CHAPTER 29

HYDRAULIC POWER

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Insert latest revised pages; destroy superseded or deleted pages.

* Asterisk indicates pages revised, added, or deleted by the current revision. The portion of the text affected by the current revision is indicated by a vertical line in the outer margin of the page.

Revision Number	Status	Date	Location	Insertion Date	Inserter's Initials	Removal Date	Removers Initials
29-1	Inactive	Sep 24/76	29-10-03 Page 201	Sep 24/76	LJ	Jun 8/79 Rev 15	LJ
29-2	Inactive	Jul 31/92	29-00-00 Page 202	Jul 31/92	LJ	Sep 25/92 Rev 57	LJ
29-3	Inactive	Nov 15/96	29-10-03 Page 203	Nov 15/96	LJ	Feb 11/00 Rev 68	LJ
29-4	Inactive	Dec 7/01	29-00-00 Page 201	Dec 7/01	LJ	Jan 17/05 Rev 73	LJ
29-5	Active	Sep 2/05	29-10-07 Page 202	Dec 16/05	ATP/MB		

1. DESCRIPTION

A. The hydraulic system supplies fluid (MIL-H-5606) under pressure of approximately 1450 psi to the brake, landing gear, flap, and spoiler systems.

B. Hydraulic fluid for systems operation is supplied from a reservoir through hydraulic supply shutoff valves to the engine-driven hydraulic pumps. The hydraulic reservoir is pressurized to approximately 20 psi by a pressure regulator. The pressure regulator is installed in a line from the bleed air duct to the reservoir.

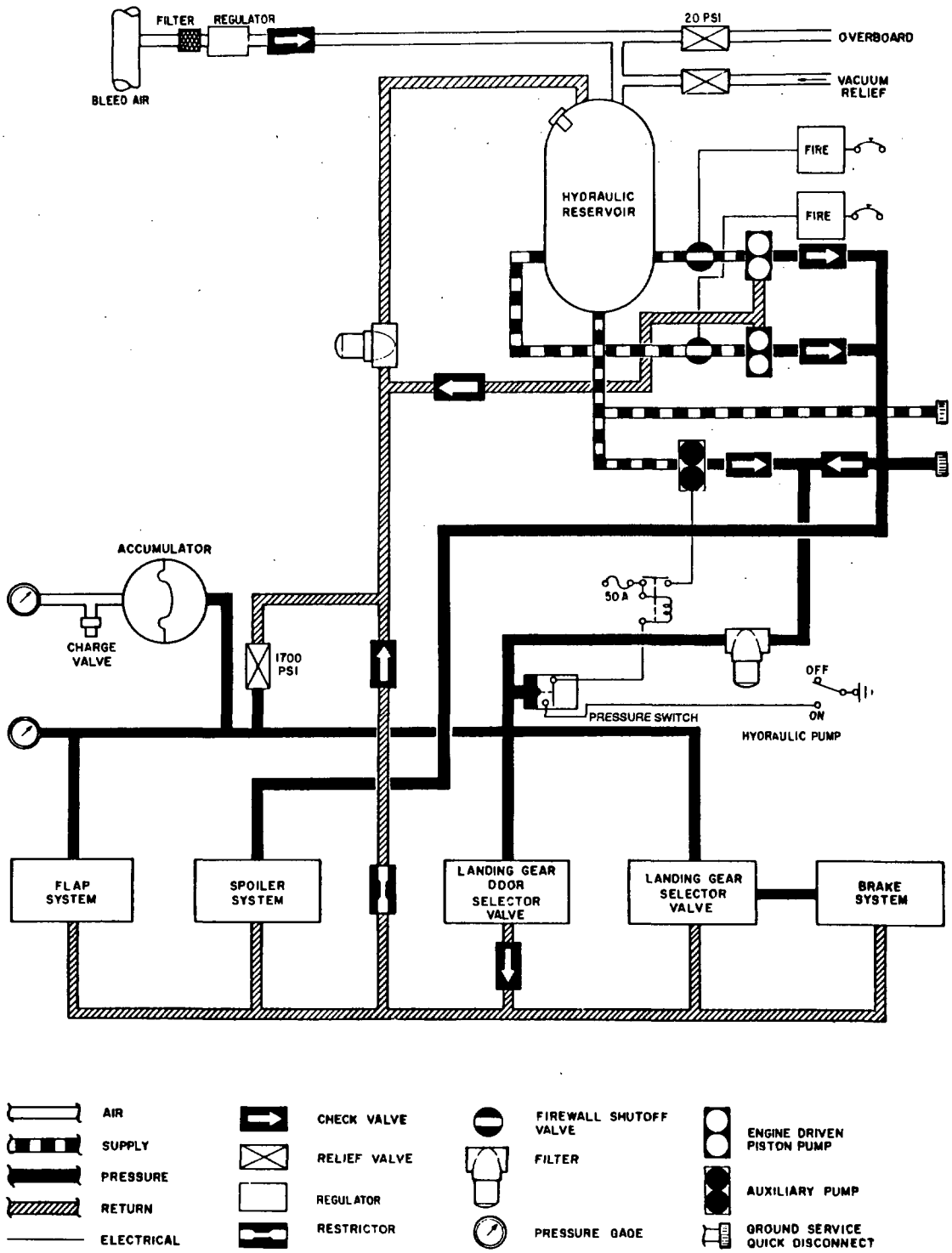
C. The engine-driven hydraulic pumps supply hydraulic fluid under pressure through check valves and a filter to the hydraulically operated systems upon demand.

D. An accumulator absorbs and dampens pressure surges, thus preventing damage to the system. On *Aircraft 35-002 thru 35-646 and 36-002 thru 36-058*, system pressure is maintained at approximately 1200 to 1550 psi. On *Aircraft 35-647 and Subsequent and 36-059 and Subsequent*, system pressure is maintained at approximately 1100 to 1550 psi. If pressure increases to approximately 1700 psi, a relief valve opens and excess pressure is routed to the return system.

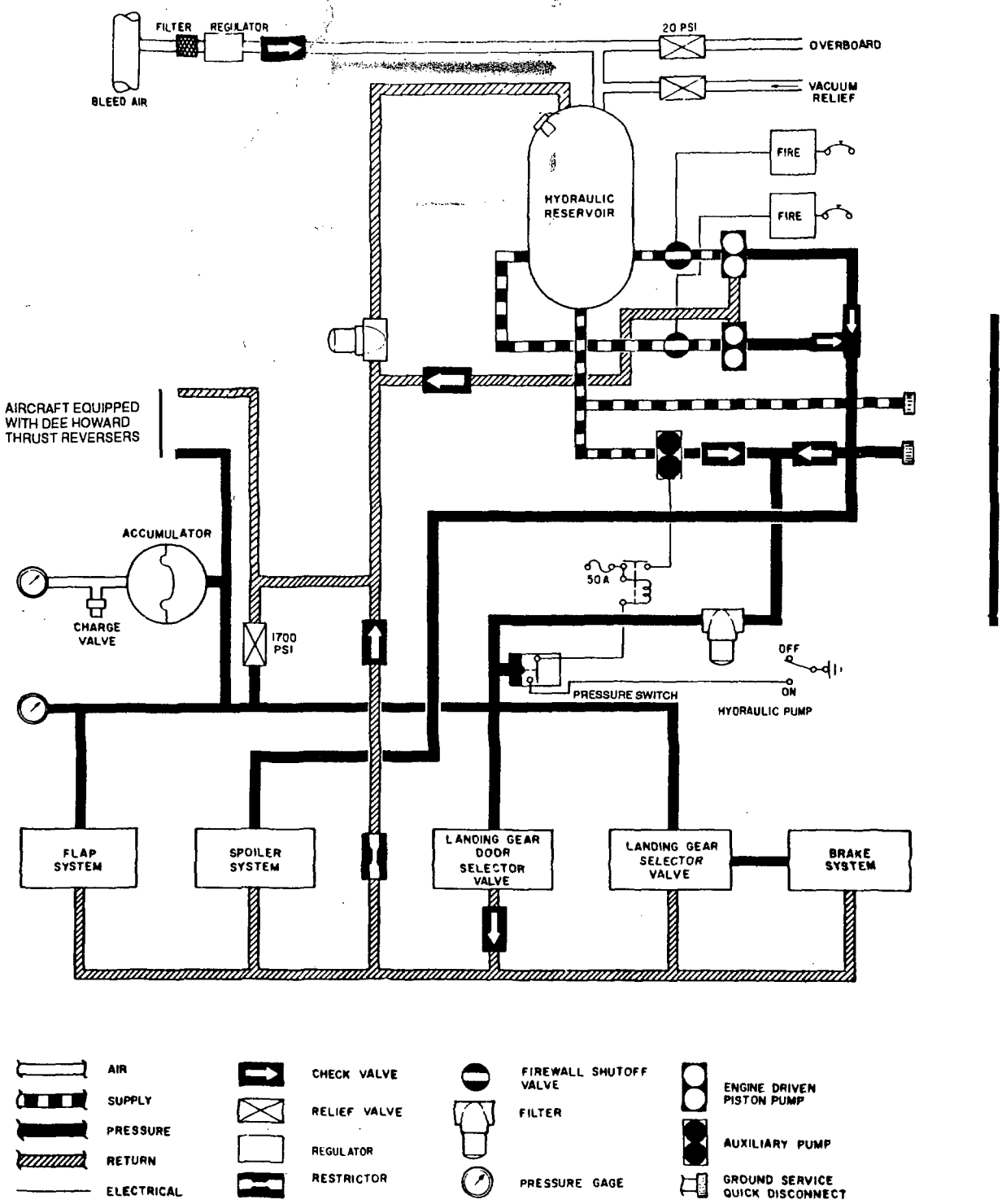
E. The system is equipped with two direct-reading pressure gages. One gage, located on the instrument panel, indicates hydraulic system pressure for the pilot and copilot. The second gage, which is used by servicing personnel, is located below the accumulator in the tailcone section and indicates accumulator pressure.

F. Ground service quick-disconnects are provided for system pressurization and functional testing.

G. The auxiliary hydraulic pump is plumbed to the hydraulic reservoir and electrically operated by the Hydraulic Pump Switch through a pressure switch. The pressure switch is plumbed to the fluid side of the accumulator. The pump provides hydraulic pressure for inflight standby power.



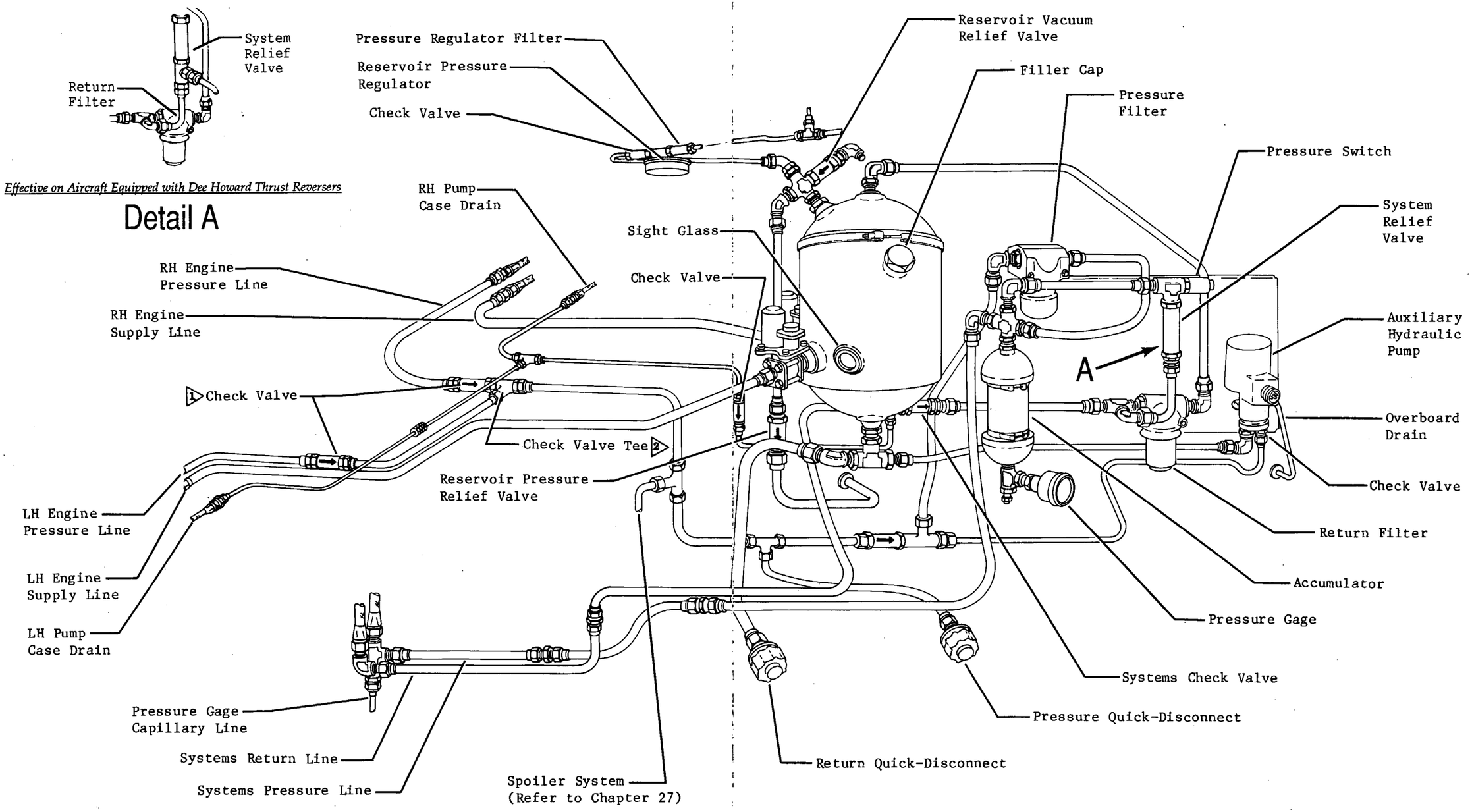
Hydraulic System Schematic
Figure 1 (Sheet 1 of 2)



Hydraulic System Schematic
Figure 1 (Sheet 2 of 2)

Effective on Aircraft Equipped with Dee Howard Thrust Reversers

Detail A



Hydraulic System Components Installation
Figure 2

1 Effective 35-002 thru 35-106 and 35-108 thru 35-112 and 36-002 thru 36-031.

2 Effective 35-107, 35-113 and Subsequent and 36-032 and Subsequent.

HYDRAULIC POWER - TROUBLE SHOOTING

1. TROUBLE SHOOTING

A. Tools and Equipment

NOTE: Equivalent substitutes may be used in lieu of the following items.

NAME	PART NUMBER	MANUFACTURER	USE
Hydraulic Power Unit		Commercially Available	Leakage test.
Multimeter	Model 260	Simpson	Voltage checks.

B. Hydraulic System Trouble Shooting

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
1. Low Hydraulic Pressure Annunciator Remains Illuminated with Auxiliary Hydraulic Pump Switch On.		
a. Loss of 28 vdc to auxiliary hydraulic pump.	Check fuse (FL21) on current limiter panel.	Replace fuse if defective.
b. Low hydraulic pressure switch malfunction.	With Auxiliary Hydraulic Pump Switch on, check for ground circuit at pin B of P302 on RH Landing Light and Hydraulic Relay Panel (E90).	If ground circuit is absent, check ground connector 38C, pin H. If ground connector is OK, replace pressure switch.
c. Hydraulic pump relay malfunction.	With Auxiliary Hydraulic Pump Switch on, check for 28 vdc between pins C and B of P302.	If voltage is present, refer to step 1.d. If voltage is absent in step 1.d, replace E90 relay box. (Refer to Chapter 33.)
d. Auxiliary hydraulic pump defective.	With Auxiliary Hydraulic Pump Switch on, verify 28 vdc between pins B and A of P149.	Replace auxiliary pump if voltage is present.
2. No Pressure Indication (Cockpit Pressure Gage).		
a. Low reservoir fluid level.	Check fluid level.	Service reservoir. (Refer to Chapter 12.)

Hydraulic System Trouble Shooting
Figure 101 (Sheet 1 of 3)

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
2. No Pressure Indication (Cockpit Pressure Gage) (Continued).		
b. Defective pressure indication system.	Inspect capillary line and instrument panel gage for damage. (Refer to 29-30-00 for component location.)	Repair or replace defective part (s).
c. Hydraulic system leaks.	Visually inspect system, beginning with pump suction lines.	Repair or replace defective part (s).
	If visual inspection does not reveal leaks, perform Hydraulic System Leakage Check, this section.	Repair or replace defective part (s).
d. Defective engine driven pump.	Perform Leak Test of Hydraulic Pump. (Refer to 29-10-03.)	Replace defective pump. (Refer to 29-10-03.)
3. Rapid Cycling of Auxiliary Pump After Engine Shut Down.		
a. Defective auxiliary pump check valve.	Remove and test valve for leakage.	Replace check valve if defective.
b. Defective pressure switch.	Remove and test switch for correct operation.	Replace pressure switch if defective.
c. Defective pressure relief valve.	Remove and test valve for internal leakage.	Replace pressure relief valve if defective.
d. Internal hydraulic system leak.	Isolate and test each using system. (Refer to Hydraulic System Leakage Check, this section.)	Repair or replace defective part (s).
4. Low Pressure Indication or Sluggish System Operation.		
a. Low reservoir fluid level.	Check fluid level.	Service reservoir. (Refer to Chapter 12.)
b. Defective pressure relief valve.	Remove and test valve for internal leakage.	Replace pressure relief valve if defective.

Hydraulic System Trouble Shooting
Figure 101 (Sheet 2 of 3)

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
4. Low Pressure Indication or Sluggish System Operation (Continued).		
c. Hydraulic system leaks.	Visually inspect system, beginning with reservoir suction lines.	Repair or replace defective part (s).
	If visual inspection does not reveal leaks, perform Hydraulic System Leakage Check, this section.	Repair or replace defective part (s).
d. Defective engine driven pump.	Perform Leak Test of Hydraulic Pump. (Refer to 29-10-03.)	Replace pump, if defective. (Refer to 29-10-03.)
e. Defective pressure indication system.	Inspect capillary line and instrument panel gage for damage. (Refer to 29-30-00 for component location.)	Repair or replace defective part (s).
f. Defective reservoir pressurization system.	Check for loose connections from bleed air manifold connection to hydraulic reservoir.	Tighten loose connections.
	Check pressure regulator filter for contamination.	Clean pressure regulator filter. (Refer to 29-10-06.)
	Remove perform functional test of pressure regulator. (Refer to 29-10-07.)	Replace pressure regulator if defective.
5. High Pressure Indication.		
a. Defective pressure indication system.	Inspect capillary line and instrument panel gage for damage. (Refer to 29-30-00 for component location.)	Repair or replace defective part (s).
b. Defective engine driven pump.	With pumps activated, verify that reading on accumulator pressure gage does not exceed 1550 psi.	Replace pump(s) if pressure limit is exceeded. (Refer to 29-10-03.)

Hydraulic System Trouble Shooting
Figure 101 (Sheet 3 of 3)

HYDRAULIC SYSTEM - MAINTENANCE PRACTICES

1. Maintenance Precautions

A. General maintenance procedures should be thoroughly read and understood prior to performing any maintenance on the hydraulic system.

