System test is accomplished by turning the cockpit rotary test switch to FIRE WARN. Proper system operation is indicated by illumination of the APU FIRE indicating light/switch, illumination of the MASTER WARNING light, and the appearance of the red EICAS message APU FIRE.

BAGGAGE COMPARTMENT SMOKE DETECTION

The baggage compartment smoke detection system is comprised of an optical sensor type detector, mounted on the left side of the baggage compartment in a protective housing.

The smoke detection system serves to notify the flight crew of smoke or fire in the tailcone baggage compartment. If smoke is detected, an electrical circuit is made and the sensor sends a signal to the EICAS system, which displays a red visual message BAGGAGE SMOKE, and sounds a double chime tone. The MASTER WARNING light will also illuminate.

The detection system is tested by selecting SMOKE/DET on the rotary test switch in the cockpit. If the system tests good the red BAGGAGE SMOKE CAS message will appear.

If the baggage smoke annunciator illuminates, the baggage compartment isolation (ISO) valve should be closed and the airplane should be landed as soon as possible. The valve will not reopen until zero cabin differential pressure is achieved at low cabin altitude.

FUEL

The Citation X fuel system is comprised of the storage, distribution, refueling/defueling, and indicating systems. The storage system is made up of a set of integral tanks in each wing, and a center wing tank which includes a forward fairing fuel tank. Each wing tank has a hopper tank which is integral to it. The two wing tanks incorporate check valves and baffles allowing each wing tank complex to function as a single tank. Other integral components of the storage system are the gravity fuel fillers, drain valves, flapper check valves, vent system components, positive/negative pressure relief valves and all of the associated system plumbing. Transfer capability is incorporated enabling all usable fuel to be available to either engine.

Each wing tank holds a total of 521 gallons (3518 Lbs.) of fuel, which includes the hopper tank. The center wing tank holds 888 gallons (5594 Lbs.), 207 (1397 Lbs.) of which are contained in the forward fairing tank. Total fuel capacity of the airplane fuel system is 1927 gallons; at 6.75 pounds per gallon the available fuel weight is 13,031 pounds.

System operation is fully automatic throughout the normal flight profile. Manual fuel system control and monitoring is available through the boost pump switches, wing gravity transfer switch (GRVTY XFLOW), The fuel CROSSFEED switch, the CTR WING XFER O'RIDE switch, fuel quantity and flow indicators, and EICAS messages, which warn of abnormal system operation. A low fuel level warning system, which indicates through the EICAS system functions independently of the normal fuel quantity indicating system.

FUEL CELLS

The left and right wing tanks are sealed “wet wing” tanks, integral to the wings outboard of wing station 54.85. The wing tanks are connected to hopper tanks (engine feed bays) which are remotely located in the center wing tank, but which are functionally part of the wing tanks and are physically isolated from the center wing tank.

The center tank is a sealed tank, integral to the wing center section between the front and rear spars and the left and right wing station 54.85. The separate forward fairing tank is in the forward belly fairing, forward of the wing leading edge, but is interconnected to and is functionally part of the center wing tank.

Each wing tank is vented to its respective surge tank through connecting tubes. The surge tanks are normally dry, but serve as collecting points for small amounts of fuel which may migrate from the wing tanks during maneuvers or when the airplane is in a climb attitude, or due to thermal expansion of the fuel. The surge tanks are vented to the atmosphere through flush NACA scoops on the lower surface of the wing below the tanks.

The center wing/forward fairing tank contains two independent vent systems, one at either outboard end of the tank. Each system vents to the atmosphere through a NACA scoop in each wing trailing edge lower skin between the inboard and outboard flaps.

Each fuel tank has a pressure relief system to relieve positive and negative pressure, which may occur during single point refueling if the system fails to shut off when the tank is full, or during other conditions if the vent system should fail closed or become blocked. The vents for the wing pressure relief valves exit through the lower wing skin forward of each outboard flap. The two center tank relief valve exits are in the lower wing skin near each center wing tank vent scoop.

Servicing may be accomplished using the single point refueling/defueling system (refer to Single Point Refueling/Defueling System below) or over the wings. Each wing is equipped with a fill port on the top of the wing. The center fairing tank is filled through the right wing only. A manual valve must be opened by pulling a handle under a door in the bottom of the fuselage near the single point refueling panel allowing fuel to pass from the right wing to the center fairing tank. The valve must be closed by pushing the handle up, when over-the-wing refueling is complete. The door will not close unless the handle is stowed.

