CHAPTER 13 – FUEL SYSTEM

LIST OF ILLUSTRATIONS

1. INTRODUCTION

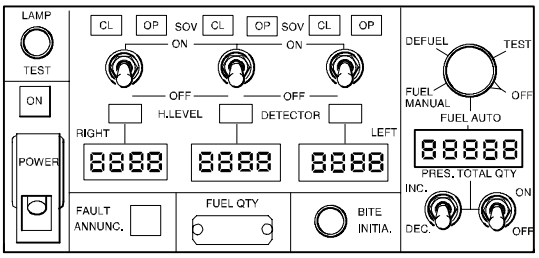
The fuel system consists of three integral tanks within the wing box structure. Ejectors and electrical boost pumps supply fuel to each engine. An independent system provides fuel to the auxiliary power unit (APU). The fuel system also provides facilities for pressure refueling/defueling and gravity refueling/defueling. Power and gravity crossflow systems allow fuel transfer between wing tanks.

A fuel quantity gauging computer (FQGC) automatically controls refueling, powered fuel crossflow and fuel transfer. The FQGC also measures the fuel quantity and temperature for display on the EICAS.

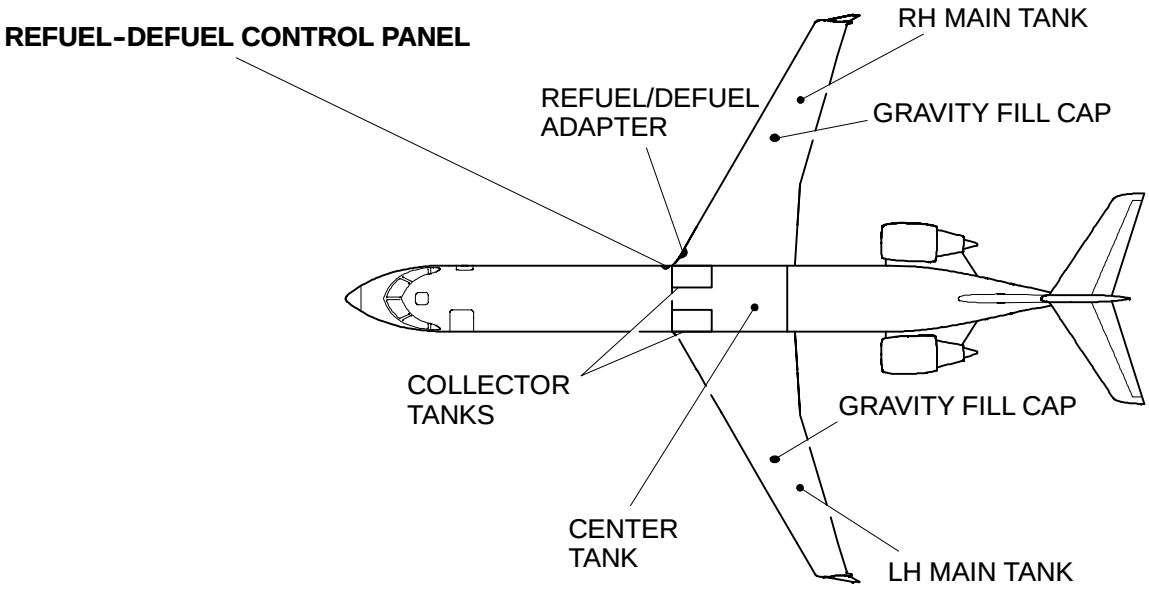
The engine indication and crew alerting system (EICAS) shows a diagram of the fuel distribution system. The operation of the ejectors, pumps and shut off valves are graphically indicated and the resulting fuel flow is depicted. Any fault detected by the fuel quantity gauging computer is annunciated in the form of a visual message.

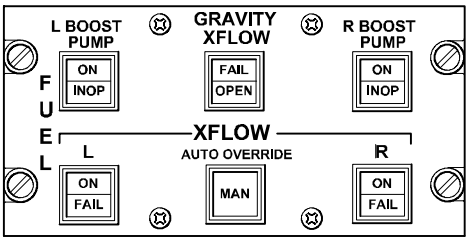
A. Fuel Tank Quantities

LOCATION	USABLE FUEL	UNUSABLE FUEL	TOTAL FUEL
Left Main Tank	7,493 LB (3,399 Kg)	62 LB (28 Kg)	7,554 LB (3,427 Kg)
Right Main Tank	7,493 LB (3,399 Kg)	62 LB (28 Kg)	7,554 LB (3,427 Kg)
Center Tank	4,610 LB (2,091 Kg)	32 LB (14 Kg)	4,642 LB (2,106 Kg)



REFUEL-DEFUEL CONTROL PANEL





FLIGHT COMPARTMENT
FUEL CONTROL PANEL

Fuel System – General
Figure 13–10–1

1. FUEL STORAGE

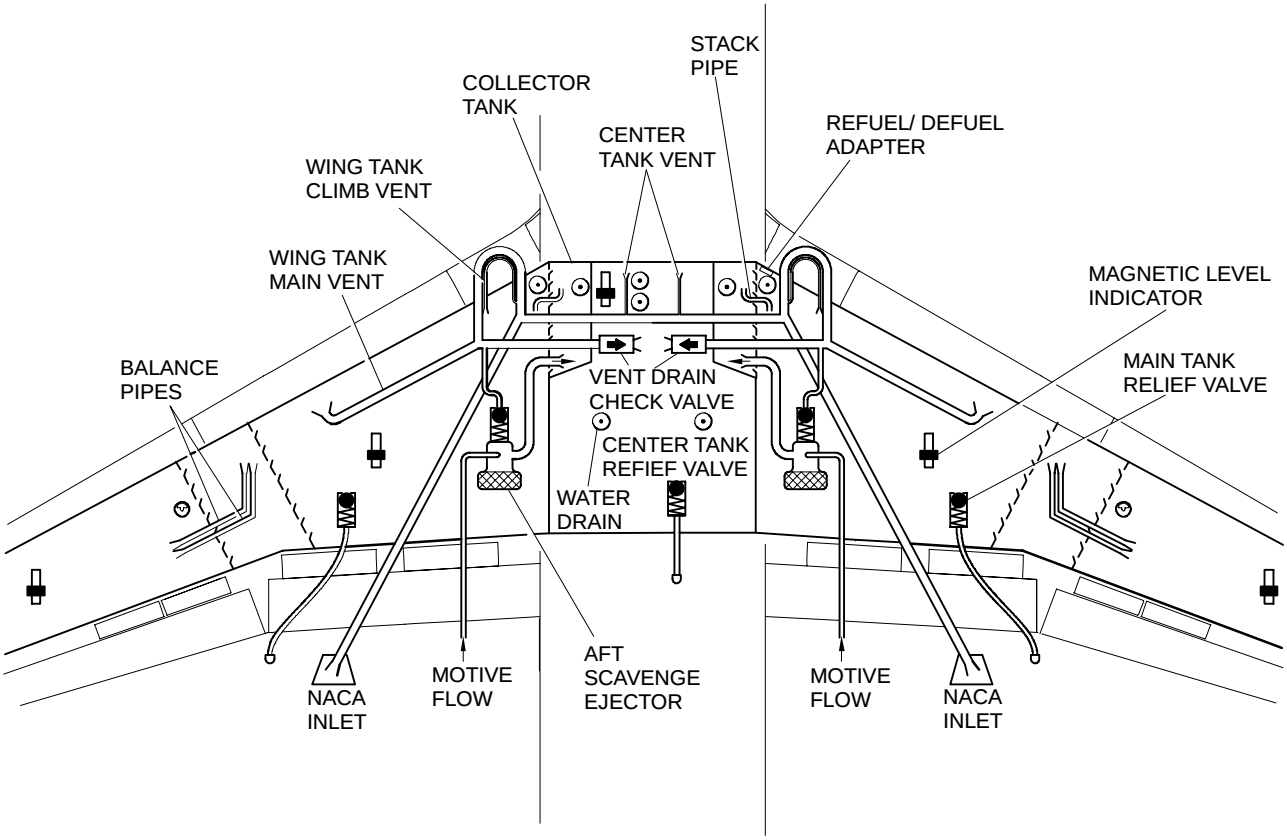
Fuel is stored in two main wing tanks and one center wing tank. For extended range flights fuel is carried in the center tank. In flight, as the wing tank fuel quantity decreases, the FQGC will automatically transfer fuel from the center tank to the wing tanks to maintain lateral balance.

A. Collector Tanks

Two collector tanks are located in the forward section of the center wing tank. Fuel from each wing tank is fed under pressure to its respective collector tank by scavenge ejectors. Fuel can also be fed from the wing tanks to the associated collector tank by gravity. There is no migration of fuel from the center tank into the collector tanks.

