also incorporated into the outflow and safety valves to prevent outside atmospheric pressure from exceeding cabin pressure during rapid descent.

h. Drain. A drain in the outflow valve static control line is provided for removal of accumulated moisture. The drain is located behind the lower sidewall upholstery access panel in the baggage section of the aft compartment.

i. Flow Control Unit. A flow control unit forward of the firewall in each nacelle controls bleed air flow and the mixing of ambient air to make up the total air flow to the cabin for pressurization, heating, and ventilation. The bleed air switches located on the overhead control panel (fig. 2-18) operates an integral electric solenoid which controls the bleed air to the firewall shutoff valves. A normally open solenoid operated by the landing gear safety switch controls the introduction of ambient air flow to the cabin on takeoff.

(1) The unit receives bleed air from the engine into an ejector which draws ambient air into the nozzle of the venturi. The mixed air is then forced into the bleed air line routed to the cabin.

(2) Bleed air flow is controlled automatically. When the aircraft is on the ground, circuitry from the landing gear safety switch prevents ambient air from entering the flow control unit to provide maximum heating.

(3) The bleed air firewall shutoff valve in the control unit is a spring loaded, bellows operated valve that is held in the open position by bleed air pressure. When the electric solenoid_ is shut off, or when bleed air diminishes on engine shutdown (in both cases the pressure to the firewall shutoff valve is cut off), the firewall valve closes.

2-61. OXYGEN SYSTEM.

a. Description. The oxygen system (fig. 2-19) is provided primarily as an emergency system, however, the system may be used to provide supplemental (first aid) oxygen. Two 64 cubic foot capacity oxygen supply cylinders charged with aviator's breathing oxygen are installed in the unpressurized portion of the aircraft behind the aft pressure bulkhead. The pilot and copilot positions are equipped with diluter demand type regulators, which mix the proper amount of oxygen for a given amount of air at altitude. Also a first aid oxygen mask is provided in the cabin. Oxygen system pressure is shown by two gages placarded OXYGEN SUPPLY PRESSURE, located aft of the pilot's oxygen regulator control panel. Two pressure reducers, located in the unpressurized portion of the aircraft behind the aft bulkhead, lower the pressure in the system to 400 PSI, and route oxygen to the regulator control panels. Both cylinders are interconnected, so refilling can be accomplished through a single filler valve located on the aft right side of the fuselage exterior. A pressure gage is mounted in conjunction with the filler valve, and each cylinder has a pressure gage. Table 2-4 shows oxygen duration capacities of the system.

b. Regulator Control Panels. Each regulator control panel contains a blinker-type flow indicator, a 500 PSI pressure gage, a red emergency pressure control lever placarded EMERGENCY NORMAL TEST MASK, a white diluter control lever placarded 100% OXYGEN -NORMAL OXYGEN, and a green supply control lever placarded ON OFF.

(1) Diluter control lever. The diluter control lever selects either normal or 100% oxygen, but acts to select only when the emergency pressure control lever is in the NORMAL position.

CAUTION

When not in use, the diluter control lever should be left in the 100% OXYGEN position to prevent regulator contamination.

(2) Emergency pressure control lever. The emergency pressure control lever has three positions.

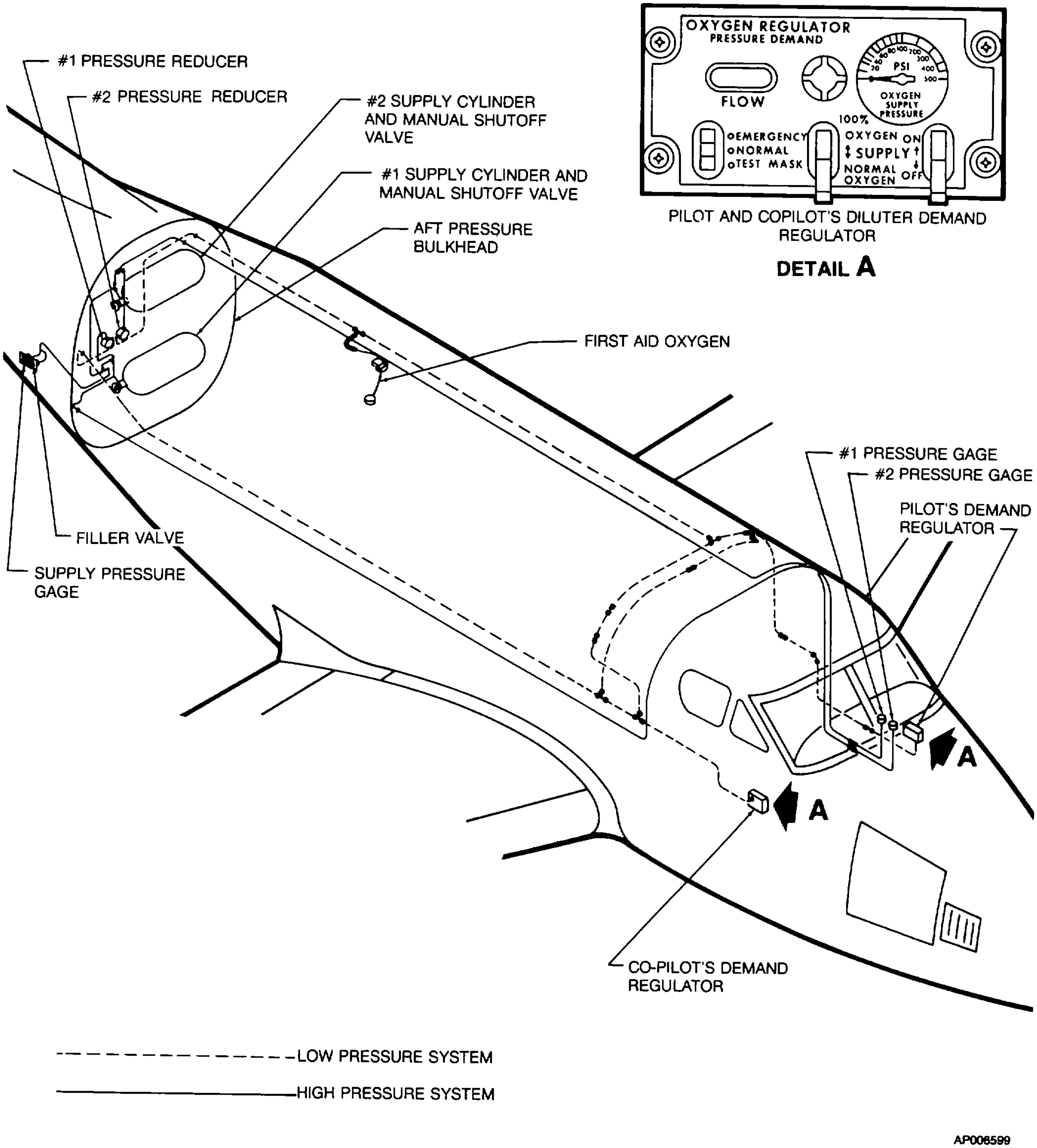

Figure 2-19. Oxygen System Schematic

Table 2-4. Oxygen Flow Planning Rates vs Altitude (All Flows in LPM Per Mask at NTPD)

CABIN PRESSURE ALTITUDE IN FEET	CREW MASK NORMAL DILUTER DEMAND) (1)	CREW MASK 100% (1)	PASSENGER MASK
31,000	-0-(2)	4.2	3.7(3)
30,000	-0-(2)	4.4	3.7(3)
29,000	-0-(2)	4.7	3.7(3)
28,000	-0-(2)	5.0	3.7(3)
27,000	-0-(2)	5.3	3.7(3)
26,000	-0-(2)	5.6	3.7(3)
25,000	-0-(2)	5.9	3.7
24,000	-0-(2)	6.2	3.7
23,000	-0-(2)	6.6	3.7
22,000	-0-(2)	6.9	3.7
21,000	-0-(2)	7.2	3.7
20,000	3.6	7.6	3.7
19,000	3.9	7.9	3.7
18,000	4.2	8.3	3.7
17,000	4.5	8.7	3.7
16,000	4.8	9.1	3.7
15,000	5.1	9.5	3.7
14,000	5.4	10.0	3.7
13,000	5.8	10.4	3.7
12,000	6.1	10.9	3.7
11,000	6.5	11.3	3.7
10,000	6.9	11.9	3.7

NOTES:
1. Based on minute volume of 20 LPM-BTPS (Body Temperature and Pressure, Saturated).
2. Use 100% oxygen above 20,000 feet.
3. Not recommended for other than emergency descent use above 25,000 feet.

If average climb or descent flows are desired, add the values between altitudes and divide by the number of values used.

For example, to determine the average rate for a uniform descent between 25,000 feet and 15,000 feet perform the following:

$(5.9+6.2+6.6+7.2+3.6+3.9+4.2+4.5+4.8+5.1)\div 11=5.4$ LPM

This method is preferred over averaging the extremes as some flow characteristics vary in such a way as to yield an incorrect answer.

BT00985

Two positions control oxygen consumption for the individual using oxygen, and the remaining position serves for testing hose and mask integrity. In the EMERGENCY position, the control lever causes 100% oxygen to be delivered at a safe, positive pressure. In the NORMAL position, the lever allows delivery of normal or 100% oxygen, depending upon the selection of the diluter control lever. In TEST MASK position, 100% oxygen at positive pressure is delivered to check hose and mask integrity.

(3) *Supply control lever*. The supply control lever (green), placarded ON OFF, turns the oxygen supply on or off at the regulator control panel.

(4) Oxygen supply pressure gage.

WARNING

The 500 PSI oxygen pressure gage provided on the oxygen control panels should never indicate over 400 PSI. If the pressure exceeds 400 PSI, a malfunction of the pressure reducer is indicated.

Whenever oxygen is inhaled, a blinker-vane slides into view within the flow indicator window, showing that oxygen is being released. When oxygen is exhaled, the blinker vane vanishes from view.

NOTE

Check to insure that the OXYGEN SUPPLY PRESSURE gage registers adequate pressure before each flight. When oxygen is in use, a check of the supply pressure should be made at intervals during flight to note the quantity available and to approximate the supply duration. The outside temperature is reduced as an aircraft ascends to higher altitudes. Oxygen cylinders thus cooled by temperature change will show a pressure drop. This type of drop in pressure will raise again upon return to a lower or warmer altitude. A valid cause for alarm would be the rapid loss of oxygen pressure when the aircraft is in level flight or descending; should this condition arise, descend as rapidly as possible to altitude which does not require the use of oxygen.

WARNING

Pure oxygen will support combustion. Do not smoke while oxygen is in use.

WARNING

If any symptoms occur suggestive of the onset of hypoxia, immediately set the emergency pressure control lever to the EMERGENCY position and descend below 10,000 feet. Whenever carbon monoxide or other noxious gas is present or suspected, set the dilutor control lever to 100% OXYGEN and continue breathing undiluted oxygen until the danger is past.

c. Oxygen Masks. Oxygen masks for the pilot and copilot are provided as personal equipment. To connect a mask into the oxygen system, the individual connects the line attached to the mask to the flexible hose which is attached to the cockpit sidewall. The microphone in the oxygen mask is provided with a cord for connecting with the helmet microphone jack. To test mask and hose integrity, the individual places the supply control lever on the regulator control panel to the ON position, puts on and adjusts his mask, selects TEST MASK position, and checks for leaks.

d. Normal Operation. Oxygen pressure is maintained at all times to the regulator control panels if the cylinder shut-off valves are on and if there is pressure in the cylinders. Each individual places the supply lever (green) on his regulator control panel to the ON position, and the diluter lever (white) to the NORMAL OXYGEN position.

e. Emergency Operation. For emergency operation, the affected crew member selects the EMERGENCY position of the emergency pressure control lever (red) on his regulator control panel. This selection provides 100% oxygen at a positive pressure, regardless of the position of the diluter control lever on his panel.

f First Aid Operation. A first aid oxygen mask is installed in the aft cabin area as a supplemental or emergency source of oxygen. The mask is stowed behind an overhead cover placarded FIRST AID OXYGEN PULL. Removing the cover allows the mask to drop out of the container, exposing a manual control valve, which releases oxygen to the mask when placed in the ON position. After using the mask, the manual valve in the container must be turned OFF before stowing the mask and replacing the cover.

g. Oxygen Duration Example Problem.

WANTED	Duration in minutes of oxygen at 100% capacity.
KNOWN	Two man crew plus one passenger, cabin pressure altitude = 15,000 feet, crew masks, normal, 100% capacity.
METHOD	Find "two man crew plus one pass" line, move right then down to 15,000 - "normal" read "232. 1" minutes.
WANTED	Duration of oxygen for previous example data at 84% of capacity.
KNOWN	232.1 minutes duration at 100%, 84% capacity, total aircraft flow = 13.9 LPM.

Table 2-5. Oxygen Duration in Minutes 128 Cubic Foot System

	CABIN PRESSURE ALTITUDE	CREW MASK CONDITION	TOTAL FLOW LPM-NTPD	DURATION IN MINUTES (1)
TWO MAN CREW	31,000	100%	8.4	384.0
	25,000	100%	11.8	273.3
	20,000	100%	15.2	212.2
	20,000	NORMAL	7.4	448.0
	15,000	100%	19.0	169.7
	15,000	NORMAL	10.2	316.2
	10,000	100%	23.8	135.5
	10,000	NORMAL	13.8	233.7
TWO MAN CREW PLUS ONE PASS	31,000	100%	12.1	266.6
	25,000	100%	15.5	208.1
	20,000	100%	18.9	170.0
	20,000	NORMAL	10.9	295.9
	15,000	100%	22.7	142.1
	15,000	NORMAL	13.9	232.1
	10,000	100%	27.5	117.3
	10,000	NORMAL	17.5	184.3

(1) For 100% capacity of useable oxygen, 3,226 L.
BT01029

METHOD Multiply 232.1 X 0.84 = 194.9 minutes. or Multiply 3,226 X 0.84 = 2709.8, divide by 13.9 LPM = 194.9 minutes.

WANTED Duration of oxygen for complement at other cabin pressure altitude, at less than 100% capacity.

KNOWN Cylinder at 84% capacity, 100% capacity = 3,226 L, cabin pressure altitude = 21,000 feet. I crew mask = 7.2 LPM (100%), I passenger mask = 3.7 LPM

METHOD Multiply 3,226 L X 0.84 = 2. 709.8 L, multiply 2 crew X 7.2 LPM = 14.4 LPM, multiply 1 passenger X 3.7 LPM, add 14.4 LPM crew plus 3.7 LPM passenger = 18.1 LPM.Divide 3,226 L by 18.1 LPM = 178.2 minutes.

h. Oxygen Cylinder Capacity Example Problem.

WANTED

a. Percent of capacity at known pressure and temperature.

b. Pressure when temperature decreases.

KNOWN Pressure = 1,600 PSIG stabilized cylinder temperature is estimated at 20° C decreased stabilized cylinder temperature is estimated at -30° C.

METHOD

c. Enter 1600 PSIG move up to 20° C line, move right to 84%.

d. Move left on 84% line to -30° C line, move down to 1250 PSIG.

WANTED 100% capacity pressure at known temperature.

KNOWN Temperature -- -30° C.

METHOD Move left along 100% line to -30° C line and move down to 1420 PSIG.

2-62. WINDSHIELD WIPERS.

a. Description. Two electrically operated windshield wipers, are provided for use at takeoff, cruise and landing speed. A rotary switch (fig. 2-18) placarded WINDSHIELD WIPER, located on the overhead control panel, selects mode of windshield wiper operation. An information placard above the switch states: DO NOT OPERATE ON DRY GLASS. Function positions on the switch, as read clockwise, are placarded: PARK OFF SLOW FAST. When the switch is held in the spring-loaded PARK setting, the blades will return to their normal inoperative position on the glass, then, when released, the switch will return to OFF position terminating windshield wiper operation. The FAST and SLOW switch positions are separate operating speed

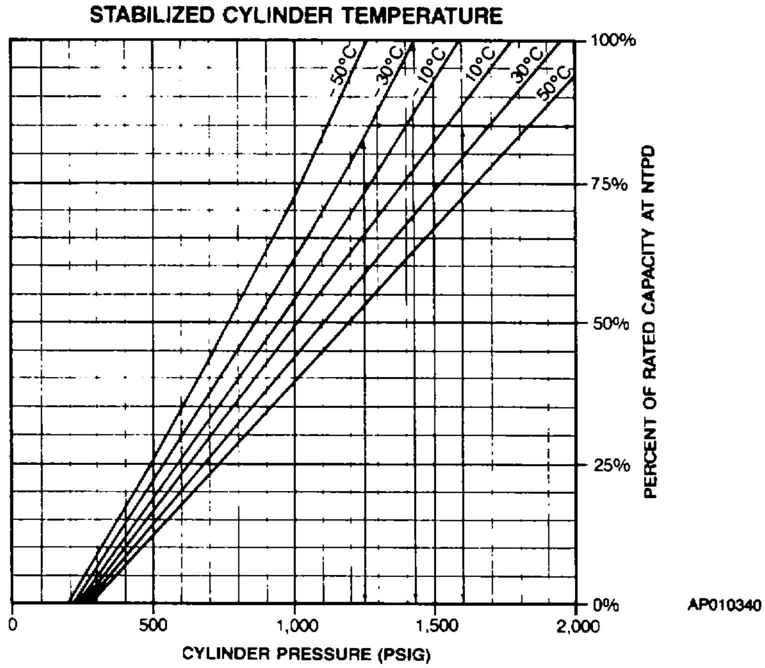

Figure 2-20. Cylinder Capacity vs Pressure and Temperature

settings for wiper operation. The windshield wiper circuit is protected by one 10-ampere circuit breaker, placarded WSHLD WIPER, located on the overhead circuit breaker panel (fig. 2-26).

CAUTION

Do not operate windshield wipers on dry glass. Such action can damage the linkage as well as scratch the windshield glass.

b. Normal Operation. To start, turn WINDSHIELD WIPER switch to FAST or SLOW speed, as desired. To stop, turn the switch to the PARK position and release. The blades will return to their normal. inoperative position and stop. Turning the switch only to the OFF position will stop the windshield wipers, without returning them to the normal inactive position.

2-63. CIGARETTE LIGHTERS AND ASH TRAYS.

The pilot and copilot have individual cigarette lighters and ash trays mounted in escutcheons outboard of their seats. The cigarette lighters are protected by a 5-ampere circuit breaker, placarded CIGAR LIGHTER, on the overhead circuit breaker panel (fig. 2-26).

2-64. ELECTRIC TOILET.

a. Description. An electric toilet is installed in the aft cabin area. The circuit is protected by a 10ampere circuit breaker located in the power distribution panel under the floor ahead of the main spar.

b. Operation. A switch, placarded PRESS TO FLUSH, is mounted on the seat assembly for operation of the toilet. Pressing the switch applies DC power to the motor which drives the pump. The pump applies flushing fluid through a nozzle in the upper rim and washes the inner surface of the bowl. Waste is carried to the waste tank mounted below the bowl. When desired, the removable waste tank may be removed from the toilet for servicing.

2-65. SUN VISORS.

CAUTION

When adjusting the sun visors, grasp only by the top metal attachment to avoid damage to the plastic shield.

A sun visor is provided for the pilot and copilot respectively (fig. 2-9). Each visor is manually adjustable. When not needed as a sun shield, each visor may be manually rotated to a position flush with the top of the cockpit so that it does not obstruct view through the windows.

2-66. RELIEF TUBES.

One relief tube is provided, located immediately aft of the cabin door, on the left side of the fuselage.

Section VIII. HEATING, VENTILATION, COOLING, AND ENVIRONMENTAL CONTROL SYSTEM

2-67. HEATING SYSTEM.

a. Description. Warm air for heating the cockpit and mission avionics compartments and warm windshield defrosting air is provided by bleed air from both engines (fig. 2-21). Engine bleed air is combined with ambient air in the heating and pressurization flow control unit in each nacelle. If the mixed bleed air is too warm for cockpit comfort, it is cooled by being routed through an air-to-air heat exchanger located in the forward portion of each inboard wing. If the mixed bleed air is not too warm, the air-to-air heat exchangers are bypassed. The mixed bleed air is then ducted to a mixing plenum, where it is mixed with cabin recirculated air. The warm air is then ducted to the cockpit outlets, windshield defroster outlets, and to the floor outlets in the mission avionics compartment.

(1) Bleed airflow control unit. A bleed air flow control unit, located forward of the firewall in each engine nacelle controls the flow of bleed air and the mixing of ambient air to make up the total airflow to the cabin for heating, windshield defrosting, pressurization and ventilation. The unit is fully pneumatic except for an integral electric solenoid firewall shutoff valve, controlled by the bleed air switches located on the overhead control panel (fig. 2-18) and a normally open solenoid valve operated by the left landing gear safety switch.

(2) Pneumatic bleed air shutoff valve. A pneumatic shutoff valve is provided in each nacelle to control the flow of bleed air to the surface, antenna and brake device systems. These valves are controlled by the bleed air valve switches located on the overhead control panel (fig. 2-18).

(3) Bleed air valve switches. The bleed air flow control unit shutoff valve and pneumatic bleed air shutoff valves are controlled by two switches placarded BLEED AIR VALVE OPEN ENVIRO OFF -PNEU & ENVIRO OFF, located on the overhead control panel (fig, 2-18). When set to the open position, both the environmental flow control unit shutoff valve and the pneumatic shutoff valve are open; when set to the ENVIRO OFF position, the environmental flow control unit shutoff valve is closed, and the pneumatic bleed air valve is open; in the PNEU & ENVIRO OFF position, both are closed. For maximum cooling on the ground, turn the bleed air valve switches to the ENVIRO OFF position.

(4) Cabin temperature mode selector switch. A switch placarded CABIN TEMP MODE MAN COOL MAN HEAT OFF AUTO A/C COLD OPN, located on the overhead control panel, controls cockpit and mission avionics compartment heating and air conditioning. When the cabin temperature mode selector switch is set to the AUTO position, the heating and air conditioning systems are automatically controlled. Control signals from the temperature control box are transmitted to the bleed air heat exchanger bypass valves. Here the temperature of the air flowing to the cabin is regulated by the bypass valves controlling the amount of air bypassing the heat exchangers. When the cabin temperature mode selector switch is set to the AUTO position, the heating and air conditioning systems are automatically controlled. When the temperature of the cabin has reached the temperature setting of the cabin temperature control rheostat, the automatic temperature control allows hot air to bypass the air-to-air exchangers. When both bypass valves are in the fully closed position, allowing no air to bypass the heat exchangers, the air conditioner begins to operate, providing additional cooling. When the cabin temperature mode selector switch is set to the A/C COLD OPN position, the air conditioning system is in continuous operation. The cabin temperature control rheostat, in conjunction with the cabin temperature control sensor, provides regulation of cockpit and mission equipment compartment temperature. Bleed air heat is added as re

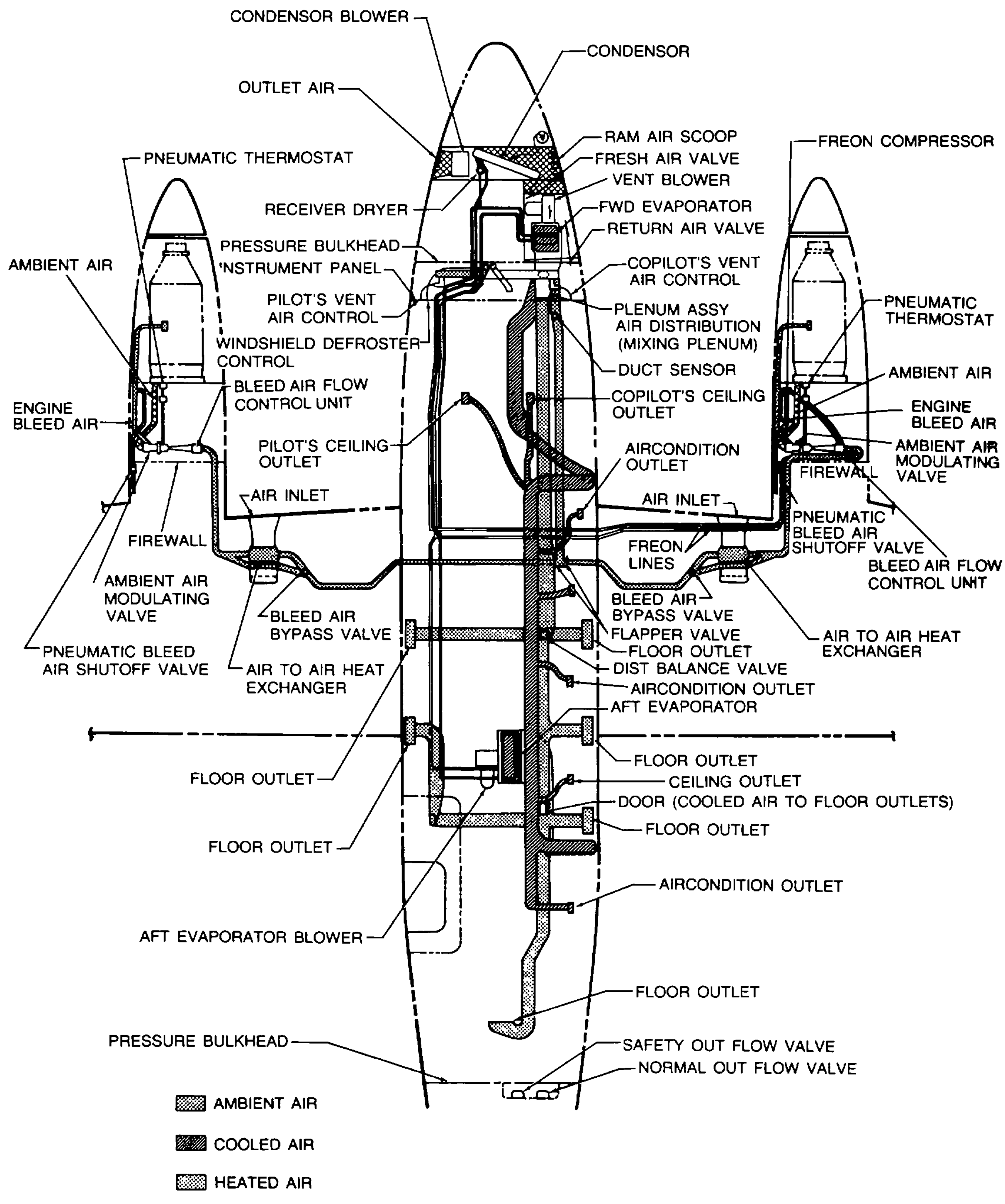

Figure 2-21. Environmental Systems

quired to maintain the temperature selected by the cabin temperature control rheostat.

(5) Cabin temperature control rheostat. A control knob placarded CABIN TEMP INCR, located on the overhead control panel (fig. 2-18), provides regulation of cabin temperature when the cabin temperature mode selector switch is set to the AUTO position, or the A/C COLD OPN position. A e temperature sensing unit in the cabin, in conjunction with the setting of the cabin temperature control rheostat, initiates a heat or cool command to the temperature controller for the desired cockpit or mission avionics compartment environment.

(6) Manual temperature control switch. A switch placarded MANUAL TEMP INCR DECR, located on the overhead control panel (fig. 2-18), controls cockpit and mission avionics compartment temperature with the cabin temperature mode selector switch set to the MAN HEAT positions. The manual temperature control switch controls cockpit and mission avionics temperature by providing a means of manually changing the amount that the bleed air bypass valves are opened or closed. To increase cabin temperature the switch is held to the INCR position. To decrease cabin temperature, the switch is held to the DECR position. Approximately 30 seconds per valve is required to drive the bypass valves to the fully open or fully closed position. Only one valve moves at a time.

(7) Forward vent blower switch. The forward vent blower is controlled by a switch placarded VENT BLOWER AUTO LO HI, located on the overhead control panel (fig. 2-18). In the auto position the fan will run at low speed except when the cabin temperature mode selector switch is set to the OFF position, in this case the blower will not operate.

(8) Aft vent blower switch. The aft vent blower is controlled by a switch placarded AFT VENT BLOWER OFF AUTO ON, located on the overhead control panel (fig. 2-18). The single speed blower operates automatically through the cabin temperature mode selector switch when the aft vent blower switch is placed in the AUTO position. The blower runs continuously when the switch is placed in the ON position, In the OFF position, the blower will not operate.

b. Automatic Heating Mode.

1. Bleed air valve switches OPEN, LEFT and RIGHT.
2. Cabin temperature mode selector switch AUTO.
3. Cabin temperature control rheostat As required.
4. Cabin, cockpit and defrost air knobs As required

c. Cabin Heating Mode.

1. Bleed air valve switches OPEN, LEFT and RIGHT.
2. Cabin temperature mode selector switch MAN HEAT.
3. Vent blower switches As required.
4. Manual temperature switch As required.
5. Cabin, cockpit and defrost air knobs As required.

2-68. AIR CONDITIONING SYSTEM.

a. Description. Cabin air conditioning is provided by a refrigerant gas vapor cycle refrigeration system consisting of a belt driven, engine mounted compressor, installed on the #2 engine accessory pad, refrigerant plumbing, N_1 speed switch, high and low pressure protection switches, condenser coil, condenser blower, forward and aft evaporator, receiver dryer, expansion valve and a bypass valve. The plumbing from the compressor is routed through the right inboard wing leading edge to the fuselage and then forward to the condenser coil, receiver-dryer, expansion valve, bypass valve, and forward evaporator, which are located in the nose of the aircraft. A circuit breaker placarded AIR COND CONTR, located on the overhead circuit breaker panel (fig. 226), protects the compressor clutch circuit.

(1) Forward evaporator. The forward evaporator and blower supplies the cockpit, forward ceiling outlets, and forward floor outlets. The forward evaporator blower has a high speed which can be selected by setting the VENT BLOWER switch, located on the overhead control panel (fig. 2-18), to the HI position. The forward vent blower is protected by a circuit breaker located on the DC power distribution panel, located in the forward equipment bay.

(2) Aft evaporator. The aft evaporator and blower are located in the fuselage center aisle equipment bay aft of the rear spar. Environmental air is circulated through the evaporator in either manual or automatic control mode. The rear evaporator supplies the aft ceiling outlets, rear floor outlets, and toilet compartment. Rear evaporator blower is protected by a circuit breaker located on the DC power distribution panel in the lower equipment bay.

(3) High and low pressure limit switches. High and low pressure limit switches are provided to prevent compressor operation beyond operational

limits. When the low or high pressure switches are activated, a reset switch/light assembly located in the nosewheel well is activated to prevent further compressor operation.

(4) Thermal sense switch. A 33° thermal sense switch is installed on the forward evaporator. This sense switch actuates a hot gas bypass valve which bleeds off a portion of the refrigerant from the forward evaporator, thereby preventing icing of the evaporator.

(5) Condenser blower. A vane-axial blower draws air through the condenser on the ground as well as in flight. The current limiter for this blower is located on the DC distribution panel in the lower equipment bay. When the cabin temperature mode selector switch is set to the A/C COLD OPN position, the condenser blower will be off, and will remain off until the added high pressure switch senses a compressor discharge pressure equal to the pressure it is set to. The condenser blower will then remain in operation until the low pressure switch senses that the system pressure has dropped to the pressure it is set to.

(6) Air conditioning cold start bypass valve. Low ambient temperature operation of the air conditioning system is accomplished by means of a bypass valve located in the nose wheel well, an additional high pressure switch, and an additional low pressure switch, both of which are located in the right inboard wing leading edge. The cold start bypass valve opens when the cabin temperature mode selector switch is set to the A/C COLD OPN position to enhance refrigerant flow at low temperatures and improve air conditioner performance.

b. Normal Operation.

(1) Automatic cooling mode.

1. Bleed air valve switches OPEN, LEFT and RIGHT.
2. Cabin temperature mode selector switch AUTO.
3. Cabin temperature control rheostat As required.
4. Cabin, cockpit and defrost air knobs As required.

(2) Manual cooling mode.

1. Bleed air valve switches OPEN, LEFT and RIGHT.

NOTE

For maximum cooling on the ground, set the bleed air valve switches to the ENVIRO OFF position.

2. Cabin temperature mode selector switch MAN COOL.

(3) Air conditioning cold start mode. (Used if ambient temperature is between 10°C and -25°C).

NOTE

Setting the cabin temperature mode selector switch to the A/C COLD OPN position at ambient temperatures below -25°C may cause the air conditioner system to exceed the compressor low pressure limit switch setting, illuminating the reset switch in the nosewheel well, thereby rendering the system inoperative for the remainder of the flight.

1. Bleed air valve switches OPEN, LEFT and RIGHT.
2. Cabin temperature mode selector switch A/C COLD OPN.
3. Cabin temperature control rheostat As required.
4. Cabin, cockpit and defrost air knobs As required.

2-69. UNPRESSURIZED VENTILATION.

Ventilation is provided by two sources. One source is through the bleed air heating system in both the pressurized and unpressurized mode. The second source of ventilation is obtained from ram air through the condenser section in the nose through a check valve in the vent blower plenum. Ventilation from this source is in the unpressurized mode only with the CABIN PRESS switch in the DUMP position. The check valve closes during pressurized operation. Ram air ventilation is distributed through the main ducting system to all outlets. Ventilation air, ducted to each individual eyeball cold air outlet, can be directionally controlled by moving the ball in the socket. Volume is regulated by twisting the outlet to open or close the valve.

2-70. ENVIRONMENTAL CONTROLS.

An environmental control section on the overhead control panel (fig. 2-18) provides for automatic or manual control of the system. This section contains all the major controls of the environmental function including bleed air valve switches, a vent blower control switch, an aft vent blower switch, a manual temperature switch for control of the heat exchanger valves, a cabin temperature level control, and the cabin temp mode selector switch for selecting automatic heating or cooling or manual heating or cooling. Four additional manual controls on the main instrument subpanels may be utilized for partial regulation of cockpit comfort when the cockpit curtain is closed and the cabin comfort level is satisfactory.

a. Heating Mode.

(1) If the cockpit is too cold:

1. Pilot and copilot air knobs As required.
2. Defrost air knob As required.
3. Cabin air knob Pull out in small increments. Allow 3 5 minutes after each adjustment for system to stabilize.

(2) If the cockpit is too hot:

1. Cabin air knob As required.
2. Pilot and copilot air knobs In as required.
3. Defrost air knob In as required.

b. Cooling Mode.

(1) If the cockpit is too cold:

1. Pilot and copilot air knob In as required.
2. Defrost air knob In as required.
3. Overhead cockpit outlets As required.

(2) If the cockpit is too hot:

1. Pilot and copilot air knobs Out as required.
2. Cabin air knob. Close in small increments. Allow 3 5 minutes after each adjustment for system to stabilize. If CABIN AIR knob is completely closed before obtaining satisfactory cockpit comfort, it may be necessary to place the aft vent blower switch in the ON position to activate the aft evaporator to recirculate cabin air.

c. Automatic Mode Control. When the AUTO mode is selected on the cabin temperature mode selector switch, the heating and air conditioning systems are automatically controlled. When the temperature of the cabin has reached the selected setting, the automatic temperature control allows heated air to bypass the air-to-air exchangers in the wing center TM section. The warm bleed air is mixed with the cooled air. The rear evaporator picks up recirculated cabin air only.

(1) When the automatic control drives the environmental system from a heat mode to a cooling mode, the bypass valves close. When the left bypass valve reaches a fully closed position, the refrigeration system provided the right engine N1 speed is above 62°. When the bypass valve is opened to a position approximately 30° from full closed, the refrigeration system will turn off.

(2) The CABIN TEMP INCR control provides regulation of the temperature level in the automatic mode. A temperature sensing unit in the cabin, in conjunction with the control setting, initiates a heat or cool command to the temperature controller for desired cockpit and cabin environment.

d. Manual Mode Control. With the cabin temperature mode selector in the MAN HEAT or MAN COOL position, regulation of the cabin temperature is accomplished manually with the MANUAL TEMP switch.

(1) In the MAN HEAT mode, the automatic system is overridden and the system is controlled by opening and closing the bypass valves (two) with the MANUAL TEMP INCR DECR switch. To increase cabin temperature, hold the switch at the INCR position, to decrease cabin temperature, hold the switch in the DECR position. Allow approximately 30 seconds per valve to drive the bypass valves to the fully open or fully closed position. Only one valve moves at a time.

(2) With the cabin temperature selector switch in the MAN COOL position, the automatic temperature control system is bypassed. In the manual cooling mode, the refrigeration system is on, providing the right engine right engine N_1speed is above 62%, however, the bypass valves may be manually positioned for the desired temperature. Hold the MANUAL TEMP switch in the DECR position approximately one minute to fully close air-to-air heat exchanger bypass valves.

e. Bleed Air and Vent Control.

(1) Bleed air entering the cabin is controlled by bleed air valve switches placarded BLEED AIR VALVE OPEN ENVIRO OFF PNUE & ENVIRO OFF. When the switch is in the OPEN position, the environmental flow control unit and the pneumatic valve are open. When the switch is in the ENVIRO OFF position, the environmental flow control unit is closed and the pneumatic bleed air valve is open; in the PNEU & ENVIRO OFF position, both are closed. For maximum cooling on the

ground, turn the bleed air valve switches to the ENVIRO OFF position.

(2) The forward vent blower is controlled by a switch placarded VENT BLOWER AUTO LOW HI. The HI and LOW positions regulate the blower to two speeds of operation. IN the AUTO position, the fan will run at low speed except when the CABIN TEMP mode selector switch is placed in the OFF position. In the OFF position, the blower will not operate.

(3) The aft vent blower is controlled by a switch placarded AFT VENT BLOWER OFF AUTO ON. In the OFF position, the blower will not operate.

Section IX. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM

2-71. DESCRIPTION.

The aircraft employs both direct current (DC) and alternating current (AC) electrical power. The DC electrical supply is the basic power system energizing most aircraft circuits. Electrical power is used to start the engines, to power the landing gear and flap motors, and to operate the standby fuel pumps, ventilation blower, lights and electronic equipment. AC power is obtained from DC power through inverters. The three sources of DC power consist of one 20 cell 34-ampere/hour battery and two 400ampere starter-generators. DC power may be applied to the aircraft through an external power receptacle on the right nacelle. The starter-generators are controlled by generator control units. The output of each generator passes through a cable to the respective generator bus (fig. 2-22). Other buses distribute por to aircraft DC loads, and derive power from the generator buses. The generators are paralleled to balance the DC loads between the two units. When one of the generators is not on line, aircraft DC power requirements continue to be supplied from one of the other generators. Most DC distribution buses are connected to both generator buses but have isolation diodes to prevent power crossfeed between the generating systems, when connection between the generator buses is lost. Thus, when either generator is lost because of a ground fault, the operating generator will supply power for all aircraft DC loads except those receiving power from the inoperative generator's bus which cannot be crossfed. When a generator is not operating, reverse current and over-voltage protection is automatically provided. Two inverters operating from DC power produce the required single-phase AC power (figure 2-23). Three phase AC electrical power for inertial navigation system and mission avionics is supplied by two DC powered inverters (figures 2-24 and 2-25).

2-72. DC POWER SUPPLY.

One nickel-cadmium battery furnishes DC power when the engines are not operating. This 24-volt, 34-ampere/hour battery, located in the right wing center section, is accessible through a panel on the 2-58 top of the wing. DC power is produced by two engine-driven 28 volt, 400-ampere starter-generators. Controls and indicators associated with the DC supply system are located on the overhead control panel (fig. 2-18) and consists of a single battery switch (BATT), two generator switches (#1 GEN and #2 GEN), and two volt-loadmeters.

a. Battery Switch. A switch, placarded BATT is located on the overhead control panel (fig. 2-18) under the MASTER SWITCH. The BATT switch controls DC power to the aircraft bus system through the battery relay, and must be ON to allow external power to enter aircraft circuits. When the MASTER SWITCH is moved aft, the BATT switch is forced OFF.

NOTE

With battery or external power removed from the aircraft electrical system, due to fault, power cannot be restored to the system until the BATT switch is moved to OFF/RESET, then ON.

b. Generator Switches. Two switches (fig. 218), placarded #1 GEN and #2 GEN are located on the overhead control panel under the MASTER SWITCH. The toggle switches control electrical power from the designated generator to paralleling circuits and the bus distribution system. Switch positions are placarded RESET, ON and OFF. RESET is forward (spring-loaded back to ON), ON is center, and OFF is aft. When a generator is removed from the aircraft electrical system, due either to fault or from placing the GEN switch in the OFF position, the affected unit cannot have its output restored to aircraft use until the GEN switch is moved to RESET, then ON.

c. Master Switch. All electrical current may be shut off using the MASTER SWITCH gangbar (fig.

2-18) which extends below the battery and generator switches. The MASTER SWITCH gangbar is moved forward when a battery or generator switch is turned on. When moved aft, the bar forces each switch to the OFF position.

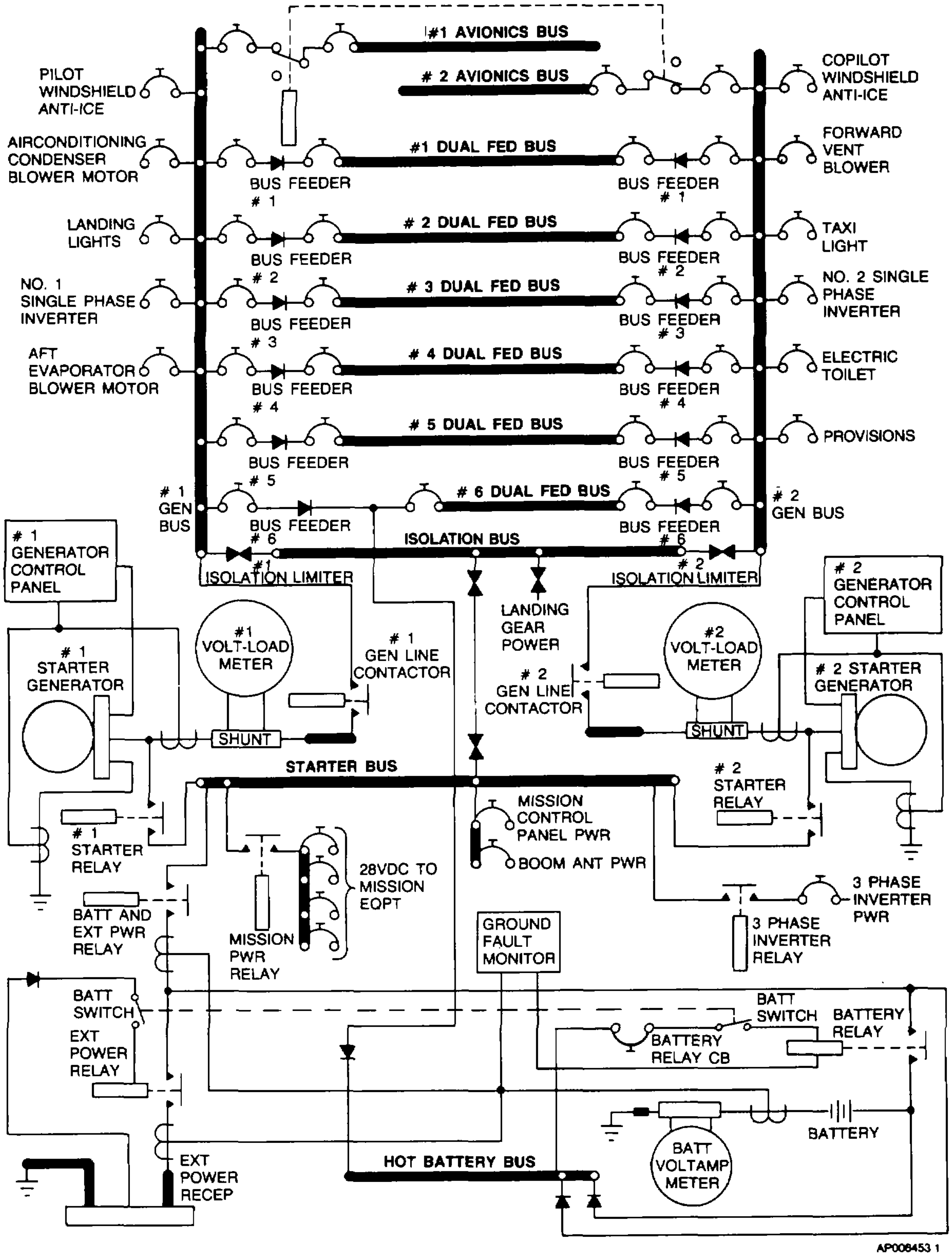

Figure 2-22. DC Electrical System (Sheet 1 of 3)

#1 AVIONICS BUS

HF RCVR
#1 VOR
#1 RMI
PILOT AUDIO
TRANSPONDER
UHF
TACAN
INS CONTROL
AFCS DIRECT
AP PWR
VHF/AM/FM

#2 AVIONICS BUS

#2 VOR
#2 RMI
COPILOT AUDIO
RADAR
RADAR-NAV
SERVO DC
RADIO RELAY
COPILOT ALT
BU VOW

#1 DUAL FED BUS

ANN IND
#1 CHIP DETR
#1 QTY IND
#1 QTY WARN
#1 OIL TEMP
STALL WARN
LANDING GEAR IND
#1 STANDBY PUMP
#1 OIL PRESS
LEFT BLEED AIR WARN
#1 AUXILIARY TRANSFER
RADOME ANTI-ICE
#1 ENG AIR SCOOP HEAT

#2 DUAL FED BUS

ANN PWR
#2 CHIP DETR
#2 QTY IND
#2 QTY WARN
#2 OIL TEMP
BATT CHARGE
FIRE DETR
LANDING GEAR WARN
#2 STANDBY PUMP
#2 OIL PRESS
RIGHT BLEED AIR WARN
#2 AUXILIARY TRANSFER
#2 ENG AIR SCOOP HEAT
ENG AIR SCOOP HEAT MONITOR

#3 DUAL FED BUS

WSHLD WIPER
SURF DEICE
LEFT PITOT HEAT
CROSSFEED
#1 START CONTR
PROP SYNC
LEFT PROP. ANTI-ICE
LEFT FUEL VENT HEAT
#1 FIREWALL VALVE
#1 ICE VANE CONTR
PROP ANTI-ICE AUTO
LEFT FUEL CONTR HEAT
#1 PRESS WARN
#1 IGNITOR CONTR

#4 DUAL FED BUS

STALL WARN HEAT
BRAKE DEICE
RIGHT PITOT HEAT
#2 START CONTR
AUTOFEATHER
HF POWER
RIGHT PROP ANTI-ICE
RIGHT FUEL VENT HEAT
#2 FIREWALL VALVE
#2 ICE VANE CONTR
PROP GOV
SCAVENGER PUMP
PROP ANTI-ICE CONTR
RIGHT FUEL CONTR HEAT
#2 PRESS WARN
#2 IGNITOR CONTR

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Figure 2-22. DC Electrical System (Sheet 2 of 3)

#5 DUAL FED BUS

ELEC TRIM
LANDING GEAR RELAY
ICE LIGHTS
INST INDIRECT LIGHTS
TEMP CONTR

FLAP MOTOR
BCN LIGHTS
LANDING LIGHTS
LEFT BLEED AIR CONTR
PROVISIONS

PILOT TURN & SLIP
SUBPANEL & CONSOLE LIGHTS
RECOGNITION LIGHTS
AIR COND CONTR

#6 DUAL FED BUS

RUDDER BOOST
EMERG LIGHTS
OVHD LIGHTS
PRESS CONTR
CIGAR LIGHTER
AVIONICS MASTER CONTR

FLAP CONTR
FLT INST LIGHTS
RIGHT BLEED AIR CONTR
TAXI LIGHT

COPILOT TURN & SLIP
NAV LIGHTS
CABIN LIGHTS
CARGO DOOR HEAT

HOT BATTERY BUS

#1 FIREWALL SHUTOFF VALVE
#1 ENGINE FIRE EXTINGUISHER
#1 STANDBY FUEL PUMP
TRANSPONDER

CABIN LIGHT
BATTERY RELAY

#2 FIREWALL SHUTOFF VALVE
#2 ENGINE FIRE EXTINGUISHER
#2 STANDBY FUEL PUMP
CRYPTO HOLD

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Figure 2-22. DC Electrical System (Sheet 3 of 3)

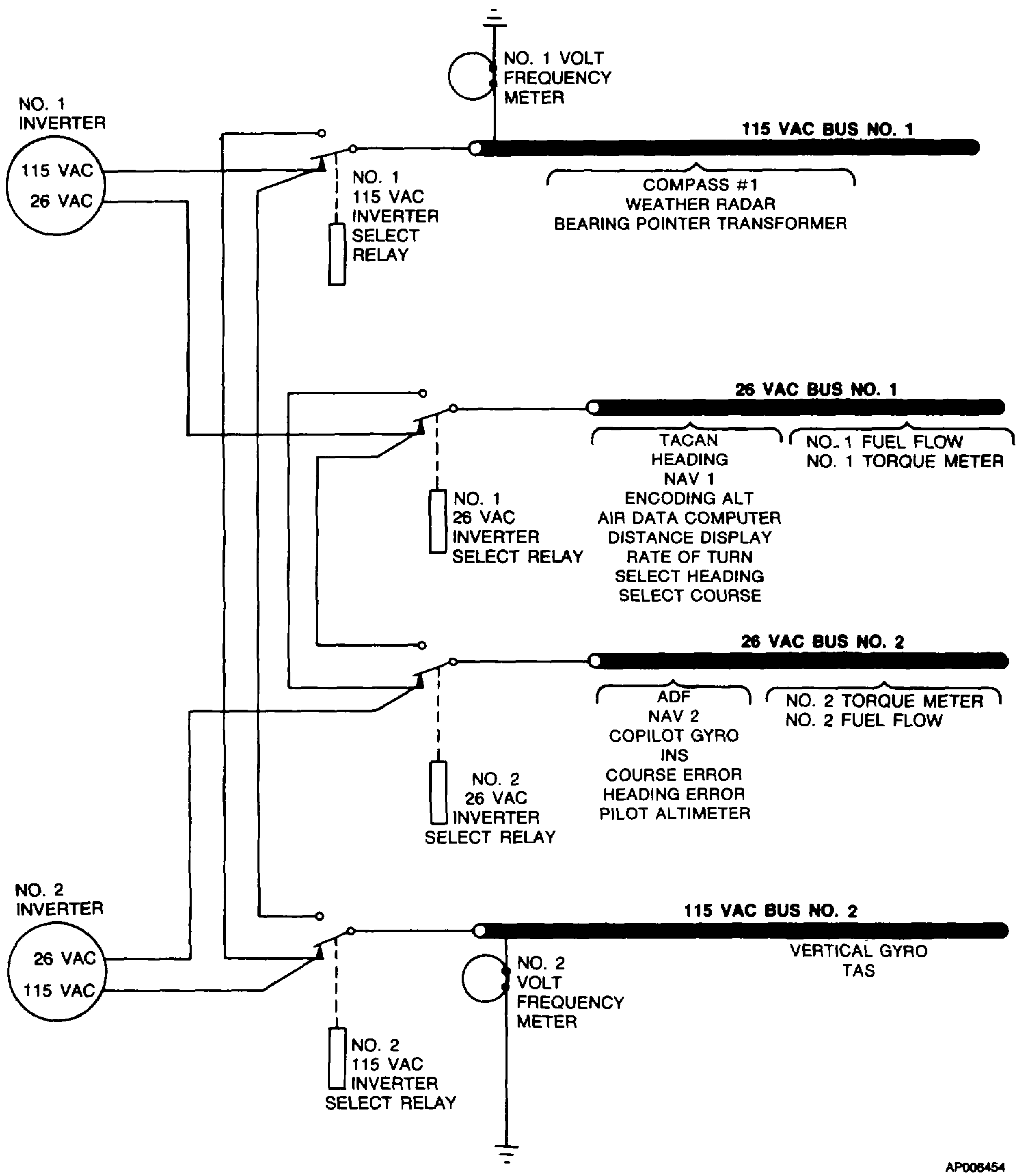

Figure 2-23. Single Phase AC Electrical System

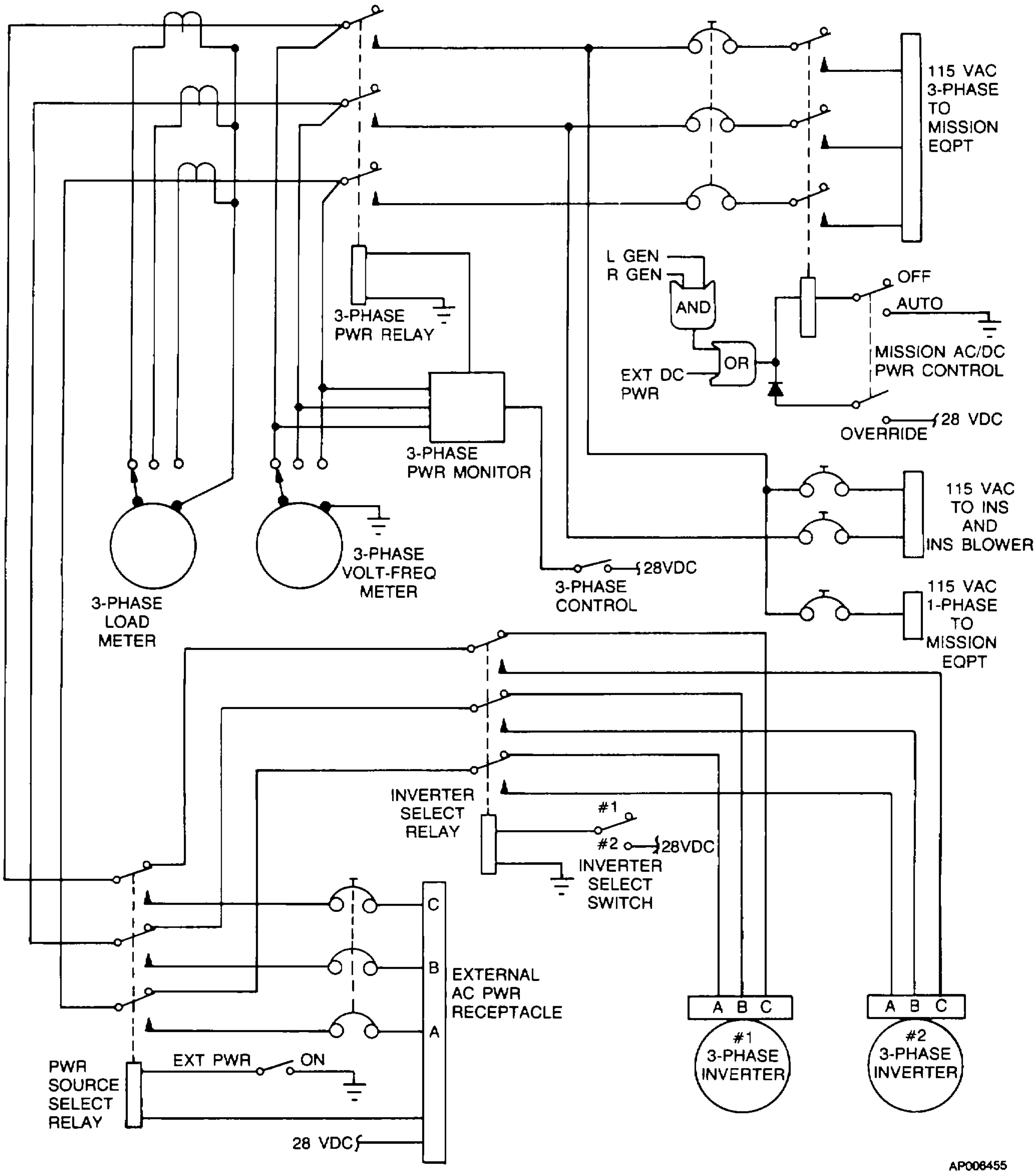

Figure 2-24. Three Phase AC Electrical System

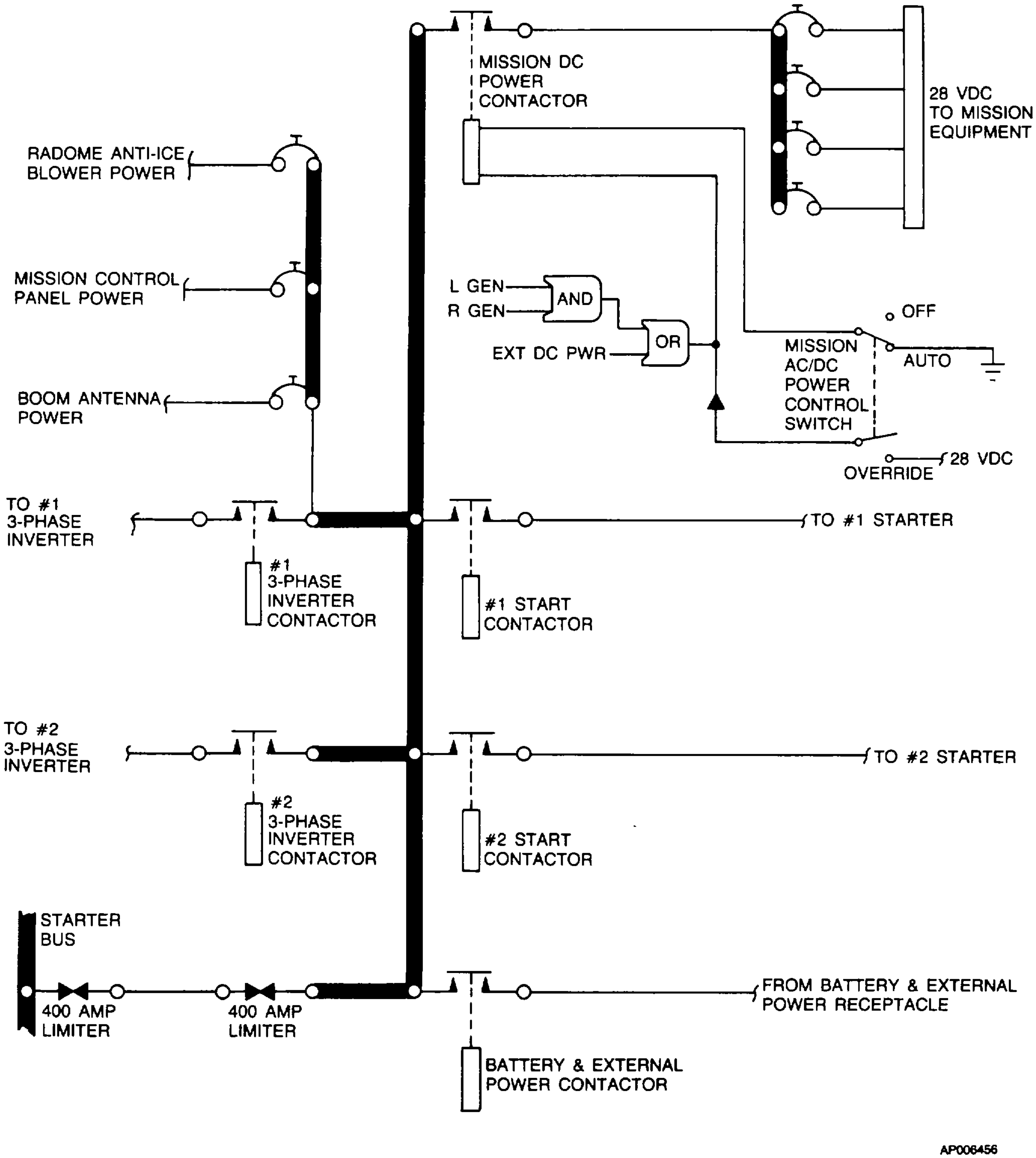

Figure 2-25. Mission Equipment Power System

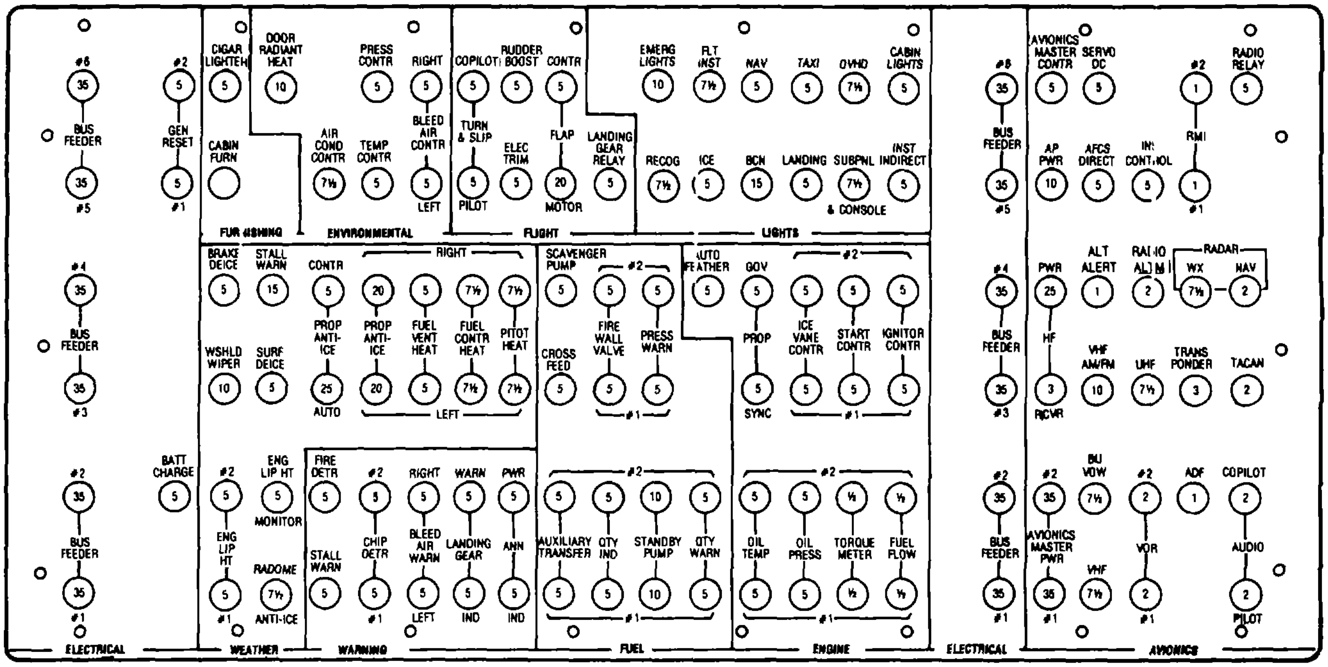

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Figure 2-26. Overhead Circuit Breaker Panel

d. Volt-Loadmeters. Two meters (fig. 2-18), on the overhead control panel display voltage readings and show the rate of current usage from left and right generating systems. Each meter is equipped with a spring-loaded push-button switch which when manually pressed will cause the meter to indicate main bus voltage. Each meter normally shows output amperage reading from the respective generator, unless the push-button switch is pressed to obtain bus voltage reading. Current consumption is indicated as a percentage of total output amperage capacity for the generating system monitored.

e. Battery Monitor. Nickel-cadmium battery overheating will cause the battery charge current to increase if thermal runaway is imminent. The aircraft has a charge-current sensor which will detect a charge current. The charge current system senses battery current through a shunt in the negative lead of the battery. Any time the battery charging current exceeds approximately 7-amperes for 6 seconds or longer, the yellow BATTERY CHARGE annunciator light and the master fault caution light will illuminate. Following a battery engine start, the caution light will illuminate approximately six seconds after the generator switch is placed in the ON position. The light will normally extinguish within two to five minutes, indicating that the battery is approaching a full charge. The time interval will increase if the battery has a low state of charge, the battery temperature is very low, or if the battery has previously been discharged at a very low rate (i.e., battery operation of radios or lights for prolonged periods). The caution light may also illuminate for short intervals after landing gear and/or flap operation. If the caution light should illuminate during normal steady-state cruise, it indicates that conditions exist that may cause a battery thermal runaway. If this occurs, the battery switch shall be turned OFF and may be turned back ON only for gear and flap extension and approach to landing. Battery may be used after a 15 to 20 minute cool down period.

f. Generator Out Warning Lights. Two caution/advisory annunciator panel lights inform the pilot when either generator is not delivering current to the aircraft DC bus system. These lights are placarded #1 DC GEN and #2 DC GEN. Two MASTER CAUTION lights and illumination of either fault light indicates that either the identified generator has failed or voltage is not sufficient to keep it connected to the power distribution system.

CAUTION

The GPU shall be adjusted to regulate at 28 volts maximum to prevent damage to the aircraft.

g. DC External Power Source. External DC power can be applied to the aircraft through an external power receptacle on the underside of the right wing leading edge just outboard of the engine nacelle. The receptacle is installed inside of the wing structure and is accessible through a hinged access panel. DC power is supplied through the DC external plug and applied directly to the battery bus after passing through the external power relay. Turn off all external power while connecting the power cable to, or removing it from, the external power supply receptacle. The holding coil circuit of the relay is energized by the external power source when the BATT switch is in the ON position. The GPU shall be adjusted to regulate at 28 volts maximum to prevent damage to the aircraft battery.

h. Security Keylock Switch. The aircraft has a security keylock switch (fig. 2-18) installed on the overhead control panel, placarded OFF ON. The switch is connected to the battery relay circuit and must be ON when energizing the battery master power switch. The key cannot be removed from the lock when in the ON position.

i. Circuit Breakers. The overhead circuit breaker panel (fig. 2-26) contains circuit breakers for most aircraft systems. The circuit breakers on the panel are grouped into areas which are placarded as to the general function they protect. A DC power distribution panel is mounted beneath the floor forward of the main spar. This panel contains higher current rated circuit breakers and is not accessible to the flight crew under normal conditions.

2-73. AC POWER SUPPLY.

a. Single Phase AC Power Supply. AC power for the aircraft is supplied by inverter units, numbered #1 and #2 (fig. 2-23) which obtain operating current from the DC power system. Both inverters are rated at 750 volt-amperes and provide single phase output only. Each inverter provides 115 volt and 26 volt 400 Hz AC output. The inverters are protected by circuit breakers mounted on the DC power distribution panel mounted beneath the floor. Controls and indicators of the AC power system are located on the overhead control panel and on the caution/advisory annunciator panel.

b. AC Power WARNING/CAUTION Lights. Two MASTER/CAUTION lights and the illumination of an annunciator caution light #1 INVERTER or #2 INVERTER indicates an inverter failure.

c. Instrument AC Light. A red warning light, located on the warning annunciator panel, placarded INST AC, will illuminate if all instrument AC busses should fail.

d. Inverter Control Switches. Two switches (fig. 2-18), placarded INVERTER #1 and #2 on the overhead control panel give the pilot control of inverters single-phase AC power.

e. Volt-Frequency Meters. Two volt-frequency meters (fig. 2-18) are mounted in the overhead control panel to provide monitoring capability for both 115 VAC buses. Normal display on the meter is shown in frequency (Hz). To read voltage, press the button located in the lower left corner of the meter. Normal output of the inverters will be indicated by 115 VAC and 400 Hz on the meters.

f Three Phase AC Power Supply. Three phase AC electrical power for operation of the inertial navigation system and mission avionics is supplied by either of two DC powered 3000 volt-ampere solid state three phase inverters (fig. 2-24).

(1) Three phase inverter control switch. A three position switch placarded #1 MISSION INV, OFF, #2 MISSION INV, located on the mission control panel controls three phase inverter operation.

(2) Three phase volt-frequency meter. A three phase volt/frequency meter, mounted on the mission control panel, monitors output of the selected three phase inverter. Frequency (Hz) is normally displayed on the meter. To read voltage press button located in the lower left corner of the meter.

(3) Three phase loadmeter. A three phase loadmeter, mounted on the mission control panel, monitors inverter output level.

(4) Three phase AC off annunciator light. An indicator light placarded 3(AC OFF, located on the mission annunciator panel indicates that three phase AC power is not being supplied.

(5) Three phase AC external power. External three phase AC power for operation of the inertial navigation system or mission equipment, can be applied to the aircraft through an external power receptacle located on the underside of the left wing leading edge just outboard of the engine nacelle. The receptacle is installed inside the wing structure and is accessible through a hinged access panel. The AC electrical system is automatically isolated from the external power source if the external power is over or under voltage, over or under frequency, or has an improper phase sequence.

(a) External AC power annunciator light. An annunciator light placarded EXT AC PWR ON, located on the mission annunciator panel indicates that an AC GPU plug is mated to the AC external power receptacle and the External AC Power control switch is On.

(b) External AC power control switch. A switch placarded AC EXT POWER, located on the mission control panel controls application of three phase AC power to the aircraft.

Section X. LIGHTING

2-74. EXTERIOR LIGHTING.

a. Description. Exterior lighting (fig. 2-27) consists of a navigation light on top of the aft section of the vertical stabilizer, one navigation light on top and bottom of each wing tip pod, two strobe beacons, one on top of the vertical stabilizer and one on the underside of the fuselage center section, dual landing lights, one taxi light mounted on the nose gear assembly, a recognition light located in each wing tip, and two ice lights, one light flush mounted in each nacelle, positioned to illuminate along the leading edge of each outboard wing.

b. Navigation Lights. The navigation lights are protected by a 5-ampere circuit breaker placarded NAV on the overhead circuit breaker panel (fig. 2-26). Control of the lights is provided by a switch placarded NAV-ON on the overhead control panel (fig. 2-18).

c. Strobe Beacons. The strobe beacons are dual intensity units. They are protected by a 15ampere circuit breaker placarded BCN on the overhead circuit breaker panel (fig. 2-26). Control of the lights is provided by a switch placarded BEACONDAY-NIGHT (fig. 2-18). Placing the switch in the DAY position will activate the high intensity white section of the strobe lights for greater visibility during daytime operation. Placing the switch in the NIGHT position activates the lower intensity red section of the strobe lights.

d. Landing/Taxi Lights. Dual landing lights and a single taxi light are mounted on the nose gear assembly. The lights are controlled by switches, placarded LANDING and TAXI, located in the LIGHTS section of the pilot's subpanel. In addition, these light are extinguished whenever the landing gear is retracted. The landing/taxi lights circuits are protected by 5-ampere circuit breakers placarded LANDING and TAXI respectively, located on the overhead circuit breaker panel (fig. 2-26). Additional circuit protection is provided by 35-ampere and 15ampere circuit breakers on the DC power distribution panel located beneath the cockpit floor.

e. Ice Lights. The ice lights circuit is protected by a 5-ampere circuit breaker placarded ICE on the overhead circuit breaker panel (fig. 2-26). Control of the lights is provided by a switch placarded ICE on the overhead control panel (fig. 2-18). Prolonged use during ground operation may generate enough heat to damage the lens.

f. Recognition Lights. A RECOG switch, located in the pilot's subpanel LIGHTS section, controls a white recognition light in each wing tip. When requested, this steady, bright light is used for identification in the traffic pattern. The recognition lights circuit is protected by a 7 1/2 ampere RECOG circuit breaker located on the overhead circuit breaker panel (fig. 2-26).

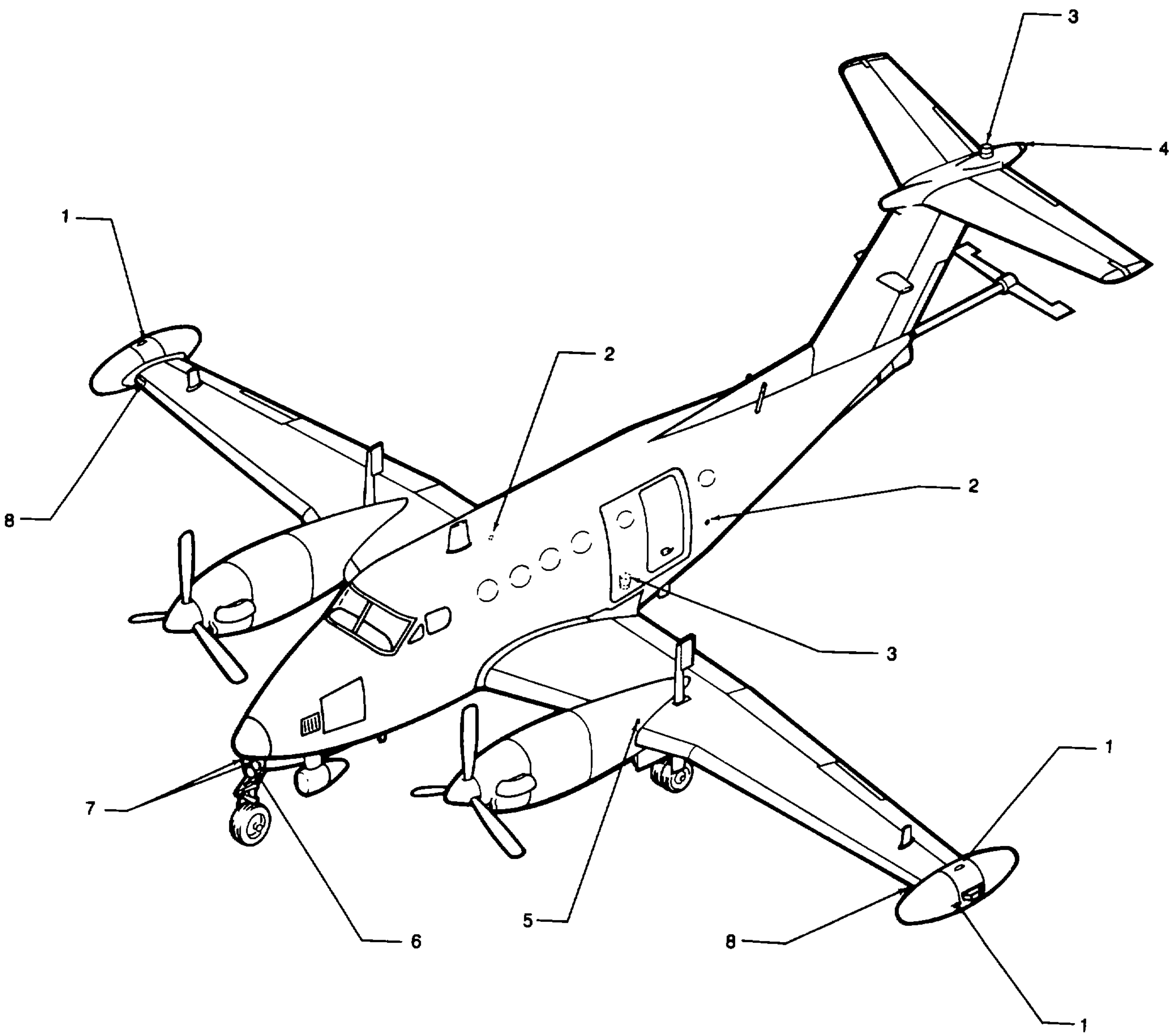
2-75. INTERIOR LIGHTING.

Lighting systems are installed for use by the pilot and copilot and by the passengers in the cabin area. The lighting systems in the cockpit are provided with intensity controls on the overhead control panel. A switch placarded MASTER PANEL LIGHTS on the overhead control panel (fig. 2-18) provides overall on-off control for all engine instrument lights, pilot and copilot instrument lights, overhead panel lights, console and subpanel lights and the free air temperature light.

a. Cockpit Lighting.

(1) Flight instrument lights. Each individual flight instrument contains internal lamps for illumination. The circuit is protected by a 7 1/2-ampere circuit breaker placarded FLT INST on the overhead circuit overhead circuit breaker panel (fig. 226). Control is provided by two rheostat switches placarded PILOT or COPILOT INST LIGHTS-OFF-BRT on the overhead control panel (fig. 2-18). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(2) Instrument indirect lights. Three lights are mounted in the glareshield overhang along the top edge of the instrument panel and provide overall instrument panel illumination. The circuit is protected by a 5-ampere circuit breaker placarded INST INDIRECT on the overhead circuit breaker panel (fig. 2-26). Control is provided by a rheostat switch placarded INST INDIRECT LIGHTS-OFF-BRT on the overhead control panel (fig. 2-18). Turning the



1. Wing navigation light
2. Emergency light
3. Strobe beacon
4. Tail navigation light
5. Ice light
6. Taxi light
7. Landing lights
8. Recognition lights

Figure 2-27. Exterior Lighting

control clockwise from OFF turns the lights on and increases their brilliance.

(3) Engine instrument lights. Each individual engine instrument contains internal lamps for illumination. The circuit is protected by a 7 1/2ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-26). Control is provided by a rheostat switch placarded ENGINE INST LIGHTS OFF BRT on the overhead control panel (fig. 2-18). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(4) Flood light. A single overhead flood light is installed. It provides overall illumination of the entire cockpit area. The circuit is protected by a 5-ampere circuit breaker mounted beneath the battery and connected to the emergency battery bus. Control is provided by a rheostat switch placarded OVERHEAD FLOODLIGHT-OFF-BRT on the overhead control panel (fig. 2-18). Turning the control clockwise from OFF turns the light on and increases its brilliance.

(5) Overhead panel lights. Lamps on the overhead circuit breaker panel, control panel, and fuel management panel are protected by a 7 1/2ampere circuit breaker placarded LIGHTS OVHD on the overhead circuit breaker panel (fig. 2-26). Control is provided by a rheostat switch placarded OVERHEAD PANEL LIGHTS-OFF-BRT on the overhead control panel (fig. 2-18). Turning the control clockwise from off turns the lights on and increases their brilliance.

(6) Subpanel and console lights. Lights on the pilot's and copilot's subpanels, console edge lit panels and pedestal extension panels are protected by a 7 1/2-ampere circuit breaker placarded LIGHTS SUBPANEL & CONSOLE on the overhead circuit breaker panel (fig. 2-26). Control is provided by two rheostat switches placarded SUBPANEL or CONSOLE LIGHTS-OFF-BRT on the overhead control panel (fig. 2-18). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(7) Free air temperature light. Two post lights are mounted adjacent to the free air temperature gage on the left cockpit sidewall trim panel. The circuit is protected by a 7 1/2-ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-26). Control is provided by a push button switch adjacent to the gage. No intensity control is provided.

b. Cabin Lighting.

(1) Interior lights. Three cabin lights are installed in the overhead trim. The circuit is protected by a 10-ampere circuit breaker placarded CABIN on the overhead circuit breaker panel (fig. 2-26). Control is provided by a switch placarded CABIN LIGHTS-BRIGHT-DIM-OFF on the subpanel (fig. 2-6).

(2) Threshold and spar cover lights. A spar cover light is installed on the left side of the sunken aisle immediately aft of the main spar cover. Both circuits are protected by a 5-ampere circuit breaker mounted beneath the battery and connected to the emergency battery bus. Both lights are controlled by the switch mounted forward of the airstair door. If the lights are illuminated, closing the cabin door will automatically extinguish them.

(3) Dome light. A dome light is installed in the baggage area, in the overhead. The circuit is protected by a 5-ampere circuit breaker mounted beneath the battery and connected to the emergency battery bus. Control is provided by a switch mounted adjacent to the light.

(4) Cabin utility light. There is a cabin utility light adjacent to each cabin light. Each utility light is individually controlled by a rheostat placarded OFF-ON-BRT on the back of the light. There is a momentary ON switch in the center of the rheostat. Each light is capable of producing a red or white spotlight by turning the selector on the front of the light. To remove the light from the stationary position, loosen the retaining screw directly below the light escutcheon and pull down on the light. The light is connected to the light housing by an 11 inch coiled cord that extends to approximately 50 inches. The CABIN LIGHTS switch must be on for utility lamps to operate.

2-76. EMERGENCY LIGHTING.

a. Description. An independent battery operated lighting system is installed. The system is actuated automatically by shock, such as a forced landing. It provides adequate lighting inside and outside the fuselage to permit the crew to read instruction placards and locate exits. An inertia switch, when subjected to a 2 3 G shock, will illuminate interior lights in the cockpit, forward and aft cabin areas, and exterior lights aft of the emergency exit and aft of the cabin door. The battery power source is automatically recharged by the aircraft electrical system.

b. Operation. An emergency lights override switch, located on the overhead control panel (fig. 218), is provided to turn the system off if it is accidentally actuated. The switch is placarded EMERG LIGHTS OVRD OFF-RESET-AUTO-TEST. Should the system accidentally actuate, placing the switch in the momentary OFF RESET position will extinguish the lights. To test the system, place the switch in the momentary TEST position. The lights should illuminate. Moving the switch to the OFF-RESET position will turn the system off and reset it.

Section XI. FLIGHT INSTRUMENTS

2-77. TURN-AND-SLIP INDICATORS.

Turn-and-slip indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-28). The pilot's indicator provides yaw damping information to the autopilot. These indicators are gyroscopically operated. They use DC power and are protected by 5-ampere circuit breakers placarded TURN & SLIP PILOT or COPILOT on the overhead circuit breaker panel (fig. 2-26).

2-78. AIRSPEED INDICATORS.

Airspeed indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-28). These indicators require no electrical power for operation. The indicator dials are calibrated in knots from 40 to 300. A striped pointer automatically displays the maximum allowable airspeed (245 KIAS, 0.47 mach) at the aircraft’s' present altitude.

2-79. PILOT'S ENCODING ALTIMETER.

The altimeter is located on the upper left side of the instrument panel (fig. 2-28). The altimeter is a self-contained unit which consists of a precision pressure altimeter combined with an altitude encoder. The display indicates and the encoder transmits, simultaneously, pressure altitude information to the transponder. Altitude is displayed on the altimeter by a 10,000 foot counter, a 1000 foot counter, and a single needle pointer which indicates hundreds of feet on a circular scale in 50 foot increments. Below an altitude of 10,000 feet, a diagonal warning symbol will appear on the 10,000 foot counter. A barometric pressure setting knob is provided to insert the desired altimeter setting in inches Hg or millibars. A DC powered vibrator operates inside the altimeter whenever aircraft power is on. If DC power to the altitude encoder is lost, a warning flag placarded CODE OFF will appear in the upper center portion of the instrument face, indicating that the altitude encoder is inoperative and that the system is not reporting altitude to ground stations. Operating instructions are contained in Chapter 3.

2-80. COPILOT'S ALTIMETER.

The copilot's altimeter is located on the upper right side of the instrument panel (fig. 2-28). It displays altitude by means of a 10,000 foot counter, a 1000 foot counter, a 100 foot counter, and a single needle pointer that indicates on a circular scale marked in 50 foot intervals. Below an altitude of 10, 000 feet, a diagonally striped symbol covers the 10, 000 foot indicator. A knob is provided at the bottom right corner of the altimeter for setting readings in the pressure windows.

2-81. VERTICAL VELOCITY INDICATORS.

Vertical velocity indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-28). They indicate the speed at which the aircraft ascends or descends based on changes in atmospheric pressure. The indicator is a direct reading pressure instrument requiring no electrical power for operation.

2-82. ACCELEROMETER.

The accelerometer, located on the instrument panel registers and records positive and negative G loads imposed on the aircraft. One hand moves in the direction of the G load being applied while the other two, one for positive G loads and one for negative G loads, follow the indicating pointer to its maximum travel. The recording pointers remain at the respective maximum travel positions of the G's being applied, providing a record of maximum G loads encountered. Depressing the push-to-reset knob at the lower left corner of the instrument allows the recording pointers to return to the normal position.

2-83. FREE AIR TEMPERATURE (FAT) GAGE.

The free air temperature gage, mounted outboard of the pilot's seat indicates the free air temperature in degrees Celsius.

2-84. STANDBY MAGNETIC COMPASS.

WARNING

Inaccurate indications on the standby magnetic compass will occur while windshield heat and/or air conditioning is being used.

The standby magnetic compass is located below the overhead fuel management panel to the right of the windshield divider. It may be used in the event of failure of the compass system, or for instrument cross check. Readings should be taken only during level flight since errors may be introduced by turning or acceleration. A compass correction chart indicating deviation is located on the magnetic compass.

2-85. MISCELLANEOUS INSTRUMENTS.

a. Annunciator Panels. Three annunciator panels are installed. One is a warning panel with red fault identification lights, and the others are caution/ advisory panels with yellow and green identification lights. the warning panel is mounted near the center of the instrument panel below the glareshield (fig. 228) and one caution/advisory panel is located on the center subpanel. The mission annunciator panel is located on the copilot's sidewall. Some normal flight operations involve indications from the mission control panel, described in Chapter 4. Illumination of a red warning light signifies the existence of a hazardous condition requiring immediate corrective action. A yellow caution light signifies a condition other than hazardous requiring pilot attention. A green advisory light indicates a functional situation. Table 2-6 provides a list of causes for illumination of the individual annunciator lights. In frontal view both panels present rows of small, opaque rectangular indicator lights. Word printing on each indicator identifies the monitored function, situation, or fault condition, but cannot be read until the light is illuminated. The bulbs of all annunciator panel lights are tested by activating the ANNUNCIATOR TEST switch, located on the right side of the caution/ advisory panel. The system is protected by two 5ampere circuit breakers placarded ANN PWR and ANN IND on the overhead circuit breaker panel (fig. 2-26). The annunciator system lights are dimmed when the MASTER PANEL LIGHTS switch is actuated and the pilot's flight instrument lights are on. The lights are automatically reset to maximum brightness if:

(1) The main aircraft power (both DC generators) are OFF.

(2) The INST INDIRECT LIGHTS switch is ON.

(3) The MASTER PANEL LIGHTS switch is OFF.

(4) The MASTER PANEL LIGHTS switch is ON and the PILOT INST LIGHTS switch if OFF.

b. Master Warning Light (Red). MASTER WARNING light is located on each side of the glareshield (fig. 2-28). Any time a warning light illuminates, the MASTER WARNING light will illuminate, and will remain illuminated until pressed. If a new fault condition occurs, the MASTER WARNING light will be reactivated, and the applicable annunciator panel warning light will illuminate.

c. Master Caution Light (Yellow). A MASTER CAUTION light is located on each side of the glareshield (fig. 2-28). Any time a caution light illuminates, the MASTER CAUTION will illuminate, and will remain illuminated until pressed. If a new fault condition occurs, the MASTER CAUTION light will be reactivated, and the applicable annunciator panel caution light will illuminate. Annunciator Panels

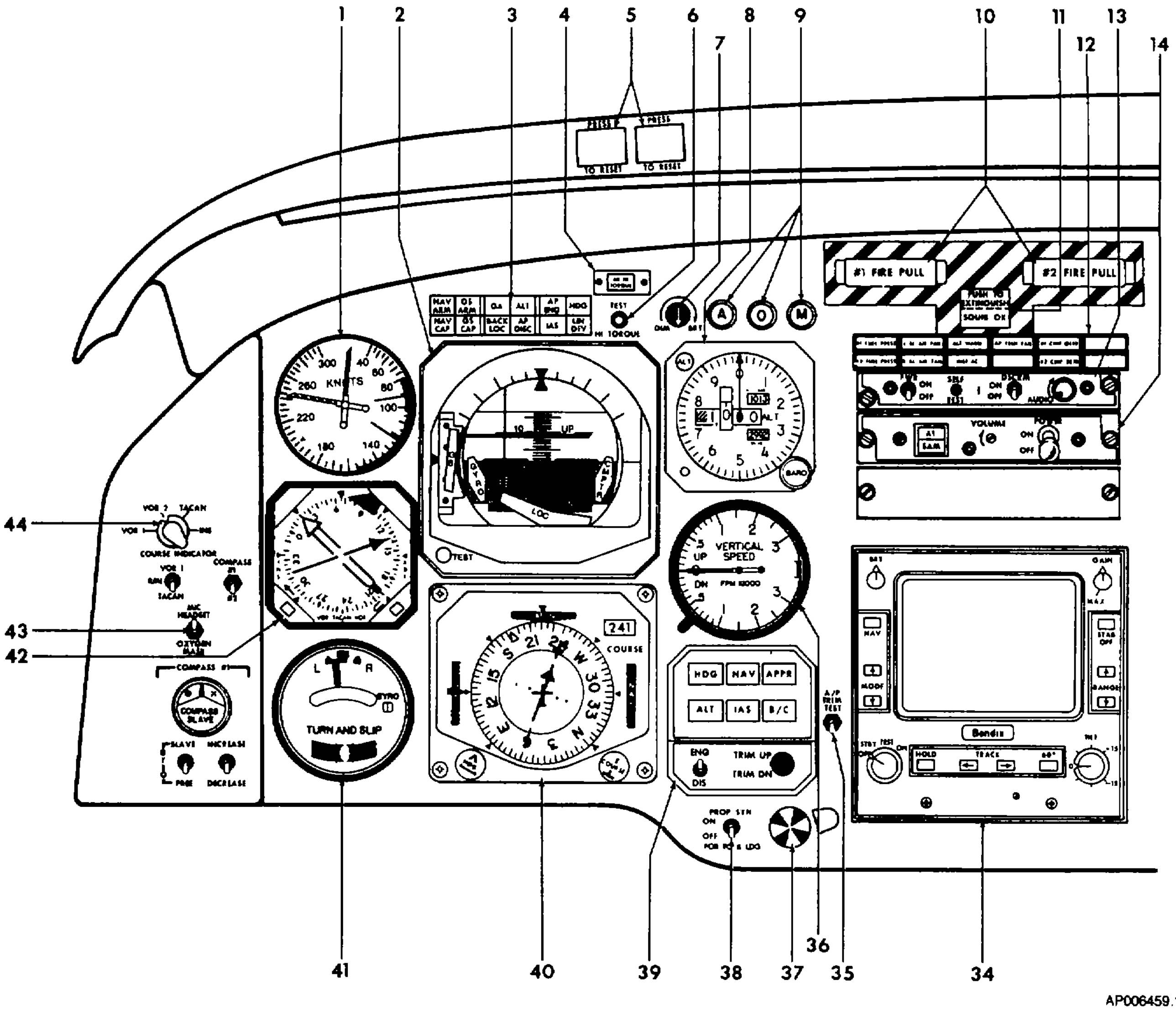
d. Pilot's Clock. One manual wind 8-day clock is mounted in the center of the pilot's control wheel (fig. 2-16).

e. Copilot's Clock. A digital quartz chronometer is mounted in the center of the copilot's control wheel (fig. 2-16). The quartz chronometer is a five function clock/timer that is controlled by three pushbutton switches located directly below the six digit liquid crystal display.

(1) Mode selection. The MODE button is pressed to select the desired mode of operation. The mode annunciator is displayed above the mode identifiers, and advances to indicate each of the following modes:

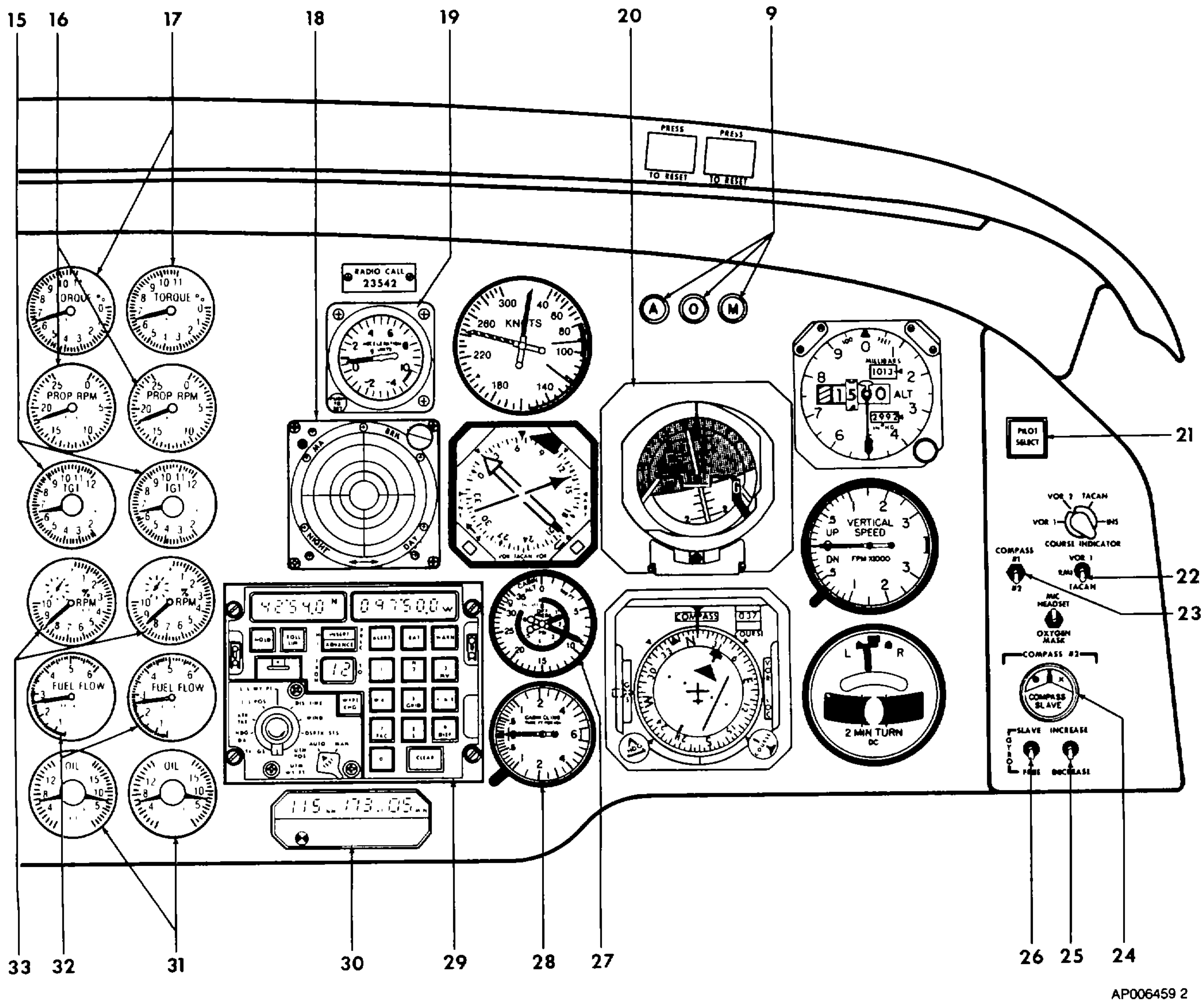
- LC Local Time
- ZU Zulu or Greenwich Mean Time
- FT Trip or Flight Timer
- ET Elapsed Time
- DC Down counter with Alarm

(2) Local time mode (LC). Press the MODE button to advance the annunciator to LC. To set the hour, press the RST button once, then press and hold the ADV button until the correct hour is displayed. To set minutes, press the RST button again, then press and hold the ADV button



23. Compass selector switch
24. Compass slaving indicator
25. Gyro rate switch
26. Gyro slaving select switch
27. Cabin altitude indicator
28. Cabin rate of climb indicator
29. INS control display unit
30. TACAN range indicator
31. Oil pressure gages
32. Fuel flow gages
33. Turbine tachometers
34. RADAR
35. Autopilot trim test switch
36. Vertical speed indicator
37. Synchroscope
38. Propeller syncronizer
39. Autopilot controller
40. Course deviation indicator
41. Turn and slip indicator
42. RMI
43. Microphone selector switch
44. Course indicator selector switch

Figure 2-28. Instrument Panel (Sheet 1 of 2)



1. Airspeed indicator
2. Flight Director Indicator
3. Autopilot annunciator panel
4. Aileron HI torque annunciator light
5. Master warning and caution lights
6. Aileron HI torque test switch
7. Marker beacon lights brightness control
8. Altimeter
9. Marker beacon lights
10. Fire pull handle
11. Fire extinguisher system annunciators
12. Systems annunciator panel
13. Radar signal detecting set
14. Radar warning receiver control panel
15. Turbine gas temperature gages
16. Propeller tachometers
17. Torquemeters
18. Radar signal detecting set indicator
19. Accelerometer
20. Gyro horizon
21. Course indicator pilot select annunciator
22. RMI selector switch

Figure 2-28. Instrument Panel (Sheet 2 of 2)

Table 2-6. Annunicator Panels

NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
No. 1 FUEL PRESS	Red	Fuel pressure failure on left side
No. 2 FUEL PRESS	Red	Fuel pressure failure on right side
L BL AIR FAIL	Red	Left bleed air warning line has melted or failed, indicating possible loss of No. 1 engine bleed air
R BL AIR FAIL	Red	Right bleed air warning line has melted or failed, indicating possible loss of No. 2 engine bleed air
ALT WARN	Red	Cabin altitude exceeds 12,500 feet
INST AC	Red	No AC power to engine instruments
AP TRIM FAIL	Red	Trim inoperative or running opposite direction commanded
NO. 1 CHIP DETR	Red	Contamination of No. 1 engine oil detected
No. 2 CHIP DETR	Red	Contamination of No. 2 engine oil detected
No. 1 DC GEN	Yellow	No. 1 engine generator off line.
No. 1 INVERTER	Yellow	No. 1 inverter inoperative.
REV NOT READY	Yellow	Propeller levers are not in the high RPM, low pitch position, with the landing gear extended.
No. 2 INVERTER	Yellow	No. 2 inverter inoperative.
No. 2 DC GEN	Yellow	No. 2 engine generator off line.
No. 1 EXTGH DISCH	Yellow	No. 1 engine fire extinguisher discharged.
No. 1 NAC LOW	Yellow	No. 1 engine has 20 minutes fuel remaining at sea level, normal cruise power consumption rate.
CABIN DOOR	Yellow	Cabin/cargo door open or not secure.
No. 2 NAC LOW	Yellow	No. 2 engine has 20 minutes fuel remaining at sea level, normal cruise power consumption rate.
No. 2 EXTGH DISCH	Yellow	No. 2 engine fire extinguisher discharged.
No. 1 VANE FAIL	Yellow	No. 1 engine ice vane malfunction. Ice vane has not attained proper position
BATTERY CHARGE	Yellow	Excessive charge rate on battery
PROP SYNC ON	Yellow	Synchrophaser turned on with landing gear extended
No. 2 VANE FAIL	Yellow	No. 2 engine vane malfunction. Ice vane has not attained proper position
DUCT OVERTEMP	Yellow	Ecessive bleed air temperature in environmental heat ducts.
IFF	Yellow	Transponder fails to reply to a valid mode 4 interrogation.
No. 1 NO FUEL XFR	Yellow	Auxiliary fuel tank on side of No. 1 engine not transferring fuel into nacelle tank.
NO. 2 NO FUEL XFR	Yellow	Auxiliary fuel tank on side of No. 2 engine not transferring fuel into nacelle tank.
No. 1 LIP HEAT	Yellow	Failure of lip heat valve to conform to selected position or in transit.
No. 2 LIP HEAT	Yellow	Failure of lip heat valve to conform to selected position or in transit.
INS	Yellow	INS cooling fan is OFF or CDU WARN lamp is illuminated.
MSN OVERTEMP	Yellow	Mission equipment is over heating.

Table 2-6. Annunicator Panels (Continued)

NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
CRYPTO ALERT	Yellow	Coded messages being received.
PWR SPLY FAULT	Yellow	Mission power out of tolerance.
CALL	Yellow	Receiving transmission on VOW.
3Ø AC OFF	Yellow	Three Phase AC power fault.
BATT FEED FAULT	Yellow	Ground fault detected in battery or external power line.
MISSION POWER	Yellow	Mission power is off.
LINK MODE	Yellow	WBDL fault in link or contact.
RADOME HOT	Yellow	Radome heat is too high.
LINK SYNC	Yellow	WBDL has synchronization fault.
SPCL EQPT OVRD	Yellow	Mission Power Switch is in override.
DIPLEXER PRESS	Yellow	Diplexer has lost pressurization.
TWTA STANDBY	Yellow	WBDL is in standby mode.
ANT MALF	Yellow	Boom antenna is out of position.
ANT STOWED	Green	Boom antenna is in horizontal position.
ANT OPERATE	Green	Boom antenna is in vertical position.
RADOME HEAT	Green	Radome heat is on.
MISSION AC ON	Green	Mission AC is on.
DAT LINK UPDATE	Green	INS is updating with information from Data Link.
TACON UPDATE	Green	INS is updating with information from TACAN.
MISSION DC ON	Green	Mission DC is on.
WAVE GUIDE	Green	Wave guide is pressurized.
EXT AC PWR ON	Green	External AC power is on.
EXT DC PWR ON	Green	External DC power is on.
No. 1 LIP HEAT ON	Green	No. 1 engine air scoop heat switch is on.
No. 2 LIP HEAT ON	Green	No. 2 engine air scoop heat switch is on.
A/C COLD OPN	Green	Air conditioner is operating in cold mode.
No. 1 VANE EXT	Green	No. 1 ice vane extended.
FUEL CROSSFEED	Green	Crossfeed valve open.
AIR COND N_1 LOW	Green	No. 2 engine RPM too low for air conditioning load.
No. 2 VANE EXT	Green	No. 2 ice vane extended.
No. 1 IGN ON	Green	No. 1 engine ignition/start switch on or No. 1 engine auto ignition switch armed and engine torque below 20 percent.
L BL AIR OFF	Green	Left environmental bleed air valve closed.
EXTERNAL POWER	Green	External power connector plugged in.
R BL AIR OFF	Green	Right environmental bleed air valve closed.
No. 2 IGN ON	Green	No. 2 engine ignition/start switch on or No. 2 engine auto ignition switch armed and engine torque below 20 percent.
No. 1 AUTOFEATHER	Green	No. 1 engine autofeather armed with power levers advanced above 90% N_1.

Table 2-6. Annunicator Panels (Continued)

NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
No. 2 AUTOFEATHER	Green	No. 2 engine autofeather armed with power levers advanced above 90% N_1.
BRAKE DEICE ON	Green	Brake deice system activated.
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until the correct minute is displayed. Press the SET button once to display and hold selected time. Press the ST-SP button to resume clock operation and/or synchronize the display with a selected time standard.

(3) Zulu or Greenwich Mean Time mode (ZU). Press the MODE button to advance the annunciator to ZU and set time as for local time shown above. Minutes and seconds do not need to be reset if local time is correctly set. Press the RST button to display minutes/seconds, then press again to activate the complete display.

When changing time zones, the hour may be changed as above. It is not necessary to change the minutes/seconds. Press the RST button twice to return to the full time display.

(4) Trip/Flight timer mode (FT). Press the MODE button to advance the annunciator to FT. Press and hold the ST-SP button and verify that the display shows zero. The timer will activate at takeoff and stop at touchdown. To prevent an accidental reset of flight time, the clock cannot manually reset during flight.

(5) Elapsed time mode (ET). Press the MODE button to advance the annunciator to ET. Press the RST button to set the time display to zero. Press the ST-SP button one time. To stop the counting, press the ST-SP button a second time. Ending time will be displayed until the RST button is pressed to clear the display. The clock may be used in other modes and the elapsed time display will remain until cleared by pressing the RST button. If the timer is counting when the RST button is pressed, the display will reset to zero and the count will begin again from zero.

(6) Downcounter mode (DC). Press the MODE button to advance the annunciator to DC. Press the SET button twice to reset the hour display to zero. Press and hold the ADV button until the desired hour is displayed. Press the SET button again, to reset the minute display to zero. Press and hold the ADV button until the desired minute is displayed. Press the SET button again, to reset the seconds display to zero. Press and hold the ADV button until the desired second is displayed. Press the SET button again, to arm the counter. Press the STSP button to begin countdown. When the countdown reaches zero, the display will flash for approximately one minute and then reset. The countdown may also be reset at any time by pressing the ST-SP button.

Section XII. SERVICING, PARKING, AND MOORING.

2-86. GENERAL

The following paragraphs include the procedures necessary to service the aircraft except lubrication. The lubrication requirements of the aircraft are covered in the aircraft maintenance manual. Tables 2-7, 2-8, 2-9 and 2-10 are used for identification of fuel, oil, etc. used to service the aircraft. The servicing instructions provide procedures and precautions necessary to service the aircraft.

2-87. FUEL HANDLING PRECAUTIONS.

Table 2-2, Fuel Quantity Data, lists the quantity and capacity of fuel tanks in the aircraft. Service the fuel tanks after each flight to keep moisture out of the tanks and to keep the bladder type cells from drying out. Observe the following precautions:

WARNING

During warm weather open fuel caps slowly to prevent being sprayed with fuel.

WARNING

When aviation gasoline is used in a turbine engine, extreme caution should be used when around the combustion chamber and exhaust area to avoid cuts or abrasions. The exhaust deposits contain lead oxide which will cause lead poisoning.

CAUTION

Proper procedures for handling JP-4 and JP-5 fuel cannot be over stressed. Clean, fresh fuel shall be used and the entrance of water into the fuel storage or aircraft fuel system must be kept to a minimum.

CAUTION

When conditions permit, the aircraft shall be positioned so that the wind will carry the fuel vapors away from all possible sources of ignition. The fuel vehicle shall be positioned to maintain a minimum distance of 10 feet from any part of the aircraft, while maintaining a minimum distance of 20 feet between the fueling vehicle and the fuel filler point.

a. Shut off unnecessary electrical equipment on the aircraft, including radar and radar equipment. The master switch may be left on, to monitor fuel quantity gages, but shall not be moved during the fueling operation. Do not allow operation of any electrical tools, such as drills or buffers, in or near the aircraft during fueling.

b. Keep fuel servicing nozzles free of snow, water, and mud at all times.

c. Carefully remove snow, frost, water, and ice from the aircraft fuel filler cap area before removing the fuel filler cap (fig. 2-29). Remove only one aircraft tank filler cap at any one time, and replace each one immediately after the servicing operation is completed.

d. Drain water from fuel tanks, filter cases, and pumps prior to first flight of the day. Preheat, when required, to insure free fuel drainage.

e. Avoid dragging the fueling hose where it can damage the soft, flexible surface of the deicer boots.

f: Observe NO SMOKING precautions.

g. Prior to transferring the fuel, insure that the hose is grounded to the aircraft.

h. Wash off spilled fuel immediately.

i. Handle the fuel hose and nozzle cautiously to avoid damaging the wing skin.

j. Do not conduct fueling operations within 100 feet of energized airborne radar equipment or within 300 feet of energized ground radar equipment installations.

k. Wear only nonsparking shoes near aircraft or fueling equipment, as shoes with nailed soles or metal heel plates can be a source of sparks.

2-88. FILLING FUEL TANKS.

WARNING

Prior to removing the fuel tank filler cap, the hose nozzle static ground wire shall be attached to the grounding lugs that are located adjacent to the filler opening.

Fill tanks as follows:

a. Attach bonding cables to aircraft.

b. Attach bonding cable from hose nozzle to ground socket adjacent to fuel tank being filled.

CAUTION

Do not insert fuel nozzle completely into fuel cell due to possible damage to bottom of fuel cell.

c. Fill main tank before filling respective auxiliary tanks unless less than a full fuel load is desired.

d. Secure applicable fuel tank filler cap. Make sure latch tab on cap is pointed aft.

e. Disconnect bonding cables from aircraft.

2-89. DRAINING MOISTURE FROM FUEL SYSTEM.

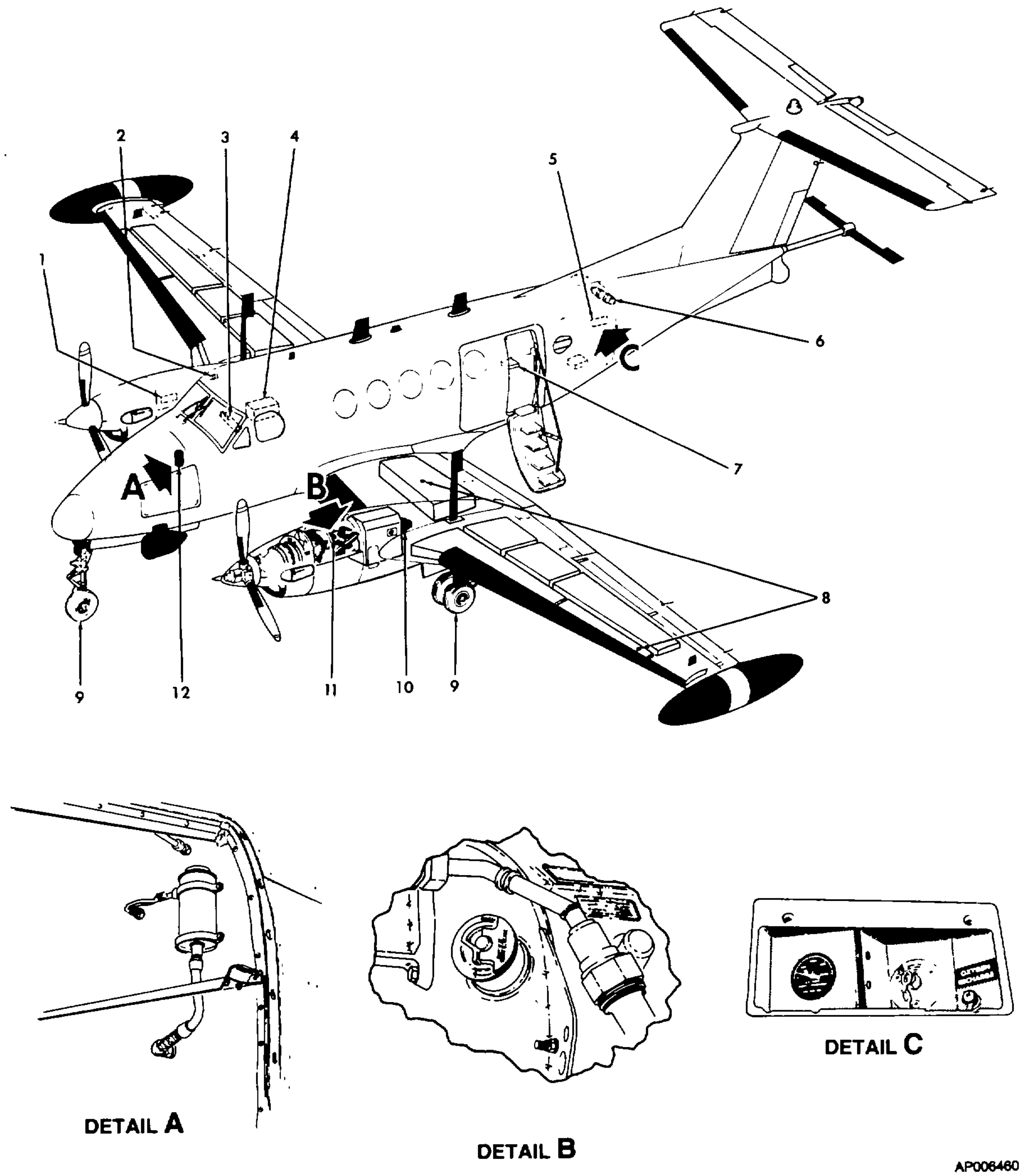
To remove moisture and sediment from the fuel system, 12 fuel drains are installed (plus one for the ferry system, when installed).

