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DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Seneca II is a twin-engine, all metal, retractable landing gear, turbocharged airplane. It has seating for up to seven occupants and two separate one hundred pound luggage compartments.

7.3 AIRFRAME

With the exception of the steel engine mounts and landing gear, the fiberglass nose cone and cowling nose bowls, and the ABS thermoplastic extremities (tips of wings, tail fin, rudder and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure. There is a front door on the right side and a rear door on the left. A cargo door is installed aft of the rear passenger door. Both rear doors may be opened for loading large pieces of cargo. A door on the left side of the nose section gives access to the nose section baggage compartment.

The wing is of a conventional design and employs a laminar flow NACA 65_2-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the center seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each wing contains two fuel tanks as standard equipment. An optional third tank may be installed on each side. The tanks on one side are filled through a single filler neck located well outboard of the engine nacelle.

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator incorporates an anti-servo tab which improves longitudinal stability and provides longitudinal trim. This tab moves in the same direction as the stabilator, but with increased travel. Rudder effectiveness is increased by an anti-servo tab on the rudder.

7.5 ENGINES

The Seneca II is powered by two Teledyne Continental six-cylinder turbocharged engines, each rated at 200 horsepower at 2575 RPM at sea level. The engines are air cooled and fuel injected and are equipped with oil coolers with low temperature bypass systems and engine mounted oil filters. A winterization plate is provided to restrict air during winter operation. (See Winterization in Handling and Servicing Section.) Asymmetric thrust during takeoff and climb is eliminated by the counter-rotation of the engines, the left engine rotating in a clockwise direction when viewed from the cockpit, and the right engine rotating counterclockwise.

The engines are accessible through removable panels, one on either side of each engine cowling. Engine mounts are constructed of steel tubing, and dynafocal engine mounts are provided to reduce vibration.

A Ray-Jay turbocharger on each engine is operated by exhaust gases. Exhaust gases rotate a turbine wheel, which in turn drives an air compressor. Induction air is compressed (supercharged) and distributed into the engine air manifold, and the exhaust gases which drive the compressor are discharged overboard. Engine induction air is taken from within the cowling, is filtered, and is then directed into the turbocharger compressor inlet. Each engine cylinder is supplied with pressurized air in operation from sea level to maximum operating altitude. The pressure relief valve protects the engine from inadvertently exceeding 42 inches Hg; 40 inches Hg is manually set with the throttles. The turbo bypass orifice is preset for 40 inches Hg at 12,000 feet density altitude at full throttle.

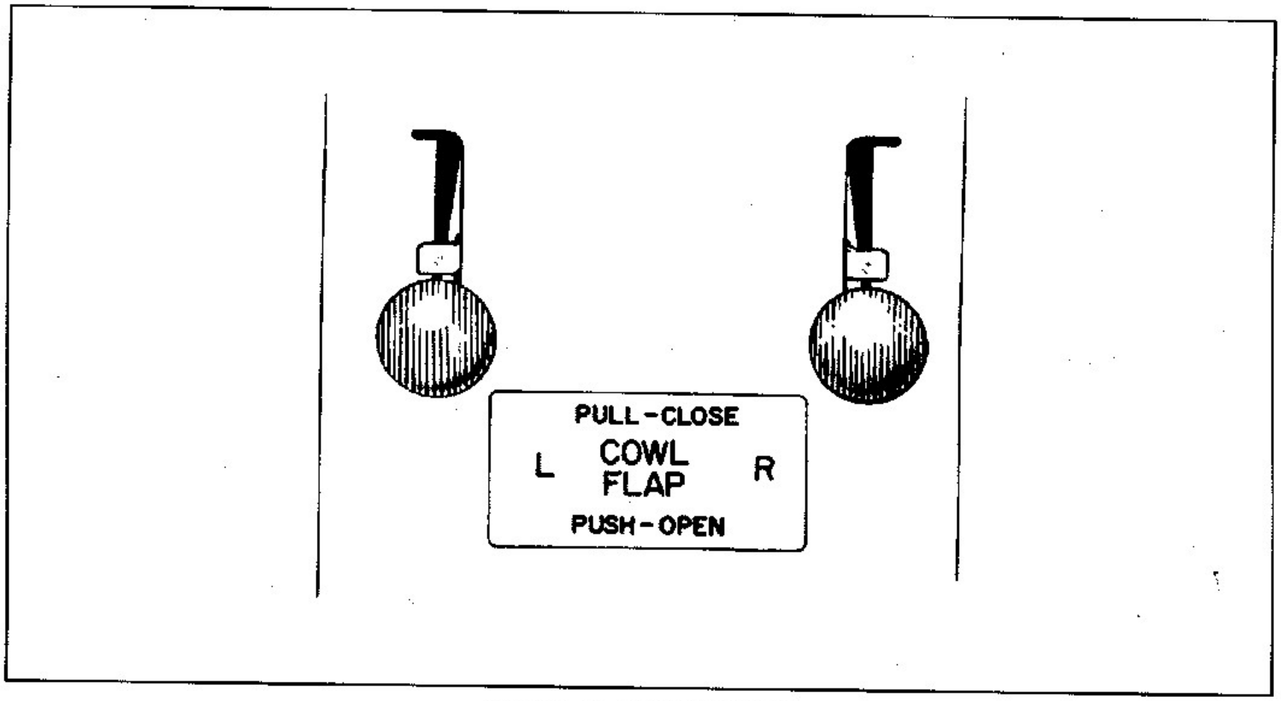
The intake filter air box incorporates a manually operated two-way valve designed to allow induction air either to pass into the compressor through the filter or to bypass the filter and supply heated air directly to the turbocharger. There is a suck in door which opens in the event that the primary air source becomes blocked. Alternate air selection insures induction air flow should the filter become blocked. Since the air is heated, the alternate air system offers protection against induction system blockage caused by snow or freezing rain, or by the freezing of moisture accumulated in the induction air filter. Alternate air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

The fuel injection system incorporates a metering system which measures the rate at which turbocharged air is being used by the engine and dispenses fuel to the cylinders proportionally. Fuel is supplied to the injector pump at a greater rate than the engine requires. The fuel injection system is a "continuous flow" type.

To obtain maximum efficiency and time from the engines, follow the procedures recommended in the Teledyne Continental Operator's Manual provided with the airplane.

Engine controls consist of a throttle, a propeller control and a mixture control lever for each engine. These controls are located on the control quadrant on the lower center of the instrument panel where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

The throttle levers are used to adjust the manifold pressure. They incorporate a gear up warning horn switch which is activated during the last portion of travel of the throttle levers to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a safety feature to warn the pilot of an inadvertent gear up landing.



COWL FLAP CONTROL
Figure 7-1

The propeller control levers are used to adjust the propeller speed from high RPM to feather.

The mixture control levers are used to adjust the air to fuel ratio. An engine is shut down by the placing of the mixture control lever in the full lean (idle cut-off) position.

The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle, propeller, and mixture controls or to lock the controls in a selected position.

The alternate air controls are located on the control quadrant just below the engine control levers. When an alternate air lever is in the up, or off, position the engine is operating on filtered air; when the lever is in the down, or on, position the engine is operating on unfiltered, heated air. Should the primary air source become blocked the suck in door will automatically select unfiltered heated air.

The cowl flap control levers (Figure 7-1), located below the control quadrant, are used to regulate cooling air for the engines. The levers have three positions: full open, full closed, and intermediate. A lock incorporated in each control lever locks the cowl flap in the selected position. To operate the cowl flaps. depress the lock and move the lever toward the desired setting. Release the lock after initial movement and continue movement of the lever. The control will stop and lock into place at the next setting. The lock must be depressed for each selection of a new cowl flap setting.

All throttle operations should be made with a smooth, not too rapid movement to prevent unnecessary engine wear or damage to the engines, and to allow time for the turbocharger speed to stabilize.

7.7 PROPELLERS

Counter-rotation of the propellers provides balanced thrust during takeoff and climb and eliminates the "critical engine" factor in single engine flight.

Two-blade, constant speed, controllable pitch and feathering Hartzell propellers are installed as standard equipment. The propellers mount directly to the engine crankshafts. Pitch is controlled by oil and nitrogen pressures. Oil pressure sends a propeller toward the high RPM or unfeather position; nitrogen pressure sends a propeller toward the low RPM or feather position and also prevents propeller overspeeding. The recommended nitrogen pressure to be used when charging the unit is listed on placards on the propeller domes and inside the spinners. This pressure varies with ambient temperature at the time of charging. Although dry nitrogen gas is recommended, compressed air may be used, provided it contains no moisture. For more detailed instructions, see "Propeller Service" in the Handling and Service Section of this handbook.

Three blade, constant speed, controllable pitch and feathering McCauley propellers are available as optional equipment. Pitch is controlled by oil pressure and compression spring force. Oil pressure sends a propeller toward the high RPM or unfeather position. Spring force sends a propeller toward the low RPM or feather position and prevents propeller overspeed.

Governors, one on each engine, supply engine oil at various pressures through the propellers shafts to maintain constant RPM settings. A governor controls engine speed by varying the pitch of the propeller to match load torque to engine torque in response to changing flight conditions.

Performance data listed in Section Five of this handbook is applicable for both two and three blade propeller installations.

Each propeller is controlled by the propeller control levers located in the center of the power control quadrant. Feathering of a propeller is accomplished by moving the control fully aft through the low RPM detent, into the "FEATHER" position. Feathering takes place in approximately six seconds. Unfeathering is accomplished by moving the propeller control forward and engaging the starter until the propeller is windmilling.

A feathering lock, operated by centrifugal force, prevents feathering during engine shut down by making it impossible to feather any time the engine speed falls below 800 RPM. for this reason, when airborne, and the pilot wishes to feather a propeller to save an engine, he must be sure to move the propeller control into the "FEATHER" position before engine speed falls below 800 RPM.

A propeller synchrophaser installation is available as optional equipment. Its function is to maintain both propellers at the same RPM and at a selected phase angle. This eliminates the propeller " beat" effect and minimizes vibration. When the synchrophaser is installed, the left engine is the master engine, and the right engine is equipped with a slave governor which automatically maintains its RPM with the left engine RPM. Pulling the circuit breakers completely deactivates the propeller synchrophaser system. If the master switch is turned "OFF" or if there is an electrical system failure. the slave engine will return to the controlled selected RPM plus approximately 25 RPM "out of synchronization" regardless of the position of the synchrophaser switch .

Two different types of synchrophaser installations have been used on this aircraft. An identification and description of each system follows:

(a) Propeller Synchrophaser with fixed phase angle.

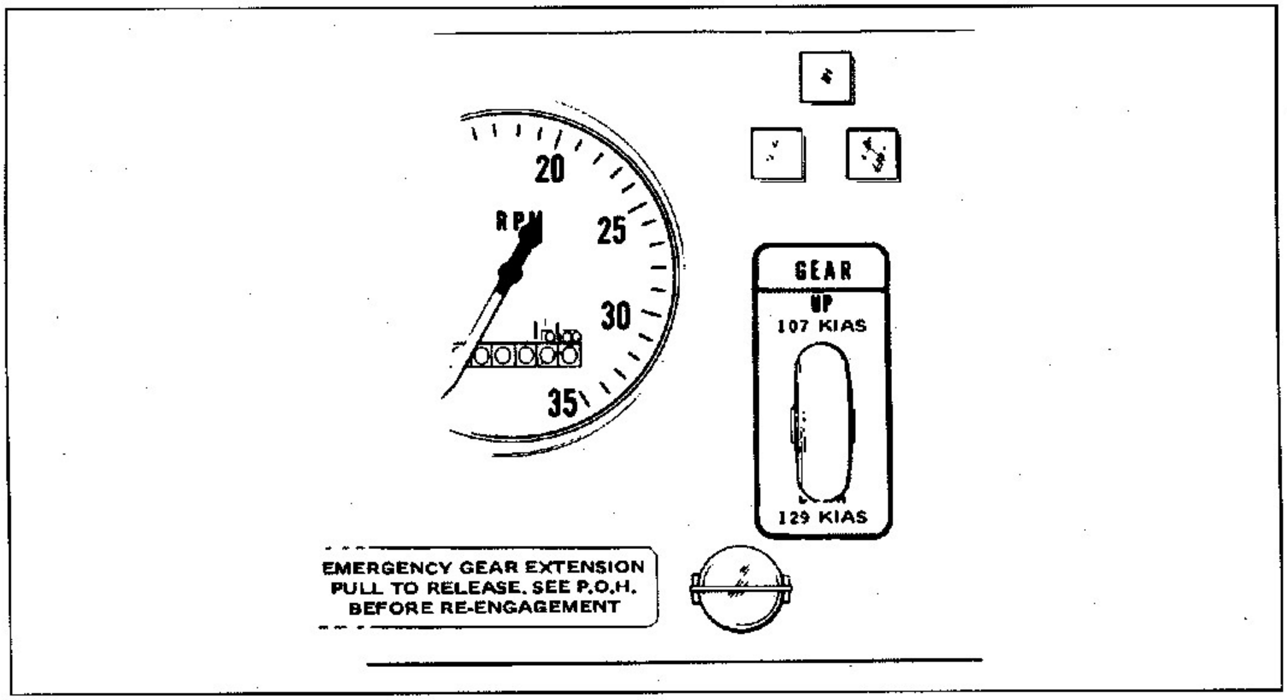
When this synchrophaser is installed a two-position switch is located on the throttle quadrant below the propeller controls. It is labeled "MANUAL" for manual control or standby and "AUTO SYNC" for propeller synchrophaser.

The propeller synchrophaser switch must be in the "MANUAL" position during taxi, takeoff, landing and single engine operations. During cruise, propellers should be synchronized manually to within approximately 30 RPM and the switch placed in the "AUTO SYNC" position. Normally, propeller synchrophasing will take place within a few seconds, but occasionally it may take up to a full minute. When changing power settings the synchrophaser switch should be set to "MANUAL" for 30 seconds before the power setting is adjusted; then the synchrophaser may be returned to the "AUTO SYNC" position. If the propeller RPM differential exceeds 50 RPM, the switch should be placed on "MANUAL" for 30 to 40 seconds; then the propellers can be synchronized again and the synchrophaser switch returned to "AUTO SYNC".

(b) Propeller Synchrophaser with adjustable phase angle.

