

DESCRIPTION

AIRPLANE AND SYSTEM

The Airplane	2-1
Airframe	2-1
Engines	2-2
Propellers	2-4
Landing Gear System.....	2-4
Flight Control Systems	2-9
Fuel System.....	2-10
Electrical System.....	2-12
Vacuum System	2-16
Instrument Panel	2-18
Pitot-Static Systems	2-18
Heating, Ventilating and Defrosting System	2-20
Ice Protection System.....	2-22
Seats	2-26
Finish.....	2-26
Baggage Area.....	2-26
Stall Warning	2-27

DESCRIPTION

AIRPLANE AND SYSTEMS

THE AIRPLANE

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

AIRFRAME

Except for the steel used in the engine mount and landing gear, and the fiberglass used in such portions as the nose and wing tips, the structural components of the airframe are made of aircraft aluminum alloy which has been heat treated and protected from corrosion. The airframe has been designed and tested to a limit positive load factor of 3.8. The Seneca is not designed for aerobatic flight, and consequently aerobatics are prohibited.

The fuselage is a conventional semi-monocoque structure, which has a front door on the right side and a rear door on the left. An additional large-size rear door, which facilitates the loading of large pieces of cargo, is available.

The wing is of conventional metal design using one main spar located at approximately 40% of the chord aft of the leading edge, to take bending loads, and a rear spar for mounting the flaps and ailerons and to assist in taking torque and drag loads. Slotted wing flaps, which are mechanically operated by a four-position handle located between the two front seats, are provided to reduce landing speed and to give the pilot a high degree of glide path control. Two interconnected fuel tanks form an integral part of each wing. Both tanks on one side are filled through a single filler neck located well outboard of the engine nacelle.

The wings are attached to each side of the fuselage by the butt ends of the main spars, which are bolted into a spar box carry through, an integral part of the fuselage structure. There are also fore and aft attachments at the rear spar and at an auxiliary front spar.

The empennage of the Seneca consists of a vertical stabilizer, a rudder, and a horizontal stabilator. The rudder has a trim tab capable of relieving the pilot of excessive pedal force during single-engine operation. The stabilator incorporates an anti-servo tab which improves longitudinal stability and provides longitudinal trim. This tab moves in the direction the stabilator moves but with increased travel.

ENGINES

The 400 total horsepower of the Seneca engines makes possible a high cruise speed and excellent climb performance. The aircraft is powered by two four-cylinder, Lycoming, fuel-injected engines, each rated at 200 horsepower at 2700 RPM. Asymmetric thrust is eliminated during take-off and climb by 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 engine compartments are easily accessible for inspection through top-hinged side panels on either side of the engine cowlings. The cowlings are cantilever structures, attached at the firewalls. Engine mounts are constructed of steel tubing, and dynafocal mounts are provided to reduce vibration.

The exhaust system is a crossover type, with exhaust gases directed outboard of the nacelles into muffler-heaters to minimize exhaust noise and provide heated air for the cabin and defroster.

The cowl flaps are located on the bottom of the engine nacelle and are manually operated by control levers below the throttle quadrant. The control levers have three positions: open, intermediate and closed. A lock, incorporated into each control lever, locks the cowl flap in the selected position. To operate, depress the lock and move the control to the desired position. Release the lock after initial movement of the control; the flap will then stop automatically in the next intermediate, open or closed position. The lock must be depressed for each selection of cowl flap.

An oil cooler for each engine is mounted on the forward side of the firewall. Air is picked up by air scoops on the side of the cowl, passed through the oil cooler and ducted overboard in the lower cowling.

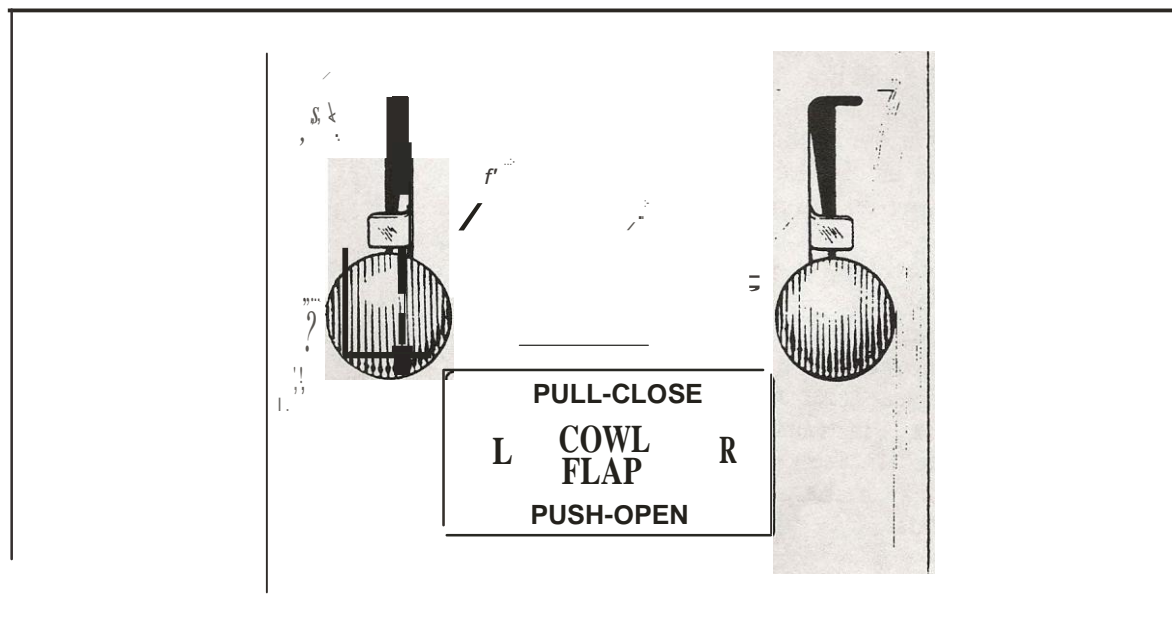
The fuel injection system reduces the possibility of induction system ice and provides better fuel distribution than does a carburetor system. Each engine is equipped with a Bendix RSA-5 fuel injection system, which operates on the principle of measuring engine air consumption and using the air flow to control fuel flow to the engine. Fuel pressure regulation by means of a servo valve causes a minimal drop in fuel pressure throughout the metering system. Metering pressure is maintained above vapor forming conditions, yet fuel inlet pressure is low enough to allow the use of a diaphragm fuel pump. Thus vapor lock and associated problems of difficult starting are minimized.

Mounted on top of the engine is the ported fuel flow divider with four nozzle lines routed to the cylinders. The divider contains a spring loaded positive shut-off valve. Within each cylinder are continuous-flow air bleed nozzles with provisions to eliminate the adverse effects of low manifold pressure when idling. Since fuel metering is provided by the servo regulator rather than the nozzles, more uniform cylinder head temperatures result and longer engine life is possible.

Induction air for the engine enters an air scoop located on the outboard side of the lower cowl. The air is directed through a filter and thence to the servo regulator. To prevent engine malfunction if the air filter becomes blocked, the induction system incorporates a method of providing heated alternate air which does not pass through the filter. Located in the air box between the filter and servo regulator is a valve which is manually operated by the alternate air control located below the power quadrant. Since the alternate air is heated by the crossover exhaust tube, it gives extra protection against icing in the system caused by snow or freezing rain. Alternate air should not be used during ground operation because the unfiltered air may contain dust and other contamination. The primary induction source should always be used for take-off.

All throttle operations should be made with a smooth, not-too-rapid movement to prevent unnecessary engine wear, or damage to dynamic counterweights on the engines.

The pilot should read and follow the procedures recommended in the Lycoming Operator's Manual for this engine, in order to obtain maximum engine efficiency and time between engine overhauls.



Cowl Flap Control

PROPELLERS

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

The propellers are constant speed, controllable pitch, full feathering Hartzell propellers, operated by oil and nitrogen pressure. Compressed air may be used instead of nitrogen, provided it contains no moisture. Oil pressure sends the propeller toward the high RPM or unfeather position, while nitrogen pressure sends the propeller toward the low RPM or feather position and keeps the propeller from overspeeding. The recommended nitrogen pressure to be used when charging the unit is listed on placards on the propeller dome and inside the spinner. This pressure varies with ambient temperature at the time of charging. A governor, mounted on each engine, supplies oil through the propeller shaft at various pressures to maintain constant RPM settings.

Each propeller is controlled by use of the propeller control lever 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 ahead and engaging the starter until the propeller is windmilling.

A feathering lock, operated by centrifugal force, prevents feathering during engine shutdown, by making it impossible to feather any time the engine speed is less than 800 RPM. For this reason if an engine is being feathered to save it the pilot must be sure to move the control to feather position before the engine speed drops below 800 RPM.

LANDING GEAR SYSTEM

To increase cruise speed, climb and other performance, the Seneca is equipped with a retractable tricycle landing gear, which is hydraulically operated. Rugged gear construction and a heavy duty braking system permit operation from a wide variety of landing areas.

Hydraulic pressure for gear operation is furnished by an electrically-powered reversible pump controlled by a two-position selector switch located on the instrument panel to the left of the control quadrant. 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. If the landing gear is in transit and the hydraulic pump is running, it is inadvisable to move the gear selector switch to the opposite direction before it has reached its travel limit, because this sudden reversal may be harmful to the electric pump. Retraction or extension normally takes six to seven seconds.

The gear system incorporates a number of features:-Gear extension can be accomplished even in the event of hydraulic failure, since the gear is held up by hydraulic pressure. If the hydraulic system develops a leak or if the pressure is relieved for any reason, gravity will cause the gear to extend. Aerodynamic loads and springs assist in extending and locking the gear down. When the landing gear is retracted, the main wheels fold toward the centerline of the airplane and the nose gear retracts forward. Once the nose gear has started toward the down position, the airstream pushes against it and assists in moving it to the locked position. When the three gears are down and the down lock hooks engage, a spring maintains force on each hook in the locked position until it is released by hydraulic pressure.

To get the gear to extend and lock if the hydraulic pump fails, it is necessary only to relieve the hydraulic pressure. An emergency gear extension knob, located near the center of the instrument panel, is provided for this purpose. Pulling this knob releases the hydraulic pressure which holds the landing gear in the up position, and the gear can then fall free. A guard over the knob is provided to prevent inadvertent extension of the gear. Prior to pulling the emergency gear extension knob, it is advisable to place the gear selector 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 up or fully down and the selector is in the corresponding position, electrical limit switches stop the flow of current to the motor of the hydraulic pump. Three green lights indicate that the landing gear is down and locked, and a convex mirror on the left engine nacelle enables the pilot to confirm the position of the nose gear. When the gear is not in the full up or the full down position, a red warning light is illuminated on the instrument panel.