2-90. FUEL TYPES.

Approved fuel types are as follows:

a. Army Standard Fuels. Army standard fuel is JP-4.

b. Alternate Fuels. Army alternate fuels are JP-5 and JP-8.



1. Air conditioning compressor
2. External power receptacle
3. Hand fire extinguisher
4. Battery 24 VDC
5. Oxygen system filler
6. Oxygen cylinders 2 (64 cu ft bottles)
7. Electric toilet
8. Fuel filler caps (typical left and right)
9. Landing gear tires
10. Engine fire extinguisher
11. Engine oil filler cap (typical left and right)
12. Wheel brake fluid reservoir

Figure 2-29. Servicing Locations

Table 2-7. Fuel, Lubricants, Specifications and Capacities

SYSTEM	SPECIFICATION	CAPACITY
Fuel	MIL-T-5624 (JP-4 and JP-5) MIL-T-83133 (JP-8)	542 U.S. Gals.
Engine Oil	MIL-L-23699	10 U.S. Quarts per Engine
Hydraulic Brake System	MIL-H-5606	1 U.S. Pint
Oxygen System	MIL-O-27210	128 Cubic Feet
Toilet Chemical	Monogram DG-19	3 Ounces
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Table 2-8. Approved Fuels
Table 2-8. Approved Fuels

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL	
US MILITARY FUEL NATO Code No.	JP4 (MIL-T-5624) NATO F-40 (Wide Cut Type)	JP-5 (MIL-T-5624) NATO F-44 (High Flash Type)	JP-8 (MIL-T-83133) NATO F-34
COMMERCIAL FUEL	JET B	JET A	JET A-1
(ASTM-D-1655)	American JP-4	American Type A	
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield	Arcojet B	Arcojet A	Arcojet A-1
Richfield Div.		Richfield A	Richfield A-1
B.P. Trading	B.P.A.T.G.		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet-B		Caltex Jet A-1
Cities Service Co.		CITGO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Co. USA	EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	*Aeroshell JP-4*	*Aeroshell 640*	*Aeroshell 650*
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Chevron A-1
Texaco	Texaco Avjet B	Avjet B	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	
Foreign Fuel	NATO F-40	NATO F-44	
Belgium	BA-PF-2B		
Canada	3GP-22F	3-6P-24e	
Denmark	JP-4 MIL-T-5624		
France	Air 3407A		
Germany (West)	VTL-9130-006	UTL-9130-007/UTL-9130-010	
Greece	JP-4 MIL-T-5624		
Italy	AA-M-C-1421	AMC-143	
Netherlands	JP-4 MIL-T-5624	D. Eng RD 2493	
Norway	JP-4 MIL-T-5624		
Portugal	JP-4 MIL-T-5624		
Turkey	JP4 MIL-T-5624		
United Kingdom (Britain)	D. Eng RD 2454	D. Eng RD 2498	

Table 2-8. Approved Fuels (Continued)

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL
NOTE Anti-icing and Biocidal Additive for Commercial Turbine Engine Fuel - The fuel system icing inhibitor shall conform to MIL-L-27686. The additive provides anti-icing protection and also functions as a biocide to kill microbial growths in aircraft fuel systems. Icing inhibitor conforming to MIL-L-27686 shall be added to commercial fuel, not containing an icing inhibitor, during refueling operations, regardless of ambient temperatures. Refueling operations shall be accomplished in accordance with accepted commercial procedures.		
BT00199		

Table 2-9. Standard, Alternate and Emergency.

ENGINE	ARMY STANDARD FUEL	ALTERNATE TYPE	EMERGENCY FUEL	
			TYPE	*MAX HOURS
PT6A	MIL-T-5624 Grade JP-4	MIL-T-5624 Grade JP-5 MIL-T-83133 Grade JP-8	MIL-G-5572 Any AV Gas	150
* Maximum operating hours with indicated fuel between engine overhauls (TBO). BT00989				

c. Emergency Fuel. Avgas is emergency fuel and subject to 150 hour time limit.

2-91. USE OF FUELS.

Fuel is used as follows:

a. Fuel Mixture. Standard and alternate fuels may be mixed in any ratio. Emergency fuels may be mixed in any ratio with standard and alternate fuels, however, use of the lowest octane rating available is suggested. Use of emergency fuel is subject to a 150 hour time limit.

b. Use of Kerosene Fuels. The use of kerosene fuels (JP-5 type) in turbine engines dictates the need for observance of special precautions. Both ground starts and air restarts at low temperature may be more difficult due to low vapor pressure. Kerosene fuels having a freezing point of minus 40 degrees C (minus 40 degrees F) limit the maximum altitude of a mission to 28,000 feet under standard day conditions.

c. Mixing of Fuels in Aircraft Tanks. When changing from one type of authorized fuel to another, for example JP-4 to JP-5, it is not necessary to drain the aircraft fuel system before adding the new fuel.

d. Fuel Specifications. Fuels having the same NATO code number are interchangeable. Jet fuels conforming to ASTM D-1655 specification may be used when MIL-T-5624 fuels are not available. This usually occurs during cross country flights where aircraft using NATO F-44 (JP-5) are refueling with NATO F-40 (JP-4) or Commercial ASTM Type B fuels. Whenever this condition occurs, the engine operating characteristics may change in that lower operating temperature, slower acceleration, lower engine speed, easier starting, and shorter range may be experienced. The reverse is true when changing from F-40 (JP-4) fuel to F-44 (JP-5) or Commercial ASTM Type A-1 fuels. Most commercial turbine engines will operate satisfactorily on either kerosene or JP-4 type fuel. The difference in specific gravity may possibly require fuel control adjustments; if so, the recommendations of the manufacturers of the engine and airframe are to be followed.

2-92. SERVICING OIL SYSTEM.

An integral oil tank occupies the cavity formed between the accessory gearbox housing and the compressor inlet case on the engine. The tank has a calibrated oil dipstick and an oil drain plug. Avoid spilling oil. Any oil spilled must be removed immediately. Use a cloth moistened in solvent to remove oil. Overfilling may cause a discharge of oil through the accessory gearbox breather until a satisfactory level is reached. Service oil system as follows:

1. Open the access door on the upper cowling to gain access to the oil filler cap and dipstick.

CAUTION

A cold oil check is unreliable. If possible, check oil within 10 minutes after engine shutdown. If over 10 minutes have elapsed, motor the engine (starter only) for 15-20 seconds, then recheck. If over 10 hours have elapsed, start the engine and run for 2 minutes, then recheck. Add oil as required. Do not overfill.

2. Remove oil filler cap.

3. Insert a clean funnel, with a screen incorporated, into the filler neck.

4. Replenish with oil to within 1 quart below MAX mark or the MAX COLD on dipstick (cold engine). Fill to MAX or MAX HOT (hot engine).

5. Check oil filler cap for damaged preformed packing, general condition and locking.

CAUTION

Insure that oil filler cap is correctly installed and securely locked to prevent loss of oil and possible engine failure.

6. If oil level is over 2 quarts low, motor or run engine as required, and service as necessary.

7. Install and secure oil filler cap.

8. Check for any oil leaks.

2-93. SERVICING HYDRAULIC BRAKE SYSTEM RESERVOIR.

1. Gain access to brake hydraulic system reservoir.

2. Remove brake reservoir cap and fill reservoir to washer on dipstick with hydraulic fluid.

3. Install brake reservoir cap.

2-94. INFLATING TIRES.

Inflate tires as follows:

1. Inflate nose wheel tires to a pressure between 55 and.60 PSI.

2. Inflate main wheel tires to a pressure between 73 and 77 PSI.

2-95. SERVICING THE ELECTRIC TOILET.

The toilet should be serviced during routine ground maintenance of the aircraft following any usage. It is more efficient and convenient to remove, clean and recharge the toilet tank on a regular basis than to wait until the tank is filled to capacity. Instructions for servicing are provided on a decal applied to the front side of the removable tank. Instructions are as follows:

a. Tank Removal.

1. Open front access to the toilet, as applicable, to remove the toilet tank.

2. Depress the lock ring of the flush hose quick disconnect coupling located on the right side at the front of the tank top.

3. Drain any residue of flush fluid in the hose by partially disengaging the plug from the quick disconnect and manipulating the hose to assist drainage.

4. Remove the flush hose from the quick disconnect and place hose in the retaining clip located on the underside of the toilet mounting plate.

5. Install the cap attached to the quick disconnect to seal the coupling.

6. Close the knife valve at the bottom of the toilet bowl by pushing the actuator handle until the valve is fully closed.

7. Press the two fasteners on each side of the knife valve actuator to unlock the tank.

8. Remove the tank by pulling the recessed carrying handle on the tank top.

b. Tank Cleaning.

1. Dispose of tank contents by holding the tank upside-down over a sewer or toilet and pull the knife valve actuator handle, opening the valve and allowing the tank to drain.

2. Rinse the tank by filling one-half full with water. Close the knife valve and shake vigorously. Drain tank as in previous step.

NOTE

Commercial detergents and disinfectants can be included in the rinse water if desired. However, do not include these materials in the tank precharge.

3. Rinse and drain the tank several times to insure that the tank is thoroughly clean.

4. Wipe the exterior surfaces of the tank using a cloth moistened with clear water and disinfectant.

c. Tank Precharge.

Caution

During freezing temperatures, toilet shall be serviced with antifreeze solution to prevent damage.

Charge the tank with a mixture of water and chemical according to chemical manufacturer's specification.

d. Tank Installation.

1. Install the tank by inserting the slides located on each side of the knife valve into the slide plate assembly on the bottom of the toilet and slide tank into place.

2. Press the two fasteners to the first detent to secure the tank.

3. Remove the cap in the flush hose quick disconnect and connect the hose coupling to the quick disconnect. Lock the disconnect lock ring.

4. Pull the knife valve actuator to fully open the valve.

5. Lift the toilet seat and shroud assembly from the top of the toilet and wipe with cloth moistened with clear water and disinfectant. Wipe the bowl and surrounding area.

6. Check flushing operation of the toilet and check for leaks.

7. Close access to the toilet.

2-96. ANTI-ICING, DEICING AND DEFROSTING PROTECTION.

The aircraft is protected in subfreezing weather by spraying the surfaces (to be covered with protective covers) with defrosting fluid. Spraying defrosting fluid on aircraft surfaces before installing protective covers will permit protective covers to be removed with a minimum of sticking. To prevent freezing rain and snow from blowing under protective covers and diluting the fluid, insure that protective covers are fitted tightly. As a deicing measure, keep exposed aircraft surface wet with fluid for protection against frost.

NOTE

Do not apply anti-icing, deicing and defrosting fluid to exposed aircraft surfaces if snow is expected. Melting snow will dilute the defrosting fluid and form a slush mixture which will freeze in place and become difficult to remove.

Use undiluted anti-icing, deicing, and defrosting fluid (MIL-A-8243) to treat aircraft surfaces for protection against freezing rain and frost. Spray aircraft surface sufficiently to wet area, but without excessive drainage. A fine spray is recommended to prevent waste. Use diluted, hot fluid to remove ice accumulations.

1. Remove frost or ice accumulations from aircraft surfaces by spraying with diluted anti-icing, deicing, and defrosting fluid mixed in accordance with Table 2-10.

2. Spray diluted, hot fluid in a solid stream (not over 15 gallons per minute). Thoroughly saturate aircraft surface and remove loose ice. Keep a sufficient quantity of diluted, hot fluid on aircraft surface coated with ice to prevent liquid layer from freezing. Diluted, hot fluid should be sprayed at a high pressure, but not exceeding 300 PSI.

3. When facilities for heating are not available and it is deemed necessary to remove ice accumulations from aircraft surfaces, undiluted defrosting fluid may be used. Spray undiluted defrosting fluid at 15 minute intervals to assure complete coverage. Removal of ice accumulations using undiluted defrosting fluid in expensive and slow.

4. If tires are frozen to ground, use undiluted defrosting fluid to melt ice around tire. Move aircraft as soon as tires are free. Recommended Fluid Dilution Chart

Table 2-10. Recommended Fluid Dilution Chart

AMBIENT TEMPERATURE (°F)	PERCENT DEFROSTING FLUID BY VOLUME	PERCENT WATER BY VOLUME	FREEZING POINT OF MIXTURE (°F) (APPROXIMATE)
30° and above	20	80	10°
20°	30	70	0°
10°	40	60	-15°
0°	45	55	-25°
-10°	50	50	-35°
-20°	55	45	-45°
-30°	60	40	-55°

1. Use anti-icing and deicing fluid (MIL-A-8243) or commercial fluids.
2. Heat mixture to a temperature or 82° to 93°C (180° to 200°F).

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2-97. APPLICATION OF EXTERNAL POWER.

CAUTION

Before connecting the power cables from the external power source to the aircraft, insure that the GPU is not touching the aircraft at any point. Due to the voltage drop in the cables, the two ground systems will be of different potentials. Should they come in contact while the GPU is operating, arcing could occur. Turn off all external power while connecting the power cable to, or removing it from the external power supply receptacle. Be certain that the polarity of the external power source is the same as that of the aircraft before it is connected. For GPU power requirements, consult the Maintenance Manual.

An external power source is often needed to supply the electric current required to properly ground service the aircraft electrical equipment and to facilitate starting the aircraft's engines. An external DC power receptacle is installed on the outboard side of the right engine nacelle. An external AC power receptacle is installed on the outboard side of the left engine nacelle.

2-98. SERVICING OXYGEN SYSTEM.

The oxygen system furnishes breathing oxygen to the pilot, copilot and first aid position. Figure 2-19 shows the location of oxygen cylinder.

a. Oxygen System Safety Precautions.

WARNING

Keep fire and heat away from oxygen equipment. Do not smoke while working with or near oxygen equipment, and take care not to generate sparks with carelessly handled tools when working on the oxygen system.

(1) Keep oxygen regulators, cylinders, gages, valves, fittings, masks, and all other components of the oxygen system free of oil, grease, gasoline, and all other readily combustible substances. The utmost care shall be exercised in servicing, handling, and inspecting the oxygen system.

(2) Do not allow foreign matter to enter oxygen lines.

(3) Never allow electrical equipment to come in contact with the oxygen cylinder.

(*4*) Never use oxygen from a cylinder without first reducing its pressure through a regulator.

b. Replenishing Oxygen System.

1. Remove oxygen access door on outside of aircraft (fig. 2-29).
2. Remove protective cap on oxygen system filler valve.
3. Attach oxygen hose from oxygen servicing unit to filler valve.

WARNING

If the oxygen system pressure is below 200 PSI, do not attempt to service system. Make an entry on DA Form 2408-13.

4. Insure that supply cylinder shutoff valves on the aircraft are open.
5. Fill system slowly to prevent overheating by adjusting recharging rate with pressure regulating valve on oxygen servicing unit.
6. Close pressure regulating valve on oxygen servicing unit when pressure gage on oxygen system indicates the pressure obtained using the Oxygen System Servicing Pressure Chart (fig. 2-30).

NOTE

Fill oxygen system to 1800 PSI at 70°F. For every degree above 70°, increase pressure 3.5 PSI to a maximum of 2000 PSI; and for every degree F below 70°, decrease pressure 3.5 PSI.

7. Disconnect oxygen hose from oxygen servicing unit and filler valve.
8. Install protective cap on oxygen filler valve.
9. Install oxygen access door.

2-99. GROUND HANDLING.

Ground handling covers all the essential information concerning movement and handling (fig. 2-31) of the aircraft while on the ground. The following paragraphs give, in detail, the instructions and precautions necessary to accomplish ground handling functions.

a. General Ground Handling Procedure. Accidents resulting in injury to personnel and damage to equipment can be avoided or minimized by close observance of existing safety standard and recognized ground handling procedures. Carelessness or insufficient knowledge of the aircraft or equipment being handled can be fatal. The applicable technical manuals and pertinent directives should be studied for familiarization with the aircraft, its components, and the ground handling procedures applicable to it, before attempting to accomplish ground handling.

b. Ground Handling Safety Practice. Aircraft equipped with turboprop engines require additional maintenance safety practices. The following list of safety practices should be observed at all times to prevent possible injury to personnel and/or damaged or destroyed aircraft:

(1) Keep intake air ducts free of loose articles such as rags, tools, etc.

(2) Stay clear of exhaust outlet areas.

(3) During ground runup, make sure the brakes are firmly set.

(4) Keep area fore and aft of propellers clear of maintenance equipment.

(5) Do not operate engines with control surfaces in the locked position.

(6) Do not attempt towing or taxiing of the aircraft with control surfaces in the locked position.

(7) When high winds are present, do not unlock the control surfaces until prepared to operate them.

(8) Do not operate engines while towing equipment is attached to the aircraft, or while the aircraft is tied down.

(9) Check the nose wheel position. Unless it is in the centered position, avoid operating the engines at high power settings.

(10) Hold control surfaces in the neutral position when the engines are being operated at high power settings.

(11) When moving the aircraft, do not push on propeller deicing boots. Damage to the heating elements may result.

c. Moving Aircraft on Ground. Aircraft on the ground shall be moved in accordance with the following:

(1) Taxiing. Taxiing shall be in accordance with Chapter 8.

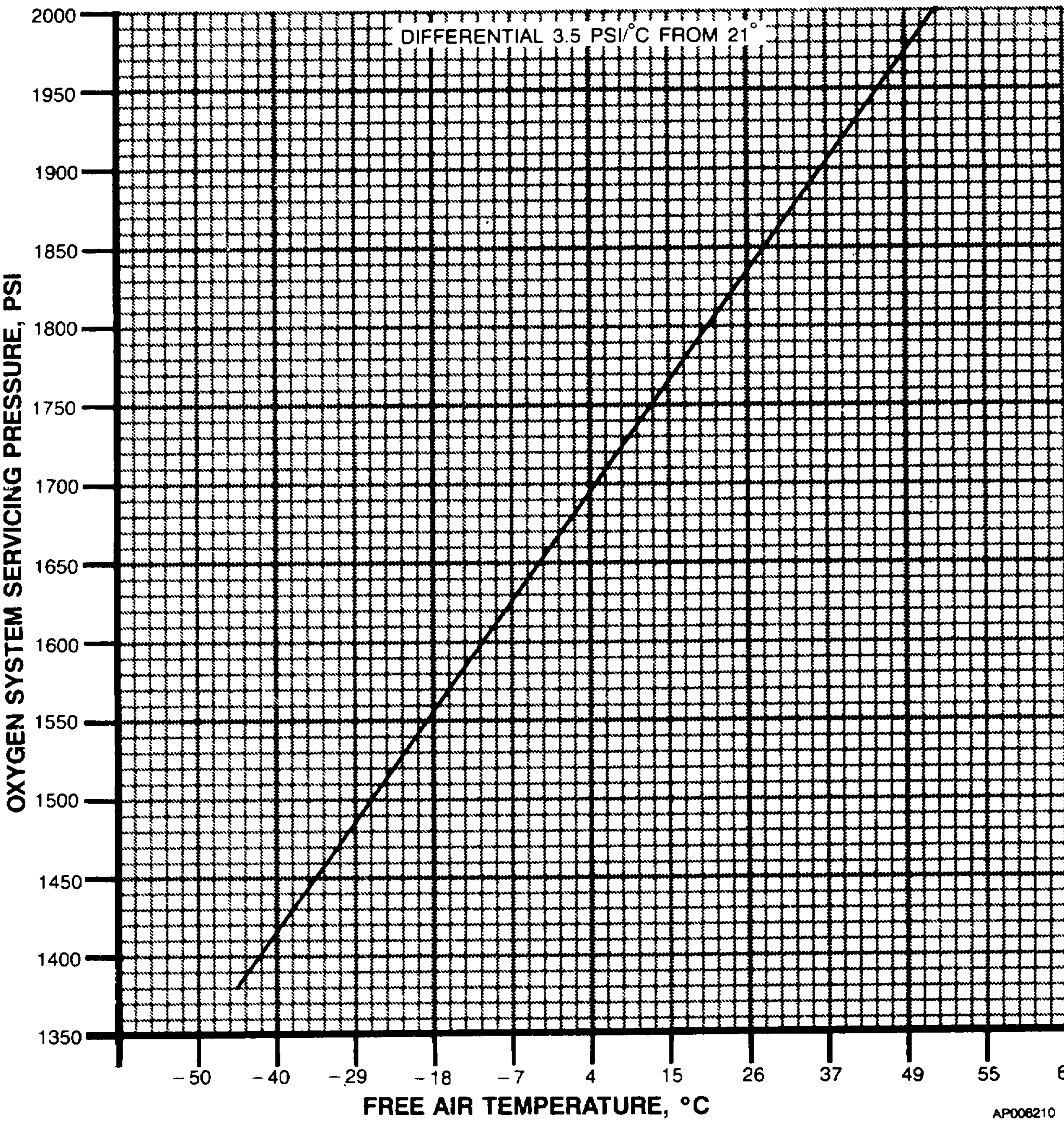


Figure 2-30. Oxygen System Servicing Pressure

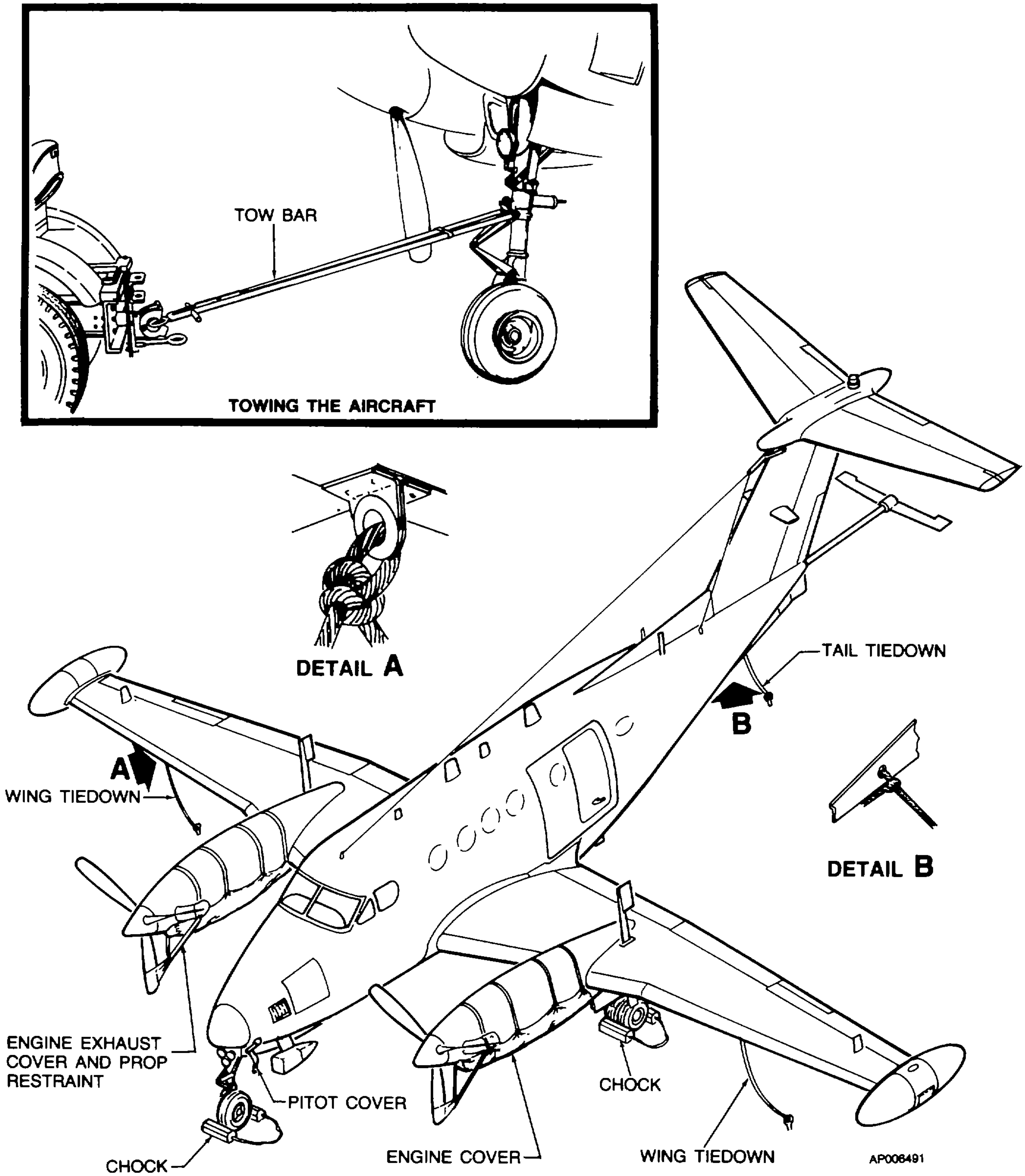


Figure 2-31. Parking, Covers, Ground Handling, & Towing Equipment

CAUTION

When the aircraft is being towed, a qualified person must be in the pilot's seat to maintain control by use of the brakes. When towing, do not exceed nose gear turn limits. Avoid short radius turns, and always keep the inside or pivot wheel turning during the operation. Do not tow aircraft with rudder locks installed, as severe damage to the nose steering linkage can result. When moving the aircraft backwards, do not apply the brakes abruptly. Tow the aircraft slowly, avoiding sudden stops, especially over snowy, icy rough, soggy, or muddy terrain. In arctic climates, the aircraft must be towed by the main gears, as an immense breakaway load, resulting from ice, frozen tires, and stiffened grease in the wheel bearings may damage the nose gear.

CAUTION

Do not tow or taxi aircraft with deflated shock struts.

(2) Towing. Towing lugs are provided on the upper torque knee fitting of the nose strut. When it is necessary to tow the aircraft with a vehicle, use the vehicle tow bar. In the event towing lines are necessary, use towing lugs on the main landing gear. Use towing lines long enough to clear nose and/or tail by at least 15 feet. This length is required to prevent the aircraft from overrunning the towing vehicle or fouling the nose gear.

d. Ground Handling Under Extreme Weather Conditions. Extreme weather conditions necessitate particular care in ground handling of the aircraft. In hot, dry, sandy, desert conditions, special attention must be devoted to finding a firmly packed parking and towing area. If such areas are not available, steel mats or an equivalent solid base must be provided for these purposes. In wet, swampy areas, care must be taken to avoid bogging down the aircraft. Under cold, icy, arctic conditions, additional mooring is required, and added precautions must be taken to avoid skidding during towing operations. The particular problems to be encountered under adverse weather conditions and the special methods designed to avoid damage to the aircraft are covered by the various phases of the ground handling procedures included in this section of general ground handling instructions. (Refer to TM 55-1500-204-25/1.)

2-100. INSTALLATION OF PROTECTIVE COVERS.

The crew will insure that the aircraft protective covers are installed.

2-101. MOORING.

The aircraft is moored to insure its immovability, protection, and security under various weather conditions. The following paragraphs give, in detail, the instructions for proper mooring of the aircraft.

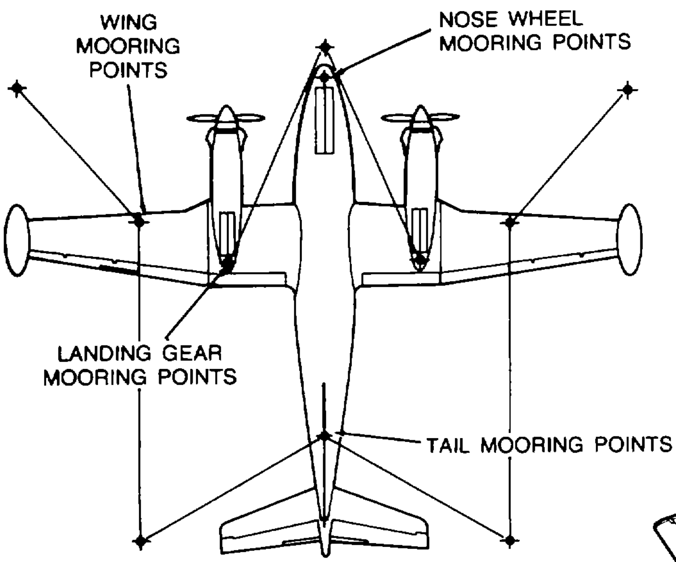
a. Mooring Provisions. Mooring points (fig. 2-32) are provided beneath the wings and tail. Additional mooring cables may be attached to each landing gear. General mooring equipment and procedures necessary to moor the aircraft, in addition to the following, are given in TM 55-1500-204-25/1.

(1) Use mooring cables of 1/4 inch diameter aircraft cable and clamp (clip-wire rope), chain or rope 3/8 inch diameter or larger. Length of the cable or rope will be dependent upon existing circumstances. Allow sufficient slack in ropes, chains, or cable to compensate for tightening action due to moisture absorption of rope or thermal contraction of cable or chain. Do not use slip knots. Use bowline knots to secure aircraft to mooring stakes.

(2) Chock the wheels.

b. Mooring Procedures for High Winds. Structural damage can occur from high velocity winds; therefore, if at all possible, the aircraft should be moved to a safe weather area when winds above 75 knots are expected. If aircraft must be secured use the following steps:

1. After aircraft is properly located, place nose wheel in centered position. Head aircraft into the wind, or as nearly so as is possible within limits determined by locations of fixed mooring rings. When necessary, a 45 degree variation of direction is considered to be satisfactory. Locate each aircraft at slightly more than wing span distance from all other aircraft. Position nose mooring point approximately 3 to 5 feet downwind from ground mooring anchors.
2. Deflate nose wheel shock strut to within 3/4 inch of its fully deflated position.
3. Fill all fuel tanks to capacity, if time permits.
4. Place wheel chocks fore and aft of main gear wheels and nose wheel. Tie each pair of chocks together with rope



NOTE

IF STRONG WINDS ARE ANTICIPATED OR AIRCRAFT IS TO BE LEFT UNATTENDED, PROPELLER RESTRAINT, PITOT MAST, AND INTAKE COVERS MUST BE INSTALLED, AND THE FLIGHT CONTROLS LOCK ENGAGED.

BEFORE TOWING, THE PROPELLER RESTRAINT MUST BE INSTALLED WITH ONE PROPELLER BLADE IN THE DOWN POSITION AS SHOWN.

THE USE OF DOUBLE OR SINGLE MOORING POINTS FOR NOSE AND/OR WING TIEDOWN IS DETERMINED BY LOCAL OPTION DEPENDING ON TYPE AND AVAILABILITY OF AIRCRAFT SECURING EQUIPMENT.

USE ROPE ONLY (NYLON TYPE IF AVAILABLE) FOR NOSE TIEDOWN (DETAIL A). ATTACH ROPE(S) TO AIRCRAFT AND GROUND MOORING POINTS IN A MANNER THAT WILL PREVENT ROPE DAMAGE TO AIRCRAFT COMPONENTS.

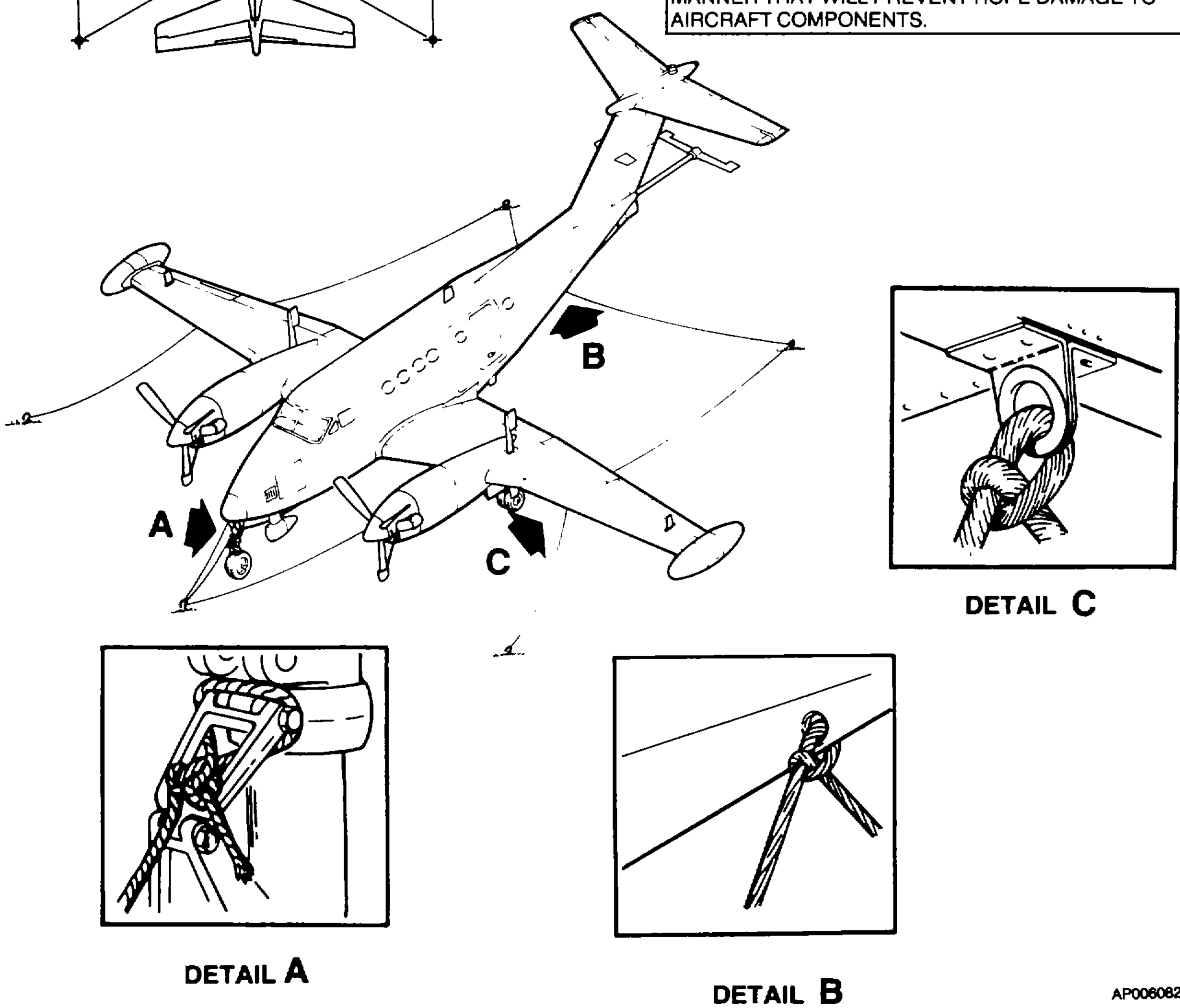


Figure 2-32. Mooring the Aircraft

or join together with wooden cleats nailed to chocks on either side of wheels. Tie ice grip chocks together with rope. Use sandbags in lieu of chocks when aircraft is moored on steel mats. Set parking brake as applicable.

5. Accomplish aircraft tiedown by utilizing mooring points shown in figure 2-32. Make tiedown with 1/4 inch aircraft cable, using two wire rope clips or bolts, and a chair tested for a 3000 pound pull. Attach tiedowns so as to remove all slack. (Use a 3/4-inch or larger manila rope if cable or chain tiedown is not available.) If rope is used for tiedown, use anti-slip knots, such as bowline knot, rather than slip knots. In the event tiedown rings are not available on hard surfaced areas, move aircraft to an area where portable tiedowns can be used. Locate anchor rods at point shown in figure 2-31. When anchor kits are not available, use metal stakes or deadman type anchors, providing they can successfully sustain a minimum pull of 3000 pounds.
6. In event nose position tiedown is considered to be of doubtful security due to existing soil condition, drive additional anchor rods at nose tiedown position. Place padded work stand or other suitable support under the aft fuselage tiedown position and secure.
7. Place control surfaces in neutral position. Place wing flaps in up position.
8. The requirements for dust excluders, protective covers, and taping of openings will be left to the discretion of the responsible maintenance officer or the pilot of the transient aircraft (fig. 2-31).
9. Secure propellers to prevent windmilling.
10. Disconnect battery.
11. During typhoon or hurricane wind conditions, mooring security can be further increased by placing sandbags along the wings to break up the aerodynamic flow of air over the wing, thereby reducing the lift being applied against the mooring by the wind. The storm appears to pass two times, each time with a different wind direction. This will necessitate turning the aircraft after the first passing.
12. After high winds, inspect aircraft for visible signs of structural damage and for evidence of damage from flying objects. Service nose shock strut and reconnect battery.

2-102. PARKING.

Parking is defined as the normal condition under which the aircraft will be secured while on the ground. This condition may vary from the temporary expedient of setting the parking brake and chocking the wheels to the more elaborate mooring procedures described under Mooring. The proper steps for securing the aircraft must be based on the time the aircraft will be left unattended, the aircraft weights, the expected wind direction and velocity, and the anticipated availability of ground and air crews for mooring and/or evacuation. When practical head the aircraft into the wind, especially if strong winds are forecast or if it will be necessary to leave the aircraft overnight. Set the parking brake and chock the wheels securely. Following engine shutdown, position and engage the control locks.

NOTE

Cowlings and loose equipment will be suitably secured at all times when left in an unattended condition.

a. The parking brake system for the aircraft incorporates two lever-type valves, one for each wheel brake. Both valves are closed simultaneously by pulling out the parking brake handle. Operate the parking brake as follows:

1. Depress both brakes.
2. Pull parking brake handle out. This will cause the parking brake valves to lock the hydraulic fluid under pressure in the parking brake system, thereby retaining braking action.
3. Release brake pedals.

CAUTION

Do not set parking brakes when the brakes are hot during freezing ambient temperatures. Allow brakes to cool before setting parking brakes.

4. To release the parking brakes push in on the parking brake handle.

b. The control lock (fig. 2-17) holds the engine and propeller control levers in a secure position, and the elevator, rudder, and aileron in neutral position. Install the control locks as follows:

1. With engine and propeller control levers in secure position, slide lock onto control pedestal to prevent operation of levers.
2. Install elevator and aileron lockpin vertically through pilot's control column to lock control wheel.
3. Install rudder lock pin through flapper door forward to pilot's seat, making sure rudder is in neutral position.
4. Reverse steps 1 through 3 above to remove control lock. Store control lock.

CHAPTER 3
AVIONICS

Section I. GENERAL

3-1. INTRODUCTION.

Except for mission avionics, this chapter covers all avionics equipment installed in the RC-12D aircraft. It provides a brief description of equipment covered, the technical characteristics and locations. It covers systems and controls and provides the proper techniques and procedures to be employed when operating the equipment. For more detailed operational information consult the vendor manuals that accompany the aircraft loose tools.

3-2. AVIONICS EQUIPMENT CONFIGURATION.

The aircraft avionics covered is comprised of three groups of electronic equipment. The Communication group consists of the Interphone, UHF command, VHF command and HF command systems. The Navigation group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position, and to make an approach on instruments under Instrument Meteorological Conditions (IMC). The Navigation group includes equipment for determining altitude, attitude, position, destination, range and bearing, heading reference, groundspeed, and drift angle. The Transponder and Radar group includes an identification, position and emergency tracking system, and a radar system to locate potentially dangerous weather areas and a radar system to differentiate between friendly and unfriendly search radar.

NOTE

All avionics equipment require a 3-minute warmup period. The weather radar has an automatic time delay of 3 to 4 minutes.

3-3. POWER SOURCE.

a. DC Power. DC power for the avionics equipment is provided by four sources: the aircraft battery, left and right generators, and external power. Power is routed through a 50-ampere circuit breaker to the avionics power relay which is controlled by the AVIONICS MASTER POWER SWITCH (fig. 2-18) on the overhead control panel. Individual system circuit breakers and the associated avionics busses are shown in fig. 2-22. With the switch in the ON position, the avionics power relay is de-energized and power is applied through both the AVIONICS MASTER POWER #1 and #2 circuit breakers to the individual avionics circuit breakers on the overhead circuit breaker panel (fig. 2-26). In the off (aft) position, the relay is energized and power is removed from avionics equipment. When external power is applied to the aircraft, the avionics power relay is normally energized, removing power from the avionics equipment. To apply external power to the avionics equipment, move the AVIONICS MASTER POWER switch to the EXT PWR position. This will de-energize the avionics power relay and allow power to be applied to avionics equipment.

b. AC Power. AC power for the avionics equipment is provided by two inverters. The inverters supply 115-volt and 26-volt single-phase AC power when operated by the INVERTER #1 or #2 switches (fig. 2-18). Either inverter is capable of powering all avionics equipment requiring AC power. AC power from the inverters is routed through fuses in the nose avionics compartment.

3-4. MICROPHONES, SWITCHES AND JACKS.

Boom, and oxygen mask microphones can be utilized in the aircraft.

a. Microphone Switches. The pilot and copilot are provided with individual MIC control switches, placarded MIC/INTPH/XMIT, attached to respective control wheels. A foot-actuated mic switch is also positioned on the floorboards forward of each pilot's seat.

b. Controls and Functions. Microphone switches and jack functions are as follows:

(1) Control wheel switches (fig. 2-16).

CONTROL	FUNCTION
MIC/INTPH XMIT switch	Keys selected facility.
MIC	(Not depressed) Microphone is disconnected.

INTPH	(depressed to first detent) Keys interphone facility, disregards position transmitter selector switch.
XMIT	(depressed full down) Keys facility selected by transmitter select switch.

(2) Floorboard switches.

CONTROL	FUNCTION
MIC foot switch	Controls connection of selected mic to audio system.
Held depressed	Connects selected mic to audio system.
Released	Disconnects selected mic from audio system.

(3) Subpanel jack selector switches.

CONTROL	FUNCTION
MIC HEADSET/ OXYGEN MASK	Selects microphone to connect to audio system switch
MIC HEADSET	Connects headset microphone to audio system.
OXYGEN MASK	Connects microphone of oxygen mask to audio system.

Section II. COMMUNICATIONS

3-5. DESCRIPTION.

The communications equipment group is comprised of an interphone system connected to individual Audio Control Panels for the pilot and copilot which interface with VHF, UHF and HF communication units.

3-6. AUDIO CONTROL PANELS (FIG. 3-1).

a. Description. Separate but identical audio control panels serve the pilot and copilot. The controls and switches of each panel provide the user with a means to select desired reception and transmission sources, and also a means to control the volume of audio signals sent and received for interphone, communication and navigation systems. The user selects between the UHF, VHF and HF transceivers. Audio control panels are protected by respective 2-ampere AUDIO PILOT and AUDIO COPILOT circuit breakers positioned on the overhead circuit breaker panel (fig. 2-26).

b. Controls and Indicators.

(1) Audio controls - Comm and Nav Radios (fig. 3-1).

CONTROL/ INDICATOR	FUNCTION
Master VOL control	Controls sidetone volume to headset. Also serves as final volume adjustment for received audio from any source before admission to headset.
Comm radios audio controls	Each is combination rotary control and "ON-OFF" push-pull switch, permitting both receiver selection and volume adjustment.
1	ON connects user's headset to audio from VHF-AM transceiver No. 1.
2	ON connects user's headset to audio from VHF/AM/FM transceiver.
3	ON connects user's headset to audio from command UHF transceiver in use.
4	ON connects user's headset to audio from HF or VOW transceiver in use.
5	ON connects user's headset to audio from backup VOW transceiver.
NAV radios audio monitor controls	Combination volume control and "ON-OFF" switches for NAV receivers.
NAV-A	ON connects user's headset to audio from VOR-1, VOR-2 or set in use.
NAV-B	ON connects user's headset to audio from TACAN or ADF set in use.

(2) Microphone switches.

CONTROL	FUNCTION
Mic impedance select switch (5 Ohm/150 Ohm)	Two-position thumb-actuated switch. Enables selection of interface circuit with best impedence match to microphone used.

Microphone select switches	Controls activation of microphones.
HOT MIC	Admits speech to interphone system without need to key selected microphone.
NORM	Blocks speech from interphone system unless selected microphone is keyed.
ICS OFF	Deactivates microphones

(3) Transmitter select switch (fig. 3-1).

CONTROL	FUNCTION
Transmit interphone selector switch	Connects microphone and headset to selected radio transmitter or interphone line routing received audio to headset. Bypasses control of respective receiver audio switch.
PVT	Position not used.
ICS	Activates pilot-to-copilot intercom.
1	Permits audio reception from VHF-AM No. 1 transceiver. Routes key and mic signals to VHF-AM No. 1 transceiver.
2	Permits audio reception from VHF/AM/FM transceiver. Routes key and mic signals to VHF/AM/FM transceiver.
3	Permits audio reception from UHF transceiver. Routes key and mic signals to UHF transceiver.
4	Permits audio reception from HF or VOW transceiver. Routes key or mic signals to transceiver.
5	Permits audio reception from backup VOW. Routes key and mic signals to transceiver.

(4) CIPHER light - not used.

c. Normal Operation.

(1) Turn-on. Both Audio Control Panels are activated when electrical power is applied to aircraft.

NOTE

It is presumed the AVIONICS MASTER POWER switch is on, and that normally used avionic circuit breakers remain depressed. The circuit breakers of routinely used avionic systems are normally left depressed.

(2) Receive.

1. Receiver audio switches (Audio panel) - As required.
2. Master VOL control (Audio panel) - As required, in combination with volume control of system being utilized.

NOTE

Audio select switches and volume controls are routinely left in positions of normal use.

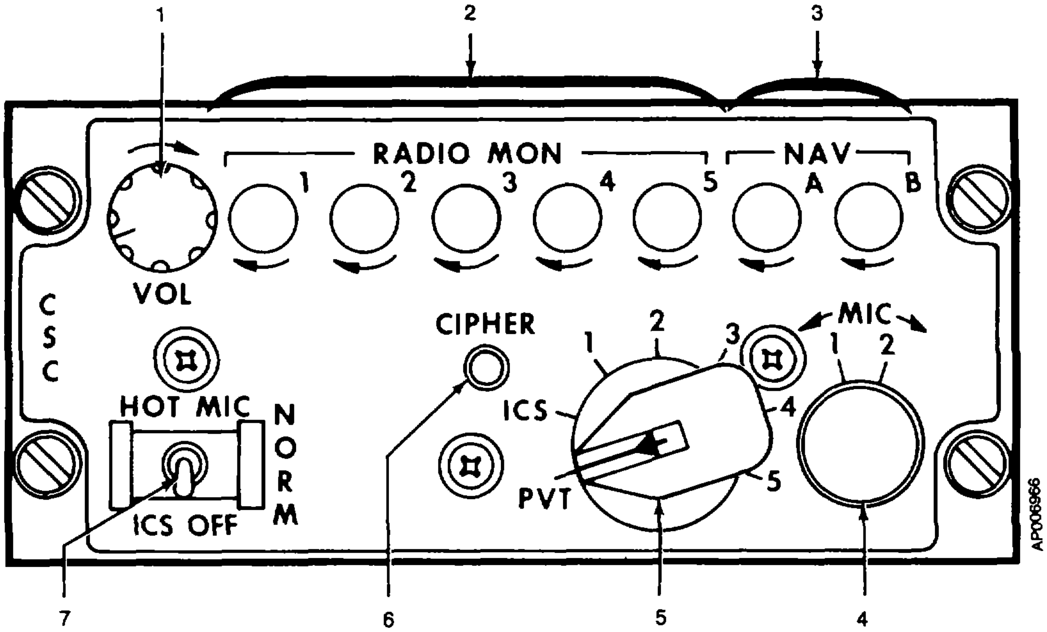
3. Move each receiver audio switch ON then OFF, separately, to verify audio presence in headphones for each system. Adjust volume.
4. Mic select switch - As desired.

(3) Transmit.

1. Transmitter-interphone selector (audio panel) - Set for transceiver desired.
2. MIC HEADSET/OXYGEN MASK switch (instrument panel) -As desired.
3. MIC/INTPH/XMIT switch (control wheel) - XMIT.
4. MIC switch (headset/oxygen mask/floorboards) -Depress to transmit.

(4) Intercommunication.

1. Transmitter-interphone selector (audio panel) -ICS.
2. MIC HEADSET/OXYGEN MASK switch (instrument panel) -As desired.
3. Mic select switch (audio panel - As desired (NORM/HOT MIC).
   a. If HOT MIC selected - Talk when ready.
   b. If NORM selected - Depress MIC switch and transmit.
   c. Master VOL control (selected transceiver) -Set for comfort.



1. Master VOL control
2. Radio audio monitor controls
3. NAV receivers audio monitor controls
4. MIC impedence matching switch
5. Transmit/interphone select switch
6. CIPHER indicator light (not used)
7. Microphone select switch

Figure 3-1. Audio Control Panel (C-499) (Typical pilot, copilot)

d. Emergency Operation. Not applicable.

e. Shutdown.

1. AVIONICS MASTER POWER switch (overhead panel) -OFF.
2. Leave avionic controls and circuit breakers positioned for normal operation.
3. Aircraft DC power - OFF.

3-7. RADIO CONTROL PANEL (FIG. 3-2).

a. Description. The radio control panel, located on the pedestal extension allows the pilot or copilot to selectively monitor audio signals from the High Frequency (HF), Marker Beacon (MKR BCN), or ADF systems. It also has controls for the selection of ADF voice or range filters. Controls and functions are as follows:

b. Controls and Indicators.

CONTROL	FUNCTION
HF VOL control	Adjusts volume of high-frequency radio signals received.
MKR BCN HI/ LO switch	Selects sensitivity of marker beacon receiver.
MKR BCN VOL control	Adjusts volume of marker beacon radio signals received.

(2) Automatic Direction Finding (ADF).

FILTER V/OFF switch	Selects filter to block voice transmissions from ADF ground station.
FILTER R/OFF switch	Selects filter to block range transmissions from ADF ground station.

3-8. UHF COMMAND SET (AN/ARC-164).

a. Description. The UHF command set is a line-of-sight radio transceiver which provides transmission and reception of amplitude modulated (AM) signals in the ultra high frequency range of 225.000 to 399.975 MHz for a distance range of approximately 50 miles. Channel selection is spaced at 0.025 MHz. A separate receiver is incorporated to provide monitoring capability for the UHF guard frequency (243.0 MHz). UHF audio output is applied to the audio panel where it is routed to the headsets.

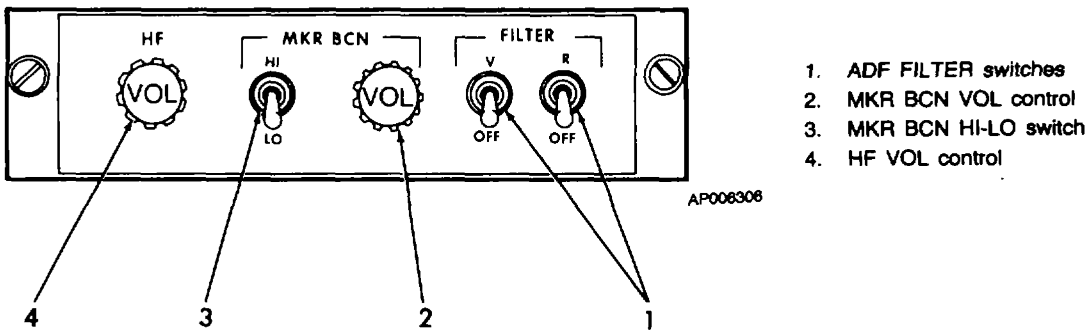


Figure 3-2. Radio Control Panel

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector is set to GUARD position. The receiver-transmitter will be set to the emergency frequency only.

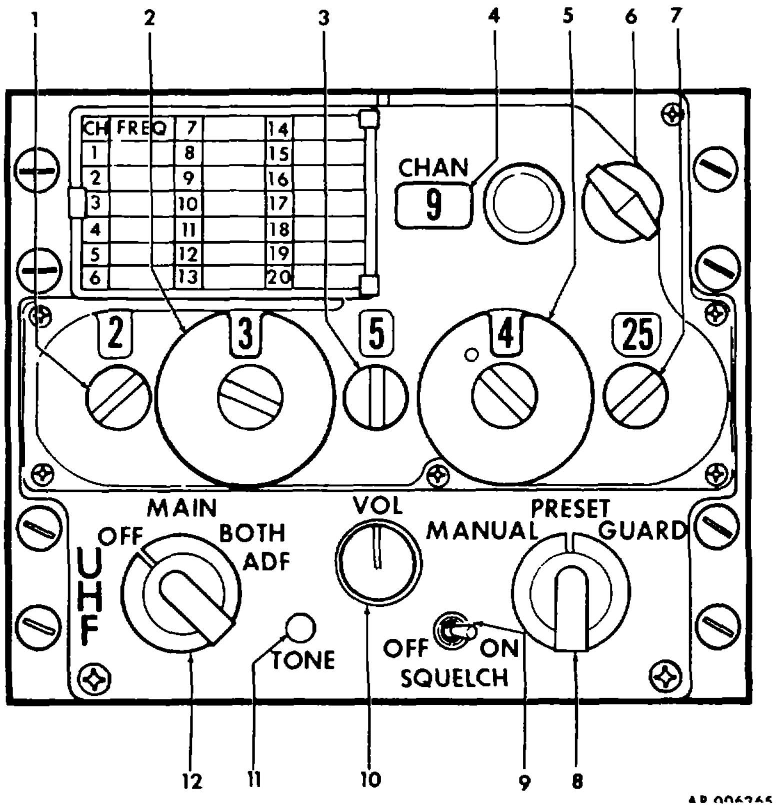
The transmit and receive sections of the UHF unit operate independently but share the same power supply and frequency control circuits.

Complete provisions only are installed for voice security device KY-28 or KY-58 to locate on the pedestal extension near the radio set. The UHF command set is protected by the 7 1/2 ampere UHF circuit breaker on the overhead circuit breaker panel (fig. 2-26). Figure 3-3 illustrates the UHF command set. The associated blade type antenna is shown in figure 2-1.

b. Controls and Indicators.

(1) UHF control panel fig. 3-3.

CONTROL	FUNCTION
Manual frequency selector (hundreds)	Selects hundreds digit of frequency (either 2 or 3) in MHz.
Manual frequency selector (tens)	Selects tens digit of frequency (O through 9) in MHz.
Manual frequency selector (units)	Selects units digit of frequency (O through 9) in MHz.
Manual frequency selector (tenths)	Selects tenths digit of frequency (O through 9) in MHz.
Manual frequency selector (hundredths and thousandths)	Selects hundredths and thousandths digits of frequency (00, 25, 50, or 75) in MHz.
Preset channel selector	Selects one of 20 preset channel frequencies.
Mode selector	Selects operating mode and method of frequency selection.
MANUAL	Enables the manual selection of any one of 7,000 frequencies,
PRESET	Enables selection of any one of 20 preset channels. preset channel selector switch.
GUARD	Selection automatically tunes the main receiver and transmitter to



1. Manual frequency selector/indicator (hundreds)
2. Manual frequency selector/indicator (tens)
3. Manual frequency selector/indicator (units)
4. Preset channel indicator
5. Manual frequency selector/indicator (tenths)
6. Preset channel selector
7. Manual frequency selector-indicator (hundredths or thousandths)
8. Mode selector
9. SQUELCH switch
10. Volume control
11. Tone pushbutton
12. Function switch

Figure 3-3. UHF Control panel (AN/ARC- 164)

	the guard frequency and the guard receiver is disabled.
SQUELCH switch	Turns main receiver squelch on or off.
VOL control	Adjusts volume.
TONE pushbutton	When pressed, transmits a 1,020 Hz tone on the selected frequency.
Function selector	Selects operating function.
OFF	Turns set off.
MAIN	Selects normal transmission with reception on main receiver.
BOTH	Selects normal transmissions with reception on both the main receiver and the guard frequency receiver.
ADF	Activates ADF or homing system (if installed) and main receiver.

c. Normal Operation.

(1) Turn on.

1. Insure aircraft power is on.

NOTE

It is presumed the AVIONICS MASTER POWER switch is on, and that normally used avionic circuit breakers remain depressed.

2. AVIONICS MASTER POWER switch (overhead panel) - ON.
3. Function switch (UHF panel) MAIN or BOTH position, as required.

NOTE

If function selector is at MAIN setting, only the normal UHF communications will be received. If selector is at BOTH position, emergency communications on the guard channel and normal UHF communications will both be received.

(2) Receive.

1. UHF audio monitor switch (#3, audio panel) - ON or transmit/interphone selector (audio panel) - 3 position.

2. VOL control (UHF panel) - Mid position.

(3) To use preset frequency (UHF panel).

1. Mode selector - PRESET position.
2. PRESET channel selector - Rotate to channel desired.

(4) To use non-preset frequency (UHF panel).

1. Mode selector - MANUAL position.
2. Manual frequency selectors (5) - Rotate each knob to set desired frequency digits.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector is set to GUARD position.

(5) Volume - Adjust.

NOTE

To adjust volume when audio is not being received, turn squelch switch OFF, adjust volume for comfortable noise level, then turn squelch switch ON.

(6) Squelch - As desired.

(7) Transmit.

1. Transmitter-interphone selector (audio panel) - 3 position.
2. UHF panel - Set required frequency using either preset channel control or manual frequency select controls.
3. MIC HEADSET/OXYGEN MASK switch (instrument panel) -As desired.
4. MIC switch - Depress to transmit.

(8) Shutdown.

1. Function selector (UHF panel) - OFF.

d. UHF Command and Voice Security Operation (KY-28).

NOTE

Disregard operating procedures involving the voice security (CIPHONY) control-indicator, if unit is not installed.

(1) Turn-on.

1. POWER ON switch (Voice Security panel, fig 3-6) -ON.
2. Function switch (UHF panel) - BOTH.

(2) Receive (UHF panel).

1. Mode selector - As required.
2. Transmitter-interphone selector (audio panel, fig. 3-1) - #3 position. or Audio monitor control #3 - ON.
3. Set required frequency using preset channel control or manual frequency selector.
4. Adjust volume.

NOTE

To adjust volume when radio is not being received, turn SQUELCH switch OFF, adjust volume for comfortable noise level, then turn squelch disable switch ON.

5. Squelch - As required.

(3) Transmit (PLAIN).

1. Transmit-interphone selector (audio panel) - No. 3 position.
2. PLAIN/CIPHER switch (Voice Security panel) - PLAIN.
3. Microphone switch - Press.

(4) Transmit (CIPHER).

1. Transmit-interphone selector (audio panel) - No. 3 position.
2. PLAIN/CIPHER switch (Voice security panel) -CIPHER. (CIPHER indicator will be on as long as switch is in CIPHER position.)
3. RE-X/REG switch (Voice security panel) - REG.

4. Microphone switch - Press momentarily (interrupted tone from voice security unit should no longer be heard).

NOTE

No traffic will be passed if the interrupted tone is still heard after pressing and releasing the microphone switch.

5. Microphone switch - Press (do not talk). Wait until beep is heard then speak into microphone.

(5) Shutdown.

1. Function switch (UHF panel)-OFF.
2. POWER ON switch (Voice security panel) - OFF.

e. UHF Command Set - Emergency Operation.

NOTE

Transmission on emergency frequencies (guard channels) is restricted to emergencies only. An emergency frequency of 121. 500 MHz is also available on the VHF command radio set.

1. Transmit/interphone selector (audio panel) - No. 3 position.
2. Mode selector switch (UHF panel) - GUARD.
3. Microphone switch - Press.

3-9. BACKUP VOW (AN/ARC-164).

A radio set identical in type and performance to the UHF command set (fig. 3-3) is installed on the pedestal extension (fig. 2-10) to serve as backup VOW (Voice Order Wire). This set provides the pilot and copilot with secure 2-way voice communications. Complete provisions only are provided for a KY-58 voice security device. The backup VOW set is protected by a 7 1/2 ampere BU VOW circuit breaker on the overhead circuit breaker panel (fig. 2-26). The backup VOW and Transponder share an antenna which is mounted on the aircraft belly (fig. 2-1).

3-10. VHF-AM COMMUNICATIONS (VHF-20B).

a. Description. VHF-AM communications provide transmission and reception of amplitude modulated signals in the very high frequency range of 116.000 to 151.975 MHz for a range of approximately 50 miles, varying with altitude. A dual head control panel (COMM 1, fig. 3-4) is mounted on the pedestal (fig. 2-10) accessible to both the pilot and copilot. The panel provides two sets of control indicators, frequency indicators, frequency select knobs, a single volume control, and a single selector switch for quick frequency changing. Transmission audio is routed by pilot and copilot #1 transmitter select switches. Received audio is routed by pilot and copilot # receiver audio switches to the respective headsets. The VHF radio is protected by one 10-ampere VHF circuit breaker on the overhead control circuit breaker panel (fig. 2-26). The associated antenna is shown in figure 2-1.

b. Controls and Indicators.

(1) VHF-AM control panel (fig. 3-4).

CONTROL	FUNCTION
Left control Frequency indicator	Indicates set operating frequency (control TRANS switch left position.)
Frequency selectors	Selects desired set operating frequency (control TRANS switch left position.)
VOL-OFF control	Adjusts volume of received audio, turns set ON or OFF.
CONTROL indicator	Illuminates, if control TRANS switch in left position.
TRANS switch	Selects right or left control head to control operating frequency of set.
Frequency indicator	Indicates set operating frequency (control TRANS switch right position.)
Frequency selectors	Selects desired set operating frequency (control TRANS switch right position.)
CONTROL indicator	Illuminates, if control TRANS switch at right position.
COMM TEST switch	Overrides automatic squelch circuit.

c. VHF-AM Set - Normal Operation.

(1) Turn-on procedure. VOL control - Turn clockwise.

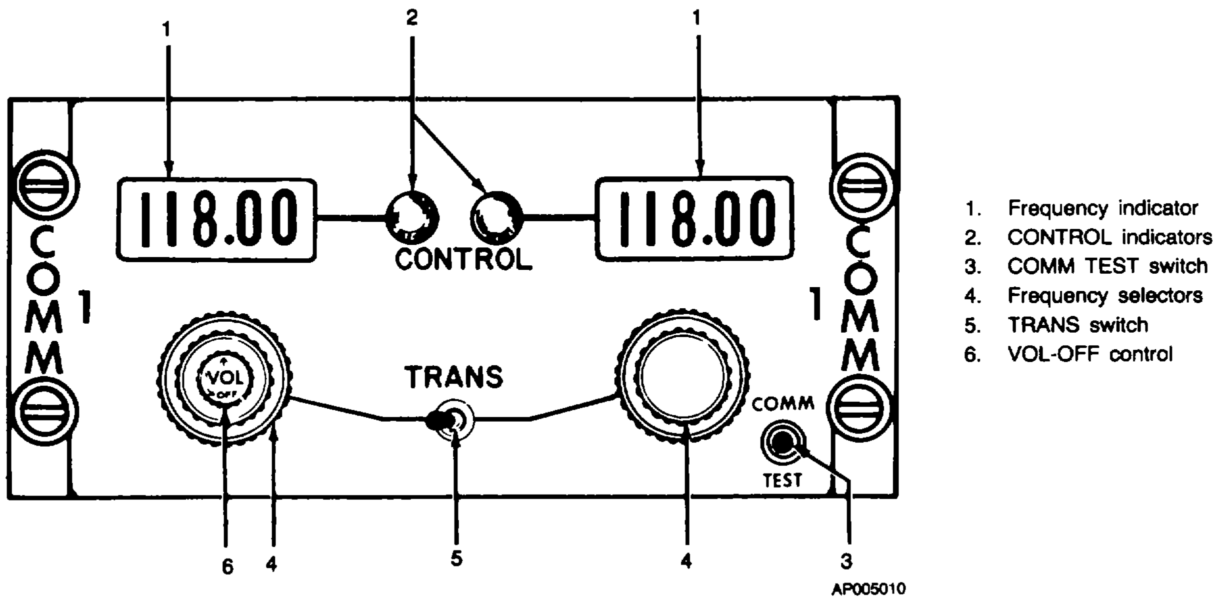


Figure 3-4. VHF-AM Control Panel (VHF-20B)

(2) *Receiver operating procedure.*

1. Transmitter-interphone selector (audio panel, fig. 3-1) - #1 position. or Audio monitor control #1 - ON.
2. Frequency selector - Set desired frequency.
3. VOL control - As required.

(3) *Transmitter operating procedure.*

1. Transmitter-interphone selector (audio panel, fig. 3-1) - #1 position.
2. Microphone switch - Press.

(4) *Shutdown procedure*. VOL control - Counter-clockwise (OFF).

d. VHF-AM Set - Emergency Operation.

NOTE

Transmissions on frequency (121.500 MHz) are restricted to emergencies only. Emergency frequency 243.000 MHz (guard channel) is also available on the UHF command radio.

1. Transmitter-interphone selector (audio panel, fig. 3-1) - #1 position.
2. Frequency selector (VHF panel) - 121. 500 MHz (emergency frequency).
3. Microphone switch - Press.

3-11. VHF AM/FM COMMAND SET (AN/ARC-186).

a. Description. The VHF AM/FM Command Set provides for normal and secure 2-way voice communication: AM in the very high frequency range of 116.000 to 151.975 MHz and FM in the 30. 000 to 87.975 MHz band. Twenty channels may be preset. Audio signals are applied through pilot and copilot transmitter select switches No. 2 position and through the pilot and copilot No. 2 receiver audio switches to their respective headsets. Complete provisions only are installed for voice security device KY-28 or KY-58. Circuits are protected by a 10-ampere VHF AM/FM circuit breaker on the overhead circuit breaker panel (fig. 2-26). Figure 3-5 illustrates the VHF AM/FM control panel. The associated antenna is shown in figure 2-1.

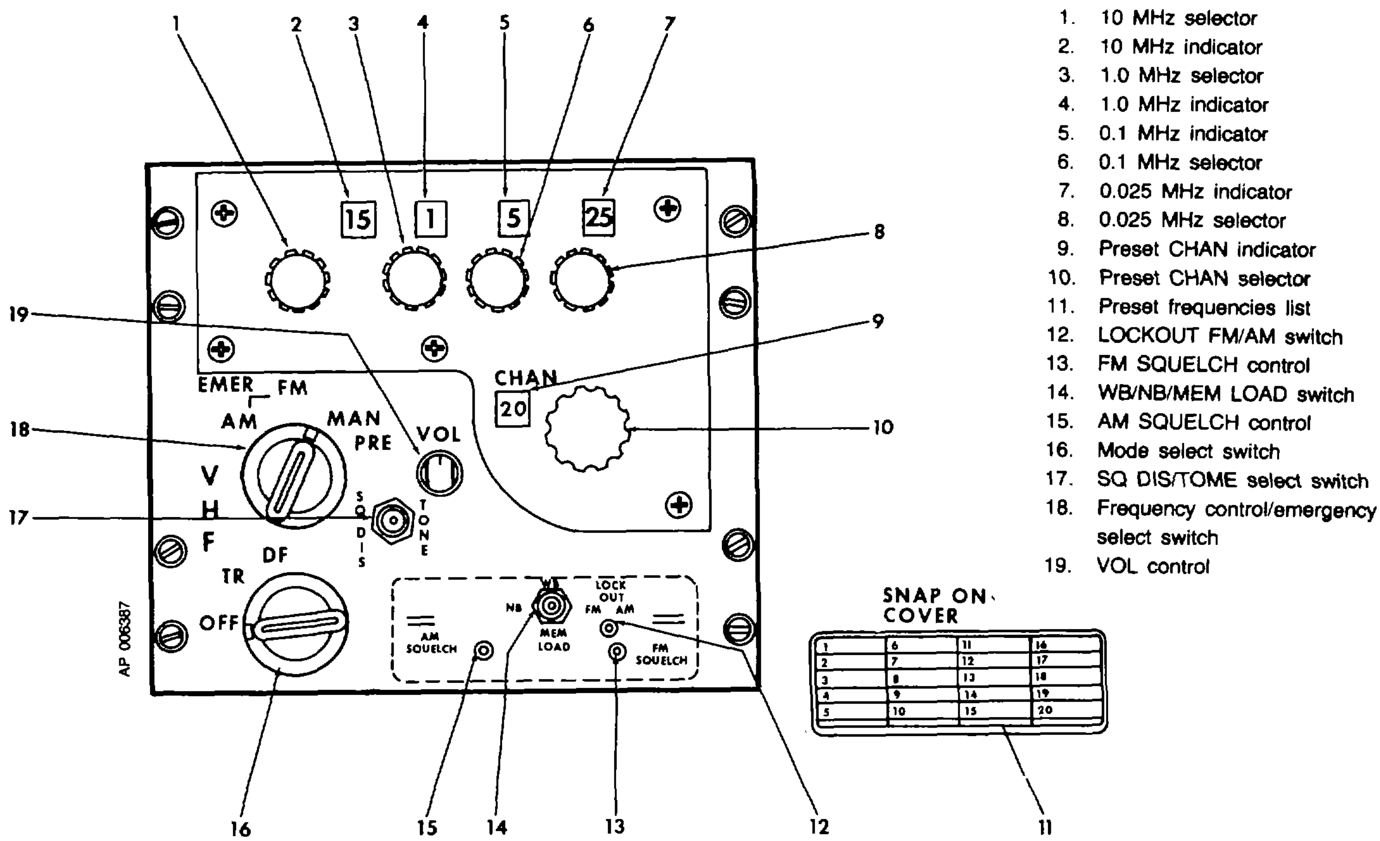


Figure 3-5. VHF AM/FM Control Panel (AN/ARC- 186)

b. Controls and Indicators.

(1) VHF AM/FM control panel (fig. 3-5).

CONTROL	FUNCTION
10 MHz selector	Selects receiver-transmitter frequency in increments of 10 MHz from 30 to 150 MHz. Clockwise rotation increases frequency.
10 MHz indicator	Indicates manually selected receiver-transmitter frequency in 10 MHz increments from 30 to 150 MHz.
1.0 MHz selector	Selects receiver-transmitter frequency in 1.0 MHz increments. Clockwise rotation increases frequency.
1.0 MHz indicator	Indicates manually selected receiver-transmitter frequency in 1.0 MHz increments.
0.1 MHz indicator	Indicates manually selected receiver-transmitter frequency in 0.1 MHz. increments.
0.1 MHz selector	Selects receiver-transmitter frequency in 0.1 Mhz increments. Clockwise rotation increases frequency.
0.025 MHz indicator	Indicates manually selected receiver-transmitter frequency in 0.025 MHz increments.
0.025 MHz selector	Selects receiver-transmitter frequency in 0.025 MHz increments. Clockwise rotation increases frequency.
CHAN indicator	Selects preset channel from 1 to 20. Clockwise rotation increases number selected.
LOCKOUT FM/ AM switch	Screwdriver adjustable three-position switch. Warning tone announces lockout.
Center	Selects AM or FM band.
AM	Disables AM band.
FM	Disables FM band.
FM SQUELCH control	Screwdriver adjustable potentiometer. Squelch fully overdriven at full counter-clockwise position. Clockwise rotation increases input signal required to open squelch.
WB/NB MEM LOAD switch	Three-position switch.

NB	Limits selectivity to narrow-band intermediate frequency.
WB	Limits selectivity to wide-band intermediate frequency of FM band.
MEM LOAD	Momentary switch. If pressed, loads manually selected frequency in preset channel memory
AM SQUELCH control	Screwdriver adjustable potentiometer. Squelch fully overridden at full counter-clockwise position. Clockwise rotation increases input signal required to open squelch.
Mode select switch	Three-position rotary switch.
OFF	Shuts off receiver-transmitter.
TR	Selects transmit/receive modes.
DF	Not used.
SQ/DIS/TONE select switch	Three-position switch.
Center	Selects squelch function,
SQ/DIS	Shuts off squelch function.
TONE	Transmits tone of approx. 1000 Hz.
Frequency control emergency/select switch	Four-position switch.
PRE	Enables preset channel selection.
MAN	Enables manual frequency selection.
EMER AM or FM	Selects a prestored guard channel.
VOL control	Clockwise rotation increases volume.

c. Normal Operation.

(1) Turn-on.

1. Mode select switch (VHF AM/FM panel) - TR.

(2) Receive.

1. Frequency control emergency select switch (fig. 3-5) - MAN or PRE, as desired.
2. Transmitter-interphone selector (audio panel, fig. 3-1) - #2 position. or Audio monitor control #2 - ON.
3. Manual frequency/preset channel selectors - Set desired frequency.
4. VOL control - As required.

(3) Transmit.

1. Transmit/interphone select switch (audio panel) -Position 2.
2. Microphone switch - Press.

(4) Shutdown.

1. Mode select switch (fig. 3-5) - OFF.

d. VHF AM/FM - Emergency Operation.

(1) Emergency AM Mode.

1. Transmit/interphone select switch (audio panel) -Position 2.
2. Mode select switch - TR.
3. PRE-MAN-FM/AM EMER switch - EMER AM.
4. Manual frequency/preset channel selector - Set emergency frequency.
5. Microphone switch - Press.

(2) Emergency FM Mode.

1. Transmit-interphone selector (audio panel, fig. 3-1) - #2 position.
2. Mode select switch - TR or DF, as desired.
3. PRE-MAN-FM/AM EMER switch - EMER FM.
4. Manual frequency/preset channel selector - Set emergency frequency.
5. Microphone switch - Press.
6. Shutdown Mode select switch - OFF.

3-12. VOICE SECURITY SYSTEM TSEC/KY-28 (PROVISIONS ONLY).

NOTE

Voice security system TSEC/KY-58 may be installed in lieu of voice security system TSEC/KY-28. Complete provisions are provided to install either the KY-28 or the KY-58 voice security system on the pedestal extension (fig. 2-10).

a. Description. The KY-28 voice security system provides secure (ciphered) two-way voice communications for the pilot and copilot in conjunction with the UHF and VHF/AM/FM command sets, and the backup VOW set. System circuits are protected by the VHF, VHF/AM/FM, RADIO RELAY, and BU VOW circuit breakers on the overhead circuit breaker panel (fig. 2-26). Figure 3-6 illustrates the KY-28 voice security (CIPHONY) control indicator.

b. Controls and Indicators.

(1) Voice security control/indicator. (fig. 3-6).

CONTROL INDICATOR	FUNCTION
POWER ON switch	Turns set on or off.

NOTE

The POWER ON switch must be in ON position for FM liaison or secure mission operations in either the plain or cipher mode.

POWER ON indicator	Illuminates when POWER ON switch is placed in ON (up) position.
PLAIN indicator	Illuminates when PLAIN/ CIPHER switch is in PLAIN position.
PLAIN/CIPHER switch	
PLAIN	Enables unciphered communications on FM liaison set.
CIPHER	Enables ciphered communications on FM liaison set.
RE-X/REG switch	
RE-X	Enables re-transmission of ciphered communications at a distant location.
REG	Enables normal cipher or plain communications.
ZEROIZE switch	Normally OFF. Place in ON position during emergency situations to neutralize and make inoperative the associated cipher equipment.
CIPHER indicator	Illuminates when PLAIN/ CIPHER switch is in CIPHER position.

c. VHF/AM/FM Set and Voice Security Operation.

(1) Turn-on.

1. POWER ON switch (fig. 3-6) - ON.

NOTE

The POWER ON switch must be in ON position, regardless of the mode of the operation, whenever the voice security (CIPHONY) KY-28 is installed in the aircraft.

(2) Receive.

1. SQUELCH control (VHF/AM/ FM panel) - As required.
2. Transmitter-interphone selector (audio panel, fig. 3-1) - #2 position. or Audio monitor control #2 - ON.
3. Mode selector (VHF/AM/FM panel) - TR.
4. Frequency selectors (VHF/AM/FM panel) - As required. PLAIN/CIPHER switch (voice security panel) - As required.

(3) Transmit (PLAIN).

1. Transmit/interphone selector (audio panel) - No. 2 position.
2. PLAIN/CIPHER switch (Voice security panel) - PLAIN.
3. Microphone switch - Press.

(4) Transmit (CIPHER).

1. Transmit/interphone selector (audio panel) - No. 2 position.
2. PLAIN/CIPHER switch (Voice security panel) -CIPHER. Indicator will be on while switch is in CIPHER position.)

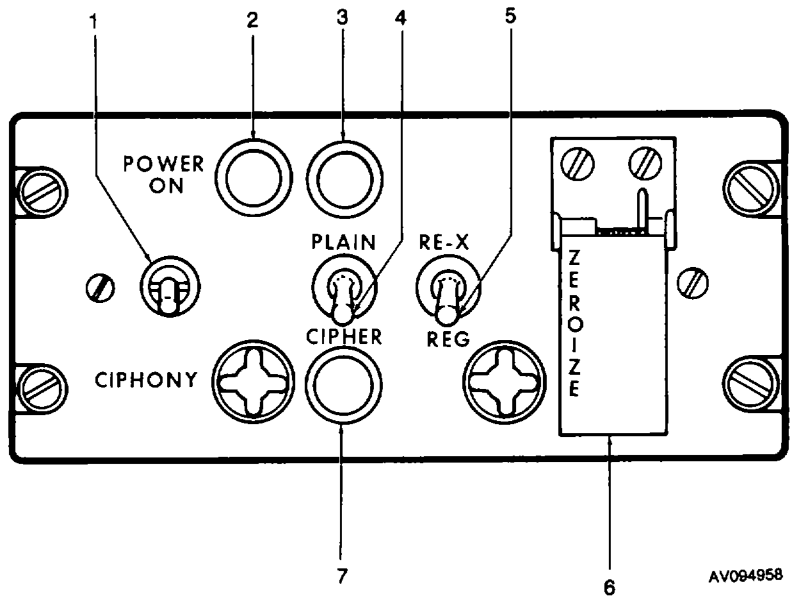


Figure 3-6. Voice Security Control Indicator (C-8157/ARC) (KY-28)

3. RE-X/REG switch (Voice security panel) - As required. (Set RE-X position only if distant station is using re-transmitting equipment.)
4. Microphone switch - Press momentarily (interrupted tone from voice security unit should no longer be heard).

NOTE

No traffic will be passed if the interrupted tone is still heard after pressing and releasing the microphone switch.

5. Microphone switch- Press (do not talk). Wait until beep is heard, then speak into microphone.

(5) Shutdown.

1. Mode selector (VHF/AM/FM panel) - OFF.
2. POWER ON switch (Voice security panel) - OFF.

3-13. VOICE SECURITY SYSTEM TSEC/KY-58 (PROVISIONS ONLY).

NOTE

Voice security system TSEC/KY-58 may be installed in lieu of voice security TSEC/KY-28. Complete provisions are provided to install either the KY-28 or the KY-58 voice security system on the pedestal extension (fig. 2-10).

The KY-58 voice security system provides secure (ciphered) two-way voice communications for the pilot and copilot in conjunction with the VHF/AM/FM command set, UHF command set and the backup VOW set. Voice security circuits are protected by the VHF, VHF/AM/FM, RADIO RELAY, and BU VOW circuit breakers on the overhead circuit breaker panel fig. 2-26). For KY-58 operating instructions, refer to TM 11-5810-262-OP and TM 11-5810-262-20.

3-14. HF COMMAND SET (718 U-5).

a. Description. The HF command set provides long-range voice communications within the frequency range of 2.000 to 29.999 MHz and employs either standard amplitude modulation (AM), lower sideband (LSB), or upper sideband (USB) modulation. The distance range of the set is approximately 2,500 miles and varies with atmospheric conditions. The unit is protected by a 3-ampere HF RCVR and the 25-ampere HF PWR circuit breaker on the overhead circuit breaker panel (fig. 2-26). The control panel is located on the pedestal extension (fig. 2-10).

b. Controls and Indicators.

(1) HF control panel fig. 3-7).

CONTROL/ INDICATOR	FUNCTION
Frequency selector	Selects the desired operating frequency.
Frequency indicator	Displays the selected frequency.
SQL control	Adjusts squelch level.
RF TEST indicator	Indicates operational status of set when RT TEST is selected with the function selector.
Function selector	Turns set off and determines operating mode.
OFF	Turns set off.
USB	Selects upper sideband modulation.
LSB	Selects lower sideband modulation.
AM	Selects amplitude modulation.
CW	Not used in this installation.
SVU	Not used in this installation.
SVL	Not used in this installation.
RF TEST	Check operational status of the system.

c. Normal Operation.

(1) Turn-on.

1. Insure aircraft power is on.

NOTE

It is presumed the AVIONICS MASTER POWER switch is on and that normally used avionic circuit breakers remain depressed.

NOTE

Aircraft can be configured for either HF or VOW on position 4 of the audio control panels.

2. AVIONICS MASTER POWER switch (overhead panel) - ON.

(2) Receive.

1. HF audio switch (#4, audio panel) - ON.
2. Function selector (HF panel, pedestal extension) -Set to USB, LSB, or AM.
3. Volume knob (audio switch #4, audio panel) - Set to mid position.
4. VOL knob (audio panel) - Adjust.
5. SQL knob (HF panel) - Adjust to just quiet noise when no signal is being received.
6. Tuning knob (HF panel) - Set desired frequency.

(3) Transmit.

1. Transmitter-interphone selector (audio panel) -No. 4 position.
2. Function selector (HF panel) - Set to USB, LSB, or AM.
3. MIC HEADSET/OXYGEN MASK switch (instrument panel) -As desired.
4. SQL knob (HF panel) - Adjust to just quiet noise when no signal is being received.
5. MIC switch - Depress to transmit.

(4) Shutdown.

1. Mode selector knob (HF panel) - OFF.

d. RF Test.

(1) Receive check.

1. Set SQL control fully clockwise and tune to WWV. Check receive operation.

NOTE

Radio station WWV operates continuously ton 2.500 Mhz, 5.000Mhz, 10.000 Mhz, 15.000 Mhz, and 20.000 Mhz. Select the frequency that provides the best received signal strength.

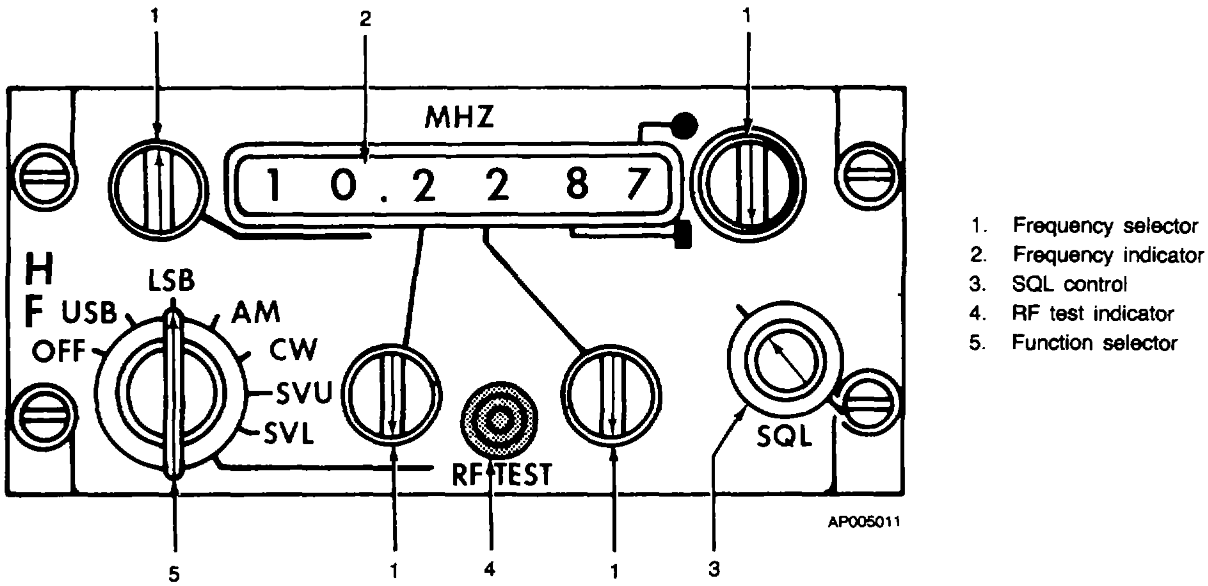


Figure 3-7.HF Control Panel (718 U-5)

(2) RF TEST lamp check (system not keyed).

1. Set the function selector to RF TEST. Do not key the system. Observe the RF TEST lamp.
   a. If the RF TEST lamp does not light, the lamp is defective or the receiver-exciter is faulty.
   b. If the RF TEST lamp blinks for more than 1 minute, the receiver- exciter is faulty.
   c. If the RF TEST lamp lights immediately or after an initial period of blinking, the RF TEST lamp and fault circuits are operational.
   d. Repeat RF TEST lamp check, as required, by selecting RF TEST with the function selector.

(3) Tune check (system keyed).

1. Set the function selector to RF TEST. Change frequency selection to any frequency and key the system momentarily. Observe the RF TEST lamp during the tune cycle. Normal tune time is 3 to 8 seconds.

NOTE

RF TEST lamp indications, during tune, are only valid for 3 to 8 seconds after initial key is applied. To repeat the tune check, key the HF system with the microphone switch.

   a. If the RF TEST lamp stays on continuously, the receiver-exciter is faulty.
   b. If the RF TEST lamp blinks on and off, the PA-coupler is faulty.
   c. If the RF TEST lamp extinguishes after a nominal tune time, and sidetone is heard when audio input is supplied through the microphone, the system is tuned and operating correctly for the selected frequency.

e. HF Command Set - Emergency Operation. Not applicable.

3-15. EMERGENCY LOCATOR TRANSMITTER (ELT).

a. Description. An emergency locator transmitter (fig.3-8) provided to assist in locating an aircraft and crew in the event an emergency landing is necessitated. The output frequency is 121.5 and 243 MHz simultaneously. Range is approximately line of-sight. The transmitter unit has separate function control switches located on one end of the case. In the event the impact switch has been inadvertently actuated, the beacon can be reset by firmly pressing the pushbutton RESET switch on the front of the case. The RESET switch and a 3-positiof toggle switch (placarded ARM, OFF and ON) also on the transmitter case, may be actuated by inserting one finger through a small, round, spring-loaded door on the right side of the aft fuselage. The transmitter unit is accessible through a service panel located on the bottom of the aft fuselage.

b. Controls - ELT Transmitter Case.

CONTROL	FUNCTION
RESET switch	When pressed, resets transmitter
Function switch	Selects operating mode of set.
ARM	Arms set to be actuated by impact switch (normal mode).
OFF	Turns set off.
ON	Activates transmitter for test purposes.

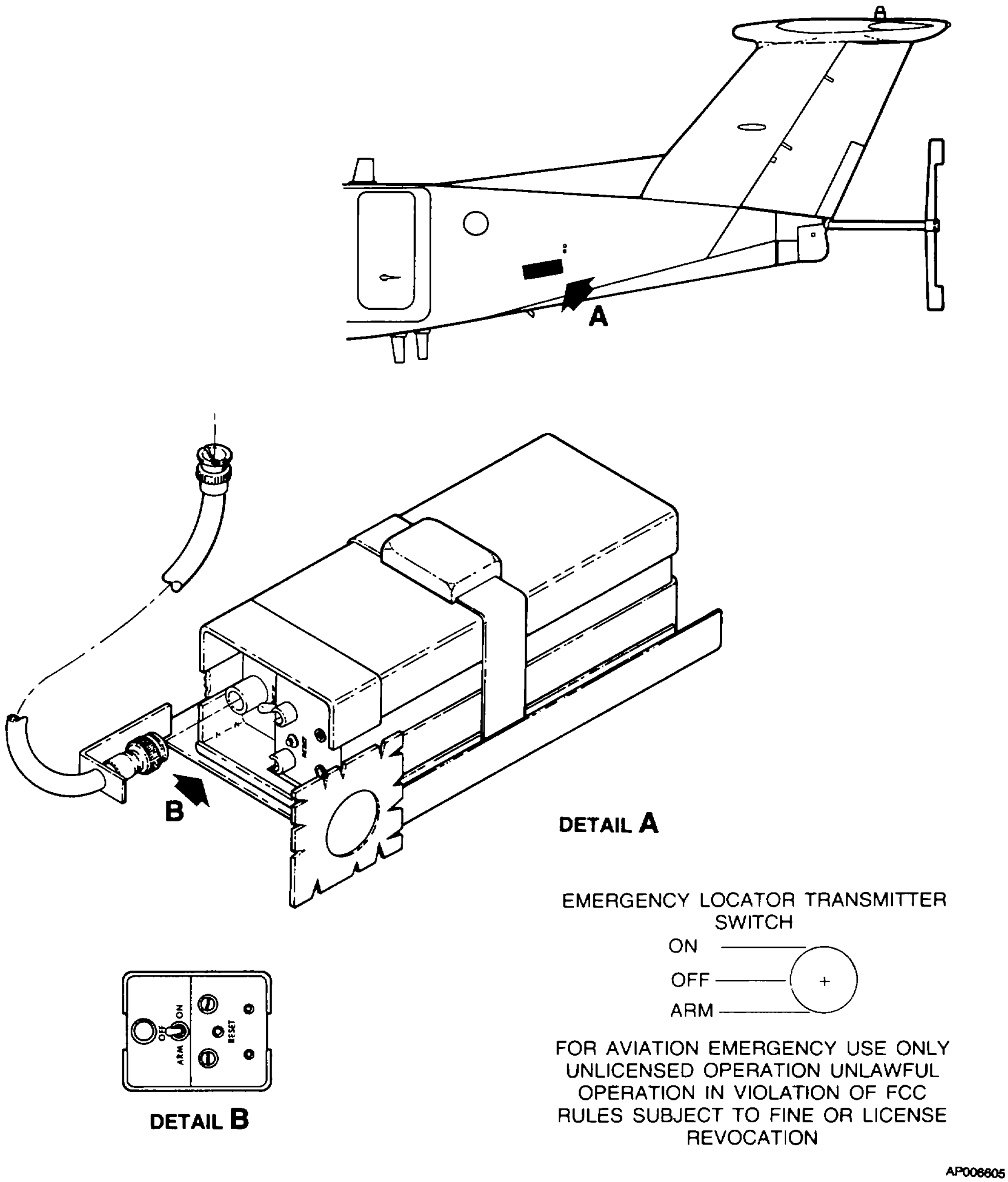


Figure 3-8. Emergency Locator Transmitter (ELT-10)

Section III. NAVIGATION

3-16. DESCRIPTION.

The navigation equipment group provides the pilot and copilot with instrumentation required to establish and maintain an accurate flight course and position, and to make an approach on instruments under Instrument Meteorological Conditions (IMC). The navigation configuration includes equipment for determining attitude, position, destination range and bearing, heading reference and groundspeed.

3-17. RADIO MAGNETIC INDICATORS (RMI).

a. Description. Two identical Radio Magnetic Indicators (RMI) are installed, one for the pilot and one for the copilot (fig. 3-9). Each unit serves as a navigational aid for the respective user and, by means of individual source select switches will display aircraft magnetic or directional gyro heading and VOR, TACAN, INS or ADF bearing information. The pilot's RMI is protected by the 1-ampere #1 RMI circuit breaker on the overhead circuit breaker panel (fig. 2-26) and the 1.5-ampere F13 fuse on the No. I junction box. The copilot's RMI is protected by the 1-ampere #2 RMI circuit breaker on the overhead circuit breaker panel and the 1.5-ampere F9 fuse on the No. 1 junction box.

b. Controls and Indicators.

(1) Switches (fig. 2-28).

INDICATOR	FUNCTION
Pilot's COMPASS No. 1/No. 2 switch	Selects desired source of magnetic heading information for display on pilot's HSI and copilot's RMI.
No. 1	Selects compass system No. 1 for display control.
No. 2	Selects compass system No. 2 for display control.
Copilot's COMPASS No. 1/No. 2 switch	Selects desired source of magnetic heading information for display on co-pilot's HSI and pilot's RMI.
No. 1	Selects compass system No. 1 for display.
No. 2	Selects compass system No. 2 for display.
RMI select switch	Selects which of two signals will be displayed on respective RMI single needle pointer, if single

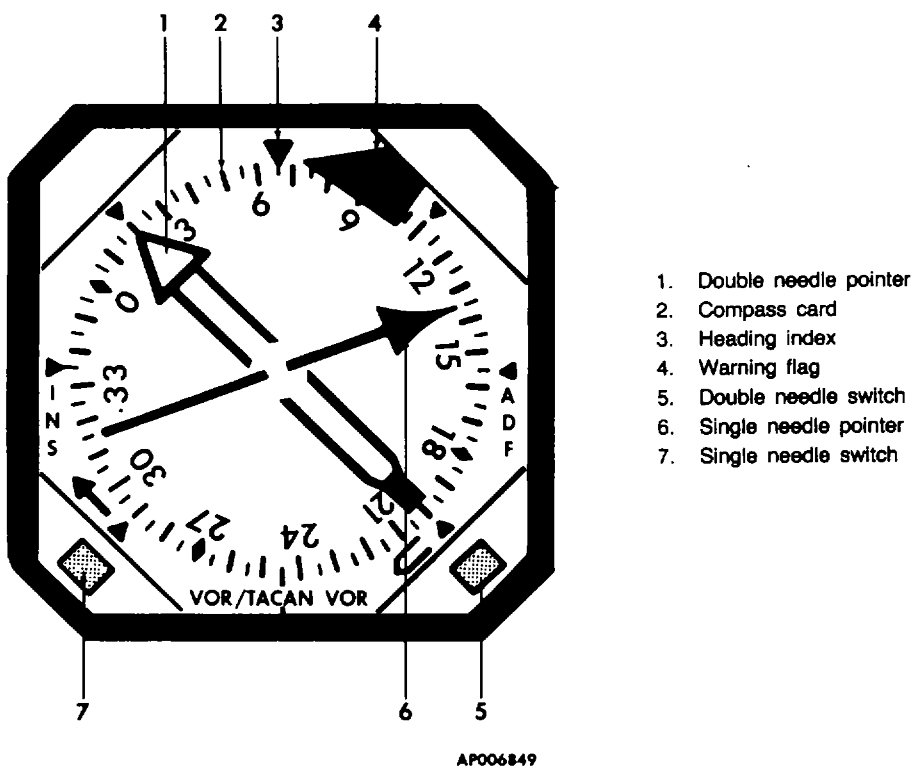


Figure 3-9. Radio Magnetic Indicator (RMI) (332C-10)

needle switch is in the VOR/ TACAN position.

VOR 1	Selects VOR 1 bearing signals for display.
TACAN	Selects TACAN bearing signal for display.

(2) RMI (fig. 2-28).

CONTROL/ INDICATOR	FUNCTION
Double needle pointer	Indicates bearing selected by double needle switch.
Compass card	Indicates aircraft heading at top of dial.
Heading index	Reference point for aircraft heading.
Warning flag	Indicates loss of compass signal.
Double needle switch	Selects desired signal to be displayed by double needle pointer.
ADF position	Selects ADF bearing information.
VOR position	Selects VOR 2 bearing information.
Single needle pointer	Indicates bearing selected by single needle switch.
Single needle switch	Selects desired signal to be displayed on single needle pointer.
INS position	Selects the bearing to waypoint position.
VOR/TACAN position	Selects VOR 1 or TACAN bearing information.

3-18. HORIZONTAL SITUATION INDICATORS.

a. Description. The pilot and copilot have separate HSI instruments on respective instrument panel sections. Each HSI indicator combines displays to provide a map-like presentation of the aircraft position. Each indicator displays aircraft heading, course deviation, and glideslope data. The pilot's HSI allows the desired course and autopilot input to be set manually. Either HSI will display back localizer sensing, when the front course is selected and back course is flown. Course deviation is supplied to the HSI by the VOR 1 or VOR 2 systems, the TACAN (Tactical Air Navigation System), or the INS (Inertial Navigation System). Glideslope data is supplied by the VOR 1 or VOR 2 systems. The HSI displays warning flags when the VOR/LOC, INS, TACAN, heading or glideslope signals are lost or become unreliable.

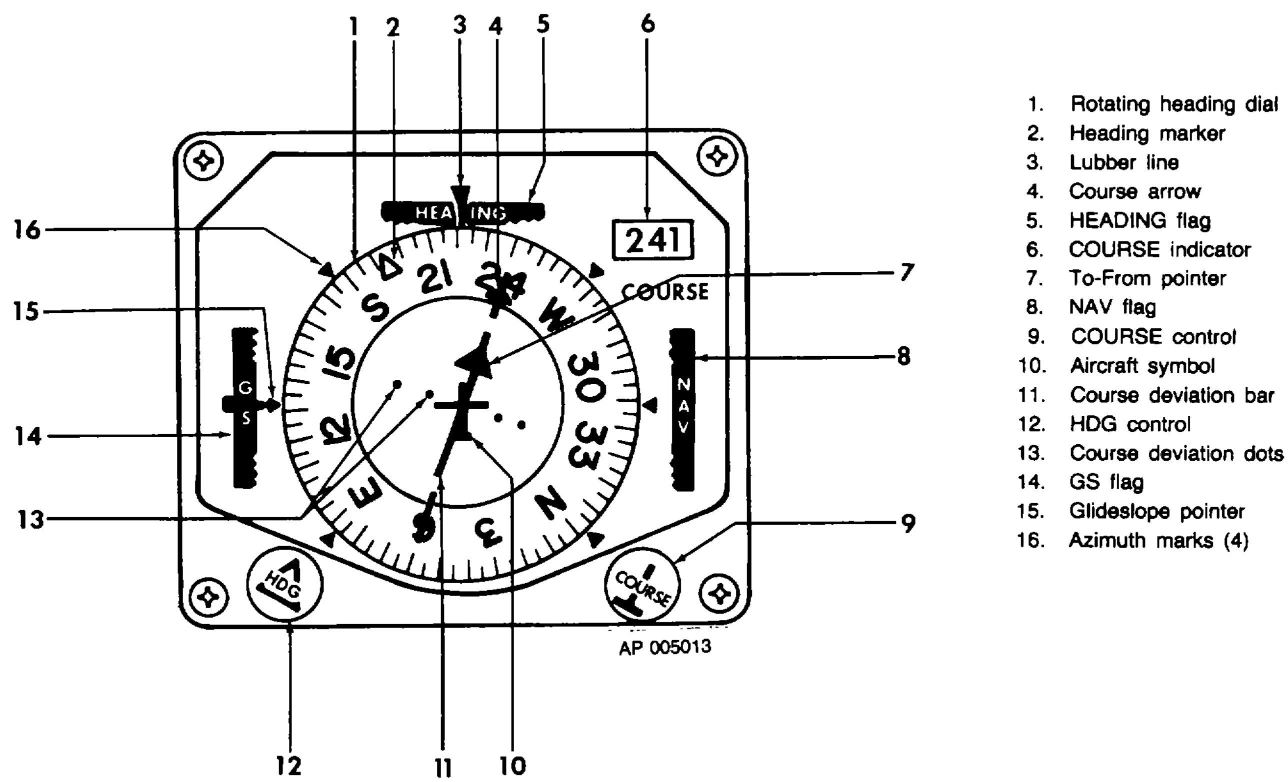


Figure 3-10. Pilot's Horizontal Situation Indicator (331A-8G)

b. Controls and Indicators - Pilot's HSI.

(1) Pilot's HSI (fig. 3-10).

CONTROL/ INDICATOR	FUNCTION
Rotating heading dial	The rotating heading dial, which rotates with the aircraft throughout 360 degrees, displays gyro stabilized magnetic compass information. The azimuth ring is graduated in five-degree increments.
Heading marker	Indicates heading selected by HDG knob.
Lubber line	This pointed fixed index mark aligns with the aircraft symbol to indicate aircraft magnetic heading on the compass card.
Course arrow	Indicates VOR or TACAN radial course selected by COURSE knob.
HEADING flag	Indicates that the heading information displayed is invalid and should not be used.
COURSE indicator	Provides a digital readout of the selected course.
TO-FROM pointers	Two to-from pointers are situated 180 degrees apart. The one which is visible points toward the station along the selected VOR/TACAN radial.
NAV flag	The NAV flag indicates that the information derived from the selected navigational beacon is invalid and should not be used.
COURSE control	The yellow course arrow is positioned on the heading dial by the course knob to select a magnetic bearing that coincides with the desired VOR/TACAN radial or localizer course. Like the heading marker, the course arrow rotates with the heading dial to provide a continuous readout of course error to the computer. When one of the radio modes is selected, the vertical command bar in the flight director will display bank commands to intercept and maintain the selected radio source.
Aircraft symbol	A fixed aircraft symbol corresponds to the longitudinal axis of the aircraft and lubber line markings. The symbol shows aircraft position and heading with respect to a radio course and the rotating dial.
Course deviation bar	This bar represents the centerline of the selected VOR or localizer course. The aircraft symbol shows pictorially, actual aircraft position in relation to this selected course.
HDG control	The heading marker is positioned on the rotating dial by the heading knob and displays preselected compass heading. The heading marker rotates with the heading dial so the difference between the marker and the fore lubber line index is the amount of heading error computer. In the heading mode, the flight director vertical command bar will display the required bank commands to bring the aircraft onto and maintain the selected heading.
Course deviation dots	In VOR operation, each dot represents five degrees deviation from centerline. In ILS operation, each dot represents one degree deviation from centerline. In INS position, each dot represents 3.75 NM linear deviation.
GS flag	Indicates that the information displayed by the glideslope pointer is invalid and should not be used.
Glideslope pointer	Indicates deviation from correct glideslope during ILS approach.
Azimuth marks	Azimuth marks are fixed at 45° bearings throughout 360 degrees of compass card for quick reference.

(2) Pilot's VOR Switches (fig. 2-28).

CONTROL	FUNCTION
Pilot's course indicator selector switch	Selects desired source of data for display on pilot's HSI and input to autopilot flight computer.
VOR I	Selects data from VOR I system.
VOR 2	Selects data from VOR 2 system.
TACAN	Selects data from TACAN system.
INS	Selects data from INS.

Pilot's compass No. 1/No. 2 switch	Selects desired source of magnetic heading data for display on HSI compass card.
No. 1	Selects data from No. 1 compass.
No. 2	Selects data from No. 2 compass.

c. Controls and Indicators - Copilot's HSI.

NOTE

A PILOT SELECT annunciator, located on the copilot side of the instrument panel, illuminates whenever the setting of the copilot's COURSE INDICATOR switch matches that of the pilot's COURSE INDICATOR switch. In this condition the copilot's HSI is "slaved" to the pilot's HSI, and the copilot has no control over course select functions of the selected NAV receiver. The PILOT SELECT annunciator does not illuminate when INS is selected.

(1) Copilot's HSI (fig. 3-11).

CONTROL/ INDICATOR	FUNCTION
Heading marker	Indicates heading selected by HDG knob.
COMPASS flag	Indicates that the heading information displayed is invalid and should not be used.
Lubber line	This pointed fixed index mark aligns with the aircraft symbol to indicate aircraft magnetic heading on the compass card.
Course pointer	Indicates VOR/TACAN radial course selected by COURSE knob.
Rotating heading dial	The rotating heading dial, which rotates with the aircraft throughout 360 degrees, displays gyro stabilized magnetic compass information. The azimuth ring is graduated in five-degree increments.
COURSE indicator	Provides a digital readout of the selected course.
VOR LOC flag	Flag indicates that information derived from the selected navigational beacon is invalid and should not be used.
COURSE control	The yellow course arrow is positioned on the heading dial by

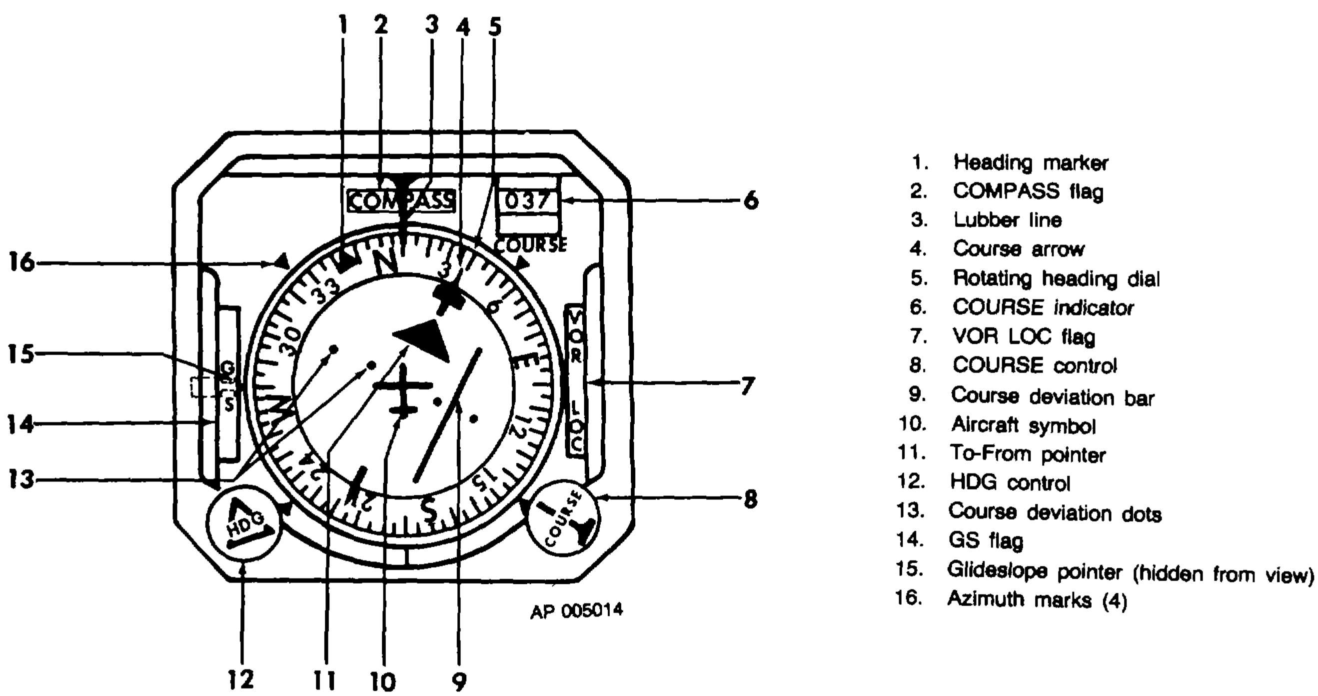


Figure 3-11. Copilot's Horizontal Situation Indicator (331A-6P)

	the course knob to select a magnetic bearing that coincides
with	the desired VOR radial or localizer course. Like the heading marker, the course arrow rotates with the heading dial to provide a continuous readout of course error to the computer. When one of the NAV modes is selected, the vertical command bar in the flight director will display bank commands to intercept and maintain the selected radio source.
Course deviation bar	This bar represents the centerline of the selected VOR or localizer course. The aircraft symbol shows pictorially, actual aircraft position in relation to this selected course.
Aircraft symbol	A fixed aircraft symbol corresponds to the longitudinal axis of the aircraft and lubber line markings. The symbol shows aircraft position and heading with respect to a radio course and the rotating dial.
TO-FROM pointers	Two to-from pointers are situated 180 degrees apart. The one which is visible points toward the station along the selected VOR radial.
HDG control	The heading marker is positioned on the rotating dial by the heading knob and displays preselected compass heading. The heading marker rotates with the heading dial so the difference between the marker and the fore lubber line index is the amount of heading error applied to the flight director computer. In the heading mode, the flight director vertical command bar will display the required bank commands to bring the aircraft onto and maintain the selected heading.
Course deviation dots.	In VOR operation, each dot represents five degrees deviation from centerline. In ILS operation, each dot represents one degree deviation centerline. In INS operation, each dot represents 3.75 NM deviation from centerline.
GS flag	Indicates that the information displayed by the glideslope pointer is invalid and should not be used.
Glideslope pointer	Indicates deviation from correct glideslope during ILS approach.
Azimuth marks	Azimuth marks are fixed at 45° bearings throughout 360 degrees of compass card for quick reference.

(2) Copilot's VOR Switches (fig. 2-28).

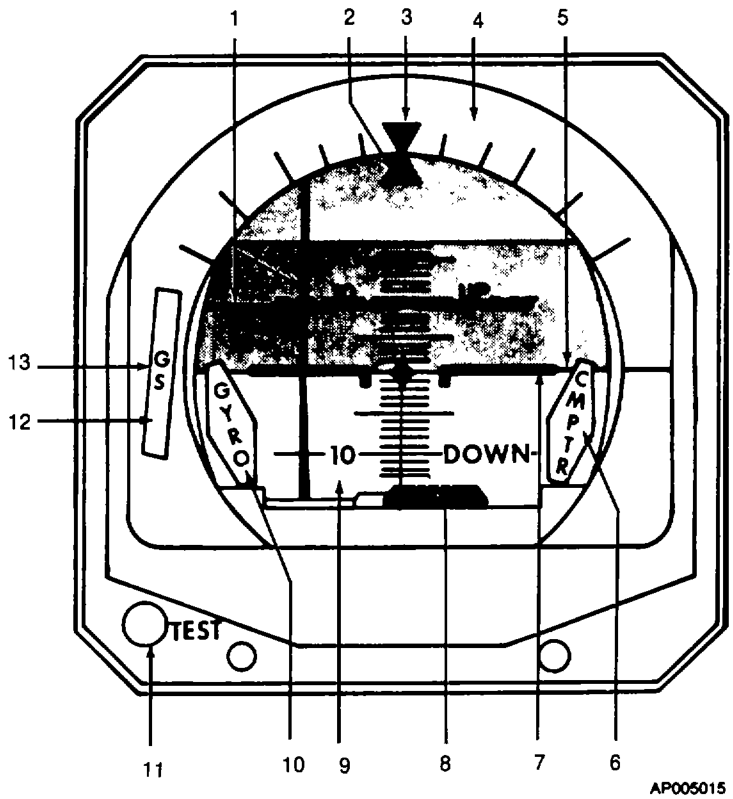
Copilot's Course Indicator Selector Switch	Selects desired source of data for display on copilot's HSI and input to autopilot.
VOR 1	Selects data from VOR 1 system.
VOR 2	Selects data from VOR 2 system.
TACAN	Selects data from TACAN system.
INS	Selects data from INS.
Copilot's compass No. 1/ No. 2 switch	Selects desired source of magnetic heading data for display on HSI compass card.
No. 1	Selects data from No. 1 compass.
No. 2	Selects data from No. 2 compass.

3-19. HORIZON REFERENCE INDICATOR.

a. *Description. The horizon reference indicator (HRI)* (fig. 3-12) is the pilot's basic attitude horizon indicator and the attitude direction instrument for the automatic flight control system.

b. Controls and Indicators.

