SECTION VI

HYDRAULIC SYSTEM

6-1. INTRODUCTION. The hydraulic system components covered in this section consist of the hydraulic pump(s), the powerpak and its related components, various valves within the system, actuating cylinders, hydraulic lines and filter. The brake system, although hydraulically operated, is not included in this section as it has its own hydraulic system independent of the landing gear and flap system. The brake system along with mechanical aspects of the landing gear is covered in Section VII.

This section provides instructions for remedying difficulties which may arise in the operation of the hydraulic system. The instructions covered are: Description and Principles of Operation, for a basic understanding of the system; Troubleshooting, for a methodical approach in locating the difficulty; Corrective Maintenance, for the removal, repair and installation of components; and Adjustments and Tests, for the operation of the repaired system.

WARNING

Prior to starting any investigation of the hydraulic system, place the airplane on jacks. (Refer to Jacking, Section II.)

6-2. DESCRIPTION AND PRINCIPLES OF OPERATION. The hydraulically operated landing gear and flap system within the PA-23 is supported by a powerpak unit located in the control pedestal below the instrument panel. The operation of the powerpak is controlled by levers protruding through the face of the pedestal; with knobs in the shape of a wheel for the landing gear, and an air foil for the flap. The powerpak also serves as a hydraulic reservoir. Pressure for the hydraulic system is supplied by a pump mounted on the left engine. Hydraulic pumps are installed on both engines on models with Serial Nos. 27-7854051 and up.

The hydraulic pump(s) draws fluid from the reservoir and pumps it through a filter back to the main check valve at the inlet pressure port of the powerpak. From the pressure port, fluid flows into the landing gear selector pressure chamber. When the gear and flap selector levers and poppet valves are in the neutral position, center poppets open, fluid travels through the landing gear selector port, through the wing flap selector port and back to the reservoir.

When either selector lever is moved to the UP or DOWN positions, the fluid then travels through the selected port into the actuating cylinders. An example of this operation, which is the same for both the gear selector lever and the flap selector lever, unless otherwise noted, is as follows. As a selector lever is moved to the UP position, it is locked in place by the action of the detent assembly. The detent snaps into the groove in the camshaft and is held in place by the detent spring. The movement of the camshaft, which is attached to the selector lever, opens and closes poppets within the powerpak to control the flow of fluid to the actuating cylinder(s). As fluid pressure is building up on one side of the piston within the actuating cylinder(s), fluid is forced from the other side of the cylinder through the selector return port and back into the reservoir. When the piston "bottoms" or moves as far as possible, fluid pressure then starts to build up until it reaches a required pressure. At this time, the pressure forces the plunger of the detent assembly up against the spring, relieving the holding pressure from the camshaft. The camshaft return spring then forces the camshaft and selector lever to neutral, thus trapping fluid under pressure in the section of the system actuated. When a selector lever is moved to the DOWN position, operation is identical. The flap may be stopped at any position by moving the selector to neutral. A pictorial description of this operation may be found in Figures 6-10 through 6-14.

NOTE

Either system may be actuated independently of the other. However, although both selector levers may be moved at the same time, the flap system will not operate until the landing gear system completes its operation.

On PA-23-250 (six place) airplanes with Serial Nos. 27-2505 and up, a timer check valve (sequence valve) is provided for each landing gear to prevent the gear doors from closing until each landing gear has fully retracted. When the landing gear is to extend, a priority valve located in the control pedestal, prevents the reverse flow of hydraulic fluid from the gear actuating cylinder to the reservoir until a pressure of 600 psi has build up in the landing gear actuating cylinders. The gear doors, with no pressure restriction, will be allowed to open first.

The hand pump serves as an emergency pump should the engine-driven pump(s) fail. The system check valve prevents the fluid from backing up through the engine-driven pump(s) into the reservoir. In the event of severe leakage of the hydraulic fluid, the standpipe prevents the fluid level from dropping below the emergency quantity required for the operation of the system by means of the hand pump. The engine-driven pump(s) are supplied fluid through the standpipe, so that when the fluid level goes below the top of the standpipe, no fluid will flow. Thus, even though the system may develop a break, and the engine-driven pump continues to operate, devoiding the system of fluid, the standpipe insures enough fluid in the system for hand pump operation. At altitudes above 10,000 feet the hand pump becomes increasingly inefficient.

Also incorporated in the powerpak is the main relief valve and four thermal relief valves. The main relief valve functions as a safety between the engine-driven pump(s) or hand pump and the selector poppets, should an uncontrollable pressure build up in this area of the system. When the main relief valve opens, fluid is directed back to the reservoir. The thermal relief valves provide a means of relieving pressure due to thermal expansion in the hydraulic system.

Included on the left main gear is an oleo actuated bypass valve which makes it impossible to retract the landing gear while the weight of the airplane is on the gear. This valve is open when the oleo strut is compressed and bypasses all hydraulic fluid on the pressure side of the system to the return side, preventing any pressure buildup in the retraction system. When the oleo strut is extended as in flight, or when the aircraft is on jacks, the valve is closed permitting the system to operate in the normal manner.

On airplanes with Serial Nos. 27-1 to 27-7954121 inclusive an independent CO2 emergency landing gear extension system is available to extend the landing gear if failure of the hydraulic system should occur due to line breakage or powerpak malfunction. The control for the system is located beneath a small cover plate under the pilot's seat. When the control is pulled, CO2 flows from a cylinder under the floor panel through separate lines to shuttle valves adjacent to the gear actuating cylinders. The gas pressure opens the shuttle valves allowing CO2 to enter the gear cylinders, extending the gears.

A mechanical latch is incorporated at the landing gear control lever to guard against inadvertent retraction of the landing gear while the aircraft is on the ground. The mechanical latch is located on the control pedestal just above the control lever and must be operated before the control lever can be moved upward. Should the landing gear control lever become movable without using the mechanical latch, the latch and related parts should be checked for wear and possible replacement. (Refer to Parts Catalog.)

Further operating procedures may be found in the Pilot's Operating Manual.

TABLE VI-I. LEADING PARTICULARS, HYDRAULIC SYSTEM

Airplane Model	PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.	PA-23-250 (six place), Serial Nos. 27-2505 and up
System Capacity	0.65 gal. (151 cu. in.)	0.68 gal. (158 cu. in.)
Pump Operating Pressure and Flow Rate	Note identification plate on pump.	Note identification plate on pump.
Hydraulic Fluid Required	MIL-H-5606 [2]	MIL-H-5606 [2]
Powerpak Model	750P-1 [1], 31800-0 [1]	31800-2, 31800-2M and 31800-3.
Priority Valve Cracking Pressure	600 psi to Timer Check Valve and 18 psi to Gear and Door Control and Gear Actuator	

NOTES:
1. ORIGINAL EQUIPMENT
2. PETROLEUM BASE 3126 HYDRAULIC OIL. PURCHASE EXXON CO. BOX 2180 HOUSTON, TEXAS 77001

TABLE VI-II. LEADING PARTICULARS, POWERPAK ASSEMBLY

Powerpak Model	750P-1, 14-volt 31800-0, 14-volt	31800-2, 14-volt 31800-2M, 14-volt 31800-3, 28-volt
Operating Pressure	1000 psi nominal	1000 psi nominal
Main Relief Valve Cracking Pressure	1250 ± 50 psi	1350 + 50-0 psi
Thermal Relief Valve Cracking Pressure	2000 ± 50 psi	2000 ± 50 psi
Selector Lever Detent Release Pressure: Landing Gear Flap	 900 ± 100 psi 900 ± 100 psi	 1250 + 50-0 psi 1000 ± 100 psi
Hand Pump Fluid per Cycle (two strokes)	0.74 cu. in.	0.74 cu. in.
Reservoir Capacity Approx. (full)	4.5 pints (120 cu. in.)	4.5 pints (120 cu. in.)
Reservoir Capacity Approx. (emergency)	0.95 pints (27 cu. in.)	1.0 pint (30 cu. in.)
Weight (dry)	8.25 pounds	8.25 pounds

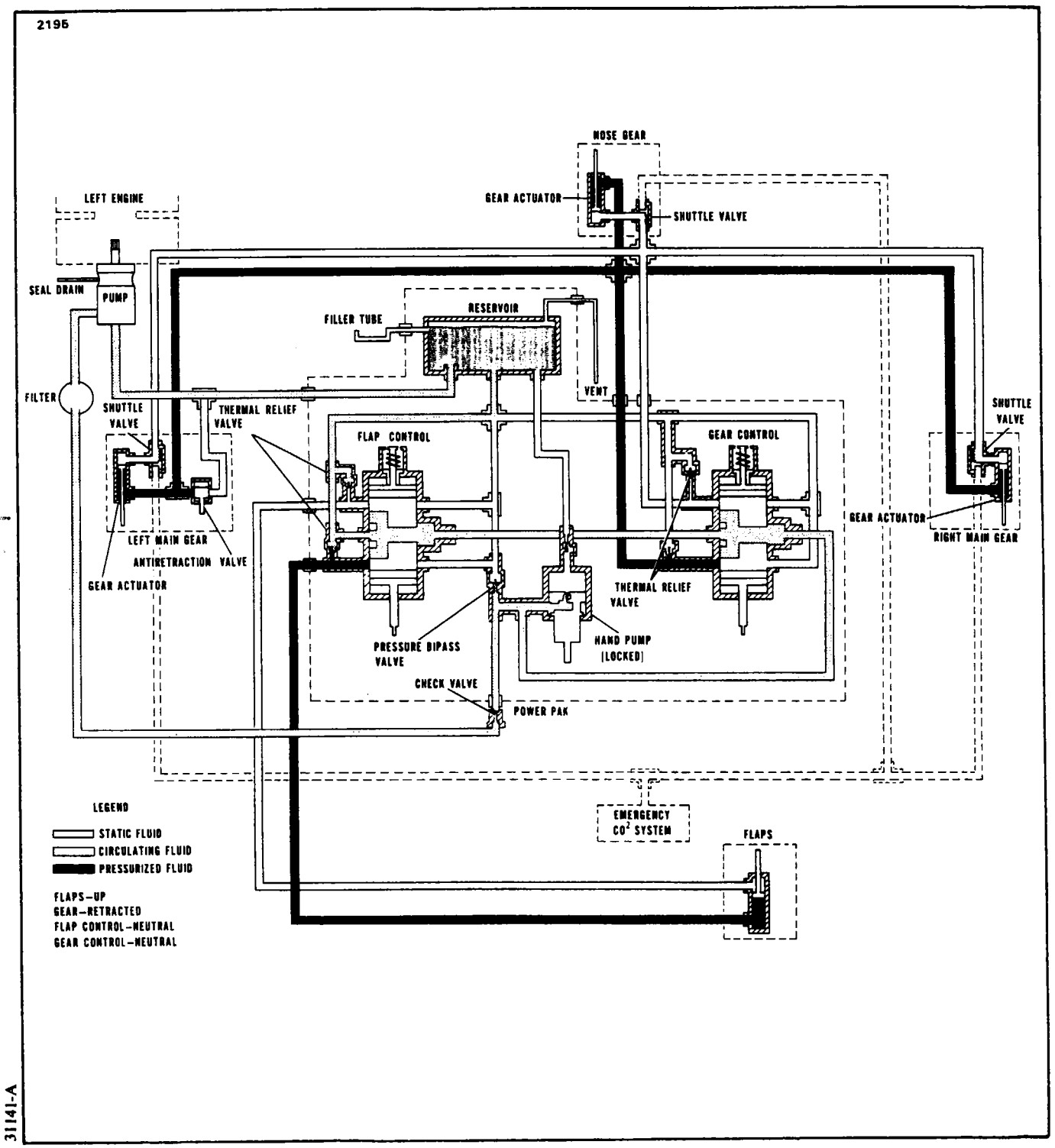


Figure 6-1. Hydraulic System Schematic. PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.

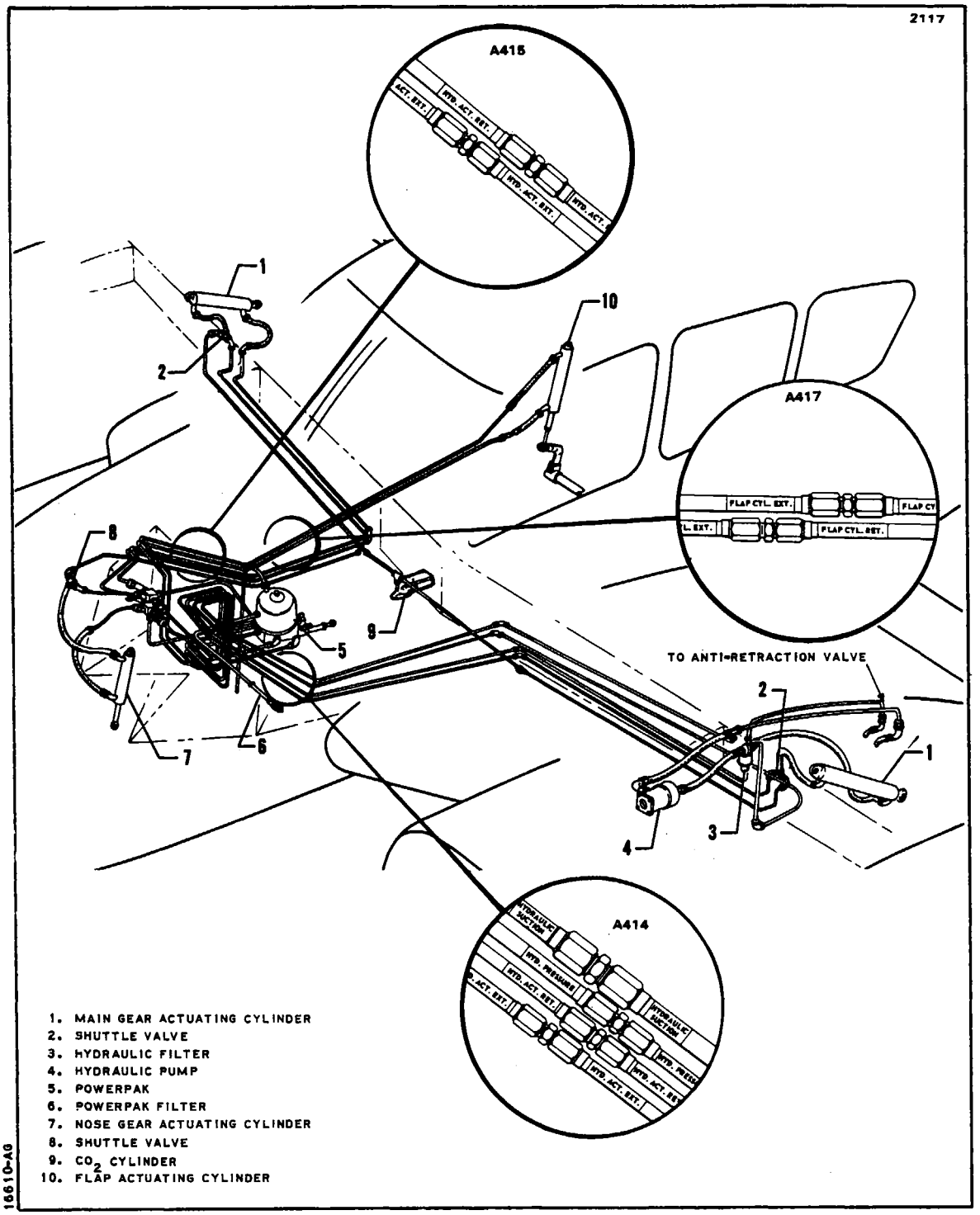


Figure 6-2. Hydraulic System Installation. PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.

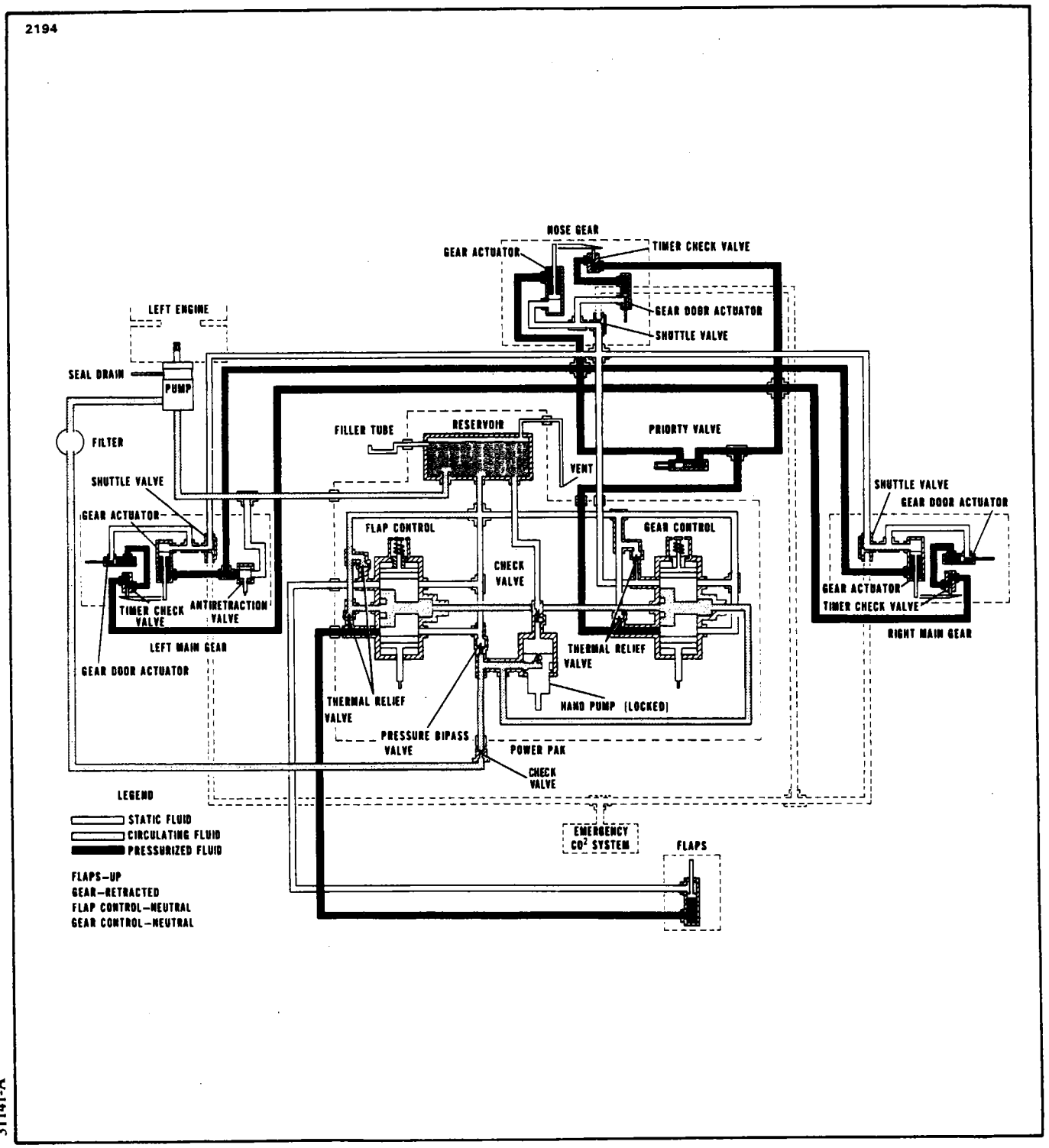


Figure 6-3. Hydraulic System Schematic
PA-23-250 (six place), Serial Nos. 27-2505 to 27-4425 incl.
and 27-4427 to 27-4573 incl.

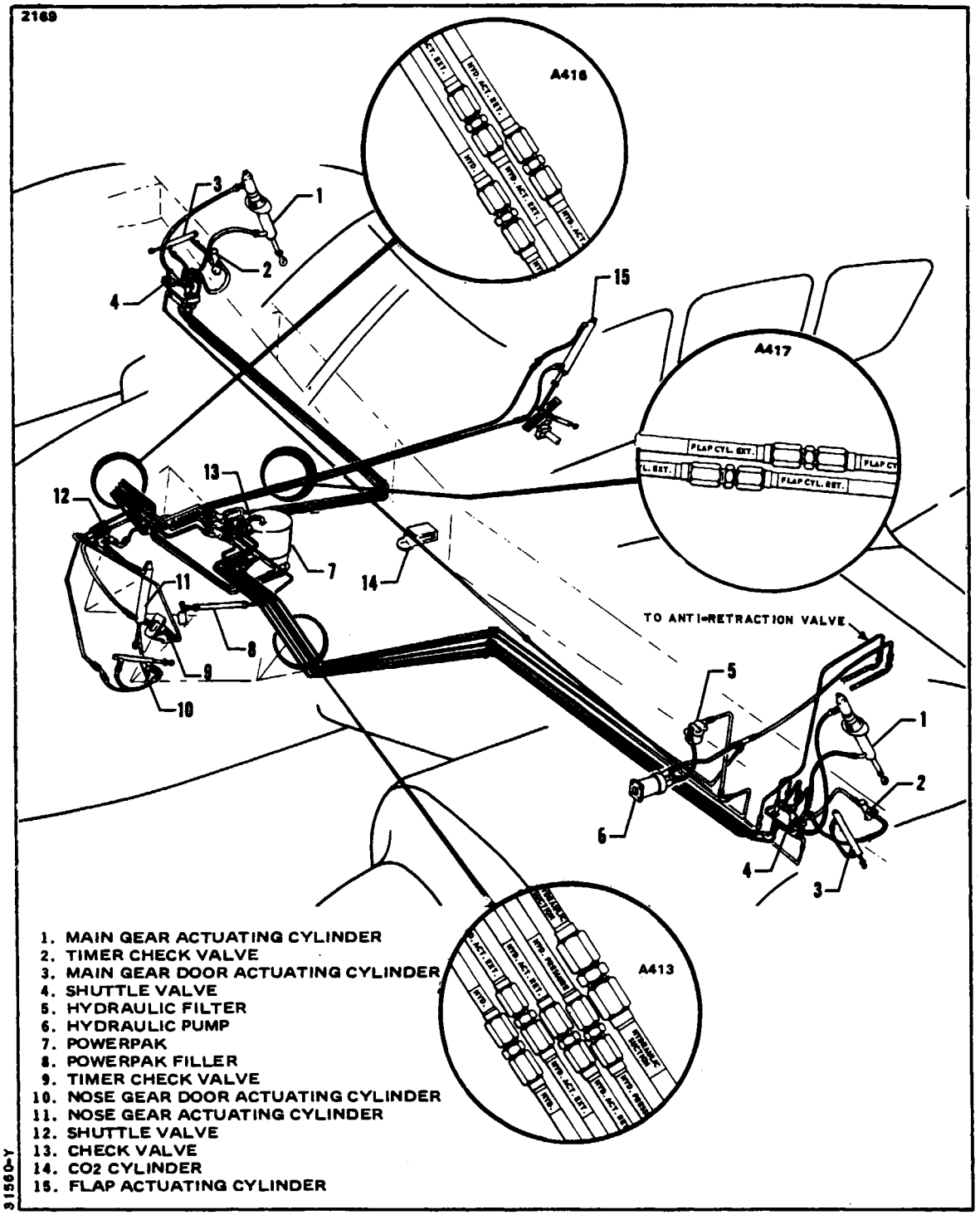
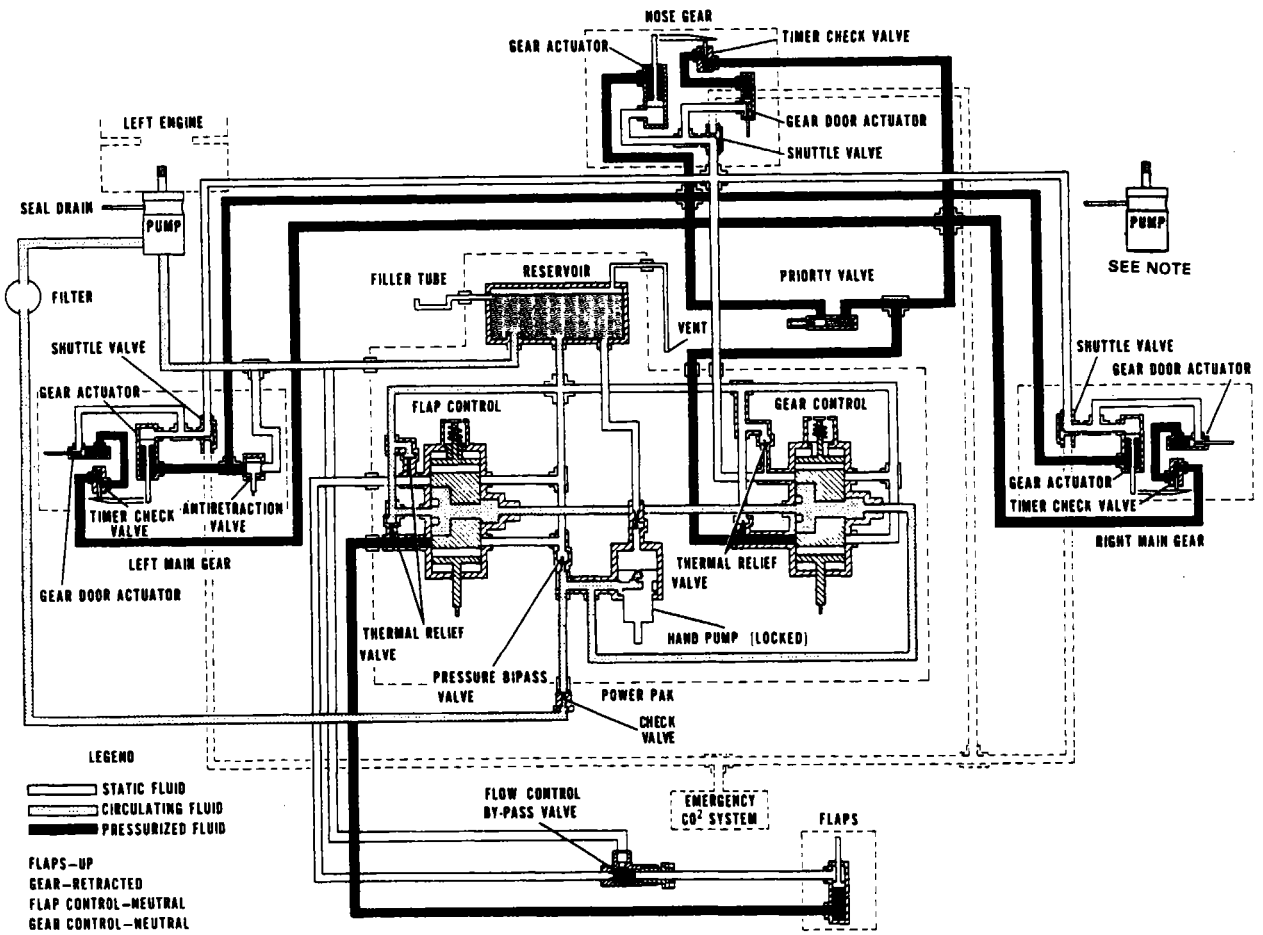


Figure 6-4. Hydraulic System Installation.
PA-23-250 (six place), Serial Nos. 27-2505 to 27-4425 incl. and 27-4427 to 27-4573 incl.



NOTE
DUAL HYDRAULIC PUMP INSTALLATION KIT PIPER P/N 763 836 AVAILABLE FOR AIRCRAFT S/N 27-7654001 THRU 27-7854050.

Figure 6-5. Hydraulic System Schematic
PA-23-250 (six place), Serial Nos. 27-4426 and 27-4574 to 27-7854050 incl.

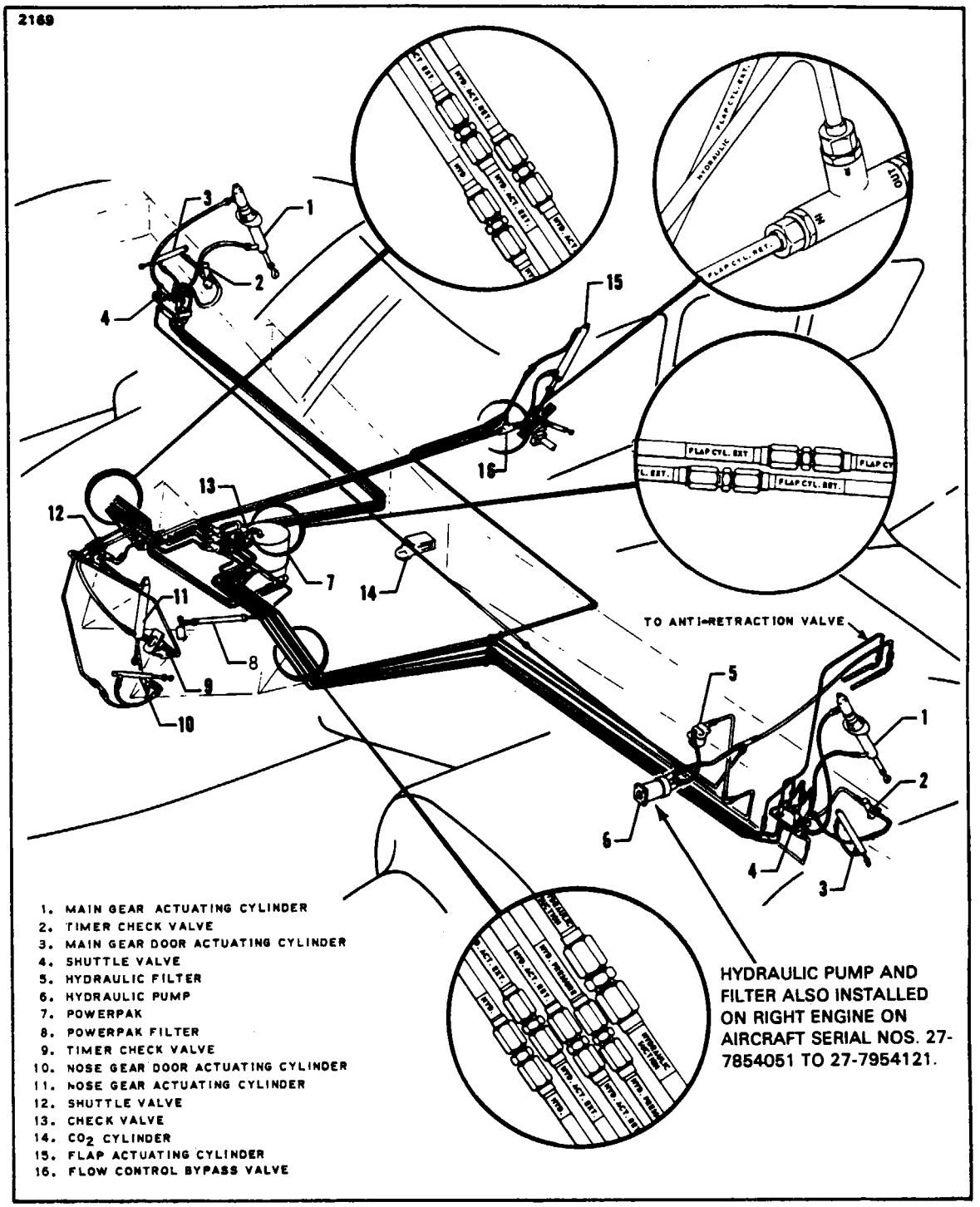


Figure 6-6. Hydraulic System Installation
PA-23-250 (six place), Serial Nos. 27-4426 and 27-4574
to 27-7954121 incl.

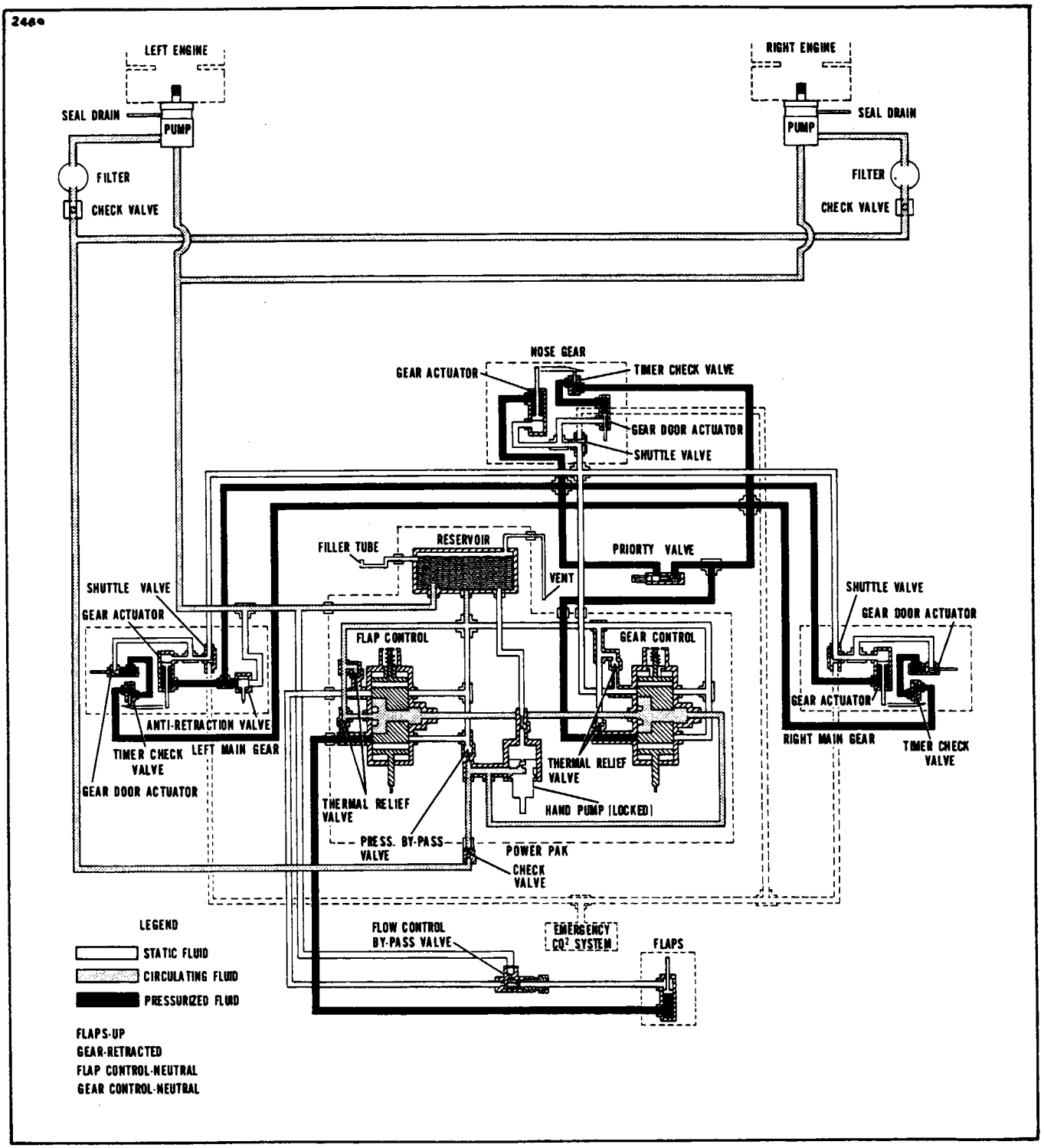


Figure 6-7. Hydraulic System Schematic
PA-23-250 (six place), Serial Nos. 27-7854051 to 27-7954121 incl.

