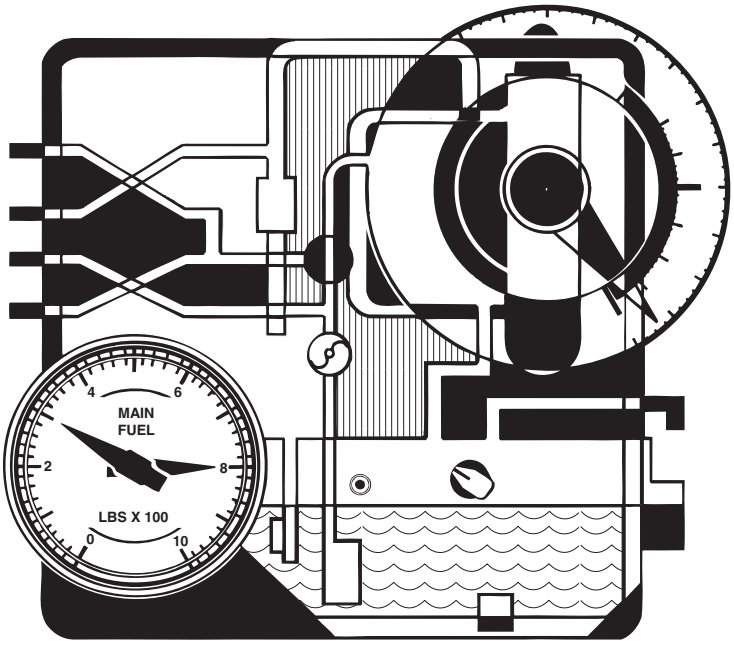
CHAPTER 5
FUEL SYSTEM



INTRODUCTION

This chapter presents information on the fuel system of the Citation Mustang. Integral fuel tanks in the left and right wings provide fuel storage. The fuel distribution system provides fuel to each engine from the corresponding wing tank. The fuel transfer system allows fuel to be transferred from one tank to the other. Crew alerting system (CAS) messages alert the pilot to fuel system emergency and abnormal situations.

Information in this chapter is provided for the airframe fuel system upstream of the high-pressure engine-driven fuel pump. For description and operation of the engine fuel system, refer to Chapter 7—"Powerplant."

GENERAL

The Citation Mustang fuel system includes two integral wing fuel tanks, an automatic fuel distribution system, and manual fuel transfer capability (Figure 5-1). Each wing tank includes an integral engine feed bay. A primary ejector pump and an electrically powered boost pump provide fuel to the respective engine. Switches on the lower pilot tilt panel and CAS messages on the multifunction display (MFD) control and indicate fuel operation and transfer.