FUEL DISTRIBUTION SYSTEM

The fuel distribution system normally operates using motive-flow powered ejector pumps and performs the following functions: fuel supply to the engines, fuel crossfeed from each wing to the opposite engine or feeding both engines from a single tank, fuel scavenge from each wing tank to its respective hopper, fuel transfer from the center tank to each wing tank, and fuel gravity crossflow between the two wing tanks.

The pilot controls the fuel supply to the engines by the fuel crossfeed switch (LH TANK-RH ENG/OFF/RH TANK-LH ENGINE) on the fuel control panel. With the crossfeed switch in its normal position, OFF, fuel is supplied from each hopper tank to its respective engine. Fuel flow is maintained by a motive-flow primary ejector pump located in the hopper tank. Motive-flow pressure is provided by an engine driven motive-flow fuel pump which taps a small amount of the fuel supply to the engine, boosts its pressure and returns it to the hopper tank for operation of the primary ejector pump. An electric fuel boost pump is mounted in each hopper tank parallel to the primary ejector and is powered in the event of failure of the primary ejector pump or the motive-flow pump, or during crossfeed operation and engine start. The fuel boost pump can also be turned on manually by the pilot, using the LH and RH FUEL BOOST ON/OFF/NORM switches. In the ON position the fuel boost pumps will run whenever there is power on the electrical bus. In the OFF position, the boost pump is always off. In the NORM position, the boost pumps are normally off, but may be automatically turned on if one of the following conditions exists: the engine supply fuel pressure falls below approximately 9 PSI, engine start sequence is initiated, CROSSFEED position is selected on the FUEL CROSSFEED switch, or the auxiliary power unit (APU) is in operation and the left engine is not running (LH boost pump only).

Operation of the fuel boost pumps is indicated by a white FUEL BOOST ON L - R engine indicating and crew alerting system (EICAS) message unless the boost pump is automatically turned on due to low engine supply fuel pressure. In this case, the FUEL BOOST ON EICAS message will be amber with illumination of the MASTER CAUTION. The FUEL PRESS LOW L - R EICAS message is inhibited for two seconds and will not be displayed if the boost pump restores the fuel pressure.

Scavenger ejector pumps, which are located at the inboard edge of each wing tank, transfer fuel from each wing into the respective hopper tank. The primary ejector pump, or the boost pump in the hopper tank in each system, provides motive flow for operation of the scavenge pumps.

Electric Boost Pumps

The electric boost pumps provide fuel pressure for engine starting, fuel transferring and act as a backup for the primary ejector pumps. When the pump is intentionally put into operation its operation is indicated by a white FUEL BOOST ON L - R annunciation in the EICAS system. If the pump is automatically activated by low fuel pressure, an amber FUEL BOOST ON L - R will be annunciated.

The pumps are controlled by a pair of three-position switches (LH and RH) located low on the pilot's instrument panel. The switches are marked ON, OFF, and NORM. In the OFF position, the boost pump is de-energized except when activated by the engine start system or by selection of transfer from that tank. In the NORM position, function is also automatic for start and transfer and is activated by the pressure switch should output from the primary ejector pump be insufficient. The respective boost pump when in NORM is disabled any time the throttle is in cut-off to preclude pump activation by low pressure sensing during shutdown. The ON position causes the selected pump to operate continuously regardless of throttle position.

