

7.17 FUEL SYSTEM

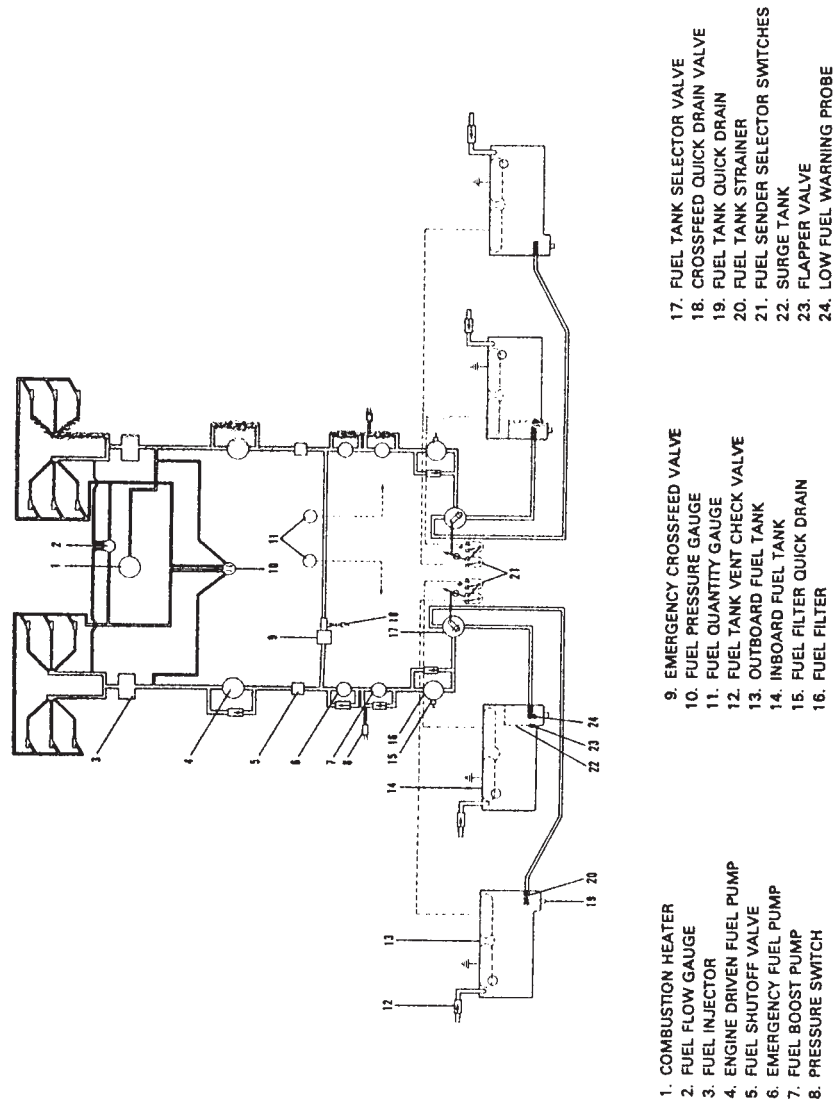
The fuel system consists of fuel cells, engine-driven and emergency fuel pumps, fuel boost pumps, control valves, fuel filters, fuel pressure and fuel flow gauges, fuel drains and non-icing NACA fuel tank vents (Figure 7-15). Lockable filler caps are optional equipment.

Fuel is stored in four flexible fuel cells, two in each wing panel. The outboard cells hold 40 U.S. gallons each, and the inboard cells hold 56 U.S. gallons each, giving a total of 192 gallons, of which 182 gallons are usable. Fuel is routed from the fuel cells to the selector valve, the fuel filter, the fuel boost pump, the emergency fuel pump, the firewall shutoff, the engine-driven fuel pump, to the injector, then to the cylinders. The fuel selector, filter, fuel boost pump, emergency fuel pump and firewall shutoff are located on the butt-rib of each wing panel.

The emergency fuel pumps are installed for emergency use in case of an engine-driven fuel pump failure. They are also used for takeoff and landing and, when necessary, to prime the engines. Control switches for the emergency fuel pumps are located in the overhead switch panel to the right of the fuel gauges.

