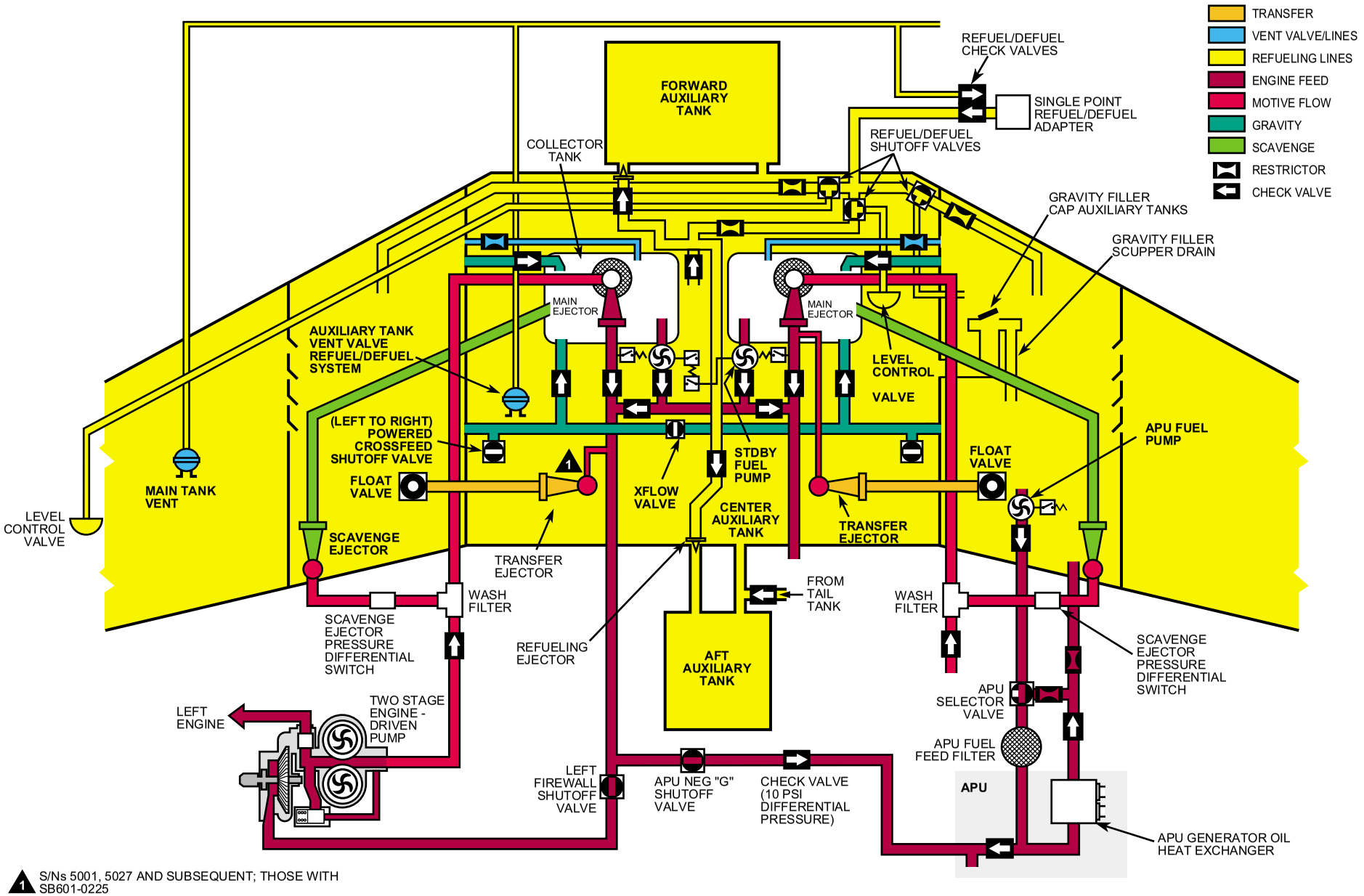
