SECTION 5 - HYDRAULIC SYSTEM

BRAKE VALVE (PEDAL OPERATED)

DESCRIPTION AND LOCATION

The brake valve is a pedal controlled, spool-type hydraulic valve. It is typically mounted on the front wall/ floor of the cab behind/under the operator's control pedal area.

OPERATION (Figure 1)

The primary function of the pedal controlled brake valve is to control hydraulic pressure in the vehicle's brake system either directly or through the control of other components.

In the released position, the pedal is relaxed and the regulator spool is in the up or relaxed position. In this state, the notches near the top of the spool are exposed to the tank cavity in the valve body. The lower portion of the notched area in the spool is exposed to the regulated pressure output port of the valve. This creates a direct link between the tank port and the regulated port of the valve. In this condition, the pressure in the brake equals that in the return lines to the hydraulic tank, approximately 0 psi (kPa). The brakes are released.

When the operator wishes to apply the brakes, the pedal is depressed. As the pedal moves, it pivots on a rod near the rear of the actuator section and moves down on the valve regulator spring. This in turn pushes the regulator spool down. As the spool begins to move down the bore, the metering notches move out of the tank cavity and closes off the return path to the tank. Continued movement downward cause the notches of the lower edge of the spool to enter the inlet pressure port area of the valve body. The pressurized flow of hydraulic oil from the inlet port is then directed to the brake port. As the pressure increases in the brake system, oil flows through the small orifice in the cavity below the spool. As the pressure rises, force builds up on the bottom of the regulator spool and begins to push the spool upward. If the control is not released, the spool moves upward and compresses the spring between the spool and the cam. Once enough pressure is built in the system, it forces the spool up against the spring and closes off the pressurized oil supply to the regulated output port. The spool is now balanced between the outlet pressure and the pressure of the spring generated by the positioning of the lever.

Further movement of the lever causes the cam to increase the pressure on the spring and repeats the above process until the forces are again balanced.

NOTE: *On some valves, the pedal movement to pressure output is a linear function, that is they are directly proportional throughout the operating range.*

On other valves, particularly those used as pilot valves the pressure is staged, that is it rises linearly at one rate to approximately mid-range, then automatically switches to a different, typically increased rate. This is done to provide increased "feel" or limited braking at low braking requirements while still maintaining full maximum braking.

If the operator wishes to release the brakes, releasing the pedal causes the spool assembly to become unbalanced and move upward. This opens the brake port to the tank. At this time, the trapped oil in the system is released, allowing the brakes to release.

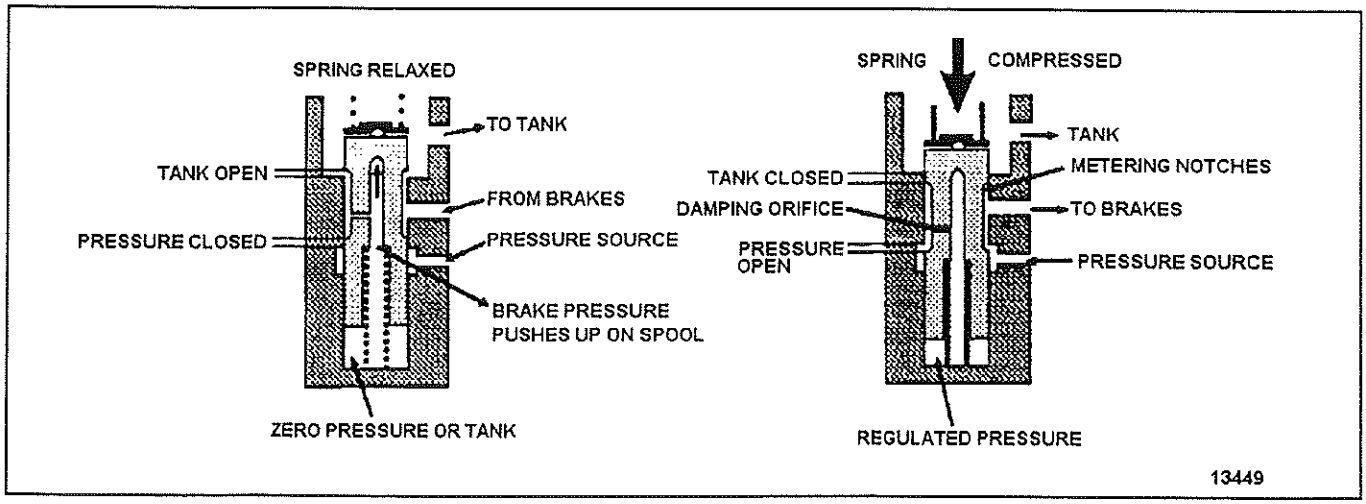


FIGURE 1 - BASIC OPERATION OF THE VALVE

This valve may also be operated by pilot pressure provided by an external source. With no pressure applied to the pilot port, operation is the same as with the pedal released. As the pilot pressure increases, the operation of the valve parallels that during pedal operation until the maximum rated pilot pressure is reached.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance of the valve should include:

1. Inspect the valve and related components and connections for evidence of damage, wear, or leakage. Repair or replace as required.

2. Check the operation of the valve as outlined in the procedures in Section 5 - Hydraulic System or equivalent. Adjust as required by the method called out in the procedures later in this portion of the module.

ADJUSTING THE VALVE (Figure 4)

Pressure Settings

The maximum outlet pressure of the valve may be adjusted as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the equipment's friction brake system.

2. Check the operation of the valve as outlined in the procedures in Section 5 - Hydraulic System or equivalent.

3. Stop the engine.

4. Drain all pressure from the brake accumulators using the manual accumulator drain valves.

5. Remove the pedal and actuator assembly by loosening the locking nuts (22) and washers (23) securing the U-bolts (38) to the assembly and removing the pivot pin (28).

6. Loosen the set screw securing the adjusting collar (1) to the threads on the plunger (2).

7. Move the adjusting collar counter-clockwise (or toward the ends of the threads) to raise the pressure or clockwise (or to the non-threaded portion of the plunger) to lower the pressure.

NOTE: *Fine adjustments may require turning the valve in increments of as little as 1/8th turn.*

8. Retest the pressure as before. Installing the pivot pin (28) and using a flat screwdriver or equivalent as a lever will allow you to depress the actuator without reinstalling the pedal/cam assembly. (Figure 2)

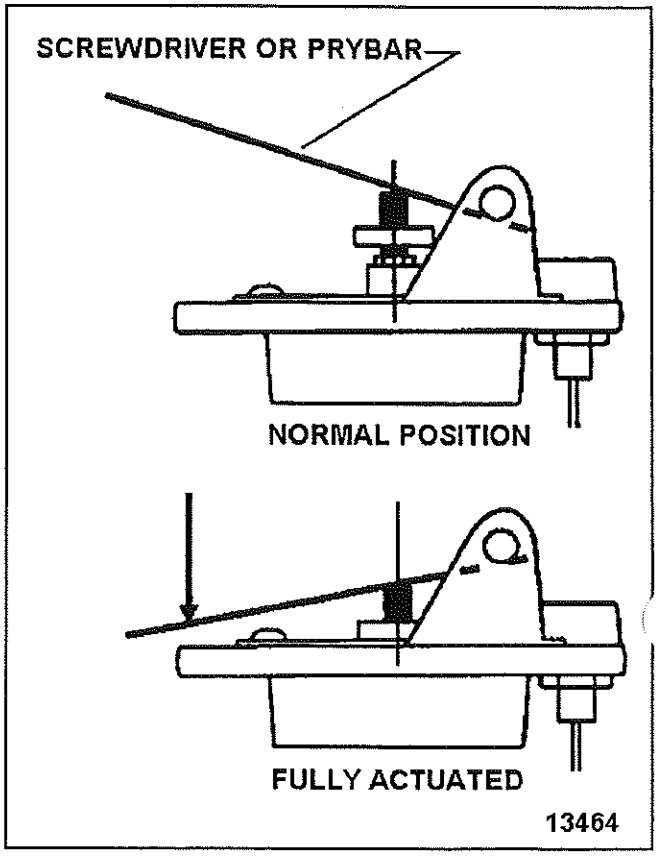


FIGURE 2 - ACTIVATION OF THE VALVE

9. Secure the collar by retightening the set screw to 25 to 30 inch-lbs (2.8 to 3.4 Nm).

10. Reinstall the pedal/cam assembly to the spool section.

11. Repeat steps 1 through 10 until the adjustment is complete.

12. Apply and release the brakes a number of times. Verify that the pressure settings do not change. If they do repeat the above process as required.

NOTE: *When the assembly is new or has been serviced, it is not uncommon for the pressures to decrease slightly due to the "seating" effect of the components.*

13. While monitoring the brake pressure and with the engine at low idle speed, depress the pedal as quickly

as possible. The pressure should reach maximum within 1 second of the time the pedal was depressed.

14. Release the pedal and reapply slowly. Make sure that the brake pressure increase is smooth and no sticking of the spool is observed.

15. Hold the pedal fully depressed for 20 seconds. Verify that the pressure remains at the proper level at all times the pedal is depressed.

16. Slowly release the pedal. Make sure that the brake pressure decrease is smooth and no sticking of the spool is observed.

17. Verify that the valve has an output of 0 psi (kPa) when fully released.

Deadband Adjustment

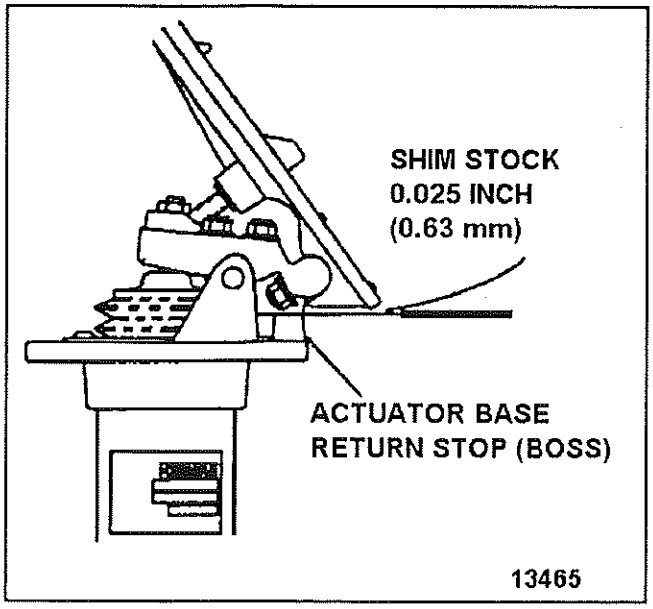


FIGURE 3 - DEADBAND ADJUSTMENT

The operational deadband of the pedal assembly may be adjusted as follows:

1. Loosen the deadband adjustment screw (25) by turning counter-clockwise until it is no longer touching the actuator cap.

2. Apply Loctite 242 (or equivalent) to the threads on the adjustment screw.

3. Install a shim between the pedal return stop and the actuator base return stop (Figure 3).

NOTES:
1. On trucks equipped with a treadle pedal, this shim should be 0.025 inches (0.63 mm).
2. On trucks equipped with suspended pedal assemblies operating as pilot valves, this shim should be 0.038 inches (0.96 mm).

4. Turn the deadband adjustment screw down (clockwise) until the adjustment screw (24) is touching the actuator cap.

5. Continue turning the adjusting screw clockwise until a pressure reading is indicated on the gauge.

6. Turn the adjustment screw 1/8 turn counter-clockwise.

7. Apply a few drops of Loctite 242 (or equivalent) to the jam nut (24) and tighten to secure the adjusting screw.

8. Remove the shim stock.

Pedal Angle Adjustments (Treadle Pedal versions only)

The operating angle of the Pedal may be adjusted as follows:

1. Loosen the two nuts (44) at the rear of the pedal cam (26). Do not loosen the four U-bolt nuts (22).

2. Adjust the pedal angle by turning the set screws (40) located in the top face or ribbed side of the pedal. Turning clockwise will increase the angle, counter-clockwise will decrease the angle.

NOTE: *Adjust the screws evenly. When the desired angle is achieved, loosen each slightly, apply Loctite 242 (or equivalent) to the threads and reinstall.*

3. While holding the pedal down, retighten the rear socket head capscrews (41) and nuts (44).

Adjusting the Proximity Switch

The proximity switch may be adjusted as follows:

1. Thread the switch (36) into the base (34) until it contacts the pedal.

2. Turn the outward 1/4 to 1/2 turn. Secure in place with jam nut.

3. Slowly depress the Brake pedal. The switch should actuate as soon as the pedal is depressed, even slightly.

NOTE: *In some applications it may be desirable to slightly delay the actuation of the switch in order to increase the system brake pressure when the switch actuates. In these cases, it will require readjusting of the pedal, deadband, and proximity switch settings to obtain the desired pressure levels.*

REMOVAL

The valve may be removed from the truck as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Drain all hydraulic pressure from the brake system as outlined in the procedures in Section 5 - Hydraulic System or equivalent.

⚠ DANGER

It is important that all pressure in the hydraulic portion of the brake actuation system be released prior to working on any components or loosening any hydraulic fittings.

3. Remove the access panel near the valve.

4. Disconnect the hydraulic connections to the valve. Cap or plug all openings. Label each to aid during the installation process.

5. Remove any electrical connections. Label each to aid during the installation process.

6. Remove the capscrews and locknuts securing the valve in place.

7. Remove the valve.

DISASSEMBLY (Figure 4)

The brake valve may be disassembled as follows:

1. Drain all oil from all ports of the valve by actuating several times over a suitable container.

2. Secure the valve upright in a table vise, using care not to damage any components.

3. Remove the treadle pedal as follows:

a. Remove the pedal (42) by loosening the two bolts (41) at the pedal heel. The two bolts need not be removed.

b. Remove the proximity switch (36) to prevent damage and set aside.

c. Loosen, but do not remove, the four 1/4 inch locknuts (22) from the two U-bolts (38) securing the actuator pivot pin (28).

d. Remove the pivot pin (28) with a punch and hammer.

e. Remove the cam assembly and inspect for evidence of wear or damage. Set aside for later reassembly.

4. Remove the suspended pedal as follows:

a. Remove the retaining rings (45).

b. Remove the pivot pin (46) using a punch and hammer.

c. Remove the pedal assembly.

5. Remove the four button head capscrews (31) securing the boot retainer plate (32).

6. Remove the boot retainer plate (32), boot (30), and actuator cap (29) as an assembly by grasping the boot and gently lifting from the valve body.

7. Loosen the socket head screw securing the adjusting collar (1) to the threads on the plunger (2).

8. Move the adjusting collar counter-clockwise (or toward the ends of the threads) and remove.

9. Remove the two socket head capscrews (33) that secure the actuator base (34) to the valve body (18). Remove the actuator base.

10. Position the valve upside down in a table vice.

11. Remove the socket head capscrews (21) from the bottom of the valve. Remove the lower end plate (19).

12. Remove the valve from the vise and sit upright on a work bench.

13. Hold the valve in one hand and push the plunger (2) down with the other hand until the regulator sleeve and spool assembly pops loose.

14. Turn the valve on its side on the work bench.

15. Remove the regulator sleeve (13) and spool (7) from the valve body (18).

16. Remove the spool (7) and spool return spring (14) from the regulator sleeve (13).

17. Remove the spring seat (6), regulator springs (4,5), and plunger return spring (3) from the valve body.

18. Position the valve upright on the work bench.

19. Remove the actuator plunger (2) by pushing down (toward the bottom of the valve) on the plunger with your hand until the plunger slides out.

20. Remove the O-rings and Teflon backup rings from the actuator sleeve and discard.

21. Remove the wiper seal (15) and the Poly-Pak seal (17) and the back-up ring (16) from the actuator section and discard.

INSPECTION AND REPAIR

The disassembled valve may be serviced as follows:

1. Clean all metal components in clean solvent and dry with dry compressed air. Do not use rags.

2. Inspect all components for evidence of wear or damage. Repair or replace as required.

3. Inspect the plunger for wear on the sides where it moves through the seals. If axial grooves are seen or any wear is apparent, replace the plunger.

4. Place the regulating spool into its sleeve. Push the spool lightly through the sleeve. The spool must be able to move freely and smoothly the entire length of the sleeve. If it cannot, it must be replaced.

IMPORTANT: *Never replace just the spool or sleeve. They must be replaced as a matched set.*

5. Inspect each spring carefully for evidence of cracks or breakage. Any spring found with a problem must be replaced.

6. Inspect the threaded inserts in the valve. If any of the threads are damaged, the inserts must be replaced. This may be done as follows:

a. Install a bolt with a matching thread into the insert from the side opposite the insert flange.

b. Support the unit around the insert on a small spacer such as a short piece of pipe.

c. Lightly tap the insert free by lightly striking the bolt head with a small hammer.

d. If the inserts were removed from the actuator base:

(1) Position the actuator base upside down on the work bench and support directly under each of the mounting holes.

(2) Install the threaded insert into the base by tapping lightly with a small hammer until the insert flanges are flush with the base.

IMPORTANT: *Be sure that the base is supported to avoid breakage.*

(3) Thoroughly re-clean the assembly.

e. If the insert was removed from the cam:

(1) Place the cam upside down on workbench and support it at the center hole.

(2) Install the insert by tapping lightly with a small hammer until flush with the cam surface.

IMPORTANT: *Be sure that the cam is supported to avoid breakage.*

(3) Thoroughly re-clean the assembly.

8. Inspect the boot (30) for evidence of cracking, tears, or other damage. If damage is evident, the boot must be replaced. This may be done as follows:

a. Remove the boot (30) from the cap (29). Discard the old boot.

b. Thoroughly clean the sides of the cap by scraping the lip where the cap contacts the boot, using a clean knife or other suitable scraper. Clean thoroughly to remove all residual adhesive or other particles from the boot.

c. Apply a thin coat of Loctite Prism 410 (or equivalent) onto the two long sides of the upper side of the cap.

NOTE: *Do not apply the sealant to the rounded sides as these must be free to allow the boot to "breath".*

d. Carefully position the cap into the new boot groove, wiping off the excess glue.

e. Position the boot such that it conforms to the top of the cap, then set aside. The adhesive requires about 30 minutes to cure.

ASSEMBLY

The valve may be assembled as follows:

NOTE: *During assembly, lightly lubricate the O-rings, seals and other components with hydraulic oil compatible with that in the unit's hydraulic system.*

1. Install the Poly-Pak seal (17) in the seal groove in the valve body first. Position the seal in the groove so that the internal O-ring inside it is facing downward toward the bottom of the valve.

2. After the seal is in the groove, push it down with a smooth O-ring tool to make sure that the internal O-ring is still seated inside the Poly-Pak seal and did not get dislodged during installation.

3. Install the back-up ring (16) on top of the Poly-Pak seal (17). Start by hand and then continue to work into the groove, either by hand or using an O-ring installation tool.

4. Install the wiper seal (15) in the top counterbore. Position in the groove so that the register lip is facing up toward the actuator.

5. Install an O-ring (9) into the smallest groove (on the top) of the regulator sleeve (13).

6. Install O-ring (12) into the largest groove (on the bottom) of the regulator sleeve.

7. Install a split nylon back-up ring (10) into each side of the O-ring (11) located in the middle of the regulator sleeve.

8. Install one split nylon back-up ring (8) above the O-ring (9) located at the top end of the sleeve. Position the back-up ring so that it is next to the top of the regulator sleeve.

NOTES:
1. This O-ring is the smallest of the three 0-rings.
2. The top of the sleeve is the end with the smallest OD.

9. If the cam is being replaced, the split sleeve must be pressed into the counterbore at the rear of the cam. Apply Loctite retaining compound 620 (or equivalent) to the outer diameter of the sleeve and press the sleeve into the counterbore in the cam until the sleeve bottoms in the counterbore.

10. Carefully insert the plunger (2) into the valve body (18). Make sure that the plunger is completely seated and bottomed out in the valve body.

11. With the valve held by a vice in an upside down position, install the plunger return spring (3), regulator springs (4,5), and spring seat (6) into the bore.

NOTE: *If the spring seat (6) does not position itself correctly on top of the regulator spring (5), lightly shake the valve to correctly seat the spring seat.*

12. Install the spring into the open end of the regulator spool (7).

13. Lightly lubricate the regulator spool (7).

14. Install the regulator spool on the regulator sleeve (13). The spherical end of the spool must be at the top of the regulator sleeve.

NOTES:
1. The top of the sleeve is the end with the smallest OD.
2. Check to ensure that the spools will slide smoothly and freely. Replace the entire sleeve assembly and spool if the spool does not slide smoothly and freely.

