A330-200
TECHNICAL TRAINING MANUAL

MECHANICS / ELECTRICS & AVIONICS COURSE

28 FUEL

GE Metric

For Training Purposes Only
Issued By SPL/GK March 2006

This document must be used for training purposes only.

Under no circumstances should this document be used as a reference.

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SYSTEM DESIGN PHILOSOPHY

General
Feed Concept
Management

GENERAL

The fuel system stores fuel in six tanks.
It supplies fuel to each Engine and APU and controls the Center of Gravity position.

Fuel is stored in the main fuel Tanks and the Trim Tank.
Most functions are controlled by the Fuel Control and Monitoring System (FCMS).

FEED CONCEPT

The Inner Tanks are the main supply tanks.
They receive fuel from other tanks by transfers.

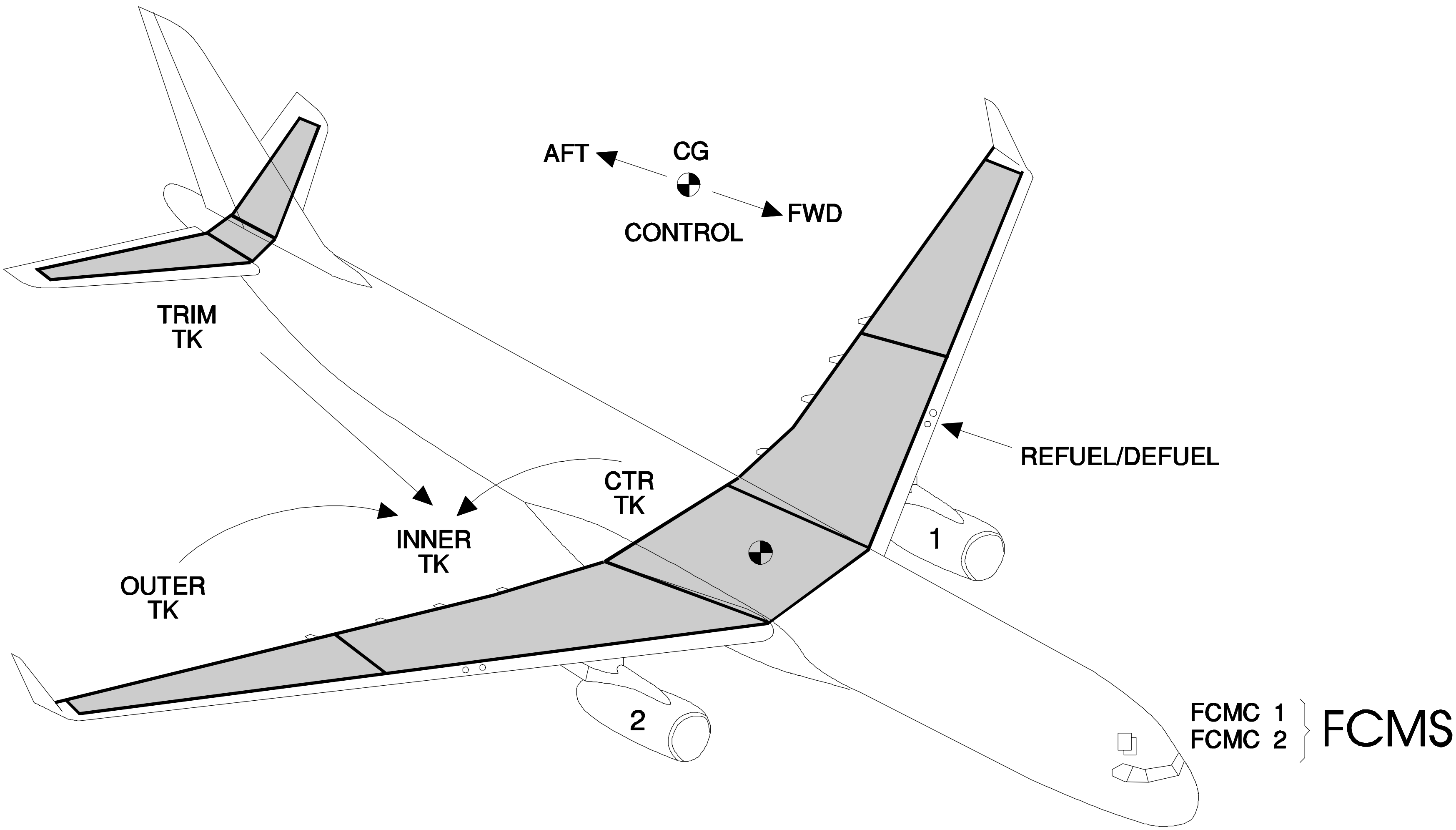
MANAGEMENT

The Fuel Control and Monitoring System (FCMS) manages the fuel system with 2 identical Fuel Control and Monitoring Computers :

- FCMC 1 and FCMC 2.

The different functions of the system are :

- Fuel level and temperature sensing,
- Fuel gauging,
- Center of Gravity calculation,
- Fuel management,
- Indication and fault reporting,
- System monitoring and test.



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STUDENT NOTES:

TANK PRESENTATION

General
Inner Tanks
Center Tank
Outer Tanks
Trim Tank
Surge Tanks
Venting
Access/Drain
Safety Precautions

GENERAL

Each tank is part of the structure.
The fuel is stored in the wings and the Trimmable Horizontal Stabilizer.

TOTAL USABLE FUEL :

36 744 US Gallons
240 714 Pounds
(fuel specific gravity 6.551)

139 090 Liters
109.200 Tonnes
(Fuel specific gravity 0.785)

The unusable fuel in the tanks and the system is less than 0.23 % of the tank capacity.

INNER TANKS

The main tanks, the Inners, are divided into 2 parts, the forward Inner Tanks and the aft Inner Tanks.
Each Inner Tank contains one collector cell. The collector cell is maintained full of fuel for the main booster pumps.

INNER TANK VOLUME =

42 000 l
11 095 US Gal

WEIGHT =

33 000 Kg
72 686 Lbs

Each collector cell quantity is 1 000 Kg / 2 200 Lbs.

CENTER TANK

The Center Tank is located in the wing center section. Its fuel is normally transferred to the Inner Tanks.

CENTER TANK VOLUME =

41 560 l
10 979 US Gal

WEIGHT =

32 625 Kg
71 926 Lbs

OUTER TANKS

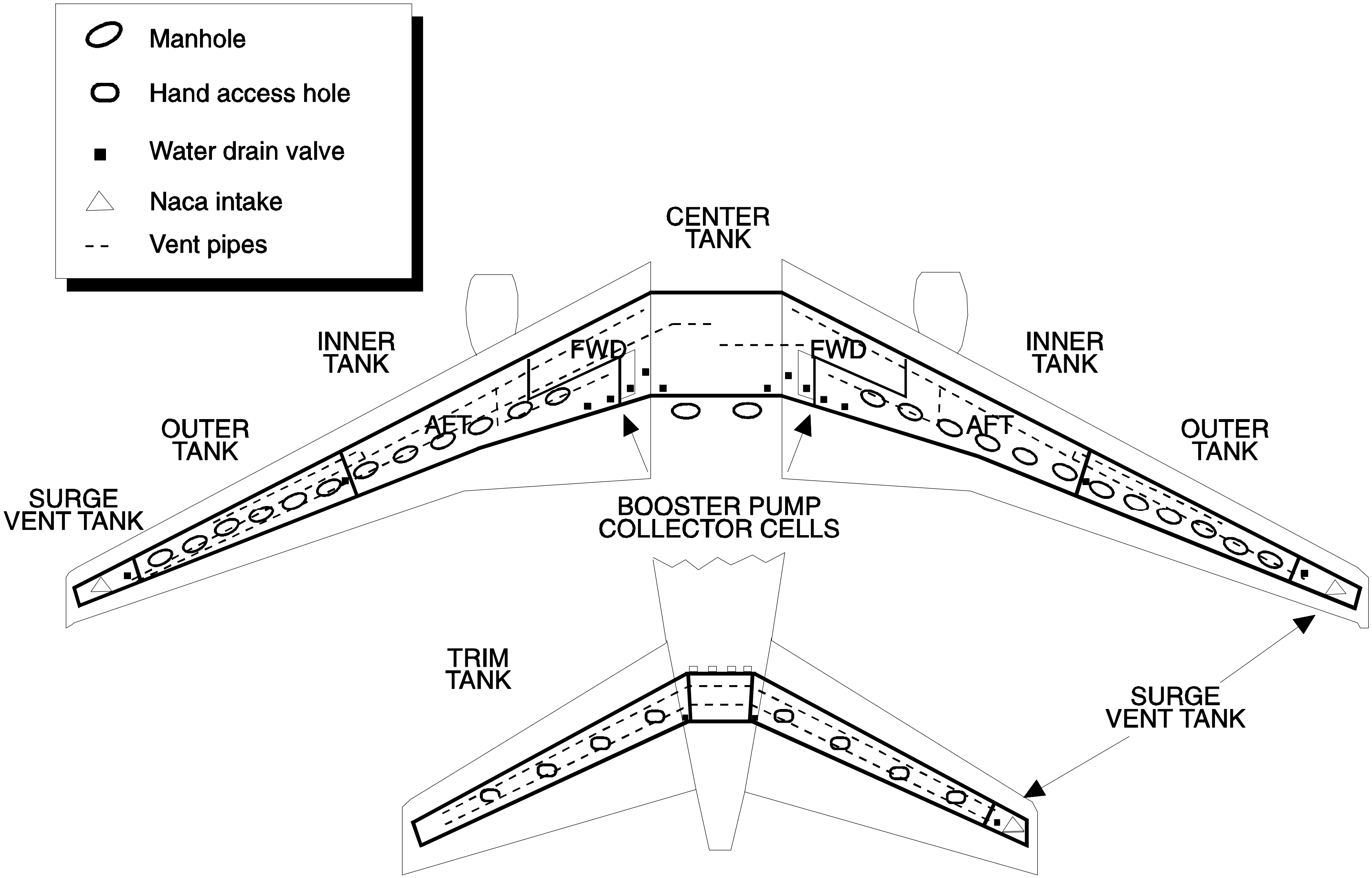
The Outer Tank maintains fuel outboard to provide bending relief.
This fuel is progressively transferred to the Inner Tank when a predetermined level is reached in this tank.

OUTER TANK VOLUME =

3650 l
954 US Gal

WEIGHT =

2865 Kg
6315 Lbs



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TRIM TANK

The Trim Tank provides additional fuel capacity.
Fuel Trim transfers enable the aircraft center of gravity to reach the optimum position so that drag is reduced and fuel economy improved.

TRIM TANK VOLUME =

6 230 l
1 646 US Gal

WEIGHT =

4 891 Kg
10 783 Lbs

SURGE TANKS

The Surge Vent Tank vents the fuel tanks to the atmosphere and collects fuel spilled from the tanks.
There is a Surge Vent Tank outboard of the Outer Tank in each wing and on the right end of the Trim Tank.
They are used for venting.

After refuelling operation to the maximum tank capacity, the fuel can expand by 2 % without spillage in the Surge Vent Tank.

WING SURGE VENT TANK VOLUME :

900 L (240 US Gal)

TRIM SURGE VENT TANK VOLUME :

115 L (30 US Gal)

VENTING

The tank venting system makes sure that the air pressure in the fuel tanks remains near to the outside ambient pressure.

Each Tank Vent pipe is connected to its related Surge Vent Tank, which is open to the atmosphere through a NACA Intake.

ACCESS/DRAIN

Access to the Wing tanks is gained through manhole panels in the wing bottom skin and access to the Center Tank is gained through the rear spar.

Access to the Trim Tank is gained through panels in the front spar and hand-hold panels in the bottom-skin.
The water drain valves are located at low points of each tank.

SAFETY PRECAUTIONS

You must obey the SAFETY PRECAUTIONS when you go into a fuel tank or when you remove the access panels.
The work area should be clean and open to the air.

Tanks must be ventilated.

You must put on protective clothing and a respirator in case of high gas concentration.

A safety person must see the person in the fuel tank and fire fighting equipment must be available.

STUDENT NOTES:

STUDENT NOTES

FUEL INDICATING

Presentation
Fuel Quantity Indicating (FQI) Probes
Fuel Quantity Indicating (FQI) Compensator Probes
Densitometers
High Level
Low Level
Overflow
Temperature
Manual Magnetic Indicators

PRESENTATION

The Indicating systems are : Fuel Quantity Indicating (FQI), Tank Level Sensing, Temperature Measurement, and Manual Magnetic level Indicators (MMI).

The Fuel Control and Monitoring System (FCMS) receives data to control the different fuel operations and to display the indications.

FUEL QUANTITY INDICATING (FQI) PROBES

Fuel Quantity Probes are installed in each tank.
Each probe has a capacitance value that changes in proportion to the fuel level.

FQI COMPENSATOR PROBES

A Compensator Probe is installed in the Aft section of the Inner Tanks and in Center Tank.
The Compensator Probe is of the capacitance type like the other fuel probes.

When fully covered with fuel, the compensator part of the probe has a capacitance, which is in proportion to the dielectric constant of the fuel. (Changes due to variations of fuel temperature).

DENSITOMETERS

A Densitometer is installed in the lowest part of the Inner Tank Aft section. It transmits the fuel density and dielectric constant signals to the Fuel Control and Monitoring System.

HIGH LEVEL

High Level sensors in each tank independently send level data to the FCMS. When High Level is sensed, the FCMS closes the related tank Inlet Valve.

LOW LEVEL

Low Level sensors in Inner, Center and Trim Tanks control fuel operations or trigger warnings.

OVERFLOW

One Overflow sensor is installed in each Vent Surge Tank.
If an Overflow sensor becomes wet, the FCMS closes all the Inlet Valves and the Refuel Isolation Valve.

TEMPERATURE

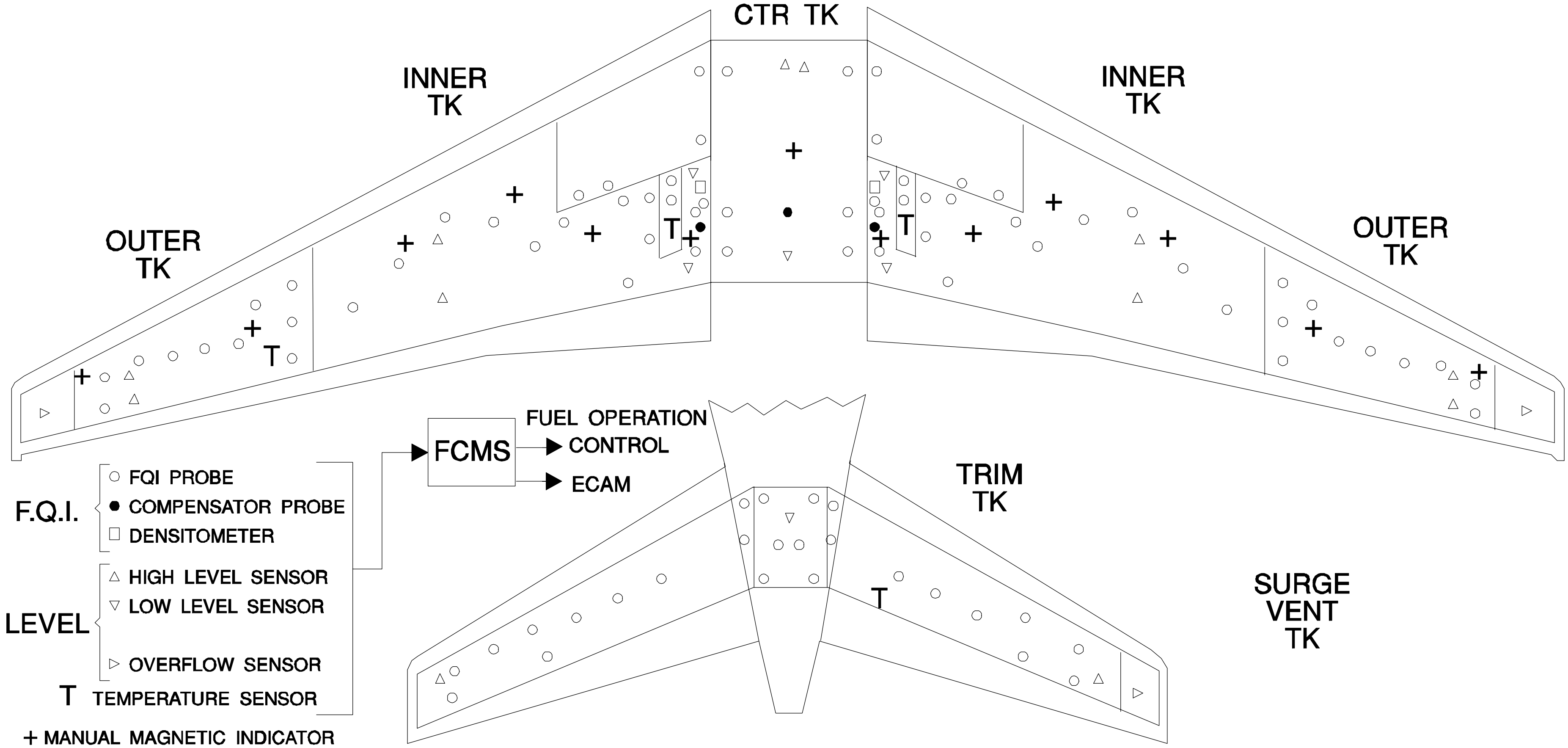
The fuel temperature is measured in the left Outer Tank, the left and right Collector Cells and the Trim Tank.

The temperature in the right Outer Tank is not shown, it is assumed that it is the same as in the left Outer Tank.

MANUAL MAGNETIC INDICATORS

Manual Magnetic Indicators (MMI) available in Center, Inner and Outer Tanks are an alternate means to determine the fuel quantity on the ground. No electrical power is required.

The combined MMI reading, aircraft attitude figure and fuel specific gravity are converted, using tables, to give the amount of fuel in each tank.



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STUDENT NOTES:

FUEL SYSTEM DISTRIBUTION

General
Engine Feed
APU Feed
Refuel\Defuel
Main Transfer
Trim Transfer Control
Trim System Components

GENERAL

The fuel distribution consists of:

- Engine and APU Feed system
- Refuel/Defuel system
- Main Transfer system
- Trim Transfer system.

The 2 sections (forward and aft) of the Inner Tank are connected together by a pipe and an Emergency Isolation Valve. The Emergency Isolation Valve is normally open and allows the fuel quantity of both sections to be balanced.

ENGINE FEED

The engines are supplied with fuel from the Inner Tanks. The Low Pressure Valves isolate the engines from the fuel supply. They normally operate with the Engine Master switch.

The normally closed Wing Crossfeed Valve divides the two Engine Feed systems.

Two main fuel booster pumps supply each engine. Another fuel pump is in standby. A pressure switch monitors the output pressure of each fuel pump. When the Crossfeed Valve is open, it is possible for the pump(s) of one Inner Tank to supply fuel to the 2 engines. If a main pump has a failure (or is set to OFF) the related side standby pump automatically starts.

The two main pumps are connected to a jet pump in the Collector Cell.

The jet pump makes sure that the Collector Cell is kept full of fuel and slightly pressurized.

APU FEED

The APU fuel feed system has two possible fuel pick-ups with two fuel pumps:

- one Forward
- and one Aft.

Only one APU pump runs at a time and the APU LP Valve opens when the APU Master Switch is set to ON. If a low pressure is detected during FWD APU pump operation, the Aft APU pump starts.

On ground and below FL250, the FWD APU pump runs, the APU Isolation Valve opens and fuel is taken from the left wing Collector Cell.

In flight, inside CG envelope control, normally the Aft APU pump runs, but also during Trim Tank refueling or defueling. The APU then takes its fuel from the Trim Transfer pipe and the Trim Tank.

REFUEL\DEFUEL

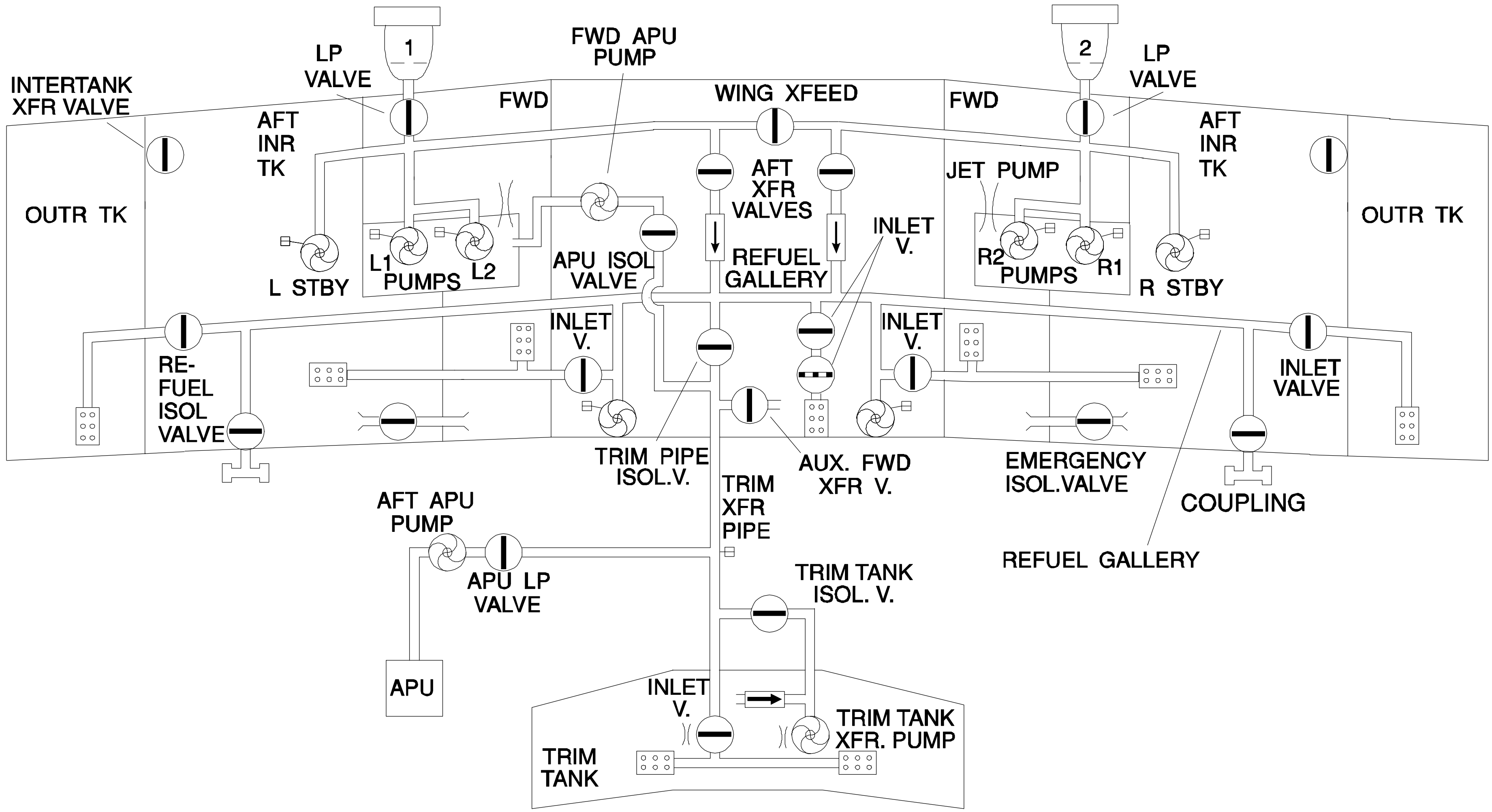
The Refuel/Defuel system controls the fuel flow during refueling and defueling of the aircraft. On the RH wing, a Refuel/Defuel coupling with two adaptors, is the interface between the aircraft system and the servicing unit. The LH coupling is optional.

In the center of each coupling, a Refuel Isolation Valve controls the fuel supply. Each tank has an Inlet Valve which lets the fuel flow into or out of the fuel tank, through diffusers.

MAIN TRANSFER

The main transfer system controls fuel flow from the Center and Outer Tanks to the both Inner Tanks. The fuel Control and Monitoring System (FCMS) automatically controls the system, but manual overrides are possible from the cockpit fuel panel.

Transfer booster pumps are used to move up fuel from the Center Tank to the Inner Tanks ; and gravity enables fuel to flow down from the Outer Tanks to the Inner Tanks.


1
2
LP VALVE
LP VALVE
INTERTANK XFR VALVE
FWD APU PUMP
FWD
WING XFEED
FWD
AFT INR TK
AFT INR TK
OUTR TK
OUTR TK
AFT XFR VALVES
JET PUMP
INLET V.
REFUEL GALLERY
L1
PUMPS
L2
L STBY
APU ISOL VALVE
R2
PUMPS
R1
R STBY
INLET V.
INLET V.
RE-FUEL ISOL VALVE
INLET VALVE
TRIM PIPE ISOL.V.
AUX. FWD XFR V.
EMERGENCY ISOL.VALVE
COUPLING
AFT APU PUMP
TRIM XFR PIPE
REFUEL GALLERY
APU LP VALVE
TRIM TANK ISOL. V.
APU
INLET V.
TRIM TANK XFR. PUMP
TRIM TANK

TRIM TRANSFER CONTROL

The Trim Transfer system controls the aircraft Center of Gravity position and allows optimization of flight efficiency and fuel economy.
For this function, the system moves fuel to the Trim Tank, this is Aft transfer, or from the Trim Tank, that is Forward transfer.

The system operates automatically with the Fuel Control and Monitoring Computers but the crew can manually select Forward fuel transfers.
The F.C.M System computes and continuously updates the aircraft Center of Gravity position. The FMGEC also monitors the CG position and provides excess Aft CG protection.

TRIM SYSTEM COMPONENTS

When an Aft transfer is required, if the Center Tank is not empty, the transfer pumps move the fuel from the Center Tank to the Trim Tank via the Trim Pipe Isolation Valve and the Trim Tank Inlet Valve.

If the Center Tank is empty, the booster pumps move the fuel from the collector cells to the Trim Tank via the Aft Transfer Valves, the Trim Pipe Isolation Valve and the Trim Tank Inlet Valve.

When a FWD transfer is required, if the Center Tank is not empty, the Trim Tank transfer pump moves the fuel from the Trim Tank to the Center Tank via the Trim Tank Isolation Valve and the Auxiliary Forward Transfer Valve.

If the Center Tank is empty, the Trim Tank Transfer Pump moves the fuel from the Trim Tank to the Inner Tanks via the Trim Tank Isolation Valve, the Trim Pipe Isolation Valve and the Inner Tank Inlet Valves.

STUDENT NOTES:

STUDENT NOTES

COCKPIT SYSTEM CONTROL PANELS

Crossfeed Valves
Center Tank Pumps
Center Tank Transfer
Main And Standby Pumps
FWD Manual Transfer
Trim Tank Selector
Outer Tank Transfer
Emergency Isolation Valve
Reset Switches

CROSSFEED VALVES PUSHBUTTON

The pushbutton for the Wing Crossfeed Valve is normally released out with no light on and the valve is closed.
The valve will open under conditional operation.

When the Wing Crossfeed Valve pushbutton is pressed in, the white ON light comes on, then the green OPEN light comes on when the valve is open.

CENTER TANK PUMPS PUSHBUTTON

The Center Tank Transfer Pumps are operated on or OFF by a left and right pushbutton.
They are normally pressed in, with no light. Center pump operation is enabled by the pushbutton but is controlled by the Computer.

The FAULT light comes on amber when the pump pressure drops or center transfer fails.
It is inhibited when OFF is selected.

CENTER TANK TRANSFER PUSHBUTTON

The Center Tank Transfer pushbutton overrides automatic transfer from Center Tank to Inner Tank.
When a failure occurs the FAULT light comes on amber.
When the pushbutton is pressed in, MAN comes on, transfer starts.

Note that the Center Tank Transfer Pumps have to be stopped manually.

MAIN AND STANDBY PUMPS PUSHBUTTON

There are 6 wing Booster Pump pushbuttons : 4 main and 2 stand-by. With all pushbuttons pressed in and no lights on, the main pumps run.
A stand-by pump starts if the related main pump is in the low press. condition.

When the pressure drops, the amber FAULT light comes on.
With the pump pushbutton selected OFF, the warning is inhibited.

FWD MANUAL TRANSFER PUSHBUTTON

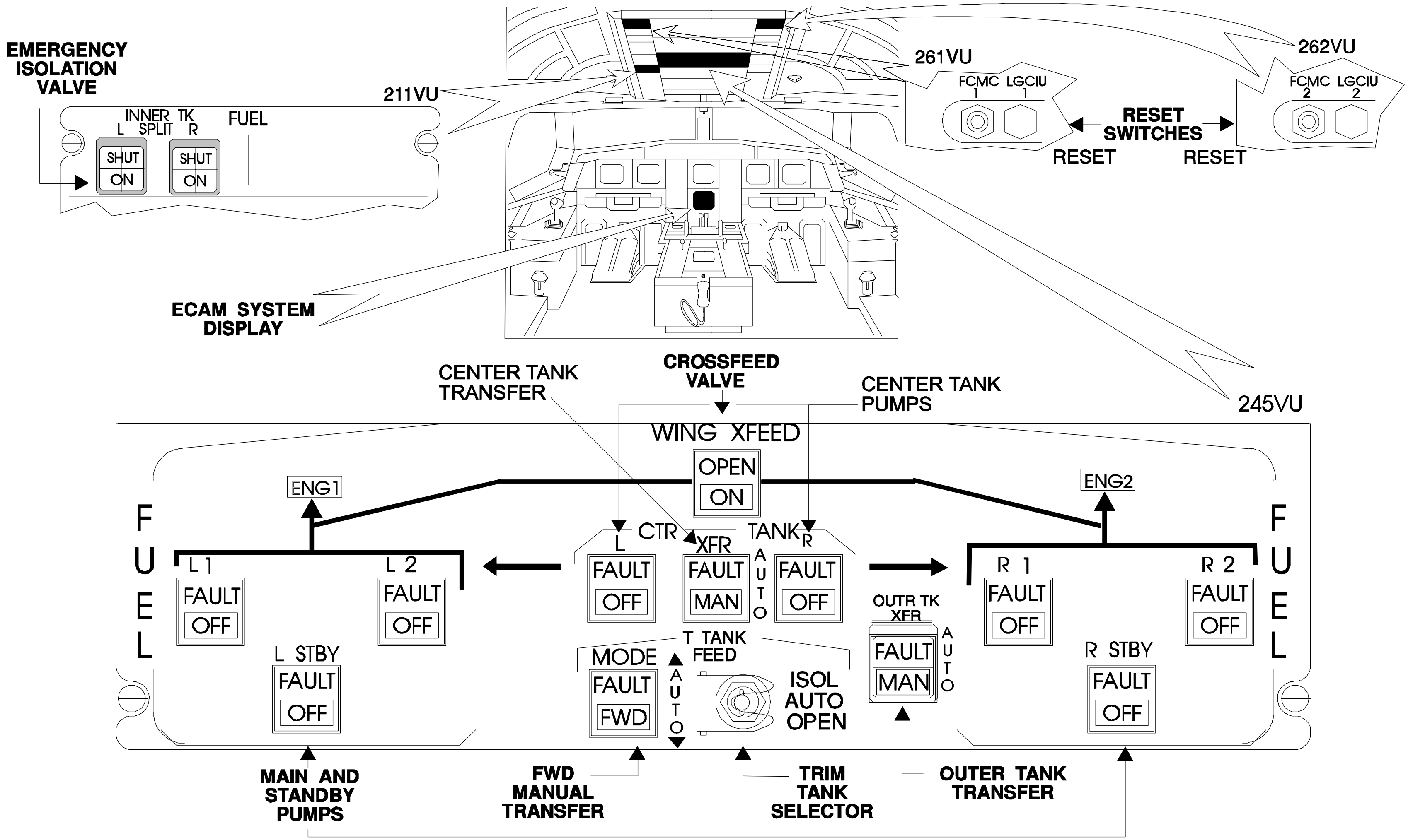
The Trim Tank MODE pushbutton allows a manual forward transfer to be initiated if a failure occurs in the automatic Center of Gravity control.

If the FAULT light comes on, due to an excess aft Center of Gravity or an inoperative auto transfer, the pushbutton must be pressed in ; the FWD light comes on.

TRIM TANK SELECTOR

The 3 position selector is guarded in the AUTO normal position and thus the transfer line is maintained full when the Trim Tank is empty.
In the ISOLation position, the Transfer line is isolated by closing all the required valves.

With Trim Tank selector set to OPEN, the valves used for forward transfer are maintained open, even if low level is detected, to allow the pipe to drain.



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OUTER TANK TRANSFER PUSHBUTTON

The FAULT light comes on, on the Outer Tank Transfer pushbutton, in case of malfunction in the computed fuel transfers from Outer Tanks to Inner Tanks.

In case of failure in the normal AUTO transfer, the OUTR TK XFR pushbutton must be pressed ; the MAN light comes on and transfer is initiated, overriding the automatism.

EMERGENCY ISOLATION VALVE PUSHBUTTONS

The 2 Inner Tank Split pushbuttons allow each section of the tank to be isolated.

Each white ON light comes on when corresponding pushbutton is pressed in, the green SHUT light comes on when the valve is closed.

RESET SWITCHES

A Reset Switch is provided for each Fuel Control and Monitoring Computer.

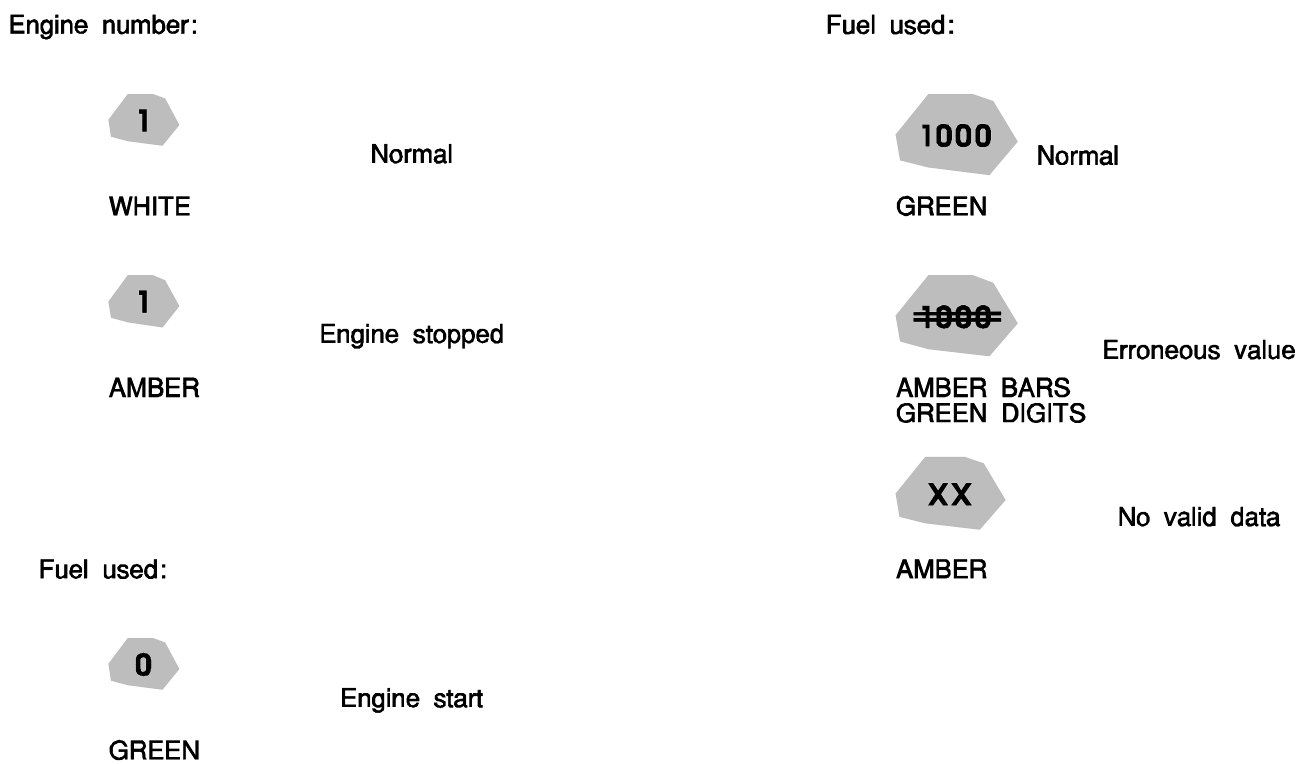
ECAM PAGE PRESENTATION

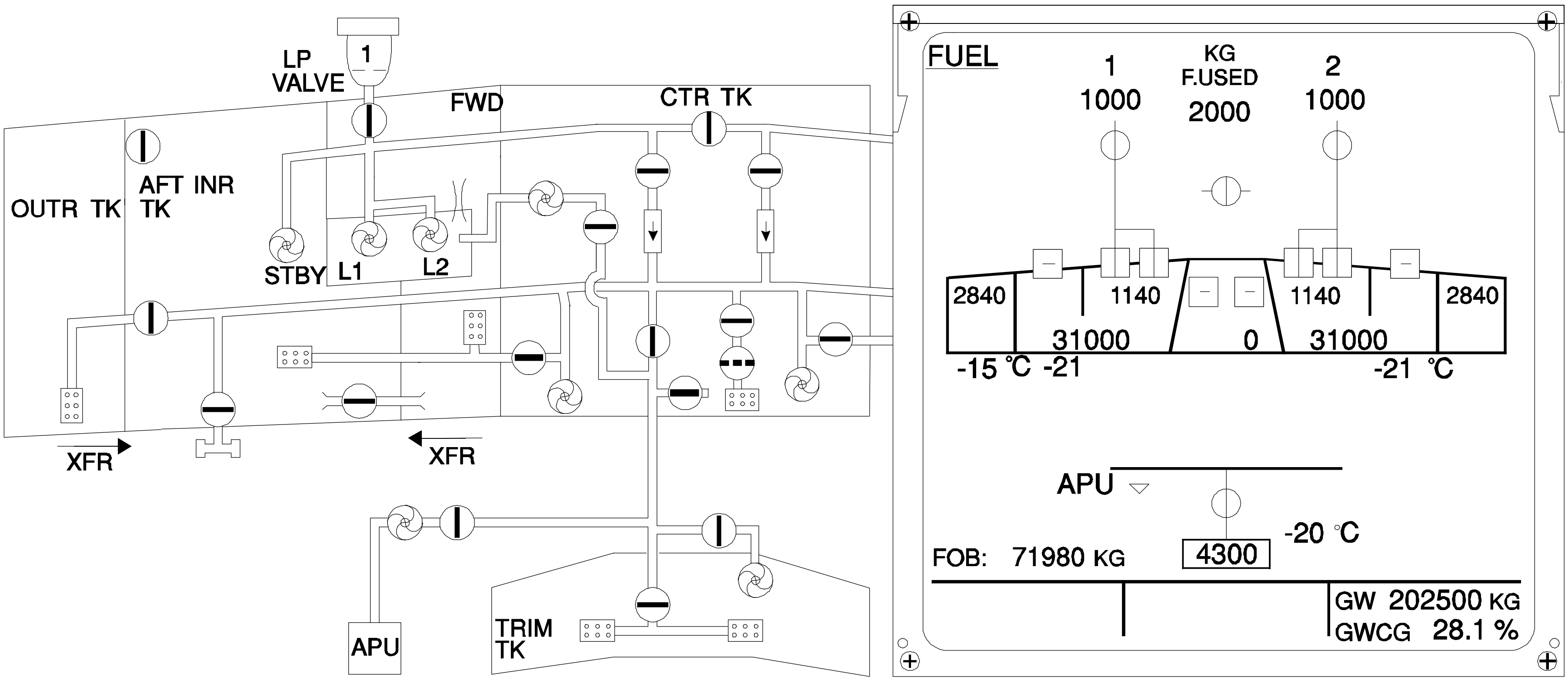
Engine Fuel Used
Low Pressure (LP) Valves
Crossfeed Valve
Main Pumps
Transfer Pumps
Quantities
Center to Inner Transfer
Outer to Inner Transfer
Trim Tank Transfer
Trim Tank Isolation
Auxiliary Power Unit (APU) Fuel Supply
Temperatures
Gross Weight Indication
Center of Gravity Indication

ENGINE FUEL USED

The quantity unit is basically displayed in kilograms.

The Engine Fuel Used and Total Fuel Used values are displayed.
They are computed by the Electronic Control Unit.





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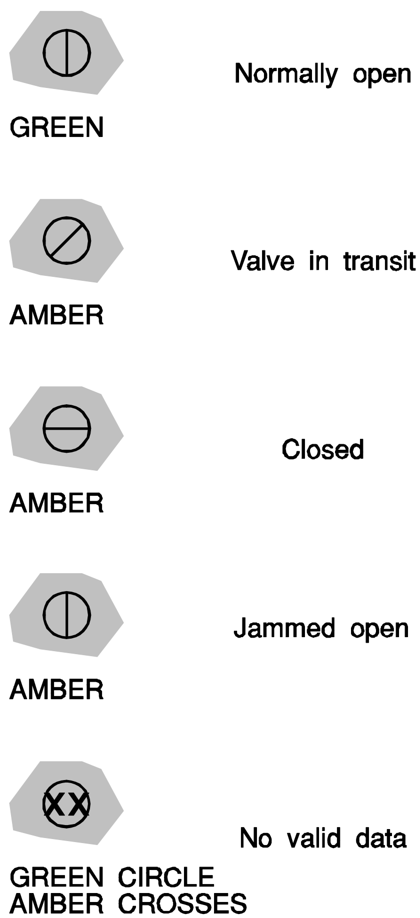
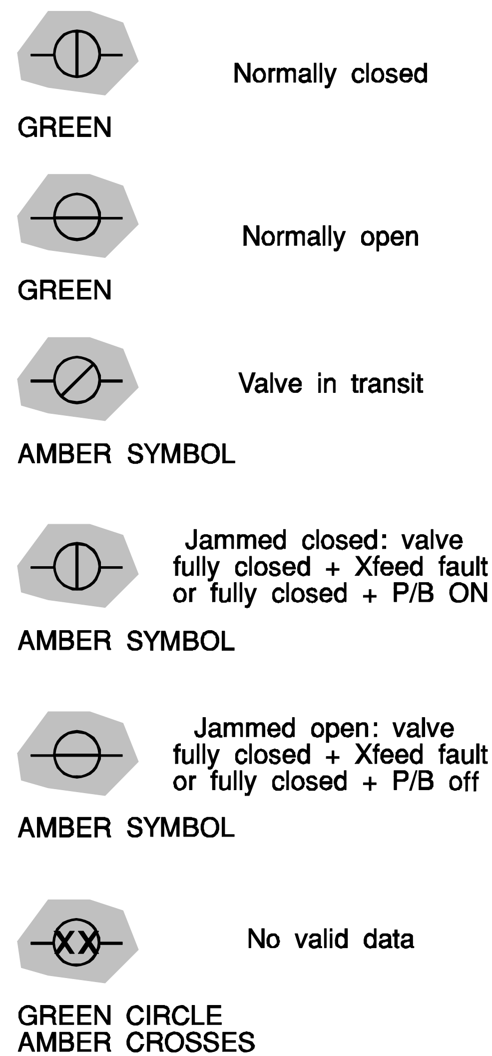
LOW PRESSURE (LP) VALVES

The position of each engine Low Pressure Valve is shown.



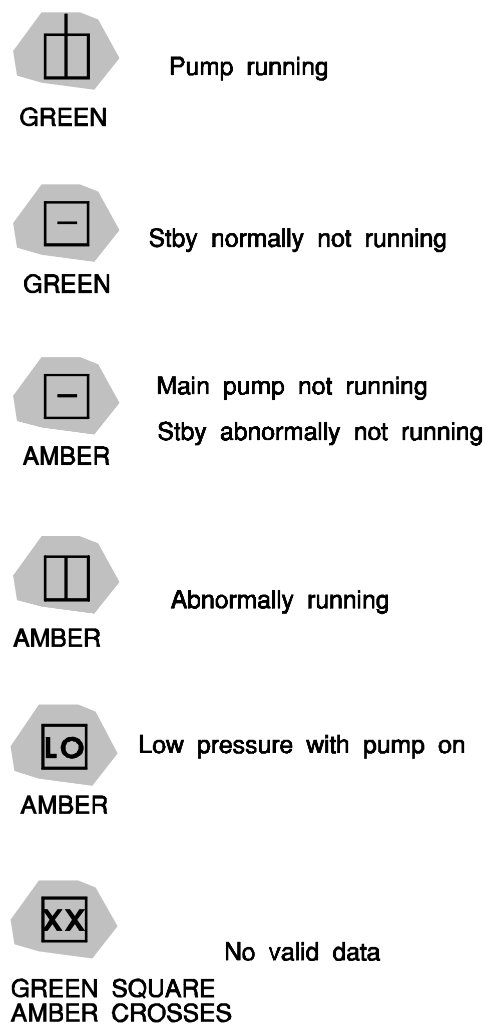
CROSSFEED VALVE

The Wing Crossfeed Valve symbol is normally green.



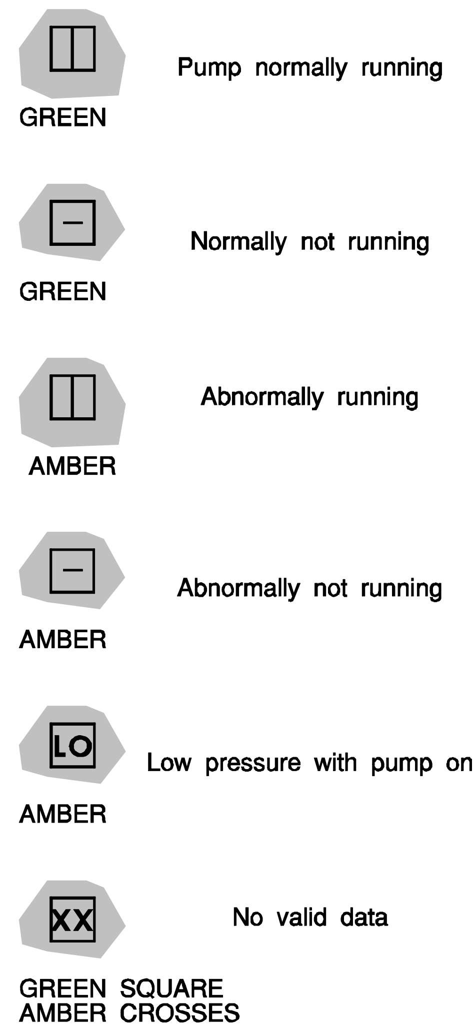
MAIN PUMPS

There are 2 sets of pumps. The Standby Pump symbol is displayed aside the corresponding normal feed pump symbol.



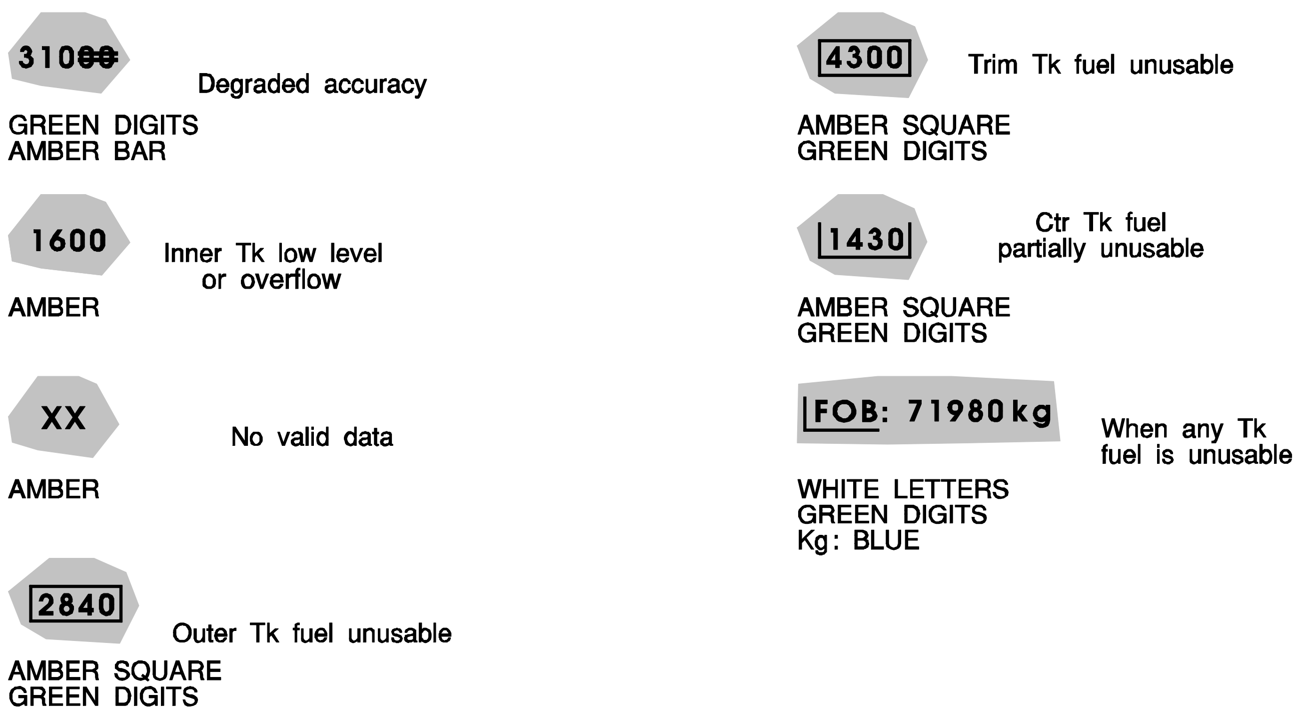
TRANSFER PUMPS

Two Center Tank Transfer Pumps are used to transfer fuel from the Center Tank to the Inner Tanks.



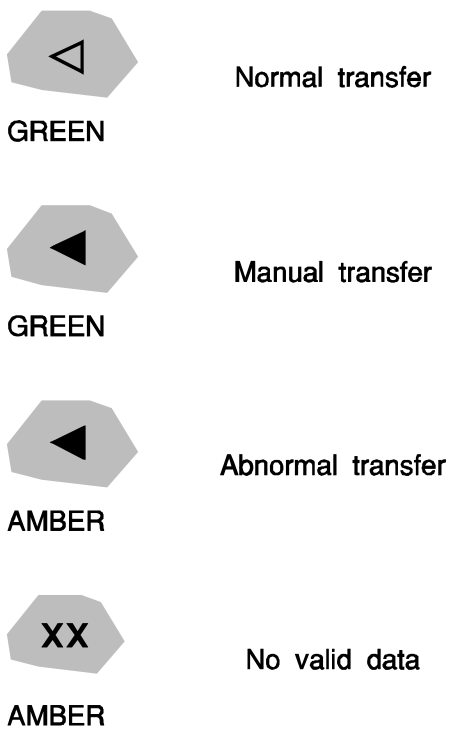
QUANTITIES

All the fuel Quantities are given by the Fuel Control and Monitoring Computer.
They are normally displayed in green.
Outer and Inner quantities can be pulsing in case of fuel unbalance.



CENTER TO INNER TRANSFER

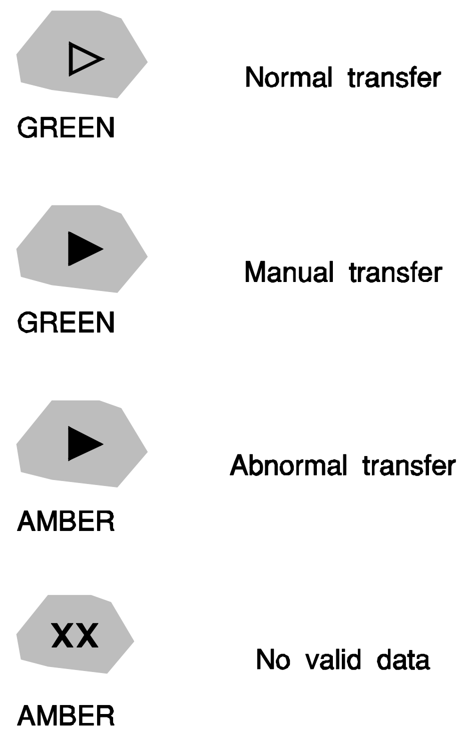
An arrow represents the Transfer from the Center Tank to the left Inner Tank and another arrow represents the transfer from the Center Tank to the right Inner Tank.



Not displayed = No Transfer

OUTER TO INNER TRANSFER

Each wing Outer Tank to Inner Tank Transfer corresponds to the opening of an InterTank Transfer valve.

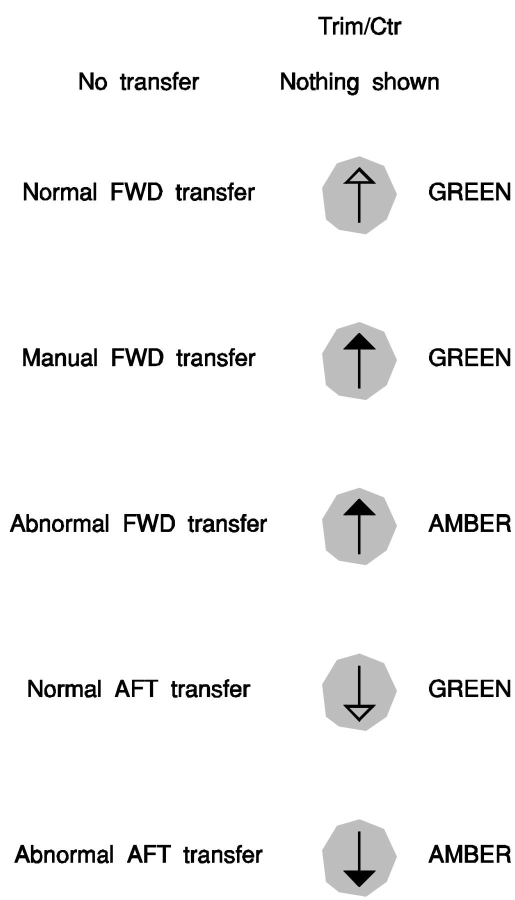


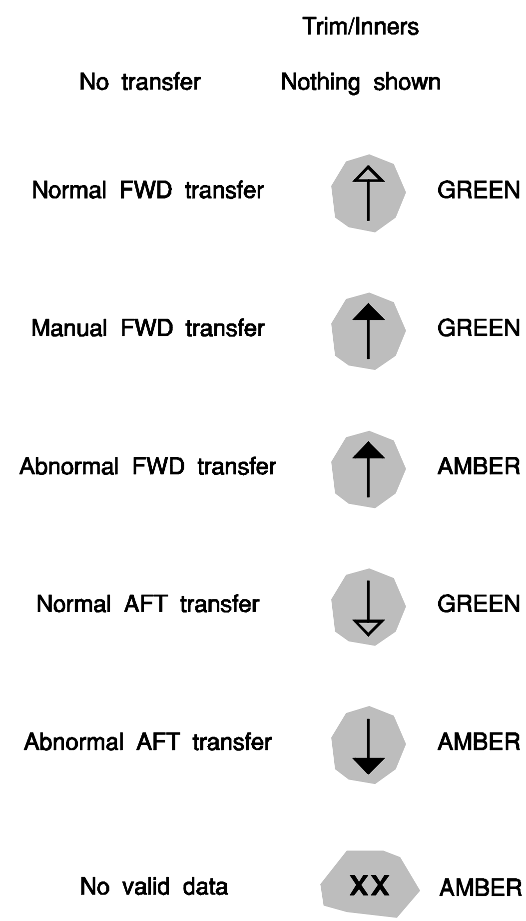
Not displayed = No Transfer

TRIM TANK TRANSFER

Trim Transfers consist of fuel transfers from or to the Trim Tank i.e. Forward or Aft Transfers.
The transfer between Trim Tank and Center Tank is shown by one arrow.

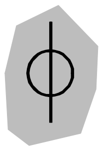
The Forward or Aft fuel transfer between the Trim Tank and the Inner Tanks is represented by 2 arrows.





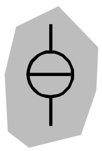
TRIM TANK ISOLATION

This symbol represents the Trim Tank Isolation Valve and Trim Tank Inlet Valve.
All the following states are provided by the FCMC.



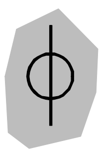
One valve normally open

GREEN



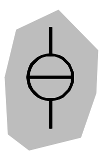
Both valves normally closed

GREEN



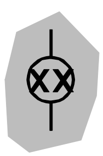
Abnormally open

AMBER



Jammed closed

AMBER

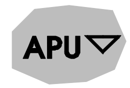


No valid data

GREEN CIRCLE
AMBER CROSSES

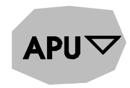
AUXILIARY POWER UNIT (APU) FUEL SUPPLY

This arrow represents the APU Fuel Supply.
It is the consequence of APU Pump and Valve operation.



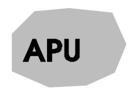
No transfer

WHITE



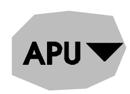
Normal fuel supply to APU

WHITE LETTERS
GREEN TRIANGLE



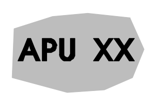
Abnormal: fuel not supplied to APU

AMBER



Abnormal: fuel supplied but APU not required

AMBER

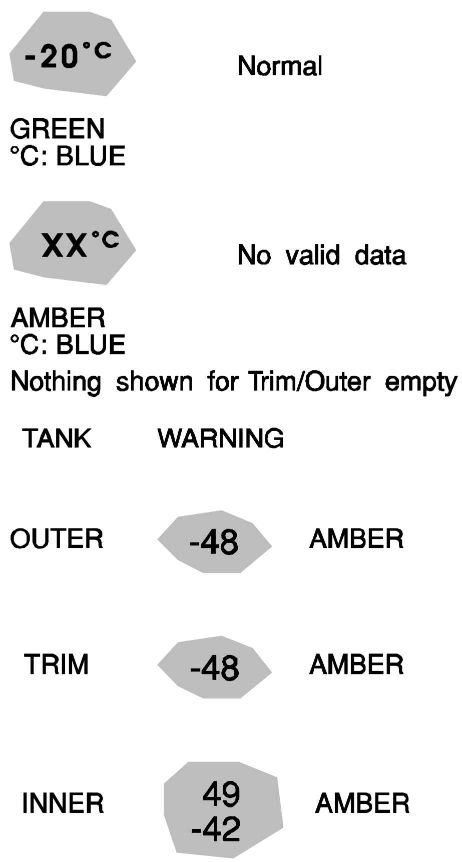


No valid data

WHITE LETTERS
AMBER CROSSES

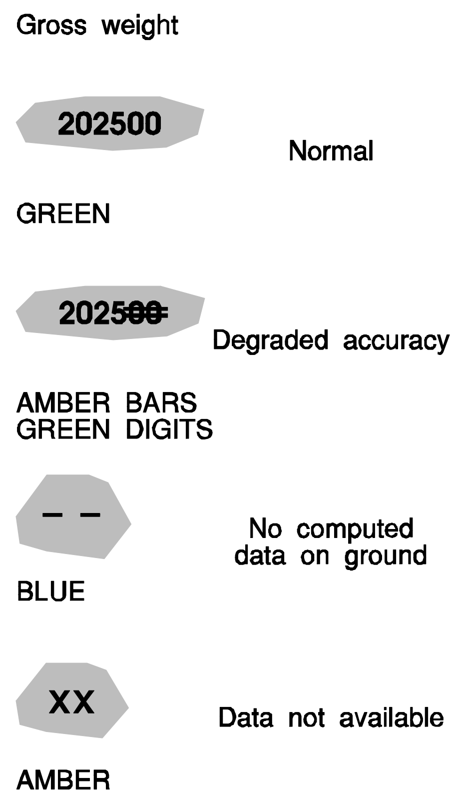
TEMPERATURES

The fuel Temperature is displayed for both Inner Tanks, the left hand Outer Tank and the Trim Tank.
All values are given by the Fuel Control and Monitoring Computer.



GROSS WEIGHT INDICATION

The Gross Weight Indication is displayed in the permanent data area.



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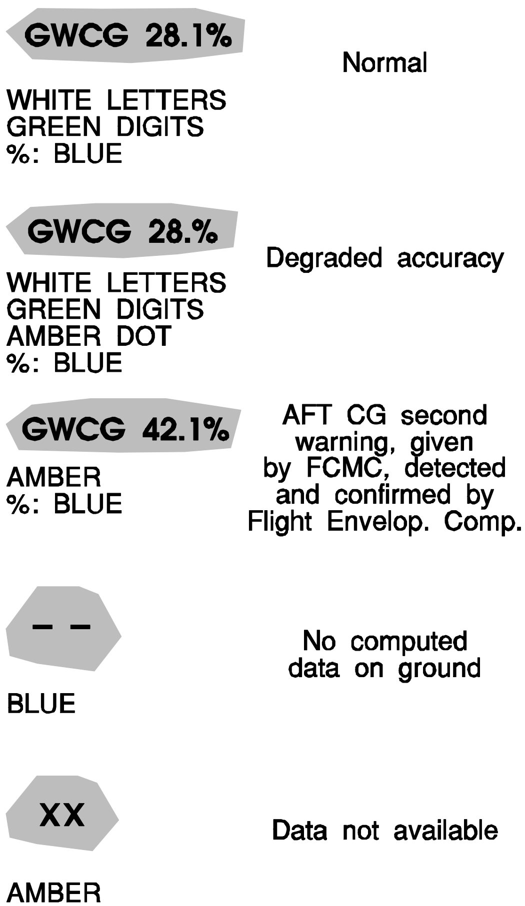
CENTER OF GRAVITY INDICATION

The Center of Gravity position is indicated in the permanent data area.



STUDENT NOTES

SYSTEM NORMAL OPERATION

Cockpit Preparation
Center to Inner Transfer
Automatic Center of Gravity Control
Aft Transfer
Inner Tank Fuel Burn
FWD Transfer
Outer to Inner Transfer
Parking

COCKPIT PREPARATION

The aircraft is electrically powered and APU is running.
Engines are not yet started.

Now engines are running and supply all aircraft systems, APU can be shut down.
The aircraft is ready for take off.

CENTER TO INNER TRANSFER

During climb engines burn fuel from Inner Tank until conditions for Center to Inner Transfer are fulfilled.
The Center to Inner Transfers allow the Center Tank to be emptied first in order to decrease wing root bending moment.

Transfers start when Inner Tank fuel level is below high level -2000 Kg and stop when high level sensors are wet or Center Tank is empty.

AUTOMATIC CENTER OF GRAVITY CONTROL

Automatic Control of Center of Gravity (CG) is available when the aircraft climbs above FL255 and is terminated by initiating a continuous forward transfer when it descends below FL245, or a time to destination signal less than 30 mn is received from FMGEC.

The automatic fuel transfers to and from Trim Tank are used to set the aircraft CG on the CG Target.
ZFCG & ZFW data has been previously entered by the crew on the MCDU.

AFT TRANSFER

Normally only one Aft Transfer per flight is required if, as the aircraft passes FL255, the CG is forward of the target by more than 0.5% and the Trim Tank is not full.

This transfer stops when Trim Tank is full or CG is forward of the Target CG or Inner Tank below 6250 Kg.

INNER TANK FUEL BURN

When the Center Tank is empty, the largest amount of Inner Tank quantity is then used for fuel burn. No transfer to the Inner tanks is made until much later in the flight, from Trim Tank or/and Outer tanks.

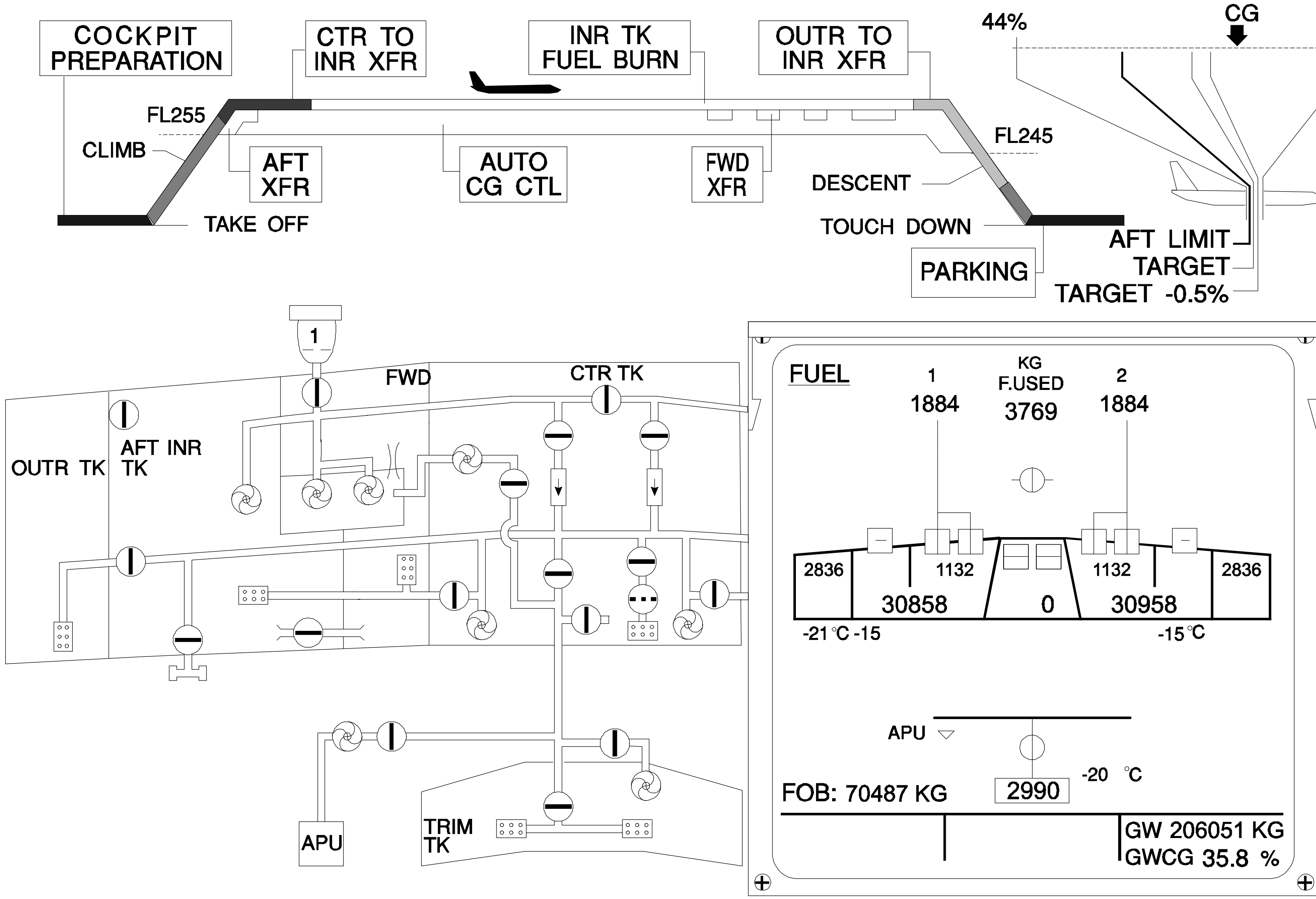
FWD TRANSFER

When most of the Inner Tank fuel is used, aircraft CG moves aft and small Forward Transfers have to be initiated.

Forward Transfers for CG control are initiated when CG > Target CG and continue until CG < target CG -0.5% of MAC.

When time to destination is less than 30 mn or aircraft passes FL245 a continuous Forward Transfer is made.
It is limited to high level to prevent overflow.

FWD Transfer is also initiated when any Inner Tank level decreases to 4000 Kg and continues until Inner Tank level reaches 4100 Kg.


COCKPIT PREPARATION
CTR TO INR XFR
INR TK FUEL BURN
OUTR TO INR XFR
44%
CG
35%
FL255
CLIMB
AFT XFR
AUTO CG CTL
FWD XFR
FL245
DESCENT
TAKE OFF
TOUCH DOWN
PARKING
AFT LIMIT
TARGET
TARGET -0.5%
1
FWD
CTR TK
OUTR TK
AFT INR TK
TRIM TK
APU
FUEL
1
KG F.USED
2
1884
3769
1884
2836
1132
1132
2836
30858
0
30958
-21°C -15
-15°C
APU
-20 °C
FOB: 70487 KG
2990
GW 206051 KG
GWCG 35.8 %

OUTER TO INNER TRANSFER

Transfer of fuel from Outer Tank to Inner Tank occurs while Center Tank and Trim Tank have been already emptied.
Transfers take place simultaneously in both wings to keep lateral balance.

Outer to Inner Transfers cycle the Inner Tank levels between 3500 Kg and 4000 Kg.

PARKING

After landing the crew has to start the APU, shut down the engines and deselect the pumps on the fuel panel.

STUDENT NOTES:

STUDENT NOTES

FUEL MANAGEMENT

Fuel Control and Monitoring System (FCMS) Introduction
Fuel Control and Monitoring Computer (FCMC)
Fuel Quantity Indicating (FQI)
Sensors
Engine Feed
Valves Control
Center of Gravity (CG) Control
Refuel/Defuel Control
Cockpit Interfaces
Other Computer Interfaces

FUEL CONTROL AND MONITORING SYSTEM (FCMS)

INTRODUCTION

The Fuel Control and Monitoring System operates in a fully automatic mode. The only actions between flights are : selecting the required fuel load for refueling, inserting the Zero Fuel Weight and the Zero Fuel Center of Gravity position.

Manual override controls are provided only when it is necessary to bring the system into a safe configuration or following failure of the automatism.

FUEL CONTROL AND MONITORING COMPUTER (FCMC)

The Fuel Control and Monitoring System comprises 2 identical computers FCMC 1 and FCMC 2.
Each Computer performs the data monitoring and the calculation simultaneously.

The control function is achieved by one computer at a time ; in normal condition, FCMC 1.

FUEL QUANTITY INDICATING (FQI)

The Fuel Control and Monitoring System computes Fuel Quantity data.
Measurement from fuel probes, densitometers, etc. provides indicating and operational logics.

SENSORS

Various temperature and level sensors are provided throughout the tanks.

Temperature and level thresholds trigger control logics and warnings.

ENGINE FEED

Engine Feed Main and Standby pumps are NOT controlled by the Fuel Control and Monitoring System, but by aircraft wiring.
The FCMS monitors the pumps states.
Each pump output is monitored by a pressure switch.

To maintain the collector cells full, the FCMS controls in flight fuel transfers : Trim Forward, Outer to Inner.

VALVES CONTROL

The Fuel Control and Monitoring Computers receive pushbutton and valve position signals, and send output signals to enable these valves to operate.

CENTER OF GRAVITY (CG) CONTROL

The Fuel Control and Monitoring System controls the Center of Gravity position with Aft or Forward fuel transfers.

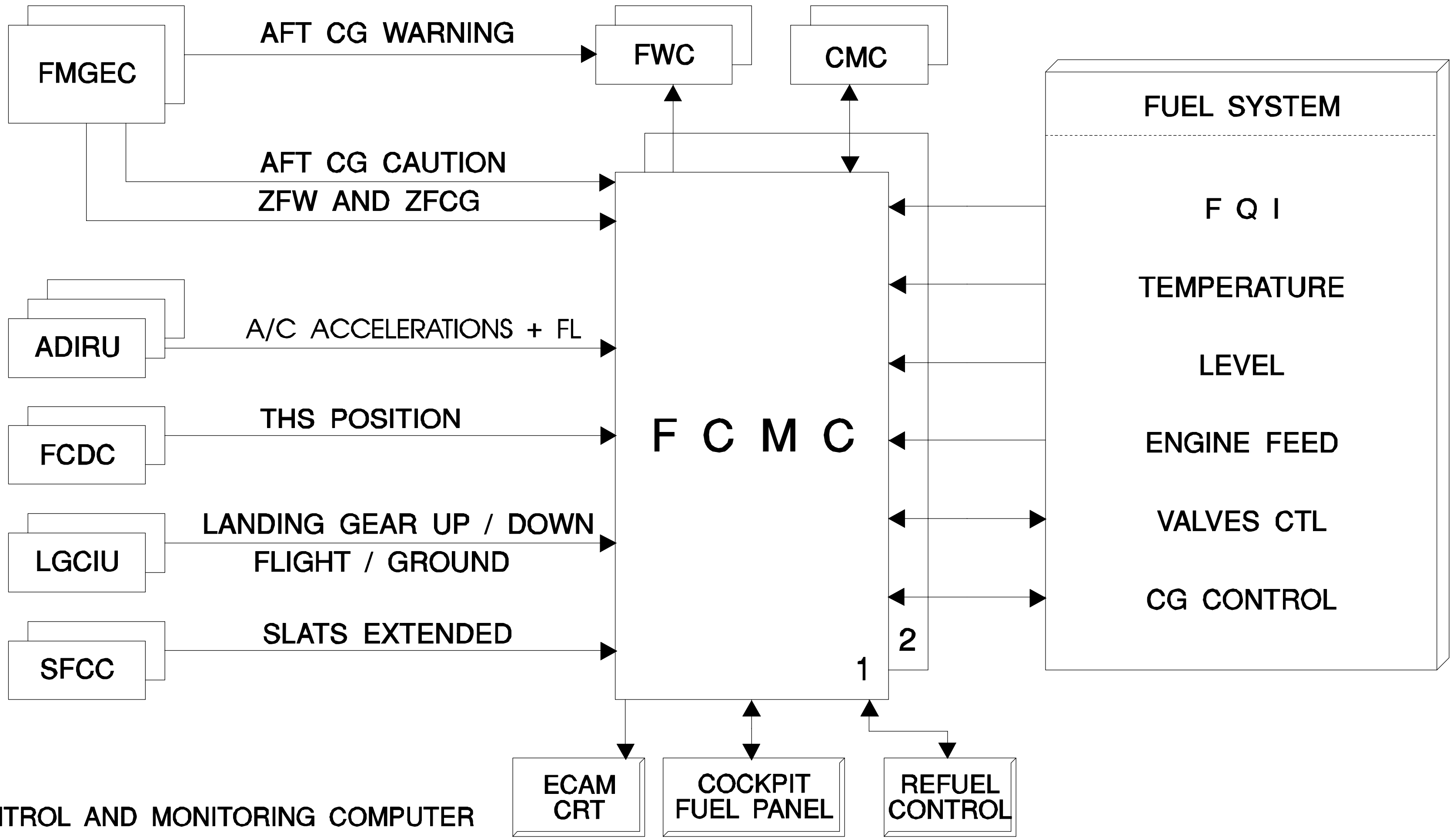
The CG position is expressed in terms of percentage of Mean Aerodynamic Chord (% MAC).

REFUEL/DEFUEL CONTROL

The computers receive selections from the Refuel/Defuel panel, and command automatic refuel or manual refuel/defuel.

COCKPIT INTERFACES

The computers receive Cockpit panel selection signals and enable the related pumps and valves to operate.
The fuel system configuration is displayed on the ECAM.



FCMC :
FUEL CONTROL AND MONITORING COMPUTER

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OTHER COMPUTER INTERFACES

The Fuel Control and Monitoring System interfaces with other aircraft systems.

FWC : Flight Warning Computer.
CMC : Central Maintenance Computer.

The Fuel Control and Monitoring Computers use inputs from these computers for the Center of Gravity calculation.

FMGEC : Flight Management, Guidance and Envelope Computer.
ADIRU : Air Data and Inertial Refence Unit.
FCDC : Flight Control Data Concentrator.

Each FCMC also uses data from other interfaced aircraft systems.

These inputs give the aircraft flight or ground condition and make sure that the FCMC functions operate only at the applicable time.

LGCIU : Landing Gear Control and Interface Unit.
SFCC : Slat Flap Control Computer.

STUDENT NOTES:

STUDENT NOTES

JETTISON SYSTEM PRESENTATION

Purpose
Jettison Valves
Jettison Control
Jettison Termination Control
ECAM Page Presentation

PURPOSE

The Purpose of the system is to Jettison some of the aircraft fuel in flight in case of an emergency landing on a fully loaded aircraft.

The fuel dumping rate is approximately 1080 Kg (2832 Lbs) per minute.