When this synchrophaser is installed, a rotary switch is located on the throttle quadrant below the propeller controls. It is labeled "OFF" for manual control or standby and "PHASE ADJUSTMENT" for propeller synchronizing and phase angle adjustment.

The rotary switch must be in the "OFF" position during taxi, takeoff, landing and single engine operations. Before operating the synchrophaser system, insure that the rotary switch is in the "OFF" position and manually synchronize the propellers to within 40 RPM. To operate, rotate the switch clockwise out of the "OFF" detent and slightly into the "PHASE ADJUSTMENT" range. It may require up to 30 seconds for the propellers to synchronize. The phase angle of the propellers may then be adjusted by rotating the switch within the "PHASE ADJUSTMENT" range to obtain the smoothest operation. Remember to wait 30 seconds after any switch movement for the propellers to assume the new phase angle. Turn the synchrophaser switch to the "OFF" position for 30 seconds before changing power settings; re-establish synchrophaser operation following power changes using the above procedure.



LANDING GEAR SELECTOR

Figure 7-3

7.9 LANDING GEAR

The Seneca II is equipped with hydraulically operated, fully retractable, tricycle landing gear.

Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-5 and 7-7). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-3). The gear selector switch, which has a wheel-shaped knob, must be pulled out before it is moved to the "UP" or "DOWN" position. When hydraulic pressure is exerted in one direction, the gear is retracted; when it is exerted in the other direction, the gear is extended. Gear extension or retraction normally takes six to seven seconds.

CAUTION

If the landing gear is in transit, and the hydraulic pump is running, it is NOT advisable to move the gear selector switch to the opposite position before the gear has reached its full travel limit, because a sudden reversal may damage the electric pump.

The landing gear is designed to extend even in the event of hydraulic failure. Since the gear is held in the retracted position by hydraulic pressure, should the hydraulic system fail for any reason, gravity will allow the gear to extend. When the landing gear is retracted, the main wheels retract inboard into the wings and the nose wheel retracts forward into the nose section. Aerodynamic loads and springs assist in gear extension and in locking the gear in the down position. During gear extension, once the nose gear has started toward the down position, the airstream pushes against it and assists in moving it to the downlocked position. After the gears are down and the downlock hooks engage, springs maintain force on each hook to keep it locked until it is released by hydraulic pressure.

To extend and lock the gears in the event of hydraulic failure, it is necessary only to relieve the hydraulic pressure. Emergency gear extension must not be attempted at airspeeds in excess of 84 KIAS. An emergency gear extension knob, located directly beneath the gear selector switch is provided for this purpose. Pulling this knob releases the hydraulic pressure holding the gear in the up position and allows the gear to fall free. During normal operation, this knob is covered by a guard to prevent inadvertent extension of the gear. Before pulling the emergency gear extension knob, place the landing gear selector switch in the "DOWN" position to prevent the pump from trying to raise the gear. If the emergency gear knob has been pulled out to lower the gear by gravity, due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gears hydraulic and electrical systems. See Aircraft Service Manual for proper landing gear system check out procedures. If the airplane is being used for training purposes or a pilot check out mission, and the emergency gear extension has been pulled out, it may be pushed in again when desired if there has not been any apparent malfunction of the landing gear system.

When the gear is fully extended or fully retracted and the gear selector is in the corresponding position, electrical limit switches stop the flow of current to the motor of the hydraulic pump. The three green lights directly above the landing gear selector switch illuminate to indicate that each of the three landing gears is down and locked. A convex mirror on the left engine nacelle both series as a taxiing aid and allows the pilot to visually confirm the condition of the nose gear. If the gear is in neither the full up nor the full down position, a red warning light on the instrument panel illuminates. Should the throttle be placed in a low setting - as for a landing approach - while the gear is retracted, a warning horn sounds to alert the pilot that the gear is retracted. The gear warning horn emits a 90 cycles per minute beeping sound.

The green gear lights are dimmed automatically when the navigation lights are turned on. For this reason, if the navigation lights are turned on in the daytime, it is difficult to see the landing gear lights. If the green lights are not observed after the landing gear selector switch is placed in the "DOWN" position, the first thing to check is the position of the navigation lights switch.

If one or two of the three green lights do not illuminate when the gear down position has been selected, any of the following conditions could exist for each light that is out:

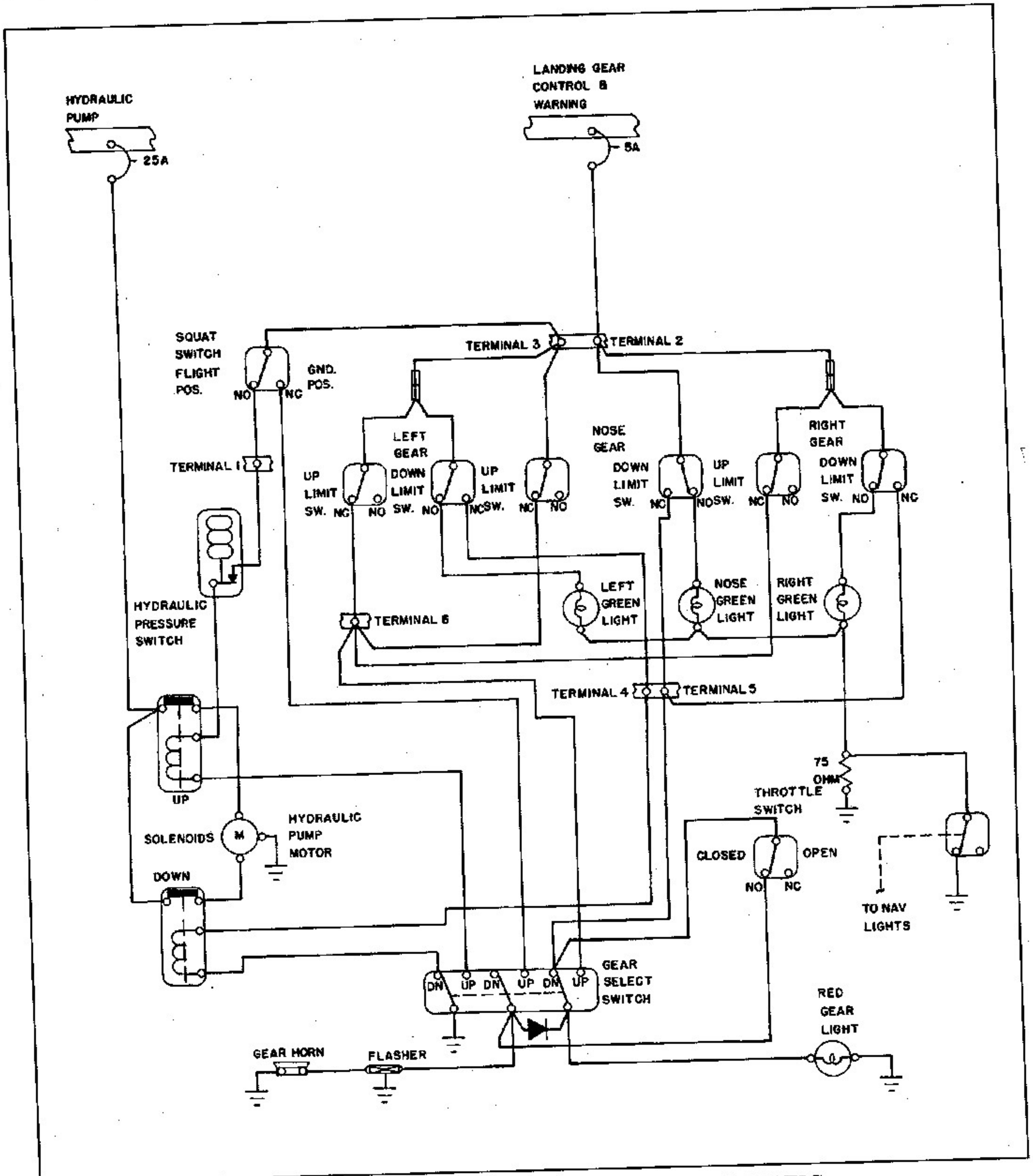
(a) The gear is not locked down.
(b) A bulb is burned out.
(c) There is a malfunction in the indicating system.

In order to check the bulbs, the square indicator lights can be pulled out and interchanged.

A micro switch incorporated in the throttle quadrant activates the gear warning horn under the following conditions:

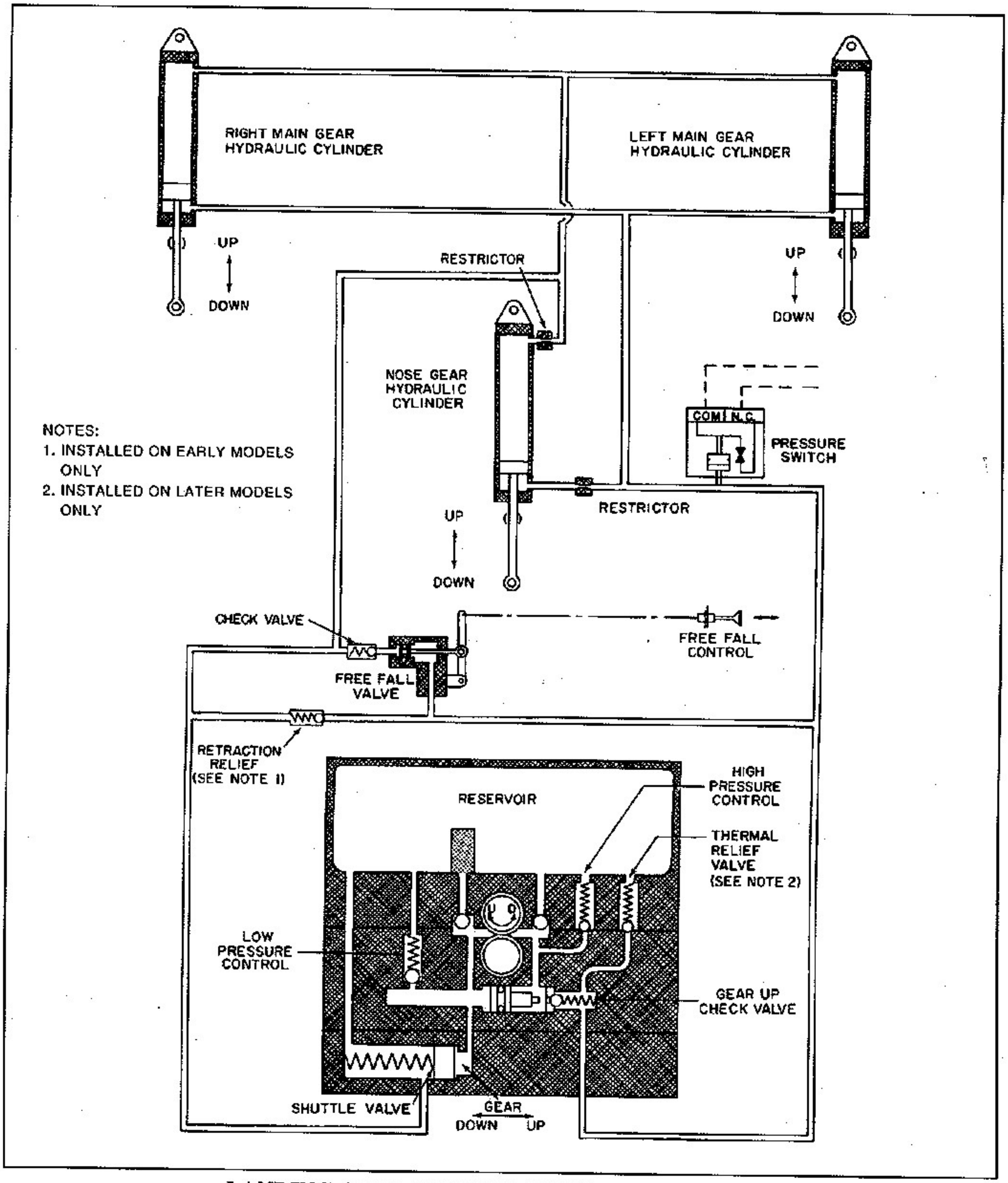
(a) The gear is not locked down and the manifold pressure has fallen below 14 inches on either one or both engines.
(b) The gear selector switch is in the "UP" position when the airplane is on the ground.

To prevent inadvertent gear retraction should the gear selector switch be placed in the "UP" position when the airplane is on the ground, a squat switch located on the left main gear will prevent the hydraulic pump from actuating if the master switch is turned on. On takeoff, when the landing gear oleo strut drops to its full extension, the safety switch closes to complete the circuit which allows the hydraulic pump to be activated to raise the landing gear when the gear selector is moved to the "UP" position. During the



LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC

Figure 7-5



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC

Figure 7-7

preflight check, be sure the landing gear selector is in the "DOWN" position and that the three green gear indicator lights are illuminated. On takeoff, the gear should be retracted before an airspeed of 107 KIAS is exceeded. The landing gear may be lowered at any speed up to 129 KIAS.

The hydraulic reservoir for landing gear operation is an integral part of the gear hydraulic pump. Access to the combination pump and reservoir is through a panel in the nose baggage compartment. For filling instructions, see the PA-34-200T Service Manual.

The nose gear is steerable through a 27 degree arc either side of center by use of a combination of full rudder pedal travel and brakes. A gear centering spring, incorporated in the nose gear steering system, prevents shimmy tendencies. A bungee assembly reduces ground steering effort and dampens shocks and bumps during taxiing. When the gear is retracted, the nose wheel centers as it enters the wheel well, and the steering linkage disengages to reduce pedal loads in flight. The landing light turns off automatically when the gear is retracted.

All three landing gears carry 6.00 x 6 tires. The nose wheel has a 6-ply tire and the main wheels have 8-ply tires. For information on servicing the tires, see "Tire Inflation" in the Handling and Servicing Section of this Handbook.

Struts for the landing gear are air-oil assemblies. Strut exposure should be checked during each preflight inspection. If a need for service or adjustment is indicated, refer to the instructions printed on the units. Should more detailed landing gear service information be required, refer to the PA-34-200T Service Manual.

7.11 BRAKE SYSTEM

The brake system is designed to meet all normal braking needs. Two single-disc, double puck brake assemblies, one on each main gear, are actuated either by toe brake pedals mounted on both the pilot's and the copilot's rudder pedals or by a hand-operated brake lever located below and behind the left center of the instrument panel. A brake system hydraulic reservoir, independent of the landing gear hydraulic reservoir, is located behind a panel in the rear top of the nose baggage compartment. Brake fluid should be maintained at the level marked on the reservoir. For further information see "Brake Service" in the Handling and Servicing Section of this Handbook.