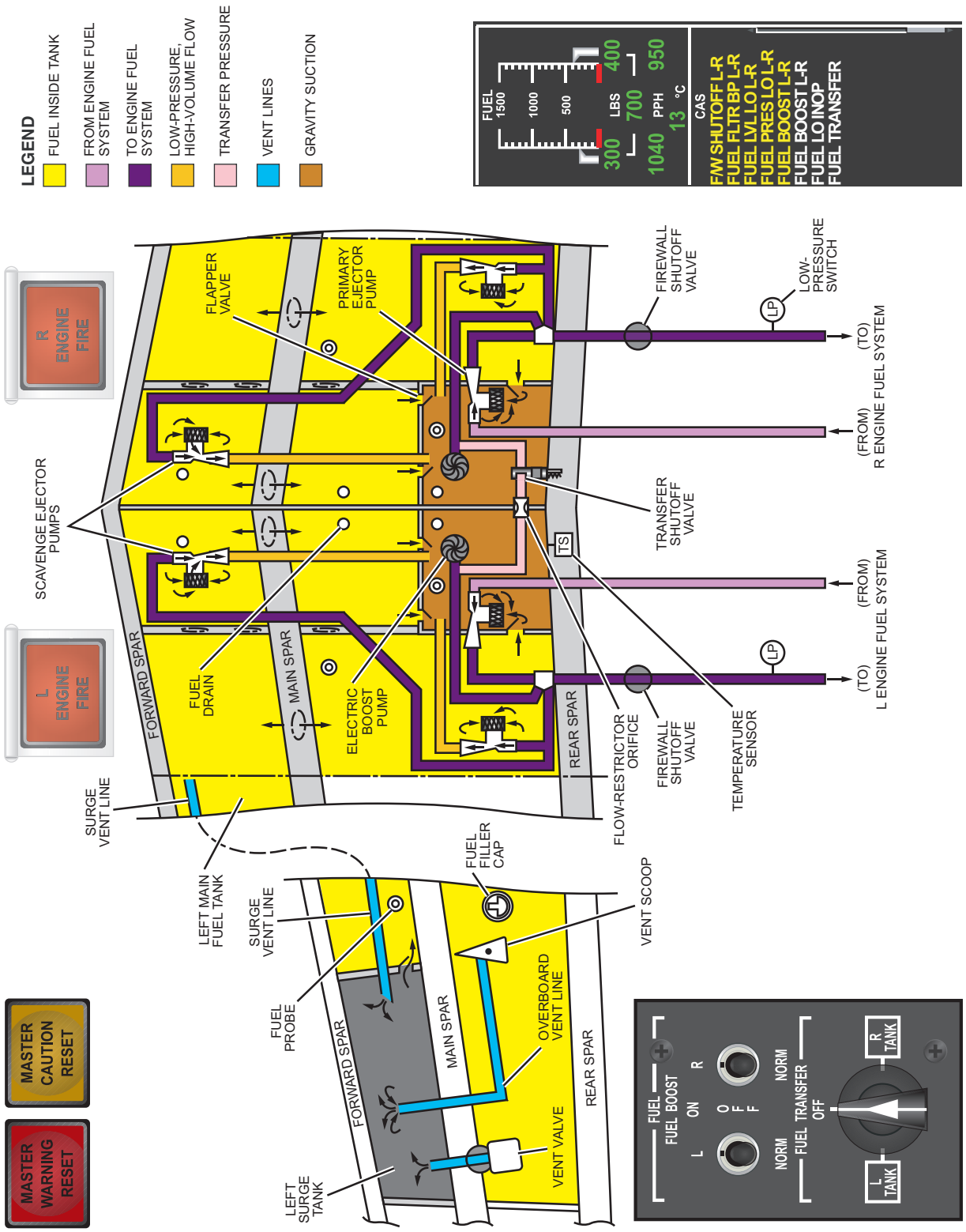


Figure 5-1. Fuel Tank System

FUEL STORAGE

DESCRIPTION

The left and right tanks each have a fuel capacity of 192.5 gallons (728.7 liters) for a total combined fuel capacity per aircraft of 385 gallons (1,457 liters). Refer to Table 5-1 for approximate volumes and weights, or refer to the *Airplane Flight Manual (AFM)* for current data. The Citation Mustang fuel system does not require the use of anti-icing additives.

Table 5-1. FUEL SYSTEM CAPACITY

	STANDARD (U.S.)		METRIC	
Total Capacity	**Weight**	**Volume**	**Weight**	**Volume**
Each Tank	1,290 pounds	192.5 gallons	585 kg	728.7 liters
Both Tanks	2,580 pounds	385 gallons	1,170 kg	1,457 liters

Each wing tank system (left wing and right wing) includes:

- Main tank cavity
- Engine feed bay
- Venting system
- Tank filler
- Sump drain valves
- Scavenge pumps
- Fuel probes
- Flapper valves

COMPONENTS

Main Tank Cavity

Each main tank cavity (one in each wing, between the forward and rear wing spars) is integral to the wing. Holes in the main spar and ribs allow fuel flow through the wing (Figure 5-1). Flapper valves, attached to spar and rib holes, allow fuel flow inboard while inhibiting flow outboard.

