SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued) Page

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued) Page

INTRODUCTION

This section provides description and operation of the airplane and its systems. Some equipment described herein is optional and may not be installed in the airplane. Refer to Section 9, Supplements, for details of other optional systems and equipment.

WARNING

COMPLETE FAMILIARITY WITH THE AIRPLANE AND ITS SYSTEMS WILL NOT ONLY INCREASE THE PILOT'S PROFICIENCY AND ENSURE OPTIMUM OPERATION, BUT COULD PROVIDE A BASIS FOR ANALYZING SYSTEM MALFUNCTIONS IN CASE AN EMERGENCY IS ENCOUNTERED. INFORMATION IN THIS SECTION WILL ASSIST IN THAT FAMILIARIZATION. THE RESPONSIBLE PILOT WILL WANT TO BE PREPARED TO MAKE PROPER AND PRECISE RESPONSES IN EVERY SITUATION.

AIRFRAME

The airplane is an all-metal, high-wing, single-engine airplane equipped with tricycle landing gear and designed for general utility purposes.

The construction of the fuselage is a conventional formed sheet metal bulkhead, stringer, and skin design referred to as semimonocoque. Major items of structure are the front and rear carry-through spars to which the wings are attached, a bulkhead and forgings for main landing gear attachment and a bulkhead with attaching plates at its base for the strut-to-fuselage attachment of the wing struts.

The externally braced wings, having integral fuel tanks, are constructed of a front and rear spar with formed sheet metal ribs, doublers, and stringers. The entire structure is covered with aluminum skin. The front spars are equipped with wing-to-fuselage and wing-to-strut attach fittings. The aft spars are equipped with wing-to-fuselage attach fittings. The integral fuel tanks are formed by the front and rear spars, upper and lower skins, and inboard and outboard closeout ribs. Extensive use of bonding is employed in the fuel tank area to reduce fuel tank sealing. Round-nosed ailerons and single-slot type flaps are of conventional formed sheet metal ribs and smooth aluminum skin construction. A slot lip spoiler, mounted above the out board end of each flap, is of conventional construction. The left aileron incorporates a servo tab while the right aileron incorporates a trimmable servo tab, both mounted on the outboard end of the aileron trailing edge.

(Continued Next Page)

INTRODUCTION (Continued)

AIRFRAME (Continued)

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a forward and aft spar, sheet metal ribs and reinforcements, four skin panels, formed leading edge skins, and a dorsal fin. The rudder is constructed of a forward and aft spar, formed sheet metal ribs and reinforcements, and a wrap-around skin panel. The top of the rudder incorporates a leading edge extension which contains a balance weight. The horizontal stabilizer is constructed of a forward and aft spar, ribs and stiffeners, four upper and four lower skin panels, and two left and two right wrap-around skin panels which also form the leading edges. The horizontal stabilizer also contains dual jack screw type actuators for the elevator trim tabs. Construction of the elevator consists of a forward and aft spar, sheet metal ribs, upper and lower skin panels, and wrap-around skin panels for the leading and trailing edges. An elevator trim tab is attached to the trailing edge of each elevator by full length piano-type hinges. Dual pushrods from each actuator located in the horizontal stabilizer transmit actuator movement to dual horns on each elevator trim tab to provide tab movement. Both elevator tip leading edge extensions provide aerodynamic balance and incorporate balance weights. A row of vortex generators on the top of the horizontal stabilizer just forward of the elevator enhances nose down elevator and trim authority.

To assure extended service life of the airplane, the entire airframe is corrosion proofed. Internally, all assemblies and sub-assemblies are coated with a chemical film conversion coating and are then epoxy primed. Steel parts in contact with aluminum structure are given a chromate dip before assembly. Externally, the complete airframe is painted with an overall coat of polyurethane paint which enhances resistance to corrosive elements in the atmosphere. Also, all control cables for the flight control system are of stainless steel construction.

FLIGHT CONTROLS

The airplane's flight control system (see Figure 7-1) consists of conventional aileron, elevator and rudder control surfaces and a pair of spoilers mounted above the outboard ends of the flaps. The control surfaces are manually operated through mechanical linkage using a control wheel for the ailerons, spoilers and elevator and rudder/brake pedals for the rudder. The wing spoilers improve lateral control of the airplane at low speeds by disrupting lift over the appropriate flap. The spoilers are interconnected with the aileron system through a push-rod mounted to an arm on the aileron bell crank. Spoiler travel is proportional to aileron travel for aileron deflections in excess of 5° up. The spoilers are retracted throughout the remainder of aileron travel. Aileron servo tabs provide reduced maneuvering control wheel forces. Fences on ailerons enhance lateral stability.

TRIM SYSTEMS

Manually-operated aileron, elevator, and rudder trim systems are provided (see Figure 7-1). Aileron trimming is achieved by a trimmable servo tab attached to the right aileron and connected mechanically to a knob located on the control pedestal. Rotating the trim knob to the right (clockwise) will trim right wing down; conversely, rotating it to the left (counterclockwise) will trim left wing down.

Elevator trimming is accomplished through two elevator trim tabs by utilizing the vertically mounted trim control wheel on the top left side of the control pedestal. Forward rotation of the control wheel will trim nose-down; conversely, aft rotation will trim nose-up. The airplane may also be equipped with an electric elevator trim system. Details of this system are presented in Section 9, Supplements.

Rudder trimming is accomplished through the nose wheel steering bungee connected to the rudder control system and a trim control wheel mounted on the control pedestal by rotating the horizontally mounted trim control wheel either left or right to the desired trim position. Rotating the trim wheel to the right will trim nose-right; conversely, rotating it to the left will trim nose-left.

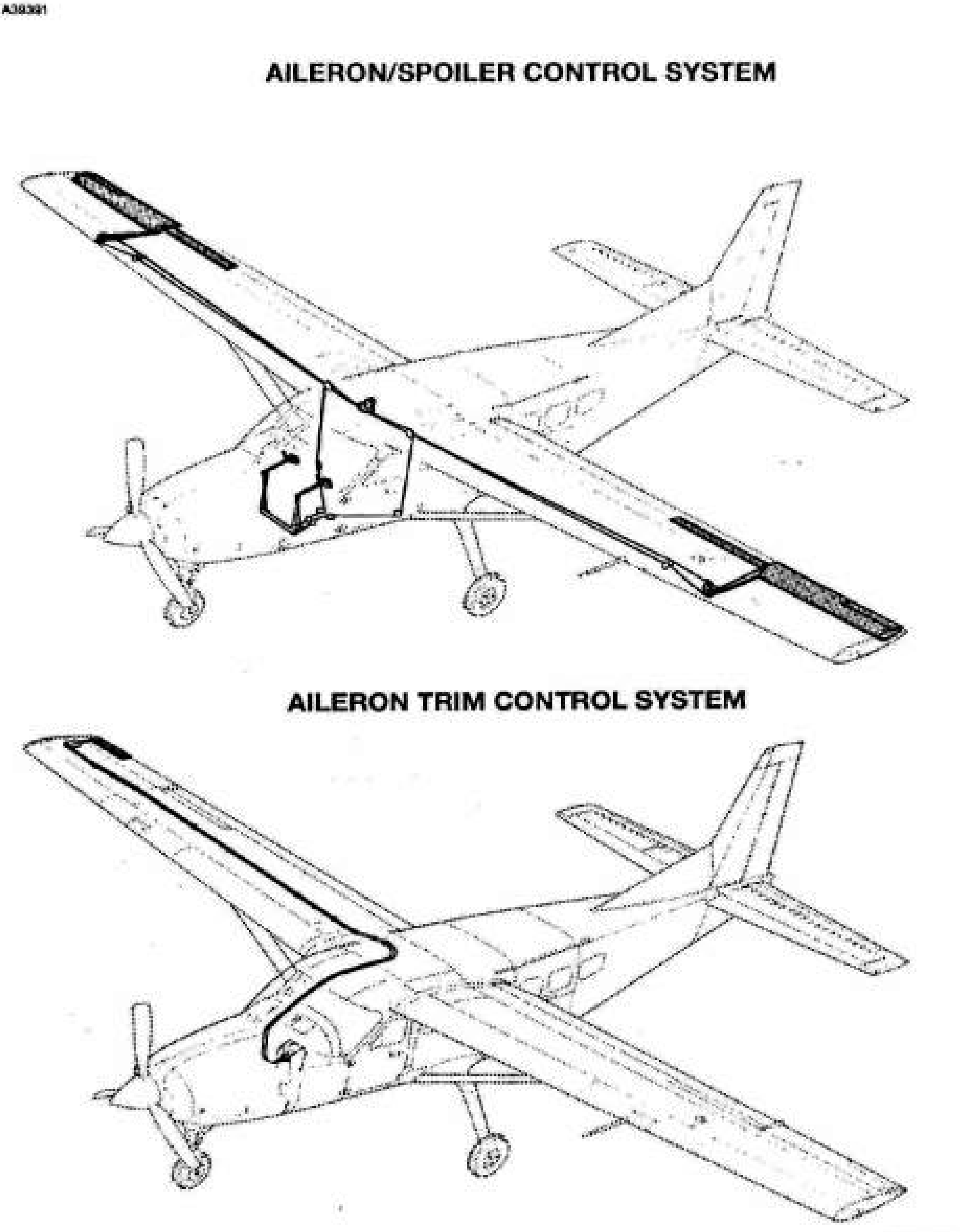
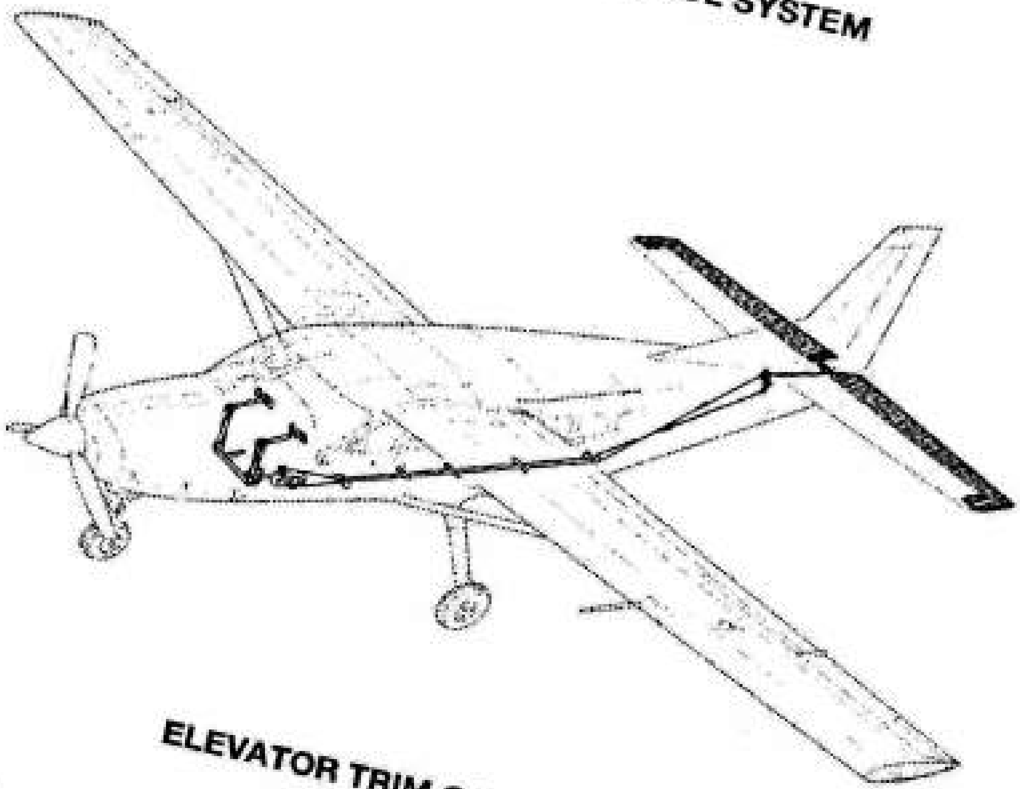


Figure 7-1. Flight Control And Trim Systems (Sheet 1 of 3)

ELEVATOR CONTROL SYSTEM



ELEVATOR TRIM CONTROL SYSTEM

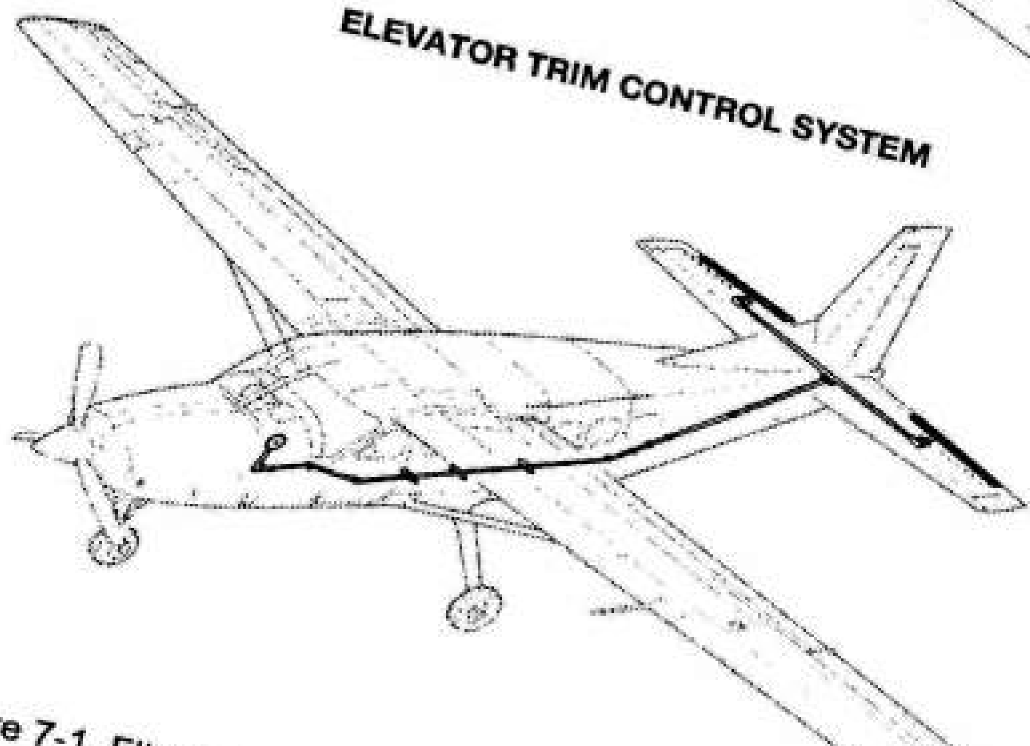


Figure 7-1. Flight Control And Trim Systems (Sheet 2 of 3)

RUDDER AND RUDDER TRIM CONTROL SYSTEM

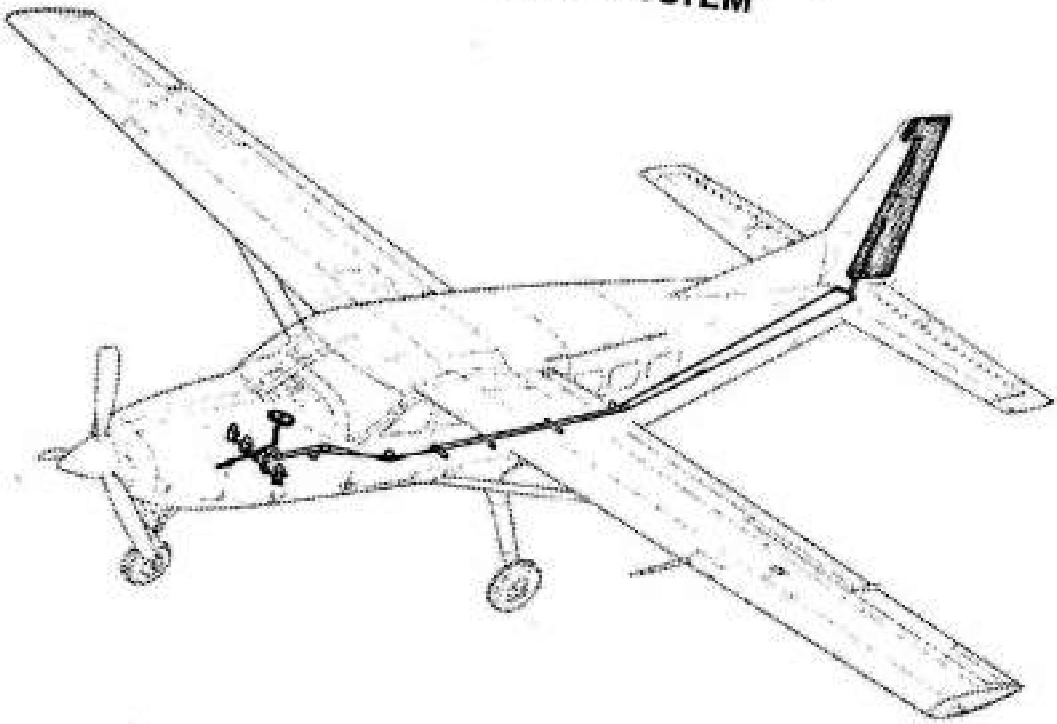


Figure 7-1. Flight Control And Trim Systems (Sheet 3 of 3)

INSTRUMENT PANEL

The instrument panel (see Figure 7-2) is designed around the basic "T" configuration. The gyros are located immediately in front of the pilot, and arranged vertically. The airspeed indicator and altimeter are located to the left and right of the gyros respectively. The remainder of the flight instruments are located around the basic "T". Immediately to the left of the flight instruments are the clock, propeller anti-ice ammeter (if installed), suction gage, altitude alerter (if installed), volt/ ammeter, volt/ammeter selector switch, propeller overspeed governor test switch, left fresh air vent pull knob, left fresh air vent outlet, and microphone and headset jacks. The lower left side of the instrument panel contains a switch panel which has many of the switches necessary to operate the airplane systems. Located directly above the flight instrument panel are the annunciator panel, annunciator panel day-night switch, annunciator panel test switch, and the fire detector test switch. Below the flight instrument panel are the lighting switch panel and the parking brake.

Avionics equipment is placed vertically in dual stacks approximately in the center and just right of center of the instrument panel. Located directly above the avionics stacks in the top center of the instrument panel are the engine instruments consisting of the torque indicator, propeller RPM indicator, ITT indicator, N_g% RPM indicator, oil pressure/ oil temperature gage, fuel flow indicator, and left and right fuel quantity indicators. The cabin heat switch and control panel, provisions for air conditioning controls, and rudder lock control handle are located directly below the avionics stacks.

The right side of the instrument panel contains space for additional flight instruments and the fuel totalizer. Directly to the right of these instruments are the hour meter, right fresh air vent pull knob, right fresh air vent, right front passenger's microphone and headset jacks, and map compartment.

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INSTRUMENT PANEL (Continued)

A control pedestal, extending from the center of the instrument panel to the floor, contains the emergency power lever, power lever, propeller control lever, fuel condition lever, wing flap selector and position indicator, elevator, rudder and aileron trim controls with position indicators, the fuel shutoff valve control, cabin heat firewall shutoff valve control, and a microphone.

For details concerning the instruments, switches, and controls on this panel, refer in this section to the description of the systems to which these items are related.

RIGHT FLIGHT INSTRUMENT PANEL

A supplementary flight instrument group is installed directly in front of the right front passenger. Like the pilot's flight instrument panel, the right flight panel groups the attitude and directional indicators vertically with the airspeed indicator to the left and the altimeter to the right to form a basic "T" arrangement. The remainder of the instruments (turn and bank indicator and vertical speed indicator) are grouped around the basic "T". The right flight instruments utilize a second, independent pitot-static pressure system for operation.

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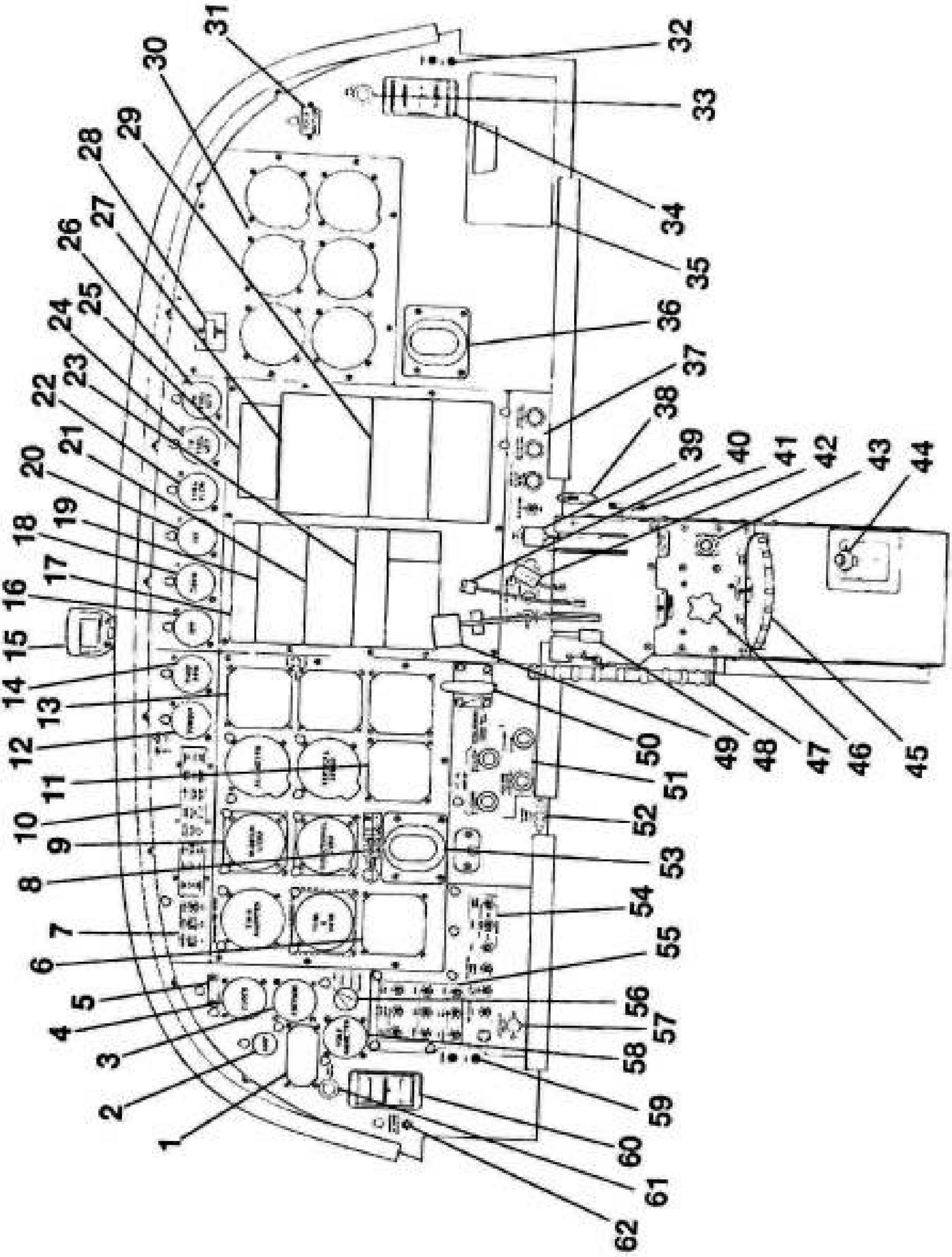

Figure 7-2. Typical Instrument Panel (Sheet 1 of 2)

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1. Altitude Alerter
2. Propeller Anti-ice Ammeter
3. Suction Gage
4. Clock
5. Airplane Registration Number
6. Additional Instrument Space
7. Fire Detection Test and Annunciator Panel Function Switches
8. Autopilot Roll Trim Indicator and Autopilot Annunciators
9. Pilot's Flight Instrument Group
10. Annunciator Panel
11. ADF Bearing Indicator (No. 2)
12. Torque Indicator
13. DME, Course Deviation Indicator (No. 2) and ADF Bearing Indicator (No. 1)
14. Propeller RPM Indicator
15. Magnetic Compass
16. ITT Indicator
17. Marker Beacon Indicator Lights and Switches/Audio Control Panel
18. N_2% RPM Indicator
19. NAV/Com Radios
20. Oil Pressure Gage/Oil Temperature Gage
21. Transponder
22. Fuel Flow Indicator
23. Autopilot Control Unit
24. Left Fuel Quanity Indicator
25. HF Radio
26. Right Fuel Quantity Indicator
27. Weather Radar
28. Fuel Totalizer
29. ADF Radios
30. Right Flight Instrument Group
31. Flight Hour Recorder
32. Right Auxilairy Mic and Phone Jacks
33. Instrument Panel Ventilating Control
34. Instrument Panel Ventilating Outlet
35. Map Compartment
36. Right Control Wheel Location
37. Cabin Heat Switch and Control Panel
38. Rudder Lock Control Handle
39. Wing Flap Selector Lever and Position Indicator
40. Propeller Control Lever
41. Quadrant Friction Lock
42. Fuel Condition Lever
43. Fuel Shutoff Control
44. Cabin Heat Firewall Shutoff Control
45. Rudder Trim Control Wheel Position Indicator
46. Aileron Trim Control Knob and Position Indicator
47. Elevator Trim Control Wheel and Postion Indicator
48. Emergency Power Lever
49. Power Lever
50. Inertial Separator Control
51. Instrument, Radio Dial, and Control Panel Lighting Rheostats
52. Parking Brake Handle
53. Pilot's Control Wheel Location
54. De-ice/Anti-ice Switch Panel
55. Lighting Control Panel
56. Volt/Ammeter Selector Switch
57. Static Pressure Alternate Source Valve
58. Volt/Ammeter
59. Pilot's Auxiliary Mic and Phone Jacks
60. Instrument Panel Ventilating Outlet
61. Instrument Panel Ventilating Control
62. Overspeed Governor Test Switch

Figure 7-2. Typical Instrument Panel (Sheet 2 of 2)

INSTRUMENT PANEL (Continued)

LEFT SIDEWALL SWITCH AND CIRCUIT BREAKER PANEL

Most of the engine control switches and all circuit breakers are located on a separate panel mounted on the left cabin sidewall adjacent to the pilot. Switches and controls on this panel are illustrated in Figure 7-3.

ANNUNCIATOR PANEL

The annunciator panel (see Figure 7-4) is located at the top edge of the instrument panel directly in front of the pilot. The panel contains separate indicator lamps which illuminate green, amber or red when a specific condition occurs in the associated airplane system. A **green** colored lamp is illuminated to indicate a normal or safe condition in the system. An illuminated **amber** lamp indicates that a cautionary condition exists which may or may not require immediate corrective action. When a hazardous condition exists requiring immediate corrective action, a **red** lamp illuminates.

NOTE

Some annunciator lights shown in Figure 7-4 are optional.

