



**HYDRAULIC POWER**  
**Table of Contents**

**Vol. 1**

**14-00-1**

REV 3, May 03/05

**CHAPTER 14 – HYDRAULIC POWER**

	Page
<b>TABLE OF CONTENTS</b>	<b>14-00</b>
Table of Contents	14-00-1
<b>INTRODUCTION</b>	<b>14-10</b>
Introduction	14-10-1
<b>SYSTEMS 1 AND 2</b>	<b>14-20</b>
Hydraulic Systems 1 and 2	14-20-1
Engine Driven Pumps	14-20-3
AC Motor Pumps	14-20-3
Shutoff Valves	14-20-4
System Circuit Breakers	14-20-8
<b>HYDRAULIC SYSTEM 3</b>	<b>14-30</b>
Hydraulic Systems 3	14-30-1
AC Motor Pumps	14-30-3
System Circuit Breakers	14-30-6

**LIST OF ILLUSTRATIONS**

<b>INTRODUCTION</b>		
Figure 14-10-1	Hydraulic Systems Overview	14-10-2
Figure 14-10-2	Hydraulic Systems Diagram	14-10-3
<b>SYSTEMS 1 AND 2</b>		
Figure 14-20-1	Hydraulic System (No. 1/2) - Schematic	14-20-2
Figure 14-20-2	Hydraulic Control Panel	14-20-3
Figure 14-20-3	Systems 1 and 2 - Shutoff Valves	14-20-5
Figure 14-20-4	Systems 1 and 2 - Synoptic Page	14-20-6
Figure 14-20-5	Systems 1 and 2 EICAS Indications	14-20-7
<b>SYSTEM 3</b>		
Figure 14-30-1	Hydraulic System 3	14-30-2
Figure 14-30-2	Hydraulic System 3 Control Panel	14-30-3
Figure 14-30-3	Hydraulic Synoptic Page	14-30-4
Figure 14-30-4	Hydraulic EICAS Indications	14-30-5



**HYDRAULIC POWER**  
**Table of Contents**

**Vol. 1**

14-00-2

Sep 09/02

THIS PAGE INTENTIONALLY LEFT BLANK

	<b>HYDRAULIC POWER</b> <b>Introduction</b>		<b>Vol. 1</b>	<b>14-10-1</b>
	REV 3, May 03/05			