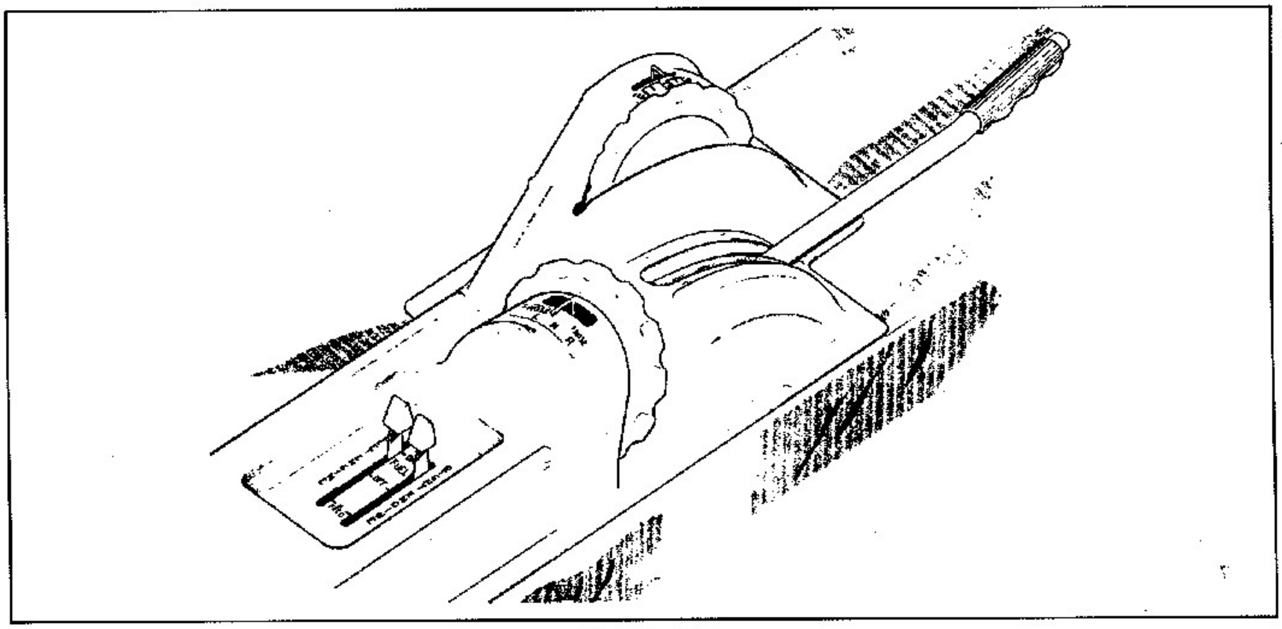
The parking brake is engaged by pulling back on the hand brake lever and depressing the button on the left of the handle. The parking brake is released by pulling back on the handle without touching the button and allowing the handle to swing forward.

7.13 FLIGHT CONTROL SYSTEM

Dual flight controls are installed in the Seneca II as standard equipment. The controls actuate the control surfaces through a cable system. The horizontal tail surface (stabilator) is of the all movable slab type with an anti-servo tab mounted on the trailing edge. This tab, actuated by a control mounted on the console between the front seats, also acts as a longitudinal trim tab (refer to Figure 7-9).

The ailerons are of the Frise type. This design allows the leading edge of the aileron to extend into the airstream to provide increased drag and improved roll control. The differential deflection of the ailerons tends to eliminate adverse yaw in turning maneuvers and to reduce the amount of coordination required in normal turns.

The vertical tail is fitted with a rudder which incorporates a combination rudder trim and anti-servo tab. The rudder trim control is located on the control console between the front seats.



CONSOLE

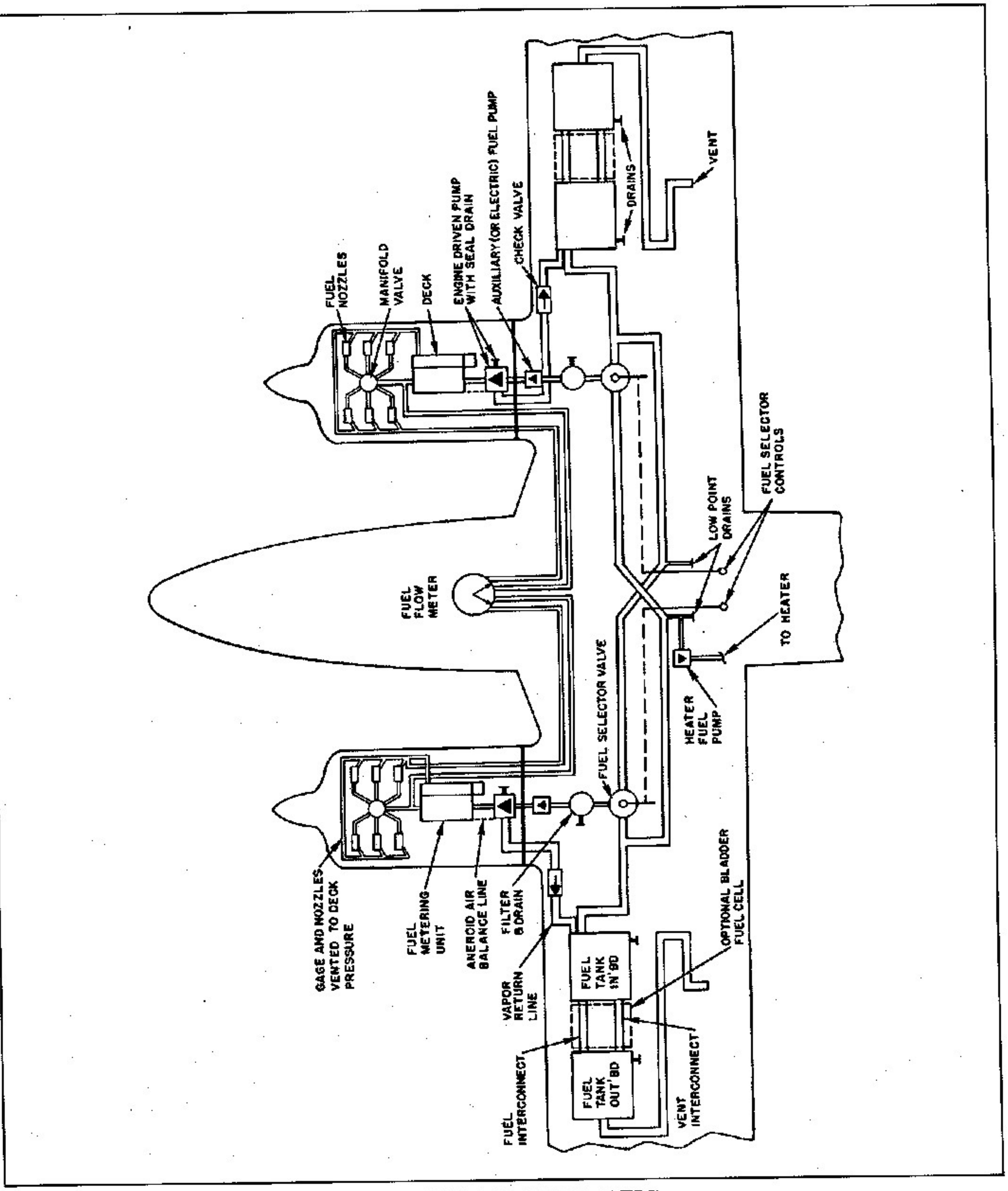
Figure 7-9

The flaps are manually operated and spring loaded to return to the retracted position. A four-position flap control lever (Figure 7-9) between the front seats adjusts the flaps for reduced landing speeds and glide path control. The flaps have three extended positions - 10, 25 and 40 degrees - as well as the fully retracted position. A button on the end of the lever must be depressed before the control can be moved. A past center lock incorporated in the actuating linkage holds the flap when it is in the retracted position so that it may be used as a step on the right side. Since the flap will not support a step load except in the fully retracted position, the flaps should be retracted when people are entering or leaving the airplane.

7.15 FUEL SYSTEM

Fuel is stored in fuel tanks located in each wing. The tanks in each wing are interconnected to function as a single tank (refer to Figure 7-11). All tanks on a side are filled through a single filler in the outboard tank, and as fuel is consumed from the inboard tank, it is replenished by fuel from outboard. Only two and one half gallons of fuel in each wing is unusable, giving the Seneca II a total of 93 usable gallons with standard fuel tanks or 123 usable gallons with the optional fuel tanks installed. The minimum fuel grade is 100 or 100LL aviation grade. The fuel tank vents, one installed under each wing, feature an anti-icing design to prevent ice formation from blocking the fuel tank vent lines.

The fuel injection system is a "continuous flow" type which utilizes a vapor return line leading back to the fuel tanks. This line provides a route back to the tanks for vapor laden fuel that has been separated in the injector pump swirl chamber. Each engine has an engine driven fuel pump that is a part of the fuel injection system. An auxiliary fuel system is provided. The purpose of the electrically powered auxiliary fuel system is to supply fuel to the engine in case of engine driven fuel pump shaft failure or malfunction, for ground and inflight engine starting, and for vapor suppression. The two auxiliary fuel pump switches are located on the electrical side panel and are three position rocker switches; LO, HI and OFF. The LO auxiliary fuel pressure is selected by pushing the top of the switch. The HI auxiliary fuel pressure is selected by pushing the bottom of the switch, but this can be done only after unlatching the adjacent guard. When the HI auxiliary fuel pump is activated, an amber light near the annunciation panel is illuminated for each pump. These lights dim whenever the pump pressure reduces automatically and manifold pressure is below approximately 21 inches.



FUEL SYSTEM SCHEMATIC

Figure 7-11

In case of a failed engine-driven fuel pump, auxiliary fuel pressure should be selected. Adequate pressure and fuel flow will be supplied for up to approximately 75% power. Manual leaning to the correct fuel flow will be required at altitudes above 15,000 feet and for engine speeds less than 2300 RPM. An absolute pressure switch automatically selects a lower fuel pressure when the throttle is reduced below 21" Hg manifold pressure and the HI auxiliary fuel pump is on.

NOTE

Excessive fuel pressure and very rich fuel/air mixtures will occur if the HI position is energized when the engine fuel injection system is functioning normally.

Low auxiliary fuel pressure is available and may be used during normal engine operation both on the ground and inflight for vapor suppression should it be necessary as evidenced by unstable engine operation or fluctuating fuel flow indications during idle or at high altitudes.

Separate spring loaded OFF primer button switches, located adjacent to the starter switches are used to select HI auxiliary fuel pump operation for priming, irrespective of other switch positions. These primer buttons may be used for both hot or cold engine starts.

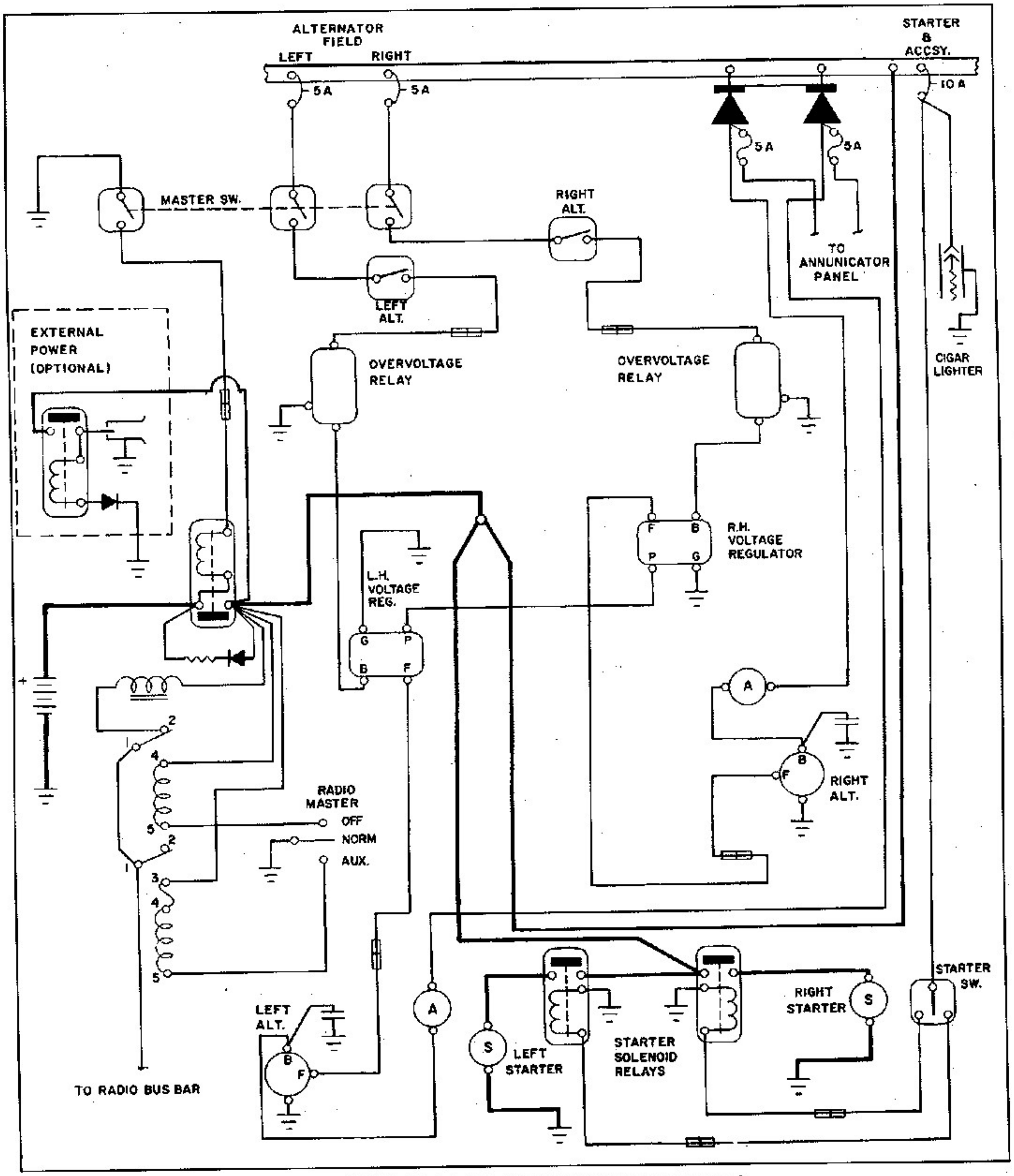
On airplanes equipped with an optional engine primer system (identified by Placard below starter switch shown in Figure 7-15), the primer switch location and actuation is the same as the basic airplane. However, this system does provide a separate primer system as an integral part of the engine fuel system. An electrically operated diverter valve is located in the metered fuel supply line between the air throttle valve and the manifold valve. Other components are two primer nozzles, located in the intake manifold on each side of the engine, the interconnecting fuel lines, and fine wire spark plugs. Actuation of the engine primer switch operates the auxiliary electric fuel pump on Hi and energizes the diverter valve which supplies fuel to each primer nozzle. The diverter valve does not shut off fuel flow to the manifold valve, therefore some quantity of fuel is also supplied to each cylinder nozzle during priming. Normal operation of the auxiliary fuel pump is unchanged.