B. Venting

The tanks are vented to atmosphere and slightly pressurized by a NACA scoop located on the lower surface of each wing. A climb vent provides ventilation when the airplane is in a nose up attitude. Relief valves eliminate the possibility of pressure build up within the tanks.



Storage and Vent System
Figure 13–20–1

1. FUEL MANAGEMENT

Fuel management is accomplished by fuel transfer from the centre tank to the wing tanks and by fuel crossflow from one wing tank to the other wing tank.

A. Fuel Transfer

Fuel transfer from the centre tank to the wing tanks is provided by transfer ejectors. The ejectors are powered by fuel pressure tapped from the engine supply lines and automatically controlled by transfer shutoff valves. The fuel quantity gauging computer (FQGC) commands the transfer shutoff valve to open when the associated wing tank fuel quantity falls to 93% and commands it to close when the quantity reaches 97%. The FQGC will cycle the transfer system on and off until the centre tank is empty.

In the event of wing tank gauging failure, the fuel quantity gauging computer will use the high level sensors, located at the top of each tank, to control fuel transfer operations.

B. Fuel Crossflow

Powered and gravity crossflow allows fuel transfer between the wing tanks to correct fuel imbalance and to mantain lateral stability. Crossflow operations are controlled and monitored through the fuel control panel located on the overhead panel.

A pump located within the centre tank provides powered crossflow in either automatic or manual mode.

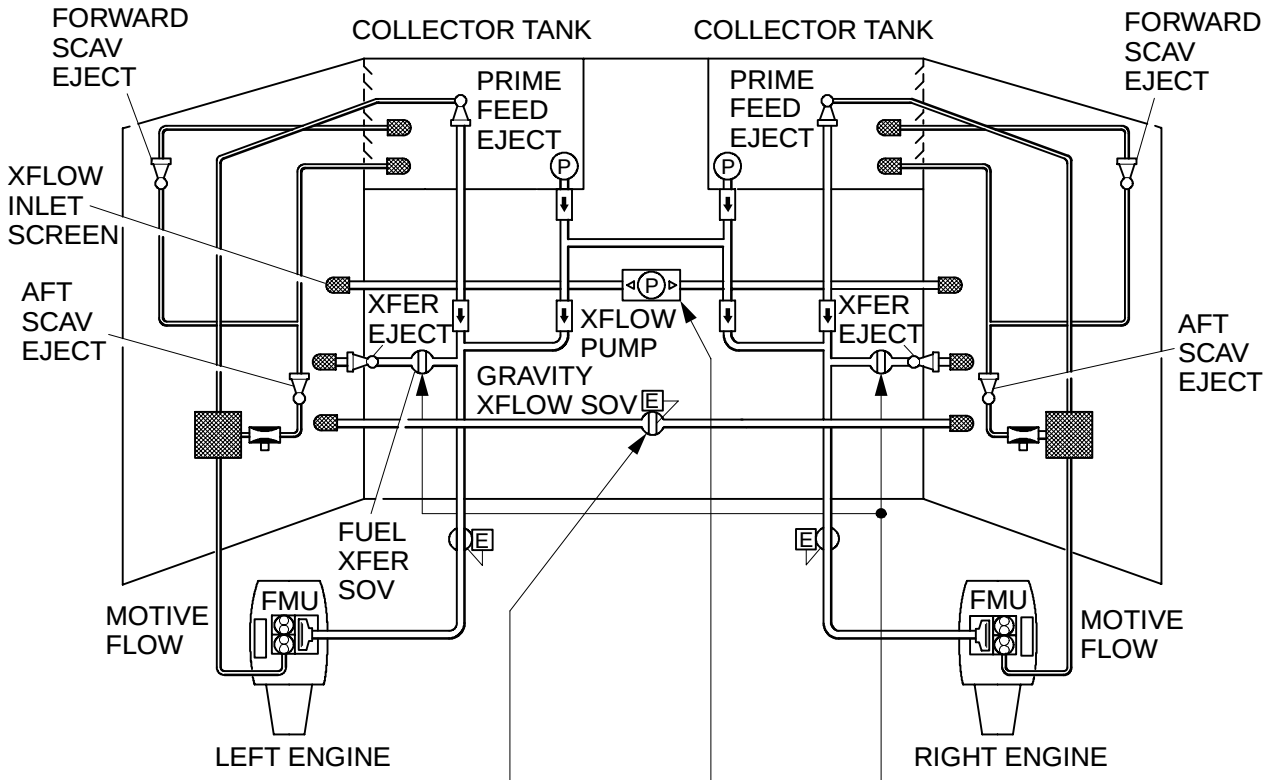
In automatic mode, the fuel quantity gauging computer controls the power crossflow. If the computer detects a fuel imbalance between the wing tanks, the crossflow pump is activated automatically in the required direction to correct the fuel imbalance.

The flight crew can control powered crossflow in manual mode by overriding automatic crossflow. In manual mode, fuel flow can be selected in either direction by selecting the direction of the crossflow pump motor.

If the powered crossflow system fails, the flight crew can open the gravity crossflow shutoff valve to allow fuel transfer by gravity between wing tanks. Gravity crossflow can be enhanced by using a sideslip maneuver.

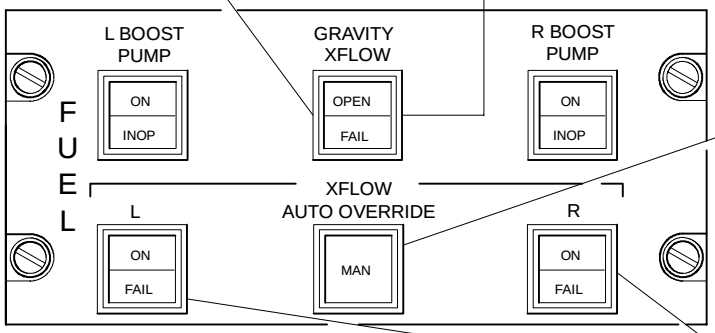
NOTE

If crossflow operations is being carried out in manual mode (Auto Override selected), only the required L or R XFLOW switchlight should be selected, not both. If both XFLOW switches are selected, power will be removed from the crossflow pump and the XFLOW PUMP caution message will come on. Also, both XFLOW FAIL switchlights will illuminate. The manual crossflow function will be inhibited until one of the XFLOW switches is deselected or the AUTO OVERRIDE switchlight is deselected.



FUEL QUANTITY GAUGING COMPUTER

GRAVITY XFLOW
Used to control gravity crossflow.
- OPEN (white) light indicates gravity crossflow is selected on.
- FAIL (amber) light indicates that the gravity crossflow shut-off valve is not in the selected position.



XFLOW AUTO OVERRIDE
Used to override automatic powered crossflow.
- MAN (white) light indicates manual powered crossflow is armed.

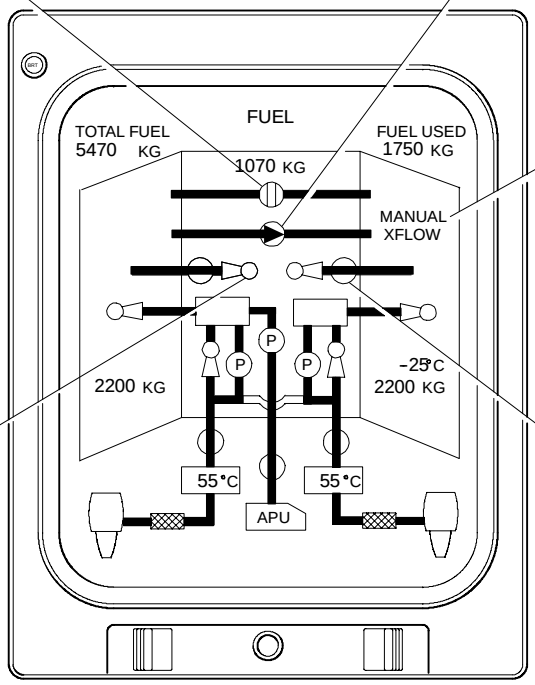
L and R XFLOW
Used to control powered crossflow in manual mode.
- ON (white) light indicates powered crossflow is operating in the indicated direction.
- FAIL (amber) light indicates that powered crossflow has failed.

Fuel Control Panel
Overhead Panel

Fuel Transfer and Crossflow System
Figure 13–30–1

Gravity Crossflow Valve
Position Indicator
- open (white)
- closed (white)
- failed to attain commanded position (white)
- invalid data (half-intensity magenta)

Powered Crossflow Pump
- White – Pump is off.
- Green – Pump is operating. Arrow indicates flow direction.
- Amber – Pump has failed.
- Half Intensity Magenta – Invalid data.



