FUEL

GENERAL

The Citation XLS utilizes a wet wing with fuel functionally divided into two separate tanks by a fuel rib in the center of the wing (BL 0.00). Normal operation supplies fuel to the engine from its respective integral wing tank. Each half of the system holds approximately 503 U.S. gallons for a total airplane capacity of 1006 gallons of usable fuel (approximately 6790 pounds).

Crossfeed capability is incorporated, and when selected, enables both engines to receive fuel from a single tank. A single-point pressure refueling receptacle is located on the right side of the fuselage, just forward of the wing. It permits simultaneous servicing of both sides of the fuel system. Refer to the Maintenance Manual, Chapter 12 for fuel servicing procedures.

System operation is fully automatic throughout the normal flight profile. Fuel system control and monitoring is available through the boost pump switches, crossfeed switch, fuel quantity and flow indicators, and annunciator panel lights which warn of abnormal system operation. A low fuel level warning system functions independently of the normal fuel quantity indicating system.

FUEL SYSTEM SCHEMATIC

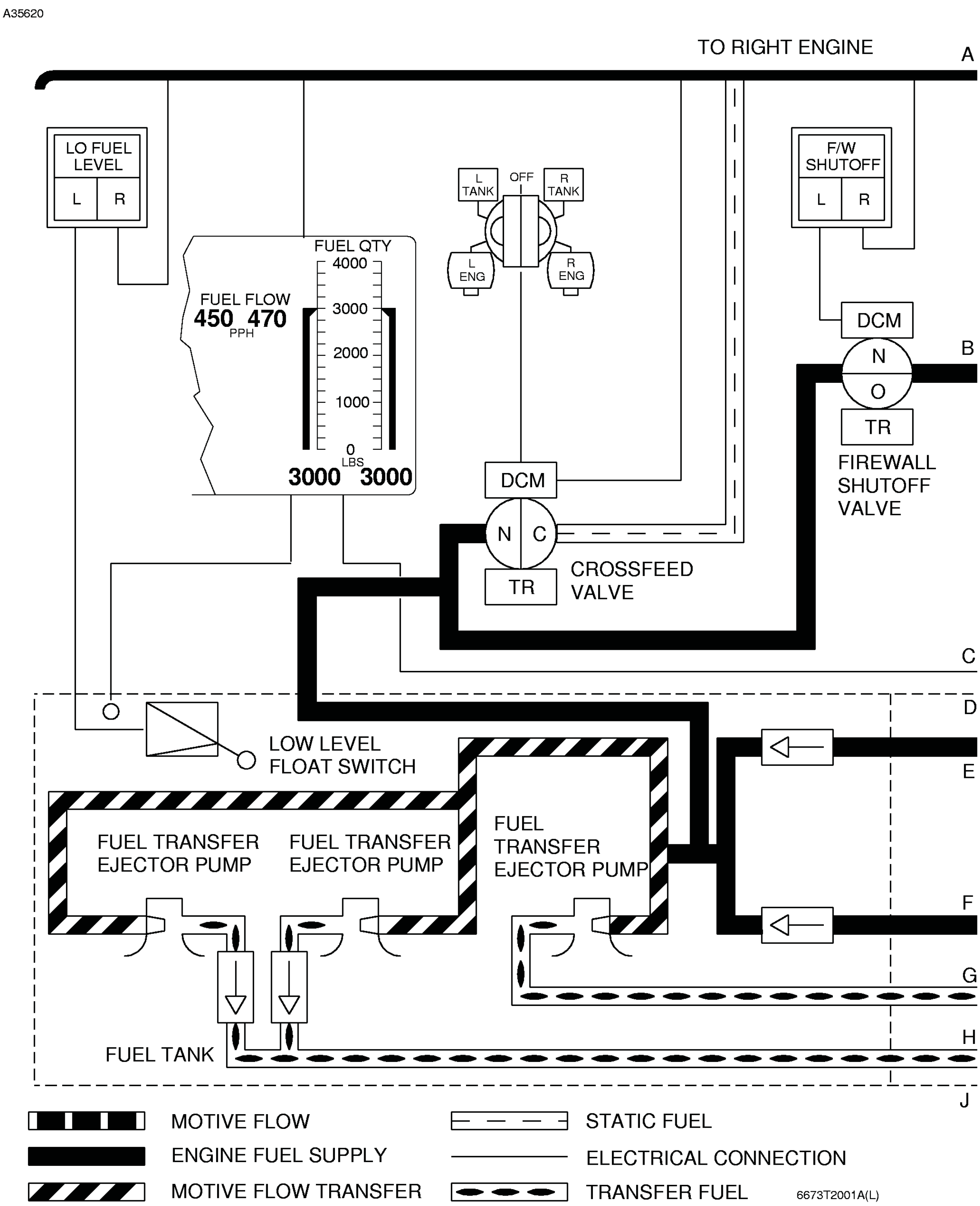

Figure 2-7 (Sheet 1 of 2)