WARNING: IF THE HYDRAULIC RESERVOIR PNEUMATIC PRESSURIZATION SYSTEM IS DISCONNECTED FOR ANY REASON, A RED STREAMER (OF SUFFICIENT LENGTH TO HANG OUTSIDE THE AIRCRAFT) MUST BE ATTACHED TO THE SYSTEM AT THE POINT OF DISCONNECT. THIS WILL SERVE AS A REMINDER TO RESTORE THE SYSTEM PRIOR TO FLIGHT. FAILURE TO RESTORE THIS SYSTEM WILL RESULT IN A LOSS OF ALL HYDRAULIC SYSTEMS IN FLIGHT.

B. Prior to disconnecting any hydraulic fitting or component, make provisions for catching the fluid draining from the fittings.

CAUTION: WHEN ANY HYDRAULIC RETURN LINE IS DISCONNECTED AND CAPPED, ANY FLUID DISPLACED BY AN ACTUATOR WOULD PRESSURIZE THE RETURN CIRCUIT. IN THIS CASE, THE NOSE GEAR RETRACT LINE WOULD PRESSURIZE, UNLOCK THE LOCKING MECHANISM, AND CAUSE THE NOSE GEAR TO COLLAPSE.

C. If maintenance requires capping of the hydraulic lines, Learjet recommends that the aircraft be placed on jacks.

D. Exercise extreme care to make sure that all the parts remain absolutely clean. A single grain of sand or particle of grit can cause internal failure of the hydraulic components. Therefore, hydraulic lines and component fittings should be capped with clean caps immediately after removal. During installation of a hydraulic system component, the hydraulic lines and component fittings should remain capped as long as possible. It is permissible to install seal fittings in the hydraulic plumbing to eliminate small leaks. Use AP50A-(X) (X = tube dash number size) on all aluminum line or hose connections. Use AP50N-(X) on steel line or hose connections. Do not reuse the seal fittings.

E. When installing O-rings, keep the mold flash of the O-ring in one position to prevent twisting. When the O-ring is in its groove, make sure that it is evenly stretched around the circumference. Hydraulic cylinder glands and piston assemblies containing O-rings must be carefully inserted with only enough pressure to overcome friction.

F. Do not replace the hydraulic system fittings indiscriminately. Identify fittings as they are removed to make sure that the replacement conforms with the original installation.

G. All fittings and B-nuts should be properly aligned before connection.

H. Service the hydraulic reservoir and accumulator after installation of the components. (Refer 12-10-01 and 12-10-02.)

I. Check the emergency air bottle charge and service if required. (Refer to 12-10-07.)

J. To expel air from the landing gear, flaps, or spoiler systems, cycle each system until the air is expelled using an external hydraulic power source. Do not use the auxiliary hydraulic pump for this purpose.

K. Some hydraulic system maintenance requires that the hydraulic supply shutoff valves be closed. To close the supply shutoff valve, proceed as follows:

CAUTION: USE CARE NOT TO PUSH EITHER ARMED SWITCH. PUSHING THE ARMED SWITCH WILL DISCHARGE THE FIRE EXTINGUISHER BOTTLES.

(1) With the aircraft electrical power applied, pull each of the FIRE PULL switch on the glareshield.
(2) Push in each FIRE PULL switch with the aircraft electrical power applied to open the shutoff valves.

L. When using an external hydraulic power source to pressurize the hydraulic system, it is permissible to use either the aircraft reservoir or the external hydraulic power source reservoir. When the hydraulic system is pressurized using the external hydraulic power source reservoir, the aircraft reservoir (above the fill cap) and the lines leading to the aircraft reservoir pressure regulator may become filled with hydraulic fluid. With the aircraft reservoir and lines filled, the pressure may build. When the aircraft reservoir pressure goes above 20 psi, fluid is drained overboard through the 20 psi relief valve. It is desirable to connect a hose from the overboard drain to the external hydraulic power source reservoir. A check valve is installed at the reservoir pressure regulator to prevent fluid from passing through the regulator. After pressurizing the aircraft hydraulic system using the hydraulic power source reservoir, the aircraft reservoir fluid level must be checked. (Refer to 12-10-07).

2. Depressurize the Hydraulic System

A. Prior to removal of any hydraulic line, fitting, or component, the hydraulic system must be depressurized as follows:
(1) Relieve the residual hydraulic pressure in the lines by pumping the brakes.
(2) Lower the tailcone access door and remove the electrical power from the aircraft.
(3) Loosen one of the hydraulic line nuts between the hydraulic reservoir and the 20 psi relief valve to bleed off 20 psi reservoir pressure. When the pressure is released, tighten the nut.

3. Inspection/Check

CAUTION: AN EXTERNAL HYDRAULIC POWER CART MUST BE USED TO RETRACT THE GEAR AND FLAPS IN THE FOLLOWING LEAKAGE CHECK. THIS WILL ELIMINATE POSSIBLE DAMAGE TO THE AUXILIARY HYDRAULIC PUMP.

A. Hydraulic System Leakage Check (Component Internal Leakage)

NOTE: The purpose of this leakage check is to determine the hydraulic components internal leakage using the cycle time of the auxiliary hydraulic pump. The minimum cycle time of the auxiliary hydraulic pump must be more than 3 minutes.

If cycle time is 3 minutes or less, the faulty component(s) must be isolated and repaired or replaced.

(1) Check the hydraulic system accumulator for proper servicing. (Refer to 12-10-01.)
(2) Place the aircraft on jacks. (Refer to 7-00-01.)
(3) Set the Auxiliary Hydraulic Pump Switch OFF. Connect the external hydraulic power cart to the aircraft.
(4) Retract the landing gear. Turn the external hydraulic power cart off.
(5) Cycle the flaps to bleed the system hydraulic pressure.

CAUTION: OPERATE THE AUXILIARY HYDRAULIC PUMP A MAXIMUM OF 3 MINUTES ON AND 20 MINUTES OFF TO PREVENT OVERHEATING AND BURNOUT OF THE PUMP MOTOR.

(6) Set the Auxiliary Hydraulic Pump Switch ON.
(7) The auxiliary hydraulic pump will energize and start to build up the system pressure. When the pump stops, start timing the cycle.
(8) When the pump starts, check the time. The time between stop and start of the pump (cycle time) must be more than 3 minutes. Repeat the procedure several times to obtain a more accurate cycle time.

NOTE: A short cycle time (less than 3 minutes) is an indication of excessive internal leakage. A long cycle time (more than 3 minutes) is an indication of acceptable internal leakage.

(9) Set the Auxiliary Hydraulic Pump Switch OFF, turn the external hydraulic power cart on and extend landing the gear and flaps. Disconnect the external hydraulic power cart.
(10) Repeat steps A.(5) thru A.(8).
(11) If the leakage check is within the prescribed limits, return the aircraft to service. If the leakage check is not within prescribed limits, isolate the faulty hydraulic component(s). (Refer to paragraph 2.B.)

NOTE: On *Aircraft equipped with the Dee Howard Thrust Reversers*, inspect the thrust reverser hydraulic plumbing for leaks.

(12) Remove the aircraft from the jacks. (Refer to 7-00-01.)

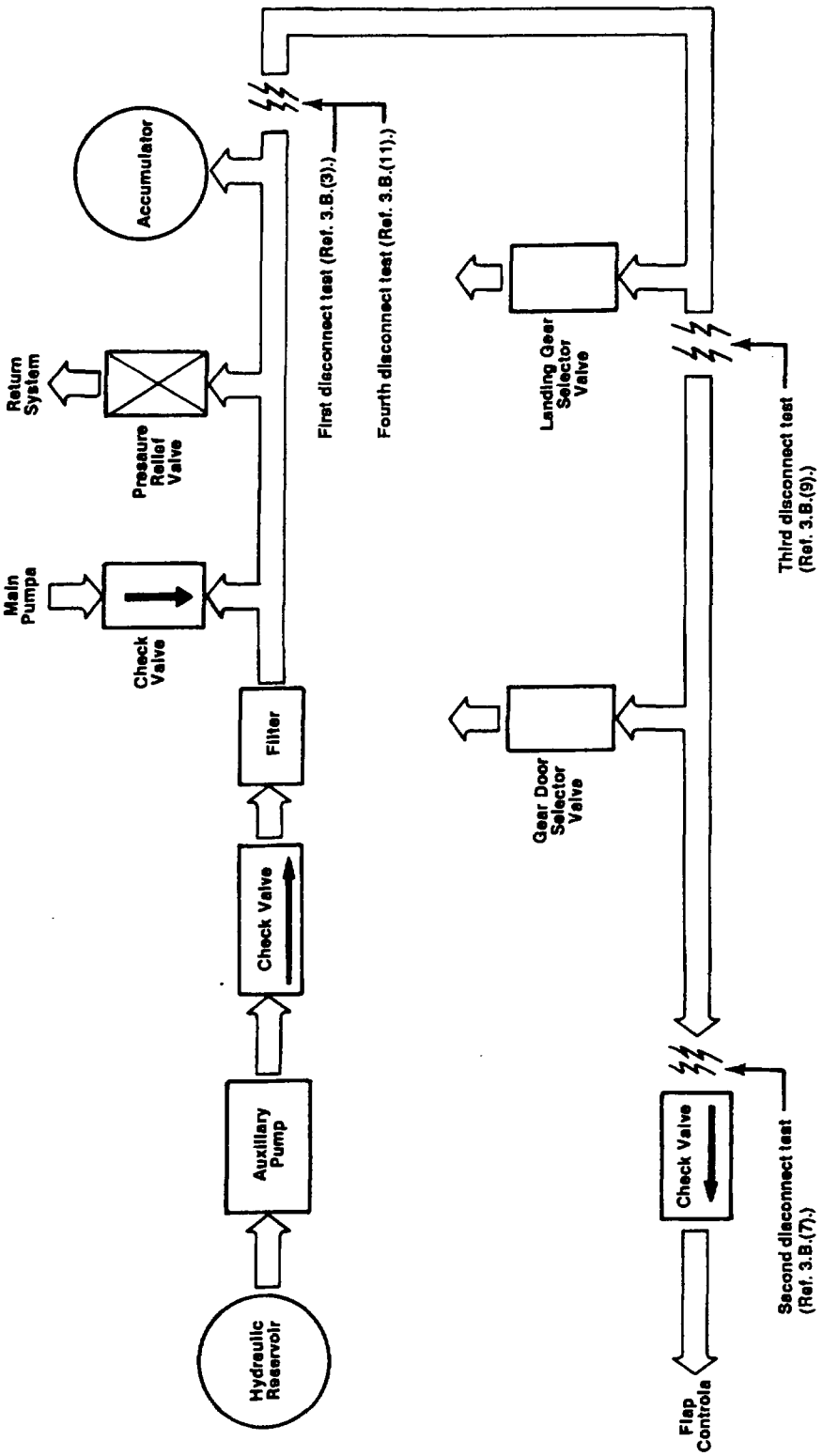
B. Isolate the Faulty Hydraulic System Component
(1) Depressurize the hydraulic system.
(2) Remove the hydraulic system return filter element and check for any contamination. (Refer to 29-10-04.) Replace the filter element.

NOTE: During the following isolation procedure, the systems will be isolated one at a time until the fault is located. A notable change in cycle time will occur when the faulty system is checked.

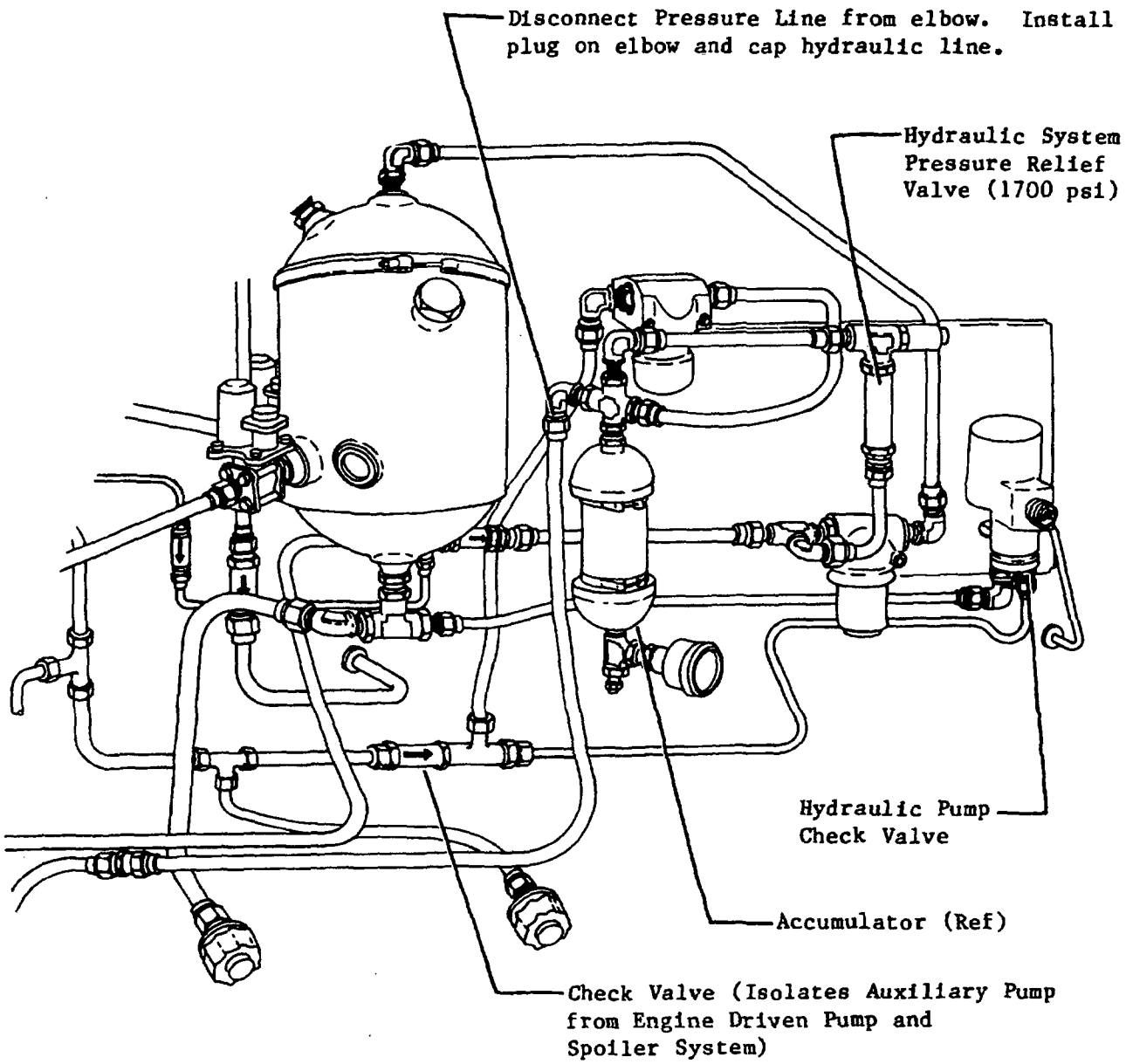
Once the faulty system has been isolated, the systems components must be isolated and checked individually.

(3) Isolate the main hydraulic system from using the systems as follows:
  (a) Disconnect the systems pressure line at the accumulator.
  (b) Install the cap and plug on the elbow at the accumulator and cap the disconnected system pressure line.
(4) Set the Battery Switches and Auxiliary Hydraulic Pump Switch ON. When the pump stops, start timing the cycle. Allow the pump to cycle several times to obtain a more accurate time.
  (a) If the cycle time is 3 minutes or less then the components in the main system are at fault. The following should be removed and checked:
    1) The hydraulic pressure relief valve (1700 psi).
    2) The hydraulic check valve which isolates the auxiliary pump from the spoiler system and the engine driven pumps.
  (b) If the cycle time is longer than 3 minutes, then the fault is within the using systems. Proceed with step B.(5).
(5) Remove all the lower fuselage access panels and wing to the fuselage fairings. Disconnect the inboard gear door actuators from the inboard doors.
(6) Connect the systems pressure line to the elbow at the accumulator.
(7) Isolate the Flap System as follows:
  (a) Remove the flap control valve pressure line at the check valve and tee at the gear door selector valve.
  (b) Install the plugs in the pressure line and cap the check valve and tee.
  (c) Make sure that the caps are tight.
(8) Set the Battery Switches and Auxiliary Hydraulic Pump Switch ON. When the pump stops, start timing the cycle. Allow the pump to cycle several times to obtain a more accurate time.
  (a) If the cycle time is lengthened and is longer than 3 minutes, the flap system is at fault and the individual components should be checked.
  (b) If the cycle time is lengthened but is still 3 minutes or less, the flap system is partly at fault and isolation procedures should continue.
  (c) If the cycle time does not change, the flap system is not at fault, continue with the isolation procedures.
(9) Isolate the main landing gear door system as follows:
  (a) Remove the main landing gear door selector valve pressure line at the downstream side of tee located on the gear selector valve.
  (b) Install caps on the fittings and plug the disconnected pressure line.
(10) Set the Battery Switches and Auxiliary Hydraulic Pump Switch ON. When the pump stops, start timing the cycle. Allow the pump to cycle several times to obtain a more accurate time.
  (a) If the cycle time is lengthened and is longer than 3 minutes, the main landing gear door system is at fault and the individual components should be checked.
  (b) If the cycle time is lengthened but is still 3 minutes or less, the main landing gear door system is partly at fault and isolation procedures should continue.
  (c) If the cycle time does not change, the main landing gear door system is not at fault, continue with the isolation procedures.
(11) Isolate the landing gear system as follows:
  (a) Disconnect the hydraulic pressure line at the accumulator.
  (b) Install the cap on the elbow. Plug the pressure line.