To add to the pilot's night vision comfort, the gear lights are automatically dimmed when the navigation lights are turned on. For this reason, if the navigation lights are unintentionally 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 switch is put in the DOWN position, the first thing to check is the position of the switch for the navigation lights.

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

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

The square indicating lights can be pulled out and moved around in order to check the bulbs.

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

1. Gear up and manifold pressure reduced below 14 inches on either one or both engines.
2. Gear selector switch in the UP position when the airplane is on the ground.

If the gear selector knob is placed in the "UP" position when the airplane is on the ground, a safety switch located on the left main gear will prevent the hydraulic pump from actuating if the master switch should be turned on. On take-off, when the oleo extends in excess of eight inches, the safety switch closes to complete the circuit so that the hydraulic pump can raise the landing gear when the gear switch is moved to the "UP" position. On take-off the gear should be retracted before an airspeed of 125 MPH is exceeded. It may be extended at any speed up to 150 MPH.

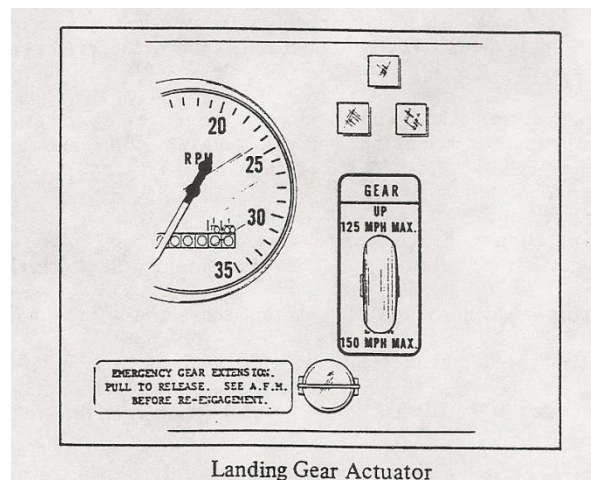
The nose gear is steerable through a 42-degree arc by use of the rudder pedals. As the gear retracts, the steering linkage disengages to reduce rudder pedal loads in flight and the nose wheel straightens as it enters the wheel well. A gear centering spring, incorporated in the nose gear steering system, prevents any tendency to shimmy.

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 Seneca Service Manual.

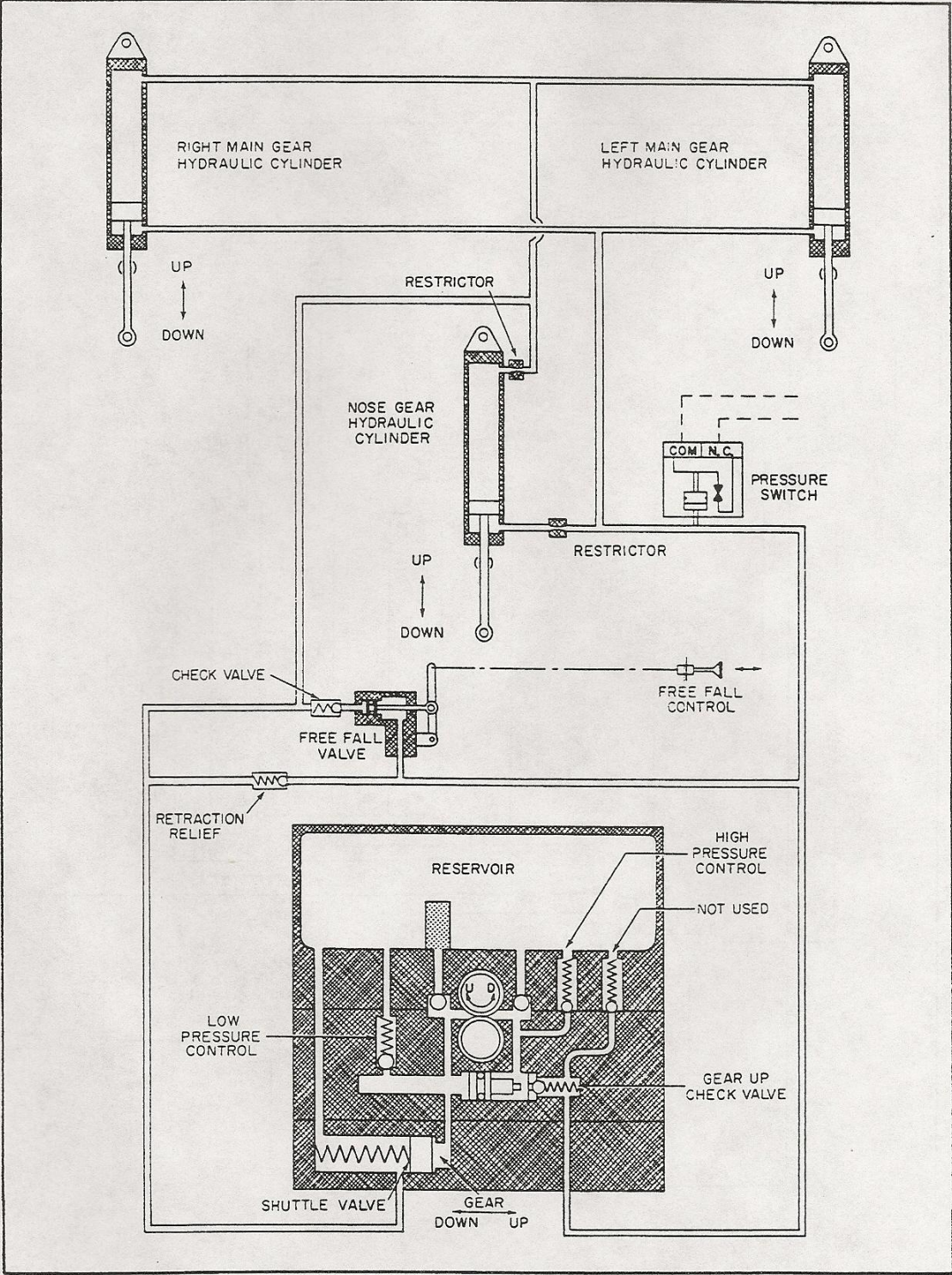
The three landing gear wheels are the same size - 6.00-6. The nose wheel has a 6-ply tire and the main gear has 8-ply tires. Struts for nose and main gear are air-oil assemblies.

The brake system, which incorporates a single-disc double puck brake assembly on each main gear strut, is designed to meet all normal braking needs and to assist in the exceptional short-field landing capabilities of the Seneca; A brake system hydraulic reservoir, independent of the landing gear hydraulic reservoir, is located behind a panel at the rear top of the nose baggage compartment. The fluid should be maintained at the level marked on the reservoir. The brake assemblies are actuated by individual toe brake cylinders mounted on the left (optional on the right) set of rudder pedals and a handle-operated brake cylinder located below and behind the left center of the instrument panel.

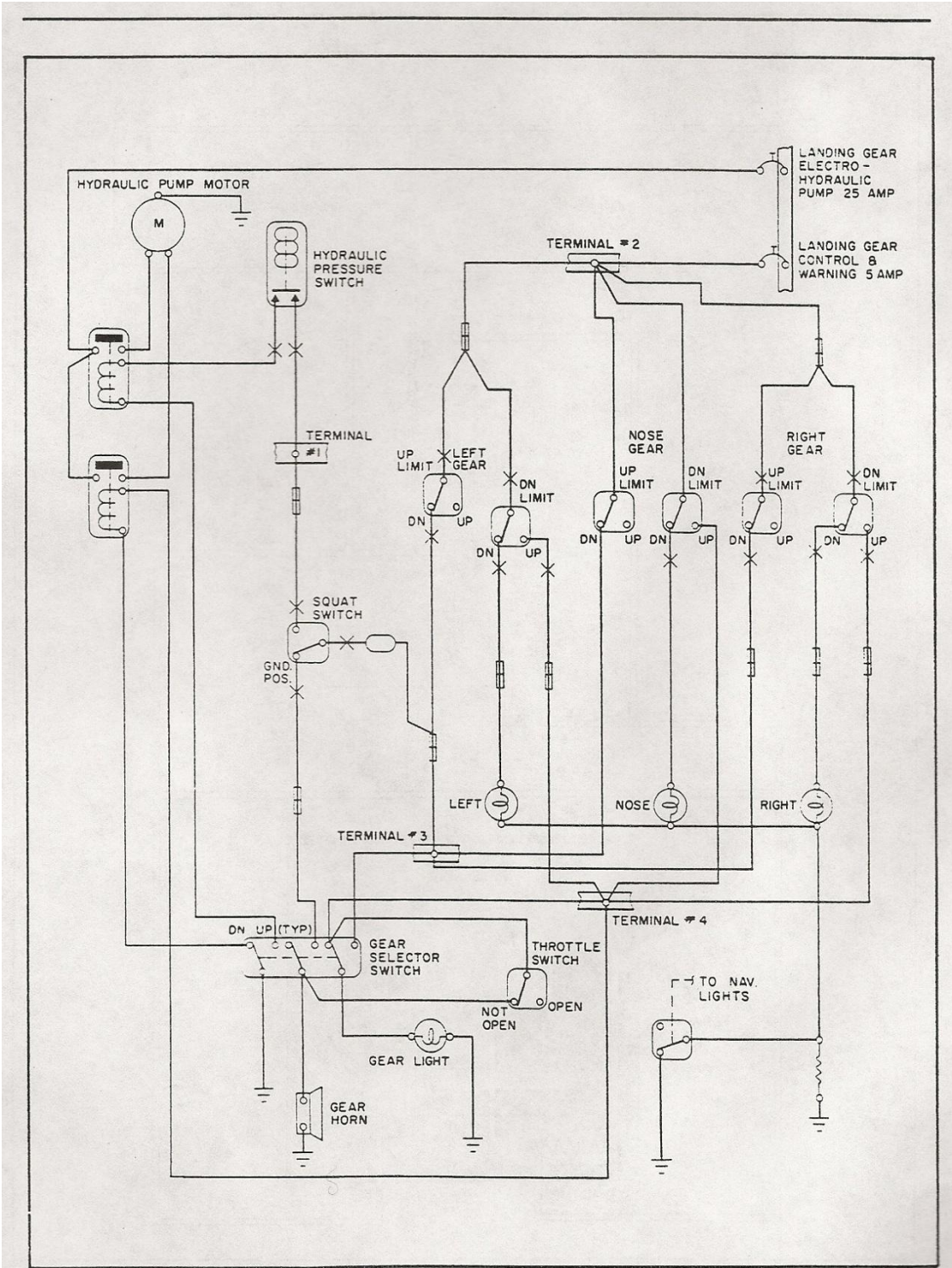
The parking brake is actuated by pulling back on the handle and pushing forward on the button to the left of the handle. The brake can be released by pulling aft on the handle without touching the button, and allowing the handle to swing forward.



