

Gulfstream G150

AIRPLANE FLIGHT MANUAL

Section VII
Systems

HYDRAULIC SYSTEM

GENERAL

The hydraulic power is supplied by two fully independent systems. Main system provides regulated hydraulic pressure of 3000 psi for normal operation of the ailerons, wheel brakes, landing gear retraction/extension, nose wheel steering, brakes and ground & flight air brakes. The auxiliary system is self contained and normally powers the ailerons (one of two actuators per side), parking brakes and thrust reversers. Emergency brakes are powered by this system when the main system fails.

Additional power source is a compressed nitrogen cylinder used only for emergency landing gear extension.

Hydraulic Reservoirs Pressurization

The main and auxiliary hydraulic reservoirs are pressurized to a nominal pressure of 30 psi to prevent cavitation at all flight altitudes.

Bleed air for pressurization is taken from the ECS bleed switching valves. If reservoirs pressure drops below 8.5 psi, **HYD TANK PRESS LOW** message comes on.

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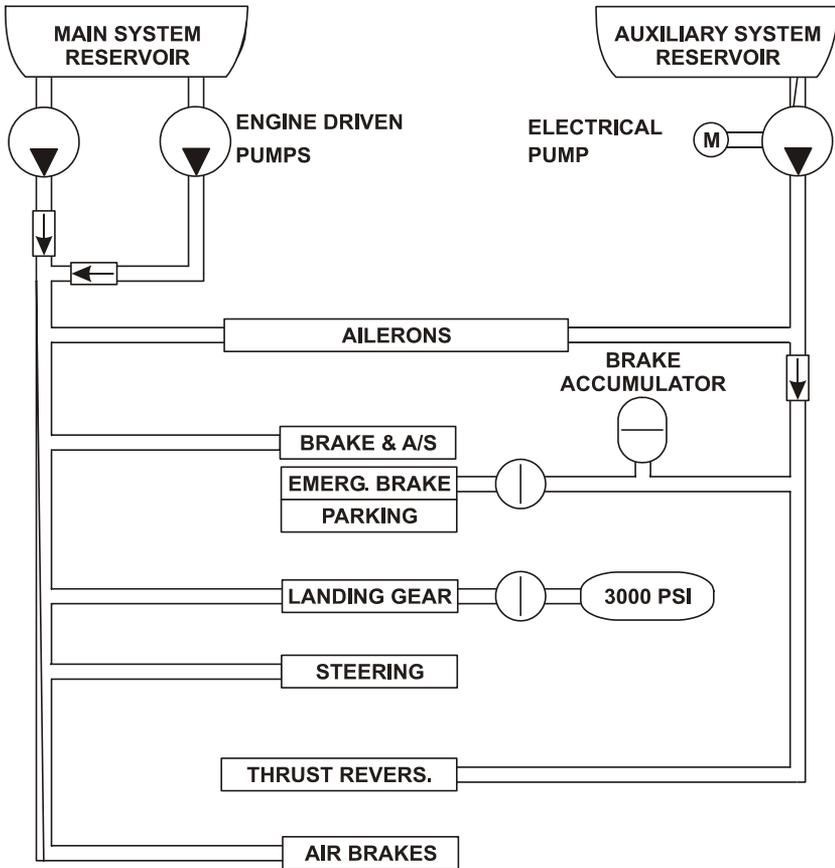


Figure 7-29-1. Hydraulic Power Systems - Schematic

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MAIN HYDRAULIC SYSTEM

The main system consists of a pressurized tank, two constant-pressure pumps, each powered by one engine and all the monitoring and safety accessories. Each pump draws hydraulic fluid through fire shut-off valve and furnishes pressure for the main system. If a pump or engine fails on one side, the remaining pump can deliver sufficient pressure to operate the system.

The auxiliary system consists of an additional pressurized tank, electrically driven hydraulic pump, brake accumulator and accessories. The system comes on when landing gear is out of retracted position (on ground and during take-off and landing). Time delay relay keeps pump operating for 10 seconds after gear retraction.