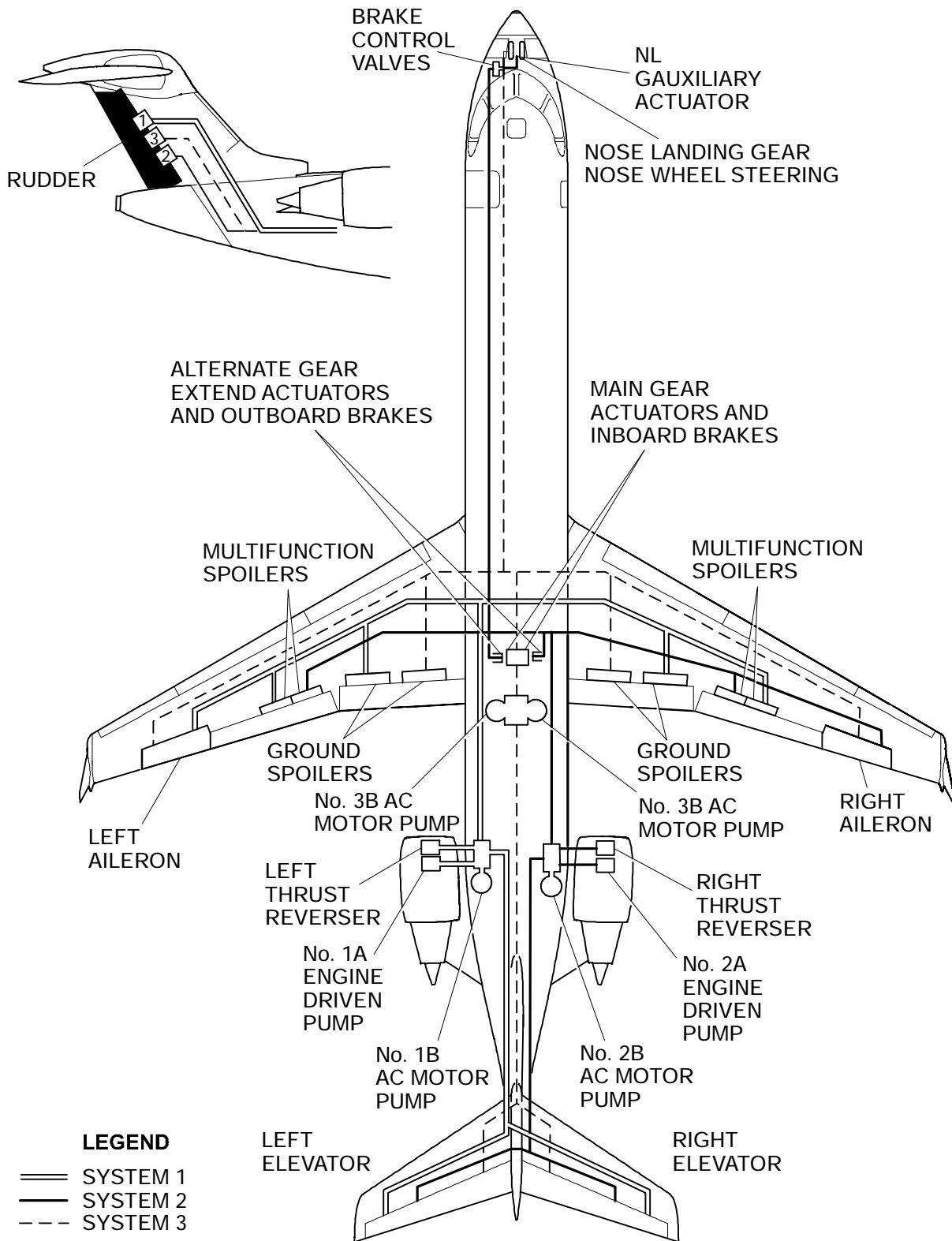
## 1. **INTRODUCTION**

Hydraulic power is provided by three independent systems designated 1, 2 and 3. All systems operate at a nominal pressure of 3000 psi (20,685 kPa). Systems 1 and 2 are serviced by ground service panels located in the aft equipment bay. System 3 is serviced by a ground service panel located on the right side of the fuselage, aft of the wing root.

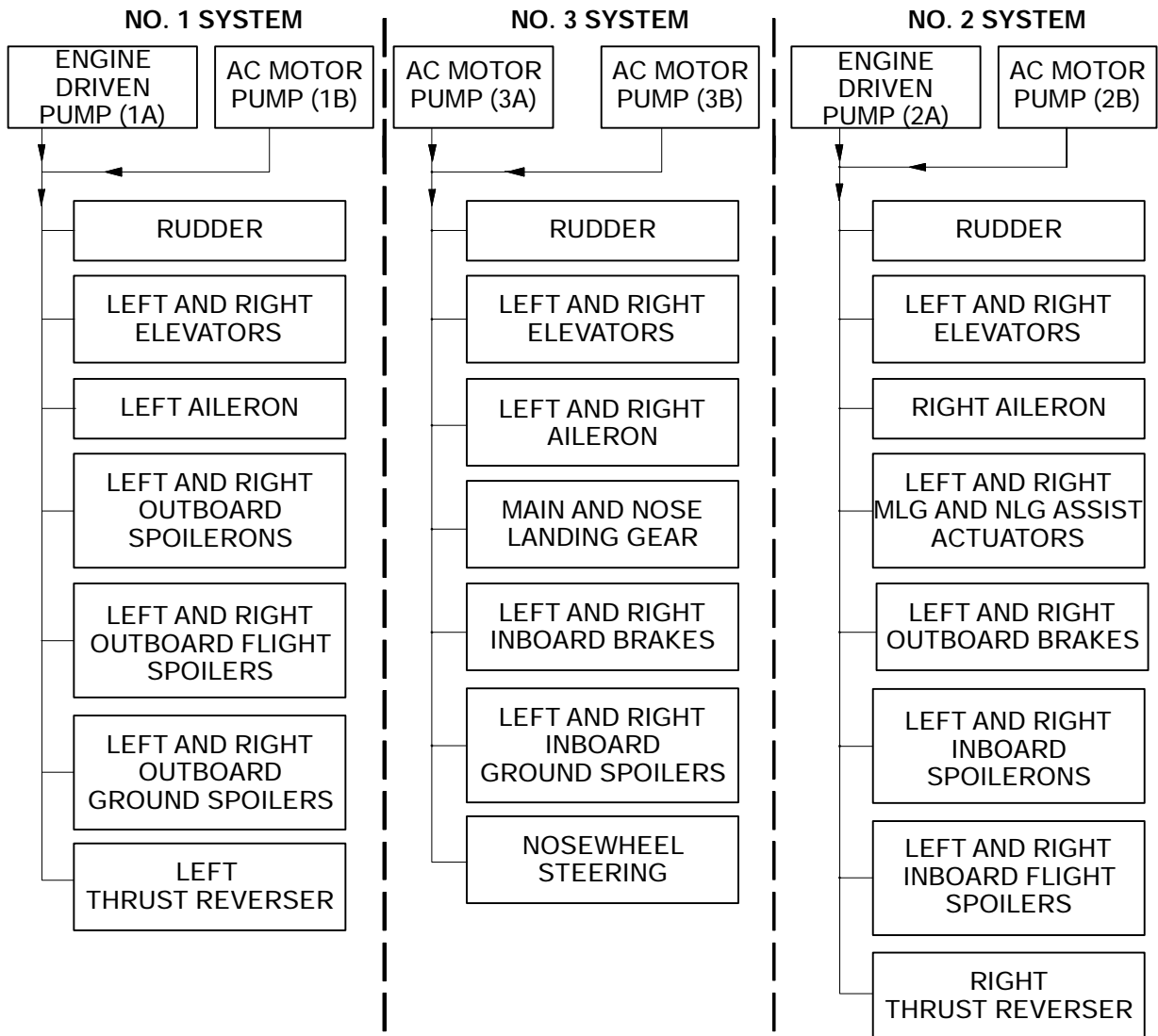
Each system has two hydraulic pumps; a main pump (A) for normal power and a backup pump (B) for supplementary power. System 1 and 2 main pumps are engine driven pumps (EDP). System 1 EDP (1A) is driven by the left engine and system 2 EDP (2A) is driven by the right engine. System 1 and 2 backup pumps (1B and 2B) are AC motor pumps (ACMP). Both pumps for System 3 are ACMPs. System 3 main pump (3A) normally runs continuously, while the backup pump (3B) is available during periods of high flow requirements. Pump 3B is automatically powered, during an AC power failure, by the air driven generator (ADG) when it is deployed.

