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INTRODUCTION

The fuel tanks are located in the left and right wings and supply fuel to the engines and APU. Tanks can be refueled through a single-point adapter or manually by overwing refueling. The fuel computer controls automatic refueling, powered cross-flow, fuel transfer, measurement of fuel quantity and temperature. Fuel system data is presented on the EICAS and synoptic pages.

FUEL TANK SYSTEM

DESCRIPTION

The Challenger 300 stores fuel in the left and right wing tanks. The tanks are sealed with a fuel resistant sealant.

The tanks provide single-point and overwing refueling capability and provisions for removing condensation from the tanks through underwing water drains. Low drag NACA vent scoops provide static venting of the tanks. Fuel quantity and temperature measurement probes in the tanks provide indications for the EICAS.

All fuel supplied to the engines flows through the collector tanks. The left and right collector tanks are located inside each wing tank at the rear and inboard of the wing. Each collector tank is replenished by gravity through flapper check valves installed on the division between the collector and the wing tanks and by a scavenge ejector when the engines are operating. The right side backup DC fuel pump takes fuel from the right collector tank and delivers it to the APU.

FUEL TANK CAPACITIES

Maximum usable fuel loads are given in the tables below.

Pressure Refuel		
Fuel Tank	**Fuel Mass †**	
Right	7075 lb	3210 kg
Left	7075 lb	3210 kg
Left & Right	14 150 lb	6420 kg
† Based on a fuel density of 6.75 lb/USG (0.809 kg/litre), rounded to the nearest 5 lb or 5 kg. Fuel Mass is provided for reference only and should not be considered limiting.		

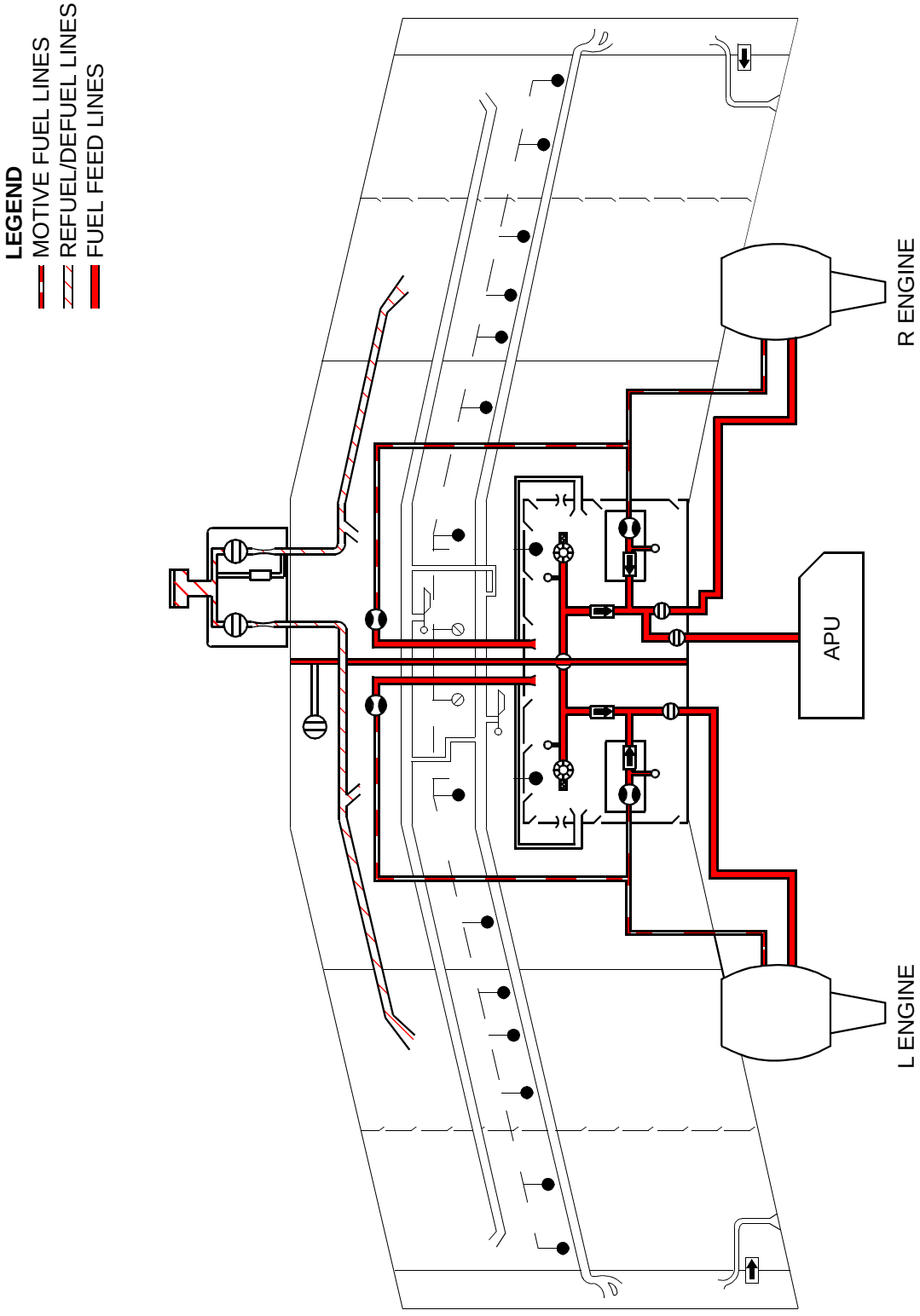
Gravity Refuel (Airplane Level)		
Fuel Tank	**Fuel Mass †**	
Right	6500 lb	2950 kg
Left	6500 lb	2950 kg
Left & Right	13 000 lb	5900 kg
† Based on a fuel density of 6.75 lb/USG (0.809 kg/litre), rounded to the nearest 50 lb or 25 kg. Fuel Mass is provided for reference only and should not be considered limiting.		

