CHAPTER 29 - HYDRAULIC POWER

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GENERAL

The hydraulic power system includes those components required to pressurize, store and supply hydraulic fluid to the aircraft systems, within pressure, temperature and cleanliness precise limits.

The hydraulic power system supplies pressurized hydraulic fluid to the following systems:

- ***Nose-Wheel Steering:*** while taxiing, the aircraft is steered by means of a hydraulic nose-wheel steering system.

- ***Landing Gear/Extension Retraction System:*** the aircraft has a retractable tricycle landing gear, raised and lowered by hydraulic actuators under normal operation of the landing gear.

- ***Normal and Anti-skid brakes:*** the normal braking system uses hydraulic pressure to actuate the main landing gear wheel brakes, and has an anti-skid system to enable maximum braking pressure under all conditions, without skidding of the wheels.

- ***Emergency and Parking Brakes:*** operated by hydraulic pressure stored in a nitrogen pressurized accumulator. When operated, this applies pressure to the four wheels of the main landing gear.

- ***Propeller Brake:*** left engine has a hydraulically-actuated brake; it allows the engine to be run without the propeller turning.

- ***Flap Actuation:*** the flap system has two inner and two outer flaps, moved by actuators and transmission shafts, driven by a hydraulic power unit.

- ***Cargo Door and Ramp:*** both are operated by hydraulic actuators. The ramp also holds hydraulically-operated locks.

For details of the diverse services, please refer to the relevant chapters.

