

DCA24FA017

OPERATIONAL FACTORS/HUMAN PERFORMANCE

Attachment 15
Hawker Fuel System Guidance
January 24, 2025

Fueling and Defueling

Fueling

The aircraft can be pressure refueled through a single-point refueling adapter or by gravity through filler caps.

Fuel Loading

Fuel tanks may be replenished in any sequence if the appropriate refuel instructions are observed and the following preflight fuel loading conditions are achieved.

- Fuel loaded into the wing tanks is equally distributed between the two wing tanks.
- Before flight if the aircraft has a ventral tank, it must not contain any fuel unless each wing tank contains at least 3,450 lbs (1,565 kg) of fuel. Before flights on which the ventral tank is to be used, it must be filled completely; for all other flights it must be empty.

Pressure Refueling System

The pressure refueling/defueling system allows filling or draining of the wing and ventral fuel tanks through a single-point coupling on the right side of the ventral tank. The system uses parts of the engine fuel feed lines to move fuel from the coupling to the tanks.



Figure 5F-15: Single-Point Coupling (Pressure Refueling)

Major system components include:

- refuel control panel
- single-point coupling and reducing valve
- master refuel valve
- left and right wing tank refuel valves
- wing high level float switches
- ventral tank refuel valve
- ventral low and high level float switches.

Safety devices protect the system from overpressurization, fuel overflow, fuel thermal expansion, and pipe fractures.

The PE bus supplies 24 VDC power for operation of all refueling/defueling system components.

Refuel Control Panel

The refuel control panel, adjacent to the cockpit vestibule right-hand bulkhead, contains the switches, indicators, and annunciators for wing and ventral tank refueling and defueling. The fuel tanks can be fueled simultaneously or individually, as desired. Magnetic indicators show valve position. When unpowered, the magnetic indicators display a cross-hatched pattern.

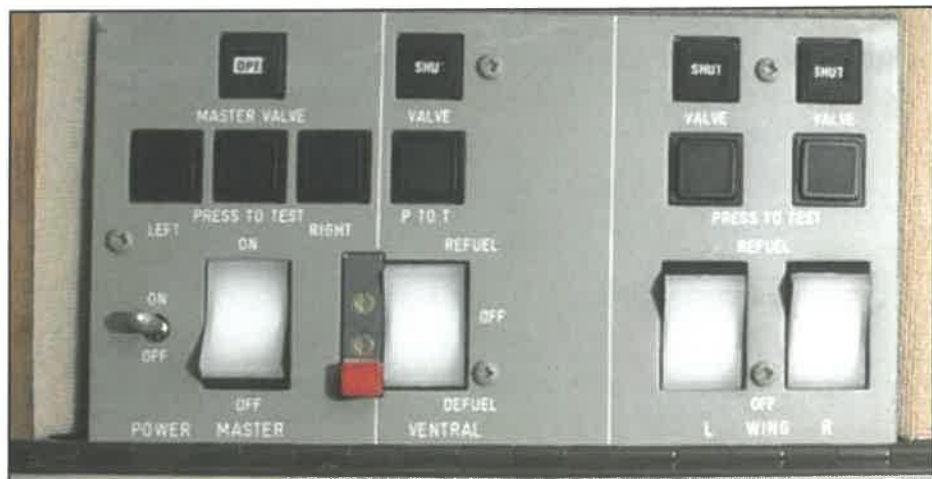


Figure 5F-16: Refuel Control Panel

The refuel control panel has a two-position (ON/OFF) master refuel switch that controls 24 VDC power from the PE bus to the system control relays, valve actuators, and system indicators. Hawker 800XP and later models and late and modified Hawker 800s refuel panels feature a power switch enabling operation of the refuel system without use of the BATT switch. A master valve magnetic indicator and the overflow and overpressure switchlights, are located above the master switch. The master valve indicator shows valve position (OPEN/cross-hatched/SHUT) and the switchlights perform the following two functions:

- visual warning of an abnormal condition
- test feature.

Next to the master switch is the three-position (REFUEL/OFF/DEFUEL) ventral tank refuel valve switch. Above the switch is the ventral tank's FULL switchlight and refuel valve position magnetic indicator. The FULL switchlight illuminates when the tank's high-level float valve closes or is pushed for testing purposes. Depending on valve position, the indicator displays OPEN, SHUT or a cross-hatched pattern (valve position between open and closed or system unpowered).

With the refuel switch in REFUEL, the valve control circuit is through the tank's high-level float valve. In contrast, placing the switch in DEFUEL connects the refuel valve control circuit through the tank's low-level float switch. Wiring the refuel valve control circuit in this manner allows the ventral tank refuel valve to open even though the high level float switch is reporting a full tank.