FUEL TANK SYSTEM (Cont)

COMPONENTS AND OPERATIONS

TANK CONSTRUCTION

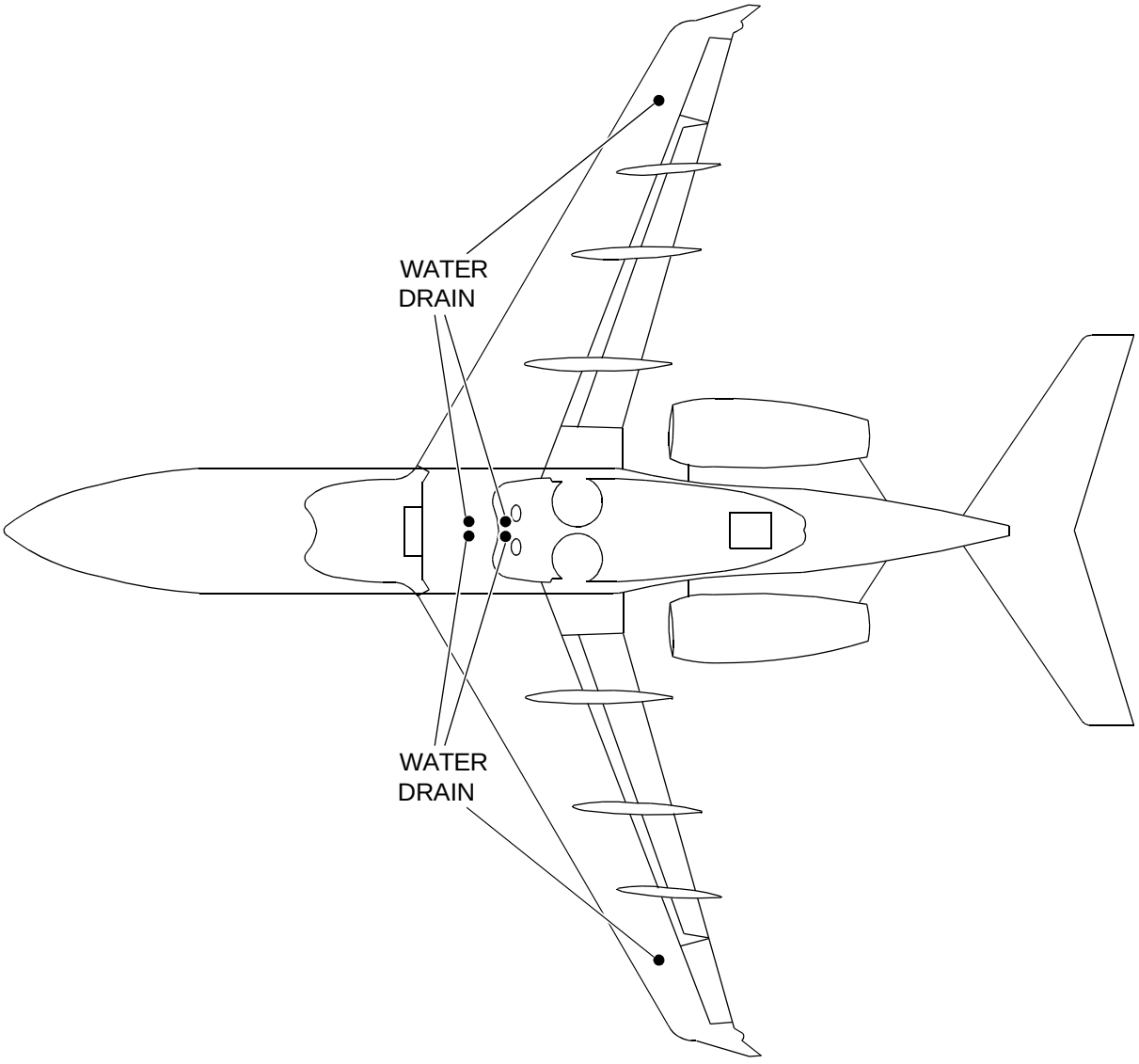
The wing tanks are integral type fuel tanks that use a wet wing design and are sealed with a fuel resistant sealant.