Fuel Page

MANUAL XFLOW (white)
Indicates that manual crossflow has been selected.

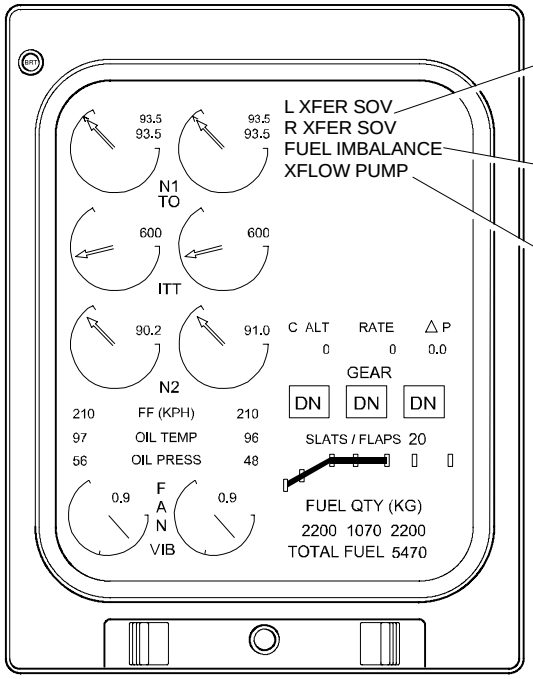
AUTO BAL INHIB (white)
Indicates that powered crossflow is inhibited in automatic mode.

Transfer Ejectors
- White – Center tank is empty or respective transfer shut-off valve is closed or respective engine not running.
- Green – Ejector operating at normal pressure with fuel in center tank.
- Amber – Low pressure at respective transfer ejector with respective engine running.
- Half Intensity Magenta – Invalid data.

Transfer Shut-off Valve
Position Indicators
- open (white)
- closed (white)
- invalid data (half-intensity magenta)

Valve outline will turn amber if valve fails to attain commanded position.

Fuel – EICAS – Synoptic Page <1001>
Figure 13–30–2



L or R XFER SOV caution (amber)
Indicates that respective transfer shut-off has failed.

FUEL IMBALANCE caution (amber)
Indicates that a fuel quantity imbalance exists between left and right wing tanks.

XFLOW PUMP caution (amber)
Indicates that the crossflow pump has failed.

Primary Page

GRAV XFLOW OPEN advisory (green)
Indicates that gravity crossflow shut-off valve is open.

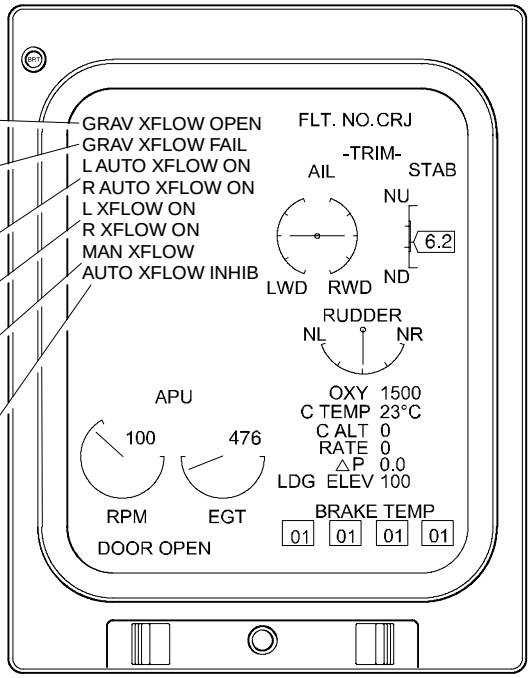
GRAV XFLOW FAIL status (white)
Indicates that gravity crossflow shut-off valve is not in selected position.

L or R AUTO XFLOW ON status (white)
Indicates that automatic powered crossflow is operating on the respective side.

L or R XFLOW ON status (white)
Indicates that crossflow shut-off valve has been manually selected open.

MAN XFLOW status (white)
Indicates that manual crossflow has been selected.

AUTO XFLOW INHIB status (white)
Indicates that powered crossflow is inhibited in automatic mode.



Status Page

Fuel System – EICAS Indications <1001>
Figure 13–30–3

C. System Circuit Breakers

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Fuel Management	Transfer	L XFER FUEL SOV	BATTERY BUS	1	N9	
		R XFER FUEL SOV		2	P8	
	Gravity Crossflow	FUEL GRAVITY XFLOW		1	N8	
	Powered Crossflow	CROSSFLOW PUMP	AC ESSENTIAL		S5	
		CROSSFLOW PUMP CONT	DC ESSENTIAL	2	R7	

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1. FUEL DISTRIBUTION

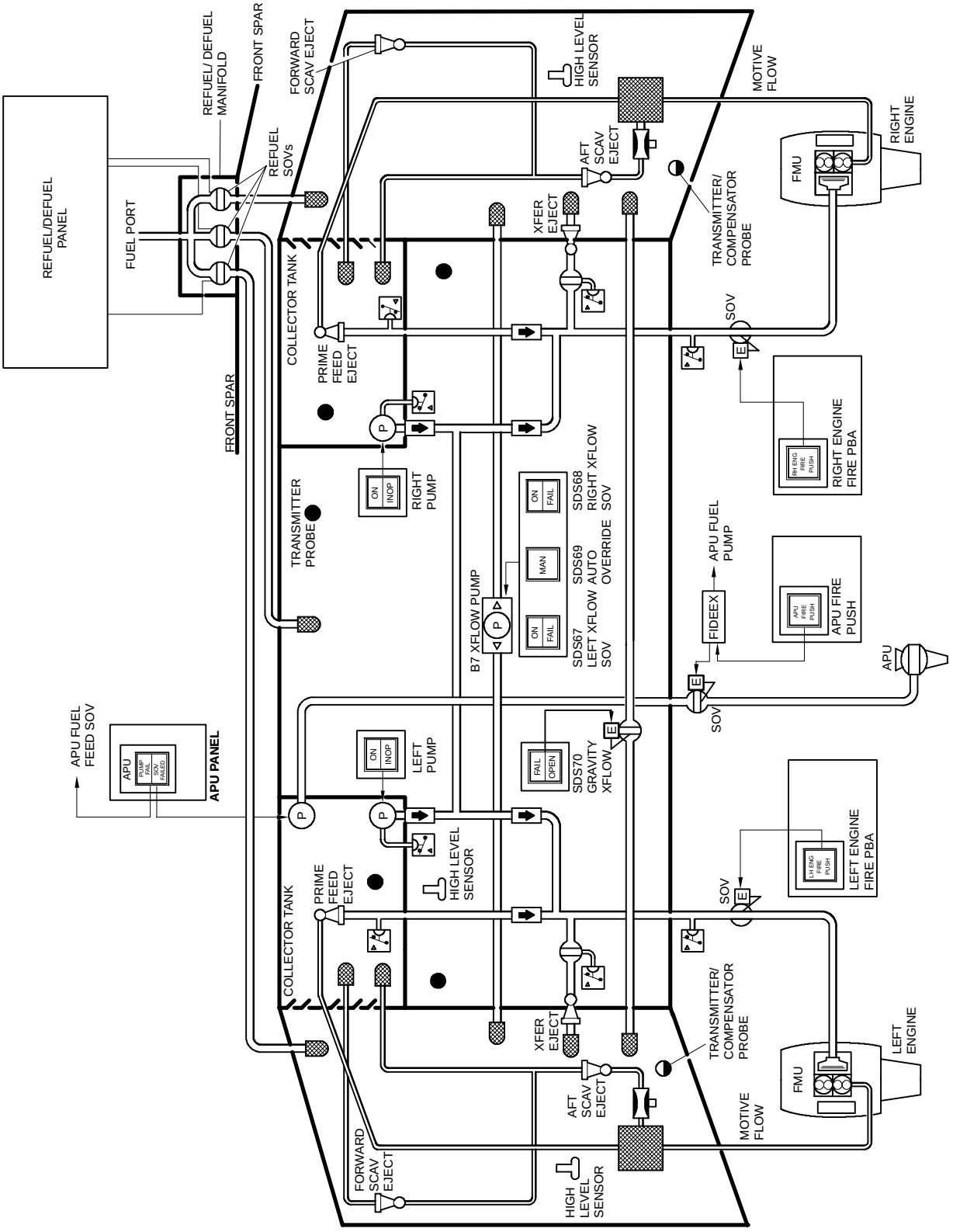
Fuel is distributed to each engine from a respective side collector tank which is an integral part of the center wing tank. Two scavenge ejectors, located at the lowest part of each wing tank, supplies fuel to each collector tank to keep it in a full condition. The collector tank is designed to maintain engine fuel feed under all normal flight and transient maneuver conditions. A main ejector, within each collector tank, supplies fuel to the respective side engine. The main and scavenge ejectors are powered by pressurized fuel tapped from the motive flow line of the respective engine fuel pump.

