

MODEL P210 SERIES SERVICE MANUAL

WARNING

Before working in landing gear wheel wells, PULL-OFF hydraulic pump circuit breaker. Circuit breaker is located in the circuit breaker panel on the left side wall. The hydro-electric power pack system is designed to pressurize the landing gear "DOOR CLOSE" system to 1500 psi at any time the master switch is turned on. Injury might occur to someone working in wheel well area if master switch is turned on for any reason.

5-1. LANDING GEAR SYSTEM.

5-2. DESCRIPTION. A hydraulically-operated, retractable landing gear is employed on the aircraft. The hydraulic power system includes equipment required to provide a flow of pressurized hydraulic fluid to the landing gear system. The Cessna-manufactured, self-contained, hydro-electric pack is located in the pedestal with the hand pump remotely located between the two front seats on the floorboard. The gear selector handle is located on the lower instrument panel. The hydraulic pump circuit breaker is located in the circuit breaker panel on the left side wall. It is necessary to pull out on the gear selector handle prior to moving the handle up or down. The right side of the pedestal cover is fitted with a quick-removable access door for checking and servicing the hydraulic fluid level.

5-3. SYSTEM OPERATION.

NOTE

Refer to the hydraulic schematic diagrams at the end of this section to trace the flow of hydraulic fluid as outlined in the following paragraph.

When the aircraft master switch is closed, the hydraulic power pack is ready to operate. When the

gear-up position is selected with the selector handle the selector valve connects the gear-up line to the system pressure, and the gear-down line to return. At the same time, the electric motor that powers the hydraulic pump is turned on. The hydraulic pressure is passed through a filter, and is then divided between the selector valve and door valve. Before hydraulic pressure can reach the selector valve, a priority valve must open. The priority valve can open only under two conditions:

1. There can be no pressure in the door close-line, because door close pressure is applied to a piston to hold priority valve closed.

2. System pressure must build up to 750 psig before the valve can open. Pressure therefore, must go to the door-open line. Pressure in the door-close line is prevented from returning by the door-close lock check valve, and the valve is opened by a piston that senses door-open pressure. When the pressure reaches 400 psig, the door-close lock check valve opens and the doors on the aircraft open. At 750 psig, the priority valve opens and the landing gear begins to retract. As soon as the landing gear is locked in the UP position, the landing gear up limit switches sequence the door solenoid valve to the door close position. When pressure in the door-close line reaches 1500 psig, the pressure switch shuts off the motor and the GEAR-DOWN cycle is similar to the GEAR-UP cycle. The system has been designed so that at any time during system operation, the direction of system of operation may be reversed. Under these conditions, the first operation of the system after the selector handle is moved is to completely open the doors, and then move the gear into the newly-selected position, after which, the doors will close again. There is no danger of interference between the gear and doors of the aircraft, since the gear does not receive hydraulic pressure unless the doors are in the fully-opened position.

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5-4. TROUBLE SHOOTING.

Just because this chart lists a probable cause, proper checkout procedures cannot be deleted and the replacement of a part is not necessarily the proper solution to the problem. The mechanic should always look for obvious problems such as loose or broken parts, external leaks, broken wiring, etc. To find the exact cause of a problem, a mechanic should use a hand pump, pressure gage and a voltmeter to isolate each item in the system. Hydraulic fluid will foam if air is pumped into system, causing fluid to be blown overboard thru pack vent line.

The problems listed are all with the systems controls in their normal operating position: Master switch ON, hydraulic pump breaker IN and landing gear breaker IN. During landing gear system servicing, a power supply capable of maintaining 27.5 volts throughout the gear cycle must be used to augment the ship's battery.

TROUBLE	PROBABLE CAUSE	REMEDY
MOTOR PUMP WILL NOT OPERATE GEAR BUT EMERGENCY HAND PUMP WILL OPERATE GEAR.	Low voltage (in flight).	Check alternator and wiring.
	Fluid level low in reservoir.	Refill reservoir.
	Motor pump failure.	Replace pump.
	Faulty check valve.	Replace Valve
	Loose or clogged suction screen assembly in power pack	Remove power pack, disassemble and clean suction screen. Check screen for contamination, determine cause of contamination and remedy. Replace screen assembly or seal existing assembly. Prime parts to be assembled with Grade T Primer, using care to avoid getting primer on screen. Seal with hydraulic sealant (Catalog #69: Loctite Corp.) upon installation. Allow 15-30 minutes cure time if primed; 2-4 hours if unprimed.
	NOTE	
	Motor and pump are not repairable and must be replaced.	
	Pump frozen.	Remove motor and coupling from top of power pack and replace pump.
	Broken pump or motor drive shaft or coupling.	Remove motor and pump from top of power pack and replace motor, pump and coupling.

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TROUBLE SHOOTING (Cont.)

TROUBLE	PROBABLE CAUSE	REMEDY
MOTOR PUMP WILL NOT OPERATE GEAR BUT EMERGENCY HAND PUMP WILL OPERATE GEAR (Cont).	If motor was not turning, check wiring and motor.	Check motor for loose or broken connections; check for frozen pump or coupling. Check circuit breaker in left side wall.
	Bad pump shaft seal.	Replace pump.
	External leakage around top of pump assembly.	Remove motor and pump assemblies from top of power pack and replace upper packing and/or back-up rings.
	Air lock in pump (new pack installation or pump replacement).	Remove filter and intermittently bump start switch until fluid flows. Replace filter.
	Bad pump body O-rings.	Remove motor and pump assemblies from top of power pack and replace lower packing and/or back-up rings.
PUMP OR EMERGENCY PUMP WILL NOT BUILD PRESSURE IN SYSTEM.	No fluid in reservoir.	Refill reservoir.
	Broken hydraulic line.	Check for evidence of leakage and repair or replace line. Flush out system and refill reservoir.
	Filter in outlet check valve improperly positioned in filter body, or seal between filter and check valve improperly positioned.	Replace seal and position filter in retainer with Petrolatum.
	Bad O-ring actuator piston; O-ring left out after repair.	Disconnect line upstream from actuator and check for pressure. Perform this check for all actuators in system.
	Bad O-ring on priority valve in gear manifold assembly. O-ring left out or damaged during repair of valve.	Disassemble manifold and replace O-ring.
	Bad O-ring on gear or door control valve.	Replace O-ring.
	Thermal relief valve stuck open.	Replace valve.
DOORS WILL NOT CLOSE GEAR INDICATOR LIGHT NOT ILLUMINATED.	Master switch not on.	Turn master switch on.
	Broken or loose door close hydraulic line.	Locate and repair or replace defective line.

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TROUBLE SHOOTING (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
DOORS WILL NOT CLOSE GEAR INDICATOR LIGHT NOT ILLUMINATED. (Cont)	Defective limit switch circuit.	Check limit switch settings; locate and repair or replace limit switch circuit.
	Landing gear did not lock into position.	Check landing gear uplock and/or downlock mechanism for proper operation.
	Broken ground wire at socket or lamp not making contact in socket.	Repair or replace wire; check lamp contact.
GEAR AND DOORS OPERATE PROPERLY BUT INDICATOR LIGHT IS NOT ILLUMINATED.	Lamp burned out.	Replace lamp.
	Defective wiring.	Check circuit and repair wiring.
	NOTE If press-to-test operates, pull wire bundle toward lamp socket.	
DOORS WILL NOT CLOSE GEAR INDICATOR LIGHT IS ILLUMINATED.	Improper wiring at gear control switch.	Check circuitry and repair or rewire.
	Door control valve stuck.	Repair or replace control valve unit.
	Broken or loose door lines.	Tighten or replace lines.
PUMP OPERATES BUT DOORS WILL NOT OPEN	Refer to second listed trouble in this chart.	Use same remedies.
	Improper wiring installation.	Check door control valve wiring circuitry.
	Door solenoid valve jammed or stuck in door - close position.	Disassemble valve and replace defective parts.
	Crossed hydraulic lines in aircraft belly.	Most common place is aft and left of hand pump.
GEAR UNLOCKS BEFORE DOORS ARE FULLY OPEN.	Priority valve setting too low.	Check for weak spring, dull seat or replace entire valve.
	Binding in door system.	Disconnect door actuators and manually move doors and check for binding in linkage.
	Stiff operation of door actuators.	Check operation of actuator piston and rod.

