CHAPTER 6

FUEL SYSTEM

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ILLUSTRATIONS

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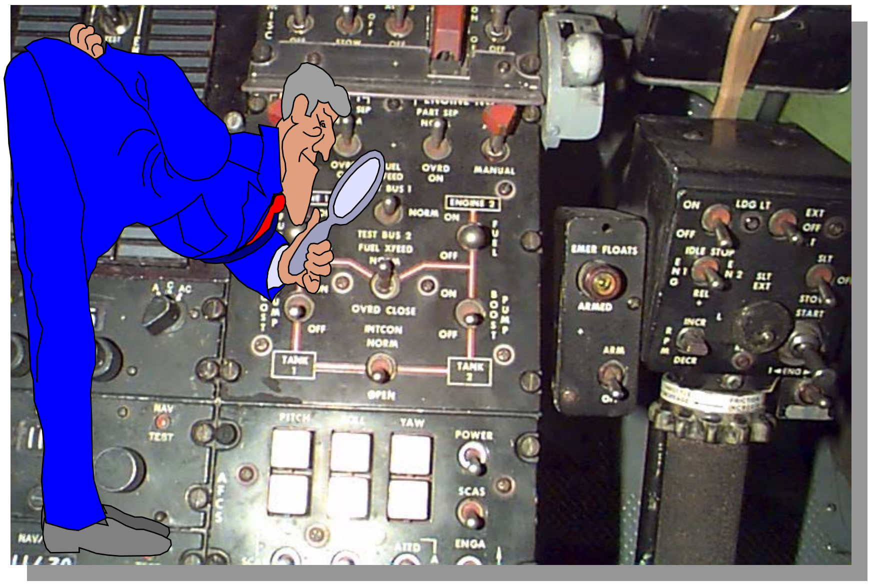
CHAPTER 6

FUEL SYSTEM



INTRODUCTION

The airframe fuel system for the Bell 212 provides an independent uninterrupted supply of fuel to each engine during all approved ground and in-flight maneuvers.

GENERAL

The fuel system (Figure 6-1) includes fuel storage cells, electrical fuel boost pumps to move the fuel from the storage cells to the engines and valves, and necessary plumbing to separate the two independent supply systems. Additional valves and plumbing allow interconnection of the two systems and also allows the engines to be crossfed from either fuel supply system. A fuel gauge system provides accurate measurement of fuel in the cells, and warning lights indicate failures in any components.

TYPES OF USABLE FUEL

Any of the approved jet fuels listed in the "Handling/Servicing/Maintenance" section of the Manufacturer's Data portion of the Flight Manual may be used. Aviation gas can be used in case of emergency, but only with significant reduction in the useful life of engine components. Consult the Engine Manufacturer for emergency fuels.

AIRFRAME FUEL SYSTEM COMPONENTS

The airframe fuel system consists of five crashworthy fuel cells; two are located horizontally below cabin floor, left and right; and three located vertically across fuselage, aft of cabin bulkhead. The lower cells act as main tanks for each power section; each contains a boost pump that furnishes fuel to its respective power section. The two lower cells are self sealing, upper aft three are not. The two lower cells are gravity fed from the aft cells. Two interconnect lines with individual interconnect valves join the forward and aft sumps of each lower fuel cell, Both interconnect valves, forward and aft, are normally closed and are controlled by a single INTERCONNECT SWITCH. (This satisfied an IFR certification requirement for separate fuel systems to each engine).

A lateral fabric baffle that is fitted with a flapper valve divides each lower cell. The flapper valve allows fuel movement from the forward section to the aft section of the cell in nose up attitude while preventing forward movement of fuel during nose down attitude.

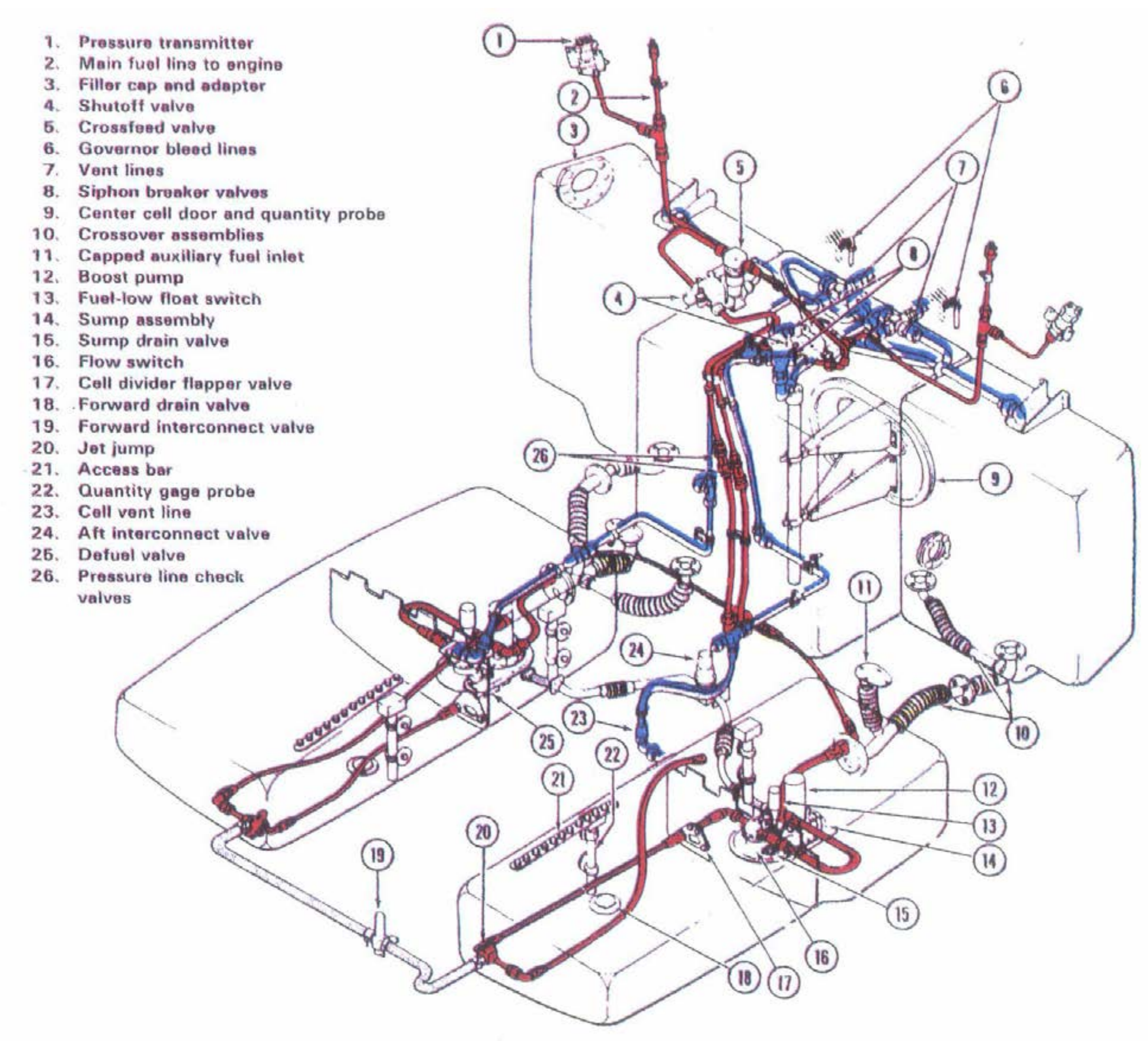


Figure 6-1 Airframe Fuel System

Figure 6-2 Lower Fuel Cell Location

FUEL STORAGE

Fuel is stored in the five crashworthy fuel cells. Each bladder is installed in a structural airframe compartment (Figure 6-2), which is specially braced to evenly support the weight of the fuel. The cells are constructed of a rubberized nylon material tied securely in place, each within an individual compartment.

The lower fuel cells are located under the passenger compartment floor and contain the majority of the components for the two fuel supply systems. The remaining three "upper" or aft cells are located above floor level, behind the rear passenger compartment wall. There is one large center cell with two smaller cells located outboard on each side of the center cell. Figure 6-3 illustrates the fuel cell components.