Landing Gear Actuator



Hydraulic System Schematic

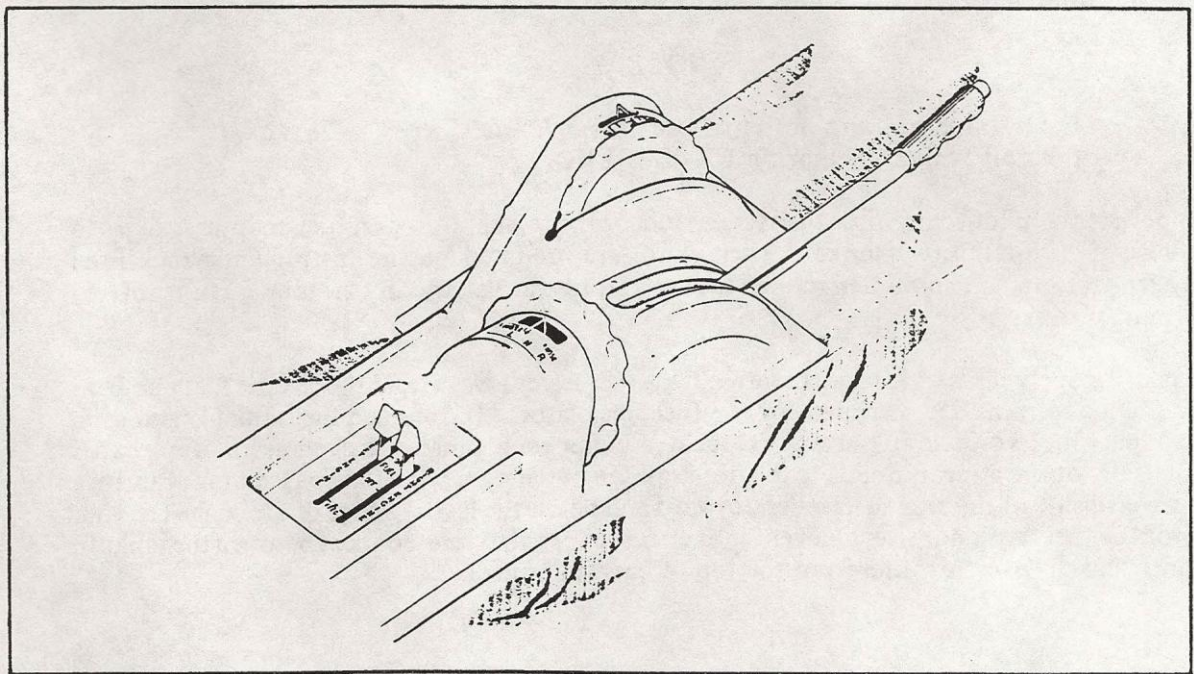


Landing Gear Electrical Schematic

FLIGHT CONTROL SYSTEMS

Dual controls are provided as standard equipment, with a cable system used between the controls and the surfaces. The horizontal tail (stabilator) is of the all movable slab type, with an anti-servo tab which also acts as a longitudinal trim tab, actuated by a control mounted on the control tunnel between the two front seats. The stabilator provides stability and controllability with less size, drag and weight than the more conventional horizontal stabilizer-elevator combination. The ailerons are provided with a differential action and are lightly interconnected by springs with the rudder. This arrangement tends to eliminate adverse yaw in turning maneuvers and to reduce the amount of coordination required in normal turns.

The flaps are manually extended, aerodynamically balanced for light operating forces and spring loaded to return to the retracted position. The flap control lever is located between the front seats on the floor. A button on the end of the lever must be depressed before moving the control. 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 when in the full retracted position, it should be completely retracted when people are entering and leaving the aircraft. The flaps have three extended positions, 10, 25 and 40 degrees.



Console

FUEL SYSTEM

The Seneca fuel system offers two 24.5 gallon aluminum tanks in each wing which are interconnected to eliminate problems of tank selection and fuel management. Both tanks in each wing are filled with a single opening in the outboard tank, and fuel from the outboard tank flows into the inboard tank as the fuel from the inboard tank is consumed. The 98 gallon fuel capacity has only 2-1/2 unusable gallons on each side, making a total of 93 usable gallons. The fuel must be 100/130 octane (light green).

An engine-driven fuel pump is the primary means of supplying fuel for each engine. An electric fuel pump, located on the aft side of the firewall, is provided for each engine as a back-up in case of engine-driven fuel pump failure. The electric pump should be used during landings and take-offs to ensure sufficient fuel pressure in case of an engine-driven fuel pump failure during these portions of the flight sequence. Switches for the electric fuel pumps are conveniently located on the switch panel to the left of the pilot.

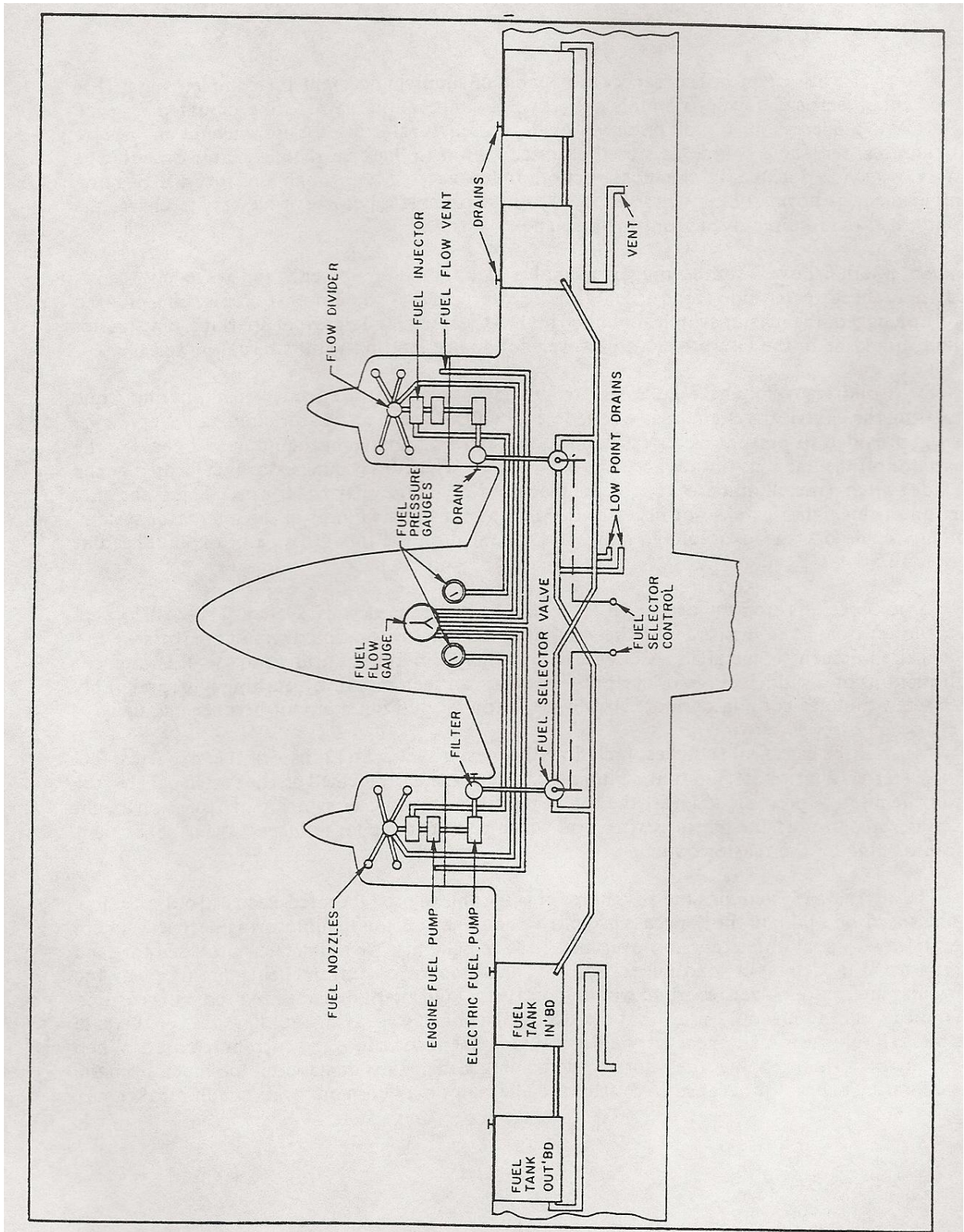
In normal operation, each engine operates with an independent fuel system, drawing fuel from the tanks in the wing on the same side as the engine. However, the two systems are interconnected by crossfeed lines which will permit an engine to use fuel from the tanks on the opposite side in order to extend single-engine range and to enable the pilot to keep fuel weight balanced. When crossfeed has been used during single-engine cruise operation, prior to landing the fuel selector should be positioned so that fuel is used from the same side as the operating engine. The fuel selectors, located on the funnel between the pilot and the copilot seats, reflect the simplified fuel system. Each lever has three positions: OFF, ON and CROSSFEED.

NOTE

Do not operate with both fuel selectors on CROSSFEED. Do not take off with a selector on CROSSFEED.

To permit the pilot to monitor the system, fuel pressure, fuel flow and fuel quantity gauges (a single fuel gauge for the two tanks in each wing) are mounted on the instrument panel. Fuel quantity sender units, one mounted in each fuel tank, transmit electrically the total quantity of fuel in each pair of tanks.