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TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
GEAR UNLOCKS BEFORE DOORS ARE FULLY OPEN.	Restriction in door open or door close line.	Using pressure gage, check pressure in door open or door close line, when gear unlocks. If pressure is greater than 700 psi, check for restrictions. Locate restrictions and remove. If contaminants are in line, investigate cause and remedy; flush system.
DOORS OPEN BUT GEAR DOES NOT OPERATE.	Priority valve setting too high or stuck closed.	Check valve components for defects. Replace as necessary.
	Faulty O-rings downstream of priority valve (anywhere in system).	Locate faulty unit and replace O-rings.
DOORS OPEN BUT GEAR DOES NOT OPERATE (DOWN AND LOCKED ONLY).	Faulty or stuck squat switch.	Check switch wiring or setting.
HAND PUMP DOES NOT BUILD PRESSURE, BUT ELECTRIC PUMP OPERATES PROPERLY.	Check valve in hand pump sticking.	Inspect check valve.
	Defective hand pump outlet check valve.	Replace valve.
	Main gear or downlock actuator O-ring leaking.	Disassemble actuator and replace O-rings.
LANDING GEAR OPERATION EXTREMELY SLOW.	Fluid level low in reservoir.	Refill reservoir.
	Downlock rod adjustment incorrect (mainly LH rod).	Adjust rod end to lengthen actuator one turn.
	Pump failure.	Replace pump.
	Low voltage in electrical system.	Check alternator and wiring.
	Pump motor brushes worn.	Replace pump motor.
	Downlocks not in full unlock position.	Adjust downlocks.
	Fluid leak in door or gear line.	Locate and repair or replace broken line or fitting.
	O-ring leakage inside gear selector valve.	Check valve for leakage; repair as necessary.

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TROUBLE SHOOTING (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
LANDING GEAR OPERATION EXTREMELY SLOW (Cont)	Air leakage around pump suction screen assembly.	Either replace suction screen assembly or seal and install existing assembly as follows: Prime parts to be assembled with Grade T Primer, using care to avoid getting primer on screen. Seal with hydraulic sealant (Catalog #69; Loctite Corp.) upon installation. Allow 15-30 minutes cure time if primed; 2-4 hours if unprimed.
	Defective piston seal in gear or door cylinder.	Replace with new seal.
	Excessive internal power pack leakage.	Remove and repair or replace power pack.
PUMP OPERATES, DOORS OPEN AND GEAR STARTS TO EXTEND. DOORS CLOSE BEFORE GEAR IS COMPLETELY EXTENDED; HAND PUMP WILL NOT PUMP GEAR DOWN.	Downlock switch makes contact before gear is down and locked.	Reset downlock actuator switches; replace if damaged.
	Interference between downlock and gear saddle clamp bolt head.	Remove interference.
POWER PACK EXTERNAL LEAKAGE.	Static seals (all fittings).	Remove and replace O-rings and/or back-up rings as required. Check tubing flares for leaks.
	Gear or door solenoid.	Replace O-rings.
	Transfer tubes between manifold and power pack body.	Disassemble power pack and replace O-rings.
	Reservoir cover.	Remove power pack and remove cover; replace seals.
GEAR DOWN-LOCK WILL NOT RETURN TO FULL-LOCK POSITION.	Binding in spring and tube assemblies.	Check operation to locate binding and eliminate.
DOORS CLOSE BEFORE ALL GEARS ARE FULLY LOCKED.	Faulty limit switch.	Replace switch.
	Short in wiring.	Check wiring continuity.
	Cracked terminal block.	Replace terminal block.
DOORS WILL OPEN BUT GEAR WILL NOT RETRACT.	Lines between downlock actuators crossed.	Properly route lines.
	Lines crossed at gear uplock valve.	Properly route lines.
	Gear uplock valve installed backward.	Install properly.

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TROUBLE SHOOTING (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
DOORS WILL OPEN BUT GEAR WILL NOT RETRACT (Cont).	Improper setting of right and left downlock actuators.	Reset in accordance with applicable paragraph in this Section.
NOSE GEAR WILL NOT UPLOCK IN FLIGHT.	Restricted line.	Blow out line.
	Faulty nose gear actuator.	Replace actuator.
	Improper setting of downlock.	Reset in accordance with applicable paragraph in this Section.
	NOTE On ground test, nose gear should have constant movement from downlock to uplock position.	
NOSE WHEEL DOOR AND MAIN WHEEL DOORS OPERATE IN REVERSE.	Crossed lines.	Check main gear door lines in wheel well at forward bulkhead; lines are very easy to cross at this location.
NOSE GEAR HITS HARD IN UPLOCK POSITION.	RH downlock actuator improperly rigged.	Reset RH downlock actuator.
RH GEAR UNLOCKS BUT LH GEAR WILL NOT UNLOCK.	Improper setting of RH downlock actuator rod.	Check rigging procedures outlined in this Section.
BOTH RH AND LH MAIN GEAR UNLOCK BUT ONLY NOSE GEAR WILL RETRACT.	Improper setting of LH downlock actuator rod.	Check rigging procedures outlined in this Section.
MOTOR PUMP TURNS OFF AFTER GEARS UNLOCK; WILL NOT TURN ON BY WORKING SELECTOR SWITCH. HAND PUMP WILL PUT GEAR DOWN.	Defective pressure switch circuit.	Check circuit continuity.
		Check switch adjustment
POWER PACK WILL OPERATE SYSTEM AFTER BEING STARTED BY HAND PUMP.	Broken wire or defective diode in wire from "DOWN" side of selector switch to contactor. (Refer to wiring diagrams in this Section or Section 20.)	Replace diode. Repair or replace wiring.
SET SCREW ON CAM NOT EXTENDED ENOUGH FOR GEAR TO MOVE CAM OVER CENTER.	Check washers under bolt on downlock arm assembly.	Add AN960-10 washer under bolt downlock arm assembly.
MAIN GEAR WILL NOT LOCK OVER CENTER.	Main gear not centered in support.	Rerig saddle per rigging instructions.
MAIN GEARS HIT UPLOCK HOOK VERY HARD.	Insufficient main gear actuator snubbing action.	Adjust flow control valve in gear manifold.

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TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
MALFUNCTION OF GEAR INDICATOR LIGHTS.	- Both lights on at same time. - Light will change from green to amber or in reverse when gear control switch is moved.	Check ground wire for proper connection.
SYSTEM WORKS NORMALLY EXCEPT MOTOR TURNS ON AND OFF AT REGULAR INTERVALS. (GEAR IN EITHER UP OR DOWN POSITION). GEAR DOORS SAG WHILE AIRCRAFT IS ON GROUND. ENGINE AND ELECTRICITY OFF. - Support aircraft on jacks or secure tail in the event something might unlock nose wheel and allow it to collapse. - Remove console cover and sheet metal cover from power pack support. - Master switch OFF. - Remove cap from pressure port on pedestal structure and install pressure gage to port. - Open doors as required to bleed any pressure in system. - Remove hand pump line from power pack port fitting (left-hand aft fitting). - Attach flex line to disconnected line. (have port open) - Remove door line from its fitting on power pack (right-hand aft fitting). - Connect flex line to door port (fitting) on power pack and pressurize to 1500 psi with hand pump. - Observe pressure gage for leak-down; pressure should hold for better than 10 minutes. - Master switch OFF - if leakage comes from hand pump fitting (open) 3 or 4 drops - thermal relief valve leaking; replace. - No leaks above - pull hydraulic circuit breaker out, master switch ON - repressurize system with hand pump to 1500 PSI. - If hand pump port leaks in this configuration, lock out valve is leaking. - With the preceding checks completed, and whether leaks were found or not, make this final check while working in this area: Remove flex line from door fitting and attach to door line and apply pressure to system. There might be a slight bleed-down on first application of pressure pump to 1500 PSI a second time. Pressure should hold. - The preceding procedure checks the door cylinders for leakage. If the system does not bleed down, disconnect added equipment and reconnect lines and pressure cap to pressure port and reinstall console covers. If on this last test, pressure does not hold, one or more of the door cylinders are leaking. They will have to be checked individually. TEST SYSTEM BEFORE FLIGHT.		

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TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
UNEVEN FALL OF MAIN GEAR.	Air in system.	Bleed system of air.
	Cold operating temperatures.	Operate power pack until fluid has reached operating temperature.
	Improper snubber adjustment.	Adjust flow control valve in gear manifold.

5-5 MAIN LANDING GEAR.

5-6 DESCRIPTION The tubular main landing gear struts rotate aft and inboard to stow the main

wheels below the baggage compartment. Struts are down locked by an overcenter lock, actuated by a hydraulic cylinder for each strut. Uplocks are located on the main wheel stowage bay forward

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c. Place wheel half into tire and tube (side opposite valve stem), aligning base of valve stem in valve slot. With washer under head of thru-bolt, insert bolt through wheel half.

d. Place wheel half into other side of tire and tube, aligning valve stem in valve slot.

e. Install washers and nuts on thru-bolts and pre-torque to 10-50 lb. in.

CAUTION

Uneven or improper torque of nuts can cause failure of bolts with resultant wheel failure. Do not use impact wrench on thru-bolts or nuts.