CONTROL	FUNCTION
Crossed needles	Display computed commands to autopilot.
Lateral deviation indicator	Displays localizer deviation information from VOR receiver.
Vertical deviation	Displays glideslope deviation information from VOR receiver. indicator
Bank angle	Indicates aircraft bank angle. pointer
Bank angle index	Reference indicating zero-degree bank.
Bank angle scale	Allows measurement of aircraft bank angle from zero to 60 degrees.



1. Crossed needles
2. Bank angle pointer
3. Bank angle index
4. Bank angle scale
5. Horizon line
6. CMPTR flag
7. Miniature aircraft
8. Lateral deviation indicator
9. Sphere
10. GYRO flag
11. TEST pushbutton
12. GS flag
13. Vertical deviation indicator

Figure 3-12. Horizon Reference Indicator (329B-9A)

Horizon line	Affixed to sphere, remains parallel to the earth's horizon at all times.
Miniature aircraft	Indicates attitude of aircraft with respect to the earth's horizon.
Sphere	Remains oriented with the earth's axis at all times.
GYRO flag	Presence indicates loss of power to, or low rotational speed of, vertical gyro.
CMPTR flag	Presence indicates a malfunction within the autopilot computer.
LOC flag	Presence indicates that localizer information is not available or not reliable.

NOTE

When flying coupled to the INS system, the CMPTR flag will be in view anytime the steering information is invalid or a malfunction exists in the autopilot computer.

GS flag	Presence indicates glideslope information is not being presented on indicator.
TEST pushbutton	When pressed, display indicates an additional 10° nose up, 20° right roll and the GYRO flag is visible.

3-20. PILOT'S TURN AND SLIP INDICATOR.

a. Description. The pilot's turn and slip indicator (fig. 3-13) is used to provide automatic yaw damping information to the autopilot in addition to performing the functions of a turn -and slip indicator. It is protected by the 5-ampere PILOT TURN & SLIP circuit breaker located on the overhead circuit breaker panel (fig 2-26).

b. Controls and Indicators.

INDICATOR	FUNCTION
Turn rate indicator	Deflects to indicate rate of turn.
Two-minute turn marks	Fixed markers indicate two-minute turn rate when covered by turn rate indicator.
GYRO warning	Presence indicates loss of power to instrument.

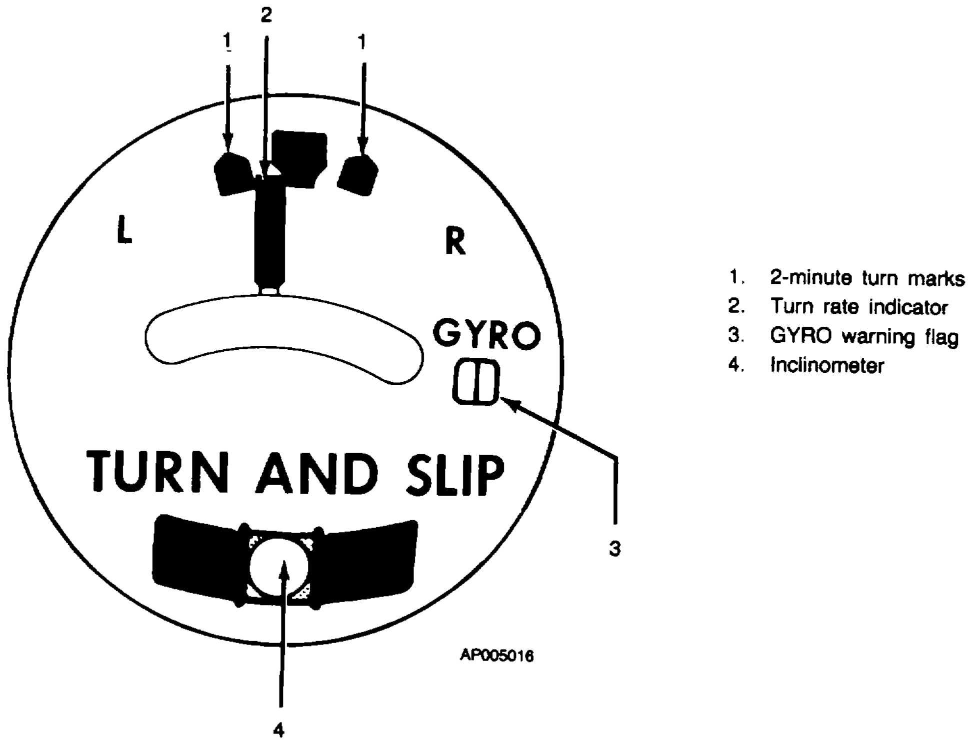


Figure 3-13. Pilot's Turn and Slip Indicator (329T- 1)

Inclinometer (	Indicates lateral acceleration side slip) of aircraft.

3-21. COPILOT'S GYRO HORIZON INDICATOR.

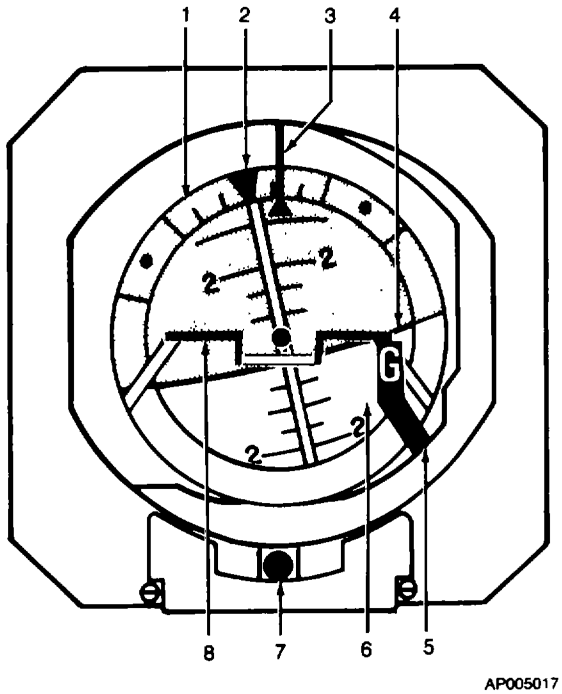
a. Description. The copilot's gyro horizon indicator (fig. 3-14) is a flight aid which indicates the aircraft's attitude. The indicator is designed to operate through all attitudes. There are no front panel fuses or circuit breakers provided for the copilot's gyro horizon indicator.

b. Controls and Indicators.

INDICATOR	FUNCTION
Bank angle index	Reference indicating zero-degree bank.
Bank angle pointer	Indicates aircraft bank angle.
Bank angle scale	Indicates aircraft bank angle from zero to 90 degrees with marks at 10, 20, 30, 45, 60, and 90 degrees.
Horizon line	Affixed to sphere, remains parallel to the earth's horizon at all times.
Miniature aircraft	Indicates attitude of aircraft with respect to the earth's horizon.
G flag	Presence announces loss of power.
Sphere	Indicates orientation with earth's axis at all times.
Inclinometer	Assists the copilot in making coordinated turns.

3-22. GYRO MAGNETIC COMPASS SYSTEMS.

a. Description. Two identical compass systems provide accurate directional information for the aircraft at all latitudes of the earth. As a heading reference, two modes of operation are used: directional gyro (FREE) mode, or slaved (SLAVE) mode. in polar regions of the earth where magnetic heading references are not reliable, the system is operated in the FREE mode. In this mode, the system furnishes an inertial heading reference, with latitude corrections introduced manually. In areas where magnetic heading references are reliable, the system is operated in the SLAVE mode. In this mode, the directional gyro is slaved to the magnetic flux detector, which supplies long-term magnetic reference to correct the apparent drift of the gyro. Magnetic heading information from both systems is



1. Bank angle scale
2. Bank angle index
3. Bank angle pointer
4. Horizon line
5. G flag
6. Sphere
7. Inclinometer
8. Miniature aircraft

Figure 3-14. Copilot's Gyro Horizon Indicator (GH-14)

applied to various aircraft systems through pilot and copilot COMPASS No. 1/No. 2 switches (fig. 2-28). There are no circuit breakers for the gyro magnetic compass systems. The circuits are protected by the 2-ampere F2 and F6 fuses on the No. 1 junction box.

b. Vertical Gyro. A vertical gyro provides line-of sight stabilization to the weather radar and roll and pitch information to the autopilot. No controls are required or provided for operation of the vertical gyro system. The circuit is protected by the 3ampere F22 fuse in the No. 1 junction box.

c. Controls and Indicators.

CONTROL/ INDICATOR	FUNCTION
Pilot's COMPASS No. 1/No. 2 switch	Selects desired source for magnetic heading information to display on pilot's HSI and copilot's RMI.
No. 1	Selects compass system No. 1 for display.
No. 2	Selects compass system No. 2 for display.
Copilot's COMPASS No. 1/No. 2 switch	Selects desired source for magnetic heading information to display on copilot's HSI and pilot's RMI.
No. 1	Selects compass system No. 1 for display.
No. 2	Selects compass system No. 2 for display.
COMPASS SLAVE annunciator	Provides visual indication of system synchronization operation.
GYRO SLAVE/ FREE switch	Selects system mode of operation.
SLAVE	Selects slaved mode of operation.
FREE	Selects free mode of operation.
INCREASE/ DECREASE	Provides manual fast synchronization of the system. switch
INCREASE	Causes gyro heading output to decrease (move in counter-clockwise direction).
DECREASE	Causes gyro heading output to increase (move in clockwise direction).

d. Normal Operation.

(1) To align.

1. Compass GYRO SLAVE/FREE switch SLAVE.
2. Compass INCREASE/ DECREASE switch Hold switch momentarily in the direction desired, and then release. This will place system in fast erect mode. The gyro will then erect at approximately 30 degrees per minute. While in the fast erect mode, the HEADING flag (HSI) will be in view. When the HEADING flag retracts from view, the heading displayed will be the magnetic heading.

(2) To determine magnetic heading.

1. Compass GYRO/SLAVE FREE switch SLAVE.
2. RMI rotating heading dial (compass card) Read heading.

(3) To determine directional gyro heading.

1. Compass GYRO/SLAVE FREE switch-FREE.
2. Compass INCREASE/ DECREASE switch Hold until the RMI compass card aligns with the magnetic heading, then release.
3. Read heading. The heading will agree with the appropriate HSI.

e. Shutdown. Both compass systems are shut down when the inverter switch is turned off. (If either system is ON, both compass sets will be energized.)

3-23. VOR/LOC NAVIGATION SYSTEM.

a. Description. The aircraft is equipped with two VOR systems which are controlled by the NAV-I NAV-2 control panel located in the pedestal (fig. 2-11).

Either VOR can direct input signals to the flight director indicator. Controls are shown in figure 315.

Each VOR system includes independent receiver units for VOR/LOC and glideslope (GS). Each VOR receiver provides a VOR input to a respective RMI indicator and VOR and localizer data to the flight director. Each glideslope receiver sends GS flag and pointer deviation information to the flight director.

VOR/LOC indicators may be used for navigation during manual control of the aircraft, or the autopilot may be coupled to the VOR system, accepting VOR inputs to the autopilot computer.

The pilot's unit (VOR 1) is a navigation radio system which receives and interprets VHF Omnidirectional Radio Range (VOR) signals, localizer (LOC) signals, glideslope signals, and marker beacon signals. The system operates in a VOR/LOC frequency range of 108.00 to 117.95 Mhz. Glideslope frequencies (329.15 to 335.00 Mhz) are paired with LOC frequencies, and are automatically selected when LOC frequencies are selected. LOC frequencies are those frequencies between 108.00 and 112.00 Mhz that end in odd tenths (108.1, 109.3, 109.5, etc.). The marker beacon receiver operates at 75 Mhz and is not tuneable.

VOR 2 is similar to VOR 1 except VOR 2 cannot receive or interpret marker beacon signals.

Each VOR system provides course deviation and glide path data, which can be switched either to the copilot's HSI or to the autopilot flight computer and pilot's HSI, or both. The audio outputs of VOR 1 and VOR 2 systems are supplied to the NAV control, on the audio control panels. VOR 1 bearing data is supplied to the single needle pointer on both Radio Magnetic Indicators. VOR 2 bearing data is supplied to the double-needle pointer on both Radio Magnetic Indicators.

Both systems use a single VOR/LOC antenna, located on the vertical stabilizer, and a single glideslope antenna, located in the radome. VOR 1 uses a marker beacon antenna located on the underside of the forward fuselage.

The VOR 1 system is protected by the 2-ampere VOR #1 and 35-ampere AVIONICS MASTER PWR #1 circuit breaker on the overhead circuit breaker panel (fig. 2-26). The VOR 2 system is protected by the 2-ampere VOR #2 and 35-ampere AVIONICS MASTER PWR #2 circuit breakers on the overhead circuit breaker panel.

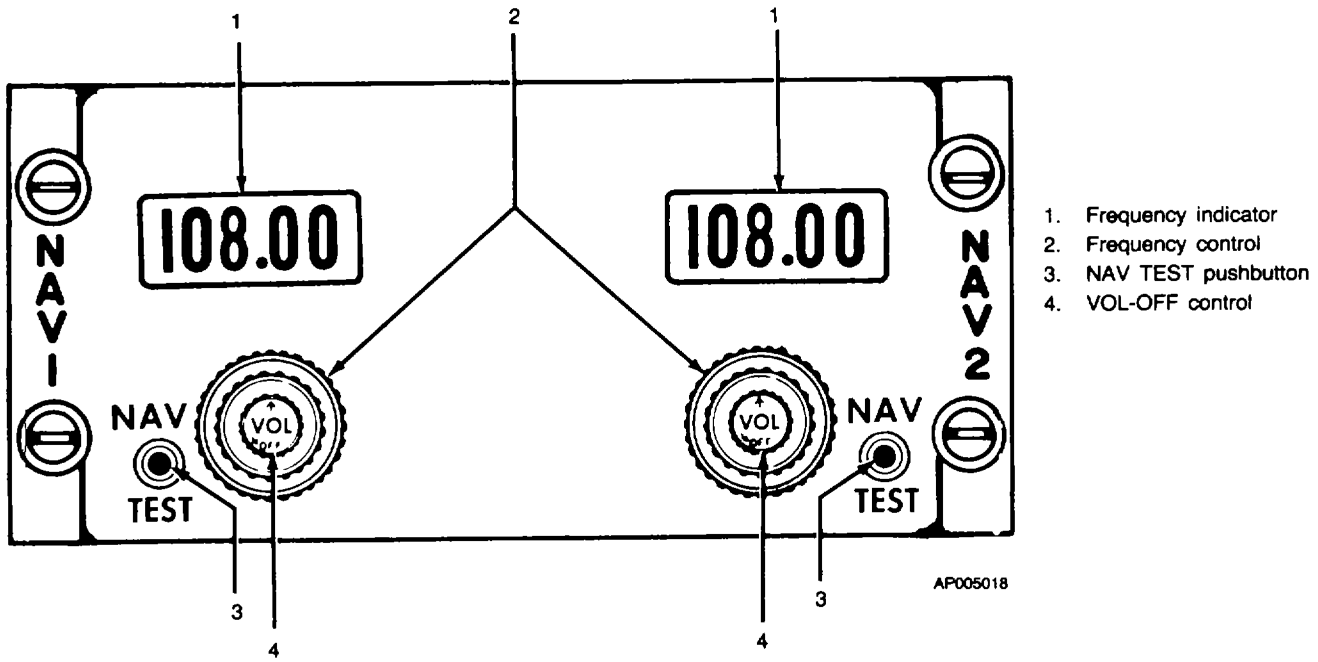


Figure 3-15. Dual NAV 1 - NAV 2 Control Panel (VIR-30AGM, VIR-30AG)

b. Controls and Indicators.

(1) NA V 1 Panel Section (VOR 1).

CONTROL/ INDICATOR	FUNCTION
Frequency indicator	Displays selected frequency of VOR 1 receiver.
Frequency control	Selects operating frequency of VOR 1 receiver.
VOL/OFF control	Activates VOR 1 receiver. Permits monitoring VOR 1 audio and adjust volume of signals received.
NAV TEST switch	Activates self test of VOR 1 navigation system.

(2) NA V 2 Panel Section (VOR 2).

CONTROL/ INDICATOR	FUNCTION
VOL/OFF control	Activates VOR 2 receiver. Permits monitoring VOR 2 audio and adjust volume of signals received.
Frequency control	Selects operating frequency of VOR 2 receiver.
Frequency indicator	Displays selected frequency of VOR 2 receiver.
NAV TEST switch	Activates self test of VOR 2 navigation systems.

(3) Marker Beacon Indicators. (fig. 2-28).

INDICATOR	FUNCTION
"A" indicators (white)	Illuminate when aircraft passes over an inner marker beacon.
"O" indicators (blue)	Illuminate when aircraft passes over an outer marker beacon.
"M" indicators (amber)	Illuminate when aircraft passes over a middle marker beacon.

(4) Switches (fig. 2-28).

CONTROL	FUNCTION
Pilot's COURSE INDICATOR switch	Selects VOR receiver to control pilot's HSI.
VOR 1	VOR 1 controls pilot's HSI.
VOR 2	VOR 2 controls pilot's HSI.
Copilot's COURSE INDICATOR switch	Selects VOR receiver to control copilot's HSI.

VOR 1	VOR 1 controls copilot's HSI.
VOR 2	VOR 2 controls copilot's HSI.
NAV-A switch	Applies VOR audio to respective headsets.
MKR BCN HI-LO switch	Controls sensitivity of marker beacon receiver.

c. Operation.

(1) Turn-on.

1. Insure aircraft DC and AC power is on.
2. AVIONICS MASTER POWER switch (overhead panel) ON.
3. Frequency controls (NAV panel) Set for both receivers.
4. VOL knobs (NAV panel) Turn clockwise to activate sets, adjust volume.
5. NAV A, audio switch ON. Confirm proper signal, then OFF.
6. Confirm proper indications RMI and HSI.

(2) Normal operation.

(a) Pilot, copilot COURSE INDICATOR switches (instrument panel): Select VOR source.

(b) To determine course to station on pilot's HSI: Rotate course knob until course deviation pointer is centered and TO-FROM flag reads TO.

(c) To determine bearing from station on pilot's HSI.: Rotate course knob until course deviation pointer is centered and TO-FROM flag reads FROM.

(d) To determine course to station on RMI.: Select VOR, verify needle points course to station.

(3) Localizer (LOC) operation.

1. VOR frequency knob (NAV panel) Select frequency.
2. Pilot's, copilot's COURSE INDICATOR switches (instrument panel) Select VOR source.
3. Course deviation bar (HSI) Steer aircraft to center bar.

(4) Glideslope operation.

1. Frequency selectors (NAV panel) Set desired localizer frequency.
2. VOR switch (instrument panel) Select VOR source.
3. Glideslope pointer (HSI) Fly aircraft to center pointer.

(5) Self-test.

(a) NA V 1.

1. Frequency select knob (NAV panel) Select a VOR frequency.
2. NAV TEST switch (NAV panel) Press and hold.
3. RMI Observe that single needle indicates approximately 005°.
4. VOR/LOC flag Check that flag is out of view.
5. TO/FROM pointer Check that pointer indicates TO.
6. HSI course deviation bar Check for centered bar.
7. Marker beacon lights Check that all three lamps are illuminated and flickering at approximately a 30 Hz rate.
8. VOR frequency knob (NAV panel) Select a LOC frequency.
9. VOR/LOC flag Check that flag is out of view.
10. HSI course deviation bar Check that bar indicates a deflection of approximately one dot right of center.
11. HSI glideslope pointer Check that pointer indicates a deflection of approximately one dot below center.
12. Marker beacon lights Check that all three lamps are illuminated and flickering at approximately a 30 Hz rate.

(b) NA V 2. All NAV 2 self-test procedures are the same as those used for NAV 1, with the exception of the marker beacon test. There is no marker beacon receiver in the NAV 2 system.

(6) Shutdown. VOL knobs (NAV panel) OFF.

3-24. MARKER BEACON.

a. Description. A marker beacon receiver module located inside the No. 1 VOR receiver, detects a marker beacon signal as the aircraft passes over a marker beacon transmitting antenna. The detected signal is selectively filtered to activate the appropriate marker beacon lamp on the instrument panel. In addition, the detected signal is coupled to the aircraft audio system to annunciate marker beacon passage. The marker beacon receiver operates on a fixed frequency of 75 Mhz. Volume and sensitivity of the system are adjusted on the radio control panel (fig. 3-2) located on the pedestal extension (fig. 2-11).

b. Controls and Indicators.

CONTROL	FUNCTION
MKR BCN HI-LO switch	Controls sensitivity of marker beacon receiver.
MKR BCN VOL control	Adjusts volume of marker beacon audio.

(1) Marker beacon indicators (fig. 2-28).

INDICATOR	FUNCTION
"A" indicators (white)	Illuminate when aircraft passes over an inner marker beacon.
"O" indicators (blue)	Illuminate when aircraft passes over an outer marker beacon.
"M" indicators (amber)	Illuminate when aircraft passes over an middle marker beacon.

c. Operation.

1. Marker beacon indicator lights (instrument panel) -Confirm beacon indication.
2. Marker beacon HI-LO switch (radio control panel) -As required.
3. Select NAV A on audio control panel to monitor marker beacon audio.

3-25. AUTOMATIC DIRECTION FINDER (DF-203).

a. Description. The Automatic Direction Finder (ADF) is a radio navigation system which provides a visible and audible indication of aircraft bearing relative to a selected ground radio station. It may also be used to home on a selected station, find aircraft position, or monitor conventional low frequency AM radio transmissions. The system is designed to provide reliable reception of a 400-watt radio station at a range of 65 nautical miles throughout a 360-degree turn of the aircraft. It operates in a frequency range of 190 to 1750 kilohertz.. Bearing indications are displayed visually on the RMI's and aural signals are applied to the audio control panels. Refer to Audio Control Panels (fig. 3-1) for controls used to monitor ADF audio signals.

The ADF consists of a receiver, located on the forward side of the aft cabin bulkhead inside the pressure vessel; a control unit, located on the pedestal extension;, a non-directional sense antenna, installed in the aircraft dorsal fin; a directional loop antenna, located on the underside of the fuselage; and a quadrangle error corrector, installed on the loop antenna (to compensate for the deflection of arriving radio signals by the wings and fuselage of the aircraft). The system is protected by the 1-ampere ADF, the 5-ampere RADIO RELAY, and the 35ampere AVIONICS BUS #2 circuit breakers on the overhead circuit breaker panel (fig. 2-26).

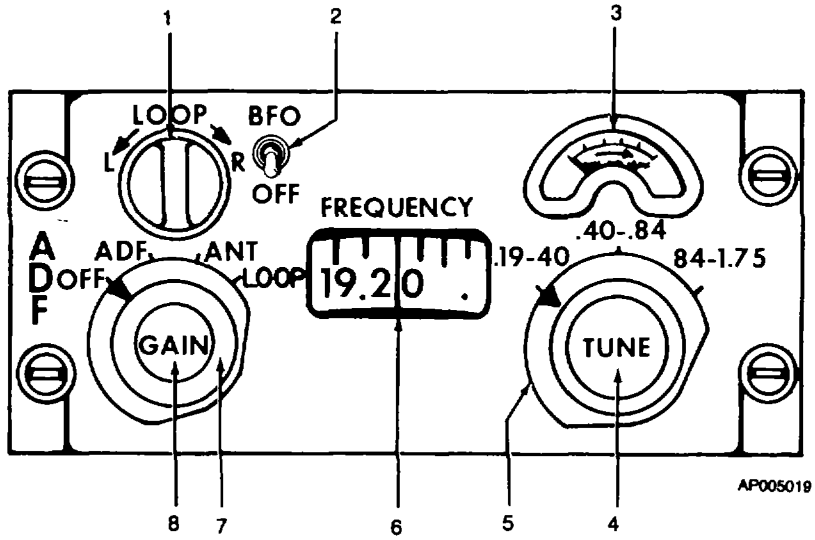
NOTE

Keying the HF radio set while operating the ADF set will cause a momentarily unreliable ADF signal.

b. Controls and Indicators.

(1) ADF control panel (fig. 3-16).

CONTROL/ INDICATOR	FUNCTION
LOOP control	Operative only when the function switch is in the LOOP or ADF position. Center position removes rotation signals from the loop antenna and the ADF pointer on the RMI's. First position L (left) or R (right) of center applies slow speed rotation signals to loop antenna and ADF pointer on RMI's for 360-degree rotation left or right. Second position L(left) or R (right) of center applies fast speed rotation signals to loop antenna and ADF pointer on RMI's for 360-degree rotation left or right. Center position holds antenna position.
BFO/OFF	At BFO (on) setting, permits fine tuning with Beat Frequency Oscillator (BFO). Also provides audio tone when receiving unmodulated CW. OFF turns BFO off.



1. LOOP control
2. BFO-OFF switch
3. Tuning meter
4. TUNE control
5. Range switch
6. FREQUENCY indicator
7. Mode selector
8. GAIN control

Figure 3-16. ADF Control Panel (DF-203)

Tuning meter	Indicates relative strength of received signals.
TUNE control	Selects operating frequency.
Range switch	Selects operating frequency band.
FREQUENCY indicator	Indicates selected frequency.
Mode selector	Selects operating mode.
OFF	Turns set off.
ADF	Permits automatic direction finding or homing operation.
ANT	Permits reception using sense antenna.
LOOP	Permits audio-null homing and manual direction finding operations.
GAIN control	Adjusts volume of received signal.

(2) Switches - audio panel (fig. 3-1).

CONTROL	FUNCTION
NAV B volume control	NAV B volume control applies ADF audio to aircraft audio system.

(3) Switches - radio panel (fig. 3-2).

CONTROL	FUNCTION
FILTER V-OFF switch	Selects whether voice filter will be used with ADF audio.
FILTER R-OFF switch	Selects whether range filter will be used with ADF audio.

c. Operation.

(1) To operate set as automatic direction finder.

1. Mode selector - ADF.
2. BFO-OFF switch - BFO.
3. Range switch - Select.
4. TUNE control - Rotate for maximum reading on tuning meter and zero BFO beat.
5. GAIN control - As required.
6. Double needle switches (RMI, fig. 3-9) - As required.

7. Double needle on RMI Read course to station.

(2) To operate set for sense antenna direction finding: 1. Mode selector ANT.

2. Range switch Select.
3. TUNE control rotate for maximum reading on tuning meter.
4. GAIN control As required.

(3) To operate set for audio-null direction finding:

1. Mode selector ANT.
2. BFO-OFF switch BFO.
3. Range switch select.
4. TUNE control Tune desired station.
5. GAIN control Adjust for minimum audio output.
6. Double needle switches (RMI, fig. 3-9) As required.
7. BFO-OFF switch OFF.
8. Mode selector LOOP.
9. LOOP switch L or R. Turn left or right until a null is reached (minimum sound in headsets).
10. Double needle on RMI (fig. 3-9) Read course to station.

NOTE

The true null and direction to the radio station may be indicated by either end of the single needle. This ambiguity must be solved to determine proper direction to the station.

(4) Shutdown. Mode selector OFF.

3-26. TACAN SYSTEMS.

a. Description. Two Tactical Air Navigation (TACAN) systems are provided. One is dedicated to the INS and is used only for position updating; the other is used in conjunction with other avionics systems, including the flight director system and the autopilot. TACAN is a radio navigation system which provides aircraft distance and bearing information relative to a TACAN ground station. Both systems operate in the L-band frequency range of 962 to 1213 MHz. Their range, though limited to line-of-sight, is designed to provide reliable reception of a TACAN ground station at a distance of 170 nautical miles at an aircraft altitude of 20,000 feet. The normal time required for the systems to lock on to a selected ground station signal is three seconds. The avionics TACAN system is protected by the 2ampere TACAN circuit breaker located on the overhead circuit breaker panel (fig. 2-26).

b. Avionics TACAN System. The AN/ARN136(V) avionics TACAN system consists of the RT1321 receiver-transmitter and the CP-1398 azimuth computer, both of which are located in the right nose avionics compartment; the ID-2218 range indicator, located on the instrument panel, the C-11265 control panel, located in the pedestal extension; and an antenna located on the top surface of the aircraft fuselage. The avionics TACAN system operates in conjunction with TACAN and VORTAC ground stations to provide distance, ground speed, time-to-station, and bearing-to-station data. It operates in the L band frequency range on one of 252 pre-selected frequencies, 126 X mode and 126 Y mode channels. Course deviation from TACAN stations is displayed on the HSI. Distance, time-to-station, and ground speed are displayed on the TACAN digital display (fig. 3-17). The ground speed and time-to-station are accurate only if the aircraft is flying directly toward the ground station at a sufficient distance that the slant range and ground range are nearly equal.

The avionics TACAN system may be operated by the flight director system or connected to and used with the autopilot system. When employed as the primary means of navigation, aircraft flight may be controlled manually or by the autopilot. Indications of aircraft heading and bearing to ground stations are displayed on the course deviation indicators (HSIs). Relative bearing to a station is displayed by the RMI bearing pointer. TACAN distance, ground speed, and time-to-station are all displayed on the TACAN indicator located on the copilot's instrument panel (fig. 2-28).

The TACAN control panel (fig. 3-17) enables selection of the TACAN frequency (channel) to be used, and provides for self-test of TACAN circuits. X or Y channel is selected by the X/Y switch. Most TACAN and VORTAC stations are operated on the X mode. When Y mode stations are operational, air navigation charts will designate the Y mode stations. A toggle switch provides system power ON/OFF control. Audio control is provided by a rotary control placarded VOL.

c. INS TACAN System. The INS TACAN system is of the same type as the avionics TACAN system. This set, inaccessible to pilot control, is coupled directly to INS circuits. It is dedicated only to updating the INS, is activated when the INS is operational, and is controlled only by the INS. The INS TACAN consists of a range unit and a distance indicator, both located on the INS equipment rack and both identical to their counterparts in the avionics TACAN, and an antenna located on the underside of the fuselage. No controls are required or provided for the INS TACAN system. The system is protected by a circuit breaker on the INS junction box.

d. Controls and Indicators.

CONTROL/ INDICATOR	FUNCTION
TEST switch	Activates system self-test.
Channel indicator	Displays TACAN channel selected.
X-Y switch	Selects X or Y mode for TACAN channels.
VOL control	Adjusts TACAN volume.
Channel selectors	Dual knob for manual selection of operating channel.
Outer knob	Selects tens and hundreds part of channel number.
Inner knob	Selects units part of channel number.
ON-OFF switch	Activates or deactivates system.
NM indicator	Displays slant range distance in nautical miles from aircraft to selected TACAN ground station.
KT indicator	Displays ground speed in knots.
MIN indicator	Displays time to TACAN station in minutes.

e. Avionics TACAN Operation.

(1) Turn-On.

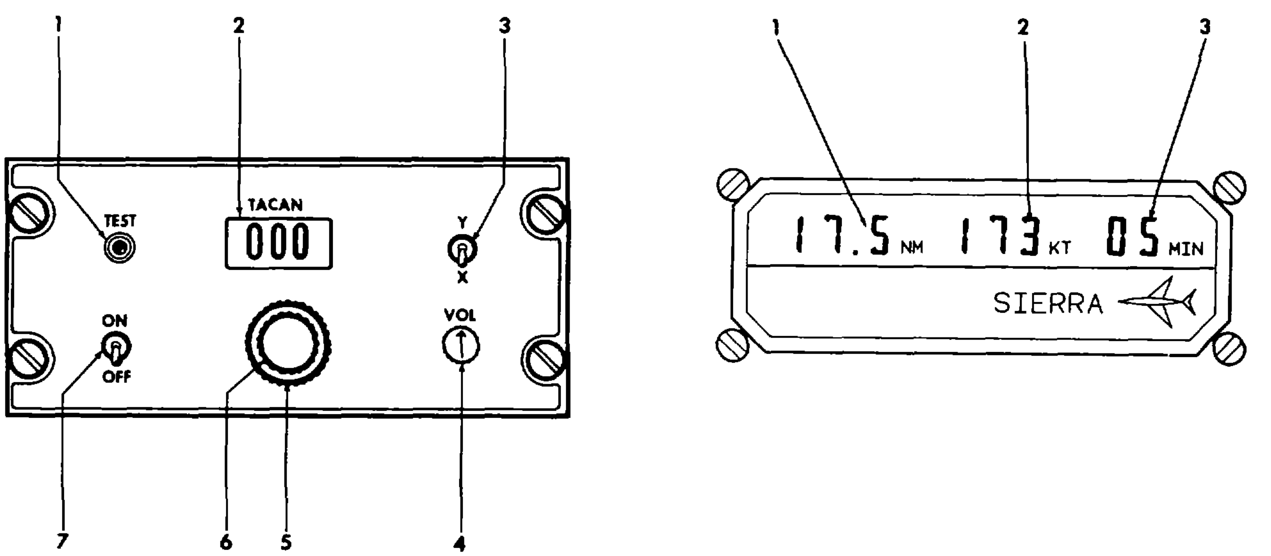
1. ON-OFF switch (TACAN panel) ON.
2. VOL knob As required.
3. Course indicator switches (instrument panel) -Select TACAN.

NOTE

The pilot and copilot should not select TACAN simultaneously for test.

(2) Normal operation.

1. Pilot's single needle switch VOR/TACAN.



1. TEST push switch
2. Channel indicator
3. X-Y switch
4. VOL control
5. Tens and hundreds channel select knob
6. Units channel select knob
7. ON-OFF switch

1. NM indicator
2. KTs indicator
3. MIN indicator

AP 006386

Figure 3-17. TACAN Control Panel and Range Indicator (ID-2218)

2. RMI select switch (side panels) TACAN.
3. Pilot's Course indicator switch TACAN.
4. Mode switch (X/Y) As required.
5. TACAN control panel Select desired channel.
6. Wait 5 seconds for signal acquisition and lock-on.
7. Insure that audio station identification signal is correct for the ground station selected.
8. Bearing pointer on RMI Read bearing heading to station.
9. COURSE knob (pilot's HSI) Set course desired.
10. Course deviation bar (pilot's HSI)Read deviation from selected course. Course arrow will show wind correction angle when the course deviation bar is centered and the aircraft is tracking the selected course.
11. TACAN indicator Read range (NM).
12. To determine course TO or course FROM a TACAN station, rotate course knob (pilot's HSI) until course deviation bar is centered and the TO/FROM flag reads TO or FROM.
13. To use TACAN during pilot-controlled flight, control aircraft by manual controls, responding to information displayed on the flight director, RMI, TACAN, and other instruments.
14. To use TACAN with the autopilot, depress A/P ENGAGE and monitor autopilot performance on flight director, RMI, and TACAN indicators. Verify adherence to preset heading and course, and confirm the execution of displayed steering commands.

NOTE

The TACAN ground speed reading will be accurate only when the aircraft is on a course directly to or from the TACAN station. When headed away from the station, the TACAN indicator minutes reading will be in error.

(3) System test.

1. TEST pushbutton Press and hold.
2. Range indicator Check for an indication of 0.0 ± 0.1 nautical miles.
3. Pilot's COURSE selector switch Select TACAN.
4. Pilot's RMI selector switch Select TACAN.
5. RMI double needle Check for an indication of 180° ± 2°.
6. HSI course selector Turn to 180° and adjust slowly until the course deviation bar is centered. The bar should center between a selected course of 178° to 182°.
7. HSI course selector Turn the selector + 10° from the setting achieved in step 6, and check that course deviation bar is located over the far left 10° dot.
8. HSI course selector Turn the selector -10° from setting achieved in step 6, and check that course deviation bar is located over the far right 10° dot.
9. TO-FROM indicator Check that TO is indicated.
10. TEST pushbutton Release.

(4) Shutdown. Turn ON/OFF switch OFF.

3-27. AUTOMATIC FLIGHT CONTROL SYSTEM.

a. Description. The AP-106 is an integrated autopilot/flight director system that provides the following:

Heading mode

Navigation mode

Approach mode with automatic glideslope capture and track

Altitude hold mode

Back course localizer mode

Go-around mode

Synchronized control wheel steering

Indicated airspeed hold mode

All-angle adaptive capture for VOR, LOC, and LOC B/C

Attitude display

Heading display

Mode selection indicators

Elevator trim indicator

System integrity warning flags

Automatic yaw damping

Turn and slip indicator

The flight director and autopilot have a common computer system. When the autopilot is engaged, the flight control system controls the aircraft and the pilot monitors the flight path by observing the information displayed on the pilot's horizon reference indicator (HRI) and the pilot's horizontal situation indicator (HSI) (flight director system indicators).

Autopilot/flight director commands are selected at the autopilot mode selector panel (fig. 3-18) on the pilot's side of the instrument panel. Manual roll rate and pitch commands are inserted at the autopilot pitch-turn panel (fig. 3-21). Autopilot operational status is indicated by the autopilot/flight director annunciator positioned above the pilot's horizon reference indicator on the instrument panel (fig. 2-28). Two autopilot switches are also provided on each control wheel (fig. 2-16). One switch is placarded PITCH SYNC & CWS (pitch synchronize and control wheel steering), and the other is placarded DISC TRIM/AP YD (disconnect trim/autopilot yaw damp).

Power for the system is provided through a 10ampere AP PWR circuit breaker located on the overhead circuit breaker panel (fig. 2-26).

b. Controls and Indicators. The following controls and indicators are provided for operation of the system.

(1) Instrument Panel (Pilot's).

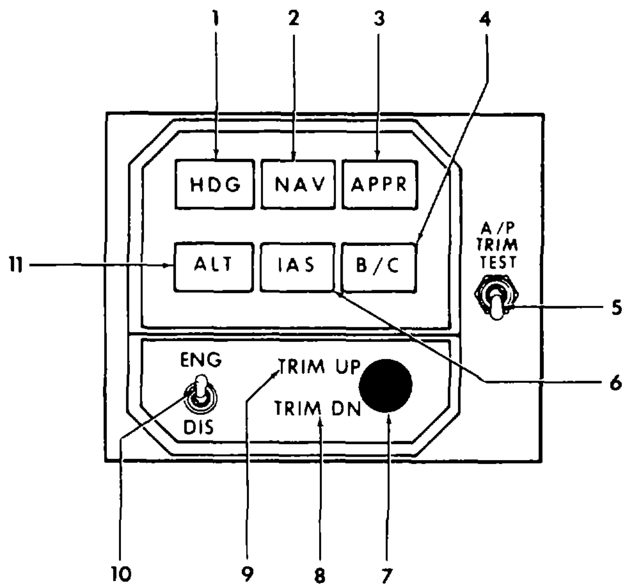
(a) Autopilot Mode select panel (fig. 3-18). The autopilot/flight director commands are selected by the autopilot mode selector. Selection is accomplished by pressing the face of the appropriate push-on/push-off switch. The lateral modes are HDG, NAV, APPR and B/C. When not in a lateral mode, the flight director command bars are biased out of view. The vertical modes are ALT, IAS, and pitch (all hold modes). If a vertical mode is not selected, the pitch hold mode is automatically operational. Selection of a mode causes the legend of that pushbutton switch to illuminate. The self-test switch on the lower right of the autopilot control panel acts as a lamp test when depressed. For operation at night, overall illumination of the autopilot mode selector and switches is adjusted by the PILOT'S INSTRUMENT light control.

CONTROL/ INDICATOR	FUNCTION
HDG switch	Engages heading mode. Commands aircraft to acquire the heading indicated by heading marker on pilot's HSI.
NAV switch	Engages navigation mode. VOR-I/VOR-2 or TACAN selected, commands aircraft to intercept and track VOR radial selected by course knob on pilot's HSI. INS selected, commands aircraft to track steering signals from INS system. Intercept of approximately 45° and tracking will be computed by the INS system.

NOTE

APPR cannot be selected with INS selected.

CONTROL/ INDICATOR	FUNCTION
APPR switch	Engages approach mode. Commands aircraft to intercept and track ILS inbound course.
ALT switch	Engages altitude hold mode. Commands aircraft to maintain pressure altitude.
IAS switch	Engages indicated airspeed hold mode. Commands aircraft to maintain airspeed.
B/C switch	Engages backcourse mode. Commands aircraft to intercept back course ILS.
ENG-DIS switch	Controls coupling of the automatic pilot.
ENG	Engages autopilot and illuminates engaged indicator.
DIS	Disengages autopilot and illuminates disengaged indicator.
TRIM UP	Illuminates when autopilot is indicator driving trim servo in up direction.
TRIM DN indicator	Illuminates when autopilot is driving trim servo in down direction.



1. HDG Switch-Indicator
2. NAV Switch-Indicator
3. APPR Switch-Indicator
4. B/C Switch-Indicator
5. AP TRIM TEST Switch
6. IAS Switch-Indicator
7. Self-Test Switch
8. TRIM DN Indicator
9. TRIM UP Indicator
10. ENG/DIS Switch
11. ALT Switch-Indicator

Figure 3-18. Autopilot Mode Selector Panel (614E-42A)

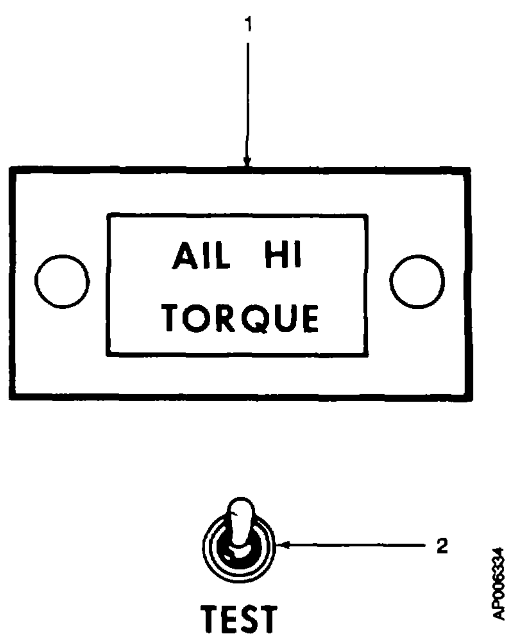
Self-test switch	Tests display and selector indicator circuits when depressed.

(b) Autopilot trim test switch (fig 3- 18).

AUTOPILOT TRIM TEST switch	Simulates trim system malfunctions and illuminates AP TRIM FAIL warning annunciator light.

(c) Aileron high torque mode test switch and annunciator (fig. 3-19).

CONTROL/ INDICATOR	FUNCTION
AIL HI TORQUE annunciator	Illumination is automatic from ground to 10,000 feet to show aileron servo is set to operate in high torque mode. Light extinguishes automatically above 10, 000 feet to indicate aileron servo has terminated high torque mode operation.
TEST switch	Normally off. Used only below 10,000 feet (TEST position) to confirm operability of aileron servo high torque mode, when AIL HI TORQUE annunciator light extinguishes.



1. AIL HI TORQUE annunciator
2. TEST switch

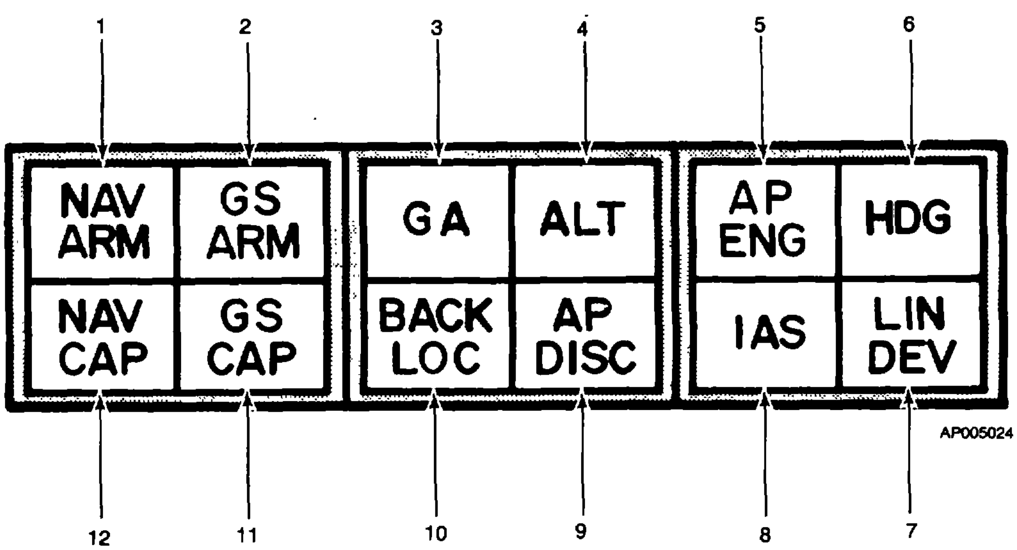
Figure 3-19. Aileron High Torque Test Switch and Annunciator

(d) Autopilot/flight director annunciator panel (fig. 3-20). The autopilot/flight director incorporates its own annunciator panel located just above the flight director display on the instrument panel. The modes and indications given on the annunciator panel are placarded on the face of the lenses and illuminate when the respective conditions are indicated. Dimming of the annunciator panel lights is provided by a switch adjacent to the panel placarded DIM-BRT.

CONTROL/ INDICATOR	FUNCTION
NAV ARM indicator	Illuminates when computer is armed to accept navigation signals.
NAV CAP indicator	VOR-I/TACAN illuminates when selected radial is captured. INS selected, illuminates when INS is coupled to the flight director.
GS ARM indicator	Illuminates when approach mode is selected prior to glideslope capture. Extinguishes after glideslope capture.
GS CAP indicator	Illuminates when glideslope is captured.
GA indicator	Illuminates when go-around mode is selected.
BACK LOC indicator	Illuminates when back course mode is selected.
ALT indicator	Illuminates when altitude hold mode is selected.
AP DISC indicator	Illuminates when autopilot is disengaged.
AP ENG indicator	Illuminates when autopilot is engaged.
IAS indicator	Illuminates when airspeed hold mode is selected.
HDG indicator	Illuminates when heading mode is selected.
LIN DEV	Not Applicable
DIM BRT control	Adjusts intensity of illumination of the flight director annunciator

(2) Pedestal - left power lever (fig. 2-11).

CONTROL/ INDICATOR	FUNCTION
GO AROUND switch (outboard side left power lever)	When pressed, autopilot disconnects, GA annunciator light (fig. 3-20) illuminates, and horizon reference indicator commands wings level, 7° nose up attitude. Autopilot may be re-engaged to follow the command.



1. NAV ARM indicator
2. GS ARM indicator
3. GA indicator
4. ALT indicator
5. AP ENG indicator
6. HDG indicator
7. LIN DEV indicator
8. IAS indicator
9. AP DISC indicator
10. BACK LOC indicator
11. GAS CAP indicator
12. NAV CAP indicator

Figure 3-20. Autopilot/Flight Director Annunciator Panel

(3) *Pedestal extension.*

(a) *Autopilot pitch-turn panel (fig. 3-21).*

CONTROL	FUNCTION
Turn control knob	Supplies roll rate commands to autopilot. Spring loaded to center detent.
Pitch control thumbwheel	Supplies pitch rate commands to autopilot. Spring loaded to center detent.

(4) *Control wheel switch (fig. 2-16).*

CONTROL/ INDICATOR	FUNCTION
DISC/TRIM/AP YD pushbutton	When pressed to first detent, autopilot system and yaw damp are disconnected. When pressed to second detent, electric trim is disconnected.
PITCH SYNC & CWS pushbutton	This button, on each control wheel, may be used instead of the pitch-turn control to establish the aircraft in a desired attitude. Depressing the button causes the autopilot servos to disengage from the control surfaces, enabling the pilot to manually fly the aircraft to the desired attitude until button is released.

c. Turn-on. Power is applied to the system anytime the aircraft avionics bus is energized.

d. Autopilot Modes of Operation.

(1) Attitude. The autopilot is in the attitude mode when the ENG-DIS switch (AP mode select panel) is in the ENG position and no mode selector switches (HDG, NAV, etc.) have been selected (fig 3-18). The autopilot will fly the aircraft and accept pitch and roll rate commands from the autopilot pitch-turn panel (fig. 3-21).

(a) Guidance mode. When the autopilot is in the attitude mode and a mode selector switch (HDG, NAV, etc.) is pressed, the autopilot accepts steering commands from the computer. Depending on which selector switch (AP mode select panel) is pressed, autopilot operation can be described by the following subguidance modes.

(b) Heading mode. When HDG mode is selected (AP mode select panel), with au topilot engaged, the autopilot will fly the aircraft to, and then maintain, the heading under the heading marker on the pilot's HSI.

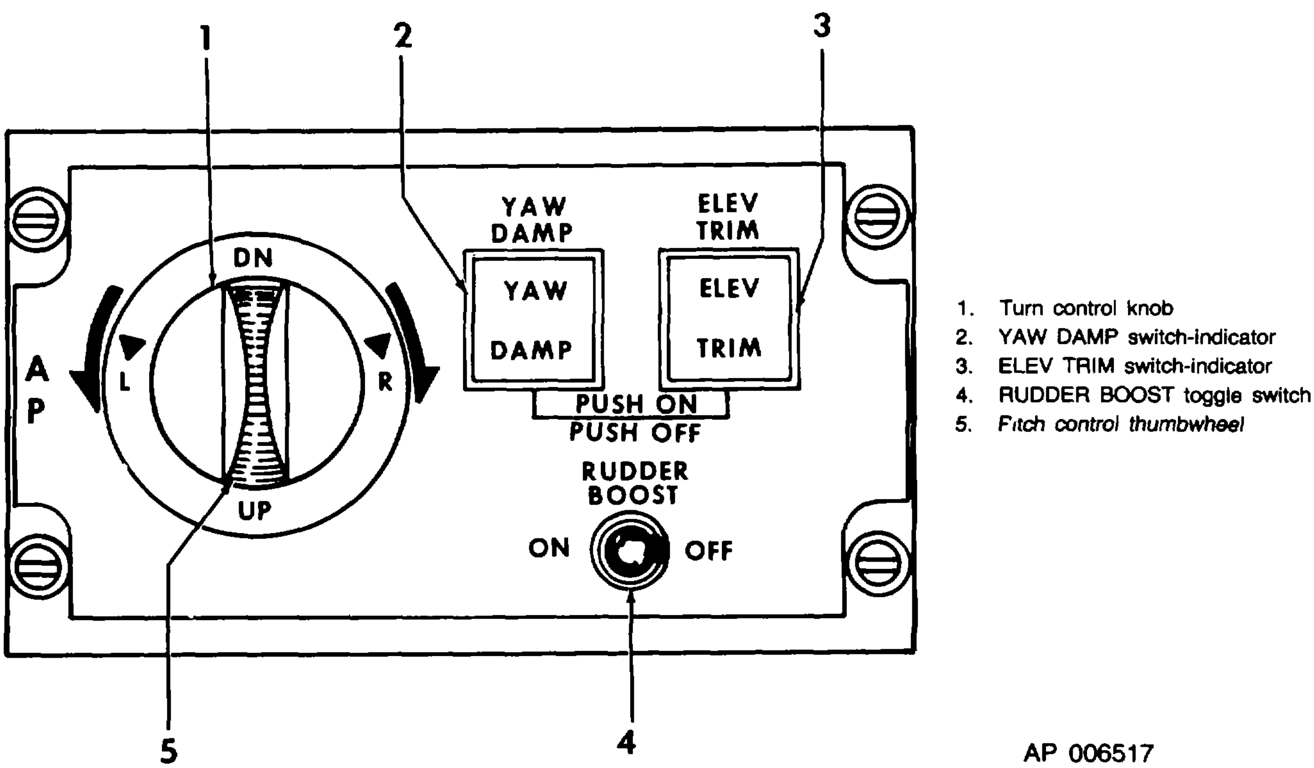


Figure 3-21. Autopilot Pitch-Turn Control Panel

(c) Navigation mode. When NAV mode is selected (AP mode select panel), the system initially switches to the NAV ARM heading hold submode, as shown by illumination of NAV ARM and HDG indicators (AP/flight director annunciator panel). The autopilot will then command the aircraft to follow the heading under the heading marker on the pilot's HSI (with the heading marker set to produce the desired VOR or localizer intercept angle). The flight computer will compute a capture point based on deviation from the desired radio beam, the rate at which the aircraft is approaching this beam, and the course intercept angle. When beam capture occurs, the HDG and NAV ARM indicator lamps (AP/flight director annunciator panel) will extinguish and the NAV CAP lamp will illuminate. The autopilot will then track the selected radio course with automatic crosswind correction.

(d) Back-course mode. When BACK LOC mode is selected on the autopilot mode selector panel, localizer capture is the same as in a frontcourse approach in NAV or APPR mode. Glideslope is inhibited during a back-course approach. The HSI must be set to the front-course heading so that lateral deviation will be directional.

(e) Approach mode. When APPR mode is selected (AP mode select panel), localizer capture is the same as in the NAV mode but glideslope arm and capture functions are also provided. When the APPR mode is selected the NAV ARM annunciator lamp will illuminate, indicating that the system is armed for localizer capture. As the aircraft approaches the localizer beam, the NAV CAP annunciator lamp will illuminate. Once the localizer is being tracked, the GS ARM annunciator lamp will illuminate. Glideslope capture is dependent on localizer capture and must occur after localizer capture. The localizer is always captured from a selected heading, but the glideslope may be captured with the autopilot operating in any vertical mode (pitch hold, altitude hold, or indicated airspeed hold), and from above (not recommended) or below the glideslope. At the point of glideslope intercept, the GS CAP annunciator lamp will illuminate and all preselected vertical modes will be cleared.

(f) Go-around mode. Pressing the GO AROUND button on the outboard side of the left power lever selects the go-around mode. Go-around mode may be selected from any lateral mode (HDG, NAV, APPR, or BACK LOC). When go-around mode is selected: (1)the autopilot is disengaged, (2) the GA annunciator lamp will illuminate, and (3) a command presentation for wings level and 3-38 7° nose up pitch attitude will appear on the pilot's horizon reference indicator.

NOTE

The heading marker may be preset to the go-around heading after the localizer is captured. After go-around airspeed and power settings are established, select the HDG mode to clear the go-around mode. Pitch attitude will remain at that used for go-around until changed with the PITCH SYNC & CWS button or the selection of a vertical mode.

(g) Pitch hold mode. The pitch hold mode is selected by (1) selecting one of the vertical mode selector switches, or (2) actuating the pitch synchronize and control wheel steering switch (PITCH SYNC & CWS), located on each control wheel.

(h) Control wheel steering mode. Pressing one of the PITCH SYNC & CWS switches located on each control wheel disconnects the autopilot servos from the control surfaces, allows the pilot to fly the aircraft to a new pitch attitude, and synchronizes the vertical command bar (pilot's horizon ref ind) to aircraft attitude. The ALT or IAS mode will disengage (if selected) when the PITCH SYNC & CWS button is depressed. When the autopilot is coupled to the HDG, NAV, APPR, or BACK LOC modes, releasing the PITCH SYNC & CWS switch will cause the autopilot to couple to the previously selected mode.

(i) Altitude hold mode. Pressing the ALT switch (AP mode select panel) when desired altitude has been reached (with autopilot engaged) will (1) cause the autopilot to fly the aircraft to maintain the barometric altitude at which the aircraft was flying when ALT switch was pressed, (2) illuminate the ALT annunciator lamp (AP/flight director annunciator panel), and (3) display the altitude hold commands on the vertical command bar (pilot's horizon reference indicator)

(j) Indicated airspeed hold mode. Pressing the IAS switch (AP mode select panel) when desired airspeed has been reached (with autopilot engaged) will (1) cause the autopilot to fly the aircraft to maintain the indicated airspeed at which the aircraft was flying when IAS switch was pressed, (2) illuminate the IAS annunciator lamp (AP/flight director annunciator panel), and (3) display IAS hold commands on the vertical command bar of the pilot's horizon reference indicator.

e. Autopilot Operation.

(1) Engaging autopilot. AP mode select panel ENG/DIS switch to ENG position.

NOTE

When the autopilot is engaged, the yaw damper is also automatically engaged as indicated by the lighted YAW DAMP button (AP pitch/turn control panel).

The autopilot and flight director are coupled when both units are engaged. When coupled, the autopilot accepts guidance commands from the flight director. When the flight director is not engaged, the autopilot accepts pitch and roll commands from the pitch/turn control knobs as selected by the pilot.

The autopilot may be engaged in any reasonable attitude and in either the coupled or uncoupled mode. The autopilot will smoothly acquire the command attitude. When uncoupled, the autopilot will maintain the bank and pitch attitude at the time of engagement.

(2) Disengaging autopilot.

(a) The autopilot may be disengaged by any of the following:

1. Actuating compass INCREASE/DECREASE switch.
2. Pressing TEST button on AP mode select panel.
3. Pressing GO AROUND switch on left power lever.
4. Pressing control wheel DISC switch to AP YD position.

(b) The following functions will cause the autopilot to automatically disengage:

1. Vertical gyro failure.
2. Directional gyro failure.
3. Autopilot power or circuit failure.
4. Torque limiter failure.

(3) Maneuvering.

1. To change flight functions, press the desired mode button on the AP mode selector panel. The button will illuminate along its edges and autopilot annunciator lights on the instrument panel will illuminate, indicating the respective modes in operation.
2. In any function except "after glideslope capture", use the autopilot pitch control for climbing or descending. Movement of the pitch control establishes a pitch rate that is proportional to knob displacement. If any vertical mode button has been selected, it will automatically release when the pitch control knob is rotated.
3. When HDG mode is selected, the autopilot will command the aircraft to execute a turn then maintain the heading set by the heading marker.
4. Use the autopilot turn control to command a roll rate when the autopilot is engaged. At the time control is returned to detent, the autopilot maintains the bank angle (up to approximately 30 degrees). Rotating the turn control when the autopilot is engaged and a lateral mode is selected will cause the selected lateral modes to release.

(4) Control wheel synchronization. The PITCH SYNC & CWS button on the pilot's control wheel can be used instead of the pitch/turn control to establish the aircraft in a desired attitude. Depressing this button causes autopilot elevator and aileron servos to disengage from the control surfaces. The pilot then flies the aircraft manually to a desired attitude, releases the PITCH SYNC & CWS button to re-engage the servos, and the autopilot holds the established attitude.

The ALT and IAS mode will immediately disengage (if selected) when the PITCH SYNC & CWS button is pressed. Upon release of the PITCH SYNC & CWS button, the autopilot will couple to the previously selected lateral mode.

NOT

The APPR mode will not disengage when the PITCH SYNC & CWS button is depressed. When the button is released, the aircraft will return to the localizer course and glideslope.

f. Takeoff and Climb Out.

(1) Before takeoff

1. Heading marker (pilot's HSI) Set to runway heading.
2. HDG switch (AP mode select panel) Press. Do not engage autopilot.

(2) Takeoff Pressing the PITCH SYNC & CWS switch on control wheel will provide pitch sync, and the cross-pointers on the pilot's horizon reference indicator will command flight to the pitch attitude that existed when the PITCH SYNC & CWS switch was pressed.

(3) Climb out.

1. Establish climb profile.
2. ENG/DIS switch (AP mode select panel) Set to ENG (above 200 feet AGL).
3. IAS switch (AP mode select panel) Press (if desired).
4. HDG knob (pilot's course indicator selector) Move heading marker as required for heading changes.

(4) Cruise altitude.

1. Vertical speed Reduce to approx. 500 feet per minute (just before reaching cruise altitude).
2. ALT button (AP mode select panel) Press (when reach cruise altitude).

g. VOR Operation.

(1) To establish aircraft on a desired VOR radial, perform the following

1. VOR receiver Tune appropriate frequency.
2. COURSE knob (pilot's HSI) Set desired course TO or FROM station shown in COURSE window.
3. HDG knob (pilot's HSI) Set desired beam intercept angle under heading marker. (The intercept angle with respect to the radio beam may be any angle of 90° or less).
4. NAV switch (AP mode select panel) Press. (Observe illumination of NAV ARM annunciator).
5. NAV CAP annunciator (AP/flight director annunciator panel) Monitor. (At point of capture, NAV CAP illuminates).

NOTE

Except as described below, do not select a different VOR frequency, TACAN channel, or course once a course and intercept have been programmed or capture achieved. To select a different course or VOR/TACAN frequency, return to the HDG mode, select the course or frequency, return to the NAV mode, then reset the desired beam.

(2) To change course over a VOR station. To change course over a VOR station while operating in NAV mode, if course change is less than 30°: COURSE knob (pilot's HSI) Set desired heading in COURSE window.

(3) To change course over a VOR station. To change course over a VOR station while operating in NAV mode, if course change is greater than 30°:

1. HDG knob (AP mode select panel) Set desired intercept heading under heading marker.
2. HDG switch (AP mode select panel) Press. (Observe HDG illuminates (AP/flight director annunciator panel).
3. COURSE knob (pilot's HSI) Set new course in COURSE window.
4. NAV switch (AP mode select panel) Press (Observe NAV ARM illuminates (AP/flight director annunciator panel).
5. NAV CAP (AP/flight director annunciator panel) -Monitor. (Illumination means capture of new radial).

h. Automatic Approach Front Course.

NOTE

The localizer and glideslope are captured automatically on the ILS front course approach. The localizer must be captured before glideslope capture can occur. The localizer is always captured from a selected heading, but the glideslope may be captured from any of the vertical modes and from above (not recommended) or below the glideslope.

1. VOR receiver Tune appropriate frequency.
2. COURSE knob (pilot's HSI) Set inbound runway heading in COURSE window.
3. HDG knob (pilot's HSI) Set heading marker to desired intercept angle.
4. HDG selector switch (AP mode select panel) Press. (Observe HDG illuminates on AP/flight director annunciator panel).
5. Vertical mode (AP mode select panel) Select IAS or ALT.
6. APPR switch (AP mode select panel) Press. (Observe NAV ARM illuminates on AP/flight director annunciator panel).
7. NAV CAP (AP/flight director annunciator panel) -Observe illumination (when capture of localizer course is achieved).
8. GS ARM (AP/flight director annunciator panel) -Observe illumination (when autopilot is armed for glideslope capture).
9. GS CAP (AP/flight director annunciator panel) -Observe illumination (which confirms that all vertical modes are cleared, and also confirms that autopilot is tracking glideslope).

i. Go-Around. If visual runway contact is not made at decision height, go-around may be activated by pressing the GA button on the left power lever, and may be initiated from any lateral mode (HDG, NAV, APPR, B/C) with the following results:

1. Illuminates GA light on autopilot annunciator panel.
2. Disengages autopilot.
3. Pilot's HRI shows command presentation for wings level and 7° nose up climb attitude.

NOTE

The heading marker may be preset to go-around heading after the localizer is captured. After go-around airspeed and power settings are established, selection of the HDG mode will clear the go-around mode. Pitch attitude will remain at that used for go-around until changed with the PITCH SYNC & CWS button or by selection of a vertical mode.

j. Back Course Approach. As in front course approach, the localizer is captured automatically. The aircraft should be maneuvered into the approach area by setting the heading marker and functioning in the HDG mode.

1. VOR receiver (NAV panel) Tune localizer frequency.
2. COURSE knob (pilot's HSI) Set front course inbound runway heading in COURSE window.
3. HDG knob (pilot's HSI) Set heading marker to desired intercept angle.
4. HDG switch (AP mode select panel) Press. (Observe HDG lamp illuminates on AP/flight director annunciator panel).
5. B/C switch (AP mode select panel) Press. (Observe BACK LOC and NAV ARM lamps illuminate (AP/flight director annunciator panel) indicating system is armed for back localizer capture.
6. NAV CAP lamp will illuminate when system has captured back localizer course.
7. PITCH control (AP/pitch-turn panel) Use to establish and maintain desired rate of descent.

NOTE

The HDG mode should be used within one mile of the runway due to the large radio deviations encountered when flying over the localizer transmitter.

k. Yaw Damper Operation.

1. The rudder channel of the autopilot may be selected separately for yaw damping by depressing the YAW DAMP switch on the pedestal. The switch face will illuminate when the yaw damper is engaged.
2. To disengage the yaw damper, press the disconnect button on the pilot's or copilot's control wheel to the first detent or press the YAW DAMP switch on the pedestal.
3. Refer to Emergency Procedures for other means of disconnecting the yaw damper.

l. Disconnecting Autopilot. The autopilot may be disconnected by any of the following actions:

1. Pressing the DISC TRIM/AP YD switch to first detent. (Location: outboard horn either control wheel.)
2. Placing the ENG-DIS switch to DIS position. (Location: AP mode select panel.) NOTE After assuming manual control, fly the aircraft using the same heading, course, and attitude displays to monitor autopilot operation prior to assuming manual control.

m. Emergency Procedures. The autopilot can be disengaged by any of the following methods:

1. Press the AP/YD disconnect switch (either control wheel).
2. Move the engage lever to DIS position (either control wheel).
3. Engage the go-around mode (yaw damper will remain on).
4. AP PWR and AFCS DIRECT circuit breakers (overhead panel) Pull.
5. AVIONICS MASTER POWER switch (overhead panel) -OFF.
6. Aircraft MASTER switch (overhead panel) OFF.

n. Automatic Disengagement. The following conditions will cause the autopilot to disengage automatically.

1. Any interruption or failure of power.
2. Vertical gyro failure indication.
3. Flight control system power or circuit failure.
4. Autopilot trim failure.

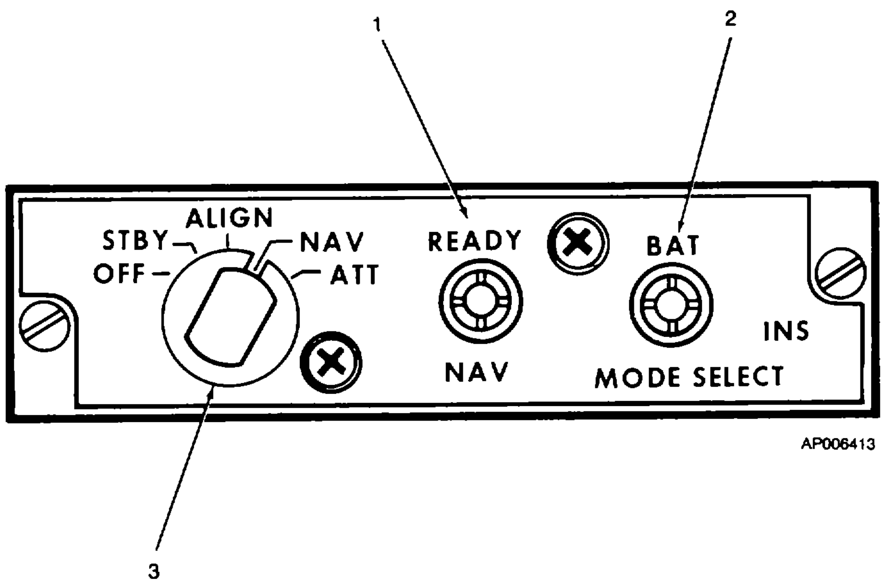
3-28. INERTIAL NAVIGATION SYSTEM.

a. Description. The Inertial Navigation System (INS) is a self-contained navigation and attitude reference system. It is aided by (but not dependent upon) data obtained from the ground-based data link system, its own TACAN system, the aircraft encoding altimeter, the true airspeed computer, and the gyro magnetic compass system. The position and attitude information computed by the INS is supplied to the automatic flight control system, weather radar system, horizontal situation indicator, radio magnetic indicators, and to mission equipment. The INS is independent of aircraft maneuvers, weather conditions and terrain, and in conjunction with other aircraft equipment permits operations on instruments alone under Instrument Meteorological Conditions (IMC). The INS provides a visual display of present position data in Universal Transverse Mercator (UTM) coordinates or conventional geographic (latitude-longitude) coordinates during all phases of flight. When approaching the point selected for a leg switch, an ALERT lamp will light informing the pilot of an eminent automatic leg switch or the need to manually insert course change data. The INS may be manually updated for precise aircraft present position accuracy by flying over a reference point of known coordinates. The INS may be updated automatically by the TACAN system or the Data Link system. Altitude information is automatically inserted into the INS computer by an encoding altimeter whenever the INS is operational.

The Mode Selector Unit (MSU) (fig. 3-22) controls system activation and selects operating modes.

The Control Display Unit (CDU) (fig. 3-23) provides controls and indicators for entering data into the INS and displaying navigation and system status information.

The INS system is protected by the 10-ampere PRIME POWER and the 5-ampere HEATER POWER circuit breakers on the mission AC/DC power cabinet, by the 5-ampere INS CONTROL circuit breaker on the overhead circuit breaker panel and by the 20-ampere circuit breaker on the front of the battery unit.



1. READY NAV lamp
2. BAT lamp
3. Mode selector

Figure 3-22. Mode Selector Unit (C-IV-E)

b. Controls and Indicators.

(1) Mode selector unit (fig. 3-22).

CONTROL	FUNCTIONS
Mode select knob	Controls INS activation and selects operating modes.
OFF	Deactivates INS.
STBY (ground use only)	To STBY from OFF mode. Starts fast warmup of system to operating conditions; activates computer so information may be inserted; all INS-controlled warning flags will indicate warning.

To STBY from any other mode:

INS operates as if in attitude reference mode; all INS warning flags and lamps, except ATTITUDE and PLATFORM HEADING, will indicate warning.

ALIGN (ground use only, parked)	To ALIGN from STBY mode. Starts automatic course alignment mode (if fast-warmup heaters are off); fine alignment will not start until present position is inserted into CDU.

To ALIGN from OFF mode:

Leveling starts after fast-warmup heaters are off.

To ALIGN from NAV mode:

INS is not downmoded but will allow automatic shutdown if overtemperature is detected.

NAV	Activates normal navigation mode after automatic alignment is completed; must be selected before moving aircraft.

To NAV from STBY mode:

Causes INS to automatically sequence through STBY and ALIGN to NAV mode, if present position is inserted and aircraft is parked.

Used to shorten time in STBY and to bypass battery test, if stored heading is valid.

ATT	Activates attitude reference mode. Used to provide only INS attitude signals. Shuts down computer and CDU leaving only BAT and WARN lamps operative. Once selected, INS alignment is lost.
BAT lamp	Lights to indicate INS shutdown due to low battery unit voltage.
READY NAV lamp	Lights to indicate INS high accuracy alignment is attained. If attained during ALIGN mode,

	lamp remains illuminated until NAV mode is selected. Lamp lights momentarily during alignment, if alignment accomplished while in NAV mode.

(2) *INS control display unit 6fig. 3-23).*

CONTROL INDICATOR	FUNCTIONS
HOLD key	Used with other CDU controls to stop present position display from changing, in order to update position and to display recorded malfunction codes. Lights when pressed first time; goes out when pressed second time or when inserted data is accepted by computer. When pressed second time, allows displays to resume showing changing current present position.
ROLL LIM key	Allows selection of Limited Roll steering mode. Press to select mode, key lights. Roll steering output is limited to 10 degrees. Press second time to exit mode, key light extinguishes. Roll steering output returns to normal limit of 25 degrees.
Data display, left and right	Composed of lamps which illuminate to display numbers, decimal points, degree symbols, left and right directions, and latitude or longitude directions.
INSERT/ ADVANCE/ HI PREC key	Allows insertion of loaded data into computer. Enters displayed data into INS. When pressed before pressing any numerical key, alternates display of normal and high precision data.
ALERT lamp	Illuminates amber to alert pilot 1.3 minutes before impending automatic course leg change. Extinguishes when switched to new leg, if AUTO/MAN switch is set to AUTO. Flashes on and off when passing waypoint, if AUTO/MAN switch is set to MAN. Light will extinguish if AUTO is selected or if a course change is inserted.
WARN lamp	Lights red to alert pilot INS self-test circuits have detected a system fault. Illumination may be

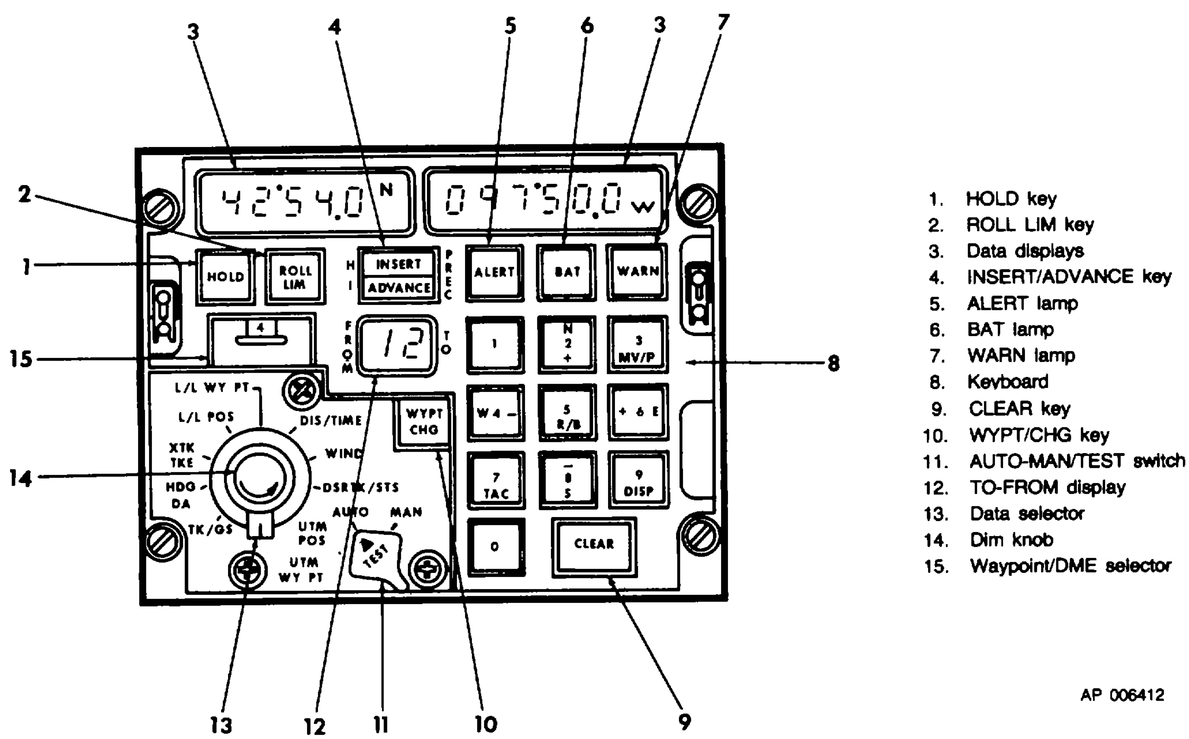


Figure 3-23. INS Control Display Unit (C-IV-E)

caused by continuous or intermittent condition. Intermittent conditions light lamp until reset by TEST switch. If continuous condition does not degrade attitude operation, lamp goes out when mode selector is set to ATT.

Keyboard — Consists of 10 keys for entering load data into data and FROM-TO displays.

"N", "S", "E", and "W" (on keys 2,8,6 and 4) indicate direction of latitude and longitude. TAC and DISP (on keys "7" and "9") enable loading and display of TACAN station data. MV and DISP (on keys "3" and "9") are associated with loading and display of Magnetic Variation and Magnetic Heading. GRID and DISP (on keys "5" and "9") are associated with loading and display of UTM coefficients.

CLEAR key — When pressed, illuminates and erases data loaded into data displays or FROM-TO display. Used to cancel erroneous data. After clearing, data loading can be resumed.

WYPT CHG key — When pressed, enables numbers in FROM-TO display to be changed. If INSERT/ADVANCE key is pressed, computer will use navigation leg defined by new number in all navigation computations. If INSERT/ADVANCE key is not pressed, computer will continue using original numbers in all navigation computations; but distance/time information, based on new leg, may be called up and read in data displays (in case of waypoints). When not in TACAN mix mode, TACAN station number is inserted to display DIS/TIME information.

AUTO-MAN TEST switch — This is a dual purpose control. When the knob is pressed inward, the TEST switch function is engaged. When the knob is rotated to either the AUTO or as a selector between those modes.

(AUTO) — Selects automatic leg switching mode. Computer switches from one leg to the next whenever waypoint in "TO" side of the FROM-TO display is reached.

(MAN) — Selects manual leg switching mode. Pilot must make waypoint changes manually.

(TEST) — When pressed, performs test of INS lamps and displays, remote lamps and indicators controlled by INS, and computer input/output operations.

Used with other controls to activate display of numerical codes denoting specific malfunctions and resets malfunction warning circuits.

During alignment, activates the HSI test. Continued pressing of switch provides constant INS outputs to drive cockpit displays in a predetermined fashion.

NOTE

The INS can provide test signals to the Horizontal Situation Indicator (HSI)and connected displays. Pressing TEST switch during Standby, Align, or NAV modes will cause all digits on connected digital displays to indicate "8's" and illuminates the HSI and ALERT lamps. Additional HSI test signals are provided when INS is in Align and the data selector is at any position other than DSRTK/STS. Under those conditions, pressing TEST switch causes the HSI to indicate heading, drift angle, and track angle error all at "0°" or "30°". At the same time, cross track deviation is indicated at "3.75" nautical miles (one dot) right or left and INS-controlled HSI flags are retracted from view.

Output test signal are also supplied to the autopilot when INS steering is selected. Rotating AUTO/MAN switch to AUTO and pressing TEST during Align furnishes a 15° left bank steering command. A 15° right bank steering command is furnished when the AUTO/MAN switch is set to MAN.

FROM-TO display — Display numbers defining waypoints of navigation leg being flown or in the case of a flashing display, displays TACAN station being used.

Waypoint numbers automatically change each time a waypoint is reached. Unless flight plan changes during flight, the automatic leg switching sequence will always be 1 2, 2 3, 3 4....8 9, 9 1, 1 2, etc.

Data selector — Selects data to be displayed in data displays or entered into INS. The rotary selector has 10 positions. Five positions (L/L

POS, L/L WYPT, UTM POS, UTM WYPT and DSRTK/STS) also allow data to be loaded into data display then inserted into computer memory.

TK/GS — Displays aircraft track angle in left display and ground speed in right display.

HDG/DA — Displays aircraft true heading in left display and drift angle in right display.

XTK/TK — Displays cross track distance in left display and track angle error in right display.

L/L POS — Displays or enters present aircraft position latitude in left data display and longitude in right data display. Both displays indicate degrees and minutes to nearest tenth of a minute.

This position also enables the insertion of present position coordinates during alignment and present position updates.

L/L WY PT — Displays or enters waypoint and TACAN station data, if used in conjunction with the waypoint/TACAN selector.

This position will also cause display of inertial present position data when the HOLD key is illuminated.

DIS/TIME — Displays distance from aircraft to TACAN station or any waypoint, or between any two waypoints in left display. Displays time to TACAN station or any waypoint, or between any two waypoints, in right display.

WIND — Displays wind direction in left display and wind speed in right display, when true airspeed is greater than the Air Data System lower limit (115-400 KIAS).

DSRTK/STS — Displays desired track angle to nearest degree in the left data display, and INS system status in right data display.

UTM POS — Displays or enters aircraft position in Universal Transverse Mercator (UTM) coordinates, with northing data in kilometers in left display and easting data in kilometers in right display. The extra precision display shows meters.

UTM WYPT — Displays or enters waypoint and TACAN station data in UTM coordinates. Also enables loading and display of spheroid coefficients if GRID and DISP keys are pressed simultaneously.

Dim knob — Controls intensity of CDU key lamps and displays.

Waypoint/DME selector — Thumbwheel switch, used to select waypoints for which data is to be inserted or displayed. Waypoint station "O" is for display only and cannot be loaded with usable data.

c. INS - Normal Operating Procedures.

NOTE

The following data will be required prior to operating the INS: Local magnetic variation, latitude and longitude or Universal Transverse Mercator (UTM) coordinates of aircraft during INS alignment. This information is necessary to program the INS computer during alignment procedure.

NOTE

When inserting data into INS computer, always start at left and work to right. The first digit inserted will appear in right position of applicable display. It will step to left as each subsequent digit is entered. The degree sign, decimal point, and colon (if applicable) will appear automatically.

(1) Preflight procedures.

CAUTION

Insure that cooling air is available to navigation unit before turning the INS on.

NOTE

The INS requires an aircraft compass system to provide accurate navigational data and mission data. The compass system selected with the copilot's compass select switch will provide information to the INS platform.

NOTE

Aircraft must be connected to a ground power unit if INS alignment is performed prior to engine starting. In this event, the engines must not be started until after the INS is placed in the NAV mode.

1. Applicable circuit breakers Check depressed.
2. INS Mode selector (MSU) ALIGN. Confirm following:

a. (CDU) FROM-TO display indicates "1 2".

b. (CDU) INSERT/ADVANCE pushbutton light illuminates.

c. (CDU) BAT lamp illuminates for approx. 12 seconds, then extinguishes when in alignment state 8.

NOTE

Avoid passenger or cargo loading or any activity which may cause aircraft to change position or attitude during alignment. If aircraft is moved during alignment, it will be necessary to restart alignment by setting the mode selector to STBY, then back to ALIGN and reinserting present position data.

3. (CDU) DIM knob Adjust for optimum brightness of CDU displays.
4. (CDU) AUTO/MAN/TEST switch AUTO.
5. (CDU) Data selector L/L POS or UTM POS, as desired.

(Observe coordinates of last present position prior to INS shutdown appear in data displays.) NOTE The stored heading procedure should have been performed within the last week.

6. Perform recommended stored heading alignment preflight procedure:

a. Appropriate circuit breakers Depress (including those for magnetic compass system.)

b. (MSU) Mode selector NAV.

(Observe (CDU) FROM-TO display indicates "1 2", and INSERT/ADVANCE pushbutton illuminates.)

NOTE

Aircraft must not be towed or taxied during INS alignment. Movement of this type during alignment causes large navigation errors. If aircraft is moved during alignment, restart alignment by setting mode selector to STBY, then back to ALIGN and reinserting present position.

Passenger or cargo loading in the aircraft could cause the type of motion which affects the accuracy of alignment. Any activity which causes the aircraft to change attitude shall be avoided during the alignment period.

c. (CDU) DIM knob Adjust for maximum brightness of CDU displays.

d. (CDU) AUTO/MAN/TEST switch AUTO.

e. (CDU) Data selector UL POS or UTM POS.

(Observe coordinates of last present position prior to INS turn-off appear in data displays.)

f. (CDU) AUTO/MAN/TEST switch Press and hold for test. Confirm following on CDU:

(Left and right data displays indicate "88°88.8 N/S" and "88°88.8 E/W" respectively.)

(FROM-TO display indicates "8.8".)

(The following pushbuttons and lamps illuminate: ROLL LIM, HOLD, INSERT/ADVANCE, WYPT CHG, ALERT, BAT (on CDU and MSU), WARN, and READY NAV.)

g. (CDU) AUTO/MAN/TEST switch Release. Confirm following:

(Data displays indicate coordinates in computer memory; all lamps and pushbuttons illuminated in Step F except INSERT/ADVANCE pushbutton light go out.)

h. If UTM coordinates are to be used Verify that appropriate Grid coefficients have been loaded.

i. Present position data Insert.

NOTE

After present position 'has been inserted and computer has advanced to state "7", present position cannot be reinserted without downmoding to STBY and restarting alignment.

j. Data selector DSRTK/STS

(Observe that the left data display indicates the desired track stored in computer memory and that the right data display indicates status "-194.")

NOTE

If the fourth digit from the right, in the right data display is blank, then a valid heading has not been stored. Proceed with normal preflight procedure.

k. Monitor the right data display for a change from alignment state "9" to alignment state "8". This will be indicated by a reading of "--184".

l. Monitor the right data display for malfunction codes (table 3-5).

(Loss of 26 VAC is indicated by an illuminated WARN lamp and a reading of ".03184" in the right-hand display. An inoperative magnetic compass system is indicated by an extinguished WARN lamp and a reading of ".03184" in the right-hand display.)

NOTE

If above displays appear, a stored heading alignment may not be possible.

m. If there are malfunction codes, proceed to ABNORMAL PROCEDURES in this chapter.

n. When alignment state "7" is reached, the INS will advance to the NAV mode.

(Observe that "---05" will appear in the STS display.)

NOTE

To achieve best accuracy, engine start and heavy loading activity should be delayed until entry into NAV mode.

NOTE

With the data selector in either the L/L WY PT or UTM WY PT position, waypoint and TACAN station data may be loaded at any time after turn-on. The operator should occasionally switch the data selector to DSRTK/STS to monitor system status indicators in the right data display.

(2) (CDU) AUTO/MAN/TEST switch Press and hold. Confirm:

1. Left and right data displays indicate "88°88.8 N/S" and "88°88.8 E/W" respectively.
2. FROM-TO display is "8.8".
3. Following pushbuttons and lamps illuminate: ROLL LIM, HOLD, INSERT/ADVANCE, WYPT CHG, ALERT, BAT (on CDU and MSU), WARN and READY NAV.

(3) TEST switch Release. (Observe data displays indicate coordinates in computer memory; also all lamps and pushbuttons lighted in step 7 except INSERT/ADVANCE pushbutton extinguish.)

(4) Appropriate grid coefficients Verify loaded (if UTM coordinates are to be used.)

(5) Verify UTM grid coefficients.

1. Data selector UTM WYPT.
2. Keys "5" and "9" Press simultaneously.

Observe FROM-TO display is blank. Earth flatness coefficient appears in left display. The relative earth radius, in meters, appears in right display.)

NOTE

These values are retained from turn-on to turn-on unless changed by operator.

3. Verify that values correspond to those required for spheroid being used.

NOTE
Values for various spheroids are listed in Table 3-1.

4. If values are correct, return CDU to normal display mode by momentarily setting data selector to any position except UTM WYPT. If values are to be changed, continue with following steps:

NOTE
The INS geographic position, as read in L/L displays, will not be affected by any changes in these coefficients.

5. Keys "2"or "8" Press to indicate following is the flatness coefficient.

(Observe INSERT/ADVANCE pushbutton light illuminates.)

6. Load earth flatness coefficient by pressing keyboard keys in sequence.

(Example: 2 9 4 9 8 = 29498. Observe number appears in left display as keys are pressed.)

7. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE pushbutton light goes out.)

8. Keys "4" or "6" Press, to indicate following load is relative earth radius.

(Observe INSERT/ADVANCE pushbutton light illuminates.)

9. Load relative earth radius by pressing keyboard keys in sequence.

(Example: 8 2 0 6 m = 8206. Observe numbers appear in the right display as keys are pressed.)

NOTE
Zone symbol is to be ignored.

Table 3-1. Various Values for UTM Grid Coefficients

SPHEROID	FLATNESS COEFFICIENT	RELATIVE RADIUS
International	29700	8388 m
Clark 1866	29498	8206 m
Clark 1880	29346	8249 m
Everest	30080	7276 m
Bessel	29915	7397 m
Modified Everest	30080	7304 m
Australian National	29825	8160 m
Airy	29932	7563 m
Modified Airy	29932	7340 m

SOURCE: Universal Transverse Mercator Grid Technical Manual, TM 5-241-8, Headquarters, Department of the Army 30 April 1973, page 4

Flatness Coefficient: 100 (1/f)
Relative Radius a-6, 3700,000

BT00991

10. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE pushbutton light extinguishes.)

11. Data selector UTM POS.

(Observe coordinate will reflect values of new spheroid.)

(6) Insert present position.

(7) Perform abbreviated INS interface test As required:

NOTE
Assuming a level aircraft, attitude indicators will become level during alignment State "8" and remain level in all modes until INS is shut down. Warning indicators for INS attitude signals from INS are valid while attitude sphere display is level.

NOTE

The INS can provide test signals to the Horizontal Situation Indicator (HSI) and connected displays. Pressing TEST switch during Standby, Align, or NAV mode causes all digits on connected digital displays to indicate "8's," and lights the HSI and the ALERT lamp. Additional HSI test signals are provided when INS is in Align and data selector is at any position other than DSRTK/STS. Under those conditions, pressing TEST switch causes HSI to indicate heading, drift angle, and track angle error all at "0°" or "30°." At the same time, cross track deviation is indicated at "3.75" nautical miles (one dot) right or left and INS-controlled HSI flags are retracted from view.

NOTE

Output test signals are supplied to the autopilot when INS steering is selected. Rotating AUTO/MAN switch to AUTO and pressing TEST during Align furnishes a 15° left bank steering command. A 15° right bank steering command is furnished when AUTO/MAN switch is set to MAN.

NOTE

The quick test procedure may be performed any time after Alignment State "8" is reached and prior to entry into NAV.

1. Mode selector ALIGN.

(Observe CDU displays are illuminated.)

2. Data selector DSRTK/STS (monitor right data display until State "8" (or lower) is reached.) (Observe right data display is ---N4, where "N" is not "9".)
3. AUTO/MAN switch MAN.
4. INS Couple to flight director and autopilot, as applicable.
5. Data selector Set to any position except DSRTK/STS.
6. TEST switch Press and hold.

NOTE

After performing the preceding step, observe:

MSU	All lamps illuminated.
CDU	All lamps illuminated. All "8's" displayed.
HSI	All angles 30°. Cross-track deviation bar is one dot right. All INS flags are retracted.
Flight Director/ Autopilot	A 15° steering command is issued.
Mission Control Panel	LINK UPDATE annunciated. TACAN UPDATE annunciated.

7. CDU TEST switch Hold depressed, and rotate AUTO/MAN switch to AUTO.

(Observe all indications are as in step (6) except a 15' left steering command is issued. On HSI, All angles are "0°" and cross-track deviation bar is one dot left.)

8. CDU TEST switch Release. If desired, decouple INS.

(Observe operation returns to normal.)

NOTE

Prior to pressing INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing CLEAR pushbutton and reloading correct data.

NOTE

While parked aircraft is undergoing alignment, encoding altimeter will supply the field elevation (aircraft altitude) into INS.

NOTE

Once present position has been inserted and computer has advanced to alignment state "7", present position cannot be reinserted without downmoding to STBY and restarting alignment.

NOTE

If longitude and latitude coordinates are being used, skip step 8 (a) and proceed with step 8 (b).

(a) Insert UTM coordinates of aircraft present position:

1. Data selector UTM POS.

(Observe that prior to initial load, INSERT/ ADVANCE pushbutton light illuminates.)

2. To load zone and easting values Press keys in sequence, starting with"E".

(Example: Zone 16, 425 km East = E16 425. Observe that zone and easting in kilometers appear in right data display as keys are pressed.)

3. INSERT/ADVANCE pushbutton Press.

(Observe pushbutton light remains illuminated.)

4. To load northing data Press keys in sequence, starting with "N" or "S" to indicate north or south hemisphere.

(Example: 4749 km North = N 4749) Observe northing kilometers appear in left data displays as keys are pressed.)

5. INSERT/ADVANCE pushbutton Press.

(Observe pushbutton light remains illuminated.)

6. INSERT/ADVANCE pushbutton Press.

(Observe extra precision display for present position northing and easting, to the nearest meter, appears in left and right data displays, respectively.)

7. To load extra precision easting data Press keys in sequence, starting with "E".

(Example: 297 m East = E 297) Observe that easting meters appear in right data display as keys are pressed.)

8. INSERT/ADVANCE pushbutton Press.

(Observe pushbutton light remains illuminated.)

9. To load extra precision northing data Press keys in sequence, starting with "N" or "S".

(Example: 901 m North = N 901) Observe that northing meters appear in left data displays as keys are pressed.)

NOTE

The value is always added to normal value regardless of which key (N/S) is pressed to initiate the entry. The normal entry establishes the hemisphere.

10. INSERT/ADVANCE pushbutton Press.

(Observe latitude and longitude data is displayed in UTM and INSERT/ ADVANCE pushbutton light extinguishes.)

NOTE

The computer will convert coordinates in the overlap area; however display values will reference appropriate zone.

NOTE

The "W" key may be used to initiate easting entries; however computer will always interpret such entries as an "E" input. "E" will be displayed in normal UTM display.

NOTE

Extra precision values are always added to normal values. As an example, South 4, 476,995 m will display "4476S" in normal display and "995" in extra precision display. There is no rounding between the two displays.

(b) To insert geographic coordinates of aircraft present position:

NOTE

Prior to pressing INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing CLEAR pushbutton and loading correct data.

1. Data selector L/L POS.

(Observe that, prior to initial load, the INSERT/ ADVANCE pushbutton light is illuminated.)

2. To load latitude data Press keys in sequence, starting with "N" or "S" to indicate north or south.

(Example: 42°54.0' North = N 4 2 5 4 0. Observe that latitude appears in left data display as keys are pressed.)

3. INSERT/ADVANCE pushbutton Press.

(Observe pushbutton light remains illuminated.)

4. To load longitude data Press keys in sequence, starting with "W" or "E" to indicate west or east.

(Example: 87°54.9' West = W 8 7 5 4 9. Observe that longitude appears in right data display as keys are pressed.)

5. INSERT/ADVANCE pushbutton- Press.

(Observe pushbutton light extinguishes.)

(8) To insert magnetic variation. (Only if compass is not operational)

1. Data selector L/L WYPT.
2. Keys "3" and "9" Press simultaneously.

(Observe that magnetic variation, to a tenth of an arc-minute, appears in the right data display.)

NOTE

Magnetic variation is retained from the last NAV mode to be used for reasonableness tests during stored heading alignment.

NOTE

During NAV mode, magnetic variation is computed when aircraft roll is less than 9° and magnetic heading input is valid (absence of Error Code 17).

3. If magnetic variation is to be loaded, proceed with next two steps.
4. Magnetic variation Load by pressing keyboard keys in sequence, starting with "E" or "W" to indicate east or west.

(Example: 14'53.6' East = E 1 4 5 3 6) Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed, and magnetic variation appears in right data display).

5. INSERT/ADVANCE pushbutton Press.

(Observe pushbutton light extinguishes.)

NOTE

If in NAV mode and magnetic heading input is valid, computer will reject loaded value.

6. To return INS to normal display mode, momentarily set data selector to any position except L/L WYPT.

(9) Data selector DSRTK/STS. Confirm.

1. Left data display indicates desired track angle in computer memory.
2. Right data display indicates ---84, ---74, ---64, or ---54, depending on which alignment state the computer has reached.

(10) To program destinations or TACAN coordinates.

NOTE

If latitude and longitude coordinates are being used, skip step I (a) and proceed with step 1 (b). Enter all of the data for a given destination or TACAN before starting to enter data for another.

1. To insert waypoint coordinates:

(a) Insertion of UTM waypoint coordinates:

1. Data selector UTM WYPT.

Data displays will indicate last coordinates inserted into related waypoint.

2. Thumbwheel Set to waypoint number to be loaded.

NOTE

UTM data may be loaded in any order and, until final entry, a value may be reloaded.

3. To load zone and easting Press keys in sequence, starting with "E".

(Example: Zone 16, 425 km East = E16 425. Observe that zone and easting in kilometers appear in the right data display as keys are pressed.)

4. INSERT/ADVANCE pushbutton Press.

(Observe pushbutton light is illuminated.)

5. To load northing Press keys in sequence, starting with "N" or "S" to indicate north or south hemisphere.

(Example: 4749 km North = N 4749. Observe that northing kilometers appear in the left data display as keys are pressed.)

6. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light remains illuminated.)

7. INSERT/ADVANCE push-button - Press.

(Observe that an extra precision display related to resident value of northing and easting, to the nearest meter, appears in left and right data displays, respectively.)

8. To load extra precision easting value - Press keys in sequence starting with "E".

(Example: 297 m East = E 297. Observe that easting meters appear in the right data display as keys are pressed.)

9. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light remains illuminated.)

10. To load extra precision northing value - Press keys in sequence, starting with "N" or "S".

(Example: 901 m North = N 901. Observe that northing meters appear in left data display as keys are pressed. The value is always added to the normal value regardless of which key (N/S) is pressed to initiate the entry. The normal entry establishes the hemisphere.)

11. INSERT/ADVANCE push-button - Press.

(Within 3 seconds computer converts input into latitude and longitude for storage in memory. The stored value is again converted to UTM for display. The INSERT/ADVANCE pushbutton light extinguishes. Conversion routines may cause displays to change by up to 10 m.)

NOTE

The computer will convert coordinates in overlap area; however, data display values will reference appropriate zone.

NOTE

The "W" key may be used to initiate easting entries; however, the computer will always interpret such entries as an "E" input. "E" will be displayed in normal UTM data display.

NOTE

The extra precision values are always added to normal values. As an example, South 4,476,995 m will display "4476 S" in the normal display and "995" in extra precision display. In other words, there is no rounding between the two displays.

12. Repeat steps 2 through 11 for each waypoint to be loaded.

NOTE

A load cycle may be terminated prior to insertion of all four values by moving data selector or thumbwheel.

(b) Insertion of geographic waypoint coordinates:

1. Data selector - L/L WYPT.

Data displays indicate last coordinates inserted into the selected waypoint.

2. Thumbwheel - Set to waypoint number to be loaded.

3. To load latitude - Press keys in sequence, starting with "N" or "S" to indicate north or south.

(Example: 42°54.0' North = N 4 2 5 4 0. Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed, and latitude appears in left data display as keys are pressed.)

4. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light extinguishes.)

5. To load longitude - Press keyboard keys in sequence, starting with "W" or "E" indicating west or east.

(Example: 87°54.9' West = W 8 7 5 4 9. Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed, and longitude appears in display as keys are pressed.)

6. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light extinguishes.)

7. If desire to insert extra precision coordinate data - Press INSERT/ ADVANCE pushbutton.

(Observe that arc-seconds for loaded latitude and longitude, to nearest tenth of a second, appear in left and right data displays, respectively.)

8. To load related arc-second values for latitude -Press keys in sequence, starting with "N".

(Example: 35.8" North = N 358.)

9. INSERT/ADVANCE push-button- Press.

(Observe pushbutton light extinguishes.)

10. To load related arc-second values for longitude -Press keys in sequence, starting with "E".

(Example: 20.1" East = E 201.)

11. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light extinguishes.)

12. Repeat steps 2 through 11 for each waypoint to be loaded.

NOTE

In above example, if INSERT/ ADVANCE pushbutton was pressed, the following normal display would appear: "42°54.5 (N)" and 87°54.3(W). The extra precision values are added to normal values and normal data displays are not rounded off.

NOTE

The normal geographic coordinates must always be loaded prior to extra precision values.

NOTE

The directions "N" or "S" and "E" or "W" are established during normal coordinate entry. Either key may be used to initiate entry during extra precision loads and values will be added to the extra precision value without affecting direction.

NOTE

It is characteristic of the computer display routine to add "0.2" arc-seconds to any display of "59.9" arc-seconds. The value in computer is as loaded by operator.

(11) To insert TACAN coordinates:

(a) Insertion of UTM TACAN station data:

NOTE

Prior to pressing the INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing CLEAR pushbutton and loading correct data.

1. Data selector - UTM WYPT.
2. Keys "7" and "9" - Press simultaneously.

(Observe that number of TACAN station being used for navigation flashes on and off in "TO" display and data displays indicate coordinates of station selected by thumbwheel.)

3. Thumbwheel - Set to number of station to be loaded. Confirm:

a. Thumbwheel is in de-tent.

b. Station "0" cannot be loaded.

(Observe that if number of station to be loaded is same as number of the TACAN station currently being used, number in "TO" display will be set to "0" when TACAN data is loaded.)

c. To load zone and easting - Press keys in sequence, starting with "E".

(Example: Zone 16, 425 km East = E16 425. Observe that zone and easting in kilometers appear in the right display as keys are pressed.)

d. INSERT/ADVANCE pushbutton - Press.

(Observe that pushbutton light is illuminated.)

To load northing - Press keys in sequence, starting with "N" or "S" to indicate north or south hemisphere.

(Example: 4749 km North = N 4749. Observe that Northing kilometers appear in left data display as keys are pressed.)

e. INSERT/ADVANCE pushbutton - Press.

(Observe pushbutton light remains illuminated.)

f. INSERT/ADVANCE pushbutton - Press.

(Observe that extra precision display related to the resident value of northing and easting, to nearest meter, appears in left and right data displays, respectively.)

NOTE

UTM data may be loaded in any order. Until final fourth entry, actuation of INSERT/ADVANCE pushbutton without a prior data entry will cause normal and extra precision UTM data to be alternately displayed.

g. To load extra precision easting value - Press keys in sequence, starting with "E".

(Example: 297 m East = E 297. Observe that easting meters appear in right data display as keys are pressed.)

h. INSERT/ADVANCE pushbutton - Press.

(Observe pushbutton remains illuminated.)

i. To load extra precision northing value - Press keys in sequence, starting with "N" or "S".

(Example: 901 m North = N 901. Observe that northing meters appear in left data display as keys are pressed. The value is always added to normal value regardless of which key (N/S) is pressed to initiate entry. The normal entry establishes hemisphere.)

j. INSERT/ADVANCE pushbutton - Press.

(Observe that during the next 1 to 3 seconds, the computer converts input into latitude and longitude for storage in memory. The stored value is again converted back to UTM for display to operator. The INSERT/ADVANCE pushbutton light extinguishes. The conversion routines may cause data displays to change by up to 10 m.)

NOTE

The computer will convert coordinates in overlap area; however, data display values will reference appropriate zone.

NOTE

The "W" key may be used to initiate easting entries; however, the computer will always interpret such entries as an E input. "E" will be displayed in normal UTM data display.

NOTE

The extra precision values are always added to normal values. As an example, South 4,476.995 m will display "4476 S" in normal display and "995" in extra precision display. In other words, there is no rounding between the two displays.

k. INSERT/ADVANCE pushbutton - Press.

(Observe right data display indicates last previously inserted altitude, and left data display is blank.)

l. To indicate the following load is altitude - Press keys "4" or "6".

(Observe INSERT/ADVANCE pushbutton light illuminates.)

m. To load altitude in feet - Press keys in sequence.

(Example: 1230 ft = 1230. Observe that numbers appear in right data display as keys are pressed.)

NOTE

Altitude inputs are limited to 15,000 feet.

n. INSERT/ADVANCE pushbutton - Press.

(Observe pushbutton light extinguishes.)

o. INSERT/ADVANCE pushbutton - Press.

(Observe that left data display indicates last previously inserted channel number, and right display is blank.)

p. To indicate following load is channel number -Press keys "2" or "8"

(Observe INSERT/ADVANCE pushbutton light illuminates.)

q. To load channel number - Press keys in sequence.

(Example: 109 = 109. Observe number appears in left data display as keys are pressed.)

r. INSERT/ADVANCE pushbutton - press.

(Observe pushbutton light extinguishes.)

NOTE

Any number will be accepted by INS; however, only stations with a channel number within range of "1" through "126" will be used for TACAN mixing.

NOTE

Channel number has an implied "X" suffix.

NOTE

Degree symbol (°) should be disregarded when reading altitude and data display.

s. INSERT/ADVANCE pushbutton - Press.

(Observe station northing, zone, and easting reappear.)

t. Repeat steps 3 through 20 for each TACAN station.

u. To return INS to normal mode, momentarily set data selector to UTM POS.

(b) Insertion of geographic TACAN station data:

NOTE

Prior to pressing INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing CLEAR pushbutton and loading correct data.

1. Data selector - L/L WYPT.

NOTE

If number of station to be loaded is same as number of TACAN station currently being used, number in "TO" display will be set to "O" when TACAN data is loaded.

2. Keys "7" and "9" - Press simultaneously.

(Observe that number of TACAN station being used for navigation flashes on and off in "TO" display. Data displays indicate coordinates of station selected via thumbwheel.)

3. Thumbwheel - Set to number of station being loaded. (Insure thumbwheel is in detent.)

NOTE

Station "0" cannot be loaded.

4. To load latitude - Press keys in sequence, starting with "N" or "S" to indicate north or south.

(Example: 42°54.0' North = N 4 2 5 4 0. Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed.)

5. INSERT/ADVANCE push-button - Press

(Observe pushbutton light extinguishes.)

6. To load longitude - Press keys in sequence, starting with "W" or "E" indicating west or east.

(Example: 87°54.9' West = W 8 7 5 4 9. Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed, and longitude appears in data display as keys are pressed.)

7. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light extinguishes.).

8. INSERT/ADVANCE push-button - Press.

(Observe that the arc-seconds related to loaded latitude and longitude, to nearest tenth of a second, appear in left and right data display, respectively.)

9. If extra precision coordinate data is to be inserted Press keys in sequence, starting with "N", to load related arc-second values for latitude.

(Example: 35.8" North = N 358.)

10. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light extinguished.)

11. To load related arc-second values for longitude -Press

keys in sequence, starting with "E".

(Example: 20.1" East = E 201.)

12. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light extinguishes.)

NOTE

In above example, if INSERT/ADVANCE pushbutton were pressed, the following normal display would appear: "42°54.5 N" and "87°54.3 W". The extra precision values are added to normal values and normal displays are not rounded off.

NOTE

The normal geographic coordinates must always be loaded prior to extra precision values.

NOTE

The directions "N" or "S" and "E" or "W" are established during normal coordinate entry. Either key may be used to initiate entry during extra precision loads and the values will be added to extra precision value without affecting direction.

NOTE

It is characteristic of the computer display routine to add 0.2 arc-seconds to any display of 59.9 arc-seconds. The value in computer is as loaded by operator.

13. INSERT/ADVANCE push-button - Press.

(Observe that right data display indicates last previously inserted altitude, and left data display is blank.)

14. To indicate the following load is altitude - Press key "4" or "6".

(Observe INSERT/ADVANCE pushbutton light illuminates.)

15. To load altitude - Press keys in sequence.

(Example: 1230 ft = 1230. Numbers appear in right data display as keys are pressed.

NOTE

Altitude inputs are limited to 15,000 feet.

16. INSER/ADVANCE push-button - Press.

(Observe pushbutton light extinguishes.

17. INSERT/ADVANCE push-button - Press.

(Observe that left data display indicates last previously inserted channel number, and right data display is blank.)

18. To indicate the following load is channel number -Press key "2" or "8".

(Observe INSERT/ADVANCE pushbutton light illuminates)

19. To load channel number - Press keys in sequence.

(Example: 109 = 109. Numbers appear in left data display as keys are pressed.)

20. INSERT/ADVANCE push-button - Press.

(Observe pushbutton light extinguishes.)

NOTE

Any number will be accepted by the INS; however only stations with a channel number within range of 1 through 126 will be used for TACAN mixing.

NOTE

The channel number has an implied "X" suffix.

NOTE

Decimal points and degree symbols should be disregarded when reading altitude and channel number displays.

21. INSERT/ADVANCE push-button - Press.

(Observe station latitude and longitude reappear.)

22. Repeat steps 3 through 19 for each TACAN station.

23. To return INS to normal display modes, momentarily set data selector to L/L POS.

(12) Designating fly-to-destinations or TACAN.

1. Data selector L/L WYPT or UTM WYPT, as required.
2. Waypoint thumbwheel Select destination number.

(Observe number of destination waypoint appears in "TO" part of FROM-TO display.)

3. Data selector HDG DA.

(Observe present aircraft heading appears, to nearest tenth of degree, in left data display; also drift angle, to nearest degree, appears in right data display.)

NOTE

Navigation information is now available from INS for display on pilot's RMI and on pilot's and copilot's HSI's as determined by COURSE INDICATOR switches.

(13) To fly selected INS course.

1. Pilot's COURSE INDICATOR switch INS.
2. Pilot's RMI select switch INS.
3. Horizontal Situation Indicators (pilot's and/or copilot's HSI) Steer toward indicators.
4. CDU ALERT lamp Monitor.

(Observe illumination approx 1.3 minutes before reaching point for automatic leg switch. Indicator flashes on and off after passing a waypoint, if AUTO/MAN switch is in MAN.)

(14) Aided TACAN operation.

1. Mode selector NAV.
2. Data selector DSRTK/STS.
3. Key "4" Press.

(Observe right data display is "000004" and INSERT/ADVANCE pushbutton light is illuminated.)

4. INSERT/ADVANCE pushbutton Press.

(Observe right data display is "1-XX4" and INSERT/ADVANCE pushbutton light is extinguished.)

NOTE

Every 15 seconds, the INS will select next eligible TACAN station in sequence for 3-58 updating. To be eligible, TACAN station range must be between 5 and 150 nmi and channel between 1 and 126.

5. Data selector L/L WYPT or UTM WYPT.
6. Keys "7" and "9" - Press simultaneously.

(Observe channel number of the TACAN station being used for navigation flashes on and off. Data displays indicate coordinates of station selected via thumbwheel.)

7. To monitor station selection Observe FROM-TO data display.

(Observe only the number of stations eligible for mixing will be displayed. A "0" indicates that none of the 9 stations are eligible for selection.)

8. Monitor "TACAN UPDATE" annunciator.

NOTE

Mixing will not be annunciated if: (a) TACAN control is inappropriately set; (b) TACAN station data loaded in error; (c) aircraft look-down angle is greater than 30°; (d) horizontal ground distance is less than two times the altitude.

9. To return INS display to normal. Set data selector to any position except WYPT or DIS/TIME.
10. To monitor progress of update Set data selector to DSRTK/ STS. (Observe Accuracy Index (AI) will decrement to "0".)

NOTE

To insure favorable geometry during the update process, the following TACAN station criteria should be observed:

* One station must be at least 15 nmi off course.

* For optimum single TACAN station updating, update should continue until aircraft has passed the station.

* For optimum dual TACAN updating, use one "off-track" TACAN station and one "on-track" station.

* For optimum multi-TACAN station updating, the stations should be evenly distributed in azimuth around the aircraft.

11. Waypoint thumbwheel Set to number of first TACAN station to be used.

(15) Switching from aided to unaided inertial. operation.

1. Data selector DSRTK/STS.

2. Key "5" Press.

(Observe INSERT/ADVANCE pushbutton light illuminates; 000005 appears in right data display.)

3 INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE pushbutton light extinguishes. Data display returns to normal with "5" appearing in first digit of right display.)

NOTE

Benefits of previous aiding are maintained but no additional automatic updates will be made.

(16) To obtain readouts from INS.

NOTE

The computer is assumed to be in the NAV mode for all data displays.

(a) System status: Data selector DSRTK/STS.

(Observe numbers indicating system status appear in right data display.)

(b) Geographic present position: Data selector L/L POS.

(Observe latitude and longitude of present position appear in left and right data displays, respectively. Both displays are to tenth of a minute.)

(c) UTM position: Data selector UTM POS.

(Observe northing and zone with easting of present position appear in left and right displays, respectively. Both displays are in kilometers.)

(d) True heading: Data selector HDG DA.

(Observe aircraft heading appears in left data display to nearest tenth of a degree.)

(e) Ground speed: Data selector TK/GS.

(Observe ground speed appears in right data display to nearest knot.)

(f) Ground track angle: Data selector TK/GS.

(Observe ground track angle appears in left data display to nearest tenth of a degree.)