All five fuel cells are filled from a single-point refueling port located on the right side of the helicopter, just aft of the passenger compartment door. If the internal auxiliary fuel cells are installed in the passenger compartment, they are also filled through the same refueling port. Additional information on auxiliary fuel systems is given in the chapter on optional systems.

During engine operation, fuel is pumped from the lower cells to the engines. As fuel is used from the lower cells, it is replaced by fuel from the upper cells draining by gravity down into the under floor cells. With the internally mounted Bell auxiliary tank, fuel also flows by gravity to the lower cells. Era Aux fuel cells require a pump to transfer fuel into the lower cells of the aircraft.

FUEL CAPACITY

The fuel capacity of the five airframe fuel cells is 220 U.S. gallons. Usable fuel is 217 gallons. With two 20-gallon auxiliary tanks installed, the total fuel capacity is approximately 260 gallons. With two 90-gallon auxiliary tanks installed, the total fuel capacity is approximately 400 gallons.

FUEL CONSUMPTION AND CENTER OF GRAVITY

As a general “rule of thumb," fuel consumption during hovering and low altitude flight averages approximately 600 - 660 pounds per hour. Cruise flight may reduce fuel consumption somewhat, depending on altitude, temperature, and airspeed.

Fuel is pumped to the engines from the lower cells, and the fuel consumed is replaced from the upper cells. The upper cells are aft of the rotor mast, so as fuel is consumed, the weight aft of the rotor mast is reduced and the CG moves forward. The

CG continues to move forward until the total fuel quantity is 72.6 gallons (472 to 494 pounds, depending on fuel density). The CG then moves aft until all fuel is consumed. Refer to "Weight and Balance," in the Manufacturer's Data portion of the approved Flight Manual for specific information on the effect of fuel consumption on CG. Should auxiliary fuel tanks be installed, refer to the approved Flight Manual Supplement for Auxiliary Fuel Operations that governs flight operations and restrictions.

It is essential that both takeoff and landing CG be properly computed to ensure that fuel consumption does not result in an out-of-CG flight condition.

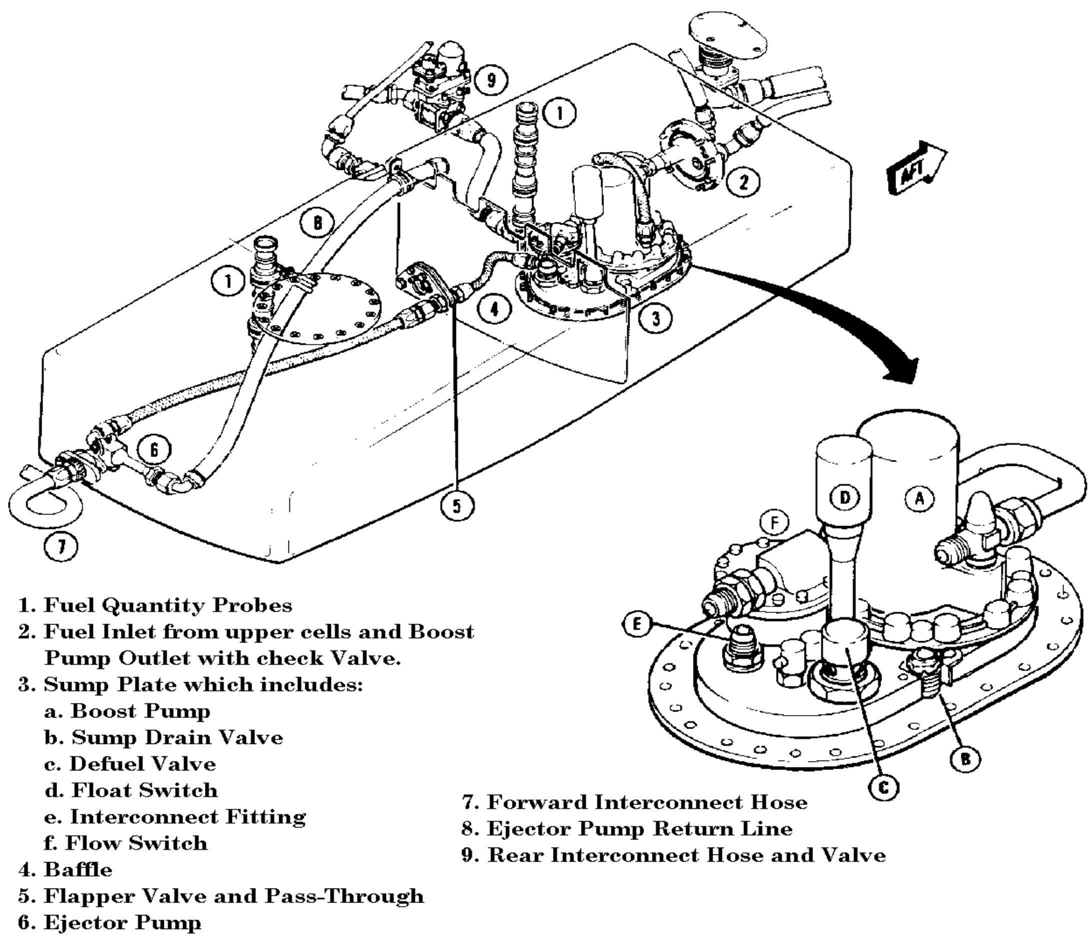


Figure 6-3 Lower Fuel Cell Components

LOWER FUEL CELL COMPONENTS

GENERAL

The lower fuel cells (Figure 6-3) contain the majority of each fuel system's working components. Installed at the rear bottom of each lower cell is a sump plate which mounts an electrically powered fuel boost pump, a fuel flow switch, a fuel float switch, a fuel sump drain valve, a defuel drain, boost pump drains, and a fuel cell interconnect fitting. At the bottom of the forward wall of each lower cell is another fuel cell interconnect fitting and a fuel-pressure-powered ejector or jet pump.

Each lower cell is partially divided by an internal baffle and flapper valve, which restrict forward movement of fuel within the cell. Two fuel quantity probes are installed in each lower cell along with necessary plumbing for boost pump output, ejector pump operation, and inter-connection to the upper aft fuel cells.

FUEL BOOST PUMP

Boost pumps are mounted on the sump assembly near the aft end of each cell. The boost pumps are operated by 28 volts DC, the left pump from the No.1 DC essential bus and the right pump from the No.2 DC essential bus. Each boost pump is controlled by a fuel boost switch on the fuel and engine control panel on the pedestal. The pumps should be ON at any time the power plant is operating to reduce wear of the engine driven fuel pumps.

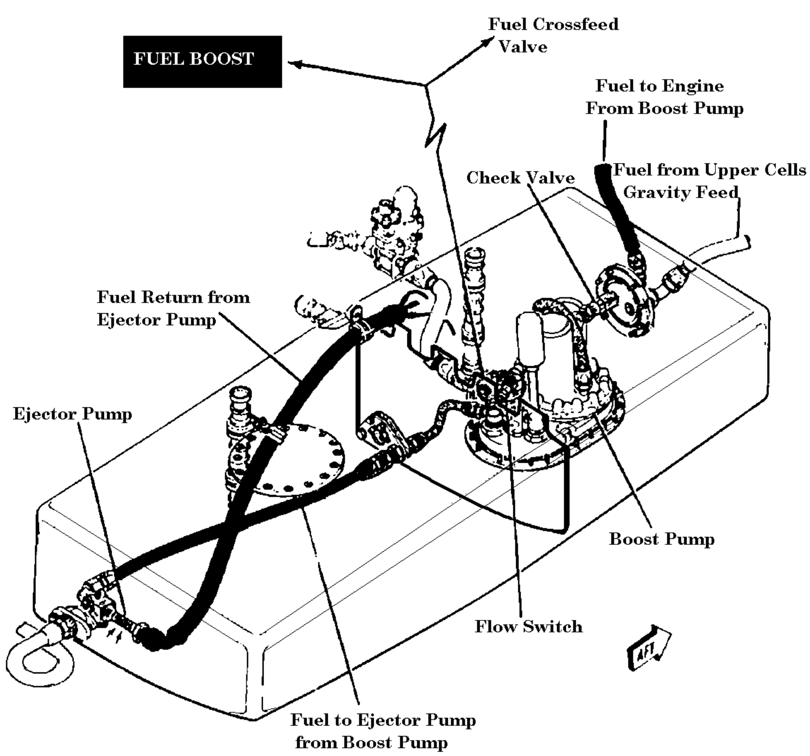


Figure 6-4 Fuel Boost Pump Operation

The pumps are centrifugal type, the output varying with altitude and fuel head pressure. The normal output pressure is 12 to 15 psi. At up to 750 pounds per hour flow, either boost pump is capable of furnishing adequate fuel supply to both power sections for continued flight, in the event of boost pump failure. Under normal operation with both pumps operating, the fuel crossfeed will be closed. Should one of the boost pumps fail the XFEED opens automatically to provide pressure from the operable boost pump to both power sections.