FUEL SYSTEM SCHEMATIC

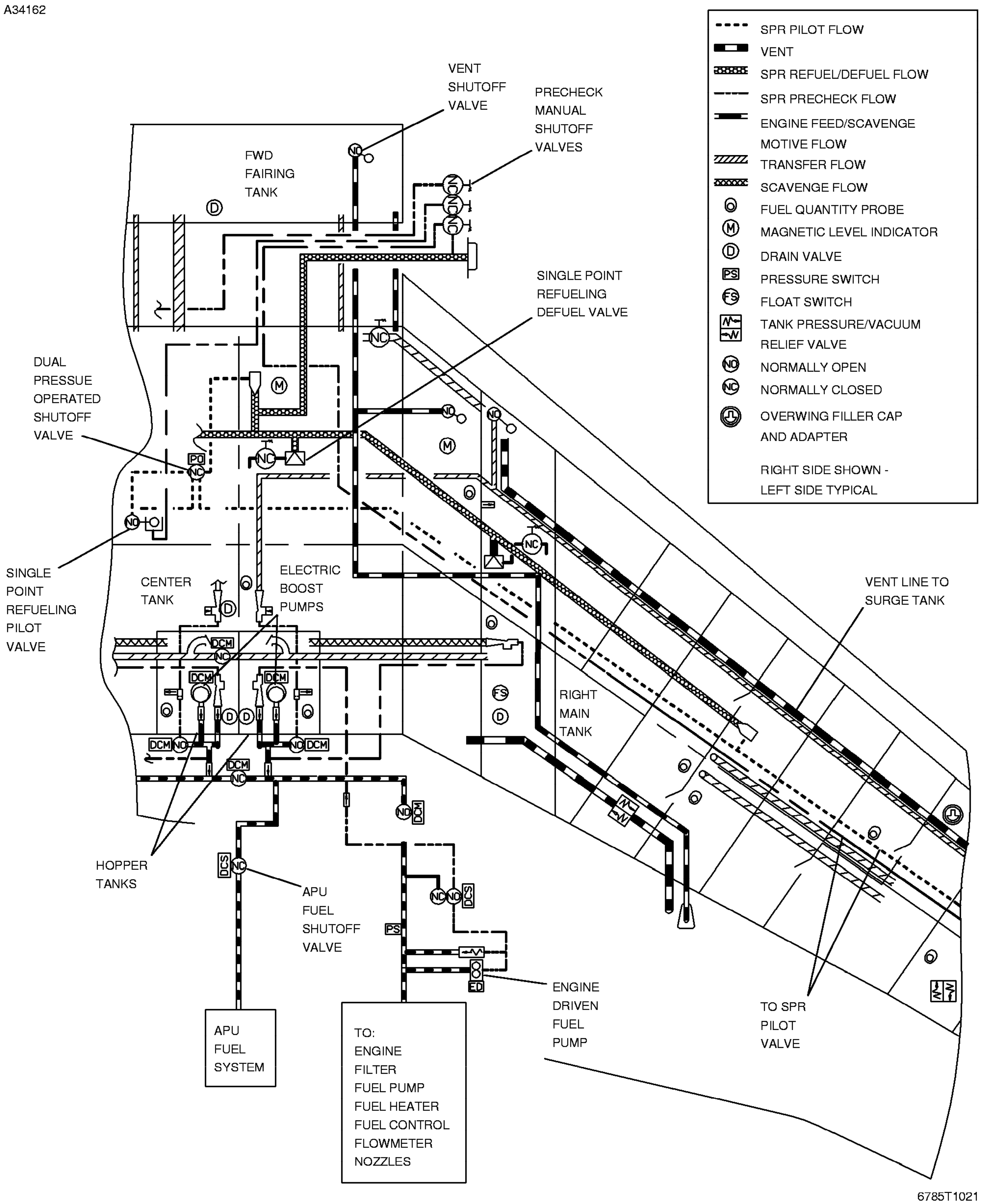

Figure 2-12 (Sheet 1 of 3)