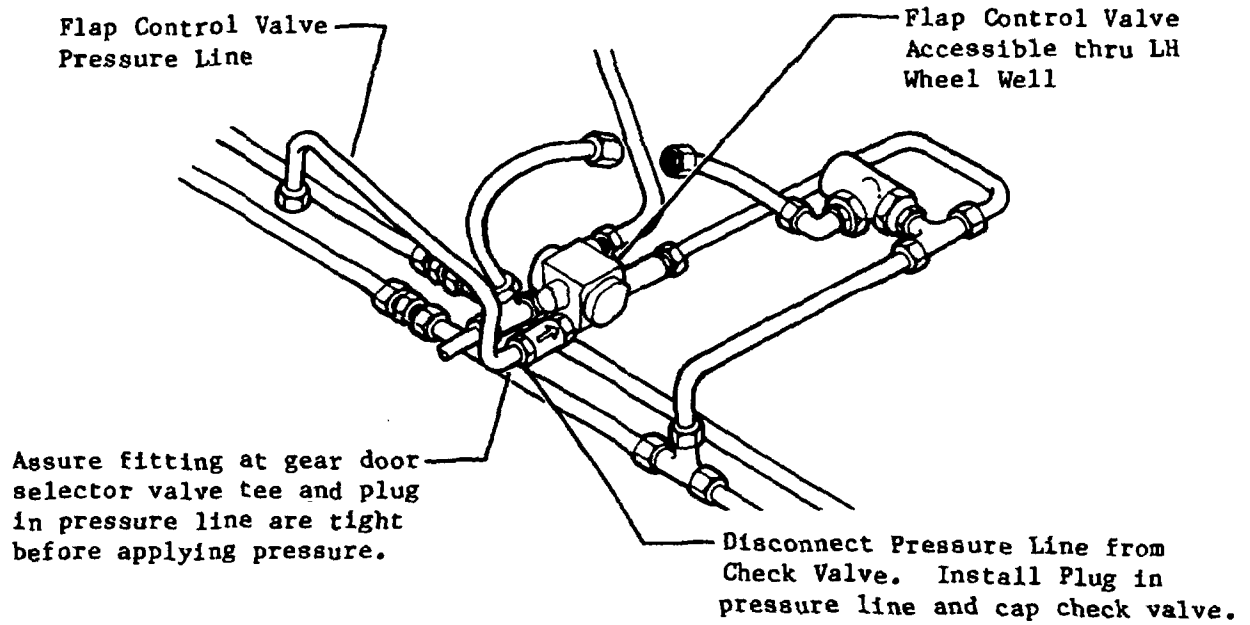
(12) Set the Battery Switches and Auxiliary Hydraulic Pump Switch ON. When the pump stops, start timing the cycle. Allow the pump to cycle several times to obtain a more accurate time.
  (a) If the cycle time is lengthened and is longer than 3 minutes, the landing gear system is at fault and the individual components should be checked.
(13) Remove the caps and plugs installed for this procedure and connect all the lines.
(14) Connect the external hydraulic power source to the aircraft.
(15) Perform the operational check and leak check of the landing gear, flap, and spoiler systems.
(16) Disconnect the external hydraulic power source from the aircraft.
(17) Remove the aircraft from the jacks. (Refer to 7-00-01.)
(18) Service the hydraulic reservoir. (Refer to 12-10-02.)



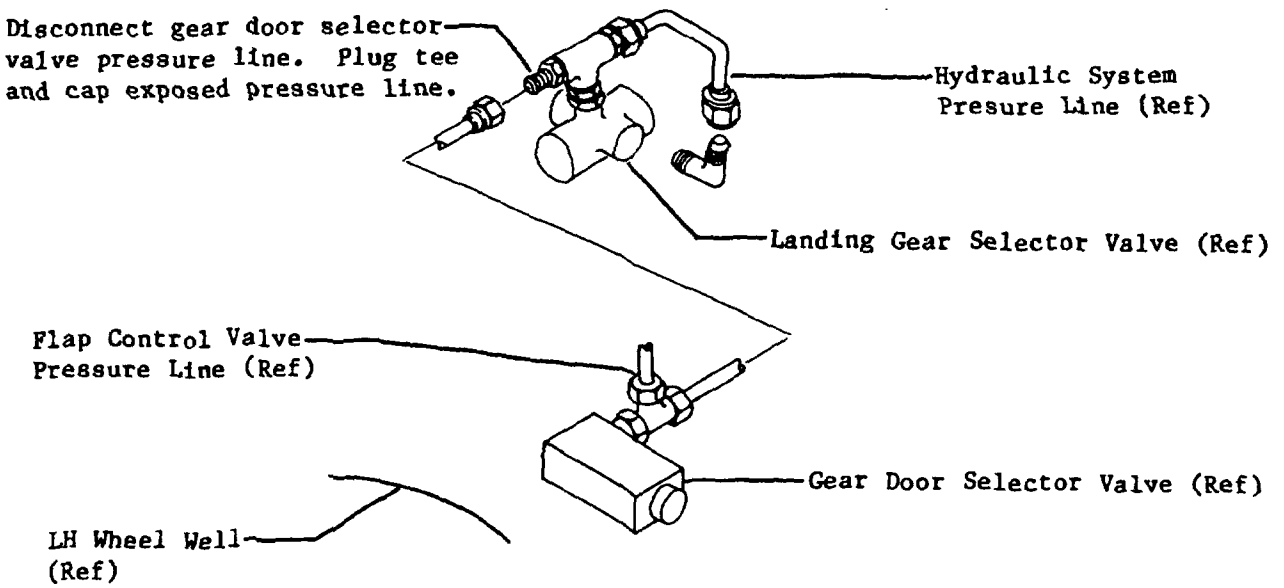
Hydraulic System Component Installation
Figure 201 (Sheet 1 of 3)



Hydraulic System Component Installation
Figure 201 (Sheet 2 of 3)



View Looking Aft
Flap Control System Isolation



View Looking Aft
Gear Door Selector Valve Isolation

Hydraulic System Component Installation
Figure 201 (Sheet 3 of 3)

4. Repairs

A. Tools and Equipment

(1) Get the necessary tools and equipment.

NOTE: You can use equivalent alternatives for these items:

NAME	PART NUMBER	MANUFACTURER	USE
Stoddard Solvent	MIL-PRF-680A	Commercially Available	Clean reservoir.
Hydraulic Fluid	MIL-H-5606	Commercially Available	Flush lines and service reservoir.
External Hydraulic Power Source 4.0 (-0.5;+1.0) gpm 1400 (±100) psig		Commercially Available	Cycle systems and flush lines.
Hydraulic Hose		Commercially Available	Connect lines.
Filter (15 micron)		Commercially Available	Check lines for cleanliness.

B. Flush the Hydraulic System

NOTE: Use the following procedure to flush the hydraulic system when contamination is evident beyond the pressure filter.

As the system components are disconnected for cleaning, use a hydraulic hose or other appropriate unions to link pressure and return lines so that each component is bypassed. This will allow the lines to be flushed all at once prior to reinstallation of the hydraulic system.

(1) Replace the pressure filter element and return the filter element. (Refer to 29-10-04.)
(2) Purge the contaminants from the hydraulic reservoir as follows:
   (a) Drain the hydraulic reservoir and remove the reservoir from the aircraft. (Refer to 29-10-01.)
   (b) Use solvent to clean the inside of the reservoir, shaking the reservoir as necessary to make sure of thorough distribution of solvent within the container. Drain the solvent from the reservoir.
   (c) With the mesh screen removed from the filler neck, inspect the inside of reservoir through the service port to make sure that the interior surface is clean. If necessary, repeat step (b).

CAUTION: IF CLEANLINESS OF THE RESERVOIR IS QUESTIONABLE, REPLACE THE RESERVOIR. ANY REMAINING CONTAMINATION MAY CAUSE FAILURE OF THE HYDRAULIC SYSTEM.

(d) Rinse the inside of the reservoir with clean hydraulic fluid, shaking the reservoir as necessary to make sure that thorough distribution of the fluid within the container. Drain the fluid from the reservoir, and rinse again using clean hydraulic fluid.

(e) Make sure that all the fluid is drained from the reservoir, and reinstall the mesh screen and filler cap.

(3) Disconnect the hydraulic lines from the engine-driven pumps (refer to 29-10-03) and auxiliary pump (refer to 29-20-01). Inspect the pumps for cleanliness, flushing them with clean hydraulic fluid as necessary.

(4) Replace the spoiler system filter element. (Refer to 27-60-02.)

(5) Remove, disassemble, clean, and replace the seals on the following actuators:

(a) Main gear actuators (Refer to 32-31-00.)

(b) Nose gear actuator (Refer to 32-32-02.)

(c) Main gear inboard door actuators (Refer to 32-31-03.)

(d) RH and LH flap actuators (Refer to 27-50-04 and 27-51-07.)

(e) Spoiler actuators (Refer to 27-60-01.)

(6) Remove and clean the anti-skid valve filter elements. (Refer to 32-44-02.)

(7) Check for contamination at the hydraulic fitting ports on the accumulator (refer to 29-10-05), power and parking brake valves (refer to 32-43-02 and 32-43-04), and the main gear inboard door uplatch actuator (refer to 32-31-03). Flush or disassemble and clean the components as necessary.

(8) Flush the hydraulic lines as follows:

NOTE: To flush the hydraulic lines, a pump and nozzle configuration should be used that produces sufficient pressure and volume to remove any metal flakes, oil, or other foreign material from the lines.

(a) Disconnect all the hydraulic lines which are suspected of being contaminated from the hydraulic system components.

(b) Make sure that all the disconnected hydraulic lines have been linked together with a hose or other appropriate unions.

CAUTION: DO NOT IMMERSE THE LINES IN THE SOLVENT WHILE FLUSHING.

(c) Flush the lines with mineral spirits under pressure from an ejection nozzle. A filtration unit (rated 25-micron nominal) must be set up to capture the contaminants during flushing.

(d) Flush the lines again in the opposite direction, using the filter to check for any remaining contaminants.

(e) If necessary, repeat the flushing and backflushing procedure until no contaminates are withdrawn from the lines.

(f) After flushing the lines, allow the excess fluid to drain from the lines.

(g) Purge the lines with dry, filtered, compressed air.

(h) Cap off the lines with caps and/or plugs as required while the lines are disconnected.

CAUTION: IF CLEANLINESS OF ANY COMPONENT IS QUESTIONABLE, REPLACE THE COMPONENT AS THE HYDRAULIC SYSTEM IS REBUILT. ANY REMAINING CONTAMINATION MAY CAUSE FAILURE OF THE HYDRAULIC SYSTEM.

(9) Replace the pressure filter element and return the filter element. (Refer to 29-10-04).
(10) Install the previously removed hydraulic system components.
(11) Service the hydraulic reservoir. (Refer to 12-10-02.)
(12) Bleed the hydraulic system.
(13) Perform the Hydraulic System Leakage Check. (Refer to 29-00-00.)

NOTE: After 25 flight hours, recheck the pressure filter element and return filter element for contamination. (Refer to 29-10-04.)

WARNING: THE HYDRAULIC SYSTEM PRESSURE AND RESERVOIR PRESSURE MUST BE DEPLETED PRIOR TO MAINTENANCE OR SERVICING.

C. Bleed the Hydraulic System.

NOTE: The aircraft hydraulic system must be bled after maintenance on any components or parts that opens the system to the atmosphere, excluding reservoir servicing.

(1) Service the hydraulic reservoir and accumulator. (Refer to 12-10-01 and 12-10-02.)
(2) Place the aircraft on jacks. (Refer to 7-00-01.)
(3) Connect the external hydraulic power source to the aircraft. Make sure that the external reservoir is full.

NOTE: The external test cart must be equipped with a 10 micron filter element.

The filter element must be inspected for cleanliness prior to use and cleaned or replaced if necessary.

(4) Connect a hose from the aircraft reservoir overboard drain to the external hydraulic power source reservoir.
(5) Connect the external electrical power to the aircraft.
(6) Set the Battery Switches on and make sure that all the applicable circuit breakers are set.

WARNING: KEEP CLEAR OF THE SPOILER CONTROL SURFACES AT ALL TIMES. THE SPOILERS MAY EXTEND OR RETRACT WITHOUT WARNING.

(7) Apply the external hydraulic power to the aircraft to pressurize the hydraulic system.

NOTE: When using an external hydraulic power source to pressurize the hydraulic system, it is permissible to use either the aircraft reservoir or the external hydraulic power source reservoir.

When the hydraulic system is pressurized using the external hydraulic power source reservoir, the aircraft reservoir (above the fill cap) and the lines leading to the aircraft reservoir pressure regulator may become filled with hydraulic fluid. With the aircraft reservoir and lines filled, pressure may build. When aircraft reservoir pressure exceeds 20 psi, fluid is drained overboard through the 20 psi relief valve. A check valve is installed at the reservoir pressure regulator to prevent fluid from passing through the regulator.

After pressurizing the aircraft hydraulic system using the hydraulic power source reservoir, the aircraft reservoir fluid level must be checked.

(8) Using the external hydraulic power source, cycle the landing gear, flap, and spoiler systems until all the air is expelled. Make sure that the systems operate smoothly and without time delay.

NOTE: To completely bleed the air perform 20 complete cycles of each system.

(9) Bleed the brake system. (Refer to 32-43-00.)
(10) Do the hydraulic system leak check.
(11) Disconnect the external hydraulic power source.
(12) Repeatedly apply the brakes until the hydraulic system pressure indicates 0 psi.
(13) Set the Battery Switches off and remove the external electrical power.
(14) Check the aircraft reservoir hydraulic fluid level and service if necessary. (Refer to 12-10-01.)
(15) Remove the aircraft from the jacks. (Refer to 7-00-01.)

MAIN HYDRAULIC SYSTEM - DESCRIPTION AND OPERATION

1. Description
   A. The main hydraulic system consists of a fluid reservoir, two supply shutoff valves, two engine-driven pumps, check valves, an accumulator, a reservoir pressure regulator, two filters, and four relief valves.
   B. Component Description
      (1) Reservoir
         (a) The reservoir supplies fluid to the aircraft hydraulic system. The unit is an airtight pressurized vessel consisting of a sight glass for servicing purposes and a filler plug attached to the filler neck. The filler neck contains an aluminum mesh screen to prevent fluid contamination. The screen may be removed for cleaning by removing the filler cap and screen-retaining nut.
         (b) Reservoir pressure is maintained at approximately 20 psi through a bleed air pressure line and a reservoir pressure regulator. Reservoir pressure in excess of 20 psi is vented overboard through a relief valve. The reservoir pressure maintains a positive fluid flow to the engine-driven pumps at high flight altitudes.
      (2) Supply Shutoff Valves (See figure 1.)
         (a) A hydraulic supply shut-off valve is installed in the supply line to each engine-driven hydraulic pump. The valves stop the flow of hydraulic fluid to the engine pumps in case of an emergency. The ball-type, motor-driven valves are controlled by the left and right pull-to-close FIRE PULL Switches. When either FIRE PULL Switch is pulled, the related fire extinguisher ARMED annunciators will illuminate and the shutoff valve will close.
      (3) Pumps (See figure 2.)
         (a) An engine-driven hydraulic pump mounted on the accessory gearbox of each engine supplies fluid, under pressure, to the hydraulic system. At approximately 6000 rpm, each pump is capable of delivering 4.0 gallons per minute at 1450 psi.
         (b) The hydraulic pump is basically a conventional, axial piston-type pump containing seven pistons installed in a rotating barrel assembly. The pistons ride on a face cam which causes the pistons to reciprocate in the barrel cylinders as the barrel rotates.
         (c) When the hydraulic system is not being used, the hydraulic pump output pressure will build to 1550 (±25) psi, at which time the pump output will drop to zero. As pump output pressure increases from 1450 to 1550 psi, a compensator valve gradually opens which causes an actuator to decrease the face cam angle. The decreased face cam angle decreases piston stroke which decreases pump output. When hydraulic system pressure drops as a result of system demand, the pump output will increase.
      (4) Check Valves
         (a) Two types of check valves are used in the hydraulic system: cone type check valves and a swing gate check valve.
            1) Cone check valves are installed in the hydraulic lines to prevent reverse flow of fluid and to isolate hydraulically operated systems. Each check valve consists of a body, spring, and cone. On *Aircraft 35-002 thru 35-106, 35-108 thru 35-112 and 36-002 thru 36-031*, a check valve is located downstream of each engine-driven hydraulic pump to prevent motoring of a deactivated pump. On *Aircraft 35-107, 35-113 and Subsequent and 36-032 and Subsequent*, a tee check valve is installed in lieu of the two check valves. The tee check valve incorporates a double check valve arrangement which prevents motoring of a deactivated pump. A check valve is also installed downstream of the auxiliary hydraulic pump to prevent auxiliary hydraulic pump damage due to back pressure.

2) A swing gate check valve is installed in the return line. The swing gate check valve consists of a gate, body, cap, and spring. The gate opens against spring pressure when the flow direction coincides with the direction of gate opening. Spring pressure immediately closes the gate when flow stops, preventing reverse flow.

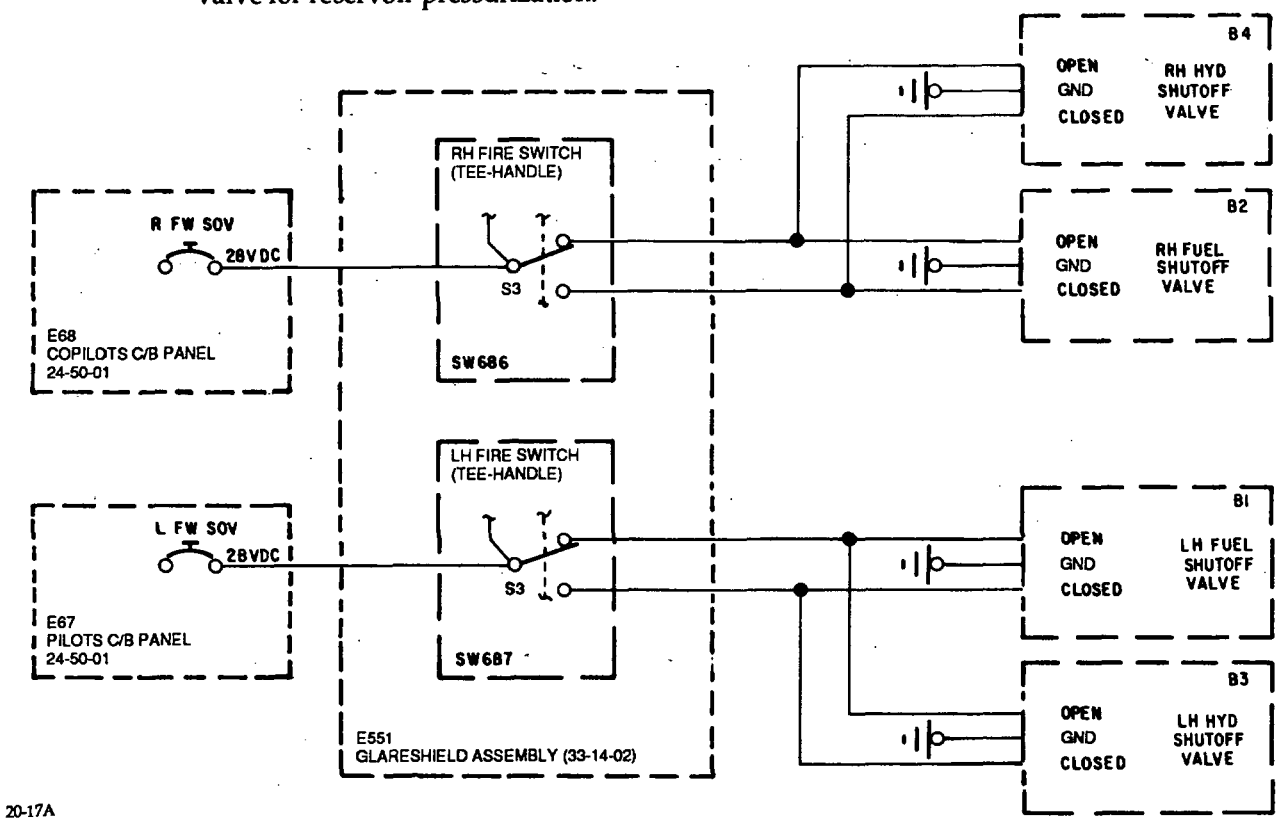
NOTE: Cone check valves and swing gate check valves are marked with directional arrows. It is suggested that maintenance personnel note the direction of the valve arrow and identify the flow direction on tubing or adjacent structure before removing component. (Reference MIL-STD-1247B for directional flow tape.)