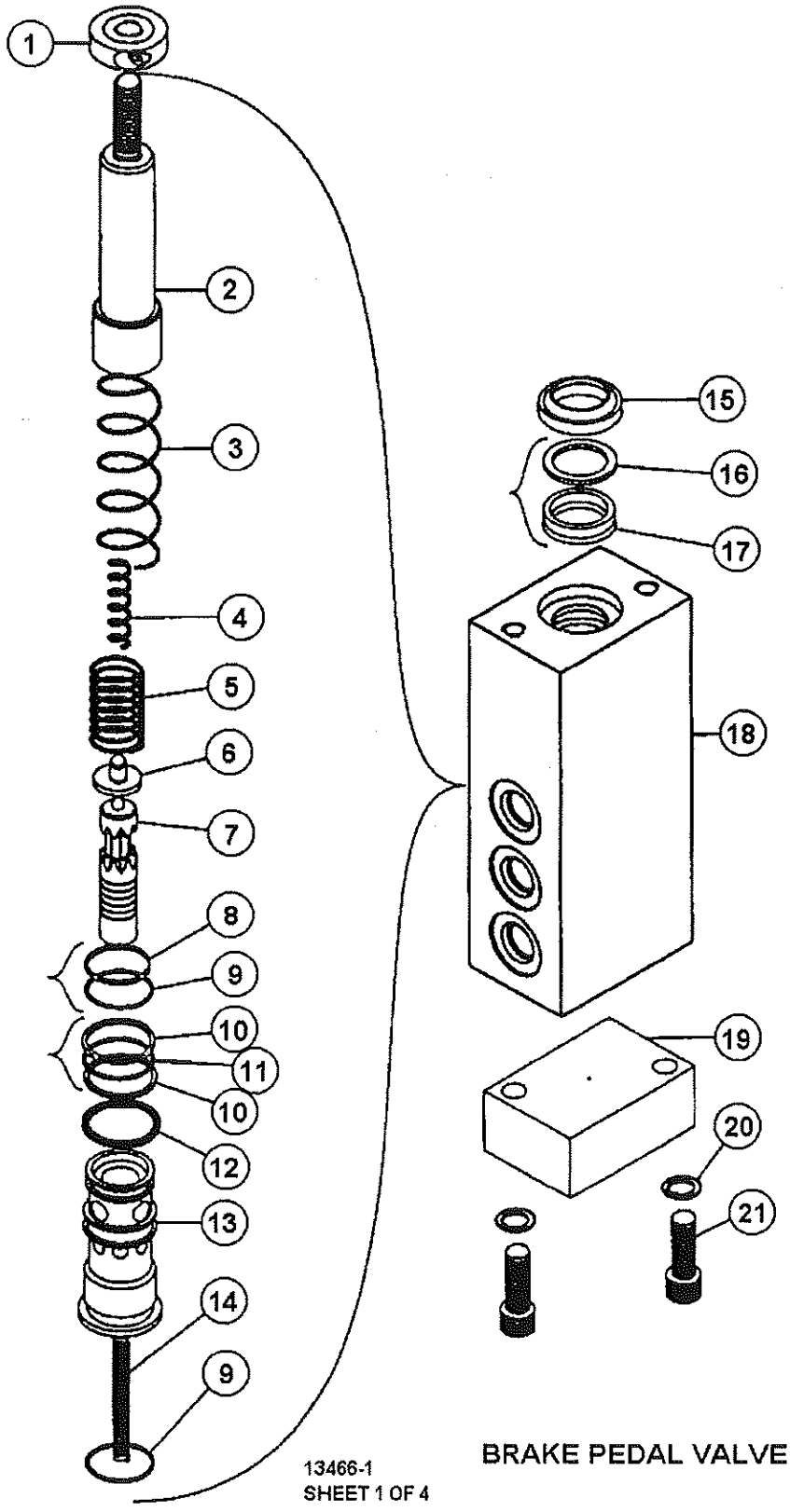
15. Lightly lubricate the O-rings on the regulator sleeve.

16. With the spool temporarily removed from the sleeve, install the regulator sleeve into the valve upside down in a vice. Push the sleeve carefully into the body until the bottom lip of the sleeve contacts the valve body.

17. Lightly lubricate the O-ring (9) and install into the groove at the bottom end of the sleeve.

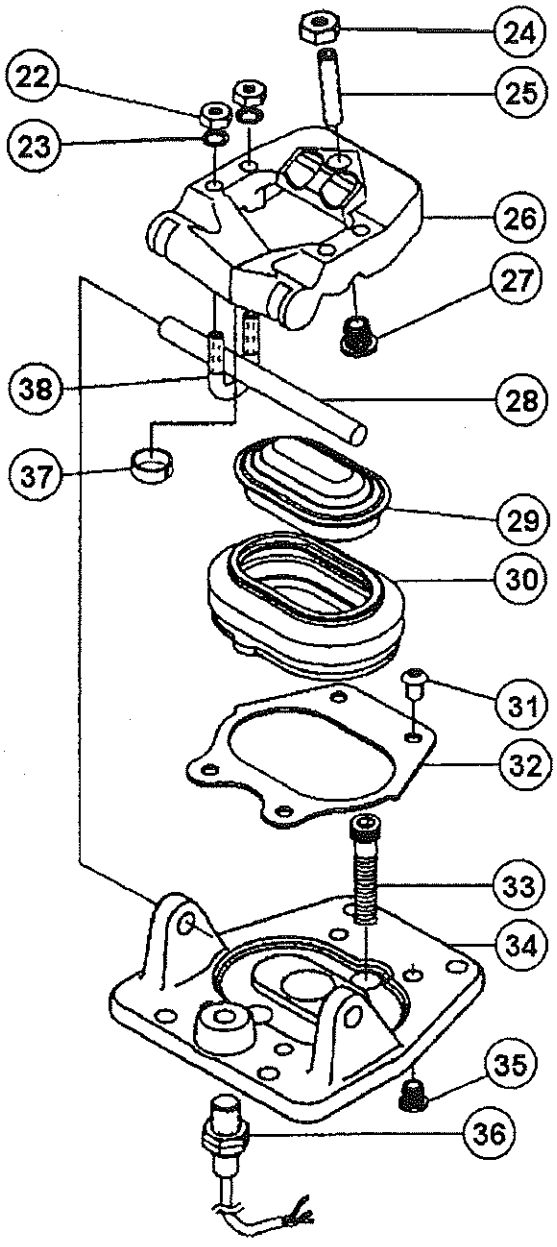
18. Install the spool into the sleeve with the spherical end of the spool toward the top of the valve.

19. Install the end cap (19) on the end of the valve body (18). Secure with the socket head capscrews and washers. Torque to 180 to 190 inch-lbs (20 to 22 Nm).



KEY	
1.	ADJUSTABLE COLLAR
2.	PILOT PLUNGER
3.	RETURN SPRING
4.	INNER REGULATOR SPRING
5.	OUTER REGULATOR SPRING
6.	SPRING SEAT
7.	METERING SPOOL
8.	BACK-UP RING
9.	0-RING
10.	BACK-UP RING
11.	0-RING
12.	PREFORMED PACKING
13.	SLEEVE
14.	SPOOL RETURN SPRING
15.	WIPER SEAL
16.	BACK-UP RING
17.	POLY-PAK SEAL
18.	VALVE BODY
19.	END PLATE
20.	LOCKWASHER
21.	SOCKET HEAD CAPSCREW
22.	SELF LOCKING NUT
23.	FLATWASHER
24.	JAM NUT
25.	ADJUSTMENT SCREW
26.	ACTUATOR CAM
27.	INSERT
28.	PIVOT PIN
29.	ACTUATOR CAP
30.	BOOT
31.	BUTTON HEAD CAPSCREW
32.	BOOT RETAINER PLATE
33.	SOCKET HEAD CAPSCREW
34.	ACTUATOR BASE
35.	INSERT
36.	PROXIMITY SWITCH
37.	SLEEVE
38.	U-BOLT
39.	INSERT
40.	SCREW
41.	SOCKET HEAD CAPSCREW
42.	PEDAL
43.	WASHER
44.	SELF LOCKING NUT
45.	RETAINING RING
46.	PIVOT PIN
47.	PEDAL RETURN SPRING
48.	NUT
49.	INSERT
50.	NUT
51.	ADJUSTMENT SCREW
52.	PEDAL

FIGURE 4 - BRAKE PEDAL VALVE ASSEMBLY

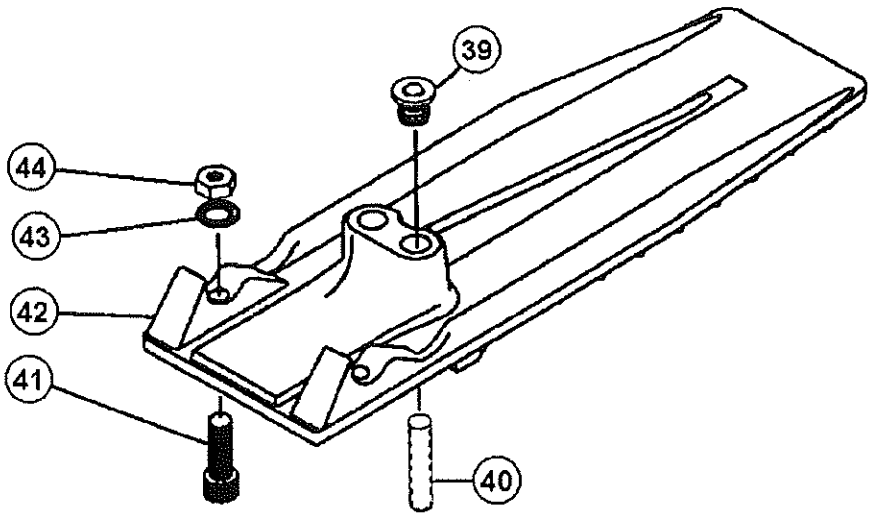


ACTUATOR

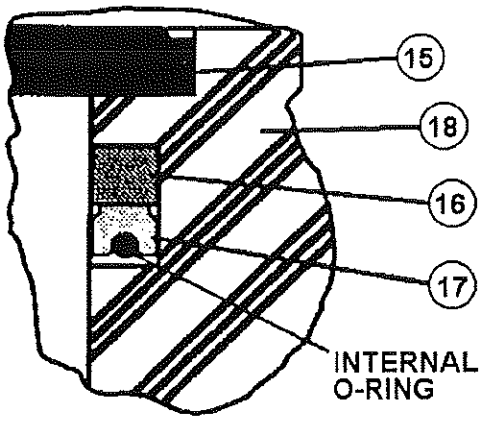
13466-2
SHEET 2 OF 4

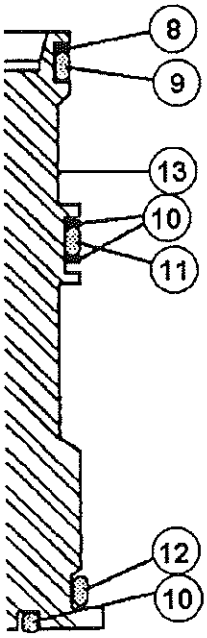
KEY	
1.	ADJUSTABLE COLLAR
2.	PILOT PLUNGER
3.	RETURN SPRING
4.	INNER REGULATOR SPRING
5.	OUTER REGULATOR SPRING
6.	SPRING SEAT
7.	METERING SPOOL
8.	BACK-UP RING
9.	0-RING
10.	BACK-UP RING
11.	0-RING
12.	PREFORMED PACKING
13.	SLEEVE
14.	SPOOL RETURN SPRING
15.	WIPER SEAL
16.	BACK-UP RING
17.	POLY-PAK SEAL
18.	VALVE BODY
19.	END PLATE
20.	LOCKWASHER
21.	SOCKET HEAD CAPSCREW
22.	SELF LOCKING NUT
23.	FLATWASHER
24.	JAM NUT
25.	ADJUSTMENT SCREW
26.	ACTUATOR CAM
27.	INSERT
28.	PIVOT PIN
29.	ACTUATOR CAP
30.	BOOT
31.	BUTTON HEAD CAPSCREW
32.	BOOT RETAINER PLATE
33.	SOCKET HEAD CAPSCREW
34.	ACTUATOR BASE
35.	INSERT
36.	PROXIMITY SWITCH
37.	SLEEVE
38.	U-BOLT
39.	INSERT
40.	SCREW
41.	SOCKET HEAD CAPSCREW
42.	PEDAL
43.	WASHER
44.	SELF LOCKING NUT
45.	RETAINING RING
46.	PIVOT PIN
47.	PEDAL RETURN SPRING
48.	NUT
49.	INSERT
50.	NUT
51.	ADJUSTMENT SCREW
52.	PEDAL

FIGURE 4 - BRAKE PEDAL VALVE ASSEMBLY - CONTINUED



TREADLE PEDAL ASSEMBLY



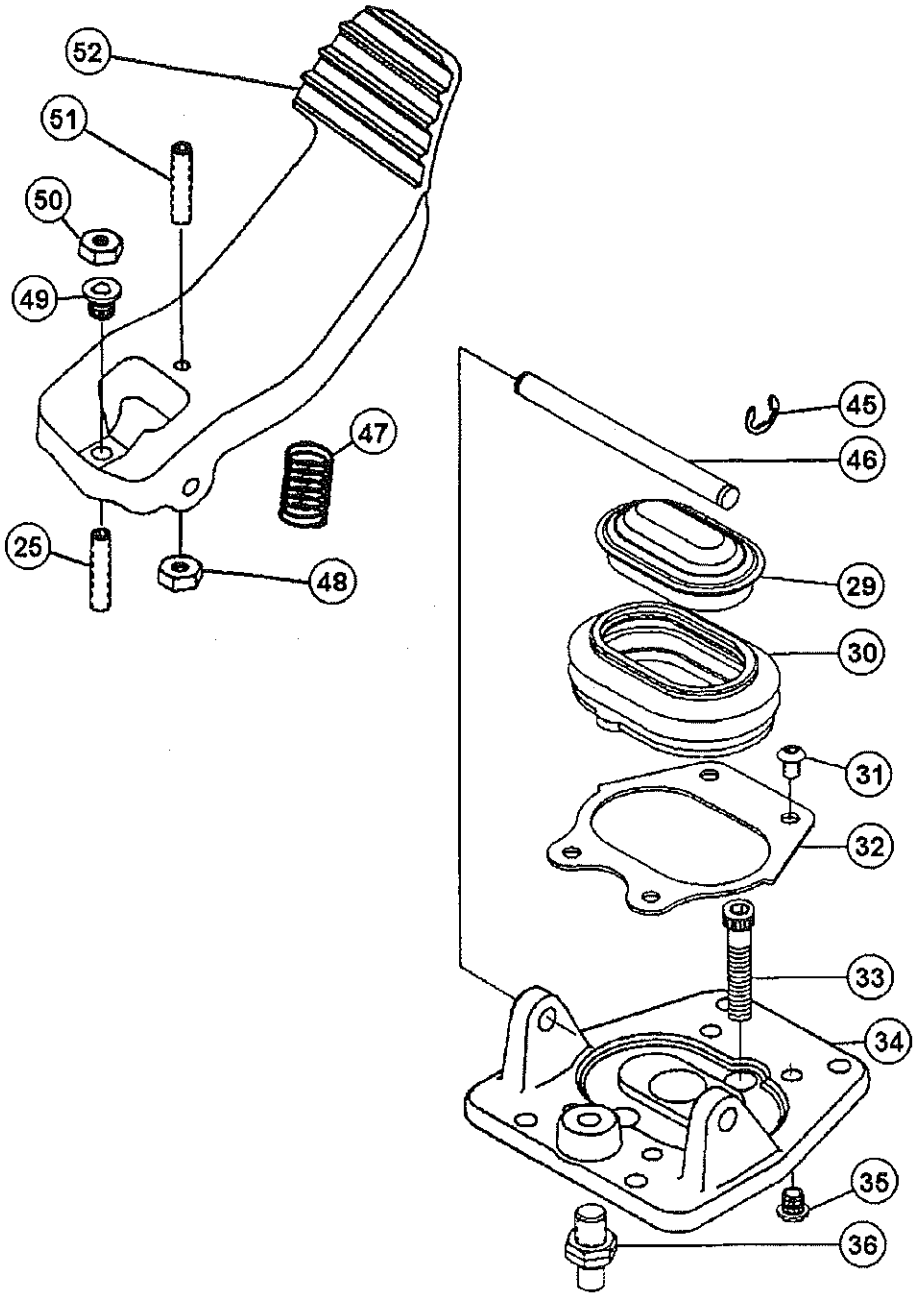


BRAKE PEDAL VALVE

13466-3
SHEET 3 OF 4

KEY	
1.	ADJUSTABLE COLLAR
2.	PILOT PLUNGER
3.	RETURN SPRING
4.	INNER REGULATOR SPRING
5.	OUTER REGULATOR SPRING
6.	SPRING SEAT
7.	METERING SPOOL
8.	BACK-UP RING
9.	O-RING
10.	BACK-UP RING
11.	O-RING
12.	PREFORMED PACKING
13.	SLEEVE
14.	SPOOL RETURN SPRING
15.	WIPER SEAL
16.	BACK-UP RING
17.	POLY-PAK SEAL
18.	VALVE BODY
19.	END PLATE
20.	LOCKWASHER
21.	SOCKET HEAD CAPSCREW
22.	SELF LOCKING NUT
23.	FLATWASHER
24.	JAM NUT
25.	ADJUSTMENT SCREW
26.	ACTUATOR CAM
27.	INSERT
28.	PIVOT PIN
29.	ACTUATOR CAP
30.	BOOT
31.	BUTTON HEAD CAPSCREW
32.	BOOT RETAINER PLATE
33.	SOCKET HEAD CAPSCREW
34.	ACTUATOR BASE
35.	INSERT
36.	PROXIMITY SWITCH
37.	SLEEVE
38.	U-BOLT
39.	INSERT
40.	SCREW
41.	SOCKET HEAD CAPSCREW
42.	PEDAL
43.	WASHER
44.	SELF LOCKING NUT
45.	RETAINING RING
46.	PIVOT PIN
47.	PEDAL RETURN SPRING
48.	NUT
49.	INSERT
50.	NUT
51.	ADJUSTMENT SCREW
52.	PEDAL

FIGURE 4 - BRAKE PEDAL VALVE ASSEMBLY - CONTINUED



SUSPENDED PEDAL ASSEMBLY

13466-4
SHEET 4 OF 4

KEY	
1.	ADJUSTABLE COLLAR
2.	PILOT PLUNGER
3.	RETURN SPRING
4.	INNER REGULATOR SPRING
5.	OUTER REGULATOR SPRING
6.	SPRING SEAT
7.	METERING SPOOL
8.	BACK-UP RING
9.	0-RING
10.	BACK-UP RING
11.	0-RING
12.	PREFORMED PACKING
13.	SLEEVE
14.	SPOOL RETURN SPRING
15.	WIPER SEAL
16.	BACK-UP RING
17.	POLY-PAK SEAL
18.	VALVE BODY
19.	END PLATE
20.	LOCKWASHER
21.	SOCKET HEAD CAPSCREW
22.	SELF LOCKING NUT
23.	FLATWASHER
24.	JAM NUT
25.	ADJUSTMENT SCREW
26.	ACTUATOR CAM
27.	INSERT
28.	PIVOT PIN
29.	ACTUATOR CAP
30.	BOOT
31.	BUTTON HEAD CAPSCREW
32.	BOOT RETAINER PLATE
33.	SOCKET HEAD CAPSCREW
34.	ACTUATOR BASE
35.	INSERT
36.	PROXIMITY SWITCH
37.	SLEEVE
38.	U-BOLT
39.	INSERT
40.	SCREW
41.	SOCKET HEAD CAPSCREW
42.	PEDAL
43.	WASHER
44.	SELF LOCKING NUT
45.	RETAINING RING
46.	PIVOT PIN
47.	PEDAL RETURN SPRING
48.	NUT
49.	INSERT
50.	NUT
51.	ADJUSTMENT SCREW
52.	PEDAL

FIGURE 4 - BRAKE PEDAL VALVE ASSEMBLY - CONTINUED

20. Screw the adjustment collar (1) onto the actuation plunger. Continue to turn it all the way down until it bottoms on the threads.

⚠ CAUTION

It is extremely important to bottom the collar on the threads to prevent over-stressing or breaking the springs during the pressure adjustment.

21. Tighten the collar tightening screw, snug only.

22. Install the treadle pedal assembly as follows:

a. Assemble the actuator cap (29), boot (30), boot retainer (32) to the actuator base (34) with the four button head capscrews (31) and tighten.

b. Attach the cam assembly to the actuator base by aligning the pivot holes in the actuator base with the holes in the U-bolts (38).

c. Insert the pivot pin through the hole in the actuator base, through the holes in the U-bolts and through the pivot pin hole in the other side of the actuator base.

d. Center the pivot pin and secure by tightening the four hex nuts (22) and washers (23) on the two U-bolts. Tighten evenly to a final torque of 85 to 95 inch-lbs (9.6 to 10.7 Nm).

e. Install the pedal (42) and secure with Socket head capscrews (41), washers, (43), and nuts (44).

23. Install the suspended pedal assembly as follows:

a. Assemble the actuator cap (29), boot (30) and boot retainer plate (32) to the actuator base with the four button head capscrews (31) and tighten.

b. Insert the pivot pin through the hole in the actuator base through the holes in the suspended pedal (52) and the hole in the other side of the actuator base.

c. Center the pivot pin (46) and secure with retaining rings (45).

d. Install the return spring (47) into the pedal and the boss on the actuator base.

INSTALLATION

The valve may be installed on the truck as follows:

1. Position the valve in the proper mounting location. Secure in place with capscrews and locknuts.

2. Reconnect the hydraulic and electrical connections to the valve assembly.

3. Bleed all entrapped air and contaminates as outlined in the system instructions in Section 5 - Hydraulic System or equivalent.

4. Test and adjust the valve as outlined in the instructions in Maintenance and Adjustment in this module and in the system instructions in Section 5 - Hydraulic System.

5. Install any access panels removed.

BRAKE CONTROLLER VALVE PILOT AND CABLE OPERATED, DUAL CIRCUIT

DESCRIPTION AND LOCATION

The brake controller valve is a hydraulic pilot and cable controlled multiple spool-type hydraulic valve. It is typically mounted in or above the superstructure platform to the rear of the operator's cab.

