

A330-200
TECHNICAL TRAINING MANUAL
MECHANICS / ELECTRICS & AVIONICS COURSE
29 HYDRAULIC POWER
GE Metric

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■ FQW4200

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HYDRAULIC SYSTEM PRESENTATION

General
Reservoir
Fire Shut-Off Valve
Engine Driven Pump
Electric Pump
Hand Pump
Ram Air Turbine
Accumulator
Leak Measurement Valve
Pressure Monitoring
HSMU

GENERAL

There are three independent hydraulic systems : Green, Blue and Yellow. In normal operation they are powered by Engine Driven Pumps (EDPs) at a nominal pressure of 3000 psi.

Auxiliary power is provided by electrically driven pumps.

A Ram Air Turbine (RAT) is provided in the green system for emergency.

A hand pump is provided in the Yellow system for cargo door manual operation.

The operation and indications of the hydraulic systems are monitored by an Hydraulic System Monitoring Unit (HSMU). The hydraulic fluid is maintained clean by filters.

RESERVOIR

Each hydraulic system has its own reservoir. It supplies hydraulic fluid to the system pumps, and is pneumatically pressurized .

The Green reservoir is located in the main landing gear bay. The Blue and Yellow reservoirs are located forward of the landing gear bay in the center fuselage section.

All three reservoirs are filled from the Green ground service panel.

FIRE SHUT-OFF VALVE

Each hydraulic system has a fire shut-off valve fitted in the suction line between the reservoir and the engine driven pump.

They are operated by their respective engine fire pushbutton switches to isolate the engine driven pump in case of engine fire or suction line rupture.

Green engine fire shut-off valves are automatically closed by the hydraulic system monitoring unit in case of green reservoir low level.

This enables isolation of a possible leak in the engine pylon, and restoration of the green system using the Ram Air Turbine (RAT), if necessary.

ENGINE DRIVEN PUMP

Engine Driven Pumps (EDPs) are located on the accessory gearbox of each engine. They are of the variable displacement type.

They supply each system at a nominal pressure of 3000 psi. They are operated by their pushbutton switches on the overhead HYD panel.

ELECTRIC PUMP

Auxiliary power is provided by electric pumps. They are identical and normally controlled by operation of their pushbutton switches on the overhead HYD panel.

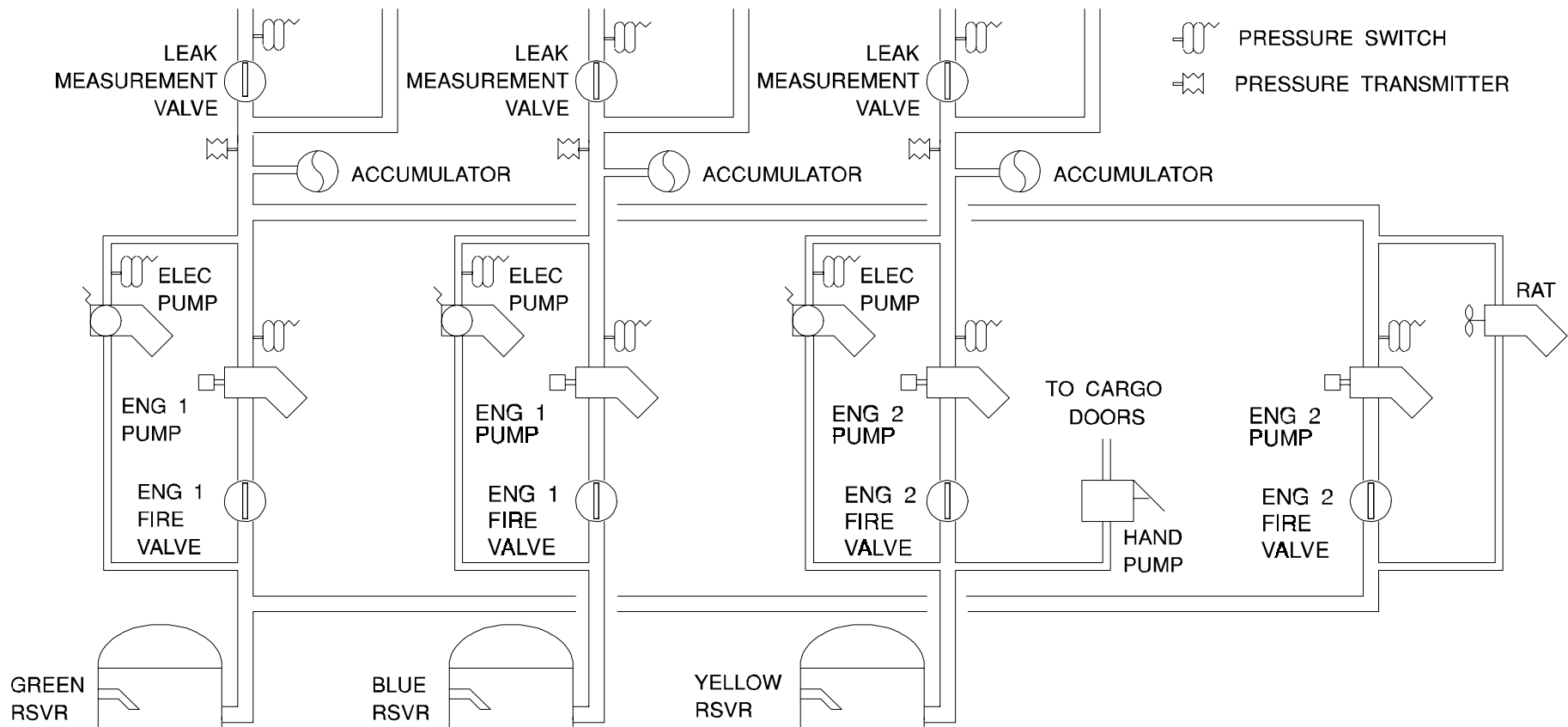
The Green and Yellow system electric pumps can operate automatically in case of engine failure.

The pumps are supplied by 3-phase 115 VAC.

HAND PUMP

A hand pump is used for operating the cargo door when electrical power is not available.

It is located on the Yellow ground service panel.



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RAM AIR TURBINE

A Ram Air Turbine (RAT), located in the number four flap track fairing on the right wing, pressurizes the green system in emergency conditions.

It automatically extends in flight, when the aircraft speed is higher than 100kts, in case of :

- failure of both engines, or
- low level in green and blue reservoirs, or
- low level in green and yellow reservoirs.

The ram air turbine stowage control panel is located on the yellow ground service panel.

ACCUMULATOR

One accumulator is fitted in each system to damp out engine driven pump pulsations and to maintain a constant pressure during normal operation to cover transient demands.

LEAK MEASUREMENT VALVE

A leak measurement valve is positioned in each circuit upstream of the primary flight controls.

Used for the leakage measurement of each circuit, they are closed, on ground only, by operation of the leak measurement valve pushbutton switches on the overhead HYD maintenance panel.

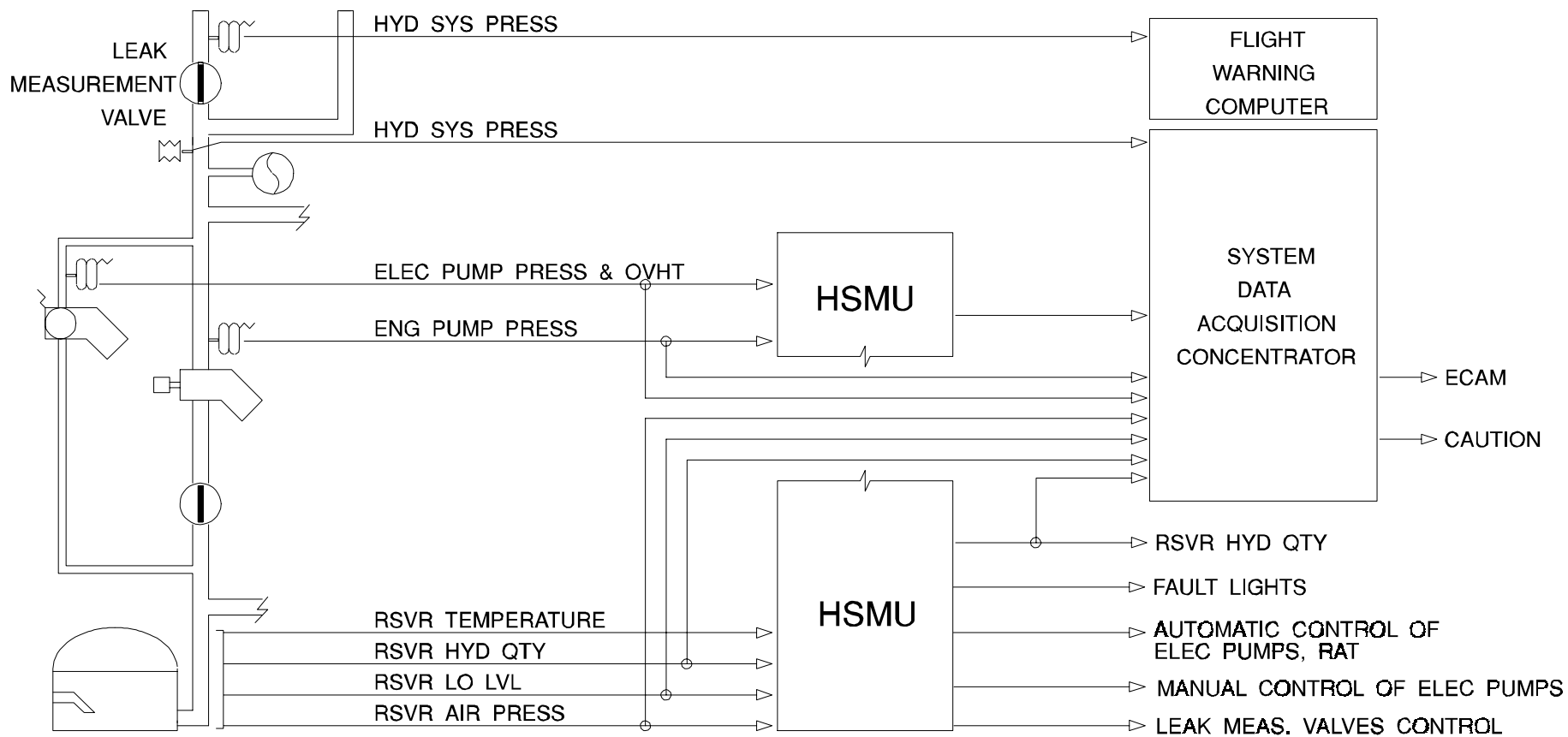
Their operation is inhibited in flight.

PRESSURE MONITORING

Pressure in the system is monitored by : Pressure switches which detect any abnormal pressure and pressure transmitters for indications on the ECAM.

HSMU

The Hydraulic System Monitoring Unit (HSMU) monitors each of the hydraulic systems and provides the associated indications.



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SYSTEM USERS

General
Green System Users
Blue System Users
Yellow System Users

GENERAL

The flight control supply is evenly divided between the three hydraulic systems.

Redundancy provides at least two different power sources for most of the hydraulic system users.

In the event of low pressure, large power consumers are isolated to give priority to the primary flight controls.

On the Green system priority to the primary flight controls is given through the Priority Valve (PV), which isolates the heavy load users (Constant Speed Motor/Generator, Nose Wheel Steering, Landing Gear) in the event of low hydraulic pressure.

GREEN SYSTEM USERS

The Green hydraulic system provides power to the users listed on the next page.

The Constant Speed Motor/Generator (CSM/G) provides electrical power in emergency conditions.

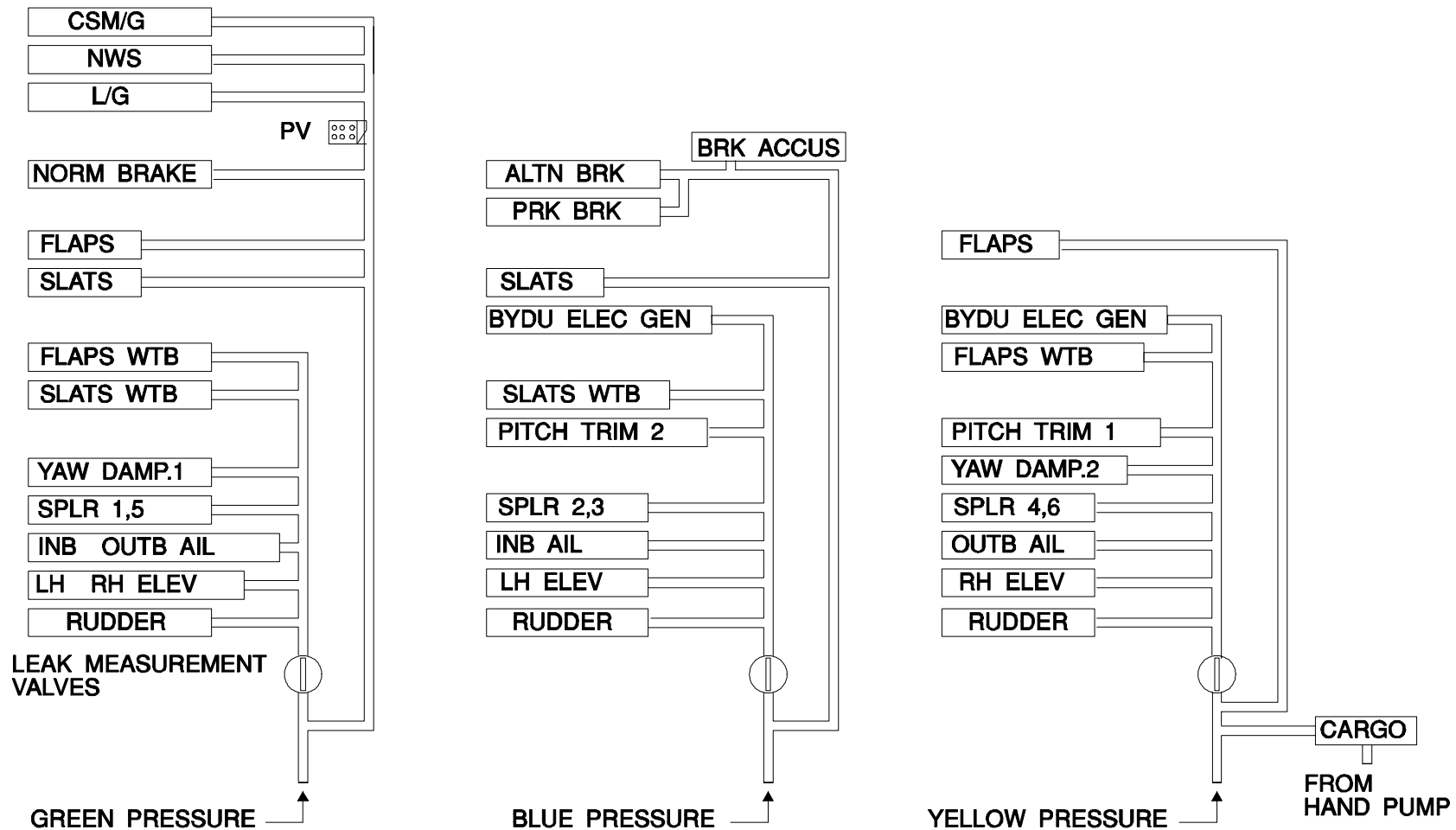
BLUE SYSTEM USERS

The Blue hydraulic system provides power to the users listed on the next page.

YELLOW SYSTEM USERS

The yellow hydraulic system provides power to the users listed on the next page.

A hand pump is provided for the manual operation of the cargo doors.



BYDU ELEC GEN : Back-up Yaw Damper Unit Electrical Generator

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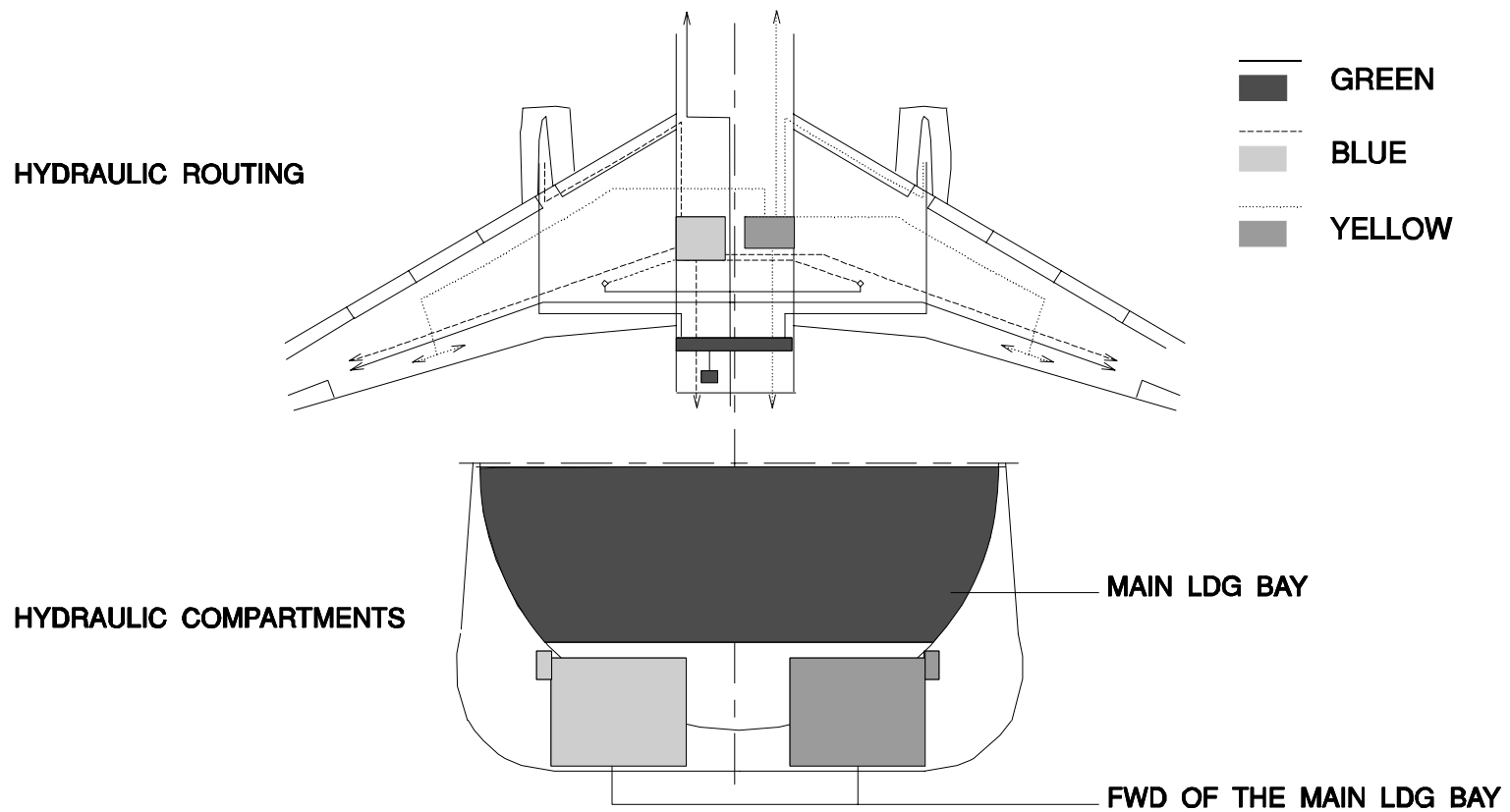
CIRCUIT IDENTIFICATION AND ROUTING

Pipe Routing
Pipe Identification
Component Identification
Connections

PIPE ROUTING

The three systems are not hydraulically connected.

There are no hydraulic pipes in the passenger cabin or flight compartment.

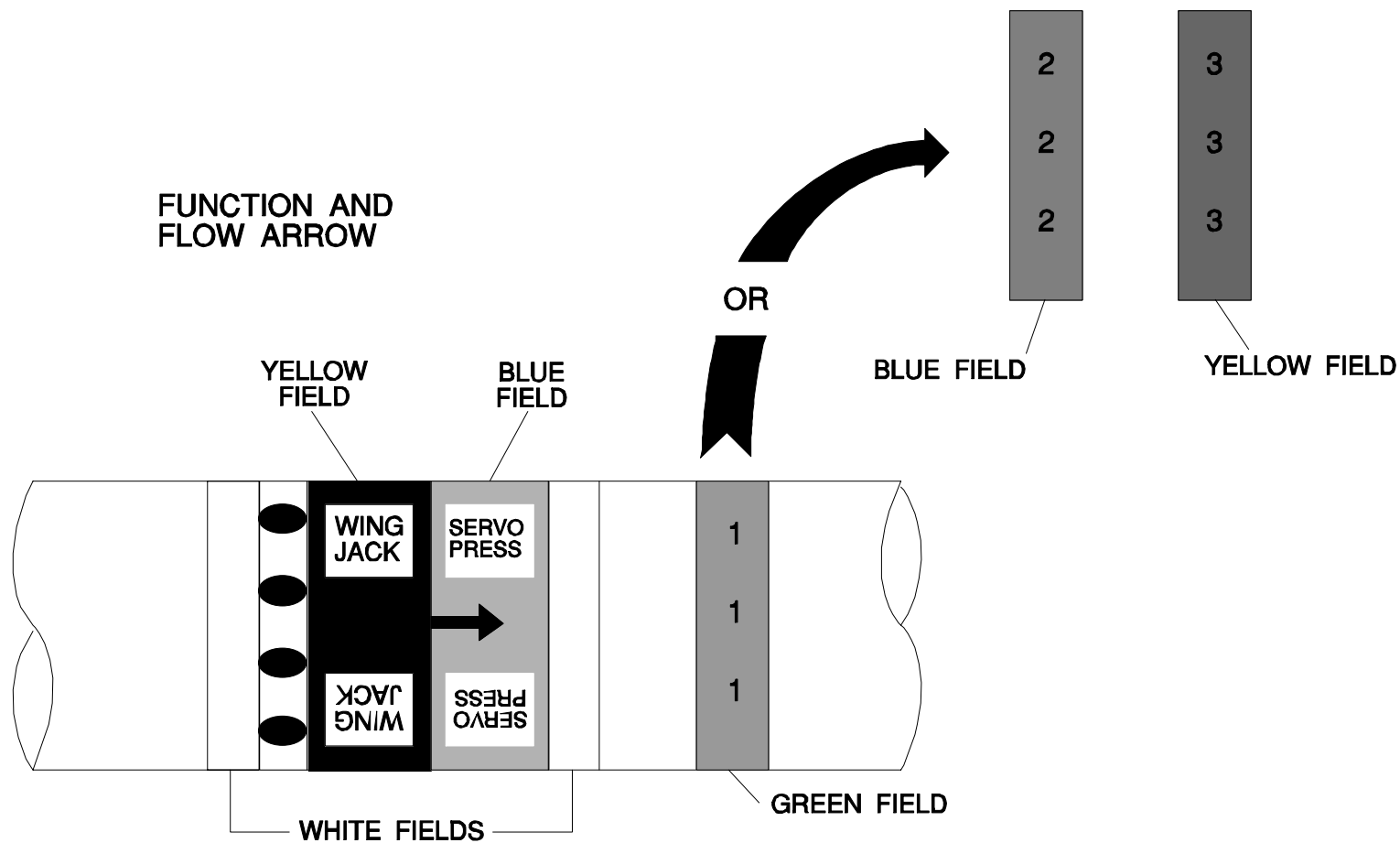


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PIPE IDENTIFICATION

Each pipe is identified by a self-adhesive label which indicates :

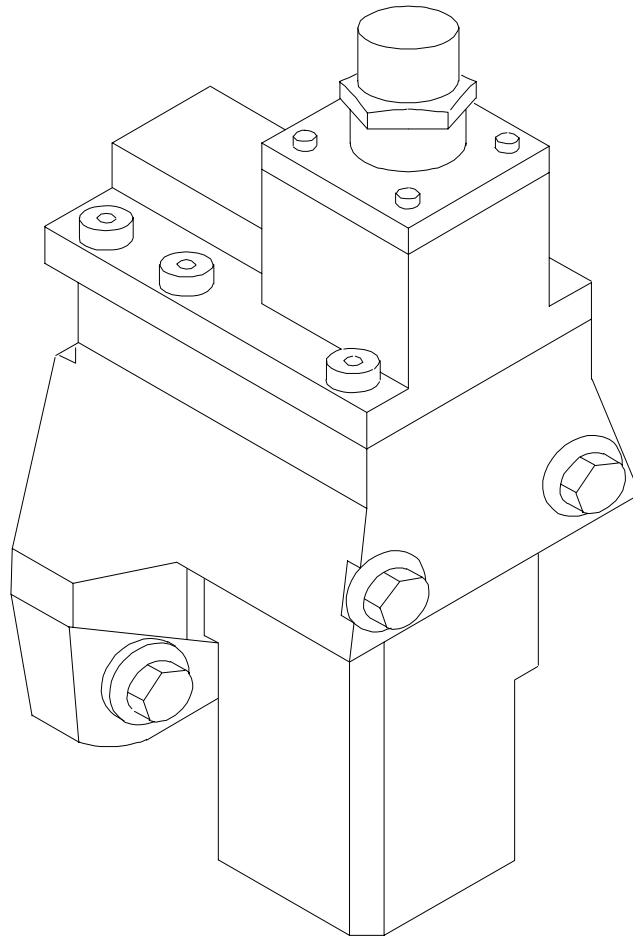
- Its part number,
- A label identifying the pipe as an hydraulic pipe (black dots, yellow and blue fields) its function and the direction of the fluid flow,
- A label identifying the system comprising a color code and a number 1, 2 or 3 respectively indicating the G, B, or Y system.



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COMPONENT IDENTIFICATION

Each hydraulic component is identified by a placard affixed on the structure near to it, which gives its FIN number and its designation.



**5021JM1
RELIEF
VALVE
HP MANIFOLD
RETURN**

**SELF ADHESIVE
IDENTIFICATION
LABEL**

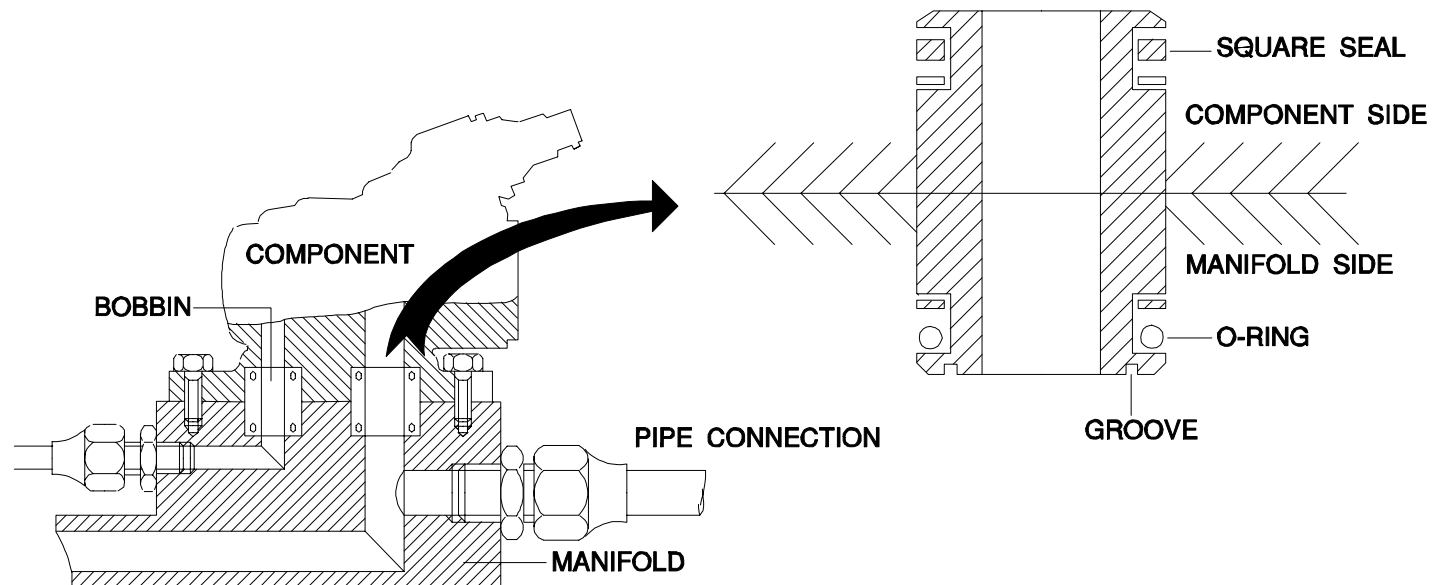
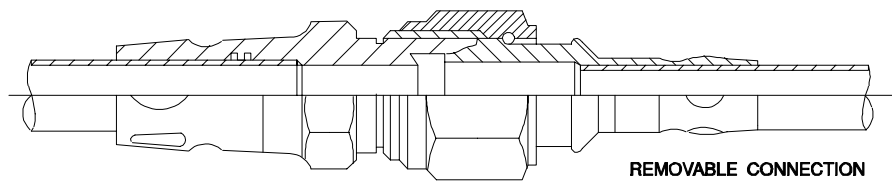
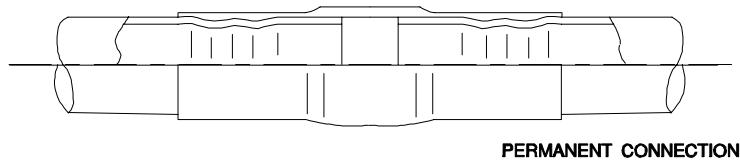
CONNECTIONS

There are two types of connections :

- permanent connections (permaswage).
- removable connections (standard straight or special fittings).

The manifolds have bobbin type connections for some components.

The bobbins are equipped with one square seal on the component side and one o-ring on the manifold side.



STUDENT NOTES:

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SYSTEM CONTROL AND INDICATING

Engine Pump P/B Switch
Electric Pump P/B Switch
RAT MAN ON P/B Switch
Leak Measurement Valve P/B Switch

ENGINE PUMP P/B SWITCH

In normal conditions the engine driven pump pressurizes the system when the engine runs.

"OFF" : Pump is depressurized, power generation stops.

"FAULT" : Illuminates amber in case of RSVR LO LVL, RSVR OVHT, RSVR LO AIR PR or PUMP LO PR.

In OVHT condition, "FAULT" light remains on as long as the OVHT is present.

ELECTRIC PUMP P/B SWITCHES

Green and yellow electric pumps have an automatic function in case of engine failure.

FAULT/OFF (P/B pressed in) : Electric pump is automatically energized in case of engine 2 failure (yellow) or, engine 1 or 2 failure (green) or manually started by pressing the "ON" P/B.

"OFF" : Electric pump is de-energized. This action cancels the manual and automatic start functions (priority is given to "FAULT/OFF" P/B switch).

"ON" : Electric pump is energized.

"FAULT" : Illuminates amber in case of RSVR LO LVL, RSVR LO AIR PR, RSVR OVHT, ELEC PUMP OVHT, or ELEC PUMP LO PR (if elec pump is running).

In OVHT condition "FAULT" light remains on as long as the OVHT is present.

RAT MAN ON P/B SWITCH

By pressing the **RAT MAN ON** pushbutton the ram air turbine will be extended.

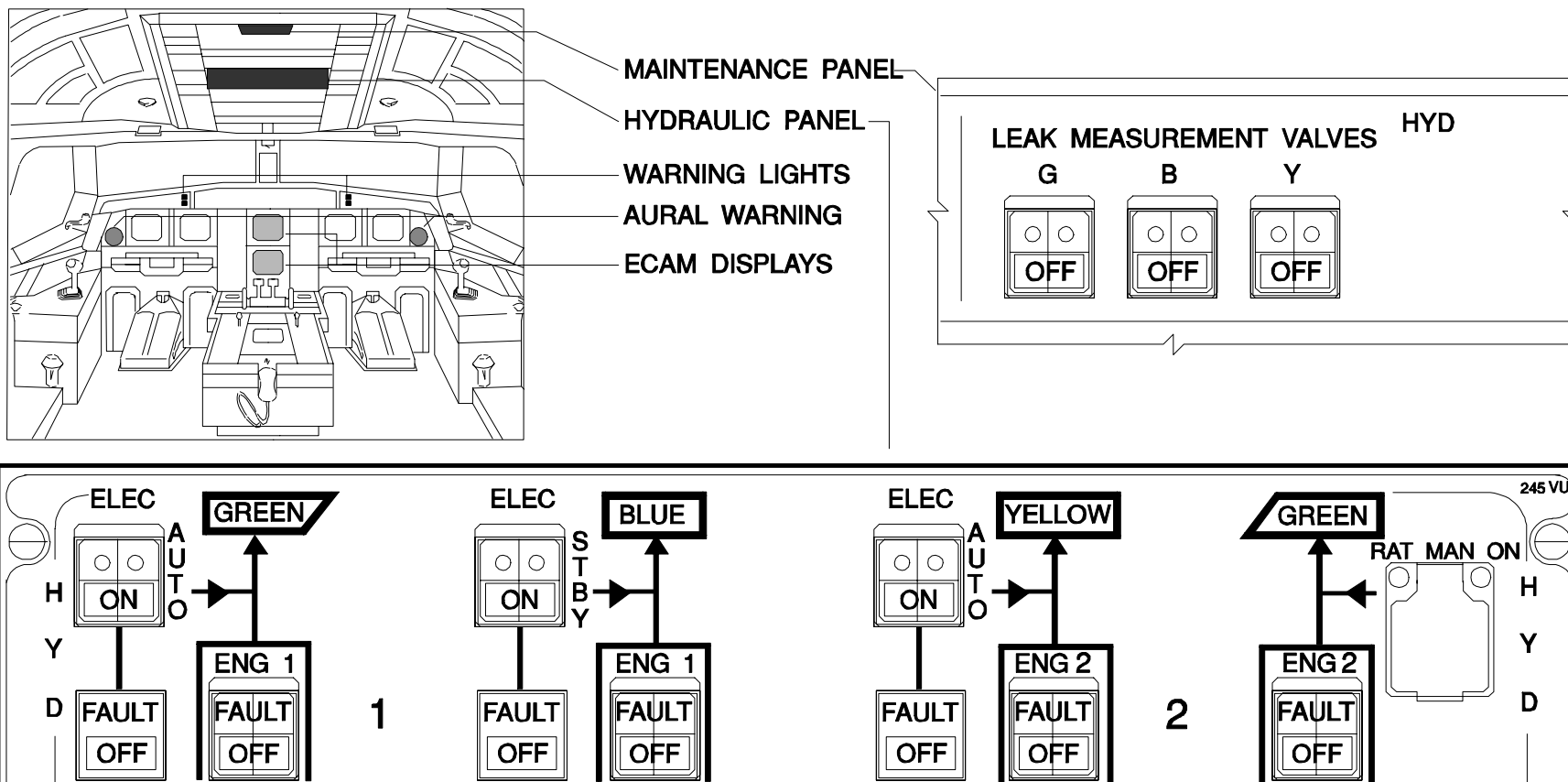
WARNING :

RAT can be manually deployed at any time.
Maintenance action is needed to stow it.

LEAK MEASUREMENT VALVE P/B SWITCH

The leak measurement system is inhibited in flight.

"OFF" : The respective electro-hydraulic valve closes and hydraulic supply to primary flight controls is stopped.