FUEL SYSTEM SCHEMATIC

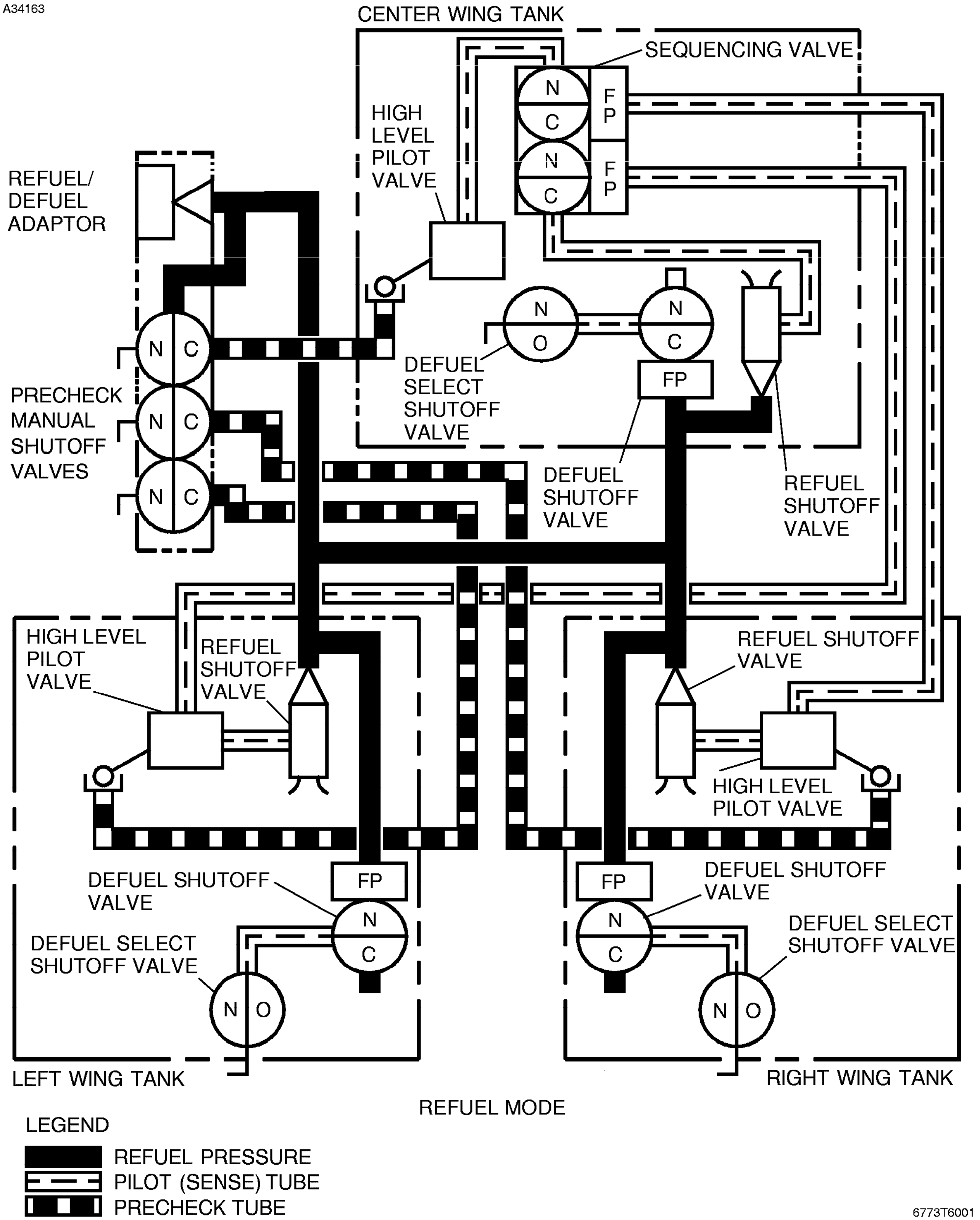

Figure 2-12 (Sheet 2)