(g) Drift angle: Data selector HDG DA.

(Observe drift angle appears in right data display to nearest degree.)

(h) Wind speed and direction: Data selector WIND.

(Wind direction appears in left data display to nearest degree and wind speed appears in right display to nearest knot.)

(i) Desired track angle: Data selector DSRTK/STS.

(Observe desired track angle in left data display to nearest degree.)

(j) Track angle error: Data selector XTK/TKE.

(Observe track angle error appears in right data display to nearest degree.)

(k) Cross track distance: Data selector XTK/TKE.

(Observe cross track distance appears in left data display to nearest nautical mile.)

(l) Distance and time to next waypoint: Data selector DIS/TIME.

(Observe distance to next waypoint, shown in "TO" side of FROM-TO display, appears in left data display to nearest nautical mile.)

(Observe time to reach next waypoint at present ground speed appears in right data display to nearest tenth of a minute.)

(m) Extra precision geographic present position display:

1. Data selector L/L POS.

(Latitude and longitude of present position, to nearest tenth of a minute, appears in left and right data displays, respectively.)

2. INSERT/ADVANCE pushbutton Press.

(Observe arc-seconds related to present position latitude and longitude, to nearest tenth of a second, appear in left and right data displays, respectively.)

(n) Geographic present inertial position display.

1. Data selector L/L WYPT.

2. HOLD pushbutton Press.

(Observe HOLD pushbutton light illuminates, latitude and longitude or present inertial position to a tenth of degree appear in left and right data displays, respectively.)

NOTE

While HOLD pushbutton light is illuminated, TACAN and data link updates are inhibited.

3. INSERT/ADVANCE pushbutton Press.

(Observe arc-second related to present inertial position latitude and longitude, to nearest tenth of a second, appears in left and right data displays, respectively.)

4. Data selector UTM WYPT.

(Observe coordinates in UTM grid.)

5. HOLD pushbutton Press.

(Observe INS returns to normal operation and HOLD pushbutton light extinguishes.)

(o) UTM present inertial position display:

1. Data selector UTM WYPT.

2. HOLD pushbutton Press.

(Observe HOLD pushbutton light illuminates. Northing and zone with easting of the present inertial position in kilometers appear in left and right data displays, respectively.)

NOTE

While HOLD pushbutton light is illuminated, TACAN and data link updates are inhibited.

3. INSERT/ADVANCE pushbutton Press.

(Observe extra precision values related to present inertial position northing and easting, to nearest meter, appear in left and right data displays, respectively.)

4. Data selector L/L WYPT.

(Observe coordinates in latitude-longitude coordinates.)

5. HOLD pushbutton Press.

(Observe INS returns to normal operation and HOLD pushbutton light extinguishes.)

(p) Distance and time to waypoint other than next waypoint:

1. WYPT CHG pushbutton Press.

(Observe WYPT CHG and INSERT/ ADVANCE pushbutton lights illuminate.)

2. Key "0" Press.

(Observe FROM side of FROM-TO data display changes to "0".)

3. Key corresponding to desired waypoint Press.

(Observe "TO" side of FROM-TO data display changes to desired waypoint number.)

NOTE

Do not press INSERT/ADVANCE pushbutton. This would cause an immediate flight plan change.

4. Data selector DIS/TIME.

(Observe distance to desired waypoint appears in left data display to nearest nautical mile. Time to reach desired waypoint at present ground speed appears in right data display to nearest tenth of a minute.)

5. CLEAR pushbutton Press.

(Observe INS returns to normal operation.)

(Observe INSERT/ADVANCE and WYPT CHG pushbutton lights extinguish. Waypoints defining current navigation leg appear in FROM-TO display.)

(q) Distance and time between any two waypoints:

1. WYPT CHG pushbutton Press.

(Observe WYPT CHG and INSERT/ADVANCE pushbutton lights illuminate.)

2. Keys corresponding to desired waypoints Press in sequence.

(Observe desired waypoint numbers appear in FROM-TO data display as keys are pressed.)

NOTE

Do not press INSERT/ADVANCE pushbutton. This would cause an immediate flight plan change.

3. Data selector DIS/TIME.

(Observe distance between desired waypoints appears in left data display to nearest nautical mile. Time to travel between desired waypoints at present ground speed appears in right data display to nearest tenth of a minute.)

4. CLEAR pushbutton Press.

(Observe INS returns to normal operation.)

(Observe WYPT CHG and INSERT/ ADVANCE pushbutton light extinguishes. Waypoints defining current navigation leg appear in FROMTO data display.)

(r) Distance to any TACAN station:

1. Data selector DIS/TIME.

(Observe distance to next waypoint to nearest nautical mile is in left data display. Time to next waypoint to nearest tenth of a minute is in right data display.)

2. Keys "7" and "9" Press simultaneously.

(Observe number of TACAN station being used for navigation flashes on and off in FROM-TO display. Distance to TACAN station to nearest nautical mile is in left data display. Time to next waypoint is in right data display.)

3. If in aided TACAN operation Monitor display.

(Observe station number is selected every 15 seconds.)

4. If not in aided TACAN operation Perform steps (5) through (7).

5. WYPT CHG pushbutton Press.

(Observe INSERT/ADVANCE and WYPT CHG pushbutton light illuminates. Station number flashing discontinues.)

6. Key indicating desired TACAN station number - Press.

(Observe number will appear in left digit location of FROM-TO data display.)

NOTE

If wrong key is pressed, press CLEAR; displays will revert to that indicated in step (2).

7. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE and WYPT CHG pushbutton lights extinguish. The loaded digit will appear in right position of FROM-TO display and will be flashing on and off. Distance to that station to nearest nautical mile appears in left data display. The right display continues to display time to next waypoint.)

8. Data selector WIND, momentarily.

(Returns INS to normal display mode.)

NOTE

If in aided TACAN operation and if the desired station is not being selected, exit aided operation per procedure: "Switching From Aided to Unaided Inertial Operation", perform steps (1) (8), and then return to aided operation per procedure: "Aided TACAN Operation".

(s) Coordinates of any waypoint:

1. Data selector L/L WYPT or UTM WYPT.

2. Waypoint thumbwheel Set desired waypoint. Observe following:

(L/L WYPT: Latitude and longitude of desired waypoint, to a tenth of a minute, appear in left and right data displays, respectively.)

(UTM WYPT: Northing and zone with easting of desired waypoint, to a kilometer, appear in left and right data displays, respectively.)

3. INSERT/ADVANCE pushbutton Press. Observe following:

(L/L WYPT: The arc-seconds related to desired waypoint, latitude, and longitude, to a tenth of an arc-second, appear in left and right data displays, respectively.)

(UTM WYPT: The extra precision display related to desired waypoint northing and easting, in meters, appear in left and right data displays, respectively.)

NOTE

L/L WYPT: A coordinate is the addition of values for degrees, whole minutes and seconds.

EXAMPLE: W87° 54' 58.6" = 870 54.9W and 58.6.

UTM WYPT: A coordinate is the addition of the values for kilometers and meters.

EXAMPLE: S 2,474,706m = 2474 S and 706.

(t) TACAN station data:

1. Data selector L/L WYPT or UTM WYPT.
2. Keys "7" and "9" Press simultaneously.
3. Waypoint thumbwheel Set desired TACAN station.

(Observe number of TACAN station being used for navigation flashes on and off.)

(L/L WYPT: Latitude and longitude of desired TACAN station, to tenth of minute, appears in left and right data displays, respectively.)

(UTM WYPT: Northing and zone with easting of desired TACAN station, to a kilometer, appear in left and right data displays, respectively.)

4. INSERT/ADVANCE pushbutton Press. Observe following:

(L/L WYPT: The arc-seconds related to desired TACAN station, to tenth of arc-second, appear in left and right data displays, respectively.)

(UTM WYPT: The extra precision display related to desired TACAN station northing and easting, in meters, appear in left and right data displays, respectively.)

NOTE

Direction is indicated in normal data displays.

NOTE

L/L WYPT: A coordinate is the addition of values for degrees, whole minutes, and seconds.

EXAMPLE: W 87° 54' 58.6" will be displayed as "87°54.9 W" and "58.6".

UTM WYPT: A coordinate is the addition of values for kilometers and meters.

EXAMPLE: S 2,474,706 m will be displayed as "2474 S" and "706".

5. INSERT/ADVANCE pushbutton Press.

(Observe TACAN station altitude, in feet, will appear in right data display; degree symbol and decimal points should be disregarded. Left data display is blank.)

6. INSERT/ADVANCE pushbutton Press.

(Observe TACAN station channel number, in whole numbers, will appear in left data display; degree symbol and decimal point should be disregarded. Right data display is blank.)

NOTE

If INSERT/ADVANCE pushbutton is pressed, the normal coordinates indicated in step (3) will be displayed.

NOTE

Waypoint thumbwheel may be moved at any time and normal coordinates for new TACAN station will be displayed.

7. Data selector Momentarily to any position other than L/L WYPT, UTM WYPT or DIS/TIME. (Returns INS to normal operation.)

(u) Magnetic heading.

1. Data selector HDG/DA.

(Observe true heading to nearest tenth of a degree appears in left data display. Drift angle to nearest degree appears in right data display.)

2. Keys "3" and "9" Press simultaneously and hold.

(Observe magnetic heading to nearest tenth of a degree appears in left data display. Drift angle continues to be displayed in right data display.)

3. Keys "3" and "9" Release.

(Observe left data display reverts to true heading.)

(17) INS updating.

(a) Data link updating.

1. Mode selector NAV.

2. Data selector DSRTK/STS.

3. Key "3" Press.

(Observe right data display is "000003" and INSERT/ADVANCE pushbutton lamp is illuminated.)

4. INSERT/ADVANCE pushbutton Press.

(Observe right data display is "1-XX3" and INSERT/ADVANCE pushbutton light is extinguished.)

5. Monitor "DAT LINK UPDATE" annunciator on mission control panel.

(Observe illumination will be within 30 seconds, if correction of less than 3 + AI nmi is being transmitted to INS.)

6. The Accuracy Index (AI) will decrement to "O" as updating progresses.

(b) Normal geographic present position check and update:

1. Data selector LIL POS.

(Observe latitude and longitude of present position appear in left and right data displays, respectively.)

2. HOLD pushbutton Press until illuminated.

(Observe latitude and longitude in data displays freeze at values present when HOLD pushbutton is pressed.)

NOTE

While HOLD pushbutton light is illuminated, TACAN and data link updates are inhibited.

3. Keys Press in sequence to load latitude of position reference, starting with "N" or "S" to indicate north or south.

(Example: 42°54.0' north = N 4 2 5 4 0.)

(Observe INSERT/ADVANCE pushbutton light illuminates when first key is pressed, and latitude appears in left data display as keys are pressed.)

4. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE pushbutton light remains illuminated, and previous value of latitude reappears.)

5. Keys Press in sequence to load longitude of position reference, starting with "W" or "E" to indicate west or east.

(Example: 87°54.9' west = W 8 7 5 4 9. Observe longitude appears in right data display as keys are pressed.)

(Observe INSERT/ADVANCE and HOLD pushbutton lights remain illuminated. North position error and east position error, in tenth of a nautical mile, will appear in left and right data displays, respectively.)

NOTE

If WARN lamp illuminates, proceed to step 8; otherwise proceed to step 9.

7. Data selector DSRTK/STS.

(Observe action code "02" and malfunction code "49". This indicates that the radial error between the loaded position and the INS position exceeds 38 nautical miles. Operator must evaluate possibility that either INS is in error or reference point position is incorrect. It is possible to force INS to accept updated position by setting data selector to L/L POS and proceeding to step (h).

8. If displayed values are within tolerance, press HOLD pushbutton to return INS to normal operation. If one or both values are out of tolerance, proceed the step (10).

9. Key "2" Press.

(Observe left data display is "00000 N"; INSERT/ADVANCE and HOLD pushbutton lights are illuminated.)

10. INSERT/ADVANCE pushbutton Press

(Observe INSERT/ADVANCE and HOLD pushbutton lights extinguish. Present position appears in data displays. Present position check and update is complete.)

NOTE

Within 30 seconds, computer will process correction and revised present position will appear in data display. If AI prior to position update is 1 or greater, computer will accept over 95 percent of correction shown in difference display. If AI is "0", amount of correction accepted will be less and is a function of time in NAV mode and number of updates which have been made.

(c) Extra precision geographic present position check and update:

1. Data selector DSRTK/STS.

2. Key "2" Press.

(Observe INSERT/ADVANCE pushbutton light illuminates, "000002" appears in right data display.)

3. INSERT/ADVANCE pushbutton Press.

(Observe right data display is "1...XX2", INSERT/ADVANCE pushbutton light is extinguished, and any TACAN or data link updating is discontinued.)

4. Data selector L/L POS.

(Observe latitude and longitude of present position appear in left and right data displays, respectively.)

5. HOLD pushbutton Press (when aircraft passes over known position reference.)

(Observe HOLD pushbutton light illuminates. Latitude and longitude in data displays freeze at values present when HOLD pushbutton was pressed.)

6. Load latitude by pressing keys in sequence, starting with "N" or "S" to indicate north or south.

(Example: 42°54.0' North = N 4 2 5 4 0. Observe latitude appears in left data display as keys are pressed.)

7. INSERT/ADVANCE pushbutton Press

(Observe INSERT/ADVANCE and HOLD pushbuttons remain illuminated.)

8. Load longitude by pressing keys in sequence, starting with "W" or "E" indicating west or east.

(Example: 87°54.9' West = W 8 7 5 4 9.)

9. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE and HOLD pushbutton lights remain illuminated.)

10. INSERT/ADVANCE pushbutton Press.

(Observe arc-seconds related to present position latitude and longitude, to nearest tenth of a second, appear in left and right data displays, respectively.)

11. Load related arc-second values for latitude in sequence, starting with "N".

(Example: 35.8° North = N 358.)

12. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE and HOLD pushbuttons remain illuminated.)

13. Load related arc-second values for longitude in sequence, starting with "E".

(Example: 20.1° East = E 201.)

NOTE

Extra precision values are added to normal values and normal displays are not rounded off.

NOTE

Normal latitude-longitude coordinates must always be loaded prior to extra precision values.

NOTE

Directions "N" or "S" and "E" or "W" are established during normal coordinate entry. Either key may be used to initiate entry during extra precision loads and values will be added to extra precision values without affecting direction.

NOTE

It is characteristic of the computer display routine to add 0.2 arc-seconds to any display of 59.9 arc-seconds. Value in computer is loaded by operator.

14. Proceed to step (6) in procedure: "Normal Geographic

Present Position Check and Update."

(d) UTM present position check and update:

NOTE

UTM data may be loaded in any order and, until final entry, a value may be reloaded.

1. Data selector UTM POS.

(Observe UTM coordinates of present position appear in data displays.)

2. HOLD pushbutton Press (when aircraft passes over known position reference.)

(Observe HOLD pushbutton light illuminates. Coordinates in data display freeze at values present when HOLD pushbutton was pressed.)

NOTE

While HOLD pushbutton light is illuminated, TACAN and data link updates are inhibited.

3. Load zone and easting by pressing keys in sequence, starting with "E".

(Example: Zone 16, 425 km East = E16 425. Observe zone and easting in kilometers appear in right data display as keys are pressed.)

4. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE pushbutton light remains illuminated.)

5. Load northing by pressing keys in sequence, starting with "N" or "S" to indicate north or south hemisphere.

(Example: North 4749 km = N 4749. Observe northing kilometers appear in left data display as keys are pressed.)

6. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE pushbutton light remains illuminated.)

7. INSERT/ADVANCE pushbutton Press.

(Observe extra precision display related to present position northing and easting, to nearest meter, appears in left and right data displays, respectively.)

8. Load extra precision easting value by pressing keys in sequence, starting with "E".

(Example: 297 m East = E 297. Observe easting meters appear in right data display as keys are pressed.)

9. INSERT/ADVANCE push-button Press.

(Observe INSERT/ADVANCE pushbutton light remains illuminated.)

10. Load extra precision northing value by pressing keys in sequence, starting with "N" or "S".

(Example: 901 m North = N 901. Observe Northing meters appear in left data display as keys are pressed. The value is always added to normal value regardless of which key (N/S) is pressed to initiate entry. Normal entry establishes the hemisphere.)

NOTE

The "W" key may be used to initiate easting entries; however, the computer will always interpret such entries as an "E" input.

NOTE

The extra precision values are always added to normal values.

NOTE

Any data inserted when HOLD pushbutton lamp is not illuminated will be rejected by computer.

11. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE and HOLD pushbutton lights remain illuminated. North position error and east position error in kilometers will appear in left and right data displays, respectively.)

12. If WARN lamp illuminates, proceed to step (13); otherwise proceed to step (9) in procedure: "Extra Precision Geographic Present Position Check and Update."

13. Data selector DSRTK/STS.

(Observe action code "02" and malfunction code "49". This indicates radial error between loaded position and INS position exceeds 62 kilometers. Operator must evaluate possibility that INS is in error or reference point position is incorrect. It is possible to force INS to accept updated position by setting data selector to UTM POS and proceeding to step (8) of procedure: "Extra Precision Geographic Present Position Check and Update.")

14. If updating is to be rejected Press HOLD pushbutton.

(Observe HOLD and INSERT/ADVANCE pushbutton lights extinguish. INS returns to normal operation.) (e) Position update eradication:

NOTE

This procedure is not considered common. Its use is limited to those times where an operational error has resulted in an erroneous position fix.

1. Data selector DSRTK/STS.

2. Key "1" Press.

(Observe INSERT/ADVANCE pushbutton light illuminates, 000001 appears in right data display.)

3. INSERT/ADVANCE pushbutton Press.

(Observe INSERT/ADVANCE pushbutton light extinguishes. Within 30 seconds, data displays return to normal with "0" (normal inertial mode) in last digit of right display. AI will be set to approximately three times the number of hours in NAV.)

(18) Flight course changes.

(a) Manual flight plan change insertion:

1. WYPT CHG pushbutton Press.

(Observe WYPT CHG and INSERT/ ADVANCE pushbuttons illuminate.)

2. Select new FROM and TO waypoints by pressing corresponding keys in sequence.

(Observe new waypoint numbers appear in FROM-TO data displays as keys are pressed.)

NOTE

Selecting zero as FROM waypoint will cause desired track to be defined by computed present position (inertial present position plus fixes) and TO waypoint.

3. INSERT/ADVANCE pushbutton Press.

(Observe WYPT CHG and INSERT/ ADVANCE pushbuttons extinguish.)

NOTE

Waypoint zero always contains ramp coordinates if no manual flight plan changes are made. When a manual flight plan change is made, present position at instant of insertion is stored in waypoint zero.

(19) After landing procedures.

CAUTION

If INS will be unattended for an extended period, it should be shut down.

CAUTION

Do not leave INS operating unless aircraft or ground power and cooling air are available to system.

NOTE

The INS may be shut down, downmoded to STBY or Align mode, or operated in the navigation mode after landing. The determining factor in choosing course of action is expected length of time before the next takeoff.

NOTE

Do not tow or taxi aircraft during INS alignment. Movement during alignment requires restarting alignment

.

(20) Transient stops.

NOTE

Action to be taken during a transient stop depends upon time available and on availability of accurate parking coordinates (latitude and longitude.)

(a) Realignment INS operating (recommended if sufficient time and accurate parking coordinates are available.)

NOTE

INS can be downmoded to perform a realignment and azimuth gyro calibration. Alignment to produce an alignment state number of "5" can be accomplished in approximately 17 minutes. During the 17 minute period, an automatic azimuth gyro recalibration is determined on basis of difference between inertial present position before downmoding and inserted present position. To obtain further refinement of azimuth gyro drift rate, calculated on basis of newly computed error data, INS can be left in alignment mode for a longer period, allowing the alignment state number to attain some value lower than "5".

1. Data selector STBY, then to ALIGN.
2. Present position coordinates Insert, according to procedure: "Geographic Present Position Insertion" or "UTM Present Position Insertion."

(b) Realignment INS shutdown. Perform complete alignment procedures.

(c) Position update (recommended if time is not available for realignment.)

NOTE

Perform position update using parking coordinates in accordance with procedure: "Insertion of Geographic Waypoint Coordinates." If parking coordinates are not available, proceed as follows:

Continue operation in NAV, if INS accuracy appears acceptable.

Perform position update using best estimate of parking coordinates.

(d) Downmoding to standby:

NOTE

INS can be downmoded to standby operation which will maintain navigation unit at operating temperature with gyro wheels running. INS is downmoded to standby as follows:

1. Mode selector STBY.

Caution

Do not leave INS operating unless aircraft or ground power and cooling air are available to system.

(e) Shutdown:

1. Mode selector OFF.

NOTE

INS will retain inertial present position data computed at time INS is downmoded. This value is compared with present position inserted for next alignment and difference is used to determine azimuth gyro drift rate.

d. Abnormal Procedures.

(1) General. INS contains self-testing features which provide one or more warning indications when a failure occurs. The WARN lamp on the CDU provides a master warning for most malfunctions occurring in the navigation unit. Malfunctions in the MSU or CDU will normally be obvious because of abnormal indications of displays and lamps. A battery unit malfunction will shut down INS when battery power is used.

(2) Automatic INS shutdown.

(a) Overtemperature. An overtemperature in navigation unit will cause INS to shut down (indicated by blank CDU displays) when mode selector is at STBY or ALIGN during ground operation. The WARN lamp on CDU will illuminate and will not extinguish until mode selector is rotated to OFF. The cooling system should be checked and corrected if faulty. If cooling system is satisfactory, navigation unit should be replaced.

Table 3-2. Malfunction Code Check

Step Indication	Control	Operation	Indicator or Display	Indication
1			WARN lamp	Lights
2	Data selector	Rotate to DSRTK/STS	R-H data display	Action code second and third digits
3	TEST switch	Press and release	R-H data display	Lowest number malfunction code which has occured since this procedure was performed replaces action code.
4	Repeat step 3 repeatedly, recording all malfunction codes until second and third digits again indicate an action code or go blank. Refer to Table 3-4 for action codes and recommended action and to Table 3-5 for malfunction code definition.			
5	If WARN lamp extinguishes and two digits go blank, failure was intermittent and has been cleared. If digits do not go blank, perform action according to displayed recommended action code.			
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Table 3-3. Malfunction Indications and Procedures
Table 3-3. Malfunction Indications and Procedures

Mode of Operation	Malfunction Indiction	Procedure	Probable Cause
STBY or ALIGN	WARN on, CDU blank (DIM control clockwise), MSU BAT off.	1. Rotate MSU mode selector OFF. 2. Check aircraft cooling system and correct if faulty. 3. Realign INS.	Automatic shutdown caused by overtemperature.
STBY, ALIGN, NAV	WARN on, MSU BAT on CDU blank.	1. Rotate MSU mode selector OFF. 2. Insure all switches and circuit breakers application to INS operation are set properly. See listing in preceeding text procedure "3". 3. If in flight, rotate MSU mode selector OFF.	Loss of INS power and low Battery Unit (BU)

Table 3-3. Malfunction Indications and Procedures (Continued)

Mode of Operation	Malfunction Indiction	Procedure	Probable Cause
		4. If on ground, replace battery unit. Battery unit test may be bypassed by rotating mode selector to OFF, then to NAV and reloading position coordinates. When INS advances to alignment State 7 (PI=7), rotate mode selector to ALIGN.	
STBY, ALIGN, or NAV	WARN on, CDU is operating	Perform Malfunction Code Check as described in Table 3-2.	(NU) failure or interfacing system problem.
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(b) Low battery charge. A low battery unit charge will cause INS to shut down when INS is operating on battery unit power. Both WARN lamp on CDU and BAT lamp on MSU will illuminate and not extinguish until the mode selector is set to OFF. The battery unit should be replaced when this failure occurs.

(c) Interpretation of failure indications. It is important to be able to correctly interpret failure indications in order to take effective action. Failure indications are listed below under two main categories: WARN light illuminated, and WARN light extinguished. Under each of these categories are listed other indications which will give the operator sufficient information to take action.

1 WARN light on/off

DISPLAY	MALFUNCTION/ RECOMMENDED ACTION
Action codes 01, 02, 03, 04, 05	See Table 3-4.
No action or malfunction codes displayed	Indicates computer failure.
Improper displays	Indicates NU computer failure.

2 WARN light off

DISPLAY	MALFUNCTION/ RECOMMENDED ACTION
CDU displays blank, incorrect or frozen	CDU failure indicated.

NOTE

It is not possible to load displays from the keyboard. A temporary failure of a numerical key may prevent data loading. If a number cannot be loaded into latitude or longitude displays, after pressing/ wiggling the key several times, the cause may be the momentary hang-up of another key. To identify the faulty key, rotate the data selector to DSRTK/STS. The right digit on right display will indicate suspect key. Press and release suspect key several times. To test whether the keyboard problem is corrected, try pressing any other numerical key. Its number should now appear as the right digit. If this test is successful, press the CLEAR key and return data selector to original data loading position. Otherwise, a CDU failure is indicated.

(d) CDU BAT indicator is illuminated.

CAUTION

Operation on battery is an indication that there may be no aircraft power to blower motor with resultant loss of cooling. The INS can operate only a limited time (normally 15 minutes) on battery power before a low voltage shutdown will occur. Then, immediate corrective action must be taken.

NOTE

CDU BAT indicator will illuminate for 12 seconds in alignment State "8" (about 5 minutes after turn-on). This is normal and indicates a battery test is in progress. No corrective action is required.

NOTE

Ground operation on battery power should not exceed 5 minutes.

(e) To determine corrective action: (Monitor CDU displays while rotating the CDU selector switch.)

1. If displays are frozen (do not change while data selector is being rotated) problem is normally in the navigation unit.

2. If displays respond normally to the data selector, the problem is normally absence of 115V AC power to INS.

(f) For corrective action: Check to assure proper settings of following switches and circuit breakers essential to INS operation:

1 Overhead circuit breaker panel (fig. 2-26): Circuit breakers In:

1. * AVIONICS MASTER CONTR
2. * INS CONTROL
3. * AVIONICS MASTER PWR #1
4. * AVIONICS MASTER PWR #2

2 Overhead control panel (fig. 2-18): INVERTER No. 1 or INVERTER No.2 switch On (either).

3 Mission control panel (fig. 4-1):

1. 3-phase AC BUS switch On.
2. INS POWER & AC CONT circuit breakers - In.

4 Mission AC/DC power cabinet: INS PWR circuit breaker In.

Table 3-4. Action Codes and Recommended Action

Code	Recommended Action
01	Shut down INS
02	Watch for degradation (NAV). During ground operation, downmode to STBY and restart alignment.
03	INS may be used for navigation. One or more analog outputs are not functioning properly. Check 26VAC circuit breakers, HSI and autopilot.
04	Downmode to STBY and restart alignment (ground operation only).
05	Correct problem in interfacing system (could be INS). Will not seriously affect performance.

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NOTE

CDU BAT indicator should extinguish after above corrective action. If it remains illuminated, INS will eventually shut down when battery voltage drops below approximately 19VDC. Flight crew should prepare for shutdown.

(3) Malfunction indications and procedures. Table 3-2 details the procedure for a Malfunction Code Check. Table 3-3 lists a number of malfunction indications which occur under given modes of operation. Follow procedure given. Table 3-4 details action codes and recommended action. Table 3-5 lists failed test symptoms by malfunction codes and lists codes for recommended actions.

(4) Read computer memory through CDU (look routine).

1. WYPT CHG key Press.

2. Keys Enter "99". Note FROM TO displays "99".

3. INSERT/ADVANCE pushbutton Press.

4. Data selector LIL WYPT.

5. CDU Enter "N" followed by octal address of desired (even numbered) memory location.

Table 3-5. Malfunction Codes

Malf Code	Failed Test	Modes of Operation	Recommended Action Code
10	Invalid platform heading	ALIGN	04
*12	Canned altitude profile in use (input altitude invalid)	ALIGN, NAV	05
13	Y velocity change	NAV	02
14	X velocity change	NAV	02
15	Torque limited	ALIGN, NAV	02
16	Invalid pitch and roll	ALIGN, NAV	05
17	Invalid magnetic heading	ALIGN, NAV	05
18	Excessive saturation time	ALIGN	04
*20	Track angle error and drift angle #1	ALIGN, NAV	03
*22	Track angle error plus drift angle	ALIGN, NAV	03
*23	Drift angle	ALIGN, NAV	03
*24	Steering converter	ALIGN, NAV	03
*25	True heading converter	ALIGN, NAV	03
*26	XTK converter	ALIGN, NAV	03
31	Ground speed	NAV	02
32	Memory parity	STBY, ALIGN, NAV	02
33	Azimuth stabilization loop	ALIGN, NAV	01
34	Inner roll stabilization loop	ALIGN, NAV	01
35	Pitch stabilization loop	ALIGN, NAV	01
36	Accelerometer loop	ALIGN, NAV	01
37	Z platform overtemperature	NAV	01
38	XY platform overtemperature	NAV	01
40	Heading error	ALIGN	04
42	Drift angle >45°	NAV	02
44	Azimuth gyro drift rate	ALIGN	02
45	Gyro scale factor or loaded altitude	ALIGN	04
47	15-second	NAV	02
49	Fix measurement too large	NAV	02
*51	Excessive wind	ALIGN, NAV	05
*54	Incomplete conversion from UTM to L/L	STBY, ALIGN, NAV	05
57	XY platform rotation rate	ALIGN	02
59	600 millisecond loop	STBY, ALIGN, NAV	02
60	Xor Y sample and hold change	ALIGN	04
62	XY platform rotation rate	NAV	02
63	CDU self-checks	STBY, ALIGN, NAV	02

* Failed test does not illuminate WARN lamp on CDU.
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NOTE

Program prevents entry of an address higher than 13777.

6. Insure waypoint wheel is at "0".

7. INSERT/ADVANCE pushbutton Press. (Observe address will appear in both data displays.)

8. Data selector DST/TIME. (Observe most significant half of desired data appears in left display and least significant half appears in right display.)

9. To obtain data at next higher memory locations -Advance waypoint thumbwheel. (For example: If address 400 was entered with thumbwheel at "0", address 402 will be available when thumbwheel is set to "1", "404" when thumbwheel is set to "2", etc.)

3-29. WEATHER RADAR SET (AN/APN-215).

a. Description. The weather radar set (fig. 3-24) provides a visual presentation of the general sky area of approximately 120° around the nose of the aircraft, extending to a distance of 240 nautical miles. The presentation on the screen shows the location of potentially dangerous areas, in terms of distance and azimuth with respect to the aircraft. The radar is also capable of ground mapping operations. The weather radar set is protected by a 5ampere RADAR circuit breaker located on the overhead circuit breaker panel (fig. 2-26).

b. Controls and Indicators.

(1) Weather radar control-indicator switch.

CONTROL	FUNCTION
GAIN control	Used to adjust radar receiver gain in the MAP mode only.
STAB OFF	Push type on/off switch. Used to switch control antenna stabilization signals.
Range switches	Momentary action type switches. When pressed, clears the screen and increases or decreases the range depending on switch pressed.
TILT control	Varies the elevation angle of radar antenna a maximum of 15

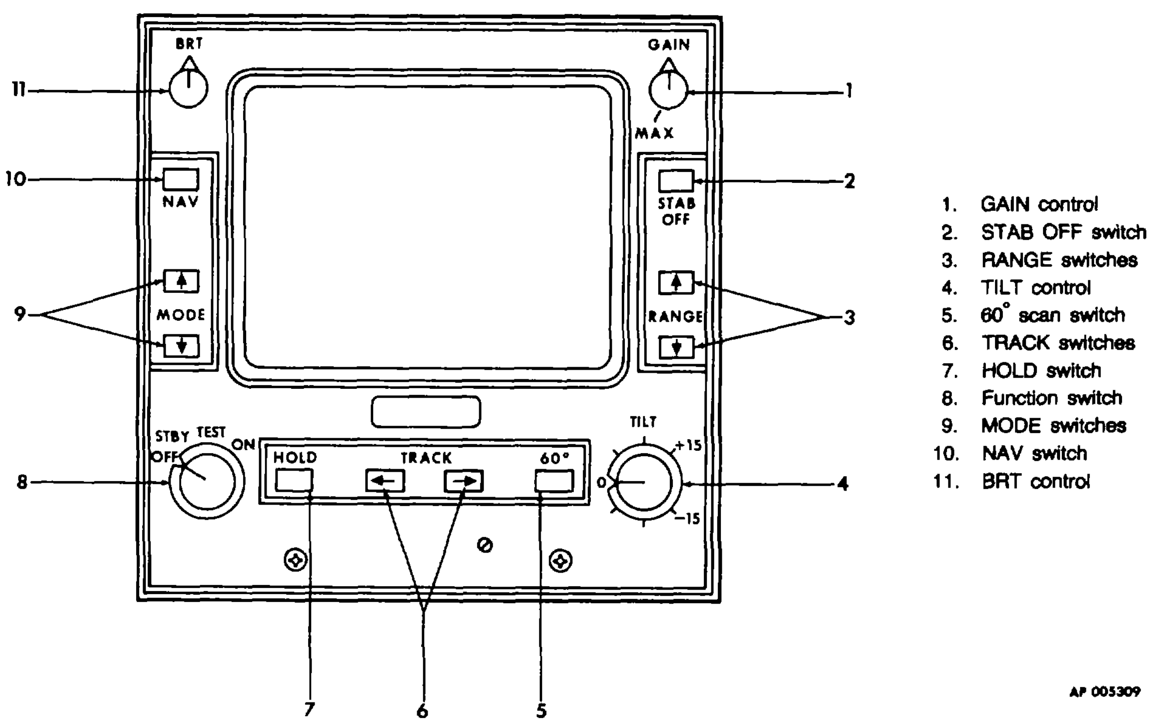


Figure 3-24. Weather Radar Control-Indicator (AN/APN-215)

	degrees up or down from horizontal attitude of aircraft.
60° switch	Push type on/off switch. When activated. reduces antenna scan from 120° to 60°.
TRACK switches	Momentary action type switches. When activated, a yellow track line extending from the apex of the display through top range mark appears and moves either left or right, depending on the switch pressed. The track line position will be displayed in degrees in the upper left corner of the screen. The line will disappear approximately 15 seconds after the switch is released. It will then automatically return to "0" degrees.
HOLD switch	Push type on/off switch. When activated, the last image presented before pressing the switch is displayed and held. The word HOLD will flash on and off in the upper left corner of the screen. Pressing the switch again will update the display and resume normal scan operation.
Function switch	Controls operation of the radar set.
OFF	Turns set off.
STBY	Places set in standby mode. This position also initiates a 90 second warmup delay when first turned on.
TEST	Displays test pattern to check for proper operation of the set. The transmitter is disabled during this mode.
ON	Places set in normal operation.
MODE switches	Momentary action type switches. Pressing and holding either switch will display an information list of operational data on the screen. The data heading will be in blue, all data except present data will be in yellow, and present selected data will show in blue. The three weather levels will be displayed in red, yellow, and green. If WXA mode has been selected, the red bar will flash on and off. If the switch is released and immediately pressed again, the mode will increase or decrease depending on switch pressed. When either top or bottom mode is reached, the opposite switch must be pressed to further change the mode.
NAV switch	Interfaces radar indicator with INS navigational information to show INS waypoint positions, superimposed on the weather display, relative to aircraft position.
BRT control	Used to adjust screen brightness.

c. Normal Operation.

WARNING

Do not operate the weather radar set while personnel or combustible materials are within 18 feet of the antenna reflector When the weather radar set is operating, high-power radio frequency energy is emitted from the antenna reflector, which can have harmful effects on the human body and can ignite combustible materials.

CAUTION

Do not operate the weather radar set in a confined space where the nearest metal wall is 50 feet or less from the antenna reflector. Scanning such surfaces may damage receiver crystals.

(1) Turn-on procedure. Function switch TEST or ON, as required. (Information will appear after time delay period has elapsed.)

(2) Initial adjustments operating procedure.

1. BRT control As required.
2. MODE switches Press and release as required.
3. RANGE switches Press and release as required.
4. TILT control Move up or down to observe targets above or below aircraft level. The echo display will change in shape and location only.

(3) *Test procedure.*

1. Function switch TEST.
2. RANGE switches Press and release as required to obtain 80 mile display.
3. BRT control As required.
4. Screen Verify proper display. (The test display consists of two green bands, two yellow bands, and a red band on a 120-degree scan. The word TEST will be displayed in the upper right corner. The operating mode selected by the MODE switches, either MAP, WX, or WXA, will be displayed in the lower left corner. If WXA has been selected, the red band in the test pattern will flash on and off. The range will be displayed in the upper right corner beneath the word TEST and appropriate range mark distances will appear along the right edge of the screen.)

(a) Weather observation operating procedure:

1. Function switch ON.
2. MODE switches Press and release as required to select WX.
3. BRT control As required.
4. TILT control Adjust until weather pattern is displayed. Include the areas above and below the rainfall areas to obtain a complete display.
5. MODE switches Press and release to select WXA. Areas of intense rainfall will appear as flashing red. These areas must be avoided.
6. TRACK switches Press to move track line through area of least weather intensity. Read relative position in degrees in upper left corner of screen.

NOTE

Refer to TM 1-230 for weather observation, interpretation and application.

(b) Ground mapping operating procedure: 1. Function switch ON.

2. MODE switches Press and release as required to select MAP.
3. BRT control As required.
4. GAIN control As required to present usable display.

(4) Standby procedure. Function switch STBY.

d. Shutdown procedure: Function switch OFF.

e. Emergency operation. Not applicable.

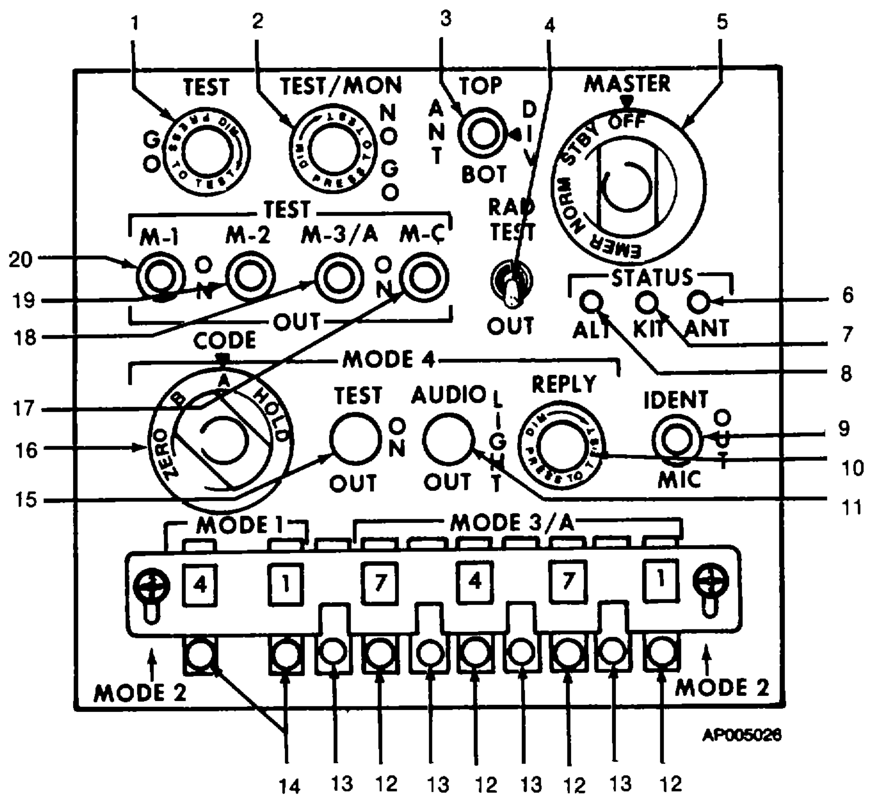
3-30. TRANSPONDER SET (APX-100).

a. Description. The transponder system receives, decodes, and responds to interrogations from Air Traffic Control (ATC) radar to allow aircraft identification, altitude reporting, position tracking, and emergency tracking. The system receives a radar frequency of 1030 MHz and transmits preset coded reply pulses on a radar frequency of 1090 MHz at a minimum peak power of 200 watts. The range of the system is limited to line-of-sight.

The transponder system consists of a combined receiver/transmitter/ control panel (fig. 3-25) located on the pedestal extension; a pair of remote switches, one on each control wheel; and two antennas, located on the underside and top of the fuselage. The system is protected by the 3-ampere TRANSPONDER and the 35-ampere AVIONICS MASTER PWR #1 circuit breakers on the overhead circuit breaker panel (fig. 2-26).

b. Transponder Control Panel fig. 3-25).

CONTROL	FUNCTION
TEST/GO indicator	Illuminates to indicate successful completion of built-in-test (BIT).
TEST/MON	Illuminates to indicate system indicator malfunction or interrogation by a ground station.
ANT switch	Selects desired antenna for signal input.
TOP	Selects upper antenna.
DIV	Selects diverse (both) antennas.
BOT	Selects lower antenna.
RAD TEST OUT switch	Enables reply to TEST mode interrogations from test set.



1. TEST TO indicator
2. TEST/MON-NO GO indicator
3. ANT switch
4. RAD TEST-OUT switch
5. MASTER control
6. STATUS ANT indicator
7. STATUS KIT indicator
8. STATUS ALT indicator
9. IDENT-MIC switch
10. MODE 4 REPLY indicator
11. MODE 4 AUDIO-LIGHT-OUT switch
12. MODE 3/A code selectors
13. MODE 2 code selectors
14. MODE 1 code selectors
15. MODE 4 TEST-ON-OUT switch
16. MODE 4 CODE control
17. M-C TEST switch
18. M3/A TEST switch
19. M-2 TEST switch
20. M-1 TEST switch

Figure 3-25. Transponder Control Panel (AN/APX - 100)

MASTER CONTROL	Selects system operating mode.
OFF	Deactivates system.
STBY	Activates system warm-up (standby) mode.
NORM	Activates normal operating mode.
EMER	Transmits emergency reply code.
STATUS ANT indicator	Illuminates to indicate the BIT or MON fault is caused by high VSWR in antenna.
STATUS KIT indicator	Illuminates to indicate the BIT or MON fault is caused by external computer.
STATUS ALT indicator	Illuminates to indicate BIT or MON fault is caused by to Altitude Digitizer.
IDENT MIC switch	Selects source of aircraft identification signal.
IDENT	Activates transmission of identification (IP) pulse.
MIC	Enables either control wheel POS IDENT switch to activate transmission of ident signal from transponder.
MODE 4 reply indicator	Illuminates to indicate a reply has been made to a valid Mode 4 interrogation.
MODE 4 AUDIO OUT switch	Selects monitor mode for Mode 4 operation.
AUDIO	Enables sound and sight monitoring of Mode 4 operation.
LIGHT	Enables monitoring REPLY indicator for mode 4 operation.
OUT	Deactivates monitor mode.
MODE 3/A code selectors	Select desired reply codes for Mode 3/A operation.
MODE 1 code selectors	Select desired reply codes for Mode 1 operation.
MODE OUT switch	4 TEST Selects test mode of Mode 4 operation.
TEST	Activates built-in-test of Mode 4 operation.
ON	Activates mode 4 operation.
OUT	Disables Mode 4 operation.
MODE 4 code control	Selects preset Mode 4 code.

M-C, M-3A, M-2, and M-1 switches	Select test or reply mode of respective codes.
TEST	Activates self-test of selected code. Transponder can also reply to ground interrogations in the selected mode during test.
ON	Activates normal operation.
OUT	Deactivates operation of selected code.
MODE 2 code selectors	Select desired reply codes for Mode 2 operation. The cover over mode select switches must be slid forward to display the selected Mode 2 code.
POS IDENT pushbutton (control wheels, fig. 2-16)	When pressed, activates transponder identification reply.

c. Transponder - Normal Operation.

(1) Turn-on procedure. MASTER switch - STBY. Depending on the type of receiver installed, the NO GO indicator may illuminate. Disregard this signal.

(2) Test procedure.

NOTE

Make no checks with the master switch in EMER, or with M-3/A codes 7600 or 7700 without first obtaining authorization from the interrogating station(s).

1. Allow set two minutes to warm up.
2. Select codes assigned for use in modes 1 and 3/A by depressing and releasing the pushbutton for each switch until the desired number appears in the proper window.
3. Lamp indicators - Operate press-to-test feature.
4. M-1 switch - Hold in TEST. Observe that no indicator lamps illuminate.
5. M-1 switch - Return to ON.
6. Repeat steps 4 and 5 for the M-2, M-3/A and M-C mode switches.
7. MASTER control - NORM.
8. MODE 4 code control - A. Set a code in the external computer.
9. MODE 4 AUDIO OUT switch - OUT.

(3) Modes 1, 2, 3/A, and/or 4 operating procedure.

NOTE

If the external security computer is not installed, a NO GO light will illuminate any time the Mode 4 switch is moved out of the OFF position.

1. MASTER control - NORM.
2. M-1, M-2, M-3/A, and/or MODE 4 ON-OUT switches - ON. Actuate only those switches corresponding to the required codes. The remaining switches should be left in the OUT position.
3. MODE 1 code selectors - Set (if applicable).
4. MODE 3/A code selectors - Set (if applicable).
5. MODE 4 code control - Set (if required).
6. MODE 4 REPLY indicator - Monitor to determine when transponder set is replying to a SIF interrogation.
7. MODE 4 AUDIO OUT switch - Set (as required to monitor Mode 4 interrogations and replies).
8. MODE 4 audio and/or indicator - Listen and/or observe (for Mode 4 interrogations and replies).
9. IDENT-MIC switch - Press to IDENT momentarily.
10. MODE 4 TEST/OUT switch - TEST.
11. Observe that the TEST GO indicator lamp illuminates.
12. MODE 4 TEST/OUT switch - ON.
13. ANT switch - BOT.
14. Repeat steps 4, 5, and 6. Observe that the TEST GO indicator illuminates.

15. ANT switch - TOP.
16. Repeat step 14.
17. ANT switch - DIV.
18. Repeat step 14.
19. When possible, obtain the cooperation of an interrogating station to exercise the TEST mode. Execute the following steps:
    a. RAD TEST OUT switch - RAD TEST.
    b. Obtain verification from interrogating station that a TEST MODE reply was received.
    c. RAD TEST OUT switch - OUT.

(4) Transponder set identification-position operating procedure: The transponder set can make identification-position replies while operating in code Modes 1, 2, and/or 3/A, in response to ground station interrogations. This type of operation is initiated by the operator as follows:

1. Modes 1, 2, and/or 3/A - On, as required.
2. IDENT-MIC switch - Press momentarily to IDENT, when directed.

NOTE

Holding circuits within the transponder receiver-transmitter will transmit identification-position signals for 15 to 30 seconds. This is normally sufficient time for ground control to identify the aircraft's position. During the 15 to 30 second period, it is normal procedure to acknowledge via the aircraft communications set that identification position signals are being generated.

NOTE

Set any of the M1, M2, M3/A, M-C, or MODE 4 switches to OUT to inhibit transmission of replies in undesired modes.

NOTE

With the IDENT/OUT/MIC switch set to the MIC position, the POS IDENT button must be depressed to transmit identification pulses.

(5) Shutdown procedure.

(a) To retain Mode 4 code in external computer during a temporary shutdown:

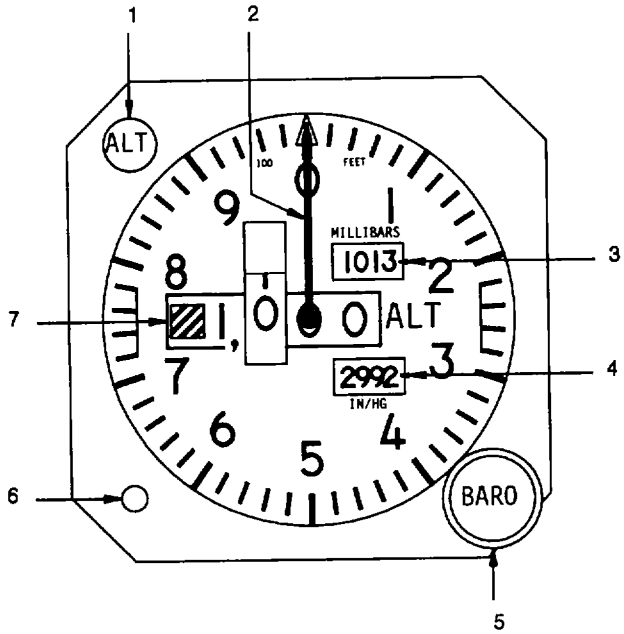
1. MODE 4 CODE switch - Rotate to HOLD.
2. Wait 15 seconds.
3. MASTER control - OFF.
4. To zeroize the Mode 4 code in the external computer turn MODE 4 CODE switch to ZERO.
5. MASTER control - OFF. This will automatically zeroize the external computer unless codes have been retained (step 1. above).

3-31. PILOT'S ENCODING ALTIMETER.

a. Description. The encoding altimeter (fig. 326), provides the pilot with an indication of present aircraft altitude above sea level. It also supplies information to the transponder for Mode C (altitude reporting) operation and to the aided inertial navigation system. The circuit is protected by the 5-ampere PILOT'S ALT ENCD circuit breaker on the overhead circuit breaker panel and the 1-ampere F21 fuse in the No. 1 junction box.

b. Controls and Indicators.

CONTROL	FUNCTION
MILLIBARS indicator	Indicates local barometric pressure in millibars. Adjusted by use of set knob.
IN HG Indicator	Indicates local barometric metric pressure in inches of mercury. Adjusted by use of set knob.
Drum indicator	Indicates aircraft altitude in ten-thousands, thousands, and hundreds of feet above sea level.
Needle indicator	Indicates aircraft altitude in hundreds of feet with subdivisions at twenty-foot intervals.
CODE OFF flag (pilot only)	Presence indicates loss of power to instrument.
ALT indicator	Not used.
Test button	When pressed, reading should decrease by 500 feet.



1. Altitude alert (ALT) annunciator
2. Altitude pointer
3. MILLIBARS barometric pressure counter
4. IN HG barometric pressure counter
5. BARO set knob
6. Test Button
7. Counter Drum Display

Figure 3-26. Pilot's Encoding Altimeter

c. Normal Operation.

(1) Turn-on procedure. Encoding altimeter will operate when transponder is operating with M-C switch set to center position.

(2) Operating procedure.

1. Barometric set knob - Set desired altimeter setting in IN. HG. window.
2. CODE OFF flag - Check not visible.
3. Needle indicator - Check operation.

NOTE

If the altimeter does not read within 70 feet of field elevation, when the correct local barometric setting is used, the altimeter needs calibration or internal failure has occurred. An error of greater than 70 feet also nullifies use of the altimeter for IFR flight.

d. Emergency Operation. Altimeter circuit breaker - Pull (if encoder fault occurs).

CHAPTER 4

MISSION EQUIPMENT

Section I. MISSION AVIONICS

4-1. MISSION AVIONICS OPERATING INSTRUCTIONS.

Operating instructions for mission avionics equipment are published in Chapter 3.

4-2. MISSION CONTROL PANEL.

The mission control panel (fig. 4-1), mounted on the copilot's sidewall, contains three sections.

a. The top section contains the mission caution/advisory annunciator panel. Refer to Table 4-1.

b. The center section of the mission control panel contains the instruments used to monitor the mission equipment. These instruments are the DC volt/ammeter, AC loadmeter, the antenna azimuth indicator and controller.

c. The bottom section of the mission control panel contains the mission equipment control switches and the mission equipment circuit breakers. Refer to Table 4-2.

Table 4-1. Mission Annunciators

MSN OVERTEMP	Yellow	Mission equipment is over heating.
CRYPTO ALERT	Yellow	Coded messages being received.
PWR SPLY FAL/LT	Yellow	Mission power out of tolerance.
CALL	Yellow	Receiving transmission on VOW.
3 O AC OFF	Yellow	Three phase AC power fault.
BATT FEED OFF	Yellow	Ground fault detected in battery.
MISSION POWER	Yellow	Mission power is off.
LINK MODE	Yellow	WBDL fault in link or contact.
RADOME HOT	Yellow	Radome heat is too high.
LINK SYNC	Yellow	WBDL has synchronization fault.
SPCL EQPT OVRD	Yellow	Mission power switch is in override.
DIPLEXER PRESS	Yellow	Diplexer has lost pressurization.
TWTA STANDBY	Yellow	WBDL is in standby mode.
ANT MALF	Yellow	Boom antenna is out of position.
ANT STOWED	Green	Boom antenna is in horizontal position.
ANT OPERATE	Green	Boom antenna is in vertical position.
RADOME HEAT	Green	Radome heat is on.
MISSION AC ON	Green	Mission AC is on.
DAT LINK UPDATE	Green	INS is updating with information from Data Link.
TACAN UPDATE	Green	INS is updating with information from TACAN.
MISSION DC ON	Green	Mission DC is on.
WAVE GUIDE	Green	Wave guide is pressurized.
EXT AC PWR ON	Green	External AC power is on.
EXT DC PWR ON	Green	External DC power is on.
BT00996		

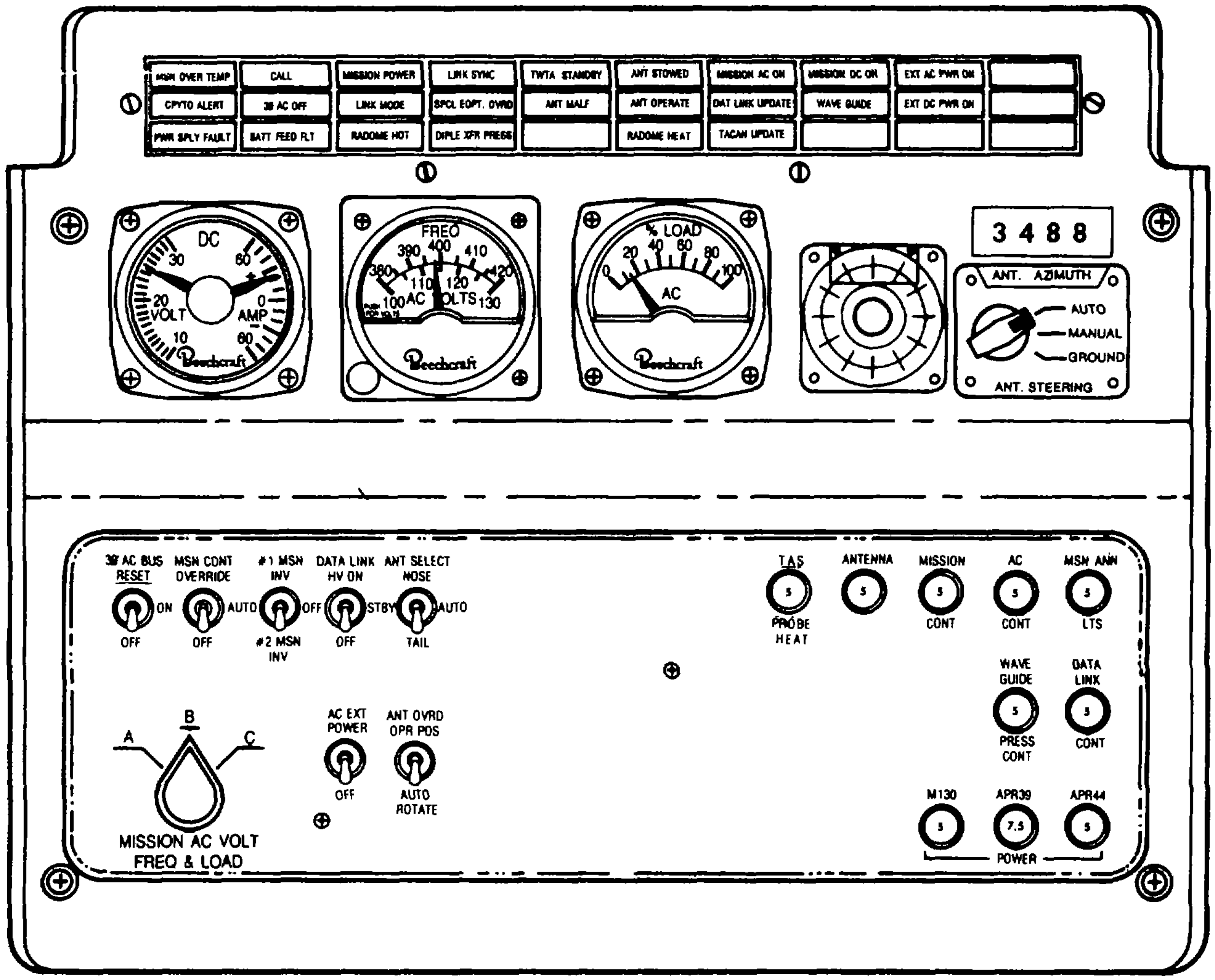


Figure 4-1. Mission Control Panel

Table 4-2. Mission Control Switches

3 ∅ AC BUS RESET ON OFF	Resets and Energizes 3 0 AC BUS.
MSN CONT OVERRIDE AUTO OFF	Overrides or turns off the mission DC POWER.
1 MSN INV OFF 2 MSN INV	Selects 1 or 2 mission inverter or turns inverters off.
DATA LINE HV ON STBY OFF	Turns data link high voltage on, off or standby.
ANT SELECT NOSE AUTO TAIL	Selects nose or tail data link antennas. In auto mode, direction and signal strength of received data link determines selection of nose or tail data link antenna.
ANT OVRD OPR POS AUTO ROTATE	Selects automatic rotating boom operation or manual selection of antenna position.
AC EXT POWER OFF	Turns external AC power on or off.
MISSION AC VOLT FREQ & LOAD	Allows monitoring of mission AC circuit.
BT00997	

Section II. AIRCRAFT SURVIVABILITY EQUIPMENT

4-3. M-130 FLARE AND CHAFF DISPENSING SYSTEM.

a. Description. The M-130 flare and chaff dispensing system provides effective survival countermeasures against radar guided weapons systems and infrared seeking missile threats. The system consists of two dispenser assemblies with payload module assemblies, a dispenser control panel, a flare dispense switch, two control wheel mounted chaff dispensing switches, an electronic module assembly, and associated wiring. The flare and chaff dispensing system is protected by a 5-ampere circuit breaker, placarded M130 POWER, located on the mission control panel (fig. 4-1).

WARNING

Right engine nacelle dispenser is for chaff only.

(1) Dispenser assemblies. Two interchangeable dispenser assemblies are mounted on the aircraft. One is located in the aft portion of the right nacelle and the other is mounted on the right side of the fuselage. On this aircraft the dispenser in the nacelle will be used for chaff only while the dispenser mounted on the fuselage can be used for either flares or chaff. The selector switch (placarded C-F) on the dispenser can be set for either chaff or flares. The unit also contains the sensor for the flare detector. The dispenser assembly breech plate has the electrical contact pins which fire the impulse cartridges. The unit also contains the sequencing mechanism.

(2) Payload module assemblies. A removable payload module assembly is provided for each dispenser assembly. Each payload module has 30 chambers which will accept either flares or chaff. Flares or chaff are loaded into the rear-end (studded end) of the payload module, and secured in place by a retaining plate.

(3) Electronic module assembly (EM). The electronic module assembly contains the programmer, the flare detector and a safety switch. The unit is located behind the pilot's seat.

(a) Flare detector. The flare detector is provided to insure that a flare is burning when it is ejected from the dispenser payload module. If the initial flare fails to ignite, the detector automatically fires another flare within 75 milliseconds. If the second flare fails to ignite, the detector will fire a third flare. If the third flare ignition is not detected, the detector will not fire another flare until the system is activated again by pressing the FLARE DISPENSE switch.

(b) Programmer. The programmer is used for the chaff mode only. It has four switches for setting count and interval of salvo and burst.

(c) Safety switch. The safety switch (with safety pin and yellow flag) prevents firing of chaff or flares when the safety pin is inserted. The safety pin shall be removed only while the aircraft is in flight or during test of the system.

(4) Flare dispenser switch. A single pushbutton switch placarded FLARE DISPENSE, located on the control pedestal, will fire a flare from the dispenser payload module each time it is pressed. If the FLARE DISPENSE switch is held down, it will dispense a flare every 2.3 seconds.

(5) Control wheel mounted chaff dispense switches. Two pushbutton switches placarded CHAFF DISP, one located on top left portion of the pilot's control wheel and the other located on the top right portion of the copilot's control wheel, activates the chaff dispensing system when pressed.

(6) Wing mounted safety switch. A wing mounted safety switch (with safety pin and red flag) located on top of the right wing, just aft of the nacelle, prevents the firing of chaff or flares when the pin is inserted. This safety pin shall be inserted while the aircraft is on the ground and removed prior to flight or during system test.

(7) Dispenser control panel (DCP). The dispenser control panel (fig. 4-2) is mounted in the control pedestal. Control functions are as follows:

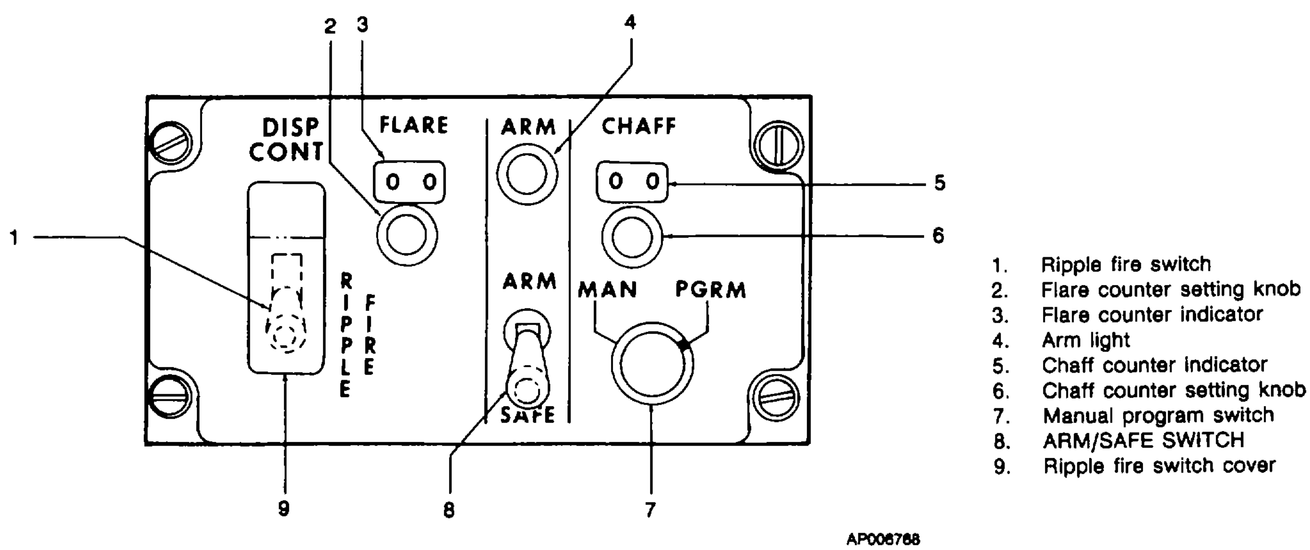


Figure 4-2. Chaff/Flare Dispenser Control Panel

CONTROL	FUNCTION
ARM-SAFE switch	When in the SAFE position, power is removed from the M130 system. When in the ARM position, power is applied to the M-130 system.
ARM light	An amber press to test indicator light placarded ARM illuminates when the ARM-SAFE switch is in the ARM position, when the safety pins are removed from the electronic module and the wing safety switch. Clockwise rotation will dim the indicator light.
RIPPLE FIRE switch	A guarded switch placarded RIPPLE FIRE fires all remaining flares when moved to the up position. It is used in the event of an inflight emergency to dispense all flares from the dispenser payload module.
FLARE counter	Indicates the number of flares remaining in the dispenser payload module.
FLARE counter setting knob	Facilitates setting FLARE counter to the number of flares in the payload module before flight.
CHAFF counter	Indicates the number of chaffs remaining in the payload module.
CHAFF counter setting knob	Facilitates setting CHAFF counter to the number of chaffs in the payload module before flight. SELECTOR SWITCH
MAN	Bypasses the programmer and fires one chaff each time one of the chaff dispense switches is pressed.
PRGM	Chaff is fired in accordance with the preset chaff program as set into the electronic module (count and interval of bursts and salvo).

(8) Ammunition for dispenser. Ammunition for the system consists of countermeasure chaff Ml, countermeasure flares M206, and impulse cartridges M796.

(a) Countermeasure chaff M1. These units consist of a plastic case 8 inches in length and 0.97 inches square. The base of the chaff case is flanged to provide one-way assembly into the dispenser payload module. The chaff consists of aluminum coated fiberglass strands.

(b) Countermeasure flare M206. These units consist of an aluminum case 8 inches in length and 0.97 inches square. The base of the flare is flanged to provide one-way assembly into the payload module. The flare material consists of a magnesium and teflon composition. A preformed packing is required in the base of the flare unit prior to inserting the impulse cartridge.

(c) Impulse cartridge M796. This cartridge fits into the base of either the flare or chaff and is electrically initiated to eject flares or chaff from the dispenser payload module.

b. Normal Operation.

NOTE

If aircraft is to be flown with flare dispenser assembly removed, fairing should be removed from fuselage.

(1) General. At the present time surface to-air intermediate range guided missiles that are launched against the aircraft must be visually detected by the aircraft crew. Crew members must insure visual coverage over the ground area where a missile attack is possible. The aircraft radar warning system will only alert the pilot and copilot when the aircraft is being tracked by radar-guided anti-aircraft weapons systems. It will not indicate the firing of weapons against the aircraft.

(2) Crew responsibilities. The pilot or designated crew member is responsible for removing the safety pin from the right wing before flight, and for replacing it immediately after flight. After the aircraft is airborne the pilot is responsible for removing the safety pin from the electronic module and moving the ARM-SAFE switch on the dispenser control panel to ARM. Before landing, he is responsible for re-inserting the safety pin in the electronic module and moving the ARM-SAFE switch to SAFE. While airborne the pilot and copilot are responsible for scanning the terrain for missile threats. When either pilot recognizes a missile launch he will press the FLARE DISPENSE button to eject flares.

(3) Conditions for firing. The dispenser system should not be fired unless a missile launch is observed or radar guided weapons systems is detected and locked on. If a system malfunction is suspected, aircraft commander may authorize attempts to dispense flares or chaff as a test in a non-hostile area.

WARNING
Aircraft must be in flight to dispense flares.

(a) *Firing procedure.*

<u>1</u>. *Flares.* Upon observing a missile launch the designated crewmember will fire a flare. If more than one missile launch is observed, the firing sequence should be continued until the aircraft has cleared the threat area.

<u>2</u>. *Chaff*. Upon receiving an alert from the aircraft radar warning system, the designated crewmember will fire the chaff and initiate an evasive maneuver. The number of burst/salvo and number of salvo/program and their intervals as established by training doctrine will be set into the programmer prior to take-off (refer to TM 9-1095206-13 for information on setting programmer). If desired, the operator may override the programmed operational mode and fire chaff countermeasures manually by moving the dispenser function selector switch to MANUAL and pressing a dispenser switch.

4-4. SYSTEM DAILY PREFLIGHT/RE-ARM TEST.

The following test procedures shall be conducted prior to the first flight of each day and prior to each re-arming of the dispensers. The first dispenser tested shall be the one used to dispense flares and the second one shall be the one used to dispense chaff. Notify AVUM if any improper indications occur during the tests.

WARNING
Assure payload module is not connected to dispenser assembly at any time during the following test procedure.

1. On flare dispenser assembly, assure the C-F selector switch is in F (flare) position.
2. Obtain M-91 test set and ensure that TEST SEQUENCE switch is in START/HOME position.
3. Connect base plate of test set to breech of dispenser assembly. Secure both mounting studs uniformly hand tight, using 5/32 inch hexagonal wrench provided in test set carrying case.
4. Obtain test set power cable from the M-91 test set carrying case and connect cable between exterior connection J1 (28V DC) on aircraft and aircraft power + 28V DC (J1) of test set.
5. Remove safety pin from EM and in the top skin of the right wing.

CAUTION
On DCP, assure that RIPPLE FIRE switch guard is in down position.

6. Provide aircraft power to DCP by setting M130 POWER circuit breaker to ON position.
7. On DCP, press ARM lamp. Lamp will illuminate. Release ARM lamp. Lamp will extinguish.
8. On DCP, set FLARE counter to 30 CHAFF COUNTER to 30 and MAN-PRGM switch to MAN position.
9. On DCP, set ARM-SAFE switch to ARM. ARM lamp will illuminate.

NOTE
When the test set is installed on the dispenser assembly and 28 volts DC aircraft power has been applied, the sequencer switch inside of dispenser assembly resets, making an audible sound as it rotates. There will be no such sound if the sequencer switch has been previously reset or if switch is in position 12 or 24.

NOTE
On test set, TS PWR ON lamp (clear) illuminates and remains illuminated throughout the test sequence until aircraft power to test set (via test set power cable) is disconnected or shut off.

10. Set mission chaff program on EM.
11. Perform the following operations on the M-91 test set: a. Press to test the remaining three lamps on test set. Each lamp will illuminate.

NOTE

Replace any lamp that does not illuminate when pressed. If none of the indicating lamps illuminate, return test set to AVUM.

b. Rotate TEST SEQUENCE switch clockwise to the next position, TS RESET. No visual indication will occur.
c. Rotate TEST SEQUENCE switch clockwise to SV SELF TEST position. STRAY VOLTAGE lamp (red) will illuminate.
d. Rotate TEST SEQUENCE switch clockwise to next position, TS RESET. STRAY VOLTAGE lamp (red) will extinguish.
e. Rotate TEST SEQUENCE switch clockwise to next position, STRAY VOLT. STRAY VOLTAGE lamp (red) should not illuminate.
f. Rotate TEST SEQUENCE switch clockwise to next position, SYS NOT RESET. SYS NOT RESET lamp (amber) should not illuminate. If lamp illuminates, press and release MANUAL SYSTEM RESET switch and SYS NOT RESET lamp should then extinguish.

NOTE

When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. If the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

g. Rotate TEST SEQUENCE switch clockwise to next position, DISP COMP.

12. Press FLARE DISP switch once. For each depressing, the FLARE counter on DCP should count down in groups of three.
13. On DCP, raise RIPPLE FIRE switch guard and set toggle switch to up position until FLARE counter counts down to 00. Return switch guard to down position. On DCP, reset FLARE counter back to 30. DISPENSER COMPLETE lamp (green) on test set will illuminate.
14. Perform the following operations on the M-91 test set:

    a. Rotate TEST SEQUENCE switch counter-clockwise to SYS NOT RESET position. SYS NOT RESET lamp (amber) will illuminate. DISPENSER COMPLETE lamp (green) will remain illuminated.
    b. Press and release MANUAL SYSTEM RESET switch. SYS NOT RESET lamp (amber) will extinguish.

NOTE

When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. If the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

    c. Rotate TEST SEQUENCE switch counterclockwise to STRAY VOLT position. STRAY VOLTAGE lamp (red) should not illuminate.
    d. Rotate TEST SEQUENCE switch counterclockwise to START/HOME position.

NOTE

When the TEST SEQUENCE switch is turned to the START/HOME position, the DISPENSER COMPLETE lamp will extinguish, the STRAY VOLTAGE lamp will illuminate and then will extinguish when passing through the TS RESET position.

15. On CHAFF dispenser assembly, assure that C-F selector switch is in C (chaff) position.
16. Remove M-91 test set from first dispenser assembly.
17. Connect M-91 test set to breech assembly of second dispenser assembly. Secure both mounting studs uniformly hand tight using ball hexagonal key screwdriver provided in test set carrying case.

NOTE
When the test set is installed on the dispenser assembly and 28 volts DC aircraft power has been applied, the sequence switch inside the dispenser assembly resets, making an audible sound as it rotates. There will be no such sound if the sequencer switch has been previously reset or if switch is in position 12 or 24.

NOTE
On test set, TS PWR ON lamp (clear) illuminates and remains illuminated through the test sequence until aircraft power to test set (via test set power cable) is disconnected or shut off.

18. Perform the following operations on the M-91 test set: a. Press to test all four lamps on test set. Each lamp will illuminate.

NOTE
Replace any lamp that does not illuminate when pressed. If none of the indicating lamps illuminate, return test set to AVUM.

b. Rotate TEST SEQUENCE switch clockwise to TS RESET position. No visual indication will occur.
c. Rotate TEST SEQUENCE switch clockwise to SV SELF TEST position. STRAY VOLTAGE lamp (red) will illuminate.
d. Rotate TEST SEQUENCE switch clockwise to next position, TS RESET. STRAY VOLTAGE lamp (red) will extinguish.
e. Rotate TEST SEQUENCE switch clockwise to next position, STRAY VOLT. STRAY VOLTAGE lamp (red) should not illuminate.
f. Rotate TEST SEQUENCE switch clockwise to next position, SYS NOT RESET. SYS NOT RESET lamp (amber) should not illuminate. If lamp illuminates, press and release MANUAL SYSTEM RESET switch and SYS NOT RESET lamp should then extinguish.

NOTE
When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. IF the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

g. Rotate TEST SEQUENCE switch clockwise to next position, DISP COMPL.

19. Press pilot CHAFF DISP switch once. Press copilot CHAFF DISP switch once. On DCP, for each depressing, the CHAFF counter should count down by an increment of one.
20. On DCP, set MAN-PRGM switch to PRGM position.
21. Press any one of CHAFF DISP switches in aircraft. In DCP, the number shown on CHAFF counter should decrease in accordance with the program set on the EM.
22. Repeatedly press other CHAFF DISPENSE switch until CHAFF counter on DCP reads 00.
23. On test set, observe DISPENSE COMPLETE lamp (green) is illuminated and then perform the following operations:

a. Rotate TEST SEQUENCE switch counter-clockwise to SYS NOT RESET position. SYS NOT RESET lamp (amber) will illuminate.
b. Press and release MANUAL SYSTEM RESET switch. SYS NOT RESET lamp (amber) will extinguish.

NOTE
When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. If the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

c. Rotate TEST SEQUENCE switch counter-clockwise to STRAY VOLT position. STRAY VOLTAGE lamp (red) should not illuminate.

d. Rotate TEST SEQUENCE switch counter-clockwise to START/HOME position.

NOTE

When the TEST SEQUENCE switch is turned to the OFF position, the DISPENSER COMPLETE lamp will extinguish, the STRAY VOLTAGE lamp will illuminate and then will extinguish when the OFF position is reached.

24. Install safety pins.
25. Disconnect test set power cable.
26. Remove M-91 test set from dispenser assembly and restore in carrying case along with the power cable and hexagonal wrench.
27. On DCP, set ARM-SAFE switch to SAFE position.
28. On DCP, reset CHAFF counter to 30.
29. Disconnect aircraft power by pulling the M130 POWER circuit breaker located on the mission control panel (fig. 4-1).
30. Proceed immediately to ammunition loading procedures.

4-5. AMMUNITION.

a. Ammunition Loading Procedure.

WARNING

Only one shipping container is to be opened at a time. If a shipping container has been opened and only partially emptied, the remaining contents will be secured in the container with an appropriate type of packaging material or filler to adequately prevent jostling. All munitions in storage must be in their original shipping containers.

1. Place payload module assembly on work bench in approved safe area so that the retaining plate is facing up.
2. Remove retaining plate by unscrewing two retaining bolts.
3. Insert one flare (or chaff) at a time into each chamber of payload module.
4. Remove plastic dust cap from each chaff or flare.

CAUTION

Prior to insertion of an impulse cartridge, be sure there is preformed packing in the flare cartridge. (There will be no preformed packing in chaff cartridges.) Reinstall any preformed packing that is inadvertently removed with dust cap. The loading of impulse cartridges into a flare or chaff shall be accomplished one at a time.

5. Insert one impulse cartridge into each flare (or chaff).
6. Install retainer plate assembly by screwing to two retainer bolts into payload module.

WARNING

The system must have been tested to assure that there is no stray voltage and all aircraft power must be removed from the system prior to unloading the payload module.

7. On the dispenser control panel, assure ARM-SAFE switch is in SAFE position.
8. On the electronic module and right wing assure safety pins and flag assemblies are installed.
9. Slide payload module assembly into dispenser assembly and secure two stud bolts, hand tight, using 5/32 inch hexagonal wrench.

b. Ammunition Unloading Procedure.

WARNING

All aircraft power to the dispenser system must be turned off prior to removal of payload module from dispenser assembly. Safety pin flag shall be installed in the electronic module prior to landing and the safety pin flag shall be installed in the wing-mounted safety switch immediately after landing.

1. On dispenser control panel, assure ARM-SAFE switch is in SAFE position.

2. Assure safety pin and flag are inserted into electronic module and in the wing mounted safety switch.

WARNING

If there is an indication that a misfire occurred, notify EOD personnel for disposition and disposal.

3. Remove module from dispenser assembly by unscrewing two stud bolts with a 5/32 inch hexagonal wrench and sliding out of dispenser assembly.
4. Remove retaining plate from payload module by unscrewing two retaining bolts.
5. Remove expended and unexpended impulse cartridges and flares (or chaff) from payload module.
6. Repack unexpended items in original containers and return to stores.

NOTE

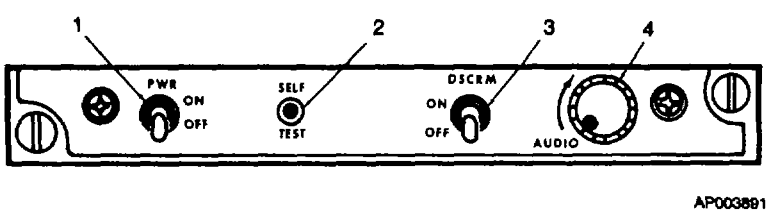
It is not unusual for the case of a chaff cartridge to crack when fired. It does not effect performance of the item and should not be reported as a malfunction.

4-6. RADAR SIGNAL DETECTING SETS AN/ APR-39(V)1 OR AN/APR-39(V)2.

The radar signal detecting system indicates the relative position of search radar stations. Audio warning signals are applied to the pilot's and copilot's headsets. The radar signal detecting set is protected by the 7.5-ampere circuit breaker placarded APR-39, located on the mission control panel (fig. 4-1). The associated antennas are shown in figure 2-1. For AN/APR-39(V)l operating instructions, refer to TM 11-5841-283-20. Refer to TM 11-584120-2 for the AN/APR-39 (V)2 operating instructions. Pattern #1, self test, shall be as shown in figure 4-5.

a. Radar Signal Detecting Set Control Panel Functions (AN/APR-39(V)1) (fig. 4-3).

CONTROL	FUNCTION
PWR switch	Turns set On or Off.
SELF TEST switch	Initiates self test.
DSCRM switch	Turns discriminate function On or Off.



1. Power switch
2. Self test switch
3. Discriminate switch
4. Audio control

Figure 4-3. Radar Signal Detecting Set Control Panel (AN/APR-39(V)1

AUDIO control	Adjusts audio level.

b. Radar Signal Detecting Set Control Panel Functions (AN/APR-39(V)2) (fig. 4-4).

CONTROL	FUNCTION
PWR switch	Turns set On or Off
ALT/HI Low switch	Selects mode of operation
HI	Selects high altitude threat mode
LOW	Selects low altitude threat mode
TEST switch	Initiates self test
AUDIO control	Adjust audio level

c. Radar Signal Detecting Set Indicator Functions (fig. 4-5).

CONTROL	FUNCTION
MA indicator	Illuminates to indicate the presence of an MA threat.
BRIL control	Adjusts brilliance.
DAY-NIGHT control	Rotation adjusts intensity of display.

4-7. RADAR WARNING RECEIVER AN/APR-44()(V)3.

The radar warning receiver (fig. 4-6) indicates the presence of certain types of search radar signals.

The radar warning receiver is protected by the 5ampere circuit breaker placarded APR-44, located on the mission control panel (fig. 4-1). For operating instructions, refer to TM 11-5841-291-12.

CONTROL	FUNCTION
Radar warning indicator	Illuminates to indicate the presence of an AI or SAM threat.
VOLUME control	Adjusts volume.
POWER switch	Turns set On or Off.

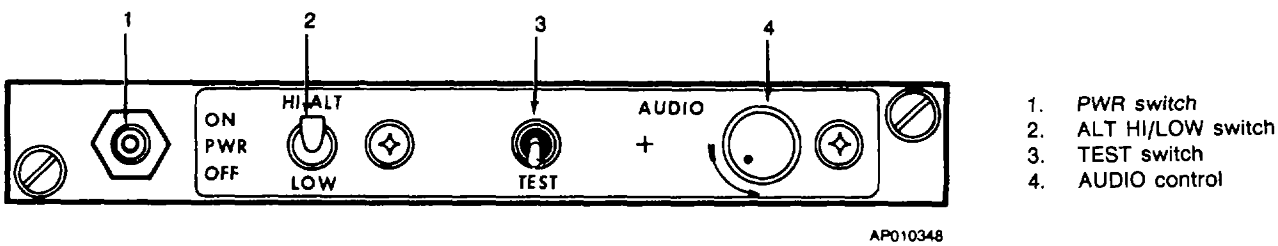


Figure 4-4. Radar Signal Detecting Set Control Panel (AN/APR-39(V)2

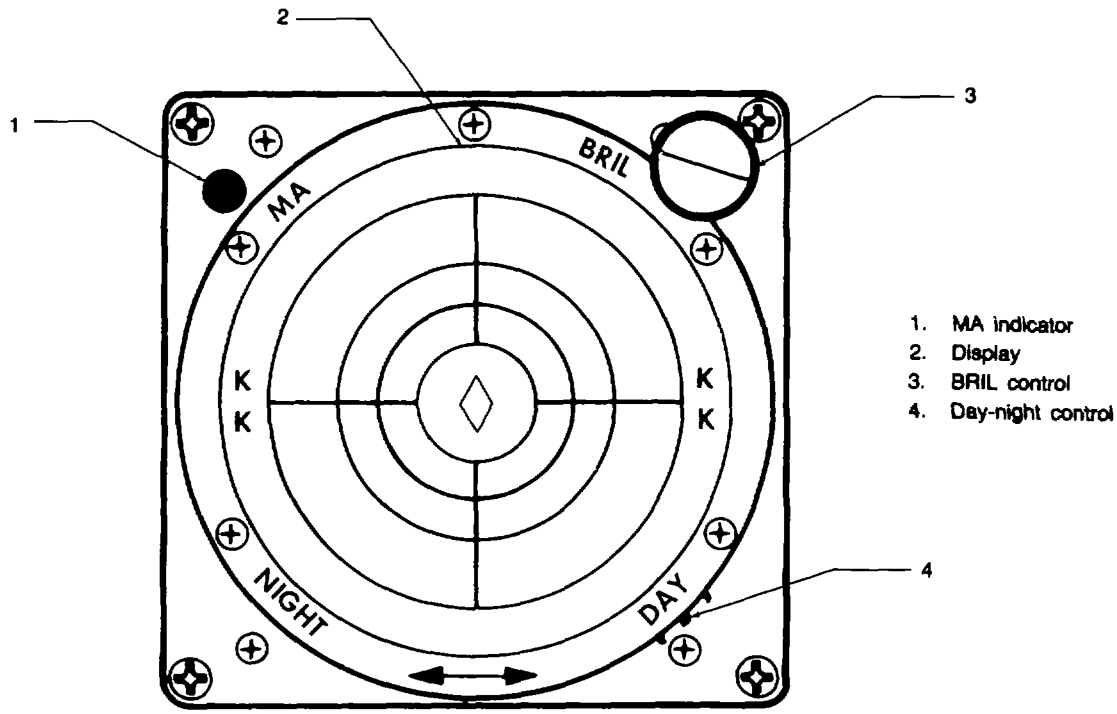


Figure 4-5. Radar Signal Detecting Set Indicator AP005715

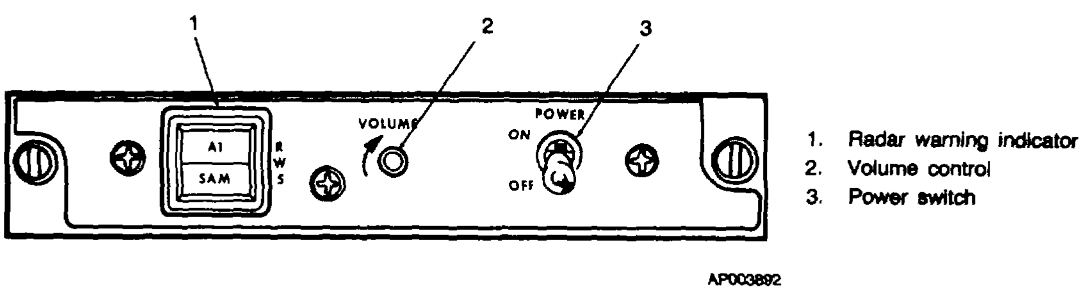


Figure 4-6. Radar Warning Receiver Control Panel AN/APR-44( )(V)3

CHAPTER 5
OPERATING LIMITS AND RESTRICTIONS

Section I. GENERAL

5-1. PURPOSE.

This chapter identifies or refers to all operating limits and restrictions that shall be observed during ground and flight operations.

5-2. GENERAL.

The operating limitations set forth in this chapter are the direct result of design analysis, tests, and operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and to derive maximum utility from the aircraft. Limits concerning maneuvers, weight, and center of gravity are also covered in this chapter.

5-3. EXCEEDING OPERATIONAL LIMITS.

Anytime an operational limit is exceeded an appropriate entry shall be made on DA Form 2408-13. Entry shall state what limit or limits were exceeded, range, time beyond limits, and any additional data that would aid maintenance personnel in the maintenance action that may be required.

5-4. MINIMUM CREW REQUIREMENTS.

The minimum crew required for flight is two pilots. Additional crewmembers will be added as required, at the discretion of the commander, in accordance with pertinent Department of the Army regulations. MACOMS may authorize maintenance test flights to be conducted with one qualified pilot at the pilot's station, and a trained technical observer at the copilot's station, in day/visual meteorological conditions only.

Section II. SYSTEM LIMITS

5-5. INSTRUMENT MARKINGS.

Instruments which display operating limitations are illustrated in figure 5-1. The operating limitations are color coded on the instrument faces. Color coding of each instrument is explained in the illustration.

5-6. INSTRUMENT MARKING COLOR CODES.

Operating limitations and ranges are illustrated by the colored markings which appear on the dial faces of engine, flight, and utility system instruments. Red markings indicate the limit above or below which continued operation is likely to cause damage or shorten life. The green markings indicate the safe or normal range of operation. The yellow markings indicate the range when special attention should be given to the operation covered by the instrument. Operation is permissible in the yellow range, but should be avoided. White markings on the airspeed indicator denotes flap operating range. The blue marking on the airspeed indicator denotes best rate of climb with one engine inoperative, at maximum gross weight, maximum forward c.g., sea level standard day conditions.

5-7. PROPELLER LIMITATIONS.

The maximum propeller overspeed limit is 2200 RPM. Propeller speeds above 2000 RPM indicate failure of the primary governor. Propeller speeds above 2080 RPM indicate failure of both primary and secondary governors. Torque is limited to 81% for sustained operation above 2000 RPM.

5-8. STARTER LIMITATIONS.

The starters in this aircraft are limited to an operating period of 30 seconds ON, then 5 minutes OFF, for two starter operations. After two starter operations the starter shall be operated for 30 seconds ON, then 30 minutes OFF.

TORQUE

49% MAXIMUM BELOW 1600 RPM

20-100% NORMAL OPERATING RANGE

100% MAXIMUM
123% TRANSIENT (5 SECONDS)

TURBINE TACHOMETER (N1 SPEED)

52% MINIMUM LOW IDLE
88% MAXIMUM REVERSE (ONE MINUTE)
101.5% MAXIMUM
100.1% MAXIMUM BELOW −48°C
102.6% TRANSIENT (10 SECONDS)

TURBINE GAS TEMPERATURE

400-750°C NORMAL OPERATING RANGE
660°C MAXIMUM LOW IDLE

(NOT MARKED) 725°C MAXIMUM CRUISE
725°C MAXIMUM CRUISE CLIMB

750°C MAXIMUM CONTINUOUS
750°C MAXIMUM REVERSE (1 MINUTE)

850°C MAXIMUM TRANSIENT
1000°C MAXIMUM STARTING (5 SECONDS)

PROPELLER TACHOMETER

1600-2000 RPM NORMAL OPERATING RANGE
1900 RPM MAXIMUM REVERSE (1 MINUTE)

2000 RPM MAXIMUM
2200 RPM TRANSIENT (5 SECONDS)

OIL TEMPERATURE AND PRESSURE

OIL TEMPERATURE SCALE

10-99°C NORMAL OPERATING RANGE
0-99°C CRUISE CLIMB AND RECOMMENDED SPEED
− 40-99°C STARTING, LOW IDLE, HIGH IDLE

99°C MAXIMUM
1-4°C TRANSIENT (5 MINUTES)

OIL PRESSURE SCALE

60 PSI MINIMUM
60 TO 85 PSI, 49% TORQUE MAXIMUM

85-135 PSI NORMAL OPERATING ABOVE 21,000 FEET
85-105 PSI CAUTION RANGE BELOW 21,000 FEET

105-135 PSI NORMAL OPERATING BELOW 21,000 FEET

200 PSI MAXIMUM STARTING WITH COLD OIL

Figure 5-1. Instrument Markings (Sheet 1 of 3)

245 KCAS (247 KIAS) MAXIMUM (Vmo) (.47 MACH)

NOTE

MAXIMUM ALLOWABLE AIRSPEED (RED STRIPPED) POINTER IS SELF ADJUSTING WITH ALTITUDE

91 KCAS (89 KIAS) MINIMUM SINGLE-ENGINE CONTROL SPEED (Vmca)

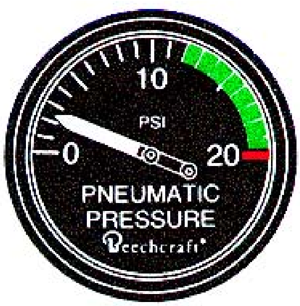
119 KCAS (120 KIAS) ONE ENGINE INOPERATIVE BEST RATE-OF-CLIMB (Vyse)

84-155 KCAS (77-157 KIAS) FULL FLAP OPERATING RANGE

84-101 KCAS (77-100 KIAS)

101-155 (100-159 KIAS)

200 KCAS (202 KIAS) MAXIMUM APPROACH FLAP EXTENSION SPEED



PNEUMATIC PRESSURE

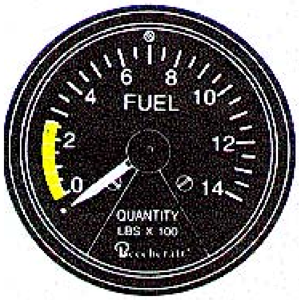
12-20 PSI NORMAL OPERATING RANGE

20 PSI MAXIMUM

PROPELLER DEICER AMMETER

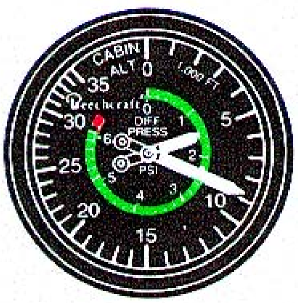
14-18 AMPERES NORMAL OPERATION

Figure 5-1. Instrument Markings (Sheet 2 of 3)



FUEL QUANTITY

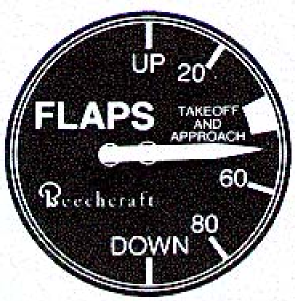
0-265 LBS NO TAKEOFF RANGE



CABIN ALTIMETER AND DIFFERENTIAL PRESSURE

0-6.1 PSI NORMAL RANGE

6.1 PSI MAXIMUM



FLAP POSITION INDICATOR

40% TAKEOFF AND APPROACH

Figure 5-1. Instrument Markings (Sheet 3 of 3)

5-9. AUTOPILOT LIMITATIONS.

a. An autopilot preflight check must be conducted and found satisfactory prior to each flight on which the autopilot is to be used.

b. A pilot must be seated at the controls with the seat belt fastened when the autopilot is in operation.

c. Operation of the autopilot and yaw damper is prohibited during takeoff and landing, and below 200 feet above terrain. Maximum speed for autopilot operation is 247 knots/0.47 Mach.

d. During a coupled ILS approach do not operate the propellers in the 1750 to 1850 RPM range.

5-10. FUEL SYSTEM LIMITS.

NOTE

Aviation gasoline (AVGAS) contains a form of lead which has an accumulative adverse effect on gas turbine engines. The lowest octane AVGAS available (less lead content) should be used. If any AVGAS is used the total operating time must be entered on DA Form 2408-13.

a. Operating Limits. Operation with FUEL PRESS light on is limited to 10 hours. Log FUEL PRESS light on time on DA Form 2408-13. One standby boost pump may be inoperative for takeoff. (Crossfeed fuel will not be available from the side with the inoperative standby boost pump.) Operation on aviation gasoline is time limited to 150 hours between engine overhaul and altitude limited to 20,000 feet with one standby boost pump inoperative. Crossfeed capability is required for climb, when using aviation gasoline above 20,000 feet.

b. Fuel Management. Auxiliary tanks will not be filled for flight unless the main tanks are full. Maximum allowable fuel imbalance is 1000 lbs. Do not take off if fuel quantity gages indicate in yellow arc (less than 265 lbs. of fuel in each main tank). Crossfeed only during single engine operation.

c. Fuel System Anti-Icing. Icing inhibitor conforming to MIL-I-27686 PRIST will be added to commercial fuel, not containing an icing inhibitor, during fueling operations, regardless of ambient temperatures. The additive provides anti-icing protection and also functions as a biocide to kill microbial growth in aircraft fuel systems.

5-11. BRAKE DEICE LIMITATIONS.

The following limitations apply to the brake deice system:

a. The brake deice system shall not be operated at ambient temperatures above + 15°C.

b. The brake deice system shall not be operated longer than 10 minutes (one timer cycle) with the landing gear retracted. If operation does not automatically terminate approximately 10 minutes after gear retraction, turn the brake deice switch OFF.

c. Maintain 85% NI or higher during simultaneous operation of the brake deice and surface deice systems. If adequate pneumatic pressure cannot be provided for simultaneous operation of the brake deice and surface deice systems, turn OFF the brake deice system.

d. In order to maintain an adequate supply of systems pneumatic bleed air, the brake deice system shall be turned OFF during single engine operation.

5-12. PITOT HEAT LIMITATIONS.

Pitot heat should not be used for more than 15 minutes while the aircraft is on the ground.

5-13. PNEUMATIC SURFACE DEICE SYSTEM LIMITATIONS.

The pneumatic surface deice system shall not be operated at ambient temperatures below -40'C.

Section III. POWER LIMITS

5-14. ENGINE LIMITATIONS.

Operation of the engines is monitored by instruments, with the operating limits marked on the face of each instrument.

CAUTION

Engine operation using only the engine driven fuel pump without boost pump fuel pressure is limited to 10 cumulative hours. All time in this category shall be entered on DA Form 2408-13 for the attention of maintenance personnel.

CAUTION

Use of aviation gasoline is time-limited to 150 hours of operation during any Time Between-Overhaul (TBO) period. It may be used in any quantity with primary or alternate fuel.

5-15. OVERTEMPERATURE AND OVERSPEED LIMITATIONS.

a. Whenever the limiting temperatures are exceeded and cannot be controlled by retarding the power levers, the engine will be shut down and a landing made as soon as possible.

b. During engine operation the temperatures, speeds and time limits listed in the Engine Operating Limitations chart (table 5-1) must be observed. When these limits are exceeded, the incident will be entered as an engine discrepancy in the appropriate maintenance forms. It is particularly important to record the amount and duration of over-temperature and/or overspeed.

c. Continuous engine operation above 725 °C will reduce engine life.

Table 5-1. Engine Operating Limitations

OPERATING CONDITION	SHP	TORQUE PERCENT (1)	MAXIMUM OBSERVED TGT °C	GAS GENERATOR RPM N_1 (10) RPM	%	PROP RPM N_2 (11)	OIL PRESS PSI (2)	OIL TEMP °C
TAKEOFF (3)	850	100%	750	38,100	101.5	2000	105 to 135	10 to 99
MAX CONT	850	100% (4)	750	38,100	101.5	2000	105 to 135	10 to 99
MAX CLIMB	850	100% (4)	725	38,100	101.5	2000	105 to 135	0 to 99
MAX CRUISE								
HIGH IDLE	—	—	—	—	(5)	—	—	-40 to 99
LOW IDLE	—	—	660 (6)	19,500	52(min)	—	60(min)	-40 to 99
STARTING	—	—	1000 (7)	—	—	—	—	-40(min)
TRANSIENT	—	123% (7)	850	38,500 (8)	102.6 (8)	2200 (7)	—	0 to 104 (3)
MAX REVERSE (9)	—	—	750	—	88	1900	105 to 135	0 to 99

NOTES:

(1) Torque limit applies within range of 1600-2000 propeller RPM (N_2). Below 1600 RPM, torque is limited to 49%.
(2) Normal takeoff and maximum continuous operation oil pressure at gas generator speeds above 72% with oil temperture between 60 and 71°C is 105 to 135 PSIG up to 21,000 feet. Above 21,000 feet, the minimum oil pressure is 85 PSIG. Plus or minus 10 PSIG fluctuations are acceptable. Oil pressure between 60 and 85 PSIG should be tolerated only for the completion of the flight at power setting not to exceed 49% torque. Oil pressures below 60 PSIG are unsafe and require that either the engine be shut down or a landing be made as soon as possible, using the minimum power required to sustain flight. During extremely cold starts, oil pressure may reach 200 PSI.
(3) These values are time limited to 5 minutes.
(4) Cruise torque values vary with altitude and temperature.
(5) At approximately 70% N_1.
(6) High TGT at ground idle may be corrected by reducing accessory load and/or increasing N_1 RPM.
(7) These values are time limited to 5 seconds
(8) These values are time limited to 10 seconds
(9) This operation is time limited to 1 minute.
(10) For every 5.6°C below -48°C ambient temperature, reduce maximum allowable N_1 by 1.6%.
(11) Torque is limited to 81% for sustained operation above 2000 propeller RPM.

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5-16. POWER DEFINITIONS FOR ENGINE OPERATIONS.

The following definitions describe the engine power ratings.

a. Takeoff Power. The maximum power available, limited to periods of five minutes duration.

b. Maximum Continuous Power. The highest power rating not limited by time. Use of this rating is intended for emergency situations at the discretion of the pilot.

5-17. GENERATOR LIMITS.

Maximum generator load is limited to 100% for flight and variable during ground operations. Observe the limits shown in Table 5-2 during ground operation.

Table 5-2. Generator Limits

GENERATOR LOAD	MINIMUM GAS GENERATOR RPM N_1
95%	61%
98%	65%
100%	70%
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Section IV. LOADING LIMITS

5-18. CENTER OF GRAVITY LIMITATIONS.

Center of gravity limits and instructions for computation of the center of gravity are contained in Chapter 6. The center of gravity range will remain within limits, providing the aircraft loading is accomplished according to instructions in Chapter 6.

5-19. WEIGHT LIMITATIONS.

WARNING

The ability to sustain loss of engine power and successfully stop, continue the takeoff, or climb before or after gear retraction is not assured for all conditions. Thorough mission planning must be accomplished, prior to takeoff, by analysis of maximum takeoff weight, accelerate-stop distance, positive engine-out climb at liftoff, accelerate-go distance, takeoff climb gradient, and climb performance.

The maximum designed gross weight is 14,200 pounds for takeoff. Maximum landing weight is 13, 500 pounds. Maximum ramp weight is 14,290 pounds. Maximum zero fuel weight is 11,500 pounds.

Section V. AIRSPEED LIMITS MAXIMUM AND MINIMUM

5-20. AIRSPEED LIMITATIONS.

Airspeed indicator readings contained in procedures, text, and illustrations throughout this Operator's Manual are given as indicated airspeed (IAS). Airspeed indicator markings (fig. 5-1) and placarded airspeeds, located on the cockpit overhead control panel (fig. 2-18), are calibrated airspeed (CAS). Airspeed Calibration Charts are provided in Chapter 7.

5-21. MAXIMUM ALLOWABLE AIRSPEED.

Refer to figure 5-2 to determine limiting airspeeds at maximum gross weight under various conditions. The maximum allowable airspeed is 247 KIAS/0.47 Mach.

5-22. LANDING GEAR EXTENSION SPEED.

The airspeed limit for extending the landing gear and for flight with the landing gear extended is 184 KIAS.

5-23. LANDING GEAR RETRACTION SPEED.

The airspeed limit for retracting the landing gear is 166 KIAS.

5-24. WING FLAP EXTENSION SPEEDS.

The airspeed limit for APPROACH extension (40%) of the wing flaps is 202 KIAS. The airspeed

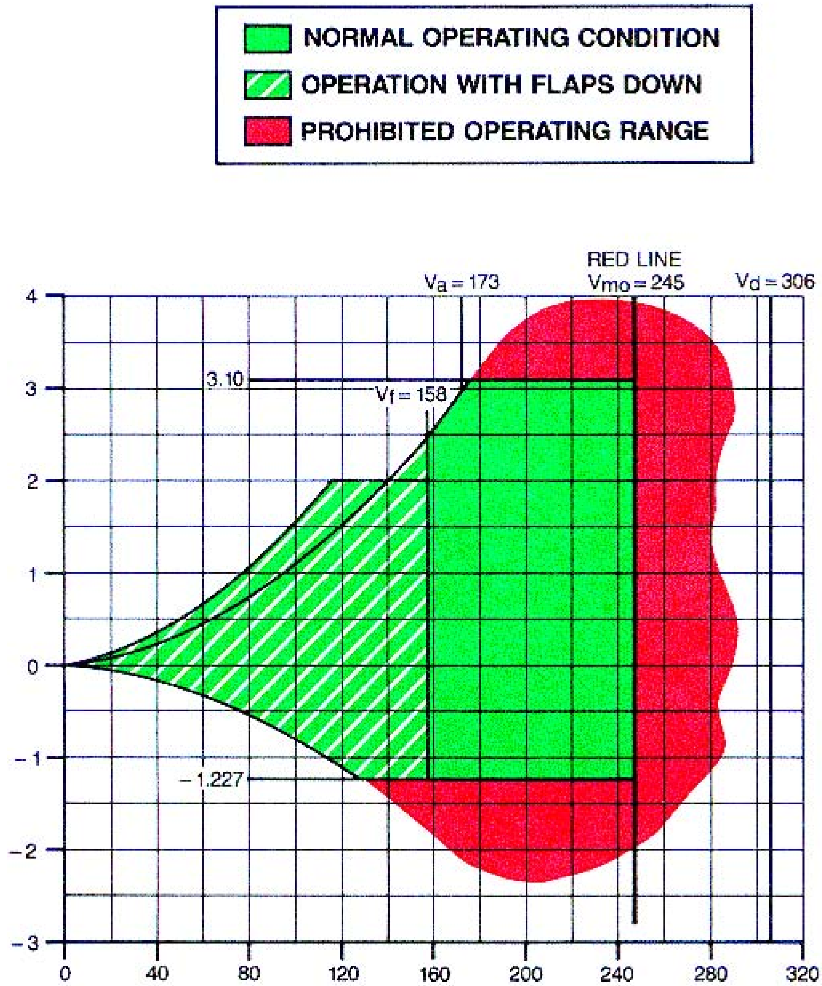


Figure 5-2. Flight Envelope

limit for full DOWN extension (100%) of the wing flaps is 157 KIAS. If wing flaps are extended above these speeds, the flaps or their operating mechanisms may be damaged.

5-25. MINIMUM SINGLE-ENGINE CONTROL AIRSPEED (VMC).

Chapter 7, Section X describes minimum single-engine control airspeed. The minimum single-engine control airspeed (V_{mc}) at sea level standard conditions is 89 KIAS.

5-26. MAXIMUM DESIGN MANEUVERING SPEED.

The maximum design maneuvering speed is 173 KIAS.

Section VI. MANEUVERING LIMITS

5-27. MANEUVERS.

a. The following maneuvers are prohibited.

1. Spins.
2. Aerobatics of any kind.
3. Abrupt maneuvers above 173 KIAS.
4. Any maneuver which results in a positive load factor of 3.10 G's or a negative load factor of 1.227 G's with wing flaps up or a positive load factor of 2.0 G's, or a negative 1.227 G's with wing flaps down.

b. Recommended turbulent air penetration airspeed is 173 KIAS.

5-28. BANK AND PITCH LIMITS.

a. Bank limits are 60° left or right.

b. Pitch limits are 30° above or below the horizon.

SECTION VII. ENVIRONMENTAL RESTRICTIONS

5-29. ALTITUDE LIMITATIONS.

The maximum altitude that the aircraft may be operated at is 31,000 feet. When operating with inoperative yaw damp, the altitude limit is 17,000 feet.

5-30. TEMPERATURE LIMITS.

a The aircraft shall not be operated when the ambient temperatures are warmer than ISA +37°C at SL to 25,000 feet, or ISA +31°C above 25,000 feet.

b. Engine ice vanes shall be retracted at +15°C and above.

5-31. FLIGHT UNDER IMC (INSTRUMENT METEOROLOGICAL CONDITIONS).

This aircraft is qualified for operational in instrument meteorological conditions.

5-31A. ICING LIMITATIONS (TYPICAL).

WARNING

While in icing conditions, if there is an unexpected 30% increase of torque needed to maintain airspeed in level flight, a cumulative total of two or more inches of ice accumulation on the wing, an unexplained decrease of 15 knots IAS, or an unexplained deviation between pilot's and copilot's airspeed indicators, the king environment should be exited as soon as practicable. Ice accumulation on the pitot tube assemblies could cause a complete loss of airspeed indication.

The following conditions indicate a possible accumulation of ice on the pitot tube assemblies and unprotected airplane surfaces. If any of these conditions are observed, the icing environment should be exited as soon as practicable.

1. Total ice accumulation of two inches or more on the wing surfaces. Determination of ice thickness can be accomplished by summing the estimated ice thickness on the wing prior to each pneumatic boot deice cycle (e.g. four cycles of minimum recommended ½-inch accumulation.

2. A 30 percent increase in torque per engine required to minimum an desired airspeed in level flight (not to exceed 85 percent torque) when operating at recommended holding speed.

3. A decrease in indicated airspeed of 15 knots after entering the icing condition (not slower than 1.4 power off stall speed) if maintaining original power setting in level flight. This can be determined by comparing pre-icing condition entry speed to the indicated speed after a surface and antenna deice cycle is completed.

4. Any variations from normal indicated airspeed between the pilot's and copilot's airspeed indicators.

5-31B. ICING LIMITATIONS (SEVERE).

WARNING

Severe icing may result from environmental conditions outside of those for which the airplane is certificated. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result is a build-up on protective surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of these protected surfaces. This ice may not shed using ice protection systems, and may seriously degrade the performance and controllability of the airplane.

a. During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from air traffic control to facilitate a route or an altitude change to exit the icing conditions:

(1) Unusually extensive ice accreted on the airframe in areas not normally observed to collect ice.

(2) Accumulation of ice on the upper (or lower, as appropriate) surface of the wing aft of the protected area.

(3) Accumulation of ice on the propeller spinner farther aft than normally observed.

b. Since the autopilot may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.

NOTE

All icing detection lights must be operative prior to flight into icing conditions at night. This supersedes any relief provided by the master minimum equipment list (MMEL) or equivalent.

5-32. WIND LIMITATIONS.

The maximum demonstrated crosswind for landing is 25 KTS. Wind limitations are described in Chapter 7.

5-33. OXYGEN REQUIREMENTS.

For oxygen requirements, see AR 95-1.

5-34. CABIN PRESSURE LIMITS.

Maximum cabin differential pressure is 6.1 PSI. If a crack in either the cabin window or windshield should occur, refer to chapter 9.

Section VIII. OTHER LIMITATIONS

5-35. INSTRUMENT LANDING SYSTEM LIMITS.

During ILS approach do not operate the propellers in the 1750 to 1850 RPM range.

5-36. FERRY CHAIR.

A ferry chair may be installed in the cabin area for use on ferry missions. The seat may be installed in the forward or the aft facing positions. The side facing lavatory is limited to 170 pounds.

5-37. INTENTIONAL ENGINE CUT SPEED.

Inflight engine cuts below the safe one-engine inoperative speed (V_{sse} - 104 KIAS) are prohibited.

5-38. RADOME ANTI-ICE OPERATION.

The following limitations apply to operation of the radome anti-ice system:

NOTE

Ice accumulation on the forward data link randome does not adversely affect the flying qualities of the aircraft, however ice accumulation does affect the data link operation. Therefore radome anti-ice should be used only in conjunction with the mission equipment.

1. Radome anti-ice shall be off during takeoff, landing, and any single engine operations.
2. Maintain 85% N_1 or above during simultaneous operation of the radome anti-ice, brake deice, and surface deice systems. If adequate pneumatic pressure cannot be provided for simultaneous operation of these systems, turn off the radome anti-ice and brake deice systems.

5-39. CABIN DOOR.

The cabin door is weight limited to 300 pounds to prevent possible structural damage.

5-40. MAXIMUM DESIGN SINK RATE.

The maximum design sink rate below 13,500 pounds gross weight is 600 feet per minute. The maximum design sink rate above 13,500 pounds gross weight is 500 feet per minute.

Section IX. REQUIRED EQUIPMENT FOR VARIOUS CONDITIONS OF FLIGHT

5-41. REQUIRED EQUIPMENT LISTING

a. A Required Equipment for Various Conditions of Right (table 5-3) is provided to enable the pilot to identify those systems/components required for flight. For the sake of brevity, the listing does not include obviously required items such as wings, rudder, flaps, engines, landing gear, etc. The list also does not include items which do not affect the airworthiness of the aircraft such as galley equipment, entertainment systems, passenger convenience items, etc. It is, however, important to note the ALL ITEMS WHICH ARE RELATED TO THAT AIRWORTHINESS OF THE AIRCRAFT AND NOT INCLUDED ON THE LIST ARE AUTOMATICALLY REQUIRED TO BE OPERATIVE

b. It is the final responsibility of the pilot to determine whether the lack or inoperative status of a piece of equipment on the aircraft will limit the conditions under which the aircraft may be operated.