FUEL TANK SYSTEM (Cont)

WATER DRAIN VALVES

There are three water drain valves in each wing. One for the collector tank, one for the wing tank, and one for the surge tank, which is located in the outboard area of each wing. They are used to drain water and contaminates that collect in the fuel tanks and to complete the removal of remaining fuel during defueling. If contamination is suspected all tanks should be drained until the fuel is clear of water or other contaminates.



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FUEL TANK SYSTEM (Cont)

FLAPPER CHECK VALVES

Each wing tank incorporates flapper check valves that are attached to the internal wing ribs. These valves prevent outward flow of the fuel during wing low maneuvers.

VENT SYSTEM

The tanks are vented through interconnecting vent lines to NACA scoops (low drag vents) located on the lower surface of the wing trailing edges (one per wing).

During operations on the ground and in flight, the NACA scoops provide static ventilation of the tanks and relieve air pressure differential caused by the refueling process, thermal expansion of the fuel, or altitude variation in flight.

Surge bays located outboard of both wing tanks provide additional expansion volume for the vent system to prevent fuel spillage. Each surge bay holds 53.6 lbs of fuel and flapper valves are located between the surge bays and tanks to prevent outward flow of fuel from the tanks.

FUEL DISTRIBUTION

DESCRIPTION

There are two separate fuel distribution systems. One feeds the left engine, and the other feeds the right engine and APU.

ENGINE FUEL FEED

The primary fuel feed to each engine is independently provided from its respective tank. The feed line is pressurized by means of an ejector taking its motive flow from the high pressure stage of the engine fuel system. This high pressure fuel is delivered to the ejector nozzle. The same high pressure source is also used to drive the scavenge ejector. The primary ejector is totally self energized by its respective engine and is not reliant on any other power source for its control or operation. Proper operation of the primary feed ejector is signaled by a pressure switch located at the ejector outlet.

APU FUEL FEED

The APU fuel feed is established from the right collector tank to the APU by the right main ejector or by the right DC fuel pump if the ejector pressure is low. This system includes an APU shutoff valve.

ELECTRIC FUEL PUMPS

The electric fuel pumps provide fuel pressure to the engines when the main ejector pumps cannot, such as during engine start and main ejector pump failure. The electric fuel pumps also provide fuel pressure to transfer fuel from one wing tank to the other.

COMPONENTS AND OPERATION

FUEL COMPUTER

A dual-channel fuel system computer calculates the onboard fuel quantity and controls the refueling. One channel controls one side and the other channel controls the opposite side. If the onside channel fails, the other channel automatically assumes control. Each channel receives signals from the probes and aircraft attitude information from the AHRS.

The computer calculates the fuel quantity as weight in each tank. The computer uses the following information: fuel density, fuel probes readings, aircraft attitude and accelerations, and WOW signal.

MOTIVE FLOW

The ejectors operate by using motive flow pressure from the engine-driven pump. As high-pressure motive flow passes through the venturi of the ejectors, fluid velocity is increased and low pressure is created. The suction caused by the low pressure moves the fuel out of the tank.

SCAVENGE EJECTOR

The scavenge ejectors are operated by motive flow created by the high-pressure output of the engine-driven fuel pumps. The two ejectors are located at the lowest inboard point of each wing tank. The ejectors transfer fuel from the wing tanks to the collector tanks.

FUEL DISTRIBUTION (Cont)

COLLECTOR TANK

All fuel consumed by the engines comes from the collector tanks. The collector tanks are located in the aft section of each wing tank. Fuel from the wings flows into the left and right collector tanks from the associated wing tank through the flapper check valves. When operating, scavenge ejectors also remove fuel from the wing tanks and delivers the fuel to the associated collector tank.

MAIN EJECTOR

Two main ejectors are operated by motive flow created by the high-pressure output of the engine-driven fuel pumps. Each ejector pump takes fuel from its associated collector tank and delivers the fuel to the engine. The main ejectors are installed on the bottom of the collector tanks.

FUEL SYSTEM CONTROLS

The fuel system controls are as follows:

- L PUMP and R PUMP standby boost pump rotary switch (OFF, AUTO, ON)
- XFER SWITCH
- GRAVITY XFLOW switch
- L (R) ENG FIRE switches

In order to provide pressure during engine start or in the event of feed ejector failure, a standby boost pump is fitted in parallel with each feed ejector. When the engine RUN switch is selected ON and the respective standby boost pump is armed, it will be commanded ON as long as the feed ejector does not deliver sufficient pressure to the dedicated engine. For added safety, when sufficient pressure is achieved at the primary ejector outlet, a time delay will command the boost pump to remain ON for an additional 10 seconds.