OPERATION (Figure 1)

The primary function of the brake controller valve is to regulate hydraulic pressure to the truck's friction brake system, either directly or through the control of other components.

In the released position, the valve is relaxed and the regulator spool is in the up or relaxed position. In this state, the notches near the top of the spools are exposed to the tank cavity in the valve body. The lower portions of the notched area in the spools are exposed to the regulated pressure output ports of the valve. This creates a direct link between the tank port and the regulated ports of the valve. In this condition, the pressure in each of the circuits of the brake system equals that in the return lines to the hydraulic tank, approximately 0 psi (kPa) and the brakes are released.

When the operator wishes to apply the brakes, depressing the brake pedal causes pilot "signal" pressures, proportionate to the amount the pedal is depressed, to enter the controller valve through the two pilot or "POX" ports. This pressure on the top of the plungers causes them to move down on the valve regulator springs. This, in turn, pushes the regulator spools down. As the spools begin to move down the bore, the metering notches move out of the tank cavity and closes off the return paths to the tank. Continued movement downward causes the notches of the lower edge of the spools to enter the inlet pressure port areas of the valve body. The pressurized flow of hydraulic oil from the inlet ports is then directed to the brake pressure ports. As the pressure increases in the brake system, oil flows through the small orifices in the cavity below the spools. As the pressure rises, force builds up on the bottom of the regulator spools and begins to push the spools upward. If the control is not released, the spool moves upward and compresses the springs between the spools and the plunger. Once enough pressure is built in the system, it forces the spool up against the spring and closes off the pressurized oil supply to the regulated output ports. The spool is now balanced between the outlet pressure and the pilot pressure.

Further depressing the pedal increases the pilot pressures which, in turn, increases the pressure on the springs and repeats the above process until the forces are again balanced.

If the operator wishes to release the brakes, releasing the pedal causes the loss of the pilot signal. This results in the spool assemblies becoming unbalanced and moving upward, opening the brake ports to the tank. At this time, the trapped oil in the system is released, allowing the brakes to release.

The valve is also designed so that it can be mechanically operated. When lever arm is moved, typically by a push-pull cable assembly, the lever assembly depresses the individual plunger assemblies in a manner similar to that caused by the pilot pressure. Pressure balancing and release also occur in similar manners.

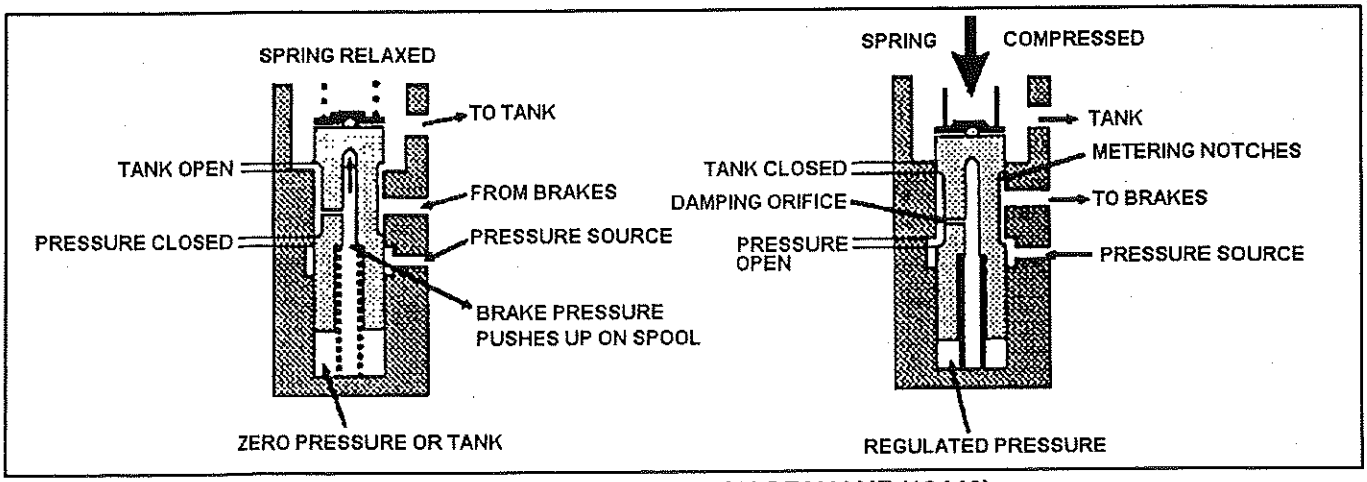


FIGURE 1 - BASIC OPERATION OF VALVE (13449)

A standard proximity switch is used to control the operation of brake lights and other functions affected by the application and release of the brake controller valve.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance of the valve should include:

1. Inspect the valve and related components and connections for evidence of damage, wear, or leakage. Repair or replace as required.

NOTE: *Visually inspect the cap and boot assembly to be properly assembled and in good repair. Problems with this assembly could result in improper operation of the valve.*

2. Check the operation of the valve as outlined in the procedures in Section 5 - Hydraulic System. Adjust as required by the method called out in these procedures or those detailed later in this portion of the module.

ADJUSTING THE VALVE (Figure 4)

Pressure Settings

The maximum outlet pressures of the valve may be adjusted as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the vehicle's friction brake system.

2. Check the operation of the valve as outlined in the procedures in Section 5 - Hydraulic System.

NOTES:
1. Adjusting the individual spools as outlined here will affect both the pilot operated service brake and the cable operated hand brake pressures.
2. If the pressure on service (or brake pedal controlled) brake pressure to the front and rear axles are both too high or too low, but still in proper proportion to each other, the adjustment is made by increasing or decreasing the pilot pressure output of the pilot valve.

3. Stop the engine.

4. Drain all pressure from the brake accumulators using the manual accumulator drain valves.

5. Remove the lever arm and actuator assembly as follows:

a. Loosen the locking nuts (27) and washers (28) securing the U-bolts (29) to the assembly and removing the pivot pin (35).

b. Remove the arm/cam assembly.

NOTE: *It is recommended that steps 6 through 10 be completed on one spool at a time to ensure proper adjustment.*

6. Loosen the set screw securing the adjusting collar (1) to the threads on the plunger (2).

7. Move the adjusting collar counter-clockwise (or toward the ends of the threads) to raise the pressure or clockwise (or to the non-threaded portion of the plunger) to lower the pressure.

NOTE: *Fine adjustments may require turning the stop in increments of as little as 1/8th turn.*

8. Retest the pressure as before. Installing the pivot pin and using a flat screwdriver or equivalent as a lever this will allow you to depress the actuator without reinstalling the arm/cam assembly (Figure 2).

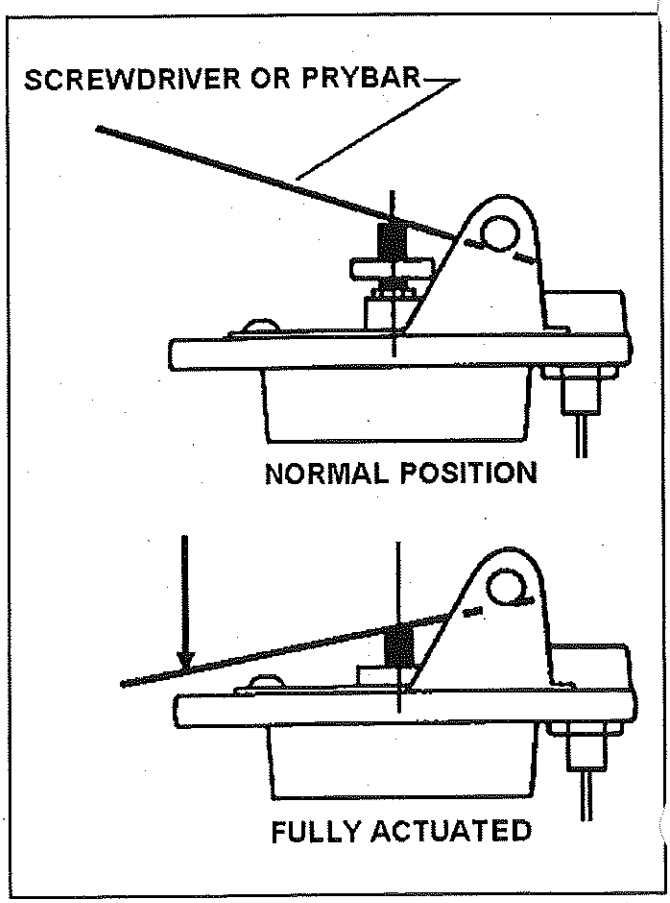


FIGURE 2 - ACTUATION OF THE VALVE (13464)

9. Secure the collar by retightening the set screw to 25 to 30 inch-lbs (2.8 to 3.4 Nm). It may be necessary to rotate the entire plunger to properly orient the screws.

10. Repeat the process with the other spool assembly if required.

11. Reinstall the arm/cam assembly to the spool section. Torque the nuts on the U-bolts in even increments a final torque of 140 to 150 inch-lbs (16 to 17 Nm).

12. Apply and release the brakes a number of times. Verify that the pressure settings do not change. If they do, repeat the above process as required.

13. Repeat steps 1 through 12 until the adjustment is complete.

NOTE: *When the assembly is new or has been serviced, it is not uncommon for the pressures to decrease slightly due to the "seating" effect of the components.*

14. While monitoring the brake pressure and with the engine at low idle speed, depress the pedal as quickly as possible. The pressures should reach maximum within 1 second of the time the pedal was depressed.

15. Release the pedal and reapply slowly. Make sure that the pressure increase on each circuit is smooth and no sticking of the spool is observed.

16. Hold the pedal fully depressed for 20 seconds. Verify that the pressures remain at the proper level at all times the pedal is depressed.

17. Slowly release the pedal. Make sure that the brake pressure decrease is smooth and no sticking of either spool is observed.

18. Verify that the valve has an output of 0 psi (kPa) when fully released.

Dead Band Adjustment (Figure 3)

The operational dead band of the arm/cam assembly may be adjusted as follows:

1. Loosen the dead band adjustment screw by turning counter-clockwise until it is no longer touching the actuator cap.

2. Apply Loctite 242 (or equivalent) to the threads on the adjustment screw.

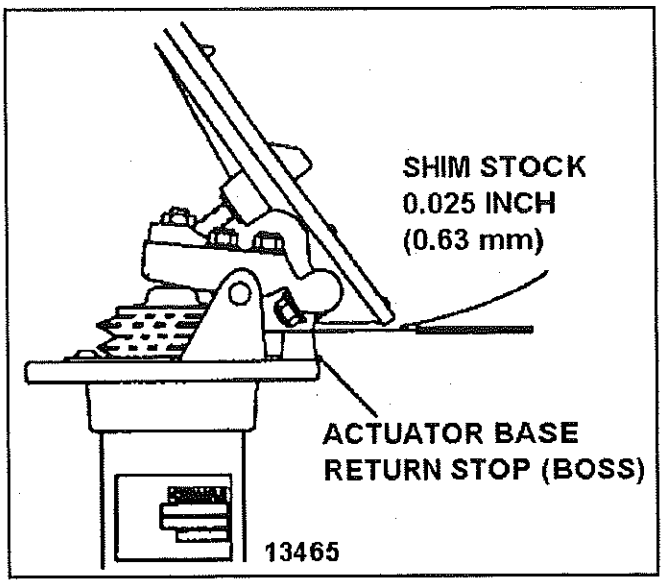


FIGURE 3 - DEAD BAND ADJUSTMENT (13465)

3. Install a 0.025 inch (0.63 mm) shim between the pedal return stop and the actuator base return stop (Figure 3).

4. Turn the dead band adjustment screw down (clockwise) until the adjustment screw is touching the actuator cap.

5. Continue turning the adjusting screw clockwise until a pressure reading is indicated on the gauge.

6. Turn the adjustment screw 1/8 turn counter-clockwise.

7. Apply a few drops of Loctite 242 (or equivalent) to the jam nut and tighten to secure the adjusting screw.

8. Remove the shim stock.

Adjusting the Proximity Switch

The proximity switch may be adjusted as follows:

1. Thread the switch into the base until it contacts the arm/cam assembly.

2. Turn the switch outward 1/4 to 1/2 turn. Secure in place with jam nut.

3. Slowly apply the Hand Brake. The switch should actuate as soon as the pedal is depressed, even slightly.

NOTE: *In some applications it may be desirable to slightly delay the actuation of the switch in order to increase the system brake pressure when the switch actuates. In these cases, it will require readjusting of the pedal, dead band, and proximity switch settings to obtain the desired pressure levels.*

REMOVAL

The valve may be removed from the truck as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Drain all hydraulic pressure from the brake system as outlined in the procedures in Section 5 - Hydraulic System or equivalent.

⚠ DANGER

It is important that all pressure in the hydraulic portion of the brake actuation system be released prior to working on any components or loosening any hydraulic fittings.

3. Open the access panel covering the valve.

4. Disconnect the hydraulic connections to the valve. Cap or plug all openings. Label each to aid during the installation process.

5. Remove any electrical connections. Label each to aid during the installation process.

6. Remove the capscrews and locknuts securing the valve in place.

7. Remove the valve.

DISASSEMBLY (Figure 4)

The brake valve may be disassembled as follows:

1. Drain all oil from all ports of the valve by actuating several times over a suitable container.

2. Secure the valve upright in a table vise, using care not to damage any components.

3. Remove the arm/cam assembly as follows:

a. Remove the proximity switch (48) to prevent damage and set aside.

b. Loosen, but do not remove, the four 1/4 inch locknuts (27) and washers (28) from the two U-bolts (29) securing the actuator pivot pin (35).

c. Remove the pivot pin (35) using a punch and hammer if necessary.

d. Remove the arm/cam assembly and inspect for evidence of wear or damage. Set aside for later reassembly.

4. Remove the four button head capscrews (40) securing the boot retainer plate (41).

5. Remove the boot retainer plate (41), boot (39), and actuator cap (38) as an assembly by grasping the boot and gently lifting from the valve body.

NOTE: *In low temperature applications the boot and actuator cap are sub-assembled with special low temperature adhesive and should be replaced as a unit.*

6. Loosen the socket head screw securing the adjusting collar (1) to the threads on the plunger (2).

7. Move the adjusting collar counter-clockwise (or toward the ends of the threads) and remove.

8. Remove the two socket head capscrews that secure the actuator base to the valve body. Remove the actuator base.

9. Position the valve upside down in a table vise.

10. Remove the capscrews (26) and washers (25) from the bottom of the valve. Remove the sleeve retainer (24).

11. Remove the valve from the vise and sit upright on a work bench.

NOTE: *Throughout the following procedures, it is important to keep the individual circuits and circuit components separated and identified as to where they came from. Otherwise varying component "tolerance stack" may cause problems.*

12. With the valve upright, the retaining plug (23) should slide out. If not, lightly tap the plug to dislodge.

13. Remove the O-ring (22) from the counterbore in the base of the valve body. Inspect, and then discard this seal.

14. With the controller still upright on the work bench, hold the valve in one hand and push one of the plungers (2) down with the other hand until the regulator sleeve and spool assembly loosens.

15. Repeat with the other spool assembly.

16. Turn the valve on its side on the work bench.

17. Remove the regulator sleeves and spool assemblies from the valve body.

18. Remove the spools (8), reaction plungers (16), and spool return springs (15) from the regulator sleeve (14).

19. Remove the spring seat (7), regulator springs (5 and 6), and plunger return spring (4) from the valve body.

20. Position the valve upright on the work bench.

21. Remove the actuator plunger (2) by pushing down (toward the bottom of the valve) on the plunger with your hand until the plunger slides out.

22. Remove the O-rings and Teflon back-up rings from the actuator sleeve and discard.

23. Remove the wiper seals (17) and the Poly-Pak seals (19) and the back-up ring (18) from the actuator section. Inspect and discard.

INSPECTION AND REPAIR (Figure 4)

The disassembled valve may be serviced as follows:

1. Clean all metal components in clean solvent and dry with dry compressed air. Do not use rags.

2. Inspect all components for evidence of wear or damage. Repair or replace as required.

3. Inspect the plunger for wear on the sides where it moves through the seals. If axial grooves are seen or any wear is apparent, replace the plunger.

4. Place the regulating spool into its sleeve. Push the spool lightly through the sleeve. The spool must be able to move freely and smoothly the entire length of the sleeve. If it cannot, it must be replaced.

IMPORTANT: *Never replace just the spool or sleeve. They must be replaced as a matched set.*

5. Inspect each spring carefully for evidence of cracks or breakage. Any spring found with a problem must be replaced.

6. Inspect the threaded inserts in the valve. If any of the threads are damaged, the inserts must be replaced. This may be done as follows:

a. Install a bolt with a matching thread into the insert from the side opposite the insert flange.

b. Support the unit around the insert on a small spacer such as a short piece of pipe.

c. Lightly tap the insert free by lightly striking the bolt head with a small hammer.

d. If the inserts were removed from the actuator base:

(1) Position the actuator base upside down on the work bench and support directly under each of the mounting holes.

(2) Install the threaded insert into the base by tapping lightly with a small hammer until the insert flanges are flush with the base.

IMPORTANT: *Be sure that the base is supported to avoid breakage.*

(3) Thoroughly re-clean the assembly.

e. If the insert was removed from the cam:

(1) Place the cam upside down on workbench and support it at the center hole.

(2) Install the insert by tapping lightly with a small hammer until flush with the cam surface.

IMPORTANT: *Be sure that the cam is supported to avoid breakage.*

(3) Thoroughly re-clean the assembly.

7. Inspect the boot (39) for evidence of cracking, tears, or other damage. If damage is evident, the boot must be replaced. This may be done as follows:

NOTE: *In low temperature installations, a kit is available (and recommended) that bonds the special boot to the actuator cap with a low temperature adhesive.*

a. Remove the boot from the cap (38). Discard the old boot.

b. Thoroughly clean the sides of the cap by scraping the lip where the cap contacts the boot, using a clean knife or other suitable scraper. Clean thoroughly to remove all residual adhesive or other particles from the cap.

c. Apply a thin coat of Loctite Prism 410 (or equivalent) onto the two long sides of the upper side of the cap.

NOTE: *Do not apply the sealant to the rounded sides as these must be free to allow the boot to "breathe".*

d. Carefully position the cap into the new boot groove, wiping off the excess glue.

e. Position the boot such that it conforms to the top of the cap, then set aside. The adhesive requires about 30 minutes curing.

ASSEMBLY (Figure 4)

The valve may be assembled as follows:

NOTES:
1. During assembly, lightly lubricate the O-rings, seals and other components with hydraulic oil compatible with that in the unit's hydraulic system.
2. It is important the components be reinstalled in the same circuits or bores from which they were removed to prevent problems from component tolerance stack.

1. Install the Poly-Pak seal (19) in one of the grooves in the valve body first. Position the seal in the groove so that the internal O-ring inside it is facing downward toward the bottom of the valve (Figure 5).

2. After the seal is in the groove, push it down with a smooth O-ring tool to make sure that the internal O-ring is still seated inside the Poly-Pak seal and did not get dislodged during installation.

3. Install the back-up ring (18) on top of the Poly-Pak seal. Start by hand and then continue to work into the groove, either by hand or using an O-ring installation tool.

4. Install the wiper seal (17) in the top counterbore. Position in the groove so that the register lip is facing up toward the actuator.

5. Repeat steps 1 through 4 for the other bore.

6. Install an O-ring (10) into the smallest groove (on the top) of the regulator sleeve (14).

7. Install O-ring (12) into the middle groove on the regulator sleeve (14).

8. Install O-ring (13) into the largest groove (on the bottom of the regulator sleeve (14)).

9. Install a split nylon back-up ring (11) into each side of the O-ring (12) located in the middle of the regulator sleeve.

10. Install one split nylon back-up ring (9) above the O-ring (10) located at the top end of the sleeve. Position the back-up ring so that it is next to the top of the regulator sleeve.

NOTES:
1. This O-ring is the smallest of the three o-rings.
2. The top of the sleeve is the end with the smallest OD.