Fuel management controls are located on the console between the front seats. There is a control lever for each of the engines, and each is placarded "ON" - "OFF" - "X FEED." During normal operation, the levers are in the "ON" position, and each engine draws fuel from the tanks on the same side as the engine. The two fuel systems are interconnected by crossfeed lines. When the "X FEED" position is selected, the engine will draw fuel from the tanks on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. The "OFF" position shuts off the fuel flow from a side.

NOTE

When one engine is inoperative and the fuel selector for the operating engine is on "X FEED" the selector for the inoperative engine must be in the "OFF" position. Do not operate with both selectors on "X FEED." Do not take off with a selector on "X FEED." Fuel and vapor are always returned to the tank on the same side as the operating engine.

Before each flight, fuel must be drained from low points in the fuel system to ensure that any accumulation of moisture or sediment is removed from the system. Fuel drains are provided for each fuel filter (2), each fuel tank (4), and each crossfeed line (2). The fuel filter drains are located on the outboard underside of each engine nacelle; two fuel tank drains are located on the underside of each wing; fuel crossfeed drains are located at the lowest point in the fuel system. on the underside of the fuselage, just inboard of the trailing edge of the right wing flap.



ALTERNATOR AND STARTER SCHEMATIC

Figure 7-13

7.17 ELECTRICAL SYSTEM

The electrical system of the Seneca II is capable of supplying sufficient current for complete night IFR equipment. Electrical power is supplied by two 65 ampere alternators (Figure 7-13), one mounted on each engine. A 35 ampere-hour, 12-volt battery provides current for starting, for use of electrical equipment when the engines are not running, and for a source of stored electrical power to back up the alternator output. The battery, which is located in the nose section and is accessible through the forward baggage compartment, is normally kept charged by the alternators. If it becomes necessary to charge the battery, it should be removed from the airplane.

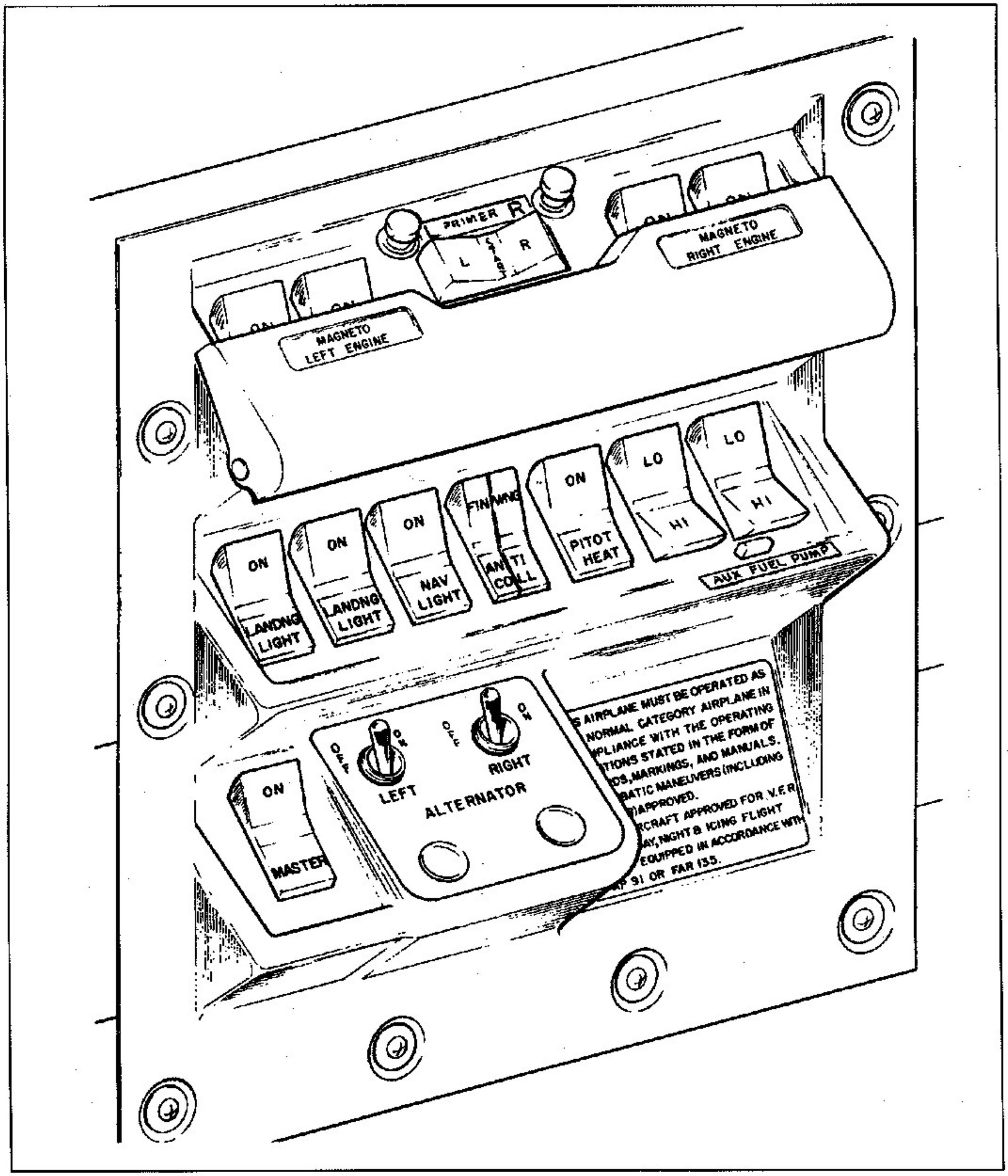
An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the lower left side of the nose section. An external battery can be connected to the socket, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.

Two solid state voltage regulators maintain effective load sharing while regulating electrical system bus voltage to 14-volts. An overvoltage relay in each alternator circuit prevents damage to electrical and avionics equipment by taking an alternator off the line if its output exceeds 14-volts. If this should occur, the alternator light on the annunciator panel will illuminate. Voltage regulators and overvoltage relays are located forward of the bottom of the bulkhead separating the cabin section from the nose section.

Approximately 2000 RPM or more is required to obtain full alternator output of 65 amperes. It is normal to have zero output at idle RPM. This is due to the reduced drive ratio from the engine. Dual ammeters and the ALT annunciator light provide a means of monitoring the electrical system operation. The two ammeters (load meters) indicate the output of the alternators. Should an ammeter indicate a load much higher than the known consumption of the electrical equipment in use, it should be suspected of a malfunction and turned off. In this event, the remaining alternator's ammeter should show a normal indication after approximately one minute. If both ammeters indicate a load much higher than the known consumption for more than approximately five minutes, an electrical defect other than the alternator system should be suspected because a discharged battery will reduce the alternator load as it approaches the charged conditions. A zero ammeter reading indicates an alternator is not producing current and should be accompanied by illumination of the ALT annunciator light. A single alternator is capable of supporting a continued flight in case of alternator or engine failure in most conditions; however, with deicing equipment and other high loads, care must be exercised to prevent the loads from exceeding the 65 ampere rating and subsequent depletion of the battery.

The annunciator panel on the upper left of the instrument panel is installed as as electrical accessory. It includes manifold pressure overboost, gyro pressure, oil pressure, and alternator indicator lights. Illumination of any light indicates that the pilot should monitor system gauges to determine if a failure has occurred and if corrective action is required. Light function may be tested with a "push to test" switch. In addition an amber light illuminates when the corresponding HI auxiliary fuel pump is energized. The auxiliary fuel pump annunciator lights will not illuminate when the "push to test" switch is actuated. Auxiliary fuel system light function is tested when the primer switches are actuated.

When all electrical equipment is turned off (except the master switch), the ammeters will indicate current being used to charge the battery and operate the instruments. If the sum of the two readings is significant, this is an indication that the battery has a low charge. The pilot should try to determine why it is low and if no cause is apparent, the condition of the battery and the electrical system should be checked by a mechanic.



SWITCH PANEL - WITH PRIMER SYSTEM

Figure 7-15

If both alternators should fail during flight, the battery becomes the only source of electrical power; therefore, all unnecessary electrical equipment should be turned off. The length of time the battery will be able to supply power to the necessary equipment depends on the current drained by the equipment, the time it took for the pilot to notice the dual failure and to execute protective procedures, and the condition of the battery.

During night or instrument flight, the pilot should continuously monitor the ammeters and warning light so that prompt corrective action may be initiated if an electrical malfunction occurs. Procedures for dealing with electrical malfunction are covered in detail in the Emergency Procedures Section.

The electrical system and equipment are protected by circuit breakers located on a circuit breaker panel on the lower right side of the instrument panel. The circuit breaker panel is provided with enough blank spaces to accommodate additional circuit breakers if extra electrical equipment is installed. In the event of equipment malfunctions or a sudden surge of current, a circuit breaker can trip automatically. The pilot can reset the breaker by pressing it in (preferably after a few minutes cooling period). The circuit breakers can be pulled out manually.

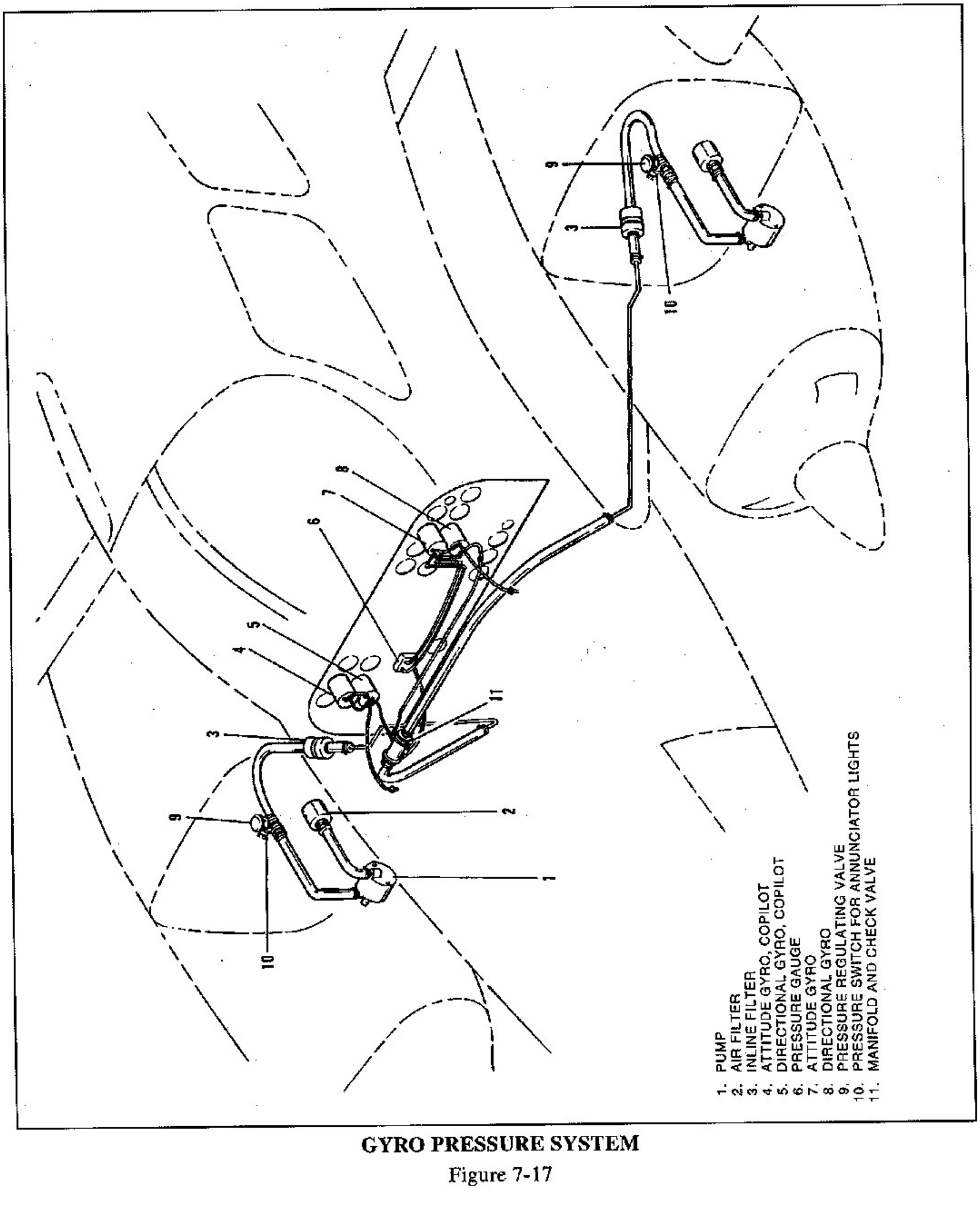
Most of the electrical switches, including the master switch and switches for magnetos, fuel pumps, starters, alternators, lights and pitot heat, are conveniently located on the switch panel (Figure 7-15) to the left of the pilot.

WARNING

> Strobe lights should not be operating when flying through overcast and clouds since reflected light can produce spacial disorientation. Do not operate strobe lights in close proximity to ground, during takeoff and landing.

An optional cabin courtesy light system consists of a front entrance light over the forward cabin door and a rear entrance light which replaces the reading light over the aft cabin door. These lights are operated individually with switches which are incorporated as part of each light assembly. The courtesy light circuit is independent of the aircraft master switch; therefore, the lights can be operated regardless of the position of the master switch. Unless the engines are running, the courtesy lights should not be left on for extended time periods, as battery depletion could result.

