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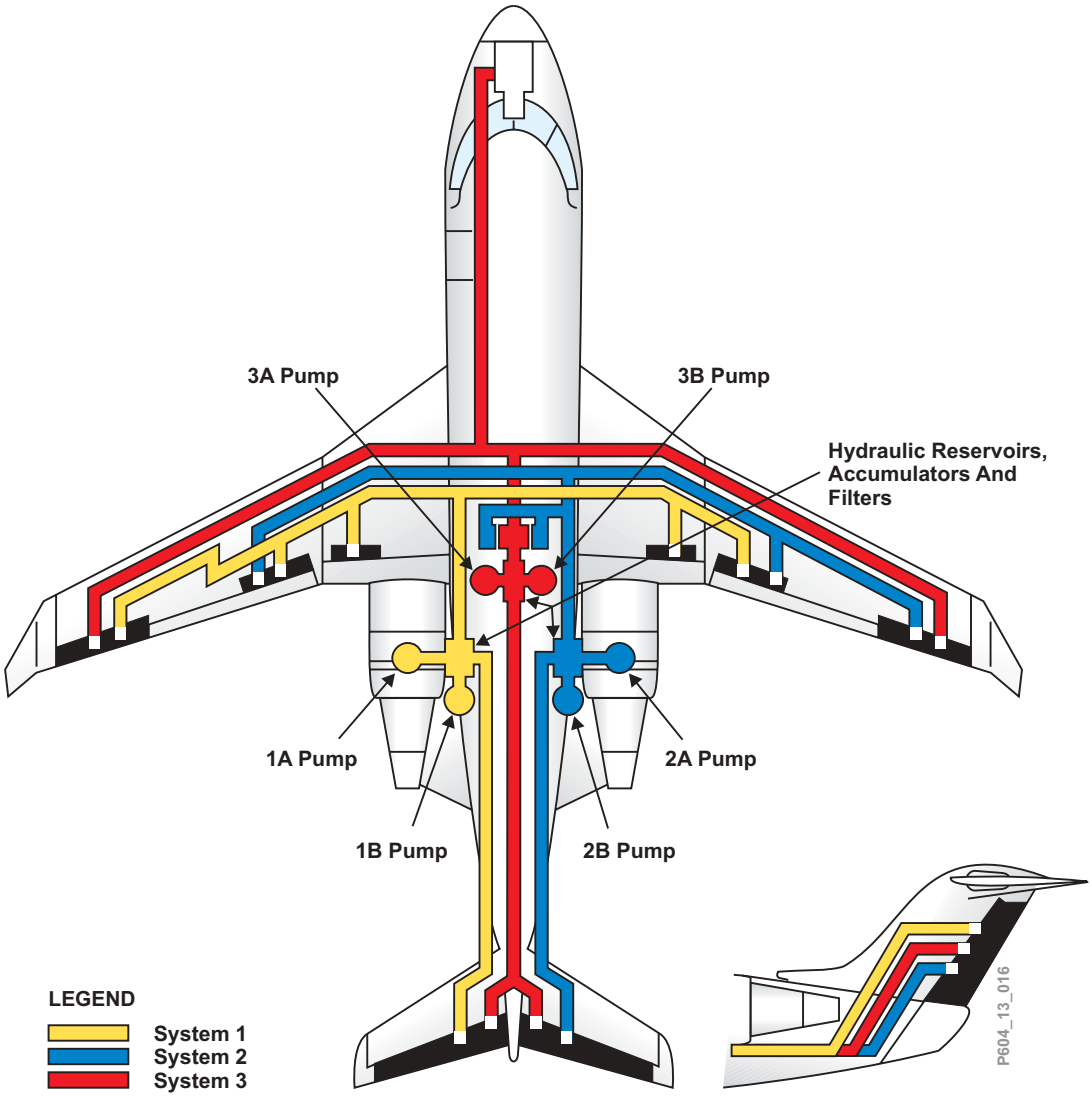
Introduction

The Challenger 604 is equipped with three independent hydraulic systems designated as 1, 2 and 3. All systems operate at a nominal pressure of 3000 psi to power the primary and secondary flight controls, landing gear, wheel brakes and nosewheel steering. Operation is automatic with redundant hydraulic power sources for primary flight controls and flight spoilers.