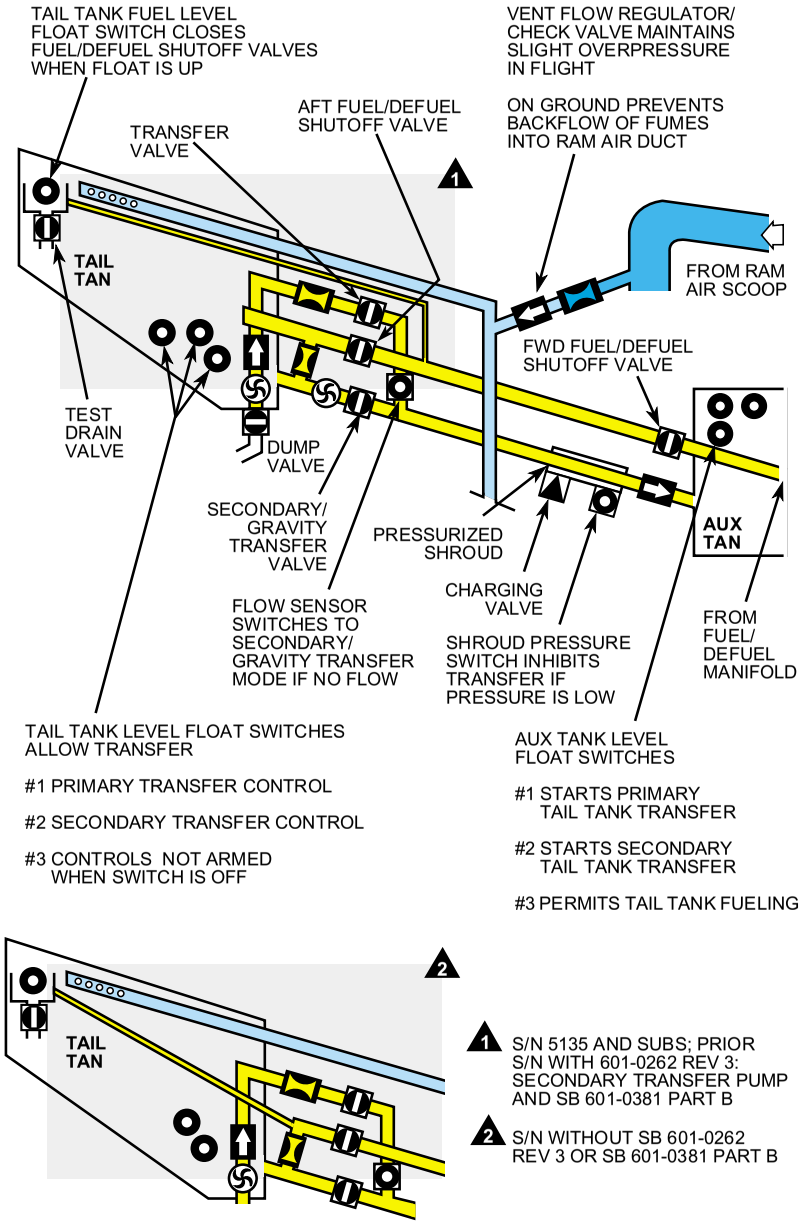
Fuel System