(5) Accumulator

(a) The hydraulic accumulator is mounted on the hydraulic compartment panel assembly. The accumulator is used to absorb and dampen sudden hydraulic surges. The accumulator is divided into halves by a diaphragm in the spherical units or by a piston in the cylindrical units. The accumulator is charged to 850 psi with dry air or nitrogen. An air charging valve and direct-reading pressure gage are attached to the air side of the accumulator. A cross fitting at the fluid side of the accumulator has tubes connected to the filter, system relief valve, and system pressure.

(6) Reservoir Pressure Regulator

(a) The reservoir pressure regulator is located in the pressure line between the bleed air duct and the hydraulic reservoir. Bleed air passes through a filter, the pressure regulator, and a check valve for reservoir pressurization.



Hydraulic Supply Shutoff Valve Electrical Control Schematic
Figure 1

(7) Filters

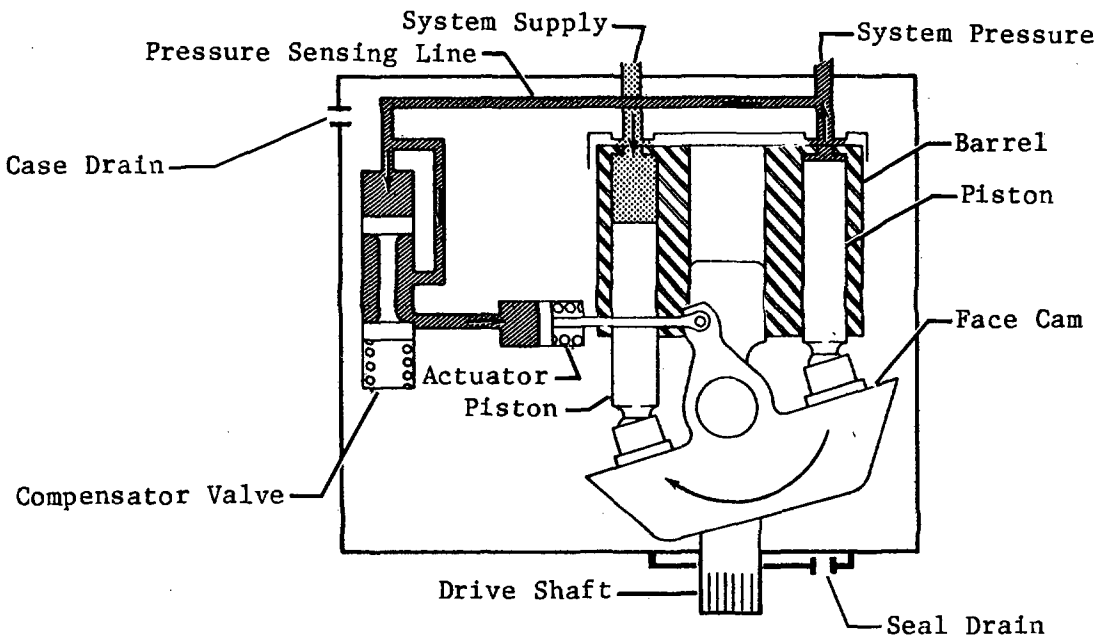
(a) A hydraulic filter is installed in the pressure and return hydraulic lines. The pressure filter prevents foreign particles from entering the hydraulic system with the pump output fluid. The return filter removes foreign particles from the hydraulic fluid before it enters the reservoir. Incorporated within the filters is a replaceable micronic element and a relief valve in the filter head. The relief valve opens at 50 (±5) psi differential pressure to bypass fluid if the filter element becomes clogged.

(8) Relief Valves

(a) One relief valve is installed in the system pressure line, one in the reservoir vent line, one in the emergency air pressure line and one in the reservoir vacuum line.

NOTE: Relief valves are marked with directional flow arrows. It is suggested that maintenance personnel note the direction of the valve arrow and identify the flow direction on tubing or adjacent structure before removing component. (Reference MIL-STD-1247B for directional flow tape.)

1) The pressure relief valve is installed to prevent damage to the system due to excessive pressure from an improperly adjusted external hydraulic power source or a hydraulic pump malfunction. It is a spring-loaded poppet valve that bypasses fluid from the pressure line into the return line when system pressure exceeds 1700 psi.
2) The reservoir overboard relief valve, set at 20 psi, prevents over-pressurization of the reservoir. Reservoir pressure in excess of 20 psi is vented overboard through the valve.
3) The vacuum line relief valve prevents a vacuum lock in the hydraulic reservoir on initial system pressurization.
4) The emergency air relief valve, set to relieve at 3350 (±50) psi, prevents overpressurization of the emergency air bottle supply. Excess pressure is vented to atmosphere. The valve will reset at 3015 psi (minimum).



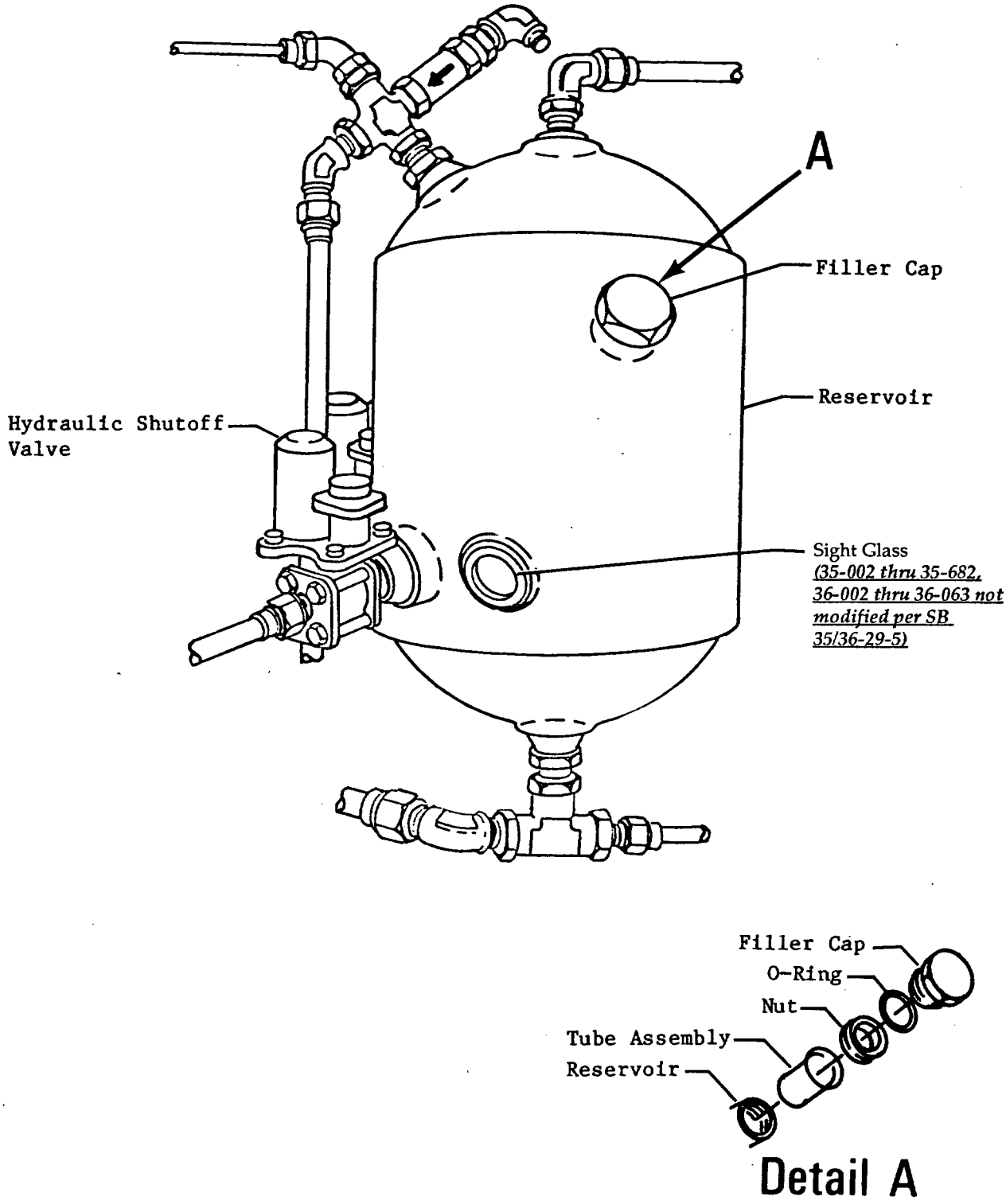
Hydraulic Pump Block Diagram
Figure 2

HYDRAULIC SYSTEM RESERVOIR - MAINTENANCE PRACTICES

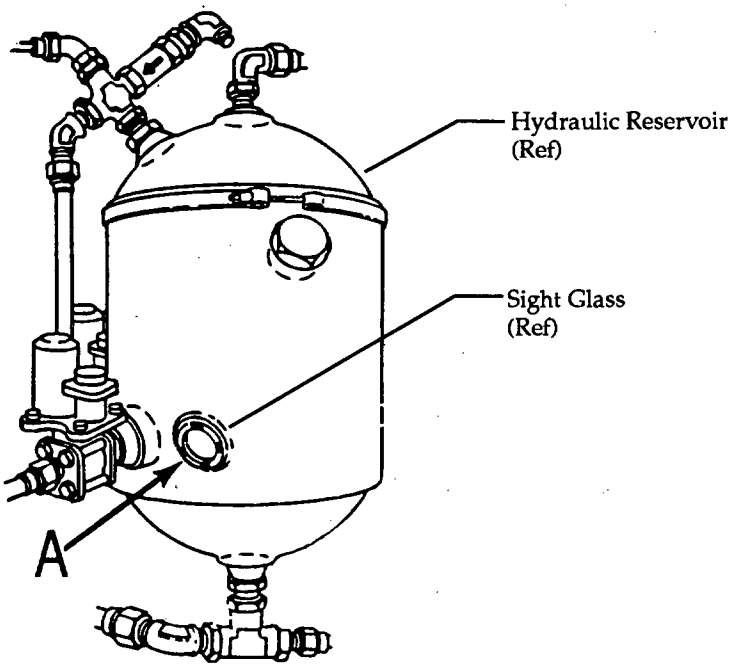
1. Removal/Installation
   A. Remove Hydraulic System Reservoir (See Figure 201.)
      (1) Remove electrical power from aircraft.
      (2) Lower tailcone access door and gain access to hydraulic reservoir.
      (3) Depressurize hydraulic system (refer to 29-00-00) and drain hydraulic reservoir.
      (4) Disconnect electrical connectors from hydraulic supply shutoff valves and reservoir fittings.
      (5) Disconnect hydraulic tube assemblies at hydraulic supply shutoff valves and reservoir fittings and cap all openings.
      (6) Loosen clamps securing reservoir to clamp support and remove reservoir from aircraft.
      (7) Remove bolts securing hydraulic supply shutoff valve and flanged fitting to reservoir.
      (8) Remove remaining flange fitting from reservoir.
   B. Install Hydraulic System Reservoir (See Figure 201.)
      (1) Clean all fittings prior to installation.
      (2) Install elbow, tees, and flanged fittings on reservoir.
      (3) Install hydraulic supply shutoff valves and flanged fittings on reservoir flange fitting and secure with attaching parts. Torque nuts 20 to 25 inch-pounds.
      (4) Position reservoir in clamp assemblies and tighten clamp bolts only enough to hold reservoir.
      (5) Remove caps and connect tube assemblies to fittings on reservoir and to hydraulic supply shutoff valves.
      (6) Tighten reservoir clamp bolts. Torque nuts 15 to 20 inch-pounds.
      (7) Connect hydraulic supply shutoff valve electrical connectors.
      (8) Service hydraulic reservoir. (Refer to Chapter 12.)
      (9) Restore aircraft to normal.
      (10) Restore electrical power to aircraft.
   C. Remove Hydraulic System Reservoir Sight Glass (See Figure 202.) *(Aircraft 35-683 and Subsequent; 36-064 and Subsequent and previous aircraft modified per SB 35/36-29-5, "Replacement of Hydraulic Reservoir Sight Glass Assembly.")*
      (1) Remove electrical power from aircraft.
      (2) Lower tailcone access door and disconnect aircraft batteries.
      (3) Gain access to hydraulic reservoir.
      (4) Depressurize hydraulic system. (Refer to 29-00-00).
      (5) Drain hydraulic reservoir to a fluid level below the sight glass.
      (6) Remove sight glass.
      (7) Remove and discard O-ring from reservoir sight glass mounting boss.
      (8) Ensure that O-ring groove is free of foreign material.
   D. Install Replacement Hydraulic System Reservoir Sight Glass (See Figure 202.) *(Aircraft 35-683 and Subsequent; 36-064 and Subsequent and previous aircraft modified per SB 35/36-29-5, "Replacement of Hydraulic Reservoir Sight Glass Assembly.)*
      (1) Lightly lubricate new O-ring and sight glass assembly threads with hydraulic fluid (MIL-H-5606).
      (2) Insert O-ring in sight glass mounting boss O-ring groove.
      (3) Install new sight glass assembly into mounting boss on reservoir.

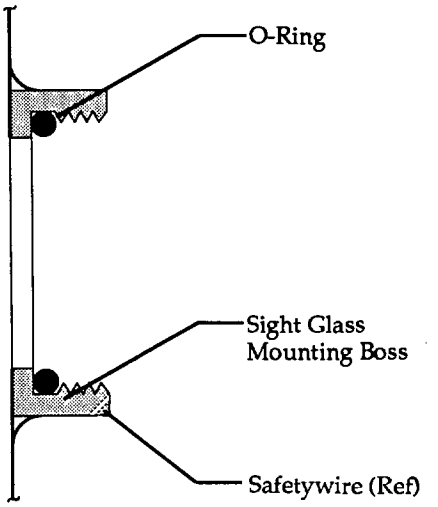
      CAUTION: EXERCISE EXTREME CAUTION WHEN TORQUING SIGHT GLASS ASSEMBLY. DAMAGE TO THREADS COULD RESULT FROM OVERTORQUING.

      (4) Torque sight glass assembly nut 86 (±10) inch-pounds. Check to ensure that O-ring is properly seated as viewed through sight glass.
      (5) Safetywire sight glass to mounting boss, using double twist method. (Refer to Chapter 20.)
      (6) Service hydraulic reservoir. (Refer to Chapter 12.)
      (7) Pressurize hydraulic system and check for leaks. (Refer to 29-00-00.)
      (8) Connect aircraft batteries and secure tailcone door.

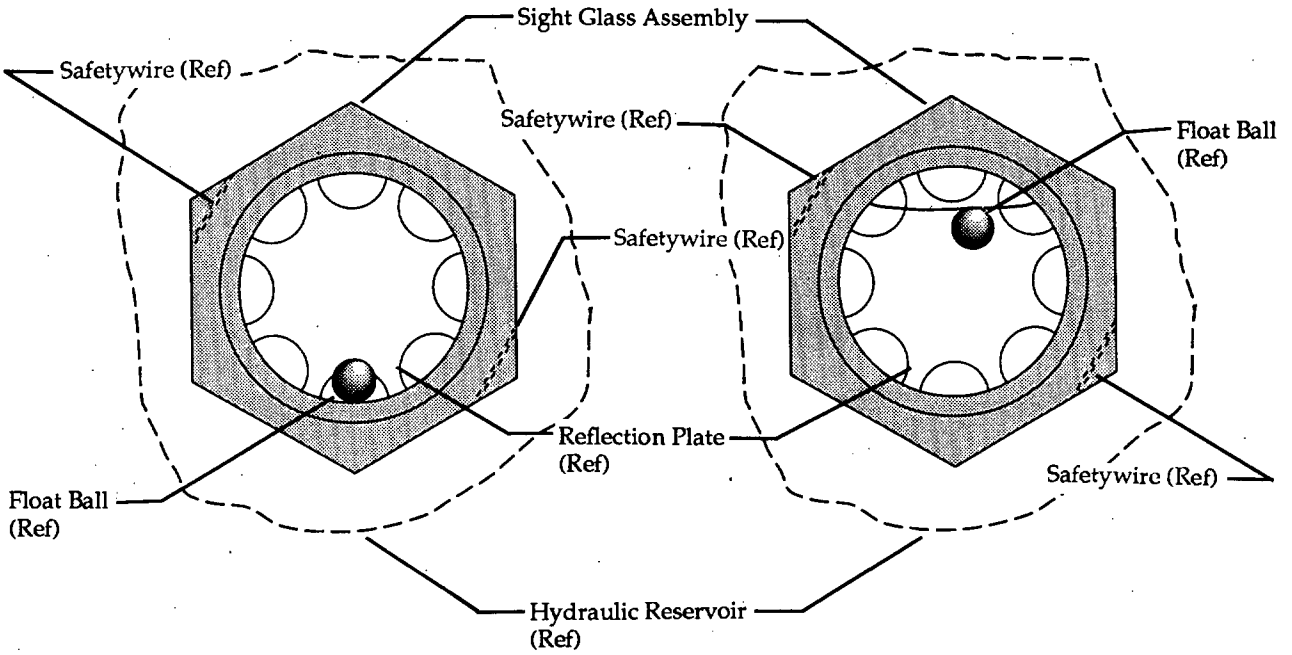


Hydraulic System Reservoir Installation
Figure 201





(O-RING INSTALLATION)



(NO FLUID IN SIGHT GLASS) (FLUID IN SIGHT GLASS)

Detail A

Hydraulic System Reservoir Sight Glass Installation
Figure 202

HYDRAULIC SUPPLY SHUTOFF VALVES — MAINTENANCE PRACTICES

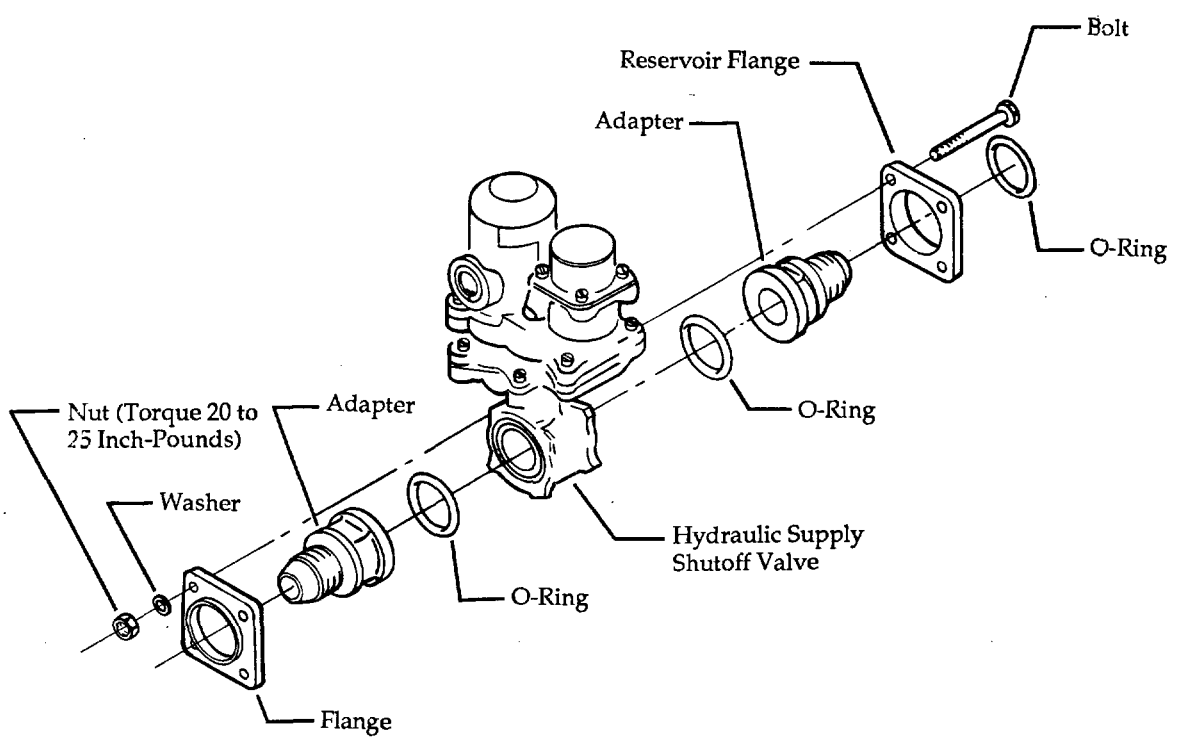
1. Removal/Installation

NOTE: Removal of both hydraulic supply shutoff valves is identical.