(-)Indicates item may be inoperative for the specified Right condition.

(*)Refers to remarks and/or exceptions column for explicit information or reference.

Numbered items contained in ( ) are required for flights by AR 95-1.

c. The pilot is responsible for exercising the necessary operational control to assure that no aircraft is flown with multiple items inoperative, without first determining that any interface or interrelationship between inoperative systems or components will not result in a degradation in the level of safety and/or cause an undue increase in crew workload.

d. The exposure to additional failures during continued operation with inoperative systems or components must also be considered in determining that an acceptable level of safety is being maintained. The REL may not deviate from requirements of the operators manual limitations section emergency procedures or safety of flight messages.

Table 5-3. Required Equipment Listing

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
AIR CONDITIONING							
Bleed Air Fail Light	2	-	-	1	1	2	Provided bleed air is not used from side of failed light.
Pressurization Controller	1	1	1	1	1	1	
Safety Valve	1	1	1	1	1	1	
Outflow Valve	1	1	1	1	1	1	
Altitude Warning	1	1	1	1	1	1	May be inoperative provided airplane remains unpressurized.
Cabin Rate of Climb	1	1	1	1	1	1	
Differential Pressure/Cabin Altitude	1	1	1	1	1	1	
Pressurization Air Source	2	1	1	1	1	1	
Duct Overtemp Light	1	-	-	-	-	-	May be inoperative provided bleed air is not used.
COMMUNICATIONS							
Interphone System	1	-	-	-	-	-	
VHF Communications Systems	2	-	-	-	-	-	
Static Discharge Wicks	24	-	-	24	24	24	Minimum required - one wick at the outboard end of each control surface plus top of vertical stabilizer
ELECTRICAL POWER							
Battery	1	1	1	1	1	1	
Battery Charge Light	1	1	1	1	1	1	
DC Generator	2	1	1	2	2	2	
DC Loadmeter	2	2	2	2	2	2	One may be inoperative provided corresponding generator caution light Is monitored. One may be
DC Generator Caution Light	2	2	2	2	2	2	inoperative provided corresponding loadmeter is monitored.
Inverter	2	1	1	2	2	2	
Inverter Warning Light	1	-	-	1	1	1	May be inoperative provided both inverters are operative.
AC Frequency/Voltmeter	2	2	2	2	2	2	
EQUIPMENT FURNISHINGS							
Seat Belts and Shoulder Harnesses; Pilot and Co-Pilot	2	*	*	*	*	*	* One per installed seat.
Emergency Locator transmitter	1	-	-	-	-	-	

Table 5-3. Required Equipment Listing

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
FIRE PROTECTION							
Fire Detector System	2	2	2	2	2	2	
Engine Fire Extinguisher	2	2	2	2	2	2	
Portable Fire Extinguisher	2	2	2	2	2	2	
FLIGHT CONTROLS							
Trim Tab Indicators - Rudder, Aileron, and Elevator	3	3	3	3	3	3	May be inoperative provided that the tabs are visually checked in the neutral position prior to each takeoff and checked for full range of operation.
Flap Position Indicator	1	1	1	1	1	1	May be inoperative provided that the flap travel is visually inspected prior to takeoff.
Flap System	1	-	-	-	-	-	
Rudder Boost	1	-	-	-	-	-	
Yaw Damp	1	1	1	1	1	1	May be inoperative for flight at and be low 17,000 feet.
Stall Warning	1	1	1	1	1	1	
Autopilot	1	-	-	-	-	-	
FUEL EQUIPMENT							
Standby Fuel Boost Pump	2	1	1	1	1	1	Both required for operation on aviation gasoline above 20,000 feet.
Engine Driven Boost Pump	2	2	2	2	2	2	
Firewall Shutoff Valve	2	2	2	2	2	2	
Fuel Quantity Indicator	2	2	2	2	2	2	One may be inoperative provided other side is operational and amount of fuel on board can be established to be adequate for intended flight. Fuel flow on affected side must be operational and monitored.
Crossfeed Valve	1	-	-	-	-	-	Required for (1) operation with aviation gasoline above 20,000 feet; 12) when operating with aviation kerosene when one standby boost pump is Inoperative. If takeoff with inoperative crossfeed is planned, mission should be limited to that range attainable with single engine operation, one engine supplying fuel.
Crossfeed Light	1	1	1	1	1	1	May be inoperative provided proper operation of crossfeed system is checked prior to takeoff. Both fuel pressure lights must be operative.

Table 5-3. Required Equipment Listing

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
Fuel Flow Indicator	2	2	2	2	2	2	One may be inoperative provided fuel quantity gages are operative.
Fuel Pressure Warning Light	2	2	2	2	2	2	One may be inoperative provided standby boost pump operation is ascertained using opposite light with cross feed prior to engine start. Standby boost pump on side of failed light must be operated in flight to assure fuel pressure, should the engine driven boost pump fail.
Motive Flow Valve	2	-	-	-	-	-	Required if aux tanks contain fuel.
Jet Transfer Pump	2	-	-	-	-	-	Required if aux tanks contains fuel.
Fuel Quantity Gage Selector Switch	1	1	1	1	1	1	May be inoperative provided MAIN quantity indicators are operational.
ICE AND RAIN PROTECTION							
Airfoil Deice System (Wing and Horizontal Stabilizer)	1	-	-	-	-	1	
Antenna Deice System	1	-	-	-	-	1	
Engine Inertial Ice Vanes	2	2	2	2	2	2	
Ice Vane Lights	4	4	4	4	4	4	May be inoperative provided manual ice vane controls are operational and used.
Windshield Heat, Left and Right	2	-	-	-	-	1	Right side may be inoperative.
Windshield Wiper	2	-	-	-	-	-	
Auto Ignition System and Lights	2	2	2	2	2	2	
Pitot Heater	2	-	-	1	1	1	Right side may be inoperative.
Alternate Static Air Source	1	1	1	1	1	1	
Propeller Deice System (Auto)	1	-	-	-	-	1	
Propeller Deice System (Manual)	1	-	-	-	-	1	
Heated Fuel Vent	2	-	-	-	-	2	
Stall Warning Heater	1	-	-	-	-	1	
Brake Deicer System	1	-	-	-	-	-	
LANDING GEAR							
Landing Gear Motor	1	1	1	1	1	1	May be inoperative provided operations are continued only to a point where re pairs can be accomplished.
Landing Gear Position Indicator Lights	3	3	3	3	3	3	One of three may be inoperative provided gear handle light is monitored.
Gear Handle Lights	2	2	2	2	2	2	
Landing Gear Aural Warning	1	1	1	1	1	1	

Table 5-3. Required Equipment Listing

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
LIGHTS							
Cockpit and Instrument Lights	*	-	*	-	*	-	*Lights must illuminate all instruments and controls.
Landing and Taxi Light	2	-	-	-	-	-	
Strobe Beacon	2	-	2	-	2	-	Per FAR 91.33
Position Lights	3	-	3	-	3	-	
Wing Ice Lights	2	-	-	-	-	*	*One required for night Icing flight.
Master Fault Warning Light	2	-	-	-	-	-	
Master Fault Caution Lights	2	-	-	-	-	-	
Cabin Door Caution Light	1	*	*	*	*	*	*May be Inoperative provided visual Indicators are checked prior to each takeoff.
NAVIGATION INSTRUMENTS							
Altimeter	2	1	1	1	1	1	Right side may be inoperative
Airspeed Indicator	2	1	1	1	1	1	Right side may be inoperative.
Vertical Speed Indicator	2	-	-	-	-	-	
Standby Magnetic Compass	1	1	1	1	1	1	
Horizon Indicator	2	-	-	2	2	2	Right side may be inoperative.
Outside Air Temperature	1	1	1	1	1	1	
Turn and Bank Indicator	2	-	-	1	1	1	Right side may be inoperative.
Directional Gyro	2	-	-	1	1	1	Right side may be inoperative.
Clock	2	-	-	1	1	1	
Transponder	1	-	-	1	1	-	
Distance Measuring Equipment	1	-	-	-	-	-	
Navigation Equipment	*	-	-	*	*	*	*Per AR-95-1
OXYGEN							
Oxygen System	1	1	1	1	1	1	
Oxygen Mask	*	-	-	-	-	-	*Refer to oxygen requirements in Section VI.
PROPELLERS							
Propeller Overspeed Governor	2	2	2	2	2	2	
Propeller Governor Test Switch	2	2	2	2	2	2	
Autofeathering System	1	-	-	-	-	-	
Autofeathering Armed Light	2	-	-	-	-	-	
Reverse Not Ready Light	1	1	1	1	1	1	
Propeller Synchrophaser	1	-	-	-	-	-	

Table 5-3. Required Equipment Listing

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
ENGINE INDICATING INSTRUMENTS							
Propeller Tachometer indicator	2	2	2	2	2	2	
Propeller Synchroscope	1	-	-	-	-	-	
Gas Generator Tachometer Indicator	2	2	2	2	2	2	
TOT Indicator	2	2	2	2	2	2	
Torque Indicator	2	2	2	2	2	2	
ENGINE OIL INDICATORS							
Oil Pressure Indicator	2	2	2	2	2	2	
Oil Temperature Indicator	2	2	2	2	2	2	
Chip Detector Light	2	2	2	2	2	2	

BT00226

CHAPTER 6
WEIGHT / BALANCE AND LOADING

Section I. GENERAL

6-1. EXTENT OF COVERAGE.

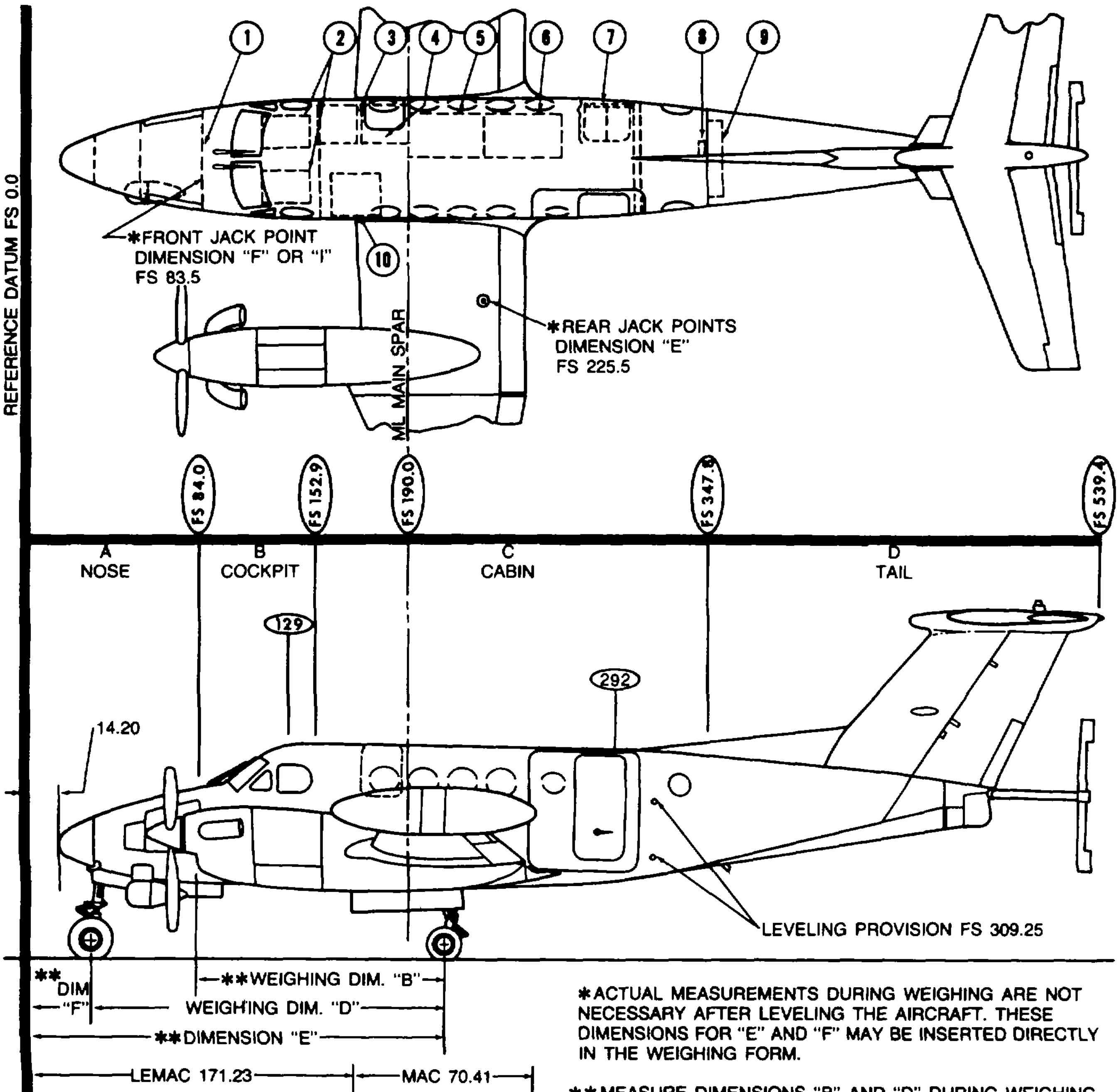
Sufficient data has been provided so that, knowing the basic weight and moment of the aircraft, any combination of weight and balance can be computed.

6-2. CLASS.

Army RC-12D aircraft are in Class 1. Additional directives governing weight and balance of Class 1 aircraft forms and records are contained in AR 95-3, TM 55-1500-342-23, and DA PAM 738-751.

6-3. AIRCRAFT COMPARTMENT AND STATIONS.

The aircraft is separated into two compartments associated with loading. These compartments are the cockpit and the cabin. Figure 6-1 shows the general description of aircraft compartments.



*ACTUAL MEASUREMENTS DURING WEIGHING ARE NOT NECESSARY AFTER LEVELING THE AIRCRAFT. THESE DIMENSIONS FOR "E" AND "F" MAY BE INSERTED DIRECTLY IN THE WEIGHING FORM.

**MEASURE DIMENSIONS "B" AND "D" DURING WEIGHING USING THESE ACTUAL DIMENSIONS AND THE JIG POINT DIMENSIONS "I". DETERMINE "E" AND "F" FOR CHECKING PURPOSES APPROXIMATE DIMENSIONS "E" AND "F" FOR VARIOUS OLEO EXTENSION ARE GIVEN IN THE LANDING GEAR DIMENSIONS TABLE

1. AVIONICS COMPARTMENT: VHF-20B COMM, VIR-30 NAV NO. 1 & NO. 2, AN/ARN-136 TACAN, AN/APN-215 RADAR, TUNEABLE DIPLEXER, INS BATTERY, AND PC-17A INVERTER (2)
2. PILOT AND COPILOT SEATS
3. MISSION AC DC POWER CABINET
4. INS EQUIPMENT RACK
5. MISSION CONSOLE
6. MISSION CONSOLE
7. LAVATORY
8. DF-203 ADF RECEIVER & MOUNT
9. 671U-4A RECEIVER-EXCITER, 548S-3 POWER AMPLIFIER & OXYGEN BOTTLES.
10. EQUIPMENT RACK

AP 006844

Figure 6-1. Aircraft Compartments and Stations

Section II. WEIGHT AND BALANCE

6-4. PURPOSE.

The data to be inserted on weight and balance charts and forms are applicable only to the individual aircraft, the serial number of which appears on the title page of the booklet entitled WEIGHT AND BALANCE DATA supplied by the aircraft manufacturer and on the various forms and charts which remain with the aircraft. The charts and forms referred to in this chapter may differ in nomenclature and arrangement from time to time, but the principle on which they are based will not change.

6-5. CHARTS AND FORMS.

The standard system of weight and balance control requires the use of several different charts and forms. Within this chapter, the following are used:

a. Chart C Basic Weight and Balance Record, DD Form 365-3.

b. Form F Weight and Balance Clearance Form F, DD Form 365-4 (Tactical).

6-6. RESPONSIBILITY.

The aircraft manufacturer inserts all aircraft identifying data on the title page of the booklet entitled WEIGHT AND BALANCE DATA and on the various charts and forms. All charts, including one sample Weight and Balance Clearance Form F, if applicable, are completed at time of delivery. This record is the basic weight and balance data of the aircraft at delivery. All subsequent changes in weight and balance are compiled by the weight and balance technician.

6-7. CHART C BASIC WEIGHT AND BALANCE RECORD, DD FORM 365-3.

Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes made in service. At all times, the last weight and moment/100 entry is considered the current weight and balance status of the basic aircraft.

6-8. WEIGHT AND BALANCE CLEARANCE FORM F, DD FORM 365-4 (TACTICAL).

Refer to TM 55-1500-342-23 for Form F instructions. Refer to tables 6-1, 6-2, and 6-3 for moments.

NOTE

The maximum baggage compartment weight is 410 pounds. Do not exceed the 100 Lbs/Sq. Ft floor loading limit.

Table 6-1. Baggage Moment

WEIGHT	AFT CABIN
10	33
20	65
30	98
40	103
50	163
60	195
70	228
80	260
90	293
100*	325
200	650
300	975
370	1203
400	1300
*410	1333

* Maximum Baggage Compartment Weight
BT00999

Table 6-2. Fuel Moments

	6.4 LB/GAL		6.5 LB/GAL		6.6 LB/GAL		6.7 LB/GAL		6.8 LB/GAL	
GAL	WEIGHT	MOM. 100	WEIGHT	MOM. 100	WEIGHT	MOM. 100	WEIGHT	MOM. 100	WEIGHT	MOM. 100
10	64	99	65	100	66	102	67	103	68	105
20	128	197	130	200	132	203	134	206	136	209
30	192	305	195	310	198	314	201	319	204	324
40	256	423	260	430	264	436	268	443	272	450
50	320	542	325	550	330	559	335	467	340	575
60	384	662	390	672	396	683	402	603	408	703
70	448	782	455	794	462	807	469	819	476	831
80	512	904	520	918	528	932	536	946	544	960
90	576	1023	585	1039	594	1055	603	1071	612	1087
100	600	1142	650	1160	660	1178	670	1196	680	1214
110	704	1260	715	1280	726	1300	737	1319	748	1339
120	768	1379	780	1400	792	1422	804	1443	816	1465
130	832	1496	845	1519	858	1543	871	1566	884	1589
140	896	1615	910	1640	924	1665	938	1690	952	1715
150	960	1734	975	1761	990	1783	1005	1815	1020	1842
160	1024	1852	1040	1881	1056	1910	1072	1939	1088	1968
170	1088	1971	1105	2002	1122	2033	1139	2064	1156	2095
180	1152	2090	1170	2122	1188	2155	1200	2188	1224	2221
190	1216	2209	1235	2244	1254	2279	1273	2313	1292	2348
200	1280	2328	1300	2365	1320	2401	1340	2437	1360	2473
210	1344	2447	1365	2486	1386	2524	1407	2562	1428	2600
220	1400	2567	1430	2607	1452	2647	1474	2687	1496	2727
230	1472	2686	1495	2728	1518	2770	1541	2812	1564	2854
240	1536	2806	1560	2850	1584	2894	1608	2938	1632	2982
250	1600	2926	1625	2971	1650	3017	1675	3063	1700	3109
260	1664	3045	1690	3093	1716	3140	1742	3188	1768	3236
270	1728	3164	1755	3213	1782	3263	1809	3312	1836	3361
280	1792	3283	1820	3334	1848	3386	1876	3437	1904	3488
290	1856	3402	1885	3455	1914	3508	1943	3562	1972	3615
300	1920	3521	1950	3576	1980	3631	2010	3686	2040	3741
310	1984	3641	2015	3698	2046	3754	2077	3811	2108	3868
320	2048	3760	2080	3819	2112	3878	2144	3936	2176	3995
330	2112	3880	2145	3940	2178	4001	2211	4062	2244	4123
340	2176	3999	2210	4062	2344	4124	2278	4187	2312	4249
350	2240	4119	2275	4184	2310	4248	2345	4312	2380	4376
360	2304	4244	2340	4310	2376	4377	2412	4443	2448	4509
370	2365	4365	2405	4434	2442	4502	2479	4570	2516	4638
380	2432	4489	2470	4560	2508	4630	2546	4700	2584	4770
386	2470	4562	2509	4634	2548	4706	2586	4776	2625	4848
400	2560	4741	2600	4815	2640	4889	2680	4963	2720	5037
410	2624	4896	2665	4945	2706	5021	2747	5097	2788	5173
420	2688	4997	2730	5075	2772	5153	2814	5231	2856	5309
430	2752	5126	2795	5206	2838	5286	2881	5366	2924	5446
440	2816	5255	2860	5337	2904	5419	2948	5501	2992	5583
450	2880	5386	2925	5470	2070	5554	3015	5638	3060	5722
460	2944	5514	2990	5600	3036	5686	3082	5773	3128	5859
470	3008	5645	3055	5733	3102	5821	3149	5909	3196	5997
480	3072	5775	3120	5866	3168	5956	3216	6046	3264	6136
490	3136	5907	3185	5999	3234	6091	3283	6184	3332	6276
500	3200	6040	3250	6134	3300	6229	3350	6323	3400	6418
510	3264	6172	3315	6269	3366	6365	3417	6462	3488	6558
520	3328	6307	3380	6405	3432	6504	3484	6602	3536	6700
530	3392	6441	3445	6542	3498	6643	3551	6743	3604	6844
540	3456	6573	3510	6676	3564	6779	3618	6881	3672	6984
544	3482	6626	3535	6729	3590	6832	3645	6936	3699	7039

BT01000

Table 6-3. Center of Gravity Moment Table - Moment / 100

GROSS WEIGHT POUNDS	FWD LIMIT	13.9	17.3	19.6	24.2	27.0	30.0	33.0	35.7
	MAC MOM/100	181.0	183.4	185.0	188.3	190.3	192.4	194.5	196.4
7200		13032	13205	13320	13558	13702	13853	14004	14141
7250		13123	13297	13413	13652	13797	13949	14101	14239
7300		13213	13388	13505	13746	13892	14045	14199	14337
7350		13304	13480	13598	13840	13987	14141	14296	14435
7400		13394	13572	13690	13934	14082	14238	14393	14534
7450		13485	13663	13783	14028	14177	14334	14490	14632
7500		13575	13755	13875	14123	14272	14430	14588	14730
7550		13666	13847	13968	14217	14368	14526	14685	14828
7600		13756	13938	14060	14311	14463	14622	14782	14926
7650		13847	14030	14153	14405	14558	14719	14879	15025
7700		13937	14122	14245	14499	14653	14815	14977	15123
7750		14028	14214	14338	14593	14748	14911	15074	15221
7800		14118	14305	14430	14678	14843	15007	15171	15319
7850		14209	14397	14523	14782	14939	15103	15268	15417
7900		14299	14489	14615	14876	15034	15200	15366	15516
7950		14390	14580	14708	14970	15129	15296	15463	15614
8000		14480	14672	14800	15064	15224	15392	15560	15712
8050		14571	14764	14893	15158	15319	15488	15657	15810
8100		14661	14855	14985	15252	15414	15584	15755	15908
8150		14752	14947	15078	15346	15509	15681	15852	16007
8200		14842	15039	15170	15441	15605	15777	15949	16105
8250		14933	15131	15263	15535	15700	15873	16046	16203
8300		15023	15222	15355	15629	15795	15969	16144	16301
8350		15114	15314	15448	15723	15890	16065	16241	16399
8400		15204	15406	15540	15817	15985	16162	16338	16498
8450		15295	15497	15633	15911	16080	16258	16435	16596
8500		15385	15589	15725	16006	16175	16354	16533	16694
8550		15476	15681	15818	16100	16271	16450	16630	16792
8600		15566	15772	15910	16194	16366	16546	16727	16890
8650		15657	15864	16003	16288	16461	16643	16824	16989
8700		15747	15956	16095	16382	16556	16739	16922	17087
8750		15838	16048	16188	16476	16651	16835	17019	17185
8800		15928	16139	16280	16570	16746	16931	17116	17283
8850		16019	16231	16373	16665	16842	17027	17213	17381
8900		16109	16323	16465	16759	16937	17124	17311	17480
8950		16200	16414	16558	16853	17032	17220	17408	17578
9000		16290	16506	16650	16947	17127	17316	17505	17676
9050		16381	16598	16743	17041	17222	17412	17602	17774
9100		16471	16689	16835	17135	17317	17508	17700	17872
9150		16562	16781	16928	17229	17412	17605	17797	17971
9200		16652	16873	17020	17324	17508	17701	17894	18069
9250		16743	16965	17113	17418	17603	17797	17991	18167
9300		16833	17056	17205	17512	17698	17893	18089	18265
9350		16924	17148	17298	17606	17793	17989	18186	18363
9400		17014	17240	17390	17700	17888	18086	18283	18462
9450		17105	17331	17483	17794	17983	18182	18380	18560
9500		17195	17423	17575	17889	18078	18278	18478	18658
9550		17286	17515	17668	17983	18174	18374	18575	18756
9600		17376	17606	17760	18077	18269	18470	18672	18854
9650		17467	17698	17853	18171	18364	18567	18769	18953

Table 6-3. Center of Gravity Moment Table - Moment / 100 (Continued)

GROSS WEIGHT POUNDS	FWD LIMIT MAC MOM/100	13.9 181.0	17.3 183.4	19.6 185.0	24.2 188.3	27.0 190.3	30.0 192.4	33.0 194.5	35.7 196.4
9700		17557	17790	17945	18265	18459	18663	18867	19051
9750		17648	17882	18038	18359	18554	18759	18964	19149
9800		17738	17973	18130	18453	18649	18855	19061	19247
9850		17829	18065	18223	18548	18745	18951	19158	19345
9900		17919	18157	18315	18642	18840	19048	19256	19444
9950		18010	18248	18408	18736	18935	19144	19353	19542
10000		18100	18340	18500	18830	19030	19240	19450	19640
10050		18191	18432	18593	18924	19125	19336	19547	19738
10100		18281	18523	18685	19018	19220	19432	19645	19836
10150		18372	18615	18778	19112	19315	19529	19742	19935
10200		18462	18707	18870	19207	19411	19625	19839	20033
10250		18552	18799	18963	19301	19506	19721	19936	20131
10300		18643	18890	19055	19395	19601	19817	20034	20229
10350		18734	18982	19148	19489	19696	19913	20131	20327
10400		18824	19074	19240	19583	19791	20010	20228	20426
10450		18915	19165	19333	19677	19886	20106	20325	20524
10500		19005	19257	19425	19772	19981	20202	20423	20622
10550		19096	19349	19518	19866	20077	20298	20520	20720
10600		19186	19440	19610	19960	20172	20394	20617	20818
10650		19277	19532	19703	20054	20267	20491	20714	20917
10700		19367	19624	19795	20148	20362	20587	20812	21015
10750		19458	19716	19888	20242	20457	20683	20909	21113
10800		19548	19807	19980	20336	20552	20779	21006	21211
10850		19369	19899	20073	20431	20648	20875	21103	21309
10900		19729	19991	20165	20525	20743	20972	21201	21408
10950		19820	20082	20258	20619	20838	21068	21298	21506
11000		19910	20174	20350	20713	20933	21164	21395	21604
11050		20001	20266	20443	20807	21028	21260	21492	21702
11100		20091	20357	20535	20901	21123	21356	21590	21800
11150		20182	20449	20628	20995	21218	21453	21687	21899
11200		20272	20541	20720	21090	21314	21549	21784	21997
11250		20363	20633	20813	21184	21409	21645	21881	22095
11300	14.0	20461	20724	20905	21278	21504	21741	21979	22193
11350	14.2	20570	20816	20998	21372	21599	21837	22076	22291
11400	14.4	20679	20908	21090	21466	21694	21934	22173	22390
11450	14.7	20789	20999	21183	21560	21789	22030	22270	22488
*11500	14.9	20899	21091	21275	21655	21884	22126	22368	22586
11550	15.1	21008	21183	21368	21749	21980	22222	22465	22684
11600	15.4	21118	21274	21460	21843	22075	22318	22562	22782
11650	15.6	21229	21366	21553	21937	22170	22415	22659	22881
11700	15.8	21339	21458	21645	22031	22265	22511	22757	22979
11750	16.1	21449	21550	21738	22125	22360	22607	22854	23077
11800	16.3	21560	21641	21830	22219	22455	22703	22951	23175
11850	16.5	21671	21733	21923	22314	22551	22799	23048	23273
11900	16.8	21782	21825	22015	22408	22646	22896	23146	23372
11950		17.0	21916	22108	22502	22741	22992	23243	23470
12000		17.2	22008	22200	22596	22836	23088	23340	23568
12050		17.5	22119	22293	22690	22931	23184	23437	23666
12100		17.7	22231	22385	22784	23026	23280	23535	23764
12150		18.0	22343	22478	22878	23121	23377	23632	23863

Table 6-3. Center of Gravity Moment Table - Moment/100 (continued)

GROSS WEIGHT POUNDS	FWD LIMIT MAC MOM/100	13.9 181.0	17.3 183.4	19.6 185.0	24.2 188.3	27.0 190.3	30.0 192.4	33.0 194.5	35.7 196.4
12200		18.2	22455	22570	22973	23217	23473	23729	23961
12250		18.4	22567	22663	23067	23312	23569	23826	24059
12300		18.7	22679	22755	23161	23407	23665	23924	24157
12350		18.9	22792	22848	23255	23502	23761	24021	24255
12400		19.1	22904	22940	23349	23597	23858	24118	24354
12450		19.4	23017	23033	23443	23692	23954	24215	24452
12500			19.6	23125	23538	23787	24050	24313	24550
12550			19.8	23238	23632	23883	24146	24410	24648
12600			20.0	23352	23726	23978	24242	24507	24746
12650			20.3	23465	23820	24073	24339	24604	24845
12700			20.5	23579	23914	24168	24435	24702	24943
12750			20.7	23693	24008	24263	24531	24799	25041
12800			21.0	23807	24102	24358	24627	24896	25139
12850			21.2	23921	24197	24454	24723	24993	25237
12900			21.4	24035	24291	24549	24820	25091	25336
12950			21.7	24150	24385	24664	24916	25188	25434
13000			21.9	24265	24479	24739	25012	25285	25532
13050			22.1	24379	24573	24834	25108	25382	25630
13100			22.4	24494	24667	24929	25204	25480	25728
13150			22.6	24610	24761	25024	25301	25577	25827
13200			22.8	24725	24856	25120	25397	25674	25925
13250			23.1	24840	24950	25215	25493	25771	26023
13300			23.3	24956	25044	25310	25589	25869	26121
13350			23.5	25072	25138	25405	25685	25966	26219
13400			23.8	25188	25232	25500	25782	26063	26318
13450			24.0	25304	25326	25595	25878	26160	26416
13500					25421	25691	25974	26258	26514
13550					25515	25786	26070	26355	26612
13600					25609	25881	26166	26452	26710
13650					25703	25976	26263	26549	26809
13700					25797	26071	26359	26647	26907
13750					25891	26166	26455	26744	27005
13800					25985	26261	26551	26841	27103
13850					26080	26357	26647	26938	27201
13900					26174	26452	26744	27036	27300
13950					26268	26547	26840	27133	27398
14000					26362	26642	26936	27230	27496
14050					26456	26737	27032	27327	27594
14100					26550	26832	27128	27425	27692
14150					26644	26927	27225	27522	27791
14200					26739	27023	27321	27619	27889

* Maximum Zero Fuel Weight

BT01001

Section III. FUEL/OIL

6-9. FUEL LOAD.

Fuel loading imposes a restriction on the amount of load which can be carried. The required fuel must first be determined, then that weight subtracted from the total weight of passengers, baggage and fuel. Weight up to and including the remaining allowable capacity can be subtracted directly from the weight of passengers, baggage and fuel. As the fuel load is increased, the loading capacity is reduced.

6-10. FUEL AND OIL DATA.

a. Fuel Moment Table. Table 6-2 shows fuel moment/100 given US gallons or pounds for JP-4 and JP-5.

b. Oil Data. Total oil weight is 62 pounds and is included in the basic weight of the aircraft. Servicing information is provided in Chapter 2.

Section IV. CENTER OF GRAVITY

6-11. CENTER OF GRAVITY LIMITATIONS.

WARNING

The forward Center of Gravity limit may be exceeded when the mission gear is removed.

Center of gravity limitations are expressed in ARM inches which refers to a positive measurement from the aircraft's reference datum. The forward CG limit at 11,279 Lbs. or less is 181.0 ARM inches. At 14,200 Lbs. or less, the aft CG limit is 196.4 ARM inches. Tables 6-4 and 6-5 provide forward and aft CG limitations.

Table 6-4. Center of Gravity Limits (Landing Gear Down) Below 12,500 Lbs.

WEIGHT CONDITION	FORWARD CG LIMIT	AFT CG LIMIT
12,500 LBS (MAX. TAKEOFF OR LANDING)	185.0	196.4
11,279 LBS OR LESS	181.0	196.4
BT01002		

Table 6-5. Center of Gravity Limits (Landing Gear Down)

WEIGHT CONDITION	FORWARD CG LIMIT	AFT CG LIMIT
14,200 LBS (MAX. TAKEOFF)	188.3	196.4
13,500 LBS (MAX. LANDING)	188.3	196.4
11,279 LBS OR LESS	181.0	196.4
BT01003		

Section V. CARGO LOADING

6-12. LOAD PLANNING.

The basic factors to be considered in any loading situation are as follows:

a. Cargo shall be arranged to permit access to all emergency equipment and exits during flight.

b. Floorboard structural capacity shall be considered in the loading of heavy or sharp-edged containers and equipment. Shorings shall be used to distribute highly condensed weights evenly over the cargo areas.

c. All cargo shall be adequately secured to prevent damage to the aircraft, other cargo, or the item itself.

6-13. LOADING PROCEDURE.

Loading of cargo is accomplished through the cabin door (21.5 in. X 50.0 in.) or the cargo door (52.0 in. X 52.0 in).

6-14. SECURING LOADS.

All cargo shall be secured with restraints strong enough to withstand the maximum force exerted in any direction. The maximum force can be determined by multiplying the weight of the cargo item by the applicable load factor. These established load factors (the ratio between the total force and the weight of the cargo item) are 1.5 to the side and rear, 3.0 up, 6.6 down, and 9.0 forward.

CHAPTER 7
PERFORMANCE

Section I. INTRODUCTION TO PERFORMANCE

7-1. INTRODUCTION

The graphs in this section present performance information for takeoff, climb, cruise, and landing at various parameters of weight, altitude, and temperature.

The following example presents calculations for a proposed flight from Denver to Reno using the conditions listed below:

7-2. CONDITIONS.

At Stapleton International (DEN):
Free Air Temperature .... 28°C (82°F)
Field Elevation....................................... 15333 feet
Altimeter Setting ....30.25 in. Hg
Wind .... 210° at 13 knots
Runway 35R Length .... 112,000 feet
At Cannon International (RNO): Free
Air Temperature .... 32°C (90°F)
Field Elevation....................................... 14412 feet
Altimeter Setting ....129.83 in. Hg feet
Wind .... 260° at 10 knots
Runway 25 Length .... 16101 feet
Route segment of trip2:
DEN J116 EKR J173 SLC J154
BAM J32 RNO

Cruise Altitude:
22,000 feet

1 Source: NOAA Standard Instrument Departures for Western United States, 9 Jun 1983.
2 Source: NOAA Enroute High Altitude -U.S. Chart H-2, 9 Jun 1983.
3 MEA on NOAA Enroute Low Altitude -U.S. Chart L-8, 9 Jun 1983.
4 Includes distance between airport and VORTAC, per Source in Footnote 1.

7-3. PRESSURE ALTITUDE.

To determine the approximate pressure altitude at origin and destination airports, add 1000 feet to field elevation for each 1.00 in. Hg that the reported altimeter setting value is below 29.92 in. Hg, and subtract 1000 feet for each 1.00 in. Hg above 29.92 in. Hg. Always subtract the reported altimeter setting from 29.92 in. Hg, then multiply the answer by 1000 to find the difference in feet between field elevation and pressure altitude.

Pressure Altitude at DEN:
29.92 in. Hg 30.25 in. Hg = 0.33
0.33 x 1000 feet = 330 feet
The pressure altitude at DEN is 330 feet below field elevation.

Pressure altitude at DEN = 5333 -330 = 5003 feet

Route Segment Data 2

ROUTE SEGMENT	AVERAGE MAGNETIC COURSE	AVERAGE MAGNETIC VARIATION	DISTANCE NM
DEN-EKR	263°	13°E	1434
EKR-SLC	269°	14°E	192
SLC-BVL	248°	14°E	81
BVL-BAM	249°	16°E	145
BAM-RNO	226°	17°E	1464

WIND AT FL 220 DIR/KNOTS	FAT AT FL 220 °C	FAT AT 316,000 FT °C	ALTIMETER SETTING IN. HG
350°/40	-2	8	30.20
350°/50	-2	8	30.10
240°/35	-12	0	30.10
340°/35	-12	0	29.90
290°/45	-12	6	29.90

Pressure altitude at RNO:

29.92 in. Hg29.83 in. Hg = 0.09

0.09 x 1000 feet = +90 feet

The pressure altitude at RNO is 90 feet above field elevation.

Pressure altitude at RNO = 4412 +90 = 4502 feet.

7-4. TAKEOFF WEIGHT.

Maximum takeoff weight (from limitations section) = 14,200 pounds.

7-5. TAKEOFF WEIGHT TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFTOFF (FLAPS 0%).

Enter the graph at 5003 feet to 28°C, to determine the maximum weight at which the accelerating procedure should be attempted.

Maximum Accelerate-Go Weight 12,990 pounds

7-6. ACCELERATE-STOP (FLAPS 0%).

Enter the accelerate-stop graph at 28°C, 5003 feet pressure altitude, 12,000 pounds, and 10 knots head wind component:

Accelerate-Stop Distance .... 4520 feet
Takeoff Decision Speed ....99 knots

7-7 TAKE-OFF DISTANCE (FLAPS 0%).

Enter the graph at 28°C, 5003 feet pressure altitude, 12,000 pounds, and 10 knots head wind component:
Ground Roll .... 2860 feet
Total Distance over 50-foot obstacle .... 4400 feet
Take-off Speed:
At Rotation ....99 knots
At 50 feet ....116 knots

7-8. ACCELERATE-GO FLIGHT PATH EXAMPLE.

The following example assumes the aircraft is loaded so that takeoff weight is 10,000 pounds.

a. Accelerate-Go Distance Over 50-foot Obstacle (Flaps 0%o). Enter the graph at 28°C, 5003 feet pressure altitude, 10,000 pounds, and 10 knots head wind component:
Total Distance Over 50-foot Obstacle.......... 5710 feet
Speed at Rotation (VR) ....94 knots
Speed at 35 Feet Above Runway (Climb Speed) ....106 knots

b. Takeoff Climb Gradient One Engine Inoperative (Flaps 0%o). Enter the graph at 28°C, 5003 feet pressure altitude, and 10,000 pounds:

Climb Gradient 5.5%
Climb Speed ....106 knots

A 5.5% climb gradient is 55 feet of vertical height per 1000 feet of horizontal distance.

NOTE

The graphs for take-off climb gradient assume a zero-wind condition. Climbing into a head wind will result in higher angles of climb, and hence better obstacle clearance capabilities.

Calculations of the horizontal distance to clear an obstacle 100 feet above the runway surface: (fig.7-1)

Distance from 50 feet to 100 feet = 50 feet
(100 50) (1000 + 55) = 910 feet
Total Distance = 5710 +910 = 6620 feet

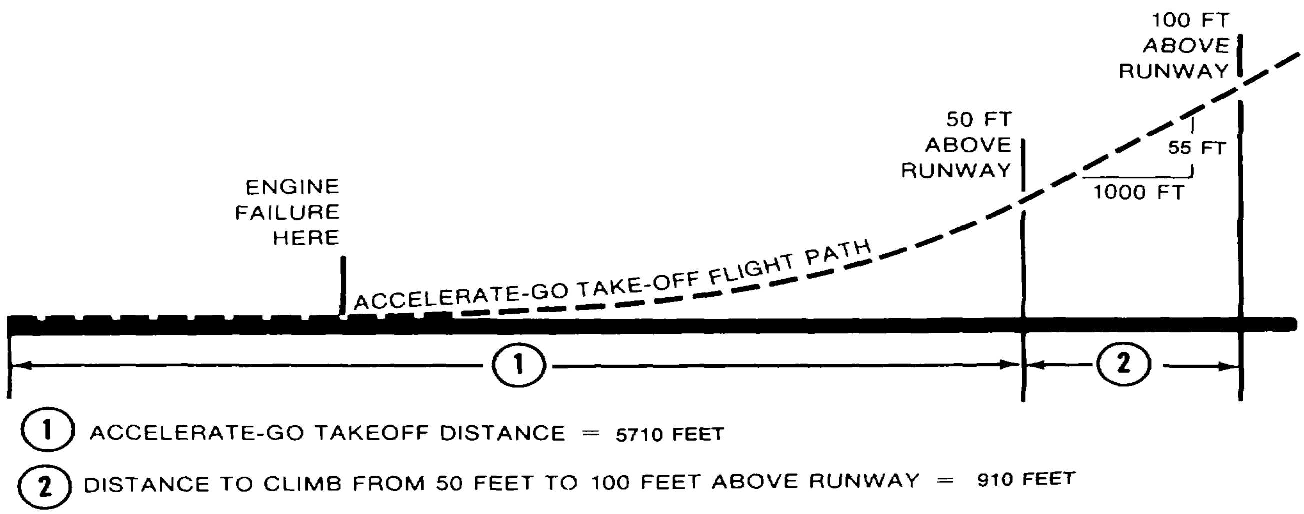


Figure 7-1. Accelerate-Go Flight Path

7-9. FLIGHT PLANNING.

Calculations for flight time, block speed, and fuel requirements for a proposed flight, are detailed below using the same conditions presented in paragraph 7-2, and a takeoff weight of 12,000 pounds:

DEN
Pressure Altitude .... 5003 feet
FAT .... 28°C
ISA Condition ....ISA +23°C
DEN-SLC
Pressure Altitude ....22,000 feet
FAT .... -20°C
ISA Condition ....ISA +27°C
SLC-RNO
Pressure Altitude ....22,000 feet
FAT .... -12°C
ISA Condition ....ISA + 1 7°C
RNO
Pressure Altitude .... 4502 feet
FAT .... 32°C
ISA Condition ....ISA +27°C

Enter the TIME, FUEL, AND DISTANCE TO CLIMB Graph at 28°C to 5003 feet, and to 12,000 pounds, and enter at -2°C to 22,000 feet, and to 12, 000 pounds, and read:

Time to Climb . ... 18.4 -2.2 = 16.2 = 16 minutes
Fuel Used to Climb .... 248 -45 = 203 pounds
Distance Traveled..............50 -7 = 43 nautical miles

Enter the TIME, FUEL, AND DISTANCE TO DESCEND Graph at 22,000 feet, and enter again at 4502 feet, and read:

Time to Descend .... 14.7 -3.1 =11.6 = 12 minutes
Fuel Used to Descend .... 162 -39 = 123 pounds
Distance Traveled . ...67 -12 = 55 nautical miles

An estimated average cruise weight of 11,200 pounds was used for this example.

Enter the tables for MAXIMUM ENDURANCE POWER @ 1700 RPM for ISA + 10°C, ISA +20°C, and ISA + 30°C, and read the cruise speeds for 22, 000 feet at 12,000 pounds and 11,000 pounds:

Interpolate between these speeds for ISA +27°C and ISA + 17°C at 11,200 pounds:

Cruise True Airspeeds At Fl 220

11,000 lbs			12,000 Lbs		
ISA +10°C 194	ISA +20°C 198	ISA +30°C 201	ISA + 10°C 194	ISA + 20°C 198	ISA + 30°C 201

Cruise True Airspeed (ISA +27°C) .... 200 knots
Cruise True Airspeed (ISA +17°C) .... 197 knots

Enter the MAXIMUM ENDURANCE POWER @ 1700 RPM Tables for ISA +10°C, ISA +20°C, and ISA +30°C at 12,000 pounds and 11,000 pounds and interpolate the recommended torque settings for ISA + 27°C and ISA +17°C.

ISA +27°C ....50% torque per engine
ISA + 17°C ....49% torque per engine

Enter the MAXIMUM ENDURANCE POWER @ 1700 RPm, Tables for ISA + 10°C, ISA +20°C, and ISA +30°C at 12,000 pounds and 11,000 pounds at 22,000 feet, and interpolate the fuel flows for ISA +27°C and ISA + 17°C at 11,200 pounds.

ISA +27°C
Fuel Flow Per Engine ....237 Lbs/hr
Total Fuel Flow ....474 Lbs/hr
ISA +17°C
Fuel Flow Per Engine ....232 Lbs/hr
Total Fuel Flow ....464 Lbs/hr

NOTE

For flight planning, enter these charts at the forecasted ISA condition; for enroute power settings and fuel flows, enter at the actual indicated FAT.

Time and fuel used were calculated at MAXIMUM ENDURANCE POWER @ 1700 RPM as follows:

$$\text{Time} = \frac{\text{Distance}}{\text{Ground Speed}}$$

$$\text{Fuel Used} = \frac{\text{Distance}}{\text{Ground Speed}} \text{ X Total Fuel Flow}$$

Results are as follows:

ROUTE	DISTANCE	ESTIMATED GROUND SPEED	TIME AT CRUISE ALTITUDE	FUEL USED FOR CRUISE
	NM	KNOTS	HRS : MIN	LBS
DEN-EKR	143-43=100*	185	0 : 32	257
EKR-SLC	192	181	1 : 04	503
SLC-BVL	81	187	0 : 26	201
BVL-BAM	145	185	0 : 47	364
BAM-RNO	146-55=91*	164	0 : 33	258

*Distance required to climb or descend has been subtracted from segment distance.

TIME - FUEL - DISTANCE

ITEM	Time HRS : MINS	FUEL POUNDS	DISTANCE NM
Runup, Taxi, and Takeoff acceleration	0 : 00	90	0
Climb	0 : 16	203	43
Cruise	3 : 22	1583	609
Descent	0 : 12	123	55
Total	3 : 50	1999	707

Block Speed: 707 NM ÷ 3 hours, 50 minutes = 184 knots

7-10. RESERVE FUEL.

Reserve Fuel is calculated for 45 minutes at Maximum Range Power @ 1700 RPM. Use planned cruise altitude (22,000 feet), forecasted ISA condition (ISA + 17°C), and estimated weight at end of planned trip (10,091 pounds). (Since the lowest weight column in the tables is 11,000 pounds, assume weight at the end of the planned trip to be 11, 000 pounds, and use that fuel flow value for this example.)

Enter the tables for MAXIMUM RANGE POWER @ 1700 RPM for ISA + 10°C and ISA +20°C at 11,000 Lbs and 22,000 feet, and read the total fuel flows:

ISA +10°C ....468 Lbs/hr
ISA +20°C..484 Lbs/hr

Then interpolate for the fuel flow at ISA + 17°C as follows: Change in Fuel Flow = 484 468 = 16 Lbs/hr.

Change in Temperature = (ISA +20°C) (ISA + 10 C) = 10°C.

Rate of Change in Fuel Flow = Change in Fuel Flow + Change in Temperature.

Rate of Change in Fuel Flow = (16 Lbs/hr) + (10°C).

Rate of Change in Fuel Flow = 1.6 Lbs/hr increase per 1°C increase.

Temperature increase from ISA + 10°C to ISA +17°C = 7°C.

Total Change in Fuel Flow = 7 X 1.6 Lbs/hr = 11.2 Lbs/hr.

Total Fuel Flow = (ISA +10°C Fuel Flow) + (Total Change in Fuel Flow).

Total Fuel Flow = (468) + (11.2) = 479.2 Lbs/ hr.

Reserve Fuel = 45 minutes X Total Fuel Flow.

Reserve Fuel = (0.75) X (479.2 Lbs/hr) = 359.4 = 360 lbs/hr.

Total Fuel Requirement = 1999 +360 = 2359 pounds.

7-11. ZERO FUEL WEIGHT LIMITATION.

For this example, the following conditions were assumed:

Ramp Weight .... 12,090 pounds
Weight of Usable Fuel Onboard ....2359 Pounds

Zero Fuel Weight = Ramp Weight - Weight of Usable Fuel Onboard

Zero Fuel Weight = (12,090) (2359) = 9731 pounds

Maximum zero fuel weight limitation (from Chapter 5) = 11,500 pounds.

Maximum Zero Fuel Weight Limitation has not been exceeded.

Anytime the Zero Fuel Weight exceeds the Maximum Zero Fuel Weight Limit, the excess must be off-loaded from PAYLOAD. If desired, additional FUEL ONLY may then be added until the ramp weight equals the Maximum Ramp Weight Limit of 14,290 Lbs.

7-12. LANDING INFORMATION.

The estimated Landing Weight is determined by subtracting the fuel required for the trip from the Ramp Weight:

Ramp Weight...12,090 Lbs
Fuel Required for Total Trip .... 1999 pounds
Landing Weight (12,090 - 1999) . ... 10,091 pounds

Enter the NORMAL LANDING DISTANCE WITHOUT PROPELLER REVERSING FLAPS 100% Graph at 32°C, 4502 feet, 10,091 pounds, and 10 knots head wind component:

Ground Roll.. 1725 feet
Total Distance Over 50-foot Roll .... 1725 feet
Total Distance Over 50-foot Obstacle .... 3060 feet
Approach Speed ....100 knots

Enter the CLIMB - BALKED LANDING Graph at 32°C, 4502 feet, and 10,091 pounds:

Rate of Climb ....1550 ft/min
Climb Gradient 12.5%

7-13. COMMENTS PERTINENT TO THE USE OF PERFORMANCE GRAPHS.

a. In addition to presenting the answer for a particular set of conditions, the example on a graph also presents the order in which the various scales on the graph should be used. For instance, if the first item in the example is FAT, then enter the graph at the existing FAT.

b. The reference lines indicate where to begin following the guidelines. Always project to the reference line first, then follow the guidelines to the next known item by maintaining the same PROPORTIONAL

DISTANCE between the guide line above and the guide line below the projected line. For instance, if the projected line intersects the reference line in the ratio of 30% down/70% up between the guidelines, then maintain this same 30%/70% relationship between the guide lines and follow them to the next known item.

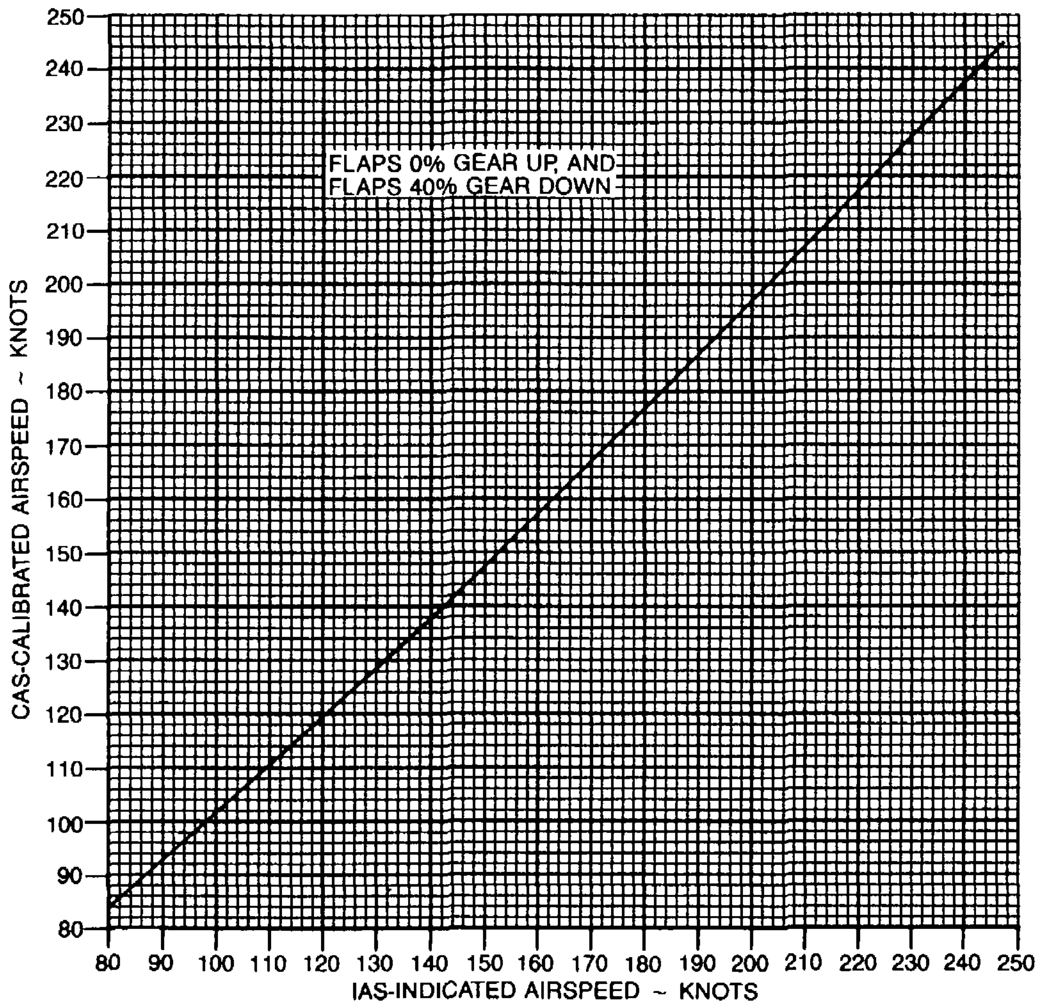
c. The associated conditions define the specific conditions from which performance parameters have been determined. They are not intended to be used as instructions; however, performance values determined from charts can only be achieved if the specified conditions exist.

d. The full amount of usable fuel is available for all approved flight conditions.

e. Notes have been provided on various graphs and tables to approximate performance with ice vanes extended. The effect will vary, depending upon airspeed, temperature, altitude, and ambient conditions. At lower altitudes, where operation on the torque limit is possible, the effect of ice vane extension will be less, depending upon how much power can be recovered after the ice vanes have been extended.

Index of Figures

AIRSPEED CALIBRATION — NORMAL SYSTEM



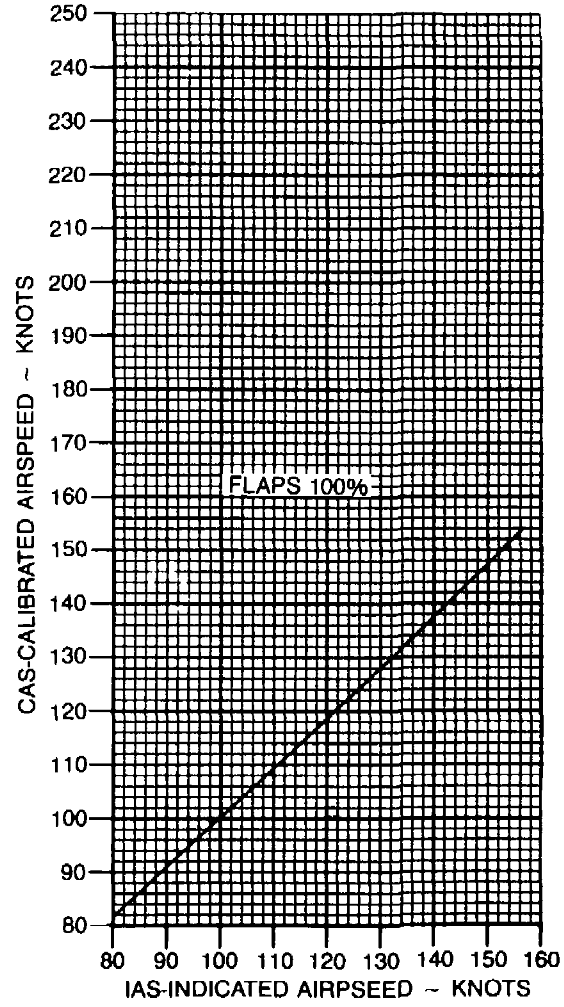


Figure 7-2. Airspeed Calibration - Normal System

AIRSPEED CALIBRATION — ALTERNATE SYSTEM

APPLICABLE FOR ALL FLAP POSITIONS

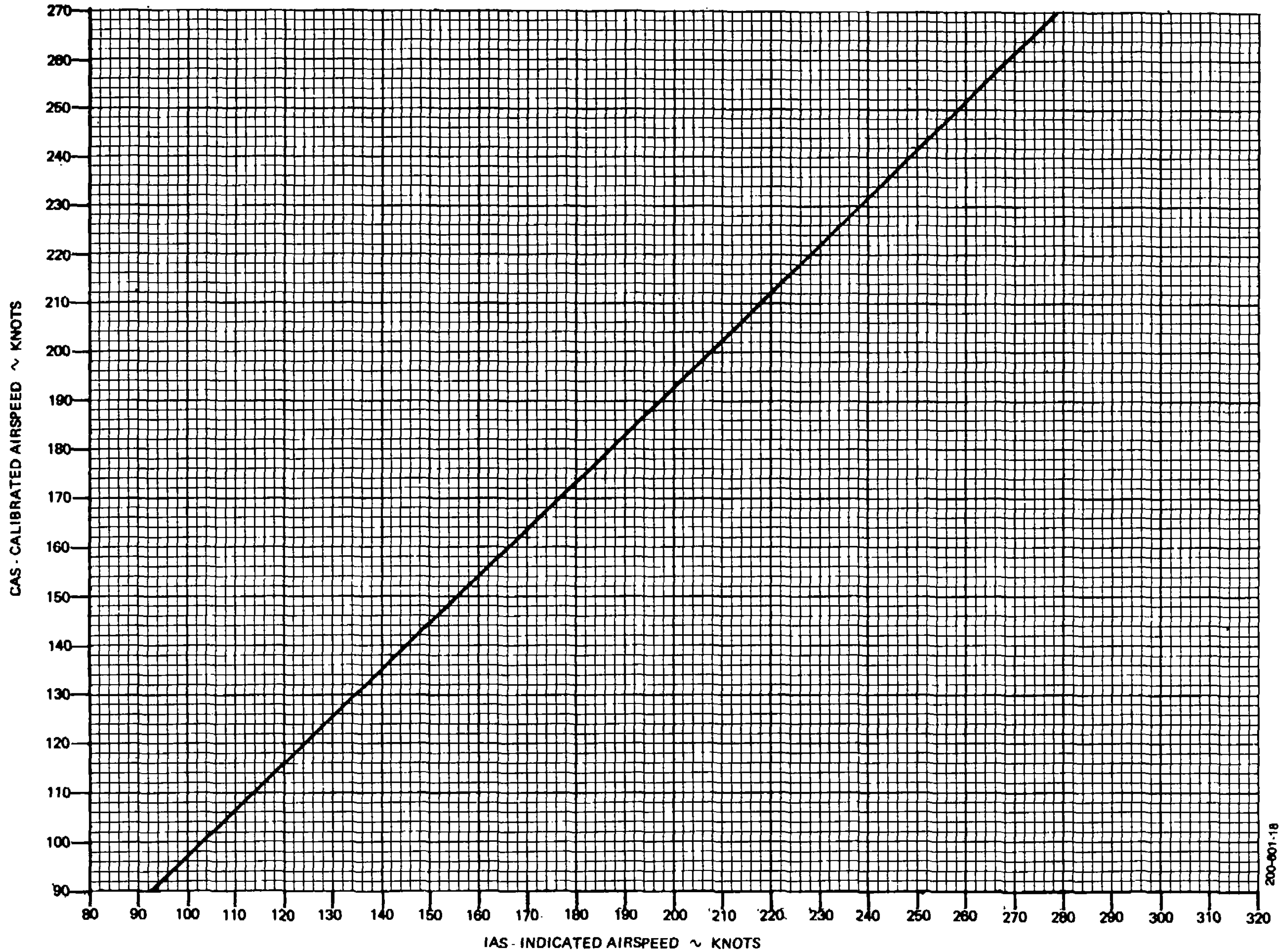


Figure 7-3. Airspeed Calibration - Alternate System

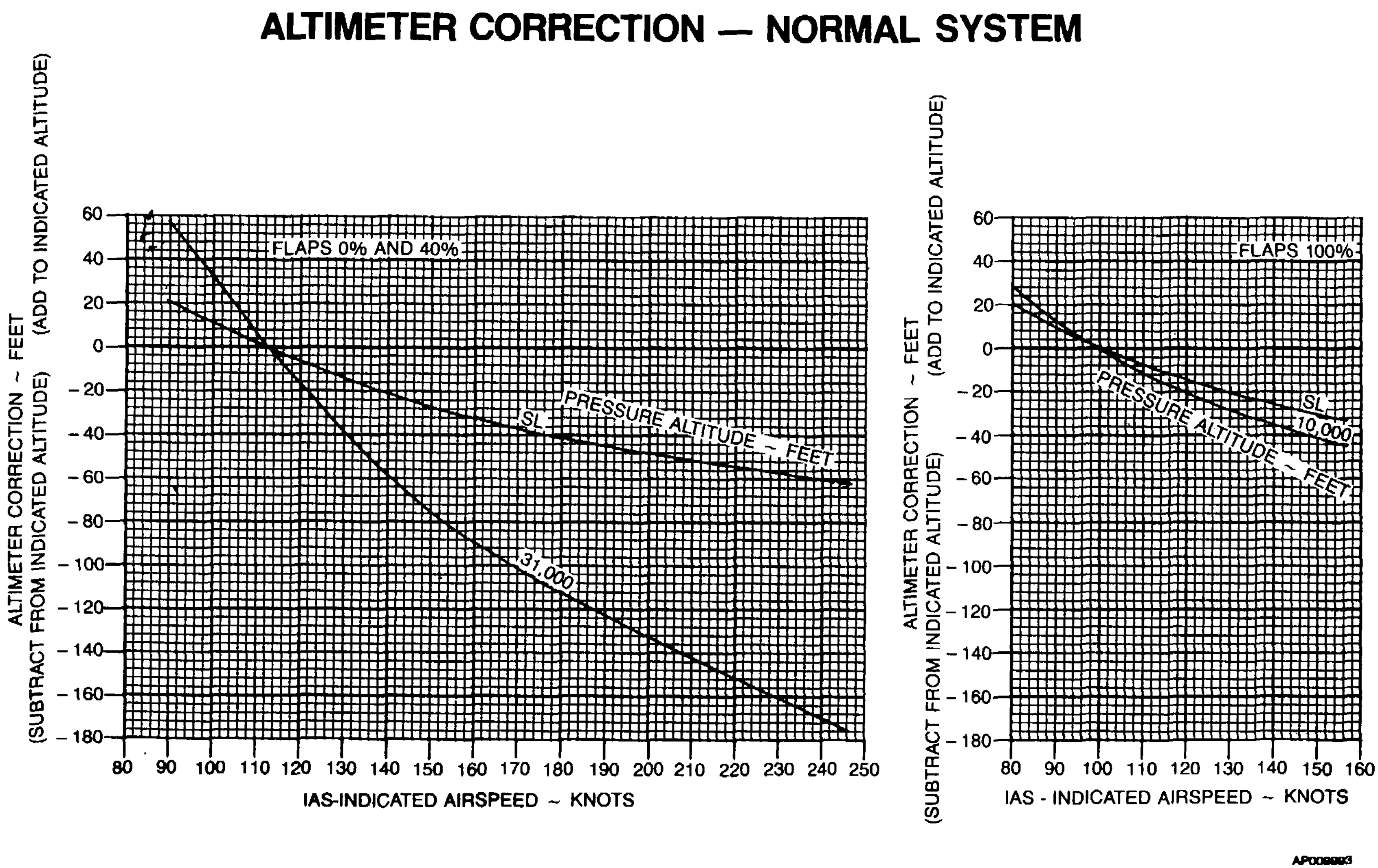


Figure 7-4. Altimeter Correction - Normal System

ALTIMETER CORRECTION – ALTERNATE SYSTEM

APPLICABLE FOR ALL FLAP POSITIONS

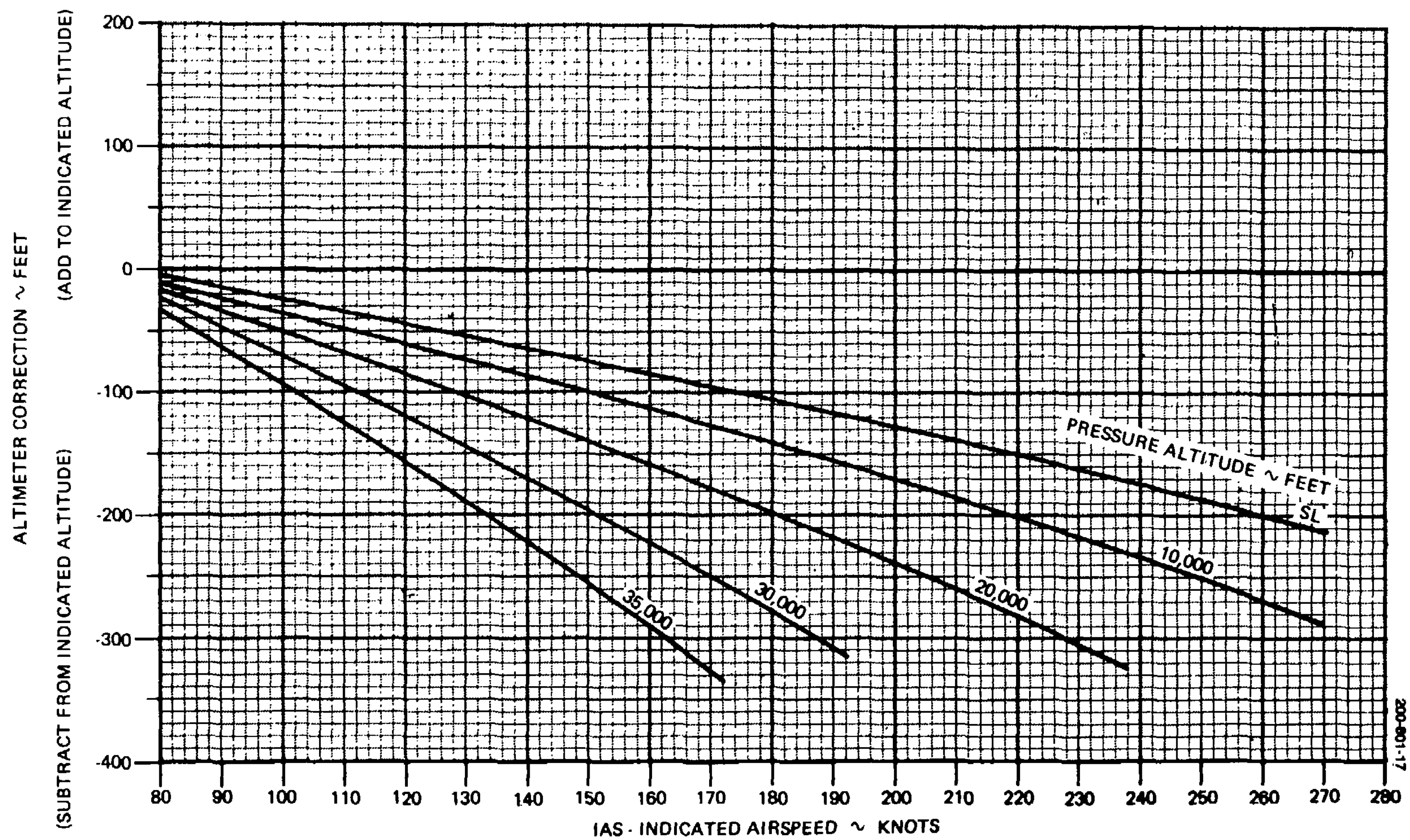


Figure 7-5. Altimeter Correction - Alternate System

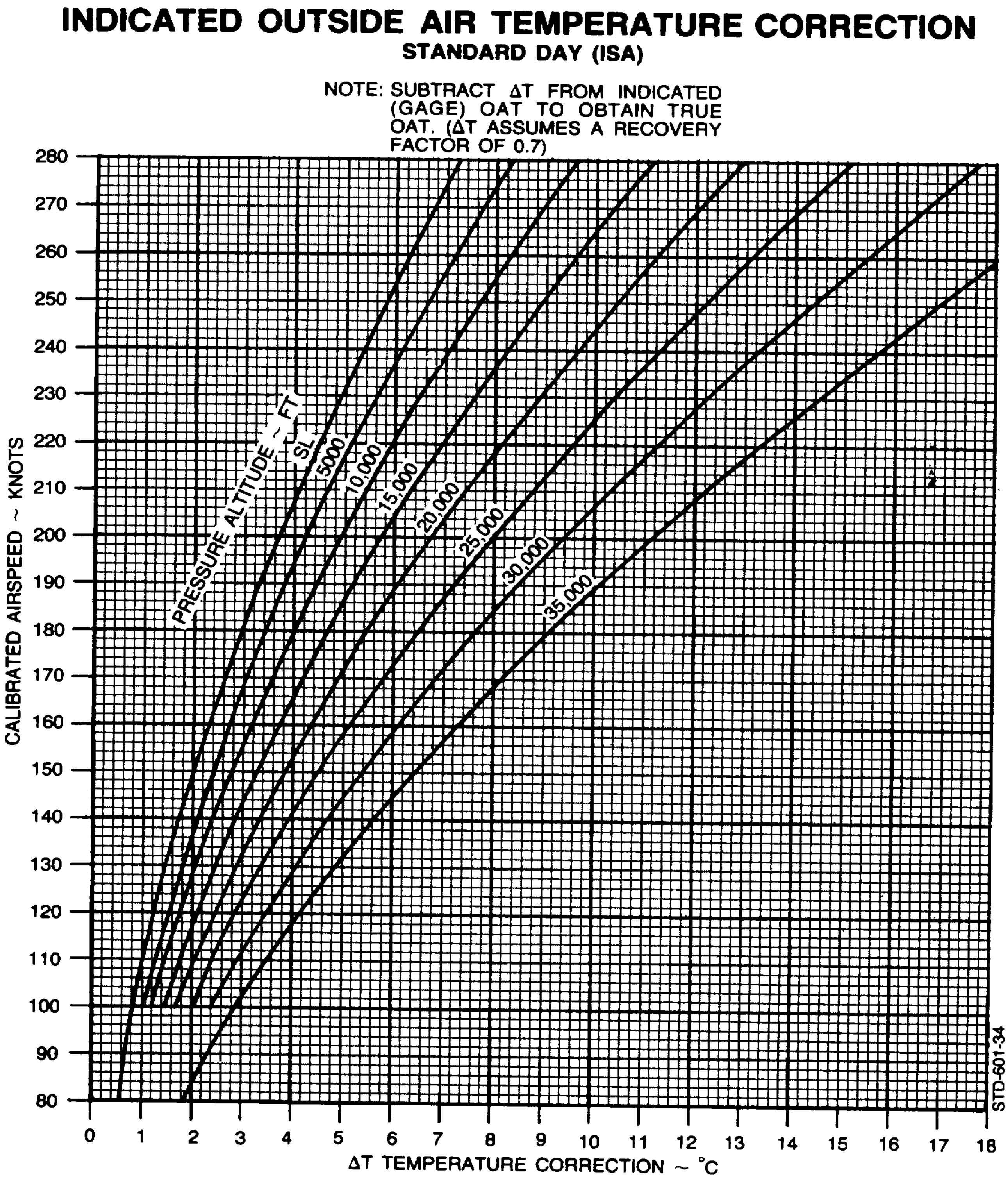


Figure 7-6. Indicated Outside Air temperature Correction

ISA CONVERSION

PRESSURE ALTITUDE vs OUTSIDE AIR TEMPERATURE

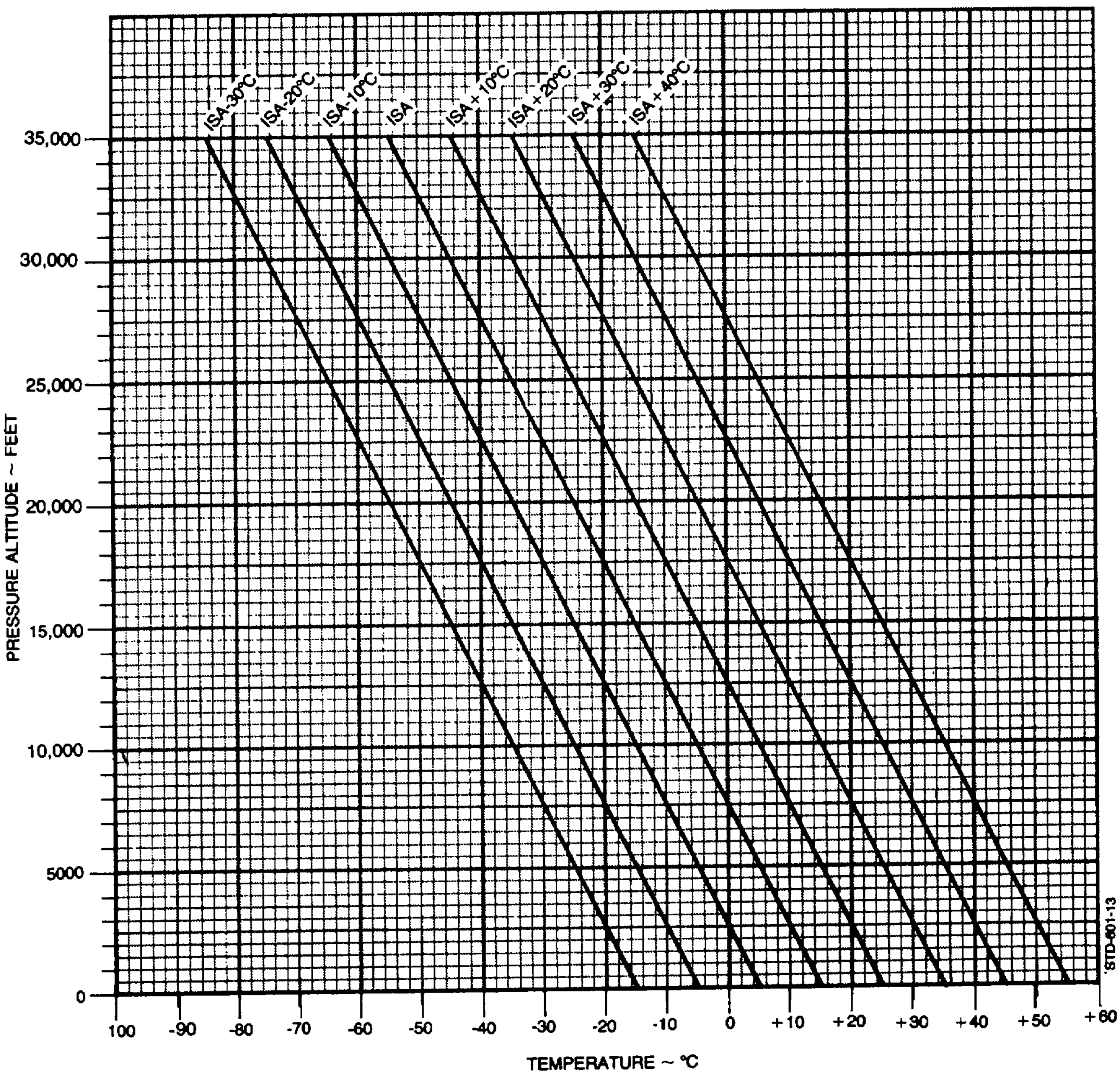


Figure 7-7. ISA Conversion

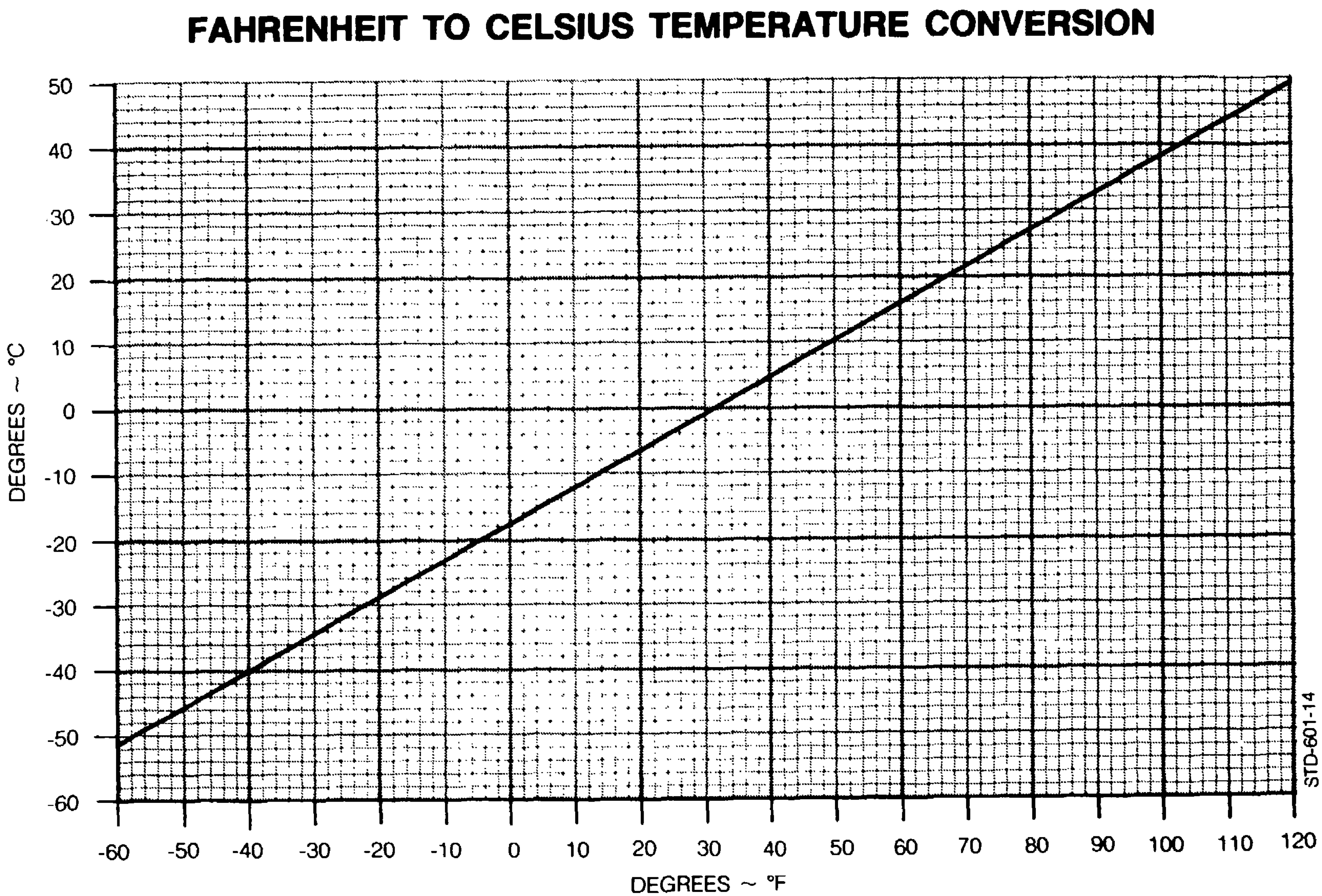


Figure 7-8. Fahrenheit to Celsius Temperature Conversion

TAKEOFF WEIGHT — FLAPS 0%
TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF

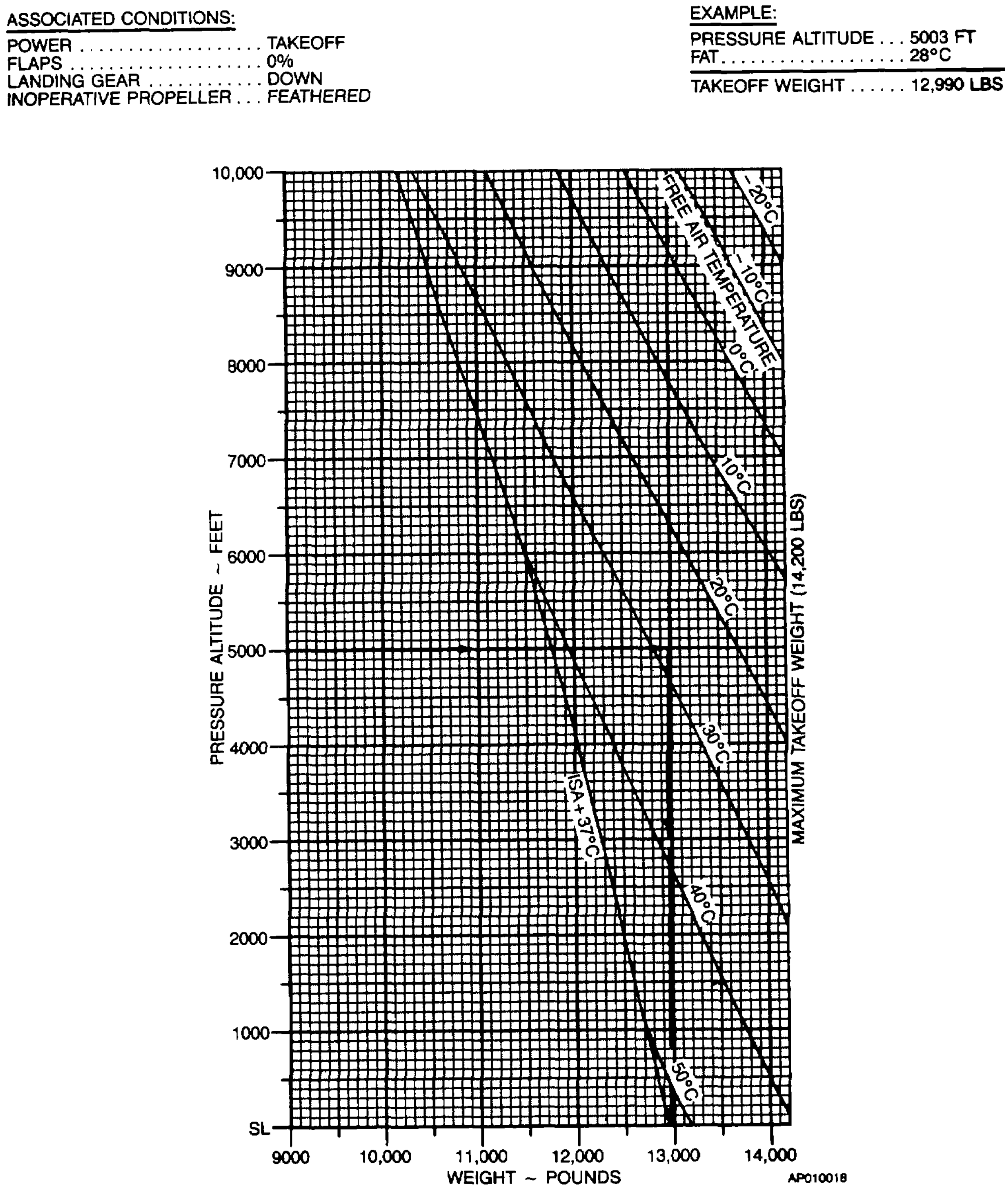


Figure 7-9. Take-Off Weight - Flaps 0%, To Achieve Positive One-Engine Inoperative Climb at Lift-Off

TAKEOFF WEIGHT — FLAPS 40%

TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFTOFF

ASSOCIATED CONDITIONS:

POWER.................... TAKEOFF
FLAPS.................... 40%
LANDING GEAR............ DOWN
INOPERATIVE PROPELLER... FEATHERED

EXAMPLE:

PRESSURE ALTITUDE... 5003 FT
FAT.................. 28°C

TAKEOFF WEIGHT...... 12,060 LBS

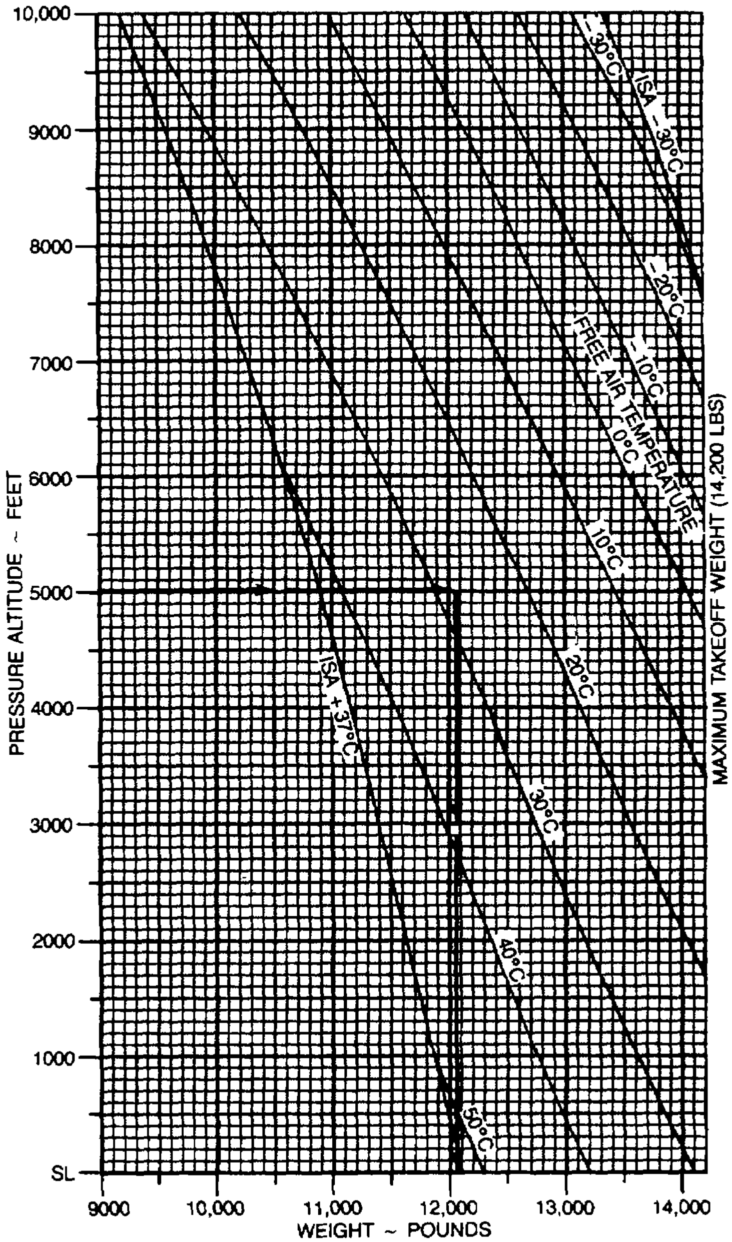


Figure 7-10. Take-Off Weight - Flaps 40%, To Achieve Positive One-Engine Inoperative Climb at Lift-Off

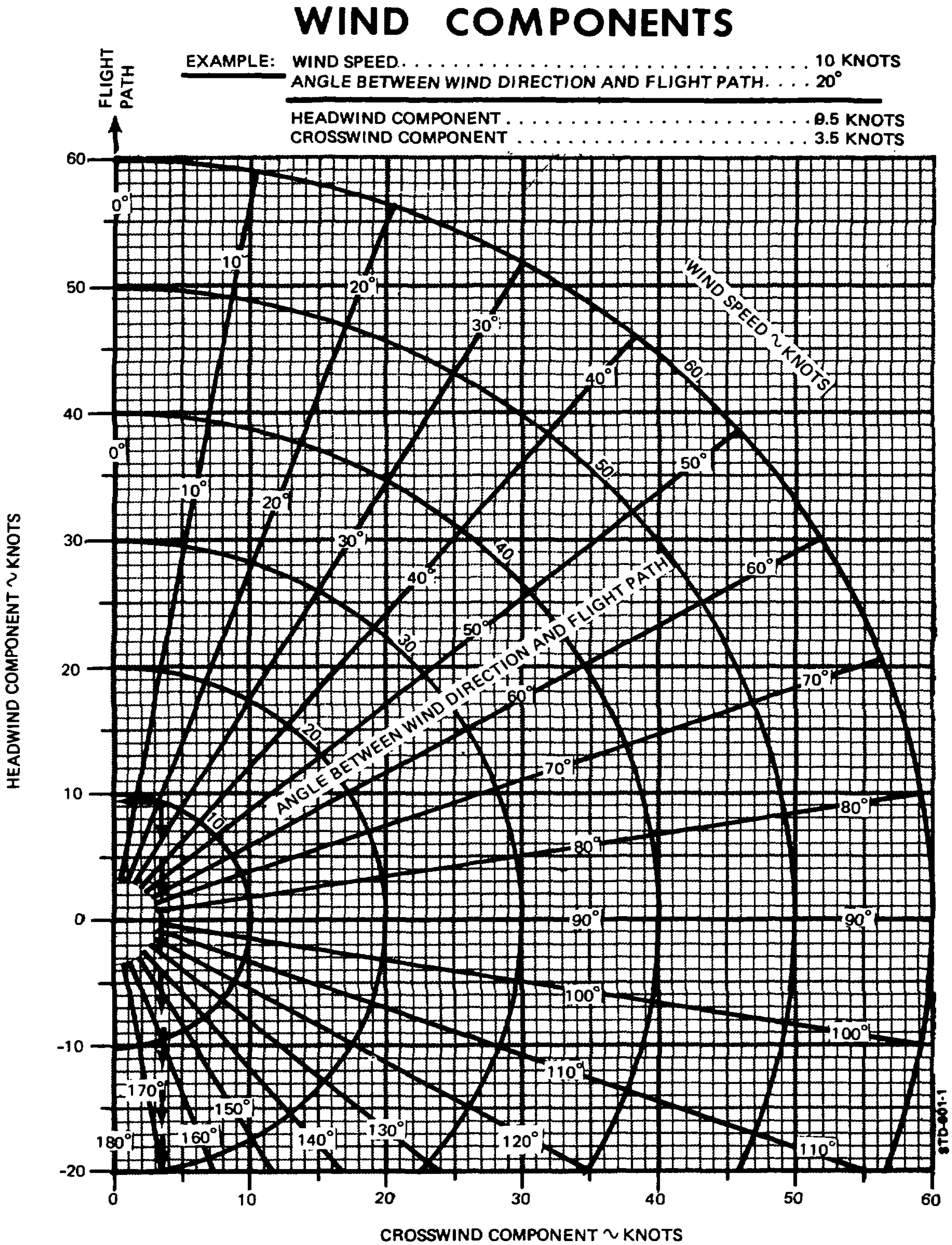


Figure 7-11. Wind Components

TAKEOFF DISTANCE — FLAPS 0%

ASSOCIATED CONDITIONS:
POWER .... TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS 0%
LANDING GEAR ... RETRACT AFTER LIFT-OFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	TAKEOFF SPEED ~ KNOTS	
	V_R	V_2
14,200	106	125
13,000	102	120
11,000	95	112
9000	92	100

EXAMPLE:
FAT .... 28°C
PRESSURE ALTITUDE .... 5003 FT
TAKEOFF WEIGHT .... 12,000 LBS
HEADWIND COMPONENT .. 10 KTS
GROUND ROLL .... 2860 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE .... 4400 FT
TAKEOFF SPEED AT V_R .... 99 KTS
AT V_2 .... 116 KTS

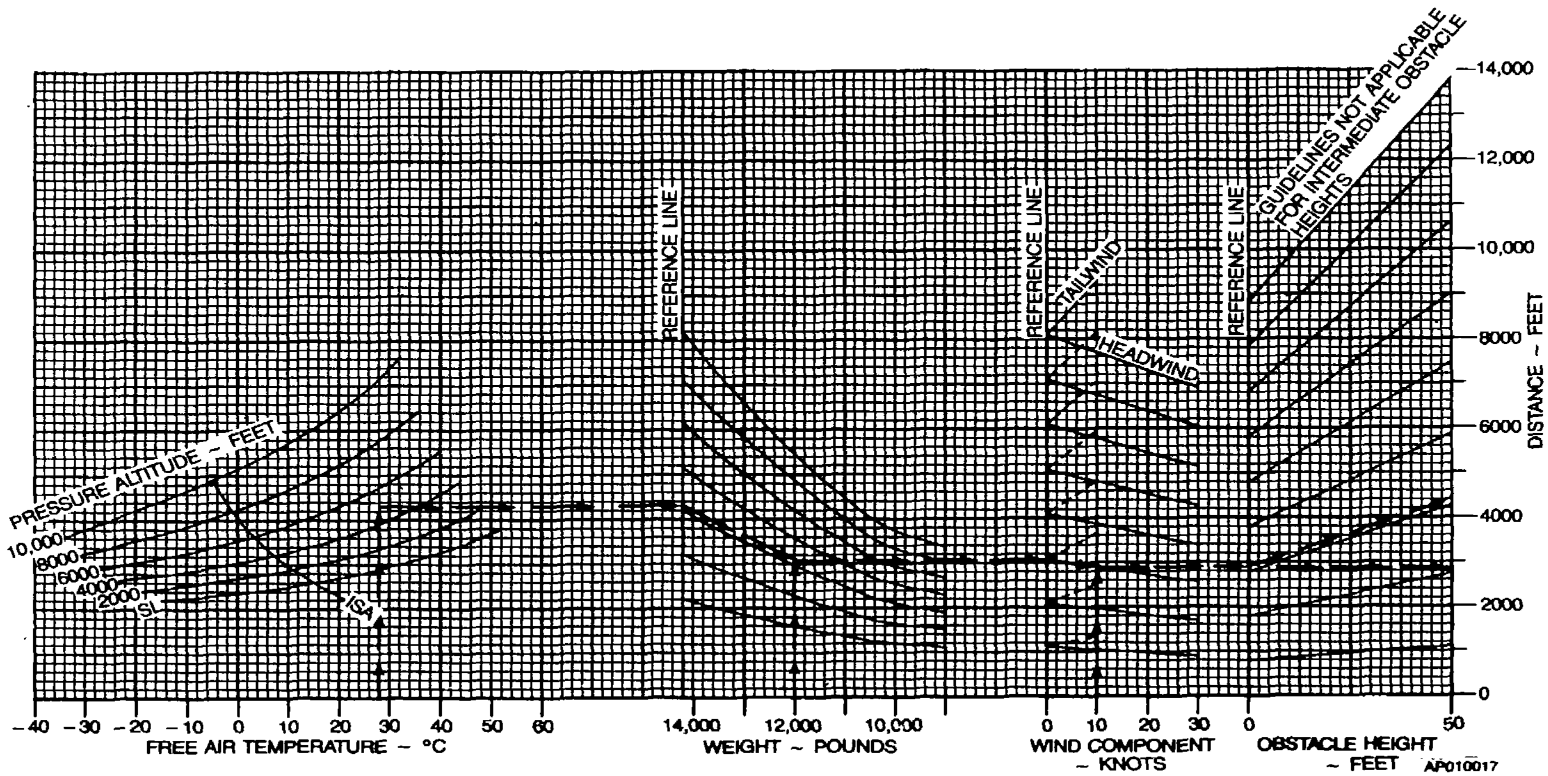


Figure 7-12. Takeoff Distance - Flaps 0%

TAKEOFF DISTANCE — FLAPS 0%

ASSOCIATED CONDITIONS:
POWER .... TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS 0%
LANDING GEAR... RETRACT AFTER LIFT-OFF
RUNWAY......... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	TAKEOFF SPEED ~ KNOTS	
	V_R	V_2
14,200	106	125
13,000	102	120
11,000	95	112
9000	92	100

EXAMPLE:
FAT .... 28°C
PRESSURE ALTITUDE...... 5003 FT
TAKEOFF WEIGHT......... 12,000 LBS
HEADWIND COMPONENT .. 10 KTS

GROUND ROLL........... 2860 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE........ 4400 FT
TAKEOFF SPEED AT V_R .... 99 KTS
AT V_2 .... 116 KTS

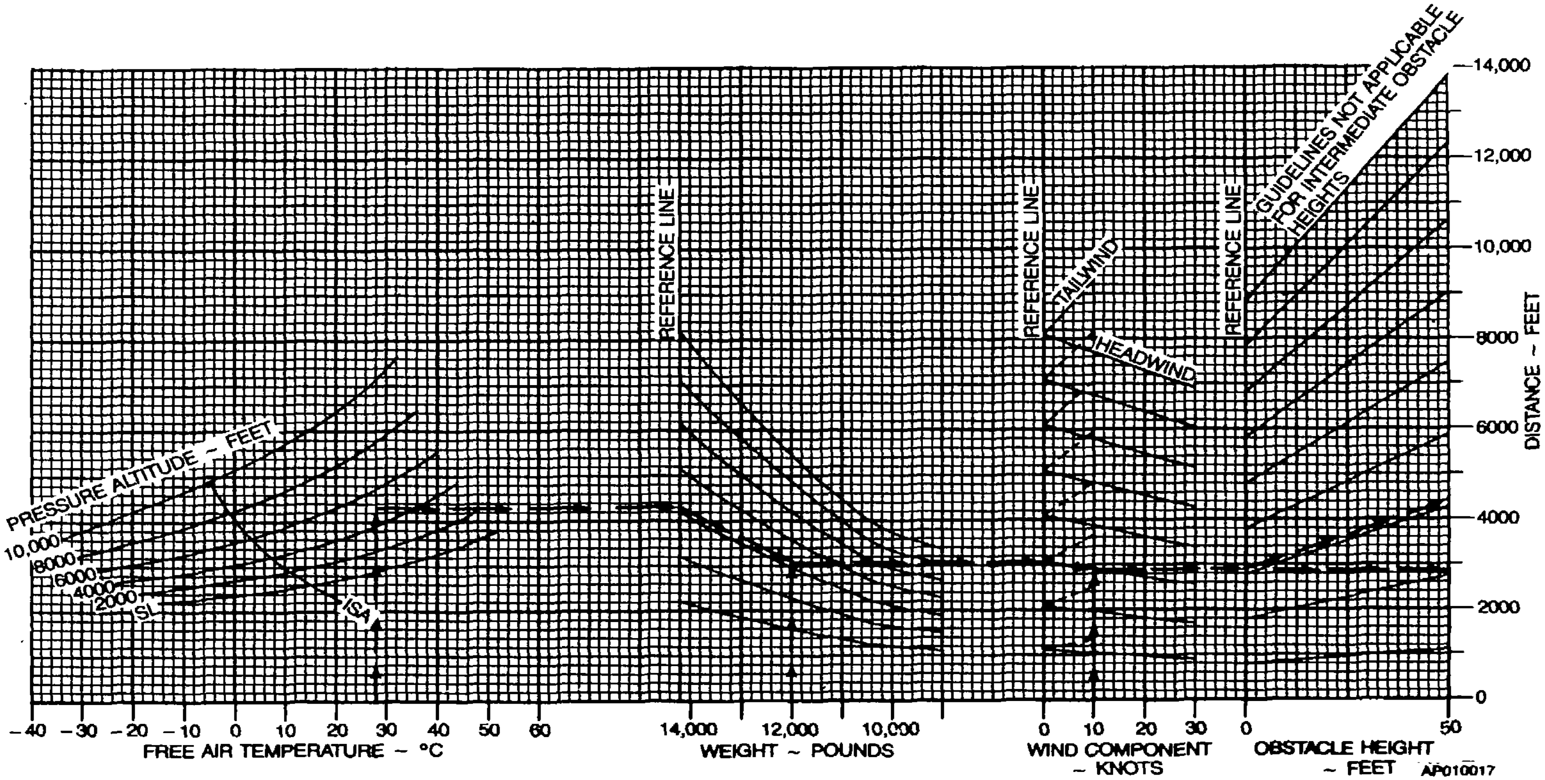


Figure 7-13. Take-Off Distance - Flaps 40%

MINIMUM TAKEOFF POWER AT 2000 RPM
(65 KNOTS)

NOTES: 1. TORQUE INCREASES APPROXIMATELY 1% FROM 0 TO 65 KNOTS.

2. THE PERCENT TORQUE INDICATED IN THIS FIGURE IS THE MINIMUM VALUE AT WHICH TAKE-OFF PERFORMANCE PRESENTED IN THE SECTION CAN BE REALIZED. ANY EXCESS POWER WHICH MAY BE DEVELOPED WITHOUT EXCEEDING ENGINE LIMITATIONS MAY BE UTILIZED.

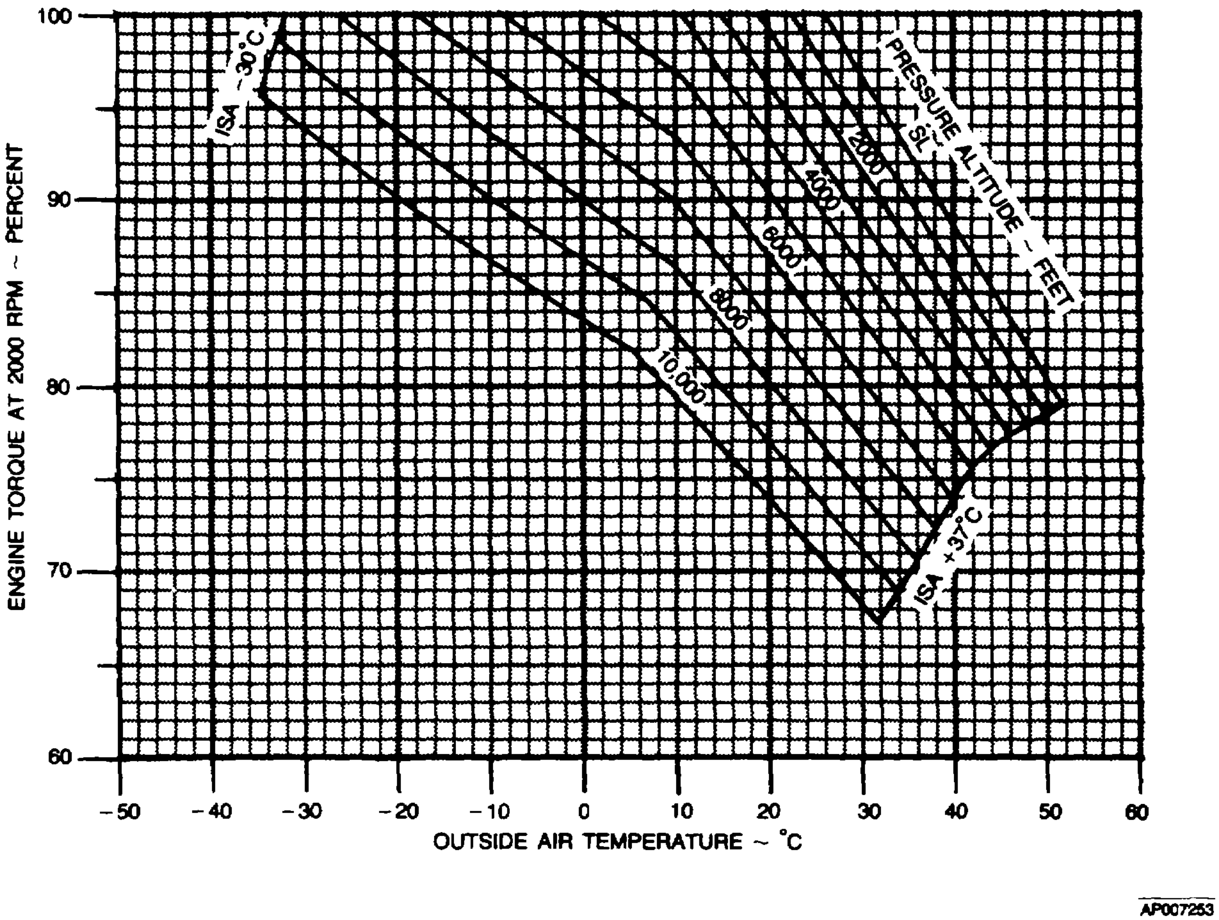


Figure 7-14. Minimum Take-Off Power at 2000, RPM

ACCELERATE-STOP — FLAPS 0%

ASSOCIATED CONDITIONS:

POWER . . . . 1. TAKEOFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT V_1 SPEED AND REVERSE OPERATING ENGINE

FLAPS 0%

AUTOFEATHER . . . ARMED

BRAKING . . . . MAXIMUM

RUNWAY . . . . PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	V_1 ~ KNOTS
14,200	106
13,000	102
11,000	95
9000	92

EXAMPLE:

FAT . . . . 28°C

PRESSURE ALTITUDE . . . . . . 5003 FT

WEIGHT . . . . 12,000 LBS

HEADWIND COMPONENT . . . 10 KTS

FIELD LENGTH . . . . 4520 FT

V_1 . . . . 99 KTS

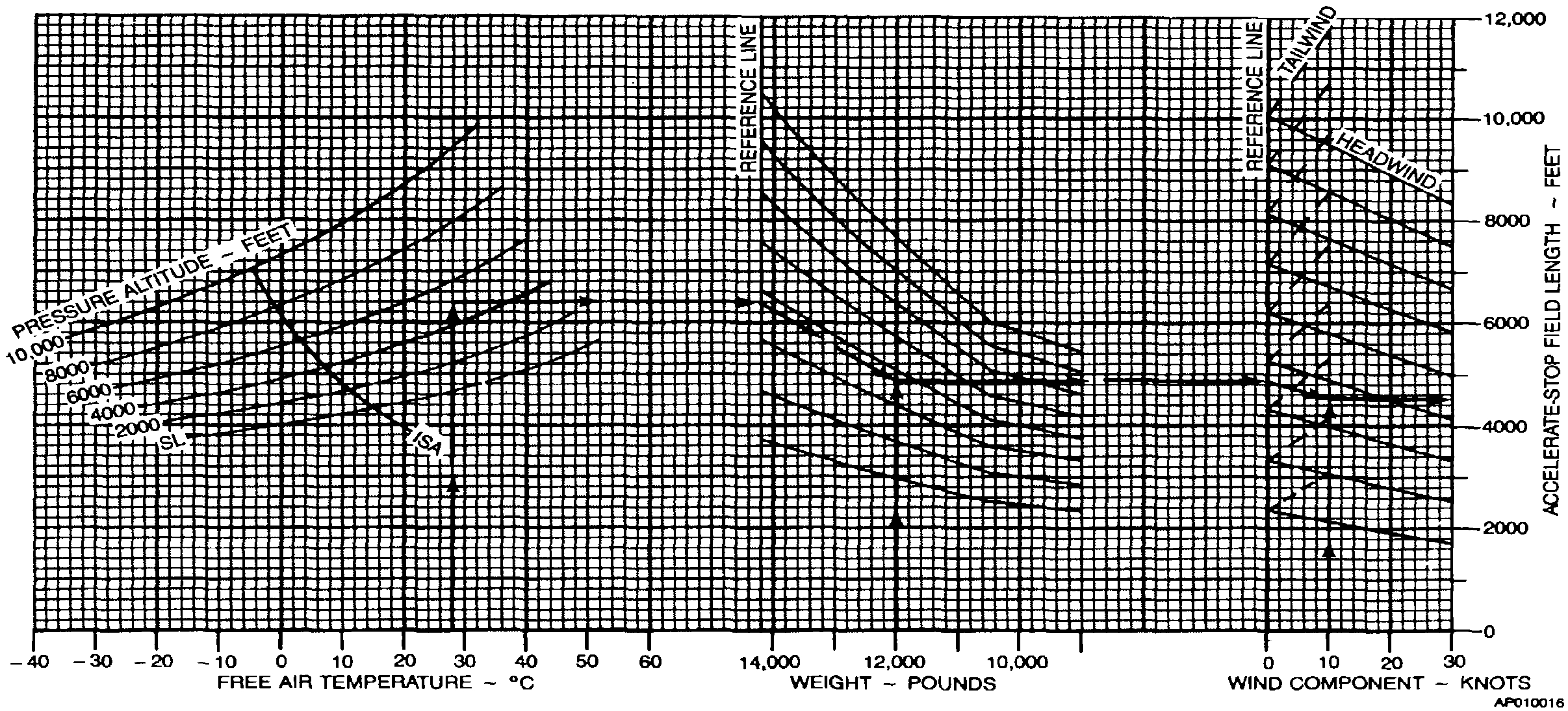


Figure 7-15. Accelerate-Stop - Flaps 0%

ACCELERATE - STOP — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... 1. TAKEOFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT V_1 SPEED AND REVERSE OPERATING ENGINE

FLAPS 40%

AUTOFEATHER ... ARMED

BRAKING .... MAXIMUM

RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	V_1 ~ KNOTS
14,200	96
13,000	92
11,000	92
9000	92

EXAMPLE:

FAT .... 28°C

PRESSURE ALTITUDE .... 5003 FT

WEIGHT .... 12,060 LBS

HEADWIND COMPONENT ... 10 KTS

FIELD LENGTH .... 4150 FT

V_1 .... 92 KTS

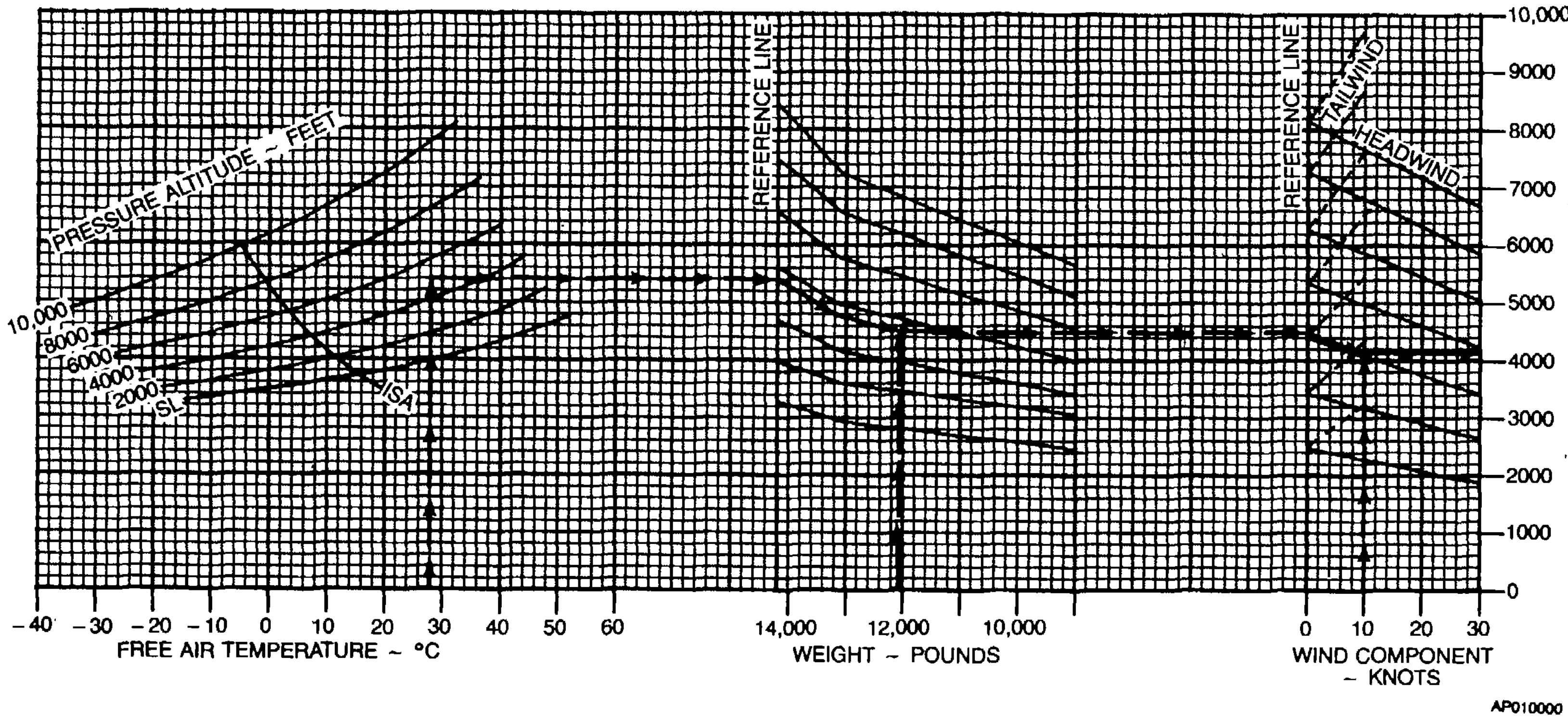


Figure 7-16. Accelerate-Stop - Flaps 40

ACCELERATE-GO DISTANCE OVER 50-FT OBSTACLE — FLAPS 0%

ASSOCIATED CONDITIONS:

POWER . . . . TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS 0%
AUTOFEATHER . . . . ARMED
LANDING GEAR . . . RETRACT AFTER LIFT-OFF
RUNWAY . . . . PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	SPEED ~ KNOTS	
	V_1	V_2
14,200	106	125
13,000	102	120
11,000	95	112
9000	92	100

EXAMPLE:

FAT . . . . 28°C
PRESSURE ALTITUDE . . . . 5003 FT
TAKEOFF WEIGHT . . . . 10,000 LBS
HEADWIND COMPONENT . . . . 10 KTS

TAKEOFF DISTANCE OVER 50-FT OBSTACLE . . . . 5710 FT
SPEEDS AT V_1 . . . . 94 KTS
AT V_2 . . . . 106 KTS

NOTE: DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION AND PROPELLER IMMEDIATELY FEATHERED.

