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B1/B2

Training Manual

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ATA 29 HYDRAULIC POWER

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29–00 GENERAL

GENERAL DESCRIPTION

System Overview

The aircraft is equipped with three continuously operating hydraulic systems, **BLUE, GREEN** and **YELLOW.**

Each system is supplied from its own hydraulic reservoir. Normal system operating pressure is 3000 PSI .There is no possibility to transfer hydraulic fluid from one system to another.

- **Green system (System 1)**
  - The green system is pressurized by a engine driven pump installed at engine 1.
- **Blue system (System 2)**
  - The blue system is pressurized by an electric pump.
  - A Ram Air Turbine (RAT) driven pump is provided for emergency use.
- **Yellow System (System 3)**
  - The yellow system is pressurized by a pump driven by engine 2.
  - An electric pump allows the yellow system to be pressurized. This enables ground operations when the engines are stopped.
  - A handpump can be used to supply the yellow system in order to operate the cargo doors when no electrical power is available.

Reservoirs

Each system is supplied by its own hydraulic reservoir. The reservoirs are pressurized using HPC-air of engine no 1 or bleed air from the pneumatic system (Engine or APU) or from a ground connection.

Fire Shut-Off Valve

On the green and yellow systems, a fire valve is positioned upstream of the engine driven pump to isolate the system.

Accumulators

- **System Accumulators**
  - An accumulator in each circuit helps to maintain a constant pressure. It acts as a damper for small changes. It also makes a supply of fluid available in case of any demand. The accumulator is precharged with nitrogen to 1885 psi (130 bar) at 20° C. It holds 1.1l of total volume of fluid when it is full.
- **LAF (Load Allevation Function) Accumulators (A320 only)**
  - The LAF (**L**oad **A**llevation **F**unction) relieves wing structure load in turbulence by moving the ailerons and spoiler 4 and 5 symetrically, in addition to giving roll orders.

PTU (Power Transfer Unit)

A bidirectional PTU (**P**ower **T**ransfer **U**nit) enables the green system to be powered by the yellow system or vice versa, without fluid transfer.

In flight, with only one engine running, the PTU (**P**ower **T**ransfer **U**nit) is automatically activated when the the differential pressure between the green and yellow system is higher than 500psi (34bar).

On ground, when the engines are shut down, the PTU allows the green system to be pressurized using the yellow electric pump.

RAT (Ram Air Turbine)

A Ram Air Turbine, which extends automatically in the event of both engines and APU generator failure, allows the blue hydraulic system to be pressurized.

NOTE: RAT delivered pressure is 2500 psi (172 bar).

NOTE: Automatic deployment is inhibited on ground. Manual operation from the cockpit is always possible.

NOTE: RAT stowage is possible on ground only.

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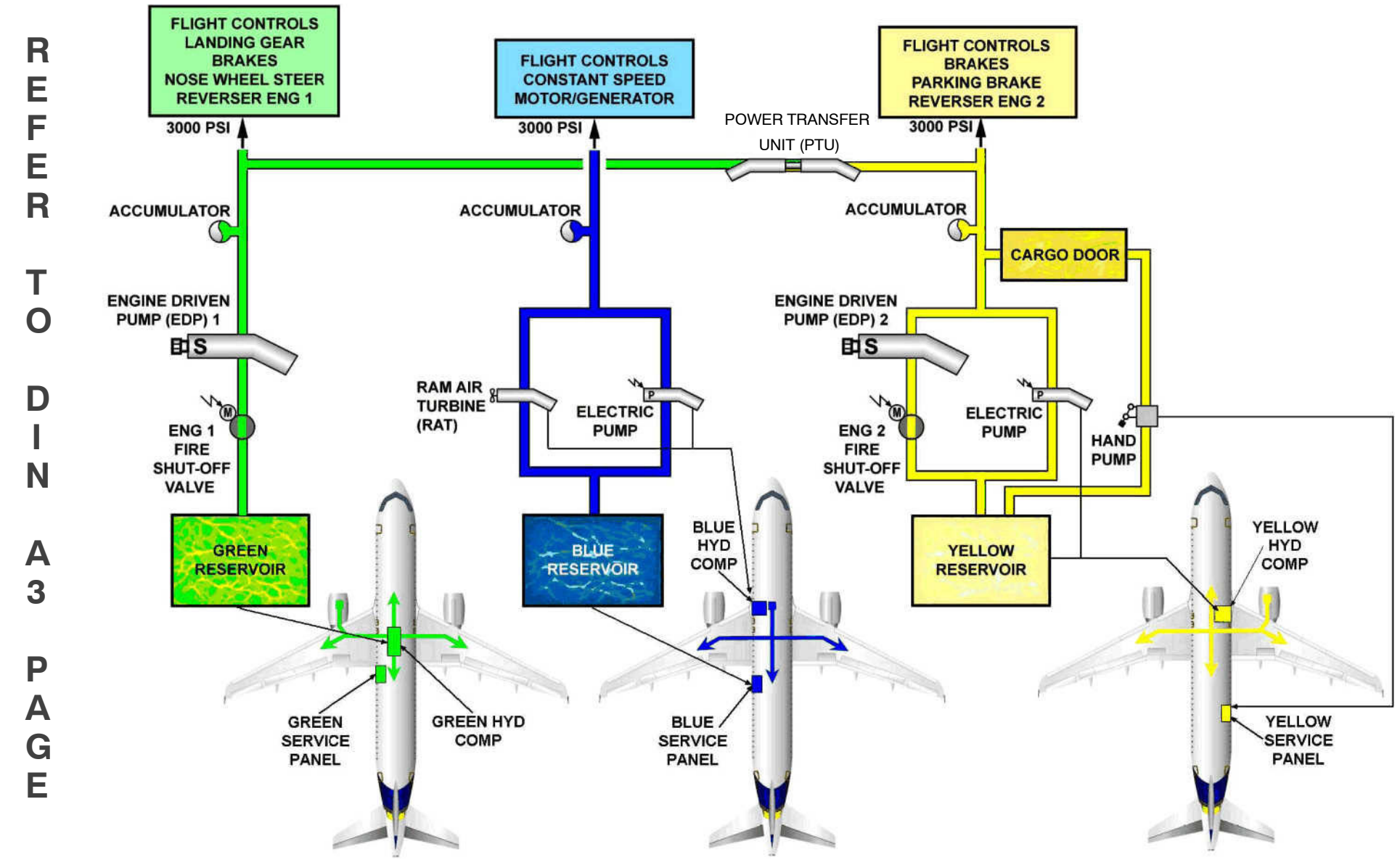

Figure 1 Hydraulic System General Layout

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SYSTEM PRESENTATION

Filters

The hydraulic fluid is maintained clean by filters.

- HP filters on each system,on the reservoir filling system and on normal braking system.
- Return filters on each line.
- Case drain filters on engine and blue electric pumps permit the monitoring of wear by detection of particles in the filters.

Leak Measurement Valves

A leak measurement valve is positioned in each circuit upstream of the primary flight controls. They are used for the leakage measurement of each circuit and are closed by operation of the leak measurement valves Pb switches on the maintenance panel.

Priority Valves

In the event of low hydraulic pressure, priority valves (attached to the PTU manifold) maintain the operation of essential systems by cutting off hydraulic power to heavy load users.

Ground Couplings

The ground service panel has two connectors used to pressurize the green hydraulic system from a ground cart. A selector valve, two connectors and a hand pump are used for hydraulic reservoir refilling.

EDP (Engine Driven Pump)

The EDP is attached to the accessory gearbox. A solenoid valve controlled by the ENG 1 PUMP P/B selects the pressurized or depressurized mode. The EDP cooling and lubricating flow goes through the case drain filter installed in the return circuit. Pump outlet pressure is 3000 psi (206 bar) at zero flow. The EDP includes a blocking valve, which isolates the pump from the hydraulic system when the pump operates in depressurized mode.

EDP Pressure Switch

The EDP pressure switch monitors the EDP outlet pressure for ECAM indications. The threshold of the pressure switch is 1740 psi (120 bar).

System Pressure Switches

The signals from both pressure switches at the HP manifold are sent to the Flight Control Computers, to the Braking/Steering Control Unit (BSCU), the ECAM will receive information from one of the two switches for LP indication, and to the Flight Augmentation Computer (FAC). The threshold of the pressure switches is 1450 psi.

Pressure Transmitter

The pressure transmitter provides data for pressure indication on the ECAM and sends information to Elevator Aileron Computers (ELACs) 1 and 2.

PTU Manifold

The PTU manifold is composed of three different valves:

- the normal braking selector valve which cuts the hydraulic supply to the normal brakes,
- the solenoid valve installed in the PTU supply line which stops the PTUoperation,
- the priority valve which makes sure that all available hydraulic pressure is sent to the primary flight controls if pressure in the system is reduced.

Sampling Valve

A sampling valve is provided on the HP manifold.

NOTE: When sampling, let the fluid run for a moment into a container, then put 0.2L of fluid into an appropriate bottle for analysis.

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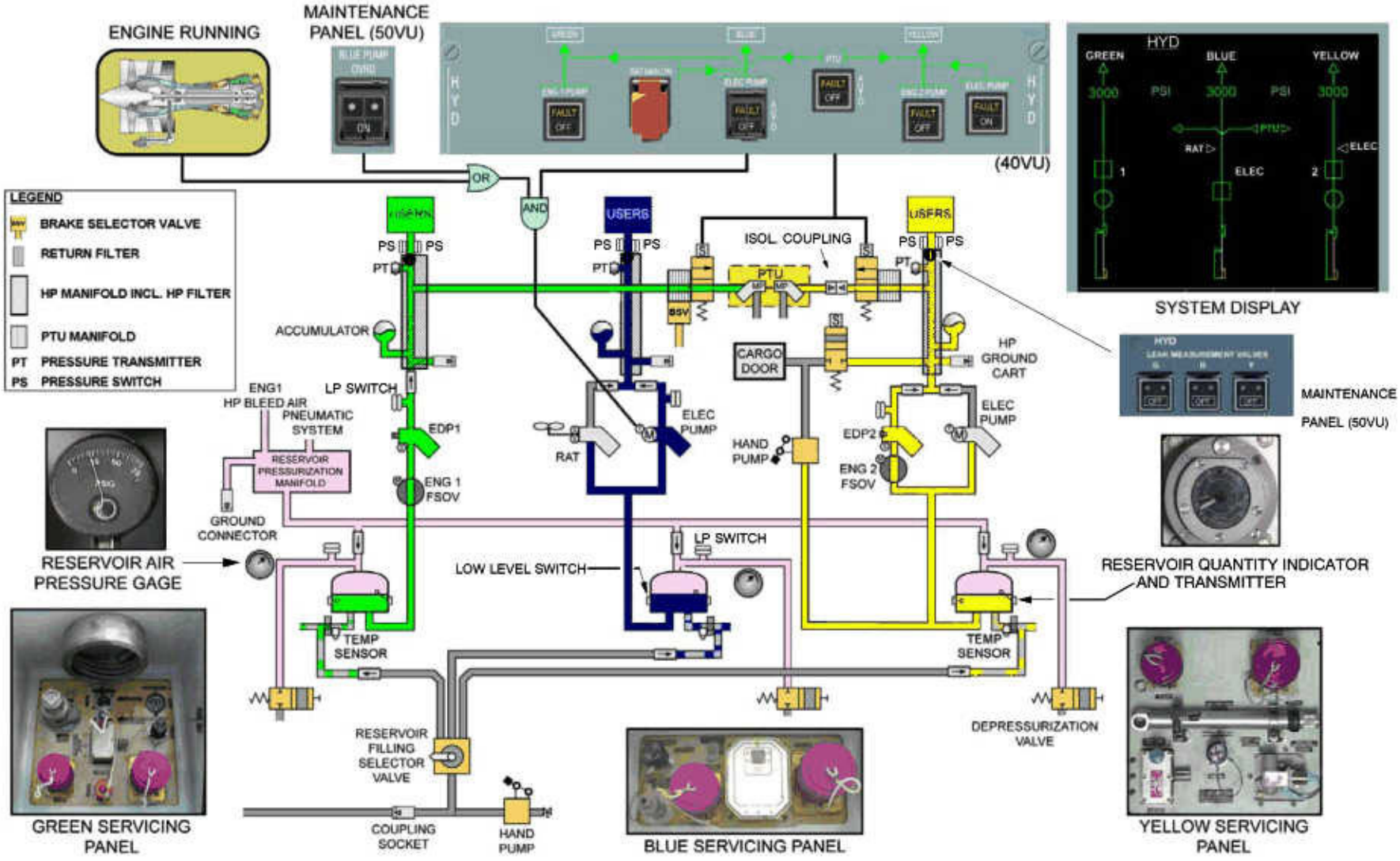

Figure 2 Hydraulic System Presentation

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Some hydraulic system users:

The Green main hydraulic system supplies:

- the landing gear and doors (including nosewheel steering),
- the normal braking system,
- the left (No.1) engine thrust reverser,
- some of the flight controls,
- the PTU (**P**ower **T**ransfer **U**nit).

The Blue hydraulic system supplies:

- some of the flight controls,
- the CSM/G

The Yellow hydraulic system supplies:

- the cargo doors,
- the alternate and parking brake systems,
- the right–hand (No. 2) engine thrust reverser,
- some of the flight controls,
- the PTU (**P**ower **T**ransfer **U**nit).

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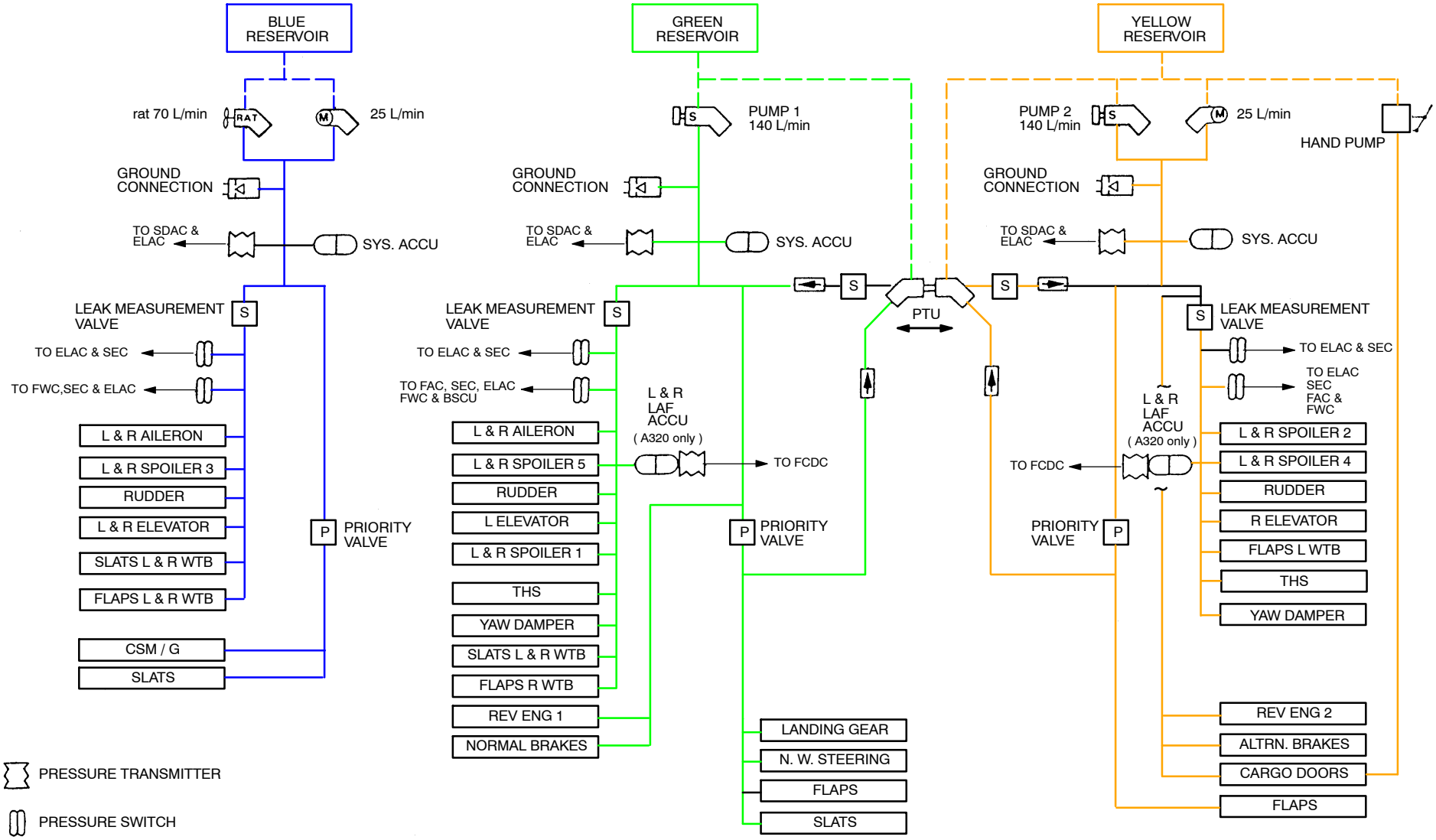

Figure 3 Hydraulic User

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CONTROLS

Hydraulic Panel (40VU)

1 Engine 1 (Green) Pump P/BSW

ENG 1 PUMP pushbutton controls the engine 1 hydraulic pump:

- **ON** (P/BSW in)
  - With the ENG 1 PUMP pushbutton selected and the engine running, engine 1 pump pressurizes the green system.
- **OFF** (P/BSW out)
  - OFF illuminates white
  - pump solenoid valve is energized
  - pump operates in the depressurized mode.
  - deactivates the FAULT LT except at overheat-condition.
- **FAULT-light**
  - illuminates amber in case of:
    - reservoir low level
    - reservoir low air press
    - pump low pressure
      (inhibited on ground and in air with engine stopped)
    - reservoir overheat **(1)**

2 RAT MAN ON P/BSW (Guarded)

- The RAT MAN ON guarded pushbutton permits Ram Air Turbine deployment at any time.
- RAT deployment is automatic in case of failure of main generators (ENG and APU) in flight.

3 Blue ELEC Pump P/BSW

- **AUTO** (P/BSW in)
  - **In flight:**
    with the BLUE ELEC PUMP pushbutton at AUTO and AC power available, the electric pump operates.
  - **On Ground:**
    - the electrical pump is energized, provided one engine is running or
    - the Blue Pump OVRD pb switch on the 50VU is pushed in.
- **OFF** (P/BSW out)
  - OFF illuminates white
  - the pump is de-energized
  - deactivates the FAULT LT except at overheat-conditions.
- **FAULT-light**
  - illuminates amber in case of:
    - pump low pressure
      (inhibited on ground with engine stopped)
    - reservoir low air press
    - reservoir low level
    - reservoir overheat **(1)**
    - pump elec motor overheat **(1)**

NOTE: **(1)** If the FAULT light is on due to an overheat condition, it stays on, with P/BSW in off, until the overheat-condition is gone.

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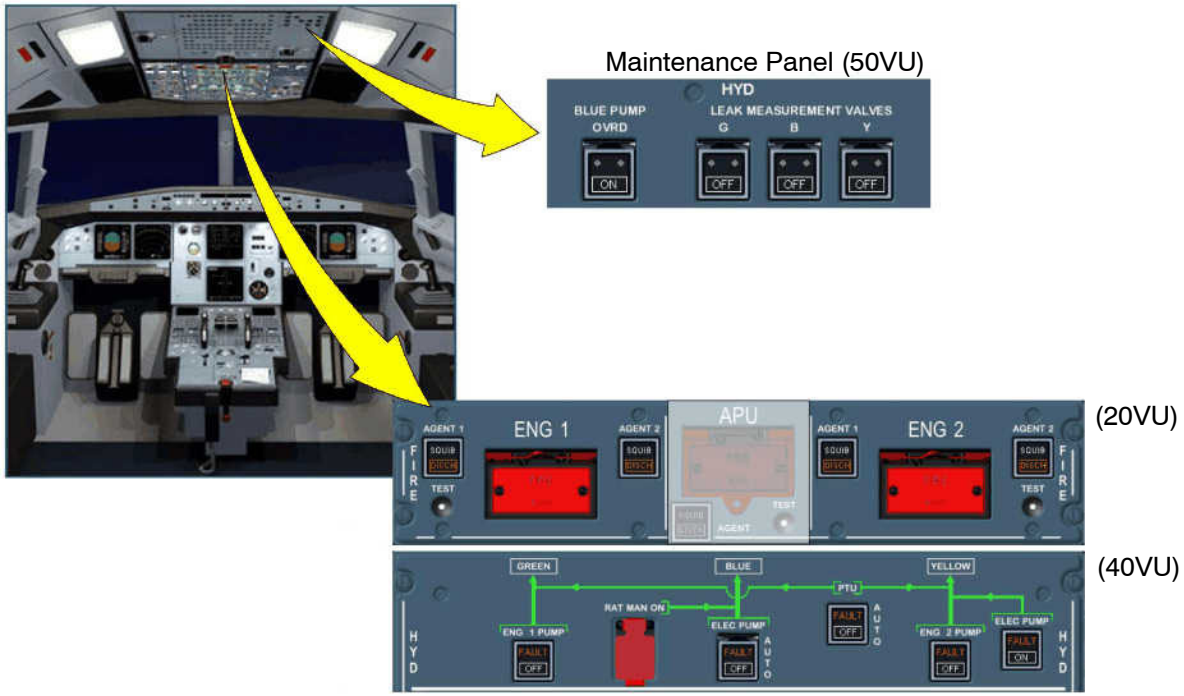

Hydraulic Panel (40VU)

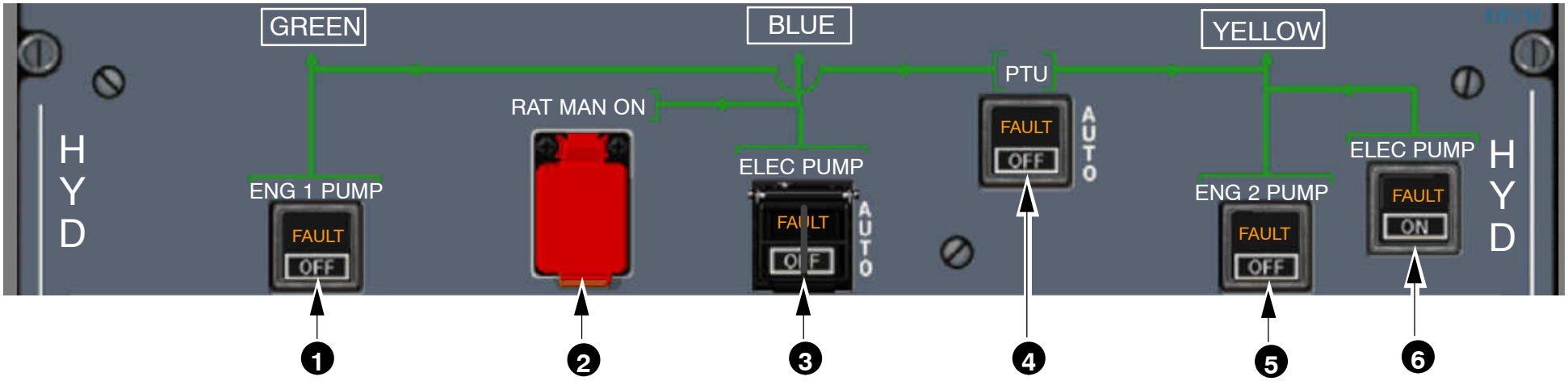

Figure 4 Hydraulic Panels (1)

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Hydraulic Panel (40VU)

4 PTU (Power Transfer Unit) P/BSW

- **AUTO** (P/BSW in)

  The bidirectional Power Transfer Unit is armed,
  - yellow and green PTU solenoid valves are deenergized open.
  - PTU operates automatically when the differential pressure between the green and yellow system is more than 500 psi.

  NOTE: The PTU is inhibited during cargo door operation and first eingine start and is automatically tested during the second engine start.
- **OFF** (P/BSW out) illuminates white
  - the PTU is off
  - yellow and green PTU solenoid valves are energized closed.
  - deactivates the FAULT LT except at overheat-condition.

FAULT-light

- illuminates amber in case of:
  - green or yellow reservoir low level
  - green or yellow reservoir overheat **(1)**
  - green or yellow reservoir low air press.

5 Engine 2 (Yellow) Pump P/BSW

ENG 2 PUMP pushbutton controls the engine 2 hydraulic pump, in the same way as ENG 1 PUMP P/BSW controls the engine 1 hydraulic pump.

6 Yellow ELEC Pump P/BSW

- **ON**
  - ON illuminates white.
  - the electrical pump is energized,
- **OFF**
  - the electrical pump is deenergized,
  - If electrical power is removed the pump will remain deenergized at the next electrical power application.
  - deactivates the FAULT LT except at overheat-condition.

  NOTE: The electrical pump is automatically energized,when the cargo doors are opened or closed.
- **FAULT** illuminates amber in case of:
  - pump low pressure
  - reservoir low level
  - reservoir low air press.
  - pump elec. motor overheat **(1)**
  - reservoir overheat **(1)**

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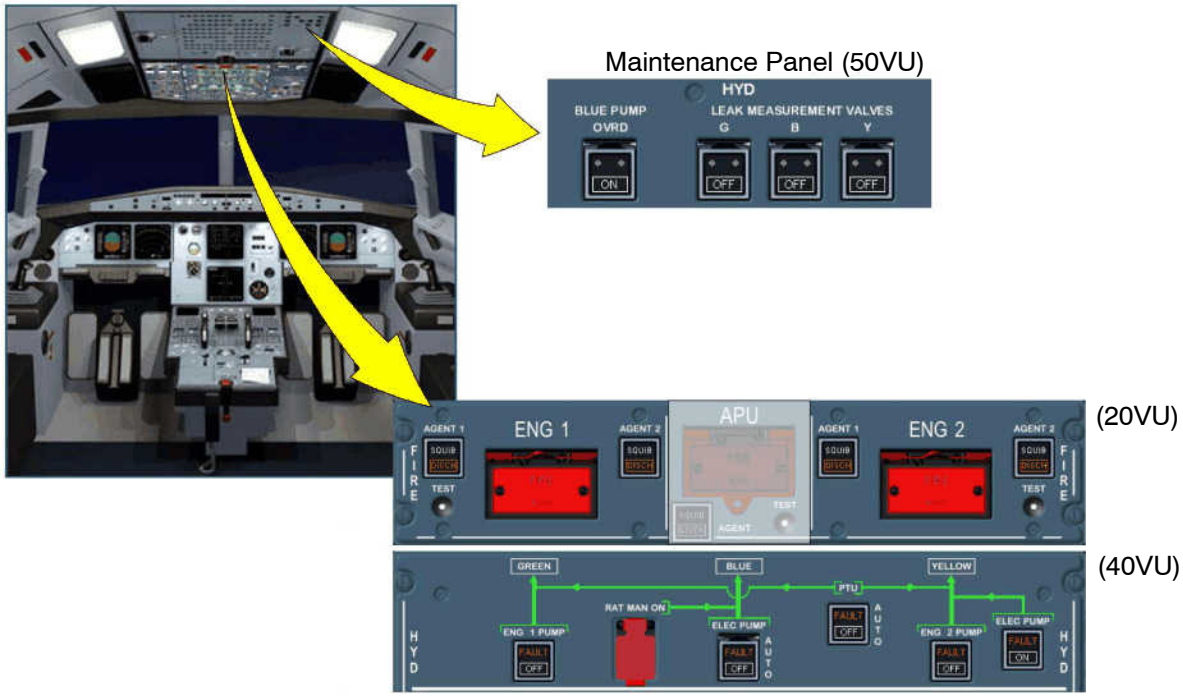

Hydraulic Panel (40VU)

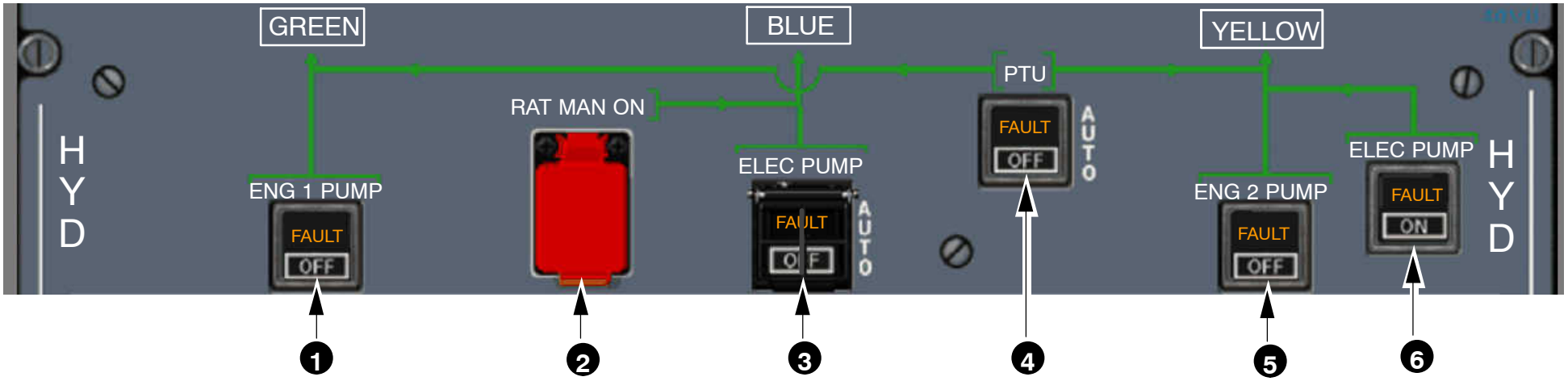

Figure 5 Hydraulic Panels (2)

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Maintenance Panel 50VU

7 Leak Measurement Valve P/BSW (Blue)

8 Leak Measurement Valve P/BSW (Green)

9 Leak Measurement Valve P/BSW (Yellow)

Panel (50VU) has the pushbutton switches which control the three leakage measurement selectors. **These are used for servicing only**.

- **OFF** (P/BSW out)
  - OFF illuminates white
  - the respective solenoid valve is energized closed and the hydraulic supply to the primary flight controls is shut off.

10 Blue Pump OVRD P/BSW

For maintenance on ground the blue hydraulic circuit can be pressurized bypressing the BLUE PUMP OVRD puschbutton on the maintenance overhead panel.

- **ON**

  On ground, the electric pump operates if the ELEC PUMP pushbutton is set to AUTO.

Emergency Electric Power Panel (21vu)

11 MAN ON P/BSW (Guarded)

The MAN ON guarded pushbutton permits Ram Air Turbine deployment at any time.

RAT deployment is automatic in case of failure of main generators (ENG and APU) in flight.

Fire Panel (45VU)

12 Engine 1 (2) Fire P/BSW (ATA 26)

- Pushed out

  The hydraulic fire shut off valve in the supply line to the EDP closes.

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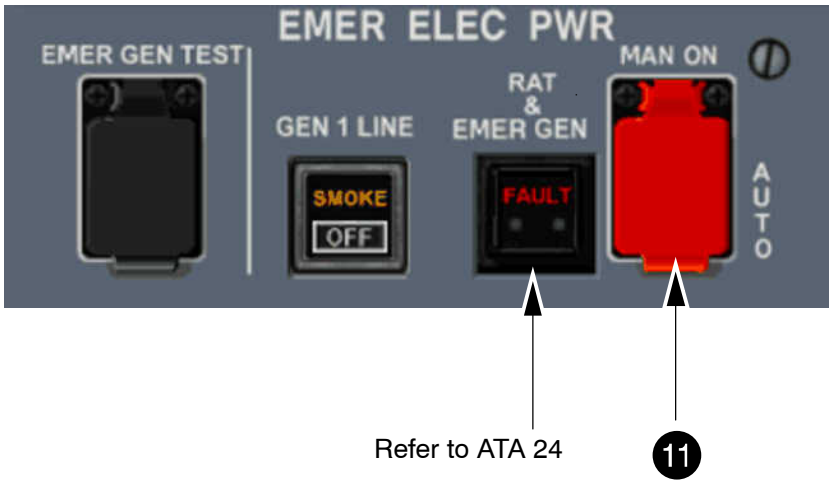
Fire Panel (45VU)

Emergency Electric Power Panel (21VU)



Maintenance Panel (50VU)

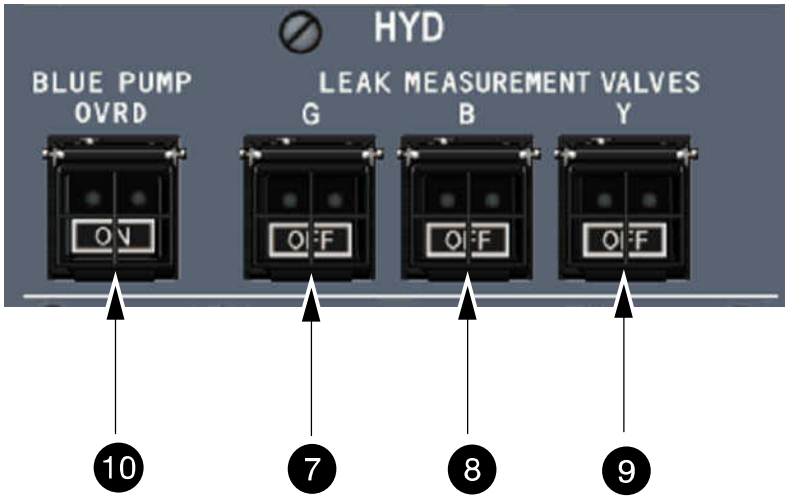


Figure 6 Hydraulic Panels (3)

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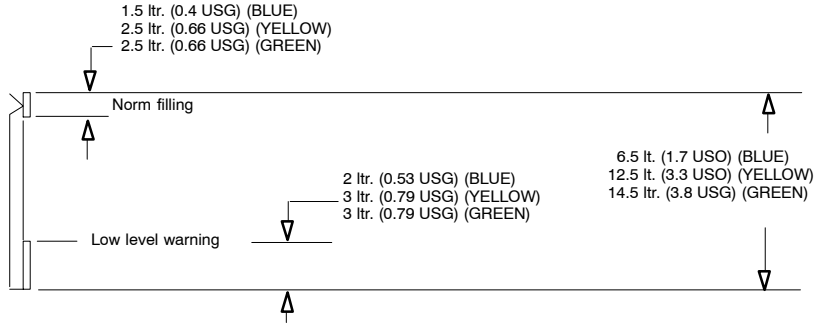
ECAM INDICATION

1 Reservoir Quantity

The reservoir quantity indication is green when normal. It becomes amber at warning level.



2 Reservoir Pressure LO AIR PRESS

Reservoir LO AIR PRESS indication appears amber if the corresponding reservoir air pressure drops below normal.

3 Reservoir Overheat

Reservoir OVHT indication appears amber if the return hydraulic fluid temperature is above normal.

4 Engine Fire Valve Indication

open or not fully closed (green)

fully closed (amber)

5 Elec Pump OVHT Indication

Appers amber in case of electro motor OVHT.

6 Ram Air Turbine

RAT ▷ RAT stowed (white)

RAT ▶— RAT not stowed (green)
RAT OUT (green) displayed on MEMO display.
–Becomes amber during flight phases 1 and 2.

RAT ▶ RAT fault (amber)
RAT stowing pressure applied RAT pump not available

7 Blue Electric Pump

ELEC PUMP pushbutton is on and hydraulic pressure is normal (green)

ELEC PUMP pushbutton is OFF (amber)

LO ELEC PUMP pushbutton is on and hydraulic pressure is low (amber)

ELEC Elec pump normal operation (green)

ELEC associated power supply failure (amber)

8 Yellow Electric Pump

◁ ELEC Pump is OFF (white)

—◀ ELEC Pump is ON (green)

◀ ELEC Pump is ON and yellow system LO PR (amber)

ELEC Electric pump normal operation (white)

ELEC Associated power supply failure (amber)

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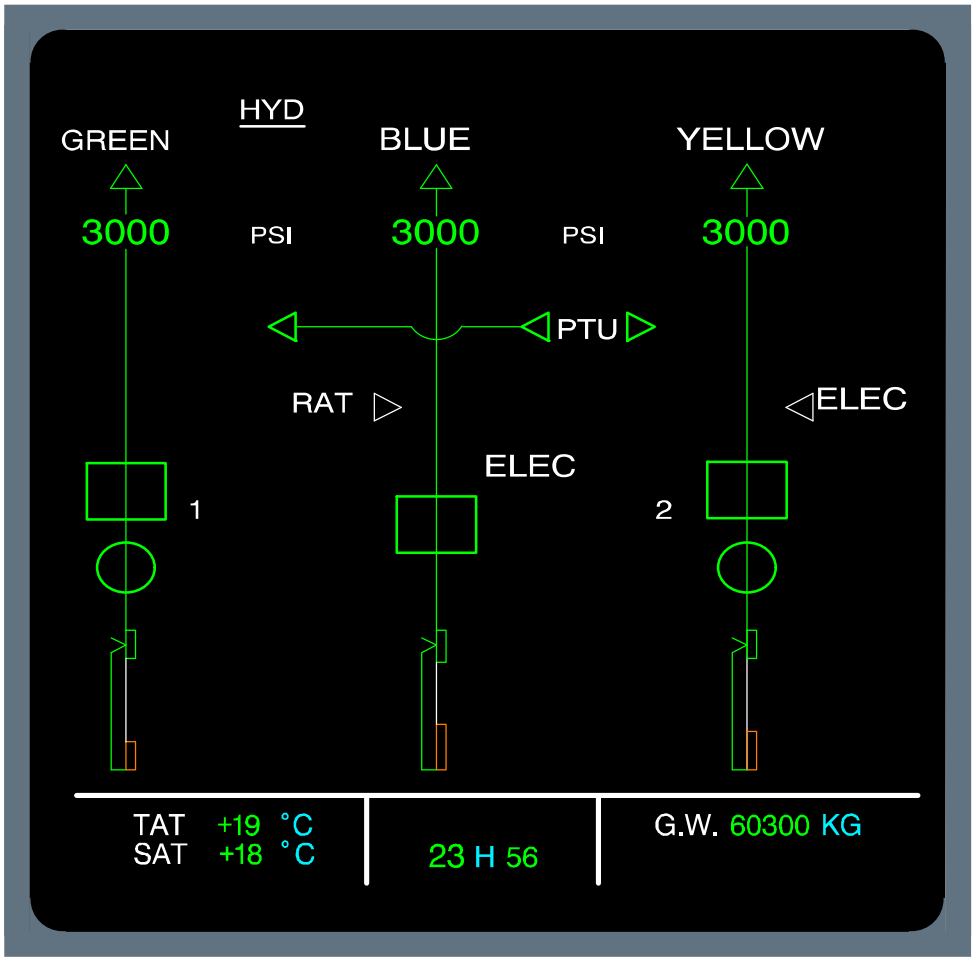
NOTE: On enhanced a/c the arrow is above the label word



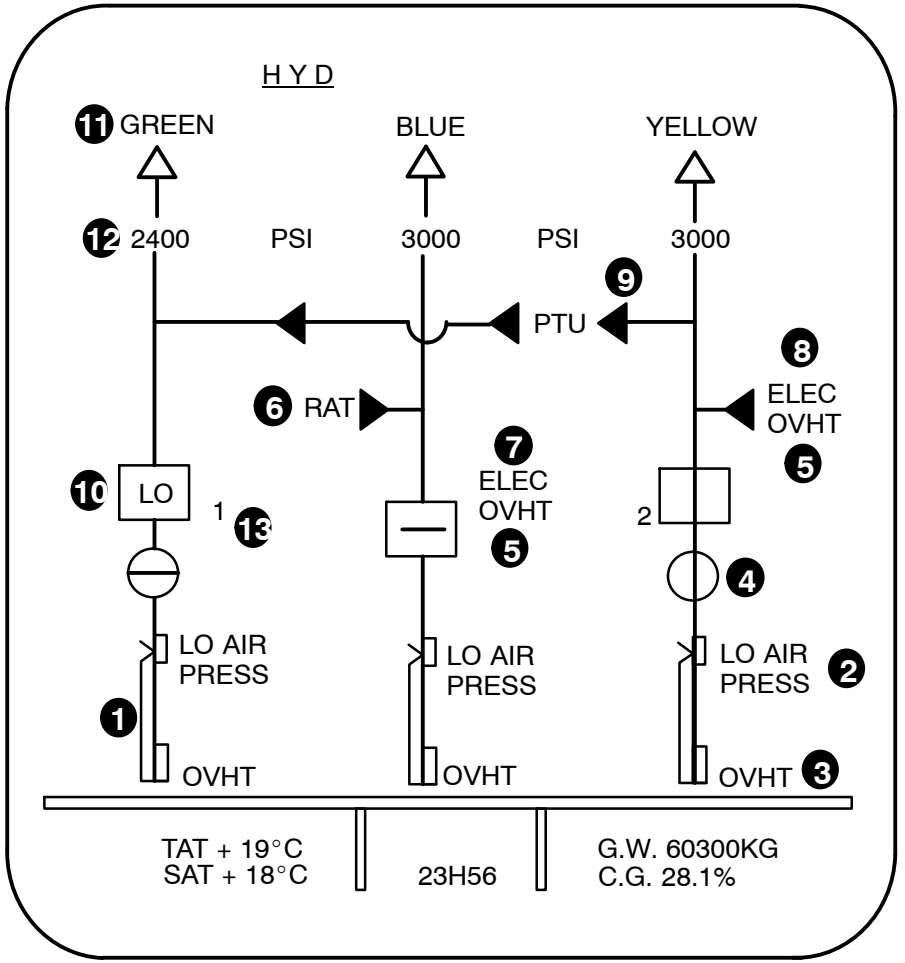


Figure 7 Hydraulic ECAM Page (1)

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9 PTU (Power Transfer Unit)

PTU ▷ (green) PTU P/B AUTO and PTU not supplying

PTU ▷ (amber) PTU P/B OFF.

PTU ◀ PTU is powering green system

PTU ▶ PTU is powering yellow system

When PTU is running HYD PTU is displayed on MEMO display

NOTE: The transfer arrow is only indicated if the pressure difference is >200 psi.

10 Engine Driven Pumps

Associated PUMP pushbutton is ON and hydraulic pressure is normal (green)

Associated PUMP pushbutton is OFF (amber)

LO — Associated PUMP pushbutton is ON and hydraulic pressure is low. (amber)

11 System Label

System Label is a white word and a green arrow when the pressure is normal. Both the word and the arrow are amber when pressure is too low.

BLUE — System pressure is normal (green)

GREEN — System pressure is too low (amber)

NOTE: On enhanced a/c the arrow is above the label word

12 System Pressure Indication

3000 — System pressure is normal (green)

1430 — System pressure is too low (amber) (pressure below 1450 psi = 100bar)

13 ENG Pump Identification

1 (2) — Engine pump identification with the related engine running (white)

1 (2) — Engine pump identification with the related engine not running (amber)

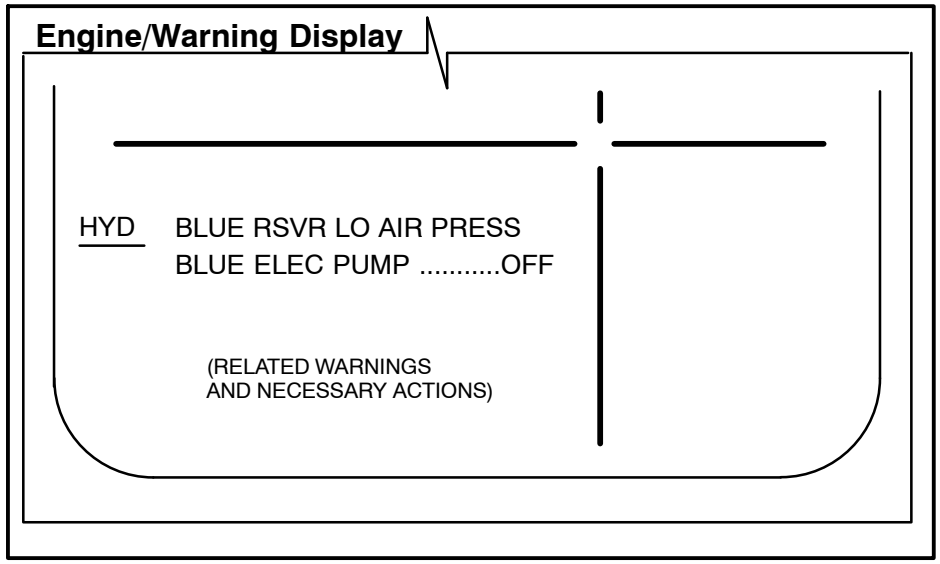

Figure 8 Hydraulic ECAM Page

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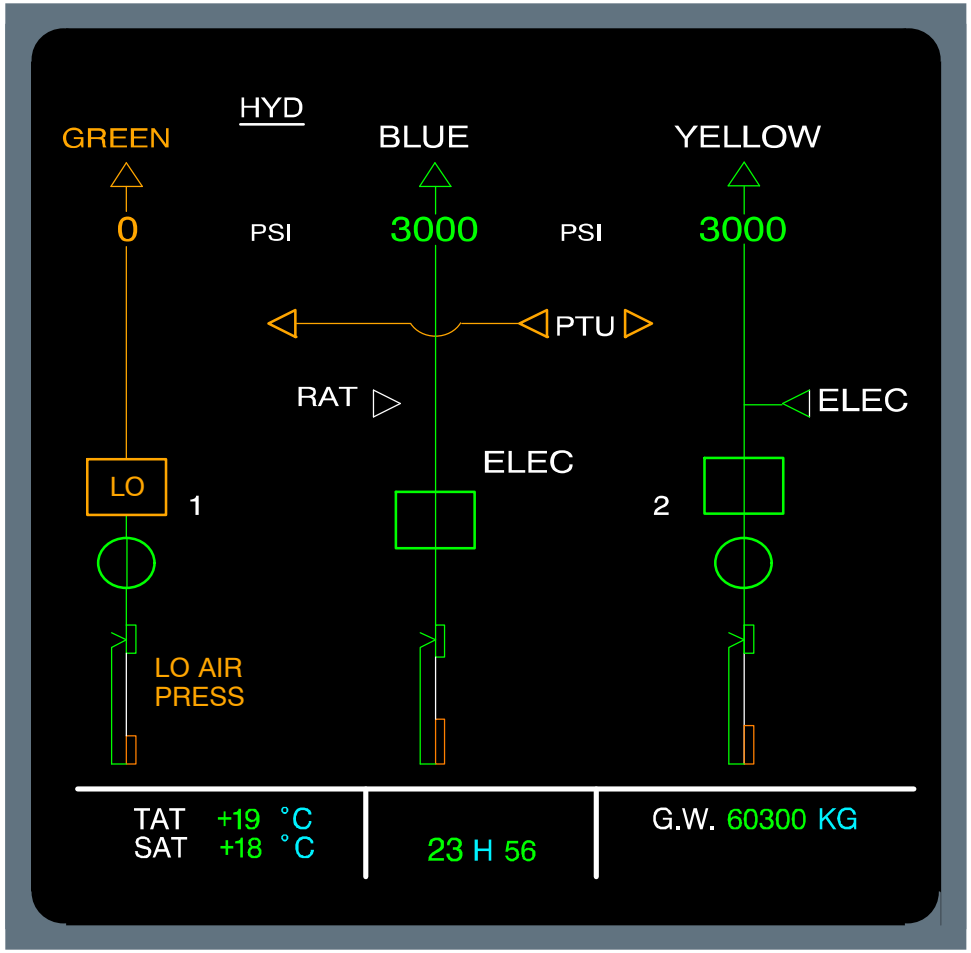
NOTE: On enhanced a/c the arrow is above the label word



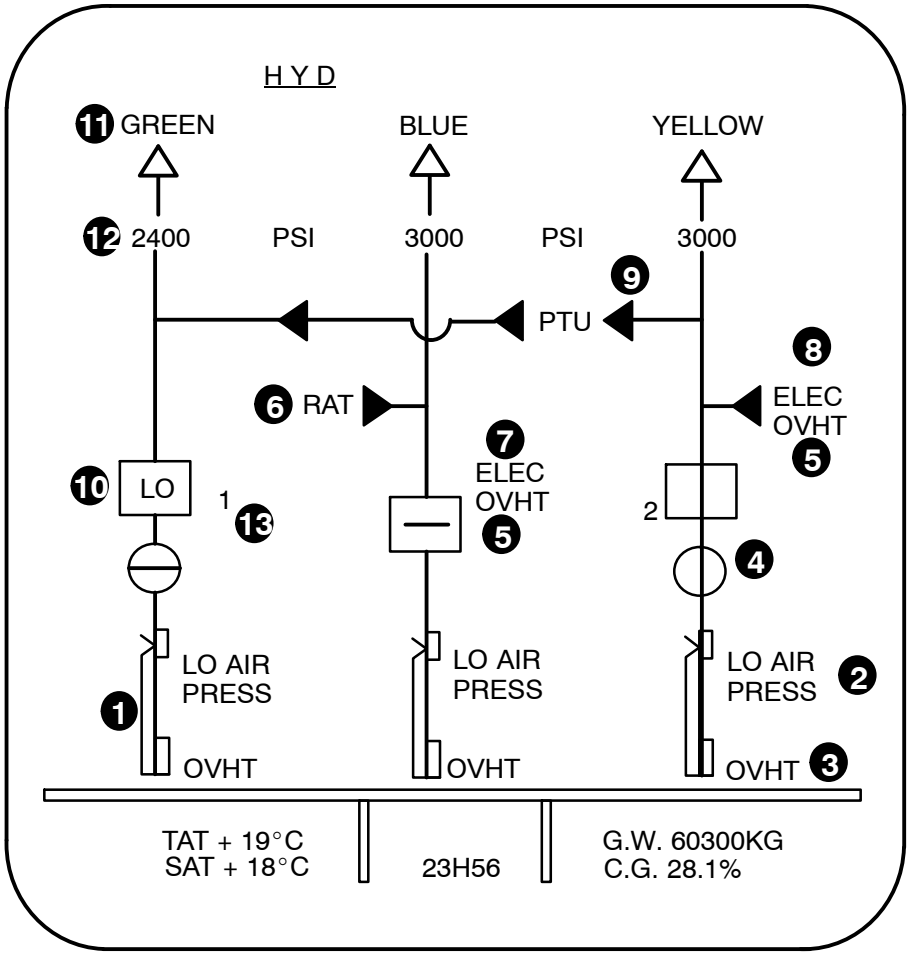


Figure 9 Hydraulic ECAM Page (2)

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ECAM WARNINGS DESCRIPTION

Possible ECAM Warnings

The possible ECAM Warnings of the hydraulic system and the related FLIGHT PHASE INHIBITIONS are shown on the page below.