JETTISON VALVES

There are 2 Jettison Valves, one per wing.
The valve is installed in a fuel line from the refuel gallery and controls the flow to the Jettison pipe.
It is operated by an actuator with 2 electrical motors.

The normally closed Jettison Valves open for dumping.

JETTISON CONTROL

When the 2 guarded Jettison pushbuttons are set to ON, the system is energized.
Then the green OPEN light comes on when a Jettison valve opens.
The fuel is simultaneously Jettisoned from the Center and Inner Tanks.
The Jettison selection starts the 2 Standby pumps and opens the Crossfeed valve.
The FCMS opens the AFT Transfer valves, closes all Tank Inlet Valves and allows the Jettison Valves to open.

Note :

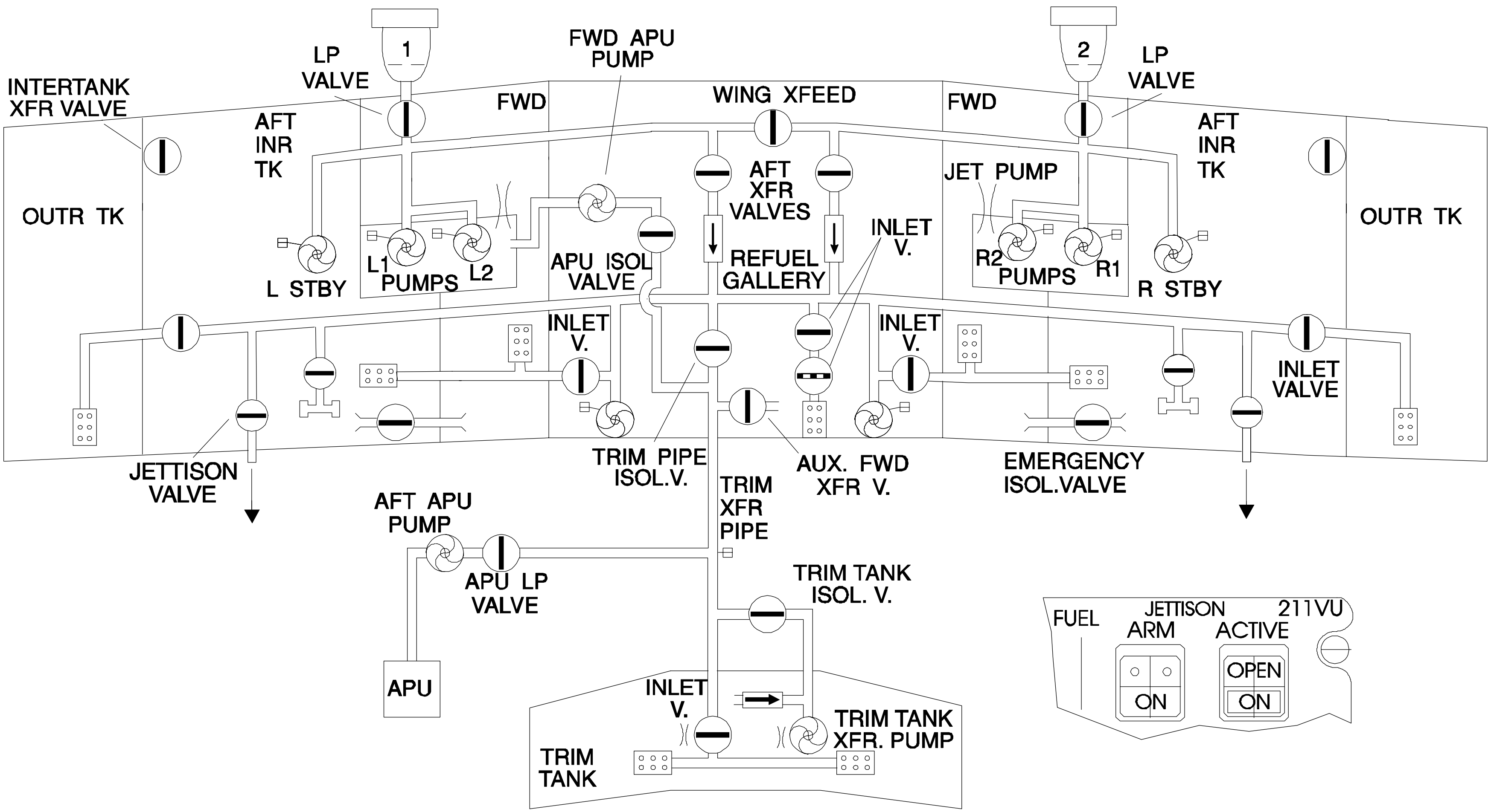
If the Trim Tank contains fuel, a forward transfer to the Center Tank is activated.

JETTISON TERMINATION CONTROL

The Jettison system can be stopped manually or automatically.

Jettison terminates when :

- one of the two JETTISON P/B switches is released,
- fuel quantity equals Jettison Final Gross Weight (as pre-entered by the crew on MCDU of FMGEC).
- the total of the two Inner Tank fuel quantities is less than 10000 Kg (22000 Lbs).
- the two ETOPS level sensors become dry,



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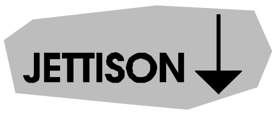
ECAM PAGE PRESENTATION

The Jettison arrow is only displayed when the system is activated.
Not displayed = no Jettison



Jettison active

WHITE LETTERS
GREEN ARROW

Abnormal jettisoning

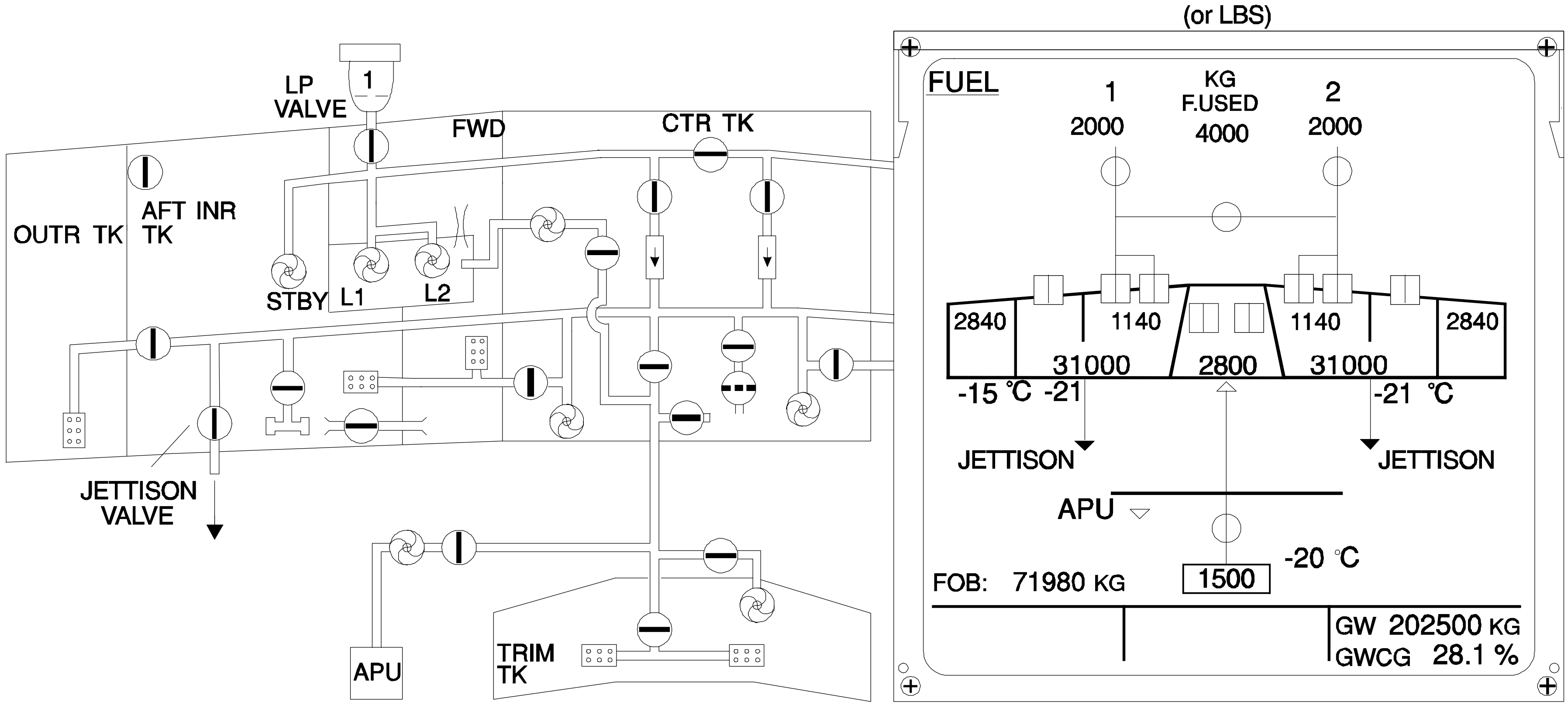
AMBER

Jettison required
but inactive

AMBER

No valid data

WHITE LETTERS
AMBER CROSSES



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STUDENT NOTES:

FUEL WARNINGS

EXCESS AFT CG
PUMP LO PR
WING XFEED FAULT
WING PUMPS LO PR
TRIM TANK PUMP LO PR
TRIM LINE FAULT
OUTER TO INR FAULT
L(R) WING TK LO LVL
WING TK OVERFLOW
FUEL LO TEMP
FCMC 1 & 2 FAULT
OPERATING LIMITATIONS

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EXCESS AFT CG

The GWCG is shown red on the permanent data display and the Trim TANK MODE FAULT light comes on amber on the control panel. A manual FWD transfer from the TRIM tank should be initiated to maintain CG within normal limits.

PUMP LO PR

The "LO" legend is shown amber on the ECAM display and the FAULT light comes on amber on the control panel. The STBY PUMP starts to run automatically.

WING XFEED FAULT

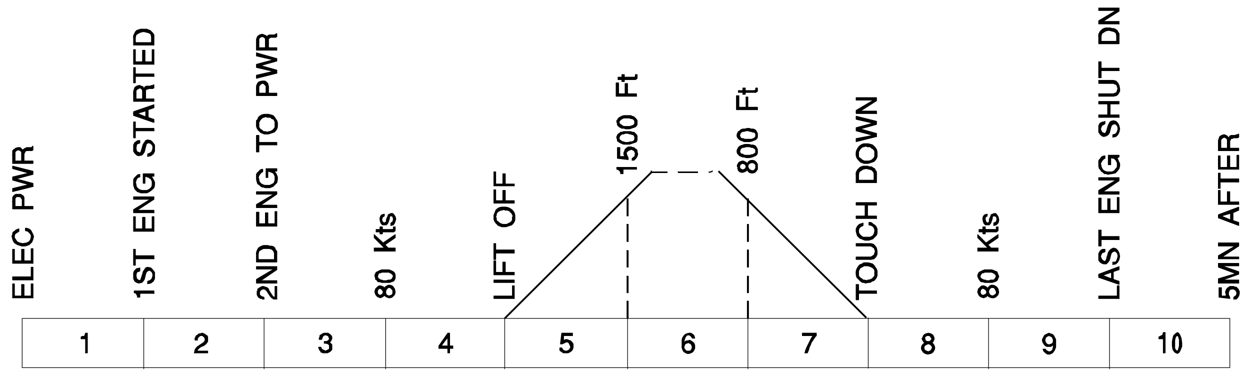
The valve symbol is shown amber in line on the ECAM display and the OPEN light comes on amber on the control panel ; the valve has failed open (amber, in line). If the valve has failed closed (amber, cross line), the "ON" white light stays on.

WING PUMPS LO PR

The "LO" legends are shown amber on the ECAM display and the FAULT lights come on amber on the control panel. The wing crossfeed valve will be used to feed the engine from the operable wing fuel pumps. If the fuel from the affected wing is required, the corresponding engine can be fed by gravity. (with max FL 150)

TRIM TANK PUMP LO PR

When the Trim Tank Transfer Pump is detected failed, the forward transfer can only continue by gravity.



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
EXCESS AFT CG	CRC	MASTER WARN	FUEL	T TK XFR FAULT lt	2 to 5, 7 to 10
L(R) PUMP 1(2) LO PR	NIL	NIL	FUEL	Associated PUMP FAULT lt	1, 3 to 5 7, 8, 10
WING X FEED FAULT	NIL	NIL	FUEL	WING X FEED OPEN or ON lt	3 to 5 7, 8
L(R) WING PUMPS LO PR All pumps of the same wing LO PR	SINGLE CHIME	MASTER CAUTION	FUEL	L PUMPS & L STBY PUMP FAULT lts	1, 3 to 5 7, 8, 10
TRIM TK PUMP LO PR	SINGLE CHIME	MASTER CAUTION	—	—	—

TRIM LINE FAULT

NOTE : the valve symbol is shown amber in line on the ECAM display in case of Trim Tank isolation fault.

When the symbol is amber cross line, "TRIM LINE is ISOLATED", all Trim Tank line system valves are shut due to detected trim line damage. The transfer line must be isolated by selecting the "T TANK SEL" to the "ISOL" position. This will cause all the valves related to the TRIM XFR line to close.

OUTER TO INNER FAULT

Note the amber arrows shown on the ECAM display and the amber FAULT light on the control panel. Manual transfer will be used to transfer fuel from the Outer Tanks to the Inner Tanks.

L(R) WING TK LO LVL

Note the amber Inner Tank quantity shown on the ECAM display and the amber FAULT lights on the control panel. When a low level is detected in the Inner Tank, all manual transfer pushbuttons have to be released out.

WING TK OVERFLOW

In case of a wing tank overflow, note the FAULT light on the T TANK MODE P/B in addition of the Inner Tank quantity shown amber.

FUEL LO TEMP

The tank temperature is displayed in amber when it exceeds the limits.
In flight, manual transfers should be initiated.
On ground, if a low fuel temperature is detected, take-off must be delayed.

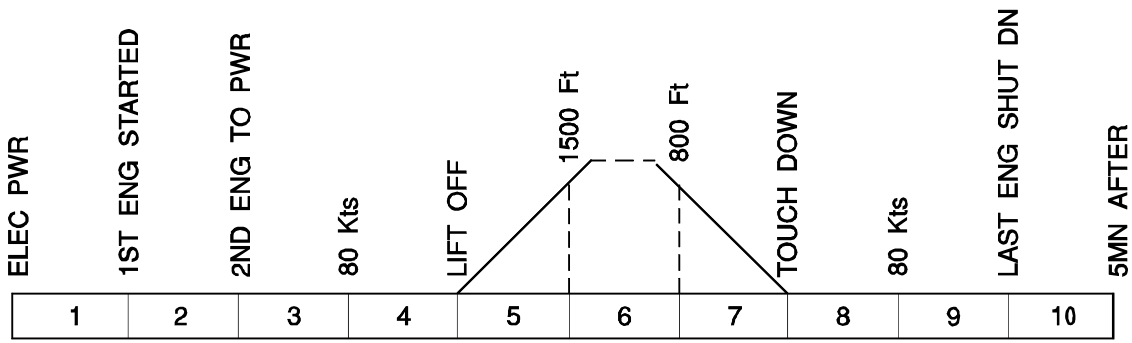
FCMC 1 & 2 FAULT

There are no Fuel Control and Monitoring Computers (FCMCs) signals received by ECAM. The automatic control of fuel transfer is lost. The control of fuel transfer has to be done manually.

OPERATING LIMITATIONS

Maximum allowed wing fuel unbalance = 3000 Kg.
Fuel temperature warning :

- maximum fuel temp. : 49°C (120°F)
- minimum fuel temp. : -48°C (-54°F)



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
TRIM LINE FAULT	SINGLE CHIME	MASTER CAUTION	FUEL	NIL	4, 5, 8
OUTER TO INR FAULT	SINGLE CHIME	MASTER CAUTION	FUEL	XFR TO INR FAULT lt	3 to 5 7, 8
L(R) WING TK LO LVL Lo level sensors	SINGLE CHIME	MASTER CAUTION	FUEL	OUTR XFR FAULT lts	3 to 5 7, 8
WING TK OVERFLOW Surge tank sensors	SINGLE CHIME	MASTER CAUTION	FUEL	T TK FAULT lt	3 to 5 7, 8
FUEL LO TEMP	SINGLE CHIME	MASTER CAUTION	FUEL	NIL	3 to 5 7, 8
FCMC 1 + 2 FAULT Loss of automatic control of XFR	SINGLE CHIME	MASTER CAUTION	FUEL	NIL	4, 5 7, 8

STUDENT NOTES

VENTING SYSTEM DESCRIPTION AND OPERATION

GENERAL
WINGS VENT
- Vent Pipes
- Breather Assembly
- Vent Float Valves
- Operation
- Overpressure Protectors
- Flame Arrestor
- Wing Fence

TRIM TANK VENT
- Installation
- Vent Float Valves
- Trim Surge Tank

GENERAL

The Tank Venting System is divided into two systems.

The two systems are:

- the Wing Tanks Venting system (which includes the Center Tank Venting),
- the Trim Tank Venting system.

WINGS VENT

VENT PIPES

The Center Tank pipe and the Inner Tank pipes are the biggest vent pipes.
The Outer Tank Vent pipe connects the open end fitting, inboard of rib 33, to the Inner pipe between the weir duct and rib 22.

The weir duct is installed in the Inner Tank Vent pipe between rib 22 and 23, for anti-syphon purposes.
The Surge Vent Tank has the smallest vent pipe section.

BREATHER ASSEMBLY

The bottom of the main vent pipes includes at different locations a breather assembly (that is a drain valve).

If fuel goes into the vent pipe, the breather assembly lets the fuel drain back into the Inner Tank.

VENT FLOAT VALVES

There are two Vent Float Valves for the Inner Tank and one for the Outer Tank.

OPERATION

During flight, fuel from Inner Tank can collect in the Surge Vent Tank before flowing overboard.

If there is fuel in the Surge Tank, gravity or pressurization from the NACA air intake causes fuel to move through its drain pipe to the Inner Vent pipes.
From there it flows through the breather assemblies into the Inner Tank.

OVERPRESSURE PROTECTORS

This is a burst disc installed in each Vent Surge Tank.
It brakes in case of too high differential pressure.

If a burst disc breaks, fuel flows overboard.

FLAME ARRESTOR

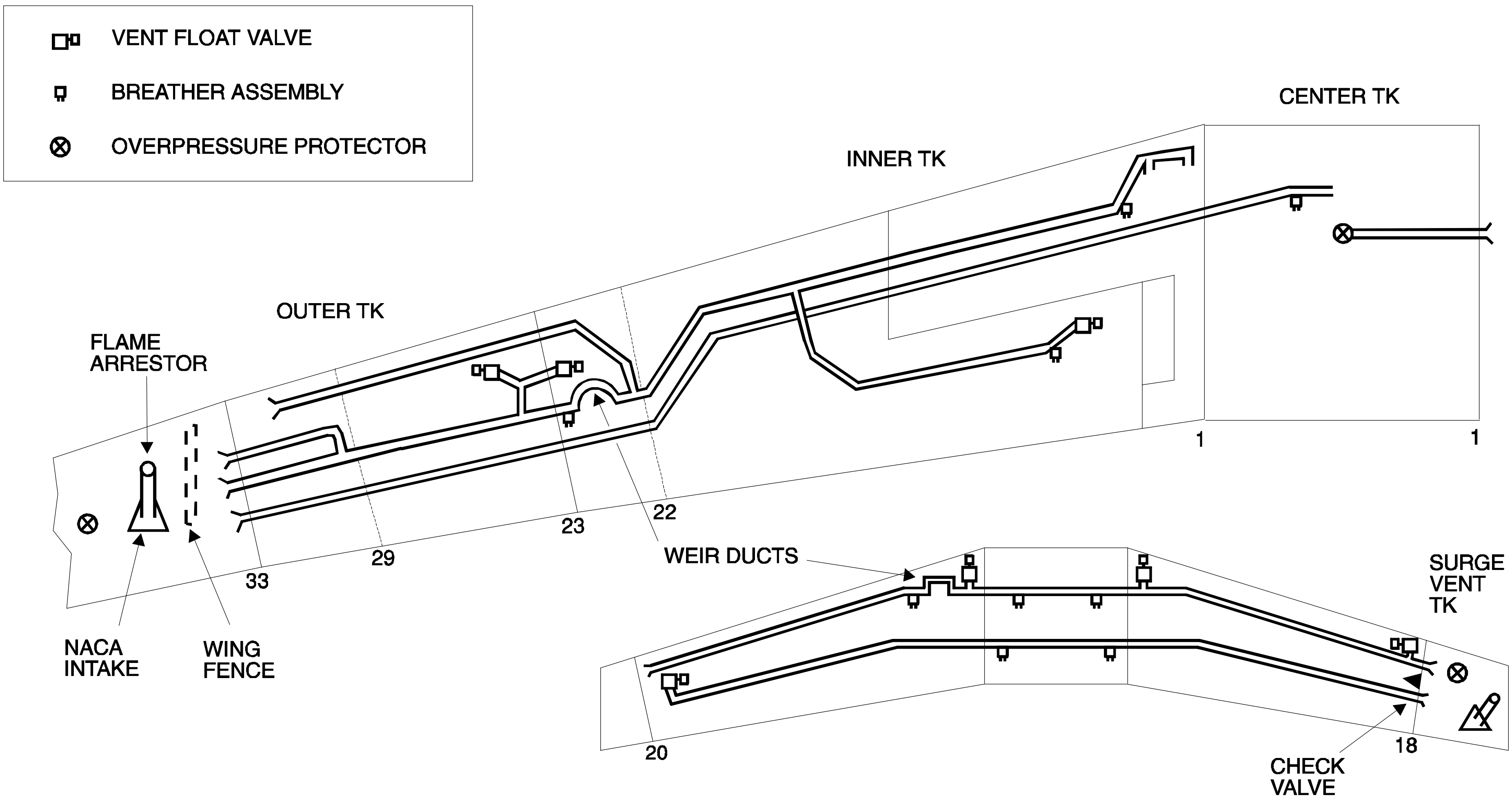
The stack pipe connected to the NACA duct is equipped with a flame arrestor.

If a ground fire occurs, it prevents the ignition of the fuel vapour in the Surge Tank (and thus the tank venting system).
It also lets air flow freely through it in two directions.

The NACA shape prevents ice formation.
If a failure occurs in the fuel system (which causes larger quantities of fuel to enter the Surge Tank) then the flame arrestor lets the fuel flow freely overboard.

WING FENCE

If fuel comes out of the NACA Intake (or the Overpressure Protector), it could go inboard along the lower surface of the wing.
A wing fence makes sure that such fuel falls off the wing.



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TRIM TANK VENT

INSTALLATION

The Trim Tank has a main vent pipe with 3 vent float valves, and a secondary vent pipe with one vent float valve.

Fuel breather assemblies attached to the bottom of each vent pipe let fuel drain back into the Trim Tank.

VENT FLOAT VALVES

The Vent Float valves keep the vent pipes open to the Surge Tank but close when the fuel level increases abnormally.
The two inboard Vent Float valves make sure that the Trim Tank is open to the Surge Tank when the aircraft climbs.

The Vent Float valve installed on the inboard face of RH rib 18 makes sure the RH part of the Trim Tank is open to the Surge Tank in normal Trim Tank attitude (and during refuel/defuel operations).

TRIM SURGE TANK

The NACA Intake, flame arrestor and overpressure protector are of the same type as for the Wing Tank Venting system.

If fuel gets into the Trim Surge Vent Tank, a check valve on the RH rib 18 lets this fuel flow back into the Trim Tank.

STUDENT NOTES:

STUDENT NOTES

TANK, VENTING AND SCAVENGE COMPONENTS

Safety Precautions
Wing Tank Manholes
Center Tank Manholes
Trim Tank Handholes
Clack Valves
Float Vent Valves
Flame Arrestors
Naca Intakes
Breather Assemblies
Trim Tank Check Valve
Trim Tank Jet Pumps

SAFETY PRECAUTIONS

Obey the fuel safety procedures.
Do not get aircraft fuel in your mouth, in your eyes or on your skin for a long time. (aircraft fuel is poisonous)
Make sure that the Landing gear safety locks and wheel chocks are in position.
Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.
Make sure that you have correct fire fighting equipment available before you start any task on fuel system.
Make sure that all circuits in maintenance are isolated before you supply electrical power to the aircraft.
Use the talcum powder procedure only on the external surfaces of the fuel tanks. This will prevent contamination of the fuel system.
Do not get your clothes soaked with fuel. Use approved protective clothing when you go into a fuel tank.

STUDENT NOTES

WING TANK MANHOLES

FIN / ZONE

Fin : 541AB,541BB,541CB,541DB,541EB,541FB,541GB,541HB,
541JB,541KB,541LB,541MB,541NB,541PB,541QB,541RB,541SB
542AB,542BB,542CB,542DB,542EB,542FB,542GB,542HB,
542JB,542KB,
550AB,550BB,550CB,550DB,550EB,550FB.
641AB,641BB,641CB,641DB,641EB,641FB,641GB,641HB,641JB
641KB,641LB,641MB,641NB,641PB,641QB,641RB,641SB,
642AB,642BB,643CB,643DB,642EB,642FB,642GB,642HB,
642JB,642KB,
650AB,650BB,650CB,650DB,650EB,650FB

Zone : 541,542,550
641,642,650

COMPONENT DESCRIPTION

Manholes permit access to the fuel system components in the wing tanks.

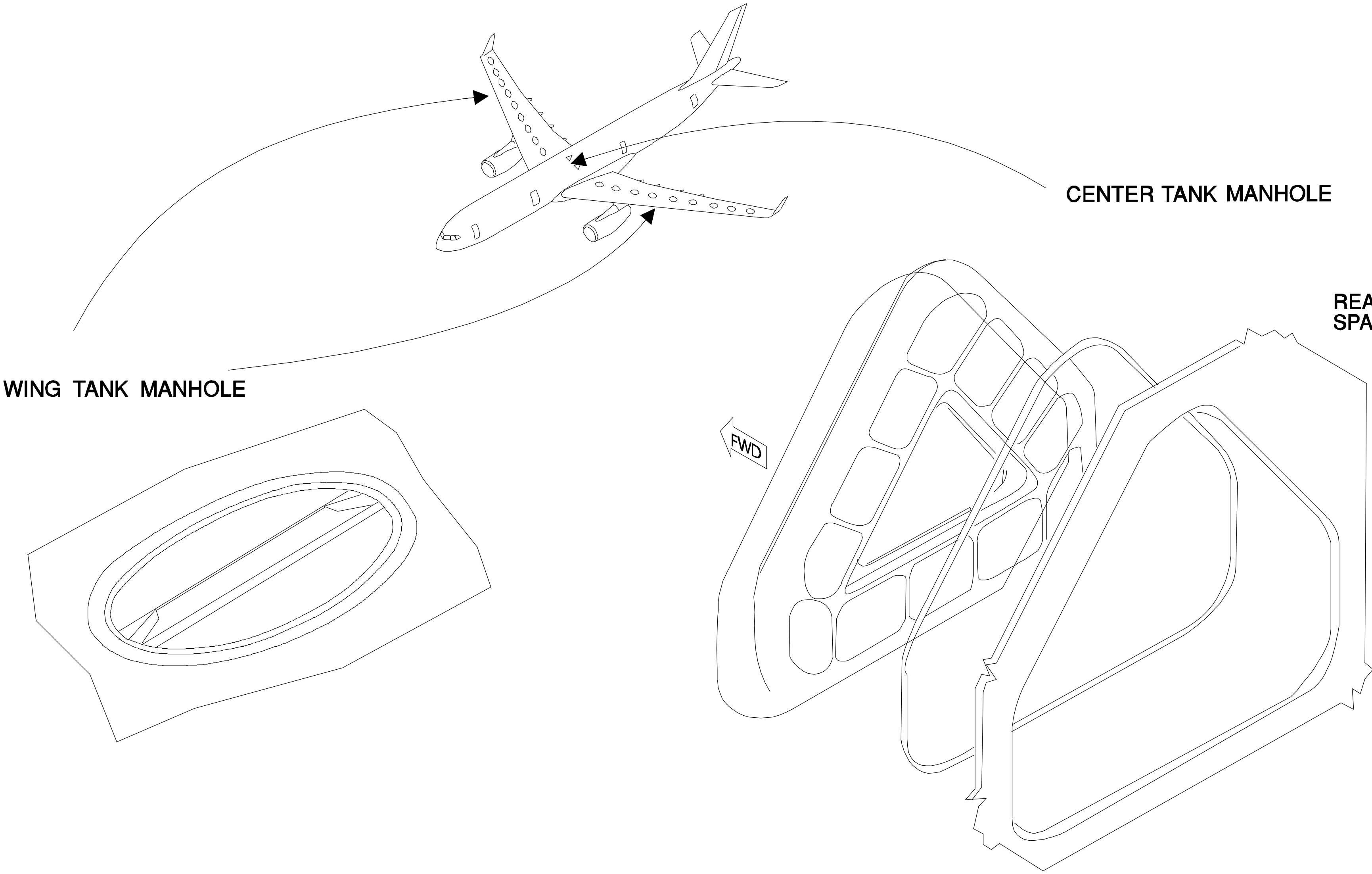
CENTER TANK MANHOLES

FIN / ZONE

Fin : 147AZ, 148AZ
Zone : 141, 142

COMPONENT DESCRIPTION

Two manholes permit access to the fuel system components within the Center Tank.



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TRIM TANK HAND-HOLES

FIN / ZONE

Fin : 333AB,333BB,333CB,333DB,333EB,333FB,
343AB,343BB,343CB,343DB,343EB,343FB.
Zone : 333, 343

COMPONENT DESCRIPTION

Hand-hole panels allow access to fuel components of the Trim tank.

REMOVAL / INSTALLATION

Remove screws and washers, then the THS hand hole cover and the gasket. Install protective ring-stabilizer.
When re-installed, check the THS hand hole cover for leaks.

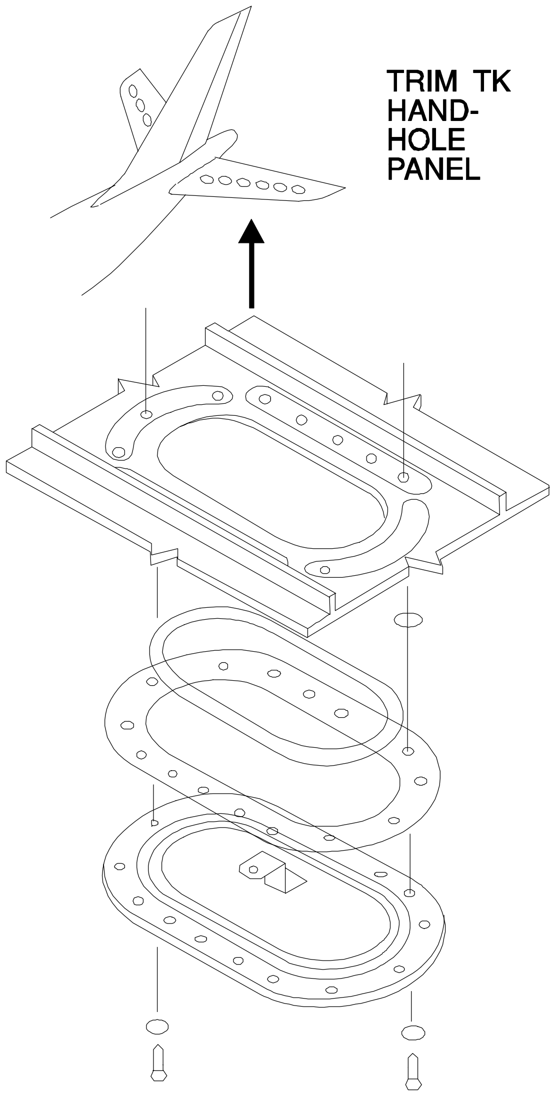
CLACK VALVES

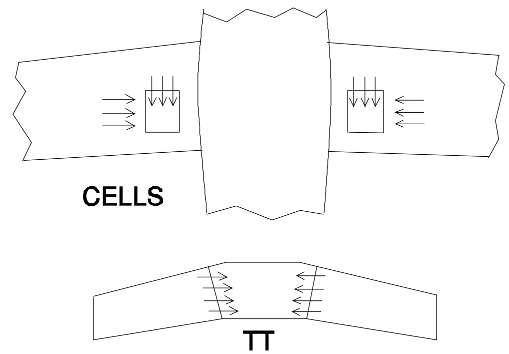
FIN / ZONE

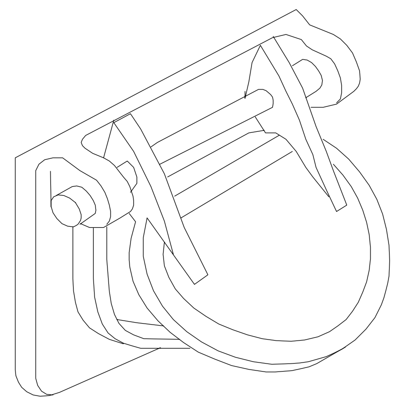
Fin : none
Zone : 541, 641, 310

COMPONENT DESCRIPTION

Clack valves are simple flap valves which let fuel in the collector cells and in the center section of the Trim tank.







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FLOAT VENT VALVES

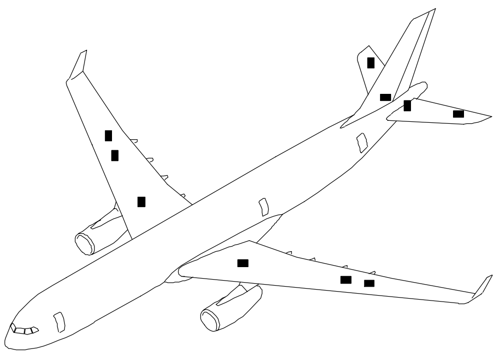
FIN / ZONE

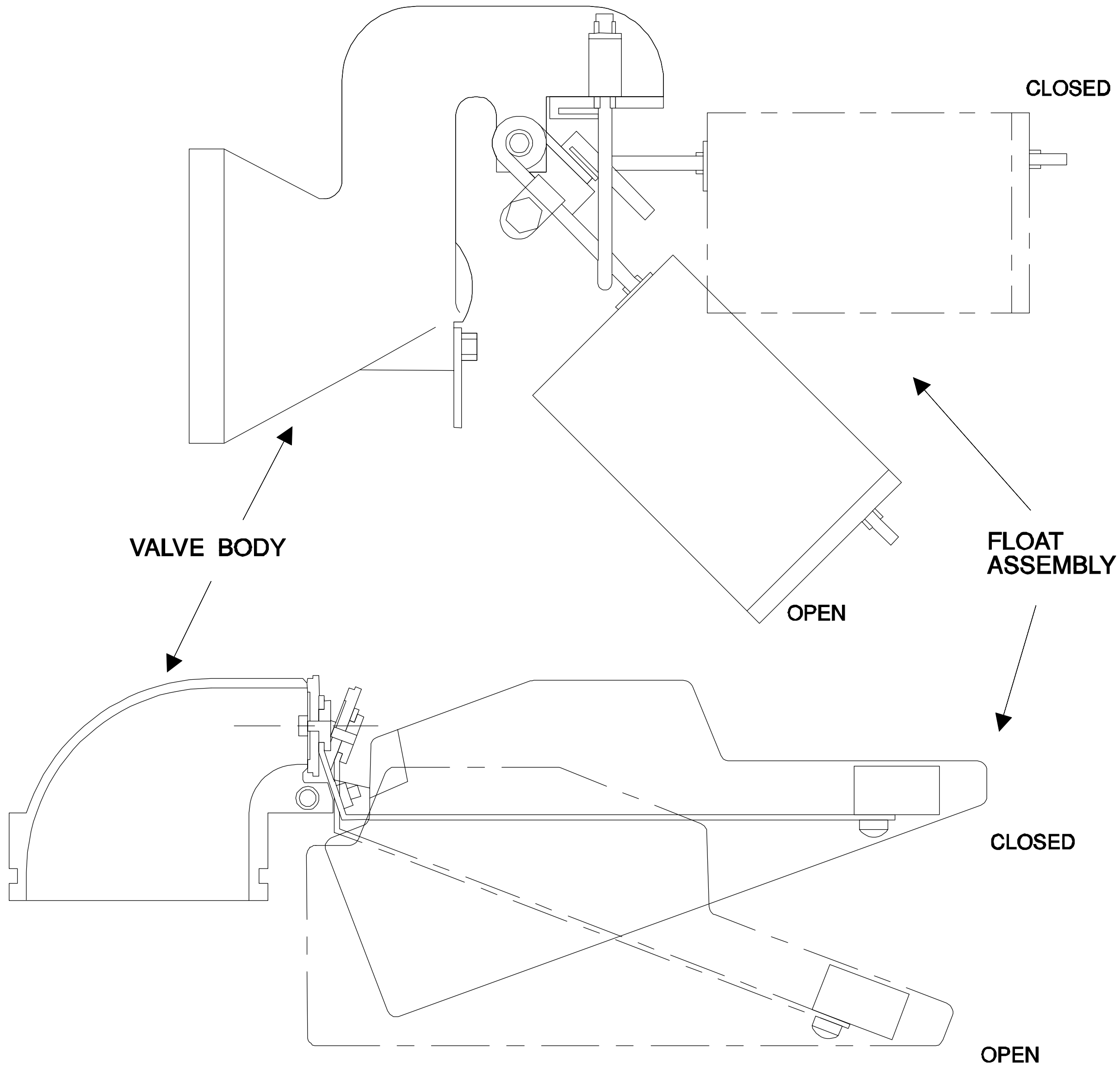
Fin : 5206QS1, 5206QS2, 5207QS1, 5207QS2
5217QS1,5217QS2.
5208QS, 5216QS
5209QS1, 5209QS2
Zone : 540, 541, 640, 641.
333, 343.

COMPONENT DESCRIPTION

The Vent Valve has a body, a float assembly and an external poppet valve. The float arm usually hangs down which keeps the poppet valve open. When the fuel lifts the float, the float arms moves up and closes the valve.

FLOAT VENT VALVES





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FLAME ARRESTORS

FIN / ZONE

Fin : 5200QS1, 5200QS2, 5205QS
Zone : 550, 650, 343

COMPONENT DESCRIPTION

The Flame Arrestors (Vent Protector) in the wing Surge tanks are the same. The Trim tank one, is smaller. They consist of a body with a number of cartridges and spacers. The body is a cylinder with a clip for attachment to the NACA intake.

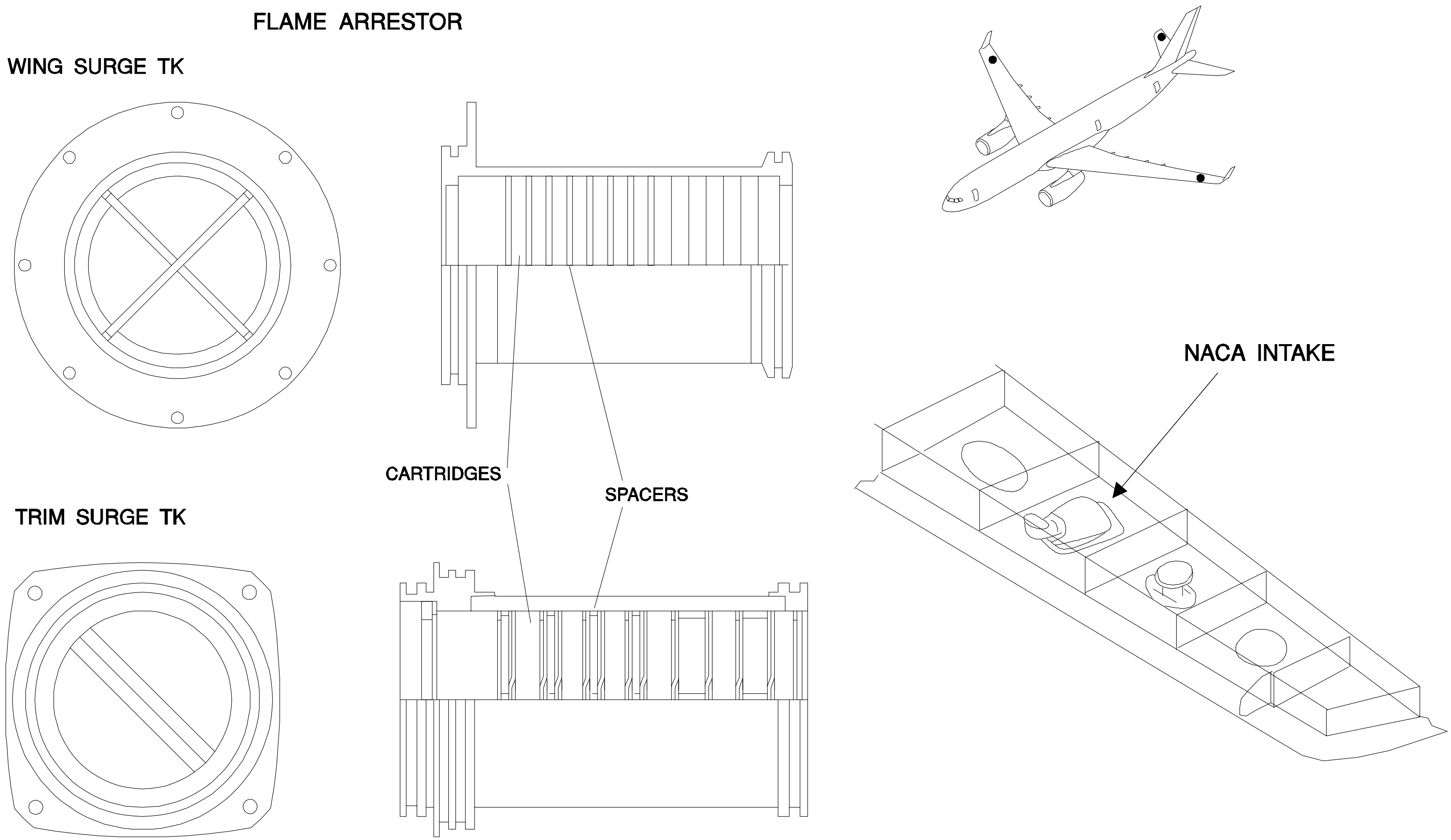
NACA INTAKES

FIN / ZONE

Fin : 550DB, 650DB, 346AB
Zone : 550, 650, 343

COMPONENT DESCRIPTION

The NACA Intake is attached to a panel assembly mounted on the lower surface of the Surge Vent Tank.



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BREATHER ASSEMBLIES

FIN / ZONE

Fin : none
Zone : 541, 641, 310

COMPONENT DESCRIPTION

A rubber check valve lets fuel drain by gravity out of the vent pipe, when fuel level in the vicinity drops.

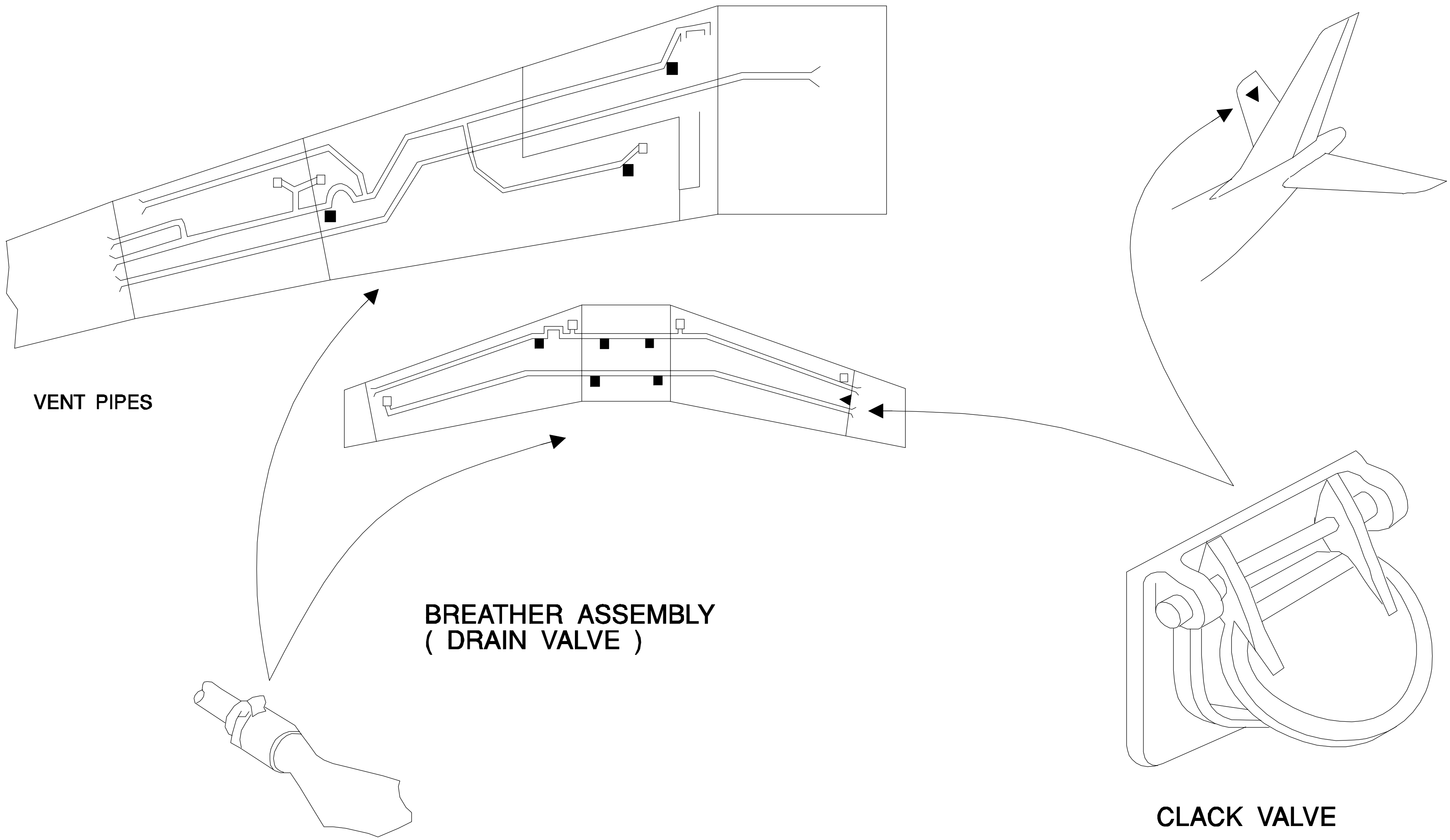
TRIM TANK CHECK VALVE

FIN / ZONE

Fin : 5211QS
Zone : 343

COMPONENT DESCRIPTION

The Trim tank Check valve is installed on Rib 18 RH of the THS. It allows fuel to return from the Surge Vent tank into the fuel tank.



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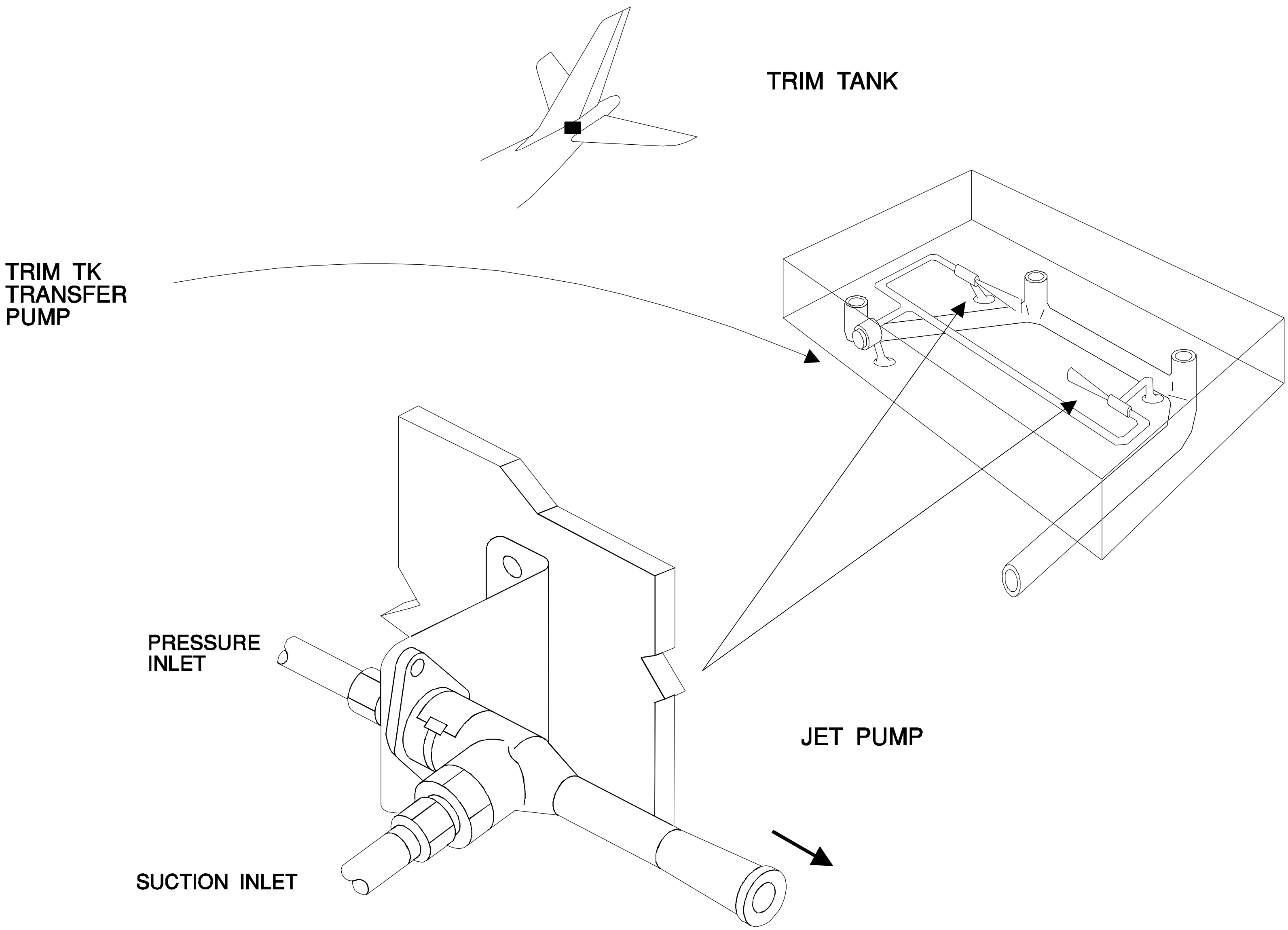
TRIM TANK JET PUMPS

FIN / ZONE

Fin : 5700QS1, 5700QS2
Zone : 319

COMPONENT DESCRIPTION

Fuel from the pressure inlet goes through the jet nozzle, it causes a suction at the suction inlet. The mixed flow of fuel/water goes through and out of the jet pump outlet.



FQW4200 GE Metric

STUDENT NOTES

TANK, VENTING AND SCAVENGE COMPONENTS

Safety Precautions
Wing Tank Water Drain Valves
Trim Water Drain Valves
Center Tank Water Drain Valves
Tank Overpressure Protector
APU Fuel Line Vent And Drain Valve
Fuel/Air Separator
Fuel/Air Separator Drain Valve

SAFETY PRECAUTIONS

Obey the fuel safety procedures.

Do not get aircraft fuel in your mouth, in your eyes or on your skin for a long time (Aircraft fuel is poisonous).

Make sure that the landing gear safety locks and wheel chocks are in position. Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.

Make sure that you have correct fire fighting equipment available before you start any task on the fuel system.

Make sure that all circuits in maintenance are isolated before you supply electrical power to the aircraft.

Use the talcum powder procedure only on the external surfaces of the fuel tanks. This will prevent contamination of the fuel system.

Do not get your clothes soaked with fuel. Use approved protective clothing when you go into a fuel tank.

STUDENT NOTES

WING TANK WATER DRAIN VALVES

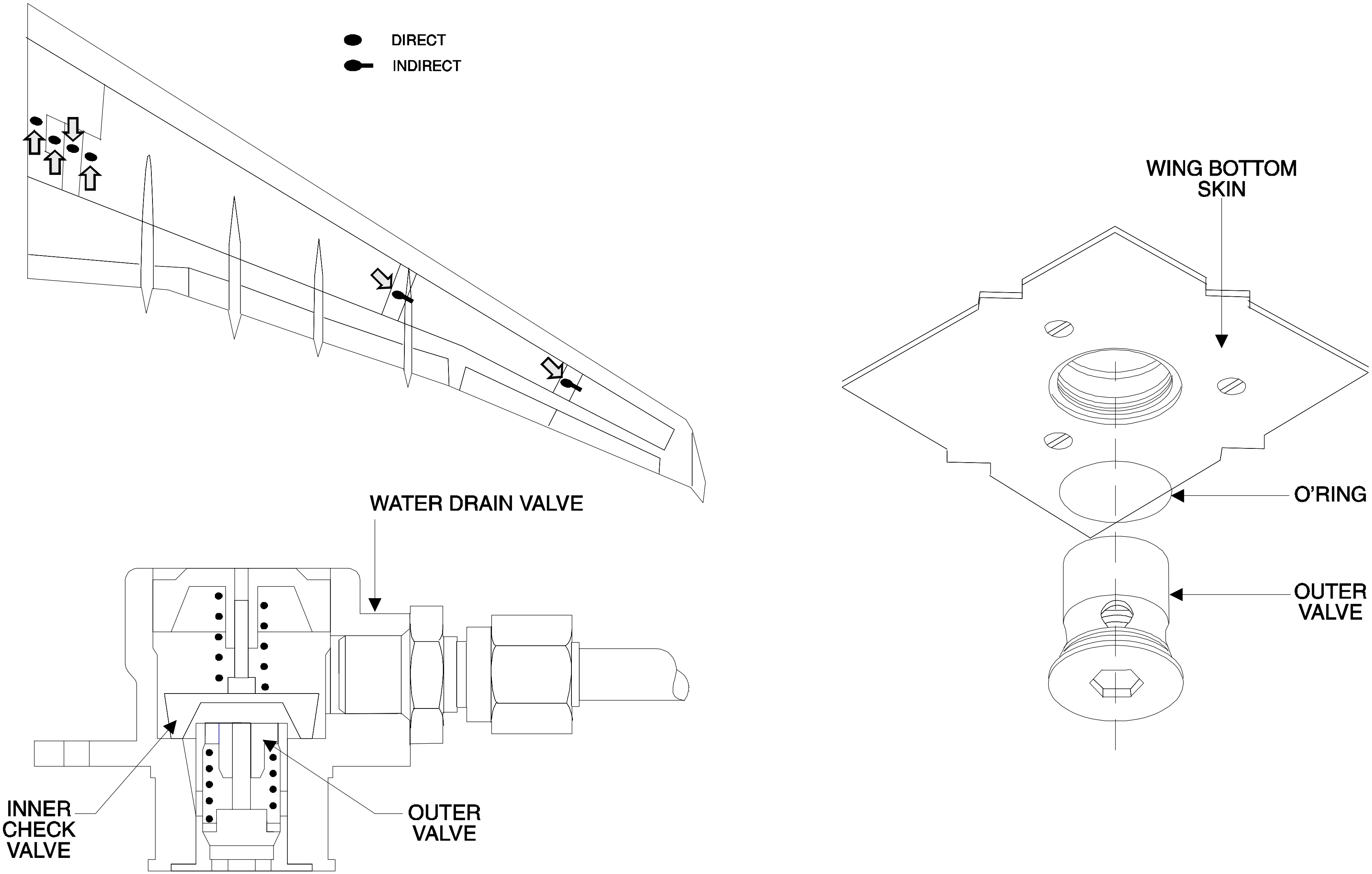
FIN / ZONE

FIN :	5100QS1(2),	5101QS1(2),	5102QS1(2)
Zone :	540(640),	540(640),	540(640)
Access door :	542KB(642KB),	541SB(641SB),	541BZ(642BZ)

FIN :	5104QS1(4),	5104QS2(3),	5107QS1(2)
Zone :	540(640),	540(640),	540(540)
Access door :	541EZ(641EZ),	541AB(641AB),	541BB(641BB)

COMPONENT DESCRIPTION

The wing water drain valves connect the lower parts of the wing tanks to the wing bottom skin (through a short pipe) in order to drain the water or to drain all the remaining fuel out of the tank.
The body contains an inner check valve and an outer valve.
When a drain tool opens the outer valve, the inner valve opens at the same time, fuel flows out through the valve.
When the outer valve is removed, the inner valve stays closed to prevent a fuel leakage.



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TRIM WATER DRAIN VALVES

FIN / ZONE

FIN :	5105QS1(2),	5106QS
Zone :	333(343),	343

COMPONENT DESCRIPTION

The THS water drain valves connect the lower parts of the THS to the THS bottom skin (through a short pipe for the indirect drain valve or directly for the direct drain valve).
The body contains a sleeve and a self locking drain valve.
When a drain tool pushes open the self locking drain valve, the sleeve opens too and the fuel flows through the valve.
When the self locking drain valve is pulled out to replace the O'ring, the sleeve stays closed to prevent a fuel leakage.

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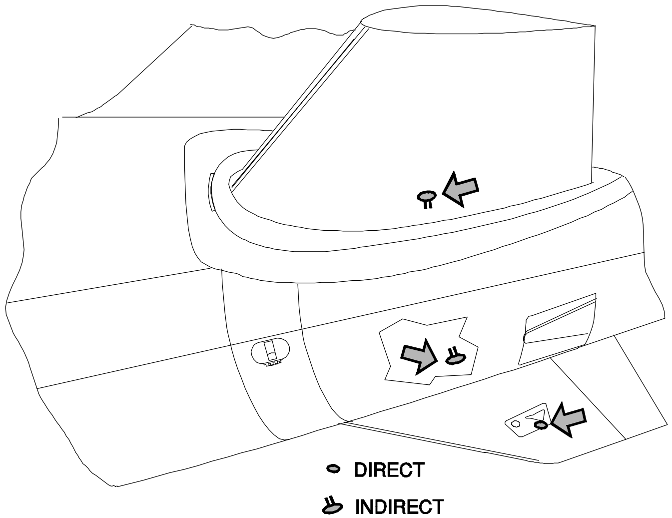
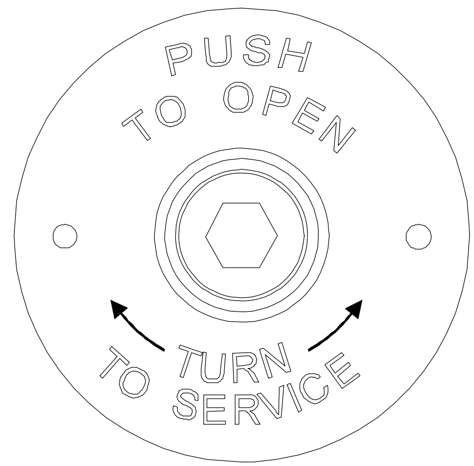
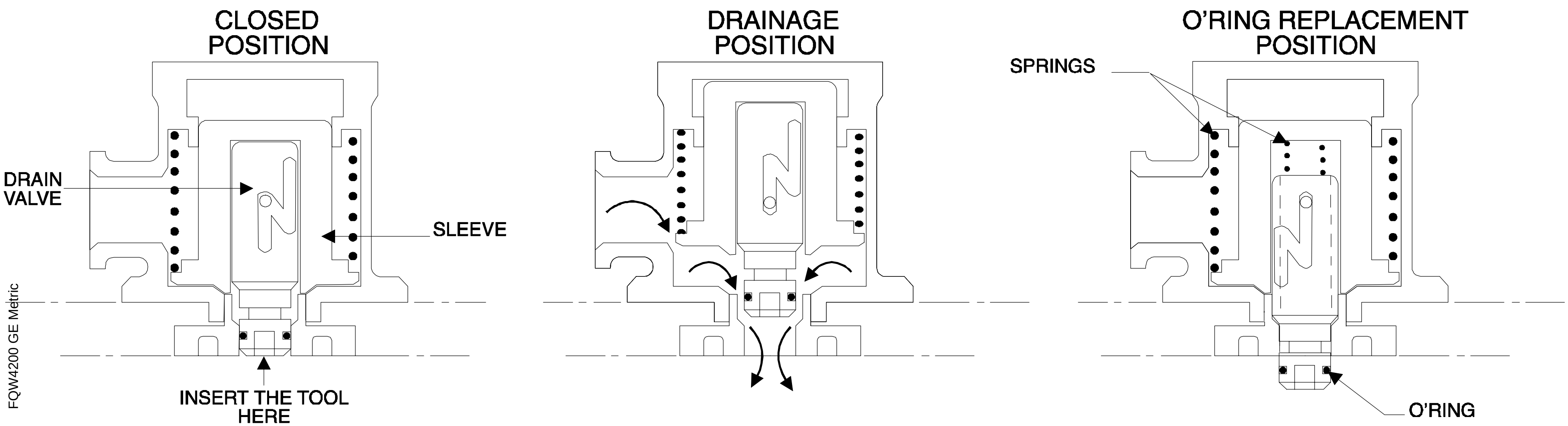




EXTERNAL VIEW



VALVE OPERATION

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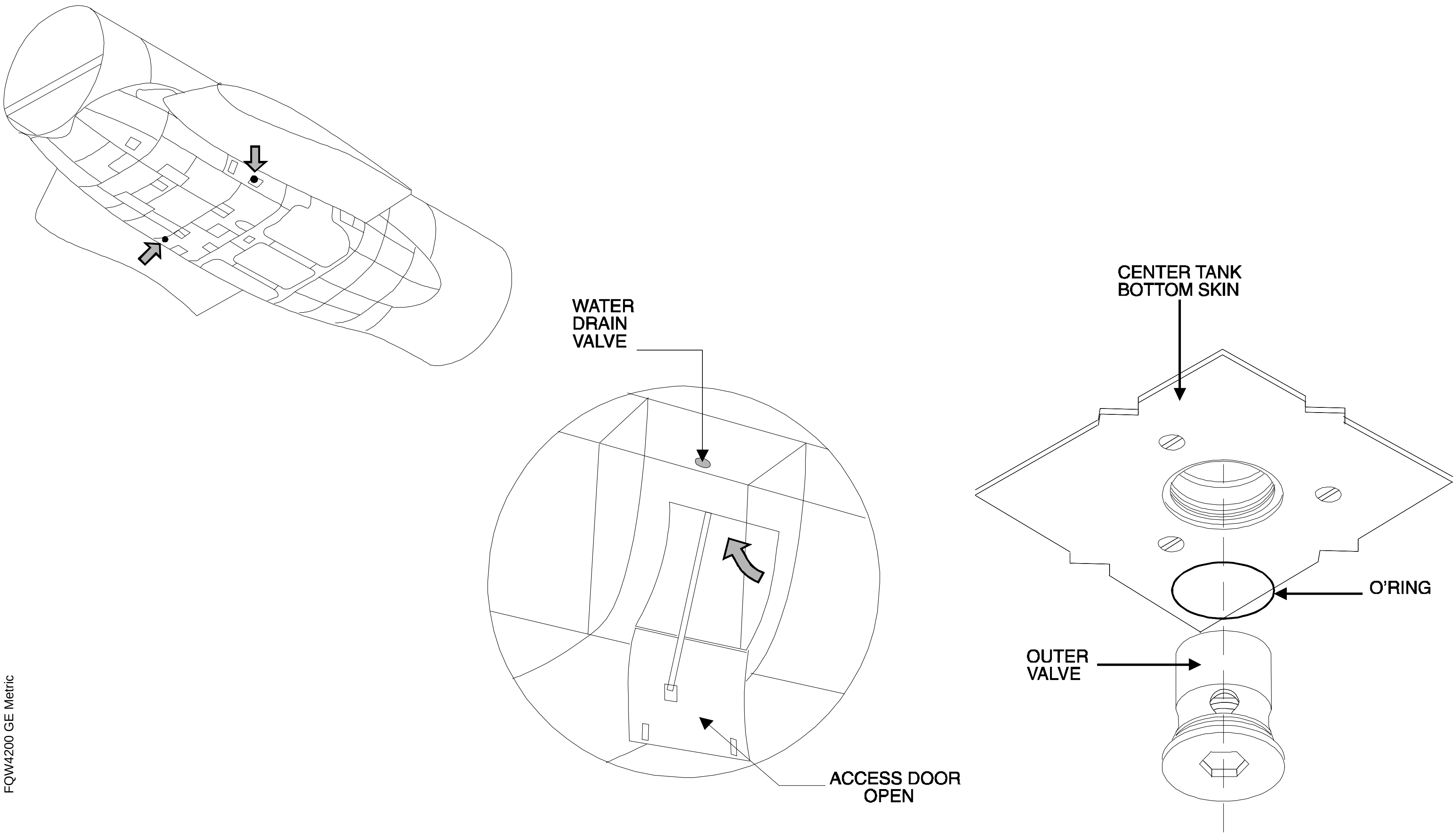
CENTER TANK WATER DRAIN VALVES

FIN / ZONE

FIN : 5103QS1(2)
Zone : 141(142)
Acces door : 191KB(192KB)

COMPONENT DESCRIPTION

The center tank water drain valves connect the lower parts of the center tank to the center tank bottom skin.
The body contains an inner check valve and an outer valve.
When a drain tool opens the outer valve, the inner valve opens at the same time, fuel flows out through the valve.
When the outer valve is removed, the inner valve stays closed to prevent a fuel leakage.



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TANK OVERPRESSURE PROTECTOR

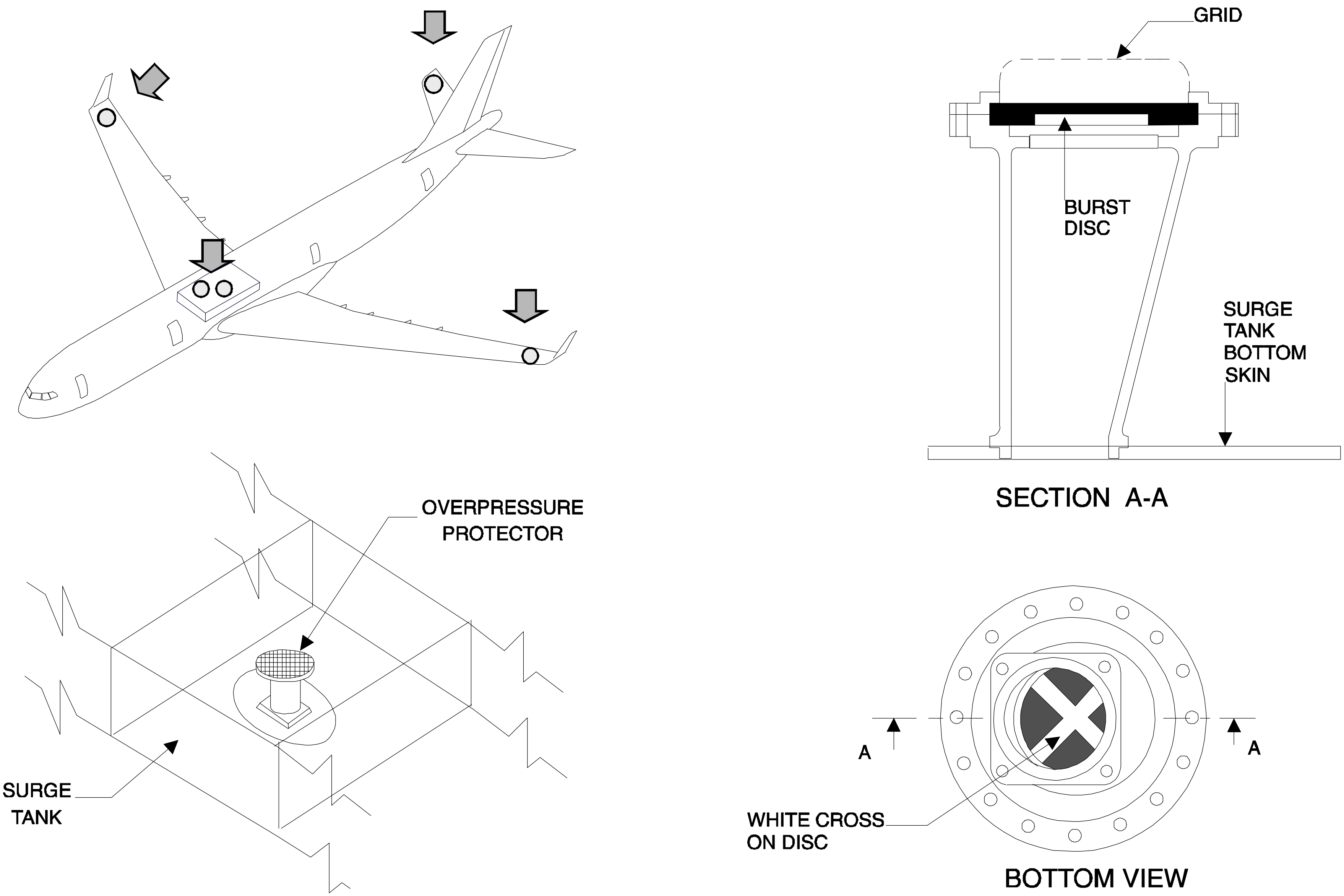
FIN / ZONE

FIN : 5201QS1(2) - Wing Surge Tank
5204QS - Trim Surge Tank
5215QS1(2) - Center Tank

Zone : 550(650) - Wing Surge Tank
343 - Trim Surge Tank
141 - Center Tank

COMPONENT DESCRIPTION

The overpressure protectors make sure the pressure in the tank does not exceed the design limits.
The body contains a burst disc which breaks in case of overpressure, the collecting grid avoids disc pieces from going into the tank.
The disc has a white cross painted on it that means the disc is not broken.
The THS surge tank overpressure protector is attached to the same panel as the NACA-duct assembly.



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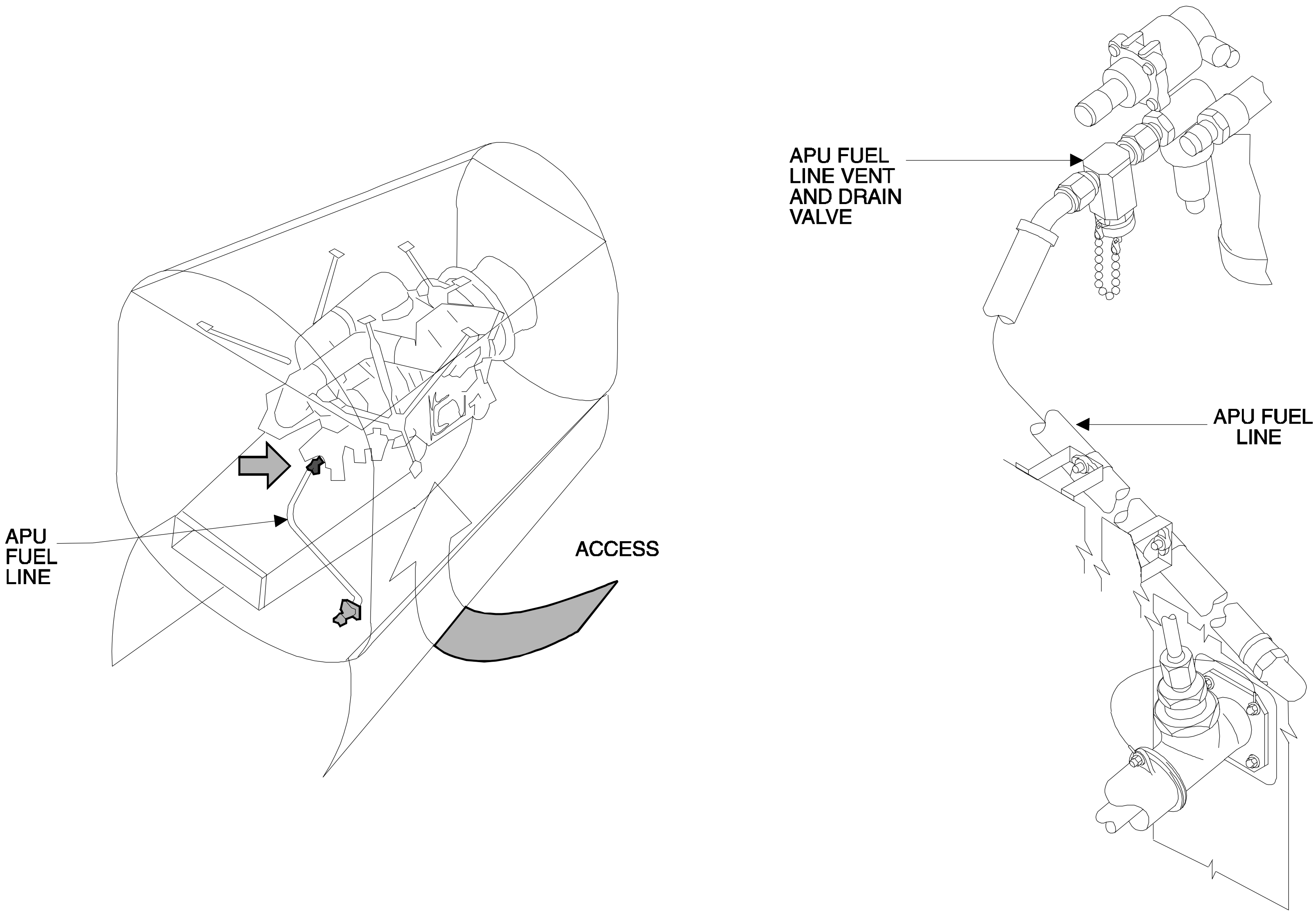
APU FUEL LINE VENT AND DRAIN VALVE

FIN / ZONE

FIN : 5202QA
Zone : 315
Access door : 316AR

COMPONENT DESCRIPTION

The vent and drain valve makes the connection between the APU fuel line and the APU fuel system.
The valve is installed with a connection pipe to the Fuel Control Unit on the APU.
The line is used for the line maintenance to drain or to bleed the APU fuel line. For this procedure you have to use a special vent adapter.