1 S/Ns 5001, 5027 AND SUBSEQUENT; THOSE WITH SB601-0225

Tail Fuel Tank Assembly



Fuel System

Refer to the Limitations chapter for approved fuel grades and additives and the Servicing chapter for specific fueling and defueling procedures.

Fuel Storage

Each main tank includes most of the internal wing structure between the forward and rear spars from the wing root to almost the wing tip. Ribs with lightening holes and two ribs with one-way flapper valves restrict fuel flow outboard to prevent sudden center-of-gravity shifts during maneuvering.

Between the left and right main tanks is the center auxiliary tank. At the bottom of the center auxiliary tank, there are two electric fuel pumps, two collector tanks with ejectors, and two transfer ejectors.

The main ejector on each collector tank supplies sufficient fuel flow to meet the engine's needs and supply motive flow fuel for main, scavenge, and transfer ejector operation. The transfer ejectors, powered by motive flow fuel from the engine fuel feed lines, move fuel from the center auxiliary tank to a main tank when a main tank's level control valve opens.

Optional installations include auxiliary fuel tanks forward and/or aft of the main auxiliary tank. As fuel level in the auxiliary tank drops, gravity transfers fuel from the forward and aft auxiliary tanks to the center auxiliary tank.

S/N 5135 and subsequent and prior S/Ns with SB 601-0262 have a tail tank aft of the vertical stabilizer rear spar. Fuel flows from the tail tank to the center auxiliary tank via a transfer pump. If punctured, a pressurized fuel shroud in the engine rotor burst zone prevents fuel loss if a catastrophic engine failure occurs. If the shroud loses pressure, transfer valves at each end of the transfer line automatically close to prevent fuel loss.

On S/N 5135 and subsequent, if the primary pump fails, a second transfer pump moves fuel from the tail tank to the center fuel tank. **On aircraft with SB 601-0262**, if the primary pump fails, fuel gravity flows from the tail tank to the center auxiliary tank.

A gravity filler cap for the left, right, and center auxiliary fuel tanks permit gravity refueling. A fuel drain valve at low points for the left, right, and center auxiliary tank allows gravity defueling. Multiple water drain valves at points where water may collect facilitate removal of accumulated water from the fuel tanks.

Tables 4-F, **4-G**, and **4-H** denote the maximum allowable fuel capacity possible during pressure and gravity refueling.

Tank	Pressure Fueling		Gravity Fueling	
	US Gal	Liters	US Gal	Liters
Left Main	717.5	2715.7	665.5	2518.9
Right Main	717.5	2715.7	665.5	2518.9
Auxiliary	1010.0	3822.9	943.0	3569.3
Total	2445.0	9254.3	2274.0	8607.1

Table 4-F; Maximum Allowable Fuel Capacity (S/Ns 3001 to 3014)

Tank	Pressure Fueling		Gravity Fueling	
	US Gal	Liters	US Gal	Liters
Left Main	722.0	2732.8	670.0	2536.0
Right Main	722.0	2732.8	670.0	2536.0
Auxiliary	1010.0	3822.9	943.0	3569.3
Total	2454.0	9288.5	2283.0	8641.3

Table 4-G; Maximum Allowable Fuel Capacity (S/Ns 3016 to 3066; 5001 to 5134 Without SB 601-0262)

Tank	Pressure Fueling		Gravity Fueling	
	US Gal	Liters	US Gal	Liters
Left Main	722.0	2732.8	670.0	2536.0
Right Main	722.0	2732.8	670.0	2536.0
Auxiliary	1010.0	3822.9	943.0	3569.3
Tail	187.7	710.4	—	—
Total	2641.7	9998.9	2283.0	8641.3

Table 4-H; Maximum Allowable Fuel Capacity (S/N 5135 and Subsequent; Aircraft With SB 601-0262)

Venting

The left and right main tanks vent to the center auxiliary tank. From the center auxiliary tank, each main tank's vent line connects with a manifold that extends into the fuselage. From the manifold, each main tank vent line continues through the center auxiliary tank to a NACA vent on bottom of the wing. Each main tank also has a second vent line connected to the manifold. During a climb, this vent line releases air trapped in the corner of a main tank.

Both the forward and aft auxiliary tanks vent through separate lines connected to the manifold. Purge lines connected to the scavenge ejector pumps remove fuel from the vent lines.

Together, the main, auxiliary, and tail tank venting systems allow fuel expansion during and after fueling, vent the tanks to atmosphere, release air trapped with aircraft attitude changes, and slightly pressurize the fuel tanks during flight.

Indicating

Capacitance type fuel quantity transmitters in the main and center auxiliary fuel tanks drive the fuel quantity transmitter through a signal conditioner. **On aircraft with a tail tank**, a separate signal conditioner connects the tank's fuel quantity transmitters to the fuel quantity gage. A totalized reading is provided in addition to individual tank indications.

A fuel flow transmitter between each engine's fuel control unit and the oil cooler drives the analog/digital FUEL FLOW displays.

Fuel Distribution

APU Fuel Feed

During APU start, pressing the PWR-FUEL ON/OFF switchlight energizes the APU fuel pump. Fuel flows from the right main tank under pressure from this pump through a check valve to the closed APU fuel shutoff valve.