11. Repeat steps 6 through 10 for the second bore or circuit.

12. Install an O-ring (3) into the O-ring groove located at the largest diameter end of the actuation plunger (2).

13. Install a split Glyde Ring (3) over the O-ring.

NOTE: *Twist and squeeze the split Glyde Ring into a small circle before installing to ensure a tight fit over the O-ring.*

14. Repeat steps 12 and 13 for the second bore or circuit.

15. If a new cam is being installed, install the threaded insert as per the instructions in Inspection and Repair.

16. Lightly lubricate the actuation plunger Glyde Ring (3).

NOTE: *In the following steps, it is important to remember to install the components in the same bore from which they were removed.*

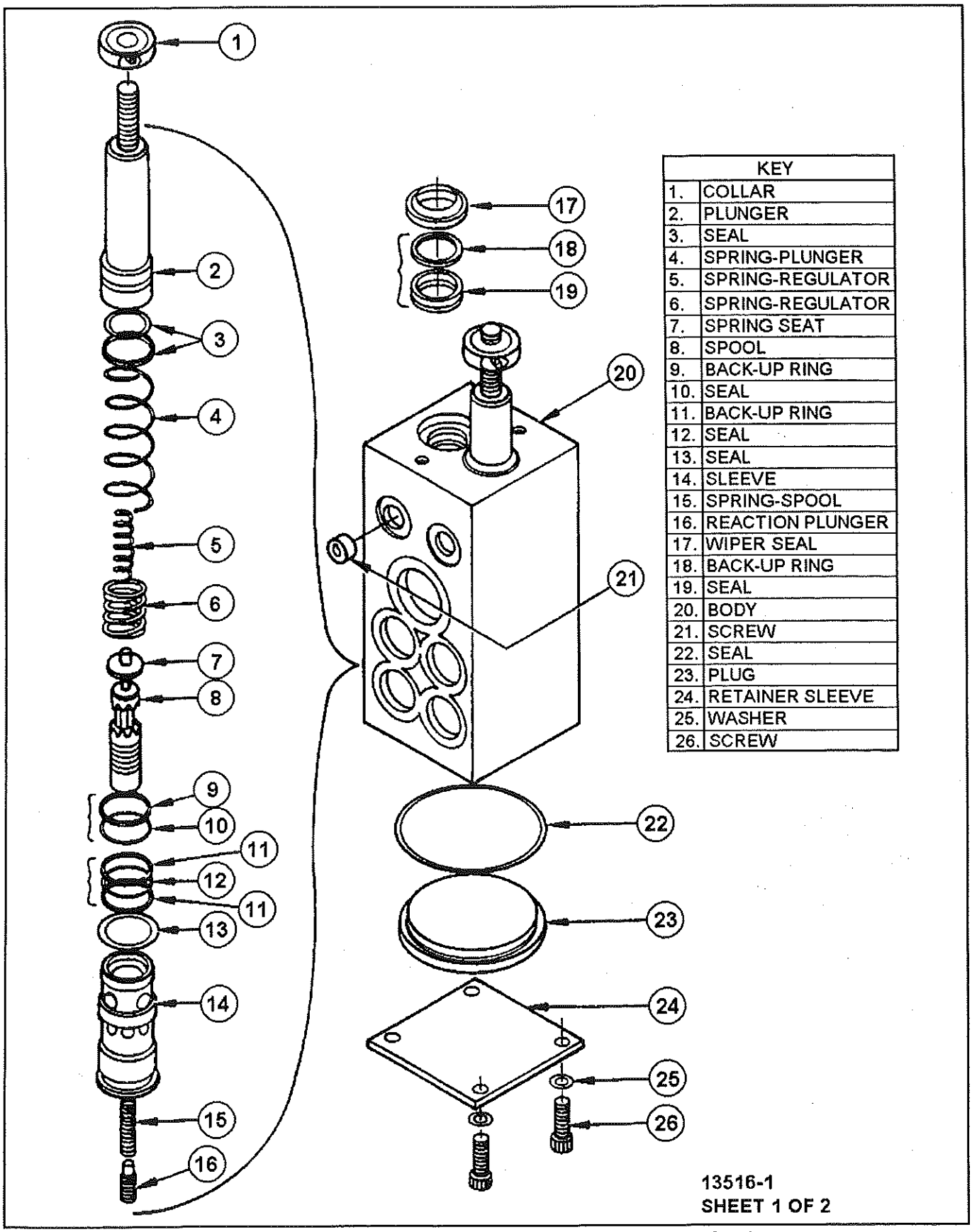
17. Install one of the actuation plungers (2) into the one of the bores or circuits. Make sure that the actuation plunger is completely seated and bottomed.

NOTE: *Be careful not to damage or cut the Glyde Ring during installation. Observe the Glyde Ring assembly through the tank port as the plunger is being installed. It may be necessary to work the Glyde Ring past the sharp edge in the body to prevent damage to the seal (Figure 6).*

18. Repeat steps 16 and 17 for the second bore or circuit.

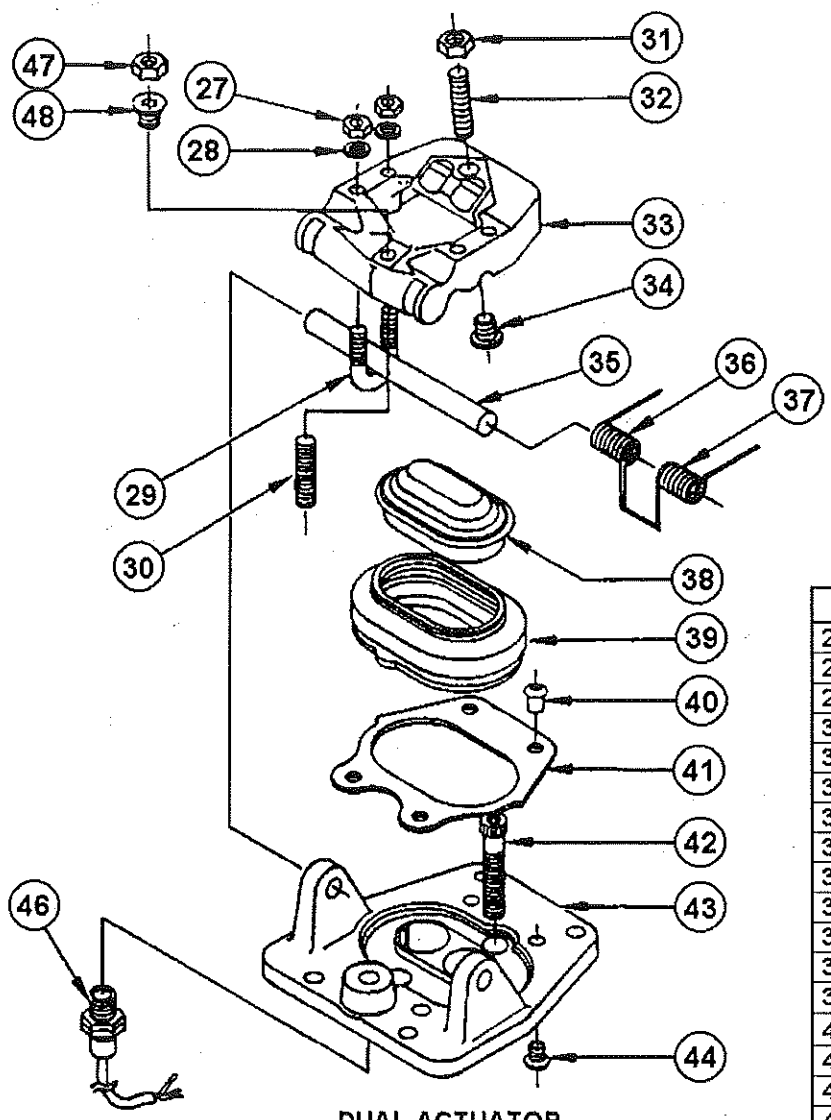
NOTE: *Again, it is recommended that the components in one bore or circuit be installed before beginning the other one.*

19. With the valve held by a vise in an upside down position install the plunger return spring (4), regulator springs (5 and 6), and spring seat (7) into the correct bore.

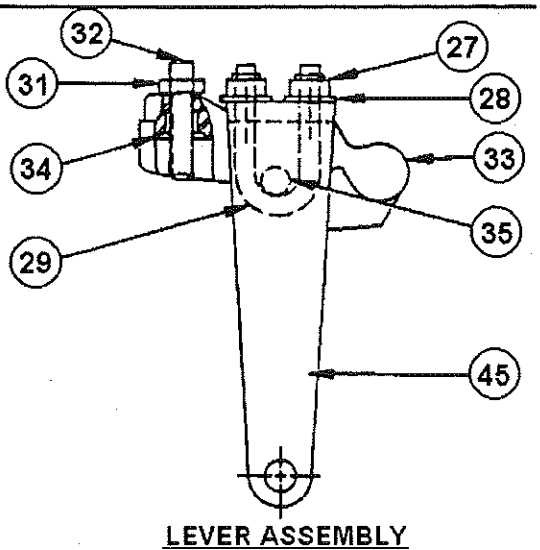


KEY	
1.	COLLAR
2.	PLUNGER
3.	SEAL
4.	SPRING-PLUNGER
5.	SPRING-REGULATOR
6.	SPRING-REGULATOR
7.	SPRING SEAT
8.	SPOOL
9.	BACK-UP RING
10.	SEAL
11.	BACK-UP RING
12.	SEAL
13.	SEAL
14.	SLEEVE
15.	SPRING-SPOOL
16.	REACTION PLUNGER
17.	WIPER SEAL
18.	BACK-UP RING
19.	SEAL
20.	BODY
21.	SCREW
22.	SEAL
23.	PLUG
24.	RETAINER SLEEVE
25.	WASHER
26.	SCREW

FIGURE 4 - BRAKE VALVE ASSEMBLY (13516, SHEET 1 OF 2)



DUAL ACTUATOR



LEVER ASSEMBLY

KEY	
27.	NUT
28.	WASHER
29.	U-BOLT
30.	SCREW
31.	NUT
32.	SCREW
33.	CAM-ACTUATOR
34.	INSERT
35.	PIN
36.	LEVER RETURN SPRING
37.	LEVER RETURN SPRING
38.	CAP
39.	BOOT
40.	SCREW
41.	RETAINER PLATE
42.	SCREW
43.	ACTUATOR BASE
44.	SCREW
45.	ACTUATOR BASE
46.	INSERT
47.	LEVER
48.	PROXIMITY SWITCH ASSY.
49.	NUT
50.	INSERT

13516-2
SHEET 2 OF 2

FIGURE 4 - BRAKE VALVE ASSEMBLY (13516, SHEET 2 OF 2)

NOTE: *If the spring seat (7) does not position itself correctly on top of the regulator spring, lightly shake the valve to correctly seat the spring seat.*

20. Install the spring into the open end of the regulator spool (8).

21. Lightly lubricate the regulator spool (8).

22. Install the regulator spool (8) on the regulator sleeve (14). The spherical end of the spool must be at the top of the regulator sleeve.

NOTES:
1. The top of the sleeve is the end with the smallest OD.
2. Check to ensure that the spools will slide smoothly and freely. Replace the entire sleeve assembly and spool if the spool does not slide smoothly and freely.

23. Remove the spool (8) from the sleeve before installing the sleeve into the body.

24. Lightly lubricate the O-rings (10, 12, and 13) on the regulator sleeve.

25. With the spool (8) temporarily removed from the sleeve, install the regulator sleeve (14) into the correct valve body bore. Push the sleeve carefully into the body until the sleeve retaining flange at the base of the sleeve contacts the valve body.

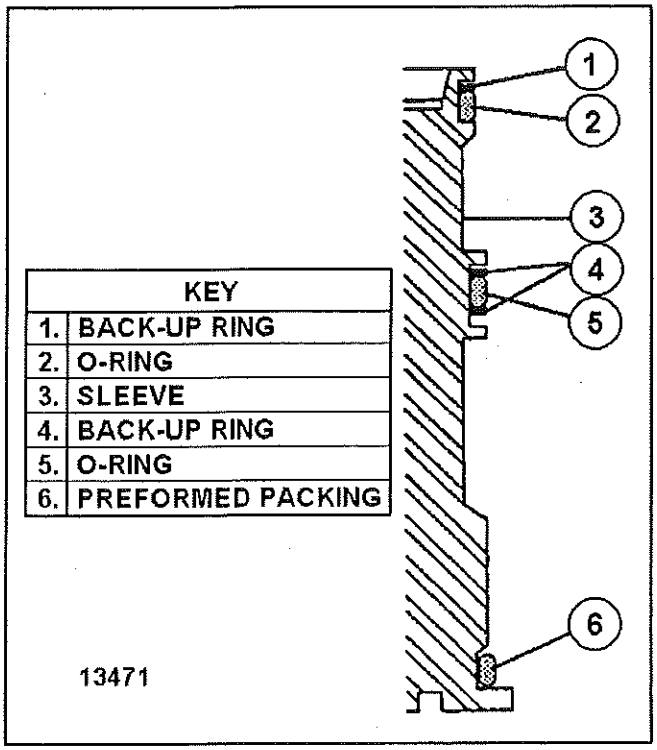


FIGURE 5 - SLEEVE SEAL PLACEMENT (13471)

26. Install the spool return spring (15) into the correct spool (8).

27. Lightly lubricate and install the reaction plunger (16) into the regulator spool.

28. Install the spool into the sleeve with the spherical end of the spool toward the top of the valve.

29. Repeat steps 19 through 28 for the second bore or circuit.

30. Lightly lubricate the large retainer plate O-ring (22) and install into the counter bore at the base of the regulator sleeve.

31. Install the retainer plug (23) into the counterbore at the bottom of the valve.

NOTE: *Make sure that the steps on the retainer plug are facing the counterbore or toward the top of the valve.*

32. Install the sleeve retainer (24) on top of the retainer plug. Secure with the socket head capscrews (26) and lockwasher (25), tightening alternately diagonally to evenly seat the regulator sleeve assembly. Torque to 140 to 150 inch-lb (16 to 17 Nm).

33. Install the actuator base on top of the valve.

NOTE: *Make sure that it is properly positioned to ensure needed port orientation. Tighten the two socket head capscrews evenly. Torque to 180 to 190 inch-lb (20 to 21 Nm).*

34. Screw the adjustment collars (1) onto the actuation plungers. Screw all the way down until each "bottoms" on the threads.

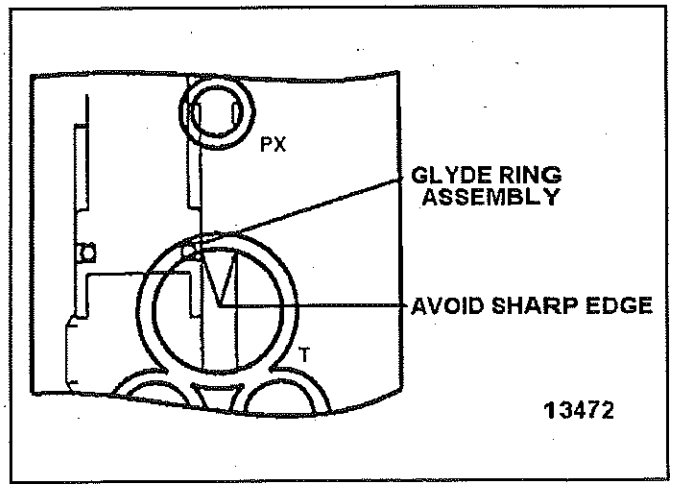


FIGURE 6 - VIEW THROUGH TANK PORT (13472)

⚠WARNING

It is extremely important to "bottom" the collar on the threads to prevent over-stressing or breaking the springs during the pressure adjustment.

35. Tighten the collar tightening screws, snug only.

36. Install the arm/cam assembly follows:

a. Assemble the actuator cap (38), boot (39), boot retainer plate (41) to the actuator base with the four button head capscrews (40) and tighten.

NOTE: *In low temperature installations, a kit is available (and recommended) that bonds the special boot to the actuator cap with a low temperature adhesive.*

b. Insert the pivot pin (35) through the hole in the actuator base, through the holes in the U-bolts and through the pivot pin hole in the other side of the actuator base. As it is being inserted, install the two lever return springs (36 and 37).

c. Center the pivot pin and secure by tightening the four hex nuts (27) and washers (28) on the two U-bolts (29). Tighten evenly to a final torque of 140 to 150 inch-lbs (16 to 17 Nm).

INSTALLATION

The valve may be installed on the truck as follows:

1. Position the valve in the proper mounting location. Secure in place with capscrews and locknuts.

2. If removed, install the proximity switch (48) into the valve and adjust as outlined in the instructions in Maintenance and Adjustment.

3. Reconnect the hydraulic and electrical connections to the valve assembly.

4. Bleed all entrapped air and contaminates as outlined in the system instructions in Section 5 - Hydraulic System or equivalent.

5. Test and adjust the valve as outlined in the instructions in Maintenance and Adjustment in this module and in the system instructions in Section 5 - Hydraulic System.

6. Close or install any access panels removed.

DUMP CONTROL VALVE

DESCRIPTION AND LOCATION

The dump control valve is a large, multi ported, split spool type hydraulic valve located on or near the dump cylinder cross tube.

The dump valve consists of two main sections:

1. Inlet Section - containing five major components:

   a. Flow Control and Relief Valve Assembly

   b. Dampening Valve Assembly

   c. Load Check Poppet

   d. Anti-Void Poppet

   e. Low Pressure Relief Valve Assembly

2. Spool Section - containing two large, ground and polished spools.

OPERATION-BASIC

The dump valve controls the flow of hydraulic oil between the pump, dump cylinders and the reservoir. Control of this system regulates movement of the dump body, providing a means for dumping payloads.

The dump valve is pilot operated by the dump control pilot valve. This pilot valve receives its oil from the pilot supply caps on the inlet sections of the main dump valve. The pilot valve controls the flow of pilot pressure oil to the spool section of the dump valve by manual movement of the Dump Controller lever in the cab.

OPERATION - INLET SECTION

1. Flow Control Valve and Pilot Dampening Valve

The flow control valve, containing the main relief cartridge, permits the supply oil from the pumps to return to the reservoir when the pilot valve spool is in either the Hold or Float position. With the pilot valve spool in either the Raise (power up) or Lower (power down) position, the flow control valve will shift in its bore, closing a return passage to the reservoir and directing the oil to the spool section by the load check poppet. Supply oil is also directed to the chamber behind the flow control valve to help the spring hold it firmly closed preventing oil loss to the reservoir. The oil, under pressure, enters the chamber behind the flow control valve through the pilot dampening valve enclosed in the pilot supply cap. The pilot supply cap receives oil from the steel tube connected to the main inlet port. The oil directed to the pilot valve and the back side of the flow control valve will be the same pressure as the oil directed to the cylinders. The greater the load in the cylinders, the greater the force behind the valve.

When the pilot valve is released to the Hold or Float position, the oil pressure behind the flow control valve will escape to the reservoir through the pilot dampening valve and the dump control pilot valve. The supply oil, no longer going to the cylinders, will push the flow control valve open and return to the reservoir.

The pilot dampening valve regulates the flow of oil to and from the chamber behind the flow control valve. When the dump control pilot valve is placed in the Raise or Lower position the restriction poppet in the pilot dampening valve will be off of its seat permitting free flow of oil under pressure, to the chamber behind the flow control valve. When the pilot valve is returned to the Hold or Float position, the flow control valve will move off its seat pushing the oil in the chamber out through the small orifice in the poppet of the pilot dampening valve. The combined action of the flow control valve and the pilot dampening valve provide quick response to the operators commands without the pressure surges found in non-dampened valves.

2. Main Relief Valve

The main relief valve, enclosed in the flow control valve, protects the pumps and hydraulic system from excessively high pressure.

The center of the relief poppet is machined to accept a metering piston. Supply oil pressure, present in the inlet chamber, will fill the cavity behind the relief poppet through the small orifice in the metering piston. The oil in the cavity behind the relief poppet will help the spring hold the relief poppet on its seat, preventing oil loss to the reservoir. The oil in the cavity will be the same pressure as the oil delivered to the cylinders. The greater the load on the pumps and cylinders, the greater the force behind the relief poppet.

When main relief pressure is achieved, the oil pressure transmitted to the cavity will push open the pilot poppet and escape to the reservoir. This action causes a pressure drop behind the relief poppet allowing it to move off its seat, opening a passage from the supply cham-

ber to the reservoir. When the relief poppet shifts in its bore, it carries with it the metering piston. The open cavity in the metering piston will seat over the protruding shaft of the pilot poppet to provide additional restriction to the oil flowing into the cavity behind the poppet. The gradual refilling of the cavity gives the main relief the ability to function smoothly and avoid a hammering action which could damage the relief valve components. When the load is released, the cavity will refill and the relief poppet will again be held on its seat preventing oil loss to the reservoir.

The main relief pressure is adjusted by turning the adjusting screw to increase or decrease the spring tension on the pilot poppet.

3. Load Check Poppet

The load check poppet is located directly across from the flow control valve assembly. The cavity behind the load check is referred to as the high pressure supply chamber leading to the spool section. Movement of the dump control pilot valve to the Raise or Lower position causes the two large spools in the spool section to shift providing a path from the high pressure supply chamber to the dump cylinders. The pressure exerted by the load on the dump cylinders is transmitted to the cavity behind the load check and will hold it closed until there is sufficient supply pressure to overcome the load in the cylinders and the load check spring. In doing this the load check poppet prevents the dump body from suddenly decreasing when the pilot valve is initially actuated.

4. Anti-Void Poppet

The anti-void poppet is identical in construction to the load check and is held on its seat by the same spring and hydraulic force that holds the load check closed. When return oil pressure is greater than supply oil pressure, the anti-void poppet will open, allowing the high pressure return oil to join the lower pressure supply oil and flow to the cylinders through the high pressure chamber.

5. Low Pressure Relief Valve

The low pressure relief valve is located next to the main flow control valve. This poppet holds a back pressure against the return oil leaving the cylinders through the low pressure chamber. This back pressure makes the anti-void poppet more effective at preventing cylinder cavitation. The low pressure relief valve is held on its seat by the combined action of hydraulic force and a spring.

OPERATION - SPOOL SECTION

The spool section controls the flow of oil to the dump cylinders. This section contains two large, ground and polished spools. One spool controls the oil flow to the base end of the cylinders, the other spool controls the oil flow to the rod end of the cylinders.

Each spool is held centered in the housing by two centering springs. The spools are hollow with a drilled passage running from end to end and across the middle. The oil pressure present in the cylinder port will also be seen on each end of the spool. When the dump control pilot valve is placed in the Raise position, the pilot oil pressure, in excess of the pressure in the cylinder port, will be directed to the pilot pressure cap to push the rod end spool to index with the high pressure chamber. At this point the high pressure oil flows through the center passage of the spool and is regulated by a small internal restrictor poppet. Oil flowing through the small orifice of the restrictor poppet will create a pressure drop from one side of the spool to the other side. This pressure drop causes the spool to shift. The color coded restrictor poppets are held in the spool by an O-ringed washer.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Inspect all hoses and lines for evidence of damage or leakage. Repair or replace as required.