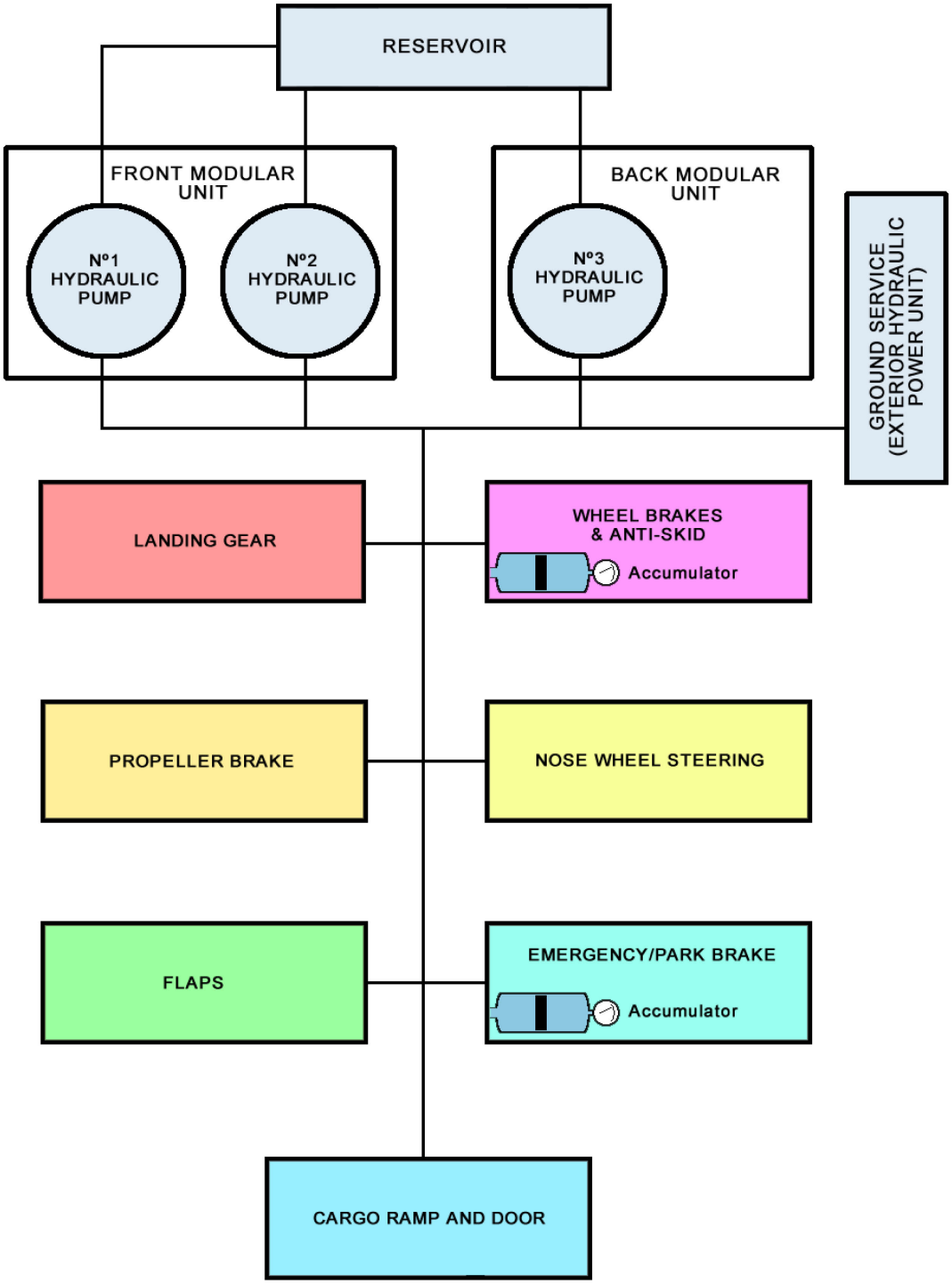

Figure 29-1 General - Schematic Overview - Architecture

HYDRAULIC POWER

The hydraulic system purpose is to provide hydraulic power as required to operate each hydraulically-powered system.

DESCRIPTION

Main components are:

– ***Electric Motor Pumps:*** three pumps linked in parallel, absorb hydraulic fluid from the tank and supply fluid at 3000 psi pressure to the aircraft systems. Each pump consists of the pump itself (with varying drawn, depending on demand), self-cooled electric motor to drive the pump, and hydraulic-fluid/air heat exchanger (to cool the drain flow used to lubricate the pump).

– ***Modular Units (Forward and Rear):*** located beneath the rear part of the right landing gear nacelle, each modular unit includes a distribution block comprising several hydraulic components to regulate, filter and deliver the fluid to each system.

  The forward modular unit has pressure (GTP) and suction (GTS) rapid couplings for the appropriate connection to an external hydraulic power unit. It is also provided with an extraction valve to get samples of hydraulic fluid.

– ***Tank:*** plunger-type tank, with 13 liters capacity and pressurized by its associated hydraulic pumps. The tank has a differential area plunger which transform the incoming high pressure from the pumps to a constant 50 psi (pressurizing the tank in this way prevents from cavitations under maximum flow conditions, and improves the fluid feeding from the pumps). The tank has a safety valve to prevent from overfilling, overheat safety breaker, drain valves, oil-filling sensor and mechanical filling indicator.

– ***HYDRAULIC SYS Control Panel:*** located in the cockpit overhead panel, enables system management and monitoring.

It also includes two hydraulic pressure accumulators fed by the pumps, located in the main landing gear right nacelle, and the nose-wheel well. In absence of enough hydraulic power at the pumps, the first accumulator provides hydraulic power to the normal brakes, and the second one provides hydraulic power for both emergency and parking brake (refer to CHAPTER 32 - LANDING GEAR).

OPERATION

When hydraulic pumps are operative, they supply high pressure fluid to the associated hydraulic devices and to the tank through the modular units. Pumps No 1 and No 2 operate if they are connected and its related bus is energized. This fact allows operating both pumps from a single DC generator, from batteries or from DC GPU. To operate the Pump No 3 the related pushbutton has to be pressed and both DC generators or DC GPU must be operative providing electrical power to the aircraft.

CAUTION

Do not operate PUMP No 3 when the aircraft is only energized from batteries. Batteries will be quickly discharged.

Third hydraulic pump cannot be operated from AC GPU. While engine start-up, hydraulic pumps are automatically disconnected.

The hydraulic pumps have two possible modes of operation:

– ***Manual (MAN):*** they are individually connected with the PUMP pushbutton. When the PUMP pushbutton is pressed, the ON light comes on, the pump is connected and starts to operate if the necessary conditions are met.

CAUTION

To avoid possible DC generator overload, hydraulic pumps manual activation can be performed in whichever order with at least 2 seconds delay between pumps activation.

– ***Automatic (AUTO):*** regardless of the PUMP pushbutton position, this mode automatically connects the pumps (ON light on) when the three necessary conditions are met:

- At least one engine is operative (N_H>60%).
- Aircraft speed below 190 KIAS.
- Aircraft altitude below 8000 ft, or the airport altitude +2000 ft.