Two annunciator panel function switches, labeled LAMP TEST and DAY/NIGHT, are located to the left of the panel. When activated, the LAMP TEST switch illuminates all lamps on the annunciator panel and activates both of the fuel selector off warning horns. The DAY/NIGHT switch provides variable intensity down to a preset minimum dim level for the green lamps and some of the amber lamps (when in the NIGHT position). This variable intensity is controlled by the ENG INST lighting rheostat.

NOTE

If a red or non-dimmable amber annunciator illuminates at night and becomes an unacceptable distraction to the pilot because of its brightness level, it may be extinguished for the remainder of the flight by pushing in on the face of the light assembly and allowing it to pop out. To reactivate the annunciator, pull the light assembly out slightly and push back in.

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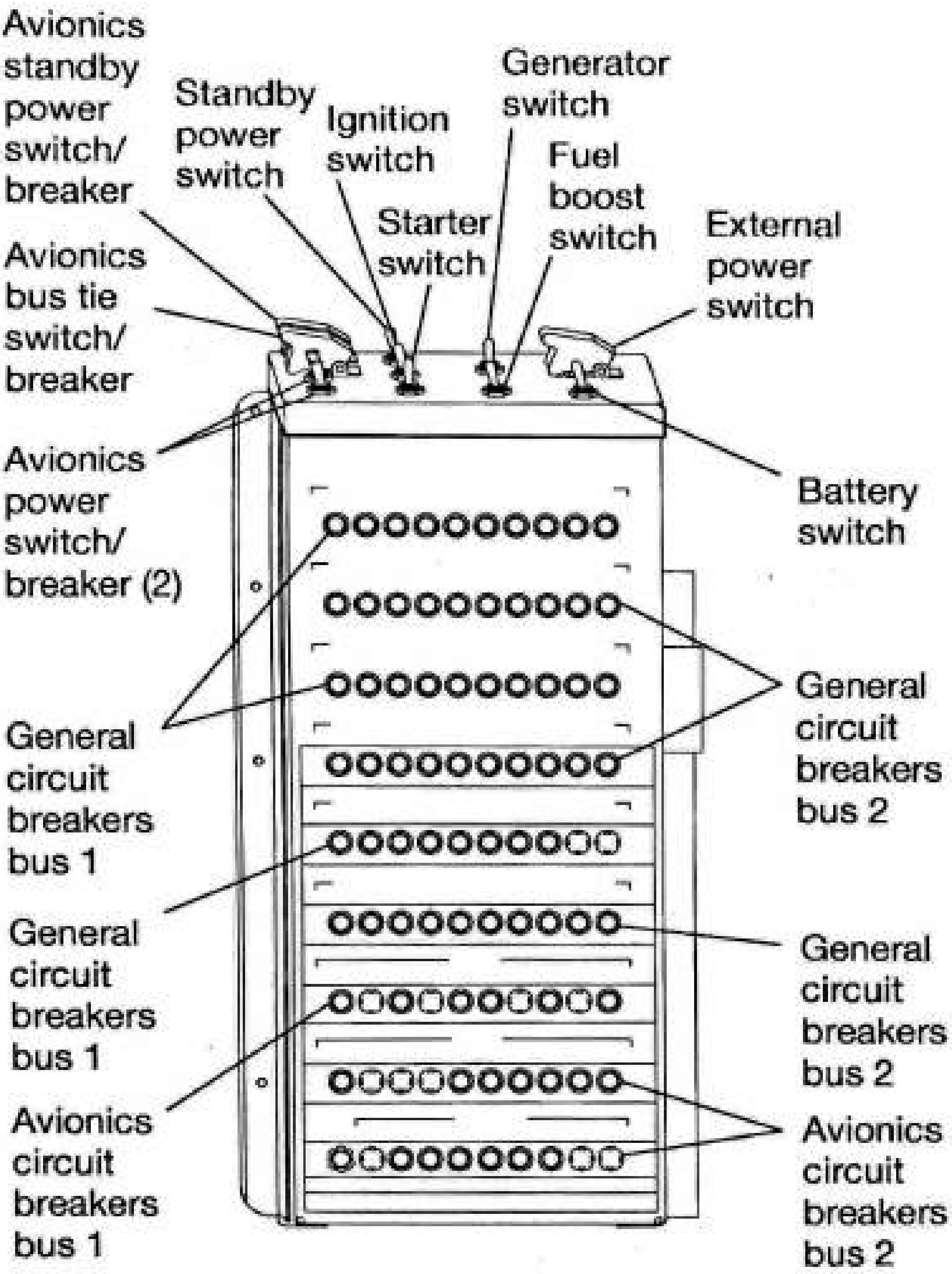

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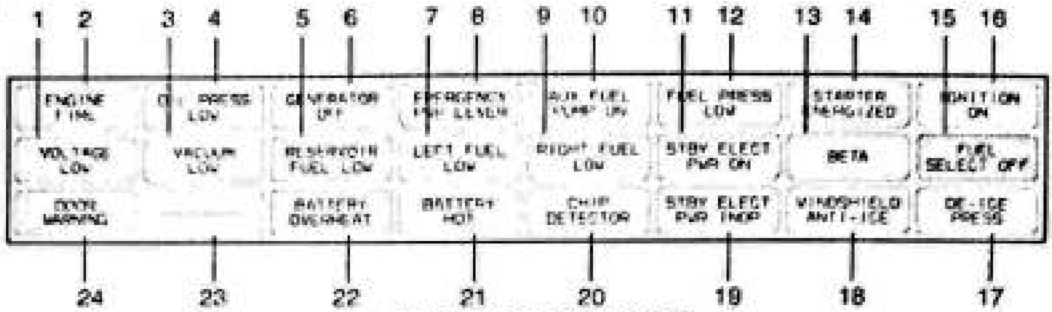
Figure 7-3. Typical Left Sidewall Switch and Circuit Breaker Panel



ILLUMINATION CODE

RED - HAZARDOUS CONDITION
(Requires Immediate Corrective Action)

AMBER - CAUTIONARY CONDITION
(May require Immediate Corrective Action)

GREEN - NORMAL OR SAFE CONDITION

UNUSED ANNUNCIATOR SPACE

1. VOLTAGE LOW (RED) - Indicates electrical system bus voltage is low and power is being supplied from the battery.
2. ENGINE FIRE (RED) - Indicates an excessive temperature condition and/or possible fire has occurred in the engine compartment.
3. VACUUM LOW (RED) - Indicates the vacuum system suction is less then approximately 3.0 in. Hg.
4. OIL PRESSURE LOW (RED) - Indicates engine oil pressure is less than 38 psi.
5. RESERVOIR FUEL LOW (RED) - Indicates the fuel level in the reservoir tank is approximately one-half full or less.
6. GENERATOR OFF (RED) - Indicates the generator is not connected to the airplane bus.
7. LEFT FUEL LOW (AMBER) - Indicates fuel quantity in the left fuel tank is 25 gallons or less.
8. EMERGENCY POWER LEVER (RED) - Indicates the emergency power lever is advanced out of the NORMAL position.
9. RIGHT FUEL LOW (AMBER) - Indicates fuel quantity in the right fuel tank is 25 gallons or less.

Figure 7-4. Typical Annunciator Panel (Sheet 1 of 2)

10. AUXILIARY FUEL PUMP ON (AMBER) - Indicates the auxiliary fuel pump is operating.
11. STANDBY ELECTRICAL POWER ON (AMBER) - Indicates the standby alternator is supplying electrical power to the bus.
12. FUEL PRESSURE LOW (AMBER) - Indicates fuel pressure in the fuel manifold assembly is below 4.75 psi.
13. BETA (AMBER) - Indicates the propeller blade angle is in "Beta" range (less than 9 degrees).
14. STARTER ENERGIZED (GREEN) - Indicates the starter-generator is operating in the starter mode.
15. FUEL SELECT OFF (RED) - Indicates one or both fuel tank selectors are off.
16. IGNITION ON (GREEN) - Indicates electrical power is being supplied to the engine ignition system.
17. DE-ICE PRESSURE (GREEN) - Indicates pressure in the de-ice boot system has reached approximately 15 psig.
18. WINDSHIELD ANTI-ICE (GREEN) - Indicates electrical power is being supplied to the windshield anti-ice power relay.
19. STANDBY ELECTRICAL POWER INOPERATIVE (AMBER) - Indicates electrical power is not available from the standby alternator.
20. CHIP DETECTOR (AMBER) (Optional) - Indicates that metal chips have been detected in either the reduction gearbox case, or accessory gearbox case.
    - -20A. AUTOPILOT BACK COURSE (AMBER) - Indicates the autopilot is in back course mode.
    - -20B. AUTOPILOT OFF (AMBER) - Indicates the autopilot has disengaged.
21. BATTERY HOT (AMBER) - Indicates the electrolyte temperature in the optional Ni Cad battery is excessively high.
22. BATTERY OVERHEAT (RED) - Indicates the electrolyte temperature in the optional Ni Cad battery is critically high.
23. NOT USED.
24. DOOR WARNING (RED) - Indicates the upper cargo door and/ or upper aft passenger doors (Standard 208 only) are not latched.

(-) Not Illustrated.

Figure 7-4. Typical Annunciator Panel (Sheet 2 of 2)

GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring-loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 15° each side of center. By applying either left or right brake, the degree of turn may be increased up to 56° each side of center for airplanes 20800001 thru 00403 not Incorporating SK208-164. The degree of turn may be increased up to 51.5° each side of center for airplanes 20800001 thru 00403 Incorporating SK208-164, and Airplanes 20800404 and On.

Moving the airplane by hand is most easily accomplished by attaching a tow bar (stowed in aft baggage/cargo compartment) to the nose gear fork axle holes. If a tow bar is not available, or pushing is required, use the wing struts as push points. Do not use the propeller blades or spinner to push or pull the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel beyond the steering limit marks either side of center. On airplanes having serial numbers 20800001 thru 20800127 which have been modified with SK208-48 and airplanes with serial numbers 20800128 and On, if excess force is exerted beyond the turning limit, a red over-travel indicator block (frangible stop) will fracture and the block, attached to a cable, will fall into view alongside the nose strut. This should be checked routinely during preflight inspection to prevent operation with a damaged nose gear.

The minimum turning radius of the airplane, using differential braking and nose wheel steering during taxi, is as shown in Figure 7-5.

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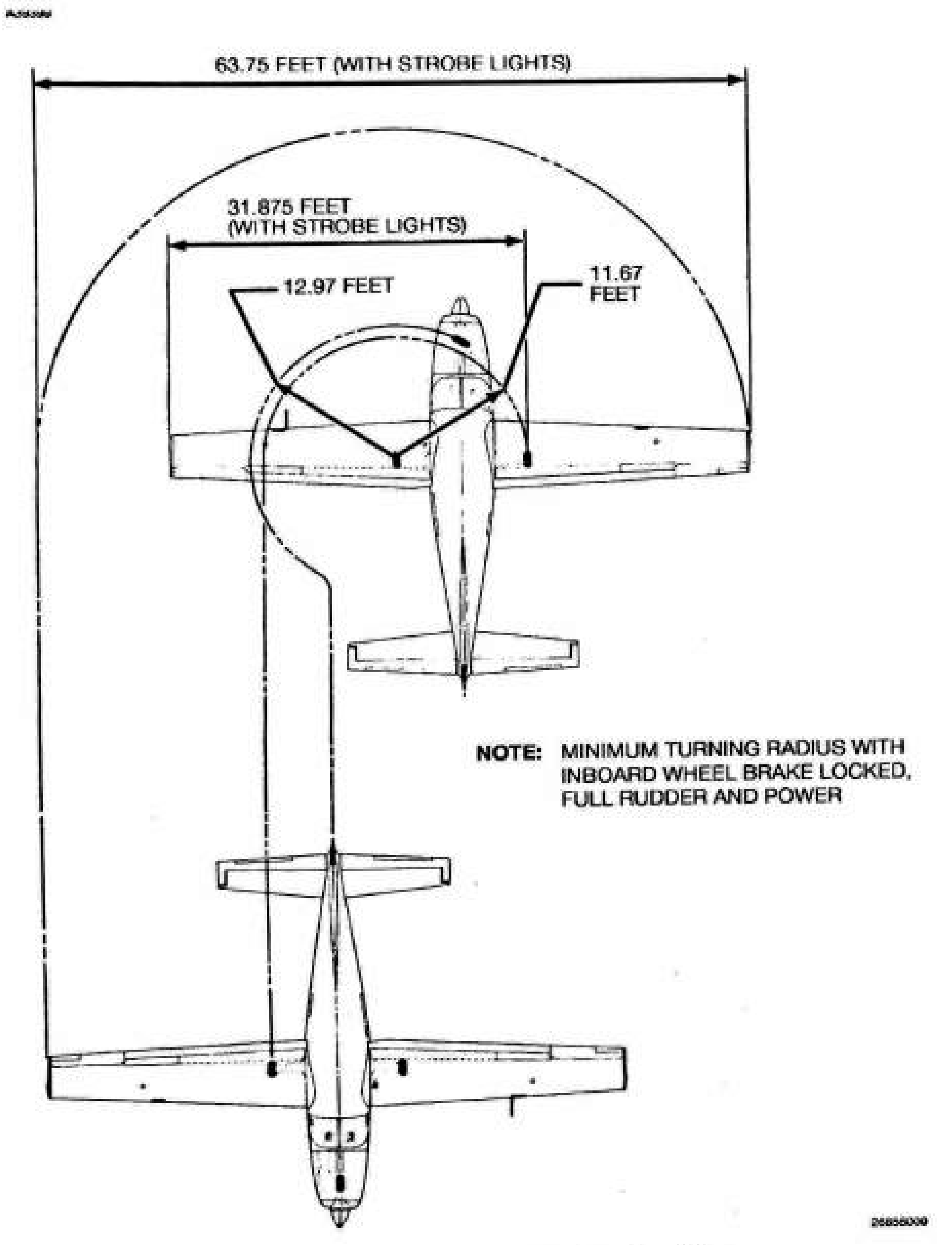

Figure 7-5. Minimum Turning Radius

For Airplanes 20800001 thru 00403 not Incorporating SK208-164.

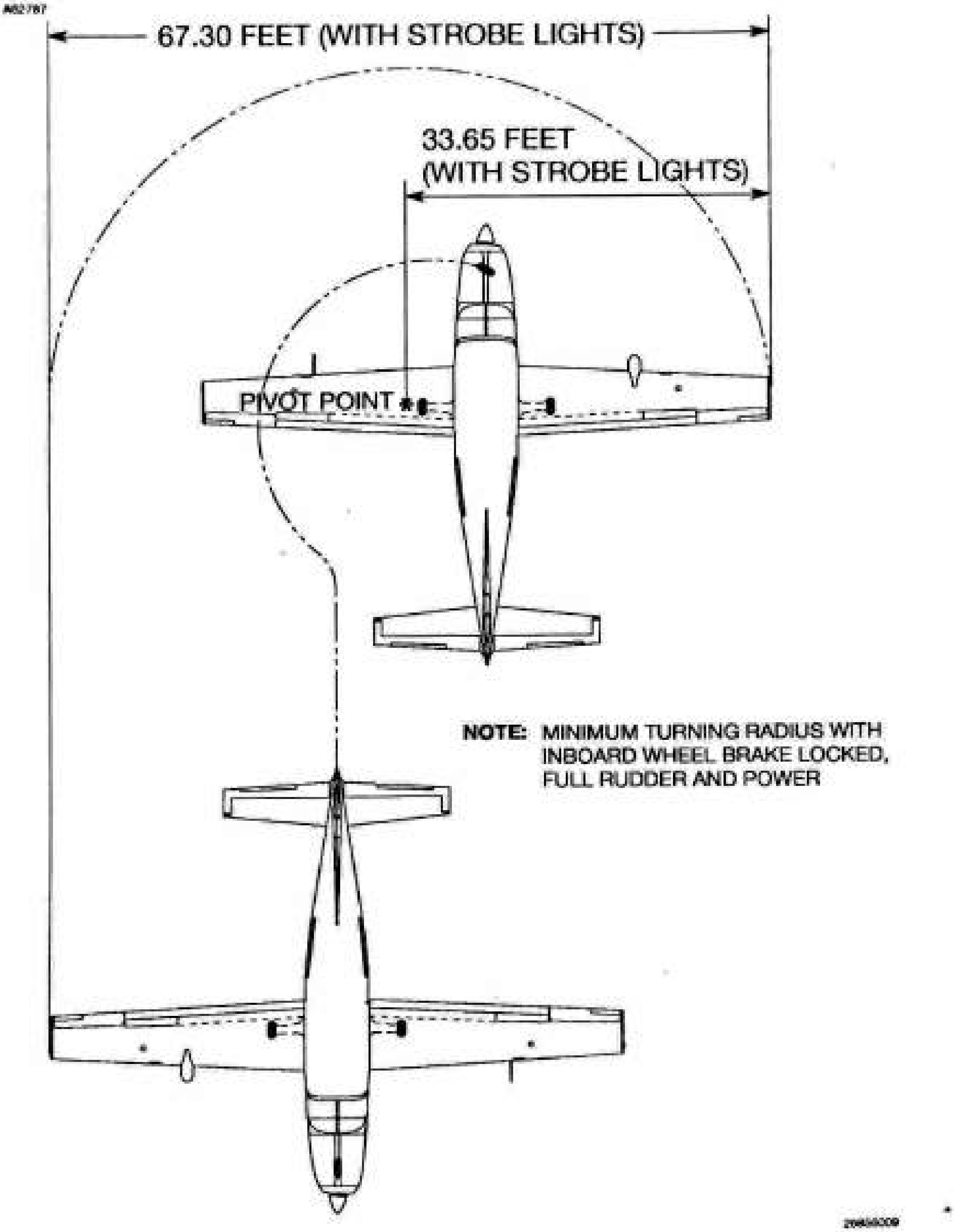

Figure 7-5A*. Minimum Turning Radius

For Airplanes 20800001 thru 00403 Incorporating SK208-164, and Airplanes 20800404 and On.

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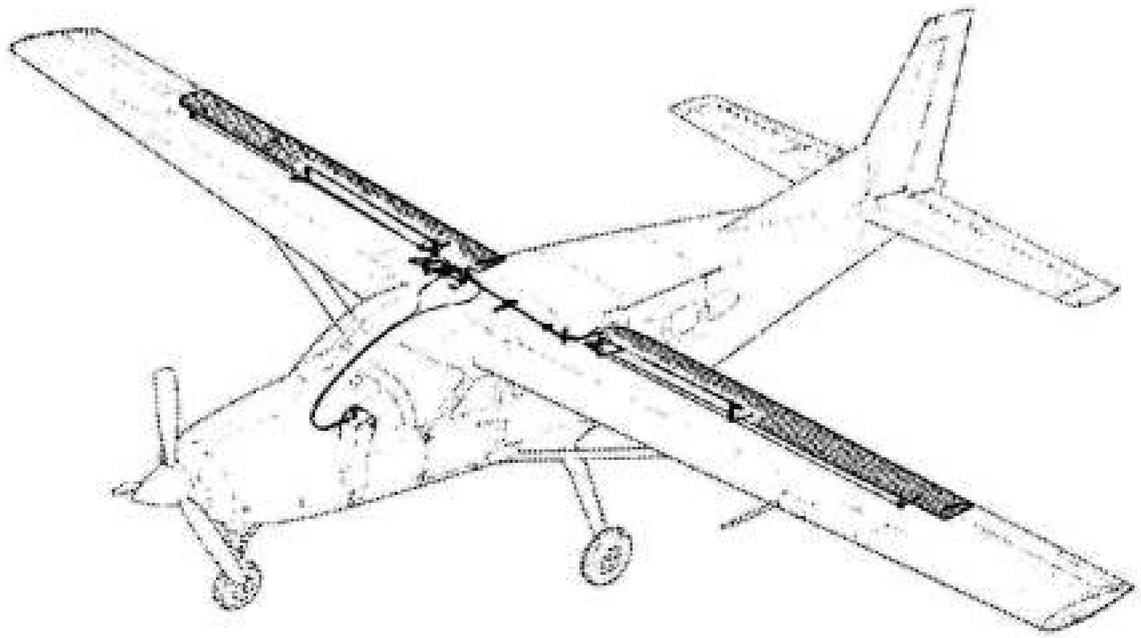

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Figure 7-6. Wing Flap System

WING FLAP SYSTEM

The wing flaps are large span, single-slot type (see Figure 7-6) and are driven by an electric motor. The wing flaps are extended or retracted by positioning the wing flap selector lever on the control pedestal to the desired flap deflection position. The selector lever is moved up or down in a slotted panel that provides mechanical stops at the 10° and 20° positions. For flap deflections greater than 10°, move the selector lever to the right to clear the stop and position it as desired. A scale and white-tipped pointer on the left side of the selector lever provides a flap position indication. The wing flap system is protected by a "pull-off" type circuit breaker, labeled FLAP MOTOR, on the left sidewall switch and circuit breaker panel.

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WING FLAP SYSTEM (Continued)

A standby system can be used to operate the flaps in the event the primary system should malfunction. On earlier airplanes, the standby system consists of a standby motor, a guarded standby flap motor switch and an unguarded standby flap motor up/down switch located on the overhead panel. On later airplanes, both switches have guards which are safetied in the closed position, with breakable copper wire. The guarded standby flap motor switch has NORM and STBY positions. The guarded NORM position of the switch permits operation of the flaps using the control pedestal mounted selector; the STBY position is used to disable the dynamic braking of the primary flap motor when the standby flap motor system is operated.

The standby flap motor up/down switch has UP, center off and DOWN positions. On later airplanes, the switch is guarded in the center off position. To operate the flaps with the standby system, lift the guard breaking safety wire (if installed), and place the standby flap motor switch in STBY position; then, lift the guard (if installed), breaking safety wire and actuate the standby flap motor up/down switch momentarily to UP or DOWN, as desired. Observe the flap position indicator to obtain the desired flap position. Since the standby flap system does not have limit switches, actuation of the standby flap motor up/down switch should be terminated before the flaps reach full up or down travel. After actuation of the standby flap motor system, switch guards should be resafetied to the closed position by maintenance personnel when maintenance action is accomplished. The standby flap system is protected by a "pull-off" type circuit breaker, labeled STBY FLAP MOTOR, located on the left sidewall switch and circuit breaker panel.

LANDING GEAR SYSTEM

The landing gear is of the tricycle type with a steerable nose wheel and two main wheels. Shock absorption is provided by the tubular spring-steel main landing gear struts, an interconnecting spring steel tube between the two main landing gear struts, and the nose gear oil-filled shock strut and spring-steel drag link. Each main gear wheel is equipped with a hydraulically actuated single-disc brake on the inboard side of each wheel. To improve operation from unpaved runways, and in other conditions, the standard nose gear fork and standard tires can be replaced with a three-inch extended nose gear fork and oversized nose and main gear tires.

BAGGAGE/CARGO COMPARTMENT

The space normally used for baggage consists of the raised area from the back of the cargo doors to the aft cabin bulkhead. Access to the baggage area is gained through the cargo doors, the aft passenger door (Standard 208 only), or from within the cabin. Quick-release tie-down ring/strap assemblies are provided for securing baggage and are attached to baggage floor anchor plates provided in the airplane. When utilizing the airplane as a cargo carrier (Standard 208 and Cargomaster) refer to Section 6 for complete cargo loading details. When loading the Standard 208, passengers should not be placed in the baggage area unless the airplane is equipped with special seating for this area. Also, any material that might be hazardous to the airplane or occupants should not be placed anywhere in the airplane. For baggage/cargo area and door dimensions, refer to Section 6.

SEATS

On earlier serial airplanes, standard seating for the Standard 208 consists of a pilot's six-way adjustable seat. A similar six-way adjustable seat is also available for the front passenger. The Cargomaster is equipped with both a pilot and a front passenger's six-way adjustable seat. On later serial airplanes, (Standard 208 and Cargomaster), standard seating consists of both a pilot's and front passenger's six-way adjustable seat. Additional cabin seating is available on the Standard 208 which consists of three rows of two-place fixed seats and two rows of one-place fixed seats in the Commuter configuration, or four rows of one-place, fixed-position collapsible seats on each side of the cabin in the Utility configuration.

WARNING

NONE OF THE AIRPLANE SEATS ARE APPROVED FOR INSTALLATION FACING AFT.

(Continued Next Page)

SEATS (Continued)

PILOT'S AND FRONT PASSENGER'S SEATS

The six-way adjustable pilot's or front passenger's seats may be moved forward or aft, adjusted for height, and the seat back angle changed. Position the seat by pulling on the small T-handle under the center of the seat bottom and slide the seat into position; then release the handle, and check that the seat is locked in place by attempting to move the seat and by noting that the small pin on the end of the T-handle protrudes.

The seat is not locked if the pin is retracted or only partially extends. Raise or lower the seat by rotating a large crank under the front right corner of the seat. Seat back angle is adjusted by rotating a small crank under the front left corner of the seat. The seat bottom angle will change as the seat back angle changes, providing proper support. Later serial airplane seats are equipped with armrests which can be moved to the side and raised to a position beside the seat back for stowage.

PASSENGERS' SEATS (COMMUTER) (Standard 208 Only)

The third and sixth seats are individual fixed-position seats with fixed seat backs. Seats for the fourth and fifth, seventh and eighth, and ninth and tenth positions are two-place, fixed-position bench type seats with fixed seat backs. All seats are fastened with quick release fasteners in the fixed position to the seat tracks. The seats are lightweight and quick-removable to facilitate cargo hauling.

PASSENGERS' SEATS (COLLAPSIBLE) (Standard 208 Only)

Individual collapsible seats are available for the aft eight passenger positions. The seats, when not in use, are folded into a compact space for stowage in the aft baggage area. When desired, the seats can be unfolded and installed in the passenger area. The seats are readily fastened with quick-release fasteners to the seat tracks in any one of the eight seat positions.

(Continued Next Page)

SEATS (Continued)

HEADRESTS

Headrests are available for all seat configurations except the aft passenger's collapsible seats. To adjust a pilot or front passenger seat headrest, apply enough pressure to it to raise or lower it to the desired level. The aft passenger seat headrests are not adjustable.

SEAT BELTS AND SHOULDER HARNESSES

All seat positions are equipped with seat belts and separate shoulder harnesses. The pilot's and front passenger's seat positions are equipped with shoulder harnesses with inertia reels.

WARNING

FAILURE TO CORRECTLY USE SEAT BELTS AND SHOULDER HARNESSES COULD RESULT IN SERIOUS OR FATAL INJURY IN THE EVENT OF AN ACCIDENT.