Each hydraulic system has two hydraulic pumps: a main pump (A) for normal power and a backup pump (B) for supplementary power. System 1 and 2 main pumps are engine-driven pumps (EDPs) and are designated as 1A and 2A. System 3 main pump is an AC motor pump (ACMP) and is designated as 3A. All of the backup pumps are ACMPs and are designated as 1B, 2B and 3B (see Figure 13-1).



Hydraulic System Distribution

Figure 13-1

Systems 1 and 2

Description

The major components of systems 1 and 2 are an engine-driven pump (EDP), an AC motor pump (ACMP), a hydraulic shutoff valve, an accumulator and a reservoir. All components are located in the aft equipment bay except for the EDP, which is located on the engine (see Figures 13-2 and 13-3).

Components and Operation

Main Pumps

The main pumps meet the needs of normal flight conditions. The main pump draws fluid from the reservoir through the firewall shutoff valve and delivers it pressurized at 3000 psi to the hydraulically powered aircraft systems. System 1 main pump is engine-driven pump 1A (EDP 1A) and System 2 main pump is engine-driven pump 2A (EDP 2A). EDP 1A and 2A operate anytime their respective engine is running.

Backup Pumps

Backup pumps for systems 1 and 2 are AC motor pumps (ACMP 1B and 2B). The operation of ACMP 1B and 2B depends on engine-driven generator output, hydraulic pump switch position and the flap position. Pumps 1B and 2B are controlled by their respective three-position toggle switches on the HYDRAULIC Panel labeled AUTO, ON and OFF.

AUTO Position

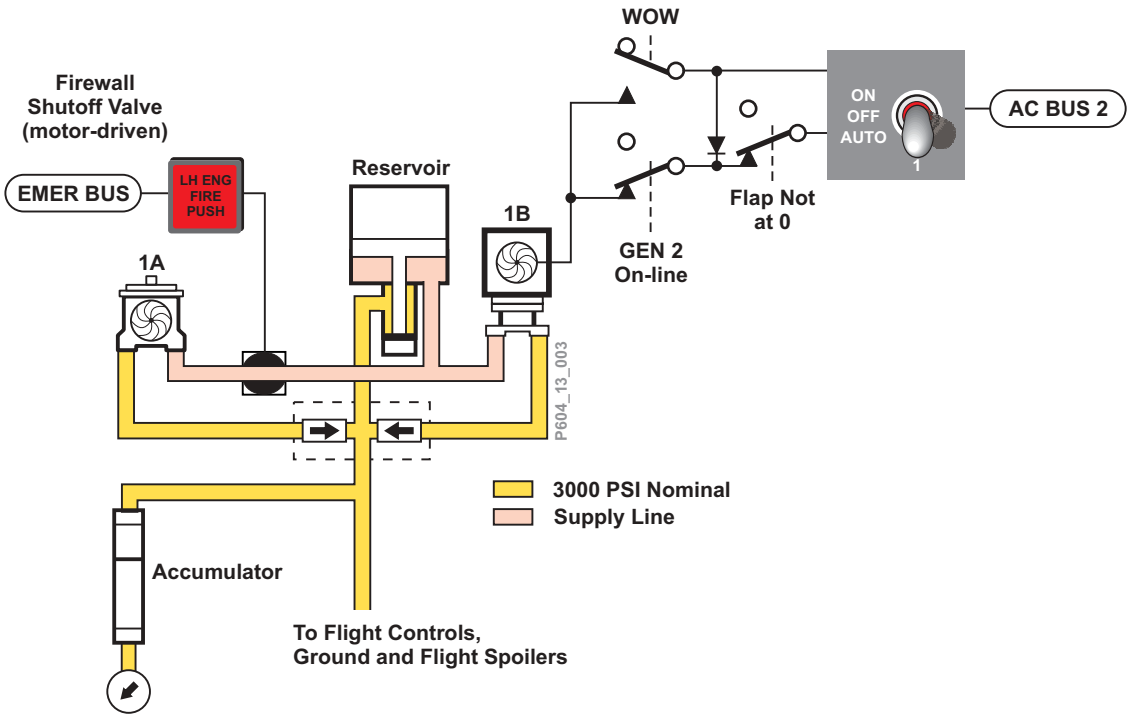
With the switches in the AUTO position, the 1B and 2B pumps automatically start when their respective bus is powered, the associated engine-driven generator is operating and the flaps are not at zero (flap position is greater than 4°). AUTO is the normal switch position for flight operations.