FUEL SYSTEM SCHEMATIC

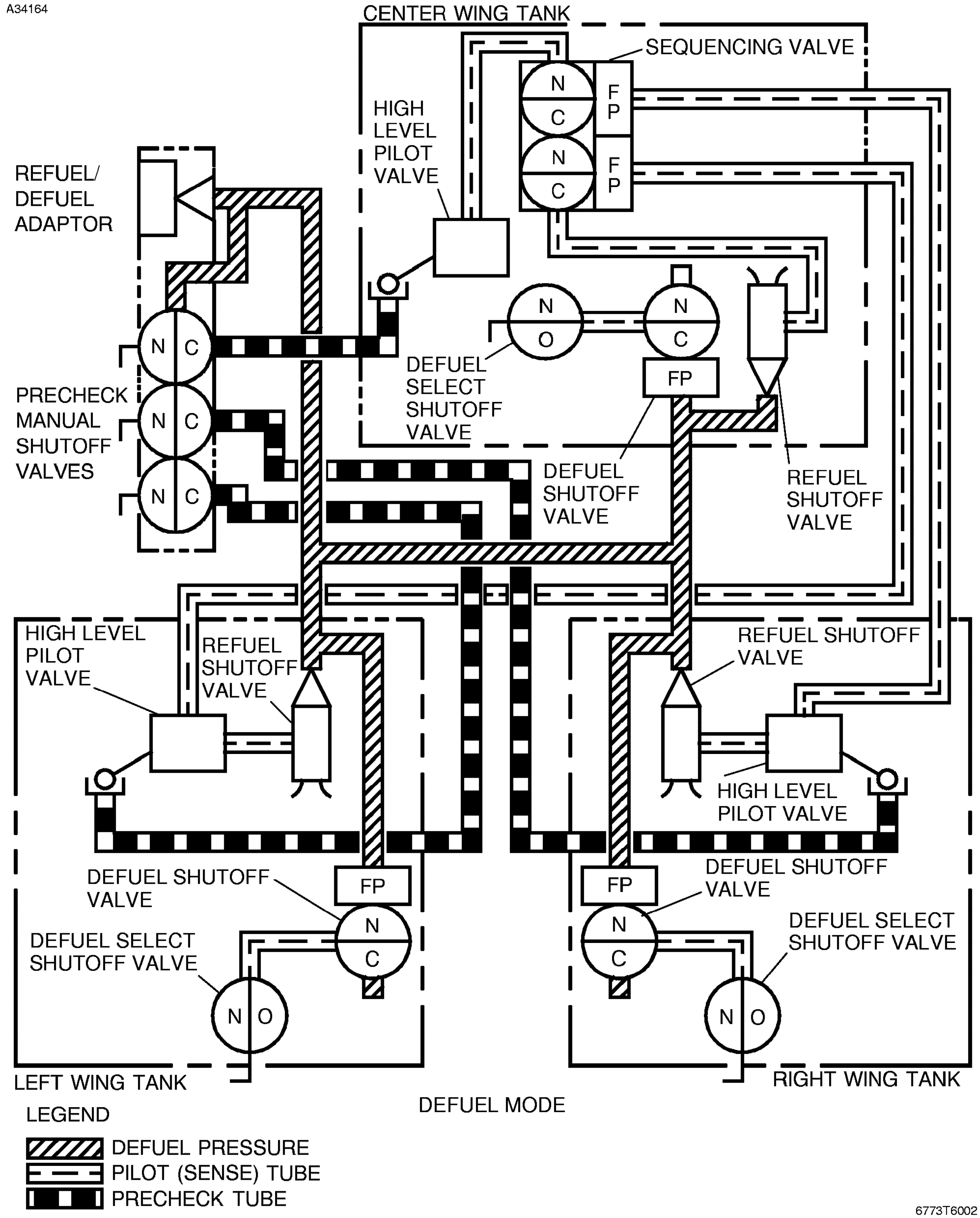

Figure 2-12 (Sheet 3)

Ejector Pumps

Two primary ejector pumps (one in each wing fuel hopper tank) utilize existing fuel pressure in conjunction with a venturi to produce a high-volume flow. The original pressure to drive the ejector pumps is generated by the engine driven fuel pumps, or in some circumstances the electrical boost pumps. As high pressure fuel (350 - 500 PSIG) is forced through the ejector orifice, a low pressure area is created at the pump inlet, drawing in a comparatively large volume of fuel and pushing it out at low pressure (12 - 22 PSIG). The motive-flow pumps are controlled by the motive-flow shutoff/bypass solenoid valves, one of which is located in each pylon. These valves shut off motive flow to the primary ejector pump in the non-feeding tank when crossfeed is selected. During normal operation the motive-flow shutoff/bypass solenoid valves are de-energized and fuel flows from the inlet to the outlet port. When the valve is energized, fuel flows from the inlet to the bypass port and then recirculates back to the inlet port.

Two transfer ejector pumps (one each for the left system and right system) are mounted in the center wing tank in a location just forward of the respective hopper tanks. These transfer pumps transfer fuel from the center tank to the outer sections of the wing tanks. Motive flow is provided by the system primary ejector pump and/or the boost pump in the pertinent hopper tank.

A scavenger ejector pump, powered by the same fuel source as the primary ejector pumps, is located in each wing tank and is used to move fuel from the wing tank to the hopper. The scavenger pumps are designed to keep the hoppers full under all operating conditions and to provide a slight pressurization to the hopper tank in order to improve the high altitude performance of the primary ejector pumps. These pumps, the outboard ends of the hopper vent, and the gravity flow lines are protected by large area screens which minimize contamination reaching the hopper tank and other fuel system components. If the ejector pump should fail or become blocked, fuel will gravity flow into the hopper from the main tank.

EJECTOR PUMP

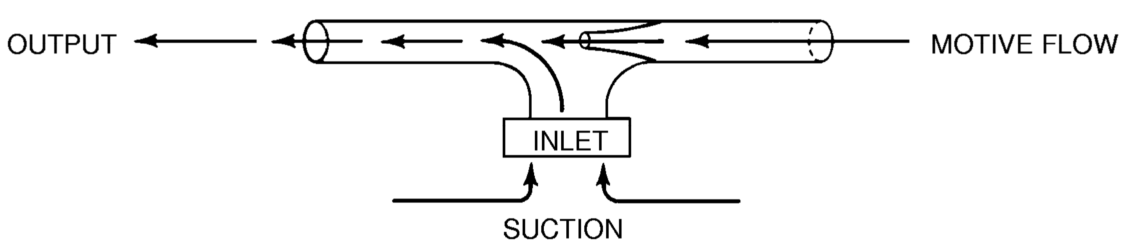

Figure 2-13

Transfer System

The transfer system allows fuel to be transferred from the center tank to both main wing tanks. The system operates automatically (if the CENTER WING XFER O'RIDE switches are in NORM position), in that fuel will normally feed from the wings first until wing fuel reaches approximately 3100 - 3400 pounds (deviations of several hundred pounds can occur due to variations from 0° pitch). The center wing tank transfer system will then start and maintain approximately 3100 - 3400 pounds (deviations of several hundred pounds can occur due to variations from 0° pitch) wing fuel until all center tank fuel is transferred.