2. Inspect each assembly component for evidence of wear, damage, or leakage.

3. Test the operation of the valve as outlined in the system test in Section 5 - Hydraulic System.

REMOVAL

The dump valve may be removed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction brake system.

2. Lower the dump body onto the frame. Move the Dump Controller lever to the Float position.

3. Shut the engine off.

4. Verify that all pressure has been relieved from th system.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
Excessive HOLD flow pressure	Restriction in pilot flow	Flush out pilot valve supply line.
	Restriction in pilot return line	Flush out line. Replace if necessary.
	Main flow control poppet stuck in closed position	Remove foreign material until poppet moves freely. Check O-rings and back-up rings. Replace damaged parts.
	Restriction in return line of main control valve	Flush out line. Replace if necessary.
High operating pressures	Main relief is not operating properly	Adjust or replace.
High operating temperature	Main relief is not operating properly	Reset to proper relief valve setting. If trouble persists, disassembly valve.
	Excessive leakage in main control valve or pilot valve	Check spools and bores for excessive wear or scoring. Replace damaged parts.
	Cylinder leaking	Replace cylinder packing.
	Defective pump	Repair or replace.
Loss of power or delay in reaction time	Restriction in the main flow control body pilot hole	Free hole of foreign material.
	Anti-void poppet in inlet section stuck open	Remove foreign material from poppet, poppet seat, and bore. Make sure poppet seats properly and moves freely. Replace return spring if fatigued or distorted.
	Ruptured supply line to pilot valve	Replace supply line.
	Pilot valve spool not positioned properly	Free and clean binding linkage. Check spool and detent balls. Replace if scored or damaged.
	Main relief valve not working properly	Replace.
	Cylinder leaking	Replace cylinder packing.
	Defective pump	Repair or replace.
	Excessive leakage in main control valve or pilot valve	Check spools and bores for excessive wear or scoring. Replace damaged parts.
	Void in system	Verify that the pilot cover is installed properly.

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PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
Noticeable voids in dump cylinder when lowering	Pilot cover installed backwards	Probe cross-hole in cover. The cross-hole on the supply side should be about 1/2 the width of the valve.
	Main flow control relief valve poppet stuck open	Replace or see service instructions covering main relief valve.
	Low pressure relief in inlet section stuck open	Remove foreign material from poppet, poppet seat, and bore. Make sure poppet seats properly and moves freely. Replace return spring if fatigued or distorted.
	Anti-void poppet in inlet section stuck closed	
Dump cylinders do not raise or move slowly	Spools binding in main control valve	Clean all foreign material until spool moves freely. Replace damaged or worn parts.
	Restriction in pilot pressure line	Flush out line or replace as required.
	Broken springs in either spool	Replace springs in pairs.
	Ruptured pilot pressure line	Replace pilot pressure line.
	Pilot valve spool not positioned properly	Free and clean binding linkage. Check spool spring and detent balls. Replace if scored or damaged.
	Main relief valve set low or not operating properly	Adjust or replace.
	Cylinder leaking	Replace cylinder packing.
	Defective pump	Repair or replace.
	Restrictor poppet incorrect or out of place	Check assembly print for correct poppet location.
Load drops with lever in Hold position	Spool in pilot control valve not positioned properly	Free and clean binding linkage. Check spool spring and detent balls. Replace if scored or damaged.
	Broken or weak spool return spring in main control valve	Replace spring in pairs.
	Holes in either spool or restrictor poppets plugged	Free holes of foreign material. Replace worn or damaged parts.

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PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
Load drops with lever in Raise position	Holes in base spool or restrictor poppet plugged	Free holes of foreign material. Replace worn or damaged parts.
	Broken springs in spool	Replace broken springs in pairs.
	Spool binding	Clean all foreign material until spool moves freely. Replace damaged or worn parts.
Slow or loss of float	Pilot valve spool not positioned properly	Free and clean binding linkage. Check spool and detent balls. Replace if scored or damaged. Check detent pin. Screw securely into pilot valve spool.
	Main control valve spools binding	Clean out all foreign material until spool moves freely. Replace damaged or worn parts.
	Float poppet stuck closed	Flush out foreign material until float poppet operates freely.
	Restriction in line between main valve and pilot valve	Flush out line or replace as required.
	Restriction in pilot valve return line	Flush out line or replace as required.
	Restriction in hole of spool	Remove foreign material from hole of spool. Replace damaged or worn parts.
	Restriction in restrictor poppet	Remove foreign material or install new parts as required.
	Low pressure relief in inlet section stuck closed	Remove foreign material until valve operated freely. Replace worn or damaged parts.
	Restriction in main control valve return line	Flush out line or replace as required.
	Restrictor poppet in spools not seating properly	Lap to mating seat or replace.
Noticeable void when lowering dump body	Broken spool spring	Replace spool springs in pairs.
	Hole in restrictor poppet plugged	Free hole of foreign material.
	Restriction in pilot flow or pilot pressure return line	Flush out line. Replace line if necessary.

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PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
Noticeable void when lowering dump body	Ruptured supply line to pilot valve	Replace supply line.
	Pilot valve spool not positioned properly	Free and clean binding linkage. Check spool and detent balls. Replace if scored or damaged.
	External restrictor	Check external restrictor for dirt and correct poppet seating. Replace if necessary.
Dump body settles down with control in hold position and engine off. Hold.	Cylinder leaking	Replace cylinder packing.
	Spools binding in main control valve	Clean all foreign material until spool moves freely. Replace damaged or worn parts.
	Excessive leakage in valves	Check spools and bores for excessive wear or scoring.
	Spool in pilot valve not centering	Free pilot valve spool. Replace pilot valve if necessary.

12665-4 Sheet 4 of 4

5. Disconnect all hoses and wiring to the valve. Label each to aid during installation. Install clean plugs or caps over all openings.

6. Remove the capscrews that secure the valve.

7. Remove the valve.

DISASSEMBLY (Figure 1)

NOTE: *Note the position and orientation of parts during disassembly. Some parts are not interchangeable. Some parts that appear symmetrical may not be turned around.*

SECTIONS

The main dump control valve may be split into sections as follows:

1. Loosen and remove the locknuts (10), flatwashers (9), and tie bolts (4) securing the sections together.

2. Carefully separate the sections. Inspect all seals between sections.

NOTE: *Do not pry the sections apart with sharp instruments as they may cause damage to mating surfaces.*

INLET SECTION

The inlet section of the dump valve may be disassembled as follows:

1. Mark both covers (17 and 47) to ensure proper reassembly.

2. Remove the eight socket screws from the inlet cover (47). Remove the cover.

3. Remove springs (24 and 31) and tag for proper reassembly.

4. Remove the low pressure relief valve sleeve (25) with subassembly.

5. Remove the main relief valve assembly (32).

6. Remove the eight socket screws (2), poppet cover (17), springs (19), and poppets (20).

7. Remove all O-rings and back-up rings from the inlet housing.

MAIN FLOW CONTROL POPPETS AND RELIEF VALVE

The main flow control poppets and relief valve may be disassembled as follows:

1. Remove the relief valve poppet (37) from the inlet section.

2. Remove the internal retaining ring (41), plug (43) (with associated parts intact), poppet (33), and piston (34).

3. Remove all O-rings and back- up rings.

NOTE: *If associated parts in the plug are removed, the relief pressure setting will be altered. However, to inspect the poppet face and seating surface in the plug, disassembly is necessary.*

4. Remove the locknut (45), adjusting screw (44), spring (42), and poppet (46).

SPOOL SECTION

The spool section of the dump valve may be disassembled as follows:

1. Mark covers (51 and 59) for proper reassembly.

2. Remove the eight socket screws (2), cover (59), and O-rings (61 and 62).

3. Mark both spools (58) with respect to their proper bores and position.

IMPORTANT: *The spools are a select fit. They are not interchangeable, and they cannot be turned around in their bores. Reversing the spools will cause improper operation.*

4. Mark poppets (55 and 65) with respect to their spools.

IMPORTANT: *The poppets are not interchangeable.*

5. Remove the spools (58) with the following:

a. Springs (60).

b. Washers (57), O-rings (52), and poppets (54, 55, and 66).

6. Remove the float poppet subassembly (65) as a unit.

7. Remove the eight socket screws (2), cover (51), O-rings (62), springs (50), washers, and poppet (68).

8. Remove the plug and O-ring from the end cover (if so equipped).

INSPECTION AND REPAIR

INLET SECTIONS

The inlet sections of the dump valve may be serviced as follows:

1. Clean all parts including subassemblies in solvent, and dry with compressed air.

2. Inspect the hole and ball poppet of the low pressure subassemblies for foreign particles, and clean with compressed air.

3. Examine all springs for breaks or distortion.

4. Inspect all poppet seating surfaces for nicks or excessive wear. All seats must be sharp and free of nicks.

5. Inspect all bores and surfaces of sliding parts for nicks, scores, or excessive wear.

6. Insert the poppets into their respective bore and test for fit. The poppets should fit freely, without binding through a complete revolution.

7. Follow the above procedure to check the fit between the low pressure sleeves and low pressure relief valves.

8. Examine all O-rings and back-up rings for damage or wear. Replace as required.

MAIN FLOW CONTROL POPPETS AND RELIEF VALVE

The main flow control poppets and relief valves may be serviced as follows:

1. Clean all parts in solvent and dry with compressed air.

2. Inspect O-ring grooves for contamination.

3. Check springs for breaks or distortion.

4. Examine poppet faces and seating surfaces in poppet and plug for scratches or excessive wear. All seats must be sharp and free of nicks.

5. With the O-rings and back-up rings removed, insert poppets into the poppet subassemblies. Test for fit. The poppet must fit snugly without binding through a complete revolution.

6. Examine all O-rings and back-up rings for damage or deterioration. Replace as required.

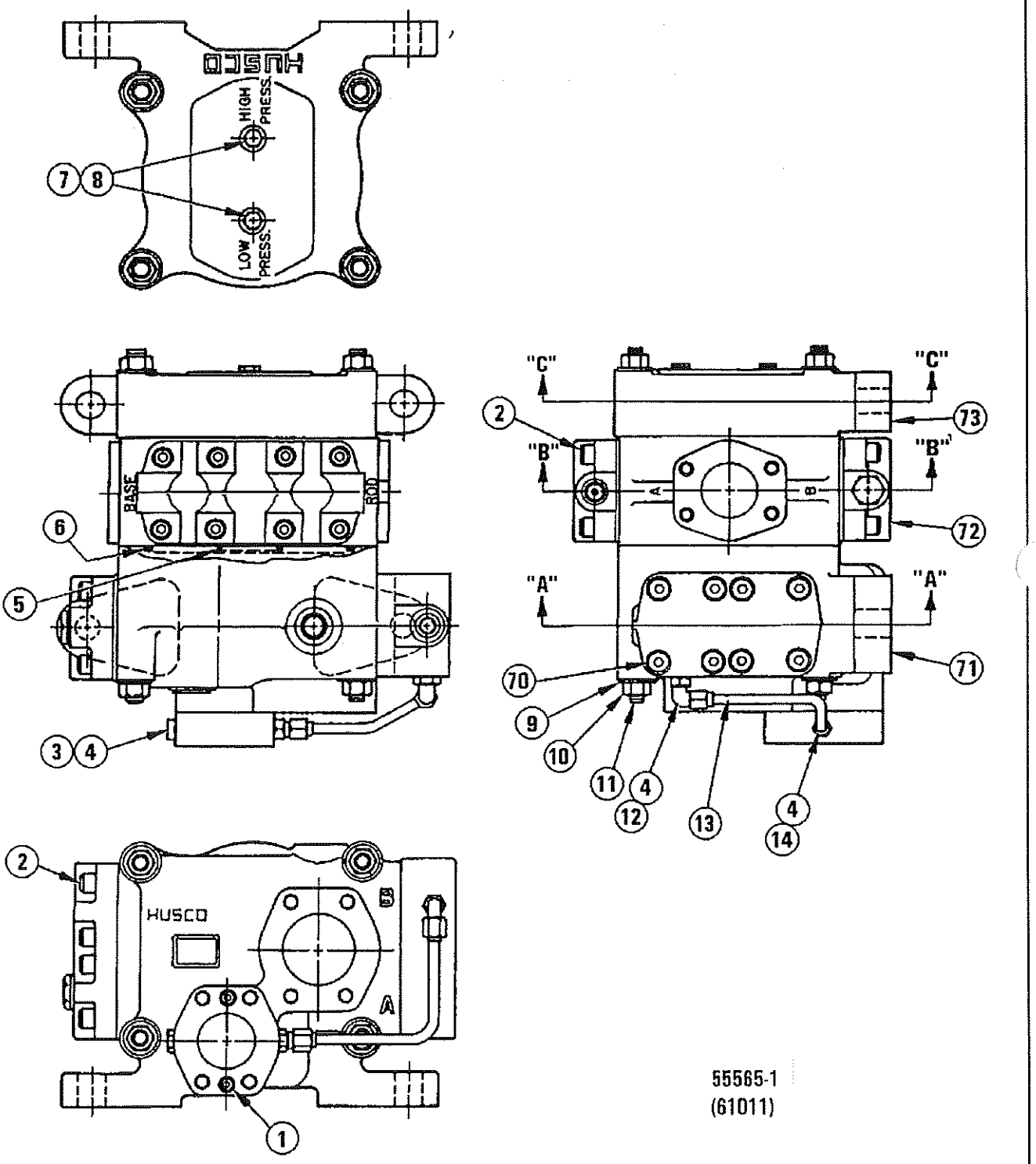
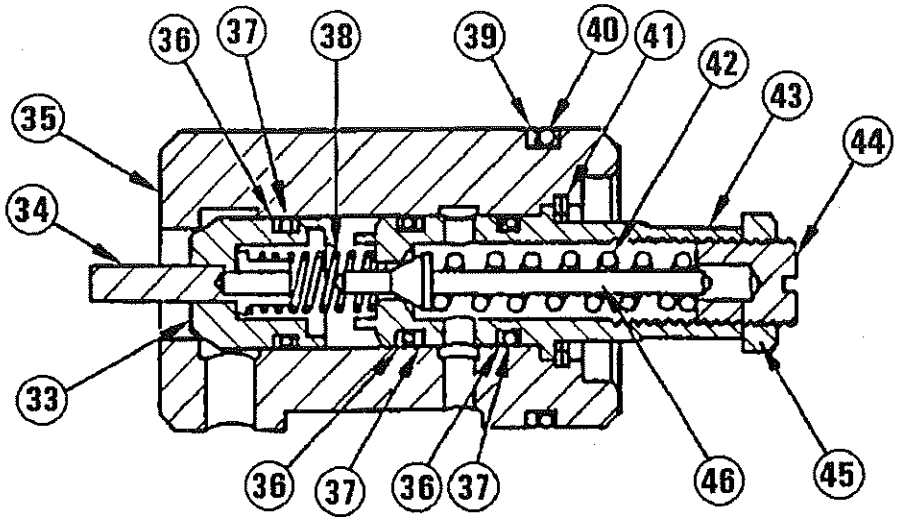
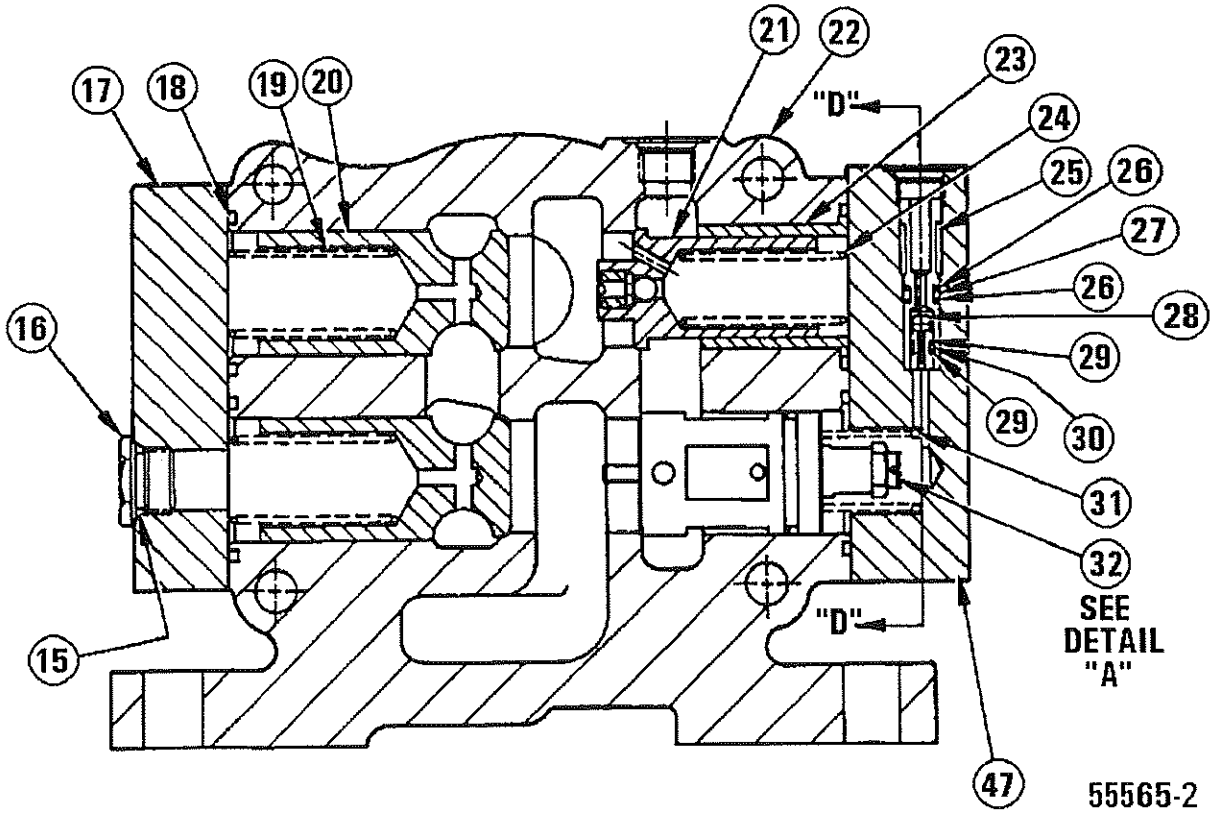


FIGURE 1 - DUMP VALVE ASSEMBLY



DETAIL "A"



SECTION "A-A"

FIGURE 1 - DUMP VALVE ASSEMBLY - CONTINUED

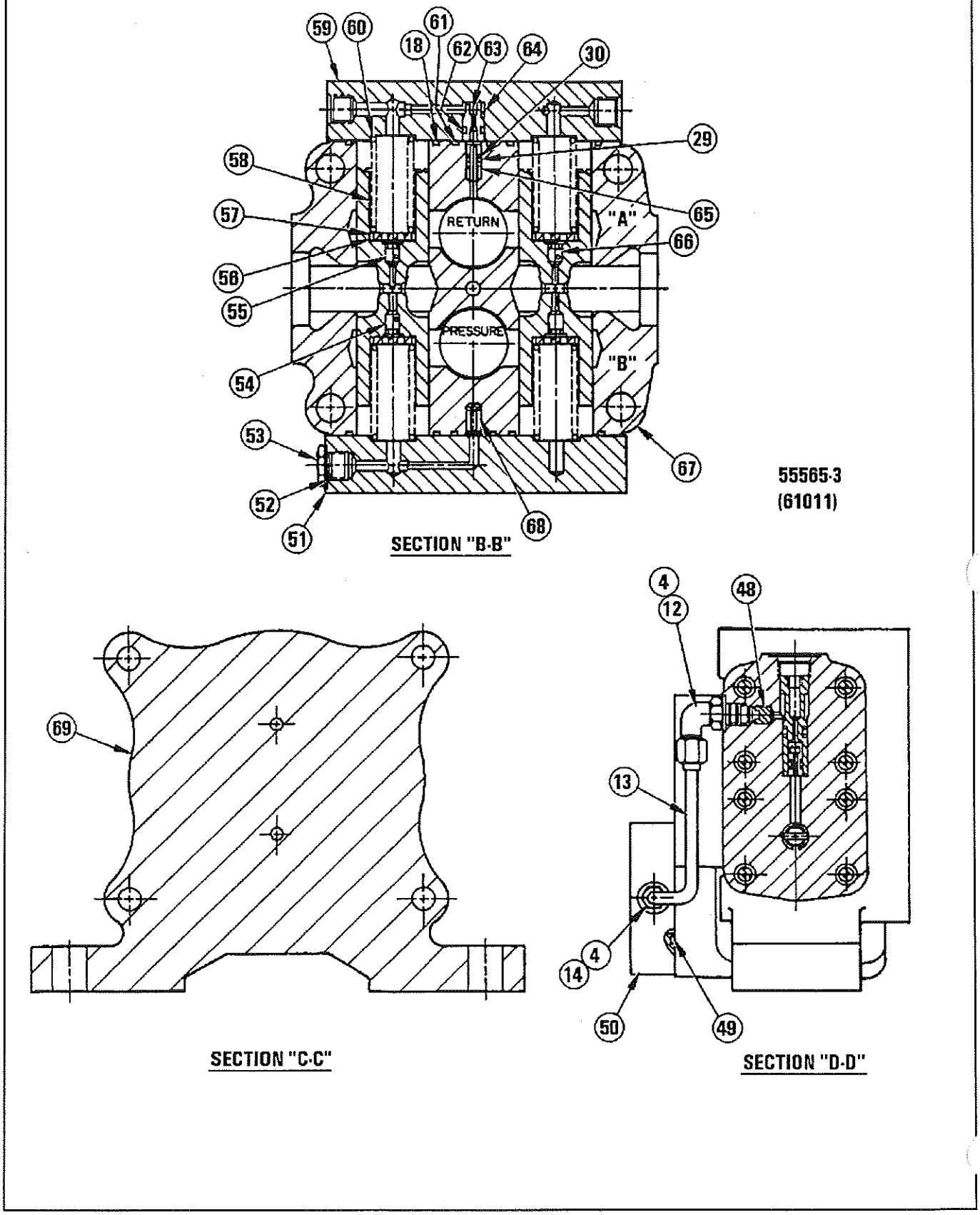


FIGURE 1 - DUMP VALVE ASSEMBLY - CONTINUED

SPOOL SECTION

The spool section of the dump valve may be serviced as follows:

1. Clean all parts in solvent, and dry with compressed air.

2. Inspect the hole and ball poppet of float poppet sub-assembly for foreign particles. Clean with compressed air.

3. Inspect all O-rings for damage or wear.

4. Inspect springs for breaks or distortion.

5. Inspect all poppet faces and seating surfaces in the spools. All seats must be sharp and free of nicks.

6 Inspect the spools and their bores for scratches or scoring. Check the fit of each spool in its bore. They should fit freely, without binding, through a complete revolution.