Engine Feed Bay

An engine feed bay is an integral part of each wing tank. It is the lowest point in the fuel system, which is the location for fuel pickup (intake) for the fuel distribution system. Each feed bay holds approximately 8 gallons and has four vent openings (ensures the bay maintains full capacity under all flight conditions).

Venting System

The venting system consists of a tank, vent lines, flapper, and float-controlled vent valve. A vent surge tank at the most outboard bay of the wing fuel tank collects fuel surges from the main tank and also provides a portion of the required expansion space. The fuel travels outboard from the main tank through the surge vent line.

During climbs and maneuvers, air trapped in the forward inboard area of the main tank escapes through the climb vent line to vent into the surge tank; this allows the main tank area to fill with fuel.

A float-controlled vent valve is connected to the vent surge tank. When the fuel level is full enough to raise the float, the valve closes, preventing fuel from overflowing into the surge tank. When the fuel level is low, the valve opens to provide venting. A flapper valve permits fuel to drain from the surge tank back into the main tank. If the vent surge tank fills, another vent line allows spillage overboard through the NACA scoop (Figure 5-2) under the wing. The vent lines normally allow air to enter or exit through the NACA scoop. The scoop does not require anti-icing.

Figure 5-2. NACA Scoop Fuel Vent

Tank Filler

The aircraft has one fuel tank filler assembly on the upper surface of each wing, between the main spar and the aileron (Figure 5-3). The filler assembly consists of a flush-type cap and a standpipe.

Figure 5-3. Fuel Tank Filler

Sump Drain Valves

Sump drain valves (Figure 5-4) are at the low points in each wing where water can collect. In each wing, there is a sump drain in each of the following locations:

- Outboard and inboard of the landing gear (behind the main spar)
- In the engine feed bay
- Between the feed bay and the main spar
- Between the forward and main spars (forward of the feed bay)

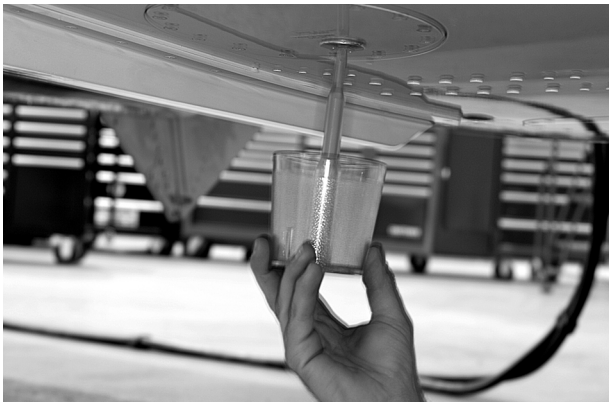


Figure 5-4. Sump Drain Valves

When draining sumps, do not turn any tool in the drain. The drain may lock open, resulting in fuel loss.

CONTROLS AND INDICATIONS

Fuel Quantity Gauging System

The fuel quantity gauging system includes a signal conditioner and five fuel quantity probes in each wing. The left and right fuel quantity signal conditioners gather data from their respective sides and convert the data into the appropriate signals for the G1000 engine indicating crew alerting system (EICAS).

The EICAS uses the data for the FUEL quantity display, and for CAS messages to alert the pilot of a low fuel quantity level (in either wing) or a failure of the gauging system.

OPERATION

Fuel Servicing

Fuel servicing includes procedures necessary for fueling, and procedures used to check the fuel for contamination or condensation. The fuel is serviced through the flush-type cap on the outboard section of either wing (Figure 5-5).

Figure 5-5. Fuel Tank Servicing

Refueling

Refuel in areas that permit the free movement of fire equipment. Follow approved grounding procedures for the airplane and

the fueling equipment. There is one approved grounding point under the outboard end of each wing (Figure 5-6).