The auxiliary system also comes on after the following failures: Pressure loss in main system (both **HYD PUMP PRESS LOW (L/R)** messages are on), low fluid level in main system (**MAIN HYD LEVEL LOW** message is on), brake accumulator pressure loss, mechanical failure in one aileron servoactuator (**AILERON FAIL** message is on). The pump automatically stops operation if all the failures are corrected except after aileron failure.

The AUX HYD PUMP switch must be in AUTO position to enable system automatic operation.

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Engine-driven Pump

There are two main axial-piston type pumps with a cylinder barrel comprising of nine pistons. Each pump is driven by an accessory drive gearbox on each engine and delivers 6.8 gpm at 6300 rpm.

Main Hydraulic Filter Assemblies

Two high pressure filters, one for each pump pressure line, are installed on the left side of the aft fuselage. Both filters have a 15 micron absolute rating. Each filter comprises of a differential pressure indicator, an automatic inlet port shut-off valve, a filter bowl, a filter head and a disposable filter element. A red indicator button, on the upper side of the filter, pops out when the filter is clogged or restricted.

A return line filter installed aft of the left side of the baggage compartment filters return system fluid. The filter comprises a differential pressure indicator, an automatic inlet port, a shut-off valve, bypass valve, relief valve, filter bowl, filter head and a disposable filter element. Hydraulic fluid enters the inlet port and flows through the filter element and shut-off valve diaphragm to the outlet port.

The filter has a 15 micron absolute rating. A red indicator button, on the upper side of the filter, pops out whenever the filter is clogged or a differential pressure of 60 ± 10 psi is exceeded. If a differential pressure of 70 ± 10 psi occurs, the relief valve opens allowing unfiltered return fluid to flow from the inlet port directly to the outlet port, bypassing the filtering element.

Main Hydraulic System Manifold Assembly

The manifold assembly comprises of a pressure relief valve, two check valves, two pressure switches and a pressure transducer. Fluid enters the manifold from the left and right pressure lines. The two pressure switches transmit signals to display EICAS message and to the logic circuit of the auxiliary system.

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Main Fire Shut-off Valve

Two fire shut-off valves are installed on the reservoir, one valve on each of the supply pressure ports. When a fire pushbutton is pressed, the shut-off valve closes and stops fluid flow to the pump.

The valve is ball type, actuated by a reversible electrical motor which automatically stops when the valve gate is fully open or closed.

Main Hydraulic Reservoir Air Pressure Relief Valve

The relief valve is installed on the main system reservoir. The valve operates if an overpressure occurs.

Main Hydraulic Relief Valve

The main hydraulic relief valve is of cartridge type, installed in the main hydraulic system manifold. Valve operation is automatic. If the pressure in the main system increases to 3650 psi, the valve opens and relieves pressure to the main reservoir. As the system pressure decreases, the valve closes fully at 3200 psi.

Main Hydraulic Manifold Pressure Transmitter

The hydraulic pressure transmitter is installed on the main manifold assembly left side next to the hydraulic reservoir. The transmitter sends a signal to display EICAS messages when manifold pressure is not within limits.

Main Hydraulic Manifold Pressure Switch

Two pressure switches are installed on the main system manifold, one in each pressure line upstream of the two check valves. The two pressure switches transmit signals to the logic circuit of the auxiliary system. The pressure switches transmit a signal to display EICAS message if the system pressure, from left or right engine-driven pumps, falls to 1500 ± 100 psi.

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Main Hydraulic Reservoir Air Release Valve

An air pressure release valve is installed on the main system reservoir to facilitate pressure release before removal of reservoir cap.

Main Hydraulic Temperature Sensor

The main hydraulic temperature sensor is installed in the main hydraulic fluid return line to measure hydraulic fluid temperature. A signal is sent to the logic circuit of the main hydraulic system to display the temperature reading on the MFD. **MAIN HYD TEMP HI** message is displayed, indicating fluid temperature of 85°C.

