ACRONYMS

APU	Auxilary Power Unit
BP	Booster Pump
CAS	Crew Alerting System
CB	Circuit Breaker
CCD	Cursor Control Device
CG	Center of Gravity
ECP	Emergency Control Panel
FCP	Fire Control Panel
FLCU	Fuel Level Control Unit
FMS	Flight Management System
FQMC	Fuel Quantity Management Computer
FQ	Fuel Quantity
FQMS	Fuel Quantity Management System
FR	Fuel Remaining
Fuel SOV	Fuel Shut Off Valve
IRS	Inertial Reference System
LP	Low Pressure
OP	Overhead Panel
PCB	Print Circuit Board
PDU	Primary Display Unit
POF	Phase Of Flight
PPH	Pound Per Hour
RCP	Refueling Control Panel
SSPC	Solid State Power Controller

INTRODUCTION

Fuel system provides engines and APU with pressurized fuel.

It is composed of three independent groups of fuel tanks that feed, in normal operation, their respective engine and the APU:

- TANK 1 (Left group of fuel tanks): feeds engine 1,
- TANK 2 (Center group of fuel tanks): feeds engine 2 and the APU,
- TANK 3 (Right group of fuel tanks): feeds engine 3.

Total usable fuel quantity is 31, 940 lb. / 14, 488 kg / 4, 766 USG / 18, 042 l (with fuel density of 6.7 lb. per USG / 0.803 kg / l).

Two booster pumps per TANK and bleed air pressurization are used to supply fuel to the three engines and APU.

A Fuel Quantity Management Computer (FQMC), and dedicated circuit boards provide fuel monitoring and fuel management.

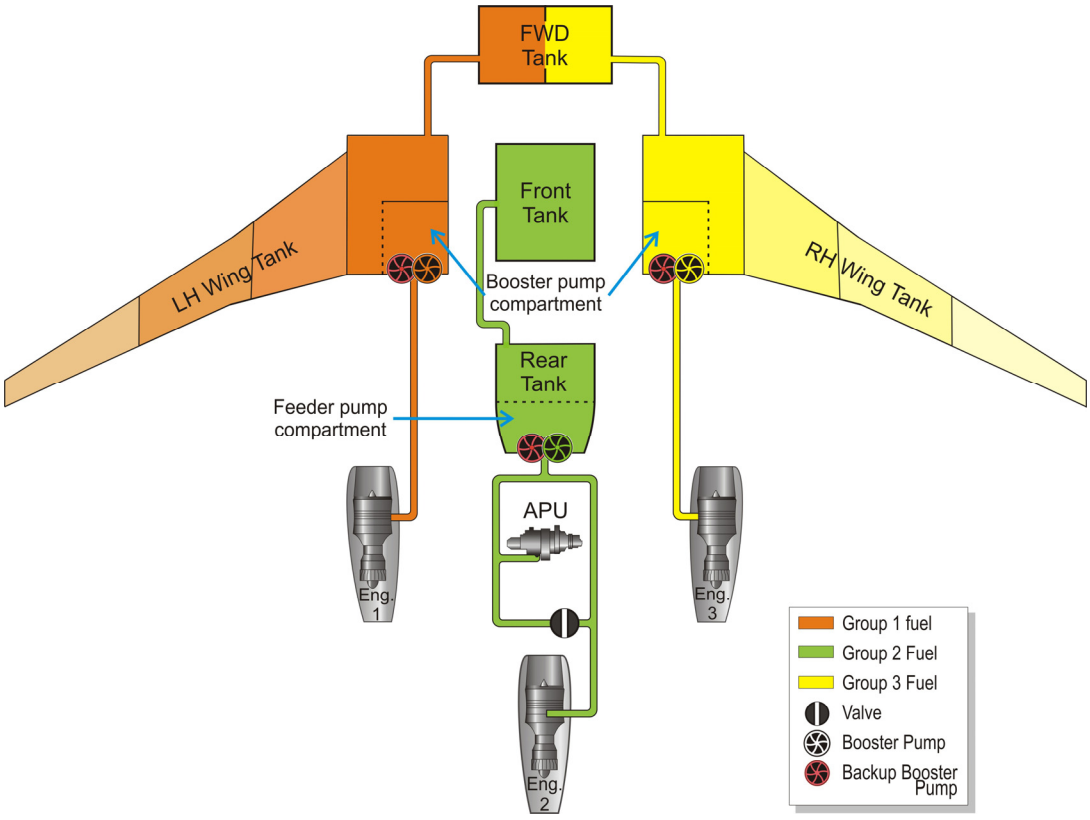


FIGURE 02-28-05-00 - FUEL PRINCIPLE DIAGRAM

FLIGHT DECK OVERVIEW

CONTROLS

Crew control of the Fuel system is performed

- Primarily via the FUEL section of the overhead panel (OP),
- Via the Emergency Control Panel in the very improbable case of engine rotor burst,
- Via the Fire Control Panel in case of engine Fire.

INDICATIONS

Crew indications with regard to Fuel system are located in:

- The HSI window of the PDU for recapitulative of Fuel Quantity and Fuel remaining,
- The ENG-TRM window of the PDU for Fuel Used and Fuel Quantity of each TANK
- The FUEL synoptic,
- The ENG-CAS window for CAS messages and white configuration message,
- The STATus synoptic / FAULT tab for fault messages.

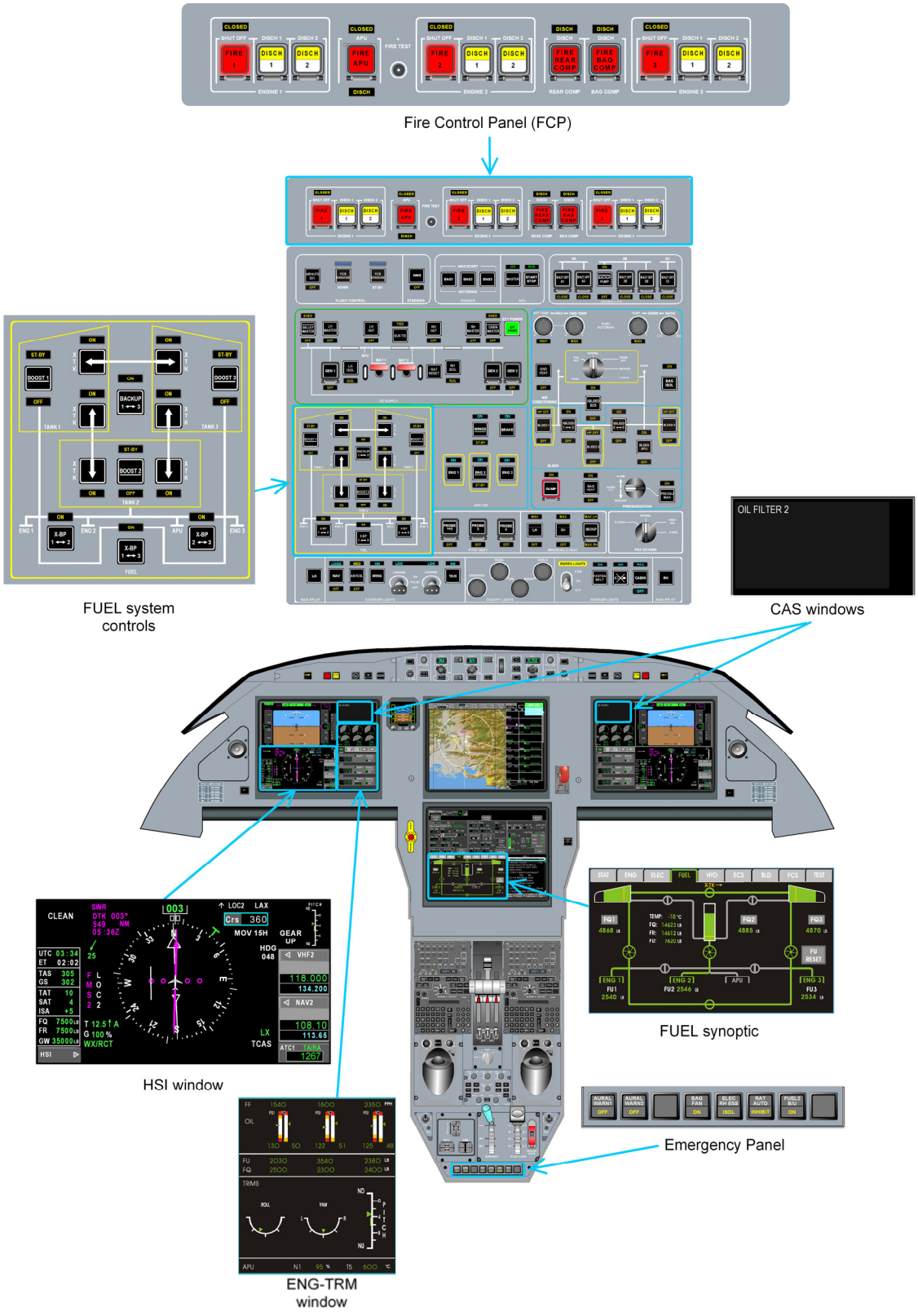


FIGURE 02-28-05-01 - FLIGHT DECK OVERVIEW

GENERAL

The Fuel system provides following main functions:

- Refueling and defueling (the airplane may be pressure or gravity refueled or de-fueled),
- Fuel storage and monitoring,
- Fuel tanks pressurization,
- Fuel distribution to the three engines and APU.

➢ *Refer to "Ground Servicing" section for a description of refueling and defueling.*

FUEL STORAGE AND MONITORING

FUEL STORAGE

The fuel is contained in three tank "groups", which will be referred to as TANK:

- Group 1 & 3 tanks (TANK1 and TANK 3) are located in the wings and the fuselage,
- Group 2 tanks (TANK2) are wholly located in the fuselage.

All tanks are structural part of the airplane.