Figure 5-6. Grounding Point

Refuel to the bottom of the standpipe to achieve maximum usable fuel for flight planning. If the fuel tank is filled above the bottom of the standpipe, there may not be room for expansion, which can result in fuel spillage through the fuel vents.

Approved fuels and additives for operation of the aircraft are listed in the "Limitations" section of the AFM. Use of avgas is not approved.

Defueling

Defueling must be performed as a maintenance function.

FUEL DISTRIBUTION

DESCRIPTION

The right side of the wing fuel system is identical to the left side, except for a fuel transfer valve in the right tank and a fuel temperature probe in the left tank.

COMPONENTS

Electric Boost Pumps

Electric boost pumps are used for:

- Engine starting
- Low fuel supply pressure
- Fuel transfer

A 28-VDC boost pump is in each engine feed bay. Either boost pump can be controlled automatically or manually. Circuit protection for the boost pumps is in the aft J-box.

Primary Ejector Pumps

The primary ejector pump is submerged in fuel in each engine feed bay (Figure 5-7). The pump utilizes a small jet of high-pressure "motive flow" fuel (from the respective engine fuel pumps). The fuel passes through a venturi, pulls a larger low-pressure flow of fuel from the feed bay, and pumps it back to the engine. Some of the resulting flow also provides motive flow to the scavenge ejector pumps. The primary ejector pump has no moving parts. It operates whenever motive flow is available.

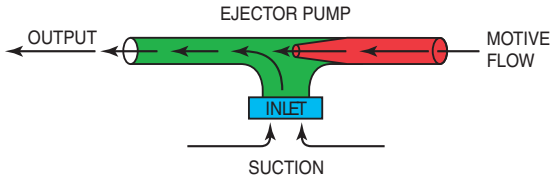


Figure 5-7. Primary Ejector Pump

Scavenge Ejector Pumps

A scavenge ejector pump constantly transfers fuel from the forward and outboard areas of each tank to its engine feed bay. This ensures the engine feed bay is full and the primary ejector and electric boost pump are submerged in fuel until the wing tank is nearly empty and the fuel level is drained in the feed bay. Each scavenge ejector pump receives low-pressure motive flow from the same side

primary ejector pump or (when operating) the same side electric boost pump.

Fuel Transfer Valve

There is a fuel transfer valve in the right engine feed bay. It opens or closes to allow flow between left and right wing tanks. It is normally closed. The valve is a direct-acting solenoid valve, controlled by the FUEL TRANSFER selector on the lower instrument tilt panel (Figure 5-8). The valve works with the boost pump on the side from which fuel is being transferred. When fuel transfer is commanded by the pilot, the valve opens and the boost pump is energized. Fuel is pumped from the engine feed bay into the opposite engine feed bay through a small opening that limits the transfer flow. Circuit protection for the transfer valve is provided by the L and R FUEL CONTROL circuit breakers in the aft J-box. The fuel transfer valve is not powered when the battery switch is in the EMER position.

Figure 5-8. Fuel Controls

Firewall Shutoff Valves

Firewall shutoff valves for each engine are in the respective aft wing fairing (between the wing and fuselage). In the event of a fire, the valves shut off fuel flow to the respective engine on pilot command. The valves can be commanded closed by the FADEC in the event the normal shutdown valve fails. Circuit protection for the shutoff valves are provided by the L FEED BUS #2 and R FEED BUS #2, through the respective L and R FIREWALL CUTOFF circuit breakers on the aft J-box.

Refer to Chapter 8—"Fire Protection" for more information on the firewall shutoff valves and their operation.

Fuel Pressure Switches

Pressure switches are in the engine fuel supply lines adjacent to each engine. The switches deactivate at 6.4 psig (maximum) and reactivate when the engine fuel supply pressure drops below 4.65 psig. When fuel pressure drops below this limit, the amber FUEL PRES LO L-R message appears.