- f. Prior to torquing nuts, inflate tire to 10-15 psi air pressure to seat tire.
- g. Dry torque nuts evenly to 140-150 in lb.
- h. Inflate tire to pressure specified in Section 1.

5-146. INSTALLATION OF NOSE WHEEL AND TIRE ASSEMBLY.

- a. Install nose wheel in fork and install ferrules.
- b. Install axle stud.
- c. Tighten axle stud until a slight bearing drag is obvious when the wheel is turned. Back off nut to nearest castellation and install cotter pins.

5-147. HYDRAULIC POWER SYSTEM COMPONENTS. (Refer to figure 5-25.)

5-148. GENERAL DESCRIPTION. The hydraulic power system includes equipment required to provide a flow of pressurized hydraulic fluid to the retractable landing gear system. Main components of the hydraulic power system include the power pack and the emergency hand pump.

5-149. HYDRAULIC COMPONENTS REPAIR. Since emphasis here is on repair and not overhaul of the basic components of the hydraulic system, it is unlikely that the mechanic will go through all of the procedures outlined. Instead, he will repair the particular item which is causing the difficulty.

5-150. REPAIR VERSUS REPLACEMENT. Often, the moderate trade-in price for a factory-rebuilt component is less than the accumulated cost of labor, parts and (often time consuming) trial and error adjustment. Repair or replacement of a component will depend on the time, equipment and skilled labor that is locally available.

5-151. REPAIR PARTS AND EQUIPMENT. Repair parts may be ordered from the applicable Parts Catalog. Test equipment may be ordered from the Special Tools and Support Equipment Catalog. Both publications are available from the Cessna Supply Division.

5-152. EQUIPMENT AND TOOLS

5-153. HAND TOOLS. The following hand tools are necessary for repair work on the power pack and other hydraulic components.

Snap Ring Pliers

Strap Wrench (for removing door solenoids and various cylinder barrels of the hydraulic actuators.)

Needle-Nose Pliers

Pin Punches

Duck-bill Pliers

Box end and Open end Wrenches

Locally-fabricated items, handy for power pack repair, are various 1/4-inch aluminum rods, ground to a gradual taper, and hooks formed from brass welding rod to extricate small plungers from hydraulic ports. Hooks formed from brass welding rod must not be over 1/16-inch in length, so as not to scratch or score the bore. Various sizes of Allen wrenches may be welded to "T" handles for use when removing, installing or adjusting the various internal wrenches, plugs or valves.

5-154. COMPRESSED AIR. The simplest method of removing some hydraulic parts in inaccessible galleries of the power pack is a quick blast of compressed air from behind. Parts can be blown out in seconds, which would otherwise take endless "fishing" operation to extricate. An air hose and nozzle are common-sense tools.

5-155. POWER PACK.

5-156. DESCRIPTION. The hydraulic power pack, located in the pedestal, is a multi-purpose control unit in the hydraulic system. It contains a hydraulic reservoir and valves which control flow of pressurized fluid to the various actuators in the door and landing gear systems.

5-157. REMOVAL OF POWER PACK. (Refer to figure 5-26.)

NOTE

As hydraulic lines are connected or removed, plug or cap all openings to prevent entry of foreign material in the lines or fittings.

- a. Remove front seats and spread drip cloth over front carpet.
- b. Remove decorative cover from pedestal as outlined in Section 9 of this manual.
- c. Remove upper panel assembly from aft face of panel.
- d. Remove screws attaching indicator assembly at top of pedestal; remove indicator assembly.
- e. Remove four bolts attaching wheel and gear box assembly; remove wheel and gear box assembly.
- f. Loosen idler sprocket assembly by loosening bolt and sliding sprocket inboard in slot.
- g. Disconnect chain at connecting link.

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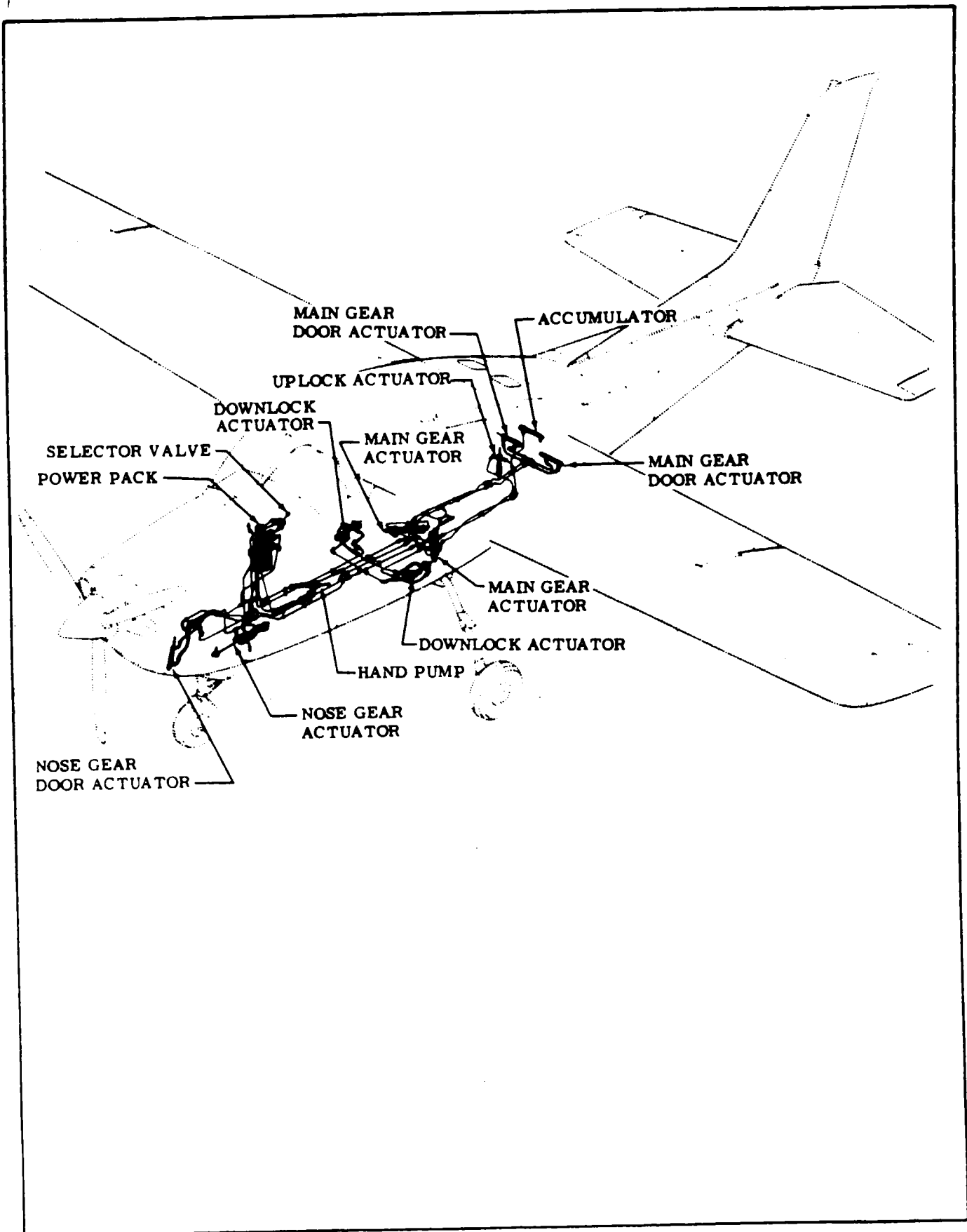