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STUDENT NOTES :

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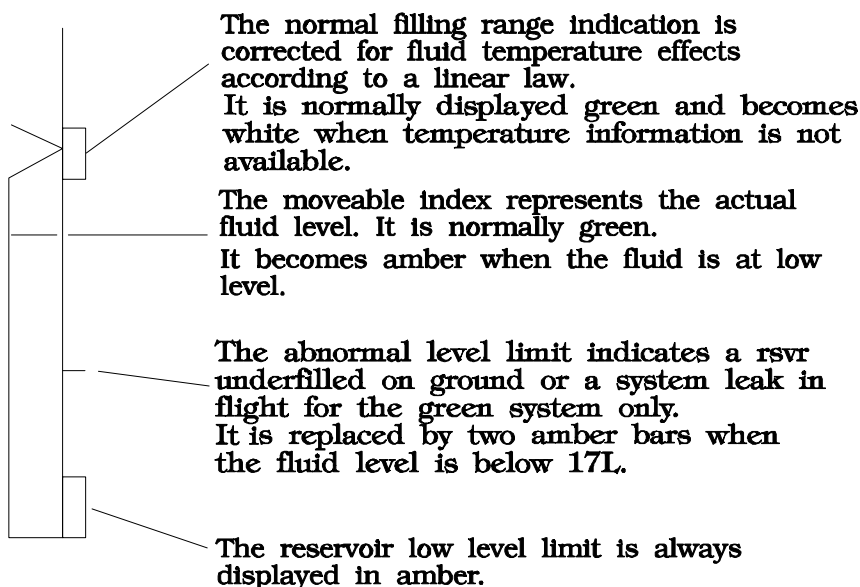
ECAM PAGE PRESENTATION

Reservoir
Fire Shut-Off Valve
Engine Driven Pump
Electric Pump
Ram Air Turbine
System Pressure
System Status

As the three systems have the same symbols, (Except the RAT on the green system), the ECAM page presentation is based on the green system display.

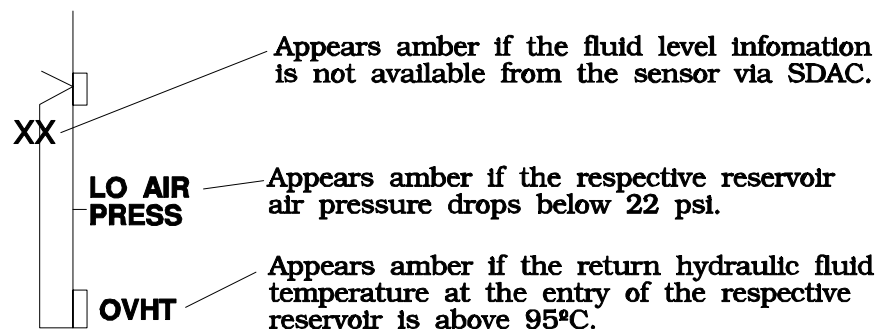
RESERVOIR

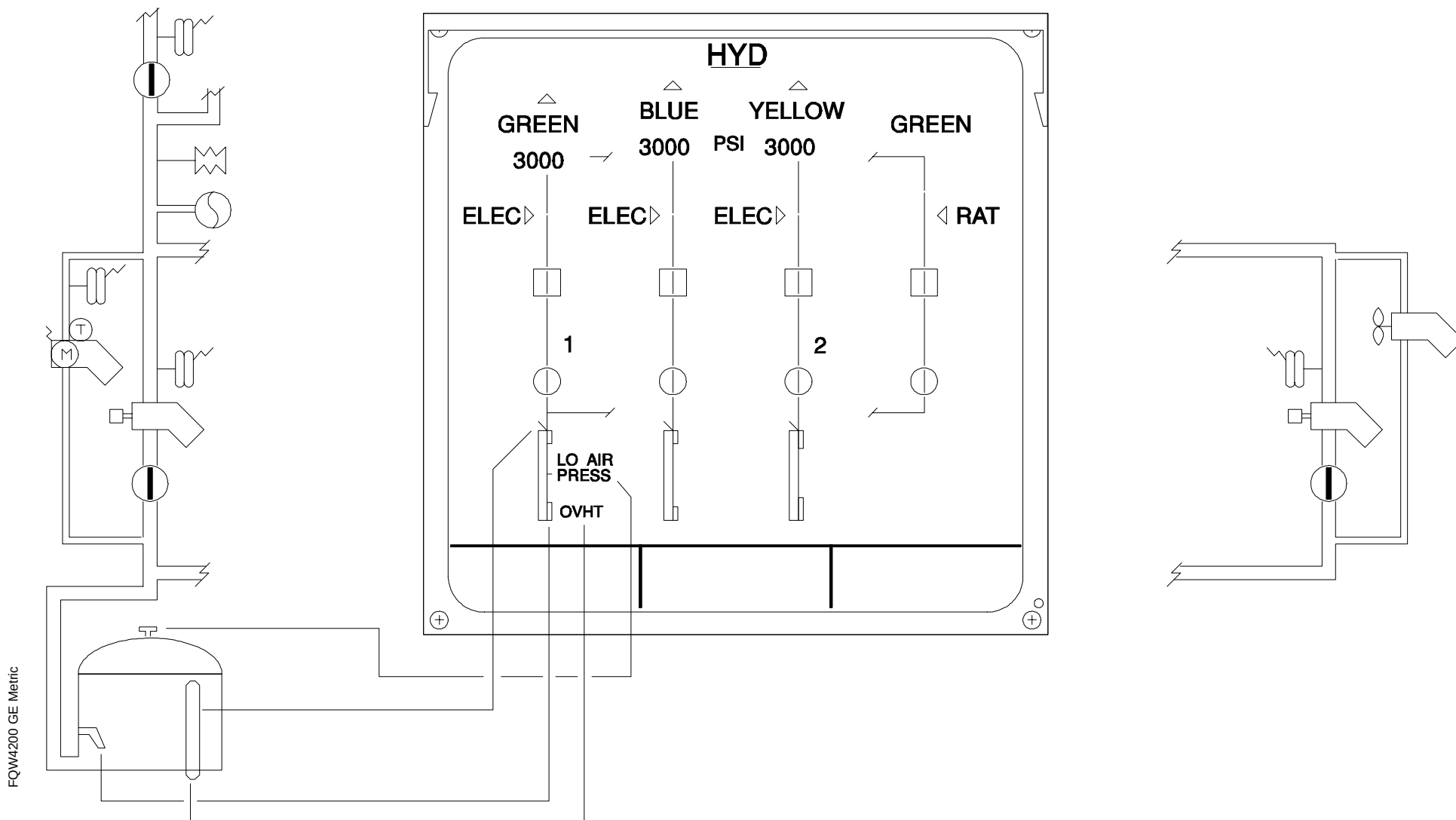
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Different levels . .

	GREEN	BLUE	YELLOW
Normal filling range	6 L 1.6 USG	5 L 1.32 USG	4 L 1.05 USG
Maximum gaugeable level	47 L 12.41 USG	32 L 8.45 USG	21 L 5.55 USG
Maximum filling level	38 L 10.04 USG	29.5 L 7.79 USG	19 L 5.02 USG
Abnormal level limit	17 L 4.5 USG	—	—
Low level warning	8 L 2.1 USG	5 L 1.32 USG	5 L 1.32 USG





FIRE SHUT-OFF VALVE



Green - Valve open or not fully closed.



Amber - Valve fully closed.

Green



Displayed when the valve status information is not available.

Amber

ENGINE DRIVEN PUMP



Green - Associated P/B switch on and pump normal pressure.



Amber - Associated P/B switch OFF.



Amber - Associated P/B switch on and pump pressure lower than 1750 psi.

Green



Displayed when the P/B status information is not available.

Amber

1,2,3,4 : Engine identification - Normally white, becomes amber when N2 below idle.

ELECTRIC PUMP



White - Electric pump not running.



Amber - Pump switched OFF (for Green or Yellow electric pumps only).



Green - Electric pump running and delivering a normal pressure.



Amber - Electric pump running and delivering a pressure lower than 1450 psi.

XX

Electric pump status information is not available.

ELEC

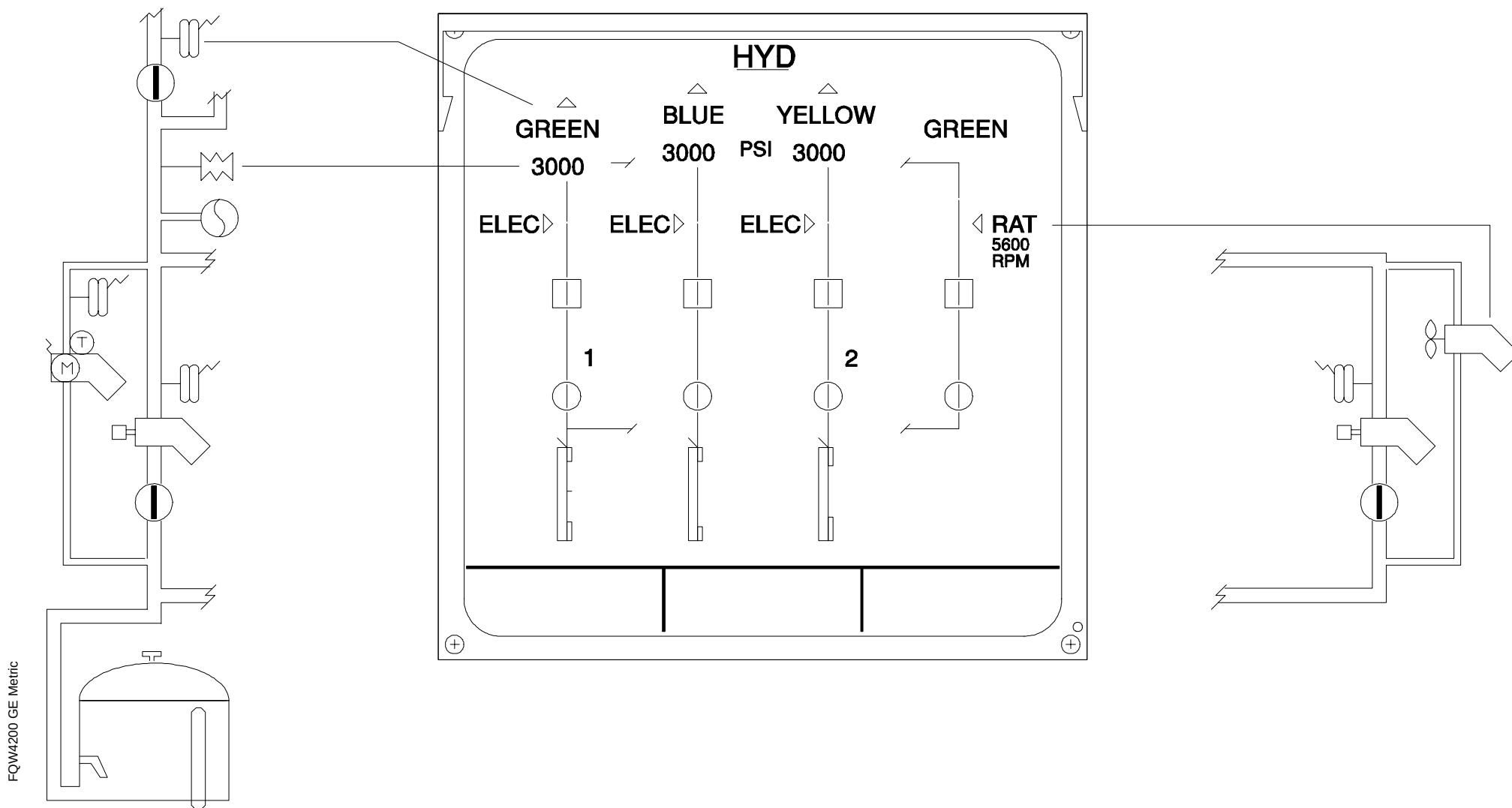


Always displayed white. Becomes amber if associated power supply fails.

ELEC
OVHT



Appears amber when electric pump temperature is above 110°C.



RAM AIR TURBINE

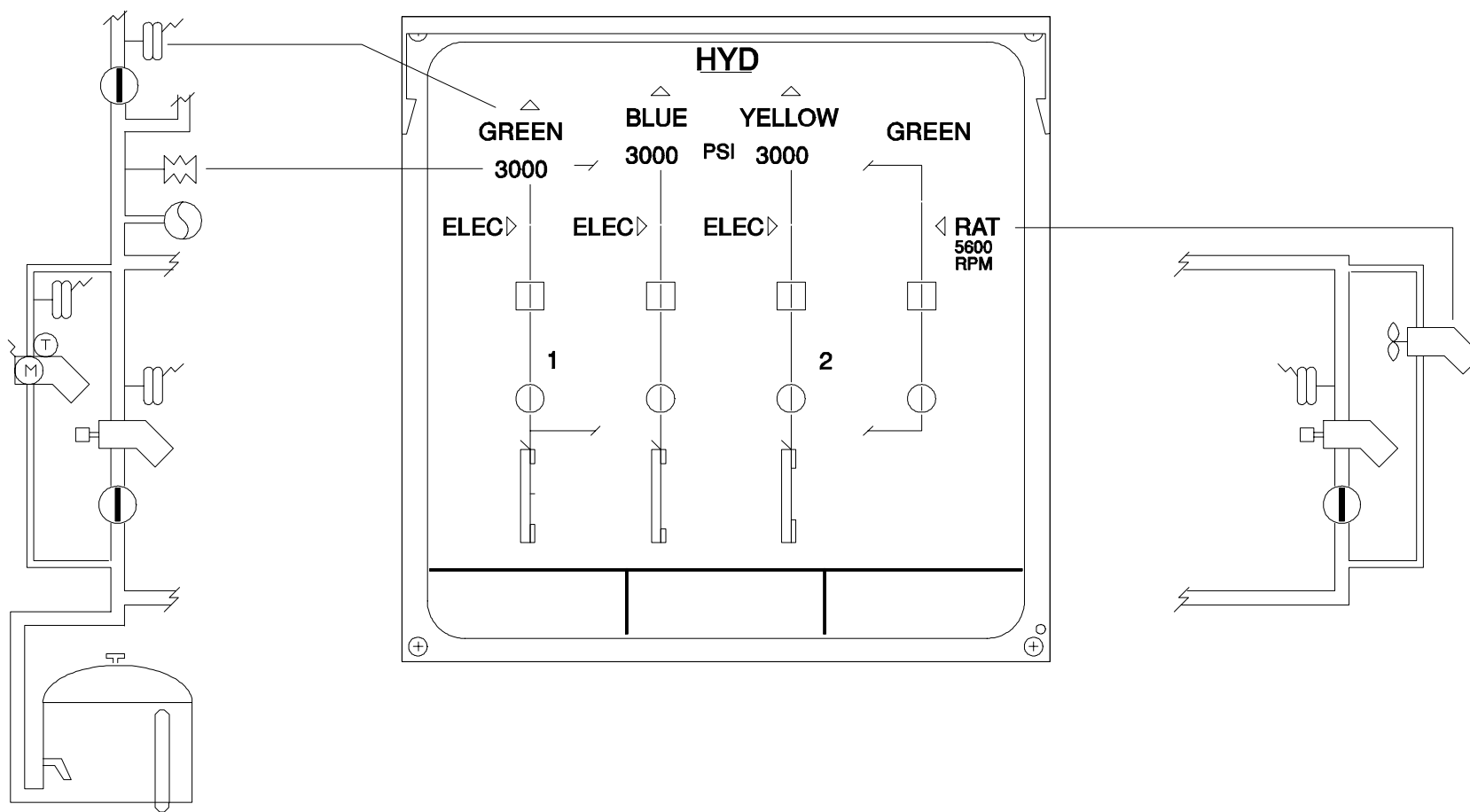
-  **RAT** White - RAT stowed.
-  **RAT** RAT stowed but RAT retraction jack pressurized.
-  **RAT** RAT not fully stowed and RAT rpm greater than 3000 rpm.
-  **RAT** Amber - RAT not fully stowed and RAT rpm lower than 3000 rpm.
-  **RAT** 5600 RPM — Green - Appears when RAT greater than 100 rpm.
- XX** RAT status information is not available.

SYSTEM PRESSURE

- 3000** Green - Becomes amber if system pressure is below 1450 psi.
- XX** Pressure information is not available.

SYSTEM STATUS

-  **GREEN** Pressure greater than 1750 psi (pressure increasing).
-  **GREEN** Pressure lower than 1450 psi (pressure decreasing).
- XX** Pressure information is not available.



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STUDENT NOTES

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GREEN HYDRAULIC SYSTEM DESCRIPTION AND OPERATION

GENERATION

- Reservoir
- Fire Valve
- Engine Driven Pump (EDP)
- Elec Pump
- Ram Air Turbine (RAT)
- Press SW
- GND Couplings

HP FILTER MANIFOLD

- HP Filters
- Sampling Valve
- Accumulator

HP MANIFOLD

- Relief Valve
- Solenoid Valve
- Pressure Transducer
- Press SW

GROUND SERVICE MANIFOLD

BRAKE MANIFOLD

- Priority Valve
- Brake Selector Valve

LP MANIFOLD

- LP Filter

GENERATION

The green hydraulic system is normally supplied by the two green engine pumps.

Auxiliary power is provided by one electric pump and, in emergency, by a ram air turbine.

RESERVOIR

The reservoir is equipped with a sight glass, a low level switch, a temperature sensor and a quantity transmitter for ECAM indicating and warning.

Maximum gaugeable level : >47 L (12.41 USG)

Filling level at 18°C : 26 L (6.84 USG)

Rsvr underfilled or system leak limit : 17 L (4.5 USG)

Low level warning : 8 L (2.1 USG)

The reservoir is normally pressurized to 50 psi to avoid pump cavitation.

A pressurization manifold is fitted on the top of the reservoir.

The manifold includes :

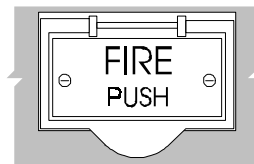
A pressure relief valve, a check valve, a direct-reading air pressure gage, an air pressure switch for low pressure indication, a connection to the Ground Service panel for depressurization.

FIRE VALVE

The green system is equipped with two fire valves, located inboard of the pylons.

They are respectively controlled by engine 1 and engine 2 fire pushbuttons.

255 VU



Green engine fire shut-off valves are automatically closed by the Hydraulic System Monitoring Unit (HSMU) in case of green reservoir low level.

The fire shut-off valves are operated by a 28VDC powered motor.

ENGINE DRIVEN PUMP (EDP)

The green system has two Engine Driven Pumps.

They are located on the accessory gearbox of engines 1 and 2.

They are controlled by their respective pushbutton switches on the overhead panel (245vu).

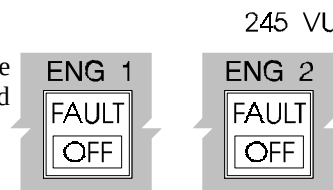
Pump nominal pressure is 3000 psi.

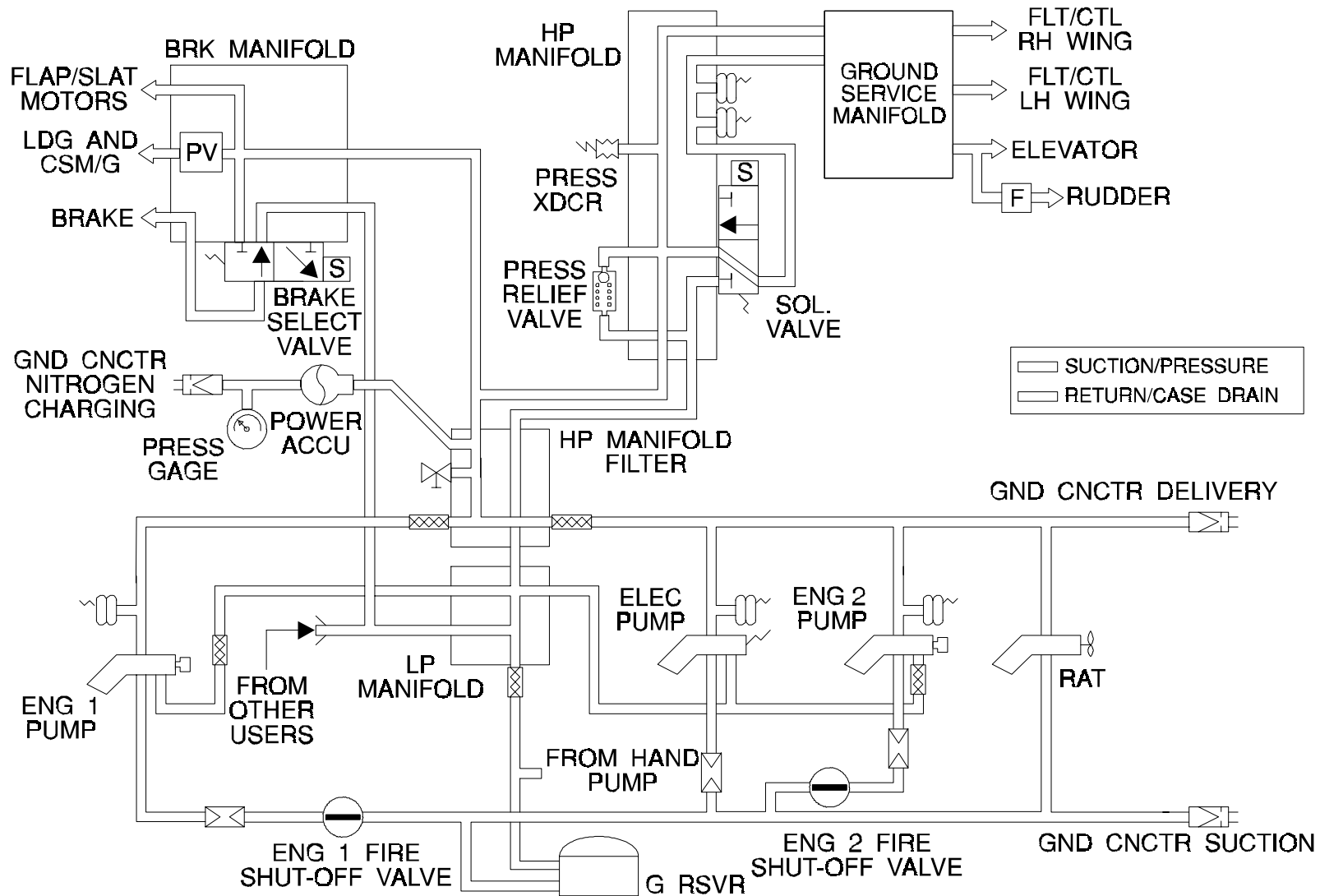
Each pushbutton switch controls a solenoid valve on its own engine driven pump to provide a pressurized or depressurized mode.

A blocking valve isolates the pump from the hydraulic system in the depressurized mode.

The engine driven pump cooling and lubricating flow passes via the case drain filter installed on the return circuit.

It is a non by-pass filter equipped with a clogging indicator.





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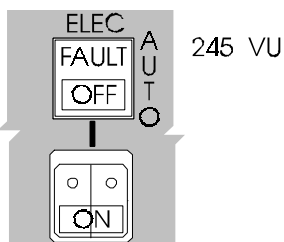
ELEC PUMP

The electric pump is the auxiliary power generator. The pump includes a variable displacement pump driven by an electric motor which is cooled by air.

The inlet boost pumps provide maximum supply for the two main pumps even if the reservoir pressure fails.

It is operated manually by selecting the corresponding "ON" P/B located on the overhead panel.

The hydraulic system monitoring unit automatically energizes the green electric pump in the following cases.

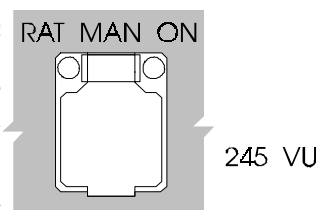


RAM AIR TURBINE

The Ram Air Turbine (RAT) is a variable pitch, two blade unit located in the number 4 flap track fairing on the right wing.

When extended, it will supply hydraulic pressure to the green system. It is operated manually by selecting the "RAT MAN ON" guarded P/B switch located on the overhead panel.

The hydraulic system monitoring unit automatically extends the ram air turbine in the following cases.



AUTOMATIC STARTING OF GREEN ELECTRIC PUMP

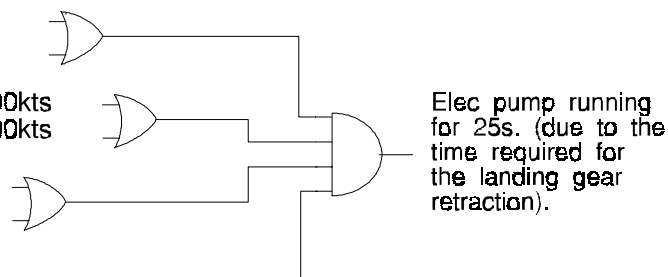
IN FLIGHT :

LGCIU 1 - flight
LGCIU 2 - flight

ADIRU 1 - $V_c > 100\text{kts}$
ADIRU 3 - $V_c > 100\text{kts}$

Eng 1 failure
Eng 2 failure

LDG selector
selected "UP"



RAT AUTOMATIC DEPLOYMENT LOGIC

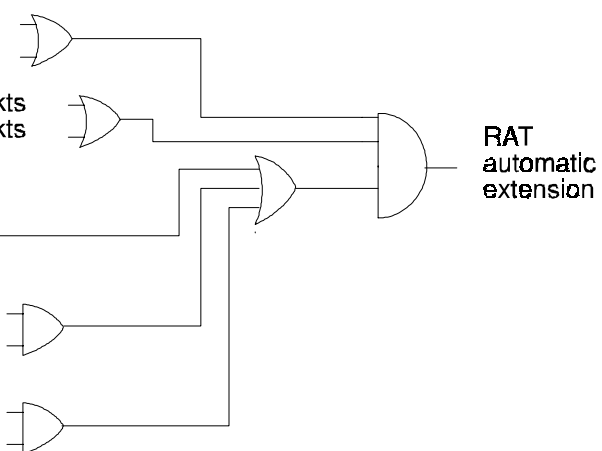
LGCIU 1 - flight
LGCIU 2 - flight

ADIRU 1 - $V_c > 100\text{kts}$
ADIRU 3 - $V_c > 100\text{kts}$

Failure of
both engines

Green rsrv low level
Blue rsrv low level

Green rsrv low level
Yellow rsrv low level



PRESSURE SWITCHES

The pressure switches monitor the engine pump and electrical pump outlet pressure, so that indications can be displayed on the ECAM, and warnings can be triggered.

Engine pumps :

Pump outlet pressure < 1750 psi
reset if pressure > 2200 psi

Electric pump :

Pump outlet pressure < 1450 psi
reset if pressure > 1750 psi

GND COUPLINGS

The ground couplings are installed on the green ground service panel located in the left aft section of the belly fairing.

The Green ground service panel comprises :

One connector for hydraulic suction, one connector for hydraulic delivery, one connector for reservoir filling, one connector for charging the accumulator with nitrogen.

HIGH PRESSURE FILTER MANIFOLD

The HP filter manifold provides a mounting for two HP filters, and the system sampling valve.

HP FILTERS

Located on the HP filter manifold, the two HP filters are of the non by-pass type with a clogging indicator.

The filters are not cleanable.

SAMPLING VALVE

Located on the HP filter manifold in the main gear bay, the sampling valve is used to monitor contamination.

Samples are taken with the system pressurized and with a flow demand.

ACCUMULATOR

Located below the HP filter manifold in the main landing gear bay, the accumulator damps pump pulsations and compensates for high flow demands.

It's a bladder type accumulator with nitrogen in the upper half and hydraulic fluid in the lower half.

HIGH PRESSURE MANIFOLD

The HP manifold is located on the main landing gear bay rear bulkhead.

RELIEF VALVE

The relief valve is located on the HP manifold. It returns the fluid directly to the reservoir in overpressure conditions.

Overpressure condition : 3436 psi.

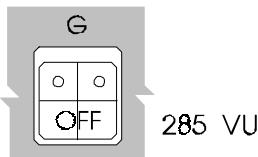
It closes when the pressure drops below 3190 psi.

SOLENOID VALVE

The leak measurement solenoid valve is located on the HP manifold.

It is a two position, three-way, solenoid operated type valve.

It is normally open, and is operated by selecting the green leak measurement valve P/B switch on the hydraulic maintenance panel.



PRESSURE TRANSDUCER (PRESS XDCR)

Located on the HP manifold, the pressure transducer provides data for system pressure indications on ECAM.

PRESSURE SWITCHES

The pressure switches give information for indication and warning, and for the flight control system.

They are directly installed on the HP manifold and are set to operate at 1450 psi (pressure decreasing) and reset at 1750 psi (pressure increasing).

GROUND SERVICE MANIFOLD

Located in the main landing gear bay, the ground service manifold contains three normally closed poppet valves.

On the ground, these valves can be manually opened for the measurement of internal flow of the flight servo controls.

BRAKE MANIFOLD

The brake manifold located on the right side of the main landing gear bay provides the supply to the user equipment of the landing gear, brakes, emergency generator and flaps and slats.

PRIORITY VALVE

Located on the brake manifold, the priority valve divides the hydraulic supply into a primary and secondary circuit.

This gives priority to the flight servo controls.

In case of low pressure, the secondary circuit (LDG, CSM/G and NWS) will be isolated.

BRAKE SELECTOR VALVE

The brake selector valve is located on the brake manifold.

When selected, it provides hydraulic pressure to the normal braking system.

LOW PRESSURE MANIFOLD

The LP manifold is located on the rear bulkhead of the main landing gear bay and it receives the return lines from the user components and directs them to the reservoir via the LP filter.

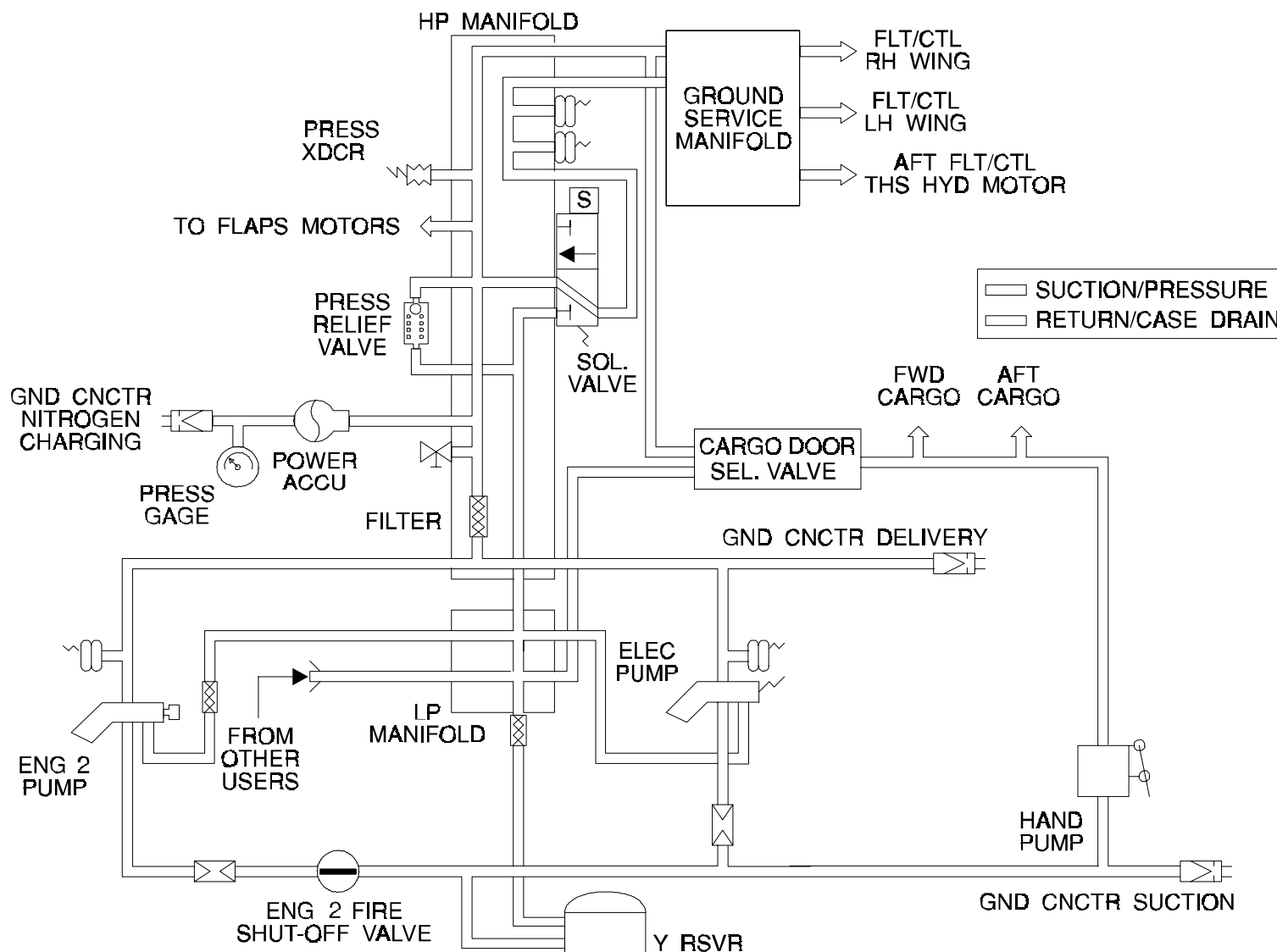
LP FILTER

The LP filter is installed in the return line below the reservoir.

The filter is fitted with a by-pass system and clogging indicator.

STUDENT NOTES:

STUDENT NOTES:

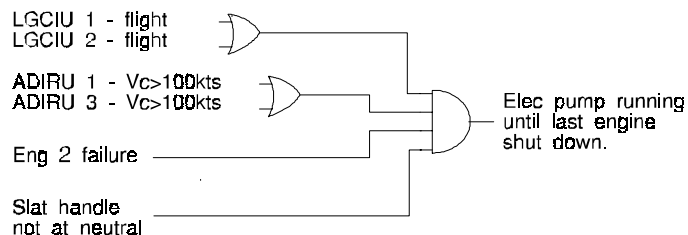


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The hydraulic system monitoring unit automatically energizes the yellow electric pump in the following cases.

AUTOMATIC STARTING OF YELLOW ELECTRIC PUMP

IN FLIGHT :



ON GROUND :

On ground during cargo door operation plus 10 seconds time delay.

HAND PUMP

The yellow hand pump is used to operate the cargo doors when electrical power is not available.

The pump is an axial-piston type with an outer splined pivot to connect the removable handle.

The handle is stowed on the green ground service panel.

The nominal operating pressure is about 2840 psi.

PRESSURE SWITCHES

The pressure switches monitor the engine pump and electrical pump outlet pressure so that indications can be displayed on the ECAM, and warnings can be triggered.

Engine pump :

Pump outlet pressure < 1750 psi
reset if pressure > 2200 psi

Electric pump :

Pump outlet pressure < 1450 psi
reset if pressure > 1750 psi

GND COUPLING

The ground couplings are installed on the yellow ground service panel located in the right forward section of the belly fairing.

The Yellow ground service panel comprises several connectors :

One for hydraulic suction, one for hydraulic delivery, one for reservoir depressurizing, one for charging the accumulator with nitrogen.

HIGH PRESSURE MANIFOLD

The HP manifold provides a mounting for the HP filter, the system sampling valve, the relief valve, the system pressure switches and the leak measurement solenoid valve.

HP FILTER

Located on the HP manifold, the HP filter is of the non by-pass type with a clogging indicator.

The filter is not cleanable.

SAMPLING VALVE

Located on the HP manifold in the yellow hydraulic compartment, the sampling valve is used to monitor contamination.

Samples are made with the system pressure on and with a flow demand.

ACCUMULATOR

Located in the yellow hydraulic compartment, the accumulator damps pump pulsations and compensates for high flow demands.

It's a bladder type accumulator with nitrogen in the upper half and hydraulic fluid in the lower half.

RELIEF VALVE

The relief valve is located on the HP manifold. It returns the fluid directly to the reservoir in overpressure conditions.

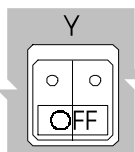
Overpressure conditions : 3436 psi.
It closes when the pressure drops below 3190 psi.

SOLENOID VALVE

The leak measurement solenoid valve is located on the HP manifold.

It is a two position, three-way, solenoid operated type valve.