Example (see Figure 13-2): When the 1B switch is set to AUTO, the pump will automatically start with its bus powered (AC BUS 2) when:

- the opposite engine-driven generator (GEN 2) is operating, and
- flap position not at zero (greater than 4°)

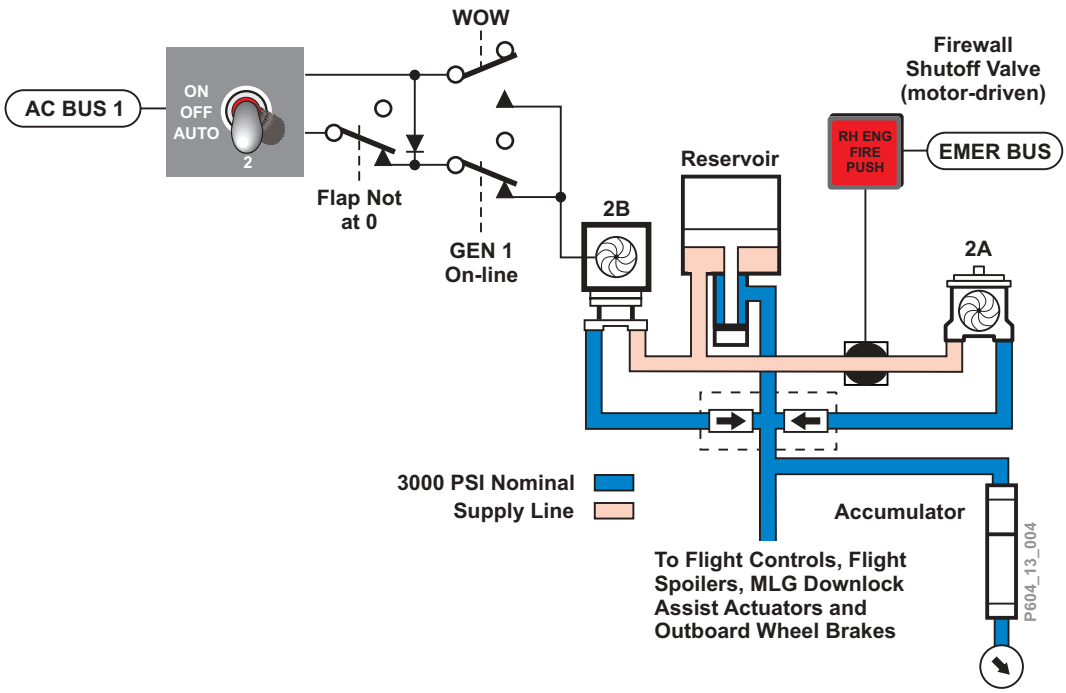
NOTE

ACMP 1B and 2B do not automatically start after an engine failure or an EDP failure.



Hydraulic System 1 - Shown in-flight with Flaps Extended

Figure 13-2



Hydraulic System 2 - Shown in-flight with Flaps Extended

Figure 13-3

ON Position

With the switches in the ON position, ACMP 1B and 2B will operate, provided their respective bus is powered and the associated cross-side engine-driven generator is operating. On the ground, an interlock circuit allows the pumps to operate when the ACMP switch is selected ON, even if the engine-driven generators are not operating (see Figures 13-2 and 13-3).

Generator Output and Load Shedding

During normal operations, ACMP 1B operation is controlled by the electrical output of GEN 2, and ACMP 2B operation is controlled by the electrical output of GEN 1. In the event of an in-flight engine-driven generator malfunction or an engine failure, the control logic inhibits any operation of the opposite side ACMP. This function is called “load shedding” and prevents an electrical overload condition during single-generator operation. The cross-side generator relationship with ACMP 1B and 2B ensures that a loss of system 1 and 2 pressure does not occur with any one of the above failures.

Hydraulic Shutoff Valves

Electrically operated hydraulic shutoff valves are installed in the suction lines of EDP 1A and 2A. Valve positions are indicated on the EICAS Hydraulic synoptic page. The valves are normally open. During an engine fire, the corresponding hydraulic shutoff valve is motored closed by pressing in the ENG FIRE PUSH switch/light (see Chapter 9 Fire Protection).