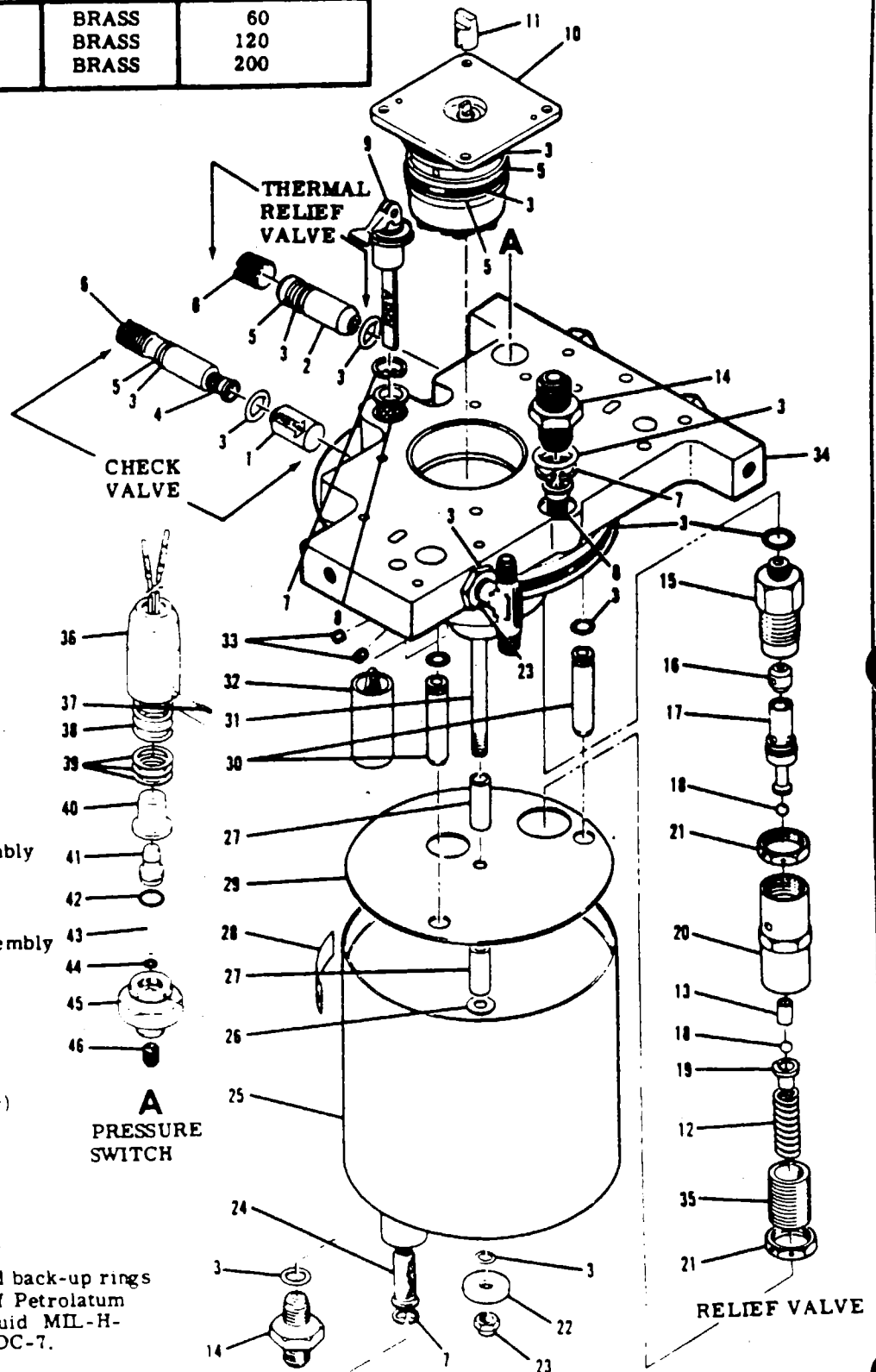
Figure 5-25. Hydraulic System Components

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SHIM APPLICABILITY

SHIM PART NO.	THICKNESS	MATERIAL	EFFECT IN PRESSURE (PSI)
9880705-1	.005	BRASS	60
9880705-2	.010	BRASS	120
9880705-3	.016	BRASS	200

1. Check Valve
2. Thermal Relief Valve
3. Packing
4. Self-Relieving Filter
5. Back-Up Ring
6. Retainer
7. Retainer Ring
8. Screen Assembly
9. Dipstick
10. Pump Assembly
11. Coupling
12. Spring
13. Piston
14. Union
15. Adapter
16. Orifice
17. Poppet
18. Ball
19. Spring Guide
20. Housing
21. Nut
22. Reservoir Washer
23. Nut
24. Screen
25. Reservoir
26. Washer
27. Spacer
28. Nameplate
29. Baffle
30. Return Tube
31. Stud
32. Suction Screen Assembly
33. Plug
34. Body Assembly
35. Adjustment Screw
36. Cap and Housing Assembly
37. Pin
38. Spring
39. Shim
40. Stop
41. Guide
42. Packing
43. Piston (Needle Roller)
44. Packing
45. Fitting
46. Snubber



NOTE

Install new packings and back-up rings lubricated with a film of Petrolatum VV-P-236, hydraulic fluid MIL-H-5606, or Dow-Corning DC-7.

Figure 5-27. Power Pack Disassembly and Reassembly

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- m. Disconnect and cap or plug all hydraulic lines at power pack.
- n. Disconnect wiring from pressure switch.
- o. Remove three mounting bolts, one on each side of pedestal, and one through mounting bracket on forward side of pedestal.

NOTE

It is not necessary to disturb the studs on the left and right sides of the pedestal to remove the power pack.

5-157. DISASSEMBLY OF POWER PACK. (Refer to figure 5-27.)

- a. Remove fittings from body assembly and place body assembly in vise.
- b. Remove nut (23), washer (22) and packing (3) at attaching stud (31) at bottom of reservoir; remove reservoir.

NOTE

If reservoir will not disengage from body assembly, replace fittings and cap or plug all fittings except vent fitting. Attach air hose at vent fitting and apply pressure (not to exceed 15 psi; reservoir proof pressure); remove reservoir. A strap clamp is not recommended as clamp may damage reservoir.

- c. Remove door manifold assembly and gear manifold assembly from body assembly of power pack.
- d. Remove pressure switch and dipstick from body assembly.
- e. Remove large packing (3) from bottom of body assembly.
- f. Remove baffle (29), spacers (27) and washer (26).
- g. Remove union (14), packing (3), retainer ring (7) and screen (24) at bottom of reservoir (25).
- h. Remove motor and pump assembly (10) from body assembly.
- i. Remove packings and back-up rings from pump assembly (10); remove coupling (11).
- j. Remove return tubes (30) and packings from body assembly.
- k. Remove relief valve assembly from body assembly.

NOTE

Suction screen (32) need not be removed from body assembly to be cleaned. However, if screen assembly is damaged, it should be removed as outlined in step "l" of this paragraph observing the following caution.

CAUTION

Use extreme caution in removing suction screen assembly. Damage to screen assembly or clearance between screen assembly and body will cause slow landing gear retraction.

- l. Working through center hole in top of body assembly, and using a drift or punch made of soft material, tap out suction screen assembly (32).
- m. Remove fittings from body assembly, if still installed, union (14), packing (3), retainer ring (7) and screen assembly (8) from body assembly.
- n. Remove thermal relief valve and check valve from body assembly.

NOTE

To remove thermal relief valve when power pack is installed in aircraft, remove retainer (6). While holding your hand to catch valve, gently pump hand pump. Valve will be ejected out into your hand. Be careful not to pump hand pump too hard.

5-158. INSPECTION AND REPAIR OF POWER PACK COMPONENTS.

- a. Wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered air.
- b. Inspect seating surfaces. They should have very sharp edges. Seats may be lapped, if necessary, to obtain sharp edges.
- c. Inspect all threaded surfaces for serviceable condition and cleanliness.
- d. Inspect all parts for scratches, scores, chips, cracks and indications of excessive wear.

5-159. REASSEMBLY OF POWER PACK. (Refer to figure 5-27.)

NOTE

Install new packings and back-up rings lubricated with a film of Petrolatum VV-P-236, hydraulic fluid MIL-H - 5606, or Dow-Corning DC-7.

- a. Assemble and install thermal relief valve and check valve in body assembly.
- b. Install screen (8), retainer ring (7), packing (3) and union (14) in top of body assembly (34).
- c. Install suction screen assembly (32), if removed.

CAUTION

Use extreme caution when installing suction screen assembly. Damage to screen assembly or clearance between screen assembly and body will cause slow landing gear retraction.

- d. Install relief valve assembly in body assembly.
- e. Install packings and return tubes (30) in body assembly.
- f. Install packings and back-up rings on pump assembly (10); install coupling (11).
- g. Install pump assembly (10) and motor on body assembly.

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- h. Install screen (24), retainer ring (7), packing (3) and union (14) on bottom of reservoir assembly (25).
- i. Install washer (26), spacers (27) and baffle (29).
- j. Install large packing on bottom of body assembly.
- k. Install dipstick (9), pressure switch, door manifold assembly and gear manifold assembly on body assembly.
- l. Attach reservoir (25) to body assembly with packing (3), washer (22) and nut (23).

5-160. INSTALLATION OF POWER PACK. (Refer to figure 5-26.)

- a. Work power pack into position and install three bolts that secure power pack to pedestal.
- b. Connect all hydraulic lines to power pack fittings. Ensure that all fittings are properly installed, with jamb nuts tight, after lines are tightened.
- c. Install wheel and gear box assembly and indicator assembly in top of pedestal.
- d. Install left-hand and right-hand chain guards for rudder trim chain.
- e. Connect chain at connecting link after stringing chain over idler sprocket.
- f. Tighten idler sprocket assembly by sliding sprocket outboard in slot and tightening bolt.
- g. Connect ground wire to pressure switch and wire to motor.
- h. Connect power pack wiring to plug.
- i. Install upper panel assembly on pedestal.
- j. Fill reservoir on right-hand side of power pack with clean hydraulic fluid in accordance with procedures outlined in Section 2 of this manual.
- k. Jack aircraft as outlined in Section 2 of this manual.
- l. Operate gear thru several cycles to bleed system. Check for correct operation and signs of fluid leakage. A 28V power supply should be used to augment the ship's battery.