It is normally open, and is operated by selecting the Yellow leak measurement valve P/B switch on the hydraulic maintenance panel.



285 VU

PRESSURE TRANSDUCER (PRESS XDCR)

Located on the HP manifold, the pressure transducer provides data for system pressure indications on ECAM.

PRESSURE SWITCHES

The pressure switches give information for indication and warning, and for the flight control system.

They are directly installed on the HP manifold and are set to operate at 1450 psi (pressure decreasing) and reset at 1750 psi (pressure increasing).

GROUND SERVICE MANIFOLD

Located in the yellow hydraulic compartment, the ground service manifold contains three normally closed poppet valves.

On the ground, these valves can be manually opened for the measurement of internal flow leakage of the flight servo controls.

LOW PRESSURE MANIFOLD

The LP manifold is located in the yellow hydraulic compartment and it receives the return lines from the user components and directs them to the reservoir via the LP filter.

LOW PRESSURE FILTER

The LP filter is installed in the return line below the reservoir.

The filter is fitted with a by-pass system and clogging indicator.

CARGO DOOR SELECTOR VALVE

The cargo door selector valve is installed in the yellow service panel.

It controls the normal mode of the cargo doors hydraulic system.

STUDENT NOTES:

FQW4200 GE Metric

BLUE HYDRAULIC SYSTEM DESCRIPTION AND OPERATION

GENERATION

- Reservoir
- Fire Valve
- Engine Driven Pump (EDP)
- Elec Pump
- Press SW
- GND Couplings

HP MANIFOLD

- HP Filter
- Sampling Valve
- Accumulator
- Relief Valve
- Solenoid Valve
- Pressure Transducer
- Press SW

GROUND SERVICE MANIFOLD

LP MANIFOLD

LP FILTER

GENERATION

The blue hydraulic system is normally supplied by one engine pump. Auxiliary power is provided by one electric pump.

RESERVOIR

The reservoir is equipped with a sight glass, a low level switch, a temperature sensor and a quantity transmitter for ECAM indicating and warning.

Maximum gaugeable level : 32L (8.45 USG)

Filling level at 18°C : 22L (5.80 USG)

Low level warning : 5L (1.32 USG)

The reservoir is normally pressurized to 50 psi to avoid pump cavitation.

A pressurization manifold is fitted on the top of the reservoir.

The manifold includes :

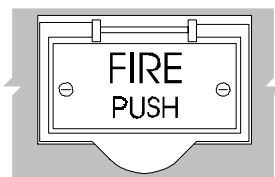
A pressure relief valve, a check valve, a direct-reading air pressure gage, an air pressure switch for low pressure indication, a connection to the Ground Service panel for depressurization.

FIRE VALVE

The blue system is equipped with a fire valve, located inboard of engine 1 pylon.

It is controlled by engine 1 fire pushbutton.

The fire shut-off valve is operated by a 28VDC powered motor.

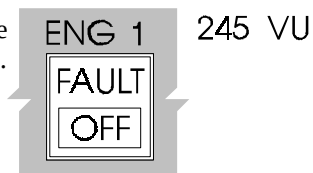


ENGINE DRIVEN PUMP (EDP)

The blue system has one engine driven pump.

It is located on the accessory gearbox of engine 1.

It is controlled by its respective pushbutton switch on the overhead panel.



Pump nominal pressure is 3000 psi.

The pushbutton switch controls a solenoid valve on the engine driven pump to provide a pressurized or depressurized mode.

A blocking valve isolates the pump from the hydraulic system in the depressurized mode.

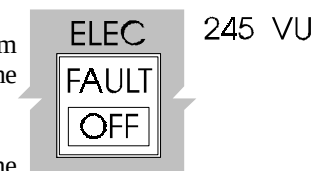
The engine driven pump cooling and lubricating flow passes via the case drain filter installed on the return circuit.

It is a non by-pass filter equipped with a clogging indicator.

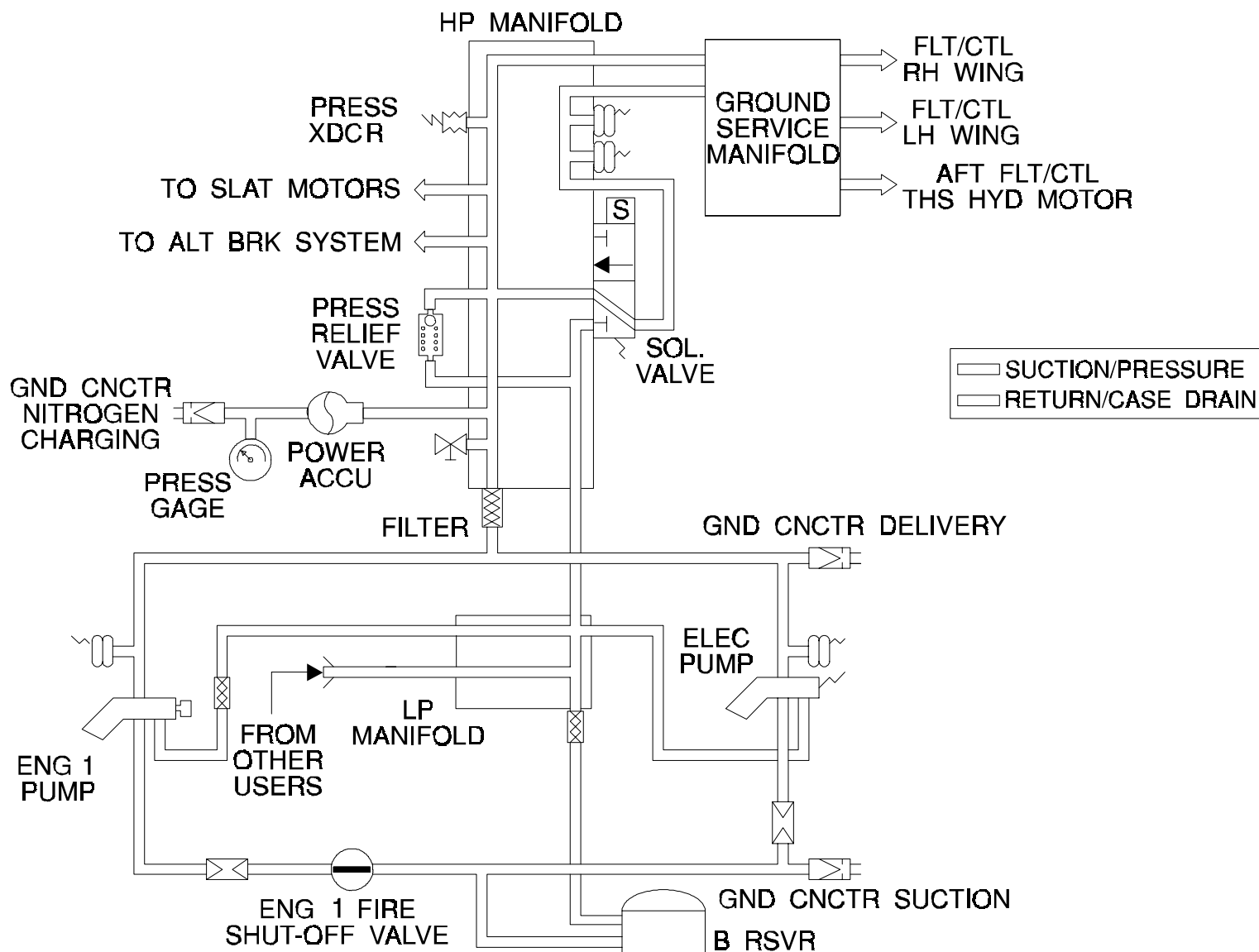
ELEC PUMP

The electric pump is the auxiliary power generator. The pump includes a variable displacement pump driven by an electric motor which is cooled by air.

The inlet boost pumps provide maximum supply for the two main pumps even if the reservoir pressure fails.



It is operated manually by selecting the corresponding "ON" P/B located on the overhead panel.



FQW4200 GE Metric

PRESS SW

The pressure switches monitor the engine pump and electric pump outlet pressure so that indications can be displayed on the ECAM, and warnings can be triggered.

Engine pumps :

Pump outlet pressure <1750 psi
reset if pressure >2200 psi

Electric pump :

Pump outlet pressure <1450 psi
reset if pressure >1750 psi

GND COUPLINGS

The ground couplings are installed on the blue ground service panel located in the left forward section of the belly fairing.

The Blue ground service panel comprises several connectors :

One for hydraulic suction, one for hydraulic delivery, two for reservoir pressurizing, three for charging the accumulator with nitrogen (prk brk + sys).

HIGH PRESSURE MANIFOLD

The HP manifold provides a mounting for the HP filter, the system sampling valve, the relief valve, the system pressure switches and the leak measurement solenoid valve.

HP FILTER

Located on the HP manifold, the HP filter is of the non by-pass type with a clogging indicator.

The filter is not cleanable.

SAMPLING VALVE

Located on the HP manifold in the blue hydraulic compartment, the sampling valve is used to monitor contamination.

Samples are made with the system pressure on and with a flow demand.

ACCUMULATOR

Located in the blue hydraulic compartment, the accumulator damps pump pulsations and compensates for high flow demands.

It's a bladder type accumulator with nitrogen in the upper half and hydraulic fluid in the lower half.

RELIEF VALVE

The relief valve is located on the HP manifold.

It returns the fluid directly to the reservoir in overpressure conditions.

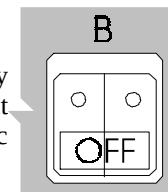
Overpressure conditions : 3436 psi.
It closes when the pressure drops below 3190 psi.

SOLENOID VALVE

The leak measurement solenoid valve is located on the HP manifold.

It is a two position, three-way, solenoid operated type valve.

It is normally open, and is operated by selecting the Blue leak measurement valve P/B switch on the hydraulic maintenance panel.



285 VU

PRESSURE TRANSDUCER (PRESS XDCR)

Located on the HP manifold, the pressure transducer provides data for system pressure indications on ECAM.

PRESS SW

The pressure switches give information for indication and warning, and for the flight control system.

They are directly installed on the HP manifold and are set to operate at 1450 psi (pressure decreasing) and reset at 1750 psi (pressure increasing).

GROUND SERVICE MANIFOLD

Located in the blue hydraulic compartment, the ground service manifold contains three normally closed poppet valves.

On the ground, these valves can be manually opened for the measurement of internal flow leakage of the flight servo controls.

LOW PRESSURE MANIFOLD

The LP manifold is located in the blue hydraulic compartment and it receives the return lines from the user components and directs them to the reservoir via the LP filter.

LOW PRESSURE FILTER

The LP filter is installed in the return line below the reservoir.

The filter is fitted with a by-pass system and clogging indicator.

STUDENT NOTES:

FQW4200 GE Metric

GROUND INTERNAL LEAK TEST PRESENTATION

General
Leak Measurement Solenoid Valve
Manual Selector Valve

GENERAL

The leak measurement solenoid valves are used to isolate the hydraulic supply of the primary flight controls.

The valves are controlled from the hydraulic leak measurement control panel.

The leak measurement solenoid valve control panel is located on the HYD maintenance overhead panel. These valves are only used on the ground.

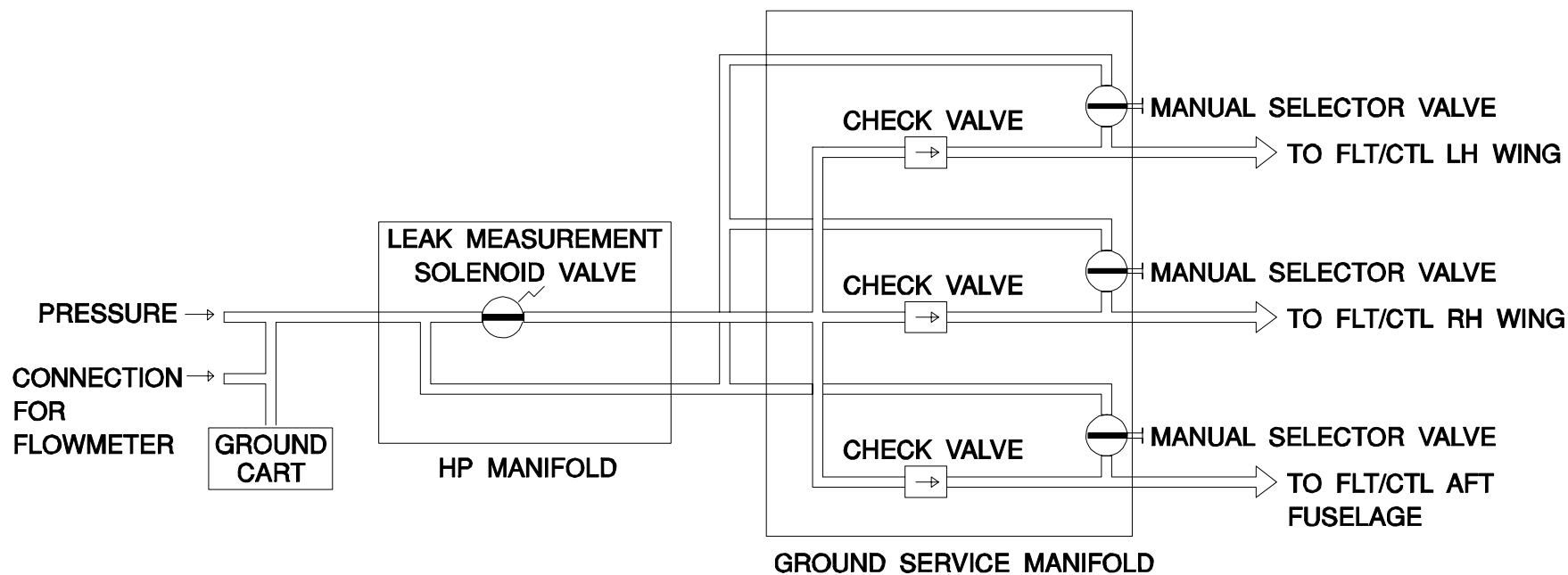
LEAK MEASUREMENT SOLENOID VALVE

Selecting the leak measurement solenoid valve pushbutton switch isolates the hydraulic system of the flight controls.

MANUAL SELECTOR VALVE

To test for leaks in the system, we have to open the manual selector valve in order to measure the flow rate for the components in the left wing, right wing or aft fuselage section.

A flowmeter can be used for correct flow rate measurement.



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STUDENT NOTES:

FQW4200 GE Metric

SEAL DRAIN SYSTEM PRESENTATION

General
FWD System
AFT System
Recovery Tank

GENERAL

In order to have the hydraulic compartment as clean as possible this system collects the hydraulic fluid leakage in transparent tanks.

The system is designed so that fluid drains into the recovery tanks under the influence of gravity.

Overflow pipes are provided to prevent a reservoir overfilling if the corresponding recovery tank is full.

The system is divided into the forward and aft drain systems.

FWD SYSTEM

The recovery tank is located in the yellow hydraulic compartment.

The components which drain into the FWD recovery tank are :

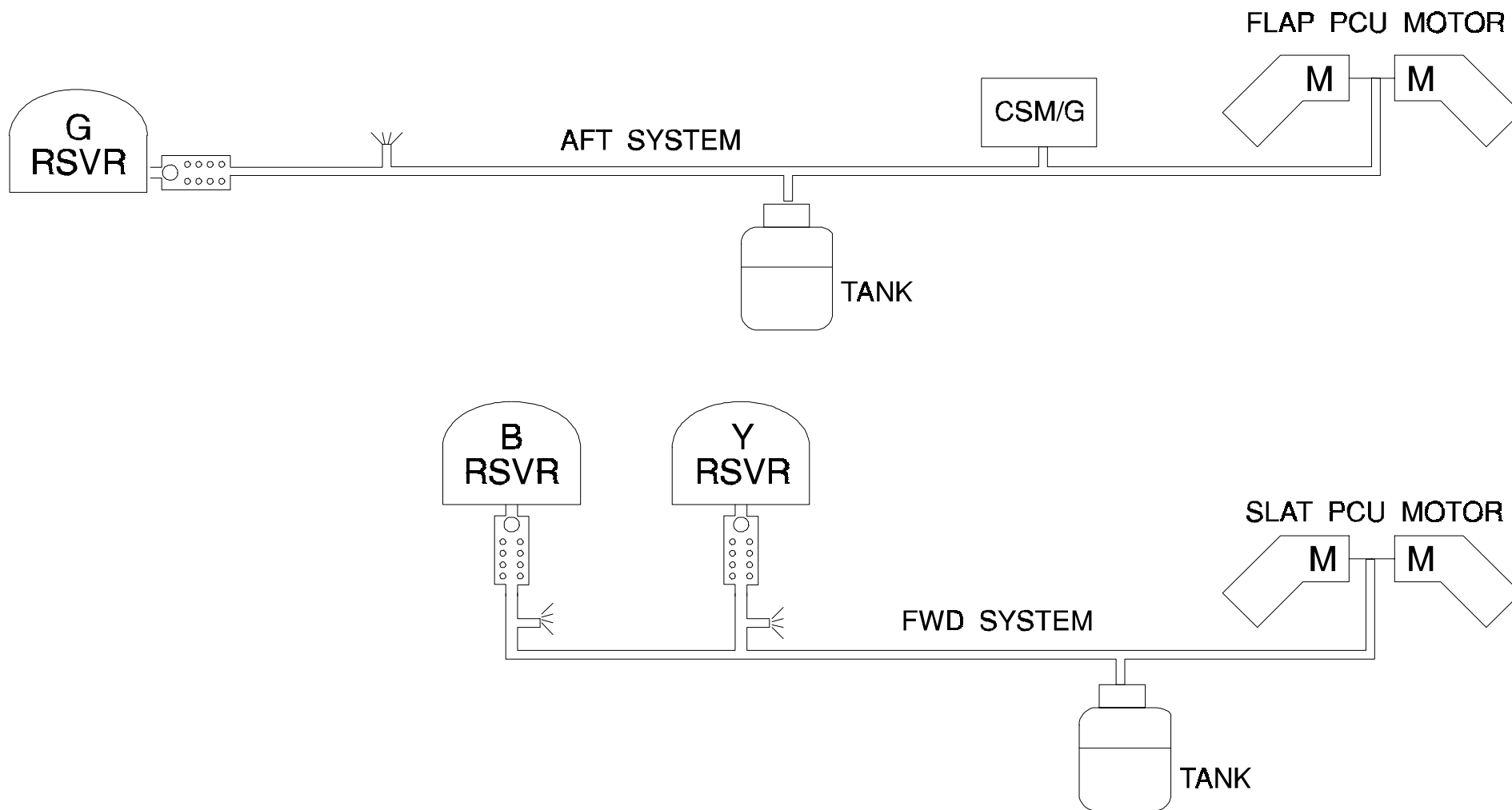
- The blue system reservoir via the air-relief valve.
- The yellow system reservoir via the air-relief valve.
- The slat Power Control Unit (PCU).

AFT SYSTEM

The recovery tank is located in the green hydraulic compartment.

The components which drain into the recovery tank are :

- The green system reservoir via the air - relief valve.
- The flap Power Control Unit (PCU).
- The Constant Speed Motor/Generator (CSM/G).



FQW4200 GE Metric

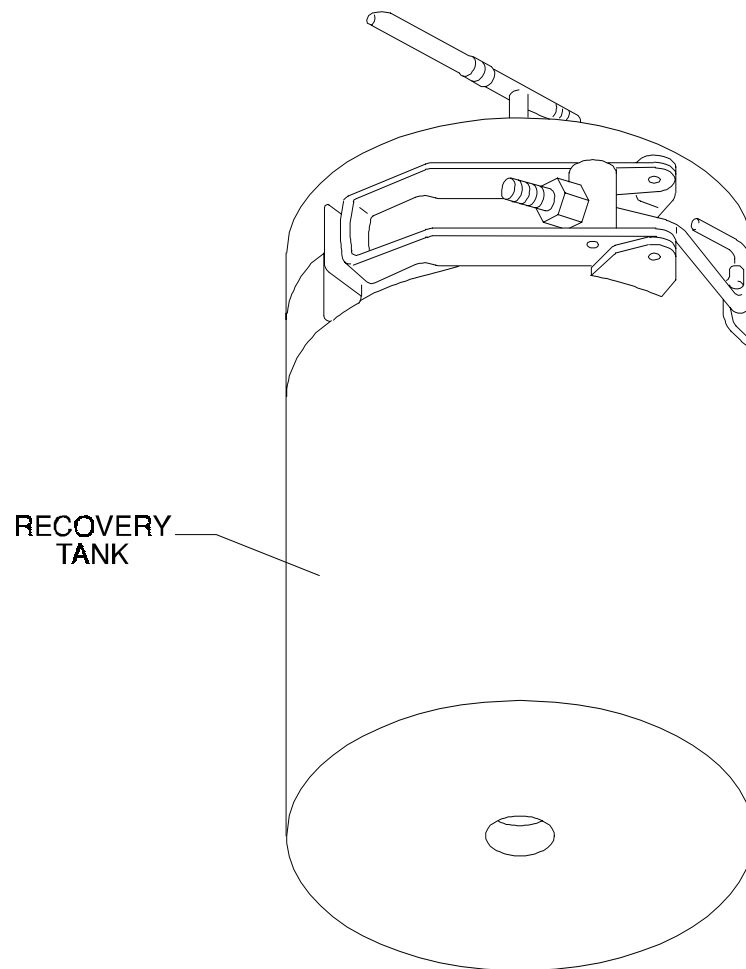
RECOVERY TANK

The two recovery tanks are made of plastic.

They are attached to the structure with quick release clamps to make them easier to empty.

They have a capacity of 0.75 l.

It is necessary to remove the hydraulic fluid at regular intervals.



FQW4200 GE Metric

STUDENT NOTES:

FQW4200 GE Metric

WARNINGS

RSVR LO AIR PR
G RSVR UNDERFILLED or G SYS LEAK
RSVR OVHT
RSVR LO LVL
ENG PUMP LO PR
ELEC PUMP FAULT
SYS LO PR
RAT FAULT
DUAL SYS LO PR
MONITORING FAULT
OPERATING LIMITATIONS

RSVR LO AIR PR

If pressure fluctuates, associated pump(s) must be selected OFF. The system can be restored for approach. The FAULT lights are inhibited when the pumps are selected off.

G RSVR UNDERFILLED or G SYS LEAK

This message appears when the reservoir level indication reaches the abnormal level limit. The ECAM message "G SYS LEAK" appears in flight only.

On ground the same warning displays this message :

HYD : G RSVR UNDERFILLED.

RSVR OVHT

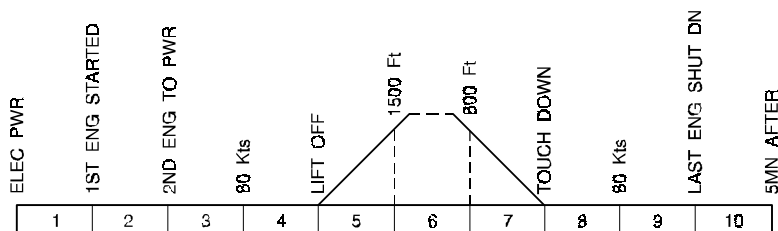
The FAULT light will remain on as long as the overheat exists, even if the pb sw is set to OFF. The B ELEC pump FAULT light is inhibited when the pump is selected off. For approach, the system can be restored if the overheat has disappeared.

RSVR LO LVL

Yellow reservoir level drops, HYD LO LVL does not immediately activate a SYS LO PR warning. The FAULT lights are inhibited when the pumps are selected OFF.

ENG PUMP LO PR

The warning is inhibited when the pump is selected OFF, or, on ground when associated engine is stopped.



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
G (Y) (B) RSVR LO AIR PR reservoir air pressure < 22 psi reset if pressure > 25 psi	SINGLE CHIME	MASTER CAUT	HYD	FAULT It on associated pump(s) pb	3, 4, 5, 7, 8
G RESERVOIR UNDERFILLED On ground, RSVR qty < 17l. if Temp > 0°C or RSVR QTY < QTY function of temp				NIL	3, 4, 5, 6, 7, 8
G SYS LEAK In flight only					1 to 5 7 to 10
G (Y) (B) RSVR OVHT Fluid temperature > 95°C				FAULT It on associated pump(s) pb	3,4,5 7,8
G (Y) (B) RSVR LO LVL Fluid quantity < 8l. (2.11 USG) Green Fluid quantity < 5l. (1.32 USG) Yellow Blue					4,5 7,8
G ENG 1 (2) G ENG 1+2 B ENG 1 PUMP LO PR or Y ENG 2 System pressure < 1450 psi or pressure sw or pump					3*,4 5,7,8 *only for G ENG1(2)

ELEC PUMP FAULT

The aircraft is at the gate. The Blue electric pump has been set to ON to pressurize the alternate braking system.
The FAULT light is inhibited when the pump is selected off.

SYS LO PR

In this case, the system detects an abnormal pressure due to an ENG 2 PUMP LO PR.

RAT FAULT

The Green and Blue systems are in low level. Note that the Green system fire valves are automatically closed to keep hydraulic fluid for the RAT.
The RAT is extended and not running. The warning is identical if the RAT is stowed with stowing pressure applied.

DUAL SYS LO PR

After a RSVR LO LEVEL, the green system is inoperative. The green hydraulic fire shut off valves have been automatically closed.
Both Green and Yellow hydraulic systems are now inoperative.

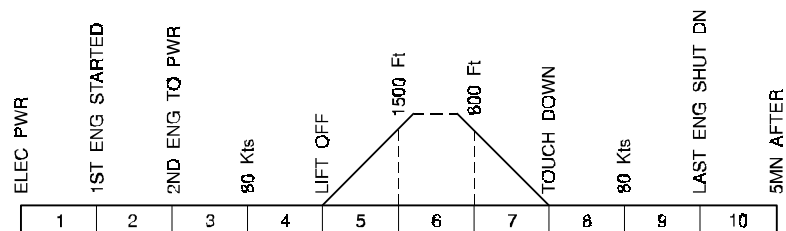
MONITORING FAULT

This message appears when the HSMU is not racked.

After a CLEAR action, this message is displayed on the STATUS page :
INOP SYS : HYD MONG

OPERATING LIMITATIONS

Normal hydraulic operating pressure is approximately 3000 psi. The minimum aircraft speed for correct RAT operation is 125 kts.



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
G (Y) (B) ELEC PUMP FAULT Elec pump LO PR or ovht	SINGLE CHIME	MASTER CAUT	HYD	FAULT It on associated pump(s) pb	3, 4, 5, 7, 8
G (B) (Y) SYS LO PR System pressure < 1450 psi reset if pressure > 1750 psi					
RAT FAULT Rat not fully stowed with stowing pressure applied or RAT not stowed with RPM < 3000	NIL	NIL		NIL	3, 4, 5 7, 8, 9, 10
B + Y G + B SYS LO PR G + Y System pressure < 1450 psi reset if pressure > 1750 psi	CRC	MASTER WARN		FAULT It on associated pump(s) pb	4,5
MONITORING FAULT	NIL				3, 4, 5 7, 8

STUDENT NOTES

FQW4200 GE Metric

SAFETY PRECAUTIONS

General
Safety Procedures
System Pressurization
Hydraulic Fluid Safety Procedures
Technical Precautions

GENERAL

At the start of each task the maintenance manual provides the relevant precautions.

WARNING

Put the safety devices and the warning notices in position before you start a task on or near :

- The flight controls.
- The flight control surfaces.
- The landing gear and the related door.
- Components that move.

SAFETY PROCEDURES

Obey the hydraulic safety procedures.

WARNING

Make sure that the hydraulic system(s) in maintenance is(are) isolated before you pressurize the other hydraulic system(s).

SYSTEM PRESSURIZATION

Make sure you fully understand the system operating procedure.

Before you pressurize an hydraulic system :

- Make sure that all persons and equipment are clear of the flight controls and the landing gear doors.
- Use the ground interphone system to get approval to pressurize the hydraulic system.

HYDRAULIC FLUID SAFETY PRECAUTIONS

The correct type of hydraulic fluid to be used is listed in ATA chapter twelve and ATA chapter twenty of the aircraft maintenance manual.

Do not mix hydraulic fluid of the phosphate ester type with hydraulic fluid of the mineral-base type.

This mixture causes a jelly in the hydraulic systems which can damage the system.

This could cause a reduction in aircraft safety.

These types of fluid are used in the hydraulic systems and landing gear respectively.

Thus there must be precautions to prevent any mixture of the fluids.

Know where your eye wash facilities are.

Read and make sure you fully understand these precautions before you start work with hydraulic fluid :

- Before you start work, clean your hands, wrists and forearms and apply barrier cream.
- Apply barrier cream under your fingernails and into creases of your skin.
- Put on goggles when you pressure test components or systems, or when there is a possibility that fluid will splash into your eyes.
- If hydraulic fluid gets into your eyes, immediately irrigate your eyes with clear cold water and report the incident.
- Clean your hands, wrists and forearms with soap and warm water if it was necessary to touch hydraulic fluid.
- Remove clothing which is soaked with hydraulic fluid as soon as possible.

TECHNICAL PRECAUTIONS

The aircraft structure is made up of a wide range of materials.

OBEY THESE TECHNICAL PRECAUTIONS WHEN YOU WORK ON THE HYDRAULIC SYSTEM.

Make sure that the hydraulic fluid does not touch these aircraft materials :

- rubber
- copper
- titanium
- plastics
- paints.

Good maintenance practice will help to prevent damage.

Make sure that the hydraulic fluid does not touch the aircraft other than components in the hydraulic system.

Keep to a minimum the hydraulic fluid which spills accidentally during maintenances.

Clean up such hydraulic fluid so that it can not go into adjacent areas. This is also to prevent future incorrect reports of hydraulic fluid leaks.

When you clean up hydraulic fluid, use dry cloth and clean the area with the correct solvent.

The correct solvents and cleaning agents are listed in ATA chapter twenty of the aircraft maintenance manual.

WARNING

- Use solvent/cleaning agents, sealants and other special materials only with a good supply of air.
 - Obey the manufacturers instructions.
 - Put on protective clothing.
 - Do not get them in your mouth.
 - Do not smoke.
 - Do not breath the gas.
 - These materials are poisonous and flammable and skin irritants.
- Get medical help if your skin or eyes become irritated.

Never fill aircraft systems from previously opened containers.

When you clean metal parts, before you assemble them, use only the correct solvents.
Make sure that all of the solvent is removed before you assemble the parts.

Use only approved hydraulic fluid when you fill the reservoirs, filter bowls, pumps or other hydraulic components before installation.

Make sure that you prevent the contamination of hydraulic fluids with unapproved hydraulic fluids, fuels, oil, water or unwanted material.

If a system becomes contaminated, keep the hydraulic fluid so that you can make an analysis of it.

Before you connect the ground supply to the aircraft, make sure that the fluid specifications (of the cart and the aircraft) are the same.

STUDENT NOTES

FQW4200 GE Metric

SYSTEM OPERATION

Safety Precautions
Green Electric Pump
Blue Electric Pump
Yellow Electric Pump

SAFETY PRECAUTIONS

Obey the hydraulic safety procedures.

WARNING

Put the safety devices and the warning notices in position before you start a task on or near:

- The flight controls,
- The flight control surfaces,
- The landing gear and the related doors,
- The engines,
- Components that move.

Make sure that the travel ranges of the flight control surfaces are clear before you pressurize or depressurize a hydraulic system.

WARNING

Pressurize only the hydraulic system(s) that is (are) necessary for the task. Isolate the other hydraulic system(s) before you supply hydraulic power to the aircraft.

Make sure that the ECAM does not show any hydraulic system warning.

GREEN ELECTRIC PUMP

The green electric pump can be controlled manually with the pushbutton switches located on the overhead panel.

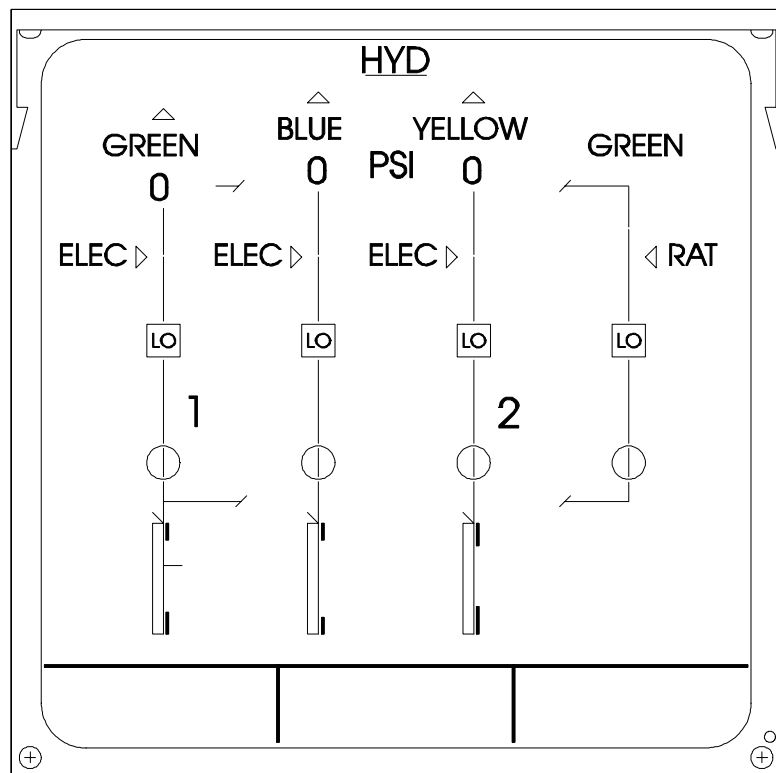
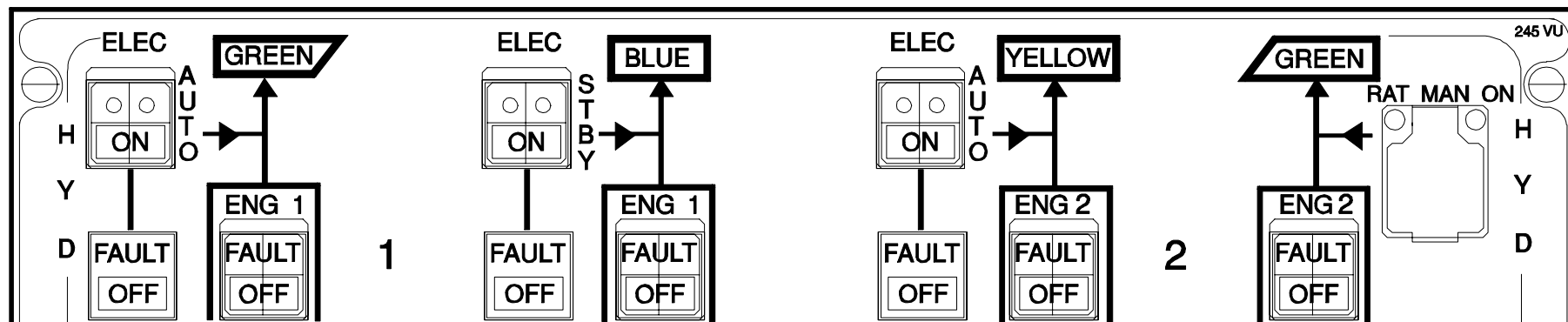
When the "FAULT-OFF" P/B switch is in the normal position (P/B pressed-in), the supply of the pump is via the "ON" P/B switch when it is activated (the "ON" legend comes on).

The green system is pressurized, it is used on the ground for pressurizing the landing gear door system.

Any action on the "FAULT-OFF" P/B switch in the "OFF" position (P/B released) cuts off the power supply of the pump (The OFF legend comes on).

The electric pump is now stopped, the Green system is depressurized. Normally you need to put the "FAULT-OFF" P/B sw in the normal position (P/B pressed-in).

Note: When the pump is manually controlled by the "ON" P/B sw, any other action on this P/B cuts off the power supply of the pump.