Two electric fuel-quantity gauges are mounted in the overhead switch panel. The right fuel-quantity gauge indicates the quantity of fuel in the selected right fuel system tank (right inboard or right outboard), and the left fuel-quantity gauge indicates the quantity of fuel in the selected left fuel system tank (left inboard or left outboard). The fuel gauges are connected electrically to micro switches mounted in the fuel selector console. The fuel senders are also connected electrically to the micro switches. When a fuel tank is selected, its corresponding micro switch is actuated, which completes the circuit between the fuel senders and its fuel quantity gauge, providing a visual reading of the fuel quantity in the selected tank. The gauges are illuminated, and the lights are controlled by a rheostat switch on the left side of the overhead switch panel.

The fuel boost pumps are operated continuously and are provided to maintain fuel under pressure to the other fuel pumps, improving the altitude performance of the fuel system. There are no fuel boost pump control switches or pressure gauges provided. Each fuel boost pump is controlled by a separate circuit breaker, located in the circuit breaker control panel. The fuel boost pumps are activated when the master switch is turned on and



FUEL SYSTEM SCHEMATIC

Figure 7-15

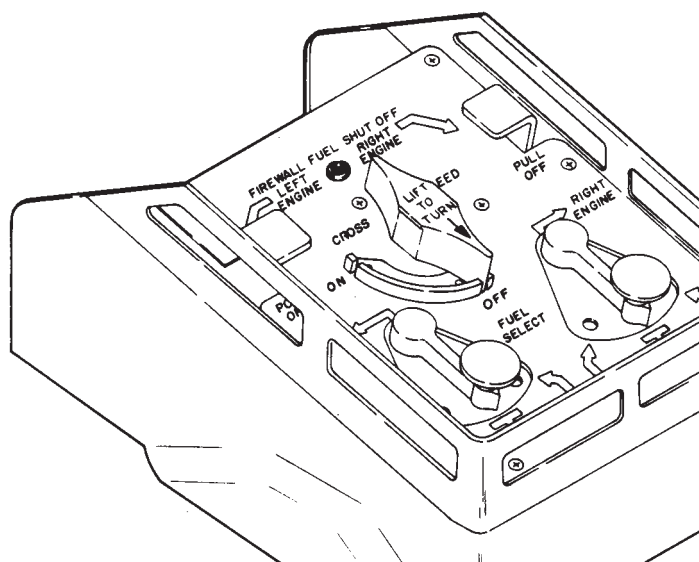
continue to operate until the master switch is turned off or the fuel boost pump circuit breakers are pulled (off). Fuel boost pump warning lights, mounted on the annunciator panel, illuminate when the fuel boost pressure is less than 3 PSI. In a full power continuous climb from takeoff to high altitude under conditions of high ambient temperature, high climb rate, and extremely volatile fuel, the boost pump may not maintain a sufficient pressure head to the engine-driven fuel pump. This condition would be indicated by engine fuel pressure fluctuations of 2-5 PSI and/or illumination of the boost pump warning light. The pilot may continue the climb by using the emergency fuel pump to provide steady fuel pressure for the high power operation; the emergency pump can be turned OFF after level-out if reduction to cruise power extinguishes the boost pump warning light. Cruise can be continued with the emergency fuel pump OFF if fuel pressure remains steady and above 34 PSI, as indicated on the engine fuel pressure gauge.

The fuel management controls (Figure 7-17) are located in the fuel control panel at the base of the pedestal. Located here are the fuel tank selectors, fuel shut offs and crossfeed controls. During normal operation each engine is supplied with fuel from its own respective fuel system. The fuel controls on the right control the fuel from the right cells to the right engine and the controls on the left control the fuel from the left fuel cells to the left engine.

For emergencies, fuel from one system can supply the opposite engine through a crossfeed system. The crossfeed valve is located in the left wing butt area and is intended only for emergencies. The crossfeed control is located in the center of the fuel control panel. A warning lights located on the fuel control panel is incorporated in the firewall shut off system to indicate that one or both of the shut off valves are not fully open.

NOTE

The crossfeed system is not to be used for normal operation. When the crossfeed valve is on, be certain fuel selector valve on tank not in use is off. Do not use crossfeed to compensate for an inoperative emergency fuel pump.



FUEL SYSTEM CONTROL CONSOLE

Figure 7-17

Fuel drains for checking fuel contamination are located at the rear inboard corner of the fuel cells, on the fuel filters and the lowest point of the crossfeed system. The quick drain for the crossfeed is located on the left wing fillet just forward of the main spar. The drains on the filters are at the base of the filter and are accessible through access doors in the lower wing fillets aft of the wing leading edge.