A portion of the boost pump output is diverted forward, through a cross fitting, through a check valve, then through a flow switch and hose to an ejector pump at the front of the cell. Boost pump operation is illustrated in Figure 6-4.

FUEL FLOW SWITCH

A portion of each boost pump's pressurized fuel output is directed forward through a flow switch (Figure 6-4) which is connected to a FUEL BOOST caution panel light and the fuel crossfeed valve system. Fuel from the Boost pump opens the flow switch, which in turn extinguishes the FUEL BOOST caution light. If a boost pump fails, or is turned off, or the flow of fuel through the flow switch is blocked, the flow switch closes, illuminating the FUEL BOOST caution light and sending an electrical signal to the fuel crossfeed valve system.

FUEL EJECTOR PUMP

An ejector pump is installed in the lower forward section of each lower cell, near the in-board wall. The pressurized fuel that passes through the flow switch is directed through internal lines, through the in-cell baffle, and on to the ejector pump. The ejector pump is a "jet" type pump, to pump trapped fuel from the forward section to the aft section of the lower fuel cells. Through venturi action in the ejector pump, the pressurized fuel scavenges fuel located forward of the baffle and returns it to the rear of the lower cell where it can be used by the boost pump. The operation of the ejector pump ensures an adequate supply of fuel to the boost pump, evacuates any trapped fuel forward of the baffle, and assists in maintaining the CG of the helicopter. Although operating at all times, its effect is not noticeable until the fuel in the lower cells is below the level of the baffle, when approximately 35 gallons remain in the lower cell.

BAFFLE FLAPPER VALVES

A flapper valve is located in each lower cell, in the lower in-board portion of the baffle assembly, on the aft side of the fitting. The valve is a one way valve, opening to allow fuel to flow from the forward section to the aft section. The valve closes to prevent flow from the aft section to the forward section during nose down flight conditions. The purpose of the baffle and flapper valve is to ensure that the boost pumps, which are in the aft section of the cell, will have fuel in all flight attitudes.

The baffle does not extend to the top of the cell, but leaves an opening for free flow between sections at higher fuel quantities. The fuel from the ejector pump flows through a return line, over the baffle, and into the aft portion of the cell.

CHECK VALVE/THERMAL RELIEF ASSEMBLY

A combined check valve/thermal relief orifice assembly is installed in each boost pump outlet line, on the aft wall of the pylon compartment. The check valve prevents reverse flow to the opposite lower cell during single boost pump operation. The assembly contains a thermal relief capability to allow a path for return flow to the lower cells with thermal expansion under static conditions.

FUEL FLOAT SWITCH

A tubular housing mounted to the sump plate of each lower fuel cell houses a float switch to indicate low fuel in the particular lower main cell. The warning switch assembly consists of a permanent magnet encased in a float, surrounding an enclosed switch assembly. Each float switch is connected to a separate FUEL LOW caution panel light (Figure 6-5). With full under floor fuel cells, the floats are held at the upper limit of the housing. When fuel has been consumed to a sufficiently low level, the floats start to descend within the housing. When the fuel level in either lower cell is reduced to approximately 70 pounds (10 to 11 gallons) of fuel remaining, the associated float descends enough to close its switch, illuminating the appropriate FUEL LOW caution light.

Total fuel remaining lasts approximately ten minutes at cruise power after illumination of the first FUEL LOW caution panel light. If a FUEL LOW caution light illuminates in flight, the pilot should verify the fuel remaining in the associated lower cell by using the fuel quantity gauge and position the fuel INTCON switch on the fuel panel to the OPEN position. This opens both interconnect valves between the lower cells and allows the fuel to equalize. The pilot should also land as soon as possible to avoid fuel starvation and engine flameout. Refer to the manufacturer's approved Flight Manual for the proper procedures. In the event the FUEL LOW caution light illuminates while the Fuel Gauge indicates fuel levels greater than would cause the FUEL LOW caution light to illuminate, the FUEL LOW caution light will serve as the primary indication of a low fuel state. ***"Always believe the light".***

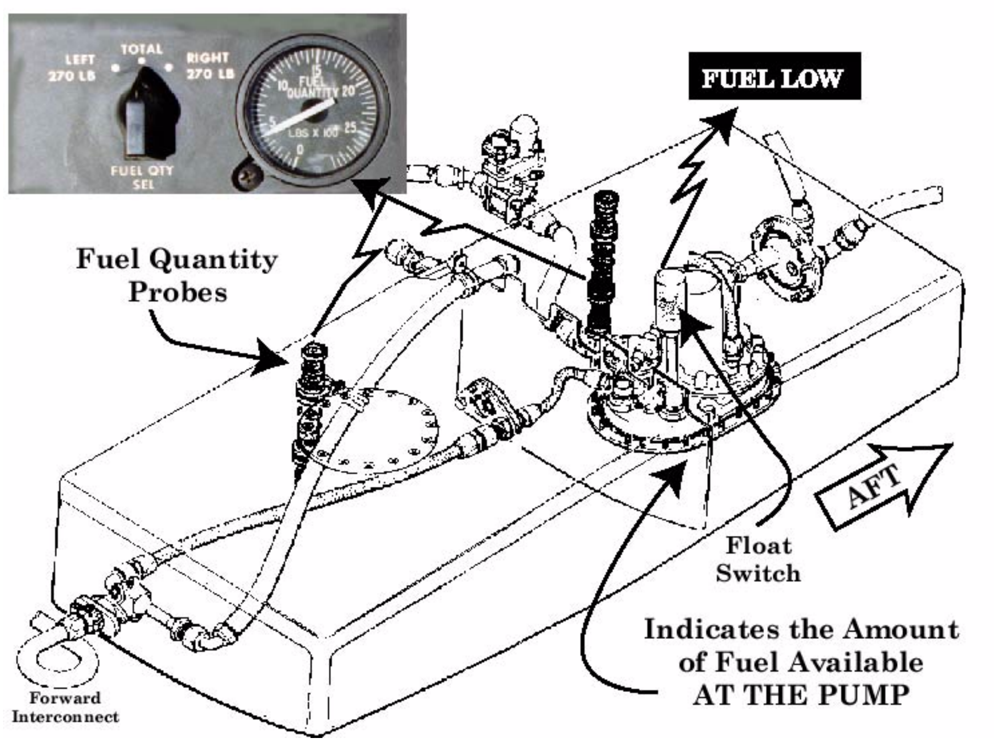


Figure 6-5 Fuel Low Warning System

FUEL SYSTEM DRAINS

Clean uncontaminated fuel is vital to proper engine operation. Filters and screens are provided within the airframe and engine fuel systems to ensure that only clean fuel is supplied to the engines. Fuel system drains are provided for checking fuel storage system quality and also facilitate removing contaminants and providing a clean fuel storage system.