BLUE ELECTRIC PUMP

The blue electric pump is only controlled manually with the pushbutton switch located on the overhead panel.

When the "FAULT-OFF" P/B switch is in the normal position (P/B pressed-in), the supply of the pump is via the "ON" P/B switch when it is activated (the "ON" legend comes on).

The blue system is pressurized, it is used on the ground for example to pressurize the alternate brake system.

Any action on the "FAULT-ON" P/B switch cuts off the power supply of the pump.

The electric pump is now stopped, the Blue system is depressurized.

YELLOW ELECTRIC PUMP

The yellow electric pump can be controlled manually with the pushbutton switches located on the overhead panel.

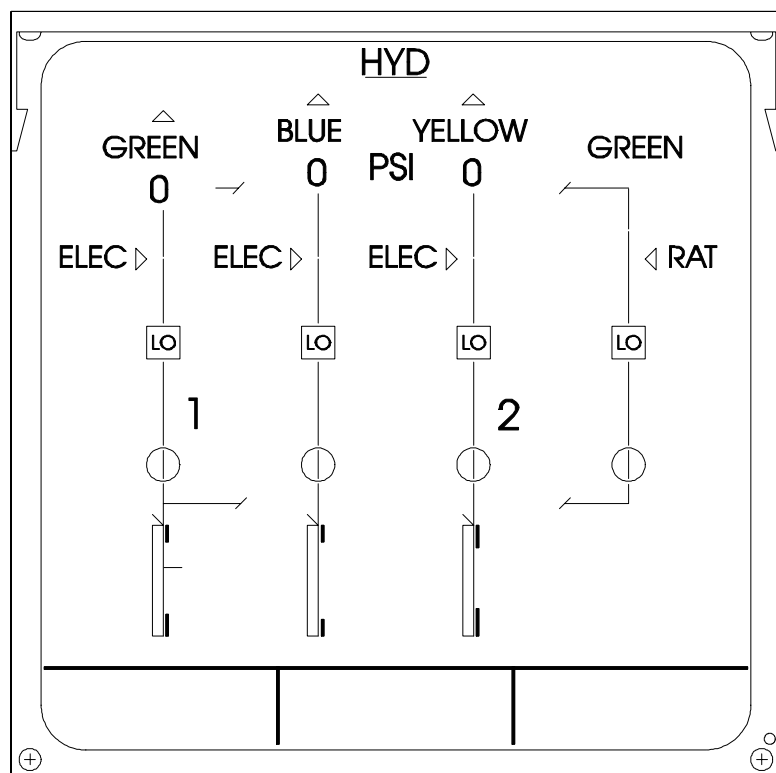
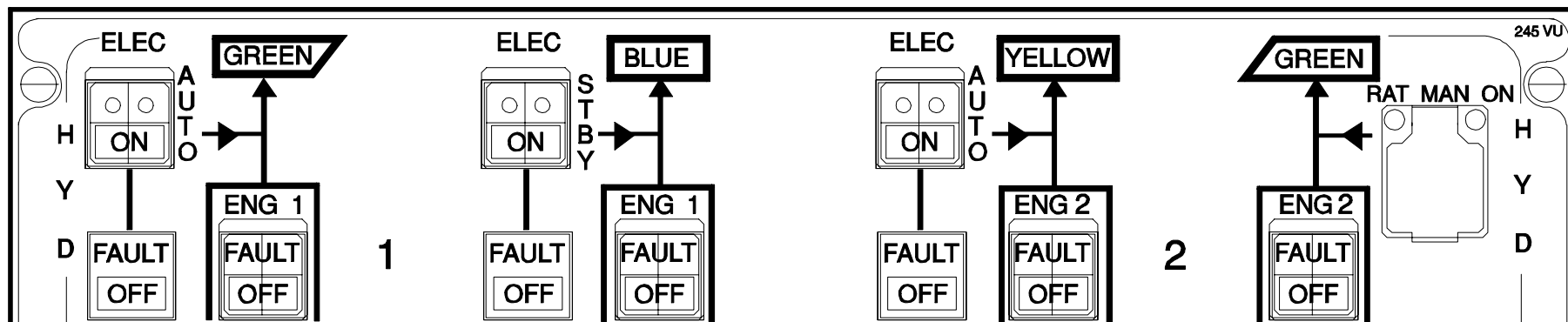
When the "FAULT-OFF" P/B switch is in the normal position (P/B pressed-in), the supply of the pump is via the "ON" P/B switch when it is activated (the "ON" legend comes on).

The yellow system is pressurized.

Any action on the "FAULT-OFF" P/B switch in the "OFF" position (P/B released) cuts off the power supply of the pump (The OFF legend comes on).

The electric pump is now stopped, the Yellow system is depressurized. Normally you need to put the "FAULT-OFF" P/B sw in the normal position (P/B pressed-in).

Note: When the pump is manually controlled by the "ON" P/B sw, any other action on this P/B cuts off the power supply of the pump.



STUDENT NOTES

FQW4200 GE Metric

RAT OPERATION

General
Manual Operation
Automatic Operation

GENERAL

The Ram Air Turbine pressurizes the green system in emergency conditions.

WARNING

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,

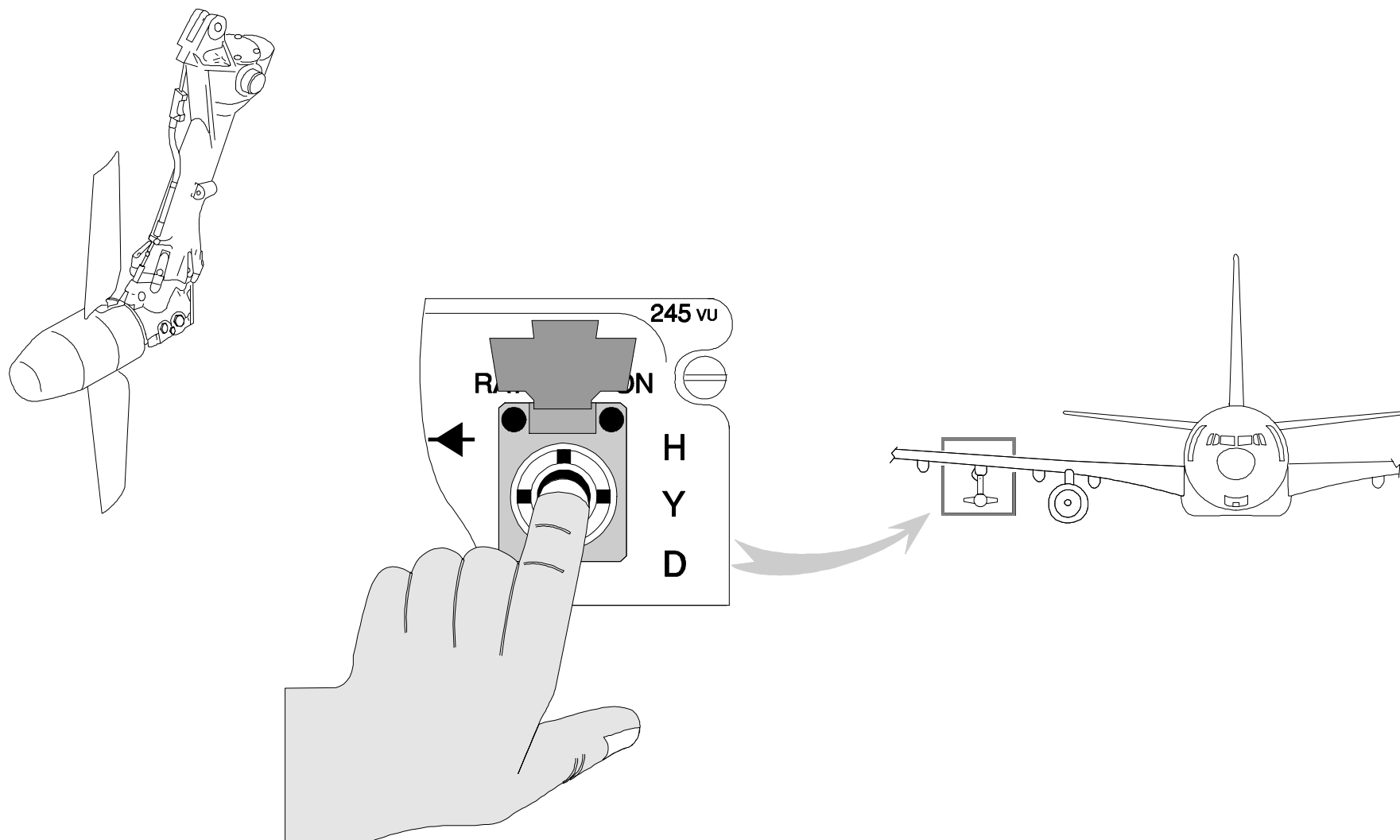
Movement of components can kill or injure persons.

The Ram Air Turbine can extend manually from the cockpit or automatically from the Hydraulic System Monitoring Unit (HSMU).

MANUAL OPERATION

The manual function is available both in flight and on the ground. It is fully independant.

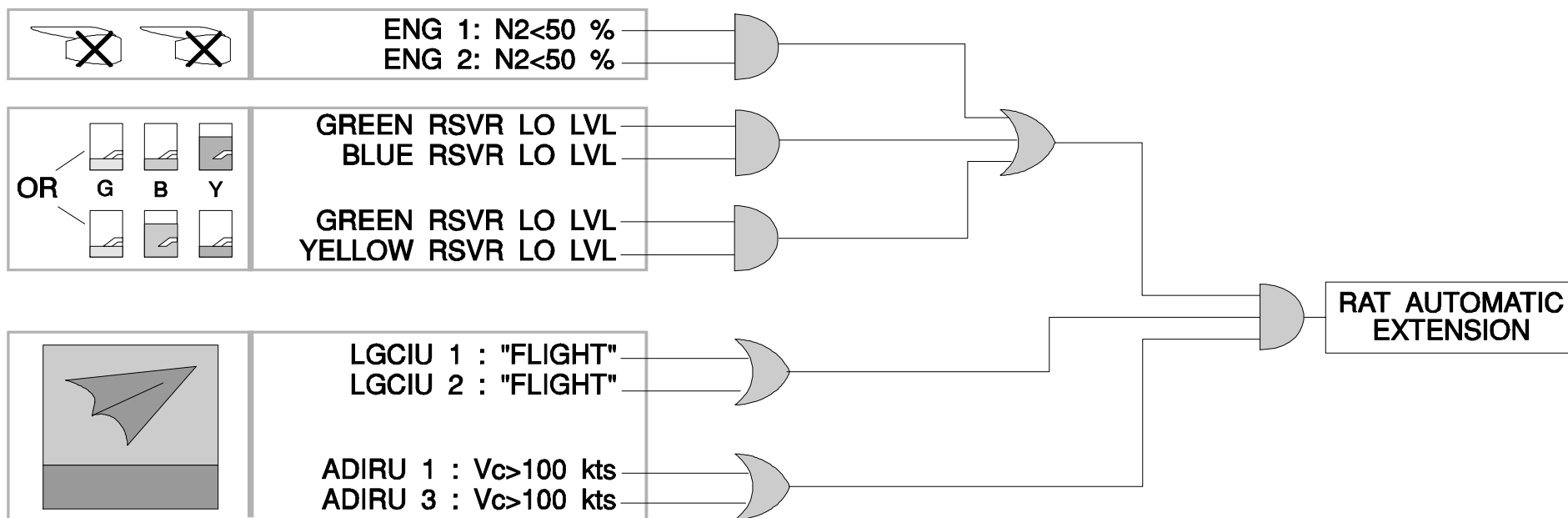
The ram air turbine is operated by an action on the safe guarded pushbutton switch located on the hydraulic panel.



FQW4200 GE Metric

AUTOMATIC OPERATION

The automatic function operates only in flight according to the following logic.



STUDENT NOTES:

FQW4200 GE Metric

MAIN HYDRAULIC POWER COMPONENTS

- Safety precautions
- Accumulator
- Pressure gage
- Charging valve
- Air pressurization unit
- Manual depressurization valve
- Reservoir filling filter
- Hand pump
- Quantity indicator
- Reservoir filling ground connector
- Manual selector valve
- Recovery tank

SAFETY PRECAUTIONS

Before carrying out any maintenance on the aircraft hydraulic systems certain safety precautions have to be carried out. Please, refer to the "SAFETY PRECAUTIONS" chapter.

STUDENT NOTES

FQW4200 GE Metric

ACCUMULATOR

FIN : 5151JM1 -5151JM2 - 5151JM3

ZONE : 147 - 195 - 196

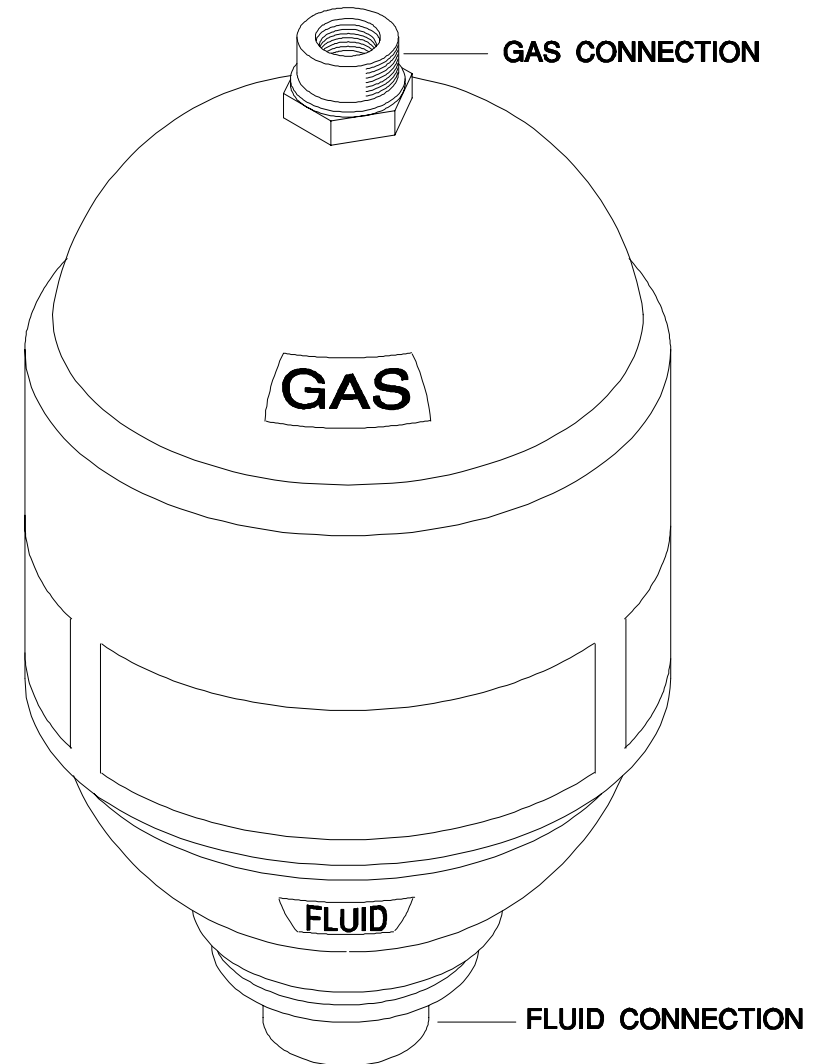
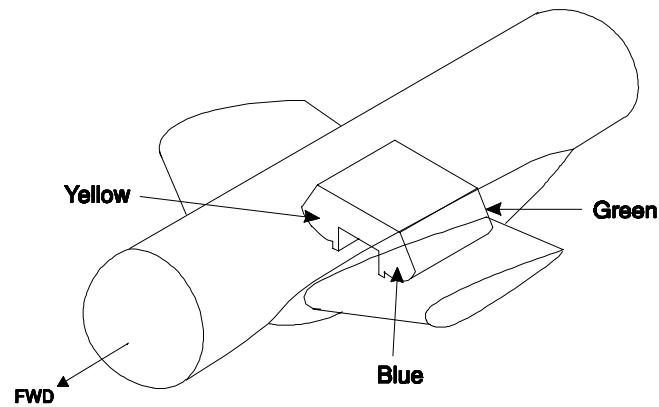
COMPONENT DESCRIPTION

It is a bladder type accumulator charged with nitrogen. The metal body has a outer layer of kevlar. It is installed in vertical position and has two ports :

- a GAS port at the upper end
- a FLUID port at the lower end.

REMOVAL/INSTALLATION

It is secured to the aircraft structure by means of a quick-release fastening system. The gas port is connected via a pipe to a nitrogen charging ground connector, and to a direct pressure gage.



PRESSURE GAGE

FIN : 5152JS1 - 5152JS2 - 5152JS3

ZONE : 197 - 195 - 196

COMPONENT DESCRIPTION

The pressure gage is a direct-reading dial indicator type. It is attached to the gas manifold, on the respective ground service panel. The gage shows the pressure in the accumulator. It indicates up to 3500 psi in steps of 100 psi.

CHARGING VALVE

FIN : 5141JM1 - 5141JM2 - 5141JM3

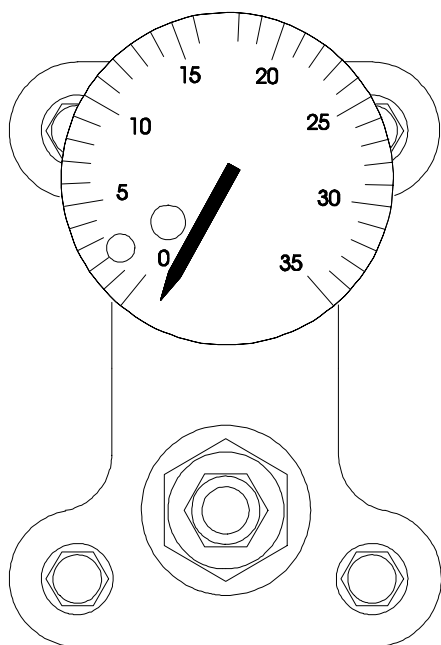
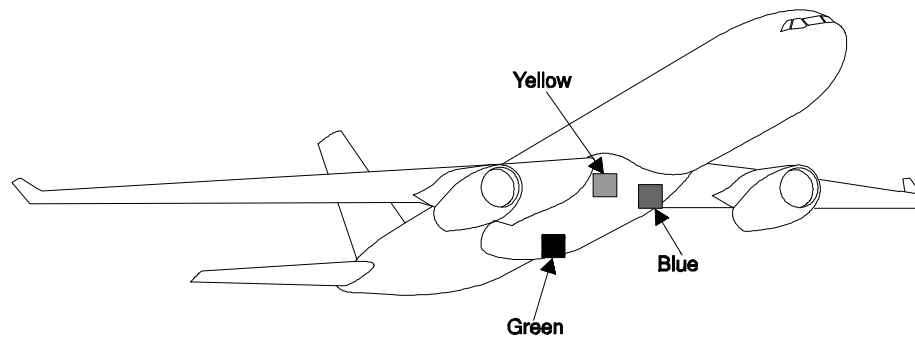
ZONE : 197 - 195 - 196

COMPONENT DESCRIPTION

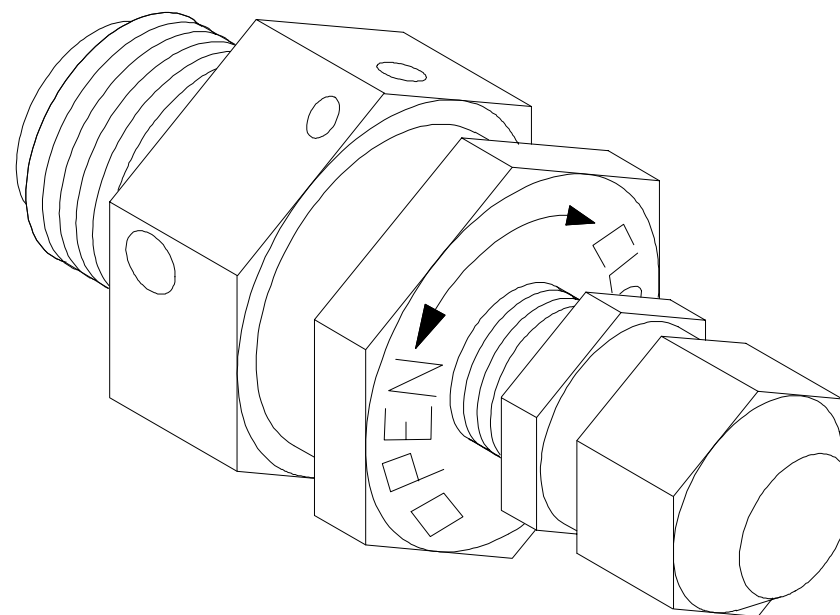
It is a manually-operated plunger-type valve with a conical metal seal. It is installed on the gas manifold in the same way as the power accumulator pressure gage.

SPECIAL DESIGN

The opening and closing of the metal seal is obtained by rotation of the nut which moves the plunger. A brass cap is mounted to prevent external contamination of the valve.



FQW4200 GE Metric



AIR PRESSURIZATION UNIT

FIN : 5240JM - 5240JM

ZONE : 195

COMPONENT DESCRIPTION

One unit provides air pressure to the G reservoir and the second unit provides pressure to the Y and B reservoirs.

The identical units are equipped with :

- Fluid separator which drains any fluid held through the drain valve.
- Air filter which cleans air. It is equipped with a clogging indicator and a by-pass device.
- Pressure reducing valve which reduces and regulates pressure.
- Relief valve to relieve excess pressure.

All these components are line replaceable units.

SPECIAL DESIGN

Air filter : filtration rating 10 microns

Clogging indication 10.15 psi

Bypass operates at 17.5 psi.

Pressure reducing valve outlet pressure : 50 psi.

Relief valve : Cracking pressure 75 psi - Reset pressure : 68 psi.

MANUAL DEPRESSURIZATION VALVE

FIN : 5125JM1 - 5125JM2 - 5125JM3

ZONE : 197 - 195 - 196

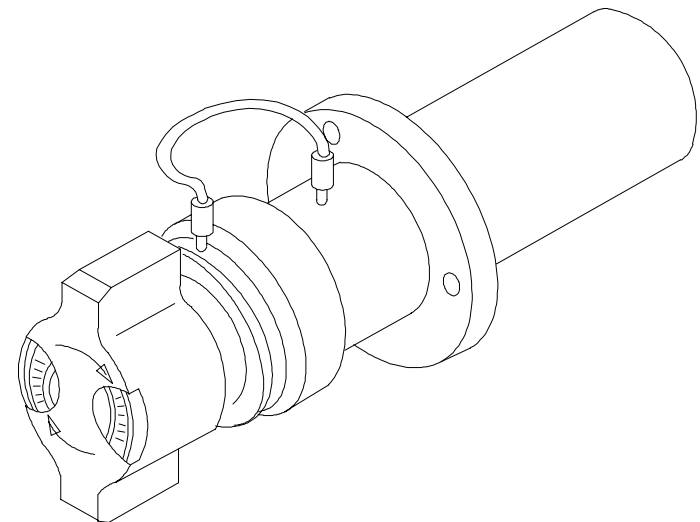
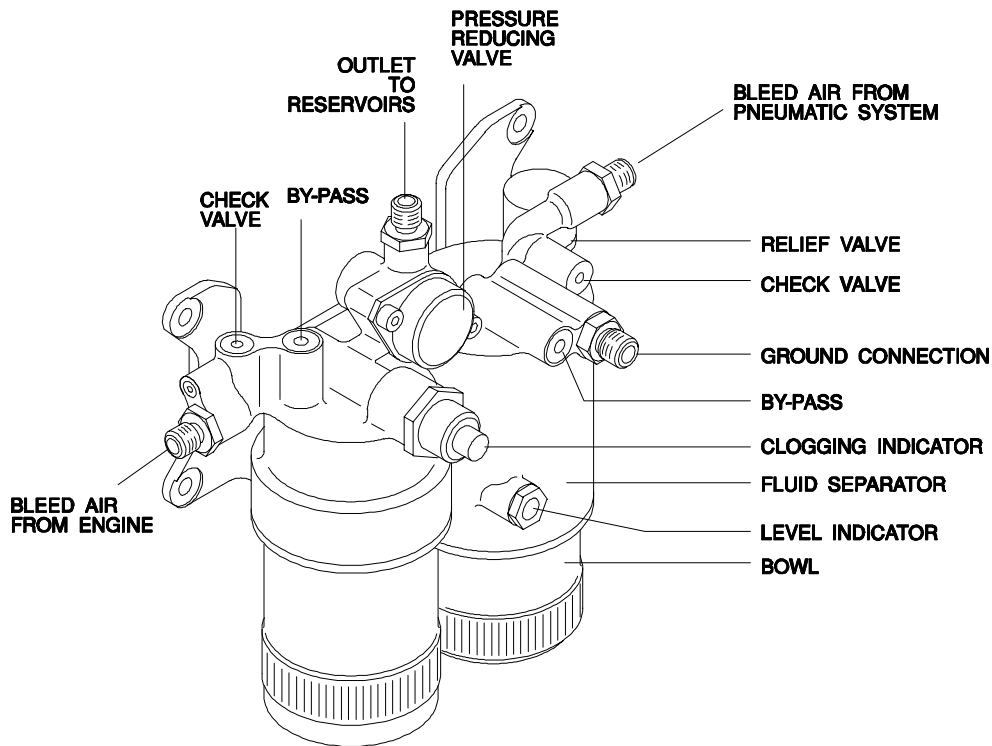
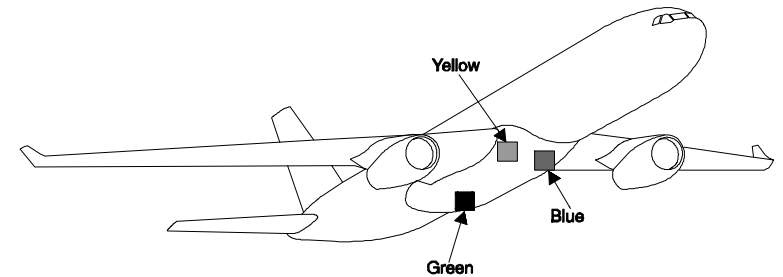
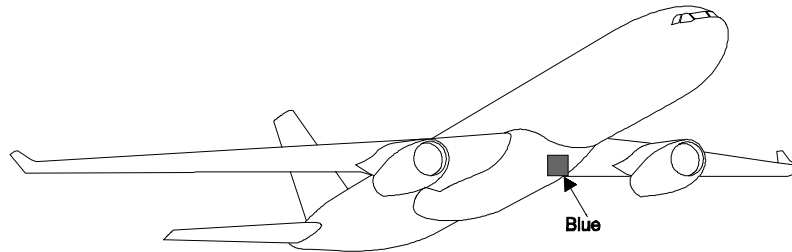
COMPONENT DESCRIPTION

The manual depressurization valve is of the 2/2 way type. It is located on the GND SVC panel of each system. The valve is usually closed under the pressure of a spring. When the ground depressurization coupling is connected or when the cap Assy is operated, the piston moves against the spring. The valve is then open. A standard hydraulic unit connects the valve to the system installation. Normally closed this valve is only manually controlled.

SPECIAL DESIGN

Valve characteristics :

Flow : 8 liters (1.76 USG) of air at 50 psi in 15 seconds maximum.



FQW4200 GE Metric

RESERVOIR FILLING FILTER

FIN : 5202JM

ZONE : 197

COMPONENT DESCRIPTION

The filter head has the hydraulic connections, a clogging indicator and a shut-off device installed in it. There is no by-pass device. The shut-off device prevents any fluid loss and any flow between the inlet and outlet port of the filter when you remove the filter bowl and element.

SPECIAL DESIGN

The clogging indicator is mechanical, a red button comes out to show that the filter element is too dirty (setting : 78 to 96 psi). The filter element is of the replaceable type. It cannot be cleaned. The filtration rating of the element is 15 microns.

REMOVAL/INSTALLATION

The installation of the filter on the green ground service panel is of the manifold mounting type. NSA8676 standard bobbins ensure sealing.

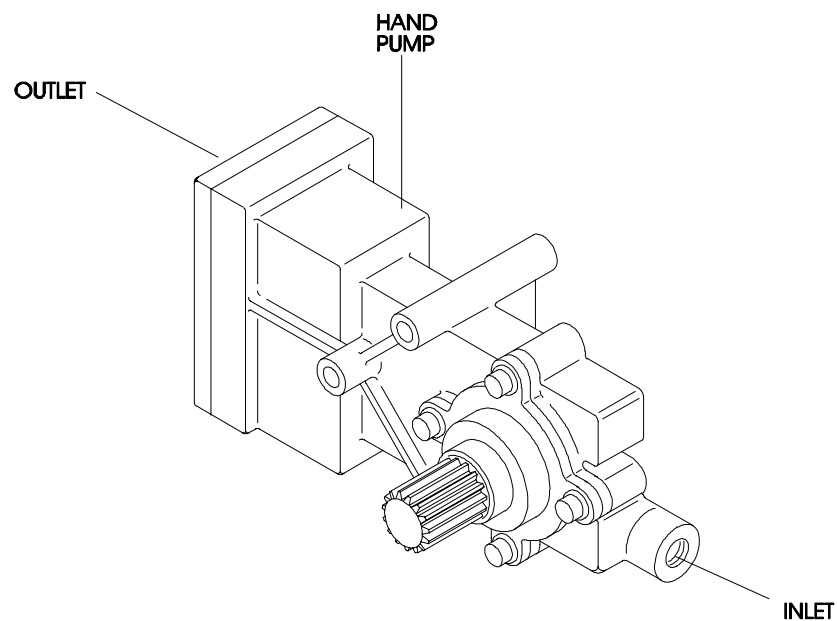
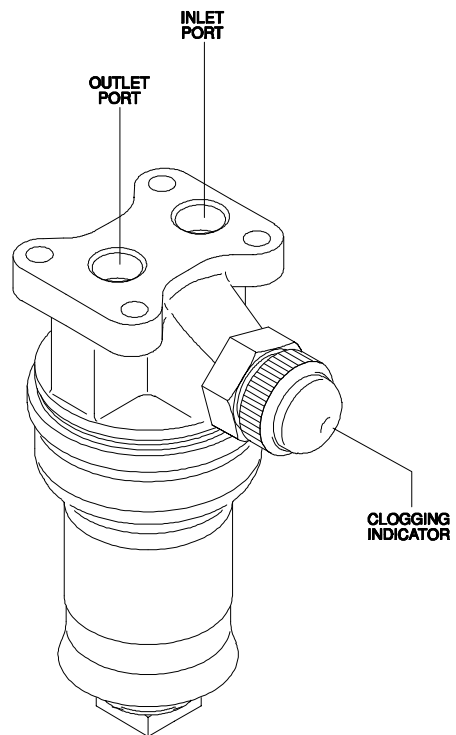
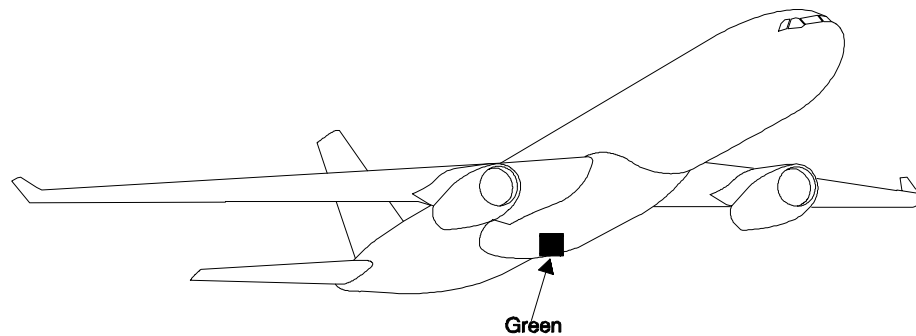
HAND PUMP

FIN : 5204JM

ZONE : 197

COMPONENT DESCRIPTION

It is a twin axial-piston type with a rotating outer splined shaft to connect the hand pump lever. The hand pump is capable of a maximum pressure of 290 + or - 72 psi.



FQW4200 GE Metric

QUANTITY INDICATOR

FIN : 5JS

ZONE : 197

COMPONENT DESCRIPTION

It shows the low or excess fluid quantity in each reservoir(after selection of the system through the selector valve). When the volume is correct the pointer is in the center position, when the indicator is not powered, the pointer is in the INOP position.

SPECIAL DESIGN

The reservoir quantity indication is corrected according to the return fluid temperature. The indicator has a -5 liter to +5 liter hydraulic quantity range. It uses a 0 to 9 volt variable DC voltage.

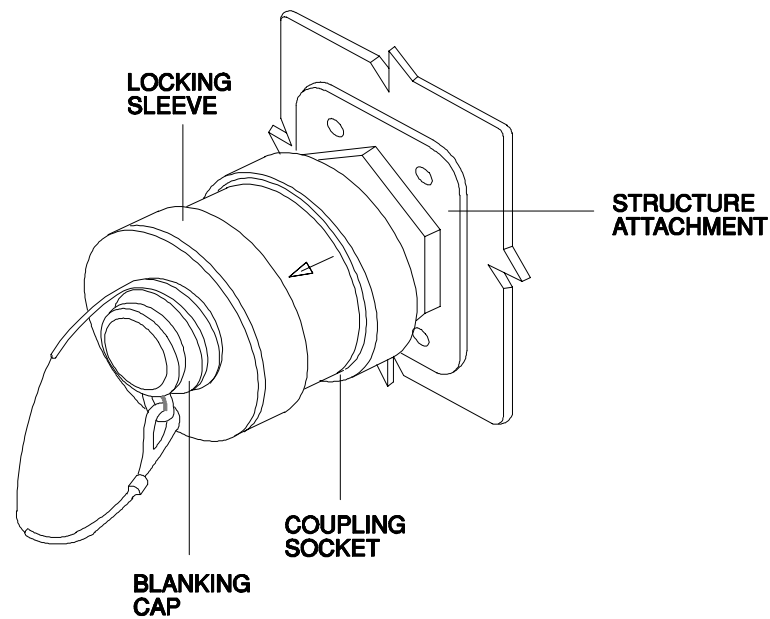
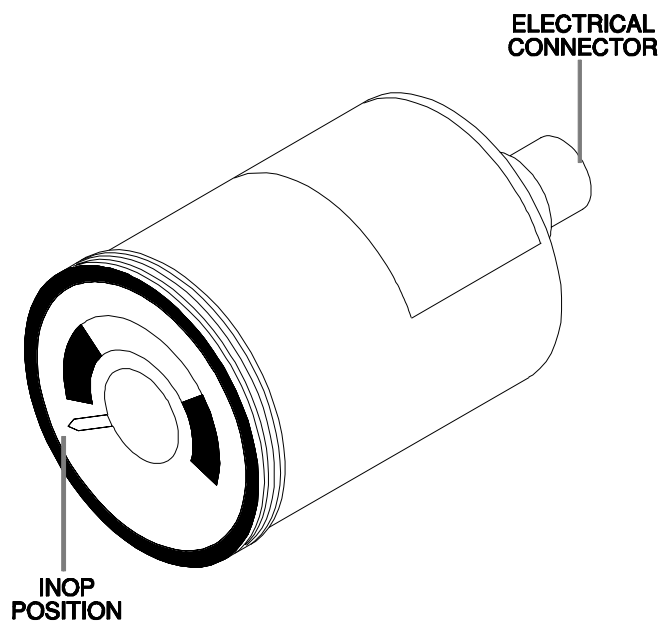
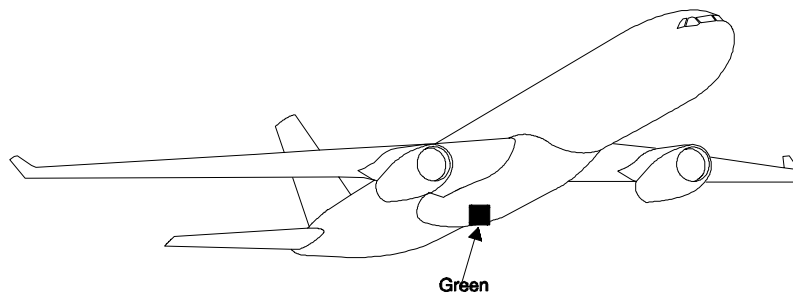
RESERVOIR FILLING GROUND CONNECTOR

FIN : 5203JM

ZONE : 197

COMPONENT DESCRIPTION

The coupling socket is one half of a self-sealing quick-disconnect coupling. The other half is attached to the ground hydraulic supply. The assembly includes a check valve. There is a blanking cap, which is attached to the body of the coupling with a cable.