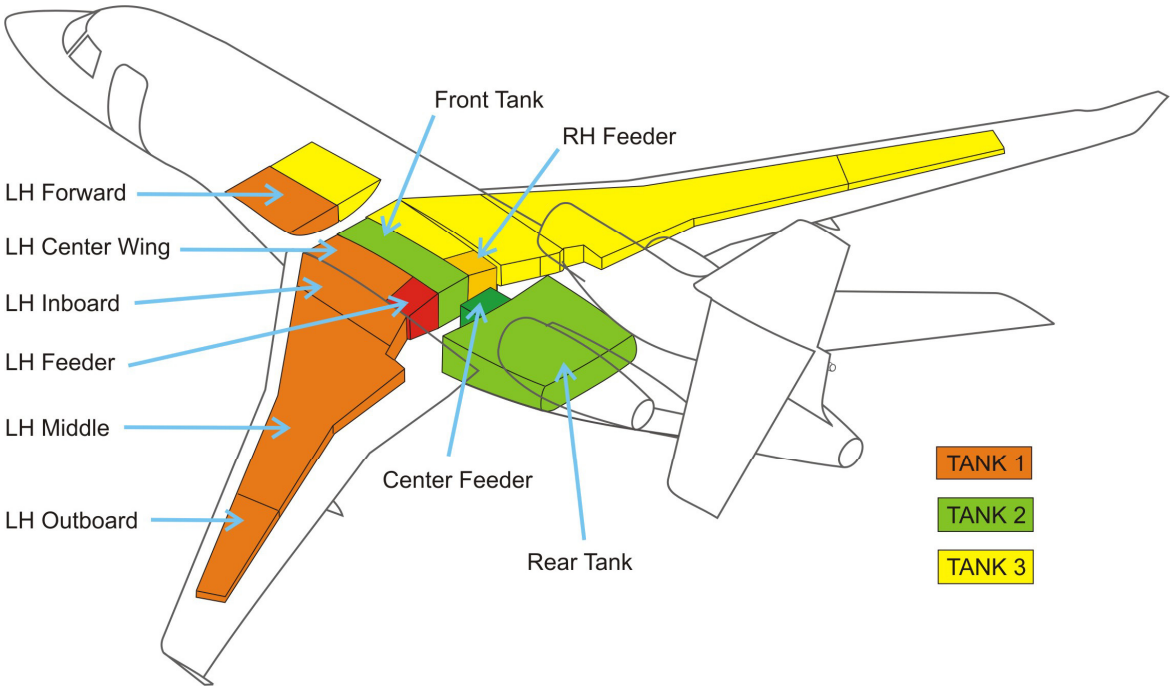


FIGURE 02-28-10-01 - TANKS REPARTITION

TANK 1 and 3

Groups 1 and 3 tanks are composed of a wing part and half of the forward fuselage tank.

- TANK 1: LH wing tanks and left fwd tank supplies engine 1,
- TANK 3: RH wing tanks and right fwd tank supplies engine 3.

Each wing tank is divided into four sections (center, inboard, middle and outboard), separated by a rib with interconnection holes at the upper part and flapper valves at the lower part.

For each group, 2 booster pumps are located in a feeder compartment separated from the wing tank by a rib with interconnection holes and flapper valves (which avoid fuel from flowing towards the wing tips during turns).

TANK 2

Fuselage group 2 tank supplies engine 2 and APU and is divided into two sections:

- The front tank, located immediately forward to the main landing gear wheels wells,
- The rear tank, located aft to the main landing gear wheel wells.

2 booster pumps are located in the feeder compartment of the rear tank. It is separated from the rest of the rear tank by a rib with interconnection holes and flapper valves.

Tank drains

There are 11 sump drains located at the low points in the tanks:

- For TANK 1 and 3: 1 under the wing, 2 under the fuselage (forward tanks),
- For TANK 2: 3 under the front tank and 2 under the rear tank.

FUEL GAUGING AND MONITORING SYSTEM

Fuel gauging and monitoring is performed by:

- The Fuel Quantity and Management Computer (2 independent channels FQMC),
- The Fuel Level Control Unit (FLCU),
- Fuel tank gauges and temperature sensors,
- Engine fuel flow meters,
- Flight Management System.

➢ *Refer to DESCRIPTION - SUPPLEMENTARY INFORMATION section for additional information on the FQMC.*

Functions performed are:

- Fuel tanks gauging,
- Fuel flow measurement,
- Fuel used computation (without APU consumption),
- Fuel remaining calculation (FMS),
- Fuel temperature measurement,
- High and low level detection ,
- Center of gravity monitoring,
- Monitoring of each valve status,
- Fuel system integrity monitoring.

In addition, channel 1 of the FQMC performs APU oil tank gauging on ground.

TANKS PRESSURIZATION

The tanks are pressurized by LP bleed air from No 1 and No 3 engines. It is available whenever engines 1 or 3 are operating without crew interaction.

The pressure is regulated at 2.9 psi.

The pressure can be read on a tank pressure gauge in the rear compartment.

- *Refer to "System Protections" section for information on Overpressure and negative pressure protections.*

DISTRIBUTION

GENERAL

In normal operation, each of the three independent TANKS (1, 2, and 3) supplies fuel to its respective engine. TANK 2 also feeds the APU during ground operation.

Two booster pumps per TANK are used for the Fuel distribution.

The normal crossfeed (X-BP) system permits any booster pump to supply pressurized fuel to any engine in the event of booster pumps failure.

The normal crosstank (X-TK) system permits to connect any tanks to another to compensate asymmetric fuel consumption. It uses the interconnection system associated to the refueling-defueling system to transfer fuel between tanks.

In case of failure of X-BP (1↔3 / 3↔1), or X-TK (1↔3 / 3↔1), backup mode (X-BP B/U or X-TK B/U) allow fuel transfer X-BP and X-TK between lateral groups.

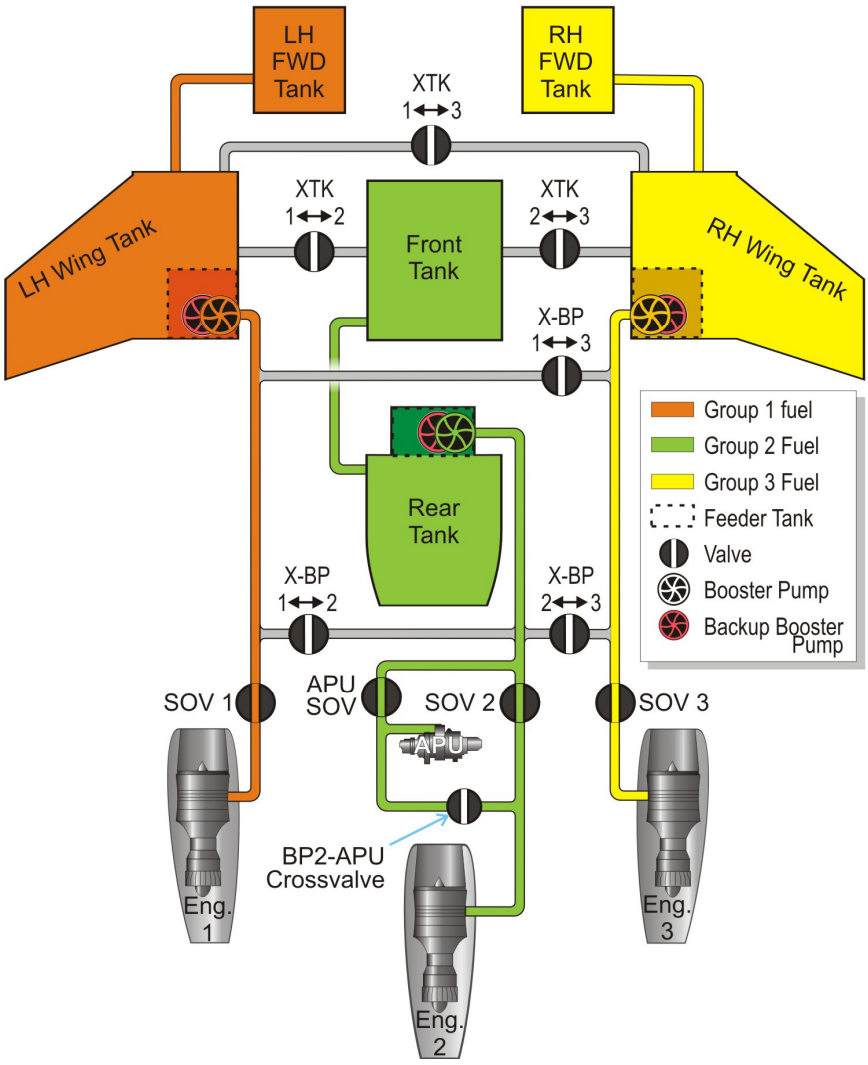


FIGURE 02-28-10-02 - FUEL DISTRIBUTION DIAGRAM

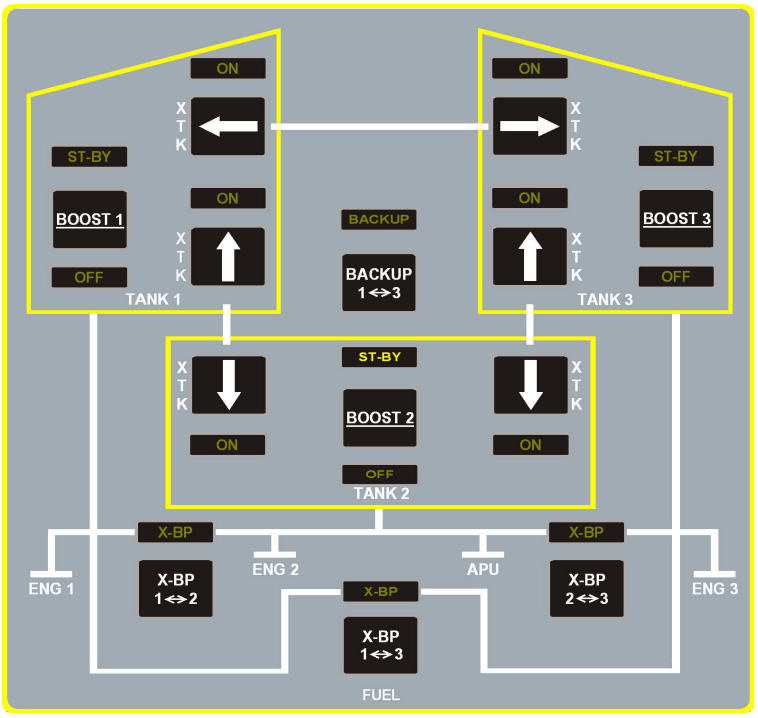


FIGURE 02-28-10-03 - FUEL SECTION OF THE OVERHEAD PANEL

BOOSTER PUMPS

Each of the three feeder tanks (or "booster pump" compartment) contains two booster pumps:

- A normal fuel Booster Pump,
- A stand-by fuel Booster Pump, which is identical to the normal booster pump.

Both pumps are used subsequently at engine start in order to ensure they both are functional:

- Engine start is performed with the stand-by pump,
- When the engine is running, the normal pump is switch on and the stand by pump is stopped.

The status of the two Booster Pumps is controlled with the “BOOST” pushbuttons on the overhead panel.

SHUT-OFF VALVES

There are 4 fuel Shut Off Valves (SOV):

- One for each engine,
- One for the APU.

FUEL CROSSFEED

Normal Crossfeed (X-BP)

The purpose of the fuel crossfeed function is to enable feeding of an engine by an other TANK than the dedicated one. This is generally used in case of an engine failure. The operating engines can run on the fuel initially dedicated to the dead engine.

It could also be used in case of booster pumps failure.

Backup Crossfeed

For the fuel crossfeed between engines 1&3 and tanks 3&1, in addition to the normal X-BP 1-3 or X-BP 3-1, a backup XBP system is available and commanded by a dedicated “BACKUP 1-3” pushbutton on the overhead panel.

Crossfeed control

For crossfeed function, transfer valves are controlled by a dedicated Circuit Board.

ENG 2 BackUp supply

In case of No 2 engine fuel line leak due to No 3 engine rotor burst, engine 2 can be supplied in emergency through the APU feeding by means of a dedicated backup fuel line.