The standby boost pumps are also used for lateral balance of the fuel load by pumping fuel from one wing to the other. If lateral imbalance of fuel loads occur (e.g. after engine failure), fuel can be pumped from wing to wing by means of the standby boost pumps which are interconnected by a transfer valve. The transfer valve is closed in order to isolate left and right engine feed systems from each other except when restoring balance. Transfer is achieved by opening the transfer valve and then switching on the standby boost pump. Fuel will be pumped from the wing through the transfer valve and the inactive standby boost pump into the other wing to restore fuel balance.

A secondary means of balancing fuel completely independent of the pumped system is provided by a gravity crossflow system that provides a direct flow path between the wings and is controlled by the opening and closing of a gravity crossflow shutoff valve. While the gravity transfer shutoff valve is opened, aircraft maneuvering (steady heading sideslip) may be required to achieve transfer of fuel if the initial imbalance is minimal. Aircraft maneuvering is not required when the imbalance between the two tanks is large.

Whether performing balancing by means of the standby boost pumps or by gravity, the action is controlled manually by the pilot while visually monitoring the fuel contents and messages on the EICAS.

An independent operated fuel shutoff valve for each engine feed is located forward of the engine rotor burst areas. In the event of an engine fire the valves are closed by the activation of L (R) ENG FIRE switches. on the center pedestal. They can be subsequently reopened if required by depressing the switches once more.

ENGINE FUEL SHUTOFF VALVE (SOV)

The engine fuel shutoff valves are located on the aft spar of the wing box in the main landing gear bay and are controlled by the L (R) ENG FIRE switches on the ENGINE control panel located on the center pedestal. The engine fuel shutoff valves are electrically operated valves that stop the flow of fuel to the engines.

FUEL HEATER/OIL COOLER

The fuel heater/oil cooler (FHOC) is located in the engine accessory gear box. The engine FHOC purpose is to heat the fuel sufficiently to prevent ice formation in the engine fuel system, while maintaining the engine oil temperature within limits.

FUEL FILTER

The fuel filter assembly is mounted just aft of the oil tank on the engine. The filters are monitored for contamination by an impending bypass switch. If the fuel pressure parameters are exceeded, a signal is sent to the EICAS.

FUEL DISTRIBUTION (Cont)

APU FUEL SHUTOFF VALVE (SOV)

The APU fuel feed SOV is an electrically operated shutoff valve. In case of an APU fire, pushing the APU FIRE switch on the ENGINE control panel, located on the center pedestal, closes the SOV. During normal operations, the SOV is automatically controlled.

REFUELING/DEFUELING

DESCRIPTION

Refueling can be accomplished using either pressure or gravity refueling procedures. Pressure refueling is preferred, while overwing gravity refueling is only used when single-point refueling capabilities do not exist.

Suction defueling of the fuel tanks is accomplished by applying suction to the single-point refuel/defuel adapter with the refuel/defuel control panel configured for defueling. Defueling of the aircraft is not a pilot function and is carried out only by maintenance personnel.

COMPONENTS AND OPERATION

FUEL COMPUTER

The dual-channel fuel system computer monitors and controls the refueling process. Each channel receives signals from the fuel system and aircraft attitude information from the AHRS. The computer uses the information to calculate the fuel weight.

PRESSURE FUELING

The refuel/defuel control panel controls all the refueling and defueling operations. It tests the integrity of the fuel system components and displays individual fuel tank quantities. The refuel/defuel control panel is located in the right wing root leading-edge fairing.

REFUELING AUTO MODE

In the AUTO MODE, the refueling personnel preselect the total fuel quantity through the INC/DEC switch. When the desired quantity is set, use the ON/OFF toggle switch to start refueling. The fuel system computer automatically directs the preselected quantity of fuel and is dispensed at 368.5 lbs per minute at 55 psi. When the desired quantity is reached, refueling will automatically stop. Reposition the ON/OFF toggle switch to OFF.

REFUELING MANUAL MODE

The manual mode allows refueling personnel to direct fuel to a specific tank by selecting the appropriate shutoff valve open or closed.

REFUELING/DEFUELING (Cont)

GROUNDING RECEPTACLES

Receptacles for grounding the aircraft to the refueling equipment are provided as follows:

- Adjacent to each gravity filler port
- Adjacent to the pressure refueling coupling
- Nose gear stud

SYSTEM TEST

The automatic pressure refueling, manual pressure refueling and automatic defueling procedures can be used after satisfactory tests on the refuel/defuel system. The tests are to verify that all panel lamps operate correctly, the SOVs operate correctly in manual and automatic modes.