5-161. PRESSURE SWITCH. (Refer to figure 5-27.)

5-162. DESCRIPTION. When installed in the aircraft, the pressure switch is mounted on the right-hand (aft) side of the power pack in the console. This switch senses pressure in the DOOR-CLOSE line. After gear extension or retraction (after the doors close), pressure builds in the DOOR-CLOSE line. At approximately 1500 psi, the pressure switch opens, turning off the power pack. The pressure switch will continue to hold the electrical circuit open until pressure in the system drops to a preset value, at which time, the pump will again operate to build up pressure to approximately 1500 psi.

5-163. DISASSEMBLY OF PRESSURE SWITCH. (Refer to figure 5-27.)

- a. Remove pin (37).
- b. Unscrew cap and housing assembly (36) from fitting (45).
- c. Remove spring (38).
- d. Remove shims (39) from flange of guide (41).

NOTE

The chart in figure 5-26 lists shims (39) by part number, thickness and effect on operating pressure (psi).

- e. Unscrew guide (41) from fitting (45).

CAUTION

Do not damage lip of guide (41). Guide threads and threads of fitting (45) are primed with Loctite Grade T primer and sealed with Loctite Grade AV sealer.

- f. Remove piston (43).
- g. Remove packings (42) and (44).
- h. Remove snubber (46) from fitting (45).

CAUTION

Threads of snubber (46) and fitting (45) are primed with Loctite Grade T primer and sealed with Loctite Grade AV sealer.

5-164. CLEANING, INSPECTION AND REPAIR OR PRESSURE SWITCH. (Refer to figure 5-27.)

- a. Clean sealant from threads of snubber (46), fitting (45) and guide (41) with wire brush.
- b. Clean all parts with cleaning solvent (Federal Specification P-S-661, or equivalent) and dry thoroughly.
- c. Discard all removed packings (42) and (44) and replace with new packings.
- d. Inspect all pressure switch parts for scratches, scores, chips, cracks and indications of wear.
- e. All damaged parts shall be replaced with new parts.

NOTE

Thorough cleaning is important. Dirt and chips are the greatest single cause of malfunctions in hydraulic systems. Carefulness and proper handling of parts to prevent damage must be observed at all times.

- f. Snubber (46) can be cleaned with solvent, then blown out with high pressure compressed air.
- g. Assure that .062-inch vent hole is open in stop (40).

5-165. ASSEMBLY OF PRESSURE SWITCH. (Refer to figure 5-27.)

- a. Prime threads of snubber (46) and internal threads of fitting (45) with Loctite Grade T primer and apply Loctite Grade AV sealer to threads of snubber (46). Install snubber into fitting with a slotted screwdriver.

NOTE

Install new packing (42) lubricated with a film of Petrolatum VV-P-236, hydraulic fluid MIL-H-5606, or Dow-Corning DC-7.

- b. Install packing (42) in fitting (45).

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- c. Lubricate packing (44) with Dow Corning DC7, and install in guide (41).
- d. Lubricate guide (41) with Petrolatum (excluding threads). Prime threads of guide and internal threads of fitting (45) with Loctite Grade T primer and apply Loctite Grade AV sealer to threads of guide (41). Install guide into fitting and finger tighten.
- e. Install test gage in power pack body fitting.
- f. Assure that sealant in fitting (45) is dry; screw fitting assembly in console.
- g. Pump emergency hand pump just enough for fluid to seep from top of guide (41).
- h. Lubricate piston (43) with Dow Corning DC7, and insert piston into hole in guide (41).
- i. Lubricate stop (40) with Petrolatum and install over guide (41).
- j. Install exact number and thickness of shims (39) as were removed.

NOTE

If same number of shims (39) are installed as were removed, pressure should not require adjustment. If readjustment is necessary, a chart of shim part numbers, thickness and effect in pressure adjustment is illustrated in figure 5-26.

- k. Lubricate spring (38) with Petrolatum and install over shims (39).
- l. Screw cap and housing assembly (36) on fitting (45).

NOTE

Do not install pin (37) until pressure adjustment has been checked.

5-166. ADJUSTMENT OF PRESSURE SWITCH. (Refer to figure 5-27.)

- a. Jack aircraft in accordance with procedures outlined in Section 2 of this manual.
- b. Screw cap and housing assembly (36) on fitting (45) enough to bottom piston (43) out in stop (40).
- c. Turn cap and piston assembly back from full thread engagement one turn, plus 0, minus one-fourth turn to locate hole in fitting (45) in slot in skirt of cap and piston assembly.
- d. Attach electrical connections to pressure switch and attach external power source.
- e. Turn on master switch.
- f. Pump hand pump to obtain 1500 psi on test gage.
- g. The switch should open the electrical circuit to the pump solenoid when pressure in the system increases to approximately 1500 psi.
- h. If switch opens electrical circuit to solenoid prematurely, disassemble pressure switch down to shims (39) and add shims as necessary to obtain desired pressure; repeat steps "b" and "c".

NOTE

The chart in figure 5-27 lists shims by part number, thickness and the effect in

psi each shim will have on switch operation.

- i. If switch opens electrical circuit to solenoid later than 1500 $\pm$ 50 psi, disassemble pressure switch down to shims (39) and remove shims as necessary to obtain desired pressure; repeat steps "b" and "c".
- j. Turn off master switch.
- k. Drive new pin (37) through slot in housing skirt and hole in fitting (45).
- l. Remove aircraft from jacks.

5-167. RELIEF VALVE ASSEMBLY. (Refer to figure 5-27.)

5-168. DISASSEMBLY.

NOTE

The relief valve assembly is preset by the factory and normally will not require disassembly. Refer to steps "h" and "i" of paragraph 5-170, to determine if disassembly or adjustment is necessary.

- a. Remove jam nut (21) and adjustment screw (35) from housing (20).
- b. Remove spring (12), guide (19), balls (18) and piston (13) from housing (20).
- c. Loosen jam nut (21) and remove adapter (15) from housing (20).
- d. Remove poppet (17) and orifice (16) from adapter (15).

5-169. INSPECTION.

- a. Wash all parts in cleaning solvent (Federal Specification P-S-661 or equivalent) and dry with filtered air.
- b. Inspect all threaded surfaces for servicable condition and cleanliness.
- c. Inspect all parts for scratches, scores, chips, cracks and indications of excessive wear.

5-170. ASSEMBLY AND ADJUSTMENT. (Refer to figure 5-27.)

NOTE

Install new packings and existing threaded parts, except as noted, lubricated with a film of Petrolatum VV-P-236, hydraulic fluid MIL-H-5606, or Dow-Corning DC-7.

- a. Install orifice (16) and poppet (17) into adapter (15). (New packing must be installed on poppet.)
- b. Install jam nut (21) and housing (20) on adapter (15).
- c. Tighten adapter (15) into housing (20) and torque to 100-150 lbs-in (jam nut must not contact housing during torquing.)
- d. Tighten jam nut (21) against housing (20) and torque to 100-150 lb-in.
- e. Install one ball (18) into housing (20) so that it rests on poppet (17). Install piston (13) into housing (20) then install remaining ball (18) into end of piston (13).

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f. Insert guide (19) and spring (12) into housing (20) making sure that balls (18) and piston (13) remain in correct position.

g. Turn adjustment screw (35) into housing (20) until it just contacts spring (12) then turn in one additional turn. Start jam nut (21) onto adjustment screw (35) and snug against housing (20).

h. Connect a hydraulic pump with a flow rate of 5 to 7 gal-per-min, and a pressure gage with 2500 psi capacity to relief valve. Apply pressure slowly to insure that relief valve assembly opens and resets at the following pressure readings.

OPEN 1800 + 00 - 50 PSI

RESET 1300 PSI

(Leakage not to exceed 10 drops per min.)

i. If adjustment of relief valve is necessary, turn adjustment screw (35) in to increase pressure; back adjustment screw out to decrease pressure. Tighten jam nut (21) against housing (20) and torque to 100-150 lb-in. Recheck pressure adjustment.

5-171. DOOR SYSTEM THERMAL RELIEF VALVE. (Refer to figure 5-27.) The relief valve is located in the power pack assembly. The valve is preset at the factory to open at 2050 ± 100 psi. No further adjustment should be necessary.

5-172. LANDING GEAR AND DOOR MANIFOLD ASSEMBLIES. (Refer to figures 5-28 and 5-29.)

5-173. DESCRIPTION. The manifolds are mounted on the pressure pack in the console. Refer to the schematic diagrams at the end of this Section for system operation.