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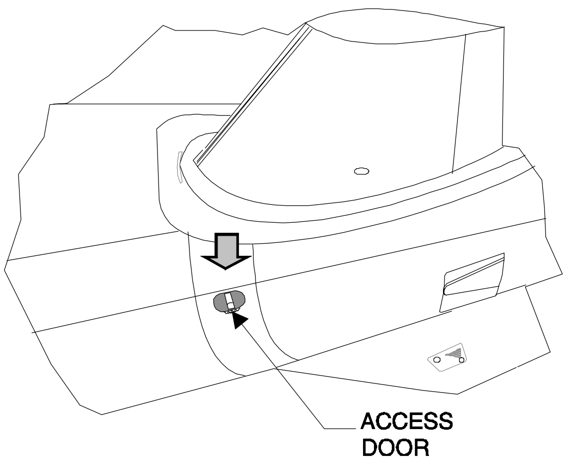
FUEL/AIR SEPARATOR

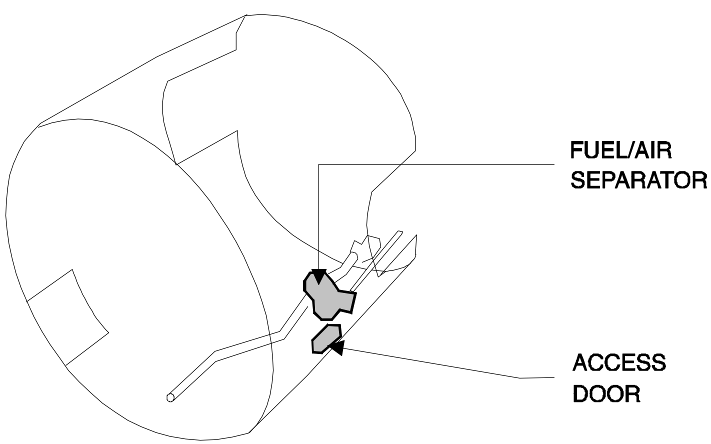
FIN / ZONE

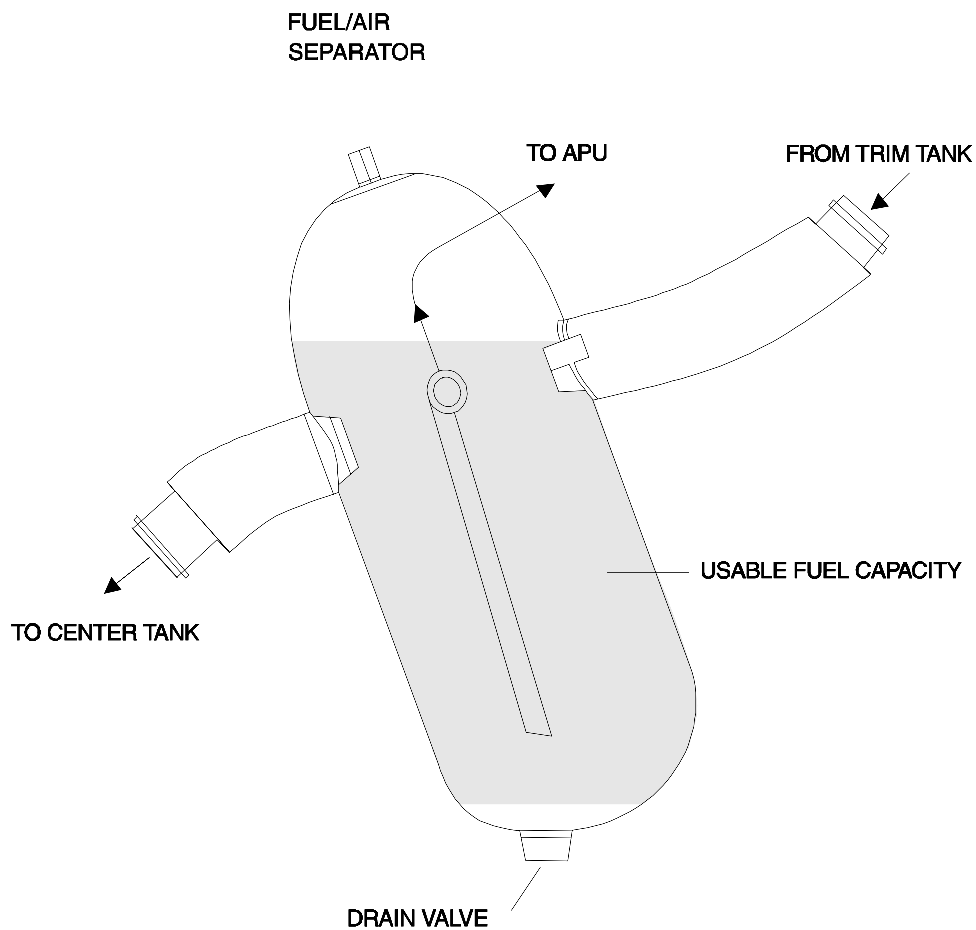
FIN : 5216QA
Zone : 311
Access door : 311AL

COMPONENT DESCRIPTION

The fuel/air separator is installed in the Trim Tank fuel transfer line between FR87 and FR88.
It keeps sufficient fuel for APU operation if air appears in the Trim Tank fuel transfer line.







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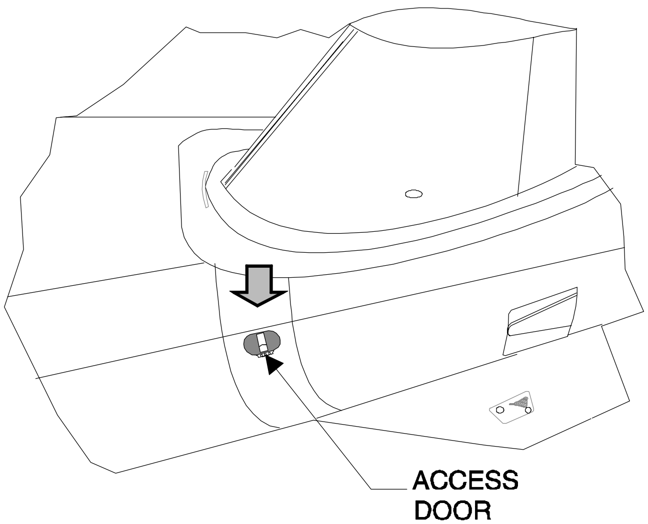
FUEL/AIR SEPARATOR DRAIN VALVE

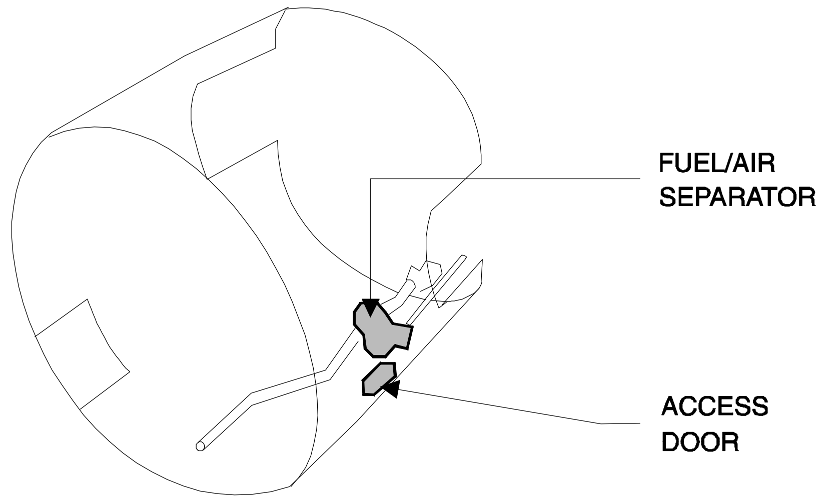
FIN / ZONE

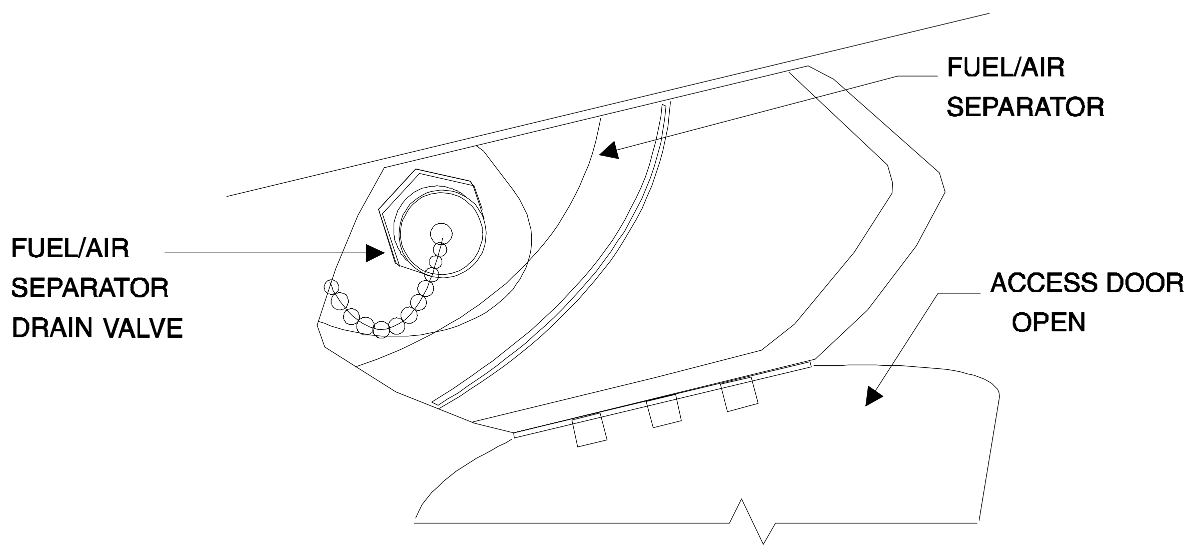
FIN : 5216QA
Zone : 312
Access door : 311AL

COMPONENT DESCRIPTION

The fuel/air separator drain valve is located at the lowest point of the fuel/air separator.
This valve is used to drain the accumulated water or to drain the fuel in order to remove the fuel/air separator.
The valve can be reached through a hand panel in the bottom skin of the aircraft.







FQW4200 GE Metric

STUDENT NOTES

WATER DRAIN VALVE OPERATION (FILM)

Draining the water accumulated in the fuel tanks, requires the operation of water drain valves.

If possible, do the water drain procedure before refueling ; otherwise, wait for one hour after refueling has been completed.

The water drain valves are located at the lowest points of tanks or cells.

Each wing is equipped with :
- one water drain valve for the surge vent tank
- one water drain valve for the outer fuel tank.

Five water drain valves are necessary to drain the two sections of the Inner tank (forward and aft) and their collector cells :
- one outboard rib 4
- one for collector cell 1 (or 4)
- one for collector cell 2 (or 3)
- between ribs 1 and 2 : one aft, one forward.

To get access to the two water drain valves of the center tank, it is necessary to open a special panel on each side of the fuselage.

On the T.H.S., a water drain valve is located on the RH side, to drain the vent surge tank.
Two valves are used to drain the center section of the trim tank, one on each side.

For the operation, push the center of the application water drain valve with the WATER DRAIN PURGER.
Drain the fuel from the valve.

NOTE that for the Trim Tank, a suction pump is necessary if its fuel level is less than 1000 kg.

When the equipment is removed, examine the drain valve for leaks.
This procedure should be applied to all water drain valves.

To drain the water accumulated in the Fuel/Air Separator, it is necessary to operate its drain valve while the forward APU pump is running.

From the platform, open the access panel 311AL.
Remove the cap from the drain valve and install the adapter

Drain between 8 and 10 liters of fuel into a container.

When the equipment is removed, do a check for no fuel leaks and then do the close-up procedure.

The fuel/water sample has been put into a transparent glass container.

Let the sample become stable before examining for water contamination.

The best way is to use a hydrokit.

The syringe allows a small quantity to be drawn.

If the pellet changes color, water is in the fuel ; so, drain the aircraft fuel until no water is present.

No change in color, fuel is good.

It is recommended to analyse the fuel from the tanker for water contamination before refueling.

ENGINE FEED SYSTEM DESCRIPTION AND OPERATION

General
Pumps
Canister Check Valves
Jet Pump
Pressure Switch
Pumps Control
Thermal Relief Valve
Air Release Valve
Wing Crossfeed Valve
Low Pressure (LP) Valve

GENERAL

The Main Fuel Pump system supplies the fuel from the Inner Tank Collector Cell to the engine. The closed Wing Crossfeed Valve divides the engine fuel feed system into two independent feed systems.

Each LP Valve isolates the engine fuel feed supply at any shut-down (normal procedure) or in case of emergency (engine fire procedure).

PUMPS

The fuel pump element is located in a canister attached to the wing bottom skin. Main and Standby Pumps and canisters are all assembled in the same way and are interchangeable.

The centrifugal type pump is driven by a 3 phase 115/200 VAC motor.
The pump output delivery pressure is 20 Psi (1.38 Bar) with a nominal flow of 13638 Liters/Hour (3603 USGal/H). The no flow pressure is 35 Psi (2.41 Bar).

CANISTER CHECK VALVES

The canister has two outlets.
The upper outlet from the canister is connected to the engine feed line and contains an internal flap-type check valve.
A spring loaded, poppet-type check valve is attached to the lower outlet which supplies pressurized fuel to the Jet Pump.

When a fuel pump is not in operation, the two check valves prevent any reverse flow of fuel through this pump.
When none of the pumps run in a collector cell (Pumps switched OFF on ground), the spring-loaded check valve prevents fuel discharge by level difference from the Collector Cell into the related Inner Tank (through the Jet Pump).

JET PUMP

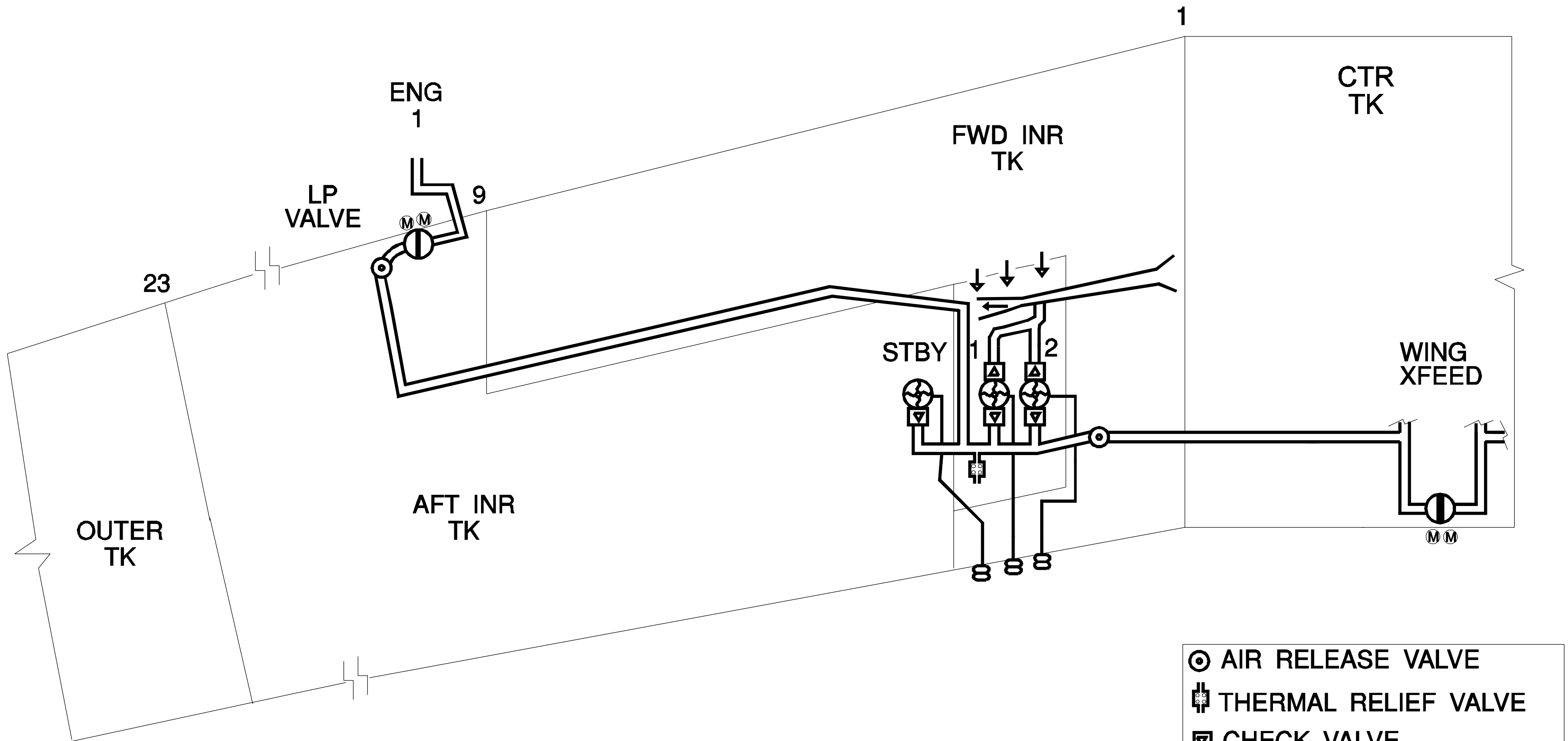
The pump boosted fuel supplied through the motive flow nozzle of the Jet Pump causes a suction.
The suction draws fuel from the related Inner Tank through the Jet Pump assembly which supplies fuel to the Collector Cell.

The rate of flow makes sure that the Collector Cell is kept full of slightly pressurized fuel so that the fuel pumps keep a positive fuel supply in the event of a negative G condition.
This fuel pressure is limited to max. 5 Psi (0.34 Bar).
Overpressurization is prevented by discharging fuel back into the tank through vent holes at the top of the cell.

PRESSURE SWITCH

The Pressure Switch monitors the output pressure of the related fuel pump. It is installed on the rear face of the wing spar.

The switch mechanism detects a LO PRESS condition when the pressure is less than 6 Psi (0.41 Bar).



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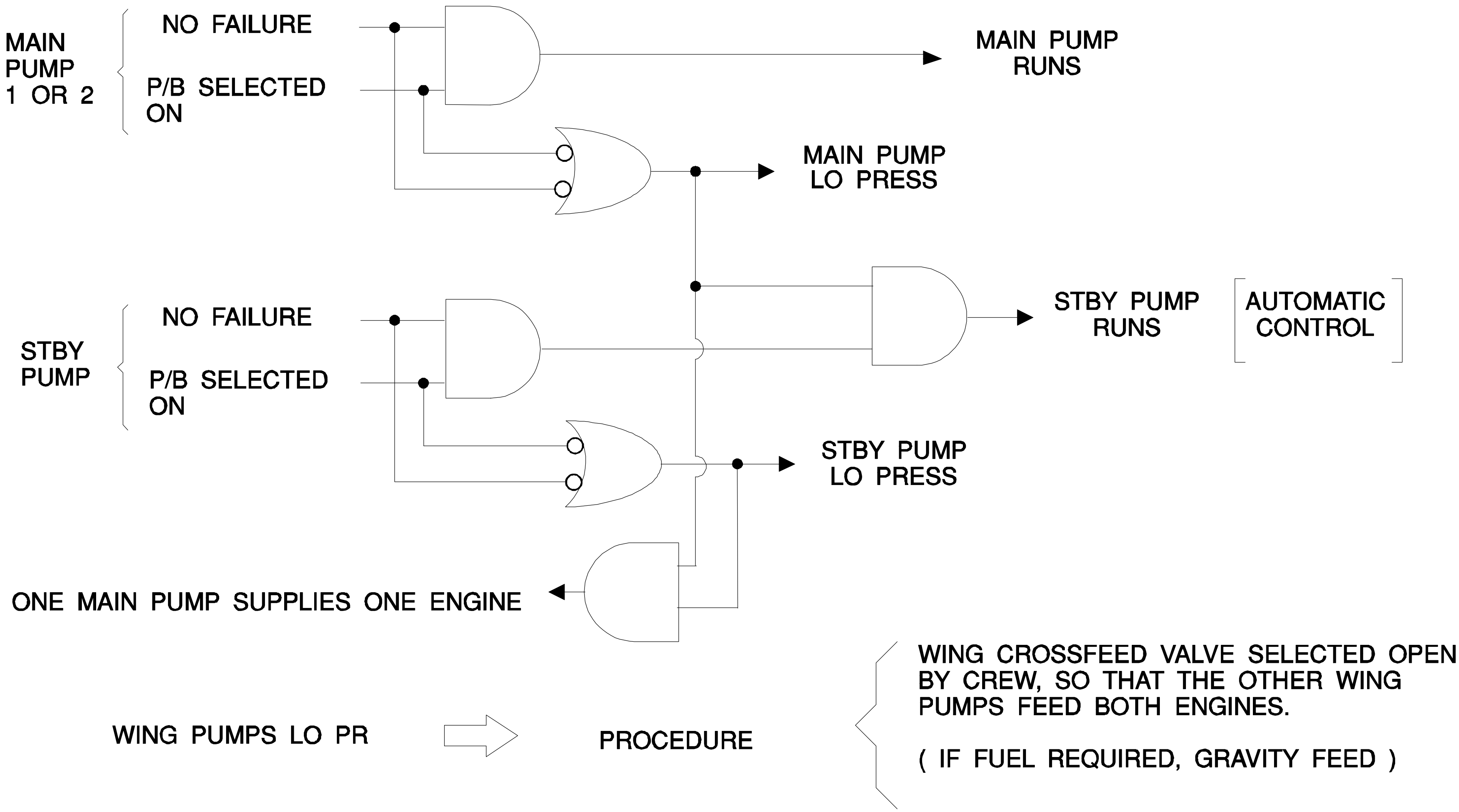
PUMPS CONTROL

Each fuel pump has its related control and indication circuit.

Usually, only the Main Pumps operate.
The Stand-by pump automatically starts by aircraft control logic if a Main Pump fails.
Wing Pumps failure requires a crew action.

Note: In emergency generator supply configuration, only the Left Main Pump 2 is available.
The Right Main Pump 2 is in back-up.



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THERMAL RELIEF VALVE

A Thermal Relief Valve is installed in the fuel feed pipe in the Collector Cell. It prevents too much pressure in the engine feed line.

The Thermal Relief Valve releases fuel in the Collector Cell if the pressure is greater than 40 Psi (2.75 Bar).

AIR RELEASE VALVE

An Air Release Valve is installed at the high point of the fuel pipe, immediately upstream of the LP Valve.
It releases air caught in the engine fuel feed line.

Upstream of each Collector Cell, another Air Release Valve is positioned in the feed pipe, to allow any air trapped, by the Crossfeed Valve, in the pipe to escape.

WING CROSSFEED VALVE

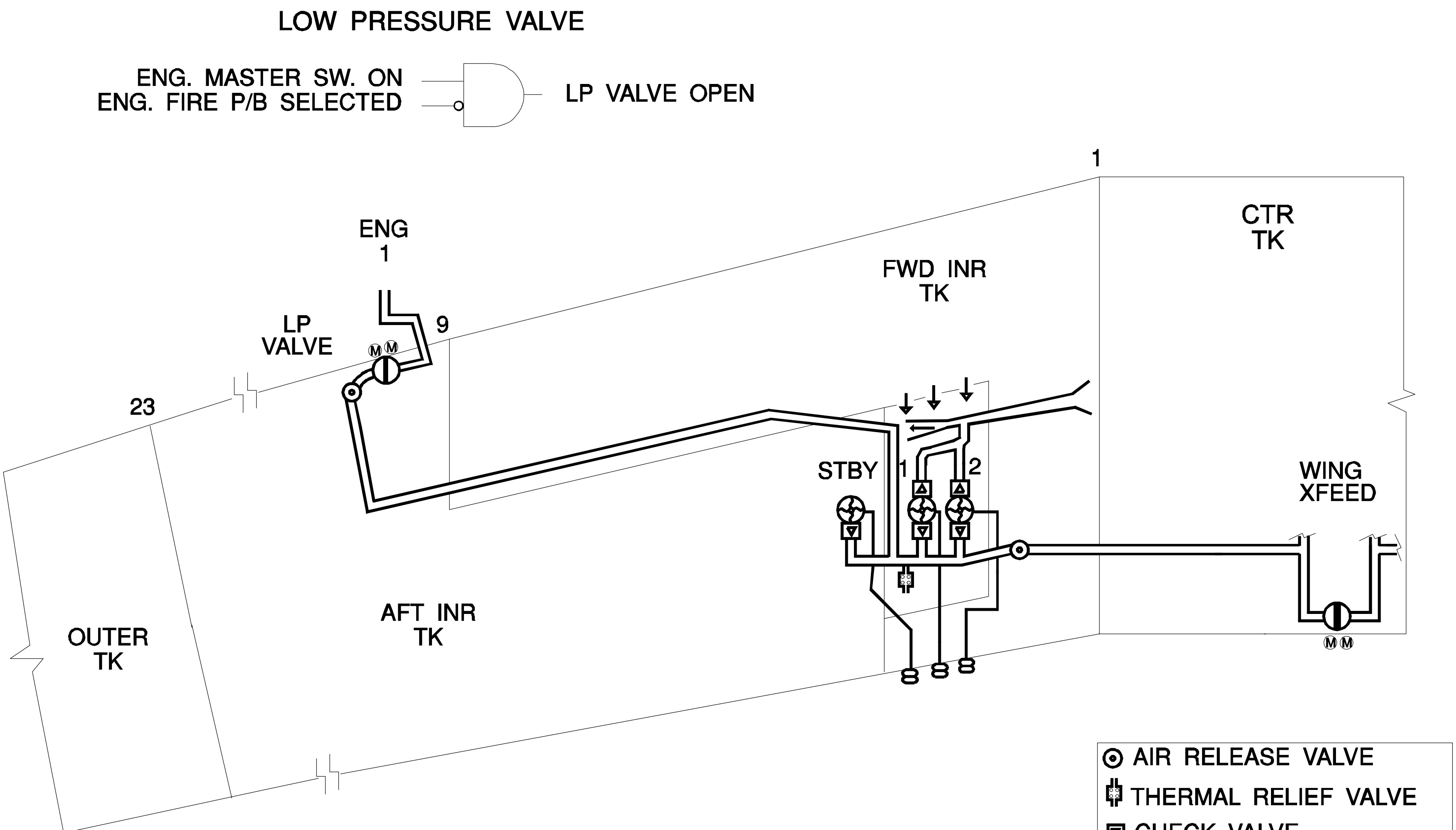
A Wing Crossfeed Valve is installed in the fuel line, in the Center Tank.

The Crossfeed Valve is driven by a twin-motor actuator mounted externally on the rear spar.
The electrical motors are supplied from separate power sources.
The Wing Crossfeed Valve is manually controlled.

LP VALVE

The L.P. Valve is installed on the Inner Tank wing front spar, in the feed line to the Engine.

Each LP Valve has an actuator with 2 electrical motors, which get their power supply from a different source.



FQW4200 GE Metric

STUDENT NOTES:

APU FEED SYSTEM DESCRIPTION AND OPERATION

General
Pumps
Valves
Fuel/Air Separator
Drainage
Normal Operations
Pumps Failure
Fire

GENERAL

The fuel supply to the APU is made from the Left Hand Inner Tank with the Forward APU Pump.

The Aft APU Pump takes its fuel from the Trim Transfer line.
Normally one pump only runs at a time

PUMPS

The Forward APU Pump is installed in a canister bolted on the Center Tank Rear Spar, and the Aft APU Pump in a canister attached to the APU LP Valve Flange bolted to a fuselage structure bracket between frame 87 and 88.

Both pumps are supplied by single phase 115 VAC power.

VALVES

The Fuel Isolation Valve is installed on the Center Tank Rear Spar and controls fuel flow from the Forward Inner Tank to the Trim Transfer Line.

The APU LP Valve is installed between the Fuel/Air Separator and the Aft APU Pump. Position switches monitor each valve position and transmit signals to the FCMS and the System Data Acquisition Concentrators (SDACs).

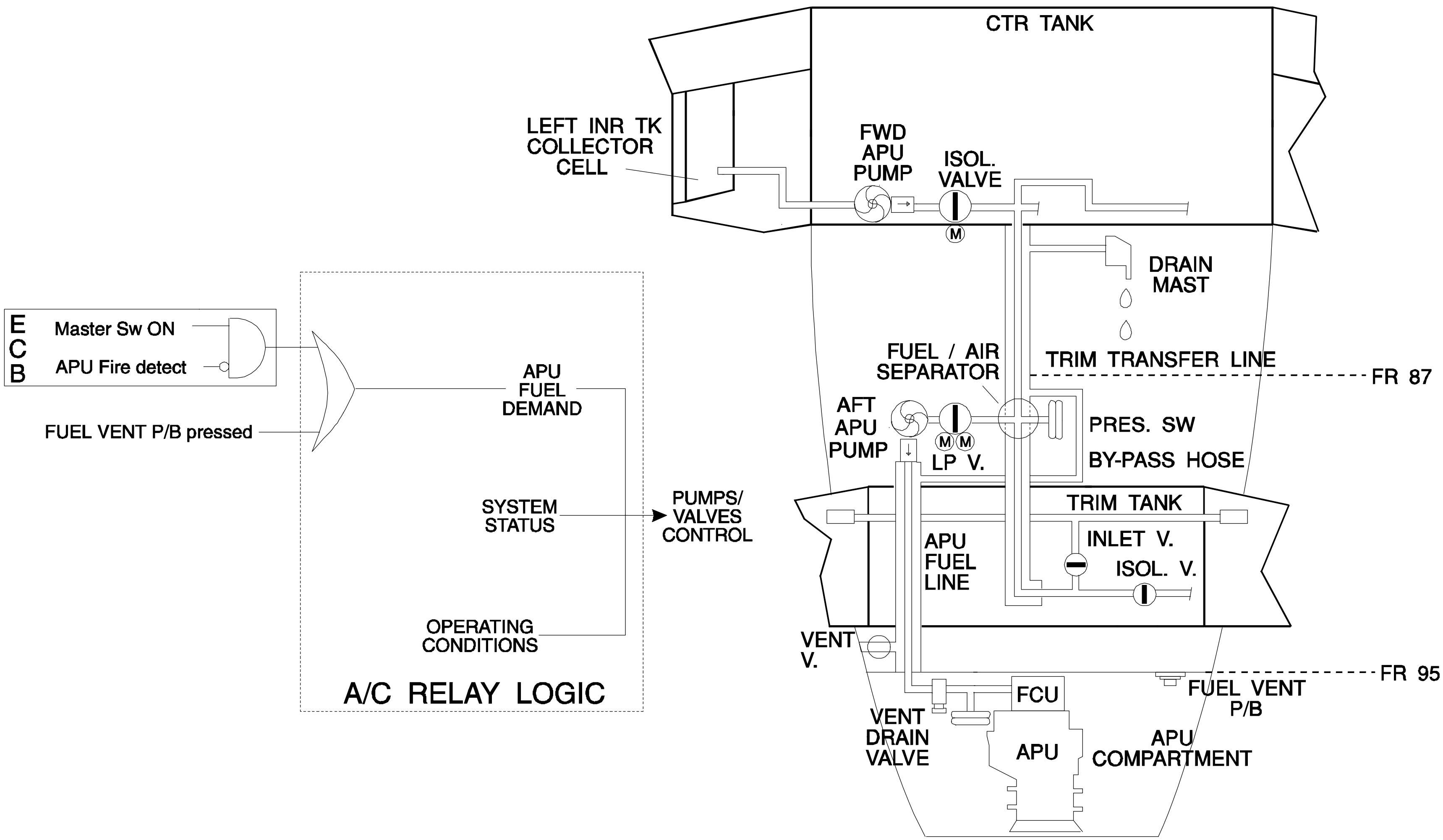
FUEL/AIR SEPARATOR

The Fuel/Air Separator, installed in the Trim Tank Fuel Transfer Line between frame 87 and 88, keeps sufficient fuel for APU operation, if air enters the transfer line.

DRAINAGE

A double-shrouded tube system extends along the Trim Transfer Line and the APU fuel Line.

A venting outlet connected to the fuselage skin next to frame 95, allows any leaking fuel to drain at the lowest end through the Drain Mast.



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NORMAL OPERATIONS

The pumps and valves operation is controlled by aircraft relays under APU Fuel Demand Logic and operating conditions.

OPERATING CONDITION	PUMP STATUS		VALVE STATUS			
	FWD	AFT	LP V.	ISOL V.	TT INLET V.	TT ISOL V.
GROUND OPERATION	THE FIRST TWO MINUTES : OFF NORMAL OPERATION : ON	 ON OFF	OPEN	OPEN	SHUT	SHUT
TRIM TANK REFUEL	OFF	ON	OPEN	SHUT	OPEN	SHUT
CLIMB TO FL245	ON	OFF	OPEN	OPEN	SHUT	SHUT
ABOVE FL245 (NO XFR)	OFF	ON	OPEN	SHUT	SHUT	OPEN
ABOVE FL245 (AFT XFR)	OFF	ON	OPEN	SHUT	OPEN	SHUT
FWD XFR	OFF	ON	OPEN	SHUT	SHUT	OPEN
DES / LAND (TT EMPTY)	ON	OFF	OPEN	OPEN	SHUT	SHUT
APU OFF	OFF	OFF	SHUT	SHUT	SHUT	SHUT
PURGING	ON	OFF	OPEN	OPEN	SHUT	SHUT

Note that when one of the Trim Tank valves is open (Trim Tank not isolated), the Aft APU pumps runs.

PUMPS FAILURE

The Trim Transfer Line Pressure Switch monitors the Forward APU pump low pressure condition.

If a low pressure is detected (Trim Transfer Line Pressure < 22 PSI/1.5 Bar), the aircraft relay logic starts the Aft APU pump after a 3 second time delay.

The Pressure switch at the inlet of the APU Fuel Control Unit monitors the Aft APU pump low pressure condition.

If a low pressure is detected, the signal is sent to the APU Electronic Control Box and to the FCMC.
A FUEL LO PR advisory appears on the APU page.

FIRE

An APU fire detection makes the ECB cancel the APU Fuel Demand Signal

An APU fire detection triggers the aircraft relay logic to control :

- the APU LP Valve to close,
- the Aft APU Pump to stop.

STUDENT NOTES:

STUDENT NOTES

ENGINE FEED SYSTEM COMPONENTS

Safety Precautions
Pump Canister
Pump Element
Pressure Switch
Jet Pump
Thermal Relief Valve
Air Release Valve
Crossfeed Valve
XFEED Valve Actuator
Low Pressure Valve
LP Valve Actuator

SAFETY PRECAUTIONS

Make sure that the safety devices and the warning notices are in position before you start a task on or near :
- the flight controls
- the landing gear and the related doors
- components that move.

Movement of components can kill or injure persons.
Make sure that you have the correct fire fighting equipment available.
OBEY THE FUEL SAFETY PROCEDURES.
THIS WILL PREVENT INJURY OR DAMAGE.
WEAR GOGGLES WHEN YOU REMOVE OR INSTALL LOCKWIRE.

STUDENT NOTES

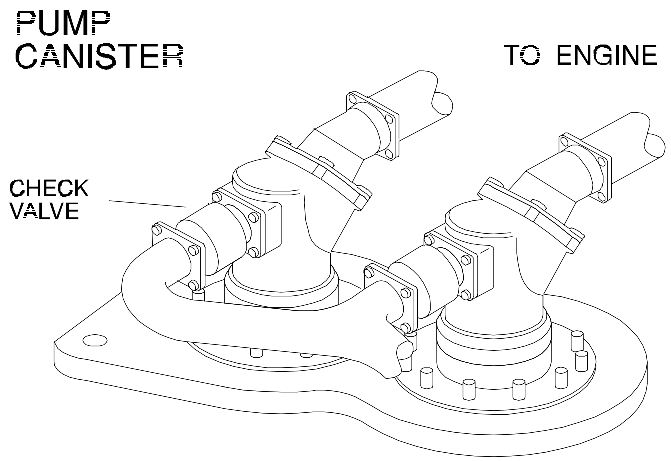
PUMP CANISTER

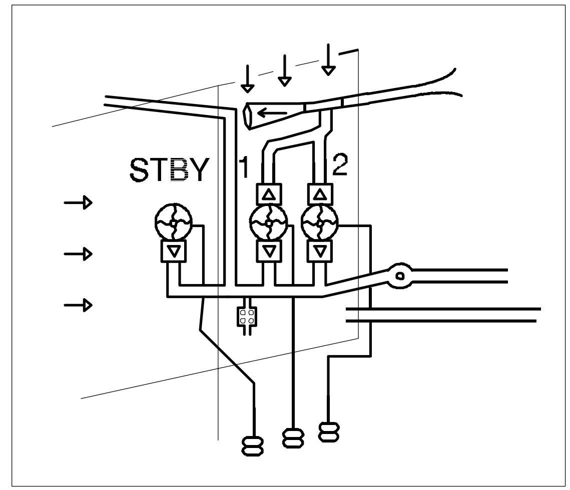
FIN / ZONE

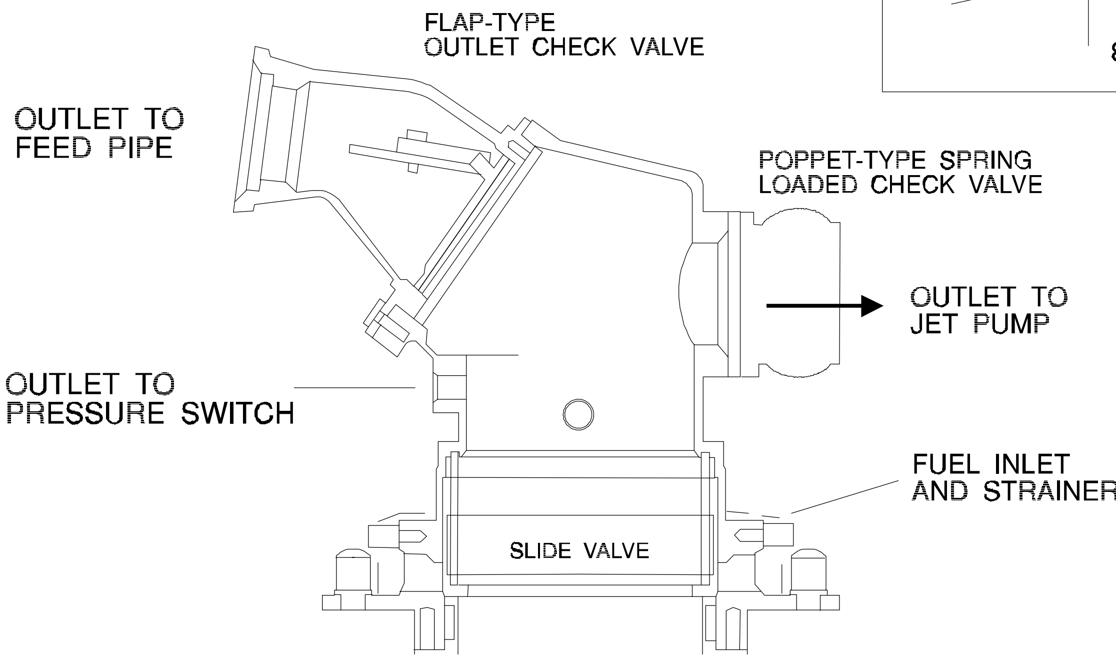
Fin : 5121 QA1,2 ; 5122 QA1,2 and 5112 QA1,2
Zone : 540,640

COMPONENT DESCRIPTION

The Pump Canister arrangement allows the Fuel Pump Element to be replaced when there is fuel in the Inner Tank. When the fuel Pump element is replaced, the two check valves and a slide valve seal the canister.







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PUMP ELEMENT

FIN / ZONE

Fin : 121 QA1,2 ; 122 QA1,2 and 112 QA1,2
Zone : 540, 640

COMPONENT DESCRIPTION

Main and Standby Pumps are interchangeable.
The Pump Element is assembled vertically. The rotor assembly is at the top. The impeller assembly is in the center and the inducer assembly is at the bottom. The shaft connects the three assemblies together. If the pump element temperature increases above 192ºC (378ºF), three thermal switches operate. The pump stops, it cannot operate again and must be replaced.

REMOVAL / INSTALLATION

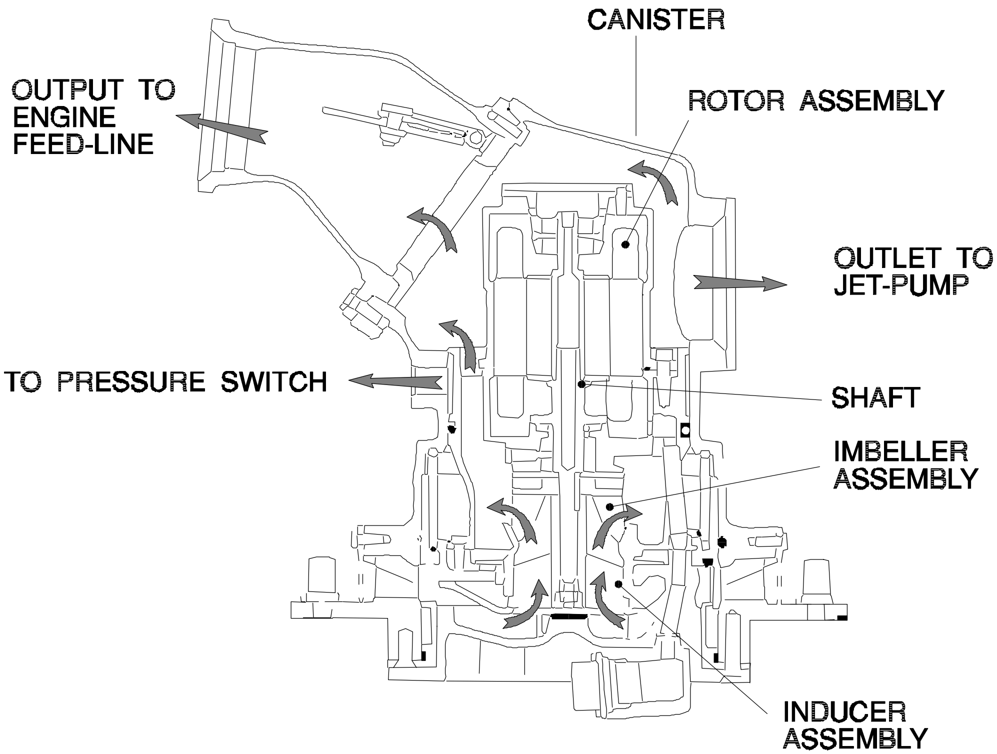
To REMOVE a Fuel Pump Element:
- open, safety and tag the corresponding Main and Stand-by Pumps circuit breakers
- remove the front section of the fuel pump fairing
- disconnect the electrical connector
- fully loosen the screws (you cannot remove them)
- put a container below the pump
- cut, remove and discard the lockwire on the drain plug
- attach the FUEL PUMP SHROUD TOOL to the pump flange
- hold the handle of the TOOL and pull down until the movement is stopped by the dowels in the canister.

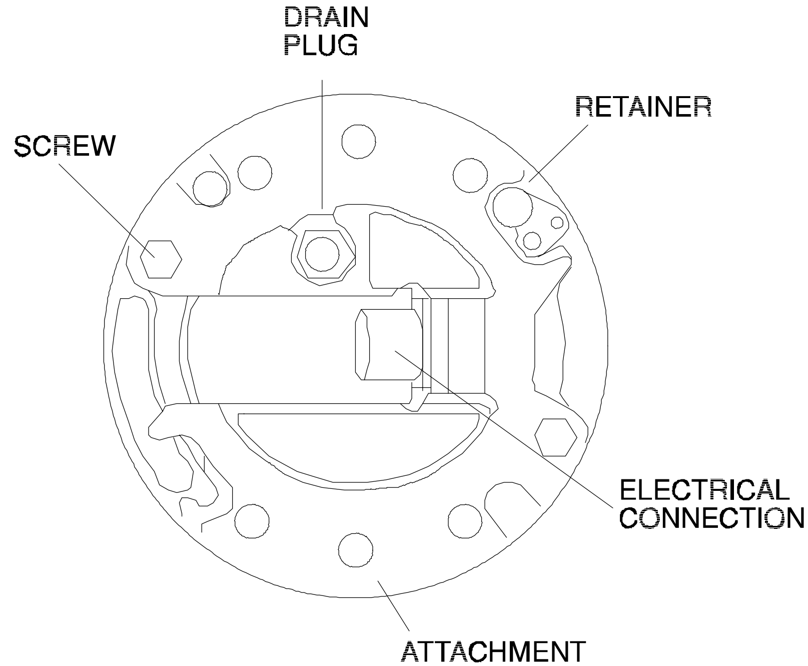
DO NOT LET THE PUMP TURN WHEN THE DRAIN PLUG IS LOOSE.
- loosen the drain plug and let the fuel drain into the container
- when all the fuel has drained, tighten the drain plug
- hold the pump, turn it 30º counterclockwise, remove.

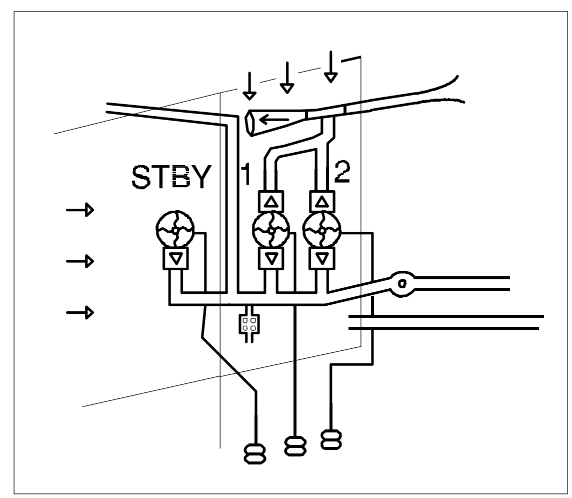
If the pump is not to be immediately installed again, put a cover in place.

For a Fuel Pump Element INSTALLATION :
- Make sure that the component and area are clean.
- Remove the cover from the fuel pump
  . remove the drain plug and install a new seal
  . torque the drain plug to 0.678 m.daN (60 lbf.in) and safety with steel wire
  . apply FUELS or COMMON GREASE to the new seals
  . remove blanking caps from electrical connectors and cover from pump location.
- Install the seals on the pump.
- Attach the FUEL PUMP SHROUD TOOL to the pump.
- Align the slot on the pump with the dowels in the canister, install the pump and push it up.
- Turn the pump 30º clockwise (when you look from the electrical connector) and push it up fully.
- Attach the pump with the screws and TORQUE them to between 1.017 and 1.085 m.daN (90 and 96 Lbf.in)

Connect the electrical connector and close the C/Bs.
An operational check must be performed


CANISTER
OUTPUT TO ENGINE FEED-LINE
ROTOR ASSEMBLY
OUTLET TO JET-PUMP
TO PRESSURE SWITCH
SHAFT
IMBELLER ASSEMBLY
INDUCER ASSEMBLY


DRAIN PLUG
RETAINER
SCREW
ELECTRICAL CONNECTION
ATTACHMENT


STBY
1
2

PRESSURE SWITCH

FIN / ZONE

Fin : 74 QA1,2 ; 75 QA1,2 and 68 QA1,2.
Zone : 540, 640

COMPONENT DESCRIPTION

When the fuel pressure increases to 8 PSI (0.55Bar), the microswitch contacts open; they close the switch when the pressure decreases to 6 PSI (0.41Bar).

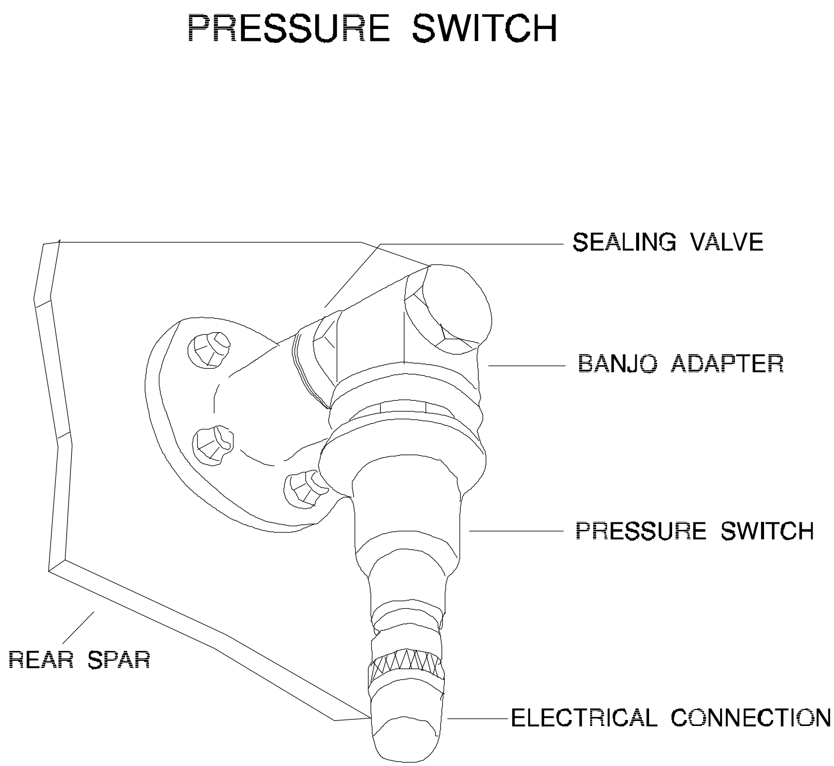
JET PUMP

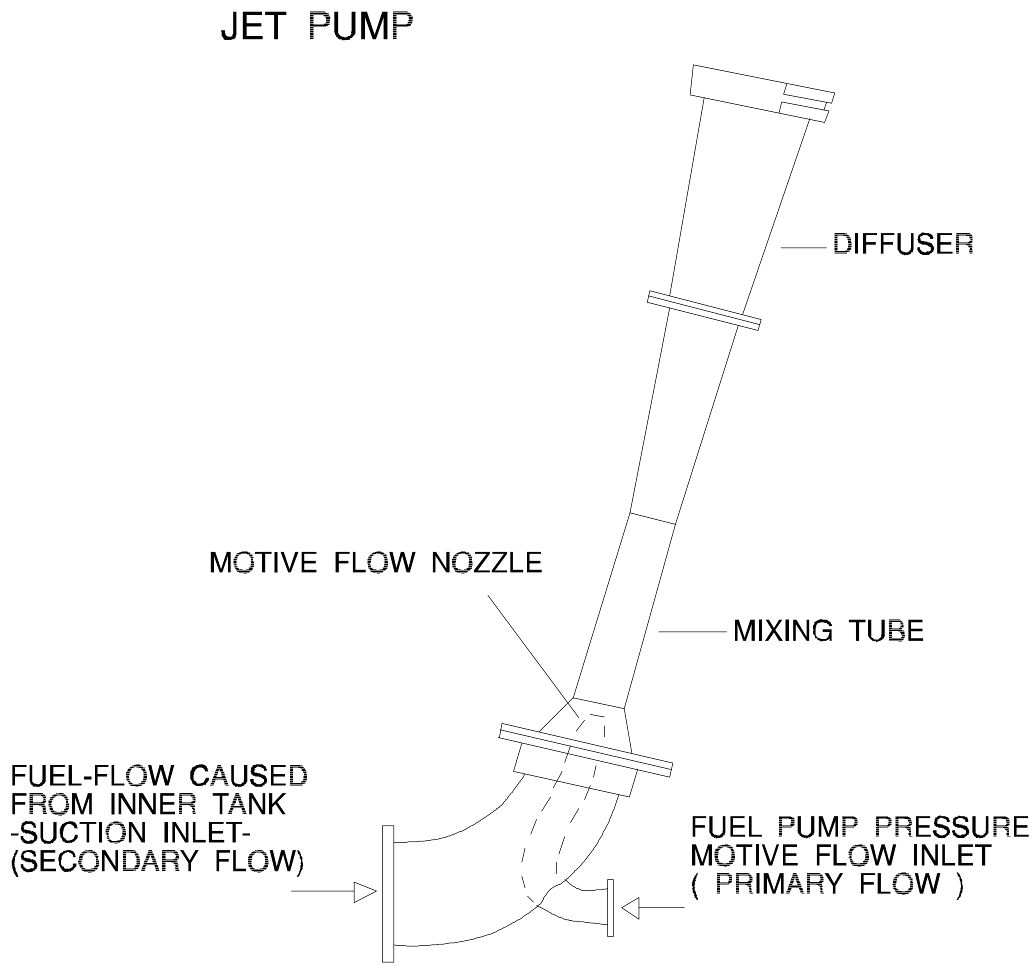
FIN / ZONE

Fin : 5113 QA1,2
Zone : 540, 640

COMPONENT DESCRIPTION

When the Jet Pump is in operation, the flow of fuel through the motive-flow nozzle causes a secondary flow. The mixed flow becomes stable in the mixing tube and slows down in the diffuser before it goes into the collector cell.





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THERMAL RELIEF VALVE

FIN / ZONE

Fin : 5115 QA1,2
Zone : 540, 640

COMPONENT DESCRIPTION

The ball type valve opens when the fuel pressure increases above 40 Psi (2.75 Bar) as a result of a fuel thermal expansion in the related fuel pipe.

AIR RELEASE VALVE

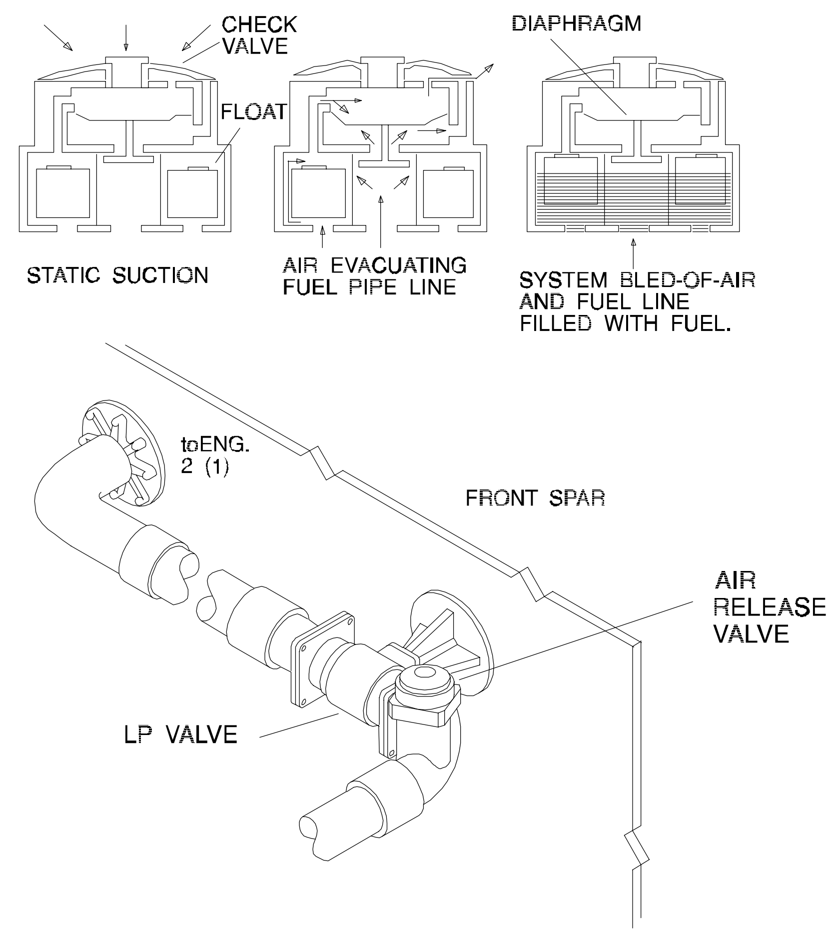
FIN / ZONE

Fin : Engine Feed = 5114 QA1,2
Crossfeed = 5311 QA1,2
Zone : 540, 640

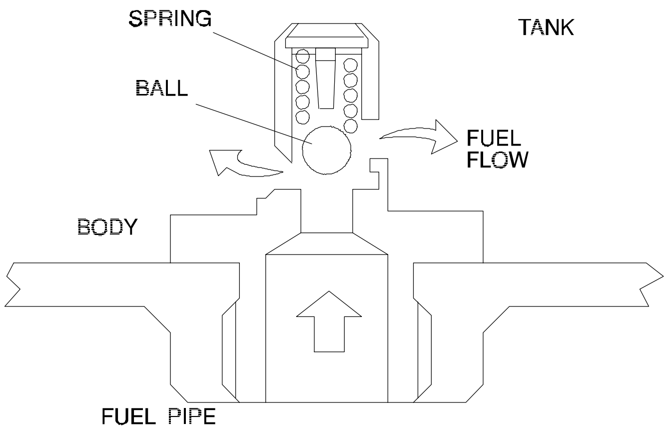
COMPONENT DESCRIPTION

The Air Release Valve body houses a diaphragm and float and is capped by a rubber check valve. Under pressure the diaghragm operates to permit air to bleed from the pipeline as it fills with fuel. Fuel loss is prevented by the float which lifts to close the valve. The check valve prevents air being sucked back into the line.

AIR RELEASE VALVE



THERMAL RELIEF VALVE



VALVE IN OPERATION

CROSSFEED VALVE

FIN / ZONE

Fin : 5300 QA
Zone : 141

COMPONENT DESCRIPTION

The Crossfeed Valve is a spherical ball type valve.
The valve is actuated by a spindle through the rear spar. A drive assembly engages with the spindle.

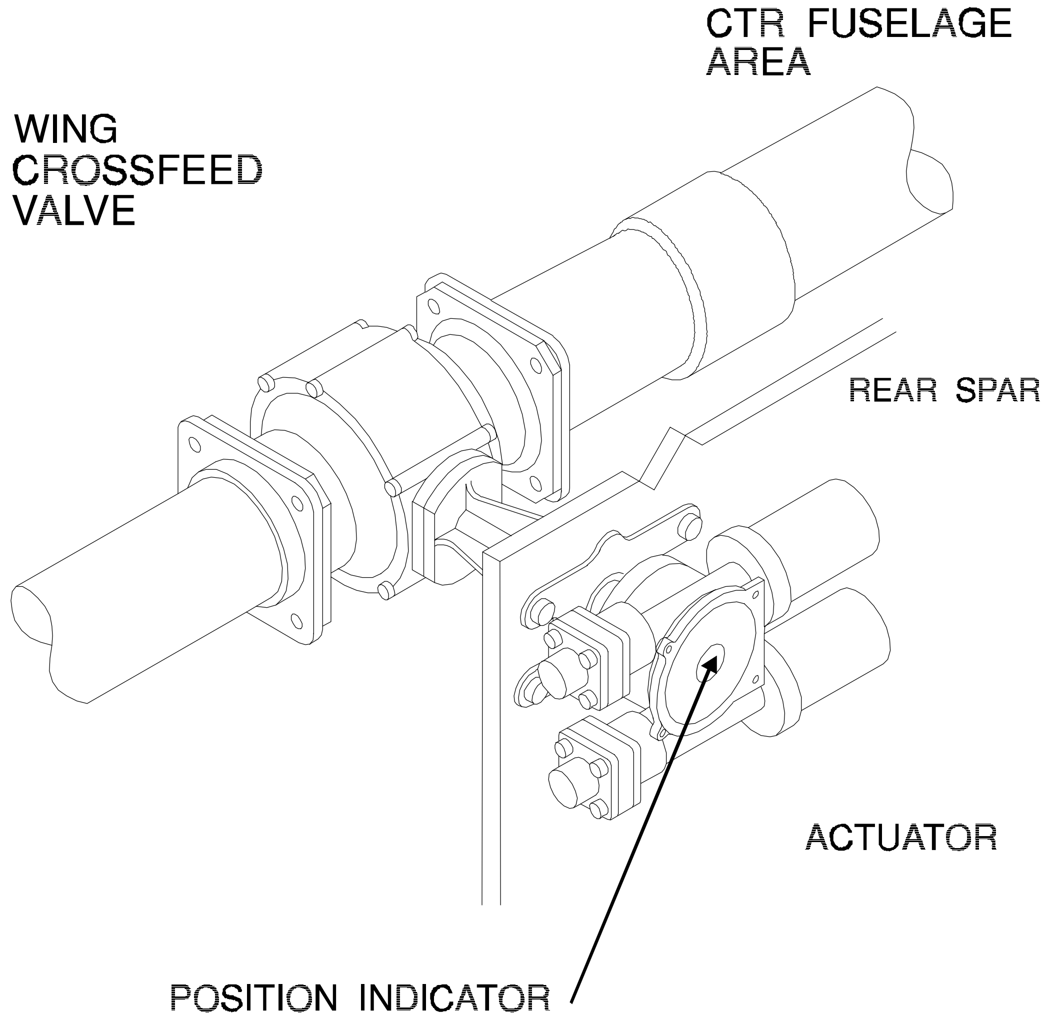
XFEED VALVE ACTUATOR

FIN / ZONE

Fin : 300 QE
Zone : 147

COMPONENT DESCRIPTION

The Crossfeed Valve has a twin motor actuator attached to the drive assembly by a V-clamp. The 2 electrical motors drive the same differential gear to turn the ball valve through 90º. The limit switches in the actuator control this rotation, set the electrical circuit for the next operation. The valve can operate with only one motor. The actuator has a see/feel position indicator.



FQW4200 GE Metric

LOW PRESSURE VALVE

FIN / ZONE

Fin : 5402 QA1,2
Zone : 540, 640

COMPONENT DESCRIPTION

The Low Pressure Valve body contains a ball valve fitted with a thermal relief valve. When the LP Valve is closed, the thermal relief valve operates at 12 PSI (0.83 Bar) to 22 PSI (1.52 Bar) to release downstream fuel pressure (caused through thermal expansion) back through the valve.

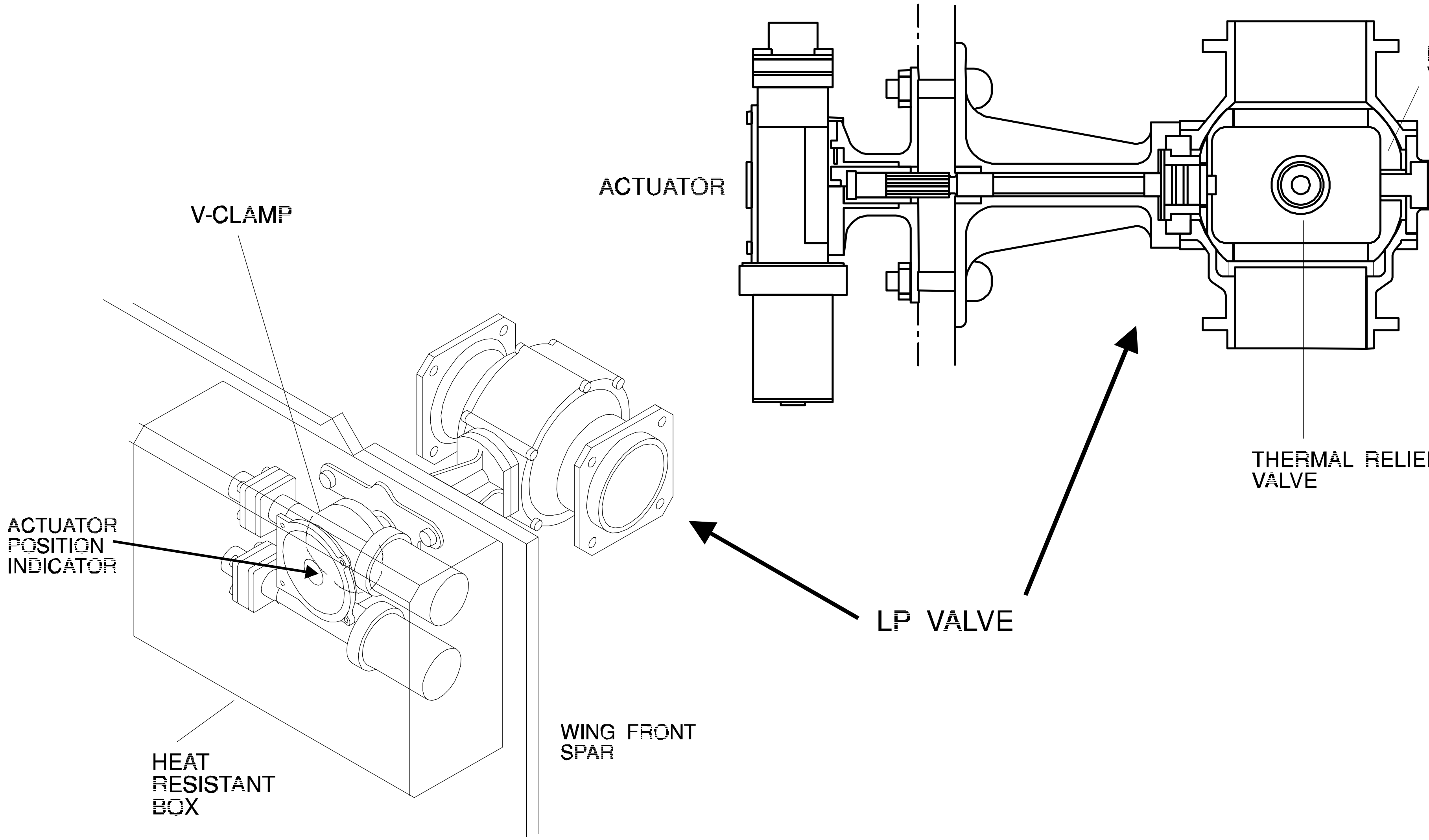
LP VALVE ACTUATOR

FIN / ZONE

Fin : 402 QG1,2
Zone : 521, 621

COMPONENT DESCRIPTION

The twin motor actuator is attached to the drive assembly by a V-clamp. The 2 electrical motors drive the same differential gear to turn the ball valve through 90º. The limit switches in the actuator control this rotation and set the electrical circuit for the next operation. If one motor fails, the other can operate the valve. Each actuator has a see/feel position indicator.



FQW4200 GE Metric

STUDENT NOTES

APU FEED SYSTEM COMPONENTS

Safety Precautions
Forward Fuel Feed Pump
Forward Pump Canister
Fuel Isolation Valve
Fuel Isolation Valve Actuator
APU LP Fuel Shut-off Valve
LP Fuel Shut-off Valve Actuator
Aft Fuel Feed Pump
Aft Pump Canister
Fuel Pressure Switch

SAFETY PRECAUTIONS

Obey the fuel safety procedures.

Do not get aircraft fuel in your mouth, in your eyes or on your skin for a long time (aircraft fuel is poisonous).

Make sure that the Landing gear safety locks and wheel chocks are in position.

Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.

Make sure that have correct fire fighting equipment available before you start any task on the fuel system.

Make sure that all circuits in maintenance are isolated before you supply electrical power to the aircraft.

Use the talcum powder procedure only on the external surfaces of the fuel tanks. This will prevent contamination of the fuel system.

Do not get your clothes soaked with fuel.

Use approved protective clothing when you go into a fuel tank.

STUDENT NOTES

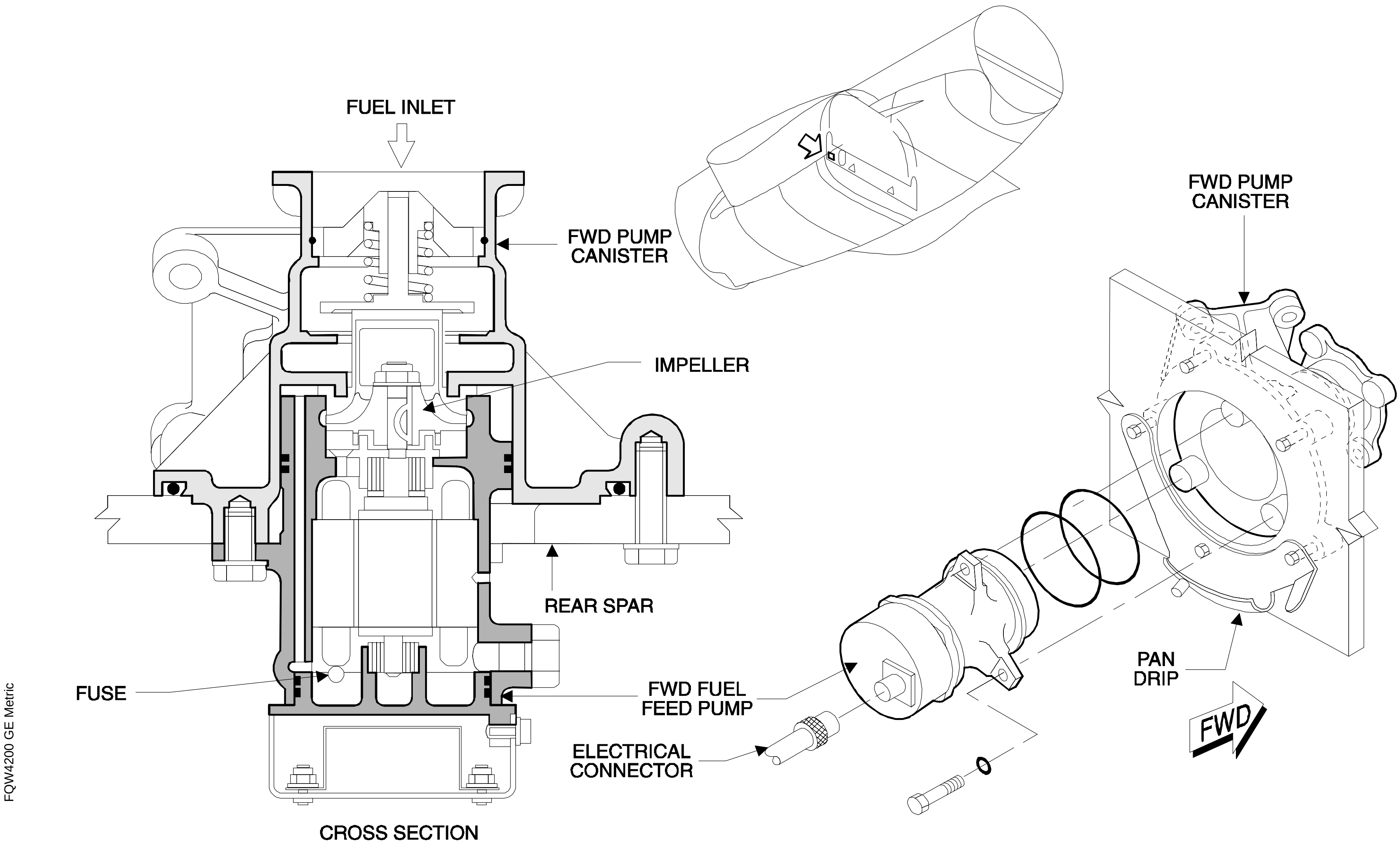
FORWARD FUEL FEED PUMP

FIN/ZONE/ACCESS

FIN: 4 QC
Zone: 145
Access: 734

COMPONENT DESCRIPTION

The fuel pump is of the centrifugal type with a single-phase 115 VAC motor which moves the pump impeller.
The pump is fitted with a thermofuse to prevent an overheat (at 175°C / 347°F).


FUEL INLET
FWD PUMP CANISTER
IMPELLER
REAR SPAR
FUSE
FWD FUEL FEED PUMP
ELECTRICAL CONNECTOR
CROSS SECTION
FWD PUMP CANISTER
PAN DRIP
FWD
FQW4200 GE Metric

FORWARD PUMP CANISTER

FIN/ZONE/ACCESS

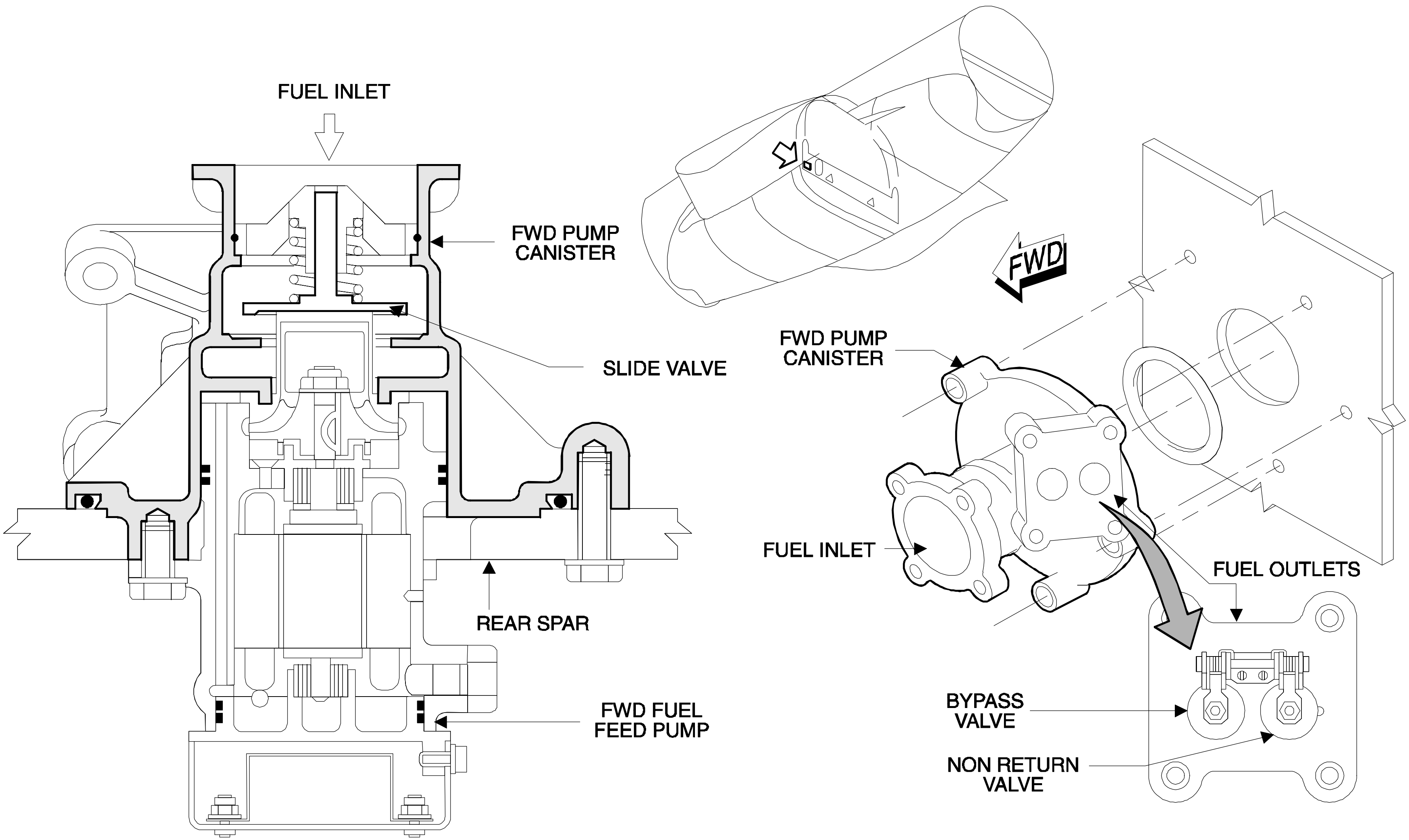
FIN: 5203 QA
Zone: 145
Access: 147 AZ

COMPONENT DESCRIPTION

The forward pump canister is installed on the rear spar (FR 47) of the wing center tank.
It contains the forward fuel feed pump.

PUMP REPLACEMENT

The canister makes it possible to replace the fuel feed-pump although there is fuel in the fuel lines. An internal valve seals the canister when the pump is removed.



CROSS SECTION

FQW4200 GE Metric

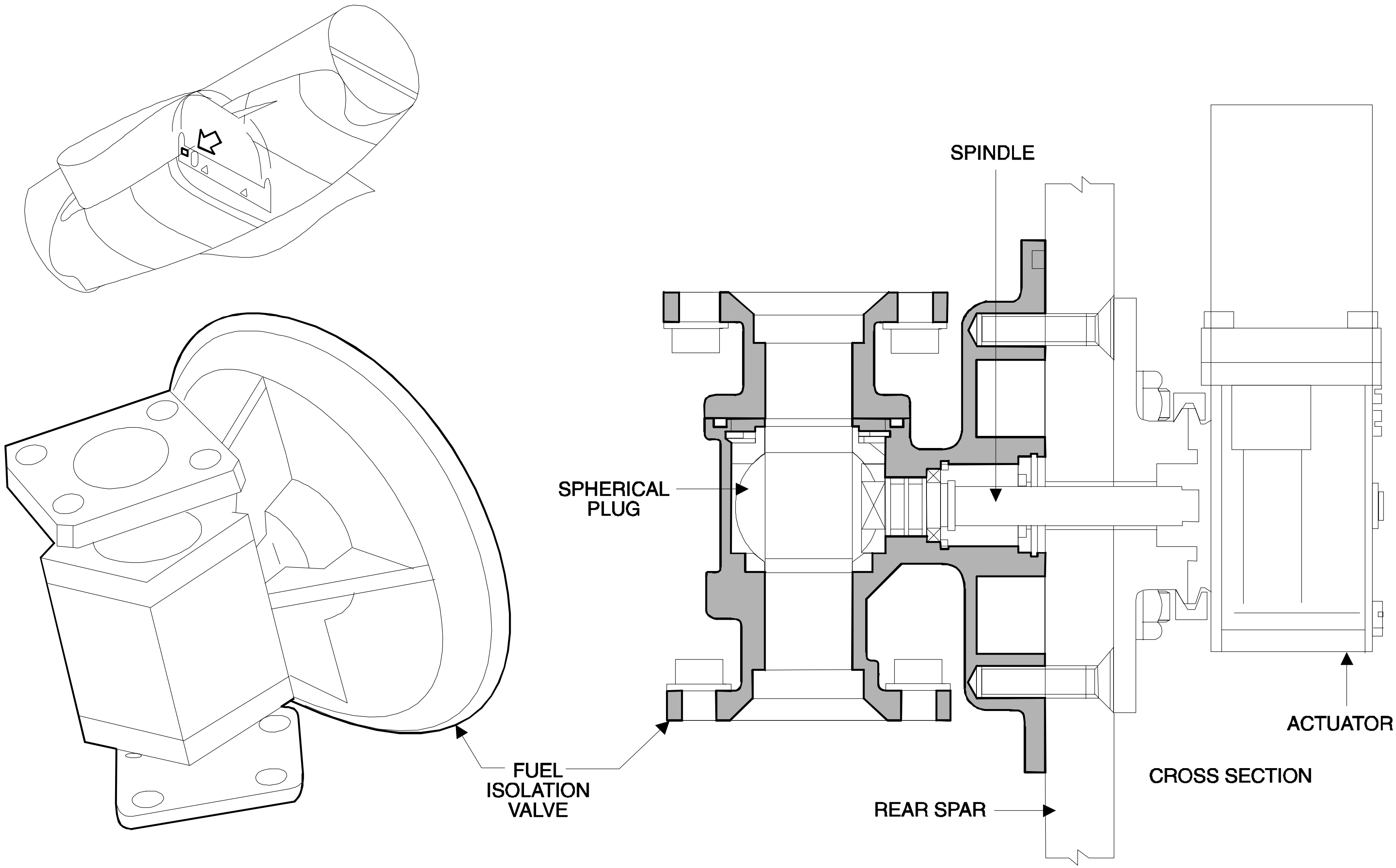
FUEL ISOLATION VALVE

FIN/ZONE/ACCESS

FIN: 5204 QA
Zone: 145
Access: 147 AZ

COMPONENT DESCRIPTION

The valve has an aluminium body which contains a spherical plug.
The flow direction is marked on the body.
A spindle connects the valve to the actuator.