FUEL SUMP DRAIN VALVES

Any contaminants that do enter the fuel storage system generally settle to the lower fuel cells after refueling. A fuel sump drain system (Figure 6-6c) is provided for each lower cell to allow draining of any contamination and checking the fuel quality. The lower fuel cell sumps should be drained before the first flight of the day and before the boost pumps are turned on to prevent stirring up any settled contamination. The fuel sumps can be drained either electrically or manually.

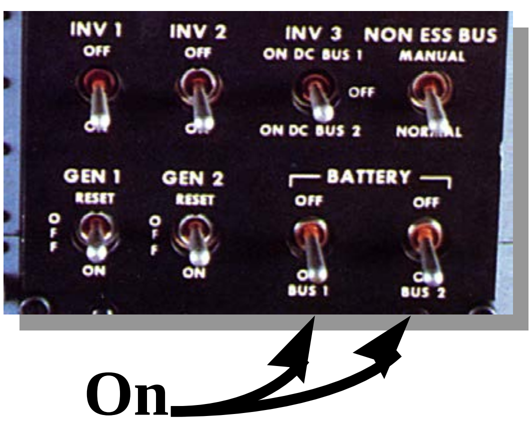


Figure 6-6a Battery Switches

The spring-loaded-closed fuel sump drains may be electrically actuated by a push-button switch under a rubber cap located on the helicopter exterior fuselage below each passenger compartment door. Electrical power (28 VDC) to operate the solenoid drain valves is provided from each essential bus through the respective fuel valve circuits, protected by the FUEL VALVE circuit breakers located on the overhead console.

Since accidental opening of a sump drain valve allows most of the fuel from the cells to be lost, electrical power to operate the sump drain valves is available *only* when the associated FUEL switch is in the OFF position. To electrically actuate the sump drain valves; battery power should be applied to the helicopter and the FUEL switches positioned to OFF.

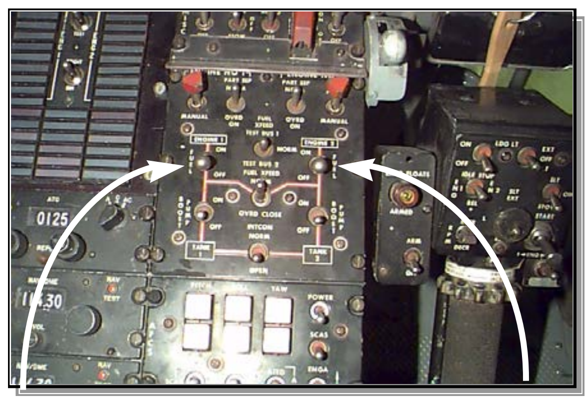


Figure 6-6b Fuel Switches

Figure 6-6c Fuel Sump Drain System

The sump drain valves may also be operated manually by reaching under the helicopter and pushing up on the bottom of the sump drain valve. Regardless of which method is used, the sumps should be drained and the drained fuel visually checked for the presence of contamination or water on a daily basis.

MISCELLANEOUS DRAINS

Each lower fuel cell sump plate also contains a defuel drain and two boost pump drains. The de-fuel drain is used by maintenance to assist in defueling operations. A boost pump seal drain is always open to the atmosphere to prevent fuel that may get past the pump seal from getting into the electrical motor of the boost pump.

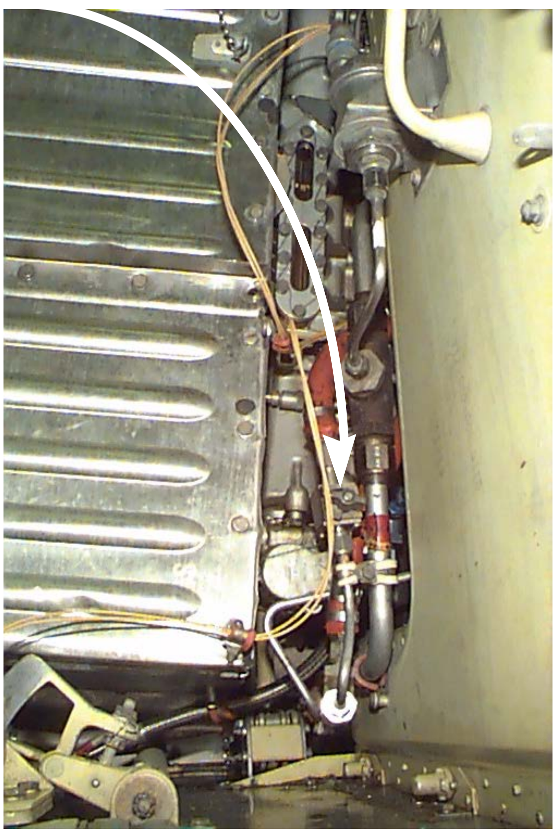


Figure 6-7 Fuel Filter Drain

There are two fuel filter drains and they should be drained before the first flight of the day as follows: Engine 1 boost pump and engine 2 boost pump switches ON. Engine 1 fuel and engine 2 fuel switches ON. Fuel filters (left and right) drain samples. Then turn off the fuel and boost pump switches.

The boost pump drain allows maintenance to drain fuel from the pump itself.

LOWER FUEL CELL INTERCONNECTION

Each lower fuel cell has two interconnect fittings (Figure 6-8), one on the sump plate at the rear of the cell and one at the bottom of the front wall of the cell. Flexible shielded hoses connect each interconnect fitting through an electrically actuated interconnect valve to the opposite lower fuel cell. Providing a method of interconnection between the lower fuel cells ensures that if a boost pump fails, the fuel remaining in the associated lower fuel cell is accessible to the other boost pump.

The forward interconnect valve and hoses are connected to each lower cell's forward fitting. The aft interconnect valve and hoses are connected to each lower cell's sump plate interconnect fitting.

Both interconnect valves are actuated by the INTCON switch on the fuel panel located on the center pedestal. The switch uses 28-VDC power from the No. 2 essential bus and is protected by the FUEL INTCON circuit breaker located on the overhead console. Turning the INTERCONNECT SWITCH to the OPEN position opens both of the interconnect valves providing a path for unrestricted fuel flow between the two lower fuel cells.

For normal operation, the INTCON switch is kept in NORM. This switch positions both interconnect valves closed and separates the two independent fuel systems. If the fuel level becomes low, a boost pump failure occurs, or an engine is shut down in flight, the pilot should move the fuel INTCON switch to the OPEN position, providing fuel equalization and/or access to the remaining fuel. See the manufacturers approved *Flight Manual* for appropriate procedures.