Two standard red lights, mounted in the overhead panel, provide instrument and cockpit lighting for night flying. The lights are controlled by rheostat switches located adjacent to each light. A white map light window in the lens is actuated by an adjacent switch.



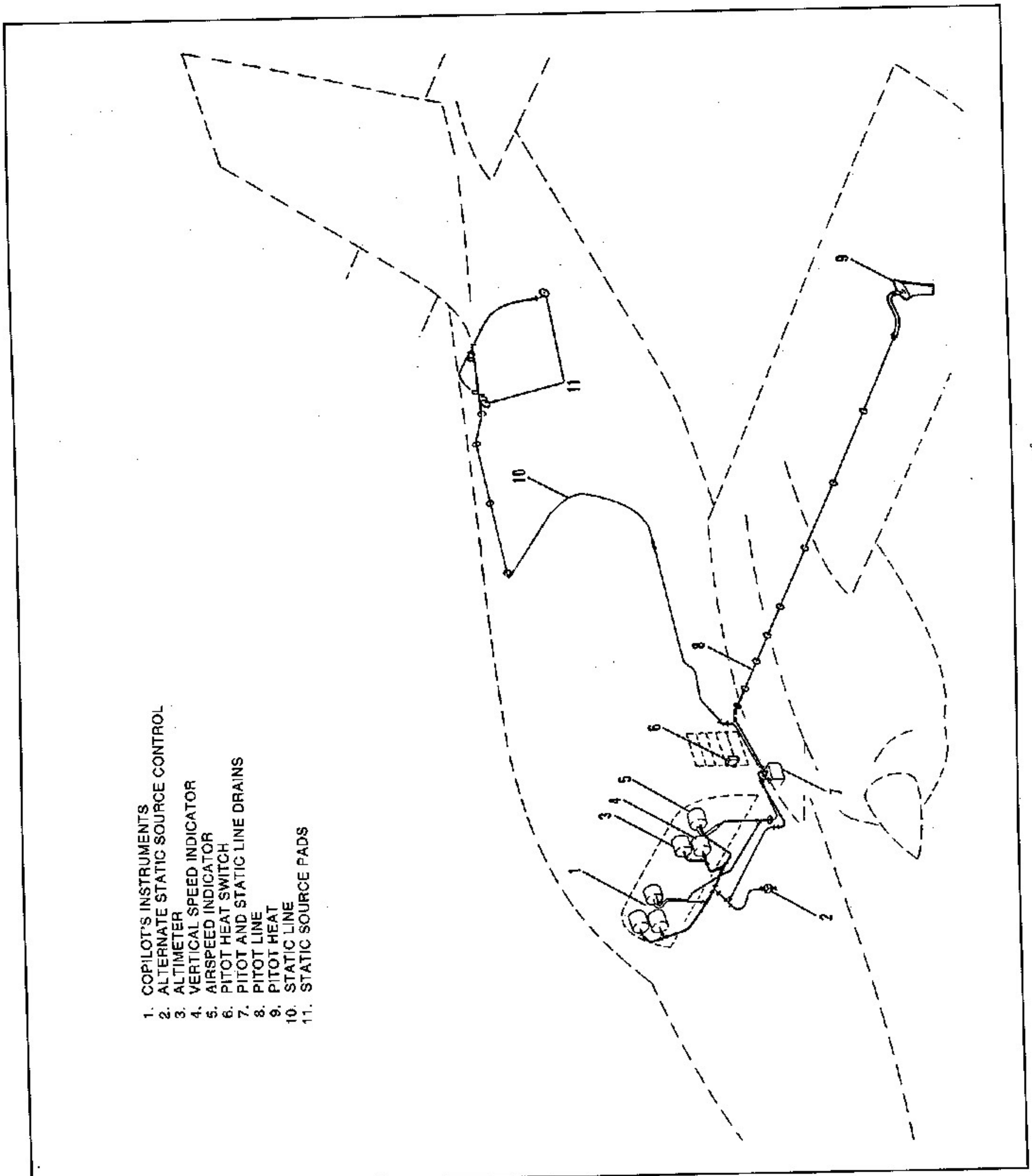
GYRO PRESSURE SYSTEM

Figure 7-17

7.19 GYRO PRESSURE SYSTEM

The directional gyros and attitude indicators are driven by positive air pressure. The pressure system (Figure 7-17) consists of a pressure pump on each engine, plus plumbing and regulating equipment. Air for the system is taken from the engine nacelle area through inlet filters and passed through pressure pumps installed on the engines. Pressure regulators mounted on the fire walls maintain the air at constant pressure to prevent damage to the instruments. An inline filter is located in each nacelle. Check valves and a pressure air manifold are mounted in the cabin at the forward bulkhead. The check valves close to allow pressure instruments to function during single-engine operation or in the event of malfunction of one of the pressure pumps. The instruments receive air from the manifold. A pressure gauge on the instrument panel, to the left of the copilot's control wheel shaft, is connected to the manifold and indicates the pressure the gyros are receiving. After air has passed through the gyro instruments, it is exhausted overboard through the forward bulkhead.

The operating limits for the gyro pressure system are 4.5 to 5.2 inches of mercury for all operations. Operation of the gyro pressure system can be monitored through a gyro pressure gauge mounted to the left of the copilot's control wheel. The two warning indicators mounted on the gauge serve to alert the pilot should one of the engines be producing less than sufficient pressure to operate the gyro instruments. Additional warning of a possible malfunction in the gyro pressure system is provided by a light in the annunciator panel.



PITOT STATIC SYSTEM

Figure 7- 19

7.21 PITOT STATIC SYSTEM

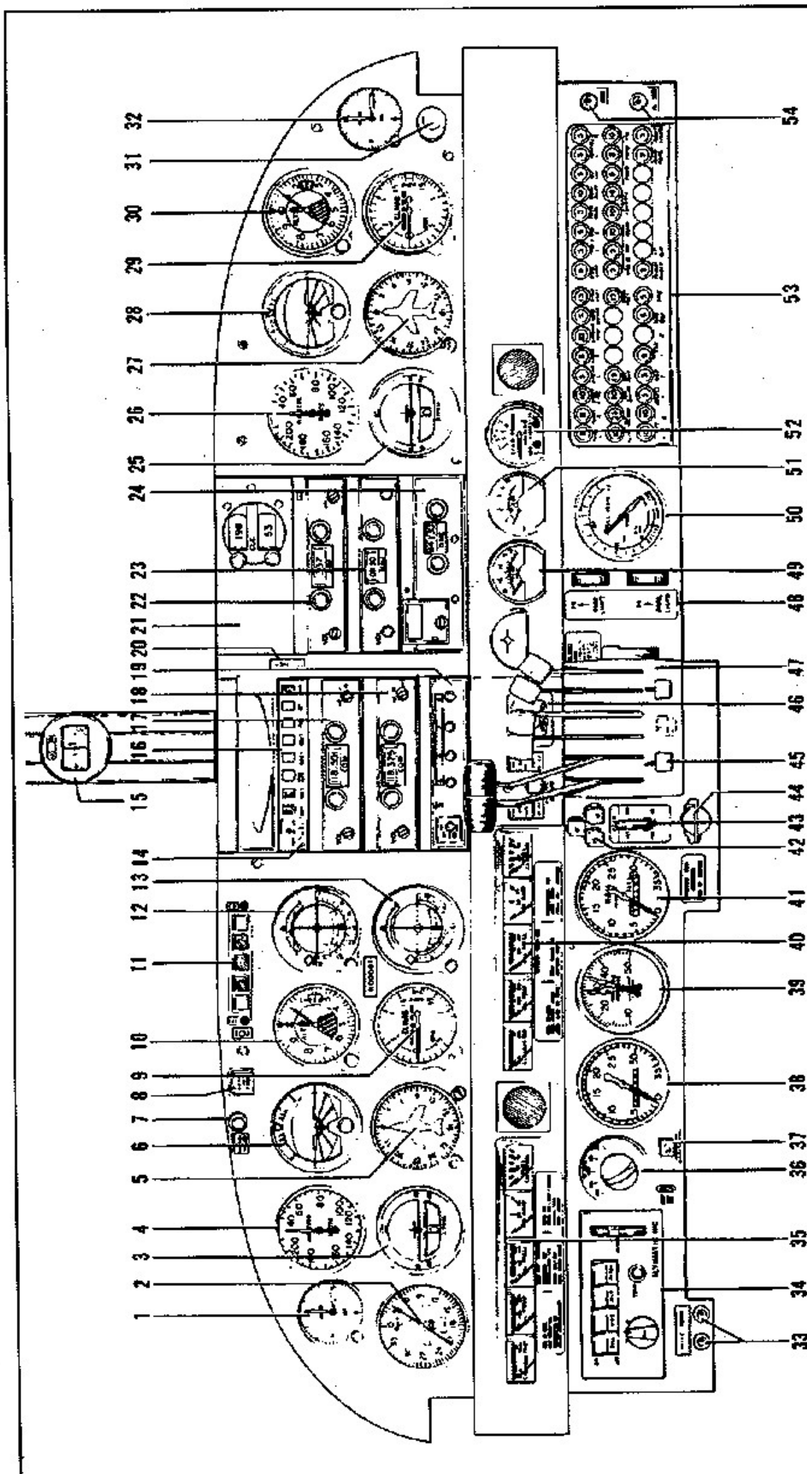
Pitot pressure for the airspeed indicator is sensed by an aluminum pitot head installed on the bottom of the left wing and carried through lines within the wing and fuselage to the gauge on the instrument panel (refer to Figure 7-17). Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static source pads, one on each side of the rear fuselage forward of the stabilator. They connect to a single line leading to the instruments. The dual pickups balance out differences in static pressure caused by side slips or skids.

An alternate static source control valve is located below the instrument panel to the right of the control quadrant. When the valve is set to the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. During alternate static source operation, these instruments may give slightly different reading, depending on conditions within the cabin. Airspeed, setting of heating and ventilating controls, or the position of the storm window can influence cabin air pressure. The pilot can determine the effects of the alternate static source on instrument readings by switching from standard to alternate sources at different airspeeds and heating and ventilating configurations (including open storm window below 129 KIAS).

If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks, or moisture. The pilot and the static lines may be drained through separate drains located on the side panel next to the pilot's seat.

The holes in the sensors for pitot and static pressure must be fully open and free from dirt, bugs, or polish. Blocked sensor holes will give erratic or zero readings on the instruments.

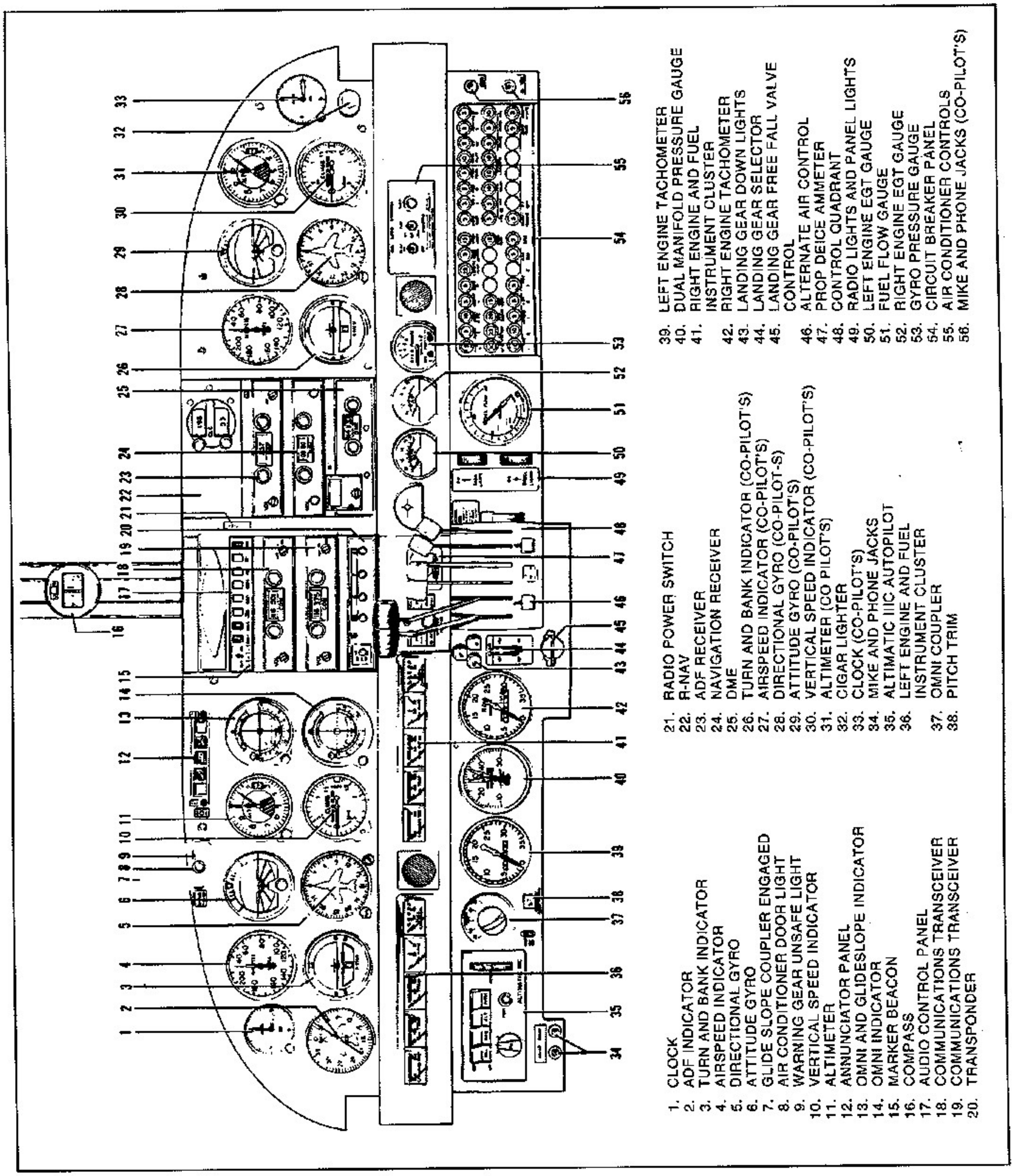
A heated pitot head, which alleviates problems with icing and heavy rain, is available as optional equipment. Static source pads have been demonstrated to be non-icing; however, in the event icing does occur, selecting the alternate static source will alleviate the problem.