FQW4200 GE Metric

FUEL ISOLATION VALVE ACTUATOR

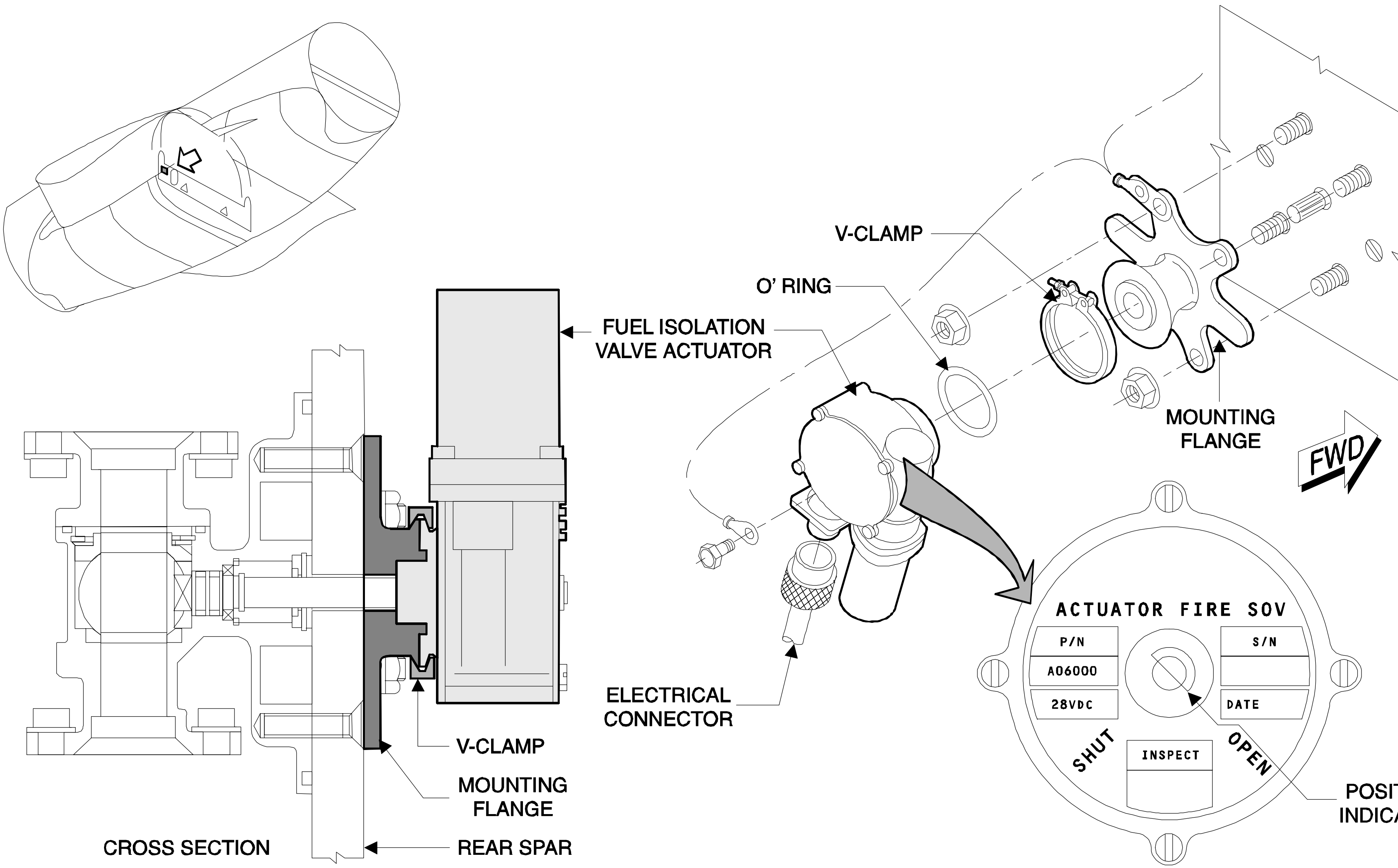
FIN/ZONE/ACCESS

FIN: 5 QF
Zone: 145

COMPONENT DESCRIPTION

The primary components of the actuator are:
- a 28 VDC motor
- a slip clutch
- two position switches
- a position indicator.

The actuator is held in position by a V-clamp.



FQW4200 GE Metric

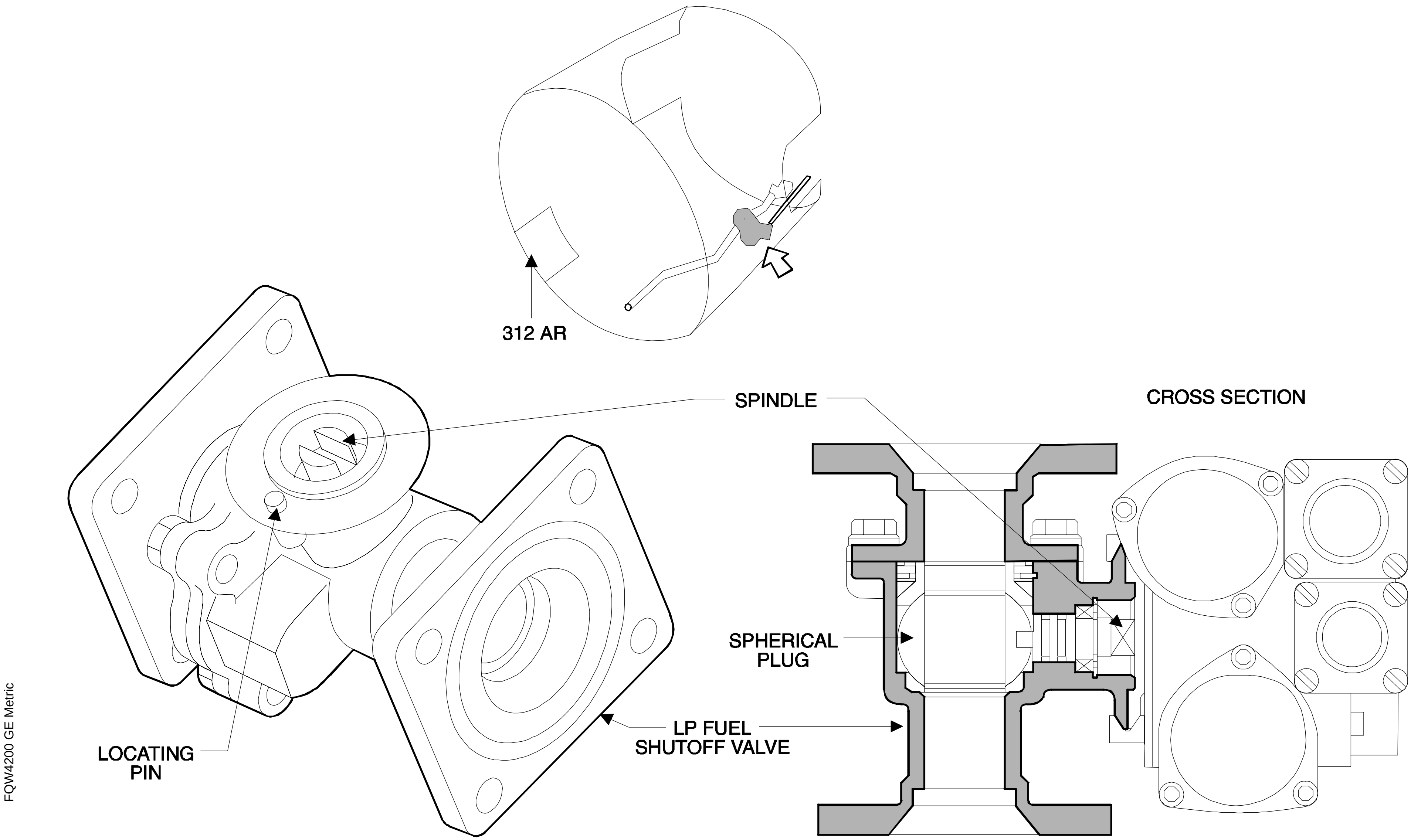
APU LP FUEL SHUT-OFF VALVE

FIN/ZONE/ACCESS

FIN: 5200 QA
Zone: 312
Access: 312 AR

COMPONENT DESCRIPTION

The valve has an aluminium body which contains a spherical plug. The flow direction is marked on the body. A spindle connects the valve to the actuator.


312 AR
SPINDLE
CROSS SECTION
SPHERICAL PLUG
LP FUEL SHUTOFF VALVE
LOCATING PIN
FQW4200 GE Metric

LP FUEL SHUT-OFF VALVE ACTUATOR

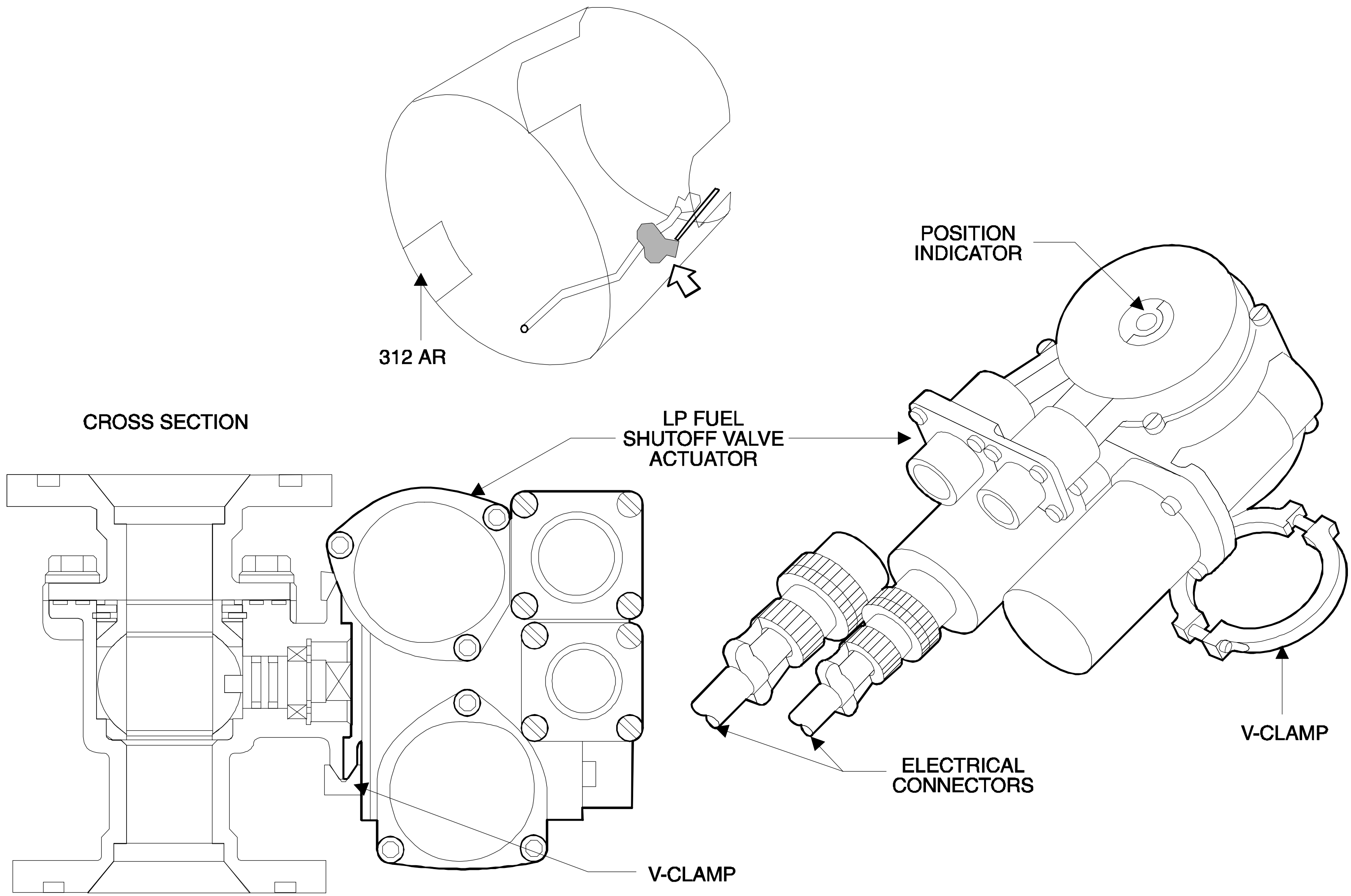
FIN/ZONE/ACCESS

FIN: 4 QF
Zone: 312

COMPONENT DESCRIPTION

The primary components of the actuator are:
- two 28 VDC motors
- a slip clutch
- two position switches
- a position indicator.

The actuator is held in position by a V-clamp.



FQW4200 GE Metric

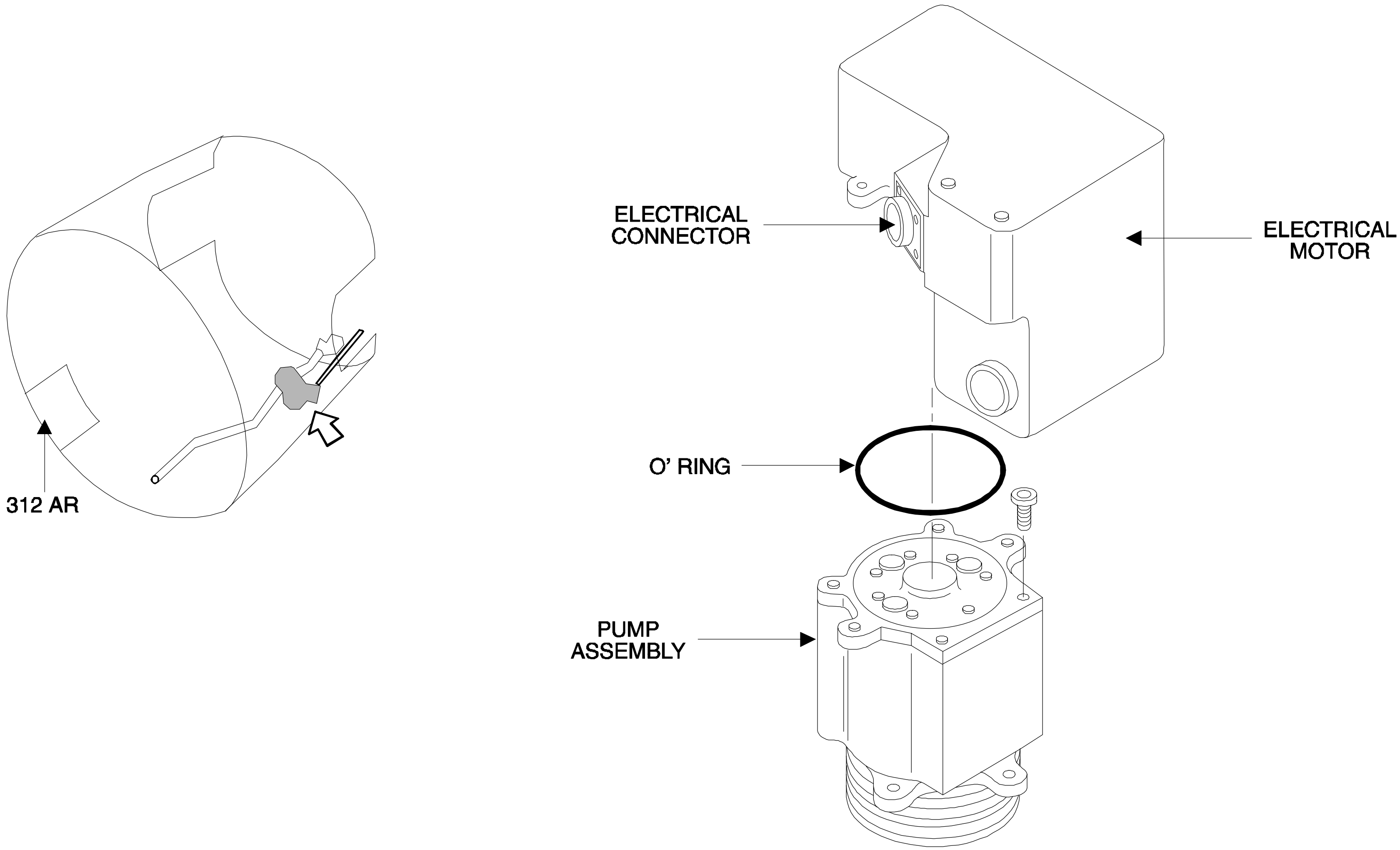
AFT FUEL FEED PUMP

FIN/ZONE/ACCESS

FIN: 3 QC
Zone: 312
Access: 312 AR

COMPONENT DESCRIPTION

The electrical fuel pump is of the vane type supplied with 115 VAC.



FQW4200 GE Metric

AFT PUMP CANISTER

FIN/ZONE/ACCESS

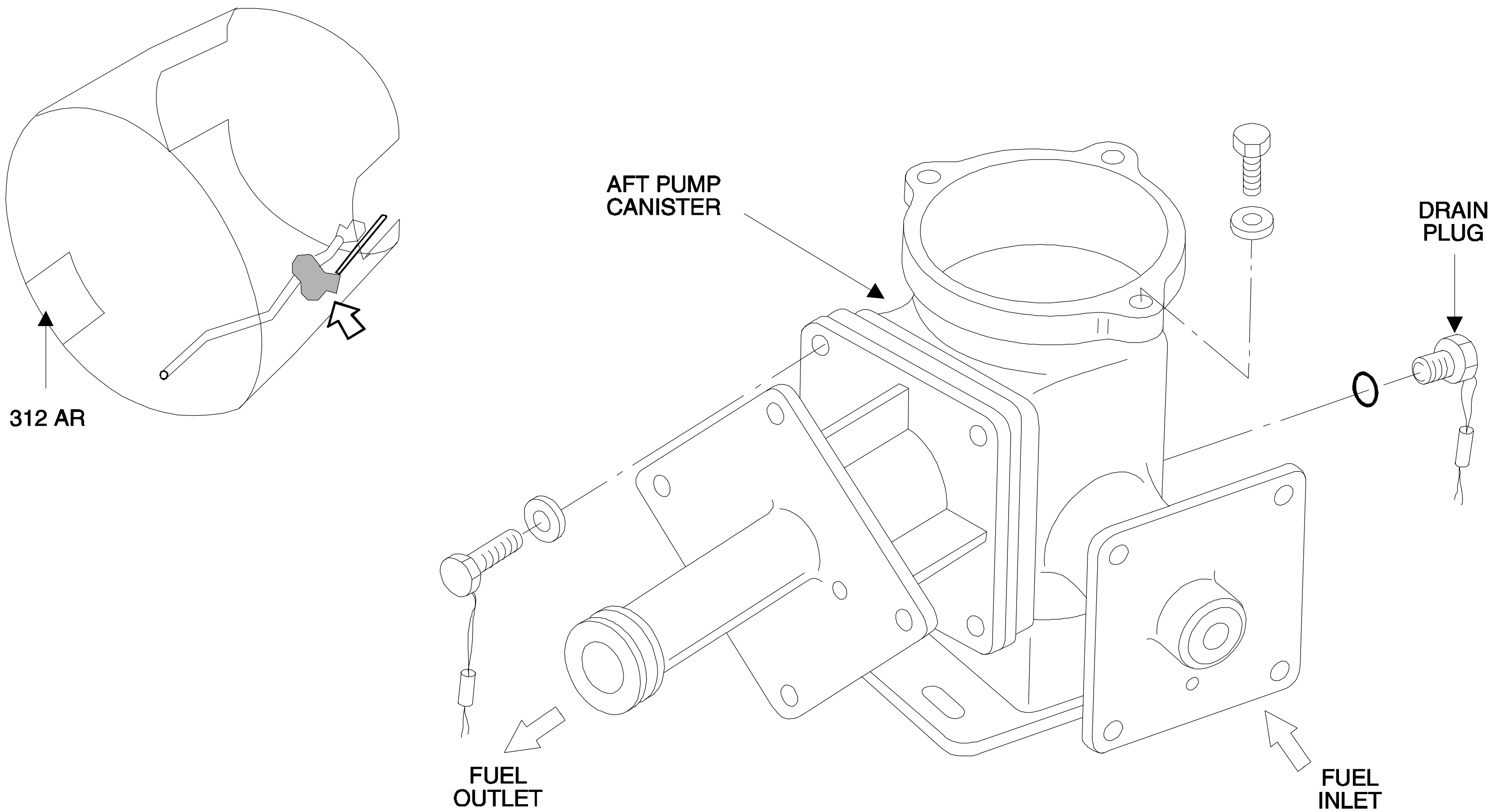
FIN: 5201 QA
Zone: 312
Access: 312 AR

COMPONENT DESCRIPTION

The aft pump canister is attached to the fire shut-off valve between frames 87 & 88.
It contains the aft fuel feed pump.

PUMP REPLACEMENT

The canister makes it possible to replace the fuel feed-pump although there is fuel in the fuel lines.
An internal valve seals the canister when the pump is removed.



FQW4200 GE Metric

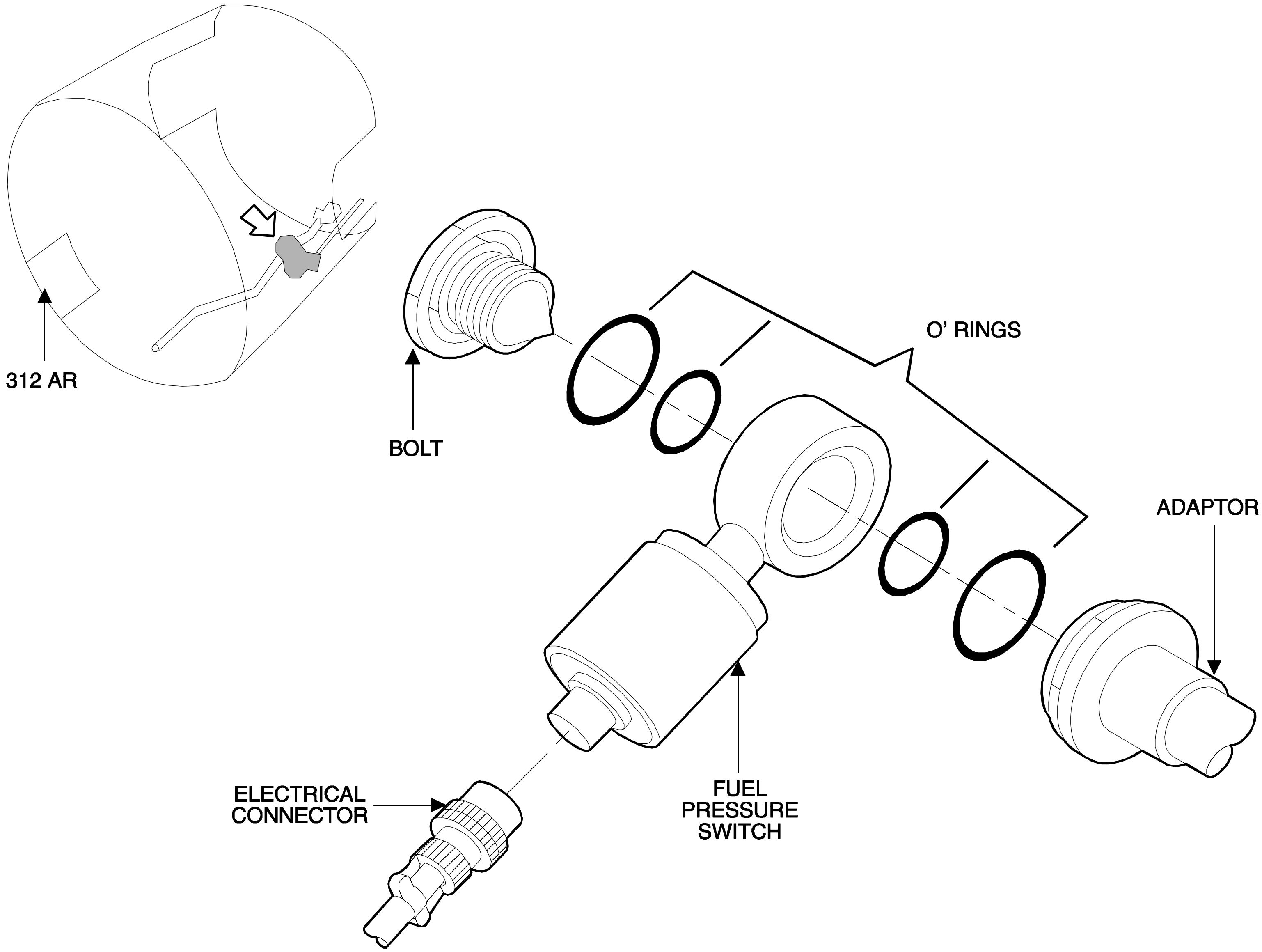
FUEL PRESSURE SWITCH

FIN/ZONE/ACCESS

FIN: 7 QC
Zone: 312
Access: 312 AR

COMPONENT DESCRIPTION

The fuel pressure switch is installed in the trim tank fuel transfer line between frames 88 & 89.
The pressure switch closes when the pressure in the trim tank fuel transfer line is less than 22 PSI A.



FQW4200 GE Metric

STUDENT NOTES

MAIN TRANSFER SYSTEM DESCRIPTION AND OPERATION

General
Transfer Pumps
Inner Tank Inlet Valves
Intertank Transfer Valves
Center to Inner Transfer Operation
Outer to Inner Transfer Operation
Manual Operations

GENERAL

The Main Transfer System controls the flow of fuel from the Center and the Outer Tanks to the two Inner Tanks. It is usually controlled automatically, but it can be operated manually when necessary.

The system uses fuel pumps to move the fuel from the Center to the Inner Tanks.
It uses gravity to move the fuel from the Outer to the Inner Tanks.

TRANSFER PUMPS

Each of the two Transfer Pumps are attached to the bottom of the Center Tank between Frame 45 and 46 in a canister.
The outlet pipe from the Canister contains a Check Valve to prevent a discharge of fuel through the pump when it is not in operation.

If the pump pressure decreases to less than 6 Psi (0.41 Bar), the Pressure Switch sends a warning.

INNER TANK INLET VALVES

One Inlet Valve for each Inner Tank independently controls the flow of fuel from the refuel gallery to the Inner Tank.

The Inner Tank Inlet Valve, with its actuator, is bolted to the Center Tank rear spar (Frame 47).

INTERTANK TRANSFER VALVES

One Intertank Transfer Valve is installed in each wing at rib 23, to control the flow of fuel from the Outer Tank to the Inner Tank.

An actuator operates the Intertank Transfer Valve through a driveshaft. The actuator is installed on the wing front spar.

Lateral balance is maintained by simultaneous operation of these valves.

CENTER TO INNER TRANSFER OPERATION

Provided the Center Tank has been refueled, both Center Tank Pump pushbuttons are set to on prior to flight.
The two Transfer Pumps operate continuously until the Center Tank is empty.

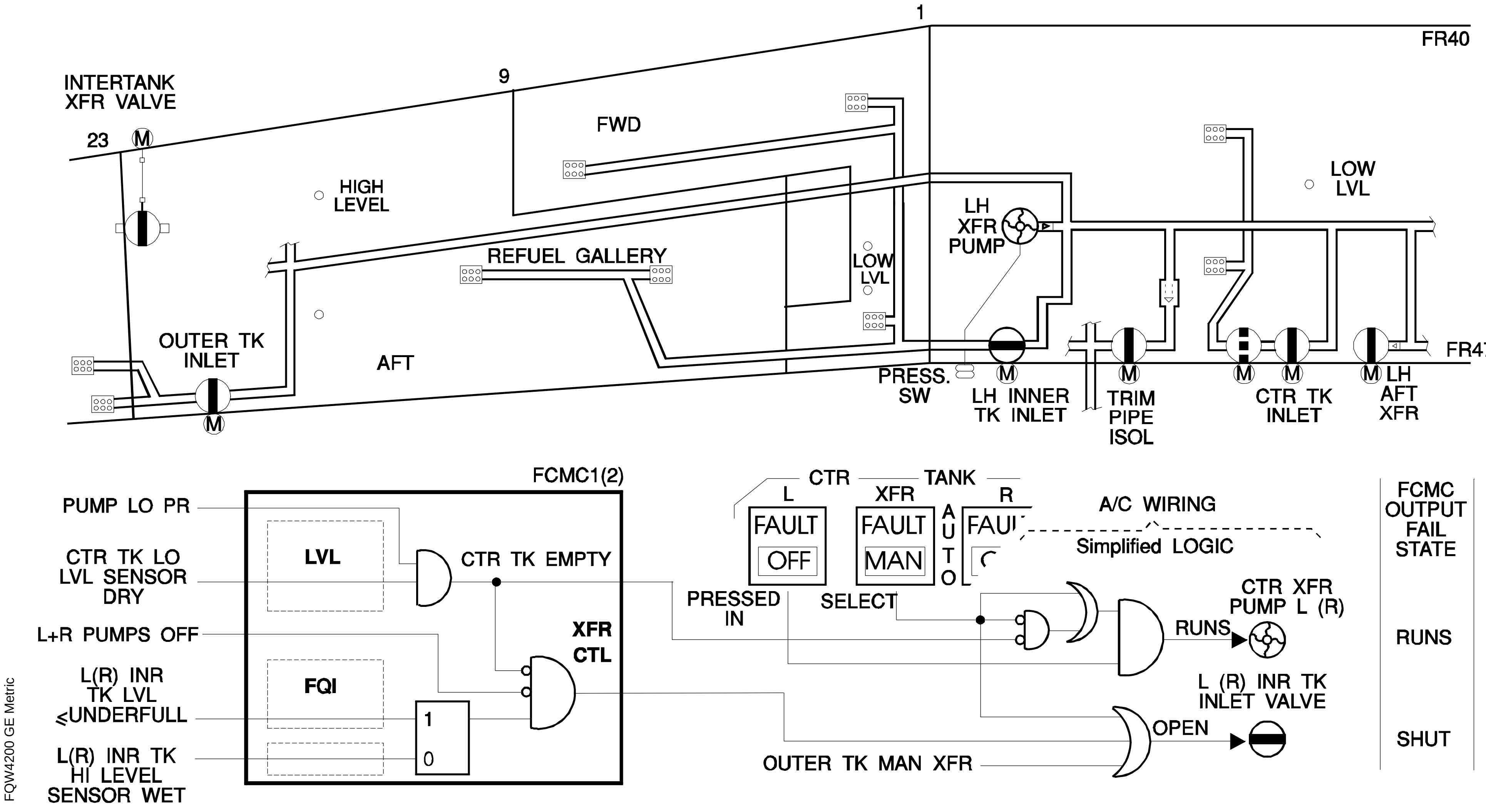
When the Underfull level (2500 l / 660 USG below High Level) is reached, the Fuel Control Monitoring System (FCMS) commands the related L (R) Inner Tank Inlet Valve to open.
Fuel from Center Tank starts to flow into the Inner Tank.

The fuel transfer continues until the High Level sensor in the Inner Tank becomes wet.

When an Inner Tank High Level sensor is wet, the FCMC commands the related Inner Tank Inlet Valve to close.
When the level drops again to Underfull, the Inner Tank Inlet valve re-opens.

Independently for each wing, the open-and-close cycle continues until the Center Tank is empty.

The FCMS stops the two Transfer Pumps and closes both Inner Tank Inlet Valves when the Center Tank is at LO LVL and both pumps are at LO PRESS.


1
FR40
9
INTERTANK
XFR VALVE
23
M
FWD
HIGH
LEVEL
LOW
LVL
LH
XFR
PUMP
REFUEL GALLERY
LOW
LVL
OUTER TK
INLET
AFT
FR47
PRESS.
SW
LH INNER
TK INLET
TRIM
PIPE
ISOL
CTR TK
INLET
LH
AFT
XFR
FCMC1(2)
PUMP LO PR
CTR TK LO
LVL SENSOR
DRY
L+R PUMPS OFF
L(R) INR
TK LVL
≤UNDERFULL
L(R) INR TK
HI LEVEL
SENSOR WET
LVL
FQI
CTR TK EMPTY
XFR
CTL
1
0
CTR TANK
L
XFR
R
FAULT
OFF
FAULT
MAN
AUTO
PRESSED
IN
SELECT
A/C WIRING
Simplified LOGIC
CTR XFR
PUMP L (R)
RUNS
L (R) INR TK
INLET VALVE
OPEN
OUTER TK MAN XFR
FCMC
OUTPUT
FAIL
STATE
RUNS
SHUT
FQW4200 GE Metric

OUTER TO INNER TRANSFER OPERATION

The fuel transfer from the Outer Tanks to the Inner Tanks occurs when the fuel quantity in one Inner Tank drops.
The first Inner Tank at 3500 Kg (7700 Lbs) leads.

The FCMS commands the two Intertank Transfer Valves to open.

Note: The Low Level warning is at 1600 Kg (3520 Lbs).

This gravity fuel transfer continues until the quantity of the Inner Tank increases to another threshold.

When the quantity of the leading Inner Tank increases to 4000 Kg (8800 Lbs), the FCMS controls the two Intertank Transfer Valves to close.
The valves re-open when the Inner Tank level drops again.

This open-and-close cycle continues until the two Outer Tanks are empty.

When an Outer Tank stays dry for 5 minutes, the related Intertank Transfer Valve is closed.

Note: If Trim Tank Transfer Pump is inoperative, OUTER TRANSFER occurs between Inner quantity of 4000 (8800) and 4500 Kg (9900 Lbs).

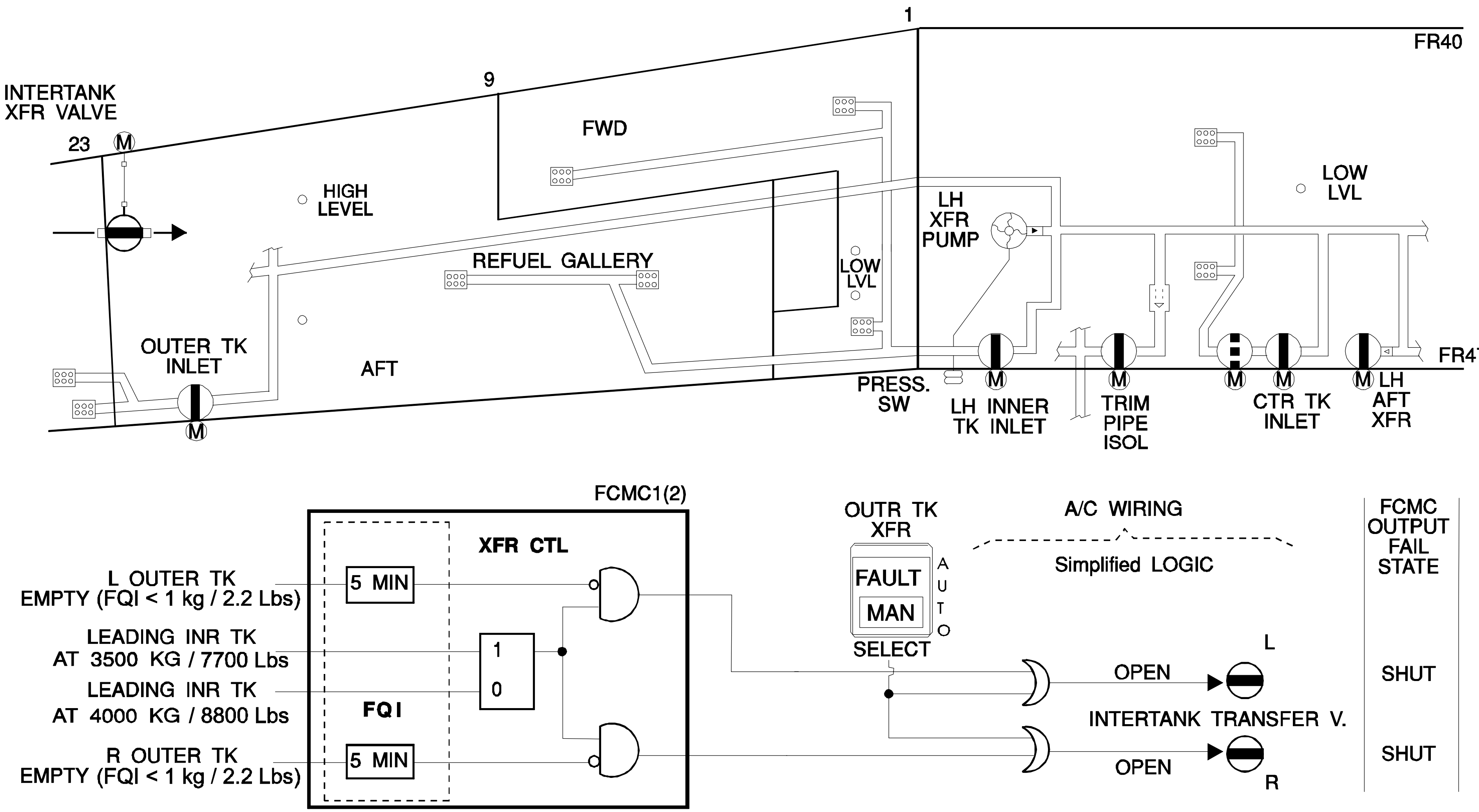
MANUAL OPERATIONS

The Center Tank Transfer pushbutton set to MAN allows the fuel to move from the Center Tank to the Inner Tanks.

In this case, it is necessary to monitor carefully that :
- the Inner Tanks are not overfilling (because Inner Tank Inlet Valves remain open without High Level protection),
- the Transfer Pumps do not operate for an extended time in a dry tank (they have to be switched OFF manually).

The Outer Tank Transfer pushbutton set to MAN allows the fuel to move from the Outer Tanks to the Inner Tanks.
Manual transfer selection controls six valves open and four valves shut.

Note that in both cases, Trim Aft Transfer is inhibited.



FQW4200 GE Metric

STUDENT NOTES:

MAIN TRANSFER SYSTEM COMPONENTS

Safety Precautions
Fuel Transfer Pump Canister
Fuel Transfer Pump Element
Fuel Transfer Pump Pressure Switch
Intertank Transfer Valve
Intertank Transfer Valve Actuator
Inlet Valve
Inlet Valve Actuator

SAFETY PRECAUTIONS

Obey the fuel safety procedures.

Do not get aircraft fuel in your mouth, in your eyes or on your skin for a long time. (aircraft fuel is poisonous)

Make sure that the Landing gear safety locks and wheel chocks are in position.

Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.

Make sure that you have correct fire fighting equipment available before you start any task on the fuel system.

Make sure that all circuits in maintenance are isolated before you supply electrical power to the aircraft.

Use the talcum powder procedure only on the external surfaces of the fuel tanks. This will prevent contamination of the fuel system.

Do not get your clothes soaked with fuel. Use approved clothing when you go into a fuel tank.

STUDENT NOTES

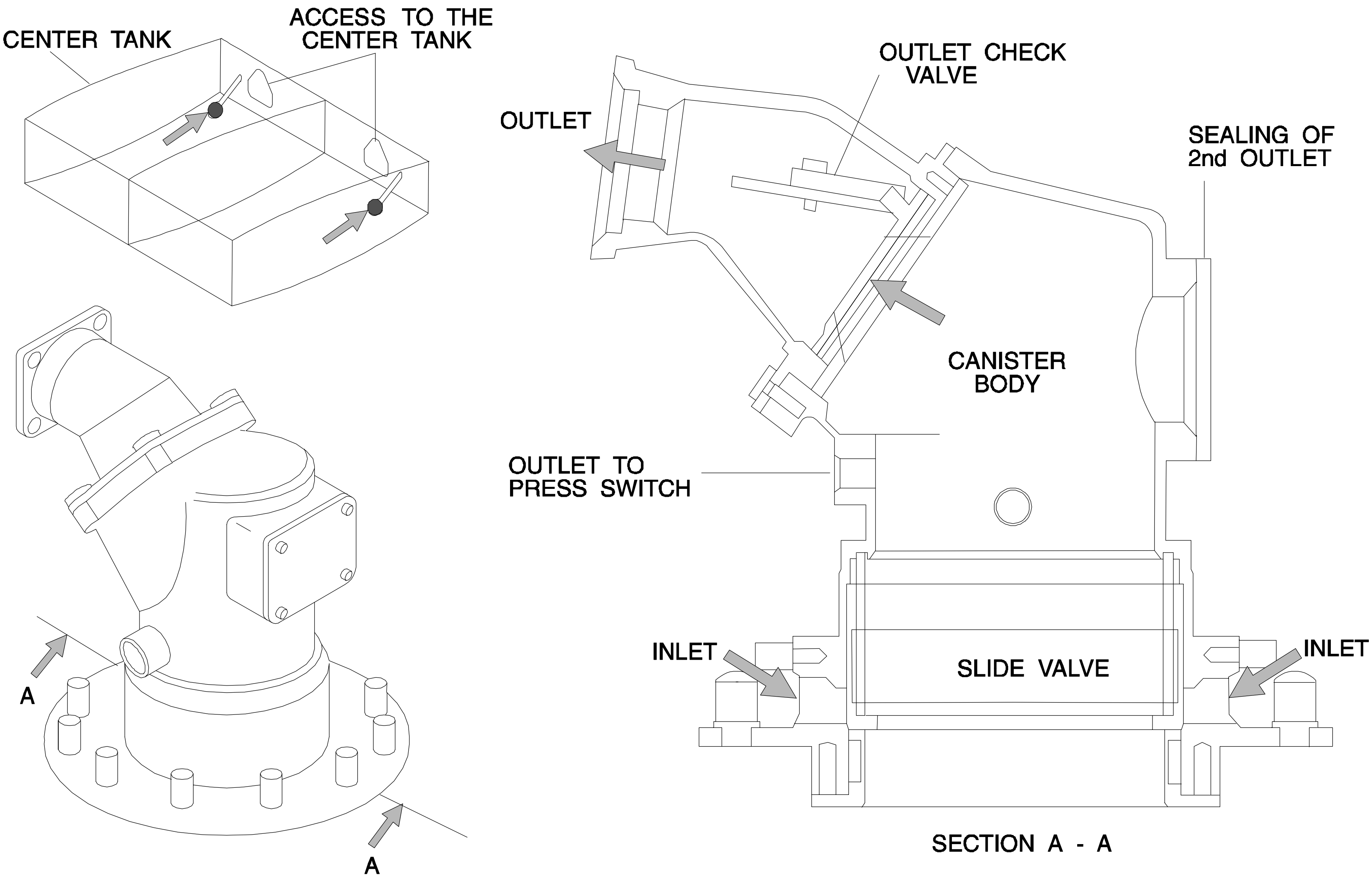
FUEL TRANSFER PUMP CANISTER

FIN / ZONE

FIN : 5600QA1(2)
ZONE: 141(142)

COMPONENT DESCRIPTION

The Pump Canister arrangement allows the Fuel Pump element to be replaced with fuel in the Center Tank. When the pump is replaced the Check Valve and a Slide valve seal the Canister. The Fuel Transfer Pump Canister is of the same type as the Main Pump canister, but with the Jet Pump outlet sealed.



FQW4200 GE Metric

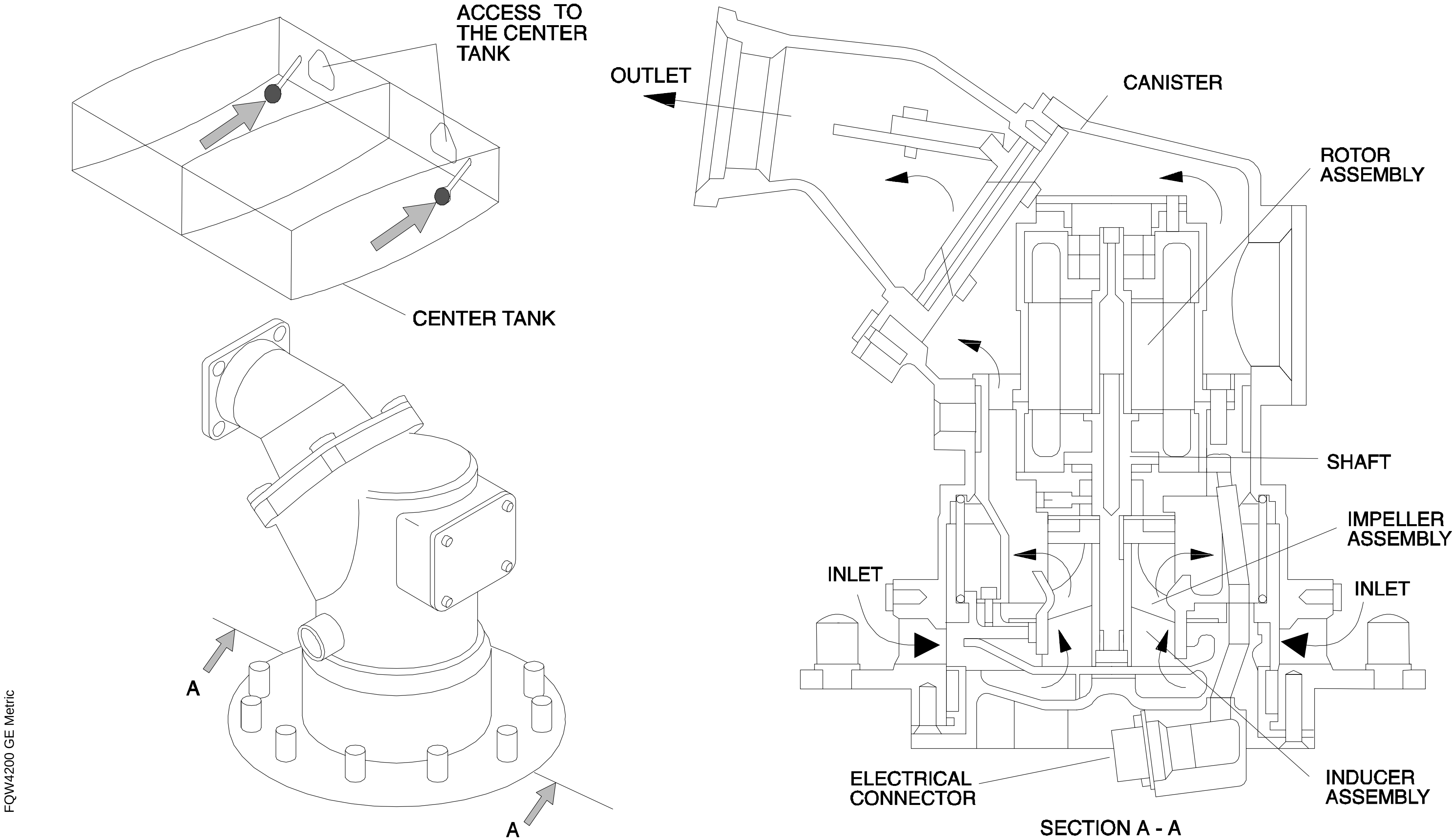
FUEL TRANSFER PUMP ELEMENT

FIN / ZONE

FIN : 600QL1(2)
ZONE : 195(196)

COMPONENT DESCRIPTION

Main Pumps, Standby Pumps and Center Pumps are interchangeable. The Pump Element is assembled vertically. The rotor assembly is at the top. The impeller assembly is in the center and the inducer assembly is at the bottom. The shaft connects the three assemblies together. If the pump element temperature increases above 192°c (378°F) three thermal switches operate. The pump stops, it cannot operate again and must be replaced.


ACCESS TO
THE CENTER
TANK
CENTER TANK
A
A
OUTLET
CANISTER
ROTOR
ASSEMBLY
SHAFT
IMPELLER
ASSEMBLY
INLET
INLET
ELECTRICAL
CONNECTOR
INDUCER
ASSEMBLY
SECTION A - A
FQW4200 GE Metric

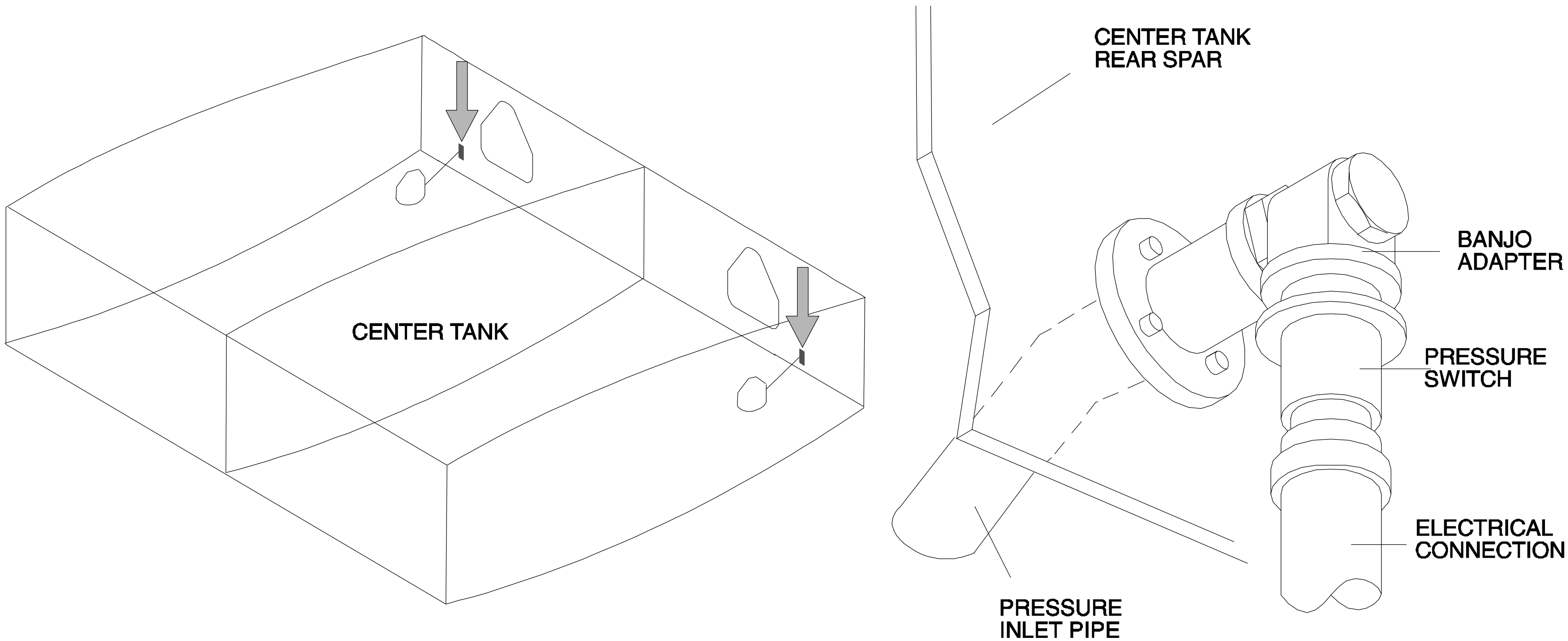
FUEL TRANSFER PUMP PRESSURE SWITCH

FIN / ZONE

FIN : 12QL1(2)
ZONE : 147

COMPONENT DESCRIPTION

When the fuel pressure increases to 8 psi (0.55bar) the microswitch contacts open, they close when the pressure decreases to 6 psi (0.41bar). The pressure switches are the same type as those in the main fuel pump system.



FQW4200 GE Metric

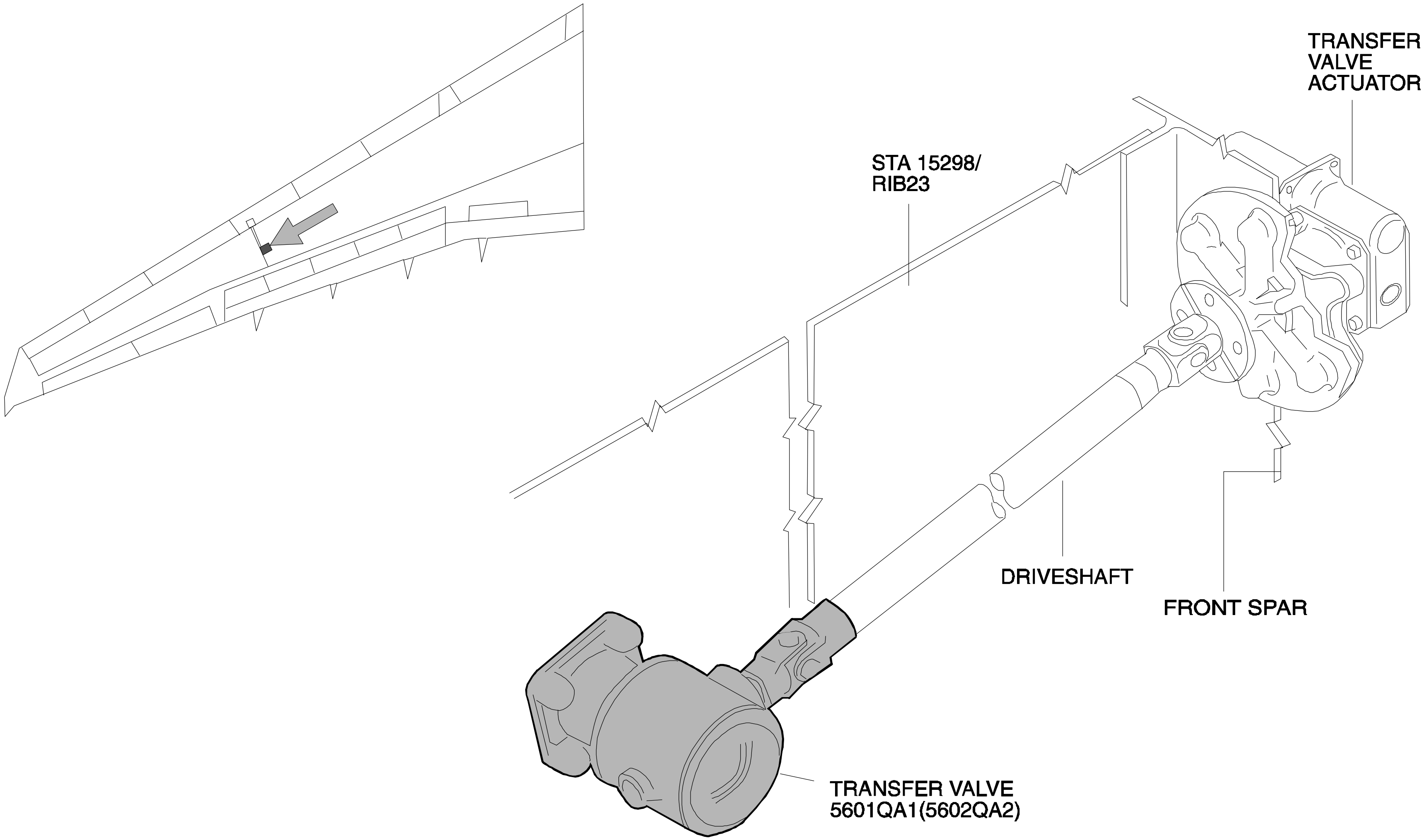
INTERTANK TRANSFER VALVE

FIN / ZONE

FIN : 5601QA1(2)
ZONE : 540(640)

COMPONENT DESCRIPTION

The valve has a body attached to a mounting flange and a driveshaft. The valve body holds a ball valve which has a bore. Four bolts connect the mounting flange to the aircraft structure. An O'ring seal in the mounting flange face prevents leakage of fuel through the mounting flange.



FQW4200 GE Metric

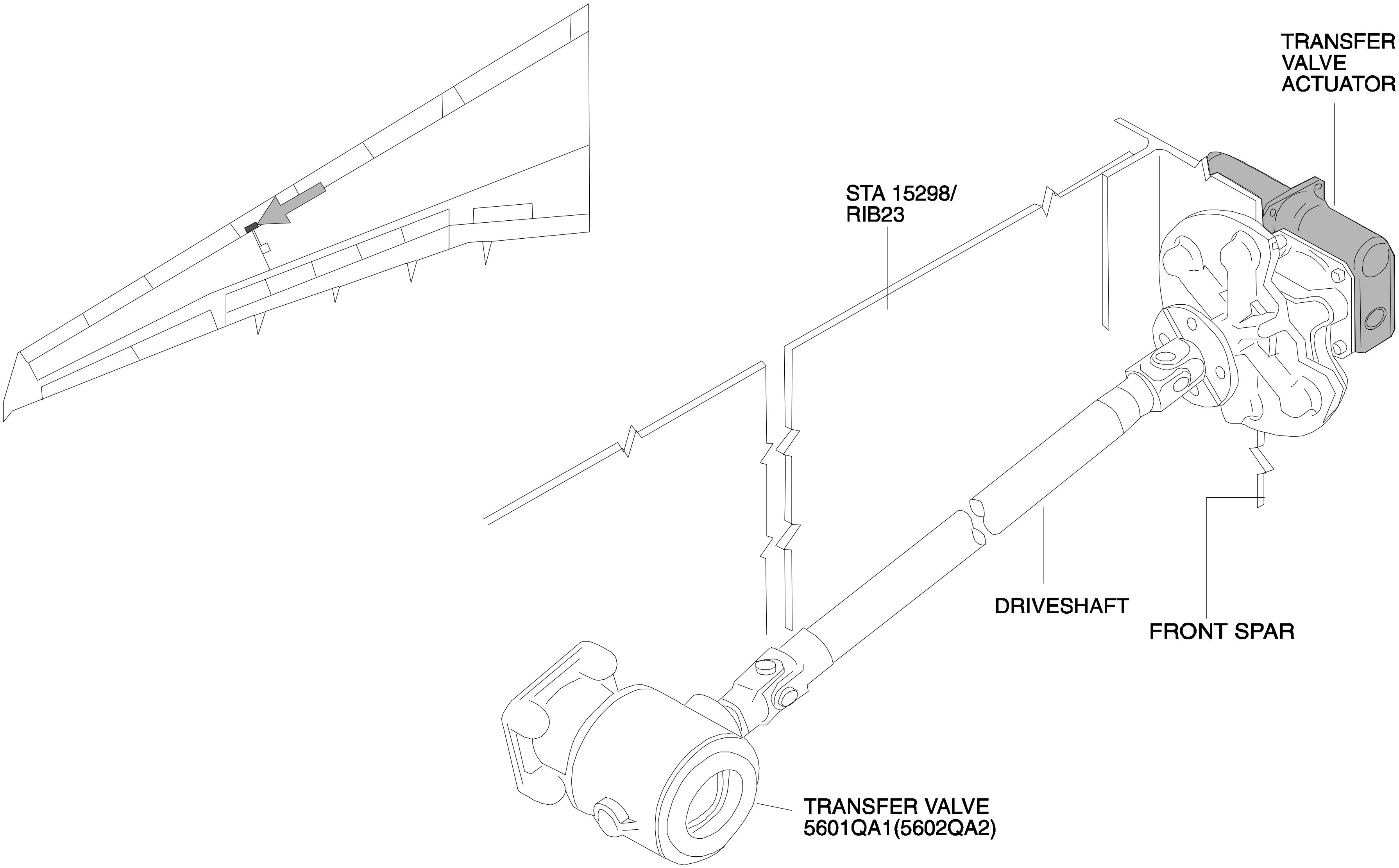
INTERTANK TRANSFER VALVE ACTUATOR

FIN / ZONE

FIN : 601QL1(2)
ZONE : 522(622)

COMPONENT DESCRIPTION

The actuator has a body with a mounting flange. The body contains a 28VDC electrical motor. This motor drives a gear which turns the Transfer Valve driveshaft and the ball valve through 90 degrees. There is a mechanical indicator on the body which shows the position of the valve.



FQW4200 GE Metric

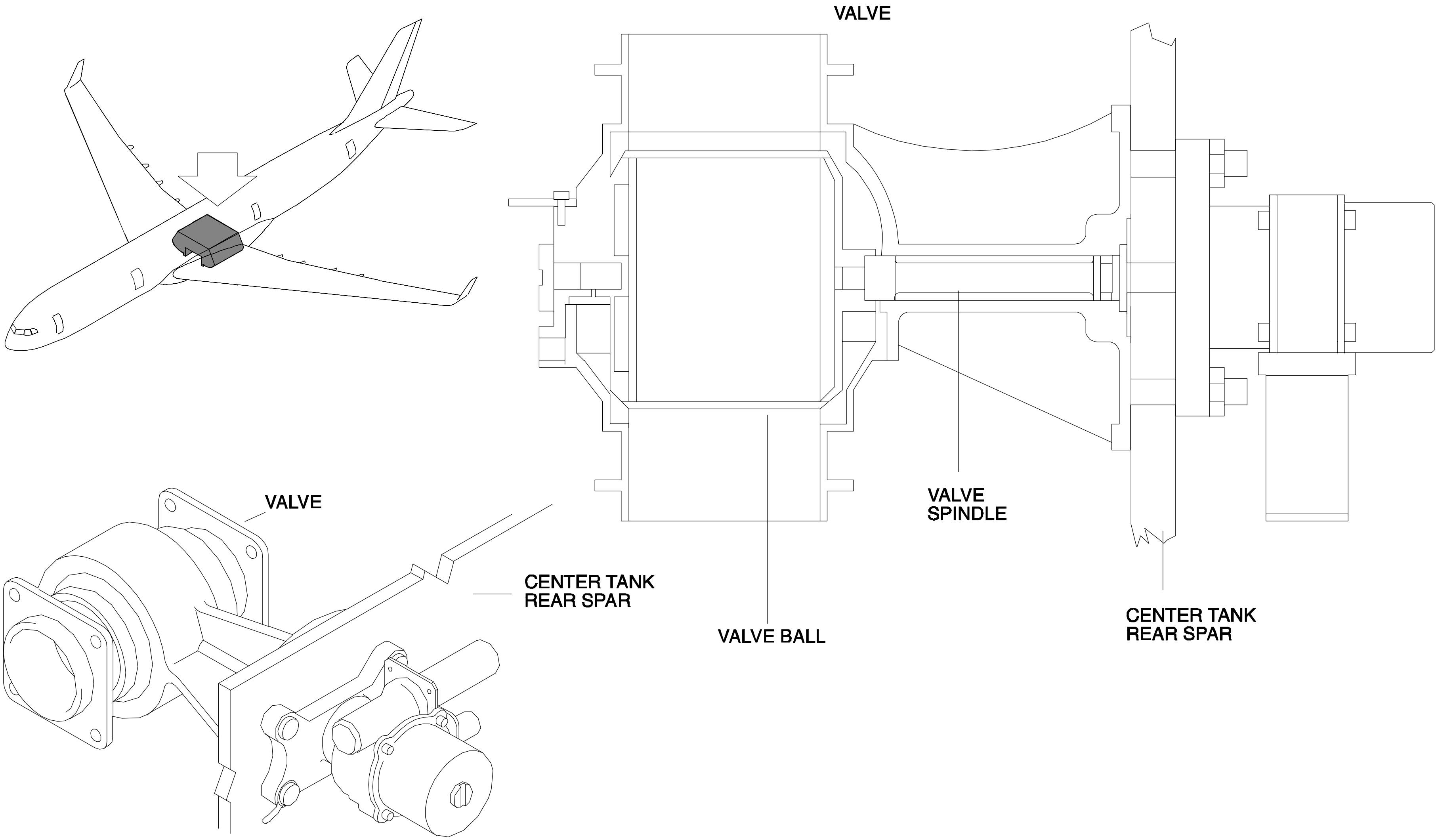
INLET VALVE

FIN / ZONE

FIN : 5603QA1(2)
ZONE : 141(142)

COMPONENT DESCRIPTION

The valve body holds the ball valve which is connected to the valve spindle in the mounting flange. The mounting flange attaches the valve to the aircraft structure. The valve spindle goes through the mounting flange and the aircraft structure to connect with the electrical actuator.



FQW4200 GE Metric

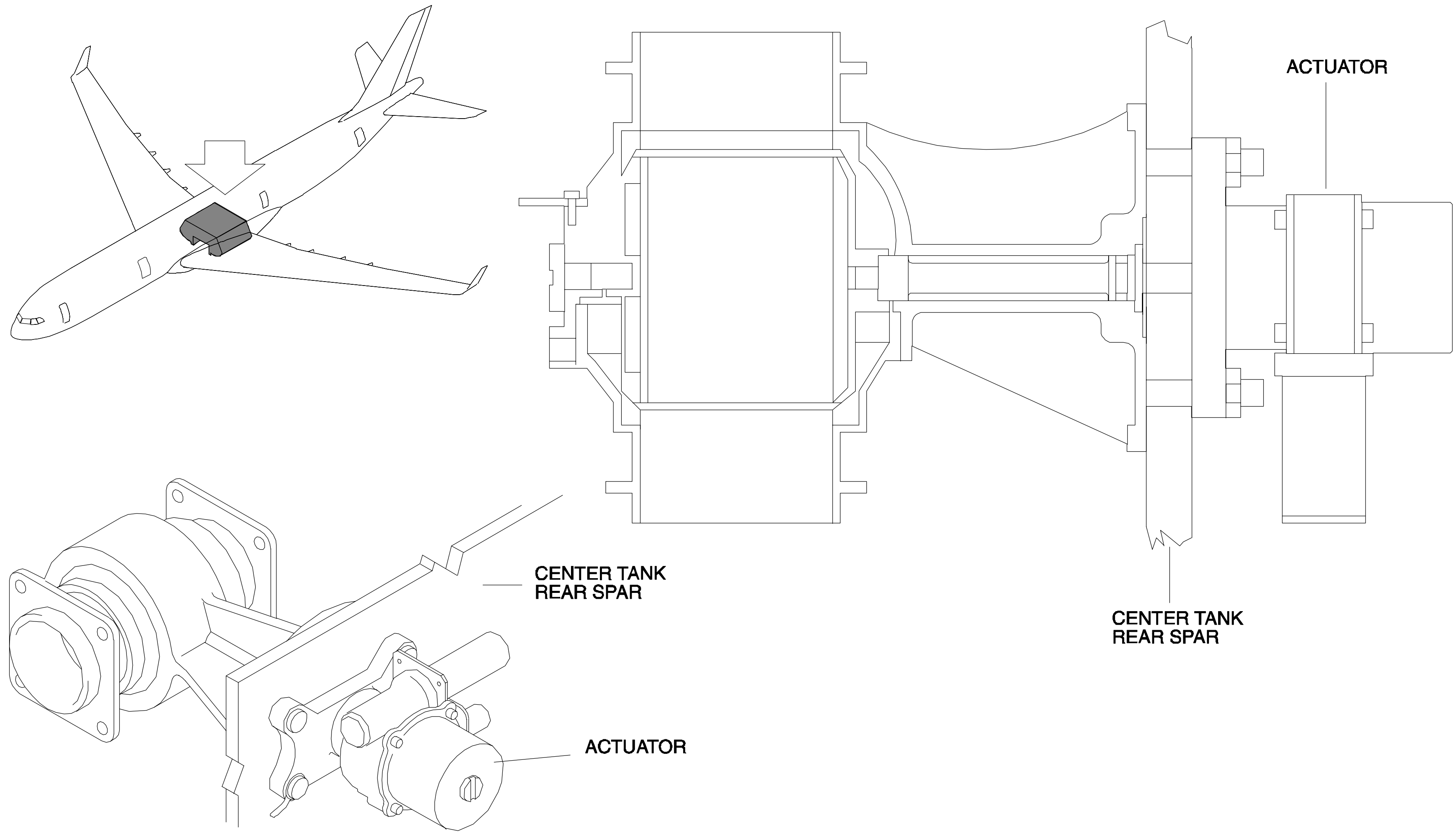
INLET VALVE ACTUATOR

FIN / ZONE

FIN : 603QL1(2)
ZONE : 147(148)

COMPONENT DESCRIPTION

The actuator has a body with a mounting flange. The body contains a 28VDC electrical motor. This motor drives a gear which turns the Transfer Valve driveshaft and the ball valve through 90 degrees. There is a mechanical indicator on the body which shows the position of the valve.



FQW4200 GE Metric

STUDENT NOTES

TRIM TRANSFER SYSTEM DESCRIPTION AND OPERATION

General
Trim Transfer Valves
In Trim Tank
In Center Tank
Trim Transfer Pipe
Trim Transfer Control
Aircraft Center of Gravity Position Calculation
Aft Center of Gravity Target Definition
FMGEC Aft Center of Gravity Monitoring
Aft Transfer
Forward Transfer

GENERAL

The Trim Transfer System controls the Center of Gravity Position of the aircraft by forward or aft transfers and allows optimization of flight efficiency and fuel economy.

TRIM TRANSFER VALVES

The Trim Transfer System comprises 6 fuel valves with their related 28 VDC electrical actuators.

The Trim Pipe Isolation Valve, Auxiliary Forward Transfer Valve, Trim Tank Inlet Valve, Trim Tank Isolation Valve and Aft Transfer Valves have the same actuator drive type.
The fail state of these valves is shut when FCMC command is lost.

IN TRIM TANK

The fuel can flow out of the Trim Tank either by gravity through the check valve and the outlet, or pushed by the Trim Tank Transfer pump. The Trim Tank Isolation Valve controls the fuel flow from the Trim Tank.

The Trim Tank Transfer pump operates in flight, landing gear and slats retracted and if the Trim Tank is above low level.

An air release valve, installed at the higher point before the Trim Tank Inlet Valve, enables the remaining air to escape from the pipe.

IN CENTER TANK

The Aft Transfer Valves control the supply of fuel from the engine Crossfeed Line to the Refuel Gallery. A Check Valve is installed at the outlet of each Aft Transfer Valve.

The Auxiliary Forward Transfer Valve permits a manual forward transfer into the Center Tank.
The Trim Pipe Isolation Valve prevents the Trim Pipe being pressurized by Center Tank Transfer Pumps and opens automatically for forward or aft transfer.

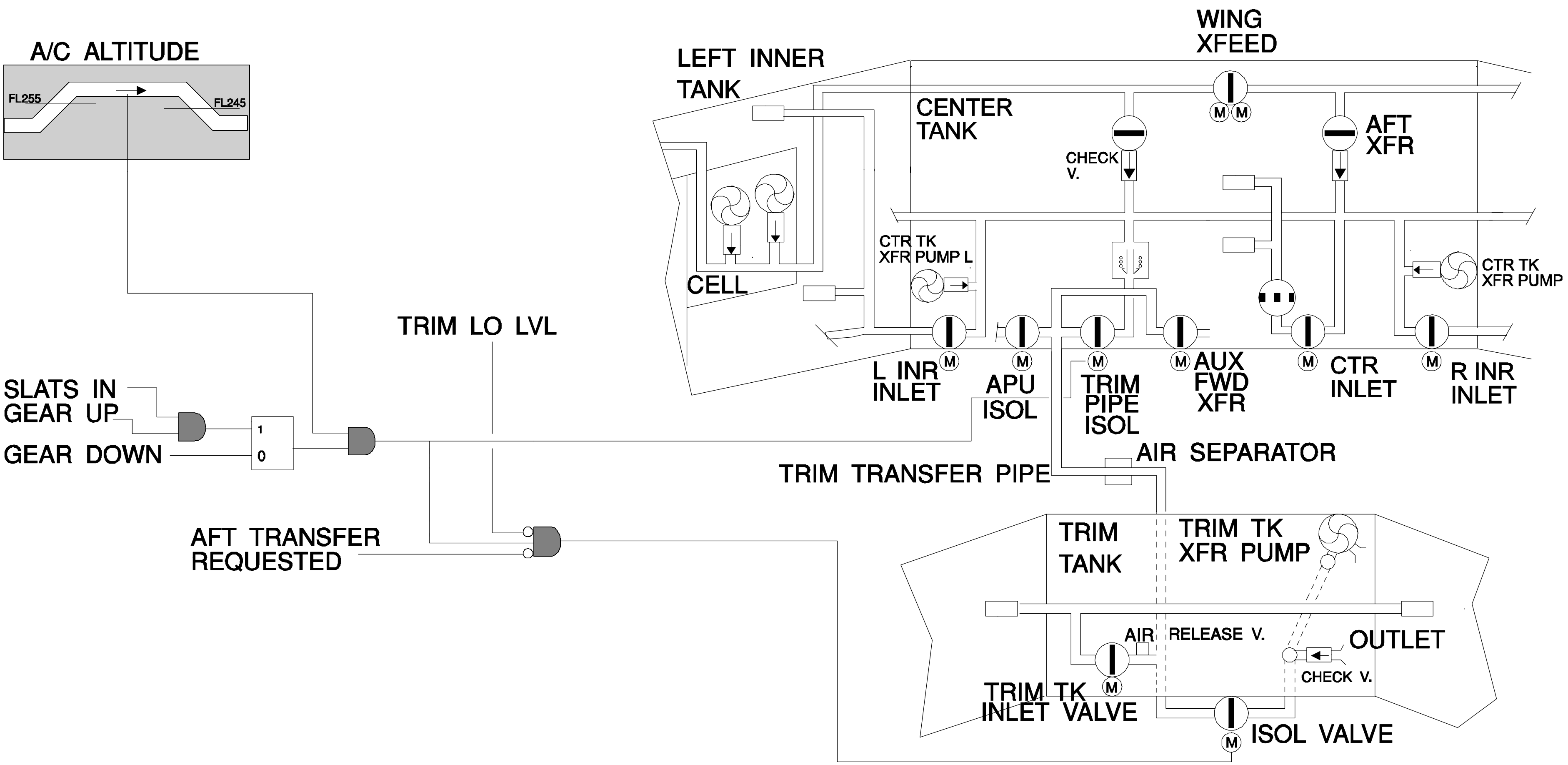
TRIM TRANSFER PIPE

The Trim Transfer pipe runs from the Center fuselage area Rear Spar, along the left hand side of the fuselage in the cargo compartment, up to the Trim Tank.

A flex hose connects the Trim Pipe to the Trim Tank. An air separator, installed before the APU connection, avoids ingestion of air by the APU.

Both the Trim Tank Isolation Valve and the Trim Pipe Isolation Valve are controlled separately by the Trim Transfer logic shown on the screen. Both forward and aft transfer logics include the Trim Transfer logic.

Both the Trim Pipe Isolation Valve and the Trim Tank Isolation Valve are normally open in flight. The Trim Tank Isolation Valve closes if the Trim Tank is at low level or when an aft transfer occurs.



FQW4200 GE Metric

TRIM TRANSFER CONTROL

The FCMC calculates the actual CG position of the aircraft and compares the result with a target value, called the Target CG.

Before each flight, the crew inputs the A/C ZFW and ZFCG data into the FMGECs (Flight Management, Guidance and Envelope Computers).
Each FCMC compares the FMGEC 1/2 data and if it is in agreement it is used for position calculation.