Accumulator and Reservoirs

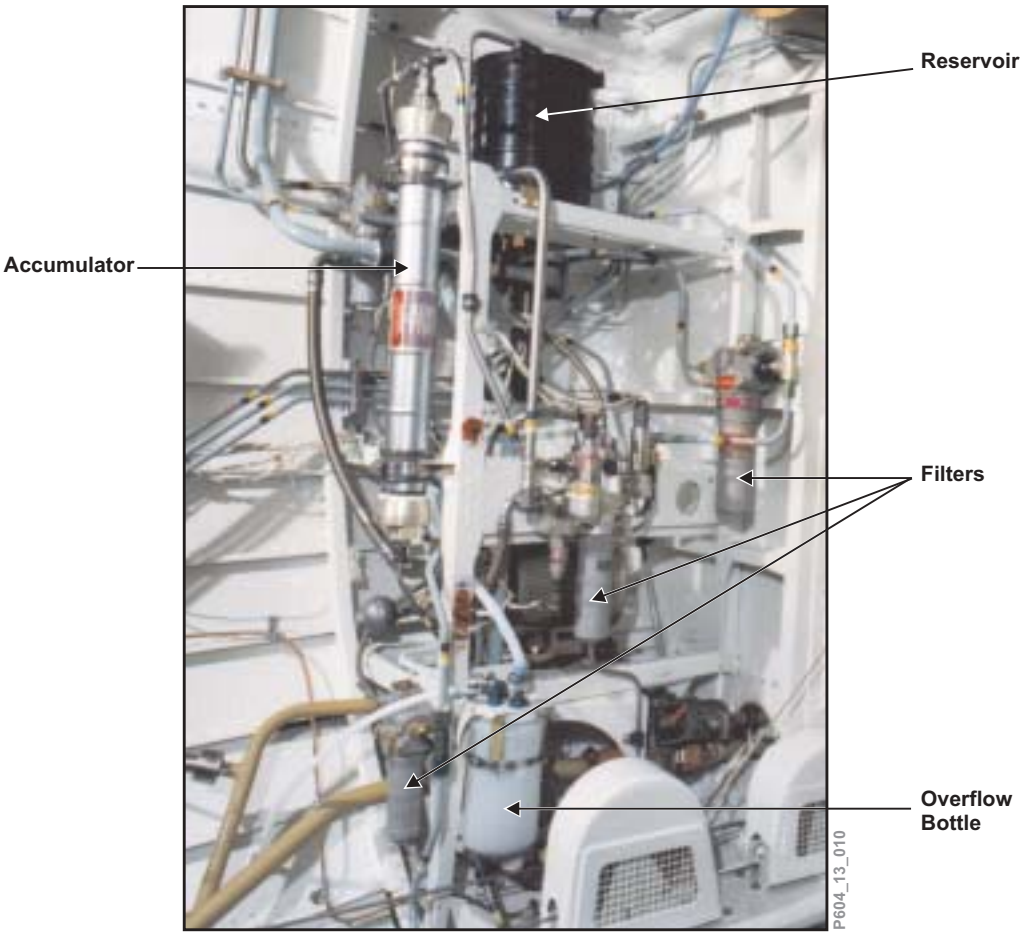
Each system has an accumulator that stores nominal hydraulic pressure to satisfy instantaneous demands of aircraft systems and to dampen pressure surges within the system. Each accumulator is precharged with nitrogen to 1500 psi.

System 1 and 2 reservoirs are hydraulic fluid storage tanks. Each reservoir is a sealed unit and is filled via the ground service panel located directly below the hydraulic equipment rack in the aft equipment bay. System 1 reservoir has a capacity of 2.95 liters (0.78 U.S. Gal.). System 2 reservoir has a capacity of 3.93 liters (1.04 U.S. Gal.).

During preflight, a visual inspection should include checks for fluid leaks and accumulator pressure at 1500 psi. As well, reservoir quantity, overflow containers and filter bypass indicators should be checked (see Figure 13-4).

CAUTION

Hydraulic systems are serviced with Skydrol-B, a fire-retardant fluid easily identified by its purplish color. It is highly corrosive and can produce severe skin and eye irritation. Avoid direct exposure to the fluid.