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E / WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
B + Y B + G SYS LO PR Y + G system pressure ≤ 1450 psi (reset if pressure ≥ 1750 psi)	CRC	MASTER WARN	HYD	FAULT lt	4, 5 *
G (Y)(B) RSVR LO AIR PR reservoir air pressure ≤ 22 psi (reset if air pressure ≥ 25 psi)	SINGLE CHIME	MASTER CAUT		FAULT lt on associated pump(s) pb and on PTU pb if Y or G sys affected	3, 4, 5, 7, 8
G (Y)(B) RSVR OVHT fluid temperature ≥ 93°C (reset if temp ≤ 88°C)					
G (Y)(B) RSVR LO LVL fluid quantity : < 3.5 L (0.92 USG) (green-yellow) < 2.4 L (0.63 USG) (blue)					4, 5, 7, 8
G (Y) ENG 1(2) PUMP LO PR pump outlet pressure ≤ 1750 psi (reset if pressure ≥ 2200 psi)				FAULT lt on affected pump pb	
Y ELEC PUMP LO PR yellow system pressure ≤ 1450 psi (reset if pressure ≥ 1750 psi) with - Y ELEC PUMP pb at ON - Y ENG PUMP and PTU not available					
B ELEC PUMP LO PR pump outlet pressure ≤ 1450 psi (reset if pressure ≥ 1750 psi)					
B ELEC PUMP OVHT Y ELEC PUMP OVHT					3, 4, 5, 7, 8
G (Y) SYS LO PR pump outlet pressure ≤ 1450 psi (reset if pressure ≥ 1750 psi)					4, 5, 7, 8*
B SYS LO PR system pressure ≤ 1450 psi (reset if pressure ≥ 1750 psi)				NIL	1, 4, 5, 7, 8, 10
PTU FAULT PTU not running on ground in case differential pressure higher than 650 psi between G and Y system, or in flight PTU still at AUTO position in case of G or Y reservoir low level and G or Y system low pressure.	SINGLE CHIME	MASTER CAUT	HYD	FAULT lt only in case of G or Y RSVR LO LVL or RSVR LO AIR PR or RSVR OVHT	3, 4, 5, 8, 9, 10
RAT FAULT RAT not fully stowed or pressure present in RAT stowing actuator or RAT pump not available				NIL	3, 4, 5, 6, 7, 8, 9

* Inhibited on ground (flight phase 1. 2. 9. 10.) by related engine shut down.

WARNINGS AND CAUTIONS

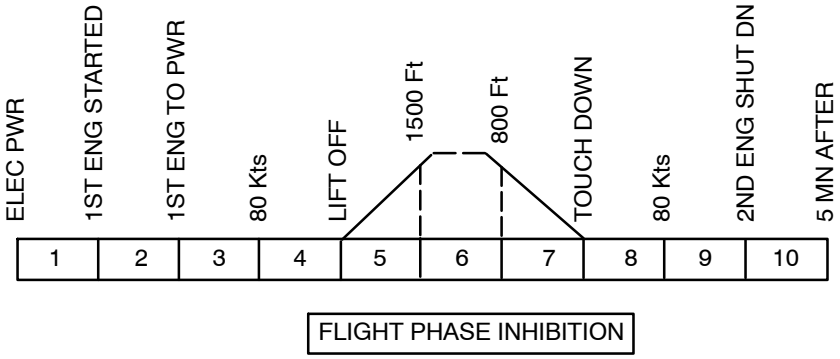

Figure 10 ECAM Warnings/Cautions

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ENVIRONMENTAL PROTECTION AND SAFETY INTRODUCTION

PTU and RAT Safety Precautions

CAUTION: TO PREVENT AN UNWANTED OPERATION OF THE PTU, THE ISOLATION COUPLING MUST BE DISCONNECTED. KEEP THE RAT EXTENSION AREA CLEAR OF GROUND EQUIPMENT AND PERSONNEL. INSTALL THE RAT SAFETY DEVICE BEFORE WORKING IN THE RAT AREA.

Reservoir Depressurization/Pressurization

WARNING: PAY ATTENTION TO PROTECT YOUR HANDS AND YOUR FACE FROM THE AIR WHICH COMES OUT WHEN YOU OPEN RESERVOIR MANUAL DEPRESSURIZATION VALVES. THE AIR MAY BE HOT AND CONTAIN HYDRAULIC FLUID. USE APPROPRIATE SAFETY WEAR.

Environmental Precautions

CAUTION: DO NOT DISCHARGE PRODUCTS SUCH AS OIL, FUEL, SOLVENT, LUBRICANT EITHER IN TRASH BINS, SOIL OR INTO THE WATER NETWORK (DRAINS, GUTTERS, RAIN WATER, WASTE WATER, ETC...).

CAUTION: SORT WASTE FLUIDS AND USE SPECIFIC WASTE DISPOSAL CONTAINERS. EACH PRODUCT MUST BE STORED IN AN APPROPRIATE AND SPECIFIC CABINET OR ROOM SUCH AS A FIRE–RESISTANT AND SEALED CUPBOARD.

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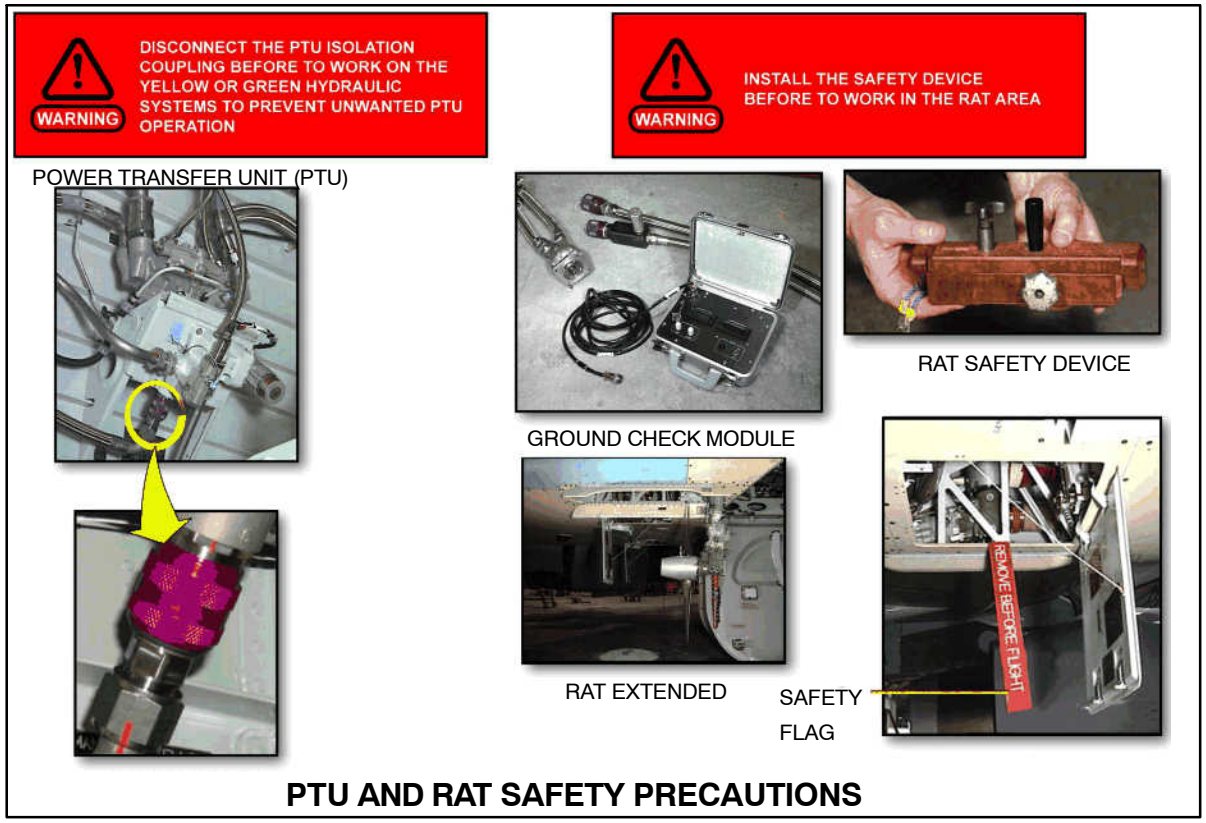
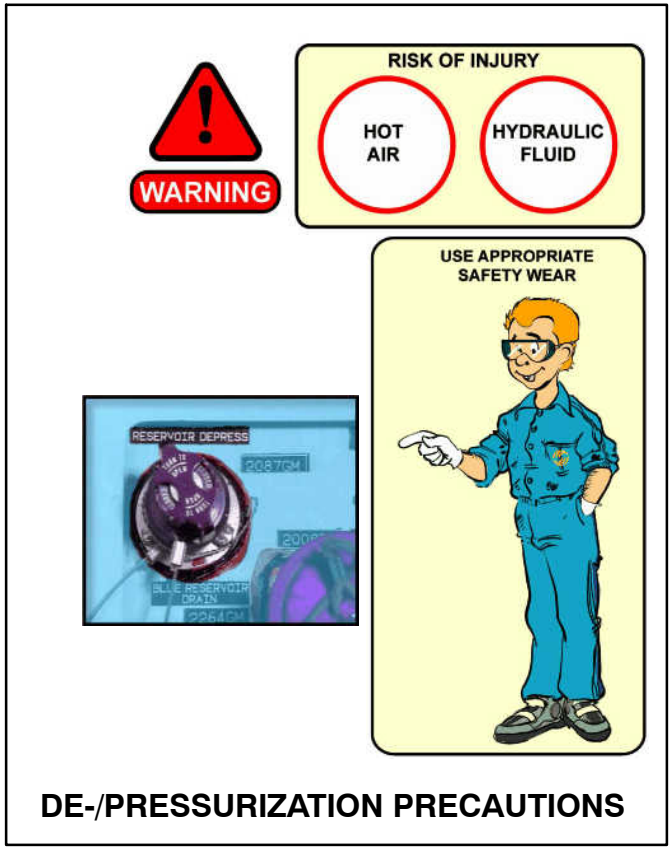


PTU AND RAT SAFETY PRECAUTIONS



DE-/PRESSURIZATION PRECAUTIONS

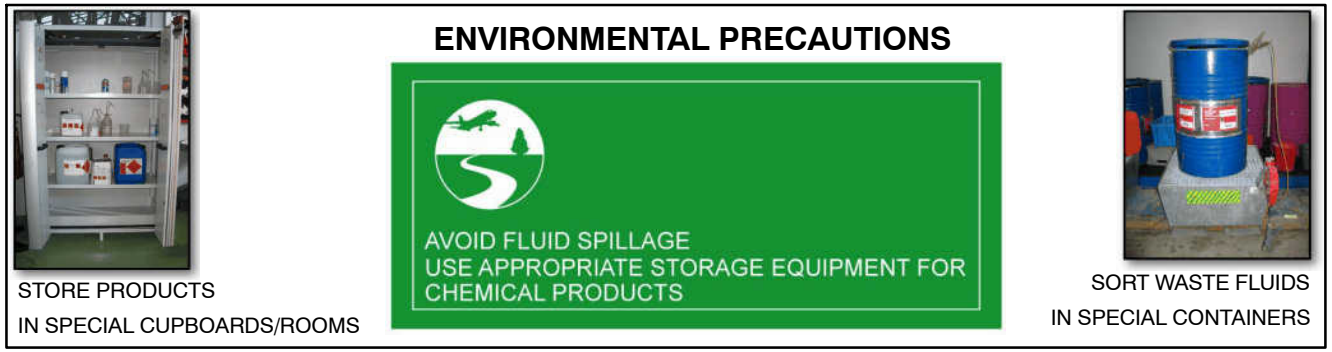


Figure 11 Environmental Protection/Safety

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IDENTIFICATION AND CONNECTIONS PRESENTATION

Component Identification

All Hydraulic components are marked with a label which contains the FIN and the name.

- FIN number 1000 = Green System
- FIN number 2000 = Blue System
- FIN number 3000 = Yellow System

Pipeline Identification

All Hydraulic pipelines are marked with a coulor code and a number for system identification.

Connections

The most common connections in the hydraulic system are shown below.

There are two types of connections:

- permanent connections or permaswage,
- removable connections or standard straight or special fittings.

The manifolds have bobbin type connections for some components.

The bobbins are equipped with a square seal on the component side and an O–ring on the manifold side.

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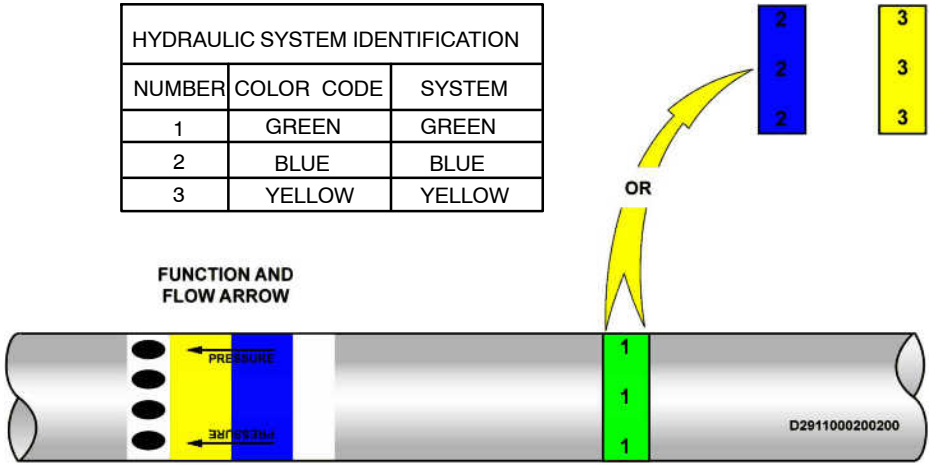
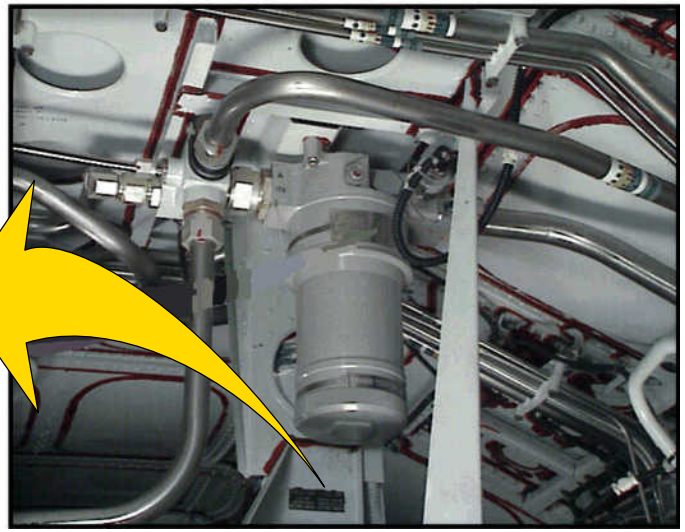
HYDRAULIC SYSTEM IDENTIFICATION		
NUMBER	COLOR CODE	SYSTEM
1	GREEN	GREEN
2	BLUE	BLUE
3	YELLOW	YELLOW



1002 GM
FILTER RSVR
RETURN, G

Identification label
on nearby structure



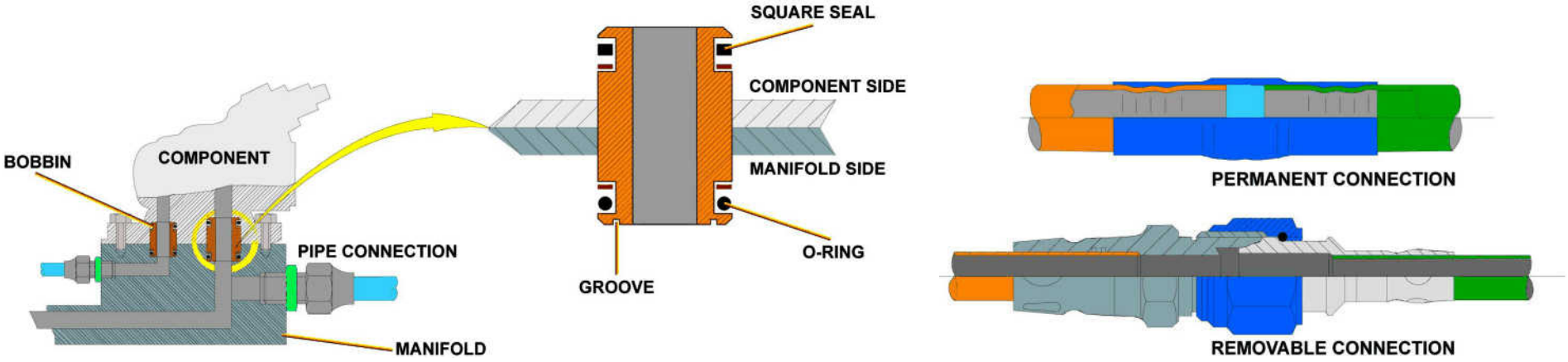


Figure 12 Identification/Connection

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29–10 MAIN HYDRAULIC POWER

PRESSURIZATION OF THE HYDRAULIC SYSTEMS DESCRIPTION

Blue Hydraulic System Pressurization

The BLUE hydraulic system is pressurized by an electric pump.

- **In flight:**
  - automatically
- **On ground:**
  - automatically, provided one engine is running

    or
  - When the BLUE PUMP OVRD pb sw has been pressed on the maintenance panel:

    Make sure that the ECAM hydraulic system page does not show any of these warnings:
    - Low air pressure in the blue reservoir.
    - Low fluid level in the blue reservoir.
    - OVHT (Fluid Overheat)

    On the overhead HYDR panel (40VU) make sure that BLUE ELEC PUMP pb sw is set to AUTO.
    - The OFF legend not illuminates.

    On the maintenance panel (50VU) lift the guard and push the BLUE PUMP OVRD pb sw.
    - The ON legend comes on.

    Refer to the ECAM indication of the BLUE system pressure and make sure that it shows approximately 3000 PSI.

Yellow and Green Hydraulic Pressurization

Make sure that the ECAM hydraulic system page does not show any of these warnings:

- Low air pressure in the yellow or green reservoirs.
- Low fluid level in the yellow or green reservoirs.
- OVHT (Fluid Overheat)

On the overhead HYDR.panel (40VU) push and release the yellow ELEC PUMP pb sw.

- The ON legend illuminates.

Refer to the ECAM indication of the yellow system pressure and make sure it is approximatly 3000 PSI.

If the PTU (**P**ower **T**ransfer **U**nit) pb sw on the overhead hydraulic panel (40VU) is in AUTO the PTU automatically pressurizes the **green** hydraulic system together with the yellow system.

Green system pressure on the ECAM indication should be between 2400 and 3100PSI.

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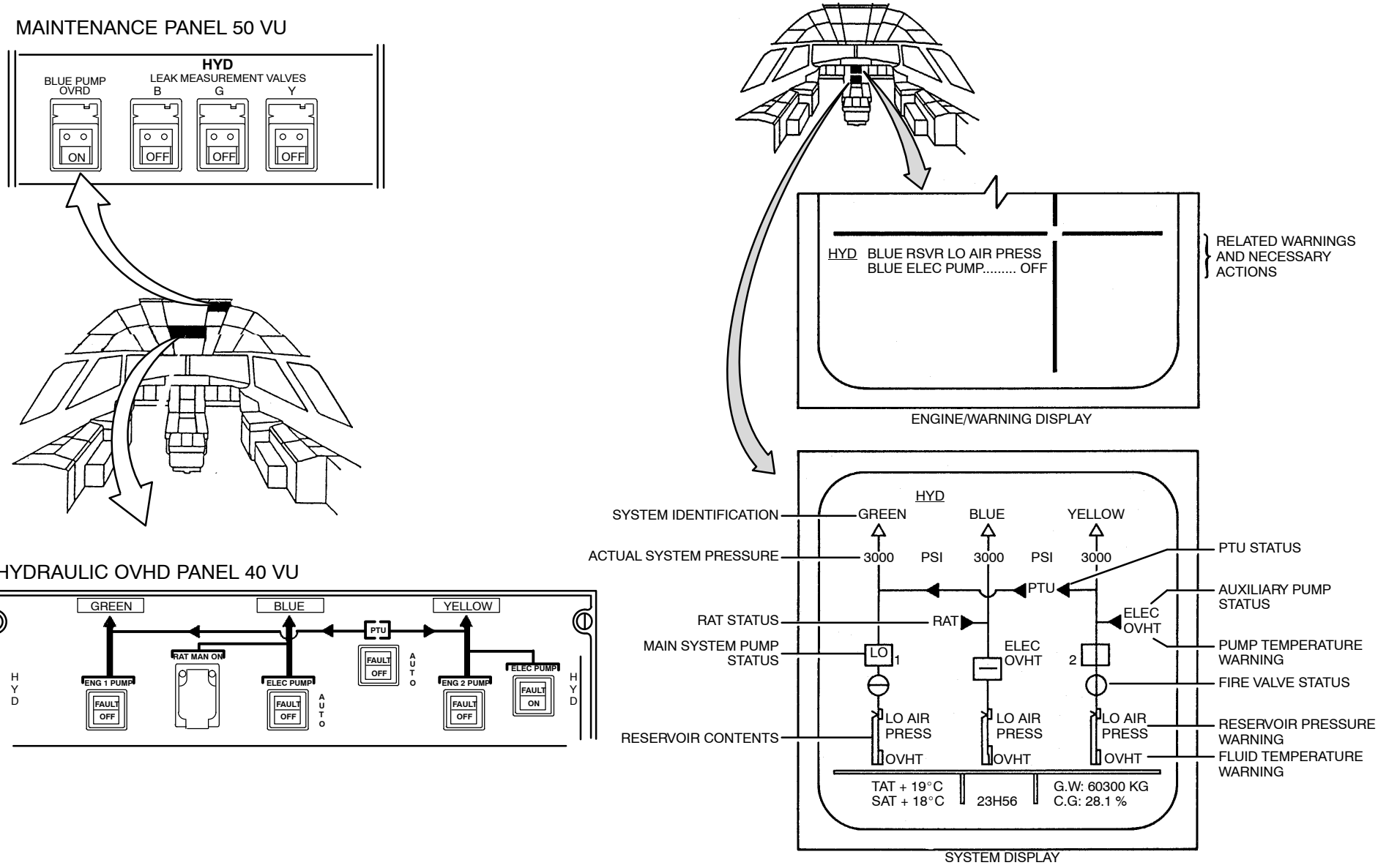

Figure 13 Hydraulic Systems Pressurization

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29–11 GREEN MAIN HYDRAULIC POWER

SYSTEM OPERATION

General

Most of the components of the system are installed in the main landing gear compartment.

The system operates at a nominal pressure of 3000 psi (206 bar). It is possible to pressurize the HP (**H**igh **P**ressure) system from three different sources:

- the EDP (**E**ngine–**D**riven **P**ump) 1030GK connected to the left (No 1) engine.
- the PTU (**P**ower **T**ransfer **U**nit)1088GM,
- the ground supply connections.

The Green main hydraulic system has two sub–systems:

- a HP (**H**igh–**P**ressure) circuit which supplies consumers,
- a LP (**L**ow–**P**ressure) or return circuit through which the fluid returns to the reservoir.

System Operation

The operation of the system is fully automatic.

If necessary (because of a fault or for maintenance) it is possible to stop the automatic operation of the system.

The EDP (**E**ngine–**D**riven **P**ump) starts to supply the system as soon as the No 1 (left) engine is started. The supply is then continuous. The EDP pressurizes the system with fluid at 3000 psi (206 bar) and changes its output to that which is necessary for the system.

The system accumulator makes allowance for any temporary decrease in pressure because of the response time of the EDP. The accumulator also smoothens the output from the EDP.

If the EDP stays in the high output configuration and there is no demand there is an increase in pressure in the system. The PRV (**P**ressure **R**elief **V**alve) opens and the fluid goes to the reservoir through the PRV. The restriction to the flow caused by the PRV causes an increase in the temperature of the fluid. This is detected by the sensor on the LP filter and a warning is given in the flight compartment.

If the pressure in the Green system decreases to 500 psi (34.5 bar) less than the pressure in the Yellow system, the PTU automatically operates.

It pressurizes the Green system to approximately the same pressure as the Yellow system (the pressure is less because the PTU is not 100 % efficient).

The condition of the system is monitored continuously. Temperature and pressure sensors send information to the flight compartment. The information is shown on the ECAM and as FAULT warnings on the overhead panel.

Two P/B (**P**ush**b**utton) switches on the overhead panel 40VU control the operation of the Green main system.

One P/B switch (1705GK) controls the solenoid valve in the EDP. When the P/B switch is operated, the solenoid valve is energized and the EDP is isolated from the HP (**H**igh **P**ressure) system. The EDP stays connected to the suction line and keeps an internal pressure which is sufficient for lubrication of the EDP.

The second P/B switch (1802GL) controls the two PTU solenoid valves (one in the Green system, one in the Yellow system). On operation of the P/B switch, the two solenoid valves are energized and the PTU is isolated from the two systems. Thus no transfer of power between the two systems is possible.

A P/B switch (1882GP) at the rear of the overhead panel 50VU controls the solenoid valve (1150GP) of the leakage measurement system.

NOTE: This P/B switch is used only for maintenance.

Operation of the ENG 1 FIRE pushbutton closes the fire valve 1046GK to stop the supply of fluid to the EDP. A symbol on the HYD page of the ECAM system display shows if the fire valve is open or closed.

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REFER TO DIN A3 PAGE

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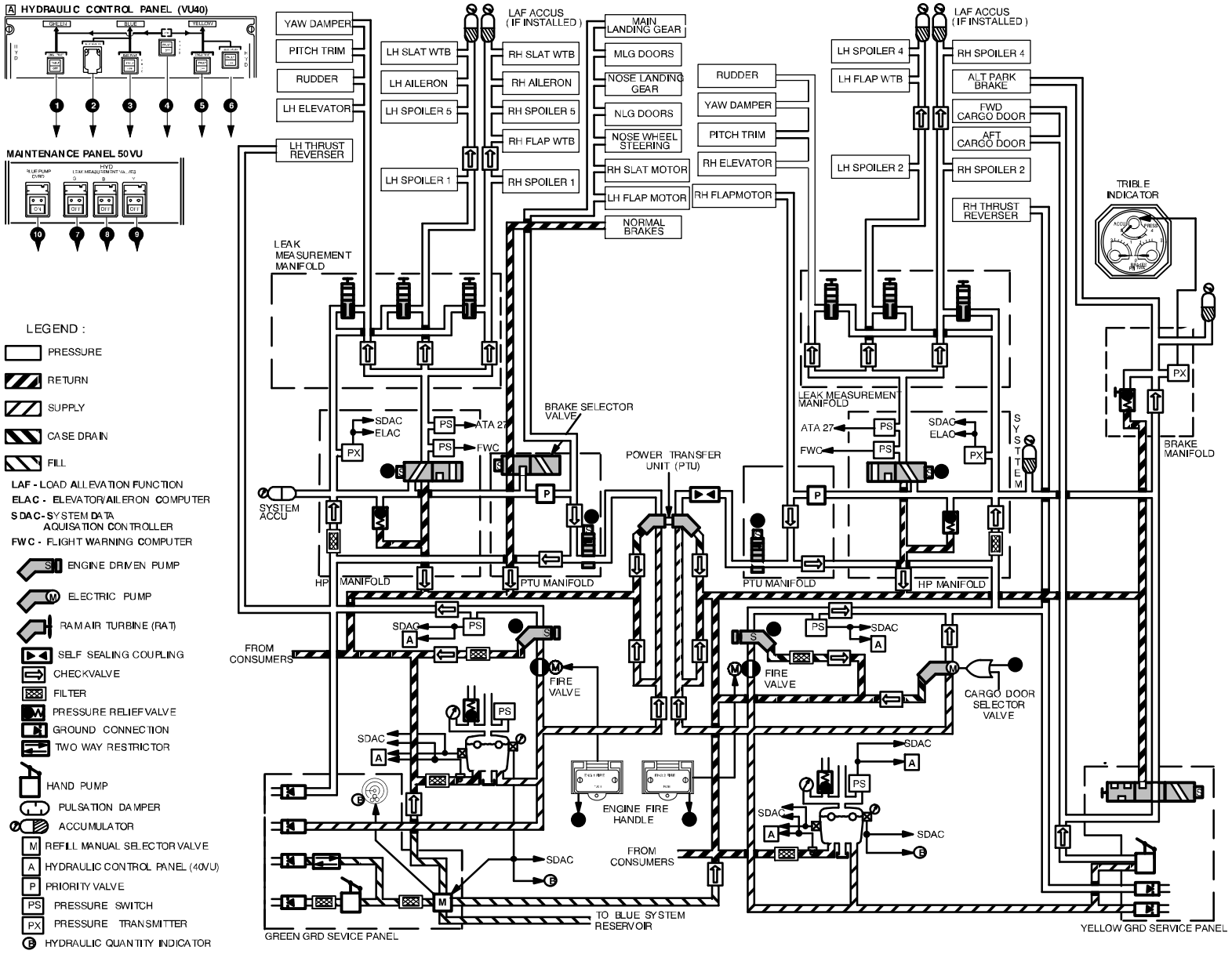

Figure 14 Green System Funct Schematic

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GREEN HYDRAULIC SYSTEM RESERVOIR PRESENTATION

General Description

The reservoir is made of two molded light alloy sections which are welded together to make a cylindrical shape. The top of the reservoir has a manifold for the components of the air pressurization system . The bottom of the reservoir has three ports for the hydraulic connections. A drain valve is installed on one of the ports, the other two are for the suction and return line connections. The reservoir also has flanges to attach the quantity indicator/transmitter and the low level switch.

The inside of the reservoir includes baffles which give a supply (for 20s) of fluid under negative 'g' conditions. The baffles also form an anti–emulsion device which limits the emulsion of the fluid when there is a large return flow.

The hydraulic fluid capacities of the reservoir are:

- the normal fill level 14L. (3.6983USGAL)
- the maximum gageable level 18L. (4.7550USGAL)
- the low level warning level 3.0 ± 0.4L. (0.8 ± 0.1USGAL)

The reservoir is pressurized to 50psi (3.5bar) and is sealed to hold the pressure if there is no supply of air (for example, when the aircraft is parked). It is possible to pressurize the reservoir from a ground supply. The reservoir is filled with hydraulic fluid through the reservoir filling system.

Quantity Indicator

Each reservoir has a gage–transmitter which gives a visual indication and sends electrical signals to show the fluid contents. The unit is a float assembly connected mechanically to a synchro transmitter. The pointer of the mechanical contents gage is connected to the synchro transmitter. When the float moves, the synchro transmitter and the pointer turn together. The synchro transmitter sends signals to the ECAM system and to the reservoir quantity indicator on the Green ground–service panel.

Low Level Switch

The low level switch is installed in the reservoir and gives a signal when the fluid level is too low. It is a float–operated switch which includes a relay. The float assembly includes a magnet which keeps the contacts of a reed switch open when the float is high. When the level of the fluid decreases, the float falls and the reed switch closes. Discrete signals are sent to the SDAC and to the overhead panel.

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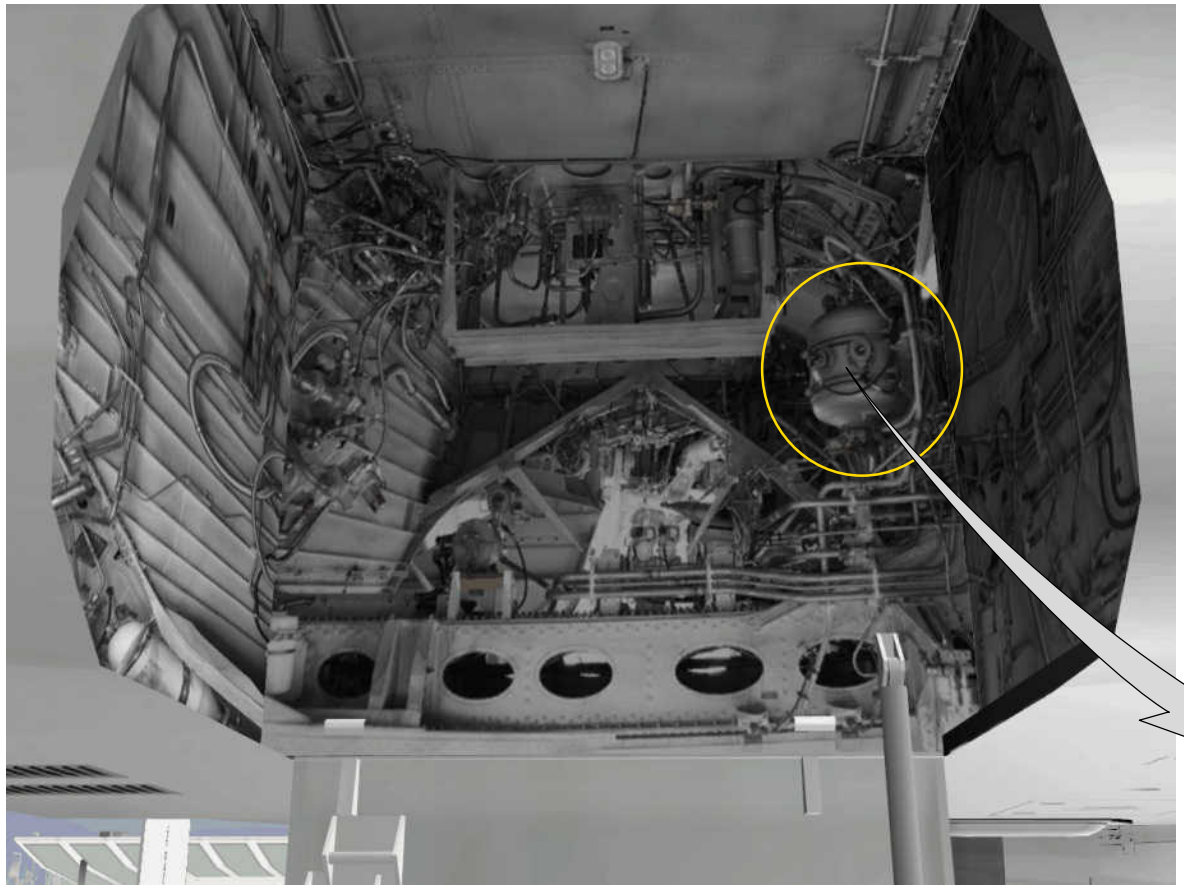

MLG Wheel Well (view from r/h side)

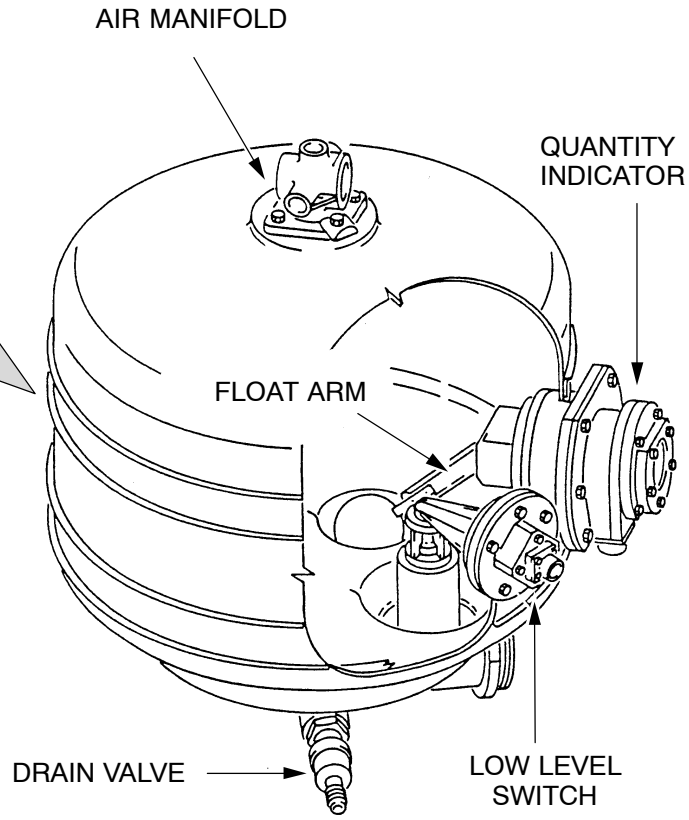

Figure 15 Green Hydraulic System Reservoir

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ENGINE PUMP FIRE VALVE PRESENTATION

Location

The engine–pump fire valve is installed in the LH wing between the rear spar and the rear false spar, inboard of the pylon. It is in the suction line between the reservoir and the EDP (**E**ngine–**D**riven **P**ump).

Purpose

The FIRE pushbutton in the flight compartment control the supply of electrical power to the motor. When the valve closes it stops the supply of fluid to the EDP.

Valve Description

The fire valve (Ball type valve) is made up of two main parts;

- the valve assembly, and
- the actuator assembly.

The two parts are connected together with screws. It is not necessary to disconnect or empty the hydraulic pipes to remove the actuator assembly from the valve assembly.

The body of the valve assembly has arrows which show the direction of flow through the valve. The valve ball has a connection for the output shaft of the actuator. The ball turns thru 90° each time it operates. The ball always turns in the same direction. The electric motor is a 28V DC type.

Visual Position Indication

Two types of valves can be installed:

- a visual indicator is attached to the gearbox output shaft. It is visible through a window in the housing. The indicator shows red when the valve is open or green when it is closed.
- a visual indicator is attached to the gearbox output shaft. It is visible on top of the valve actuator an shows the position open or shut.

Pulsation Damper (optional)

Pressure pulsations emitted by the hydraulic pistons of the Engine Driven Pump (EDP) in the Green and Yellow hydraulic system, generate vibrations of the hydraulic piping that carry through the structure into the cabin. These excitations generate airborne noise in the cabin, especially around the wheel well area, as the piping and associated manifolds of the Green hydraulic system are concentrated there.

The induced noise is characterized by a tonal component at approximately 500 Hz, depending on the engine power settings.

A Service Bulletin introduces an attenuator (damper) in the Green hydraulic system with associated pipework modifications. This will address the tonal noise issues associated with the EDP.

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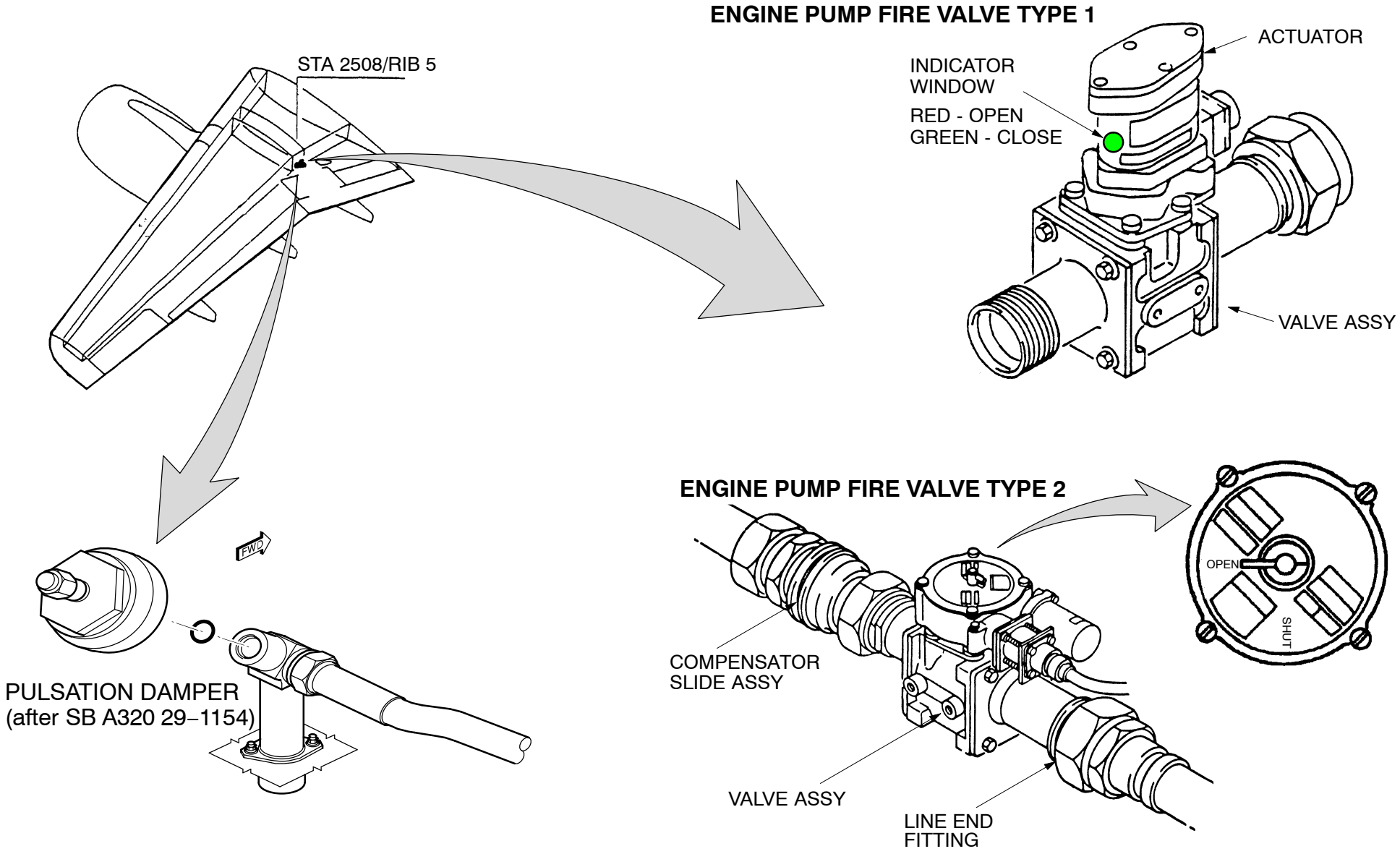

Figure 16 Engine Pump Fire Valve

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EDP AND LO PRESS SWITCH FUNCTIONAL OPERATION

General Description

There are two different types of EDP which are permitted. ABEX make one type, VICKERS the other. The two types are completely interchangeable. They give equivalent supplies of hydraulic power and their mechanical and electrical connections are the same.

The EDP (**E**ngine-**D**riven **P**ump) is attached to the accessory gearbox on the bottom of the engine. A splined quill drive connects the gearbox to the input shaft of the pump. The quill drive is made to shear if the pump can not turn. The attachment flange of the pump has keyhole slots where the installation bolts are.

The suction line connection has a quick-release self-sealing coupling. Together, they make it possible to replace the pump quickly.

The pump is of the variable-displacement type. The rotating assembly turns all of the time that the engine operates.

A solenoid valve (controlled from the flight compartment) makes it possible to change the operation of the pump so that it does not supply pressure to the system (depressurized mode). The EDP includes a blocking valve which isolates the pump from the hydraulic system when the pump operates in the depressurized mode.

In the depressurized mode the outlet of the pump is connected internally directly to the inlet of the pump. The pump then operates with an internal pressure of approximately 1000psi (70bar), with zero flow. This is the pressure necessary on the actuator piston to reduce the angle of the yoke to near zero when the outlet and control pressures are balanced.

Engine Pump Low Press Switch

General

The pressure switch downstream of the engine pump monitors the output of the pump.

When the pressure falls below 1740 ± 72.5psi (120 ± 5bar) the switch contacts close .

At the same time a signal is sent to the overhead panel 40VU and the applicable FAULT legends come on.