FQW4200 GE Metric

MANUAL SELECTOR VALVE

FIN : 4JS

ZONE : 197

COMPONENT DESCRIPTION

The reservoir filling manual selector valve can be set in any one of four positions : one for each reservoir and off position. A spring detent mechanism keeps the selector valve in its set position. The selector valve assembly has two main parts :

- The hydraulic selector unit which controls the flow of fluid to the reservoirs (It is a 4 port/4 way valve).
- The electrical switch unit which controls the supply of power to the electrical contents indicator.

SPECIAL DESIGN

A thermal relief valve protects the selector valve from thermal expansion of fluid when it is in the NEUTRAL position. The thermal-relief valve opens at 35 + or -5 bars (498 + or - 71 psi) and closes at 20 bars (285 psi).

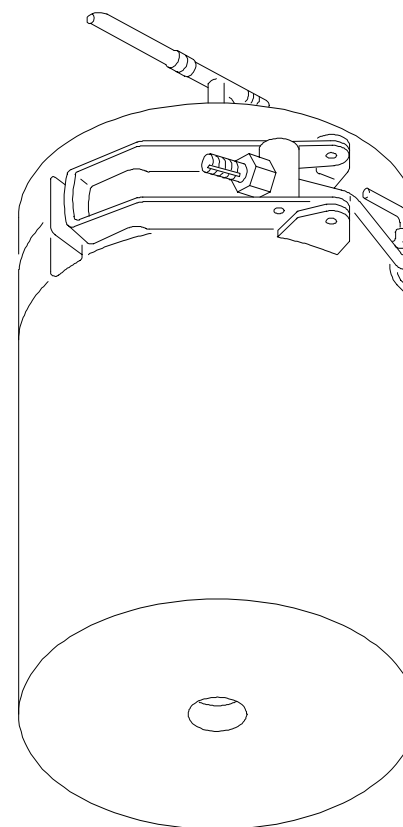
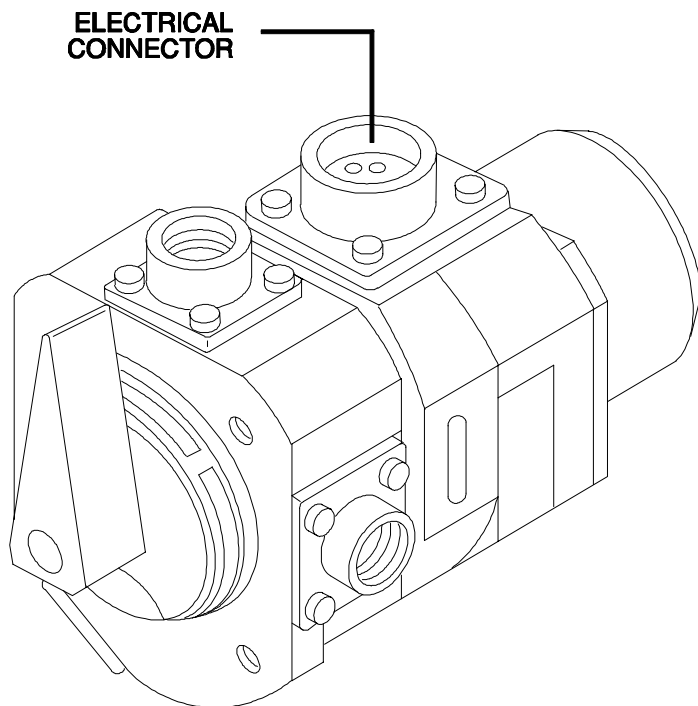
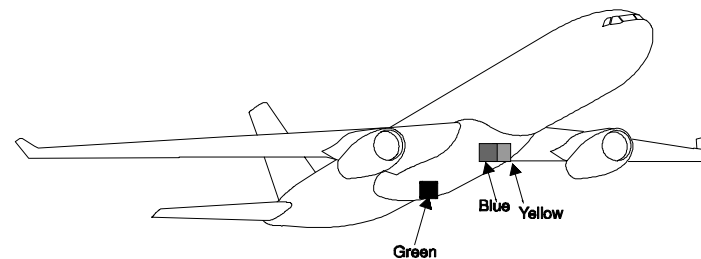
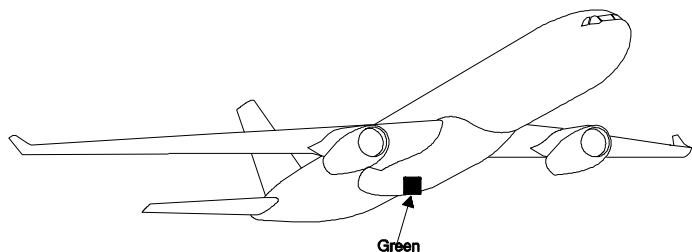
RECOVERY TANK

FIN : 5230JM001 - 5230JM002

ZONE : 196 - 147

COMPONENT DESCRIPTION

The two recovery tanks are made of plastic. They have a capacity of 0.75 l (0.1981 USG). They are attached to the structure with quick-release clamps to make them easier to empty. It is necessary to remove the hydraulic fluid at regular intervals.



FQW4200 GE Metric

STUDENT NOTES

FQW4200 GE Metric

MAIN HYDRAULIC POWER COMPONENTS

Engine Pump Pressure Switch
HP Relief Valve
Priority Valve
HSMU
Reservoir
Case Drain Filter
Engine Pump
Fire Shut-off Valve
LP Filter
HP Filter
Leak Measurement Valve
Reservoir Air Pressure Switch
Low Level Switch
Pressure Transducer
Pressure Switch

SAFETY PRECAUTIONS

Before carrying out any maintenance on the aircraft hydraulic systems certain safety precautions have to be carried out. Please, refer to the "SAFETY PRECAUTIONS" chapter.

STUDENT NOTES

FQW4200 GE Metric

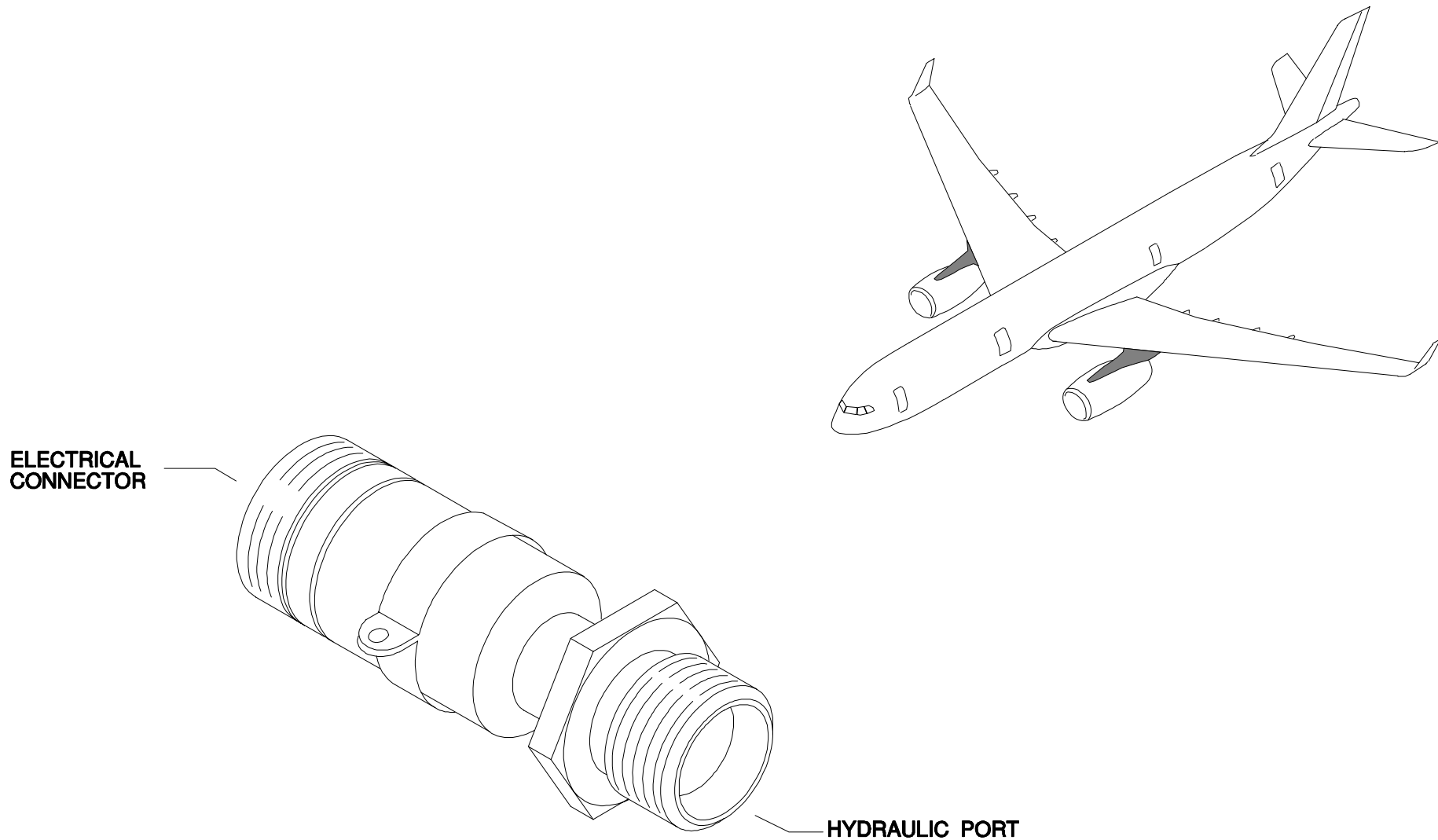
ENGINE PUMP PRESSURE SWITCH

FIN : 11JG1 - 11JG2 - 5JB - 8JY

ZONE : 416 - 426

COMPONENT DESCRIPTION

It is installed on the delivery line of the engine driven pump. It detects any pressure drop and sends a low pressure signal when the pressure decreases to 1750 psi. This signal disappears when the pressure reaches 2200 psi.



FQW4200 GE Metric

HP RELIEF VALVE

FIN : 5021JM1 - 5021JM2 - 5021JM3

ZONE : 147 - 195 - 196

COMPONENT DESCRIPTION

The HP relief valve returns the fluid directly to the reservoir in overpressure conditions. It is of the high pressure type and has two stages, the pilot valve and the main valve.

Cracking pressure : 3436 psi.

Reset pressure : 3190 psi.

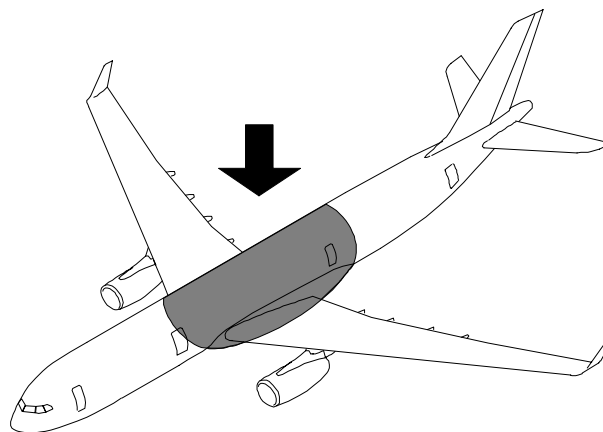
PRIORITY VALVE

FIN : 5121 JM

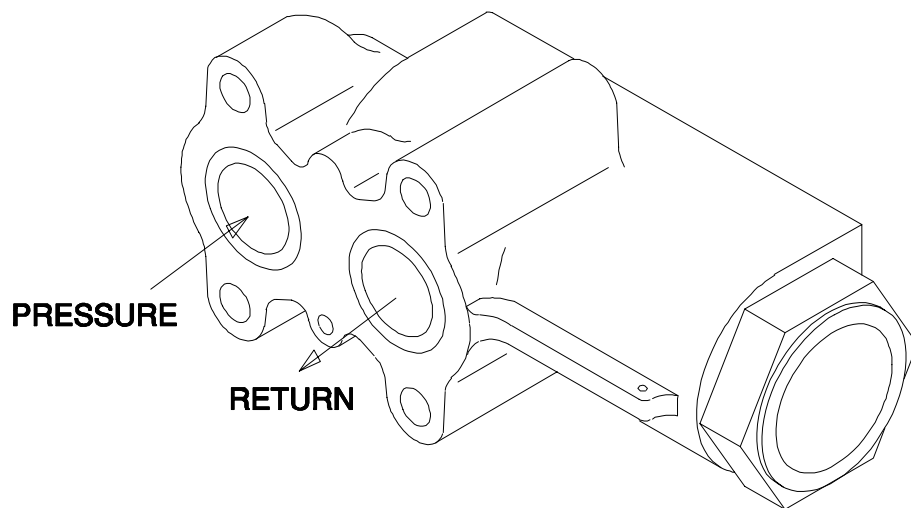
ZONE : 148

COMPONENT DESCRIPTION

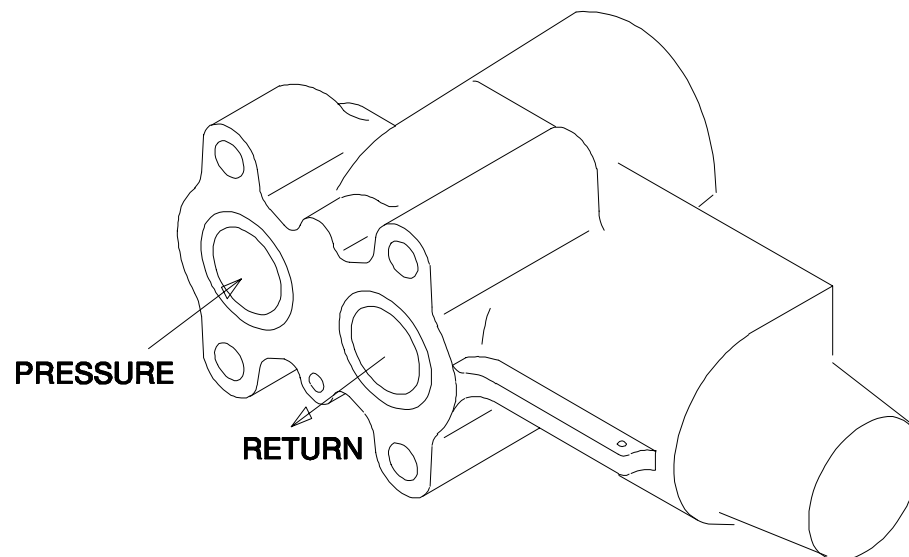
The valve is pilot operated and spring loaded in the closed position. It closes for an upstream pressure lower than 1842 psi. It starts to open as soon as the pressure reaches 2030 psi. It is fully open when the pressure reaches 2101 psi.



HP RELIEF VALVE



PRIORITY VALVE



FQW4200 GE Metric

HSMU

FIN : 1JG

ZONE : 121

COMPONENT DESCRIPTION

One Hydraulic System Monitoring Unit is installed in the avionics compartment. It receives analog and discrete inputs from the interfaces, components or system. It processes these inputs and transmits ARINC 429 digital outputs and analog or discrete outputs.

RESERVOIR

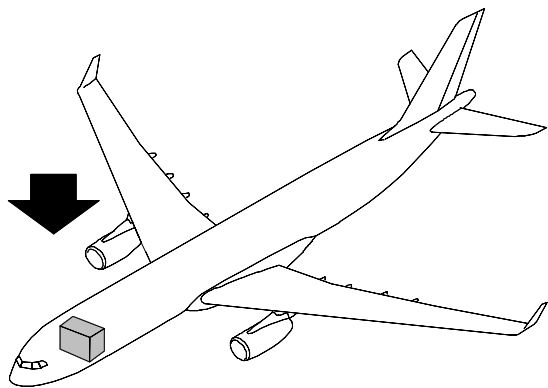
FIN : 11JS - 12JS - 13JS

ZONE : 147 - 195 - 196

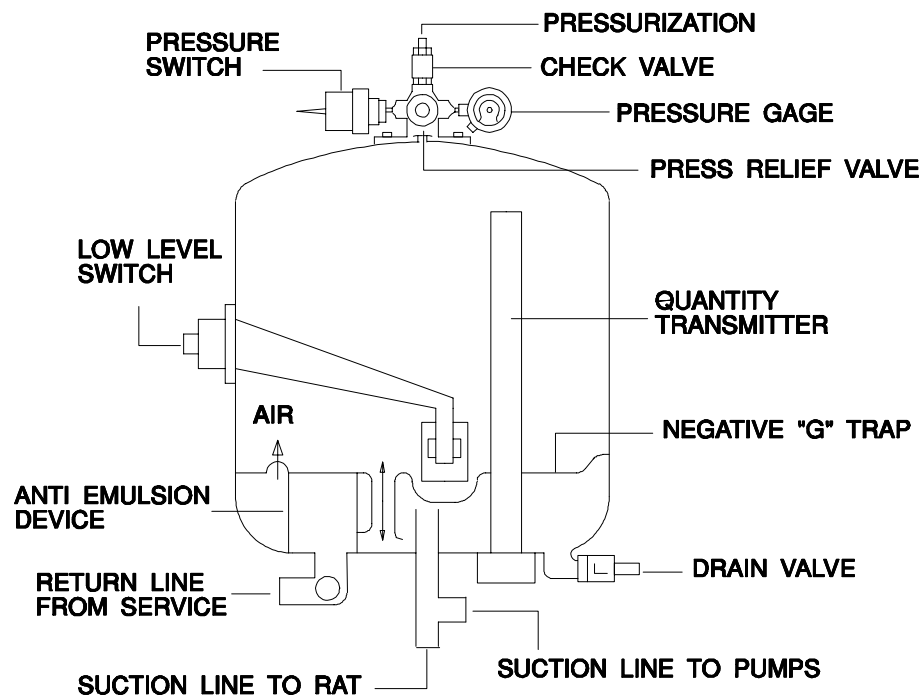
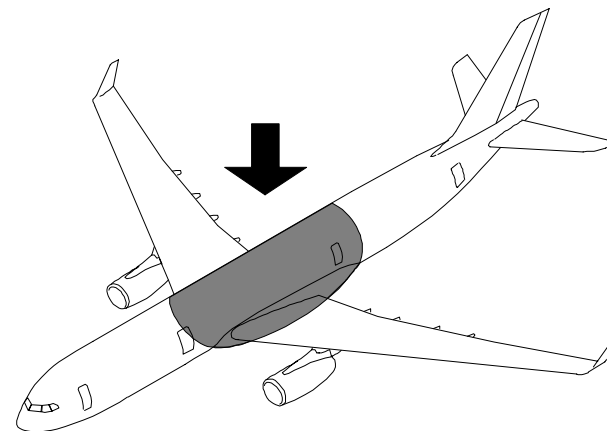
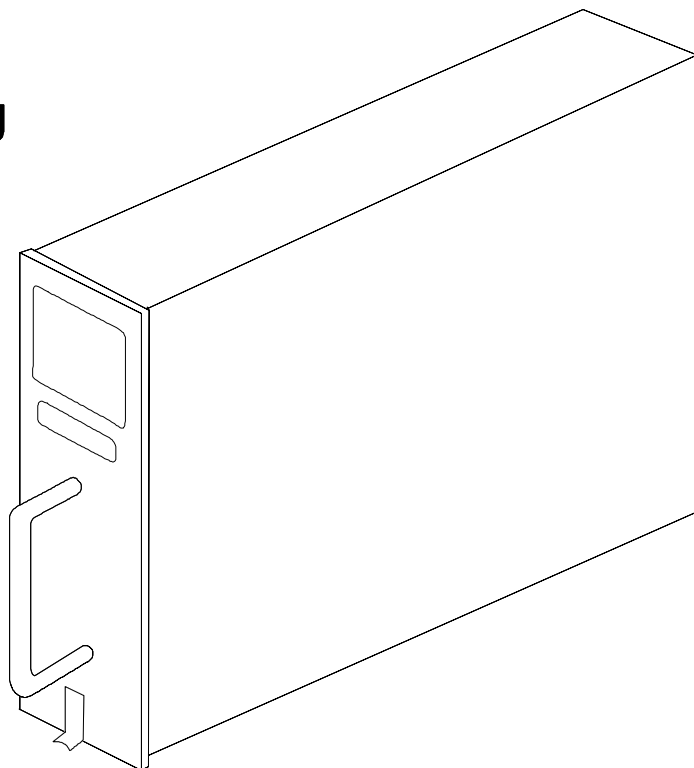
COMPONENT DESCRIPTION

It compensates for variations in fluid volume due to operation of the users and to the fluid temperature. It is designed to remain pressurized for at least 12 hours, at ISO temperature.

It is attached to the aircraft structure by two clamp-secured straps. A negative "g" trap ensures positive fluid supply to the pumps in negative "g" conditions. An anti-emulsion device eliminates any possible emulsion of fluid.



HSMU



CASE DRAIN FILTER

FIN : 5013JM1 - 5013JM2

ZONE : 412 - 422

COMPONENT DESCRIPTION

It is installed on each engine fan case. It is of the non-bypass type with a clogging indicator set to operate at 87 psi.
The filtering capability is 15 microns.
It is of the non-cleanable type.

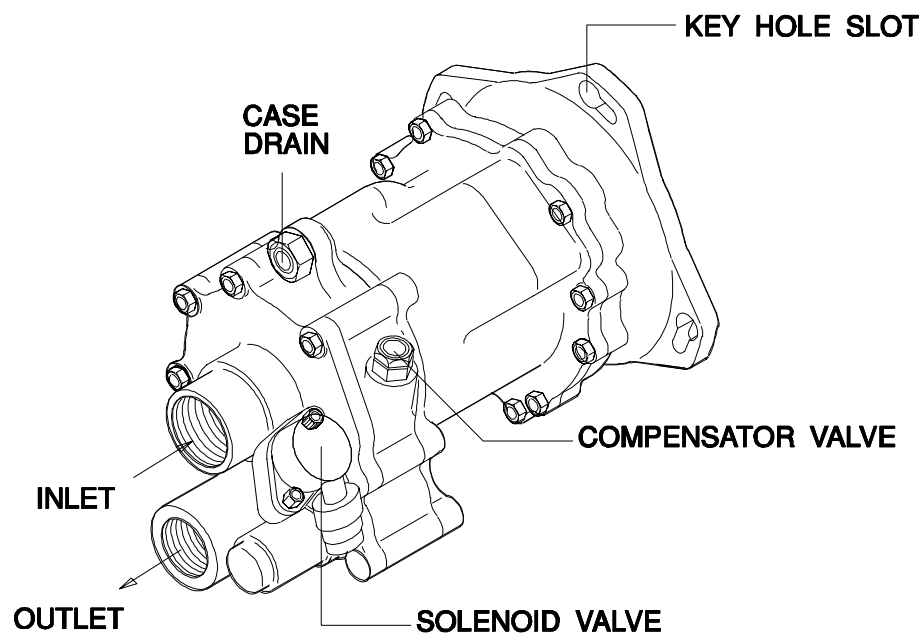
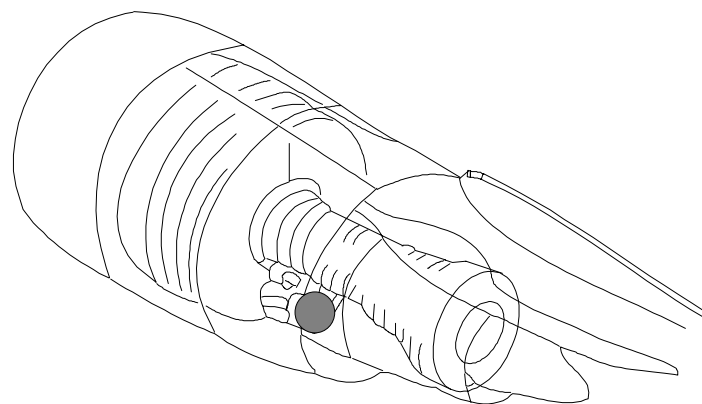
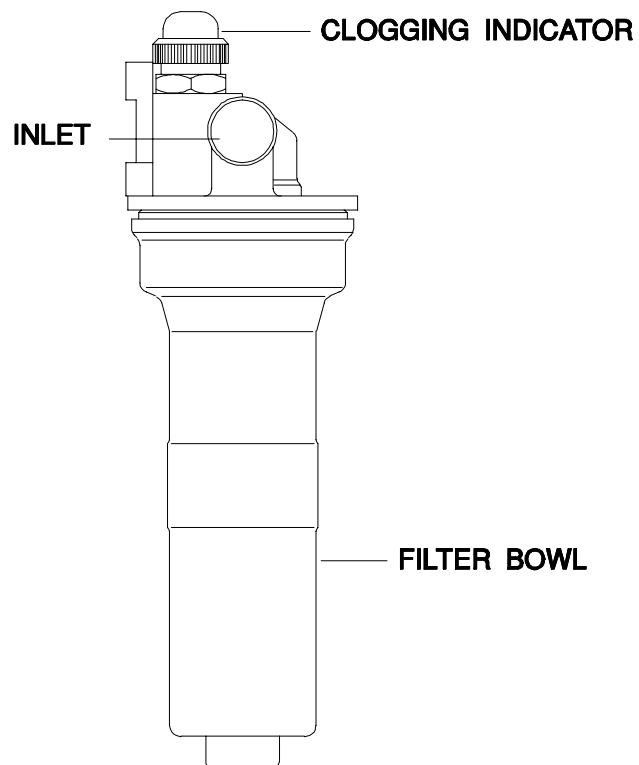
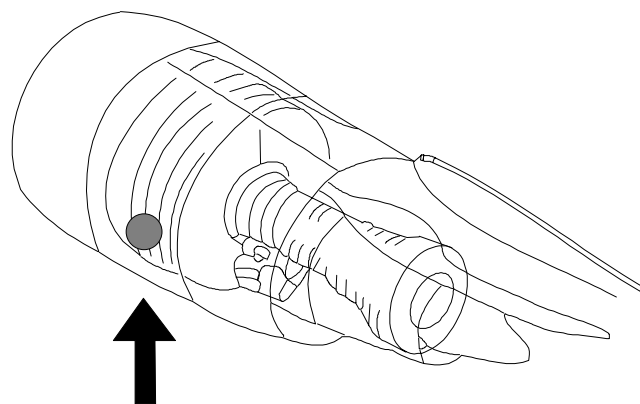
ENGINE PUMP

FIN : 4000JG1 - 4000JG2

ZONE : 416 - 426

COMPONENT DESCRIPTION

It is of the variable displacement type.
The nominal speed at 100% N2 is 3702 rpm.
The rotating assembly turns all of the time that the engine operates.
A solenoid valve permits the engine pump to be isolated from the hydraulic system.



FIRE SHUT-OFF VALVE

FIN : 2JG1 - 2JG2

ZONE : 588 - 688

COMPONENT DESCRIPTION

The valve assembly is made up of an inlet and an outlet with a ball valve between them.

The two connections are not the same, thus it is not possible to install the valve incorrectly.

The electric motor is a 28VDC type.

The two limit switches and the fire P/B switch in the cockpit control the supply of electrical power to the motor.

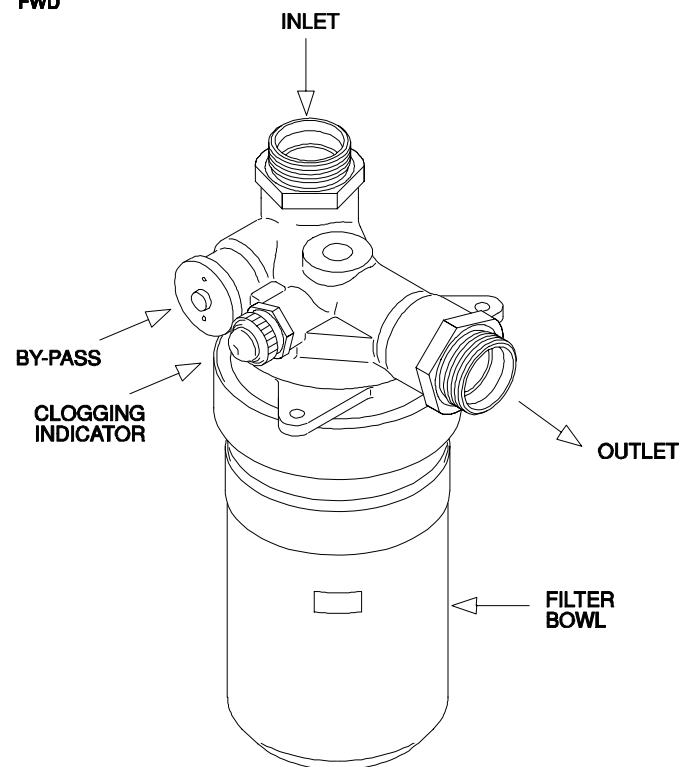
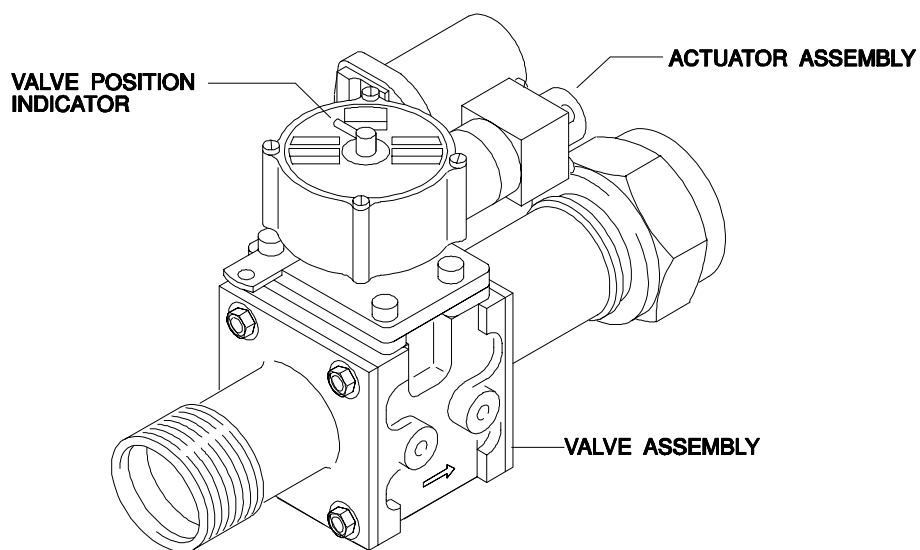
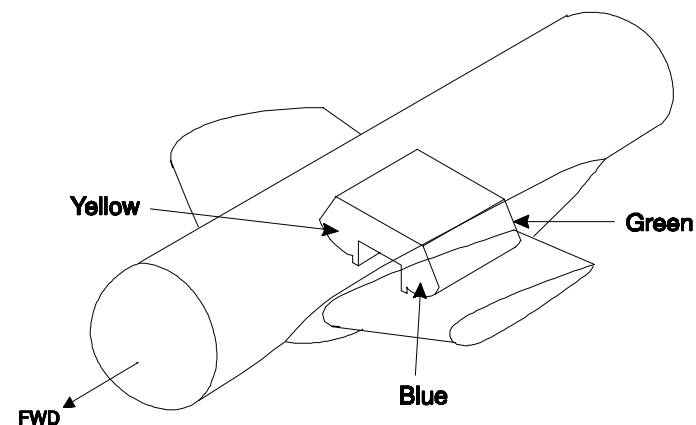
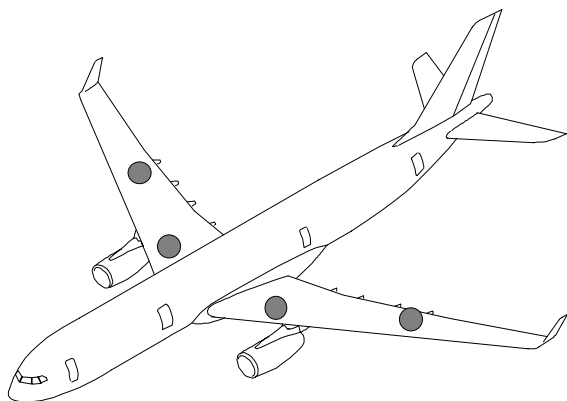
LP FILTER

FIN : 5011JM1 - 5011JM2 - 5011JM3

ZONE : 147 - 195 - 196

COMPONENT DESCRIPTION

It is installed on line on the return system, adjacent to the reservoir. It is of the bypass type with a clogging indicator. The filtering capability is 3 microns. It is of the non-cleanable type.



FQW4200 GE Metric

HP FILTER

FIN : 5111JM101 - 5111JM102 - 5111JM2 - 5111JM3

ZONE : 147 - 195 - 196

COMPONENT DESCRIPTION

It is installed on line on the HP manifold. It is of the non-bypass type with a clogging indicator. The filtering capability is 15 microns. It is of the non-cleanable type.

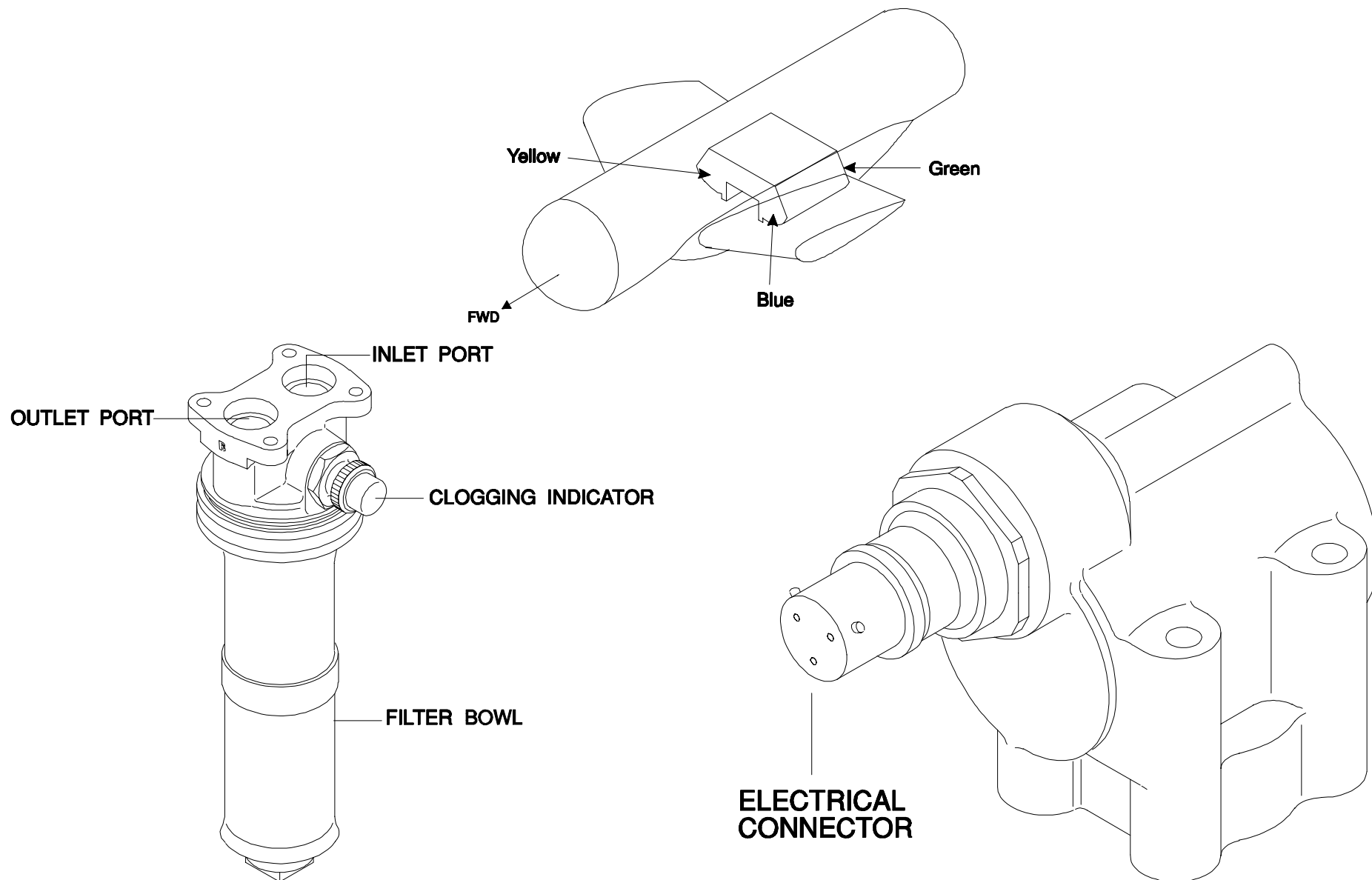
LEAK MEASUREMENT VALVE

FIN : 1JL1 - 1JL2 - 1JL3

ZONE : 147 - 195 - 196

COMPONENT DESCRIPTION

It is a two position, three way, solenoid-operated type. It is normally open. It is closed when the solenoid is energized. In this case there is a leakage flow of about 2 or 2.5 l/mn.