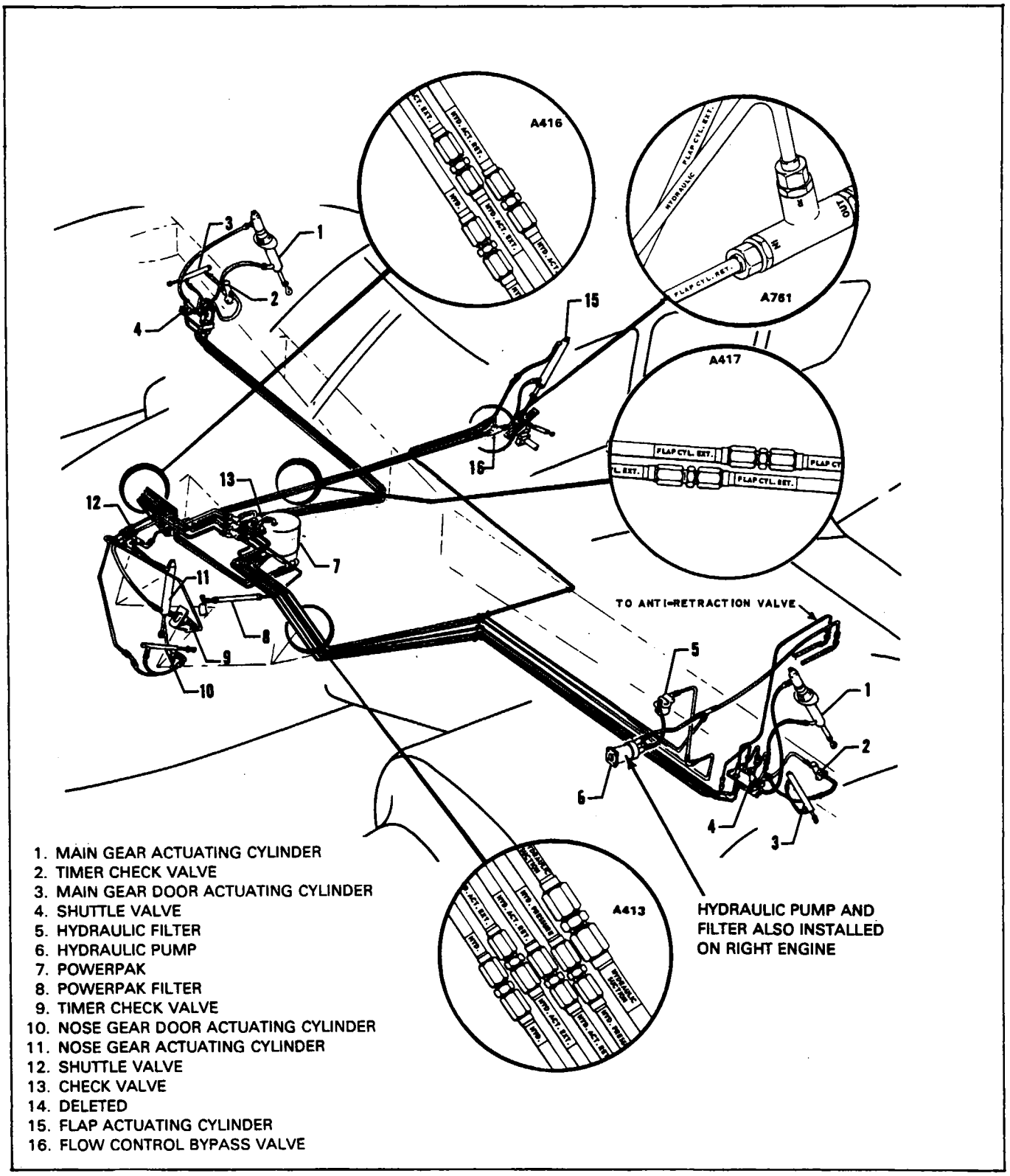


Figure 6-8. Hydraulic System Installation
PA-23-250 (six place), Serial Nos. 27-8054001 and up

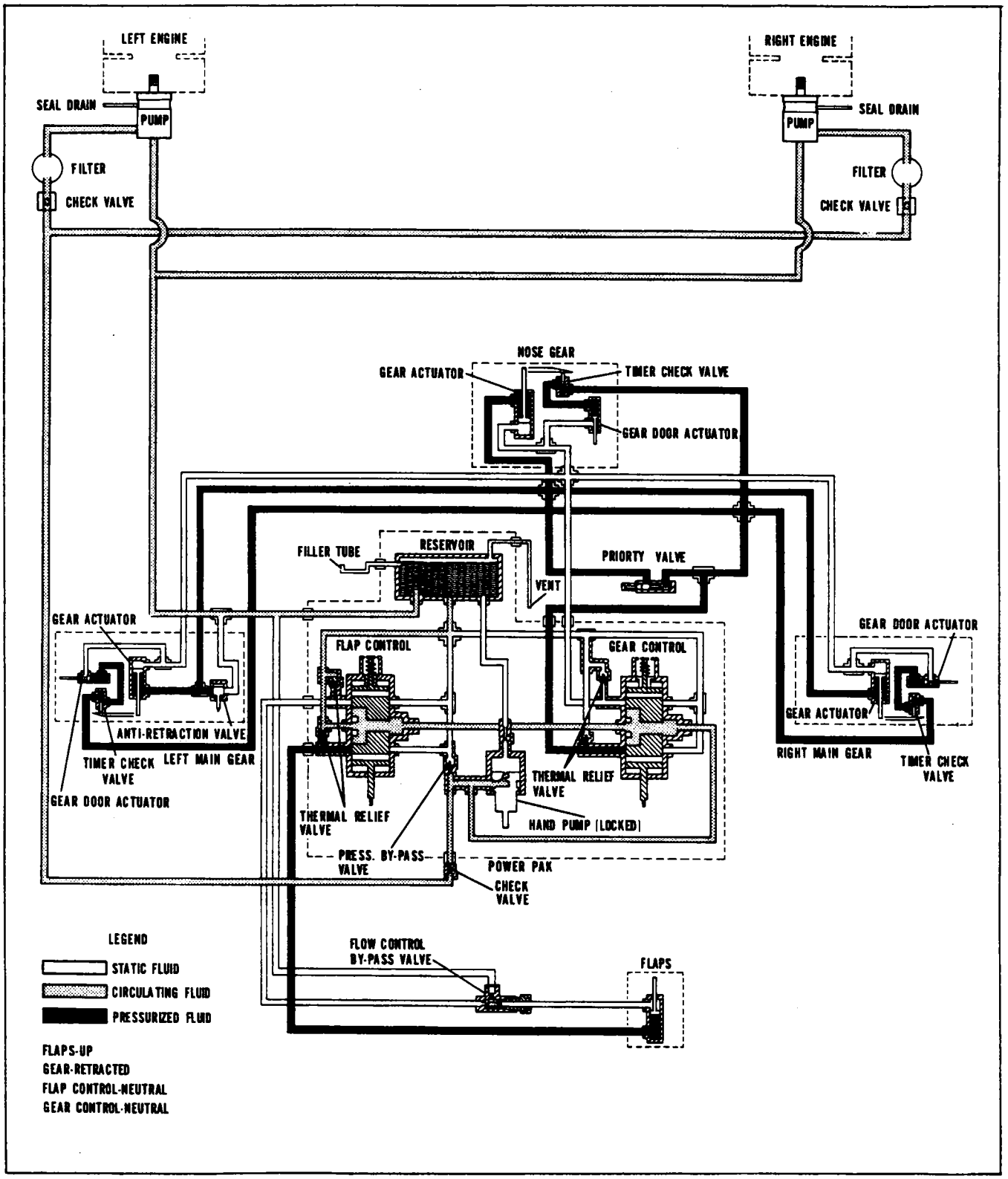


Figure 6-9. Hydraulic System Schematic
PA-23-250 (six place), Serial Nos. 27-8054001 and up

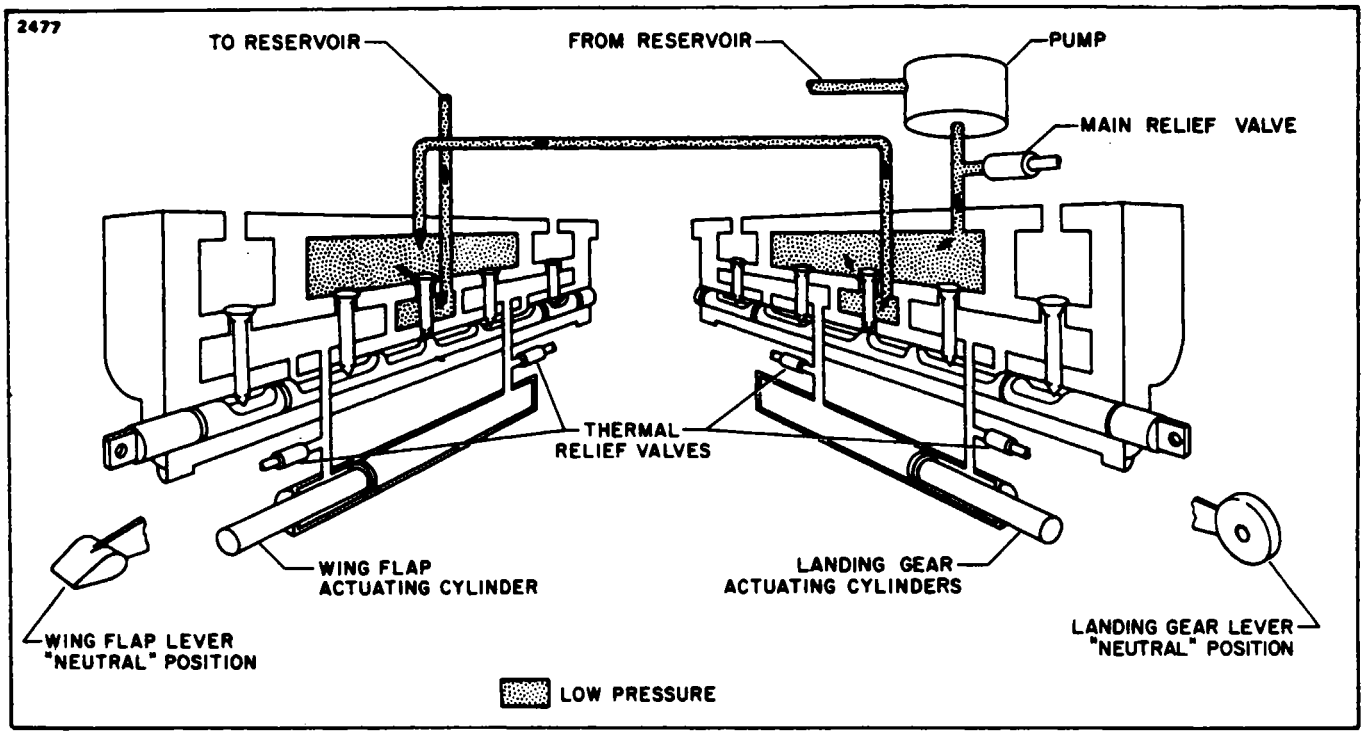


Figure 6-10. Flow Diagram, Both Selector Levers Neutral

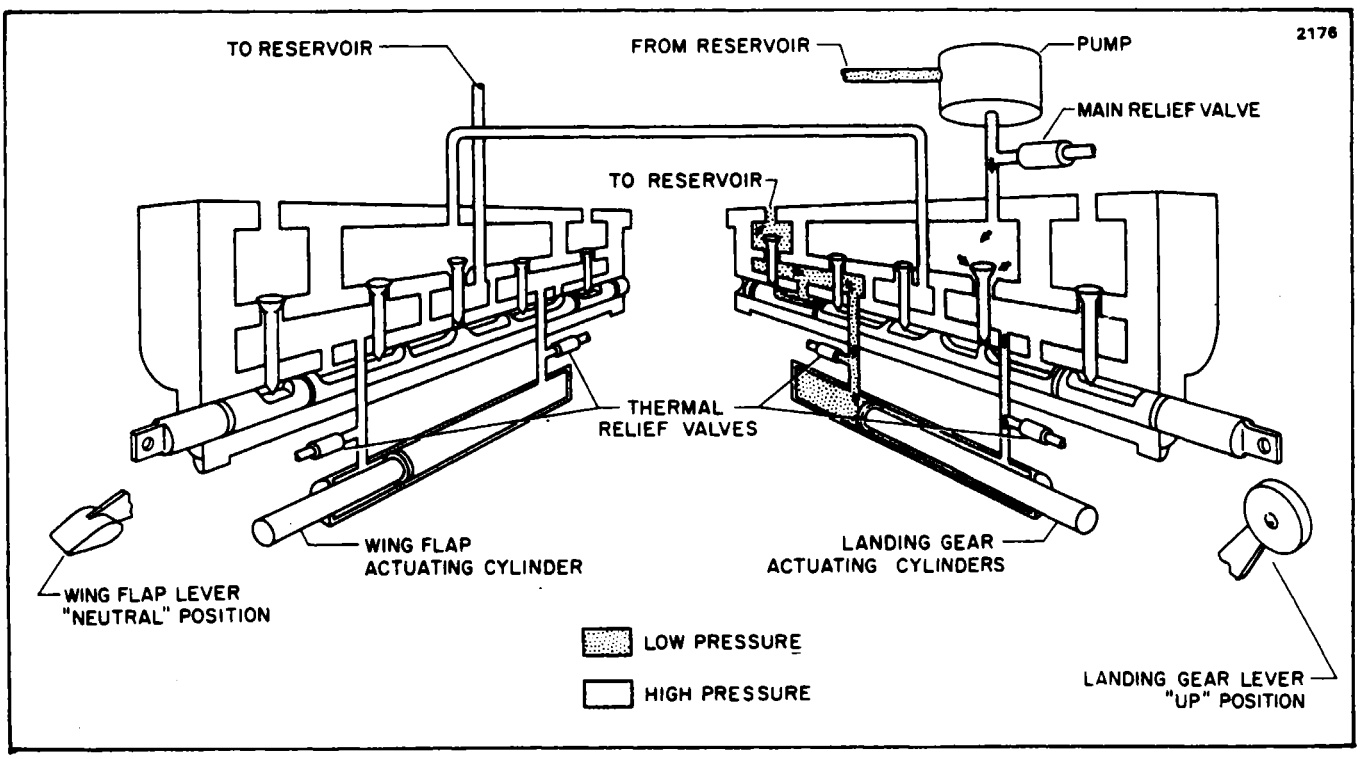


Figure 6-11. Flow Diagram, Landing Gear Selector Lever Up

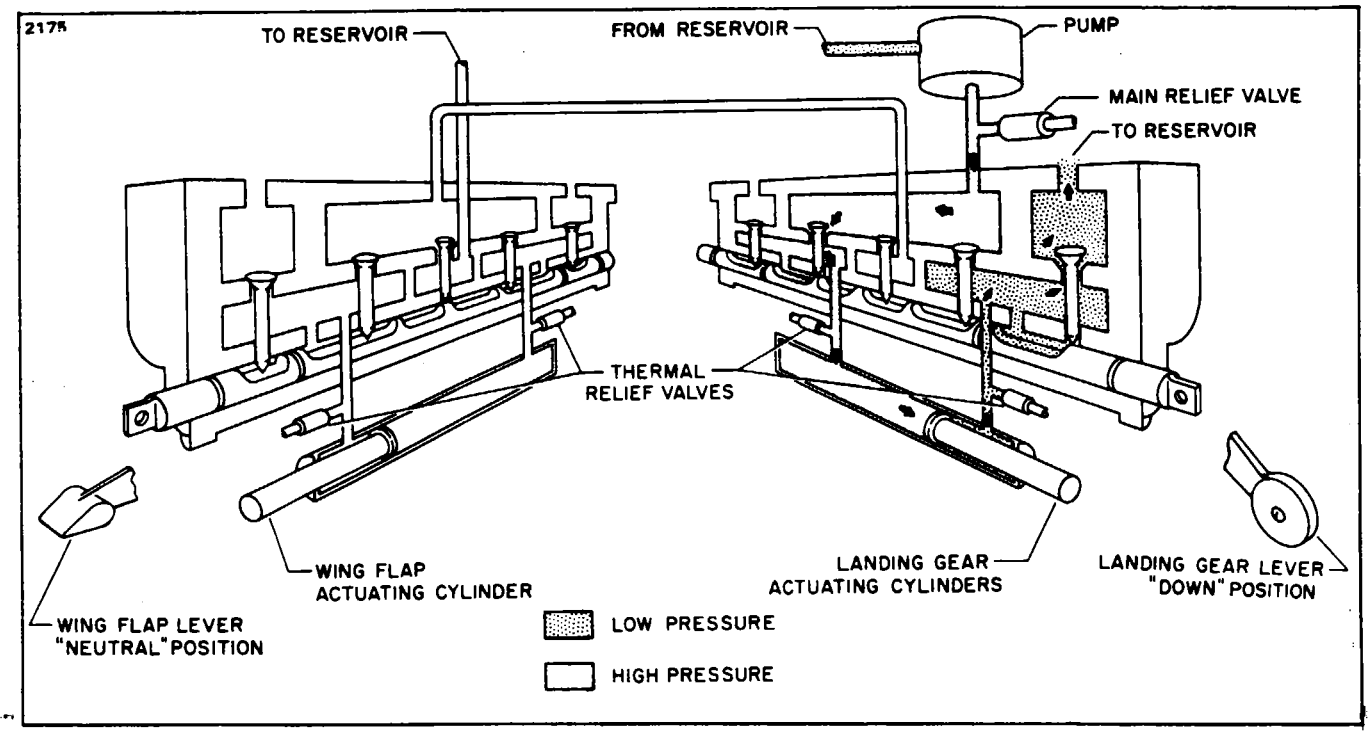


Figure 6-12. Flow Diagram, Landing Gear Selector Lever Down

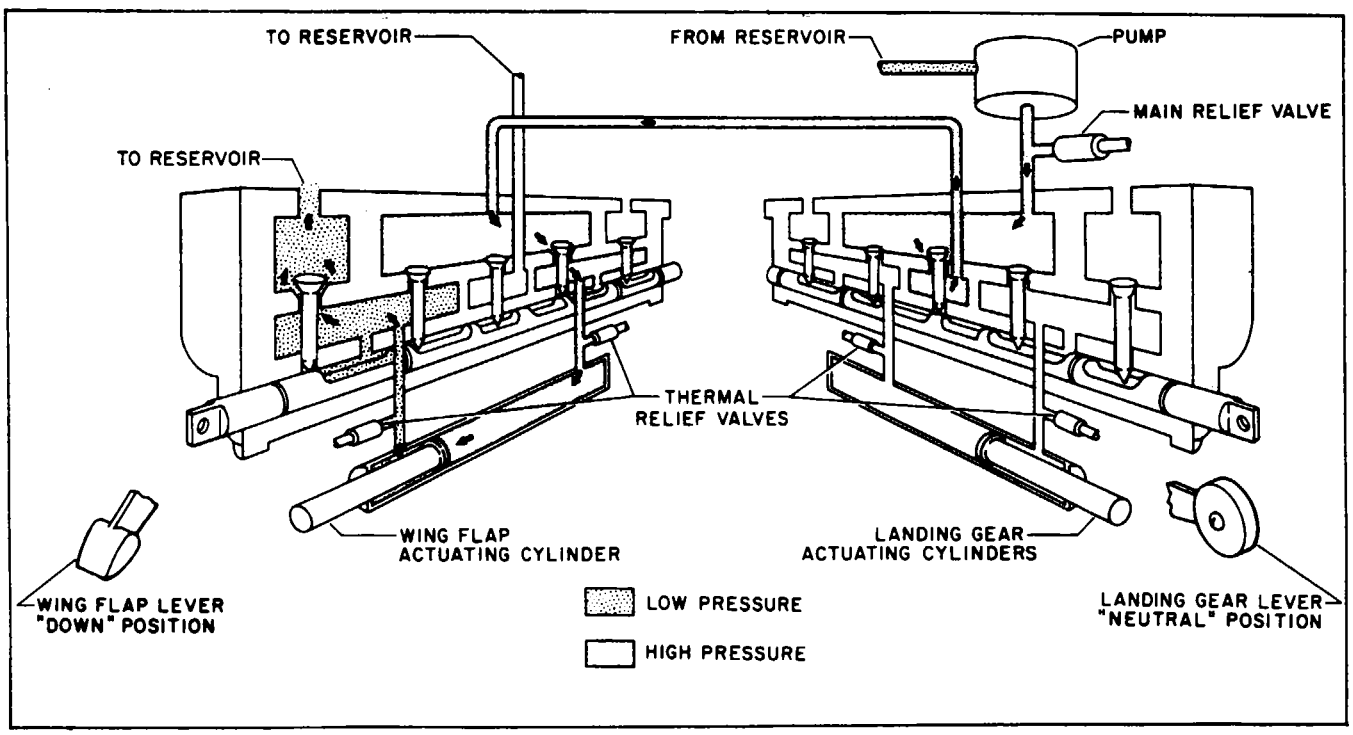


Figure 6-13. Flow Diagram, Flap Selector Lever Down

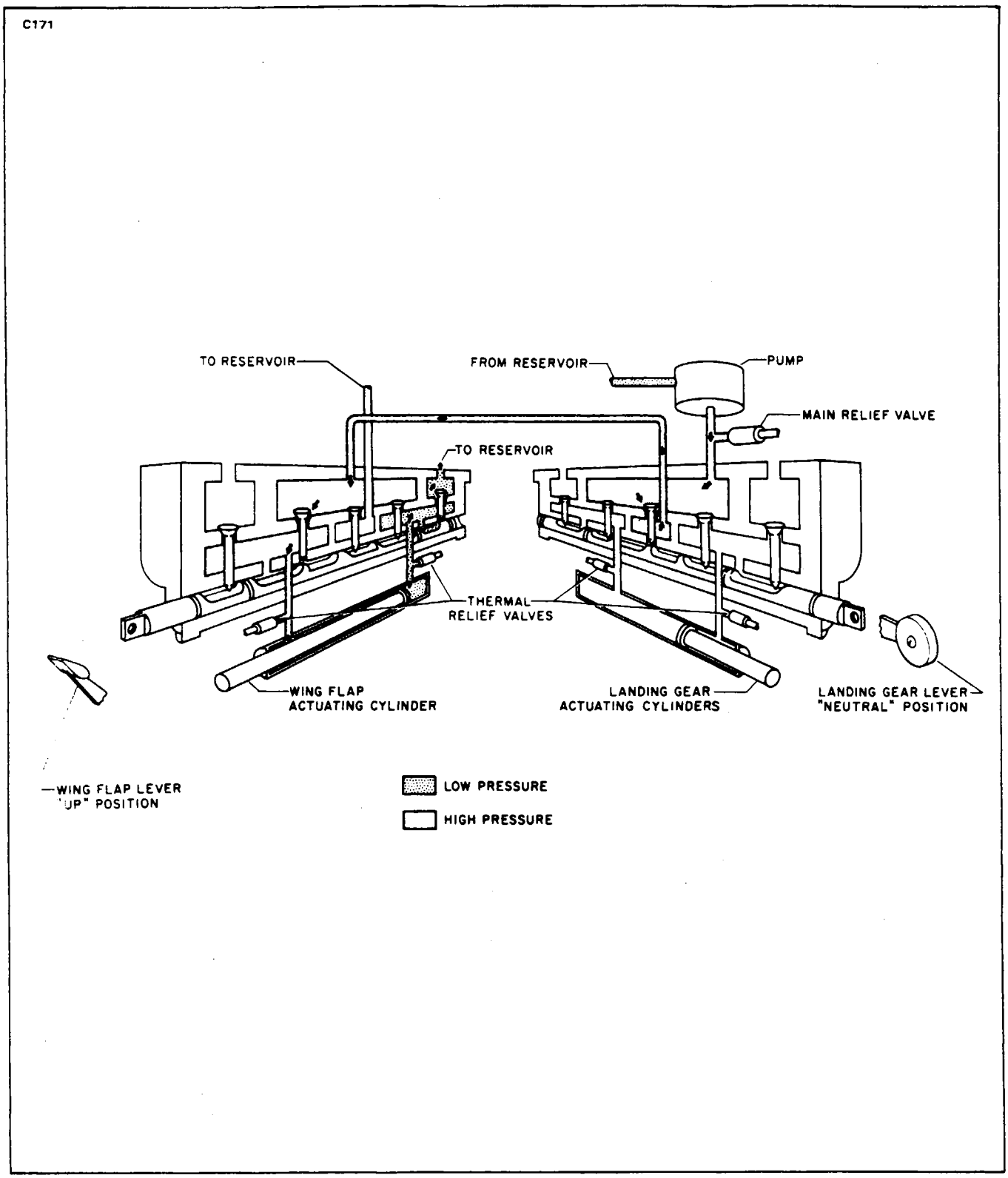


Figure 6-14. Flow Diagram, Flap Selector Lever Up

6-3. TROUBLESHOOTING. Malfunctions of the hydraulic system will result in failure of the landing gear or flaps to operate properly. When trouble arises, jack up the airplane (Refer to Jacking, Section II) and then proceed to determine the extent of the trouble. Table VI-V, at the back of this section, lists the troubles which may be encountered and their probable cause, and suggests a remedy for the trouble involved. A hydraulic system operational check may be conducted beginning with paragraph 6-11. When the trouble has been recognized, the first step in troubleshooting is isolating the cause. Hydraulic system troubles are not always traceable to one cause. It is possible that a malfunction may be the result of more than one difficulty within the system. Starting first with the most obvious and most probable reasons for the trouble, check each possibility in turn and, by process of elimination, isolate the troubles. Table VI-VI lists the possible troubles that may arise with the powerpak.

NOTE

If it is found that the powerpak is at fault and requires disassembly, it is recommended that it be replaced on an exchange basis or overhauled by an overhaul shop recommended by Piper Aircraft Corporation. If, however, this cannot be achieved, the powerpak may be repaired in accordance with the instructions in this section.

6-4. HYDRAULIC TEST UNITS.

6-5. HYDRAULIC TEST UNIT (PIPER NO. 753 080). The Piper unit would offer invaluable assistance in checking hydraulic systems, hydraulic powerpaks and related components in the PA-23. Examples are: Gear and flap cycling, and mechanical operations. Powerpak operating pressure, main relief valve cracking pressure, thermal relief valve cracking pressure, and landing gear detent release pressure.

This unit consists of an electric motor driven hydraulic pump, by-pass valve, fluid reservoir, filter, pressure gauge, hoses and adapter fittings housed in a metal cabinet mounted on casters. This unit is available through Piper Dealers.

6-6. HYDRAULIC TEST UNIT (OPTIONAL). The use of an optional test unit, or one which has many capabilities, must be capable of duplicating the same operating pressures and flow rate as given in Table VI-I for the particular powerpak being tested. Some of its uses are: To flush or fill the airplane's system with micronically filtered hydraulic fluid, to provide hydraulic flow and pressure for testing leakage, and operation of the airplane's hydraulic system without the necessity of operating the airplane's engines. Also, to test and adjust the various components of the airplane's powerpak and hydraulic system. This type of unit should be equipped with a hydraulic hand pump as well as its power driven pump.

6-7. CONNECTING HYDRAULIC TEST UNIT.

a. Remove the inboard engine access panel from the left engine by turning the quarter turn fasteners.

b. Disconnect the hydraulic pump suction hose from the fitting at the engine compartment firewall and connect the suction hose of the test unit to the fitting. Cap the disconnected suction hose.

c. Disconnect the hydraulic pump pressure hose from the inlet side of the hydraulic filter on the engine mount and connect the pressure hose of the test unit to the filter's inlet fitting. Cap the disconnected pressure hose.

d. Connect the vent hose of the test unit, if supplied, to the vent fitting of the powerpak.

e. Operate the test unit per instructions with the unit.

6-8. DISCONNECTING HYDRAULIC TEST UNIT.

a. Ascertain that the landing gear is down and locked, and the selector lever is in the neutral position.

b. Close or open any valves on the test unit per instructions with the unit.

c. Disconnect the test unit suction hose from the firewall fitting. Ascertain that there is fluid in the suction hose from the airplane's pump before connecting it to the firewall fitting.

d. Disconnect the test unit pressure hose from the hydraulic filter. Ascertain that there is fluid in the pressure hose from the airplane's pump before connecting it to the inlet side of the filter.

e. When connected, disconnect the vent hose and check fluid level in the powerpak reservoir.

f. Install the access panel to the inboard side of the left engine.

6-9. CYCLING LANDING GEAR.

a. Jack the airplane as outlined in Section II and connect the hydraulic test unit in accordance with paragraph 6-7.

b. If any reason exists to suspect fluid contamination, take a fluid sample from the hydraulic filter bowl located on the engine mounts.

NOTE

Fluid sampling is necessary only when good reason exists to suspect contamination. If examination of fluid reveals contamination, flush complete hydraulic system with clean hydraulic fluid (MIL-H-5606) and examine several seals and cylinder bores for damage.

c. Operate the hydraulic test unit per instructions furnished with the unit.

d. Set hydraulic test unit by-pass valve open.

e. Start hydraulic test unit pump motor.

f. Slowly close by-pass valve completely.

g. Observe fluid flowing through test unit sight gauge, if test unit is equipped with one. When all air bubbles have dissipated, operations may be continued.

h. Using landing gear selector lever in airplane, operate gear as desired.

NOTE

Gear cycling time can be prolonged by slowly opening the test unit by-pass valve part way. This will bleed off part of the pump flow.

i. After completion of cycling, open test unit by-pass valve and stop pump motor.

j. Disconnect hydraulic test unit in accordance with paragraph 6-8.

k. Ascertain that the landing gear is down and locked and the selector lever is in the neutral position.

l. Remove the airplane from jacks as outlined in Section II.

6-10. FLUSHING HYDRAULIC SYSTEM. When contamination of the hydraulic system is suspected, the complete system should be drained and flushed to remove the contaminated fluid. The cause and type of contamination should be determined and corrected. Use the following steps to perform this operation:

a. Remove the engine cowlings as explained in Section VIII or VIIIA.

b. Using the hand pump, lower the flaps to the full DOWN position.

c. Drain the hydraulic system by disconnecting the hydraulic extension line at the nose gear actuating cylinder, place the end of the line in a suitable container; select lever to the DOWN position and operate the hand pump until the system is empty.

d. Disconnect the hydraulic lines at the actuating cylinders and drain the fluid from the hydraulic lines and cylinders.

e. Disconnect the hydraulic lines from the filter inlet line and the firewall suction line fitting.

f. Remove the hydraulic filter element(s) and flush out the filter bowl(s) and install a new filter element(s).

g. Using a hydraulic test unit, pump clean hydraulic fluid (MIL-H-5606) through the entire system. Examine several seals and cylinder bores for damage.

h. When the hydraulic system is completely flushed and there is no more indication of contamination, reconnect the previously disconnected fittings and replenish the system with clean hydraulic fluid.

i. Bleed the hydraulic system and check for leaks. (Refer to Paragraph 6-9.)

j. Replace the engine cowlings as explained in Section VIII or VIIIA.

k. Recheck filter element(s) after 10 hours of airplane's operation.

6-11. HYDRAULIC SYSTEM OPERATION CHECKS.

6-12. PRE-CHECK AND GENERAL INSTRUCTIONS. Should the hydraulic system malfunction, it may be necessary to perform operational checks to determine the specific cause of the malfunction. The checks in the following paragraphs are intended as a guide for isolating a malfunction to a specific area or component of the system. These checks do not have to be accomplished in order of which they are listed; however, it is recommended that the instructions in paragraphs 6-13 thru 6-26 be read and understood before commencing. In many instances, one check will lead to the next. A review of Description and Principles of Operation, paragraph 6-2, will also help to give a better understanding of the hydraulic system. The following may be helpful in performing operational checks.

WARNING

Before attempting any hydraulic system operational checks, the airplane should be supported on jacks. (Refer to Jacking, Section II.)

a. Before commencing with checks, remove the access panels from both sides of the fuselage nose section. For some of the various checks, remove the panel from the nacelle section aft of the engine firewall.

b. For most checks, a hydraulic test unit of the type described in Paragraph 6-5 or 6-6 may be used. The use of a test unit will require the removal of the inboard access panel at the left engine. The powerpak hand pump may be used to cycle the system should a test unit not be available. The hand pump will not check the pressure and suction lines from the engine driven pumps.

c. Before attempting a check for internal leaks, the entire system should be visually checked for external leaks.

d. Special tools required in addition to a hydraulic test unit are a minimum of two pressure gauges with a range from zero to 2000 psi, and necessary tee fittings and plugs or caps to accomplish the required checks.

e. During checks, ascertain that the powerpak reservoir has sufficient fluid.

f. Before disconnecting any hydraulic lines, place rags or similar material under the connection to absorb any spilled fluid.

g. When disconnecting hydraulic line connection, secure the union fitting while rotating the line coupling.

h. Slowly loosen all line couplings when disconnecting hydraulic lines should any pressure remain present in the system. Moving the selector lever through its full range of travel should remove any high pressure from the system.

6-13. CHECKING ENGINE-DRIVEN HYDRAULIC PUMP(S) OPERATION. To determine the operational condition of the hydraulic system, the following checks may be conducted to determine condition of the engine-driven hydraulic pump(s).

a. Start the left engine and allow it to warm up.

b. With the engine operating at 1200 RPM, move the landing gear selector lever to the DOWN position. The engine-driven hydraulic pump should build up pressure in the system and return the selector lever to the neutral position within a few seconds.

c. Should it be found that the selector lever is abnormally slow during the check, it can be assumed that the hydraulic pump or powerpak is at fault.

d. To determine which of the two units is defective, proceed with the following steps:

1. Shut down the engine and select gear DOWN.

2. Operate the powerpak hand pump until the gear selector lever returns to the neutral position.

3. If the time is shorter than the engine-driven time, it is an indication of a defective engine-driven pump. (Refer to paragraph 6-27.)

4. If the time is approximately the same as the engine-driven time, it is an indication that the powerpak is at fault and requires further checks to isolate the trouble. (Refer to paragraph 6-16.)

e. On airplanes with Serial Nos. 27-7854051 and up, an engine-driven pump has also been installed on the right engine. Check this pump by shutting down the left engine and repeating the preceding steps with the right engine operating. Should it be found that the selector handle is abnormally slow for one pump, but will return normally with the other pump, then it can be assumed that the pump is at fault and it should be removed to determine the cause of the malfunction.

6-14. CHECKING POWERPAK MAIN RELIEF VALVE. The cracking pressure that the main relief valve opens within the powerpak may be determined as follows:

a. Connect a test unit in accordance with instructions given in paragraph 6-7.

b. Open the hydraulic test unit by-pass valve.

c. Hold the landing gear selector lever full DOWN.

d. Operate the test unit, and slowly close the by-pass valve, observing pressure build-up and point at which the pressure stabilizes on test unit gauge. Stabilization indicates relief valve setting. (Refer to Table VI-II for powerpak and its pressure requirement.)

e. The powerpak must be removed (refer to paragraph 6-38) and partially disassembled to adjust the relief valve. (Refer to paragraph 6-61.)

f. If no further checks are desired, remove the hydraulic test unit per instructions in paragraph 6-8.

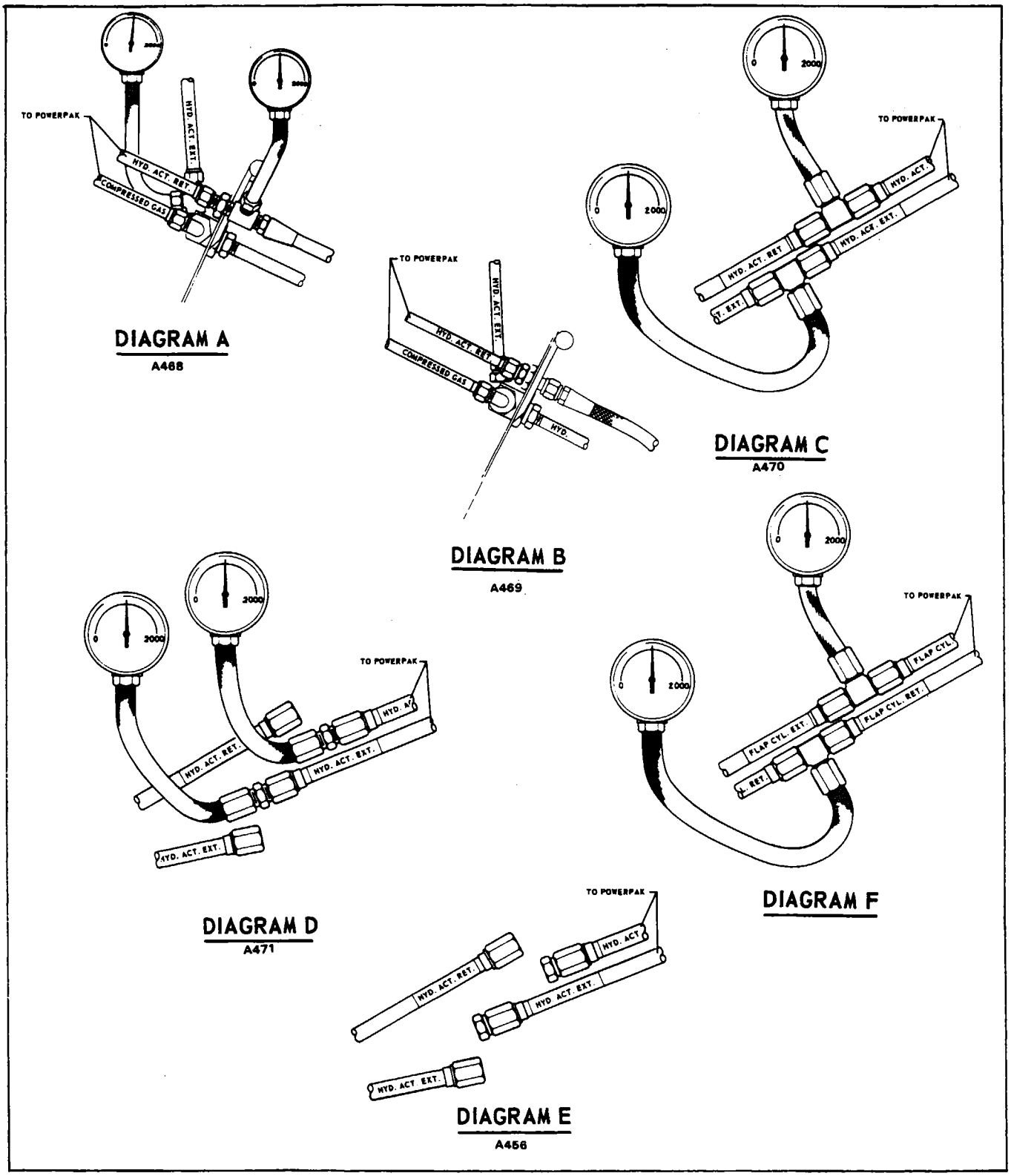


Figure 6-15. Hydraulic System Checking Diagrams, PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl.