During engine start, a boost pump within each collector tank supplies fuel to the engines. The fuel control panel, located on the overhead panel, is used to control and monitor boost pump operation. Normally both boost pumps operate simultaneously and are capable of feeding either engine.

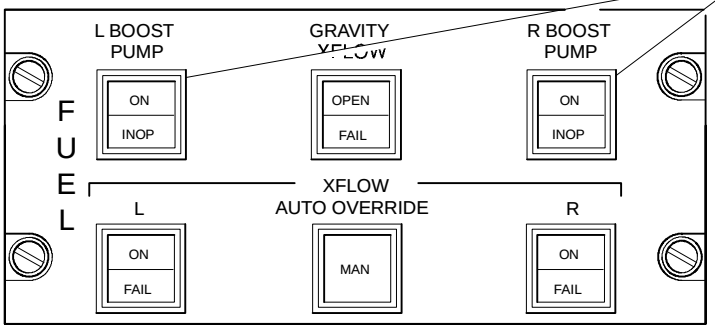
The fuel output pressure from the main ejector is monitored by a pressure switch and when the output pressure is sufficient to supply the engines, the boost pumps are automatically turned off. The boost pumps will remain in standby mode with the engines running, as a back up to the main ejectors in the event of a failure.

A dedicated fuel pump within the left collector tank supplies fuel to the APU. The APU pump is controlled by the APU control panel located on the overhead panel. In the event of fuel pump failure, the APU has suction feed capability.

In the event of a fire, fuel flow to the engine or APU is terminated by the closure of a shut-off valve when the associated fire push switchlight is selected.

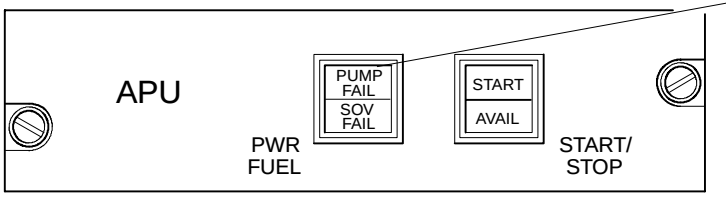


Fuel Distribution Schematic
Figure 13–40–1



Fuel Control Panel
Overhead Panel

L and R BOOST PUMP
Used to control engine boost pump.
- ON (white) light indicates boost pump is operating.
- INOP (amber) light indicates that low pump pressure exists or a pump failure has been detected.



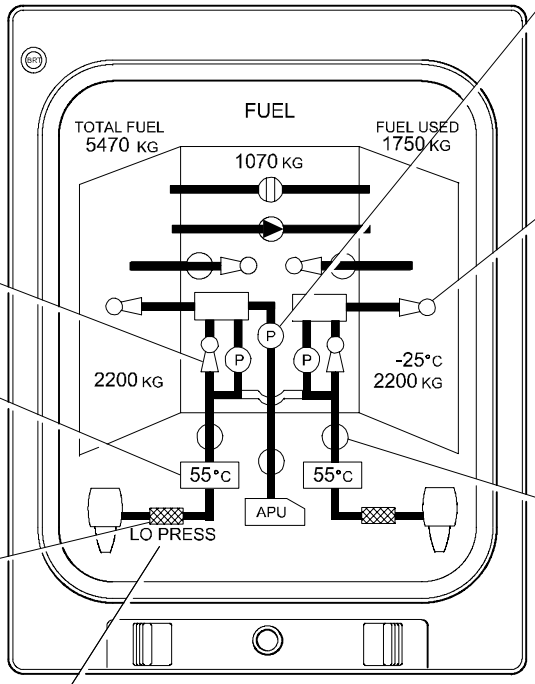
APU Control Panel
Overhead Panel

PWR FUEL
Used to control APU fuel pump.
- PUMP FAIL (amber) light Indicates that APU fuel pump has failed.
- SOV FAIL (amber) light Indicates that the APU fuel shut-off valve has failed.

Fuel Distribution – ENG and APU Control Panels
Figure 13–40–2

APU and Boost Pumps
- White – Pump is off.
- Green – Pump is operating.
- Amber – Pump has failed or has no power.
- Half Intensity Magenta – Invalid data.

Main Ejectors
- White – Engine not running.
- Green – Ejector operating at normal pressure.
- Amber – Ejector operating at low pressure with respective engine running.
- Half Intensity Magenta – Invalid data.



Fuel Page

Scavenge Ejectors
- White – Engine not running.
- Green – Ejector operating at normal pressure.
- Amber – Ejector operating at low pressure with respective engine running.
- Half Intensity Magenta – Invalid data.

Fuel Feed Temperatures
- Green - Fuel feed temperature is ≥5° C
- Amber - Fuel feed temperature is < 5° C
- Amber dashes - Invalid data (may be intermittent)

Fuel Feed Shut-off Valve Position Indicators


open (white)


closed (white)

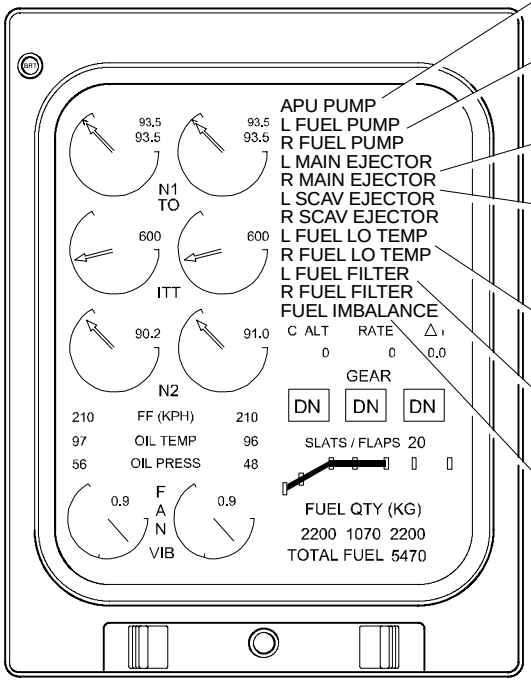

failed to attain commanded position (amber)

invalid data (half-intensity magenta)

Fuel Filters
- Green – Normal fuel flow through filter.
- Amber – Fuel pressure drop exists across respective fuel filter.
- Half Intensity Magenta – Invalid data.

LOW PRESS (amber)
Indicates that a low fuel pressure condition has been detected.

Fuel Synoptic Distribution <1001>
Figure 13–40–3



Primary Page

APU PUMP caution (amber)
Indicates that APU pump has failed.

L and R FUEL PUMP caution (amber)
Indicates that the respective engine boost pump has failed.

L and R MAIN EJECTOR caution (amber)
Indicates that a low fuel pressure condition exists at respective ejector with engine running.

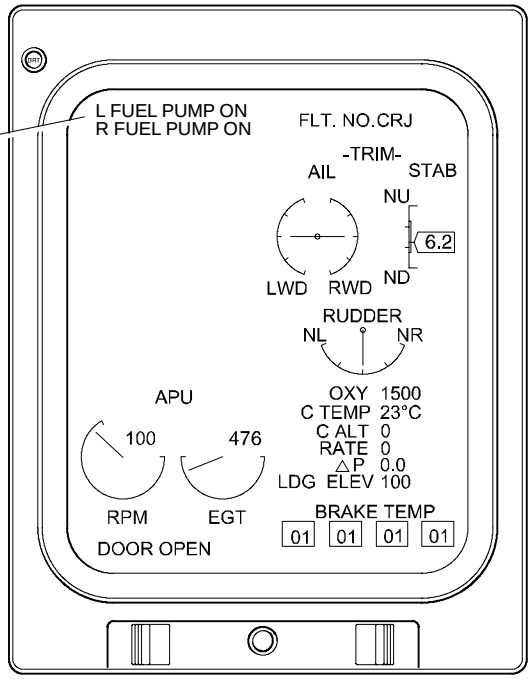
L and R SCAV EJECTOR caution (amber)
Indicates that a low fuel pressure condition exists at respective ejector with engine running or a high fuel pressure condition exists at respective ejector with engine not running.

L and R FUEL LO TEMP caution (amber)
Indicates that fuel temperature is less than 4.3° C with respective engine running.

L and R FUEL FILTER caution (amber)
Indicates that a bypass or impending bypass condition exists at respective filter.