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AFT PASSENGERS' SEATS
(Left Hand Commuter Seating Shown)

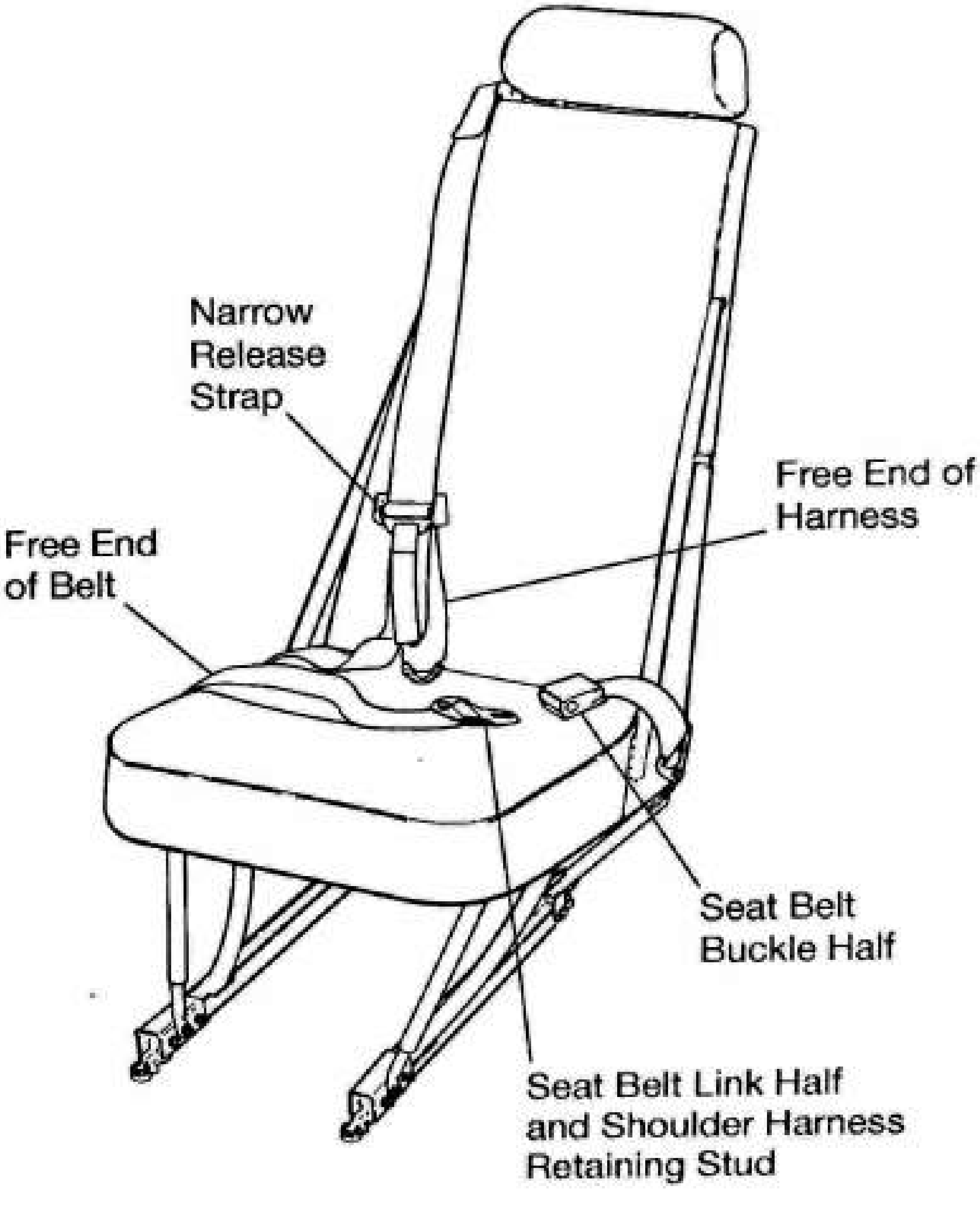


Figure 7-7*. Seat Belts and Shoulder Harnesses (Sheet 1 of 4)

PILOT'S AND FRONT PASSENGER'S SEATS (Typical)

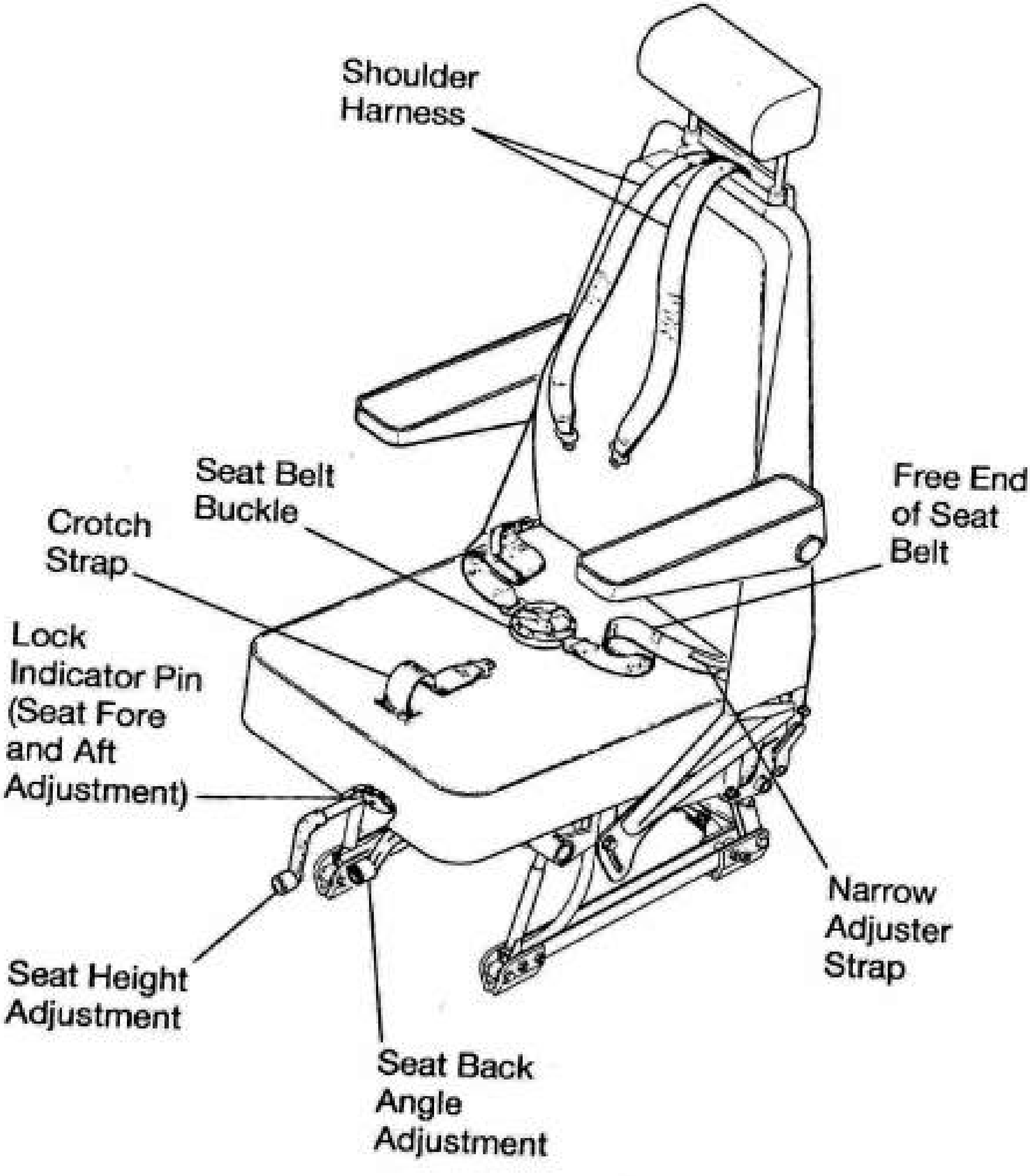


Figure 7-7*. Seat Belts and Shoulder Harnesses (Sheet 2 of 4)

AFT PASSENGERS' SEATS

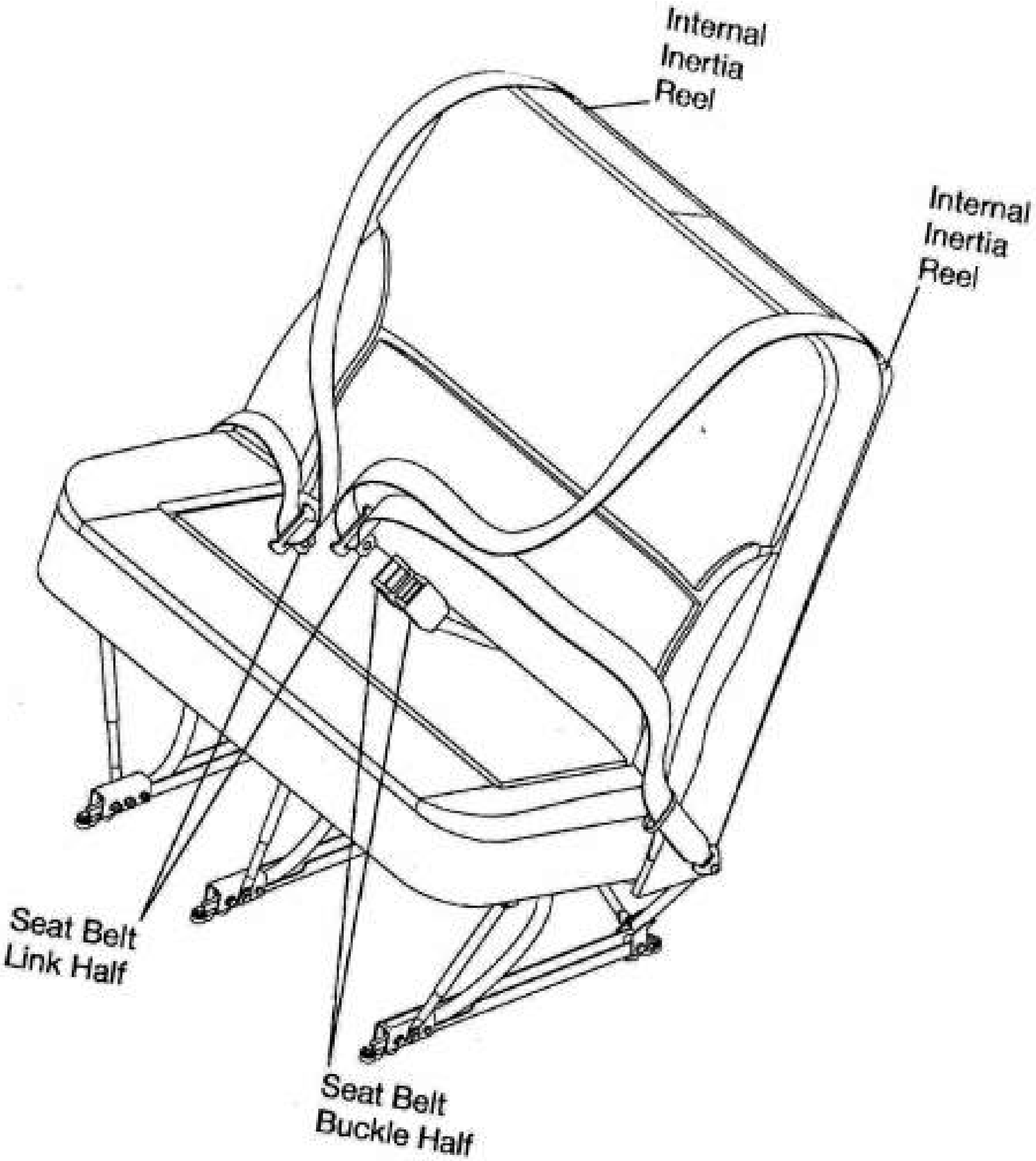
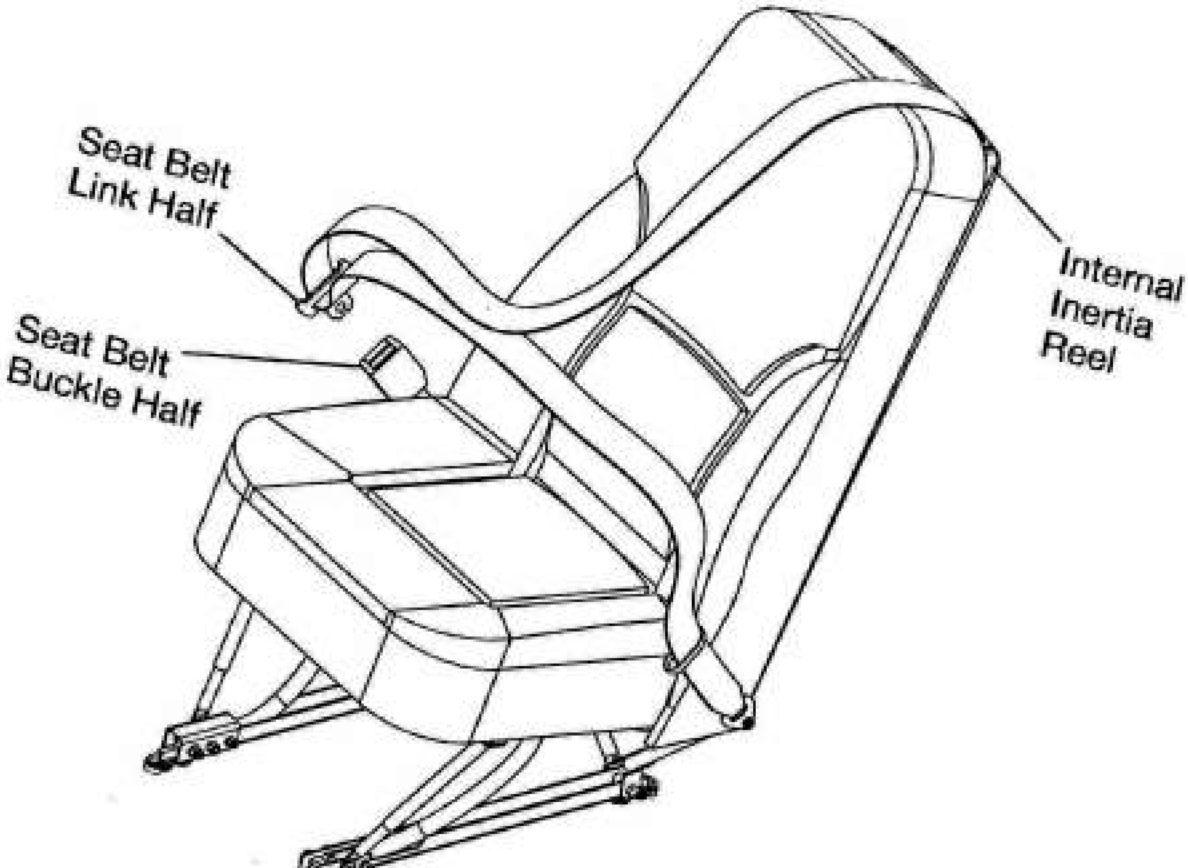


Figure 7-7*. Seat Belts and Shoulder Harnesses (Sheet 3 of 4)



igure 7-7*. Seat Belts and Shoulder Harnesses (Sheet 4 of 4)

SEAT BELTS AND SHOULDER HARNESSES (Continued)

SEAT BELTS (Pilot And Front Passenger Seats in Early Serial Airplanes And All Aft Seats)

Seat belts for all seats attach to fittings on the seat frame. The belts consist of a link half and a buckle half on each seat. to use the seat belts, lengthen the link half of the belt as needed by grasping the sides of the link and pulling against the belt. Insert and lock the belt link into the buckle. Tighten the belt to a snug fit. To release the seat belts, grasp the top of the buckle opposite the link and pull upward.

SHOULDER HARNESSES (Pilot And Front Passenger Seats in Early Serial Airplanes And All Aft Seats)

The pilot's and front seat passenger's shoulder harness consists of double straps which attach to an inertia reel, located in the back of the seat. From the inertia reel, the straps are routed up over the back of the seat, down over each shoulder of the seat occupant, and then down between the seat cushion and seat back on each side where the straps are secured with the seat belts to fittings on the seat frame. To use the should harness, lengthen the harness by pulling down on each harness strap. When the shoulder straps are sufficiently lengthened, position each strap over each shoulder; the inertia reel will automatically take up any excess slack of the shoulder harness. The inertia reel allows complete freedom of body movement; however, in the event of a sudden deceleration, will lock automatically to protect the occupant.

The aft passengers' shoulder harnesses each consist of a single strap which is attached to the back of the seat. The strap is then routed over the back of the seat and down to the occupants lap where it attaches to a retaining stud on the seat belt. To use a shoulder harness, fasten and adjust the seat belt first. Lengthen the harness as required by pulling on the connecting link on the end of the harness and the narrow release strap. Snap the connecting link firmly onto the retaining stud on the seat belt link half. then adjust to length. A properly adjusted harness will permit the occupant to lean forward enough to sit completely erect, but will prevent excessive forward movement and contact with objects during sudden deceleration.

(Continued Next Page)

SEAT BELTS AND SHOULDER HARNESSES
(Continued)

SEAT BELTS, STRAP, AND SHOULDER HARNESSES (Pilot/Front Passenger Seats In Later Serial Airplanes And Floatplane/Amphibians)

Both the pilot's and front passenger's seat positions are equipped with a five-point restraint system which combines the function of conventional type seat belts, a crotch strap, and an inertia reel equipped double-strap shoulder harness in a single assembly. The seat belts and crotch strap attach to fittings on the lower seat frame and the inertia reel for the shoulder harness attaches to the frame of the seat back.

The right half of the seat belt contains the buckle, which is the connection point for the left belt half, crotch strap and harnesses. The left belt, crotch strap and harnesses are fitted with links which insert into the buckle. Both halves of the seat belt have adjusters with narrow straps to enable the belt halves to be lengthened prior to fastening.

To use the restraint system, lengthen each half of the belt as necessary by pulling the buckle (or connecting link) to the lap with one hand while pulling outward on the narrow adjuster strap with the other hand. Insert the left belt link into the left slot of the buckle. Bring the crotch strap upward and insert its link into the bottom slot in the buckle. Finally, position each strap of the shoulder harness over the shoulders and insert their links into the upper slots in the buckle. The seat belts should be tightened for a snug fit by grasping the free end of each belt and pulling up and inward.

During flight operations, the inertia reel allows complete freedom of upper body movement; however, in the event of a sudden deceleration, the reel will lock automatically to protect the occupant.

WARNING

FAILURE TO CORRECTLY USE SEAT BELTS AND SHOULDER HARNESSES COULD RESULT IN SERIOUS OR FATAL INJURY IN THE EVENT OF AN ACCIDENT.

Release of the belts, strap, and harnesses is accomplished by simply twisting the front section of the buckle in either direction and pulling all connecting links free.

CABIN ENTRY DOORS

Entry to, and exit from the airplane is accomplished through an entry door on each side of the cabin at the pilot's and front passenger's positions and, on the Standard 208 only, through a two-piece, airstair type door on the right side of the airplane just aft of the wing (refer to Section 6 for cabin and cabin entry door dimensions). A cargo door on the left side of the airplane also can be used for cabin entry.

CREW ENTRY DOORS

The left crew entry door incorporates a conventional exterior door handle, a key-operated door lock, a conventional interior door handle, a lock override knob, and an openable window. The right crew entry door incorporates a conventional exterior door handle, a conventional interior door handle, and a manually-operated inside door lock. To open either entry door from outside the airplane (if unlocked), rotate the handle down and forward to the OPEN position. To close the door from inside the airplane, use the conventional door handle and door pull. The inside door handle is a three-position handle with OPEN, CLOSE and LATCHED positions. Place the handle in the CLOSE position and pull the door shut; then rotate the handle forward to the LATCHED position. When the handle is rotated to the LATCHED position, an over-center action will hold it in that position.

CAUTION

FAILURE TO PROPERLY CLOSE AND LATCH THE CREW DOORS MAY ALLOW THEM TO OPEN IN FLIGHT.

A lock override knob on the inside of the left crew door provides a means of overriding the outside door lock from inside the airplane. To operate the override, pull the knob and rotate it in the placarded direction to unlock or lock the door. Both crew doors should be latched prior to flight, and should not be opened intentionally during flight. To lock the crew entry doors when leaving the airplane, lock the right entry door with the manually-operated inside door lock, close the left crew entry door, and using the key, lock the door.

(Continued Next Page)

CABIN ENTRY DOORS (Continued)

PASSENGER ENTRY DOOR (Standard 208 Only)

The passenger entry door consists of an upper and lower section. When opened, the upper section swings upward and the lower section drops down providing integral steps to aid in boarding or exiting the airplane. The upper door section incorporates a conventional exterior door handle with a separate key-operated lock, a push button exterior door release, and an interior door handle which snaps into a locking receptacle. The lower door section features a flush handle which is accessible from either inside or outside the airplane. This handle is designed so that when the upper door is closed, the handle cannot be rotated to the open position. The lower door also contains integral door support cables and a door lowering device. A cabin door open warning system is provided as a safety feature so that if the upper door is not properly latched, a red light, labeled DOOR WARNING, located on the annunciator panel, illuminates to alert the pilot.

To enter the airplane through the passenger entry door, depress the exterior push button door release, rotate the exterior door handle on the upper door section counterclockwise to the open position, and raise the door section to the over-center position. Following this action, the gas spring telescoping door lift automatically raises the door to the full up position. Once the upper section is open, release the lower section by pulling up on the inside door handle and rotating the handle to the OPEN position. Lower the door section until it is supported by the integral support cables. The door steps deploy automatically from their stowed positions.

WARNING

THE OUTSIDE PROXIMITY OF THE LOWER DOOR SECTION MUST BE CLEAR BEFORE OPENING THE DOOR.

Closing the passenger entry door from inside the airplane is accomplished by grasping the support cables of the lower door section and pulling the door up until the top edge is within reach, then grasping the center of the door and pulling inboard until the door is held snugly against the fuselage door frame. Latch the lower door section by rotating the inside handle forward to the CLOSE position.

(Continued Next Page)

CABIN ENTRY DOORS (Continued)

Check that the lower front and rear latches are properly engaged. After the lower door section is secured, grasp the pull strap on the upper door section and pull down and inboard. As the door nears the closed position, pull inboard firmly to assure engagement of the latching pawls. Once the latching pawls are engaged, the inside handle should be rotated counterclockwise to the horizontal (latched) position, but do not use excessive force. If the handle will not rotate easily, the door is not fully closed. A more firm closing motion should allow the latching pawls to engage and permit the door handle to rotate to the latched position. Then snap the interior handle into its locking receptacle.

CAUTION

REFER TO SECTION 3, EMERGENCY PROCEDURES, FOR PROPER OPERATIONAL PROCEDURES TO BE FOLLOWED IF THE PASSENGER ENTRY DOOR SHOULD INADVERTENTLY OPEN IN FLIGHT.

Exit from the airplane through the passenger entry door is accomplished by pulling the upper door section inside handle from its locked position receptacle, rotating the handle clockwise to the open position, and pushing the door outward. Once the door is partially open, the automatic door lift will raise the upper door section to the fully open position. Next, rotate the lower section door handle up and aft to open position and push the door outward. The telescoping damper will lower the door to its fully open position and the integral steps will deploy.

WARNING

THE OUTSIDE PROXIMITY OF THE LOWER DOOR SECTION MUST BE CLEAR BEFORE OPENING THE DOOR.

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CABIN ENTRY DOORS (Continued)

Closing the passenger entry door from outside the airplane is accomplished by raising the lower door section until the door is held firmly against the fuselage door frame. Latch the lower door section by rotating the inside handle forward and down to the CLOSE position. After the lower door section is secured, grasp the pull strap on the upper door section and pull down. As the door nears the closed position, grasp the edge of the door and push inward firmly to assure engagement of the latching pawls. Once engaged, the outside door handle can be rotated clockwise to the horizontal (latched) position. After entering the airplane, snap the upper door interior handle into its locking receptacle (unless cargo obstructs access to the door). If desired when leaving the airplane parked, lock the handle in the horizontal position by use of the key in the outside key lock.

WARNING

DO NOT USE THE OUTSIDE KEY LOCK TO LOCK THE DOOR PRIOR TO FLIGHT SINCE THE DOOR COULD NOT BE OPENED FROM THE INSIDE IF IT WERE NEEDED AS AN EMERGENCY EXIT.

The exterior push button-type lock release, located on the upper door section just forward of the exterior door handle, operates in conjunction with the interior door handle and is used whenever it is desired to open the door from outside the airplane while the interior door handle is in the locked position. Depressing the push button releases the interior door handle lock and allows the exterior door handle to function normally to open the door.

CARGO DOORS

A two-piece cargo door is installed on the left side of the airplane just aft of the wing trailing edge. The cargo door is divided into an upper and a lower section. When opened, the upper section swings upward and the lower section swings forward to create a large opening in the side of the fuselage which facilitates the loading of bulky cargo into the cabin. The upper section of the cargo door incorporates a conventional exterior door handle with a separate key-operated lock, and, on the Standard 208 only, a push button exterior emergency door release, and an interior door handle which snaps into a locking receptacle.

(Continued Next Page)

CARGO DOORS (Continued)

The upper door also incorporates two telescoping door lifts which raise the door to the fully open position, when opened. A cargo door open warning system is provided as a safety feature so that if the upper door is not properly latched, a red light, labeled DOOR WARNING, located on the annunciator panel, illuminates to alert the pilot. The lower door section features a flush handle which is accessible from either inside or outside the airplane. The handle is designed so that when the upper door is closed, the handle cannot be rotated to the open position.

CAUTION

FAILURE TO PROPERLY LATCH THE UPPER CARGO DOOR SECTION WILL RESULT IN ILLUMINATION OF THE RED DOOR WARNING ANNUNCIATOR. INATTENTION TO THIS SAFETY FEATURE MAY ALLOW THE UPPER CARGO DOOR TO OPEN IN FLIGHT.

To open the cargo door from outside the airplane, depress the upper door section exterior push button door release (Standard 208 only) and rotate the exterior door handle clockwise to the open position. Following this action, the telescoping door lifts will automatically raise the door to the full up position. Once the upper section is open, release the lower section by pulling up on the inside door handle and rotating the handle to the OPEN position. Open the door forward until it swings around next to the fuselage where it can be secured to the fuselage by a holding strap or chain.

To close the cargo door from outside the airplane, disconnect the holding strap or chain from the fuselage, swing the door aft to the closed position, and hold the door firmly against the fuselage door frame to assure engagement of the latching pawls. Latch the lower door section by rotating the inside handle forward and down to the CLOSE position. After the lower door section is secured, grasp the pull strap on the upper door section and pull down.

As the door nears the closed position, grasp the edge of the door and push inward firmly to assure engagement of the latching pawls. Once engaged, the exterior door handle can be rotated counterclockwise to the horizontal (latched) position. On the Standard 208 only, after entering the airplane, snap the upper door interior handle into its locking receptacle (unless cargo obstructs access to the door). If desired when leaving the airplane parked, lock the handle in the horizontal position by use of the key in the outside key lock.