The hydraulic systems supply power to operate the rudder, elevators, ailerons, spoilers, flight spoilers, ground spoilers, thrust reversers, wheel brakes, nosewheel steering and landing gear extension and retraction. Rudder, elevators and ailerons are powered by more than one hydraulic system to prevent loss of critical flight controls.

	<b>Flight Crew Operating Manual</b> <b>CSP C-013-067</b>	
--	---	--



Hydraulic Systems – Overview  
Figure 14-10-1



Hydraulic Systems Diagram  
Figure 14-10-2



**HYDRAULIC POWER  
Introduction**

**Vol. 1**

**14-10-4**

REV 3, May 03/05

THIS PAGE INTENTIONALLY LEFT BLANK

## 1. HYDRAULIC SYSTEMS 1 AND 2

Hydraulic systems (1 and 2) are identical in construction and operation with each system consisting of an:

- Engine driven pump (EDP)
- AC motor pump (ACMP)
- Shutoff valve
- Reservoir
- Accumulator
- Overflow container
- Pressure and return manifolds
- Case drain filters
- Ground servicing panel

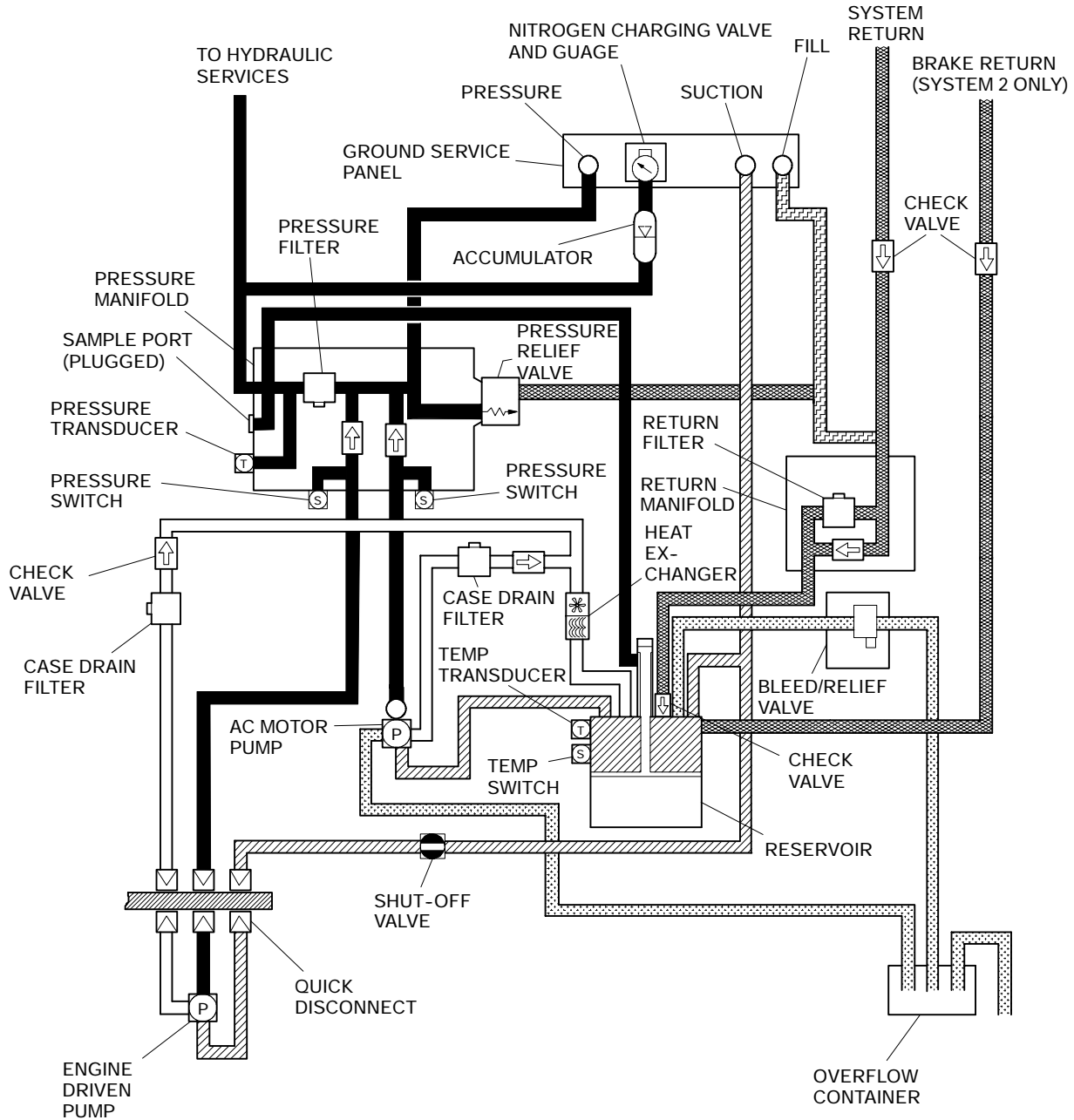
Both systems share a ram air heat exchanger for fluid cooling. Fluid from each system is not mixed with the other system as it passes through the heat exchanger. A fan within the heat exchanger assists in cooling the hydraulic fluid when the aircraft is on the ground.