A gascolator (fuel filter) is located between the fuel selector valve and the electric fuel pump on each side. Quick drains are provided for the fuel gascolators (2), for each fuel tank (4) and each crossfeed line (2). Two fuel tank drains are located under each wing; crossfeed drains are located under the belly of the aircraft opposite the trailing edge of the right wing flap; gascolator drains are on the inboard side of the engine nacelles, forward and below the leading edge of the wing. The vent system for the fuel tanks consists of a vent in each fuel cap, a vent interconnect between the tanks in each wing, and an overflow line from the top of each filler neck.



Fuel Schematic

ELECTRICAL SYSTEM

The electrical system of the Seneca is capable of supplying current for complete night IFR equipment. Electrical power is supplied by two 60-ampere alternators, one mounted on each engine. A 35 ampere-hour 12 volt battery provides current for starting, for use 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.

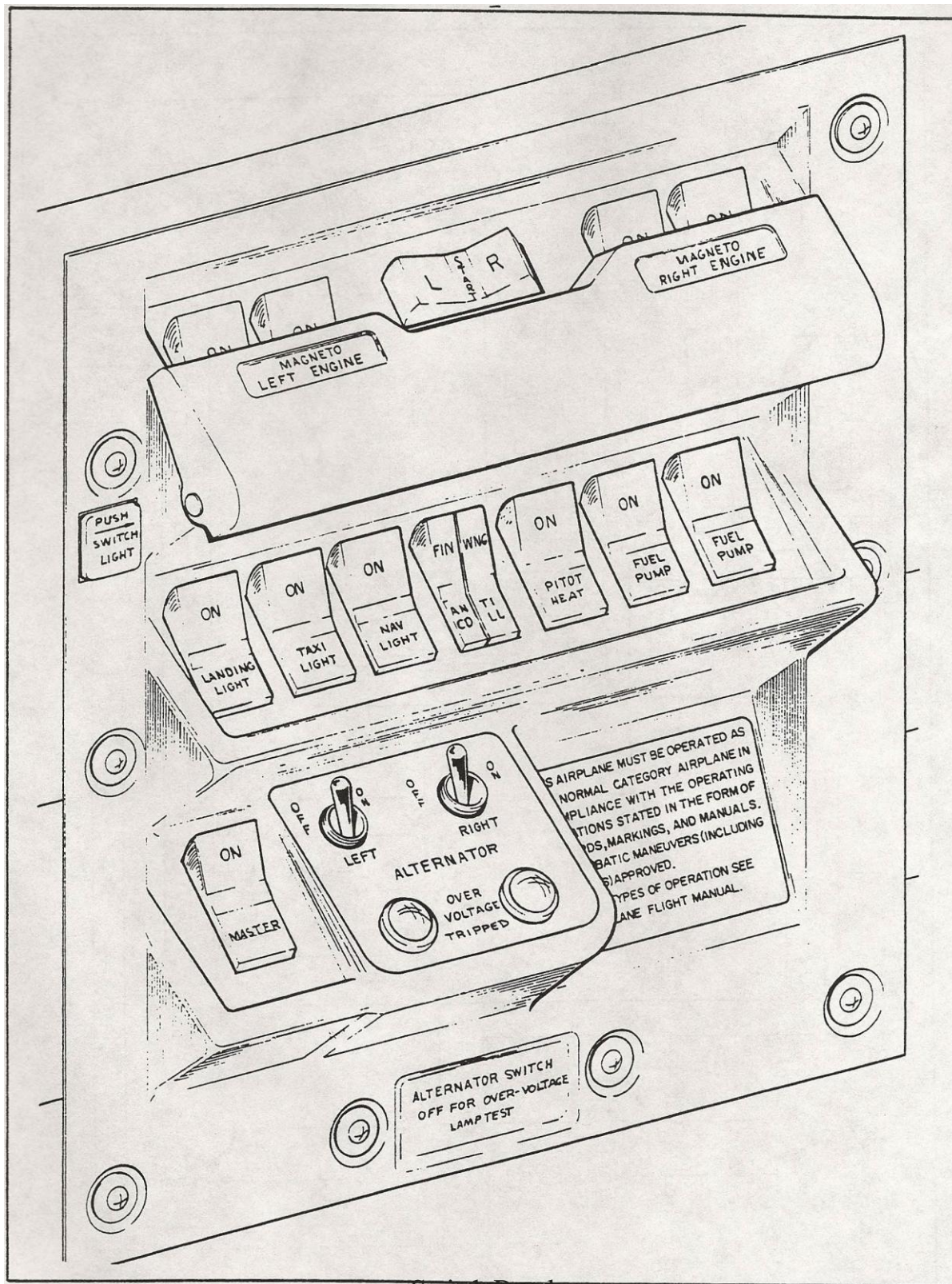
An external power source plug is available as optional equipment, and when installed is located on the lower left side of the nose. While an external 12-14 volt power source is being plugged in or unplugged, the master switch should be in the OFF position to prevent sparking. The master switch should be in the ON position, however, for engine starting with external power.

Two solid state voltage regulators are provided to maintain effective load sharing while regulating the electrical system bus voltage to 14.0 volts. In each alternator circuit an overvoltage relay is provided to prevent electrical damage to electrical and avionics equipment by taking the alternator off the line if its output goes above 14.0 volts. When this occurs, a red light located on the left side switch panel illuminates to indicate that the overvoltage relay has tripped. This is the only function of this light; it does not necessarily come on for other failures of the alternator system. Voltage regulators and overvoltage relays are mounted on the forward side of the bulkhead at station 49.5

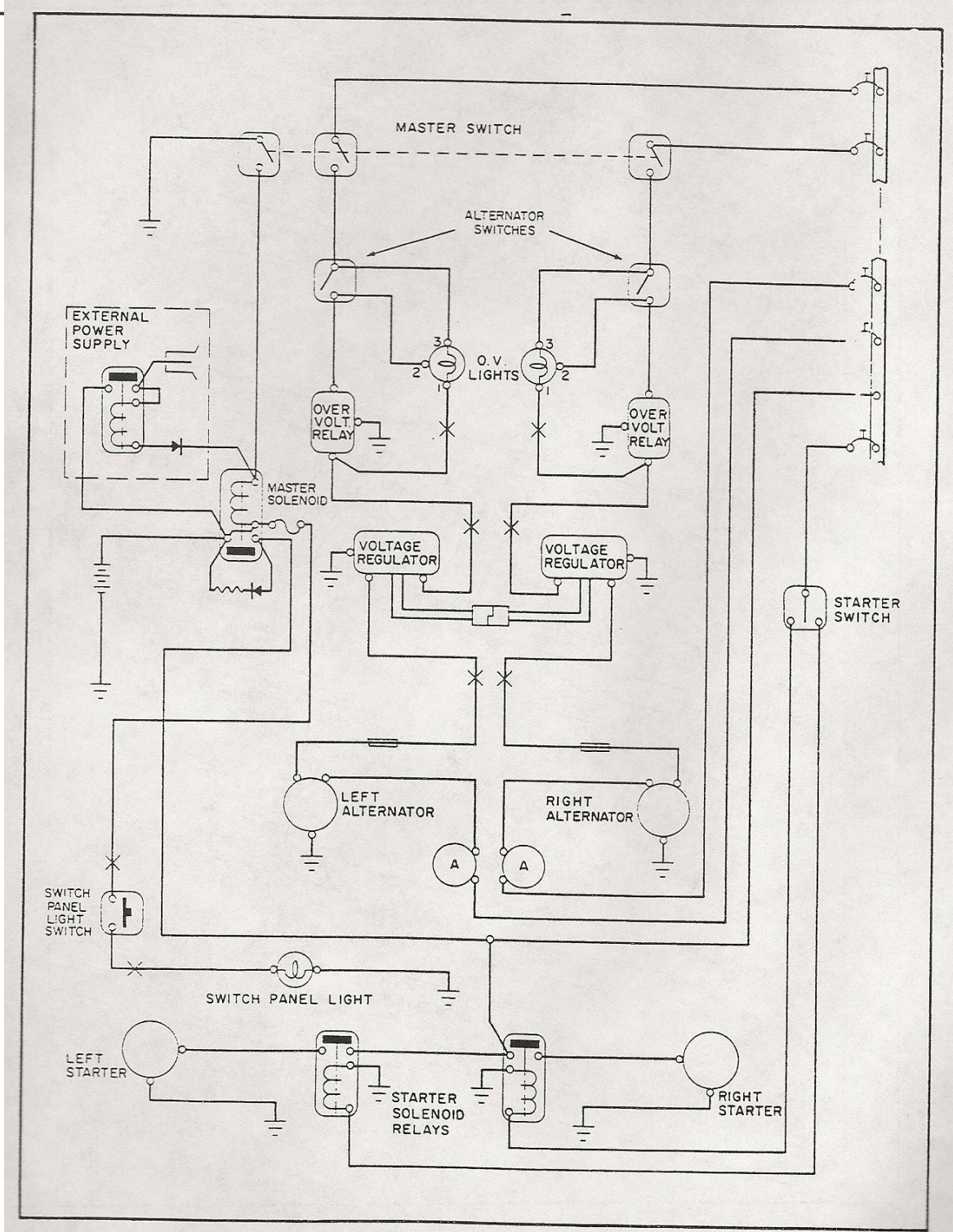
Circuit breakers are provided to protect equipment and the electrical system. These are located on the lower right hand instrument panel, and there is room for additional circuit breakers if extra electrical equipment is installed. A circuit breaker may trip automatically in case of equipment malfunctions or a sudden surge of current. The pilot can then reset it by pushing it in (preferably after a few minutes cooling period). However, he cannot pull out a circuit breaker manually.

Most of the electrical switches including the master switch and those for the magnetos, fuel pumps, starter, alternators, lights and pitot heat, are conveniently located on the switch panel to the left of the pilot. A press switch near the top of the alternator-master switch panel turns on a light which is wired around the master switch and which permits the pilot to inspect the panel at night before turning on the master switch.

The alternator system has the advantage of being able to produce rated electrical output at low engine speed. The pilot of the Seneca is provided with an easy means of monitoring electrical system operation with dual ammeters and overvoltage warning lights. An ammeter is provided for each alternator. This acts as a load-meter, showing the amount of current being produced by the particular alternator. A zero reading would indicate that the alternator was not producing current. An indication near 60 would show that the electrical demand was taxing the alternator. In this case the pilot should turn off unnecessary electrical equipment to reduce the current required. When operating on a single engine, the pilot should be on guard against demanding too much from the one operating alternator because an overloaded alternator may burn out or its circuit breaker may trip.