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CARGO DOORS (Continued)

To open the cargo door from inside the airplane (Standard 208 only), open the upper door section by pulling the inside door handle from its locked position receptacle, rotating the handle counterclockwise to the vertical position, and pushing the door outward. Once the door is partially open, the automatic door lifts will raise the upper door section to the fully open position. Next, rotate the lower section door handle up and aft to the open position and push the aft end of the door outward. The door may be completely opened and secured to the fuselage with the holding strap or chain from outside.

WARNING

DO NOT ATTEMPT TO EXIT THE CARGOMASTER THROUGH THE CARGO DOORS. SINCE THE INSIDE OF THE UPPER DOOR HAS NO HANDLE, EXIT FROM THE AIRPLANE THROUGH THESE DOORS IS NOT POSSIBLE.

To close the cargo door from inside the airplane (Standard 208 only), disconnect the holding strap or chain from the fuselage and secure it to the door. Pull the door aft to the closed position and hold the aft edge of the door firmly against the fuselage door frame to assure engagement of the latching pawls. Latch the lower door section by rotating the inside handle forward and down to the CLOSE position.

After the lower door section is secured, grasp the pull strap on the upper door section and pull down. As the door nears the closed position, grasp the edge of the door and pull inward firmly to assure engagement of the latching pawls. Once engaged, the interior door handle can be rotated clockwise to the horizontal position. Snap the handle into its locking receptacle.

WARNING

IF THE AIRPLANE HAS UTILITY SEATING, THE AFT LEFT SEAT IS IN CLOSE PROXIMITY TO THE CARGO DOOR HANDLES. EXTRA PRECAUTION SHOULD BE TAKEN TO ENSURE THAT THE OCCUPANT OF THIS SEAT DOES NOT INADVERTENTLY ACTUATE THE UPPER CARGO DOOR HANDLE TO THE OPEN POSITION WHILE IN FLIGHT.

CABIN WINDOWS

The airplane is equipped with a two-piece windshield reinforced with a metal center strip. The Standard 208 has twelve cabin side windows of the fixed type, including one each in the two crew entry doors, two windows in the cargo door upper section, and one window in the upper section of the passenger entry door. The side window installed adjacent to the pilot's position incorporates a small triangular foul weather window. The foul weather window may be opened for ground ventilation and additional viewing by utilizing the twist latch which is integral to the window. The Cargo version has two cabin side windows, one each in the two crew entry doors.

CONTROL LOCKS

A control lock is provided to lock the aileron and elevator control surfaces to prevent damage to the these systems by wind buffeting while the airplane is parked. The lock consists of a shaped steel rod and flag. The flag identifies it as a control lock and cautions about its removal before starting the engine. To install the control lock, align the hole in the left side of the pilot's control wheel shaft with the hole in the left side of the shaft collar on the instrument panel and insert the rod into the aligned holes. Installation of the lock will secure the ailerons in a neutral position and the elevators in a slightly trailing edge down position. Proper installation of the lock will place the flag over the left sidewall switch panel.

Earlier serial airplanes may be equipped with a rudder lock which is operated by a spring-loaded, pull-type T-handle located on the bottom of the instrument panel to the right of the control pedestal. The handle is labeled RUDDER LOCK - PULL, and when pulled out, locks the rudder in the neutral position. An interlock between the rudder lock and the fuel condition lever prevents locking the rudder when the fuel condition lever is in any position other than CUTOFF. Should the rudder lock T-handle be left in the locked position inadvertently, moving the fuel condition lever out of cutoff, such as during the engine starting sequence, will automatically release the T-handle to the unlocked position. The T-handle is normally released from the locked position by rotating it 90° and allowing it to retract forward to the unlocked position.

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CONTROL LOCKS (Continued)

Later serial airplanes are equipped with a rudder gust lock which is operated by an external handle on the left side of the tailcone. For information and operating procedures pertaining to this type of lock, refer to Aero Twin Rudder Gust Lock in Section 9, Supplements.

NOTE

The control lock, rudder lock, and any other type of locking device should be removed or unlocked prior to starting the engine.

ENGINE

The Pratt & Whitney Canada Inc. PT6A-114 power plant is a free turbine engine. It utilizes two independent turbines; one driving a compressor in the gas generator section, and the second driving a reduction gearing for the propeller.

Inlet air enters the engine through an annular plenum chamber formed by the compressor inlet case where it is directed to the compressor. The compressor consists of three axial stages combined with a single centrifugal stage, assembled as an integral unit. It provides a compression ratio of 7.0:1.

A row of stator vanes located between each stage of compressor rotor blades diffuses the air, raises its static pressure and directs it to the next stage of compressor rotor blades. The compressed air passes through diffuser ducts which turn it 90° in direction. It is then routed through straightening vanes into the combustion chamber.

The combustion chamber liner located in the gas generator case consists of an annular reverse-flow weldment provided with varying sized perforations which allow entry of compressed air. The flow of air changes direction to enter the combustion chamber liner where it reverses direction and mixes with fuel. The location of the combustion chamber liner eliminates the need for a long shaft between the compressor and the compressor turbine, thus reducing the overall length and weight of the engine.

Fuel is injected into the combustion chamber liner by 14 simplex nozzles supplied by a dual manifold. The mixture is initially ignited by two spark igniters which protrude into the combustion chamber liner. The resultant gases expand from the combustion chamber liner, reverse direction and pass through the compressor turbine guide vanes to the compressor turbine. The turbine guide vanes ensure that the expanding gases impinge on the turbine blades at the proper angle, with a minimum loss of energy. The still expanding gases pass forward through a second set of stationary guide vanes to drive the power turbine.

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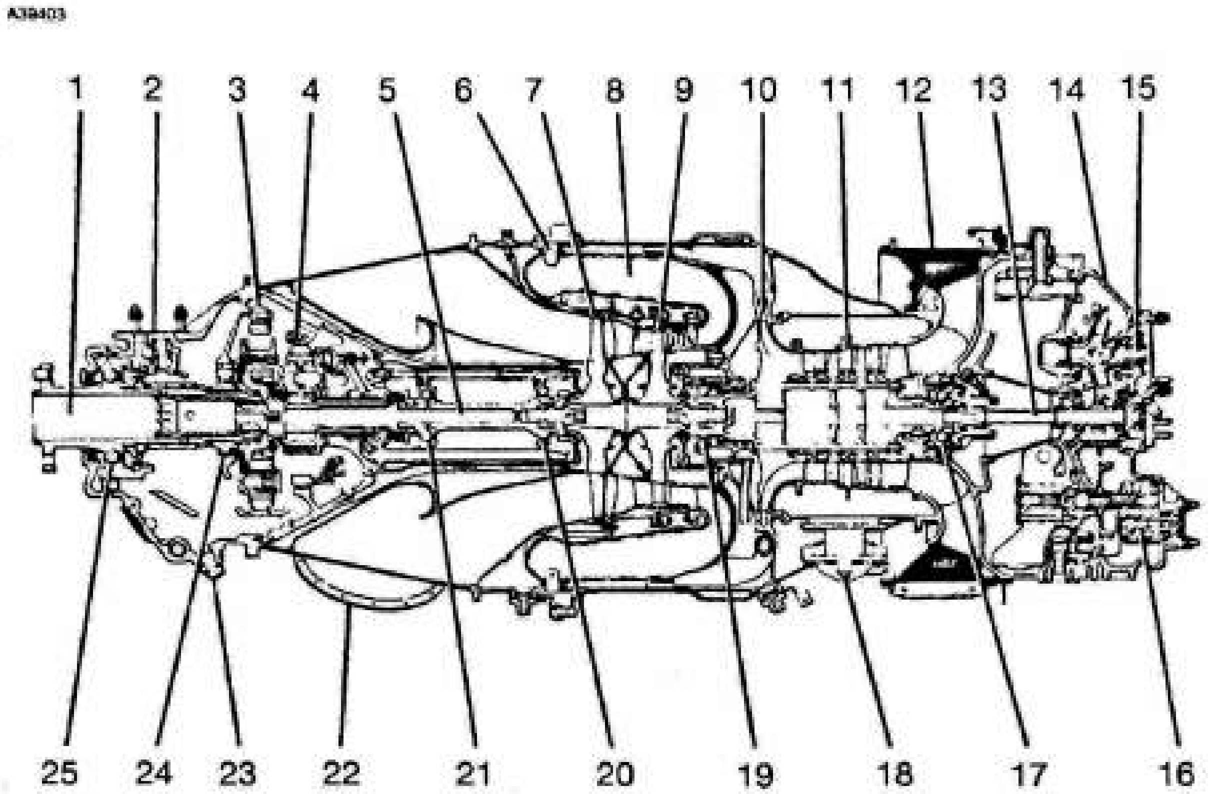

1. Propeller Shaft
2. Propeller Governor Drive Pad
3. Second Stage Planetary Gear
4. First Stage Planetary Gear
5. Power Turbine Shaft
6. Fuel Nozzle
7. Power Turbine
8. Combustion Chamber
9. Compressor Turbine
10. Centrifugal Compressor Impeller
11. Axial-Flow Compressor Impellers (3)
12. Compressor Air Inlet
13. Accessory Gearbox Drive Shaft
14. Accessory Gearbox Cover
15. Starter-Generator Drive Shaft
16. Oil Scavenge Pump
17. Number 1 Bearing
18. Compressor Bleed Valve
19. Number 2 Bearing
20. Number 3 Bearing
21. Number 4 Bearing
22. Exhaust Outlet
23. Chip Detector
24. Roller Bearing
25. Thrust Bearing

Figure 7-8. Typical Engine Components

ENGINE (Continued)

The compressor and power turbines are located in the approximate center of the engine with their shafts extending in opposite directions. The exhaust gas from the power turbine is directed through an exhaust plenum to the atmosphere via a single exhaust port on the right side of the engine.

The engine is flat rated at 600 shaft horsepower (1658 foot-pounds torque at 1900 RPM varying linearly to 1970 foot-pounds torque at 1600 RPM). The speed of the gas generator (compressor) turbine (Ng) is 37,500 RPM at 100% Ng. Maximum permissible speed of the gas generator is 38,100 RPM which equals 101.6% Ng. The power turbine speed is 33,000 RPM at a propeller shaft speed of 1900 RPM (a reduction ratio of 0.0576:1).

All engine-driven accessories, with the exception of the propeller tachometer-generator and the propeller governors, are mounted on the accessory gearbox located at the rear of the engine. These are driven by the compressor turbine with a coupling shaft which extends the drive through a conical tube in the oil tank center section.

The engine oil supply is contained in an integral tank which forms part of the compressor inlet case. The tank has a capacity of 9.5 U.S. quarts and is provided with a dipstick and drain plug.

The power turbine drives the propeller through a two-stage planetary reduction gearbox located on the front of the engine. The gearbox embodies an integral torquemeter device which is instrumented to provide an accurate indication of the engine power output.

ENGINE CONTROLS

The engine is operated by four separate controls consisting of a power lever, emergency power lever, propeller control lever, and a fuel condition lever. The power and fuel condition levers are engine controls while the propeller control lever controls propeller speed and feathering.

(Continued Next Page)

ENGINE (Continued)

POWER LEVER

The power lever is connected through linkage to a cam assembly mounted in front of the fuel control unit at the rear of the engine. The power lever controls engine power through the full range from maximum takeoff power back through idle to full reverse. The lever also selects propeller pitch when in the BETA range. The power lever has MAX, IDLE, and BETA and REVERSE range positions. The range from MAX position through IDLE enables the pilot to select the desired power output from the engine. The BETA range enables the pilot to control propeller blade pitch from idle thrust back through a zero or no-thrust condition to maximum reverse thrust.

CAUTION

THE PROPELLER REVERSING LINKAGE CAN BE DAMAGED IF THE POWER LEVER IS MOVED AFT OF THE IDLE POSITION WHEN THE PROPELLER IS FEATHERED.

EMERGENCY POWER LEVER

The emergency power lever is connected through linkage to the manual override lever on the fuel control unit and governs fuel supply to the engine should a pneumatic malfunction occur in the fuel control unit. When the engine is operating, a failure of any pneumatic signal input to the fuel control unit will result in the fuel flow decreasing to minimum idle (about 48% Ng at sea level and increasing with altitude). The emergency power lever allows the pilot to restore power in the event of such a failure. The emergency power lever has NORMAL, IDLE, and MAX positions. The NORMAL position is used for all normal engine operation when the fuel control unit is operating normally and engine power is selected by the power lever. The range from IDLE position to MAX governs engine power and is used when a pneumatic malfunction has occurred in the fuel control unit and the power lever is ineffective. A mechanical stop in the lever slot requires that the emergency power lever be moved to the left to clear the stop before it can be moved from the NORMAL (full aft) position to the IDLE position.

(Continued Next Page)

ENGINE (Continued)

EMERGENCY POWER LEVER (Continued)

NOTE

The knob on the emergency power lever has crosshatching. The crosshatching is visible when the lever is in MAX position. Also, the emergency power lever is annunciated on the annunciator panel whenever it is unstowed from the NORMAL position. These precautions are intended to preclude starting of the engine with the emergency power lever inadvertently placed in any position other than NORMAL.

CAUTION

- **THE EMERGENCY POWER LEVER AND ITS ASSOCIATED MANUAL OVERRIDE SYSTEM IS CONSIDERED TO BE AN EMERGENCY SYSTEM AND SHOULD BE USED ONLY IN THE EVENT OF A FUEL CONTROL UNIT MALFUNCTION. WHEN ATTEMPTING A NORMAL START, THE PILOT MUST MAKE SURE THAT THE EMERGENCY POWER LEVER IS IN THE NORMAL (FULL AFT) POSITION; OTHERWISE, AN OVERTEMPERATURE CONDITION MAY RESULT.**
- **WHEN USING THE FUEL CONTROL MANUAL OVERRIDE SYSTEM, ENGINE RESPONSE MAY BE MORE RAPID THAN WHEN USING THE POWER LEVER. ADDITIONAL CARE IS REQUIRED DURING ENGINE ACCELERATION TO AVOID EXCEEDING ENGINE LIMITATIONS.**

Operation of the emergency power lever is prohibited with the primary power lever out of the IDLE position. The emergency power lever overrides normal fuel control functions and results in the direct operation of the fuel metering valve. The emergency power lever will override the automatic fuel governing and engine acceleration scheduling controlled during normal operation by the primary power lever.

(Continued Next Page)

ENGINE (Continued)

EMERGENCY POWER LEVER (Continued)

CAUTION

INAPPROPRIATE USE OF THE EMERGENCY POWER LEVER MAY ADVERSELY AFFECT ENGINE OPERATION AND DURABILITY. USE OF THE EMERGENCY POWER LEVER DURING NORMAL OPERATION OF THE POWER LEVER MAY RESULT IN ENGINE SURGES, OR EXCEEDING THE ITT, Ng, AND TORQUE LIMITS.

Airplanes incorporating Service Kit SK208-142 have a copper witness wire installed that indicates when the emergency power lever has been moved from the NORMAL position. In the event that the emergency power lever is required due to an engine malfunction, moving the emergency power lever out of the NORMAL position and into the IDLE position easily breaks the copper wire.

After EPL use, the witness wire should be replaced after appropriate maintenance action. An entry shall be made in the airplane logbook indicating the circumstances of the EPL use and the action taken.

PROPELLER CONTROL LEVER

The propeller control lever is connected through linkage to the propeller governor mounted on top of the front section of the engine, and controls propeller governor settings from the maximum RPM position to full feather. The propeller control lever has MAX, MIN, and FEATHER positions. The MAX position is used when high RPM is desired and governs the propeller speed at 1900 RPM. Propeller control lever settings from the MAX position to MIN permit the pilot to select the desired engine RPM for cruise. The FEATHER position is used during normal engine shutdown to stop rotation of the power turbine and front section of the engine. Since lubrication is not available after the gas generator section of the engine has shut down, rotation of the forward section of the engine is not desirable. Also, feathering the propeller when the engine is shut down minimizes propeller windmilling during windy conditions. A mechanical stop in the lever slot requires that the propeller control lever be moved to the left to clear the stop before it can be moved into or out of the FEATHER position.

(Continued Next Page)

ENGINE (Continued)

FUEL CONDITION LEVER

The fuel condition lever is connected through linkage to a combined lever and stop mechanism on the fuel control unit. The lever and stop also function as an idle stop for the fuel control unit rod. The fuel condition lever controls the minimum RPM of the gas generator turbine (Ng) when the power lever is in the IDLE position. The fuel condition lever has CUTOFF, LOW IDLE, and HIGH IDLE positions. The CUTOFF position shuts off all fuel to the engine fuel nozzles. LOW IDLE positions the control rod stop to provide an RPM of 52% Ng. HIGH IDLE positions the control rod stop to provide an RPM of 65% Ng.

QUADRANT FRICTION LOCK

A quadrant friction lock, located on the right side of the pedestal, is provided to minimize creeping of the engine controls once they have been set. The lock is a knurled knob which increases friction on the engine controls when rotated clockwise.

ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: torque indicator, propeller RPM indicator, ITT indicator, Ng% RPM indicator, fuel flow indicator, oil pressure gage, and oil temperature gage.

TORQUE INDICATOR

The torque indicator is located on the upper portion of the instrument panel and indicates the torque being produced by the engine. Two independent lines enter the back of the indicator. One line measures the engine torque pressure and one line measures the reduction gear box internal pressure. The torque indicator monitors the engine torque pressure and converts this pressure into an indication of torque in foot-pounds. Instrument markings indicate that the normal operating range (green arc) is from 0 to 1658 foot-pounds, the alternate power range (striped green arc) is from 1658 to 1970 foot-pounds, and maximum torque (red line) is 1970 foot-pounds. Maximum takeoff torque is denoted by "T.O." and a red wedge at 1658 foot-pounds.

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ENGINE INSTRUMENTS (Continued)

PROPELLER RPM INDICATOR

The propeller RPM indicator is located on the upper portion of the instrument panel. The instrument is marked in increments of 50 RPM and indicates propeller speed in revolutions per minute. The instrument is electrically-operated from the propeller tachometer-generator which is mounted on the right side of the front case. Instrument markings indicate a normal operating range (green arc) of from 1600 to 1900 RPM and a maximum (red line) of 1900 RPM.

ITT INDICATOR

The ITT (interturbine temperature) indicator is located on the upper portion of the instrument panel. The instrument displays the gas temperature between the compressor and power turbines. Instrument markings indicate a normal operating range (green arc) of from 100°C to 740°C, and a maximum (red line) of 805°C. Also, instrument markings indicate a maximum starting temperature (red triangle) of 1090°C.

N_g% RPM INDICATOR

The N_g% RPM indicator is located on the upper portion of the instrument panel. The instrument indicates the percent of gas generator RPM based on a figure of 100% at 37,500 RPM. The instrument is electrically-operated from the gas generator tachometer-generator mounted on the lower right-hand portion of the accessory case. Instrument markings indicate a normal operating range (green arc) of from 52% to 101.6% and a maximum (red line) of 101.6%.

FUEL FLOW INDICATOR

Details of the fuel flow indicator are included under Fuel System in a later paragraph in this section.

OIL PRESSURE GAGE

The oil pressure gage is the left half of a dual-indicating instrument mounted on the upper portion of the instrument panel. A direct pressure oil line from the engine delivers oil at engine operating pressure to the oil pressure gage. Instrument markings indicate a minimum operating pressure (red line) of 40 psi, a cautionary range (yellow arc) of from 40 to 85 psi, a normal operating range (green arc) of from 85 to 105 psi, and a maximum (red line) of 105 psi.

(Continued Next Page)

ENGINE (Continued)

FUEL CONDITION LEVER

The fuel condition lever is connected through linkage to a combined lever and stop mechanism on the fuel control unit. The lever and stop also function as an idle stop for the fuel control unit rod. The fuel condition lever controls the minimum RPM of the gas generator turbine (N_g) when the power lever is in the IDLE position. The fuel condition lever has CUTOFF, LOW IDLE, and HIGH IDLE positions. The CUTOFF position shuts off all fuel to the engine fuel nozzles. LOW IDLE positions the control rod stop to provide an RPM of 52% N_g. HIGH IDLE positions the control rod stop to provide an RPM of 65% N_g.

QUADRANT FRICTION LOCK

A quadrant friction lock, located on the right side of the pedestal, is provided to minimize creeping of the engine controls once they have been set. The lock is a knurled knob which increases friction on the engine controls when rotated clockwise.

ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: torque indicator, propeller RPM indicator, ITT indicator, N_g% RPM indicator, fuel flow indicator, oil pressure gage, and oil temperature gage.

TORQUE INDICATOR

The torque indicator is located on the upper portion of the instrument panel and indicates the torque being produced by the engine. Two independent lines enter the back of the indicator. One line measures the engine torque pressure and one line measures the reduction gear box internal pressure. The torque indicator monitors the engine torque pressure and converts this pressure into an indication of torque in foot-pounds. Instrument markings indicate that the normal operating range (green arc) is from 0 to 1658 foot-pounds, the alternate power range (striped green arc) is from 1658 to 1970 foot-pounds, and maximum torque (red line) is 1970 foot-pounds. Maximum takeoff torque is denoted by "T.O." and a red wedge at 1658 foot-pounds.

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ENGINE INSTRUMENTS (Continued)

OIL TEMPERATURE GAGE

The oil temperature gage is the right half of a dual-indicating instrument mounted on the upper portion of the instrument panel. The instrument is operated by an electrical-resistance type temperature sensor which receives power from the airplane electrical system.

Instrument markings:

Airplanes not equipped with Service Kit SK208-147: Minimum operating temperature (red line) -40°C, cautionary range (yellow arc) from -40°C to 10°C, normal operating range (green arc) from 10°C to 99°C, and maximum (red line) 99°C.

Airplanes equipped with Service Kit SK208-147: Minimum operating temperature (red line) -40°C, cautionary range (yellow arc) from -40°C to 10°C, normal operating range (green arc) from 10°C to 99°C, 10-minute transient range (yellow arc) 99°C to 104°C, and maximum (red line) 104°C.

NEW ENGINE BREAK-IN AND OPERATION

There are no specific break-in procedures required for the Pratt & Whitney Canada Inc. PT6A-114 turboprop engine. The engine may be safely operated throughout the normal ranges authorized by the manufacturer at the time of delivery of your airplane.

ENGINE LUBRICATION SYSTEM

The lubrication system consists of a pressure system, a scavenge system and a breather system. The main components of the lubrication system include an integral oil tank at the back of the engine, an oil pressure pump at the bottom of the oil tank, an external double-element scavenge pump located on the back of the accessory case, an internal double-element scavenge pump located inside the accessory gearbox, an oil-to-fuel heater located on the top rear of the accessory case, an oil filter located internally on the right side of the oil tank, and an oil cooler located on the right side of the nose cowl.

A large capacity oil cooler is installed in modified early serial airplanes and later serial airplanes to replace the standard capacity oil cooler and to increase the hot day outside air temperature limits for flight operations. The large oil cooler has 25% more airflow area than the standard cooler.

(Continued Next Page)

ENGINE LUBRICATION SYSTEM (Continued)

Oil is drawn from the bottom of the oil tank through a filter screen where it passes through a pressure relief valve for regulation of oil pressure. The pressure oil is then delivered from the main oil pump to the oil filter where extraneous matter is removed from the oil and precluded from further circulation. Pressure oil is then routed through passageways to the engine bearings, reduction gears, accessory drives, torquemeter, and propeller governor. Also, pressure oil is routed to the oil-to-fuel heater where it then returns to the oil tank.

After cooling and lubricating the engine moving parts, oil is scavenged as follows:

1. Oil from the number 1 bearing compartment is returned by gravity into the accessory gearbox.
2. Oil from the number 2 bearing is scavenged by the front element of the internal scavenge pump back into the accessory gearbox.
3. Oil from the number 3 and number 4 bearings is scavenged by the front element of the external scavenge pump into the accessory gearbox.
4. Oil from the propeller governor, front thrust bearing, reduction gear accessory drives, and torquemeter is scavenged by the rear element of the external scavenge pump where it is routed through a thermostatically-controlled oil cooler and then returned to the oil tank.
5. The rear element of the internal scavenge pump scavenges oil from the accessory case and routes it through the oil cooler where it then returns to the oil tank.

Breather air from the engine bearing compartments and from the accessory and reduction gearboxes is vented overboard through a centrifugal breather installed in the accessory gearbox. The bearing compartments are connected to the accessory gearbox by cored passages and existing scavenge oil return lines. A bypass valve, immediately upstream of the front element of the internal scavenge pump, vents the accessory gearbox when the engine is operating at high power.

An oil dipstick/filler cap is located at the rear of the engine on the left side and is accessible when the left side of the upper cowling is raised. Markings which indicate U.S. quarts low if the oil is hot are provided on the dipstick to facilitate oil servicing. The oil tank capacity is 9.5 U.S. quarts and total system capacity is 14 U.S. quarts. For engine oil type and brand, refer to Section 8.

IGNITION SYSTEM

The ignition system consists of two igniters, an ignition exciter, two high-tension leads, an ignition monitor light, an ignition switch, and a starter switch. Engine ignition is provided by two igniters in the engine combustion chamber. The igniters are energized by the ignition exciter mounted on the engine mount on the right side of the engine compartment. Electrical energy from the ignition exciter is transmitted through two high-tension leads to the igniters in the engine. The ignition system is normally energized only during engine start.

Ignition is controlled by an ignition switch and a starter switch located on the left sidewall switch and circuit breaker panel. The ignition switch has two positions, ON and NORMAL. The NORMAL position of the switch arms the ignition system so that ignition will be obtained when the starter switch is placed in the START position. The NORMAL position is used during all ground starts and during air starts with starter assist. The ON position of the switch provides continuous ignition regardless of the position of the starter switch. This position is used for air starts without starter assist, for operation on water or slush-covered runways, during flight in heavy precipitation, during inadvertent icing encounters until the inertial separator has been in bypass for 5 minutes, and when near fuel exhaustion as indicated by illumination of the RESERVOIR FUEL LOW annunciator.

The main function of the starter switch is control of the starter for rotating the gas generator portion of the engine during starting. However, it also provides ignition during starting. For purposes of this discussion, only the ignition functions of the switch are described. For other functions of the starter switch, refer to paragraph titled Starting System, in this section. The starter switch has three positions, OFF, START, and MOTOR. The OFF position shuts off the ignition system and is the normal position at all times except during engine start or engine clearing. The START position energizes the engine ignition system provided the ignition switch is in the NORMAL position. After the engine has started during a ground or air start, the starter switch must be manually positioned to OFF for generator operation.

A green annunciator, located on the annunciator panel, is labeled IGNITION ON, and will illuminate when electrical power is being applied to the igniters. The ignition system is protected by a "pull-off" type circuit breaker, labeled IGN, on the left sidewall switch and circuit breaker panel.

AIR INDUCTION SYSTEM

The engine air inlet is located at the front of the engine nacelle to the left of the propeller spinner. Ram air entering the inlet flows through ducts and an inertial separator system and then enters the engine through a circular plenum chamber where it is directed to the compressor by guide vanes. The compressor air inlet incorporates a screen which will prevent entry of large articles, but does not filter the inlet air.