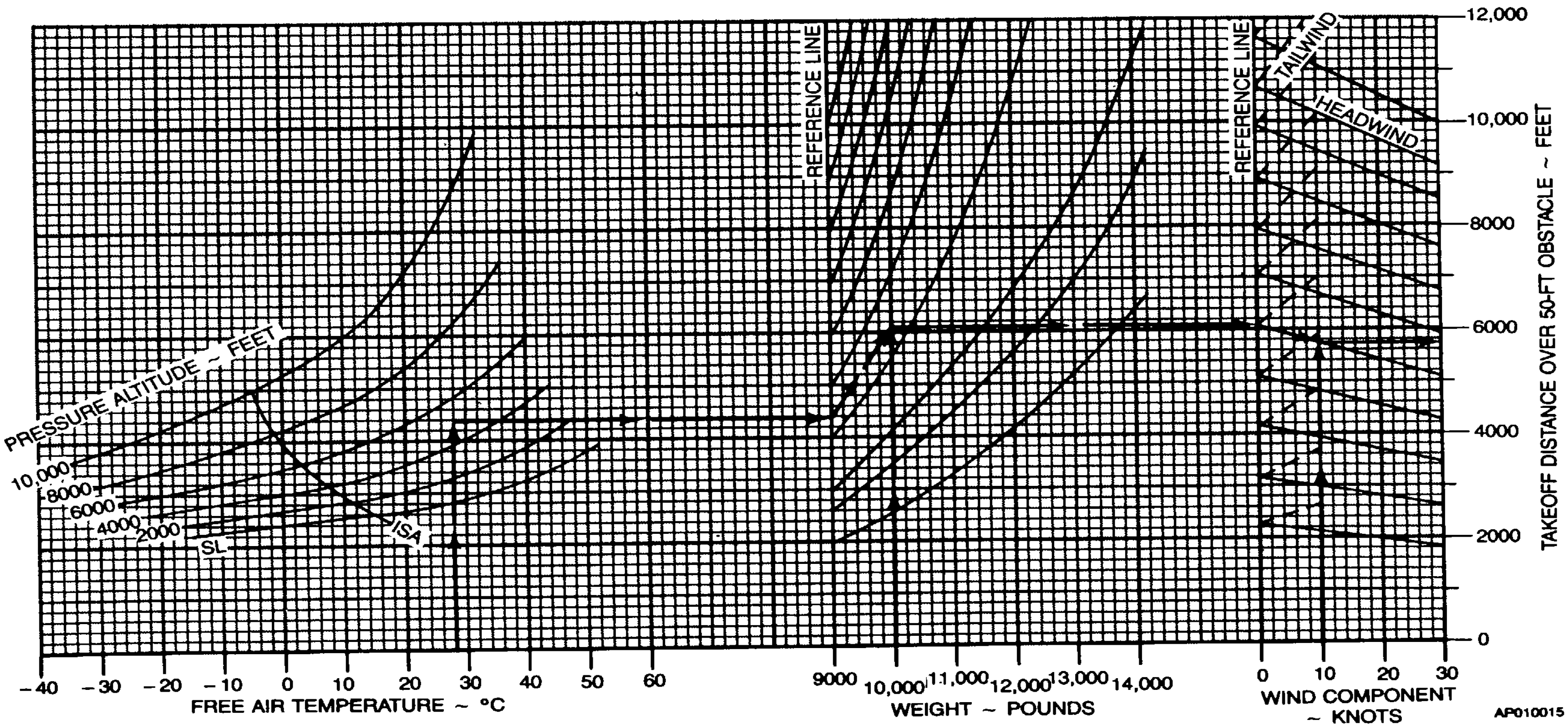


Figure 7-17. Accelerate-Go Distance Over 50-Ft Obstacle - Flaps 0%

ACCELERATE-GO DISTANCE OVER 50-FT OBSTACLE — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS 40%
AUTOFEATHER .... ARMED
LANDING GEAR ... RETRACT AFTER LIFTOFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	SPEED ~ KNOTS	
	V_1	V_2
14,200	96	112
13,000	92	108
11,000	92	101
9000	92	99

EXAMPLE:

FAT .... 28°C
PRESSURE ALTITUDE .... 5003 FT
TAKEOFF WEIGHT .... 10,000 LBS
HEADWIND COMPONENT .... 10 KTS

TAKEOFF DISTANCE OVER 50-FT OBSTACLE .... 5100 FT
SPEEDS V_1 .... 92 KTS
V_2 .... 100 KTS

NOTE:
1. GROUND ROLL DISTANCE IS 50% OF TAKEOFF DISTANCE OVER 50-FT OBSTACLE.
2. DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION SPEED AND PROPELLER IMMEDIATELY FEATHERED.
3. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB. REFER TO "MAXIMUM TAKEOFF WEIGHT TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFTOFF" GRAPH FOR MAXIMUM WEIGHT AT WHICH THE ACCELERATE-GO PROCEDURE SHOULD BE ATTEMPTED.

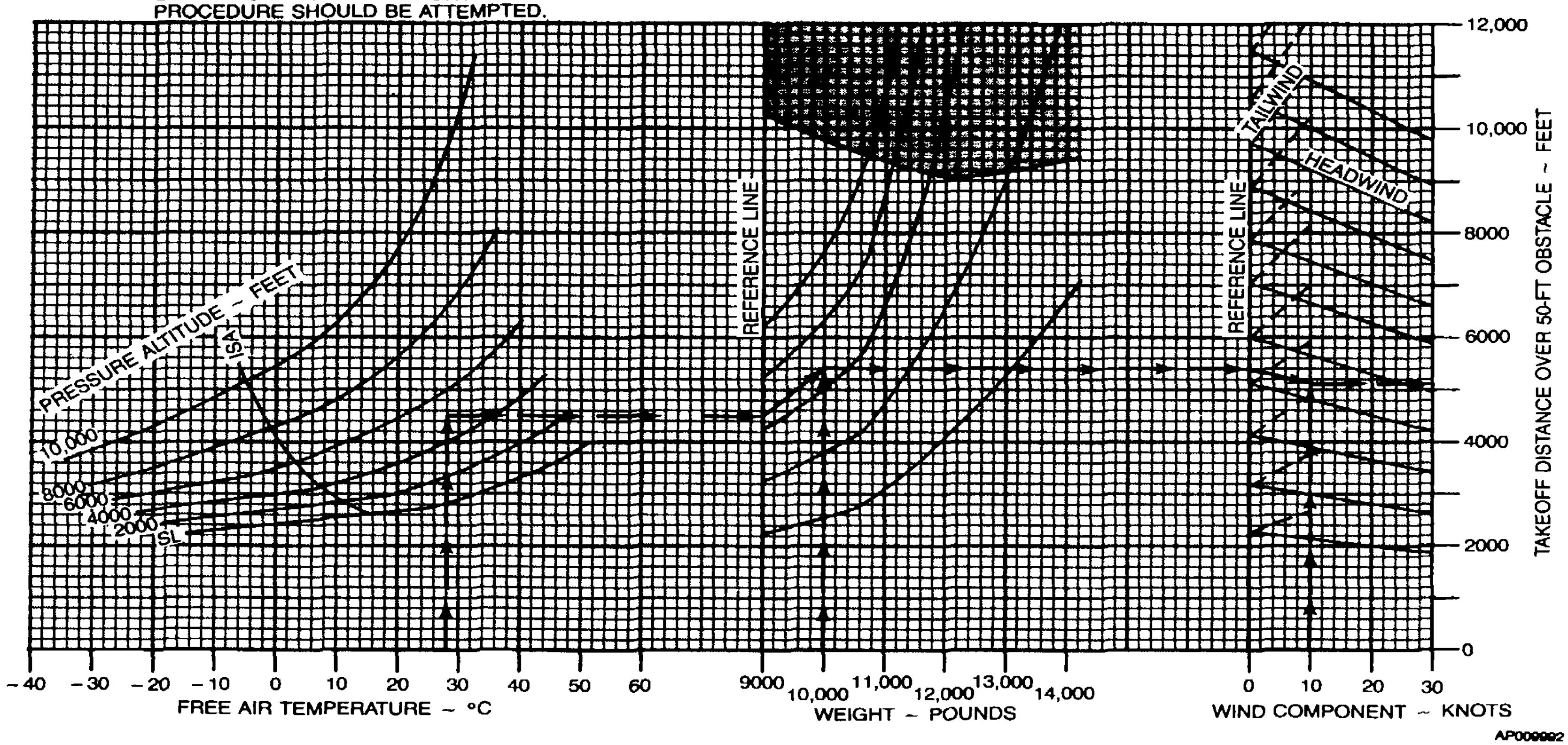


Figure 7-18. Accelerate-Go Distance Over 50-Ft Obstacle - Flaps 40%

TIME, FUEL, AND DISTANCE TO CRUISE CLIMB

ASSOCIATED CONDITIONS:

PROPELLER SPEED . . . 1900 RPM
POWER:
ITT . . . . 750°C
OR TORQUE 100%

ALTITUDE ~ FEET	CLIMB SPEED ~ KNOTS
SL TO 10,000	140
10,000 TO 20,000	130
20,000 TO 31,000	120

EXAMPLE:

FAT AT TAKEOFF . . . . 28°C
FAT AT CRUISE . . . . −2°C
AIRPORT PRESSURE ALTITUDE . . . 5003 FT
CRUISE ALTITUDE . . . . 22,000 FT
INITIAL CLIMB WEIGHT . . . . 12,000 LBS

TIME TO CLIMB . . . . (18.4 − 2.2) 16.2 MIN
FUEL TO CLIMB . . . . (248 − 45) 203 LBS
DISTANCE TO CLIMB . . . . (50 − 7) 43 NM

NOTE: ADD 90 POUNDS FUEL FOR START, TAXI, AND TAKEOFF.

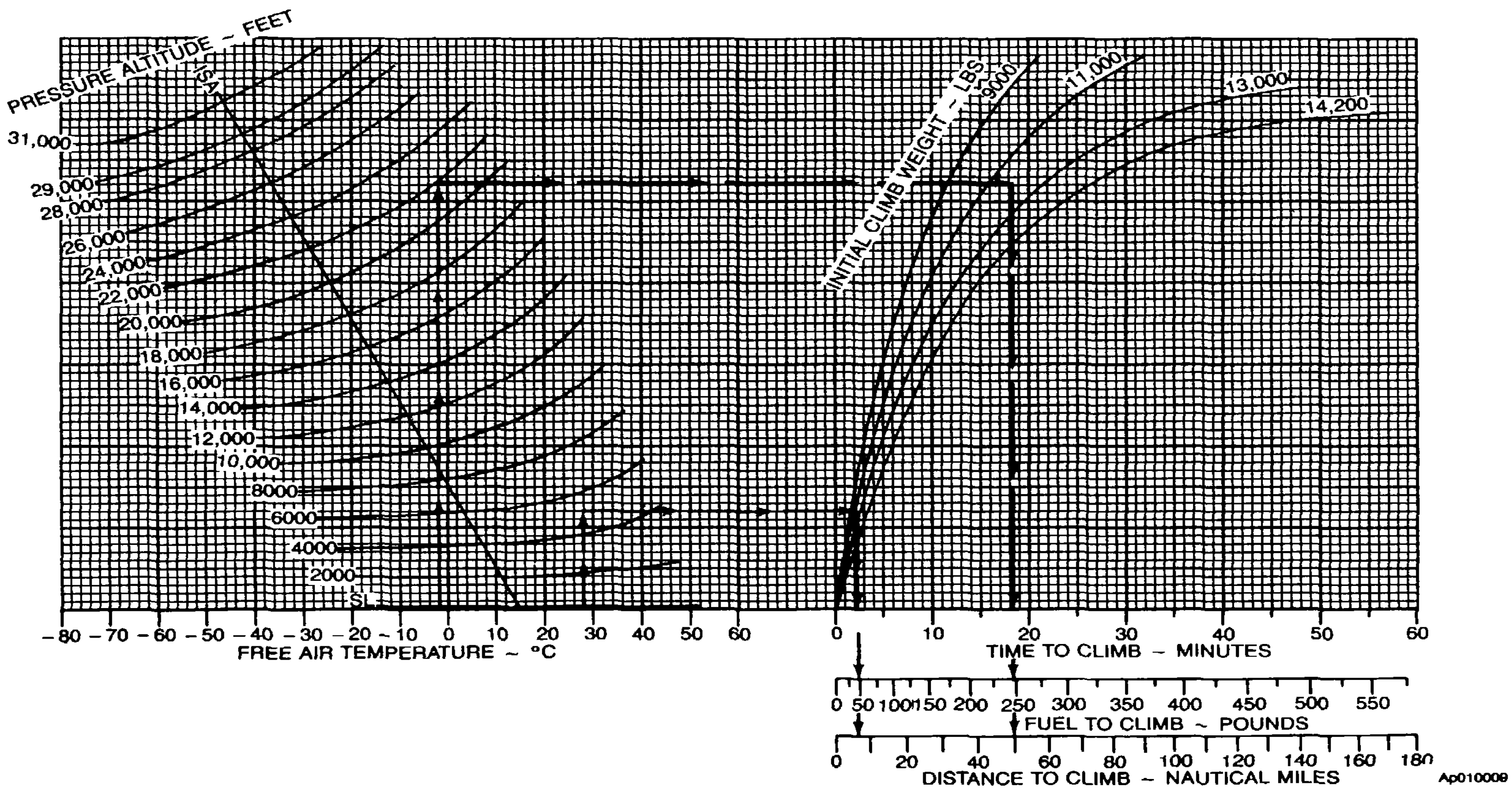


Figure 7-19. Time, Fuel, and Distance to Cruise Climb

CLIMB — TWO ENGINES — FLAPS 0%

ASSOCIATED CONDITIONS:
POWER. . . . . MAXIMUM CONTINUOUS
FLAPS. 0%
LANDING GEAR . . . UP

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
14,200	130
13,000	126
11,000	121
9000	120

EXAMPLE:
FAT . . . . 8°C
PRESSURE ALTITUDE . . . 16,000 FT
WEIGHT . . . . 10,500 LBS

RATE OF CLIMB 1450 FT/MIN
CLIMB GRADIENT 8.6%
CLIMB SPEED . . . . 121 KTS

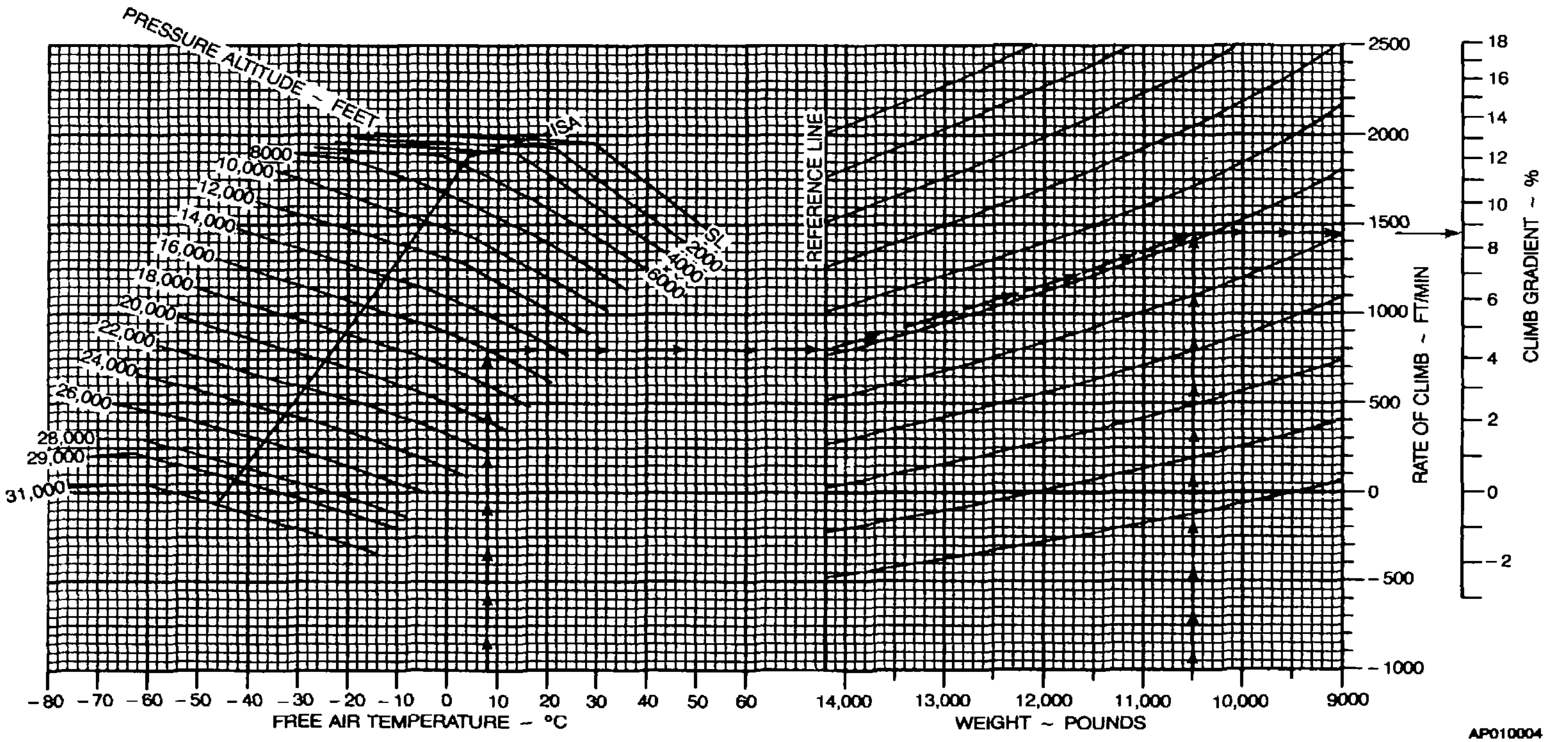


Figure 7-20. Climb - Two Engines - Flaps 0%

CLIMB — TWO ENGINES — FLAPS 40%

ASSOCIATED CONDITIONS:
POWER.......... MAXIMUM CONTINUOUS
FLAPS........... 40%
LANDING GEAR . . . UP

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
14,200	124
13,000	121
11,000	120
9000	120

EXAMPLE:
FAT .... 8°C
PRESSURE ALTITUDE . . . 16,000 FT
WEIGHT .... 10,500 LBS

RATE OF CLIMB........ 1130 FT/MIN
CLIMB GRADIENT 7.2%
CLIMB SPEED .... 120 KTS

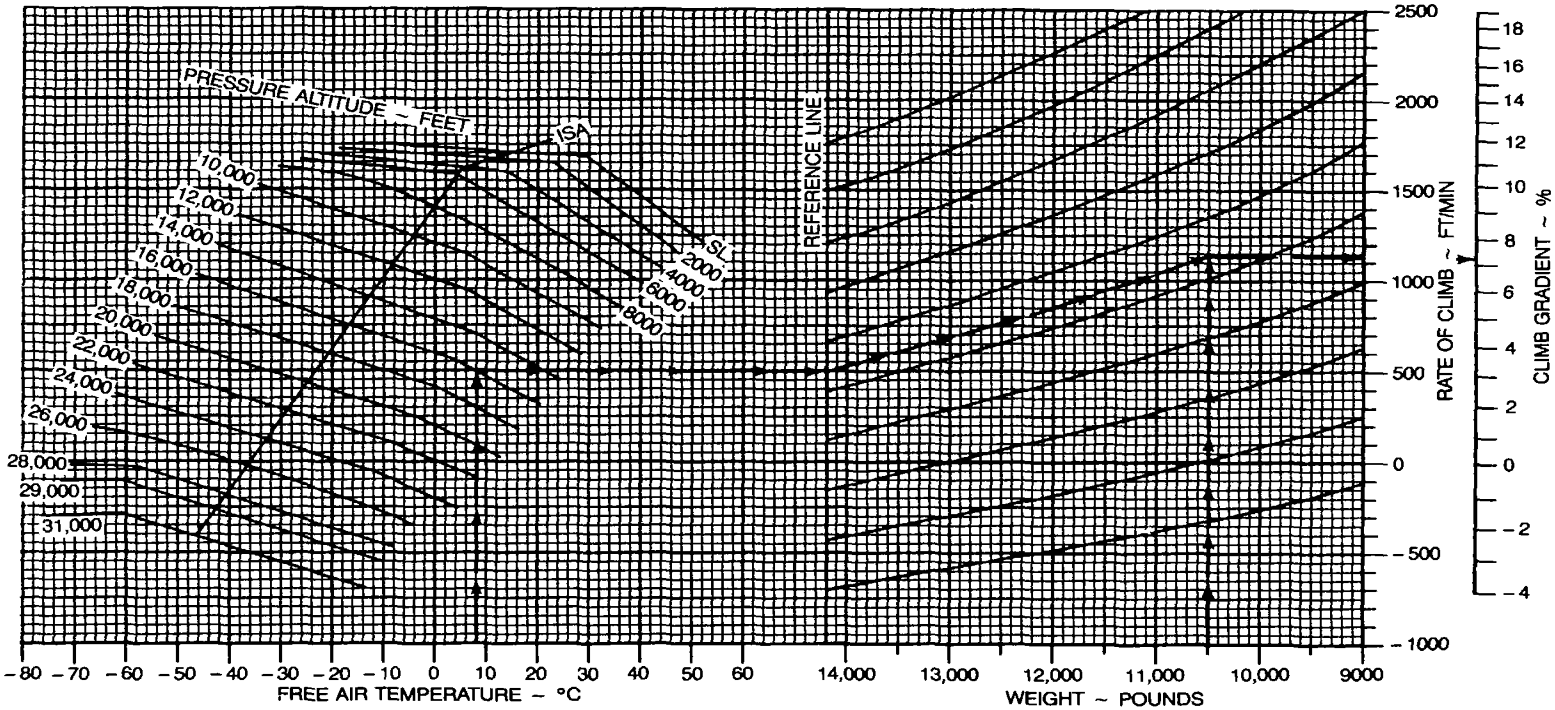


Figure 7-21. Climb - Two Engines - Flaps 40%

TAKEOFF CLIMB GRADIENT — ONE ENGINE - INOPERATIVE — FLAPS 0%

ASSOCIATED CONDITIONS:
POWER .... TAKEOFF
FLAPS 0%
LANDING GEAR .... UP
INOPERATIVE PROPELLER... FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
14,200	125
13,000	120
11,000	112
9000	100

EXAMPLE:
FAT .... 28°C
PRESSURE ALTITUDE... 5003 FT
WEIGHT .... 10,000 LBS

CLIMB GRADIENT 5.5%
CLIMB SPEED .... 106 KTS

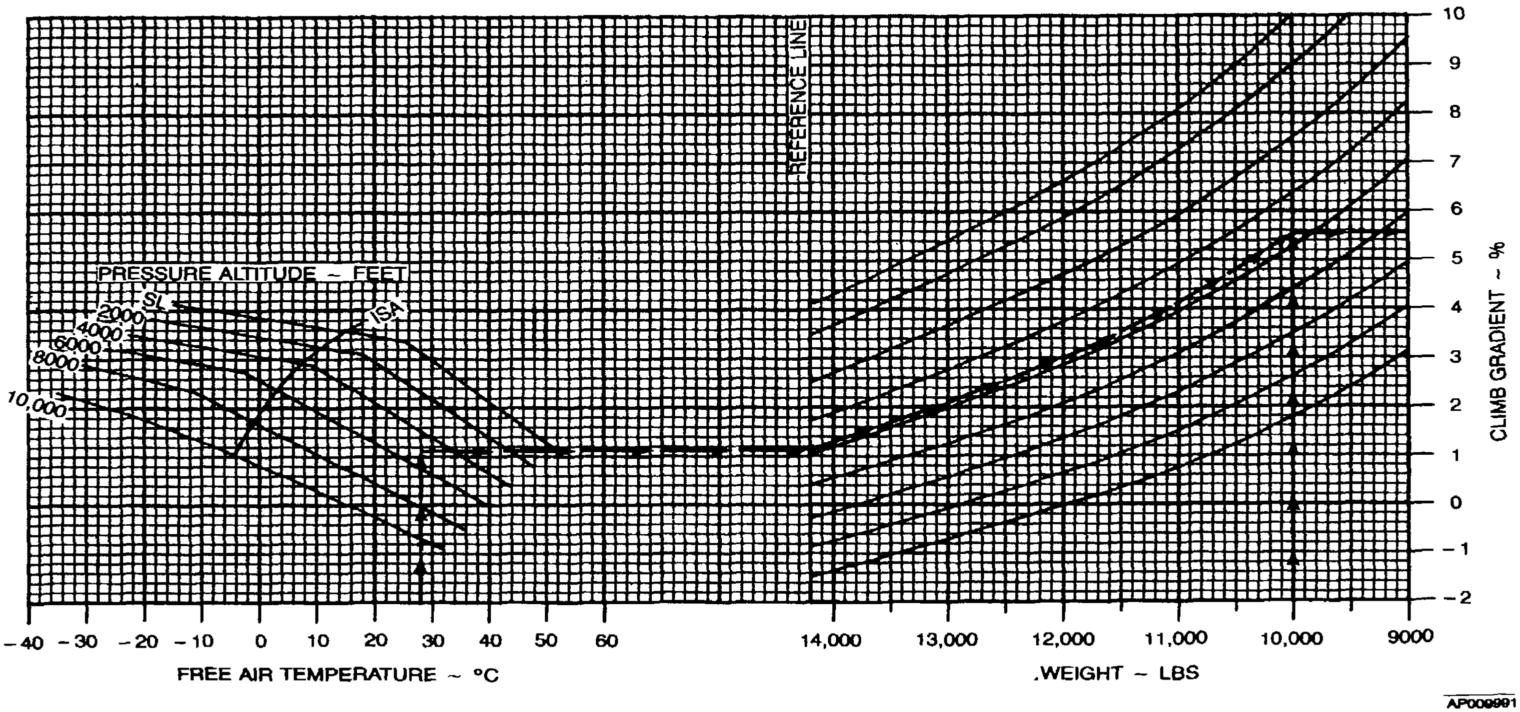


Figure 7-22. Take-Off Climb Gradient - One-Engine Inoperative - Flaps 0%

TAKEOFF CLIMB GRADIENT — ONE ENGINE INOPERATIVE — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . TAKEOFF
FLAPS 40%
LANDING GEAR . . . . UP
INOPERATIVE PROPELLER . . . FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
14,200	112
13,000	108
11,000	101
9000	99

EXAMPLE:

FAT . . . . 28°C
PRESSURE ALTITUDE . . . 5003 FT
WEIGHT . . . . 12,060 LBS

CLIMB GRADIENT 1.7%
CLIMB SPEED . . . . 105 KTS

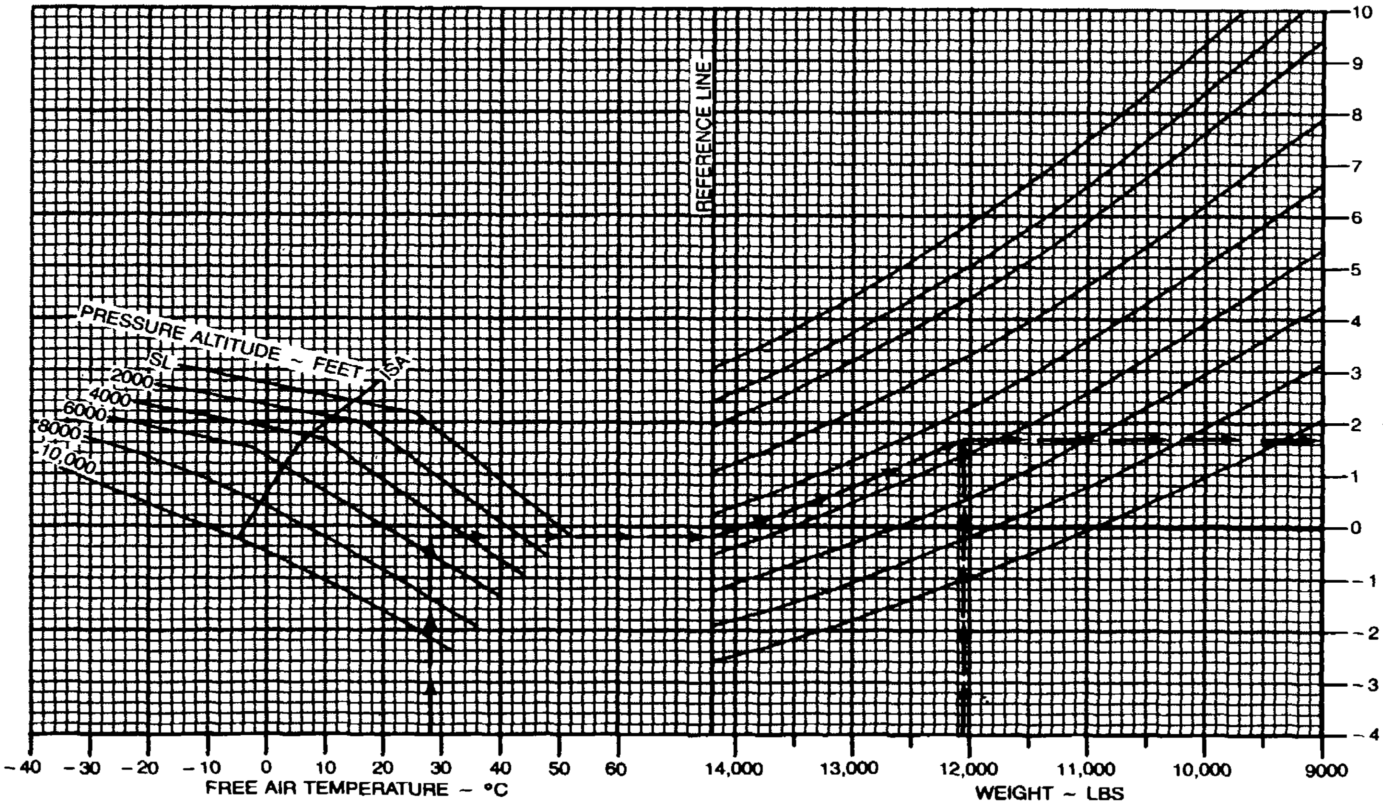


Figure 7-23. Take-Off Climb Gradient - One-Engine Inoperative - Flaps 40%

CLIMB — ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:
POWER .... MAXIMUM CONTINUOUS
FLAPS 0%
LANDING GEAR .... UP
INOPERATIVE PROPELLER ... FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
14,200	124
13,000	121
11,000	120
9000	120

EXAMPLE:
FAT .... 8°C
PRESSURE ALTITUDE ... 16,000 FT
WEIGHT .... 10,500 LBS

RATE OF CLIMB .... 26 FT/MIN
CLIMB GRADIENT 0.15%
CLIMB SPEED .... 120 KTS

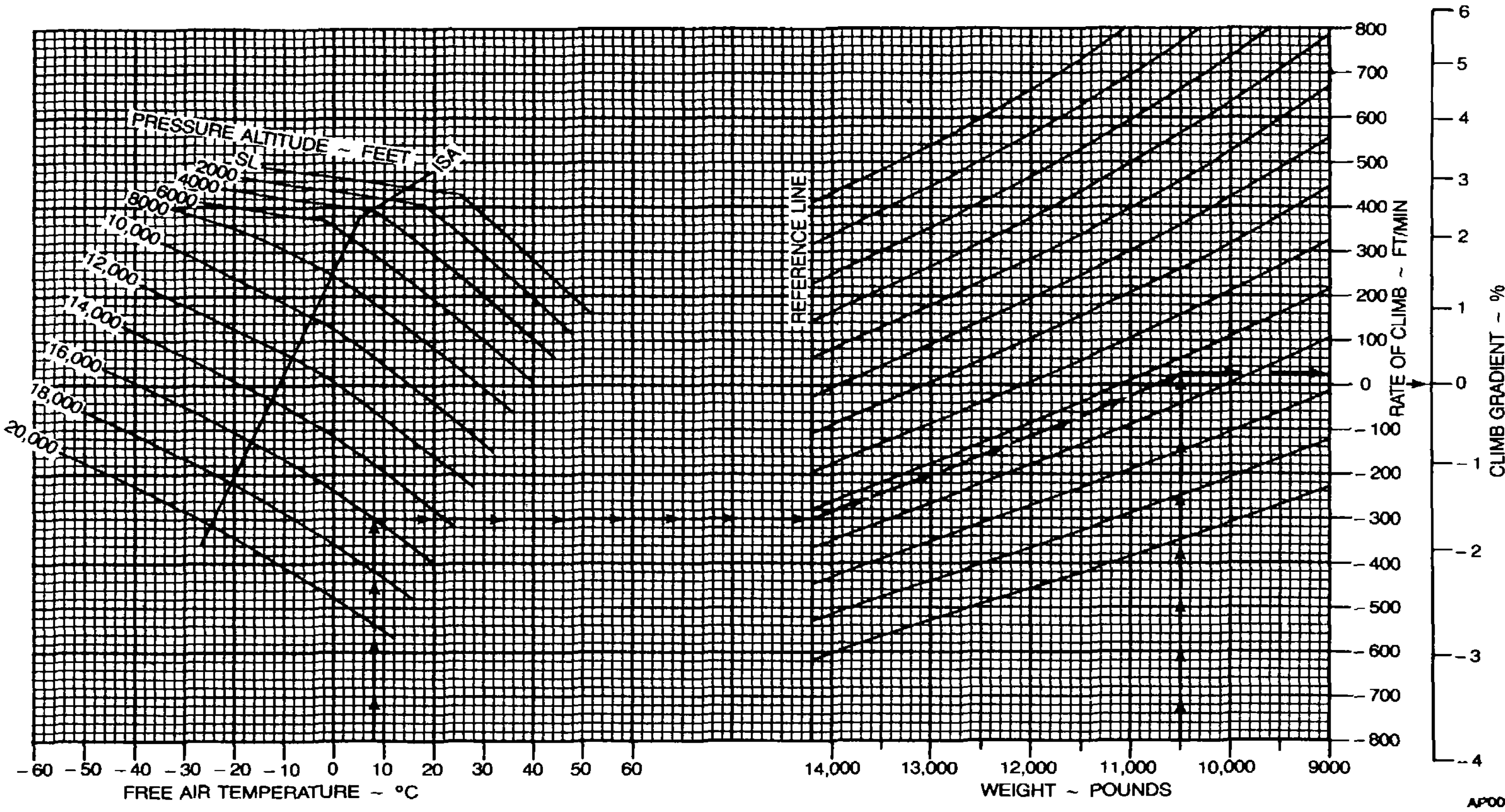


Figure 7-24. Climb - One Engine Inoperative

CLIMB — BALKED LANDING

CLIMB SPEED: 100 KNOTS (ALL WEIGHTS)

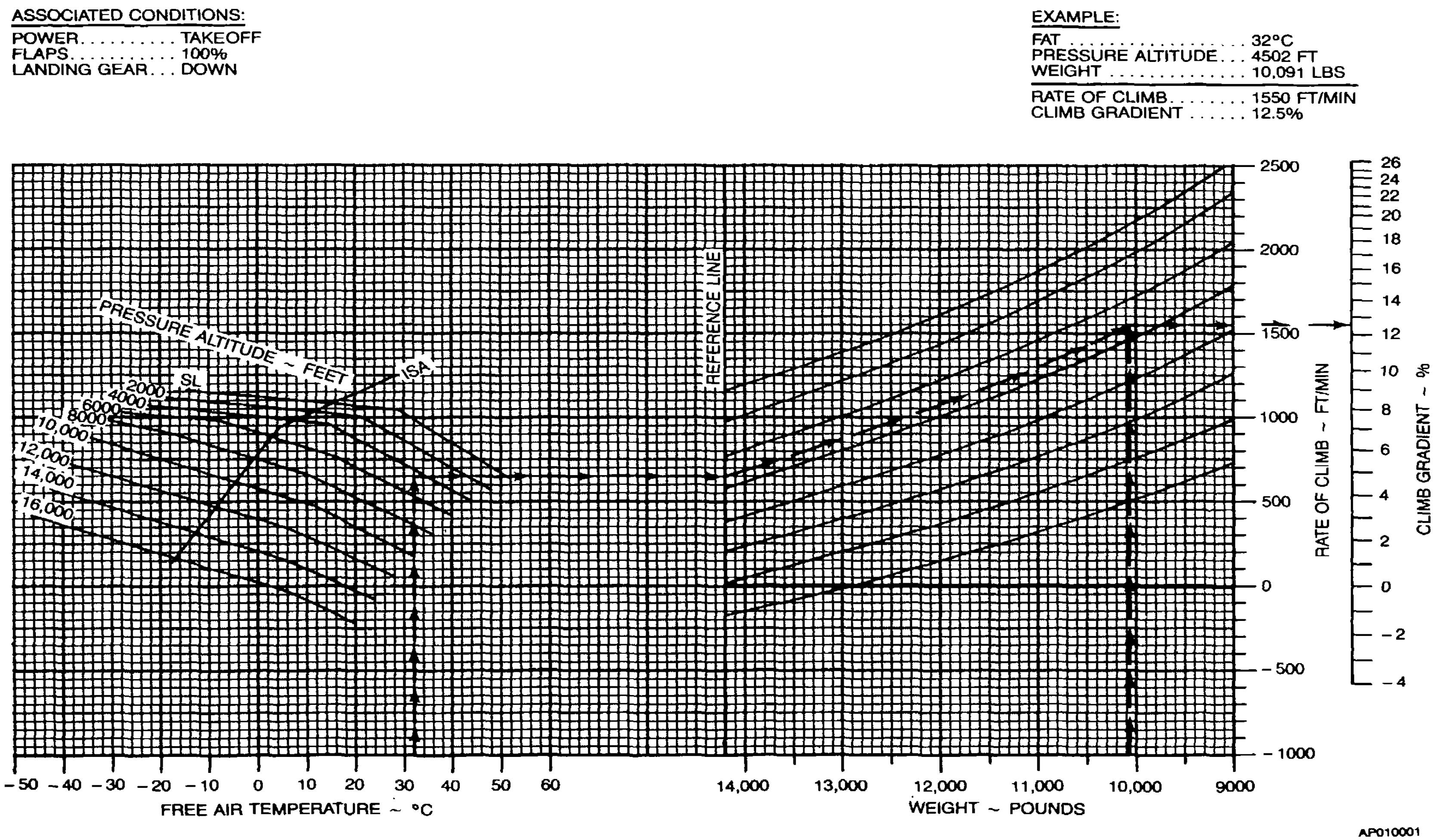


Figure 7-25. Climb - Balked Landing

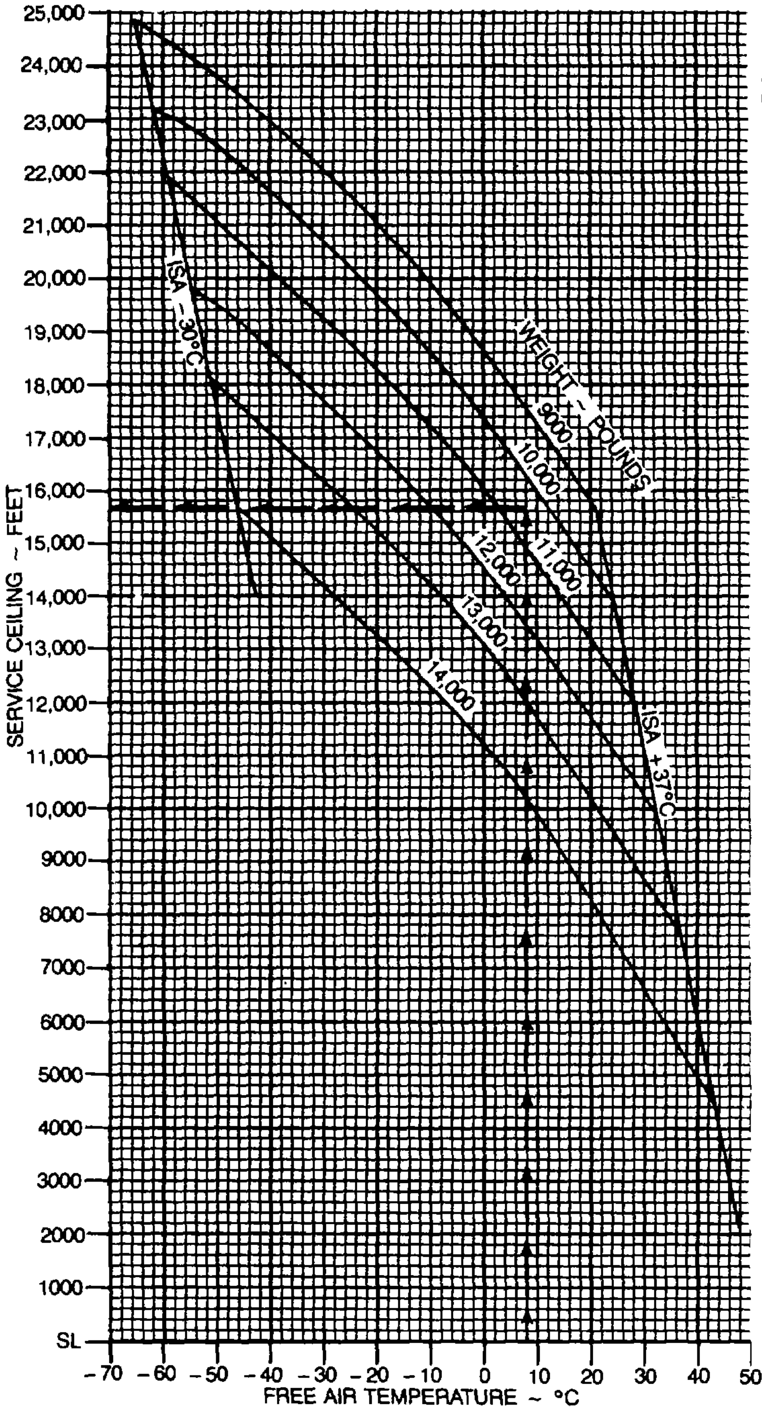
SERVICE CEILING — ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

POWER . . . . MAXIMUM CONTINUOUS
LANDING GEAR . . . . UP
INOPERATIVE PROPELLER . . . FEATHERED
FLAPS . . . . UP (0%)

EXAMPLE:

FAT . . . . 8°C
WEIGHT . . . . 10,500 LBS
SERVICE CEILING . . . 15,620 FT



NOTE:
SERVICE CEILING IS THE MAXIMUM ALTITUDE AT WHICH THE AIRPLANE IS CAPABLE OF CLIMBING 50-FT PER MINUTE WITH ONE PROPELLER FEATHERED.

AP009997

Figure 7-26. Service Ceiling - One Engine Inoperative

MAXIMUM CRUISE POWER
1900 RPM
ISA -30 °C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-11	-15	100	519	1038	231	217	100	519	1038	232	217
2000	-15	-19	100	507	1014	229	220	100	506	1012	230	221
4000	-18	-23	100	495	990	227	224	100	494	988	228	225
6000	-22	-27	100	484	968	225	228	100	483	966	226	230
8000	-26	-31	100	474	948	222	233	100	474	948	223	234
10,000	-30	-35	100	464	928	220	237	100	464	928	221	238
12,000	-33	-39	100	458	916	217	241	100	457	914	219	243
14,000	-37	-43	100	452	904	215	246	100	452	904	214	247
16,000	-41	-47	97	435	870	207	247	97	436	872	211	249
18,000	-45	-51	90	405	810	201	244	90	406	812	203	247
20,000	-49	-55	83	377	754	192	241	84	378	756	195	244
22,000	-53	-59	78	352	704	184	238	78	353	706	186	241
24,000	-58	-63	71	327	654	174	233	72	328	656	177	237
26,000	-62	-67	65	299	598	163	225	65	301	602	167	231
28,000	-66	-71	57	268	536	147	211	58	271	542	154	220
29,000	-69	-72	52	250	500	136	199	54	255	510	146	213
31,000	-66	-71	---	---	---	---	---	49	237	474	135	201

BT00684 - RC-12D

Figure 7-27. Maximum Cruise Power 1900 RPM, ISA -30°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -30 °C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-11	-15	100	519	1038	233	218	100	518	1036	234	219
2000	-14	-19	100	506	1012	231	222	100	506	1012	232	223
4000	-18	-23	100	494	988	229	226	100	494	988	230	227
6000	-22	-27	100	483	966	227	231	100	483	966	228	231
8000	-26	-31	100	473	946	224	235	100	473	946	225	236
10,000	-30	-35	100	464	928	222	239	100	464	928	223	240
12,000	-33	-39	100	457	914	220	244	100	457	914	221	245
14,000	-37	-43	100	452	904	218	248	100	452	904	219	250
16,000	-41	-47	97	436	872	213	251	97	437	874	214	252
18,000	-45	-51	91	407	814	205	249	91	407	814	206	250
20,000	-49	-55	84	379	758	197	247	84	379	758	198	249
22,000	-53	-59	78	354	708	189	244	78	355	710	191	247
24,000	-57	-63	72	329	658	180	241	72	330	660	183	244
26,000	-61	-66	66	303	606	169	236	66	304	608	174	240
28,000	-66	-71	59	273	546	159	227	59	275	550	163	233
29,000	-68	-72	55	257	514	152	221	55	260	520	156	227
31,000	-73	-76	47	227	454	135	205	48	230	460	143	216

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Figure 7-27. Maximum Cruise Power 1900 RPM, ISA -30°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -20 °C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-1	-5	100	521	1042	230	219	100	521	1042	231	220
2000	-4	-9	100	509	1018	227	223	100	508	1016	228	224
4000	-8	-13	100	496	992	225	227	100	496	992	226	228
6000	-12	-17	100	485	970	223	231	100	485	970	224	232
8000	-16	-21	100	475	950	220	235	100	475	950	222	237
10,000	-20	-25	100	466	932	218	240	100	466	932	219	241
12,000	-23	-29	100	459	918	216	244	100	459	918	217	246
14,000	-27	-33	99	451	902	212	248	99	451	902	214	250
16,000	-31	-37	92	420	840	204	245	93	421	842	206	248
18,000	-35	-41	86	391	782	195	243	86	392	784	198	245
20,000	-39	-45	80	365	730	186	239	82	366	732	189	243
22,000	-43	-49	74	340	680	178	235	74	341	682	181	239
24,000	-48	-53	68	315	630	168	230	69	316	632	172	235
26,000	-52	-57	62	291	582	157	223	63	293	586	162	229
28,000	-56	-61	57	268	536	144	212	58	271	542	151	222
29,000	-59	-62	54	256	512	136	204	55	259	518	145	217
31,000	-63	-66	---	---	---	---	---	42	233	466	126	197

BT00686 - RC-12D

Figure 7-28. Maximum Cruise Power 1900 RPM, ISA -20°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -20 °C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-1	-5	100	521	1042	232	221	100	520	1040	232	222
2000	-4	-9	100	508	1016	229	225	100	508	1016	230	226
4000	-8	-13	100	496	992	227	229	100	496	992	228	230
6000	-12	-17	100	485	970	225	233	100	484	968	226	234
8000	-16	-21	100	475	950	223	238	100	474	948	224	239
10,000	-19	-25	100	465	930	221	242	100	465	930	221	243
12,000	-23	-29	100	458	916	218	247	100	458	916	219	248
14,000	-27	-33	100	452	904	215	251	100	453	906	217	253
16,000	-31	-37	93	422	844	207	250	93	422	844	209	251
18,000	-35	-41	87	393	786	199	248	87	393	786	201	250
20,000	-39	-45	81	366	732	192	245	81	367	734	193	248
22,000	-43	-49	75	342	684	183	243	75	343	686	186	246
24,000	-47	-53	69	317	634	175	239	69	318	636	177	243
26,000	-51	-57	63	294	588	166	234	64	295	590	169	239
28,000	-56	-61	58	272	544	156	229	59	274	548	160	234
29,000	-58	-62	55	261	522	151	225	56	263	526	155	231
31,000	-62	-66	49	237	474	137	213	50	239	478	144	223

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Figure 7-28. Maximum Cruise Power 1900 RPM, ISA -20°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -10 °C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	10	5	100	522	1044	228	221	100	522	1044	229	222
2000	6	1	100	508	1016	226	225	100	508	1016	227	227
4000	2	-3	100	497	994	223	230	100	496	992	224	231
6000	-2	-7	100	486	972	221	234	100	486	972	222	235
8000	-6	-11	100	476	952	219	238	100	476	952	220	239
10,000	-9	-15	100	467	934	216	242	100	466	932	217	244
12,000	-13	-19	100	459	918	214	247	100	459	918	215	248
14,000	-17	-23	94	431	862	206	245	94	431	862	207	247
16,000	-21	-27	88	403	806	198	243	88	403	806	200	245
18,000	-25	-31	82	376	752	189	240	82	377	754	192	243
20,000	-29	-35	76	351	702	180	236	76	352	704	183	240
22,000	-34	-39	70	327	654	171	232	71	328	656	175	237
24,000	-38	-43	65	304	608	161	226	65	305	610	166	232
26,000	-42	-47	59	281	562	150	218	60	282	564	155	225
28,000	-46	-51	54	259	518	135	204	55	261	522	144	217
29,000	-48	-52	51	248	496	125	193	52	251	502	138	211
31,000	-53	-56	---	---	---	---	---	47	230	460	119	191

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Figure 7-29. Maximum Cruise Power 1900 RPM, ISA - 10°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -10 °C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	10	5	100	521	1042	230	223	100	521	1042	231	224
2000	6	1	100	508	1016	228	227	100	508	1016	229	228
4000	2	-3	100	496	992	226	232	100	496	992	226	233
6000	-2	-7	100	486	972	223	236	100	486	972	224	237
8000	-6	-11	100	476	952	221	241	100	476	952	222	242
10,000	-9	-14	100	466	934	219	245	100	466	932	220	246
12,000	-13	-19	100	459	918	216	250	100	459	918	217	251
14,000	-17	-23	94	432	864	209	249	94	452	864	210	251
16,000	-21	-27	88	404	808	201	248	88	405	810	203	250
18,000	-25	-31	82	377	754	194	246	82	378	756	195	248
20,000	-29	-35	76	352	704	186	243	77	353	706	188	246
22,000	-33	-39	71	329	658	178	241	71	330	660	180	244
24,000	-37	-43	66	306	612	169	237	66	307	614	172	241
26,000	-42	-47	60	284	568	160	232	61	285	570	164	237
28,000	-46	-51	55	293	526	150	225	56	264	528	154	232
29,000	-48	-52	53	253	506	145	221	54	254	508	150	229
31,000	-52	-56	49	232	464	131	209	49	235	470	139	222

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Figure 7-29. Maximum Cruise Power 1900 RPM, ISA -10°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	20	5	100	524	1048	226	224	100	524	1048	228	225
2000	16	11	100	511	1022	224	228	100	511	1022	225	229
4000	12	7	100	498	996	272	232	100	498	996	223	233
6000	8	3	100	487	974	219	236	100	486	972	221	238
8000	5	-1	100	477	954	217	241	100	477	954	218	242
10,000	1	-5	99	463	926	213	244	99	464	928	215	246
12,000	-3	-9	94	437	874	206	243	94	437	874	208	245
14,000	-7	-13	88	409	818	199	241	88	410	820	201	244
16,000	-11	-17	82	383	766	191	239	82	383	766	193	242
18,000	-16	-21	76	356	712	182	236	77	357	714	185	239
20,000	-20	-25	71	332	664	173	231	71	333	666	176	236
22,000	-24	-28	66	310	620	164	226	66	311	622	167	232
24,000	-28	-33	60	287	574	153	219	61	289	578	158	226
26,000	-33	-37	55	265	530	139	207	56	267	534	147	218
28,000	-37	-40	49	244	488	117	183	51	247	494	133	206
29,000	-39	-42	---	---	---	---	---	48	237	474	124	197
31,000	---	---	---	---	---	---	---	---	---	---	---	---

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Figure 7-30. Maximum Cruise Power 1900 RPM, ISA (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	20	15	100	524	1048	228	226	100	524	1048	229	227
2000	16	11	100	511	1022	226	230	100	510	1020	227	231
4000	12	7	100	498	996	224	234	100	497	994	225	235
6000	8	3	100	486	972	222	239	100	486	972	223	240
8000	5	-1	100	477	954	219	243	100	476	952	220	244
10,000	1	-5	99	464	928	216	247	99	465	930	217	248
12,000	-3	-9	94	438	876	210	247	94	438	876	211	249
14,000	-7	-13	88	410	820	202	246	89	411	822	204	248
16,000	-11	-17	83	384	768	195	244	83	384	768	197	246
18,000	-15	-21	77	358	716	187	241	77	359	718	189	245
20,000	-19	-25	72	334	668	179	239	72	335	670	181	242
22,000	-23	-29	66	310	624	171	236	67	313	626	174	240
24,000	-28	-33	61	290	580	162	232	62	291	582	165	236
26,000	-32	-37	56	269	538	152	226	57	270	540	156	232
28,000	-36	-41	51	249	498	141	218	52	251	502	147	226
29,000	-38	-42	49	239	478	135	212	50	241	482	142	222
31,000	-43	-46	44	220	440	120	196	45	222	444	131	213

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Figure 7-30. Maximum Cruise Power 1900 RPM, ISA (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +10 °C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	30	25	100	526	1052	225	226	100	526	1052	226	227
2000	26	21	100	513	1026	223	230	100	512	1024	224	231
4000	22	17	100	449	998	220	235	100	499	998	221	236
6000	18	13	100	487	974	217	239	100	487	974	219	240
8000	14	9	96	463	926	212	239	96	463	926	213	241
10,000	11	5	92	439	878	206	240	92	439	878	208	242
12,000	7	1	87	413	826	199	239	87	414	828	201	241
14,000	2	-3	81	387	774	191	236	82	388	776	193	239
16,000	-2	-7	76	362	724	183	233	76	363	726	185	237
18,000	-6	-11	71	338	676	174	230	71	339	678	177	234
20,000	-10	-15	66	315	630	165	226	66	316	632	169	231
22,000	-14	-19	61	294	588	155	219	61	295	590	160	226
24,000	-18	-23	56	271	542	143	209	56	273	546	149	219
26,000	-22	-27	50	249	498	124	190	51	252	504	137	208
28,000	-27	-30	---	---	---	---	---	46	232	464	119	189
29,000	---	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---	---

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Figure 7-31. Maximum Cruise Power 1900 RPM, ISA + 10°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +10 °C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	30	25	100	526	1052	227	228	100	526	1052	228	229
2000	26	21	100	512	1024	225	233	100	512	1024	226	233
4000	22	17	100	499	998	222	237	100	499	998	223	238
6000	18	13	100	487	974	220	241	100	487	974	221	242
8000	15	9	96	464	928	215	243	96	464	928	216	244
10,000	11	5	92	440	880	209	243	93	440	880	211	245
12,000	7	1	88	415	830	203	243	88	415	830	204	245
14,000	3	-3	82	388	776	195	241	82	389	778	197	244
16,000	-1	-7	77	363	726	187	240	77	364	728	190	242
18,000	-5	-11	72	340	680	180	238	72	341	682	182	241
20,000	-10	-15	67	317	634	172	235	67	318	636	175	239
22,000	-14	-19	62	296	592	164	231	62	297	594	167	236
24,000	-18	-23	57	275	550	154	226	57	276	552	158	231
26,000	-22	-27	52	254	508	144	218	53	255	510	149	226
28,000	-26	-31	47	234	468	131	208	48	237	474	139	219
29,000	-28	-33	45	225	449	122	198	46	228	456	133	214
31,000	-33	-36	---	---	---	---	---	41	209	418	119	200

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Figure 7-31. Maximum Cruise Power 1900 RPM, ISA + 10°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +20 °C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	40	35	99	526	1052	223	228	99	526	1052	224	229
2000	36	31	97	504	1008	218	230	97	505	1010	220	231
4000	32	27	94	482	964	214	232	95	483	960	215	233
6000	28	23	92	460	920	209	233	92	460	920	210	235
8000	24	19	88	437	874	203	234	88	437	874	205	236
10,000	20	15	84	414	828	197	234	85	414	828	199	236
12,000	16	11	80	390	780	190	233	80	390	780	193	236
14,000	12	7	75	365	730	183	231	75	366	732	185	234
16,000	8	3	70	342	684	175	228	71	343	686	178	232
18,000	4	-1	66	319	638	166	224	66	320	640	170	229
20,000	0	-5	60	296	592	155	217	61	298	596	160	223
22,000	-5	-9	56	276	552	144	208	56	278	556	151	217
24,000	-8	-13	51	256	512	129	194	52	258	516	140	209
26,000	-13	-17	---	---	---	---	---	47	238	476	124	193
28,000	---	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---	---

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Figure 7-32. Maximum Cruise Power 1900 RPM, ISA +20°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +20 °C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	40	35	99	527	1054	225	230	100	527	1054	226	231
2000	36	31	97	505	1010	221	232	97	505	1010	222	234
4000	32	27	95	483	966	217	235	95	483	966	218	236
6000	28	23	92	461	922	212	236	92	461	922	213	238
8000	24	19	88	438	876	207	237	89	438	876	208	239
10,000	20	15	85	415	830	201	238	85	415	830	203	240
12,000	16	11	80	391	782	195	238	81	392	784	196	240
14,000	12	7	76	367	734	188	237	76	367	734	190	239
16,000	8	3	71	343	686	180	235	71	344	688	183	238
18,000	4	-1	66	321	642	173	233	67	322	644	175	236
20,000	0	-5	61	299	598	164	228	62	300	600	167	233
22,000	-4	-9	57	279	558	156	224	57	280	560	159	229
24,000	-8	-13	53	260	520	146	218	53	261	522	151	225
26,000	-12	-17	48	240	480	134	209	49	242	484	141	219
28,000	-17	-22	43	221	442	119	193	44	223	446	130	210
29,000	-19	-22	---	---	---	---	---	42	214	428	123	203
31,000	-23	-26	---	---	---	---	---	38	196	392	102	178

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Figure 7-32. Maximum Cruise Power 1900 RPM, ISA +20°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +30 °C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	50	45	89	496	992	212	221	89	496	992	214	222
2000	46	41	87	476	952	209	223	87	476	952	210	224
4000	42	37	86	456	912	204	225	86	456	912	206	227
6000	38	33	83	435	870	200	227	84	436	872	202	229
8000	34	29	80	413	826	194	227	80	413	826	196	230
10,000	30	25	77	390	780	189	227	77	391	782	191	230
12,000	26	21	73	367	734	182	226	73	368	736	184	229
14,000	22	17	68	344	688	174	223	69	344	688	177	227
16,000	18	13	64	321	642	165	219	64	322	644	169	224
18,000	14	9	60	300	600	156	214	60	301	602	161	220
20,000	9	5	55	279	558	145	206	56	281	562	152	215
22,000	5	1	51	259	518	130	193	51	261	522	140	207
24,000	1	-3	---	---	---	---	---	47	241	482	125	192
26,000	---	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---	---

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Figure 7-33. Maximum Cruise Power 1900 RPM, ISA +30°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +30 °C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	50	45	89	496	992	215	223	90	497	994	216	225
2000	46	41	88	476	952	211	226	88	476	952	213	227
4000	42	37	86	456	912	208	228	86	457	914	209	230
6000	38	33	84	436	872	203	231	84	436	872	205	232
8000	34	29	81	414	828	198	232	81	414	828	200	233
10,000	30	25	78	391	782	193	332	78	392	784	195	235
12,000	26	21	73	368	736	186	232	74	369	738	188	234
14,000	22	17	69	345	690	179	230	69	346	692	182	233
16,000	18	13	65	323	646	172	228	65	324	648	175	232
18,000	14	9	61	302	604	164	225	61	302	604	167	229
20,000	10	5	56	282	564	156	222	57	283	566	160	227
22,000	6	1	52	263	526	147	216	52	264	528	151	222
24,000	1	-3	47	243	486	135	207	48	245	490	142	216
26,000	-3	-7	43	224	448	120	192	44	226	452	131	209
28,000	-7	-10	---	---	---	---	---	40	210	420	118	195
29,000	---	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---	---

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Figure 7-33. Maximum Cruise Power 1900 RPM, ISA +30°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +37 °C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	56	52	82	476	952	205	215	83	476	952	207	217
2000	52	48	81	457	914	201	217	81	457	914	203	219
4000	49	44	80	438	876	198	220	80	438	876	199	222
6000	45	40	78	418	836	193	222	78	418	836	195	224
8000	41	36	75	397	794	188	222	75	397	794	190	225
10,000	37	32	72	376	752	182	222	72	376	752	185	225
12,000	33	28	68	353	706	175	220	69	353	706	178	224
14,000	29	24	64	330	660	167	217	64	330	660	170	222
16,000	24	20	60	307	614	158	212	60	308	616	162	218
18,000	20	16	55	286	572	148	205	56	287	574	153	213
20,000	16	12	51	266	532	135	195	52	268	536	143	207
22,000	11	8	46	246	492	101	155	48	249	498	131	196
24,000	---	----	---	---	---	---	---	---	---	---	---	---
26,000	---	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---	---

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Figure 7-34. Maximum Cruise Power 1900 RPM, ISA +37°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA +37 °C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	56	52	83	477	954	208	219	83	477	954	210	220
2000	53	48	81	457	914	205	221	81	457	914	206	223
4000	49	44	80	438	876	201	224	80	438	876	202	225
6000	45	40	78	419	838	197	226	78	419	838	199	227
8000	41	36	75	398	796	192	227	76	398	796	194	229
10,000	37	32	73	377	754	187	228	73	377	754	189	230
12,000	33	28	68	354	708	181	227	69	354	708	183	230
14,000	29	24	65	331	662	173	225	65	332	664	176	229
16,000	25	20	61	309	618	166	223	61	310	620	169	227
18,000	21	16	56	288	576	158	219	57	289	578	161	224
20,000	17	12	52	269	538	149	215	53	270	540	154	221
22,000	12	8	48	251	502	139	208	49	252	504	145	216
24,000	8	4	44	232	464	126	197	45	234	468	135	209
26,000	3	-1	40	214	428	107	174	41	216	432	123	199
28,000	0	-3	---	---	---	---	---	37	200	400	105	179
29,000	---	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---	---

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Figure 7-34. Maximum Cruise Power 1900 RPM, ISA +37°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER

1900 RPM

WEIGHT: 12,000 LBS

NOTE: ISA DEVIATION LINES REFLECT ACTUAL TEMPERATURES FOR FLIGHT PLANNING. INDICATED TEMPERATURES SHOULD BE USED FOR IN-FLIGHT CRUISE POWER SETTINGS.

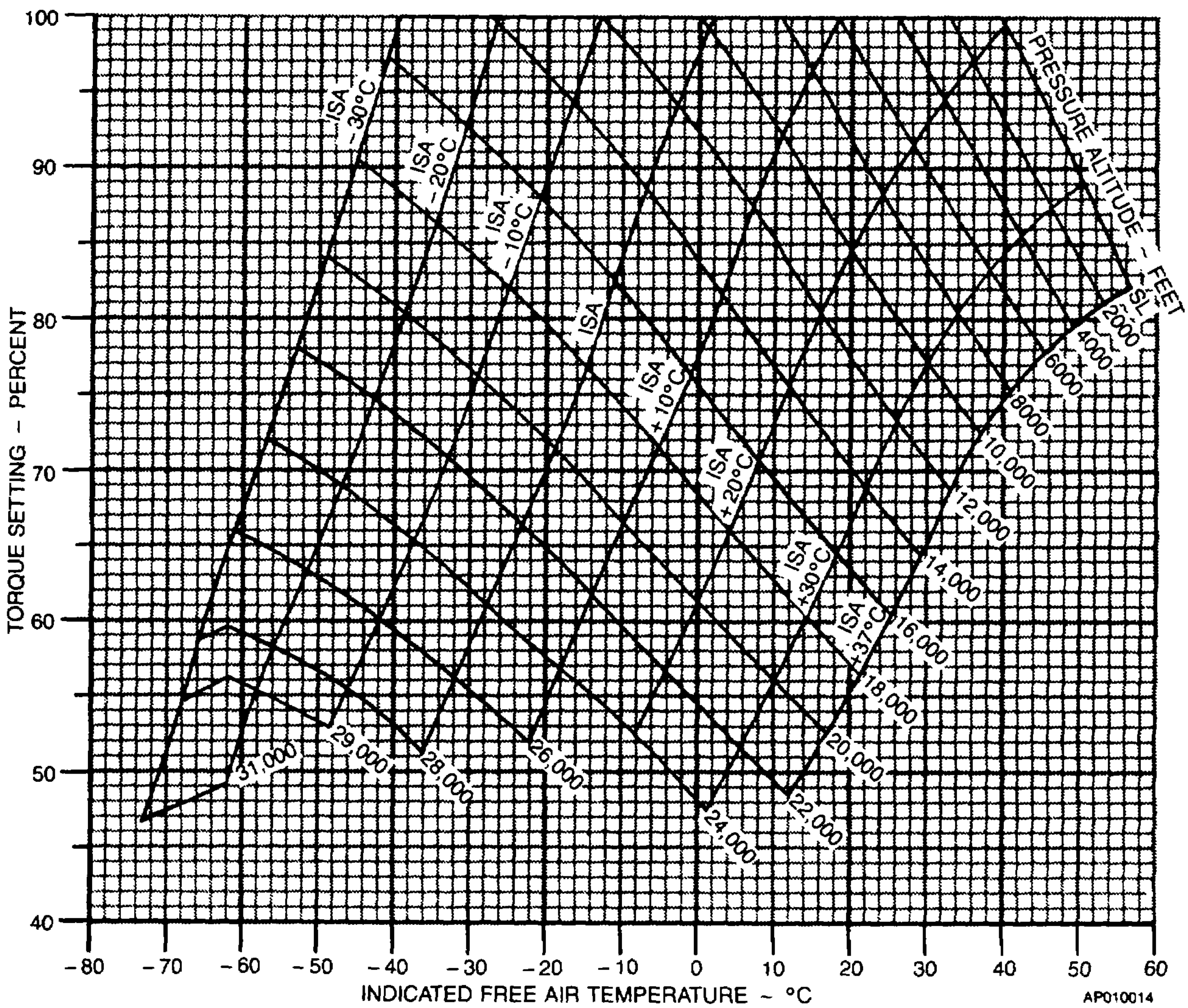

Figure 7-35. Maximum Cruise Speeds @ 1900 RPM

MAXIMUM CRUISE SPEEDS

1900 RPM

WEIGHT: 12,000 LBS

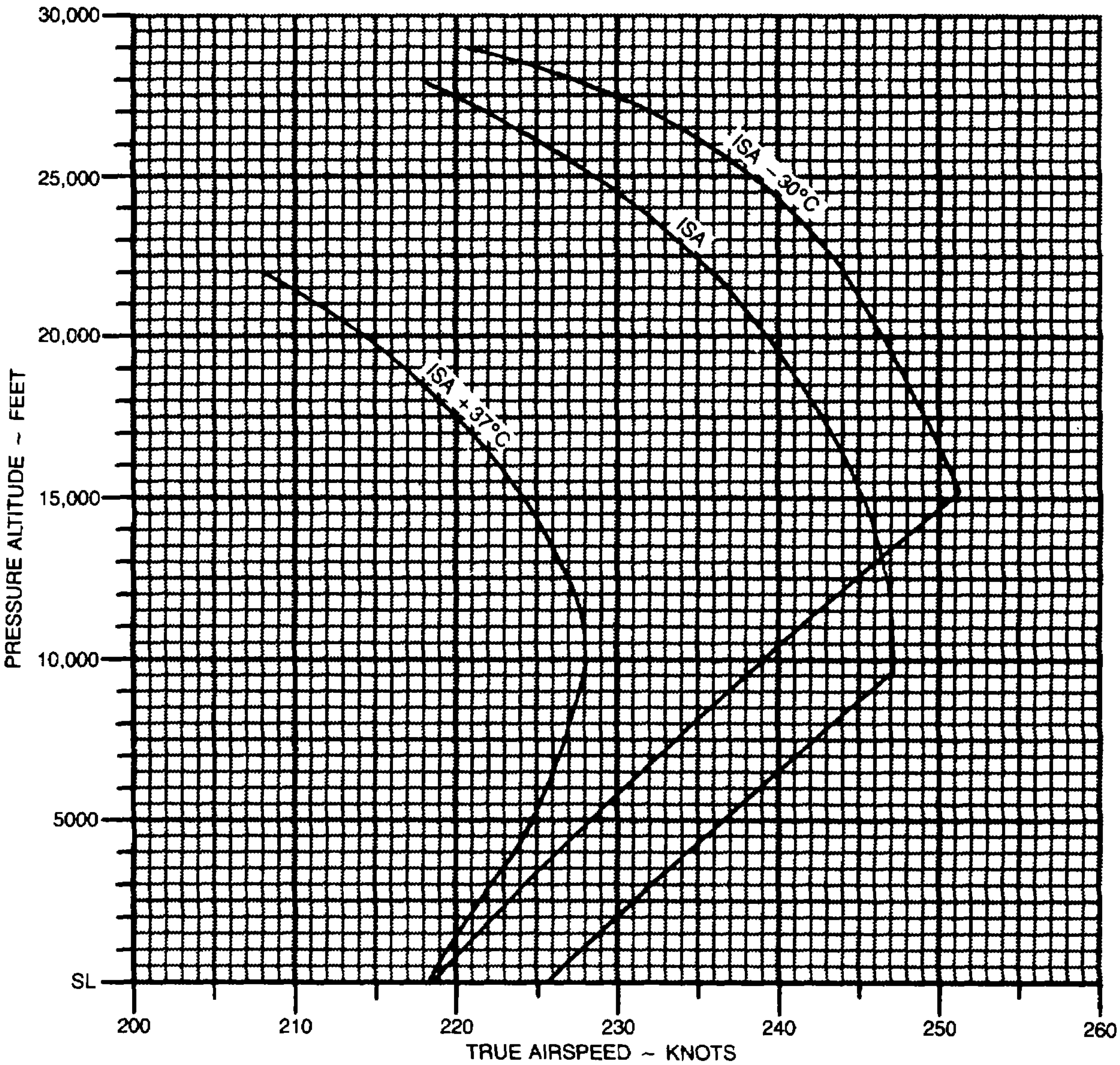

Figure 7-36. Maximum Cruise Power @ 1900 RPM

FUEL FLOW AT MAXIMUM CRUISE POWER

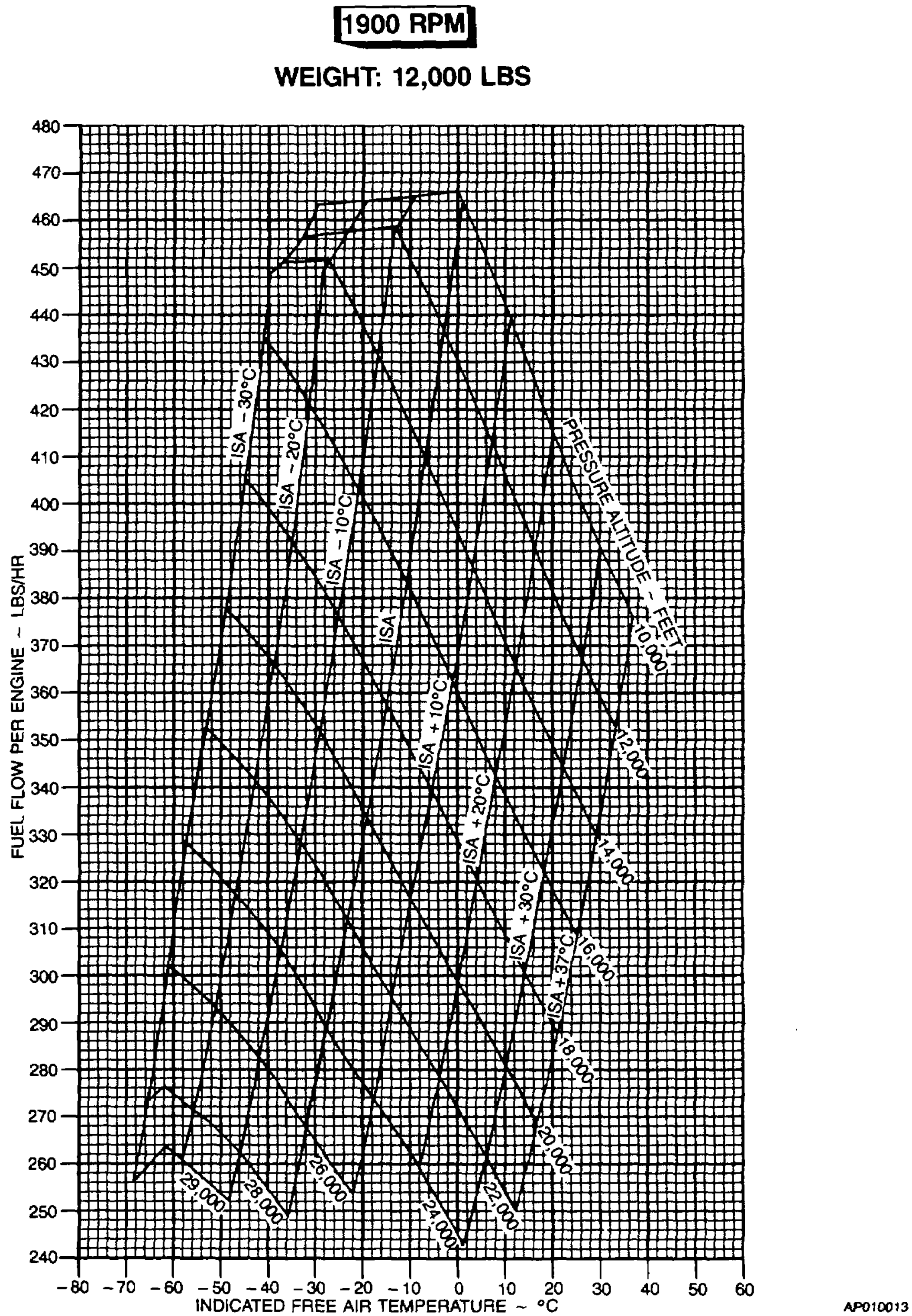

Figure 7-37. Fuel Flow at Maximum Cruise Power @ 1900 RPM

ONE-ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-13	-15	100	528	528	172	161	100	528	528	175	163
2000	-16	-19	100	516	516	170	163	100	515	515	172	166
4000	-20	-23	100	503	503	167	165	100	503	503	170	168
6000	-24	-27	100	492	492	164	167	100	491	491	167	170
8000	-28	-31	100	482	482	161	169	100	481	481	165	172
10,000	-32	-35	100	473	473	158	171	100	472	472	162	175
12,000	-36	-39	100	466	466	155	172	100	466	466	159	177
14,000	-40	-43	95	442	442	147	168	95	443	443	152	175
16,000	-44	-47	88	411	411	134	159	89	413	413	143	169
18,000	-48	-51	—	—	—	—	—	82	384	384	130	160
20,000	---	---	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00264 - RC-12D

Figure 7-38. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA -30°C (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-13	-15	100	528	528	177	165	100	528	528	179	167
2000	-16	-19	100	515	515	175	168	100	515	515	177	170
4000	-20	-23	100	502	502	173	170	100	502	502	175	173
6000	-24	-27	100	491	491	170	173	100	491	491	173	175
8000	-28	-31	100	481	481	168	176	100	481	481	170	178
10,000	-32	-35	100	472	472	165	178	100	472	472	168	181
12,000	-36	-39	100	466	466	163	181	100	465	465	166	184
14,000	-40	-43	96	444	444	157	180	96	445	445	160	183
16,000	-44	-47	89	414	414	148	175	90	415	415	153	180
18,000	-48	-51	83	385	385	139	170	83	387	387	144	176
20,000	-52	-55	77	358	358	127	161	77	360	360	135	171
22,000	-56	-59	—	—	—	—	—	71	334	334	124	163
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00265 - RC-12D

Figure 7-38. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA -30°C (Sheet 2 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-2	-5	100	531	531	170	162	100	530	530	173	165
2000	-6	-9	100	517	517	168	164	100	517	517	171	167
4000	-10	-13	100	504	504	165	166	100	504	504	168	169
6000	-14	-17	100	493	493	162	168	100	493	493	166	172
8000	-18	-21	100	484	484	159	170	100	483	483	163	174
10,000	-22	-25	100	474	474	156	172	100	473	473	160	176
12,000	-26	-29	98	458	458	150	171	98	459	459	155	176
14,000	-30	-33	91	427	427	139	163	91	428	428	146	171
16,000	-34	-37	---	—	—	—	—	85	399	399	135	164
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00266 - RC-12D

Figure 7-39. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA -20°C (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-2	-5	100	530	530	175	167	100	530	530	177	169
2000	-6	-9	100	517	517	173	170	100	516	516	175	172
4000	-10	-13	100	504	504	171	172	100	504	504	173	174
6000	-14	-17	100	493	493	168	175	100	493	493	171	177
8000	-18	-21	100	483	483	166	177	100	483	483	169	180
10,000	-22	-25	100	473	473	164	180	100	473	473	166	183
12,000	-26	-29	98	459	459	159	181	99	460	460	163	184
14,000	-30	-33	92	429	429	151	177	92	430	430	155	182
16,000	-34	-37	85	400	400	142	172	86	401	401	147	178
18,000	-38	-41	80	372	372	132	165	79	374	374	139	173
20,000	-42	-45	—	—	—	—	—	74	348	348	129	167
22,000	-46	-49	—	—	—	—	—	68	324	324	116	157
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00267 - RC-12D

Figure 7-39. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA -20°C (Sheet 2 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	8	5	100	532	532	169	163	100	532	532	172	166
2000	4	1	100	518	518	166	166	100	518	518	169	169
4000	-0	-3	100	506	506	163	168	100	505	505	167	171
6000	-4	-7	100	495	495	160	169	100	495	495	164	173
8000	-8	-11	100	485	485	157	171	100	484	484	161	175
10,000	-12	-15	99	471	471	153	172	99	472	472	158	177
12,000	-16	-19	93	440	440	143	165	93	441	441	149	173
14,000	-20	-23	86	410	410	129	155	87	412	412	139	167
16,000	-24	-27	—	—	—	—	—	81	384	384	126	157
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00268 - RC-12D

Figure 7-40. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA - -10°C (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -10 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	8	5	100	531	531	174	169	100	531	531	176	171
2000	4	1	100	518	518	172	171	100	517	517	174	173
4000	-0	-3	100	505	505	169	174	100	505	505	172	176
6000	-4	-7	100	494	494	167	176	100	494	494	169	179
8000	-8	-11	100	484	484	164	179	100	484	484	167	182
10,000	-12	-15	100	472	472	161	181	100	473	473	164	184
12,000	-16	-19	93	442	442	154	178	94	442	442	157	182
14,000	-20	-23	87	413	413	145	174	88	413	413	150	179
16,000	-24	-27	81	385	385	136	168	82	386	386	142	175
18,000	-28	-31	75	359	359	123	159	76	360	360	133	170
20,000	-32	-35	—	—	—	—	—	70	335	335	121	161
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00269 - RC-12D

Figure 7-40. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA -10°C (Sheet 2 of 2)

ONE-ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	18	15	100	534	534	167	165	100	534	534	170	168
2000	14	11	100	520	520	164	167	100	520	520	167	170
4000	10	7	100	507	507	161	169	100	507	507	165	172
6000	6	3	100	495	495	158	171	100	495	495	162	175
8000	2	-1	97	474	474	152	169	97	475	475	157	174
10,000	-2	-5	92	446	446	143	164	92	447	447	149	171
12,000	-6	-9	86	418	418	131	156	87	420	420	140	166
14,000	-10	-13	—	—	—	—	—	81	393	393	129	158
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00270 - RC-12D

Figure 7-41. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	18	15	100	533	533	173	170	100	533	533	175	172
2000	14	11	100	520	520	170	173	100	519	519	172	175
4000	10	7	100	506	506	168	175	100	506	506	170	178
6000	6	3	100	495	495	165	178	100	495	495	168	181
8000	2	-1	97	475	475	161	178	98	476	476	164	182
10,000	-2	-5	92	448	448	154	176	93	449	449	158	180
12,000	-6	-9	87	421	421	146	173	87	422	422	151	178
14,000	-10	-13	82	394	394	138	168	82	395	395	143	175
16,000	-14	-17	76	368	368	126	160	77	369	369	135	170
18,000	-18	-21	—	—	—	—	—	71	343	343	124	163
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00271 - RC-12D

Figure 7-41. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA (Sheet 2 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	28	25	100	537	537	165	166	100	536	536	169	169
2000	24	21	100	522	522	163	168	100	522	522	166	171
4000	20	17	98	500	500	157	167	98	500	500	161	172
6000	16	13	94	475	475	151	165	94	476	476	156	171
8000	12	9	90	450	450	143	161	90	451	451	149	168
10,000	8	5	85	424	425	132	155	86	425	425	141	164
12,000	4	1	---	—	—	—	—	81	398	398	130	157
14,000	—	—	—	—	—	---	---	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00272 - RC-12D

Figure 7-42. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA + 10°C (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +10 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	28	25	100	536	536	171	172	100	536	536	173	174
2000	24	21	100	522	522	169	174	100	521	521	171	177
4000	20	17	98	500	500	165	175	98	501	501	167	178
6000	16	13	94	476	476	159	175	95	477	477	162	178
8000	12	9	90	451	451	153	173	91	451	451	157	177
10,000	8	5	86	426	426	147	171	86	426	426	151	176
12,000	4	1	81	399	399	138	167	81	400	400	144	173
14,000	0	-3	75	373	373	127	159	76	374	374	135	169
16,000	-4	-7	—	—	—	—	—	71	349	349	125	162
18,000	-9	-11	—	—	—	—	—	66	326	326	112	151
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00273 - RC-12D

Figure 7-42. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA + 10° C (Sheet 2 of 2)

ONE-ENGINE INOPERATIVE
MAXIMUM CRUISE POWER

ISA +20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	38	35	94	518	518	158	161	94	518	518	162	165
2000	34	31	92	496	496	153	161	92	497	497	158	166
4000	30	27	89	475	475	148	160	90	475	475	153	165
6000	26	23	86	451	451	140	157	87	452	452	147	164
8000	22	19	82	426	426	129	149	83	427	427	139	160
10,000	17	15	—	—	—	—	—	79	402	402	129	154
12,000	—	—	—	—	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00274 - RC-12D

Figure 7-43. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA +20°C (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	38	35	94	518	518	165	168	94	519	519	168	171
2000	34	31	92	497	497	161	169	92	497	497	164	172
4000	30	27	90	475	475	157	170	90	476	476	160	173
6000	26	23	87	452	452	151	169	87	452	452	155	173
8000	22	19	83	427	427	145	167	83	428	428	149	172
10,000	18	15	79	403	403	138	164	79	403	403	143	170
12,000	14	11	74	377	377	128	158	75	378	378	135	166
14,000	10	7	—	—	—	—	—	70	354	354	126	161
16,000	5	3	—	—	—	—	—	66	331	331	114	151
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00275 - RC-12D

Figure 7-43. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA +20°C (Sheet 2 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	47	45	84	488	488	146	152	84	488	488	152	157
2000	43	41	83	468	468	141	151	83	469	469	147	157
4000	40	37	81	449	449	135	149	81	449	449	143	157
6000	36	33	78	427	427	124	142	79	428	428	136	155
8000	31	29	—	—	—	—	—	75	404	404	126	148
10,000	—	—	—	—	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00276 - RC-12D

Figure 7-44. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA +30°C (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	47	45	85	489	489	156	161	85	489	489	159	165
2000	43	41	83	469	469	152	162	83	469	469	155	166
4000	40	37	82	450	450	148	163	82	450	450	152	167
6000	36	33	79	429	429	142	162	79	429	429	147	167
8000	31	29	76	405	405	135	159	76	406	406	141	165
10,000	27	25	72	381	381	127	154	73	382	382	134	163
12,000	24	21	—	—	—	—	—	68	358	358	125	157
14,000	19	17	—	—	—	—	—	64	334	334	113	148
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00277 - RC-12D

Figure 7-44. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA +30°C (Sheet 2 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +37 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	54	52	78	468	468	136	143	78	468	468	144	151
2000	50	48	76	449	449	130	141	77	450	450	139	150
4000	46	44	---	—	—	—	—	76	432	432	134	149
6000	42	40	—	—	—	—	—	73	411	411	126	145
8000	—	—	—	—	—	—	—	—	—	—	—	—
10,000	—	—	—	—	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00278 - RC-12D

Figure 7-45. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA +37°C (Sheet 1 of 2)

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +37 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	IAS KTS	TAS KTS	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	IAS KTS	TAS KTS
SL	54	52	78	469	469	149	156	79	469	469	152	160
2000	50	48	77	450	450	145	156	77	451	451	149	161
4000	46	44	76	432	432	141	157	76	432	432	145	162
6000	42	40	74	412	412	135	155	74	412	412	141	162
8000	38	36	71	390	390	127	151	71	390	390	134	160
10,000	34	32	67	367	367	116	143	68	368	368	127	157
12,000	30	28	—	—	—	—	—	64	344	344	117	149
14,000	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00279 - RC-12D

Figure 7-45. Maximum Cruise Power One-Engine Inoperative 1900 RPM, ISA +37°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA -30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-11	-15	100	478	956	222	207	100	478	956	223	208
2000	-15	-19	100	465	930	219	211	100	465	930	220	212
4000	-19	-23	100	453	906	217	214	100	453	906	218	216
6000	-23	-27	100	442	884	214	218	100	442	884	216	219
8000	-26	-31	100	433	866	212	222	100	433	866	214	224
10,000	-30	-35	100	424	848	210	226	100	424	848	211	227
12,000	-34	-39	100	417	834	207	230	100	417	834	209	232
14,000	-38	-43	100	412	824	205	234	100	411	822	207	236
16,000	-41	-47	100	408	816	203	239	100	407	814	205	241
18,000	-45	-51	100	404	808	201	244	100	404	808	202	246
20,000	-49	-55	93	377	754	192	240	93	378	756	194	243
22,000	-53	-59	86	352	704	183	237	87	353	706	186	240
24,000	-58	-63	79	326	652	173	231	80	327	654	176	236
26,000	-62	-67	72	298	596	161	222	73	301	602	166	229
28,000	-67	-70	63	266	532	144	206	64	270	540	152	217
29,000	-68	-72	58	249	498	132	194	60	253	506	143	208
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00632 - RC-12D

Figure 7-46. Maximum Cruise Power 1700 RPM, ISA -30°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA -30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-11	-15	100	477	954	224	209	100	477	954	225	210
2000	-15	-19	100	465	930	221	213	100	452	904	222	214
4000	-19	-23	100	453	906	219	217	100	452	904	220	218
6000	-22	-27	100	442	884	217	221	100	442	884	218	222
8000	-26	-31	100	433	866	215	225	100	432	864	216	226
10,000	-30	-35	100	424	848	212	229	100	423	846	214	230
12,000	-34	-39	100	417	834	210	233	100	416	832	211	235
14,000	-38	-43	100	411	822	208	238	100	411	822	209	239
16,000	-41	-47	100	407	814	206	243	100	407	814	208	245
18,000	-45	-51	100	404	808	204	248	100	403	806	205	249
20,000	-49	-55	94	379	758	196	246	94	379	758	198	248
22,000	-53	-59	87	354	708	188	244	87	354	708	191	246
24,000	-57	-63	80	329	658	180	240	81	330	660	182	243
26,000	-61	-67	73	302	604	170	234	74	304	608	173	239
28,000	-66	-70	65	272	544	157	225	66	274	548	162	231
29,000	-68	-72	61	257	514	150	218	62	259	518	155	226
31,000	-73	-76	52	225	450	132	201	54	229	458	141	213

BT00633 - RC-12D

Figure 7-46. Maximum Cruise Power 1700 RPM, ISA -30°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA -20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-1	-5	100	481	962	220	210	100	481	962	221	211
2000	-5	-9	100	468	936	218	213	100	468	936	219	215
4000	-9	-13	100	456	912	215	217	100	456	912	217	218
6000	-12	-17	100	445	890	213	221	100	445	890	214	222
8000	-16	-21	100	435	870	210	225	100	435	870	212	226
10,000	-20	-25	100	426	852	208	229	100	426	852	209	230
12,000	-24	-29	100	418	836	205	233	100	418	836	207	234
14,000	-28	-33	100	413	826	203	237	100	413	826	205	239
16,000	-31	-37	100	410	820	201	242	100	410	820	203	244
18,000	-35	-41	96	391	782	195	242	96	392	784	197	245
20,000	-39	-45	89	364	728	186	238	89	365	730	189	242
22,000	-44	-49	82	340	680	177	234	83	341	682	180	238
24,000	-48	-53	76	315	630	166	228	76	316	632	170	233
26,000	-52	-57	69	290	580	154	219	70	292	584	160	227
28,000	-57	-60	63	267	534	140	206	64	270	540	148	218
29,000	-59	-62	59	255	510	130	196	61	258	516	141	212
31,000	-63	-66	—	—	—	—	—	53	231	462	120	188

BT00634 - RC-12D

Figure 7-47. Maximum Cruise Power 1700 RPM, ISA -20°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA -20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-1	-5	100	481	962	222	212	100	480	960	223	213
2000	-5	-9	100	468	936	220	216	100	468	936	221	217
4000	-8	-13	100	455	910	218	220	100	455	910	219	221
6000	-12	-17	100	445	890	215	223	100	444	888	216	225
8000	-16	-21	100	435	870	213	227	100	435	870	214	229
10,000	-20	-25	100	426	852	211	232	100	425	850	212	233
12,000	-24	-29	100	418	836	208	236	100	418	836	210	238
14,000	-27	-33	100	413	826	207	241	100	413	826	208	243
16,000	-31	-37	100	409	818	205	246	100	409	818	206	248
18,000	-35	-41	96	393	786	199	247	97	393	786	201	249
20,000	-39	-45	90	366	732	191	245	90	367	734	193	248
22,000	-43	-49	83	342	684	183	232	84	343	686	185	245
24,000	-47	-53	77	317	634	174	238	77	318	636	177	242
26,000	-51	-57	71	294	588	164	233	71	295	590	168	238
28,000	-56	-60	65	272	544	154	226	65	273	546	159	233
29,000	-58	-62	62	261	522	149	222	62	263	526	154	230
31,000	-63	-66	55	235	470	133	206	56	238	476	142	220

BT00635 - RC-12D

Figure 7-47. Maximum Cruise Power 1700 RPM, ISA -20°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA -10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	9	5	100	483	966	218	212	100	482	964	220	213
2000	5	1	100	470	940	216	216	100	469	938	217	217
4000	2	-3	100	458	916	213	219	100	458	916	215	221
6000	-2	-7	100	447	894	211	223	100	447	894	212	225
8000	-6	-11	100	437	874	208	227	100	437	874	210	229
10,000	-10	-15	100	428	856	206	231	100	428	856	208	233
12,000	-14	-19	100	421	842	204	236	100	421	842	206	238
14,000	-17	-23	100	416	832	202	240	100	415	830	203	242
16,000	-21	-27	97	402	804	197	242	98	403	806	199	245
18,000	-25	-31	91	376	752	188	239	91	377	754	191	242
20,000	-30	-35	84	350	700	179	235	85	351	702	183	239
22,000	-34	-39	78	327	654	170	230	79	328	656	174	235
24,000	-38	-43	72	303	606	159	223	73	304	608	164	230
26,000	-42	-47	66	280	560	146	213	66	282	564	153	222
28,000	-47	-50	59	258	516	130	196	61	260	520	141	212
29,000	-49	-52	—	—	—	—	—	58	250	500	133	205
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00636 - RC-12D

Figure 7-48. Maximum Cruise Power 1700 RPM, ISA - 10°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA -10°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	9	5	100	482	964	221	214	100	482	964	222	215
2000	5	1	100	469	938	218	218	100	469	938	219	219
4000	2	-3	100	457	914	216	222	100	457	914	217	223
6000	-2	-7	100	447	894	214	226	100	447	894	215	227
8000	-6	-11	100	437	874	211	230	100	437	874	212	231
10,000	-10	-15	100	428	856	209	235	100	427	854	210	236
12,000	-13	-19	100	421	842	207	239	100	420	840	208	241
14,000	-17	-23	100	415	830	205	244	100	415	830	206	246
16,000	-21	-27	98	404	808	201	247	98	405	810	203	249
18,000	-25	-31	91	377	754	193	245	92	378	756	195	248
20,000	-29	-35	85	352	704	185	243	85	353	706	188	246
22,000	-33	-39	79	329	658	177	240	79	330	660	180	243
24,000	-37	-43	73	306	612	168	235	73	307	614	171	240
26,000	-42	-47	67	283	566	158	230	68	285	570	162	235
28,000	-46	-50	62	262	524	148	222	62	264	528	153	230
29,000	-48	-52	59	252	504	142	218	59	254	508	148	226
31,000	-53	-56	53	232	464	127	204	54	234	468	137	218

BT00637 - RC-12D

Figure 7-48. Maximum Cruise Power 1700 RPM, ISA - 10°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	19	15	100	485	970	217	214	100	485	970	218	215
2000	15	11	100	472	944	214	218	100	472	944	215	219
4000	12	7	100	459	918	212	222	100	459	918	213	223
6000	8	3	100	448	896	209	226	100	448	896	211	227
8000	4	-1	100	439	878	207	230	100	439	878	208	231
10,000	0	-5	100	431	862	205	234	100	430	860	206	236
12,000	-4	-9	100	423	846	202	238	100	423	846	204	240
14,000	-7	-13	98	409	818	198	241	98	410	820	200	243
16,000	-11	-17	91	382	764	190	238	92	383	766	192	241
18,000	-16	-21	85	356	712	181	234	85	357	714	184	238
20,000	-20	-25	79	332	664	171	229	79	333	666	175	234
22,000	-24	-29	73	309	618	161	223	73	311	622	166	230
24,000	-28	-33	67	286	572	149	214	67	288	576	156	223
26,000	-33	-37	60	263	526	134	199	62	266	532	143	213
28,000	-37	-40	—	—	—	—	—	56	245	490	128	199
29,000	-39	-42	—	—	—	—	—	53	236	472	118	187
31,000	—	—	—	—	—	—	—	—	—	—	—	—

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Figure 7-49. Maximum Cruise Power 1700 RPM, ISA (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	19	15	100	485	970	219	216	100	485	970	220	217
2000	16	11	100	472	944	217	220	100	472	944	218	221
4000	12	7	100	459	918	215	224	100	459	918	216	226
6000	8	3	100	448	896	212	229	100	448	896	213	230
8000	4	-1	100	439	878	210	233	100	439	878	211	234
10,000	0	-5	100	430	860	208	237	100	430	860	209	239
12,000	-3	-9	100	422	844	206	242	100	422	844	207	244
14,000	-7	-13	98	410	820	202	246	99	411	822	204	248
16,000	-11	-17	92	384	768	194	244	92	384	768	196	246
18,000	-15	-21	86	358	716	186	241	86	359	718	189	244
20,000	-19	-25	80	334	668	178	238	80	335	670	181	242
22,000	-23	-29	74	312	624	170	235	74	313	626	173	239
24,000	-28	-33	68	290	580	160	229	69	291	582	164	235
26,000	-32	-37	62	268	536	150	223	63	270	540	155	230
28,000	-36	-40	57	248	496	138	213	58	250	500	145	223
29,000	-38	-42	54	238	476	132	207	55	241	482	140	219
31,000	-43	-46	49	219	438	113	186	50	222	444	127	208

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Figure 7-49. Maximum Cruise Power 1700 RPM, ISA (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	29	25	100	488	976	215	216	100	488	976	217	218
2000	26	21	100	475	950	213	220	100	475	950	214	221
4000	22	17	100	462	924	210	224	100	462	924	212	225
6000	18	13	100	451	902	208	228	100	451	902	209	229
8000	14	9	100	441	882	205	232	100	440	880	207	234
10,000	10	5	100	431	862	203	236	100	431	862	205	238
12,000	6	1	97	413	826	198	238	97	414	828	200	240
14,000	2	-3	91	387	774	190	235	91	387	774	192	238
16,000	-2	-7	85	361	722	181	232	85	362	724	184	235
18,000	-6	-11	79	338	676	173	228	79	339	678	176	233
20,000	-10	-15	73	315	630	163	223	74	316	632	167	229
22,000	-14	-19	68	293	586	152	215	68	294	588	158	223
24,000	-19	-23	62	270	540	138	203	63	272	544	146	215
26,000	-23	-27	—	—	—	—	—	57	250	500	132	201
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—
BT00640 - RC-12D												

Figure 7-50. Maximum Cruise Power 1700 RPM, ISA ± 10°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +10 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	29	25	100	488	976	218	219	100	487	974	219	220
2000	26	21	100	475	950	215	223	100	474	948	216	224
4000	22	17	100	462	924	213	227	100	474	924	214	228
6000	18	13	100	450	900	211	231	100	450	900	212	232
8000	14	9	100	440	880	208	235	100	440	880	210	237
10,000	11	5	100	430	860	206	240	100	430	860	208	242
12,000	7	1	98	414	828	202	243	98	415	830	204	244
14,000	3	-3	91	388	776	194	241	91	389	778	196	243
16,000	-1	-7	85	363	726	187	239	86	364	728	189	241
18,000	-5	-11	80	340	680	179	236	80	340	680	182	240
20,000	-10	-15	74	317	634	171	233	75	318	636	174	237
22,000	-14	-19	69	296	592	162	229	70	297	594	166	234
24,000	-18	-23	63	274	548	152	223	64	275	550	157	229
26,000	-22	-27	58	253	506	141	214	58	255	510	147	223
28,000	-27	-30	52	233	466	127	201	53	236	472	136	215
29,000	-29	-32	50	224	448	119	192	51	227	454	130	209
31,000	—	—	—	—	—	—	—	46	208	416	115	194

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Figure 7-50. Maximum Cruise Power 1700 RPM, ISA + 10°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	39	35	100	491	982	214	218	100	491	982	215	220
2000	36	31	100	478	956	211	222	100	478	956	213	224
4000	32	27	100	465	930	209	226	100	464	928	210	228
6000	28	23	100	453	906	206	230	100	452	904	208	232
8000	24	19	98	437	874	202	232	98	437	874	204	235
10,000	20	15	94	414	828	196	233	94	414	828	198	235
12,000	16	11	89	389	778	189	231	89	390	780	192	234
14,000	12	7	84	365	730	181	229	84	366	732	184	232
16,000	8	3	78	341	682	173	226	79	342	684	176	230
18,000	4	-1	73	319	638	164	221	74	320	640	168	226
20,000	0	-5	67	296	592	153	213	68	297	594	158	220
22,000	-5	-9	62	275	550	140	203	63	277	554	148	214
24,000	-9	-13	56	255	510	123	185	57	257	514	136	203
26,000	-13	-17	—	—	—	—	—	52	237	474	118	184
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

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Figure 7-51. Maximum Cruise Power 1700 RPM, ISA +20°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	40	35	100	491	982	216	221	100	490	980	217	222
2000	36	31	100	477	954	214	225	100	477	954	215	226
4000	32	27	100	464	928	211	229	100	464	928	213	230
6000	28	23	100	452	904	209	233	100	452	904	210	235
8000	24	19	99	438	876	206	237	99	438	876	207	238
10,000	20	15	95	415	830	200	237	95	415	830	202	239
12,000	16	11	90	391	782	194	237	90	391	782	196	239
14,000	12	7	84	366	732	187	235	85	367	734	189	238
16,000	8	3	79	343	686	179	233	80	344	688	182	237
18,000	4	-1	74	321	642	171	231	74	321	642	174	235
20,000	0	-5	68	298	596	162	226	69	299	598	166	231
22,000	-4	-9	63	279	558	153	221	64	280	560	158	227
24,000	-8	-13	58	259	518	143	215	59	260	520	149	222
26,000	-13	-17	53	239	478	131	204	54	241	482	139	215
28,000	-17	-20	48	220	440	113	185	49	222	444	127	205
29,000	-19	-22	—	—	—	—	—	47	213	426	119	197
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00643 - RC-12D

Figure 7-51. Maximum Cruise Power 1700 RPM, ISA +20°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	49	45	100	494	988	212	220	100	494	988	213	222
2000	46	41	98	476	952	208	222	99	476	952	210	224
4000	42	37	96	456	912	204	224	96	456	912	206	226
6000	38	33	94	435	870	199	226	94	435	870	201	228
8000	34	29	90	413	826	193	226	90	413	826	195	228
10,000	30	25	86	390	780	187	226	86	391	782	190	229
12,000	26	21	87	366	732	180	224	82	367	734	183	227
14,000	22	17	76	343	686	172	221	77	344	688	175	225
16,000	18	13	71	321	642	163	217	72	322	644	167	222
18,000	13	9	66	299	598	153	211	67	300	600	159	218
20,000	9	5	61	278	556	142	202	62	280	560	149	212
22,000	5	1	56	259	518	126	186	57	260	520	137	202
24,000	1	-3	—	—	—	—	—	52	241	482	120	185
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

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Figure 7-52. Maximum Cruise Power 1700 RPM, ISA +30°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	50	45	100	494	988	215	223	100	493	986	216	224
2000	46	41	99	476	952	211	226	99	476	952	212	227
4000	42	37	97	456	912	207	228	97	457	914	208	229
6000	38	33	94	436	872	203	230	94	436	872	204	231
8000	34	29	90	413	826	197	231	90	414	828	199	233
10,000	30	25	87	391	782	192	231	87	391	782	194	233
12,000	26	21	82	368	736	185	230	82	368	736	187	233
14,000	22	17	77	345	690	178	229	77	345	690	180	232
16,000	18	13	72	323	646	171	226	73	323	646	173	230
18,000	14	9	67	301	602	163	223	68	302	604	166	228
20,000	10	5	63	281	562	154	219	63	282	564	158	225
22,000	6	1	58	262	524	144	212	58	263	526	150	220
24,000	1	-3	53	242	484	132	202	53	244	488	139	213
26,000	-3	-7	48	224	448	116	186	49	226	452	128	203
28,000	-7	-10	—	—	—	—	—	45	209	418	114	189
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—					

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Figure 7-52. Maximum Cruise Power 1700 RPM, ISA +30°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +37 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	56	52	93	476	952	206	216	94	476	952	207	217
2000	52	48	91	457	914	201	218	92	457	914	203	219
4000	49	44	90	438	876	197	220	90	438	876	199	222
6000	45	40	87	418	836	193	221	87	418	836	195	223
8000	41	36	84	397	794	187	221	84	397	794	189	224
10,000	37	32	81	376	752	181	221	81	376	752	184	224
12,000	33	28	76	352	704	174	219	77	353	706	177	223
14,000	29	24	71	329	658	165	215	72	330	660	169	220
16,000	24	20	66	307	614	156	210	67	308	616	161	216
18,000	20	16	62	285	570	145	202	62	287	574	151	210
20,000	16	12	57	266	532	132	190	58	267	534	141	203
22,000	12	8	—	—	—	—	—	53	249	498	128	191
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

BT00646 - RC-12D

Figure 7-53. Maximum Cruise Power 1700 RPM, ISA +37°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1700 RPM
ISA +37 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	56	52	94	477	954	209	219	94	477	954	210	220
2000	53	48	92	457	914	205	221	92	457	914	206	223
4000	49	44	90	438	876	201	224	90	438	876	202	225
6000	45	40	88	419	838	197	225	88	419	838	198	227
8000	41	36	85	398	796	191	226	85	398	796	193	228
10,000	37	32	81	376	752	186	227	82	377	754	188	229
12,000	33	28	77	353	706	179	226	77	354	708	182	229
14,000	29	24	72	331	662	172	224	73	331	662	175	227
16,000	25	20	68	309	618	164	221	68	310	620	168	225
18,000	21	16	63	288	576	156	217	63	289	578	160	222
20,000	17	12	58	269	538	147	212	59	270	540	152	219
22,000	12	8	54	250	500	137	204	55	252	504	143	213
24,000	8	4	49	232	464	124	192	50	233	466	133	206
26,000	4	0	—	—	—	—	—	46	216	432	120	194
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

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Figure 7-53. Maximum Cruise Power 1700 RPM, ISA +37°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER

1700 RPM

WEIGHT: 12,000 LBS

NOTES: 1. ISA DEVIATION LINES REFLECT ACTUAL TEMPERATURES FOR FLIGHT PLANNING. INDICATED TEMPERATURES SHOULD BE USED FOR IN-FLIGHT CRUISE POWER SETTINGS.

2. FOR OPERATION WITH ICE VANES EXTENDED, TORQUE WILL DECREASE APPROXIMATELY 20%. IF DESIRED, ORIGINAL POWER MAY BE RESET, PROVIDED ITT LIMIT IS NOT EXCEEDED.