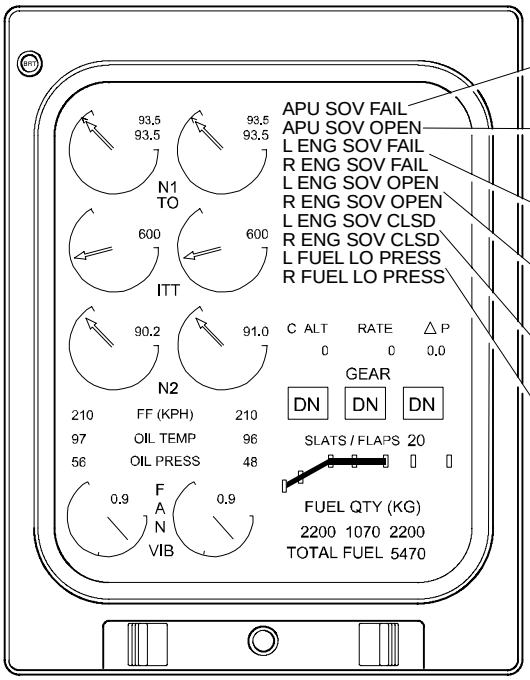
FUEL IMBALANCE caution (amber)
Indicates that fuel imbalance greater than 800 lbs is detected by the fuel computer.

L and R FUEL PUMP ON advisory (green)
Indicates that respective fuel boost pump is operating.



Status Page

Fuel System EICAS Indications <1001>
Figure 13–40–4 Sheet 1



Primary Page

APU SOV FAIL caution (amber)
Indicates that APU shut-off valve is not in commanded position.

APU SOV OPEN caution (amber)
Indicates that APU shut-off valve is open with APU ready to load and an APU fire is detected.

L and R ENG SOV FAIL caution (amber)
Indicates that respective engine fuel shut-off valve is not in commanded position.

L and R ENG SOV OPEN caution (amber)
Indicates that respective engine fuel shut-off valve is open and an engine fire is detected.

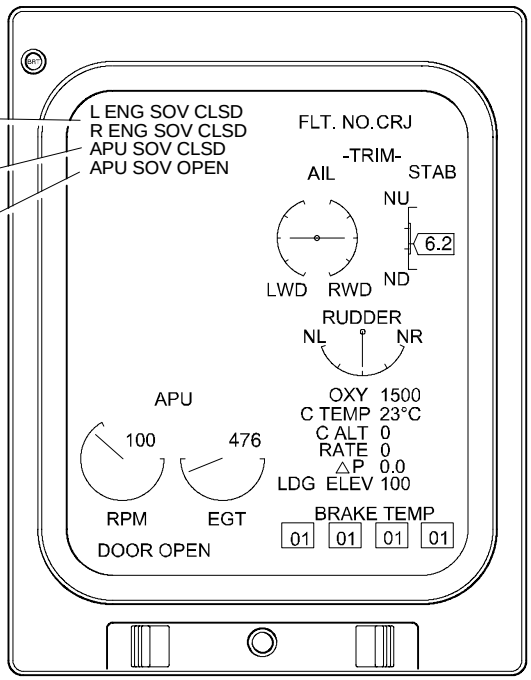
L and R ENG SOV CLSD caution (amber)
Indicates that respective engine fuel shut-off valve is closed and no engine fire is detected.

L and R FUEL LO PRESS caution (amber)
Indicates that a low fuel pressure condition exists at the respective engine inlet.

L and R ENG SOV CLSD advisory (green)
Indicates that respective engine fuel shut-off valve is closed and an engine fire is detected.

APU SOV CLSD advisory (green)
Indicates that APU shut-off valve is closed and an APU fire is detected.

APU SOV OPEN status (white)
Indicates that APU shut-off valve is open with APU not ready to load and no APU fire detected.



Status Page

Fuel System EICAS Indications <1001>
Figure 13–40–4 Sheet 2

A. System Circuit Breakers

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Fuel Distribution	Pumps	L FUEL PUMP	BATTERY BUS	1	M6	
		R FUEL PUMP	DC BUS 2	2	G9	
		APU FUEL PUMP	BATTERY BUS	1	N10	
	Pump Control	L FUEL PUMP CONT			M7	
		R FUEL PUMP CONT	DC BUS 2	2	G10	
	Shut-off Valves	FUEL SOV R ENG	DC EMERGENCY	1	R7	
		FUEL SOV L ENG			R8	
		FUEL SOV APU			R9	

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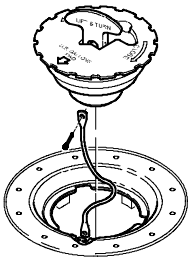
1. REFUELING AND DEFUELING

The refuel/defuel system is controlled by the Fuel Quantity and Gauging Computer (FQGC) through selection on a refuel/defuel control panel. Pressure refueling and suction defueling of the aircraft are accomplished using a refuel/defuel adapter located in the right wing, leading edge, root fairing.

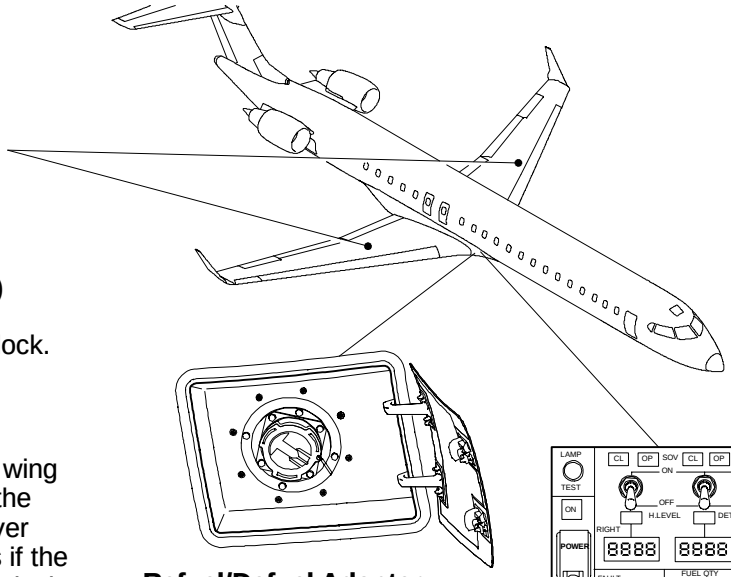
Gravity refueling is carried out through filler caps installed on the upper wing surface. The fuel quantity can be monitored using magnetic level indicators installed in the tanks. Water drain valves are installed at various low points in the tanks. The water drain valves are used to drain out any accumulated water in the tanks and to take fuel samples for testing of the fuel for contamination.



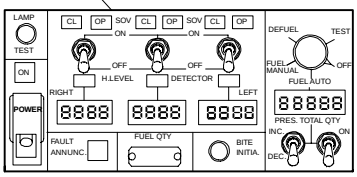
Gravity Filler Caps (2)
Lift latch and turn counterclockwise to unlock.

WARNING

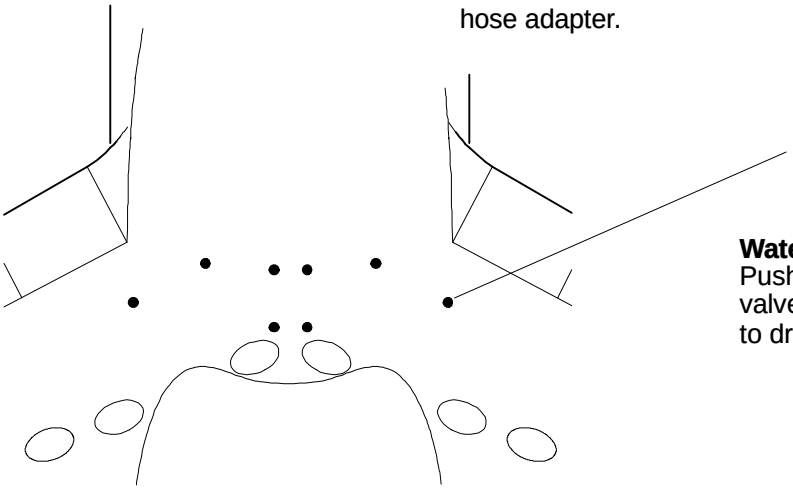
Gravity filler caps for the wing tanks are located below the maximum fuel level. Never remove gravity filler caps if the tanks are full or fuel quantity is not known.

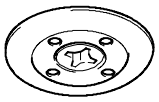


Refuel/Defuel Adapter
Remove protective cap to connect refuel/defuel hose adapter.



Refuel/Defuel Control Panel





Water Drain Valves (8)
Push and rotate water drain valve core with fuel sampler to drain fuel into fuel sampler.