FUEL SYSTEM CONTROL PANEL

A34170

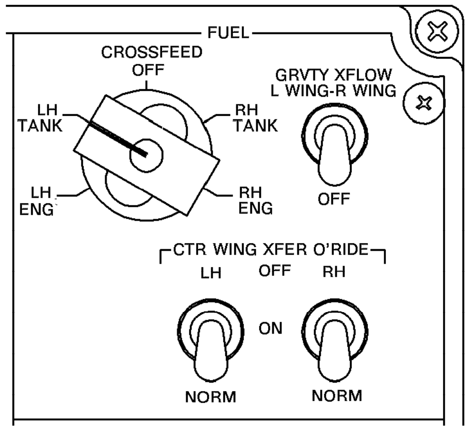

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Figure 2-14

The transfer rate is designed to keep the wing tanks approximately at the level they were when transfer began, until the center wing fuel is exhausted. This keeps the airplane center-of-gravity in a favorable condition. Transfer is effected by the transfer ejector pumps.

The rate of transfer is regulated by the transfer float valves (two in each tank - one outboard and one inboard). They operate by controlling the discharge rate of each ejector pump. If the tank wing level decreases the float valve opens, admitting more fuel; if the level increases, the float valve closes off, slowing the rate of pumping and causing the relative fuel level in the center and the wing tanks to change more slowly.

As discussed above, center wing transfer is normally automatic, however, in unusual circumstances manual control may be desired. Manual control can be exercised through operation of the LH and RH CTR WING XFER O'RIDE OFF/ON/NORM switches on the fuel control panel. These switches control the respective transfer ejector pump by operating shut-off valves which control fuel to the ejector pumps. In OFF transfer will not occur. In NORM transfer will occur unless there is less than 500 pounds fuel in the respective wing tank. The ON position will override the NORM position, where 500 pounds of fuel would remain in the tank. In ON position all of the fuel will be pumped out of the tank. The valve's usual position should be NORM, to allow automatic operation. If the wing tank fuel quantity falls below 500 pounds during transfer, however, the respective valve will close in order to prevent motive flow fuel from being trapped in the center wing tank. If either transfer valve should fail to fully operate to the open or closed position, an EICAS message CTR XFER XSIT L, R will be displayed.

Engine Crossfeed System

A crossfeed system allows the left engine to be fed from the right tank or the right engine to be fed from the left tank. If crossfeed is selected (LH TANK - RH ENG or RH TANK - LH ENG), the selected engine is fed from the opposite tank, which also continues to feed its respective engine. No wing-to-wing fuel transfer occurs during crossfeed operation.

Once crossfeed is selected, the boost pump in the selected hopper tank is turned on, a crossfeed valve opens to supply fuel to the opposite engine, and the opposite engine motive flow shutoff valve closes to disable the primary ejector pump in the opposite hopper tank. Crossfeed is possible without the boost pump being in operation but the boost pump should always be on, automatically or manually, in order to preclude having both engines supplied by a single ejector pump. A FUEL XFEED OPEN white EICAS message indicates that the crossfeed valve has opened. The crew should verify that the selected tank white FUEL BOOST ON message is displayed and the opposite boost pump is not operating. Operation of the opposite boost pump will stop crossfeed from occurring. If a cyan FUEL XFEED XSIT message should appear, it indicates that a failure has caused the crossfeed valve to remain between the fully open and fully closed positions. If the fuel motive flow valve fails to stop motive flow to the non-feeding side, an amber CAS message FUEL MOTV FAIL L-R will appear. In this case crossfeed will likely be impossible.