FUEL SYSTEM SCHEMATIC

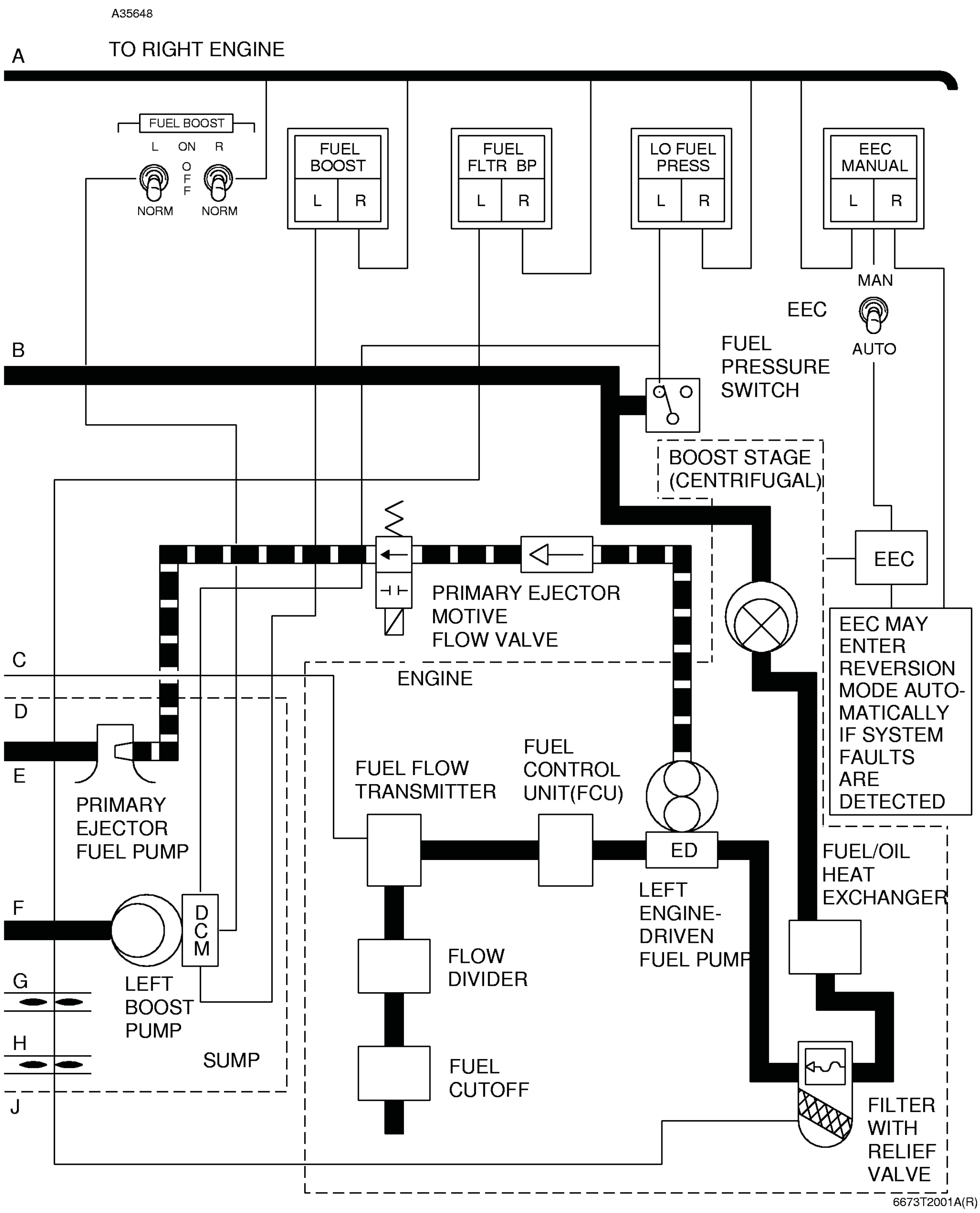

Figure 2-7 (Sheet 2)

WING FUEL TANKS

Fuel for each tank is contained between the fore and aft spars, and from the center point of the wing (BL 0.00) outboard to the wing tip (WS 284.52) with necessary deviations in the wheel well area. Fuel flows freely inward across the ribs through lightening holes and stringer cutouts, but is restricted from flowing outward by flapper vales located in three different wing ribs.