A. Remove Hydraulic Supply Shutoff Valve (See figure 201.)
(1) Open tailcone access door and disconnect both aircraft batteries.
(2) Depressurize the hydraulic system. (Refer to 29-00-00, Depressurize Hydraulic System.)

CAUTION:
- **PROVIDE ADEQUATE COVER FOR AVIONICS AND OTHER EQUIPMENT IN TAILCONE BEFORE DISCONNECTING HYDRAULIC LINES.**
- **TAKE PRECAUTIONS TO CATCH ANY RESIDUAL HYDRAULIC FLUID REMAINING IN HYDRAULIC LINES.**

(3) Drain hydraulic fluid from reservoir as follows:
(a) Fabricate a drain line using a quick-disconnect adapter and hose long enough to reach a proper receptacle.
(b) Remove dust cap from return line quick-disconnect.
(c) Plug drain line adapter into return line quick-disconnect and drain reservoir.
(4) Disconnect electrical connector from shutoff valve.
(5) Disconnect engine supply line from valve assembly. Immediatly cap line.



Hydraulic Supply Shutoff Valve Assembly
Figure 201

CAUTION: WHEN REMOVING SUPPLY VALVE ASSEMBLY, ENSURE THAT BOLTS ARE NOT REMOVED FROM ASSEMBLY. IF BOLTS ARE REMOVED, THE ASSEMBLY WILL INADVERTENTLY SEPARATE.

(6) Loosen shutoff valve assembly nuts and bolts enough to allow reservoir adapter to be screwed out of reservoir without rotating shutoff valve. Plug reservoir opening.
(7) Remove hydraulic supply shutoff valve assembly from aircraft.
(8) Remove nuts and washers securing valve assembly and carefully remove shutoff valve from adapters and flanges.

B. Install Hydraulic Supply Shutoff Valve (See figure 201.)
(1) Lubricate new outer O-rings and install on shutoff valve.
(2) Assemble shutoff valve, adapters and flanges with attaching parts.

NOTE: Tighten bolts finger snug, allowing reservoir to turn without rotating shutoff valve.

(3) Lubricate new reservoir adapter O-ring and install on reservoir adapter.
(4) Remove plug from reservoir and position hydraulic supply shutoff valve assembly on reservoir. Tighten reservoir adapter to reservoir.

NOTE: When installing valve:
(a) Ensure position indicators are visible.
(b) Ensure reservoir adapter O-ring is installed on reservoir adapter.

(5) Torque hydraulic supply shutoff valve assembly nuts 20 to 25 inch-pounds.
(6) Uncap engine hydraulic supply line and connect supply line to valve assembly.
(7) Connect shutoff valve electrical connector.
(8) Service the hydraulic reservoir. (Refer to Chapter 12.)
(9) Perform operational check of hydraulic system and inspect for leaks.
(10) Connect aircraft batteries and close tailcone access door.

2. Adjustment/Test

A. Functional Test of Hydraulic Supply Shutoff Valve.

CAUTION: DO NOT DEPRESS FIRE EXTINGUISHER SWITCHES (ARMED SWITCHES) WHEN PERFORMING THIS CHECK AS THE SYSTEM IS ARMED WHEN THE FIREWALL VALVES ARE CLOSED.

NOTE:
- Perform functional test of hydraulic supply shutoff valve in accordance with the current inspection interval specified in Chapter 5.
- Two mechanics are required to perform this check; one in the cockpit operating the valve switch and one in the tailcone observing valve operation.

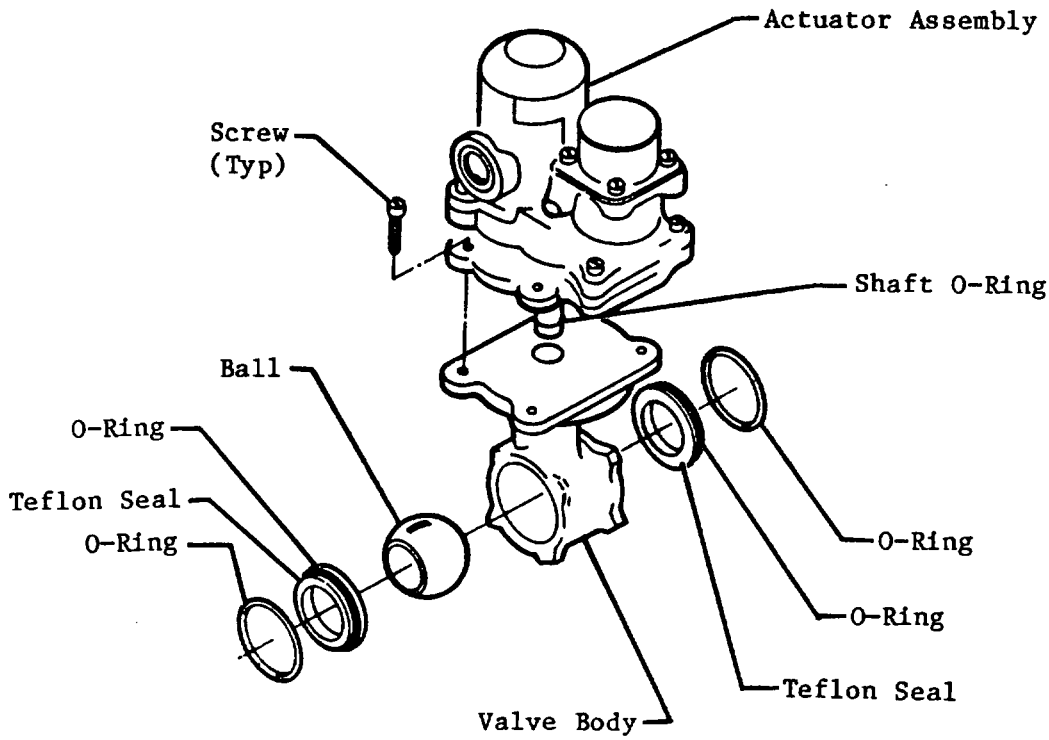
(1) Set Battery Switch to ON and close left firewall shutoff valve. This can be determined by visually checking the valve pointer. The fire extinguisher ARMED lights will illuminate.
(2) Open the left firewall shutoff valve. Visually check pointer on shutoff valve. Check that the shutoff valve indicator light and ARMED lights will extinguish.
(3) Cycle the valve three times by pulling and pushing LH FIRE PULL T-handle to insure proper valve operation.
(4) Perform steps (1), (2) and (3) for the RH shutoff valve.
(5) Return system to normal by pushing in FIRE PULL T-handle and setting Battery Switch to OFF.

3. **Approved Repairs**

A. O-Ring Replacement (See Figure 202.)

NOTE: It is important to note the position of each O-ring to ensure that each new O-ring is installed in its proper position.

(1) Remove hydraulic supply valve. (Refer to Removal/Installation, this Section.)
(2) Remove outer O-rings, teflon seals, and ball.
(3) Remove safety wire and remove screws which attach valve body to actuator assembly. Remove actuator assembly from valve body to expose shaft O-ring.
(4) Remove old O-ring from actuator shaft. Lubricate a new O-ring on shaft. Ensure that O-ring is not twisted and is properly installed on shaft.
(5) Apply a light coating of petroleum jelly to shaft O-ring and insert shaft into valve body. Secure valve body to actuator assembly with attaching screws and safety wire.
(6) Align groove of ball with actuating shaft which protrudes into valve body and install ball.
(7) Remove old O-rings from teflon seals. Lubricate new O-rings with petroleum jelly and install O-rings on teflon seals. Ensure that O-rings are not twisted and are properly installed on teflon seals.
(8) Apply a light coating of petroleum jelly to O-rings installed on teflon seals and install teflon seals in valve body.
(9) Lubricate outer O-rings with petroleum jelly and install in valve body.
(10) Install adapter on valve and install this assembly in aircraft as described in paragraph 1.B.



Hydraulic Supply Shutoff Valve O-Ring Replacement
Figure 202

1. REMOVAL/INSTALLATION

NOTE: The engine-driven hydraulic pumps are located on the bottom of each engine on the forward side of the accessory gearbox.

A. Remove Hydraulic Pump (See figure 201.)
   (1) Remove electrical power from aircraft.
   (2) Remove lower engine nacelle to gain access to pump.
   (3) Close hydraulic supply shutoff valves.
   (4) Depressurize hydraulic system.
   (5) Disconnect and remove seal drain line at pump and cap all openings.
   (6) Disconnect clamps and remove pressure and supply lines from pump. Cap pressure and supply lines immediately.
   (7) Disconnect clamps and remove case drain line and cap all openings.

CAUTION: USE EXTREME CAUTION NOT TO BUMP THE PUMP SHAFT. BUMPING THE SHAFT WILL CAUSE THE SHAFT SEAL TO LEAK.

   (8) Remove four nuts and washers attaching pump to accessory gear box and remove pump and gasket.
   (9) Remove fittings and packings from pump. Discard packings.
   (10) Inspect fittings for serviceability and, if serviceable, retain for installation on new pump.

B. Install Hydraulic Pump (See figure 201.)

CAUTION: USE EXTREME CAUTION NOT TO BUMP THE PUMP SHAFT OR TIGHTEN MOUNTING NUTS IN SUCH A MANNER AS TO INDUCE MISALIGNMENT. BUMPING THE PUMP SHAFT OR IMPROPER TIGHTENING OF MOUNTING NUTS WILL CAUSE THE SHAFT SEAL TO LEAK.

NOTE: Ensure that hydraulic pump case is filled with hydraulic fluid (MIL-H-5606) prior to installation.

   (1) Install fittings with new packings on pumps.
   (2) Position new gasket on accessory gearbox.
   (3) Apply Mobil No. 29 or Braycote 664S grease to the male spline on the hydraulic pump and to the female spline on the engine hydraulic pump pad.
   (4) Position pump on accessory gearbox with splines aligned and secure with four nuts and washers. Torque nuts evenly to ensure proper alignment.
   (5) Remove caps and connect seal drain, pressure, and supply lines. Secure with clamps.
   (6) Fill pump through case drain fitting with MIL-H-5606 hydraulic fluid, remove caps, and connect case drain line.
   (7) Open hydraulic supply shutoff valves.
   (8) Check hydraulic pump for leakage. (Refer to Inspection/Check.)
   (9) Install lower engine nacelle.
   (10) Restore aircraft to normal.
   (11) Restore electrical power to aircraft.

2. INSPECTION/CHECK
   A. Perform Leak Test of Hydraulic Pump
      (1) Remove lower engine nacelle.
      (2) Disconnect seal drain line at hydraulic pump.
      (3) Wipe excess fluid from drain port.
      (4) Start applicable engine in accordance with procedures outlined in the approved FAA Airplane Flight Manual.
      (5) Allow engine to stabilize at ground IDLE and obtain normal hydraulic system pressure. With pressure applied for 5 minutes, maximum allowable leakage shall not exceed one drop per minute from seal drain port.

CAUTION: **USE EXTREME CARE NOT TO BUMP PUMP SHAFT OR TIGHTEN MOUNTING NUTS IN SUCH A MANNER AS TO INDUCE MISALIGNMENT. BUMPING THE PUMP SHAFT OR IMPROPER TIGHTENING OF MOUNTING NUTS WILL CAUSE THE SHAFT SEAL TO LEAK.**

NOTE:
- The preceding allowable limits for leakage are at normal hydraulic system pressure. As the engine is slowed during engine shutdown, normal system pressures are no longer on the pump which allows the pump shaft to move away from the pump internal seal and a temporary leakage to occur. The temporary leakage is normal during system shutdown and the pump should not be rejected because the temporary leakage exceeds the maximum allowable leakage of this test.
- If a leakage should exceed acceptable limits, proceed as follows:
- **Method 1.** Shut down engine and loosen the four nuts attaching pump to accessory gear box and reposition (jiggle) pump. Torque attaching nuts evenly. This method allows the pump shaft to center in its internal seal and stop a leak.
- **Method 2.** Shut down engine and remove four nuts and washers attaching pump to accessory gear box. Pull pump out of accessory box enough to rotate pump shaft by hand. Align pump splines with gear box splines and install hydraulic pump in accordance with the Installation Procedures.
- It may be necessary to repeat Methods 1 and/or 2 several times to ensure that the pump shaft centers in its internal seal to stop a leak. Repeat steps (3) and (4) after each adjustment to ensure the leak is within acceptable limits. If repeated attempts to stop a leak fail, replace pump in accordance with Removal/Installation Procedures.

      (6) Shut down engine.
      (7) Connect seal drain line and install lower engine nacelle.
      (8) Restore aircraft to normal.

B. Operational Check of Engine-Driven Hydraulic Pumps

NOTE: Perform Operational Check of Engine-Driven Hydraulic Pumps in accordance with the current inspection interval specified in Chapter 5.

This operational check can be accomplished during a normal engine run.

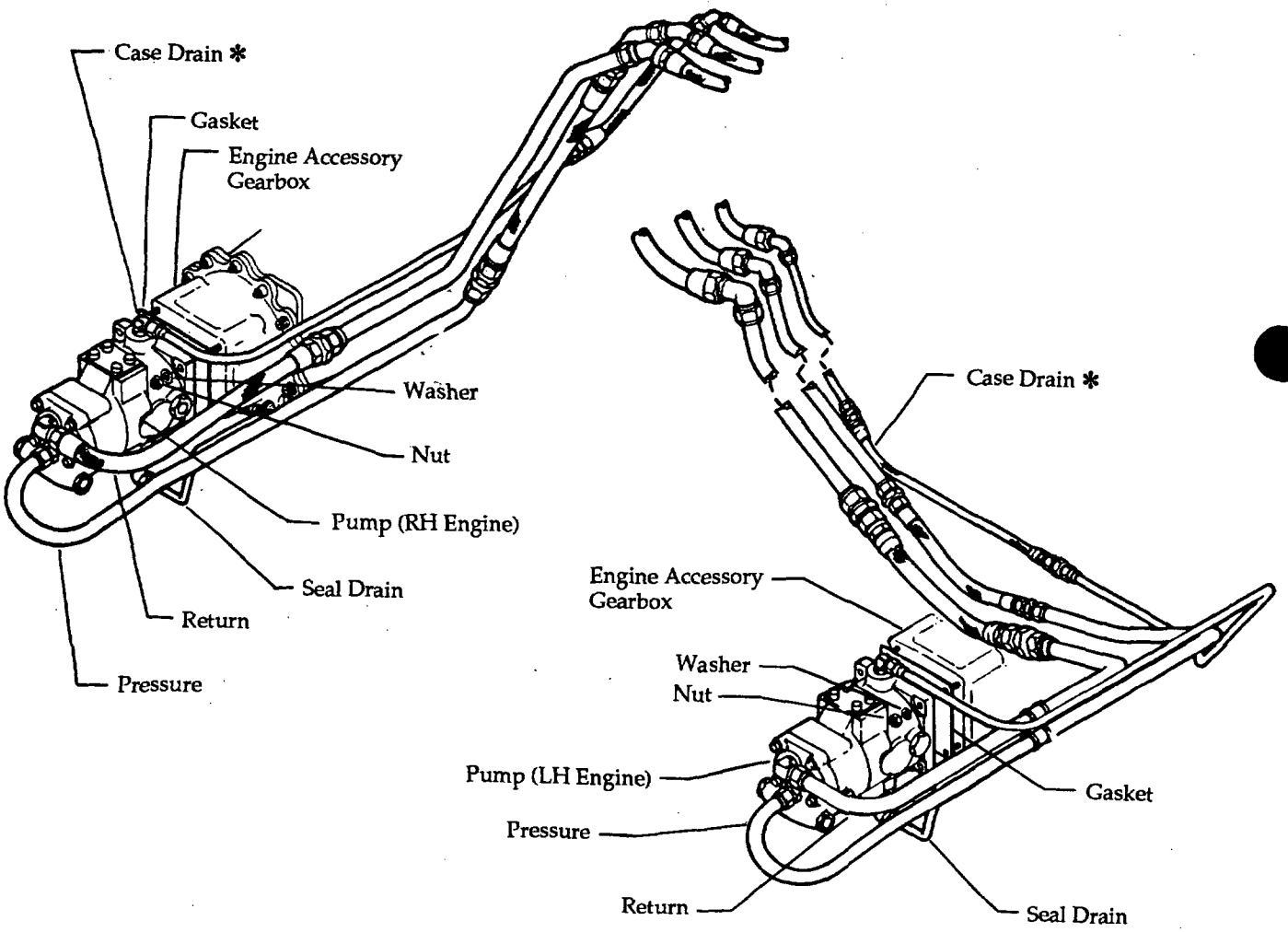
(1) Connect external electrical power to aircraft and set Battery Switches on.
(2) Set Auxiliary Hydraulic Pump Switch located on center switch panel off.
(3) Start left engine. (Refer to FAA Approved Airplane Flight Manual.)
(4) Observe hydraulic pressure indicator and allow hydraulic system to reach its normal operating pressure.

NOTE: Normal hydraulic system pressure is 1525 (±25) psi (10,515 [±172] kPa) when the hydraulic system is static (not being used).

(5) Cycle flaps to ensure left engine-driven hydraulic pump is pressurizing the hydraulic system.
(6) Start right engine. (Refer to FAA Approved Airplane Flight Manual.)
(7) Shut down left engine. (Refer to FAA Approved Airplane Flight Manual.)
(8) Cycle flaps to ensure right engine-driven hydraulic pump is pressurizing the hydraulic system.
(9) Shut down right engine. (Refer to FAA Approved Airplane Flight Manual.)
(10) Set Battery Switches off and disconnect external electrical power.

* Insure that hydraulic pump case is filled with MIL-H-5606 hydraulic fluid prior to installation.

The hydraulic pump is self-priming. Priming is not necessary prior to installation.



Hydraulic Pump Installation
Figure 201

HYDRAULIC FILTER - MAINTENANCE PRACTICES

1. REMOVAL/INSTALLATION

NOTE:
- The hydraulic filter elements must be changed periodically to avoid filter clogging and fluid contamination in accordance with current inspection intervals. (Refer to Chapter 5.)
- The filters are located on the hydraulic panel in the tailcone and are accessible through the tailcone access door.
- Removal and installation of both pressure and return filter assemblies is identical.
- Removal and installation of both pressure and return filter elements is identical with the exception of filter bowl torque values.