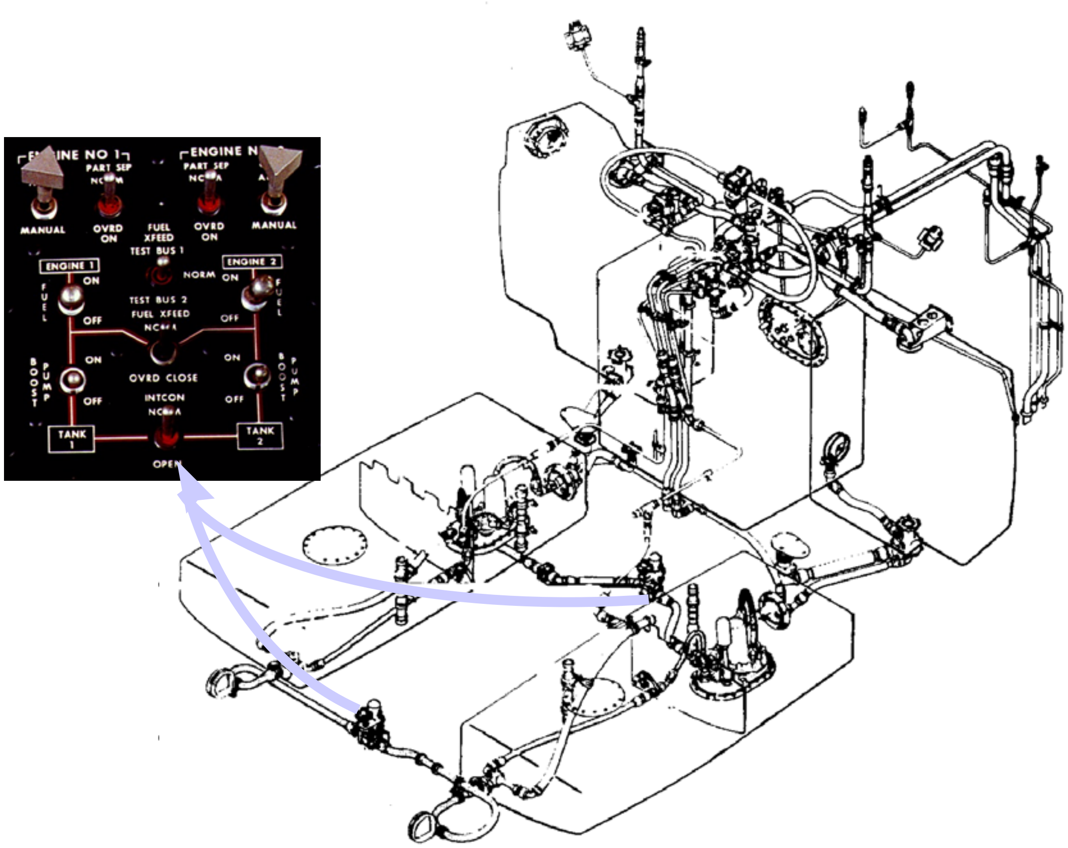


Figure 6-8 Lower Fuel Cell Interconnection

AIRFRAME FUEL SUPPLY SYSTEM

GENERAL

Once fuel has been pressurized by the boost pumps and directed through the one-way check valves and out of the lower cells, other valves and hoses direct the fuel to the engines for use (Figure 6-9). A fuel valve for each engine controls fuel flow to the associated engine. The crossfeed valve and the associated FUEL X-FEED switch automatically or manually control crossfeeding of fuel. Fuel pressure gauges advise the pilot if pressurized fuel is getting to the engine fuel systems, and a fuel quantity system provides cockpit indication of the airframe fuel supply.

FUEL SHUT-OFF VALVE

Pressurized fuel from each boost pump is directed from the lower fuel cells to the engine that it serves. A fuel valve, also referred to the fuel shut-off valve, controls the flow of fuel to each engine. The two valves are electrically operated, and are located above the center aft fuel cell, one valve for each power section.

The valve is a gate type valve which operates from 28 volts DC, the left power section shut-off valve from essential Bus No.1 and the right power section shut-off valve from essential Bus No.2. Each shut-off valve is controlled from the respective engine fuel switch on the fuel and engine control panel. The fuel switch is a four pole-double throw switch, with three poles used; in the "ON" position, 28V DC is furnished to the start relay for the ignition, the fuel control sense air line sense heater and the fuel shut-off valve. At the same time a relay in the Electric Fuel Sump Drain system opens, preventing Fuel Sump Drain Electrical actuation.

The FUEL VALVE segment of the caution panel will illuminate when the shut-off valve cannot be energized from the respective bus or when normal valve operation is interrupted.

The "ON" position of the switch is electrically connected through the Emergency Fire Pull Handle to close the fuel shut-off valve when the fire handle is pulled.

The fuel shut-off valve has a manual open-close provision of the valve on the ground without electrical power. The red lever is the control for opening or closing the valve as well as a position indicator.

The shut-off valve has an internal thermal relief valve to bypass trapped fuel back to the fuel tanks when temperatures increase during static conditions. The relief valve is set to crack at 35 psi, and reset at 5 psi. This allows trapped pressure/fluid to bypass the shut-off valve, through the check valve/thermal relief orifice back to the fuel tanks, protecting the fuel lines and components.

FUEL VALVE CAUTION PANEL LIGHT

Any time a fuel valve either opens or closes the appropriate FUEL VALVE caution light should illuminate momentarily and then extinguish. Sustained or continued illumination of a FUEL VALVE caution panel light indicates that the respective fuel valve either has not fully opened or is not fully closed. The FUEL VALVE caution panel lights are often referred to as "agreement/disagreement" lights. If the FUEL VALVE caution light illuminates and then extinguishes when the appropriate FUEL switch is moved, the fuel valve and the caution light are in "agreement." If a FUEL switch is moved and the FUEL VALVE caution light illuminates and remains illuminated, the fuel valve and the caution light are in "disagreement."

When a FUEL VALVE caution panel light remains illuminated after the FUEL switch has been moved, the pilot should check that the appropriate FUEL VALVE circuit breaker is in. The pilot should also check the associated fuel pressure gauge indications: if the fuel valve is open, fuel pressure is in the normal range; if the fuel valve is closed, the gauge indicates no pressure.

Fuel Pressure Transmitters

A fuel pressure transmitter is installed in the line from each shut-off valve to the power section, to provide boost pump pressure indication. The transmitter is mounted on the aft wall of the aft cabin bulkhead, above the engine work deck.

The transmitters operate on 26 volts AC from the inverters. Transmitter for No.1 operates from 26 volts AC Bus No.1. Transmitter for No.2 operates from the 26 volt AC Bus No.2.

The transmitter provides pressure indication for the respective system with the system crossfeed valve closed. With either boost pump inoperative and the XFEED valve open, both transmitters will indicate the positive boost pump pressure.

Fuel Vent System

All five fuel cells are vented by means of a vent system, and have two overboard vent outlets. A siphon break valve is installed in each of the vent lines from the lower main cells, at the highest point in the system. Their purpose is to prevent siphoning of fuel overboard. Each siphon break valve is also connected into the common venting of the three aft cells, with two overboard vent lines.

There is also a governor bleed line from each power section automatic fuel control unit to the center aft fuel cell access plate, fitting with a restrictor .015 to .020, allows fuel and air to be vented back to the tank.