BOTTOM VIEW OF WING

Refuel/ Defuel Components <2224>
Figure 13–50–1

A. Control Panel

The aircraft is fitted with a refuel/defuel control panel installed adjacent to the refuel/defuel adapter on the right wing-to-fuselage fairing. Fuel quantity indications on the panel are displayed in kilograms (kg). <1001>

The refueling operation can be initiated in automatic or manual mode. Automatic mode allows the required total aircraft fuel quantity to be preselected. In automatic mode, the fuel quantity gauging computer controls the distribution of the fuel by filling the wing tanks before allowing any excess to be loaded into the center tank. High level detectors located at the top of each tank prevent fuel tank overfilling during refueling operations by closing the refuel shut-off valves.

Refueling of individual tanks is possible in manual mode by manually opening and closing the refuel shut-off valves from the control panel.

The defuel mode is similar to the manual mode except that defueling is selected.

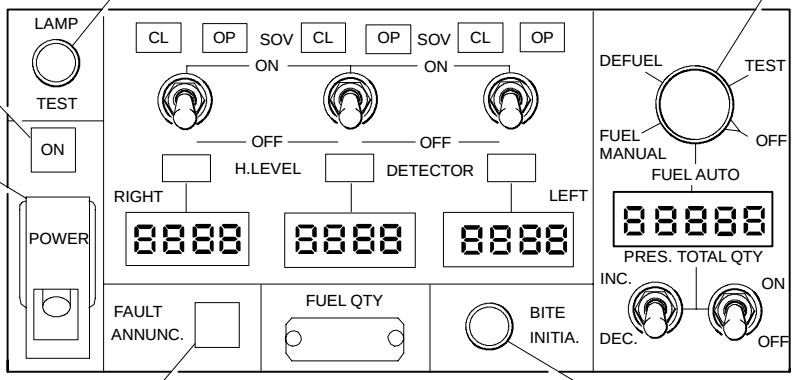
The test mode checks that the fuel quantity gauging computer, high level detectors and refuel/defuel shutoff valves are operating properly.

ON (green)
Indicates that battery bus power has been applied to the panel.

LAMP TEST
Used to test all lights and LED displays on the panel.

Mode Selector
- TEST – Verifies operation of refuel/defuel shut-off valves and high level detectors.

POWER (Guarded)
Supplies power directly from the battery bus to the control panel.



Refuel/Defuel Control Panel

FAULT ANNUNC. (amber)
Indicates that a fault exists in the refuel/defuel system.

BITE INITIA.
Used to display fault codes on the fuel quantity displays. Refer to the Airplane Maintenance Manual for code descriptions.

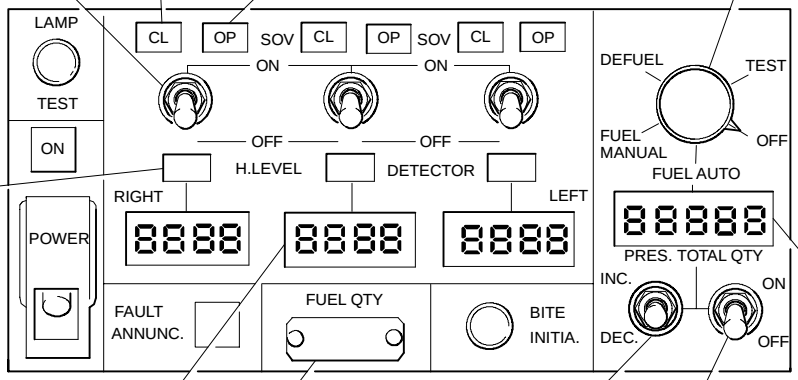
Refuel/ Defuel Control Panel
Figure 13–50–2 Sheet 1

SOV CL (green) (3)
Indicates that the respective refuel/defuel shut-off valves (SOV) are closed.

SOV OP (amber) (3)
Indicates that the respective refuel/defuel shut-off valves (SOV) are open.

Mode Selector
- FUEL AUTO – Configures refuel/defuel system for automatic refueling.
- FUEL MANUAL – Configures refuel/defuel system for manual pressure refueling.
- DEFUEL – Configures refuel/defuel system for suction defueling.
- OFF – Shuts off refuel/defuel system.

SOV switches (3)
- ON – Opens respective shut-off valve (SOV OP light comes on).
- OFF – Closes respective shut-off valve (SOV CL light comes on).



HIGH LEVEL DETECTOR (amber) (3)
Indicates that the fuel level in the respective tank has reached the full capacity.

Fuel Quantity Displays (3)
Displays the fuel quantity of the respective tank.

PRES. TOTAL QTY
Displays the fuel quantity target for automatic refueling.

Unit of Measure Label
Indicates the unit of measure for the fuel quantity displays.

ON / OFF
Used to start and stop automatic refueling.

INC. / DEC.
(spring loaded to center)
Used to increase and decrease the preselected total fuel quantity for automatic refueling.

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Refuel/ Defuel Control Panel
Figure 13–50–2 Sheet 2

B. System Circuit Breakers

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Refueling and Defueling	Refuel	EMER REFL	APU BATT DIRECT BUS	5	B5	
	Defuel	FUEL DEFL			B4	

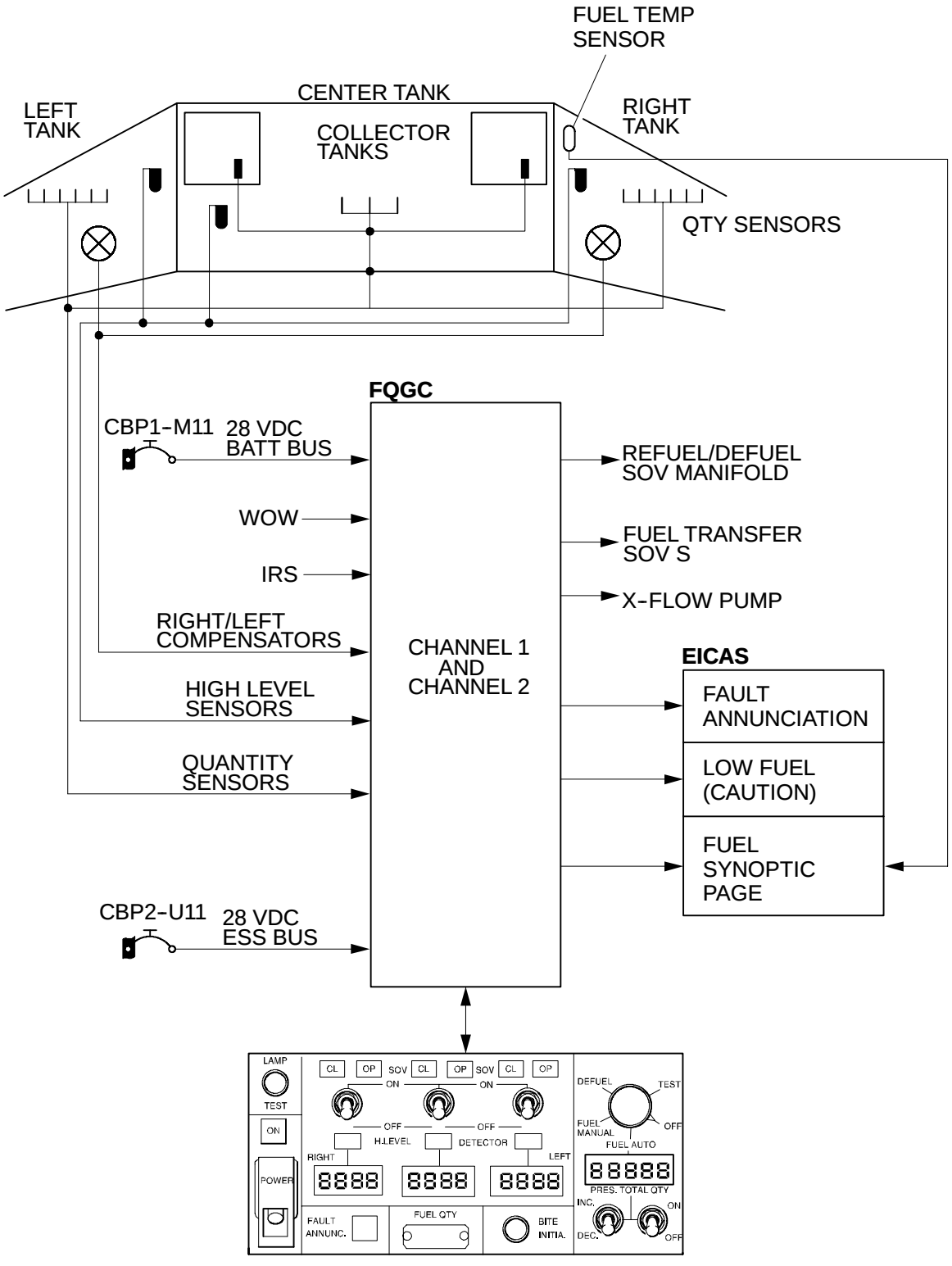
1. FUEL QUANTITY GAUGING

A fuel quantity gauging computer monitors and controls the operation of the fuel system. The computer uses information from the fuel system to calculate the fuel quantity.