A. Remove Hydraulic Filter Element (See figure 201.)

CAUTION: TAKE NECESSARY PRECAUTIONS TO CATCH ANY RESIDUAL HYDRAULIC FLUID WHICH MAY REMAIN IN HYDRAULIC LINES.

(1) Lower tailcone access door and disconnect battery quick-disconnects.
(2) Depressurize hydraulic system. (Refer to 29-00-00)
(3) Loosen return line connection at reservoir.

NOTE: If connection is not broken, hydraulic fluid will siphon from reservoir.

(4) Unscrew filter bowl, and remove and discard filter element.

B. Install Hydraulic Filter Element (See figure 201.)
(1) Clean filter bowl and install new element.
(2) Inspect O-ring and backup rings for serviceability and replace if necessary.
(3) Fill bowl, with filter installed, with MIL-H-5606 hydraulic fluid.
(4) Install bowl, torque, and safety wire. Torque return filter bowl to 100 inch-pounds. See figure 201 for pressure filter bowl torque values.
(5) Reset fire tee-handle.
(6) Pressurize system and check for leaks. Service hydraulic reservoir if necessary.
(7) Connect battery quick-disconnects and secure tailcone access door.

C. Remove Hydraulic Filter Assembly

CAUTION: TAKE NECESSARY PRECAUTIONS TO CATCH ANY RESIDUAL HYDRAULIC FLUID WHICH MAY REMAIN IN HYDRAULIC LINES.

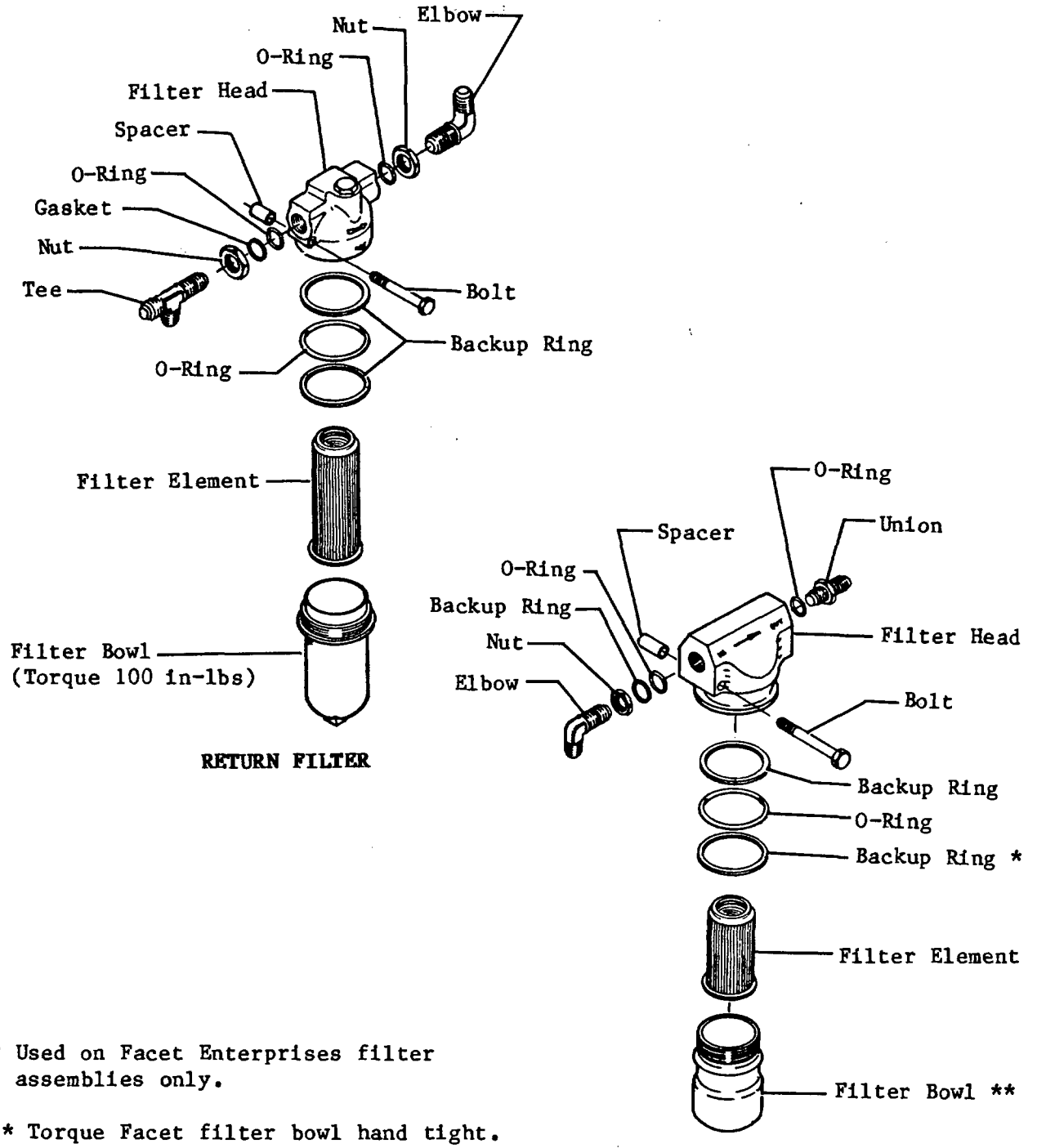
(1) Lower tailcone access door and disconnect battery quick-disconnects.
(2) Depressurize hydraulic system. (Refer to 29-00-00.)
(3) Loosen return line connection at reservoir.

NOTE: If connection is not broken, hydraulic fluid will siphon from reservoir.

(4) Disconnect and cap lines at hydraulic filter.
(5) Remove two bolts securing hydraulic filter to hydraulic panel and remove filter assembly.

NOTE: Spacers are installed on bolts behind filter assembly. Do not lose spacers.

D. Install Hydraulic Filter Assembly
   (1) If a new filter assembly is being installed, install fittings using new O-rings.
   (2) Remove filter bowl and fill bowl, with filter element installed, with MIL-H-5606 hydraulic fluid.
   (3) Install bowl, torque, and safety wire. Torque return filter bowl to 100 inch-pounds. See figure 201 for pressure filter bowl torque values.
   (4) Insert bolts through holes in filter head and slip spacers over bolts from back side of filter.
   (5) Position filter on hydraulic panel and tighten bolts.
   (6) Remove caps and connect hydraulic lines to filter assembly.
   (7) Reset fire tee-handle.
   (8) Pressurize system and check for leaks. Service hydraulic reservoir if necessary.
   (9) Connect battery quick-disconnects and secure tailcone access door.



* Used on Facet Enterprises filter assemblies only.

** Torque Facet filter bowl hand tight. Torque Purolator filter bowl 120 to 180 inch-pounds.

11-4C

Hydraulic Filter Assembly
Figure 201

HYDRAULIC ACCUMULATOR - MAINTENANCE PRACTICES

1. REMOVAL/INSTALLATION

NOTE:
- The hydraulic accumulator is mounted on the hydraulic panel located in the tailcone section of the aircraft.
- The hydraulic accumulator is accessible through the tailcone access door.
- Extreme caution should be exercised when releasing air pressure from accumulator. Remove dust cap and loosen end nut 3/4 turn. Do not loosen or remove air valve assembly to release air.

A. Remove Hydraulic Accumulator (See figure 201.)

CAUTION: WHEN ENG FIRE PULL TEE HANDLE SWITCH IS PULLED, USE EXTREME CARE NOT TO DEPRESS EITHER ENG EXT ARMED SWITCH. DEPRESSING AN ARMED SWITCH WILL DISCHARGE A FIRE EXTINGUISHER BOTTLE.

(1) With Battery Switches set to BAT 1 and BAT 2, pull FIRE PULL tee-handle to close hydraulic supply shutoff valves.
(2) Lower tailcone access door and gain access to hydraulic accumulator.
(3) Remove electrical power from aircraft.
(4) Depressurize hydraulic system. (Refer to 29-00-00.)

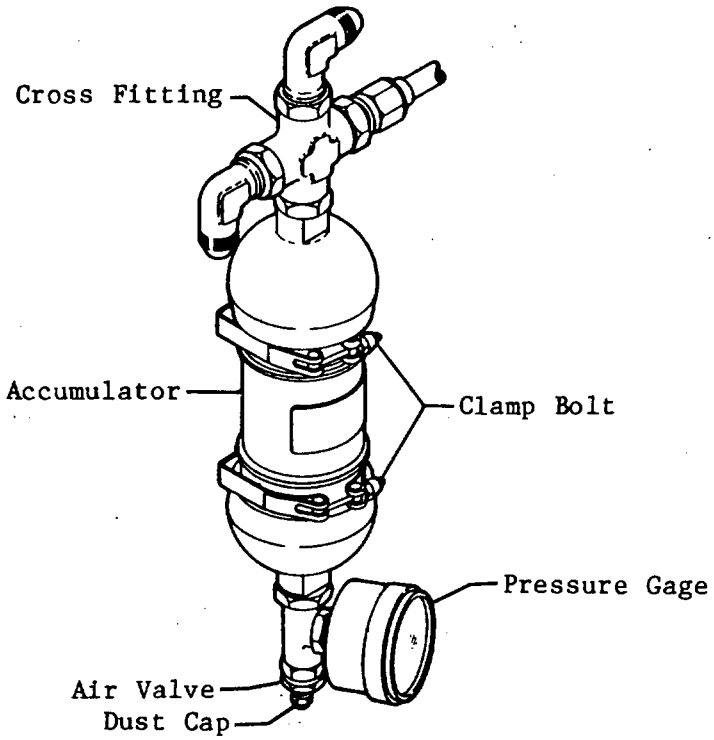
WARNING: DO NOT RELEASE ACCUMULATOR AIR PRESSURE BY LOOSENING OR REMOVING AIR VALVE. THE VALVE MAY BLOW OUT, POSSIBLY CAUSING INJURY.

(5) Release accumulator air charge by removing dust cap and loosening end nut 3/4 of a turn to release air pressure.
(6) Remove and cap tubes from three fittings attached to cross fitting.
(7) Support accumulator and loosen clamp bolt until clamp is loose enough to release accumulator and remove accumulator from aircraft.

B. Install Hydraulic Accumulator (See figure 201.)

CAUTION: DO NOT OVER TIGHTEN CLAMP BOLTS.

(1) Position hydraulic accumulator at clamp position and tighten clamp bolt.
(2) Attach tubes to cross fitting using new O-rings.
(3) Restore electrical power to aircraft.
(4) Push FIRE PULL tee-handle to open hydraulic shutoff valves.
(5) Service accumulator. (Refer to Chapter 12.)
(6) Restore aircraft to normal.



Hydraulic Accumulator Installation
Figure 201

HYDRAULIC PRESSURE REGULATOR FILTER - MAINTENANCE PRACTICES

1. REMOVAL/INSTALLATION

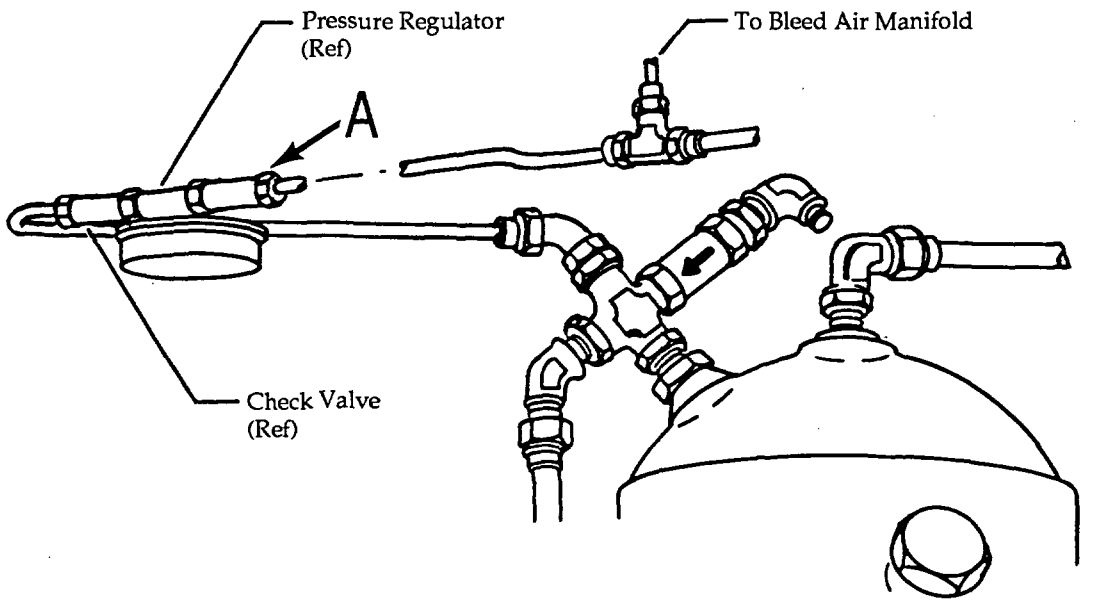
NOTE:
- The hydraulic pressure regulator filter is located in the line between the bleed air manifold and the reservoir pressure regulator.
- The pressure regulator filter must be removed and cleaned in accordance with the current inspection interval specified in Chapter 5.

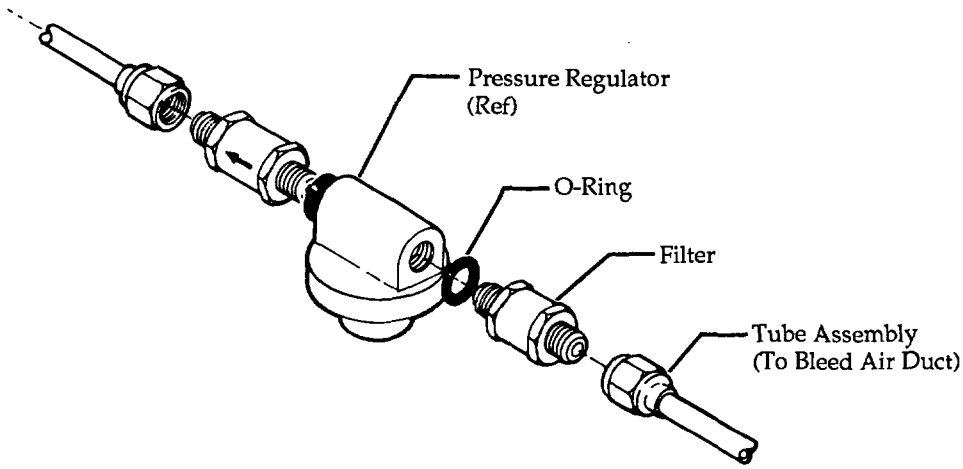
A. Remove Hydraulic Pressure Regulator Filter (See figure 201.)
   (1) Remove electrical power from aircraft.
   (2) Lower tailcone access door and gain access to hydraulic pressure regulator filter.
   (3) Disconnect bleed air line from filter and filter from pressure regulator and cap all openings.

B. Install Pressure Regulator Filter (See figure 201.)
   (1) Attach filter to pressure regulator.
   (2) Remove caps and connect bleed air line to filter.
   (3) Restore aircraft to normal.
   (4) Restore electrical power to aircraft.

2. CLEANING/PAINTING

A. Clean Hydraulic Pressure Regulator Filter (See figure 201.)
   (1) Clean pressure regulator filter with MEK and thoroughly dry air filter with clean, dry air.





Detail A

11-5C-10

Pressure Regulator Filter Installation
Figure 201

TEMPORARY REVISION NO. 29-5

MANUALS AFFECTED:	Learjet 35/35A/36/36A Maintenance Manual.
FILING INSTRUCTIONS:	Insert adjacent to 29-10-06, Page 202, dated Sep 15/89, and retain until further notice.
REASON:	Add new procedure 29-10-07 to the maintenance manual.
INSTRUCTIONS:	Added procedures to do a Removal/Installation of the Hydraulic Pressure Regulator and the Functional Test of the Pressure Regulator.

HYDRAULIC PRESSURE REGULATOR - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: The hydraulic pressure regulator is in the line between the bleed air manifold and the reservoir.

A. Removal of the Hydraulic Pressure Regulator (See Figure 201.)
   (1) Open the access door.
   (2) Disconnect the two battery quick-disconnects to remove the electrical power from the aircraft.
   (3) Get access to the hydraulic pressure regulator.
   (4) Depressurize the hydraulic system. (Refer to 29-00-00.)
   (5) Disconnect the hydraulic line from the pressure regulator filter.
   (6) Disconnect the hydraulic line from the check valve.
   (7) Put protective caps on the hydraulic lines and fittings.
   (8) Remove the pressure regulator from the aircraft.
   (9) If you replace the hydraulic pressure regulator, remove the check valve and pressure regulator filter. (Refer to 29-10-06.)

B. Installation of the Hydraulic Pressure Regulator (See Figure 201.)
   (1) Remove the protective caps from the hydraulic lines and fittings.
   (2) If necessary, install the check valve and the pressure regulator filter on the hydraulic pressure regulator. (Refer to 29-10-06.)
   (3) Put the hydraulic pressure regulator in position on the aircraft.
   (4) Attach the hydraulic line to the check valve.
   (5) Attach the hydraulic line to the pressure regulator filter.
   (6) Tighten all of the connections.
   (7) Connect the two battery quick-disconnects.
   (8) Connect electrical power to the aircraft.
   (9) Pressurize the hydraulic system then do a leak check of the hydraulic pressure regulator.
   (10) Bleed the hydraulic system. (Refer to 29-00-00.)
   (11) Close the tailcone access door.
   (12) Restore the aircraft to normal.

2. Adjustment/Test

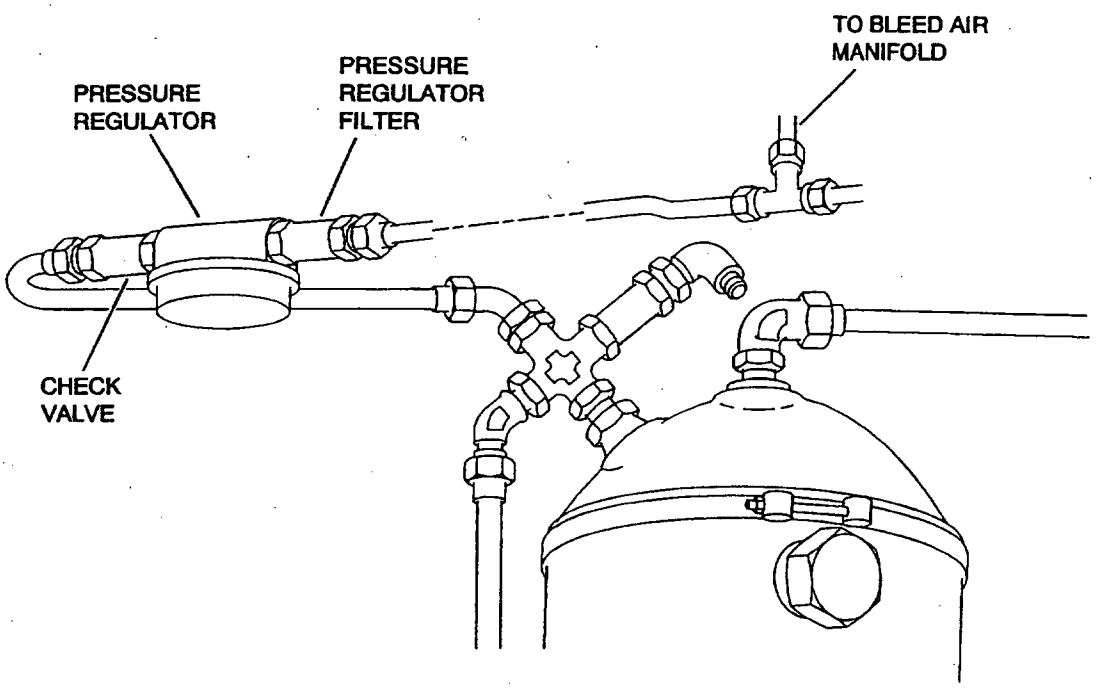
A. Functional Test of the Hydraulic Pressure Regulator

(1) Get the necessary tools and equipment.