Test the panel lamps with the following procedures:

- Select power switch ON
- Push Lamp Test button and verify all panel indication lamps illuminate
- Connect fuel nozzle to the refuel/defuel adapter to supply fuel pressure
- Select TEST position on the fuel selector switch
    - Verify H. LEVEL DETECTOR, SOV CL and OP lamps illuminate
- Select OFF position on the fuel selector switch
    - Verify that only the SOV OP lamps illuminate

Test the SOV operation with the following procedures:

- Select FUEL AUTO position with the fuel selector switch and the two SOV toggle switches OFF
    - Verify SOV indication lamps are off
- Select FUEL AUTO position with the fuel selector switch and the two SOV toggle switches ON
    - Verify SOV indication lamps illuminate OP
- Select TEST position with the fuel selector switch and the two SOV toggle switches ON
    - Verify SOV lamps illuminate CL

HIGH-LEVEL SENSORS

The high-level sensors provide the fuel computer with a tank full signal, and provides for a 3% expansion space. When the high-level sensor signals the computer a full condition during refueling operations, the computer closes the respective refuel shutoff valve.

REFUEL/DEFUEL SINGLE-POINT ADAPTER

The refuel/defuel single-point adapter lets the operator connect the refueling nozzle to the aircraft to refuel or defuel. The adapter is installed in the right fuselage fairing just forward of the right wing.

GRAVITY REFUELING

Gravity refueling is accomplished only in exceptional circumstances. The refueling process is done through the filler ports located on the upper wing surfaces. Due to the shallow depth of the wing at the location of the filler cap, a protective plate is provided in the tank in order to avoid damage to the bottom skin by the refueling nozzle.

The gravity filler port and cap for each wing tank is located approximately mid-wing.

WARNING: Gravity filler caps for the wing tanks are located below the maximum pressure refueling level. Never remove the gravity filler caps if the wing tanks are full or fuel quantity is unknown.

FUEL INDICATION AND CONTROL

DESCRIPTION

The fuel indication and control system provides fuel quantity indication and control of refuel and defuel functions. The system consists of the fuel quantity gaging computer, fuel quantity probes, fuel temperature probes, fuel level sensors, and the refuel/defuel panel.

COMPONENTS AND OPERATION

FUEL QUANTITY PROBES

Nine fuel quantity probes are distributed throughout each wing tank. The probes provide fuel level indications to the fuel quantity gaging computer.

FUEL TEMPERATURE PROBE

The fuel temperature probe is located in the right wing tank and provides temperature information to the fuel indicating system.

FUEL LEVEL SENSORS

A tank full fuel level sensor is located at the top of each tank. This sensor provides a cutoff signal to the refuel valve when the tank is full.

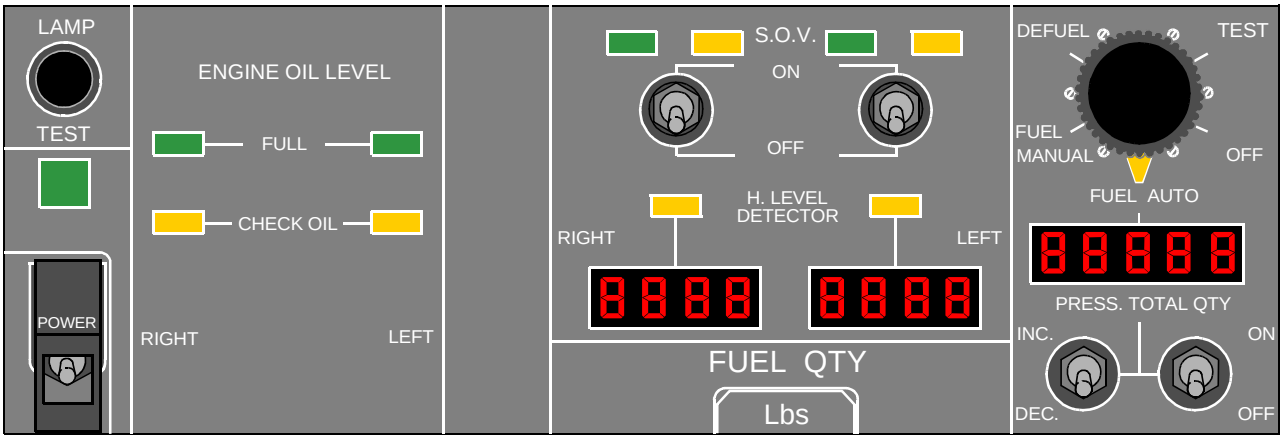
FUEL QUANTITY GAGING COMPUTER

The fuel quantity gaging computer provides the following functions:

- Fuel quantity probe, fuel density probe, fuel level, fuel temperature, and sensor signal processing. The fuel computer uses weight-off-wheels indications and pitch and roll attitude from the AHRS to correct the fuel quantity probe data and display accurate fuel quantity information on the EFIS.
- Failure monitoring and indication to EICAS and the maintenance diagnostic computer.
- Automatic control of refueling and defueling when selected.
- Engine oil level indication to the refuel/defuel panel.