The engine feed hopper is located forward of the rear spar and extends outward approximately 11.5 inches from each side of centerline. It is sealed except for vent openings at the top (in order to maintain a full hopper under low fuel conditions). It is equipped with flapper valves that allow for gravity fuel flow into the hopper. Components which supply fuel to the engine are located within the hopper.

A vent system ensures ambient pressure within the tank and fuel expansion overflow capability. A float-type valve restricts flow through the vent during in-flight maneuvering. Design features of the vent prevent it from becoming blocked by in-flight ice accumulation.

DRAIN VALVES

Five fuel tank drains (push to drain, turn to lock) are located underneath each wing. Four of the drains are located near the wing center line (from fore to aft) and one drain is located outboard of the wheel well.

VENT SYSTEM

The left and right tanks have separate yet similar vent systems, with each tank containing pressure/ vacuum relief provisions separate from the vent system. Components of the vent system are as follows:

CLIMB VENT LINE

This is a series of tubes which extend from the outboard surge tank to the forward upper corner of the wing tank, just inboard of WS 34.00. The climb vent line serves as the primary vent during climb and descent at normal fuel levels and attitudes.

VENT SURGE TANKS

The vent surge tanks are located near each wing tip in a semi-isolated location. These surge tanks function as a fuel collector for relatively small amounts of fuel which may be trapped in the climb vent line during flight maneuvers and climb attitudes, or during thermal expansion of the fuel. Each surge tank is vented to atmosphere by a flush, non-icing NACA scoop located on the lower wing surface. The vent scoop is connected to the surge tank with an open-ended tube located at a high point in the surge tank, preventing fuel from siphoning overboard. This also prevents fuel from spilling overboard during wing-low conditions of flight, or in uncoordinated turns.

Additionally, each surge tank also contains a vent valve which allows air to either enter or leave the fuel cell through the surge tank. It is the primary vent used during level attitudes, including refueling and defueling. The valve is float actuated so that whenever fuel moves to the wing tip for any reason, the valve closes, preventing fuel flow into the surge tank. Each surge tank also contains an inboard mounted flapper valve which allows fuel to drain back to the wing tank and prohibit it from flowing into the surge tank.

RELIEF VALVES

Each wing tank incorporates a relief valve which prevents excessive positive or negative tank pressures during single point refueling, or during other conditions if the normal vent system is blocked. The valve automatically reseats itself once system pressure has returned to normal pressure levels.

EJECTOR PUMP

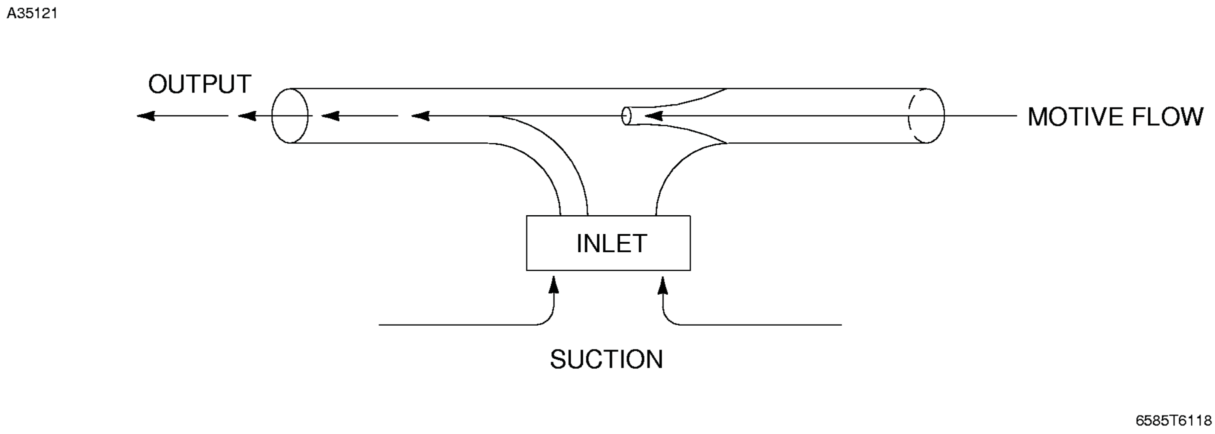

Figure 2-8

ENGINE FUEL SUPPLY COMPONENTS

Each engine is supplied with fuel primarily by the motive flow-powered ejector pump and secondarily by the electric boost pump. Both components for each engine are located in the engine feed hopper.