On the right side of the panel are the left and right wing tank refuel valve switches. Each supplies power to open and close its wing tank refuel valve. Above each switch is a magnetic indicator that shows refuel valve position (OPEN/crosshatched/SHUT) and a tank FULL switchlight. When the tank fuel level reaches full, a high-level float switch closes to illuminate the FULL switchlight and close the master and tank refuel valves. The switch can be pushed for system testing.

Control System Test

Before beginning refueling, the refuel control system must be tested. After placing the MASTER switch ON, verify the MASTER VALVE indicator shows OPEN. Place the WING and VENTRAL switches in the REFUEL position.

Test the wing system by pressing the respective OVERFLOW switchlight. Verify the OVERFLOW caption illuminates and the master refuel valve and all tank refuel valve magnetic indicators change to SHUT. After releasing the OVERFLOW switchlight, the OVERFLOW caption extinguishes and the refuel valve indicators change to OPEN. Repeat this test for the other wing tank.

Press the VENTRAL FULL switchlight to test the ventral fuel tank's control system. Verify the tank's FULL light illuminates and the ventral fuel tank magnetic indicator changes from OPEN to SHUT. After releasing the VENTRAL FULL switchlight, check that the FULL light extinguishes and the indicator changes from SHUT to OPEN. Repeat this test for the wing tanks by pressing the associated fuel tank's FULL switchlight. The indications for a successful test of the tank systems should be similar to the ventral tanks.

Place the WING and VENTRAL switches in the OFF position. All tank VALVE indicators should change to SHUT.

Press the OVERPRESS switchlight for more than one second. Note that the OVERPRESS caption illuminates and the master refuel valve indicator changes to SHUT. After indicating SHUT, the indicator should not change. Place the MASTER refuel switch in OFF for approximately two seconds then place the switch in ON. Check that the master refuel valve indicator changes to OPEN.

If all indications occur as indicated, the system is operating normally.

Single-Point Coupling and Reducing Valve

A standard single-point, self-sealing coupling (Refer, **Figure 5F-15**) is on the right side of the ventral tank behind an access door. Immediately downstream of the coupling is a pressure reducing valve. The valve consists of a pressure-actuated, spring-loaded sleeve that opens and closes to regulate the fuel inlet area to maintain fuel output pressure at 25 PSI.

Master Refuel Valve

The electrically controlled, actuator-driven master refuel valve is downstream of the reducing valve. Valve opening and closing power is through the master refuel valve control relay.

If an overpressure or overflow condition occurs, the fuel system safety devices initiate a chain of events that supply power to close the master refuel valve and stop fueling (see Safety Devices).

Wing Tank Refuel Valves

Each wing tank has an electrically controlled, actuator-driven refuel valve to control fuel flow into the tank. Both the left and right wing tank refuel valves actuators are on the aft side of the wing rear spar. If an actuator fails, it is possible to open and close the refuel valve with a lever. A see/feel indicator on the actuator face shows valve position. The actuator drive shaft extends through the wing rear spar into the wing tank No. 1 compartment to operate the refuel valve.

Turning a REFUEL switch ON supplies 24 VDC from the PE bus to energize a relay controlled by the wing's high-level float switch. With the float switch below the full position, it provides a ground circuit for the relay. Power then flows through the REFUEL switch and energized tank relay to open the wing tank refuel valve. When the refuel valve begins to open, the shut limit switch breaks its contacts and removes power from the magnetic indicator allowing it to change from SHUT to cross-hatched. When the refuel valve opens, its open limit switch supplies power to change the refuel valve magnetic indicator from crosshatched to OPEN. With the master and refuel valves open, wing refueling can begin.

Fuel flows through the master refuel valve, wing refuel valve, and feed pipes into the wing. When the wing tank fuel level reaches full, its high-level float switch actuates to illuminate the respective refuel panel FULL switchlight and de-energize the refuel valve control relay. When the relay de-energizes, it supplies 24 VDC power to shut the refuel valve. The refuel valve stop limit switch then supplies power to change the valve position indicator from OPEN to SHUT.

Vent Surge Tank Overflow

If fuel overflows into a vent surge tank, an overflow float switch in the tank closes to energize its wing overflow relay. One pair of contacts in the relay supplies power to illuminate the respective OVER FLOW switchlight and the other de-energizes the master refuel valve control relay. The master refuel valve closes and, through the tank relay, all tank refuel valves close. Fueling stops.

Ventral Refuel Valve

The ventral fuel tank has an electrically controlled, actuator-driven refuel valve that controls fuel flow into the tank during refueling and out of the tank during defueling. The refuel valve is on the forward wall of the ventral fuel tank. If the valve actuator fails, it is possible to manually open and close the control valve. A see/feel indicator on the valve actuator face shows valve position.

Refuel valve control is through the ventral REFUEL/OFF/DEFUEL switch on the refuel panel. Magnetic indicators controlled by stop limit switches in the refuel valve actuator show valve position as either SHUT or OPEN.