INERTIAL SEPARATOR SYSTEM

An inertial separator system in the engine air inlet duct prevents moisture particles from entering the compressor air inlet plenum when in bypass mode. The inertial separator consists of two movable vanes and a fixed airfoil which, during normal operation, route the inlet air through a gentle turn into the compressor air inlet plenum. When separation of moisture particles is desired, the vanes are positioned so that the inlet air is forced to execute a sharp turn in order to enter the inlet plenum. This sharp turn causes any moisture particles to separate from the inlet air and discharge overboard through the inertial separator outlet in the left side of the cowling.

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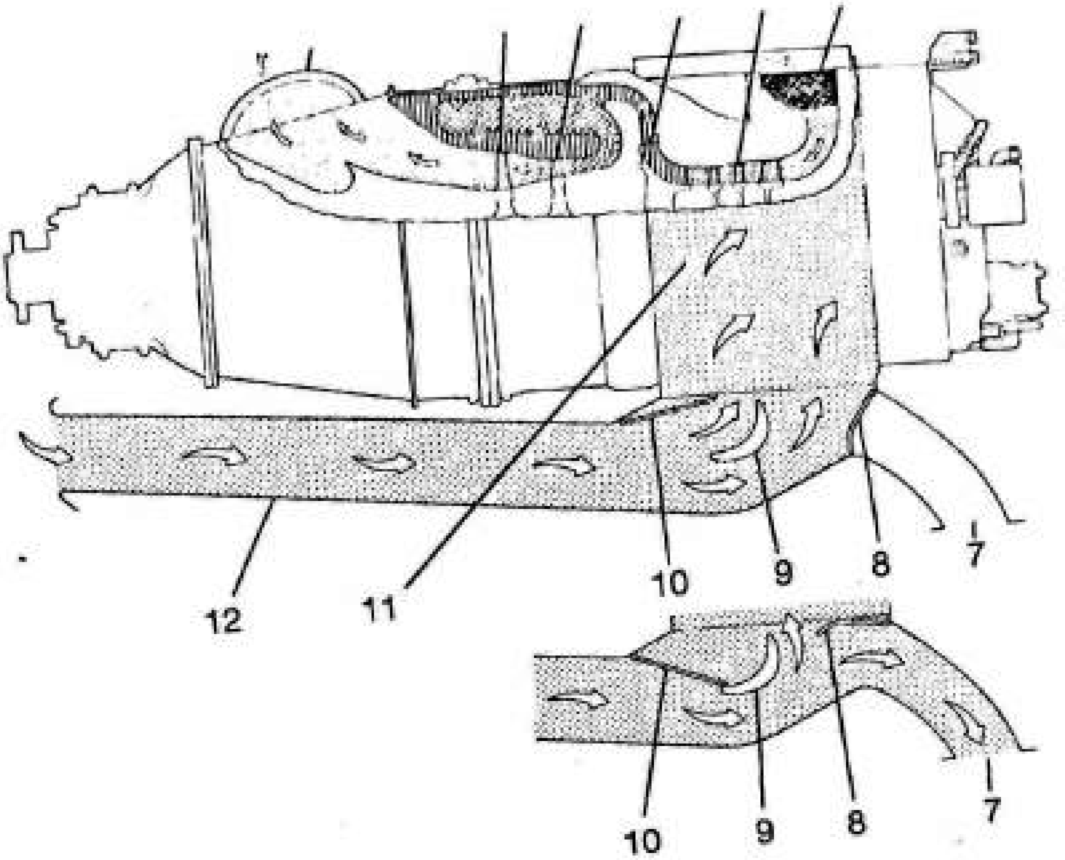

- Ram air
- Ram air compressed while flowing through three stages of axial-flow impellers
- Ram air compressed while flowing through centifugal impeller
- Compressed air injected with fuel and ignited
- Burned fuel-air mixture is expanded and drives compressor turbine and power turbine, and is then exhausted

1. Primary Exhaust Pipe
2. Power Turbine
3. Compressor Turbine
4. Centrifugal Impeller
5. Axial-Flow Impellers (3)
6. Engine Air Inlet
7. Inertial Seperator Outlet
8. Inertial Seperator Rear Vane
9. Inertial Seperator Airfoil
10. Inertial Seperator Front Vane
11. Induction Air Inlet Plenum
12. Induction Air Inlet Duct

NOTE

The above view shows inertial separator in NORMAL position. Auxiliary view shows inertial separator in BYPASS position.

Figure 7-9. Engine Air Flow

INERTIAL SEPARATOR SYSTEM (Continued)

Inertial separator operation is controlled by a T-handle located on the lower instrument panel. The T-handle is labeled BYPASS-PULL, NORMAL-PUSH. The inertial separator control should be moved to the BYPASS position prior to running the engine during ground or flight operation in visible moisture (clouds, rain, snow, ice crystals) with an OAT of 4°C or less. It may also be used for ground operations or takeoffs from dusty, sandy field conditions to minimize ingestion of foreign particles into the compressor. The normal position is used for all other operations.

The T-handle locks in the NORMAL position by rotating the handle clockwise 1/4 turn to its vertical position. To unlock, push forward slightly and rotate the handle 90° counterclockwise. The handle can then be pulled into the BYPASS position. Once moved to the BYPASS position, air loads on the movable vanes hold them in this position.

NOTE

When moving the inertial separator control from bypass to normal position during flight, reduction of engine power will reduce the control forces.

EXHAUST SYSTEM

The exhaust system consists of a primary exhaust pipe attached to the right side of the engine just aft of the propeller reduction gearbox. A secondary exhaust duct, fitted over the end of the primary exhaust pipe, carries the exhaust gases away from the cowling and into the slipstream. The juncture of the primary exhaust pipe and secondary exhaust duct is located directly behind the oil cooler. Since the secondary exhaust duct is of larger diameter than the primary exhaust pipe, a venturi effect is produced by the flow of exhaust. This venturi effect creates a suction behind the oil cooler which augments the flow of cooling air through the cooler. This additional airflow improves oil cooling during ground operation of the engine.

ENGINE FUEL SYSTEM

The engine fuel system consists of an oil-to-fuel heater, an engine-driven fuel pump, a fuel control unit, a flow divider and dump valve, a dual fuel manifold with 14 simplex nozzles, and two fuel drain lines. The system provides fuel flow to satisfy the speed and power demands of the engine.

Fuel from the airplane reservoir is delivered to the oil-to-fuel heater which is essentially a heat exchanger which utilizes heat from the engine lubricating oil system to preheat the fuel in the fuel system. A fuel temperature-sensing oil bypass valve regulates the fuel temperature by either allowing oil to flow through the heater circuit or bypass it to the engine oil tank.

Fuel from the oil-to-fuel heater then enters the engine-driven fuel pump chamber through a 74-micron inlet screen. The inlet screen is spring-loaded and should it become blocked, the increase in differential pressure will overcome the spring and allow unfiltered fuel to flow into the pump chamber. The pump increases the fuel pressure and delivers it to the fuel control unit via a 10-micron filter in the pump outlet. A bypass valve and cored passages in the pump body enables unfiltered high pressure fuel to flow to the fuel control unit in the event the outlet filter becomes blocked.

The fuel control unit consists of a fuel metering section, a temperature compensating section, and a gas generator (N_g) pneumatic governor. The fuel control unit determines the proper fuel schedule to provide the power required as established by the power lever input. This is accomplished by controlling the speed of the compressor turbine. The temperature compensating section alters the acceleration fuel schedule to compensate for fuel density differences at different fuel temperatures, especially during engine start. The power turbine governor, located in the propeller governor housing, provides power turbine overspeed protection in the event of propeller governor failure. This is accomplished by limiting fuel to the gas generator. During reverse thrust operation, maximum power turbine speed is controlled by the power turbine governor. The temperature compensator alters the acceleration fuel schedule of the fuel control unit to compensate for variations in compressor inlet air temperature. Engine characteristics vary with changes in inlet air temperature, and the acceleration fuel schedule must, in turn, be altered to prevent compressor stall and/or excessive turbine temperatures.

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ENGINE FUEL SYSTEM (Continued)

The flow divider schedules the metered fuel, from the fuel control unit, between the primary and secondary fuel manifolds. The fuel manifold and nozzle assemblies deliver fuel to the combustion chamber through 10 primary and 4 secondary fuel nozzles. During engine start, metered fuel is delivered initially by the primary nozzles, with the secondary nozzles cutting in above a preset value. All nozzles are operative at idle and above.

When the fuel cutoff valve in the fuel control unit closes during engine shutdown, both primary and secondary manifolds are connected to a dump valve port and residual fuel in the manifolds is allowed to drain into the fuel drain can attached to the firewall where it can be drained daily.

COOLING SYSTEM

No external cooling provisions are provided for the PT6A-114 engine in this installation. However, the engine incorporates an extensive internal air system which provides for bearing compartment sealing and for compressor and power turbine disk cooling. For additional information on internal engine air systems, refer to the engine maintenance manual for the airplane.

STARTING SYSTEM

The starting system consists of a starter/generator, a starter switch, and a starter annunciator light. The starter/generator functions as a motor for engine starting and will motor the gas generator section until a speed of 46% Ng is reached, at which time, the start cycle will automatically be terminated by a speed sensing switch located in the starter/generator. The starter/generator is controlled by a three-position starter switch located on the left sidewall switch and circuit breaker panel. The switch has OFF, START, and MOTOR positions. The OFF position de-energizes the ignition and starter circuits and is the normal position at all times except during engine start. The START position of the switch energizes the starter/generator which rotates the gas generator portion of the engine for starting. Also, the START position energizes the ignition system, provided the ignition switch is in the NORMAL position. When the engine has started, the starter switch must be manually placed in the OFF position to de-energize the ignition system and activate the generator system. The MOTOR position of the switch motors the engine without having the ignition circuit energized and is used for motoring the engine when an engine start is not desired. This can be used for clearing fuel from the engine, washing the engine compressor, etc. The MOTOR position is spring-loaded back to the OFF position. Also, an interlock between the MOTOR position of the starter switch and the ignition switch prevents the starter from motoring unless the ignition switch is in the NORMAL position. This prevents unintentional motoring of the engine with the ignition on. Starter contactor operation is indicated by an amber annunciator, labeled STARTER ENERGIZED, on the annunciator panel.

ENGINE ACCESSORIES

All engine-driven accessories, with the exception of the propeller tachometer-generator and the propeller governors, are mounted on the accessory gearbox located at the rear of the engine. These accessories are driven from the compressor turbine by a coupling shaft which extends the drive through a conical tube in the oil tank center section.

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ENGINE ACCESSORIES (Continued)

OIL PUMP

Pressure oil is circulated from the integral oil tank through the engine lubrication system by a self-contained, gear-type pressure pump located in the lowest part of the oil tank. The oil pump is contained in a cast housing which is bolted to the front face of the accessory diaphragm, and is driven by the accessory gear shaft. The oil pump body incorporates a circular mounting boss to accommodate a check valve, located in the end of the filter housing. A second mounting boss on the pump accommodates a pressure relief valve.

FUEL PUMP

The engine-driven fuel pump is mounted on the accessory gearbox at the 2 o'clock position. The pump is driven through a gear shaft and splined coupling. The coupling splines are lubricated by oil mist from the auxiliary gearbox through a hole in the gear shaft. Another splined coupling shaft extends the drive to the fuel control unit which is bolted to the rear face of the pump. Fuel from the oil-to-fuel heater enters the fuel pump through a 74-micron inlet screen. Then, fuel enters the pump gear chamber, is boosted to high pressure, and delivered to the fuel control unit through a 10-micron pump outlet filter. A bypass valve and cored passages in the pump casing enable unfiltered high pressure fuel to flow from the pump gears to the fuel control unit should the outlet filter become blocked. An internal passage originating at the mating face with the fuel control unit returns bypass fuel from the fuel control unit to the pump inlet downstream of the inlet screen. A pressure regulating valve in this line serves to pressurize the pump gear bushings.

N_g TACHOMETER-GENERATOR

The N_g tachometer-generator produces an electric current which is used in conjunction with the gas generator RPM indicator to indicate gas generator RPM. The N_g tachometer-generator drive and mount pad is located at the 5 o'clock position on the accessory gearbox and is driven from the internal scavenge pump. Rotation is counterclockwise with a drive ratio of 0.1121:1.

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ENGINE ACCESSORIES (Continued)

PROPELLER TACHOMETER-GENERATOR

The propeller tachometer-generator produces an electric current which is used in conjunction with the propeller RPM indicator. The propeller tachometer-generator drive and mount pad is located on the right side of the reduction gearbox case and rotates clockwise with a drive ratio of 0.1273:1.

TORQUEMETER

The torquemeter is a hydro-mechanical torque measuring device located inside the first stage reduction gear housing to provide an accurate indication of engine power output. The difference between the torquemeter pressure and the reduction gearbox internal pressure accurately indicates the torque being produced.

The two pressures are internally routed to bosses located on the top of the reduction gearbox front case and are then plumbed to the torquemeter indicator which indicates the correct torque pressure.

STARTER/GENERATOR

The starter/generator is mounted on the top of the accessory case at the rear of the engine. The starter/generator is a 28-volt, 200-amp engine-driven unit that functions as a motor for engine starting and, after engine start, as a generator for the airplane electrical system. When operating as a starter, a speed sensing switch in the starter/generator will automatically shut down the starter, thereby providing overspeed protection and automatic shutoff. The starter/generator is air cooled by an integral fan and by ram air ducted from the front of the engine cowling.

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ENGINE ACCESSORIES (Continued)

INTERTURBINE TEMPERATURE SENSING SYSTEM

The interturbine temperature sensing system is designed to provide the operator with an accurate indication of engine operating temperatures taken between the compressor and power turbines. The system consists of twin leads, two bus bars, and eight individual chromel-alumel thermocouple probes connected in parallel. Each probe protrudes through a threaded boss on the power turbine stator housing into an area adjacent to the leading edge of the power turbine vanes. The probe is secured to the boss by means of a floating, threaded fitting which is part of the thermocouple probe assembly. Shielded leads connect each bus bar assembly to a terminal block which provides a connecting point for external leads to the ITT indicator in the airplane cabin.

PROPELLER GOVERNOR

The propeller governor is located in the 12 o'clock position on the front case of the reduction gearbox. Under normal conditions, the governor acts as a constant speed unit, maintaining the propeller speed selected by the pilot by varying the propeller blade pitch to match the load to the engine torque. The propeller governor also has a power turbine governor section built into the unit. Its function is to protect the engine against a possible power turbine overspeed in the event of a propeller governor failure.

If such an overspeed should occur, a governing orifice in the propeller governor is opened by flyweight action to bleed off compressor discharge pressure through the governor and computing section of the fuel control unit. When this occurs, compressor discharge pressure, acting on the fuel control unit governor bellows, decreases and moves the metering valve in a closing direction, thus reducing fuel flow to the flow divider.

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ENGINE ACCESSORIES (Continued)

PROPELLER OVERSPEED GOVERNOR

The propeller overspeed governor is located at the 10 o'clock position on the front case of the reduction gearbox. The governor acts as a safeguard against propeller overspeed should the primary propeller governor fail. The propeller overspeed governor regulates the flow of oil to the propeller pitch-change mechanism by means of a flyweight and speeder spring arrangement similar to the primary propeller governor. Since it has no mechanical controls, the overspeed governor is equipped with a test solenoid that resets the governor below its normal overspeed setting for ground test. The overspeed governor test switch is located on the left side of the instrument panel. For a discussion of this switch, refer to the paragraph titled Propellers in this section.

ENGINE MOUNT

The engine mount is a 9-element space frame weldment fabricated from 4130 steel. The space frame attaches to the firewall at five points and has an engine mounting ring that attaches to the front of the frame at four points. The forward mounting ring also facilitates engine removal without disturbing the nose gear attachment.

ENGINE FIRE DETECTION SYSTEM

The engine fire detection system consists of a heat sensor in the engine compartment, a warning light, labeled ENGINE FIRE, on the annunciator panel, and a warning horn above the pilot. The heat sensor consists of three flexible closed loops. When high engine compartment temperatures are experienced, the heat causes a change in resistance in the closed loops. This change in resistance is sensed by a control box, located on the aft side of the firewall, which will illuminate the annunciator light and trigger the audible warning horn. Fire warning is initiated when temperatures in the engine compartment exceed 425°F (218°C) on the first section (firewall), 625°F (329°C) on the second section (around the exhaust), or 450°F (232°C) on the third section (rear engine compartment). A test switch, labeled FIRE DETECT TEST, is located adjacent to the annunciator panel. When depressed, the ENGINE FIRE annunciator will illuminate and the warning horn will sound indicating that the fire warning circuitry is operational. The system is protected by a "pull-off" type circuit breaker, labeled FIRE DET, on the left sidewall switch and circuit breaker panel.

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ENGINE ACCESSORIES (Continued)

ENGINE GEAR REDUCTION SYSTEM

The reduction gear and propeller shaft, located in the front of the engine, are housed in two magnesium alloy castings which are bolted together at the exhaust outlet. The gearbox contains a two-stage planetary gear train, three accessory drives, and propeller shaft. The first-stage reduction gear is contained in the rear case, while the second-stage reduction gear, accessory drives, and propeller shaft are contained in the front case. Torque from the power turbine is transmitted to the first-stage reduction gear, from there to the second-stage reduction gear, and then to the propeller shaft. The reduction ratio is from a maximum power turbine speed of 33,000 RPM down to a propeller speed of 1900 RPM or a reduction ratio of 0.0576:1.

The accessories, located on the front case of the reduction gearbox, are driven by a bevel gear mounted at the rear of the propeller shaft thrust bearing assembly. Drive shafts from the bevel drive gear transmit rotational power to the three pads which are located at the 12, 3 and 9 o'clock positions.

Propeller thrust loads are absorbed by a flanged ball bearing assembly located on the front face of the reduction gearbox center bore. The bevel drive gear adjusting spacer, thrust bearing, and seal runner are stacked and secured to the propeller shaft by a key washer and spanner nut. A thrust bearing cover assembly is secured by bolts at the front flange of the reduction gearbox front case.

CHIP DETECTORS (Optional)

Some airplanes have two chip detectors installed on the engine, one on the underside of the reduction gearbox case and one on the underside of the accessory gearbox case. The chip detectors are electrically connected to an annunciator, labeled CHIP DETECTOR, on the instrument panel. The annunciator will illuminate when metal chips are present in one or both of the chip detectors. Illumination of the CHIP DETECTOR annunciator necessitates the need for inspection of the engine for abnormal wear.

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ENGINE ACCESSORIES (Continued)

OIL BREATHER DRAIN CAN

Some Model 208 airplanes have an oil breather drain can mounted on the right lower engine mount truss. This can collects any engine oil discharge coming from the accessory pads for the alternator drive pulley, starter/generator and air conditioner compressor (if installed), and the propeller shaft seal. This can should be drained after every flight. A drain valve on the bottom right side of the engine cowling enables the pilot to drain the contents of the oil breather drain can into a suitable container. The allowable quantity of oil discharge per hour of engine operation 14 cc for airplanes with air conditioning and 11 cc for airplanes without air conditioning. If the quantity of oil drained from the can is greater than specified, the source of the leakage should be identified and corrected prior to further flight.

PROPELLER

The airplane may be equipped with either a Hartzell, composite material, three-bladed propeller, or a McCauley three-bladed aluminum propeller. Both propellers are constant-speed, full-feathering, reversible, single-acting, and governor-regulated propellers. With either propeller, a setting introduced into the governor with the propeller control lever which establishes the propeller speed.

The propeller utilizes oil pressure which opposes the force of springs and counterweights to obtain correct pitch for the engine load. Oil pressure from the propeller governor drives the blades toward low pitch (increases RPM) while the springs and counterweights drive the blades toward high pitch (decreasing RPM). The source of oil pressure for propeller operation is furnished by the engine oil system, boosted in pressure by the governor gear pump, and supplied to the propeller hub through the propeller flange.

To feather the propeller blades, the propeller control lever on the control pedestal is placed in the FEATHER position; counterweights and spring tension will continue to twist the propeller blades through high pitch and into the streamlined or feathered position. Unfeathering the propeller is accomplished by positioning the propeller control lever forward of the feather gate. The unfeathering system uses engine oil pressure to force the propeller out of feather.

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PROPELLER (Continued)

Reversed propeller pitch is available for decreasing landing ground roll during landing. To accomplish reverse pitch, the power lever is retarded beyond IDLE and well into the BETA range. Maximum reverse power is accomplished by retarding the power lever to the MAX REVERSE position which increases power output from the gas generator as well as positions the propeller blades at full reverse pitch. An externally grooved feedback ring is provided with the propeller.

Motion of the feedback ring is proportional to propeller blade angle, and is picked up by a carbon block running in the feedback ring. The relationship between the axial position of the feedback ring and the propeller blade angle is used to maintain control of blade angle from idle to full reverse.

CAUTION

THE PROPELLER REVERSING LINKAGE CAN BE DAMAGED IF THE POWER LEVER IS MOVED AFT OF THE **IDLE** POSITION WHEN THE PROPELLER IS FEATHERED.

OVERSPEED GOVERNOR TEST SWITCH

An overspeed governor test switch is located on the left side of the instrument panel. The switch is the push-to-test type and is used to test the propeller overspeed governor during engine run-up. The switch, when depressed, actuates a solenoid on the propeller overspeed governor which restricts propeller RPM when the power lever is advanced. To check for proper operation of the overspeed governor during engine run-up, depress the press-to-test switch and advance the power lever until propeller RPM stabilizes; propeller RPM should not exceed 1750 ± 60 RPM.

PROPELLER BETA ANNUNCIATOR

An amber "Beta" annunciator is located on the annunciator panel. The annunciator is labeled BETA, and will illuminate when the propeller blade angle is in the "Beta" range (less than 9 degrees).

FUEL SYSTEM

The airplane fuel system (see Figure 7-10) consists of two vented, integral fuel tanks with shutoff valves, a fuel selectors off warning system, a fuel reservoir, an ejector fuel pump, an electric auxiliary boost pump, a reservoir manifold assembly, a firewall shutoff valve, a fuel filter, an oil-to-fuel heater, an engine-driven fuel pump, a fuel control unit, a flow divider, dual manifolds, and 14 fuel nozzle assemblies. A fuel drain can and drain is also provided. Refer to Figure 7-11 for fuel quantity data for the system.

WARNING

UNUSABLE FUEL LEVELS FOR THIS AIRPLANE WERE DETERMINED IN ACCORDANCE WITH FEDERAL AVIATION REGULATIONS. FAILURE TO OPERATE THE AIRPLANE IN COMPLIANCE WITH THE FUEL LIMITATIONS SPECIFIED IN SECTION 2 MAY FURTHER REDUCE THE AMOUNT OF FUEL AVAILABLE IN FLIGHT.

Fuel flows from the tanks through the two fuel tank shutoff valves at each tank. The fuel tank shutoff valves are mechanically controlled by two fuel selectors, labeled LEFT, ON and OFF and RIGHT, ON and OFF, located on the overhead panel. By manipulating the fuel selectors, the pilot can select either left or right fuel tanks or both at the same time. Normal operation is with both tanks on. Fuel flows by gravity from the shutoff valves in each tank to the fuel reservoir.

The reservoir is located at the low point in the fuel system which maintains a head of fuel around the ejector boost pump and auxiliary boost pump which are contained within the reservoir. This head of fuel prevents pump cavitation in low-fuel quantity situations, especially during inflight maneuvering. Fuel in the reservoir is pumped by the ejector boost pump or by the electric auxiliary boost pump to the reservoir manifold assembly. The ejector boost pump, which is driven by motive fuel flow from the fuel control unit, normally provides fuel flow when the engine is operating. In the event of failure of the ejector boost pump, the electric boost pump will automatically turn on, thereby supplying fuel flow to the engine. The auxiliary boost pump is also used to supply fuel flow during starting. Fuel in the reservoir manifold then flows through a fuel shutoff valve located on the aft side of the firewall. This shutoff valve enables the pilot to cut off all fuel to the engine.

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FUEL SYSTEM (Continued)

After passing through the shutoff valve, fuel is routed through a fuel filter located on the front side of the firewall. The fuel filter incorporates a bypass feature which allows fuel to bypass the filter in the event the filter becomes blocked with foreign material. A red filter bypass flag on the top of the filter extends upward when the filter is bypassing fuel. Fuel from the filter is then routed through the oil-to-fuel heater to the engine-driven fuel pump where fuel is delivered under pressure to the fuel control unit. The fuel control unit meters the fuel and directs it to the flow divider which distributes the fuel to dual manifolds and 14 fuel nozzles located in the combustion chamber. For additional details concerning the flow of fuel at the engine, refer to the Engine Fuel System paragraph in this section.

Fuel rejected by the engine on shutdown drains into a fireproof fuel can located on the front left side of the firewall. The can should be drained during preflight inspection. If left unattended, the drain can fuel will overflow overboard.

Fuel system venting is essential to system operation. Complete blockage of the vent system will result in decreased fuel flow and eventual engine stoppage. Venting is accomplished by check valve equipped vent lines, one from each fuel tank, which protrude from the trailing edge of the wing at the wing tips. Also the fuel reservoir is vented to both wing tanks.