7. Inspect the flow passages in the spools and both covers. The passages must be clean and free of foreign particles. Clean with compressed air.

KEY			55565
01.	Socket Head Capscrew	38.	Spring
02.	Socket Head Capscrew	39.	Back-up Ring
03.	Plug	40.	O-ring
04.	O-ring	41.	Internal Retaining Ring
05.	O-ring	42.	Spring
06.	O-ring	43.	Relief Valve Plug (Non Serviceable)
07.	Plug	44.	Screw (Non Serviceable)
08.	O-ring	45.	Special Nut
09.	Compression Washer	46.	Relief Valve Poppet (Non Serviceable)
10.	Locknut	47.	Relief Valve Cover
11.	Tie Rod	48.	Restriction Screw
12.	Fitting	49.	O-ring
13.	Tubing	50.	Flange Cap
14.	Fitting	51.	Spool Cover
15.	O-ring	52.	O-ring
16.	Plug	53.	Plug
17.	Poppet Cover	54.	Restriction Poppet (Red)
18.	O-ring	55.	Restriction Poppet (White)
19.	Spring	56.	O-ring
20.	Check Valve Poppet	57.	Spool Washer
21.	Low Pressure Relief Valve Assembly	58.	Spool
22.	Inlet Housing	59.	Spool Cover
23.	Sleeve	60.	Spring (Green)
24.	Low Pressure Spring (White)	61.	O-ring
25.	Sleeve	62.	O-ring
26.	Back-up Ring	63.	Ball
27.	O-ring	64.	Poppet
28.	Restriction Poppet	65.	Restriction Poppet
29.	Back-up Ring	66.	Restriction Poppet
30.	O-ring	67.	Spool Housing
31.	Spring (Orange)	68.	Check Valve Poppet
32.	Relief Valve Assembly	69.	Outlet Housing
33.	Relief Valve Poppet (Non Serviceable)	70.	Socket Head Capscrew
34.	Relief Valve Piston (Non Serviceable)	71.	Inlet Section Assembly
35.	Relief Valve Body (Non Serviceable)	72.	Spool Section Assembly
36.	Back-up Ring	73.	Outlet Section Assembly
37.	O-ring		

ASSEMBLY

PRIMARY INLET SECTION

Main Flow Control Poppets and Relief Valve

Assemble the main flow control and relief valve subassembly as follows:

NOTE: *It is recommended that all O-rings be replaced during assembly. Lightly lubricate all O-rings with a multi-purpose grease. Do not use O-rings other than the manufacturer's, as they are made of special compounds.*

1. Coat all parts with hydraulic oil.

2. Insert poppet (46) and spring (42) into plug (43), and thread in the adjusting screw (44).

NOTE: *When the adjusting screw contacts the spring, an approximate adjustment only can be made. Turn the screw in to raise pressure, and out to lower. 1/4 turn changes the pressure about 150 psi (1 035 kPa). An accurate adjustment can be made when the dump valve is installed.*

3. Make an approximate adjustment with the adjusting screw.

NOTE: *When changing pressure to a lower pressure, perform the following:*

a. Determine how much the adjustment screw must be turned.

b. Turn the screw 1/2 turn beyond the final position.

c. Turn the screw back to the final position and install the locknut. Torque the locknut 20 to 30 ft-lb. (27 to 40 Nm).

4. Assemble O-rings and back-up rings as outlined in the illustration.

5. Insert the piston (34) and spring into the poppet, and install as an assembly into poppet.

IMPORTANT: *The spring is flared on one end. When correctly installed, the flared end will contact the plug.*

6. Insert the plug with associated parts into poppet (43), and install the internal retaining ring (41).

7. Install the relief valve subassembly into the inlet section of the dump valve. The relief valve must fit snugly without binding through a complete revolution.

NOTE: *When checking the main relief valve for freedom of poppet, the poppet may not spring back after being pushed toward the plug. This condition is normal as hydraulic oil on the parts will prevent the poppet from returning. The relief valve should be checked in the main dump valve for proof of proper operation.*

INLET SECTION

Assemble the primary inlet section of the dump valve as follows:

NOTE: *It is recommended that all O-rings be replaced during assembly. Lightly lubricate all O-rings with a multi-purpose grease. Do not use O-rings other than the manufacturer's, as they are made of special compounds.*

1. Coat all parts including the housing bores with hydraulic oil.

2. Insert poppets (20) and springs (19) into their respective bores. Ensure that the poppets are positioned properly.

3. Place O-rings (18) into their corresponding grooves.

4. Attach cover (17) with socket screws, and torque to 60 ft-lb. (80 Nm) in a cross corner sequence.

5. Insert the low pressure relief valve (21) with its sleeve (23) and spring (24) into the proper bore.

6. Insert main flow control/relief valve assembly (32) and springs (31) into its proper bore.

7. Install O-ring.

8. Attach inlet cover (47) with socket screws. Torque to 60 ft-lb. (80 Nm) in a cross corner sequence.

9. Install the pilot control valve assembly as follows:

a. Install O-ring and back-up ring (26 and 27) on sleeve (25).

b. Install O-ring and back-up ring (30 and 25) on the poppet.

c. Install the poppet (28) into the sleeve (25).

d. Install the assembly into the end cover (47) and secure.

SPOOL SECTION

Assemble the spool section of the dump valve as follows:

NOTE: *It is recommended that all O-rings be replaced during assembly. Lightly lubricate all O-rings with a multi-purpose grease. Do not use O-rings other than the manufacturer's, as they are made of special compounds.*

1. Coat all parts, including the housing bores with hydraulic oil.

2. Insert poppets (54, 55, and 66) into spools (58). Ensure that the poppets are installed in proper position.

3. Install washers (57) with O-rings (56) and springs (60) into spools (58).

4. Slide the spools into their respective bores. Ensure that the spools are positioned correctly. The spools cannot be turned around even though they appear symmetrical.

NOTE: *The "V" groove on the end of the spool should always be nearest the cover that the pilot lines connect to.*

5. Place all O-rings and back-up rings into their corresponding grooves.

6. Install the check valve poppet (68) and float poppet subassembly (65).

7. Assemble O-ring to the plug, and install the blank cover.

8. Attach blank cover with socket screws, and torque to 60 ft-lb. (80 Nm) in a cross corner sequence.

NOTE: *The covers are marked to correspond with the section they belong on. Each plunger section has cast webs with an "A" and a "B" designation on it. The number of the section and the nearest web letter is stamped on the cover. The inlet section is always considered section number 1. When the valve is correctly assembled, the stamped letter and number on the cover should match the web letter and section number.*

VALVE SECTIONS

The valve sections may be connected as follows:

1. Install all O-rings between the spool and the two inlet sections.

2. After verifying their respective positioning place the spool and two inlet sections together.

3. Install the tie bolts, lockwashers and nuts. Tighten the nuts as follows:

a. Torque evenly to 20 ft-lb. (27 Nm) in the following pattern :

(1) Top bolt on side opposite side with the cast section designators labeled A and B.

(2) Bottom bolt on side labeled with designator A and B.

(3) Bottom bolt on same side as (1).

(4) Top bolt on same side as (2).

b. Retorque to 50 ft-lb. (67 Nm) in the same sequence.

c. Retorque to 100 ft-lb. (135 Nm) in the same sequence.

d. Retorque to 160 ft-lb. (215 Nm) in the same sequence.

INSTALLATION

The dump valve may be installed as follows:

1. Position the valve on the mounting bracket.

2. Install capscrews and tighten to secure the valve in place.

IMPORTANT: *The dump valve has provisions for four mounting bolts. It is recommended that only three be used. The use of four bolts may cause undue binding or distortion.*

3. Install all hydraulic and electrical connections and secure to the valve.

IMPORTANT: *Remember to install the orifice that controls overcenter operation in the cavity behind the fitting for the Lower pilot inlet line. The orifice should be installed with the flat side toward the fitting. See the information on the dump system in Section 5 - Hydraulic System for more information.*

4. Test the operation of the system as outlined in the testing procedures under system operation in Section 5 - Hydraulic System.

NOTE: *Verify that all relief valves are properly set.*

DUMP PILOT VALVE

DESCRIPTION AND LOCATION

The dump pilot valve is a small multi-ported, spool-type valve mounted in the hydraulic components box behind the left side of the cab.

OPERATION

The dump pilot valve has two functions:

1. It serves as a directional valve, controlling the pilot flow of pressurized fluid to the main spools in the dump valve. This flow directs their operation and thus controls the operation of the entire system.

2. It limits the maximum pressure in the Lower or Power down mode to assist in controlling the rate at which oil is returned to the hydraulic reservoir.

TROUBLESHOOTING

For detailed troubleshooting information, see the chart in the module on the dump valve in Section 5 - Hydraulic System.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Inspect all hoses and lines for evidence of damage or leakage. Repair or replace as required.

2. Inspect each assembly component for evidence of wear, damage, or leakage.

3. Test the operation of the valve as outlined in the system operation test in Section 5 -Hydraulic System.

REMOVAL

The dump pilot valve may be removed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction brake system.

2. Lower the dump body onto the frame. Move the Dump Controller lever to the Float position.

3. Shut the engine off.

4. Verify that all pressure has been relieved from the system.

5. Disconnect all hoses and wiring to the valve. Label each to and during installation. Install clean plugs or caps over all openings.

6. Remove the capscrews that secure the valve.

NOTE: *The Dump Controller cable linkage must be removed to remove the pilot valve assembly.*

7. Remove the valve.

DISASSEMBLY

NOTE: *Note the position and orientation of parts during disassembly. Some parts are not interchangeable. Some parts that appear symmetrical may not be turned around.*

The pilot valve may be disassembled as follows:

1. Separate the inlet (1), spool (2), and outlet (3) sections of the valve as follows:

   a. Loosen and remove the locknuts securing the sections together.

2. Carefully separate the sections. Inspect all seals between sections.

NOTE: *Do not pry the sections apart with sharp instruments as they may cause damage to mating surfaces.*

2. Remove screws (12).

3. Remove the end cover (13), O-ring (30), and wiper ring (29).

4. Remove the detent assembly from the other end of the section.

5. Carefully slide the entire spool assembly out of the main body with the detent section.

6. Remove the O-ring (30), and wiper ring (29) from the detent end of the housing.

7. Unscrew the spool from the detent assembly.

8. Disassemble the detent assembly as follows:

a. Remove internal retaining ring (23) and spacer (22).

b. Remove the internal retainer and balls as required.

c. Remove all remaining seals and components.

9. Remove the relief valve (4) from the side of the spool section.

INSPECTION AND REPAIR

The pilot valve may be serviced as follows:

1. Clean all parts, including the housing, and dry with compressed air.

2. Inspect seal counter-bores. They must be free of nicks and contamination.

3. Inspect the springs for cracks, distortion, or fatigue.

4. Inspect all sliding surfaces for nicks, scores, or excessive wear.

5. Inspect all spools for damage or wear. Test spools for proper fit in their bores. They should turn free through one complete revolution.

6. Examine O-rings for damage or excessive wear.

ASSEMBLY

The pilot valve may be assembled as follows:

1. Coat all parts, including the housing bores, with hydraulic oil.

2. Install the relief valve assembly (4) fitted with new seals (5) on the side of the spool section.

3. Assemble the detent assembly as follows:

a. Assemble the components as shown in the reverse order removed.

NOTE: *It may be desirable to hold the detent balls in place with grease during the assembly process.*

b. Secure with internal retaining ring (23) and spacer (22).

4. Install the spool on the detent assembly and tighten to approximately 5 ft-lbs (7 Nm).

NOTE: *It is recommended that a thread locking compound (Loctite 271 or equivalent) be used to prevent accidental separation of the components during operation. No compound should remain on the outer surface of the spool when assembled.*

6. Install the O-ring (30), and wiper ring (29) on the detent end of the housing.

7. Carefully slide the entire spool assembly into the main body with the detent section.

8. Install the detent assembly onto the end of the spool section.

NOTE: *It is recommended that a mild thread locking compound (Loctite 242 or equivalent) be used to prevent accidental separation of the components during operation. No compound should remain on the outer surface of the spool when assembled.*

INSTALLATION

The dump pilot valve may be installed as follows:

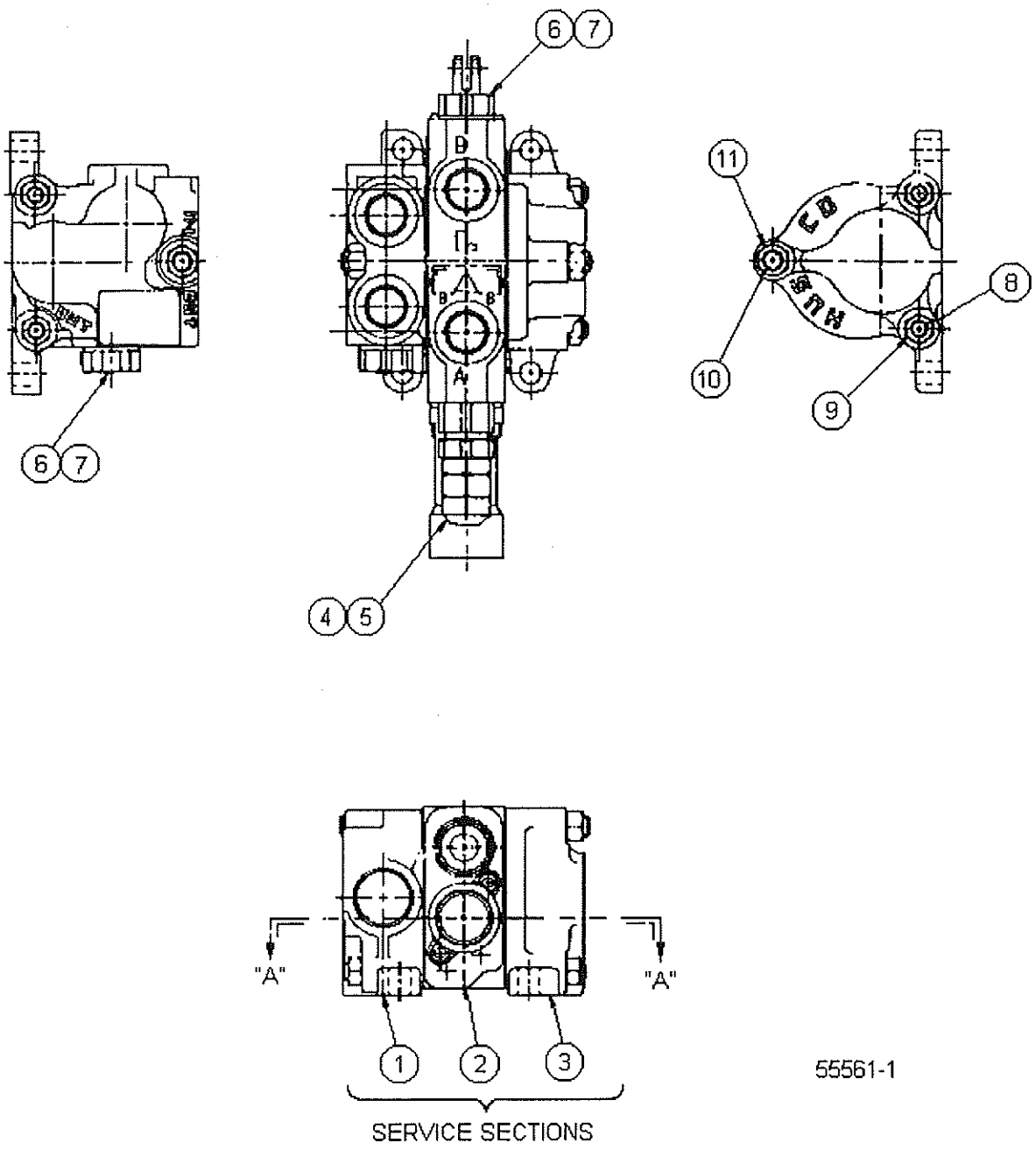
1. Position the valve on the mounting bracket.

2. Install capscrews and tighten to secure the valve in place.

3. Install all hydraulic and electrical connections and secure to the valve.

4. Test the operation of the system as outlined in the testing procedures under system operation in Section 5 - Hydraulic System.

NOTE: *Verify that all relief valves are properly set, particularly the pressure down relief setting controlled by the pilot valve.*



KEY 55561

01.	Inlet Section Assembly	10.	Tie Rod	19.	Spool Cap	28.	Inlet Housing
02.	Spool Section Assembly	11.	Special Nut	20.	Ball	29.	O-ring
03.	Outlet Section Assembly	12.	Machine Screw	21.	Spool End Detent Pin	30.	Wiper
04.	Relief Valve Assembly	13.	Seal Plate	22.	Spacer	31.	Spool
05.	Seal and Spring Repair Kit	14.	Outlet Housing	23.	Internal Retaining Ring	32.	Spool Housing
06.	Shut-off Plug Assembly	15.	O-ring	24.	Ball	33.	Check Valve Poppet
07.	Special Seal	16.	Spring Seat	25.	Spring	34.	Spring
08.	Tie Rod	17.	Spring	26.	Spacer		
09.	Special Nut	18.	Detent Sleeve	27.	Socket Head Capscrew		

FIGURE 1 - DUMP PILOT VALVE

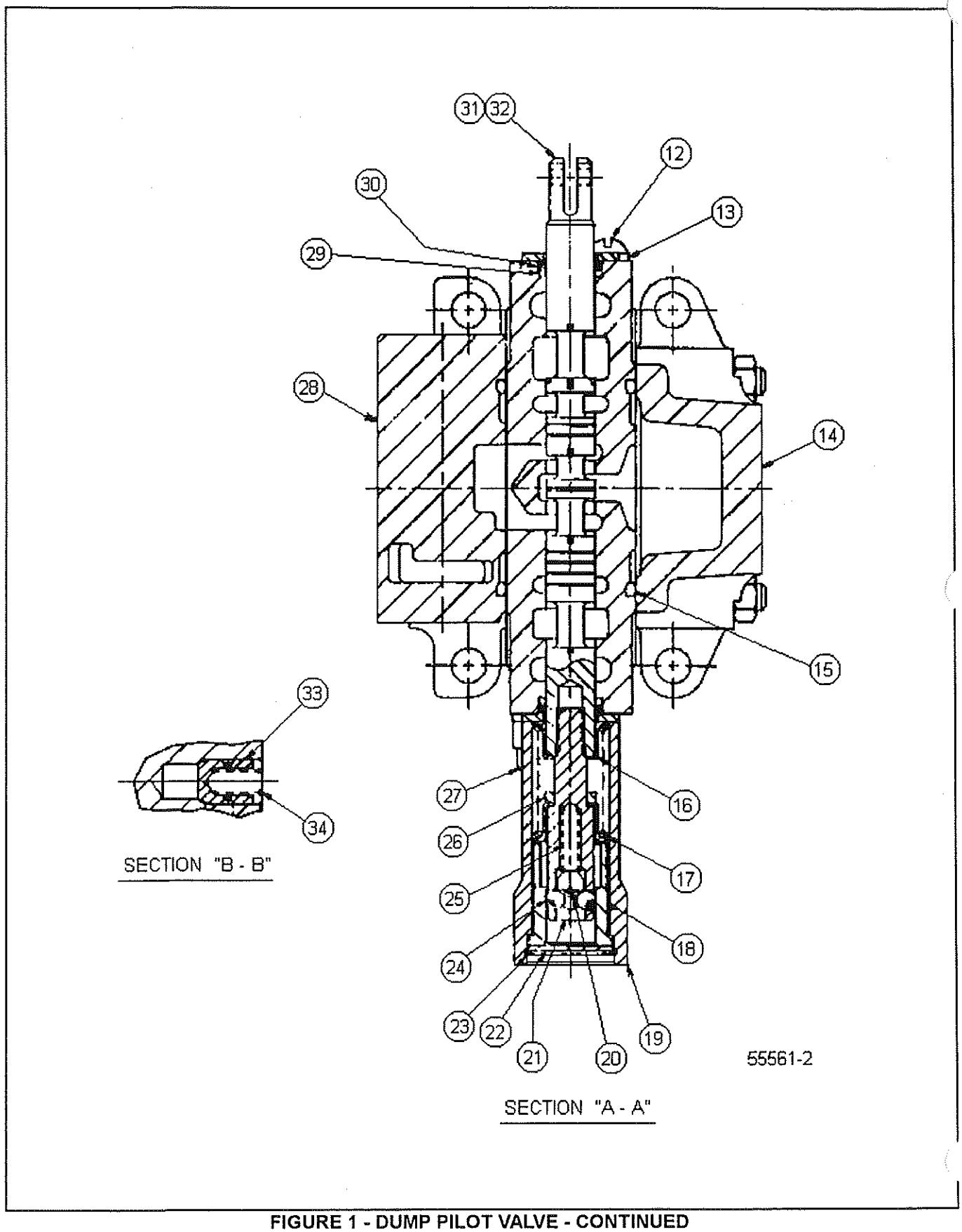


FIGURE 1 - DUMP PILOT VALVE - CONTINUED

STEERING PUMP

DESCRIPTION AND LOCATION

The steering pump is the smaller piston pump assembly mounted on the rear of the tandem section dump pump assemblies. The pumps are mounted on a special bracket assembly between the main frame rails, just in front of and above the nose cone receiver.