1. CLOCK
2. ADF INDICATOR
3. TURN AND BANK INDICATOR
4. AIRSPEED INDICATOR
5. DIRECTIONAL GYRO
6. ATTITUDE GYRO
7. GLIDE SLOPE COUPLER ENGAGED
8. WARNING GEAR UNSAFE LIGHT
9. VERTICAL SPEED INDICATOR
10. ALTIMETER
11. ANNUNCIATOR PANEL
12. OMNI AND GLIDE SLOPE INDICATOR
13. OMNI INDICATOR
14. MARKER BEACON
15. COMPASS
16. AUDIO CONTROL PANEL
17. COMMUNICATIONS TRANSCEIVERS
18. COMMUNICATIONS TRANSCEIVERS
19. TRANSPONDER
20. RADIO POWER SWITCH
21. R-NAV
22. ADF RECEIVER
23. NAVIGATION RECEIVER
24. DME
25. TURN AND BANK INDICATOR (COPILOT'S)
26. AIRSPEED INDICATOR (COPILOT'S)
27. DIRECTIONAL GYRO (COPILOT'S)
28. ATTITUDE GYRO (COPILOT'S)
29. VERTICAL SPEED INDICATOR (COPILOT'S)
30. ALTIMETER (COPILOT'S)
31. CIGAR LIGHTER
32. CLOCK (COPILOT'S)
33. MIKE AND PHONE JACKS
34. ALTIMATIC III C AUTOPILOT
35. LEFT ENGINE AND FUEL INSTRUMENT CLUSTER
36. OMNI COUPLER
37. PITCH TRIM
38. LEFT ENGINE TACHOMETER
39. DUAL MANIFOLD PRESSURE GAUGE
40. RIGHT ENGINE AND FUEL INSTRUMENT CLUSTER
41. RIGHT ENGINE TACHOMETER
42. LANDING GEAR DOWN LIGHTS
43. LANDING GEAR SELECTOR
44. LANDING GEAR FREE FALL VALVE CONTROL
45. ALTERNATE AIR CONTROL
46. PROP DEICE AMMETER
47. CONTROL QUADRANT
48. RADIO LIGHTS AND PANEL LIGHTS
49. LEFT ENGINE EGT GAUGE
50. FUEL FLOW GAUGE
51. RIGHT ENGINE EGT GAUGE
52. GYRO PRESSURE GAUGE
53. CIRCUIT BREAKER PANEL
54. MIKE AND PHONE JACKS (COPILOT'S)

INSTRUMENT PANEL (SERIAL NUMBERS 34-7770001 THROUGH 34-7870474)

Figure 7-21



INSTRUMENT PANEL (SERIAL NUMBERS 34-7970001 AND UP)

Figure 7-21a

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7.23 INSTRUMENT PANEL

Flight instruments are grouped in the upper instrument panel (Figure 7-21); engine and electrical system monitoring instruments, the autopilot, and the circuit breaker panel are in the lower instrument panel. Left and right engine instruments are separated by the left control wheel shaft.

Radios are mounted in the center of the upper instrument panel. The control quadrant - throttles and propeller and mixture controls - is in the center of the lower instrument panel. To the left of the control quadrant is the landing gear selector.

Various warning lights are located with the pilot's flight instruments on the left upper instrument panel. The gear unsafe warning light is to the left of the annunciator panel.

The annunciator panel, with manifold pressure overboost, oil pressure, gyro pressure and alternator lights, and incorporating a press-to-test feature, is located to the upper left of the radios. The illumination of these lights in flight is an indication of a possible system malfunction. The pilot should closely monitor instrument panel gauges to check the condition of a system whose corresponding light on the annunciator panel illuminates. Illumination of the manifold pressure overboost lights indicates manifold pressure at or above the maximum allowable 40 inches Hg. During preflight, the operational status of the annunciator panel, except auxiliary fuel pump lights, should be tested by use of the press-to-test button. When the button is depressed, all annunciator panel lights, except auxiliary fuel pump lights, should illuminate.

NOTE

When an engine is feathered, the alternator, gyro air and engine oil pressure annunciator lights will remain illuminated.

Instrument panel lighting can be dimmed or brightened by rheostat switches to the right of the control quadrant. Back-lights are standard equipment, and map lights, and reading lights are available as options. When instrument panel lights are turned on, annunciator lights are dimmed. However, they will not show dim when the press-to-test switch is depressed.

Most of the electrical switches are located on the switch panel on the left side of the cockpit. A radio power switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft MASTER switch. The radio power switch has an OFF, NORMAL and AUXILIARY position. The AUXILIARY position provides a secondary power circuit for all radios.

On later models equipped with the two position switch (NORMAL AND OFF), an emergency bus switch is also provided to provide auxiliary power to the avionics bus in event of a radio master switch circuit failure. The emergency bus switch is located behind the lower right shin guard left of the circuit breaker panel.

The manifold pressure lines have drain valves located behind and below the dual manifold pressure gauge. This allows any moisture which may have collected from condensation to be pulled into the engines. This is accomplished by depressing the two valves for 5 seconds while operating the engines at 1000 RPM.

NOTE

Do not depress the valves when manifold pressure exceeds 25 inches Hg.

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7.25 HEATING, VENTILATING AND DEFROSTING SYSTEM

Heated air for cabin heat and windshield defrosting is provided by a Janitrol combustion heater located in the aft fuselage behind the cabin baggage compartment close-off (refer to Figure 7-23). Air from the heater is ducted forward along the cabin floor to outlets at each seat and to the windshield area.

Operation of the combustion heater is controlled by a three-position switch located on the control console (Figure 7-25) between the front seats and labeled FAN, OFF and HEATER. Airflow and temperature are regulated by the two levers on the console. The right-hand lever regulates air intake and the left-hand lever regulates cabin temperature. Cabin comfort can be maintained as desired through various combinations of lever positions. Passengers have secondary control over heat output by individually adjustable outlets at each seat location.

For cabin heat, the air intake lever on the heater control console must be partially or fully open and the three-position switch set to the HEATER position. This simultaneously starts fuel flow and ignites the heater; and, during ground operation, it also activates the ventilation blower which is an integral part of the combustion heater. With instant starting and no need for priming, heat should be felt within a few seconds. When cabin air reaches the temperature selected on the cabin temperature lever, ignition of the heater cycles automatically to maintain the selected temperature. Two safety switches activated by the intake valve and located aft of the heater unit prevent both fan and heater operation when the air intake lever is in the closed position. A micro switch, which actuates when the landing gear is retracted, turns off the ventilation blower so that in flight the cabin air is circulated by ram air pressure only.

When the three-position switch is in the FAN position during ground operation, the ventilation fan blows fresh air through the heater ductwork for cabin ventilation and windshield defogging when heat is not desired. When the heater controls are used either for cabin heat or for ventilation, air is automatically ducted to the windshield area for defrosting.

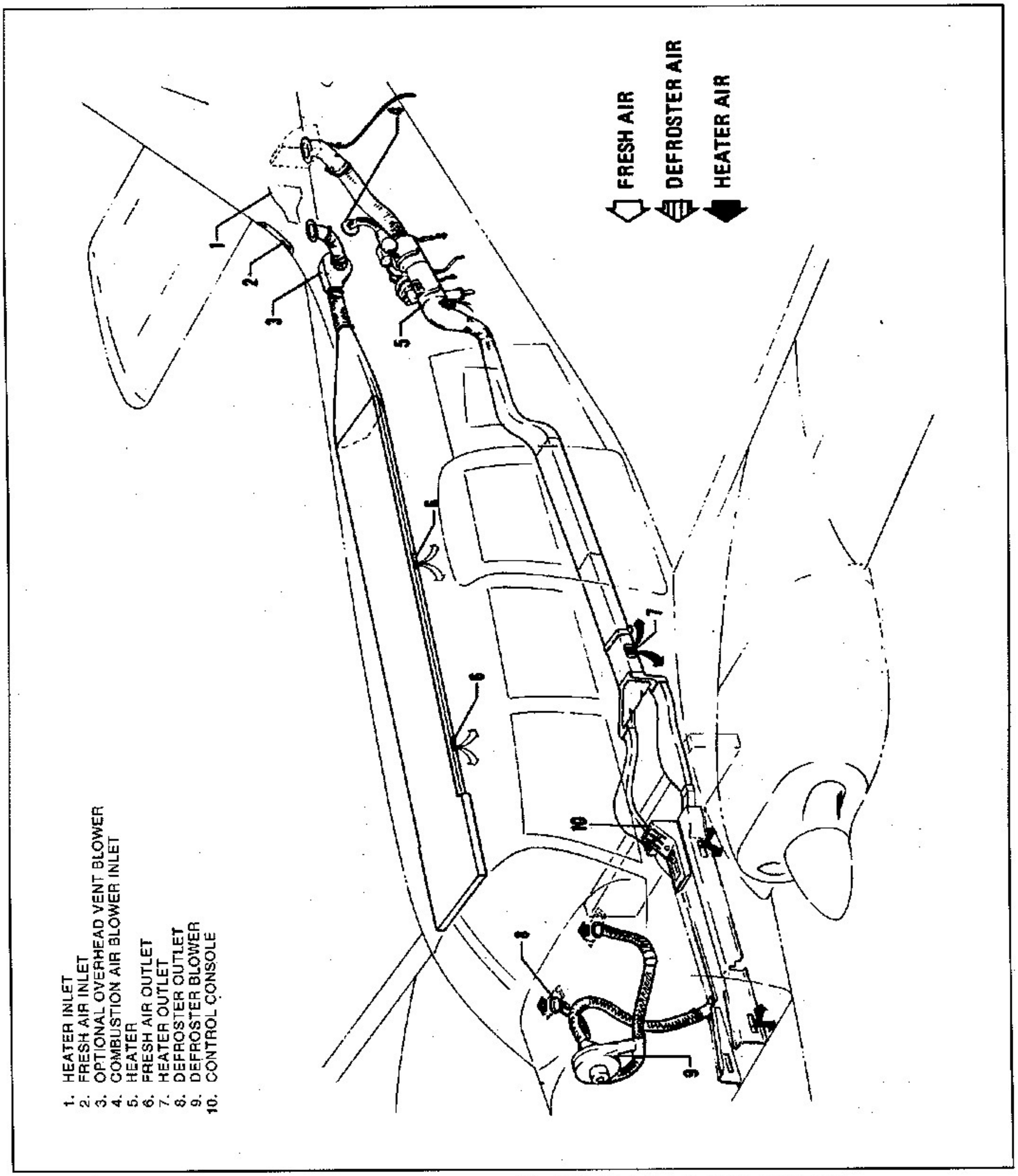
The flow of defroster air to the windshield area can be increased by the activation of a defroster fan. The fan is controlled by a defroster switch located on the control console between the two front seats.

To introduce fresh, unheated air into the cabin during flight, the air intake should be open and the heater off. Ram air enters the system and can be individually regulated at each floor outlet. Overhead outlets also supply fresh air for cabin ventilation. The occupant of each seat can manually adjust an outlet in the ceiling to regulate the flow of fresh air to that seat area. An optional fresh air blower may be installed in the overhead ventilation system to provide additional fresh air flow during ground operation.

An overheat switch located in the heater unit acts as a safety device to render the heater inoperative if a malfunction should occur. Should the switch deactivate the heater, the OVERHEAT light on the control console will illuminate. The overheat switch is located on the forward outboard end of the heater vent jacket. The red reset button on the heater shroud can be reached through the bulkhead access panel in the aft cabin close-out panel.

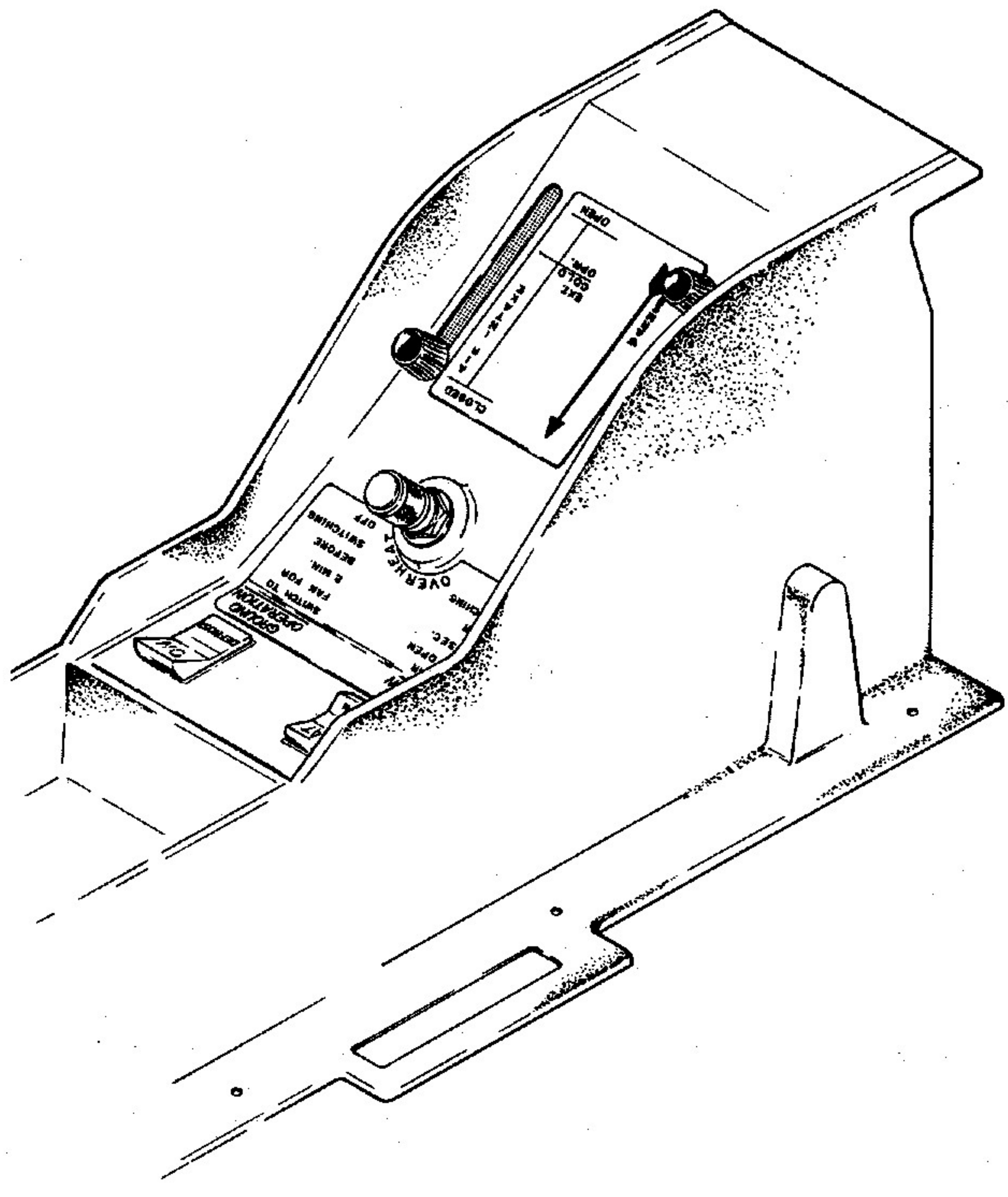
To prevent activation of the overheat switch upon normal heater shutdown during ground operation, turn the three-position switch to FAN for two minutes with the air intake lever in the open position before turning the switch to OFF. During flight, leave the air intake lever open for a minimum of fifteen seconds after turning the switch to OFF.