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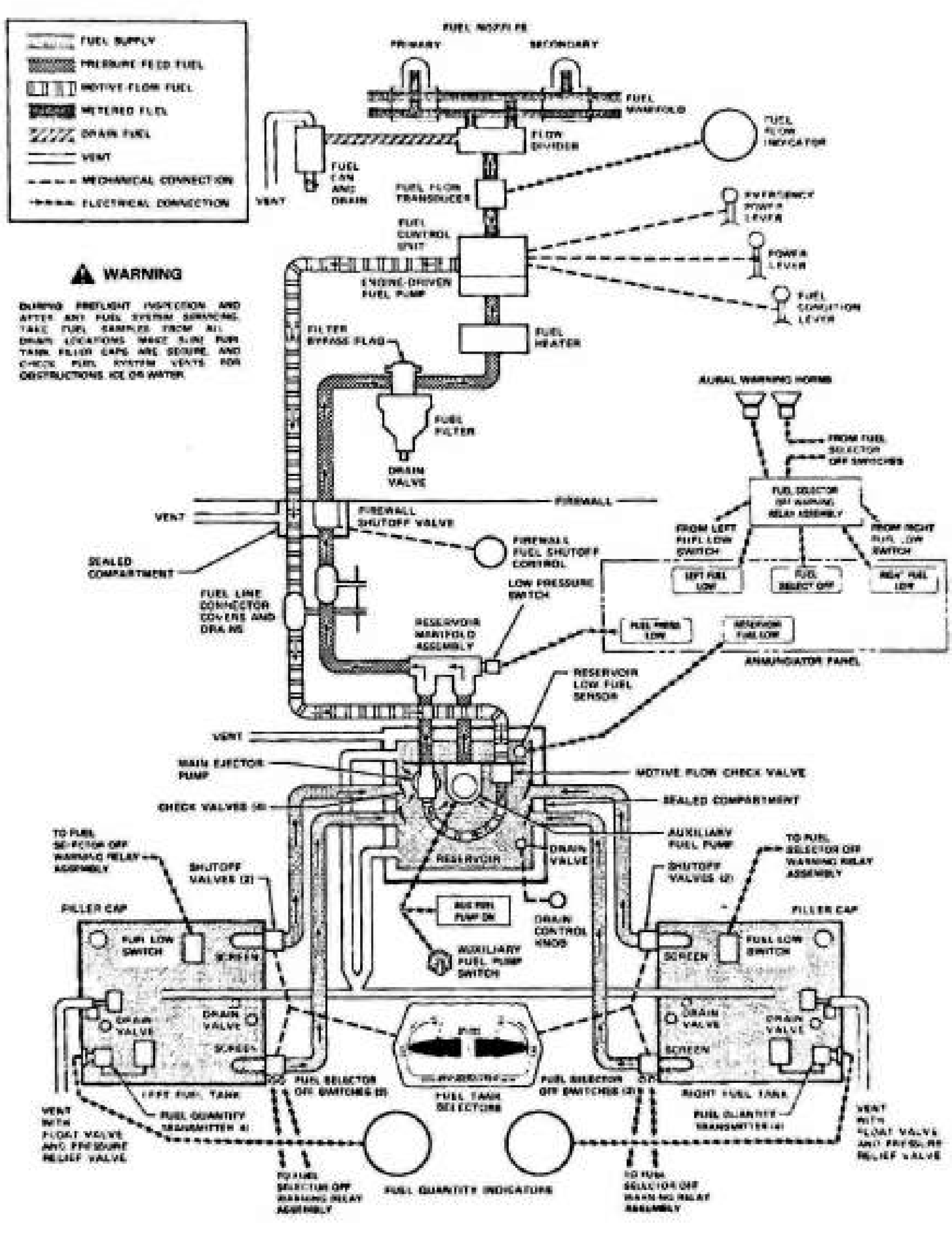

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Figure 7-10. Fuel System

FUEL QUANTITY DATA

UNITS OF MEASURE	FUEL LEVEL (QUANTITY EACH TANK)	TOTAL FUEL	TOTAL UNUSABLE	TOTAL USABLE ALL FLIGHT CONDITIONS
POUNDS	FULL (OUTBOARD FILLERS) 1122.25 **1124.25**	2244.5 **2248.5**	20.1 **24.1**	2244.4 **2224.4**
GALLONS (U.S.)	FULL (OUTBOARD FILLERS) 167.5 **167.8**	335 335.6	3.0 **3.6**	332 **332**
POUNDS	FULL (INBOARD FILLERS) 804 **806**	1608 **1612**	20.1 **24.1**	1587.9 **1587.9**
GALLONS (U.S.)	FULL (INBOARD FILLERS) 120.0 **120.3**	240 **240.6**	3.0 **3.6**	237 **237**

NOTE

1. Pounds/gallons in light-faced type are capacities for S/N 20800001 thru 20800130 not modified with SK208-52 (wing tank sump).
2. Pounds/gallons in **bold-faced** type are capacities for S/N 20800001 thru 20800130 modified with SK208-52 (wing tank sump) and S/N 20800131 and On.
3. Pounds are based on a fuel specific weight of 6.7 pounds per U.S. gallon.

WARNING

TO ACHIEVE FULL CAPACITY, FILL FUEL TANK TO THE TOP OF THE FUEL FILLER NECK. FILLING FUEL TANKS TO THE BOTTOM OF THE FUEL FILLER COLLAR (LEVEL WITH FLAPPER VALVE) ALLOWS SPACE FOR THERMAL EXPANSION AND RESULTS IN A DECREASE IN FUEL CAPACITY OF FOUR GALLONS PER SIDE (EIGHT GALLONS TOTAL).

FUEL SYSTEM (Continued)

FUEL FLOW INDICATOR

A fuel flow indicator, located at the top of the instrument panel, indicates the fuel consumption of the engine in pounds per hour based on Jet A fuel. The indicator measures the flow of fuel downstream of the fuel control unit just before being routed into the flow divider. When power is removed from the indicator, the needle will stow below zero in the OFF band.

The fuel flow indicator receives power from a "pull-off" type circuit breaker labeled FUEL FLOW, on the left sidewall switch and circuit breaker panel.

FUEL QUANTITY INDICATORS

Fuel quantity is measured by eight fuel quantity transmitters (four in each tank) and indicated by two electrically-operated fuel quantity indicators on the upper portion of the instrument panel. The fuel quantity indicators, which measure volume, are calibrated in pounds (based on the weight of Jet A fuel on a standard day) and gallons. An empty tank is indicated by a red line and the letter E. When an indicator shows an empty tank, approximately 2.5 gallons (2.8 gallons in S/N 20800001 thru 20800130 modified with SK208-52 and S/N 20800131 and On) remain in the tank as unusable fuel. The left and right fuel quantity indicators each receive power from a "pull-off" type circuit breaker. The breakers are labeled LEFT FUEL QTY and RIGHT FUEL QTY, respectively, and are located on the left sidewall switch and circuit breaker panel.

WARNING

BECAUSE OF THE RELATIVELY LONG FUEL TANKS, FUEL QUANTITY INDICATOR ACCURACY IS AFFECTED BY UNCOORDINATED FLIGHT OR A SLOPING RAMP IF READING THE INDICATORS WHILE ON THE GROUND. THEREFORE, TO OBTAIN ACCURATE FUEL QUANTITY READINGS, VERIFY THAT THE AIRPLANE IS PARKED IN A LATERALLY LEVEL CONDITION, OR IF IN FLIGHT, MAKE SURE THE AIRPLANE IS IN A COORDINATED AND STABILIZED CONDITION.

(Continued Next Page)

FUEL SYSTEM (Continued)

WING TANK FUEL LOW WARNING ANNUNCIATORS

Two amber fuel low warning annunciators, one for each wing tank, are located on the annunciator panel. The annunciators are labeled LEFT FUEL LOW and RIGHT FUEL LOW. Each annunciator will illuminate when the fuel in the respective tank is 25 gallons or less.

RESERVOIR FUEL LOW WARNING ANNUNCIATOR

A red reservoir fuel low warning annunciator is located on the annunciator panel. The annunciator is labeled RESERVOIR FUEL LOW, and will illuminate when the level of fuel in the reservoir drops to approximately one-half full.

FUEL PRESSURE LOW WARNING ANNUNCIATOR

An amber fuel pressure low warning annunciator is located on the annunciator panel. The annunciator is labeled FUEL PRESS LOW, and will illuminate when fuel pressure in the reservoir fuel manifold assembly is below 4.75 psi.

AUXILIARY FUEL PUMP ON ANNUNCIATOR

An amber auxiliary fuel pump on annunciator is located on the annunciator panel. The annunciator is labeled AUX FUEL PUMP ON and will illuminate when the auxiliary boost pump is operating, such as when the auxiliary boost pump switch is placed in the ON position or when the auxiliary boost pump switch is in the NORM position and fuel pressure in the fuel manifold assembly drops below 4.75 psi.

(Continued Next Page)

FUEL SYSTEM (Continued)

DRAIN VALVES

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. Drain valves are located on the lower surface of each wing at the inboard end of the fuel tank, in fuel tank external sumps on S/N 20800001 thru 20800130 modified with SK208-52 and S/N 20800131 and On, on the underside of the reservoir tank, and on the underside of the fuel filter. Outboard fuel tank drain valves may be installed, and their use is recommended if the airplane is parked with one wing low on a sloping ramp (as evidenced by the ball of the turn and bank indicator displaced from center). The drain valves for the wing tanks (and their external sumps, if installed) are tool-operated poppet type and are flush-external mounted. The wing tank and external sump drain valves are constructed so that the Phillips screwdriver on the fuel sampler which is provided can be utilized to depress the valve and then twist to lock the drain valve in the open position. The drain valve for the reservoir consists of a recessed T-handle which can be depressed and then turned to lock the valve open. The drain valve for the fuel filter consists of a drain pipe which can be depressed upward to drain fuel from the filter. The fuel sampler can be used on all of these drain valves for fuel sampling and purging of the fuel system. The fuel tanks should be filled after each flight when practical to minimize condensation.

Before each flight of the day and after each refueling, use a clear sampler and drain fuel from the inboard fuel tank sump (and external sump, if installed) quick-drain valves, fuel reservoir quick-drain valve, and fuel filter quick-drain valve to determine if contaminants are present, and that the airplane has been fueled with the proper fuel. If the airplane is parked with one wing low on a sloping ramp, draining of the outboard fuel tank sump quick-drain valves (if installed) is also recommended. If contamination is detected, drain all fuel drain points again. Take repeated samples from **all** fuel drain points until all contamination has been removed. If after repeated sampling, evidence of contamination still exists, the fuel tanks should be completely drained and the fuel system cleaned. **Do not** fly the airplane with contaminated or unapproved fuel.

WARNING

JP-4 AND OTHER NAPHTHA BASED FUELS CAN CAUSE SEVERE SKIN AND EYE IRRITATION.

(Continued Next Page)

FUEL SYSTEM (Continued)

FUEL DRAIN CAN

When the engine is shut down, residual fuel in the engine drains into a fuel drain can mounted on the front left side of the firewall. This can should be drained once a day or at an interval not to exceed six engine shutdowns. A drain valve on the bottom side of the cowling enables the pilot to drain the contents of the fuel drain can into a suitable container.

FUEL PUMP DRAIN RESERVOIR

To control expended lubricating oil from the engine fuel pump drive coupling area and provide a way to determine if fuel is leaking past the fuel pump seal, early serial airplanes modified with Service Kit SK 208-57 and later serial airplanes are equipped with a drainable reservoir to collect this allowable discharge of oil and any fuel seepage. The reservoir is mounted on the front left side of the firewall. It should be drained once a day or at an interval not to exceed six engine shutdowns. A drain valve on the bottom side of the cowling enables the pilot to drain the contents of the reservoir into a suitable container. A quantity of up to 3 cc of oil and 20 cc of fuel discharge per hour of engine operation is allowable. If the quantity of oil or fuel drained from the reservoir is greater than specified, the source of leakage should be identified and corrected prior to further flight.

BRAKE SYSTEM

The airplane has a single-disc, hydraulically-actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (front passenger's) set of rudder pedals, which are interconnected. When the airplane is parked, both main wheel brakes may be set by utilizing the parking brake which is operated by a handle on the lower left side of the instrument panel. To apply the parking brake, set the brakes with the rudder pedals and pull the handle aft. To release the parking brake, push the handle fully in.

(Continued Next Page)

BRAKE SYSTEM (Continued)

A brake fluid reservoir, located just forward of the firewall on the left side of the engine compartment, provides additional brake fluid for the brake master cylinders. The fluid in the reservoir should be checked for proper level prior to each flight.

For maximum brake life, keep the brake system properly maintained. Early serial airplanes were equipped with organic-type brake linings, and brake life is prolonged by conservative brake application during taxi operations and landing. Airplanes with serial numbers 20800136 and On, and early serial airplanes with replaced linings may have metallic-type brakes, and these were given a special brake burn-in before delivery (or after brake replacement). Unlike organic brakes, the day-to-day braking technique is different. When conditions permit, hard brake application is beneficial in that the resulting higher brake temperatures tend to maintain proper brake glazing and will prolong the expected brake life. Conversely, the habitual use of light and conservative brake application is detrimental to metallic brakes.

Some of the symptoms of impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If, during taxi or landing roll, braking action decreases, let up on the pedals and then re-apply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder, as required, to offset the good brake.

ELECTRICAL SYSTEM

The airplane is equipped with a 28-volt, direct-current electrical system (see Figure 7-12). The system uses a 24-volt lead-free battery; or 24-volt sealed lead acid battery; or 24-volt Ni-Cad battery located on the front right side of the firewall, as a source of electrical energy. A 200-amp engine-driven starter-generator is used to maintain the battery's state of charge. Power is supplied to most general electrical and all avionics circuits through two general buses, two avionics buses, and a battery bus. The battery bus is energized continuously for memory keep-alive, clock, and cabin/courtesy lights functions. The two general buses are on anytime the battery switch is turned on. All DC buses are on anytime the battery switch and the two avionics switches are turned on.

(Continued Next Page)

ELECTRICAL SYSTEM (Continued)

An optional standby electrical system, which consists of an engine-driven alternator and separate busing system, may be installed in the airplane. For details of this system, refer to Section 9, Supplements.

GENERATOR CONTROL UNIT

The generator control unit (GCU) is mounted inside the cabin on the left forward fuselage sidewall. The unit provides the electrical control functions necessary for the operation of the starter-generator. The GCU provides for automatic starter cutoff when engine RPM is above 46%. Below 46%, the starter-generator functions as a starter, and above 46%.

The starter-generator functions as a generator when the starter switch is OFF. The GCU provides voltage regulation plus high voltage protection and reverse current protection. In the event of a high-voltage or reverse current condition, the generator is automatically disconnected from the buses. The generator contactor (controlled by the GCU) connects the generator output to the airplane bus. If any GCU function causes the generator contactor to de-energize, the red GENERATOR OFF light on the annunciator panel will come on.

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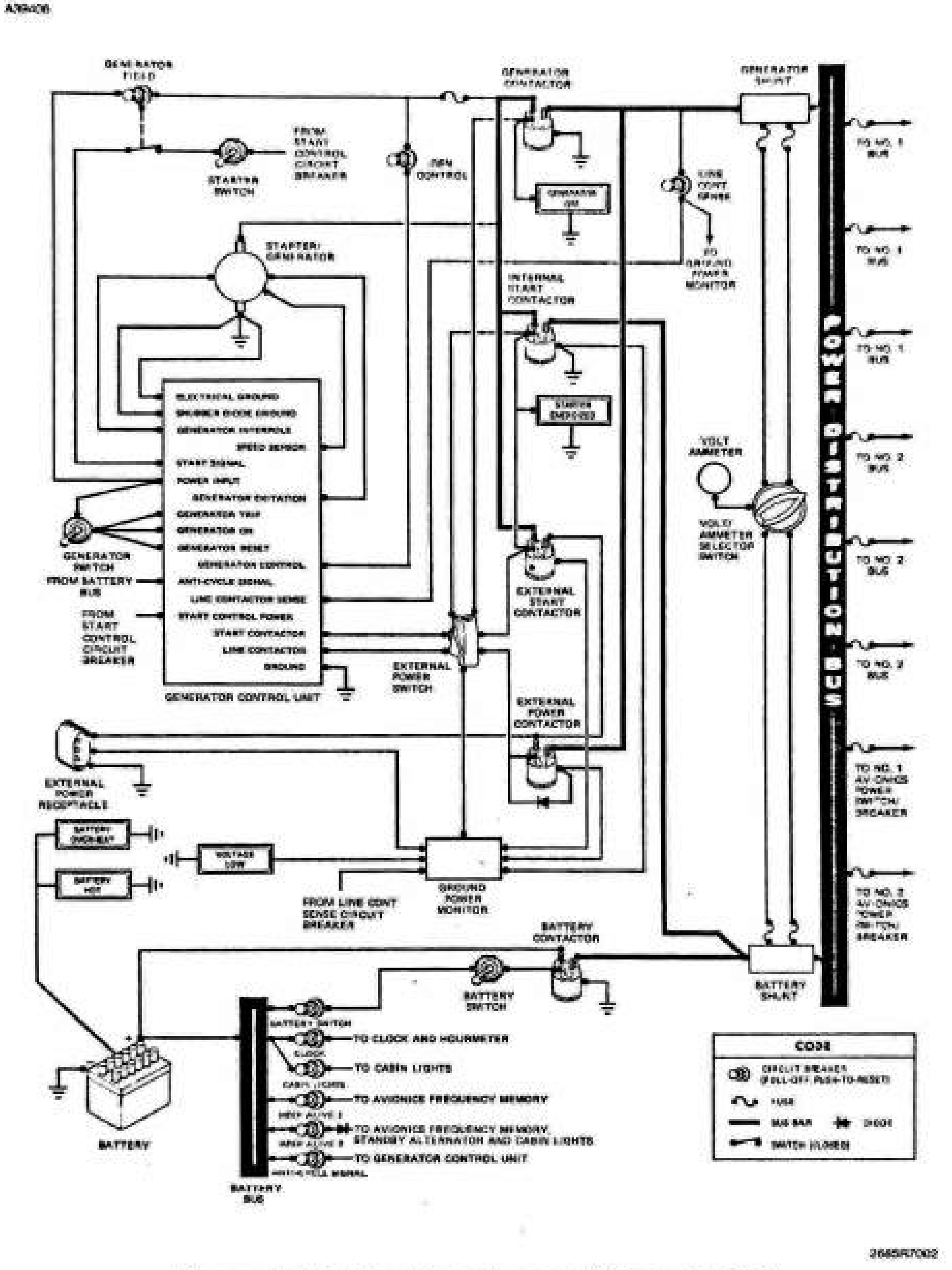

Figure 7-12. Electrical System (Sheet 1 of 3)

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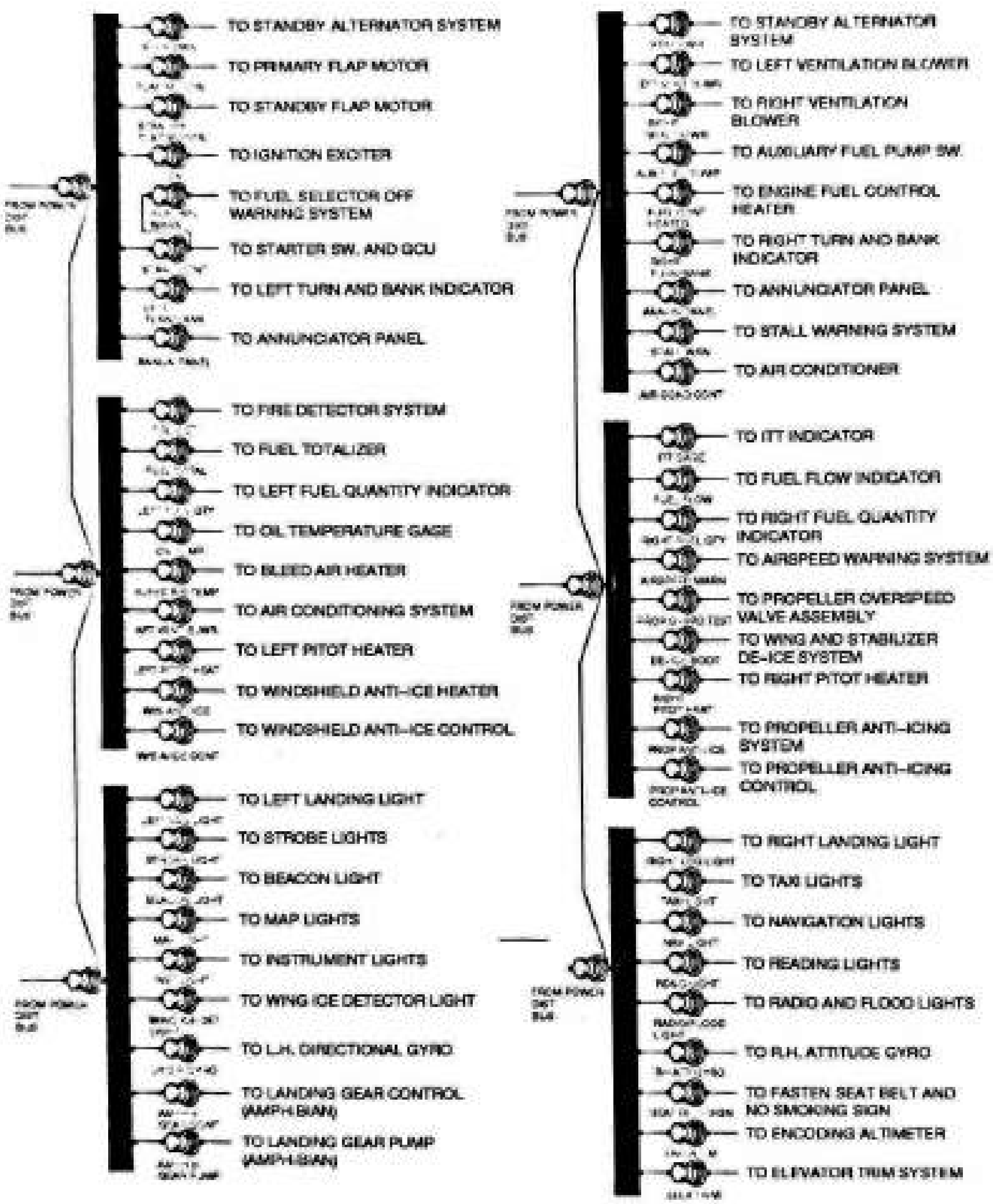

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Figure 7-12. Electrical System (Sheet 2 of 3)

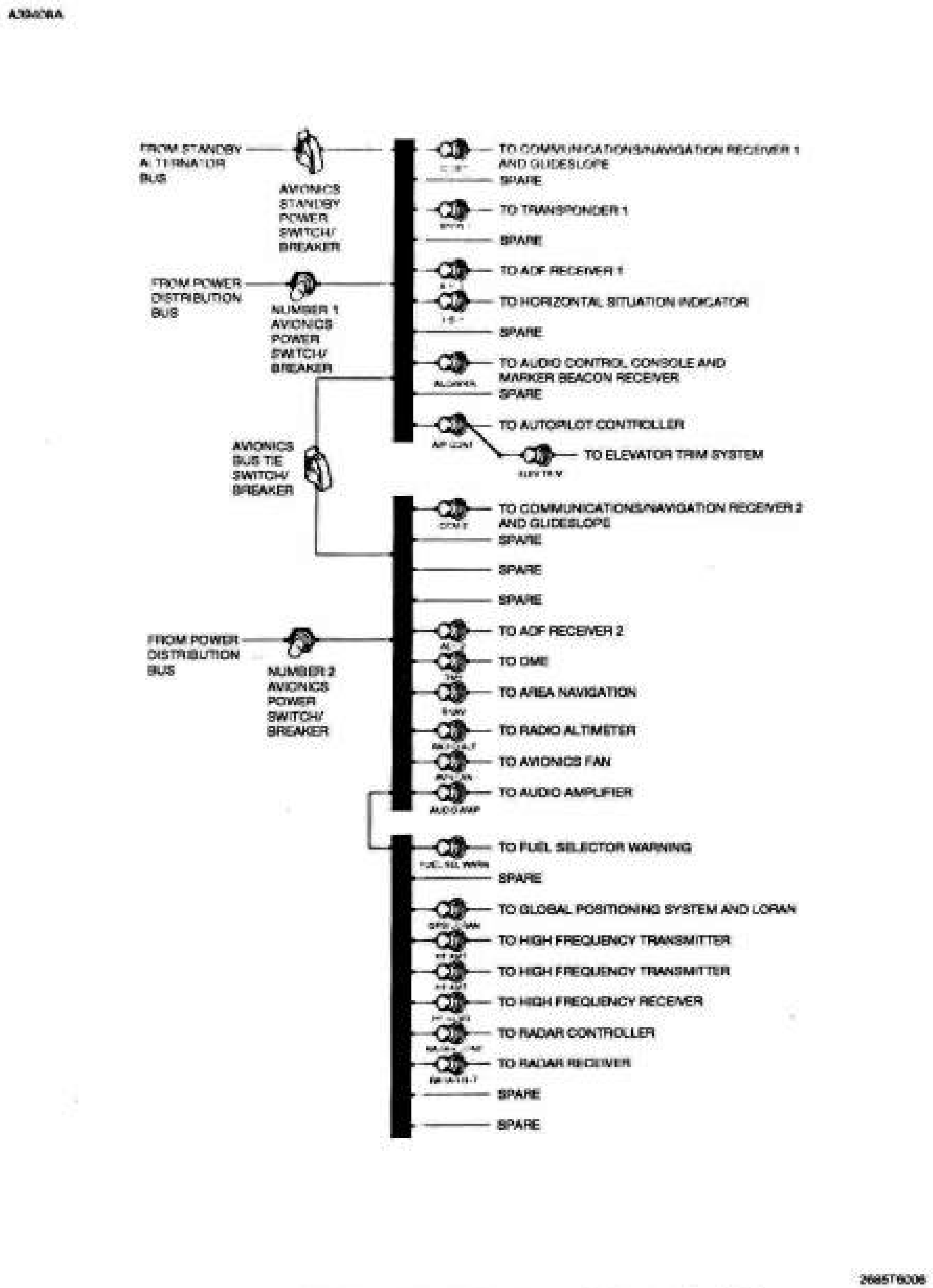

Figure 7-12. Electrical System (Sheet 3 of 3)

ELECTRICAL SYSTEM (Continued)

GROUND POWER MONITOR

The ground power monitor is located inside the electrical power control assembly mounted on the left hand side of the firewall in the engine compartment. This unit senses the voltage level applied to the external power receptacle and will close the external power contactor when the applied voltage is within the proper limits. In addition, the ground power monitor senses airplane bus voltage and will illuminate the VOLTAGE LOW light on the annunciator panel when bus voltage drops to battery voltage.

BATTERY SWITCH

The battery switch is a two-position toggle-type switch, labeled BATTERY, and is located on the left sidewall switch and circuit breaker panel. The battery switch is ON in the forward position and OFF in the aft position. When the battery switch is in the ON position, battery power is supplied to the two general buses. The OFF position cuts off power to all buses except the battery bus.

STARTER SWITCH

The starter switch is a three-position toggle-type switch, labeled STARTER, on the left sidewall switch and circuit breaker panel. The switch has OFF, START, and MOTOR positions. For additional details of the starter switch, refer to the Starting System paragraph in this section.

(Continued Next Page)

ELECTRICAL SYSTEM (Continued)

IGNITION SWITCH

The ignition switch is a two-position toggle-type switch, labeled IGNITION, on the left sidewall switch and circuit breaker panel. The switch has ON and NORMAL positions. For additional details of the ignition switch, refer to the Ignition System paragraph in this section.

GENERATOR SWITCH

The generator switch is a three-position toggle-type switch, labeled GENERATOR, on the left sidewall switch and circuit breaker panel. The switch has ON, RESET, and TRIP positions. With the switch in the ON position, the GCU will automatically control the generator line contactor for normal generator operation. The RESET and TRIP positions are momentary positions and are spring-loaded back to the ON position. If a momentary fault should occur in the generating system (as evidenced by the GENERATOR OFF and/or VOLTAGE LOW lights illuminating), the generator switch can be momentarily placed in the RESET position to restore generator power. If erratic operation of the generating system is observed, the system can be shutoff by momentarily placing the generator switch to the TRIP position. After a suitable waiting period, generator operation may be recycled by placing the generator switch momentarily to RESET.