FQW4200 GE Metric

RESERVOIR AIR PRESSURE SWITCH

FIN : 1JS1 - 1JS2 - 1JS3

ZONE : 147 - 195 - 196

COMPONENT DESCRIPTION

It is fitted on the top of each reservoir. The contact closes when the pressure decreases to 22 psi relative. The contact opens when the pressure reaches 25 psi.

LOW LEVEL SWITCH

FIN : 10JS1 - 10JS2 - 10JS3

ZONE : 147 - 195 - 196

COMPONENT DESCRIPTION

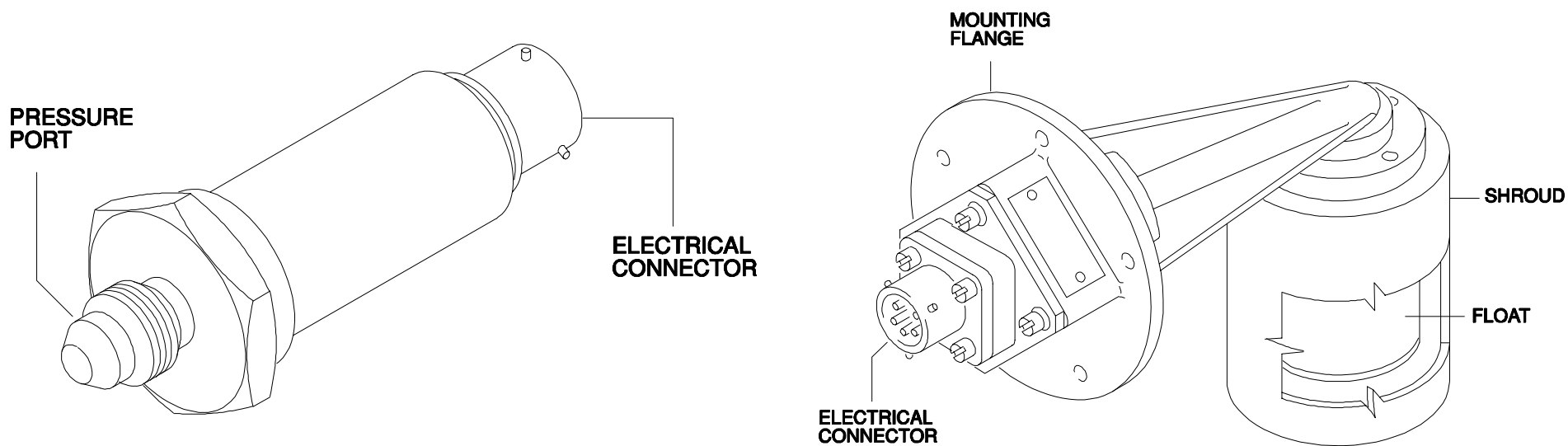
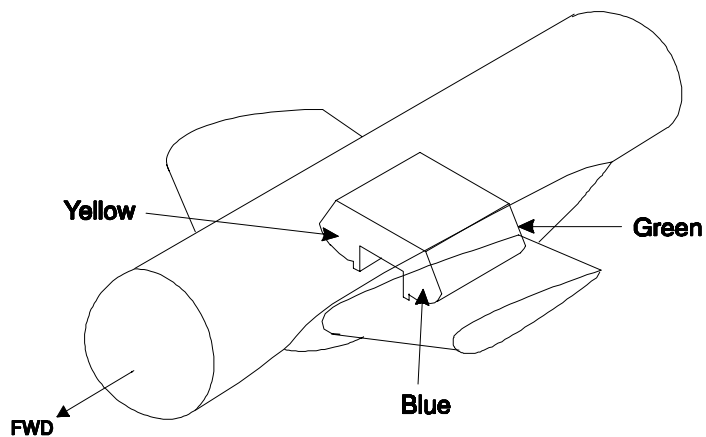
Located in each reservoir, this equipment includes a reed switch controlled by a magnet located inside a metallic float which follows the hydraulic fluid level.

The float is encased in a metal shroud.

This shroud operates as a damper of small changes in the level of the fluid.

The switch is supplied with 28VDC.

Low level warning : 8l(G), 5l(B,Y).



FQW4200 GE Metric

PRESSURE TRANSDUCER

FIN : 6JS1 - 6JS2 - 6JS3

ZONE : 147 - 195 - 196

COMPONENT DESCRIPTION

It is installed on the HP manifold. It is supplied with 28VDC. The output voltage varies linearly from 1VDC for 0 psi to 5VDC for 3000 psi.

It is made of two sections, a pressure-sensing section, and an electronic section.

PRESSURE SWITCH

FIN : 7JS1 - 7JS2 - 7JS3

ZONE : 147 - 195 - 196

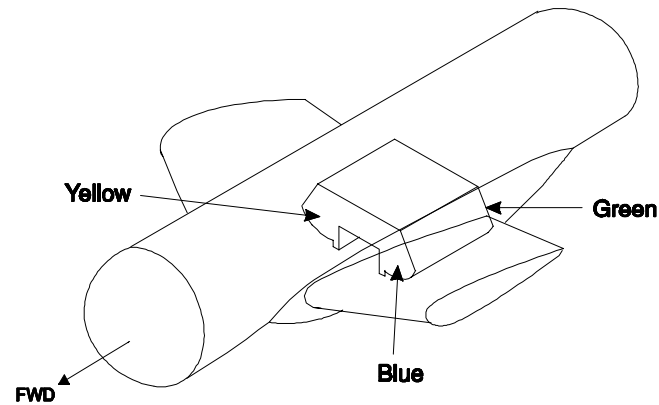
COMPONENT DESCRIPTION

It is directly installed on the HP manifold.

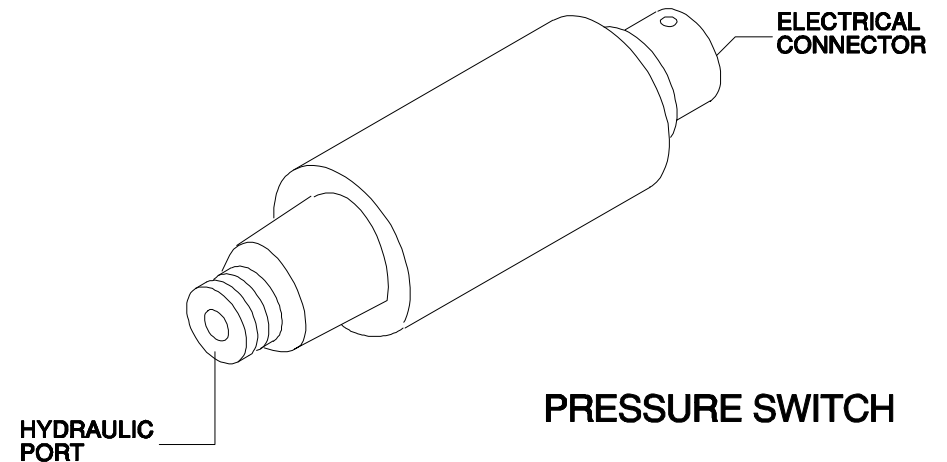
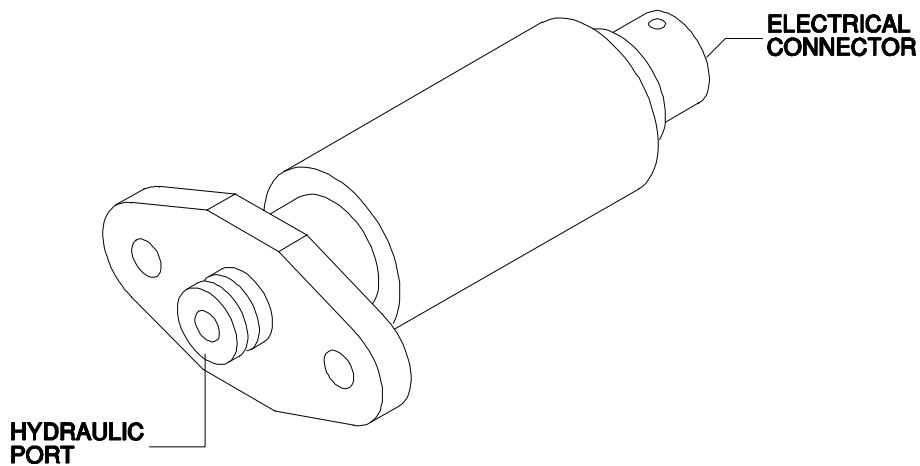
It is set to :

1450 psi, pressure decreasing

1750 psi, pressure increasing.



PRESSURE TRANSDUCER



PRESSURE SWITCH

FQW4200 GE Metric

STUDENT NOTES :

FQW4200 GE Metric

AUXILIARY HYDRAULIC POWER COMPONENTS

Current Unbalance Detector Units
Electric Pump Pressure Switch
Electric Pump
RAT Stow Panel
RAT Turbine Assembly

SAFETY PRECAUTIONS

Before carrying out any maintenance on the aircraft hydraulic systems certain safety precautions have to be carried out. Please, refer to the "SAFETY PRECAUTIONS" module.

STUDENT NOTES

FQW4200 GE Metric

CURRENT UNBALANCE DETECTOR UNITS

FIN : 2JV (G) ; 2JC (B) ; 2JJ (Y)

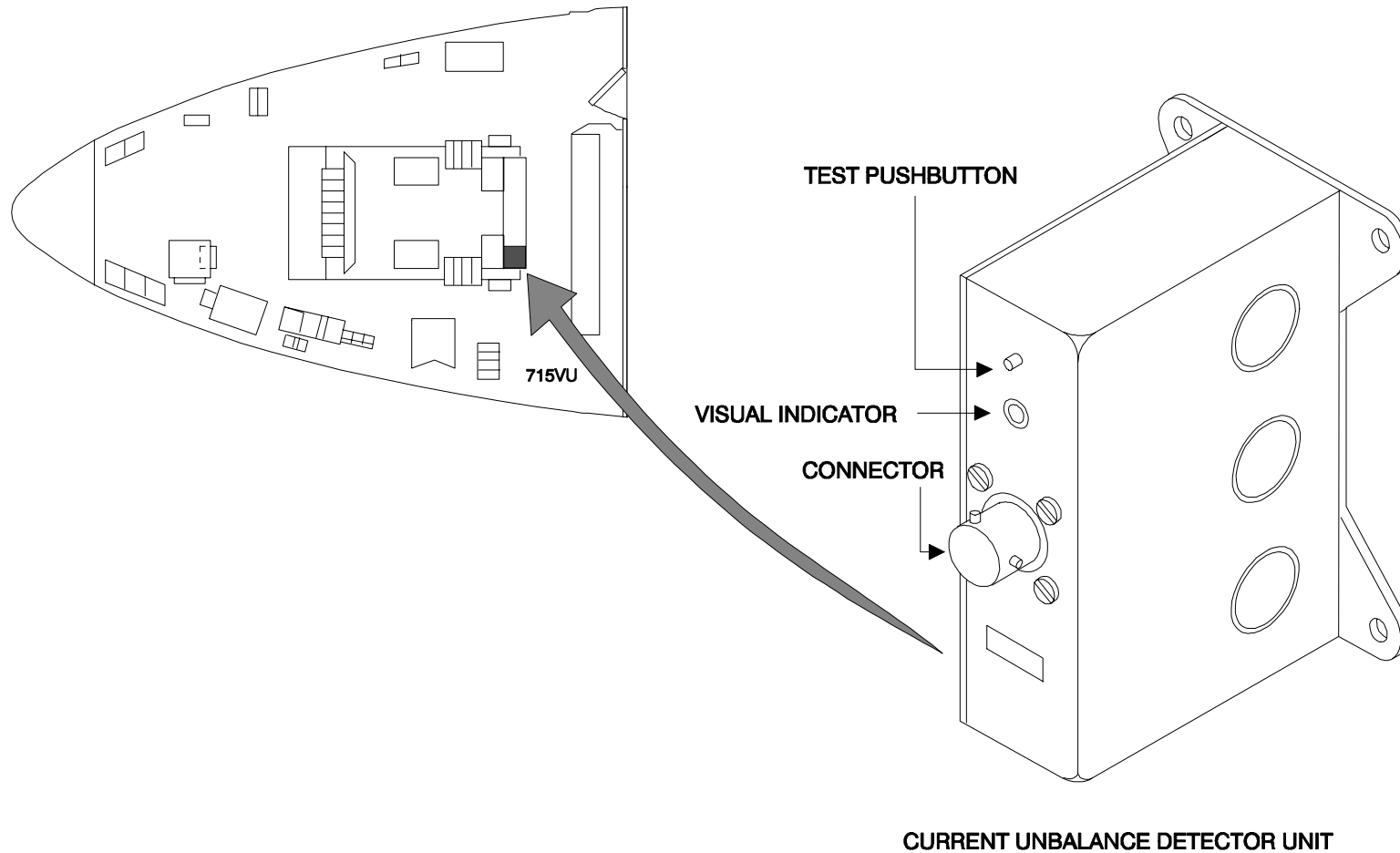
ZONE : 120

COMPONENT DESCRIPTION

The current unbalance detector units (CUDU) monitor the supply current of the electric pumps. They detect a current unbalance or a cut-off of one or two phases in the three phase power supply of the electric pumps. They send, to the HSMU, a signal to cut-off the power supply of the contactors associated to the electric pumps when they detect an unbalance between the three phases. Reset is done by switching off the power supply of the current unbalance detector units.

SPECIAL DESIGN

A test pushbutton associated to an annunciator light comes on when the test has been performed and the CUDU operates properly. (The equipment must be reset by switching off the power supply).



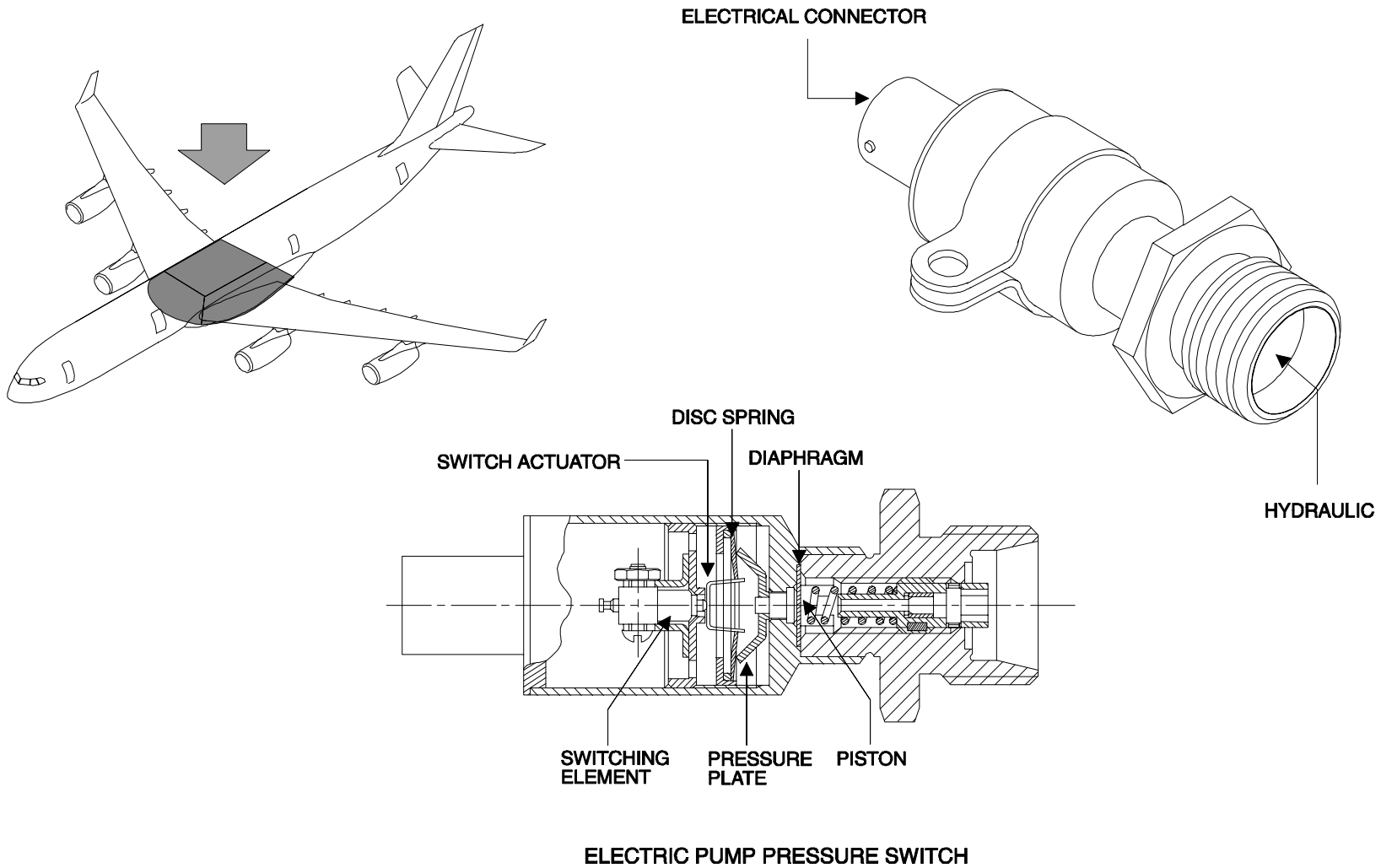
ELECTRIC PUMP PRESSURE SWITCH

FIN : 5JV (G) ; 5JC (B) ; 5JJ(Y)

ZONE : 147(G) ; 195(B) ; 196 (Y)

COMPONENT DESCRIPTION

The pressure switch assembly is made of two main sections : the hydraulic part and the electric part. The hydraulic piston moves a diaphragm which transfers the movement to the switch actuator through the pressure plate. The switching assembly always operates at the same pressure and sends a low pressure signal to the HSMU when the pressure reaches 100 bars + or - 5 bars (1422 psi + or - 71). The signal disappears when the pressure reaches 120 bars (1706 psi).



ELECTRIC PUMP

FIN : 1JV(G) ; 1JC (B) ; 1JJ (Y)

ZONE : 147(G) ; 196(B) ; 196(Y)

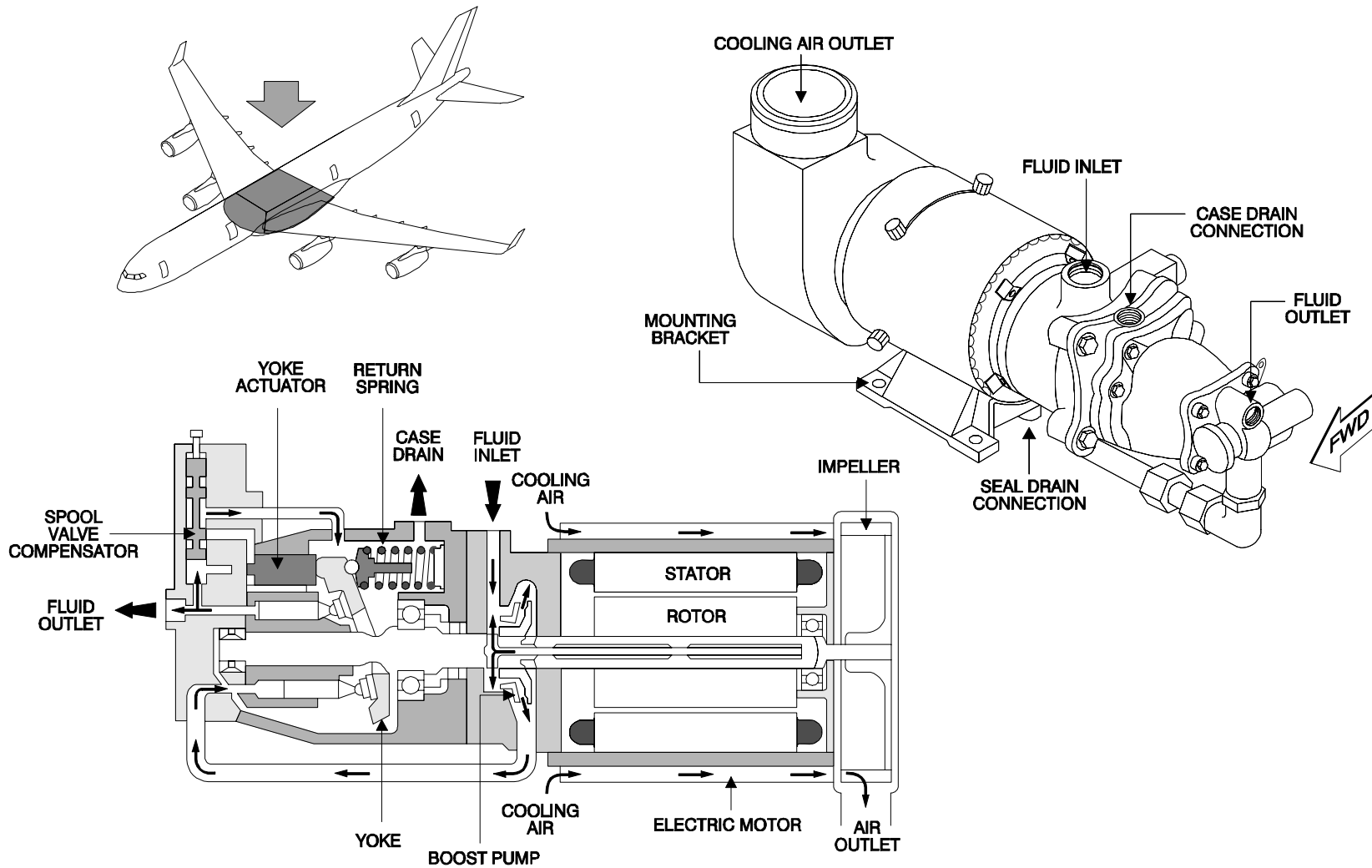
COMPONENT DESCRIPTION

The electric pump assembly includes three main parts :

- a 3 phase air fan cooled electric motor,
- a boost pump to increase the hydraulic pressure before it goes into the hydraulic pump,
- a 7 piston variable displacement inline type hydraulic pump.

SPECIAL DESIGN

A temperature switch is installed in the electric motor. If the temperature of the motor increases to 162° C (323° F) the switch operates and sends signals to the overhead panel and ECAM.
The electric pump switch cannot be reset manually and the electric pump assembly has to be changed.



FQW4200 GE Metric

RAT STOW PANEL

FIN : 12JR

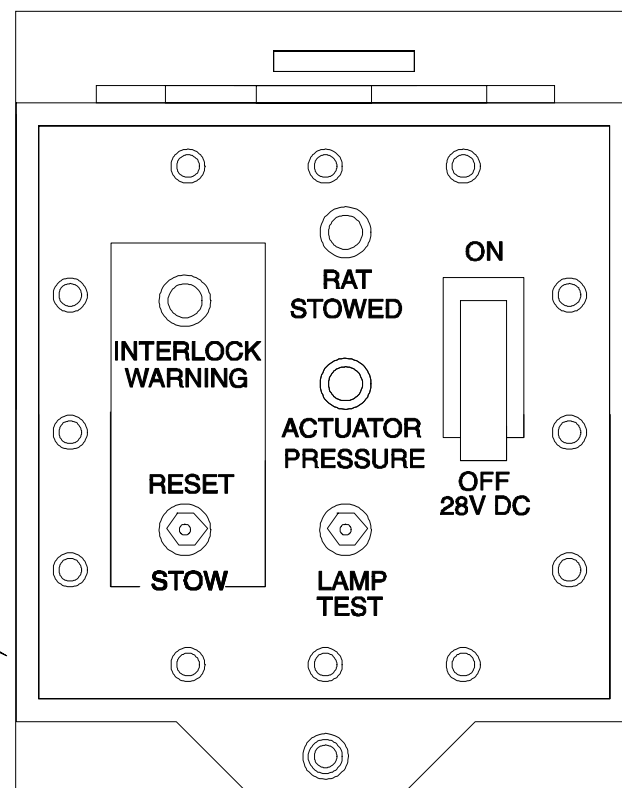
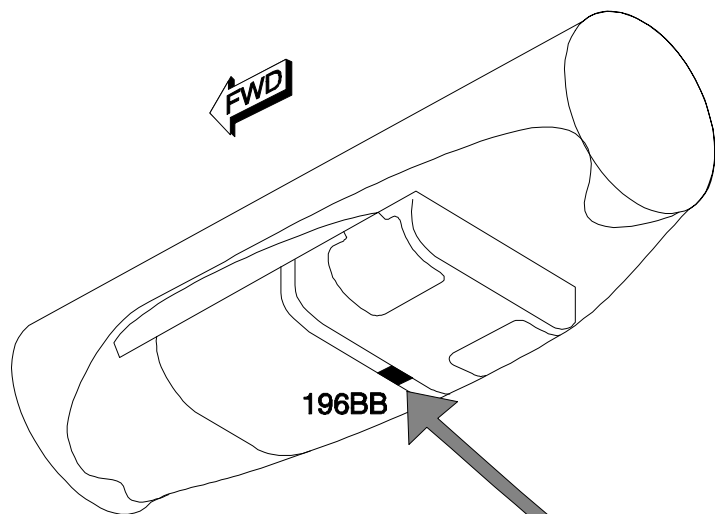
ZONE : 196BB

COMPONENT DESCRIPTION

The RAT stow panel is installed on the Yellow system ground service panel. It is provided with a control to retract the RAT after extension. The ACTUATOR PRESSURE lamp can be seen through a window when the RAT stow panel cover is closed.

SPECIAL DESIGN

The LAMP TEST switch provides a lamp test of the STOWED lamp, the restow INTERLOCK WARNING lamp and the ACTUATOR PRESSURE lamp.
When you press it, all lamps come on. When you release it, all lamps go off.



RAT STOW PANEL

FQW4200 GE Metric

RAT TURBINE ASSEMBLY

FIN : 11JR

ZONE : 633

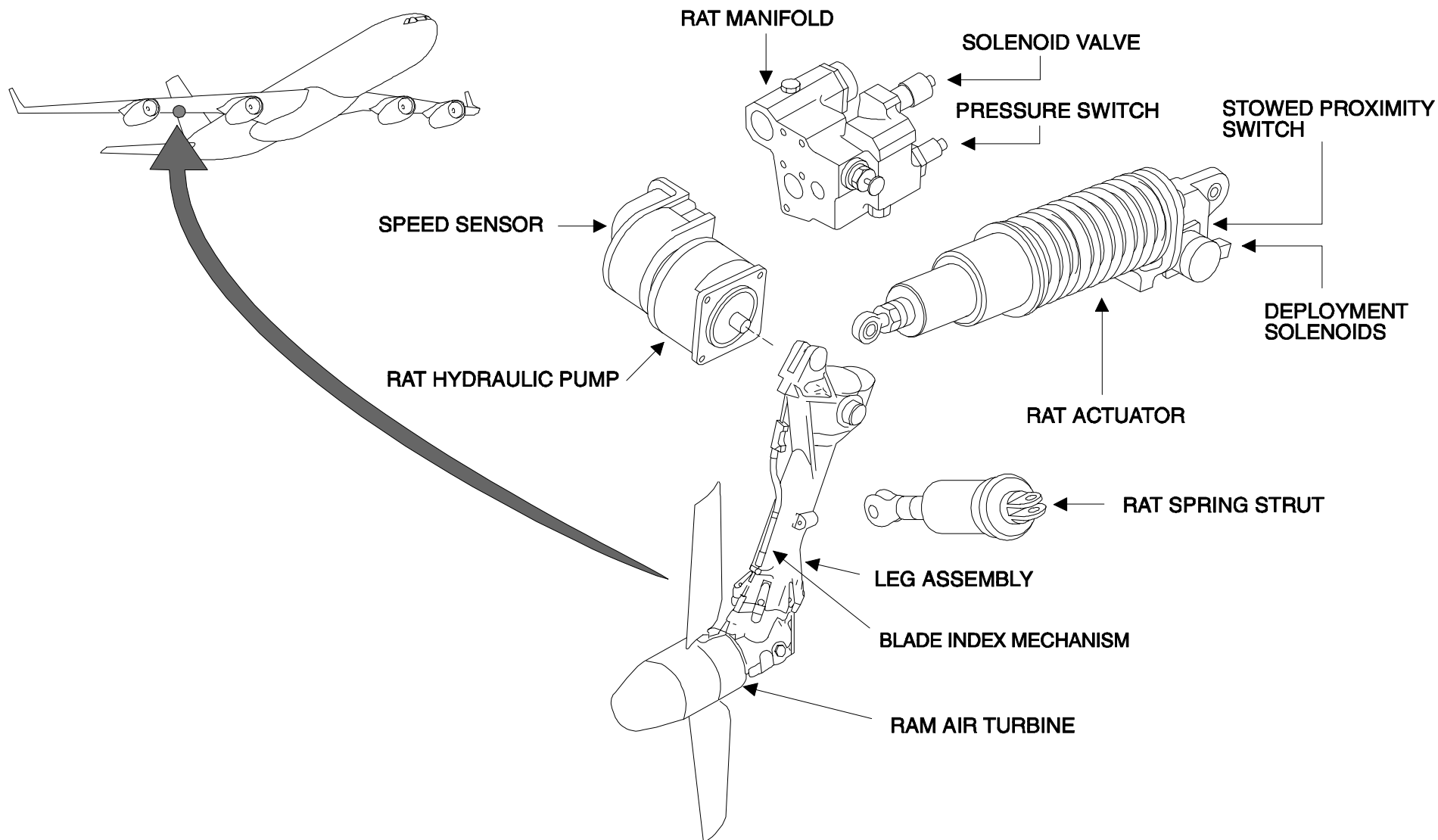
COMPONENT DESCRIPTION

The RAT turbine assembly is installed in flap track n-4 of the right wing. It includes :

- The RAT Turbine,
- The RAT Leg Assy,
- The RAT Hydraulic Pump,
- The RAT actuator,
- The RAT manifold.

SPECIAL DESIGN

At the front of the leg assembly, there is a blade index mechanism. It locks the turbine and blades so that they do not turn when the turbine is retracted or not fully extended. The mechanism is engaged when the arrows on the hub and the lower leg gearbox are lined up. It automatically disengages when the RAT is approximately 10 degrees from full extension position.



STUDENT NOTES

HYDRAULIC SYSTEM MONITORING UNIT (HSMU) INTERFACES

Inputs From Other Systems
Hydraulic Inputs
Outputs

INPUTS FROM OTHER SYSTEMS

The Hydraulic System Monitoring Unit receives a flight/ground discrete input.

This input comes from LGCIU 1 and 2 and is used for :

Engine pump signaling, inhibition of automatic Ram Air Turbine (RAT) extension on ground, inhibition of leak measurement valves closure in flight.

The Hydraulic System Monitoring Unit receives speed, flap/slat and landing gear position discrete inputs.

These inputs, coming from ADIRU 1 and 3, SFCCs and Landing Gear Selector Lever, are used for :

Green and Yellow electric pump automatic control, automatic RAT extension.

The Hydraulic System Monitoring Unit receives engine status discrete inputs.

These inputs, coming from EIVMU (Eng < 50% N2), are used for :

Engine pump signaling, Green and Yellow electric pump automatic control, RAT extension automatic control, overheat test on ground.

The Hydraulic System Monitoring Unit receives electrical power system input discretes, used for automatic Ram Air Turbine extension control.

It receives a cargo door control input discrete for Yellow electric pump automatic control and a discrete from CMC used for overheat test on ground.

HYDRAULIC INPUTS

The Hydraulic System Monitoring Unit receives discrete inputs from the hydraulic system.

These inputs come from sensors, switches and overhead panel and give the state of engine pumps, electric pumps and reservoirs.

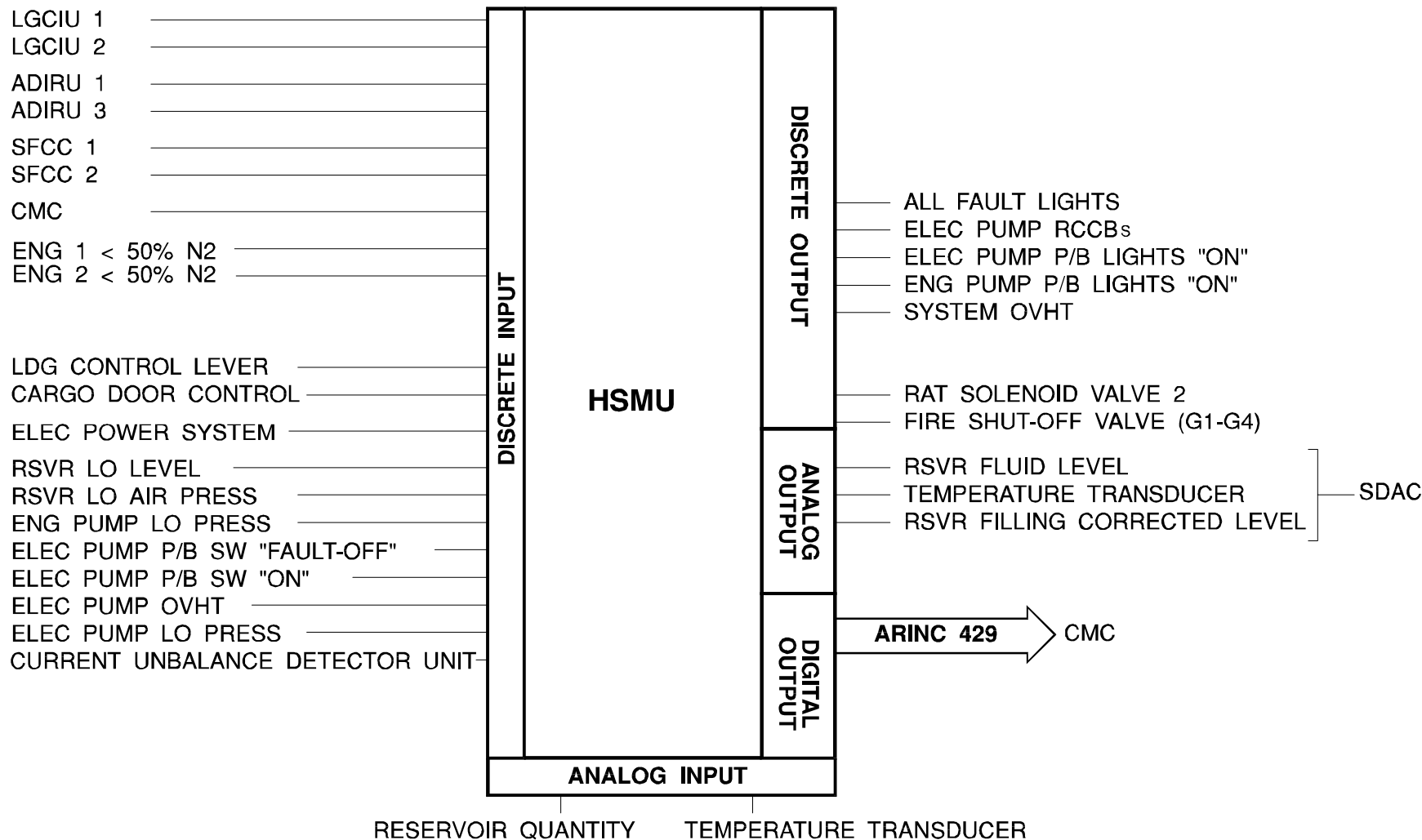
The Hydraulic System Monitoring Unit receives analog inputs from the fluid temperature transducer and the reservoir quantity transmitter.