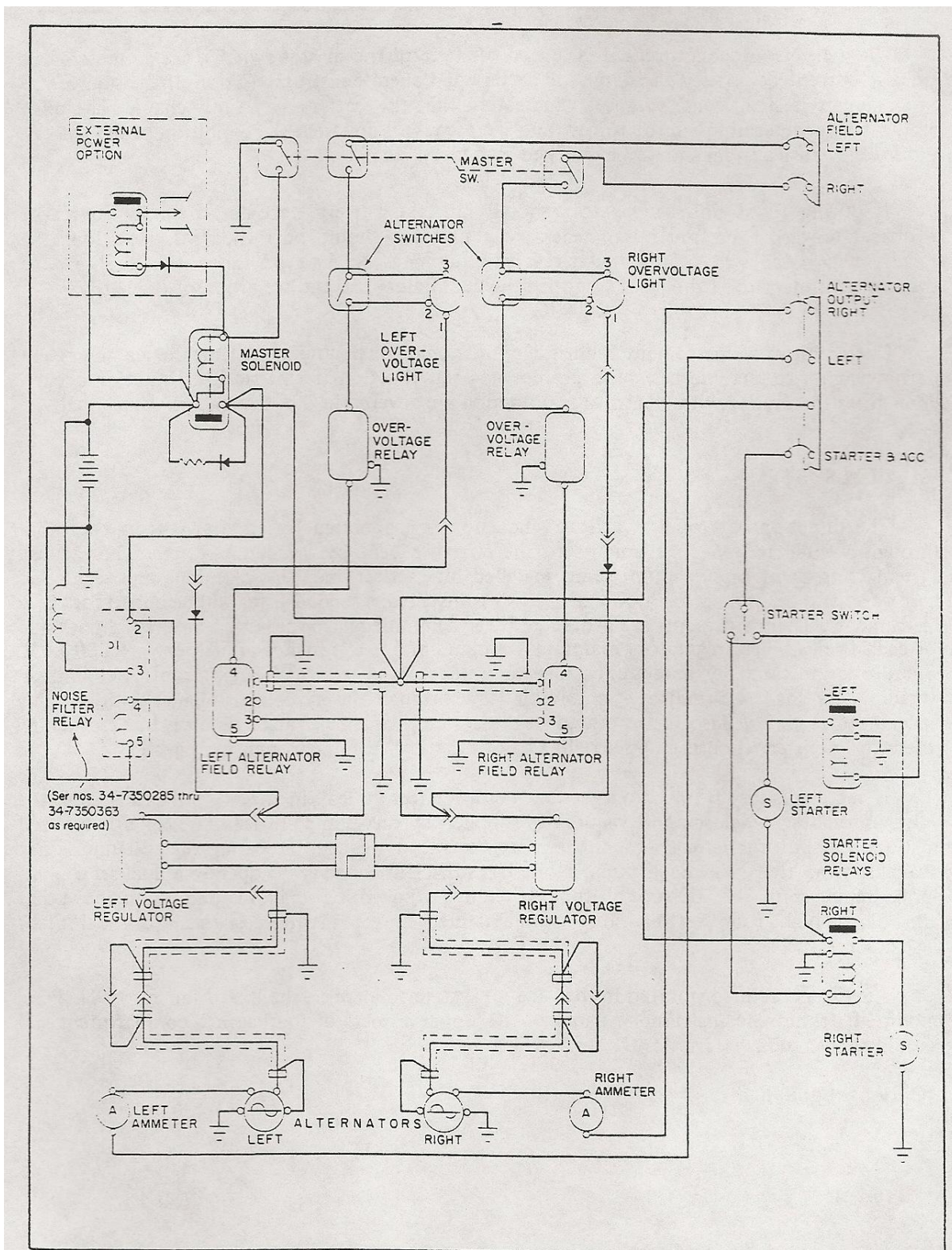


Switch Panel



Alternator and Starter Schematic (Ser. Nos. 34-7250001 thru 34-7350135)

Alternator and Starter Schematic (Ser. Nos. 34-7250001 thru 34-7350135)



Alternator and Starter Schematic (Ser. Nos. 34-7350136 thru 34-7350363)

When all electrical equipment is turned off (except the master switch), the ammeters will indicate current being used to charge the battery and operate instrumentation. 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.

If during flight both alternators should fail, the battery becomes the only source of electrical power. Therefore all unnecessary equipment should be turned off. How long the battery will be able to supply the necessary equipment depends on the current drain of the equipment, time it took the pilot to notice the dual failure and the condition of the battery.

During night or instrument flight the pilot should continuously monitor the ammeters and warning lights so that he can take prompt corrective action if electrical malfunction occurs. Procedures for dealing with electrical malfunction are covered in the Airplane Flight Manual.

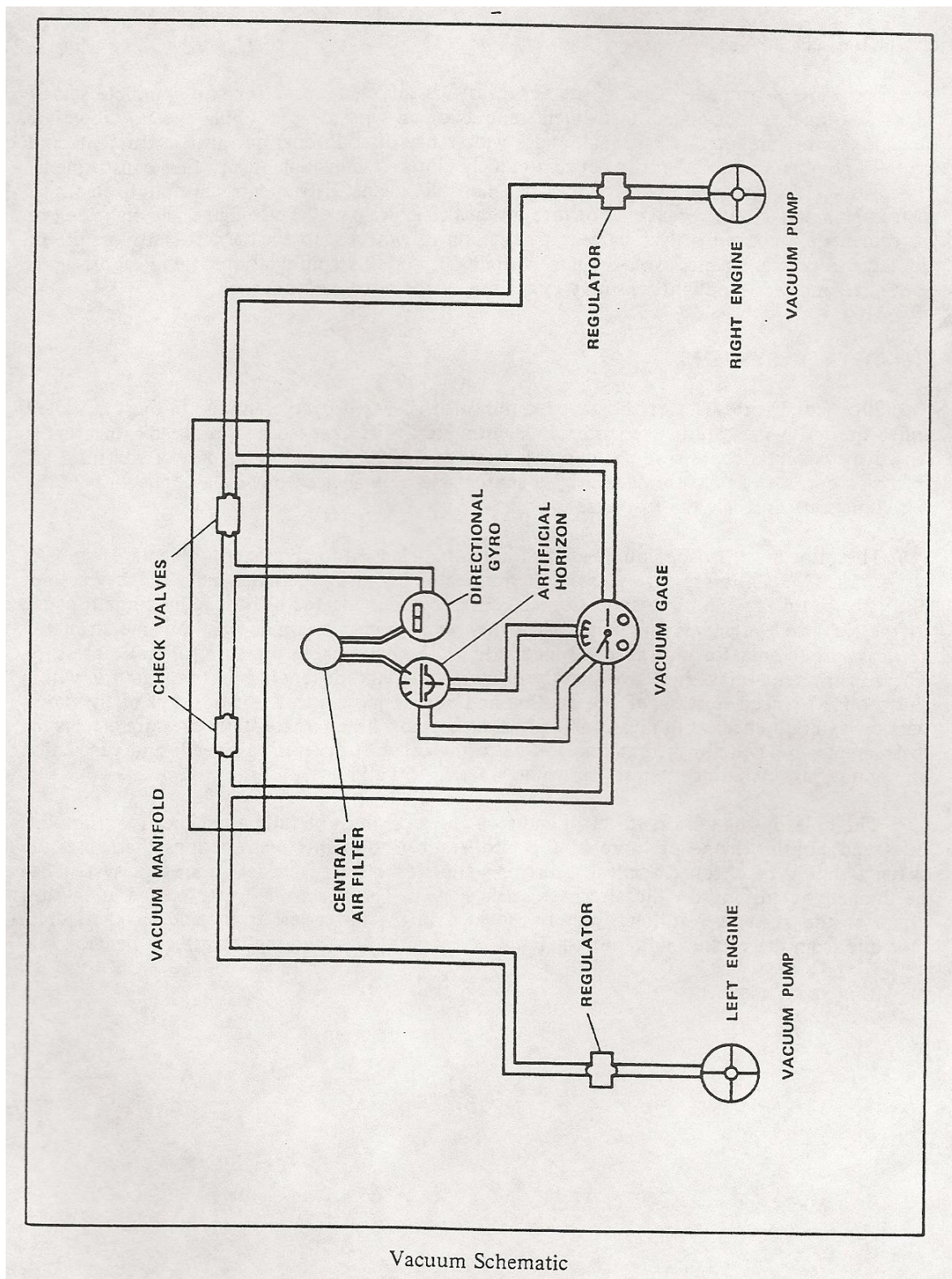
VACUUM SYSTEM*

The directional gyros and attitude indicators are operated by air drawn from the cabin through a filter and the instruments to the engine nacelle by a vacuum system. The vacuum system consists of one vacuum pump installed on each engine, plus plumbing and regulating hardware. If a second set of gyro instruments is installed, a second filter will be added for these instruments. The instruments are protected by a vacuum regulator mounted on the right aft side of each firewall. The regulators maintain a vacuum of $5.0 \pm .1$ inches of mercury at 2000 RPM. Suction is indicated by a vacuum gauge mounted to the left of the right control column. A vacuum less than 4.5 indicates a low air flow through the gyro instruments, with possibly inaccurate readings. Also incorporated in the system is a check valve, which is located behind the instrument panel on the upper right side of the baggage compartment bulkhead.

If suction is lost from either vacuum pump or from a leak in the hose of either side, the valve automatically closes and vacuum is supplied by one pump. In this case, one of two malfunction buttons appears on the face of the vacuum gauge, indicating that vacuum is not available from that side. Each pump alone has sufficient capacity to operate a dual set of gyro instruments up to a 12,500-foot altitude. When operating with a single vacuum pump above that altitude, a high RPM setting must be maintained to get adequate suction for dual flight instrument.

Air filters are incorporated in the vacuum system to increase the life of the gyros. They are mounted behind the instrument panel in the upper corners of the baggage compartment and should be cleaned regularly.