Ventral Tank Refueling

Placing the ventral tank REFUEL/OFF/DEFUEL switch in REFUEL supplies 24 VDC directly from the PE bus through the switch relay and high-level float switch (fuel level less than full) to ground. The switch relay then energizes to allow PE power to pass through the energized tank relay to the ventral tank refuel valve actuator. The refuel valve begins opening and its shut limit switch changes over to open the circuit to the magnetic indicator, changing it from SHUT to crosshatched. Opening of the limit switch also de-energizes the ventral refuel annunciator relay allowing PE power to illuminate the MWS REFUEL ON annunciator. When the refuel valve reaches the open position, the open limit switch changes over to change the magnetic indicator from cross-hatched to OPEN.

When the ventral tank is empty, the ventral tank low level switch actuates to change the full/empty magnetic indicator to EMPTY. As fuel starts to enter the tank, the low-level switch opens to change the indicator from EMPTY to cross-hatched. In this condition (ventral fuel tank not empty), the low level switch also provides a "hold in circuit" for the LOW V_{MO} relay (280 Kts).

As the fuel level reaches full, the high level switch opens to de-energize the refuel switch relay. In this condition, the high level switch also illuminates the tank FULL switchlight and changes the FULL/EMPTY magnetic indicator from cross-hatched to FULL. De-energizing the refuel switch relay supplies PE power to close the ventral refuel valve through its shut limit switch. As the refuel valve starts to close, its open limit switch removes power from the OPEN/SHUT magnetic indicator changing it from OPEN to crosshatched. As the refuel valve reaches the shut position to stop fuel flow into the tank, the shut limit switch removes power from the refuel valve, supplies power to change the magnetic indicator from cross-hatched to SHUT, and energizes the refuel annunciator relay to extinguish the MWS REFUEL ON annunciator. All pressure refueling valves must be shut before the REFUEL ON annunciator extinguishes.

NOTE: Ensure that the LP fuel cocks are closed during this procedure to prevent inadvertent defueling of the wing tanks.

Defueling

Aircraft defueling includes:

- wing tank defueling
- ventral tank defueling.

Wing Defueling

Before beginning, place both LP cock levers in the up (open) position. Placing the master refuel switch in ON routes PE bus power from the left main landing gear weight-on-wheels (squat) switch to energize the master refuel valve. When the relay energizes, it supplies power to open the master refuel valve. As the refuel valve moves toward open, its limit switches change over to illuminate the MWS REFUEL ON annunciator, change the refuel valve indicator to OPEN, arm the valve shut circuit, and stop the refuel valve when it reaches full open.

With the master refuel valve opening, the shut limit switch changes over and removes power from the master refuel relay. Power routed through the normally closed contacts of the over pressure switch (fuel pressure below 45 PSI) completes a hold-on circuit created by energizing the master refuel relay to remain energized and the master refuel valve to continue to open. As the master refuel valve reaches the open position, the open limit switch removes power from the master refuel valve and energize the tank refuel relay. This establishes the refuel/defuel circuits.

Ventral Tank Defueling

Placing the ventral tank REFUEL/OFF/DEFUEL switch in DEFUEL supplies 24 VDC directly from the PE bus through the switch relay and low level float switch (fuel level not empty) to ground. The switch relay energizes and allows PE bus power to pass through the energized tank relay to the ventral tank refuel valve actuator. The refuel valve begins opening. Its shut limit switch opens the circuit to the magnetic indicator and changes it from SHUT to cross-hatched. Opening of shut limit switch also de-energizes the ventral refuel annunciator relay to illuminate the MWS REFUEL ON annunciator with PE bus power. When the refuel valve reaches the open position, the open limit switch supplies PE bus power to the magnetic indicator to change it from cross-hatched to OPEN.

When the ventral fuel tank is full, the ventral tank high-level switch supplies a ground for the PE bus powered full/empty magnetic indicator and the FULL switchlight. This changes the magnetic indicator to FULL and illuminates the FULL switchlight. As fuel level starts to decrease, the high level switch opens the ground circuit to the magnetic indicator and FULL switchlight. The indicator changes from FULL to cross-hatched and the FULL switchlight extinguishes.

When the fuel level reaches empty, the low level switch opens to deenergize the refuel switch relay. In this condition (ventral tank fuel level empty), the low-level switch opens the "hold in circuit" to ground for the LOW V_{MO} relay and provides a ground circuit that changes the FULL/EMPTY magnetic indicator from cross-hatched to EMPTY. De-energizing the refuel switch relay supplies PE power to close the ventral refuel valve through its shut limit switch. As the refuel valve starts to close, its open limit switch removes power from the OPEN/SHUT magnetic indicator, changing it from OPEN to cross-hatched. When the refuel valve reaches the shut position, the shut limit switch removes power from the refuel valve and supplies power to change the magnetic indicator from cross-hatched to SHUT. It also energizes the refuel annunciator relay to extinguish the MWS REFUEL ON annunciator.