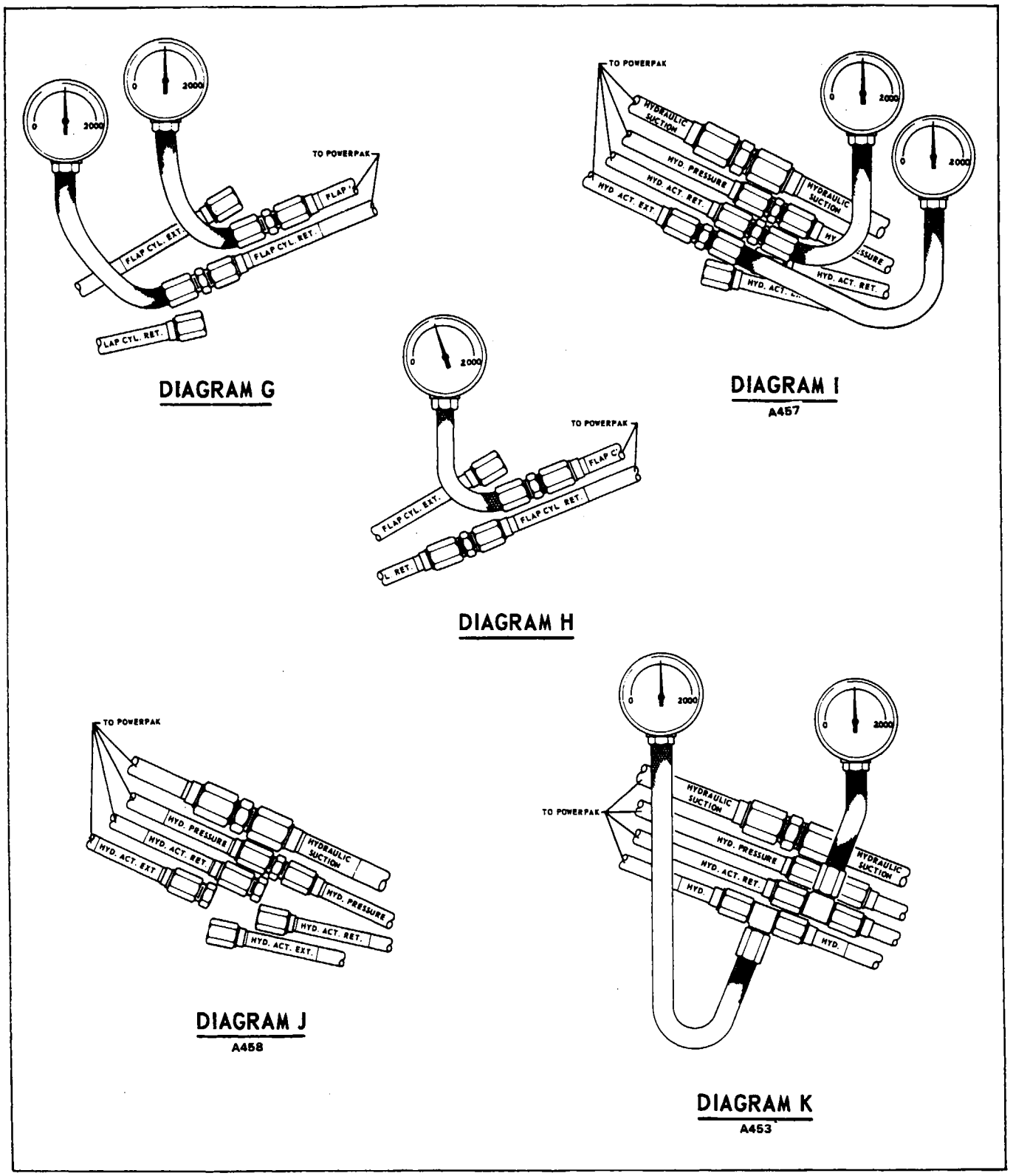


DIAGRAM G

DIAGRAM I
A457

DIAGRAM H

DIAGRAM J
A458

DIAGRAM K
A453

Figure 6-15. Hydraulic System Checking Diagrams, PA-23-250; PA-23-235; and PA-23-250 (six place), Serial Nos. 27-2000 to 27-2504 incl. (cont.)

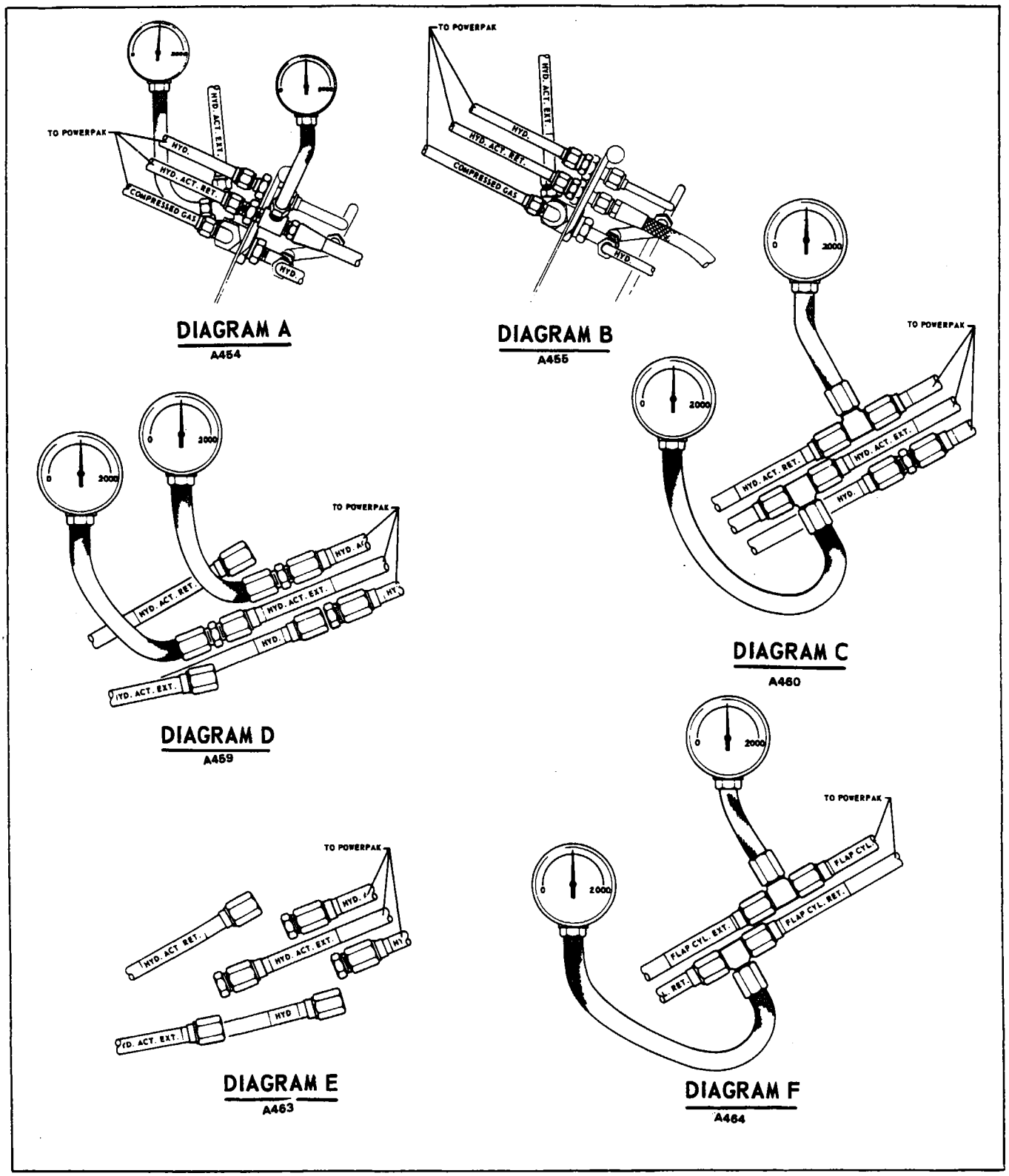


Figure 6-16. Hydraulic System Checking Diagrams, PA-23-250 (six place), Serial Nos. 27-2505 and up

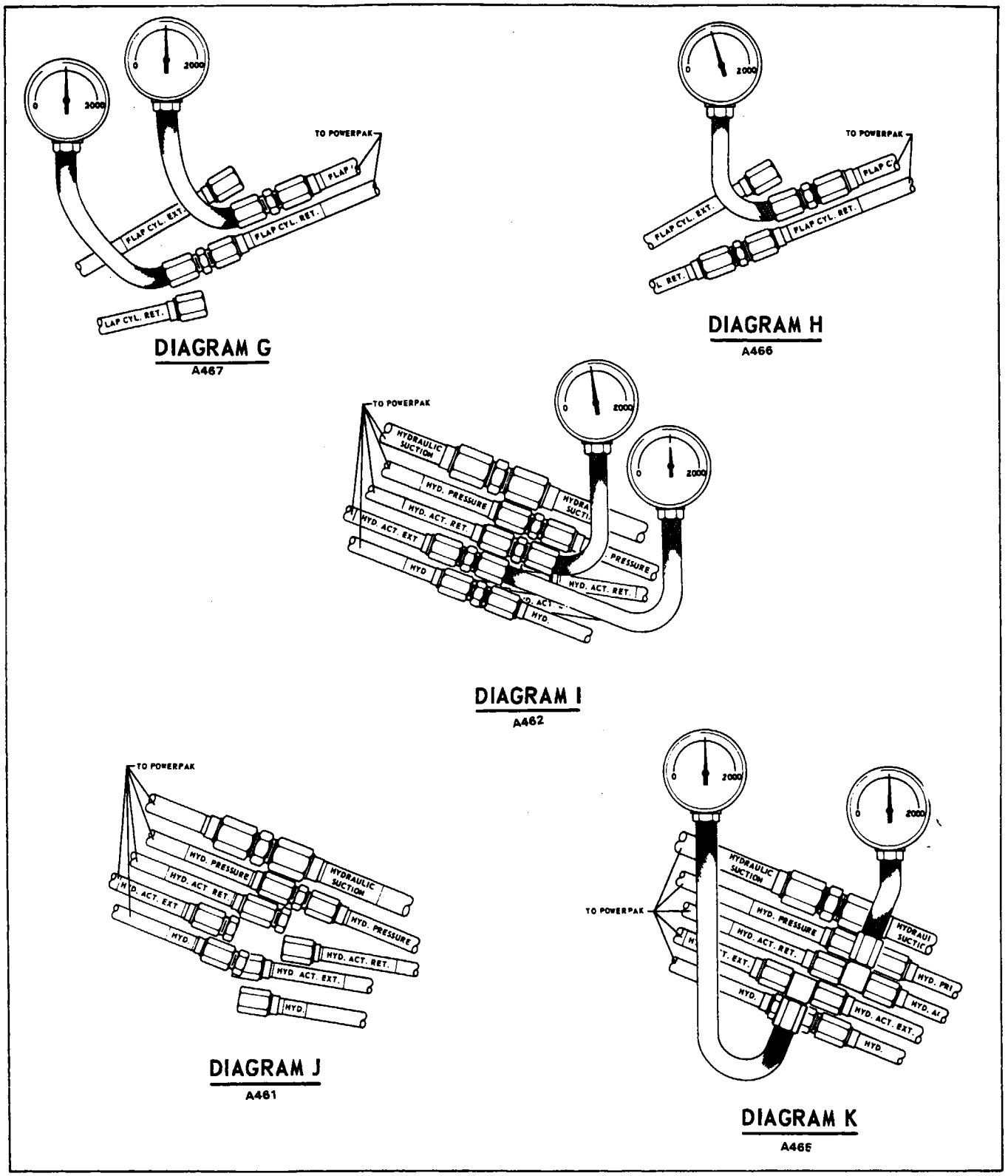


Figure 6-16. Hydraulic System Checking Diagrams, PA-23-250 (six place), Serial Nos. 27-2505 and up (cont.)

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6-15. CHECKING SELECTOR LEVER RELEASE TO NEUTRAL. The following outline may be used to determine the pressure at which the detent assemblies within the powerpak release the gear and flap selector camshafts, thus allowing their respective levers to return to neutral from either the up or down position. This check may be conducted as follows:

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Connect a hydraulic test unit in accordance with instructions given in paragraph 6-7. (The airplane's hand pump may be used for this check should a test unit not be available.)

c. To check operation of the gear selector lever, proceed as follows:

1. Connect pressure gauges to the landing gear extension and retraction lines, at their connections, located in the access opening at the right side of the fuselage just forward of the cabin entrance door. Separate the lines, removing the union fittings, and reconnect using tee fittings with gauges attached. (Refer to Diagram C, Figure 6-15 or 6-16.) To allow separation of the lines, loosen the line support blocks located above the fittings.

NOTE

An alternate and less accurate method for checking release pressures is to use the pressure gauge supplied with the test unit in lieu of connecting gauges into the retraction and extension lines.

2. Turn on the hydraulic test unit (or operate the airplane's hand pump) and operate the landing gear several times through its complete cycle. As the selector lever returns to neutral from both the up and down positions, check the pressure at which the lever trips. The selector lever detent release pressure with powerpak model or part number may be found in Table VI-II.

NOTE

To identify model number of powerpak, refer to paragraph 6-37.

d. To check the operation of the flap selector lever, proceed as follows:

1. Connect pressure gauges to the flap extension and retraction lines, at their connections, located in the access opening at the right side of the fuselage. Separate the lines, removing the union fittings, and reconnect using tee fittings with gauges attached. (Refer to Diagram F, Figure 6-15 or 6-16.) If not previously accomplished, loosen the line support blocks.

2. Operate the flap through several complete cycles and check the pressure at which the lever trips to neutral. The flap lever detent release pressure may also be found in Table VI-II.

e. Should either lever not return to neutral at the required pressure, the external components of the powerpak should be checked for such things as binding of the selector levers and broken or damaged camshaft return springs. The powerpak must be removed (refer to paragraph 6-38) and partly disassembled to adjust the detent assemblies. (Refer to paragraph 6-63.)

f. If no further checks are desired, remove the pressure gauges from the lines, reinstall union fittings and secure support blocks. Also, as desired, disconnect the test unit in accordance with instructions in paragraph 6-8. Check that the landing gear is down and locked and the gear selector lever is at neutral. Remove the airplane from jacks.

6-16. INTERNAL LEAKAGE CHECKS.

6-17. CHECKING HYDRAULIC SYSTEM FOR INTERNAL LEAKS. The outline in this paragraph is given to help determine if an internal leak exists in one of the four areas of operation of the hydraulic system, including the powerpak; these being landing gear retraction, landing gear extension, flap retraction and flap extension. To check each of these areas, proceed as follows:

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Connect a hydraulic test unit in accordance with instructions given in paragraph 6-7. (The airplane's hand pump may be used for this check should a test unit not be available.)

c. To check for internal leaks within the landing gear retraction and extension areas of operation, proceed as follows:

1. Connect pressure gauges to the landing gear extension and retraction lines, at their connections, located in the access opening at the right side of the fuselage just forward of the cabin entrance door. Separate the lines, removing the union fittings, and reconnect using tee fittings with gauges attached. (Refer to Diagram C, Figure 6-15 or 6-16.) To allow separation of the lines, loosen the line support blocks located above the fittings.

2. Operate the hydraulic test unit (or hand pump) and select gear UP. Allow the selector lever to return to neutral and note pressure reading over a 10 minute period.

3. After gear up check, select gear DOWN. Allow the selector handle to return to neutral and note pressure reading over a 10 minute period.

4. As the selector lever returns to neutral, the pressure reading on either gauge will drop slightly and then should stabilize. Once the pressure drop has stabilized, a further drop should not be indicated. Under no circumstances should the initial pressure drop below 700 psi. A slow decrease in pressure or a droppage below 700 psi indicates a possible internal leak in the landing gear section of the powerpak or one of the components in the landing gear portion of the hydraulic system.

d. To check for leaks within the flap areas of operation, continue as follows:

1. Connect pressure gauges to the flap extension and retraction lines also located in the access opening at the right side of the fuselage. Separate the lines, removing the union fitting, and reconnecting using the fittings with gauges attached. (Refer to Diagram F, Figure 6-15 or 6-16.) If not previously accomplished, loosen the line support blocks.

2. Operate the hydraulic test unit (or hand pump) and select flap DOWN. Allow the selector handle to return to neutral and note pressure reading over a 10 minute period.

3. After flap down check, select flap UP. Allow handle to return to neutral and note pressure reading over a 10 minute period.

4. As in the landing gear check, once the pressure drop has stabilized, there should be no further drop indicated on either gauge. Here, too, a slow decrease in pressure or a droppage below 500 psi indicates a possible internal leak in the powerpak or one of the flap components.

e. Should an internal leak be indicated, isolate by using the procedures outlined in the following paragraphs.

f. If no internal leaks are indicated, remove the pressure gauges from the lines, reinstall union fittings and re-secure support blocks. Disconnect the test unit as described in paragraph 6-8. Check that the landing gear is down and locked and the gear selector is at neutral. Remove the airplane from jacks.

6-18. CHECKING POWERPAK FOR INTERNAL LEAKS. The procedure outlined in this paragraph enables a check of the powerpak for internal leaks. The system main check valve, an external component of the powerpak, may also be checked from instructions given in this paragraph. The check may be conducted as follows:

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Connect a hydraulic test unit in accordance with paragraph 6-8. (The airplane's hand pump may be used should a test unit not be available.)

c. To check for internal leaks within landing gear section of the powerpak, proceed as follows:

1. Connect pressure gauges to the landing gear extension and retraction lines that lead from the powerpak, at the line connections, located in the access

opening at the right side of the fuselage. Separate the lines at the union fittings, allowing the fittings to remain attached to the lines from the powerpak. Attach pressure gauges to the union fittings. (Refer to Diagram D, Figure 6-15 or 6-16.) To allow separation of lines, loosen the line support blocks located above the fittings. Lines to the landing gear should be covered to prevent contamination.

NOTE

On airplanes with Serial Nos. 27-2505 and up, two retraction lines are incorporated in the system; these are to the landing gear actuating cylinder and to the door actuating cylinder via the timer check valve. Disconnect the line not fitted with a pressure gauge at the union fitting and cap to prevent leakage.

2. At the access opening in the left side of the fuselage, disconnect the retraction and extension lines at the union fittings and cap off the lines leading from the powerpak. (Refer to Diagram J.)

3. At the shuttle valve located on the aft side of the forward cabin bulkhead, disconnect and cap the retraction and extension lines leading from the powerpak. (Refer to Diagram B.)

4. Operate the hydraulic test unit (or hand pump) and select gear UP. Allow the selector lever to return to neutral and note pressure reading over a 10 minute period.

5. After gear up check, select gear DOWN. Allow the selector lever to return to neutral and note reading over a 10 minute period.

6. As the selector lever returns to neutral, the pressure reading on either gauge will drop slightly and then should stabilize. Once the pressure drop has stabilized, a further drop should not be indicated. A slow decrease in pressure indicates an internal leak in the landing gear section of the powerpak.

d. To check for internal leaks within the flap section of the powerpak, proceed as follows:

1. Connect pressure gauges to the flap extension lines that lead from the powerpak, at the line connections, located in the access opening at the right side of the fuselage. Separate the lines at the union fitting allowing the fittings to remain attached to the lines from the powerpak. Attach pressure gauges to the union fittings. (Refer to Diagram G, Figure 6-15 or 6-16.) Lines to the flap cylinder should be covered.

2. Operate the hydraulic test unit (or hand pump) and select flap DOWN. Allow the selector lever to return to neutral and note pressure reading over a 10 minute period.

3. After flap down check, select flap UP. Allow the selector lever to return to neutral and note reading over a 10 minute period.

4. As in the landing gear check, once the pressure has stabilized there should be no further drop indicated on either gauge. Here, too, a slow decrease in pressure indicates an internal leak in the flap section of the powerpak.

e. Should an internal leak be indicated in either the landing gear or flap section, the powerpak must be removed (Refer to Paragraph 6-36.) and exchanged or overhauled. Uncap and reconnect lines as required. If no internal leaks are indicated in the powerpak, continue with the checks outlined in the following paragraphs.

f. The main check valve may be checked as follows:

1. Disconnect the engine driven pump pressure line at the inlet side of the main check valve, located on the right side of the powerpak.

2. Select flap DOWN, operate the powerpak hand pump and allow the handle to return to neutral.

3. With pressure built up in the system, note if any fluid is seeping from the check valve.

4. If a leak is indicated, remove the valve and replace or overhaul.

g. If no further checks are desired, remove remaining gauges and reconnect lines. Disconnect hydraulic test unit in accordance with instructions in paragraph 6-8. Check that the landing gear is down and locked, and the selector levers are at neutral. Remove the airplane from jacks.

6-19. CHECKING HAND PUMP FOR INTERNAL LEAKS.

a. Connect a gauge to the flap extension line from the powerpak, located in the access opening at the right side of the fuselage, just forward of the cabin entrance door. Separate the line at the union fitting allowing the fitting to remain on the line from the powerpak. Attach the gauge to the fitting. (Refer to Diagram H, Figure 6-15 or 6-16.)

b. Select flap DOWN with the selector lever. Operate the hand pump and observe the pressure reading. The gauge should show a steady increase in pressure during both the up and down stroke.

c. As the gauge reaches approximately 1000 psi, stop the handle operation at mid-stroke; the handle should remain steady. If the handle moves up from the stopped position, the hand pump piston valve is leaking. If the handle moves down, the hand pump suction valve in the powerpak is leaking. A slow build-up of pressure indicates a leaking piston packing.

6-20. CHECKING COMPONENTS FOR INTERNAL LEAKS. This check is given as a method for isolating an internal leak to a specific area of the hydraulic system, such as the nose landing gear, left main landing gear or right main landing gear. Components affected in these areas are the actuating cylinders, the shuttle valves and, for the left gear, the anti-retraction valve. Once the defective area is determined, then each component may be individually checked as found in further paragraphs. The three areas as stated may be checked as follows:

NOTE

Before any of the following checks can accurately be accomplished, it must be determined that the power-pak has been checked and found not defective.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Connect a hydraulic test unit in accordance with instructions given in paragraph 6-7. (The airplane's hand pump may be used for this check should a test unit not be available.)

c. The check for internal leaks in the hydraulic components located within the area of the nose landing gear may be accomplished as follows:

1. Connect gauges to the nose landing gear extension line at the shuttle valve located at the aft side of the forward cabin bulkhead and the retraction line at the bulkhead fitting forward of the bulkhead. Use tee fitting in the lines to facilitate use of gauges. (Refer to Diagram A, Figure 6-15 or 6-16.)

2. At the access openings in both the left and right sides of the fuselage, disconnect and cap off the retraction and extension lines leading from the power-pak. (Refer to Diagram J for the left side and E for the right side, Figure 6-15 or 6-16.)

3. Operate the hydraulic test unit (or hand pump) and select gear UP (only the nose gear will retract). Allow the selector lever to return to neutral and note pressure reading over a 10 minute period.

4. After gear up check, select gear DOWN. Allow the selector lever to return to neutral and note reading over a 10 minute period.

5. As the selector lever returns to neutral, the pressure reading on either gauge will drop slightly and then should stabilize. Once the pressure drop has stabilized, a further drop should not be indicated. A slow decrease in pressure indicates an internal leak in the actuating cylinder(s) and/or shuttle valve.

d. The check for internal leaks within the left main gear area may be conducted as follows:

1. Connect pressure gauges to the landing gear extension and retraction lines, at their connections, located in the access opening at the left side of the fuselage. Separate the lines, removing the union fittings, and reconnect using

tee fittings with gauges attached. (Refer to Diagram K, Figure 6-15 or 6-16.)

2. At the access opening in the right side of the fuselage, just forward of the cabin entrance door, disconnect the landing gear retraction and extension lines at the union fittings and cap off the lines leading from the powerpak. (Refer to Diagram E.)

3. At the shuttle valve located on the aft side of the forward cabin bulkhead, disconnect and cap the retraction and extension lines leading from the powerpak. (Refer to Diagram B.)

4. Operate the hydraulic test unit (or hand pump) and select gear UP (only the left gear will retract). Allow the selector lever to return to neutral and note pressure reading over a 10 minute period.

5. After gear up check, select gear DOWN. Allow the selector lever to return to neutral and note reading over a 10 minute period.

6. As the selector lever returns to neutral and the pressure drop has stabilized, hereto a further drop should not be indicated. A slow decrease in pressure indicates an internal leak in the actuating cylinder(s), shuttle valve and/or anti-retraction valve.

e. The check for internal leaks within the right main gear area may be conducted as follows:

1. Connect gauges to the landing gear extension and retraction lines, at their connections, located in the access opening at the right side of the fuselage, just forward of the cabin entrance door. Separate the lines, removing the union fittings, and reconnect using tee fittings with gauges attached. (Refer to Diagram C, Figure 6-15 or 6-16.)

2. At the access opening in the left side of the fuselage, disconnect the landing gear extension and retraction lines at the union fittings and cap off lines leading from the powerpak. (Refer to Diagram J.)

3. At the shuttle valve in the nose, disconnect and cap the retraction and extension lines leading from the powerpak. (Refer to Diagram B.)

4. Operate the hydraulic test unit (or hand pump) and select gear UP (only the right gear will retract). Allow the selector lever to return to neutral and note pressure reading over a 10 minute period.

5. After gear up check, select gear DOWN. Allow lever to return to neutral and note reading over a 10 minute period.

6. For either the gear up or down check, once the pressure has stabilized there should be no further drop. A slow decrease in pressure indicates an internal leak in the actuating cylinder(s) and/or shuttle valve.

f. Should a leak be indicated and isolated to one of the three landing gear areas, the components within that area may be individually checked in accordance with instructions given in paragraphs 6-21 thru 6-23.

g. If no further checks are desired, remove the remaining gauges and reconnect hydraulic lines. Disconnect hydraulic test unit in accordance with instructions in paragraph 6-8. Check that the landing gear is down and locked, and the selector levers are at neutral. Remove the airplane from jacks.

6-21. CHECKING ANTI-RETRACTION VALVE FOR INTERNAL LEAKS. The anti-retraction valve, located on the strut housing of the left main landing gear, may be checked as follows:

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Disconnect the left landing gear doors at the control rods, and secure back.

c. Connect a hydraulic test unit in accordance with instructions given in paragraph 6-7. (The airplane's hand pump may be used for this check should a test unit not be available.)

d. Operate the test unit (or hand pump) and retract the landing gear. Allow the selector lever to return to neutral.

e. Disconnect the hydraulic line from the valve at the port stamped "R".

f. Check for evidence of fluid leakage at the open port. An alternate method is to attach a pressure gauge to the fitting at the port stamped "R" and note if a pressure reading on the gauge begins to appear over a few minutes period.

g. Should the valve show indications of leakage, by seepage or by the pressure gauge, the valve should be repaired or replaced. (Refer to paragraph 6-73.)

h. If no further checks are desired, reinstall the hydraulic line and disconnect the hydraulic test unit in accordance with instructions in paragraph 6-8. Check that the landing gear is down and locked, and the selector levers are at neutral.

i. Reconnect gear doors, check adjustment and remove the airplane from jacks.

6-22. CHECKING SHUTTLE VALVE FOR INTERNAL LEAKS. The shuttle valves, one of which is located on the aft side of the forward cabin bulkhead and one located in each engine nacelle aft of the firewall, may be checked by the following procedure:

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Connect a hydraulic test unit in accordance with instructions given in paragraph 6-7. (The airplane's hand pump may be used for this check should a test unit not be available.)

c. Operate the test unit (or hand pump) and extend the landing gear. Allow the selector lever to return to neutral.

d. Disconnect the hydraulic line from the valve at the port stamped "EMG".

e. Check for evidence of fluid leakage at the open port. An alternate method is to attach a pressure gauge to the fitting at the port stamped "EMG" and note if a pressure reading on the gauge begins to appear over a few minutes period.

f. Should a valve show indications of leakage, by seepage or by the pressure gauge, the valve should be repaired or replaced. (Refer to Paragraph 6-80.)

g. If no further checks are desired, reinstall the hydraulic line and disconnect the hydraulic test unit in accordance with instructions in paragraph 6-8. Check that the landing gear is down and locked, and the selector levers are at neutral. Remove the airplane from jacks.

6-23. CHECKING LANDING GEAR ACTUATING CYLINDERS FOR INTERNAL LEAKS. The landing gear actuating cylinders and, if installed, the door actuating cylinders, whether they be installed within the fuselage nose section or wing, may be checked by the following procedure:

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Connect a hydraulic test unit in accordance with instructions given in paragraph 6-7. (The airplane's hand pump may be used for this check should a test unit not be available.)

c. Operate the test unit (or hand pump) and select gear DOWN. Allow the selector lever to return to neutral.

d. To check a landing gear actuating cylinder, disconnect the hydraulic line from the cylinder at its lower end. (The end closest to the exposed actuating rod.)

WARNING

Slowly loosen the line coupling from the cylinder should any pressure remain present in the system.

e. To check a landing gear door actuating cylinder, disconnect the hydraulic line from the forward end of the nose cylinder or inboard end of the left or right main cylinder. (The end closest to the cylinder attachment lug.)

f. Check for evidence of fluid leakage at the open port. An alternate method is to attach a pressure gauge to the fitting from where the line was disconnected and note if a pressure reading on the gauge begins to appear over a few minutes period.

g. Should a cylinder show indications of leakage, by seepage or by the pressure gauge, the cylinder should be replaced or repaired. (Refer to Paragraph 6-85.)

h. If no further checks are desired, reinstall the hydraulic line, and disconnect the hydraulic test unit in accordance with instructions in paragraph 6-8. Check that the landing gear is down and locked, and the selector levers are at neutral. Remove the airplane from jacks.

6-24. CHECKING TIMER CHECK VALVE (SEQUENCE VALVE) FOR INTERNAL LEAKS. (PA-23-250 [six place], Serial Nos. 27-2505 and up.) Three timer check valves are incorporated in the hydraulic system. The valve for the nose gear is located in the lower area of the nose section, just ahead of the forward cabin bulkhead. The valve for each main landing gear is located in the wheel well, above the gear support brace. Any one valve may be checked by the following procedure:

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Disconnect both hydraulic lines from the valve.

c. Connect the pressure line of a hydraulic test unit to the port of the valve furthest from its mounting base.

d. Open the test unit by-pass valve.

e. Operate the test unit and slowly close the by-pass valve.

f. Apply 2000 psi maximum hydraulic pressure to the valve and ascertain that fluid does not appear at the open port.

g. Should the valve show indications of internal leakage, the unit should be replaced or repaired. (Refer to paragraph 6-105.)

h. After completion of check, ascertain that the landing gear is down and locked, and the selector levers are at neutral. Remove the airplane from jacks.

6-25. CHECKING PRIORITY VALVE FOR INTERNAL LEAKS. (PA-23-250 [six place], Serial Nos. 27-2505 and up.) The priority valve, located in the lower right side of the control pedestal, should be removed and checked for internal leaks according to instructions given in paragraph 6-112.

6-26. CHECKING FLAP ACTUATING CYLINDER FOR INTERNAL LEAKS.

NOTE

Before the following checks can accurately be accomplished, it must be determined that the flap section of the powerpak has been checked and found not defective. (Refer to paragraph 6-18.)

a. Connect a hydraulic test unit in accordance with instructions given in paragraph 6-7. (The airplane's hand pump may be used for this check should a test unit not be available.)

b. Connect pressure gauges to the flap extension and retraction lines, at their connection, located in the access opening at the right side of the fuselage just forward of the cabin entrance door. Separate the lines, removing the union fitting and reconnect using tee fittings with gauges attached. (Refer to Diagram F, Figure 6-15 or 6-16.)

c. Operate the hydraulic test unit (or hand pump) and select flap DOWN. Allow the selector lever to return to neutral and note pressure reading over a 10 minute period.

d. After flap down check, select flap UP. Allow lever to return to neutral and note pressure reading over a 10 minute period.

e. As the selector lever returns to neutral, the pressure reading on either gauge will drop slightly and then should stabilize. Once the pressure drop has stabilized, a further drop should not be indicated. A slow decrease in pressure indicates a possible internal leak in the flap actuating cylinder.

f. Should a leak be indicated in the cylinder, the unit should be replaced or repaired.

g. After completion of check, remove the pressure gauges from the lines and reinstall union fitting. Disconnect the hydraulic test unit as described in paragraph 6-8.

6-27. ENGINE-DRIVEN HYDRAULIC PUMP(S).

6-28. PROCEDURE AFTER ENGINE-DRIVEN PUMP FAILURE. Should a pump breakage occur, there may be metal particles in the hydraulic system. To rectify this condition, the hydraulic system should be flushed. Proceed with the following steps:

a. Replace the defective engine-driven hydraulic pump and prime it in accordance with paragraph 6-34. Do not connect the pump to the rest of the hydraulic system until the system has been flushed.

b. Proceed to flush the system in accordance with paragraph 6-10.

c. Remove the filter element and check for metal particles. If metal particles are evident in the filter, clean the filter bowl with dry cleaning solvent and dry with compressed air. Install new filter element in accordance with paragraph 6-123.

6-29. REMOVAL OF ENGINE-DRIVEN PUMP.

a. Remove the engine cowl by releasing skin fasteners and screws from around the cowl, and separate the two halves.

b. Place a drip pan under the engine to catch spillage.

NOTE

If desired, to facilitate easier removal of the pump, the right magneto may be removed.

c. Disconnect the two hydraulic hoses from the pump.
d. Disconnect drain hose from bottom of pump.
e. Remove four nuts, lockwashers, and flat washers from the base of the pump.
f. Remove the pump from engine housing.
g. Upon removal of the pump from its drive pad, remove and discard the gasket from the pump mounting face. The gasket and all seal rings should be replaced with new parts upon reassembly. Never reinstall an old gasket or seal ring.

6-30. DISASSEMBLY OF ENGINE-DRIVEN PUMP. (Refer to Figure 6-17.)

NOTE

The following instructions apply only to Eastern Industries pumps, (Model 1233 HNG, Type 284), (1235 HGG, Type 263) or (1233 HNG, Type 311).

a. Clean outside of pump thoroughly.
b. Mark a line from the rear side, across the centerplate to the drive side with blue Dykem or some equivalent removable substance. This will assure proper reassembly.

CAUTION

During disassembly, do not use a screwdriver or sharp tool to separate the parts.

c. Remove the four socket head cap screws (12) securing the rear side (13), centerplate (10) and drive side (7) together. These screws are threaded into the drive side.
d. Remove the four locknuts (8) from the studs (14) extending out of the drive side flange that mates with the center plate.
e. Remove the rear side by rocking it from side to side and sliding it from the four dowels (11). In case of sticking, tap gently with a plastic or rubber hammer.
f. Remove the four studs (14) from the rear side. Remove and discard the large "O" ring seal (15) from the rear side. Pull the drive (1) and secondary shafts (17) until drive pins (16 and 2) clear gears. Remove drive pins.

g. Remove drive gear (19), secondary gear (18), and secondary shaft (17) by pulling from centerplate (10).

h. Remove drive shaft by pushing out of drive side. Remove centerplate with dowels by rocking it from side to side.

i. Remove large "O" ring seal (9) from drive side and discard.

j. Remove retainer ring (3) securing seal (4 or 5) in drive side seal bore. Note proper position of seal (4 or 5) upon disassembly. Seal must not be reversed at reassembly. Remove and discard the two part seal.

6-31. CLEANING, INSPECTION, REPAIR OF ENGINE DRIVEN PUMP.

a. Immerse and wash all metallic parts in trichlorethylene (Military Specification MIL-T-7003) or some equivalent commercial cleaning solvent. Clean all openings and passages with a fine fiber brush, or equivalent, dipped in solvent. Do not scrub any surface with a tool that will scratch surface.

WARNING

Wear goggles, rubber gloves and provide adequate ventilation when using trichlorethylene or cleaning solvents. Repeated contact of solvent with skin may produce irritation. If vapors are inhaled, serious damage may result.

b. Dry all parts thoroughly with a clean, lint-free cloth or with dry, filtered compressed air at 20 psi maximum. Blow out all parts, bores and passages with compressed air.

c. Under strong light and preferably under magnification, inspect all parts for scoring, nicks, scratches, pitting, corrosion, cracks and excessive wear. Inspect all threaded surfaces for chipping and crossed or stripped threads. Inspect parts for conformance to information given in Table VI-III. The table gives the items which should be inspected and the corrective action necessary when the pump parts do not pass this inspection.

TABLE VI-III. INSPECTION AND REPAIR, ENGINE-DRIVEN HYDRAULIC PUMP

ITEM	INSPECTION	REPAIR
Rear Side	Visually inspect the lapped face for scratches or signs of scoring.	Lap the surface to remove any scratches.
Centerplate	Visually inspect the two lapped faces for scratches or scoring. Inspect the gear pockets for deep scratches.	Lightly stone any burrs around the gear pockets. Lap the faces, but do not remove more than 0.0001 in. total of metal from both sides.
Drive Side	Visually inspect the lapped surface for scratches or signs of scoring.	Lap the surface to remove any scratches. If deep scratches are present, replace part.
Secondary Shaft	Inspect the shaft for deep scratches in the bearing area.	If deep scratches are present, replace secondary shaft.
Gears	Visually inspect gears for evidence of chipped teeth or cracks around the bore. Measure the gear O.D., which should be 1.1646/1.1644 in.	If gears are not within tolerance or if there are any cracked teeth, replace the pump.
Bearings	Visually inspect the bearing bores for scratches and/or scoring.	If badly scored, replace pump.

NOTE

The PA-23 Parts Catalog, P/N 753522, should be used to obtain repair kits to service this pump.