When pump pressure on **S/Ns 3017 and subsequent and aircraft with SB 601-0114 incorporated** exceeds approximately 10 PSI, a pressure switch opens to extinguish the PUMP INOP light. The switch will close on a decreasing pressure of approximately 8.5 PSI illuminating the PUMP INOP light with the PWR-FUEL ON/OFF switchlight selected ON. On **aircraft with SB 601-0114 not incorporated** the pressure switch opens extinguishing the PUMP INOP light when pressure exceeds 13 PSI. The pressure switch closes with decreasing below 10 PSI and illuminating the PUMP INOP light.

Pressing the START/STOP switchlight opens the APU fuel and negative G shutoff valves and the SOV CLOSED light extinguishes. Fuel flows under pressure through the open shutoff valve to the APU.

When the APU is no longer required, pressing the START/STOP switchlight closes the shutoff valves and stops the APU. The SOV CLOSED light illuminates. Pressing the PWR-FUEL ON/OFF switchlight de-energizes the APU fuel pump.

Engine Fuel Feed

Pressing the PUMP switchlights energizes the electric fuel pumps during engine start. When fuel pressure exceeds approximately 13 PSI, the pump pressure switches open to extinguish the INOP light and illuminate the ON light. Under electric fuel pump pressure, fuel flows from each collector tank through check valves and the open firewall shutoff valves to the engine-driven fuel pumps.

As the engine begins rotating, its engine-driven fuel pump begins supplying pressurized fuel for engine use and motive flow fuel. Fuel then flows through a check valve and wash filter to the main and scavenge ejectors. As main and scavenge ejector outlet pressures exceed minimum valves, pressure switches open to extinguish the MAIN and SCAV lights and de-energize the electric fuel pump. With both fuel pumps selected ON, both green ON switchlights remain illuminated until the second engine has been started.

With both fuel pumps selected, the MAIN and SCAV lights remain illuminated until both engine-driven fuel pumps provide sufficient pressure for normal operation.

On S/Ns 3001 to 3016 without SB 601-0114, the MAIN ejector light remains illuminated until pressure reads 13 PSI. The MAIN light re-illuminates on decreasing pressure at 10 PSI.

On aircraft 3017 and subsequent, 5001 and subsequent and those with SB 601-0114, the MAIN ejector light remains illuminated until 10 PSI. The MAIN light re-illuminates on decreasing pressure at 8.5 PSI.

The SCAV ejector light remains illuminated on increasing pressure until 3.3 PSI and re-illuminates on decreasing pressure at 2.3 PSI.

Main ejector operation then supplies fuel under pressure from its collector tank to the engine-driven fuel pump and the transfer ejector and will permit the electric pump to stop if not required for the other engine.

Fuel Transfer

As an engine consumes fuel from its collector tank, the tank is replenished by gravity flow and scavenge ejector operation. Scavenge ejector operation refills the collector tank from its main tank faster than the engine can consume fuel. This ensures steady engine fuel flow regardless of aircraft attitude by constantly covering the main ejector inlet. Excess collector tank fuel vents into the main tank.

When fuel level in a main tank drops, its level control valve opens. Transfer ejector operation then moves fuel from the center auxiliary tank to the main tank. The resulting drop in center auxiliary fuel tank level then allows gravity to move fuel from the forward and aft auxiliary tanks into the center auxiliary tank.

If an imbalance exists between the left and right main tanks, pressing the X-FLOW switchlight opens the crossflow valve. The OPEN caption illuminates; fuel gravity flows from one main tank to the other.

On S/Ns 5001, 5027 and subsequent, and aircraft with SB 601-0225: if needed, fuel can be transferred from a main tank to the center auxiliary tank. Pressing FEED LEFT TO RIGHT or FEED RIGHT TO LEFT switchlight opens the associated transfer valve. Fuel then flows from the respective main tank to the center auxiliary tank and is evenly redistributed to the main tanks. This method of balancing fuel is faster and easier to use than gravity balancing with the X-FLOW switchlight. The FEED LEFT TO RIGHT and FEED RIGHT TO LEFT will start flashing after approximately eight minutes as a reminder to shutoff the system. An interlock prevents simultaneous opening of both valves.