The primary ejector pump is powered by high pressure motive flow from the engine fuel control unit, and it supplies low pressure fuel to its respective engine during normal fuel operation and operates only when that engine is operating. It also supplies the scavenge ejectors with low pressure motive flow. A check valve is installed in the pump discharge fitting to prevent backflow through the pump. The 28 VDC wet electric motor pump is used for engine starting, fuel crossfeed, APU only operation, and in the event of primary ejector pump failure. The pump includes a cartridge element for the motor and impeller which allows motor replacement without the need for airplane defueling.

A pressure switch is located in the engine nacelle area and actuates between 5.3 and 5.8 PSIG with decreasing pressure, and deactivates by 7.5 PSIG with increasing pressure. Actuation of the switch is indicated by the LO FUEL PRESS L or R light on the annunciator panel, and will cause the boost pump to operate automatically, as long as the boost pump switch is in the NORM position.

Each fuel supply line (left engine and right engine) also contains a firewall shutoff valve. These valves are located behind the rear spar in an access panel area, and are actuated by the fire tray annunciator/switches.

FUEL SCAVENGE COMPONENTS

Fuel for the engine feed hopper is supplied by the fuel scavenge system (and to a much lesser extent by gravity flow). This system uses ejector pumps to pick up fuel at three distinct points in the inner portion of each wing tank and deliver it to the hopper area. The scavenge ejectors are powered by low pressure motive flow from the primary ejector pump. The scavenge system also contains wire mesh screens which minimize contamination reaching the hopper and fuel system components.

CROSSFEED COMPONENTS

The crossfeed system allows either or both engines and the auxiliary power unit to be fed from the primary ejector and/or auxiliary boost pumps in either tank. The system consists of the following components:

- CROSSFEED VALVE

  This is a normally closed, motor-operated ball valve. This valve is installed in the rear spar area of the engine feed hopper, and connects left and right engine supply manifolds. The motor portion of this valve is installed outside of the engine feed hopper to allow motor removal/installation without removing the ball valve.

- MOTIVE FLOW SHUTOFF VALVE

  These normally open valves are installed aft of the rear spar area. Each motive flow shutoff valve is installed in-line to allow normal left engine/left tank and right engine/right tank feeding operation. In crossfeed operation, one of the valves will be closed (dependent on switch position).

CROSSFEED OPERATION

Crossfeed operation is controlled by a selector on the left switch panel labeled L TANK - OFF - R TANK and allows both engines to be supplied from one fuel cell.

Selecting either tank automatically turns on the electric boost pump in that cell, opens the crossfeed valve, illuminates the XFEED annunciator on the annunciator panel, and three seconds later closes the motive flow shutoff valve on the engine receiving crossfeed. Returning the selector to OFF reverses the sequence.

NOTE

When selecting crossfeed, it is important to allow sufficient time for the cycle of events to be completed before returning the switch to OFF. Not allowing sufficient time can interfere with the normal operation of the time delay relays resulting in loss of control of the crossfeed system. If experienced, this condition can be corrected by placing the battery switch in EMER and turning both generators off. After several seconds, electrical power can be restored and crossfeed will function normally.

SINGLE POINT REFUEL/DEFUEL SYSTEM

The single-point refueling system is provided to enable the airplane to be refueled or defueled more safely and conveniently by connecting to one port, which is not open to the atmosphere. Advantages of single-point refueling and defueling include minimized refuel/defuel time, reduced possibilities of fuel contamination, reduced static electricity hazard, less airplane skin damage, and elimination of personnel contact with the fuel.

The refueling/defueling system is independent of the airplane fuel supply system. It is designed for refueling with a truck or refueling hydrant (pit) having single point provisions. The system allows for fuel to be delivered to both wings, or to each wing independently. Major components of the system include the refueling/defueling adapter (receptacle), the precheck control panel, refuel/defuel shutoff valve, the pilot (precheck) valve, the low level pilot valve, the high level pilot valve and associated system plumbing.

Single-point refueling is accomplished by connecting the refueling truck or refueling pit equipment to the airplane at the single-point refuel/defuel adapter on the right side of the fuselage just forward of the wing leading edge.