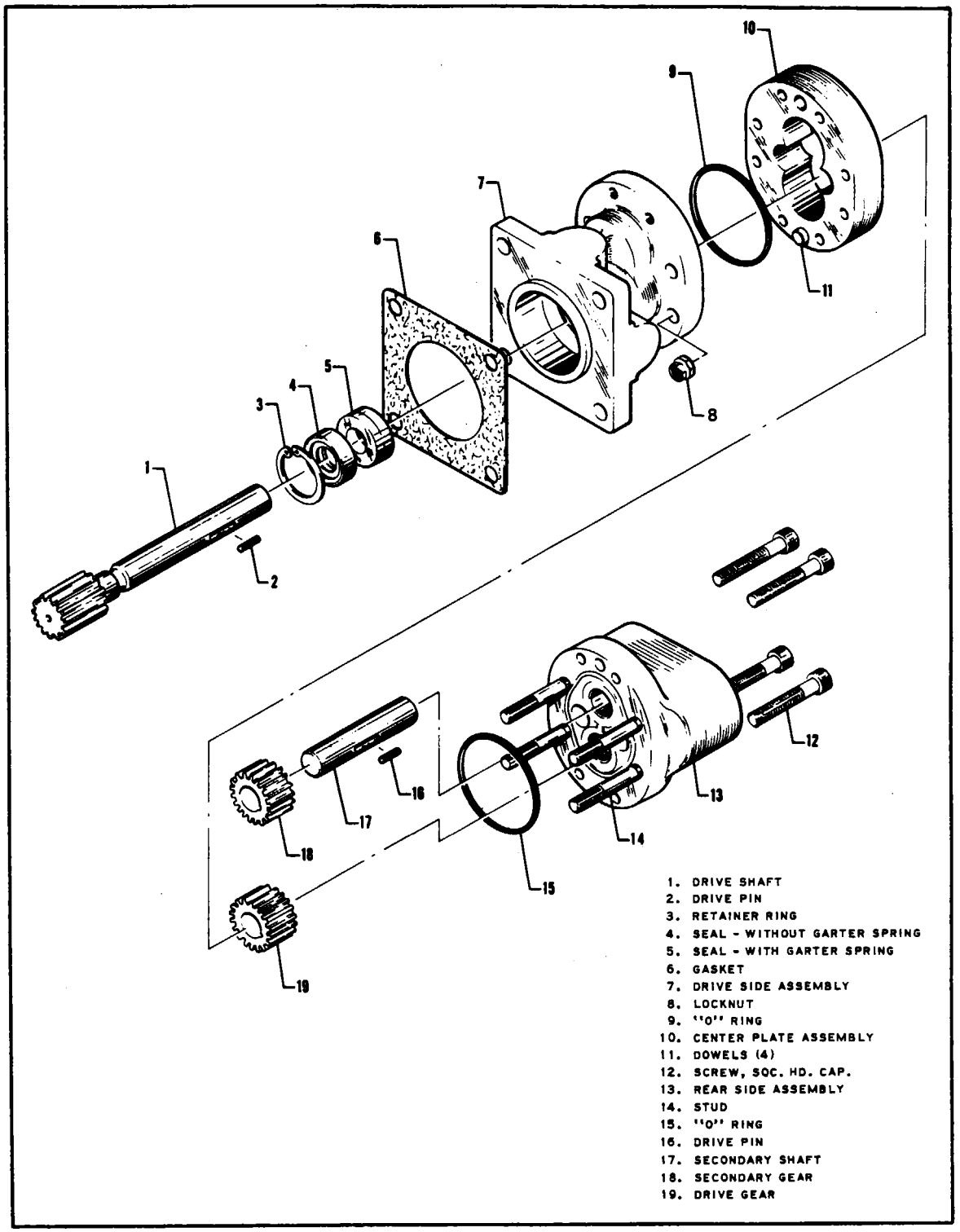


Figure 6-17. Hydraulic Pump, Exploded View

NOTE

Although the pump may still operate under conditions where some of the parts exceed the wear limits, it will probably be found that the pump is not producing its rated capacity and, therefore, the system may not be doing an adequate job. Therefore, it is necessary to repair or replace any parts that are not within the stated limits.

6-32. ASSEMBLY OF ENGINE-DRIVEN PUMP. (Refer to Figure 6-17.) The seal and seal rings should be soaked in the hydraulic (MIL-H-5606) fluid for two hours minimum time before installation.

a. Replace drive shaft seal (4 or 5) into drive side seal bore. Be sure to install drive shaft seal, "back to back", as noted during disassembly.

b. Replace retainer ring (3) into drive side seal bore.

c. Install new "O" ring seal (9) on drive side.

d. Mate centerplate assembly (10) with drive side assembly (7) and align dowel pins.

e. Install drive shaft (1) from engine side of drive side assembly.

f. Install secondary shaft (17) into centerplate. Install drive and secondary gears (19 and 18) onto drive and secondary shafts (1 and 17). Be sure the drive pin counterbore on the drive gear faces the pump rear side. Install drive pins.

g. Install the four studs (12) and new "O" ring seal (15) on the rear side assembly (13).

h. Lightly oil gear teeth with hydraulic fluid before completing assembly.

i. Mate the rear side assembly (13) with the centerplate (10), using caution to align the drive and secondary shafts with the respective holes in the rear side assembly.

j. Replace the four locknuts (8) on the studs (14) extending out of the drive side flange that mates with the centerplate.

k. Replace the four socket head cap screws (12) that secure the rear side, centerplate and drive side assemblies together. Torque the socket head cap screws and locknut to 60 inch-pounds.

l. When the pump is assembled, turn drive shaft by hand to make sure the pump turns freely. If there is any sticking or binding at all, disassemble pump and determine the trouble. Do not apply power to the pump until it turns freely by hand.

NOTE

If possible, run pump at rated speed while gradually increasing the pressure up to rated pressure by the end of the thirty minute period.

6-33. INSTALLATION OF ENGINE DRIVEN PUMP(S).

a. Place new gasket on the base of housing.
b. Install pump on the housing.

NOTE

When installing pump, keep the drain fitting facing downward.

c. Line shaft up with the gear inside of the housing.
d. Install flat washers, lockwashers and nuts on the base of pump and tighten.
e. Install the two hydraulic hoses and prime the pump before completing the hookup to the firewall fittings in accordance with paragraph 6-34.
f. Install and time magneto.
g. Check to be sure that system reservoir contains the required amount of clean fluid.
h Check all fluid lines for leaks, obstructions or restrictions.
i. Change system fluid filter in accordance with paragraph 6-123.
j. Replace cowling.
k. Run up the engine and check for leaks.

6-34. PRIMING ENGINE DRIVEN PUMP. The following instructions for priming the hydraulic pump assures that the pump will not be operated in a dry condition and shall be followed whenever a pump is serviced or replaced.

a. Remove the hydraulic suction and pressure lines from the firewall fitting and oil filter.
b. Install caps on suction and pressure fitting at the firewall and oil filter to prevent the loss of fluid prior to the hookup of the hydraulic lines.
c. Holding both lines at a level higher than the pump; pour hydraulic fluid, MIL-H-5606, into the lines.
d. Remove one cap at a time from the fittings and connect the appropriate line to the fitting, trying not to spill any of the hydraulic fluid previously put into the lines.
e. After the engine has been operated, check the hookups for leaks.

6-35. HYDRAULIC SYSTEM FAILURE. The emergency use of the hand pump or CO2 system to extend the gears is an indication the engine driven pump(s) were operating without sufficient fluid. This condition causes additional wear on the engine driven pump(s). Therefore, the filter element(s) must be removed and checked even if pump failure is not apparent and/or the primary cause of the problem.

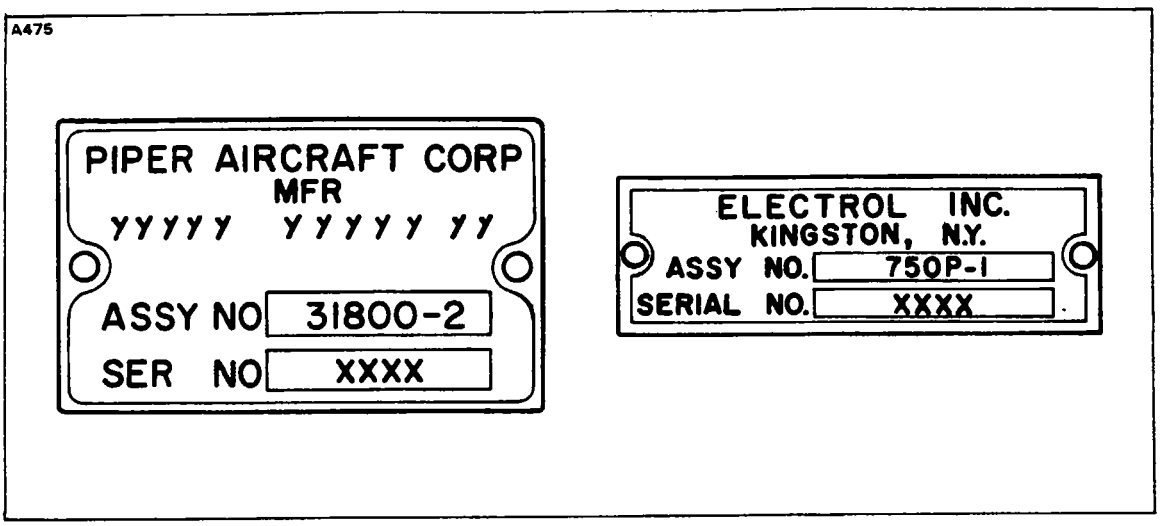


Figure 6-18. Identification of Powerpak

a. Remove the filter element(s) and check for metal particles.
b. If no metal particles are evident, proceed with the following:
   1. Replace filter element(s) per paragraph 6-123.
   2. Replenish fluid as noted in Section II.
c. If metal particles are evident in filter, proceed with the following:
   1. Inspect, replace or repair hydraulic pump. On aircraft with dual pumps both pumps must be inspected if metal particles are found in either filter. (Refer to paragraphs 6-29 to 6-33.)
   2. Prime pump(s) in accordance with paragraph 6-34. Do not connect the pump(s) to the rest of the hydraulic system until the system has been flushed.
   3. Proceed to flush the system in accordance with paragraph 6-10.

6-36. HYDRAULIC POWERPAK.

6-37. IDENTIFICATION OF POWERPAKS. The manufacturer's identification placard located on the powerpak reservoir body, as shown in Figure 6-18, should be used to determine which powerpak is in the airplane being serviced. The placard furnishes the part/model number and serial number of each unit.

6-38. REMOVAL OF POWERPAK.
a. Place the airplane on jacks. (Refer to Jacking, Section II.)
b. Lower the flaps to the full down position, using the hand pump.
c. Drain the hydraulic system by disconnecting the hydraulic extension line at the nose gear actuating cylinder and placing the end of the line in a suitable container. Move the landing gear selector to the DOWN position and operate the hand pump until the system is empty.
d. Remove the two front seats and the carpet from around the base of the control pedestal.

e. Remove the access plate from both sides of the upper section of the pedestal.

f. Disconnect the cannon plug inside the left access opening.

NOTE

On airplanes equipped with turbocharges, disconnect both cannon plugs and mark them for identification.

g. Remove the flap and landing gear selector knobs by removing the Allen screw from the flap knob and the nut and bolt from the landing gear knob.

h. Disconnect the carburetor heat or alternate air knobs on the pedestal control placard. Extend the control knob approximately one inch. Unscrew the outside knob and remove the spring. Unscrew the inside knob and the outside nut that secures the cable to the placard. (The removed cables should be marked for identification.)

i. Remove the attaching screws from around the upper pedestal control cover and remove the cover with placard attached.

j On airplanes with Serial Numbers 27-2505 and up, disconnect the voltage regulator selector switch from the lower placard panel by removing the nut which holds it to the panel.

k. On airplanes with Serial Numbers 27-2505 and up, remove the quick drain from its line coming through the lower placard panel.

l. Disconnect the cabin air controls from the lower placard panel. Extend the control knobs approximately one inch. Unscrew the outside knob and remove the spring. Unscrew the inside knob and the outside nut that connects the cables to the placard panel. (The removed cables should be marked for identification.)

m. Remove the attaching screws from the lower placard panel. On airplanes with Serial Numbers 27-1 to 27-2504 inclusive, swing the panel off to the left. On airplanes with Serial Numbers 27-2505 and up, remove the panel.

n. Disconnect the two wire leads coming through the top left forward section of the upper pedestal plate assembly.

o. On airplanes with Serial Numbers 27-2505 and up, remove the screw from the right side of the lower pedestal plate assembly that secures the priority valve to the plate.

p. Remove the attaching screws from around the outside edge of the lower pedestal plate assembly.

NOTE

It may be necessary to loosen or remove the drip pan and the spacer bar by removing the screws on both sides that hold them in place.

q. Remove the "U" shaped brace from the aft section mounting channel.

r. Remove all hydraulic lines at the powerpak. The lines should be capped or plugged to prevent dirt or dust from entering the system.

s. Remove the vent hose from the grommet at the base of the pedestal assembly.

t. Remove the attaching screws from the two mounting channels that hold the powerpak.

u. Remove the powerpak and place on a rigid base prepared for removal.

6-39. INSTALLATION OF POWERPAK.

a. Insert the powerpak, with mounting channels attached, into the pedestal and attach the channels to the top side panels.

b. Insert the vent hose into the grommet at the base of the pedestal assembly.

c. Connect all hydraulic lines to the powerpak.

d. Connect the "U" shaped brace to the bottom of the aft section mounting channel.

e. Install the lower pedestal plate assembly.

f. On airplanes with Serial Numbers 27-2505 and up, connect the priority valve to the lower pedestal plate assembly on the right side.

g. Insert the two wires from the horn through the grommet on the upper left side of the pedestal plate assembly.

h. Install the lower placard panel.

i. Connect the cabin air controls to the lower placard panel. Screw on the nut that holds the cable to the panel. Screw on the inside knob. Install the spring and screw on the outside knob.

j. On airplanes with Serial Numbers 27-2505 and up, install the quick drain on its line coming through the lower placard panel.

k. On airplanes with Serial Numbers 27-2505 and up, connect the voltage regulator switch to the lower placard panel.

l. Install the upper pedestal cover with placard attached.

m. Connect the carburetor heat or alternate air knobs. Screw on the nut that secures the cable to the placard. Screw on the inside nut. Install the spring and screw on the outside nut.

n. Install the flap and landing gear selector knobs to their respective levers.

o. Connect the cannon plug inside the left access opening.
p. Connect the hydraulic line at the nose gear actuating cylinder.
q. Fill and bleed the hydraulic system (refer to Filling Hydraulic System, Section II) and check for leaks.
r. Install the access plates on both sides of the upper section of the pedestal.
s. Install the two front seats and the carpet around the base of the pedestal.
t. Raise the flaps using the hand pump.

CAUTION

Before removing the airplane from the jacks, ascertain that landing gear is down and locked and selector levers are neutral.

6-40. OVERHAUL OF POWERPAK.

6-41. OVERHAUL INSTRUCTIONS AND PRECAUTIONS. For complete disassembly and assembly of the powerpak, refer to Figure 6-20. The procedure described in the following paragraphs is presented in such a manner that a complete or partial overhaul may be conducted.

NOTE

Before attempting to disassemble the powerpak, be sure the special tools and test equipment specified in paragraph 6-42 are available. The test equipment is necessary for checking adjusting pressures following re-assembly. Refer to paragraph 6-58 for adjustment and check procedures.

Be sure to observe the precautions listed below when overhauling the powerpak. Strict adherence to these precautions ensures a minimum of time and expense for repair of the powerpak and reduces the chance of damage to poppet and valve seats due to careless mishandling of tools. Damage to poppet or valve seats requires return of powerpak to Piper Aircraft Corporation for overhaul or exchanged.

a. Keep the unit free of all foreign matter.
b. For removal and replacement of internal snap rings, use Waldes-Kohinoor, Inc. snap ring pliers No. 1 and 3 (or equivalent).

c. Use long-nose pliers for removal and replacement of all retainer plugs, detent plungers and poppets.

d. Use a hooked tool to remove check valve, relief valve and poppet seats. (These tools may be fabricated from dimensions given in Figures 6-37 and 6-38.)

CAUTION

Use extreme care when handling poppet seats, check valves and seats, relief valve seats and bores. Damage to these parts requires returning the powerpak for overhaul.

NOTE

Poppets and seats are matched parts and must be kept together. Damage to either a poppet or a seat requires replacement of the poppet and seat subassembly.

e. It is recommended that the powerpak be mounted to a combination work and test stand. A stand of this type may be fabricated from dimensions given in Figure 6-36.

f. All threads, either straight or pipe, are right-hand twist unless otherwise noted in instructions.

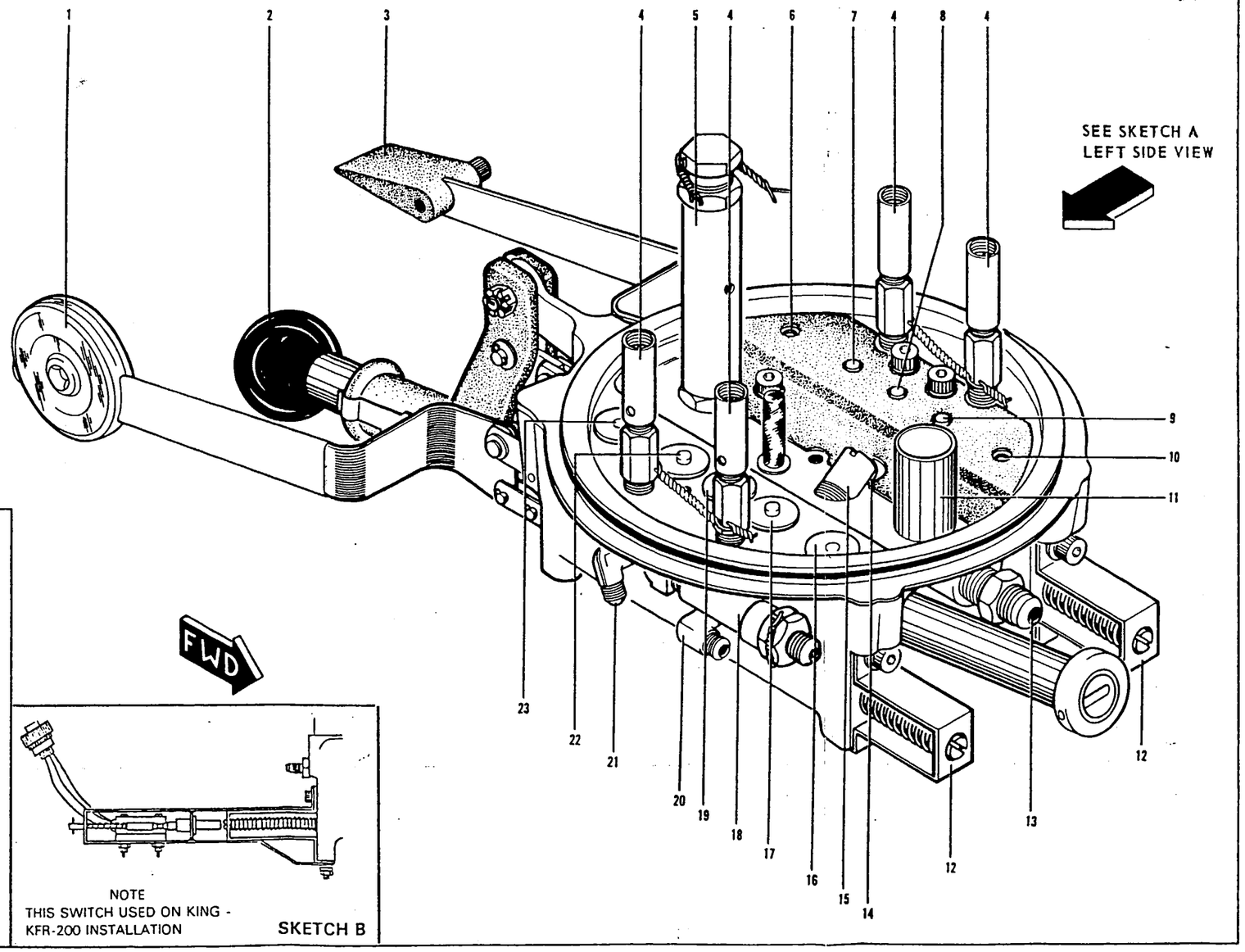
g. Prior to removal of camshafts, relieve the tension on the appropriate spring loaded detent plungers and poppets.

h. Use care when handling "O" rings. Coat "O" rings and associated parts with grease (MIL-G-4343) or hydraulic fluid before reassembly.

6-42. SPECIAL TOOLS AND TEST EQUIPMENT. Refer to Table VI-IV for special tools and test equipment required for disassembly, reassembly and testing of the powerpak.

INTENTIONALLY LEFT BLANK

1. SELECTOR LEVER, LANDING GEAR
2. EMERGENCY HAND PUMP
3. SELECTOR LEVER, FLAP
4. VALVE, THERMAL RELIEF
5. VALVE, MAIN RELIEF
6. POPPET ASSY, RETURN, FLAP RETRACTION
7. POPPET ASSY, PRESSURE, FLAP EXTENSION
8. POPPET ASSY, PRESSURE, FLAP OPEN CENTER
9. POPPET ASSY, PRESSURE, FLAP RETRACTION
10. POPPET ASSY, RETURN, FLAP EXTENSION
11. RESERVOIR STAND PIPE
12. SPRING ASSY, CAMSHAFT RETURN
13. SUCTION PORT, TO PUMP
14. CAMSHAFT DETENT ASSY, FLAP
15. CAMSHAFT DETENT ASSY, LANDING GEAR
16. POPPET ASSY, RETURN, GEAR RETRACTION
17. POPPET ASSY, PRESSURE, GEAR EXTENSION
18. CHECK VALVE, MAIN
19. POPPET ASSY, PRESSURE, GEAR OPEN CENTER
20. PRESSURE PORT, GEAR EXTENSION
21. PRESSURE PORT, GEAR RETRACTION
22. POPPET ASSY, PRESSURE, GEAR EXTENSION
23. POPPET ASSY, RETURN, GEAR RETRACTION
24. PRESSURE PORT, FLAP RETRACTION
25. PRESSURE PORT, FLAP EXTENSION
26. IDENTIFICATION PLACARD



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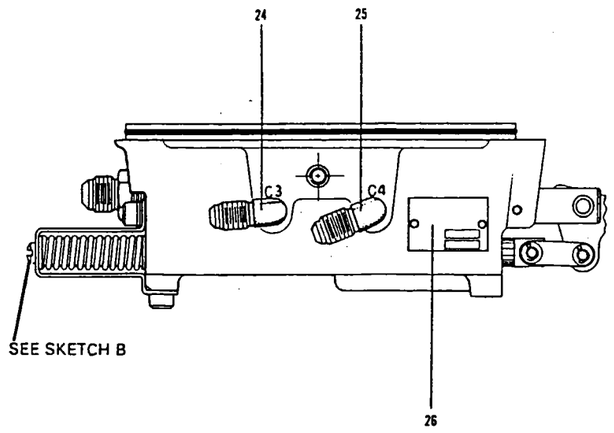


SKETCH A

NOTE
THIS SWITCH USED ON KING - KFR-200 INSTALLATION

SKETCH B

31600

Figure 6-19. Location of Powerpak Components

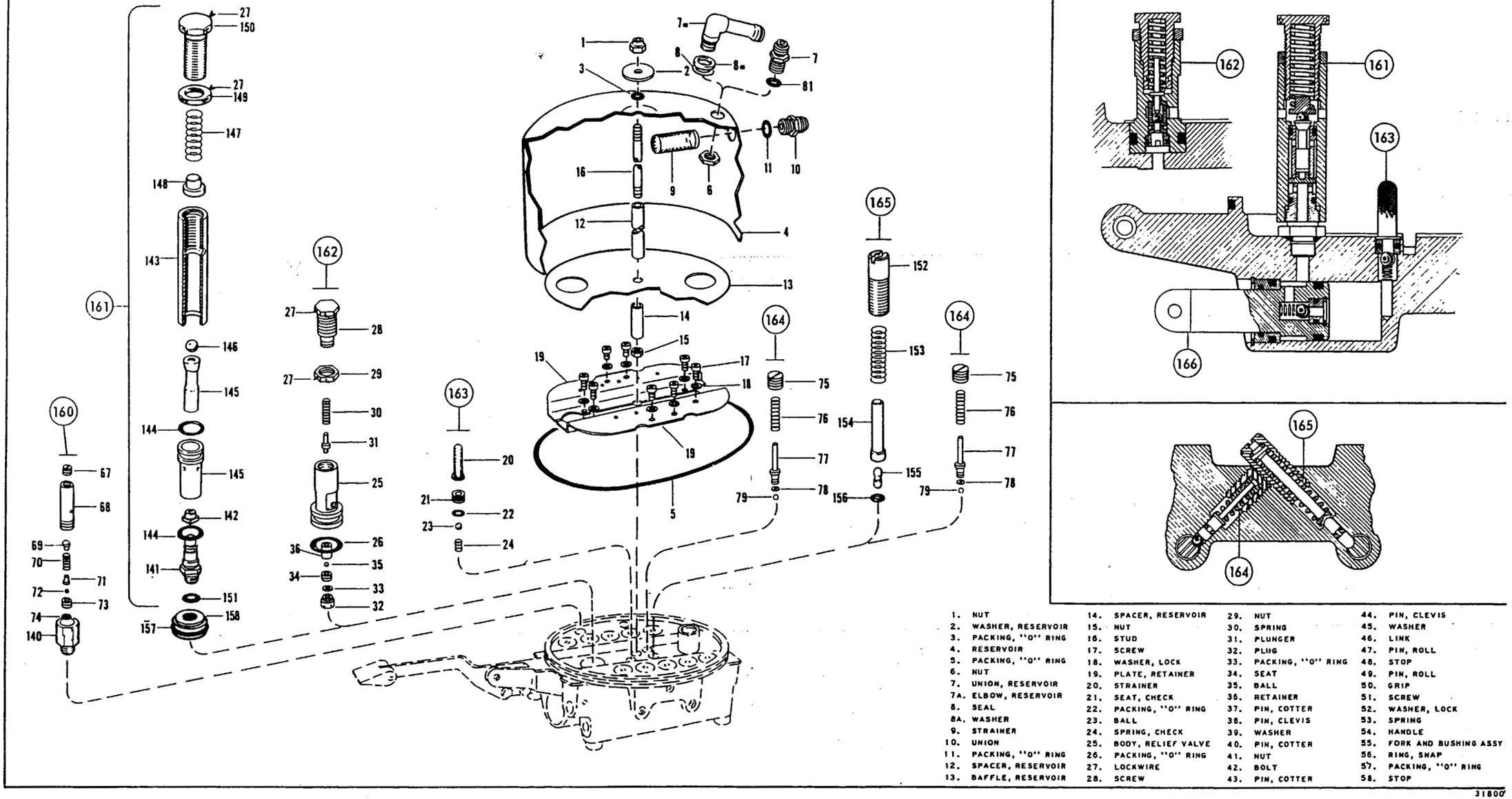
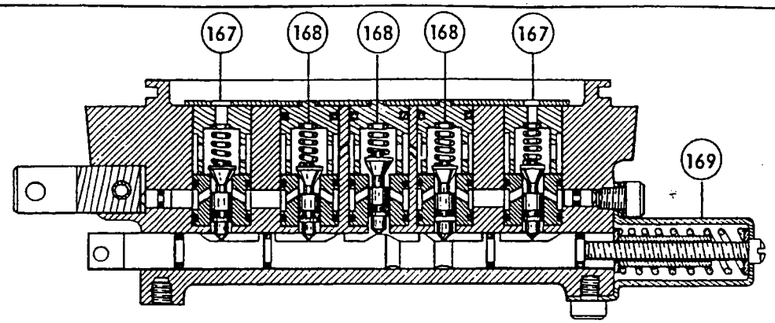


Figure 6-20. Hydraulic Powerpak, Exploded View



59. PACKING, "O" RING
60. PISTON
61. PACKING, "O" RING
62. RING, SNAP
63. PACKING, "O" RING
64. SEAT, CHECK
65. BALL
66. SPRING, CHECK
67. SCREW ASSY
68. BODY
69. RETAINER, UPPER
70. SPRING
71. RETAINER, LOWER
72. BALL
73. SEAT
74. PACKING, "O" RING
75. PLUG
76. SPRING
77. PLUNGER
78. PACKING, "O" RING
79. BALL
80. RETAINER, RETURN
81. PACKING, "O" RING
82. SPRING
83. PACKING, "O" RING
84. POPPET AND SEAT ASSY
85. PACKING, "O" RING
86. PACKING, "O" RING
87. RETAINER, PRESSURE
88. PACKING, "O" RING
89. SPRING
90. PACKING, "O" RING
91. POPPET AND SEAT ASSY
92. PACKING, "O" RING
93. PACKING, "O" RING
94. PIN, COTTER
95. WASHER
96. PIN, CLEVIS
97. LINK
98. PIN, COTTER
99. WASHER
100. WASHER
101. PIN, CLEVIS
102. NUT, LOCK
103. BOLT
104. KNOB, LANDING GEAR
105. PIN, ROLL
106. TUBE, LEVER
107. LEVER, LANDING GEAR
108. TERMINAL BLOCK AND WIRE ASSY
109. LEVER
110. SCREW
111. WASHER
112. KNOB, WING FLAP
113. PIN, ROLL
114. STUD
115. PLUG
116. PACKING, "O" RING
117. SCREW
118. WASHER, LOCK
119. WASHER
120. RETAINER
121. PLUG
122. PACKING, "O" RING
123. SCREW
124. WASHER
125. SPRING
126. SPACER
127. WASHER
128. CAMSHAFT
129. PACKING, "O" RING
130. END FITTING
131. GASKET
132. PACKING
133. POPPET
134. SPRING
135. BODY
136. ELBOW
137. PIPE, STAND
138. BODY
139. PLUG
140. HEAD, THERMAL RELIEF VALVE
141. END FITTING
142. RETAINER
143. BODY
144. "O" RING
145. POPPET ASSY
146. BALL
147. SPRING
148. GUIDE
149. NUT
150. CAP
151. PACKING, "O" RING
152. GEAR DETENT CAP
153. SPRING
154. DETENT SPRING GUIDE
155. PLUNGER DETENT
156. PACKING
157. PACKING, "O" RING
158. ADAPTER, RELIEF VALVE
159. NOT ASSIGNED
160. THERMAL RELIEF VALVE ASSY
161. MAIN RELIEF VALVE ASSY
162. MAIN RELIEF VALVE ASSY
163. HAND PUMP SUCTION VALVE ASSY
164. CAMSHAFT RELEASE DETENT ASSY
165. CAMSHAFT RELEASE DETENT ASSY
166. HAND PUMP ASSY
167. POPPET ASSY, RETURN
168. POPPET ASSY, PRESSURE
169. CAMSHAFT AND RETURN SPRING ASSY
170. MAIN CHECK VALVE ASSY

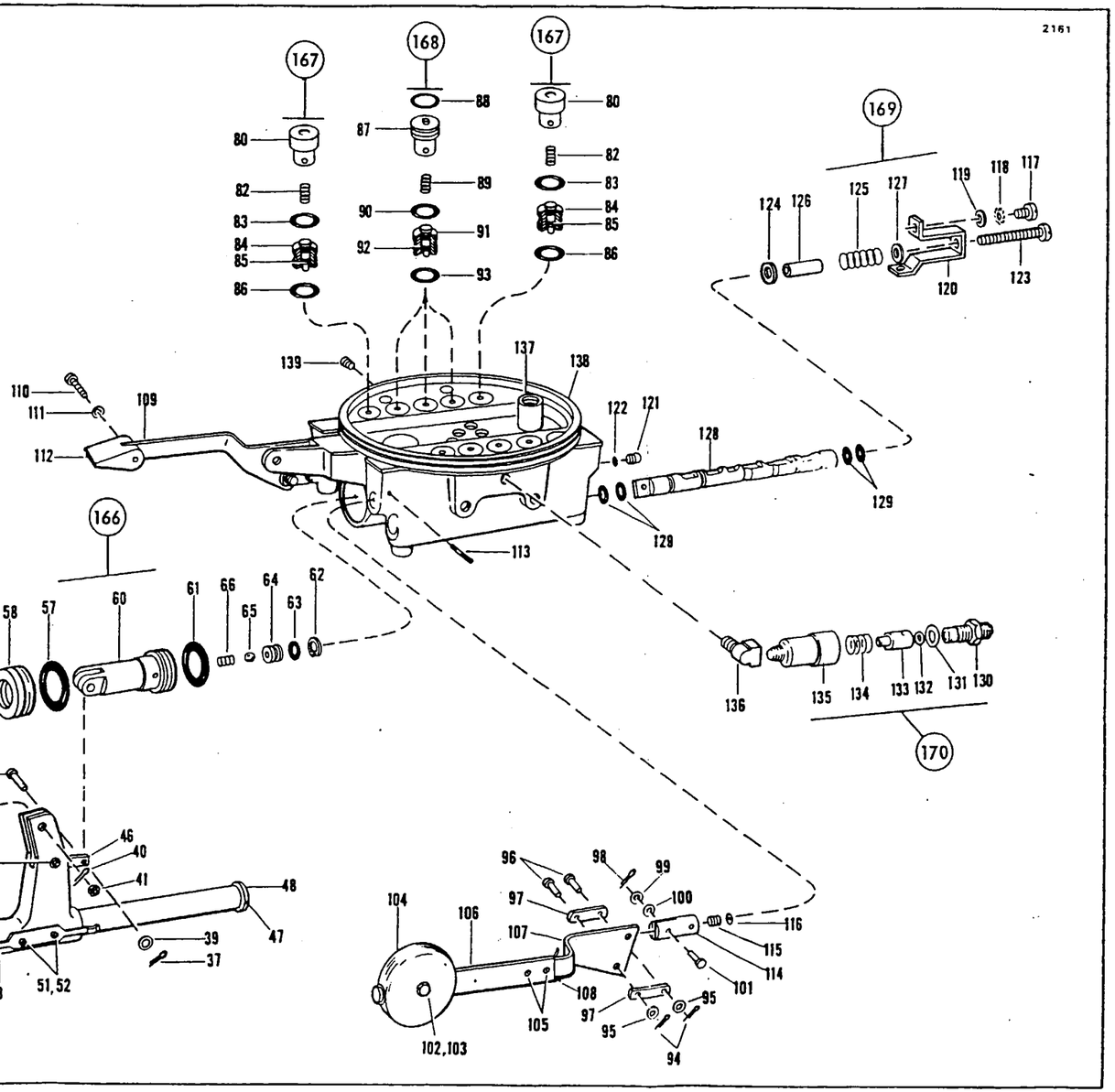


Figure 6-20. Hydraulic Powerpak, Exploded View (cont.)

TABLE VI-IV. SPECIAL TOOLS AND TEST EQUIPMENT

Nomenclature	Part No.	Manufacturer
Retaining Ring Pliers or equivalent	Cat. No. 1	Waldes-Kohinoor, Inc. 47-16 Austel Place Long Island City 1, N.Y. 11101
Retaining Ring Pliers or equivalent	Cat. No. 3	Waldes-Kohinoor, Inc. 47-16 Austel Place Long Island City 1, N.Y. 11101
Piper Hydraulic Test Unit or equivalent	753 080	Piper Aircraft Corporation Lock Haven, Pa. 17745
Actuating Cylinder, 2 reqd. (double acting, 1-1/4 in. ID x 8-in. stroke)	31870-02	Piper Aircraft Corporation Lock Haven, Pa. 17745
Speed Control Valve, 4 reqd. (adjusted for 300-400 psi back pressure)	CA111-5	Canfield Supply Comp. 17 Dederick Street Kingston, New York
Pressure Gage, 4 reqd. (2000 psi, 2-in. dial)		Standard
Reservoir, Open Top	31827-00 (Mod.)	Piper Aircraft Corporation Lock Haven, Pa. 17745

6-43. DISASSEMBLY OF POWERPAK.

6-44. REMOVAL OF RESERVOIR, BAFFLE AND PLATES. (Refer to Figure 6-20.)

a. Remove the self-locking nut (1), washer (2) and "O" ring (3) from the top of the powerpak reservoir (4).

b. Remove the powerpak reservoir. The reservoir is held by a snug fit, and can be removed by grasping it firmly on both sides and applying a steady twisting and lifting force.

c. Remove the "O" ring (5) from around the powerpak body (138).

d. Remove the safety wire (27) from around the upper reservoir spacer (12) and main relief valve (161 or 162).

e. Remove the safety wire from between the thermal relief valves (160).

f. Remove the baffle (13) and lower spacer (14).

NOTE

Before disassembling the powerpak further, any checks and/or adjustments should be accomplished at this time. (Refer to paragraph 6-58.)

g. Remove the stud (16) and nut (15). To assist in removal of the stud, install two nuts at the top; lock one against the other and remove with a wrench on the lower of the two nuts.

h. Remove one or both retainer plates by removing screws (17) and washers (18) securing the plate(s) to the powerpak body.

CAUTION

When removing the retainer plates, use caution that the poppet retainers and springs do not "fly" from their ports.

NOTE

On powerpaks with part numbers 31800-2 and 31800-3, it may be necessary to loosen the main relief valve (162) before the retainer plates can be lifted from the powerpak body.

6-45. REMOVAL AND DISASSEMBLY OF MAIN RELIEF VALVE. (Refer to Figure 6-20.) Two style relief valves are used with the various model powerpaks. Powerpaks with part numbers 750P-1 and 31800-0 incorporate the shorter valve (162) of the two shown, while those with part numbers 31800-2, 31800-2M and 31800-3 incorporate the taller valve (161). An adapter (158) is used with the taller valve in powerpak, part number 31800-2M.

a. The main relief valve (162) in powerpaks with part numbers 750P-1 or 31800-0 may be removed and disassembled as follows:

1. Ascertain that the retainer plates (19) have been removed.
2. Lift the valve assembly from the powerpak body.
3. Remove the "O" ring (26) from the valve body (25).
4. Support the valve body in an upside down position and with a 3/16 Allen wrench, remove plug (32) from the bottom of the body.
5. Loosen the jam nut (29) and remove the valve adjusting screw (28).
6. Remove the spring (30) and plunger (31) from the top of the body.
7. With a 0.25 inch aluminum rod inserted into the top of the body, push out the seat (34) with "O" ring (33), check ball (35) and retainer (36).

b. The main relief valve (161) in powerpaks with part numbers 31800-2, 31800-2M and 31800-3 may be removed and disassembled as follows:

1. Ascertain that the retainer plates (19) have been removed.
2. Note if the valve is fitted with an adapter (158) in the powerpak body, and if so, lift the valve assembly from the body. A valve without an adapter installed will require removal by turning a wrench affixed to the hexagon surface of the end fitting (141) at the base of the assembly.
3. If installed, and only if necessary, remove the adatper from the end fitting.
4. If an adapter has been installed, remove the "O" ring (157) from the adapter.
5. Remove the "O" ring (151) from the base of the end fitting.
6. Loosen the jam nut (149) and remove the valve adjusting cap (screw) (150).
7. Remove the spring (147), guide (148), ball (146) and poppet (145) from the top of the valve body (143).
8. Support the end fitting and remove the valve body from the fitting by inserting an aluminum rod, 0.187 of an inch, through the holes in the body and turning it from the fitting.
9. Remove the "O" ring (144) from the fitting.
10. From the inside of the body, remove the retainer (142) and poppet seat (145). An aluminum rod, 0.375 of an inch, may be inserted through the top of the body to push out the seat.
11. Remove the "O" ring from the poppet seat.