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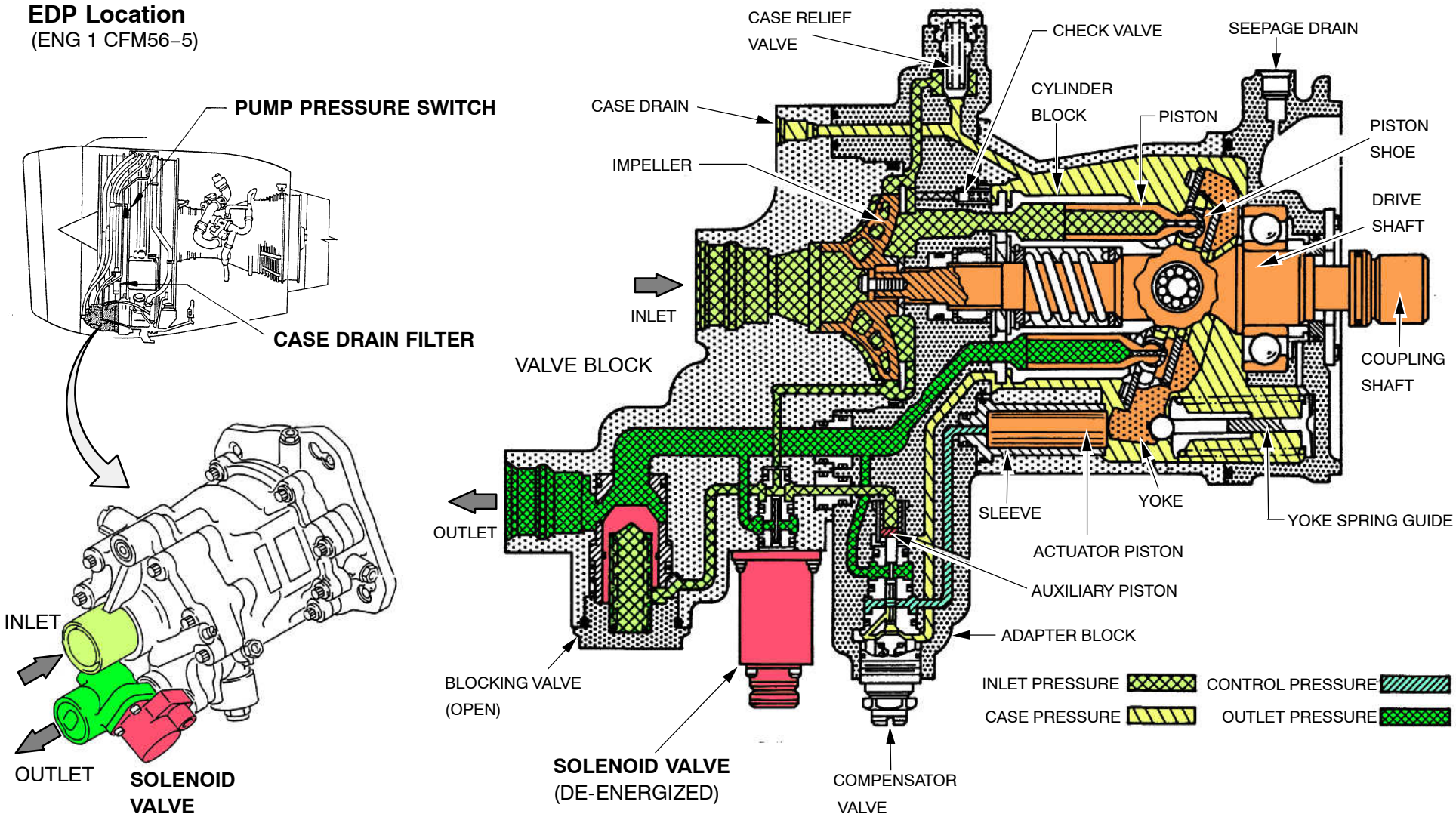

Figure 17 Engine Driven Pump (CFM56–5)

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MANIFOLDS PRESENTATION

There are three manifolds in the system, they are:

- **the HP (High Pressure) manifold,**
- **the PTU (Power Transfer Unit) manifold,**
- **the LP (Low Pressure) manifold.**

General

All of the manifolds are aluminum alloy castings. They are machined to make it possible to install different components on them. Some of the hydraulic connections between the manifolds and components are of the bobbin type. Thus, replacement of components is possible with minimum effect on other components or pipes. The manifolds are drilled to make the internal connections between components.

The following are the components installed on their related manifolds:

HP (High Pressure) Manifold

- the solenoid valve
- the pressure relief valve
- the HP filter
- the check valves
- the sampling valve
- the pressure transmitter
- the pressure switch
- the pressure switch

PTU Manifold

- the priority valve
- the check valves
- the solenoid valve
- the solenoid valve .

LP (Low Pressure) Manifold

The LP manifold is the connection point for return lines from different parts of the LP system. It is connected directly to the LP filter. Check valve is installed in one of the ports of the LP manifold.

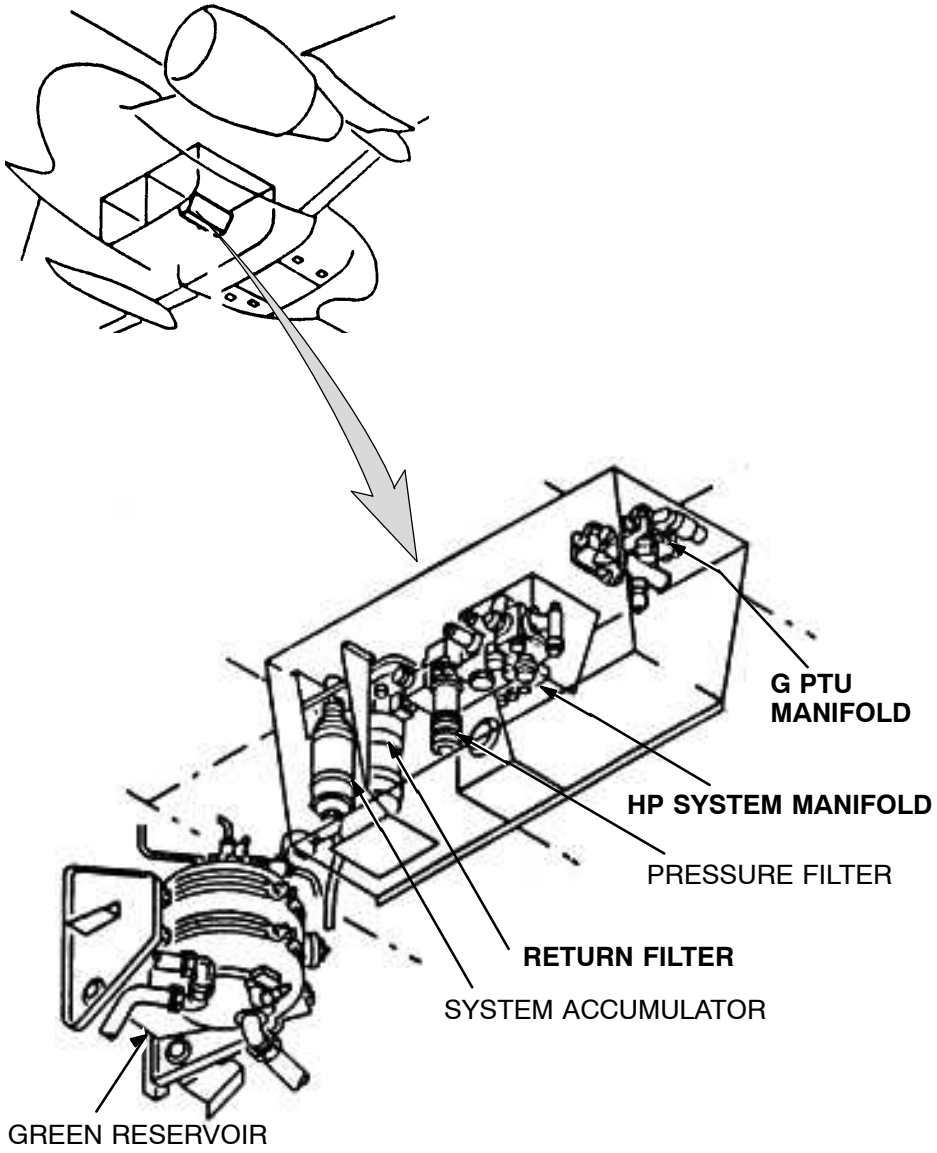

Figure 18 Manifolds Location

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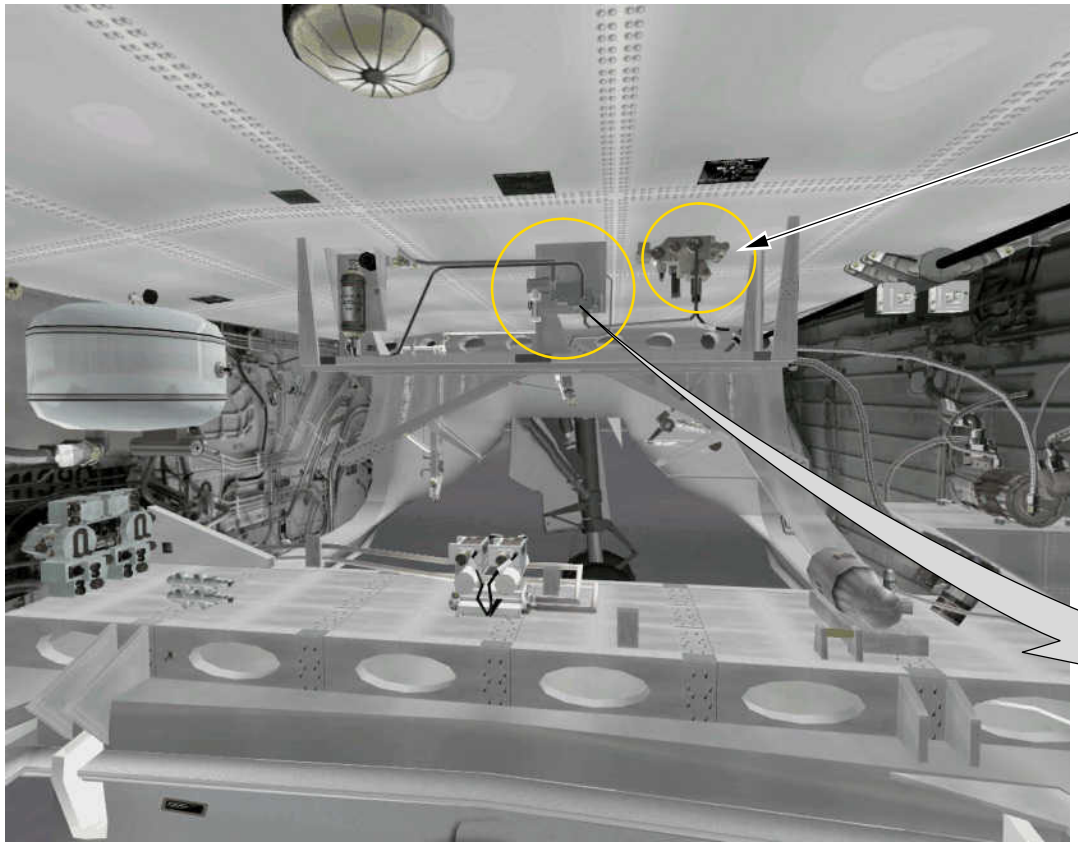

MLG Wheel Well (view from l/h)

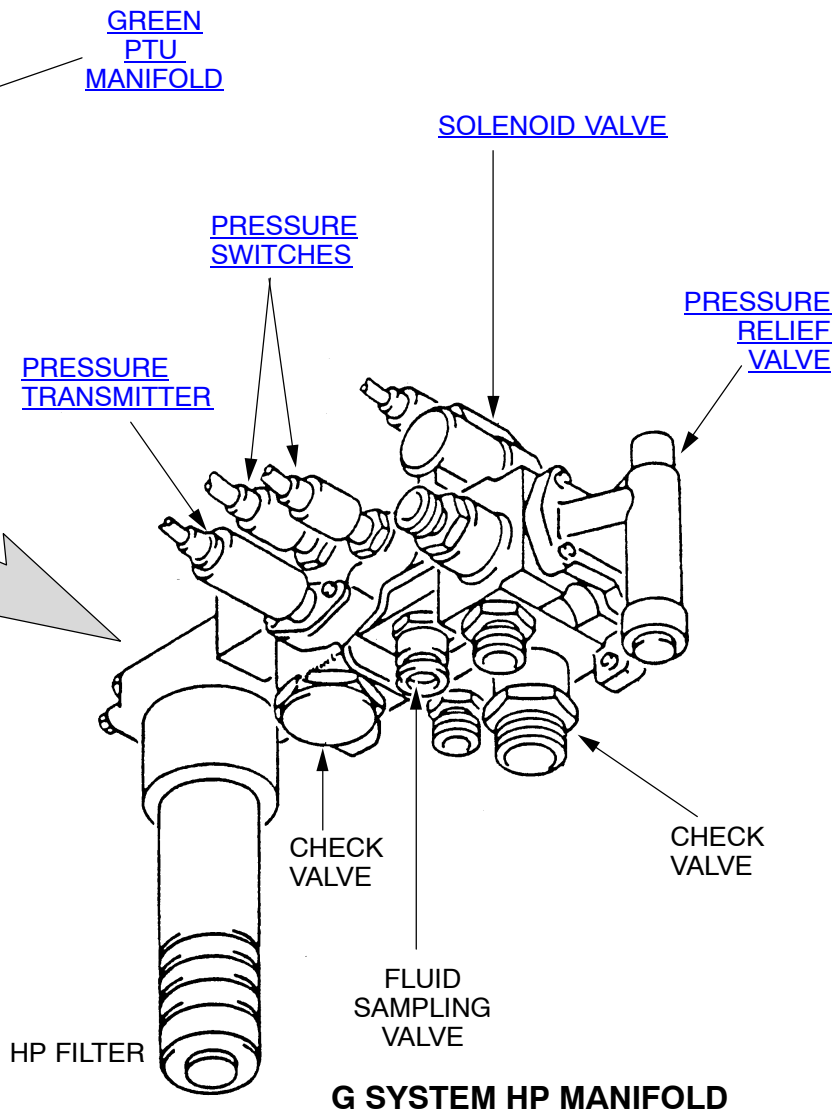

Figure 19 G System HP Manifold

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SYSTEM ACCUMULATOR PRESENTATION

The system accumulator is a cylindrical type with an internal bladder.

The metal body of the accumulator has an outer layer of kevlar to make it stronger. The bladder is made of rubber and isolates the gas (nitrogen) from the hydraulic fluid. A gas port is on one end of the body of the accumulator. It is the connection for the gas charging valve and for the gas pressure gage. A hydraulic connection which includes an oil valve is at the other end of the accumulator. It is the connection between the accumulator and the aircraft system. The oil valve stops overpressurization of the bladder.

The accumulator has a total volume of 1L. (0.26USGAL) and the gas precharge pressure is 130bar (1885 psi).

HYDRAULIC ACCUMULATOR SERVICING

To fill the hydraulic system accus with nitrogen:

- depressurize the hydraulic systems
- fill the accus to the correct pressure according to the ambient pressure.

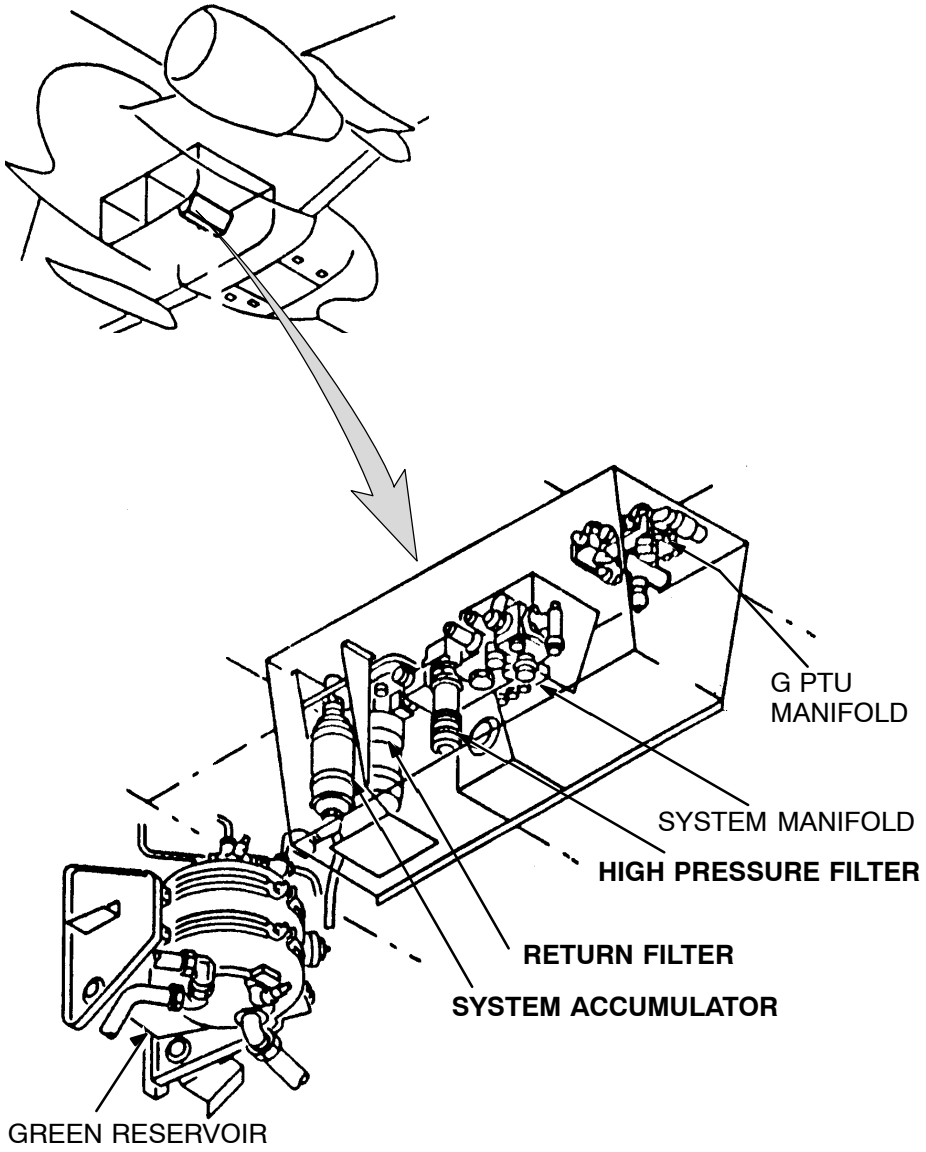

Figure 20 G Accumulator/Filter Location

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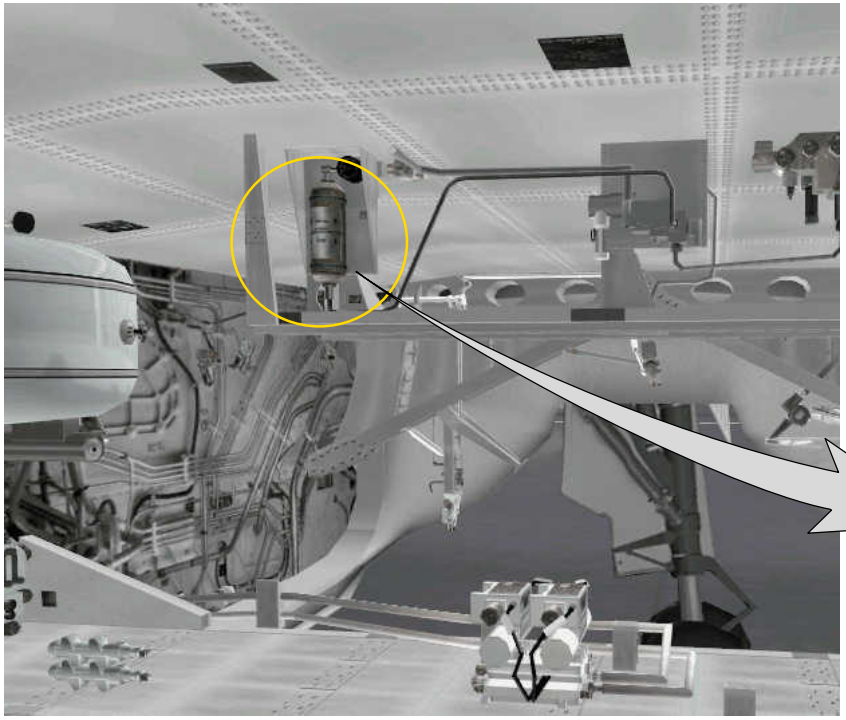

MLG Wheel Well (view from l/h)

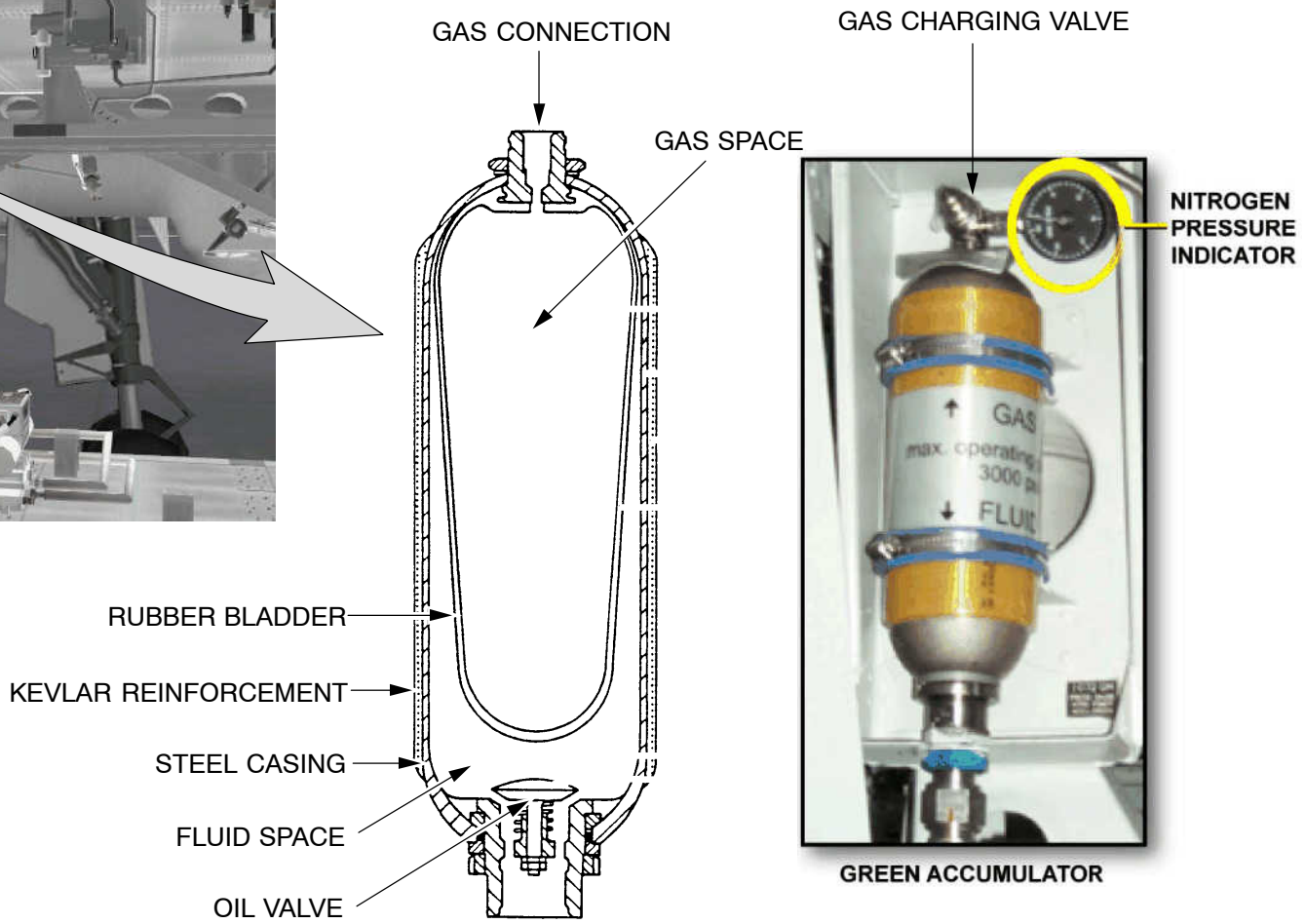

Figure 21 G System Accumulator

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HYDRAULIC FILTER PRESENTATION

The HP (High Pressure) filter has three main parts:

- the filter head
- the filter bowl
- the filter element

The filter head includes the hydraulic connections and the mounting for the attachment of the filter to the structure and the filter clogging indicator.

The clogging indicator is a red pin which comes out to show that the filter element is too dirty. It operates when the pressure differential accross the filter reaches a certain amount. When the red pin is pushed back in, the clogging indicator resets itself. It is latched magnetically.

It does not operate if the temperature of the fluid is lower than 0°C (32°F).

An anti–spill device in the filter head operates when the filter element and bowl are removed. It stops fluid coming out of the system or air going in to it when the filter element is changed.

The filter does not have a by–pass device to let fluid through if the element is clogged. The filter bowl holds the filter element. It has a thread to attach it to the filter head. It is not necessary to use tools to tighten the filter bowl in the filter head. The filter element is of the replaceable type. It can not be cleaned. The filtration rating of the element is 15microns.

LP (Low Pressure) Filter

The low pressure filter is functionally the same as the HP filter, the differences between the two types are:

- the LP filter is a different size from the HP filter,
- the filtration rating is 3 microns,
- the configuration of the filter head is different,
- the LP filter has an extra port to attach a fluid temperature sensor,
- the LP filter has a by–pass device.

The by–pass device operates when the pressure differential across the filter element is more than 4.0 ± bar (58 ± 6psi). It allows fluid to go from the inlet to the outlet without filtration.

Case Drain Filter

The case drain filter is functionally the same as the HP filter. The only differences are in its size and the configuration of the filter head.

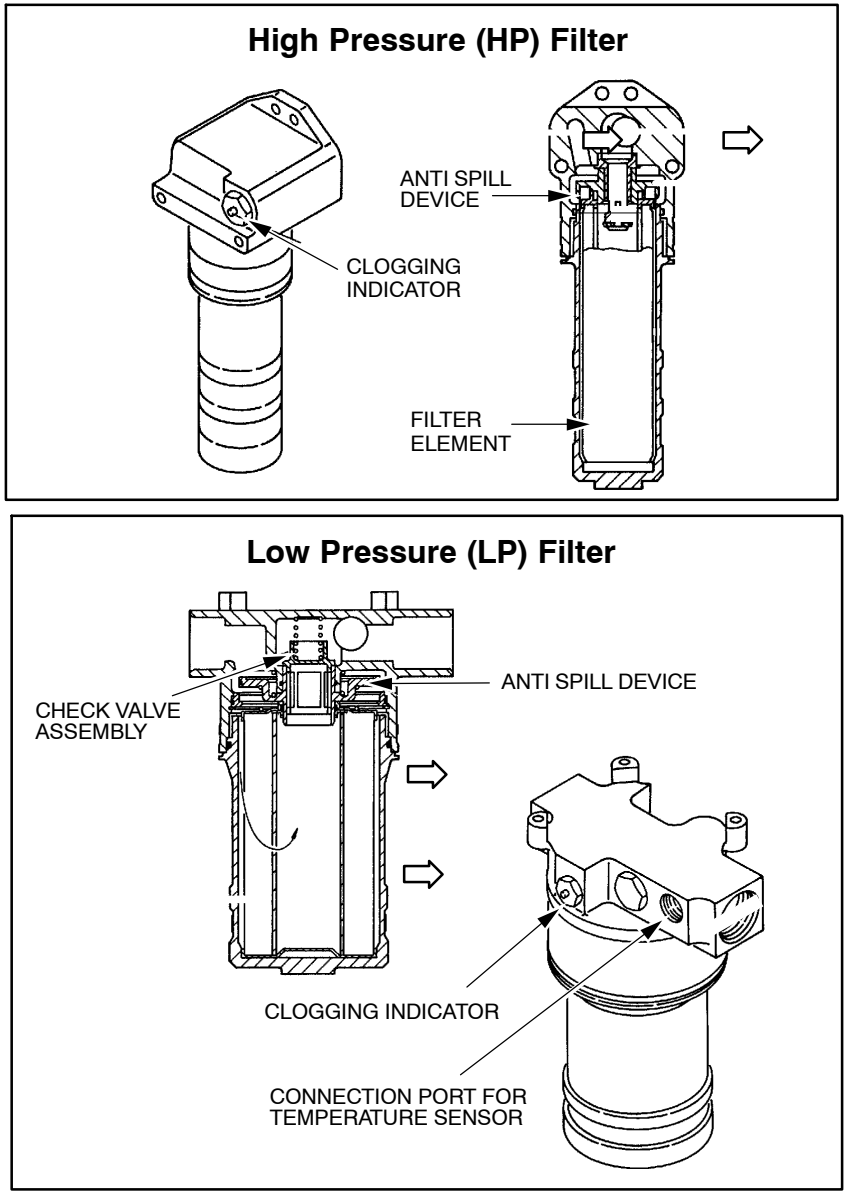

Figure 22 HP/LP Filter

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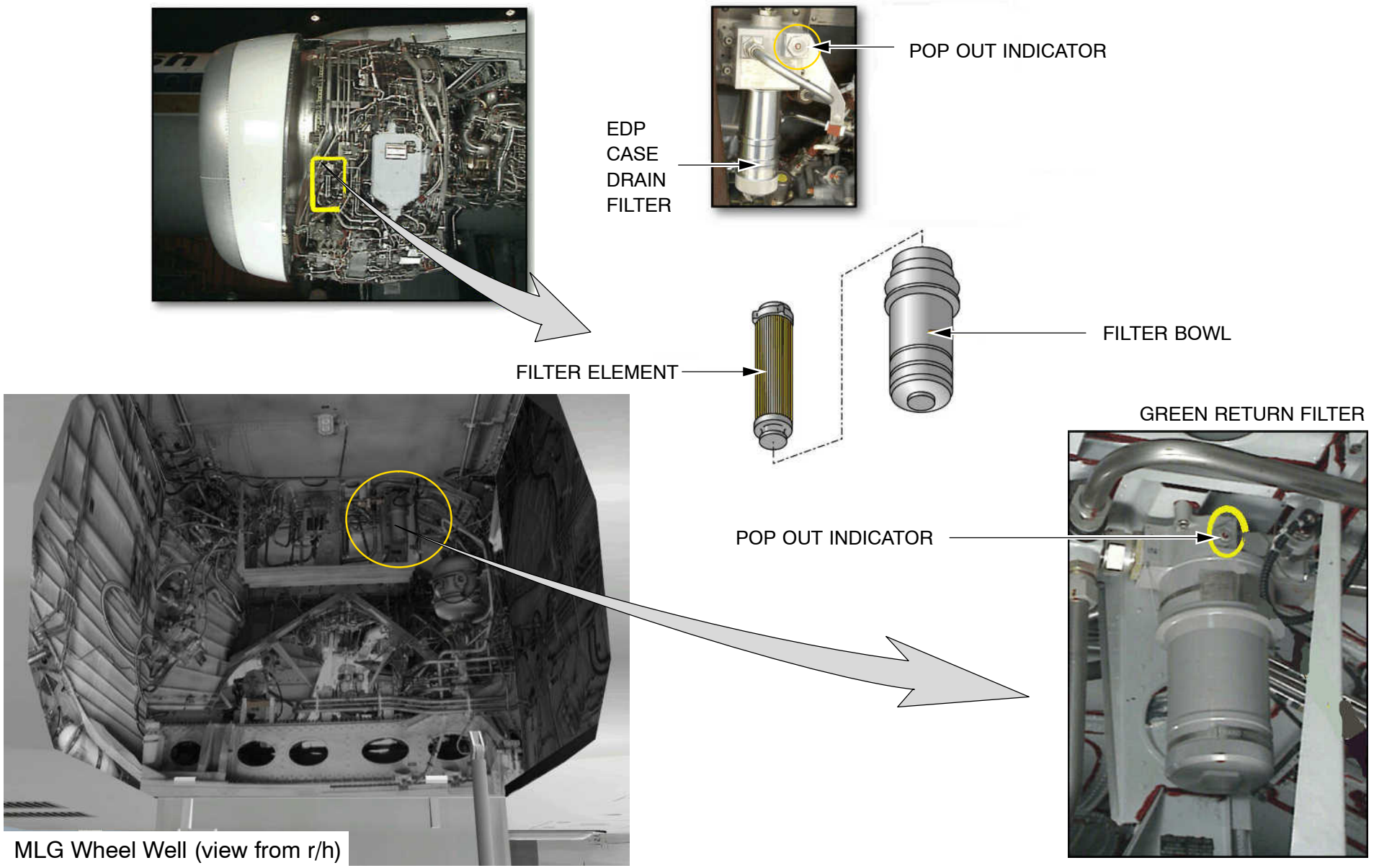

Figure 23 Case Drain/LP Filter Location

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GRD SERVICE PANEL (GREEN) PRESENTATION

The ground service panel for the Green system is installed in the left belly fairing aft of the main gear compartment. The components and connections necessary to service the Green system (not including the ground connection of the reservoir pressurization system and the reservoir drain) are installed in a group together on it.

The ground service panel is composed of:

- the ground test pressure and suction self–sealing connectors,
- the Green reservoir depressurization valve,
- the hand pump of the reservoir filling system
- the reservoir quantity indicator
- the selector valve of the reservoir filling system
- the ground supply connector of the reservoir filling system
- the fill valve of the reservoir filling system
- the filter of the reservoir filling system
- the restrictor of the reservoir filling system

The flexible hose, which is part of the reservoir filling equipment, is also kept in the compartment of the ground service panel

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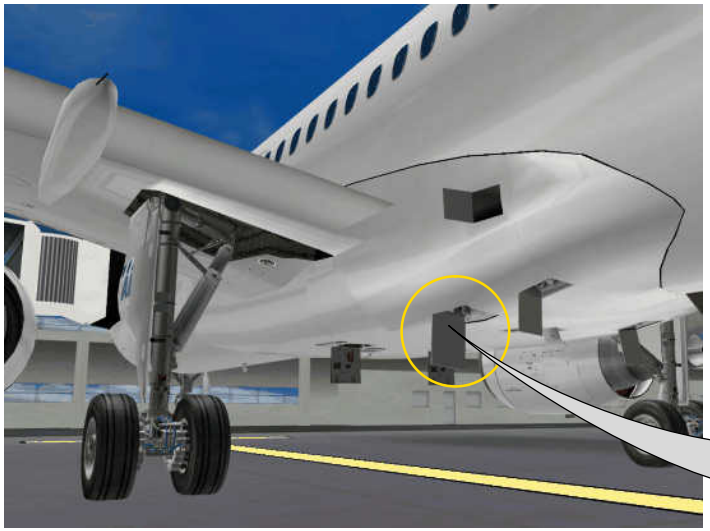
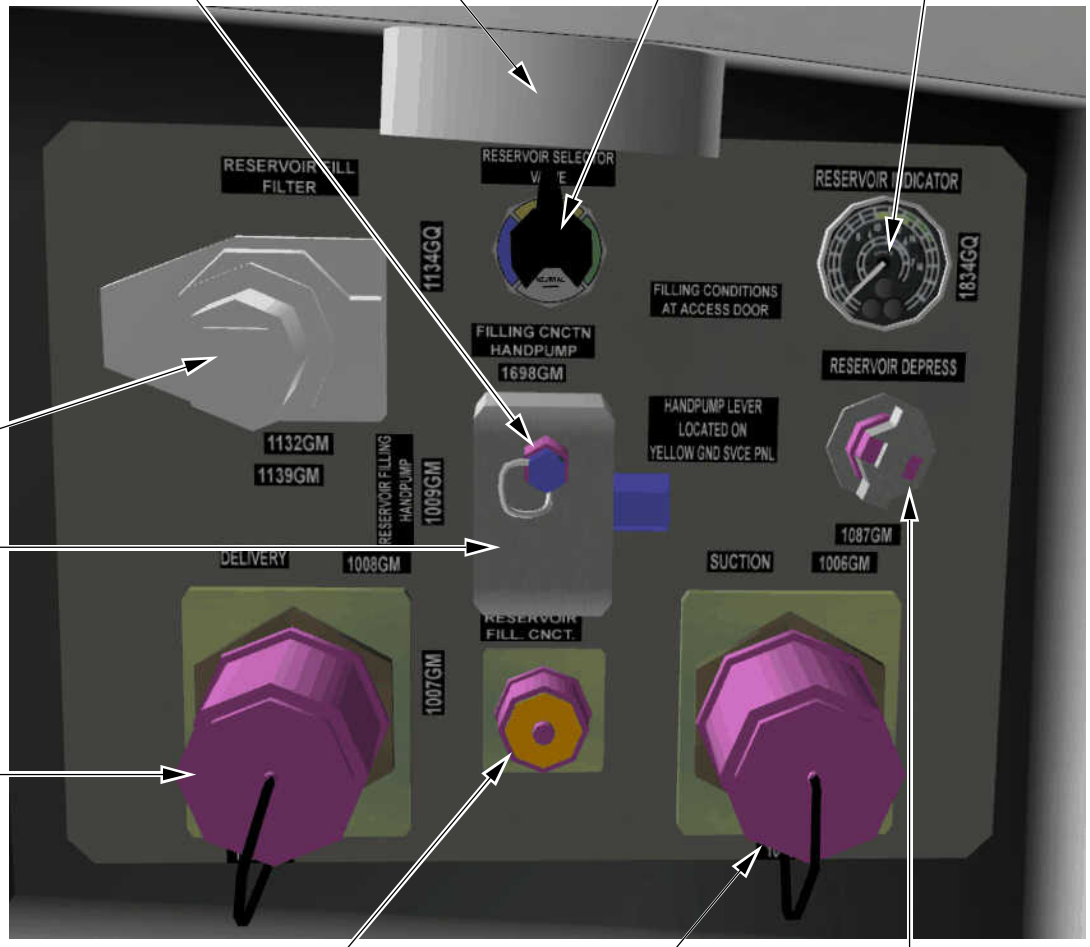


Green Service Panel



Capacities Green System:	
Total Capacity	23Ltr (6.1 USG)
Max. Gageable	18Ltr (4.8 USG)
Fill Level	14Ltr (3.7 USG)
Low Level Warn.	3Ltr (0.8 USG)

Figure 24 Green System Ground Service Panel

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GROUND SERVICE PANEL COMPONENTS

Reservoir Filling Selector Valve

The reservoir filling selector valve directs hydraulic fluid from the supply to the reservoir of the system which is selected. The selector valve can be set in any one of four positions. They are one for each hydraulic system (YELL0W, BLUE or GREEN) and an off position (identified as NEUTRAL). 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,
- the electrical switch unit which controls the supply of power to the electrical contents indicator.

The hydraulic selector is a 4 port/4 way valve. It is turned by a shaft connected to the operating handle. The operating handle is also a pointer to show which system is selected.

The four set positions are at 90°. to each other.

The four hydraulic ports are identified as:

- supply inlet,
- outlet to the reservoir of the Blue hydraulic system,
- outlet to the reservoir of the Green hydraulic system,
- outlet to the reservoir of the Yellow hydraulic system.

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 ± 5bar (507 ± 72psi) and closes at 20 bar (290 psi). The fluid released through the thermal relief valve goes out of a port connected to the Yellow hydraulic system.

Electrical Switch Unit

The electrical switch unit is attached to the bottom of the hydraulic selector. The same shaft which operates the hydraulic selector also operates the hydraulic switch unit. The switch assembly is made up of a double wafer and a double rotor. Together they make it possible to switch the five circuits to the four possible selections (N,Y,B,G). Seals are installed between the hydraulic and electrical parts of the selector valve assembly. They make sure that no fluid goes into the electrical switch mechanism, but goes out as external leakage.

Coupling Socket

The coupling socket is the connection for a pressurized ground supply of hydraulic fluid. 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.

Fill Valve

The fill valve is the connection for the flexible hose. Use the flexible hose to fill the reservoirs with the hand pump from an unpressurized Container.

The fill valve is installed on the suction connection of the hand pump. The valve assembly includes a filter and a check valve. The check valve makes sure that the fluid in the flexible pipe does not flow back into the Container. The filter is removeable and has a filtration rating of 50 microns. A blanking cap is included with the assembly. It is attached to the valve body with a nylon cord.

Filter

It is a HP filter with a filtration rating of 15 microns. It is made up of three main parts:

- the filter head,
- the filter bowl,
- the filter element.

The filter head has the hydraulic connections, a clogging indicator and a shut–off device installed in it. There is no by–pass device on the filter in case of a blocked filter element. The shut-off device operates when you remove the filter bowl and element. It makes sure that no fluid leaks out of the system and no air enters while the element is removed.

Hand Pump

The hand pump provides the flow of fluid to fill the reservoirs if a ground supply is not available. The hand pump is the same as the hand pump installed on the ground service panel of the Yellow system. The pump has a HP pressure relief valve which opens at between 234 and 237.5 bar (3400 and 3445 psi).

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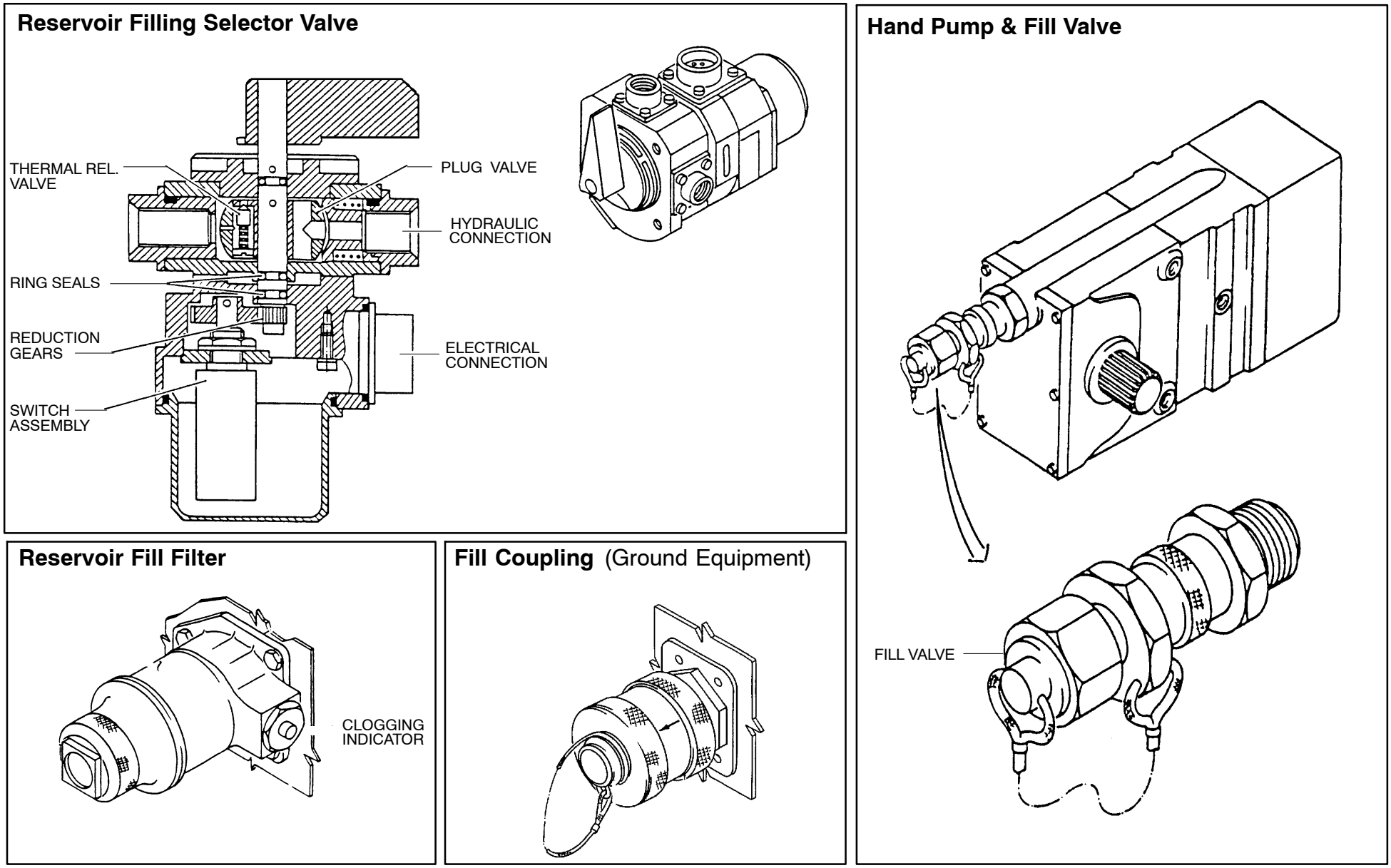

Figure 25 Service Panel Components

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29–12 BLUE MAIN HYDRAULIC POWER

SYSTEM OPERATION

Most of the components of the system are installed in the blue hydraulic compartment. The compartment is in the left–hand belly fairing, forward of the main landing–gear compartment. The reservoir and the Low Pressure (LP) filter are not in the hydraulic compartment. They are in the left–hand belly fairing aft of the main landing–gear compartment.

The system operates at a nominal pressure of 3000 psi (206bar). It can provide 32L/min (8.45USGAL) from the electric pump.

It is possible to pressurize the HP (**H**igh **P**ressure) system from any of three different sources:

- the electric pump,
- the RAT (**R**am **A**ir **T**urbine),
- the ground supply connections.

Operation of the system is usually automatic, but the crew can control parts of the system from the flight compartment if required. The Blue hydraulic system is made up of two main parts;

- a HP circuit which supplies the consumers,
- a LP or return circuit through which fluid returns to the reservoir.

System Function

The electric pump usually pressurizes the HP circuit and starts automatically when one of the engines is started. It then operates continuously until the two engines are stopped. The system accumulator avoids any temporary decrease in pressure because of the response time of the electric pump.

Two P/BSW in the flight compartment control the operation of the electric pump. The BLUE ELEC PUMP P/BSW is on the overhead panel. The crew members use it to stop the pump when there is a fault. It is usually set to AUTO and has the legends FAULT and OFF which come on as necessary. The ON legend of the BLUE PUMP OVRD P/BSW is on the maintenance panel shows that the electric pump is started on the ground when the engines are not in operation.

Operating Conditions

If the two engines stop in flight, the electric pump of the blue system will continue to operate if the supply of AC power comes from the APU. In this case, compression of the nose landing gear will stop the electric pump by a time delay circuit two minutes later. This makes sure that the electric pump does not stop immediately when the aircraft land has landed.

If there is a total failure of the AC power supply (which causes the electric pump to stop), the RAT automatically extends and pressurizes the system. It is also possible to operate the RAT from the flight compartment.

The case drain fluid from the electric pump assembly passes the LP circuit through a check valve and a filter.

The system has a pulsation dampener installed immediately downstream of the electric pump. It smoothens the output of the electric pump. Also installed downstream of the electric pump are a pressure switch and a check valve. The pressure switch monitors the output pressure of the electric pump whereas the check valve stops the flow of fluid toward the electric pump if the system is pressurized from another source.

The supply to all of the consumers passes the HP manifold. The supply to all other consumers than the slat motor and CSM/G also passes the LMS (**L**eakage **M**easurement **S**ystem) manifold.

A solenoid valve in the HP manifold controls the hydraulic flow of to the LMS manifold. This valve is operated from the maintenance panel. An HP filter is installed on the system pressure inlet of the HP manifold. A pressure relief valve is also installed to protect the system from overpressure.

Two pressure switches on the HP manifold monitor the pressure in the system to send information to the ECAM/Warning system and to the flight control system. A pressure transmitter supplies pressure information to the ECAM/Warning system.

A sampling valve is installed on the HP manifold to make it possible to get samples of the system fluid for analysis.

A priority valve is also installed on the HP manifold to stop the hydraulic supply to non–essential consumers (slats and CSM/G) if the pressure in the system is too low.