*Optional Equipment



Vacuum Schematic

INSTRUMENT PANEL

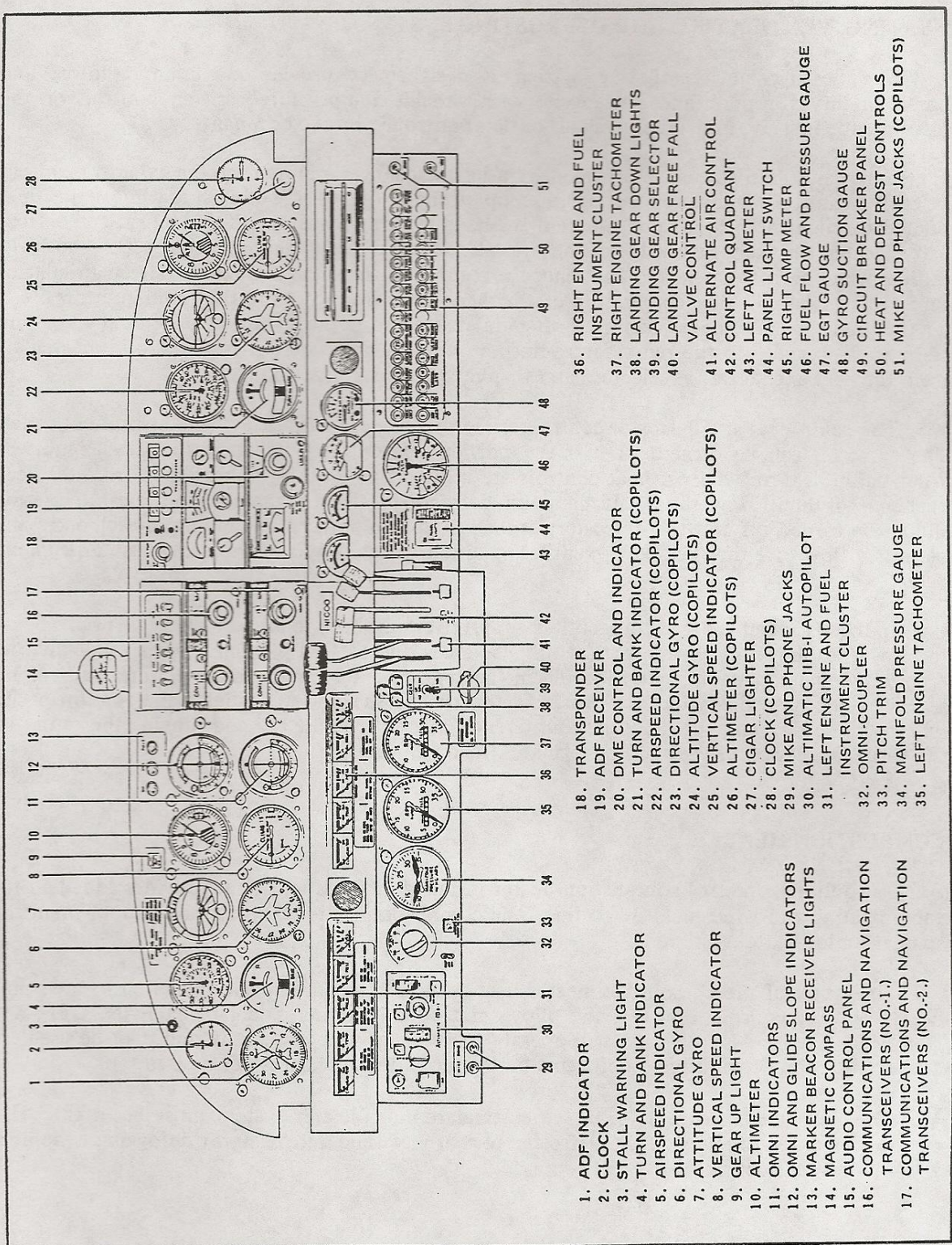
The wide instrument panel of the Seneca offers sufficient space for two complete sets of flight instruments plus engine instrument and avionics, with ideal grouping and no crowding. Dual flight instruments are optional, and a wide range of additional optional instruments and avionics permits an equipment selection uniquely suited to individual needs. Flight instruments and avionics are grouped in the upper panel, while engine instruments, autopilot, electrical instruments and circuit breakers are located on the lower panel. Left engine and right engine instruments are conveniently separated by the control wheel shaft on the left side. In spite of the large instrument panel, over-the-nose visibility is good. A combination of white post lights (optional) and red floodlights ensure easy reading of the instruments at night.

PITOT-STATIC SYSTEMS

Pitot (total) pressure for the airspeed indicator is sensed by the aluminum mast mounted under the left wing. Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static pressure units, one located on each side of the rear part of the fuselage. Differences in static pressure caused by a slip or skid are balanced out by a connection of the two static sources inside the fuselage.

The pitot mast can be equipped with a heating element to eliminate problems from ice or heavy rain. The static pressure sensors are not heated because experience indicates they are not likely to ice up. An alternate static source control valve is located below the instrument panel, to the right of the power quadrant. When the valve is set to alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin pressure for static pressure. These instruments may then give slightly different readings, depending on the situation within the cabin. Airspeed, setting of the heating and ventilating controls, or position of the storm window can influence cabin pressure. A pilot can see how his alternate static pressure affects the instruments, by switching from one source to the other at different airspeeds and ventilation configurations (including open storm window below 150 MPH).

The holes in the sensors for pitot and static pressure must be fully open and free from dirt, bugs and polish. If one or more of the pitot-static instruments malfunctions these pressure systems should be checked for leaks, dirt or water. If moisture is present, the static system can be drained by turning on the alternate static system. The selector valve is located at the low point of the system. Another drain is provided in the lower left front side panel to drain moisture from the pressure line running between the pitot mast and the instrument panel.



Instrument Panel

HEATING, VENTILATING AND DEFROSTING SYSTEM

The heating and ventilating system is designed to provide maximum comfort and controllability for pilot and passengers, with variable temperature-fresh air controls on the instrument panel and individual fresh air outlets controlled by the occupants.

Cabin and defrost heat is provided by a heat exchanger mounted on the exhaust manifold of each engine. Air is taken in through a scoop on the outboard side of each cowling and is then ducted through the heater muff, where it is heated by the exhaust manifold. A heat and defrost valve located on the forward side of the firewall sends some of the air directly to the windshield outlets when defrost is selected and sends the rest of the air to the temperature-fresh air control box, which regulates the temperature of the air to be introduced into the cabin interior. Fresh air for the cabin interior is taken in through inlets located in the leading edge of each wing. The fresh air is forced into the temperature-fresh air control box where it is mixed with heated air from the heat exchanger (as selected) and then into the cabin interior.

The cabin heat and defroster controls are located on the right side of the instrument panel. The defroster can be turned off with an individual lever when its operation is not required. When cabin heat and defrost heat controls are in the "OFF" position, heated air from the heat exchanger is dumped overboard. If maximum defrosting is desired, the heat to the cabin interior should be turned off and the defroster turned full on. An outlet near the feet of each occupant permits a flow of either heated or ventilating air, as selected by the control on the instrument panel.

Individual overhead fresh air outlets supply fresh air from an inlet located on each side of the lower leading edge of the vertical fin. The air is ducted to a plenum chamber and then to each individual adjustable outlet located in the ceiling. The amount and direction of air can be regulated for individual comfort. Rotating the rim of the outlet regulates the amount of air (clockwise to decrease the amount, counterclockwise to increase it), and moving the outlet in the desired direction of the air flow regulates the direction.

COMBUSTION HEATER*

An optional Janitrol combustion heater installed in the aft fuselage provides added air for cabin heating and windshield defrosting. The combustion heater can be used to supplement the standard muff-heater system.

Operation of the combustion heater is controlled by a three position switch located on a heater control console between the pilot's and copilot's seats, and labeled FAN, OFF, and HEATER. The "FAN" position will operate the ventilation blower only and may be used for cabin ventilation or windshield defogging on the ground when heat is not desired.

The defroster control lever for the standard muff heater system must be in the "HI" position in order to energize the defroster blower any time defrosting or defogging is desired, with or without heat.

*Optional Equipment

For cabin heat, the air intake lever located on the heater control console must be partially or fully open and the three position switch set to "HEATER." This will start fuel flow and ignite the burner simultaneously. With instant starting and no need for priming, heat should be felt within a few seconds. Two safety switches which are installed and activated by the intake valve located aft of the Janitrol heater unit are wired to prevent both fan and heater operation unless the air intake lever is moved off the closed position.

Regulating the combustion cabin heat and airflow is accomplished by adjusting levers on the heater control console between the pilot's and copilot's seats. The right hand lever regulates the air intake valve. The left hand lever regulates cabin temperature. Cabin temperature and air circulation can be maintained by using various combinations of lever settings to suit individual desires.

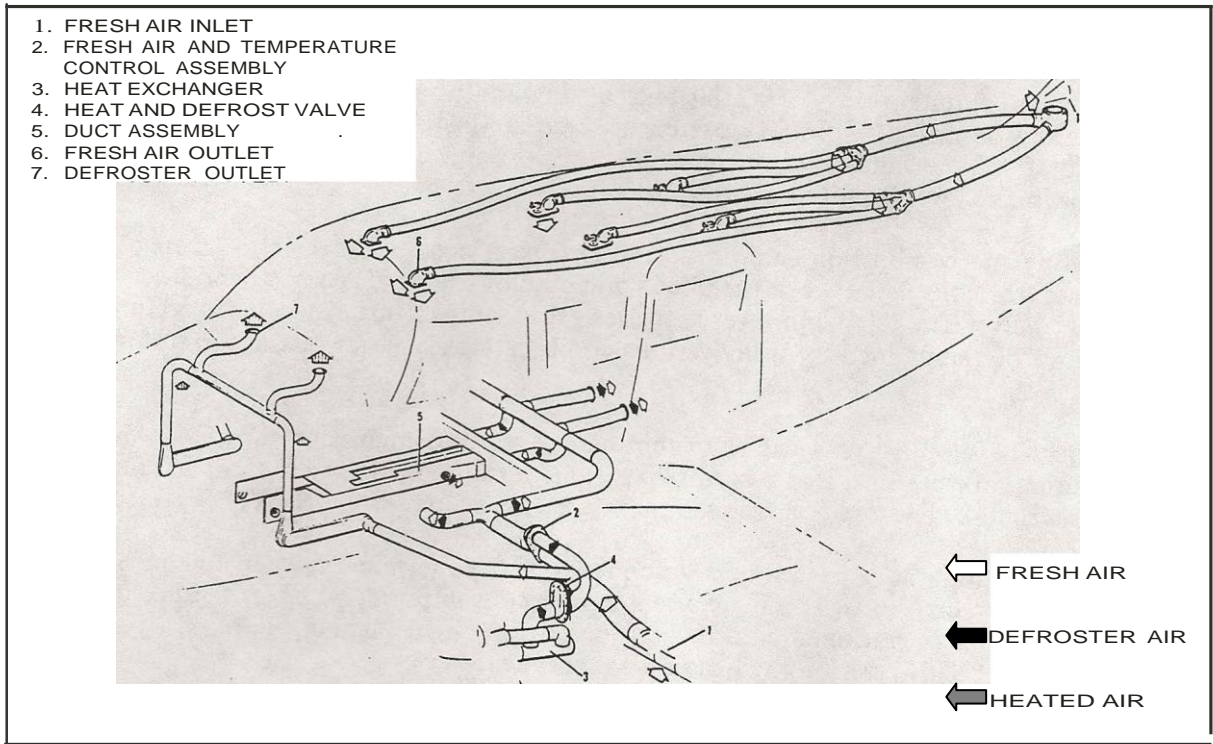
Heat may be supplied to warm the cabin before starting engines by turning on the master switch, insuring mixture in the idle cut-off position, turning on the right auxiliary fuel pump, opening the air intake lever and placing the three position switch in the HEATER position.