NOTE

The poppet and seat assembly (145) is a matched set. If necessary to replace, replace as a set only.

6-46. REMOVAL AND DISASSEMBLY OF THERMAL RELIEF VALVES. (Refer to Figure 6-20.) Four identical valve assemblies (160) are installed in the powerpak; each is removed and disassembled by the following procedure:

a. Cut safety wire attached to the valve.

b. To disassemble the valve assembly, first remove the adjusting screw (67) from the top of the valve body (68).

c. Remove the upper spring retainer (69) and spring (70). The retainer may be lifted from the valve body with a small amount of grease on a small stick or rod.

d. Remove the valve body by inserting a brass rod, 0.156 of an inch, through the holes in the body and turning it from the powerpak body or head (140), whichever applies.

e. Remove the lower spring retainer (71) and ball (72).

f. Remove the valve seat (73) by inserting a fabricated hooked tool into the port hole in the seat and pulling it from the powerpak body or head. (A tool may be fabricated from dimensions given in Figure 6-37.)

g. Remove the "O" ring (74) from the seat.

h. If installed, and only if necessary, the valve head (140) may be removed. Use caution not to damage or crush the head.

6-47. REMOVAL OF CAMSHAFT RELEASE DETENT ASSEMBLIES. (Refer to Figure 6-20.) The two detent assemblies found in the various model powerpaks will be either alike or different in design; this being determined by the model of the powerpak. Powerpaks with part numbers 750P-1 and 31800-0 incorporate the like detent assemblies depicted by call out number 164, while those with part numbers 31800-2, 31800-2M and 31800-3 incorporate one of 164 and one of the later design, used only for the landing gear release, and this is depicted by call out 165. When removing the assemblies, it will be noted that the later assembly (165) must be removed before the earlier or shorter detent assembly (164) can be removed.

a. The later or longer design detent assembly (165) may be removed as follows:

1. Turn the adjusting cap (152) from the powerpak body (138).
2. Remove the spring (153) and spring guide (154) from the port.

3. Remove the plunger detent (155). To facilitate removal of the detent, affix an air hose to the port marked C1 at the right side of the powerpak body and select gear up. Apply air pressure slowly, plug any air leaks and allow the air pressure to push the detent from the port. Place a rag over the port to catch the detent should it leave the port with force. (If the camshaft is removed, apply pressure directly to the port from where the shaft was removed.)

4. Remove the "O" ring (156) from the detent.

b. The earlier or shorter design detent assembly (164) may be removed as follows:

1. Turn the adjusting plug (75) from the powerpak body.
2. Remove the spring (76) and plunger (77) from the port.
3. Remove the "O" ring (78) from the plunger.
4. Remove the ball (79) from the detent. Turn the powerpak upside down to allow the ball to drop out (Use caution that no other parts drop out unintentionally.) or use air pressure applied to port C1 or C4 of the powerpak body and with the selector lever up.

6-48. REMOVAL OF POPPETS AND SELECTOR CAMSHAFTS. (Refer to Figure 6-20.) The arrangement of the poppet assemblies (167 and 168) and selector camshaft assembly (169) is identical for both the landing gear or flap sections of the powerpak. The instructions that follow may be used when working with either section.

CAUTION

Do not mix parts. When removing the various components of the powerpak, keep them in order. The poppet and seat assemblies (84 and 91) are matched sets and should be replaced as a set.

a. Ascertain that the reservoir (4), baffle (13) and plates (19) have been removed in accordance with paragraph 6-44.

b. Ascertain that the camshaft release detent assemblies have been removed in accordance with instructions given in paragraph 6-47.

c. The pressure poppet assemblies (168) that control either the landing gear or flap may be removed as follows:

1. Remove the poppet retainer (87) from the port. Movement of the selector lever through its full travel should move the retainer up from its position in the port.
2. Remove the "O" ring (88) from the retainer.

3. Remove the poppet return spring (89) from the port.

4. Remove the poppet from the poppet seat by lightly gripping the tang on the top of the poppet with a pair of long nose pliers and, while applying a steady pulling force, bring the poppet from the seat.

5. Remove the "O" ring (92) from the poppet.

6. Remove the poppet seat from the port by inserting a tool, fabricated of aluminum, down into the hole in the seat and allowing the hooks of the tool to enter the flow passages. (The tool may be fabricated from dimensions given in Figure 6-38.) Applying a steady pulling force, bring the seat up from the port.

7. Remove the "O" rings (90 and 93) from the seat.

8. Place the poppet back into the seat. Each poppet and seat is a matched set and must be kept together to insure proper operation.

9. The remaining pressure poppet assemblies may be removed, as required, using the same procedure as above.

d. The return poppet assemblies (167) for either the landing gear or flap sections may be removed as follows:

1. Remove the poppet retainer (80) from the port. Movement of the selector through its full travel should move the retainer up from its position in the port.

2. Remove the poppet return spring (82) from the port.

3. Remove the poppet from the poppet seat by lightly gripping the tang on the top of the poppet with a pair of long nose pliers and, while applying a steady pulling force, bring the poppet from the seat.

4. Remove the "O" ring (85) from the poppet.

5. Remove the poppet seat from the port by inserting the tool down into the hole in the seat and allowing the hooks of the tool to enter the flow passages. Applying a steady pulling force, bring the seat from the port.

6. Remove the "O" rings (83 and 86) from the seat.

7. Place the poppet back into the seat.

8. The remaining return poppet assemblies may be removed, as required, using the same procedure as above.

e. The selector levers, either the landing gear or flap, may be removed from the powerpak as follows:

1. Disconnect the selector lever (107 or 109) from the camshaft (128) at the links (97) by removing cotter pin (94), washer (95) and clevis pin (96).

2. Separate the lever from the stud (114) by removing cotter pin (98), washers (99 and 100) and clevis pin (101).

3. The stud may be removed by driving the roll pin (113) from the body and stud with a 3/16 inch punch. (This operation need not be accomplished during cleaning and/or replacement of other components. Normally, only when replacing a damaged stud or an "O" ring (116) on the plug (115).)

4. The forward plug (115) or aft plug (121) may be removed by inserting a soft aluminum wire into either the forward or aft return port and pushing it from the body. To remove the aft plug, it will first require that the spring retainer attaching screw (117) be removed. (It is not recommended either plug be removed unless an external leak around the plug area has been observed.) Remove "O" ring (116 or 122) from plug.

f. The landing gear or flap selector camshaft assembly (128) may be removed as follows:

1. Remove the spring retainer (120) by removing attaching screw (117) and washers (118 and 119). At the lower attachment point, temporarily remove the screw holding the powerpak to the work stand.

2. Remove the return spring (125), spacer (126) and washers (124 and 127) by turning the retaining screw (123) from the camshaft. (Should there be more than two washers (124 and 127) installed on each adjusting screw, note and replace with the same amount.)

3. Remove the camshaft (128) by grasping the selector attachment end with pliers and pulling while rotating it from the body.

4. Remove the "O" ring (129) from the camshaft.

6-49. REMOVAL AND DISASSEMBLY OF HAND PUMP. (Refer to Figure 6-20.)

a. Remove the hand pump handle assembly from the powerpak as follows:

1. Disconnect the link (46) from between the fork (55) and piston (60) by removing cotter pin (37), washer (39) and clevis pin (38).

2. Disconnect the fork from the powerpak housing (138) by removing cotter pin (40), nut (41) and bolt (42).

b. The pump piston assembly may be removed and disassembled as follows:

1. Remove the snap ring (56), that holds the assembly in the powerpak body, from the annular slot in the body.

2. Pull the piston assembly from the body.

3. Withdraw the stop gland (58) with "O" rings (57 and 59) from the piston (60).

4. Remove the piston valve assembly from the piston by removing the snap ring (62), seat (64) with "O" ring (63), check ball (65) and spring (66).

c. The suction valve assembly (163) may be removed as follows:

1. Ascertain that the reservoir (4), baffle (13) and plates (19) have been removed in accordance with paragraph 6-44.

2. Lift the strainer (20) from the housing.

3. Using a small hook fabricated from aluminum rod, pull the seat (21) from the body.

4. Remove "O" ring (22) from the seat.

5. Withdraw the check ball (23) and spring (24) from the body.

6-50. CLEANING, INSPECTION AND REPAIR OF POWERPAK.

a. Discard all old "O" rings and gaskets.

b. Clean all parts with a dry type cleaning solvent (Federal Specification P-S-661 or equivalent) and dry with filtered compressed air.

NOTE

The conditions at repair require cleanliness, carefulness and proper handling of parts to prevent entrance of foreign materials or prevent damage.

c. Inspect all parts for scratches, scores, chips, cracks and indications of excess wear.

d. Service wear limits for components of the powerpak may be found in Table VI-VIII at the back of this section.

e. If the selector lever release detent adjusting plug or cap has been staked to prevent it from rotating, it will be required that the hole be cleaned with a 1/2-20NF-3 tap. Flush body with solvent to remove any metal chips.

f. Repairs are limited to replacement of parts, "O" rings and gaskets.

g. The parts catalog should be used to obtain the proper parts for the powerpak being serviced.

6-51.. ASSEMBLY OF POWERPAK.

6-52. ASSEMBLY AND INSTALLATION OF HAND PUMP. (Refer to Figure 6-20.)

a. The piston assembly may be assembled and installed as follows:

1. Place an "O" ring (63) on the check seat (64).

2. Insert into the piston (60), in order, the check ball spring (66), check ball (65) and seat. Note the two lands on the seat; the thicker land must be inserted into the piston first or next to the ball.

3. Secure the seat with snap ring (62).

4. Place an "O" ring (61) on the piston.

5. Insert the piston into the port provided in the powerpak body.

6. Install "O" rings (57 and 59) on and in the piston stop gland (58).

7. Slide the stop gland over the end of the piston and into the port.

CAUTION

The stop gland must be installed on the piston with the outside "O" ring forward or first.

8. Secure stop gland in position by inserting a snap ring (56) into the annular slot.

b. The hand pump handle may be installed as follows:

1. Position the pump handle fork (55) to the powerpak and secure with bolt (42), nut (41) and cotter pin (40).

2. Attach the fork with the piston using link (46) and secure with clevis pin (38), washer (39) and cotter pin (37).

c. The suction valve assembly (163) may be installed as follows:

1. Place into the suction port in the powerpak body, the spring (24) and check ball (23).

2. Place an "O" ring (22) on the check seat (21).

3. Insert the check seat into the suction port. Note the two lands on the seat, the thicker land must be inserted into the port first or next to the ball.

4. Position the strainer (20) in place on the powerpak body.

5. If no other assembly and/or adjustments are required, install the plates (19), baffle (13) and reservoir (4) in accordance with instructions in paragraph 6-57.

6-53. INSTALLATION OF POPPETS AND SELECTOR CAMSHAFTS. (Refer to Figure 6-20.) The procedure for the installation of the poppet assemblies (167 and 168) and the camshaft assembly (169) for either the landing gear or flap sections of the powerpak is identical, unless otherwise noted in the instructions to follow. It is recommended that before commencing with this assembly, the overhaul precaution in paragraph 6-41 be reviewed.

a. The landing gear or flap selector camshaft assembly (169) may be installed as follows:

NOTE

The landing gear and flap camshafts are not identical. For identification purposes, the landing gear shaft is stamped with the letter "R" on its aft or selector lever attachment end. The flap camshaft is stamped with the letter "L".

1. Place two "O" rings (129) on the aft end of the camshaft (128).
2. Insert the forward end of the camshaft into the aft end of the powerpak body by applying a steady pushing and rotating pressure. Allow the forward end of the shaft to extend through the body far enough to expose the two forward "O" ring grooves in the shaft.
3. Place the two remaining "O" rings (129) on the shaft.
4. Push the camshaft back into the body until the end of the shaft is flush with the surface of the body. Ascertain that the lobes of the shaft are up.
5. Assemble onto the retaining screw (123), in order, a washer (127), spacer (126), spring (125) and remaining washer (124). (If an additional washer was installed, install that washer also.)
6. Turn the screw with attachments into the end of the camshaft.
7. Place the spring retainer (120) over the end of the screw and secure it at the top with flat washer (119), lockwasher (118) and screw (117). Secure the bottom of the retainer with the screw that also attaches the powerpak to the work stand.
8. Adjust the camshaft return spring by first setting the camshaft at neutral. (Neutral position is when the forward end of the camshaft is flush with the powerpak body.) Next, turn the retaining screw in until a gap exists between the aft washer (127) and spring retainer, and then back out until the washer just contacts the retainer.

b. The landing gear or flap selector lever may be installed as follows:

1. If plug (115 or 121) from the flow passage was removed, install an "O" ring (116 or 122) on the plug and insert it into the open port where required. The flat end of the plug is inserted first.

2. Install the selector lever attaching stud (114) by inserting it into the port provided, aligning the holes in the plug and body and securing with roll pin (113).

3. Attach the selector lever (flap to left side and landing gear to right side of powerpak) to the stud and secure with clevis pin (101), washers (99 and 100) and cotter pin (98).

NOTE

Determine that the lobes of the shaft are up before proceeding further.

4. Attach the links (97) with the lever to the camshaft using clevis pin (96), washer (95) and cotter pin (94).

5. Place the selector lever at neutral.

c. The return poppet assemblies (167) for either the landing gear or flap sections of the powerpak may be installed as follows:

1. Place an "O" ring (85) on the poppet of the poppet seat assembly (84).

2. Place "O" rings (83 and 86) on the outside of the poppet seat.

3. Install the poppet into the poppet seat. The poppet must be assembled with the flow passages of the seat pointing toward the head of the poppet as viewed from the outside of the seat.

4. Insert the poppet seat assembly (84) into the port provided in the powerpak until it bottoms.

NOTE

The poppet seat assembly must be installed with the flow passages pointing upward as viewed from the outside of the seat.

5. Position the spring (82) on the head of the poppet. Determine that the spring surrounds the tang on the poppet.

6. Insert the poppet retainer (80) into the port allowing it to align and bottom.

d. The pressure poppet assemblies (168) for either the landing gear or flap sections of the powerpak may be installed as follows:

1. Place an "O" ring (92) on the poppet of the poppet seat assembly (91).
2. Place "O" rings (90 and 93) on the outside of the poppet seat.
3. Install the poppet into the poppet seat. The poppet must be assembled with the flow passages of the seat pointing toward the head of the poppet as viewed from the outside of the seat.
4. Place an "O" ring (88) on the poppet retainer (87).
5. Insert the retainer into the port allowing it to align and bottom.

e. If no other assembly and/or adjustments are required, install the retainer plates (19) in accordance with instructions in paragraph 6-57.

6-54. INSTALLATION OF CAMSHAFT RELEASE DETENT ASSEMBLIES. (Refer to Figure 6-20.) Powerpaks with part numbers 750P-1 and 31800-0 require two like detent assemblies as depicted by callout 164, while those with part numbers 31800-2, 31800-2M and 31800-3 require one each of detent assembly 165 and assembly 164.

a. Ascertain that the threads within the ports that receive the detent cap or plug have been retaped and cleaned. This is required if the cap or plug was staked in place during previous assembly.

b. If the camshaft (128) is not installed, install in accordance with instructions given in paragraph 6-53.

c. The earlier or shorter design detent assembly (164) may be installed into left (flap) port or, if applicable, into the right (gear) port of the powerpak body, as follows:

1. Insert the detent ball (79) into the detent port.
2. Place an "O" ring (8) on the plunger (77).
3. Insert the plunger and spring (76) into the port.
4. Turn the plug (75) into the port until its top is flush with the top of the port.

d. The later or longer design detent assembly (163) may be installed into the right (gear) port as follows:

1. Place an "O" ring (156) on the plunger detent (155).
2. Insert the detent, spring guide (154) and spring (153) into the port.
3. Place the adjusting cap (152) over the spring and turn the cap into the port.

e. Check and adjust either assembly in accordance with instructions given in paragraph 6-63.

f. After completion of adjustment, lightly stake the body next to the cap or plug to prevent it from turning.

6-55. ASSEMBLY AND INSTALLATION OF THERMAL RELIEF VALVES.

a. Place the "O" ring (74) on the valve seat (73).

b. Insert the valve seat into the powerpak body or valve head (140), whichever applies. The end of the seat with the port countersunk or bored larger is inserted first or toward the powerpak body or base of the head.

c. If applicable, secure the head into the powerpak body.

d. Turn the valve body (68) into the powerpak body or until it bottoms against the seat. Turn by inserting a 0.156 rod through the holes in the body.

e. Insert into the top of the body, in order, the ball (72), lower spring retainer (71), spring (70) and upper retainer (69).

f. Turn the adjusting screw (67) into the top of the valve body (68). Pre-set the valve by turning the cap in until its top is approximately 0.156 of an inch below the top of the body.

g. Check and adjust the valve in accordance with instructions in paragraph 6-62.

h. After completion of adjustment, safety as explained in paragraph 6-57.

6-56. ASSEMBLY AND INSTALLATION OF MAIN RELIEF VALVE. (Refer to Figure 6-20.)

a. The main relief valve (162) for powerpaks with part numbers 750P-1 and 31800-0 may be assembled and installed as follows:

1. With the valve body (25) supported in the upside down position, insert the retainer (36) into the base end of the body. The end of the retainer with the small hole is inserted first.

2. Install an "O" ring (33) on the valve seat (34).

3. Insert the check ball (35) and valve seat into the base end of the body. A countersink has been machined into the port at one end of the seat; this end is installed away from the check ball.

4. Install the plug (32) into the base of the valve, small end first, and using 3/16 Allen wrench, torque to 25 inch pounds. If the plug turns into the base and bottoms with no drag, due to worn camlock inserts, a new plug must be installed.

5. Insert the plunger (31), small diameter end first, into the top of the valve body and ascertain that the end of the plunger positions itself into the retainer (36).

6. Insert the valve spring (30) into the body.

7. Twist the jam nut (29) on the valve adjusting screw (28), and install the screw over the exposed end of the spring and into valve body.

8. Place an "O" ring (26) on the base of the valve.

9. Push the base of the valve into the port provided in the powerpak base and allow to bottom.

10. If the retainer plates (19) can be installed at this time, do so as explained in paragraph 6-57.

11. Check and adjust the valve in accordance with instructions given in paragraph 6-61.

12. After completion of adjustment, safety as explained in paragraph 6-57.

b. The main relief valve (161) for powerpaks with part numbers 31800-2, 31800-2M and 31800-3 may be assembled and installed as follows:

1. Place an "O" ring (144) on the poppet and seat assembly (145).

2. Insert the small end of the square based retainer (142) into the end of the poppet seat opposite the "O" ring.

3. With the valve body (143) supported in an upside down position, install the poppet and seat assembly with retainer into the base of the body. The end of the seat with the "O" ring is inserted first.

4. Place an "O" ring (144) on the end fitting (141).

5. Install the end fitting into the valve body and tighten finger tight. Rotate the body end for end, support, and tighten with an aluminum rod (0.187) inserted through the holes in the valve body until the retainer bottoms against the fitting.

6. Install the ball (146) and guide (148) with spring (147) into the body.

7. Twist the jam nut (149) on the valve adjusting cap (screw) (150) and install the cap over the exposed end of the spring and into the valve body. Pre-set the valve by turning the adjusting cap in until a dimension of approximately 4.165 inches overall is obtained.

8. Place an "O" ring (151) on the end fitting.

9. If an adapter (158) is required with the valve, install it on the valve. Place an "O" ring (157) on the adapter.

10. Install the valve. Valves with an adapter, push the assembly into the port provided in the powerpak base and allow it to bottom. Valves without adapters will require twisting into the base. (On powerpaks with part numbers 31800-2 and 31800-3, it may be necessary to install the valve after the retainer plates have been installed.)

11. If the retainer plates (19) can be installed at this time, do so as explained in paragraph 6-57.

12. Check and adjust the valve in accordance with instructions given in paragraph 6-61.

13. After completion of adjustment, safety as explained in paragraph 6-57.

6-57. INSTALLATION OF RESERVOIR, BAFFLE AND PLATES. (Refer to Figure 6-20.) Before installing retainer plates and baffle, check that the main relief valve (161 or 162), poppet assemblies (167 and 168), and hand pump suction screen assembly (162) are all properly installed.

a. Place the retainer plates (19) in position on the powerpak base (138) and secure with washers (18) and screws (17).

b. If the thermal relief valve heads (140) are drilled to allow for safety wire, safety between the left set and then the right set with MS20995-F32 wire.

c. Complete all checks and adjustments as required. (Refer to Paragraph 6-58.)

d. Install reservoir retaining stud (16) and lock with jam nut (15).

e. Place the lower spacer (14) on the stud.

f. Position the baffle and allow it to rest on the lower spacer.

g. Place the upper spacer (12) on the stud.

h. If holes are provided, safety the thermal relief valves by routing MS20995-F32 wire between the holes in the valve bodies of the left set and then the right set.

i. Safety the main relief valve with MS20995-F32 wire. For the short valve in powerpaks with part numbers 750P-1 and 31800-0, the wire is routed through valve hole and the edge of the baffle, through the provided hole in the valve jam nut (29) and to the valve adjusting screw (28). For the taller valve in powerpaks with part numbers 31800-2, 31800-2M and 31800-3, the wire is routed from the upper spacer (12), to the valve jam nut (149) and then to the adjusting cap (150).

j. Install an "O" ring (5) around the powerpak body.

k. Ascertain that the strainer and fittings are installed, and install reservoir, with fittings forward.

l. Secure the reservoir with "O" ring (3), washer (2) and locknut (1).

6-58. POWERPAK BENCH CHECKS AND ADJUSTMENTS.

6-59. CHECK AND ADJUSTMENT INSTRUCTIONS AND PRECAUTIONS. Before overhaul, to determine faults of the powerpak; to adjust components of the unit; or after completion of overhaul, before installation in the airplane, the powerpak may be bench checked using a minimum of test equipment and the instructions given in the paragraphs that follow. Observe the preliminary instructions and precautions that follow:

a. Use only clean hydraulic fluid (MIL-H-5606).

b. Cap all fittings with high pressure caps.

c. Because of using high pressure during check, determine that caps, where

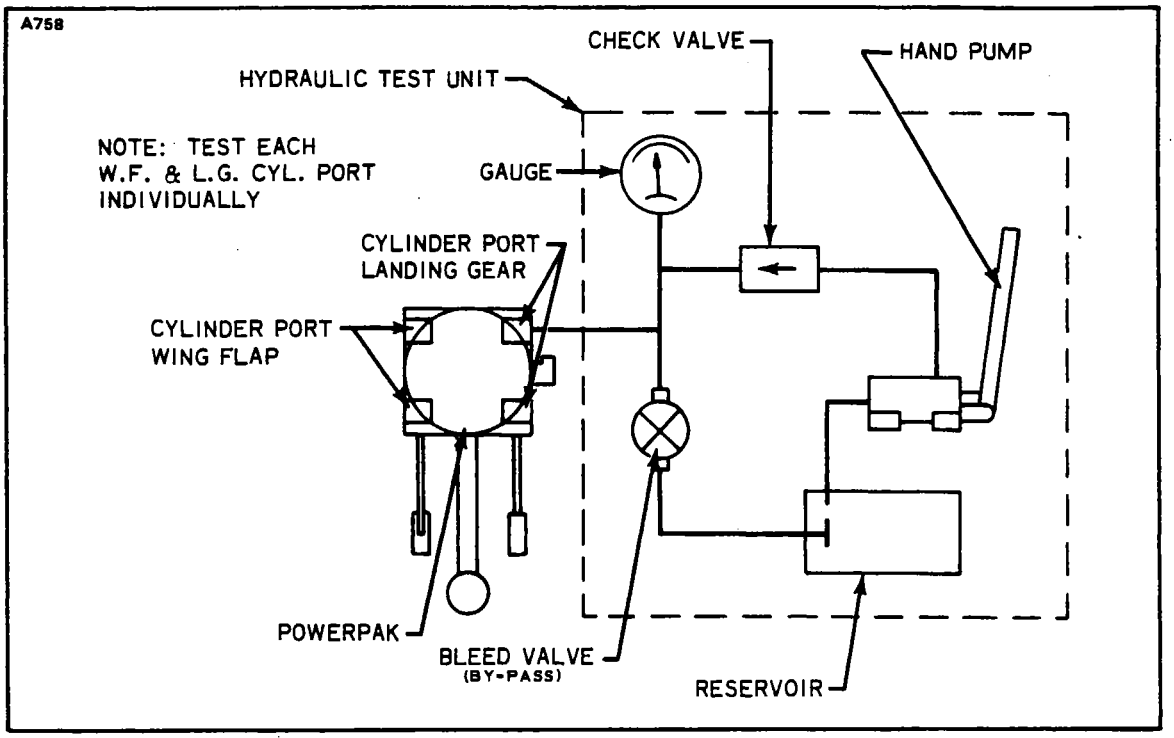


Figure 6-21. Checking and Adjusting Powerpak

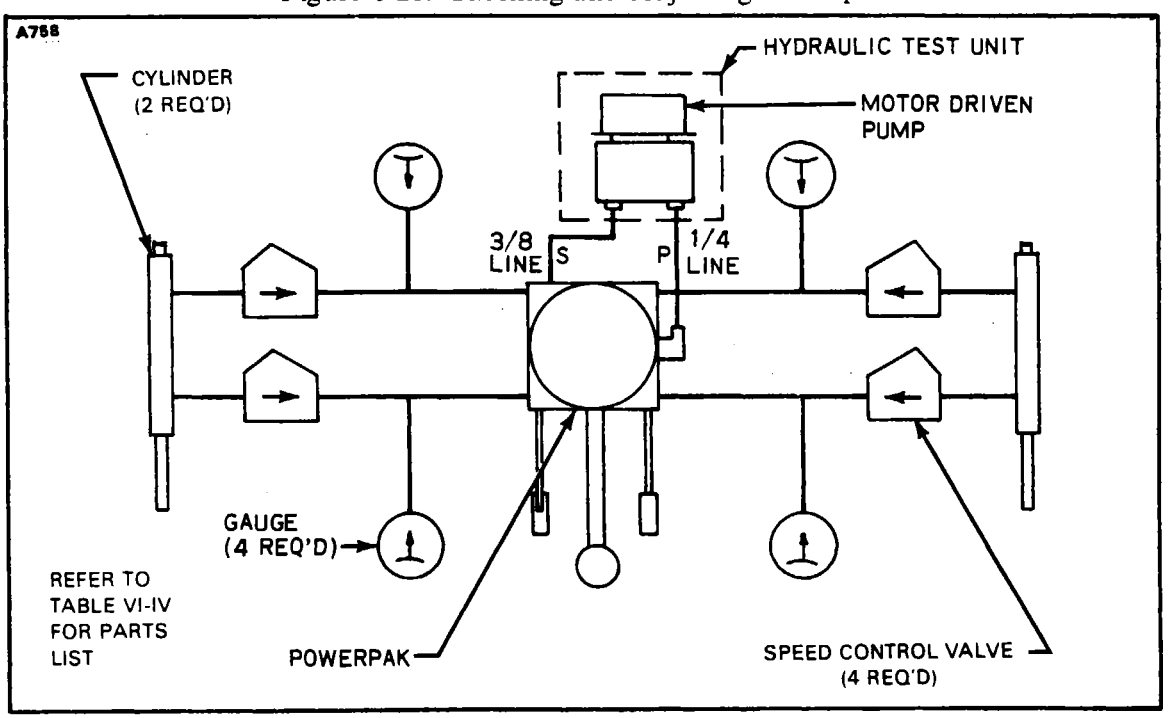


Figure 6-22. Checking Powerpak Operation

required, are secure.

d. Mound the base on a combination work and test stand which may be manufactured from dimensions given in Figure 6-36.

e. Minimum equipment is as follows:

1. Hydraulic test unit as described in paragraphs 6-5 or 6-6 and arranged as shown in Figure 6-21 and 6-22.

2. Tools and test equipment as required in Table VI-IV.

6-60. POWERPAK BLEEDING PROCEDURE. Before conducting any cracking pressure checks and adjustments, the powerpak passages should be free of trapped air and filled with hydraulic fluid. This may be accomplished as follows:

a. Install an open top reservoir.

b. Add hydraulic fluid maintaining level below the top of the powerpak stand pipe.

c. While operating the powerpak hand pump, move the selector levers through each cycle, in sequence, until fluid begins to flow from each pressure port. Provide a container to catch fluid.

d. To check leakage of the poppet assemblies, paragraph 6-64, it will be required to drain the reservoir and wipe the bottom of the reservoir dry.

6-61. CHECK AND ADJUSTMENT OF MAIN RELIEF VALVE. The main relief valve, located in the aft center area of the powerpak, may be pressure checked and adjusted as follows:

a. Connect the pressure line of a hydraulic test unit to the landing gear extension port (C2) fitting at the right forward side of the powerpak. (Refer to Figure 6-21.)

b. Open the hydraulic test unit by-pass valve.

c. Hold the landing gear selector lever full DOWN.

d. Operate the power driven pump or hand pump of the hydraulic test unit and slowly close the by-pass valve.

e. Observe pressure build-up to the point at which the pressure stabilizes on the test unit gauge and fluid begins to ooze from the main relief valve. The required cracking pressure to open the valve for the powerpak being checked will be found in Table VI-II.

f. Should the valve open at a pressure higher or lower than that required, it will be necessary to adjust it by first loosening the jam nut to allow turning of the adjusting plug or cap. To adjust pressure, turn the plug or cap in a clockwise direction to increase pressure or in a counterclockwise direction to decrease pressure.

g. Tighten jam nut and recheck cracking pressure.

h. Again, build up pressure to approximately 100 psi below that required for cracking and note if any fluid seeps from the valve. If so, the valve should be rechecked for a possible leak between the valve and seat or around the seat.

6-62. CHECK AND ADJUSTMENT OF THERMAL RELIEF VALVES. Four thermal relief valves are located in the powerpak, one receiving pressure from each pressure port. Each valve may be checked as follows:

a. Connect the pressure line of a hydraulic test unit to the landing gear extension port (C2) fitting at the right forward side of the powerpak. (Refer to Figure 6-21.)

b. Cap the fittings at the pressure ports not being utilized.

c. Open the hydraulic test unit by-pass valve.

d. Allow the selector levers to remain neutral.

e. Operate the power driven pump or hand pump of the hydraulic test unit and slowly close the by-pass valve.

f. Observe pressure build-up to the point at which the pressure stabilizes on the test unit gauge and fluid begins to ooze from the valve. The cracking pressure required to open the valve will be found in Table VI-II.

g. Should the valve open at a pressure higher or lower than that required, it will be necessary to adjust it by turning adjusting screw in the valve body. To adjust pressure, turn the screw in a clockwise direction to increase pressure or in a counterclockwsie direction to decrease pressure.

h. After adjustment, recheck cracking pressure.

i. Again, build up pressure to approximately 100 psi below that required for cracking and note if any fluid seeps from the valve. If so, the valve should be rechecked for a possible leak between the check ball and seat or around the seat.

j. To check the remaining thermal relief valves, connect the pressure line to the fittings at ports C1, C3 and C4 and check by following steps b thru i for each valve.

6-63. CHECK AND ADJUSTMENT OF CAMSHAFT RELEASE DETENT ASSEMBLIES. The camshaft release detents, installed diagonally into the center of the powerpak body, may be checked and adjusted as follows:

a. The flap detent assembly may be adjusted as follows:

1. Should the landing gear detent assembly be that of the later type, with the adjusting cap extending above the surface of the powerpak body, as depicted by callout 165 in Figure 6-20, it will be required that the cap, spring and spring guide be removed and a plug (75, P/N 31904-00) be installed in the port to prevent loss of pressure. This step is not necessary if the detent assembly is of the

early or short type.

2. Connect the pressure line of a hydraulic test unit to the flap retraction port (C4) fitting at the left rear side of the powerpak.

3. Cap the fittings at the pressure ports not being utilized.

4. Open the test unit by-pass valve.

5. Select flap UP, operate the power driven pump or hand pump of the hydraulic test unit and slowly close the by-pass valve.

6. Observe pressure build-up and note the pressure at which the selector lever returns to neutral. The detent release pressure for the flap with powerpak model may be found in Table VI-II.

7. Should the lever return to neutral at a pressure higher or lower than that required, it will be necessary to adjust by turning the adjusting plug. To adjust release of the detent, turn the plug in a clockwise direction to increase release pressure or counterclockwise to decrease pressure.

8. After adjustment, re-cycle and recheck release pressure.

9. Reconnect the pressure line to the flap extension port (C3) fitting and cap the fitting from where the line was removed.

10. Open the test unit by-pass valve.

11. Select flap DOWN, operate the power driven pump or hand pump and slowly close the by-pass valve.

12. Observe pressure build-up and note the pressure at which the selector lever returns to neutral.

13. Should the lever return to neutral at a pressure higher or lower than that required, it will be necessary to adjust the plug slightly to bring both release pressures within tolerance.

14. Again re-cycle and check release pressure.

15. If a plug was temporarily installed in the landing gear detent port, remove and reinstall the spring guide, spring and cap. (Refer to paragraph 6-54.)

b. The landing gear detent assembly, whether it be the early (short) type or the later (long) type, may be checked and adjusted as follows:

1. Connect the pressure line of the test unit to the landing gear retraction port (C1) fitting at the right rear side of the powerpak.

2. Cap the fittings at the pressure ports not being utilized.

3. Open the test unit by-pass valve.

4. Select landing gear UP, operate the power driven pump or hand pump of the hydraulic test unit and slowly close the by-pass valve.

5. Observe pressure build-up and note the pressure at which the selector lever returns to neutral. The detent release pressure for the landing gear with powerpak model may be found in Table VI-II.

6. Should the lever return to neutral at a pressure higher or lower than that required, it will be necessary to adjust by turning the adjusting plug or cap. To adjust release of the detent, turn the plug or cap in a clockwise direction to increase release pressure or counterclockwise to decrease pressure.

7. After adjustment, re-cycle and recheck release pressure.

8. Reconnect the pressure line to the landing gear extension port (C2) fitting and cap the fitting from where the line was removed.

9. Open the test unit by-pass valve.

10. Select landing gear DOWN, operate the power driven pump or hand pump and slowly close the by-pass valve.

11. Observe pressure build-up and note the pressure at which the selector lever returns to neutral.

12. Should the lever return to neutral at a pressure higher or lower than that required, it will be necessary to adjust the plug or cap slightly to bring both release pressures within tolerance.

13. Again re-cycle and check release pressure.

c. Upon completion of the adjustment of the flap and landing gear detents, lightly stake the body next to the threads of the plug or cap to prevent them from turning out of adjustment.

6-64. CHECK OF POPPETS FOR LEAKAGE. The check procedure for the poppet assemblies to determine if any leakage occurs between a poppet and seat may be conducted by grouping each return and pressure assembly with a port in the powerpak, thus dividing this check into four individual checks. The open center poppet assemblies are checked separately. These checks may be conducted as follows:

a. The cylinder return and pressure poppets may be checked as follows:

1. Connect the pressure line of a hydraulic test unit to the landing gear retraction port (C1) fitting at the right rear side of the powerpak.

2. Cap the fittings at the ports not being utilized.

3. Open the hydraulic test unit by-pass valve.

4. Allow the selector lever to remain neutral.

5. Operate the power driven pump or hand pump of the hydraulic test unit and slowly close the by-pass valve.

6. Increase pressure to approximately 1200 psi for powerpaks with part numbers 750P-1 and 31800-0 or 1300 psi for powerpaks with part numbers 31800-2, 31800-2M and 31800-3. Hold pressure at this requirement.

7. To check a return poppet assembly (that assembly closest to the port being pressurized) for leakage, observe the area around the return hole in the

retainer plate for any evidence of fluid leakage. Should fluid seepage be evident, the return poppet seat sub-assembly should be inspected and replaced as necessary.

8. To check a pressure poppet assembly (that assembly adjacent to the port being pressurized) for leakage, observe the area around the hole in the top of the detent assembly for any evidence of fluid leakage. Due to the area to fill between the poppet and detent, fluid may not appear for a few minutes after pressure has been applied. Should fluid seepage be evident, the pressure poppet-seat sub-assembly should be inspected and replaced as necessary.

9. To check the remaining return and pressure poppet assemblies for leakage, connect the pressure line to the fitting at ports C2, C3 and C4 and check by following steps b thru h for each set.

b. The landing gear and flap center poppet assemblies may be checked as follows:

1. Connect the pressure line of a hydraulic test unit to the engine driven pump pressure port (system check valve) at the right side of the powerpak. (The airplane's hand pump can also be used for this check.)

2. Cap the fitting at all pressure ports, C1 thru C4.

3. Open the hydraulic test unit by-pass valve.

4. Move the landing gear selector lever to the DOWN position. (This will allow the landing gear center poppet assembly to be checked.)

5. Operate the power driven pump or hand pump of the hydraulic test unit (or powerpak hand pump) and slowly close the by-pass valve.

6. Increase pressure to approximately 1200 psi for powerpaks with part numbers 750P-1 and 31800-0 or 1300 psi for powerpaks with part numbers 31800-2, 31800-2M and 31800-3. Hold pressure at this requirement.

7. To check the landing gear center poppet assembly, observe the area around the hole in the top of the detent assembly for any evidence of fluid leakage. Should fluid seepage be evident, the landing gear center poppet-seat sub-assembly should be inspected and replaced as required.

8. Move the landing gear selector lever to neutral and the flap lever to the DOWN position.

9. To check the flap center poppet assembly, again observe the area around the hole in the top of the detent assembly for any evidence of fluid leakage. Should fluid seepage be evident, the flap center poppet-seat sub-assembly should be inspected and replaced as required.