AIRCRAFT CENTER OF GRAVITY POSITION CALCULATION

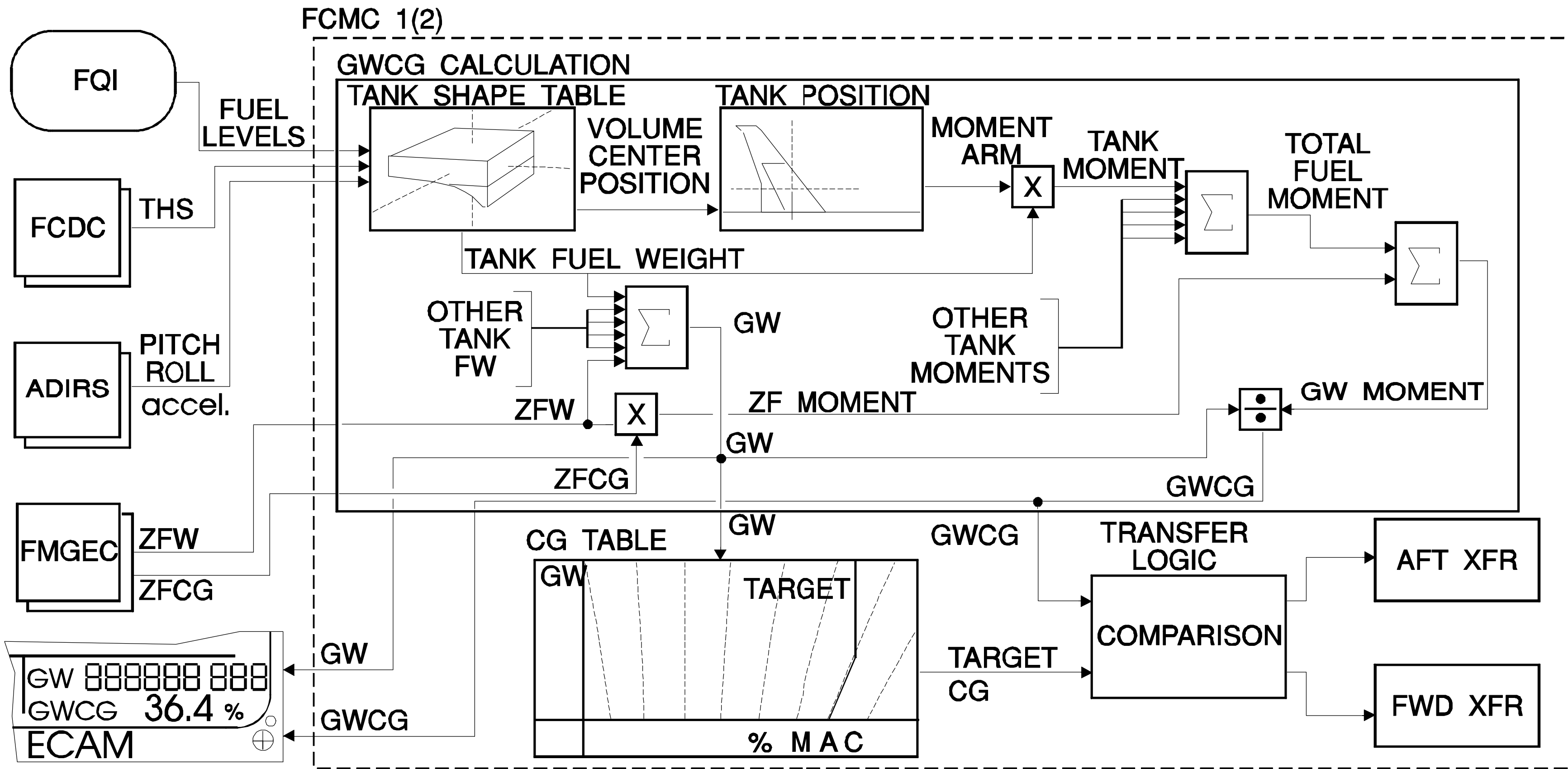
The FCMC tables provide "measured volume" and volume position for each tank as a function of the effective tank attitudes and related fuel level.

The CG position is calculated using tank quantity information (Fuel Quantity Indicating) and stored tank positions and shapes.

Each Tank Volume CG is used to calculate tank moment arm.
The total fuel moment is the sum of each of them.

Each tank fuel weight and the Zero Fuel Weight (ZFW from FMGECs) are used to obtain the Gross Weight (GW) which is output to the ECAMs.

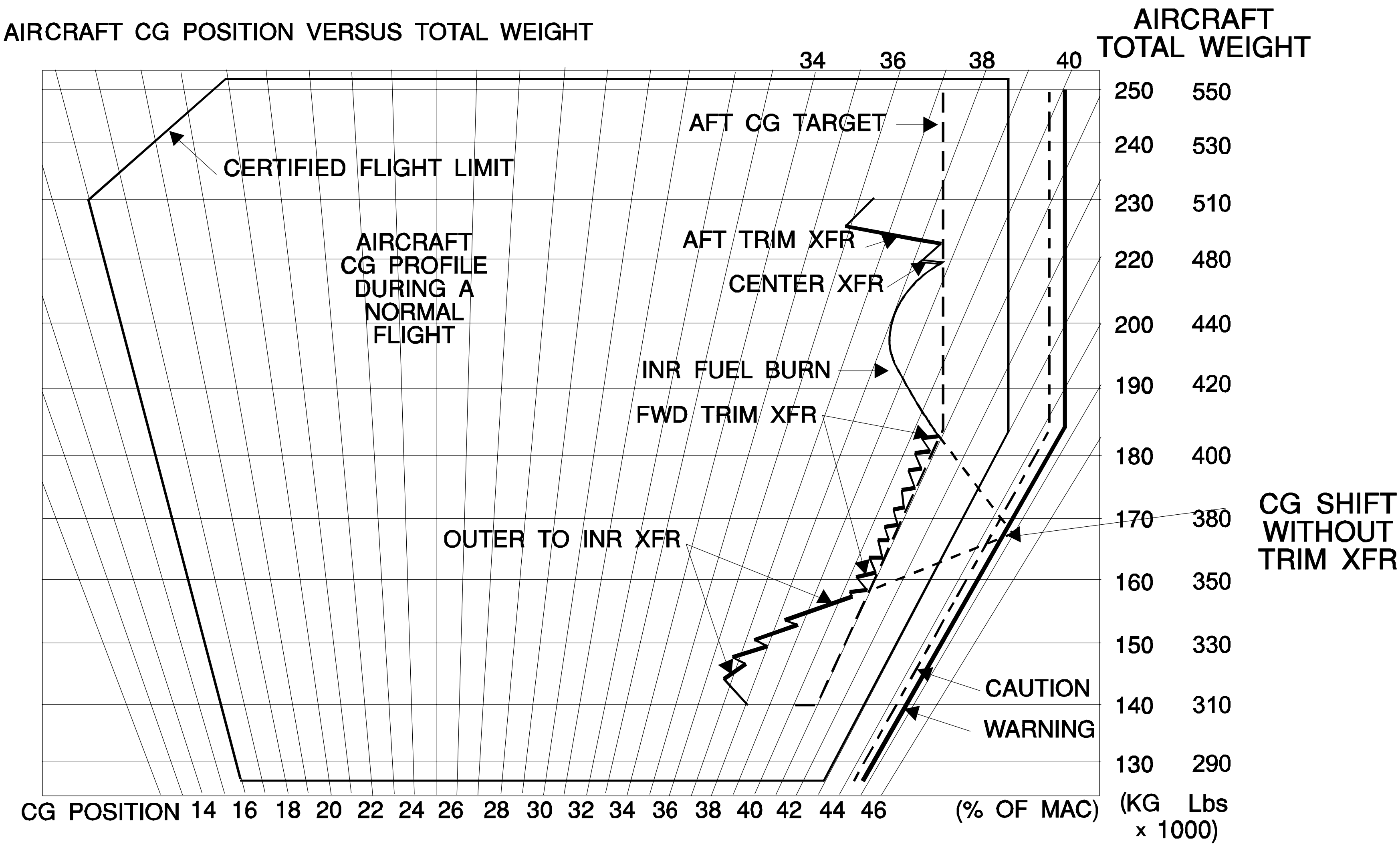
The Gross Weight Center of Gravity (GWCG), calculated by means of GW and ZFW from FMGEC, is output to the ECAMs and input for comparison in the FCMC Transfer logic.



FQW4200 GE Metric

AFT CENTER OF GRAVITY TARGET DEFINITION

The optimum CG targets are memorized in the FCMC on a figure from which one CG target corresponds to one aircraft GW.
The FCMC CG target figure is set by pin programming to match the aircraft type.

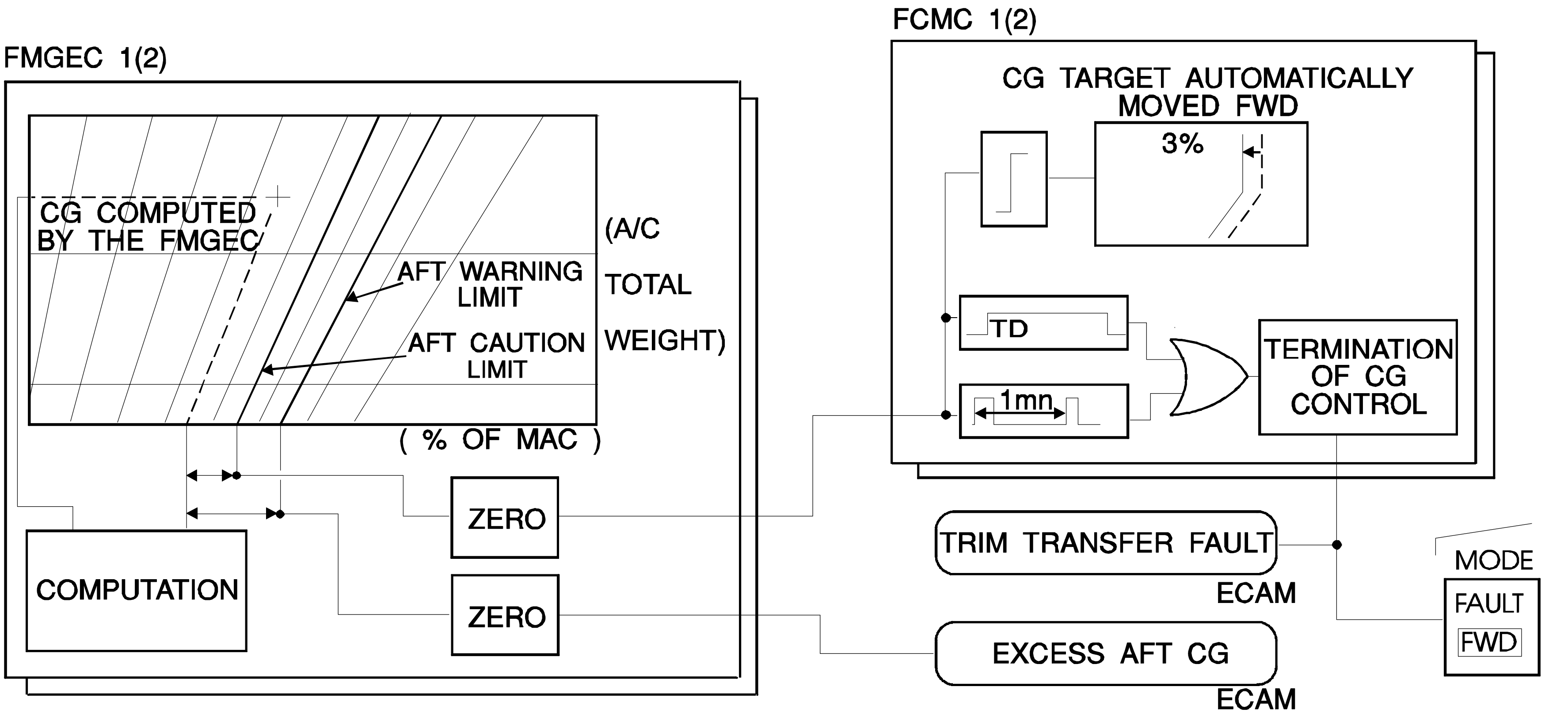


FQW4200 GE Metric

FMGEC AFT CENTER OF GRAVITY MONITORING

If the FCMC receives a "CG target FWD" signal from either FMGECs, the CG target is moved forward by 3% of MAC.
If the same signal remains detected or is detected a second time by the FCMC, it results in the termination of the automatic CG control and the display of an amber ECAM warning.

The FMGEC independently monitors the CG position of the aircraft.
The weight computed by FMGEC is used to determine the aft limits tolerated by the aircraft flying qualities.
The FMGEC also computes A/C CG position by means of THS position, speed, thrust, ...



FQW4200 GE Metric

AFT TRANSFER

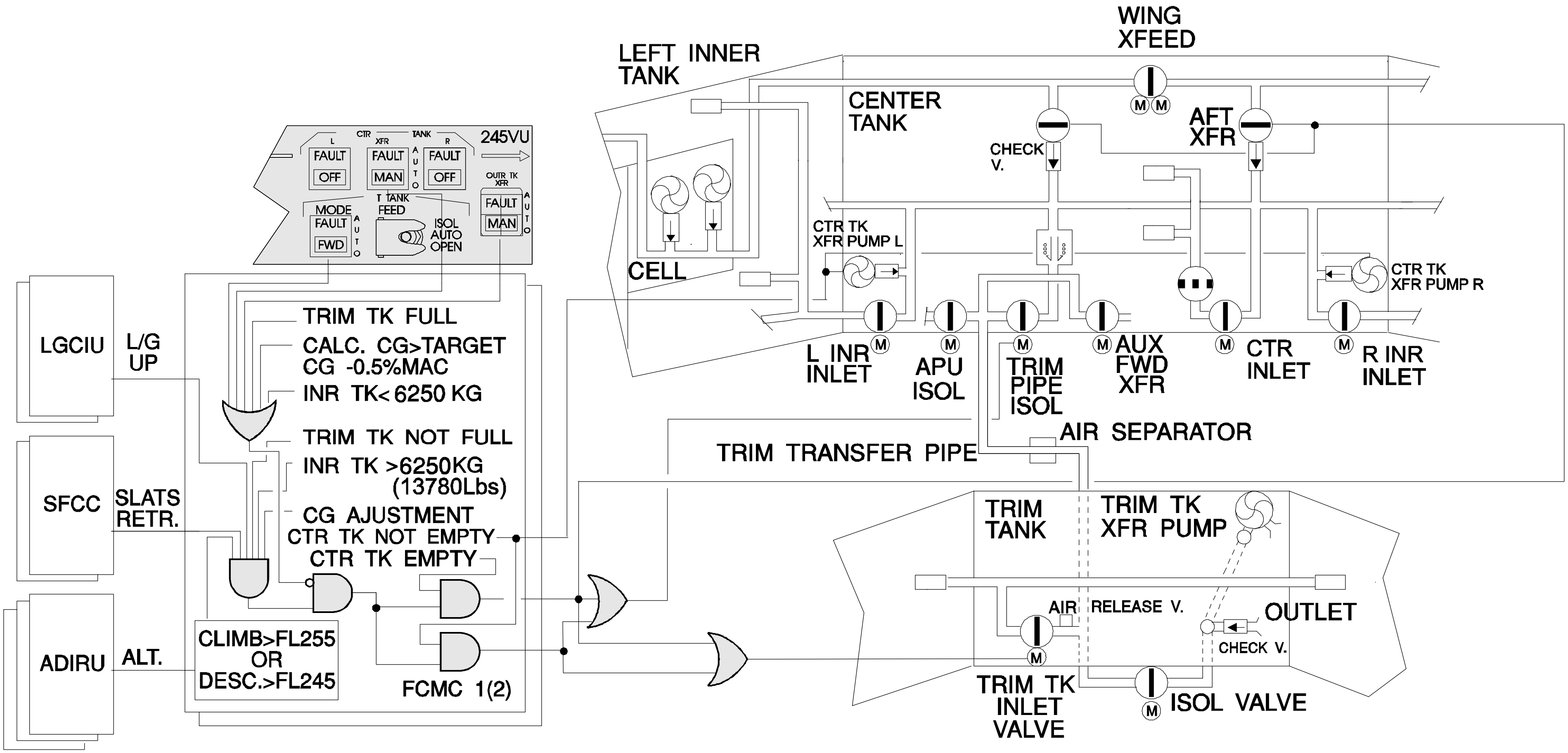
If the Center Tank contains fuel, an Aft Transfer is made from the Center Tank. The Center Tank Transfer pumps move the fuel to the Trim Tank. The FCMS opens the Trim Pipe Isolation Valve and the Trim Tank Inlet Valve.

Usually only one Transfer is made during each flight.
If the CG is forward of the target by more than 2% and Trim Tank quantity < 3000KG (6600 Lbs), a further Aft Transfer may be carried out.

If the Center Tank empties during Aft Transfer, then the transfer is completed by transfers from the Inner Tanks. The Main Fuel Pumps move fuel from the Inner Tanks to the Trim Tank. The FCMS opens Trim Pipe Isolation Valve, the Aft Transfer Valves and the Trim Tank Inlet Valve.

When one of the conditions to terminate the Aft Transfer occurs, the FCMS closes the Trim Pipe Isolation Valve, Trim Tank Inlet Valve, then Aft Transfer Valves.

Trim Tank Isolation Valve is opened anyway when the aircraft is above FL255 and there is no Aft Transfer.

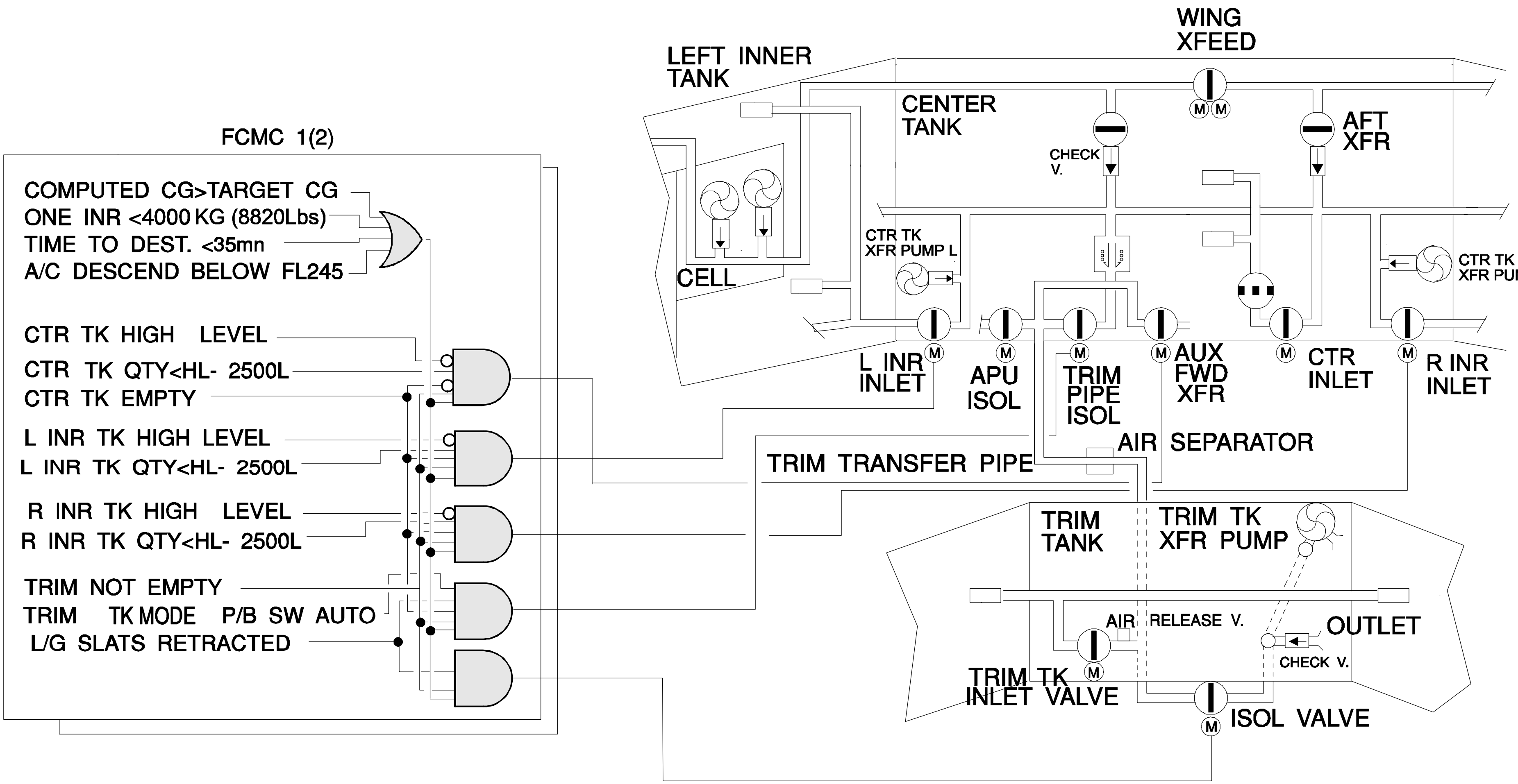


FQW4200 GE Metric

FORWARD TRANSFER

In the last sequence of cruise, many small Forward Transfers can be required to control the CG along the Target.
If the Center Tank contains fuel, the Transfer is from the Trim Tank to the Center Tank, the Trim Pipe Isolation Valve is closed.
If the Center Tank is empty, the fuel is moved from the Trim Tank to the Inner Tanks through the Inner Tank Inlet Valves.
The Trim Pipe and Trim Tank Isolation Valves are open.

During a Forward Transfer from Trim to Inners, if an Inner Tank becomes full, its Inlet Valve closes.
Transfer is in two steps if Center Tank contains fuel and ZFCG is forward of 23% MAC.



FQW4200 GE Metric

STUDENT NOTES:

TRIM TRANSFER MANUAL CONTROL

Trim Tank Mode Pushbutton
Pushbutton Fault
Trim Tank Feed Selector

TRIM TANK MODE PUSHBUTTON

When the Trim Tank Mode pushbutton is pressed in, the computer generated commands, affecting Automatic Trim Transfers for CG control, are overridden. Fuel from the Trim Tank is transferred into the Center Tank.
Center Tank High Level Protection is overriden
The Manual Forward Transfer stops when Low Level is reached in Trim Tank.

TRIM TK ISOL VALVE AUXILIARY FWD XFR VALVE	open up to Trim Tank Low Level
TRIM PIPE ISOL VALVE AFT XFR VALVES	close
TRIM TK XFR PUMP	runs

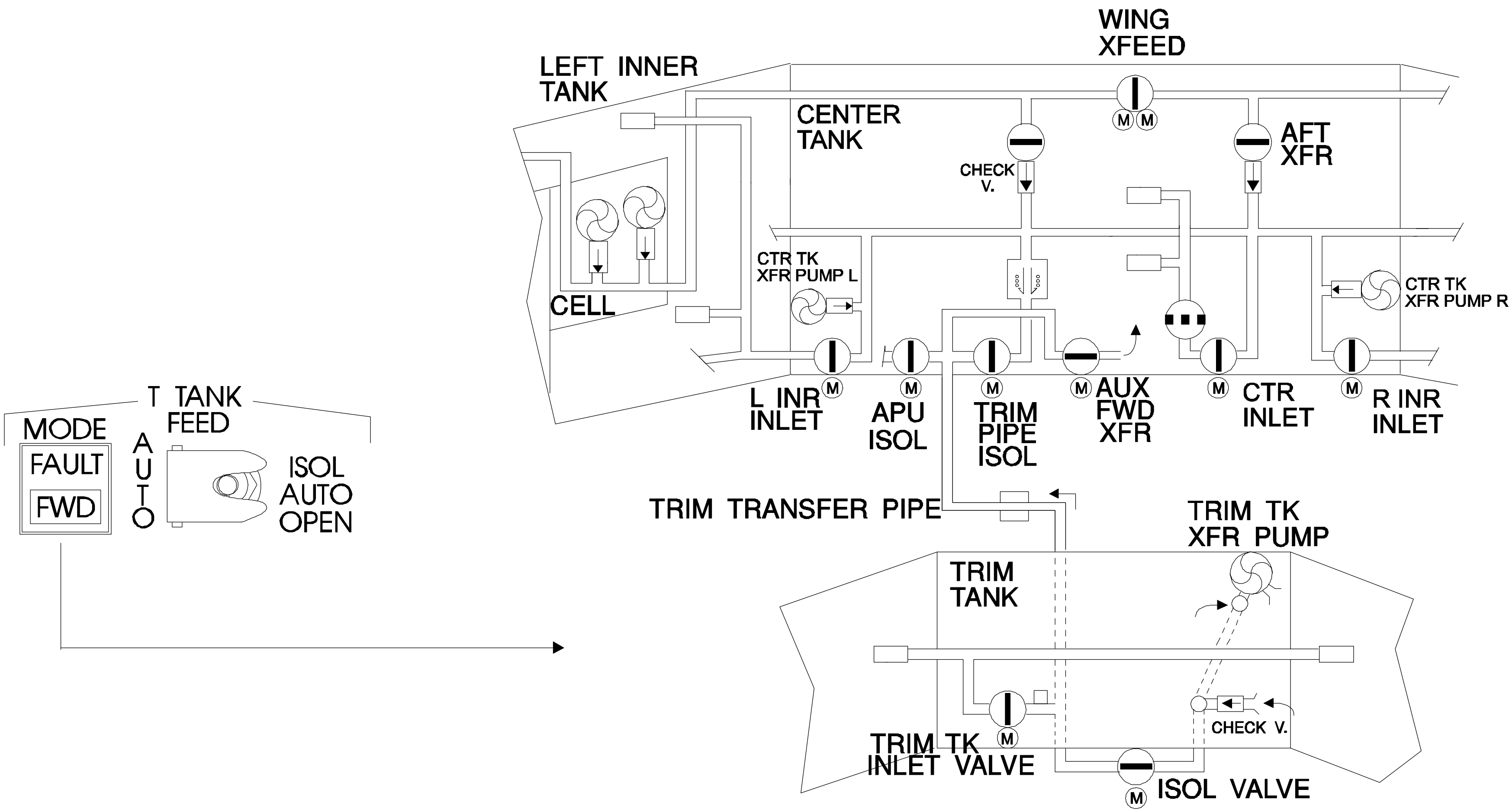
PUSHBUTTON FAULT

The Trim Tank Mode FAULT light comes on when the FCMCs detect a failure in the CG control function.
Any one of the listed conditions triggers the P/B FAULT and displays a TRIM TK TRANSFER FAULT warning on ECAM:

TRIM TK OVERFLOW DURING AFT XFR
TRIM PIPE ISOL VALVE FAILS CLOSED
TRIM PIPE ISOL VALVE FAILS OPEN AND THERE IS FUEL IN CTR TK
INR TK INLET V. FAILS OPEN WITH OVERFLOW
OUTER TK INLET VALVE FAILS OPEN
CTR TK INLET VALVE OPEN (CTR TK EMPTY)
CTR TK HIGH LEVEL FAILS WET IN FWD MODE
AUXILIARY FWD XFR VALVE FAILS OPEN
TRIM TK ISOL VALVE FAILS CLOSED
COMPLETE LOSS OF FQI IN ANY TANK

The following ECAM warnings also trigger the P/B FAULT:

INNER TK LOW LEVEL
EXCESS AFT CG
FUEL LOW TEMPERATURE



FQW4200 GE Metric

TRIM TANK FEED SELECTOR

The Trim Tank Feed Selector is usually in the guarded AUTO position which gives the FCMS full control of the Trim Transfer System.

"AUTO" SELECTED

- TRIM TK INLET VALVE
- TRIM PIPE ISOLATION VALVE
- AUXILIARY FORWARD TRANSFER VALVE
- TRIM TK ISOLATION VALVE

ARE CONTROLLED EITHER :

- AUTOMATICALLY BY FCMC
- MANUALLY IF MODE P/B SELECTED

In the OPEN position, the valves used for the Forward Transfer are opened. This selection overrides the Trim Tank Low Level Detection, allowing the Trim Transfer Pipe to drain.

"OPEN" SELECTED :

SIMULATES TRIM TK LOW LEVEL SENSOR TO WET STATE

- TRIM TK ISOLATION VALVE
- TRIM TK INLET VALVE
- AUXILIARY FORWARD TRANSFER VALVE

ARE OPEN CAUSING THE TRIM LINE TO DRAIN AS TRIM TK LOW LEVEL S/O IS OVERRIDEN.

In the ISOL position, the Auxiliary Forward Transfer, Trim Tank Isol, Trim Tank Inlet and Trim Pipe Isolation Valves are closed.
The APU Feed System is not isolated and APU can still be operated on demand.

"ISOL" SELECTED

- AUXILIARY FORWARD TRANSFER VALVE
- TRIM TK ISOLATION VALVE
- TRIM TK INLET VALVE
- TRIM PIPE ISOLATION VALVE

ARE SHUT

STUDENT NOTES:

STUDENT NOTES

TRIM TRANSFER SYSTEM COMPONENTS

Safety Precautions
Aft Transfer Valves
Aft Transfer Valve Actuators
Fuel Transfer Check Valves
Auxiliary FWD Fuel Transfer Valve
Auxiliary FWD Fuel Transfer Valve Actuator
Trim Pipe Isolation Valve
Trim Pipe Isolation Valve Actuator
Air Release Valve
Trim Tank Inlet Valve
Trim Tank Inlet Valve Actuator
Trim Tank Isolation Valve
Trim Tank Isolation Valve Actuator
Trim Check Valve
Trim Transfer Pump
Trim Transfer Pump Canister
Trim Transfer Pump Pressure Switch

SAFETY PRECAUTIONS

Obey the fuel safety procedures.

Do not get aircraft fuel in your mouth, in your eyes or on your skin for a long time. (aircraft fuel is poisonous)

Make sure that the Landing gear safety locks and wheel chocks are in position.

Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.

Make sure that have correct fire fighting equipment available before you start any task on the fuel system.

Make sure that all circuits in maintenance are isolated before you supply electrical power to the aircraft.

Use the talcum powder procedure only on the external surfaces of the fuel tanks. This will prevent contamination of the fuel system.

Do not get your clothes soaked with fuel. Use approved protective clothing when you go into a fuel tank.

STUDENT NOTES

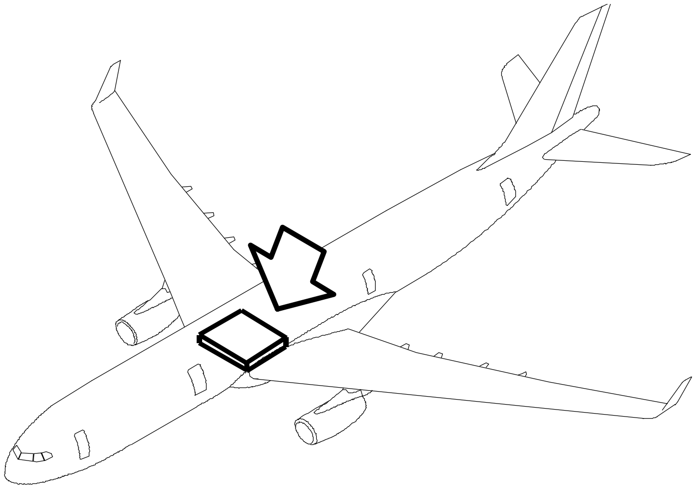
AFT TRANSFER VALVES

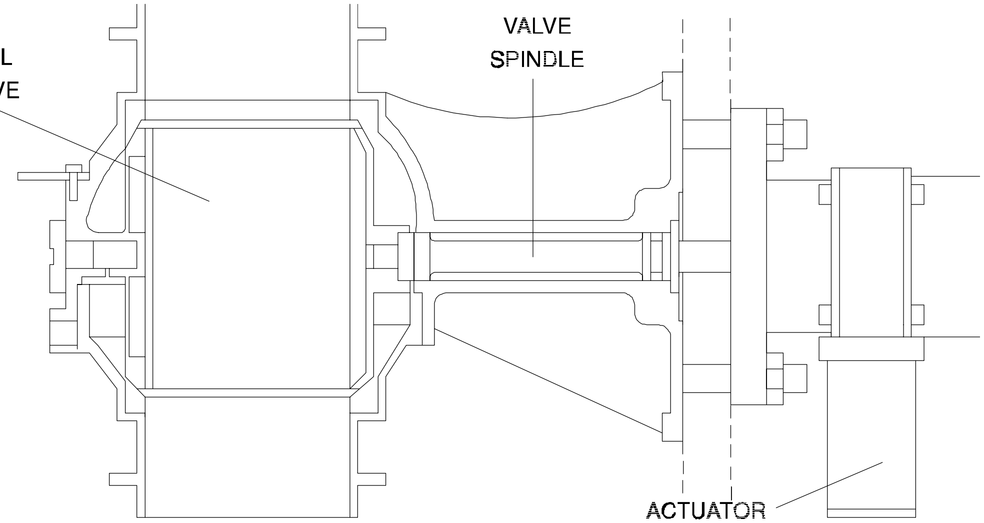
FIN / ZONE

FIN : 5700 QA 1 (2)
Zone : 141 (142)

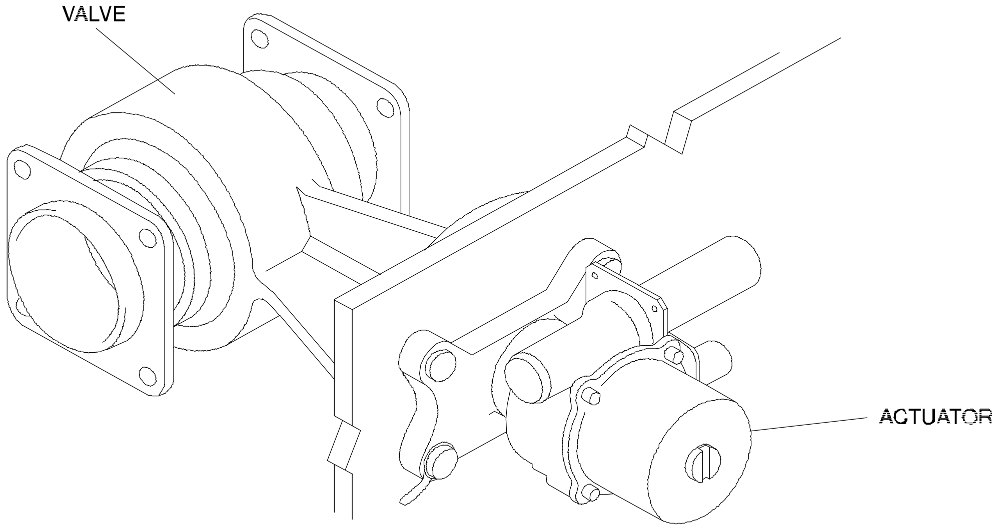
COMPONENT DESCRIPTION

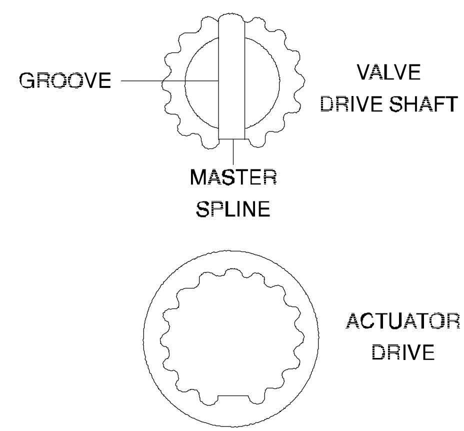
The valve body holds a ball valve. The ball valve is connected to the valve spindle in the mounting flange. The valve spindle comes out of the mounting flange through the rear spar. It has a masterspline to make sure that it engages correctly with the actuator.





VALVE SECTION





FQW4200 GE Metric

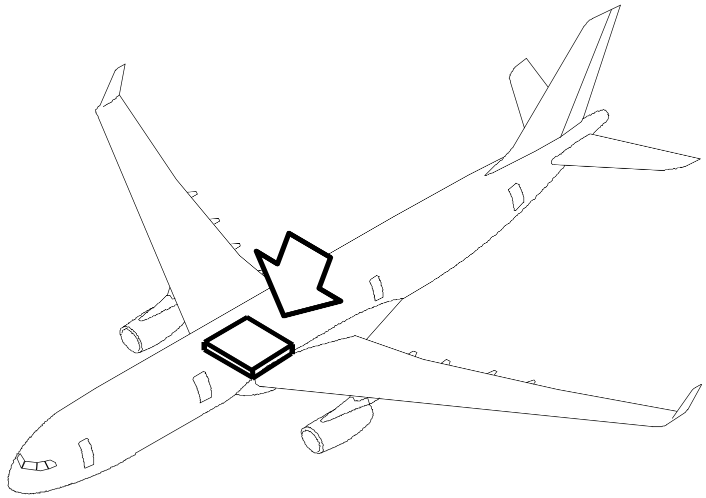
AFT TRANSFER VALVE ACTUATORS

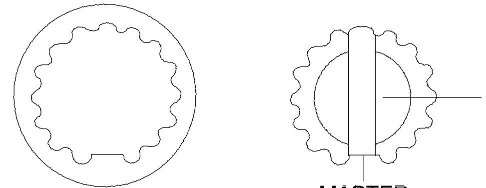
FIN / ZONE

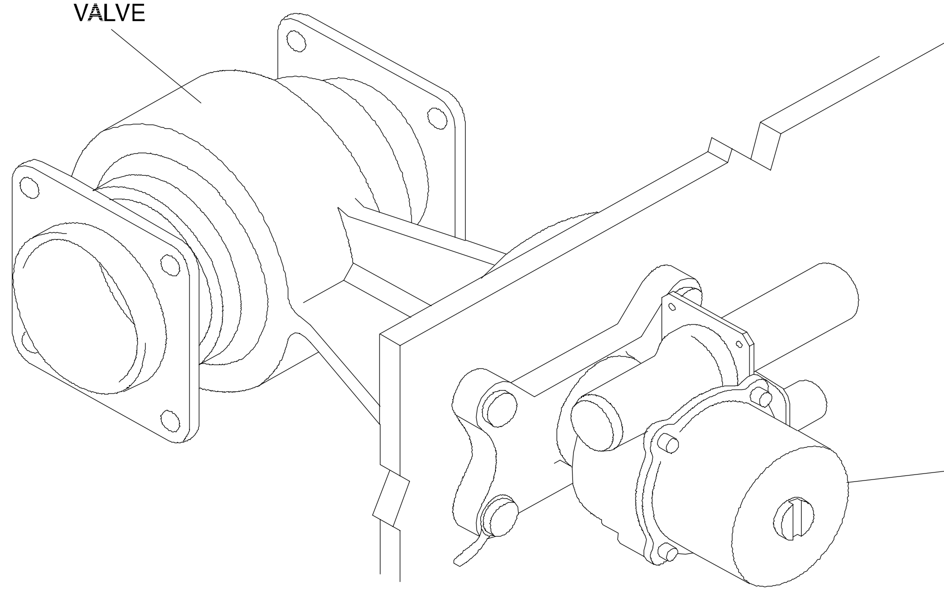
FIN : 700 QN 1(2)
Zone : 147 (148)

COMPONENT DESCRIPTION

The actuator has a 28 VDC electrical motor which drives a gear to turn the ball valve through 90 degrees. Limit switches in the actuator control this 90 degrees movement and set the electrical circuit for the next operation. The actuator drive has a masterspline to make sure it is correctly aligned with the valve spindle.







FQW4200 GE Metric

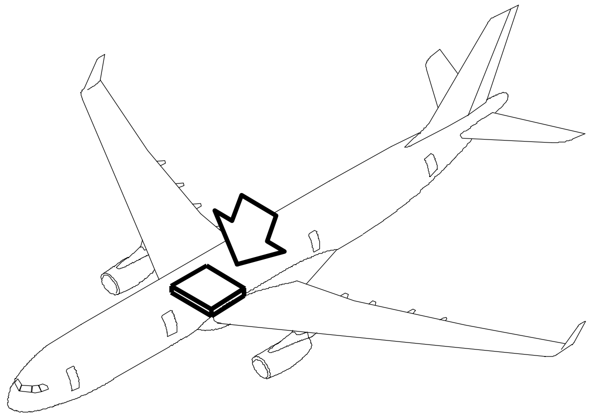
FUEL TRANSFER CHECK VALVES

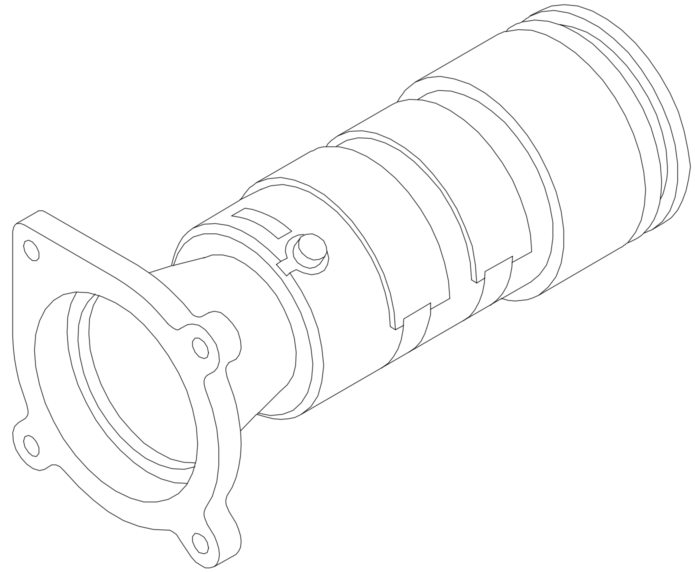
FIN / ZONE

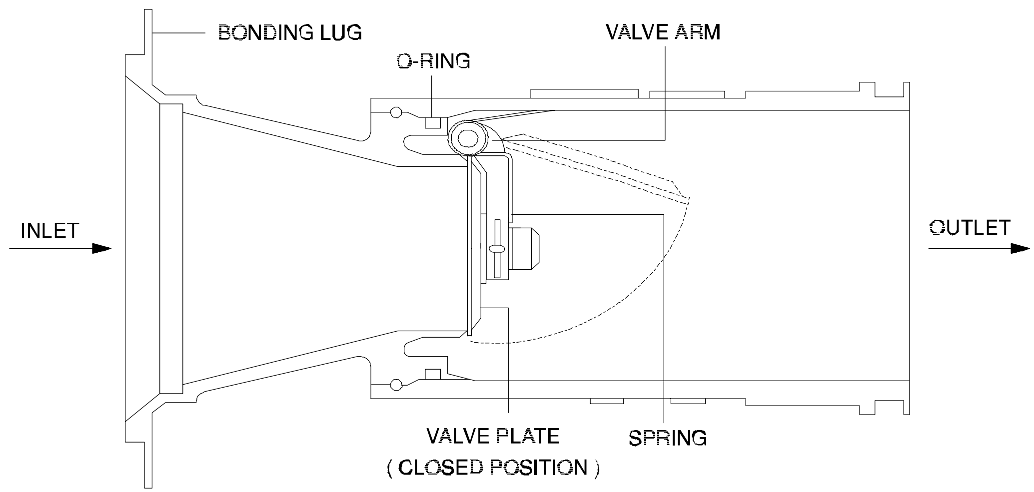
FIN : 5704 QA 1 (2)
Zone : 141 (142)

COMPONENT DESCRIPTION

The valve body contains a valve plate, an arm and a spring. The spring holds the valve plate in the closed position. When the fuel pressure comes from the inlet, it lifts the valve plate and the fuel flows through the valve. When the fuel pressure comes from the outlet, the valve plate closes and prevents a fuel flow back through the valve.







CHECK VALVE SECTION

FQW4200 GE Metric

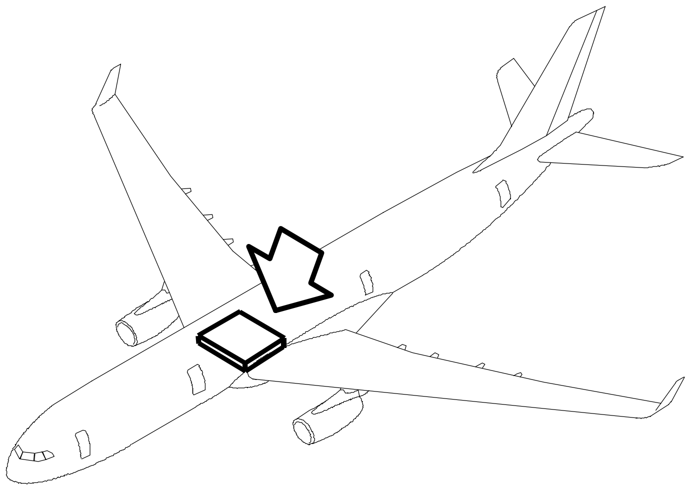
AUXILIARY FWD FUEL TRANSFER VALVE

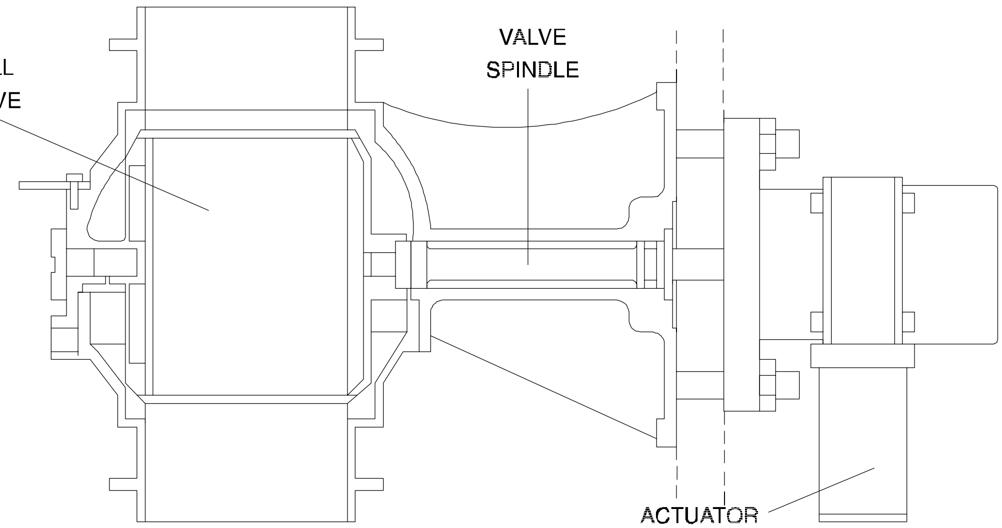
FIN / ZONE

FIN : 5703 QA
Zone : 141

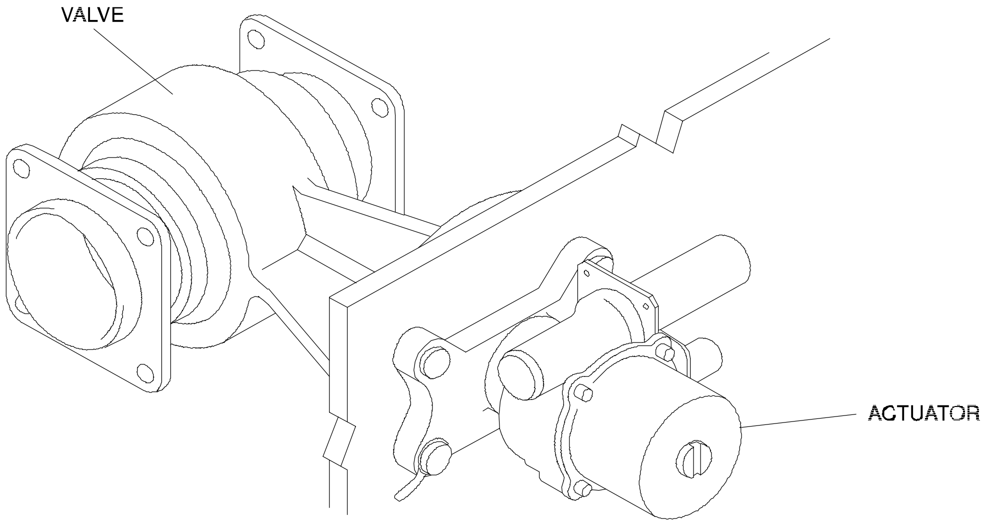
COMPONENT DESCRIPTION

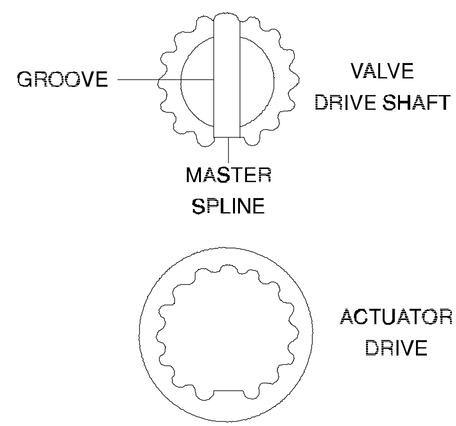
The valve body holds a ball valve. The ball valve is connected to the valve spindle in the mounting flange. The valve spindle comes out of the mounting flange through the rear spar. It has a masterspline to make sure that it engages correctly with the actuator.





VALVE SECTION





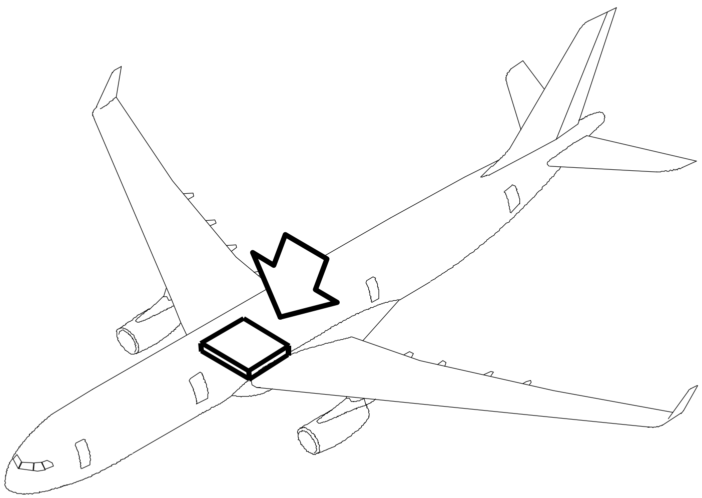
AUXILIARY FWD FUEL TRANSFER VALVE ACTUATOR

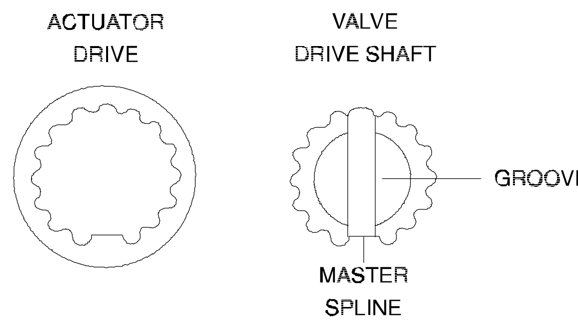
FIN / ZONE

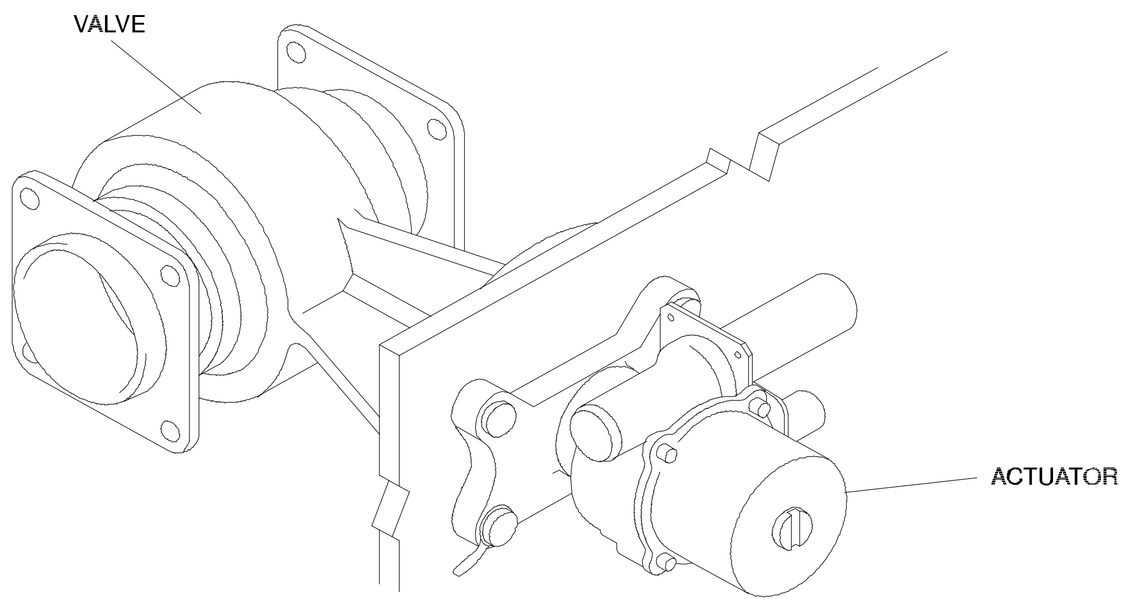
FIN : 703 QN
Zone : 147

COMPONENT DESCRIPTION

The actuator has a 28 VDC electrical motor which drives a gear to turn the ball valve through 90 degrees. Limit switches in the actuator control this 90 degrees movement and set the electrical circuit for the next operation. The actuator drive has a masterspline to make sure it is correctly aligned with the valve spindle.







FQW4200 GE Metric

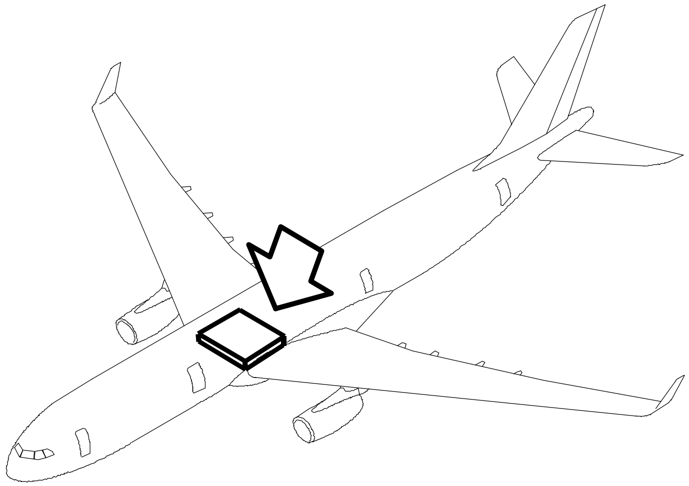
TRIM PIPE ISOLATION VALVE

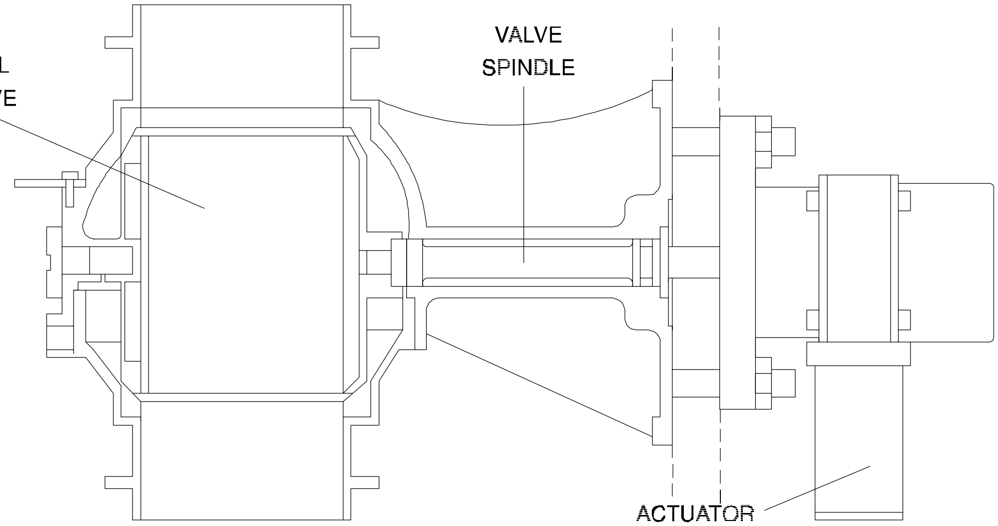
FIN / ZONE

FIN : 5701 QA
Zone : 141

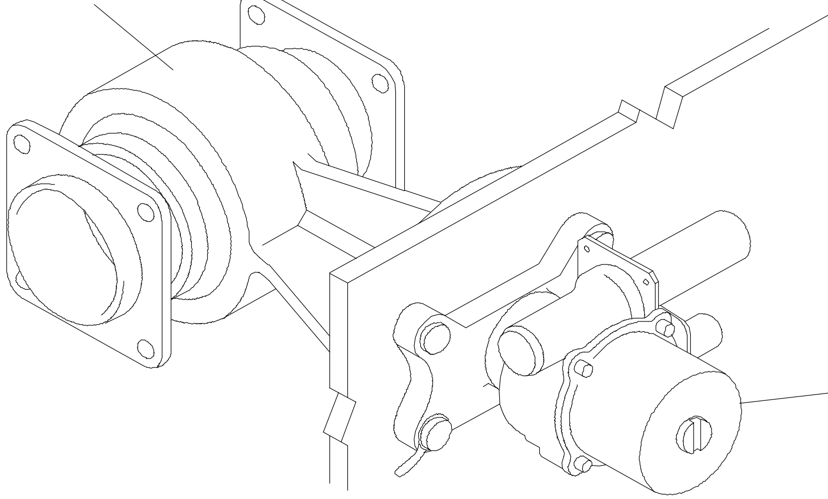
COMPONENT DESCRIPTION

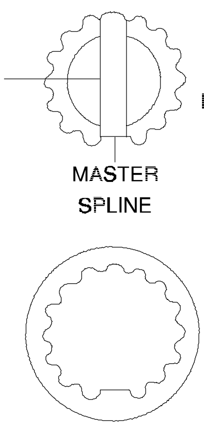
The valve body holds a ball valve. The ball valve is connected to the valve spindle in the mounting flange. The valve spindle comes out of the mounting flange through the rear spar. It has a masterspline to make sure that it engages correctly with the actuator.





VALVE SECTION





FQW4200 GE Metric

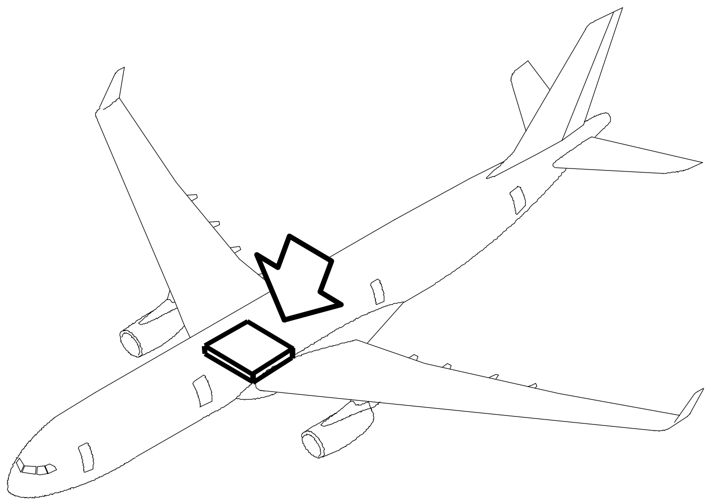
TRIM PIPE ISOLATION VALVE ACTUATOR

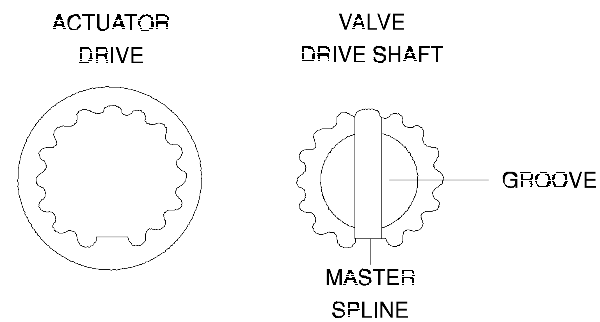
FIN / ZONE

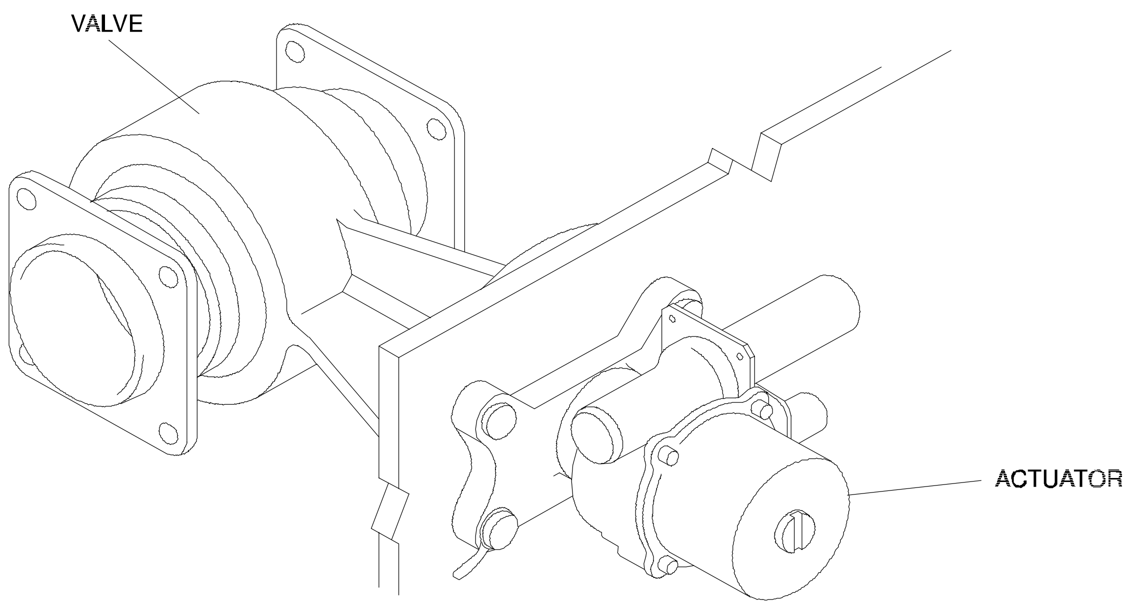
FIN : 701 QN
Zone : 147

COMPONENT DESCRIPTION

The actuator has a 28 VDC electrical motor which drives a gear to turn the ball valve through 90 degrees. Limit switches in the actuator control this 90 degrees movement and set the electrical circuit for the next operation. The actuator drive has a masterspline to make sure it is correctly aligned with the valve spindle.







FQW4200 GE Metric

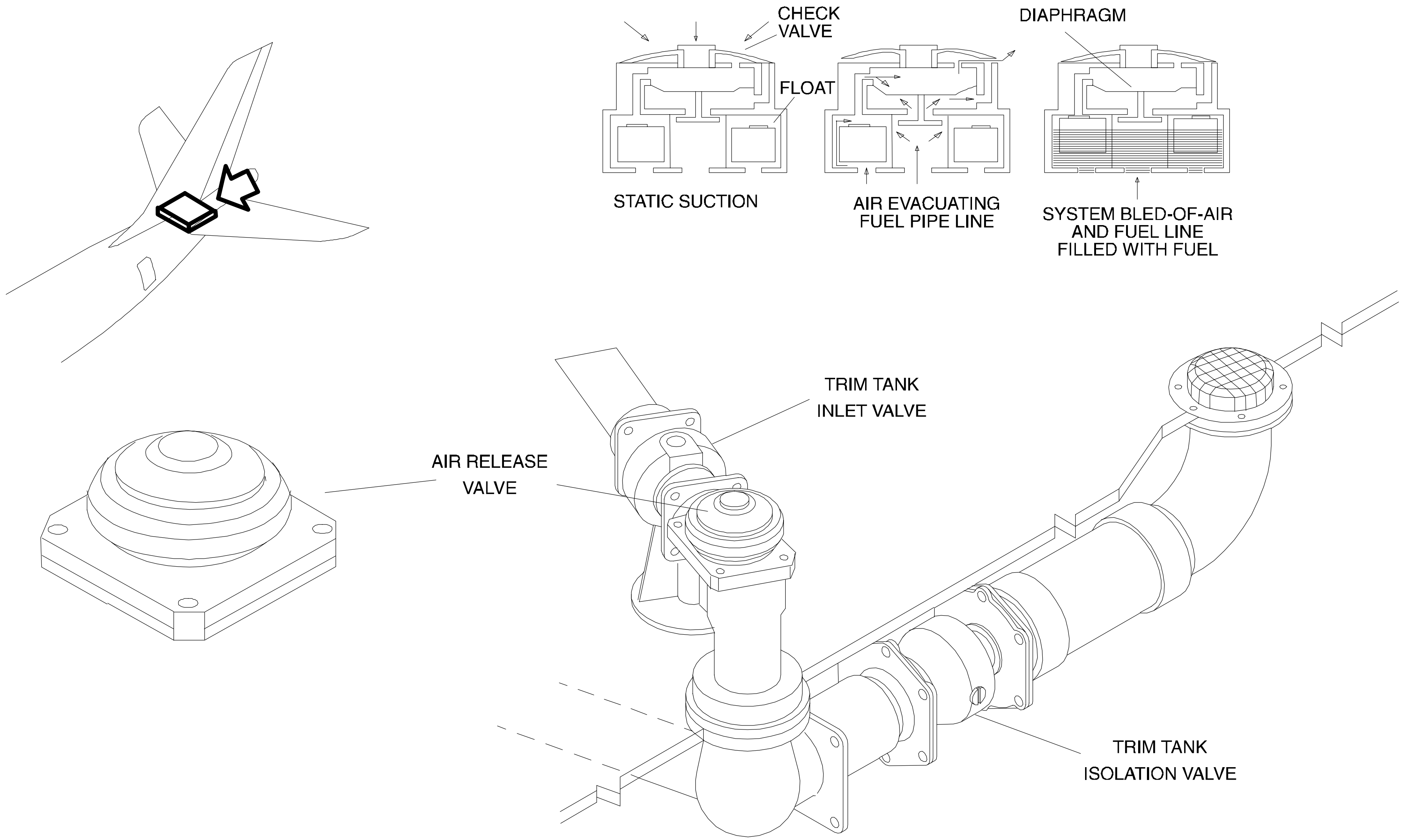
AIR RELEASE VALVE

FIN / ZONE

FIN : 5707 QA
Zone : 311

COMPONENT DESCRIPTION

The Air Release Valve body houses a diaphragm and float and is capped by a rubber check valve. Under pressure the diaphragm operates to permit air to bleed. Fuel loss is prevented by the float which lifts to close the valve. The check valve prevents air being sucked back into the line.



FQW4200 GE Metric

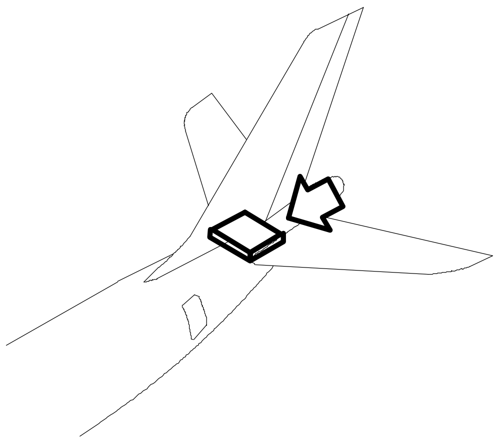
TRIM TANK INLET VALVE

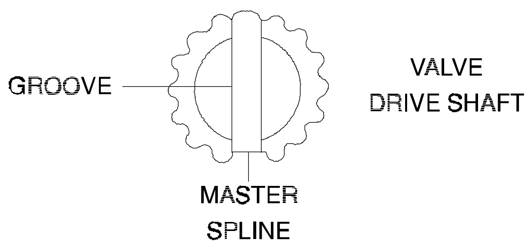
FIN / ZONE

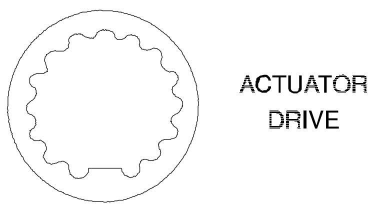
FIN : 5705 QA
Zone : 319

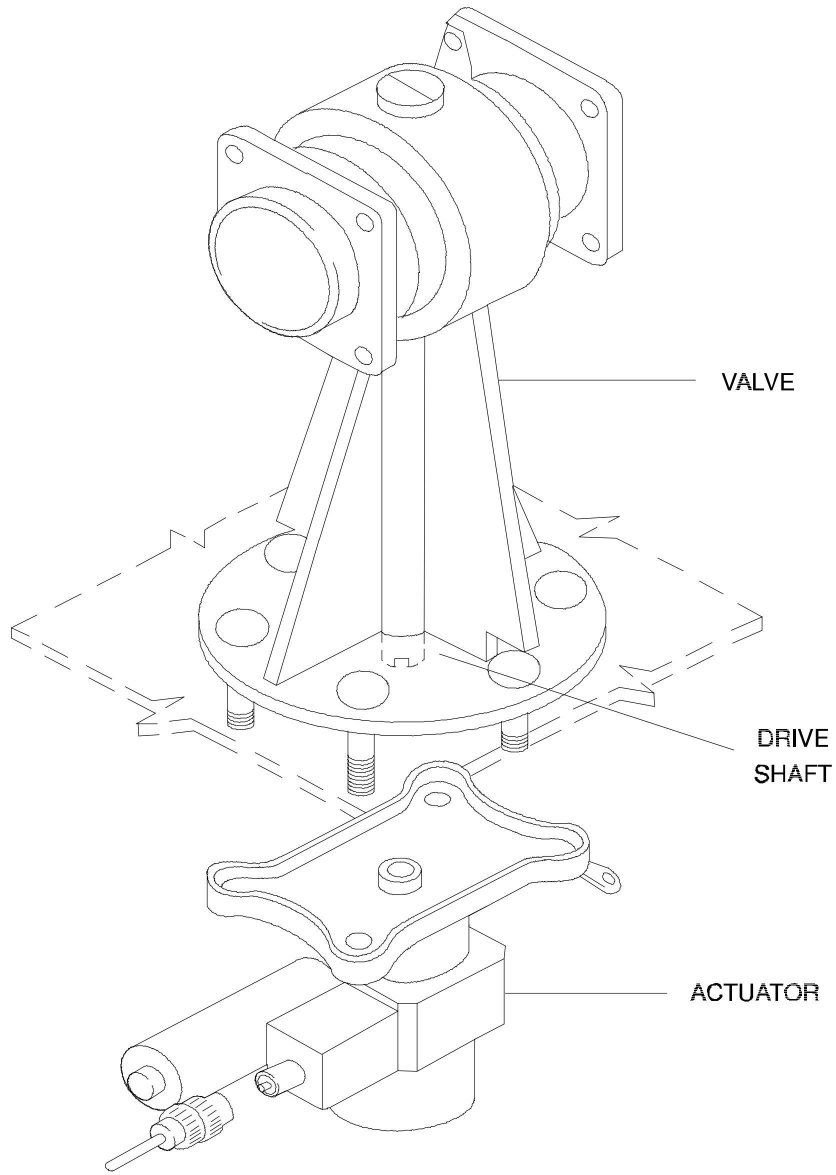
COMPONENT DESCRIPTION

The valve body holds the ball valve which is connected to the valve spindle in the mounting flange. The mounting flange attaches the valve to the aircraft structure. The valve spindle goes through the mounting flange and the aircraft structure to connect with the electrical actuator.









FQW4200 GE Metric

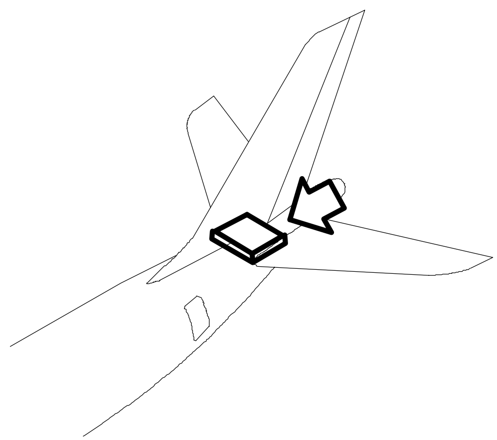
TRIM TANK INLET VALVE ACTUATOR

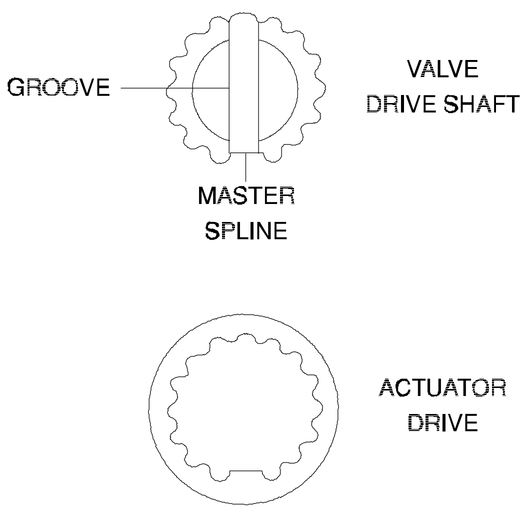
FIN / ZONE

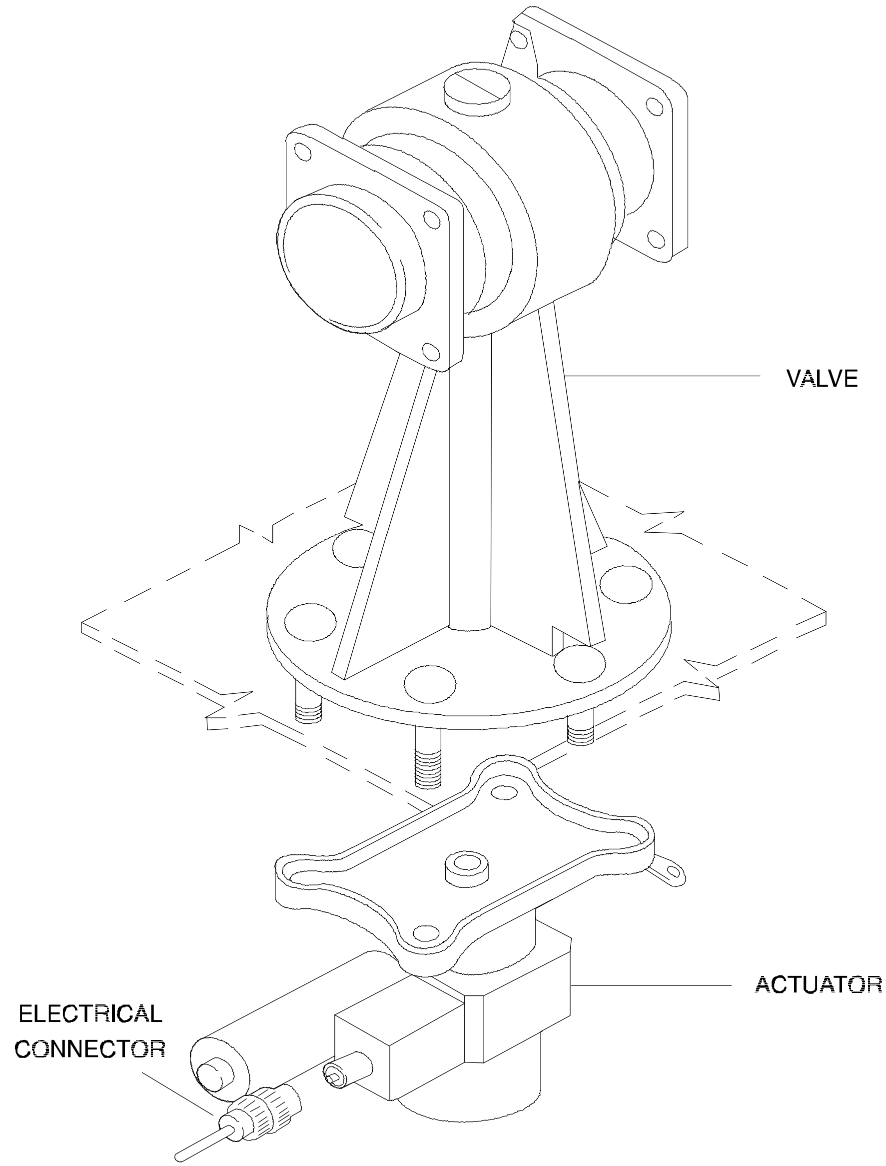
FIN : 705 QN
Zone : 311

COMPONENT DESCRIPTION

The actuator has a body with a mounting flange. The body contains a 28 VDC electrical motor. This motor drives a gear which turns the valve spindle and the ball valve through 90 degrees. There is mechanical indicator on the body which shows the valve’s position.