The back up fuel line is activated using the “FUEL 2 B/U” switch on the emergency panel.

FUEL TRANSFER

Fuel Transfer within each TANK

During normal emptying of the fuel tank, fuel is transferred within each tank from the different compartments to the feeder tank. This transfer is performed by Jet pumps, holes between tanks and piping.

Jet pumps operate according to the venturi principle by using motive fuel flow delivered from the booster pumps. The jet pumps ensure that the booster pumps remain always immersed in their compartments.

Commanded Fuel Transfer between TANKS (X-TK)

- **Normal X-TK**

  Fuel can be transferred from any TANK to any other TANK upon pilots manual command.

- **Back Up X-TK**

  For the fuel transfer between TANKS 1 and 3, in addition to the normal XTK, a backup XTK system is available and commanded by a dedicated “BACKUP 1-3” pushbutton on the overhead panel.

- **X-TK control**

  For X-TK function, transfer valves are controlled by a dedicated Circuit Board. When normal XTK is selected, the corresponding X-BP is set on. Booster pumps on the low level side are not automatically switched off.

NOTE

In case of loss of Fuel gauges, the normal fuel transfer mode is not available.

INTERACTIONS OF CROSSFEED AND X-TK

Include a brief description of interactions of X-BP and X-TK
Also explain interactions between XTK back up and X-BP

DESIGN PRINCIPLES

The main concept of Fuel system is:

- Each tank provides fuel to his own engine, that means Tank 1 to Engine 1, Tank 2 to Engine 2 and Tank 3 to Engine 3.
- Transfer between all tanks is available 1➔3, 3➔1;1➔2, 2➔1;3➔2, 2➔3 through a pressurised system
- A back up transfer allows each lateral to provide fuel to the other side by gravity
- Tanks are pressurised to cope with the following operation conditions:
  - Hot fuel,
  - Pumps failure during take off,
  - Possible evaporation at high altitude.
- Two independent devices provide low fuel alerts for each TANK.

EQUIPMENT LOCATION

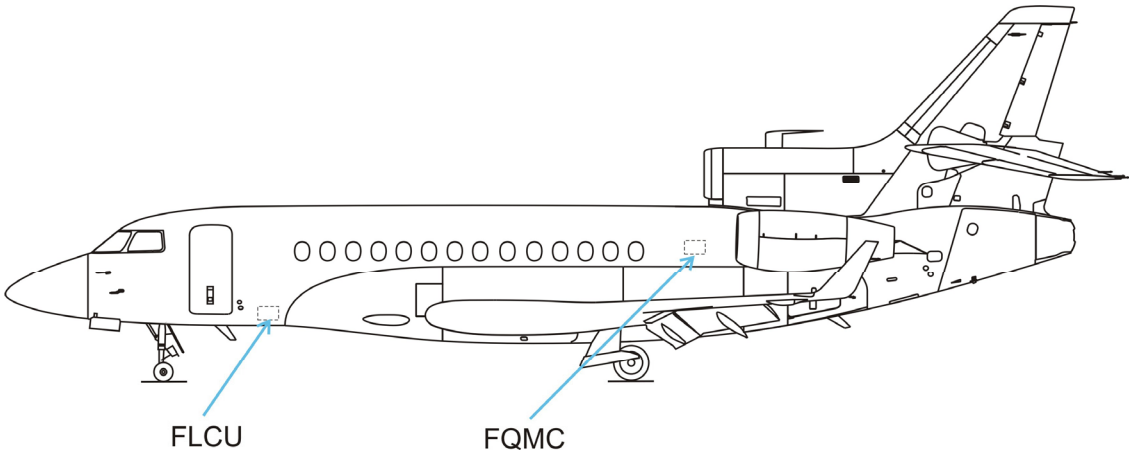


FIGURE 02-28-15-00 - FUEL SYSTEM EQUIPMENT LOCATION

The FQMC is located in a pressurized area (aft toilet compartment), away from hot air ducts, hydraulic piping and fuel piping. The FLCU is located under the passenger cabin.

ELECTRICAL POWER SUPPLY

Following paragraph describes the power supply for the main equipment of the Fuel system.

Electrical protection is provided either:

- By Solid State Power Controllers (SSPC) ,
- By Circuit Breakers (CB).

➢ *Refer to ATA 24 – ELECTRICAL POWER for additional information.*

EQUIPMENT	POWER SUPPLY	TYPE OF PROTECTION
LH FQMC	LH ESS / BAT 2	SSPC
RH FQMC	RH ESS / BAT 2	CB
LH FLCU	LH ESS / BAT 2	CB
RH FLCU	RH ESS / BAT 2	CB
Normal BP1	LH MAIN	CB
STBY BP1	LH ESS	CB
Normal BP2	LH ESS	CB
STBY BP2	RH ESS	CB
Normal BP3	RH MAIN	CB
STBY BP3	LH ESS	CB
Fuel SOV1 (dual motors)	RH ESS / BAT 1	CB
Fuel SOV2 (dual motors)	LH ESS / BAT 2	CB
Fuel SOV3 (dual motors)	RH ESS / BAT 1	CB
Normal XBP, XTK circuit board	LH ESS	SSPC
Stby XBP, XTK circuit board	RH ESS	SSPC

FUEL SYSTEM PRINCIPAL

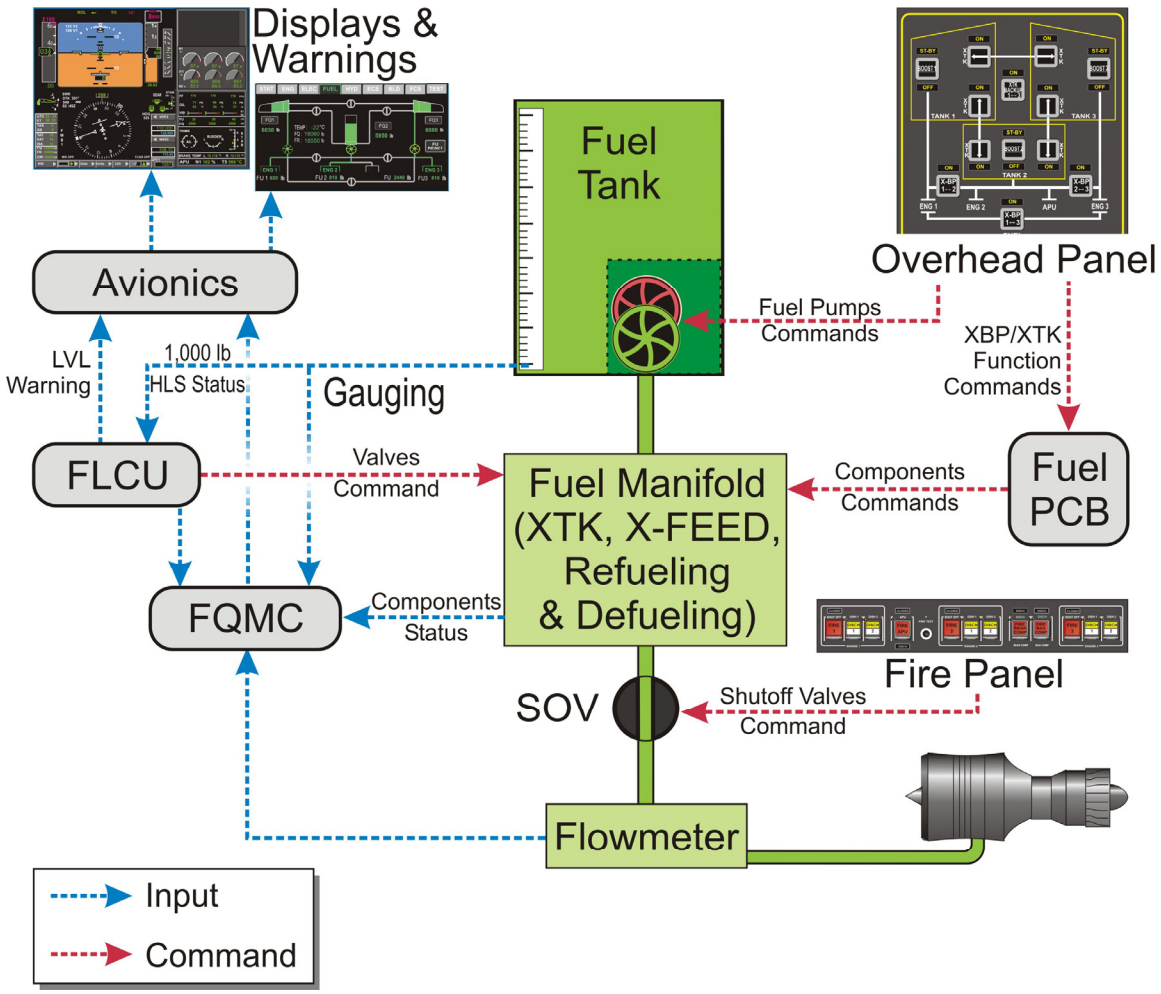


FIGURE 02-28-15-01 - FUEL SYSTEM GENERAL DIAGRAM

Fuel pump can be directly controlled through Overhead Panel with Boost 1, 2, 3 pushbuttons.

To be efficient, the others pushbuttons functions (X-TK / X-BP) require:

- A whole of conditions to be checked and,
- The sequences of opening / closing valves to be realized.

These actions are transferred from the OP to the PCB.

The fuelling valves are controlled by the FLCU which in directed by:

- The FQMC in partial fuelling,
- The Height Level Sensors in the full fuelling.

FUEL STORAGE AND MONITORING - DETAILED DESCRIPTION

FUEL TYPES

- *Refer to CODDE 2 for a list of various fuel types which may be used, as per engines specifications.*

The minimum fuel temperature is 3°C above the fuel type freezing point.

FUEL QUANTITIES

The fuel quantities in the different TANKS are:

TANK 1	TANK 2	TANK 3
10, 522 lb	10, 895 lb	10, 552 lb
4, 773 kg	4, 942 kg	4, 773 kg
1, 570 USG	1, 626 USG	1, 570 USG
5, 944 l	6, 154 l	5, 944 l

The usable capacities are determined by the position of the end filling thermistors, and these levels are determined to ensure a volume of air permitting an expansion of at least 2%.

Unusable fuel including fuel pipes is 85 Kg (190 Lbs).

FUEL QUANTITY MANAGEMENT COMPUTER

The FQMC has two independent channels which are separated electrically and mechanically but executing the same tasks.

The FQMC channel 1 is supposed to be master, channel 2 being slave.

Each channel of FQMC measures the engines oil remaining (ground only).

Channel 1 of FQMC measures APU oil remaining (ground only).

FQMC has his own internal test which checks the validity of the configuration. In case of a mismatch the FQMC would trigger a CAS message.

FQMC implements compensation signal for:

- Density (sensor in feeder tank),
- Aircraft attitude,
- Wing deflection.

The FQMC monitors the validity of the gauges.