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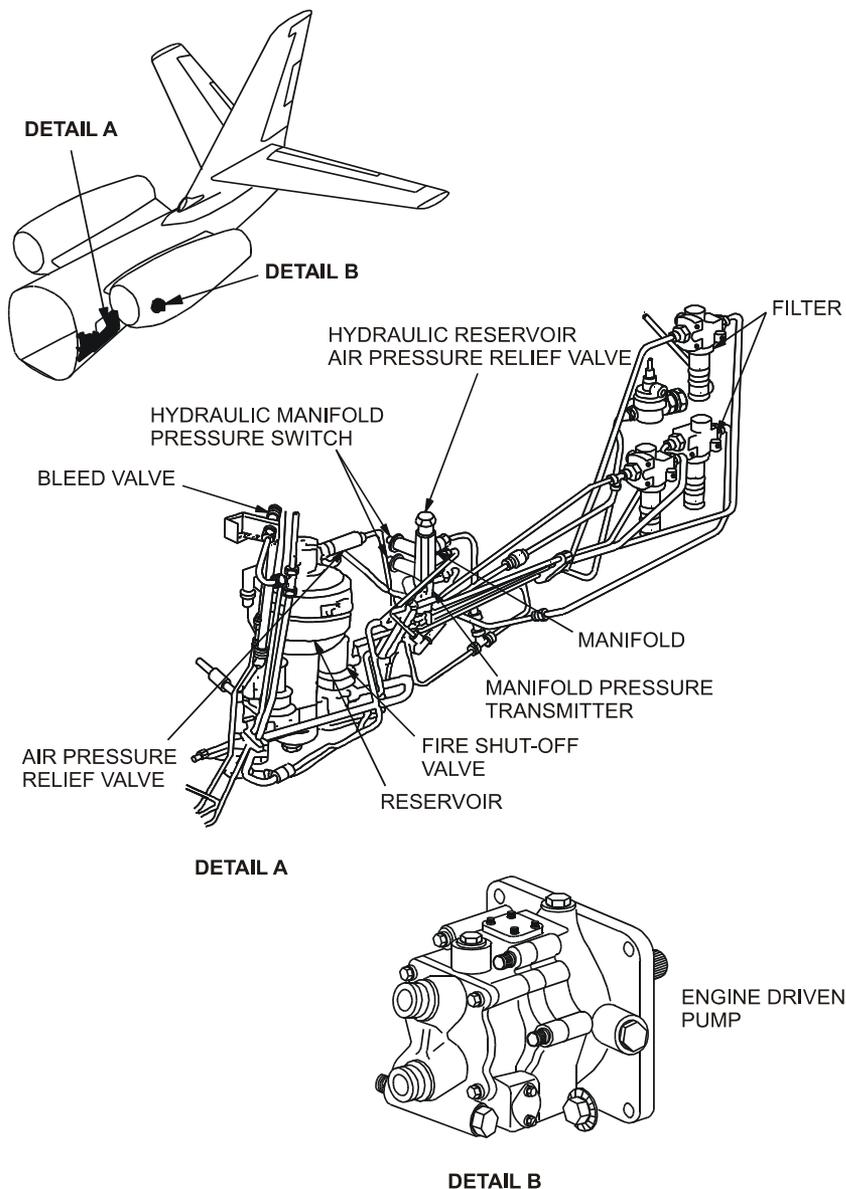


Figure 7-29-2. Main Hydraulic System

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AUXILIARY HYDRAULIC SYSTEM

The auxiliary power system comprises a separate pressurized hydraulic reservoir and an electrically driven pump, together with the associated monitoring and safety accessories.

The system is active during take-off and landing through a three-position switch and automatically cuts in if the main system pressure fails.

The auxiliary system supplies power to the thrust reversers, ailerons, parking brakes and emergency braking system.

The electrical power is supplied from number two main bus, through a remote controlled circuit breaker (RCCB).

Auxiliary Hydraulic Pump

The auxiliary pump and motor, comprise of a variable delivery hydraulic pump driven by an electric motor. The pump is installed on the right side of the baggage compartment. The rated flow is 2.9 gpm provided by nine pistons which reciprocate in a cylinder barrel driven by a splined drive shaft from the electric motor. The pistons are retained by a hold down plate and hydrostatically balanced shoes which run on an inclined cam face.

As the barrel rotates, the pistons reciprocate within their bores, drawing in and discharging fluid. A pressure sensing mechanism within the pump provides variable output flow, depending on aircraft system demand, by regulating the amount of fluid delivered.