OUTPUTS

The Hydraulic System Monitoring Unit sends digital outputs via an ARINC 429 bus to the Centralized Maintenance Computer (CMC) for maintenance purposes.

The Hydraulic System Monitoring Unit provides control and monitoring of the hydraulic system.

It sends analog outputs to the System Data Acquisition Concentrator (SDAC) concerning the reservoir filling correction versus fluid temperature.



FQW4200 GE Metric

STUDENT NOTES

FQW4200 GE Metric

MAINTENANCE PRACTICES : RESERVOIR FILLING

General
Ground Connector
Filling Valve
Hand Pump
Reservoir Filling Filter
Manual Selector Valve
Quantity Indicator
Check Valve

GENERAL

The filling system is used to refill or top up the hydraulic reservoirs from one place.

The supply of fluid can be in a container or a pressurized ground hydraulic supply.

For filling, the hydraulic reservoir is always required to be pressurized. Most of the components of the reservoir filling system are installed on the green ground service panel.

GROUND CONNECTOR

The coupling socket is one half of a self-sealing quick-disconnect coupling. The other half is attached to the ground hydraulic supply.

The assembly includes a check valve.

There is a blanking cap, which is attached to the body of the coupling with a cable.

A restrictor protects the system against overpressure.

FILLING VALVE

The filling valve is the connection for the flexible hose.

It is installed on the suction connection of the hand pump and is operated by hand to open or close it.

The coupling includes a removeable filter and a check valve.

The check valve makes sure that the fluid in the flexible pipe does not flow back into the container.

HAND PUMP

The hand pump is a twin axial piston with a rotating outer splined shaft to connect the hand pump lever.

The hand pump is capable of a maximum pressure of 290 psi, the displacement volume per cycle is about 62 cubic centimeters.

RESERVOIR FILLING FILTER

The reservoir filling filter is installed on the green ground service panel. It is of the manifold mounting type.

The filter is equipped with the hydraulic connections, a clogging indicator and a shut-off device.

There is no by-pass device.

The clogging indicator is mechanical, a red button comes out to show when the filter element is too dirty.

The filter element is of the replaceable type. It cannot be cleaned.

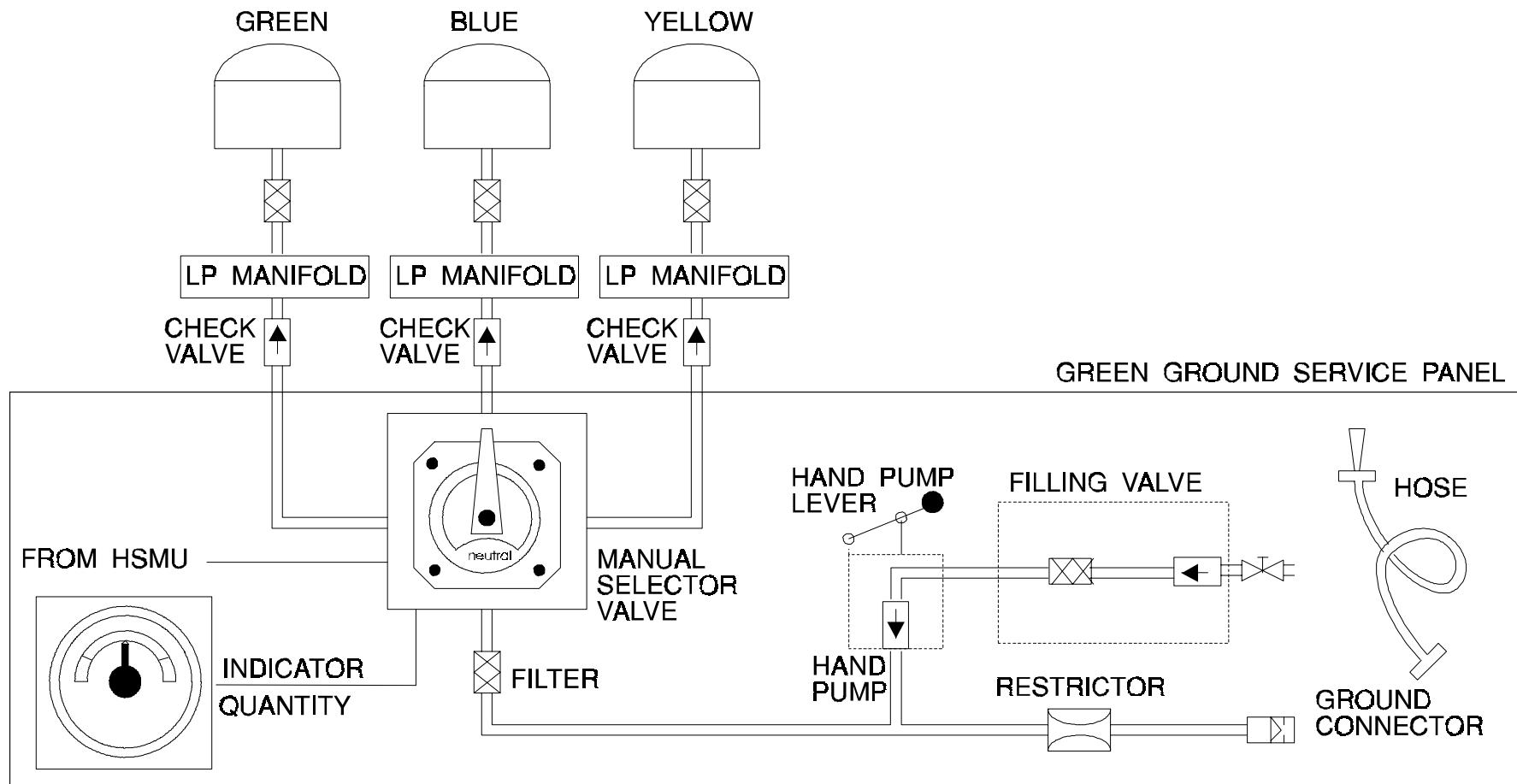
MANUAL SELECTOR VALVE

The reservoir filling manual selector valve directs hydraulic fluid from the supply to the reservoir of the system which is selected.

The selector valve can be set in anyone of the four positions (one for each hydraulic system, and neutral position).

A spring detent mechanism keeps the selector valve in its set position.

A thermal relief valve protects the selector from thermal expansion of fluid when it is in neutral position.



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QUANTITY INDICATOR

The hydraulic filling correction indicator is installed on the green ground service panel.

It shows the low or excess fluid quantity in each reservoir (after selection of the system through the selector valve).

Correction according to the reservoir temperature is made by the HSMU.

CHECK VALVE

The check valves isolate the low pressure circuits of the main hydraulic systems from the reservoir filling system when it is not in use.

STUDENT NOTES:

FQW4200 GE Metric

STUDENT NOTES

FQW4200 GE Metric

RESERVOIR PRESSURIZING

SOURCES

FILTER AND RESTRICTOR

AIR PRESSURE UNIT MANIFOLD

AIR PRESSURIZATION UNIT

General

Check Valves

Relief Valves

Fluid Separator

Filters

Pressure Reducing Valve

CHECK VALVE

PRESSURE GAGE

RELIEF VALVE

MANUAL DEPRESSURIZATION VALVE

PRESSURE SWITCH

The pressurizing system ensures an air pressure of 50 psi, in each reservoir, to avoid pump cavitation through out the complete flight envelope.

SOURCES

The reservoir pressurizing system is supplied in normal operation by high pressure air, bled from engine 1 compressor.

This is the priority source.

The system can also be pressurized by an LP source from the pneumatic system which receives air from the Auxiliary Power Unit (APU) and both engines.

The system can also be pressurized, on ground, through two ground connectors.

They are located on the blue ground service panel.

FILTER AND RESTRICTOR

A restrictor which includes a filter is installed on the air bleed line, in the engine 1 pylon.

The restrictor limits the airflow to the pressurization units, and in the case of rupture of the pressurizing line in the wing or in the fuselage.

AIR PRESSURE UNIT MANIFOLD

A manifold which includes two restrictors is installed on the low pressure source line.

The two restrictors limit the airflow in case of line rupture or overpressure.

AIR PRESSURIZATION UNIT

GENERAL

The two air pressurization units are installed in the blue hydraulic compartment.

One unit provides air pressure to the green hydraulic reservoir, and the second unit provides pressure to the blue and yellow reservoirs.

CHECK VALVES

The functions of the two check valves in each unit are to prevent back pressure and hold reservoir pressurization in case of pipe rupture.

RELIEF VALVES

A relief valve, at the pneumatic system inlet, avoids an overpressure in case of a check valve failure.

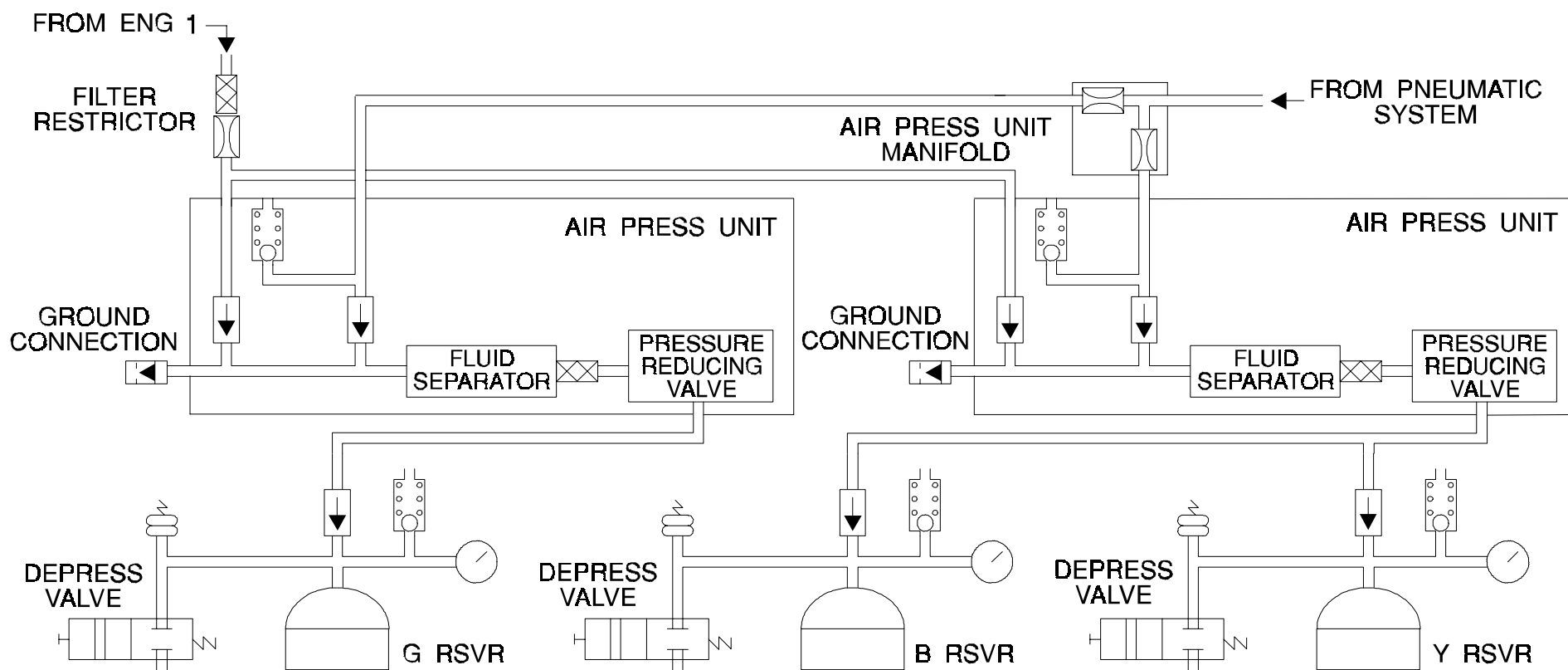
The cracking pressure of the relief valve is 75.5 psi.

FLUID SEPARATOR

The fluid separator separates the water or other fluid, in the air supply to the hydraulic reservoirs.

In case of failure, it prevents contamination by hydraulic fluid of the air supply.

A drain valve under the container drains the fluid separator.



FQW4200 GE Metric

FILTERS

The filter in each unit cleans the air which comes from the 3 sources :

- engine 1,
- ground connections,
- pneumatic system.

The filter has a clogging indicator and by-pass facility.

The filter element can be cleaned.

PRESSURE REDUCING VALVE

The pressure reducing valve reduces and regulates the air pressure.

Its outlet pressure is 65 psia in any flight or ground condition.

The control pressure is independent of the ambient pressure.

CHECK VALVE

A check valve is installed on each reservoir, it is of the flapper type.

When supply pressure is lost, the check valves retain the reservoir pressure.

PRESSURE GAGE

An air pressure gage installed on each reservoir gives the relative pressure in the reservoir.

The indicating range is from 0 to 120 psi.

RELIEF VALVE

An air relief valve installed on each reservoir relieves excess pressure to the seal drain system.

In the case of a reservoir filling quantity error, the relief valve will evacuate the excess fluid in flight.

MANUAL DEPRESSURIZATION VALVE

The manual depressurization valve is of the two/two way type.

It is installed on the ground service panel of the related system.

When using the manual depressurization, put on eye protection and keep away from the outlet of the valve.

The air can be hot and contain particles of dust and/or hydraulic fluid.

Each hydraulic reservoir can be depressurized individually using a special tool.

Each valve is connected to the applicable hydraulic reservoir.

PRESSURE SWITCH

The air pressure is monitored by a switch installed on each reservoir.

It sends a signal to the Hydraulic System Monitoring Unit (HSMU) and the System Data Acquisition Concentrator (SDAC) when the reservoir air pressure drops below 22 psi.

STUDENT NOTES:

FQW4200 GE Metric

STUDENT NOTES

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GROUND INTERNAL LEAK TEST

General
Full system
Component Check

As the three systems have the same ground internal leak test, this module is based on the green system test.

GENERAL

Obey these safety precautions.

WARNING

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 flight control surfaces
- the landing gear and the related doors
- engines
- components that move.

Make sure that the ground safety-locks are correctly installed on the landing gear.

The purpose of the ground leak test is to make sure that the internal leakage of a system is in limits.

Even if hydraulic users are at neutral there is a permanent flow.
If the permanent flow is too high, the corresponding system operation will be affected.

Before starting the test operation make sure that all servo-controls are in their neutral position and that the spoilers are retracted.

Only a hydraulic ground cart equipped with a flowmeter has to be used to pressurize the circuit.

The internal leakage check has to be done with the hydraulic fluid at its normal working temperature.

Once the hydraulic system is pressurized from the ground cart, make sure that the PRIM and SEC P/Bs are set to ON to supply the hydraulic users.

First make a full system check, then, if a leak is detected, do the check on parts of the system to identify the faulty component.

PRIM : FCPC
SEC : FCSC

FULL SYSTEM CHECK

To make a full system check you need to pressurize the green system from the ground supply making sure that the green leak measurement valve pushbutton switch is pressed in (the OFF light is off).

Monitor the flow shown on the ground hydraulic supply flowmeter.
It must not be more than : TBD.

If the internal leakage is too high, do the check of sections of the system to find the cause.

COMPONENT CHECK

To make a component check you need to pressurize the green system from the ground supply.

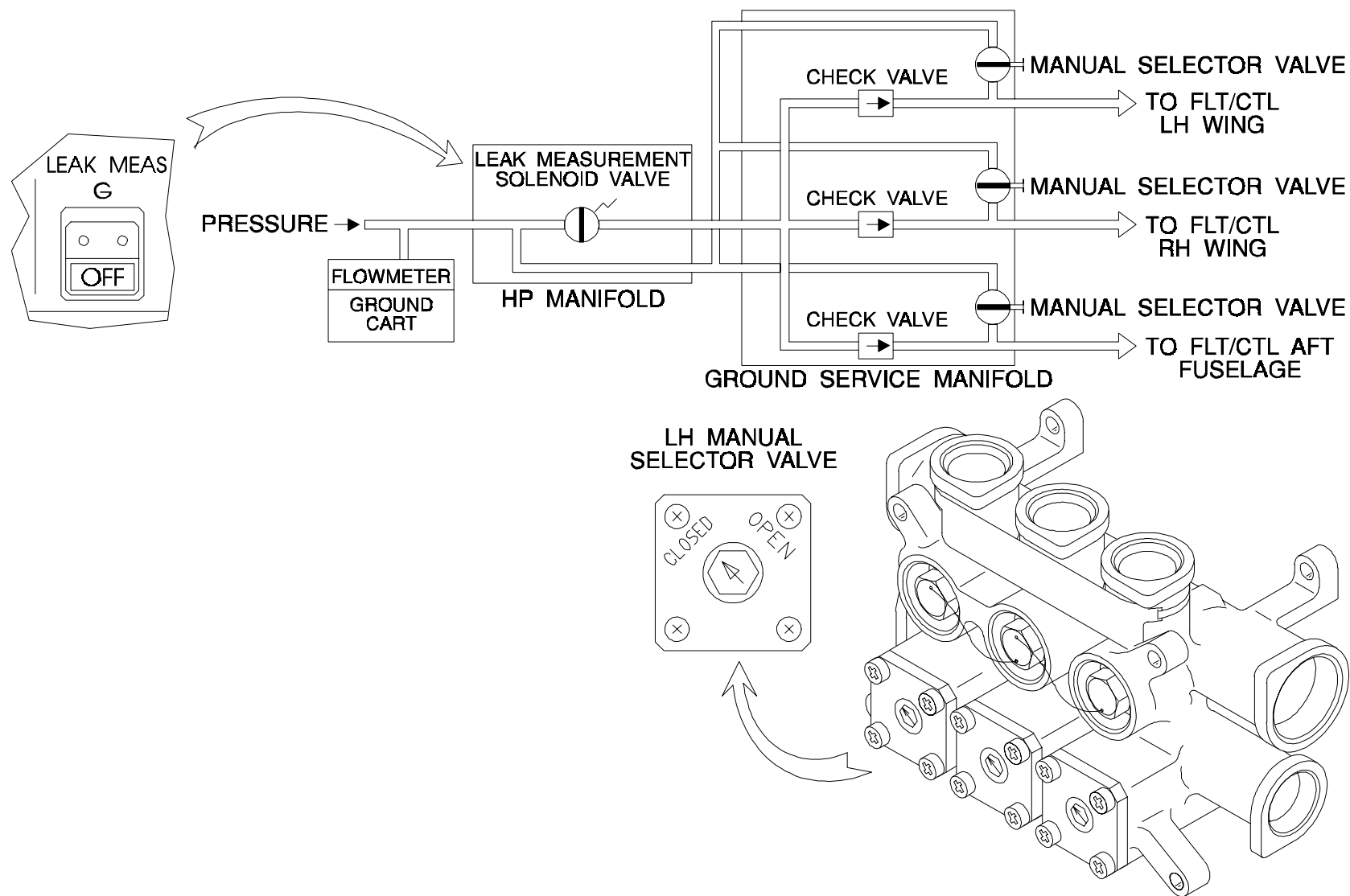
To test for leaks you need to isolate the primary flight controls.
The primary flight controls are now depressurized.

Here is the ground service manifold.
It is equipped with valves which are manually operated with a standard tool.

Each valve permits the LH wing, the RH wing and the AFT fuselage to be independently pressurized.
The valves are of the spring-loaded poppet type.

Now, monitor the flow on the ground supply flowmeter.
It must not be more than : TBD.

If the internal leakage rate is too high, you must find the defective component.
The same operation must be done on the RH wing and AFT fuselage section.
Then the check is completed.



STUDENT NOTES:

FQW4200 GE Metric

RAT STOWAGE AND SERVICING

- Safety Precautions
- RAT Extension
- RAT Retraction
- Safety Pin Installation
- Safety Pin Removal
- RAT Servicing

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 flight control surfaces
- The landing gear and the related doors
- Components that move.

Movement of components can kill or injure persons.

To perform a task, apply maintenance manual procedures.

RAT EXTENSION

To extend the ram air turbine on the ground you need to obey the hydraulic safety procedures.

Energize the aircraft electrical circuits.

Make sure that the corresponding circuit breaker(s) is(are) closed. Remove the RAT safety pin if installed.

WARNING

MAKE SURE THAT THE TRAVEL RANGE IS CLEAR BEFORE YOU EXTEND THE RAT. MOVEMENT OF THE RAT CAN CAUSE INJURY TO PERSONS AND/OR DAMAGE.

CAUTION

DO NOT PUSH THE RAT MAN ON PUSHBUTTON SWITCH FOR MORE THAN 1 MINUTE.

On the overhead panel 245vu, open the cover and push the RAT MAN ON switch.

NOTE : You can operate it more than one time.

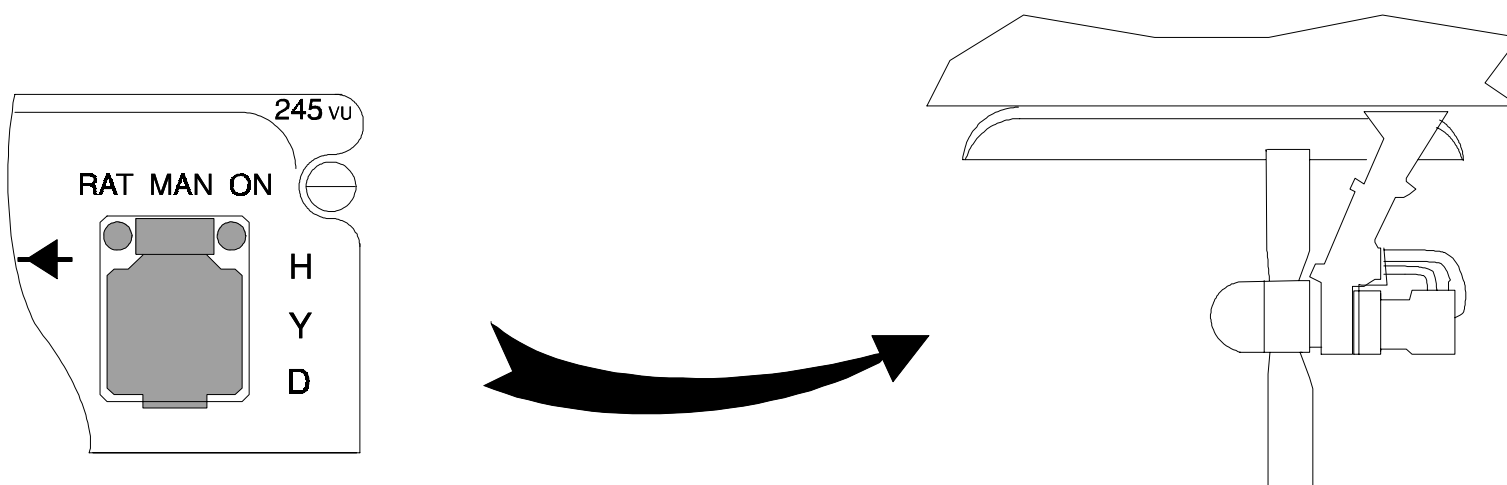
When the sum of the operation time (solenoid energized) is 60 seconds, you must let the solenoid cool for 30 seconds.

NOTE : Make sure that a second person examines the extension of the RAT.

Make sure that the RAT extends.

Manually push the RAT in the retract direction to make sure that the RAT actuator downlock is engaged.

De-energize the aircraft electrical circuits.



RAT RETRACTION

The ram air turbine retraction can be done on ground only.

Energize the aircraft electrical circuits.

Make sure that the corresponding circuit breaker(s) is(are) closed.

Pressurize the Green hydraulic system.

Open the Yellow service panel access door.

Open the RAT stow panel access door.

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

Set the ON/OFF switch on the RAT stow panel to the ON position.

Push and hold the LAMP TEST pushbutton switch.

Make sure that the STOWED light, the INTERLOCK WARNING light, and the ACTUATOR PRESSURE light come on.

Release the LAMP TEST pushbutton switch.

Make sure that the three lights go off.

Turn the blades manually to the index position.

WARNING

MAKE SURE THAT THE RAT TRAVEL RANGE IS CLEAR BEFORE YOU RETRACT THE RAT. MOVEMENT OF THE RAT CAN CAUSE INJURY TO PERSONS AND/OR DAMAGE.

Set and hold the STOW/RESET switch in the STOW position.

If the blades are not aligned, the INTERLOCK WARNING light comes on. You need to manually turn the blades in their index position, do a reset with the STOW/RESET switch and set the switch back to the STOW position.

Make sure that the ACTUATOR PRESSURE light comes on. Make sure that the RAT retracts in 30 seconds or less.

NOTE : Make sure that a second person examines the retraction of the RAT.

The RAT STOWED light comes on.

Release the STOW/RESET switch.

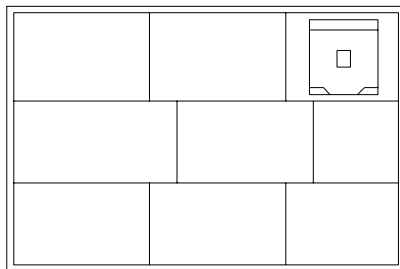
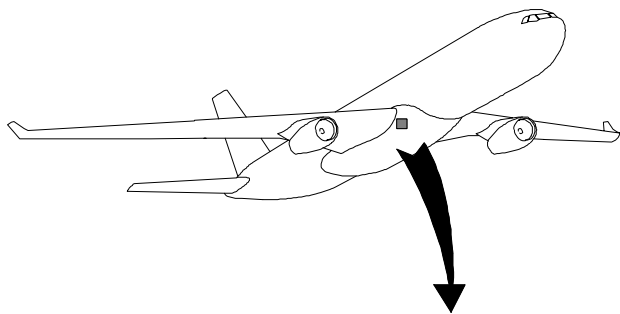
Make sure that the ACTUATOR PRESSURE light goes off.

Set the ON/OFF switch to the OFF position.

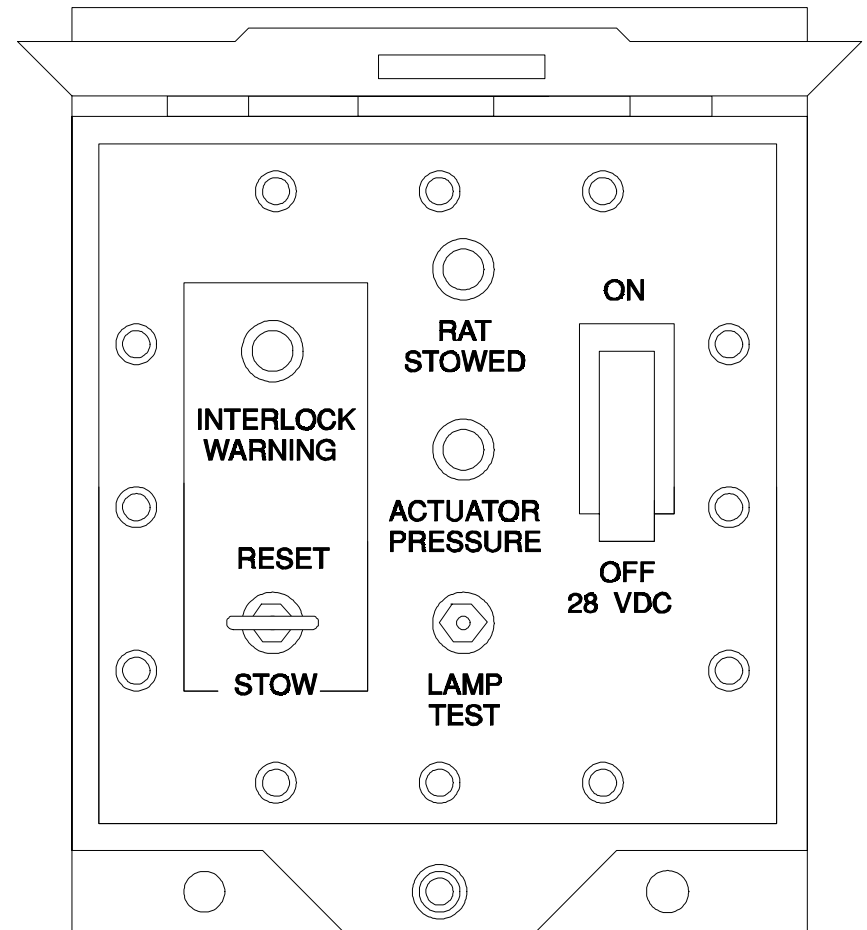
Make sure that the STOWED light goes off.

Depressurize the Green hydraulic system, de-energize the aircraft electrical circuit, close access doors.

RAT retraction is completed.



YELLOW GROUND SERVICE PANEL



RAT SAFETY PIN INSTALLATION

When you work near the ram air turbine , you must install the safety pin to prevent accidental deployment.

To install the RAT safety pin you need to open, safety and tag the corresponding circuit breaker(s).

Put the safety pin in position.

NOTE : Make sure that the bolt engages in the slot of the safety pin.

Put the sleeve in position against the RAT mounting frame and tighten the sleeve

Make sure that the safety pin touches the RAT leg.

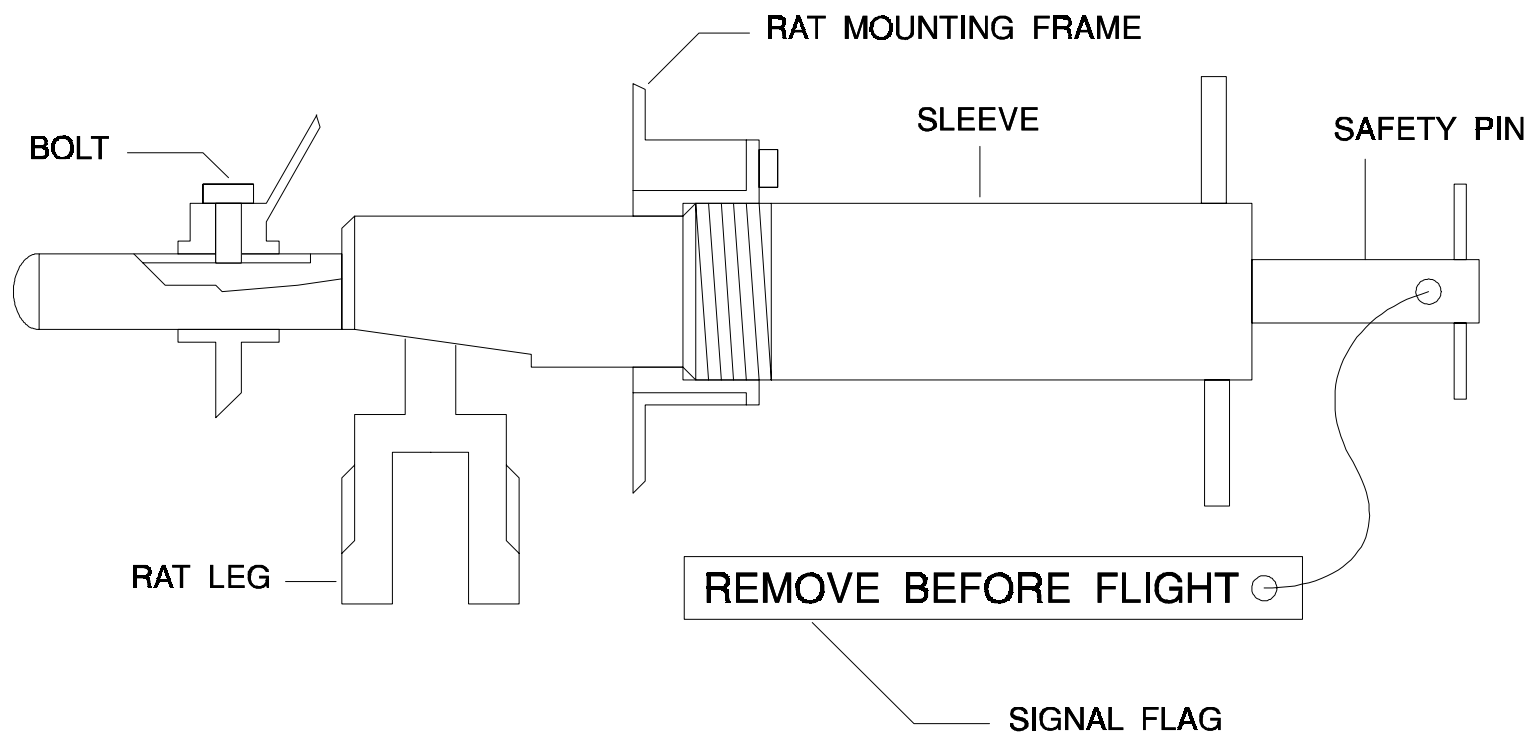
NOTE : Make sure that the signal flag hangs outside of the aircraft so that you can clearly see it.

RAT SAFETY PIN REMOVAL

Before removal of the safety pin, make sure that the warning notice is in position to tell persons not operate the ram air turbine.

To remove the RAT safety pin you need to open, safety and tag the corresponding circuit breaker(s).

Loosen the sleeve and move it back. Remove the safety pin.