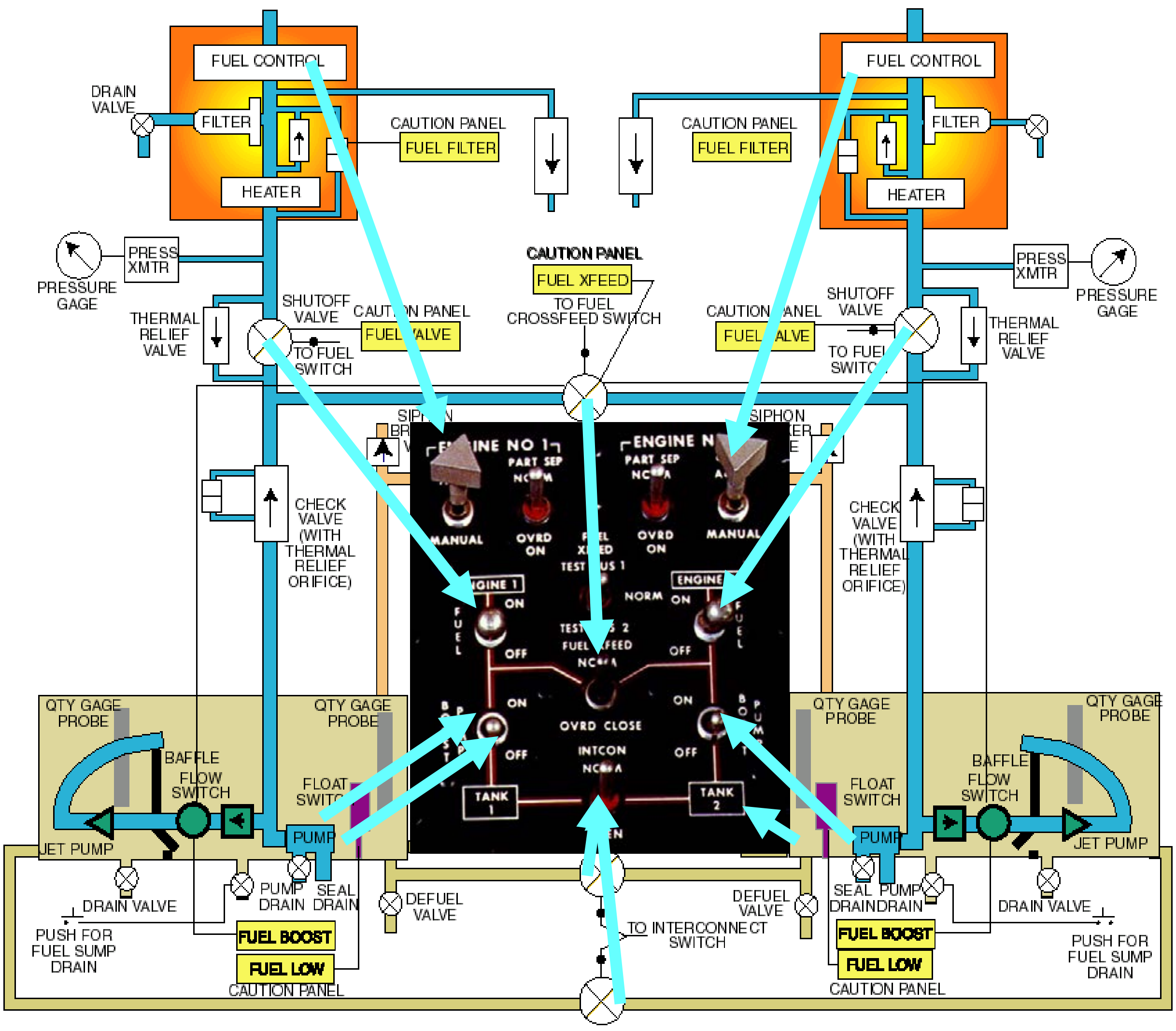


Figure 6-9 Normal Fuel Supply System Operation

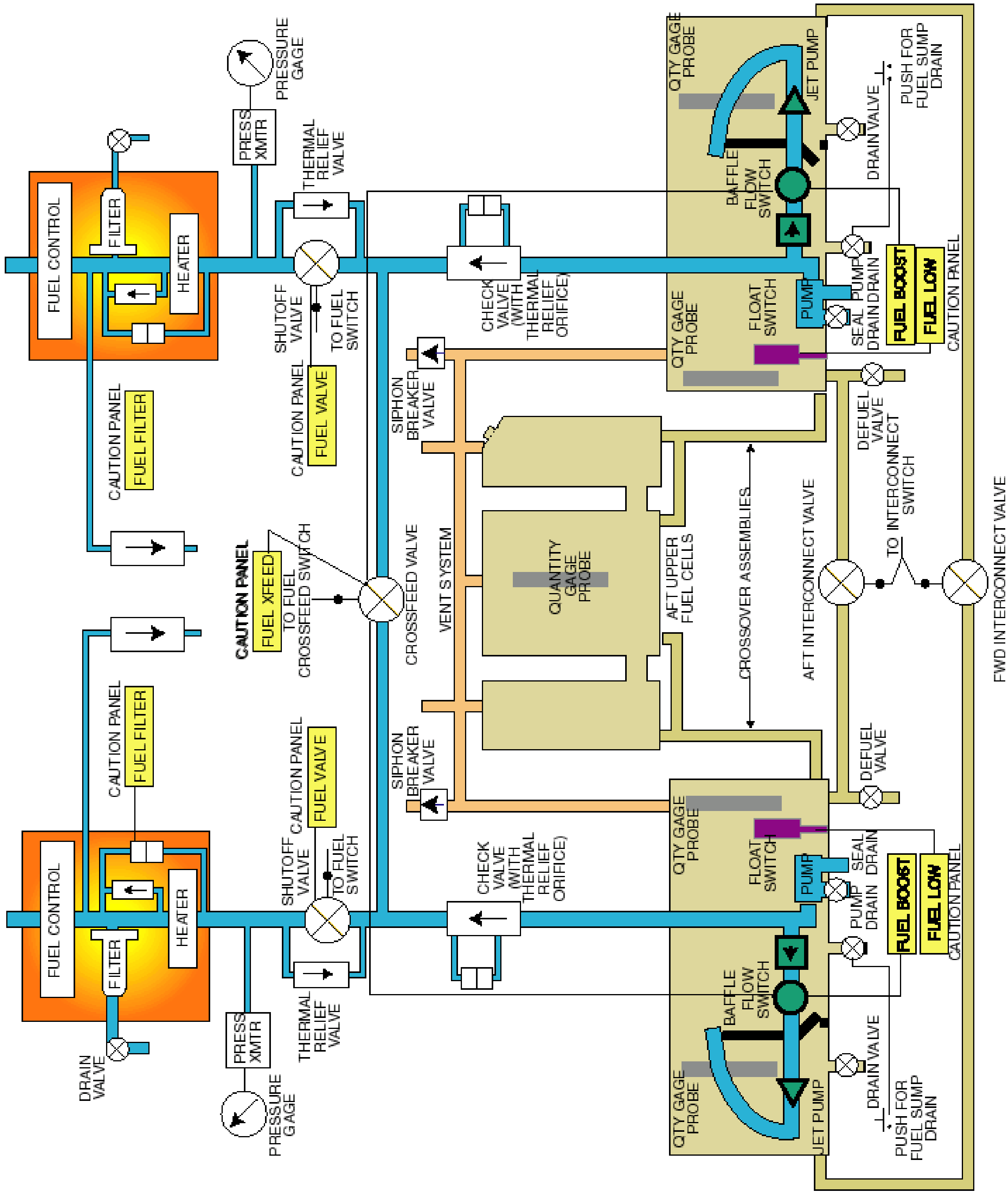


Figure 6-10 Fuel Crossfeed System Operation

FIRE PULL HANDLE

If an engine fire occurs, fuel should be a prime suspect, and fuel flow to the associated engine must be stopped as soon as possible. Because each fuel valve's electrical circuitry is wired through the associated engine's FIRE PULL handle, the pilot can close the necessary fuel valve by pulling the appropriate FIRE PULL handle. When the handle is pulled, a circuit is completed that closes the associated fuel valve regardless of the FUEL switch position. The FUEL VALVE caution panel light illuminates momentarily to indicate that the fuel valve is closing.

Figure 6-11 Fire Pull Handles

FUEL PRESSURE GAUGES

Fuel gauges provide cockpit indications of pressure and fuel flow to each engine. Fuel pressure transmitters are located on the fuel supply line between each engine and its fuel valve. Each pressure transmitter utilizes 26 VAC, is protected by an ENG 1 or ENG 2 FUEL PRESS circuit breaker located on the overhead console, and indicates boost pump fuel pressure in psi on the associated gauge.

Figure 6-12 Fuel Pressure Gauges

FUEL CROSSFEED VALVE

A fuel crossfeed system (Figure 6-10) between the two fuel systems ensures that a boost pump failure does not cause the associated engine to flameout due to fuel starvation. The crossfeed system includes a crossfeed valve, fuel lines between both airframe fuel systems, flow switch sensors to detect a failure of either boost pump, and associated electrical and test circuitry.

The system crossfeed valve is located inboard and above the fuel shut-off valves. 28 volts DC from Bus No.1 and Bus No.2 power it. A FUEL X-FEED bus test switch, located on the fuel and engine control panel, permits an operational check of the valve from either bus. The three-position switch, TEST BUS 1 - NORM - TEST BUS

2, is spring loaded to the center, NORM, position. When held to the TEST BUS 1 or TEST BUS 2 position, the FUEL X-FEED segment of the caution panel should remain out.