OPERATION

The steering pump supplies the pressurized hydraulic oil to operate the steering and brake systems.

The pump is basically a variable swashplate, piston type assembly. The oil supply for the pump enters from the reservoir and is routed internally to the pump piston assembly. As the pistons turn on the angled swashplate, they move up and down in their respective bores. This movement results in the pressurization of the oil and direct it to the outlet chambers. There it exits the pump through the outlet ports.

In this configuration, the pump is set up to operate as a pressure compensating device with self contained, preset, spring loaded piston assemblies controlling the operation of the moveable swashplate. The stroke of the pumping pistons is varied to increase or decrease the output flow to maintain as a constant, the preset pressure in the system.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

NOTE: *The pumps themselves require no internal maintenance or adjustment beyond periodic verification of the pumps ability to maintain required pressures and flows.*

1. Clean the pump assembly and inspect for evidence of wear, leakage or damage. Repair or replace as required.

2. Test the operation of the steering and brake systems as outlined in the appropriate test procedures in Section 5 - Hydraulic System. If adjustment of the pump's output pressure is found to be necessary, it may be made as follows: (Figure 1)

a. Verify that the reason for the incorrect pressure is truly the setting of the pump. Since the systems receiving the flow have a number of components and involve other systems, it is important to eliminate the possibility that the incorrect pressure (especially if too low) is not a symptom of another problem and adjusting the pump is treating the symptom and not the cause.

NOTE: *For example, incorrect operation of the dump solenoid valve in the steering manifold may allow the flow to bypass to the dump system. This would result in a low system pressure reading, even though the pump may be fully stroked and operating properly. Adjusting the pump pressure will not correct the cause only mask it.*

b. Remove the acorn nut and seal washer (35) from the pressure adjustment screw (larger barrel of the two) on the steering pump control valve assembly.

c. While holding the adjusting screw (33) with the appropriate Allen wrench, loosen the locknut (34).

d. Turn the adjusting screw inward (clockwise) to increase the pressure or outward (counter-clockwise) to decrease the pressure. The pressure changes approximately 200 psi (1400 kPa) per turn of the adjusting screw.

NOTE: *The other adjusting screw is turned completely in ("bottomed out") in the installation used.*

e. When the adjustments are complete, secure the adjusting screw with the locknut (34) while holding the adjusting screw to maintain the pressure setting.

f. Install and secure with the acorn nut.

REMOVAL (Figure 2)

The steering pump may be removed from the dump pumps as follows:

NOTE: *It is not necessary to remove the pump assembly to service the steering pump. These procedures are written if the pump is being removed with the pump assembly still on the truck. Modify as required if the pumps have been removed and are on a work bench.*

1. Park the truck in SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Shut the oil supply to the pumps by closing the valve on the supply line (near the reservoir tank) or other ap-

proved method.

3. Remove the inlet and outlet hoses from the pumps. Cap or plug all openings and label to assist in the installation process.

4. Install a suitable lifting device to the pumps to prevent unwanted movement.

NOTE: *Provisions should be made for lowering the pumps to the floor, a distance in excess of 6 feet (2 meters). The approximate weight of the steering pump is 75 lbs. (35 kgs).*

5. Remove the capscrews and washers securing the tail support braces to the pump and the pump bracket.

6. Remove the capscrews (12) and lockwashers (13) securing the rear piston pump assembly (2) to the dump pump sections (1).

7. Carefully separate the two pump sections, making sure that the splined shafts and couplers are not damaged.

⚠ CAUTION

Do not attempt to pry the pumps apart with a screwdriver or other means. They should be separated by tapping with a soft-faced hammer.

8. Lower the pump to the ground.

DISASSEMBLY (Figure 1)

Prior to beginning disassembly of the pump:

1. Clean the work area of dirt, grease, foreign material or other items which might contaminate the pump.

2. Clean the unit thoroughly with a solvent. Remove all sharp edges from splines, drill points, keyways and end of shaft. Mark the adapter and cover/housing sections to ensure correct reassembly.

3. To aid in disassembly and reassembly, the pump should be retained in some manner. For example, a steel plate bolted to and extending over the edge of a work bench will suffice. The plate should have a hole large enough for the adapter flange pilot to drop through, and two holes in the adapter flange. The pump can now be firmly fixed to the plate by bolts. This is especially helpful in removal and torquing of capscrews.

The steering pump may be disassembled as follows:

1. Mark the position of the port block (22) relative to the pump housing (43).

2. Remove the socket head capscrews (23) securing the port block.

3. Remove the port block (22) together with all parts of the controlling valve assembly (26).

4. Remove the tapered roller bearing (19) and shim washer (20) near the port block.

5. Remove the rotary group assembly (Detail A and the driveshaft (36) and bearing (40) assembly) from the housing.

6. Remove the O-ring (39).

7. Remove the bearing shells or cradles (38) and (37).

NOTE: *Make sure to note the orientation of the bore reliefs on the high pressure side. This is important for proper reassembly.*

8. Use an appropriate puller to remove the outer bearing race from the front bearing.

9. Remove the control or lens plate (10).

10. Use an appropriate puller to remove the outer bearing race from the rear bearing.

11. Remove the O-rings (21).

12. Loosen the jam nut on the threaded pin.

13. Remove the threaded pin assembly (16).

14. Disassemble the guide of the control piston (15).

15. Disassemble the guide of the counter piston (14).

16. Pull the driveshaft (36) with the bearing (40) out of the rotary drive assembly.

17. Remove the pistons (2) and retaining plate (3).

18. Remove the retaining ball (4).

19. Compress the center spring (8) in order to allow the removal of the retaining ring (9).

20. Remove the retaining ring (9).

21. Remove the remaining parts of the pump as housing assemblies.

22. Disassemble the control valve assembly as follows:

a. Remove the socket head capscrews (29) securing the valve assembly to the port block.

b. Remove the O-rings (32).

c. Remove the acorn nuts (35) from the adjusting screws.

d. Loosen the locknuts (34) and remove the adjusting screws (33).

e. Remove the plug assemblies (30).

f. Remove the disc or usit ring (31).

g. Remove the springs from the bores.

NOTE: *There are two of them in the smaller flow control bore.*

h. Remove the spring cup.

i. Remove the plug (27).

j. Very carefully remove the piston from the bore.

k. Remove the orifice in the spring area of the pressure control valve.

l. Disassemble the plug or orifice (spring area of the flow control).

INSPECTION AND REPAIR

The disassembled pump may be serviced as follows:

1. Clean all metal parts in solvent and dry with compressed air. Inspect for evidence of wear, damage, cracks, or leakage. Repair or replace as required.

2. Inspect the pistons and piston bores. Replace the body if the groove is too deep or the bores look as if they had been sand blasted.

3. Inspect the piston "shoes" and the swashplate. Replace if wear is noticed or damage or grooves are apparent.

4. Inspect the driveshaft for evidence of damage or wear particularly in the bearing journal and the seal operating areas.

5. Replace the seals in the pump housing as follows:

a. Lay the housing on a work bench or other suitable work surface.

b. Using an appropriate tools, remove the retaining ring (45).

NOTE: *Use extra caution not to scratch or damage the bore or bearing surfaces or their end projections.*

c. Remove the seal (44) from the housing.

d. After the seal is out:

(1) Thoroughly clean the bore.

(2) Inspect the bore for scratches or gouges that might interfere with the installation of the new seal.

NOTE: *If found, the bore can be smoothed with No. 400 Emery paper (only). Clean the bore after the smoothing process is complete.*

(3) Clean and prepare a suitable seal press ring or plug for use when installing the new seal.

(4) Coat the new seal in hydraulic oil or grease compatible with that in the truck's hydraulic system.

(5) Using the tool listed in step 3, install the new seal (44) in the pump housing (43).

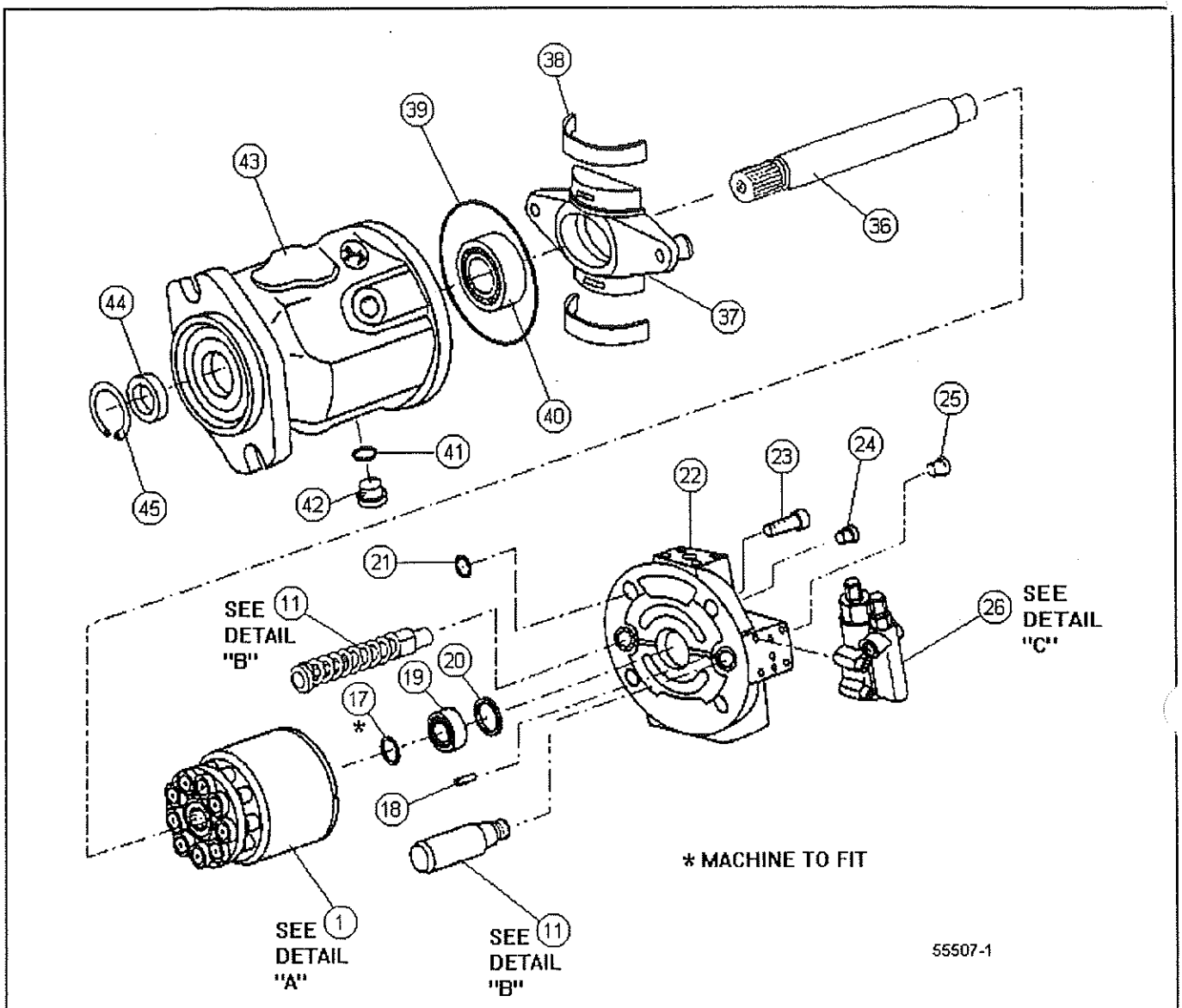
(6) Install and secure the retaining ring (45) into the correct position in the grooves.

ASSEMBLY

Prior to beginning assembly of the pump:

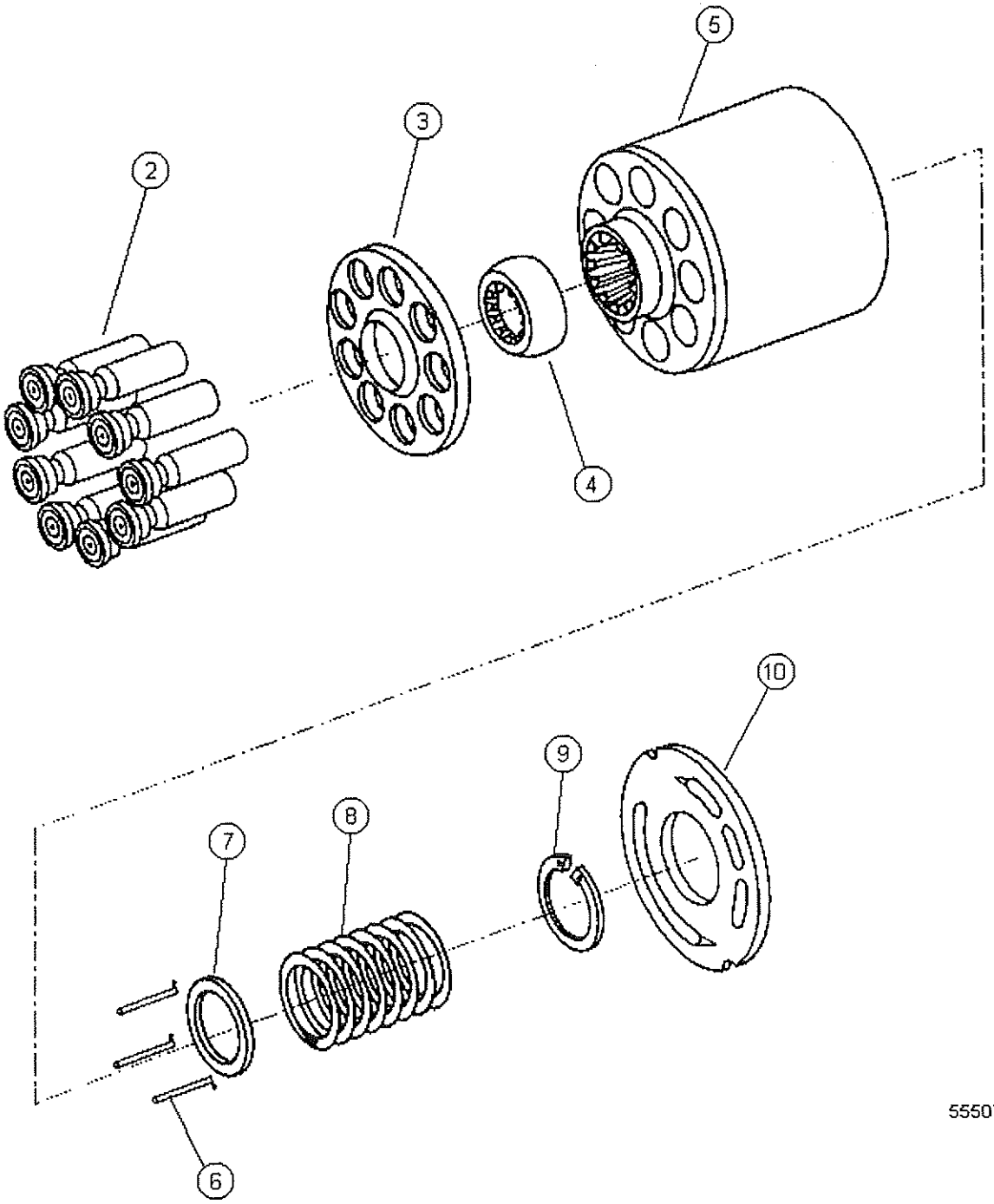
1. Clean the work area of dirt, grease, foreign material or other items which might contaminate the pump.

2. To aid in reassembly, the pump should be retained in some manner. For example, a steel plate bolted to and extending over the edge of a work bench will suffice. The plate should have a hole large enough for the adapter flange pilot to drop through, and two holes in the adapter flange. The pump can now be firmly fixed to the plate by bolts. This is especially helpful in re-



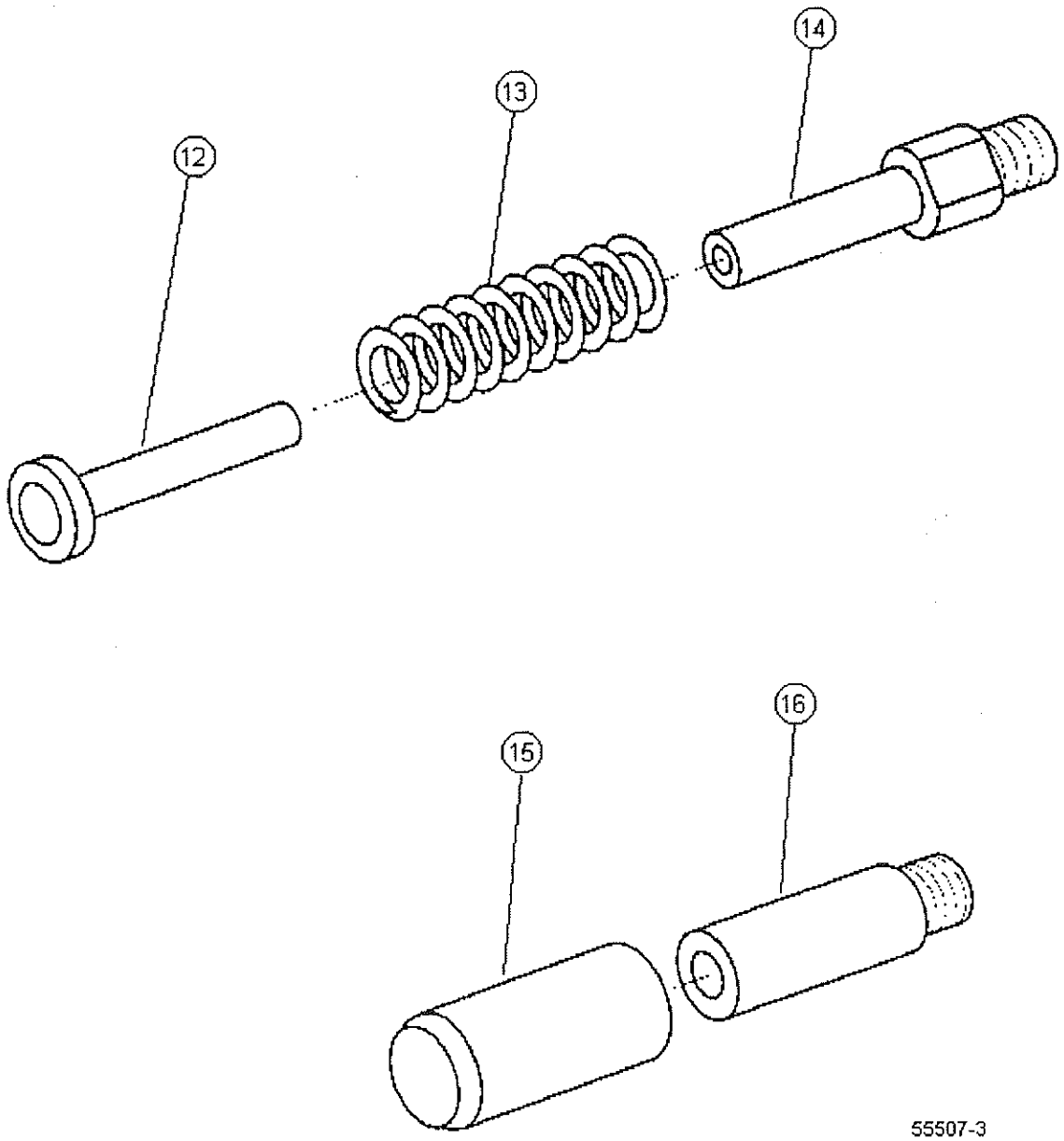
KEY					
01.	Rotary Piston Group	16.	Control Piston Guide	31.	Usit Ring
02.	Piston	17.	Adjusting Disc	32.	O-ring
03.	Retaining Plate	18.	Dowel Pin	33.	Adjusting Screw
04.	Retaining Ball	19.	Tapered Roller Bearing	34.	Jam Nut
05.	Barrel	20.	Washer	35.	Acorn Nut
06.	Pressure Pin	21.	O-ring	36.	Driveshaft
07.	Disc Retaining Clip	22.	Port Block	37.	Cradle Assembly
08.	Spring	23.	Socket Head Capscrew	38.	Bearing Cradle
09.	Retaining Ring	24.	Plug	39.	O-ring
10.	Lens Plate	25.	Plug	40.	Tapered Roller Bearing
11.	Piston Control Assembly	26.	Control Valve Assembly	41.	O-ring
12.	Counter Piston	27.	Plug	42.	Plug (with O-ring)
13.	Spring	28.	O-ring	43.	Pump Housing
14.	Counter Piston Guide	29.	Socket Head Capscrew	44.	Shaft Seal
15.	Control Piston	30.	Plug	45.	Seegar V-ring