FQW4200 GE Metric

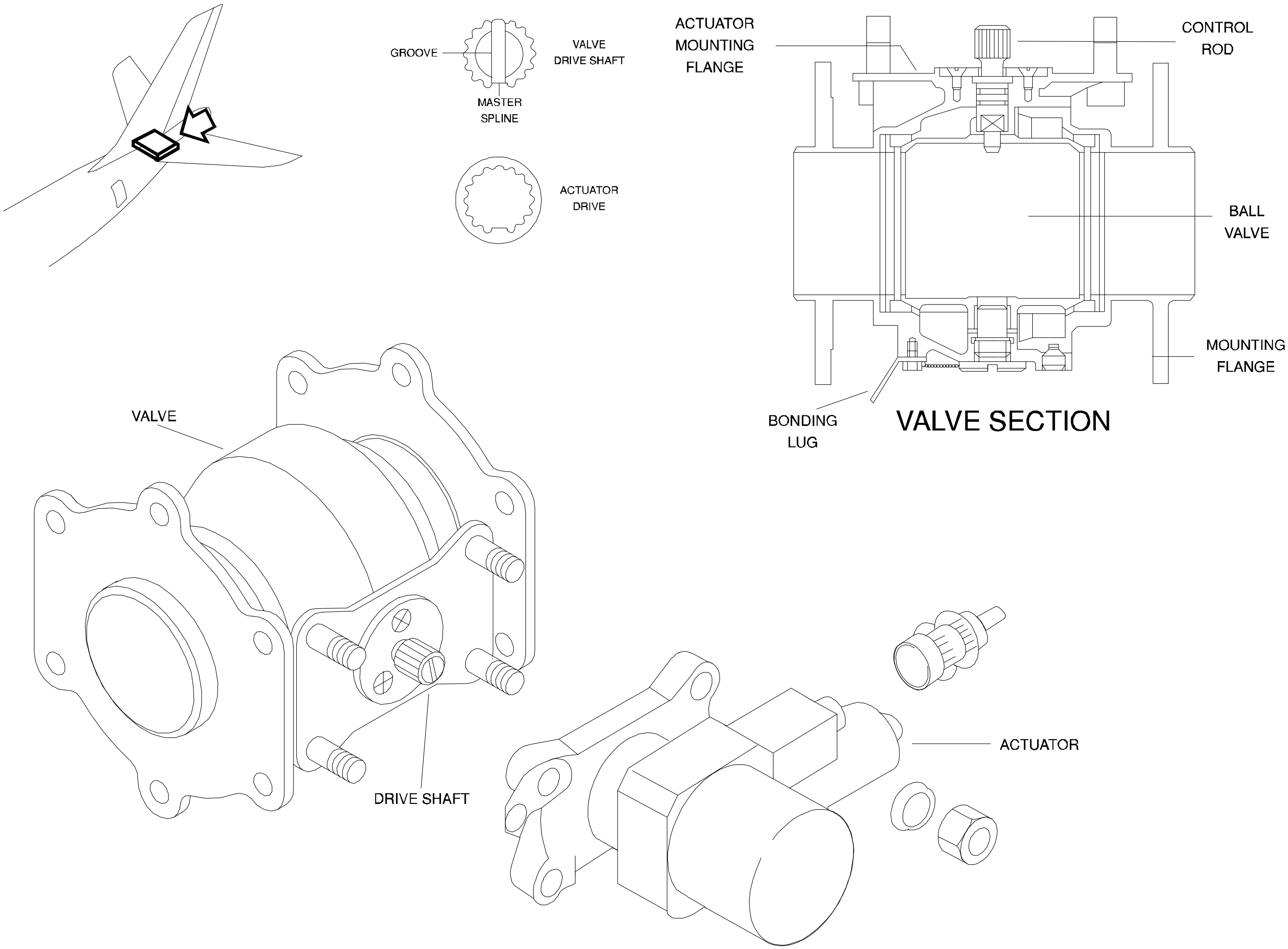
TRIM TANK ISOLATION VALVE

FIN / ZONE

FIN : 5702 QA
Zone : 311

COMPONENT DESCRIPTION

The valve body holds a ball valve. The ball valve is connected to the control rod in the mounting flange. The control rod has a masterspline to make sure it engages correctly with the actuator.



FQW4200 GE Metric

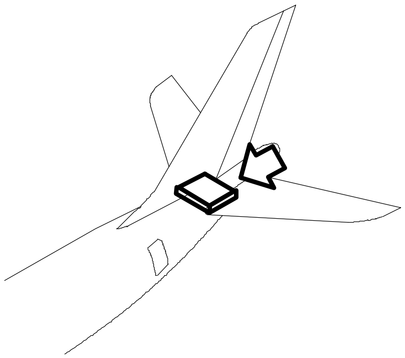
TRIM TANK ISOLATION VALVE ACTUATOR

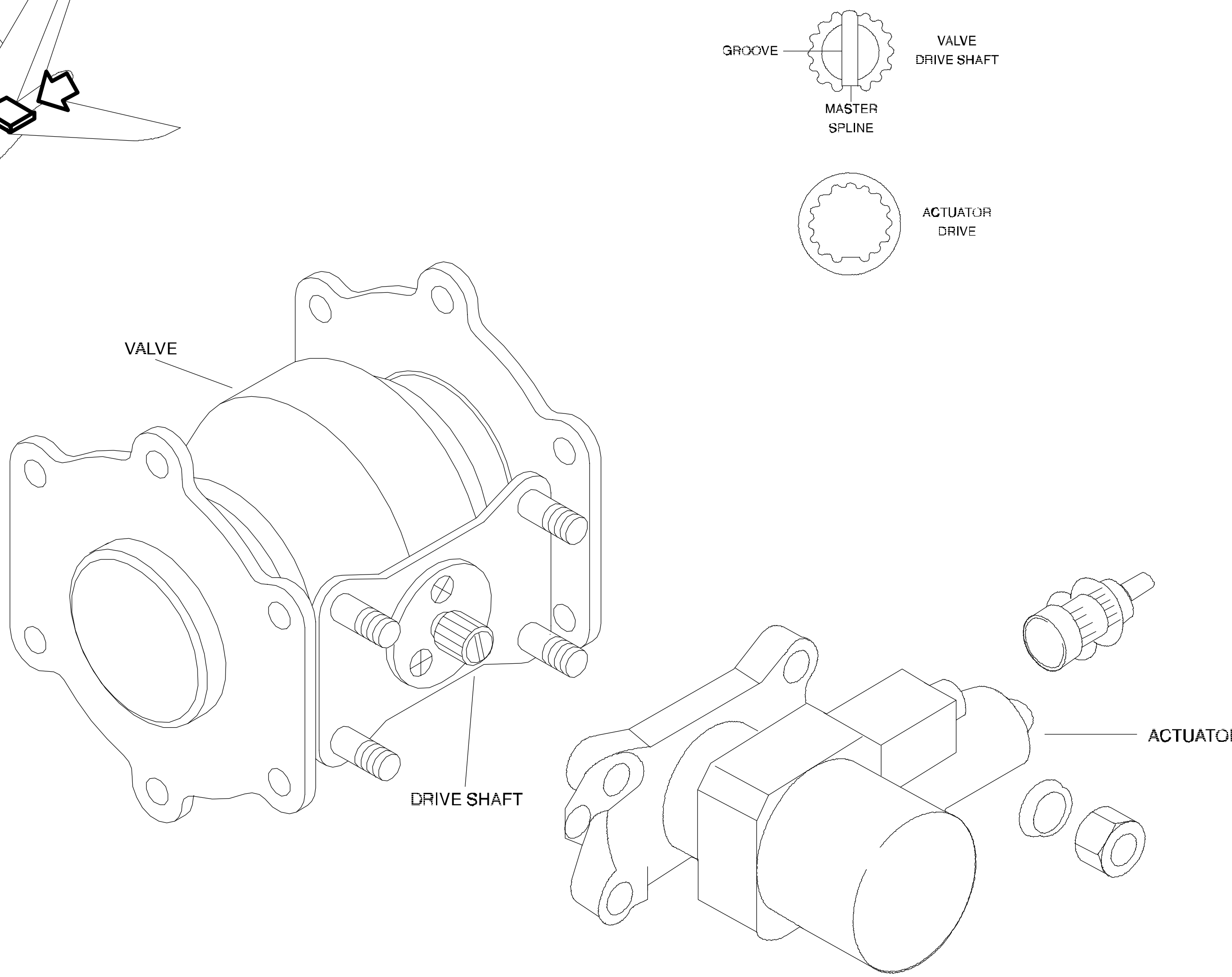
FIN / ZONE

FIN : 702 QN
Zone : 311

COMPONENT DESCRIPTION

The actuator has a 28 VDC electrical motor which drives a gear to turn the ball valve through 90 degrees. Limit switches in the actuator control this 90 degrees movement and set the electrical circuit for the next operation. The actuator drive has a masterspline to make sure it is correctly aligned with the valve spindle.





FQW4200 GE Metric

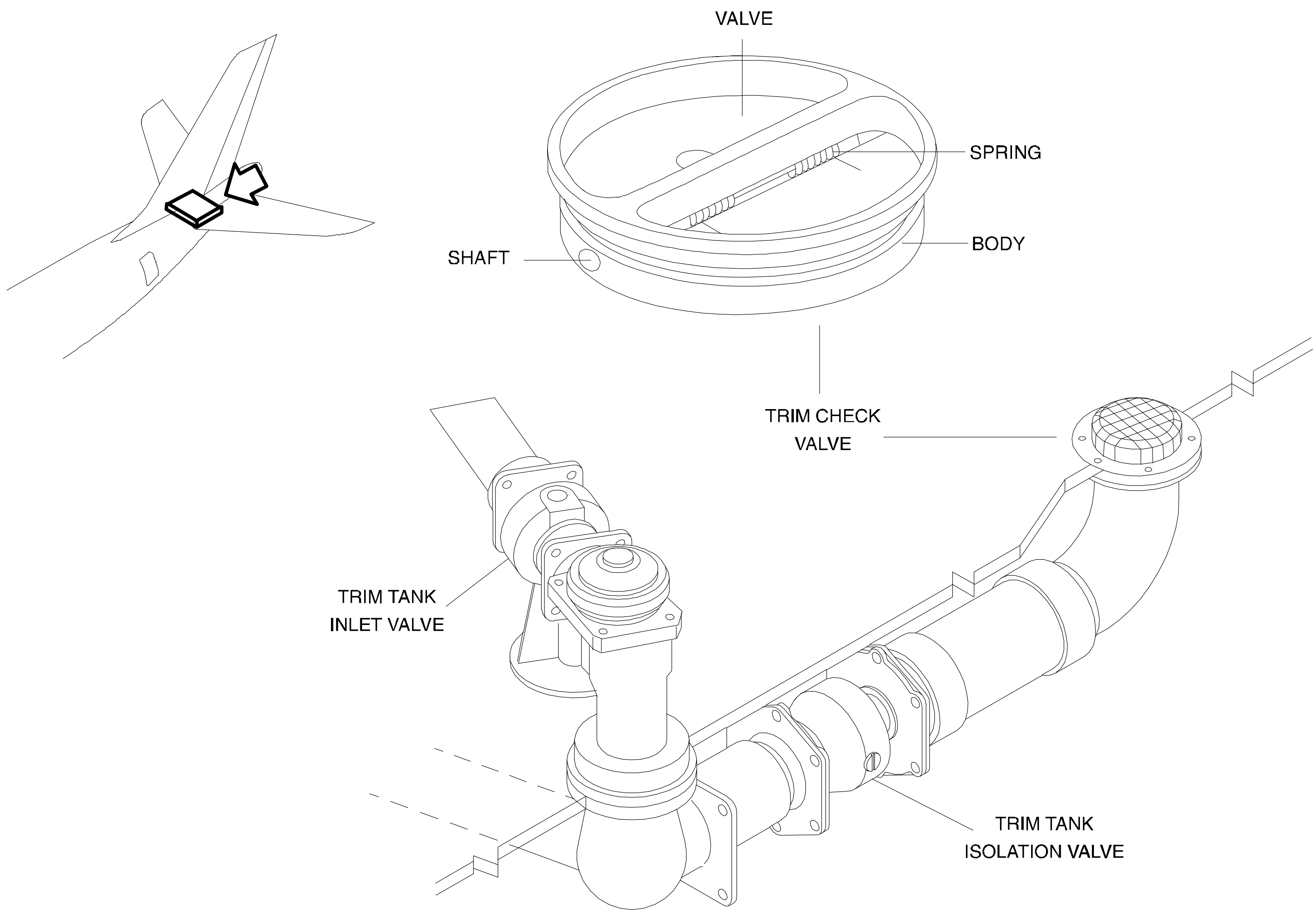
TRIM CHECK VALVE

FIN / ZONE

FIN : 5710 QA
Zone : 311

COMPONENT DESCRIPTION

The valve body contains valve plates and a spring. The spring holds the valve plates in the closed position. When the fuel pressure from the trim Pump pushes on the outlet, the valve plates close to prevent fuel flowing back to the Trim Tank. When the gravity fuel pressure comes from the inlet, it opens the plates and fuel flows through the valve.



FQW4200 GE Metric

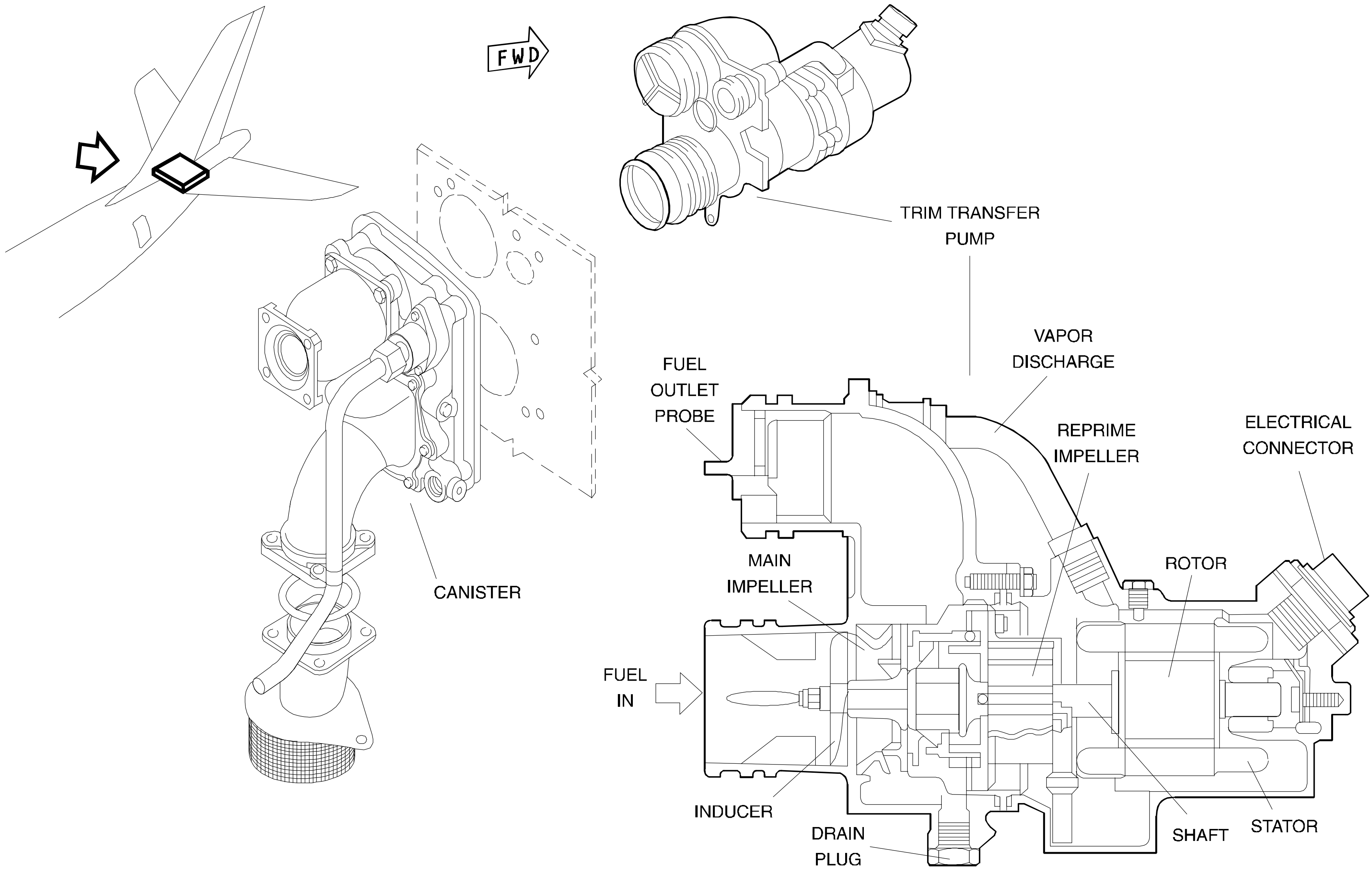
TRIM TRANSFER PUMP

FIN / ZONE

FIN : 709 QN
Zone : 312

COMPONENT DESCRIPTION

As the pump assembly is not imerged into the fuel, a special function allows the fuel to be de-aerated and helps the fast repriming of the pump. The reprime impeller causes any air to go through vent holes and drillings in the main impeller backplate. The air, once separated from the fuel, is evacuated by the discharge pipe. The pump motor is a start connected unit which operates on a 3 phase 115 VAC supply. Each phase is protected through a non-resettable thermal fuse.



FQW4200 GE Metric

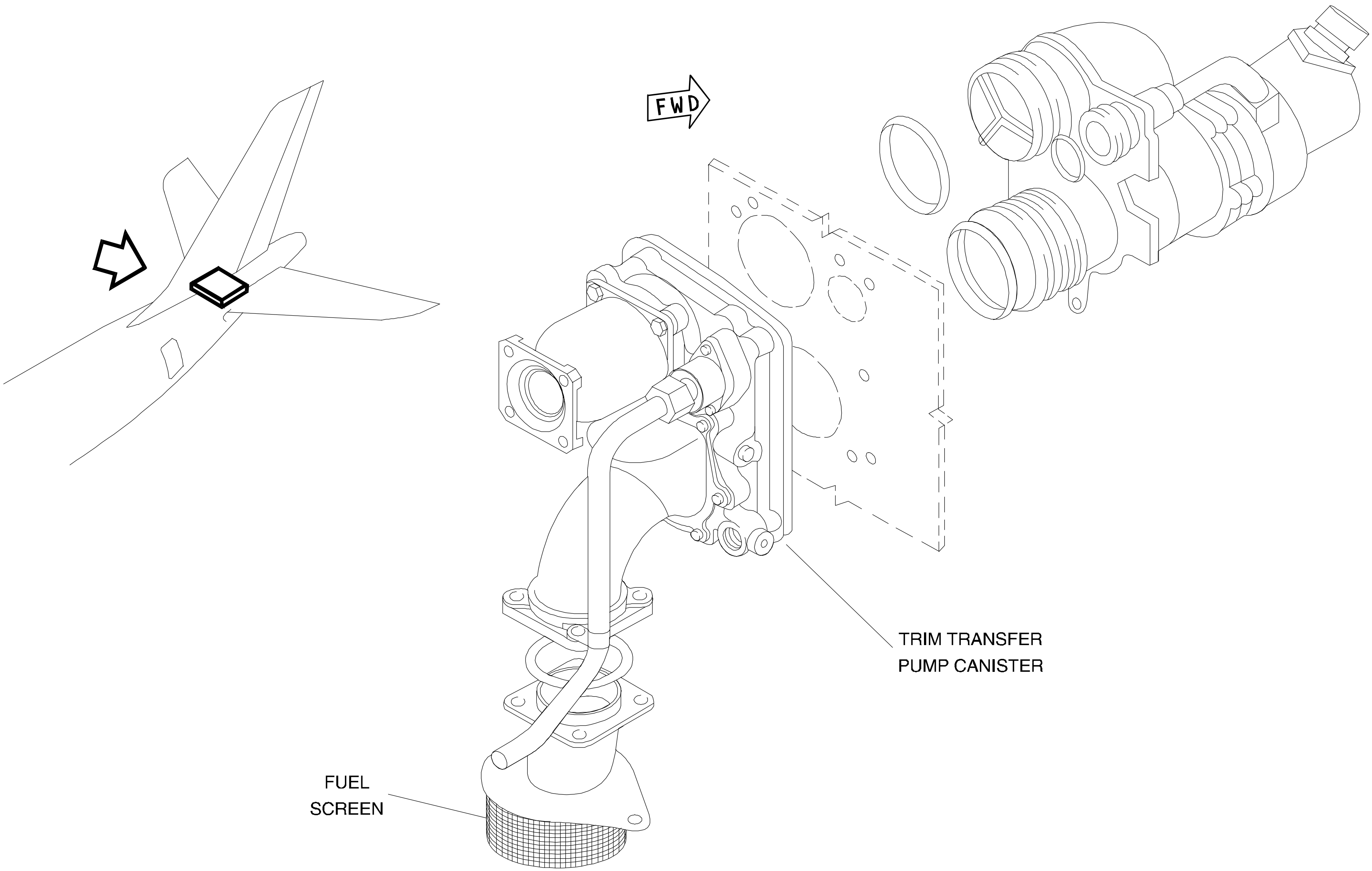
TRIM TRANSFER PUMP CANISTER

FIN / ZONE

FIN : 5709 QN
Zone : 312

COMPONENT DESCRIPTION

The Trim XFR Pump Canister has three check valves. Before removing the pump, the Canister has to be drained by means of the drain plug located on the fuel XFR pump. When the pump is removed, the three check valves close and avoid fuel leaks.



FQW4200 GE Metric

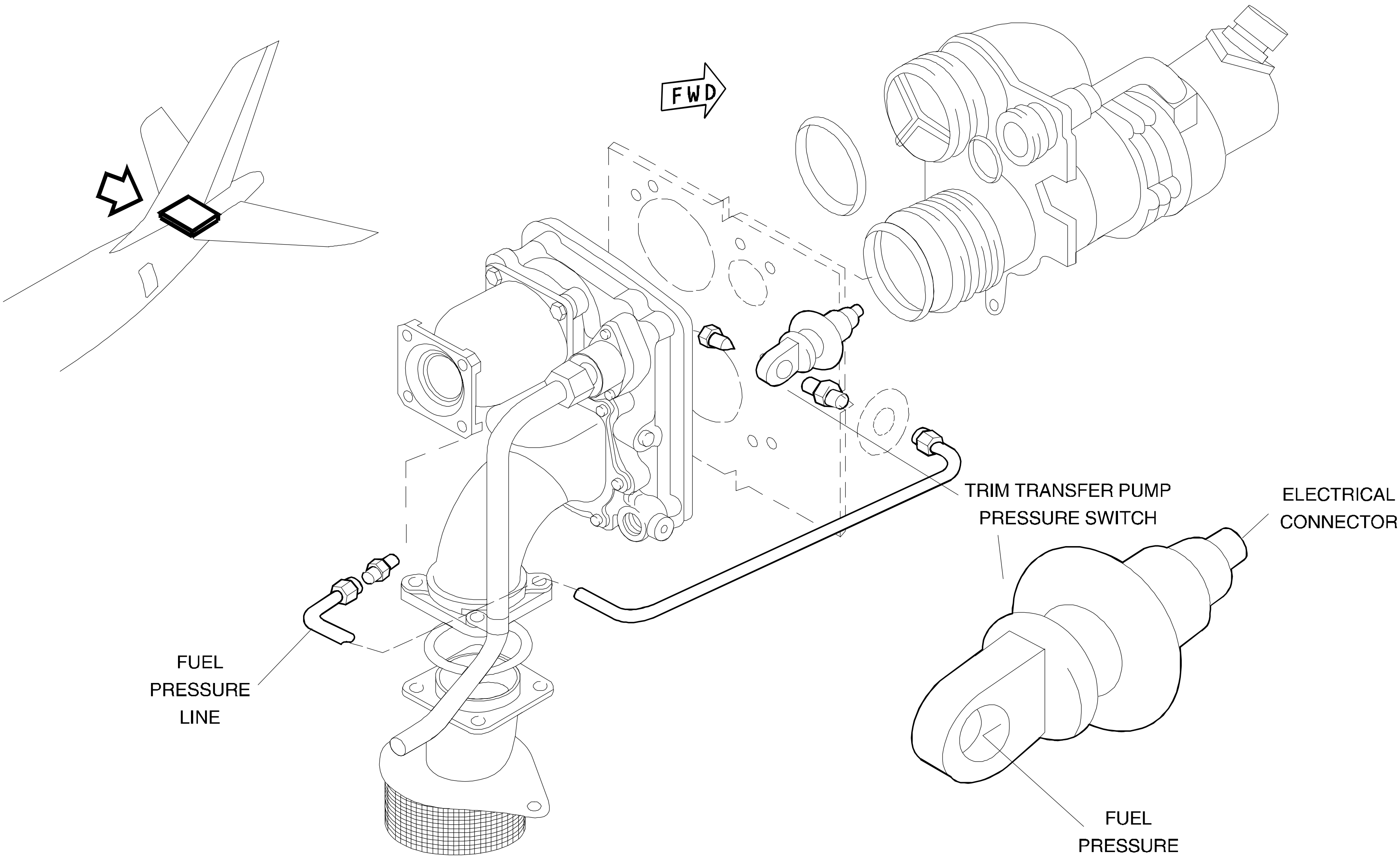
TRIM TRANSFER PUMP PRESSURE SWITCH

FIN / ZONE

FIN : 28 QN
Zone : 312

COMPONENT DESCRIPTION

When the fuel pressure increases to 8 psi (0.55 bar), the microswitch contacts open, they close when the pressure decreases to 6 psi (0.41 bar). The pressure switches are the same type as those in the main fuel pump system.



FQW4200 GE Metric

STUDENT NOTES

REFUEL/DEFUEL SYSTEM DESCRIPTION

General
Refuel Gallery
Refuel Isolation Valve
Tank Inlet Valve
Surge Pressure Relief Valve
Depressurizing Valve
Pressure Switch
Restrictor Valves
Refuel/Defuel Station
Refuel/Defuel Panel Preparation

GENERAL

The Refuel/Defuel System controls the flow of fuel into or out of the aircraft. Automatic Refueling can be performed from the ground at the Refuel/Defuel Control Panel.

Any Manual Refuel, Defuel or Ground Transfer is controlled from the Refuel/Defuel Control Panel.

The R/D Coupling, in the leading edge of each wing, is the interface between the R/D System and the external fuel source.
Inner Tank gravity refueling is possible through the overwing refuel adaptor.

REFUEL GALLERY

The main Refuel Gallery is a fuel pipe that runs from the left wing Refuel Isolation Valve through to the right wing Refuel Isolation Valve.

From this pipe, other branch pipes supply fuel, through Inlet Valves, to the fuel tanks.

In each fuel tank the branch pipe is divided into a number of smaller pipes. At the end of each of these smaller pipes is a Refuel Diffuser.

REFUEL ISOLATION VALVE

The Refuel Isolation Valve is installed in the center of each Refuel/Defuel Coupling.
The valve is electrically controlled but hydraulically operated. When the valve is energized and a pressure or suction is applied, the valve opens.

If the valve does not open electrically, a Manual Override Button can be used.
A Refuel Pressure Switch monitors the fuel pressure downstream of the Refuel Isolation Valve.

TANK INLET VALVE

Each Tank Inlet Valve has a valve spindle which goes through the rear spar to engage with the electrical actuator.

Except for the Trim Tank Inlet Valve-spindle which goes through the bottom of the Trim Tank to engage with the actuator.

SURGE PRESSURE RELIEF VALVE

During a refuel, the Surge Pressure Relief Valves make sure that the pressure in the refuel gallery is in the design limits.

If a valve operates, the fuel goes into the related Inner Tank.

DEPRESSURIZING VALVE

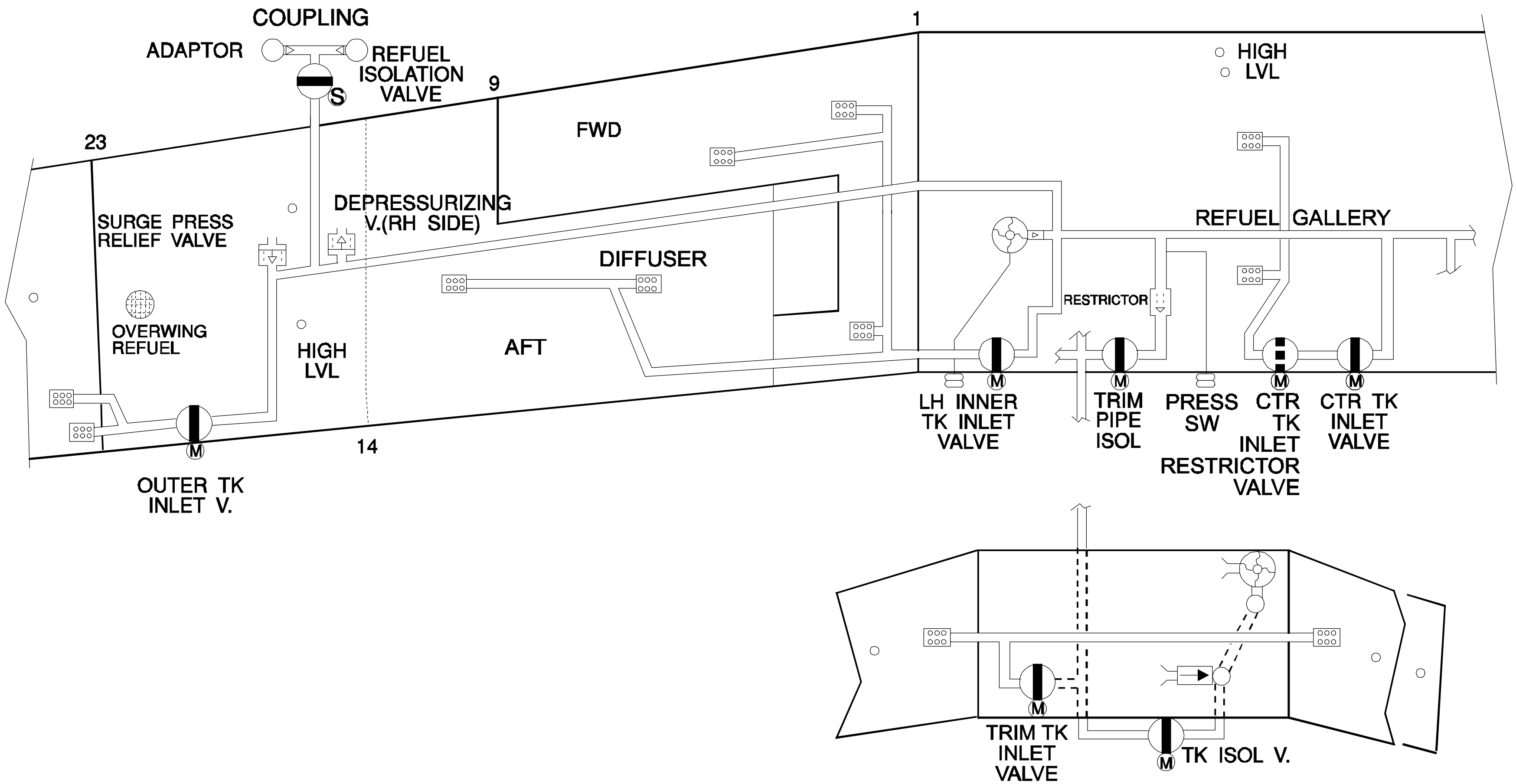
A Depressurizing Valve is installed on the Refuel Gallery in the right Inner Tank only.

After a Refuel operation is completed, the Valve releases the remaining pressure in the refuel gallery into the Inner Tank.

PRESSURE SWITCH

A Pressure Switch, referenced to the refuel gallery, is installed at the wing center section rear wall.

During a refuel, if insufficient pressure is detected, the Trim Transfer Line will be isolated.



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RESTRICTOR VALVES

A Center Tank Inlet Restrictor Valve is located immediately downstream from the Inlet Valve.

It is a two position valve (restricted / unrestricted) used to prevent an overpressure of the Center Tank structure at the end of the refueling.

A Restrictor Valve is installed in the Refuel supply line, upstream of the Trim Pipe Isolation Valve.

The Restrictor Valve decreases the fuel flow (and pressure) that goes to the Trim Tank.
But, when necessary, it lets the fuel flow freely in the opposite direction.

REFUEL/DEFUEL STATION

The aircraft has two Refuel Couplings, with two Refuel hose adaptors on each Coupling.
(The RH coupling is standard, the LH coupling is optional).

The aircraft can be refueled or defueled through one or more of these adaptors.
With 4 refuel hoses connected at the same time, max refueling load is reached within 36 minutes.

But, for Defueling, if only one Adaptor is used, it must be the one identified "USE THIS ADAPTOR TO DEFUEL".

Note that the JET FUEL maximum pressure is 50 Psi (3.45 Bar) and max. suction 11 Psi (0.8 Bar).

REFUEL/DEFUEL PANEL PREPARATION

When the quick-release door to the ground Refuel/Defuel Control Panel is opened, it operates a door microswitch.

The Microswitch supplies a Refuel-panel door position relay which sends a signal to the FCMC and connects the 28 VDC supply to the Refuel/Defuel electrical circuits.

Before any job is performed, a High Level TEST has to be done. When the pushbutton is pressed, all lights change state.

A successful test means that the circuits and sensors are serviceable ; the job can be continued.

STUDENT NOTES:

STUDENT NOTES

REFUEL/DEFUEL SYSTEM CONTROLS AND INDICATING

Fuel Quantity Indicator
High Level Lights
Refuel Load Increase/Decrease Switch
Overflow Lights
Mode Selector
Refuel/Defuel Valve Switches
High Level Test Pushbutton
Power Supply Switch
Auxiliary Power Unit (APU) Emergency Switch
Transfer Valve Switch
Cockpit Refuel Pushbutton (Option)

FUEL QUANTITY INDICATOR

The Fuel Quantity Indicator (FQI) displays the quantity of fuel in each tank, the actual total fuel in the aircraft, and the preselected fuel.

The END light comes on, when an auto refuel is completed.
It flashes in case of malfunction.
A CocKPiT light comes on if a cockpit refuel selection has control.

HIGH LEVEL LIGHTS

The HIGH LEVEL lights come on blue when the related fuel tank high level sensors are wet.
Each light has a filament press-to-test facility.

REFUEL LOAD INCREASE/DECREASE SWITCH

This switch selects the refuel load for automatic refueling.
This is displayed in the PRESELECTED window of the Fuel Quantity Indicator.
The preselected load can be INCreased or DECreased using the switch.

OVERFLOW LIGHTS

An amber OVERFLOW light comes on if the associated Surge Vent Tank sensor is covered by fuel.
Each light has a filament press-to-test facility.

MODE SELECTOR

The MODE SELECTor is guarded in the OFF position.
When set to REFUEL or DEFUEL it energizes the Refuel Isolation Valves.

With the selector in the REFUEL position, the Inlet Valves operate automatically or manually, depending on their Refuel/Defuel Valve switch position.

When the MODE SELECTor is in the DEFUEL position, the Refuel/Defuel Valves switches can be opened and closed as necessary.

REFUEL/DEFUEL VALVE SWITCHES

There is one Refuel/Defuel Valve switch per tank.
Guarded in the NORM position, it automatically controls its Inlet Valve depending on the MODE SELECTor position.

With the Refuel/Defuel Valve switch in the SHUT position, the Inlet Valve is always closed.

When a Refuel/Defuel Valve Switch is set to OPEN, the Inlet Valve opens if the MODE SELECTor is also set to REFUEL or DEFUEL.
In refuel mode, the Valve closes if High Level is detected in its fuel tank.

Trim Tank refueling is only possible if the Inner or Center Tanks are receiving fuel simultaneously.
Wing Tank defueling is only possible if Trim Tank is empty.

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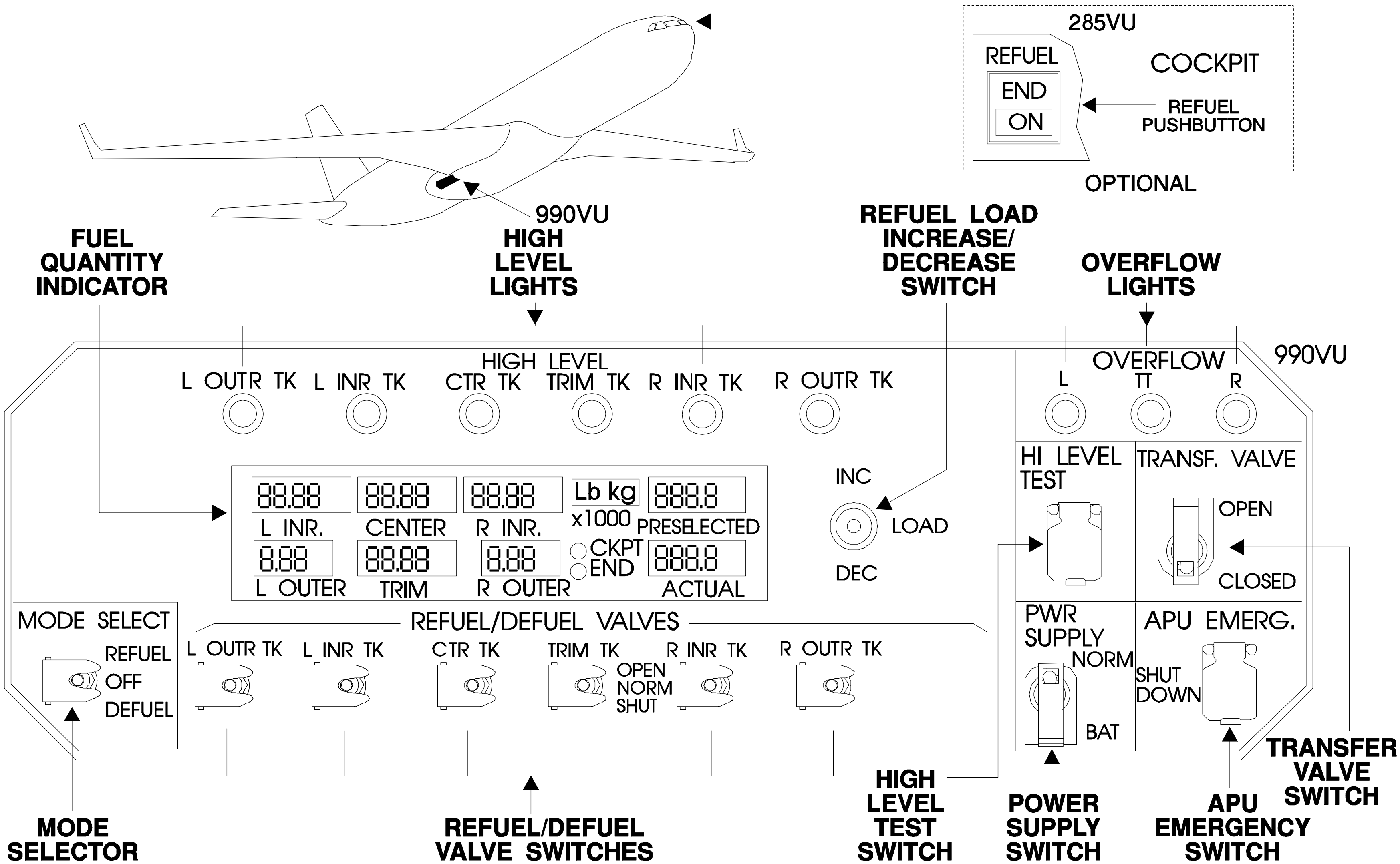

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HIGH LEVEL TEST PUSHBUTTON

When the HI LEVEL TEST pushbutton is pressed, all HIGH LEVEL and OVERFLOW lights come on, if their circuits and sensors are serviceable or not already at High Level.
Also, the FQI Indicator shows "8s", CKPT and END lights come on. This test has to be performed before any refuel or defuel operation.

POWER SUPPLY SWITCH

The PoWeR SUPPLY switch is normally guarded in the NORM position.
In this position, refueling and defueling operations are powered by external power connected or APU generator on line.

If the PoWeR SUPPLY switch is in the BAT position, the refueling and defueling operations are powered by batteries 1 and 2.

AUXILIARY POWER UNIT (APU) EMERGENCY SWITCH

When the APU EMERGency pushbutton is pressed, the APU shut-down sequence is started .
It is used if a fuel spill or overflow occurs; or, any other emergency condition.

TRANSFER VALVE SWITCH

To transfer fuel on ground, a TRANSFer VALVE switch can be used. Transfer is possible from the Inner or Center Tanks to any tank except to the Trim Tank.
The switch is normally guarded in the closed position and the Aft Transfer Valves are closed.

When the TRANSFer VALVE switch is set to OPEN, the Aft Transfer Valves only open if specific conditions are fulfilled in FCMC.
The Fuel Crossfeed Line is connected to the refuel gallery.

REFUEL PUSHBUTTON

A REFUEL pushbutton is installed in the cockpit on the overhead panel, as an option.

It permits automatic refueling.

AUTOMATIC REFUEL OPERATION (FILM)

Before starting the refuel/defuel procedure, some safety precautions have to be taken, such as safety barriers and "no smoking" warning notices. Especially, if a fuel tanker is used.
Make sure that the fire-fighting equipment is available.
The landing gear chocks should not touch their tires. But the parking brake must be on.
The weight of the fuel can suddenly compress the landing gear and lower the aircraft : make sure there is no equipment below the aircraft which can cause damage.
All electrical equipment you use must not cause sparks and a water contamination check on a fuel sample must be performed.

For refuelling at the terminal, a ground pumping unit is used.
The ground pumping unit is positioned under the wing, below the refuel/defuel coupling access panel.
The ground cable is connected to the aircraft on the landing gear.
The platform is lifted up to the refuel/defuel station.

One, two, three or four refuel hoses can be connected to perform an automatic pressure refuel.
We are going to use two on the LH wing.
The panel is opened.
The two refuel/defuel coupling caps removed.
The two fuel supply hoses are connected.
The caution placard indicates : do not let the refuel pressure get to more than 50 psi or 3.5 bars.
As we are at the terminal, the refuelling pump unit is connected to the ground installation.

Under the fuselage fairing, open the door of the refuel/defuel control panel 990 VU.
If external electrical power or APU electrical power is not available, it is also possible to use the aircraft batteries.
First of all, a test is to be performed.
Lift the guard, then push and hold the high level test switch.

Check that :
- the high level and overflow lights change state
- cockpit and end lights come on, on the F.Q.I. indicator
- the fuel quantity, preselected and actual displays show all eights.

When the test switch is released, after a few seconds, all lights and quantity displays return to their initial condition.

With the load switch, increase the preselected quantity up to the necessary fuel load. Adjust it. 74 tonnes are selected.

Make certain that all refuel/defuel valves switches are in the norm position and guarded.

Set the mode selector switch to the refuel position.
The pump on the ground pumping unit can be started.
Monitor that the fuel quantity indication increases.

All tanks that are to receive fuel are filled simultaneously.
The actual indication increases together with the tank quantities.

Note as the refuelling is performed only from the left hand side couplings, the left hand fuel tanks will be filled before the right hand ones.

When a tank is full, its high level light comes on.
Here, the left outer tank. Its inlet valve closes.
The right outer tank is also full.

As the preselected quantity is 74 tonnes, no fuel is sent to the center tank, but there is some fuel in the trim tank.
The inner tanks continue to fill.

The Fuel Control and Monitoring Computer (F.C.M.C.) controls the distribution of the fuel in the different tanks.

The left inner tank is full. (The left inner tank blue high level light is on).

Now, both wing tanks are full.

The refuelling automatically stops as the end light comes on, steady ; "actual" and "preselected" displays agree and are stable with a 200 kg tolerance.

Stop the pump on the ground pumping unit.

On the refuel/defuel control panel, set the mode selector switch to off.
All switches being in the normal and guarded position, the panel door is closed.

Disconnect the fuel supply hoses from the aircraft refuel/defuel couplings, and re-install the coupling caps.
Close the access panel.
Remove the platform.
Disconnect the ground/bonding cables.

If not needed, de-energize the aircraft electrical circuits.
Put the chocks back in their original position.

The automatic refuel operation is finished, verify that the area is clean and clear of any equipment.

When servicing and passenger loading is completed, the A340 is ready for departure.

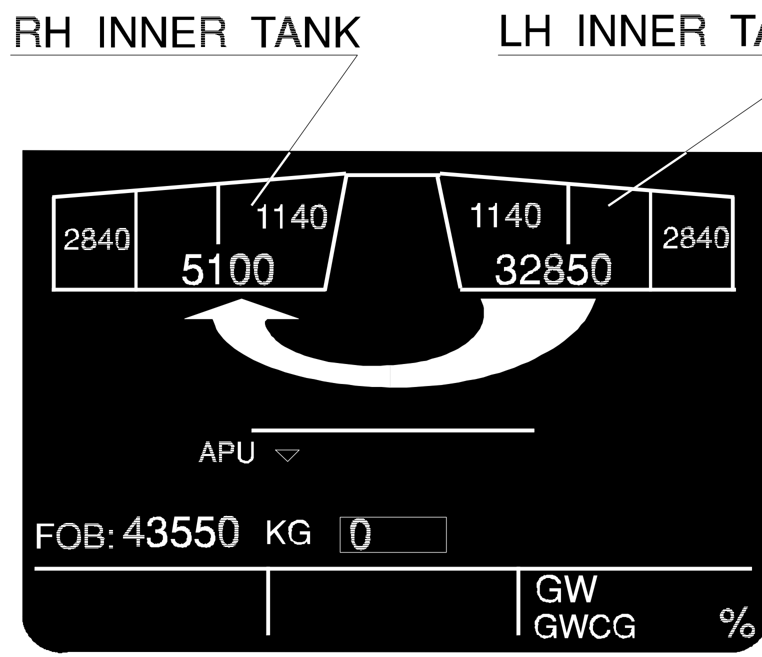
STUDENT NOTES

GROUND TRANSFER OPERATION

Purpose
Aircraft Maintenance Manual

PURPOSE

The purpose is to carry out the procedure required to rebalance both Inner tanks by transfering fuel from the RH Inner tank into the LH Inner tank.
There is about 5,000Kg of fuel in the LH Inner tank and the RH Inner Tank is full, the Outer tanks are full and there is no fuel in the Trim tank.



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AIRCRAFT MAINTENANCE MANUAL

The following pages are presented here for training purpose only.
They are similar to the AMM pages required when performing the procedure in situ.

The patterned parts of the AMM procedure feature the related actions to be performed in the VACBI simulation.

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TASK 28-25-00-869-801

Ground Fuel-Transfer Procedure

WARNING : OBEY THE FUEL SAFETY PROCEDURES. THIS CAN PREVENT INJURY OR DAMAGE.

1. Reason for the Job

   To move fuel from tank to tank when the aircraft is on the ground.

   NOTE : This procedure cannot be used to move fuel to the trim tank.

2. Job Set-up Information

   A. Fixtures, Tools, Test and Support Equipment

REFERENCE	QTY	DESIGNATION
No specific		circuit breaker(s) safety clip(s)
No specific		access platform 2.5 m (8 ft. 2 in.)

   B. Referenced Information

REFERENCE	DESIGNATION
24-41-00-861-801	Energize the Aircraft Electrical Circuits from the External Power A
24-41-00-862-801	De-energize the Aircraft Electrical Circuits from th External Power A
31-60-00-860-801	EIS Start Procedure
28-25-00-991-005	Fig. 302
28-25-00-991-003	Fig. 304
28-25-00-991-004	Fig. 305

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3. Job Set-up

Subtask 28-25-00-860-055

A. Aircraft Maintenance Configuration

(1) Energize the aircraft electrical circuits (Ref. TASK 24-41-00-861-801).

(2) Start the EIS (Ref. TASK 31-60-00-860-801).

(3) Push the FUEL P/BSW (in) and make sure that the ECAM System Display shows the FUEL page.

NOTE : When the fuel quantity in the inner tank decreases to 3200 kg (7055 lb) the two intertank transfer valves open automatically. The fuel in the outer tanks then flows into the inner tanks.

B. To Empty an Inner Tank

(1) Get Access to the Avionics Compartment
Make sure that the access platform is below the 811.

(a) Open the access door 811.

Subtask 28-25-00-865-053

C. Open, safety and tag this(these) circuit breaker(s):

PANEL	DESIGNATION	FIN	LOCATION
742VU	FUEL MAIN XFR R	6QL2	B68
742VU	FUEL MAIN XFR L	6QL1	B67

Subtask 28-25-00-010-054

D. Get Access

(1) Open the access panel 198DB.

Subtask 28-25-00-740-050

E. Test

(1) Do this test:
(Ref. Fig. 304/TASK 28-25-00-991-003)

ACTION	RESULT
On the refuel/defuel control panel 990VU:	On the refuel/defuel control panel 990VU:
1. Lift the guard, then push (in) and hold the **HI LVL TEST** switch 3QJ.	- the hi-level lights (4QJ1, 4QJ2, 5QJ1, 5QJ2 and 7QJ) and the **OVERFLOW** lights (8QJ1, 8QJ2 and 9QJ) go to the opposite condition - the **CKPT** and **END** lights come on - the fuel quantity, **PRESELECTED** and **ACTUAL** displays show all 8's.
2. Release (out) the **HI LVL TEST** switch.	- the lights go back to their initial condition - the fuel quantity, **PRESELECTED** and **ACTUAL** displays go back to their initial condition.

Subtask 28-25-00-869-052

F. Preparation for the Ground Fuel-Transfer

(1) On the refuel/defuel control panel 990VU:

(a) Make sure that the **REFUEL-DEFUEL-VALVES** switch(es) (of the tank(s) you want to move fuel from) are in the **NORM** (guarded) position.

(b) Set the **REFUEL-DEFUEL-VALVES** switch(s) (of the tank(s) you want to move fuel into) to the **OPEN** position.

(c) Set the **TRANSF VALVE** switch (11QU) to the **OPEN** position.

(d) Set the **MODE SELECT** switch (3QU) to the **REFUEL** position.

4. Procedure

Subtask 28-25-00-869-053

A. To Move Some of the Fuel from the LH(RH) Inner Tank
(Ref. Fig. 302/TASK 28-25-00-991-005, 305/TASK 28-25-00-991-004)

(1) On the cockpit overhead panel 245VU:

(a) Push (in) the X FEED P/BSW. Make sure that:
- the ON and OPEN lights come on
- the FUEL page shows the crossfeed valve symbol is in-line, (valves open).

(b) Push (in) the L(R) TANK STBY P/BSW. Make sure that:
- the OFF light goes off
- the FUEL page shows the standby-pump symbol is in-line (pump i operation).

(2) Continuously monitor the ground fuel-transfer.

(3) When the fuel contents are at the necessary level, release (out) the L(R) TANK P/BSW. Make sure that:
- the OFF light comes on
- the FUEL page shows the standby-pump symbol is cross-line (pump no in operation).

B. To Move All of the Fuel from the LH(RH) Inner Tank

CAUTION : DO NOT LET THE FUEL PUMPS OPERATE FOR MORE THAN 15 MINUTES WIT THE FAULT LIGHT ON. THIS PREVENTS DAMAGE TO THE FUEL PUMPS.

(1) Operate the standby fuel pump until the L(R) INR TANK FAULT light come on.

(2) Release (out) the L(R) INR TANK P/BSW. Make sure that:
- the OFF light comes on and the FAULT light goes off
- the FUEL page shows the standby pump symbol is cross-line (pump no in operation).

(3) Release (out) the X FEED P/BSW. Make sure that:
- the ON and OPEN lights go off
- the FUEL page shows the crossfeed valve symbol is cross-line (valv closed).

5. Close-up

Subtask 28-25-00-869-055

A. On the refuel/defuel control panel 990VU:

(1) Set the **MODE SELECT** switch to the **OFF** position.

(2) Set the **REFUEL-DEFUEL-VALVES** switch(es) to the **NORM** (guarded) position.

(3) Set the **TRANSF VALVE** switch to the **CLOSED** position.

Subtask 28-25-00-410-054

B. Close Access

(1) Close the access panel **198DB**.

Subtask 28-25-00-860-056

C. Aircraft Maintenance Configuration

(1) On the **ECAM** control panel, set the **UPPER** and **LOWER** potentiometers tc OFF.

(2) De-energize the aircraft electrical network (Ref. TASK 24-41-00-862-801).

D. Inner Tank Empty, Outer Tank has Fuel Condition

(1) If it is necessary for maintenance to keep the inner tank empty, yoi must do the next step after that maintenance.

Subtask 28-25-00-865-054

CAUTION : FUEL IN THE OUTER TANKS WILL TRANSFER TO THE INNER TANKS WHEN THE CIRCUIT BREAKERS FOR THE INTERTANK TRANSFER VALVE ARE CLOSED.

E. Remove the safety clip(s) and the tag(s) and close this(these) circuit breaker(s):
6QL1, 6QL2.

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Subtask 28-25-00-942-054

F. Removal of Equipment

(1) Remove the ground support and maintenance equipment, the special and standard tools and all other items.

(2) Make sure that the work area is clean and clear of tools and .ther items.

STUDENT NOTES

PRESSURE DEFUEL OPERATION

Purpose
Aircraft Maintenance Manual

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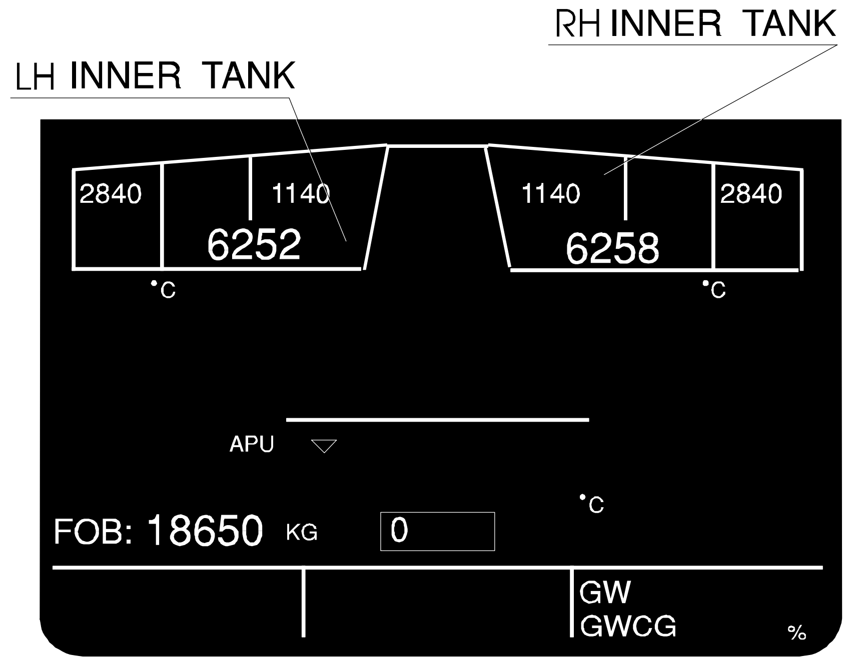
PURPOSE

In order to empty all the aircraft tanks you will perform a pressure defuel.
There is about 6,000Kg of fuel in each Inner tank, the Outer tanks are full and there is no fuel in the Trim tank.



AIRCRAFT MAINTENANCE MANUAL

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AIRCRAFT MAINTENANCE MANUAL
REFUEL/DEFUEL SYSTEM - SERVICING

TASK 28-25-00-650-801

Pressure Defuel Procedure

WARNING : MAKE SURE THE AREA AROUND THE AIRCRAFT IS SAFE BEFORE YOU START A REFUEL/DEFUEL PROCEDURE. IN THIS SAFE AREA, DO NOT LET PERSONS:
- SMOKE
- MAKE SPARKS OR FIRE
- USE ANY EQUIPMENT WHICH IS NOT APPROVED FOR THE TASK.
AIRCRAFT FUEL IS FLAMMABLE.

WARNING : MAKE SURE THAT THE GROUND SAFETY-LOCKS ARE CORRECTLY INSTALLED ON THE LANDING GEAR.
THIS PREVENTS UNWANTED MOVEMENT OF THE LANDING GEAR.

1. Reason for the Job

To make an adjustment to the fuel load.
To defuel all the aircraft fuel tanks.

2. Job Set-up Information

A. Fixtures, Tools, Test and Support Equipment

REFERENCE	QTY	DESIGNATION
No specific	2	access platforms 5.0 m (16 ft. 5 in.)

B. Referenced Information

REFERENCE	DESIGNATION
12-11-28-650-801	General Refuel/Defuel Safety Procedures
12-11-28-650-802	Refuel/Defuel Safety Procedures In The Hangar
12-34-24-860-801	Aircraft Grounding for the Refuel/Defuel Operations
24-41-00-861-801	Energize the Aircraft Electrical Circuits from the External Power A
24-41-00-862-801	De-energize the Aircraft Electrical Circuits from the External Power A
27-40-00-866-801	Operation of the THS Actuator
31-60-00-860-801	EIS Start Procedure

EFF :

REFERENCE	DESIGNATION
28-25-00-991-001	Fig. 301
28-25-00-991-005	Fig. 302
28-25-00-991-002	Fig. 303
28-25-00-991-003	Fig. 304
28-25-00-991-004	Fig. 305

3. Job Set-up

Subtask 28-25-00-941-050

A. Safety Precautions
(Ref. Fig. 301/TASK 28-25-00-991-001)

WARNING : OBEY THE FUEL SAFETY PROCEDURES.
THIS CAN PREVENT INJURY OR DAMAGE.

(1) Obey the refuel/defuel safety procedures (Ref. TASK 12-11-28-650-801) and (Ref. TASK 12-11-28-650-802).

WARNING : MAKE SURE THAT YOU GROUND THE FUEL TANKER AND THE AIRCRAFT CORRECTLY.
IF YOU DO NOT A DANGEROUS ELECTRICAL DISCHARGE CAN OCCUR.

(2) Ground the aircraft and the fuel tanker(s) correctly (Ref. TASK 12-34-24-860-801). Then bond them together electrically.

(3) Make sure that the fuel tanker(s) has(have) sufficient space for the fuel quantity to be defuelled.

Subtask 28-25-00-860-053

B. Aircraft Maintenance Configuration
(Ref. Fig. 302/TASK 28-25-00-991-005)

(1) Energize the aircraft electrical circuits (Ref. TASK 24-41-00-861-801).

(2) Start the Electronic Instrument System (EIS) (Ref. TASK 31-60-00-860-801).

(3) Push (in) the FUEL pushbutton switch and make sure that the ECAM System Display Unit shows the FUEL page.

(4) Read and make a record of the fuel quantities.

WARNING : MAKE SURE THAT THE TRAVEL RANGES OF THE FLIGHT CONTROLS ARE CLEAR. MOVEMENT OF FLIGHT CONTROLS CAN CAUSE INJURY TO PERSONS AND/OR DAMAGE.

(5) If you want to fully defuel the trim tank tank, set the Trimmable Horizontal Stabilizer to 0 degrees (Ref. TASK 27-40-00-866-801).

Subtask 28-25-00-010-050

C. Get Access
(Ref. Fig. 303/TASK 28-25-00-991-002)

NOTE : You can use 1, 2, 3 or 4 defuel hoses to do a pressure defuel. But when only one refuel/defuel adaptor (on a refuel/defuel coupling) is used, it must be the one identified USE THIS ADAPTOR TO DEFUEL. This procedure uses four defuel hoses.

(1) Put 2 access platforms in position, one below the access panel 522HB and one below the access panel 622HB.

(2) Open the access panels 522HB and 622HB.

(3) Remove the refuel/defuel coupling caps 5503QA1, 5503QA2, 5504QA1 and 5504QA2 from the refuel/defuel couplings 5502QA1 and 5502QA2.

(4) Make sure that the couplings of the defuel hoses are clean, then connect them to the aircraft refuel/defuel couplings.

(5) Open the access panel 198DB.

Subtask 28-25-00-650-050

D. Preparation for the Pressure Defuel

(1) On the Refuel/Defuel Control Panel 990VU:
(Ref. Fig. 304/TASK 28-25-00-991-003)

(a) Make sure that the REFUEL-DEFUEL-VALVES switches (5QU1, 5QU2. 6QU1, 6QU2 and 8QU) are in the NORM (guarded) position.

(b) Set the MODE SELECT switch (3QU) to the DEFUEL position.

4. Procedure

(Ref. Fig. 305/TASK 28-25-00-991-004)

Subtask 28-25-00-650-054

A. Defuel of the Trim Tank

(1) Defuel of the trim tank to a lower quantity

(a) Push (in) the T TANK MODE P/BSW (21QL). Make sure that:

1 The FWD light comes on.

2 The FUEL page shows:
- the trim-tank isolation valve symbol is in-line (valve open)
- the forward-transfer triangular symbol (fuel-transfer in operation).

(b) Monitor the fuel contents, and make sure that the trim tank figure decreases.

NOTE : During the defuel, the fuel from the trim tank goes into the two inner tanks. Make sure that there is enough space in the inner tanks. If the inner tanks are full, you must use the suction defuel procedure to defuel the trim tank.

(c) When the fuel contents have decreased to the necessary level:

1 Release (out) the T TANK MODE P/BSW (21QL). Make sure that:

a The FWD light goes off.

b The FUEL page shows:
- the trim-tank isolation valve symbol is cross-line (valve closed)
- the forward-transfer triangular symbol (fuel-transfer is not in operation).

(d) Monitor the fuel contents on the FUEL page. Make sure the trim tank indications become stable. Read and make a record of the fuel quantities.

(2) Defuel of the trim tank and the trim pipe until empty.

(a) Push (in) the **T TANK MODE P/BSW** (21QL) and put the **T TANK FEED** (fuel isolation) switch (13QN) to the **OPEN** position. Make sure that:

1 The **FWD** light comes on.

2 The FUEL page shows:
- the trim-tank isolation valve symbol is in-line (valve open)
- the forward-transfer triangular symbol (fuel-transfer in operation).

(b) Monitor the fuel contents, and make sure that the trim tank fuel contents figure decreases.

(c) Continue the defuel until the trim-tank fuel quantity indication is zero and the inner-tank fuel quantity indications are stable.

(d) Release (out) the **T TANK MODE P/BSW** and put the **T TANK FEED** switch to the **AUTO** position. Make sure that:

1 The **FWD** light goes off.

2 The FUEL page shows:
- the trim-tank isolation valve symbol is cross-line (valve closed)
- the forward-transfer triangular symbol is not in view (fuel-transfer not in operation).

Subtask 28-25-00-650-056

B. Defuel of the Wing Tanks

(1) Defuel of the wing tanks to a lower quantity

NOTE : The Fuel Control and Monitoring System (FCMS) prevents a defuel of the wing tanks until the trim tank is empty.

(a) Push (in) the **L TANK STBY** and the **R TANK STBY** switches to start the pumps. Make sure that:
- the **OFF** lights go off
- the FUEL page shows that the related fuel pump symbol is in-line (pumps in operation).

(b) Monitor the fuel contents on the FUEL page. Make sure that the inner tank contents and the total fuel contents figures decrease.

NOTE : When the fuel quantity in one of the inner tanks decreases to 3200 kg (7055 lb) the two intertank transfer valves open. Fuel from the outer tanks then flows into the inner tanks.

(c) When the fuel contents have decreased to the necessary level:

1 Release (out) the L TANK STBY and the R TANK STBY P/BSWs. Make sure that:
- the related TANK P/BSW OFF light comes on
- the FUEL page shows the related fuel pump symbol is cross-line (pumps not in operation).

(d) Monitor the fuel contents indications on the FUEL page. Make sure that the indications become stable. Read and make a record of the fuel quantities.

(2) Defuel of the wing tanks until they are empty

CAUTION : DO NOT LET THE FUEL PUMPS OPERATE FOR MORE THAN 15 MINUTES WITH THE FAULT LIGHT ON. THIS PREVENTS DAMAGE TO THE FUEL PUMPS.

(a) Push (in) the L TANK STBY and the R TANK STBY P/BSWs to start the pumps. Make sure that:
- the OFF light goes off
- the FUEL page shows the related fuel pump symbol is in-line (pump in operation).

(b) Operate the pump until a TANK pump FAULT-light comes on.

(c) Release (out) the related TANK P/BSW. Make sure that:
- the related FAULT light goes off
- the related TANK P/BSW OFF light comes on
- the FUEL page shows the related fuel pump symbol is cross-line (pump not in operation).

(d) Do this operation for each standby pump.

(e) On the ECAM make sure that the FUEL page shows:
- the trim-tank isolation valve symbol is cross-line (valve closed)
- the forward fuel-transfer symbol is not in view (fuel-transfer not in operation)

- the fuel pump symbols are cross-line (pumps not in operation).

5. Close-up

(Ref. Fig. 303/TASK 28-25-00-991-002, 304/TASK 28-25-00-991-003, 305/TASK 28-25-00-991-004)

Subtask 28-25-00-410-050

A. Close Access

(1) On the refuel/defuel control panel 990VU:

(b) Set the **MODE SELECT** switch to the **OFF** position.

(c) Close the access panel 198DB.

(2) At the refuel/defuel couplings:

(a) Disconnect the defuel hose couplings of the fuel tanker(s) from the aircraft.

(b) Install the refuel/defuel coupling caps 5503QA1, 5503QA2, 5504QA1, and 5504QA2 on the refuel/defuel couplings 5502QA1 and 5502QA2.

(c) Close the access panels 522HB and 622HB.

(3) Disconnect the ground cable(s) from the aircraft and the fuel tanker(s).

Subtask 28-25-00-860-054

B. Aircraft Maintenance Configuration

(1) On the **MCDU**, push the line key adjacent to the **RETURN** indication until the **MCDU MENU** page comes into view.

(2) On the **MCDU**, set the **BRT** knob to **OFF**.

(3) On the **ECAM** control panel, set the **UPPER DISPLAY** and the **LOWER DISPLAY** potentiometers to **OFF**.

(4) De-energize the aircraft electrical circuits (Ref. TASK 24-41-00-862-801).

(5) Disconnect these ground cables:
- between the aircraft and the fuel tanker/pump unit
- between the fuel tanker/pump unit and the ground
- if the aircraft maintenance is completed, between the aircraft and the ground.

Subtask 28-25-00-942-050

C. Removal of Equipment

(1) Make sure that the work area is clean and clear of tools and other items.

(2) Remove the access platform(s).

(3) Remove the ground support and maintenance equipment, the special and standard tools and all other items.

STUDENT NOTES

REFUEL/DEFUEL SYSTEM COMPONENTS

Safety Precautions
Refuel Isolation Valves
Inlet Valves
Inlet Valve Actuators
Depressurizing Valve
Restrictor Valve
Refuel Gallery Low Pressure Switch
Diffusers
Fuel Jettison Valves (optional)
Fuel Jettison Valve Actuators (optional)

SAFETY PRECAUTIONS

Obey the fuel safety procedures.

Do not get your clothes soaked with fuel. Use the approved protective clothing when you go into a fuel tank.

Do no get A/C fuel in your mouth, in your eyes or on your skin (A/C fuel is poisonous).

Make sure that the landing gear safety locks and wheel chocks are in position.

Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.

Make sure you have fire fighting equipment available before you start any task on the fuel system.

Make sure that all circuits in maintenance are isolated before you supply electrical power to the A/C.

Use the talcum powder procedure only on the external surfaces of the fuel tanks. This will prevent contamination of the fuel system.

Make sure that you ground the fuel tanker and the aircraft correctly. If you do not a dangerous electrical discharge can occur.

STUDENT NOTES

REFUEL ISOLATION VALVES

FIN / ZONE

FIN : 502QU2(1)

Zone : 622 (522)

COMPONENT DESCRIPTION

The primary components of the valve are :
- the body,
- the piston and compression springs,
- the solenoid valve,
- the discharge valve,
- the drain valve,
- the manual command pushbutton and valve.

ARCHITECTURE

The piston and the body form an internal chamber. The solenoid valve controls the flow of fuel from the piston chamber to a second chamber. The manual command valve can also control the flow of fuel from the piston chamber to the second chamber. The discharge valve controls the flow of fuel from the second chamber to the refuel gallery.

REFUEL OPERATION

When the solenoid valve is de-energized, the piston stays closed : the compression spring forces the piston on its seat and fuel trapped in the piston chamber acts as an hydraulic lock.

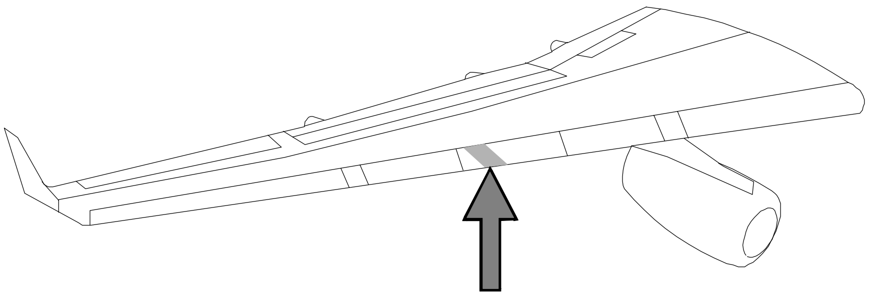
When the solenoid valve is energized, the hydraulic lock is released. The fuel pressure then pushes the piston to the open position. The fuel that made the hydraulic lock is pushed through the discharge valve into the refuel gallery.

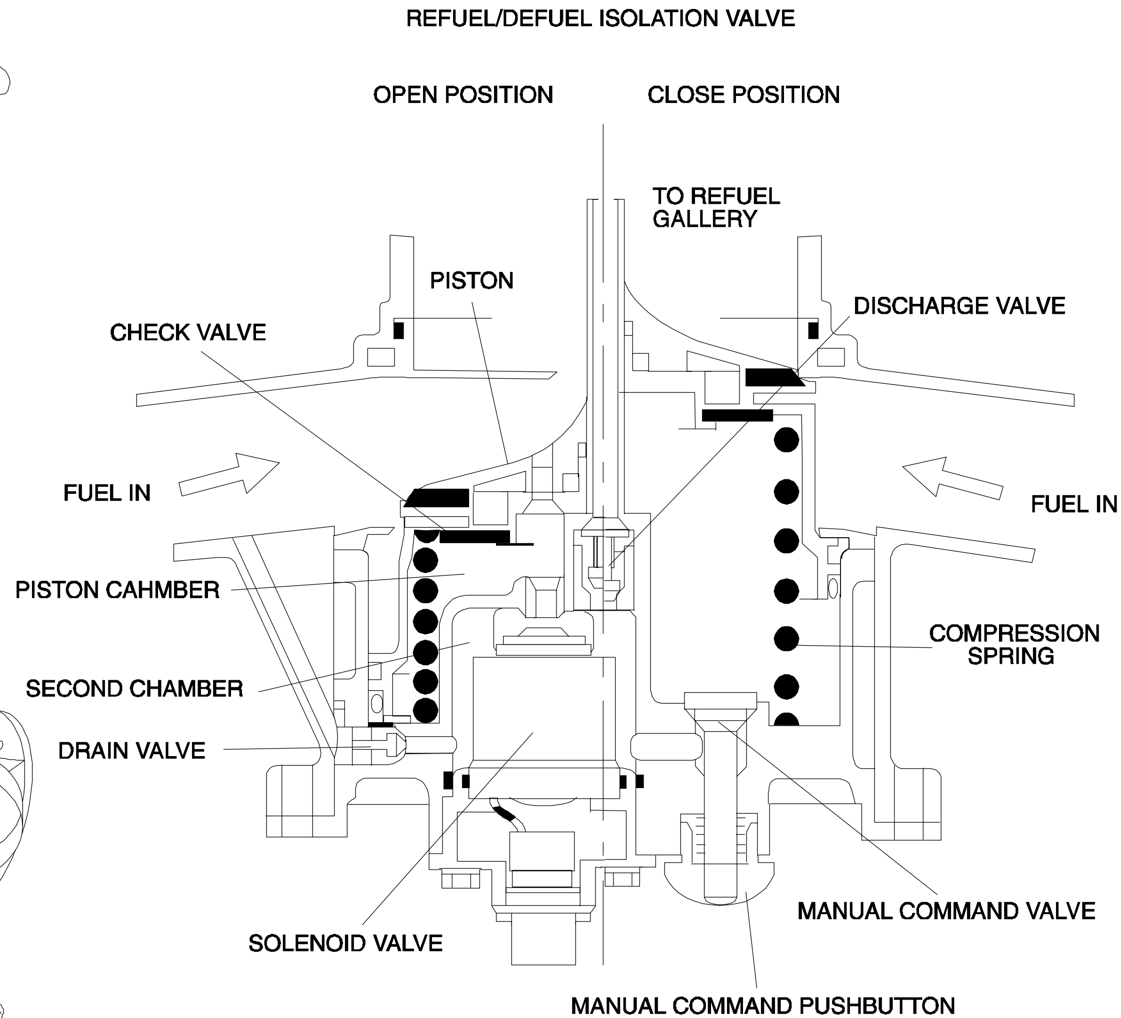
SUCTION DEFUEL

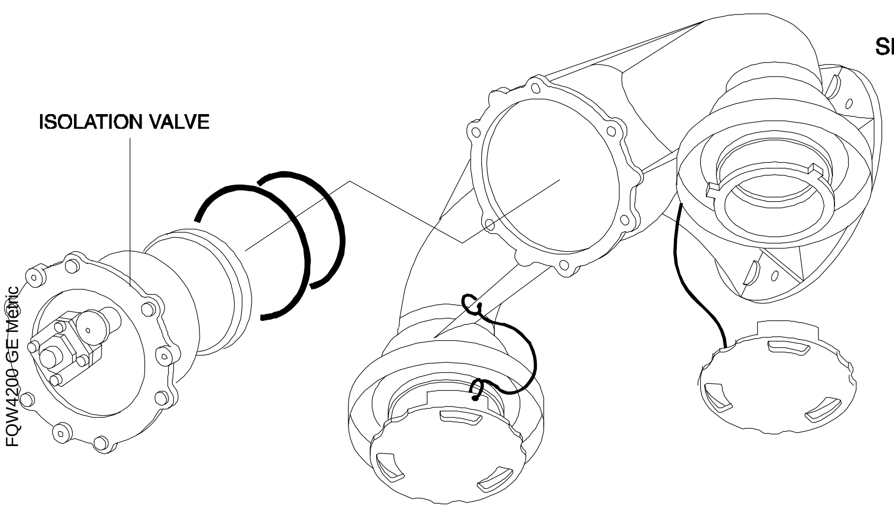
During a suction defuel, the suction pressure opens the drain valve which lets fuel drain from the second and the piston chambers. The suction then opens the valve against the spring pressure.

MANUAL OVERRIDE

If the solenoid valve does not operate, the manual command pushbutton can be pushed and held to release the hydraulic lock. The isolation valve then operates as usual.