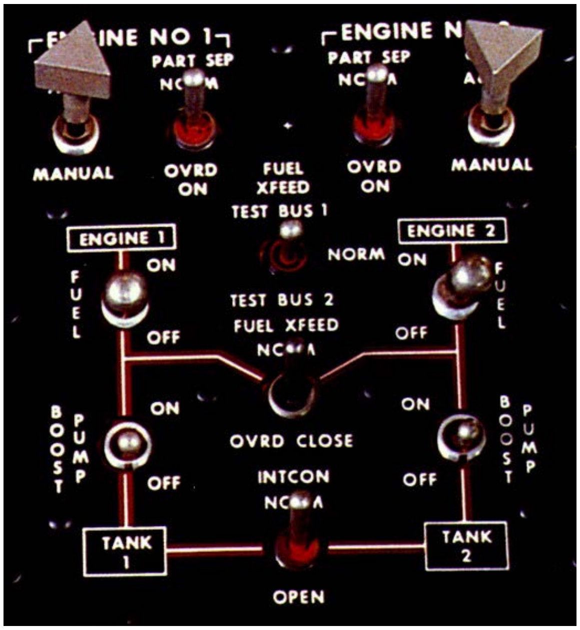


Figure 6-13 Fuel Panel

Illumination of the FUEL X-FEED segment, when the test switch is held to either position indicates that the crossfeed valve cannot be powered from the respective bus. With the crossfeed switch in normal and both pumps operating, the system crossfeed valve is closed to isolate power section fuel system and pressure operation. With either boost pump inoperative, the system crossfeed valve automatically opens to provide pressure from the operable boost pump to both power sections. At the same time, the FUEL BOOST caution panel segment will illuminate. A two-position crossfeed switch on the fuel and engine control panel controls the system crossfeed valve. NORM and OVRD CLOSE, and by a fuel crossfeed relay. In NORM, the fuel crossfeed relay is de-energized as long as boost pressure is keeping the flow switches open. If either flow switch closes and FUEL BOOST caution light is on, the relay is energized to open the system crossfeed valve. In the OVRD CLOSE position, the fuel crossfeed relay is bypassed and the system crossfeed valve is closed to override the automatic operation.

In addition to the test function, the FUEL X-FEED segment of the caution panel will illuminate when the crossfeed valve cannot be energized from both buses or when normal valve operation is interrupted.

FUEL X-FEED TEST SWITCH

The FUEL X-FEED TEST switch is spring loaded to the NORM (center) position where DC power from both essential buses provides for crossfeed valve operation. The TEST BUS 1 and TEST BUS 2 positions of the FUEL X-FEED TEST switch provide for testing the operation of the crossfeed valve using power from either essential DC bus. The "Normal Procedures" section of the manufacturer's approved *Flight Manual* contains specific crossfeed valve check procedures.

During the fuel crossfeed valve check, with the FUEL X-FEED switch in the NORM position and a boost pump switched off, the pilot should check the appropriate fuel pressure gauge indications to ensure that the crossfeed valve has opened and that the one-way check valve is functioning correctly. A 4 to 6 psi lower fuel pressure for the deactivated boost pump indicates a malfunction of the one-way check valve for that pump.

CHECK VALVE/THERMAL RELIEF ASSEMBLY

A combined check valve/thermal relief orifice assembly is installed in each boost pump outlet line, on the aft wall of the pylon compartment. The check valve prevents reverse flow to the opposite lower cell during single boost pump operation. The assembly contains a thermal relief capability to allow a path for return flow to the lower cells with thermal expansion under static conditions.

FUEL QUANTITY INDICATING SYSTEM

The fuel quantity indicating system (Figure 6-15) is a capacitor-type system, designed to provide a continuous indication of total fuel quantity in pounds to the pilot. The system operates on 115 volts AC, 400 Hz (hertz-cycles), single phase provided by either the No.2 inverter under normal operation or if No.2 fails, by No.3 inverter. A total of five fuel quantity transmitters or probes and One Fuel Gauge are used in the indicating system.

FUEL QUANTITY PROBES

A total of five fuel quantity probes are used in the indicating system. Two are installed in the lower right main cell, two in the lower left main cell, and one in the center aft cell. The probes in each lower cell are mounted, one in the forward section (forward of the dividing baffle), and one in the aft section, against the inboard wall of the cell. The fifth probe is located in the center upper cell. Electrical signals from the probes are routed to the selector switch. Additional fuel quantity probes are included if Bell Helicopter auxiliary fuel tanks are installed. Electrical signals from auxiliary tank probes are also routed to the selector switch. For additional information concerning Bell Helicopter auxiliary fuel tanks and the Era Aviation Services Auxiliary tanks see Chapter 25, "Kits and Accessories" in this training manual.

FUEL QUANTITY SELECTOR SWITCH

The selector switch determines which fuel quantity indications are displayed on the fuel quantity gauge.

Figure 6-14 Fuel Quantity Selector

The transmitter probes are connected so that the total capacity for all cells can be indicated on the fuel quantity indicator in the cockpit, through the fuel quantity selector switch. The fuel quantity selector switch has three positions, (left), (total), and (right). The fuel quantity selector switch is spring-loaded to the center (Total) position. In the total position the entire fuel quantity is indicated, including any internally mounted Auxiliary Fuel Cells.

With the fuel at low quantity, the switch in LEFT provides the quantity of the left cell only, or in RIGHT it provides the quantity in the right cell only. If the switch is turned toward either left or right without going fully to the stop, the fuel Gauges will give an incorrect reading and in most cases go to “0” lbs. of fuel