The starting sequence is: pump No. 2, then No. 1 and finally No. 3 with one second delay between each pump.

Failure of the automatic mode is detected when the above conditions have been met, but the ON lights in the PUMP pushbuttons stay off.

When a hydraulic pump is connected, its pressure sensor starts to measure the pressure in the pump outlet. If the pressure drops below 1800 psi, the related 1, 2 or 3 HYD P caution message will be displayed in the IEDS. This caution message will go off when the pressure in the pump outlet rises again above 2300 psi.

If one of the hydraulic pumps gets overheated, the O.TEMP amber light in the related pushbutton will come on and the pump will be disconnected (ON light goes off).

In the forward modular unit, hydraulic fluid pressure from pumps No 1 and No 2 is delivered to the tank and associated hydraulic devices through two unidirectional valves and a shared filter. If the pressure rises above 3750 psi, a safety valve relieves the fluid extra pressure into the common hydraulic return line. Additionally, the forward module incorporates a pressure sensor to show the feed pressure on the HYDRAULIC SYS panel. When the external hydraulic power unit is connected, each modular unit component works in the same way as if powered by the aircraft hydraulic pumps however, in this mode the pumps are disengaged by the modular units unidirectional valves.

In the rear modular unit, the hydraulic fluid pressure from pump No 3 is delivered, through an unidirectional valve and a filter, to the associated hydraulic devices and then to the tank.

The tank can be filled through the suction rapid coupling (GTS).

HYD HOT caution message is displayed in the IEDS if the temperature sensor, located in the tank, detects an overheat in the hydraulic fluid.