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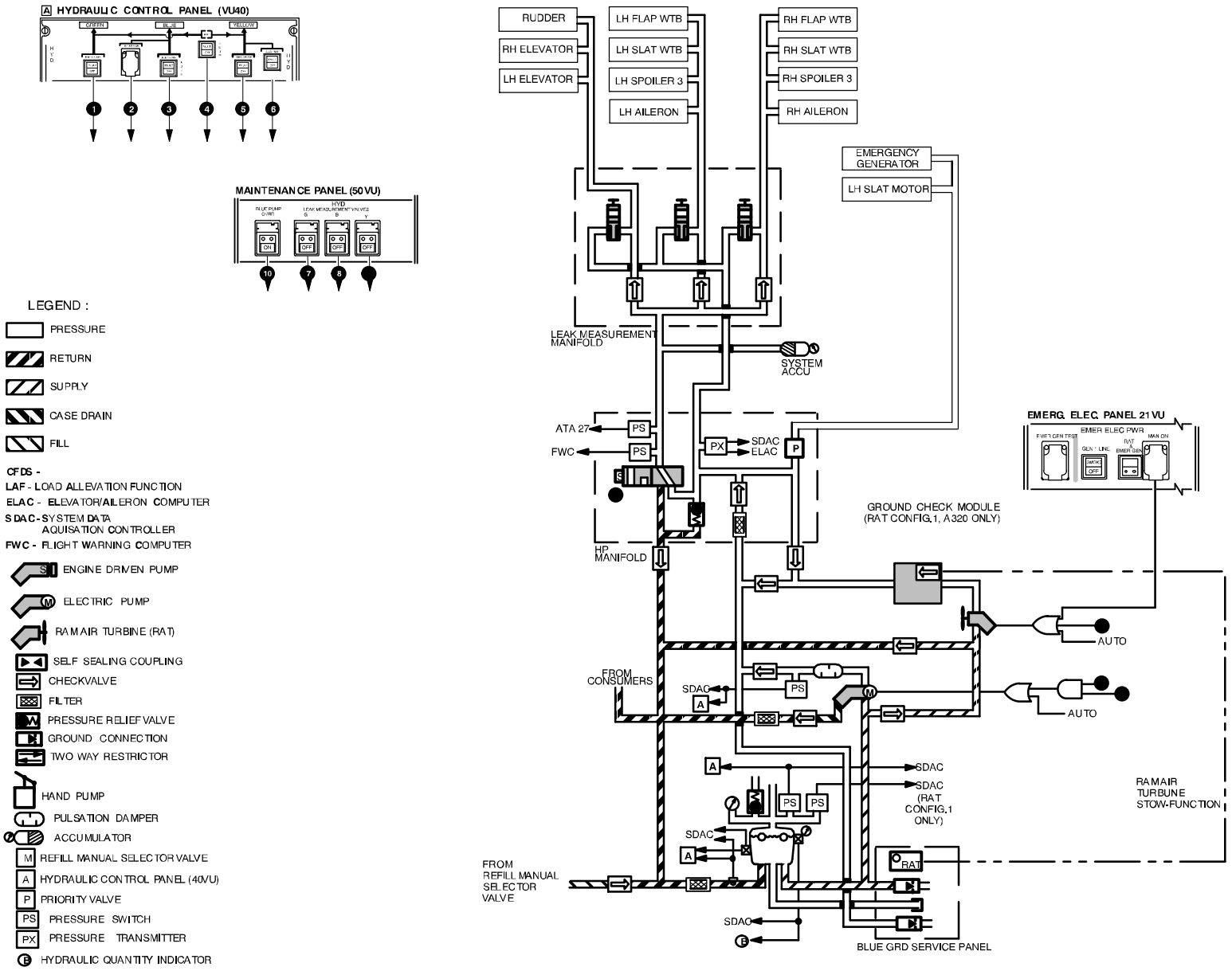

Figure 26 Blue System Funct Schematic

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BLUE SYSTEM COMPONENTS LOCATION

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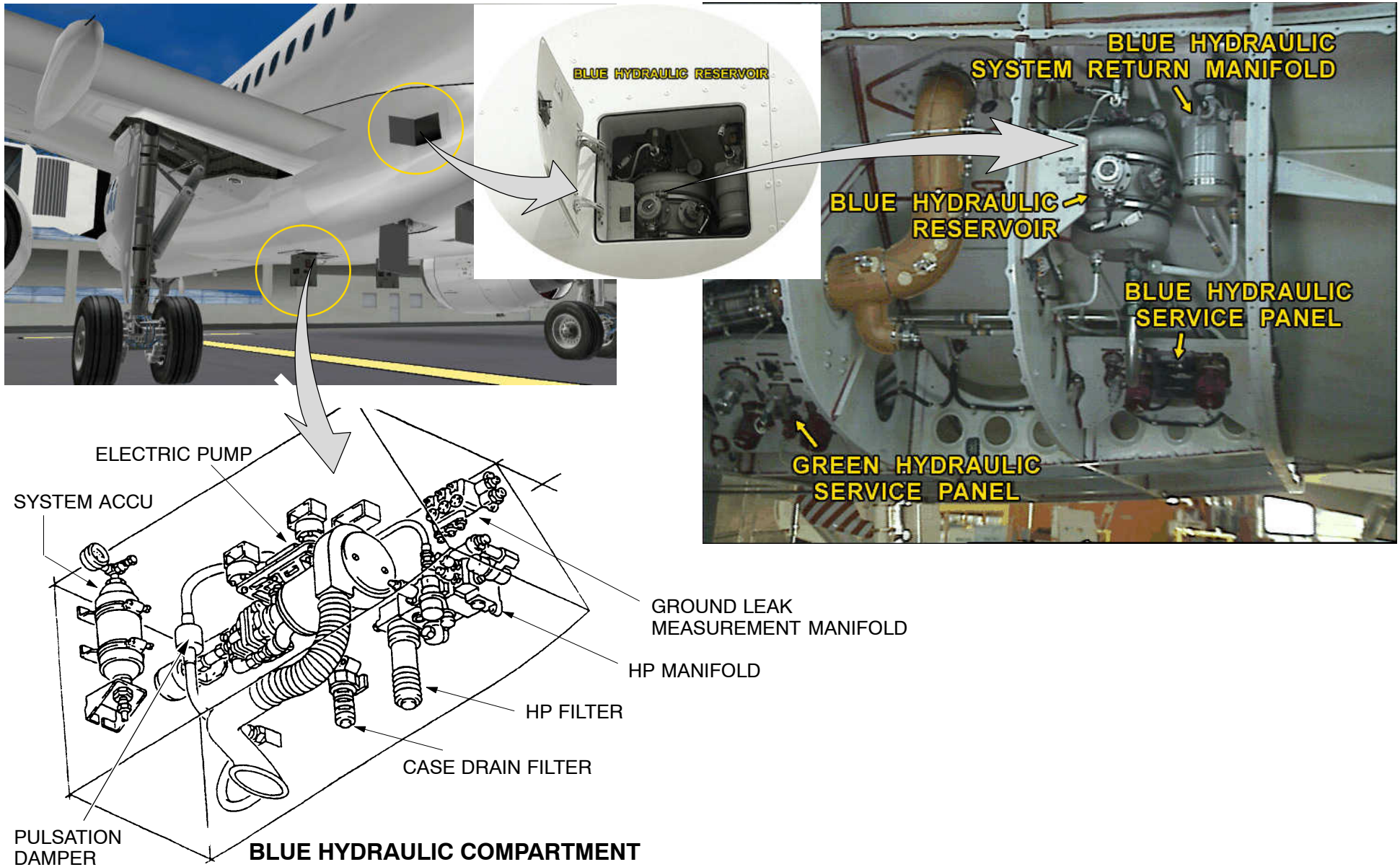

Figure 27 Blue System Components Location

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BLUE SYSTEM COMPONENTS PRESENTATION

Blue System Reservoir

The description of the Hydraulic Reservoir is the same as in the Green Hydraulic system.

The hydraulic fluid capacities of the reservoir are:

- the normal fill level 6L (1.5850USGAL)
- the maximum gageable level 8L (2.1133USGAL),
- the low–level warning level 2.0 and 2.3 (0.52 and 0.6USGAL)

The Tank drain valve is not installed at the tank. It is installed at the Blue Ground Service panel.

Electric Pump

The electric pump is installed in the Blue hydraulic compartment. It supplies the Blue hydraulic system with hydraulic power. The electric pump is basically the same as the pump in the yellow system.

The electric pump has three main parts:

- an electric motor,
- a boost pump
- the hydraulic pump.

The electric motor is a conventional induction motor. It operates with a threephase supply of electrical power.

A temperature switch is installed in the electric motor. If the temperature of the motor increases to 162°C (503°F) the switch operates and sends signals to the overhead panel and ECAM.

The electric pump starts automatically when any one of the engines starts. It then operates continuously until the two engines are stopped. A pushbutton switch in the flight compartment makes it possible for the crew to stop the electric pump.

It is also possible to pressurize the system with the electric pump when the engines are stopped. A P/B switch on the maintenance panel 5OVU in the flight compartment stops the automatic function and starts the electric pump. The case drain fluid from the electric pump assembly goes to the LP circuit through a check valve and a filter.

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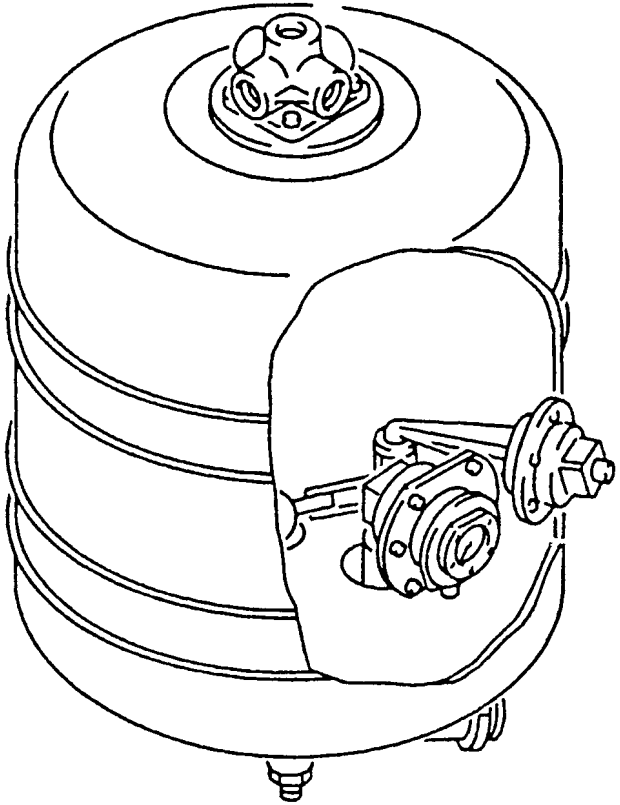
Blue System Reservoir



Electric Pump

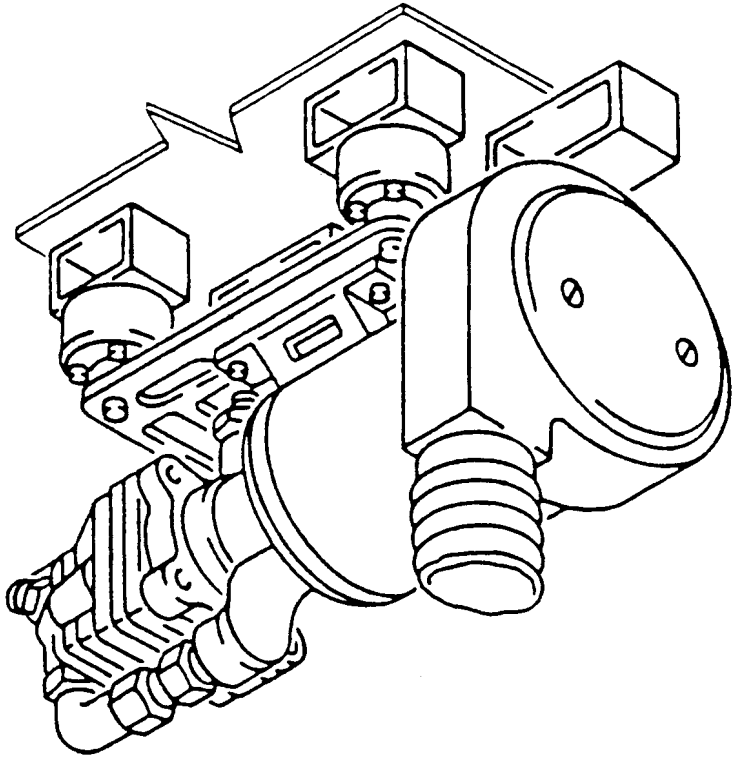


Figure 28 Blue System Components (1)

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1 Pulsation Damper

The pulsation damper is installed in the outlet line from the electric pump.

It removes the pulses of pressure of the HP flow from the pump.

The pulsation. damper consists of an empty metal sphere, with inlet and outlet connections on opposite sides.

2 Phase Unbalance Detector

The phase unbalance detector is installed in the avionics compartment.

- It operates together with the current transformer to detect a phase unbalance of the electric pump.

3 Current Transformer

The current transformer is installed in the avionics compartment.

- It operates together with the phase unbalance detector to detect a phase unbalance of the electric pump.

4 HP Manifold

The HP manifold is the same as the HP manifold installed in the Green hydraulic system.

The priority valve is also installed.

The HP manifold is installed in the Blue hydraulic compartment.

5 Case Drain Filter

The case drain filter is functionally the same as the HP filter. The only differences are in its size and the configuration of the filter head.

6 LP (Low Pressure) filter

The LP filter is installed in a compartment on the L/H side of the fuselage behind the MLG wheel well.

- it is the same as the LP filter installed in the Green hydraulic system the only differences are in its size .

7 System Accumulator

The accumulator is installed in the Blue hydraulic compartment.

- The system accumulator is the same as the system accumulator installed in the Green hydraulic system.

8 HP (High Pressure) filter

The HP filter is installed on the HP manifold.

- it is the same as the HP filter installed in the Green hydraulic system the only differences are in its size .

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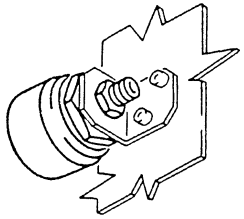
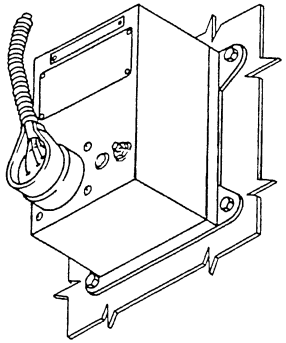
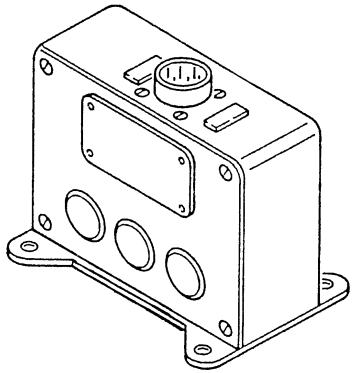
1 **Pulsation Damper**



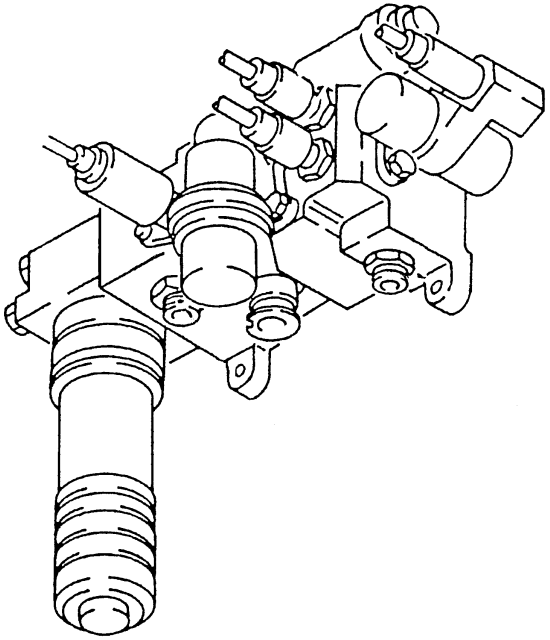
2 **Phase Unbalance Detector**



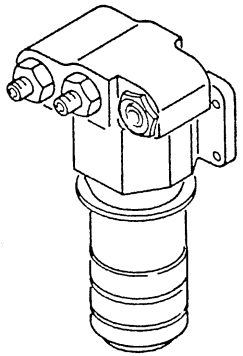
3 **Current Transformer**



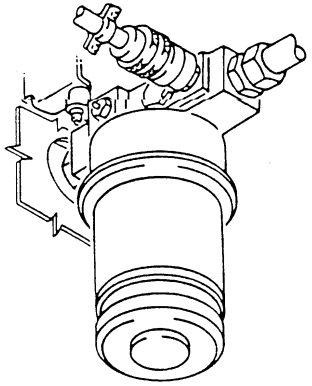
4 **HP Manifold**



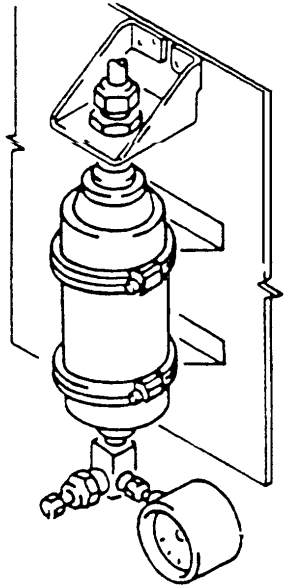
5 **Case Drain Filter**



6 **Low Pressure (LP) filter**



7 **System Accumulator**



8 **High Pressure (HP) Filter**

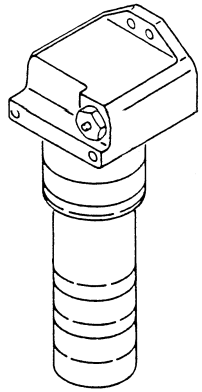


Figure 29 Blue System Components (2)

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GRD SERVICE PANEL BLUE SYSTEM PRESENTATION

Description

The ground service panel for the Blue hydraulic system is in the left–hand belly fairing, aft of the main landing–gear compartment.

The components and connections which are necessary to service the Blue hydraulic system (not including the pressurization connection for the reservoir) are installed together in a group on it.

On the ground, it is possible to pressurize the system from a ground supply.

The system has self–sealing connections for a ground supply.

They are installed on the ground service panel of the Blue hydraulic system.

The ground service panel has these components on it:

- the ground test pressure and suction self–sealing connectors,
- the depressurization valve of the reservoir,
- the drain valve of the reservoir,
- the RAT control panel.

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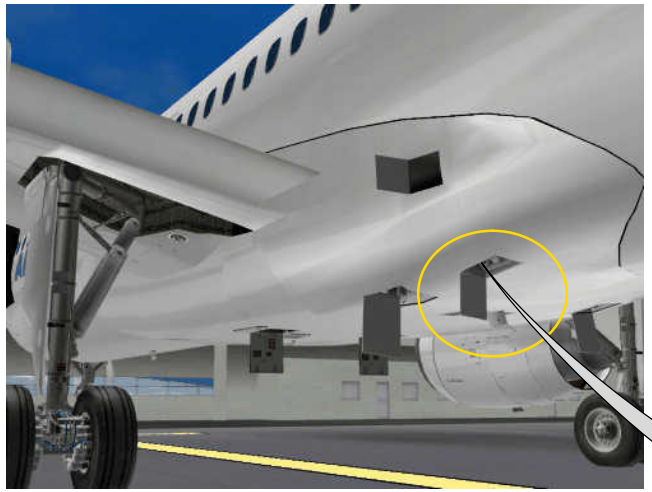

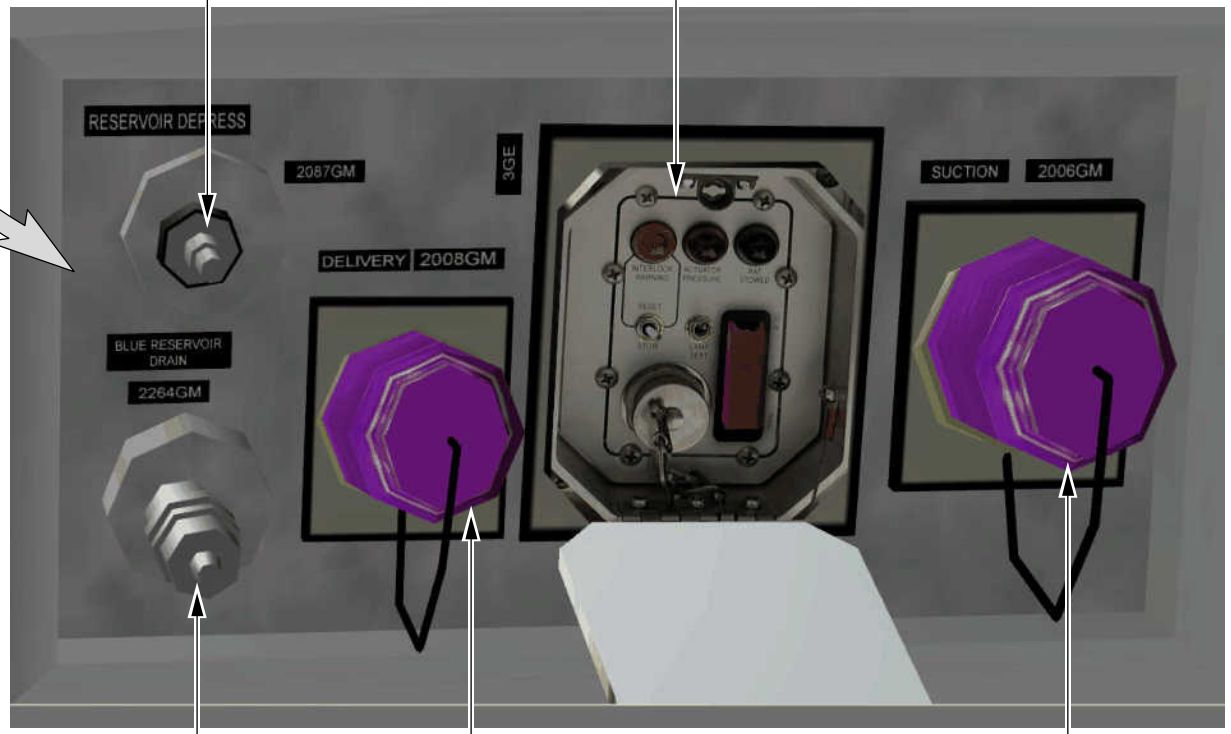

Capacities Blue System:

Total Capacity	10Ltr (2.6 USG
Max. Gageable	8Ltr (2.1 USG)
Fill Level	6Ltr (1.7 USG)
Low Level Warn.	2Ltr (0.5 USG)

Figure 30 Blue System Ground Service Panel

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29–13 YELLOW MAIN HYDRAULIC POWER

SYSTEM OPERATION

Most of the components of the system are installed in the Yellow hydraulic compartment in the RH belly fairing, forward of the main gear compartment.

The system is kept physically apart from the other two systems where possible. The system is hydraulically isolated from the other two systems. It is not possible for fluid to go from one system to another.

The system operates at a nominal pressure of 3000 psi (206 bar). It is possible to pressurize the HP (**H**igh **P**ressure) system from three different sources:

- the EDP (**E**ngine–**D**riven **P**ump) connected to the right (No 2) engine.
- the PTU (**P**ower **T**ransfer **U**nit),
- the Yellow electric pump
- the hand pump for the operation of the cargo doors
- the ground supply connections.

The Yellow hydraulic system has two sub–systems:

- a HP (**H**igh–**P**ressure) circuit which supplies consumers,
- a LP (**L**ow–**P**ressure) or return circuit through which the fluid returns to the reservoir.

System Function

The operation of the system is fully automatic. The EDP starts to supply the system as soon as the No. 2 (right) engine is started. The EDP supplies the system with fluid at 3000psi (206 bar) and changes its output to that which is necessary for the system. A pressure switch and a check valve are installed downstream of the EDP. The pressure switch monitors the output pressure of the pump . The system accumulator has direct hydraulic connections to the HP and brake manifolds and to the cargo door selector valve. The accumulator keeps the pressure in the system free of small changes. It also makes a supply of fluid available to replace any temporarily shortage. This can occur if there is a sudden large demand and the pump has not had time to respond. The accumulator is pre–charged with nitrogen at 1885psi (130 bar) and holds 0.18L. (0.0475 USGAL) of the useable fluid when it is full. The Power Transfer Unit (PTU) can also pressurize the Yellow HP circuit. The PTU gets its power from the Green hydraulic system. It supplies power to the Yellow hydraulic system if the pressure in the system falls to approximately 500psi (34.48bar) below the pressure in the Green hydraulic system. There is no hydraulic connection between the two hydraulic systems so no fluid can get from one system to the other. The PTU pushbutton switch in the flight compartment controls the operation of the two solenoid valves. When the pushbutton switch is operated, the two solenoid valves are energized and the supply of fluid to / from the PTU is stopped. If the EDP fails, or for maintenance on the ground, it is possible to pressurize the Yellow hydraulic system with the electric pump.

The system pressure inlet to the HP manifold has a filter. A check valve is installed on the manifold. A sampling valve makes it possible to take samples of fluid from the system for analysis. You can take the sample when the system is at full pressure.

A PRV (**P**ressure **R**elief **V**alve) is installed on the HP manifold to protect the system against overpressure. Two pressure switches and a pressure transducer are also installed on the HP manifold to monitor the pressure in the system The supply to most of the consumers goes through the HP and LMS (**L**eakage **M**easurement **S**ystem) manifolds. Thus it is possible to isolate some consumers to measure the internal leakage of parts of the system. The supply to the alternate and parking brake systems goes from the HP manifold through the brake parking brake systems goes from the HP manifold through the brake manifold.

A solenoid valve on the HP manifold controls the flow of fluid to the LMS manifold. The solenoid valve is usually operated from the flight compartment by the switch on the maintenance panel (50VU) but it also has an automatic function. This function is related to the operation of the cargo doors. When the cargo doors are set to open or close (and the Yellow electric pump starts), the solenoid valve is automatically closed. This stops the supply of fluid to the flight controls.

The condition of the system is monitored continuously. Temperature and pressure sensors send information to the flight compartment. The information is shown on the ECAM displays and as FAULT warnings on the overhead panel.

The crew can stop the supply of fluid to the EDP (if there is a fire in the nacelle) by operation of the fire valve. The fire valve closes when the ENG 2 FIRE pushbutton is operated. A symbol on the HYD page of the ECAM system display shows if the fire valve is open or closed.

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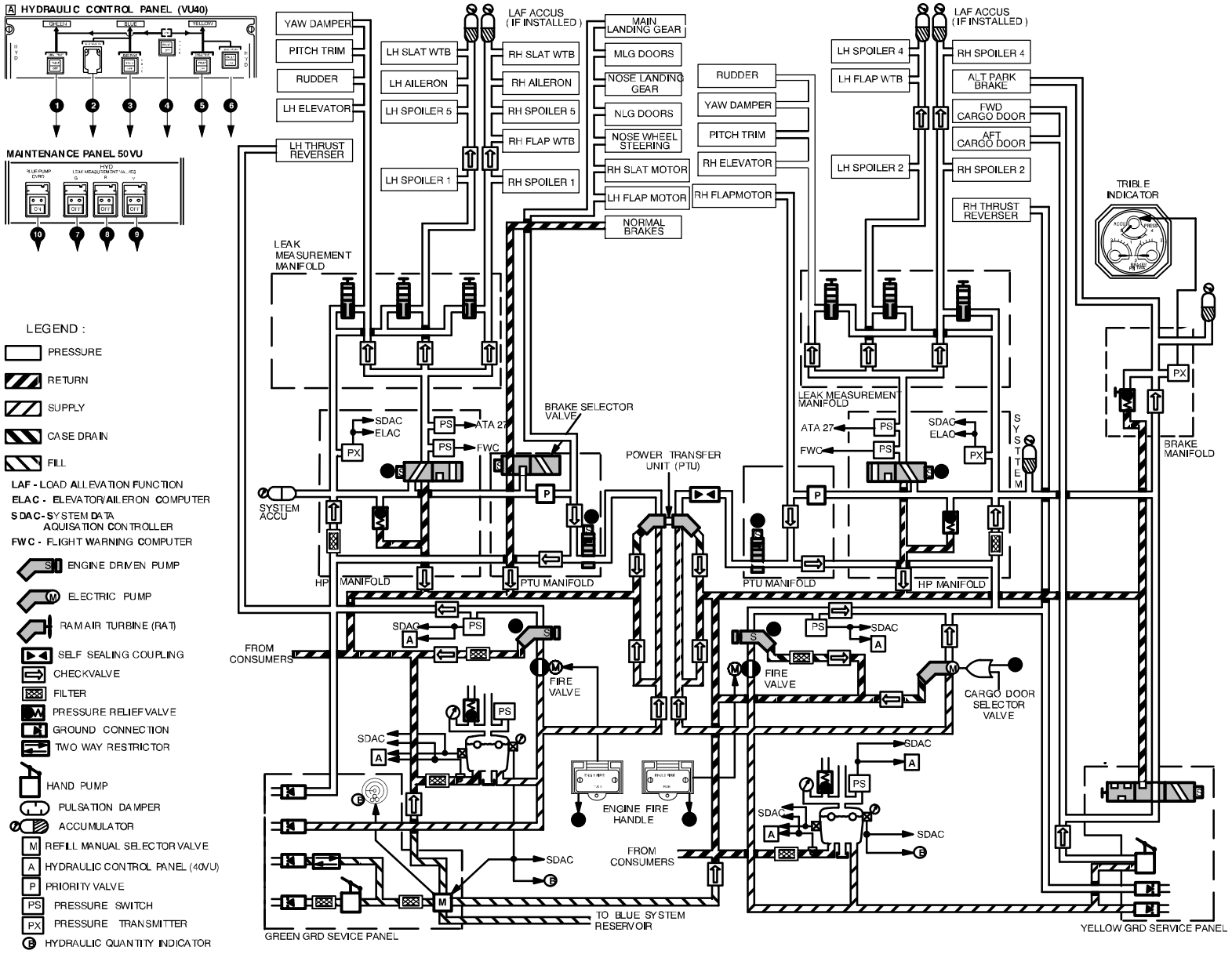

Figure 31 Yellow System Func Schematic

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YELLOW SYSTEM COMPONENTS

Yellow System Reservoir

For component description refer to the green system.

The hydraulic fluid capacities of the reservoir are:

- the normal fill level 12L. (3.8USGAL),
- the maximum gaugeable level 18L. (4.77USGAL),
- the low–level warning level 3.0 ± 0.4L. (0.8 ± 0.1USGAL).

Engine Pump Fire–Valve

The engine pump fire–valve is installed in the RH wing between the rear spar and rear false spar, inboard of the pylon. It is in the suction line between the reservoir and the EDP. When the valve closes, it stops the supply of fluid to the EDP.

The engine pump fire–valve is the same as the fire valve installed in the Green hydraulic system.

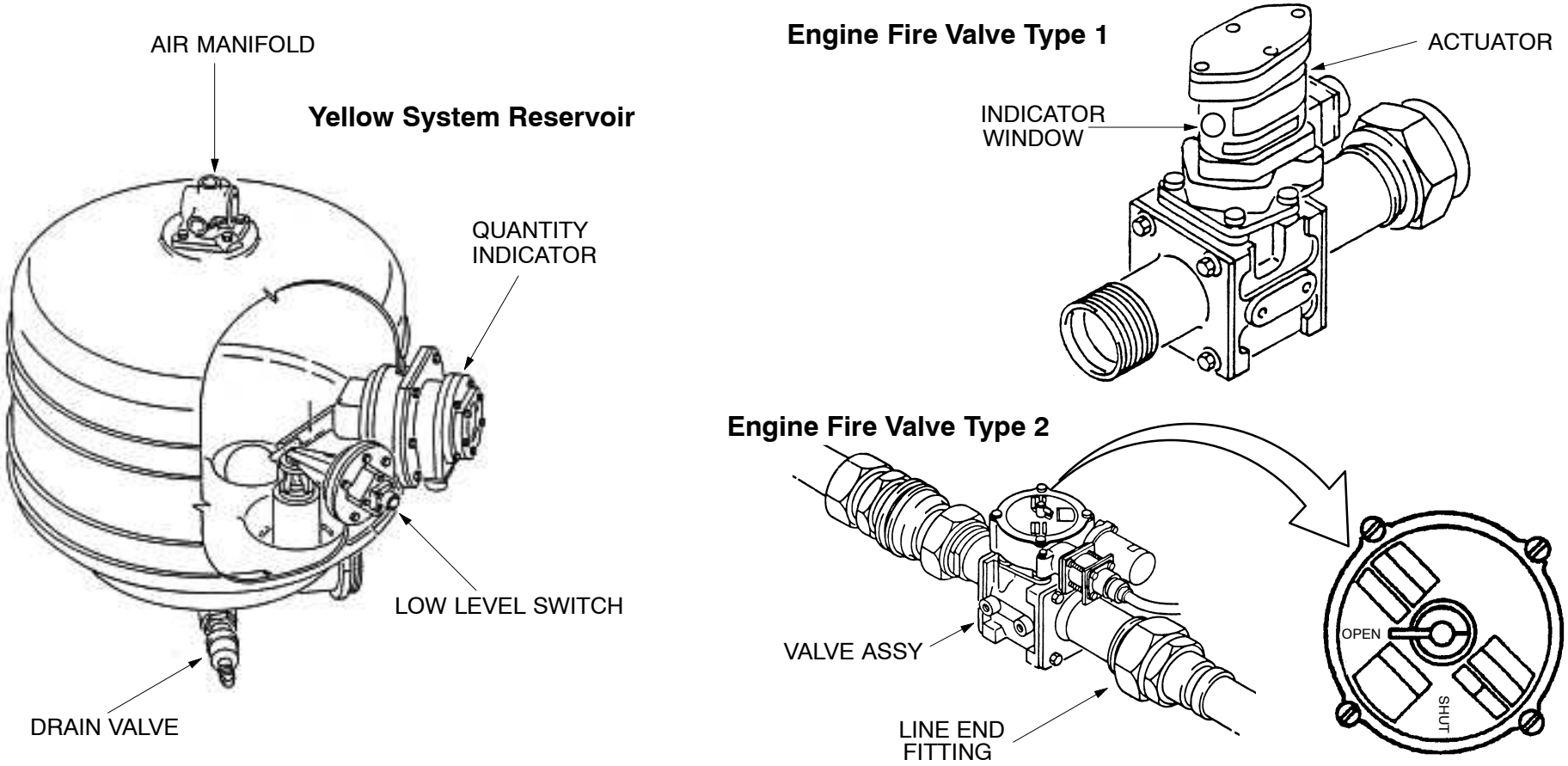

Figure 32 Y System Reservoir/Fire Valve

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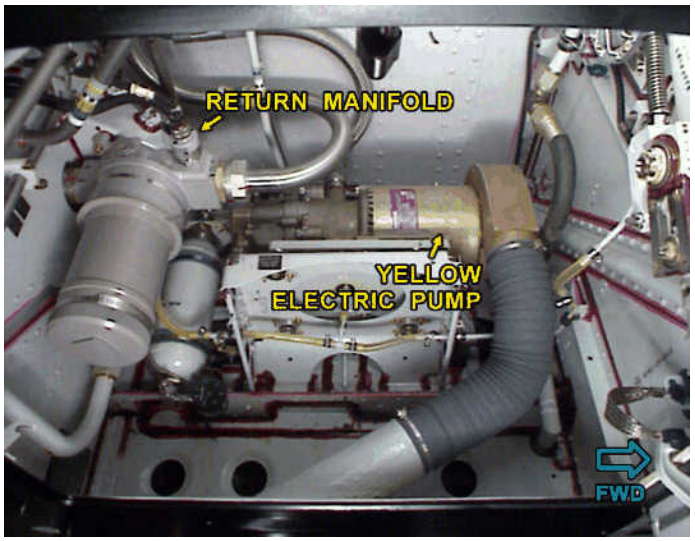

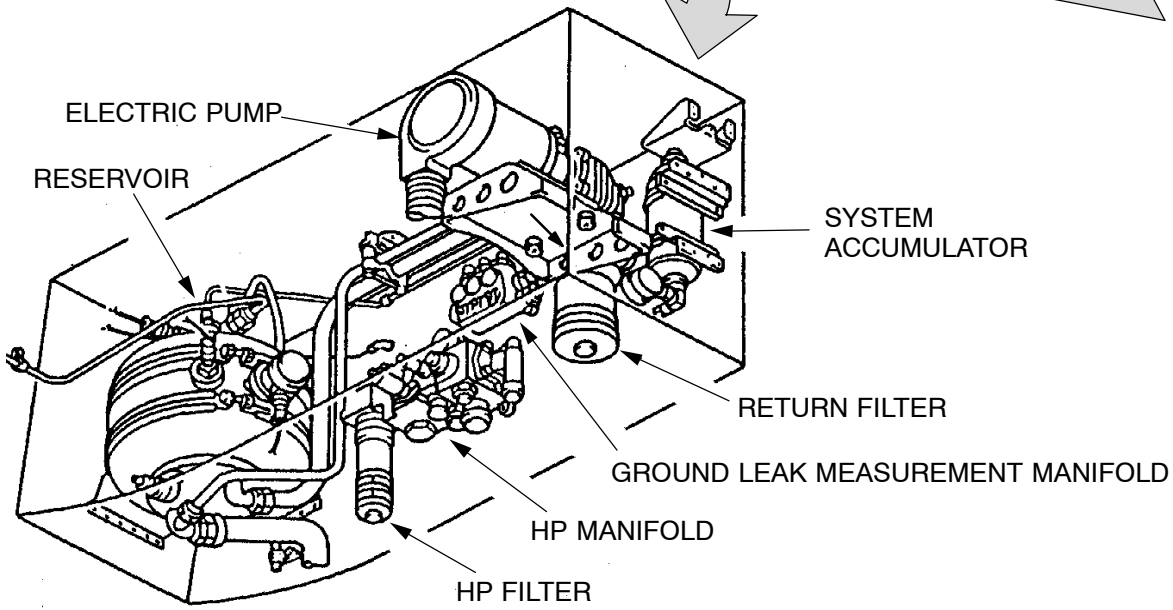

Figure 33 Y System Components Location

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YELLOW SYSTEM COMPONENTS PRESENTATION

1 Engine Driven Pump

The engine pump is installed on the accessory gearbox of the RH (No. 2) engine. It is the same as the engine pump installed in theGreen hydraulic system.

2 System Accumulator

The system accumulato is the same as the system accumulator installed in the Green hydraulic system.

3 HP (High Pressure) Manifold

The HP manifold is the same as the HP manifold installed in the Green hydraulic system.

4 HP (High Pressure) Filter

The HP filter is installed on the HP manifold. It is the same as the HP filter 1048GM installed in the Green hydraulic system.

5 Case Drain Filter

The case drain filter is functionally the same as the HP filter.

The only differences are in its size and the configuration of the filter head.

6 LP (Low Pressure) Filter

The LP filter is the same as the LP filter installed in the Green hydraulic system.

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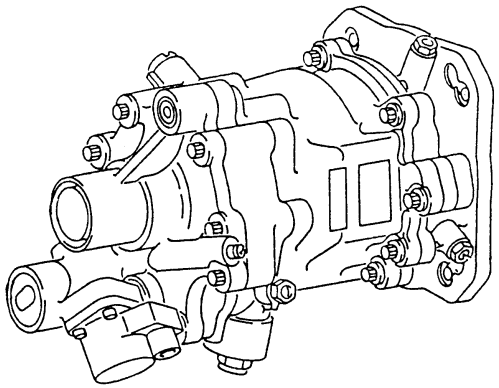
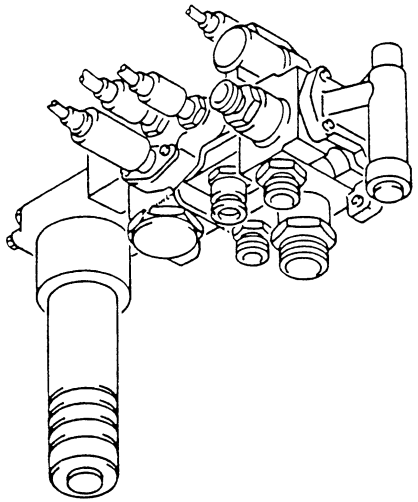
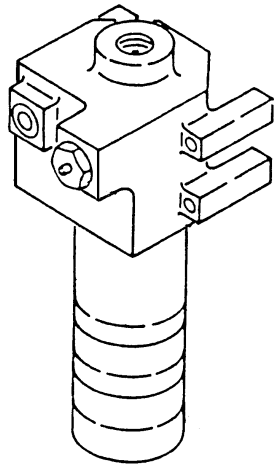
1 Engine Driven Pump



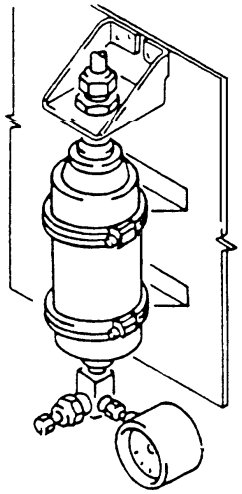
3 High Pressure (HP) Manifold



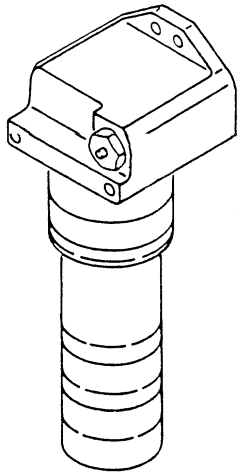
5 Case Drain Filter



2 System Accumulator



4 High Pressure (HP) Filter



6 Low Pressure (LP) Filter

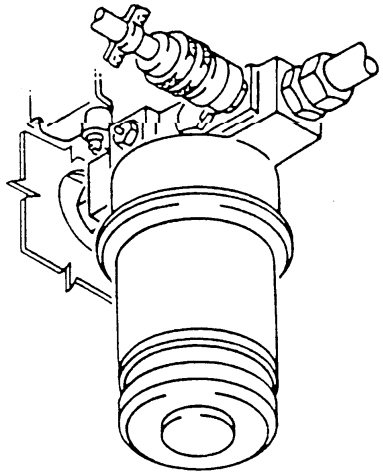


Figure 34 Y System Components

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GRD SERVICE PANEL YELLOW SYSTEM PRESENTATION

The ground service panel for the Yellow hydraulic system is installed in the right belly fairing aft of the main gear compartment.

The components and connections necessary to service the Yellow hydraulic system (not including the reservoir air pressurization connection and the reservoir drain) are installed in a group together on it.

The ground service panel has these components on it:

- the ground test pressure and suction self–sealing connectors,
- the Yellow reservoir depressurization valve,
- the Yellow reservoir depressurization valve
- the hand pump lever
  (which is for the reservoir filling and cargo door hand–pumps),
- the EL/MAN selector valve of the cargo door system
- the hand pump of the cargo door system

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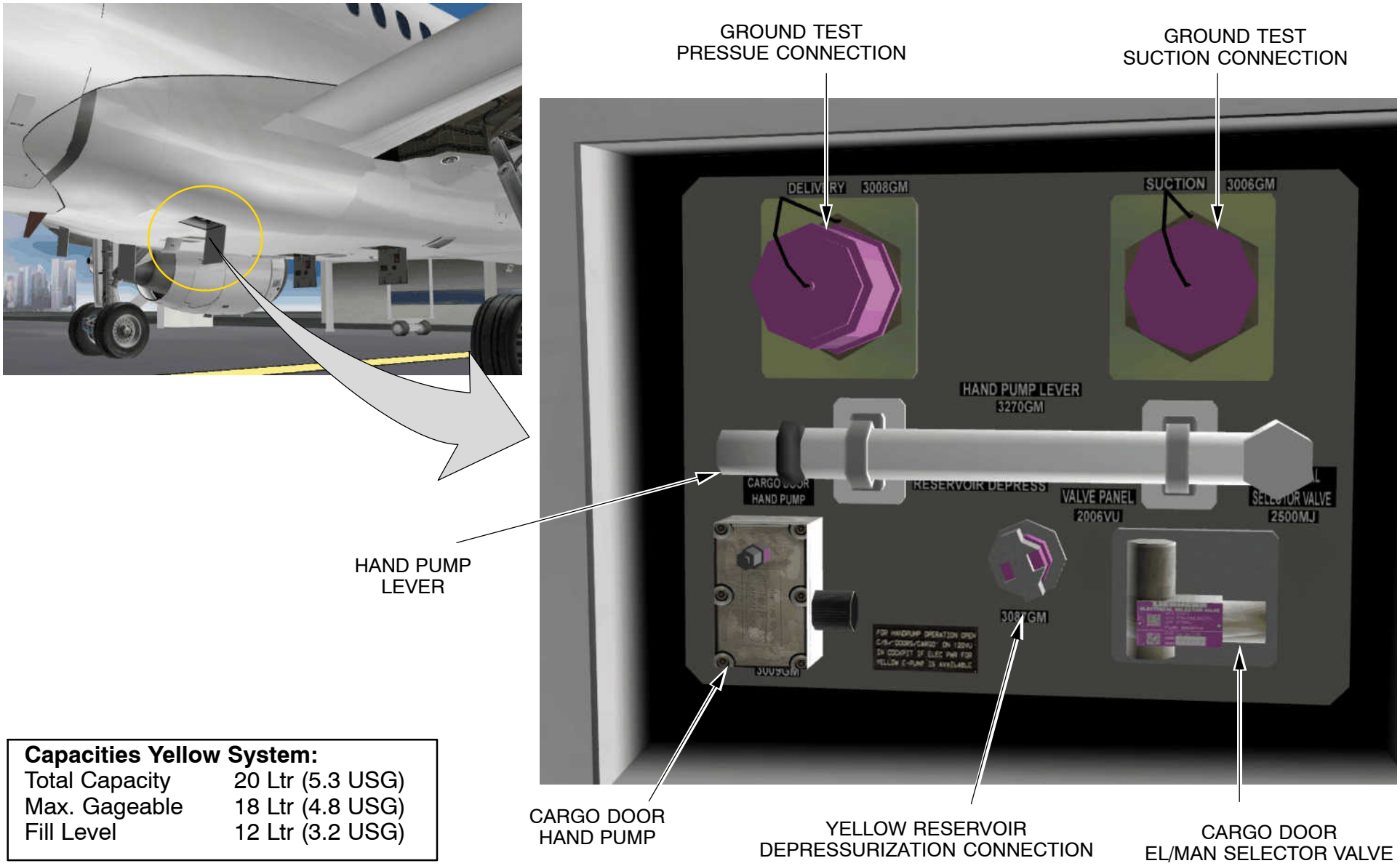

Capacities Yellow System:	
Total Capacity	20 Ltr (5.3 USG)
Max. Gageable	18 Ltr (4.8 USG)
Fill Level	12 Ltr (3.2 USG)

Figure 35 Yellow System Ground Service Panel

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29–14 HYDRAULIC RESERVOIR PRESSURIZING SYSTEM

SYSTEM DESCRIPTION

The aircraft has a pressurization system for the hydraulic reservoirs .

Each reservoir gets pressurized air to 50psi (3.5 bar) (usual operation), which prevents cavitation of the pumps. The system also remains airtight in the event of failure of the pressurization system or after an engine shutdown.

Air for the reservoir pressurization is supplied by:

- Engine 1 high pressure compressor
- Low pressure bleed air from the pneumatic manifold.
- Ground supply through the air charging ground connector on the reservoir pressurization manifold.

PRESSURIZATION COMPONENTS

Air Pressurization Manifold

The reservoir pressurization manifold has three inlet ports,one from each supply source.

Outlet of the airflow is through the fluid separator which is fitted to the manifold. Also fitted to the manifold is the pressure reducing valve.

Two filters are installed in the manifold assembly. Indicators are fitted to the filters to show when the filters are clogged.

Reservoir Pressurization Unit

Purpose same as the Pressurization Manifold

Depressurization Valve

Each hydraulic reservoir can be depressurized independently on the applicable ground service panel with the depressurization valve.

Air Pressure Gage

An air pressure gage is installed in the air supply line to each reservoir. The gage gets input of the system pressure which is constantly displayed. The gage has an analog display with a range of 0–75psi.

PRESSURIZATION OF HYDRAULIC RESERVOIRS

The three reservoirs are pressurized at the same time.

The ground connector is installed on the reservoir pressurization manifold. The connector is a plunger type valve. It is opened and closed manually. Rotation of the nut moves the plunger in or out to open or close the valve. A cap fitted to the connector prevents external contamination.