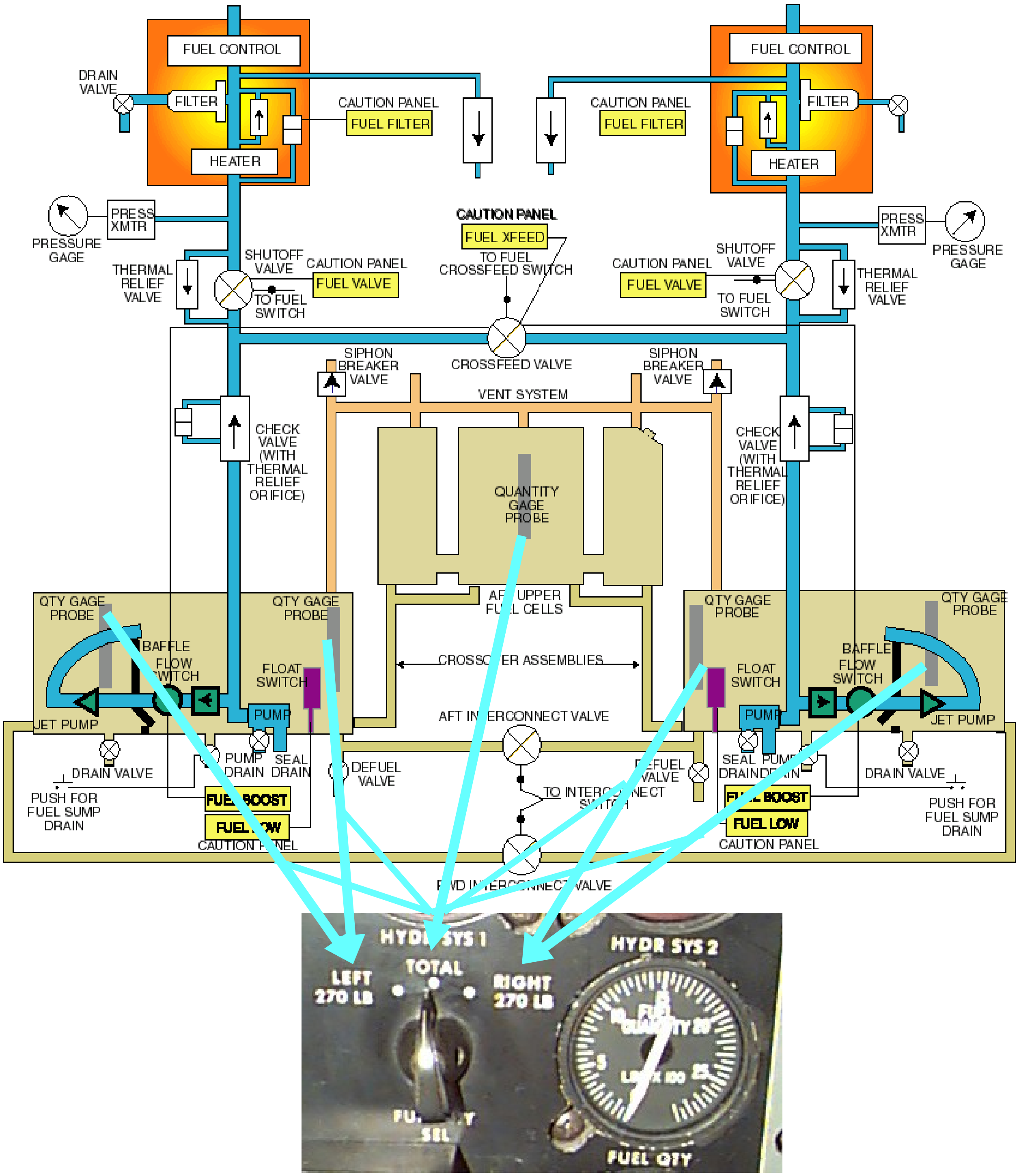


Figure 6-15 Fuel Quantity Indicating System

Figure 6-16 Fuel Gauges Selector Switch

With the selector switch held manually in either the LEFT 270 LB or RIGHT 270 LB position, signals from the two left lower cell probes or the two right lower cell probes, as applicable, indicate the fuel in the associated cells. The left and right lower fuel cell quantities are checked for proper readings during the Fuel Quantity Check portion of the Prestart checklist. With a total fuel quantity of at least 600 pounds, the left and right indications should not be less than 270 or more than 300 pounds, depending on the density of the fuel used. A gauge reading of *less* than 270 indicates a problem with the probes in the associated cell or the selector has not been moved fully to either the Left or Right positions, in which case an indication of 0 pounds is likely.

FUEL QUANTITY GAUGE

The standard gauge, used on helicopters without auxiliary fuel provisions, provides indications from 0 to 1,500 pounds of fuel. On helicopters with auxiliary fuel provisions, the gauge reads from 0 to 2,900 pounds.

Loss of AC power to the fuel quantity system causes the fuel quantity gauge to stay in the last indicated position and also renders the selector switch inoperative.

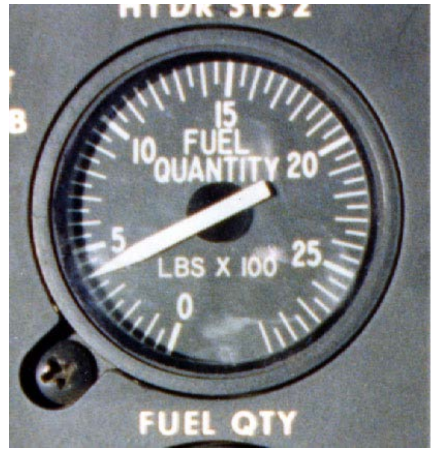


Figure 6-17 Fuel Quantity Gauges

NORMAL FUEL SYSTEM OPERATION

Normal fuel system operation is achieved by following the normal procedures outlined in Section 2 of the manufacturer's approved *Flight Manual.*

Electrical Power On, Static

With both No.1 and No.2 fuel switches "OFF", No.1 and No.2 fuel boost switches "OFF", crossfeed switch NORM and fuel interconnect switch NORM, the FUEL BOOST caution segment lights for No.1 and No.2 engine will be illuminated and the No.1 and No.2 fuel pressure indicator will read zero (no thermal expansion). Each lower main cell fuel system is isolated to its respective power section.

Electrical Power On, Fuel Switches On

With both No.1 and No.2 fuel switches "ON" and both No.1 and No.2 boost switches "ON", the FUEL BOOST caution segment lights will be extinguished, the No.1 fuel pressure indicator will register the left boost pump output pressure, and the No.2 fuel pressure indicator will register the right boost pump output pressure.

FUEL SYSTEM (AIRFRAME) MALFUNCTIONS

BOOST PUMP MALFUNCTION

Failure of a boost pump is indicated by illumination of the respective FUEL BOOST caution panel light. The failure is detected by the associated flow switch, causing it to close (due to loss of fuel flow through it) and illuminate the caution light. Closing of the flow switch also activates the crossfeed valve to the open position and ensures an uninterrupted flow of fuel to the engines.

The primary indication of a boost pump failure is illumination of the FUEL BOOST caution light. If the malfunction is noticed soon enough, a temporary drop in fuel pressure and momentary illumination of the FUEL X-FEED caution light may also be noticed.

The fuel pressure gauge for the failed boost pump should be checked to ensure that fuel is now being directed from the operating boost pump to both engines. Additionally, the fuel INTCON switch should be positioned to OPEN to allow the fuel in the lower cell with the failed boost pump to be accessed by the remaining boost pump. If above 5,000 feet pressure altitude, descend the helicopter below that level to prevent fuel starvation should the remaining boost pump fail. Check that the appropriate FUEL BOOST circuit breaker is set. If boost pump operation cannot be regained, switch the pump off.

Other malfunctions, such as a short within the flow switch or a blockage of fuel through either the flow switch or the ejector pump, may cause illumination of the FUEL BOOST caution light. A boost pump failure check can determine if a boost pump has actually failed.

BOOST PUMP FAILURE CHECK

WARNING

The following check should be performed ***only*** on the ground to preclude the possibility of inadvertent engine flameout.

The failed boost pump should be switched on and the FUEL X-FEED switch placed to OVRD CLOSE. Fuel pressure for the failed boost pump indicates 0 pressure if the boost pump has actually failed. If fuel pressure is normal, some other malfunction caused illumination of the FUEL BOOST caution light. The results of the boost pump failure check should be reported to maintenance for corrective action.

FUEL OR CROSSFEED VALVE MALFUNCTION

Momentary illumination of a FUEL VALVE or a FUEL X-FEED caution light is normal and should be noted whenever these valves change position. Sustained illumination of a caution light indicates that the associated valve has not either fully opened or fully closed. The caution light is illuminated by a break in electrical continuity when the valve leaves one position (or if electric power to the switch is lost (i.e. popped circuit breaker). The caution light remains illuminated until continuity is regained when the valve reaches the opposite position, extinguishing the light. Pilot actions for the sustained illumination of a valve caution light depend on flight conditions and other cockpit indications.

Check that the failed valve's circuit breaker is in because any break in the electrical circuit causes the valve to stop moving, thereby illuminating the caution light. Resetting the circuit breaker may allow the valve to continue moving and extinguish the caution light. If the circuit breaker does not reset, maintenance action is required.

Check the fuel pressure gauges for proper indications. A fuel valve that has not fully opened or closed may be indicated by lower than normal fuel pressure. An on-the-ground check of alternate boost pumps and pressure readings shows actual status of the fuel valves and the crossfeed valve. Illumination of a valve caution light in flight, especially if no switches have been actuated, could be an indication of a short or a malfunctioning switch. Resetting a tripped circuit breaker or cycling the associated valve's switch should be carefully weighed against flight conditions and the possibility of engine fuel starvation.

EMERGENCY ENGINE SHUTDOWN

The airframe fuel system controls are an integral part of emergency engine shutdown procedures, particularly as related to engine fires. Procedures provided in the manufacturer's approved *Flight Manual* direct that a specific sequence be followed when shutting down the airframe fuel system:

1. FUEL switch-OFF
2. FUEL X-FEED switch-OVRD CLOSE
3. BOOST PUMP switch-OFF
4. INTCON switch-OPEN

This sequence ensures that fuel flow to the associated engine is stopped and prevents fuel from feeding the fire, as well as insuring that the remaining fuel in the cells is available to the remaining engine.

FUEL LEAKS AND FUEL CONTAMINATION

Airframe fuel leaks are indicated by a higher than normal fuel consumption rate. Fuel leaks increase in-flight fire potential and the possibility of unanticipated engine failure. The pilot should land the helicopter as soon as possible and have the problem corrected.

Fuel contamination may be indicated by erratic engine operation or engine flameout. If only one engine is affected, the lower cell providing fuel to that engine may be isolated by switching the associated boost pump off and leaving the fuel INTCON (interconnect) valve switch in NORM.