WARNING

If either the right or left fuel flow warning light illuminates and the fuel gauge indicates fuel remaining in the corresponding inboard tank, this will indicate a malfunction of the flapper door in the inboard tank. Immediately select the outboard tank or select crossfeed to avoid fuel flow interruption.

Right and left fuel flow warning lights illuminate to warn the pilot of an impending fuel flow interruption. The lights are activated by a sensing probe mounted near each inboard fuel tank outlet. In the event the fuel level near the tank outlet drops to a point where a fuel flow interruption and power loss could occur, the sensing probe will illuminate its corresponding warning light. The warning light will be on for a minimum of 10 seconds and will remain on if the cause is not corrected.

The warning lights are incorporated in the annunciator panel. For press-to-test procedures, refer to Paragraph 7.23.

NOTE

Heater operation will cause the right fuel pressure gauge to fluctuate during heater cycling.

7.19 ELECTRICAL SYSTEM

The electrical system is a 28-volt system (Figure 7-19). Control switches are located in the overhead switch panels and in the circuit breaker panel. The circuit breaker panel (Figure 7-21), located on the side wall of the cockpit, has provisions to handle a full complement of equipment. Switches and circuit breakers are clearly marked as to their function. Switches are of the toggle and rocker type and the circuit breakers are the push to reset type. If a breaker pops it is recommended to allow the breaker to cool for a couple of minutes before resetting. When a white band can be seen around the shank of the circuit breaker button, the breaker is open. The breakers can be manually tripped by pulling on the reset button.

The standard electrical equipment includes alternators, starters, ammeter, battery, voltage regulators and external power source receptacle.

The starters are energized by a rocker style switch located in the overhead switch panel (Figure 7-23 or 7-24) between the magneto switches. To operate, push on the side of the switch that corresponds to the engine to be started and hold until the selected engine has started. Release the switch and it will return to neutral.

NOTE

Starters should not be energized for more than 30 seconds of continuous cranking. Allow to cool between starting attempts.

The primary electrical source is two 28-volt 70-ampere alternators (Figure 7-19). The alternators are controlled independently by two voltage regulators which are interconnected electrically to provide parallel outputs at normal engine operating speeds. Alternator inoperative lights illuminate when the respective alternator fails to provide voltage. The lights can be checked by turning on the master switch with the engines shut down. If a light fails to illuminate, it should be replaced. Whenever the engines are operating at a high differential RPM, the alternator inoperative light for the slower engine may come on.

**SECTION 2
LIMITATIONS**

**PIPER AIRCRAFT CORPORATION
PA-31-350, CHIEFTAIN**

	KCAS	KIAS
Maximum Gear Extended Speed (V_{LE}) - Do not exceed this speed with landing gear extended.	156	153
Maximum Landing Gear Operating Speed (V_{LO}) - Do not extend or retract landing gear above this speed.		
Extend	156	153
Retract	130	128
		
Stall Speed (full flaps, gear down, power off, 7000 lbs.) (See Section 5, Performance, for stall speeds at reduced weights.)	74	74

NOTE

The maximum altitude loss during a single-engine stall, gear and flaps retracted is 600 feet. For a symmetrical power-off stall, gear and flaps retracted, maximum altitude loss is 500 feet. Altitude loss is less for other aircraft configurations.

Demonstrated Crosswind Velocity 20 KTS

3.3 EMERGENCY CHECK LIST

SPEEDS

Air Minimum Control	76 KIAS
Best Single Engine Angle of Climb	104 KIAS
Best Single Engine Rate of Climb.....	106 KIAS
Maneuvering	160 KIAS
Never Exceed	236 KIAS

ENGINE INOPERATIVE PROCEDURES

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Throttle	close
Propeller.....	FEATHER (1000 RPM min.)
Mixture	IDLE CUT-OFF
Cowl flaps.....	close
Air conditioner	OFF
Magneto switch	OFF
Emergency fuel pump	OFF
Fuel selector	OFF (detent)
Fuel boost pump CB	pulled
Alternator CB switch	OFF
Prop. Sync.	OFF
Electrical load	reduced
Crossfeed.....	if required

ENGINE FAILURE DURING CLIMB

Airspeedmaintain 106 KIAS
Directional controlmaintain
Inop. engineidentify and verify
Inop. enginecomplete Engine
Securing Procedure
Land as soon as practical at nearest suitable airport.