Gravity Crossflow System

The gravity crossflow system permits gravity flow between the left and right hand wing tanks for backup to the crossfeed system, and to equalize wing tank levels during conditions which could occur if a center-to-wing tank transfer pump were to fail on one side. Control of gravity crossflow is by the GRVTY XFLOW L WING - R WING/OFF switch on the fuel control panel. The L WING - R WING position causes the gravity crossflow valve in a line between the two wing tanks to open. A white EICAS message (FUEL XFLOW OPEN) will appear to remind the pilot that the valve is open. If the fuel quantity differential is small, gravity leveling will be slow. The process can be accelerated by sideslipping the airplane. If a cyan EICAS message (FUEL GRV XFLW XSIT) appears it means that the gravity crossflow valve did not fully open or close. To preclude fuel vent spills, the gravity crossflow valve must be closed whenever the airplane is parked on uneven ground.

Engine-Driven Fuel Pump

The engine-driven fuel pump is a high capacity positive displacement vane-type pump which supplies the high pressure (350 to 500 PSIG) motive flow for the primary ejector pump. It is driven by a shaft off the engine accessory gearbox and is piggybacked to the hydraulic pump. A fail safe shear section allows continued operation of either pump in case of seizure of the other one. The fuel pump has a built-in bypass relief valve to regulate pressure at high engine speeds and to bypass fuel in case of the plugging of the primary ejector orifice.

FUEL FLOW INDICATORS

Fuel flow rate is measured by a fuel flow transmitter in the fuel inlet line to the engine and is presented in pounds-per-hour in the FUEL portion of the (EICAS).

QUANTITY INDICATORS

The fuel quantity gaging/indicating system is a capacitance system. There are three independent channels; left wing, right wing, and center wing. The left and right wing systems consist of six sensing probes in each wing tank and one in each hopper tank, which is considered part of each wing tank. The center wing tank has four probes; two in the center of the tank and one on each side at the outboard edge of the tank.

There is one signal processing unit for each independent system. It provides conditioned electrical power to the sensing probes and computes fuel quantity based on the sensing probe output data, and provides ARINC 429 bus output signals for the quantity indications as well as for the built-in-test (BIT) functions which aid maintenance in troubleshooting the system. Aircraft pitch data is provided to the processing units from the AIRINC 429 bus in order to enable it to provide more accurate fuel quantity indications in all aircraft attitudes. Fuel quantity readings can be corrected for airplane attitudes from +10 to -10 degrees of pitch.

Fuel quantity is presented in pounds in the FUEL portion of the engine indicating and crew alerting system (EICAS). Indications are given for both the total fuel quantity and for the amount in each tank. If the fuel quantity of the left or right wing tanks should fall below 500 pounds, the indication of that tank will be presented in amber. If the total fuel falls below 1200 pounds, the total fuel reading will be displayed in amber digits. If an indicating system should fail, the quantity in that tank will be indicated by amber dashes, to indicate that the amount is unknown. The total quantity will be presented as amber dashes, since it is also unknown.

MAGNETIC FUEL LEVEL INDICATORS

Magnetic fuel level indicators are installed in four locations on the lower surface of the outer wing and the center wing fuel tanks. The indicator consists of a calibrated stick and magnet, and a float with magnet attached. These level indicators allow ground calculation of the tank fuel levels, independent of the electronic system.

Level indicators are installed in the left and right main wing fuel tanks between the forward and center (main) spar, just outboard of center wing station 178, and two in the center wing tank; one just inboard of wing station 19.00 and one just inboard of wing station 55.00.

To read the magnetic fuel level indicator the calibrated stick and magnet must be lowered by using a straight bladed screw driver, or other suitable tool. Insert the screw driver in the slot, push upward (against spring tension) and rotate until the assembly is free of its housing and drops to the lowered position. When the assembly drops, the float magnetic will engage the magnet on the calibrated stick resulting in a reading of the fuel quantity on the stick. The calibrated stick can be pulled free of the float magnet, but with practice it can be determined by “feel” when the magnet is engaged.

LOW FUEL WARNING SYSTEM

Two float switches are installed in the left and right outboard wings. They are designed to actuate at a fuel quantity of approximately 500 pounds remaining in the respective tank. Actuation of the switches initiates an amber EICAS system message FUEL LEVEL LOW L - R, and after a five-second delay turns off the center wing transfer system. The delay in turning off the center wing transfer is designed to prevent nuisance activation due to fuel sloshing in the tank.

The warning from the low fuel warning system is separate from, and in addition to, the amber EICAS annunciations in the fuel quantity indicating system which occurs when fuel quantity falls below 500 pounds in a tank.

WING OVERFULL WARNING SYSTEMS

Two wing overfull float switches are located in the left/right outboard wing. They are designed to actuate when the wing vent surge tanks are almost full and are at the point of impending overflow.