Prior to beginning refueling, a precheck of system operation is accomplished at the precheck panel located adjacent to the adapter. A successful precheck indicates that the system is working properly and that system shutoff will occur when the tanks are filled. If the precheck is not successful, the system must not be used until repaired. System damage or dangerous spills can occur.

Precheck is accomplished by lifting the precheck handle and applying fuel pressure. Flow should stop within approximately thirty seconds. During the precheck operation fuel is pumped into a small bowl at the high level pilot valve, which will operate the refuel shutoff valve, stopping the flow of fuel just as it does when the tank is full. When one wing tank reaches the full level and flow is discontinued, the opposite wing (if not yet full) will receive the full refueling flow until it also reaches the full level. When both wings have been filled, the system will stop the flow of fuel just downstream of the refuel adaptor. A check valve in the adaptor will ensure no fuel is spilled when the hose is removed from the panel. When refueling the wings to less than full, small differences in fuel flow within the single point distribution system may result in slightly more fuel entering one wing tank than the other.

DEFUELING OPERATION

Single-point defueling is accomplished using the same adapter as the single-point refueling system. When defueling is desired, the manual defuel select valves must be opened for each tank not requiring defueling. When any of the manual defuel select shutoff valves are opened, the corresponding defuel valve is deactivated.

When negative pressure is applied through the defueling equipment, the defuel shutoff valves are opened and fuel is drawn from the tank through the open defuel shutoff valve. When the tank is depleted of its fuel, the defuel shutoff valve is pressurized by tank pressure. The resulting force imbalance closes the defuel valve and terminates the defueling operation.

ENGINE FUEL SYSTEM

The two-stage, engine-driven pump, is integral to the engine fuel control unit and is mounted on the accessory gearbox. The pump supplies high pressure flow to the fuel control unit. Fuel enters the pump at low pressure from the primary ejector pump and exits at high pressure. Part of the pump output is bypassed through the motive flow valve to drive the primary ejector pump and the remainder is directed downstream to the fuel control. This positive pressure to the fuel control must be maintained by the engine-driven pump for the engine to continue to operate.

The fuel control unit determines the proper fuel schedule for all phases of engine operation and contains the shutoff mechanism that terminates fuel flow to the engine when the throttles are placed in cutoff.

A flow divider downstream of the fuel control unit provides proper fuel distribution to the combustion chamber by dividing the flow from the fuel control between the primary and secondary fuel manifolds. When the engine is shut down, the fuel manifold is drained. The drained fuel is collected in the flow divider until the next engine start when it is returned to the fuel manifold and burned in the engine.

Protection against severe overspeed or explosive structural failure of the engine is provided by an automatic fuel shutoff. It is actuated through mechanical linkage should a predetermined amount of rearward displacement take place on the turbine shaft. Fuel flow to the manifold is terminated, automatically shutting down the engine.

FLOW INDICATORS

Fuel flow rate is measured downstream of the fuel control and presented on a digital format gage in pounds per hour per engine.

FILTER

Each engine-driven pump incorporates a filter. A pressure differential sensing switch and a bypass valve alert the pilot and allow flow to continue should the filter become obstructed. The switch closes and illuminates the FUEL FLTR BP annunciator panel light if the difference between filter inlet and outlet pressure reaches 6 to 8 PSI. The bypass valve will open at 9 to 12 PSI differential. Illumination of the annunciator panel light indicates impending or actual bypass of fuel around the filter.

QUANTITY INDICATORS

Seven capacitance-type probes and one temperature compensator in each cell supply information to the vertical scale quantity gauge. The indicator converts these signals into fuel weight and displays it in pounds per cell.

LOW LEVEL WARNING

Low level warning functions independently of the normal quantity indicating system and provides a visual warning to the crew when a minimum amount of usable fuel remains in either tank. The system consists of a float switch in each fuel cell and L and R LO FUEL LEVEL annunciator panel lights. A minimum usable fuel quantity of 360 pounds in either tank will illuminate the associated light. When operating with light fuel loads, it is possible for the lights to illuminate momentarily in turbulent flight conditions or while taxiing on rough surfaces. The system is calibrated to give an accurate indication in level unaccelerated flight.

FUEL SHUTOFF

Electrically operated firewall shutoff valves can be individually closed by depressing the LH or RH ENGINE FIRE button. Actuation of a shutoff valve will be indicated by illumination of the respective LH or RH F/W SHUTOFF annunciator panel light.