REFUEL/DEFUEL CONTROL PANEL

Pressure refueling and suction defueling can be conducted using the single-point fuel port and the refuel/defuel panel, both located in the right wing root leading-edge fairing. The controls allow the required total fuel load to be preselected and automatically controlled by the fuel system computer. Alternatively, the quantity of fuel loaded into the aircraft can be manually controlled from the refuel panel. A high-level sensor is provided in each tank to prevent the tanks from being overfilled if the automatic or manual refuel control fails. For testing the operation of the refuel shutoff valve, a control allows high-level sensor operation to be simulated electrically and checks the refuel valves closure.



FUEL INDICATION AND CONTROL (Cont)

FUEL QUANTITY GAGING

DESCRIPTION

Fuel quantities are displayed in lbs or kg on the EICAS and FUEL synoptic displays.

COMPONENTS AND OPERATION

FUEL COMPUTER

The dual-channel fuel system automatically calculates the quantity of fuel in the wing tanks. Each channel receives signals from the fuel system and aircraft attitude information from the AHRS. The computer uses the information to calculate the fuel weight in each tank.

CONTROLS AND INDICATION

DESCRIPTION

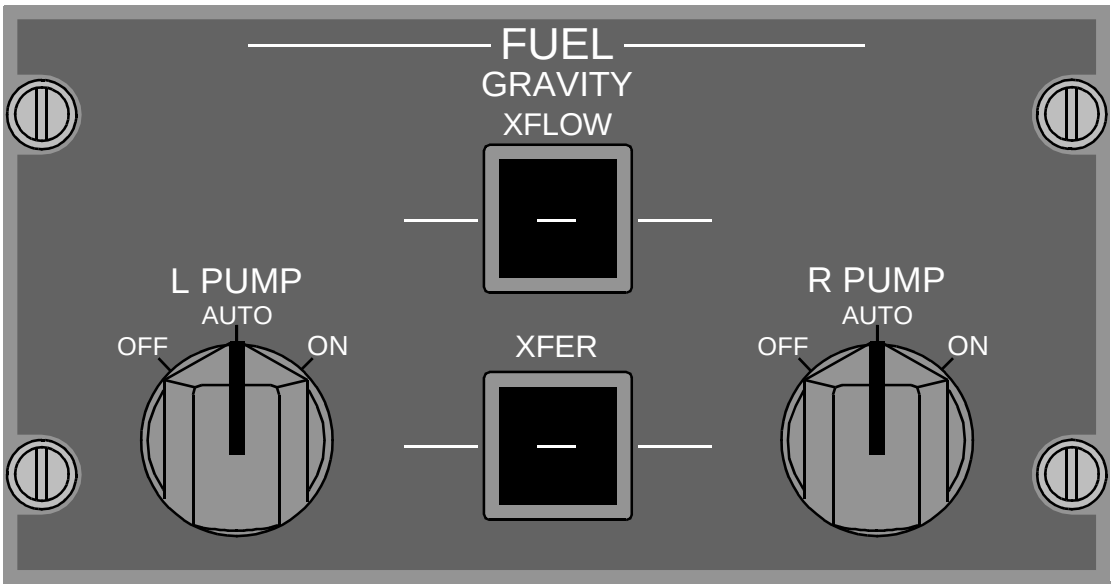
The FUEL control panel provides control and system indications for the fuel system. The panel controls the boost pumps and provides manual control and indications of the gravity and powered crossflow system.

Fuel system information is presented on the EICAS and FUEL synoptic pages. Fuel temperature is displayed in degrees celsius and quantity is displayed in pounds or kilograms.

The refuel/defuel control panel controls all of the refueling and defueling operations. It tests the integrity of the components of the fuel system and displays individual fuel tank quantities.

FUEL CONTROL PANEL

L (R) PUMP, GRAVITY XFLOW, and XFER are selected on the FUEL control panel.



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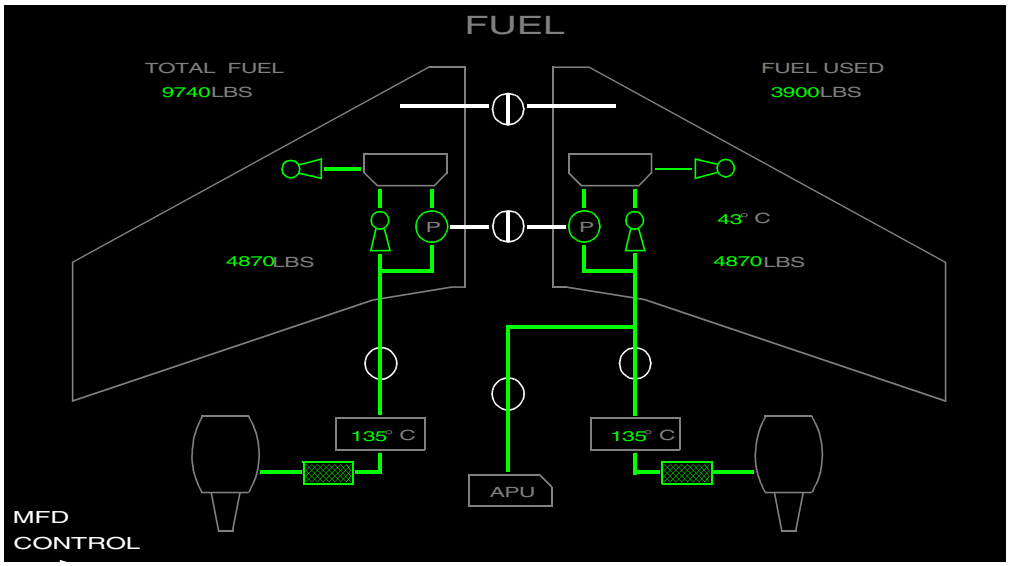
CONTROLS AND INDICATION (Cont)