Operation

- Make sure that the reservoir depressurization valves are closed.
- Fill the reservoirs with air until 50psi is shown on the reservoir pressure gages.

  NOTE: If the system pressure gets higher than 5.3bar (76.85psi) relative the pressure relief valve opens to relieve the high pressure.

Depressurization of Hydraulic Reservoirs

- Turn the cap of the reservoir depressurization valve clockwise through 90°.This allows the air pressure through the valve to the atmosphere.
- Listen to hear if all air is released.

Alternatively the air pressure can be released by the connection of a depressurization coupling.

WARNING: WHEN OPENING THE MANUAL DEPRESSURIZATION VALVE OF THE RESERVOIRS IT IS POSSIBLE THAT THE GAS IS HOT AND CONTAINS HYDRAULIC FLUID.

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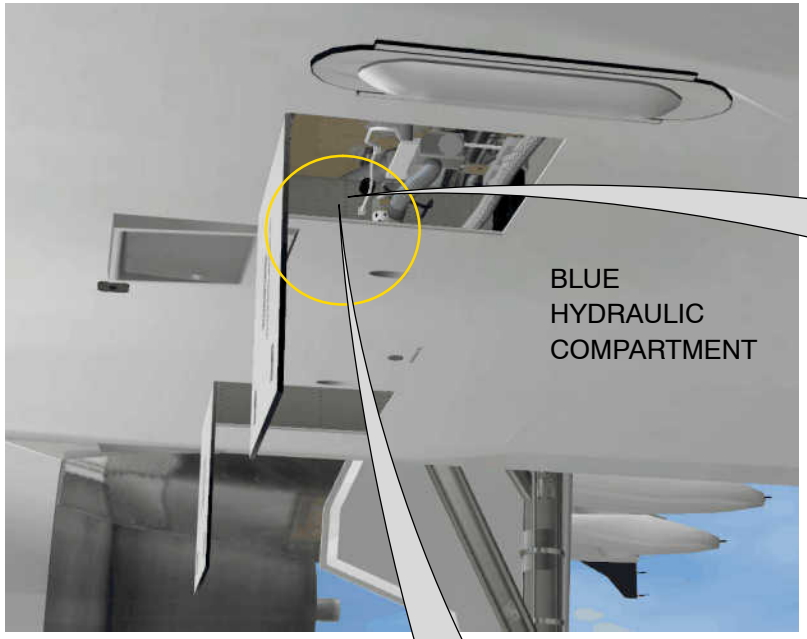
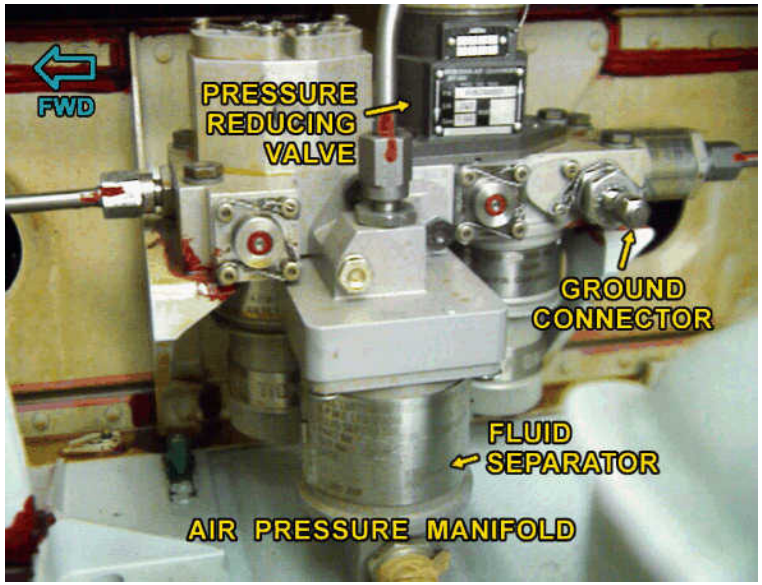
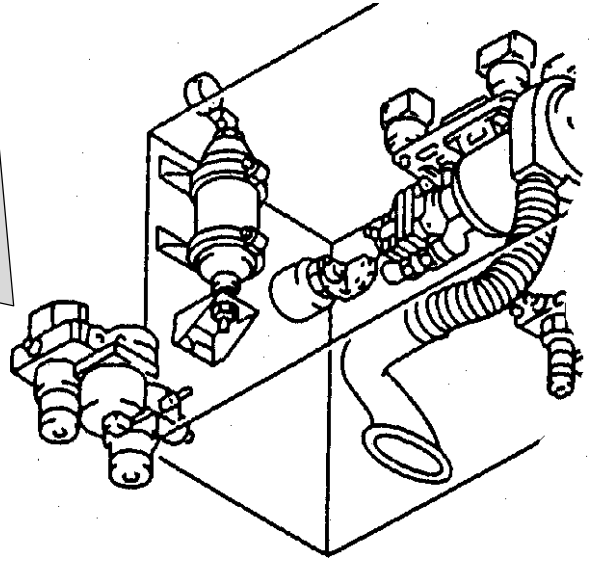




AIR PRESSURIZATION MANIFOLD

PRESSURE GAGE

Reservoir Depressurization Valve
(installed on each Hydraulic service panel)



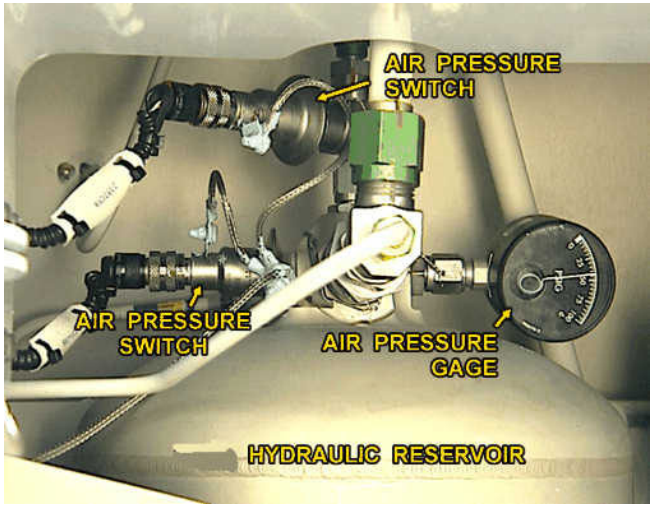


Figure 36 Reservoir Pressurization Components

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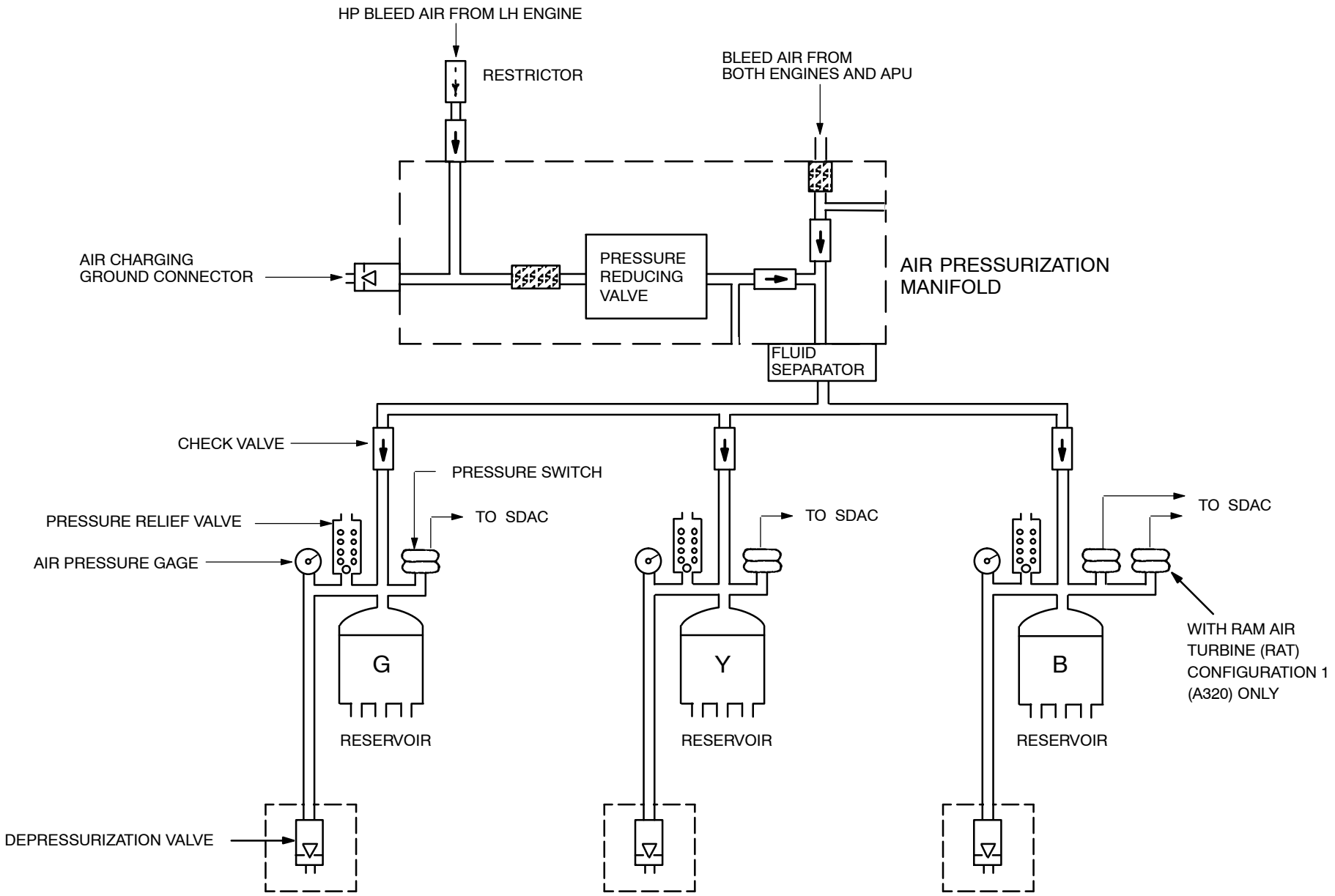

Figure 37 Reservoir Pressurization System (Configuration 1)

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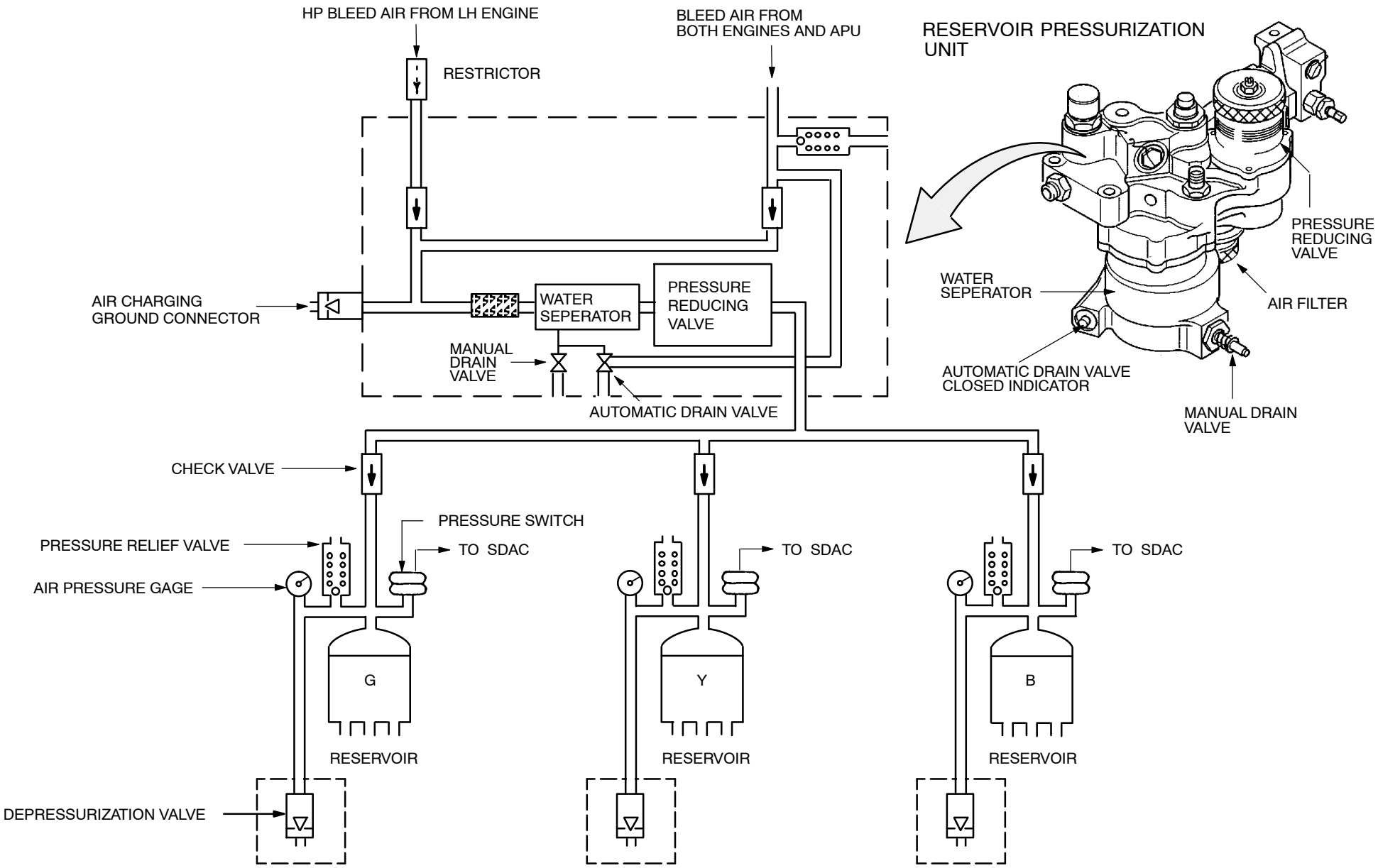

Figure 38 Reservoir Pressurization System (Configuration 2)

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29–16 HYDRAULIC RESERVOIR FILLING

FILLING/SERVICING DESCRIPTION

It is possible to fill any of the three hydraulic reservoirs from one place. Most of the components of the reservoir filling system are installed on the ground service panel of the Green system.

The system can be serviced using a container or a ground hydraulic supply .

If the source is a container, a flexible pipe makes the connection between the container and the hand pump. You must connect it to the fill valve.

The fill valve is installed in the suction port of the hand pump. It includes a filter and a check valve. The hand pump is the same as the pump in the Yellow hydraulic system, but a different suction port is used.

The self-sealing coupling socket is the connection for a pressurized ground hydraulic supply. There is a restrictor between the coupling socket and the selector valve. The restrictor protects the system against overpressure.

A HP (**H**igh–**P**ressure) filter is installed upstream of the selector valve. The selector valve is a 4 port/4 way valve which gets fluid from the supply and sends it to the applicable reservoir. The selector valve also controls the power supply to the electrical contents indicator

The check valves isolate the LP (**L**ow–**P**ressure) circuits of the main hydraulic systems from the reservoir filling system when it is not in use.

The reservoir quantity indicator on the Green ground service panel,operates together with the filling selector valve and shows the contents of the reservoir which the selector valve is set to.

Refer to AMM 12-12-00

Preconditions for correct filling

- Hydraulic systems depressurized
- Speed brakes and spoilers retracted,
  Thrust reversers closed
- Landing gear doors closed
- Cargo compartment doors closed
- Brake and system accu pressures correct
- Reservoir Air pressure 50 psi.

Reservoir fluid filling procedure (with container):

- Remove the handpump handle from the yellow system service panel.
- Connect the handpump handle to the reservoir filling handpump at the green system service panel.
- Remove the filling hose, kept in position at the green system service panel and connect it to the fill valve
- Put the other end of the fill hose into the hydraulic fluid container.
- Turn the selector to the position of the system you want to fill.

Operate the pump and monitor the increase of the fluid level on the quantity indicator.

Stop the flow of hydraulic fluid when the pointer of the quantity indicator is at the end of the coloured line of the system you have selected.

If a reservoir is overfilled it can be drained by operating a drain valve at the bottom of the green and yellow reservoirs.

To drain the blue reservoir a drain valve is located at the blue system service panel.

NOTE: If a ground hydraulic supply is used fit a adapter to the fill valve. The use of the handpump and the flexible hose from the hydraulic service panel is not necessary.

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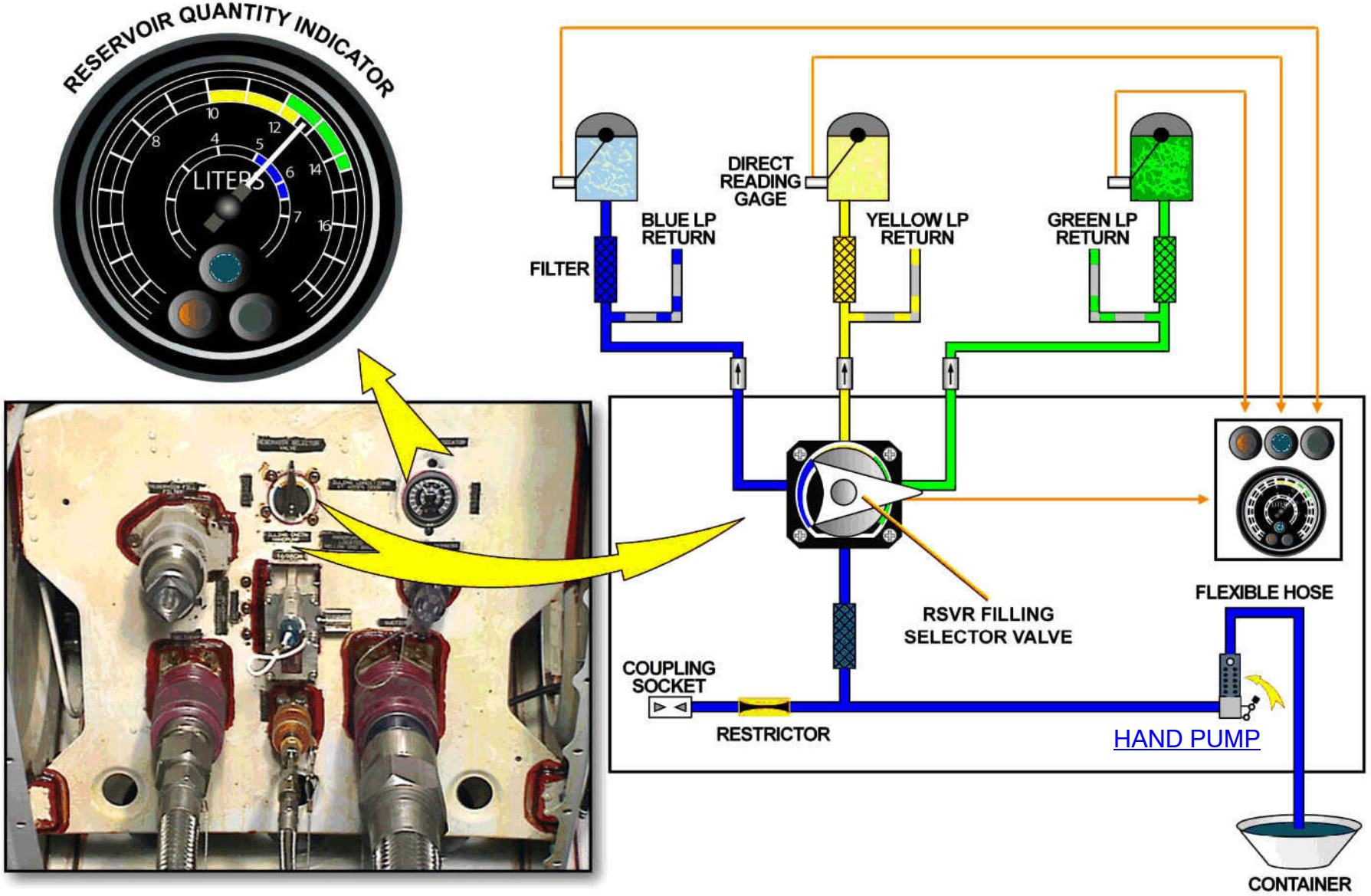

Figure 39 Reservoir Filling System

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29–17 SEAL DRAIN SYSTEM

SEAL DRAIN SYSTEM DESCRIPTION

Purpose

The seal drain system collects hydraulic fluid in 2 collector tanks from the seal drains of specified components of the three hydraulic systems.

The air relief valves of the reservoirs are also connected to the seal drain system. This is to collect any fluid which comes out of a reservoir if the pressure in the reservoir is too high.

The system also gives some protection if the reservoirs are overfilled.

However, if there is an excessive flow of fluid, or if the collector tank is full, the fluid comes out of the overflow pipe. In this case the fluid is not contained and goes into the hydraulic compartment.

Location

The FWD collector tank is in the Yellow hydraulic compartment and is attached between FR40 and FR41.

The AFT collector tank is in the main hydraulic compartment. It is attached to the right side of the keelbeam, forward of FR46.

System Description

The seal drain system has two plastic collector tanks (FWD and AFT) with related pipes and hoses. Each collector tank has a capacity of 0.75L. (0.1981USGAL) . Remove the hydraulic fluid from the collector tanks at regular times. The collector tanks are attached to the structure with quick release clamps to make them easier to drain.

The components which drain into the FWD collector tank are:

- Electric Pump, Blue System
- Electric Pump, Yellow System
- PCU (**P**ower **C**ontrol **U**nit), Slats
- Air Relief Valve, Green System Reservoir
- Air Relief Valve, Yellow System Reservoir.

The components which drain into AFT collector tank are:

- PCU (**P**ower **C**ontrol **U**nit), Flaps
- PTU (**P**ower **T**ransfer **U**nit)
- CSM/G (**C**onstant **S**peed **M**otor/**G**enerator)
- Air Relief Valve, Blue System Reservoir.

The components of the system are connected with silicon hoses and aluminium pipes. The system is designed so that fluid drains into the collector tanks under the influence of gravity.

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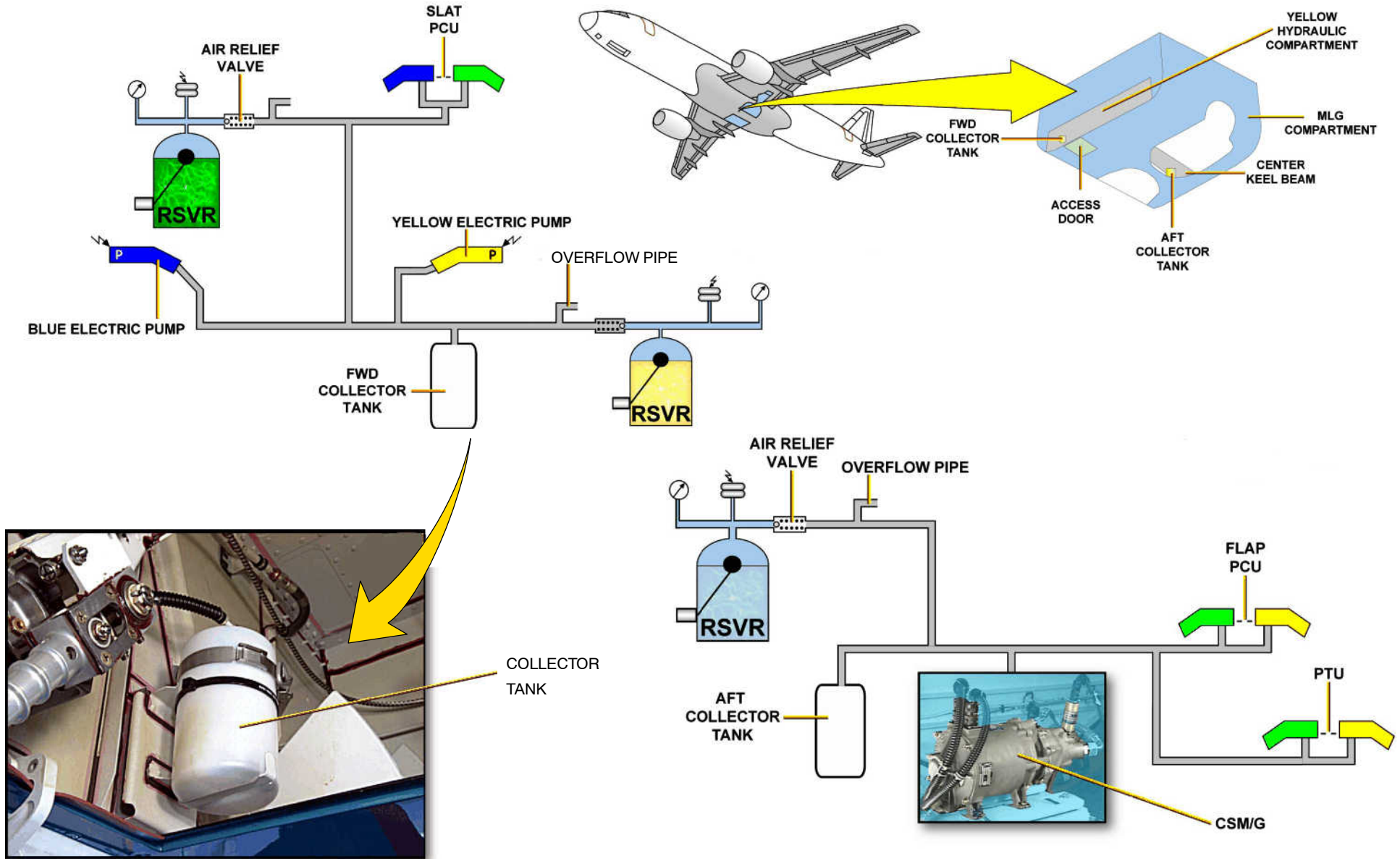

Figure 40 Seal Drain System

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29–19 GROUND INTERNAL LEAK TEST SYSTEM

SYSTEM OPERATION

General

The ground internal leak test system is divided into three parts, one for each of the Green, Blue and Yellow hydraulic systems.

Each part has:

- a ground leakage–measurement manifold
- a solenoid valve
- a pushbutton switch in the cockpit (50VU).

Purpose:

The ground internal leak test system makes it possible to check the total leakage of specified parts of the hydraulic systems.

It is necessary to measure the leakage to make sure that the system performance keeps in the specified limits. It is also possible to make sure of the Condition of components during maintenance.

A ground test rig and flowmeter are used to supply and measure the flow of fluid.

Power Supply

The ground internal leak test system gets electrical power from the DC system of the aircraft. The service bus supplies 28V DC to each solenoid valve through the applicable pushbutton switch.

Ground Leakage – Measurement Manifold

There are three ground leakage–measurement manifolds. 0ne is installed in each hydraulic system. All three manifolds are the same.

The manifold has two pairs of inlet ports (2 are identified as A and 2 are identified as B) and three outlet ports (identified as C, D and E). Only one inlet port from each pair is used, the ports which are not used are sealed.

In the manifold there are three check valves and three 2/2 way valves. All of the valves are spring loaded poppet type valves. The 2/2 way valves are manually operated. They are only selected to open for ground maintenance tasks.

Solenoid Valve

Each hydraulic system has a 3/2 way solenoid valve. It controls the supply of fluid to the leakage measurement manifold. The solenoid valves are attached to the HP (**H**igh **P**ressure) manifold of their related system. Each solenoid valve has three hydraulic connections between it and the manifold.

They are:

- HP inlet (from system), port A,
- HP outlet (to consumers), port C,
- LP outlet (to return), port B.

All hydraulic connections are of the bobbin type. When the system is pressurized, and the solenoid is de–energized, ports A and C are connected together. When the solenoid is energized ports B and C are connected and the connection between ports A and C is closed. In addition, the solenoid valve (3150GP) of the Yellow hydraulic system has a restrictor. When the solenoid is energized, this restrictor allows a small (2.5 ± 0.2 1.min (0.6604 ± 0.0528 USGAL.min)) flow between ports A and B. This internal leakage is related to the automatic function of the solenoid valve on operation of the cargo doors.

It makes sure that the flight control surfaces do not move during such operation.

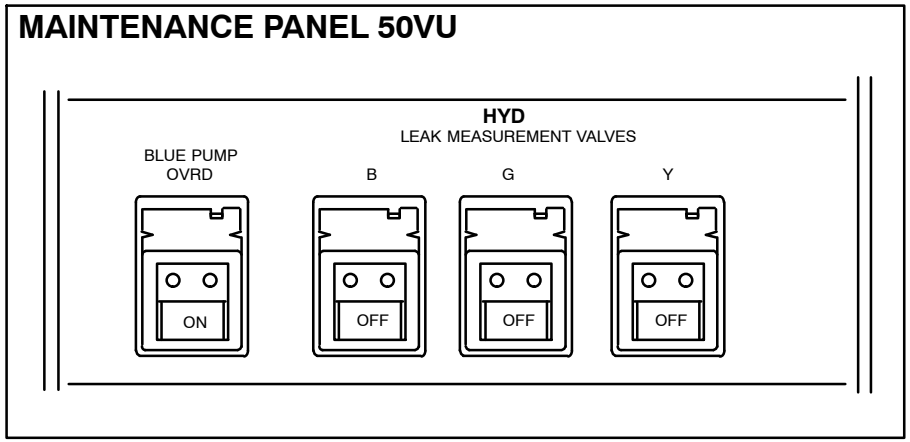

Figure 41 Ground Internal Leak Test – Maintenance Panel

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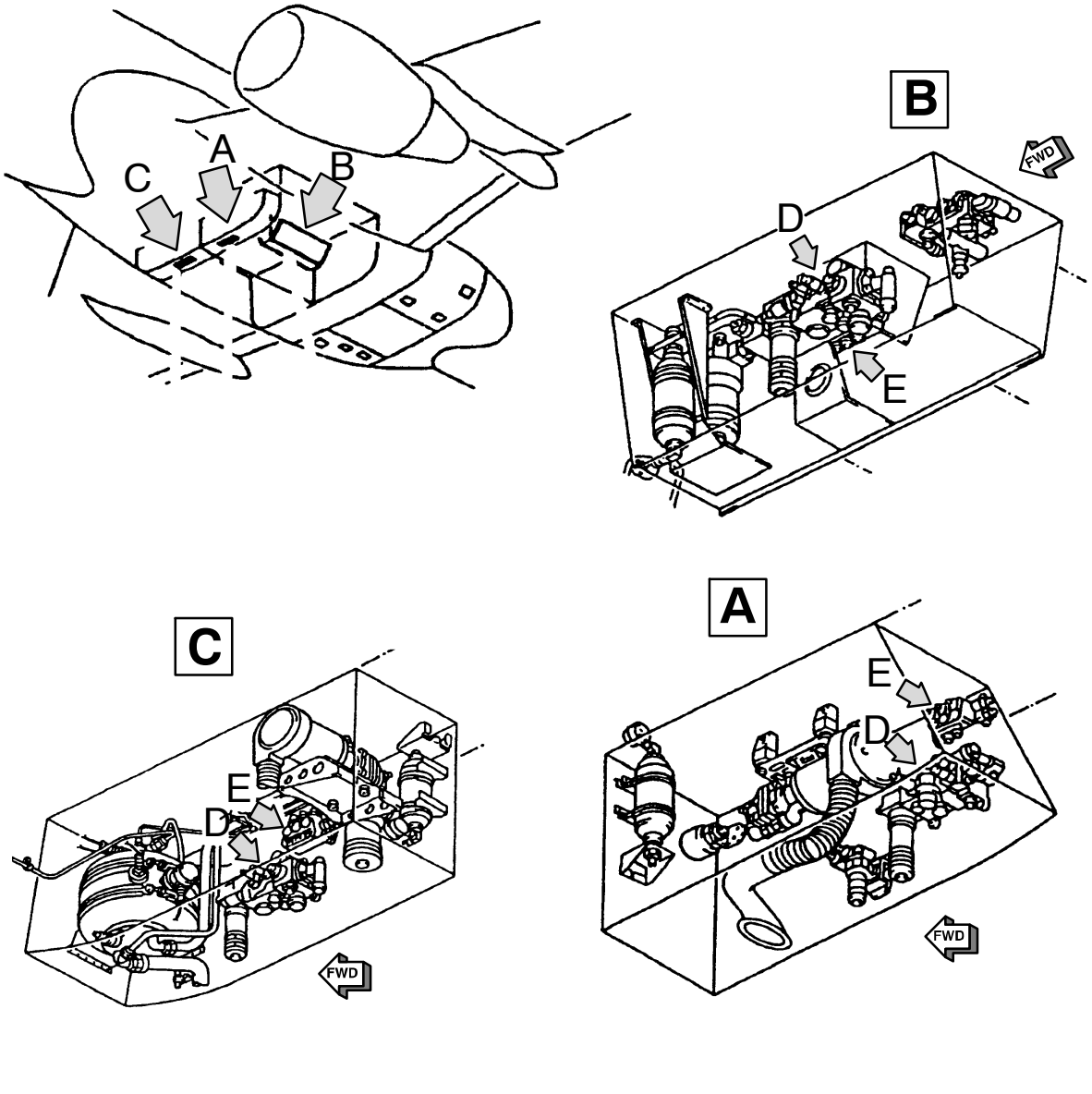

Figure 42 Internal Leak Test Components

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System Description

The ground leakage – measurement manifold and the solenoid valve are installed in the HP (**H**igh **P**ressure) circuit of the applicable system. The solenoid valve controls the flow of the hydraulic fluid between the HP manifold and the ground leakage – measurement manifold.

When the Yellow electric pump starts because of the operation of the cargo doors, the movement of the flight controls is prevented. Electrical power is supplied to the solenoid valve and the two solenoid valves.

Operation

The operation of the ground internal leak test system in each system is the same.

During Flight

During flight, the solenoid valve is open (de–energized) and the 2/2–way valves in the ground leakage–measurement manifold are closed. Inlet port A of the ground leakage–measurement manifold gets HP fluid through the solenoid valve.

The fluid divides into three flows. Each flow goes through the applicable check valve to the outlet port of the applicable 2/2–way valve (closed). It then leaves the ground leakage–measurement manifold through the applicable outlet port (C, D or E) to supply the related systems.

Fluid also goes into the ground leakage–measurement through inlet port B. The fluid divides into three flows. Each flow goes to the inlet port of the applicable 2/2–way valve. The valve is closed and the flow of fluid stops.

During Ground Maintenance Tasks

During ground operation of the system, the applicable pushbutton switch on the maintenance panel (50VU) is set to close the related solenoid valve. This means that the HP inlet port is closed and the HP supply port is connected to LP return. No HP fluid goes to inlet port A of the ground leakage measurement manifold.

A ground test rig and flow meter, connected to the applicable ground service panel supply HP fluid to the system. The HP fluid goes through the HP manifold to inlet port B of the ground leakage–measurement manifold. The HP fluid divides into three flows and goes to the inlet ports of the three 2/2–way valves. It then goes through the valve which has been opened to supply the applicable part of the aircraft.

The pushbutton switch controls the solenoid valve. When the solenoid valve is energized the supply of fluid goes only to the manual valves of the manifold. Thus it is possible to control the supply of fluid to different parts of the aircraft.

Thus no hydraulic power is supplied to the power transfer unit (PTU)and the flight controls.

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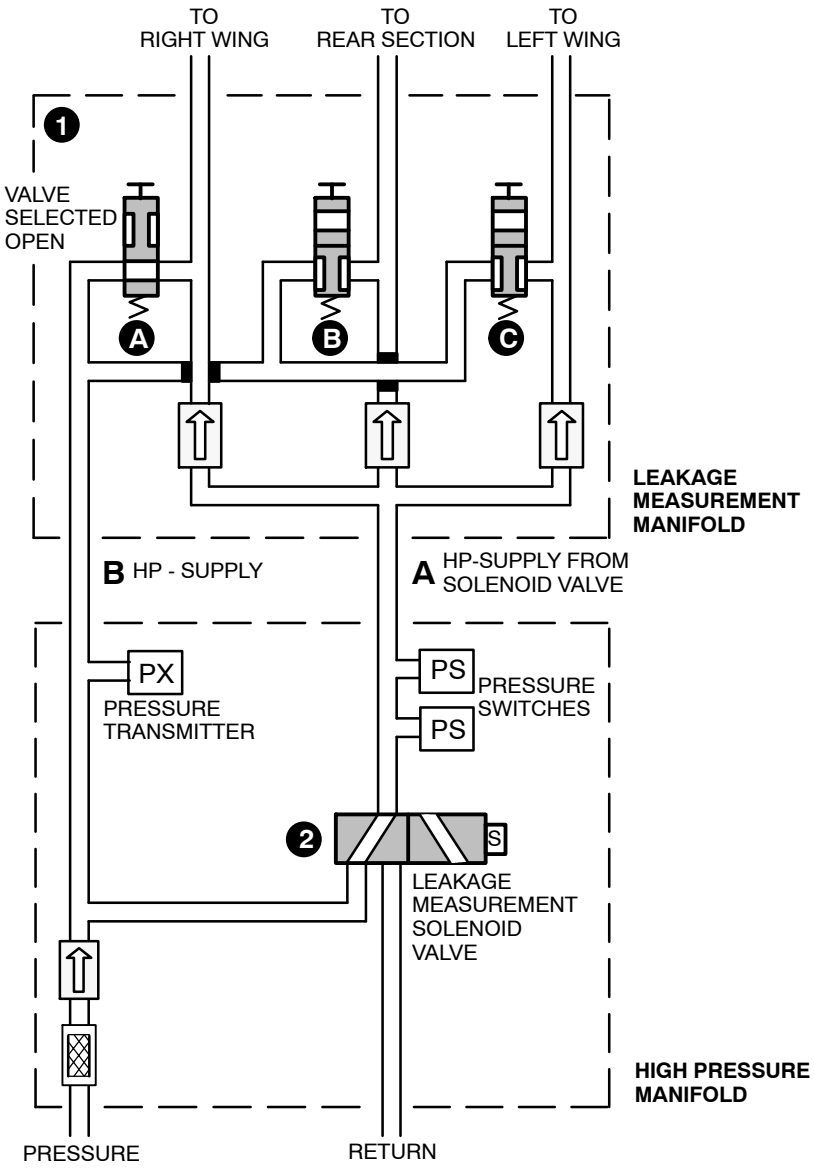
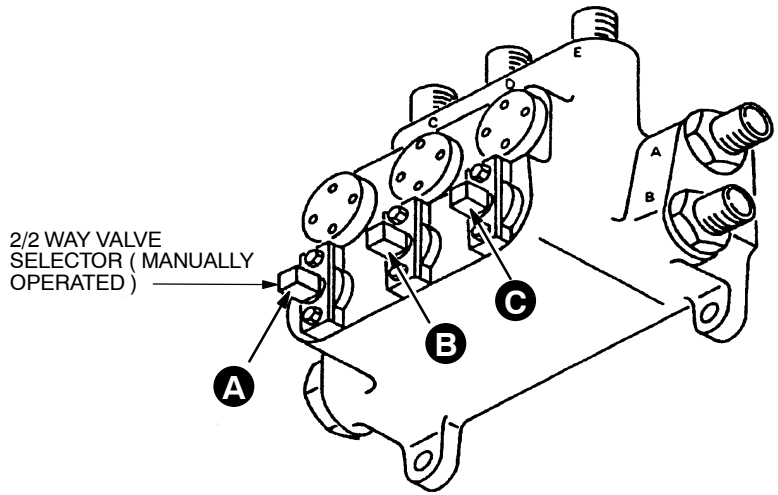


1 Ground Leak Measurement Valve



Note: The valve block may be removed on enhanced A/C

2 Leak Measurement Solenoid Valve

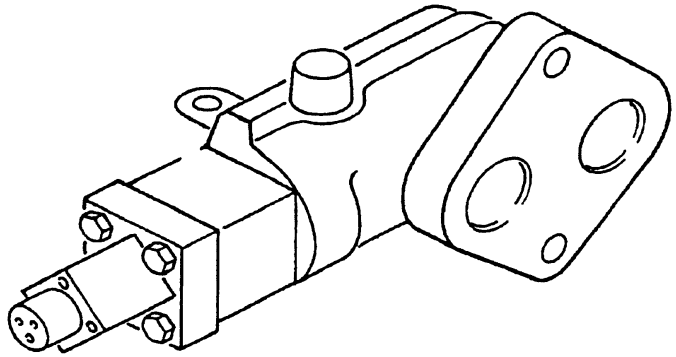


Figure 43 Internal Leak Test System

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ULTRASONIC FLOW METERING SYS DESCRIPTION

The UltraSonic Flowmeter (USF) is used to measure the internal leakage of the green, blue and yellow hydraulic systems.

The USF is only used on ground.

The Transmitter and the leakage transducer are the main components of the USF.

The USF transmitter has on its front panel:

- a keypad,
- a display,
- three indication LEDs,
- a connection port for the leakage transducer.

The leakage transducer has:

- two transducer measuring heds to measure the flow rate,
- a temperature probe to measure the hydraulic fluid temperature,
- a transducer cable to be connected to the transmitter,
- a fly nut for the attachment to the hydraulic pipe,
- a fastening chain with a protection tube and a chain clamp to safety the
- leakage transducer during the leakage measurement procedure.

NOTE: The Ultasonic Flow Metering System can be used as an alternative measuring method or if the ground leak measurement valve block is removed (enhabced A/C).

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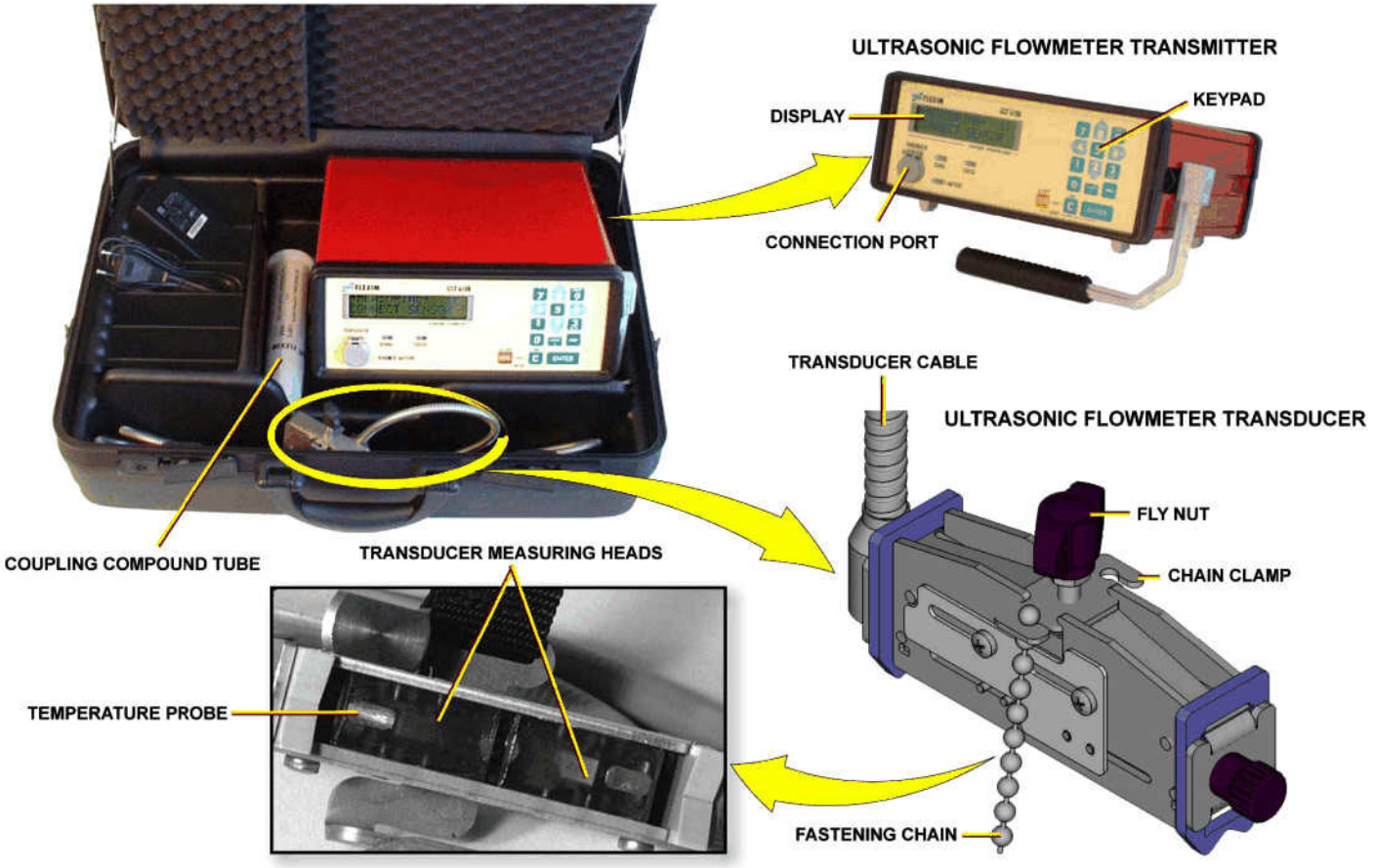

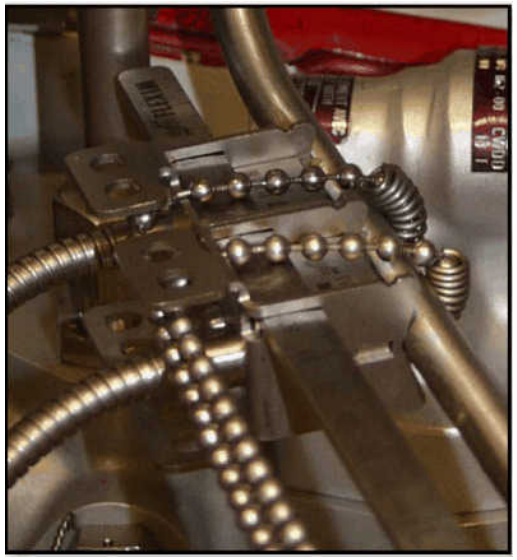

Figure 44 Ultrasonic Flow Metering System

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29–22 BLUE AUXILIARY HYDRAULIC POWER (RAT)

RAM AIR TURBINE GENERAL DESCRIPTION

NOTE: The Ram Air Turbine is available in two different configurations (Config 1 & 2).

– Configuration 1 is used on early manufactured A320 aircraft

– Configuration 2 is used on A318/A319/A320/A321 aircraft

Purpose

The RAT supplies the Blue main hydraulic system with hydraulic power in emergency conditions.When necessary an actuator extends the RAT automatically into the airflow.The flight and maintenance crews can also extend the RAT from the flight compartment.

Location

The RAT is installed in the left belly fairing FWD of the main landing gear.The RAT does not operate when in its stow position, but is on stand–by during the entire flight.

RAT Deployment Conditions

Deployment of the RAT can be achieved with:

- **Manual operation**

  of the pushbutton switch RAT MAN ON on the HYD section of the overhead panel 40VU, or
- **Manual operation**

  of the pushbutton switch MAN ON on the emergency electric panel 21VU. The Blue auxiliary system then also supplies the aircraft with electrical power through the constant speed motor/generator (CSM/G) or
- **Automatic**

  into the airflow when there is a total loss of AC power (when the aircraft speed is greater than 100kts).

RAT Retraction

It is only possible to retract the RAT from the RAT control panel when the aircraft is on ground. The RAT control panel is part of the Blue ground–service panel, and the selector switches are in the flight compartment.

Power Supply

The RAT system gets electrical power from the DC system of the aircraft. Hot Battery Bus 1 supplies 28 V DC to solenoid 1 on the RAT actuator through the automatic deployment logic. It also supplies solenoid 1 directly when the HYD OVRD switch is operated. Battery No. 2 supplies 28 V DC directly to solenoid 2 when the ELEC OVRD switch is operated.