REFUEL/DEFUEL ISOLATION VALVE
OPEN POSITION
CLOSE POSITION
TO REFUEL GALLERY
PISTON
DISCHARGE VALVE
CHECK VALVE
FUEL IN
FUEL IN
PISTON CAHMBER
COMPRESSION SPRING
SECOND CHAMBER
DRAIN VALVE
MANUAL COMMAND VALVE
SOLENOID VALVE
MANUAL COMMAND PUSHBUTTON


ISOLATION VALVE
FQW4200-GE Metric

INLET VALVES

FIN / ZONE

FIN : 5500QA1(2) (outer tanks)
5603QA1(2) (inner tanks)
5501QA (center tank)
5515QA (center tank restrictor)

Zone : 540 (640)
141 (142)

COMPONENT DESCRIPTION

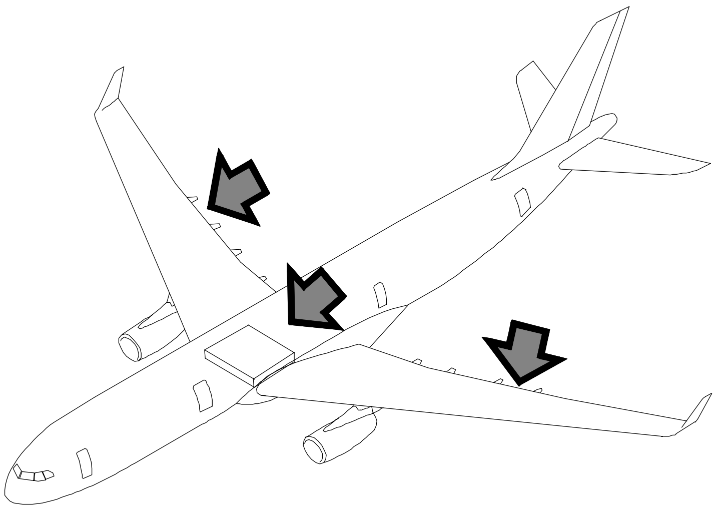
Each inlet valve is the interface between the refuel gallery and its respective tank.

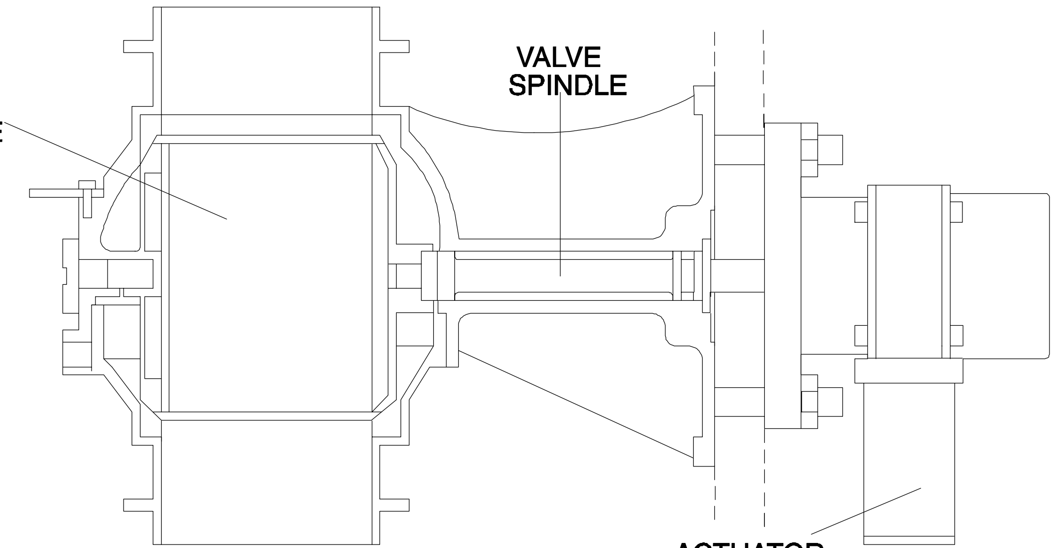
The primary components are :
- the valve body,
- the ball valve with its valve spindle,
- the mounting flange.

The ball valve, held in the body, is operated by a spindle connected to an electrical actuator. The spindle goes through the mounting flange and the aircraft structure and ends with a masterspline (to make sure that the spindle is correctly engaged with the actuator).

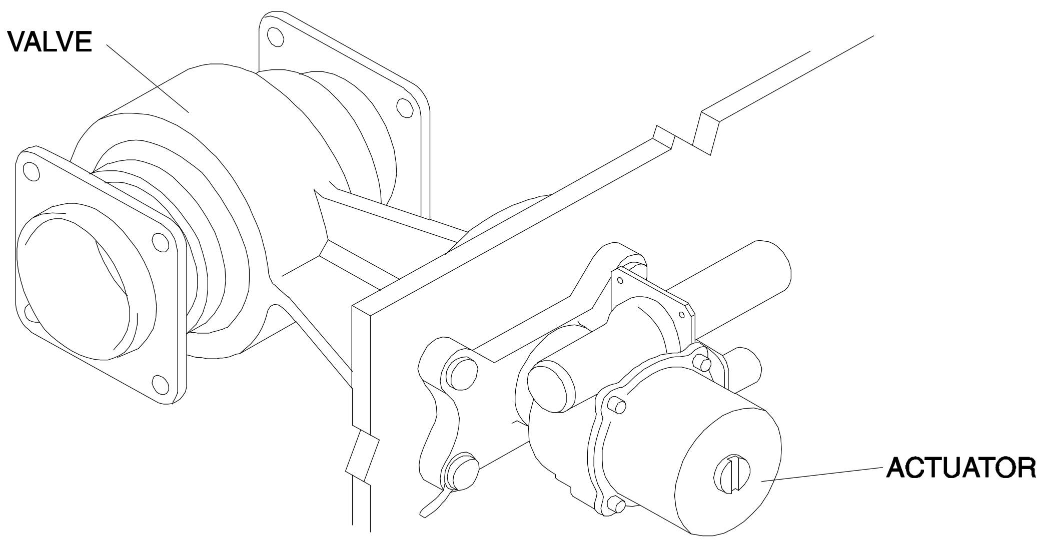
SPECIAL DESIGN

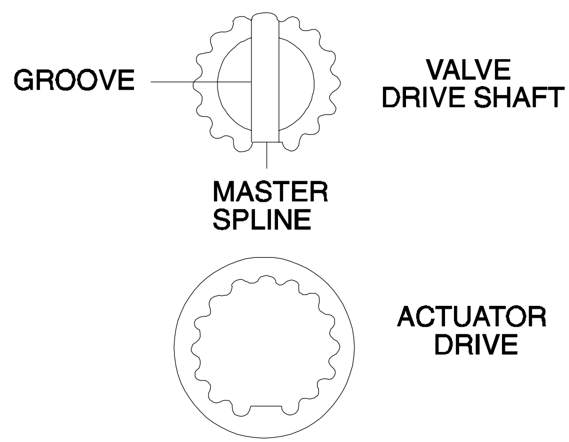
The Center Tank Inlet Restrictor Valve has 2 positions.
When the ball is in the open position, there is an unrestricted flow of fuel ; when closed, there is a restricted flow through two holes.





VALVE SECTION





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INLET VALVE ACTUATORS

FIN / ZONE

FIN : 500QU1(2) (outer tank actuators)
603QL1(2) (inner tank actuators)
501QU (center tank actuator)
515QU (CTIRV actuator)

Zone : 575 (675)
147 (148)

COMPONENT DESCRIPTION

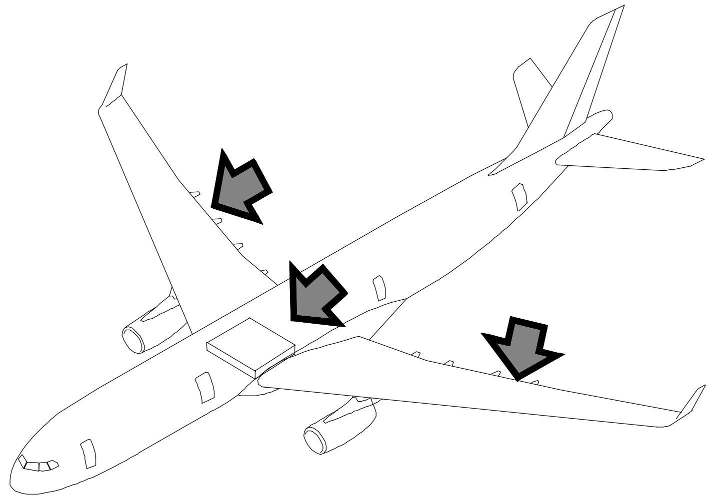
Each actuator has a body with a mounting flange. The body holds a 28 VDC electrical motor. This motor drives a gear which turns the inlet valve through 90 degrees.

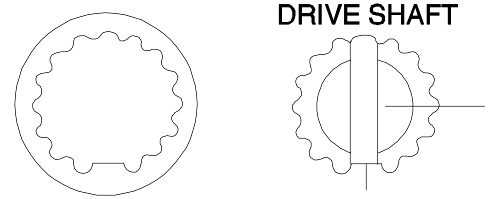
VISUAL INSPECTION

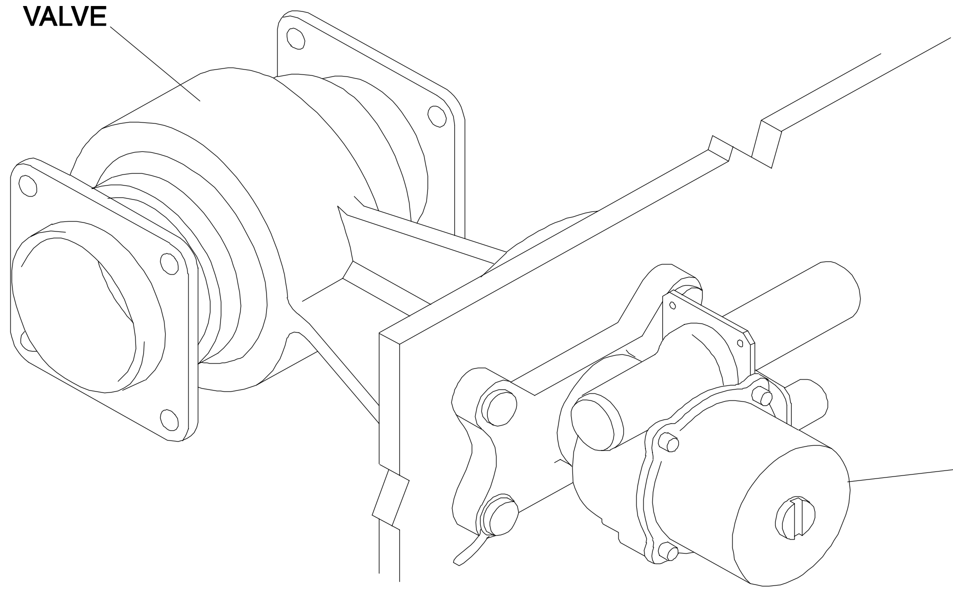
There is a mechanical indicator on the body to show the position of the actuator (open or shut).

INSTALLATION

The studs from the mounting flange of the inlet valve attach the actuator to the aircraft structure.







FQW4200 GE Metric

DEPRESSURIZING VALVE

FIN / ZONE

FIN : 5509QA

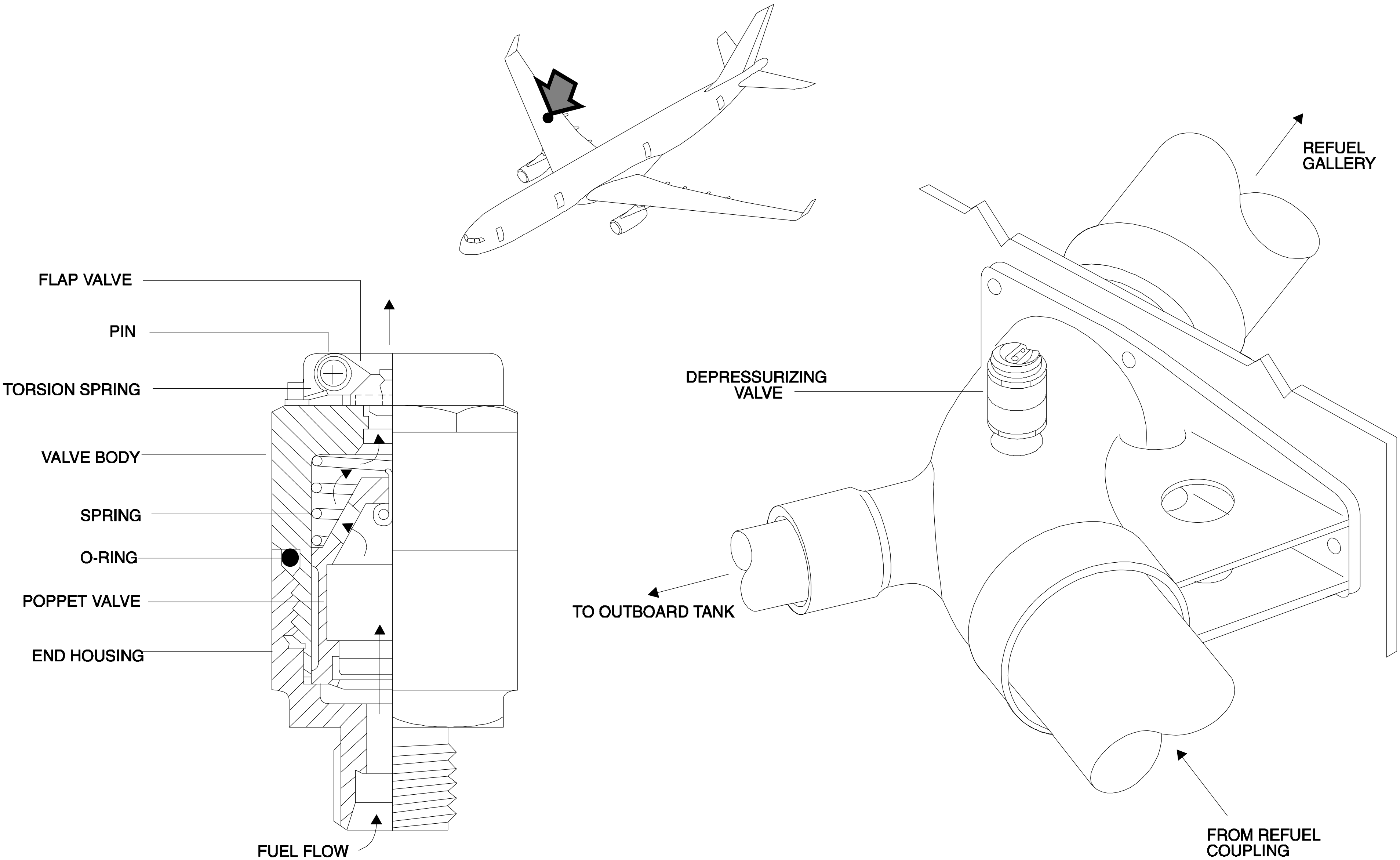
Zone : 640

COMPONENT DESCRIPTION

The primary components of the depressurizing valve are :
- the body,
- the end housing,
- the poppet valve and spring,
- the flap valve and a light torsion spring.

OPERATION

With no fuel pressure, the poppet valve is spring loaded open.
When the fuel pressure increases to 3 PSI, the poppet valve closes against the spring.
When the pressure decreases to less than 2 PSI, the spring reopens the poppet valve letting the remaining fuel pressure open the flap valve.
With no fuel pressure, the flap valve is spring loaded closed to prevent a fuel flow in the opposite direction.



FQW4200 GE Metric

RESTRICTOR VALVE

FIN / ZONE

FIN : 5506QA

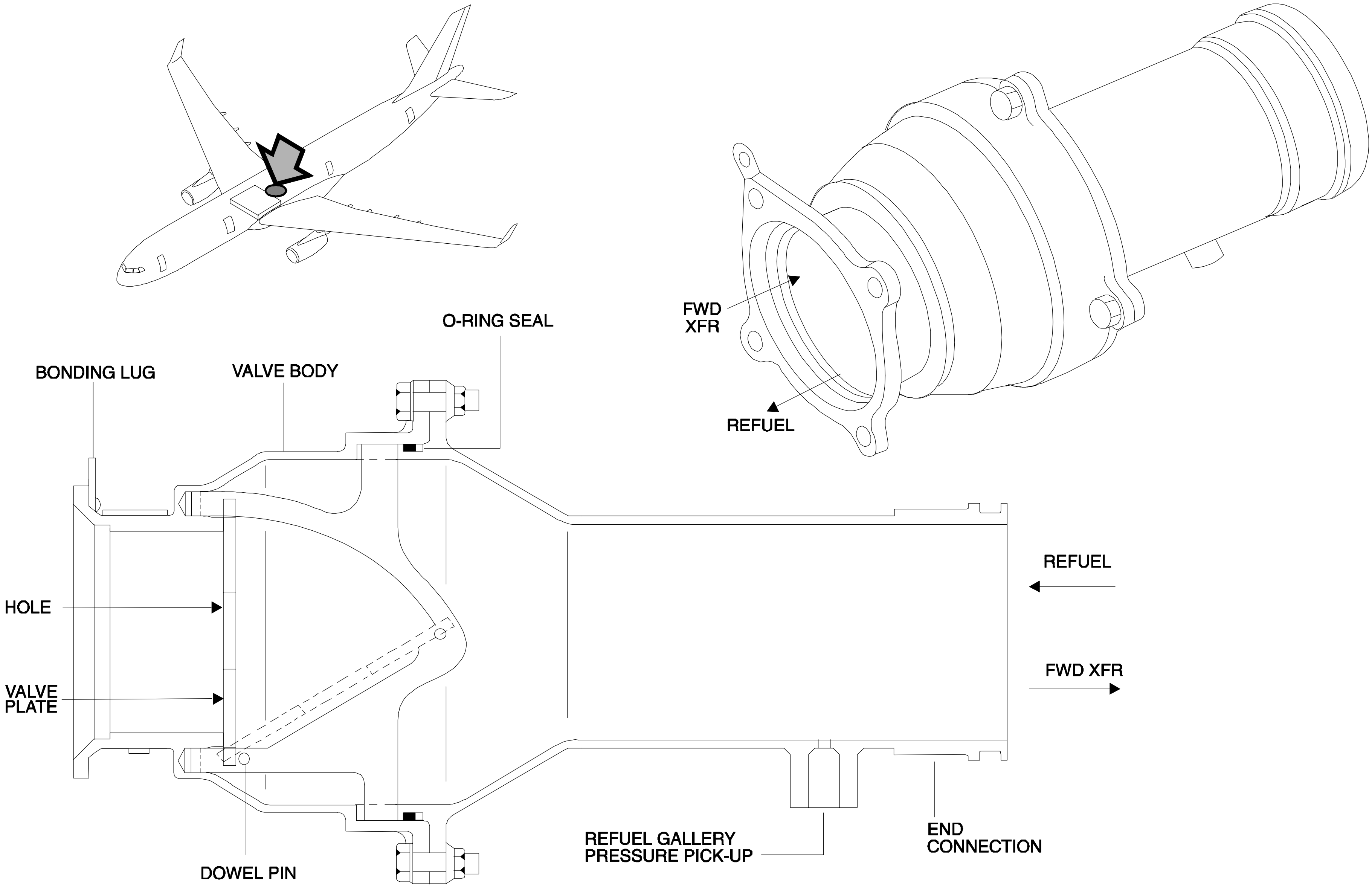
Zone : 141

COMPONENT DESCRIPTION

The primary components of the restrictor valve are :
- the valve body with its mounting flange,
- the end connection,
- the valve plate with a hole through the center.

OPERATION

In the body, the valve plate rotates around a dowel pin, its travel is limited by an internal guide.
When the fuel flows through the valve in the REFUEL direction, the valve plate moves to the closed position, limiting the fuel flow.
When the fuel pressure comes from the opposite direction, the valve plate opens.



FQW4200 GE Metric

REFUEL GALLERY LOW PRESSURE SWITCH

FIN / ZONE

FIN : 53QU

Zone : 147

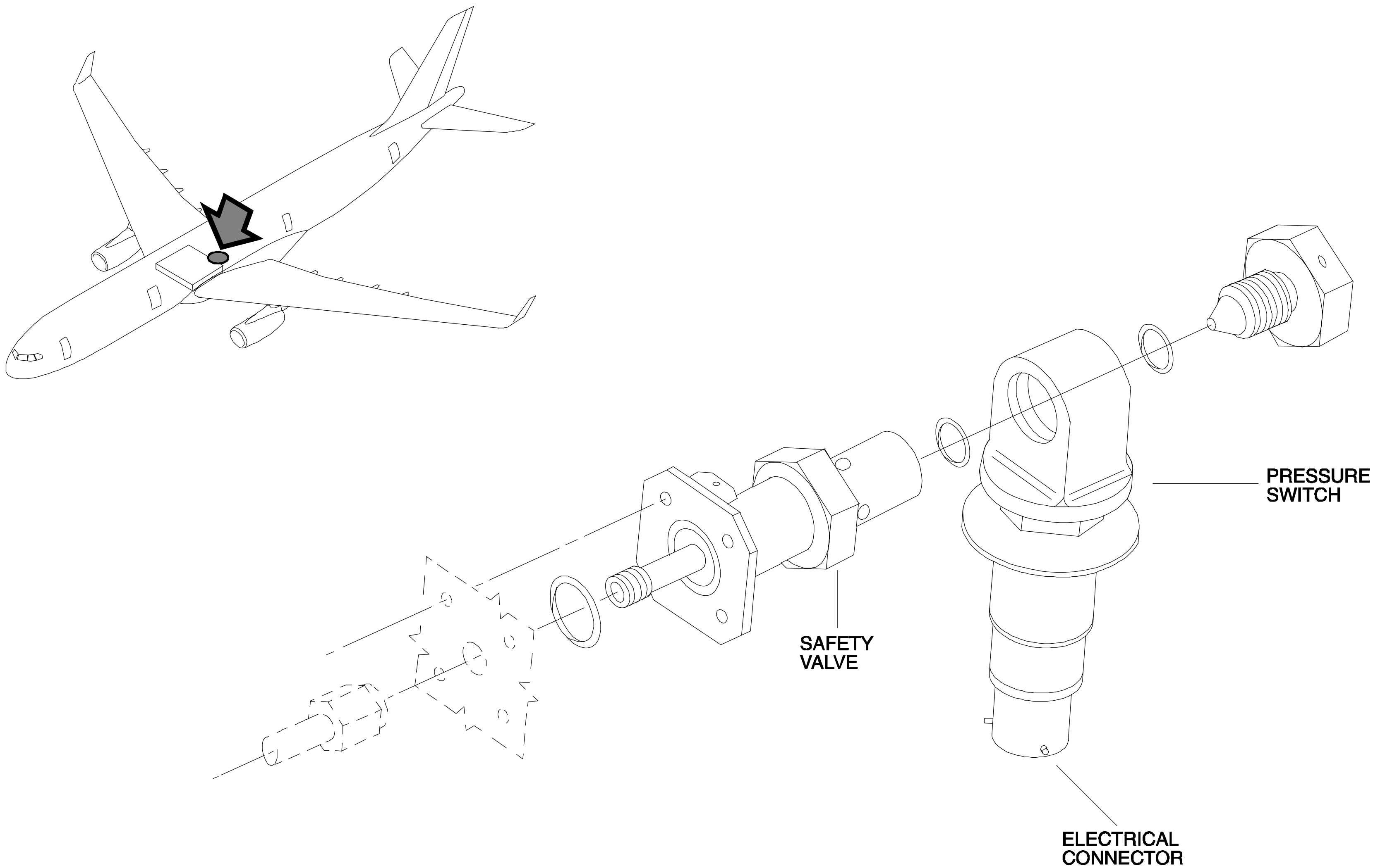
COMPONENT DESCRIPTION

The primary components of the pressure switch are the body and the safety valve adapter.
The body contains :
- a flexible diaphragm,
- a switch mechanism,
- an electrical microswitch.

The flexible diaphragm isolates the switch mechanism and the microswitch from the fuel.

OPERATION

When the fuel presssure increases, the flexible diaphragm moves to operate the switch mechanism which opens the contact of the microswitch.



FQW4200 GE Metric

DIFFUSERS

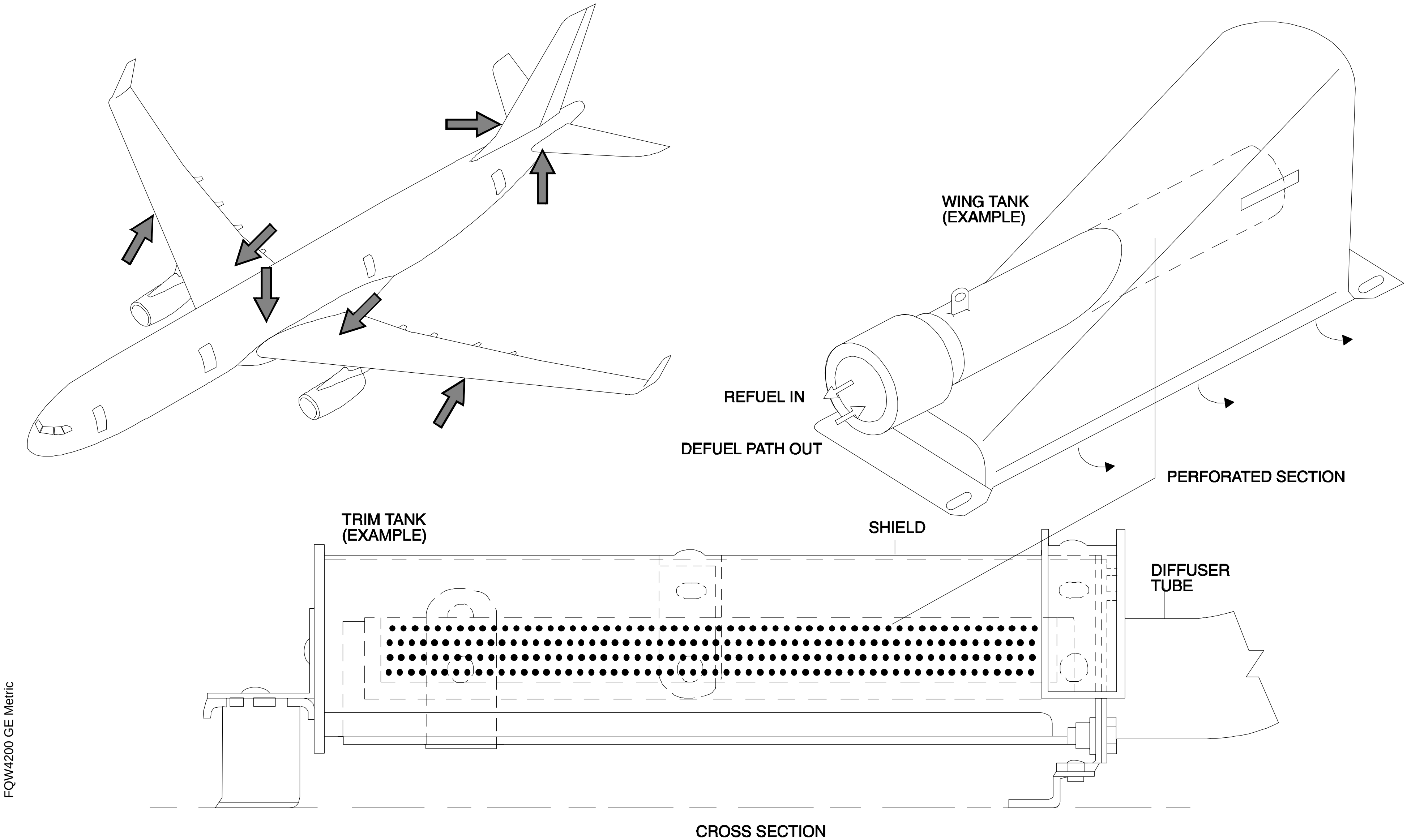
FIN / ZONE

FIN : -

Zone : 540 (640), 333 (343)

COMPONENT DESCRIPTION

The diffusers are of two different types : one for wing tanks and an other one for the trim tank.
The diffuser comprises a pipe with a baffle that goes into a trough.


WING TANK
(EXAMPLE)
REFUEL IN
DEFUEL PATH OUT
PERFORATED SECTION
TRIM TANK
(EXAMPLE)
SHIELD
DIFFUSER
TUBE
CROSS SECTION
FQW4200 GE Metric

FUEL JETTISON VALVES (OPTIONAL)

FIN / ZONE

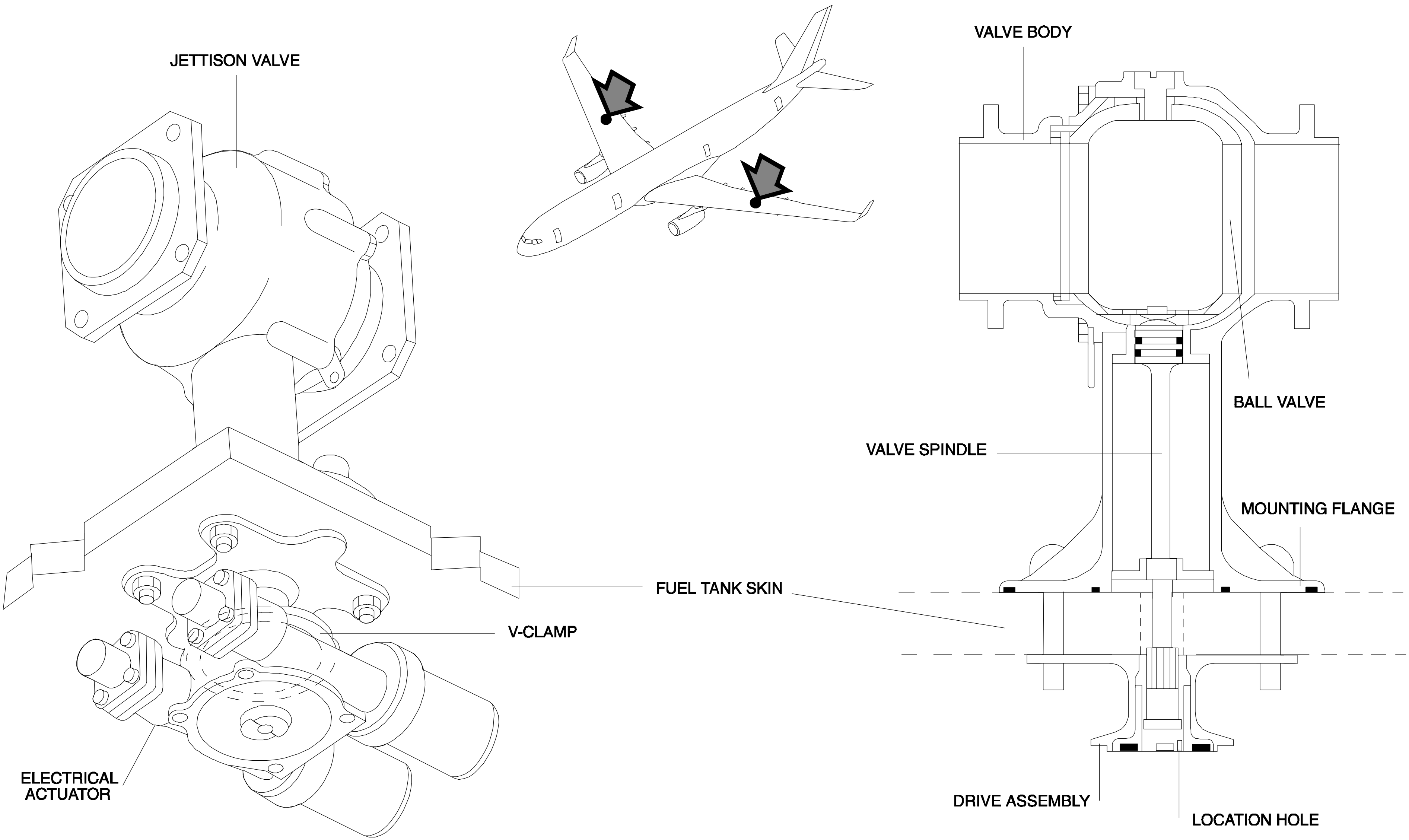
FIN : 5100QV1(2)

Zone : 540 (640)

COMPONENT DESCRIPTION

The primary components of the jettison valve are :
- the valve body with its mounting flange,
- the ball valve with its valve spindle,
- the drive assembly.

The ball valve, held in the body, is operated by a spindle and a drive assembly (connected to an electrical actuator). The spindle goes through the mounting flange and the fuel tank skin and ends with a masterspline (to make sure that the spindle is correctly engaged with the drive assembly).



FQW4200 GE Metric

FUEL JETTISON VALVE ACTUATORS (OPTIONAL)

FIN / ZONE

FIN : 100QV1(2)

Zone : 590 (690)

COMPONENT DESCRIPTION

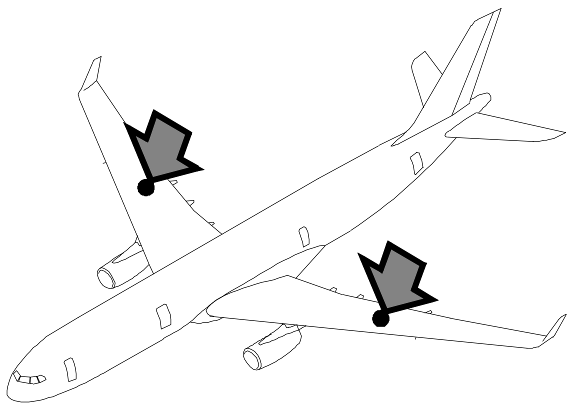
Each actuator has two electrical motors which operate the same differential gear to turn the ball valve through 90 degrees. Limit switches in the actuator control this movement and set the electrical circuit for the next operation.

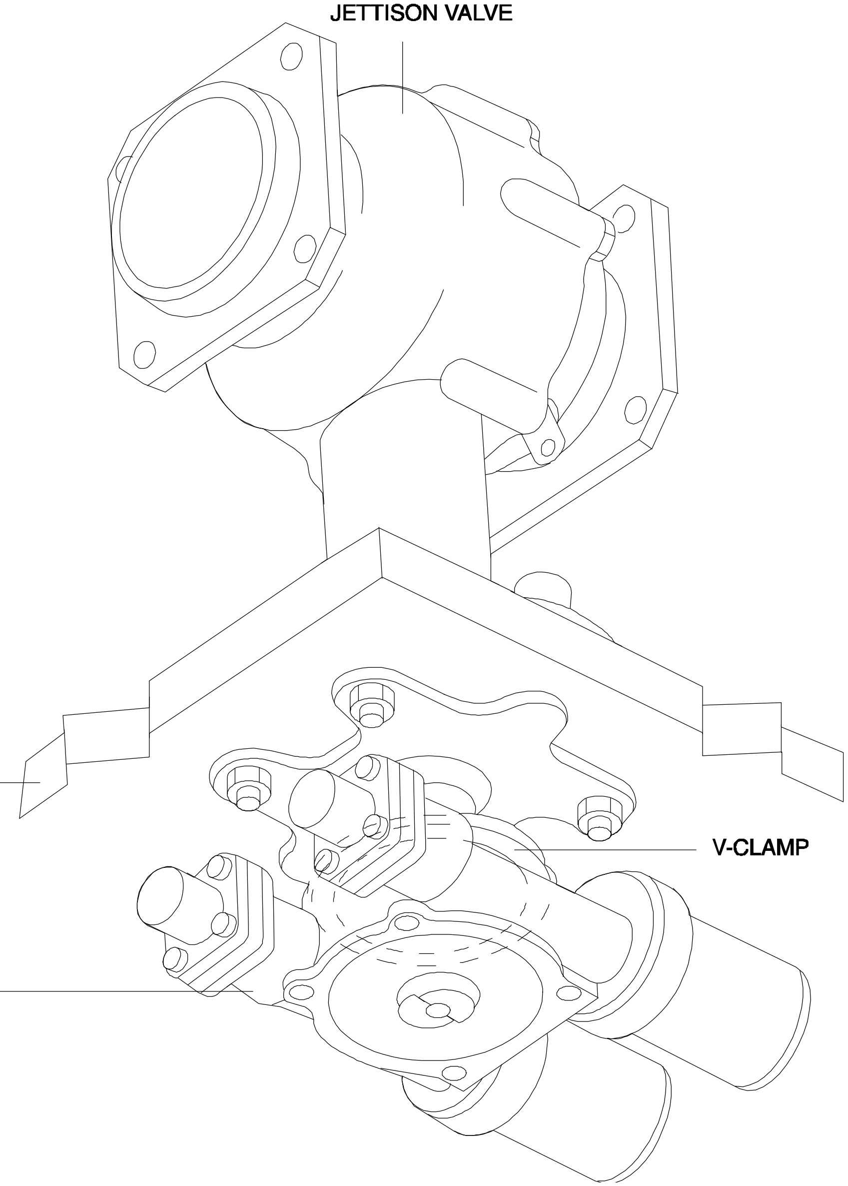
FAULT PROTECTION

If one of the two motors does not operate, the other motor can open or close the valve. The motors get their 28VDC power supply from two different sources.

INSTALLATION

A V-clamp attaches the actuator to the flange of the drive assembly. A location peg makes sure the actuator engages correctly.





FQW4200 GE Metric

STUDENT NOTES

FQW4200 GE Metric

REFUEL / DEFUEL COMPONENTS

Safety Precautions
Overwing Refuel Adaptor / Cap
Refuel / Defuel Coupling / Cap
Refuel / Defuel Control Panel

FQW4200 GE Metric

SAFETY PRECAUTIONS

Obey the fuel safety procedures.

Do not get your clothes soaked with fuel. Use the approved protective clothing when you go into a fuel tank.

Do not get A/C fuel in your mouth, in your eyes or on your skin for long periods of time (A/C fuel is poisonous).

Make sure that the landing gear safety locks and wheel chocks are in position.

Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.

Make sure you have fire fighting equipment available before you start any task on the fuel system.

Make sure that all circuits in maintenance are isolated before you supply electrical power to the A/C.

Use talcum powder procedure only on the external surfaces of the fuel tanks. This will prevent contamination of the fuel system.

Make sure that you ground the fuel tanker and the aircraft correctly. If you do not a dangerous electrical discharge can occur.

STUDENT NOTES

OVERWING REFUEL ADAPTER / CAP

FIN / ZONE

FIN : Adaptor 5507QA1(2)
Cap 5508QA1(2)
ZONE : 540(640)

COMPONENT DESCRIPTION

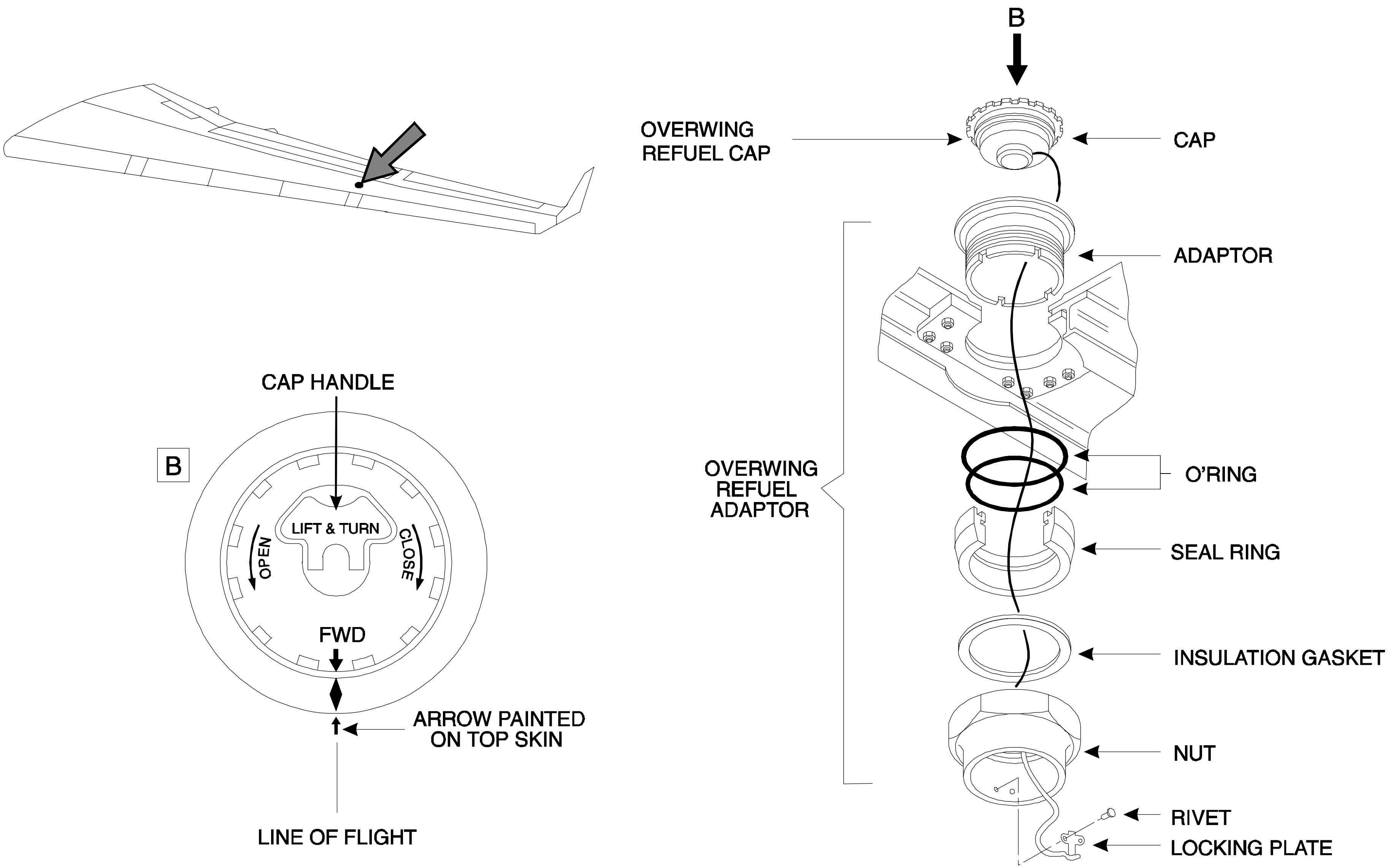
The overwing refuel adaptor is used as an alternative way of refueling.
The overwing refuel adaptor and its refuel cap are installed in the wing upper skin above the inner tank.
The primary components are :
- the adaptor and its nut,
- the locking plate and lanyard attached to the cap.

REFUEL

Refueling is manual and no special hose or connector is needed.
When the inner tanks are refueled, a ground transfer is necessary to refuel the other tanks, then the inner tanks need to be refueled again to get the correct fuel load.

CAUTION

Make sure that the arrow on the cap points to the mark painted on the wing upper skin and that the handle is in its housing, when the cap is closed.



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REFUEL / DEFUEL COUPLING / CAP

FIN / ZONE

FIN	: Refuel/defuel coupling	5502QA1(2)
	Coupling cap	5504 / 5503QA1(2)
ZONE	:	522(622)
ACCESS	:	522HB(622HB)

COMPONENT DESCRIPTION

The refuel/defuel coupling has a Y- shaped hollow body, with a circular housing in the center (where the isolation valve is installed). One end is attached to the front spar and the other end is fitted with two refuel adaptors.
Each adaptor contains :
- an inner and outer compression spring,
- a valve and its seal,
- a coupling ring,

It is closed by a cover cap secured by a lanyard.

CAUTION

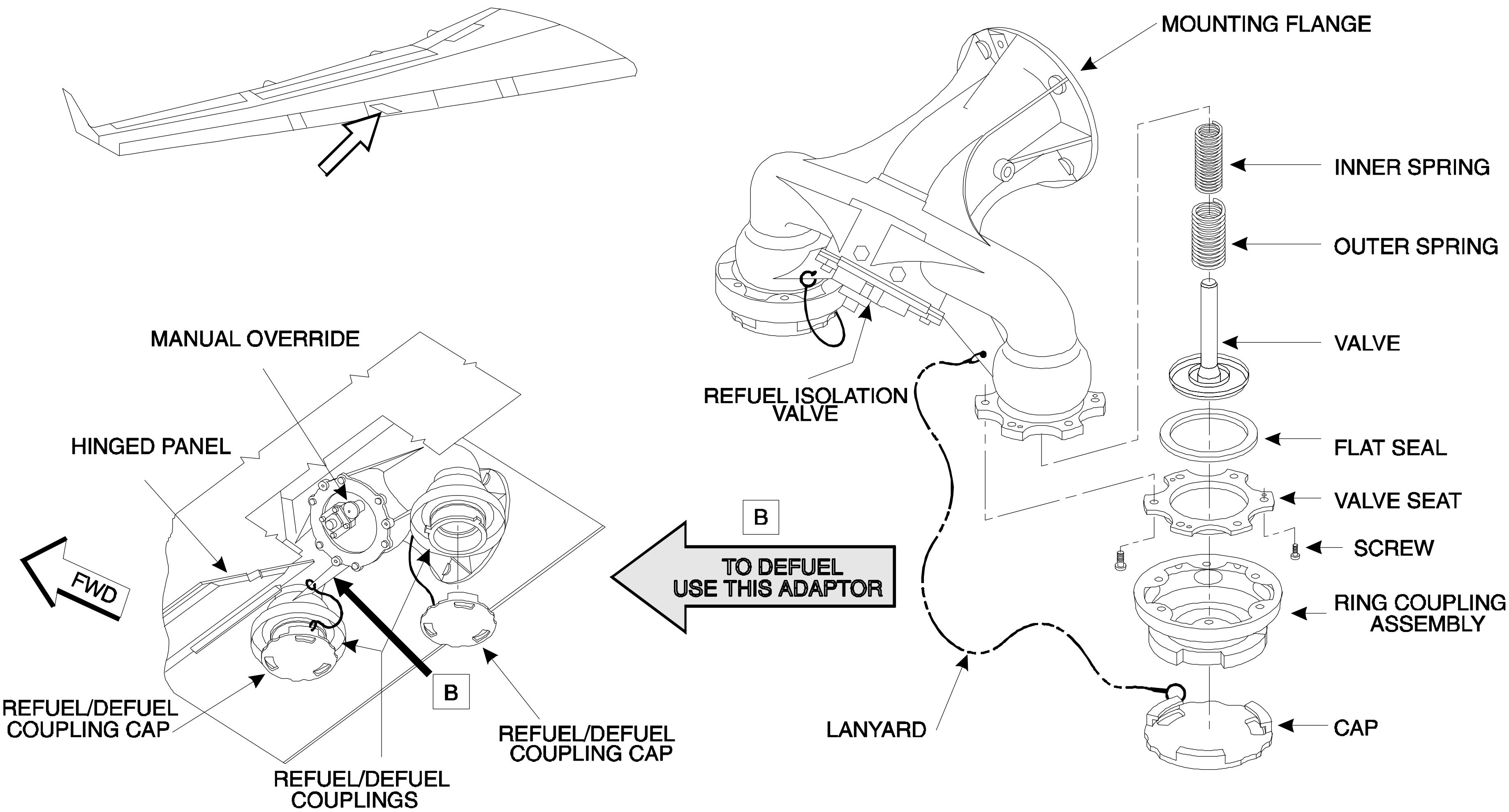
The A/C can be defueled through one or more of the refuel hose adaptors ; but when only one adaptor on a coupling is used, it must be the one identified "TO DEFUEL USE THIS ADAPTOR".

REFUEL/DEFUEL

The coupling enables automatic or manual refuel/defuel operation using the refuel/defuel control panel 990 VU.
Four hoses (of a standard type) can be connected to the A/C at the same time.

OPERATION

When the R/D coupling is not in use, spring pressure holds the valve against its seal. The cap, when closed, acts as a secondary seal to the coupling.
With the refuel hose connected to the coupling ring, the valve is forced off its seal when the operator turns the appropriate lever on the hose connector.



FQW4200 GE Metric

REFUEL / DEFUEL CONTROL PANEL

FIN / ZONE

VU : 990
ZONE : 540
ACCESS : 198DB

COMPONENT DESCRIPTION

The refuel/defuel panel controls the operation of :
- an automatic or manual pressure refuel,
- a pressure defuel,
- a suction defuel,
- ground transfers.

It comprises different switches, high level and overflow lights and tank quantity indicators.

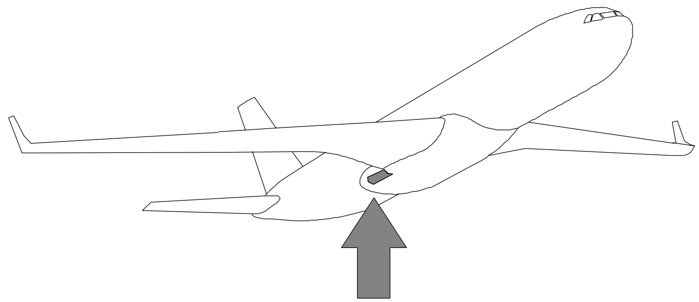
OPERATION

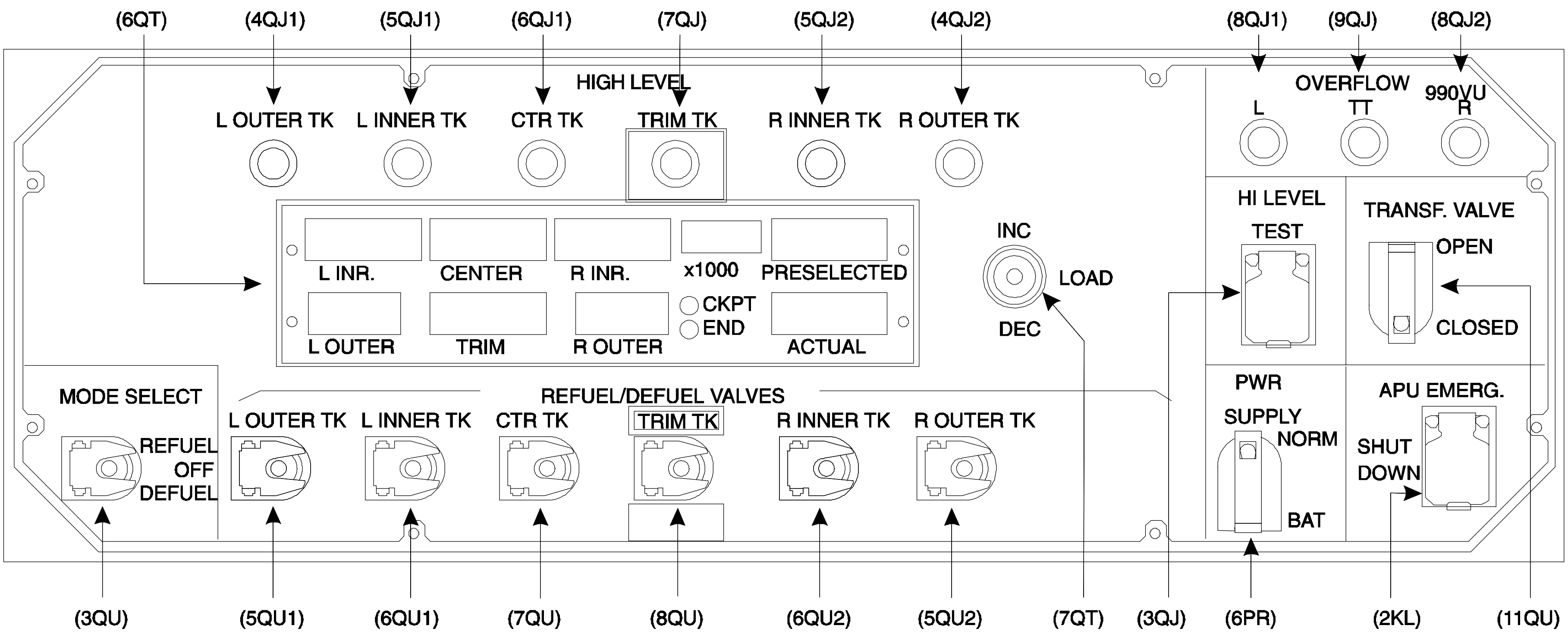
When the quick-release door 198 DB opens, it operates a micro switch. This micro switch supplies a ground to a relay which :
- sends a signal to the FCMS,
- supplies the primary ground for the refuel/defuel electrical circuits,
- connects a 28 VDC supply to the panel lights.

Then, the operator can perform the desired operation.

CAUTION

To fill the fuel tanks to their maximum capacity, the A/C must be at a ground attitude of less than 2 degrees,





FQW4200 GE Metric

STUDENT NOTES

FUEL QUANTITY AND TEMPERATURE SENSING

General
F.Q.I.
Probes
Temperature Sensor
Measurement
Quantity Indication
Accuracy
Failures

GENERAL

The FCMCs receive input data from:

- Quantity probes
- Compensators
- Temperature sensors
- Densitometers.

The FCMCs continuously calculate the fuel repartition in the aircraft in order to control the necessary fuel transfer.

F.Q.I.

The FCMS has full control of the Fuel Quantity Indicating system.

The FQI function calculates the fuel quantity comprised between unusable fuel and overflow. Unusable fuel is 0.3 % of any tank (cell) quantity; whereas overflow level is at about 99 % of total internal tank volume.

PROBES

In each tank or cell, probes are divided into two groups (A and B) and their data is sent, respectively, to FCMC1 and 2.

The capacitance value of each probe increases in proportion to the fuel level. Compensator probes are positioned to ensure that they are immersed in fuel most of the time.

TEMPERATURE SENSOR

The Temperature sensors are positioned to ensure that they are immersed in fuel for most of the time. The FCMS measures their electrical resistance, which is proportional to the fuel temperature.

Temperature data is equally distributed between the two FCMCs.
Within the temperature envelope of -65 to 85°C, the accuracy is +/- 1 %.

MEASUREMENT

To calculate the fuel quantity, the FCMCs use the fuel probe data plus the densitometer data, and the fuel tank geometry stored in their memory.
Each FCMC interfaces with the Quantity probes of its group, two Temperature sensors and one Densitometer.

This data is converted into ARINC outputs by each Signal Conditioning board and sent to all Command and Monitor Processors. Therefore each FCMC receives all of the probe data.

QUANTITY INDICATION

The fuel quantity data controls some automatic functions and is transmitted to the ECAM.

The 300 liters of fuel trapped in the Refuel Gallery and in the Trim Pipe is ungauged but included in the FOB display. This fuel will be included in the tank display when it drains.

ACCURACY

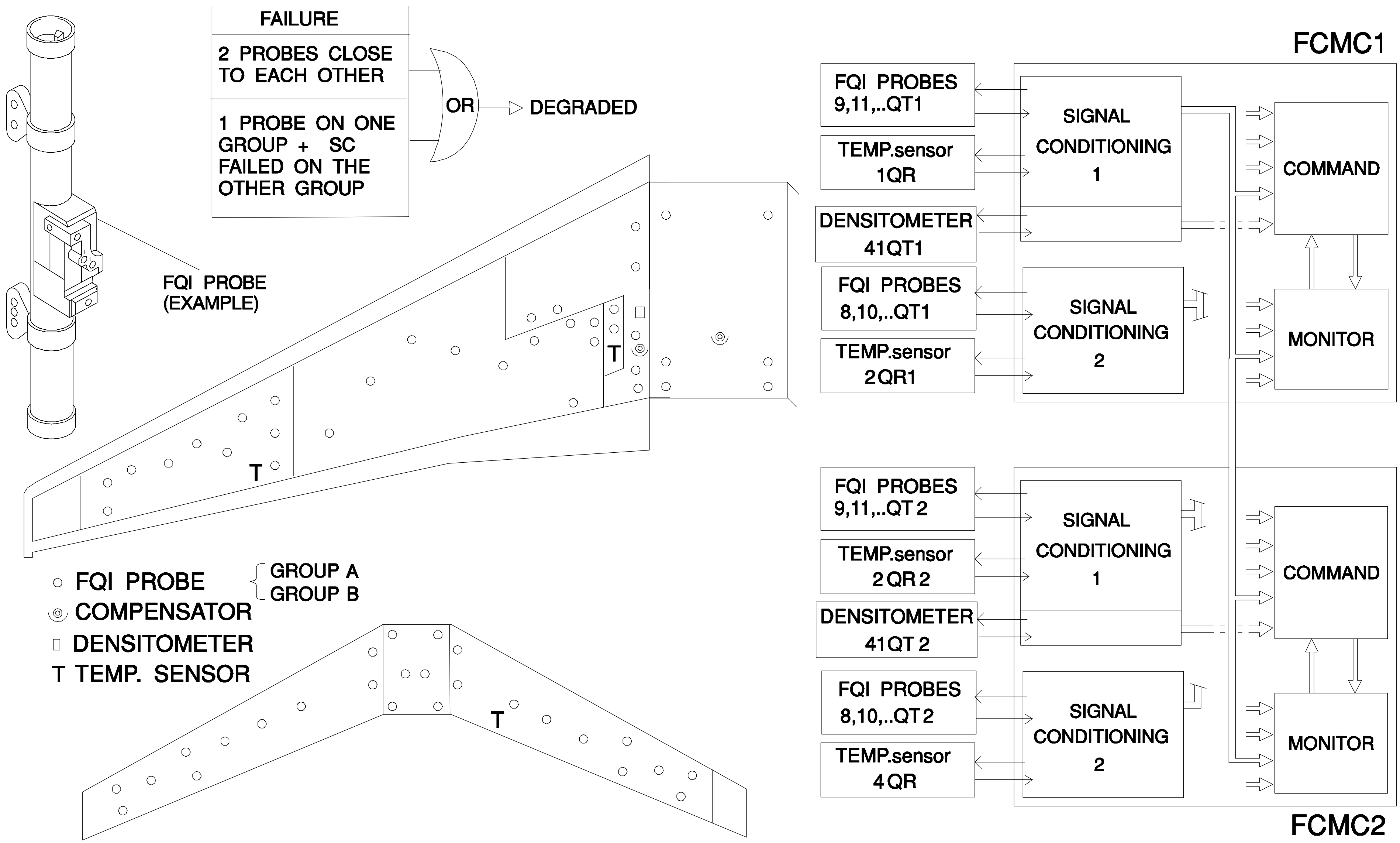
On the ground, the Fuel Quantity Indicating system is accurate to +/- 0.5 % of total capacity plus 0.5 % of actual Fuel On Board.

In flight, during all effective attitudes, the FQI system is accurate to +/- 0.3 % of total capacity plus 0.95 % of actual FOB (effective attitude = aircraft attitude + acceleration effects).

FAILURES

When the accuracy is between 2 and 4 times worse than usual, the fuel quantity indications are given in degraded mode; after, the indications for that tank are replaced by amber crosses.

There is no deterioration of fuel quantity data if one Processor or one Signal Conditioning fails because each FCMC receives all of the probe data.



FQW4200 GE Metric

STUDENT NOTES:

LEVEL SENSING

General
Level Sensor
FCMS Function
High Level
Low Level
Overflow
High Level TEST

GENERAL

Each FCMC uses all Level Sensing data for command computation.
For each FCMC applicable Level sensing area, one probe is connected to FCMC 1 and the other to FCMC 2. FCMC 1(or 2) receives the opposite FCMC level sensing status by cross-wired discretes.

LEVEL SENSOR

The level sensor is a moulded probe with a thermistor. The FCMS measures the difference in resistance of the thermistor to find when the probe is in the fuel or out of the fuel.
All High Level sensors, and Surge Overflow sensors are arranged to fail predominantly to the " WET " state. All Low Level sensors FAIL STATE is "DRY".

FCMS FUNCTION

The level sensing operates independently inside the FCMC. Each FCMC has an independent Level sensing board.
Each FCMC interfaces with a maximum of 14 level sensing channels. Each level sensing channel delivers a voltage to its DRY/WET Comparator and its Monitoring Comparator.
The Dry/Wet Comparator status can operate with a Time Delay.
The Monitoring Comparator detects short or open circuit of the thermistor.
If a CPU(Processor) fails, the Level Sensing channel continues to operate.

HIGH LEVEL

The Outer, Inner and Trim fuel tanks each have a pair of Hi-level sensors which are installed at the same height in the tank. Each sensor independently sends fuel level data to the FCMS.
Each sensor of a pair sends its signal to a different FCMC.
When the 2 High Level sensors in a fuel tank become wet, the FCMS closes the related tank Inlet valve.
The center tank has two Hi-level sensors but at different heights.
During refueling, when the first sensor becomes wet, the FCMS closes the center tank inlet restrictor valve. When the second sensor becomes wet, the FCMS closes the center tank inlet valve.

LOW LEVEL

When the 2 Low Level sensors in one Inner Tank are dry for more than 30 seconds, the FCMS sends a warning to the ECAM.
Inner Tank Low Level Quantity = 1 600 Kg (3 600 Lbs)

When the Center Tank Low Level sensor has been dry for more than 3 minutes, the Transfer Pumps receive a signal to stop.
Note that the Center Tank unusable fuel is 130 liters. There is a 10 sec. time delay to start the Transfer Pumps, when the level sensor becomes wet again.

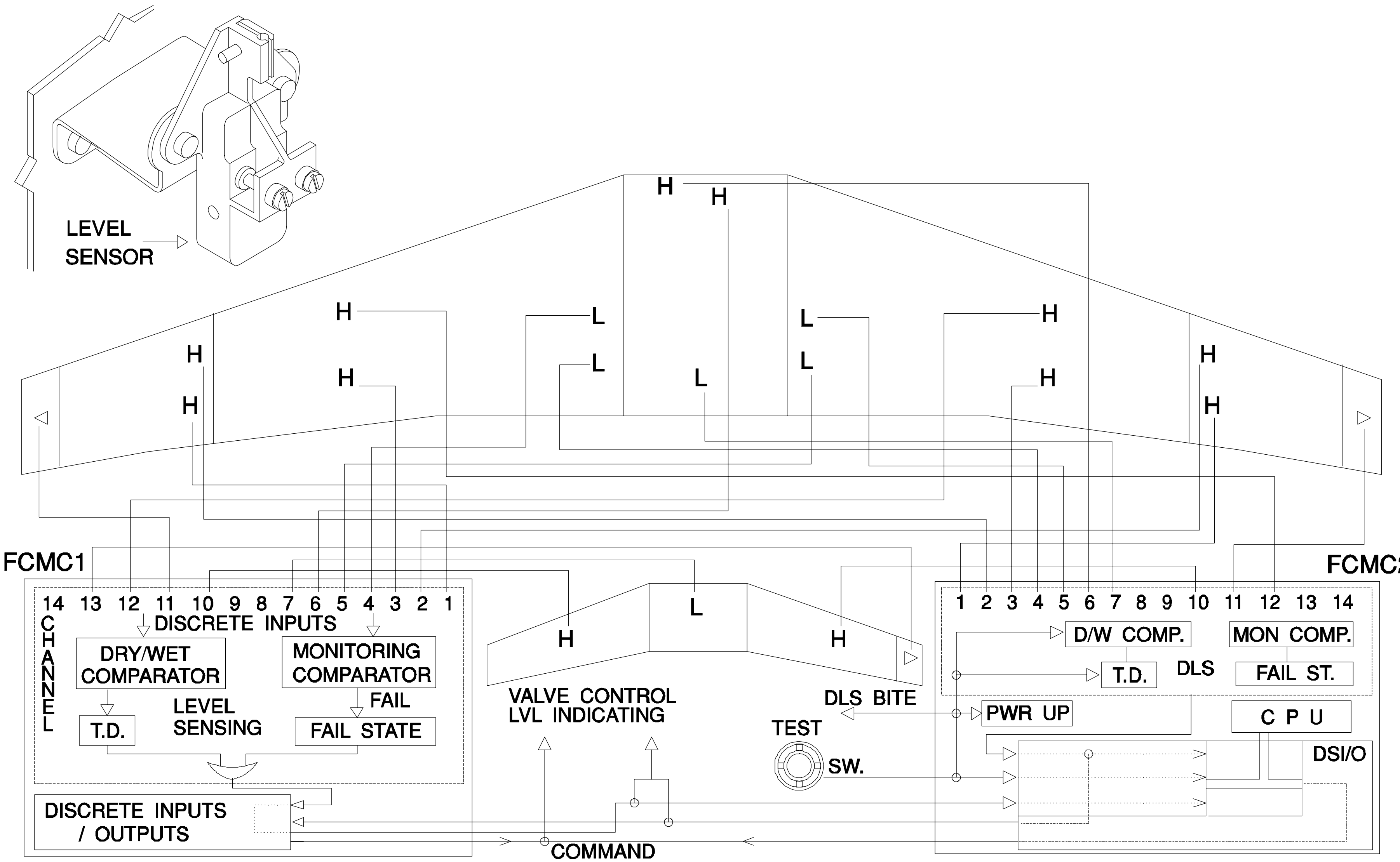
The Low Level sensor in the Trim Tank makes sure that the Trim Tank does not drain and prevents air entering the trim pipe.
When the Low Level sensor is dry, the FCMS closes the Trim Tank Isolation Valve. (Trim Tank unusable fuel is 25 l).

OVERFLOW

Usual operation of the Tank Venting System does not cause an Overflow.
The Overflow sensor may become wet during refueling, the FCMS

- closes all open Inlet Valves
- closes the Refuel Isolation Valves
- sends an ECAM warning.

A wing Overflow sensor becomes wet when there are 450 liters in the Surge Tank.
If the Overflow is wet, the warning is sent after a 30 sec. delay. This time delay is inhibited during Refuel.



FQW4200 GE Metric

HIGH LEVEL TEST

A TEST is provided to check the function of the High Level shut-off and indicating system of all tanks prior to refueling.
The Test function forces High Level and Overflow level detection circuits to invert the status of each sensor: Dry or Wet. It illuminates or extinguishes the appropriate level light on the Refuel panel.
The FCMC software (CPU processing) also inverts the Level sense data in order to read the true level state of each tank.
By A/C wiring interlock, only Open Inlet Valves change state.
During initial Power-up test the Master FCMC also inverts each level sensing channel for BITE purposes.
The slave FCMC is signalled by a dedicated DLS BITE discrete.

STUDENT NOTES:

STUDENT NOTES

FCMC INTERNAL INTERFACES

Discrete Inputs
Discrete Outputs
ARINC Outputs

DISCRETE INPUTS

For each pump, there are three signals.
Each valve inputs 2 signals :

- open / not open,
- shut / not shut.

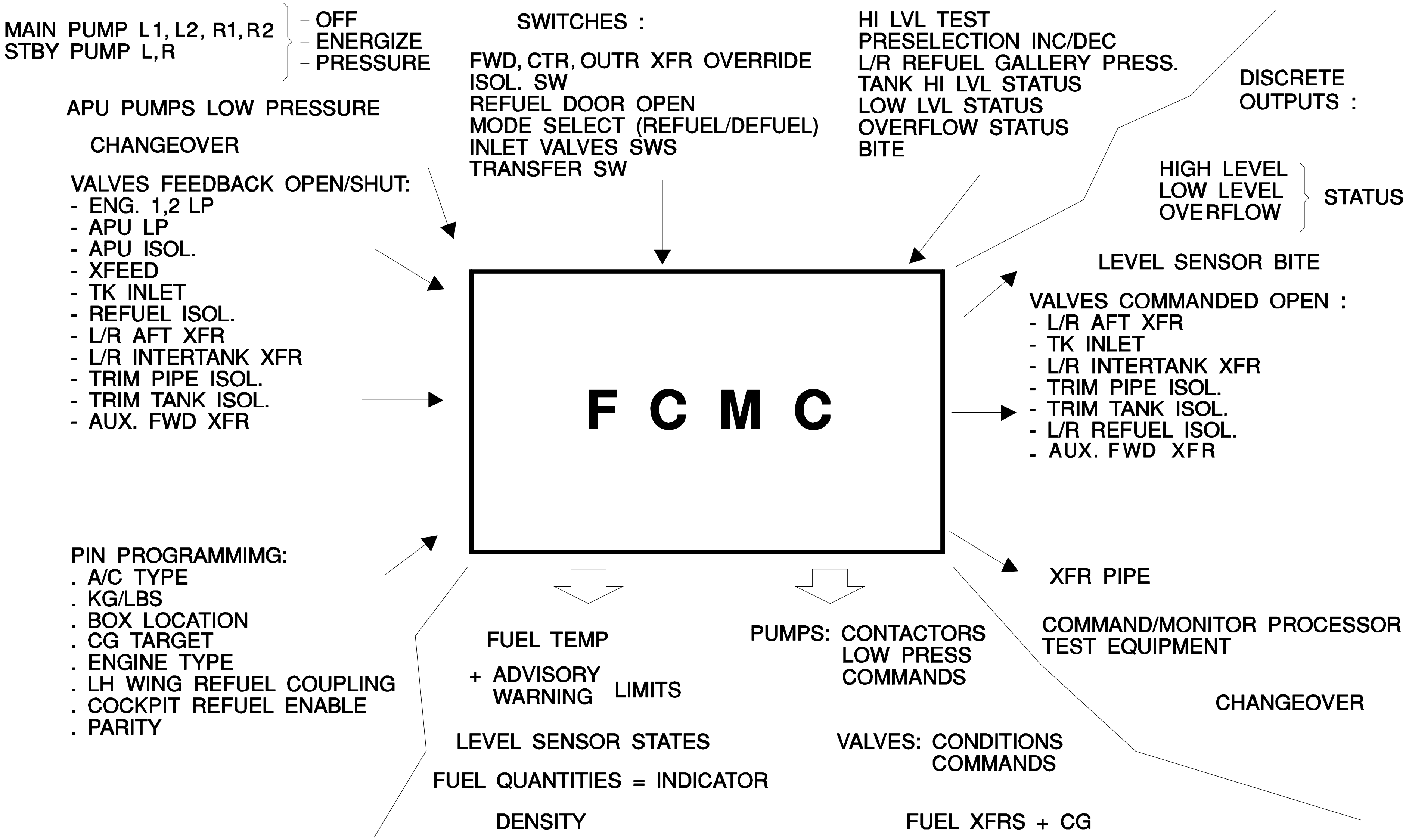
Switch orders are sent to the FCMC, as well as the status of the system.

DISCRETE OUTPUTS

The FCMCs send output discrete signals of level status and command signals to the valves.

ARINC OUTPUTS

These are ARINC output signals.



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STUDENT NOTES

FCMC EXTERNAL INTERFACES

Centralized Maintenance Computer (CMC)
Flight Management Guidance and Envelope Computer (FMGEC)
Air Data and Inertial Reference Unit (ADIRU)
Flight Control Data Concentrator (FCDC)
Flight Warning Computer (FWC)
Display Management Computer (DMC)
Data Management Unit (DMU) (option)
Slat Flap Control Computer (SFCC)
Landing Gear Control and Interface Unit (LGCIU)
Electronic Control Box (ECB)

CENTRALIZED MAINTENANCE COMPUTER (CMC)

The Centralized Maintenance System is in constant relation with all aircraft systems. Each FCMC is only connected to Centralized Maintenance Computer 1, although on separate ARINC 429 buses.

However, if CMC 1 fails, data will be received from CMC 2 via CMC 1 and the source will be transparent to the FCMS.

The ARINC inputs from the CMCs are the Universal Time Correlation, Flight Phase, Aircraft Configuration, Date and Aircraft Identification.
ARINC outputs to the CMCs are LRU Identification and Maintenance Information.

FLIGHT MANAGEMENT GUIDANCE AND ENVELOPE COMPUTER (FMGEC)

The Auto Flight System sends ARINC data. Each FMGEC sends a discrete input of an Aft CG Target Forward signal.

The FMGEC sends the Zero Fuel Weight, Aircraft Gross Weight, Aircraft Longitudinal Center of Gravity, Zero Fuel Center of Gravity, Preselected Fuel Quantity and remaining time to destination.

AIR DATA AND INERTIAL REFERENCE UNIT (ADIRU)

The Air Data and Inertial Reference Unit transmits altitude and accelerations by ARINC busses.

The Air Data and Inertial Reference Unit transmits the Barometric Altitude, the Longitudinal, Lateral and Normal Accelerations.

FLIGHT CONTROL DATA CONCENTRATOR (FCDC)

The Flight Control Data Concentrators send the Horizontal Tailplane Angle data.

FLIGHT WARNING COMPUTER (FWC)

Fuel System warnings are sent through ARINC busses to the Flight Warning Computers.

DISPLAY MANAGEMENT COMPUTER (DMC)

ECAM FUEL Indications are displayed through the Display Management Computers.

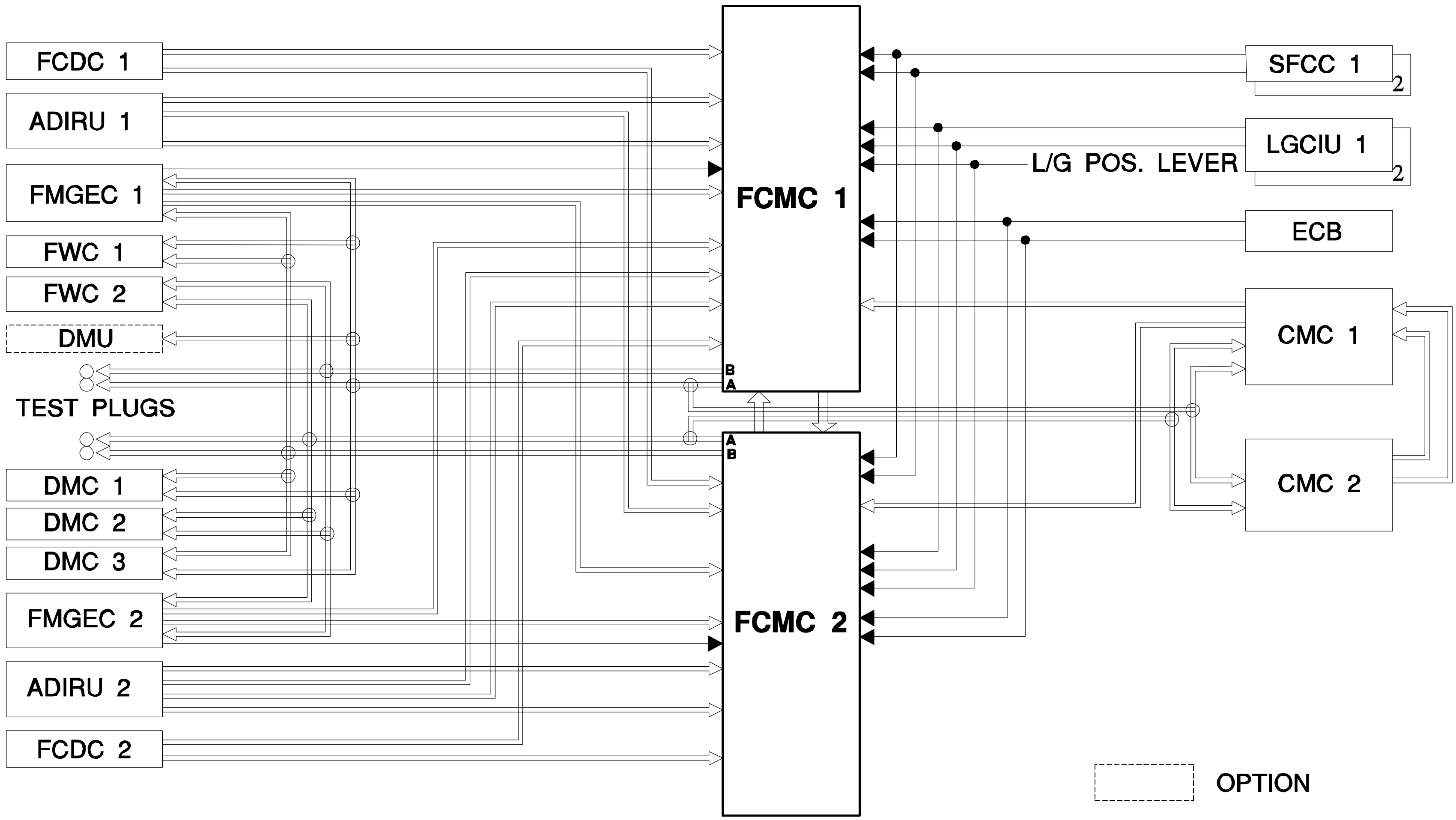
DATA MANAGEMENT UNIT (DMU) (OPTION)

Fuel parameters are transmitted to the Data Management Unit.

SLAT FLAP CONTROL COMPUTER (SFCC)

Each Slat Flap Control Computer inputs two discrete signals.

The two SFCC input signals are the Slat/Flap Lever Position (retracted or not) and Slats extended or not.



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LANDING GEAR CONTROL AND INTERFACE UNIT (LGCIU)

The two Landing Gear Control and Interface Units transmit two discrete signals. A third discrete input comes from the Landing Gear Position Lever.

The LGCIU inputs are :

- LH Main Landing Gear locked down,
- Nose Gear compressed.

ELECTRONIC CONTROL BOX (ECB)

An APU fuel command discrete signal is received from the Electronic Control Box when fuel is required. The FCMCs receive APU Pumps Low Pressure signals.