The electric motor is a totally enclosed, fan cooled, 28 Vdc motor, complete with radio noise filters.

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Auxiliary Hydraulic System Filters and Filter Elements

The auxiliary high pressure filter, located in the auxiliary pump pressure line, filters hydraulic fluid entering the auxiliary system. The filter is installed on a mounting bracket on the right side of baggage compartment. The filter is equipped with a disposable filtering element with a 15 micron absolute rating. A red indicator pop out button on the upper side of the filter housing indicates if the element becomes restricted or clogged. The indicator button is actuated at a differential pressure of 60 - 80 psi and extends approximately 1/4 inch from flush position.

The auxiliary return filter filters the return fluid to the reservoir. The filter is equipped with a disposable filtering element with a 15 micron absolute rating. A red indicator pop out button on the upper side of the filter housing indicates if the element becomes clogged or restricted. The indicator button is actuated at a differential pressure of 35 ± 5 psi and extends approximately $\frac{1}{4}$ inch from flush position. When the differential pressure increases to 50 ± 5 psi a relief valve in the filter open and allows unfiltered fluid to bypass the clogged element and flow directly from inlet to outlet port.

Auxiliary Hydraulic System Manifold Assembly

There are two separate manifolds in the system, No. 1 manifold is located in the aft fuselage forward right side of the baggage compartment and No. 2 manifold is located at in the main landing gear wheel well. The No. 1 manifold comprises of a pressure transmitter which provides a signal to the auxiliary system pressure indicator.

The No. 2 manifold directs system pressure to the thrust reverser and emergency brake system. The manifold comprises of two check valves, two pressure switches and a relief valve. One check valve prevents pressure loss from the auxiliary hydraulic accumulator and thrust reverser system and the other prevents pressure loss from the emergency brake system.

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Auxiliary Hydraulic Pressure Release Valve

A manually operated pressure release valve connected to a pressure line from the No. 2 manifold is installed in the refueling panel on the right side of the fuselage. The release valve is used to release auxiliary system pressure for servicing and maintenance purposes.

Pressing the release button releases pressure from the thrust reverser systems to the return line back to the reservoir.

Auxiliary Hydraulic Manifold Pressure Transmitter

The No. 1 manifold comprises of a pressure transmitter which provides a signal to the auxiliary system pressure indication and a pressure switch.

Auxiliary Hydraulic Accumulator

An accumulator connected to a pressure line from the No. 2 manifold is used to keep fluid under pressure for emergency brake operation and parking. The accumulator is installed in the right main landing gear wheel well. The accumulator is charged with nitrogen through a charge valve installed on the refueling panel on the right side of the fuselage. The charge pressure for the accumulator is 1500 psi.

Auxiliary Hydraulic Pressure Relief Valve

The relief valve opens and allow pressure fluid to return to the reservoir if the system pressure increases to 3650 psi.

Auxiliary Hydraulic Temperature Sensor

The auxiliary hydraulic temperature sensor is installed in the auxiliary hydraulic fluid return line to measure the fluid temperature. A signal is sent to the logic circuit of the auxiliary system to display the temperature reading on the MFD. **AUX HYD TEMP HI** message is displayed when fluid temperature exceeds 85°C.