5-174. LANDING GEAR MANIFOLD.

5-175. DISASSEMBLY. (Refer to figure 5-28.)

NOTE

As gear manifold assembly is removed from body of power pack, transfer tube (18) will fall free.

- a. Remove packing from bottom of manifold.
- b. Remove packings from transfer tube.
- c. Remove retainer (10) from gear manifold assembly.

NOTE

Retainer (10) is sealed in manifold assembly with Loctite Hydraulic Sealant or STA-LOK No. 550, or equivalent sealant.

d. Remove AN316-4R nut (2) and remove screw (1).

e. Using a blunt tool or welding rod, push flow valve assembly (4 and 11), spring (13) and spring guide (16) through bottom of manifold assembly.

NOTE

Use care to prevent damage to spring guide (16), flow valve spool (11) or flow valve sleeve (4).

f. Remove flow valve spool (11) from sleeve (4).

g. Remove packings and back-up rings from sleeve (4).

h. Remove packing from spool (11).

i. Remove packing and back-up ring from spring guide (16).

5-176. INSPECTION AND REPAIR.

a. Wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered air.

b. Inspect seating surfaces. They should have very sharp edges. Seats may be lapped, if necessary, with No. 1200 lapping compound.

c. Inspect all threaded surfaces for serviceable condition and cleanliness. Clean sealant from retainer threads.

d. Inspect all parts for scratches, scores, chips, cracks and indications of excessive wear.

5-177. REASSEMBLY.

a. Install screw (1) and AN316-4R nut (2) in top of manifold.

b. Install packing (15) and back-up ring (14) on spring guide (16).

c. Install spring guide (16).

d. Install spring (13).

e. Install packings (6 and 8) and back-up rings (5 and 7) on flow valve sleeve (4).

f. Install packing (12) on spool (11).

g. Install spool (11) in sleeve (4): install assembly in bottom of manifold.

h. Install packing (9) on retainer (10).

i. Prime threads of retainer (10) with Grade T Primer and seal with Loctite Hydraulic Sealant or STA-LOK No. 550, or equivalent sealer.

j. Install retainer (10).

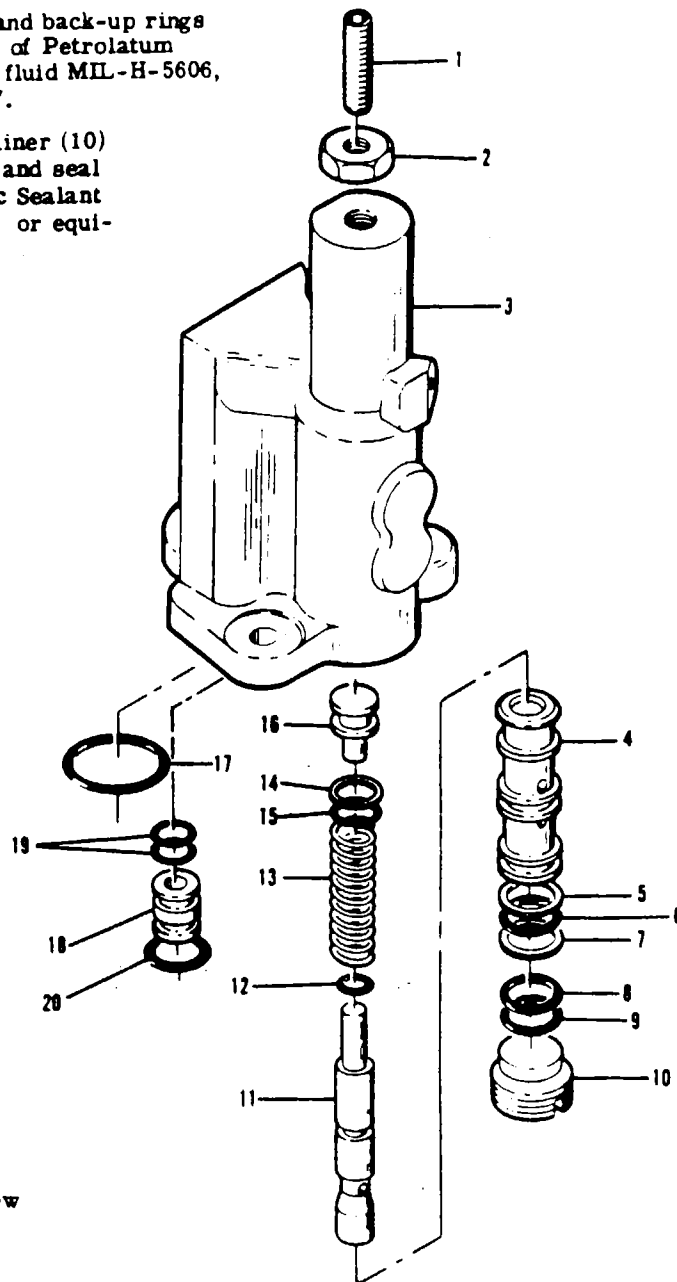
k. Install packings (19) on transfer tube (18).

l. Prior to installing manifold on body of power pack, install transfer tube (18) in body of pack.

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Install new packings and back-up rings lubricated with a film of Petrolatum VV-P-236, hydraulic fluid MIL-H-5606, or Dow-Corning DC-7.

Prime threads of retainer (10) with Grade T Primer and seal with Loctite Hydraulic Sealant or STA-LOK No. 550, or equivalent sealant



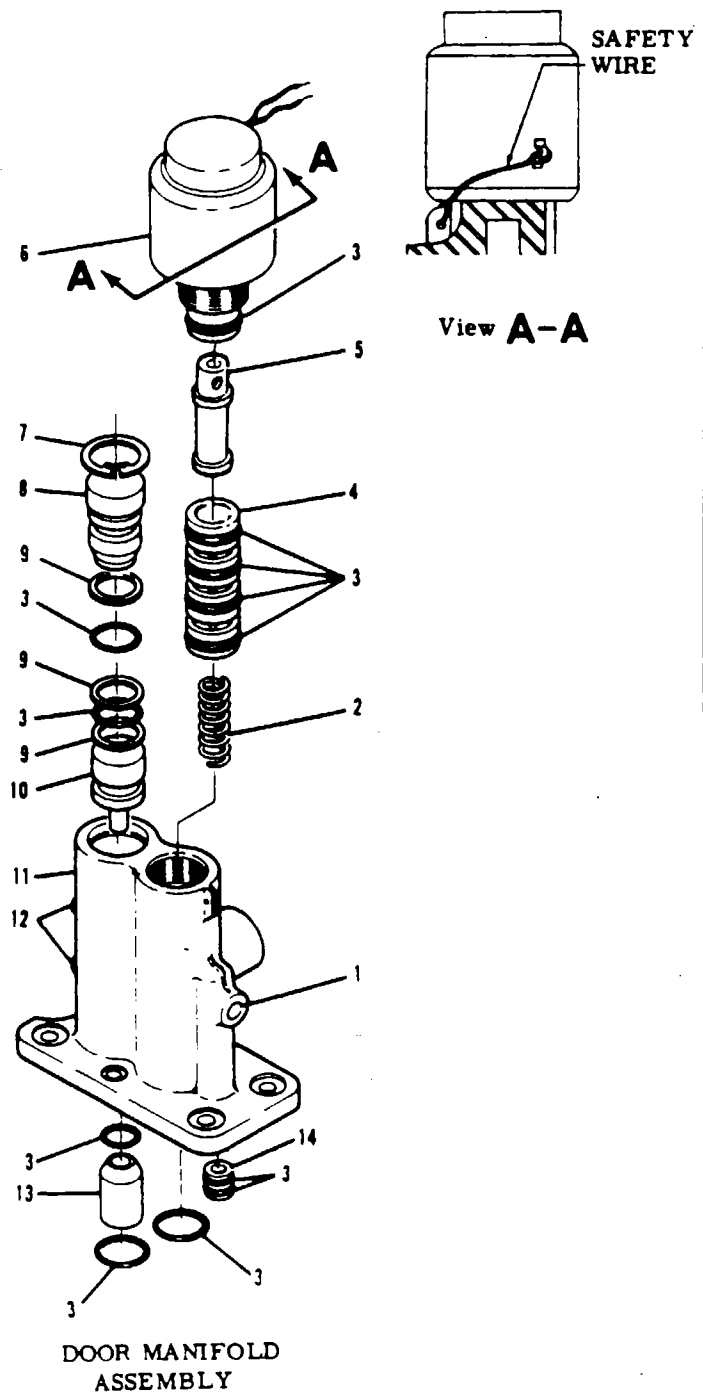
GEAR MANIFOLD ASSEMBLY

- | | |
|---------------------|--|
| 1. Adjustment Screw | |
| 2. Jam Nut | |
| 3. Body | |
| 4. Sleeve | |
| 5. Back-Up Ring | |
| 6. Packing | |
| 7. Back-Up Ring | |
| 8. Packing | |
| 9. Packing | |
| 10. Retainer | |
| 11. Spool | |
| 12. Packing | |
| 13. Spring | |
| 14. Back-Up Ring | |
| 15. Packing | |
| 16. Spring Guide | |
| 17. Packing | |
| 18. Transfer Tube | |
| 19. Packing | |
| 20. Packing | |

Figure 5-28. Gear Manifold Assembly

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Install new packings and back-up rings lubricated with a film of Petrolatum VV-P-236, hydraulic fluid MIL-H-5606, or Dow-Corning DC-7.