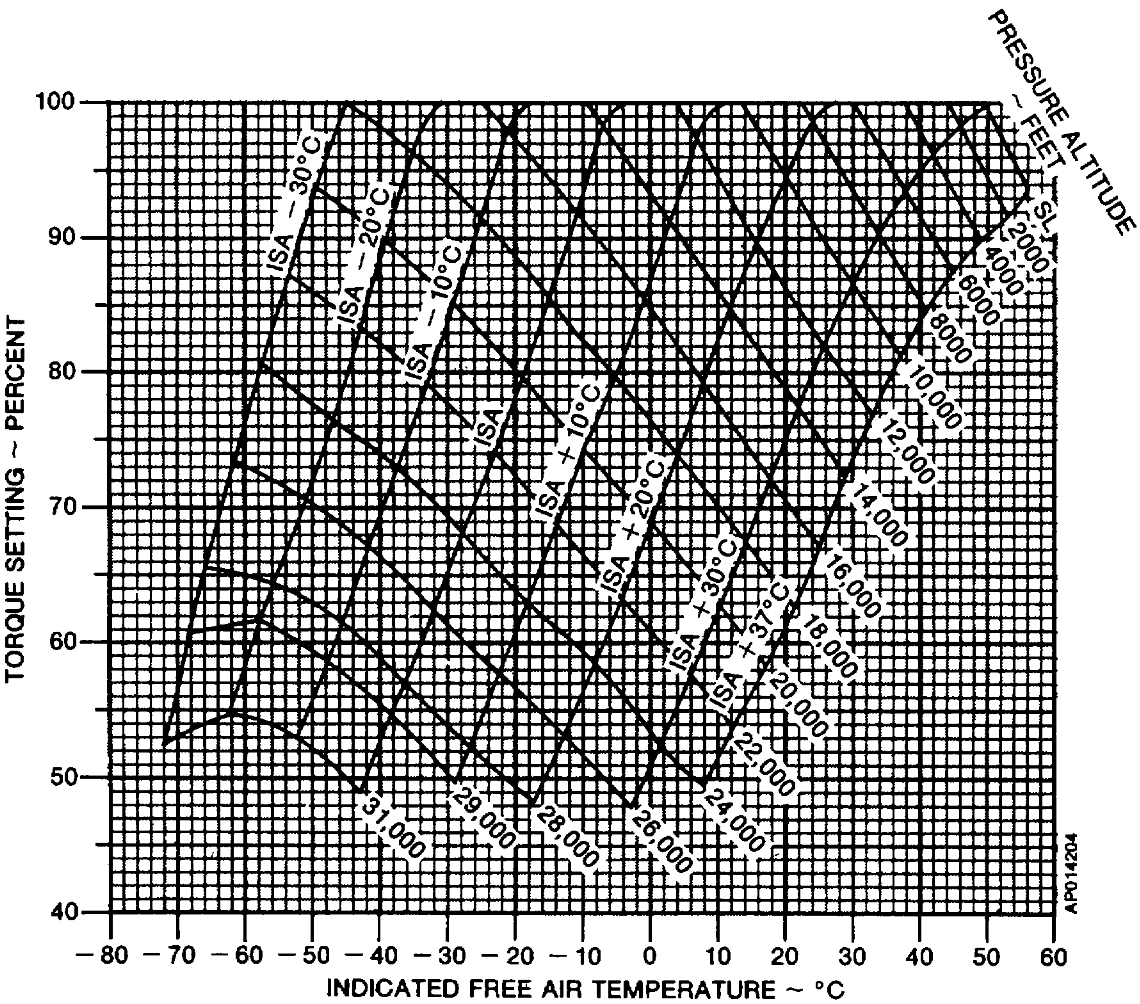


Figure 7-54. Maximum Cruise Power @ 1700 RPM

MAXIMUM RANGE POWER

1700 RPM

ISA -30°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-12	-15	77	410	820	200	187	74	401	802	198	185
2000	-16	-19	73	385	770	193	185	69	373	746	190	183
4000	-20	-23	69	361	722	187	184	65	349	698	183	181
6000	-24	-27	67	343	686	181	184	62	330	660	178	181
8000	-28	-31	65	327	654	177	185	61	313	626	174	182
10,000	-32	-35	64	313	626	174	187	59	299	598	170	183
12,000	-35	-39	64	303	606	171	190	59	288	576	167	185
14,000	-39	-43	64	295	590	168	192	59	279	558	164	188
16,000	-43	-47	63	286	572	165	194	58	271	542	161	190
18,000	-47	-51	62	276	552	160	195	58	264	528	158	193
20,000	-51	-55	61	268	536	155	195	58	257	514	155	195
22,000	-55	-59	61	266	532	153	198	56	250	500	150	195
24,000	-59	-63	62	266	532	150	202	56	246	492	146	196
26,000	-63	-67	64	270	540	149	207	57	247	494	144	201
28,000	-67	-71	—	—	—	—	—	59	253	506	144	207
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009927

Figure 7-55. Maximum Range Power @ 1700 RPM, ISA-30°C (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA −30°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	−12	−15	71	392	784	196	183	67	383	766	194	181
2000	−16	−19	65	363	726	187	180	61	352	704	185	177
4000	−20	−23	61	337	674	180	178	57	324	648	177	174
6000	−24	−27	58	316	632	174	177	53	302	604	170	173
8000	−28	−31	56	300	600	170	178	51	286	572	166	174
10,000	−32	−35	55	284	568	166	179	50	270	540	162	174
12,000	−36	−39	54	273	546	163	181	49	259	518	159	176
14,000	−40	−43	53	264	528	160	183	49	249	498	156	178
16,000	−44	−47	53	256	510	157	186	48	240	480	153	180
18,000	−47	−51	53	249	498	155	188	48	233	466	150	183
20,000	−51	−55	53	244	488	152	192	48	227	454	148	186
22,000	−55	−59	53	239	478	150	195	48	224	448	146	190
24,000	−59	−63	52	232	464	145	195	49	220	440	144	193
26,000	−63	−67	51	226	452	140	195	48	215	430	140	194
28,000	−67	−71	52	228	456	139	199	—	—	—	—	—
29,000	−69	−72	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009928

Figure 7-55. Maximum Range Power @ 1700 RPM, ISA-30°C (Sheet 2 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA −20°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	− 2	− 5	72	399	798	193	184	71	395	790	193	184
2000	− 6	− 9	71	383	766	190	186	69	378	756	190	186
4000	− 10	− 13	70	366	732	186	188	68	359	718	186	187
6000	− 14	− 17	68	350	700	182	189	65	341	682	181	187
8000	− 18	− 21	67	334	668	178	190	64	325	650	176	188
10,000	− 21	− 25	65	319	638	173	191	62	308	616	172	189
12,000	− 25	− 29	64	305	610	169	191	61	295	590	168	190
14,000	− 29	− 33	62	293	586	164	192	60	284	568	164	192
16,000	− 33	− 37	61	282	564	159	192	58	272	544	159	192
18,000	− 37	− 41	61	277	554	157	195	57	261	522	154	192
20,000	− 41	− 45	63	276	552	156	200	57	257	514	151	195
22,000	− 45	− 49	63	272	544	152	202	58	257	514	150	200
24,000	− 49	− 53	63	270	540	149	204	58	252	504	146	201
26,000	− 52	− 57	66	280	560	150	213	58	250	500	142	202
28,000	− 56	− 61	—	—	—	—	—	61	261	522	144	212
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009929

Figure 7-56. Maximum Range Power @ 1700 RPM, ISA-200C (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA −20°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	−2	−5	70	391	782	194	184	68	386	772	193	184
2000	−6	−9	67	372	744	189	185	66	366	732	189	185
4000	−10	−13	65	351	702	184	186	61	340	680	182	183
6000	−14	−17	61	329	658	178	184	58	317	634	175	181
8000	−18	−21	59	312	624	173	185	55	299	598	170	181
10,000	−22	−25	57	295	590	168	185	53	281	562	164	181
12,000	−26	−29	56	282	564	164	187	52	268	536	161	182
14,000	−29	−33	56	272	544	162	189	51	258	516	158	184
16,000	−33	−37	55	263	526	158	191	51	249	498	155	187
18,000	−37	−41	54	253	506	154	192	50	241	482	152	190
20,000	−41	−45	53	243	486	149	192	50	233	466	149	191
22,000	−45	−49	52	238	476	146	194	49	227	454	145	193
24,000	−49	−53	53	237	474	144	198	48	220	440	141	193
26,000	−53	−57	53	235	470	141	201	48	217	434	138	197
28,000	−57	−61	53	233	466	137	203	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009930

Figure 7-56. Maximum Range Power @ 1700 RPM, ISA-20°C (Sheet 2 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA −10°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	8	5	72	400	800	191	185	69	390	780	189	183
2000	4	1	69	377	754	185	185	66	369	738	184	183
4000	0	− 3	67	359	718	181	185	64	351	702	180	185
6000	− 4	− 7	66	344	688	177	187	63	336	672	176	186
8000	− 8	− 11	65	332	664	174	189	62	321	642	172	188
10,000	− 11	− 15	64	318	636	170	191	61	306	614	169	189
12,000	− 15	− 19	64	308	616	168	194	60	294	588	165	191
14,000	− 19	− 23	64	301	602	165	197	59	284	568	161	192
16,000	− 23	− 27	64	293	586	162	199	59	277	554	158	195
18,000	− 27	− 31	63	284	568	158	200	59	270	540	155	198
20,000	− 31	− 35	63	277	554	153	201	59	264	528	152	200
22,000	− 35	− 39	65	281	562	153	208	58	258	516	148	201
24,000	− 38	− 43	65	279	558	149	210	60	260	520	147	206
26,000	− 42	− 47	—	—	—	—	—	60	260	520	144	209
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009931

Figure 7-57. Maximum Range Power @ 1700 RPM, ISA-10°C (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA – 10°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	8	5	66	382	764	188	182	64	376	752	187	181
2000	4	1	64	362	724	183	183	63	359	718	184	183
4000	0	– 3	63	346	692	180	185	61	341	682	180	185
6000	– 4	– 7	61	330	660	176	186	59	325	650	176	186
8000	– 8	– 11	60	315	630	172	187	57	307	614	171	186
10,000	– 12	– 15	58	299	598	168	188	55	290	580	166	187
12,000	– 15	– 19	56	285	570	163	189	54	276	552	162	188
14,000	– 19	– 23	55	272	544	159	190	52	264	528	158	189
16,000	– 23	– 27	54	261	522	155	191	51	252	504	154	190
18,000	– 27	– 31	53	252	504	151	192	50	241	482	149	190
20,000	– 31	– 35	54	248	496	149	196	48	231	462	145	191
22,000	– 35	– 39	54	245	490	147	199	48	227	454	142	194
24,000	– 39	– 43	54	240	480	143	201	49	225	450	141	198
26,000	– 43	– 47	54	238	476	140	203	49	222	444	138	201
28,000	– 46	– 51	55	241	482	138	209	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009932

Figure 7-57. Maximum Range Power @ 1700 RPM, ISA- 10°C (Sheet 2 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	18	15	75	414	828	194	191	73	405	810	193	190
2000	14	11	73	391	782	189	191	68	379	758	186	188
4000	10	7	70	369	738	183	191	65	355	710	179	187
6000	7	3	68	353	706	178	192	63	338	676	175	188
8000	3	−1	67	340	680	175	194	62	324	648	171	190
10,000	−1	−5	67	327	654	172	196	62	312	624	168	192
12,000	−5	−9	66	315	630	168	198	61	301	602	165	195
14,000	−9	−13	64	303	606	163	199	61	293	586	163	198
16,000	−13	−17	63	291	582	158	198	60	282	564	158	199
18,000	−17	−21	63	286	572	155	202	58	269	538	152	198
20,000	−21	−25	66	288	576	155	208	59	266	532	150	201
22,000	−24	−29	66	285	570	152	210	61	268	536	150	207
24,000	−28	−33	—	—	—	—	—	60	264	528	146	209
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP006933

Figure 7-58. Maximum Range Power @ 1700 RPM, ISA (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	18	15	69	394	788	190	188	65	383	766	188	185
2000	14	11	64	366	732	182	185	60	355	710	180	182
4000	10	7	61	343	686	176	184	58	333	666	175	182
6000	6	3	59	324	648	172	185	56	316	632	170	183
8000	2	−1	57	309	618	167	186	54	300	600	166	184
10,000	−2	−5	56	296	592	164	188	53	286	572	162	186
12,000	−5	−9	56	286	572	161	190	52	273	546	158	187
14,000	−9	−13	56	278	556	159	194	51	262	524	155	189
16,000	−13	−17	56	269	538	157	197	51	254	508	152	192
18,000	−17	−21	55	260	520	153	198	51	247	494	150	195
20,000	−21	−25	54	251	502	148	199	51	240	480	147	197
22,000	−25	−29	54	246	492	144	200	50	234	468	143	199
24,000	−29	−33	56	248	496	144	206	49	227	454	139	200
26,000	−32	−37	55	244	488	140	208	51	227	454	137	205
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009934

Figure 7-58. Maximum Range Power @ 1700 RPM, ISA (Sheet 2 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +10°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	28	25	72	407	814	189	190	70	401	802	189	189
2000	24	21	71	389	778	185	191	69	383	766	185	191
4000	20	17	69	371	742	181	192	67	364	728	180	192
6000	17	13	68	354	708	177	194	65	345	690	176	193
8000	13	9	67	339	678	172	195	64	330	660	172	194
10,000	9	5	66	325	650	168	196	62	315	630	168	195
12,000	5	1	65	312	624	164	197	61	302	604	164	197
14,000	1	−3	65	307	614	162	201	60	290	580	159	197
16,000	−3	−7	66	302	604	160	205	60	283	566	156	199
18,000	−7	−11	66	296	592	157	207	60	278	556	154	203
20,000	−11	−15	66	293	586	154	211	61	274	548	151	207
22,000	−15	−19	—	—	—	—	—	61	272	544	148	210
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009935

Figure 7-59. Maximum Range Power @ 1700 RPM, ISA + 10°C (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +10°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	28	25	68	395	790	188	189	66	388	776	187	188
2000	24	21	67	376	752	184	190	64	368	736	183	189
4000	20	17	64	355	710	179	191	60	344	688	177	188
6000	16	13	62	335	670	174	191	57	322	644	171	187
8000	13	9	60	318	636	170	192	55	305	610	166	188
10,000	9	5	58	302	604	165	192	54	288	576	161	188
12,000	5	1	58	290	580	162	194	53	276	552	158	190
14,000	1	-3	57	280	560	158	196	53	268	536	156	194
16,000	-3	-7	55	269	538	154	197	52	259	518	153	196
18,000	-7	-11	54	259	518	149	197	51	249	498	148	197
20,000	-11	-15	55	255	510	147	201	50	239	478	144	197
22,000	-15	-19	56	255	510	146	206	50	234	468	141	199
24,000	-19	-23	56	251	502	142	208	51	234	468	140	205
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009936

Figure 7-59. Maximum Range Power @ 1700 RPM, ISA + 10°C (Sheet 2 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +20°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	38	35	74	415	830	190	193	70	402	804	187	190
2000	35	31	72	394	788	185	194	67	379	758	181	191
4000	31	27	69	374	748	179	194	65	361	722	177	191
6000	27	23	68	356	712	175	195	63	343	686	172	192
8000	23	19	67	344	688	172	197	62	328	656	168	193
10,000	19	15	67	330	660	168	199	61	313	626	164	195
12,000	15	11	67	323	646	166	203	61	303	606	161	197
14,000	11	7	67	313	626	163	206	62	298	596	160	202
16,000	7	3	66	302	604	158	206	62	291	582	158	206
18,000	3	−1	66	297	594	155	209	61	280	560	152	206
20,000	−1	−5	—	—	—	—	—	61	276	552	149	208
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009937

Figure 7-60. Maximum Range Power @ 1700 RPM, ISA +20°C (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +20°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	38	35	66	391	782	184	188	63	382	764	183	186
2000	34	31	64	370	740	179	188	62	363	726	179	188
4000	30	27	62	352	704	176	190	60	346	692	175	190
6000	27	23	61	335	670	172	191	59	329	658	171	191
8000	23	19	59	318	636	167	192	57	311	622	167	191
10,000	19	15	58	303	606	163	193	55	293	586	162	192
12,000	15	11	56	289	578	159	194	53	280	560	158	193
14,000	11	7	56	279	558	155	196	52	267	534	154	194
16,000	7	3	56	272	544	153	200	51	256	512	149	195
18,000	3	−1	57	267	534	151	204	51	249	498	147	198
20,000	−1	−5	56	261	522	147	205	52	247	494	145	203
22,000	−5	−9	56	256	512	143	207	52	242	484	142	205
24,000	−9	−13	—	—	—	—	—	51	235	470	137	206
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009938

Figure 7-60. Maximum Range Power @ 1700 RPM, ISA +20°C (Sheet 2 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +30°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	49	45	75	421	842	189	196	73	413	826	188	195
2000	45	41	73	401	802	185	197	70	390	780	183	195
4000	41	37	72	382	764	181	199	67	369	738	178	196
6000	37	33	71	366	732	177	200	66	353	706	174	198
8000	33	39	69	351	702	173	202	65	338	676	171	199
10,000	29	25	68	336	672	168	203	64	324	648	167	201
12,000	25	21	67	323	646	164	204	63	312	624	163	203
14,000	21	17	66	313	626	160	206	62	301	602	159	204
16,000	17	13	—	—	—	—	—	61	290	580	154	205
18,000	13	9	—	—	—	—	—	62	286	572	153	209
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009939

Figure 7-61. Maximum Range Power @ 1700 RPM, ISA+30°C (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +30°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	48	45	69	402	804	186	193	65	390	780	183	190
2000	44	41	66	378	756	180	193	61	365	730	177	189
4000	41	37	63	355	710	175	192	59	342	684	172	189
6000	37	33	61	338	676	171	193	57	325	650	168	190
8000	33	29	60	322	644	167	195	55	308	616	163	191
10,000	29	25	59	307	614	163	196	54	293	586	159	192
12,000	25	21	58	297	594	160	199	53	281	562	156	194
14,000	21	17	58	288	576	157	202	53	271	542	153	197
16,000	17	13	58	278	556	153	204	53	264	528	151	200
18,000	13	9	56	267	534	149	204	53	256	512	148	203
20,000	9	5	56	261	522	145	207	52	246	492	143	204
22,000	5	1	—	—	—	—	—	51	241	482	139	205
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009940

Figure 7-61. Maximum Range Power @ 1700 RPM, ISA +30° C (Sheet 2 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +37°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	56	52	74	418	836	186	195	71	410	820	186	195
2000	52	48	72	399	798	182	197	69	390	780	181	196
4000	48	44	70	380	760	178	198	68	372	744	177	197
6000	44	40	69	364	728	174	199	66	355	710	174	199
8000	40	36	68	349	698	170	201	65	340	680	169	200
10,000	36	32	67	334	668	166	202	64	324	648	165	201
12,000	32	28	67	326	652	163	205	62	310	620	161	202
14,000	28	24	70	324	648	163	212	62	301	602	157	204
16,000	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009941

Figure 7-62. Maximum Range Power @ 1700 RPM, ISA +37°C (Sheet 1 of 2)

MAXIMUM RANGE POWER

1700 RPM

ISA +37°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	55	52	68	402	804	185	194	66	394	788	184	193
2000	52	48	66	382	764	180	195	63	371	742	178	192
4000	48	44	64	362	724	176	196	60	350	700	173	193
6000	44	40	63	344	688	172	197	58	330	660	168	193
8000	40	36	61	327	654	168	198	57	314	628	164	194
10,000	36	32	60	313	626	164	200	55	298	596	160	195
12,000	32	28	59	300	600	160	201	55	286	572	158	198
14,000	28	24	58	288	576	155	202	54	276	552	154	200
16,000	24	20	57	277	554	151	203	53	266	532	150	202
18,000	20	16	58	273	546	150	208	52	255	510	146	203
20,000	16	12	—	—	—	—	—	52	248	496	142	205
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009942

Figure 7-62. Maximum Range Power @ 1700 RPM, ISA +37°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA −30°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	−14	−15	39	303	606	137	128	36	297	594	137	128
2000	−17	−19	39	290	580	137	132	37	282	564	137	132
4000	−21	−23	40	277	554	137	135	37	269	538	137	135
6000	−25	−27	41	267	534	137	139	38	259	518	137	139
8000	−29	−31	42	259	518	137	143	39	251	502	137	143
10,000	−33	−35	43	252	504	137	148	40	243	486	137	148
12,000	−37	−39	45	247	494	137	152	42	238	476	137	152
14,000	−40	−43	46	243	486	137	157	43	234	468	137	157
16,000	−44	−47	48	240	480	137	162	45	231	462	137	162
18,000	−48	−51	49	238	476	137	167	46	228	456	137	167
20,000	−52	−55	51	237	474	137	172	47	227	454	137	172
22,000	−56	−59	52	237	474	137	178	49	227	454	137	178
24,000	−59	−63	54	241	482	137	184	51	228	456	137	184
26,000	−63	−67	57	246	492	137	190	53	232	464	137	190
28,000	−67	−71	59	253	506	137	197	55	238	476	137	197
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009943

Figure 7-63. Maximum Endurance Power @ 1700 RPM, ISA-30°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA −30°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	−14	−15	34	290	580	137	128	32	284	568	137	128
2000	−17	−19	34	276	552	137	132	32	269	538	137	132
4000	−21	−23	35	262	524	137	135	33	255	510	137	135
6000	−25	−27	36	251	502	137	139	33	244	488	137	139
8000	−29	−31	37	243	486	137	143	34	236	472	137	143
10,000	−33	−35	38	235	470	137	148	35	228	456	137	148
12,000	−37	−39	39	230	460	137	152	37	222	444	137	152
14,000	−40	−43	40	225	450	137	157	38	218	436	137	157
16,000	−44	−47	42	222	444	137	162	39	214	428	137	162
18,000	−48	−51	43	219	438	137	167	40	211	422	137	167
20,000	−52	−55	45	217	434	137	172	42	209	418	137	172
22,000	−56	−59	46	217	434	137	178	43	208	416	137	178
24,000	−59	−63	48	217	434	137	184	45	208	416	137	184
26,000	−63	−67	49	220	440	137	190	46	209	418	137	190
28,000	−67	−71	51	225	450	137	197	48	213	426	137	197
29,000	−69	−72	52	230	460	137	200	49	215	430	137	200
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009944

Figure 7-63. Maximum Endurance Power @ 1700 RPM, ISA-30°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA −20°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	− 3	− 5	40	309	618	137	130	38	302	604	137	130
2000	− 7	− 9	40	296	592	137	134	38	289	578	137	134
4000	−11	−13	41	284	568	137	138	39	276	552	137	138
6000	−15	−17	42	274	548	137	142	40	266	532	137	142
8000	−19	−21	43	266	532	137	146	41	258	516	137	146
10,000	−23	−25	44	258	516	137	151	42	249	498	137	151
12,000	−27	−29	46	252	504	137	156	43	243	486	137	156
14,000	−30	−33	47	248	496	137	160	44	239	478	137	160
16,000	−34	−37	49	244	488	137	165	46	235	470	137	165
18,000	−38	−41	50	242	484	137	171	47	232	464	137	171
20,000	−42	−45	52	242	484	137	176	48	231	462	137	176
22,000	−46	−49	54	244	488	137	182	50	232	464	137	182
24,000	−49	−53	56	247	494	137	188	52	234	468	137	188
26,000	−53	−57	58	253	506	137	195	54	239	478	137	195
28,000	−57	−61	61	261	522	137	201	57	245	490	137	201
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009945

Figure 7-64. Maximum Endurance Power @ 1700 RPM, ISA-20°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA −20°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	−3	−5	36	296	592	137	130	34	291	582	137	130
2000	−7	−9	36	282	564	137	134	34	276	552	137	134
4000	−11	−13	36	270	540	137	138	34	263	526	137	138
6000	−15	−17	37	259	518	137	142	35	252	504	137	142
8000	−19	−21	38	250	500	137	146	36	243	486	137	146
10,000	−23	−25	39	241	482	137	151	37	234	468	137	151
12,000	−27	−29	40	235	470	137	156	38	228	456	137	156
14,000	−30	−33	42	230	460	137	160	39	223	446	137	160
16,000	−34	−37	43	226	452	137	165	40	218	436	137	165
18,000	−38	−41	44	223	446	137	171	42	215	430	137	171
20,000	−42	−45	46	221	442	137	176	43	213	426	137	176
22,000	−46	−49	47	221	442	137	182	44	212	424	137	182
24,000	−49	−53	49	223	446	137	188	46	212	424	137	188
26,000	−53	−57	51	225	450	137	195	47	215	430	137	195
28,000	−57	−61	53	231	462	137	201	49	219	438	137	201
29,000	−59	−62	54	234	468	137	205	50	221	442	137	205
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009946

Figure 7-64. Maximum Endurance Power @ 1700 RPM, ISA-20°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA −10°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	7	5	41	312	624	137	133	39	305	610	137	133
2000	3	1	41	299	598	137	137	39	293	586	137	137
4000	−1	−3	42	288	576	137	141	40	280	560	137	141
6000	−5	−7	43	279	558	137	145	41	271	542	137	145
8000	−9	−11	44	270	540	137	149	42	263	526	137	149
10,000	−13	−15	45	262	524	137	154	43	254	508	137	154
12,000	−16	−19	47	257	514	137	159	44	248	496	137	159
14,000	−20	−23	48	252	504	137	164	45	243	486	137	164
16,000	−24	−27	49	249	498	137	169	46	239	478	137	169
18,000	−28	−31	51	248	496	137	174	48	237	474	137	174
20,000	−32	−35	53	247	494	137	180	50	236	472	137	180
22,000	−35	−39	55	250	500	137	186	51	237	474	137	186
24,000	−39	−43	58	254	508	137	193	54	240	480	137	193
26,000	−43	−47	60	261	522	137	199	56	245	490	137	199
28,000	−47	−51	—	—	—	—	—	58	252	504	137	206
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009947

Figure 7-65. Maximum Endurance Power @ 1700 RPM, ISA-10°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA – 10°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	7	5	37	300	600	137	133	35	294	588	137	133
2000	3	1	37	286	572	137	137	35	281	562	137	137
4000	– 1	– 3	38	274	548	137	141	35	268	536	137	141
6000	– 5	– 7	38	264	528	137	145	36	258	516	137	145
8000	– 9	– 11	39	255	510	137	149	37	249	498	137	149
10,000	– 13	– 15	40	246	492	137	154	38	239	478	137	154
12,000	– 16	– 19	41	240	480	137	159	39	233	466	137	159
14,000	– 20	– 23	42	235	470	137	164	40	227	454	137	164
16,000	– 24	– 27	44	231	462	137	169	41	223	446	137	169
18,000	– 28	– 31	45	227	454	137	174	42	219	438	137	174
20,000	– 32	– 35	46	226	452	137	180	44	216	432	137	180
22,000	– 35	– 39	48	227	454	137	186	45	217	434	137	186
24,000	– 39	– 43	50	228	456	137	193	47	218	436	137	193
26,000	– 43	– 47	52	232	464	137	199	49	220	440	137	199
28,000	– 47	– 51	54	238	476	137	206	51	225	450	137	206
29,000	– 49	– 52	—	—	—	—	—	52	228	456	137	210
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009948

Figure 7-65. Maximum Endurance Power @ 1700 RPM, ISA- 10°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	17	15	40	313	626	137	135	38	307	614	137	135
2000	13	11	42	301	602	137	139	39	295	590	137	139
4000	9	7	43	290	580	137	143	40	283	566	137	143
6000	5	3	44	281	562	137	148	41	273	546	137	148
8000	1	− 1	45	273	546	137	152	42	265	530	137	152
10,000	− 3	− 5	46	265	530	137	157	43	257	514	137	157
12,000	− 6	− 9	47	261	522	137	162	44	251	502	137	162
14,000	− 10	− 13	49	257	514	137	167	46	247	494	137	167
16,000	− 14	− 17	51	254	508	137	172	47	244	488	137	172
18,000	− 18	− 21	52	252	504	137	178	49	241	482	137	178
20,000	− 21	− 25	54	253	506	137	184	51	241	482	137	184
22,000	− 25	− 29	57	256	512	137	190	53	243	486	137	190
24,000	− 29	− 33	59	261	522	137	197	55	246	492	137	197
26,000	− 33	− 37	—	—	—	—	—	57	252	504	137	203
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009949

Figure 7-66. Maximum Endurance Power @ 1700 RPM, ISA (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	17	15	36	301	602	137	135	35	296	592	137	135
2000	13	11	37	289	578	137	139	36	283	566	137	139
4000	9	7	38	277	554	137	143	36	271	542	137	143
6000	5	3	39	267	534	137	148	37	260	520	137	148
8000	1	− 1	40	258	516	137	152	38	251	502	137	152
10,000	− 3	− 5	41	250	500	137	157	39	243	486	137	157
12,000	− 6	− 9	42	243	486	137	162	40	236	472	137	162
14,000	− 10	− 13	43	238	476	137	167	41	230	460	137	167
16,000	− 14	− 17	44	235	470	137	172	42	226	452	137	172
18,000	− 18	− 21	46	232	464	137	178	43	223	446	137	178
20,000	− 21	− 25	48	231	462	137	184	45	221	442	137	184
22,000	− 25	− 29	49	232	464	137	190	46	221	442	137	190
24,000	− 29	− 33	51	234	468	137	197	48	223	446	137	197
26,000	− 33	− 37	54	238	476	137	203	50	225	450	137	203
28,000	− 36	− 41	56	244	488	137	211	52	231	462	137	211
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009950

Figure 7-66. Maximum Endurance Power @ 1700 RPM, ISA (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +10°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	27	25	41	315	630	137	137	38	308	616	137	137
2000	23	21	42	304	608	137	141	39	296	592	137	141
4000	19	17	43	293	586	137	146	40	285	570	137	146
6000	15	13	44	284	568	137	150	41	275	550	137	150
8000	11	9	46	276	552	137	155	43	267	534	137	155
10,000	8	5	47	269	538	137	160	44	260	520	137	160
12,000	4	1	48	264	528	137	165	45	254	508	137	165
14,000	0	−3	50	261	522	137	170	47	251	502	137	170
16,000	−4	−7	52	259	518	137	176	48	248	496	137	176
18,000	−8	−11	54	258	516	137	181	50	246	492	137	181
20,000	−11	−15	56	259	518	137	188	52	247	494	137	188
22,000	−15	−19	58	263	526	137	194	54	249	498	137	194
24,000	−19	−23	61	267	534	137	201	57	253	506	137	201
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP09951

Figure 7-67. Maximum Endurance Power @ 1700 RPM, ISA + 10°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +10°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	27	25	36	301	602	137	137	34	296	592	137	137
2000	23	21	37	290	580	137	141	35	284	568	137	141
4000	19	17	38	279	558	137	146	36	273	546	137	146
6000	15	13	39	269	538	137	150	37	262	524	137	150
8000	11	9	40	260	520	137	155	38	253	506	137	155
10,000	8	5	41	251	502	137	160	39	244	488	137	160
12,000	4	1	43	246	492	137	165	40	238	476	137	165
14,000	0	− 3	44	242	484	137	170	41	234	468	137	170
16,000	− 4	− 7	45	239	478	137	176	43	230	460	137	176
18,000	− 8	− 11	47	236	472	137	181	44	227	454	137	181
20,000	− 11	− 15	49	236	472	137	188	46	225	450	137	188
22,000	− 15	− 19	51	237	474	137	194	47	226	452	137	194
24,000	− 19	− 23	53	240	480	137	201	49	228	456	137	201
26,000	− 22	− 27	55	244	488	137	208	51	231	462	137	208
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009952

Figure 7-67. Maximum Endurance Power @ 1700 RPM, ISA + 10°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +20°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	37	35	42	320	640	137	140	39	312	624	137	140
2000	33	31	43	308	616	137	144	40	300	600	137	144
4000	29	27	44	297	594	137	148	41	289	578	137	148
6000	25	23	45	289	578	137	153	42	280	560	137	153
8000	21	19	46	281	562	137	158	44	272	544	137	158
10,000	18	15	48	273	546	137	163	45	264	528	137	163
12,000	14	11	49	268	536	137	168	46	259	518	137	168
14,000	10	7	51	265	530	137	173	48	254	508	137	173
16,000	6	3	53	263	526	137	179	49	252	504	137	179
18,000	3	−1	55	261	522	137	185	51	250	500	137	185
20,000	−1	−5	57	265	530	137	191	53	252	504	137	191
22,000	−5	−9	60	269	538	137	198	56	255	510	137	198
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009953

Figure 7-68. Maximum Endurance Power @ 1700 RPM, ISA +20°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +20°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	37	35	37	305	610	137	140	35	299	598	137	140
2000	33	31	38	293	586	137	144	36	287	574	137	144
4000	29	27	39	282	564	137	148	37	275	550	137	148
6000	25	23	40	273	546	137	153	38	266	532	137	153
8000	21	19	41	264	528	137	158	39	257	514	137	158
10,000	18	15	42	256	512	137	163	40	248	496	137	163
12,000	14	11	43	250	500	137	168	41	242	484	137	168
14,000	10	7	45	245	490	137	173	42	237	474	137	173
16,000	6	3	46	242	484	137	179	43	233	466	137	179
18,000	3	−1	48	240	480	137	185	45	230	460	137	185
20,000	−1	−5	50	241	482	137	191	47	231	462	137	191
22,000	−5	−9	52	242	484	137	198	48	231	462	137	198
24,000	−9	−13	54	246	492	137	205	50	234	468	137	205
26,000	−13	−17	53	239	478	137	204	53	236	472	137	212
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009954

Figure 7-68. Maximum Endurance Power @ 1700 RPM, ISA +20 °C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +30°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	47	45	42	323	646	137	142	40	316	632	137	142
2000	43	41	43	311	622	137	146	41	304	608	137	146
4000	39	37	44	301	602	137	151	42	293	586	137	151
6000	35	33	46	292	584	137	155	43	284	568	137	155
8000	32	29	47	284	568	137	160	44	276	552	137	160
10,000	28	25	49	278	556	137	165	45	268	536	137	165
12,000	24	21	50	273	546	137	171	47	263	526	137	171
14,000	20	17	52	270	540	137	176	49	259	518	137	176
16,000	16	13	54	267	534	137	182	50	256	512	137	182
18,000	13	9	56	268	536	137	188	52	255	510	137	188
20,000	9	5	58	269	538	137	195	54	256	512	137	195
22,000	5	1	—	—	—	—	—	57	260	520	137	201
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009955

Figure 7-69. Maximum Endurance Power @ 1700 RPM, ISA +30°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +30°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	47	45	38	309	618	137	142	36	303	606	137	142
2000	43	41	39	297	594	137	146	37	290	580	137	146
4000	39	37	40	285	570	137	151	37	279	558	137	151
6000	35	33	41	276	552	137	155	38	269	538	137	155
8000	32	29	42	268	536	137	160	39	260	520	137	160
10,000	28	25	43	260	520	137	165	40	252	504	137	165
12,000	24	21	44	254	508	137	171	42	246	492	137	171
14,000	20	17	46	250	500	137	176	43	241	482	137	176
16,000	16	13	47	246	492	137	182	44	237	474	137	182
18,000	13	9	49	244	488	137	188	46	235	470	137	188
20,000	9	5	51	244	488	137	195	47	233	466	137	195
22,000	5	1	53	247	494	137	201	50	236	472	137	201
24,000	1	-3	—	—	—	—	—	52	238	476	137	209
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009956

Figure 7-69. Maximum Endurance Power @ 1700 RPM, ISA +30°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +37°C

WEIGHT →			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	54	52	42	324	648	137	143	38	316	632	137	143
2000	50	48	44	314	628	137	148	39	305	610	137	148
4000	46	44	45	303	606	137	152	40	295	590	137	152
6000	42	40	46	295	590	137	157	41	286	572	137	157
8000	39	36	48	288	576	137	162	42	278	556	137	162
10,000	35	32	49	281	562	137	167	43	271	542	137	167
12,000	31	28	51	276	552	137	173	45	266	532	137	173
14,000	27	24	52	273	546	137	178	46	262	524	137	178
16,000	23	20	55	272	544	137	184	48	259	518	137	184
18,000	20	16	57	271	542	137	191	50	259	518	137	191
20,000	16	12	57	266	532	137	191	52	260	520	137	197
22,000	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009957

Figure 7-70. Maximum Endurance Power @ 1700 RPM, ISA +37°C (Sheet I of 2)

MAXIMUM ENDURANCE POWER

1700 RPM

ISA +37°C

WEIGHT →			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	54	52	38	310	620	137	143	36	304	608	137	143
2000	50	48	39	299	598	137	148	37	292	584	137	148
4000	46	44	40	287	574	137	152	38	281	562	137	152
6000	42	40	41	278	556	137	157	39	271	542	137	157
8000	39	36	42	270	540	137	162	40	262	524	137	162
10,000	35	32	43	262	524	137	167	41	254	508	137	167
12,000	31	28	45	257	514	137	173	42	248	496	137	173
14,000	27	24	46	253	506	137	178	43	244	488	137	178
16,000	23	20	48	249	498	137	184	45	240	480	137	184
18,000	20	16	50	248	496	137	191	46	237	474	137	191
20,000	16	12	52	248	496	137	197	48	237	474	137	197
22,000	12	8	54	250	500	137	204	50	239	478	137	204
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

AP009958

Figure 7-70. Maximum Endurance Power @ 1700 RPM, ISA +37°C (Sheet 2 of 2)

RANGE PROFILE — MAXIMUM CRUISE POWER

1900 RPM

STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:
WEIGHT .... *14,290 LBS BEFORE ENGINE START
FUEL........... AVIATION KEROSENE
FUEL DENSITY... 6.7 LBS/GAL
WIND........... ZERO

EXAMPLE:
PRESSURE ALTITUDE ... 22,000 FT
FUEL .... 2359 LBS
RANGE .... 680 NM

NOTES:
1. RANGE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.
*2. AT 14,290 LBS RAMP WEIGHT, THE MAXIMUM ZERO-FUEL-WEIGHT LIMITATION OF 11,500 LBS WOULD BE EXCEEDED AT FUEL LOADINGS LESS THAN 2790 LBS.

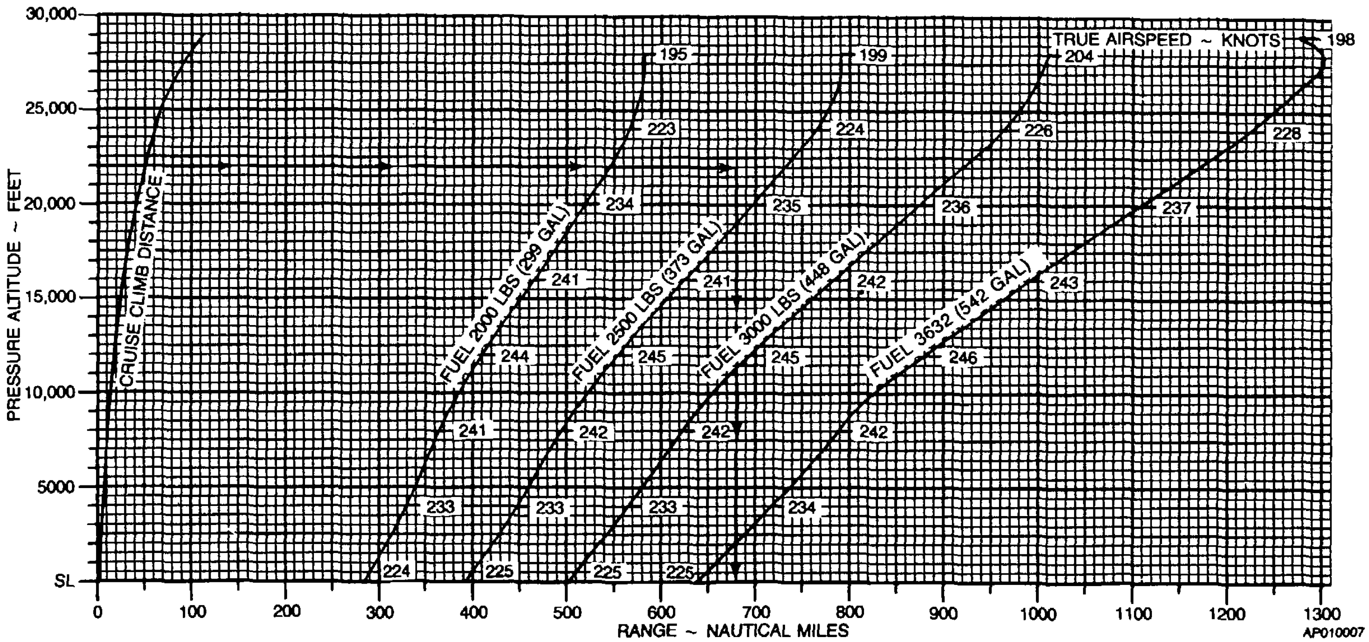


Figure 7-71. Range Profile-Maximum Cruise Power @ 1900 RPM

RANGE PROFILE — MAXIMUM RANGE POWER

1700 RPM

STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:
WEIGHT .... *14,290 LBS BEFORE ENGINE START
FUEL .... AVIATION KEROSENE
FUEL DENSITY .... 6.7 LBS/GAL
WIND .... ZERO

EXAMPLE:
PRESSURE ALTITUDE .... 22,000 FT
FUEL .... 2359 LBS
RANGE .... 698 NM

NOTES:
1. RANGE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.

*2. AT 14,290 LBS RAMP WEIGHT, THE MAXIMUM ZERO-FUEL-WEIGHT LIMITATION OF 11,500 LBS WOULD BE EXCEEDED AT FUEL LOADINGS LESS THAN 2790 LBS.

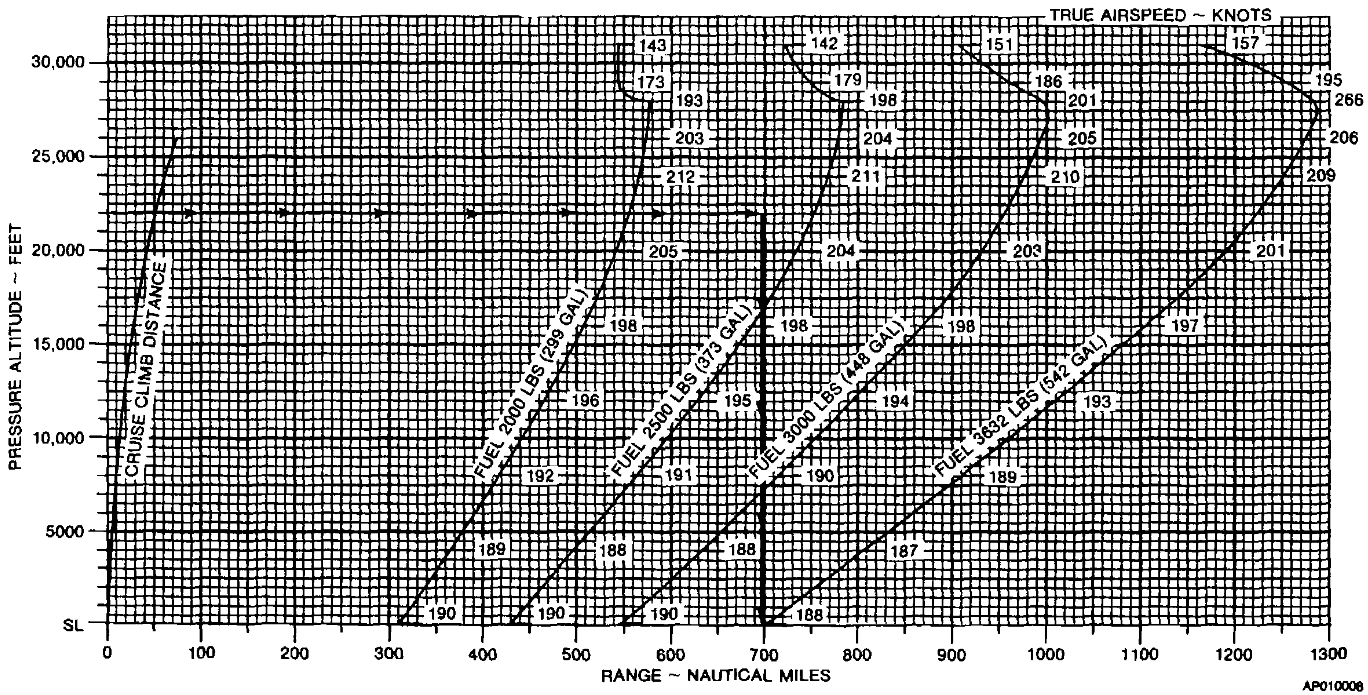


Figure 7-72. Range Profile-Maximum Range Power @ 1700 RPM

RANGE PROFILE — 542 GALLONS USABLE FUEL
STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:

WEIGHT . . . . 14,290 LBS BEFORE ENGINE START
FUEL. . . . . AVIATION KEROSENE
FUEL DENSITY. . . 6.7 LBS/GAL
WIND. . . . . ZERO

EXAMPLE:

PRESSURE ALTITUDE . . . . 22,000 FT

RANGE AT:
MAXIMUM CRUISE POWER . . . . 1167 NM
MAXIMUM RANGE POWER . . . . 1223 NM
MAXIMUM ENDURANCE POWER. . . 1235 NM

NOTE: RANGE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.

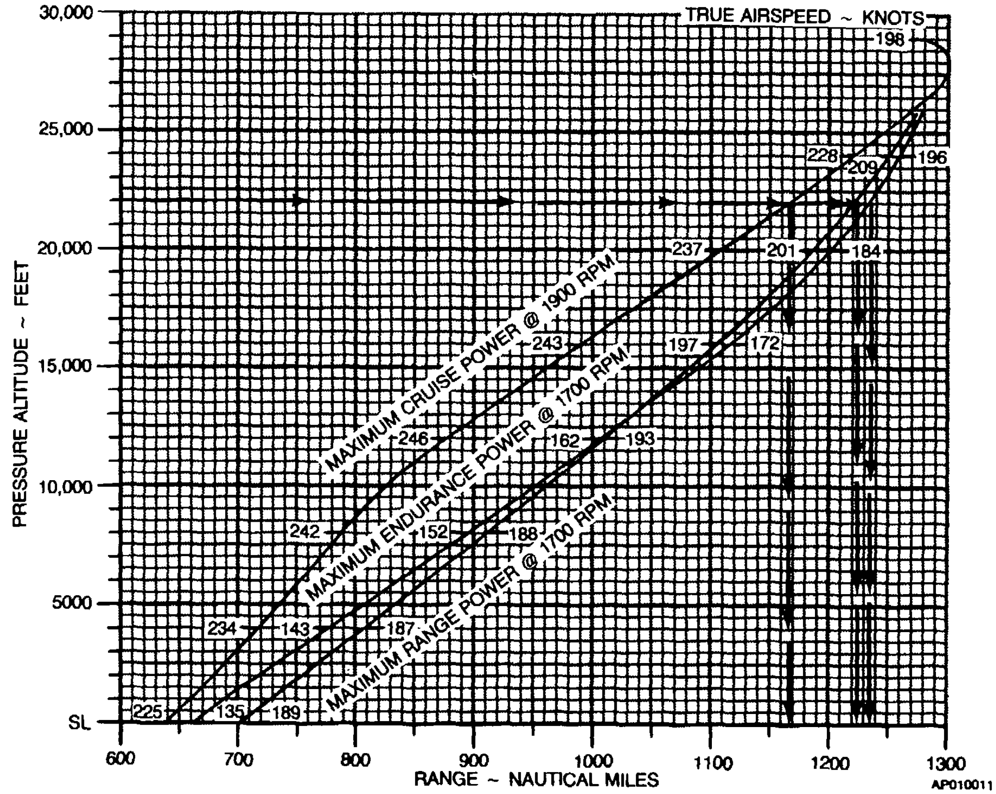


Figure 7-73. Range Profile-542 Gallons Usable Fuel

ENDURANCE PROFILE — 542 GALLONS USABLE FUEL
STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:
WEIGHT .... 14,290 LBS BEFORE ENGINE START
FUEL .... AVIATION KEROSENE
FUEL DENSITY .... 6.7 LBS/GAL

EXAMPLE:
PRESSURE ALTITUDE .... 22,000 FT

ENDURANCE AT:
MAXIMUM CRUISE POWER .... 5.05 HR
MAXIMUM RANGE POWER .... 5.97 HR
MAXIMUM ENDURANCE POWER .... 6.43 HR

NOTE: ENDURANCE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.

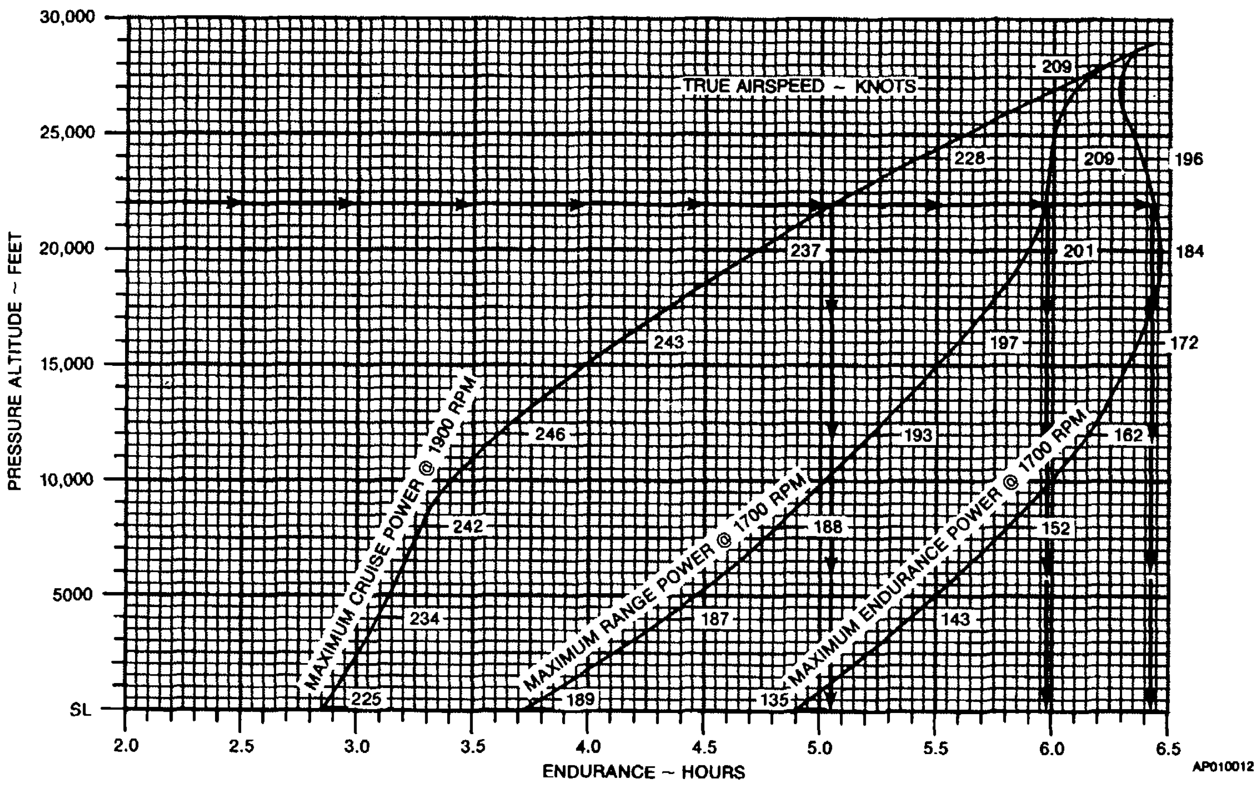


Figure 7-74. Endurance Proflie-542 Gallons Usable Fuel

TIME, FUEL, AND DISTANCE TO DESCEND

ASSOCIATED CONDITIONS:

POWER. . . AS REQUIRED TO DESCEND AT 1500 FT/MIN
GEAR . . . . UP
FLAPS. . . . 0%

EXAMPLE:

INITIAL ALTITUDE. . . . . 22,000 FT
FINAL ALTITUDE. . . . . 4502 FT

TIME TO DESCEND . . . . (14.7 – 3.1) 11.6 MIN
FUEL TO DESCEND. . . . . . . (162 – 39) 123 LBS
DISTANCE TO DESCEND. . . (67 – 12) 55 NM

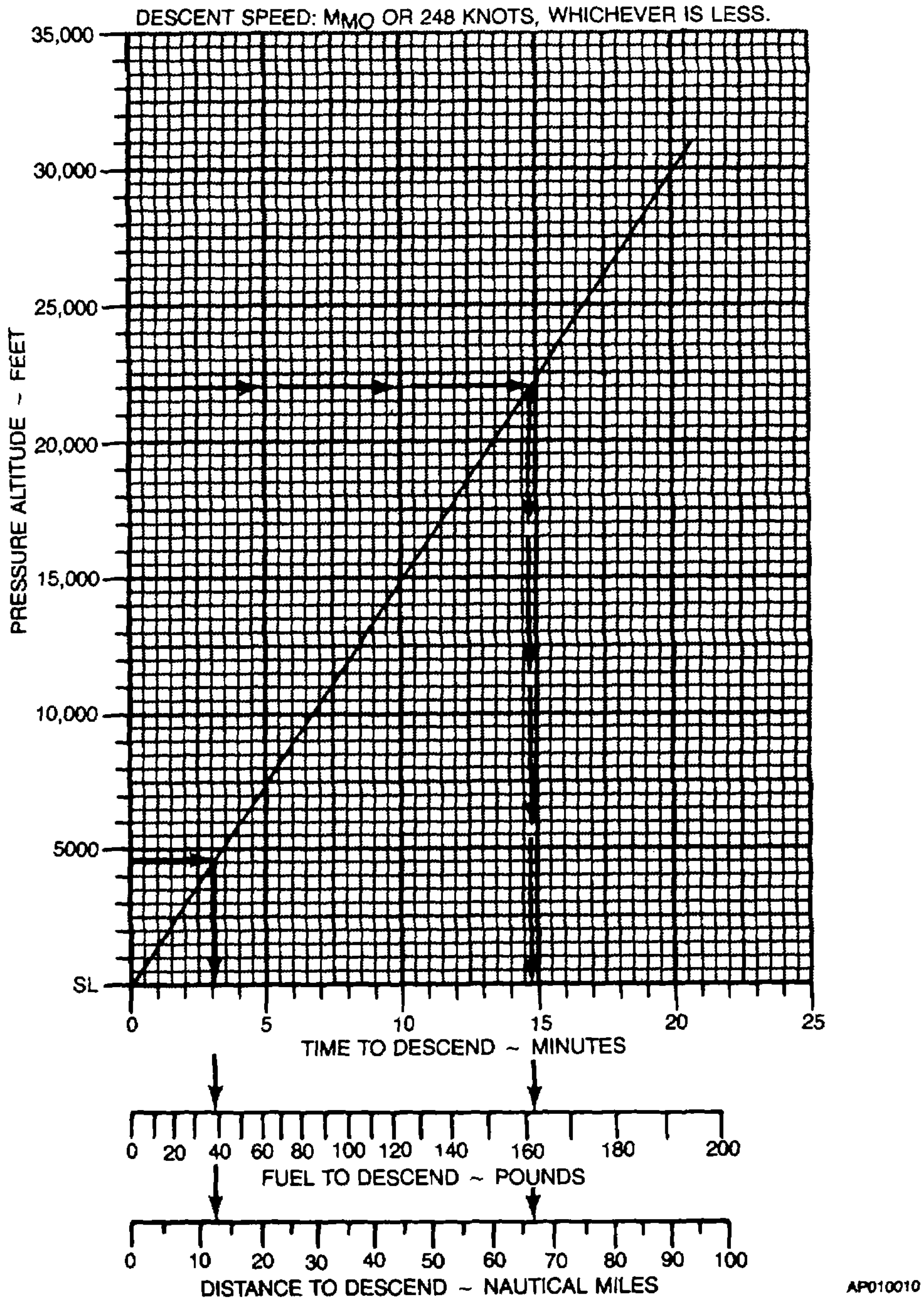


Figure 7-75. Time, Fuel, and Distance to Descend

LANDING DISTANCE WITHOUT PROPELLER REVERSING — FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... RETARD TO MAINTAIN 900 FT/MIN ON FINAL APPROACH
FLAPS 0%
RUNWAY........... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED... IAS AS TABULATED
BRAKING .... MAXIMUM

EXAMPLE:

FLAPS-100% LANDING DISTANCE OVER 50-FT OBSTACLE .... 3310 FT
LANDING WEIGHT................ 10,091 LBS

FLAPS-UP LANDING DISTANCE OVER 50-FT OBSTACLE .... 3725 FT
APPROACH SPEED .... 116 KTS

WEIGHT ~ POUNDS	APPROACH SPEED ~ KNOTS
13,500	133
13,000	131
11,000	122
9000	109

NOTES:
1. LANDING WITH FLAPS FULL DOWN (100%) IS NORMAL PROCEDURE. USE THE GRAPH BELOW WHEN IT IS NECESSARY TO LAND WITH FLAPS UP (0%).
2. TO DETERMINE FLAPS-UP LANDING DISTANCE, READ FROM THE "NORMAL LANDING DISTANCE WITHOUT PROPELLER REVERSING - FLAPS 100%" GRAPH THE LANDING DISTANCE APPROPRIATE TO OAT, ALTITUDE, WIND, AND 50-FOOT OBSTACLE. THEN ENTER THE GRAPH BELOW WITH THE DERIVED VALUE AND READ THE FLAPS-UP LANDING DISTANCE.

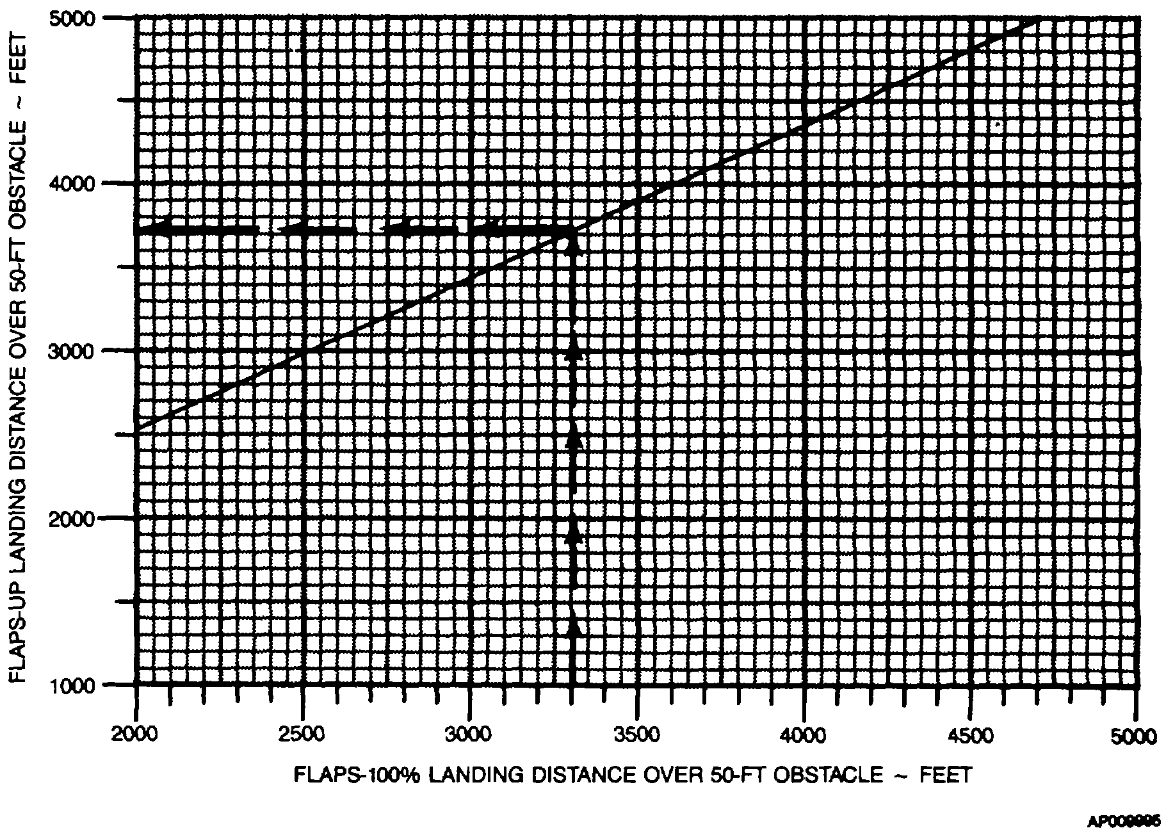


Figure 7-76. Landing Distance Without Propeller Reversing-Flaps 0%

NORMAL LANDING DISTANCE WITHOUT PROPELLER REVERSING FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARD TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
FLAPS 100%
RUNWAY............ PAVED, LEVEL, DRY SURFACE
APPROACH SPEED... IAS AS TABULATED
BRAKING .... MAXIMUM

WEIGHT ~ POUNDS	APPROACH SPEED ~ KNOTS
13,500	108
13,000	106
11,000	100
9000	100

EXAMPLE:

FAT .... 32°C
PRESSURE ALTITUDE ...... 4502 FT
HEADWIND COMPONENT... 10 KTS
WEIGHT.................. 10,091 LBS

GROUND ROLL 1725
TOTAL OVER 50-FT OBSTACLE.............. 3060 FT
APPROACH SPEED .... 100 KTS

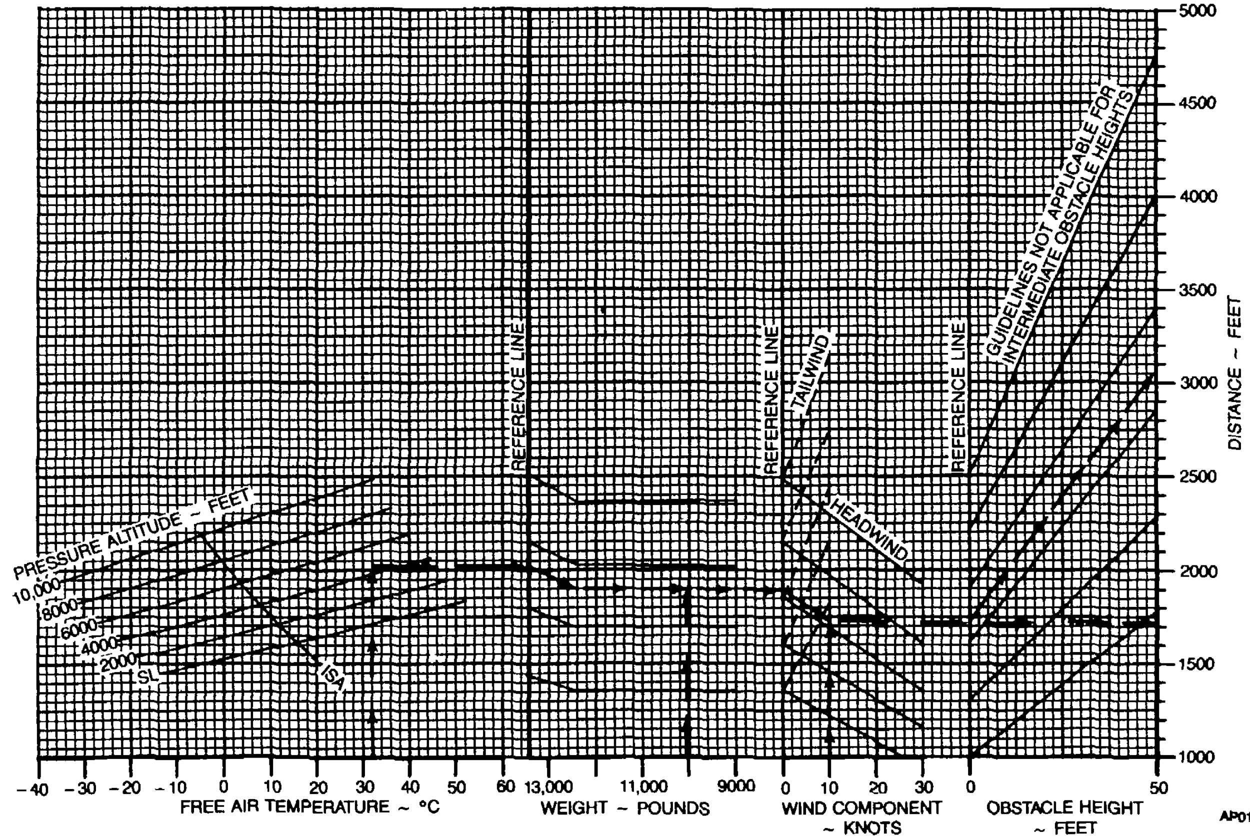


Figure 7-77. Landing Distance Without Propeller Reversing-Flaps 100%

LANDING DISTANCE WITH PROPELLER REVERSING — FLAPS 0%

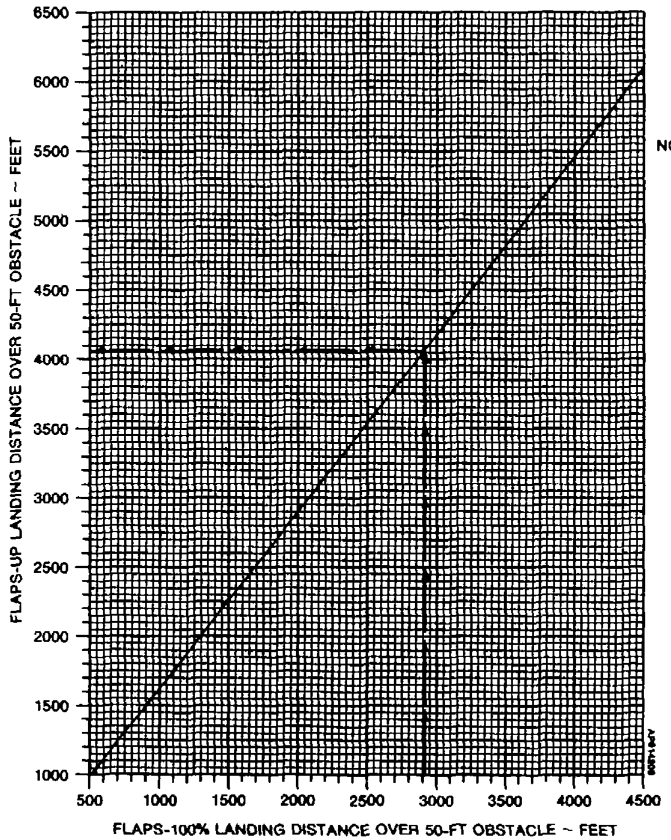
ASSOCIATED CONDITIONS:

POWER .... RETARD TO MAINTAIN 600 FT/MIN ON FINAL APPROACH
FLAPS 0%
RUNWAY .... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED .... IAS AS INDICATED
BRAKING .... MAXIMUM

WEIGHT ~ POUNDS	APPROACH SPEED
13,500	133
13,000	131
11,000	121
9000	109

EXAMPLE:

FLAPS-100% LANDING DISTANCE (W/REV) OVER 50-FT OBSTACLE .... 2920 FT
LANDING WEIGHT .... 10,091 LBS
FLAPS-UP LANDING DISTANCE OVER 50-FT OBSTACLE .... 4065 FT
APPROACH SPEED .... 116 KTS



NOTES:
1. LANDING WITH FLAPS FULL DOWN (100%) IS NORMAL PROCEDURE, USE THE GRAPH AT LEFT WHEN IT IS NECESSARY TO LAND WITH FLAPS UP (0%).
2. TO DETERMINE FLAPS-UP DISTANCE, READ FROM THE "LANDING DISTANCE WITH PROPELLER REVERSING — FLAPS 100%" GRAPH THE LANDING DISTANCE APPROPRIATE TO FAT, ALTITUDE, WIND, AND 50-FT OBSTACLE. THEN ENTER THE GRAPH AT LEFT WITH THE DERIVED VALUE AND READ THE FLAPS-UP LANDING DISTANCE.
3. INCREASE TOTAL GROUND ROLL DISTANCE 10% FOR EACH 1% RUNWAY DOWNSLOPE. DECREASE TOTAL GROUND ROLL DISTANCE 20% FOR EACH 1% RUNWAY UPSLOPE.

Figure 7-78. Landing Distance With Propeller Reversing-Flaps 0%

LANDING DISTANCE WITH PROPELLER REVERSING — FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARD TO MAINTAIN 600 FT/MIN ON FINAL APPROACH.
FLAPS 100%
RUNWAY .... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED .... IAS AS TABULATED
BRAKING .... MAXIMUM

WEIGHT ~ POUNDS	APPROACH SPEED
13,500	108
13,000	106
11,000	100
9000	100

EXAMPLE:

FAT .... 32°C
PRESSURE ALTITUDE .... 4502 FT
HEADWIND COMPONENT .... 10 KTS
WEIGHT .... 10,091 LBS
GROUND ROLL .... 1265 FT
TOTAL OVER 50-FT OBSTACLE .... 2920 FT
APPROACH SPEED .... 100 KTS

NOTE: INCREASE TOTAL GROUND ROLL DISTANCE 3% FOR EACH 1% RUNWAY DOWNSLOPE. DECREASE TOTAL GROUND ROLL DISTANCE 3% FOR EACH 1% RUNWAY UPSLOPE.

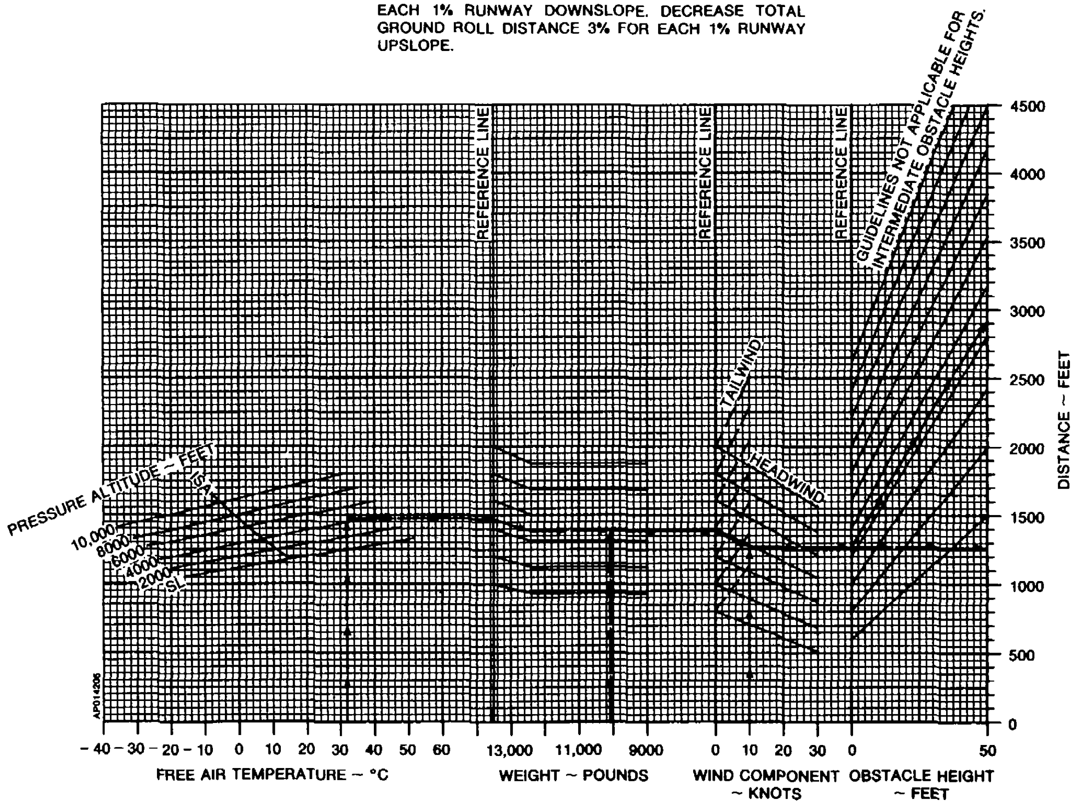


Figure 7-79. Landing Distance With Propeller Reversing-Flaps 100%

STOPPING DISTANCE FACTORS

EXAMPLES:

1. LANDING DISTANCE (FLAPS 100%, NO REV)
   GROUND ROLL (DRY) .... 1725 FT
   TOTAL OVER 50-FT OBSTACLE .... 3060 FT
   RUNWAY CONDITION READING 8
   LANDING WEIGHT .... 10,091 LBS
   STOPPING FACTOR 2.01
   LANDING DISTANCE (FACTORED)
   GROUND ROLL (1725 X 2.01) .... 3467 FT
   AIR DISTANCE (3060 – 1725) .... 1335 FT
   TOTAL OVER 50-FT OBSTACLE .... 4802 FT

2. ACCELERATE-STOP DISTANCE (FLAPS 0%, NO REV)*
   ACCELERATE-STOP DISTANCE .... 4520 FT
   ACCELERATE BEFORE LIFT-OFF
   GROUND ROLL .... 2860 FT
   RUNWAY CONDITION READING 10.0
   TAKE-OFF WEIGHT .... 12,000 LBS
   STOPPING FACTOR 1.60
   STOPPING DISTANCE
   (4520 – 2860) X 1.60 .... 2656 FT
   ACCELERATE DISTANCE .... 2860 FT
   ACCELERATE-STOP DISTANCE .... 5516 FT

NOTES: 1. IF RCR READING IS NOT AVAILABLE, ASSUME ICY RUNWAY RCR = 5 AND WET RUNWAY RCR = 12.
*2. DO NOT USE "WITH REVERSING" CURVES TO DETERMINE ONE-ENGINE-INOPERATIVE STOPPING DISTANCE FACTORS.

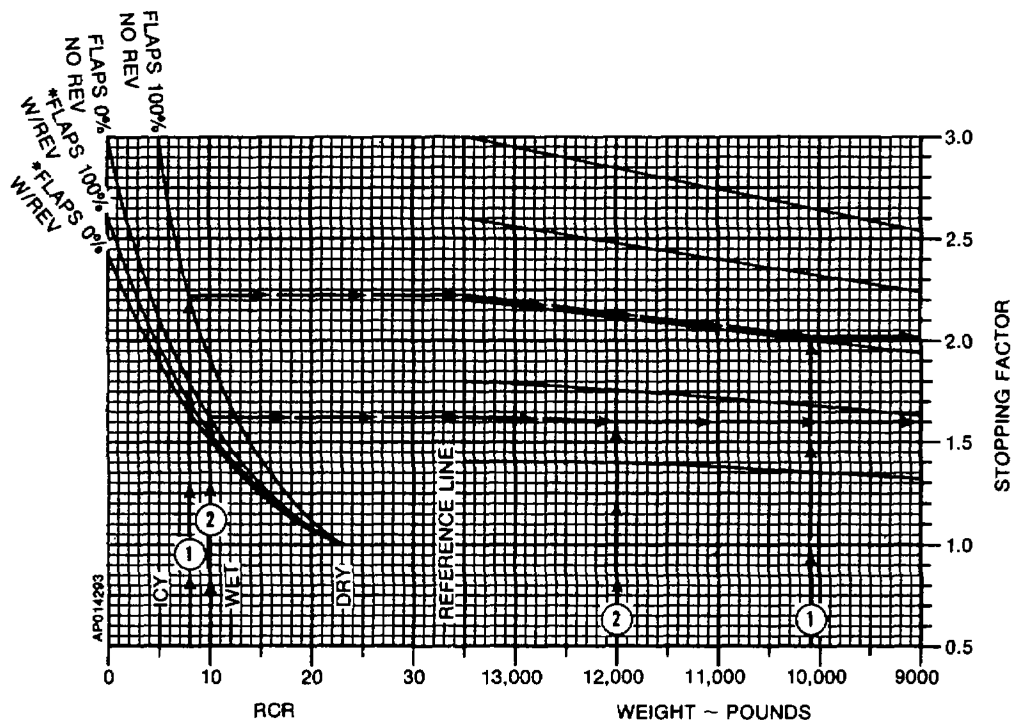


Figure 7-80. Stopping Distance Factors

CHAPTER 8
NORMAL PROCEDURES

Section I. MISSION PLANNING

8-1. MISSION PLANNING.

Mission planning begins when the mission is assigned and extends to the preflight check of the aircraft. It includes, but is not limited to, checks of operating limits and restrictions; weight, balance, and loading; performance; publications; flight plan; and crew and passenger briefings. The pilot in command shall insure compliance with the contents of this manual that are applicable to the mission.

8-2. CREW BRIEFINGS.

A crew briefing must be conducted for a thorough understanding of individual and team responsibilities. The briefing should include, but not be limited to, copilot, crew chief, and ground crew responsibilities and the coordination necessary to complete the mission most efficiently. A review of visual signals is desirable when ground guides do not have a direct voice communications link with the crew. Refer to Section VI for crew briefings.

Section II. OPERATING PROCEDURES AND MANEUVERS

8-3. OPERATING PROCEDURES AND MANEUVERS.

This section deals with normal procedures and includes all steps necessary for safe and efficient operation of the aircraft from the time, a preflight begins until the flight is completed and the aircraft is parked and secured. Unique feel, characteristics, and reaction of the aircraft during various phases of operation and the techniques and procedures used for taxiing, takeoff, climb, etc., are described, including precautions to be observed. Only the duties of the minimum crew necessary for the actual operation of the aircraft are included.

8-4. CHECKLIST.

Normal procedures are given primarily in checklist form and are amplified as necessary in accompanying paragraph form when a detailed description of a procedure or maneuver is required. A condensed version of the amplified checklist, omitting all explanatory text, is contained in the Operator's and Crewmember's Checklist, TM 55-1510-219-CL. To provide for easier cross referencing, the procedural steps are numbered to coincide with the corresponding numbered steps in TM 55-1510-219-CL.

8-5. SYMBOLS DEFINITION.

Items which apply only to night or only to instrument flying shall have an "N" or "I", respectively, immediately preceding the check to which it is pertinent. The symbol "O" shall be used to indicate "if installed." The star symbol ☆ indicates an operational check contained in the performance section of the condensed checklist. The asterisk symbol "*" indicates that performance of the step is mandatory for all thru-flights. The asterisk applies only to checks performed prior to takeoff. Placarded items appear in upper case.

8-6. BEFORE EXTERIOR CHECK.

1. Publications-Check DA Forms 2408-12, -13, -14, and -18, DD Form 365-4, locally required forms and publications, and availability of operator's manual (-10) and checklist (-CL).

☆2. Oxygen system-Check as required.

   a. Oxygen supply pressure gages-Check.

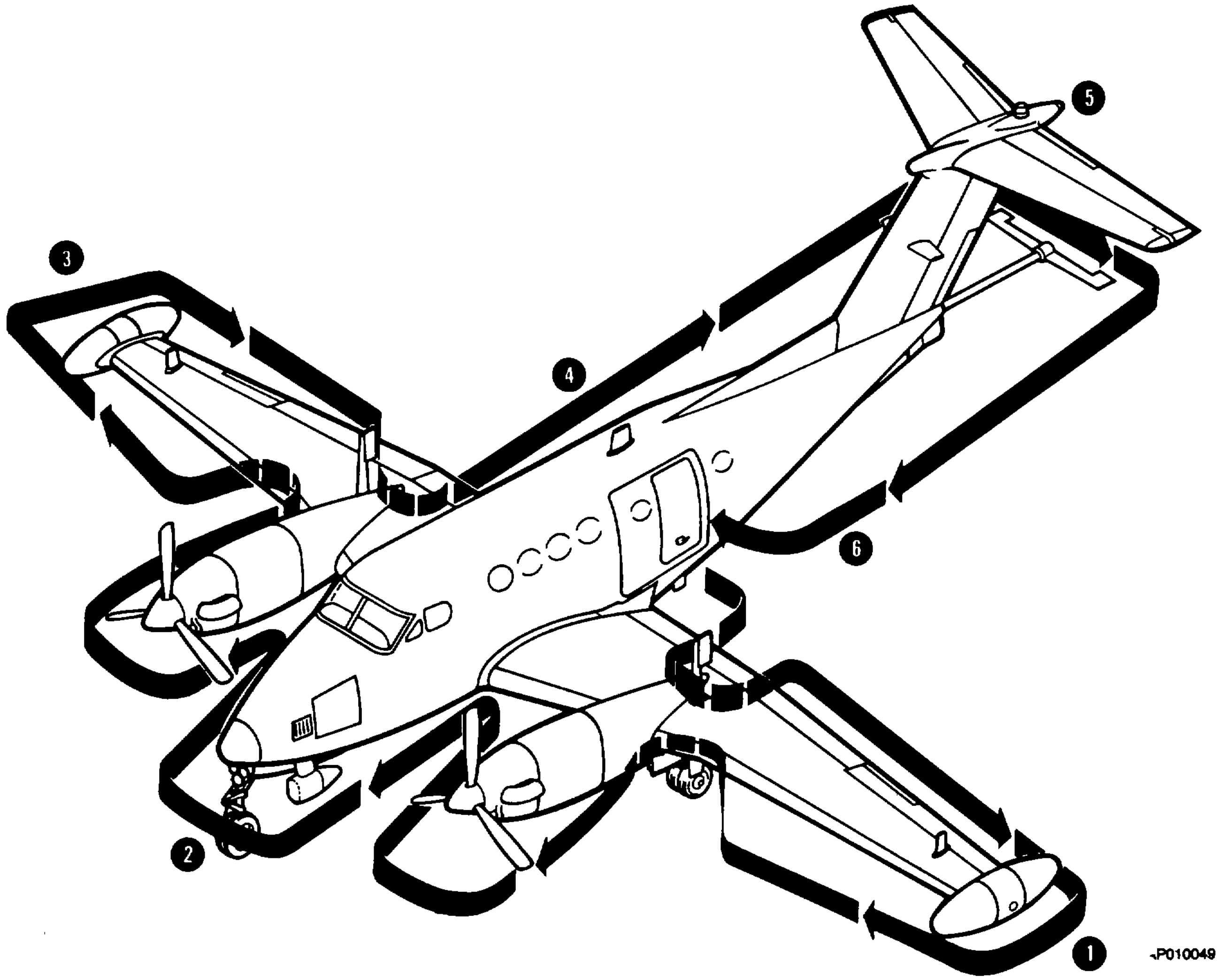
   b. Supply control lever (green)-ON.

   c. Diluter control lever-100% OXYGEN.

   d. Emergency control lever (red)-Set to TEST MASK position while holding mask directly away from face, then return to NORMAL.

   e. Oxygen mask-Don and adjust.

   f. Emergency control lever (red)-Set to TEST MASK position and check mask for leaks, then return lever to NORMAL.



AREA 1. Left wing, landing gear, engine, nacelle and propeller
AREA 2. Nose section
AREA 3. Right wing, landing gear, engine, nacelle and propeller
AREA 4. Fuselage, right side
AREA 5. Empennage and tail
AREA 6. Fuselage, left side

Figure 8-1. Exterior Inspection

   g. Flow indicator-Check, during inhalation blinker appears, during exhalation blinker disappears). Repeat a minimum of 3 times.
3. Flight controls-Unlock and check.
4. Parking brake-Set.
5. Manual trim-Zero.
6. Gear-Down.
7. Ice vanes-IN.
8. Overhead panels witches and circuit breakers-Set as follows.
   a. Circuit breakers-Check.
   b. Light dimming controls-As required.
   c. Cabin temperature mode-OFF.
   d. Ice and rain switches-As required.
   e. Exterior light switches-As required.
   f. Master panel light switch-As required.
   g. Inverter switches-OFF.
   h. Avionics master power switch-As required.
   i. Environmental switches-As required.
   j. Autofeather switches-OFF.
   k. #1 ignition and engine start switch-OFF.
   l. Master switch-OFF.
   m. #2 ignition and engine start switch-OFF.
   n. Standby pump switches-OFF.
   o. Auxiliary transfer switches-AUTO.
   p. Crossfeed switch-OFF.
9. AC and DC GPU's-As required.
10. External power advisory lights-As required.
11. Keylock switch-ON.

☆12. Fuel pumps/crossfeed operation-Check as follows:
   a. Fire pull handles-Pull.
   b. Standby pump switches-ON.
   c. Battery switch-ON.
   d. #1 and#2 fuel press warning lights-Illuminated.
   e. Fire pull handles-IN.
   f. #1 and#2 fuel pressure warning lights-Extinguished.
   g. Standby pump switches-STANDBY PUMP.
   h. #1 and #2 fuel pressure warning lights-Illuminated.
   i. Crossfeed-Check. Check system operation by activating switch momentarily left then right, noting that #1/#2 FUEL PRESS warning lights extinguish and that the FUEL CROSSFEED advisory light illuminates as switch is energized.

13. DC power-Check (24 VDC minimum for battery, 28 maximum for GPU starts).
14. Lighting systems-Check.

☆15. Anti-ice systems-Check.
   a. Stall warning heat switch-ON.
   b. Pitot heat switches (2)-ON. Check cover removed.
   c. Fuel vent heat switches (2)-ON.
   d. Left wing heated fuel vent-Check by feel for heat and condition.
   e. Stall warning vane-Check by feel for heat and condition.
   f. Left pitot tube-Check by feel for heat and free of obstructions.
   g. Right pitot tube-Check by feel for heat and free of obstructions.
   h. Right wing heated fuel vent-Check by feel for heat and condition.
   i. Stall warning heat switch-OFF.
   j. Pitot heat switches (2)-OFF.
   k. Heated fuel vent switches (2)-OFF.

☆16. Annunciator panels-Test as required.
   a. MASTER CAUTION, MASTER WARNING, #1 FUEL PRESSURE, #2 FUEL PRESSURE, GEAR DN, L BL AIR FAIL, R BL AIR FAIL, ALT WARN, INST AC, #1 DC GEN, #1 INVERTER, #1 NO FUEL XFR, #2 NO FUEL XFR, #2 INVERTER, #2 DC GEN-Check on.
   b. ANNUNCIATOR TEST switch-Press and hold. Check that all lights in aircraft and mission annunciator panels illuminate, FIRE PULL handle lights, marker beacon lights, MASTER CAUTION and MASTER WARNING

lights are on. Release switch and check that all lights except those in step (a.) are extinguished.

c. MASTER CAUTION and MASTER WARNING lights-Press. Both lights extinguish.

d. Stall and gear warning system-TEST. Check that warning horn sounds and that the LDG gear control handle lights (2) illuminate.

☆17. Fire protection system-Check as follows:

a. Fire detector test switch-Rotate counterclockwise to check three DETR positions. FIRE PULL handles should illuminate in each position. Reset MASTER WARNING in each position.

b. Fire detector test switch-Rotate counterclockwise to check two EXTGH positions. SQUIB OK light, associated EXTGH DISCH caution light and MASTER CAUTION LIGHT should illuminate in each position.

☆18. INS alignment-As required.

a. Exterior power 28 VDC-Connected.
b. Key lock switch-ON.
c. Battery switch-ON.
d. Aircraft inverters-ON.
e. Mission inverters-ON.
f. Mission control switch-As required.
g. 3 phase A.C. bus-RESET.

Check inertial cooling for ON.

h. Aircraft master avionics switch-EXTERNAL POWER
i. Mode selector-ALIGN
j. Data selector-DSTRK/STS

Align condition is shown on 5 digit RH display. Align will not progress beyond 8 until present position is loaded.

k. Test button-PRESS AND HOLD.

All displays read 8, ROLL LIMIT, HOLD, INSERT/ADVANCE, WY PT, CHG, ALERT, BAT, WARN, and READY NAV LAMPS lit. When released, all extinguish except INSERT/ADVANCE. Insure all malfunction codes are cleared.

l. Data selector-L/L POS (UTM for grid nav).

m. Load present position.

(1) Select N or S degrees, minutes and tenths -INSERT/ADVANCE - PRESS.

(2) Select E or W degrees, minutes and tenths -INSERT/ADVANCE-PRESS.

NOTE

Insure correct values for UTM grid spheroid coefficients are loaded using UTM coordinates.

WAYPOINT SELECTION

a. Data selector-L/L WY PT.
b. WYPT thumb wheel-DESIRED WY PT (Do not use 0).
c. LAT/LONG waypoint (Deg., Min., Tenths)-LOAD.
d. INSERT ADVANCE-PRESS AGAIN.

Latitude and longitude in arc-seconds relating to tenths entered is shown.

e. ARC/SEC LAT & LONG (Sec. and Tenths)-LOAD.

Repeat a thru e for each WY PT.

f. Flight plan cross check-Data selector to DIS/TIME (left display will indicate distance between WY PTS TO-FROM). Press WY PT change. Verify logical distance between waypoints.

TACAN STATION SELECTION

a. Data selector-L/L WY PT.
b. Simultaneously press-Keys 7 and 9.
c. WY PT thumb wheel-DESIRED TACAN.
d. TACAN station position-LOAD LAT/LONG.
e. INSERT/ADVANCE-PRESS.

Latitude and longitude in arc-seconds relating to tenths entered is shown.

f. ARC/SEC and Tenths-LOAD.
g. INSERT/ADVANCE-PRESS.
h. TACAN station altitude-LOAD (select Key 4 or 6). Enter altitude.
i. INSERT/ADVANCE-PRESS.

j. TACAN channel number-LOAD (select Key 2 or 8). Enter channel.

Repeat steps a thru j for all TACAN stations.

HSI INTERFACE TEST

NOTE

Interface test must be performed after alignment progresses from state 8 but prior to switching to NAV.

a. AUTO/MAN switch-MAN.

b. Couple INS to FD and engage AP.

c. Data selector (any position but DSRTK).

d. CDU TEST-PRESS and HOLD.

MSU and CDU all lamps lit 8's. RMI all angles are 30 degrees. Cross track deviation bar is 1 dot right, NAV flags are retracted, WX radar NAV display indicates 1 dot right of course.

On HRI, a 15 degree RH steering command. Aircraft panel LINK UPDATE/TACAN UPDATE annunciated and INS light illuminated.

e. Continue holding TEST switch from MAN to AUTO. RMI all angles are 0. Cross track deviation is one dot left. A 15 degree left steering command is issued.

f. Release TEST switch-Operations return to normal.

☆19. Electric elevator trim and autopilot/flight director operation-Check as follows:

a. Pilot and copilot PITCH TRIM switches-Press to NOSE UP and NOSE DN positions, singularly and in pairs. Check that trim wheel moves in proper direction and operates only when trim switches are pressed in pairs. Any deviation requires that electric elevator trim be turned off and flight conducted using manual trim.

b. TRIM DISC switch-Press and check that electric trim disconnects and that ELEV TRIM light extinguishes.

c. Flight director (FD) and radio magnetic indicator (RMI) warning flags masked-Check.

NOTE

Since the pressure of airflow that normally opposes movement of control surfaces is absent during preflight check, it is possible to get a hard over control surface deflection if an autopilot command is allowed to remain active for any appreciable length of time. Move turn knob and pitch thumbwheel only enough to check operation, then return them to the center position.

d. Select HDG mode-Check.

e. Horizontal situation indicator (HSI) heading marker under lubber line-Set.

f. Engage autopilot and check controls stiff, and AIL HI TORQUE, HDG, and AP ENG are illuminated-Check.

g. Move HSI heading marker 10° left and right and verify that FD and control wheels respond in the appropriate direction-Check.

h. Press AP/YD disengage switch and verify that autopilot disengages and that flight controls are free -Check.

i. Engage autopilot-Check.

j. Command 5° trim UP with AP pitch wheel and verify that manual trim wheel moves nose UP and AP trim light indicates UP trim-Check.

k. Press pitch trim switch nose down and verify that autopilot disengages and AUTOPILOT TRIM FAIL and MASTER WARNING lights illuminate-Check.

NOTE

The AP TRIM FAIL annunciator will extinguish by pressing the AP/YD disconnect button on the control wheel to the first detent.

l. Repeat steps i thru k above using opposite commands.

m. Engage autopilot-Check.

n. Move HSI heading marker to command a bank on flight director-Check.

o. Press GO-AROUND switch and verify that GA annunciator light illuminates, autopilot disengages, and that flight director commands a wings level, 7° nose-up attitude-Check.

p. Press TEST switch (pilot's HRI) and verify that attitude display indicates an additional 10° pitch up and 20° right bank-Check.

q. Engage autopilot command DN with AP pitch wheel and engage and hold AUTO PILOT TRIM TEST switch when elevator trim wheel starts to rotate.

r. Verify that autopilot disengages and AP TRIM FAIL and MASTER WARNING lights illuminate within 10 seconds.

☆20. Avionics-Check as follows:

a. NAV 1

(1) Frequency select knob (NAV panel)-Select a VOR frequency.

(2) NAV TEST switch (NAV PANEL)-Press and hold.

(3) RMI-Observe that single needle indicates approximately 005°.

(4) VOR/LOC flag -Check that flag is out of view.

(5) TO/FROM pointer-Check that pointer indicates TO.

(6) HSI course deviation bar-Check for centered bar.

(7) Marker beacon lights-Check that all three lamps are illuminated and flickering at approximately a 30 Hz rate.

(8) VOR frequency knob (NAV panel)-Select a LOC frequency.

(9) HSI course deviation bar-Check that bar indicates a deflection of approximately one dot right of center.

(10) HSI glideslope pointer-Check that pointer indicates a deflection of approximately one dot below center.

(11) Marker beacon lights-Check that all three lamps are illuminated and flickering at approximately a 30 Hz rate.

b. NAV 2

All NAV 2 self-test procedures are the same as those used for NAV 1, with the exception of the marker beacon test. There is no marker beacon receiver in the NAV 2 system.

c. TACAN

(1) TEST pushbutton -Press and hold.

(2) Range indicator-Check for an indication of 0.0 ± 0.1 nautical miles.

(3) Pilot's COURSE SELECTOR switch-Select TACAN.

(4) Pilot's RMI selector switch-Select TACAN.

(5) RMI double needle-Check for an indication of 180° ± 2°.

(6) HSI course selector-Turn to 180° and adjust slowly until the course deviation bar is centered. The bar should center between a selected course of 178° to 182°.

(7) HSI course selector-Turn the selector + 10° from the setting achieved in step 6, and check that course deviation bar is located over the far left 10° dot.

(8) HSI course selector-Turn the selector + 10° from the setting

(9) HSI course selector-Turn the selector -10° from the setting achieved in step 6, and check that course deviation bar is located over the far right 10° dot.

(10) TO-FROM indicator-Check that TO is indicated.

(11) TEST pushbutton-Release.

21. Flaps-Check.
22. Battery switch-As required.
23. Toilet-Check.
24. Emergency equipment-Check.
25. Mission equipment and circuit breakers-Check and set.
26. Parachutes-Check (as required).

8-7. FUEL SAMPLE.

NOTE

Fuel and oil quantity check may be performed prior to BEFORE EXTERIOR CHECK. During warm weather open fuel cap slowly to prevent being sprayed by fuel under pressure due to thermal expansion.

*1. Check collective fuel sample from all drains for possible contamination. Thru-flight check is only required if aircraft has been refueled.

8-8. LEFT WING, AREA 1.

a. Left wing area-Check as follows (fig. 8-1):

*1. General condition-Check for skin damage such as buckling, splitting, distortion, dents, or fuel leaks.
2. Flaps-Check for full retraction (approximately 0.25 inch play) and skin damage such as buckling, splitting, distortion, or dents.
3. Fuel sump drains (3)-Check for leaks.
4. Controls and trim tab-Check security and trim tab rig.

NOTE

All static wicks (24) must be installed for optimum radio performance.

5. Static wicks-Check security and condition.
6. Wing pod, navigation lights and antennas (2) -Check condition.
7. Recognition light-Check condition.
8. Outboard antenna set-Check condition.
*9. Main tank fuel and cap-Check fuel level visually, condition of seal, and cap tight and properly installed.
10. Outboard wing fuel vent-Check free of obstructions.
11. Outboard deice boot-Check for secure bonding, cracks, loose patches, stall strips, and general condition.
12. Stall warning vane-Check free.
13. Tiedown-Released.
14. Inboard dipole antenna set-Check for security and cracks at mounting points. Check bonding secure, boots free of cuts and cracks.
15. Wing ice light-Check condition.
16. AC GPU access door-Secure.
17. Recessed and heated fuel vents-Check free of obstruction.
18. Inverter inlet and exhaust louvers-Check free of obstructions.

8-9. LEFT MAIN LANDING GEAR.

a. Left main landing gear-Check as follows:

1. Tires-Check for cuts, bruises, wear, proper inflation and wheel condition.
2. Brake assembly-Check brake lines for damage or signs of leakage, brake linings for wear (0.25-inch), brake deice assembly and bleed air hose for condition and security.
3. Shock strut-Check for signs of leakage, minimum strut extension, (5.50 inches) and that left and right strut extension is approximately equal.
4. Torque knee-Check condition.
5. Safety switch-Check condition, wire, and security.
6. Fire extinguisher pressure-Check pressure within limits.
7. Wheel well, doors, and linkage-Check for signs of leaks, broken wires, security, and general condition.
8. Fuel sump drains (forward)-Check for leaks.

8-10. LEFT ENGINE AND PROPELLER.

a. Left engine-Check as follows:

CAUTION

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engine. If more than 10 minutes have elapsed, motor engine for 30 seconds, then recheck. If more than 10 hours have elapsed, run engine for 2 minutes, then recheck. Add oil as required. Do not overfill.

*1. Engine oil-Check oil level, oil cap secure, locking tab aft, and access door locked.

NOTE

Secure front cowling latches first.

2. Engine compartment, left side-Check for fuel and oil leaks, security of oil cap, door locking pins, and general condition.
*3. Left cowl locks-Locked.
4. Left exhaust stack-Check for cracks, security and free of obstructions.
*5. Propeller blades and spinner-Check blade condition, boots, security of spinner and free propeller rotation.
*6. Engine air inlets and ice vane-Check free of obstruction and ice vane retracted.
7. Bypass door-Check condition.
*8. Right cowl locks-Locked.
9. Right exhaust stack-Check for cracks, security and free of obstructions.
10. Engine compartment, right side-Check for fuel and oil leaks, ice vane linkage, door locking pins, and general condition. Lock compartment access door.

8-11. CENTER SECTION, LEFT SIDE.

a. Center section-Check as follows:

1. Heat exchanger inlet and outlet-Check for cracks and free of obstruction.
2. Auxiliary tank fuel sump drain-Check for leaks.
3. Deice boot-Check for secure bonding, cracks, loose patches, and general condition.
*4. Auxiliary tank fuel gage and cap-Check fuel level visually, condition of seal, and cap tight and properly installed.
5. Monopole antenna-Check condition.

8-12. FUSELAGE UNDERSIDE.

a. Fuselage underside-Check as follows:

*1. General condition-Check for skin damage, such as buckling, splitting, distortion, dents, or fuel leaks.
2. Antennas-Check security and general condition.

8-13. NOSE SECTION, AREA 2.

a. Nose section-Check as follows:

1. Free air temperature probe-Check condition.
2. Avionics door, left side-Check secure.
3. Air conditioner exhaust-Check free of obstruction.
4. Wide band data link antenna pod-Check for cracks and chips.
5. Wheel well-Check for signs of leaks, broken wires and general condition.
6. Doors and linkage-Check condition, security, and alignment.
7. Nose gear turning stop-Check condition.
*8. Tire-Check for cuts, bruises, wear, appearance of proper inflation, and wheel condition.
*9. Shock strut-Check for signs of leakage and 3.0 inches minimum extension.
10. Torque knee-Check condition.
11. Shimmy damper and linkage-Check for security and condition.
12. Landing and taxi lights-Check for security and condition.
13. Pitot tubes-Check covers removed, alignment, security, and free of obstructions.
14. Radome-Check for cracks and chips.

CAUTION

Do not move wipers on dry windshield or clean windshield with anything other than mild soap and water.

15. Windshields and wipers-Check windshield for cracks and cleanliness and wipers for contact with glass surface.
16. Air conditioner inlet-Check free of obstructions.
17. Avionics door, right side-Check secure.

8-14. RIGHT WING CENTER SECTION.

a. Right wing center section-Check as follows:

1. Deice boot-Check for secure bonding, cracks, loose patches and general condition.
2. Battery access panel-Secure.
3. Battery vents-Check free of obstruction.

*4. Auxiliary tank fuel and cap-Check fuel level visually, condition of seal, and cap tight and properly installed (locking tab aft).

5. Battery compartment drain-Check free of obstruction.
6. Battery ram air intake-Check free of obstruction.
7. INS temperature probe-Check condition and free of obstructions.
8. Auxiliary tank fuel sump drain-Check for leaks.
9. Heat exchanger outlet and inlet-Check for cracks and free of obstructions.
10. Monopole antenna-Check condition.

8-15. RIGHT ENGINE AND PROPELLER.

a. Right engine and propeller-Check as follows:

CAUTION

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engine. If more than 10 minutes have elapsed, motor engine for 30 seconds, then recheck. If more than 10 hours have elapsed, run engine for 2 minutes, then recheck. Add oil as required. Do not overfill.

*1. Engine oil-Check oil level, oil cap secure (locking tab aft), and access door locked.

2. Engine compartment, left side-Check for fuel and oil leaks, security of oil cap, door locking pins, and general condition.

*3. Left cowl locks-Locked.

4. Left exhaust stack-Check for cracks, security and free of obstructions.

*5. Propeller blades and spinner-Check blade condition, boots, security of spinner, and free propeller rotation.

*6. Engine air inlets and ice vane-Check free of obstruction and ice vane retracted.

7. Bypass door-Check condition.

*8. Right cowl locks-Locked.

9. Right exhaust stack-Check for cracks, security and free of obstructions.
10. Engine compartment, right side-Check for fuel and oil leaks, ice vane linkage, door locking pins, and general condition. Lock compartment access door.

8-16. RIGHT MAIN LANDING GEAR.

a. Right main landing gear-Check as follows:

1. Fuel sump drains (forward)-Check for leaks.

*2. Tires-Check for cuts, bruises, wear, proper inflation and wheel condition.

3. Brake assembly-Check brake lines for damage or signs of leakage, brake linings for wear (0.25 inch maximum) and brake deice assembly and bleed air hose condition and security.

*4. Shock strut-Check for signs of leakage and minimum strut extension (5.50 inches).

5. Torque knee-Check condition.

6. Safety switch-Check condition, wire, and security.
7. Fire extinguisher pressure-Check pressure within limits.
8. Wheel well, doors, and linkage-Check for signs of leaks, broken wires, security, and general condition.

8-17. RIGHT WING, AREA 3.

a. Right wing-Check as follows:

1. Recessed and heated fuel vents-Check free of obstructions.
2. Inverter inlet and exhaust louvers-Check free of obstructions.
3. GPU access door-Secured.
4. Inboard dipole antenna set-Check for security and cracks at mounting points, bonding secure, free of cuts and cracks.
5. Wing ice light-Check condition.
6. Outboard deice boot-Check for secure bonding, cracks, loose patches, stall strips, and general condition.

*7. Tiedown-Released.

*8. Main tank fuel and cap-Check fuel level visually, condition of seal, and cap tight and properly installed.

9. Outboard wing fuel vent-Check free of obstruction.
10. Outboard antenna set-Check for security and cracks at mounting points, bonding secure, free of cuts and cracks.
11. Recognition light-Check condition.
12. Wing pod, navigation lights and antennas (2) -Check condition.
13. Static wicks-Check security and condition.
14. Controls-Check security and condition of ground adjustable tab.
15. Fuel sump drains (3)-Check for leaks.
16. Flaps-Check for full retraction (approximately 0.25 inch play) and skin damage, such as buckling, splitting, distortion, or dents.
17. Chaff dispenser-Check number of chaffs in payload module and for security.

*18. General condition-Check for skin damage, such as buckling, splitting, distortion, dents, or fuel leaks.

8-18. FUSELAGE RIGHT SIDE, AREA 4.

a. Fuselage right side-Check as follows:

* 1. General condition-Check for skin damage such as buckling, splitting, distortion or dents.

2. Flare/Chaff dispenser-Check number of flares in payload module and for security.
3. Emergency light-Check condition.
4. Beacon-Check condition.
5. Aft access door-Check secure.
6. Oxygen filler door-Check secure.
7. Static ports-Check clear of obstructions.
8. ASE antennas (2)-Check.
9. Emergency locator transmitter ARMED.
10. Emergency locator transmitter antenna-Check condition.

8-19. EMPENNAGE, AREA 5.

a. Empennage-Check as follows:

1. Vertical stabilizer, rudder, and trim tab-Check for skin damage, such as buckling, distortion, or dents, and trim tab rig.
2. Antennas-Check condition.
3. Deice boots-Check for secure bonding, cracks, loose patches, and general condition.
4. Horizontal stabilizer and elevator-Check for skin damage, such as buckling, distortion and dents.

NOTE

Any difference between the indicated position on the trim tab position indicator and the actual position of the elevator trim tab signifies an unairworthy condition and must be corrected prior to the next flight of the aircraft.

5. Elevator trim tab-Verify "O" (neutral) position.

WARNING

If the possibility of ice accumulation on the horizontal stabilizer or elevator exists, takeoff will not be attempted.

6. Static wicks (16)-Check installed.
7. Position and beacon lights-Check condition.
8. Rotating boom dipole antenna-Check condition and position.
9. Wide band data link antenna pod-Check for cracks and chips.

8-20. FUSELAGE, LEFT SIDE, AREA 6.

a. Fuselage-Check as follows:

* 1. General condition-Check for skin damage, such as buckling, distortion, or dents.

2. Static ports-Check clear of obstructions.
3. ASE antennas (2)-Check.
4. Emergency light-Check condition.
5. Cabin door-Check door seal and general condition.
6. Fuselage top side-Check general condition and antennas.

*8-21. INTERIOR CHECK.

1. Cargo/loose equipment-Check secure.
2. Cabin door-Locked and checked. Insure that the cabin door is closed and locked as follows: Check position of safety arm and diaphragm plunger (lift door step) and that each of the six rotary cam locks align within the sight indicators.
3. Cargo door-Locked and checked. Insure that the cargo door is closed and locked as follows:
   a. Upper handle position-Closed and locked (the index marks on each of the four rotary cam locks must align within the sight indicators).
   b. Lower pin latch handle position-Closed and latched (the indicator must align with stripe on carrier rod).

NOTE

The untapered shoulder of the latching pins extend past each attachment lug.

In addition, the following inspection and test shall be performed prior to the first flight of the day:

   c. Open cabin door-Check that the "CABIN/CARGO DOOR" annunciator light is extinguished.
   d. Latch cabin door but do not lock-Check that the "CABIN/CARGO DOOR" annunciator light illuminates.
   e. Battery switch ON-Check that the "CABIN/CARGO DOOR" annunciator light is still illuminated.
   f. Close and lock the cabin door-Check that the "CABIN/CARGO DOOR" annunciator light is extinguished.
   g. Battery switch-OFF.
4. Emergency exit-Check secure and key removed.
5. Mission cooling ducts-Check open and free of obstructions.
6. Flare/Chaff dispenser preflight test-Completed.
7. Crew briefing-As required.

8-22. BEFORE STARTING ENGINES.

* 1. Parking brake-Set.

2. Magnetic compass-Check for fluid, heading and current deviation card.

*3. Pedestal controls-Set as follows.

CAUTION

Movement of power levers into reverse range while engines are shut down may result in bending and damage to control linkages.

a. Power levers-IDLE.
b. Propeller levers-As required.
c. Condition levers-FUEL CUTOFF.
d. Flaps-UP.

4. Lower console switches-Set as follows.
   a. Flare/Chaff dispenser control-SAFE.
   b. Avionics-As required.
   c. Rudder boost switch-ON.
5. Gear alternate engage and ratchet handles-Stowed.
6. Free air temperature gage-Check, note current reading.
7. Instrument panel-Check and set as follows.
   a. Pilot's and copilot's course indicator switches -As required.
   b. Pilot's and copilot's RMI switches-As required.
   c. Pilot's and copilot's MIC switch-As required.
   d. Pilot's and copilot's compass switches-As required.
   e. Gyro switches-SLAVE.
   f Flight instruments-Check instruments for protective glass, warning flags (10) pilot, 5 copilot), static readings, and heading correction card.
   g. Radar- OFF.
   h. APR-39 and APR-44-OFF.
   i. Engine instruments-Check for protective glass and static readings.
8. Prop sync switch-OFF.
9. Mission panel switches and circuit breakers-Set.
10. Subpanels-Check and set as follows.
    a. Fire protection test switch-OFF.
    b. Landing, taxi, and recognition lights-OFF.
    c. Gear-Recheck DN.
    d. Cabin lights-As Required.
    e. Pilot's static air source-NORMAL.
    f. Pilot's and copilot's audio control panels-As required.

NOTE

Do not use alternate static source during takeoff and landing except in an emergency. Pilot's instruments will show a variation in airspeed and altitude.

11. AC and DC GPU's-As required.
12. External power advisory lights-As required.

*13. Battery-ON.

14. DC power-Check.

***8-23. FIRST ENGINE START (BATTERY START).**

CAUTION

Mission control switch should be OFF prior to start.

NOTE

The engines must not be started until after the INS is placed into the NAV mode or OFF as required.

Starting procedures are identical for both engines. When making a battery start, the right engine should be started first. When making a ground power unit (GPU) start, the left engine should be started first due to the GPU receptacle being located adjacent to the right engine. A crew member should monitor the outside observer throughout the engines
start.

1. Avionics master switch-OFF.

NOTE

Use the beacons NIGHT position for all ground operations, changing to the DAY position only when taking the active runway for takeoff (when conditions permit).

2. Exterior light switches-As required.

3. Ignition and engine start switch-ON. Propeller should begin to rotate and associated IGN ON light should illuminate. Associated FUEL PRESS light should extinguish.
4. Condition lever (after N1 RPM stabilizes, 12% minimum)-LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During starting, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

5. TGT and N1-Monitor (TGT 1000°C maximum, N1 52% minimum).
6. Oil pressure-Check (60 PSI minimum).
7. Ignition and engine start switch-OFF after TGT stabilized.
8. Condition lever-HIGH IDLE. Monitor TGT as the condition lever is advanced.
9. Generator switch-RESET, then ON.

8-24. SECOND ENGINE START (BATTERY START).

1. First engine generator load-50% or less.
2. Ignition and engine start switch-ON. Propeller should begin to rotate and associated IGN on light should illuminate. Associated FUEL PRESS light should extinguish.
3. Condition lever (after N1 RPM passes 12% minimum)-LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During starting, the maximum allowable TGT is 10000C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

4. TGT and N1-Monitor (TGT 1000IC maximum, N1 52% minimum).
5. Oil pressure-Check (60 PSI minimum).
6. Ignition and engine start switch-OFF after TGT stabilized.
7. Battery charge light-ON.
8. Second engine generator-RESET, then ON.
9. Inverter switches-ON, check INVERTER lights OFF.
10. Condition levers-As required.

8-25. ABORT START.

1. Condition lever-FUEL CUTOFF.
2. Ignition and engine start switch-STARTER ONLY.
3. TGT-Monitor for drop in temperature.
4. Ignition and engine start switch-OFF.

8-26. ENGINE CLEARING.

1. Condition lever-FUEL CUTOFF.
2. Ignition and engine start switch-OFF (1 minute minimum).

CAUTION

Do not exceed starter limitation of 30 seconds ON and 5 minutes OFF for two starting attempts and engine clearing procedure. Allow 30 minutes off before additional starter operation.

3. Ignition and engine start switch-STARTER ONLY (15 seconds minimum, 30 seconds maximum).
4. Ignition and engine start switch-OFF.

8-27. FIRST ENGINE START (GPU START).

1. INS-As required.

CAUTION

Mission control switch should be OFF prior to start.

NOTE

The engines must not be started until after the INS is placed into the NAV mode or OFF as required.

2. Avionics master switch-As required.

NOTE

Use the beacons NIGHT position for all ground operations, changing to the DAY position only when taking the active runway for takeoff (when conditions permit).

3. Exterior light switches-As required.
4. Ignition and engine start switch-ON. Propeller should begin to rotate and associated IGN ON light should illuminate. Associated FUEL PRESS light should extinguish.
5. Condition lever (after N1 RPM stabilizes, 12% minimum)-LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During engine start, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

6. TGT and N1-Monitor (TGT 1000°C maximum, NI 52% minimum).
7. Oil pressure-Check (60 PSI minimum).
8. Ignition and engine start switch-OFF after TGT stabilized.
9. Condition lever-As required. Monitor TGT as the condition lever is advanced.
10. DC GPU disconnect-As required.
11. Generator switch (GPU disconnected)-RESET, then ON.
12. Condition lever-HIGH IDLE.

8-28. SECOND ENGINE START (GPU START).

1. Ignition and engine start switch-ON. Propeller should start to rotate and associated IGN ON light should illuminate. Associated FUEL PRESS light should extinguish.
2. Condition lever (after N1 RPM passes 12% minimum)-LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During engine start, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

3. TGT and N1-Monitor (TGT 1000°C maximum, N1 52% minimum).
4. Oil pressure-Check (60 PSI minimum).
5. Ignition and engine start switch-OFF after TGT stabilized.
6. Propeller levers-FEATHER.
7. GPU-Disconnect. (Check aircraft external power and mission external power light extinguished).
8. Propellers levers-HIGH RPM.
9. Generator switches-RESET, then ON.
10. Aircraft inverter switches-ON, check INVERTER lights OFF.
11. Condition levers-As required.