The precision of the computer is:

- Close to empty➔ 0,6% (approximately 100 Lbs)
- Close to full ➔ 1,2% (approximately 500 Lbs)

FUEL LEVEL CONTROL UNIT

The Fuel Level Control Unit (FLCU) performs the following functions:

- High level detection,
- Low level detection 1000 lbs and warning,
- Refueling valves management,
- ARINC communications with FQMC for system integrity monitoring.

In case of total FQMC failure to avoid a complete loss of fuel indication, the 1000 lbs level detection is made by an independent system including dedicated level sensors connected to the FLCU.

The FLCU detects the 1000 lbs fuel level using the data received from the three 1000 lbs fuel level sensors and sends the data to the Modular Avionic Unit (MAU), for display in the cockpit.

The FLCU commands the 4 refueling valves associated to the wing tanks and the front and rear fuselage tanks either in refueling mode or transfer mode. This refueling valves management is performed according to the level sensors state and external signals received from the FQMC or the Refueling Control Panel (RCP).

FUEL DISTRIBUTION - DETAILED DESCRIPTION

BOOSTER PUMPS

Booster pumps are all identical, immersed and of centrifugal type. Each pump is AC powered, by mean of a built-in inverter converting 28 VDC to 115 VAC 400Hz.

The pump cavity is explosion proof and the temperature is controlled by a current limiter. The temperature will never exceed 90°C.

When no pumps are available on an engine without XBP, the flight altitude is limited to 35000 feet with JET A-1.

Automatic control of booster pumps at Aircraft power up and shut down

During aircraft power up, the fuel booster pumps are controlled by the "virtual pilot" within the MAU.

When APU is started (APU MASTER pushbutton depressed), the stand-by booster pump 2 is automatically activated.

At engine start, the respective fuel stand-by pump is started.

When engine reaches idle,

- The fuel stand-by pump is set off
- The normal booster pump is activated.

When APU or engines are stopped, the booster pumps remain on.

Automatic control of booster pumps during Fuel transfer (on ground and in-flight)

During Fuel transfer (X-TK), the fuel booster pumps are controlled by a dedicated circuit board.

When normal fuel transfer is activated (X-TK), both booster pumps are activated in the tank that supplies fuel.

JET PUMPS

They are installed in the booster pump compartment located in the feeder tanks, all identical and operate according to the venturi principle by using motive fuel flow delivered from the booster pumps.

In TANK 1 and TANK 3:

- Four jet pumps transfer fuel from the center, inboard, middle and outboard wing sections into the booster pump compartment,
- One jet pump transfers fuel from forward section to the booster pump compartment.

In TANK 2: three jet pumps are installed in the booster pump compartment:

- One in the front tank,
- Two in the rear tank.

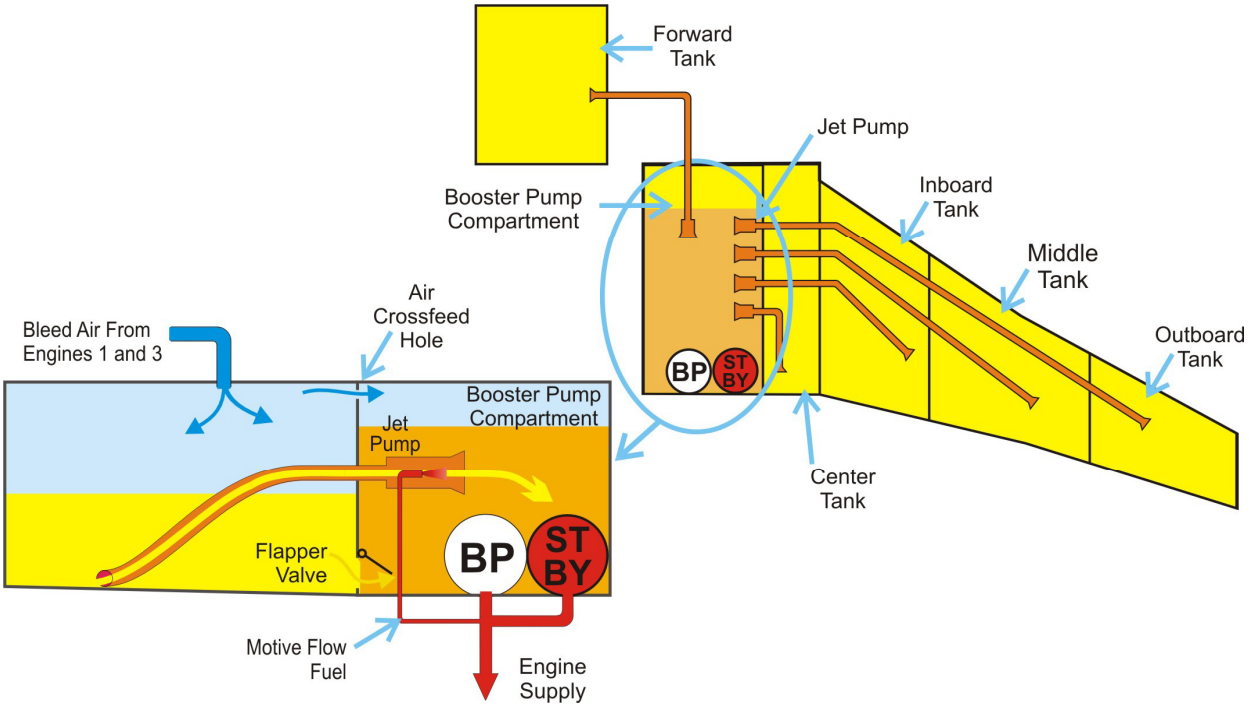


FIGURE 02-28-15-02 - FUEL TANK CIRCULATION SCHEMATIC

EMPTYING SEQUENCE OF THE FUEL TANKS

The normal emptying sequence of the tanks, through the jet pumps and holes between tanks is:

TANK 1 and 3:

- 1: forward tank
- 2: outboard wing tank,
- 3: middle wing tank,
- 4: inboard wing tank,
- 5: center wing tank,
- 6: feeder tank.

TANK 2:

- 1: front tank,
- 2: rear tank,
- 3: central feeder tank.

CONTROLS

Crew control of the Fuel system is performed:

- Primarily via the FUEL section of the Overhead Panel (OP),
- Via the Emergency Control Panel (ECP) in the very improbable case of engine rotor burst,
- Via the Fire Control Panel (FCP) in case of engine Fire
- Via the SERVICING page to test the fuel thermistor (1000 lb measurement).

FUEL SECTION OF THE OVERHEAD PANEL

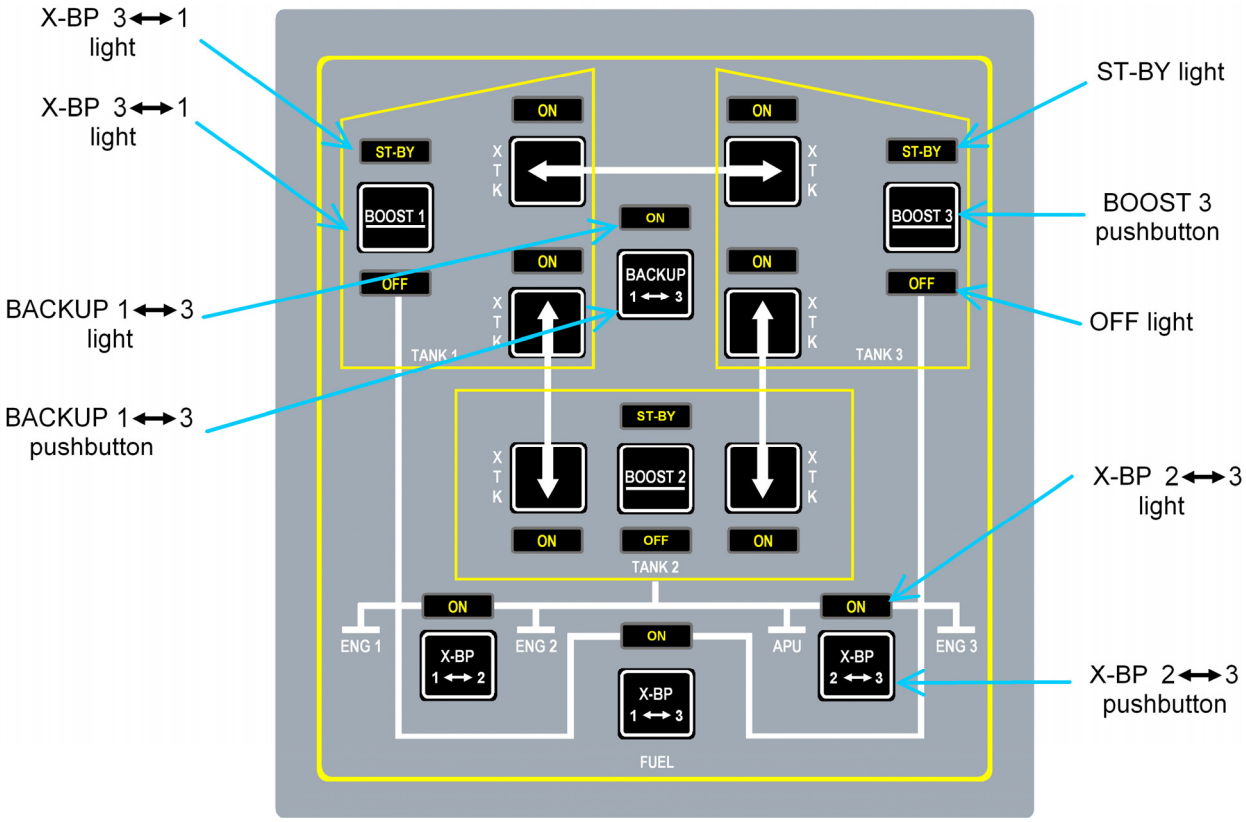
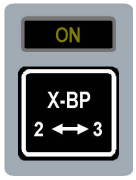
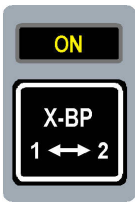
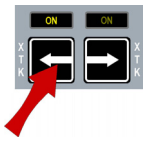
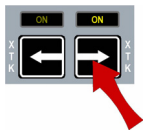
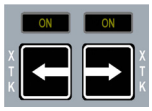
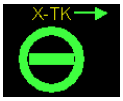
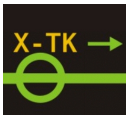


FIGURE 02-28-20-00 - FUEL SYSTEM SECTION OF THE OVERHEAD PANEL

SYNTHETIC TABLE

CONTROL	FUNCTION	TO ACTIVATE TO DEACTIVATE	SYNOPTIC
  	Manually controls to on or OFF either the Normal or ST-BY BOOST 1, BOOST 2 and BOOST 3 pumps. Pressing the BOOST pushbutton for less than 2 sec. switches between: - Unlighted On - ST-BY Pressing the BOOST pushbutton for more than 2 sec. switches the corresponding pump to: - OFF Automatic operation (on ground only): - When APU is started (APU MASTER pushbutton depressed), the stand-by booster pump 2 is automatically activated. - During engine start, the respective stand-by then normal booster pump are successively activated (when engine reaches idle, the stand-by is set off and the normal booster pump activated). - When APU or engines are stopped, the booster pumps remain on.	Unlighted on 	On 
		Push ST-BY 	ST-BY On 
		Push OFF 	OFF 