The combustion heater uses fuel from the airplane fuel system. An electric fuel pump draws fuel from the left tank at a rate of approximately one-half gallon per hour. Fuel used for heater operation should be considered when planning for a flight.



CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

Figure 7-23



HEATING, VENTILATING AND DEFROSTING CONTROL CONSOLE

Figure 7-25

7.27 CABIN FEATURES

The front seats are adjustable fore and aft. Each seat reclines and is provided with an armrest. The center and rear seats are easily removed to provide additional cargo space.

NOTE

To remove the center seats, retainers securing the back legs of the seats must be unlocked. This is accomplished on earlier models by turning the slotted head aft of each back leg ninety degrees with a coin or a screwdriver. In the locked position, the slot on the head runs fore to aft. Releasing the retainers on later models is accomplished by depressing the plunger behind each front leg. Any time the seats are installed in the airplane, the retainers should be in the locked position. To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.

An optional jump seat, which can be mounted between the two center seats, gives the Seneca II seven-place capabilities.

Single strap adjustable shoulder harnesses are standard equipment for the front seats and are offered as optional equipment for the third, fourth, fifth and sixth seats, but not for the seventh or aft facing seats. The shoulder strap is routed over the shoulder adjacent to the windows and attached to the top belt in the general area of the person's inboard hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint to the occupant.

Shoulder harnesses with inertial reels are available for all seats except the seventh seat. The inertial reel should be checked by tugging sharply on the strap. The reel will lock in place under this test and prevent the strap from extending. Under normal movement, the strap will extend and retract as required.

Standard cabin features include a pilot's storm window, ashtrays, map pockets, coat hooks and assist straps, a cigar lighter, sun visors, and pockets on the front and center seat backs. Among the options which may be added to suit individual needs are headrests, a fire extinguisher, and a special cabin sound-proofing package.

An optional club seating interior is also available. In the club seating interior the center seats face aft. These seats are equipped with lap belts only. Removal of the seats is accomplished by removing the two bolts holding the aft attach points and sliding the seat aft.

An optional refreshment console is located between the center seats. It is removed in an identical manner to the center seats.

An optional oxygen system is located between the center seats. It is strapped to the jump seat in the standard seating arrangement. In the club seating arrangement it utilizes the same attach points as the refreshment console.

An optional cabin work table, serving the two seats on the right side of the passenger cabin, is offered to the club seating arrangement. The table must be stowed during takeoff and landing. If the table is to be used, it should be set up after a level cruise is established.

To remove the cabin work table from the aft baggage compartment, unlock the stud located on the bottom of the close-out bulkhead. Loosen the white tie-down strap and remove the table from the mounting brackets by lifting the table two inches straight up until it clears the mounting brackets. Do not twist the table while it is in the brackets.

To install the cabin work table during flight, hold the table in place and tilt the free end of the table upward 30° until the lobed upper knobs on the table supports align with the top holes of the escutcheons located below the right cabin window trim. Hold the upper lobes in place and lower the free end of the table to the level work position. The retaining springs will click when secure.

To stow the cabin work table, remove the table by lifting the free end of the table upward to disengage the bottom lobes of the table supports. Lift until the top support lobes disengage at approximately 30° of tilt and remove the table. Position the table in the stowage area and, with the table work surface facing forward, place the slots in the table support into the receptacle clips mounted on the hat shelf. Make sure the white tie-down strap is not behind the table. With the table fully placed in the clips, bring the white tie-down strap across the face of the table and lock over the stud located on the bottom of the close-out bulkhead.

7.29 STALL WARNING

An approaching stall is indicated by a stall warning indicator which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on a graph in the Performance Charts Section. The stall warning indicator consists of a continuous sounding horn located behind the instrument panel. The stall warning horn has a different sound from that of the gear warning horn which also has a 90 cycles per minute beeping sound. The stall warning indicator is activated by two lift detectors on the leading edge of the left wing, outboard of the engine nacelle. The inboard detector activates the indicator when the flaps are in the 25 and 40 degree positions, the outboard when the flaps are in other positions.

7.31 BAGGAGE AREA

There are two separate baggage compartments. One, the nose section baggage compartment, is accessible through a baggage door on the left side of the nose section. It has a maximum weight capacity of 100 pounds. The cabin baggage compartment, located aft of seats five and six has a weight capacity of 100 pounds. This compartment is loaded and unloaded through the rear cabin door, and it is accessible during flight. Tie-down straps are provided and they should be used at all times. A cargo loading door, installed aft of the rear door, facilitates the loading of bulky items. All cargo, baggage compartment and passenger doors use the same key. The nose section baggage compartment door key can be removed only when in the locked position.

A nose section baggage compartment light illuminates automatically whenever the baggage door is opened. The baggage compartment light is independent of the aircraft master switch; therefore, when the baggage door is opened, the light will illuminate regardless of the position of the master switch. When the baggage compartment light option is installed, the baggage door should not be left open or ajar for extended time periods as battery depletion could result.

NOTE

It is the pilot's responsibility to be sure when baggage is loaded that the airplane C.G. falls within the allowable C.G. range. (See Weight and Balance Section.)

7.33 FINISH

All exterior surfaces are finished with acrylic lacquer. To keep the finish attractive, economy size spray cans of touch-up paint are available from Piper Dealers. An optional polyurethane finish is available.

7.35 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT) when installed, is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate is attached with slotted-head nylon screws for ease of removal; these screws may be readily removed with a variety of common items such as a dime, a key, a knife blade, etc. If there are no tools available in an emergency the screw heads may be broken off by any means. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52.

A battery replacement date is marked on the transmitter to comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If the tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

NARCO ELT 10 OPERATION

On the ELT unit itself is a three position switch placarded "ON," "OFF" and "ARM." The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

To use the ELT as a portable unit in an emergency, remove the cover and unlatch the unit from its mounting base. The antenna cable is disconnected by a left quarter-turn of the knurled nut and a pull. A sharp tug on the two small wires will break them loose. Deploy the self-contained antenna by pulling the plastic tab marked "PULL FULLY TO EXTEND ANTENNA." Move the switch to ON to activate the transmitter.

In the event the transmitter is activated by an impact, it can only be turned off by moving the switch on the ELT unit to OFF. Normal operation can then be restored by pressing the small clear plastic reset button located on the top of the front face of the ELT and then moving the switch to ARM.

A pilot's remote switch located on the left side panel is provided to allow the transmitter to be turned on from inside the cabin. The pilot's remote switch is placarded "ON" and "ARMED." The switch is normally in the ARMED position. Moving the switch to ON will activate the transmitter. Moving the switch back to the ARMED position will turn off the transmitter only if the impact switch has not been activated.

The ELT should be checked to make certain the unit has not been activated during the ground check. Check by selecting 121.50 MHz on an operating receiver. If there is an oscillating chirping sound, the ELT may have been activated and should be turned off immediately. This requires removal of the access cover and moving the switch to OFF, then press the reset button and return the switch to ARM. Recheck with the receiver to ascertain the transmitter is silent.

*Optional Equipment

CCC CIR 11-2 OPERATION

On the unit itself is a three position selector switch placarded "OFF," "ARM" and "ON." The ARM position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the OFF position. The ARM position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane. The ON position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

Select the OFF position when changing the battery, when rearming the unit if it has been activated for any reason, or to discontinue transmission.

NOTE

If the switch has been placed in the ON position for any reason, the OFF position has to be selected before selecting ARM. If ARM is selected directly from the ON position, the unit will continue to transmit in the ARM position.

A pilot's remote switch, located on the left side panel, is provided to allow the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON," "AUTO/ARM" and "OFF/RESET." The switch is normally left in the AUTO/ARM position. To turn the transmitter off, move the switch momentarily to the OFF/RESET position. The aircraft master switch must be ON to turn the transmitter OFF. To actuate the transmitter for tests or other reasons, move the switch upward to the ON position and leave it in that position as long as transmission is desired.

The unit is equipped with a portable antenna to allow the locator to be removed from the aircraft in case of an emergency and used as a portable signal transmitter.

The locator should be checked during the ground check to make certain the unit has not been accidentally activated. Check by tuning a radio receiver to 121.50 MHz. If there is an oscillating sound, the locator may have been activated and should be turned off immediately. Reset to the ARM position and check again to insure against outside interference.

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7.37 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) allows the airplane engine to be started from an external battery without the necessity of gaining access to the airplane battery. The cable from the external battery can be attached to a receptacle under the left side of the nose section of the fuselage. Instructions on a placard located on the cover of the receptacle should be followed when starting with external power. For instructions on the use of the PEP, refer to Starting Engines - Section 4.

7.39 ICE PROTECTION SYSTEM*

For flight into known icing conditions, a complete ice protection system (Figure 7-27) is available as optional equipment on the Seneca II.

The ice protection system consists of the following components: pneumatic wing and empennage boots, wing ice detection light, electrothermal propeller deice pads, electric windshield panel, heated lift detectors, and heated pitot head.

The pneumatic wing and empennage boots are installed on the leading edges of the wings, the vertical stabilizer and the horizontal stabilator. During normal operation, when the surface deicer system is turned off, the engine-driven pressure pumps apply a constant suction to the deicer boots to provide smooth, streamlined leading edges.

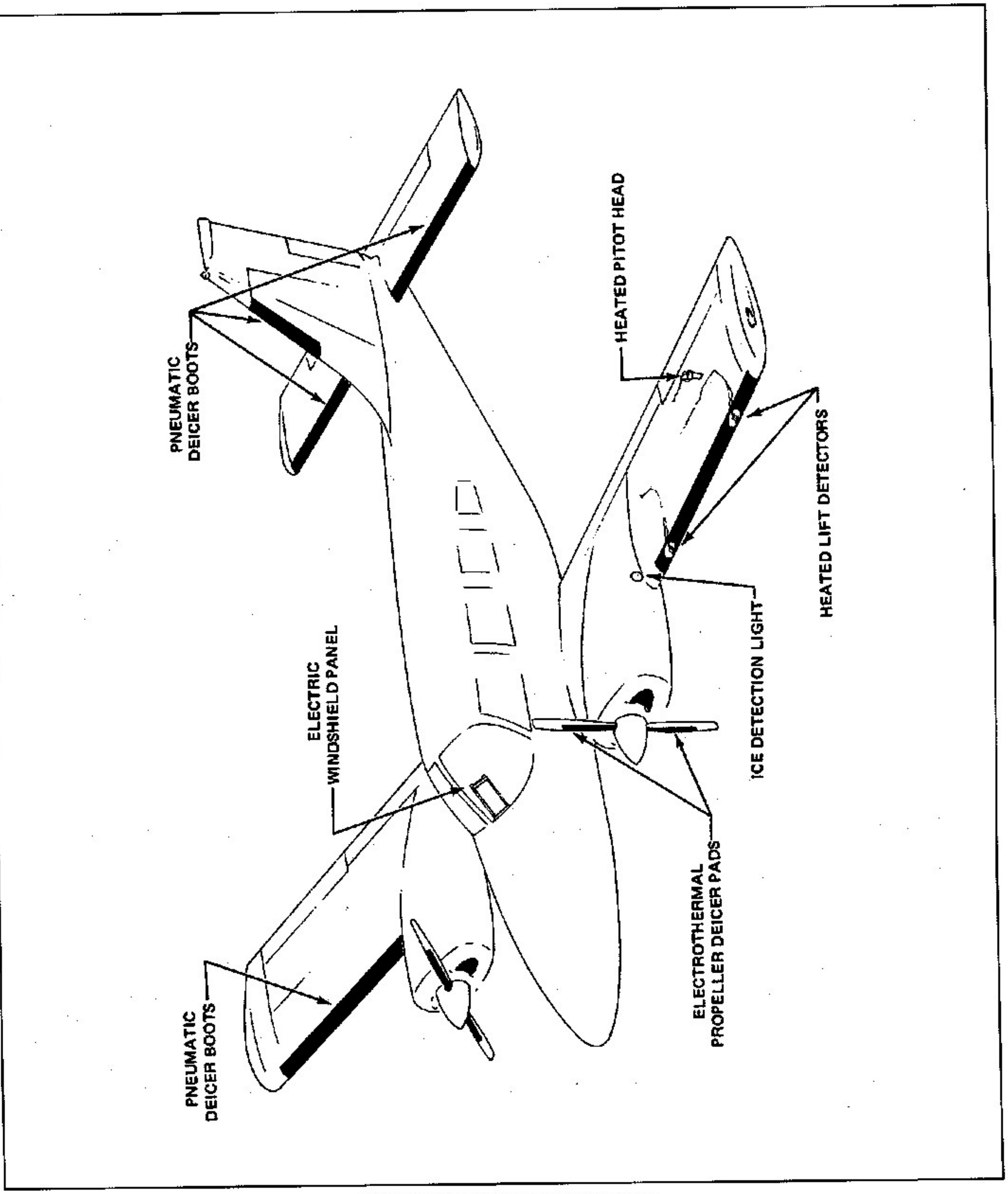
Deicer boots are inflated by a momentary "ON"-type "SURFACE DE-ICE" switch (Figure 7-29) located on the instrument panel directly above the control quadrant. Actuation of the surface deice switch activates a system cycle timer which energizes the pneumatic pressure control valves for six seconds. The boot solenoid valves are activated and air pressure is released to the boots, inflating all surface deicers on the airplane. A "Wing-Tail Deicer" indicator light, with a press-to-test feature, illuminates when the surface deicer boots inflate. When the cycle is complete, the deicer solenoid valves permit automatic overboard exhaustion of pressurized air. Suction is then reapplied to the deicer boots. The deicer boots do not inflate during the press-to-test cycle.