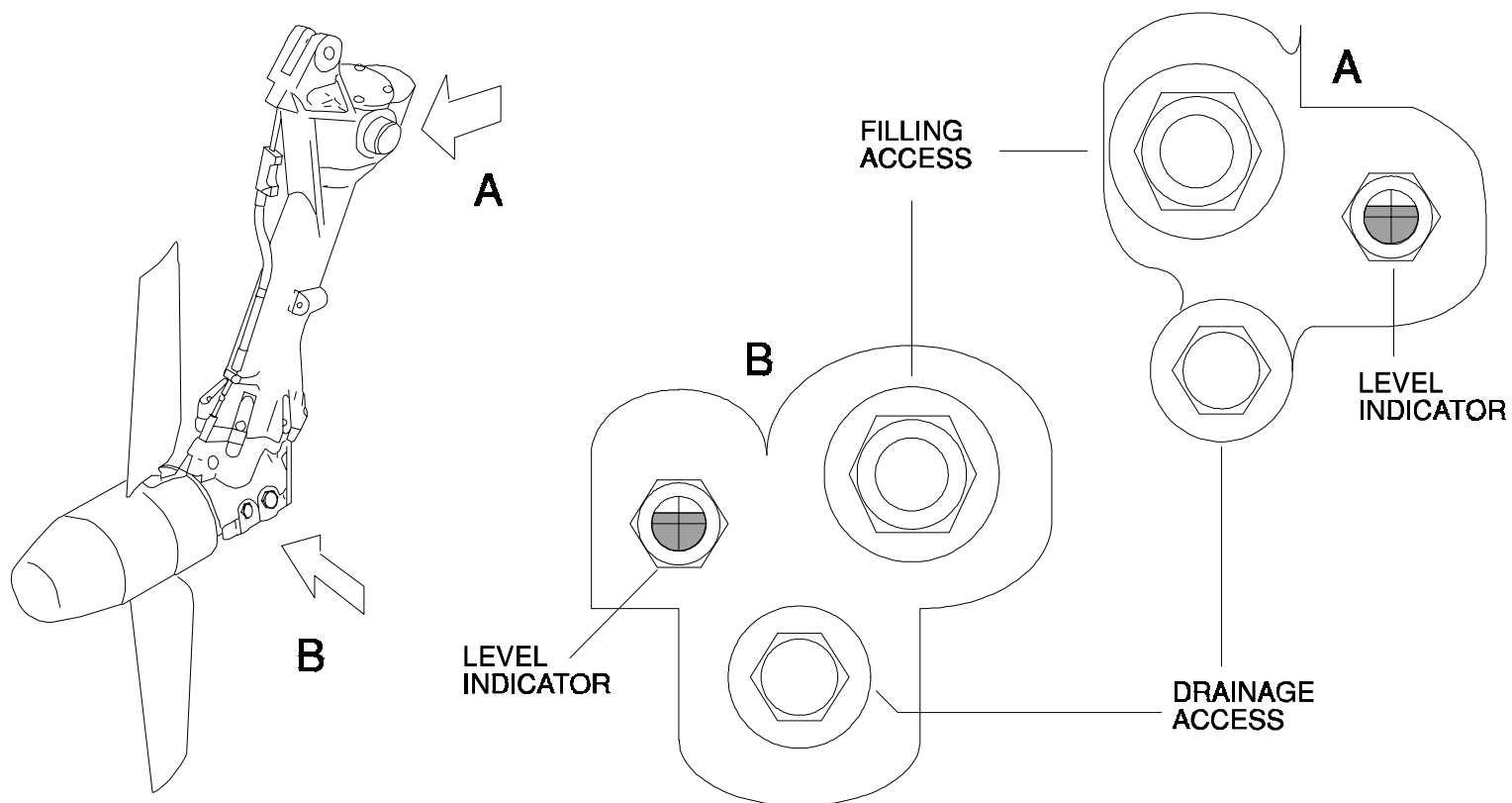


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RAT SERVICING

The ram air turbine leg comprises two gearboxes, one in its upper part, the other one in the lower part.

Each gearbox is equipped with a level indicator, a filling access and a drainage access.



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STUDENT NOTES:

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HYDRAULIC LEAKAGE

Preventing Hydraulic Leaks

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PREVENTING HYDRAULIC LEAKS

These simple plumbing problems can also be real hard to fix if you don't know the basic hydraulic plumbing rules. If you don't work carefully and follow these rules, your work may be the cause of the next hydraulic leak that delays or cancels a flight.

Let's look at these basic hydraulic plumbing rules :

Always wear clean, and cap open lines.

Contamination that gets into a system or collects on sealing surfaces can cause leaks internal and external.

Hydraulic fluid itself is a contaminant. It can eat paint and decals.

When hydraulic fluid is allowed to penetrate a composite structure, it will attack the core material and reduce it to mush.

Once a composite assembly has been attacked, its structural integrity will be lost.

To avoid damage caused by twisting, tearing, and chipping, always lubricate O-rings, packing seals, back-up rings, and fitting threads with hydraulic fluid before assembly.

When assembling hydraulic system fittings, be sure that seals and back-up rings are properly positioned before torquing the connection.

When installing an elbow fitting into a component, be sure that all the threads are completely screwed into the boss. This is to make sure that the O-ring packing rides in the undercut, and not on the threads.

To prevent an elbow fitting from turning while its lock-nut is being torqued, hold it with a second wrench.

To make a stress-free installation, be sure that all elbow-to-pipe connections are correctly aligned before torquing the B-nuts.

Do not use pointed, sharp-edged, or steel tools to remove or install O-ring packing, back-up rings, and seals. Damage may occur.

Never reinstall used O-ring packing or seals. Once they have been compressed, they will never regain their original shape again.

Before torquing a B-nut, be sure that the tube fits squarely into the fitting. Never force or bend a tube to make it fit. Metal tubes don't stretch.

If the piece seems shorter upon reinstallation or after a component change, something is wrong.

Stop ! Think ! And investigate the problem before you proceed.

Make sure that tubes are not forced into clamps or line blocks. A stressed installation will lead to a cracked tube at the nearest fitting or B-nut.

You can bet it won't be long before it happens.

If clamps or line blocks are removed so a tube or component can be replaced, be sure that they are reinstalled again.

Tubes that are not properly supported will vibrate. Vibration is the greatest enemy of a hydraulic system.

It causes tubes to crack, and connections at fittings to loosen up and leak.

When repairs are finished, always bleed the system, and leak check your work.

We, the mechanics, have control of torquing.

The lack of proper torquing is the single greatest cause of leaks. Those calibrated elbows are notorious for being out of calibration. Use a torque wrench.

HYDRAULIC FLUID PRECAUTIONS AND SPECIFICATIONS

Precautions
Fluid Specifications

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PRECAUTIONS

Hydraulic fluid and hydraulic pressurization are dangerous. Before you follow the procedures, please read the safety precautions carefully and obey them.

The hydraulic safety precautions are presented in this module only. They will NOT BE REPEATED in the other modules.

For more information, refer to AMM chapters 12-12-29 , 12-13-29 and 12-32-29.

FLUID SPECIFICATIONS

The specifications of the hydraulic fluid, used for the hydraulic power, are presented in the table.

HYDRAULIC PRECAUTIONS

USE SOLVENTS/CLEANING AGENTS, SEALANTS AND OTHER SPECIAL MATERIALS ONLY WITH A GOOD FLOW OF AIR THROUGH THE WORK AREA. THESE MATERIALS ARE POISONOUS, FLAMMABLE AND SKIN IRRITANT. OBEY THE MANUFACTURERS INSTRUCTIONS.
PUT ON PROTECTIVE CLOTHING.
DO NOT GET THEM IN YOUR MOUTH.
DO NOT SMOKE.
DO NOT BREATHE THE GAS.
IF YOU GET THE FLUID ON YOUR SKIN OR IN YOUR EYES, FLUSH IT AWAY WITH CLEAN WATER AND GET MEDICAL HELP.

MAKE SURE THAT THE CONTROLS AGREE WITH THE POSITION OF THE ITEMS THEY OPERATE BEFORE YOU PRESSURIZE A HYDRAULIC SYSTEM. UNWANTED MOVEMENT OF HYDRAULICALLY OPERATED ITEMS CAN BE DANGEROUS AND/OR CAUSE DAMAGE.

MAKE SURE THAT THE SAFETY DEVICES AND WARNING NOTICES ARE IN POSITION BEFORE YOU START A TASK ON OR NEAR:
- THE FLIGHT CONTROLS
- THE FLIGHT CONTROL SURFACES
- THE LANDING GEAR AND RELATED DOORS
- COMPONENTS THAT MOVE
MOVEMENT OF COMPONENTS CAN KILL OR INJURE PERSONS.

HYDRAULIC FLUID SPECIFICATIONS

HYDRAULIC FLUID	HYDRAULIC FLUID (PHOSPHATE ESTER BASE)			
USAGE	HYDRAULIC POWER			
REF	HYJET IV	SKYDROL 500B/4	SKYDROL LD4	HYJET IV-A
EUROPE	NSA-307-110 TYPE 4	NSA-307-110 TYPE 4	NSA-307-110 TYPE 4	NSA-307-110 TYPE 4
USA	BMS-3-11F	BMS-3-11F	BMS-3-11F	NONE

STUDENT NOTES

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HYDRAULIC RESERVOIR FILLING

Conditions For Filling

Filling With Hand Pump Or Servicing Cart.

CONDITIONS FOR FILLING

This item shows how to fill up a hydraulic reservoir using either a hand pump or a hydraulic servicing cart.

The green hydraulic panel 197CB is located in the left aft section of the belly fairing.

Note that the procedure is exactly the same for the A330.

We consider here that the aircraft electrical circuits are energized.

WARNING:

MAKE SURE THAT THE TRAVEL RANGES OF THE FLIGHT CONTROLS ARE CLEAR BEFORE YOU PRESSURIZE/DEPRESSURIZE A HYDRAULIC SYSTEM.

MOVEMENT OF THE FLIGHT CONTROL SURFACES CAN BE DANGEROUS AND/OR CAUSE DAMAGE.

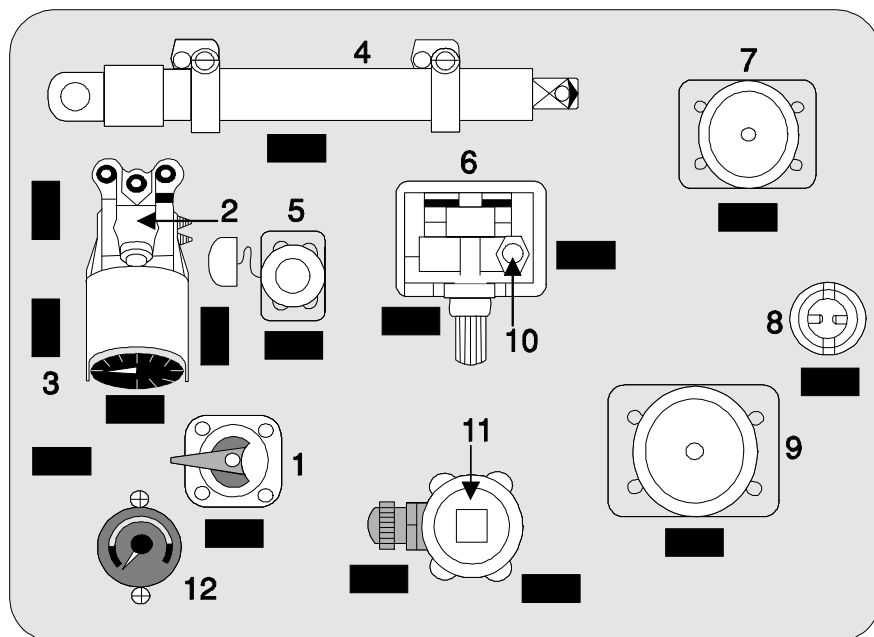
WARNING:

DO NOT GET FLUID ON YOUR SKIN OR IN YOUR EYES.

IF YOU DO:

- FLUSH IT AWAY WITH CLEAN WATER
- GET MEDICAL AID.

GREEN HYDRAULIC SERVICE PANEL 197 CB



- (1) 4JS
RESERVOIR FILLING MANUAL SELECTOR VALVE
- (2) 5141 JM1
NITROGEN CHARGING GROUND CONNECTOR
- (3) 5152 JS1
GREEN POWER ACCUMULATOR PRESSURE GAGE
- (4) 5205 JM
HAND PUMP LEVER
- (5) 5203 JM
RESERVOIR FILLING SELF-SEALING GROUND CONNECTOR
- (6) 5204 JM
RESERVOIR FILLING HAND PUMP
- (7) 5131 JM1
DELIVERY SELF-SEALING GROUND CONNECTOR
- (8) 5125 JM1
MANUAL DEPRESSURIZATION VALVE
- (9) 5132 JM2
SUCTION SELF-SEALING GROUND CONNECTOR
- (10) 5211 JM
RESERVOIR FILLING VALVE
- (11) 5202 JM
RESERVOIR FILLING FILTER
- (12) 5 JS
RESERVOIR QUANTITY INDICATOR

FILLING WITH HAND PUMP OR SERVICING CART.

- On the avionics compartment panel 721 VU, open, safety and tag the "hydraulic pump green control" circuit breaker and make sure that the other related circuit breakers are closed.
- Make sure that:
 - the surfaces are retracted
 - the thrust reversers are stowed
 - the landing gear is extended and the landing gear doors are closed
 - the forward and aft cargo doors are closed.
- Make also sure that:
 - the Green hydraulic system is depressurized
 - the Green hydraulic reservoir is pressurized.
- Now let us start the filling procedure.
- Open the Green ground service panel 197CB. Make sure that the green system accumulator pressure is correct.
- Remove and connect the hand pump lever to the shaft of the reservoir filling hand pump.
- Above the panel, you find the filling hose. Remove its cap.
- Remove the blanking cap of the pump and connect the filling hose to the filling valve. The other end of the filling hose is plunged in the hydraulic fluid container.
- On the reservoir filling manual selector valve, select the green position.
- Operate the hand pump lever .
- Monitor the increase of fluid level on the reservoir hydraulic quantity indicator.
- Stop the flow when the pointer is in the center position on the quantity indicator.
- Turn the reservoir filling manual selector valve to the NEUTRAL position.
- Remove the filling hose and install the blanking cap on the hand pump.
- Close the filling valve.
- Put the filling hose back in position on its mount.
- Remove the hand pump lever from the hand pump and put it back in position on the panel.

You can also fill the reservoir by using a hydraulic service cart.

- Remove the blanking cap from the reservoir filling self-sealing connector.
- Connect the hydraulic service cart to the reservoir filling self sealing ground connector.
- On the reservoir filling manual selector valve, select the GREEN position.
- Operate the ground hydraulic service cart.
 - CAUTION: Pump slowly to prevent a too high flow rate and supply pressure.
- Monitor the increase of fluid level on the reservoir hydraulic quantity indicator.
- Stop when the pointer is in the center position on the quantity indicator.
- Turn the filling manual selector valve to the neutral position.
- Disconnect the ground hydraulic service cart from the reservoir filling self-sealing ground connector and install the blanking cap.
- Once the reservoir has been filled either through the hydraulic service cart or through the hand pump, the close up tasks must be carried out.
- Close the green ground service panel 197CB.
- On the ECAM system display, verify the quantity of fluid in the green hydraulic system.
- Close the relevant circuit breaker and put the aircraft back into service.

HYDRAULIC RESERVOIR DEPRESSURIZATION AND PRESSURIZATION

Conditions For Filling
Green Hydraulic Reservoir Depressurization And Pressurization.

CONDITIONS FOR FILLING

This sequence shows how to depressurize and pressurize the hydraulic reservoirs. The procedure being the same for the three reservoirs, the green one is shown as an example.

The same applies for both the A340 and the A330.

WARNING:

MAKE SURE THAT THE TRAVEL RANGES OF THE FLIGHT CONTROLS ARE CLEAR BEFORE YOU PRESSURIZE/DEPRESSURIZE A HYDRAULIC SYSTEM.

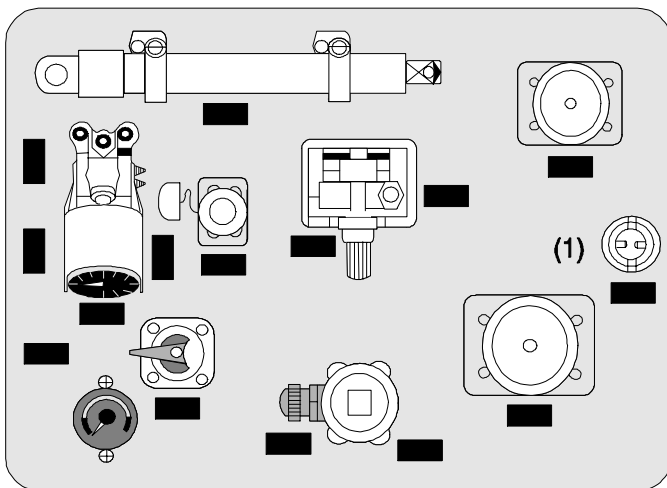
MOVEMENT OF THE FLIGHT CONTROL SURFACES CAN BE DANGEROUS AND/OR CAUSE DAMAGE.

WARNING:

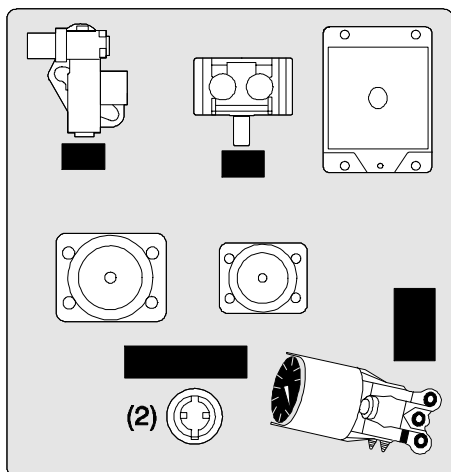
DO NOT GET FLUID ON YOUR SKIN OR IN YOUR EYES. IF YOU DO:

- FLUSH IT AWAY WITH CLEAN WATER
- GET MEDICAL AID.

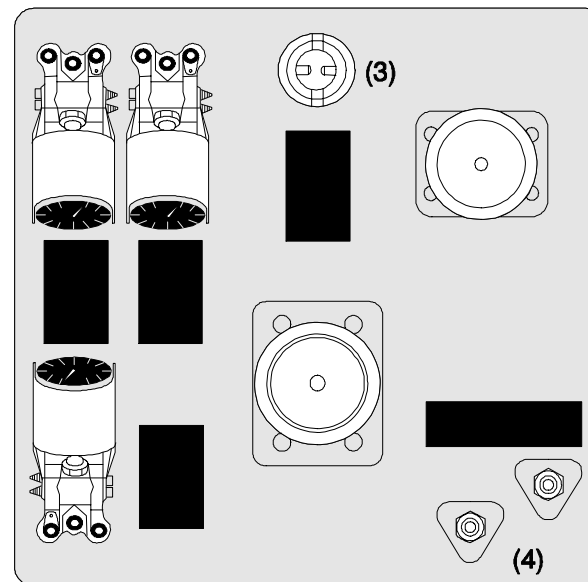
GREEN HYDRAULIC SERVICE PANEL 197 CB



YELLOW HYDRAULIC SERVICING PANEL



BLUE HYDRAULIC SERVICING PANEL



- (1) 5125 JM1
MANUAL DEPRESSURIZATION VALVE (GREEN)
- (2) 5125 JM3
MANUAL DEPRESSURIZATION VALVE (YELLOW)
- (3) 5125 JM2
MANUAL DEPRESSURIZATION VALVE (BLUE)
- (4) 5241 JM (BLUE/YELLOW)
5241 JM2 (GREEN)
PRESSURIZATION CHARGING POINTS

GREEN HYDRAULIC RESERVOIR DEPRESSURIZATION AND PRESSURIZATION

Two air pressurization charging valves are located on the Blue hydraulic service panel.

One is used for pressurization of the Blue and Yellow hydraulic reservoirs, the other one for the Green reservoir.

Each reservoir can be manually depressurized by means of a depressurization valve located on each ground hydraulic service panel.

- We consider that the ground service network has been energized.

In the cockpit, make sure that there is no pressure in the BLEED system.

- Make sure that the Green hydraulic system is depressurized and put it in the maintenance configuration.

- Put a warning notice in position on panel 245VU so that nobody can pressurize the related hydraulic system.

- On the avionics compartment panel 721VU, open, safety and tag the green hydraulic pump control circuit breaker.

- Open the left main landing gear door.

- Open the green ground service panel 197CB.

- WARNING:

- Before continuing the procedure, protect your hands and face from the air which comes out when you open the reservoir manual depressurization valve. There could be a risk of burns from hot gas and contamination from hydraulic fluid.

- On the green ground service panel, turn the cap of the depressurization valve 90 degrees clockwise to the OPEN position.

- Listen to check that all the air is released.

- In the left main landing gear bay, check the depressurization on the green reservoir air pressure gage.

- NOTE:

- Keep the depressurization valve open until you have completed the maintenance operation to prevent accidental pressurization of the reservoir.

- Close the depressurization valve when the maintenance operation is completed.

- Put the aircraft in the configuration corresponding to the next operation.

- The reservoirs will be automatically pressurized when the BLEED system is supplied or by using the charging points located on the BLUE hydraulic service panel.

MAINTENANCE PRACTICES

Accumulator Servicing
Hydraulic Safety Valve Resetting
Sampling

ACCUMULATOR SERVICING

Note:

The filling procedure is identical for the green, blue and yellow hydraulic system accumulator. Only the filling of the green system accumulator is presented in this module.

FILL THE GREEN SYSTEM ACCUMULATOR WITH NITROGEN

Suppose that the green hydraulic system is depressurized.

Attention:

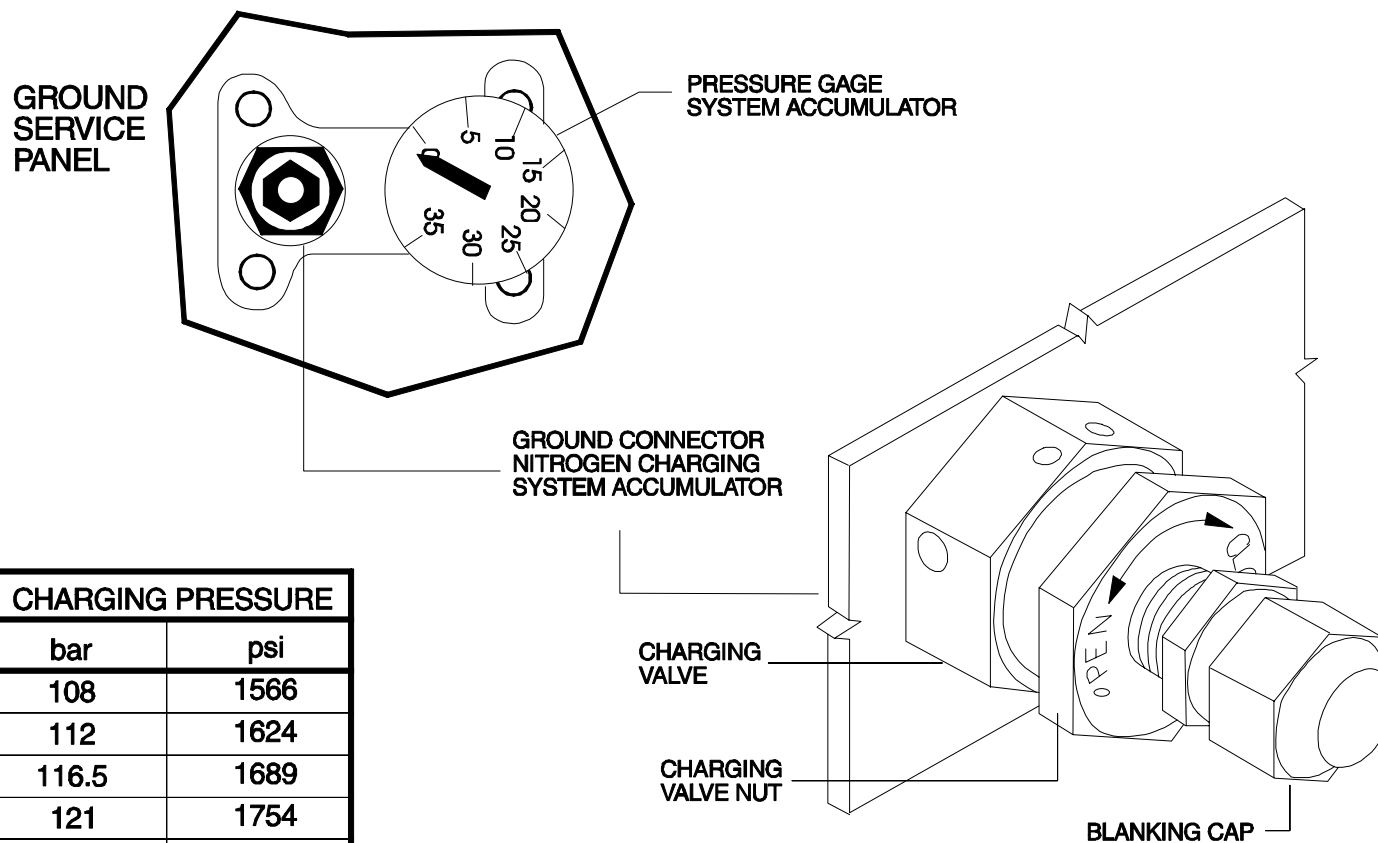
If the decrease in nitrogen pressure is more than 30 bar (435.1131 psi), with respect to the nominal pressure of the accumulator, you must make sure that there are no leaks before you start the filling procedure.

Support Equipment: 98F29103500000 1 FILL UNIT-NITROGEN.

- (1) Remove the blanking cap from the charging valve.
- (2) Connect the nitrogen fill unit to the charging valve.
- (3) Loosen the charging valve nut.
- (4) Open the charging valve nut slowly and fill the accumulator to the correct pressure for the ambient temperature (see table).
- (5) When the pressure is stable and correct, tighten the charging valve nut.
- (6) Make sure that the pressure shown on the pressure gage is correct.
- (7) Stop the supply and remove the filling unit.
- (8) Install the blanking cap on the charging valve.

Note:

The simplified procedure is described here, refer to the AMM 12-14-29 for the detailed procedure.



TEMPERATURE		CHARGING PRESSURE	
deg.C	deg.F	bar	psi
-30	-22	108	1566
-20	-4	112	1624
-10	14	116.5	1689
0	32	121	1754
10	50	125.5	1820
20	68	130	1885
30	86	134.5	1950
40	104	139	2015
50	112	143.5	2081
60	140	148	2146

HYDRAULIC SAFETY VALVE RESETTING

PITCH TRIMMER SAFETY VALVE

As soon as the hydraulic fuse on the safety valve has operated it must be reset.

Reset the safety valve by pushing the plunger.

Note:

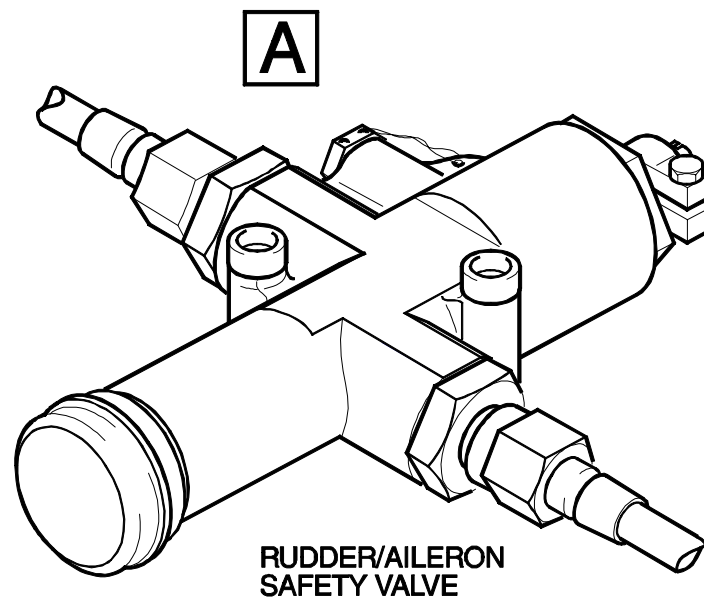
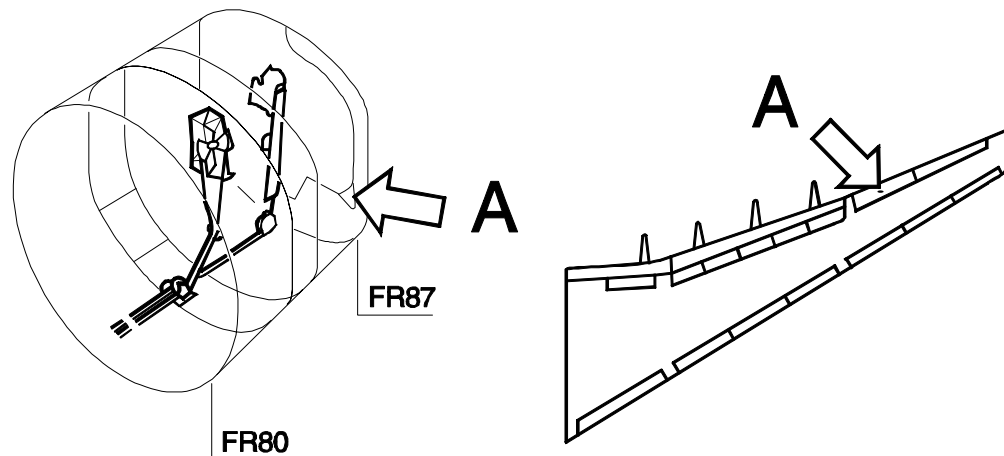
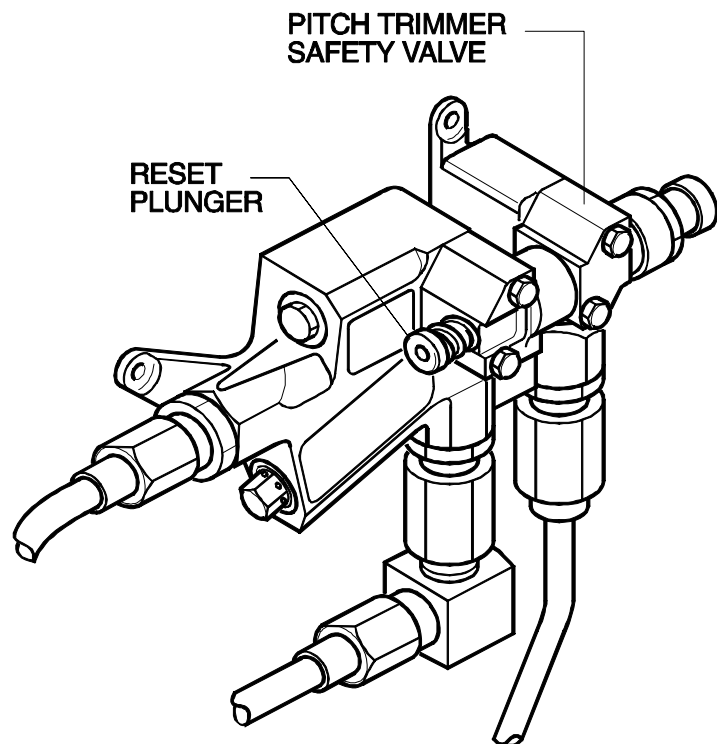
For detailed information, refer to AMM chapter 32-11-00.

RUDDER SAFETY VALVE / AILERON SAFETY VALVE

The rudder safety valve and the lefthand and righthand aileron safety valves are automatically reset when the system integrity is restored.

Note:

For detailed information, refer to AMM chapter 29-11-00.



SAMPLING

SAMPLING FOR ANALYSIS

NOTE:

The "SAMPLING FOR ANALYSIS" procedure is applicable for both the A340 and the A330.

Material No. 11-003 USA TT-M-261
METHYL-ETHYL-KETHONE

We consider that the aircraft electrical circuits are energized and that the hydraulic circuits are pressurized. The main landing gear doors are open. We are going to show how to take a sample of the blue hydraulic system fluid.

The sampling valves are located on their associated High Pressure manifold.

- (1) Get access to the sampling valve installed on the blue HP manifold.
- (2) Clean the sampling valve and cap with a lint-free cloth and cleaning agents. WARNING, obey the manufacturer instructions when using the cleaning agents. This material is dangerous.
- (3) Remove and discard the lockwire from the sampling valve.
- (4) Remove the cap from the sampling valve.

Note that you must flush the sampling valve before you remove a sample.

- (5) Put the notch in the head of the cap below the head of the needle valve.
- (6) Pull the needle valve down and drain 0.2 liters (0.0528 US gallons) into a container.
- (7) After drainage, put a clean sample tube below the sampling valve to remove a sample.
- (8) Put the notch in the head of the cap below the head of the needle valve.
- (9) Pull the needle valve down and drain 0.2 liters (0.0528 US gallons) into the sampling tube.
- (10) Put the sample into a clean glass sample bottle that you seal.

- (11) Put a tag with aircraft registration, system identification, date and time, before you send the bottle to the analysis laboratory.

Particle contamination must be to NAS 1638 class 8 or better.

- (12) Depressurize the blue hydraulic system before you re-install the cap on the sampling valve.

- (13) Safety the cap with corrosion resistant steel lockwire.

For sampling on the green hydraulic system, get access to the green HP manifold, also located in the left main landing gear bay.

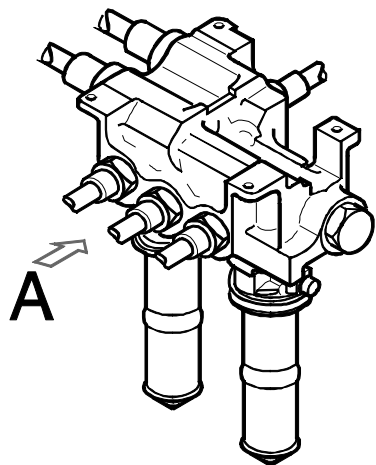
For sampling on the yellow hydraulic system, get access to the yellow HP manifold, located in the right main landing gear bay.

- (14) Make sure that the work area is clean and clear of tools and other items and that the fluid level in the hydraulic reservoir is correct before closing the access.

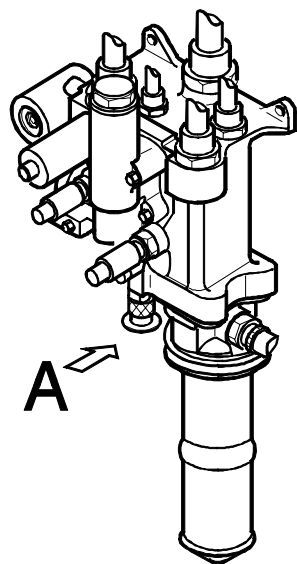
Note:

For more detailed information about the permissible limits for the hydraulic fluid or about this procedure, please refer to the AMM 12-32-29.

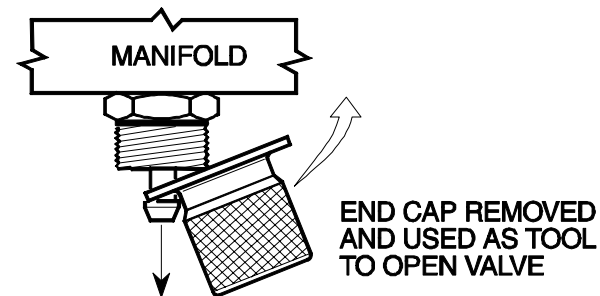
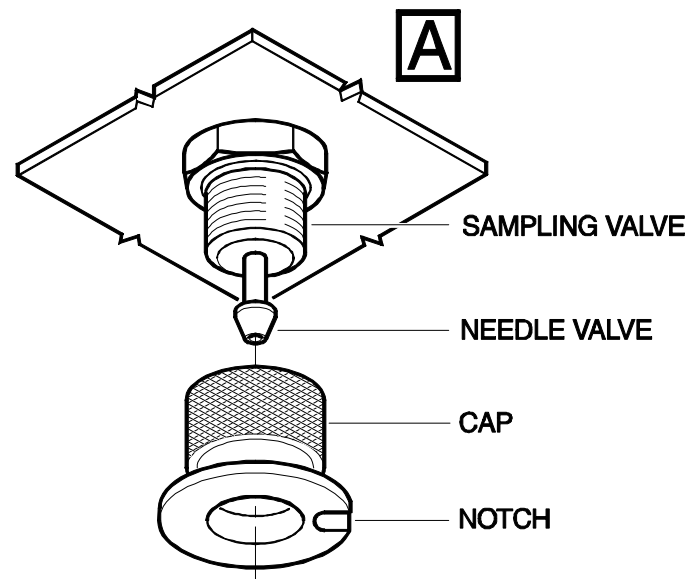
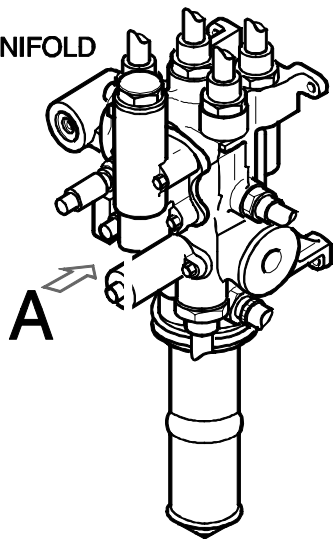
GREEN HP FILTER MANIFOLD



YELLOW HP MANIFOLD



BLUE HP MANIFOLD



STUDENT NOTES

FQW4200 GE Metric