Each system is monitored by:

- Temperature and pressure switches
- Temperature and pressure transducers
- Quantity transducers and indicating gauges.

### NOTE

Figure 14-20-1 represents No. 1 or No. 2 hydraulic system.



- |  |   |
|--|---|
|  SUCTION  |  CASE DRAIN        |
|  PRESSURE |  DRAIN TO OVERFLOW |
|  RETURN   |  FILL              |

Hydraulic System ( No. 1/2) – Schematic  
Figure 14-20-1



**A. Engine Driven Pumps**

EDP 1A and 2A draw fluid from their respective reservoirs through firewall shutoff valves. Fluid is pumped to the applicable pressure manifold, filtered and distributed to the airplane's hydraulically actuated components.

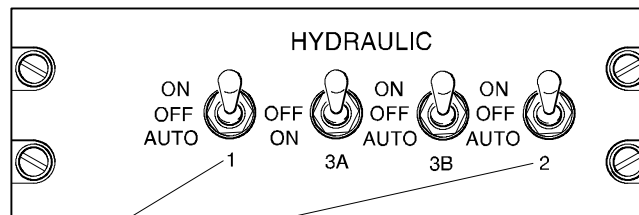
**B. AC Motor Pumps**

AC motor pump 1B is powered from AC bus 2 and AC motor pump 2B is powered from AC bus 1. Each AC motor pump is controlled by a separate toggle switch on the hydraulic pump control panel located on the overhead panel in the flight compartment. When a pump switch is set to AUTO, the pump will automatically start under the following conditions:

- -AC BUS 2 must be powered for hydraulic pump 1B operation,  
-AC BUS 1 must be powered for hydraulic pump 2B operation.
- Flaps are out of the 0° position.

**NOTE**

AC motor pumps 1B and 2B do not automatically start during or after an engine failure.



**AC Motor Pump 1 and 2**  
Used to control the operation of AC motor pumps 1B and 2B.

- ON - Pump will operate at 3000 psi output
- OFF - Pump inoperative
- AUTO - Pump will operate in AUTO position, when flaps are greater than 0-degrees.

**Hydraulic Control Panel  
Overhead Panel**

Hydraulic Control Panel  
Figure 14-20-2



## HYDRAULIC POWER Systems 1 and 2

Vol. 1

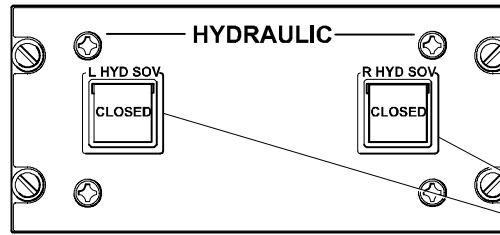
14-20-4

Sep 09/02

### C. Shutoff Valves

Electrically operated ball type shutoff valves are installed in the suction lines of the engine driven pumps (1A and 2A). The valves are normally open. Valve position is indicated on the EICAS, HYD synoptic page.

During an engine fire condition, the corresponding shutoff valve is motored closed when the ENG FIRE PUSH switchlight is pressed in (See Chapter 10, Fire Protection). Each shutoff valve can be manually closed by pressing the L or R HYD SOV switchlight on the hydraulic shutoff panel in the overhead panel.