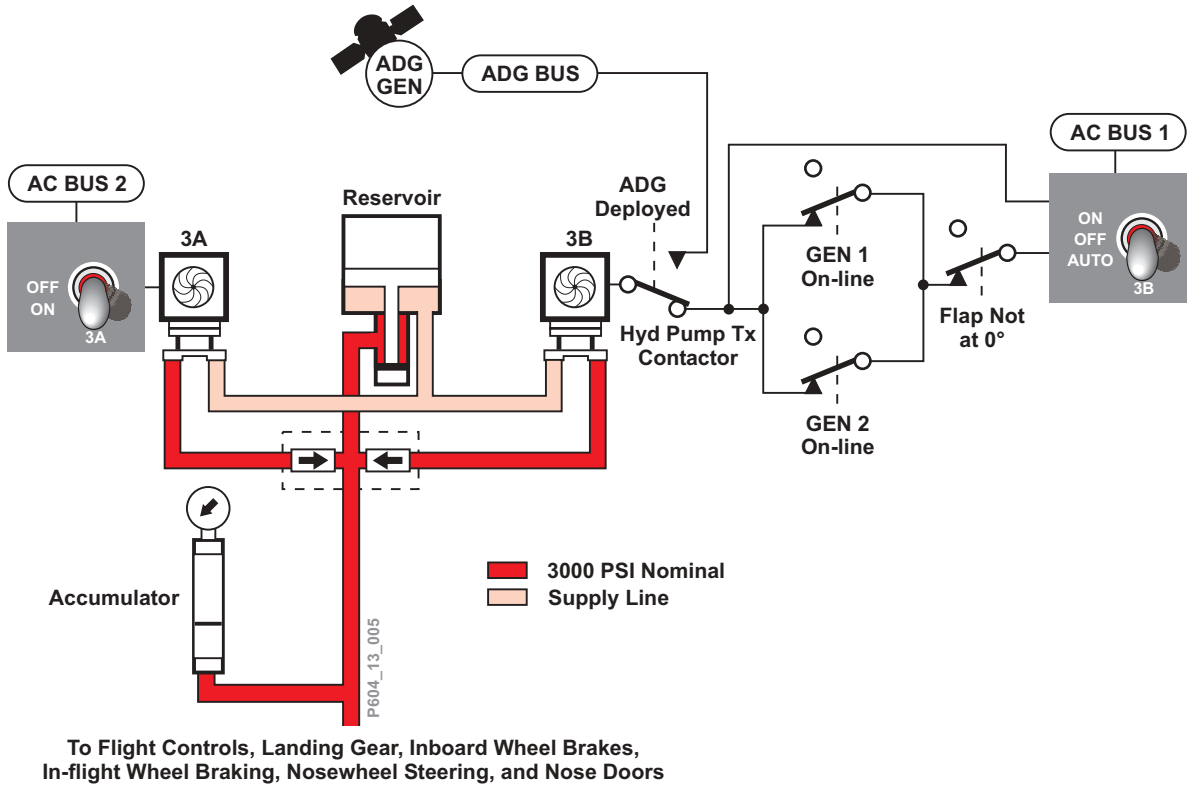
Hydraulic System 2 Equipment Rack

Figure 13-4

System 3

Description

The major components of hydraulic system 3 are two AC motor pumps (ACMP 3A and 3B), an accumulator and a reservoir. ACMP 3A and 3B are located in the left and right side fillets of the aft belly fairing, respectively. The accumulator, reservoir and ground service panel are located in the right main wheel well (see Figure 13-6).



System 3 Schematic - Shown in-flight with Flaps Extended

Figure 13-5

Components and Operation

Main Pump

The main pump for system 3 is AC motor pump 3A (ACMP 3A). A two-position toggle switch on the HYDRAULIC Panel labeled ON and OFF controls the 3A pump. The 3A pump operates continuously with the switch in the ON position, provided AC BUS 2 is powered (see Figure 13-5).

Backup Pump

The backup pump for system 3 is AC motor pump 3B (ACMP 3B). The operation of ACMP 3B depends on hydraulic pump switch position, flap position, engine-driven generator 1 or 2 output and emergency power mode activation (ADG deployment). The 3B pump is controlled by a three-position toggle switch on the HYDRAULIC Panel labeled AUTO, ON and OFF.

AUTO Position

With the switch in the AUTO position, the 3B pump operates when AC BUS 1 is powered, either engine-driven generator is operating, and the flaps are not at zero (flap position is greater than 4°). AUTO is the normal switch position for flight operations.

NOTE

ACMP 3B does not automatically start after ACMP 3A failure.

ON Position

With the ACMP 3B switch in the ON position, the 3B pump will operate provided AC BUS 1 is powered.