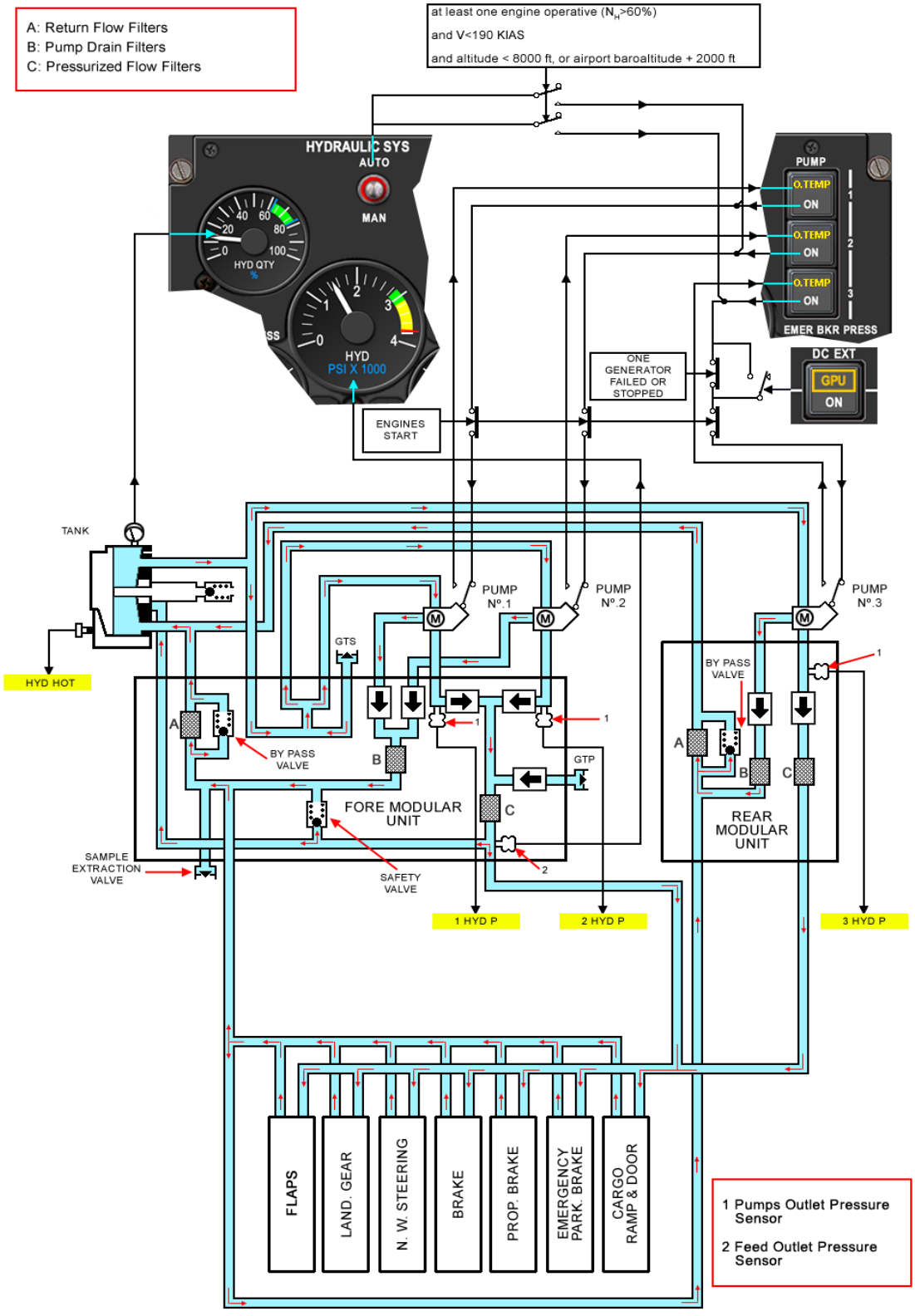

Figure 29-2 Hydraulic Power

CONTROLS AND INDICATORS

(1) HYD QTY Indicator:

it displays the quantity of hydraulic fluid in the tank, as a percentage.

(2) AUTO MAN Selector:

- *AUTO:* pumps operate in mode AUTO.
- *MAN:* pumps operate in mode MAN.

(3) PUMP Pushbutton:

- *Pressed:* in mode MAN, connects the pump.
- *ON light on:* the pump is connected.
- *O.TEMP (amber) light on:* hydraulic pump is overheated.

(4) HYD Pressure Indicator:

shows the feed pressure in the front modular unit.

(5) EMER BKR PRESS Indicator:

(refer to CHAPTER 32 - LANDING GEAR)

(6) BKR PRESS Indicator:

(refer to CHAPTER 32 - LANDING GEAR)

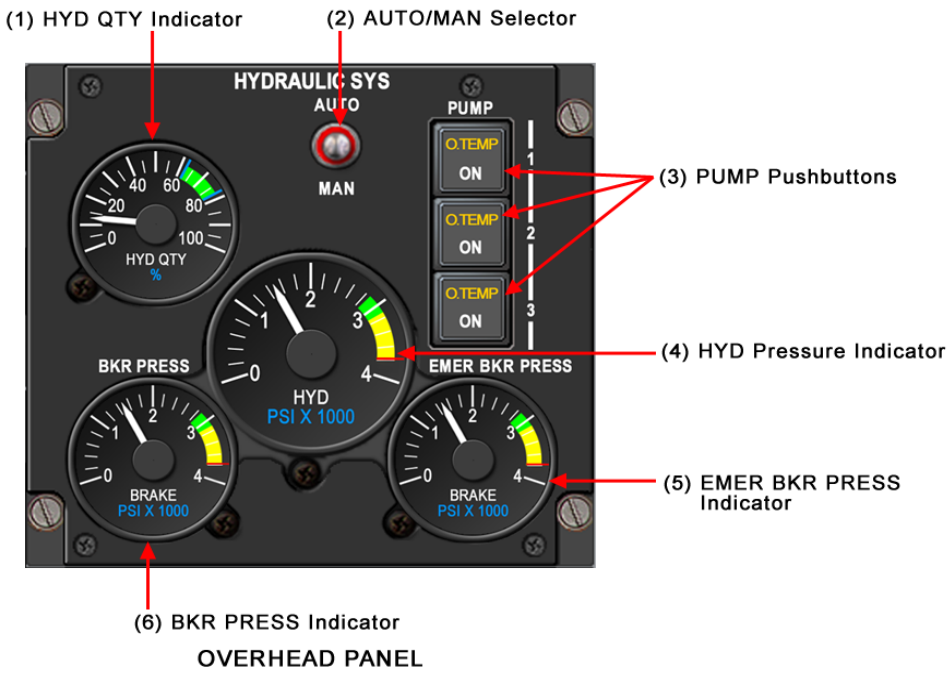

Figure 29-3 Hydraulic Power - Controls and Indicators