The combustion cabin heater uses gasoline from the fuel line between the engine driven pump and injector on the right engine. Heater fuel consumption is one half gallon per hour. Fuel used for heater operation should be considered for Flight Planning Purposes. If the right fuel selector is in the off position the heater is inoperative.

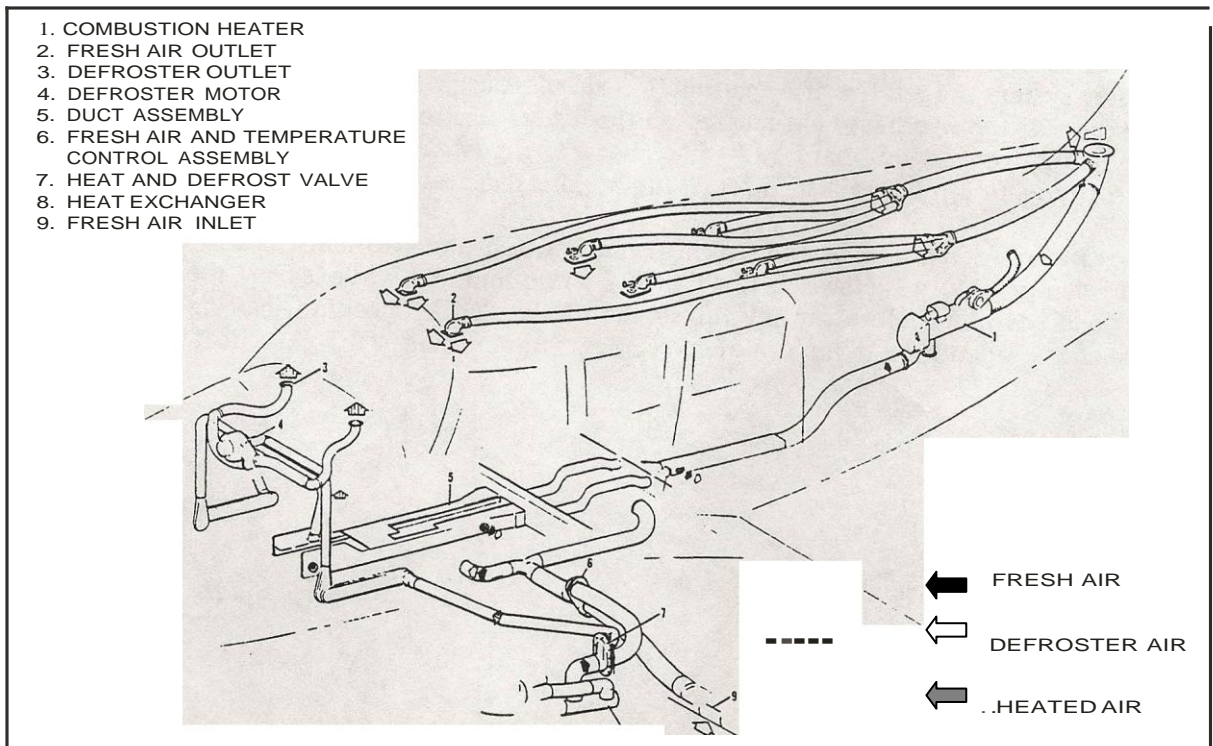
In case of right engine failure the heater can be operated by leaving the fuel selector on, insuring that the mixture control is in idle cut-off position, while operating the auxiliary fuel pump. Before the heater is operated under these conditions, determine that there are no fuel leaks between the tank and the engine.

Located in the heater is a heat limit overheat switch, which acts as a safety device to render the heater system inoperative if a malfunction should occur. Operation of this switch results in illumination of the overheat light located on the heater control console. The heat limit switch is located in the forward outboard end of the heater vent jacket, with a red reset button on the heater shroud and can be reached through the bulkhead access panel into the aft fuselage.

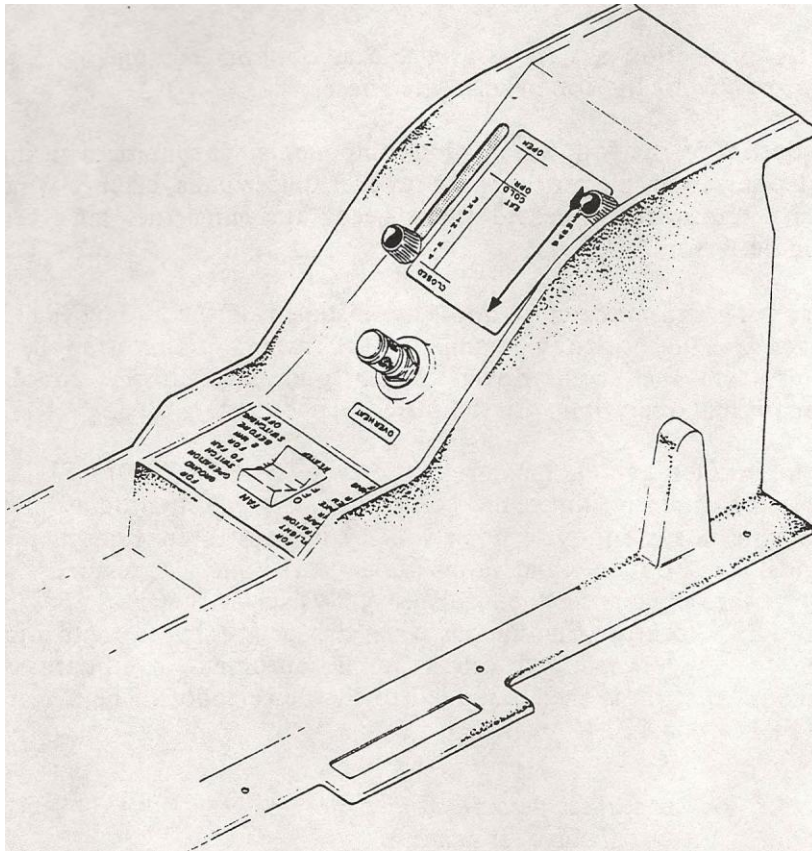
To prevent activation of the overheat limit switch upon normal heater shutdown during ground operation, turn the switch to "FAN" for two minutes, while leaving the air intake lever in the open position, before turning the switch to the "OFF" position. During flight leave the air intake lever open for a minimum of 15 seconds after turning "OFF" the heater switch.



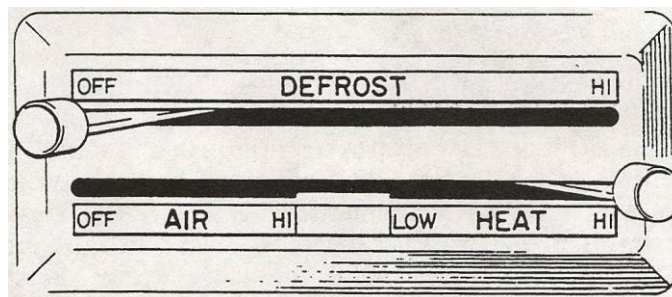
Heat and Ventilating System



Optional Heating and Ventilating System



Optional Combustion Heater Control Console



Heater and Defroster Controls

ICE PROTECTION SYSTEM*

A complete ice protection system is available as optional equipment in the Seneca to allow for flight into known icing conditions, when necessary.

This system consists of the following major components: pneumatic wing and empennage boots, wing ice detection light, electro thermal propeller deicer pads, electric windshield panel heated stall warning transmitters, heated pitot head, anti-icing fuel tank vents, propeller governor shields and deflectors.

The pneumatic wing and empennage boots are installed on the leading edges of the wings, the vertical stabilizer and the horizontal stabilator. A constant suction is applied to all of the surface deicer boots from the engine driven vacuum pumps to provide smooth streamlined leading edges during normal operation with the surface deicer system off.

Deicer boots are inflated by a momentary "ON" type "SURFACE DE-ICE" switch located on the instrument panel directly above the control quadrant. Actuation of the "SURFACE DE-ICE" 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 DE-ICER" 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. Vacuum suction is then reapplied to the deicer boots. The deicer boots do not deflate during the "PRESS TO TEST" cycle.