ADG Deployment

During ADG deployment ACMP 3B is automatically energized, regardless of its switch position, by the ADG BUS through the Hydraulic Pump Transfer Contactor. This ensures that hydraulic system 3 is available when AC BUS 1 and 2 are unpowered. If AC power is subsequently restored by an engine-driven generator or the APU generator, ACMP 3B will return to normal operation when the PWR TXFR OVERRIDE switch is selected. For additional information on the PWR TXFR OVERRIDE switch, see Chapter 7 Electrical System.

NOTE

If ADG deployment is caused by a double engine failure, ACMP 3B will provide emergency hydraulic power to the primary flight controls while all other pumps are inoperative or load shed.

NOTE

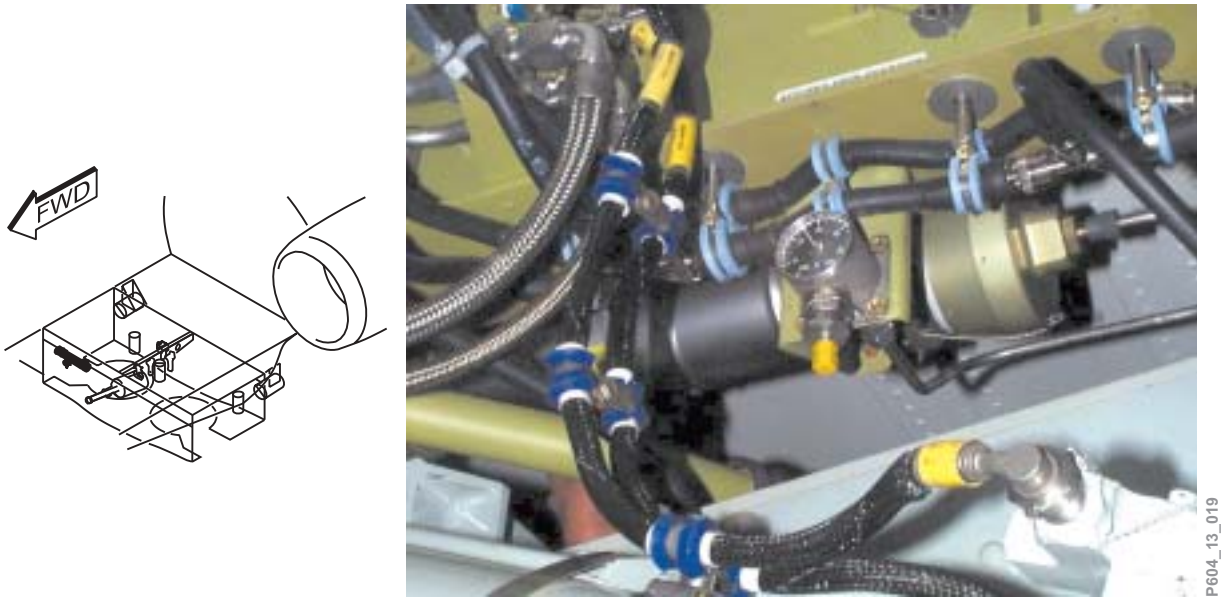
To ensure priority to the primary flight controls, a spring-loaded-closed priority valve cuts off hydraulic system 3 pressure to the landing gear selector valves if hydraulic system 3 pressure drops below 2100 psi. Alternate landing gear extension will be required in this case.

Accumulator and Reservoirs

System 3 has an accumulator that stores nominal hydraulic pressure to satisfy instantaneous demands of aircraft systems and dampen pressure surges within the system. The accumulator is precharged with nitrogen to 1500 psi.

System 3 reservoir is the largest of the three hydraulic systems with a capacity of 11.14 liters (2.94 U.S. Gal.). It is filled via the ground service panel located in the right main wheel well.

During preflight, a visual inspection should include a check for accumulator pressure at 1500 psi. With the exception of the accumulator gauge, system 3 components are not readily accessible with the wheel well bins installed.