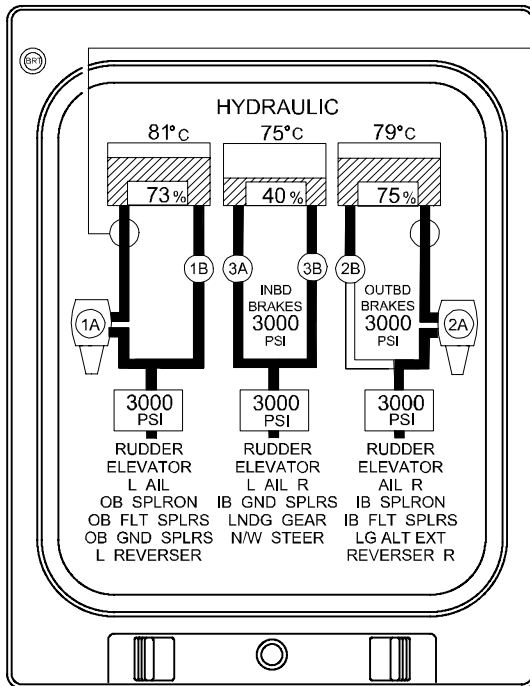


**Hydraulic Shutoff Valve Panel  
Overhead Panel**

**L and R HYD SOV**

Used to manually close the hydraulic shutoff valves.

- CLOSED (white) light indicates shutoff valve is selected closed.



**Hydraulic Page**

**Shutoff Valve Position Indicator**

- valve open (white)
- valve closed (white)
- failed (half-intensity magenta)

Valve outline will turn amber if valve fails to attain commanded position.

Systems 1 and 2 – Shutoff Valves  
Figure 14-20-3

**Hydraulic Temperature**

Displays reservoir fluid temperature (in 1°C increments).

- Green - < 96°C (205°F).
- Amber - ≥ 96°C (205°F).
- Amber dashes - Invalid data.

**Hydraulic Quantity**

Displays reservoir fluid quantity (in 5% increments). Normal quantity is 45 to 85 percent.

- White - Hydraulic quantity < 45% or > 85%.
- Green - Hydraulic quantity ≥ 45% and ≤ 85%.
- Amber dashes - Invalid data.

**Reservoir Output Line**

- Green - Sufficient quantity (≥ 5%).
- Blank - Insufficient quantity (< 5%).

**Engine Driven Pump Input Line**

- Green - SOV open.
- Red - SOV not closed with an engine fire.

**Pump Output and Pressure Manifold Lines**

- Green - Pressure (> 1800 psi).
- Amber - Low pressure (< 1800 psi).

**Pump**

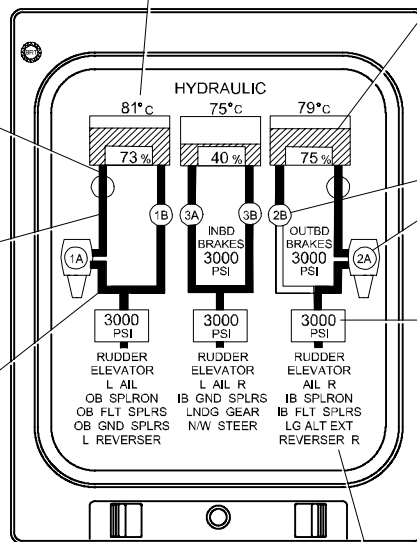
Displays pump status.

- White - Pump not operating and selected off.
- Green - Pump output normal.
- Amber - Pump output low.
- Half-intensity magenta - Invalid data.

**Hydraulic Pressure**

Displays hydraulic pressure (in 100 psi increments). Normal operating pressure is 2800 to 3200 psi.

- White - Hydraulic pressure > 3200 psi.
- Green - Hydraulic pressure > 1800 psi and ≤ 3200 psi.
- Amber - Hydraulic pressure ≤ 1800 psi.
- Amber dashes - Invalid data.



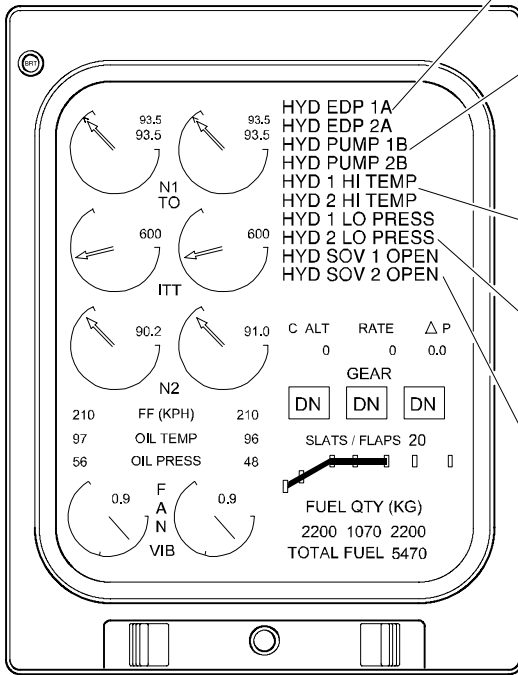
**Hydraulic Page**

**System Distribution Table**

Displays status of corresponding airplane systems.