WARNING: IF YOU PUSH THE OVRD HYD PB ON 40VU OR THE OVRD ELEC PB ON PANEL 21VU IN THE COCKPIT WHEN THE AIRCRAFT ELECTRICAL CIRCUITS ARE DEENERGIZED (BATTERIE 1 & 2 CONNECTED TO HOT BUS) THE RAT WILL DEPLOY !

Fault Monitoring

When the RAT is in its stowed position, the system is monitored for faults. If a fault is found, the lower DU (**D**isplay **U**nit) of the ECAM shows the RAT fault warning.

These faults will cause a RAT fault warning:

- the RAT is not in its stowed position (and no manual or automatic selection has been made to extend it),
- the change–over valve in the ground check module is in the ”ground check” position (there is an unwanted electrical supply to the change–over valve),
- there is hydraulic pressure in the ”retract” side of the RAT jack (the jack control module is in the wrong configuration).

Only Ram Air Turbine Configuration 1 (A320)

To make sure that sufficient inlet pressure for the RAT is available, the air pressure in the Blue system reservoir is monitored. A pressure switch is installed on the air manifold of the reservoir. The pressure switch sends information to the SDAC/FWC. If the air pressure during flight decreases to less than 3.1bar absolut (45 psia) a class 1 warning is given when the aircraft lands.

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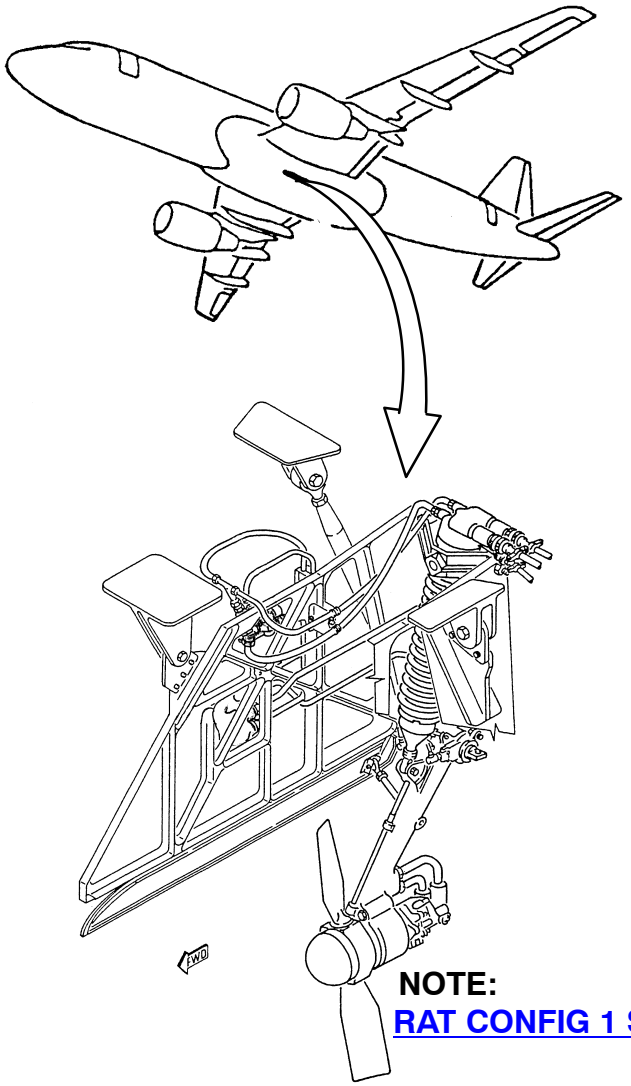
LOCATION



NOTE:
RAT CONFIG 1 Shown !

RAT Extension Electrical Schematic

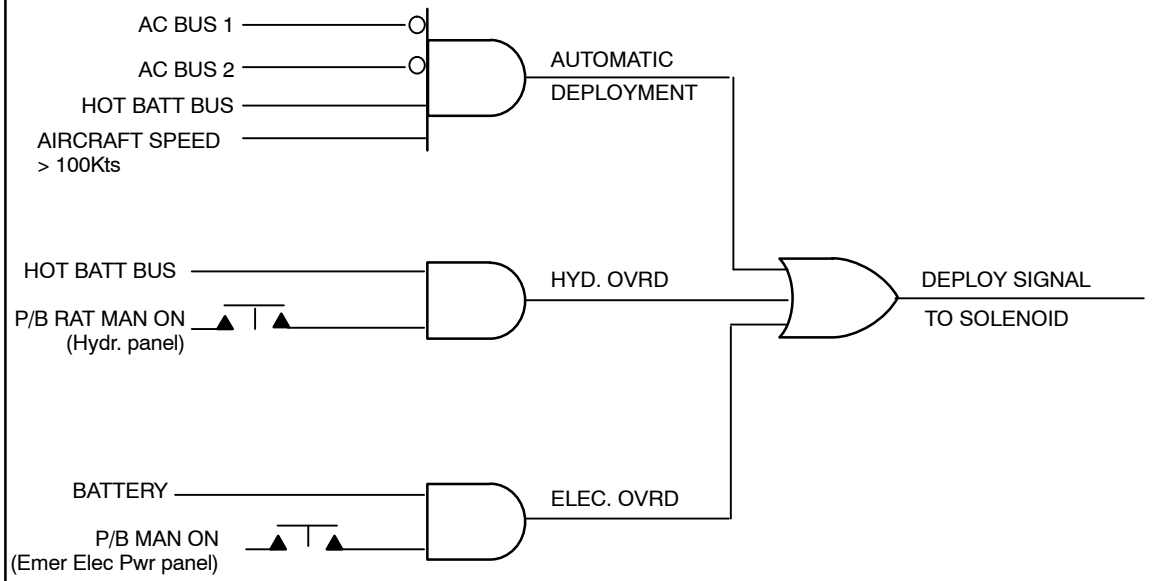


Figure 45 Ram Air Turbine General

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RAT (CONFIG. 1) DESCRIPTION

The hydraulic power available from the RAT (with the landing gear retracted) is sufficient to supply the flight controls and the CSM/G (for electrical power). When the landing gear is extended the effect of the nose gear on the airflow reduces the performance of the RAT. Because of that, the CSM/G is automatically switched off when the landing gear is extended. The RAT is available and will operate through all of the flight envelope, but it will stall if the airspeed is less than 130knots.

The RAT is a constant–speed unit with two variable–pitch blades which have a disc diameter of 27.5 in. (69.8cm). The pitch change mechanism is hydraulically operated and contained in the hub together with the speed control governor.

When the RAT is stopped and there is no servo pressure, the blades are held in the fully coarse position. This makes sure that the turbine does not turn too fast on start–up when the RAT is extended.

Also contained in the hub of the RAT are centrifugally–operated overspeed valves.

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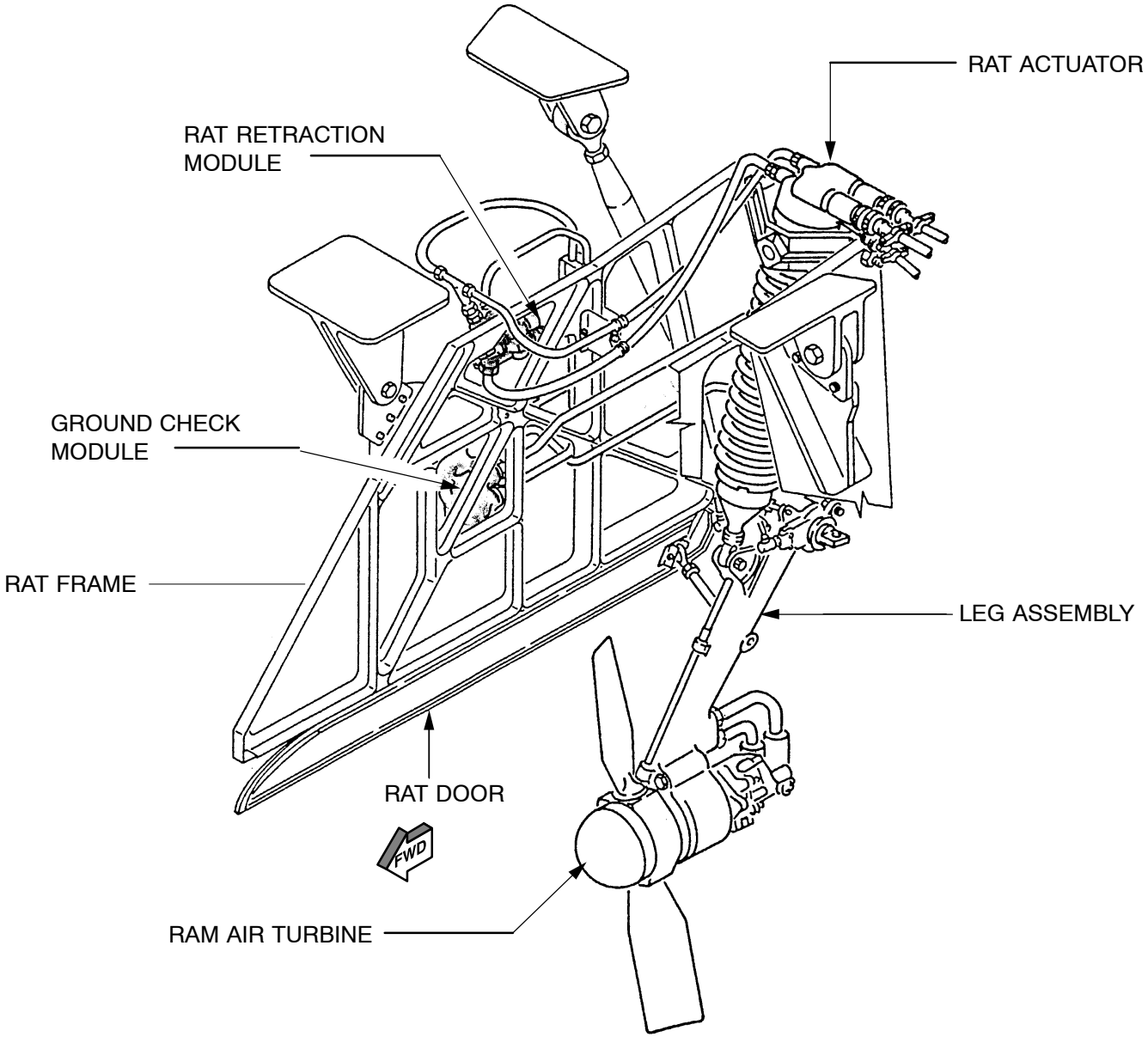

Figure 46 Ram Air Turbine Configuration 1

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RAT (CONFIG. 1) COMPONENTS PRESENTATION

RAT (Ram Air Turbine) Actuator

Two solenoids control the extension. Any one of the solenoids can cause the actuator to extend. Spring pressure causes the ejection jack to extend, which extends the RAT into the airflow. The RAT compartment doors open with the extension of the RAT. When the RAT extends, the stowed proximity switch operates and sends a signal to the ECAM system where the legend RAT OUT appears. The limit switch also stops the supply of electrical power to the RAT retraction module when the RAT is fully retracted. As the RAT is caught by the airstream, the actuator operates as a shock absorber which prevents high–shock loads on the RAT and aircraft structure. In its retracted position in flight, the actuator is not pressurized.

RAT (Ram Air Turbine) Leg Assembly

The leg assembly is the mechanical and hydraulic connection between the turbine/pump assembly and the aircraft.The main part of the leg assembly is a one–piece forging which includes attachments for other components. At the bottom end, the leg assembly holds the turbine at the front and the hydraulic pump at the rear. The top of the leg assembly has a pivot where it is attached to the aircraft structure. The pivot includes swivel connections for the hydraulic supply to and from the pump. The front of the leg assembly has a blade index mechanism. The mechanism locks the turbine so that it does not turn when it is retracted or not fully extended. The blades are locked in position in line with the leg assembly. Thus the blades cannot cause damage to the aircraft skin when the RAT is extended.

RAT (Ram Air Turbine) Index Lock Mechanism

The index lock mechanism is automatically disengaged when the RAT is approximately 5 degrees from full extension.The index mechanism includes a position switch which prevents the retraction of the RAT if the lock is not correctly engaged. The lower end of the leg assembly between the turbine and pump contains a gerotor (gear–type) pump and a frequency wheel/pulse generator. The gerotor pump supplies the pitch change mechanism with servo pressure. The frequency wheel / pulse generator supplies turbine speed data during ground test. The data is sent to the ground test connection in the RAT control panel. The RAT ground test box uses the data during test of the RAT.

The pivot includes two microswitches. One microswitch monitors the turbine index position and will stop the retraction of the RAT if the turbine blades are not in the correct position (this switch only operates until the leg assembly is 11 degrees from its extended position). The other microswitch monitors the position of the leg assembly.

It completes the circuit when the leg assembly is more than 10.5 degrees from its extended position.

RAT (Ram Air Turbine) Hydraulic Pump

The hydraulic pump is installed on the bottom of the RAT leg assembly at the rear. During a ground test of the RAT system the pump operates as a motor.

RAT (Ram Air Turbine) Retraction Control Panel

The RAT control panel is part of the ground–service panel of the Blue hydraulic system .The RAT control panel is a switch box for the ground retraction of the RAT.

RAT (Ram Air Turbine) ground check module

The RAT ground check module is installed in the RAT compartment in the left belly fairing. Its main use is to isolate the RAT from the high-pressure system of the aircraft when the RAT is retracted. It also makes it possible for the RAT to supply the aircraft system when necessary.

A third function is to supply fluid from the high–pressure system to the RAT pump for ground test.

RAT (Ram Air Turbine) retraction module

It is used to retract the RAT.The RAT ground retraction module is installed in the RAT compartment in the left belly fairing. It is a two–position, three-way, solenoid-operated valve. The RAT control panel controls it.

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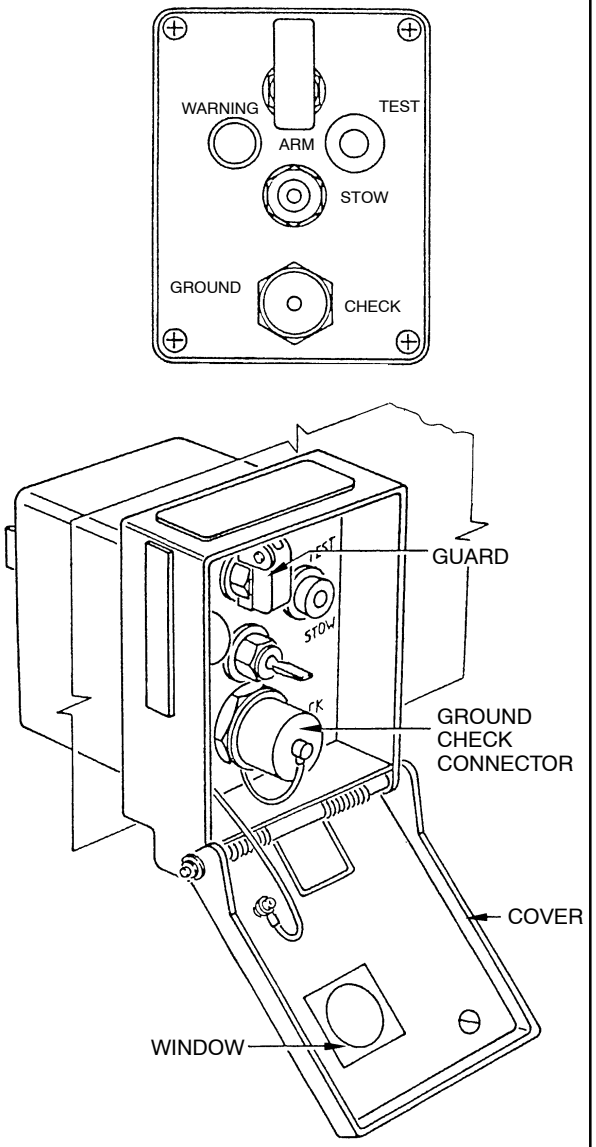
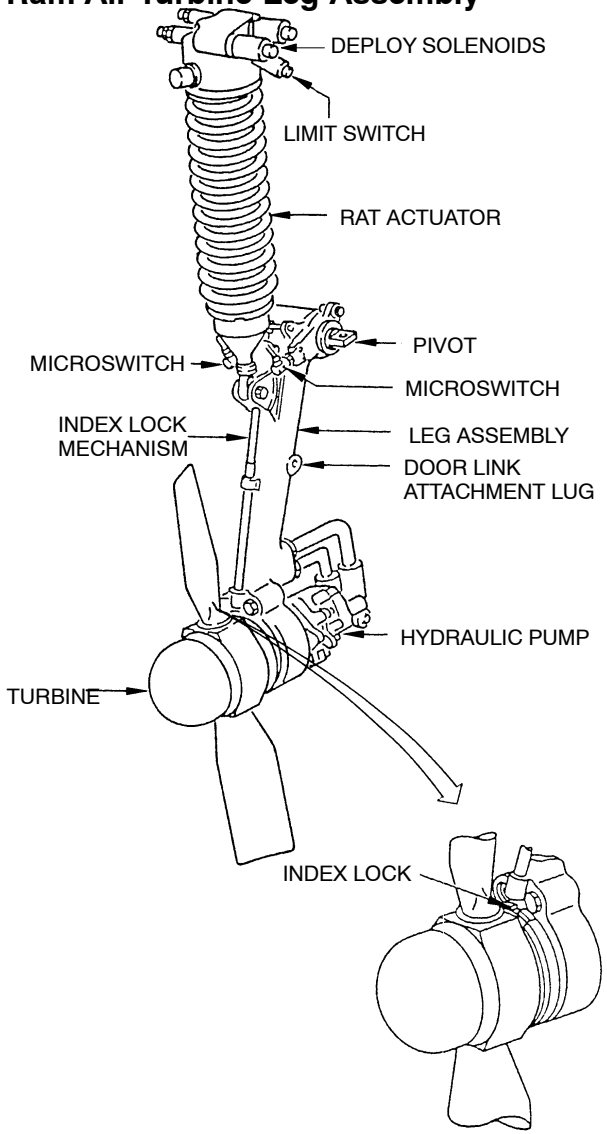
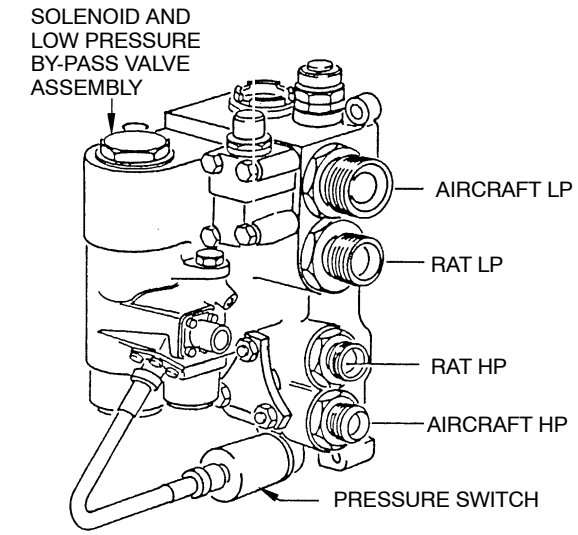
Ram Air Turbine Control Panel



Ram Air Turbine Actuator & Ram Air Turbine Leg Assembly



Ram Air Turbine Ground Check Module



Ram Air Turbine Retraction Module

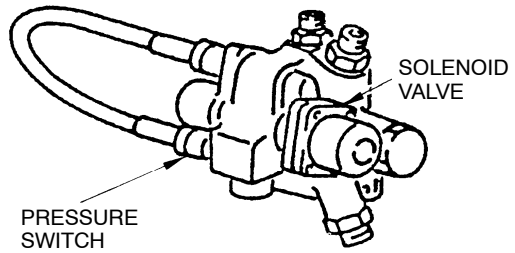


Figure 47 RAT (Config. 1) Components

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RAT RETRACTION PROCEDURE (CONFIG. 1) DESCRIPTION

WARNING: MAKE SURE THAT THE TRAVEL RANGES OF THE FLIGHT CONTROL SURFACES ARE CLEAR BEFORE YOU PRESSURIZE / DEPRESSURIZE A HYDRAULIC SYSTEM.

To retract the RAT ,the blue hydraulic system must be pressurized.

- Open the door of the RAT control - panel in the blue hydraulic service panel.
- Set the ARM switch to the ON position
- Manually set the blades of the RAT in line with the leg assembly.

  (Make sure that the rod of the index lock mechanism is exactly in line with the groove on the turbine spin).
- Make sure the RAT travel range is clear before you retract the RAT.
- The test switch allows to test the red warning light.
- Set the stow switch to the stow position.
- The red warning light illuminates to indicate that the RAT retraction hydraulic module is pressurized.
- Make sure the RAT retracts.

  NOTE: If the stow switch is released during retraction the electrical power supply is stopped and the RAT extends again!

  If the turbine is not correctly lined up,and the stow selection is made,the RAT will start to retract. When the leg gets to approx. 8 degrees from full extension the turbine index switch operates and the RAT returns to the extended position.
- When the RAT is retracted set the ARM switch to the OFF position.
- Make sure the red warning light goes OFF.

  NOTE: The red warning light indicates that the RAT ground retraction module is still in retract mode

  (hydraulic pressurized)

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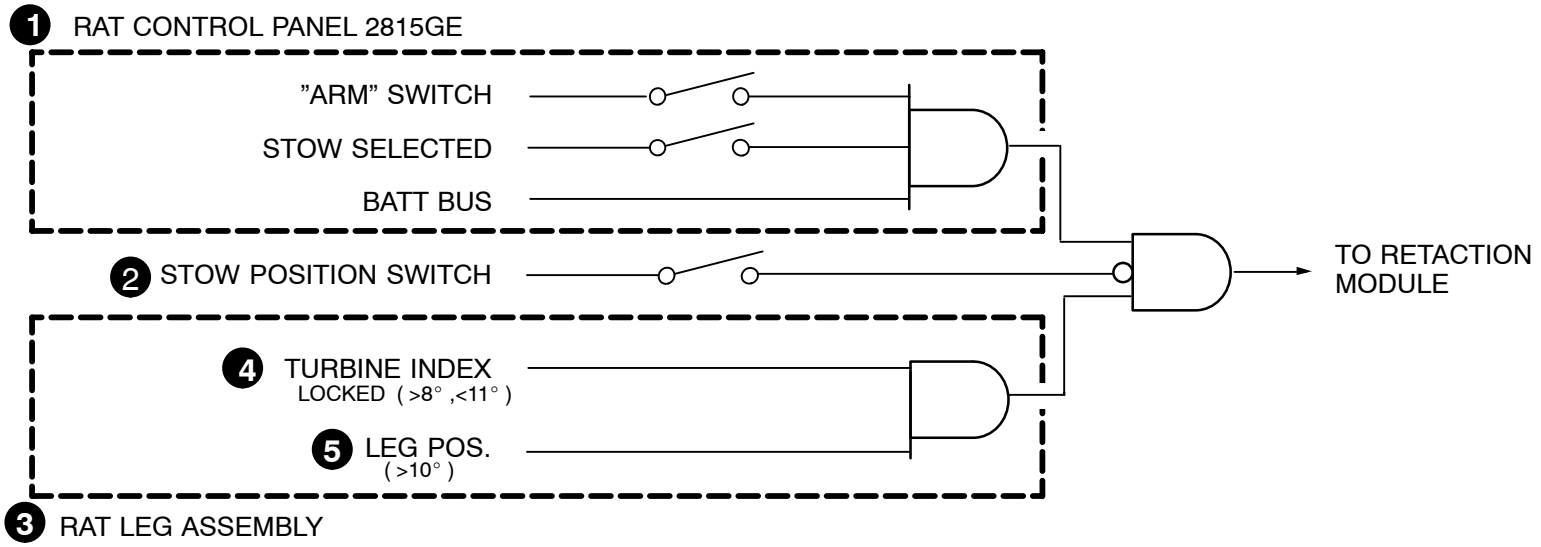

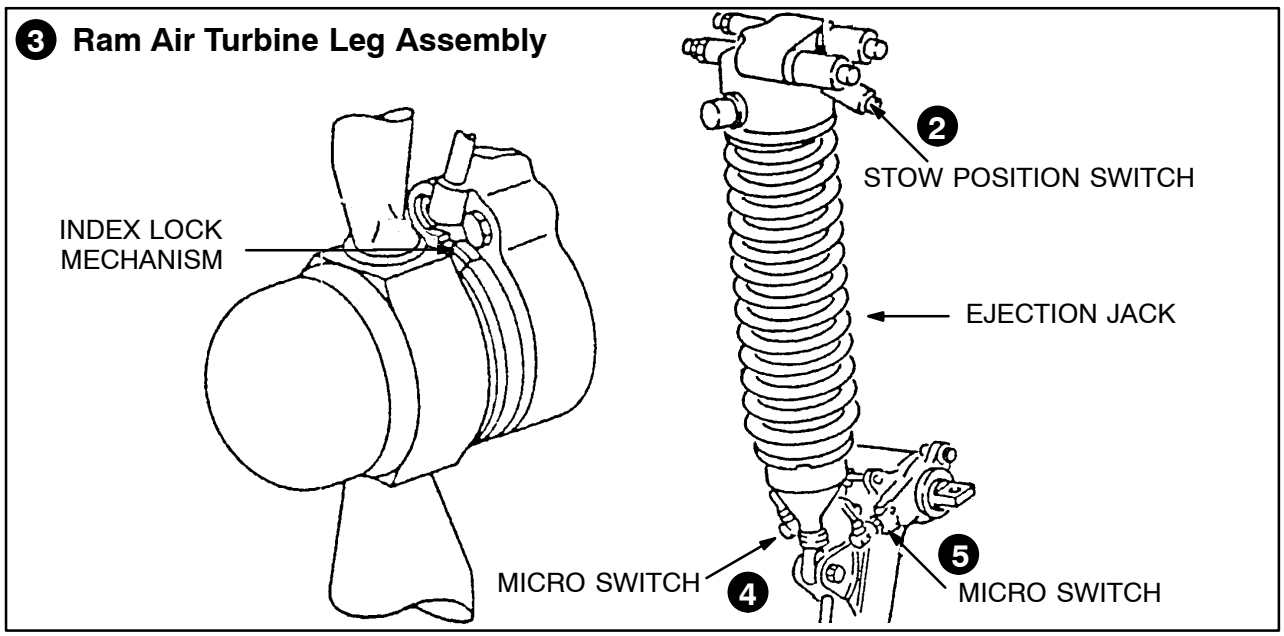

Figure 48 RAT (Config. 1) Retraction

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RAT SAFETY DEVICE (CONFIG. 1) PRESENTATION

Maintenance Operations

A RAT safety device must be installed when working near the RAT to prevent accidental deployment of the RAT.

The device is installed in position between the RAT and the aircraft structure.

When this work is performed circuit breakers of the RAT extension system must be pulled.

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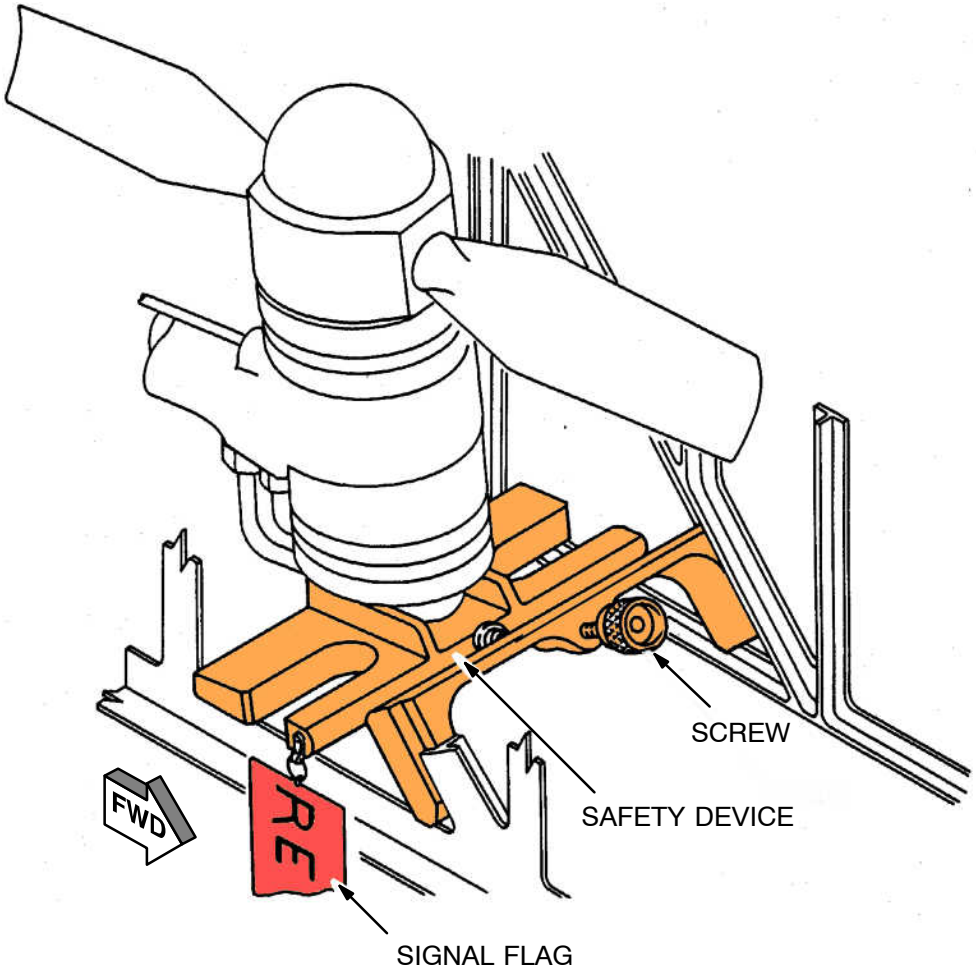

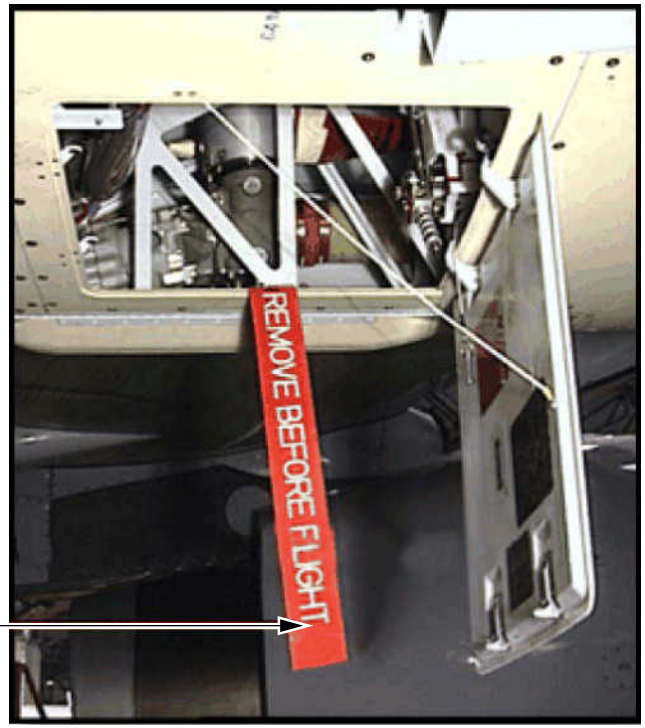

BLUE HYDRAULIC COMPARTMENT

Figure 49 RAT (Config. 1) Safety Device

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RAM AIR TURBINE (CONFIG. 2) DESCRIPTION

The hydraulic power available from the RAT in emergency case is sufficient to supply the flight controls and the CSM/G (for electrical power).

The turbine is a constant–speed variable–pitch unit with two blades. The diameter of the hub assembly with the two turbine blades has an overall diameter of 1003 mm (39.4882in.). The rotation speed of the turbine is kept between 4.800 and 6.540 RPM (**R**evolutions **P**er **M**inute) because of the blade pitch angle adjustment. A governor mixes the blade counterweight, the governor, the spring and the aerodynamic forces to adjust the blade pitch angle.

The turbine is attached to the lower end of the leg assembly and operates the gearbox which drives the hydraulic pump.

An index mechanism locks the rotary assembly (turbine blade and hub) in the stowed position and during extension. During extension the rotary assembly is locked until not more than 10 deg. before full extension. A clearance of 19 mm (0.7480in.) between the RAT doors and turbine blades is given.

The hub has markings to make sure that the index mechanism and the hub align easily for the retraction of the RAT. It is not possible to retract the RAT more than 10°. if the rotary assembly is not correctly locked or if the ground tool is installed. The index mechanism therefore prevents damage to the RAT, the RAT doors and the aircraft structure.

The RAT is available and will operate through the entire flight envelope. The RAT has a stall protection device which prevents a RAT stall below the governed speed range. The stall protection device limits the maximum power the pump can take from the turbine. When the stall protection device is in operation, the pump displacement is adjusted to get a constant RAT speed not related to the aircraft speed.

The RAT has a de–icing device which is installed in the nose of the turbine hub. This prevents icing when the RAT is in operation.

The de–icing device does not use external power sources. The heat is produced by the eddy current heating device. The heating device has two basic components, an electrically conductive aluminium plate and an even number of samarium cobalt magnets. The magnets are circumferential mounted on a stationary magnetic plate. When relative rotation take place, the flux field, when it passes through the aluminium plate, produces a current. As aluminium has an electrical resistance, power is generated which is than dissipated in the form of heat.

The ejection jack is attached to the top end of the leg assembly and the RAT mounting frame. The ejection jack extends the RAT into the airflow with the force of a spring. Therefore no hydraulic power is necessary to extend the RAT.

Two solenoids and one proximity switch are installed on the top of the ejection jack. The two solenoids release a lock and the RAT extends. The RAT extends when both or one solenoid is energized. An extend lock keeps the RAT in the extended position.

A stow proximity switch gives a signal to the ECAM system if the RAT actuator is extended. Two links attach the RAT compartment doors to the leg assembly and open the doors when the RAT extends. The two links also keep the RAT doors closed when the RAT is in its normal stow position.

The stowed proximity sensor sends a signal to the RAT control panel and the indicator light RAT STOWED comes on when the RAT is locked in its retracted position. The RAT control panel (3GE) is part of the ground–service panel of the Blue hydraulic in the left rear belly fairing. The control panel (3GE) has the controls which operate the RAT retraction.

CAUTION: THIS RAM AIR TURBINE DOES NOT HAVE THE RAM AIR TURBINE GROUND CHECK MODULE.

Hydraulic Pump

The hydraulic pump is a standard axial piston–type pump.

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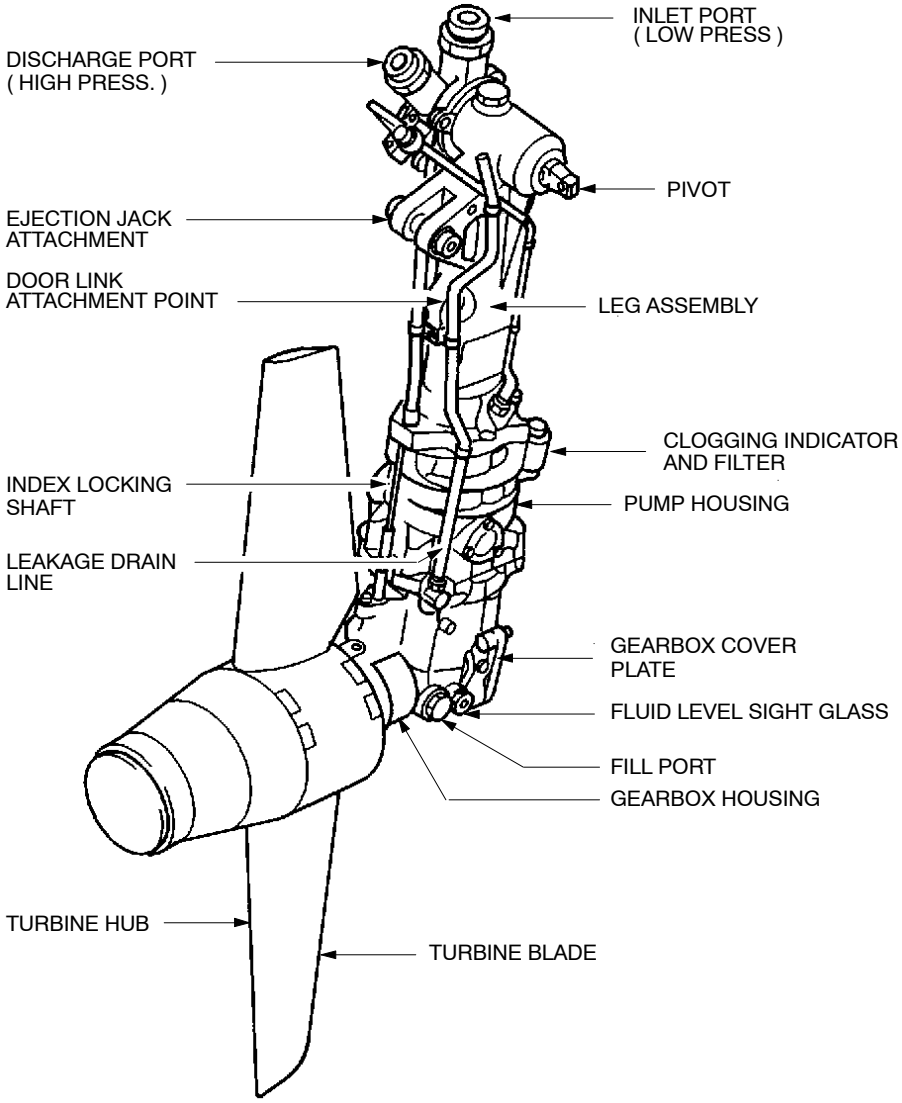

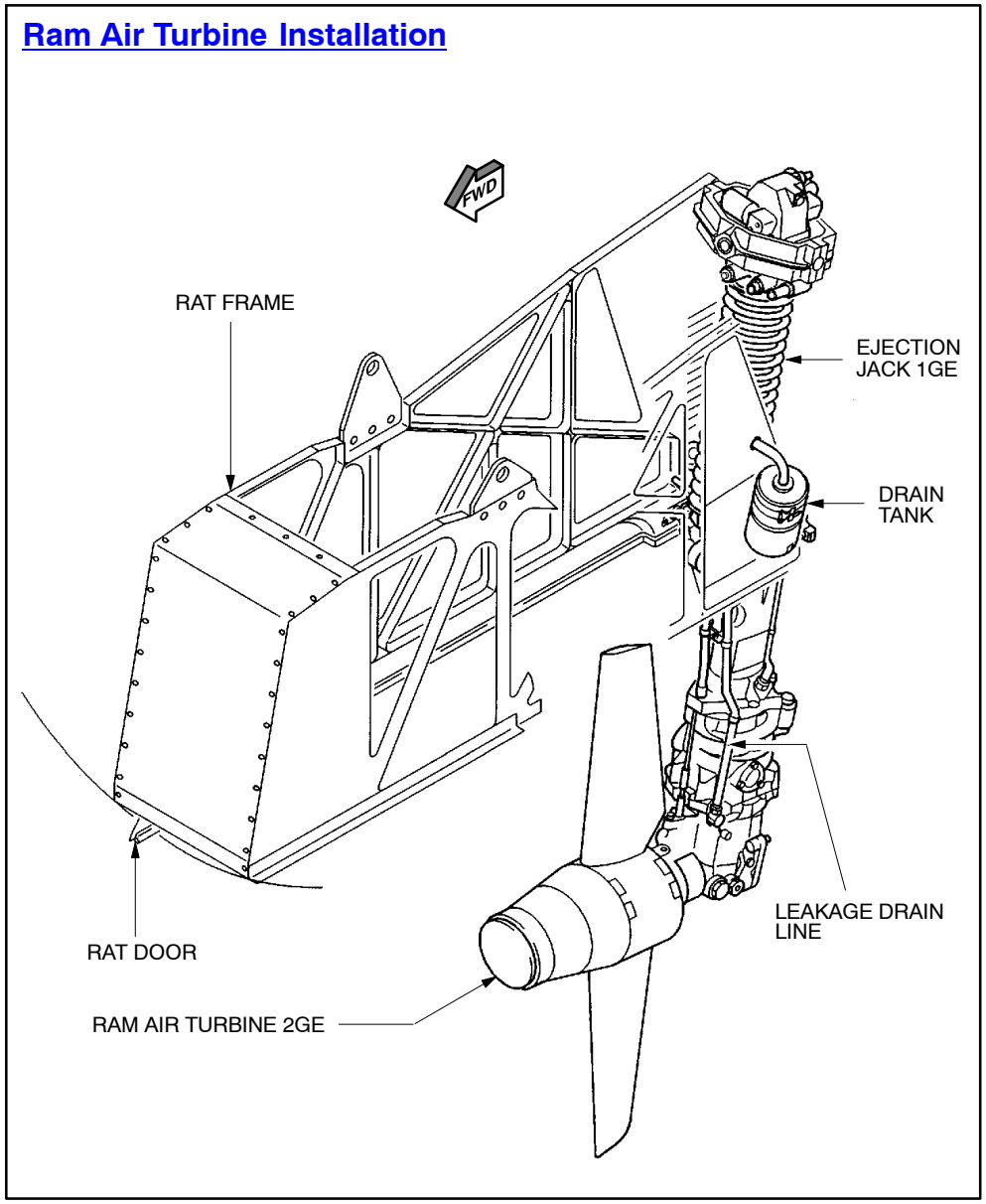

Figure 50 Ram Air Turbine Configuration 2

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RAT RETRACTION PROCEDURE (CONFIG. 2) DESCRIPTION

WARNING: MAKE SURE THAT THE TRAVEL RANGES OF THE FLIGHT CONTROL SURFACES ARE CLEAR BEFORE YOU PRESSURIZE/DEPRESURIZE A HYDRAULIC SYSTEM.

The RAT can only be retacted if:

- the ground test equipment is not attached,
- the cover plate is installed correctly,
- the position arrows on the hub and the lower leg gearbox align (the turbine is then in the index position),
- the ON/OFF (ARM) switch on the RAT control panel is in the ON position (28 V DC is supplied to the RAT stow panel),
- the INTERLOCK WARNING lamp on the RAT control panel is off,
- the Blue main hydraulic system is pressurized.

NOTE: You must manually turn the turbine to the index position, you must also press the warm up flow indicator (which pops out when the RAT extends) back in.

When the ON/OFF switch is set to the ON position:

electrical power is supplied to the STOW/RESET selector switch.

To retract the RAT you must set the spring–loaded STOW/RESET selector switch to the STOW position and hold it there for approximately 20 seconds, then:

- the solenoid operates and connects the high pressure supply of the aircraft to the retract side of the RAT ejection jack,
- the high pressure fluid operates the pressure switch and the ACTUATOR PRESSURE indicator lamp comes on to indicate that the RAT ejection jack is pressurized,
- the high pressure supply releases the ejection jack extend lock and retracts the RAT into the stow compartment,
- the return fluid from the ejection jack goes directly into the low–pressure system of the aircraft.

When the RAT is in its fully retracted position:

- the retract lock of RAT the ejection jack engages and holds the RAT in place,
- the stowed proximity sensor on the RAT ejection jack operates,
- the STOWED indicator lamp comes on.

When the STOW/RESET switch is released and is in the neutral position:

- the RAT ejection jack is depressurized,
- the ACTUATOR PRESSURE indicator lamp goes off.

When the ON/OFF switch is set to the OFF position:

- the power supply is stopped,
- the STOWED indicator lamp goes off.

When the STOW/RESET switch is released before the RAT is fully retracted,the RAT will immediately stop and return in the fully extended position.

Also the RAT will not retract but return to its fully extended position when the RAT retract lock does not engage.

If the marks on the turbine hub and the leg are not aligned and the STOW/RESET switch is set to STOW, the RAT will start to retract but:

- when the RAT is approximately 8 degrees from full extension the interlock proximity switch operates,
- the INTERLOCK WARNING indicator lamp comes on,
- the high pressure supply to the RAT ejection jack stops,
- the RAT returns to its fully extended position. Before you do the retraction again, you must do the subsequent:
- press the warm up flow indicator in,
- align the index marks of the hub with the index marks on the leg so that the index is in the correct position,
- put the STOW/RESET switch to the RESET position to reset the interlock logic in the stow panel.

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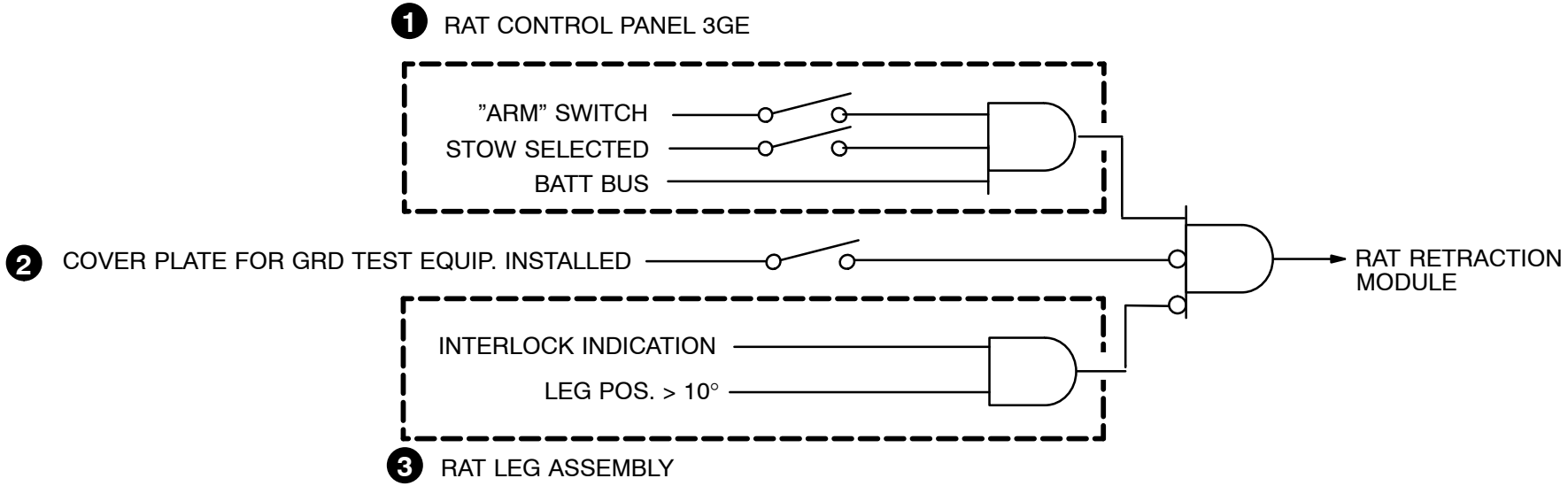

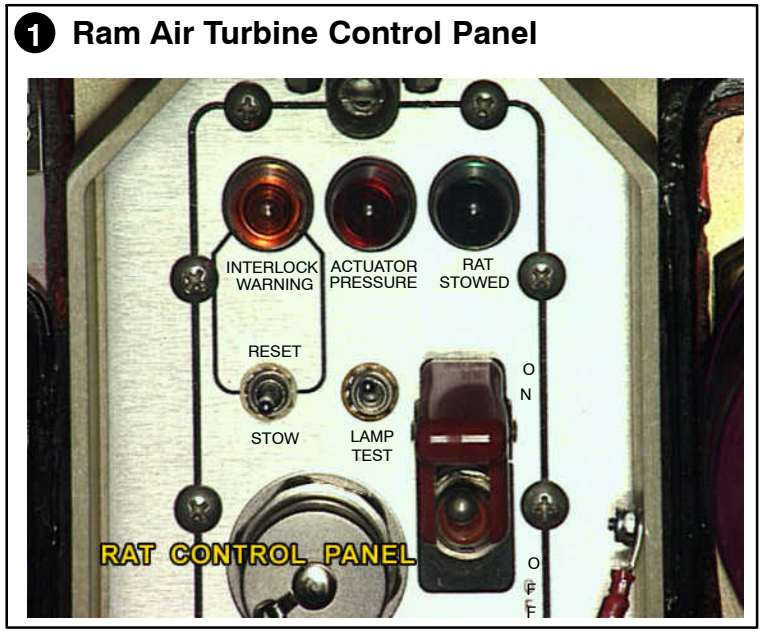

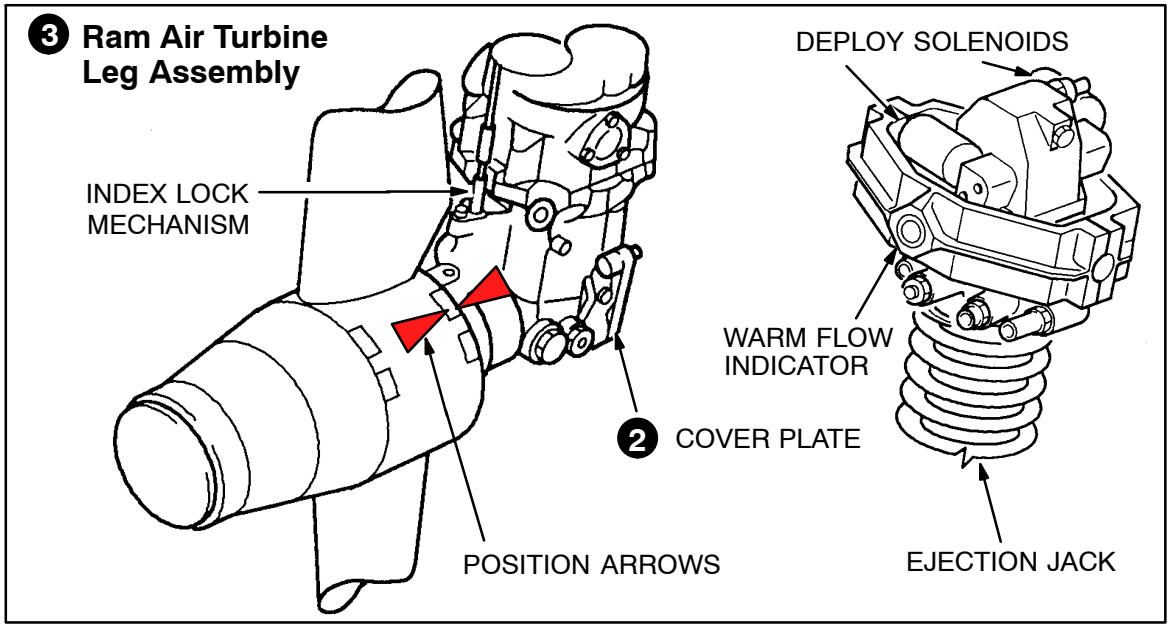

Figure 51 RAT (Config. 2) Retraction

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RAT SAFETY DEVICE (CONFIG 2)

Maintenance Operations

To prevent accidental deployment of the RAT (**R**am **A**ir **T**urbine). When you work near the RAT, you must install the safety device.