Fuel quantity is measured using fuel probes which provide a signal directly proportional to fuel level. There are 6 probes in each wing tank, 1 in each collector tank and 3 in the centre tank. A compensator probe in the bottom of each wing tank supplies data to compute the fuel density correction. The temperature of the fuel is continuously monitored by a fuel temperature sensor installed in the right wing tank.

Fuel quantity gauging is calibrated for both ground and flight operations. The computer receives weight-on-wheel signals to determine if the aircraft is on the ground or in flight. In flight, the computer takes into account the effects of wing deflection and aircraft attitude on the fuel quantity measurement.

Corrected individual tank quantities, total fuel quantity, fuel used quantity and fuel temperature are displayed on the Engine Indication and Crew Alerting System (EICAS) as well as any fault detected in the fuel quantity gauging computer.

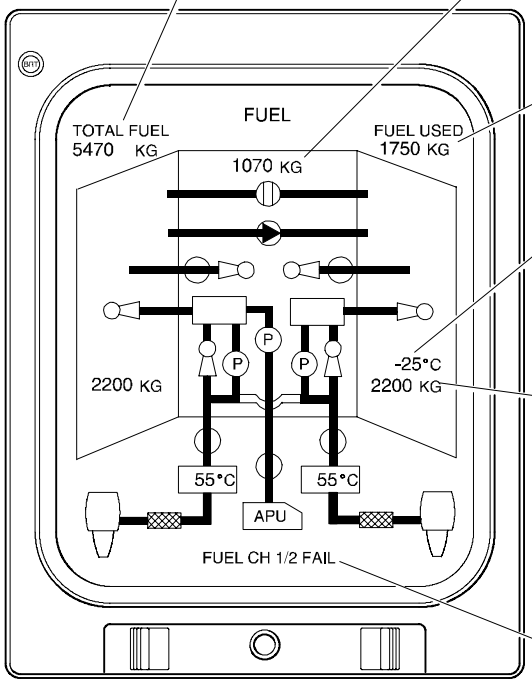


Fuel Quantity System – Schematic <1025>
Figure 13–60–1

TOTAL FUEL
Displays total fuel quantity of all tanks (in 5 kg increments).
- Green - Total fuel quantity is > 408 kg.
- Amber - Total fuel quantity is < 408 kg.

Center Tank Fuel Quantity
Displays fuel quantity of center tank (in 5 kg increments).
- Green - Fuel quantity is > 5 kg.
- White - Fuel quantity is < 5 kg.

FUEL USED (white)
Displays amount of fuel used (in 5 kg increments). Reset to zero through the EICAS MENU page.



Fuel Page

Bulk Fuel Temperature
- Green - Temperature of fuel in right wing tank is -40 °C or greater.
- Amber - Temperature of fuel in right wing tank is less than -40 °C.

Left and RIght Tank Fuel QuantIty
Displays fuel quantity of respective tank (in 5 kg increments).
- Green - Fuel imbalance between left and right tanks is within limits, respective tank quantity is > 204 kg and total fuel quantity is > 408 kg.
- Amber - Fuel imbalance between left and right tanks exceeds limits, or respective tank quantity is < 204 kg or total fuel quantity is < 408 kg.

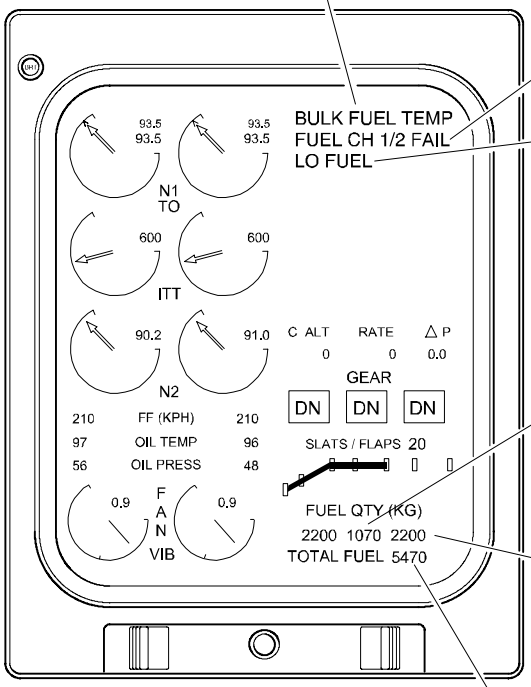
FUEL CH 1 or 2 FAIL (white)
Indicates that respective channel of fuel quantity gauging computer has failed.
FUEL CH 1/2 FAIL (amber)
Indicates that both channels of fuel quantity gauging computer have failed.

Fuel System Synoptic Page – Gauging <1001>
Figure 13–60–2

BULK FUEL TEMP caution (amber)
Indicates that fuel temperature in left wing tank is less than -40 °C.

FUEL CH 1/2 FAIL caution (amber)
Indicates that fuel quantity gauging computer has failed.

LO FUEL caution (amber)
Indicates the following:
- Fuel quantity in either tank is < 272 kg or
- Total fuel quantity is < 544 kg or
- Quantity in both collector cells is low.



Primary Page

FUEL QTY (center tank)
Displays fuel quantity of center tank (in 5 kg increments).
- Green - Fuel quantity is > 5 kg.
- White - Fuel quantity is < 5 kg.

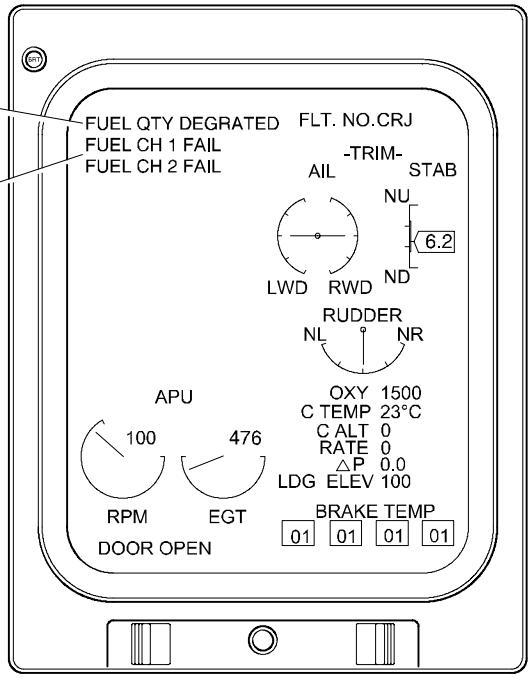
FUEL QTY (left and right tank)
Displays fuel quantity of respective tank (in 5 kg increments).
- Green - Fuel imbalance between left and right tanks is within limits and respective tank quantity is > 204 kg and total fuel quantity is > 408 kg.
- Amber - Fuel imbalance between left and right tanks exceeds limits or respective tank quantity is < 204 kg or total fuel quantity is < 408 kg.

TOTAL FUEL
Displays total fuel quantity of all tanks (in 5 kg increments).
- Green - Total fuel quantity is > 408 kg.
- Amber - Total fuel quantity is < 408 kg.

Fuel System Gauging EICAS Indications – Primary Page <1001>
Figure 13–60–3

FUEL QTY DEGRADED status (white)
Indicates an error in the attitude input to the fuel quantity gauging computer.

FUEL CH 1 or 2 FAIL status (white)
Indicates that respective channel of fuel quantity gauging computer has failed.



Status Page

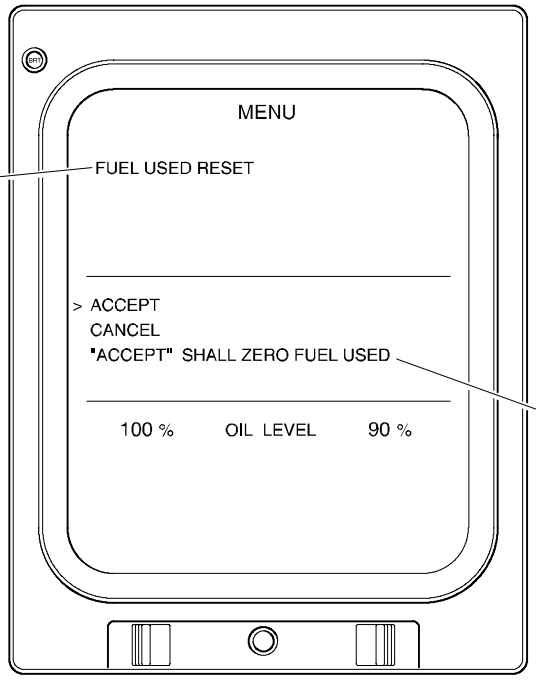
Fuel System Gauging EICAS Indications – Status Page
Figure 13–60–4

FUEL USED RESET

- Accessed through UP/DN keys on EICAS control panel.
- Cursor will go to ACCEPT line and prompt message will appear.
- SEL switch on EICAS control panel is used to confirm selection.