1. Plug
2. Spring
3. Packing
4. Selector Valve
5. Spool
6. Door Open - Close Solenoid
7. Retainer Ring
8. End Gland
9. Back-Up Ring
10. Piston
11. Door Manifold Assembly
12. Plug
13. Door Lock Valve

Figure 5-29. Door Manifold Assembly

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5-178. ADJUSTMENT OF GEAR MANIFOLD ASSEMBLY (Refer to figure 5-28.)

NOTE

With manifolds installed on power pack and power pack installed on aircraft, if main landing gear moves into the up or down locks with sufficient force to jar the aircraft, the flow control valve in the landing gear manifold should be adjusted in accordance with the following procedures.

- a. Jack aircraft in accordance with procedures outlined in Section 2 of this manual, and attach external power source.
- b. Loosen AN 316-4R nut (2).
- c. Back off screw (1) counterclockwise to maximum snub position.
- d. Rotate screw (1) clockwise to increase speed of gear rotation and counterclockwise to slow speed of gear rotation. Make necessary adjustments to obtain desired cycling time.

NOTE

Desired cycling time is specified in inspection charts in Section 2 of this manual under LANDING GEAR RETRACTION SYSTEM.

- e. When desired setting has been achieved, tighten AN 316-4R nut (2).

5-179. DOOR MANIFOLD ASSEMBLY. (Refer to figure 5-29.)

5-180. DISASSEMBLY OF DOOR MANIFOLD. (Refer to figure 5-29.)

NOTE

As door manifold assembly is removed from body of power pack, transfer tube (14) will fall free.

- a. Remove packings (3) from transfer tube (14).
- b. Remove packings from bottom of manifold, and remove door lock valve (13).
- c. Remove spring (2).
- d. Cut safety wire and remove solenoid (6); remove packing (3) from solenoid.
- e. Using a hook, formed from brass welding rod, and inserted into oil hole in selector valve (4), withdraw selector valve from manifold.

CAUTION

Be sure that end of hook is not over 1/16-inch long. Use with care to prevent

scratching bore in manifold. Removal of selector valve will be difficult due to friction caused by packings.

- f. Remove packings (3) from selector valve (4).
- g. Remove spool (5) from selector valve.
- h. Remove retainer ring (7).
- i. Remove end gland (8).
- j. Remove piston (10).
- k. Remove packings and back-up rings from end gland and piston.

5-181. CLEANING AND INSPECTION OF DOOR MANIFOLD COMPONENTS.

- a. Wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered air.
- b. Inspect seating surfaces. They should have very sharp edges. Seats may be lapped, if necessary, to obtain sharp edges.
- c. Inspect all threaded surfaces for serviceable condition and cleanliness.
- d. Inspect all parts for scratches, scores, chips, cracks and indication of excessive wear.

5-182. REASSEMBLY OF DOOR MANIFOLD. (Refer to figure 5-29.)

NOTE

Install new packings, back-up rings and existing threaded parts, lubricated with a film of Petrolatum VV-P-236, hydraulic fluid MIL-H-5606, or Dow-Corning DC-7.

- a. Install new packings on end gland (8), piston (10), selector valve (4) and transfer tube (14).
- b. Install packings and door lock valve in bottom of manifold.
- c. Install spring (2) and selector valve (4) in manifold.

NOTE

Be sure spool (5) is installed in selector valve (4) in position shown in figure 5-28.)

- d. Install packing (3) on solenoid (6).
- e. Install solenoid on manifold and safety wire.
- f. Install piston (10) and end gland (8) in manifold.
- g. Install retainer ring (7).
- h. Prior to installing manifold on body of power pack, install transfer tube (14) in body of power pack.

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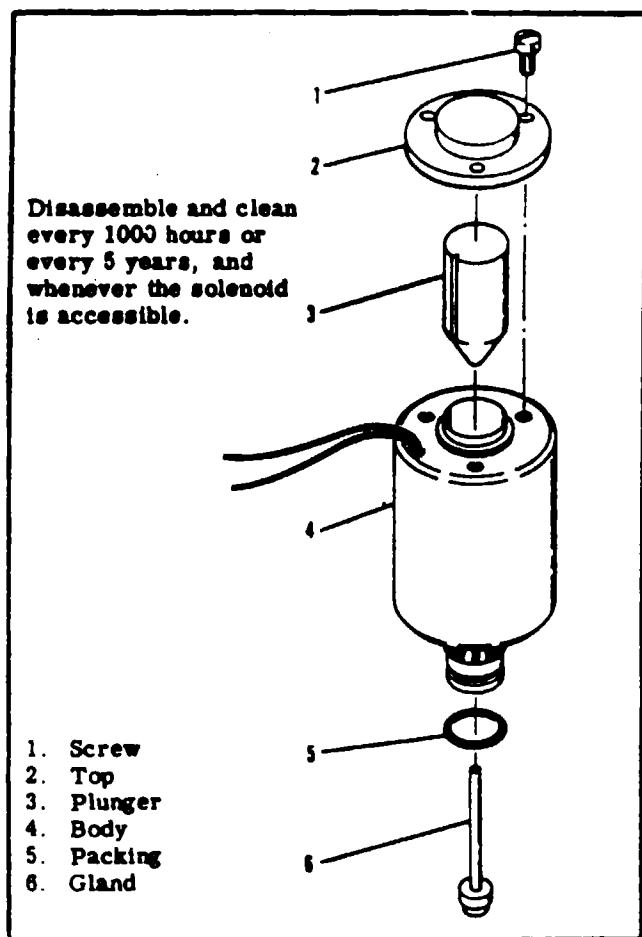


Figure 5-30. Door Solenoid

5-183. **DOOR SOLENOID.** The solenoid is mounted on top of the door manifold, and should be disassembled, cleaned and reassembled every 1000 hours or 5 years, and whenever the solenoid is accessible.

5-184. **DISASSEMBLY OF SOLENOID.** (Refer to figure 5-30.)

- Cut safety wire and remove solenoid from manifold.
- Remove screws (1).
- Remove top (2).
- Remove plunger (3).
- Remove gland (6).
- Remove and discard packing (5).
- Reverse this procedure to reassemble solenoid.

5-185. **INSPECTION AND CLEANING OF SOLENOID COMPONENTS.** Wash all parts in solvent (Federal Specification P-S-661, or equivalent) and dry with filtered air. If any parts are found defective or worn, replace the entire solenoid assembly. (Replace packing (5).

5-186. **LANDING GEAR HAND PUMP** (Refer to figure 5-31.)

5-187. **DESCRIPTION.** The hand pump is located in the cabin floor area between the pilot and copilot seats. The pump supplies a flow of pressurized hydraulic fluid to open the doors and extend the landing gear if hydraulic pressure should fail.

5-188. **REMOVAL OF LANDING GEAR HAND PUMP.** (Refer to figure 5-31.)

- Remove seats as required for access.
- Remove screws attaching cover over hand pump and remove cover.
- Pull back carpet as required for access to pump mounting bolts.
- Wedge cloth under hydraulic fittings to absorb fluid, then disconnect the two hydraulic lines and plug or cap open fittings to prevent entry of foreign material.
- Remove two bolts, washers and nuts securing pump to mounting bracket.
- Work pump from aircraft.
- Install hand pump by reversing the preceding steps, bleeding lines and pump as lines are connected.
- Fill reservoir as required.

5-189. **DISASSEMBLY OF HAND PUMP.**

NOTE

After emergency hand pump has been removed from aircraft and ports are capped or plugged, spray with cleaning solvent (Federal Specification P-S-661, or equivalent) to remove all accumulated dust or dirt. Dry with filtered compressed air.

- Remove hand pump handle by removing pivot and linkage pins after removing cotter pins.
- Remove end fitting from body assembly.
- Push piston from body assembly.
- Remove retaining ring from end fitting to remove valve assemblies.
- Remove and discard all O-rings and back-up rings.

5-190. **INSPECTION OF PARTS.**

- Inspect seating surfaces of valves.
- Inspect piston for scores, burrs or scratches which could cut O-rings. This is a major cause of external and internal leakage. The piston may be polished with extremely fine emery paper. Never use paper coarser than No. 600 to remove scratches or burrs. If defects do not polish out, replace piston.