ENGINE FAILURE DURING FLIGHT
(Below 76 KIAS)

Rudderapply towards
operative engine
Throttles (both engines)retard to stop turn
Pitch attitudelower nose to
accelerate above
76 KIAS
Operative eng.increase power as
airspeed increases
above 76 KIAS

If altitude permits, a restart may be attempted.

If restart fails or altitude does not permit:

Inop. eng. prop.....FEATHER
Trim.....adjusted (5° bank
into operative eng.)
Inop. eng.complete Engine
Securing Procedure
Cowl flap (operative eng.)as required

ENGINE FAILURE DURING FLIGHT
(Above 76 KIAS)

Inop eng.....identify
Operative eng.adjust as required
Airspeedattain and maintain
at least 106 KIAS

**SECTION 3
EMERGENCY PROCEDURES**

**PIPER AIRCRAFT CORPORATION
PA-31-350, CHIEFTAIN**

Before securing inop. engine:

Fuel flowcheck (if deficient - emergency fuel pump ON)
Fuel quantitycheck
Fuel selector (inop. eng.)switch to other
tank containing fuel
Oil pressure and tempcheck
Magnetos switchescheck
Air startattempt

If engine does not start, complete Engine Securing Procedure.

Power (operative eng.)as required
Mixture (operative eng.)full rich
Fuel quantity (operative eng. tank)sufficient
Emergency fuel pump
(operative eng.)as required
Cowl flap (operative eng.)as required
Trimadjusted (5° bank
into operative eng.)
Electrical loaddecrease to min.
required

Land as soon as practical at nearest suitable airport.

SINGLE ENGINE LANDING

Inop engineEngine Securing
Procedure complete
Hydraulic pumpcheck
Seat belts/harnessessecure
HeaterFAN position
Emergency fuel pump (operative eng.)ON
Mixture (operative eng.)RICH
Propeller (operative eng.)full FORWARD
Fuel selector on
operative engine sideON INBOARD tank
CrossfeedOFF
Cowl flap (operative eng.)as required
Airspeedmaintain 116 KIAS
min. until landing is
assured
Altitudehigher than normal
until landing is assured

**SECTION 3
EMERGENCY PROCEDURES**

**PIPER AIRCRAFT CORPORATION
PA-31-350, CHIEFTAIN**

CROSSFEED

Fuel selector (inop. eng.) level flight.....either tank
Boost pump CB (inop. eng.)IN
Emergency fuel pump (inop. eng.)ON
CrossfeedON
Fuel selector (op. eng.)OFF
Boost pump CB (op. eng.).....pulled
Emergency fuel pump (op. eng.).....OFF

**COMING OUT OF CROSSFEED
(PRIOR TO LANDING)**

Fuel selector (op. eng.)INBOARD tank
Boost pump CB (op. eng.)in
Emergency fuel pump (op. eng.)ON
CrossfeedOFF
Boost pump CB (inop. eng.).....pulled
Emergency fuel pump (inop. eng.)OFF
Fuel selector (inop. eng.)OFF

ONE ALTERNATOR INOP. LIGHT ON

Electrical loadreduced
Approp. side of master switchOFF
Tripped CBsreset
Approp. side of master switchON
Elec. Load (if light goes out)reinstated
If light remains lit or alt. CB has tripped:
Approp. side of master switchOFF
Electrical load.....reduction continued

TWO ALTERNATOR INOP. LIGHTS ON

Repeat above procedure for each side.
If both lights stay on:
Master switch (both sides).....ON
Alternator CB switchesOFF
Electrical load.....minimum
Land as soon as practical.

3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of the recommended course of action and probable cause of an emergency situation.

3.7 ENGINE INOPERATIVE PROCEDURES

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

The engine securing procedure should always be accomplished in a sequential order according to the nature of the engine failure (ie., practice, engine failure during takeoff, engine failure during climb, etc.).

Begin the securing procedure by closing the throttle of the inoperative engine and moving its propeller control to FEATHER (fully aft) before the propeller speed drops below 1000 rpm. The inoperative engine mixture control should be moved fully aft to the IDLE CUT-OFF position. CLOSE its cowl flaps to reduce drag and turn OFF the air conditioner (if installed). Turn OFF the magneto switch, the emergency fuel pump switch and the fuel selector. Pull out the fuel boost pump circuit breaker and turn OFF the alternator circuit breaker switch of the inoperative engine. The propeller synchrophaser (if installed) should be OFF. Complete the procedure by reducing the electrical load and considering the use of the fuel crossfeed if the fuel quantity dictates.