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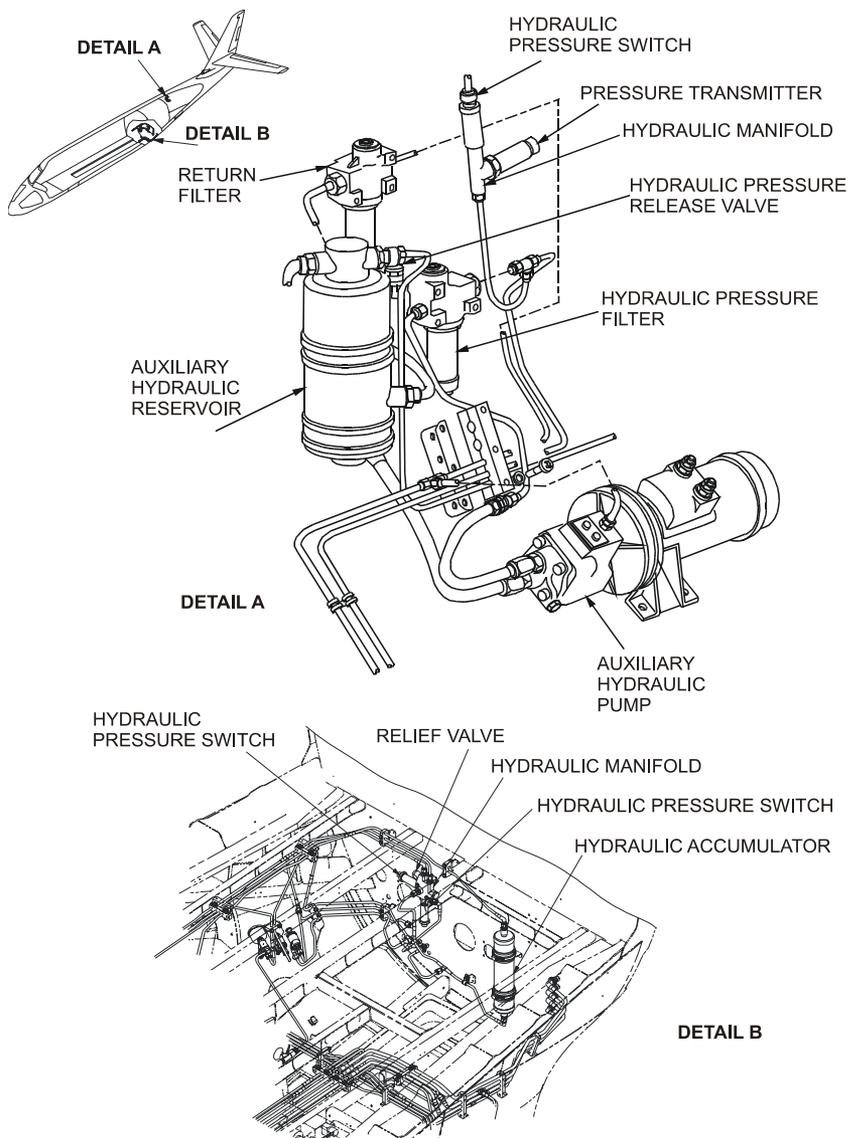


Figure 7-29-3. Auxiliary Hydraulic System

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Aileron Hydraulic System

The ailerons are operated each by dual servo actuators, mechanically controlled from the cockpit by the control wheels. The actuators consist of two independent and identical cylinders, installed side by side and operate in parallel.

Each actuator is powered from a different hydraulic system (main and auxiliary).

One hydraulic system only is sufficient for safe maneuvering of the aircraft. Even with total loss of hydraulic power, it is possible to fly the aircraft manually.

If the control linkage disconnects, the affected actuator is centered by a spring. Each cylinder has an integral bypass valve which allows direct interflow between both sides of the piston, when hydraulic power is not available, to prevent hydraulic lock of the servo actuator.

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HYDRAULIC SYSTEM CONTROLS AND INDICATORS

AUX HYD PUMP switch - Controls operation of auxiliary hydraulic system according to the following positions:

OFF - Auxiliary system is off

AUTO - Normal switch position; the auxiliary system comes on automatically when: landing gear is out of retracted position, pressure loss in main system, low fluid level in main system, brake accumulator pressure loss and mechanical failure in an aileron servoactuator.

The pump automatically stops operation if all the failures are corrected except after aileron failure.

OVRRD - Auxiliary system is activated regardless of the normal AUTO position determinants.

Landing gear NITROGEN vessel indicator

(on refueling panel) - Indicates pressure of emergency gear nitrogen bottle (3000 psi).

BRAKE ACCUMULATOR Indicator

(on refueling panel) - Indicates pressure of brake accumulator (1500 psi precharge pressure and 3000 psi when fully charged by the auxiliary system). Fully charged accumulator permits 10 cycles of EMERG brakes or one T/R deployment.