Tail Tank Transfer

On aircraft with a tail tank, when center auxiliary tank fuel level drops approximately 20% and the X-FER ARMED/OFF switch is in the ARMED position, the No. 1 auxiliary tank low level switch opens the tail tank transfer shutoff valve and energizes the tail tank transfer pump. The transfer pump then moves fuel from the tail tank to the center auxiliary tank.

With fuel in the tail tank and the ARMED/OFF switch in the OFF position, the NOT ARMED light illuminates. When center auxiliary tank fuel level reaches the No. 2 auxiliary tank low level switch, the NOT ARMED light flashes. Placing the ARMED/OFF switch in the ARMED position extinguishes the NOT ARMED light, opens the transfer shutoff valve, and energizes the transfer pump. Pump operation continues until the tail tank is empty.

When approximately 1.3 gallons of fuel remain in the tail tank (unusable fuel), the No. 1 tail tank empty level switch de-energizes the transfer pump and closes the transfer shutoff valve.

If the normal tail tank transfer system fails, a flow sensing switch closes the transfer shutoff valve, de-energizes the transfer pump, and opens the gravity feed shutoff valve. The MASTER CAUTION lights flash and the FUEL and GRAV TRANS lights illuminate to indicate a fuel transfer system malfunction. Fuel then flows by gravity from the tail tank to the center auxiliary tank. Fuel transfer continues until approximately 2.3 gallons remains in the tail tank. The No. 2 empty level switch then closes the gravity shutoff valve and extinguishes the GRAV TRANS light.

On S/N 5135 and subsequent and prior S/Ns with SB 601-0262, Rev. 2 or 601-0355, if the normal transfer system fails, the flow sensing switch closes the transfer shutoff valve, de-energizes the transfer pump, opens the gravity feed shutoff valve, and energizes the secondary transfer pump. The MASTER CAUTION lights flash and the FUEL and SEC TRANS lights illuminate. Fuel transfer continues until approximately 2.3 gallons remains in the tail tank. The No. 2 empty level switch then closes the gravity shutoff valve, de-energizes the secondary transfer pump, and extinguishes the SEC TRANS light.

Fuel Jettison

On S/Ns 3001 to 3066 and 5001 to 5134 with SB 601-0262, pressing the DUMP SW ARMED switchlight arms the tail tank jettison system. The switchlight illuminates. Pressing the PRESS TO DUMP switchlight opens the jettison shutoff valve and fuel discharges from the tail tank at approximately 100 lbs per minute. Pressing the PRESS TO DUMP switchlight a second time closes the shutoff valve and fuel jettisoning stops.

On S/N 5135 and subsequent; prior S/Ns with SB 601-0262 Rev. 2, pressing the DUMP SW ARMED switchlight arms the fuel jettison system. The switchlight illuminates. Pressing the DUMP SELECT switchlight opens the jettison shutoff valve, illuminates the DUMP OPEN light, and discharges fuel from the tail tank at approximately 100 lbs per minute. Pressing either switchlight closes the shutoff valve.

Refueling

Pressure Refueling

Pressure refueling requires battery or external power to operate the vent and fuel tank shutoff valves.

Before connecting the fuel hose, verify that the MODE selector is in the OFF position.

After connecting the fuel hose to the single point refueling adapter, set the fuel panel POWER switch to the ON position to supply 28V DC from the Battery Direct bus to the refueling panel. The POWER ON light illuminates and the SOV-CL (shut-off valve closed) lights illuminate.

Opening the fuel nozzle supplies fuel at approximately 50 PSI through the adapter into the fuel manifold. **On S/Ns 5001, 5007 and subsequent and prior S/Ns with SB 601-0217**, the VV-OPEN lights remain extinguished. **On aircraft without the modified refueling system**, the VV-OPEN lights illuminate when the manifold is pressurized.

Rotating the MODE selector to the TEST position tests the fueling shutoff system by closing the solenoid-operated valve on the bottom of each level control valve and simulating a full fuel tank.