8-29. BEFORE TAXIING.

*1. Brake deice-As required. To activate the brake deice system proceed as follows:
   a. Bleed air valves-As required.
   b. Brake deice switch-DEICE. Check BRAKE DEICE ON light illuminated.
   c. Condition levers-HIGH IDLE.

CAUTION

Verify airflow is present from aft cockpit eyeball outlets to insure sufficient cooling for mission equipment.

*2. Cabin temperature and mode-Set.

3. AC/DC power-Check.

WARNING

Do not operate radar in congested areas. Injury could result to personnel in close proximity to operating radar.

CAUTION

Do not operate the weather radar or data link systems in an area where the nearest effective surface is 50 feet or less from the antenna reflector. Scanning such surfaces within 50 feet of the antenna reflector may damage receiver crystals.

4. Avionics master power switch-ON as required.
5. Mission panel-Set.
   a. Mission control-AUTO.
   b. Data link high voltage-Standby.
   c. Antenna select-AUTO.
   d. Antenna steering-AUTO (check azimuth).
   e. Antenna override-AUTO rotate.
   f. Antenna circuit breaker-As required.
6. Electric elevator trim and autopilot/flight director operation-Check as required.
7. Avionics-Check as required.
8. Flaps-Check as required.
9. Altimeters-Check and set.

*8-30. TAXIING.

1. Brakes-Check.
2. Flight instruments-Check for normal operation.
3. Mission control panel-Set as required.
   a. Data link high voltage-ON as required.

8-31. ENGINE RUNUP.

1. Propeller manual feathering-Check by pulling propeller levers aft through detent to FEATHER. Check that propeller will feather, then advance levers to the HIGH RPM position.

☆2. Autofeather-Check as follows:
   a. Condition levers-LOW IDLE.
   b. Autofeather switch-Hold to TEST.
   c. Power levers-Advance until AUTOFEATHER lights are illuminated (approximately 22% torque).
   d. #1 power lever-Retard.
   (1) At approximately18% torque-#2 AUTOFEATHER light out.
   (2) At approximately12% torque-Both AUTOFEATHER lights out (propeller starts to feather).
   e. #1 power lever-Approximately 22% torque.
   f. Repeat steps b thru d for #2 engine.

☆3. Overspeed governors-Check as follows:
   a. Power levers-Set approximately 1950 RPM (both engines).
   b. #1 propeller governor test switch-Hold.
   c. #1 propeller RPM 1830 to 1910-Check.
   d. Repeat steps b and c for #2 engine.
   e. Power levers-Set 1800 RPM.

☆4. Primary governors-Check as follows:
   a. Power 1800 RPM-Set/check.
   b. Propeller levers aft to detent-Set.
   c. Propeller RPM 1600-1640-Check.
   d. Propeller levers to HIGH RPM-Set.

☆5. Ice vanes-Check as follows:
   a. Ice vane switches to EXTEND. Verify torque drop, TGT increase, and illumination of ICE VANE EXT light-Check.
   b. Ice vane switches to RETRACT. Verify return to original torque and TGT, and ICE VANE light extinguished-Check.

☆6. Anti-ice and deice systems-Check as follows:
   a. Left pitot switch ON-Check for loadmeter rise, then OFF.
   b. Right pitot switch ON-Check for loadmeter rise, then OFF.

c. Stall warning switch ON-Check for loadmeter rise, then OFF.
d. Fuel vent switch ON-Check for loadmeter rise, then OFF.
e. Windshield anti-ice switches NORMAL and HI-Check PILOT and COPILOT (individually) for loadmeter rise, then OFF.
f. Propeller- AUTO (check 14-18 amps).
g. Propeller switches-INNER and OUTER (momentarily), check for loadmeter rise.
h. Surface deice switch AUTO-Check for a drop in pneumatic pressure and wing deice boots inflation and after 6 seconds for a second drop in pneumatic pressure. Check manual position for proper indications.
i. Antenna deice single cycle auto-Check for drop in pneumatic pressure and boots inflated. Check manual position for proper indications.
j. Radome anti-ice-ON, check for proper indications.
k. Engine inlet lip heat switches-ON, Check for proper indications.
l. Anti-ice and deice systems switches-As required.

7. Beacon-As required (DAY or NIGHT).

☆8. Pneumatic pressure-Check as follows:
a. Condition levers-HIGH IDLE.
b. Power levers-IDLE.
c. Left bleed air valve switch-PNEU & ENVIRO OFF.
d. Pneumatic pressure-12 to 20 PSI-Check.
e. Left bleed air light-Check illuminated.
f. Right bleed air valve switch-PNEU & ENVIRO OFF.
g. Left and right bleed air off and left and right bleed air fail lights-Check illuminated.
h. Left bleed air valve switch-OPEN.
i. Left bleed air off, and left and right bleed air fail lights off, and pneumatic pressure-Check (12 to 20 PSI).
j. Right bleed air valve switch-OPEN.
k. Right bleed air off light-Extinguished.

☆9. Pressurization system-Check as follows:
a. Cabin door caution light extinguished-Check.
b. Storm windows closed-Check.
c. Bleed air valve switches OPEN-Check.
d. Cabin altitude 500 feet lower than field pressure altitude-Set.
e. Cabin pressurization switch-TEST (hold).
f. Cabin climb gage descending indication-Check, then release TEST switch.
g. Aircraft altitude set to planned cruise altitude plus 500 feet-Check (if this setting does not result in a CABIN ALT indication of at least 500 feet over takeoff field pressure altitude, adjust as required).
h. Rate control set between 9 and 12 o'clock-Check.

10. Windshield anti-ice-As required.

NOTE

If windshield anti-ice is needed prior to takeoff, use normal setting for a minimum of 15 minutes prior to selecting high temperature to provide adequate preheating and minimize effects of thermal shock.

☆8-32. BEFORE TAKEOFF.

1. Autofeather switch-ARM.
2. Bleed air valves-As required.
3. Ice & rain switches-As required.
4. Fuel panel-Check fuel quantity and switch positions.
5. Flight and engine instruments-Check for normal indications.
6. Cabin controller-Set.
7. Annunciator panels-Check (Note indications).
8. Propeller levers-HIGH RPM.
9. Friction locks-Set.
10. Flaps-As required.
11. Trim-Set.
12. Avionics-Set.
13. Flights controls-Check.
14. Departure briefing-Complete.

☆8-33. LINE UP.

1. Transponder-As required.
2. Engine auto ignition switch- ARM.

3. Power stabilized-Check approximately 25% minimum.
4. Condition levers-LOW IDLE.
5. Lights-As required (landing, taxi, beacon).
6. Mission control panel-Set.

8-34. TAKEOFF.

To aid in planning the takeoff and to obtain maximum aircraft performance, make full use of the information affecting takeoff shown in Chapter 7. The data shown is achieved by setting brakes, setting TAKEOFF POWER, and then releasing brakes. When runway lengths permit, the normal takeoff may be modified by starting the takeoff after power has been stabilized at approximately 25% torque, then applying power smoothly so as to attain full power. This will result in a smoother takeoff but will significantly increase takeoff distance.

8-35. AFTER TAKEOFF.

WARNING

Immediately after takeoff, the pilot flying the aircraft should avoid adjusting controls located on the aft portion of the extended pedestal to preclude inducing spatial disorientation due to coriolis illusion.

As cruise climb airspeed is attained, adjust power to the climb power setting. The copilot then activates the YAW DAMP and checks that the cabin is pressurizing. Both pilots check the wings and nacelles for fuel or oil leaks. The procedural steps after takeoff are as follows:

1. Gear-UP.
2. Flaps-UP.
3. Landing lights-OFF.
(4.) Windshield anti-ice-As required.

NOTE

Turn windshield anti-ice on to normal when passing 10,000 feet AGL or prior to entering the freezing level (whichever comes first). Leave on until no longer required during descent for landing. High temperature may be selected as required after a minimum warm-up period of 15 minutes.

8-36. CUMB.

a. Cruise Climb. Cruise climb is performed at a speed which is the best combination of climb, fuel bum-off, and distance covered. Set propellers at 1900 RPM and torque as required. Adhere to the following airspeed schedule as closely as possible.

SL to 10,000 feet .... 140 KIAS
10,000 to 20,000....................... 130 KIAS
20,000 to 31,000 feet................ 120 KIAS

b. Climb-Maximum Rate. Maximum rate of climb performance is obtained by setting propellers at 2,000 RPM, torque at 100% (or maximum climb TGT), and maintaining best rate-of-climb airspeed. Refer to Chapter 7 for best rate-of-climb airspeed for specific weights.

1. Climb power-Set.
2. Propeller sync-As required.
3. Autofeather-As required.
4. Yaw damp- As required.
5. Cabin pressurization-Check.
6. Wings and nacelles-Check.
7. ASE-As required.
   a. Flare/chaff dispenser safety pin-As required
   b. Flare/chaff function selector switch-As required.
   c. APR-39-As required.
   d. APR-44-As required.

8-37. CRUISE.

Cruise power settings are entirely dependent upon the prevailing circumstances and the type of mission being flown. Refer to Chapter 7 for airspeed, power settings, and fuel flow information. The following procedures are applicable to all cruise requirements.

1. Power-Set Refer to the cruise power graphs contained in Chapter 7. To account for ram air temperature increase, it is essential that temperature be obtained at stabilized cruise airspeed.
2. Wings and nacelles-Check.
3. Ice & rain switches-As required. Insure that anti-ice equipment is activated before entering icing conditions.

NOTE

Ice vanes must be extended when operating in visible moisture at 5°C or less. Visible moisture .is moisture in any form, clouds, ice crystals, snow, rain, sleet, hail, or any combination of these.

4. Auxiliary fuel gages-Monitor. Insure that fuel is being transferred from auxiliary tanks. (Chapter 2, Section IV.)

5. Altimeters-Check. Verify that altimeter setting complies with transition altitude requirement.
6. Engine instrument indications-Noted. Check all engine instruments for normal indications and record on appropriate forms for use in engine trend monitoring.
7. Recognition lights-As required.

8-38. DESCENT.

Descent from cruising altitude should normally be made by letting down a cruise airspeed with reduced power.

NOTE

CABIN pressure CONTROLLER should be adjusted prior to starting descent.

a. Descent-Max Rate (Clean). To obtain the maximum rate of descent in clean configuration, perform the following:

1. Power levers-IDLE.
2. Propeller levers-HIGH RPM.
3. Flaps-UP.
4. Gear-UP.
5. Airspeed-V_{mo}.
6. Cabin pressurization-Set. Adjust CABIN CONTROLLER dial as required and adjust RATE control knob so that cabin rate of descent equals one-third aircraft rate of descent.
7. Ice & rain switches-As required.
8. Recognition lights-As required.

b. Descent-Max Rate (Landing Configuration). If required to descend at a low airspeed (e.g., to conserve airspace or in turbulence), approach flaps and landing gear may be extended to increase the rate and angle of descent while maintaining the slower airspeed. To perform the maximum rate of descent in landing configuration, perform the following:

1. Power levers-IDLE.
2. Propeller levers-HIGH RPM.
3. Flap switch-APPROACH.
4. Gear switch-DN.
5. Airspeed-184 KIAS maximum.
6. Cabin pressurization-Set. Adjust CABIN CONTROLLER dial as required and adjust RATE control knob so that cabin descent rate equals one-third aircraft descent rate.
7. Ice and rain switches-As required.
8. Recognition lights- As required

8-39. DESCENT-ARRIVAL

Perform the following checks prior to the final descent for landing.

1. Cabin pressurization-Set. Adjust CABIN CONTROLIER dial as required.
2. Ice & rain switches-As required.

(3.) Windshield anti-ice-As required.

NOTE

Set windshield anti-ice to normal or high as required well before descent into icing conditions or into warm moist air to aid in defogging. Turn off windshield anti-ice when descent is completed to lower altitudes and when heating is no longer required. This will preclude possible wind screen distortions.

4. Lights-ON.
5. Altimeters-Set to current altimeter setting.
6. ASE-As required.

8-40. BEFORE LANDING.

1. Prop sync switch-OFF.
2. Autofeather switch-ARM.
3. Propeller levers-As required.

NOTE

During approach, propellers should be set at 1900 RPM to prevent glideslope interference (ILS approach), provide better power response during approach, and minimize attitude change when advancing propeller levers for landing.

4. Flap switch (below 202 KIAS)-APPROACH.
5. Gear switch (below 184 KIAS)-DN.
6. Rotating boom dipole antenna-Check stowed.
7. Landing lights-As required.
8. Brake deice-As required.

8-41. LANDING.

Performance data charts for landing computations assume that the runway is paved, level and dry. Additional runway must be allowed when these conditions are not met Refer to Chapter 7 for landing data. Do not consider headwind during landing computations; however, if landing must be down wind, include the tailwind in landing distance computations. Plan the final approach to arrive at 50 feet over the landing area at APPROACH SPEED (V_{ref}) plus 1/2 wind gust speed. Perform the following procedures as the aircraft nears the runway.

1. Autopilot and yaw damp-Disengaged.
2. Gear down lights-Check.
3. Propeller levers-HIGH RPM.

8-42. GO-AROUND.

When a go-around is commenced prior to the LANDING check, use power as required to climb to, or maintain, the desired altitude and airspeed. If the go-around is started after the LANDING check has been performed, apply maximum allowable power and simultaneously increase pitch attitude to stop the descent. Retract the landing gear after insuring that the aircraft will not touch the ground. Retract the flaps to APPROACH, adjusting pitch attitude simultaneously to avoid an altitude loss. Accelerate to best rate-of-climb airspeed (V_y), retracting flaps fully after attaining the V_{ref} speed used for the approach. Perform the following checks:

1. Power-Maximum allowable.
2. Gear- UP.
3. Flaps-UP.
4. Landing lights-OFF.
5. Climb power-Set.
6. Yaw damp-As required.

8-43. AFTER LANDING.

Complete the following procedures after the aircraft has cleared the runway:

1. Condition levers-As required.
2. Engine auto ignition switch-OFF.
3. Ice and rain switches-OFF.
4. Flaps-UP.
5. Avionics-As required.
6. Lights-As required.

NOTE

Reverse should not be used as a normal practice when maneuvering or parking the aircraft.

7. Mission control panel-Set (DL HV OFF).

8-44. ENGINE SHUTDOWN.

CAUTION

To prevent sustained loads on rudder shock links, the aircraft should be parked with the nose gear centered.

1. Brake deice-OFF.
2. Parking brake-Set.
3. Landing/taxi lights-OFF.
4. Overhead floodlight-As required.
5. Cabin temperature mode switch-OFF.
6. Autofeather switch-OFF.
7. Vent and aft vent blower switches-AUTO.
8. INS-OFF.
9. Mission equipment-OFF, as required.
10. Inverter switches-OFF.
11. Battery condition-Check as required.
12. Avionics master switch-OFF.
13. TGT-Check. TGT must be 660°C or below for one minute prior to shutdown.
14. Propeller levers-FEATHER.

CAUTION

Monitor TGT during shutdown. If sustained combustion is observed, proceed immediately to ABORT START procedure.

15. Condition levers-FUEL CUTOFF.

WARNING

Do not turn exterior lights off until propeller's rotation has stopped.

16. Exterior lights -OFF.
17. Master panel lights - OFF.
18. Master switch - OFF
19. Keylock switch - OFF.
20. Oxygen system - As required.

8-45. BEFORE LEAVING AIRCRAFT.

1. Wheels-Chocked.
2. Parking brake-As required.

NOTE

Brakes should be released after chocks are in place (ramp conditions permitting).

3. Flight controls-Locked.
4. Fuel pumps-Set.
   a. Standby pumps-OFF
   b. Aux transfer-AUTO
   c. Crossfeed-CLOSED
5. Emergency exit lock-As required.
6. Mode 4-As required.
7. Aft cabin light-OFF.
8. Door light-OFF.

CAUTION

If strong winds are anticipated while the aircraft is unattended, the propellers shall be secured to prevent their windmilling with zero engine oil pressure.

9. Walk-around inspection-Complete. Conduct a thorough walk-around inspection, checking for damage, fluid leaks, and levels. Check that covers, tiedowns, restraints, safety pins and chocks are installed as required.
10. Aircraft forms-Complete. In addition to established requirements for reporting any system defects, unusual and excessive operation such as hard landings, etc., the flight crew will also make entries on DA Form 2408-13 to indicate when limits in the Operator's Manual have been exceeded.
11. Aircraft secured-Check; lock cabin door as required.

NOTE

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engine.

Section III. INSTRUMENT FLIGHT

8-46. GENERAL.

This aircraft is qualified for operation in instrument meteorological conditions. Flight handling, stability characteristics and range are approximately the same during instrument flight conditions as when under visual flight conditions.

8-47. INSTRUMENT TAKEOFF.

Complete the BEFORE TAKEOFF check. Engage the heading (HDG) mode on the autopilot computer/control. (DO NOT ENGAGE AUTOPILOT.) Set heading marker (HDG) to runway heading and adjust pitch bar. Align the aircraft with the runway centerline, insuring that nosewheel is straight before stopping aircraft. Hold brakes and complete the, LINEUP check. Insure that the roll steering bar is centered. Power application and copilot duties are identical to those prescribed for a "visual" takeoff. After the brakes are released, initial directional control should be accomplished predominantly with the aid of outside visual references. As the takeoff progresses, the crosscheck should transition from outside references to the Flight Director and airspeed indicator. The rate of transition is directly proportional to the rate at which the outside references deteriorate. Approaching rotation speed (V_r), the cross-check should be totally committed to the instruments so that erroneous sensory inputs can be ignored. At rotation speed, establish takeoff attitude on the Flight Director. Maintain this pitch attitude and wings-level attitude until the aircraft becomes airborne. When both the vertical velocity indicator and altimeter show positive climb indications, retract the landing gear. After the landing gear is retracted, adjust the pitch attitude as required to attain best rate-of-climb airspeed (V_y). Use PITCH-SYNC as required to reposition the Flight Director pitch steering bar. Retract flaps after obtaining best single-engine rate-of-climb speed (V_{yse}), and readjust pitch as required. Control the bank attitudes to maintain the desired heading. Support Flight Director indications throughout the maneuver by cross-checking "raw data" information displayed on supporting instruments.

NOTE

Due to possible precession error, the pitch steering bar may lower slightly during acceleration, causing the pitch attitude to appear higher than actual pitch attitude. To avoid lowering the nose prematurely, crosscheck the vertical velocity and altimeter to insure proper climb performance. The erection system will automatically remove the error after the acceleration ceases.

8-48. AUTOMATIC APPROACHES.

There are no special preparations required for placing the aircraft under autopilot control. Refer to Chapter 3 for procedures to be followed for automatic approaches.

NOTE

The ILS localizer and glideslope warning flags indicate insufficient signal strength to the receiver.

Section IV. FLIGHT CHARACTERISTICS

8-49. STALLS.

A prestall warning in the form of very light buffeting can be felt when a stall is approached. An aural warning is provided by a warning horn. The warning horn starts approximately five to ten knots above stall speed with the aircraft in any configuration.

a. Power-On Stalls. The power-on stall attitude is very steep and unless this high-pitch attitude is maintained, the aircraft will generally "settle" or "mush" instead of stall. It is difficult to stall the aircraft inadvertently in any normal maneuver. A light buffet precedes most stalls, and the first indication of approaching stall is generally a decrease in control effectiveness, accompanied by a "chirping" tone from the stall warning horn. The stall itself is characterized by a rolling tendency if the aircraft is allowed to yaw. The proper use of rudder will prevent the tendency to roll. A slight pitching tendency will develop if the aircraft is held in the stall, resulting in the nose dropping sharply, then pitching up toward the horizon; this cycle is repeated until recovery is made. Control is regained very quickly with little altitude loss, providing the nose is not lowered excessively. Begin recovery with forward movement of the control wheel and a gradual return to level flight. The roll tendency caused by yaw is more pronounced in power-on stalls, as is the pitching tendency; however, both are easily controlled after the initial entry. Power-on stall characteristics are not greatly affected by wing flap position, except that stalling speed is reduced in proportion to the degree of wing flap extension.

b. Power-Off Stalls. The roll tendency is considerably less pronounced in power-off stalls (in any configuration) and is more easily prevented or corrected by adequate rudder and aileron control, respectively. The nose will generally drop straight through with some tendency to pitch up again if recovery is not made immediately. With wing flaps down, there is little or no roll tendency and stalling speed is much slower than with wing flaps up. The Stall Speed Chart (Fig. 8-2) shows the indicated power-off stall speeds with aircraft in various configurations. Altitude loss during a full stall will be approximately 800 feet.

c. Accelerated Stalls. The aircraft gives noticeable stall warning in the form of buffeting when the stall occurs. The stall warning and buffet can be demonstrated in turns by applying excessive back pressure on the control wheel.

8-50. SPINS.

Intentional spins are prohibited. If a spin is inadvertently entered use the following recovery procedure:

NOTE

Spin demonstrations have not been conducted. The recovery technique is based on the best available information. The first three actions should be as nearly simultaneously as possible.

1. Power levers IDLE.

2. Apply full rudder opposite the direction of spin rotation.

3. Simultaneously with rudder application, push the control wheel forward and neutralize ailerons.

4. When rotation stops, neutralize rudder.

STALL SPEEDS — POWER IDLE

NOTES:
1. A NORMAL STALL RECOVERY TECHNIQUE MAY BE USED. THE BEST PROCEDURE IS A BRISK FORWARD WHEEL MOVEMENT TO A NOSE-DOWN ATTITUDE. LEVEL THE AIRPLANE AFTER AIRSPEED HAS INCREASED APPROXIMATELY 25 KNOTS ABOVE STALL.
2. LANDING GEAR POSITION HAS NO EFFECT ON STALL SPEED.

EXAMPLE:

WEIGHT . . . . 10,000 LBS
FLAPS 100%
ANGLE OF BANK . . . 30°

STALL SPEED . . . . . . 78 KCAS

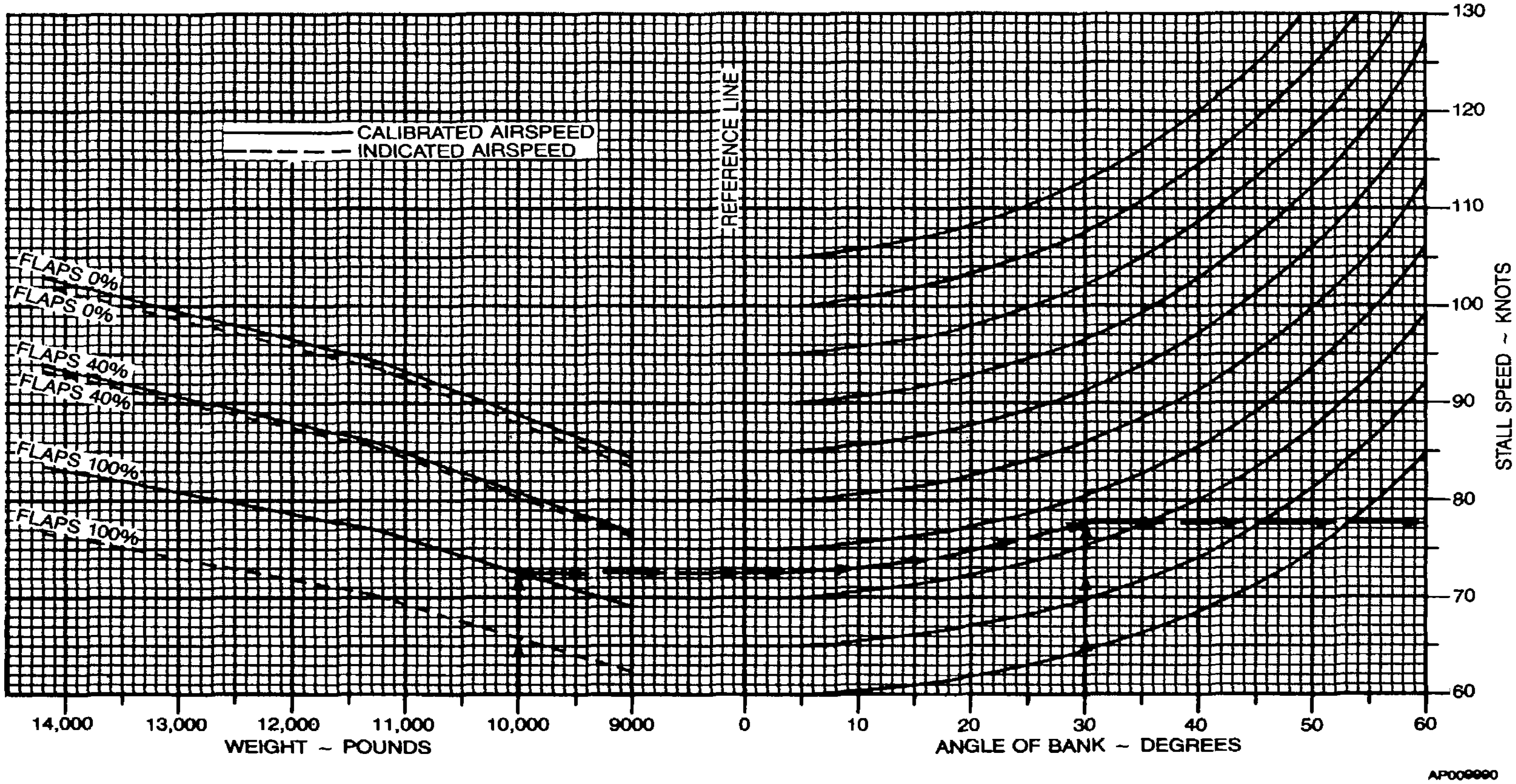


Figure 8-2. Stall Speeds

CAUTION

Do not pull out of the resulting dive too abruptly as this could cause excessive wing loads and a possible secondary stall.

5. Pull out of dive by exerting a smooth, steady back pressure on the control wheel, avoiding an accelerated stall and excessive aircraft stresses.

8-51. DIVING.

Maximum diving airspeed (red line) is 245 KIAS or 0. 47 Mach. Flight characteristics are conventional throughout a dive maneuver; however, caution should be used if rough air is encountered after maximum allowable dive speed has been reached, since it is difficult to reduce speed in dive configuration. Dive recovery should be very gentle to avoid excessive aircraft stresses.

8-52. MANEUVERING FLIGHT.

The maximum speed (Va) at which abrupt full control inputs can be applied without exceeding the design load factor of the aircraft (Va 170 KIAS is shown in Chapter 5). The data is based on 14,200 pounds. There are no unusual characteristics under accelerated flight.

Section V. ADVERSE ENVIRONMENTAL CONDITIONS

8-53. INTRODUCTION.

The purpose of this part is to inform the pilot of the special precautions and procedures to be followed during the various weather conditions that may be encountered in flight. This part is primarily narrative, only those checklists that cover specific procedures characteristic of weather operations are included. The checklist in Section II provides for adverse environmental operations.

8-54. COLD WEATHER OPERATIONS.

Operational difficulties maybe encountered during extremely cold weather, unless proper steps are taken prior to or immediately after flight. All personnel should understand and be fully aware of the necessary procedures and precautions involved.

a. Preparation For Flight. Accumulations of snow, ice, or frost on aircraft surfaces will adversely affect takeoff distance, climb performance and stall speeds to a dangerous degree. Such accumulations must be removed before flight. In addition to the normal exterior checks, following the removal of ice, snow, or frost, inspect wing and empennage surfaces to verify that these remain sufficiently cleared. Also, move all control surfaces to confirm full freedom of movement. Assure that tires are not frozen to wheel chocks or to the ground. Use ground heaters, antiice solution, or brake deice to free frozen tires. When heat is applied to release tires, the temperature should not exceed 71°C (160°F). Refer to Chapter 2 for anti-icing, deicing, and defrosting treatment.

b. Engine Starting. When starting engines on ramps covered with ice, propeller levers must be in the FEATHER position to prevent the tires from sliding. To prevent exceeding torque limits when advancing CONDITION levers to HIGH IDLE during the starting procedure, place the . power lever in BETA and the propeller lever in HIGH RPM before advancing the condition lever to HIGH IDLE.

c. Warm-Up and Ground Test. Warm-up procedures and ground test are the same as those outlined in Section II.

d. Taxiing. Whenever possible, taxiing in deep snow, light weight dry show or slush should be avoided, particularly in colder FAT conditions. If it is necessary to taxi through snow or slush, do not set the parking brake when stopped. If possible, do not park the aircraft in snow or slush deep enough to reach the brake assemblies. Chocks or sandbags should be used to prevent the aircraft from rolling while parked. Before attempting to taxi, activate the brake deice system, insuring that the bleed air valves are OPEN and that the condition levers are in HIGH IDLE. An outside observer should visually check wheel rotation to insure brake assemblies have been deiced. The condition levers may be returned to LOW IDLE as soon as the brakes are free of ice.

e. Before Takeoff If icing conditions are expected, activate all anti-ice systems before takeoff, allowing sufficient time for the equipment to become effective.

f. Takeoff. Takeoff procedures for cold weather operations are the same as for normal takeoff. Taking off with temperatures at or below freezing, with water, slush or snow on the runway, can cause ice to accumulate on the landing gear and can throw ice into the wheel well areas. Such takeoffs shall be made with brake deice on and with the ice vanes extended to preclude the possibility of ice build-up on engine air inlets. Monitor oil temperatures to insure operation within limits. Before flight into icing conditions, the pilot and copilot WSHLD ANTI-ICE switches should be set at NORMAL position.

g. During Flight.

(1) After takeoff from a runway covered with snow or slush, it may be advisable to leave brake deice ON to dislodge ice accumulated from the spray of slush or water. Monitor BRAKE DEICE annunciator for automatic termination of system operation and then turn the switch OFF. During flight, trim tabs and controls should also be exercised periodically to prevent freezing. Insure that anti-icing systems are activated before entering icing conditions. Do not activate the surface deice system until ice has accumulated one-half to one inch. The propeller deice system operates effectively as an anti-ice system and it may be operated continuously in flight. If propeller imbalance due to ice does occur, it may be relieved by increasing RPM briefly, then returning to desired setting.

Ice vanes must be extended when operating in visible moisture or when freedom from visible moisture cannot be assured, at 5°C FAT or less. Ice vanes are designed as an anti-ice system, not a deice system. After the engine air inlet screens are blocked, lowering the ice vanes will not rectify the condition. Ice vanes should be retracted at 15°C FAT and above to assure adequate engine oil cooling.

(2) Stalling airspeeds should be expected to increase when ice has accumulated on the aircraft causing distortion of the wing airfoil. For the same reason, stall warning devices are not accurate and should not be relied upon. Keep a comfortable margin of airspeed above the normal stall airspeed. Maintain a minimum of 140 knots during sustained icing conditions to prevent ice accumulation on unprotected surfaces of the wing. In the event of windshield icing, reduce airspeed to 226 knots or below.

h. Descent. Use normal procedures in Section II. Brake icing should be considered if moisture was encountered during previous ground operations or inflight in icing conditions with gear extended.

i. Landing. Landing on an icy runway should be attempted only when absolutely necessary and should not be attempted unless the wind is within 10 degrees of runway heading. Application of brakes without skidding the tires on ice is very difficult, due to the sensitive brakes. In order not to impair pilot visibility, reverse thrust should be used with caution when landing on a runway covered with snow or standing water. Use procedures in Section II for normal landing.

j. Engine Shutdown. Use normal procedures in Section II.

k. Before Leaving the Aircraft. When the aircraft is parked outside on ice or in a fluctuating freeze-thaw temperature condition the following procedures should be followed in addition to the normal procedures in Section II. After wheel chocks are in place, release the brakes to prevent freezing. Fill fuel tanks to minimize condensation, remove any accumulation of dirt and ice from the landing gear shock struts, and install protective covers to guard against possible collection of snow and ice.

8-55. DESERT OPERATION AND HOT WEATHER OPERATION.

Dust, sand, and high temperatures encountered during desert operation can sharply reduce the operational life of the aircraft and its equipment. The abrasive qualities of dust and sand upon turbine blades and moving parts of the aircraft and the destructive effect of heat upon the aircraft instruments will necessitate hours of maintenance if basic preventive measures are not followed. In flight, the hazards of dust and sand will be difficult to escape, since dust clouds over a desert may be found at altitudes up to 10,000 feet. During hot weather operations, the principle difficulties encountered are high turbine gas temperatures (TGT) during engine starting, over-heating of brakes, and longer takeoff and landing rolls due to the higher density altitudes. In areas where high humidity is encountered, electrical equipment (such as communication equipment and instruments) will be subject to malfunction by corrosion, fungi and moisture absorption by nonmetallic materials.

a. Preparation For Flight. Check the position of the aircraft in relation to other aircraft. Propeller sand blast can damage closely parked aircraft. Check that the landing gear shock struts are free of dust and sand. Check instrument panel and general interior for dust and sand accumulation. Open main entrance door and cockpit vent storm windows to ventilate the aircraft.

CAUTION

N_1 speeds of 70% or higher may be required to keep oil temperature within limits.

b. Engine Starting. Use normal procedures in Section II. Engine starting under conditions of high ambient temperatures may produce a higher than normal TGT during the start. The TGT should be closely monitored when the condition lever is moved to the LO IDLE position. If overtemperature tendencies are encountered the condition lever should be moved to IDLE CUTOFF position periodically during acceleration of gas generator RPM (N_1). Be prepared to abort the start before temperature limitations are exceeded.

c. Warm-Up Ground Tests. Use normal procedures in Section II. To minimize the possibility of damage to the engines during dusty/sandy conditions, activate ICE VANES if the temperature is below 15°C.

d. Taxiing. Use normal procedures in Section II. When practical, avoid taxing over sandy terrain to minimize propeller damage and engine deterioration that results front impingement of sand and gravel. During hot weather operation, use minimum braking action to prevent overheating.

e. Takeoff. Use normal procedures in Section II. Avoid taking off in the wake of another aircraft if the runway surface is sandy or dusty.

f. During Flight. Use normal procedures in Section II.

g. Descent. Use normal procedures in Section II.

h. Landing. Use normal procedures in Section II.

i. Engine Shutdown. Use normal procedures in Section II.

CAUTION

During hot weather, if fuel tanks are completely filled, fuel expression may cause overflow, thereby creating a fire hazard.

j. Before Leaving Aircraft. Use normal procedures in Section II. Take extreme care to prevent sand or dust from entering the fuel and oil system during servicing. During hot weather, release the brakes immediately after installing wheel chocks to prevent brake disc warpage.

8-56. TURBULENCE AND THUNDERSTORM OPERATION.

CAUTION

Due to the comparatively light wing loading, control in severe turbulence and thunderstorms is critical. Since turbulence imposes heavy loads on the aircraft structure, make all necessary changes in aircraft attitude with the least amount of control pressures to avoid excessive loads on the aircraft's structure.

Thunderstorms and areas of severe turbulence should be avoided. If such areas are to be penetrated. it will be necessary to counter rapid changes in attitude and accept major indicated altitude variations. Penetration should be of an altitude which provides adequate maneuvering margins as a loss or gain of several thousand feet of altitude may be expected. The recommended penetration speed in severe turbulence is 170 KIAS. Pitch attitude and constant power settings arc vital to proper flight technique. Establish recommended penetration speed and proper attitude prior to entering turbulent air to minimize most difficulties. False indications by the pressure instruments due to barometric pressure variations within the storm make them unreliable. Maintaining a preestablished attitude will result in a fairly constant airspeed. Turn cockpit and cabin lights on to minimize the blinding effects of lighting. Do not use autopilot altitude hold. Maintain constant power settings and pitch attitude regardless of airspeed or altitude indications. Concentrate on maintaining a level attitude by reference to the Flight Director/attitude indicator. Maintain original reading. Make no turns unless absolutely necessary.

8-57. ICE AND RAIN (TYPICAL).

WARNING

While in icing conditions, if there is an unexplained 30% increase of torque needed to maintain airspeed in level flight, a cumulative total of two or more inches of ice accumulation on the wing, an unexplained decrease of 15 knots IAS, or an unexplained deviation between pilot's and copilot's airspeed indicators, the icing environment should be exited as soon as practicable. Ice accumulation on the pitot tube assemblies could cause a complete loss of airspeed indication.

The following conditions indicate a possible accumulation of ice on the pitot tube assemblies and unprotected airplane surfaces. If any of these conditions are observed, the icing environment should be exited as soon as practicable.

(1) Total ice accumulation of two inches or more on the wing surfaces. Determination of ice thickness can be accomplished by summing the estimated ice thickness on the wing prior to each pneumatic boot deice cycle (e.g. four cycles of minimum recommendation ½-inch accumulation.

(2) A 30 percent increase in torque per engine required to maintain a desired airspeed in level flight (not to exceed 85 percent torque) when operating at recommended holding/loiter speed.

(3) A decrease in indicated airspeed of 15 knots after entering the icing condition (not slower than 1.4 power off stall speed) if maintaining original power setting in level flight. This can be determined by comparing pre-icing condition entry speed to the indicated speed after a surface and antenna deice cycle is completed.

(4) Any variations from normal indicated airspeed between the pilot's and copilot's airspeed indicators.

a. Typical Ice. Icing occurs because of supercooled water vapor such as fog, clouds or rain. The most severe icing occurs on aircraft surfaces in visible moisture or precipitation with a true outside air temperature between -5°C and +1°C; however, under some circumstances, dangerous icing conditions may be encountered with temperatures below -10°C. The surface of the aircraft must be at a temperature of freezing or below before ice will stick to the aircraft. If severe icing conditions are encountered, ascend or descend to altitudes where these conditions do not prevail. If flight into icing conditions is unavoidable, proper use of aircraft anti-icing and deicing systems may minimize the problems encountered Approximately 15 minutes prior to flight into temperature conditions which could produce frost or icing conditions, the pilot and co-pilot windshield anti-ice switches should he set at normal or high temperature position (after preheating) as necessary to eliminate windshield ice. Stalling airspeeds should be expected to increase when ice has accumulated on the aircraft causing distortion of the wing airfoil. For the same reason, stall warning devices are not accurate and should not be relied upon. Keep a comfortable margin of airspeed above the normal stall airspeed with ice on the aircraft. Maintain a minimum of 140 knots during sustained icing conditions to prevent ice accumulation on unprotected surfaces of the wing. In the event of windshield icing, reduce airspeed to 226 knots or below.

b. Rain. Rain presents no particular problems other than restricted visibility and occasional incorrect airspeed indications.

c. Taxiing. Extreme are must be exercised when taxiing on ice or slippery runways. Excessive use of either brakes or power may result in an uncontrollable skid.

d. Takeoff. Extreme care must be exercised during takeoff from ice or slippery runways. Excessive use of either brakes or power may result in an uncontrollable skid.

e. Climb. Keep aircraft attitude as flat as possible and climb with higher airspeed than usual, so that the lower surfaces of the aircraft will not be iced by flight at a high angle of attack.

f. Cruising Flight. Prevention of ice formation is far more effective and satisfactory than attempts to dislodge the ice after it has formed. If icing conditions are inadvertently encountered, turn on the anti-icing systems prior to the first sign of ice formation.

Do not operate deicer boots continuously. Allow at least one-half inch of ice on the boots before activating the deicer boots to remove the ice. Continued flight in severe icing conditions should not be attempted. If ice forms on the wing area aft of the deicer boots, climb or descend to an altitude where conditions are less severe.

g. Landing. Extreme care must be exercised when landing on ice or slippery runways. Excessive use of either brakes or power may result in an uncontrollable skid. Ice accumulation on the aircraft will result in higher stalling airspeeds due to the change in aerodynamic characteristics and increased weight of the aircraft due to ice buildup. Approach and landing airspeeds must be increased accordingly.

NOTE

When operating on wet or icy runways, refer to stopping distance factors shown in Chapter 7.

8-57A. ICING (SEVERE).

a. The following weather conditions may be conducive to severe in-flight icing:

(1) Visible rain at temperatures below zero degrees Celsius ambient air temperature.

(2) Droplets that splash or splatter on impact at temperatures below zero degrees Celsius ambient air temperature.

b. The following procedures for exiting a severe icing environment are applicable to all flight phases from takeoff to landing.

(1) Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present.

(2) Upon observing the visual cues specified in the limitations section of the airplane flight manual (Military Operations Manual) for the identification of severe icing conditions (reference paragraph 5-31B.), accomplish the following:

(a) Immediately request priority handling from air traffic control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.

(b) Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.

(c) Do not engage the autopilot.

(d) If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.

(e) If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.

(f) Do not extend flaps during extended operation in icing conditions. Operations with flaps extended can result in a reduced angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.

(g) If the flaps are extended, do not retract them until the airframe is clear of ice.

(h) Report these weather conditions to air traffic control.

Section VI. CREW DUTIES

8-58. CREW/PASSENGER BRIEFING.

The following guide should be used in accomplishing required passenger briefings. Items that do not pertain to a specific mission may be omitted.

a. Crew introduction.

b. Equipment.

1. Personal, to include ID tags.
2. Professional (medical equipment, etc.).
3. Survival.

c. Flight data.

1. Route.
2. Altitude.
3. Time enroute.
4. Weather.

d. Normal Procedures.

1. Entry and exit of aircraft.
2. Seating and seat position.
3. Seat belts.
4. Movement in aircraft.
5. Internal communications.
6. Security of equipment.
7. Smoking.
8. Oxygen.
9. Refueling.
10. Weapons and prohibited items.
11. Protective masks.
12. Toilet.

e. Emergency Procedures.

1. Emergency Exits.

2. Emergency equipment.

3. Emergency landing/ditching procedures.

8-59. DEPARTURE BRIEFING.

The following is a guide that should be used as applicable in accomplishing the required crew briefing prior to takeoff; however, if the crew has operated together previously and the pilot is certain that the copilot understands all items of the briefing, he may omit the briefing by stating "standard briefing," when the briefing is called for during the BEFORE TAKEOFF CHECK.

a. ATC Clearance Review.

1. Routine.
2. Initial altitude.

b. Departure Procedure Review.

1. SID.
2. Noise abatement procedure.
3. VFR departure route.

c. Copilot Duties Review.

1. Adjust takeoff power.
2. Monitor engine instruments.
3. Power check at 65 knots.
4. Call out engine malfunctions.
5. Tune/ident all Nav/Com radios.
6. Make all radio calls.
7. Adjust transponder and radar as required.
8. Complete flight log during flight (note altitudes and headings).
9. Note departure time.

d. PPCReview.

1. Takeoff power.
2. Vr.
3. Vy (climb to 500' AGL).
4. Vyse

8-60. ARRIVAL BRIEFING.

The following is a guide that should be used as applicable in accomplishing the required crew briefing prior to landing; however, if the crew has operated together previously and the pilot is certain that the copilot understands all items of the briefing, he may omit the briefing by stating "standard briefing," when the briefing is called for during the DESCENT-ARRIVAL CHECK.

a. Weather/Altimeter Setting.

b. Airfield/Facilities Review.

1. Field elevation.
2. Runway length.
3. Runway condition.

c. Approach Procedure-Review.

1. Approach plan/profile.
2. Altitude restrictions.
3. Missed approach.
   a. Point.
   b. Time.
   c. Intentions.
4. Decision height or MDA.
5. Lost communications.

d. Back Up Approach/Frequencies.

e. Copilot Duties Review.

1. Nav/Com set-up.
2. Monitor altitude and airspeeds.
3. Monitor approach.
4. Callout visual/field in sight.

f. Landing Performance Data Review.

1. Approach speed.
2. Runway required.

CHAPTER 9

EMERGENCY PROCEDURES

Section I. AIRCRAFT SYSTEMS

9-1. AIRCRAFT SYSTEMS.

This section describes the aircraft systems emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency procedures are given in checklist form when applicable. A condensed version of these procedures is in the Operator's and Crewmember's Checklist, TM 55-1510-219-CL. Emergency operations of avionics equipment are covered when appropriate in Chapter 3, Avionics, and are repeated in this section only as safety of flight is affected.

9-2. IMMEDIATE ACTION EMERGENCY CHECKS.

Immediate action emergency items are underlined for your reference and shall be committed to memory. During an emergency, the checklist will be called for to verify the memory steps performed and to assist in completing any additional emergency procedures.

NOTE

The urgency of certain emergencies requires immediate action by the pilot. The most important single consideration is aircraft control. All procedures are subordinate to this requirement.

9-3. DEFINITION OF LANDING TERMS.

The term **LANDING IMMEDIATELY** is defined as executing a landing without delay. (The primary consideration is to assure the survival of occupants.) The term **LAND AS SOON AS POSSIBLE** is defined as executing a landing at the nearest suitable landing area without delay. The term **LAND AS SOON AS PRACTICABLE** is defined as executing a landing to the nearest suitable airfield.

9-4. AFTER EMERGENCY ACTION.

After a malfunction has occurred, appropriate emergency actions have been taken, and the aircraft is on the ground, an entry shall be made in the remarks section of DA Form 2408-13 describing the malfunction.

9-5. EMERGENCY EXITS AND EQUIPMENT.

Emergency exits and equipment are shown in figure 9-1.

9-6. EMERGENCY ENTRANCE.

Entry may be made through the cabin emergency hatch. The hatch may be released by pulling on its flush-mounted pull-out handle, placarded EMERGENCY EXIT-PULL HANDLE TO RELEASE. The hatch is of the nonhinged plug type which removes completely from the frame when the latches are released. After the latches are released, the hatch may be pushed in.

9-7. ENGINE MALFUNCTION.

a. Flight Characteristics Under Partial Power Conditions. There are no unusual flight characteristics during single-engine operation as long as airspeed is maintained at or above minimum control speed (Vmc) and power-off stall speeds. The capability of the aircraft to climb or maintain level flight depends on configuration, gross weight, altitude, and free air temperature. Performance and control will improve by feathering the propeller of the inoperative engine, retracting the landing gear and flaps, and establishing the appropriate single-engine best rate-of-climb speed (Vyse). Minimum control speed (Vmc) with flaps retracted is approximately 1 knot | higher than with flaps at takeoff (40%) position.

b. Engine Malfunction During And After Takeoff The action to be taken in the event of an engine malfunction during takeoff depends on whether or not liftoff speed (V1of) has been attained. If an engine fails immediately after liftoff, many variables such as airspeed, runway remaining, aircraft weight, altitude at time of engine failure, and single-engine performance must be considered in deciding whether it is safer to land or continue flight.

c. Engine Malfunction Before Liftoff (Abort). If an engine fails and the aircraft has not accelerated

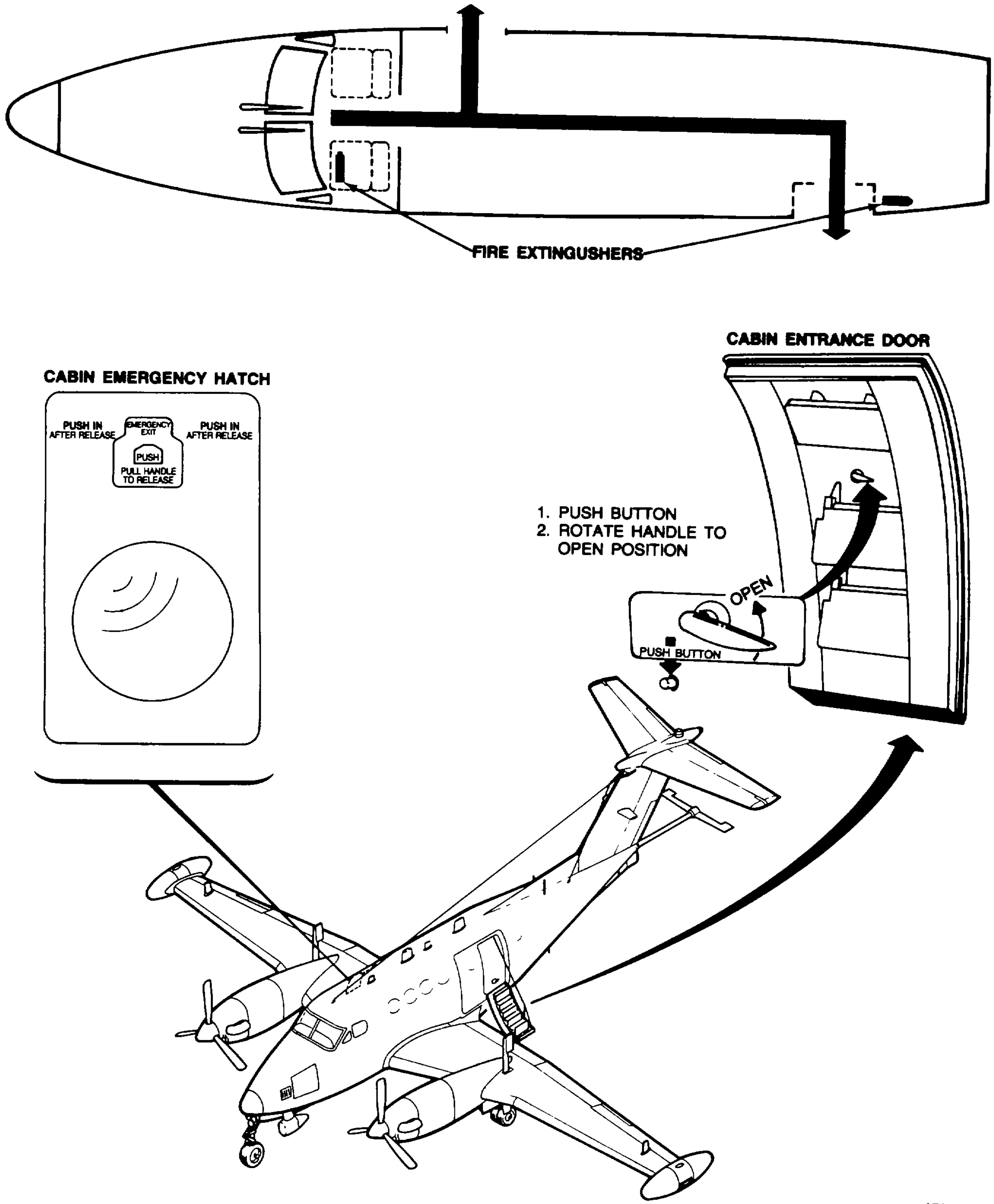


Figure 9-1. Emergency Exits and Equipment

to recommend liftoff speed (V_{1of}), retard power levers immediately to IDLE and stop the aircraft with brakes and reverse thrust. Perform the following:

1. Power levers - IDLE.

2. Braking as required.

NOTE

If insufficient runway remains for stopping, perform steps 3. through 5.

3. Condition levers - FUEL CUT-OFF.

4. Fire pull handles - Pull.

5. Master switch - OFF.

d. Engine Malfunction after Liftoff. If an engine fails after becoming airborne, maintain single-engine best rate-of-climb speed (V_{yse}) or, if airspeed is below V_{yse} maintain whatever airspeed is attained between liftoff (V_{1of}) and V_{yse} until sufficient altitude is attained to trade altitude for airspeed and accelerate to V_{yse}.

(1) Engine Malfunction after Liftoff (Abort). Perform the following and land in a wings-level attitude:

1. Power levers - IDLE.

2. Gear - Down.

NOTE

If able to land on remaining runway, use brakes and reverse thrust as required, then perform steps 3. through 5.

3. Condition levers - FUEL CUT-OFF.

4. Fire pull handles - Pull.

5. Master switch - OFF.

(2) Engine Malfunction after Liftoff (Flight Continued). Perform the following:

NOTE

Do not retard the malfunctioning engine power lever, or turn the autofeather system OFF until propeller is completely feathered. To do so will deactivate the autofeather circuit and prevent automatic feathering.

1. Power - Maximum controllable.

2. Gear - UP.

3. Flaps - UP.

4. Landing lights - OFF.

5. Brake deice - OFF.

6. Engine cleanup - Perform.

7. Generator load - 100% Maximum.

NOTE

If the autofeather system fails to operate, identify the affected engine, then feather the propeller of the affected engine.

(3) Engine Malfunction after Liftoff (Flight Continued without Autofeather). Perform the following:

1. Power - Maximum controllable.

NOTE

If airspeed is below V_{yse}, maintain whatever airspeed has been attained (between V_{1of} and V_{yse}) until sufficient altitude can be obtained to trade off altitude for airspeed to assist in acceleration to V_{yse}.

2. Dead engine - Identify.

3. POWER lever (dead engine) - IDLE.

4. PROP lever (dead engine) - FEATHER.

5. GEAR-UP.

NOTE

If takeoff was made with flaps extended, insure that airspeed is above computed approach speed (V_{ref}) before retracting flaps.

6. FLAPS-UP.

7. LANDING LIGHTS - OFF.

8. BRAKE DEICE - OFF.

9. Engine cleanup - Perform.

10. Generator load - 100% Maximum.

e. Engine Malfunction During Flight.

1. Autopilot/yaw damper - Disengage.
2. Power - As required.
3. Dead Engine - IDENTIFY.
4. Power lever (affected engine) - IDLE.
5. Propeller lever (affected engine) - FEATHER.
6. Gear - As required.
7. Flaps - As required.
8. Power - Set for single engine cruise.
9. Engine cleanup - Perform.
10. Generator load - 100% Maximum.

f. Engine Malfunction During Final Approach. If an engine malfunctions during a final approach (after LANDING CHECK), the propeller should not be manually feathered unless time and altitude permit or conditions require it. Continue approach using the following procedure:

1. Power - As required.
2. Gear - DN.

g. Engine Malfunction (Second Engine). If the second engine fails, do not feather the propeller if an engine restart is to be attempted. Engine restart without starter assist can not be accomplished with a feathered propeller, and the propeller will not unfeather without the engine operating. 140 KIAS is recommended as the best all-around glide speed (considering engine restart, distance covered, transition to landing configuration, etc.), although it does not necessarily result in the minimum rate of descent. Perform the following procedure if the second engine fails during cruise flight.

1. Airspeed - 140 KIAS.
2. Power lever - IDLE.
3. Propeller lever - Do not FEATHER.
4. Conduct engine restart procedure.

9-8. ENGINE SHUTDOWN IN FLIGHT.

If it becomes necessary to shut an engine down during flight, perform the following:

1. Power lever - IDLE.

2. Propeller lever - FEATHER.
3. Condition lever - FUEL CUTOFF.
4. Engine cleanup - Perform.

9-9. ENGINE CLEANUP.

The cleanup procedure to be used after engine malfunction, shutdown, or an unsuccessful restart is as follows:

1. Condition lever - FUEL CUTOFF.
2. Engine auto ignition switch - OFF.
3. Autofeather switch - OFF.
4. Generator switch - OFF.
5. Prop sync switch - OFF.
6. Radome heat - OFF.

9-10. ENGINE RESTART DURING FLIGHT (using STARTER).

Engine restarts may be attempted at all altitudes. If a restart is attempted, perform the following:

1. Cabin temperature mode switch - OFF.
2. Electrical load - Reduce to minimum.
3. Fire pull handle - In.
4. Power lever - IDLE.
5. Propeller lever - FEATHER.
6. Condition lever - FUEL CUTOFF.
7. TGT (operative engine) - 700°C or less.
8. Ignition and engine start switch - ON.
9. Condition lever - LOW IDLE.

NOTE

If a rise in TGT does not occur within 10 seconds after moving the condition lever to LOW IDLE, abort the start.

10. TGT - 1000°C, 5 seconds maximum.

NOTE

If N_1 is below 12%, starting temperatures tend to be higher than normal. To preclude overtemperature (1000°C or above) during engine acceleration to idle speed, periodically move the condition lever into FUEL CUTOFF position as necessary.

11. Oil pressure - Check.
12. Ignition and engine start switch - OFF.
13. Generator switch - RESET, then ON.
14. Engine cleanup - Perform if engine restart unsuccessful.
15. Cabin temperature mode switch - As required.
16. Electrical equipment - As required.
17. Auto ignition switch - ARMED.
18. Propellers - Synchronized.
19. Power - As required.

9-11. ENGINE RESTART DURING FLIGHT (NOT USING STARTER).

A restart without starter assist may be accomplished provided airspeed is at or above 140 KIAS altitude is below 20,000 feet, and the propeller is not feathered. If altitude permits, diving the aircraft will increase N_1 and assist in restart. N_1 required for airstart should be at or above 9%. If a start is attempted, perform following:

1. Cabin temperature mode switch - OFF.
2. Electrical load - Reduce to minimum.
3. Generator switch (affected engine) - OFF.
4. Fire pull handle - Check in.
5. Power lever - IDLE.
6. Propeller lever - HIGH RPM.
7. Condition lever - FUEL CUTOFF.
8. Airspeed 140 KIAS minimum - Check.
9. Altitude below 20,000 feet - Check.
10. Engine auto ignition switch - ARM.
11. Condition lever - LOW IDLE.
12. TGT - 1000°C 5 seconds maximum.
13. Oil pressure - Check.
14. Generator switch - RESET then ON.
15. Engine cleanup - Perform if engine restart unsuccessful.
16. Cabin temperature mode switch - As required.
17. Electrical equipment - As required.
18. Auto ignition switch - ARMED.
19. Propellers - Synchronized.

20. Power - As required.

9-12. MAXIMUM GLIDE.

In the event of failure of both engines, maximum gliding distance can be obtained by feathering both propellers to reduce propeller drag and by maintaining the appropriate airspeed with the gear and flaps up. Figure 9-2 gives the approximated gliding distances in relation to altitude.

9-13. LANDING WITH TWO ENGINES IN-OPERATIVE.

Maintain best glide speed (figure 9-2). If sufficient altitude remains after reaching a suitable landing area, a circular pattern will provide best observation of surface conditions, wind velocity and direction. When the condition of the terrain has been noted and the landing area selected, set up a rectangular pattern. Extending APPROACH flaps and landing gear early in the pattern will give an indication of glide performance sooner, and will allow more time to make adjustments for the added drag. Fly the base leg as necessary to control Point of touch-down. Plan to overshoot rather than undershoot, then use flaps as necessary to arrive at the selected landing point.

Keep in mind that, with both propellers feathered, the normal tendency is to overshoot due to less drag. In the event a positive gear-down indication cannot be determined, prepare for a gear-up landing. Also, unless the surface of the landing area is hard and smooth, the landing should be made with the landing gear up. If landing on rough terrain, land in a slightly tail-low attitude to keep nacelles from possibly digging in. If possible, land with flaps fully extended.

9-14. LOW OIL PRESSURE.

In the event of a low oil pressure indication, perform the procedures below, as applicable:

1. Oil pressure below 105 PSI below 21,000 feet or 85 PSI at 21,000 feet and above, torque - 49% maximum.
2. Oil pressure below 60 PSI - Perform engine shutdown, or land as soon as practicable using minimum power to ensure safe arrival.

9-15. CHIP DETECTOR WARNING ANNUNCIATOR ILLUMINATED.

If the L CHIP DET or R CHIP DET warning annunciator illuminates, and safe single-engine flight can be maintained, perform the following:

1. Perform engine shutdown.
2. Land as soon as practicable.

9-16. DUCT OVERTEMP CAUTION LIGHT ILLUMINATED.

Insure that the cabin floor outlets are open and unobstructed, then perform the following steps in sequence until the light is extinguished. After completion of steps 1. through 4., if the light does not extinguish, allow approximately 30 seconds after each adjustment for the system temperature to stabilize. The overtemperature condition is considered corrected at any point during the procedure that the light goes out.

1. Cabin air control - In.
2. Cabin temperature mode switch - AUTO.
3. Cabin temperature rheostat - Full decrease.
4. Vent blower switch - HI.
5. Cabin temperature mode switch - MAN HEAT.
6. Manual temperature switch - DECREASE (hold).
7. Left bleed air valve switch - ENVIRO OFF.
8. Light still illuminated (30 seconds) - Left bleed air valve switch - OPEN.
9. Right bleed air valve switch - ENVIRO OFF.
10. Light still illuminated (30 seconds) - Right bleed air valve switch - OPEN.

NOTE

If the overtemperature light has not extinguished after completing the above procedure, the warning system has malfunctioned.

9-17. ICE VANE FAILURE.

Ice vane failure is indicated by VANE FAIL caution light illumination. If an ice vane fails to operate electrically, perform the following:

MAXIMUM GLIDE DISTANCE
STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:

POWER.......... BOTH ENGINES INOPERATIVE
PROPELLERS..... FEATHERED
LANDING GEAR... UP
FLAPS........... 0%
AIRSPEED........ IAS AS TABULATED
WIND............ ZERO

EXAMPLE:

HEIGHT ABOVE TERRAIN..... 10,000 FT
WEIGHT.................... 11,000 LBS

MAXIMUM GLIDE DISTANCE... 20 NM
GLIDE SPEED................ 107 KTS

WEIGHT ~ LBS	BEST GLIDE SPEED ~ KNOTS
14,200	122
13,000	116
12,000	112
11,000	107

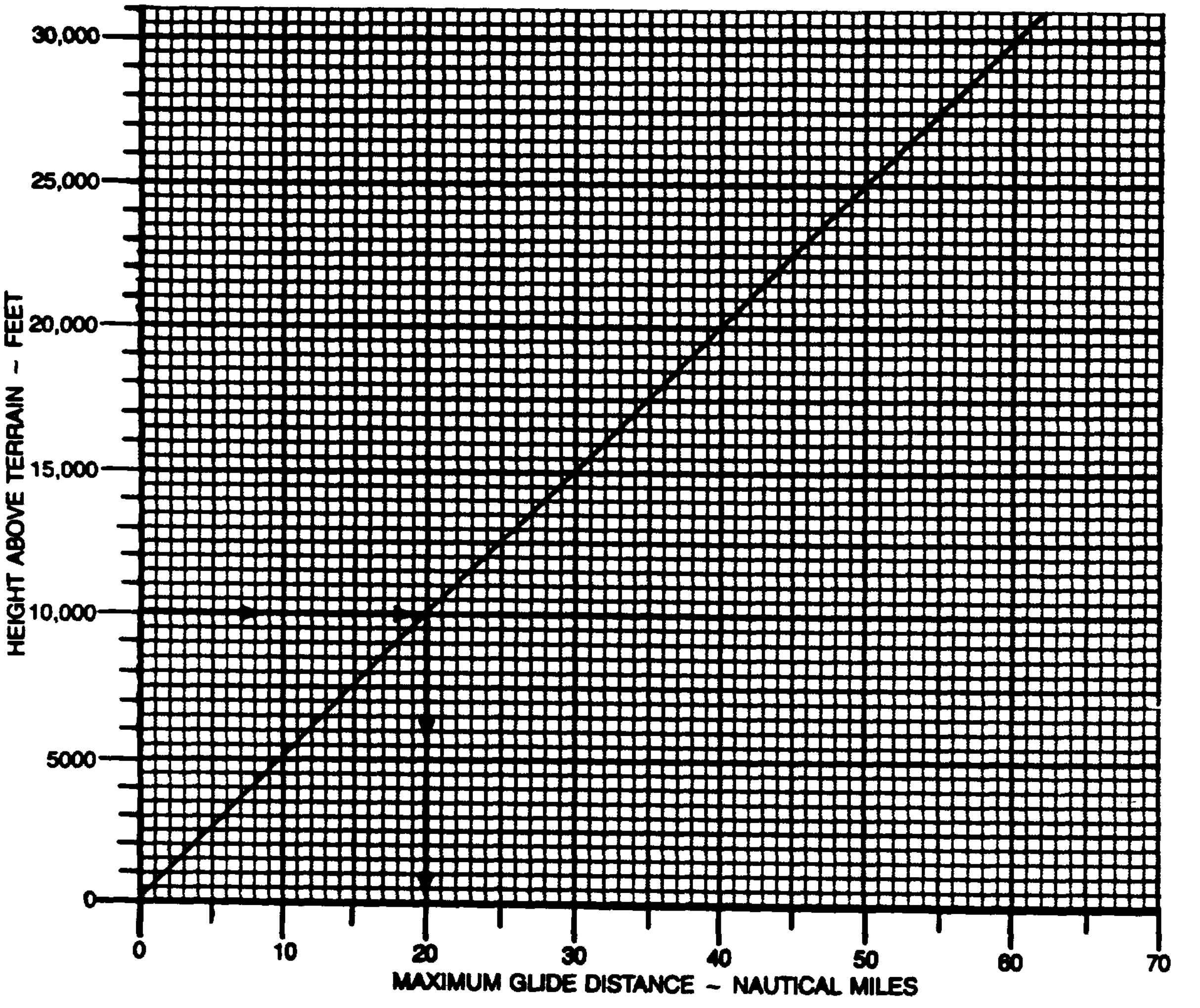


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Figure 9-2. Maximum Glide Distance

CAUTION

After the ice vanes have been manually extended, they may be mechanically retracted. No electrical extension or retraction shall be attempted as damage to the electric actuator may result. Linkage in the nacelle area must be reset prior to operation of the electric system. Do not reset ice vane control circuit breaker.

1. Airspeed - 160 KIAS or below.
2. Ice vane control circuit breaker - Pull.
3. Ice vane - Operate manually.
4. Airspeed - Resume normal airspeed.

CAUTION

DO NOT RETRACT ice vanes electrically after manual extension.

9-18. ENGINE BLEED AIR SYSTEM MALFUNCTION.

a. Bleed Air Failure Light Illuminated. Steady illumination of the warning light in flight indicates a possible ruptured bleed air line aft of the engine firewall. The light will remain illuminated for the remainder of flight. Perform the following:

NOTE

BLEED AIR FAIL lights may momentarily illuminate during simultaneous surface deice and brake deice operation at low N_1. speeds.

1. Brake deice switch - OFF.
2. TGT and torque - Monitor (note readings).
3. Bleed air valve switch - PNEU & ENVIRO OFF.

NOTE

Brake deice on the affected side, and rudder boost, will not be available with BLEED AIR VALVE switch in PNEU & ENVIRO OFF.

4. Cabin pressurization - Check.

b. Excessive Differential Pressure. If cabin differential pressure exceeds 6.1 PSI, perform the following:

1. Cabin controller - Select higher setting.
2. If condition persists: Left bleed air valve switch - ENVIRO OFF flight illuminated).
3. If condition still persists: Right bleed air valve switch - ENVIRO OFF (light illuminated).
4. If condition still persists - Descend immediately.
5. If unable to descend: Crew oxygen masks - 100% and on.
6. If unable to descend: CABIN PRESS switch - DUMP.
7. Bleed air valve switches - OPEN, if cabin heating is required.

9-19. LOSS OF PRESSURIZATION (ABOVE 10, 000 FEET).

If cabin pressurization is lost when operating above 10,000 feet or the ALTITUDE warning light illuminates, perform the following:

1. Crew oxygen masks - 100% and on.

9-20. CABIN DOOR CAUTION LIGHT ILLUMINATED.

Remain clear of cabin door and perform the following:

1. Bleed air valve switches - ENVIRO OFF.
2. Descend below 14,000 feet as soon as practicable.
3. Oxygen - As required.

9-21. SINGLE-ENGINE DESCENT/ARRIVAL.

NOTE

Approximately 85% N_1 is required to maintain pressurization schedule.

Perform the following procedure prior to the final descent for landing.

1. Cabin controller - Set.
2. Seat belts and harnesses - Secure.

3. Ice and rain switches - As required.
4. Altimeters - Set.
5. Recognition lights - ON.
6. Arrival briefing - Complete.

9-22. SINGLE-ENGINE BEFORE LANDING.

1. Propeller lever - As required.

NOTE

During approach, propeller should be set at 1900 RPM to prevent glideslope interference (ILS approach), provide better power response during approach, and to minimize attitude change when advancing propeller levers for landing.

2. Flaps - APPROACH.
3. Gear - DN.
4. Landing lights - As required.
5. Yaw damp - OFF.
6. Brake deice - OFF.

9-23. SINGLE-ENGINE LANDING CHECK.

Perform the following procedure during final approach to runway.

1. Autopilot/yaw damp - Disengaged.
2. Gear lights - Check.
3. Propeller lever (operative engine) - HIGH RPM.

NOTE

To insure constant reversing characteristics. the propeller control must be in the HIGH RPM position.

9-24. SINGLE-ENGINE GO-AROUND.

WARNING

Once flaps are fully extended, a single-engine go-around may not be possible when close to grouud under conditions of high gross weights and/or high density altitude.

1. <u>Power - Maximum controllable.</u>
2. <u>Gear - UP.</u>
3. <u>Flaps - As required.</u>
4. Landing lights - OFF.
5. Power - As required.
6. Yaw damp - As required.

9-25. PROPELLER FAILURE (OVER 2000 RPM).

If an overspeed condition occurs that cannot be controlled with the propeller lever, or by reduciug power, perform the following:

1. <u>Power lever (affected engine) - IDLE.</u>
2. <u>Propeller lever - FEATHER.</u>
3. <u>Condition lever - As required.</u>
4. Engine cleanup - As required,

9-26. FIRE.

The safety of aircraft occupants is the primary consideration when a fire occurs; therefore, it is imperative that every effort be made by the flight crew to put the fire out. On the ground it is essential that the engines be shut down, crew evacuated, and fire fighting begun immediately. If the aircraft is airborne when a fire occurs, the most important single action that can be taken by the pilot is to land safely as soon as possible.

a. Engine Fire. The following procedures shall be performed in case of engine fire:

(1) Engine/nacelle fire during start or ground operations. If engine/nacelle fire is identified during start or ground operation, perform the following:

1. <u>Propeller levers - FEATHER.</u>
2. <u>Condition levers - FUEL CUT-OFF.</u>
3. <u>Fire pull handle - Pull.</u>

CAUTION

If fire extinguisher has been used to extinguish an engine fire, do not attempt to restart until maintenance personnel have inspected the aircraft and released it for flight.

4. Push to extinguish switch - Push.

5. Master switch - OFF.

(2) Engine fire in flight (fire pull handle light illuminated). If an engine fire is suspected in flight, perform the following:

1. Power lever - IDLE.

2. Fire pull handle out - Advance power.

3. Fire pull handle light still illuminated - Perform engine fire in flight procedures (identified).

NOTE

Flight into the sun at high aircraft pitch attitude may actuate the fire warning system. Lowering the nose and/or changing headings will confirm a warning system failure caused by sun rays.

(3) Engine fire in flight (identified). If an engine fire is confirmed in flight, perform the following:

CAUTION

Due to the possibilities of fire warning system malfunctions, the fire should be visually identified before the engine is secured and the extinguisher actuated.

1. Power lever - IDLE.

2. Propeller lever - FEATHER.

3. Condition lever - FUEL CUT-OFF.

4. Fire pull handle - Pull.

5. Fire extinguisher - Actuate as required.

6. Engine cleanup - Perform.

b. Fuselage Fire. If a fuselage fire occurs, perform the following:

WARNING

The extinguisher agent (Bromochlorodifluoromethane) in the fire extinguisher can produce toxic effects if inhaled.

1. Fight the fire.

2. Land as soon as possible.

c. Wing Fire. There is little that can be done to control a wing fire except to shut off fuel and electrical systems that may be contributing to the fire, or which could aggravate it. Diving and slipping the aircraft away from the burning wing may help. If a wing fire occurs, perform the following:

1. Perform engine shutdown on affected side.

2. Land as soon as possible.

d. Electrical Fire. Upon noticing the existence or indications of an electrical fire, turn off all affected electrical circuits, if known. If electrical fire source is unknown, perform the following:

1. Crew oxygen - 100%.

2. Master switch - OFF (Visual Conditions Only).

3. All nonessential electrical equipment - OFF.

NOTE

With loss of DC electrical power, the aircraft will depressurize. All electrical instruments, with the exception of the Prop RPM, N_1 RPM, and TGT gages will be inoperative.

4. Battery switch - ON.

5. Generator switches (individually) - RESET, then ON.

6. Circuit breakers - Check for indication of defective circuit.

CAUTION

As each electrical switch is returned to ON, **note loadmeter reading** and check for evidence of fire.

7. Essential electrical equipment - On (individually until fire source is isolated).

8. Land as soon as practicable.

e. Smoke and Fume Elimination. To eliminate smoke and fumes from the aircraft, perform the following:

1. Crew oxygen - 100% and on.

2. Bleed air valve switches - ENVIRO OFF.

3. Vent blower switch - AUTO.

4. Aft vent blower switch - OFF.

5. Cabin temperature mode switch - OFF.

6. If smoke and fumes are not eliminated, CABIN PRESS switch - DUMP.

NOTE

Opening storm window (after depressurizing) will facilitate smoke and fume removal.

7. Engine oil pressure - Monitor.

9-27. FUEL SYSTEM.

a. Fuel Press Warning Light Illuminated. Illumination of the #1 or #2 FUEL PRESS warning light usually indicates failure of the respective engine-driven boost pump. Perform the following:

1. Standby pump switch - ON.

2. Fuel pressure light out - Check.

3. Fuel pressure light still on - Record unboosted time.

b. No Fuel Transfer Caution Light Illuminated. Illumination of the #1 or #2 NO FUEL XFR light with fuel remaining in the respective auxiliary fuel tank indicates a failure of that automatic fuel transfer system. Proceed as follows:

1. AUX TRANSFER switch (affected side) OVERRIDE.

2. Auxiliary fuel quantity - Monitor.

3. AUX TRANSFER switch (after respective auxiliary fuel has completely transferred) - AUTO.

c. Nacelle Fuel Leak. If nacelle fuel leaks are evident, perform the following:

1. Perform engine shutdown.

2. Fire pull handle - Pull.

3. Land as soon as practicable.

d. Fuel Crossfeed. Fuel crossfeed is normally used only during single-engine operation. The fuel from the dead engine side may be used to supply the live engine by routing the fuel through the crossfeed system. During extended flights, this method of fuel usage will provide a more balanced lateral load condition in the aircraft. For fuel crossfeed. use the following procedure:

1. AUX TRANSFER switches - AUTO.

NOTE

With the FIRE PULL handle pulled, the fuel in the auxiliary tank for that side will not be available (usable) for crossfeed.

2. Standby pumps - OFF.

3. Crossfeed switch - As required.

4. Fuel crossfeed light illuminated - Check.

NOTE

With the FIRE PULL handle pulled, the FUEL press light will remain illuminated on the side supplying fuel.

5. Fuel pressure light extinguished - Check.

6. Fuel quantity - Monitor.

e. NAC LOW Light Illuminated. Illumination of the #1 or #2 NAC LOW caution light indicates that the affected tank has 20 minutes remaining at sea level, maximum cruise power consumption rate. Proceed as follows:

WARNING

Failure of the fuel tank venting system will prevent the fuel in the wing tanks from gravity feeding into the nacelle tank. Fuel vent system failure may be indicated by illumination of the #1 or #2 NAC LOW caution light with greater than 20 minutes of usable fuel indicated in the main tank fuel system. The total usable fuel remaining in the main fuel supply system with the LOW FUEL caution light illuminated may be as little as 114 pounds, regardless of the total fuel quantity indicated. Continued flight may result in engine flameout due to fuel starvation.

1. Twenty minutes fuel remaining - Confirm.

2. Land as soon as possible.

9-28. ELECTRICAL SYSTEM EMERGENCIES.

a. DC GEN Light Illuminated. Illumination of a #1 or #2 DC GEN caution light indicates failure.

(Go to page 9-11)

of a generator or one of its associated circuits (generator control unit). If one generator system becomes inoperative, all nonessential electrical equipment should be used judiciously to avoid overloading the remaining generator. The use of accessories which create a very high drain should be avoided. If both generators are shut off due to either generator system failure or engine failure, all nonessential equipment should be turned off to preserve battery power for extending the landing gear and wing flaps. When a DC GEN light illuminates, perform the following:

1. Generator switch-OFF, RESET, then ON.
2. Generator switch (no reset)-OFF.
3. Mission control switch-OVERRIDE.
4. Operating loadmeter-100% maximum.

b. Both DC GEN Lights Illuminated.

1. All nonessential equipment-OFF.
2. Land as soon as practicable.

c. Excessive Loadmeter Indication (Over 100%). If either loadmeter indicates over 100%, perform the following:

1. Battery switch-OFF (monitor loadmeter).
2. Loadmeter over 100%-Nonessential electrical equipment OFF.
3. Loadmeter under 100%-BATT switch ON.

d. Inverter Light Illuminated. Illumination of the #1 or #2 AIRCRAFT INVERTER caution light indicates failure of the affected inverter. When either inverter fails, the total aircraft load is automatically switched to the remaining inverter. When a #1 or #2 AIRCRAFT INVERTER light illuminates, perform the following:

1. Affected AIRCRAFT INVERTER switch-OFF.

e. INST AC Light Illuminated. Illumination of the INST AC warning light indicates that 26 VAC power is not available. All items connected to the 26 VAC bus will be inoperative. Under these conditions, power must be controlled by indications of the N1 and TGT gages. Perform the following:

1. N1 and TGT indications-Check.
2. Other engine instruments-Monitor.

f: Circuit Breaker Tripped. If the circuit breaker is for a nonessential item, do not reset in flight. If the circuit breaker is for an essential item, the circuit breaker may be reset once. If a bus feeder circuit breaker (on the overhead circuit breaker panel) trips, a short is indicated. Do not reset in flight. If a circuit breaker trips, perform as follows:

1. BUS FEEDER breaker tripped-Do not reset.
2. Nonessential circuit-Do not reset.
3. Essential circuit-Reset once.

g. BATTERY CHARGE Light Illuminated.

1. Battery volt-amp meter Check.
   a. Amp reading above 7 amps and decreasing Monitor.
   b. Amp reading above 7 amps and increasing Battery switch OFF.
2. Battery switch ON (for landing prior to gear/flap extension).

9-29. EMERGENCY DESCENT.

Emergency descent is a maximum effort in which damage to the aircraft must be considered secondary to getting the aircraft down. The following procedure assumes the structural integrity of the aircraft and smooth flight conditions. If structural integrity is in doubt, limit speed as much as possible, reduce rate of descent if necessary, and avoid high maneuvering loads. For emergency descent, perform the following:

NOTE
Windshield defogging may be required.

1. <u>Power lever-IDLE.</u>
2. <u>Propeller lever-HIGH RPM.</u>
3. <u>Flap lever-APPROACH.</u>
4. <u>Gear-DN.</u>
5. <u>Airspeed-184 KIAS maximum.</u>

9-30. LANDING EMERGENCIES.

WARNING

Structural damage may exist after landing with brake, tire, or landing gear malfunctions. Under no circumstances shall an attempt be made to inspect the aircraft until jacks have been installed.

a. Landing Gear Unsafe Indication. Should one or more of the landing gear fail to indicate a safe condition, the following steps should be taken before proceeding manually to extend the gear.

1. LANDING GEAR RELAY circuit breaker Check in.
2. Gear lights Check.
3. Gear handle DN.
4. Manual gear extension As required.

NOTE

If gear continues to indicate unsafe, attempt to verify position visually by other aircraft.

b. Landing Gear Emergency Extension.

CAUTION

After an emergency landing gear extension has been made, do not stow the gear ratchet handle or move any landing gear controls or reset any switches or circuit breakers until the cause of the malfunction has been corrected.

1. Airspeed 130 KIAS.
2. LANDING GEAR RELAY circuit breaker Out.
3. Gear handle DN.
4. Landing gear alternate engage handle Lift and turn clockwise to the stop.
5. Alternate landing gear extension handle Pump.
6. Gear lights illuminated Check.

NOTE

After a practice manual extension, the alternate handle may be stowed and the landing gear retracted electrically. Rotate the alternate engage handle counterclockwise and push it down. Stow the handle, push in the LANDING GEAR RELAY circuit breaker on the overhead circuit breaker panel and retract the gear in the normal manner with the landing gear switch.

c. Gear-up Landing (All Gear Up or Unlocked). Due to decreased drag with the gear up, the tendency will be to overshoot the approach. The center-of-gravity with the gear retracted is aft of the main wheels. This condition will allow the aircraft to be landed with the gear retracted and should result in a minimum amount of structural damage to the aircraft, providing the wings are kept level. It is recommended that the fuel load be reduced and the landing made with flaps fully extended on a hard surface runway. Landing on soft ground or dirt is not recommended as sod has a tendency to roll up into chunks, damaging the underside of the aircraft's structure. When fuel load has been reduced, prepare for a gear-up landing as follows:

1. Crew emergency briefing Complete.
2. Loose equipment Stowed.
3. Bleed air valves ENVIRO OFF.
4. Cabin pressure switch DUMP.
5. Cabin emergency hatch Remove and stow.
6. Seat belts and harnesses Secured.
7. Landing gear alternate engage handle Disengaged.
8. Alternate landing gear extension handle Stowed.
9. Gear relay circuit breaker In.
10. Gear handle UP.
11. Nonessential electrical equipment OFF.
12. Flaps As required (DOWN for landing).

NOTE

Fly a normal approach to touchdown. After landing, accomplish the following:

13. Condition levers FUEL CUTOFF.
14. Fire pull handles Pull.
15. Master switch OFF.

d. Landing With Nose Gear Unsafe. If the LDG GEAR CONTROL warning light is illuminated and the nose GEAR DOWN LIGHT shows an unsafe condition, the nose gear is probably not locked down, and the gear position should be checked visually by another aircraft, if possible. If all attempts to lock the nose gear fail, a landing should be made with the main gear down and locked. Hold the nose off the runway as long as possible and do not use brakes. Use the following procedures:

1. Crew emergency briefing Complete.
2. Loose equipment Stowed.
3. Bleed air valves ENVIRO OFF.
4. Cabin pressure switch DUMP.
5. Cabin emergency hatch Remove and stow.
6. Seat belts and harnesses Secured.
7. Nonessential electrical equipment OFF.

NOTE

Fly a normal approach to touchdown. After landing, accomplish the following:

8. Condition levers FUEL CUTOFF.
9. Fire pull handle Pull.
10. Master switch OFF.

e. Landing With One Main Gear Unsafe. If one main landing gear fails to extend, retract the other gear and make a gear-up landing. If all efforts to retract the extended gear fail, land the aircraft on a hard runway surface, touching down on the same edge of the runway as the extended gear. Roll on the down and locked gear, holding the opposite wing up and the nose gear straight as long as possible. If the gear has extended, but is unsafe, apply brakes lightly on the unsafe side to assist in locking the gear. If the gear has not extended or does not lock, allow the wing to lower slowly to the runway. Use the following procedures:

1. Crew emergency briefing Complete.
2. Loose equipment Stowed.
3. Bleed air valves ENVIRO OFF.
4. Cabin pressure switch DUMP.
5. Cabin emergency hatch Remove and stow.
6. Seat belts and harnesses Secured.
7. Nonessential electrical equipment OFF.
8. Touchdown On safe main gear first.

NOTE

Fly a normal approach to touchdown. After landing, accomplish the following:

9. Condition levers FUEL CUTOFF.
10. Fire pull handle Pull.
11. Master switch OFF.

f Landing With Flat Tire(s). If aware that a main gear tire(s) is flat, a landing close to the edge of the runway opposite the flat tire will help avoid veering off the runway. If the nose wheel tire is flat, use minimum braking.

9-31. CRACKED WINDSHIELD.

a. External Crack. If an external windshield crack is noted, no action is required in flight.

NOTE

Heating elements may be inoperative in areas of crack.

b. Internal Crack. If an internal crack occurs, perform the following:

1. Descend Below 25,000 feet.

2. Cabin Pressure Reset pressure differential to 4 PSI or less within 10 minutes.

9-32. CRACKED CABIN WINDOW

If crack in a single ply of the external cabin window occurs, unpressurized flight may be continued. Proceed as follows:

1. Oxygen As required.
2. Cabin pressurization Depressurize.
3. Descend As required.

NOTE

If both plys of the external cabin window have developed cracks, the aircraft shall not be flown once landed, without proper ferry flight authorization.

9-33. DITCHING.

If a decision to ditch is made, immediately alert all crewmembers to prepare for ditching. Plan the approach into the wind if the wind is high and the seas are heavy. If the swells are heavy but the wind is light, land parallel to the swells. Set up a minimum rate descent (power on or off, as the situation dictates airspeed 110-120 KIAS). Do not try to flare as in a normal landing, as it is very difficult to judge altitude over water, particularly in a slick sea. Leveling off too high may cause a nose low "drop in," while having the tail too low on impact may result in the aircraft pitching forward and "digging in. " Expect more than one impact shock and several skips before the final hard shock. There may be nothing but spray visible for several seconds while the aircraft is decelerating. To prevent cartwheeling, it is important that the wings be level when the aircraft hits the water. After the aircraft is at rest, supervise evacuation of passengers and exit the aircraft as quickly as possible. In a planned ditching, the life raft and first-aid kits should be secured close to the cabin emergency hatch for easy access when evacuating; however, do not remove the raft from its carrying case inside the aircraft. After exiting the aircraft, keep the raft away from any damaged surfaces which might tear or puncture the fabric. The length of time that the aircraft will float depends on the fuel level and the extent of aircraft damage caused by the ditching. Refer to Figure 9-3 for body positions during ditching, and Table 9-1 for personnel procedures. Figure 9-4 shows wind swell information. Perform the following procedures:

WARNING

Do not unstrap from the seat until all motion stops. The possibility of injury and disorientation requires that evacuation not be attempted until the aircraft comes to a complete stop.

1. Radio calls/transponder-As required.
2. Crew emergency briefing-As required.
3. Bleed air valves-ENVIRO OFF.
4. Cabin pressurization switch-DUMP.
5. Cabin emergency hatch-Remove and stow.
6. Seat belts and harnesses-Secured.
7. Gear-UP.
8. Flaps-DOWN.
9. Nonessential electrical equipment-OFF.
10. Approach-Normal, power on.
11. Emergency lights-As required. Ditching

9-34. FLIGHT CONTROLS MALFUNCTION.

Use the following procedures, as applicable, for flight control malfunctions.

a. Unscheduled Rudder Boost Activation. Rudder boost operation without a large variation of power between engines indicates a failure of the system. Perform the following:

1. Rudder boost-OFF.

NOTE

The rudder boost system may not operate when the brake deice system is in use. Availability of the rudder boost system will be restored to normal when the BRAKE DEICE switch is turned OFF.

IF CONDITION PERSISTS:

2. Bleed air valve switches-PNEU & ENVIRO-OFF.
3. Rudder trim-Adjust.

b. Unscheduled Electric Elevator Trim. In the event of unscheduled electric elevator trim, perform the following:

1. ELEV TRIM switch OFF.
2. ELEC TRIM circuit breaker OUT.

9-35. BAILOUT.

When the decision has been made to abandon the aircraft in flight. the pilot will give the warning signal. Exit from the aircraft will be through the main entrance door, and in the departure sequence using the exit routes as indicated in Figure 9-1. Proceed as follows if bailout becomes necessary:

1. Notify copilot to prepare to bail out.
2. Distress message Transmit.
3. Voice security ZEROIZE.

Table 9-1. Personnel Procedures During Ditching

PLANNED DITCHING	IMMEDIATE DITCHING
PILOT	**PILOT**
A. ALERT OCCUPANTS B. ORDER TO PREPARE SURVIVAL GEAR FOR AERIAL DROP C. TRANSMIT DISTRESS MESSAGE D. LIFE VEST - CHECK (DO NOT INFLATE) E. DISCHARGE MARKER F. LAND AND DITCH AIRCRAFT G. ABANDON AIRCRAFT	A. WARN OCCUPANTS B. TRANSMIT DISTRESS MESSAGE C. LIFE VEST - CHECK (DO NOT INFLATE) D. APPROACH - NORMAL E. NOTIFY OCCUPANTS TO BRACE FOR DITCHING F. LAND AND DITCH AIRCRAFT G. ABANDON AIRCRAFT AFTER COPILOT THROUGH CABIN EMERGENCY HATCH
COPILOT	**COPILOT**
A. REMOVE CABIN EMERGENCY HATCH B. LIFE VEST - CHECK (DO NOT INFLATE) C. ABANDON AIRCRAFT (TAKE LIFE RAFT AND FIRST AID KIT)	A. REMOVE CABIN EMERGENCY HATCH B. LIFE VEST - (DO NOT INFLATE) C. ABANDON AIRCRAFT (TAKE LIFE RAFT AND FIRST AID KIT)
PASSENGERS	PASSENGERS
A. SEAT BELTS - FASTEN B. LIFE VEST - CHECK (DO NOT INFLATE) C. ON PILOT'S SIGNAL - BRACE FOR DITCHING D. ABANDON AIRCRAFT THROUGH CABIN DOOR (TAKE LIFE RAFT AND FIRST AID KIT	A. SEAT BELTS - FASTEN B. LIFE VEST - CHECK (DO NOT INFLATE) C. ON PILOT'S SIGNAL -BRACE FOR DITCHING D. ABANDON AIRCRAFT THROUGH CABIN DOOR (TAKE LIFE RAFT AND FIRST AID KIT)
BT01131	

4. Transponder-7700.

5. Flaps-DOWN.

6. Airspeed-100 KIAS.

7. Trim-As required.

8. Autopilot-Engage.

9. Cabin pressure switch-DUMP.

10. Radio cord, oxygen hose, harnesses and seat belt-Disconnect.

11. Parachute-Attach to harness.

12. Cabin door-Open.

13. Abandon the aircraft.

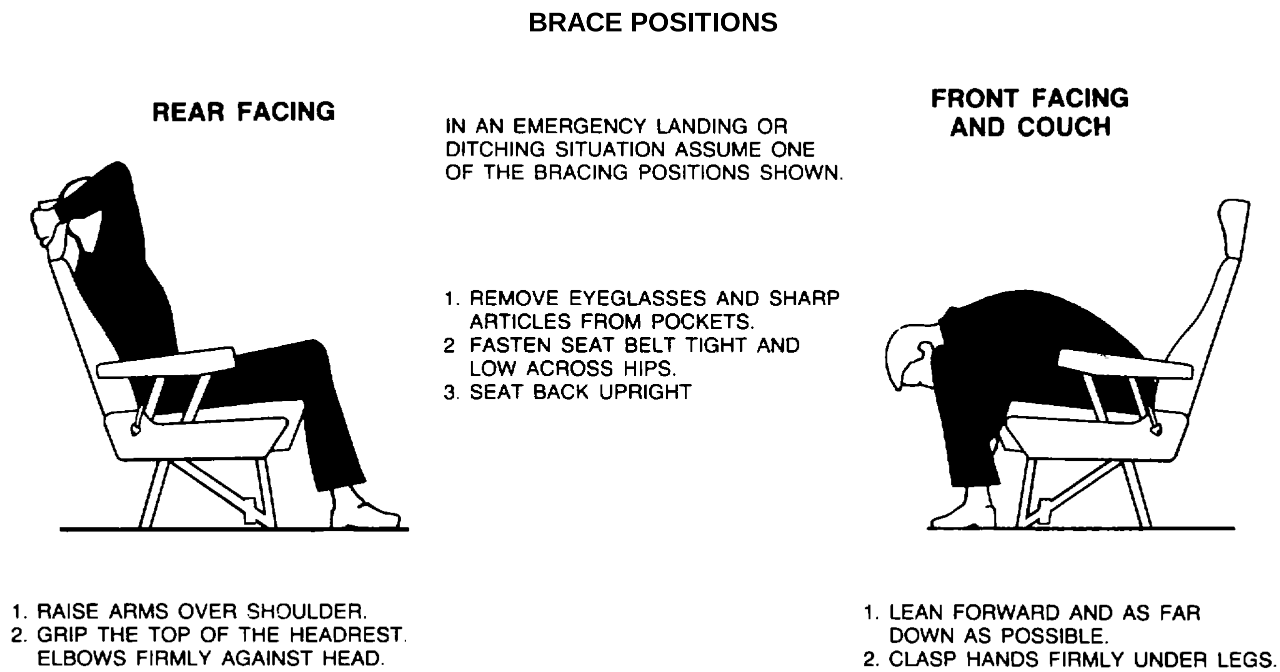

Figure 9-3. Emergency Body Positions

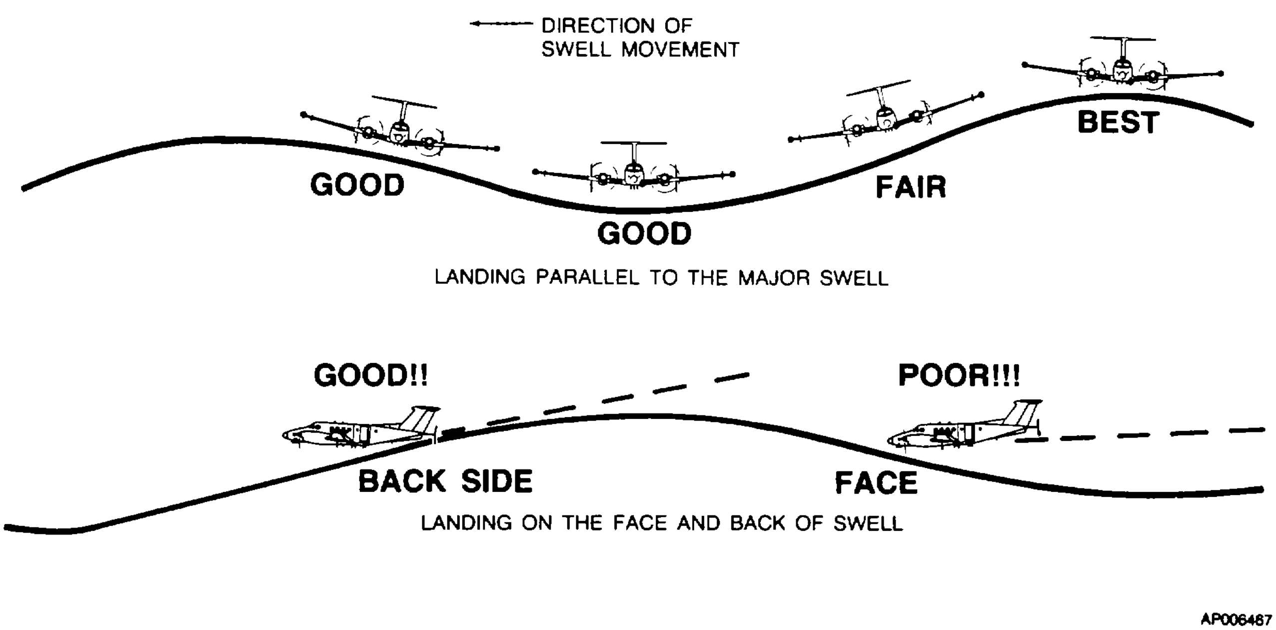

Figure 9-4. Wind Swell Ditch Heading Evaluation

APPENDIX A

REFERENCES

Reference information for the subject material contained in this manual can be found in the following publications.

AR 70-50	Designating and Naming Defense Equipment, Rockets, and Guided Missiles
AR 95-1	Army Aviation - General Provisions and Flight Regulations
AR 95-3	Weight and Balance - Army Aircraft
AR 380-40	Safeguarding COMSEC Information
AR 385-40	Accident Reporting and Records
AR 700-26	Aircraft Designation System
FAR Part 91	General Operating and Flight Rules
FM 1-230	Meteorology for Army Aviators
TB 55-9150-200-24	Engine and Transmission Oils, Fuels, and Additives for Army Aircraft
TB AVN 23-13	Anti-icing, Deicing and Defrosting Procedures for Parked Aircraft
TB MED 501	Noise and Conservation of Hearing
TM 9-1095-206-13&P	Operator's Aviation Unit Maintenance and Aviation Intermediate Maintenance Manual (Including Repair Parts and Special Tools List) to Dispenser, General Purpose Aircraft: M-130
(C) TM 11-5825-252-15	Operator, Organizational, DS, GS, and Deport Maintenance Manual: RC-12D Aircraft Mission Equipment, (V)
TM 11-5841-291-12	Operator and Organizational Maintenance Manual, Radar Warning System, AN/APR-44(V) 1
TM 11-5841-283-20	Organizational Maintenance Manual for Detection Set, Radar Signal AN/APR-39(V) 1.
TM 11-6140-203-14-2	Operator's Organizational, Direct Support, General Support and Depot Maintenance Manual Including Repair Parts and Special Tools List: Aircraft Nickel-Cadmium Batteries
TM 11-6940-214-12	Operator and Organizational Maintenance Manual, Simulator, Radar Signal, SM-756/APR-44(V)
TM 55-410	Aircraft Maintenance, Servicing and Ground Handling Under Extreme Environmental Conditions
TM 55-1500-314-25	Handling, Storage, and Disposal of Army Aircraft Components Containing Radioactive Materials
TM 55-1500-204-25/1	General Aircraft Maintenance Manual
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use

APPENDIX B
ABBREVIATIONS AND TERMS

For the purpose of this manual, the following abbreviations and terms apply. See appropriate technical manuals for additional terms and abbreviations.

AIRSPEED TERMINOLOGY.

CAS	Calibrated airspeed is indicated airspeed corrected for position and instrument error.
FT/MIN	Feet per minute.
GS	Ground speed, though not an airspeed, is directly calculable from true airspeed if the true wind speed and direction are known.
IAS	Indicated airspeed is the speed as shown on the airspeed indicator and assumes no error.
KT	Knots.
TAS	True airspeed is calibrated airspeed corrected for temperature, pressure, and compressibility effects.
Va	Maneuvering speed is the maximum speed at which application of full available aerodynamic control will not overstress the aircraft.
Vf	Design flap speed is the highest speed permissible at which wing flaps may be actuated.
Vfe	Maximum flap extended speed is the highest speed permissible with wing flaps in a prescribed extended position.
Vle	Maximum landing gear extended speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
Vlo	Maximum landing gear operating speed is the maximum speed at which the landing gear can be safely extended or retracted.
Vlof	Lift off speed (takeoff airspeed).
Vmca	The minimum flight speed at which the aircraft is directionally controllable as determined in accordance with Federal Aviation Regulations. Aircraft Certification conditions include one engine becoming inoperative and windmilling; a 5° bank towards the operative engine; takeoff power on operative engine; landing gear up; flaps up; and most rearward CG. This speed has been demonstrated to provide satisfactory control above power off stall speed (which varies with weight, configuration, and flight attitude).
Vmo	Maximum operating limit speed.
Vne	Never exceed speed.
Vr	Rotation speed.
Vs	Power off stalling speed or the minimum steady flight speed at which the aircraft is controllable.
Vso	Stalling speed or the minimum steady flight speed in the landing configuration.
Vsse	The safe one-engine inoperative speed selected to provide a reasonable margin against the occurrence of an unintentional stall when making intentional engine cuts.

Vx	Best angle of climb speed.
Vxse	Best single-engine angle of climb speed.
Vy	Best rate of climb speed.
Vyse	The best single engine rate of climb speed.

METEOROLOGICAL TERMINOLOGY.

Altimeter Setting	Barometric pressure corrected to sea level.
°C	Degrees Celsius.
°F	Degrees Fahrenheit.
FAT	Free air temperature is the free air static temperature, obtained either from ground meteorological sources or from inflight temperature indications adjusted for compressibility effects.
Indicated Pressure Altitude	The number actually read from an altimeter when the barometric scale (Kollsman window) has been set to 29.92 inches of mercury (1013 millibars).
ISA	International standard atmosphere in which: a. The air is a dry perfect gas; b. The temperature at sea level is 59 degrees Fahrenheit, 15 degrees Celsius; c. The pressure at sea level is 29.92 inches Hg; d. The temperature gradient from sea level to the altitude at which the temperature is -69.7 degrees Fahrenheit is -0.003566 Fahrenheit per foot and zero above that altitude.
Pressure Altitude (press alt)	Indicated pressure altitude corrected for altimeter error
SL	Sea level.
Wind	The wind velocities recorded as variables on the charts of this manual are to be understood as the headwind or tailwind components of the actual winds at 50 feet above runway surface (tower winds).
Beta Range	The region of the power lever control which is aft of the idle stop and forward of reversing range where blade pitch angle can be changed without a change of gas generator RPM.
Cruise Climb	Is the maximum power approved for normal climb. This power is torque or temperature (ITT) limited.
High Idle	Obtained by placing the condition lever in the HIGH IDLE position.
HP	Horsepower.
Low Idle	Obtained by placing the condition lever in the LO IDLE position.
Maximum Cruise Power	Is the highest power rating for cruise and is not time limited.
Maximum Power	The maximum power available from an engine for use during an emergency operation.
Normal Rated Climb Power	The maximum power available from an engine for continuous normal climb operations.
Normal Rated Power	The maximum power available from an engine for continuous operation in cruise (with lower ITT limit than normal rated climb power).

Reverse Thrust	Obtained by lifting the power levers and moving them aft of the beta range.
RPM	Revolutions per minute.
Takeoff Power	The maximum power available from an engine for takeoff, limited to periods of five minutes duration.

CONTROL AND INSTRUMENT TERMINOLOGY.

Condition Lever (Fuel Shut-off Lever)	The fuel shut-off lever actuates a valve in the fuel control unit which controls the flow of fuel at the fuel control outlet and regulates the idle range from LO to HIGH.
Interstage Turbine Temperature (ITT)	Eight probes wired in parallel indicate the temperature between the compressor and power turbines.
N1 Tachometer (Gas Generator RPM)	The tachometer registers the RPM of the gas generator with 100% representing a gas generator speed of 37,500 RPM.
Power Lever (Gas Generator N1 RPM)	This lever serves to modulate engine power from full reverse thrust to takeoff. The position for idle represents the lowest recommended level of power for flight operation.
Propeller Control Lever (N2 RPM)	This lever requests the control to maintain RPM at a selected value and, in the maximum decrease RPM position, feathers the propeller.
Propeller Governor	This governor will maintain the selected propeller speed requested by the propeller control lever.
Torquemeter	The torquemeter system determines the shaft output torque. Torque values are obtained by tapping into two outlets on the reduction gear case and recording the differential pressure from the outlets.

GRAPH AND TABULAR TERMINOLOGY.

AGL	Above ground level.
Best Angle of Climb	The best angle-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance with gear and flaps up.
Best Rate of Climb	The best rate-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible time with gear and flaps up.
Clean Configuration	Gear and flaps up regardless of mission antenna installation.
Demonstrated Crosswind	The maximum 90° crosswind component for which adequate control of the aircraft during takeoff and landing was actually demonstrated during certification tests.
Gradient	The ratio of the change in height to the horizontal distance, usually expressed in percent.
Landing Weight	The weight of the aircraft at landing touchdown.
Maximum Zero Fuel Weight	Any weight above the value given must be loaded as fuel.
MEA	Minimum enroute altitude.
Obstacle Clearance Climb Speed	Obstacle clearance climb speed is a speed near Vx and Vy, 1.1 times power off stall speed, or 1.2 times minimum single-engine stall-speed, whichever is higher.
Ramp Weight	The gross weight of the aircraft before engine start. Included is the takeoff weight plus a fuel allowance for start, taxi, run up and takeoff ground roll to liftoff.

Route Segment	A part of a route. Each end of that part is identified by: a. A geographic location; or b. A point at which a definite radio fix can be established.
Service Ceiling	The altitude at which the minimum rate of climb of 100 feet per minute can be attained for existing aircraft weight.
Takeoff Weight	The weight of the aircraft at liftoff from the runway.

WEIGHT AND BALANCE TERMINOLOGY.

Arm	The distance from the center of gravity of an object to a line about which moments are to be computed.
Approved Loading Envelope	Those combinations of aircraft weight and center of gravity which define the limits beyond which loading is not approved.
Basic Empty Weight	The aircraft weight with unusable fuel, full oil, and full operating fluids.
Center-of-Gravity	A point at which the weight of an object may be considered concentrated for weight and balance purposes.
CG Limits	CG limits are the extremes of movement which the CG can have without making the aircraft unsafe to fly. The CG of the loaded aircraft must be within these limits at takeoff, in the air, and on landing.
Datum	A vertical plane perpendicular to the aircraft longitudinal axis from which fore and aft (usually aft) measurements are made for weight and balance purposes.
Engine Oil	That portion of the engine oil which can be drained from the engine.
Empty Weight	The aircraft weight with fixed ballast, unusable fuel, engine oil, engine coolant, hydraulic fluid, and in other respects as required by applicable regulatory standards.
Landing Weight	The weight of the aircraft at landing touchdown.
Maximum Weight	The largest weight allowed by design, structural, performance or other limitations.
Moment	A measure of the rotational tendency of a weight, about a specified line, mathematically equal to the product of the weight and the arm.
Standard	Weights corresponding to the aircraft as offered with seating and interior, avionics, accessories, fixed ballast and other equipment specified by the manufacturer as composing a standard aircraft.
Station	The longitudinal distance from some point to the zero datum or zero fuselage station.
Takeoff Weight	The weight of the aircraft at liftoff.
Unusable Fuel	The fuel remaining after consumption of usable fuel.
Usable Fuel	That portion of the total fuel which is available for consumption as determined in accordance with applicable regulatory standards.
Useful Load	The difference between the aircraft ramp weight and basic empty weight.

MISCELLANEOUS ABBREVIATIONS

Deg	Degrees	LB	Pounds
DN	Down	MAX	Maximum
FT	Foot or feet	MH	Megahertz
FT LB	Foot-pounds	MIN	Minimum
GAL	Gallons	NAUT	Nautical
HR	Hours	NM	Nautical miles
kH	Kilohertz	PSI	Pounds per square inch
RC	Rate of climb		

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Subject	Paragraph, Figure, Table Number

Subject	Paragraph, Figure, Table Number

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Z

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To: ls-lp @ redstone.army.mil
Subject: DA Form 2028
1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** AL
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
8. ***Pub No:*** 55-2840-229-23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. ***Submitter Fname:*** Joe
14. Submitter Mname: T
15. ***Submitter Lname:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Problem:*** 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
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28. Total: 123
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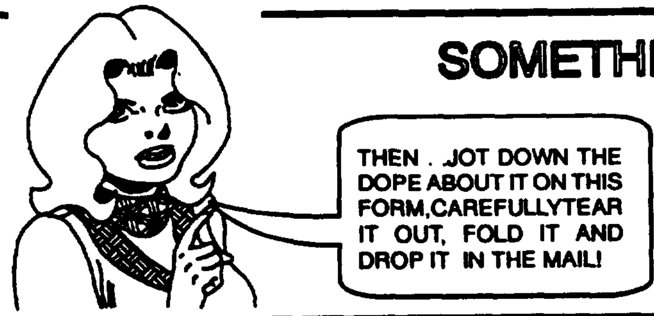

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FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC John DOE
CO A 3rd Engineer Bn
Ft. Leonardwood, MO 63108

DATE SENT 22 August 1992

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 1-1520-250-10	15 June 1992	Operator's manual MH60K Helicopter

BE EXACT PIN-POINT WHERE IT IS — IN THIS SPACE, TELL WHAT IS WONG AND WHAT SHOULD BE DONE ABOUT IT:

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointed at a bolt. In key to figure 4-3, item 16 is calle a shim. Please correct one or the other

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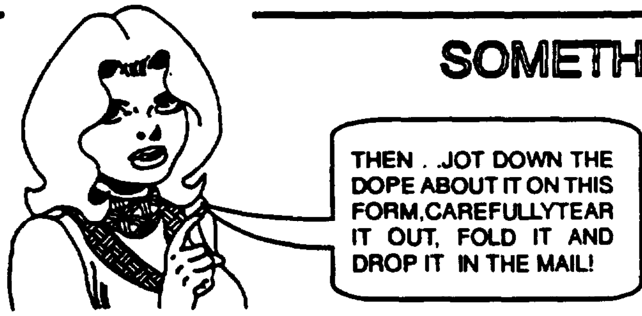

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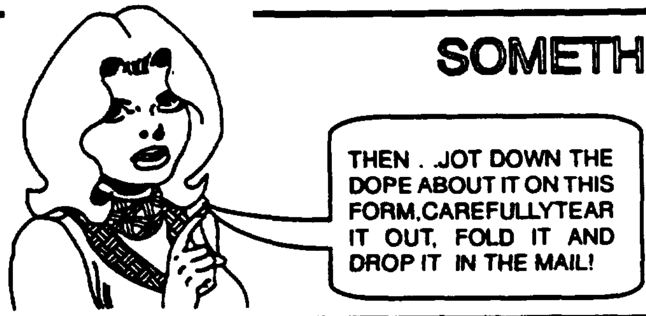

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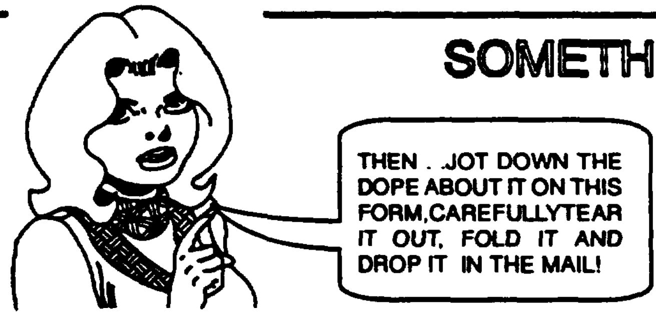

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THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3.2808.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu in.
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Square measure

1 sq. centimeter = 100 sq. millimeters =.155 sq. in.
1 sq. decimeter = 100 sq. centimeters = 15.5 inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 feet
1 sq. dekameter (are) = 100 sq. meters = 1.076.4 sq. ft.
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 hectometers = .386 sq. miles

Liquid Measure

1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons
1 liter = 10 deciliters = 33.81 fl. ounces
1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3 38 fl. ounces
1 metric ton = 10 quintals = 1.1 short tons

Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce inches	newton-meters	.0070062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
sq. inches	sq. centimeters	6.451	kilometers	miles	.621
sq. feet	sq. meters	.093	sq. centimeters	sq. inches	.155
sq. yards	sq. meters	.836	sq. meters	sq. yards	10.764
sq. miles	sq. kilometers	2.590	sq. kilometers	sq. miles	1.196
acres	sq. hectometers	.405	sq. hectometers	acres	2.471
cubic feet	cubic meters	.028	cubic meters	cubic feet	35.315
cubic yards	cubic meters	.765	milliliters	fluid ounces	.034
fluid ounces	milliliters	29.573	liters	pints	2.113
pints	liters	.472	liters	quarts	1.057
quarts	liters	.946	grams	ounces	.035
gallons	liters	3.785	kilograms	pounds	2.205
ounces	grams	28.349	metric tons	short tons	1.102
pounds	kilograms	.454	pound-feet	newton-meters	1.356
short tons	metric tons	.907			
pound inches	newton-meters	.11296			

Temperature (Exact)

°F Fahrenheit temperature	5/9 (after subtracting 32)	Celsius Temperature °C

PIN: 057981-000