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Caution Messages

AUX HYD LEVEL LOW - Auxiliary hydraulic tank fluid level is low
AUX HYD PRESS LOW - Hydraulic pressure below 1200 psi
AUX HYD PRESS HI - Hydraulic pressure above 3500 psi
AUX HYD TEMP HI - Auxiliary hydraulic system temperature above
85°C
HYD PUMP PRESS LOW (L/R) - Hydraulic pump failure
HYD TANK PRESS LOW - Hydraulic tank pressurization is low
(both systems)
MAIN HYD LEVEL LOW - Main Hydraulic tank fluid level is low
MAIN HYD PRESS HI - Hydraulic pressure above 3500 psi
MAIN HYD TEMP HI - Main hydraulic system temperature above
limits

EICAS Displays

Main system Color Code:

100 – 1850 psi - Amber
1850 – 2750 psi - White
2750 – 3250 psi - Green
3250 – 3500 psi - White
3500 psi and more - Amber

Auxiliary system Color Code:

100 – 1200 psi - Amber
1200 – 2750 psi - White
2750 – 3250 psi - Green
3250 – 3500 psi - White
3500 psi and more - Amber

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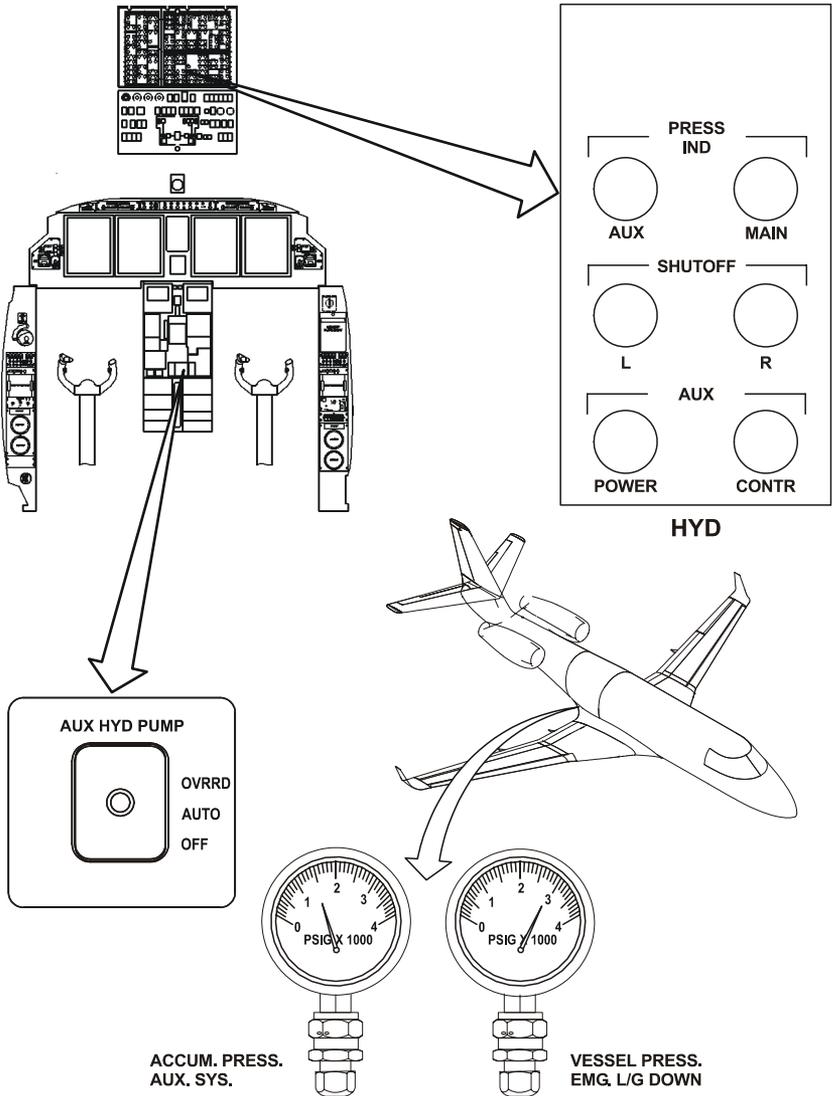


Figure 7-29-4. Hydraulic System Controls and Indicators