The device is installed in position between the RAT and the aircraft structure.

To perform this work circuit breakers of the RAT extension system must be pulled.

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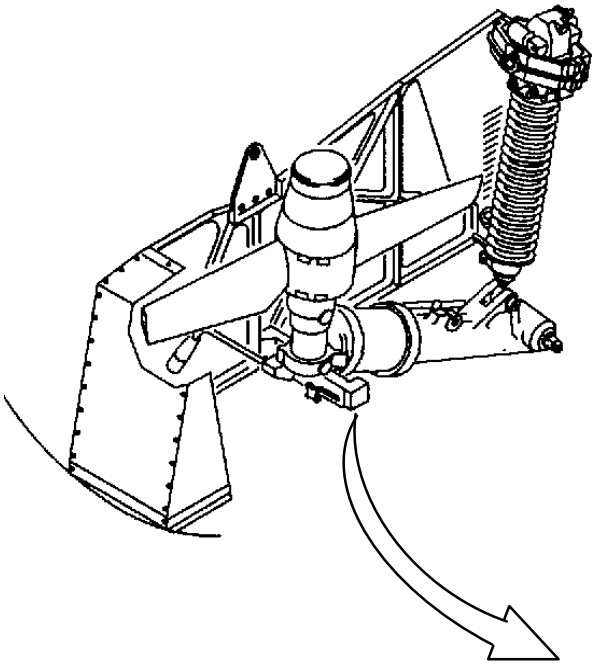

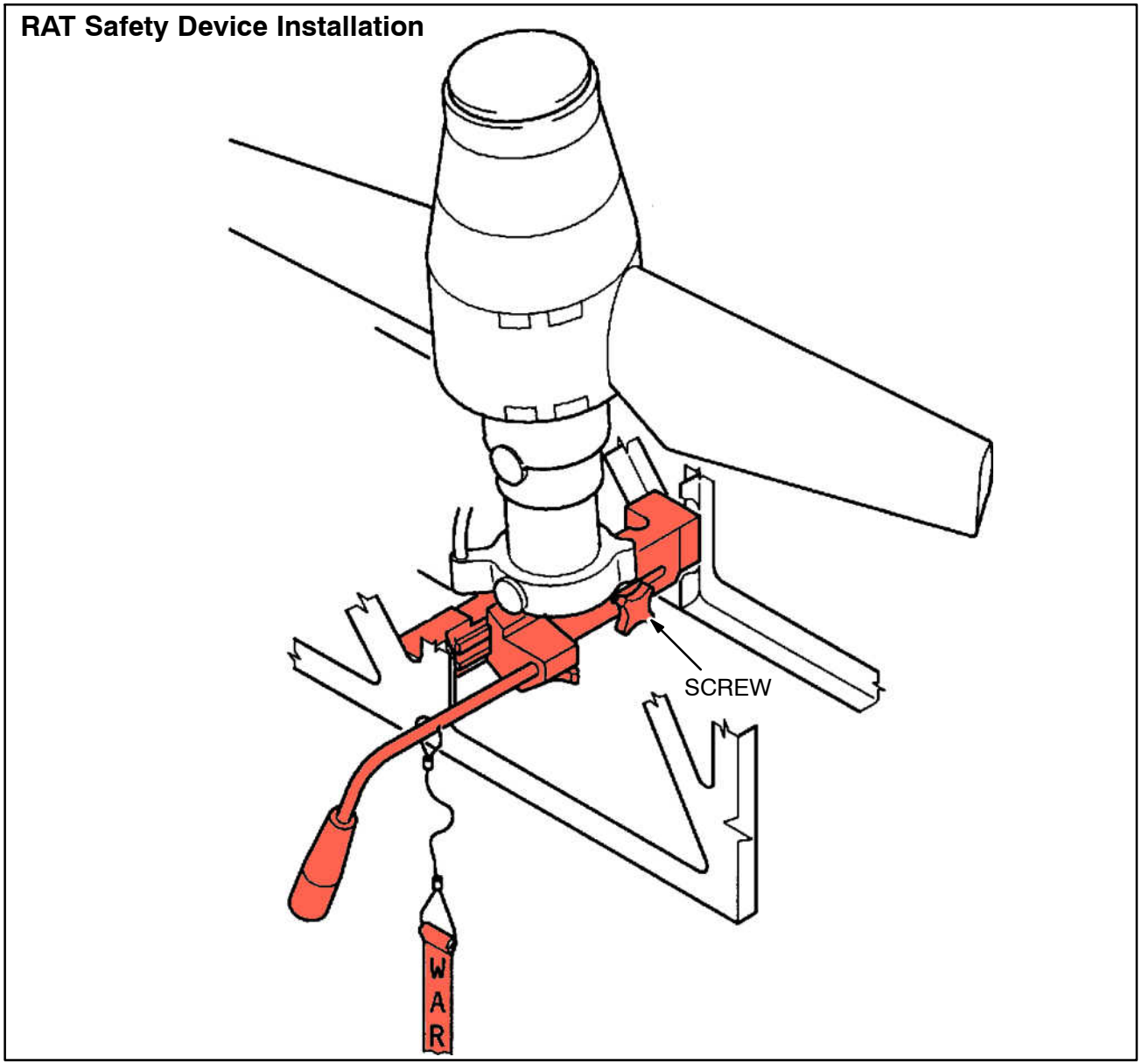

Figure 52 RAT (Config.2) Safety Device

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RAM AIR TURBINE GROUND TEST (CONFIG. 2)

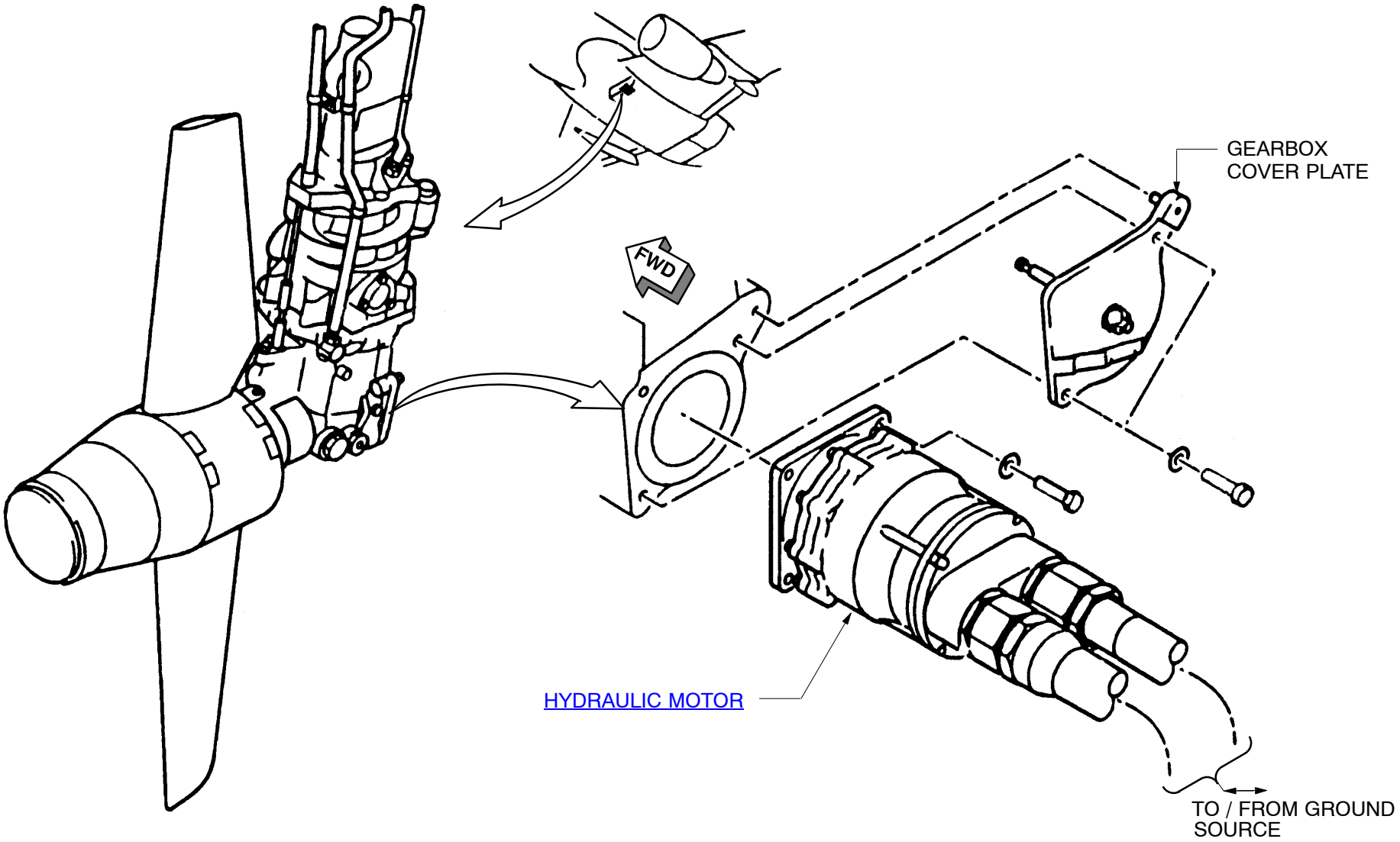

Figure 53 RAT (Config. 2) Ground Test Connection

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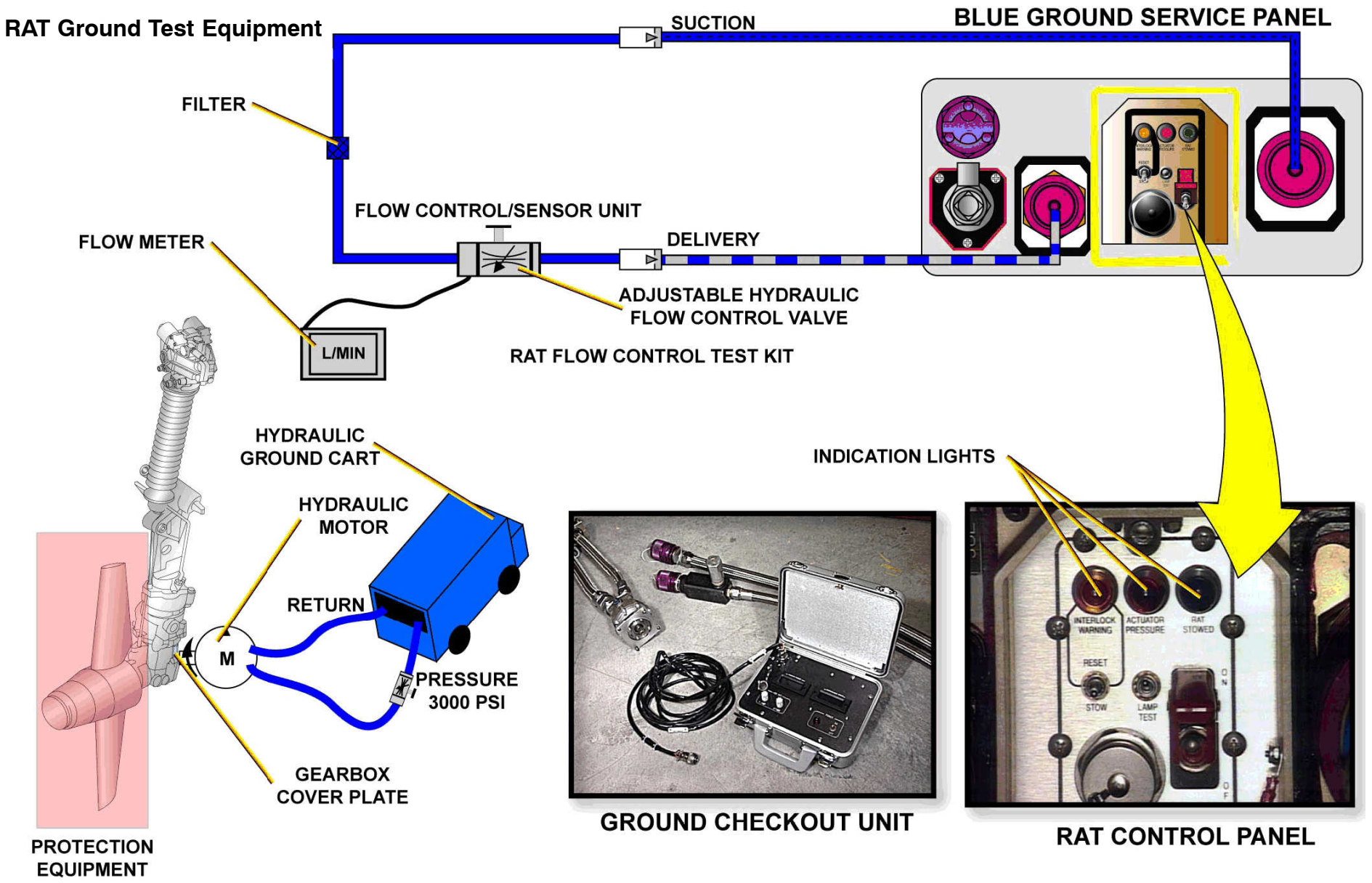

Figure 54 RAT (Config. 2) Flow Control Test Kit

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RAT AUTOMATIC DEPLOYMENT TEST OPERATION

Description

The Automatic deployment of the RAT can be checked on ground by simulating a airspeed and a power loss .

NOTE: For further information refer to
AMM Task 29-22-00-710-004 (ConfigURATION 2)
or
AMM Task 29-22-00-710-001 (ConfigURATION 1)

Brief Description of the Test

For the test the ADIRS must be switched on. A speed can be simulated through the ADIRU system Report Test menu on the MCDU (Test function INTERFACE TEST for ADR) When the Airspeed Indicator shows a speed >100 KT after 10 sec and the CBs ELEC / EMER GEN AUTO / 1 (Z 25) & ELEC/EMER GEN AUTO / 2 (Z 26) on the 122VU are pulled the RAT solenoid 1 is energized and the RAT will deploy.

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Example A319: Airspeed Simulation > 100 Kts
(When CB.s :ELEC / EMER GEN AUTO1 & 2 pulled the RAT will deploy)

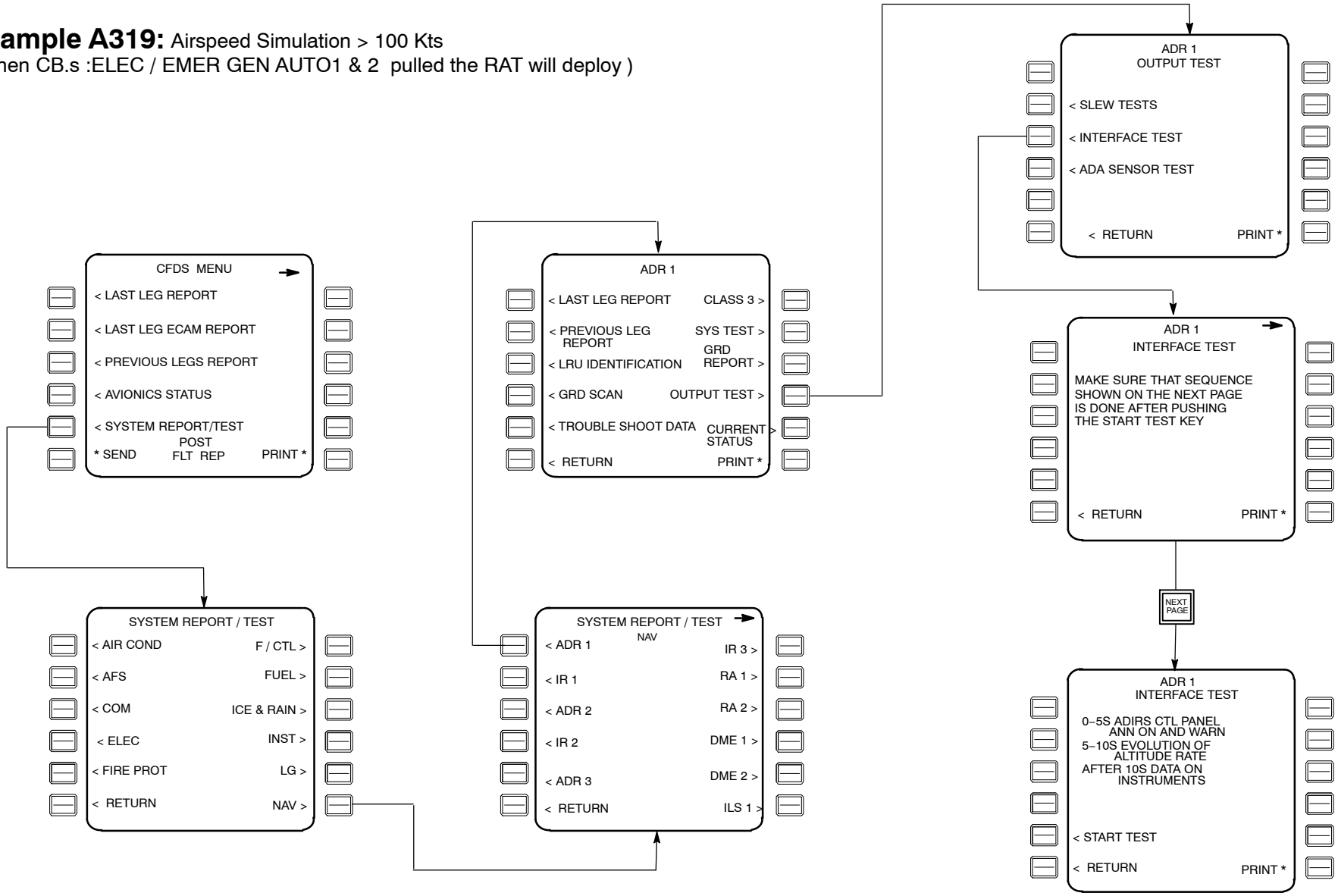

Figure 55 Ram Air Turbine Auto Deployment Test

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29–23 POWER TRANSFER

POWER TRANSFER UNIT DESCRIPTION

Purpose

The aircraft has a power transfer system to transfer hydraulic power between the Green and Yellow systems.

This is necessary if one of the engine pumps fails. It also makes it possible to pressurize the Green system from the Yellow system for maintenance (with the Yellow system electric pump).

The power transfer system is always armed when the hydraulic systems are pressurized. However, the crew can switch it off if necessary.

The connection between the two systems is mechanical. It is impossible for fluid to get from one system to the other.

Location

All components are installed in the main landing gear compartment.

Electrical Power Supply

The power transfer system gets electrical power from the DC System of the aircraft. The service bus supplies 28V DC to the solenoid valves through the PTU switch.

PTU (Power Transfer Unit) Component Description

The main components in the power transfer system are:

- the PTU,
- the solenoid valve (Green system),
- the solenoid valve (Yellow system),
- the isolation coupling,
- the PTU switch.

The PTU is made up of a variable displacement unit coupled to a fixed displacement unit. The variable displacement unit is connected to the yellow hydraulic system. The fixed displacement unit is connected to the green hydraulic system. Displacement of the variable displacement unit is varied to maintain the required running and breakdown pressure differentials between systems.

Isolation Coupling

An isolation coupling is installed in the Yellow system supply line. It is a quick–release coupling which seals automatically when it is disconnected.

It also has a ratchet lock to keep it connected. When the isolation coupling is disconnected (during ground maintenance operations only), there is no transfer of power.

Operation

The usual flight condition is the PTU system ”armed” (the P/B SW set to AUTO and both solenoid valves deenergized open) and the Green and Yellow hydraulic systems at the same pressure. Because the pressures of the two hydraulic systems are within 500psi of each other the PTU does not turn.

The PTU automatically starts to operate when the pressure in one of the two hydraulic systems is approximately 500psi more than the pressure in the other system.

A difference of pressure between the two systems moves the PTU servo valve and the variable cam. This causes a change in the stroke of the variable displacement motor. When the pressure difference is approximately 500psi the change is enough to make the PTU start. Depending on the direction of movement of the servo valve, the variable displacement unit operates as a pump or as a motor. If the Green system has less pressure than the Yellow system, the stroke increases to its maximum. The variable displacement (Yellow) unit operates as a motor and the fixed displacement (Green) unit operates as a pump.

If the Yellow system has less pressure than the Green system the stroke decreases to its minimum. The variable and fixed displacement units then operate as a pump and a motor respectively.

When the Yellow electric pump starts because of operation of the cargo doors, movement of the flight controls is prevented. Electrical power is supplied to the two solenoid valves and the solenoid valve of the Yellow leakage measurement system. Thus no hydraulic power is supplied to the Green or Yellow systems.

Two solenoid valves (one in each system) keep the PTU either armed or off. The solenoid valve of the Green system is connected to the Green PTU manifold. The solenoid valve of the Yellow system is connected to the Yellow PTU manifold. The two solenoid valves operate at the same time. The PTU switch on the overhead panel (40VU) controls the solenoid valves.

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Power Transfer Unit (PTU) System Installation

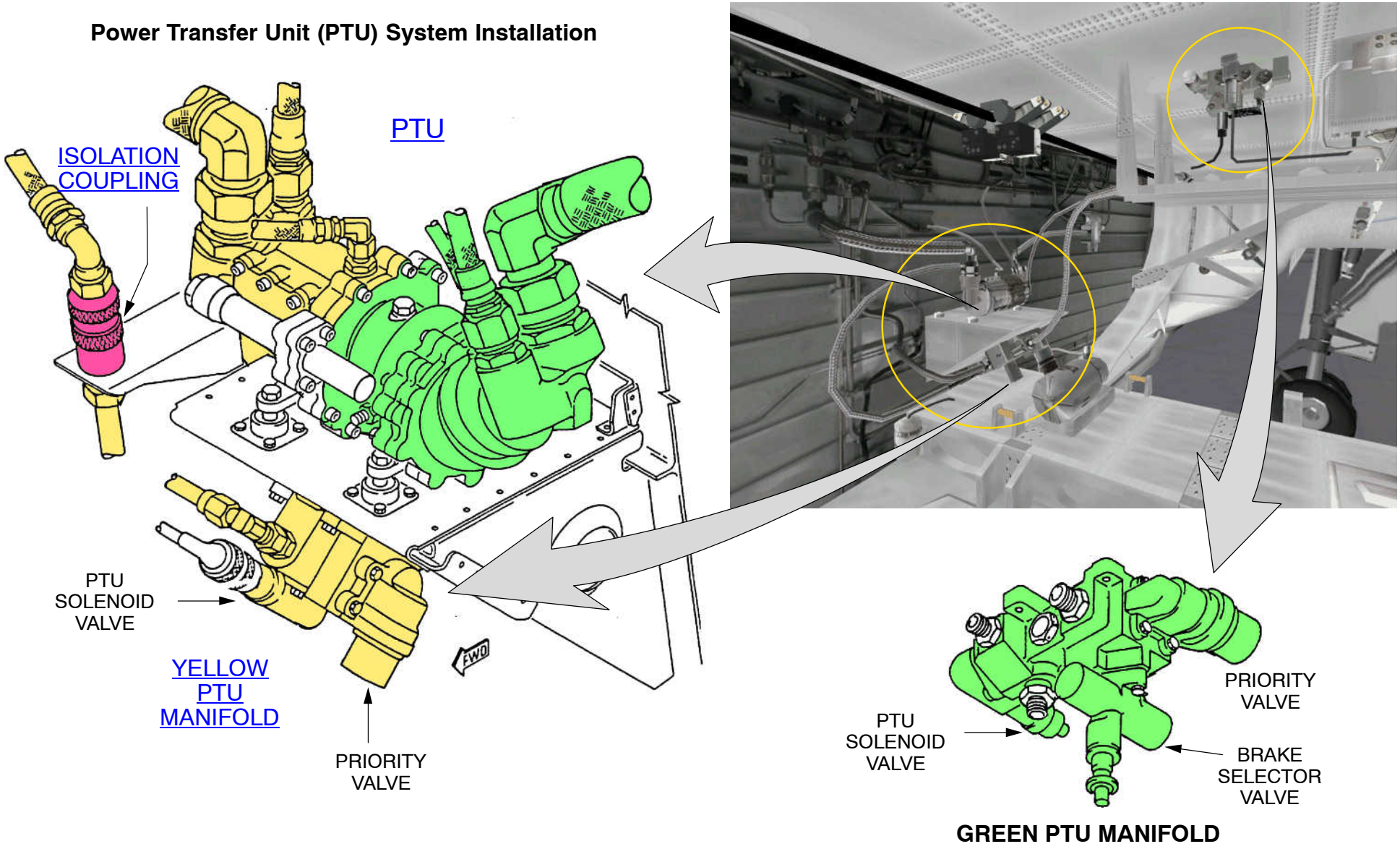

Figure 56 Power Transfer Unit/Manifold Installation

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PTU INHIBITION FUNCTIONAL OPERATION

Aircraft on the Ground Inhibitions of the PTU (Power Transfer Unit)

To prevent unwanted operation of the PTU when the aircraft is on the ground, different switches and relays are installed in the aircraft. They operate together to supply power to the two solenoid valves under certain conditions.

The PTU (Power Transfer Unit) will not operate if:

- the Yellow electric pump is in operation to close the cargo doors, or
- the aircraft is on the ground, only one engine is in operation and the parking brake is ON, or
- the aircraft is on the ground, only one engine is in operation, the parking brake is OFF and the nose wheel steering is deactivated,
- the PTU P/BSW on panel 40VU is set to OFF.

Because the solenoid valves are energized to close them, a 28 VDC supply is necessary to automatically prevent operation of the PTU. If no supply is available, the isolation coupling prevents operation of the PTU during maintenance.

NOTE: In addition the FWC (**F**light **W**arning **C**omputer) does a check of the PTU during the start of the engines. If the master switch of the engine 1 (2) is ON and the master switch of the engine 2 (1) is OFF, the PTU is inhibited. As soon as the master switches of engine 1 and engine 2 are in the ON position, the PTU is no longer inhibited. If there is now a difference in the Green and Yellow hydraulic system of more than 650 psi during at least 4 sec., the ECAM shows a PTU FAULT indication.

Additional inhibition logic after SB A320–29–1126

If after green (or yellow) reservoir low level, the PTU is not switched off, it starts trying to pressurize the green (or yellow) system but due to no fluid in this system, the PTU runs in high speed condition, overheating the fluid of the yellow (or green) system.

To prevent such occurrences, the PTU inhibition logic activation will be done.

The new PTU inhibition logic is armed when A/C is in flight (NLG SHOCK ABSORBER not compressed) and when both engines have been started, stay armed with one engine running, and is de–armed only once aircraft is on ground or both engines stopped.

The PTU is inhibited when the green (or yellow) hydraulic system low pressure condition is detected, for more than 6 seconds, by the two green (or yellow) system pressure switches located on the High Pressure manifold.

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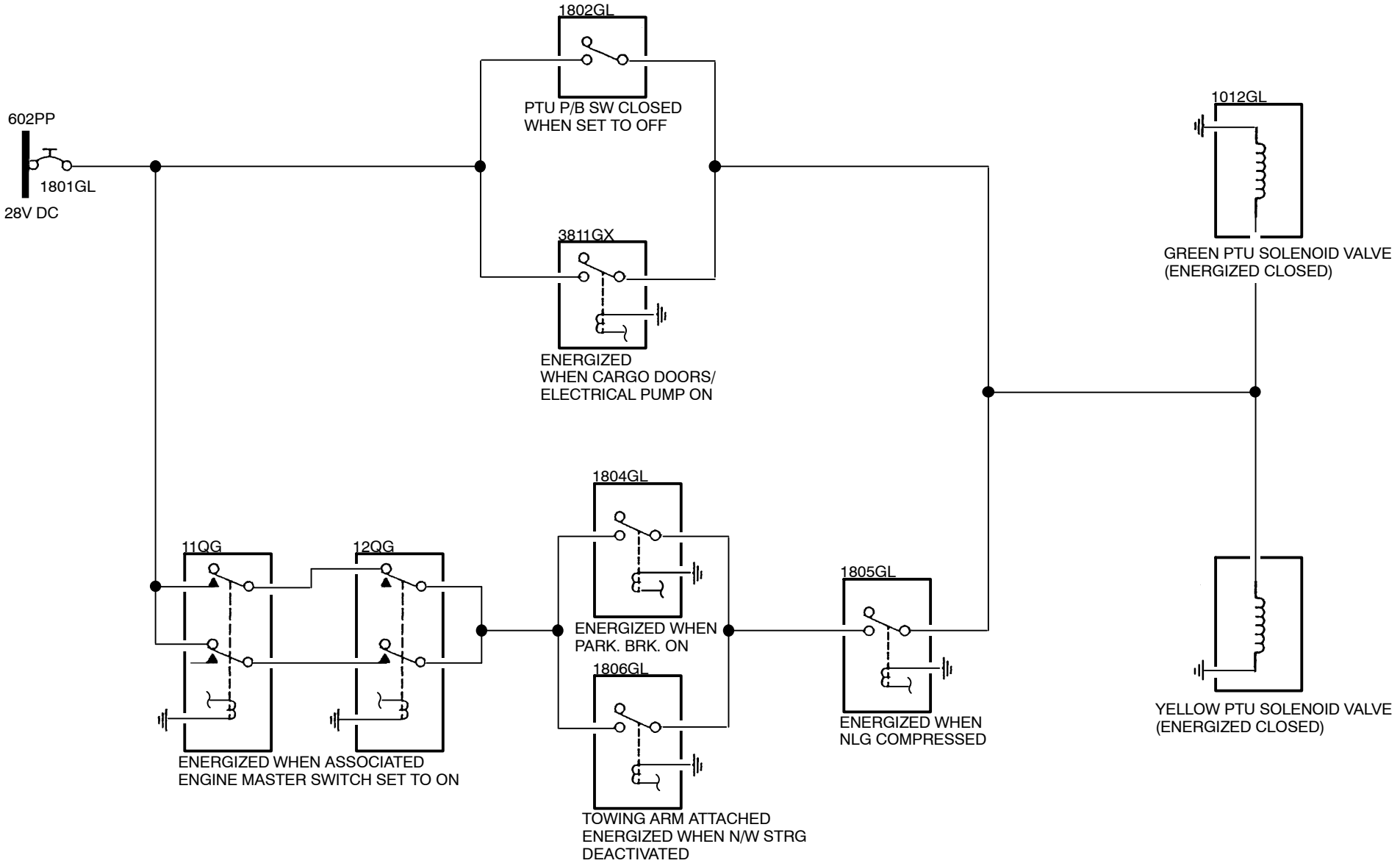

Figure 57 Power Transfer Unit Inhibition (Ground)

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29–24 YELLOW AUXILIARY HYDRAULIC POWER

YELLOW SYSTEM PUMPS PRESENTATION

YELLOW ELECTRIC PUMP

Purpose and Location

The electric pump provides hydraulic pressure for the auxiliary generation system.

It is installed in the Yellow hydraulic bay.

Operation

Operation of the yellow elec. pump pushbutton switch on overhead panel (40VU) controls the electric pump. When the P/BSW is pressed and released, the ON light comes on and the electric pump starts. At the same time the lower unit (DU) of the ECAM shows the operation of the pump (if the HYD page is selected).

It is also possible to start the electric pump from the cargo door operating panel. In this case, only the cargo door system gets a supply of hydraulic power.

The pump gets its supply of fluid from the reservoir of the Yellow hydraulic system and pressurizes the system to a nominal pressure of 206 bar (3000 psi). The pump automatically changes its output to match the demands of the system. When the outlet pressure changes, the compensator moves the yoke plate by movement of the actuator. This increases or decreases the stroke of the pistons and thus controls the output of the pump.

Some inlet fluid goes through the hollow drive shaft of the motor to keep the bearings and rotor cool.

The output from the electric pump goes to the RH thrust reverser and to the HP (**H**igh **P**ressure) manifold. From the HP manifold the supply is sent to all of the services including the cargo doors.

If the motor of the electric pump overheats, the temperature switch in the motor sends signals to the ECAM and overhead panel. The message ”ELEC OVHT” appears on the ECAM lower DU and the YELLOW ELEC PUMP/FAULT light comes on. The applicable messages appear on the STATUS page of the ECAM upper DU.

If the temperature decreases, the warnings stop and a message on the STATUS page gives the information that the electric pump is available.

Yellow Hand pump

A hand pump is installed on the ground service panel of the Yellow system. It supplies pressure to the forward and aft cargo–compartment doors (through the selector valve).

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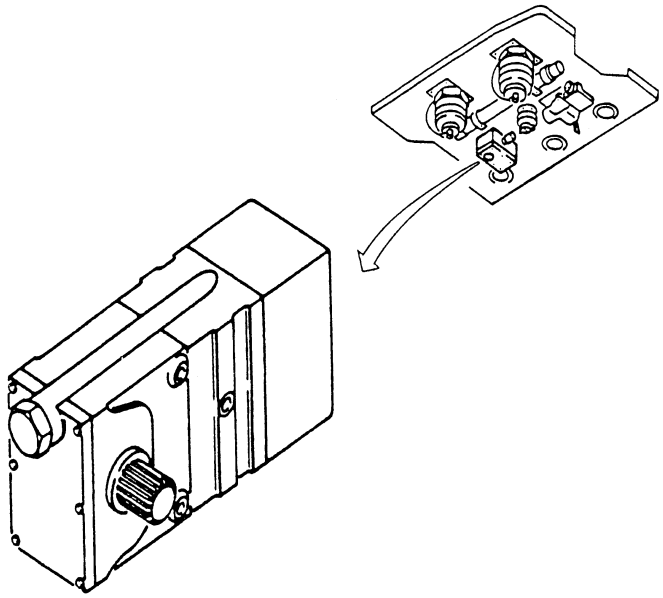
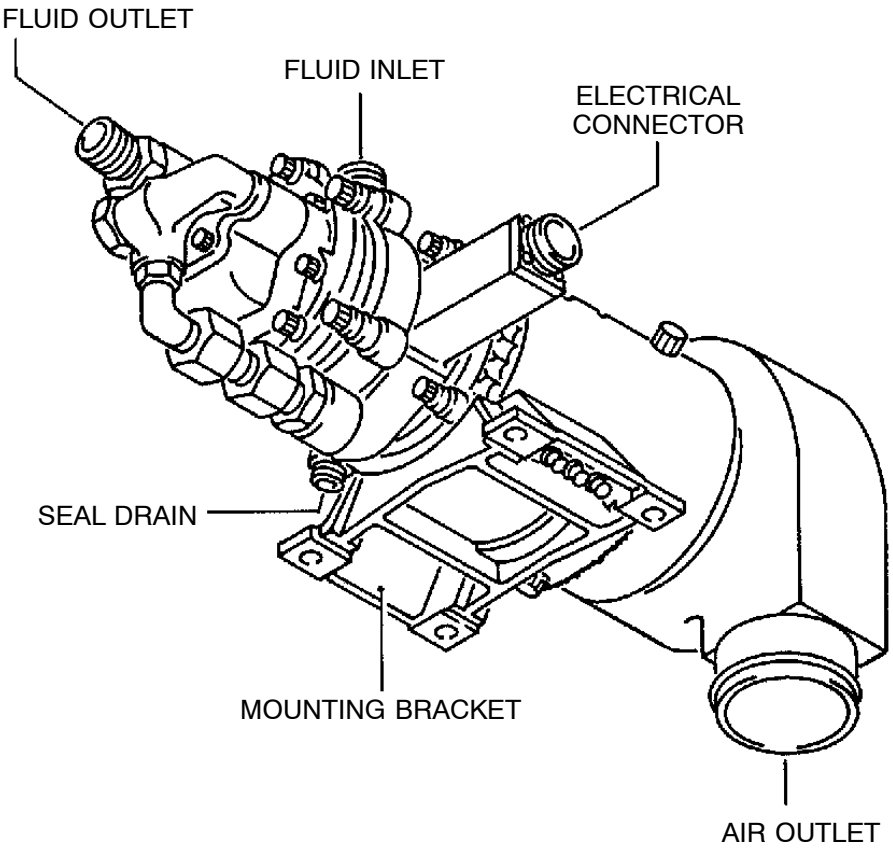


YELLOW HAND PUMP



YELLOW ELECTRIC PUMP

Figure 58 Yellow Hand and Electrical Pump

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PHASE UNBALANCE DETECTOR COMPONENT DESCRIPTION

Purpose

The Blue and the Yellow electrical pump motor are monitored each by a current transformer and the phase unbalance detector. In case of a phase unbalance the pump (motor) is switched off.

Operation

If there is a difference the current flow of the three phases of the supply to the motor the current transformer sends a to the phase unbalance detector.

The phase unbalance detector then sends signals to the electrical pump power relay and the motor is stopped.

The indicator light comes on to show that the unit has operated. When the detector unit has operated,it stays in that condition until it is reseted.

This happens automatically when the power supply (28V DC) to the unit is stopped or the elec pump push button switch in the cockpit is pushed/reset.

Location

The blue and yellow current transformer and phase unbalance detectors are installed in the avionics compartment.

Current Transformer & Phase Unbalance Detector Test

REFER: TASK 29–24–00–710–002 (Yellow System)

Obey the safety precautions!

- On overhead panel 40VU push the YELLOW ELEC PUMP
  - The electric pump of the Yellow hydraulic system starts.
- On the ECAM lower DU the pressure of the YELLOW hydraulic system is approximately 3000psi.
- On the phase unbalance detector push and hold the TEST P/B.
  - the test indicator light comes on.
- The electric pump of the Yellow hydraulic system stops.
- On the overhead panel 40VU the YELLOW ELEC PUMP/FAULT light comes on.
- On the ECAM lower DU the pressure of the YELLOW hydraulic system is 0 psi.-the color of the system name changes from white to amber.
- On the phase unbalance detector release the TEST P/B.
  - the test indicator light stays on.
- On the overhead panel 40VU push and release the YELLOW
  - the ON/FAULT light of the YELLOW ELEC ELEC PUMP P/BSW. PUMP P/BSW goes off.
- On the phase unbalance detector
  - the test indicator light goes off.

NOTE: The procedure for the Test of the Blue pump is the same.

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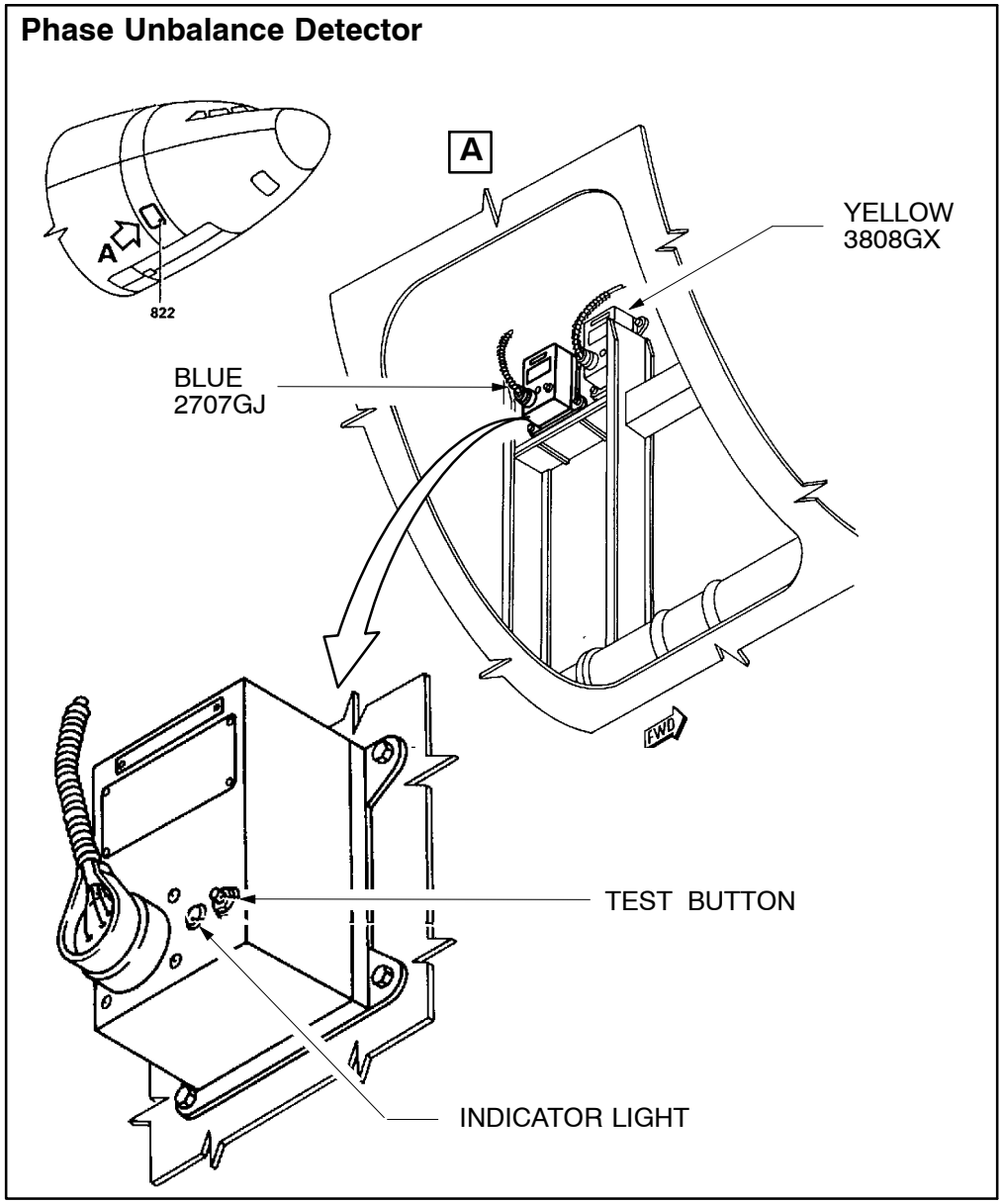

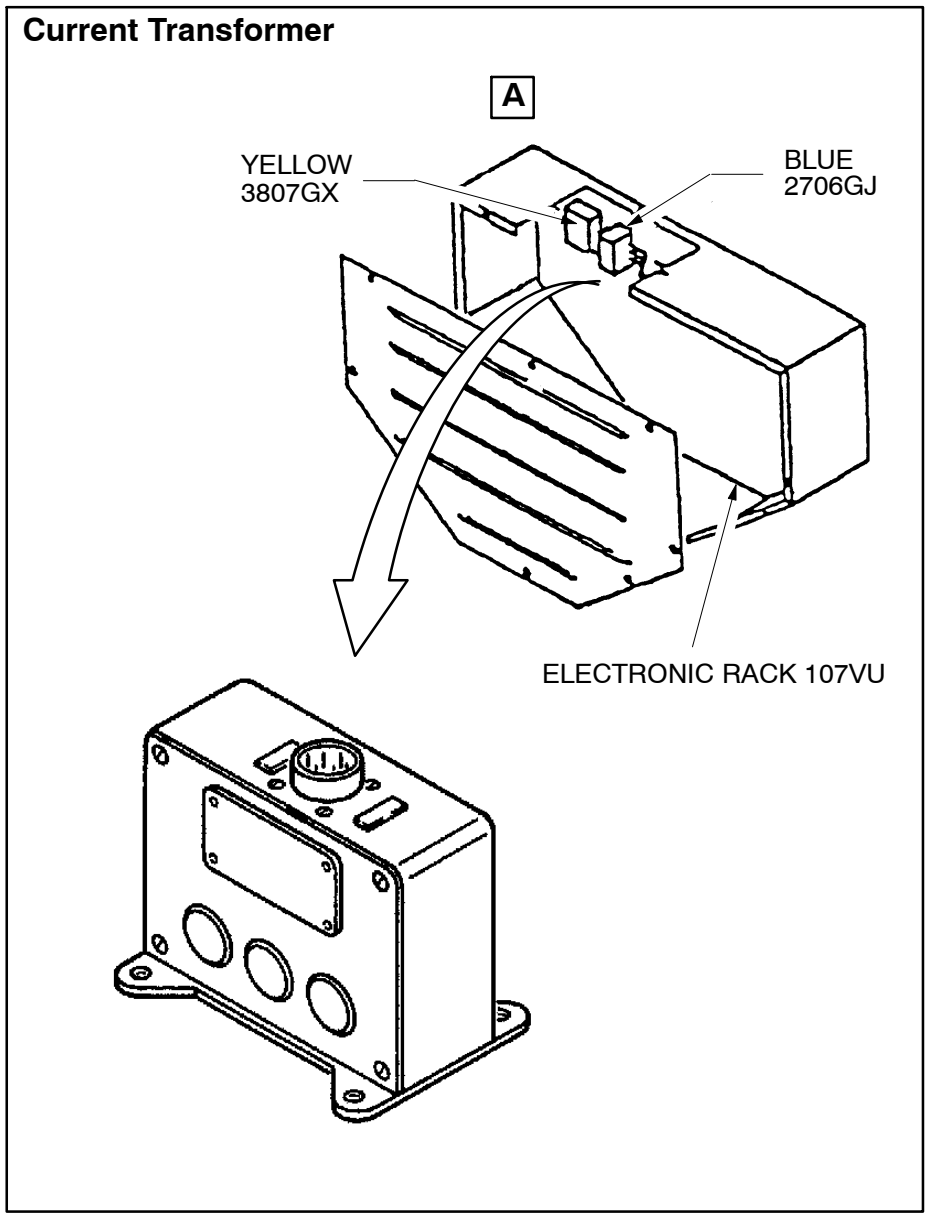

Figure 59 Phase Unbalance Detector (Blue & Yellow)

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YELLOW ELECTRICAL PUMP POWER SUPPLY

Description

The power supply for the electric pump is three–phase, 115V AC. It comes from either AC bus 2 2XP or external supply.