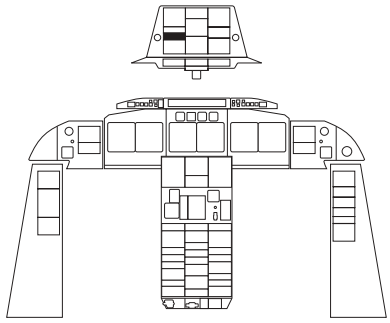
Hydraulic System 3 Accumulator Gauge

Figure 13-6

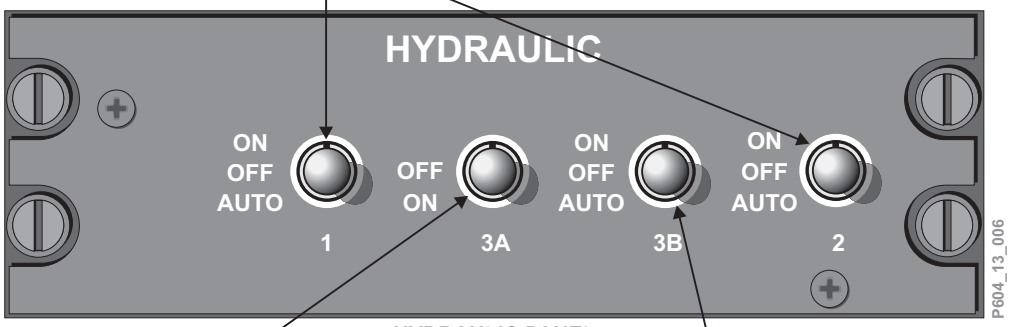
Controls and Indicators

The HYDRAULIC Panel provides the system controls; the EICAS Hydraulic Synoptic Page provides a pictorial representation of the system status, and the EICAS Primary and Status pages provide the system caution and advisory messages respectively (see Figures 13-7 to 13-9 and Table 13-1).

HYDRAULIC Panel



Hydraulic Pump 1B and 2B Switches
ON – On the ground, pump operates continuously; in flight, pump operates if cross-side engine generator is on-line.
OFF – Pump is off.
AUTO – Pump operates automatically whenever flaps are extended and the cross-side engine generator is on-line.



HYDRAULIC PANEL

Hydraulic Pump 3A Switch
ON – Pump operates continuously.
OFF – Pump is off.

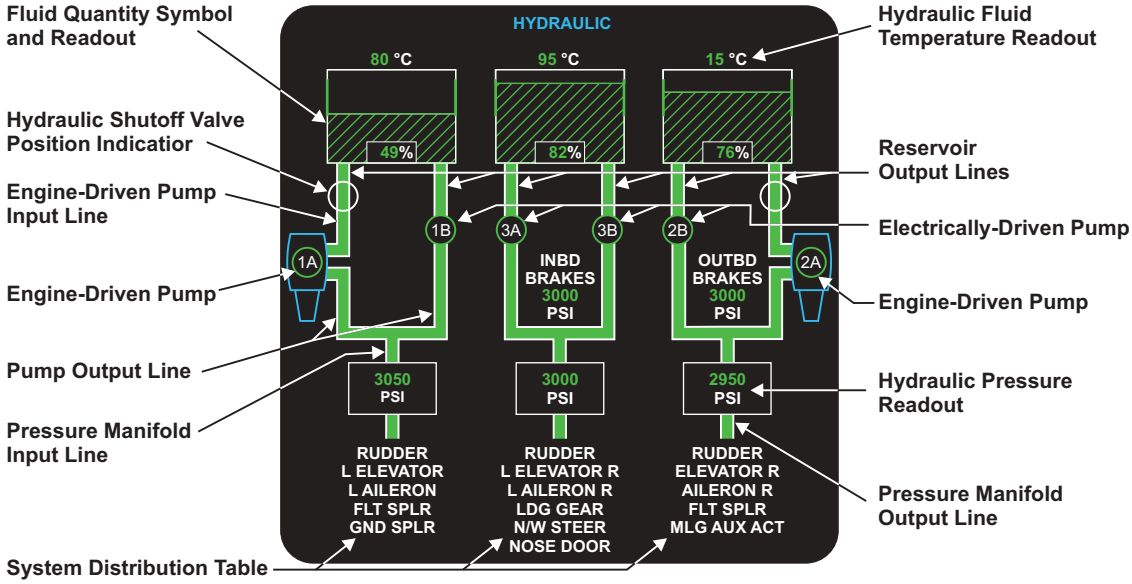
Hydraulic Pump 3B Switch
ON – Pump operates continuously.
OFF – Pump is off.
AUTO – Pump operates automatically whenever flaps are extended and either engine generator is on-line.