- White - Adequate pressure to operate (> 1800 psi).
- Amber - Hydraulic supply to system inadequate (< 1800 psi).
- Half-intensity magenta - Invalid data.

Systems 1 and 2 – Synoptic Page  
Figure 14-20-4



**Primary Page**

**HYD EDP 1A or 2A caution (amber)**  
Indicates that corresponding engine driven pump has a low pressure output (<1800 psi).

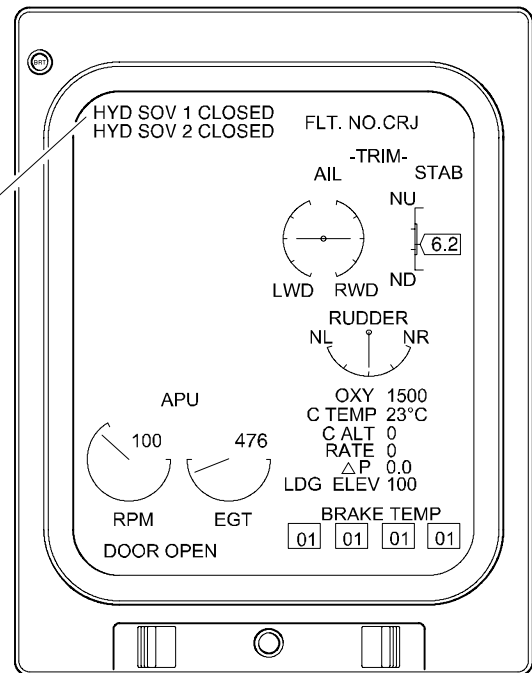
**HYD PUMP 1B or 2B caution (amber)**  
Indicates that corresponding AC motor pump has a low pressure output (<1800 psi).  
• With engine driven pump operating and 1B or 2B pump operating ON or AUTO.

**HYD 1 or 2 HI TEMP caution (amber)**  
Indicates that corresponding system has a fluid temperature of 96° C (205° F) or greater.

**HYD 1 or 2 LO PRESS caution (amber)**  
Indicates that corresponding system pumps (both EDP and AC motor pump) have a low pressure output (<1800 psi).

**HYD SOV 1 or 2 OPEN caution (amber)**  
Indicates that the respective shut-off valve is open with an associated engine fire.

**HYD SOV 1 or 2 CLOSED advisory (green)**  
Indicates that corresponding shut-off valve has been closed.



**Status Page**

Systems 1 and 2 EICAS Indications <1001>  
Figure 14-20-5



**HYDRAULIC POWER  
Systems 1 and 2**

**Vol. 1**

14-20-8

Sep 09/02

**D. System Circuit Breakers**

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Hydraulic Systems 1 and 2	Pumps	HYD SYST AC PUMP CONT 1	DC BUS 2	2	F13	
		HYD SYST AC PUMP CONT 2	DC BUS 1	1	F14	
	Indication	HYD SYST IND 1	DC BUS 2	2	F12	
		HYD SYST IND 2	DC BUS 1	1	F13	
	Fans	HYD SYST FAN	AC BUS 1		A8	
		HYD SYST FAN CONT	DC BUS 1		F12	
	Shutoff Valves	HYD SOV R ENG	DC EMERGENCY		R5	
		HYD SOV L ENG			R6	



**1. HYDRAULIC SYSTEM NO 3**

Hydraulic system No. 3 consists of the following components:

- Two AC motor pumps (identified as 3A and 3B)
- Reservoir
- Accumulator
- Three overflow containers
- Pressure and return manifolds
- Case drain filters
- Ground servicing panel