Safety Devices

Safety devices in the fuel system provide protection against:

- overpressure
- overflow
- thermal expansion
- pipe fracture
- surges.

Overpressure

Downstream of the pressure reducing valve, normal refueling pressure is 25 PSI. If pressure during refueling reaches 45 PSI, a pressure switch between the refuel/defueling coupling and the master refuel valve actuates. This action cuts normal holding power to the master refuel valve control relay, supplies alternative relay holding power from the overpressure switch relay, and supplies power to a 0.4 second time delay unit. The time delay unit supplies power to illuminate the OVER PRESS switchlight and energize the overpressure switch relay. When the overpressure switch relay energizes, it cuts relay holding power to the master refuel valve control relay. The valve control relay then de-energizes to close the master refuel valve and any other tank refuel valve that is open. Fueling stops.

Indications of an overpressure condition include:

- OVER PRESS switchlight illuminated
- refuel valve magnetic indicators SHUT

After an overpressure condition, reset the system by turning the MASTER switch OFF. Remove excessive fuel pressure from the system. This unlatches the overpressure switch, closes the master refuel valve and tank refuel valves, and closes the vent valves.

To check the overpressure system, turn the MASTER switch ON and verify that the master refuel valve indicators show OPEN. Press the OVER PRESS switchlight. Once it illuminates, release. The master refuel valve indicator should change to SHUT. Turn the MASTER switch OFF. The OVER PRESS switchlight should extinguish. Turning the MASTER switch ON will then open the master refuel valve.

Overflow

If fuel overflows into a vent surge tank, an overflow float switch in the tank closes to energize its overflow relay. When the relay energizes it illuminates the tanks OVERFLOW switchlight and cuts power to the master refuel valve control relay. When the control relay de-energizes, it supplies power from the master refuel relay to close the master and tank refuel valves.

With the MASTER switch ON and the master refuel valve indicator showing OPEN, pressing one of the OVER FLOW switchlights initiates an overflow system test. The OVER FLOW switchlight illuminates and the master refuel valve closes (indicator shows SHUT). Releasing the switchlight should allow the master refuel valve to open. Continue the test by pressing the other OVER FLOW switchlight.

Thermal Expansion

Thermal relief valves in the wing tank No. 1 compartments and between the refuel/defuel coupling and the master refuel valve protect the fuel system from fuel thermal expansion. Each relief valve is a simple device that opens to relieve fuel pressure caused by excessive temperature.

Pipe Fracture

If a refueling pipe begins leaking in the No. 1 tank compartment, fuel could fill the tank and result in a structure overpressure. A stack pipe prevents this from occurring by routing fuel to flow from the No. 1 compartment to the No. 3 compartment.

Surge Relief

A surge relief valve, in the boost pump LP line downstream of the NRV in each No. 1 wing tank compartment, opens to reduce fuel overpressure transients caused by initial application of fuel pressure and relief valve closing. Each relief valve opens to vent excess fuel pressure into the No. 1 compartment.

Gravity Refueling and Defueling

When necessary, either because of unavailability of pressure refueling equipment or component failure, the wing and ventral fuel tanks can be gravity filled through filler caps on the wings and a ventral tank filler cap on the left rear fuselage.

Refer to the Approved Flight Manual, the Ground Handling Checklist or the Maintenance Manual as appropriate for exact procedures and precautions.

Gravity defueling is through the fuel drains in the wing and ventral tanks.

Wing Filler Cap

During gravity refueling, fuel flows from wing tank compartment No. 6 inboard through wing flap valves to the other compartments.

Remove the filler cap by lifting its locking handle and rotating it 90° counterclockwise. Lifting the handle extends the filler cap bowl lock and releases pressure against the adapter seal. Rotating the handle aligns the lock bowl lands with cutouts in the adapter. Lift and remove the cap. A lanyard secures the cap to the adapter.

When replacing the cap, verify that the cap arrow faces forward.

A rubber flap valve, below the cap adapter, prevents fuel siphoning if the filler cap is left off. When locked, the cap is capable of providing a fuel-tight seal up to 50 PSI.

Ventral Tank Filler Cap

The ventral tank filler cap is behind an access door on the left side of the fuselage, aft of the rear equipment bay door.

Remove the filler cap by lifting its locking handle, turning it counterclockwise, and removing it from its adapter. A chain secures the cap to the adapter. Replace the cap by fitting it in the adapter and turning the handle clockwise. Press down on the cap handle to lock it in its recess. A balk attached inside the filler cap door makes it impossible to close the door without the cap in its adapter.

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