NOTE: You can use equivalent alternatives for these items:

NAME	PART NUMBER	MANUFACTURER	USE
Pressure Gage (0 to 25 psi)		Commercially Available	Check the regulator pressure.
Compressed Air Source (filtered) with gage (0 to 25 psi)	Dry air or Nitrogen	Commercially Available	Check the regulator pressure.

(2) Remove the hydraulic pressure regulator from the aircraft. (Refer to 29-10-07.)
(3) Remove the check valve and the pressure regulator filter from the hydraulic pressure regulator. (Refer to 29-10-06.)
(4) Attach the pressure gage to the outlet of the hydraulic pressure regulator.
(5) Attach the compressed air source to the inlet of the hydraulic pressure regulator.
(6) Slowly increase the pressure to 20 psi.
(7) Make sure that the pressure gage on the outlet shows 16 (±2) psi.
(8) Install the check valve and the pressure regulator filter on the hydraulic pressure regulator. (Refer to 29-10-06.)
(9) Install the hydraulic pressure regulator on the aircraft. (Refer to 29-10-07.)



Pressure Regulator Installation
Figure 201

M35-291007-201-01

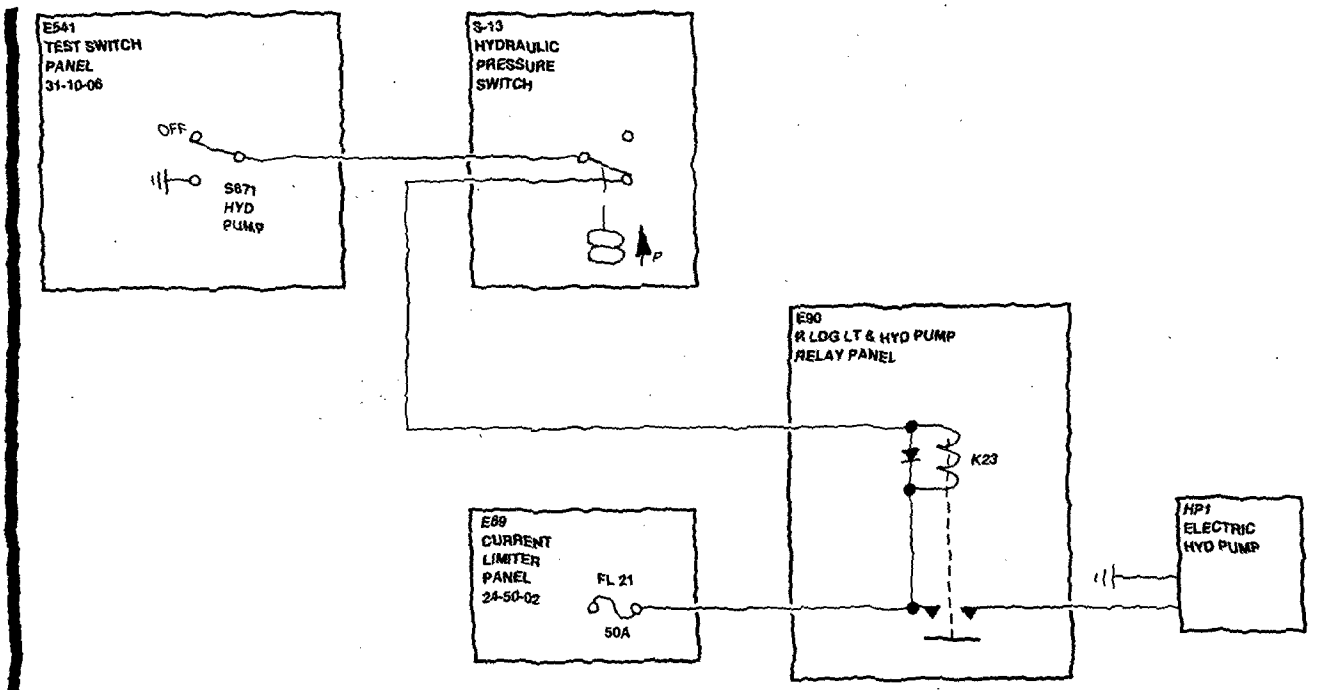
AUXILIARY HYDRAULIC SYSTEM - DESCRIPTION AND OPERATION

1. **Description**
   A. The auxiliary hydraulic pump is installed on the hydraulic panel located in the tailcone section of the aircraft.
   B. The electrically driven auxiliary hydraulic pump provides hydraulic system pressure for inflight standby power.
   C. The auxiliary hydraulic pump is controlled by the Hydraulic Pump Switch and cycled automatically by a pressure switch (S13) located in the system pressure line.
   D. *On Aircraft 35-490 and Subsequent and 36-051 and Subsequent,* a LO HYD annunciator is installed on the RH side of the glareshield adjacent to the RH ENG FIRE PULL Switch.
   E. On *Aircraft 35-002 thru 35-617 and 36-002 thru 36-055 modified per AMK 86-5, "Tailcone Electrical Circuit Protection,"* fuse box (E8602) is installed to provide circuit protection to the auxiliary hydraulic pump. On *Aircraft 35-002 thru 35-505 and 36-002 thru 36-053,* fuse box (E8602) is located on the hydraulic panel. On *Aircraft 35-506 thru 35-617 and 36-054 and 36-055,* the fuse box is located on the RH electrical equipment tray.
   F. *On Aircraft 35-618 and Subsequent and 36-056 and Subsequent,* a printed circuit board (PCB 1) is installed to provide wire protection circuits. Printed circuit board (PCB 1) is located in the R landing and hydraulic pump relay box (E90). Refer to Chapter 33 for relay box E90.

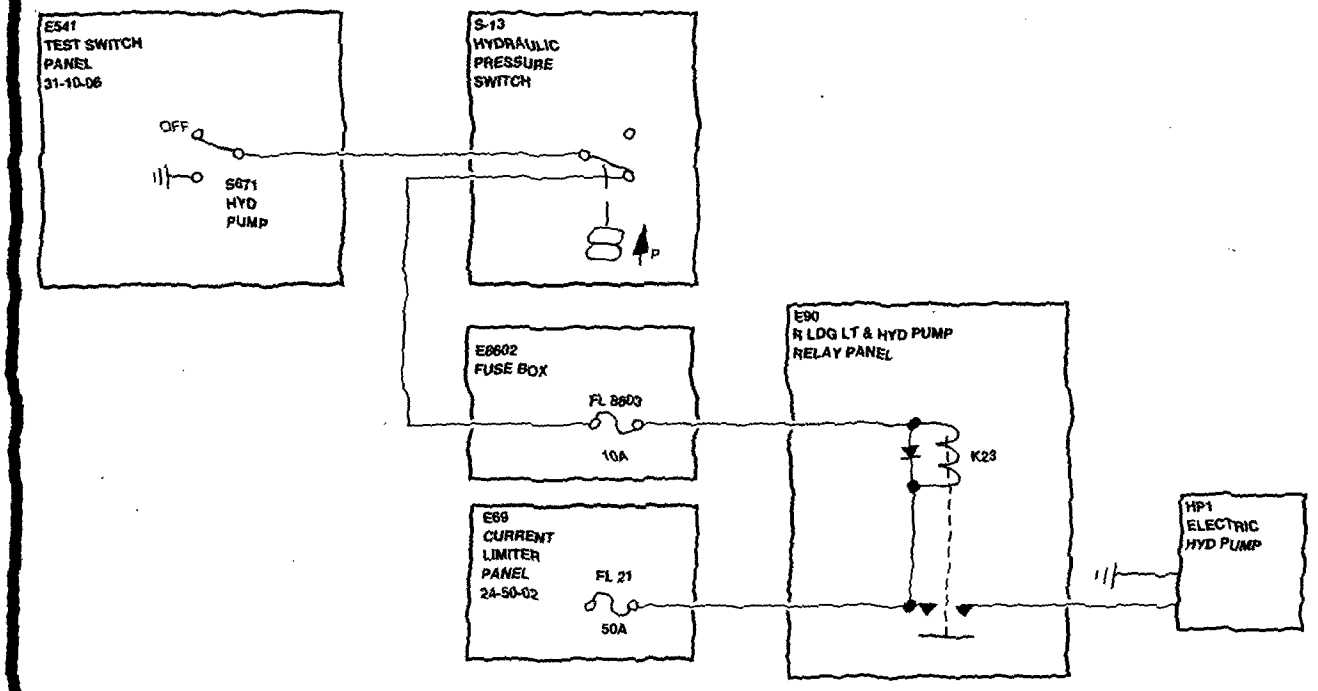
2. **Operation** (See Figure 1.)

   CAUTION: OPERATE AUXILIARY HYDRAULIC PUMP A MAXIMUM OF 3 MINUTES ON AND 20 MINUTES OFF TO PREVENT OVERHEATING AND BURNOUT OF PUMP MOTOR.

   A. With the Hydraulic Pump Switch on the Test Switch Panel set to HYD PUMP, an abnormal drop in hydraulic system pressure will actuate the pressure switch and energize the pump.
   B. The auxiliary pump draws fluid from the bottom or reserve portion of the reservoir. This ensures that fluid will be available even with low fluid in the reservoir.
   C. When normal system pressure is restored, the pressure switch will reset and de-energize the pump.
   D. On *Aircraft 35-002 thru 35-646 and 36-002 thru 36-058,* the pressure switch is set to open at 1250 (±40) psi and close at 1125 (±25) psi. On *Aircraft 35-647 and Subsequent and 36-059 and Subsequent,* the pressure switch is set to open at 1125 (±40) psi and close at 1000 (±25) psi.
   E. *On Aircraft 35-490 and Subsequent and 36-051 and Subsequent,* when the pressure switch (S13) actuates (closes) a ground circuit is completed to energize the auxiliary hydraulic pump and illuminate the LO HYD annunciator. The auxiliary hydraulic pump is de-energized and the LO HYD annunciator is extinguished when the pressure switch (S13) actuates (opens).
   F. On *Aircraft 35-002 thru 35-617 and 36-002 thru 36-055 modified per AMK 86-5, "Tailcone Electrical Circuit Protection,"* fuse box (E8602) is installed to provide circuit protection to the auxiliary hydraulic pump.
   G. *On Aircraft 35-618 and Subsequent and 36-056 and Subsequent,* a printed circuit board PCB 1 provides wire protection if the diode across the coil of the hydraulic pump relay or the diode on the hydraulic pump should short out. The fuse in the respective circuit will open and isolate that component from power.

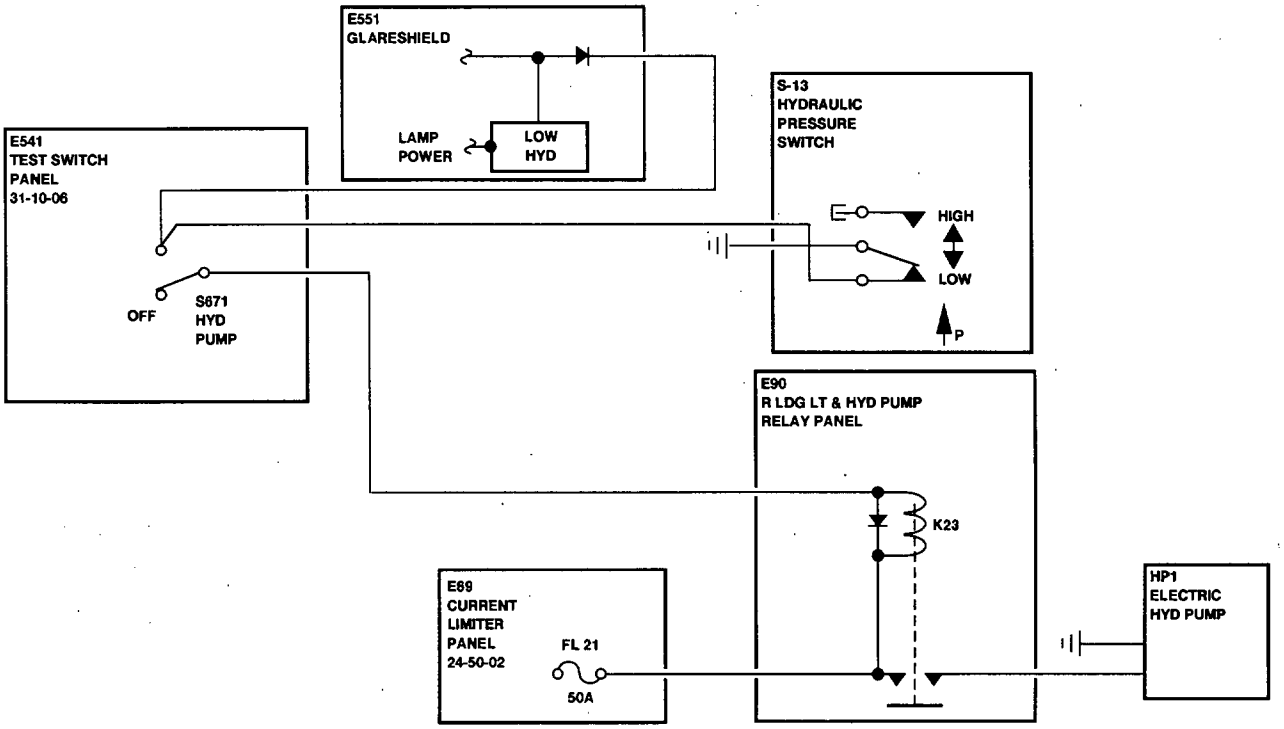


(AIRCRAFT 35-002 THRU 35-489, 36-002 THRU 36-050 NOT MODIFIED PER AMK 86-5A, "TAILCONE ELECTRICAL CIRCUIT PROTECTION")

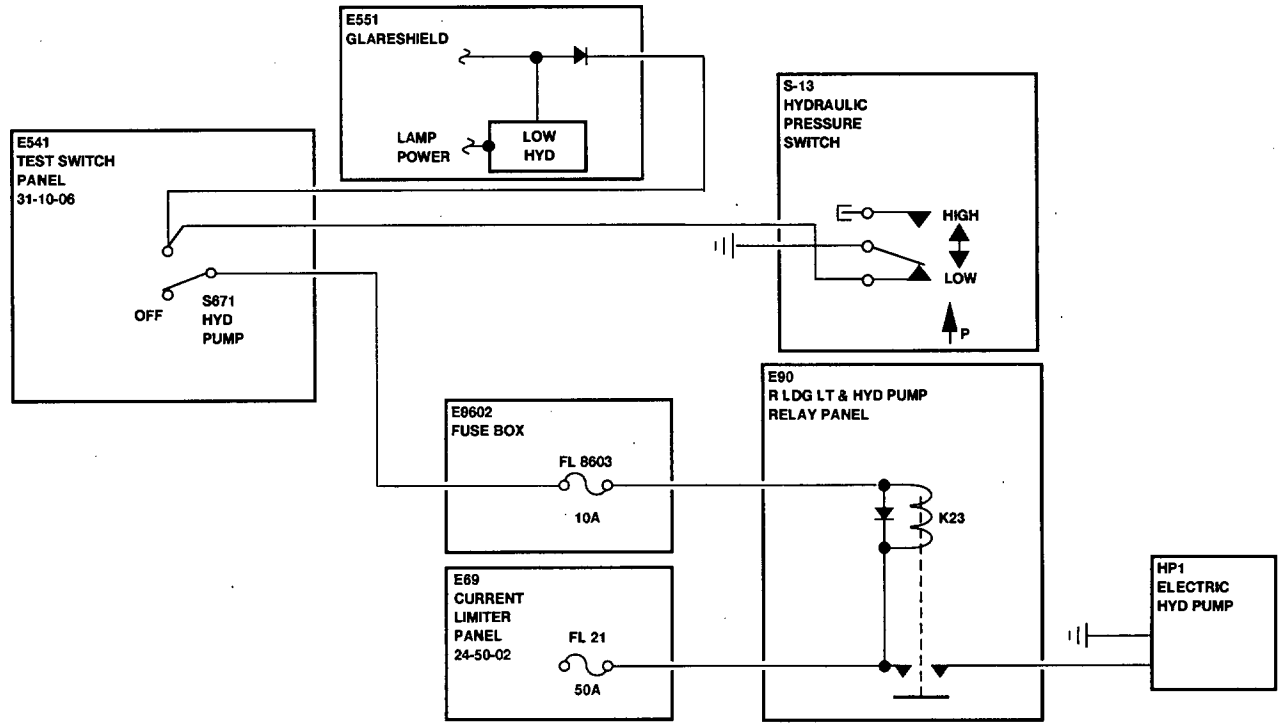


(AIRCRAFT 35-002 THRU 35-489, 36-002 THRU 36-050 MODIFIED PER AMK 86-5A, "TAILCONE ELECTRICAL CIRCUIT PROTECTION")

Auxiliary Hydraulic Pump Electrical Control Schematic
Figure 1 (Sheet 1 of 3)