CONTROL	FUNCTION	TO ACTIVATE TO DEACTIVATE	SYNOPTIC
			Low pressure in fuel line  Invalid data 
No control available for the crew	When one XTK is selected, Both NORMAL and ST-BY BP are operating at the same time to speed up X-TK fuel transfer:	No action	BOTH 
  	Manually turns ON or off the X-BP in order to feed any engine by any group of tanks.	Push X-BP ON 	X-BP valve Open 
		X-BP off 	X-BP valve Closed 
			Invalid data 

CONTROL	FUNCTION	TO ACTIVATE TO DEACTIVATE	SYNOPTIC
	Manually controls the fuel transfer between LH wing tanks, RH wing tanks and fuselage tanks When XTK is selected, the BP of the furnishing side are both running.	Push X-TK ON   Push X-TK off 	X-TK valve Open (1←3)  Open (1➔3)  X-TK valve Closed 
			Invalid data 
	Selection of the alternate way to engine 1-3 / Tank 1-3 crossfeed or fuel transfer. Caution: BACKUP 1↔3 should never be actuated whenever a normal X-TK is in progress.	Normal  Push on to activate 	No synoptic Backup X-TK 1↔3 operating 

EMERGENCY PANEL

FIGURE 02-28-20-01 - EMERGENCY PANEL

CONTROL	FUNCTION	TO ACTIVATE TO DEACTIVATE		SYNOPTIC
	Manually controls to ON or OFF the fuel feeding of No 2 engine through the APU fuel line in case of No 2 engine fuel line leak due to engine 3 rotorburst.	Depressed off		No indication
		Pushed ON		No indication

FIRE CONTROL PANEL

The FIRE 1, FIRE 2, FIRE 3 and FIRE APU pushbuttons activate the respective fuel (FSOV) and hydraulic shut-off valves of No 1 engine, No 2 engine, No 3 engine and the fuel shut-off valve of the APU.

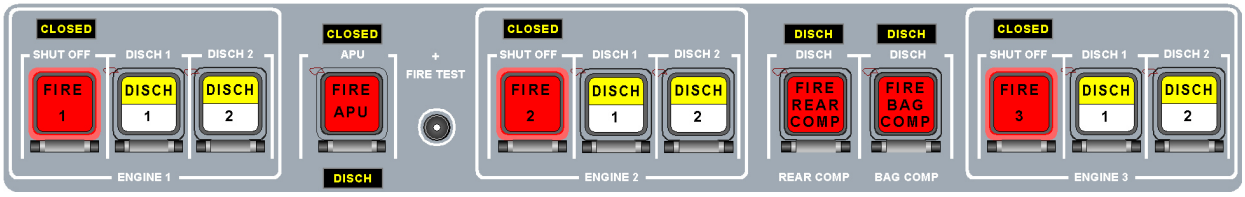


FIGURE 02-28-20-02 - FIRE CONTROL PANEL

SERVICING PAGE

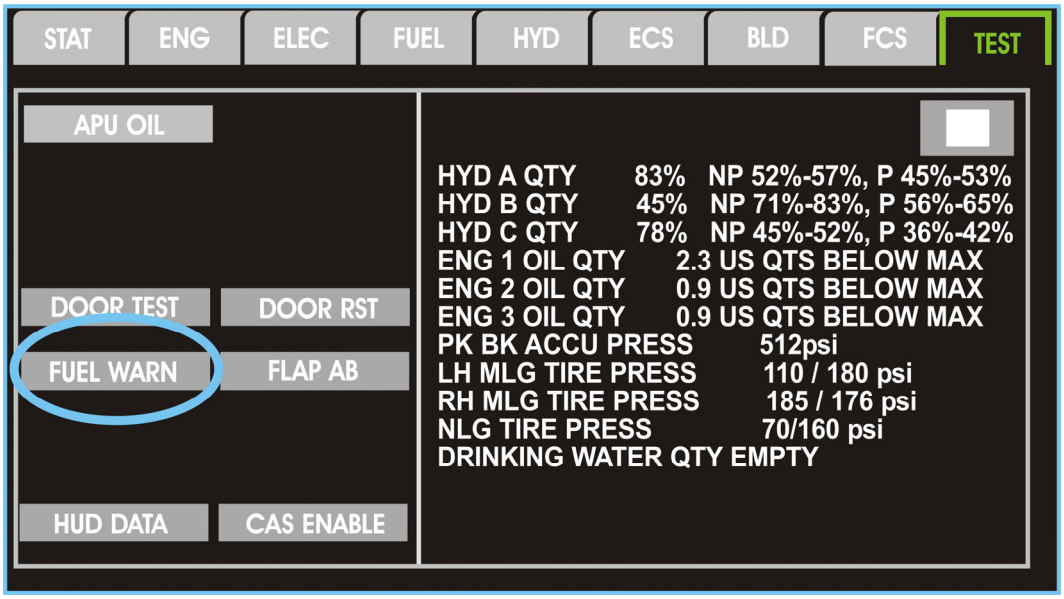


FIGURE 02-28-20-03 - SERVICING PAGE

INDICATIONS

Crew indications with regard to Fuel system are located in:

- The HSI window of the PDU for recapitulative of Fuel Quantity and Fuel Remaining,
- The ENG-TRM window of the PDU for Fuel Used and Fuel Quantity of each TANK,
- The FUEL synoptic,
- The STATus synoptic / FAULT tab for fault messages,
- The ENG-CAS window for CAS messages.

HSI WINDOW

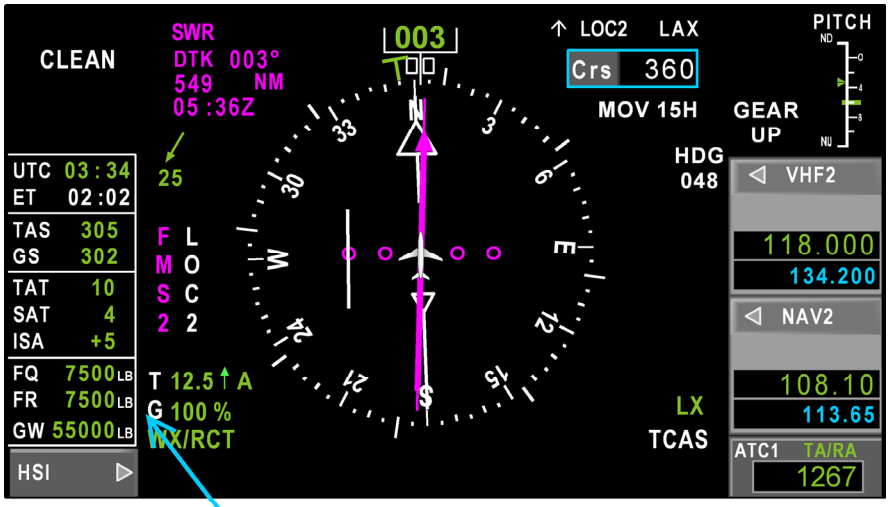


FIGURE 02-28-20-04 - FUEL QTY INDICATION ON THE HSI

The total Fuel Quantity (FQ), sum of the different tanks quantities gauged by the Fuel Quantity Management Computer (FQMC), and the Fuel Remaining (FR), computed by the FMS, are permanently displayed on the PDU.

NOTE

Fuel Remaining does not decrease despite APU consumption. Therefore, just before start up the crew will need to synchronize FR (Fuel Remaining) with the fuel quantity displayed.

Fuel Remaining is synchronized up to the first engine fuel flow movement and re-synchronizes after the last engine fuel flow movement.

ENG-TRM WINDOW

FF, FU and FQ are permanently displayed on ENG-TRM window of the PDU.