Placing the fuel tank switches in the FUEL position opens the tank shutoff and vent relief valves. **On S/Ns 5001, 5007 and subsequent, and aircraft with the modified fuel refueling system**, the VV-OPEN lights illuminate. **On aircraft without the modified fuel system**, the VV-OPEN lights remain illuminated.

The SOV-CL lights extinguish and the SOV-OP lights illuminate. Fuel flows from the fuel manifold into the tank level control valves. As the level control valves fill, their floats rise until they shut off the control valve's pilot valve. The resulting back pressure forces the tank shutoff valves to the closed position. The SOV-OP lights extinguish and the SOV-CL lights illuminate. Testing stops.

After testing the system, place the MODE selector in the FUEL position to open the tank shutoff valves and the level control valve solenoid valves. Fuel flows from the fuel manifold and continues into the fuel tanks through the level control valves. When fuel quantity reaches 98%, the level control valve floats close the pilot valves. The resulting back pressure forces the tank shutoff valves closed, fueling stops, the SOV-OP lights extinguish, and the SOV-CL lights illuminate. Place tank switches to OFF prior to moving the MODE selector from the FUEL position to avoid fuel spillage.

On S/Ns 5001, 5007 and subsequent and aircraft with a modified fuel system, the three VV-OPEN lights extinguish after rotating the mode selector to FUEL. **On aircraft without a modified fuel system**, the VV-OPEN lights remain illuminated until pressure is removed from the fueling manifold.

On S/N 5135 and subsequent and prior aircraft with a tail tank, if tail tank fuel is required after filling the wing and auxiliary tanks, rotate the mode selector to TEST to verify proper operation of the system. Place the tail tank switch in the TEST position and verify the TAIL TANK SOV-CL light extinguishes and the SOV-OP light illuminates. Within 30 seconds, the SOV-OP light illuminates and the SOV-CL light extinguishes. After testing the system, rotate the mode selector to FUEL to allow filling of the tail tank. When the tail tank reaches full, the fuel shutoff valves close; fueling stops. After filling the tail tank, place the tail tank switch in the OFF position to prevent fuel spilling from the vent valves.

Close the nozzle valve, disconnect the nozzle from the single-point adapter, replace the cap, and secure the access door.

On S/Ns 5001, 5007 and subsequent, and aircraft with a modified refueling system, the VV-OPEN lights should remain extinguished. **On aircraft without a modified refueling system**, the VV-OPEN lights remain illuminated until fueling manifold pressure bleeds off. Ensure that the VV-OPEN lights extinguish before placing the POWER switch in the OFF position.

Rotate the mode selector to OFF and place the POWER switch in the OFF position. Stow and secure the control panels and access doors, then disconnect or shut off aircraft power as required.

Gravity Refueling

The main and auxiliary tanks can also be gravity fueled through the three overwing gravity filler caps. Fueling to maximum capacity is not possible with gravity refueling. Tail tanks, when installed, can be fueled only with the single point fueling system.

WARNING: Do not remove main fuel tank filler caps when fuel quantity is greater than 4,000 lbs or contents are unknown.

Fuel System

Power Source	Engine-driven fuel pumps Standby fuel pumps Tail tank transfer pump(s) Battery bus Battery Direct bus DC Bus 1 and DC Bus 2
Distribution	Left/right engines Auxiliary power unit Primary and secondary ejectors Transfer ejectors
Control	Switchlights PUMP XFLOW FEED LEFT TO RIGHT FEED RIGHT TO LEFT DUMP SW ARMED PRESS TO DUMP X-FER ARMED/OFF switch Refueling panel ENG FIRE PUSH switchlights
Monitor	Pump ON/INOP lights VALVE CLOSED/FILTER lights SCAV/MAIN lights Crossflow valve OPEN light Tail tank NOT ARMED light Tail tank FUEL and GRAV TRANS lights VV-OPEN, SOV-CL, and SOV-OP lights TAIL TANK SOV-CL light Fuel temperature gage Fuel quantity indicators
Protection	Circuit breakers Venting system Refueling shutoff valves Low pressure switches Fuel filter bypass valves