FUEL DISPLAY

The fuel display synoptic page presents digital indications of fuel flow and quantity.

Fuel flow is indicated in either pounds per hour (PPH) or in kilograms per hour (KPH). Magenta dashes will be displayed if the input value is invalid.

Fuel tank quantity for the left and right fuel tanks are presented in pounds or kilograms.



FUEL TEMPERATURE READOUTS

Bulk fuel temperature readout indicates the temperature of the fuel in the right wing. Green readouts indicate temperatures above -38.3 °C (-36.9 °F), while a WING FUEL TEMP LOW(C) CAS message indicates -38.2 °C (-36.7 °F) or below.

FUEL QUANTITY INDICATIONS

TOTAL FUEL

Green digits indicate total fuel quantity over 600 lb (272 kg) and each wing over 300 lb (136 kg).

LEFT OR RIGHT WING TANKS

Amber digits and a FUEL IMBALANCE (C) CAS message will illuminate if the following conditions exist:

- 250 lb (113 kg) or more with a total fuel weight of more than 13 700 lb (6214 kg)
- 315 lb (143 kg) or more with a total fuel weight between 13 700 (6214 kg) and 10 000 lb (4536 kg)
- 450 lb (204 kg) or more with a total fuel weight between 10 000 lb (4536 kg) and 4700 lb (2132 kg)
- 600 lb (272 kg) or more with a total fuel weight of less than 4700 lb (2132 kg)