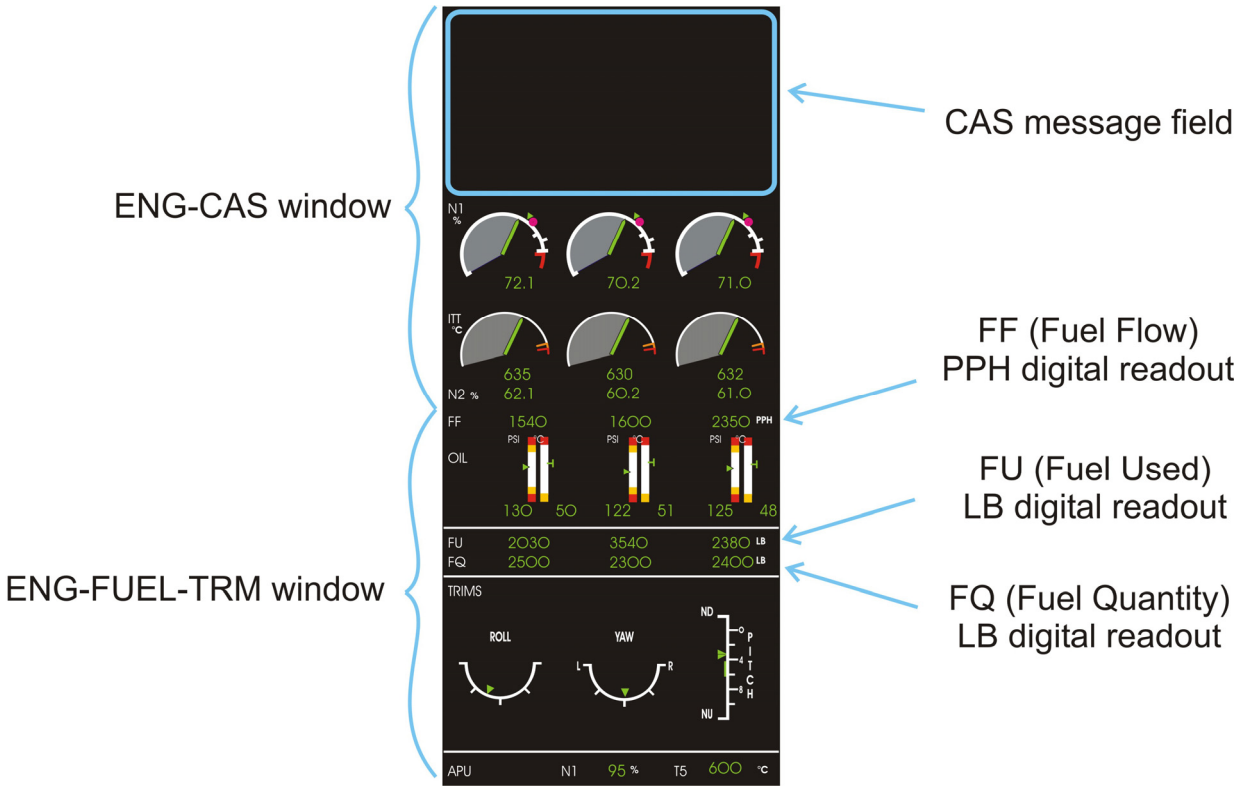


FIGURE 02-28-20-05 - PDU ENGINE WINDOW INDICATIONS

FUEL SYNOPTIC PAGE

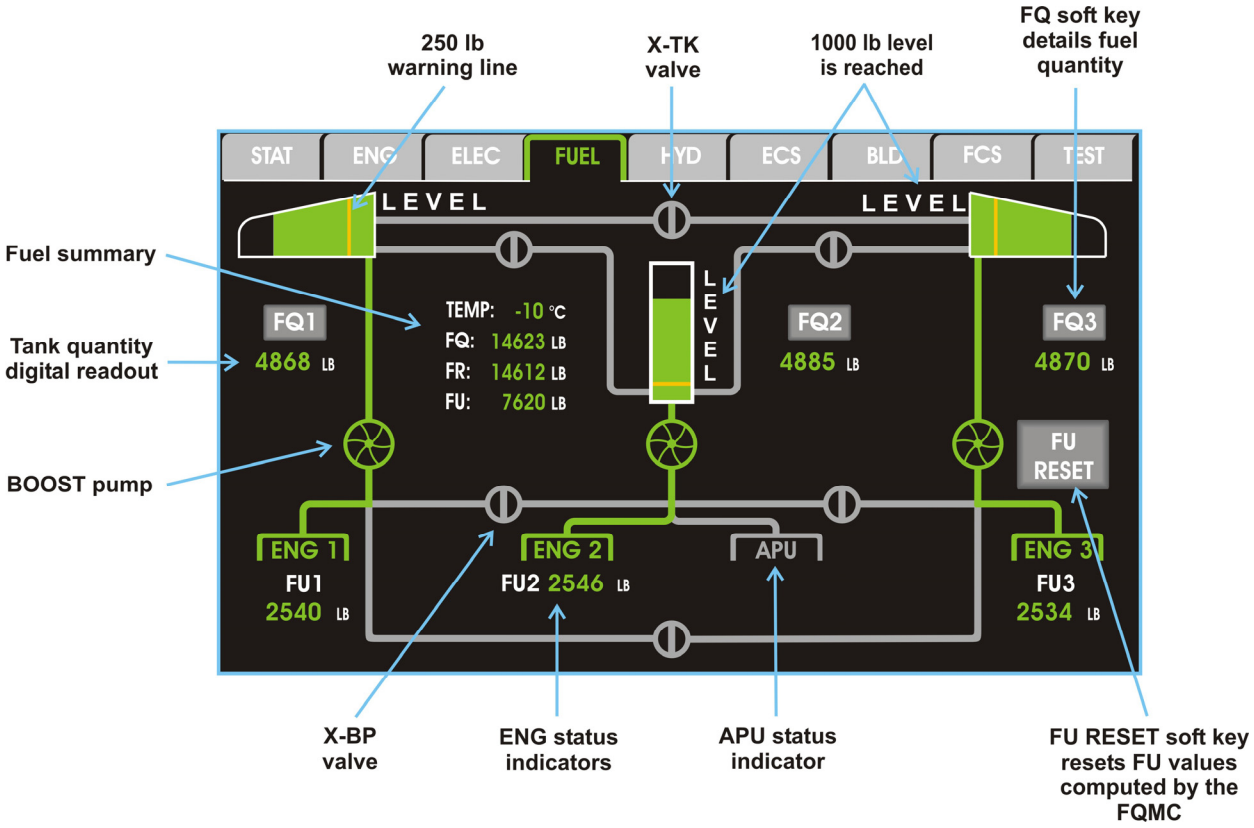


FIGURE 02-28-20-06 - FUEL SYNOPTIC PAGE

Fuel line denomination

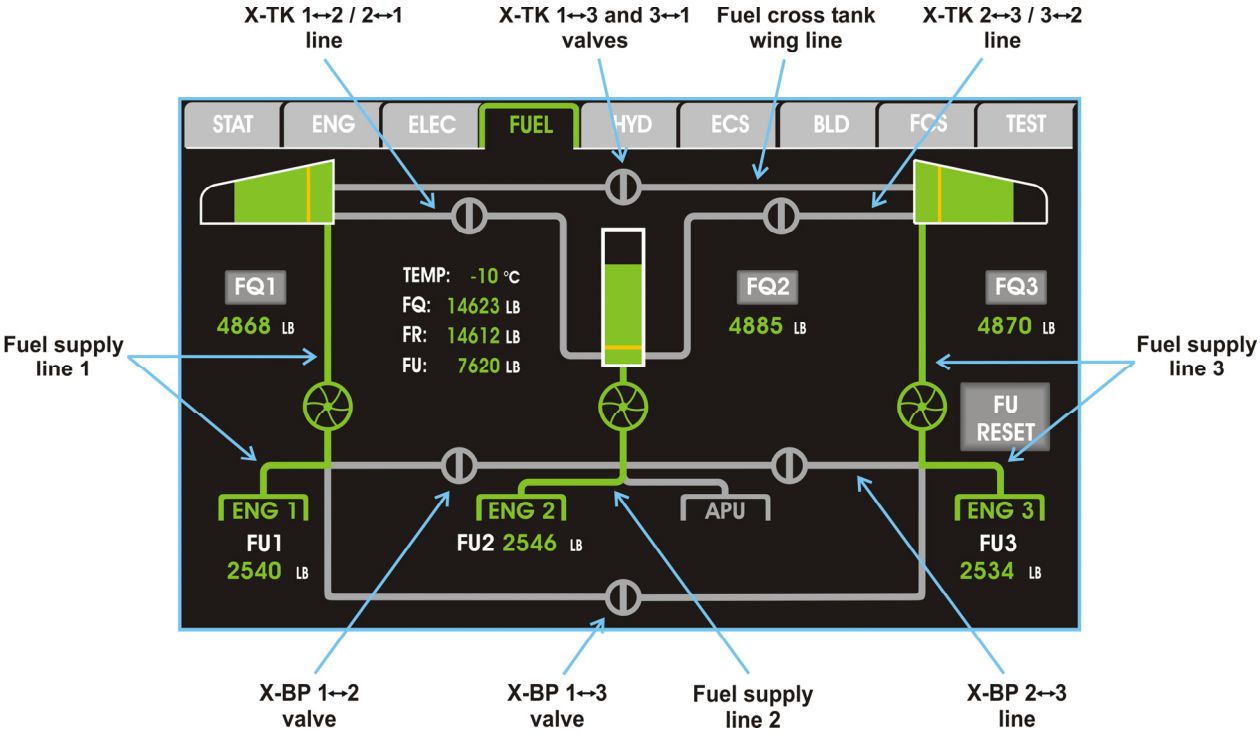


FIGURE 02-28-20-07 - FUEL LINE DENOMINATION

Fuel line color symbology

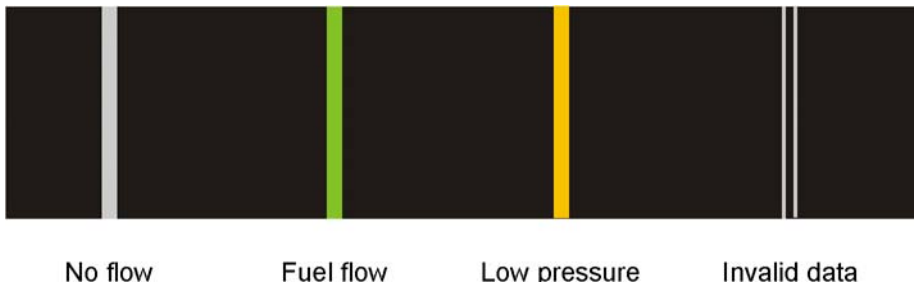


FIGURE 02-28-20-08 - FUEL LINE COLOR SYMBOLOGY

Temperature and gauging indications

TEMP Fuel TEMPerature probes stand in the LH and center feeder tanks and provide temperature indication on the FUEL page: the lowest of the two measured temperatures is displayed, or the remaining valid one in case of a sensor failure.

FU Fuel Used is computed by the FQMC. Computation starts as soon as one engine is running and stops when the three engines are shut off. It does not compute fuel burned by the APU. It can be reset with the RESET FU soft key on the FUEL page.

FR Fuel Remaining is supplied by FMS. It is the result of Fuel Quantity inserted in the Preflight POF page at system initialization minus Fuel Used. The FR is automatically synchronized with the FQ (APU fuel consumption is not taken into account) :

- At aircraft power on.
- After all engine start.

FQ Fuel Quantity calculated by the FQMC based on fuel gauges through the MAU.

FQ1, FQ2 and FQ3 buttons give access to a separate dialog box that displays individual fuel quantity for each tank of the group.

Clicking on FQ1, 2 or 3 open their respective window.

To close the windows, place the cursor in the upper part, on the X box and click with enter button of the CCD.

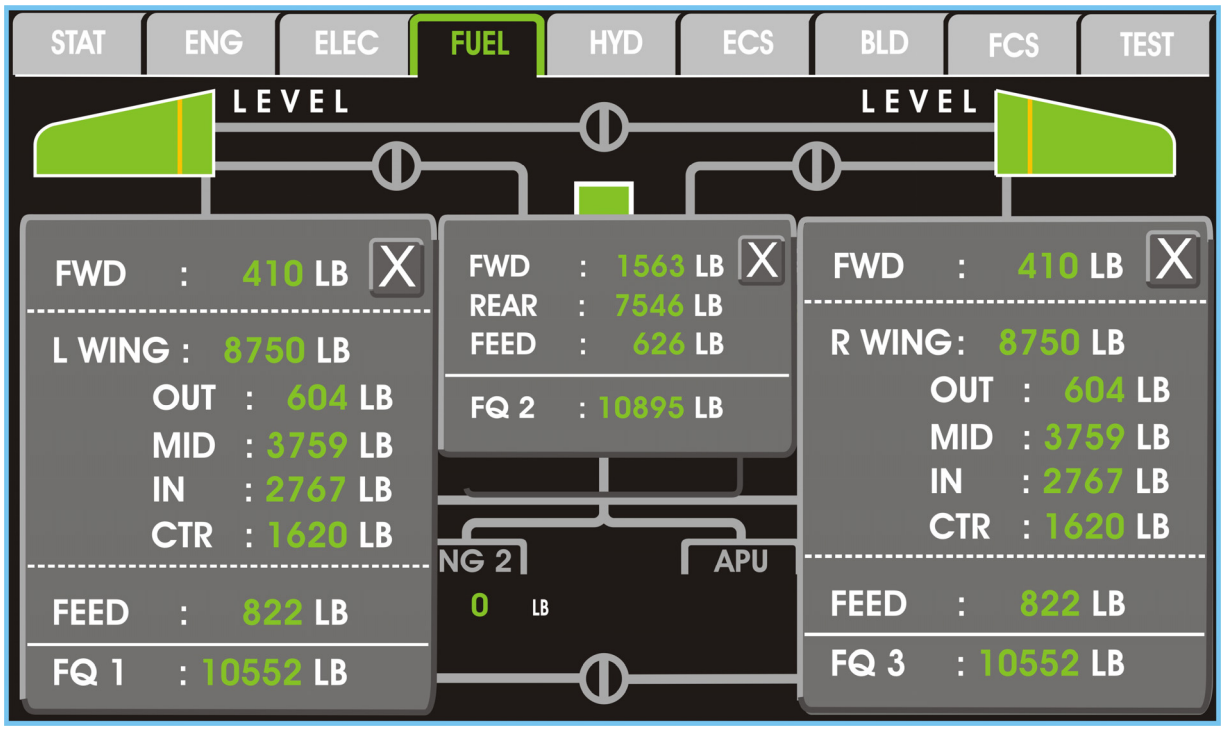


FIGURE 02-28-20-09 - FUEL FIELD FQ 1, 2 AND 3 - FULL CAPACITY

FQ1 or FQ3 windows

FWD	Forward tank fuel quantity
OUT	Wing outer tank fuel quantity
MID	Wing middle tank fuel quantity
IN	Wing inner tank fuel quantity
CTR	Wing center tank fuel quantity

When any of the above fuel quantity data is invalid, the corresponding indication is replaced by four amber dashes.