NOTE

1. CANCEL line used to cancel change (not reset fuel used).
2. Fuel synoptic page will display reset value.
3. Fuel used reset through Menu page does not update FMS.



Data Entry Message
Comes on when the cursor goes to the ACCEPT line after selection of the FUEL USED RESET line.

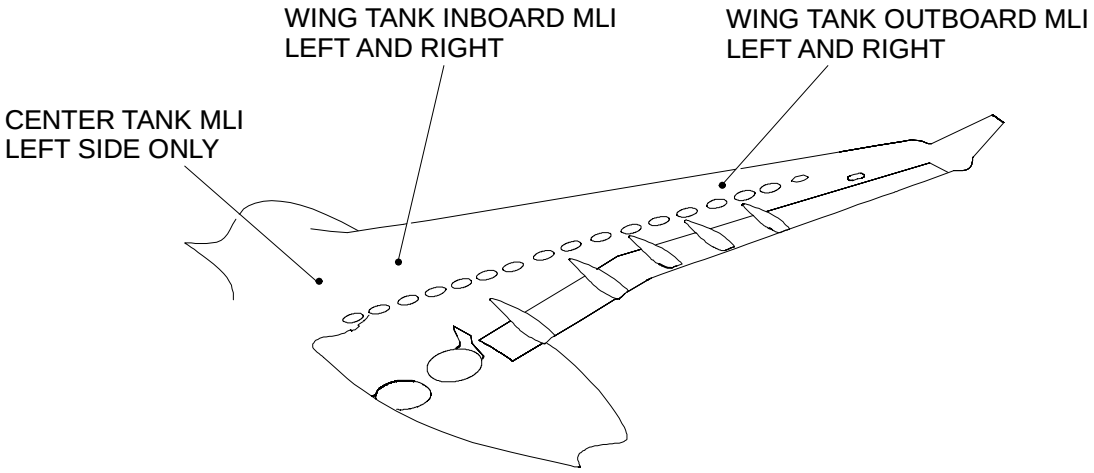
Menu Page

Fuel System – Menu Page
Figure 13–60–5

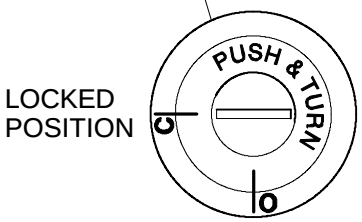
A. Magnetic Level Indicators

Two magnetic level indicators (MLIs) are installed in each wing tank and one is installed in the center tank.The MLIs are located under the wing and are used to manually check the fuel level in each tank.

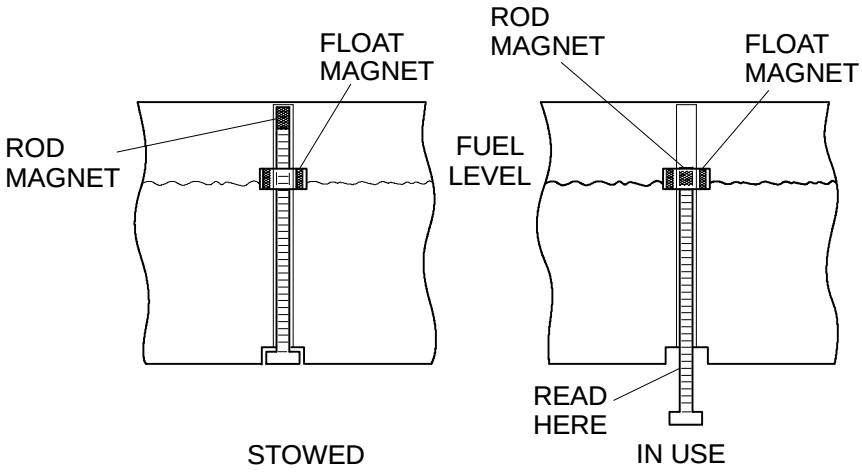
To make sure that the MLI readings are acurate, the airplane must be level. Pitch and roll inclinometers are provided on the right flight compartment bulkhead to verify that the airplane is level. After the MLI readings are taken they are then converted to units of fuel quantity using tabulated charts contained in FCOM 2, Supplementary Procedures.



Magnetic Level Indicators (MLI) (5)
Push and rotate MLI core with a screwdriver to the unlocked position to deploy.



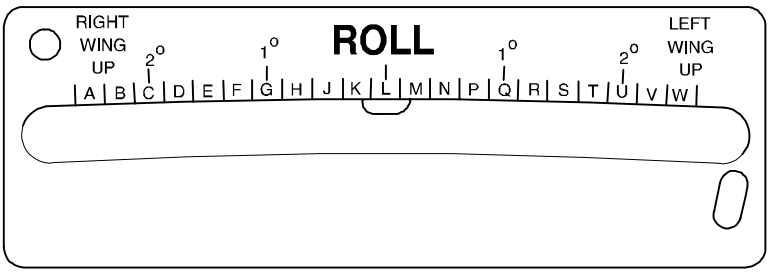
VIEW LOOKING UP WITH THE MLI LOCKED IN THE CLOSED POSITION



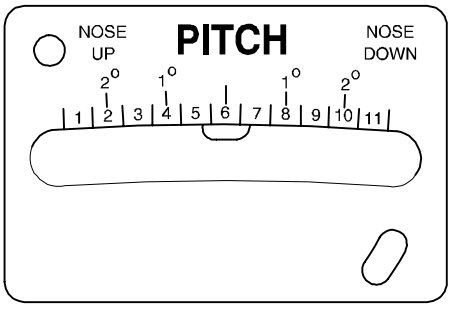
NOTE

For MLI readings conversion, refer to FCOM Vol. 2, SUPPLEMENTARY PROCEDURES, FUEL SYSTEM.

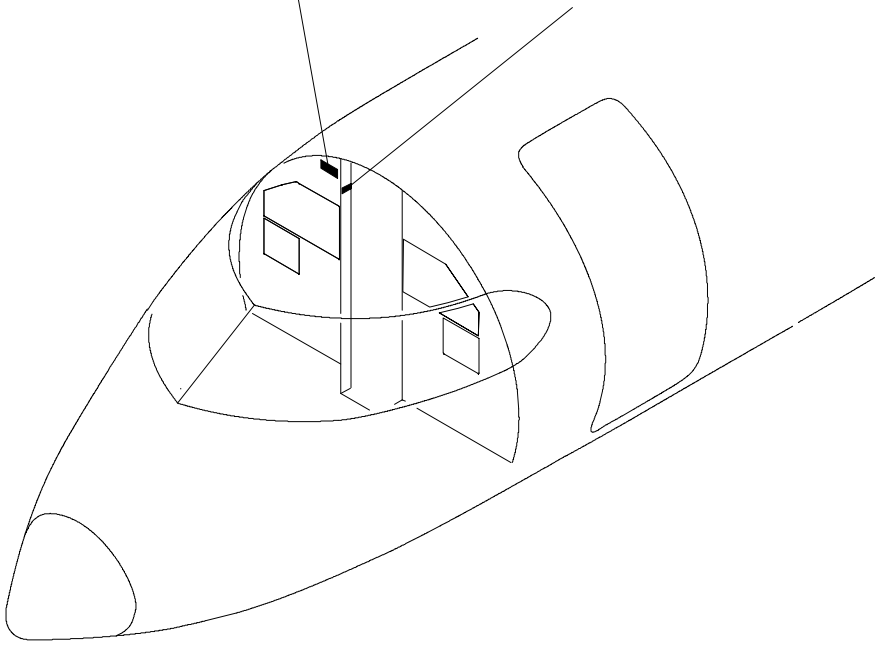
Magnetic Level Indicators
Figure 13–60–6



ROLL INCLINOMETER



PITCH INCLINOMETER



Pitch and Roll Inclinometers
Figure 13–60–7

B. System Circuit Breakers

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Fuel Quantity Gauging	Control	FUEL SYST CONT	BATTERY BUS	1	M11	
		FUEL SYST CONT	DC ESSENTIAL	2	U11	