6-65. CHECK OF HAND PUMP.

a. Connect a pressure gauge to the landing gear extension port (C2) fitting at the right forward side of the powerpak.

b. Select landing gear DOWN with the selector lever.

c. Operate the powerpak hand pump and observe the pressure reading. The gauge should show a steady increase in pressure during both the up and down stroke.

d. As the gauge reaches approximately 1000 psi, stop the handle operation at mid-stroke; the handle should remain steady. If the handle moves up from the stopped position, the hand pump piston valve is leaking. If the handle moves down, the hand pump suction valve in the powerpak is leaking.

e. Disconnect the pressure gauge and at the fitting from where the gauge was attached, connect a line to a pint (one U.S. pint) container.

f. With gear selector lever down, operate the hand pump and allow fluid to flow into the container. It should not take more than 40 cycles of the handle, both up and down, to fill the pint container.

6-66. FINAL CHECK OF POWERPAK.

a. Ascertain that the powerpak is completely assembled.

b. Mount the powerpak on the test stand.

c. Using a test unit of the type described in paragraph 6-5 or 6-6, connect the pressure line of the unit to the inlet fitting of the main relief valve and the suction line to the suction port of the powerpak.

d. Connect a hose from the powerpak vent to the vent fitting or reservoir of the test unit.

e. Cap the filler fitting on the forward side of the reservoir.

f. Connect the pressure gauges, speed control valves and actuating cylinders called for in Table VI-IV to the pressure ports of the powerpak as shown in Figure 6-22.

g. Operate the test unit and fill the powerpak reservoir.

h. With the test unit operating, operate the landing gear and flap selector levers UP and DOWN through a minimum of five cycles to remove any air from the circuit.

i. During the operation in step h, adjust all speed control valves to provide 300 to 400 psi back pressure.

j. The main relief valve cracking pressure may be checked as follows:

1. Open the test unit by-pass valve.

2. Hold the landing gear selector lever full DOWN.

3. Operate the power driven pump or hand pump of the hydraulic test unit and slowly close the by-pass valve.

4. Observe pressure build-up to the point at which the pressure stabilizes on the pressure gauge of the test unit. Stabilization indicates the valve has begun to open. The required pressure will be found in Table VI-II.

5. Should the valve not open at the required pressure, check and adjust the valve in accordance with instructions in paragraph 6-61.

k. The pressures at which landing gear and flap selector levers return to neutral may be checked as follows:

1. Open the test unit by-pass valve.

2. Select landing gear DOWN.

3. Operate the power driven pump or hand pump and close the by-pass valve.

4. Observe the pressure at which the lever returns to neutral. The required pressure will be found in Table VI-II.

5. Repeat the above steps for landing gear up, flap down and flap up.

6. Should either lever not return to neutral at their required pressure, check and adjust the camshaft detent release assemblies in accordance with instructions in paragraph 6-63.

l. During the checks in step k, upon return to neutral of the landing gear and flap selector levers, a minimum of 500 psi should be trapped and maintained between the powerpak and actuating cylinders. A loss in pressure indicates a leak in one or more poppet valves. Check poppets in accordance with instructions in paragraph 6-64.

m. Operate the powerpak hand pump and select gear DOWN. When pressure builds up to 1000 psi, stop the handle at mid-stroke; the handle should not creep up or down. Creeping of the handle indicates an internal leak in the pump and should be further checked as found in paragraph 6-65.

n. Disconnect the lines from the pressure ports of the powerpak.

o. The thermal relief valves may be checked as follows:

1. Connect the pressure line of the hydraulic test unit to the landing gear extension port (C2) fitting as shown in Figure 6-22.

2. Cap the fittings at the pressure ports not being utilized.

3. Open the test unit by-pass valve.

4. Allow the selector unit to remain neutral.

5. Operate the test unit and slowly close the by-pass valve.

6. Observe pressure build-up to the point at which the pressure stabilizes on the test unit pressure gauge. Stabilization indicates the valve adjacent to the port has begun to open. The required pressure will be found in Table VI-II.

7. To check the remaining valves, connect the pressure line to the fittings at ports C1, C3 and C4 and repeat steps 2 thru 6 for each valve.

8. Valves not opening at the required pressure should be further checked and adjusted as given in paragraph 6-62.

p. Check the powerpak reservoir for leakage per instructions given in paragraph 6-67.

q. Disconnect lines and remove powerpak from test stand.

6-67. TESTING RESERVOIR FOR LEAKAGE.

a. Cap the powerpak suction port.

b. Fill the powerpak reservoir with hydraulic fluid.

c. Attach an air valve to either the reservoir overflow fitting or filler fitting. Cap the fitting not being utilized.

d. Apply 1 psig of air for 12 hours. At the end of the 12 hour period, check for external leaks.

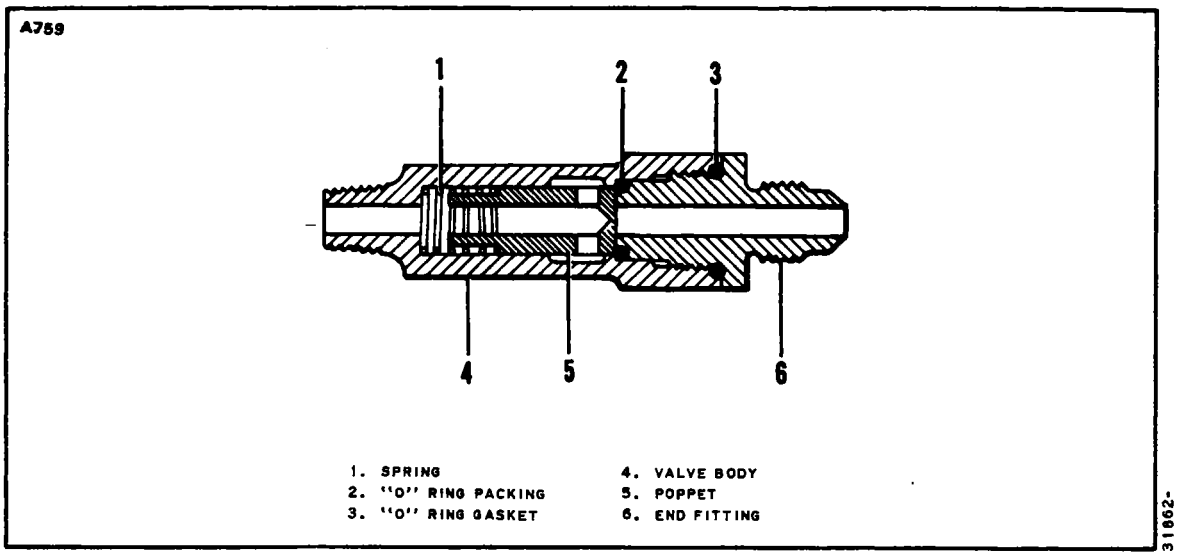


Figure 6-23. Hydraulic System Check Valve

6-68. SYSTEM CHECK VALVE.

6-69. REMOVAL OF CHECK VALVE.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Drain the hydraulic powerpak by disconnecting the hydraulic extension line at the nose gear actuating cylinder and placing the end of the line in a suitable container. Move the landing gear selector to the DOWN position and operate the hand pump until the system is empty.

c. Remove the access plate from the right side of the pedestal.

d. Disconnect the fitting from the forward end of the valve.

e. Remove the valve from the side of the powerpak.

6-70. CLEANING, INSPECTION AND OVERHAUL OF CHECK VALVE. (Refer to Figure 6-23.)

NOTE

The following procedure covers only valves with part number 31862-00 as shown in Figure 6-23. Valves with no part number on them should be replaced with the new type valve.

a. Cut the safety wire and remove the end fitting (6) from the end of the valve.
b. Remove the poppet (5) and spring (1) from inside the valve body (4).
c. Inspect the valve and valve parts for nicks, scratches and broken or cut "O" rings.
d. Overhaul of the valve is limited to polishing out small nicks or scratches and replacement of "O" rings.
e. Install the spring (1) into the valve body (4).
f. Install the poppet (5) into the valve body by inserting the open end of the poppet first.
g. Install the end fitting (6) with new "O" rings (2 and 3).
h. Safety the end fitting to the valve body with MS20995-NC32 safety wire.

6-71. TESTING CHECK VALVE.

a. Connect the pressure line of a hydraulic test unit to the discharge end of the check valve. (Fittings, AN816 nipple and AN910 coupling may be used to make this connection.)
b. Open the test unit by-pass valve.
c. Operate the test unit and slowly close the by-pass valve.
d. Apply 2000 psi maximum pressure to the valve and ascertain that there is no leakage from the open end.

6-72. INSTALLATION OF CHECK VALVE.

a. Install the check valve to the side of the powerpak.
b. Connect the hydraulic line to the forward end of the valve.
c. Fill the powerpak and cycle the landing gear and flaps several times. (Refer to Filling Powerpak, Section II.)
d. Ascertain that the check valve is not leaking and install the access plate to the right side of the nacelle.
e. Remove the airplane from jacks.

6-73. ANTI-RETRACTION VALVE.

6-74. REMOVAL OF ANTI-RETRACTION VALVE.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)
b. Place a drip pan under the landing gear to catch hydraulic fluid spillage.
c. Move the landing gear selector lever in the cabin to the up position, down position, and to neutral to relieve the pressure in the system.

d. Disconnect the hydraulic lines from the valve. Mark lines to facilitate reinstallation.

e. Remove the barrel nut on the top of the valve arm rod.

f. Disconnect the valve arm return spring from the valve arm.

g. Remove the valve by removing the self-locking nuts, washers and bolts securing it in place.

NOTE

Be careful that the valve arm does not come out of the valve body.

6-75. DISASSEMBLY OF ANTI-RETRACTION VALVE. (Refer to Figure 6-24.)

a. Holding the valve with the end plug (1) up, remove the plug, being careful not to drop the valve spring (2).

b. Remove the valve spring and poppet assembly (3 thru 8) from the valve body (10).

c. Remove the valve arm (13) with the cam (12) attached from the valve body.

d. Remove the line fittings (6 and 9) from the valve body.

6-76. CLEANING, INSPECTION AND REPAIR OF ANTI-RETRACTION VALVE. (Refer to Figure 6-24.)

a. Clean the valve parts with a suitable solvent and dry thoroughly.

b. Inspect the following parts of the valve for defects:

1. Inspect the cam for corrosion, burrs, scratches and excess wear specifically in the areas where the valve rides on the cam, where the attaching bolt extends through the slot in the cam, and the surfaces between the cam and valve body. Check the handle for security of mounting.

2. Inspect the poppet assembly for corrosion, burrs, scratches and excess wear specifically in the areas where the valve contacts the seat and the surfaces between the valve poppet and valve seat.

3. Inspect the line fittings in the threaded area for crossed threads and corrosion.

c. Repairs to the valve are limited to polishing out small scratches and replacing "O" rings.

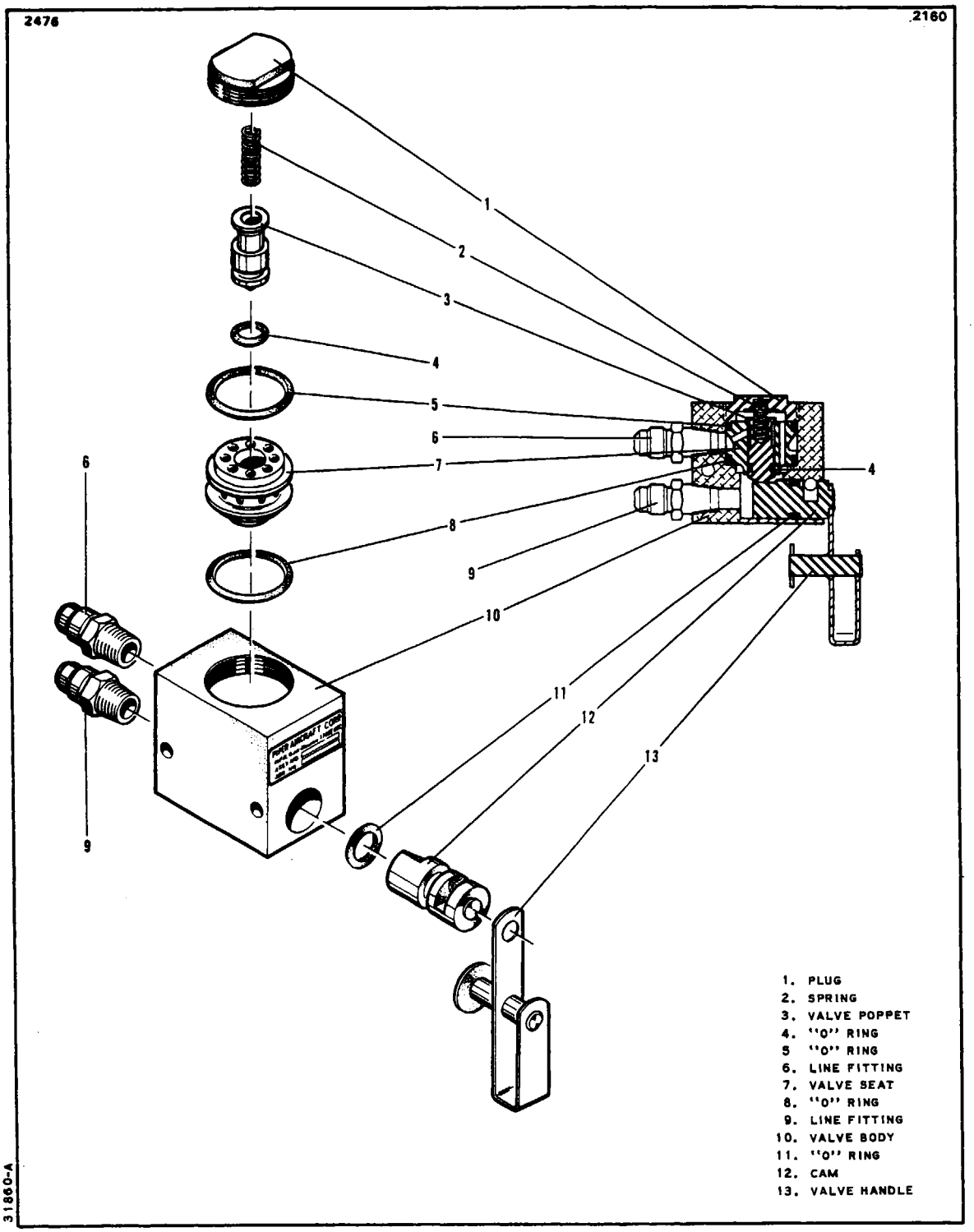


Figure 6-24. Anti-Retraction Valve

6-77. ASSEMBLY OF ANTI-RETRACTION VALVE. (Refer to Figure 6-24.)

a. Install the line fittings (6 and 9) to the valve body (10) being careful not to strip the threads.

b. Lubricate with hydraulic fluid (MIL-H-5606), and install new "O" rings on the cam (12), valve poppet (3) and seat (7).

c. Insert the cam into the valve body.

d. Assemble the valve and seat, and insert the unit into the end of the valve body.

e. Install the valve spring (2) in the hole in the top of the valve.

f. Install the plug into the valve and torque to 20 foot-pounds.

6-78. TESTING ANTI-RETRACTION VALVE.

a. Connect the pressure line of a hydraulic test unit to the port of the valve marked "P".

b. Ascertain that the valve is closed.

c. Open the test unit by-pass valve.

d. Operate the test unit and slowly close the by-pass valve.

e. Apply 1500 psi maximum hydraulic pressure to the valve and ascertain that fluid does not appear at the open end marked "R".

f. Cap the fitting at the port marked "R", open the valve and ascertain that fluid does not appear around the cam or from the attaching hole in the valve body.

6-79. INSTALLATION OF ANTI-RETRACTION VALVE.

a. Position the valve on the landing gear and install two AN3-16A bolts with washers down through the valve and secure with washers and self-locking nuts.

b. Connect the hydraulic lines to the valve, the outboard line is pressure "P" and the inboard line is return "R".

c. Connect the arm return spring to the valve arm.

d. Install the barrel nut to the top of the valve arm rod and adjust per instructions in paragraph 6-80.

e. Fill the powerpak and cycle the landing gear several times to bleed the air out of the system. (Refer to Filling Powerpak, Section II.)

NOTE

When cycling the gear, allow the landing gear selector handle to return to neutral automatically

f. Check the anti-retraction valve to determine that there is no evidence of hydraulic fluid leakage.

g. Remove the airplane from the jacks.

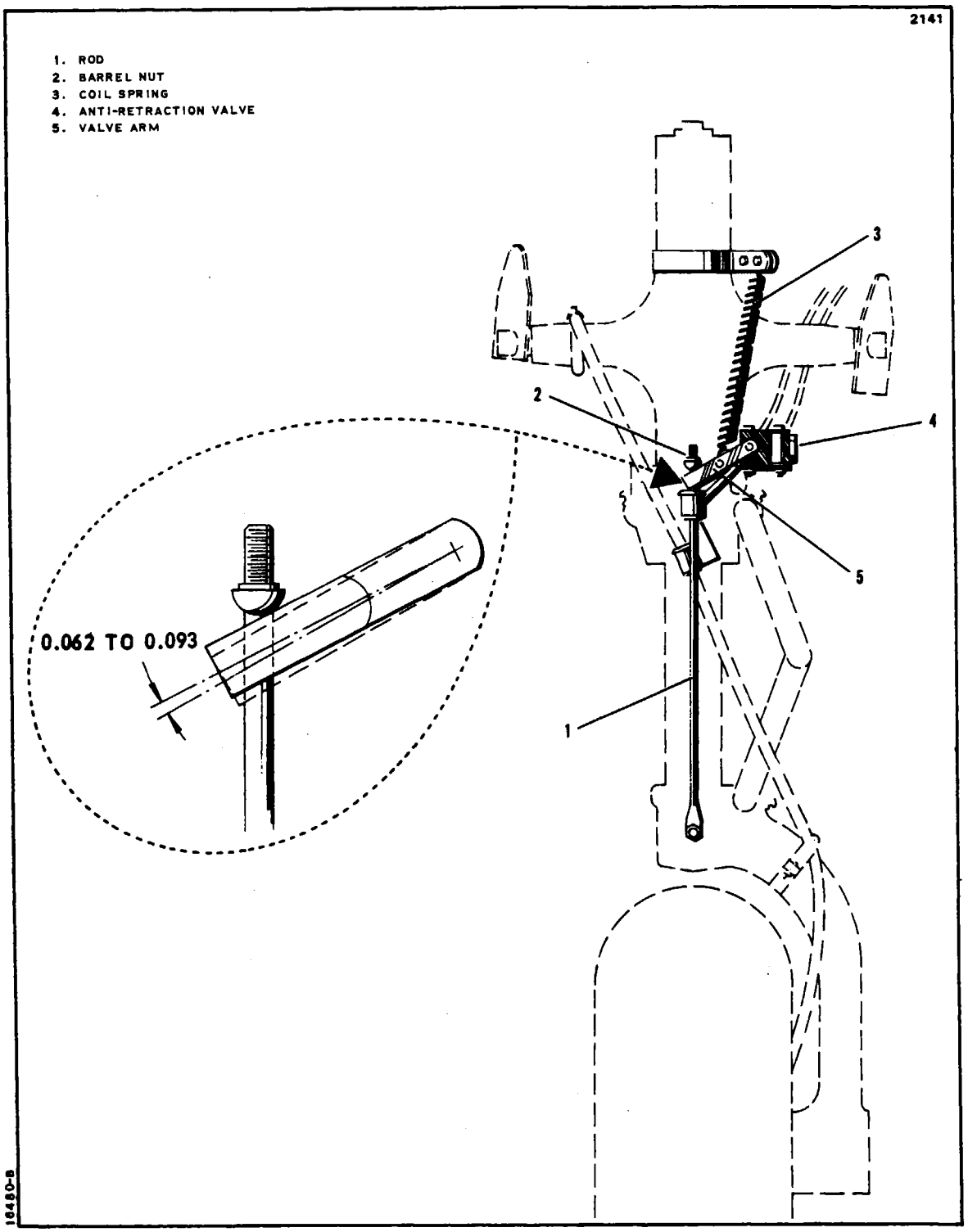


Figure 6-25. Adjustment of Anti-Retraction Valve

6-80. ADJUSTMENT OF LANDING GEAR ANTI-RETRACTION VALVE. (Refer to Figure 6-25.) The landing gear anti-retraction valve, located on the left main gear strut housing, restricts hydraulic fluid pressure from building up in the retraction system until the landing gear strut is fully extended.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. With the landing gear strut piston in the fully extended position, hold the valve arm in the full down position.

c. Adjust the barrel nut on top of the actuating rod to allow 0.062 to 0.093 of an inch as measured at the end of the valve arm.

6-81. SHUTTLE VALVES.

6-82. REMOVAL OF SHUTTLE VALVES. (Refer to Figure 6-2 or 6-4.)

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Operate the landing gear selector lever to the up position, down position and to neutral to relieve any pressure in the lines.

c. The nose landing gear shuttle valve may be removed by the following procedure:

1. Remove the access panel(s) from the right side of the nose section by turning the quarter turn fasteners and/or attaching screws.

2. Disconnect the hydraulic line and CO2 line from the shuttle valve inside the cabin section, just aft of the forward bulkhead.

3. Disconnect the hydraulic line(s) from the forward side of the shuttle valve inside the nose section just forward of the forward cabin bulkhead.

4. On PA-23-250 (six place) airplanes, Serial Nos. 27-2505 and up, remove the tee fitting installed in the forward end of the valve.

5. Remove the retaining nut securing the valve to the forward cabin bulkhead and remove the valve.

d. The right or left main landing gear shuttle valves may be removed by the following procedure:

1. Remove the top center section of the engine nacelle by removing attaching screws.

2. Disconnect the hydraulic line(s) from the top side of the shuttle valve.

3. Disconnect the hydraulic line and the CO2 line from the valve.

4. Remove the retaining nut securing the valve to the mounting plate inside the nacelle center section and remove the valve.

6-83. CLEANING, INSPECTION AND OVERHAUL OF SHUTTLE VALVE. (Refer to Figure 6-26.)

NOTE

The following procedure covers only valves with part number 32803-00. Valves with part numbers 492 047 and 31424-00 should be replaced if found defective.

a. For I.B.C. Products Inc. shuttle valves refer to the following:

1. Remove the end fitting (4) from the end of the valve marked "MAIN".

2. Remove the piston (6) by pushing from the end of the valve marked "EMG".

3. Inspect the valve and valve parts for nicks, scratches and broken or cut "O" rings.

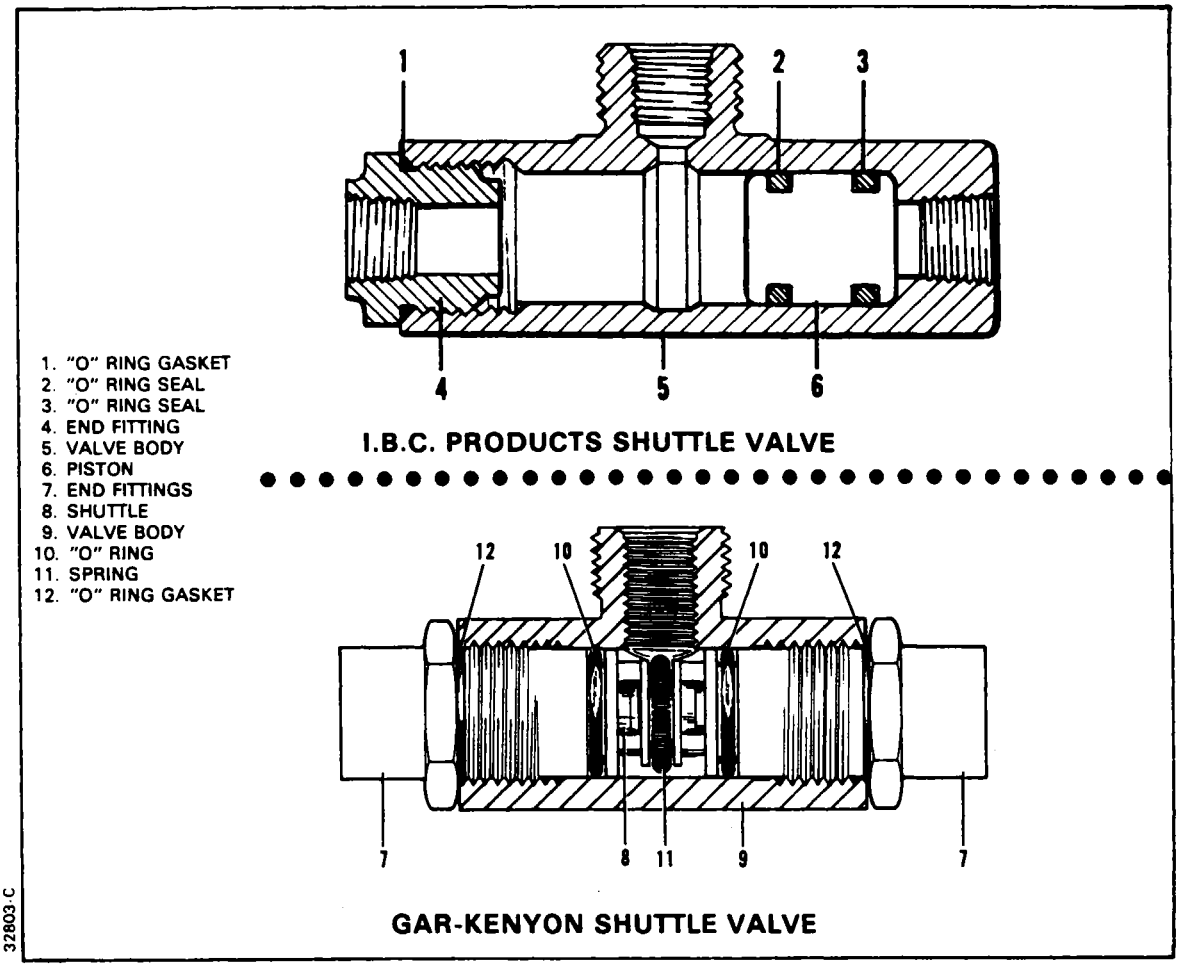


Figure 6-26. Shuttle Valve

4. Overhaul of the valve is limited to replacement of "O" rings and polishing out small nicks and scratches.

5. Lubricate with hydraulic fluid (MIL-H-5606) and install the piston (6) with new "O" rings into the open end of the valve.

6. Install the end fitting (4) with a new "O" ring (1) to the valve.

b. For Gar-Kenyon shuttle valves refer to the following:

1. Remove the end fittings (7).

2. Remove the shuttle (8) from the valve body (9).

3. Inspect the valve and components for nicks, scratches and broken or cut "O" rings.

4. Overhaul of the valve is limited to replacement of "O" rings and polishing out small nicks and scratches.

5. Lubricate end fittings (7) with hydraulic fluid (MIL-H-5606) and install new "O" rings (10 and (12).

6. Position spring (11) on shuttle to close the "EMG" port.

7. Install end fitting (7) and shuttle (8) as noted in Figure 6-26.

6-84. TESTING SHUTTLE VALVE.

a. Connect the pressure line of a hydraulic test unit to the end of the valve marked "MAIN."

b. Plug the outlet port of the valve.

c. Open the test unit by-pass valve.

d. Operate the test unit and slowly close the by-pass valve.

e. Apply 2000 psi maximum hydraulic pressure and ascertain that the valve does not leak fluid from the "EMG" port of the valve.

6-85. INSTALLATION OF SHUTTLE VALVES. (Refer to Figure 6-2 or 6-4.)

a. Install the nose landing gear shuttle valve by the following procedure:

1. Position the valve to the forward cabin bulkhead with the body of the valve on the aft side of the bulkhead and secure the assembly with the retaining unit.

2. On PA-23-250 (six place), Serial Nos. 27-2505 and up, install the tee fitting port of the valve on the forward side of the bulkhead.

3. Connect the hydraulic line(s) to the forward side of valve or the tee fitting.

4. Connect the hydraulic line to the side of the valve stamped "MAIN" and the CO2 line to the side stamped "EMG."

b. Install the right or left main landing gear shuttle valve by the following procedure:

1. Position the valve inside the top center section of the nacelle with the body of the valve below the mounting plate. Secure the valve with the retaining nut.

2. Connect the hydraulic line to the side of the valve stamped "MAIN" and the CO2 line to the side stamped "EMG."

3. On PA-23-250 (six place), Serial Nos. 27-2505 and up, install the tee fitting to the remaining open port of the valve.

4. Connect the hydraulic line(s) to the shuttle valve or the tee fitting.

c. Install the access panels as required.

d. Fill the hydraulic system to replace any hydraulic fluid spillage (refer to Filling Powerpak, Section II), and cycle the landing gear to check for leaks and remove any air trapped in the system.

e. Remove the airplane from jacks.

6-86. ACTUATING CYLINDERS.

6-87. VISUAL CHECKS OF ACTUATING CYLINDERS. Actuating cylinders may leak externally at either elbow or at the seal. A coating of oil between the upper and lower elbows indicates leakage of the top elbow, whereas a coating of oil immediately under the bottom elbow only indicates leakage of the bottom elbow. If the bottom of the cylinder is coated with oil, the seal is leaking.

CAUTION

If one or more of the landing gear actuating cylinders are damaged, be sure the airplane is on jacks before attempting any repairs. This is not necessary if the wing flap cylinder is to be repaired or replaced. Be sure both selector levers are in the neutral position before disconnecting a hydraulic line from a fitting.

a. If either elbow fitting is leaking, do not remove the actuating cylinder from the airplane. Remove the appropriate line and take out the fitting. If the leakage is through the threads, apply a suitable sealing compound to the threads of the fitting and install the fitting. If the fitting is damaged, replace with a new one and reconnect the hydraulic line.

b. If a seal is leaking, remove the actuating cylinder by instructions in the following paragraphs.

6-88. GEAR AND FLAP ACTUATING CYLINDERS.

6-89. REMOVAL OF NOSE GEAR ACTUATING CYLINDER.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Remove the access panels from both sides of the nose section. (Refer to Access and Inspection Provisions, Section II.)

c. Disconnect the hydraulic lines from the actuating cylinder and cover the open line ends to prevent contamination.

d. Remove the cotter pin, nut, washers and bolt securing the top end of the hydraulic cylinder to the fuselage frame.

e. Remove the cotter pin, nut, washers and bolt securing the actuating rod end bearing to the drag link assembly.

f. Remove the cylinder from the wheel well..

6-90. REMOVAL OF MAIN GEAR ACTUATING CYLINDERS.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Remove the access panel from the top center section of the nacelle. (Refer to Access and Inspection Provisions, Section II.)

c. Disconnect the hydraulic lines from the actuating cylinder and cover the open line ends to prevent contamination.

d. Remove the cotter pin, nut, washers and bolt securing the actuating rod end bearing to the drag link assembly.

e. Remove the cotter pin, nut, washers and bolt securing the top end of the hydraulic cylinder.

f. Remove the cylinder from the wheel well by removing the black plastic tape around the cylinder and rubber boot and drawing the cylinder through the boot.

6-91. REMOVAL OF FLAP ACTUATING CYLINDER.

a. Remove the center seats from the airplane.

b. Remove the trim panels from right side of the cabin just aft of the cabin entrance door by removing attaching screws.

c. Place the flap selector to the up position, to the down position, and then to neutral to relieve any pressure in the hydraulic lines.

d. Disconnect the hydraulic lines from the flap cylinder. Cap the open line fittings to prevent contamination.

e. Disconnect the cylinder piston rod end bearing from the flap bellcrank by removing the self-locking nut, washer and bolt.

f. Remove the cylinder from airplane by removing the cotter pin, nut, washer and bolt securing the cylinder end fitting to the fuselage frame fitting.

6-92. DISASSEMBLY OF GEAR AND FLAP ACTUATING CYLINDERS. (Refer to Figures 6-27 or 6-28.)

a. With the cylinder removed from the airplane, on early cylinders cut the safety wire (1) and remove the two plugs (2) from the side of the cylinder body (10).

b. On early cylinders draw the piston assembly (8) and cylinder end (6) from the cylinder body (10). On later cylinders, unscrew cylinder end (6) from cylinder body (10).

c. If necessary, the piston assembly (8) may be separated from the cylinder end (6) by loosening the jam nut (4) and unscrewing the rod end (3) from the piston assembly.

d. For the flap actuating cylinder (refer to Figure 6-23), it may be necessary to remove the tube (12), jam nut (13) and bushing (14) from the piston assembly (8).

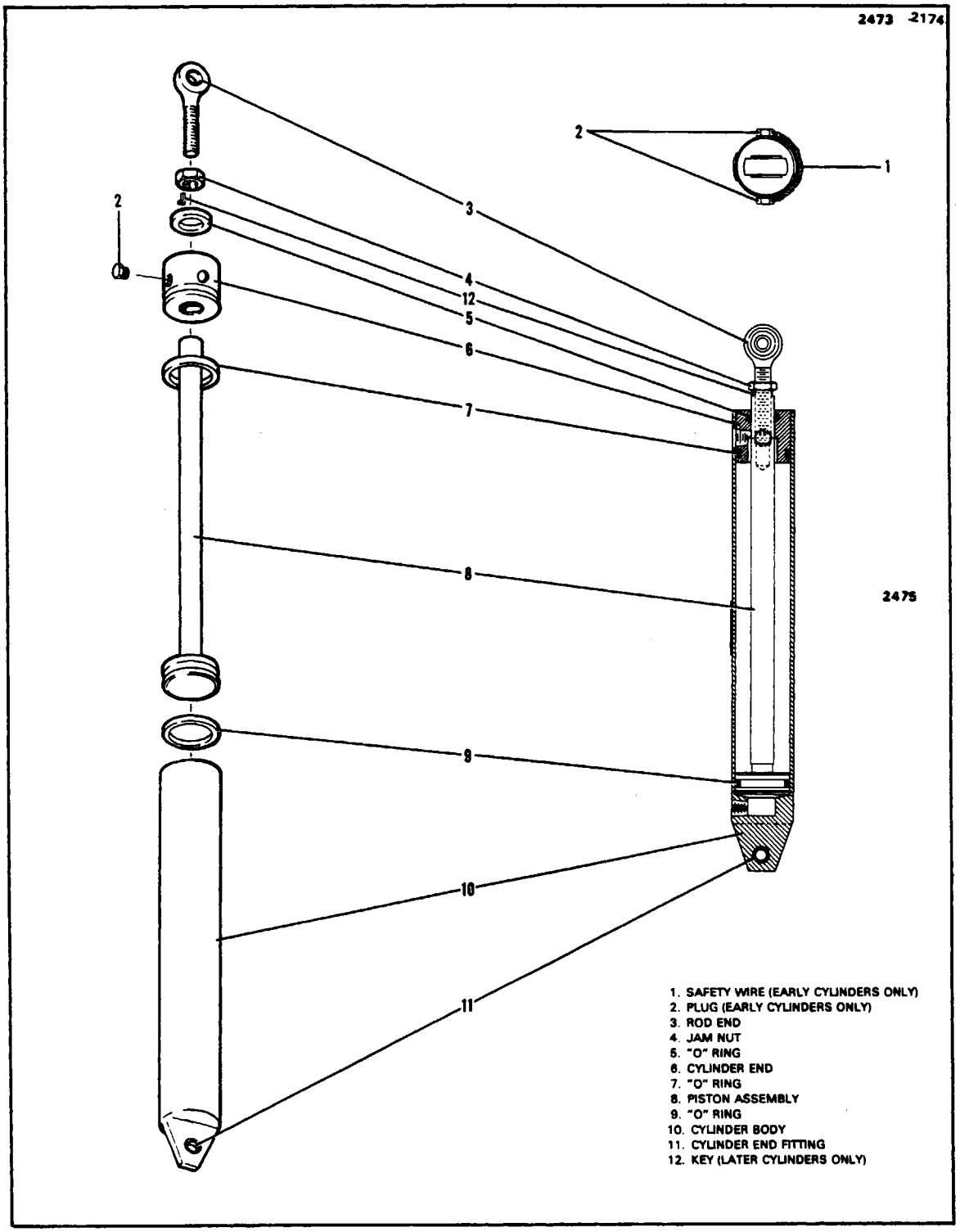


Figure 6-27. Nose and Main Landing Gear Actuating Cylinder

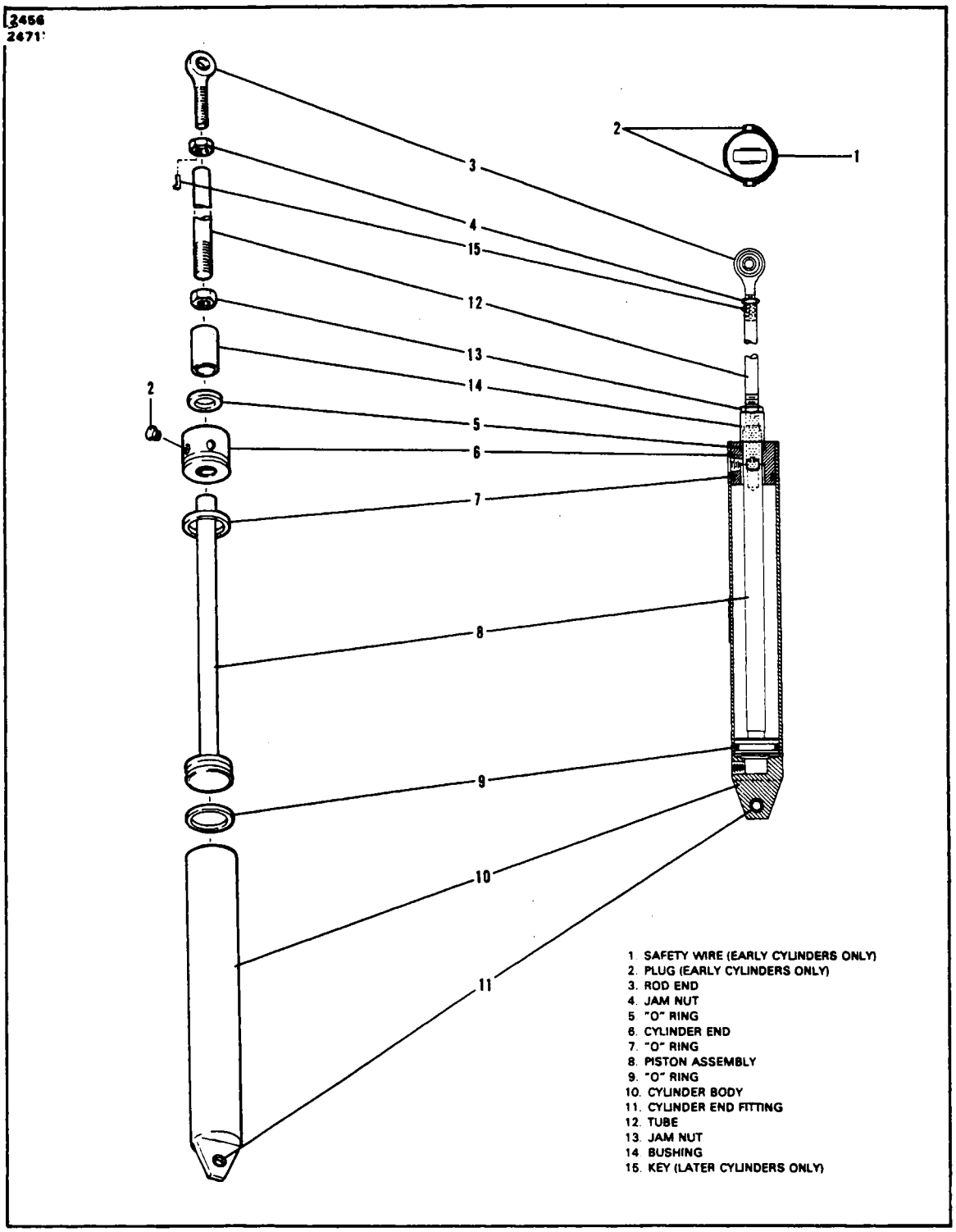


Figure 6-28. Flap Actuating Cylinder

6-93. CLEANING, INSPECTION AND REPAIR OF GEAR AND FLAP ACTUATING CYLINDER.

a. Clean the cylinder parts with a suitable solvent and dry thoroughly.

b. Inspect the cylinder interior walls and piston exterior surfaces for scratches, burrs, corrosion, etc.

c. Inspect threaded areas for damage.

d. Inspect the rod end fitting for wear and corrosion.

e. Repairs to the cylinder are limited to polishing out small scratches, burrs, and replacing parts.