If any of the above fuel quantity is degraded, the appropriate value is displayed in an amber box.

For example: 

FEED	Feeder compartment tank fuel quantity
FQ1 or 3	Circuit total fuel quantity

When any of the above fuel quantity data is invalid, the corresponding indication is replaced by four amber dashes for the FEED and five amber dashes for the FQ1 or FQ3.

If CAS message **FUEL : TK LO LVL** is active, the value is displayed with black digits on amber background.

If any of the above fuel quantity is degraded, the appropriate value is displayed in an amber box.

FQ2 window

FRONT	Center front tank fuel quantity
REAR	Center rear tank fuel quantity

When any of the above fuel quantity data is invalid, the corresponding indication is replaced by four amber dashes.

If any of the above fuel quantity is degraded, the appropriate value is displayed in an amber box.

FEED	Center collector tank fuel quantity
FQ2	Center circuit total fuel quantity

When any of the above fuel quantity data is invalid, the corresponding indication is replaced by four amber dashes for the FEED and five amber dashes for the FQ1 or FQ3.

If CAS message **FUEL : TK _ LO LVL** is active, the value is displayed with black digits on amber background.

If any of the above fuel quantity is degraded, the appropriate value is displayed in an amber box.

Low level

Fuel levels are monitored for each group of tank through two types of detection:

When the 1,000 lb level is reached in a TANK, a white **LEVEL** label is displayed next to the Fuel Quantity (FQ) readout of the FUEL synoptic page and the **FUEL: TK .. LVL** message appears in the CAS window.

When the 250 lb. level is reached in a feeder tank: **FUEL: TK .. LO LVL** message appears in CAS window, in HSI window FQ is displayed amber, in ENG-TRM window corresponding FQ is displayed amber, in FUEL synoptic corresponding FQ group and wing symbol are displayed amber.

Degraded gauging situations can occur during a loss of fuel gauge. In this case GAUGING DEGRAD message appears in the FAULT tab of the STATus window and the normal fuel transfer mode is not available.

WHITE CONFIGURATION MESSAGES

The system provides the following verification of configuration:

- For multiple XBP or XTK pushbutton selection, the message **FUEL: X-CMD INVALID INPUTS** is displayed

FUEL PRESSURIZATION INDICATION

A fuel pressurization indication is available in the airplane rear compartment on the right side when facing the plane nose (pressure gauge).

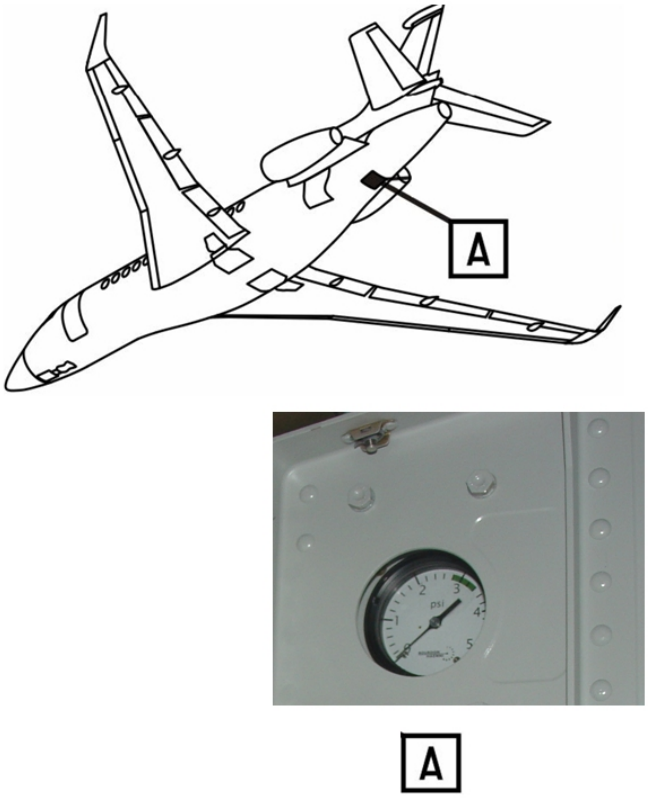


FIGURE 02-28-25-00 - PRESSURE FUEL GAUGE

LOW LEVEL MANAGEMENT

The two CAS messages **FUEL: TK .. LVL** and **FUEL: TK .. LO LVL** are based on two different types of detection:

- Detection for **FUEL: TK .. LVL** (quantity in a group is less than 1,000 ± 200 lb) is based on separate detection thermistors located in center wing lateral tanks and in central rear tank.
- Detection for **FUEL: TK .. LO LVL** (quantity in a feeder tank is less than 250 lb) is based on the fuel gauged quantities.

SYSTEM MONITORING

Monitoring of the following functions is provided by the fuel system:

- Fuel pressure feeding the engine,
- Integrity of Fuel pressure sensor integrity,
- Fuel tank unbalance to respect maximum lateral and longitudinal unbalance,
- Fuel CG,
- Low level.

FUEL PRESSURE SENSORS

For each engine, a pressure sensor located in the engine supply line downstream of the Fuel Shut-Off valve monitors the fuel pressure feeding the engines. When pressure is insufficient (booster pump failure or fuel leak), a CAS message is triggered.

Pressure sensor integrity is monitored by a CAS message.

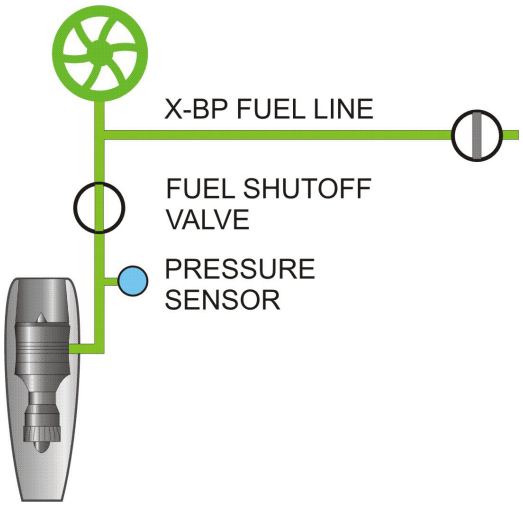


FIGURE 02-28-30-00 - CIRCUIT PROTECTION DIAGRAM

LOW LEVEL MANAGEMENT

➢ *Refer to section 02-28-20 and 02-28-25 for information related to low level detection*

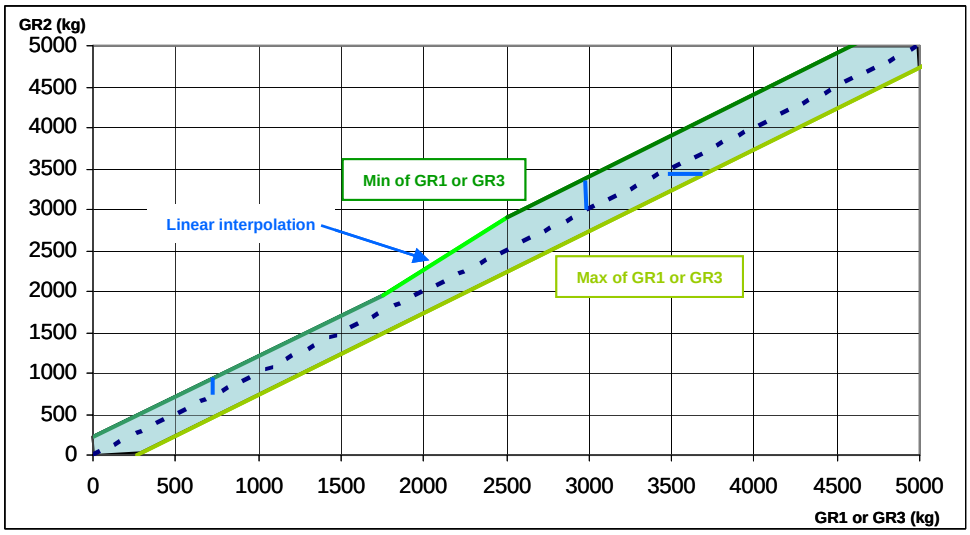
FUEL TRANSFER MONITORING

In case of significant fuel CG location drift or unbalance due to:

- Fuel transfer system multiple failures,
- Crew action,

The fuel computer detects it by comparing fuel quantities gauges in the three groups.

A **FUEL : TKS LVL MISCONFIG** message is triggered when the gauged values depart from the domain presented hereunder:



A **FUEL : WINGS QTY MISMATCH** message is triggered when a 1500 lbs difference occurs between groups 1 and 3.

ACTIVE PROTECTIONS

OVERPRESSURE AND NEGATIVE PRESSURE RELIEF VALVES

2 valve boxes provide:

- Negative pressure relief to allow air to replace the consumed fuel in tanks,
- Overpressure relief in all tanks, in case of excessive pressure in the tanks.

4 negative pressure relief valves (2 per wing) located near the wing tip also provide negative pressure relief.

On ground, during fueling operation, pressure relief of the tanks is provided by:

- Three electrical vent valves,
- Two electrical pressurization valves.

These valves are closed in flight.

BOOSTER PUMP TEMPERATURE

A current limiter ensures each booster pump temperature does not exceed 90°C (also in case the feeder tank runs dry or due to a jammed rotor)

SYSTEM MONITORING

LOW LEVEL MANAGEMENT

- *Refer to section 02-28-20 and 02-28-25 for information related to Low level detection*

INTRODUCTION

The airplane is normally pressure-refueled.

All tanks can be automatically refilled fully or partially through the single-point fueling connector.

When pressurized fuel is not available, gravity refueling may be performed through the two wing gravity filler ports.

The airplane may be defuelled through the normal pressure-refueling system and through a gravity defueling system.

NOTE

For further information, refer to the Ground Servicing Manual.

SUMP DRAINS

Eleven sump drains are located underneath the airplane.