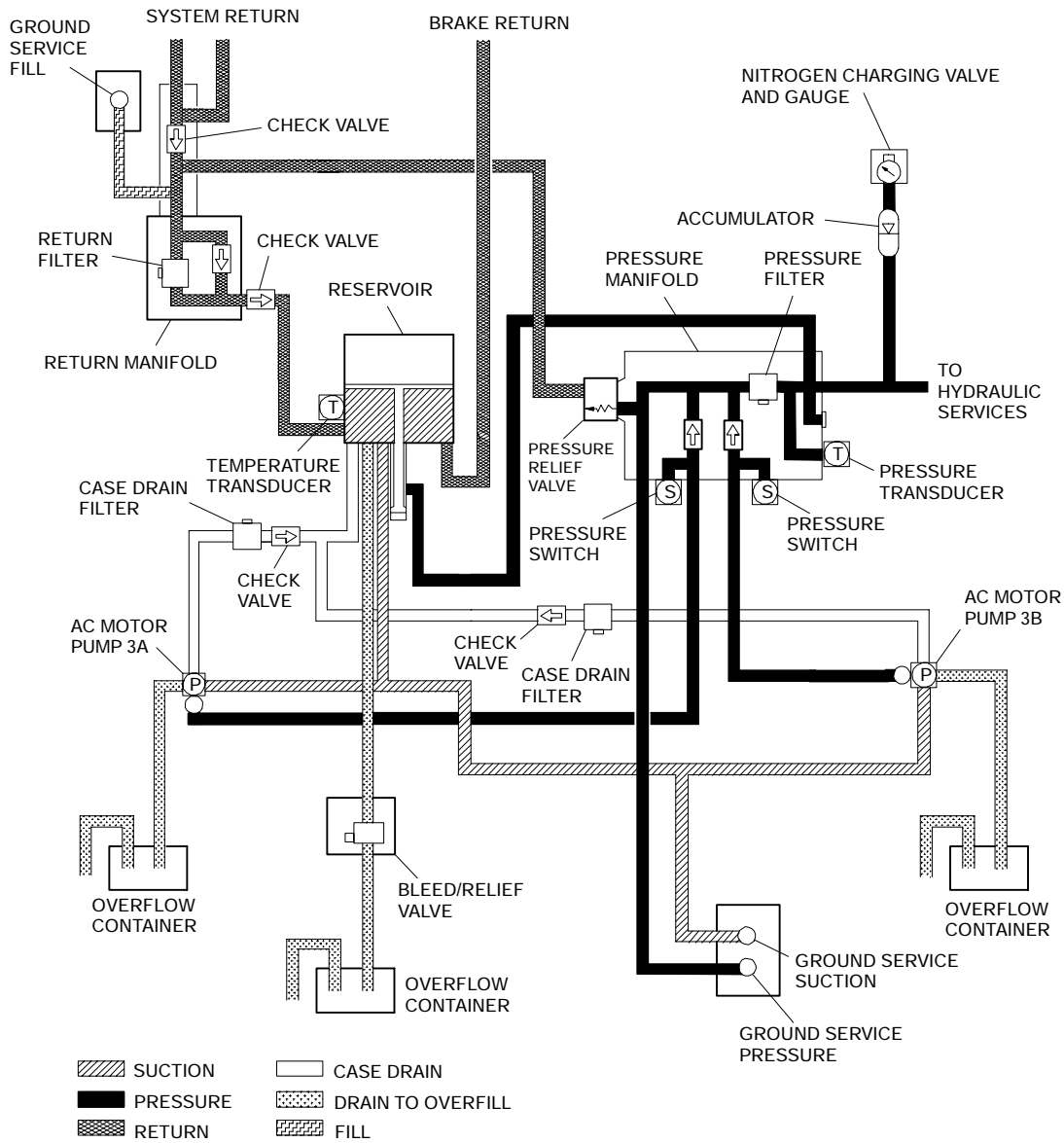
Hydraulic system No. 3 provides pressure to the following systems:

- Ailerons
- Elevators
- Rudder
- Inboard ground spoilers
- Landing gear actuators
- Inboard brakes
- Nosewheel steering

Hydraulic system No. 3 does not have a heat exchanger and does not use the No.1 and No. 2 system heat exchanger for cooling the system fluid. The No. 3 system hydraulic fluid runs through lines that pass through the fuel tanks thereby allowing the fluid to be cooled through natural convection.

No. 3 hydraulic system is monitored by:

- Temperature and pressure switches
- Temperature and pressure transducers
- A quantity transducer and gauge

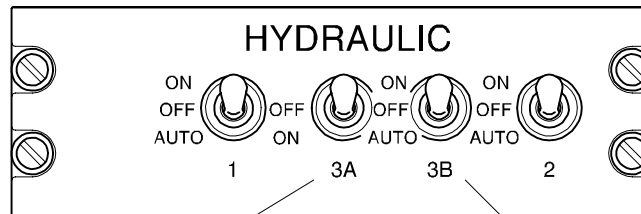


Hydraulic System 3  
Figure 14-30-1



**A. AC Motor Pumps**

Hydraulic system No. 3 AC motor pumps (ACMPs) are controlled by switches on the hydraulic control panel. ACMP 3A runs continuously to maintain normal system pressure. ACMP 3B operates during takeoffs and landings. The ADG bus automatically powers ACMP 3B when the ADG is deployed (independent of the flight compartment 3B switch setting).



**AC Motor Pump 3A**  
Used to control the operation of AC motor pump 3A.

- ON - Pump will operate at 3000 psi output.
- OFF - Pump inoperative.

**Hydraulic Pump Panel  
Overhead Panel**

**AC Motor Pump 3B**  
Used to control the operation of AC motor pump 3B. Pump will operate irrespective of switch position when ADG is deployed.

- ON - Pump will operate at 3000 psi output.
- OFF - Pump inoperative.
- AUTO - Pump will operate in AUTO position, when flaps are greater than 0-degrees and either IDG 1 or IDG 2 is operating.