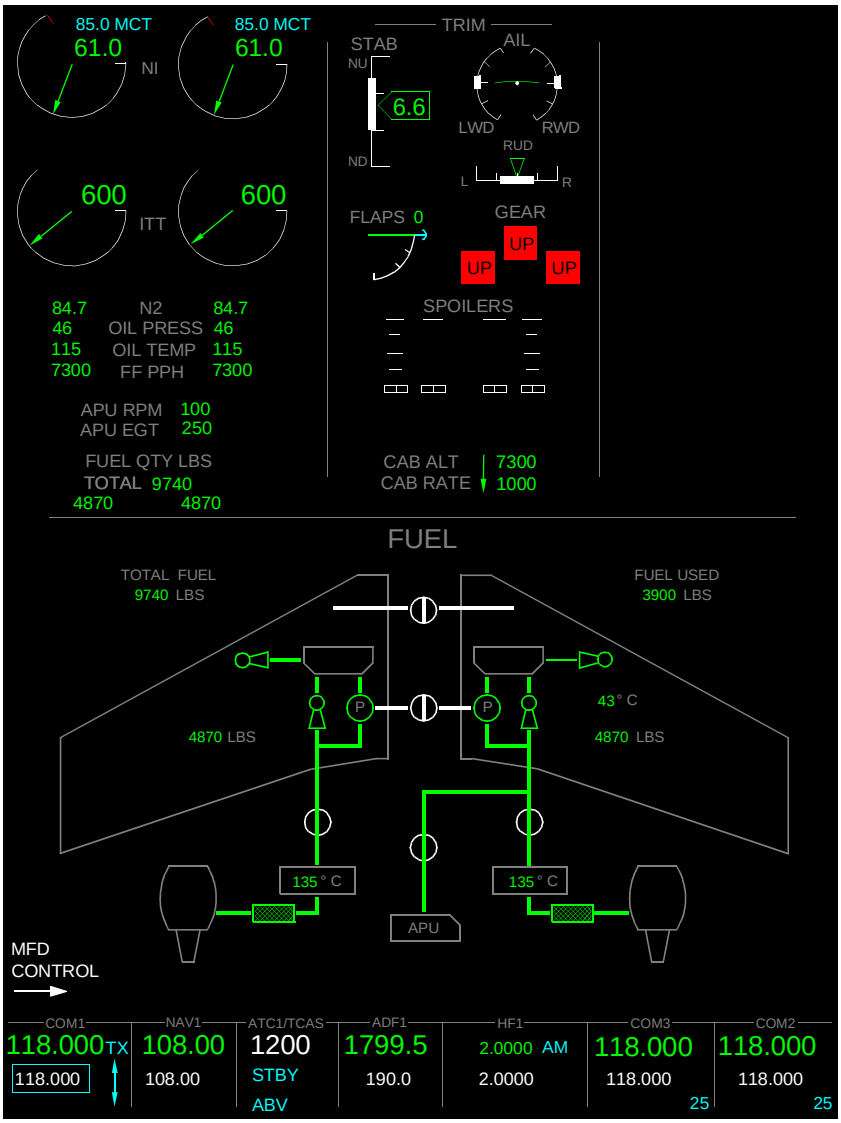
FUEL USED

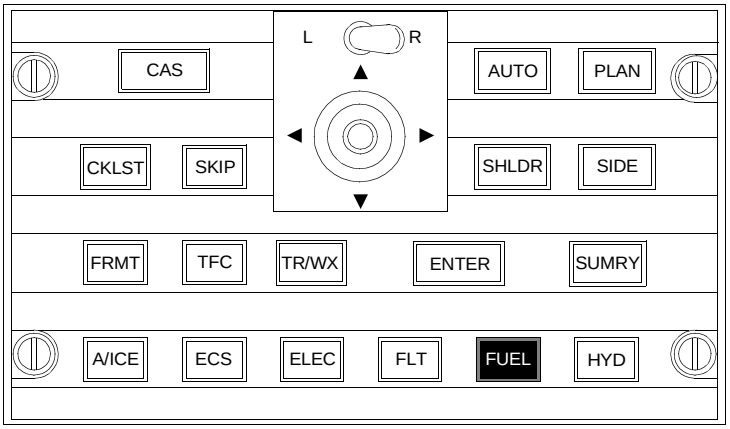
This indication shows the amount of fuel used since the counter was reset. The reset is carried out automatically on powerup by the FADEC. Magenta dashes indicate the input data is invalid.

CONTROLS AND INDICATION (Cont)

FUEL SYNOPTIC PAGE

The EICAS synoptic page displays a pictorial view of the system operation.





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EICAS MESSGAES

The fuel system messages are shown on the EICAS. In the table below, the fuel system messages and inhibits are listed. A brief explanation of each messages is provided.

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) ENG FUEL SOV FAIL	TO/LAND	The respective engine fuel shutoff valve has failed to close when commanded	
L (R) FUEL COLLECTOR LOW	TO	The fuel collector tank quantity is less than 200 pounds	
L (R) FUEL EJECTOR FAIL	TO/LAND	The affected ejector pump has failed to provide sufficient pressure.	
FUEL IMBALANCE	TO/LAND	The wing fuel imbalance is greater than: - 250 lb (113 kg) with a total fuel weight of more than 13 700 lb (6214 kg) - 315 lb (143 kg) with a total fuel weight between 13 700 lb (6214 kg) - 450 lb (204 kg) with a total fuel weight between 10 000 lb (4536 kg) - 600 lb (272 kg) with a total fuel weight of less than 4700 lb (2132kg)	
L (R) FUEL PRESSURE LOW		The engine fuel pressure is below 6 psig	
L (R) FUEL PUMP FAIL	TO/LAND	The respective electric fuel pump has failed	
FUEL QUANTITY FAIL	TO/LAND	Both channels of the fuel quantity gauging computer have failed. fuel quantities will be indicated as magenta dashes on the EICAS	
FUEL QUANTIT Y LOW		Total fuel quantity is 300 lb (136 kg) or less in either wing, when the aircraft is in unaccelerated level flight	
WING FUEL TEMP LOW	TO/LAND	Fuel temperature in the wing is below -38 °C (-36 °F)	
L (R) FUEL EJECTOR FAIL	TO/LAND	The affected ejector pump has failed to provide sufficient pressure. The electric fuel pump should automatically turn on to provide sufficient fuel pressure.	
FUEL GRAV XFLOW FAIL	TO/LAND	The wing fuel gravity crossflow valve is not fully opened or closed as commanded	
L (R) FUEL PUMP ON		The respective electric fuel pump has been automatically turned on	

EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
FUEL QUANTITY FAULT	TO/LAND	The left or right channel has detected a fault or loss of temperature compensation	
FUEL XFER FAIL	TO/LAND	The fuel transfer valve has failed	
L (R) ENG FUEL SOV CLOSED		Respective engine fuel shutoff valve is closed	
FUEL BALANCED	TO/LAND	The fuel is balanced within 100 lb with the FUEL XFER valve open	
FUEL GRAV XFLOW OPEN		Wing fuel gravity crossflow valve is open	
L (R) FUEL PUMP OFF		The respective fuel pump is OFF	
L (R) FUEL PUMP ON		The respective fuel pump is ON	
FUEL XFER OPEN		The fuel transfer valve is open	