Two contactors are installed in the system.

One contactor is connected to the supply line from the AC bus supply, the other is connected to the supply line from the external power supply.

The two contactors are connected to each other by shunts.

Operation of the contactors controls the supply of electrical power to the electric pump.

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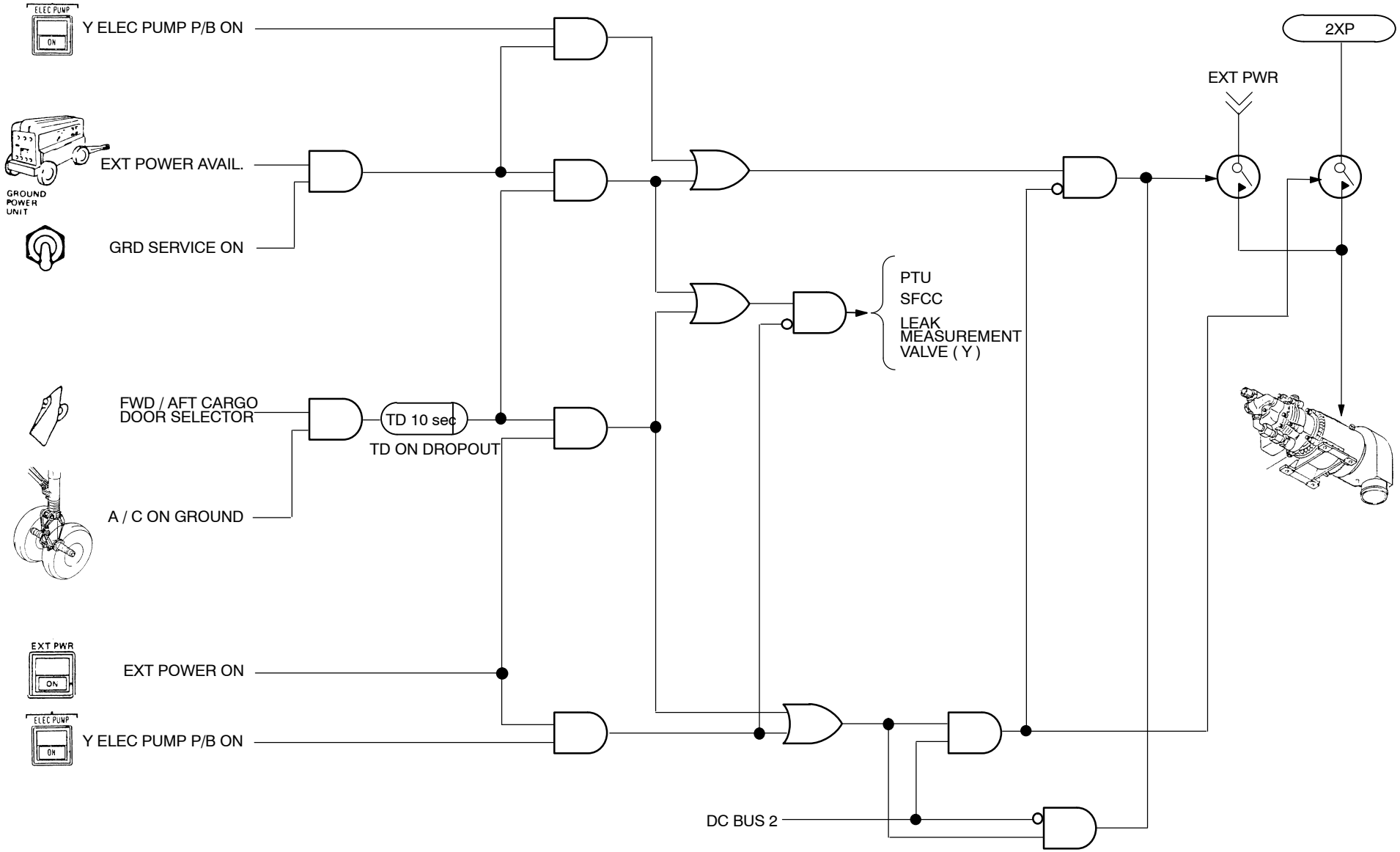

Figure 60 Yellow Electric Pump Control

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29–30/34 INDICATING/WARNING

PRESSURE INDICATION

System Pressure Monitor

The pressure switches on the HP manifolds of the three systems monitor the pressure in the systems.

When the pressure is above the low pressure warning threshold 1450 ± 72.5psi (100 ± 5bar), the switch sends a signal to the flight control system.

The Blue and Yellow system switches also send signals to the autoflight system. The Green system switch also sends a signal to the brake system. When the pressure in the system falls below 1450 ± 72.5psi (100 ± 5bar), the pressure switch operates and stops the signals to the flight controls (and autoflight/brake systems). At the same time the switch sends a signal to the FWC which gives these warnings.

System Pressure Indication

The three pressure transmitters measure the pressure in each system and send signals to the SDAC. The SDAC uses the data to give a digital display of the actual system pressure (with a resolution of 50 psi) on the ECAM display unit.

If the pressure falls to below 1450 psi (100bar), the SDAC changes the color of the digital display from green to amber.

These three transmitters also send information to the flight control system.

The pressure transmitter is for the brake system and only supplies that system with data.

Hydraulic Pressure Transmitter

The four pressure transmitters are of the same type.

They are cylindrical with a hydraulic connection at one end and an electrical connector receptacle at the other end.

The transmitters are made of two main sections.

- The first section has the pressure–sensing element. It includes a diaphragm which is under hydraulic pressure. The diaphragm causes a piezoresistive sensing element to operate on the Wheatstone bridge principle, according to the pressure applied.
- The other section of the transmitter contains two circuit boards.

The circuit boards have circuits which control the input voltage and increase the strength of the output signal from the switching element. The specified input voltage is 28V DC, but the transmitter will operate satisfactorily between 18 and 32VDC. The output voltage varies linearly from 1V DC for 0bar (0psi) to 5V DC for 200bar (2900 psi).

The transmitters are sealed units and no maintenance is necessary or possible.

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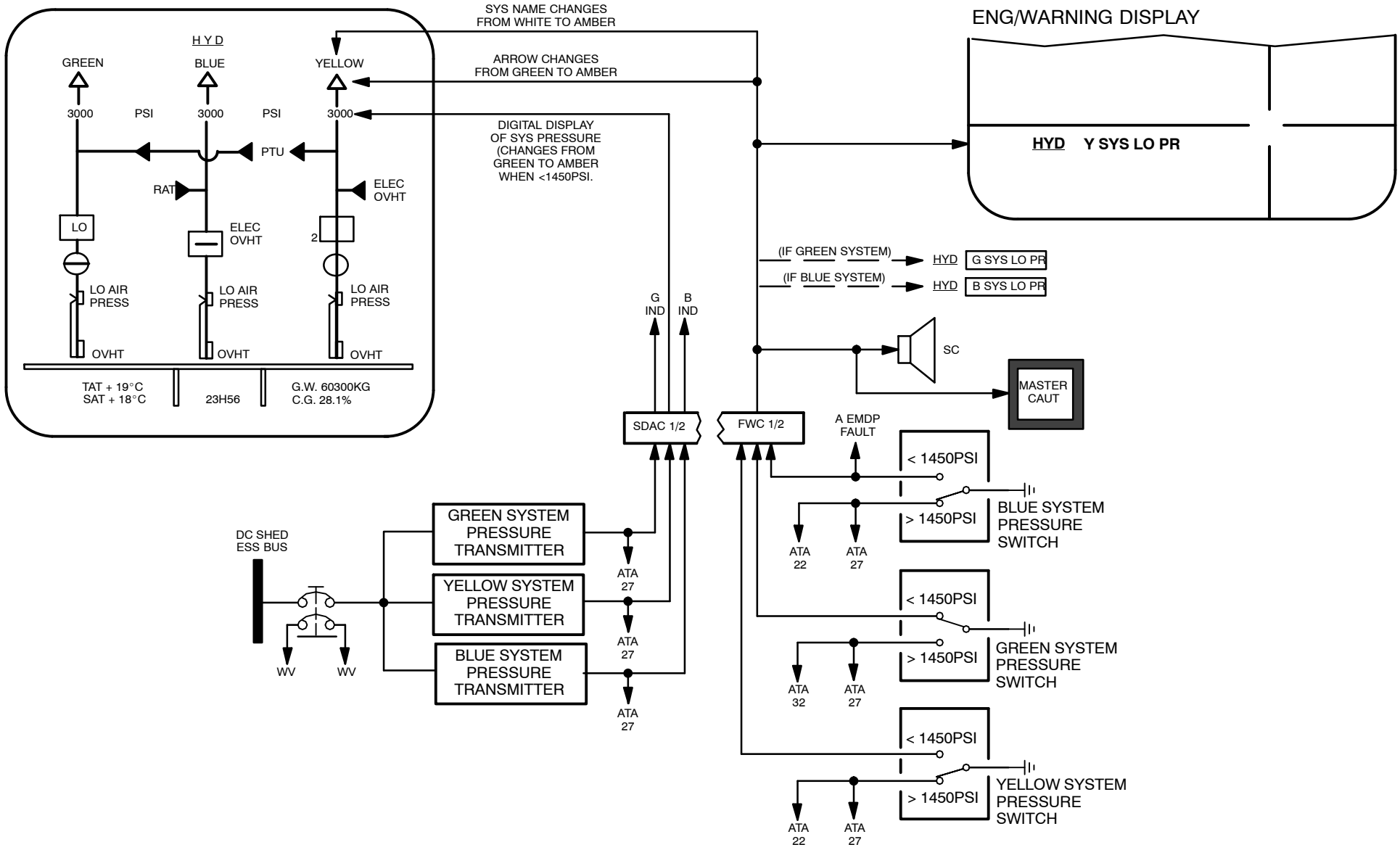

Figure 61 System Pressure Indication/Low Pressure Warning

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PUMP OUTPUT INDICATION

Pump Indication and Monitoring

The pressure switches downstream of the engine pumps and downstream of the Blue electric pump monitor the output of the pumps.

When the pressure falls below a specified pressure, 1740 ± 72.5psi (120 ± 5bar) for the engine pumps (1450 ± 72.5psi (100 ± 5bar) for the Blue electric pump), the switch contacts close and complete the circuits.

A signal is sent to the SDAC which gives these warnings:

- the pump low pressure warning on the HYD page of the system display of the ECAM,
- the applicable text on the engine/warning display of the EACM,
- the single–chime audio warning,
- the MASTER CAUT warning light comes on.

At the same time a signal is sent to the overhead panel 40VU and the applicable FAULT legends come on.

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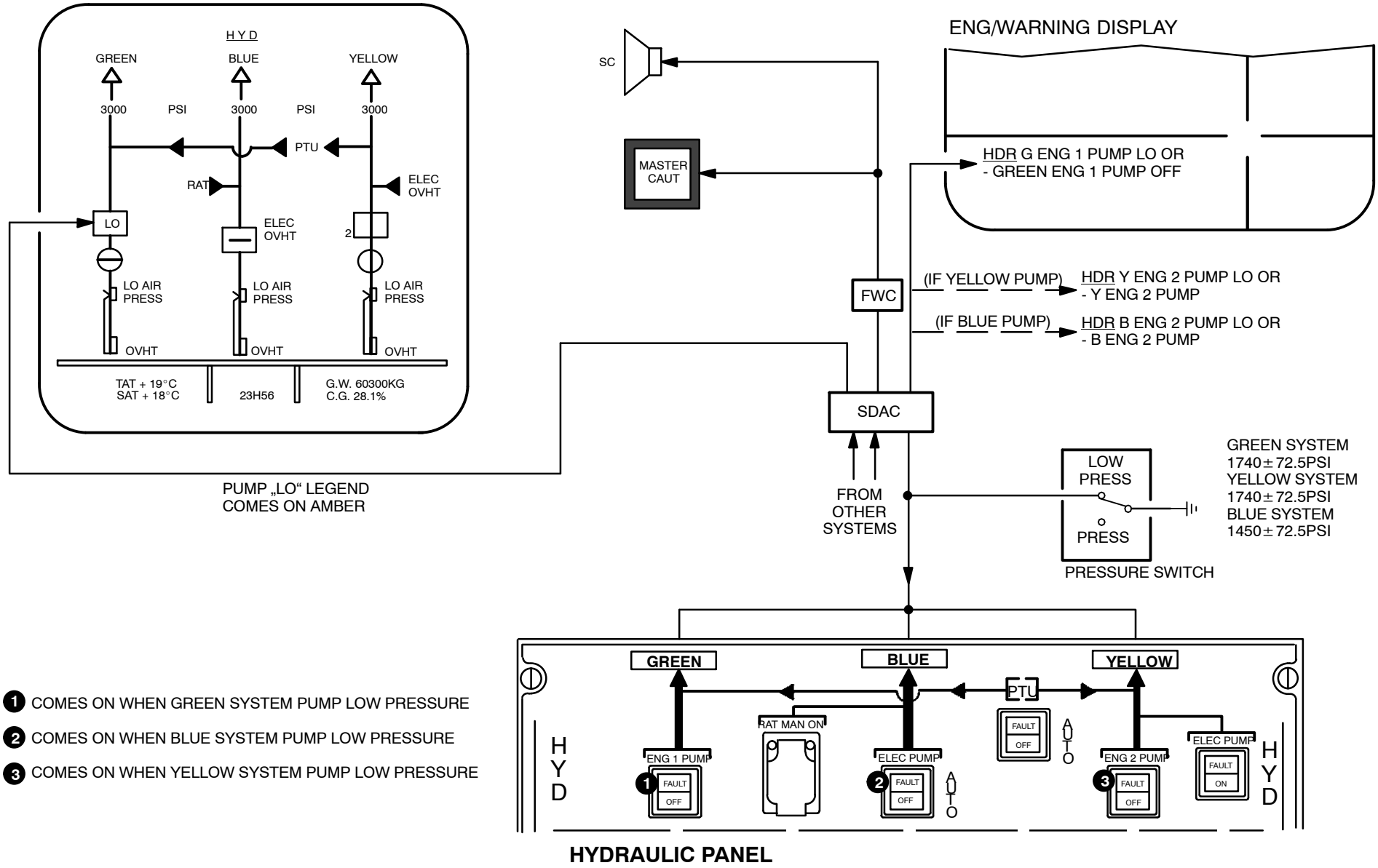

Figure 62 Pump Low Pressure Warning

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FLUID LEVEL INDICATION

Quantity Monitoring

Each reservoir has a gage–transmitter which sends electrical signals to show the fluid contents.

The unit is a float assembly connected mechanically to a synchro transmitter. The pointer of the mechanical contents gage is connected to the synchro transmitter. If the float moves, the synchro transmitter and the pointer turn together. The synchro transmitter sends signals to ECAM and to the reservoir quantity indicator on the green ground–service panel.

A reservoir quantity indicator is installed on the Green ground–service panel. It operates together with the filling selector valve and shows the contents of the reservoir which the selector valve is set to. Each reservoir also has a float assembly which operates a switch at a specified level between 2.0 and 2.3L in (Blue reservoir) and between 2.6 and 3.4L (Green and Yellow reservoirs) to show that the fluid content is to low.

The contents of the hydraulic reservoirs are shown:

- on a mechanically-operated gage on each reservoir,
- on an electrical reservoir quantity indicator on the ground–service panel of the Green system,
- on the ECAM system display (HYD page).

The low level switches send signals to ECAM and to the overhead panel.

Power Supply

26VAC is used for synchro excitation of the transmitters and for the synchro in the reservoir quantity indicator on the Green ground-service panel. The reservoir quantity indicator has LEDs and filament lamps which use the same supply. The DC bus supplies 28VDC to the three low level switches in the reservoirs.

Gage–Transmitter

The gage–transmitter has four primary assemblies. They are:

- a float and arm assembly, together with a mechanism to change the movement of the arm so that it turns the synchron
- a synchro transmitter
- a mechanical contents gage,
- a sealed outer case.

The mechanical contents gage is the end part of the casing and is secured with screws to the primary casing.

Low Level Switch

The low level switch is installed in the reservoir and gives a signal when the fluid level is too low. It is a float–operated switch which includes a relay. The float assembly includes a magnet which keeps the contacts of a reed switch open when the float is high. When the level of the fluid decreases, the float falls and the reed switch closes. Discrete signals are sent to the SDAC and to the overhead panel.

These warnings come on:

- a low level warning on the engine/warning display,
- the MASTER CAUT attention getter,
- a single-chime audio warning.

The signal to the overhead panel makes the applicable FAULT annunciator(s) come on. If the low level switch does not operate, the SDAC uses the data from the contents transmitter to start low level warning procedure. The warning is generated when the transmitter data show that the contents are below the low level switch threshold. The SDAC makes the warnings occur when the content of the reservoirs are 2.5L. (0.6604USGAL) (Green And Yellow reservoirs) or 1.8L. (0.4755USGAL) (Blue reservoir). In this case, there will be no FAULT indication on the overhead panel.

Reservoir Quantity Indicator

The reservoir quantity indicator is installed on the ground–service panel of the Green system. It shows the contents of the reservoir which the filling selector valve is set to.

The indicator has a cylindrical case which contains a synchro. on one end of the case there is the electrical receptacle. The indicator face is on the other end. The indicator has three colored scales (one for each reservoir) and three lights which show which system the indicator is set to. Lighting of the indicator face is given by three lights installed in the indicator. The Green and Yellow system indicators are LED; all of the other lights (including the Blue system indicator) are filament lamps.

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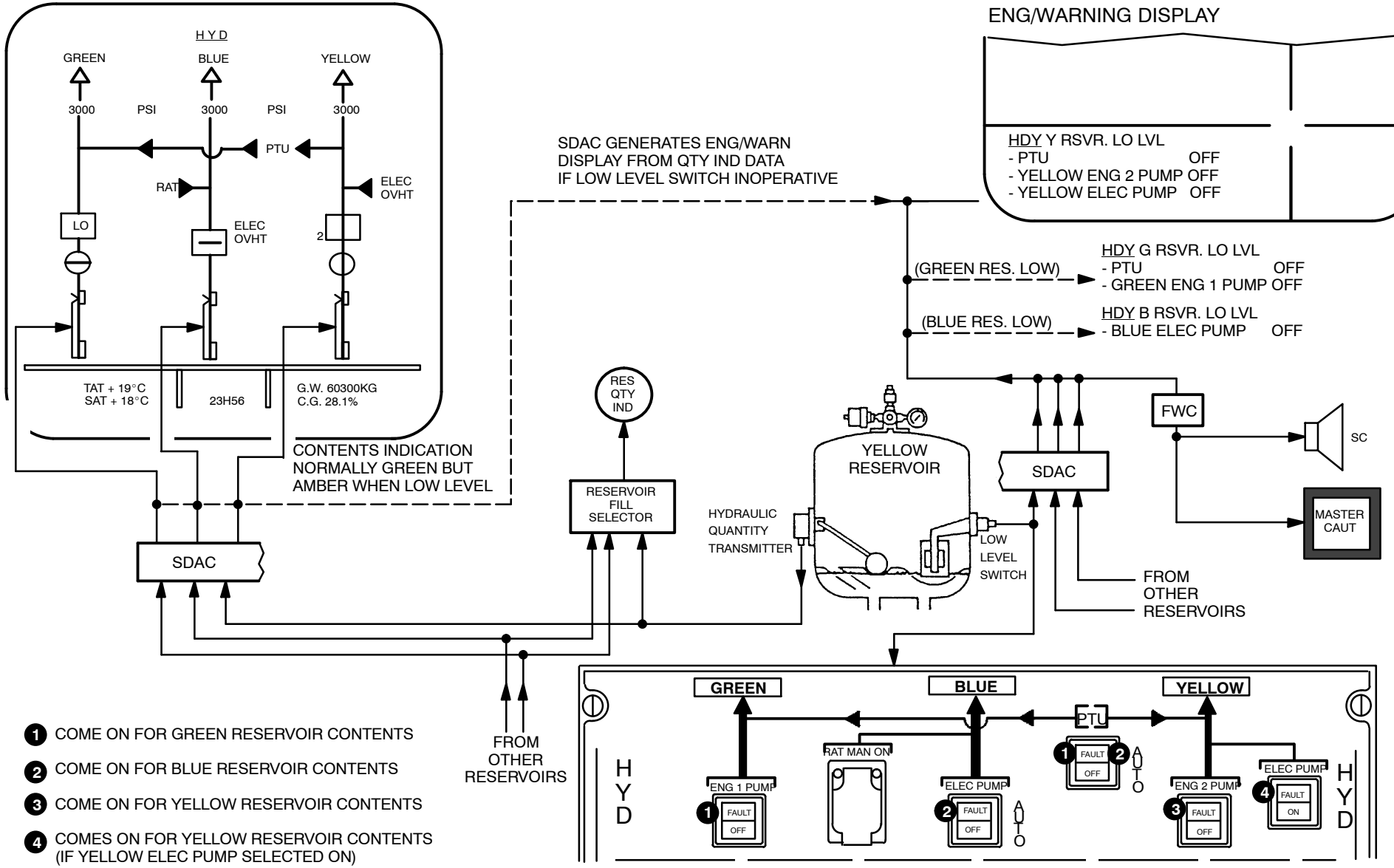

Figure 63 QTY Monitoring & Low QTY Warning

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FLUID TEMPERATURE INDICATION

System Description

The indicating system sends fluid temperature data to the ECAM (**E**lectronic **C**entralized **A**ircraft **M**onitor). Discrete signals also make the FAULT light on the overhead panel come on.

The temperature of the hydraulic fluid is monitored at the outlet of the LP (**L**ow **P**ressure) filter of each system. The LP filter is the last component in each system before the fluid returns to the reservoir of that system.

A temperature transmitter is installed on the head of each system LP filter. Each temperature transmitter sends analog signals to each SDAC (**S**ystem **D**ata **A**cquisition **C**oncentrator) (for ECAM) and a discrete signal to the SDAC and overhead panel (for FAULT light).

Temperature Transmitters

The three temperature transmitters are all the same and are interchangeable. Each temperature transmitter has three sensors together in one unit. The body of the temperature transmitter has an electrical connector and a bonding stud attached to it.

The sensors are of two types:

- a temperature switch which sends the discrete signal to the overhead panel and ECAM (through the SDAC)
- two temperature transducers which provide the analog signals for the two ECAM displays (via the SDAC)

The temperature switch is set to operate at 95 ± 2.2°C (203.00 ± 3.96°.F) and to reset if the fluid temperature is equal to or greater than 88.4°C (191.12°F)

The temperature transducers measure fluid temperatures between minus 55°C (131.00°F) and plus 120°C (248.00°F) with an accuracy of plus 2.2°C (35.96°F) and minus 2.2°C (35.96°F)

NOTE: Temperature transducers are used so that it will be possible (as an option) to show actual fluid temperature on the ECAM display as well as the warning which is shown at present.

Operation

The temperature transmitters monitor the temperature of the hydraulic fluid in the return line. When the temperature of the fluid reaches 92.8°C (199.04°F), the OVHT legend on the system display of the ECAM comes on in amber.

When the temperature of the fluid goes higher than 95 ± 2°C (203.00 ± 3.60°F) the temperature switch closes.

A discrete signal then passes the SDAC and the FWC to the overhead panel. The following warnings occur:

- the single–chime audio warning operates,
- the MASTER CAUT lights on the glareshield come on,
- the applicable FAULT light(s) come(s) on on the overhead panel,
- the applicable warnings are shown on the system and engine/warning displays of the ECAM.

At the same time, the two transducers in the temperature transmitters send analog data to the two SDAC. If the transducer data shows that the temperature of the fluid is more than 98°C (208.40°F) (and the SDAC have not received a discrete signal from the temperature switch), then the FWC start FAULT procedure.

The warning indications are the same as above.

NOTE: The FAULT light(s) (if applicable) and the warning (HYD Y (G/B) RSVR OVHT) on the engine warning display stay on as long as the temperature of the fluid is too high.

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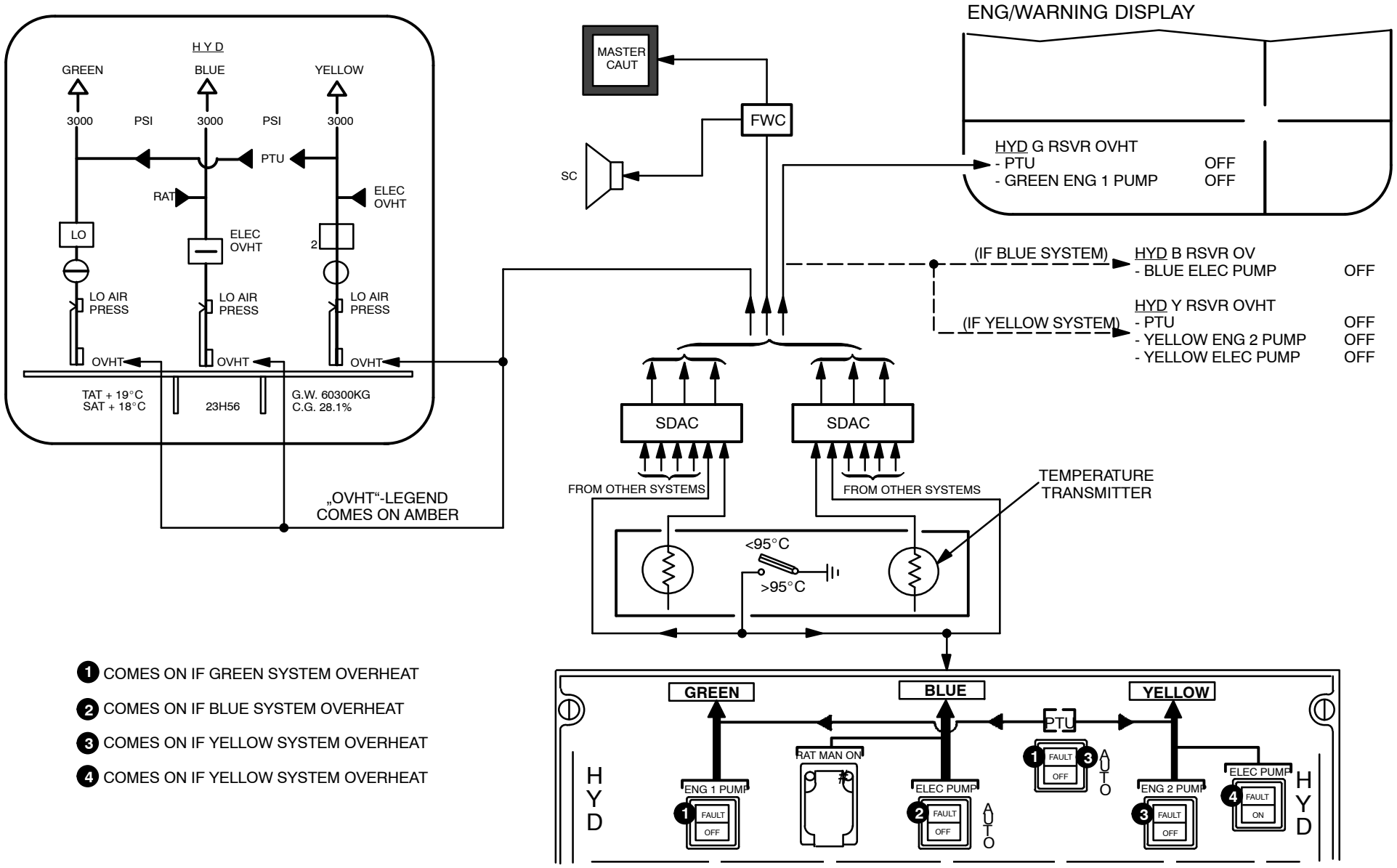

Figure 64 High Temperature Warning

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RESERVOIR AIR PRESSURE INDICATION

System Description

The reservoir pressurization indicating system has three pressure switches. 0ne pressure switch is installed on the reservoir of each hydraulic system and is connected directly to its air space.

Each pressure switch sends a discrete signal if the pressure in the related reservoir is too low. The signal goes to the two SDACs (**S**ystem **D**ata **A**cquisition **C**oncentrators) for ECAM (**E**lectronic **C**entralized **A**ircraft **M**onitor) warnings. The signal also goes to the overhead panel for FAULT light operation.

Reservoir Air Pressure—Switches

The three reservoir air pressure switches are the same and they are interchangeable.

The switches are cylindrical with a steel body.

The body holds a microswitch assembly. At one end of the body is the electrical connector. The other end of the body has a thread to connect it to the reservoir. It is also the pressure inlet. A bonding tag is attached to the body.

Operation

ECAM (Flight) Warnings

The pressure switches monitor the air pressure in each reservoir. Usually the reservoirs are pressurized to 3.5bar relative (50psig) (4.5bar absolute (65 psia).

If the pressure decreases to less than 2.5 ± 0.1bar absolute (37 ± 1.45psia) (1.5 ± 0.1bar relative (22 ± 1.45psig), the contacts of the pressure switch close. A discrete signal is sent to the two SDAC which causes the ECAM system to show the applicable warnings. A discrete signal which causes the applicable FAULT lights to come on, is also sent to the overhead panel.

The following warnings occur:

- the single–chime audio warning operates,
- the MASTER CAUT lights on the glareshield come on,
- the applicable FAULT lights on the overhead panel come on,
- the applicable warnings appear on the system and engine/warning displays (lower DU and upper DU) of the ECAM.

When the air pressure in the reservoir increases to more than 2.7bar absolute (39 psia) (1.7bar relative (25 psig), the contacts of the pressure switch open and the warnings are cancel led.

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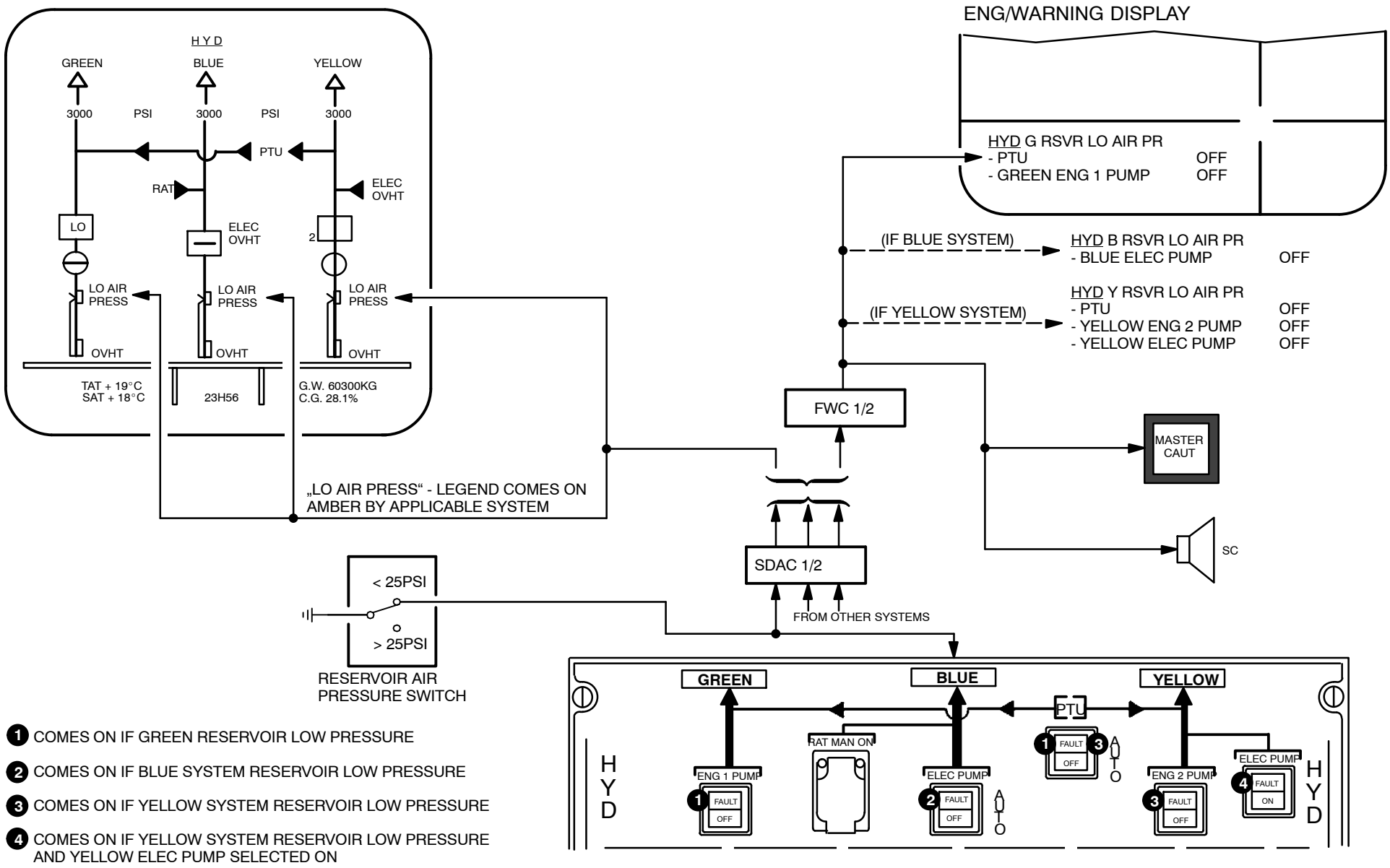

Figure 65 Reservoir Low Air Pressure Warning

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RESERVOIR AIR PRESSURE INDICATION (CONFIG 1 ONLY)

On Aircrafts with Ram Air Turbine Configuration 1

The pressure switch which is installed only in the Blue hydraulic system sends a discrete signal through some relays to the SDAC.

If the air pressure in the Blue reservoir decreases to less than 3.1 bar absolute (45psia) (2.1bar) relative (30psig), the pressure switch gives a signal in flight (flight phases 5, 6 and 7) which is then memorized only and displayed after landing (flight phases 8, 9 and 10).

The following warnings occur:

- the single–chime audio warning operates,
- the MASTER CAUT lights on the glareshield come on,
- the applicable FAULT lights on the overhead panel come on,
- the applicable warnings appear on the system and engine/warning displays (lower DU and upper DU) of the ECAM.

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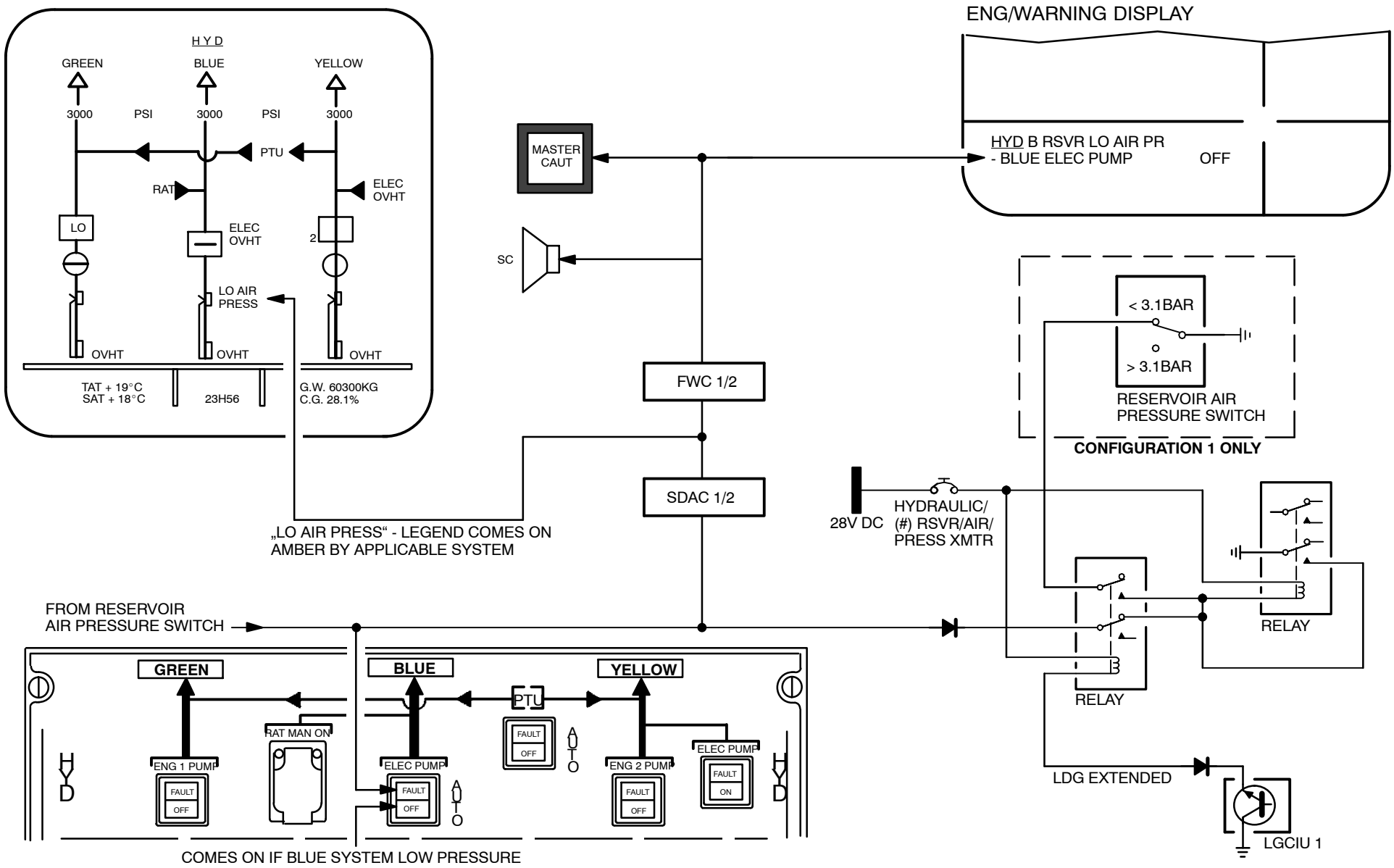

Figure 66 Reservoir Low Air Pressure Warning

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CFDS FAULT MONITORING PRESENTATION

The ECAM system monitors the condition of the system all the time. The information to ECAM is send via the 2 SDAC.

CFDS Monitoring

The following components are monitored by ECAM and send to the CFDS:

- system pressure switches
- system pressure XMTRs
- reservoir QTY indicator XMTRs
- temperature XMTRs
- the reservoir air pressure switches

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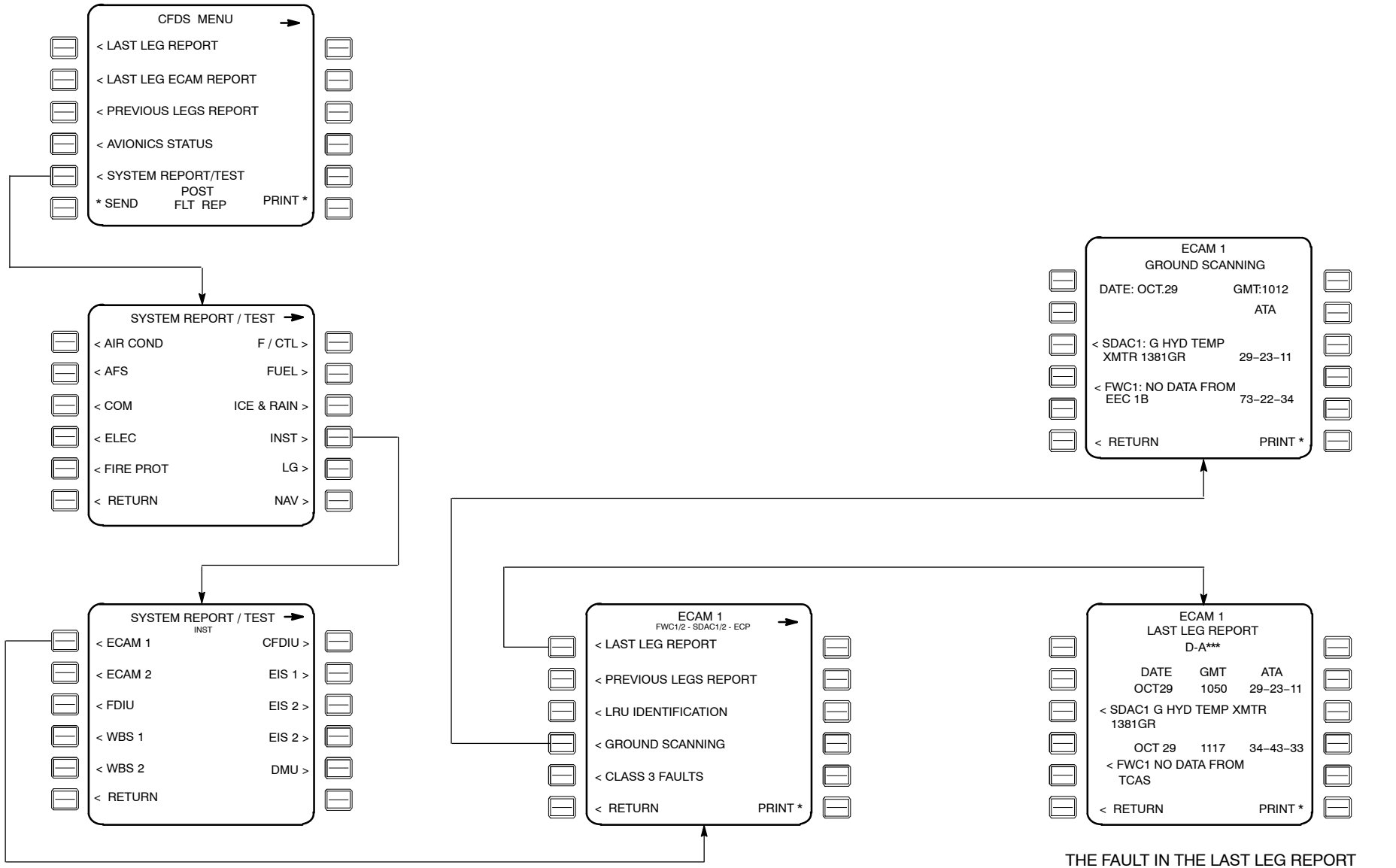

Figure 67 Fault Monitoring

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29–00 GENERAL

HYDRAULIC POWER GENERAL INSPECTION CHECK

TASK 29–00–00–790–001

Check of the External Leaks of the Hydraulic Components

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A320 HYDRAULIC SYSTEM
EXTERNAL LEAK TEST OF COMPONENTS

EQIPMENT	NORMAL OPERATION LIMIT	DISPATCH LIMIT TO AVOID DELAY
1 HYDRAULIC PUMP Engine Driven Pump (EDP) Electric Motor Pump (EMP) Ram Air Turbine (RAT) Power Transfer Unit (PTU)		
Static Seals (at Unions and Connections)	NONE	2 drops in 10 min.
Static Casing (Housing)	1 drops in 10 min.	
Shaft Seals (in operation)	EDP: 5 drops/min. EMP: 5 drops/min RAT: 1 drops/min. PTU: 5 drops/min.	EDP: 60 drops/min. EMP: 30 drops/min RAT: 1 drops/min. PTU: 30 drops/min.

NOTE: Examples shown. For actual limits check relevant AMM

Figure 68 Check of the External Leaks

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HYDRAULIC SYMBOLS PRESENTATION

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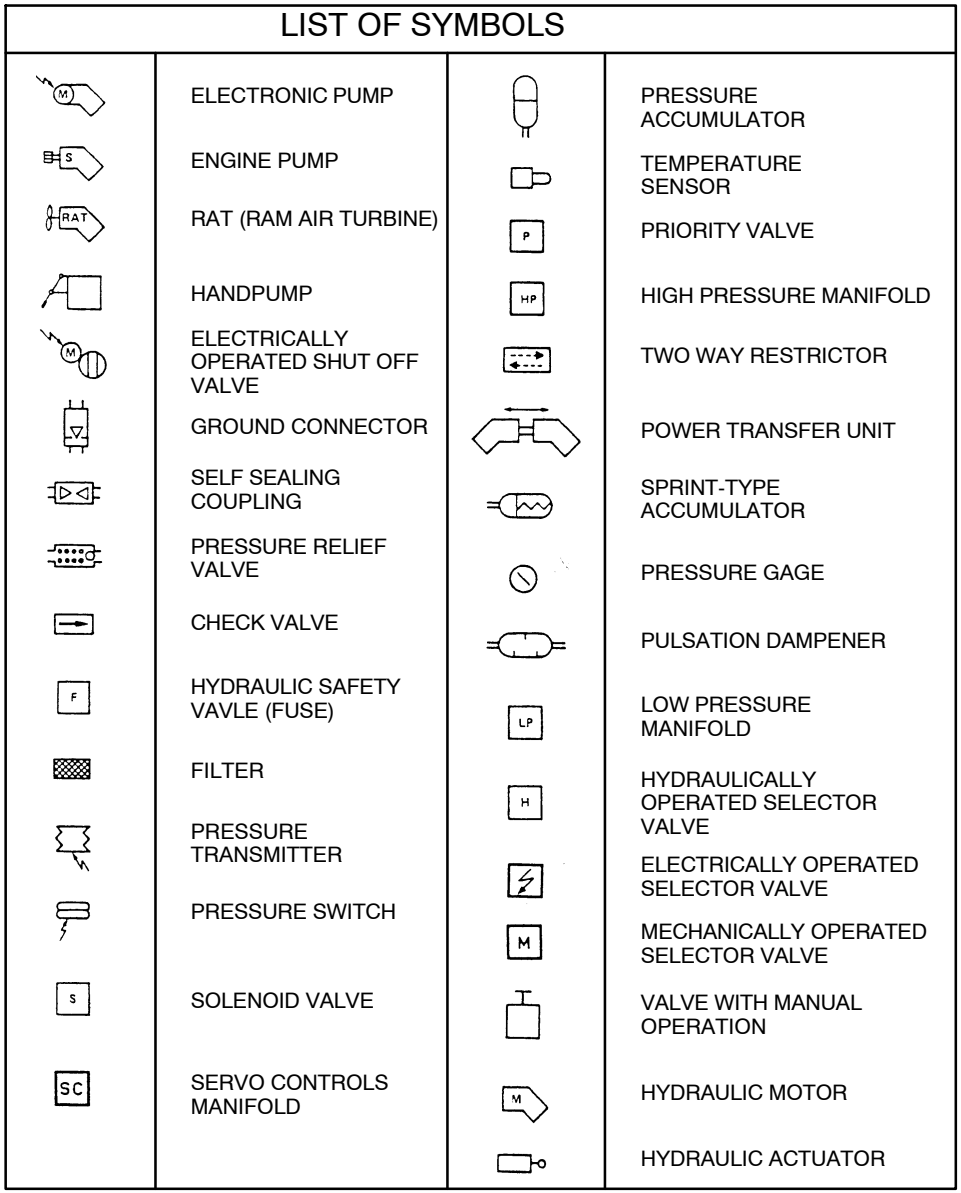

Figure 69 Hydraulic System Symbols

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