FUEL MANAGEMENT AND INDICATING SYSTEM COMPONENTS

Safety Precautions
Fuel Quantity Indicator (FQI) Probes
FQI Compensator Probes
FQI Densitometers
FQI Indicator
Manual Magnetic Indicators
Attitude Monitor
Tank Level Sensors
Fuel Temperature Sensors
Fuel Control and Monitoring Computer (FCMC)

SAFETY PRECAUTIONS

Obey the fuel safety procedures.

Do not get your clothes soaked with fuel.

Use the approved protective clothing when you go into a fuel tank.

Do not get aircraft fuel in your mouth, in your eyes or on your skin for long periods of time (aircraft fuel is poisonous).

Make sure that the landing gear safety locks and wheel chocks are in position.

Make sure you put a warning notice in the cockpit to advise not to operate the flight controls.

Make sure you have fire fighting equipment available before you start any task on the fuel system.

Make sure that all circuits in maintenance are isolated before you supply electrical power to the aircraft.

Use the talcum powder procedure only on the external surfaces of the fuel tanks.
This will prevent contamination of the fuel system.

Make sure that you ground the fuel tanker and the aircraft correctly.
If you do not a dangerous electrical discharge can occur.

STUDENT NOTES

FUEL QUANTITY INDICATOR PROBES

FIN/ZONE

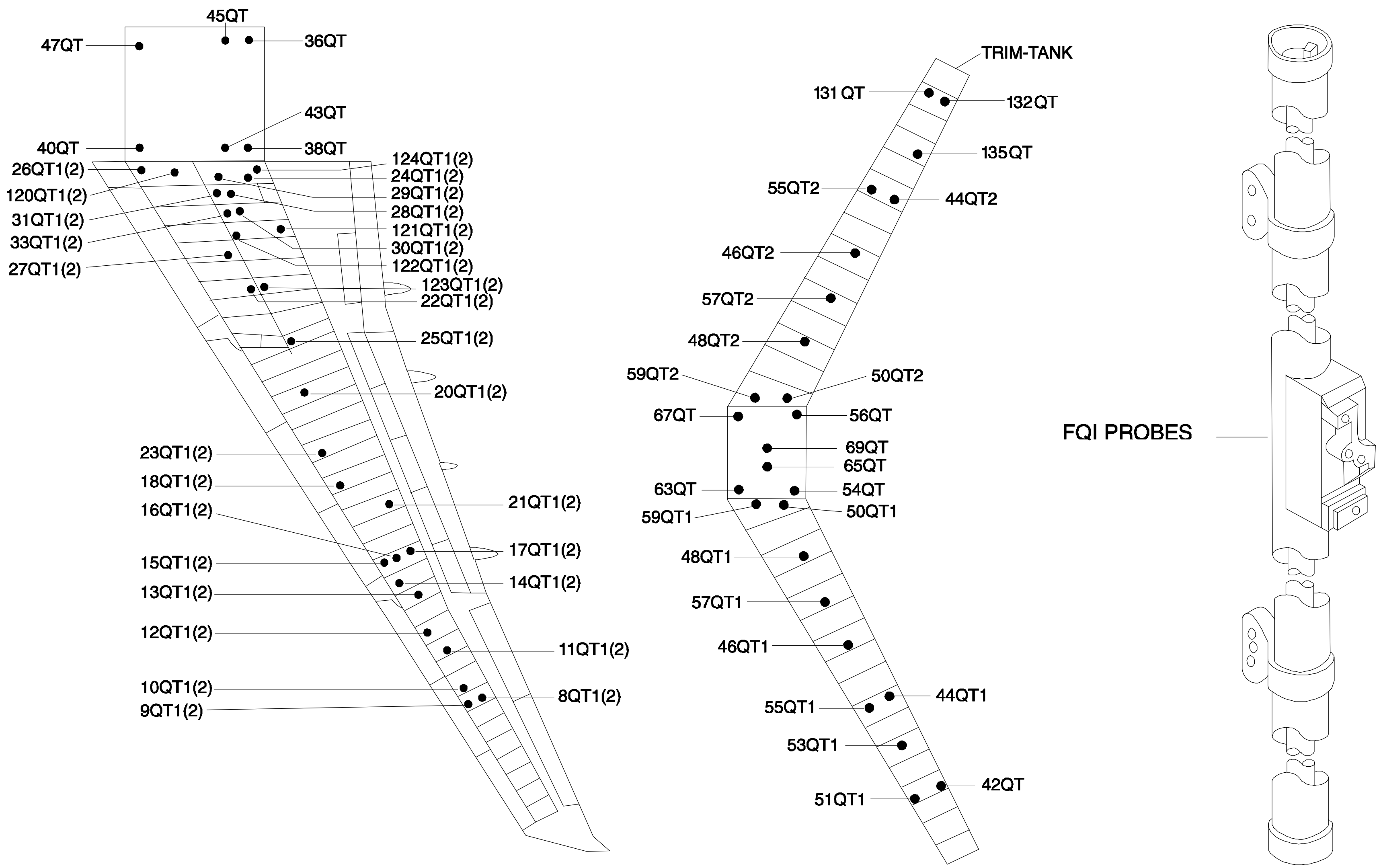
FIN	36QT 38QT 40QT 43QT 45QT 47QT	56QT 63QT 65QT 67QT 69QT	42QT 44QT1(2) 46QT1(2) 48QT1(2) 50QT1(2) 51QT 53QT1 54QT 55QT1(2) 57QT1(2) 59QT1(2) 131QT 132QT 135QT	8QT1(2),9QT1(2),10QT1(2) 11QT1(2),12QT1(2),13QT1(2) 14QT1(2),15QT1(2),16QT1(2) 17QT1(2),18QT1(2),20QT1(2) 21QT1(2),22QT1(2),23QT1(2) 24QT1(2),25QT1(2),26QT1(2) 27QT1(2),28QT1(2),29QT1(2) 30QT1(2),31QT1(2),33QT1(2) 120QT1(2),121QT1(2) 122QT1(2),123QT1(2) 124QT1
ZONE	141	319	333(343)	540(640)

DESCRIPTION

The probe is made of two concentric aluminium tubes, between which fuel can freely flow. The probe is held in position by two ajustable mounting brackets.

FUNCTIONS

The probe is of the capacitance type, proportional to the depth of fuel in the tank. When the probe is dry, the capacitance value is low, but as the fuel moves up the probe, the capacitance value increases.



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FQI COMPENSATOR PROBES

FIN/ZONE

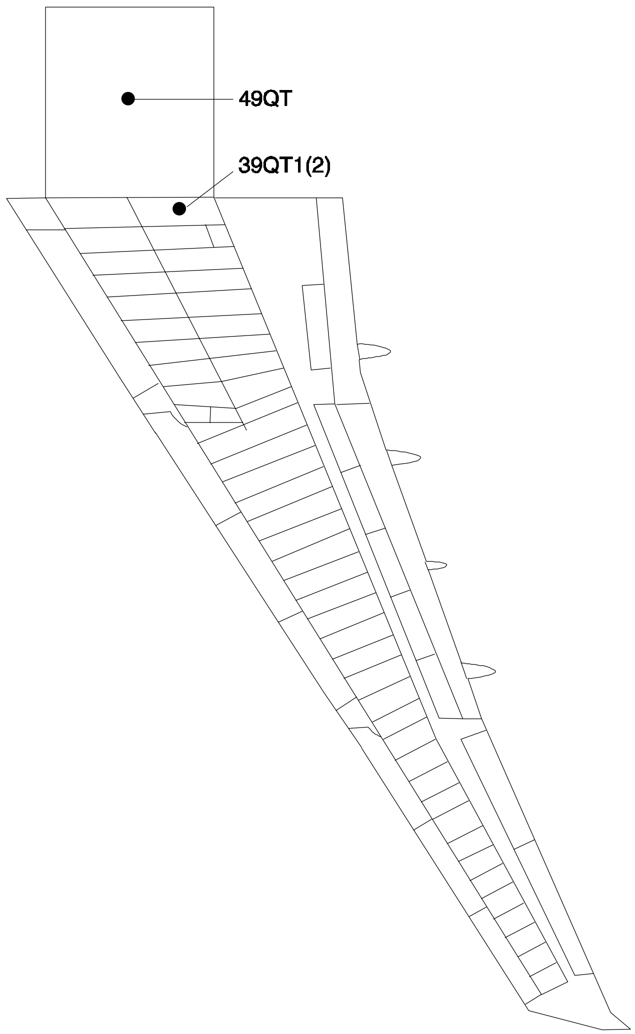
FIN : 39QT1(2) / 49QT
Zone : 541(641) / 141

DESCRIPTION

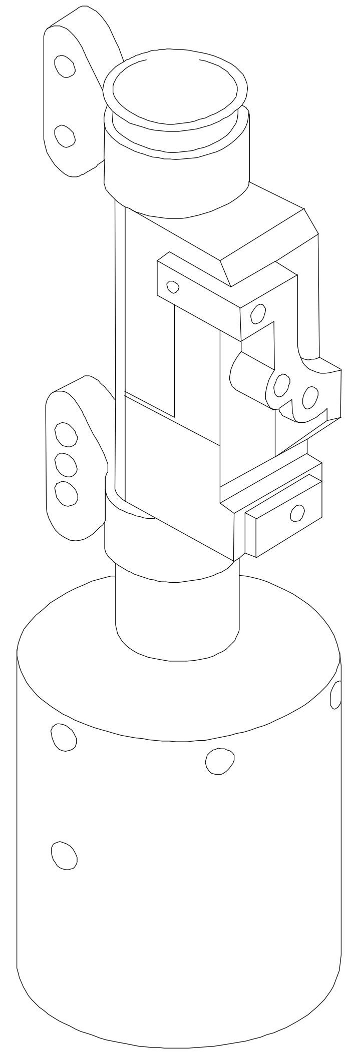
The probe is made of two concentric aluminium tubes enclosed in a cylinder in which fuel can freely enter.
The probe is held in position by two fixed mounting brackets.

FUNCTION

The FQI Compensator probe operates correctly only when it is fully immersed in fuel.
The probe is of capacitance type, proportional to the dielectric constant of the fuel.



FQI COMPENSATOR PROBE



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FQI DENSITOMETERS

FIN/ZONE

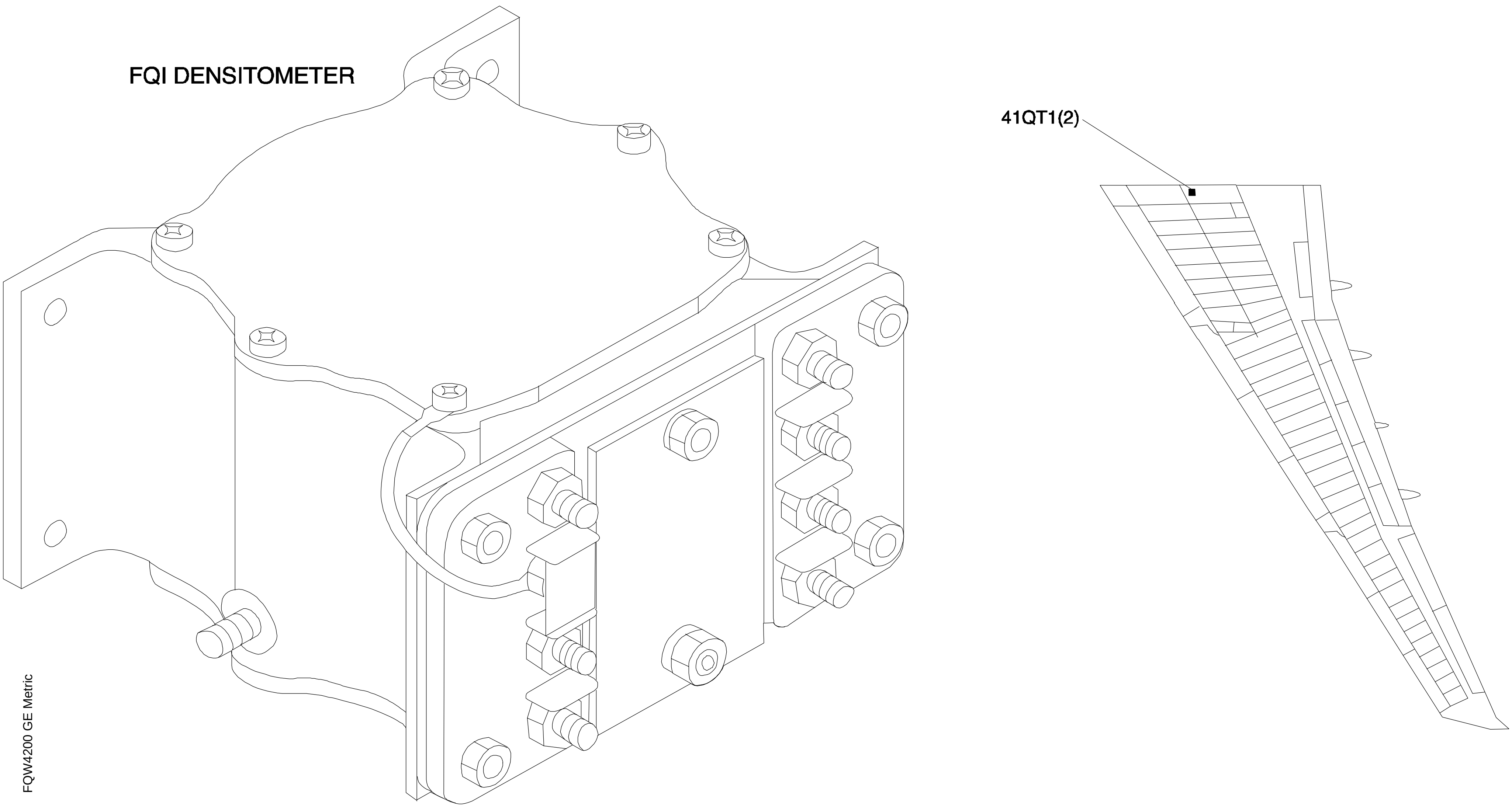
FIN : 41QT1(2)
Zone : 541(641)

DESCRIPTION

The primary components of the FQI densitometer are:
- a housing,
- a vibrating-spool transducer,
- a circuit-card assembly.

FUNCTION

When the densitometer is immersed in the fuel, the resonant frequency of the transducer is proportional to the fuel density.



FQW4200 GE Metric

FQI INDICATOR

FIN/ZONE

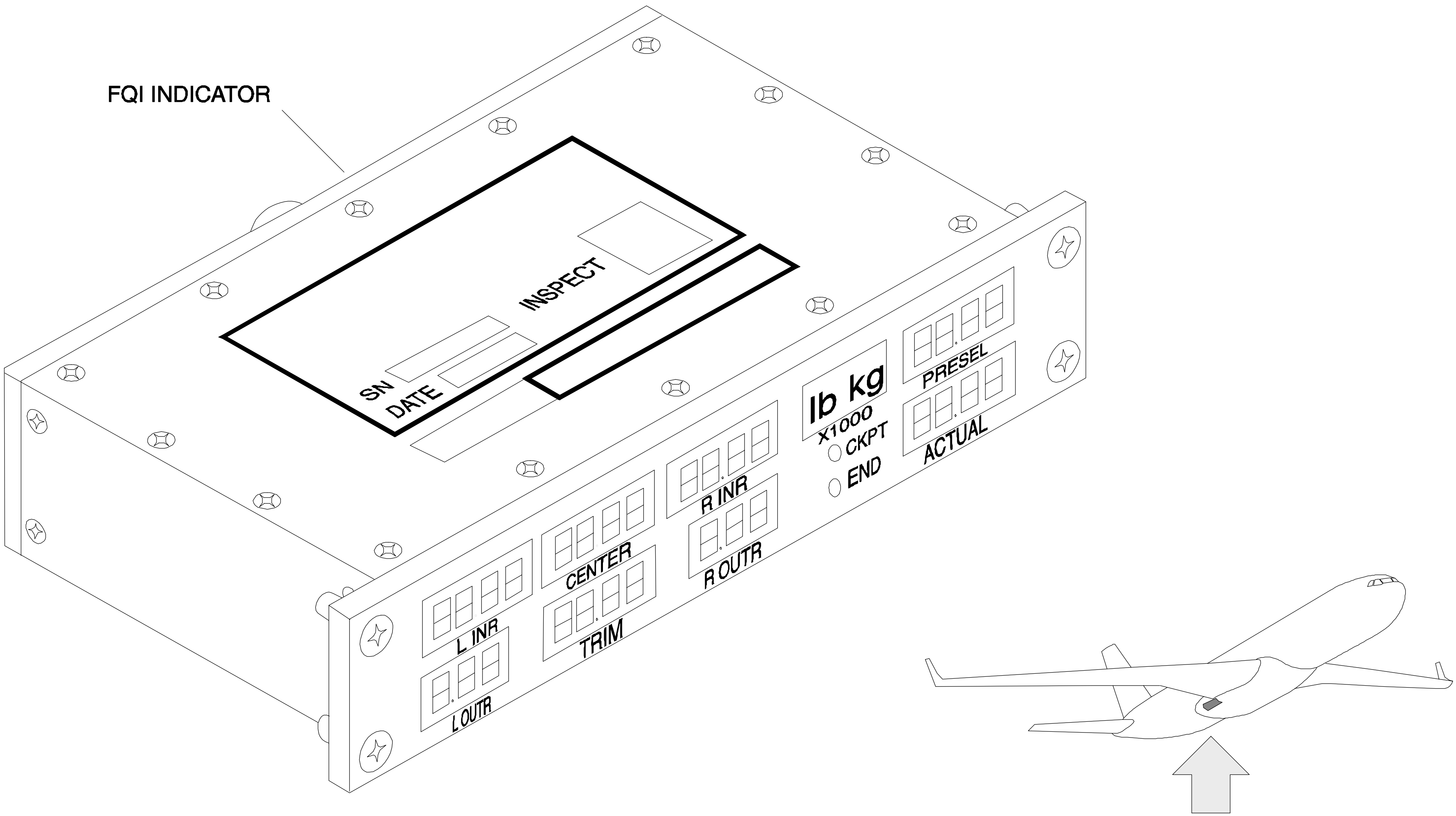
FIN : 6QT
Zone : 198
Access: 198 DB

DESCRIPTION

The primary components of the FQI indicator are:
- two printed circuit boards,
- a green LED display module,
- an END indicator light,
- a CKPT priority annunciator light.

FUNCTION

The LED display module gives the fuel quantity indications (L OUTER, R OUTER, L INR, R INR, CENTER, TRIM, PRESELECTED, ACTUAL) and the unit (LB or KG).



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MANUAL MAGNETIC INDICATORS

FIN/ZONE

FIN : MLI : 5300QT		5301QT1(2) thru 5308QT1(2)
MLIH : 5310/20QT		5311QT1(2) thru 5318QT1(2)
	CTR TK	WING TK
Zone:	141	540/640

DESCRIPTION

Each MMI is made of:
- a Magnetic Level Indicator (MLI),
- a Magnetic Level Indicator Housing (MLIH).

They are installed as follows:
- 1 in the center tank,
- 4 in each inner tank,
- 2 in each outer tank.

MLI

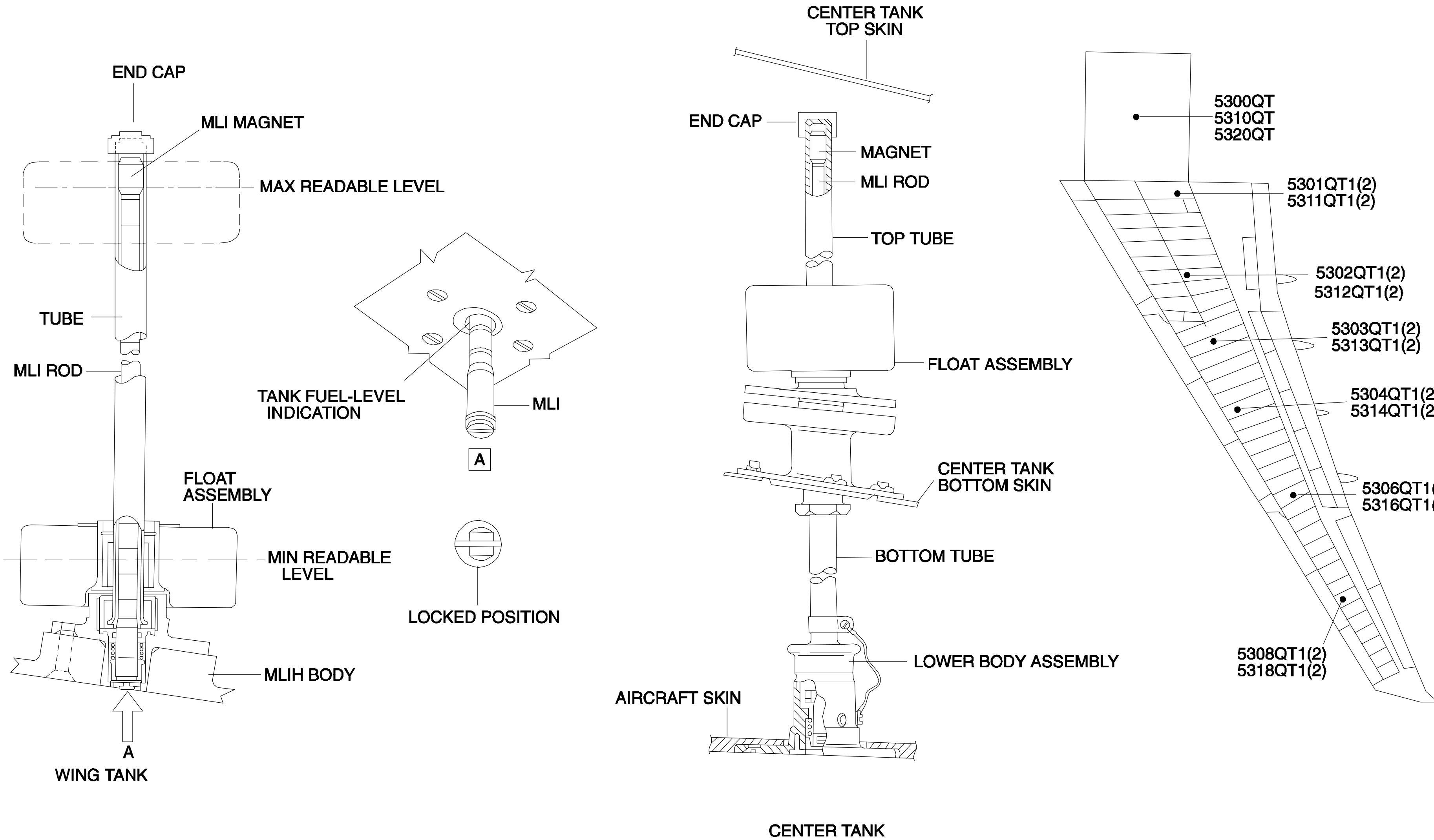
The MLI is a glass-reinforced plastic rod which has marks to show fuel levels. At one end of the rod is a magnet; at the other end is a slot and a bayonet-type lock. The rod is installed in the MLIH.

MLIH

The MLIH has:
- a tube sealed at the top with an end cap,
- a float assembly,
- a body.

CAUTION:

Be careful when you remove/install the MLI.
The length of the indicator rods can be up to 3m (9ft).
Bend the rod carefully to remove/install it.
You can easily break or cause damage to the rod.



FQW4200 GE Metric

ATTITUDE MONITOR

FIN/ZONE

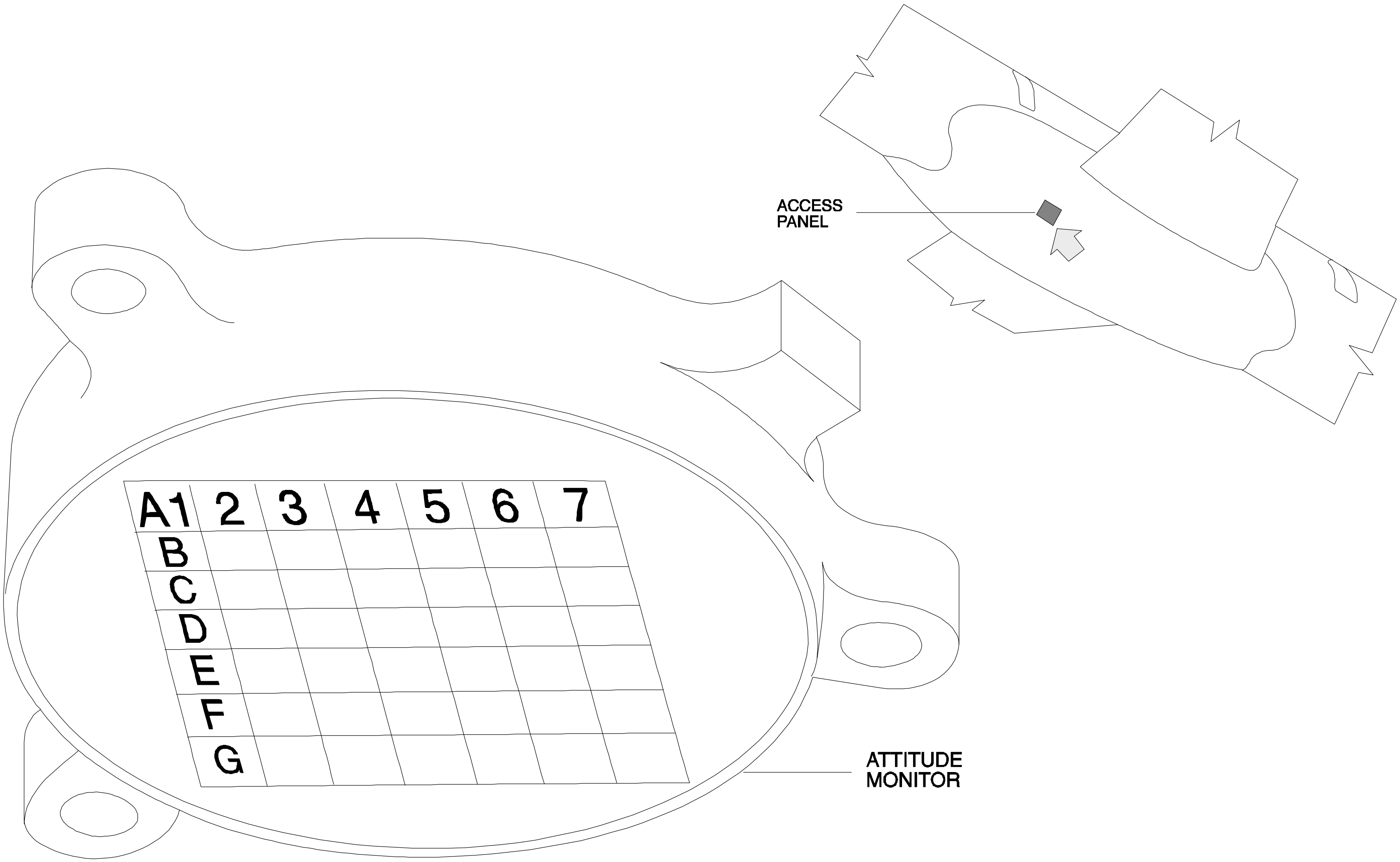
FIN : 5000QT
Zone : 198
Access : 198DB

DESCRIPTION

The attitude monitor is a circular level with graduations on the surface. Each square of the grid is equal to 0.5 degrees change of attitude.

FUNCTION

The position of the bubble in relation to the grid gives the aircraft attitude in pitch and roll axis.
Associated to the reading of the MMIs, it enables the calculation of the fuel quantity using mathematical tables.



FQW4200 GE Metric

TANK LEVEL SENSORS

FIN/ZONE/ACCESS

TANK / SENSOR	CTR	INNER	OUTER	WING SURGE	TRIM	TRIM SURGE
HI-LEVEL	22QJ 66QJ	21QJ1(2) 34QJ1(2)	20QJ1(2) 35QJ1(2)		23QJ1(2)	
LO-LEVEL	37QJ	26QJ1(2) 27QJ1(2)			28QJ	
OVERFLOW				24QJ1(2)		25QJ
ZONE	141	541(641)	542(642)	550(650)	333(343) 319	343
ACCESS	148AZ 147AZ	541(641)MB 541(641)AB	542(642)MB	550CB	333(343)FB 319AL	

DESCRIPTION

The level sensor is a moulded probe including a thermistor. Holes in the probe let the fuel flow close to the thermistor.

FUNCTION

When supplied, the resistance of the thermistor increases with its temperature. The FCMS measures the difference in resistance to find if the probe is in the air (high temp) or in the fuel (low temp).

BITE TEST

When pressed in, the high level test P/B sends a signal to the FCMC, which does a continuity test of the hi-level and overflow sensors and their circuits.
If these are serviceable, the FCMC toggles the state of the relays and the corresponding lights.

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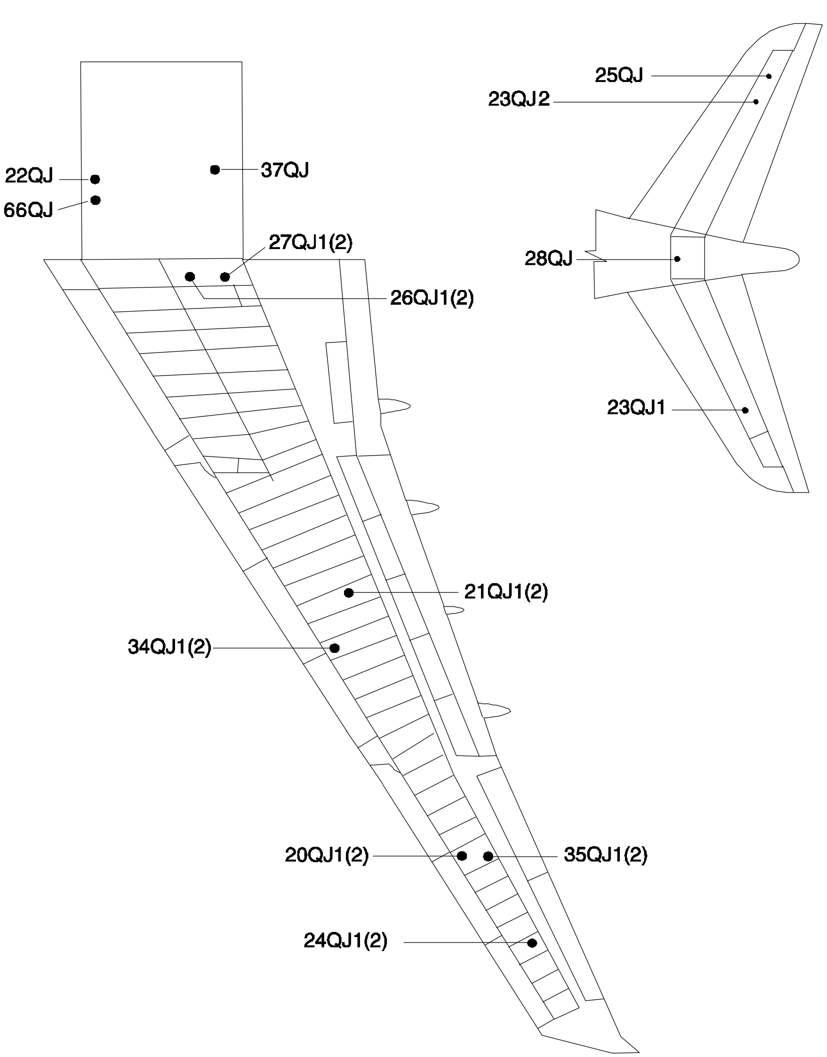
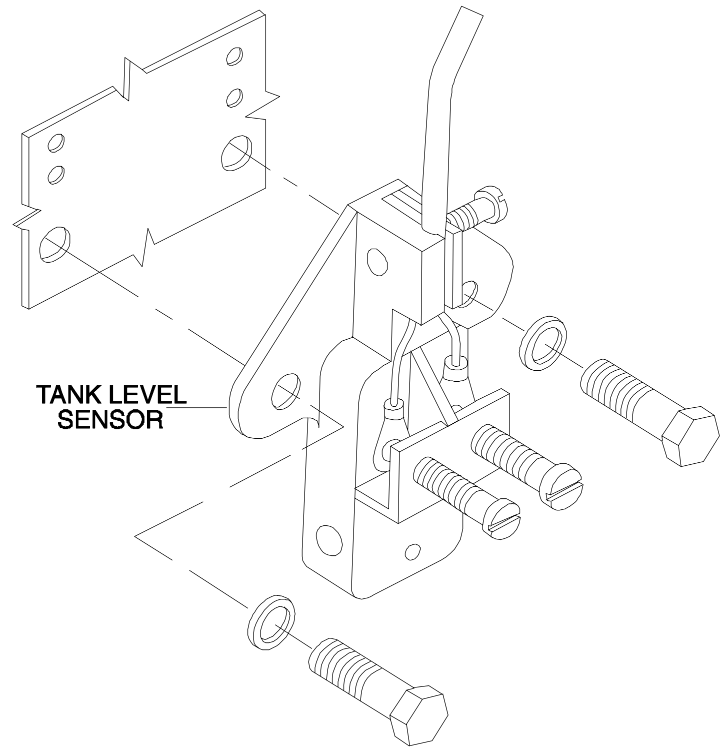
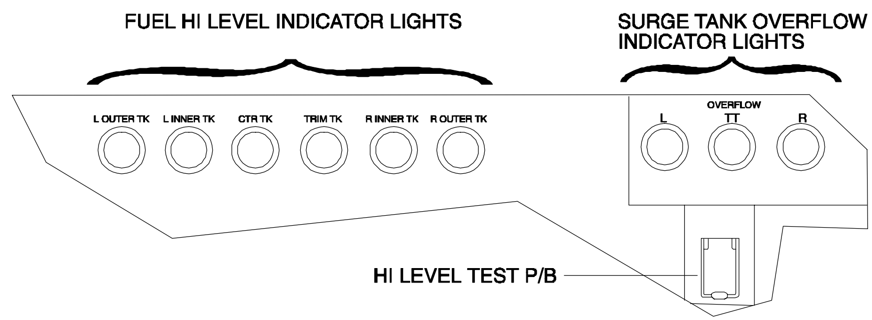






FQW4200 GE Metric

FUEL TEMPERATURE SENSORS

FIN/ZONE/ACCESS

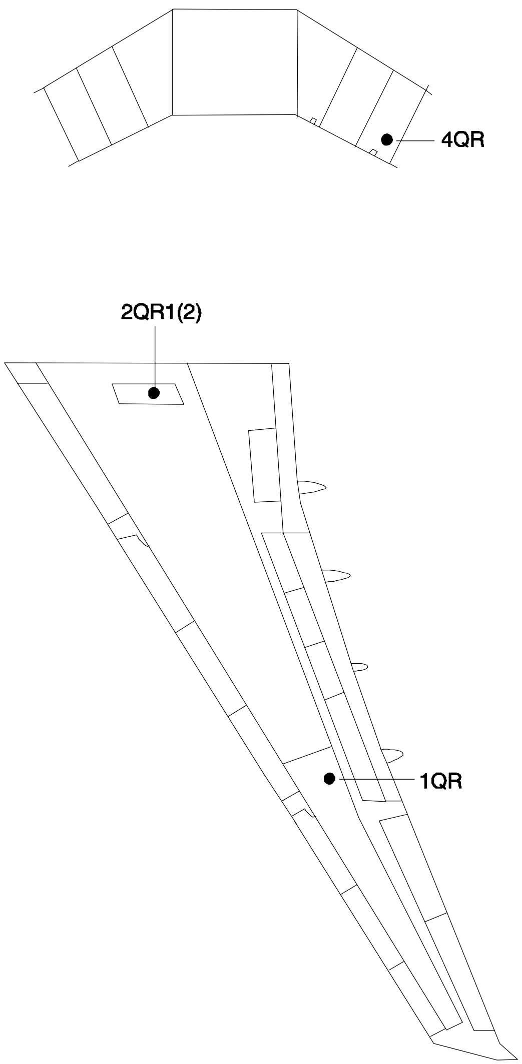
TANK	RH WING OUTER TK	LH WING INNER COLLECTOR	RH WING INNER COLLECTOR	TRIM TK
SENSOR	1QR	2QR1	2QR2	4QR
ZONE	542	541	641	343
ACCESS	542KB	541AB	641AB	343AB

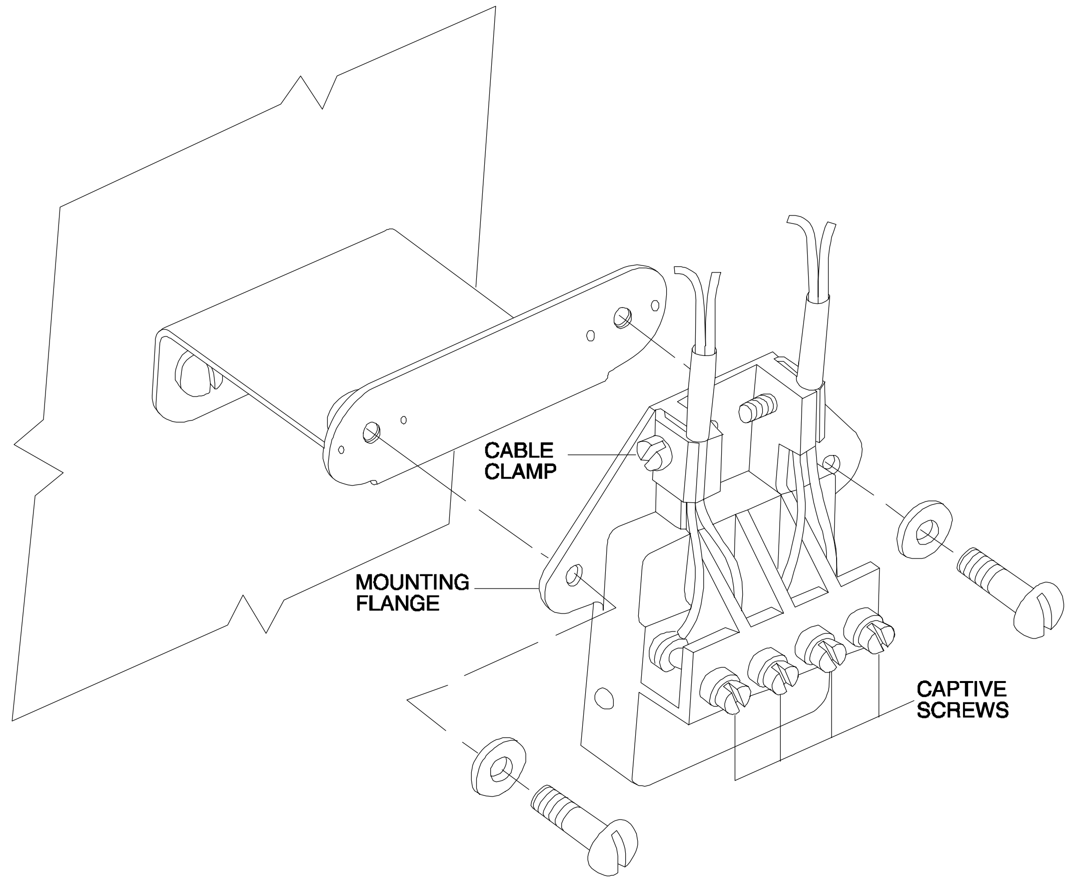
DESCRIPTION

The temperature sensor unit contains two temperature sensors.
Four holes let fuel into the body so that it can flow around the sensors.

FUNCTION

The electrical resistance of the temperature sensors changes in proportion to the changes in temperature.
The FCMC transmits the different temperatures to the ECAM for display.





FUEL TEMPERATURE SENSOR

FQW4200 GE Metric

FCMC

FIN/ZONE/ACCESS

FIN : 5QM1(2)
Zone : 121(122)
Access : 811

DESCRIPTION

Each FCMC comprises:
- 9 operation boards,
- 2 mother boards,
- lightning protection devices,
- electromagnetic induction protection devices.

ARCHITECTURE

Each FCMC has two microprocessors: one is used for the command function and the other is used for the monitor function. The internal structure is separated into two computer lanes which let the different functions operate independently.

OPERATION BOARDS

The nine operation boards are:
- two power supply boards,
- one command processor,
- one monitor processor,
- one discrete level sensor board,
- two signal conditioning boards,
- one discrete input/output board,
- one discrete input board.

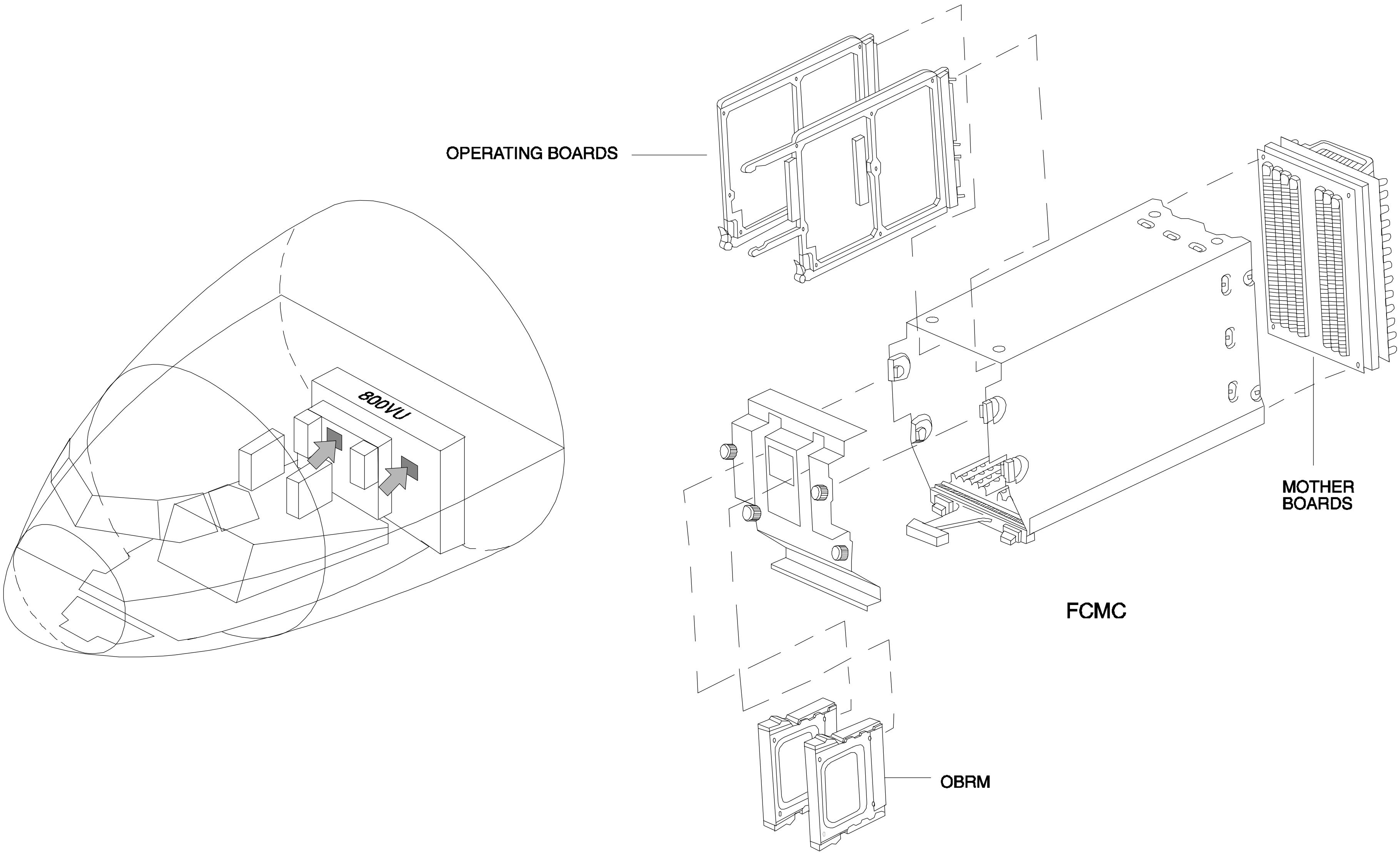
MOTHER BOARDS

The FCMC has two mother boards:
- one board supplies the power to the command and monitor channels,
- one board gives the internal connections to each operation board.

BITE FUNCTION

The BITE enables:
- to continously monitor the FCMC and fuel system for failure,
- to do a BITE test,
- to do a valves test,
- to do a level sense test.

ARINC 429 I/O busses connect the FCMC-BITE to the CMCs.



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STUDENT NOTES

CMS SPECIFIC PAGE PRESENTATION

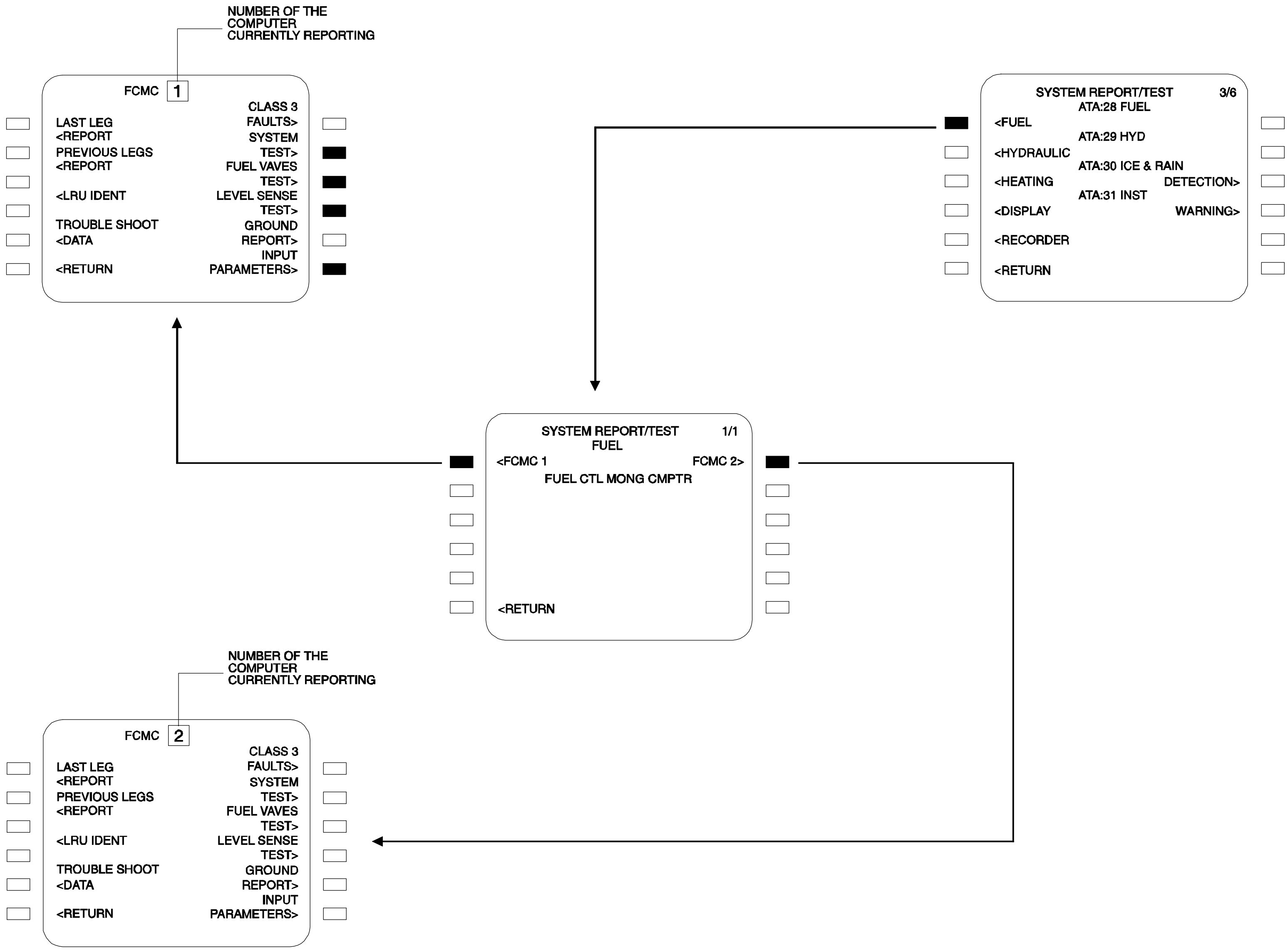
Main Menu
System Test
Valves Test
Level Sense Test
Input Parameters

MAIN MENU

This menu allows you to interrogate FCMC1 or FCMC2 independently. When one FCMC is in interrogative mode the other one remains in normal mode.

This is the FCMC1 main menu. From this step the data available in the FCMC1 BITE memory can be accessed open through the different sub-menus.

All the FCMC2 menus are the same as FCMC1.
The fuel valve test can be initiated from the master FCMC only.



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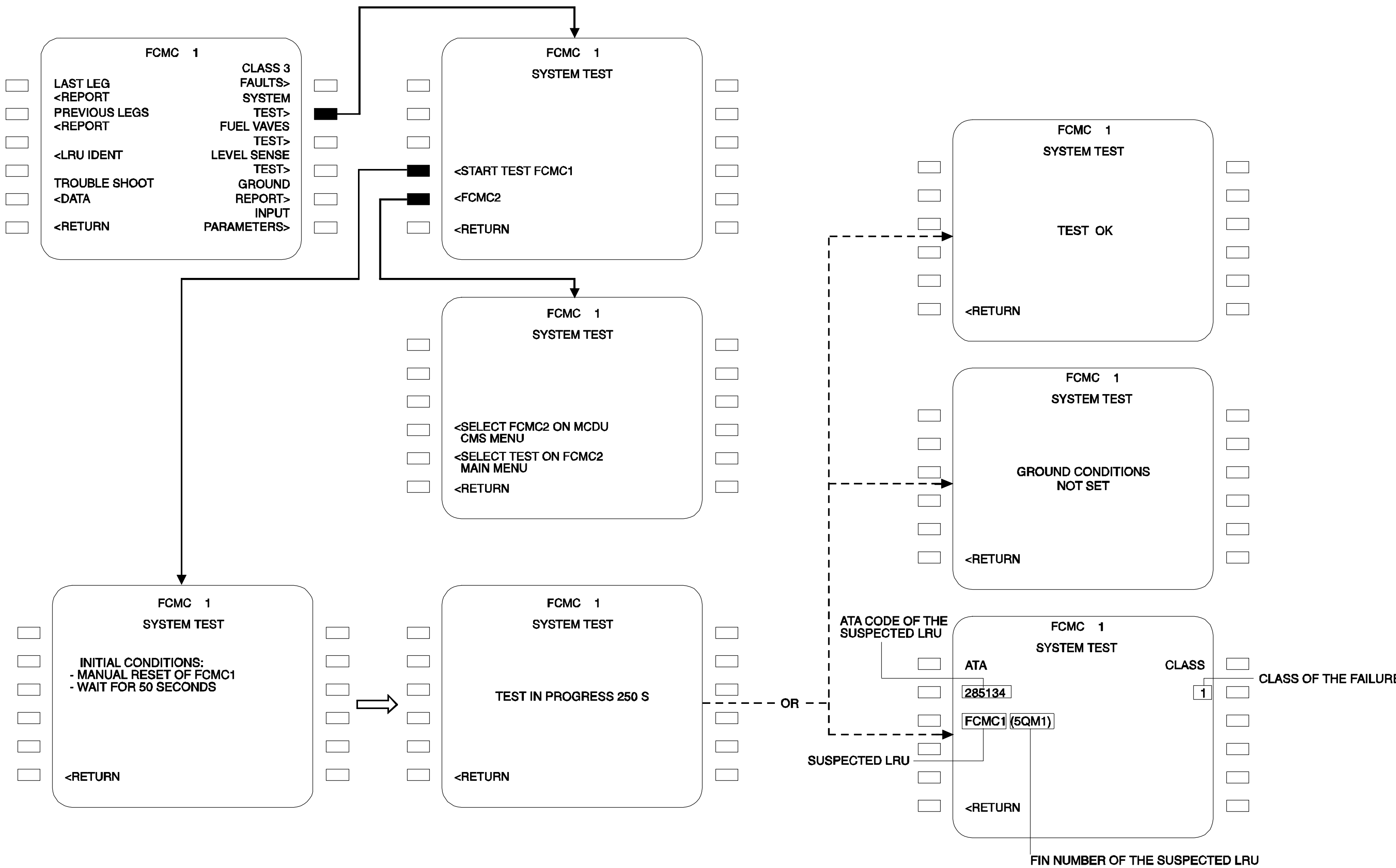
SYSTEM TEST

This test displays all class 1,2 and 3 FAULTS detected during safety tests and indicates any internal monitoring FAULT.
During the test the FCMC analyses its last power-up test.
Conditions to start a test on the opposite FCMC are described on MCDU page.
A maximum of 2 messages can be displayed on the same page.
More information about these failures is available using the Trouble Shooting Data Function.


FCMC 1
CLASS 3 FAULTS>
LAST LEG <REPORT
SYSTEM TEST>
PREVIOUS LEGS <REPORT
FUEL VAVES TEST>
<LRU IDENT
LEVEL SENSE TEST>
TROUBLE SHOOT <DATA
GROUND REPORT>
INPUT PARAMETERS>
<RETURN
FCMC 1
SYSTEM TEST
<START TEST FCMC1
<FCMC2
<RETURN
FCMC 1
SYSTEM TEST
<SELECT FCMC2 ON MCDU CMS MENU
<SELECT TEST ON FCMC2 MAIN MENU
<RETURN
FCMC 1
SYSTEM TEST
INITIAL CONDITIONS:
- MANUAL RESET OF FCMC1
- WAIT FOR 50 SECONDS
<RETURN
FCMC 1
SYSTEM TEST
TEST IN PROGRESS 250 S
<RETURN
OR
FCMC 1
SYSTEM TEST
TEST OK
<RETURN
FCMC 1
SYSTEM TEST
GROUND CONDITIONS NOT SET
<RETURN
ATA CODE OF THE SUSPECTED LRU
FCMC 1
SYSTEM TEST
ATA
CLASS
CLASS OF THE FAILURE
285134
1
FCMC1 (5QM1)
SUSPECTED LRU
<RETURN
FIN NUMBER OF THE SUSPECTED LRU

VALVES TEST

This test allows the user to manually command any fuel valve controlled by the master FCMC.
If this test is requested by the slave FCMC, it is necessary to select the other FCMC.
When the test starts, the FCMC shuts all valves commanded by itself.
All valves go back to their initial position when the user returns to the main menu.
Each of the 5 valves test pages displays the current valve status, its identification and indicates the OPEN and SHUT line keys.
A table, given in your TTM, shows the valve corresponding to the FIN number and the number of the related page on the MCDU. Selection of OPEN or SHUT line key makes the corresponding valve open or shut.

Note: during refueling or defueling, the test is inhibited.

PAGE	FIN	LETTER	FUNCTIONAL DESIGNATION
1/5	700QN1	B	AFT TRANSFER VALVE, LEFT
1/5	700QN2	D	AFT TRANSFER VALVE, RIGHT
1/5	502QU2	S	REFUEL ISOLATION VALVE, RIGHT
1/5	502QU1	R	REFUEL ISOLATION VALVE, LEFT
2/5	500QU1	M	OUTER TANK INLET VALVE, LEFT
2/5	500QU2	N	OUTER TANK INLET VALVE, RIGHT
2/5	603QL1	F	INNER TANK INLET VALVE, LEFT
2/5	603QL2	H	INNER TANK INLET VALVE, RIGHT
3/5	601QL1	Q	INTERTANK TRANSFER VALVE, LEFT
3/5	601QL2	P	INTERTANK TRANSFER VALVE, RIGHT
4/5	705QN	L	TRIM TANK INLET VALVE
4/5	702QN	T	TRIM TANK ISOLATION VALVE
4/5	701QN	W	TRIM PIPE ISOLATION VALVE
5/5	703QN	V	AUXILIARY FORWARD TRANSFER VALVE
5/5	501QU	G	CENTER TANK INLET VALVE

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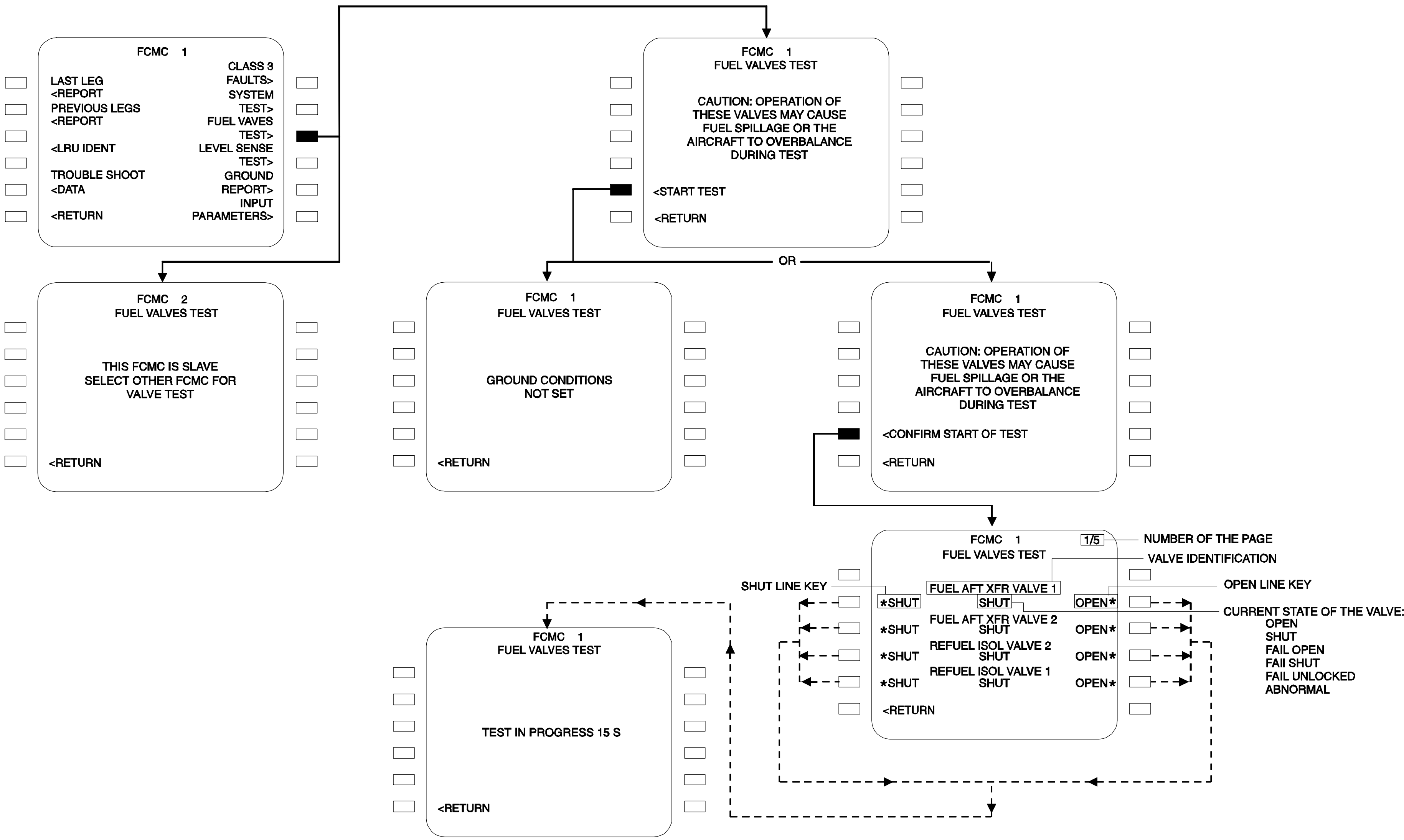

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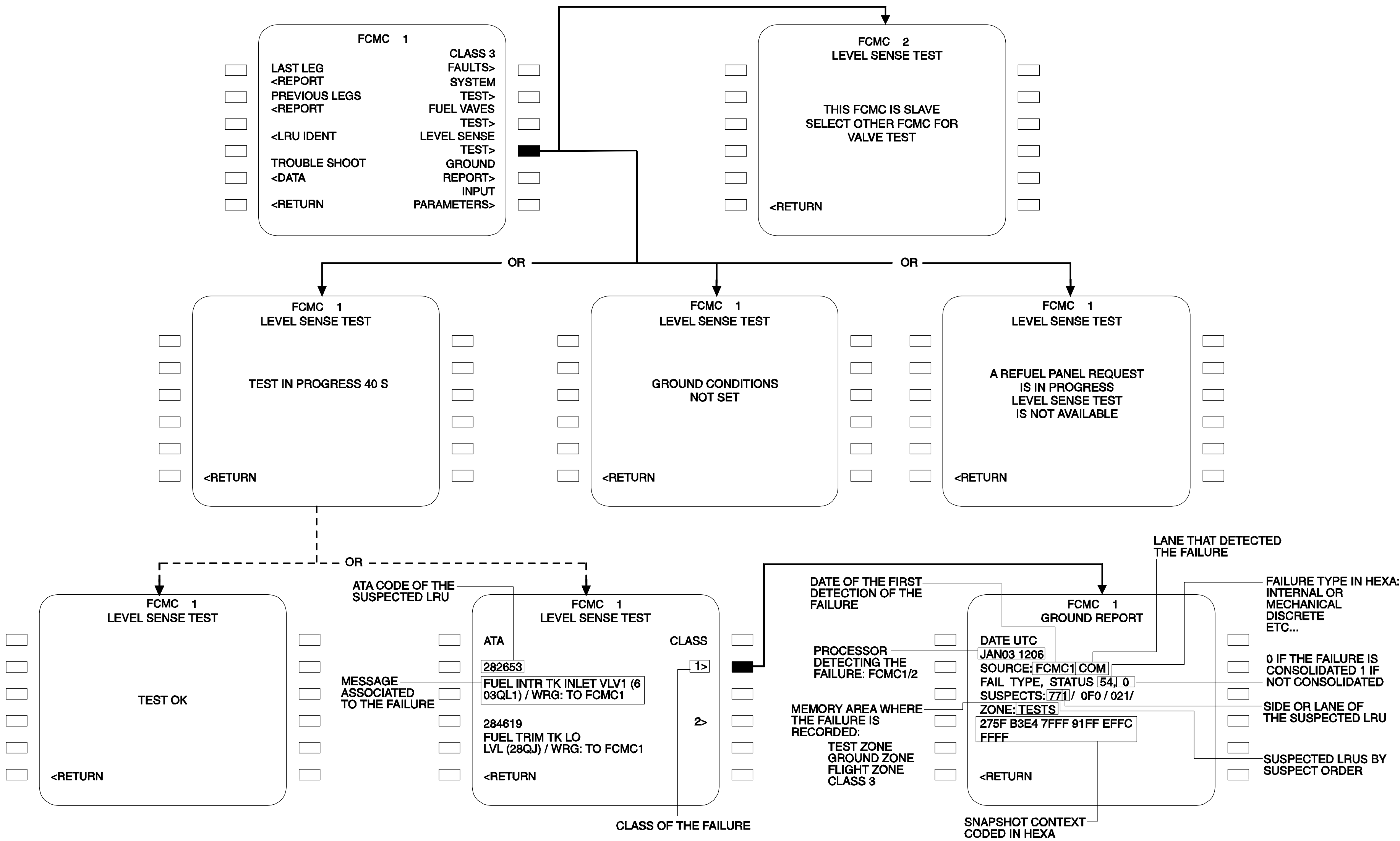
LEVEL SENSE TEST

The level sense test tests the level sensors and the tank inlet valve health.
This test can only be performed from the master FCMC with refuel mode selected.
This test can either be initiated from the MCDU FCMC menu or from the refuel panel.
In this last case, the FCMC cannot simultaneously perform the test from the MCDU.
In case of failure reported, the report gives Class 1, Class 2 and Class 3 failure messages existing when the test starts.
A maximum of 4 messages can be recorded.
An access to supplementary coded information is directly available after pressing the MCDU line key in front of the message.
A page gives, in a coded way, an overview of the binary context of both lanes of the FCMC. It is necessary to use special tools to decode it.



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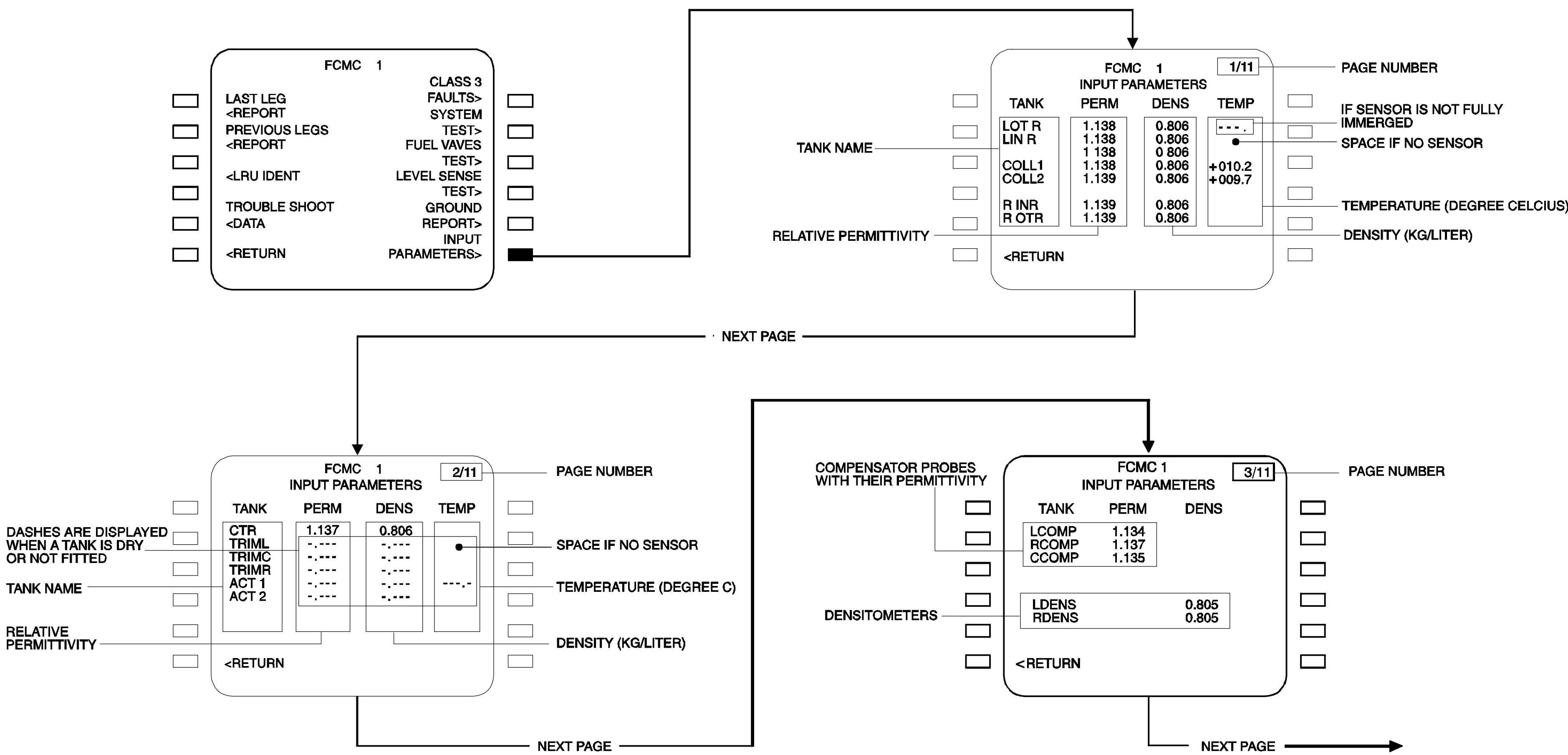
INPUT PARAMETERS

This selection enables access to parameters stored in the FCMC.
The following parameters are available:

- fuel permittivities,
- densities,
- temperatures,
- effective fuel surface attitude (pitch and roll) (data from ADIRU and Flight Control Data Concentrator: FCDC)
- probe capacitances and
- numerous discrete inputs.

Eleven MCDU pages are used to display these parameters.
The displayed page is automatically updated every 5.4 seconds.
An unavailable parameter is replaced with dashed characters.
Pages 1, 2 and 3 display the fuel relative permittivity, density and temperature of each tanks.
Pages 4 and 5 display the effective fuel surface attitude of each tank.
Pages 6, 7, 8, 9 display the capacitances of each probe and compensator.
Page 10 and 11 display all the discrete inputs to the FCMC.
Refer to your AMM for interpretation of the codes.



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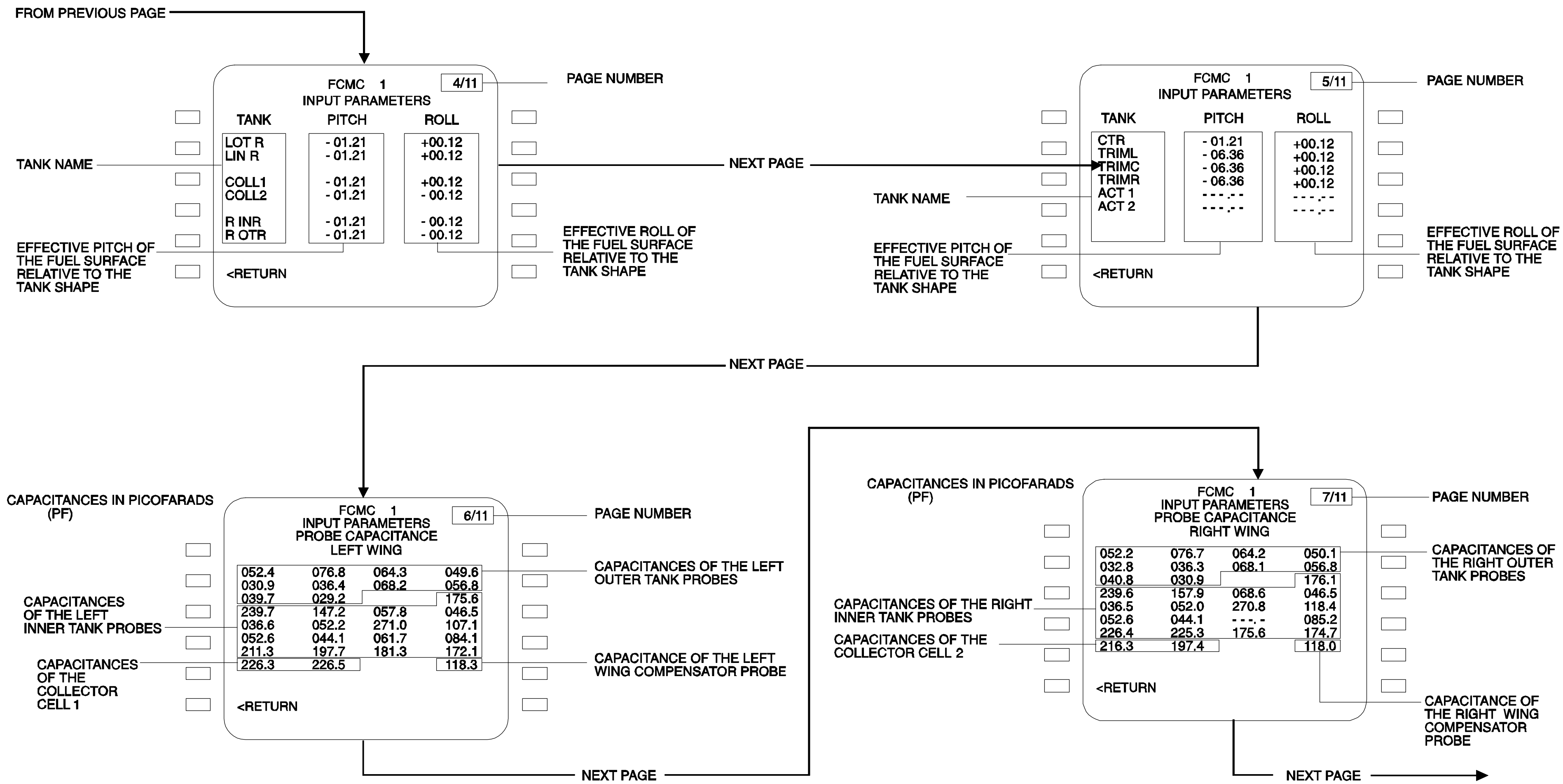
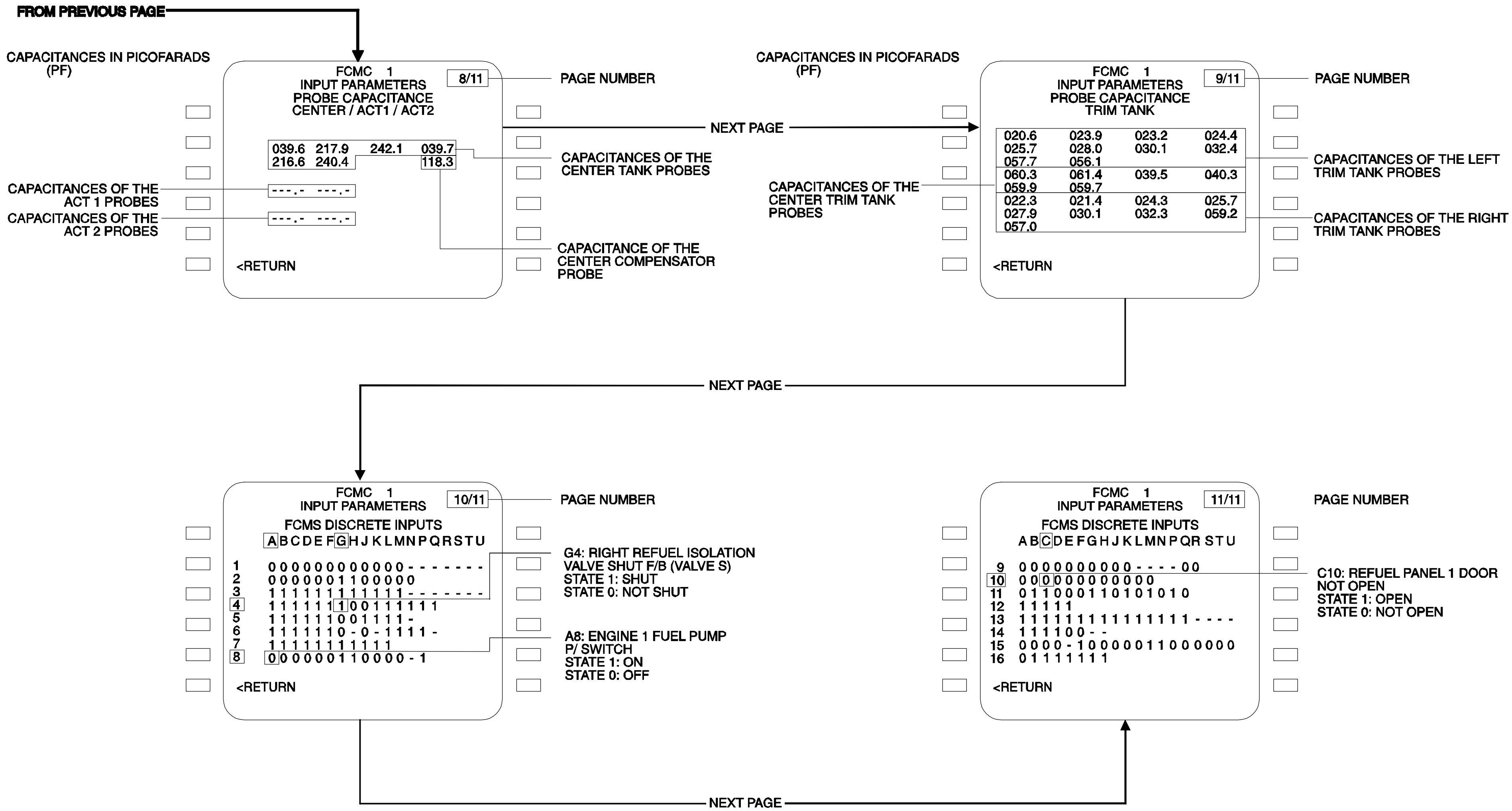


FQW4200 GE Metric



FQW4200 GE Metric

STUDENT NOTES