5-191. **REASSEMBLY.** (Refer to figure 5-31.)

Assemble the emergency hand pump, using the figure as a guide. Also, for detailed instructions, reverse the procedures outlined in paragraph 5-189. Lubricate all parts with hydraulic fluid during re-assembly.

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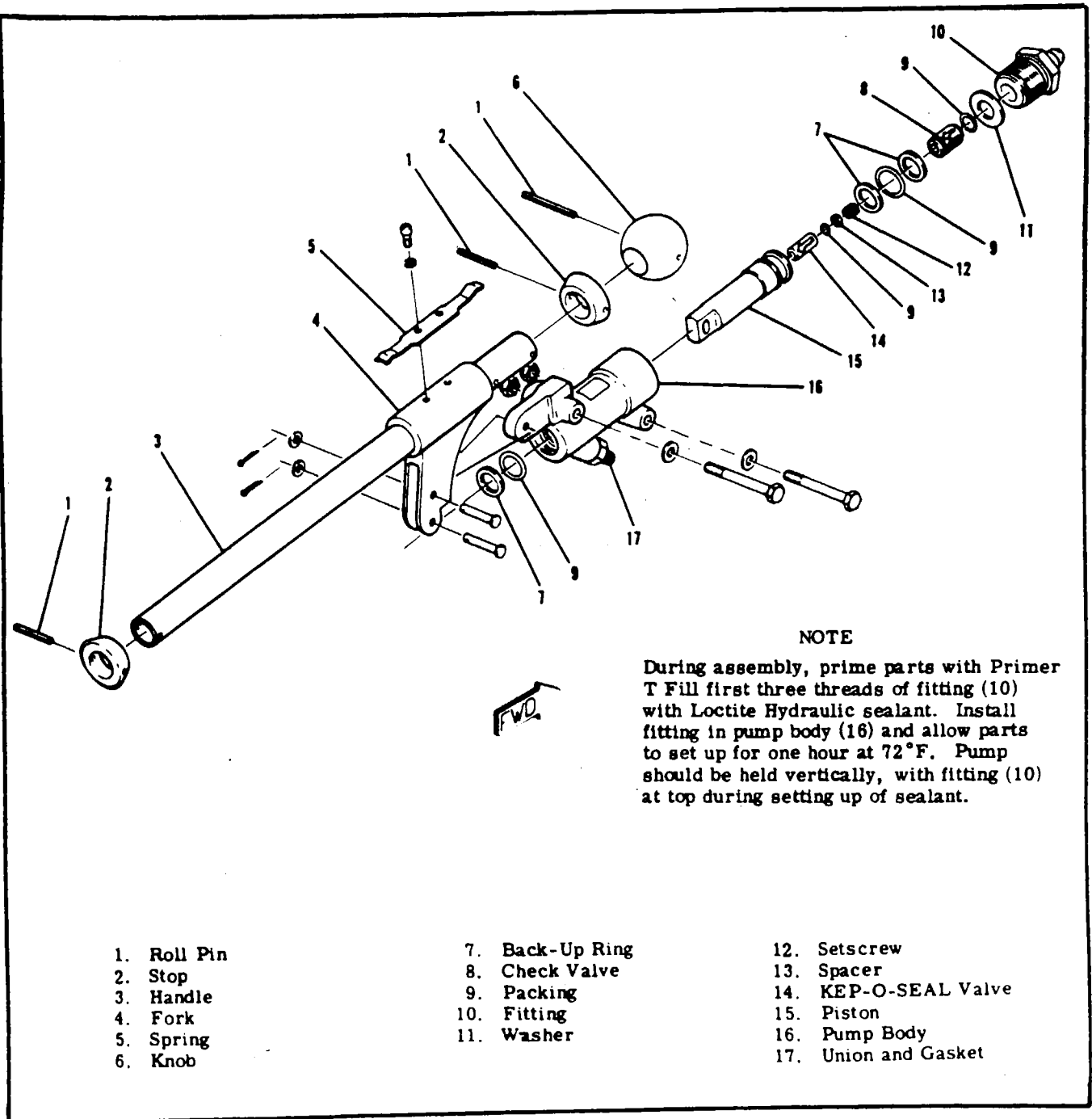
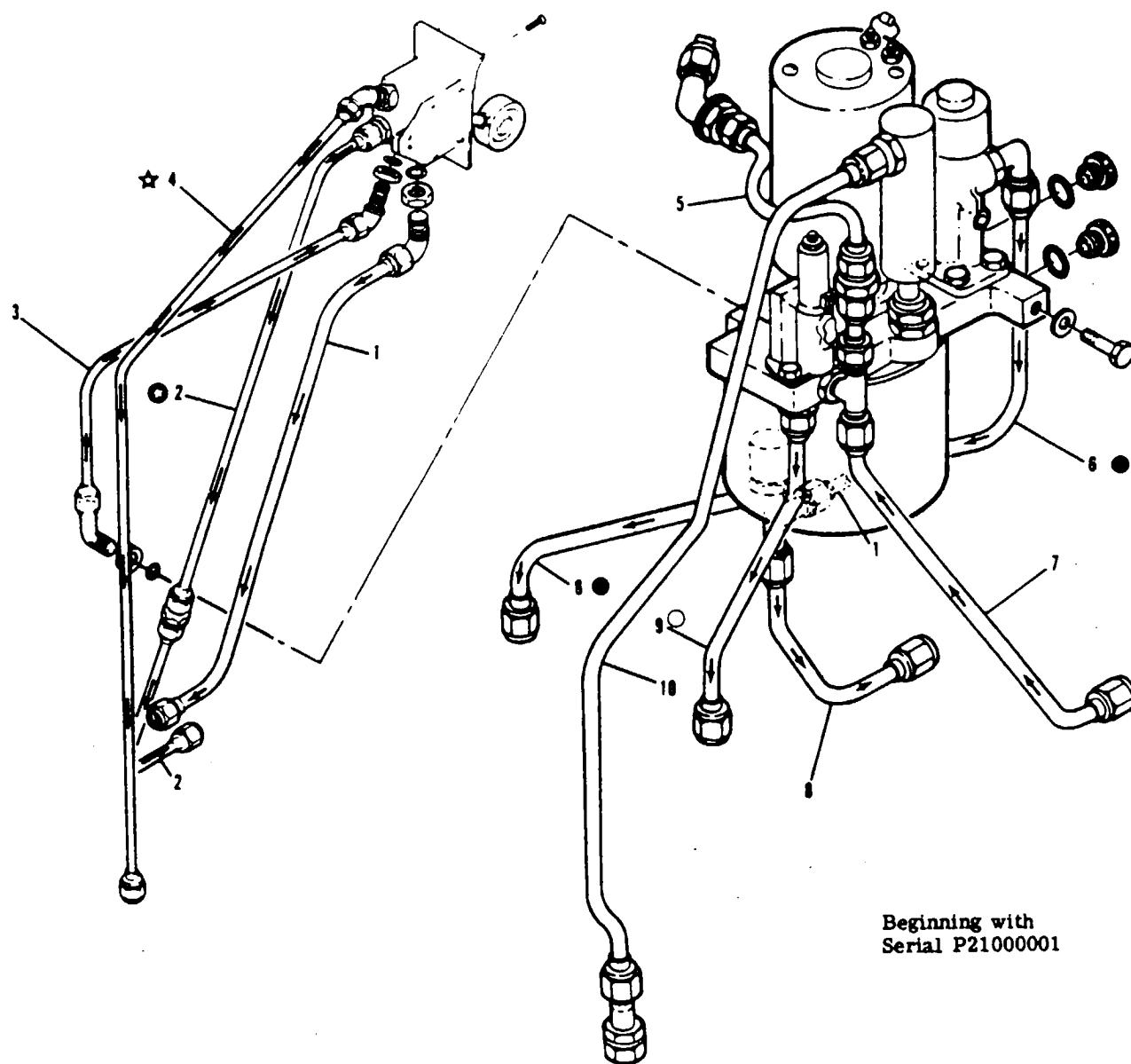


Figure 5-31. Landing Gear Hand Pump

SHOP NOTES:

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Beginning with
Serial P21000001

- 1. Return
- 2. Gear Up
- 3. Pressure
- ☆ 4. Gear Down
- 5. Test Fitting & Line
- 6. Door Open
- 7. Hand Pump Pressure
- 8. Hand Pump Suction
- 9. Door Close
- 10. Vent

- ☆ Flow reverses during gear up cycle.
- Flow reverses during gear down cycle.
- Flow reverses during door open cycle.
- Flow reverses during door close cycle.

Figure 5-35. Hydraulic Power Pack Line Routing