6-94. ASSEMBLY OF GEAR AND FLAP ACTUATING CYLINDERS. (Refer to Figure 6-27 or 6-28.)

a. Install an "O" ring (9) on the piston (8).

b. Install "O" rings (5 and 7) on the interior and exterior of the cylinder end (6). The exterior "O" ring on later cylinders has an "O" ring back up which must be installed along with the "O" ring.

c. Lubricate the piston assembly (8), interior of the cylinder body (10) and the cylinder end (6) with hydraulic fluid (MIL-H-5606).

d. Slide the cylinder end (6) onto the piston assembly (8).

e. Slide the piston assembly (8) and cylinder end (6) into the cylinder body (10). Later cylinders require the cylinder end (6) to be screwed into the cylinder body (10).

f. On early cylinders install the two plugs (2) to the side of the cylinder and safety with MS20995-C41 wire.

g. For the flap actuating cylinder (refer to Figure 6-28), install the tube (12) into the piston assembly (8) and place the bushing (14) over the tube and secure in place with jam nut (13).

h. Install the rod end bearing (3) and jam nut (4) to the piston assembly (8). Later cylinders include the key which must be installed in the reverse order of removal.

6-95. INSTALLATION OF NOSE AND MAIN GEAR ACTUATING CYLINDERS.

CAUTION

Be sure to install each cylinder with its ports pointing down. If installed with the ports pointing up, the cylinder will not clear the tubular structure when the landing gear is retracted.

a. Position the cylinder and attach the cylinder end to the frame with bolt, washers, nut and cotter pin.

b. Connect the hydraulic lines to the cylinder.

c. Cycle the landing gear several times, using the hand pump, to ascertain that all the air is bled from the cylinder being installed.

CAUTION

While cycling the landing gear, make certain the piston rod does not make contact with any items installed in the wheel well.

d. Ascertain that the piston rod of the actuating cylinder being installed is fully extended by operating the landing gear hand pump with the selector in the down position.

e. Connect the piston rod end bearing to the drag links and adjust the landing gear per instructions given in Adjustment of Nose Landing Gear or Adjustment of Main Landing Gear, Section VII.

f. Install any access panels removed for access to the actuating cylinders.

g. Remove the airplane from the jacks.

6-96. INSTALLATION OF FLAP ACTUATING CYLINDER.

a. Position the cylinder to the attachment bracket of the fuselage frame and secure with bolt, washer, nut and cotter pin.

NOTE

Do not tighten attaching bolt completely; allow sufficient clearance to permit approximately 0.25 of an inch side play at the attachment point of where the cylinder rod end bearing attaches to the flap torque tube arm, with the piston rod fully extended.

b. Temporarily connect the piston rod end of the cylinder to the flap bellcrank using a bolt, washer and self-locking nut.

c. Connect the hydraulic lines to the flap cylinder.

d. Check rigging and adjustment of flap as described in Section V.

e. Install the trim panels with attaching screws.

6-97. GEAR DOOR ACTUATING CYLINDERS. (PA-23-250 [six place], Serial Nos. 27-2505 and up.)

6-98. REMOVAL OF NOSE AND MAIN GEAR DOOR ACTUATING CYLINDERS.

a. Disconnect the hydraulic lines from the cylinder and cover the open line ends to prevent contamination.

b. Remove the self-locking nut and machine bolt securing the top end of the cylinder and the self-locking nut, washers and bolt securing the rod end bearings to the door mechanism.

c. Remove the cylinder from the airplane.

6-99. DISASSEMBLY OF NOSE GEAR DOOR ACTUATING CYLINDER. (Refer to Figure 6-29.)

a. Cut the safety wire and drive the roll pins (6) from the cylinder barrel bearing end (5).

b. Remove the bearing end (5) by drawing it from the cylinder barrel (12).

c. The piston assembly (8) may be removed from the bearing end by loosening the jam nut (2) and unscrewing the rod end bearing (1) from the piston.

d. Remove the "O" rings (4, 7 and 10) from the bearing end and piston.

6-100. DISASSEMBLY OF MAIN GEAR DOOR ACTUATING CYLINDERS. (Refer to Figure 6-30.) On main gear door cylinders with Assembly No. 451 844 or 455 934 stamped on the name plate, refer to Disassembly of Nose Gear Door Actuating Cylinder, paragraph 6-99.

a. Cut the safety wire and drive out the roll pins (6 and 12) from both ends of the cylinder.

b. Remove the anchor assembly (14) and the gland fitting (5) by drawing them from the cylinder barrel ends (8).

c. The gland fitting (5) may be removed from the piston assembly (9) by loosening the jam nut (2) and unscrewing the rod end bearing (1) from the piston.

d. Remove the "O" rings (11, 7 and 10) from the anchor assembly, gland fitting and piston.

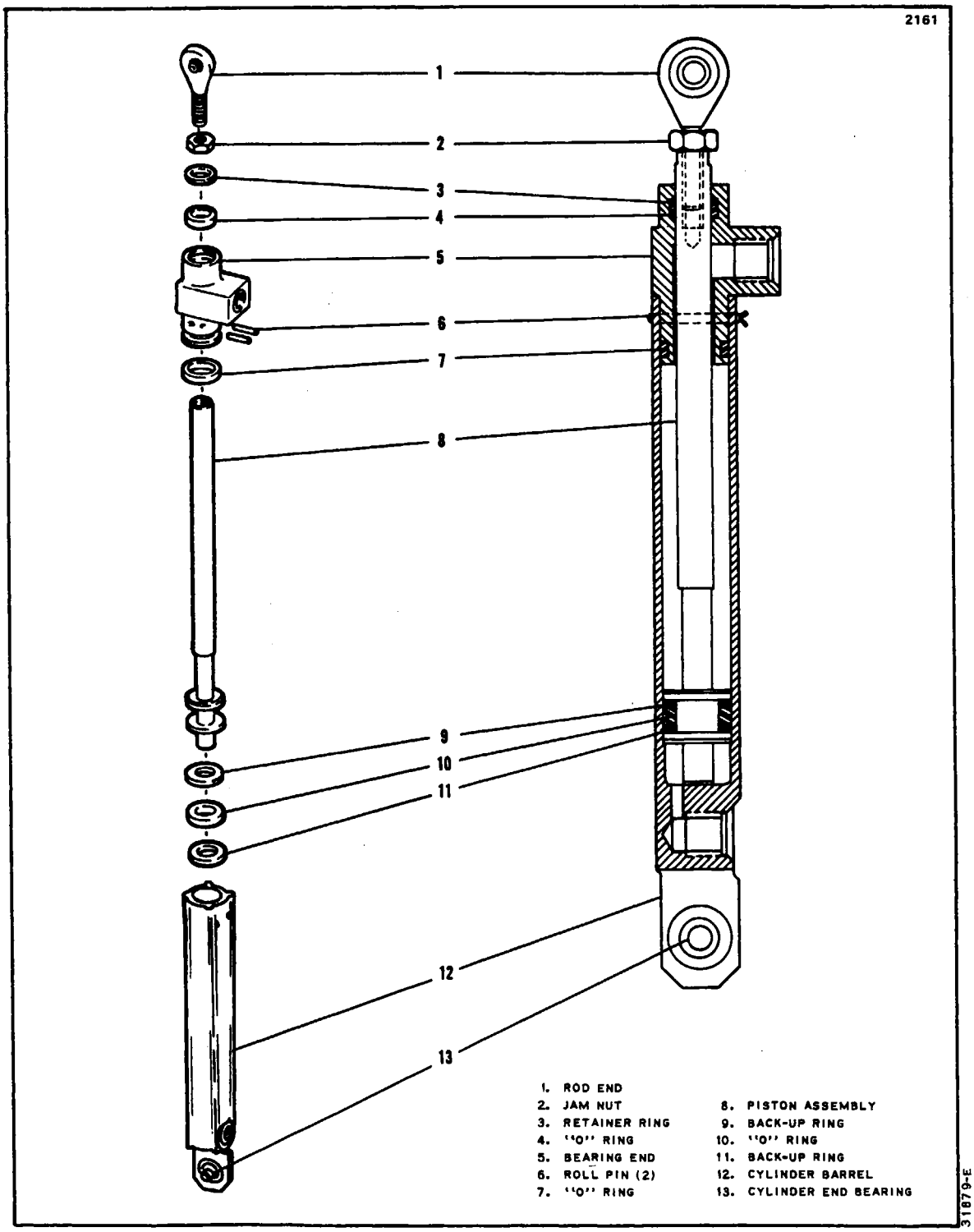


Figure 6-29. Nose Gear Door Actuating Cylinder (451 844 and 451 934)

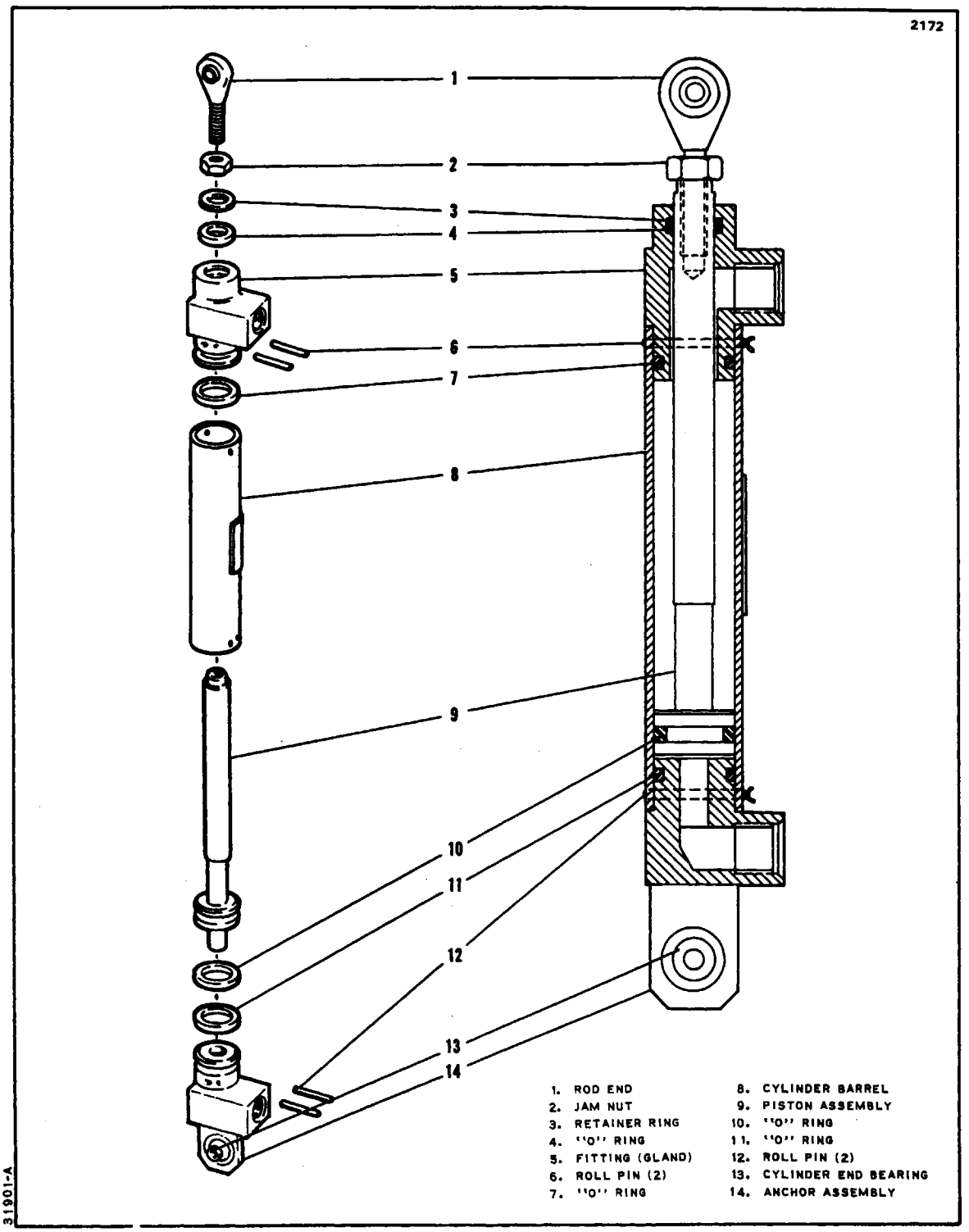


Figure 6-30. Main Gear Door Actuating Cylinder (451 845)

6-101. CLEANING, INSPECTION AND REPAIR OF NOSE AND MAIN GEAR DOOR ACTUATING CYLINDERS.

a. Clean the cylinder parts with a suitable solvent and dry thoroughly.

b. Inspect all surfaces for cleanliness, freedom from cracks and excessive wear.

c. Repair of most parts of the landing gear door actuator assembly is impractical. Replace defective parts with serviceable parts. Minor scratches and scores may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458) providing their removal does not affect the operation of the unit. Install all new "O" rings and back-up rings during reassembly of the actuator.

6-102. ASSEMBLY OF NOSE GEAR DOOR ACTUATING CYLINDER. (Refer to Figure 6-29.)

a. Install new "O" rings to the piston assembly (8) and barrel end (5).

b. Insert the piston assembly into the barrel end and install the jam nut (2) and rod end bearing (1) to the piston end.

c. Insert the piston assembly and barrel end into the open end of the cylinder barrel (12).

d. Align the holes in the cylinder barrel and the barrel end. Install a roll pin (6) to each hole.

NOTE

Install the roll pins with the slots outboard or away from each other.

e. Safety the roll pins with MS20995-C32 wire.

6-103. ASSEMBLY OF MAIN GEAR DOOR ACTUATING CYLINDER. (Refer to Figure 6-30.) On main gear door, cylinders with Assembly No. 451 844 or 455 934 stamped on the name plate, refer to Assembly of Nose Gear Door Actuating Cylinder, paragraph 6-102. The following steps are for Cylinder Assembly No. 451 845 only:

a. Install new "O" rings to the anchor assembly (14), gland fitting (5) and piston (9).

b. Insert the piston into the gland fitting and install the jam nut (2) and rod end bearing (1) to the end of the piston assembly.

c. Insert the piston and gland fitting into one end of the cylinder barrel (8) and the anchor assembly (14) into the other end.

d. Align the holes in the cylinder barrel, gland fitting and the anchor assembly. Install a roll pin (6 and 12) to each hole securing the cylinder ends.

NOTE

Install the roll pins with the slots outboard or away from each other.

e. Safety the roll pins with MS20995-C32 safety wire.

6-104. INSTALLATION OF NOSE AND MAIN GEAR DOOR ACTUATING CYLINDERS.

a. Position the cylinder inside the wheel well.
b. Install the machine bolt securing the cylinder end to the mounting bracket.
c. Connect the hydraulic lines to the cylinder.
d. Connect the rod end bearing to the door mechanism by following the procedure outlined in Adjustment of Main Landing Gear Doors or Adjustment of Nose Landing Gear Doors, Section VII.

6-105. TIMER CHECK VALVE. (SEQUENCE VALVE.) (PA-23-250 [six place], Serial Nos. 27-2505 and up.)

6-106. REMOVAL OF TIMER CHECK VALVE.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)
b. Place a drip pan to catch hydraulic fluid spillage under the landing gear where the valve is to be removed.
c. Disconnect the hydraulic lines from the valve and cover the open line ends to prevent contamination.
d. Remove the valve by removing the self-locking nuts, washers and bolts securing it inside the wheel well.

6-107. DISASSEMBLY OF TIMER CHECK VALVE. (Refer to Figure 6-31.)

a. Holding the valve with the plug end up, remove the plug (14) by unscrewing it from the valve body (1). The plunger (9), washer (10), back-up rings (11 and 13) and the "O" rings (8 and 12) will come out with the plug.
b. Separate the plunger assembly (8 thru 13) from the plug.
c. Remove the back-up seat (6) and its "O" rings (5 and 7).
d. Remove the ball (4), guide (3) and spring (2) from the valve body (1).

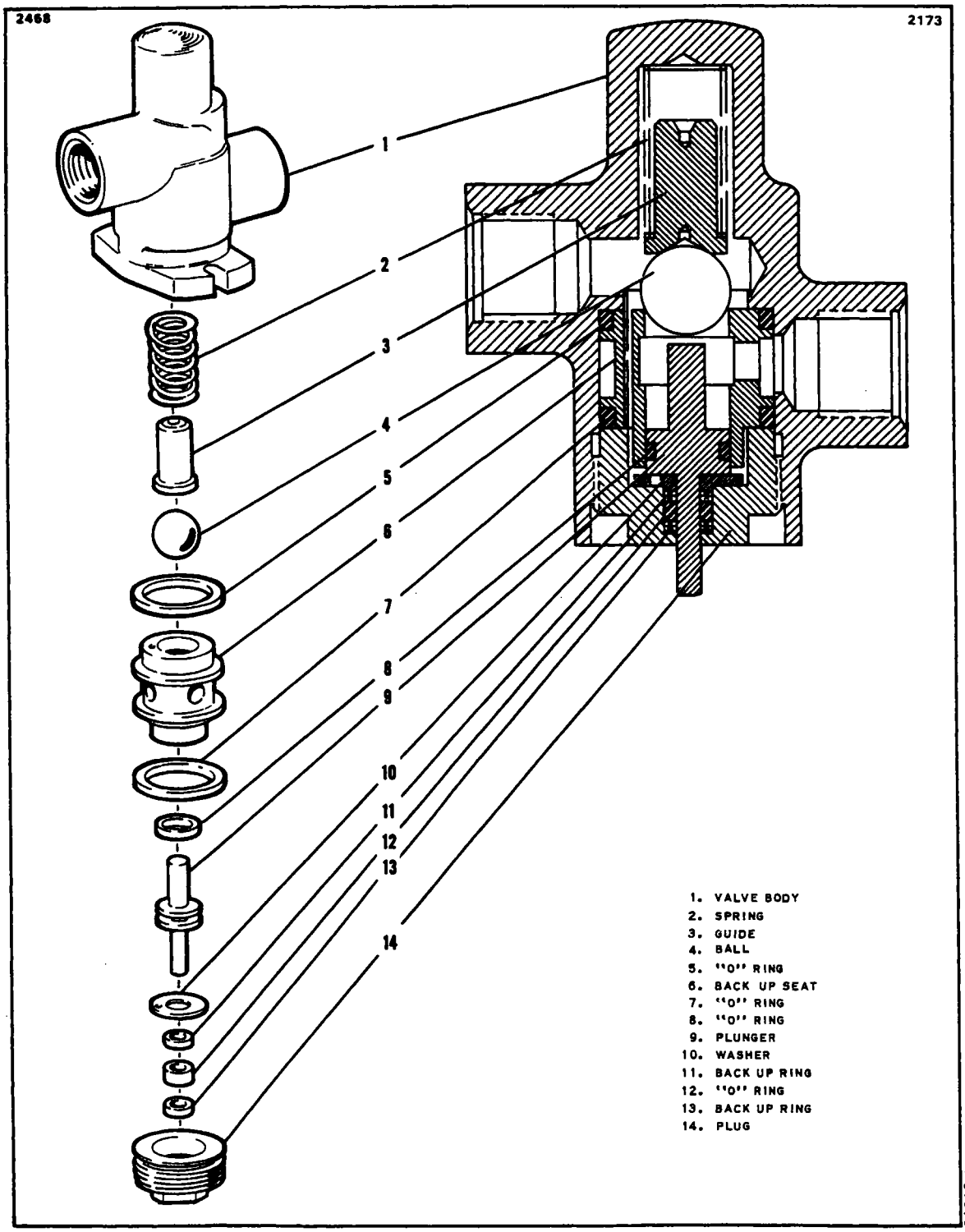


Figure 6-31. Timer Check Valve

6-108. CLEANING, INSPECTION AND REPAIR OF TIMER CHECK VALVE.

a. Clean the valve parts with a suitable solvent and dry thoroughly.

b. Inspect all surfaces for cleanliness and for freedom from cracks and excessive wear.

c. Replace defective parts with serviceable parts. Minor scratches and scores may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458) providing their removal does not affect the operation of the unit. Install all new "O" rings and back-up rings during reassembly of the valve.

6-109. ASSEMBLY OF TIMER CHECK VALVE. (Refer to Figure 6-31.)

a. Install the spring (2), guide (3) and ball (4) to valve body (1).

b. Install new "O" rings (5 and 7) to the back-up seat (6) and install the assembly to the valve body by inserting the large diameter end first.

c. Install an "O" ring (8) to the plunger (9).

d. On the small diameter end of the plunger, install a washer (10), back-up ring (11), "O" ring (12) and back-up ring (13).

e. Insert the small end of the plunger assembly (8 thru 13) into the plug (14).

f. Position the plug and piston assembly to valve body and secure.

6-110. TESTING TIMER CHECK VALVE.

a. Connect the pressure line of a hydraulic test unit to the port of the valve furthest from its mounting base.

b. Open the test unit by-pass valve.

c. Operate the test unit and slowly close the by-pass valve.

d. Apply 2000 psi maximum hydraulic pressure to the valve and ascertain that fluid does not appear at the open end.

6-111. INSTALLATION OF TIMER CHECK VALVE.

a. Position the valve to its bracket inside the wheel well and secure with bolts, washers and self-locking nuts.

b. Uncover and connect the hydraulic lines to the valve. The line coming from the landing gear door cylinder should be connected to the lower of the two valve ports.

c. Fill the powerpak (Refer to Filling Hydraulic System, Section II.) and cycle the landing gear several times using the hand pump. Check the valve for proper operation and leaks.

d. Remove the drip pan and the airplane from jacks.

6-112. PRIORITY VALVE. (PA-23-250 [six place], Serial Nos. 27-2505 and up.)

6-113. REMOVAL OF PRIORITY VALVE.

a. Place the airplane on jacks. (Refer to Jacking, Section II.)

b. Place a container or rag under the priority valve to catch any hydraulic fluid spillage.

c. Disconnect the control wire from lock pin in the end of the priority valve.

d. Disconnect the hydraulic lines from the top of the valve.

e. Remove the valve by removing the self-locking nuts, washers and bolts securing the valve in place.

6-114. DISASSEMBLY OF PRIORITY VALVE. (Refer to Figure 6-32.)

a. Cut the safety wire and loosen the jam nut (5).

b. Remove the lock pin (3).

c. Unscrew the adjusting cap (1) and remove the lock pin bushing (2), spring guide (4), spring (6) and spring guide (7) from the valve body (8).

d. Remove cap (16) and "O" ring (15) from the opposite end of the valve body.

e. Remove the spring (14), check seat (12) with "O" ring (13), and the poppet and pin assembly (11) with back-up ring (10) and "O" ring (9) by pulling on the pin portion of the poppet and pin assembly.

6-115. CLEANING, INSPECTION AND REPAIR OF PRIORITY VALVE.

a. Clean the cylinder parts with a suitable solvent and dry thoroughly.

b. Inspect all surfaces for cleanliness, freedom from cracks and excessive wear.

c. Replace defective parts with serviceable parts. Minor scratches and scores may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458) providing their removal does not affect the operation of the unit. Install all new "O" rings and back-up rings during reassembly.

6-116. ASSEMBLY OF PRIORITY VALVE. (Refer to Figure 6-32.)

a. Install a new "O" ring (9) and back-up ring (10) to the poppet and pin assembly (11) and insert the assembly into the valve body (8) with the round headed poppet end first.

b. Install a new "O" ring (13) to the check seat (12) and install the assembly into the valve body with the slotted end of the seat toward the outside.

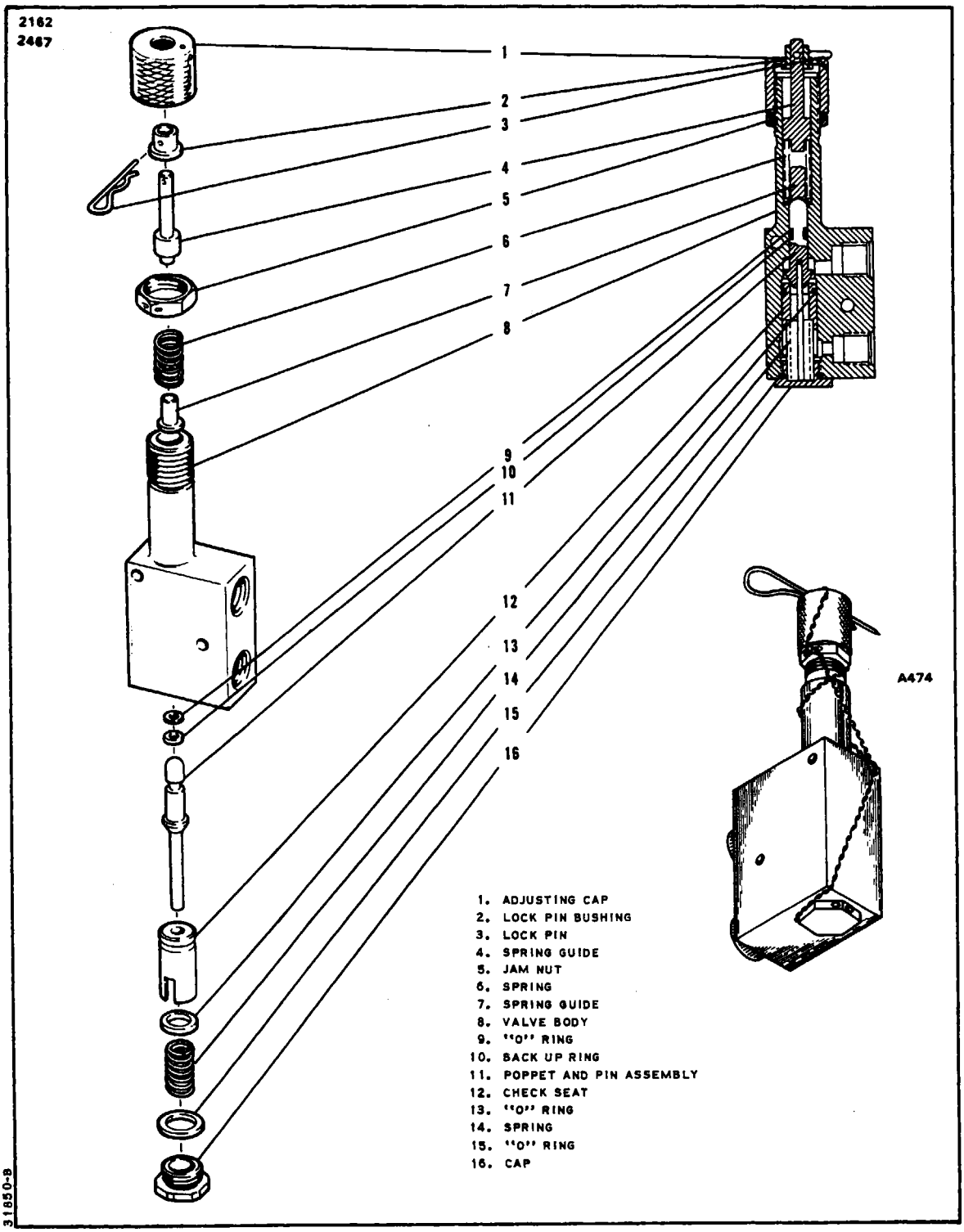


Figure 6-32. Priority Valve

c. Install the spring (14) into the valve body.

d. Install a new "O" ring (15) to the cap (16) and secure the cap to the end of the valve body.

e. In the opposite end of the valve, install the spring guide (7), spring (6), spring guide (4), lock pin bushing (2) and the knurled adjusting cap (1).

f. Tighten the adjusting cap until the lock pin can be freely inserted through the lock pin bushing (2) and the end of the spring guide (4).

g. Test and adjust the valve in accordance with instructions in Paragraph 6-117, and safety valve with MS20995-F20 wire as shown in Figure 6-32.

6-117. TESTING AND ADJUSTMENT OF PRIORITY VALVE.

a. Using a suitable hydraulic test stand, connect a pressure line to the side of the valve marked "GEAR UP."

b. Connect a clear plastic line to the side of the valve marked "DOOR CYL."

c. Apply pressure to the valve slowly to ascertain cracking pressure. The valve should open and hydraulic fluid should appear in the clear plastic tube when 600 ± 25 psi is reached. If the valve does not open or opens below 600 ± 25 psi is obtained, the following procedure may be used to adjust the valve:

1. Loosen the jam nut and tighten the adjusting cap until it stops.
2. Adjust the test unit to maintain 600 psi between the unit and the valve.
3. Slowly unscrew the adjusting cap until fluid starts to flow in the clear plastic tube.
4. Tighten the jam nut against the adjusting cap. Recheck the pressure.

d. If the test stand permits, the valve may be checked for proper flow rate of 1.1 gallons per minute at 700 psi.

e. To check the reverse flow, connect the pressure line to the side of the valve marked "DOOR CYL" and the clear plastic line to the side marked "GEAR UP."

f. Apply pressure to the valve slowly to ascertain cracking pressure. The valve should open and hydraulic fluid should appear in the clear plastic tube when 18 psi is reached.

g. If the test stand permits, the valve may be checked for a proper reverse flow rate of 1.1 gallons per minute at 22 psi.

h. If any of the preceding conditions cannot be obtained, the valve must be overhauled or replaced.

i. Safety the valve in a figure 8 pattern with MS20995-F20. (Refer to Figure 6-32.)

6-118. INSTALLATION OF PRIORITY VALVE.

a. Position the priority valve to its mounting bracket inside the control pedestal and secure with bolts, washers and self-locking nuts.

b. Uncover the hydraulic lines and connect them to the valve.

c. Connect the control wire to the lock pin installed through the end of the valve. Position the pin with the round portion to the left.

d. Remove the airplane from jacks.

6-119. HYDRAULIC LINES.

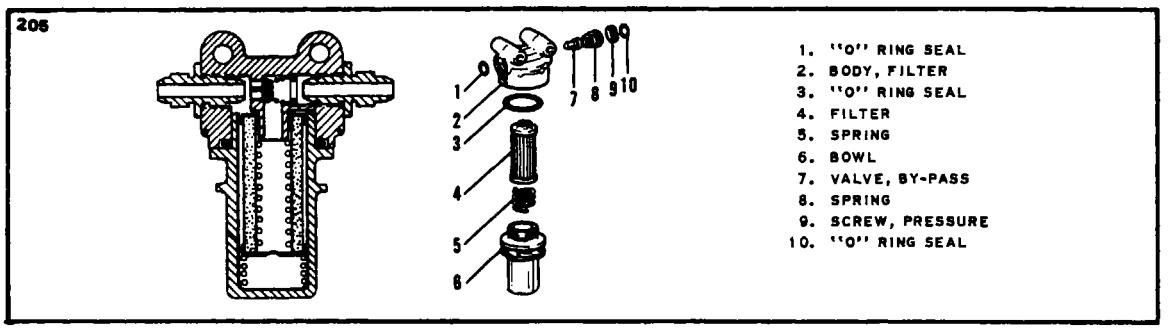


Figure 6-33. Hydraulic Filter

6-120. REMOVAL AND INSTALLATION OF HYDRAULIC LINES. Remove a damaged hydraulic line by disconnecting the fittings at each end and by disconnecting where secured by brackets. Refer to Figure 6-2 or 6-4 as an aid in the location of attaching brackets and bends in the lines. Provide a small container for draining the line. Install a new or repaired line in reverse order.

NOTE

Where straight thread type fittings are used, the locknuts are to be tightened so that the "O" ring seals are on the non-threaded portion of the fitting.

6-121. HYDRAULIC FILTER(S).

6-122. REMOVAL AND INSTALLATION OF HYDRAULIC FILTER. The hydraulic filter, located on the upper tube of the engine motor mount, is removed by the following procedure:

a. Remove the inboard side panel from the left engine cowl. On airplanes with serial nos. 27-7854051 and up, a filter is also installed on the right engine mount. Access is gained through the outboard side panel of the right engine cowl.

b. Disconnect the filter inlet hose and outlet line from the filter.

c. Remove the filter from the motor mount by holding the bolts at the filter and turning off the nuts at the bracket.

d. The filter may be installed in the reverse procedure.

e. After the engine has been operated, check for leaks.

6-123. REPLACEMENT OF FILTER ELEMENT. (Refer to Figure 6-33.)

a. Remove the side panel from the engine cowl.

b. Cut safety wire, unscrew bowl and remove filter element.

c. Clean filter bowl with a suitable cleaning solvent and dry.

d. Replace filter element and "O" ring on bowl.

e. Half fill filter bowl to minimize trapped air in the hydraulic system and replace bowl.

f. Safety filter bowl with MS20995-C20 safety wire and replace the side panel on the engine cowl.

g. After engine has been operated, check for leaks.

6-124. EMERGENCY GEAR EXTENSION SYSTEM. (Serial Numbers 27-1 to 27-7954121 incl.)

6-125. DESCRIPTION OF EMERGENCY GEAR EXTENSION SYSTEM. In the event of a hydraulic system failure caused by a line breaking or the powerpak malfunctioning, the landing gear can be lowered by using the emergency gear extender. The control for the extender is located beneath a small cover plate under the pilot's seat. When the control is pulled, CO2 flows from a cylinder under the floorboards through separate lines to the landing gear cylinders and extends the gear.

6-126. SERVICING EMERGENCY GEAR EXTENDER. Replace the CO2 bottle whenever it weighs less than 132 grams or one gram less than the weight marked on the bottle.

6-127. RESETTING EMERGENCY GEAR EXTENDER.

CAUTION

After using the emergency gear extender, do not actuate landing gear or flap until the following procedures have been performed.

a. Place the aircraft on jacks. (Refer to Jacking, Section II.)

WARNING

Do not remove CO2 bottle until the pressure is released.

b. Loosen the CO2 lines at the fitting, adjacent to the CO2 bottle, thus allowing release of the pressure in the hydraulic system.

c. In airplanes with Serial Nos. 27-2505 and up, reset priority valve per instructions given in Paragraph 6-128.

d. On Gar-Kenyon shuttle valves only (Refer to Figure 6-26) remove the elbow fitting from the side of the valve marked "MAIN" and reset the shuttle to the "EMG" side of the valve. Use a wood dowel rod to push on the shuttle. Listen for the click as the shuttle snaps into position.

e. Repair the hydraulic system as required. If necessary for troubleshooting, fill the hydraulic system. (Refer to Hydraulic System, Section II.)

f. After the hydraulic system has been repaired, filled and checked, cycle the landing gear several times, using the hand pump or test unit to ascertain that all the air is bled from the cylinders. Reconnect the CO2 lines and safety the discharge mechanism ring with 0.016 inch soft aluminum safety wire. After arming the cutter head by positioning the cable actuated lever against the cutter head body, install a charged CO2 bottle and anchor with the set screw.

CAUTION

The bottle attachment must be gas tight.

6-128. RESETTING PRIORITY VALVE. (PA-23-250 [six place], Serial Nos. 27-2505 and up.) When the emergency gear extender is pulled, a locking pin is withdrawn from the hydraulic system priority valve, allowing the valve to open. The priority valve is located approximately six inches up from the floor on the right rear side of the control pedestal.

a. Ascertain that the extender cable is not damaged.

b. Insert lock pin (3, Figure 6-32) into one side of the lock pin bushing (2). This holds the bushing out.

c. Push the guide shaft (4) into the valve, align the holes and finish inserting pin.

d. Ascertain that when the extender ring is pulled, the priority valve will open prior to the CO2 bottle discharging.