NOTE 1: With generators 1 and 2 off, hydraulic pump 3B is load shed when AUTO is selected. (See System 3 schematic, fig. 13-5)

NOTE 2: Whenever the ADG is deployed and supplying electrical power to the aircraft, hydraulic pump 3B will automatically operate regardless of switch position. (See System 3 schematic, fig. 13-5)

HYDRAULIC Panel
Figure 13-7

Hydraulic Synoptic Page



Description	Symbol	Condition
Hydraulic Fluid Temperature Readout	70 °C	Hydraulic fluid temperature is less than 96°C
	110 °C	Hydraulic fluid temperature is greater than or equal to 96°C
	- - - °C	Invalid data
Hydraulic Fluid Symbol and Quantity Readout	80%	Hydraulic fluid quantity is between 45% and 85%
	35%	Hydraulic fluid quantity is less than 45% or more than 85%
	- - %	Invalid data
Hydraulic Shutoff Valve Position Indicator		Hydraulic shutoff valve is open
		Hydraulic shutoff valve is closed after actuation of the respective ENG FIRE PUSH switch/light
		Invalid data
Reservoir Output Line	49%	Sufficient fluid quantity in reservoir (> 2%)
	0%	Insufficient fluid quantity in reservoir (< 2%)

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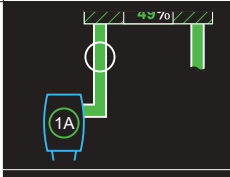
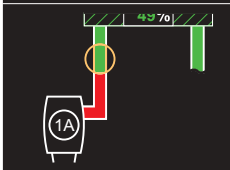
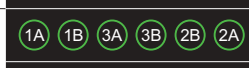
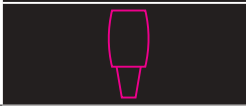
EICAS Hydraulic Synoptic Page Color Coding (1 of 2)

Figure 13-8

Description	Symbol	Condition
Engine-Driven Pump Input Line		Hydraulic shutoff valve is open
		Hydraulic shutoff valve is not closed after actuation of the respective ENG FIRE PUSH switch/light with an engine fire
Hydraulic Pump		Hydraulic pump output pressure is normal
		Hydraulic pump output pressure is low (less than 1800 psi)
		Hydraulic pump output pressure is ready for operation
		Invalid data
Engine Outline		Engine off
		Engine running
		Invalid data
Hydraulic Pump Output Line, Pressure Manifold Input Line, Pressure Manifold Output Line		Hydraulic pressure is greater than 1800 psi
		Hydraulic pressure is less than 1800 psi
Hydraulic Pressure Readout	3000 PSI	Hydraulic pressure is between 1800 psi and 3200 psi
	3300 PSI	Hydraulic pressure is greater than 3200 psi
	1700 PSI	Hydraulic pressure is 1800 psi or less
	- - - - PSI	Invalid data
System Distribution Table	RUDDER L ELEVATOR L AILERON FLT SPLR GND SPLR	Adequate pressure (greater than 1800 psi) is available to operate systems (e.g. all systems powered by Hydraulic System 1 are receiving adequate pressure)
	RUDDER L ELEVATOR L AILERON FLT SPLR GND SPLR	Insufficient pressure (less than 1800 psi) is available to operate systems (e.g. FLT SPLR and GND SPLR are inoperative due to insufficient pressure)
	RUDDER L ELEVATOR L AILERON FLT SPLR GND SPLR	Invalid data (e.g. Hydraulic System 1 system distribution table shown)

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EICAS Hydraulic Synoptic Page Color Coding (2 of 2)

Figure 13-9

EICAS Messages

MESSAGE	MEANING
HYD EDP 1A	Respective engine pump pressure is less than 1800 psi.
HYD EDP 2A	
HYD PUMP 1B	Respective AC motor pump pressure is less than 1800 psi.
HYD PUMP 2B	
HYD PUMP 3A	
HYD PUMP 3B	
HYD SOV 1	Respective hydraulic shutoff valve is not closed after actuation of the respective ENG FIRE PUSH switch/light.
HYD SOV 2	
HYD 1 HI TEMP	Respective system temperature is greater than 96°C or greater than 107°C for 4 minutes after takeoff power is applied.
HYD 2 HI TEMP	
HYD 3 HI TEMP	
HYD 1 LO PRESS	Respective system pressure is less than 1800 psi.
HYD 2 LO PRESS	
HYD 3 LO PRESS	
HYD SOV 1 CLSD	Respective hydraulic shutoff valve has closed after actuation of the respective ENG FIRE PUSH switch/light.
HYD SOV 2 CLSD	

EICAS Messages

Table 13-1

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