Circuit protection for the surface deicer system is provided by a "Wing-Tail De-icers" circuit breaker located on the circuit breaker panel.

Wing icing conditions may be detected during night flight by use of an ice detection light installed in the outboard side of the left engine nacelle. The light is controlled by an "ICE LIGHT" switch (Figure 7-29) located on the instrument panel to the right of the surface deice switch. A "Wing Ice Light" circuit breaker located in the circuit breaker panel provides circuit protection.

Electrothermal propeller deicer pads are bonded to the leading edges of the propeller blades. Each deicer pad has two separate heaters, one for the outboard and one for the inboard half. The system is controlled by an "On-Off"-type "PROP DE-ICE" switch (Figure 7-29) located to the right of the surface deice switch. Power for the propeller deicers is supplied by the airplane's electrical system through a "Prop De-ice" circuit breaker in the circuit breaker panel. When the prop deice switch is actuated, power is applied to a timer through the "Prop De-icer" ammeter which monitors the current through the propeller deicing system. With the propeller deicing system on, the prop deicer ammeter needle should indicate within the shaded portion of the ammeter for a normal reading.

*Optional equipment



ICE PROTECTION SYSTEM

Figure 7-27

Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller deicer pads.

The Hartzell propellers are deiced by heating the outboard half and then the inboard half of the deicer pads in a timer controlled sequence. The heating sequence of the deicer pads is conducted in the following order.

(a) Outboard halves of the propeller deicer pads on the right engine.
(b) Inboard halves of the propeller deicer pads on the right engine.
(c) Outboard halves of the propeller deicer pads on the left engine.
(d) Inboard halves of the propeller deicer pads on the left engine.

The optional McCauley propellers are deiced by heating the entire deicer pads alternately in the following sequence.

(a) The entire deicer pads on the right engine for 90 seconds.
(b) The entire deicer pads on the left engine for 90 seconds.

When the system is turned on, heating may begin on any one of the above steps, depending upon the positioning of the timer switch when the system was turned off from previous use. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off.

A preflight check of the propeller deicers can be performed by turning the prop deice switch on and feeling the propeller deicer pads for proper heating sequence. The deicer pads should become warm to the touch.

The heat provided by the deicer pads reduces the adhesion between the ice and the propeller so that centrifugal force and the blast of airstream cause the ice to be thrown off the propeller blades in very small pieces.

A heated glass panel is installed on the exterior of the pilot's windshield to provide visibility in icing conditions. The panel is heated by current from the airplane's electrical power supply and controlled by an "ON-OFF" control switch/circuit breaker. The control switch/circuit breaker is located in the right hand side of the de-ice panel and placarded "WINDSHIELD PANEL HEAT - SEE PILOT'S OPERATING HANDBOOK."

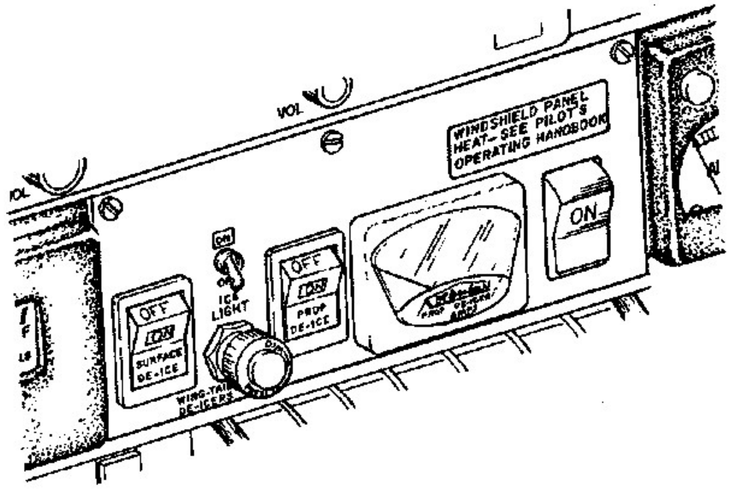
An operational check may be performed by turning the heated windshield panel switch on for a period not exceeding 30 seconds. Proper operation is indicated by the glass section being warm to the touch.

CAUTION

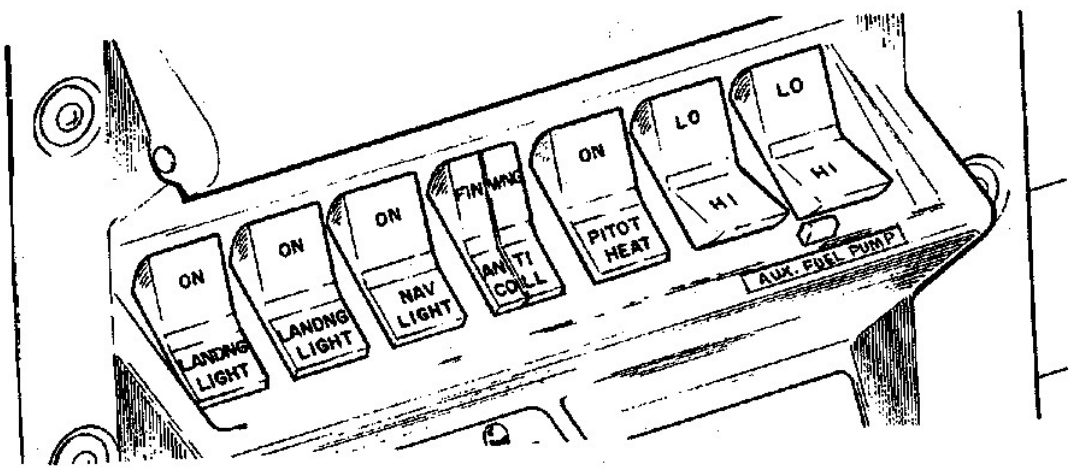
If the airplane is to be flown with the heated glass panel removed, rotate the receptacle plate 180° and replace it to cover the holes in the fuselage skin. Also replace the windshield collar screws.

Two heated lift detectors and a heated pitot head installed on the left wing are controlled by a single "On-Off"-type "HEATED PITOT" switch located on the switch panel to the left of the pilot.

The heated lift detectors, one inboard and one outboard on the left wing, are installed to prevent icing conditions from interfering with operation of the stall warning transmitters. A "Stall Warn Heat" circuit breaker in the circuit breaker panel protects the system against an overvoltage condition. The stall warning system should not be depended on when there is ice on the wing.



ICE DETECTION LIGHT, SURFACE DEICER, PROPELLER DEICER AND HEATED WINDSHIELD CONTROL SWITCHES



HEATED PITOT AND HEATED STALL WARNING TRANSMITTER CONTROL SWITCHES

ICE PROTECTION SYSTEM CONTROL SWITCHES

Figure 7-29

A heated pitot head, mounted under the left wing, is installed to provide pitot pressure for the airspeed indicator with heat to alleviate ice accumulation from blocking the pressure intake. The heated pitot head also has a separate circuit breaker located in the circuit breaker panel and labeled "Pitot Heat."

With the heated pitot switch on, check the heated pitot head and heated lift detector for proper heating.

CAUTION

> Care should be taken when an operational check of the heated pitot head and the heated lift detectors is being performed. Both units become very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

7.41 RADAR*

A weather radar system can be installed in this airplane. The basic components of this installation are an antenna, a transmitter/receiver, and a cockpit indicator. The function of the weather radar system is to detect weather conditions along the flight path and to visually display a continuous weather outline on the cockpit indicator. Through interpretation of the advance warning given on the display, the pilot can make an early decision on the most desirable weather avoidance course.

In addition to its primary purpose, weather mapping, the system can be used for navigation. A ground mapping feature allows the pilot to identify coastlines, water masses, islands, high ground, etc. This provides the pilot with a guidance feature which may be useful in adverse weather conditions or over areas where ground-based navigational aids are limited.

For detailed information on the weather radar system and for procedures to follow in operating and adjusting the system to its optimum efficiency, refer to the appropriate operating and service manuals provided by the radar system manufacturer.

WARNING

> Heating and radiation effects of radar can cause serious damage to the eyes and tender organs of the body. Personnel should not be allowed within fifteen feet of the area being scanned by the antenna while the system is transmitting. Do not operate the radar during refueling or in the vicinity of trucks or containers accomodating explosives or flammables. Flashbulbs can be exploded by radar energy. Before operating the radar in any mode other than STANDBY, direct the nose of the airplane so that the forward 120 degree sector is free of any metal objects such as other aircraft or hangars for a distance of at least 100 yards, and tilt the antenna upward 15 degrees. Do not operate the radar while the airplane is in a hangar or other enclosure.

*Optional equipment

NOTE

When operating weather avoidance radar systems inside of moderate to heavy precipitation, it is advisable to set the range scale of the radar to its lowest scale.

7.43 AIR CONDITIONING

The air conditioning system is a recirculating air system. The major components include an evaporator, a condensor, a compressor, a blower, switches and temperature controls.

The evaporator is located behind the rear baggage compartment. This cools the air used for the air conditioning system.

The condensor is mounted aft of the firewall on the left engine. A retractable condensor scoop extends when the air conditioner is on and retracts to a flush position when the air conditioner is off.

If the air conditioner is operated on the ground, the condenser scoop operates to a ground opening position which is larger than the in-flight opening. A circuit through the squat switch on the right main gear prevents the scoop operating to the ground opening when the aircraft is in flight.

The compressor is mounted on the rear left side of the left engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel. The temperature control regulates the temperature of the cabin. Turning the control clockwise increases cooling; counterclockwise decreases cooling.

The fan speed switch and the air conditioning ON-OFF switch are inboard of the temperature control. The fan can be operated independently of the air conditioning; however, the fan must be on for air conditioner operation. Turning either switch off will disengage the compressor clutch and retract the condensor door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

The fan switch allows operation of the fan with the air conditioner turned OFF to aid in cabin air circulation. "LOW" or "HIGH" can be selected to direct a flow of air through the air conditioner outlets in the overhead duct. These outlets can be adjusted or turned off individually.

The condenser door light is located to the left of the warning gear unsafe light in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

A circuit breaker on the circuit breaker panel protects the air conditioning electrical system.

7.45 PORTABLE OXYGEN SYSTEM

A portable oxygen system to provide supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet) is available as optional equipment. The system is secured to the middle center seat with the forward facing seating arrangement and mounted between the center seats with the club seating arrangement. (Refer to Section 9, Supplement 2, for FAA Approve supplemental information.)

The major components of the system consist of two console cylinder kits and six oxygen masks. Each console is equipped with a 22 cubic foot oxygen cylinder, an oxygen supply gauge, an ON-OFF flow control knob and two plug-in receptacles. Two single supply line masks and two dual supply line masks, which utilize dual manifold connectors. are provided to supply six masks with only four outlets.

Each cylinder is enclosed in a console carrying case with a separate supply gauge and ON-OFF flow control knob mounted on the sloped face of each unit. Two plug-in outlets are mounted below the gauge and control knob on each console. The masks for the rear seats are stowed in the pockets on the center seats and all other masks are stowed in the consoles.

When fully charged, each cylinder contains oxygen at a pressure of 1850 psi at 70°F. the filler port is enclosed by a cover at the rear of each unit. If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, insert the mask plug-in connector into an outlet and lock by rotating the connector approximately 1/4 turn. Don mask (s) and rotate the ON-OFF control knob fully counterclockwise (approximately two full turns).

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen is essential, the airplane should be lowered to a safe altitude immediately.

Always remove fittings from the oxygen receptacles and stow the masks when they are not in use. Connect only those mask assemblies being used to prevent oxygen loss through and unused mask assembly. If the control knob is ON and the fitting is in the receptacle, oxygen will flow through the mask continuously. If a dual manifold connector is used, both masks must be donned. Masks may be damaged if they are not properly stowed.

WARNING

Positively no smoking while oxygen is being used by anyone in the airplane.

To stop the flow of oxygen through the system, the control knob should be turned OFF by rotating fully clockwise, finger tight.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid and other flammable material should be kept away from oxygen equipment.

7.47 FIXED OXYGEN SYSTEM

A fixed oxygen system to provide supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet) is available as optional equipment. The major components of the Scott oxygen system are a 63 cubic foot oxygen cylinder, an oxygen supply gauge, an on-off flow control knob, a pressure regulator, six plug in receptacles and six oxygen masks.

The oxygen cylinder is mounted aft in the tail cone. When fully charged, the cylinder contains oxygen at a a pressure of 1850 psi at 70°F. The oxygen supply guage is mounted in the aft overhead vent duct. The oxygen flow control knobs labeled "Pull-On" is mounted in the pilot's overhead panel. The pressure regualtor is mounted directly on the oxygen cylinder, once the oxygen flow control knob is on, each of the oxygen plug-in receptacles operates as an automatic on-off valve. The oxygen cylinder can be recharged through the access door aft of the rear window on the left side of the fuselage.

If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, the control knob should be pulled forward to the ON positions allowing oxygen to flow from the cylinder through the system. Connecting the constant flow mask fitting to a receptacle and turning it 90 degrees clockwise, automatically releases oxygen to the mask through the on-off valve feature of the receptacle. The occupant then dons the mask and breathes normally for a sufficient supply of oxygen.

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen use is essential, the airplane should be lowered to a safe altitude immediately.

When not in use, mask may be stowed in the storage pockets behind the front and center seats. Always remove fittings from the oxygen receptacles and stow the mask when they are not is use. If the control knob is pulled on and the fitting is in the receptacle, oxygen will flow through the mask continuously. Masks may be damaged if they are not properly stowed.

CAUTION

Positively NO SMOKING while oxygen is being used by anyone in the aircraft.

To stop the flow of oxygen through the system, the control knob should be pushed aft to the OFF position. To bleed down low pressure lines, it is recommended that the mask assembly be left connected to the outlet for at least three minutes after the control knob is turned off.

To prelude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid, and other flammable material should be kept away from oxygen equipment.