6-129. EMERGENCY GEAR EXTENDER CABLE RIGGING. (Refer to Figure 6-34.) It is possible that flexing or slipping of the priority valve actuating cable may retard landing gear extension with the CO2 system. If not previously installed, Kit number 756 878 should be installed in aircraft Serial Nos. 27-2505 to 27-2658 inclusive to prevent further flexing or slipping of this cable. The rigging of the cable follows:

a. Remove the CO2 bottle from the discharge unit.

b. Check the 2.50 inch dimension on the end of the cable housing to the pin in the priority valve as shown in Figure 6-34, Sketch "A" and tighten clamp. If necessary, cut end of flexible housing to obtain the 2.50 inch dimension. This dimension must be maintained.

c. Lift the emergency gear extension cover located under the pilot's seat. Gently pull on the ring until all of the slack is taken up in the cable to the priority valve.

d. Gently take up the slack in the cable to the CO2 discharge unit so that it will slide up the ring as shown in Figure 6-34, Sketch "B." The CO2 cable should be 1 inch longer than the priority valve cable at this point.

e. This will give you the proper rigging of the cables to mechanically open the priority valve before introducing CO2 to the system.

f. Replace the gear extension cover and CO2 bottle in the discharge unit.

6-130. BYPASS FLOW VALVE. (PA-23-250 [six place], Serial Nos. 27-4426, 27-4574 and up.) When the flap system is activated the bypass flow valve allows a set amount of hydraulic fluid to bypass the flap actuating cylinder, thus delaying the time required to extend the flaps.

6-131. BYPASS FLOW VALVE TEST. This test should be performed in flight. Use a power setting of 2400 RPM to obtain an indicated airspeed of 125 MPH. Select flaps down and record the time required for the selector handle to return to neutral; it should be 10 seconds +1 -2 seconds. If the selector handle does not return to neutral it could be due to the bypass valve allowing an excess amount of fluid to flow through the return part of the valve. To check this condition, remove the bypass line from the valve and plug the outlet port and cap the bypass line. Then try the system again, if the handle returns to neutral it means the valve needs readjustment. A slightly less time adjustment may be required to correct this condition.

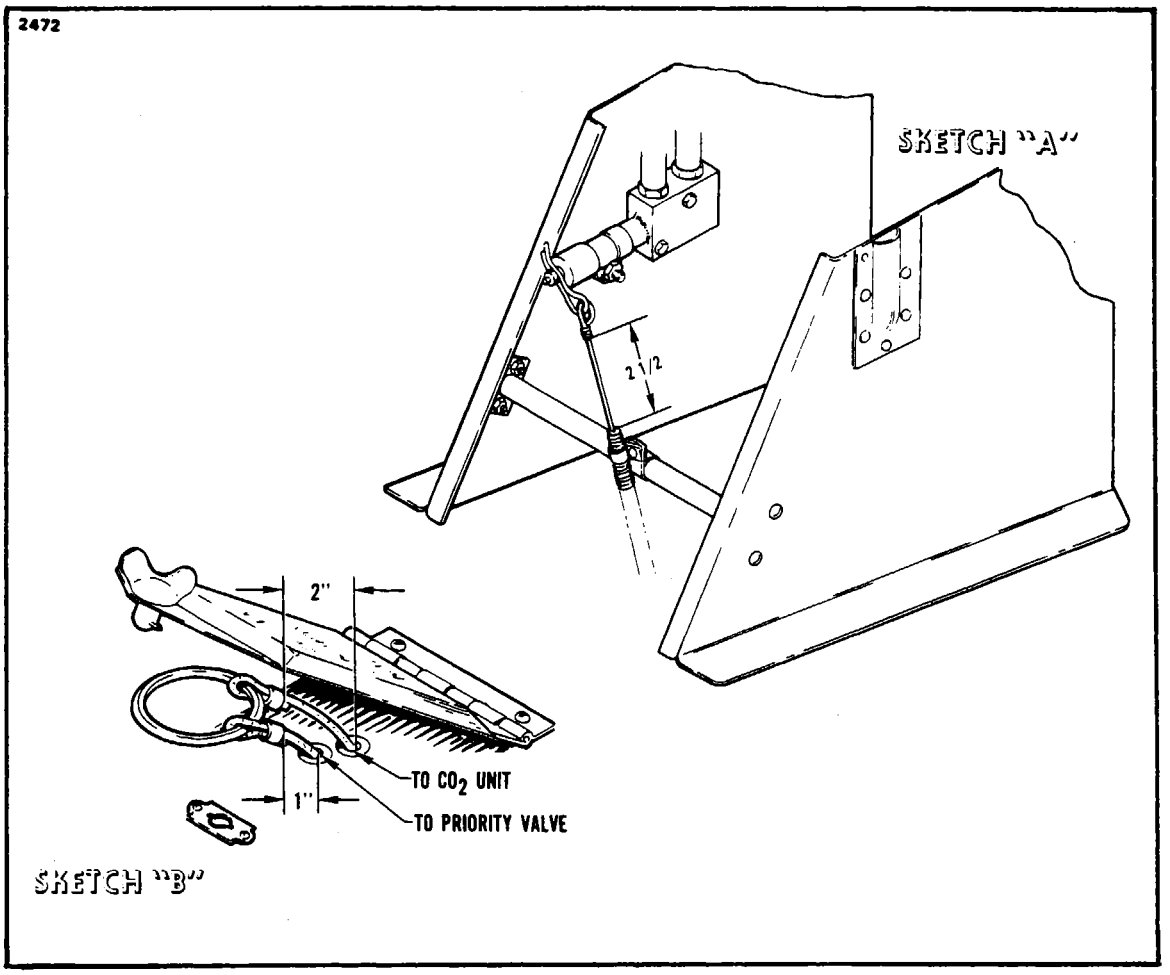


Figure 6-34. Emergency Gear Extender Cable Rigging

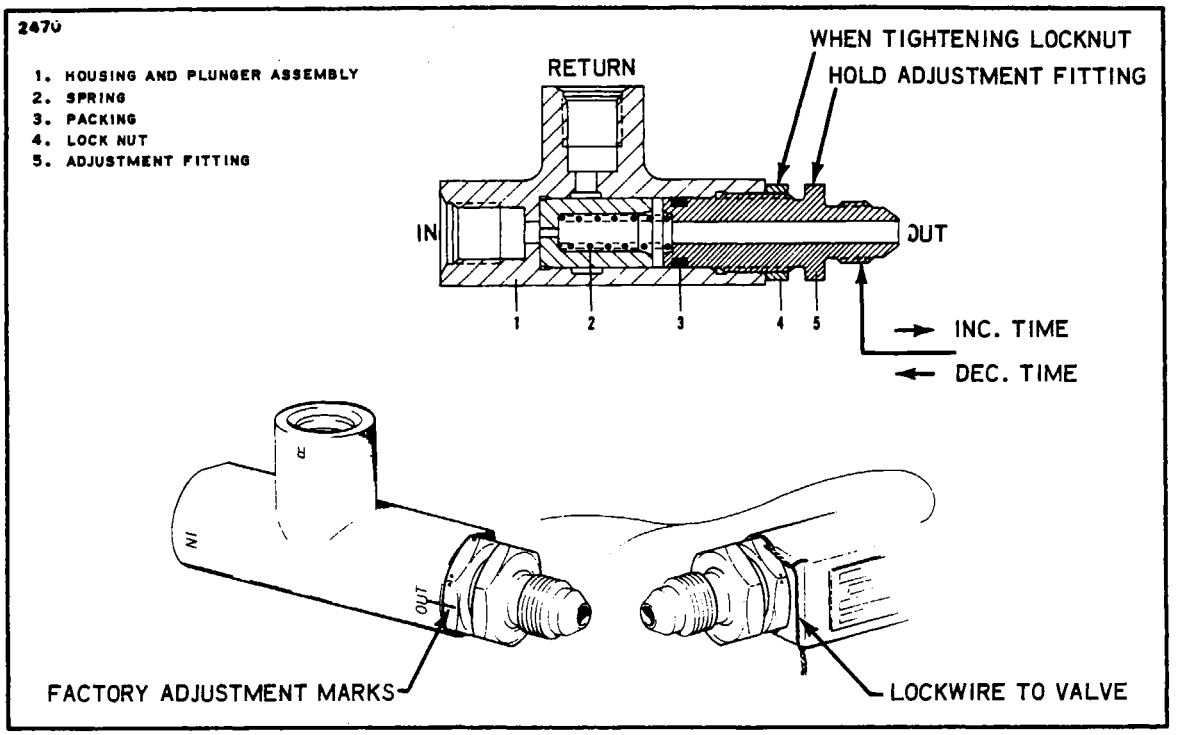


Figure 6-35. Bypass Flow Valve

6-132. BYPASS FLOW VALVE ADJUSTMENT. (Refer to Figure 6-35.)

a. Remove the right center seat from the airplane.

b. Remove the trim panels from the right side of the cabin, just aft of the cabin entrance door.

c. Cut and remove the safety wire from the bypass valve locknut.

d. Adjust the valve by loosening the locknut and turning the fitting IN to decrease or OUT to increase the time.

NOTE

The adjustment fitting should be turned a quarter of a turn between tests as this will give a one or two second change in time.

e. Hold the adjustment fitting securely when tightening the locknut so as not to change the setting.

f. Perform the test given in paragraph 6-131.

g. When the valve is properly adjusted, safety the locknut to the valve body with MS20995C20 safety wire.

h. Install the trim panels and center seats.

TABLE VI-V. HYDRAULIC SYSTEM TROUBLESHOOTING

Trouble	Cause	Remedy
Flap and landing gear systems (both) fail to operate.	Hydraulic fluid reservoir below operating level.	Refer to paragraph 6-35. Then fill powerpak with hydraulic fluid. (Refer to Servicing Hydraulic System, Section II.)
	Hydraulic pump(s) failure.	If both systems function using hand pump and lines are not damaged, check condition of hydraulic pump. (Refer to paragraphs 6-13 and 6-28.)
	Leak or obstruction in hydraulic lines between pump(s) and powerpak.	Check each system with hand pump. If they both work, check lines for damage. Replace damaged line. (Refer to paragraphs 6-35 and 6-120.) If hand pump fails to work refer to "Hydraulic Powerpak failure" under the column heading "Cause."
Landing gear system fails to operate.	Leak or damage in hydraulic lines between the three landing gears actuating cylinders and the powerpak.	Check lines for damage. Replace damaged line. (Refer to paragraphs 6-35 and 6-120.)
	Internal or external leakage in actuating cylinder.	Check all three actuating cylinders for damage. (Refer to paragraph 6-35.)
		Replace defective cylinder. (Refer to paragraph 6-86.)

TABLE VI-V. HYDRAULIC SYSTEM TROUBLESHOOTING (cont.)

Trouble	Cause	Remedy
Landing gear system fails to operate. (cont.)	Hydraulic Powerpak failure.	Refer to Table VI-VI.
Wing flap system fails to operate.	Leak or damage in hydraulic lines between actuating cylinder and Powerpak.	Check lines for damage. Replace damaged line. (Refer to paragraphs 6-35 and 6-120.)
	Internal or external leakage in actuating cylinder.	Check actuating cylinder for damage. Replace if defective. (Refer to paragraph 6-35.)
	Hydraulic Powerpak failure.	Refer to Table VI-VI.
Landing gear system functions improperly.	Hydraulic Powerpak failure.	Refer to Table VI-VI.
Landing gear operation extremely slow.	Hydraulic fluid reservoir level low.	Refer to paragraph 6-35. Then fill Powerpak with hydraulic fluid. (Refer to Servicing Hydraulic System, Section II.)
	Engine-driven hydraulic pump(s) output low.	Replace or rebuild pump(s). (Refer to paragraph 6-29.)
	Internal leak in Powerpak.	Refer to Table VI-VI.
Landing gear fails to retract fully.	Excessive hydraulic fluid in CO2 system.	Drain CO2 lines.

TABLE VI-V. HYDRAULIC SYSTEM TROUBLESHOOTING (cont.)

Trouble	Cause	Remedy
Landing gear drops in flight.	Leakage in Anti-Retraction valve. Leakage in Actuating cylinder.	Replace "O" rings in valve or replace valve. Replace "O" rings in actuating cylinder or replace cylinder.
Up light will not stay on in flight.	Hydraulic fluid internal leak in system. Powerpak valve sticking.	Check system for fluid leaks. Refer to Table VI-VI.
(1)Landing gear door(s) closing prior to wheel(s) retracting into well.	Timer check (sequence) valve leaking.	Check condition of valve and replace if necessary.
(1)Landing gear door(s) not opening prior to landing gear(s) starting to extend.	Priority valve leaking below required pressure on valve side.	Check valve required pressure (Refer to Table VI-I and adjust or replace if necessary.

1. PA-23-250 (SIX PLACE), SERIAL NOS. 27-2505 AND UP ONLY.

TABLE VI-VI. POWERPAK TROUBLESHOOTING

Trouble	Cause	Remedy
Flap and landing gear systems both fail to operate.	Broken inner "O" ring seal (129) on landing gear selector spool.	Isolate and replace "O" ring seal.
	External leakage at base of hand pump handle.	Replace "O" rings (57 and 59).
	Internal leakage in main relief valve.	Check for damage or foreign matter lodged between ball (35) and seat (34) of short valve assembly (162), or poppet assembly (145) of tall valve assembly (161). Replace damaged "O" ring (33 or 144).
	Internal leakage in hand pump and filter. (only when using hand pump.)	Check for damage or foreign matter lodged between ball (23) and seat (21). Replace damaged "O" rings (22 and 61).

NOTE

Where duplicate parts are used in the two systems, only one part is illustrated and indexed on the exploded view. Be sure to check the part applicable to the landing gear or flap systems. Also, check the parts which are under pressure first. (Refer to the flow diagrams, Figures 6-10 through 6-14 for illustrations of the parts under pressure for the position of the selector valve when the Powerpak fails.)

NOTE: Reference numbers, refer to Figure 6-20.

TABLE VI-VI. POWERPAK TROUBLESHOOTING (cont.)

Trouble	Cause	Remedy
Landing gear system fails to operate.	Internal leakage in poppets (84 and 91).	Check for damage or foreign matter lodged between poppets and seats. Replace damaged "O" rings (81, 83, 86, 88, 90 and 93).
	Internal or external leakage at cam spools (128).	Replace damaged "O" rings (129).
	Internal leakage at detent plunger (77).	Replace damaged "O" ring (78).
	Internal leakage in thermal relief valve.	Check for damage or foreign matter lodged between ball (72) and seat (73). Replace damaged "O" ring (74).
	External leakage at at plugs (115 and 121).	Replace damaged "O" rings (116 and 122).
Flap system fails to operate.	Internal leakage in poppets (84 and 91).	Check for damage or foreign matter lodged between poppets and seats. (Replace damaged "O" rings (81, 83, 86, 88, 90 and 93).
	Internal leakage at detent plunger (77).	Replace damaged "O" ring (78).

TABLE VI-VI. POWERPAK TROUBLESHOOTING (cont.)

Trouble	Cause	Remedy
Flap system fails to operate. (cont.)	Internal leakage in thermal relief valve.	Check for damage or foreign matter lodged between ball (72) and seat (73). Replace damaged "O" ring (74).
	External leakage at plugs (115 and 121).	Replace damaged "O" rings (116 and 122).
Landing gear drops in flight.	Thermal contraction of hydraulic fluid.	"Ground check".
Hydraulic fluid leaks out of vent after filling reservoir.	Excessive fluid in system due to improper filling technique.	Refer to Servicing Hydraulic System, Section II.
Hydraulic fluid continues to leak out of vent after three or more gear cycles.	Engine pump(s) shaft leaking.	Replace pump(s) or seal.
Landing gear drops in flight.	Leak in pressure and/or return poppet (84 and 91).	Replace poppet(s) as required.

TABLE VI-VII. POWERPAK PARTS LIST

Electrol No.	Piper No.
750P-1[1]	31800-0[1]
-	31800-2
-	31800-2M
-	31800-3

FIGURE 6-20 INDEX NUMBER	PART NUMBER	DESCRIPTION	UNITS PER ASSY
1	AN365-428	NUT	1
2	31926-00	WASHER, Reservoir	1
3	AN6227-5	PACKING, O-ring	1
4	31827-00	RESERVOIR	1
5	AN6230-36	PACKING, O-Ring	1
6	AN924-6D	NUT	1
7		UNION, Reservoir	1
7a	31927-00	ELBOW, Reservoir	1 [2]
8	Cleveland - 110-9/16	SEAL	1
8a	AN960-916L	WASHER	1
9	31925-00	STRAINER	1
10	AN815-6D	UNION	1
11	AN6290-6	PACKING, O-ring	1
12	31924-00	SPACER, Reservoir	1
13	31944-00	BAFFLE, Reservoir	1
14	31940-00	SPACER, Reservoir	1
15	AN316-4R	NUT	1
16	31939-00	STUD	1
17	1/4-28 NF3	SCREW, Cap socket hd 5/16 in. lg	8[3] or 10[4]
18	AN936B416	WASHER, Lock	8[3] or 10[4]
19	31886-02 (L)	PLATE, Retainer	1
	31886-03 (R)	PLATE, Retainer	1
20	31912-00	STRAINER	1
21	31937-00	SEAT, Check	1
22	AN6227-6	PACKING, O-ring	1

1. NOT AVAILABLE FOR SERVICE
2. USED ONLY WITH POWERPAK ASSEMBLIES 750P-1 AND 31800-0.
3. USED ONLY WITH POWERPAK ASSEMBLIES 750P-1, 31800-0, 31800-2M AND 31800-3.
4. USED ONLY WITH POWERPAK ASSEMBLY 31800-2M.

INDEX NUMBER	PART NUMBER	DESCRIPTION (cont.)	UNITS PER ASSY
23	31804-05	BALL	1
24	31936-00	SPRING, Check	1
25	31951-00	BODY, Relief Valve	1 (2)
26	AN6227-15	PACKING, O-ring	1 (2)
27	MS20995F32	LOCKWIRE	1 (2)
28	31955-00	SCREW	1 (2)
29	31848-00	NUT	1 (2)
30	31957-00	SPRING	1 (2)
31	31952-00	PLUNGER	1 (2)
32	31953-00	PLUG	1 (2)
33	AN6227-4	PACKING, O-ring	1 (2)
34	31954-00	SEAT	1 (2)
35	31814-07	BALL	1 (2)
36	31956-00	RETAINER	1 (2)
37	AN380-2-2	PIN, Cotter	1
38	AN394-19	PIN, Clevis	1
39	AN960PD416	WASHER	1
40	AN380-2-2	PIN, Cotter	1
41	AN320-3	NUT	1
42	AN3-10	BOLT	1
43	AN380-2-2	PIN, Cotter	1
44	AN393-27	PIN, Clevis	1
45	AN960PD10	WASHER	1
46	31922-00	LINK	1
47	52-028-125-1.187	PIN, Roll (ESNA)	2
48	31934-00	STOP	2
49	52-028-125-1.375	PIN, Roll (ESNA)	1
50	31933-00	GRIP	1
51	AN500-6-3	SCREW	2
52	AN935-6L	WASHER, Lock	2
53	31906-00	SPRING	1
54	31825-00	HANDLE	1

2. USED ONLY WITH POWERPAK ASSEMBLIES 750P-1 AND 31800-0.

INDEX NUMBER	PART NUMBER	DESCRIPTION (cont.)	UNITS PER ASSY
55	31829-00	FORK AND BUSHING ASSY	1
56	5000-106	RING, Snap	1
57	AN6227-16	PACKING, O-ring	1
58	31935-00	STOP	1
59	AN6227-13	PACKING, O-ring	1
60	31938-00	PISTON	1
61	AN6227-15	PACKING, O-ring	1
62	NAS50-43	RING, Snap	1
63	AN6227-6	PACKING, O-ring	1
64	31937-00	SEAT, Check	1
65	31814-05	BALL	1
66	31936-00	SPRING, Check	1
67	31876-00	SCREW ASSY	4
68	31872-00	BODY	4
69	31875-00	RETAINER, Upper	4
70	31871-00	SPRING	4
71	31877-00	RETAINER, Lower	4
72	31814-02	BALL	4
73	31874-00	SEAT	4
74	AN6227-4	PACKING, O-ring	4
75	31904-00	PLUG	1 or 2 (5)
76	31947-00	SPRING	1 or 2 (5)
77	31905-00	PLUNGER	1 or 2 (5)
78	PRP902-3/4	PACKING, O-ring	1 or 2 (5)
79	31814-04	BALL	1 or 2 (5)
80	31923-00	RETAINER, Return	4
81	AN6290-6	PACKING, O-ring	1 (2)
82	31856-00	SPRING	4
83	2-15PSI-30-5AN	PACKING, O-ring	4
84	31854-00	POPPET AND SEAT ASSY	4
85	AN6227-3	PACKING, O-ring	4

2. USED ONLY WITH POWERPAK ASSEMBLIES 750P-1 AND 31800-0.
5. TWO USED WITH POWERPAK ASSEMBLIES 750P-1AND 31800-0, ONE USED WITH POWERPAK ASSEMBLIES 31800-2, 31800-2M AND 31800-3.

INDEX NUMBER	PART NUMBER	DESCRIPTION (cont.)	UNITS PER ASSY
86	2-15PSI-30-5AN	PACKING, O-ring	4
87	31913-00	RETAINER, Pressure	6
88	AN6227-10	PACKING, O-ring	6
89	31856-00	SPRING	6
90	2-15PSI-30-5AN	PACKING, O-ring	6
91	31854-00	POPPET AND SEAT ASSY	6
92	AN6227-3	PACKING, O-ring	6
93	2-15PSI-30-5AN	PACKING, O-ring	6
94	AN380-2-1	PIN, Cotter	4
95	AN960-PD4L	WASHER	4
96	AN392-11	PIN, Clevis	4
97	31930-00	LINK	4
98	AN380-2-2	PIN, Cotter	2
99	AN960PD10L	WASHER	2
100	AN960PD10	WASHER	2
101	AN393-21	PIN, Clevis	2
102	AN364-832	NUT, Lock	1
103	31908-00	BOLT	1
104	31909-02 (24V)	KNOB, Landing gear	1
	31909-00 (12V)	KNOB, Landing gear	1
105	52-040-187-0312	PIN, Roll (ESNA)	2
106	31910-00	TUBE, Lever	1
107	31931-00	LEVER, Landing gear	1
108	31932-00	TERMINAL BLOCK AND WIRE ASSY	2
109	31928-00	LEVER	1
110	10-32NF3	SCREW, Cap 11/16 in. lg	1

INDEX NUMBER	PART NUMBER	DESCRIPTION (cont.)	UNITS PER ASSY
111	AN935-10L	WASHER	1
112	31929-00	KNOB, Wing flap	1
113	52-040-187-0750	PIN, Roll (ESNA)	2
114	31942-00	STUD	2
115	31941-00	PLUG	2
116	PRP902-3/4	PACKING, O-ring	2
117	1/4-28NF3	SCREW, Cap socket hd 5/16 in. lg	2
118	AN936B416	WASHER, Lock	2
119	AN960-PD416	WASHER	2
120	31943-00	RETAINER	2
121	31941-00	PLUG	2
122	PRP902-3/4	PACKING, O-ring	2
123	31907-00	SCREW	2
124	31902-00	WASHER	2
125	31946-00	SPRING	2
126	31888-00	SPACER	2
127	31902-00	WASHER	2
128	31887-00 (L)	CAMSHAFT	1
	31887-01 (R)	CAMSHAFT	1
129	AN6227-6	PACKING, O-ring	8
130	31803-00	END FITTING	1
131	MS28778-6	GASKET	1
132	MS28775-011	PACKING	1
133	31861-00	POPPET	1
134	31799-00	SPRING	1
135	31801-00	BODY	1
136	W/H3400X2	ELBOW	1
137	31911-00	PIPE, Stand	1
138	31840-02	BODY	1
139	AN932-1	PLUG	1
140	31873-00	HEAD, Thermal Relief Valve	4
141	31948-00	END FITTING	1 (6)

6. USED ONLY WITH POWERPAK ASSEMBLIES 31800-2, 31800-2M AND 31800-3.

INDEX NUMBER	PART NUMBER	DESCRIPTION (cont.)	UNITS PER ASSY
142	31885-00	RETAINER	1 (6)
143	31963-00	BODY	1 (6)
144	AN6227-7	O-RING	2 (6)
145	31899-00	POPPET ASSY	1 (6)
146	31814-03	BALL	1 (6)
147	31949-00	SPRING	1 (6)
148	31900-00	GUIDE	1 (6)
149	31848-00	NUT	1 (6)
150	31962-00	CAP	1 (6)
151	AN6290-4	PACKING, O-ring	1 (6)
152	31917-00	GEAR DETENT CAP	1 (6)
153	31915-00	SPRING	1 (6)
154	31916-00	DETENT SPRING GUIDE	1 (6)
155	31914-00	PLUNGER DETENT	1 (6)
156	PRP902-3/4	PACKING	1 (6)
157	AN6227-15	PACKING, O-ring	1 (7)
158	32278-00	ADAPTER, Relief Valve	1 (7)
159	-	Not assigned	
160	31878-00	THERMAL RELIEF VALVE ASSY	4
161	31950-00	MAIN RELIEF VALVE ASSY	1 (6)
162	-	MAIN RELIEF VALVE ASSY	1 (2)
163	-	HAND PUMP SUCTION VALVE ASSY	1
164	-	CAMSHAFT RELEASE DETENT ASSY	1 or 2 (5)
165	-	CAMSHAFT RELEASE DETENT ASSY	1 (6)
166	-	HAND PUMP ASSEMBLY	1
167	-	POPPET ASSEMBLY, Return	2
168	-	POPPET ASSEMBLY, Pressure	6
169	-	CAMSHAFT AND RETURN SPRING ASSY	2
170	31862-00	MAIN CHECK VALVE ASSEMBLY	1

2. USED ONLY WITH POWERPAK ASSEMBLIES 750P-1 AND 31800-0.
5. TWO USED WITH POWERPAK ASSEMBLIES 750-1 AND 31800-0, ONE USED WITH POWERPAK ASSEMBLIES 31800-2, AND 31800-2M AND 31800-3.
6. USED ONLY WITH POWERPAK ASSEMBLIES 31800-2, 31800-2M AND 31800-3.
7. USED ONLY WITH POWERPAK ASSEMBLY 31800-2M.

TABLE VI-VIII. POWERPAK SERVICE LIMITS

FIGURE 6-20 INDEX NUMBER	PART NO.	ITEM	MFG. TOL.	NOMINAL	MIN. SERVICE LIMIT	MAX. SERVICE LIMIT
21	31937-00	I.D. Seat - Check	±.005	.171	.1655	.1765
25	31951-00	I.D. Body - Relief Valve	+.002 -.000	.343	.343	.3452
31	31952-00	O.D. Plunger	+.000 -.005	.160	.1545	.160
34	31954-00	I.D. Seat	±.001	.135	.1339	.1361
58	31935-00	I.D. Stop	+.002 -.000	.705	.705	.7072
60	31938-00	O.D. Piston - Shaft	+.000 -.001	.704	.7029	.704
60	31938-00	O.D. Piston - Head	+.000 -.004	.998	.9936	.998
64	31937-00	I.D. Seat - Check	±.005	.171	.1655	.1765
73	31874-00	I.D. Seat	±.001	.100	.0989	.1011
77	31905-00	O.D. Plunger	+.000 -.003	.217	.2137	.217

POWERPAK SERVICE LIMITS (cont.)

INDEX NUMBER	PART NO.	ITEM	MFG. TOL.	NOMINAL	MAX. SERVICE LIMIT	MIN. SERVICE LIMIT
91 & 84	31854-00	Poppet & Seat Ass'y				
	31853-00	I.D. Seat	+.0005 -.0000	.3125	.3125	.31305
	31852-00	O.D. Poppet	+.0000 -.0003	.3122	.31187	.3122
128	31887-00 31887-01	O.D. Spool (Camshaft) (L) (R)	+.0000 -.0005	.4365	.43595	.4365
138	31840-02 31840-03	Body - Bushing Ass'y				
		I.D. Piston Head Bore	+.003 -.000	1.000 1.000	1.000	1.0033
		I.D. Spool Bore	+.002 -.000	.437	.437	.4392
		I.D. Spool Detent Bore	+.003 -.000	.219	.219	.2223

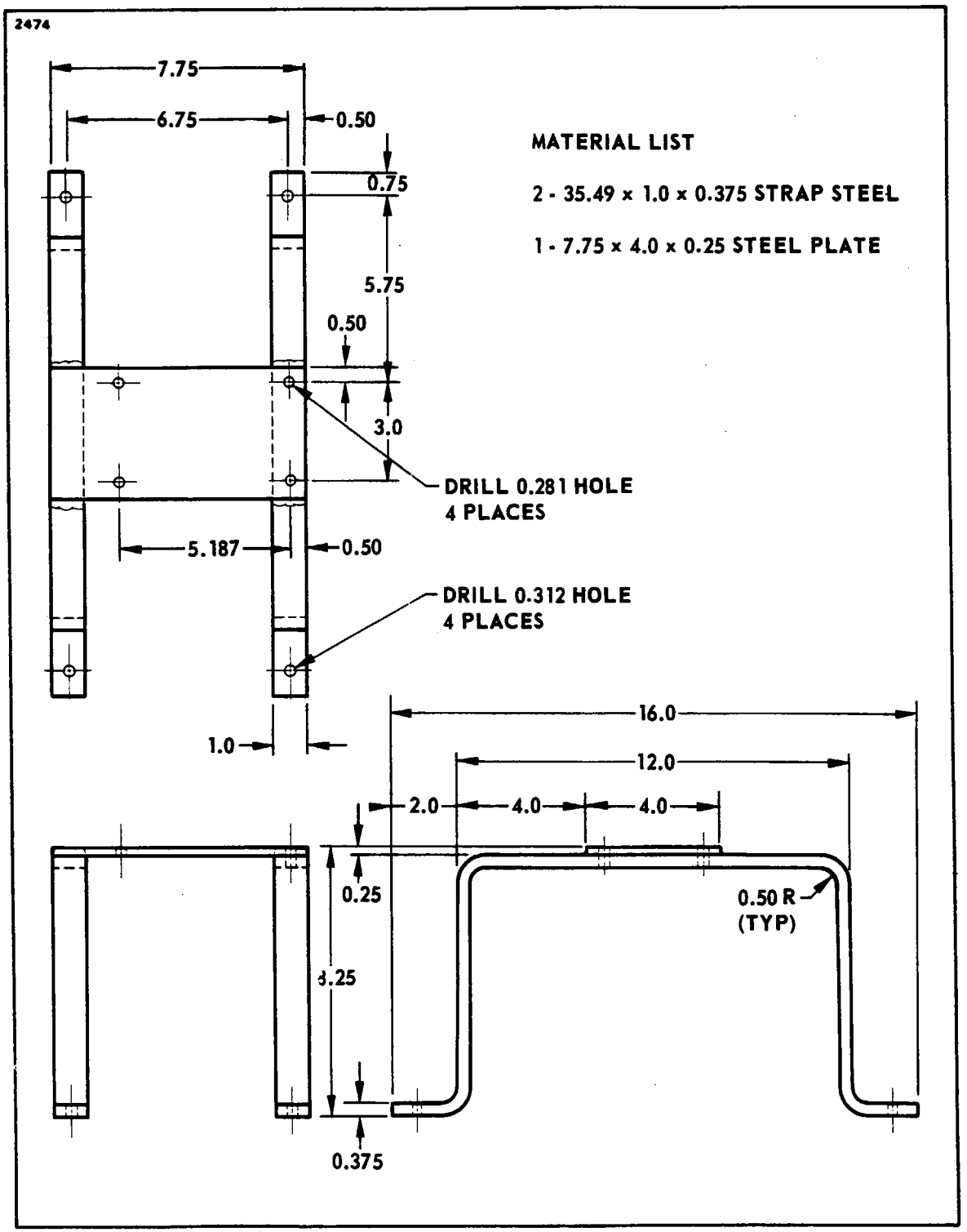


Figure 6-36. Fabricated Work and Test Stand

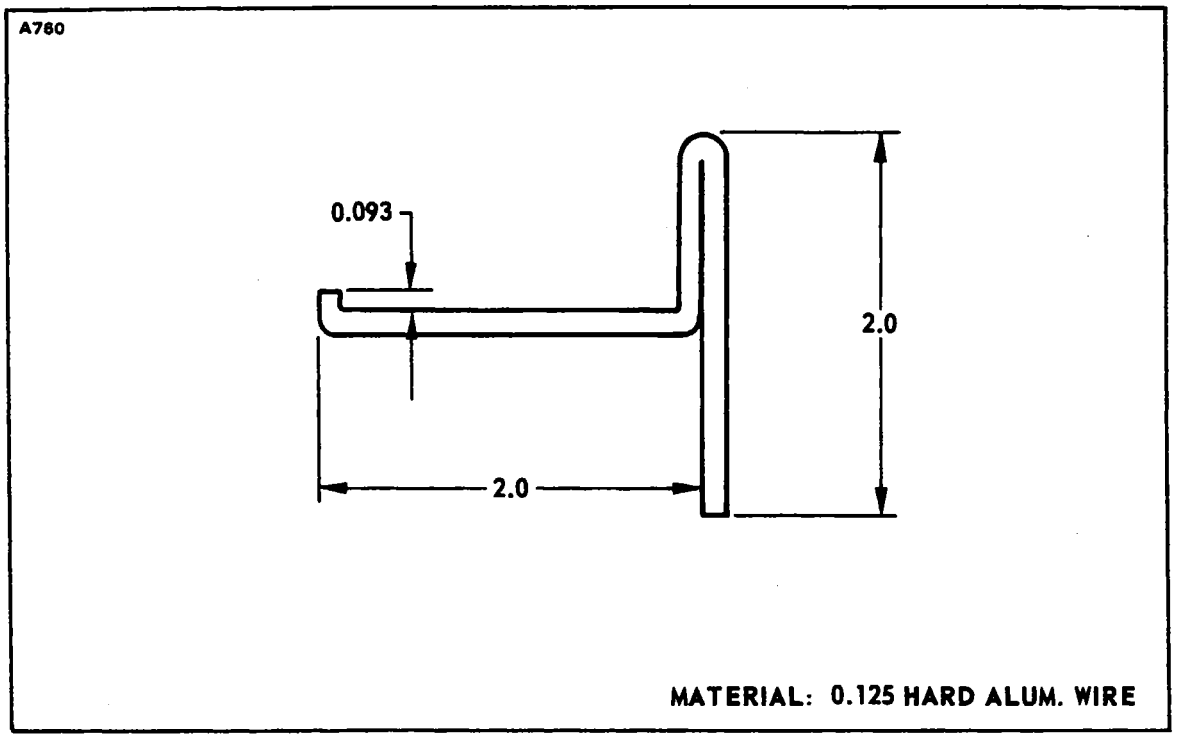


Figure 6-37. Fabricated Hook

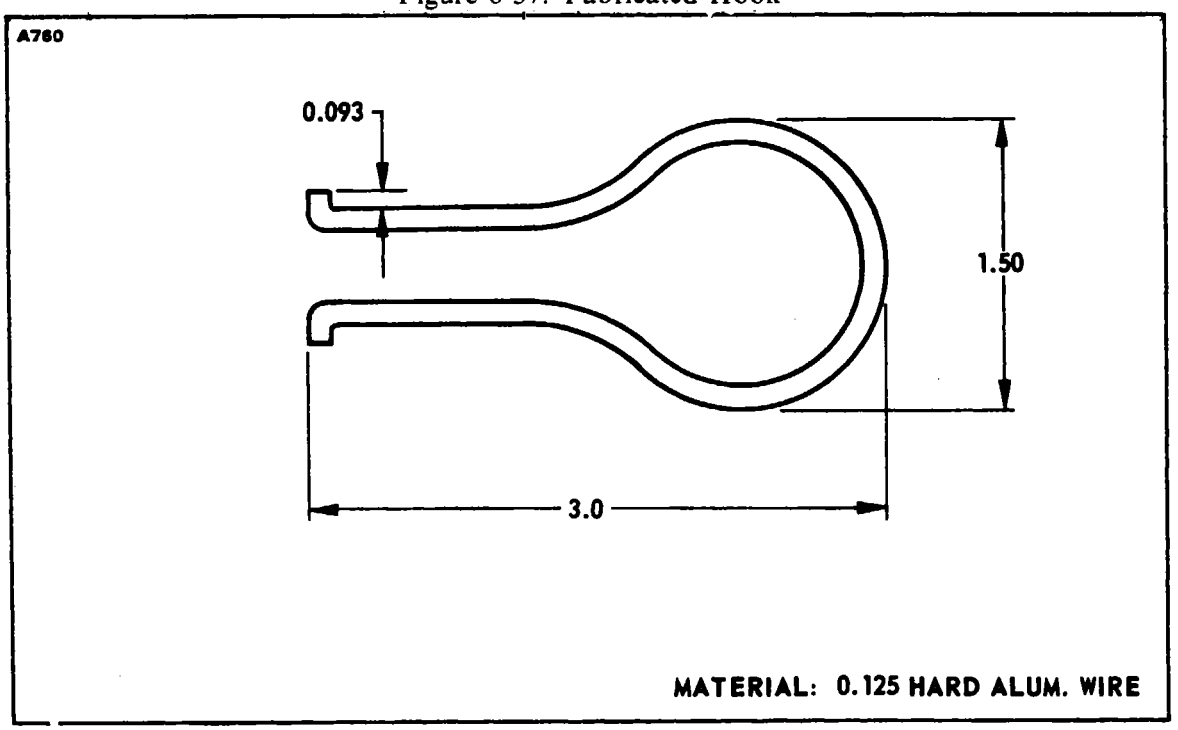


Figure 6-38. Fabricated Hook, Double