Fuel Flow Transmitter

A fuel flow transmitter is on each engine fuel supply line. The transmitter sends a 0-5 volt analog signal to the G1000 system, which translates the signal to pounds/kilograms per hour.

CONTROLS AND INDICATIONS

The pilot controls the fuel system with the L and R FUEL BOOST switches and the FUEL TRANSFER selector. Fuel indications are displayed on the MFD in the EICAS window, which is displayed in two columns on the left side. In the event of MFD failure or revision, the EICAS section is shown in a single-column format on whichever displays are in reversionary mode.

FUEL BOOST Switches

The FUEL BOOST switches are on the lower instrument tilt panel (Figure 5-8). Each switch (L and R) has three positions: ON, OFF, and NORM.

The switches manually control the respective boost pumps in the ON and OFF positions. In the NORM position, boost pump operation is automatically controlled.

FUEL TRANSFER Selector

A FUEL TRANSFER selector (Figure 5-8) on the lower left instrument tilt panel controls the (normally closed) fuel transfer valve.

The selector has three positions: L TANK, OFF, and R TANK.

The selector opens the fuel transfer valve and energizes the supply side fuel boost pump, which allows fuel to be pumped to the selected engine feed bay from the opposite engine feed bay.

Fuel is transferred at approximately 10 ppm (4.5 kg per minute). Rate varies with engine(s) fuel flow.

Fuel Quantity Indication

The aircraft has a passive capacitance-type fuel quantity system. The system consists of:

- Independent dual-channel digital signal conditioner (in the left aft wing fairing)
- Five fuel probes in each wing tank
- EICAS displays

Fuel quantity is displayed on the G1000 GDU 1500 MFD "AUX" page and in the left EICAS column of the MFD (Figure 5-9). Quantity can be displayed in either pounds or kilograms. Fuel tank levels are displayed with a white pointer on a white scale on the fuel display and by green digits just below the scale. In reversionary mode, only the digits are displayed (Figure 5-10).

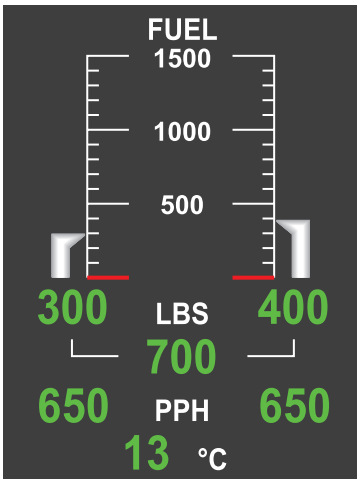


Figure 5-9. Fuel Display in MFD (EICAS Normal Mode)

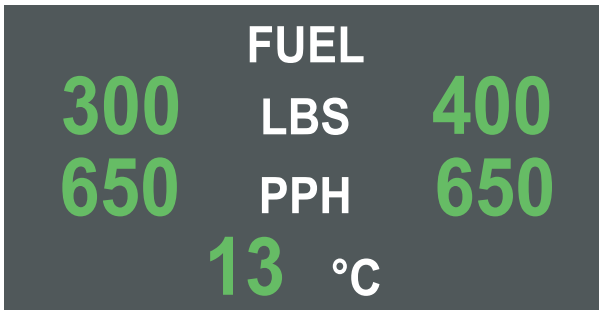


Figure 5-10. Alternate Fuel Display (EICAS Reversionary Mode)

Total aircraft fuel is the sum of the fuel quantities displayed for each tank. This value is displayed below the individual tank quantities in green digits. Total fuel quantity is displayed in the same units as the fuel tank levels. Invalid data is displayed by a red X or white dashes.

Fuel Temperature Indication

The fuel temperature probe is inside the left side engine feed bay. The probe temperature appears in the fuel display. Fuel tank temperature is displayed as green digits (in °C) below the fuel flow (see Figure 5-9). If invalid data is received, a red X is displayed. The temperature displayed is invalid if below –70°C (–94°F) or above 99°C (210°F).