AVIONICS POWER SWITCHES

Electrical power from the airplane power distribution bus to the avionics buses (see Figure 7-12) is controlled by two toggle-type switch breakers located on the left sidewall switch and circuit breaker panel. One switch controls power to the number 1 avionics bus while the other switch controls power to the number 2 avionics bus. The switches are labeled AVIONICS and are ON in the forward position and OFF in the aft position. The avionics power switches should be placed in the OFF position prior to turning the battery switch ON or OFF, starting the engine, or applying an external power source. The avionics power switches may be used in place of the individual avionics equipment switches.

(Continued Next Page)

ELECTRICAL SYSTEM (Continued)

AVIONICS BUS TIE SWITCH

The avionics bus tie switch is a two-position guarded toggle-type switch located on the left sidewall switch and circuit breaker panel. The switch connects the number 1 and number 2 avionics buses together in the event of failure of either bus feeder circuit. Since each avionics bus is supplied power from a separate current limiter on the power distribution bus, failure of a current limiter can cause failure of the affected bus. Placing the bus tie switch to the ON position will restore power to the failed bus. Operation without both bus feeder circuits may require an avionics load reduction, depending on equipment installed.

EXTERNAL POWER SWITCH

The external power switch is a three-position guarded toggle-type switch located on the left sidewall switch and circuit breaker panel. The switch has OFF, STARTER, and BUS positions and is guarded in the OFF position. When the switch is in the OFF position, battery power is provided to the main bus and to the starter-generator circuit, external power cannot be applied to the main bus, and, with the generator switch in the ON position, power is applied to the generator control circuit. When the external power switch is in the STARTER position, external power is applied to the starter circuit only and battery power is provided to the main bus. No generator power is available in this position. When the external power switch is in the BUS position, external power is applied to the main bus and no power is available to the starter. The battery, if desired, can be connected to the main bus and external power by the battery switch; however, battery charge should be monitored to avoid overcharge.

(Continued Next Page)

ELECTRICAL SYSTEM (Continued)

CIRCUIT BREAKERS

Most of the electrical circuits in the airplane are protected by "pull-off" type circuit breakers mounted on the left sidewall switch and circuit breaker panel. Should an overload occur in any circuit, the controlling circuit breaker will trip, opening the circuit. After allowing the circuit breaker to cool for approximately three minutes, it may be reset (pushed in).

WARNING

MAKE SURE ALL CIRCUIT BREAKERS ARE ENGAGED BEFORE ALL FLIGHTS. NEVER OPERATE WITH DISENGAGED CIRCUIT BREAKERS WITHOUT A THOROUGH KNOWLEDGE OF THE CONSEQUENCES.

VOLT/AMMETER AND SELECTOR SWITCH

A volt/ammeter and four-position rotary-type selector switch are mounted on the left side of the instrument panel so that electrical system operation can be monitored. The selector switch has GEN, ALT, BATT, and VOLT positions and selects either generator current, standby alternator current, battery charge or discharge current, or system voltage, respectively, on the volt/ammeter. The ALT position of the selector switch is used for the optional standby alternator system which may not be installed on some airplanes. In that case, the position will be inoperative. Refer to Standby Electrical System in Section 9 of this handbook for further details.

ANNUNCIATOR LIGHTS

Six lights on the annunciator panel indicate the condition of the electrical system to the pilot. These lights are GENERATOR OFF, VOLTAGE LOW, BATTERY OVERHEAT, STARTER ENERGIZED, BATTERY HOT, and IGNITION ON. These lights should be observed at all times during airplane operation and if any light illuminates unexpectedly, a malfunction may have occurred and appropriate action should be undertaken to correct the problem. For details of other lights on the annunciator panel, refer to the Annunciator Panel paragraph in this section.

(Continued Next Page)

ELECTRICAL SYSTEM (Continued)

GROUND SERVICE PLUG RECEPTACLE

A ground service plug receptacle permits the use of an external power source for cold weather starting and during lengthy maintenance work on the electrical and avionics equipment. External power control circuitry is provided to prevent the external power and the battery from being connected together during starting. The external power receptacle is installed on the left side of the engine compartment near the firewall.

The ground service circuit incorporates polarity reversal and overvoltage protection. Power from the external power source will flow only if the ground service plug is correctly connected to the airplane. If the plug is accidentally connected backwards or the ground service voltage is too high, no power will flow to the electrical system, thereby preventing any damage to electrical equipment.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Exterior lighting consists of three navigation lights, two landing lights, two taxi/recognition lights, and two strobe lights. A flashing beacon and two under-wing courtesy lights are also available. All exterior lights are controlled by toggle switches located on the lighting control panel on the left side of the instrument panel. The toggle switches are ON in the up position and OFF in the down position.

NAVIGATION LIGHTS

Conventional navigation lights are installed on the wing tips and tailcone stinger. The lights are protected by a "pull-off" type circuit breaker, labeled NAV LIGHT, on the left sidewall switch and circuit breaker panel.

LANDING LIGHTS

Two landing lights are installed on the airplane, one in each wing leading edge mounted outboard. The lights provide illumination forward and downward during takeoff and landing. The lights are protected by two "pull-off" type circuit breakers, labeled LEFT LDG LT and RIGHT LDG LT, on the left sidewall switch and circuit breaker panel.

(Continued Next Page)

LIGHTING SYSTEMS (Continued)

NOTE

It is not recommended that the landing lights be used to enhance the visibility of the airplane in the traffic pattern or enroute, because of their relatively short service life. The taxi/recognition lights have considerably longer service life and are designed for this purpose, if desired.

TAXI/RECOGNITION LIGHTS

Two taxi/recognition lights are mounted inboard of each landing light in each wing leading edge. The lights are focused to provide illumination of the area forward of the airplane during ground operation and taxiing. The lights are also used to enhance the visibility of the airplane in the traffic pattern or enroute. The taxi/recognition lights are protected by a "pull-off" type circuit breaker, labeled TAXI LIGHT on the left sidewall switch and circuit breaker panel.

STROBE LIGHTS

A high intensity strobe light system is installed on the airplane. The system includes two strobe lights (with remote power supplies) located one on each wing tip. The lights are used to enhance anticollision protection for the airplane and are the required anticollison lights for night operations. The strobe lights are protected by a "pull-off" type circuit breaker, labeled STROBE LIGHT, on the left sidewall switch and circuit breaker panel.

WARNING

STROBE LIGHTS SHOULD BE TURNED OFF WHEN TAXIING. GROUND OPERATION OF THE HIGH INTENSITY ANTICOLLISION LIGHTS CAN BE OF CONSIDERABLE ANNOYANCE TO GROUND PERSONNEL AND OTHER PILOTS. DO NOT OPERATE THE ANTI-COLLISION LIGHTS IN CONDITIONS OF FOG, CLOUDS, OR HAZE AS THE REFLECTION OF THE LIGHT BEAM CAN CAUSE DISORIENTATION OR VERTIGO.

(Continued Next Page)

LIGHTING SYSTEMS (Continued)

FLASHING BEACON LIGHT

A red flashing beacon light is installed on the top of the vertical fin as additional anticollision protection in flight and for recognition during ground operation. The light is visible through 360°. The flashing beacon light circuit is protected by a "pull-off" type circuit breaker, labeled BEACON LIGHT, on the left sidewall switch and circuit breaker panel.

WARNING

THE FLASHING BEACON SHOULD NOT BE USED WHEN FLYING THROUGH CLOUDS OR OVERCAST; THE FLASHING LIGHT REFLECTED FROM WATER DROPLETS OR PARTICLES IN THE ATMOSPHERE, PARTICULARLY AT NIGHT, CAN CAUSE DISORIENTATION OR VERTIGO.

COURTESY LIGHTS

Two courtesy lights may be installed, one under each wing. The lights illuminate the area outside of the airplane adjacent to the crew entry doors. The lights operate in conjunction with the cabin lights and are controlled by the cabin light switches as described in the Cabin Lights paragraph in this section.

INTERIOR LIGHTING

Instrument and control panel lighting is provided by integral, flood, and post lights. Four concentric-type dual lighting control knobs are grouped together on the lower part of the instrument panel to the left of the control pedestal. These four controls vary the intensity of the instrument panel lighting, the left sidewall switch and circuit breaker panel lighting, the pedestal lighting, and the overhead panel lighting. The following paragraphs describe the function of these controls. Other miscellaneous lighting provided or available includes a control wheel maplight, cabin lights, passenger reading lights, and a no smoking/seat belt sign. Discussion of these lights and their controls is also included in the following paragraphs.

(Continued Next Page)

LIGHTING SYSTEMS (Continued)

LEFT FLIGHT PANEL/LEFT FLOOD LIGHTING CONTROL KNOBS

The large (outer) knob of this control, labeled L FLT PANEL, varies the intensity of the postlights illuminating the left portion of the instrument panel directly in front of the pilot. The control also varies the intensity of the integral lighting of the digital clock, HSI, ADI, and radio instruments. The small (inner) knob of the control, labeled L FLOOD, varies the brightness of the left side floodlight located on the right aft side of the overhead panel. This floodlight may also be used to illuminate the left sidewall switch and circuit breaker panel. Clockwise rotation of either of the concentric control knobs increases lamp brightness and counterclockwise rotation decreases brightness.

RIGHT FLIGHT PANEL/RIGHT FLOOD LIGHTING CONTROL KNOBS

The large (outer) knob of this control, labeled R FLT PANEL, varies the intensity of the postlights illuminating the right flight panel directly in front of the right passenger. The small (inner) knob of this control, labeled R FLOOD, varies the brightness of the right side floodlight located on the left aft side of the overhead panel. Clockwise rotation of either of the concentric control knobs increases lamp brightness and counterclockwise rotation decreases brightness.

LOWER PANEL, PEDESTAL, OVERHEAD, SWITCH/CIRCUIT BREAKER LIGHTING CONTROL KNOBS

The large (outer) knob of this control, labeled LWR PANEL/PED/OVHD, varies the intensity of postlights and a floodlight illuminating the lower portion of the instrument panel, a floodlight illuminating the pedestal, and lights illuminating the overhead panel and OAT gage. The small (inner) knob of the control, labeled SW/CKT BKR, varies the intensity of two floodlights illuminating the left sidewall switch and circuit breaker panel. Clockwise rotation of either of the concentric control knobs increases lamp brightness and counterclockwise rotation decreases brightness.

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LIGHTING SYSTEM (Continued)

ENGINE INSTRUMENTS/RADIO LIGHTING CONTROL KNOBS

The large (outer) knob of this control, labeled ENG INST, varies the intensity of the post lights which illuminate the engine instruments on the top center of the instrument panel and the intensity of the dimmable lamps on the annunciator panel. The small (inner) knob of this control, labeled RADIO, controls the integral lights and digital readouts of the avionics equipment. Clockwise rotation of either of the concentric control knobs increases lamp brightness and counterclockwise rotation decreases brightness. However, extreme counterclockwise rotation of the RADIO knob turns the digital readouts on bright for daylight viewing.

CONTROL WHEEL MAPLIGHT

A control wheel maplight is mounted on the bottom of the pilot's control wheel. This light illuminates the lower portion of the cabin in front of the pilot, and is used for checking maps and other flight data during night operation. Brightness of the light is adjusted with a rheostat control knob on the bottom of the control wheel.

CABIN LIGHTS

Three cabin lights are installed in the interior of the airplane to facilitate boarding or deplaning the airplane or loading and unloading cargo during night operations. On the Standard 208, the lights are located one above the aisle, one above the aft cargo door, and one above the passenger entry door. On the Cargomaster, the lights are located one above the center of the forward cargo area, one above the aft cargo door, and one on the aft right side of the aft cargo area. These lights (and the courtesy light located under each wing) are controlled by a two-position toggle switch, labeled CABIN, on the lighting control panel, a rocker-type switch, located just forward of the cargo door on the inside left sidewall and, on the Standard 208, a rocker-type switch located just forward of the passenger entry door on the inside right sidewall. Activating either of these switches turns on the cabin lights regardless of the corresponding position of the other switches. This light circuit does not require power to be applied to the main electrical system buses (battery switch on) for operation. The courtesy lights circuit may be equipped with a solid-state timer which allows the lights to remain illuminated for a period of 30 minutes after the lights have been turned on.

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LIGHTING SYSTEM (Continued)

PASSENGER READING LIGHTS (Standard 208 Only)

Passenger reading lights may be installed at each of the aft passengers positions. The lights are located above the window line in small convenience panels above each seat. A pushbutton-type ON, OFF switch, mounted in each panel, controls the lights. The lights can be pivoted in their mounting sockets to provide the most comfortable angle of illumination for the passenger.

NO SMOKING/SEAT BELT SIGN (Standard 208 Only)

A lighted warning sign may be installed in the airplane to facilitate warning passengers of impending flight operations necessitating the fastening of seat belts and/or the extinguishing of all smoking materials. This installation consists of a small lighted panel mounted in the cabin headliner immediately aft of the overhead console and two toggle-type switches, labeled SEAT BELT and NO SMOKE, on the lighting control panel. When these switches are placed in the ON position, the warning signs illuminate, displaying the international graphic symbolism for "fasten seat belts" and "no smoking" to the rear cabin passengers. The circuit for the warning sign lights is protected by a "pull-off" type circuit breaker, labeled SEAT BELT SIGN, on the left sidewall switch and circuit breaker panel.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow to the cabin is regulated by the cabin heating, ventilating and defrosting system (see Figure 7-13). In the heating system, hot compressor outlet air is routed from the engine through a flow control valve, then through a mixer/muffler where it is mixed with cabin return air or warm air from the compressor bleed valve (depending on the setting of the mixing air valve) to obtain the correct air temperature before the air is routed to the cabin air distribution system. Controls are provided to direct the heated air to the forward and/or aft portions of the cabin for heating and to the windshield for defrosting. Ventilating air is obtained from an inlet on each side at the forward fuselage and through two ram air inlets, one on each wing at the upper end of the wing struts. The wing inlet ventilating air is routed through the wing into a plenum chamber located in the center of the cabin top. The plenum distributes the ventilating air to individual overhead outlets at each seat position. Two electric blowers are available for the overhead ventilating system. Details of this installation are presented in Section 9, Supplements.

BLEED AIR HEAT SWITCH

A two-position toggle switch, labeled BLEED AIR HEAT, is located on the cabin heat switch and control panel. The switch controls the operation of the bleed air flow control valve. The ON position of the switch opens the flow control valve, allowing hot bleed air to flow to the cabin heating system. The OFF position closes the valve, shutting off the flow of hot bleed air to the heating system.

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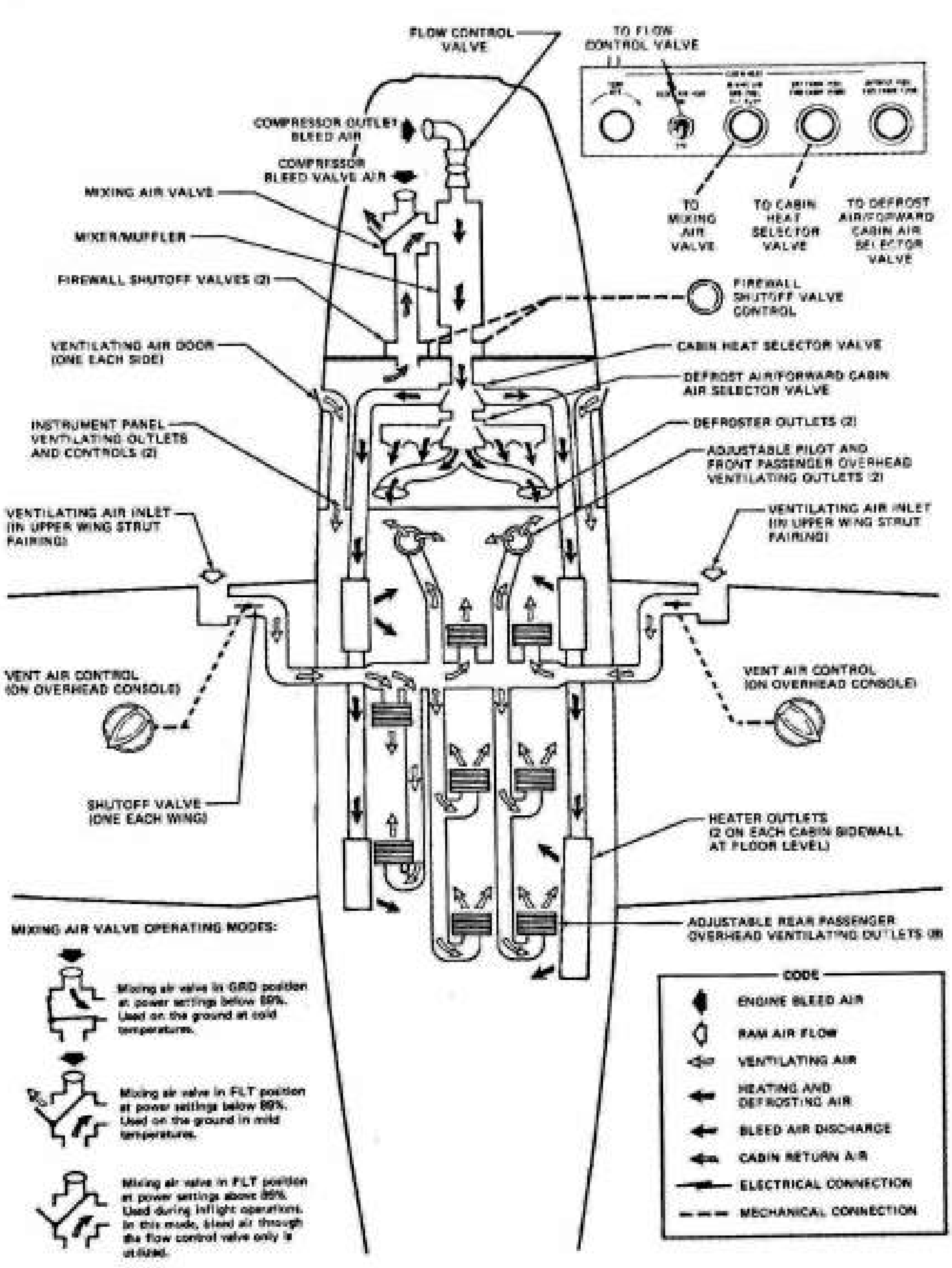

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Figure 7-13. Cabin Heating, Ventilating and Defrosting System (Passenger Version) (Sheet 1 or 2)

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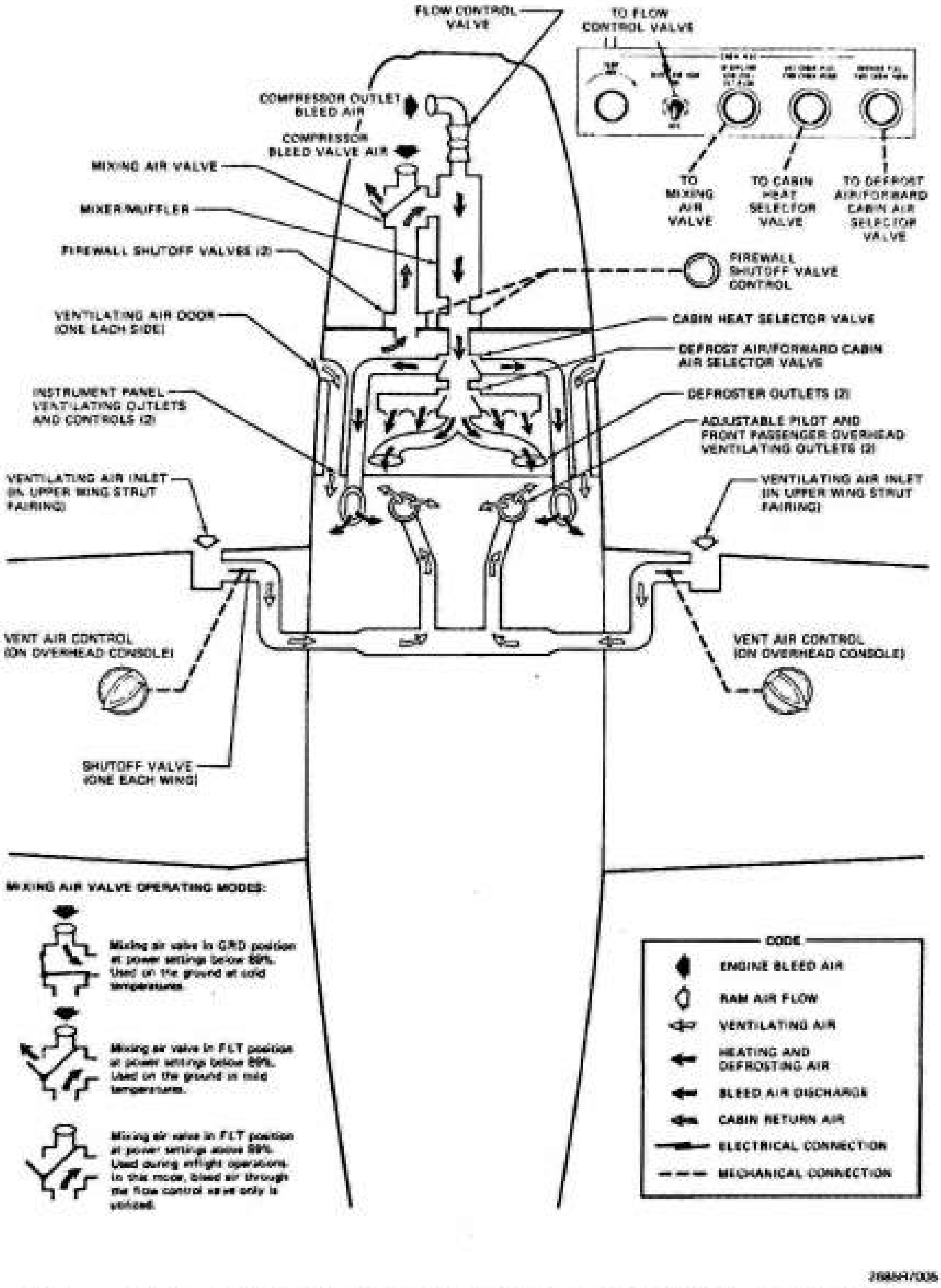

Figure 7-13. Cabin Heating, Ventilating and Defrosting System (Cargo Version) (Sheet 2 or 2)

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM (Continued)

TEMPERATURE SELECTOR KNOB

A rotary temperature selector knob, labeled TEMP, is located on the cabin heat switch and control panel. The selector modulates the opening and closing action of the flow control valve to control the amount and temperature of air flowing into the cabin. Clockwise rotation of the knob increases the mass flow and temperature of the air.

NOTE

- If more cabin heat is needed while on the ground, move the fuel condition lever to HIGH IDLE.
- Some hysteresis may be encountered when adjusting bleed air temperature. The resulting amount and temperature of bleed air may be different when approaching a particular temperature selector knob position from a clockwise versus a counterclockwise direction. Best results can usually be obtained by turning the temperature selector knob full clockwise and then slowly turning it counterclockwise to decrease bleed airflow to the desired amount.

A temperature sensor, located in the outlet duct from the mixer/muffler operates in conjunction with the temperature selector knob. In the event of a high temperature condition (overheat) in the outlet duct, the temperature sensor will be energized, closing the flow control valve and thus shutting off the source of hot bleed air from the engine.

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CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM (Continued)

MIXING AIR PUSH-PULL CONTROL

A push-pull control, labeled MIXING AIR, GRD-PULL, FLT-PUSH, is located on the cabin heat switch and control panel. With the push-pull control in the GRD position (pulled out), warm compressor bleed valve air is mixed with hot compressor outlet air in the mixer/muffler. This mode is used during ground operation when warm compressor bleed valve air is available (at power setting below 89% N_g) and can be used as additional bleed air heat to augment the hot compressor outlet bleed air supply during periods of cold ambient temperature. With the push-pull control in the FLT position (pushed in), cabin return air is mixed with the hot compressor outlet air in the mixer/muffler. This recirculation of cabin return air enables the heating system to maintain the desired temperature for proper cabin heating. If desired, the FLT position of the push-pull control can be used on the ground when ambient temperatures are mild and maximum heating is not required. In this mode, the excess warm compressor bleed valve air available at power settings below 89% N_g is exhausted overboard from the mixing air valve.

CAUTION

THE MIXING AIR PUSH-PULL CONTROL SHOULD ALWAYS BE IN THE FLT POSITION (PUSHED IN) WHEN THE AIRPLANE IS IN FLIGHT. CABIN RETURN AIR MUST BE ALLOWED TO FLOW THROUGH THE MIXING VALVE AND BLEND WITH HOT COMPRESSOR OUTLET AIR DURING HIGH ENGINE POWER OPERATION IN ORDER TO MAINTAIN PROPER TEMPERATURE IN THE CABIN HEAT DISTRIBUTION SYSTEM. IF THE FLT POSITION IS NOT USED DURING FLIGHT, THE SYSTEM MAY OVERHEAT AND CAUSE AN AUTOMATIC SHUTDOWN.

(Continued Next Page)

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM (Continued)

AFT/FORWARD CABIN PUSH-PULL CONTROL

A push-pull control, labeled AFT CABIN-PULL, FWD CABIN-PUSH, is located on the cabin heat switch and control panel. With the control in the AFT CABIN position (pulled out), heated air is directed to the aft cabin heater outlets located on the cabin sidewalls at floor level on the Standard 208 and the outlets in the floor behind the pilot and front passenger on the Cargomaster.

With the control in the FWD CABIN position (pushed in), heated air is directed to the forward cabin through four heater outlets located behind the instrument panel and/or the two windshield defroster outlets. The push-pull control can be positioned at any intermediate setting desired for proper distribution of heated air to the forward and aft cabin areas.

DEFROST/FORWARD CABIN PUSH-PULL CONTROL

A push-pull control, labeled DEFROST-PULL, FWD CABIN-PUSH, is located on the cabin heat switch and control panel. With the control in the DEFROST position (pulled out), forward cabin air is directed to two defroster outlets located at the base of the windshield (the aft/forward cabin push-pull control also must be pushed in for availability of forward cabin air for defrosting). With the defrost/forward cabin push-pull control in the FWD CABIN position (pushed in), heated air will be directed to the four heater outlets behind the instrument panel.

CABIN HEAT FIREWALL SHUTOFF KNOB

A push-pull shutoff knob, labeled CABIN HEAT FIREWALL SHUTOFF, PULL OFF, is located on the lower right side of the pedestal. When pulled out, the knob actuates two firewall shutoff valves, one in the bleed air supply line to the cabin heating system and one in the cabin return air line, to the off position. This knob should normally be pushed in unless a fire is suspected in the engine compartment.