Hydraulic Control Panel  
Figure 14-30-2

**Hydraulic Temperature**

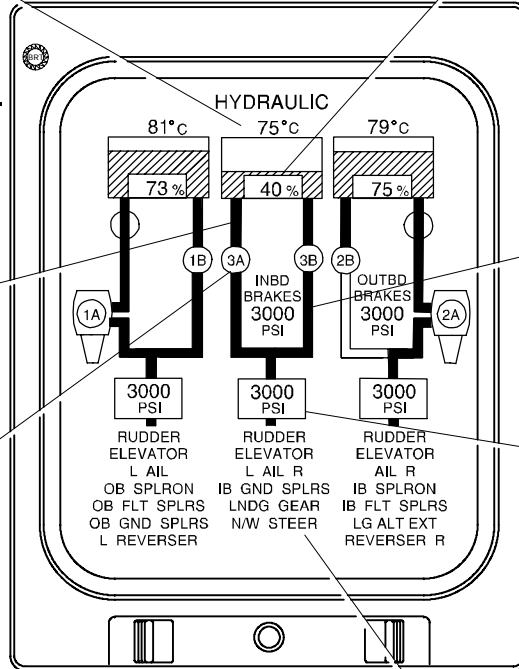
Displays reservoir fluid temperature (in 1° C increments).

- Green - < 96°C (205°F).
- Amber - ≥ 96°C (205°F).
- Amber dashes - Invalid data.

**Hydraulic Quantity**

Displays reservoir fluid quantity (in 5% increments). Normal quantity is 45 to 85 percent.

- White - Hydraulic quantity < 45% or > 85% .
- Green - Hydraulic quantity ≥ 45% and ≤ 85% .
- Amber dashes - Invalid data.



**Pump Output and Pressure Manifold Lines**

- Green - Pressure > 1800 psi.
- Amber - Low pressure (< 1800 psi).

**Reservoir Output Line**

- Green - Sufficient quantity (≥ 5%).
- Blank - Insufficient quantity (< 5%).

**Hydraulic Pressure**

Displays hydraulic pressure (in 100 psi increments). Normal operating pressure is 2800 to 3200 psi.

- White - Hydraulic pressure > 3200 psi.
- Green - Hydraulic pressure > 1800 psi and ≤ 3200 psi.
- Amber - Hydraulic pressure ≤ 1800 psi.
- Amber dashes - Invalid data.

**Pump**

Displays pump status.

- White - Pump not operating and selected off.
- Green - Pump output normal.
- Amber - Pump output low.
- Half-intensity magenta - Invalid data.

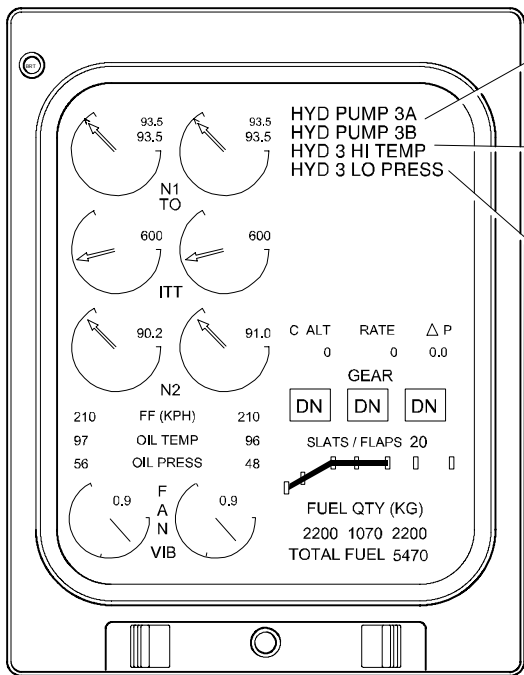
**System Distribution Table**

Displays status of corresponding airplane systems.

- White - Adequate pressure to operate (> 1800 psi).
- Amber - Hydraulic supply to system inadequate (< 1800 psi).
- Half-intensity magenta - Invalid data.

**Hydraulic Page**

**Hydraulic Synoptic Page  
Figure 14-30-3**



**HYD PUMP 3A or 3B caution (amber)**  
Indicates that corresponding AC motor pump has a low pressure output (< 1800 psi).

**HYD 3 HI TEMP caution (amber)**  
Indicates that corresponding system has a fluid temperature of 96° C (205° F) or greater.

**HYD 3 LO PRESS caution (amber)**  
Indicates that corresponding system pumps (both AC motor pumps) have a low pressure output (< 1800 psi).

**Primary Page**

Hydraulic EICAS Indications <1001>  
Figure 14-30-4



**HYDRAULIC POWER  
System 3**

**Vol. 1**

**14-30-6**

Sep 09/02

**B. System Circuit Breakers**

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Hydraulic System 3	Pumps	HYD SYST AC PUMP CONT 3A	DC BUS 2	2	F14	
		HYD SYST AC PUMP CONT 3B	DC BUS 1	1	F11	
	Indication	HYD SYST IND 3	BATTERY BUS		L8	