FIGURE 02-28-40-00 - SUMP DRAIN VALVES LOCATION

FIGURE 02-28-40-01 - FUEL DRAIN FILLER CUP

NOTE

The fuel drain filler cup is stored in the mechanic-servicing compartment.

PRESSURE REFUELING OPERATION

The pressure-refueling system comprises mainly:

- The FQMC,
- The Fuel Level Control Unit (FLCU),
- The fuelling connector,
- The refuelling control panel,
- Fuel vent valves,
- Refuelling valves.

The FQMC and FLCU are mainly used to control the refueling sequence, manage the refueling valves and for partial/high level detection.

FIGURE 02-28-40-02 - FUELING CONNECTOR

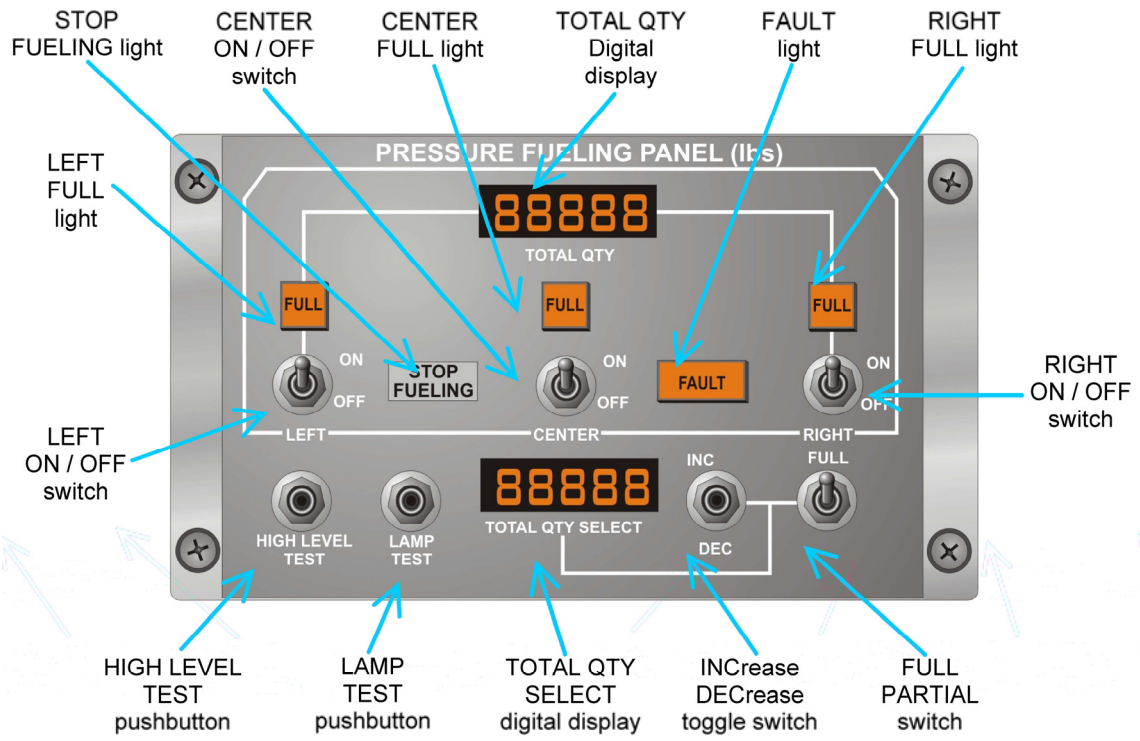


FIGURE 02-28-40-03 - PRESSURE FUELING PANEL

The pressure refueling system is powered by the battery bus 2. This allows refueling without the Ground Power Unit (GPU). Lifting the depressurization lever of the fueling connector supplies electrical power to:

- The refuelling control panel,
- The FLCU,
- The FQMC,
- The vent valves which are commanded open.

Refueling valves for each tank, will be powered only when all vent valves are opened.

The refueling pressure must be between 30 psi and 50 psi maximum.

For a partial refueling, refueling stops automatically when the selected fuel quantity is attained (accuracy is of 50 lb).

Pressure refueling controls are located on the pressure fueling panel, behind an access door on the right hand lower fuselage, aft of the wing.

NOTE

As long as fuel tanks are pressurized, the fueling panel is not electrically powered (the depressurization lever needs to be pulled).

GRAVITY REFUELING

GRAVITY FILLER PORTS

Each wing has one gravity filler port.

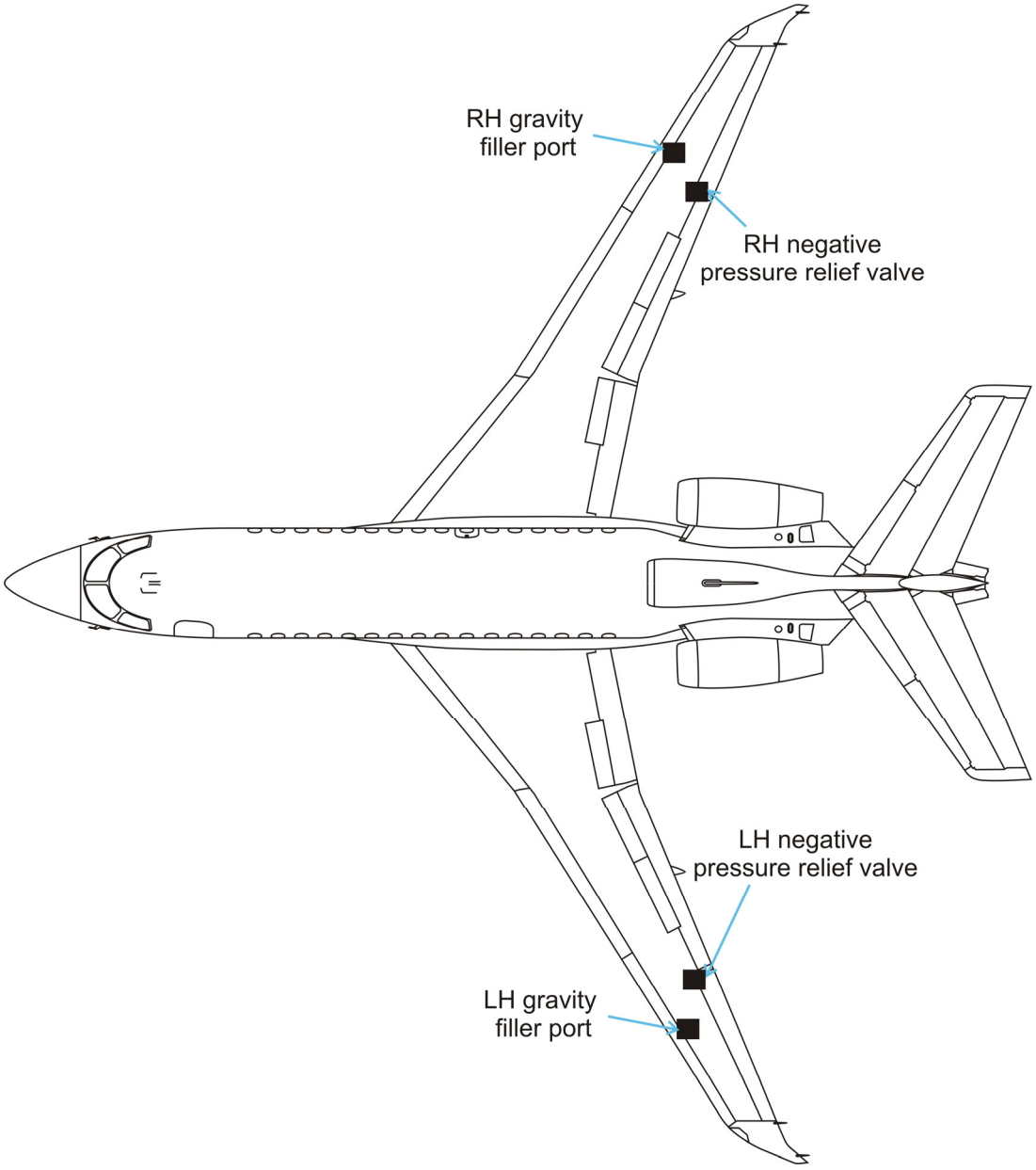


FIGURE 02-28-40-04 - NEGATIVE PRESSURE RELIEF VALVES AND GRAVITY FILLER PORTS LOCATION

The airplane may be refueled through gravity filler ports located on each upper wing surface. Electrical power on the airplane is required for gravity refueling to be able to transfer fuel from wing to center tanks. The center tank refueling requires pressurized fuel.

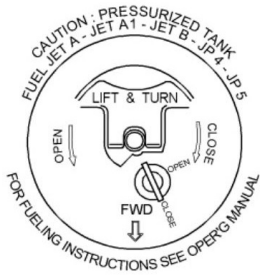


FIGURE 02-28-40-05 - GRAVITY REFUELING FILLER PORT

As there is no automatic stop, refueling progress must be monitored on the quantity indicators.

DEFUELING

A DEFUELING guarded switch located on the cockpit maintenance panel (RH side, behind the copilot seat) controls the opening of the defueling / refueling valve allowing fuel to be transferred from wings to center tanks.

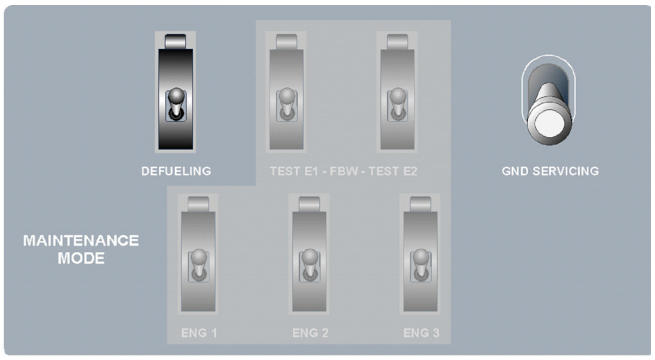


FIGURE 02-28-40-06 - DEFUELING SWITCH ON MAINTENANCE PANEL

This switch is used for pressure or gravity defueling.

PRESSURIZED DEFUELING

Truck recovery defueling is done through a defueling valve incorporated in the defuelling manifold.

The selection of the tank to be defueled is done by starting up of either pump.

GRAVITY DEFUELING

Gravity defueling is done by a manual defueling valve incorporated in the defueling manifold an operation needs to energize the booster pumps.

NOTE

For further information, refer to the Ground Servicing Manual.

REFUELING OPERATIONS

Following refueling, pilots can control fuel quantity delivered using the density and regarding truck fuel temperature and fuel amount (Liters / US gallons)

Eg: Fuel amount =12000 l

- Fuel temperature= 20°c imply a fuel density around 0,790 kg/l
- Fuel quantity delivered = 12000 x 0,790= 9480 Kg = 20899 Lbs

Pressurization valves are automatically commanded open when:

- Aircraft is On Ground AND
- Fuel BP are in OFF position AND,
- The coupling lever is lowered.

➢ *Refer to Ground Servicing Manual.*