Fuel Flow Indication

Fuel flow is displayed digitally below the total fuel display. The digits are green and are displayed in pounds per hour (PPH) or kilograms per hour (KGH). Invalid data displays as a red X.

CAS Messages

F/W SHUTOFF L-R

The engine fire-warning and fire-extinguishing systems allow the crew to detect and suppress fires in the aircraft engine compartments. When the red L–R ENGINE FIRE lights are pressed, the appropriate fuel shutoff valve closes and the amber F/W SHUTOFF L or R message appears on the EICAS (Figure 5-11). This message may also appear after engine shutdown if the normal engine shutdown valve fails.

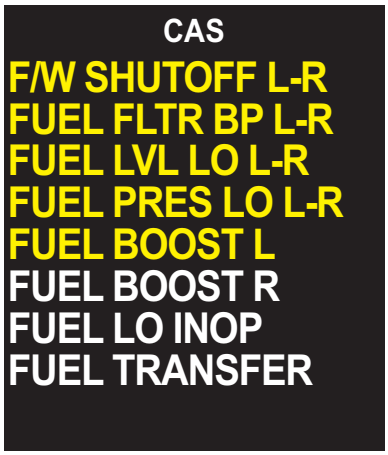


Figure 5-11. CAS Messages

FUEL FLTR BP L-R

If the fuel filter becomes clogged, the bypass valve allows unfiltered fuel to enter the engines. Before the bypass valve is opened, a signal is sent to the EICAS system to indicate an impending bypass, which displays the amber FUEL FLTR BP L-R message (Figure 5-11). Refer to the Chapter 7—"Powerplant" for more information.

FUEL LVL LO L-R

The amber FUEL LVL LO L-R message indicates that fuel level is low in the indicated wing tank. Each signal conditioner channel sends an ARINC discrete signal (low fuel level warning) to the EICAS system when the respective wing usable fuel quantity is less than approximately 170 pounds (25 gallons) (Figure 5-11).

FUEL LO INOP L-R

The white FUEL LO INOP L-R message indicates the amber FUEL LVL LO L-R message is not operational and cannot provide reliable indication of low fuel level.

In some situations, if the fuel quantity gauging system fails (indicated by a red X on either fuel quantity EICAS display), there may still be sufficient reliable data for the system to determine whether or not fuel level is below 170 pounds (25 gallons). In this situation, the FUEL LVL LO L-R message is still useable as a minimum indication of fuel level (appearing only when fuel level is below 170 pounds in either tank). However, if there is not sufficient reliable data to determine that fuel level is above or below 170 pounds, the FUEL LO INOP L-R message appears, indicating which tank cannot supply valid data to control the FUEL LVL LO L-R message.

FUEL PRES LO L-R

When the fuel-supply pressure to an engine drops below the activation point, its pressure switch closes. The fuel pressure switch completes an electrical circuit, which displays the respective amber FUEL PRES LO L-R message. If the boost switch(es) is in the NORM position, the boost pump(s) automatically energizes.

FUEL TRANSFER

The FUEL TRANSFER selector, when in the L TANK or R TANK position, completes an electrical circuit that automatically energizes the electric fuel boost pump in the opposite tank and opens the fuel transfer valve. This activates the white FUEL TRANSFER message and either the L or R FUEL BOOST white CAS message, assuming the boost switches are in the NORM position.

FUEL BOOST L-R

The FUEL BOOST L-R message is present anytime the boost pumps are on. The message is usually white.

The *white* FUEL BOOST L-R message appears when the pilot *commands* the fuel boost pump on (by selecting the FUEL TRANSFER selector to L TANK or R TANK, by selecting either FUEL BOOST switch to ON, or by pressing a start button).

The *amber* FUEL BOOST L-R message appears when the corresponding fuel boost pump is energized *automatically* in response to low fuel pressure. This is only possible when either FUEL BOOST switch is selected to NORM.