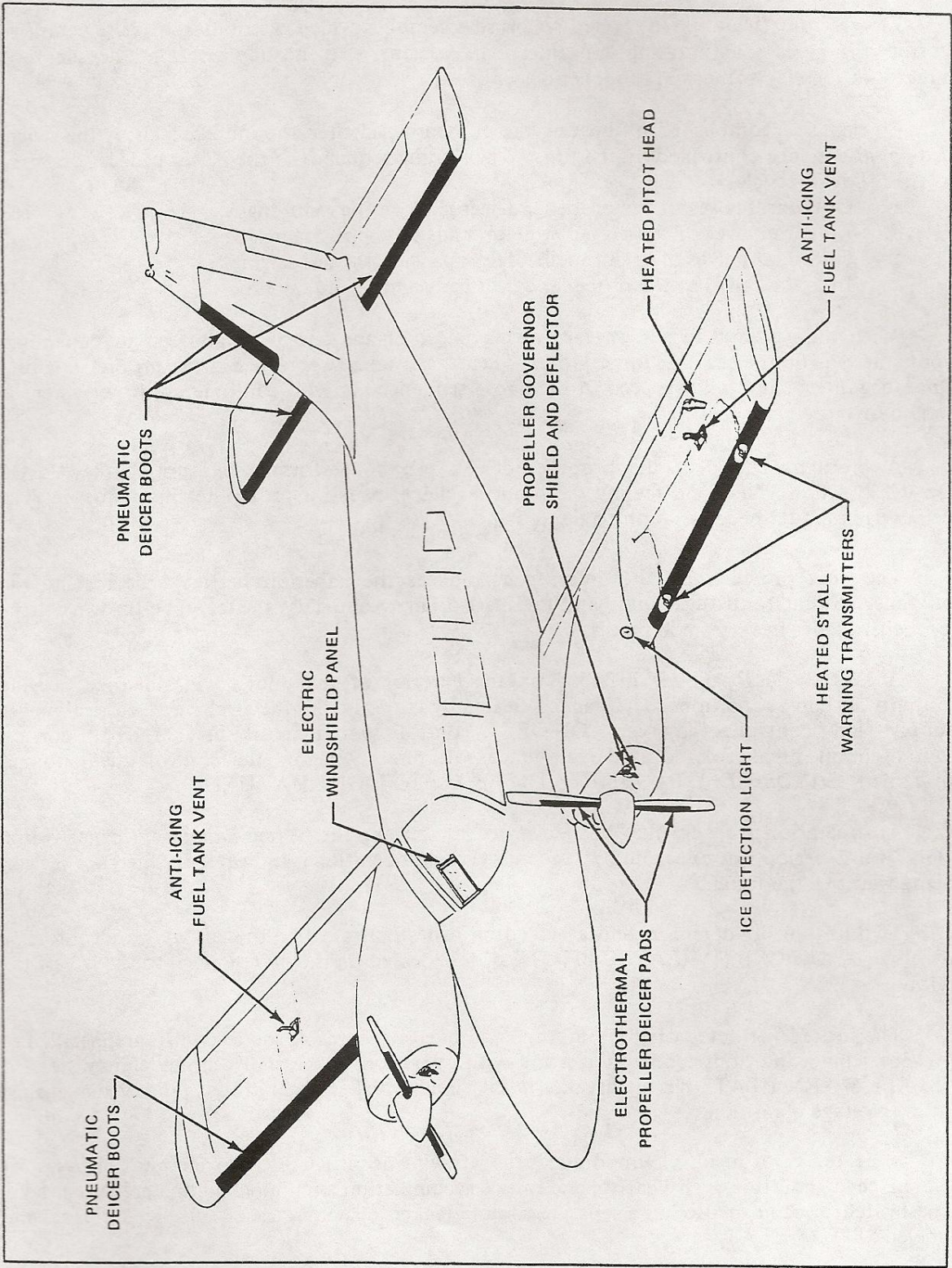
Circuit protection for the surface deicer system is provided by a "WING-TAIL DE-ICERS" circuit breaker located in the circuit breaker panel.

Wing icing conditions may be detected during night flight with the 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 located on the instrument panel to the right of the "SURFACE DE-ICE" switch. A "WING ICE LIGHT" circuit breaker located in the circuit breaker panel provides circuit protection.

Electro thermal 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 located to the right of the "SURFACE DE-ICE" switch above the control quadrant. Power for the propeller deicers is supplied by the airplane's electrical system through a "PROP DE-ICE" circuit breaker, located in the circuit breaker panel, to the "PROP DE-ICE" switch. When the "PROP DE-ICE" switch is actuated, power is supplied 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 DE-ICER" ammeter needle should be within the shaded portion on the ammeter for a normal reading.

*Optional equipment



Ice Protection System

Power from the timer is cycled to brush assemblies which distribute power to modified starter ring gears incorporating slip rings. The current is then supplied from the slip rings directly to the electro thermal propeller deicer pads.

Deicing is accomplished by heating the outboard and then the inboard half of the deicer pads in a sequence controlled by the timer. The heating sequence of the deicer pads is according to the following cycle:

- 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.

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 DE-ICE" 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.

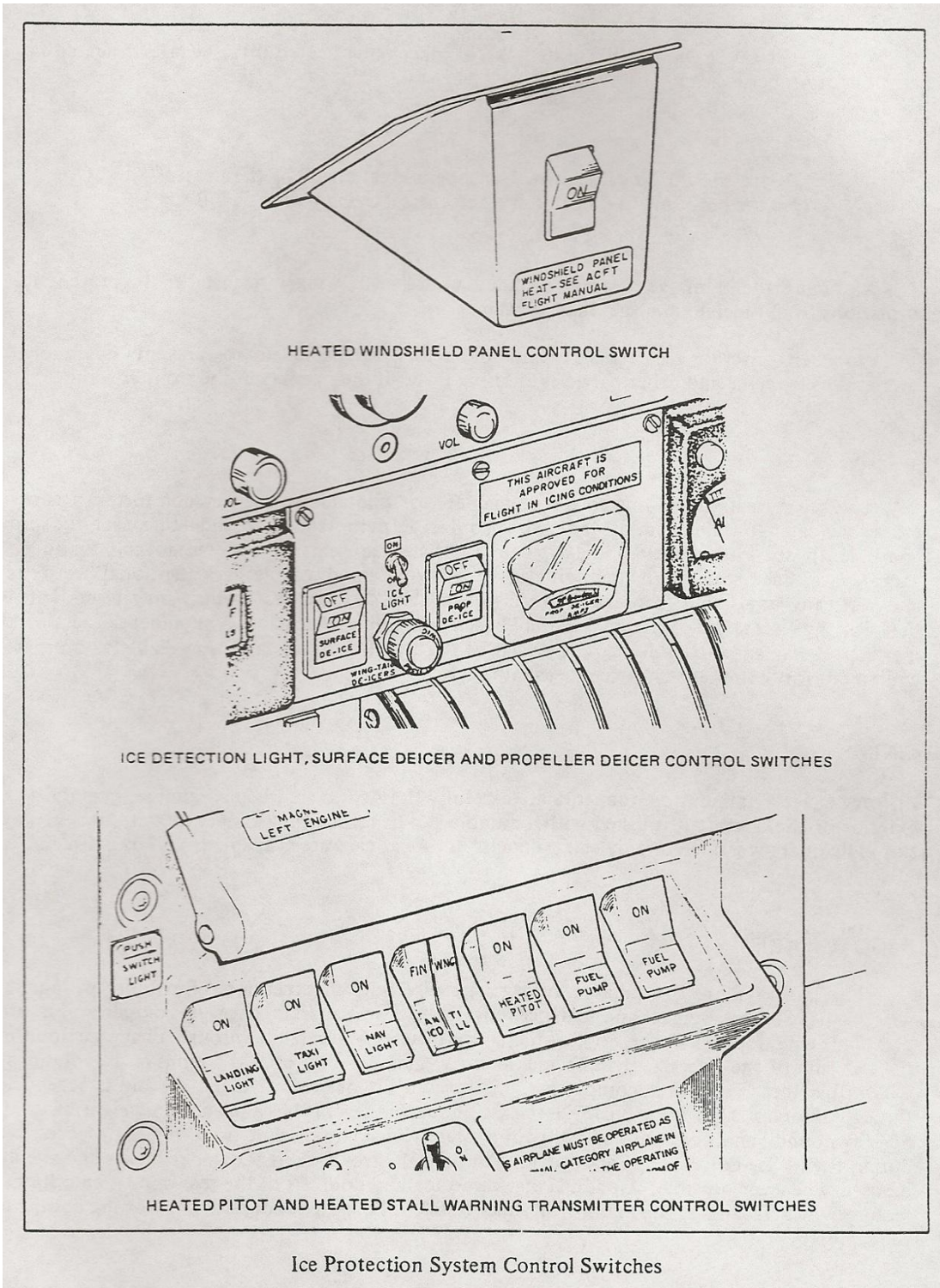
A heated glass panel is installed on the exterior of the pilot's windshield to provide visibility in icing conditions. The panel is heated by current from the airplane's electrical power supply and controlled by an "ON-OFF" control switch/circuit breaker. The control switch / circuit breaker is located on the console directly below the control quadrant and placarded "WINDSHIELD PANEL HEAT- SEE ACFT FLIGHT MANUAL."

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.

Two heated lift detectors and a heated pitot head installed on the left wing are controlled by a single "ON-OFF." "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.

A heated pitot head, mounted under the left wing, is installed to provide pitot pressure for the airspeed indicator with heat to prevent 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.

Anti-icing fuel tank vents, one installed under each wing, are installed to prevent ice formations from blocking the fuel tank vent lines.

Propeller governor ice shields and deflectors are installed to prevent operational interference from ice and other particles entering through the opening in the front cowling.

SEATS

The front seats are adjustable fore and aft for pilot and passenger comfort. An easily accessible catch on the top of the right front seat permits one to slide that seat forward conveniently for ease of entry and exit. The center and rear seats are easily removable for added cargo space. Each seat is provided with an armrest and an adjustable back. Optional headrests and vertically adjustable front seats are also available. A jump seat, which may be mounted between the two middle seats, makes the Seneca a seven-place airplane. A shoulder harness with inertia reel is standard equipment for each of the two front seats and is available as optional equipment for the other seats except seventh seat.

FINISH

All sheet aluminum components are carefully finished to assure maximum service life. The exterior of the aircraft is finished with a durable acrylic lacquer in a variety of tasteful colors to suit individual owners. Economy size "Touch-Up" spray cans are available from Piper dealers.

BAGGAGE AREA

The large amount of available baggage space permits an exceptional flexibility of loading within the Seneca weight and balance envelope. Two separate baggage compartments are provided. One, located in the nose of the aircraft, is easily accessible through a baggage door on the left side of the aircraft. It has a maximum weight capacity of 100 pounds and a volume of 15.3 cubic feet. The other compartment is located aft of seats five and six and is accessible through the rear cabin door on the left side of the fuselage. It has a maximum weight capacity of 100 pounds and a volume of 20.0 cubic feet. This compartment is conveniently accessible during flight. Tie-down straps are provided in both the front and rear compartments and should be used whenever possible. An additional cargo loading door aft of the rear door is an optional feature which facilitates the loading of bulky items. All baggage and passenger loading doors use the same key.

STALL WARNING

An approaching stall is indicated by a stall warning light and horn, activated by two lift detectors installed on the leading edge of the left wing outboard of the engine nacelles. The inboard detector triggers the warning when the flaps are in the 25 and 40 degree positions. The outboard when the flaps are in the other positions. The stall warning horn has a different sound from that of the landing gear warning horn.