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CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM (Continued)

CABIN HEAT FIREWALL SHUTOFF KNOB (Continued)

CAUTION

DO NOT PLACE THE CABIN HEAT FIREWALL SHUTOFF KNOB IN THE OFF POSITION WHEN THE MIXING AIR CONTROL IS IN THE GRD POSITION BECAUSE A COMPRESSOR STALL WILL OCCUR AT LOW POWER SETTINGS WHEN THE COMPRESSOR BLEED VALVE IS OPEN. THE ENGINE MUST BE SHUT DOWN TO RELIEVE BACK PRESSURE ON THE VALVES PRIOR TO OPENING THE VALVES.

VENT AIR CONTROL KNOBS

Two vent air control knobs, labeled VENT AIR, are located on the overhead console. The knobs control the operation of the shutoff valves in each wing which control the flow of ventilating air to the cabin. The knob on the right side of the console controls the right wing shutoff valve and similarly, the knob on the left side controls the left wing shutoff valve. When the vent air control knobs are rotated to the CLOSE position, the wing shutoff valves are closed; rotating the knobs to the OPEN position progressively opens the wing shutoff valves. When the optional cabin ventilation fans are installed, rotating the knobs to the full OPEN position also turns on the ventilation fans.

INSTRUMENT PANEL VENT KNOBS

Two vent knobs, labeled VENT, PULL ON, are located one on each side of the instrument panel. Each knob controls the flow of ventilating air from an outlet located adjacent to each knob. Pulling each knob opens a small air door on the fuselage exterior which pulls in ram air for distribution through the ventilating outlet.

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CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM (Continued)

VENTILATING OUTLETS

Adjustable ventilating outlets (one above each seat position) permit individual ventilation to the airplane occupants. The pilot's and front passenger's outlets are the swivel type for optimum positioning, and airflow volume is controlled by rotating the outlet nozzle which controls an internal valve. Eight additional rear seat passenger outlets on the Standard 208 are adjustable fore and aft, and each have a separate rotary type control beside the outlet, with positions labeled AIR ON and AIR OFF, to control airflow volume through the outlet.

OXYGEN SYSTEM

The airplane is equipped with oxygen system provisions which consist of the system plumbing for a 10-port system. If the airplane is equipped with a complete 2-port or 10-port oxygen system, refer to Section 9, Supplements, for complete details and operating instructions.

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, vertical speed indicator, and altimeter. The system is composed of a heated pitot-static tube mounted on the leading edge of the left wing, a static pressure alternate source valve located below the de-ice/anti-ice switch panel, a drain valve located on the left sidewall beneath the instrument panel, an airspeed pressure switch located behind the instrument panel, and the associated plumbing necessary to connect the instruments and sources.

The pitot-static heat system consists of a heating element in the pitot-static tube, a two-position toggle switch, labeled PITOT/STATIC HEAT, on the de-ice/anti-ice switch panel, and a "pull-off" type circuit breaker, labeled LEFT PITOT HEAT, on the left sidewall switch and circuit breaker panel. When the pitot-static heat switch is turned on, the element in the pitot-static tube is heated electrically to maintain proper operation in possible icing conditions.

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PITOT-STATIC SYSTEM AND INSTRUMENTS (Continued)

A static pressure alternate source valve is installed below the deice/anti-ice switch panel, and can be used if the static source is malfunctioning. This valve supplies static pressure from inside the cabin instead of from the pitot-static tube. If erroneous instrument readings are suspected due to water or ice in the pressure line going to the static pressure source, the alternate source valve should be pulled on. Pressures within the cabin will vary with vents open or closed. Refer to Sections 3 and 5 for the effect of varying cabin pressures on airspeed and altimeter readings.

A drain valve is incorporated into the system and is located on the left cabin sidewall beneath the instrument panel. The valve is used to drain suspected moisture accumulation in the system by lifting the drain valve lever to the OPEN position as indicated by the placard adjacent to the valve. The valve must be returned to the CLOSED position prior to flight.

An airspeed pressure switch in the pitot-static system is used to actuate an airspeed warning horn in the event excessive airspeed is inadvertently attained. The horn is located behind the headliner in the area above the pilot, and will sound when airspeed exceeds V_{MO} (175 KIAS). A warning signal may also be heard in the pilot's headset.

RIGHT FLIGHT INSTRUMENT PANEL PITOT-STATIC SYSTEM

A second, independent pitot-static system is included whenever the right flight instrument panel is installed. The system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, vertical speed indicator, and altimeter utilized in the right flight panel instrument group. The system is composed of a heated pitot-static tube on the leading edge of the right wing, a drain valve on the right cabin sidewall beneath the instrument panel, and the plumbing necessary to connect the instruments to the sources. The right pitot-static system is not connected to the pilot's flight instrument pitot-static (left) system.

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PITOT-STATIC SYSTEM AND INSTRUMENTS (Continued)

PITOT-STATIC SYSTEM AND INSTRUMENTS (Continued)

The pitot-static heat system for the right flight instrument panel consists of a heating element in the right pitot-static tube, the standard system two-position toggle switch, labeled PITOT/STATIC HEAT, on the de-ice/anti-ice switch panel, a "pull-off" type circuit breaker, labeled RIGHT PITOT HEAT, on the left sidewall switch and circuit breaker panel, and the associated wiring.

The drain valve incorporated into the right flight panel static system functions identically to the standard system drain valve. Use the right valve to drain suspected moisture accumulation in the system lines as indicated by the placard, labeled STATIC SOURCE DRAIN, OPEN, CLOSED, adjacent to the valve. Make sure the valve is returned to the CLOSED position prior to flight.

AIRSPEED INDICATOR(S)

The airspeed indicator(s) is calibrated in knots. Limitation and range markings (in KIAS) include the white arc (full flap operating range of 50 to 125 knots), green arc (normal operating range of 63 to 175 knots), and a red line (maximum speed of 175 knots). The left-hand instrument is a true airspeed indicator and is equipped with a rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer. To operate the indicator, first rotate the ring until pressure altitude is aligned with outside air temperature in degrees Fahrenheit. Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, momentarily set the barometric scale on the altimeter to 29.92 and read pressure altitude on the altimeter. Be sure to return the altimeter barometric scale to the original barometric setting after pressure altitude has been obtained. Having set the ring to correct for altitude and temperature, read the true airspeed shown on the rotatable ring by the indicator pointer. For best accuracy, the indicated airspeed should be corrected to calibrated airspeed by referring to the Airspeed Calibration chart in Section 5. Knowing the calibrated airspeed, read true airspeed on the ring opposite the calibrated airspeed.

(Continued Next Page)

PITOT-STATIC SYSTEM AND INSTRUMENTS (Continued)

VERTICAL SPEED INDICATOR(S)

The vertical speed indicator(s) depicts airplane rate of climb or descent in feet per minute. The pointer is actuated by atmospheric pressure changes resulting from changes of altitude as supplied by the static source(s).

ALTIMETER(S)

Airplane altitude is depicted by a barometric type altimeter(s). A knob near the lower left portion of the indicator provides adjustment of the instrument's barometric scale to the current altimeter setting.

VACUUM SYSTEM AND INSTRUMENTS

A vacuum system (see Figure 7-14) provides the suction necessary to operate the left-hand attitude indicator and directional indicator. Vacuum is obtained by passing regulated compressor outlet bleed air through a vacuum ejector. Bleed air flowing through an orifice in the ejector creates the suction necessary to operate the instruments. The vacuum system consists of the bleed air pressure regulator, a vacuum ejector on the forward left side of the firewall, a vacuum relief valve and vacuum system air filter on the aft side of the firewall, vacuum operated instruments and a suction gage on the left side of the instrument panel, and a vacuum-low warning annunciator on the annunciator panel.

ATTITUDE INDICATOR

The attitude indicator gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which has index marks at 10°, 20°, 30°, 60°, and 90° either side of the center mark. Pitch and roll attitudes are presented by a miniature airplane superimposed over a symbolic horizon area divided into two sections by a white horizon bar. The upper "blue sky" and the lower "ground" area have arbitrary pitch reference lines useful for pitch attitude control. A knob at the bottom of the instrument is provided for inflight adjustment of the miniature airplane to the horizon bar for a more accurate flight attitude indication.

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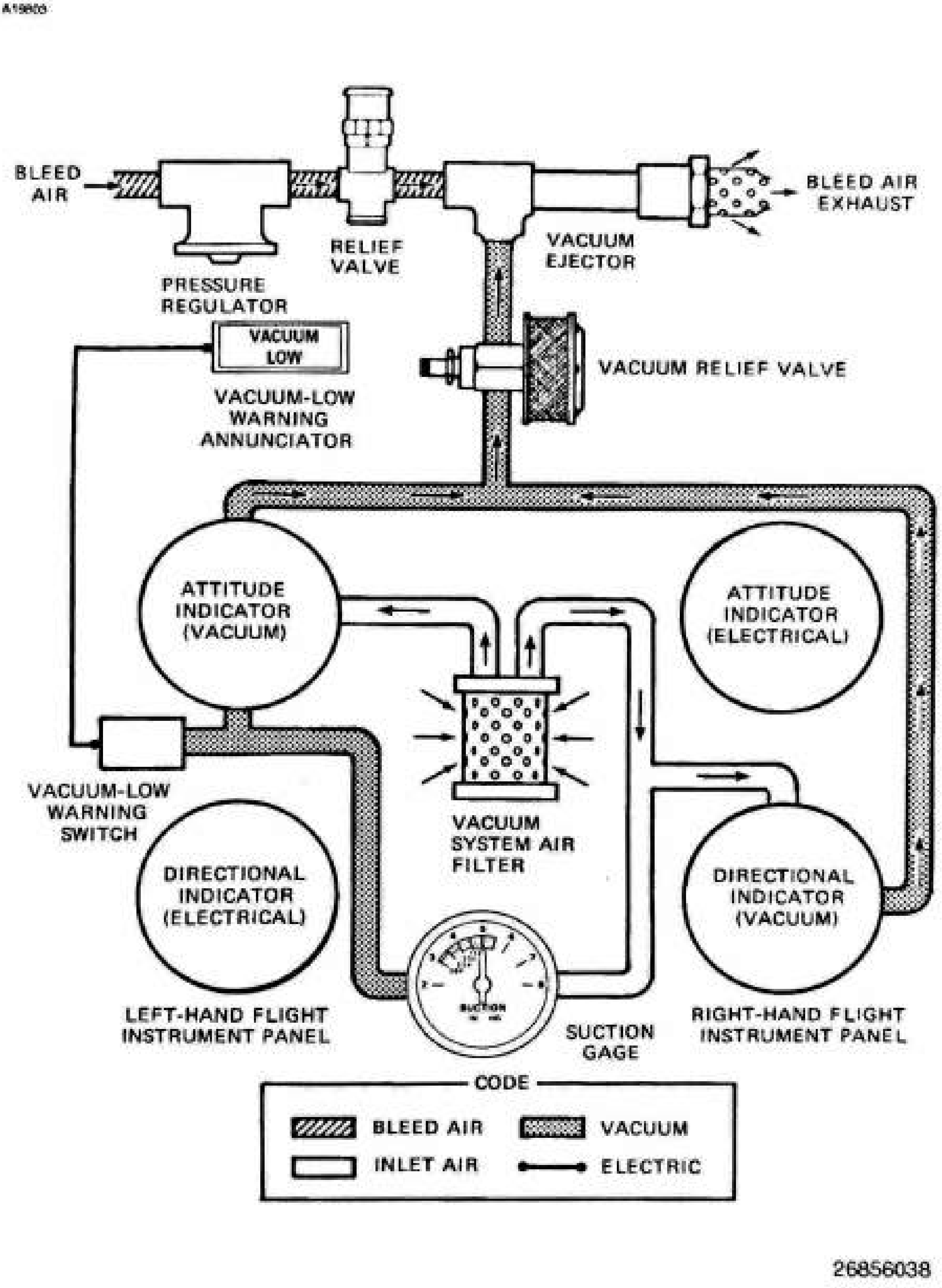

Figure 7-14. Typical Vacuum System

VACUUM SYSTEM AND INSTRUMENTS (Continued)

When the airplane is equipped with a right flight instrument panel, the attitude indicator is electrically powered. The instrument is protected by a "pull-off" type circuit breaker, labeled RH ATT GYRO on the left sidewall switch and circuit breaker panel. The instrument is energized any time the battery switch is on and the circuit breaker is pushed in.

Special procedures for caging the attitude indicator must be followed when caging the gyro prior to flight. If takeoff is soon after engine start, cage the gyro immediately after engine start by exercising a moderate even pull on the caging knob. Hold for approximately five seconds and release the caging knob smoothly but quickly. Allow the gyro to attain full speed and do not re-cage unless the gyro will not erect after approximately five minutes.

If time between engine start and takeoff is ten minutes or more, the alternate caging procedure is recommended. After engine start, do not cage the gyro. Allow gyro to run until ready for the Before Takeoff checklist. If necessary, cage the gyro just before takeoff. In many cases, the gyro will have erected itself sufficiently so that caging is not necessary.

CAUTION

AVOID RE-CAGING ONCE THE GYRO HAS BEEN CAGED. REPEATED CAGING MAY CAUSE INTERNAL DAMAGE.

DIRECTIONAL INDICATOR

The directional indicator displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator will precess slightly over a period of time. Therefore, the compass card should be set in accordance with the magnetic compass just prior to takeoff, and occasionally re-adjusted on extended flights. A knob on the lower left edge of the instrument is used to adjust the compass card to correct for any precession.

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VACUUM SYSTEM AND INSTRUMENTS (Continued)

SUCTION GAGE

The suction gage, located on the left side of the instrument panel, is calibrated in inches of mercury and indicates suction available for operation of the attitude and directional indicators. The desired suction range is 4.5 to 5.5 inches of mercury up to 15,000 feet altitude, 4.0 to 5.5 inches of mercury from 15,000 to 20,000 feet, and 3.5 to 5.5 inches of mercury from 20,000 to 25,000 feet. The 15K, 20K, 25K and 30K markings at the appropriate step locations indicate the altitude (in thousands of feet) at which the lower limit of that arc segment is acceptable. A suction reading out of these ranges may indicate a system malfunction or improper adjustment, and in this case, the attitude and directional indicators should not be considered reliable.

VACUUM-LOW WARNING ANNUNCIATOR

A red vacuum-low warning annunciator is installed on the annunciator panel to warn the pilot of a possible low-vacuum condition existing in the vacuum system. Illumination of the annunciator warns the pilot to check the suction gage and to be alert for possible erroneous vacuum-driven gyro instrument indications. The annunciator is illuminated by operation of a warning switch which is activated anytime suction is less than approximately 3.0 in. Hg.

OUTSIDE AIR TEMPERATURE (OAT) GAGE

An outside air temperature (OAT) gage is installed in the upper left side of the windshield. The gage is calibrated in degrees Fahrenheit and Celsius.

STALL WARNING SYSTEM

The airplane is equipped with a vane-type stall warning unit, in the leading edge of the left wing, which is electrically connected to a stall warning horn located overhead of the pilot's position. The vane in the wing senses the change in airflow over the wing, and operates the warning horn at airspeeds between 5 and 10 knots above the stall in all configurations.

The stall warning system should be checked during the preflight inspection by momentarily turning on the battery switch and actuating the vane in the wing. The system is operational if the warning horn sounds as the vane is pushed upward. Aircraft equipped with a stall warning ground disconnect switch will require that the elevator control be off the forward stop before the stall warning horn is enabled.

A "pull-off" type circuit breaker, labeled STALL WRN, protects the stall warning system. Also, it is provided to shut off the warning horn in the event it should stick in the on position.

WARNING

THIS CIRCUIT BREAKER MUST BE PUSHED IN FOR LANDING.

The vane and sensor unit in the wing leading edge is equipped with a heating element. The heated part of the system is operated by the STALL HEAT switch on the de-ice/anti-ice switch panel, and is protected by the STALL WRN circuit breaker on the left sidewall switch and circuit breaker panel.

AVIONICS SUPPORT EQUIPMENT

Various avionics support equipment is installed in the airplane, and includes an avionics cooling fan, microphone-headset installation, and control surface static dischargers. The following paragraphs discuss these items. Description and operation of radio equipment is covered in Section 9 of this handbook.

(Continued Next Page)

AVIONICS SUPPORT EQUIPMENT (Continued)

AVIONICS COOLING FAN

An avionics cooling fan system is provided in the airplane to supply internal cooling air for prolonged avionics equipment life. The fan will operate when the battery switch is on and the number 2 avionics power switch is on. If the fan malfunctions, it can be shut off using the "pull-off" type circuit breaker, labeled AVN FAN, located on the left sidewall switch and circuit breaker panel.

MICROPHONE-HEADSET INSTALLATIONS

The airplane is equipped with a padded microphone-headset for the pilot. A padded microphone-headset is also available for the front seat passenger. The microphone-headsets utilize remote keying switches located on the left grip of the pilot's control wheel and the right grip of the front passenger's control wheel. Use of the keying switches permits radio communications without interrupting other control operations to handle a hand-held microphone.

A hand-held microphone, which plugs into a mic jack on the left side of the control pedestal, is also available and can be used with the airplane speaker when a microphone-headset is not being utilized.

The microphone stows in a hanger on the front of the pedestal. Microphone and headset jacks are located on the left side of the instrument panel for the pilot and the right side of the instrument panel for the front passenger. Audio to the headsets is controlled by the individual audio selector switches and adjusted for volume level by using the selected receiver volume controls.

NOTE

To ensure audibility and clarity when transmitting with the hand-held microphone, always hold it as closely as possible to the lips, then key the microphone and speak directly into it. Avoid covering the opening on the back side of microphone for optimum noise cancelling.

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AVIONICS SUPPORT EQUIPMENT (Continued)

STATIC DISCHARGERS

As an aid in IFR flights, wick-type static dischargers are installed to improve radio communications during flight through dust or various forms of precipitation (rain, snow or ice crystals). Under these conditions, the build-up and discharge of static electricity from the trailing edges of the wings, rudder, elevator, propeller tips, and radio antennas can result in loss of usable radio signals on all communications and navigation radio equipment. Usually the ADF is first to be affected and VHF communication equipment is the last to be affected.

Installation of static dischargers reduces interference from precipitation static, but it is possible to encounter severe precipitation static conditions which might cause the loss of radio signals, even with static dischargers installed. Whenever possible, avoid known severe precipitation areas to prevent loss of dependable radio signals. If avoidance is impractical, minimize airspeed and anticipate temporary loss of radio signals while in these areas.

Static dischargers lose their effectiveness with age, and therefore, should be checked periodically (at least at every annual inspection) by qualified avionics technicians, etc. If testing equipment is not available, it is recommended that the wicks be replaced every two years, especially if the airplane is operated frequently in IFR conditions. The discharger wicks are designed to unscrew from their mounting bases to facilitate replacement.

CABIN FEATURES

CABIN FIRE EXTINGUISHER

A portable Halon 1211 (Bromochlorodifluoromethane) fire extinguisher is available for installation on the inside of the pilot's entry door where it would be accessible in case of fire. The extinguisher has an Underwriters Laboratories classification of 5B:C.

If installed, the extinguisher should be checked prior to each flight to ensure that its bottle pressure, as indicated by the gage on the bottle, is within the green arc (approximately 125 psi) and the operating lever lock pin is securely in place.

To operate the fire extinguisher:

1. Loosen retaining clamp(s) and remove extinguisher from bracket.
2. Hold extinguisher upright, pull operating lever lock pin, and press lever while directing the discharge at the base of the fire at the near edge. Progress toward the back of the fire by moving the nozzle rapidly with a side-to-side sweeping motion.

CAUTION

CARE MUST BE TAKEN NOT TO DIRECT THE INITIAL DISCHARGE DIRECTLY AT THE BURNING SURFACE AT CLOSE RANGE (LESS THAN FIVE FEET) BECAUSE THE HIGH VELOCITY STREAM MAY CAUSE SPLASHING AND/OR SCATTERING OF THE BURNING MATERIAL.

3. Anticipate approximately eight seconds of discharge duration.

WARNING

VENTILATE THE CABIN PROMPTLY AFTER SUCCESSFULLY EXTINGUISHING THE FIRE TO REDUCE THE GASES PRODUCED BY THERMAL DECOMPOSITION. OCCUPANTS SHOULD USE OXYGEN MASKS UNTIL THE SMOKE CLEARS.

Fire extinguishers should be recharged by a qualified fire extinguisher agency after each use. Such agencies are listed under "Fire Extinguisher" in the telephone directory. After recharging, secure the extinguisher to its mounting bracket; do not allow it to lie loose on shelves or seats.

(Continued Next Page)

CABIN FEATURES (Continued)

SUN VISORS

Two sun visors are mounted overhead of the pilot and front passenger. The visors are mounted on adjustable arms which enable them to be swung and telescoped into the desired windshield area.

MAP AND STORAGE COMPARTMENTS

A map compartment is located in the lower right side of the instrument panel. A hinged door covers the compartment and can be opened to gain access into the compartment. Storage pockets are also installed on the back of the pilot's and front passenger's seats and along the bottom edge of each crew entry door and can be used for stowage of maps and other small objects.

BEVERAGE CUP HOLDERS

Two beverage cup holders, one for the pilot and one for the right front passenger, are installed under the instrument panel. The holders are hinge-mounted and swing out from under the instrument panel where they can be used for holding beverage cups. When not in use, the cup holders should be returned to their stowed position.

MISCELLANEOUS EQUIPMENT

CARGO BARRIER/NETS

The airplane may be equipped with a cargo barrier and three barrier nets installed directly behind the pilot's and front passenger's seats to prevent the movement of cargo into the forward position of the cabin during abrupt deceleration. Refer to Section 6 for complete details of the cargo barrier and its nets.

CARGO PARTITIONS

Cargo partitions are available and can be installed to divide the cargo area into convenient compartments. Partitions may be installed in all of the five locations at stations 181.5, 208.0, 234.0, 259.0, and 284.0. Refer to Section 6 for complete details of the cargo partitions.

(Continued Next Page)

MISCELLANEOUS EQUIPMENT (Continued)

CARGO DOOR RESTRAINING NET

A restraining net may be installed on the inside of the airplane over the cargo door opening. The restraining net precludes loose articles from falling out the cargo door opening when the doors are opened. Refer to Section 6 for complete details of the cargo door restraining net.

CARGO/AIRPLANE TIE-DOWN EQUIPMENT

Various items of tie-down equipment are available for securing cargo within the airplane and/or tying down the airplane. This equipment consists of tie-down belt assemblies having various load ratings and adjustment devices and two types of quick-release tiedown ring anchors for securing the belts to the cabin seat tracks and anchor plates. Refer to Section 6 for the recommended use and restrictions of this equipment.

CARGO POD

The airplane may be equipped with a cargo pod which provides additional cargo space. Refer to Section 9, Supplements, for complete details of the cargo pod.

ENGINE INLET COVERS AND PROPELLER ANCHOR

Various covers and an anchor are available to close engine openings and restrain the propeller during inclement weather conditions and when the airplane is parked for extended periods of time, such as overnight. The covers preclude the entrance of dust, moisture, bugs, etc. into the engine and engine compartment. Two covers are provided which plug into the two front inlets, thereby closing off these openings. The engine inlet covers may be installed after the engine has cooled down (ITT indicator showing "off scale" temperature). To prevent the propeller from windmilling during windy conditions, the propeller anchor can be installed over a blade of the propeller and its anchor strap hook engaged over the lower forward flange of the nose gear fairing. During towing operations, the hook should be moved to the bracket on the lower right hand cowl near the secondary exhaust.

(Continued Next Page)

FUEL SYSTEM (Continued)

FIREWALL FUEL SHUTOFF VALVE

A manual firewall fuel shutoff valve, located on the aft side of the firewall, enables the pilot to shut off all fuel flow from the fuel reservoir to the engine. The shutoff valve is controlled by a red push-pull knob labeled FUEL SHUTOFF - PULL OFF and located on the right side of the pedestal. The push-pull knob has a press-to-release button in the center which locks the knob in position when the button is released.

FUEL TANK SELECTORS

Two fuel tank selectors, one for each tank, are located on the overhead console. The selectors - labeled LEFT, ON and OFF (left tank) and RIGHT, ON and OFF (right tank) - mechanically control the position of the two fuel tank shutoff valves at each wing tank. When a fuel tank selector is in the OFF position, the shutoff valves for that tank are closed. When in the ON position, both shutoff valves in the tank are open, allowing fuel from that tank to flow to the reservoir. Normal fuel management is with both fuel tank selectors in the ON position.

Before refueling, or when the airplane is parked on a slope, turn off one of the fuel tank selectors (if parked on a slope, turn high wing tank off). This action prevents crossfeeding from the fuller or higher tank and reduces any fuel seepage tendency from the wing tank vents.

FUEL SELECTORS OFF WARNING SYSTEM

A fuel selectors off warning system is incorporated to alert the pilot if one or both of the fuel tank selectors are left in the OFF position inadvertently. The system includes redundant warning horns, a red annunciator light labeled FUEL SELECT OFF, actuation switches, and miscellaneous electrical hardware. The dual aural warning system is powered through the START CONT circuit breaker with a non-pullable FUEL SEL WARN circuit breaker installed in series to protect the integrity of the start system. The annunciator is powered from the ANNUN PANEL circuit breaker.

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FUEL SYSTEM (Continued)

The warning system functions as follows: (1) If both the left and right fuel tank shutoff valves are closed (fuel tank selectors in the OFF position), the red FUEL SELECT OFF annunciator illuminates and one of the fuel selector off warning horns is activated; (2) During an engine start operation (STARTER switch in START or MOTOR position) with either the left or right fuel tank shutoff valves closed, the red FUEL SELECT OFF annunciator illuminates and both of the fuel select off warning horns are activated; (3) With one fuel tank selector OFF and fuel remaining in the tank being used less than approximately 25 gallons, the FUEL SELECT OFF annunciator illuminates and one of the fuel selector off warning horns is activated.

If the FUEL SEL WARN circuit breaker has popped or the START CONT circuit breaker has been pulled (possibly for ground maintenance), the FUEL SELECT OFF annunciator will be illuminated even with both fuel tank selectors ON. This is a warning to the pilot that the fuel selector warning system has been deactivated.

AUXILIARY BOOST PUMP SWITCH

An auxiliary boost pump switch, located on the left sidewall switch and circuit breaker panel, is labeled FUEL BOOST and has OFF, NORM, and ON positions. When the switch is in the OFF position, the auxiliary boost pump is inoperative. When the switch is in the NORM position, the auxiliary boost pump is armed and will operate when fuel pressure in the fuel manifold assembly drops below 4.75 psi. This switch position is used for all normal engine operation where main fuel flow is provided by the ejector boost pump and the auxiliary boost pump is used as a standby. When the auxiliary boost pump switch is placed in the ON position, the auxiliary boost pump will operate continuously. This position is used for engine start and any other time that the auxiliary boost pump cycles on and off with the switch in the NORM position.

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