ENGINE FIRE Light

In the event of an engine fire, the fire detector in the engine compartment illuminates the red L or R ENGINE FIRE light (Figure 5-12). Pushing the light (which has an integral push-button switch) closes the corresponding firewall shutoff valve, which shuts off the fuel flow to the engine and illuminates the amber F/W SHUTOFF L-R message. For details, refer to Chapter 8—"Fire Protection."

Figure 5-12. ENGINE FIRE and BOTTLE ARMED Lights

OPERATION

Normal Operation

During normal operation of the fuel system, the L and R FUEL BOOST pump switches are in the NORM position. In this position, each boost pump operates automatically:

- *During engine start*—White FUEL BOOST L-R message appears.
- *During fuel transfer operation*—White FUEL TRANSFER and white FUEL BOOST L-R messages appear.
- *When low fuel pressure is sensed in the engine fuel supply line*—An amber FUEL PRES LO L-R message appears for a moment, followed quickly by an amber FUEL BOOST L-R message. As the boost pump quickly increases the fuel pressure, the amber FUEL PRES LO L-R message extinguishes quickly; it may not even be seen by the pilot.

If the throttle is OFF, the boost pumps do not energize automatically in a low fuel pressure condition, even though the boost pump switch is in the NORM position. When the switch is OFF, the boost pump does not operate. In the ON position, the pump operates continuously.

With the L and R FUEL BOOST pump switches in the NORM position, pressing an ENGINE START button energizes the corresponding fuel boost pump. This moves fuel from the wing tank engine feed bay on that side through the firewall shutoff valve to the engine-driven fuel pump on the respective engine.

When the engine start terminates, the boost pump is deenergized and the white FUEL BOOST L-R message disappears from the CAS window.

During normal operation, each engine is supplied with fuel from the primary ejector pump in the engine feed bay of each tank. The electric boost pump (when energized automatically or by pilot command) may augment the operation of the ejector pump.

Fuel Transfer System Operation

Using the fuel transfer system, fuel is transferred from the wing tank engine feed bay to the opposite wing tank engine feed bay. The arrow on the FUEL TRANSFER selector points to the wing tank where transfer fuel is directed.

Rotating the FUEL TRANSFER selector knob from the OFF position to the R TANK position:

1. Energizes the left tank electric boost pump. This displays the white FUEL BOOST L message if the boost pump switch is in the ON or NORM position. (If the boost pump is set to OFF, there is no flow and no FUEL BOOST L message.)

2. Energizes the fuel transfer valve open. The white FUEL TRANSFER message is displayed. The left tank boost pump pressure supplies fuel from the left wing tank engine feed bay through the open transfer valve and into the right wing tank engine feed bay.

Check that the FUEL BOOST L-R message indicates *only* the correct boost pump is energized. If both boost pumps are energized, fuel transfer does not occur. To deenergize the pump in the nonselected tank, cycle its L or R FUEL BOOST switch to OFF, then ON, then NORM, and leave in NORM position.

To verify fuel transfer, monitor the fuel quantity white tape pointers or the digital indicators (see Figure 5-9). Fuel normally transfers to the selected tank at approximately 10 ppm (600 pph). Maximum normal fuel imbalance is 200 pounds. Maximum emergency fuel imbalance is 600 pounds.

To terminate fuel transfer and return the system to normal operation, rotate the fuel transfer selector to OFF. The electric boost pump deenergizes (if the FUEL BOOST switch is in the NORM position), the white FUEL TRANSFER message disappears, and the fuel transfer valve spring-loads closed.

If electrical power fails during fuel transfer operation, the fuel transfer solenoid valve returns to the closed position, preventing fuel transfer.

EMERGENCY/ABNORMAL

For specific information on emergency/abnormal procedures, refer to the appropriate abbreviated checklists or the FAA-approved *AFM*.