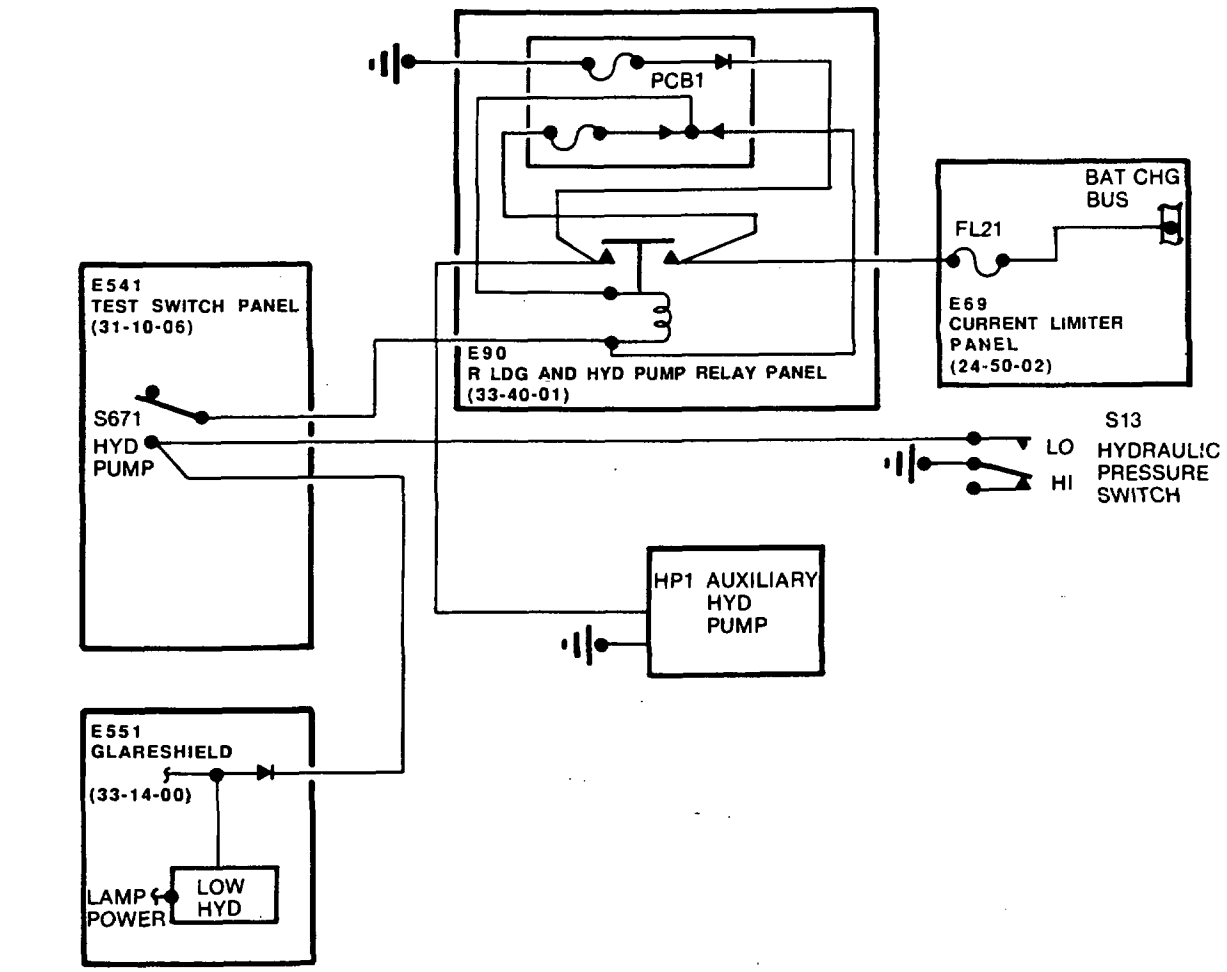


(AIRCRAFT 35-490 THRU 35-617, 36-051 THRU 36-055 NOT MODIFIED PER AMK 86-5A, "TAILCONE ELECTRICAL CIRCUIT PROTECTION")



(AIRCRAFT 35-490 THRU 35-617, 36-051 THRU 36-055 MODIFIED PER AMK 86-5A, "TAILCONE ELECTRICAL CIRCUIT PROTECTION")

Auxiliary Hydraulic Pump Electrical Control Schematic
Figure 1 (Sheet 2 of 3)



Auxiliary Hydraulic Pump Electrical Control Schematic
Figure 1 (Sheet 3 of 3)

AUXILIARY HYDRAULIC PUMP - MAINTENANCE PRACTICES

1. REMOVAL/INSTALLATION

A. Remove Auxiliary Hydraulic Pump (See figure 201.)

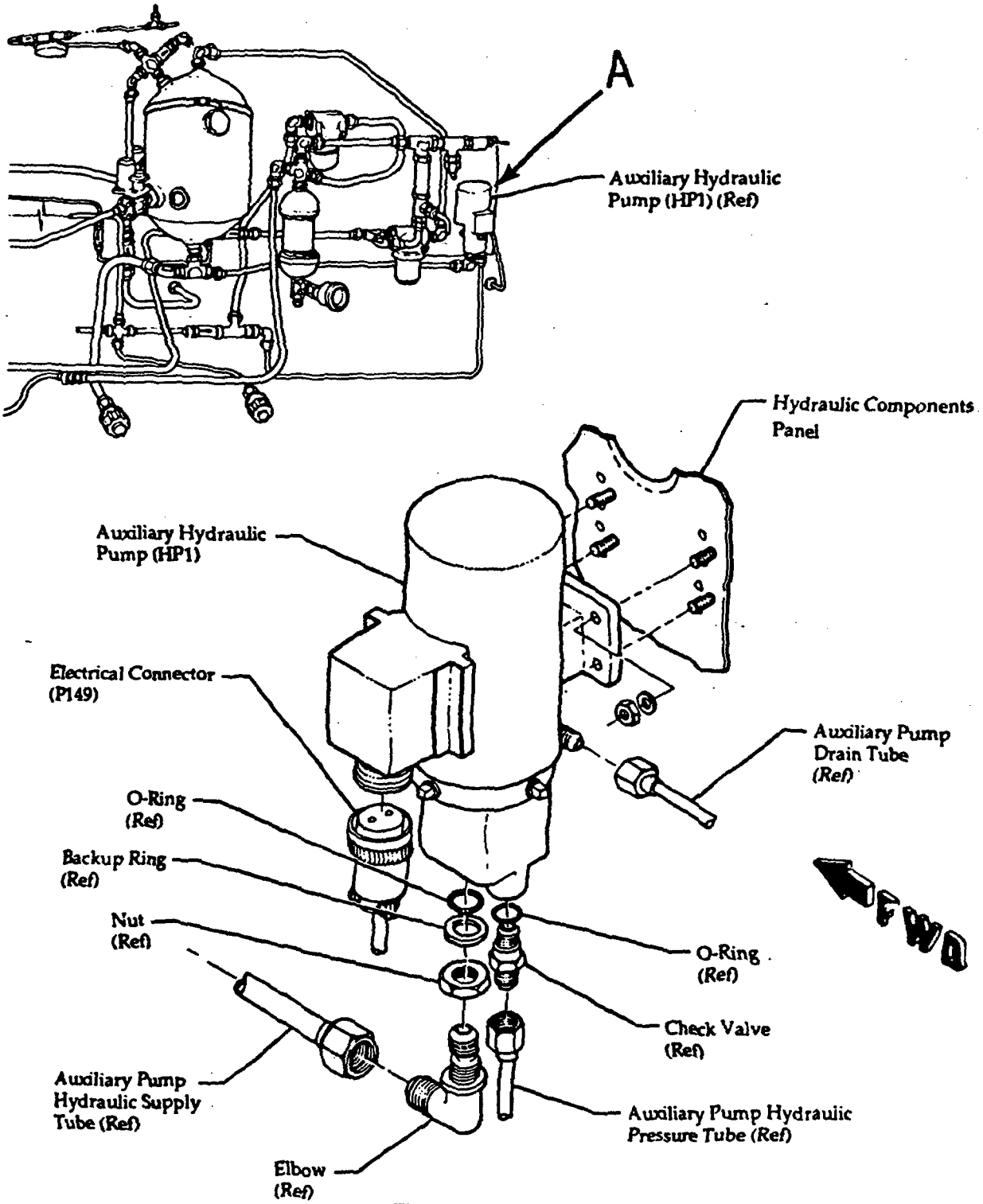
CAUTION:
- **WITH BATTERY SWITCHES IN THE ON POSITION, PULL FIRE TEE-HANDLE TO CLOSE HYDRAULIC SHUTOFF VALVES. THE ENGINE FIRE EXTINGUISHER SYSTEM WILL BE ARMED AT THIS TIME, DO NOT DEPRESS ARM SWITCHES.**
- **TAKE NECESSARY PRECAUTIONS TO CATCH ANY RESIDUAL HYDRAULIC FLUID REMAINING IN HYDRAULIC LINES.**

(1) Close hydraulic supply shutoff valves.

CAUTION:
- **PROVIDE ADEQUATE COVER FOR AVIONICS AND OTHER EQUIPMENT IN TAILCONE BEFORE DISCONNECTING HYDRAULIC LINES.**
- **TAKE PRECAUTIONS TO CATCH ANY RESIDUAL HYDRAULIC FLUID REMAINING IN HYDRAULIC LINES.**

(2) Depressurize and drain hydraulic reservoir. (Refer to 29-00-00.)
(3) Disconnect electrical connector from pump and cap and cover plug and jack.
(4) Disconnect hydraulic and drain lines from pump. Cap or plug openings.
(5) Remove attaching hardware, and remove pump from hydraulic panel.

B. Install Auxiliary Hydraulic Pump (See figure 201.)
(1) Position pump and secure with attaching parts.
(2) Remove caps and plugs, and connect hydraulic and drain lines to pump.
(3) Remove cap and cover and connect electrical connector.
(4) Connect battery quick-disconnects.
(5) Open hydraulic supply shutoff valves.
(6) Service hydraulic reservoir. (Refer to Chapter 12.)
(7) Perform operational check of hydraulic system and check connections for leaks.



Detail A

Auxiliary Hydraulic Pump Installation
Figure 201

11-5C-20
A11-88A

1. REMOVAL/INSTALLATION

A. Remove Auxiliary Hydraulic Pump Pressure Switch (See figure 201.)

CAUTION:
- WITH BATTERY SWITCHES IN THE ON POSITION, PULL FIRE TEE-HANDLE TO CLOSE HYDRAULIC SHUTOFF VALVES. THE ENGINE FIRE EXTINGUISHER SYSTEM WILL BE ARMED AT THIS TIME, DO NOT DEPRESS ARM SWITCHES.
- TAKE NECESSARY PRECAUTIONS TO CATCH ANY RESIDUAL HYDRAULIC FLUID REMAINING IN HYDRAULIC LINES.

(1) Close hydraulic supply shutoff valves.
(2) Depressurize hydraulic system. (Refer to 29-00-00.)

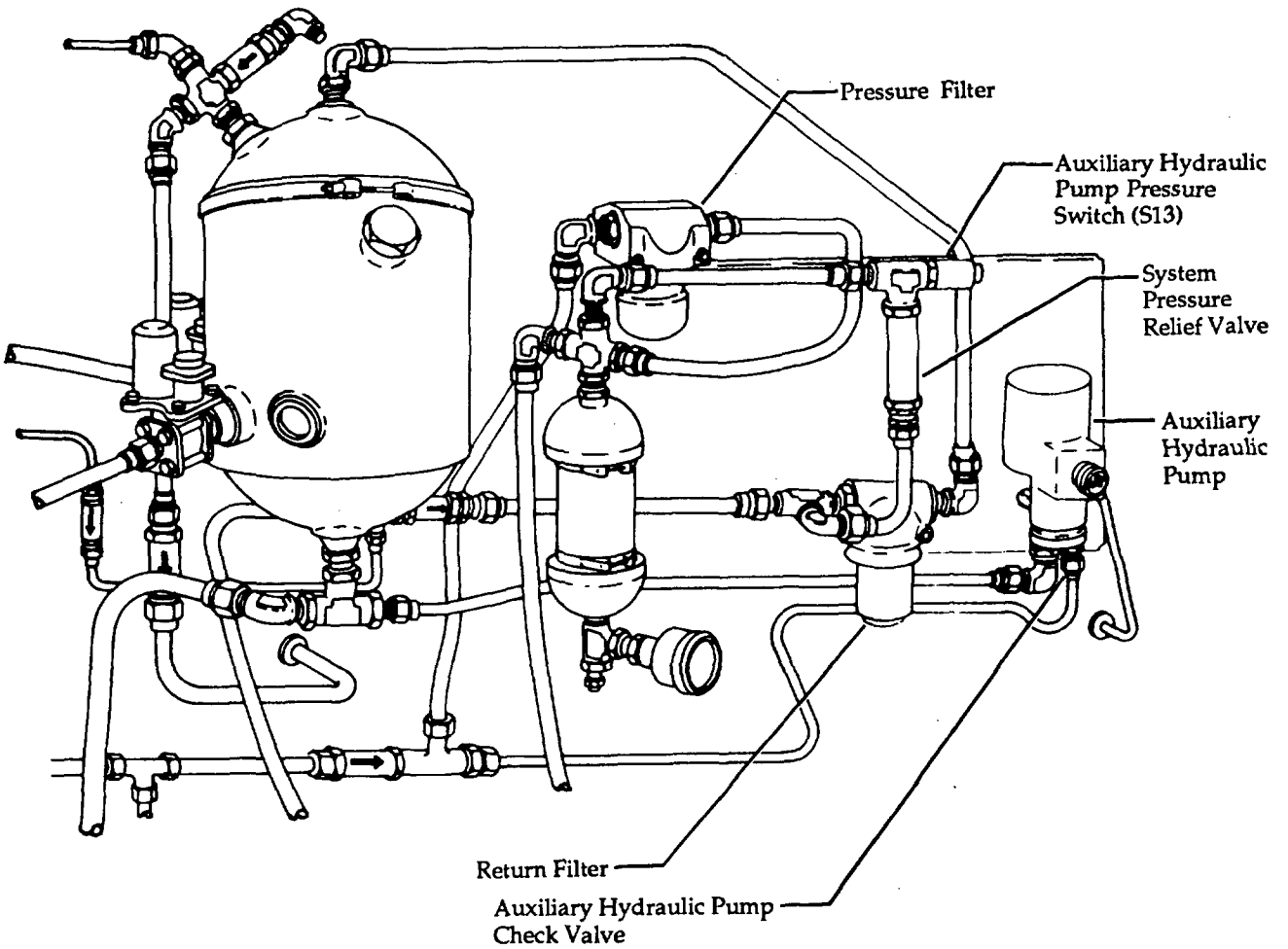
CAUTION:
- PROVIDE ADEQUATE COVER FOR AVIONICS AND OTHER EQUIPMENT IN TAILCONE BEFORE DISCONNECTING HYDRAULIC LINES.
- TAKE PRECAUTIONS TO CATCH ANY RESIDUAL HYDRAULIC FLUID REMAINING IN HYDRAULIC LINES.

(3) Disconnect wires from pressure switch. Tag wires.
(4) Remove pressure switch from reducer.
(5) Plug openings.

B. Install Auxiliary Hydraulic Pump Pressure Switch (See figure 201.)
(1) Inspect O-ring for cuts, abrasions, or other damage.
(2) Remove plug from reducer and install pressure switch.
(3) Connect pressure switch electrical wires. (Refer to Wiring Manual.)
(4) Restore electrical power to aircraft.
(5) Verify LO HYD annunciator is illuminated.

CAUTION: WHEN ENGINE FIRE PULL TEE HANDLE SWITCH IS PULLED, USE EXTREME CARE NOT TO DEPRESS EITHER ENGINE EXTINGUISHER ARMED SWITCH. DEPRESSING AN ARMED SWITCH WILL DISCHARGE THE ASSOCIATED FIRE EXTINGUISHER BOTTLE.

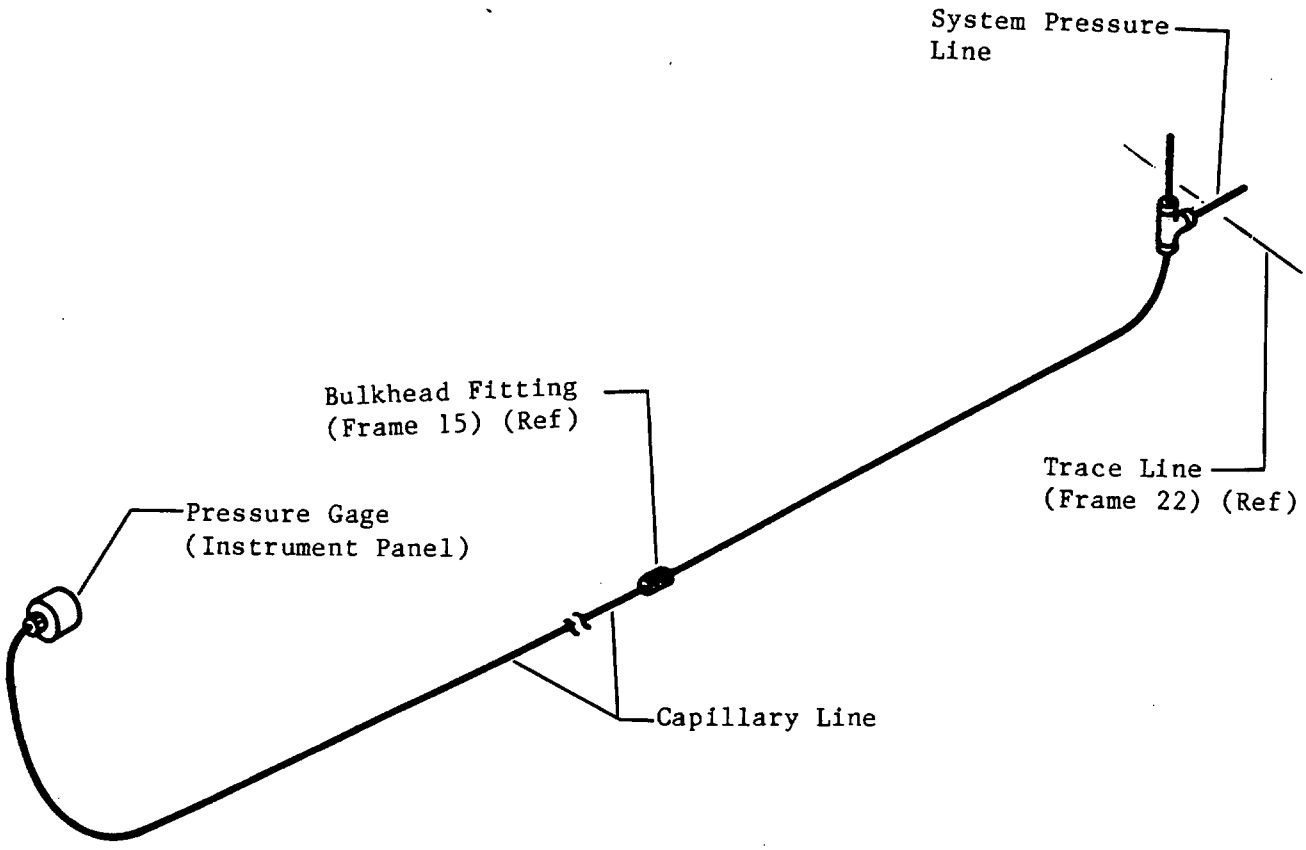
(6) Open hydraulic supply shutoff valves.
(7) Pressurize hydraulic system.
(8) Verify LO HYD annunciator is extinguished.
(9) Check low hydraulic pressure switch for leaks.
(10) Close tailcone access door.



Auxiliary Hydraulic Pump Pressure Switch Installation
Figure 201

HYDRAULIC SYSTEM INDICATION - DESCRIPTION AND OPERATION

1. DESCRIPTION
   A. The hydraulic system is equipped with two direct indicating pressure gages. One is located on the instrument panel and the other is located in the tailcone equipment section of the aircraft.
   B. The direct indicating hydraulic pressure gage located in the tailcone section is for use by service personnel when servicing the hydraulic system. The gage is plumbed to the air side of the hydraulic accumulator.
   C. The direct indicating hydraulic pressure gage on the instrument panel gives a constant hydraulic pressure indication to the pilot and copilot. The gage is plumbed to the hydraulic pressure line in the tailcone by a capillary line.



Hydraulic System Pressure Gage Installation
Figure 1