Actuation causes an amber engine instrument and crew alerting system (EICAS) message WING TANK O'FULL L - R to be annunciated. This advises the flight crew that the fuel transfer system has malfunctioned and is overfilling the wing fuel tank(s) to the point of impending overflow.

FUEL TEMPERATURE INDICATING SYSTEM

There are two temperature sensing bulbs in the aircraft fuel system. They are mounted near the fuel gravity crossfeed valves with the temperature bulbs extending into the respective left and right fuel hoppers.

The fuel sensors are designed to operate in a temperature range of between -70°C and +300°C. If the temperature drops below -60°C or rises above +70°C an amber engine instrument and crew alerting system (EICAS) message (FUEL TEMP L - R) will be annunciated. Refer to the Section 1, Limitations, to determine the temperature limitations of the particular fuel in use.

When FUEL HYD is selected on the bezel button below the EICAS display tube, the temperature indications of fuel in the airplane tanks (TANK °C) and at the engine fuel control unit (ENGINE °C) will be added to the fuel display on the EICAS tube. Temperatures of fuel in the tanks between -37°C and +52°C will be in green. Indications below -37°C and above +52°C will be in amber. Engine fuel temperatures of from +4°C to +99°C will be in green, and those above or below these numbers will be shown in amber.

FUEL SHUTOFF VALVES

Electrically operated firewall shutoff valves to each engine are controlled by the LH or RH ENG FIRE button. Pressing the fire button will shut off the respective fuel and hydraulic valves and disconnect the generator. The switch also sets up the fire extinguisher bottles to be discharged into the selected engine.

When the firewall shutoff valve has been used to close the fuel firewall shutoff valve, a white engine instrument and crew alerting system (EICAS) message (FUEL FW VLV CLSD L - R) will be displayed. Other status messages will also be displayed, but these are discussed under their individual systems headings.

SINGLE-POINT REFUELING DEFUELING SYSTEM

The single-point refueling system is provided to enable the airplane to be refueled or de-fueled more safely and conveniently by connecting to one port, which is not open to the atmosphere. Advantages of a single-point refueling and defueling include minimized refuel/defuel time, reduced possibilities of fuel contamination, reduced static electricity hazard, less airplane skin damage, and there is no personnel contact with the fuel.

The refueling/defueling system is independent of the airplane system. It is designed for refueling with a truck or refueling hydrant (pit) having single point provisions. The major components of the system include the refueling/defueling adapter (receptacle), the precheck control panel, refuel shutoff valves, the pilot (precheck) valves, defuel valves, a sequencing valve, manual defuel select shutoff valves, internal drain valves 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.

CAUTION

IF SINGLE-POINT REFUELING IS CONDUCTED WITH THE AUXILIARY POWER UNIT (APU) OPERATING, SELECT THE LH CENTER-WING XFER SWITCH TO OFF. THE COMBINATION OF HIGH-LEVEL SHUTOFF DUE TO PRECHECK, SINGLE-POINT SHUTOFF AND TRANSFER SHUTOFF MAY CAUSE FUEL OVERBOARD VENTING. APU ON CAUSES THE LEFT-HAND BOOST PUMP TO OPERATE.

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 handles (left wing, center wing and right wing) 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. Sequencing is automatic; the two wing tanks will fill first, followed by the center wing tank.

When one or both wing tanks reach 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. As pilot pressure builds up in other wing tank pilot tubes, the sequencing valve will open the center fuel tank pilot line and allow center tank pilot flow. When full the center wing will shut off in the same manner as the other tanks. When refueling the wings to less than full, small differences in fuel flow within the single point distribution system may result in more fuel entering one wing tank than the other. Placing 75 to 100 gallons of fuel in the center tank will allow fuel transfer from the center tank to the appropriate wing tank to balance this condition.

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.

Fuel tank drains (push to drain, turn to lock) are located below each wing approximately parallel to the outboard edge of the inboard flap (2), and parallel to the side of the fuselage (2), and under the fuselage just forward of the wheel wells (2).

ENGINE INDICATING AND CREW ALERTING SYSTEM (EICAS) INDICATIONS

There are other indications, concerning the fuel system (and other aircraft systems) which have not been discussed here. These are colored (green, amber, red, cyan, white) digital messages located in the crew alerting system (CAS) section of the EICAS display. For continuity and convenience, all airplane system EICAS indications are grouped together and discussed under Engine Indicating and Crew Alerting (EICAS) in this section.