ENGINE FAILURE DURING NORMAL TAKEOFF (85 KIAS or below)

Determination of runway length, single engine climb rate, and accelerate/stop distance will aid in determining the best course of action in the event of an engine failure during takeoff. If engine failure occurs while sufficient runway remains for a deceleration and a safe stop, cut power immediately and stop straight ahead.

If an engine failure occurs before an airspeed of 85 KIAS is attained, and there is not adequate runway remaining for deceleration and stop, immediately retard the throttle and mixture levers fully aft. Turn OFF the master switch, the fuel selectors, and the magneto switches. During these procedures, maintain directional control and maneuver to avoid obstacles if necessary.

**SECTION 3
EMERGENCY PROCEDURES**

**PIPER AIRCRAFT CORPORATION
PA-31-350, CHIEFTAIN**

ENGINE FAILURE DURING FLIGHT (Below 76 KIAS)

Should an engine fail during flight at an airspeed below 76 KIAS, apply rudder towards the operative engine to maintain directional control. The throttles should be retarded to stop the yaw force produced by the inoperative engine. Lower the nose of the aircraft to accelerate above 76 KIAS and increase the power on the operative engine as the airspeed exceeds 76 KIAS.

After an airspeed above 76 KIAS has been established, an engine restart attempt may be made if altitude permits. If the restart has failed, or altitude does not permit, the engine should be secured. Move the propeller control of the inoperative engine to FEATHER and complete the "Engine Securing Procedure." Adjust the trim to a 5° bank into the operating engine. The cowl flaps on the operative engine should be adjusted as required to maintain engine temperatures within allowable limits.

ENGINE FAILURE DURING FLIGHT (Above 76 KIAS)

If an engine fails at an airspeed above 76 KIAS during flight, begin corrective response by identifying the inoperative engine. The operative engine should be adjusted as required after the loss of power has been verified. Attain and maintain an airspeed of 106 KIAS. Once the inoperative engine has been identified and the operating engine adjusted properly, an engine restart may be attempted if altitude permits.

Prior to securing the inoperative engine, check to make sure the fuel flow to the engine is sufficient. If the fuel flow is deficient, turn ON the emergency fuel pump. Check the fuel quantity on the inoperative engine side and switch the fuel selector to the other tank if a sufficient supply is indicated. Check the oil pressure and oil temperature and insure that the magneto switches are ON.

If the engine fails to start it should be secured using the "Engine Securing Procedure".

After the inoperative engine has been secured, the operative engine can be adjusted. Power should be maintained as required and the mixture control should be adjusted for power. Check the fuel supply and turn ON the emergency fuel pump if necessary. The cowl flaps on the operative engine should be adjusted as required to maintain engine temperatures within allowable limits. Adjust the trim to a 5° bank into the operating engine. The electrical load should be decreased to a required minimum. Land as soon as practical at the nearest suitable airport.

**REPORT: LK-1208
3-18**

**ISSUED: SEPTEMBER 14, 1979
REVISED: APRIL 4, 1980**

SINGLE ENGINE LANDING

If a single-engine landing is necessary, a check should be performed to determine whether or not the hydraulic pump is functioning for normal gear extension. This check is accomplished by placing the landing gear control in the UP position with the gear retracted. If the hydraulic pump is functioning, pressure will return the control to the neutral position. This check should be performed before entering the traffic pattern so that there will be time to pump the gear down with the hand pump if necessary.

The "Engine Securing Procedure" should be complete on the inoperative engine. Fasten the seat belts and shoulder harness and select the FAN position of the heater switch. The operative engine emergency pump should be ON and the mixture RICH. Advance the propeller control (operative engine) full forward. Check to ensure that the fuel selector is ON the main (inboard) tank on the same side as the operating engine. The fuel crossfeed valve should be OFF. The cowl flaps on the operative engine should be adjusted as required.

Maintain an airspeed of 116 KIAS or above and an altitude higher than normal until a landing is assured. When a landing is assured, extend the gear and flaps. Slowly retard the power on the operative engine and flare out the airplane for a normal landing. Trim as necessary as power is reduced. The airplane will tend to yaw toward the operative engine.