FIGURE 1 - STEERING PUMP ASSEMBLY - SHEET 1 OF 4



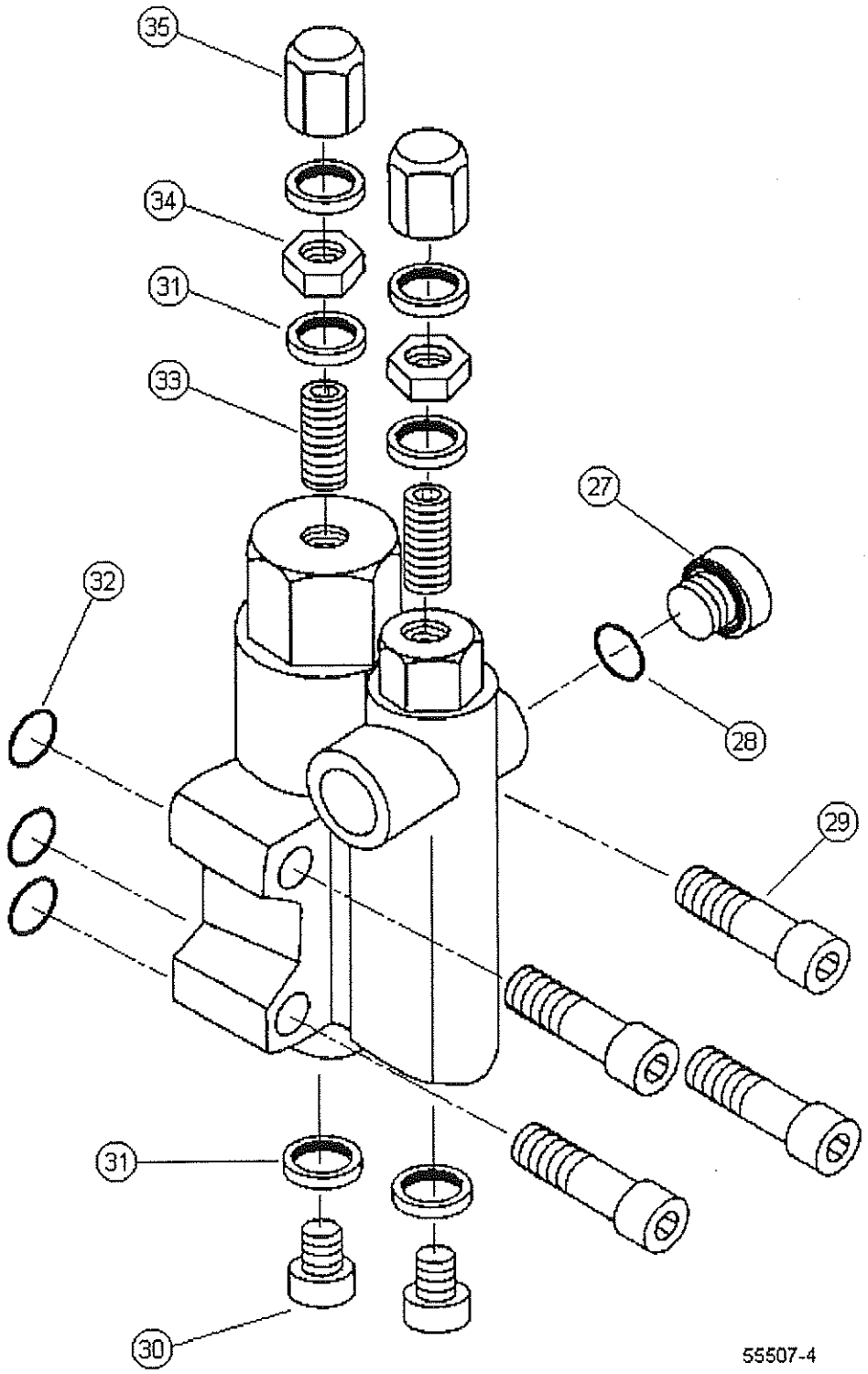
DETAIL "A"
(ROTARY GROUP ASSEMBLY)

FIGURE 1 - STEERING PUMP ASSEMBLY - SHEET 2 OF 4



DETAIL "B"
CONTROL PISTON ASSEMBLY

FIGURE 1 - STEERING PUMP ASSEMBLY - SHEET 3 OF 4



DETAIL "C"
CONTROL VALVE ASSEMBLY

FIGURE 1 - STEERING PUMP ASSEMBLY - SHEET 4 OF 4

moval and torquing of capscrews.

The steering pump may be assembled as follows:

NOTE: *Coat all seals and parts with hydraulic oil compatible with that in the truck's hydraulic system prior to installation.*

1. Assemble the control valve assembly as follows:

a. Verify that the opening in the center is clear, then install the plug or orifice (spring area of the flow control valve).

NOTE: *Use Loctite 242 or equivalent to secure the orifice in place. Exercise care not to allow excess to escape and cover the opening or other components.*

b. Verify that the opening in the center is clear, then install the orifice in the spring area of the pressure control valve.

NOTE: *Use Loctite 242 or equivalent to secure the orifice in place. Exercise care not to allow excess to escape and cover the opening or other components.*

c. Very carefully install the piston in the bore. Check that it moves freely in its range of motion.

d. Install the plug (27).

e. Install the spring cup.

f. Install the springs in the bores.

NOTE: *There are two of them in the smaller flow control bore.*

g. Install the disc or usit ring (31).

h. Install the plug assemblies (30).

i. Install the adjusting screws (33) and locknuts (34). They will need to be properly adjusted later.

j. Install the acorn nuts (35) on the adjusting screws.

k. Install the O-rings (32).

l. Install the valve assembly on the port block with the socket head capscrews (29)

2. Assemble the rotary group assembly as follows:

a. Install the pressure pins (6) and disc retaining clip (7).

b. Install and compress the center spring (8) in order to install the retaining ring (9).

c. Install the retaining ring (9).

d. Install the retaining ball (4).

e. Remove the pistons (2) and retaining plate (3).

3. Install the bearing (40) and driveshaft (36) into the rotary group assembly.

4. Assemble the control piston assembly as follows:

a. Assemble the guide of the counter piston (14). Check that it moves freely in its range of motion.

b. Assemble the guide of the control piston (15). Check that it moves freely in its range of motion.

c. Install the threaded pin assembly (16).

d. Install the jam nut on the threaded pin.

5. Install the O-rings (21).

6. Use an appropriate installation device to install the outer bearing race for the rear bearing into the pump housing.

7. Install the control or lens plate (10).

8. Use an appropriate installation device to install the outer bearing race for the front bearing into the pump housing.

9. Install the bearing shells or cradles (38) and (37).

NOTE: *Make sure that they are properly oriented in the same configuration as removed.*

10. Install the O-ring (39).

11. Install the rotary group assembly (Detail A) into the housing.

12. Install the tapered roller bearing (19) and shim washer (20) near the port block.

13. Install the control valve spring assembly onto the port block assembly.

NOTE: *It will be necessary to retain the spring tension with a bolt during the assembly process only.*

14. Install the port block (22) together with all parts of the controlling valve assembly (26).

15. Remove the retaining screw on the control valve assemly and install the proper plug.

16. Install the socket head capscrews (23) to secure the port block to the pump housing. Tighten in an even, alternate bolt manner.

17. Cover or block all openings.

INSTALLATION

The steering pump may be installed onto the dump pumps as follows:

NOTE: *It is not necessary to remove the pump assembly to service the steering pump. These procedures are written if the pump is being installed with the pump assembly still on the truck. Modify as required if the pumps have been removed and are on a work bench.*

1. Make sure the O-ring and splined coupler are properly positioned in the rear of the tandem dump pump assembly.

2. Raise the pump into position on the rear of the dump pump assembly.

NOTE: *Provisions should be made for raise the pumps from the floor, a distance in excess of 6 feet (2 meters). The approximate weight of the pump is 75 lbs. (35 kgs).*

3. Carefully align the splines on the pump and coupler in the dump pump and mate the two pump assemblies.

4. Install the capscrews (12) and lockwashers (13) securing the rear piston pump assembly (2) to the dump pump sections (1).

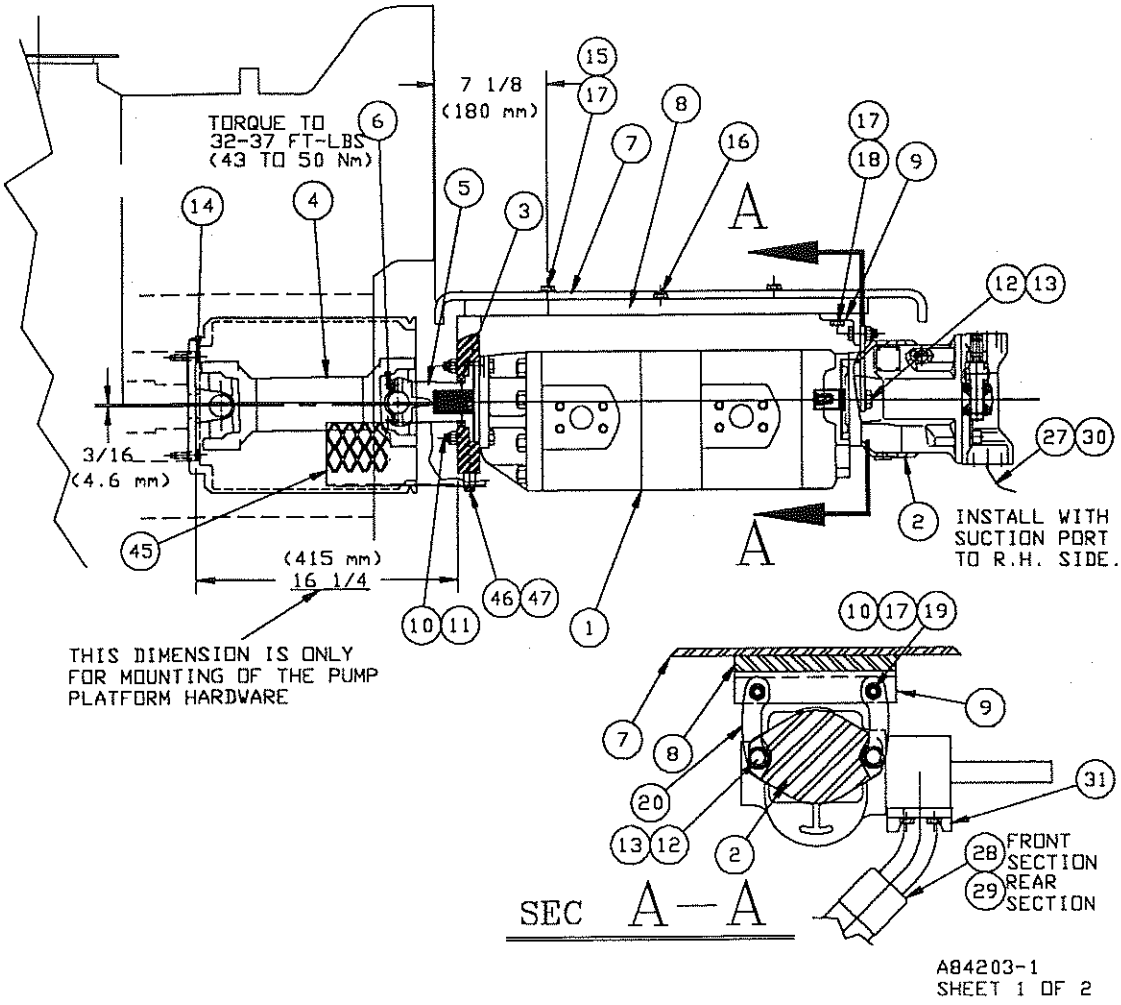
5. Install the tail section supports and braces to the pump and the pump bracket with the appropriate capscrews and washers.

6. Install the inlet and outlet hoses to the pumps.

7. Replenish the oil supply to the pumps by opening the valve on the supply line (near the reservoir tank).

8. Fill the pump by removing the case drain line and filling the pump with hydraulic oil compatible with that in the truck's hydraulic system.

9. Test the operation of the truck's steering and brake systems as outlined in the procedures in Section 5 - Hydraulic System.



KEY					
01.	Double Dump Pump Assembly	17.	Hardened Flatwasher	33.	Not Used
02.	Steering Piston Pump	18.	Capscrew	34.	Not Used
03.	Seal	19.	Capscrew (Grade 8)	35.	Hose Clamp Bracket
04.	Pump Driveshaft	20.	Support Bracket	36.	Clamp Halves
05.	Slip Yoke	21.	Capscrew	37.	Clamp Cap Plate
06.	Strap and Bolt Kit	22.	Locknut	38.	Capscrew
07.	Pump Platform	23.	Rubber Mounting Block	39.	Clamp Halves
08.	Pump Bracket	24.	Bushing	40.	Clamp Cap Plate
09.	Pump Tail Support Bracket	25.	Mounting Washer	41.	Capscrew
10.	Locknut	26.	Hardened Flatwasher	42.	Not Used
11.	Capscrew (Grade 8)	27.	Hose Assembly	43.	Not Used
12.	Capscrew (Grade 8)	28.	Hose Assembly	44.	Not Used
13.	Lockwasher	29.	Hose Assembly	45.	Driveline Guard
14.	Capscrew (Grade 8)	30.	Flange Kit	46.	Capscrew
15.	Capscrew	31.	Flange Kit	47.	Flatwasher
16.	Capscrew	32.	Not Used		

FIGURE 2 - PUMP INSTALLATION

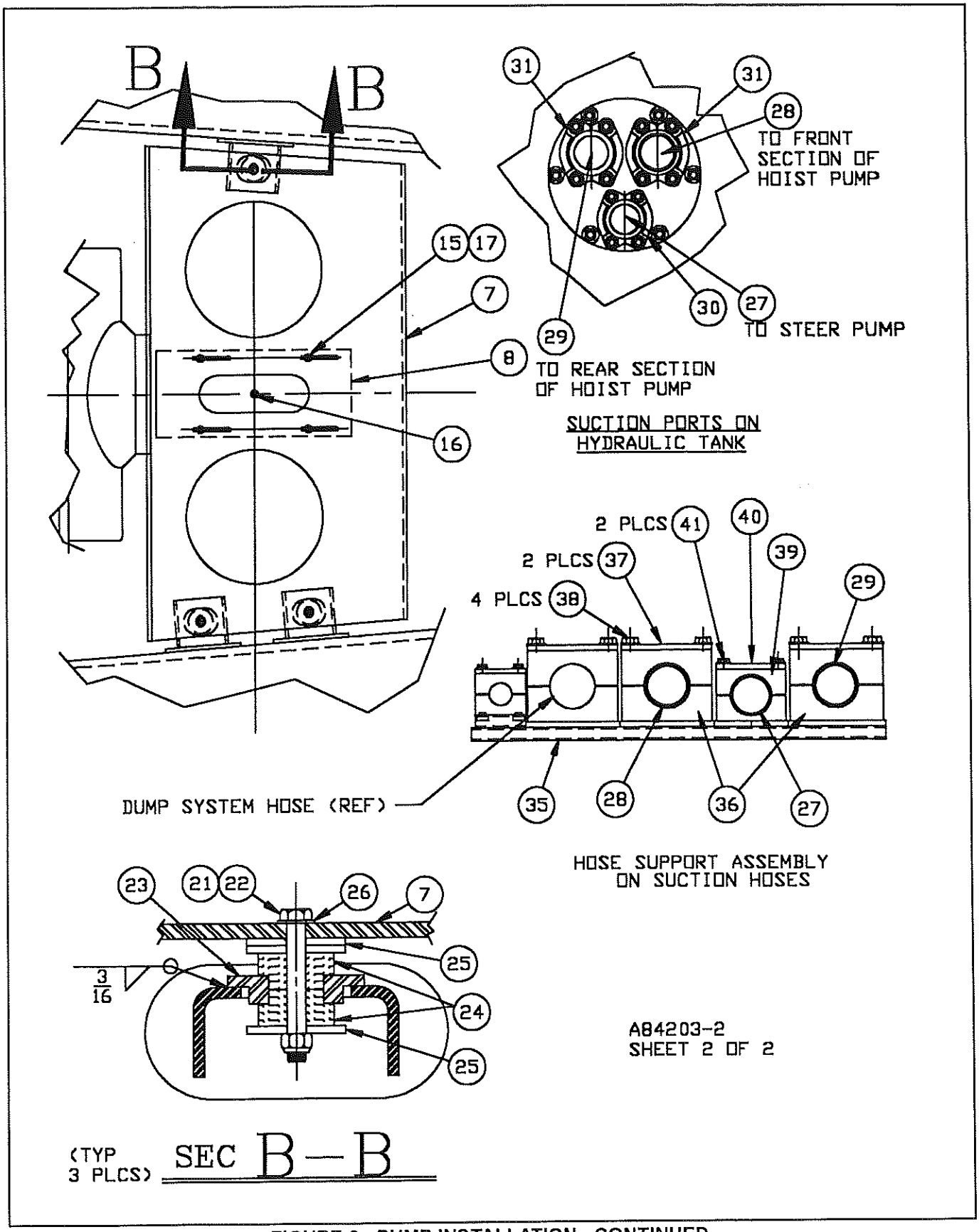


FIGURE 2 - PUMP INSTALLATION - CONTINUED

ACCUMULATORS

DESCRIPTION AND LOCATION

The accumulators are long, heavy metal cylinders with two removable ends or heads.

The accumulators are mounted together on the side of the frame near the hydraulic tank.

OPERATION

The accumulators store energy; oil under pressure. They serve several distinct functions in this application.

1. They act as a ready source of pressurized oil to the system, including a reserve in the case of restricted or inadequate flow from the supplying pumps.

2. They also allow the system to maintain a more constant pressure by absorbing high or low pressure surges.

The accumulator used operates on the sliding piston principle. One end is precharged (pressurized) with dry nitrogen gas. The other end is plumbed directly into the system supply lines. A sliding multi-ringed piston separates the oil from the gas charge.

With no oil in the fluid end, the precharged gas end holds the piston against the fluid end cap. As pressurized oil enters the fluid end, it causes the piston to move, compressing the gas. As oil is removed to assist in meeting the system flow demands, the compressed gas moves the piston back down the cylinder. In this accumulator the pressure in the hydraulic and gas sides are always equal.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Inspect the accumulator cylinders and connecting hardware for evidence of leakage, damage, or wear. Repair or replace as required.

2. Check the precharge pressure level of the gas in the gas end of the accumulator as outlined in the procedure entitled Precharging the Accumulator in these instructions to the pressure defined in the system test procedures in Section 5 - Hydraulic System in this manual.

Recharge as instructed. Frequent recharging indicates the need to service the unit (replace the seals).

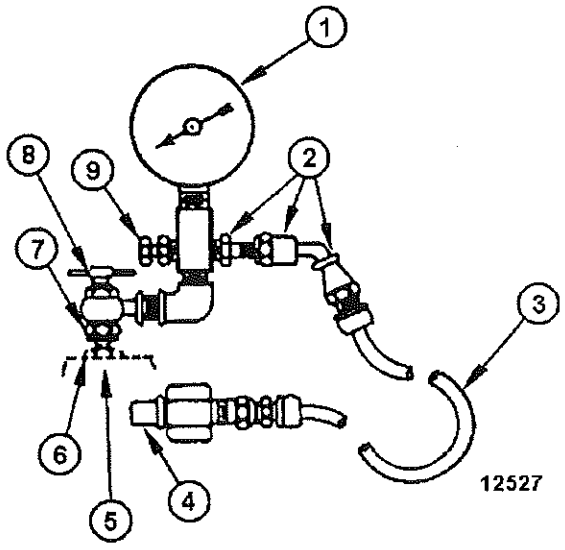
NOTE: *Worn piston seals may allow the gas to enter the hydraulic oil in the system. The addition of this gas to the oil would adversely affect system operation (possibly including spotty or uneven system performance and "spongy" or unsteady operation) similar to operation with air or other gases in the system. If gas does transfer, it is important to properly "bleed" all entrapped contaminants from the oil prior to placing the truck into service.*

PRECHARGING THE ACCUMULATOR (Figures 1 and 2)

The accumulators should be precharged as follows:

IMPORTANT: *The supply cylinder must be of the type that vaporizes the nitrogen when it is withdrawn. Do not charge with liquid nitrogen or any other gas.*

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction and park brake systems.



KEY	12527
1.	PRESSURE GAUGE
2.	HIGH PRESSURE FITTINGS
3.	HOSE ASSEMBLY
4.	CONNECTION TO NITROGEN BOTTLE
5.	ACCUMULATOR
6.	ACCUMULATOR GAS VALVE
7.	SWIVEL NUT
8.	GAS CHECK STEM
9.	BLEEDER VALVE

FIGURE 1 - ACCUMULATOR PRECHARGING EQUIPMENT

2. Drain all hydraulic pressure from each of the accumulators by pulling all valves and holding until indications that all pressure is released are noted (typically the "noise" of the released pressurized oil stops). Release the valve(s).

⚠ DANGER

Never loosen any line or begin any activity without first releasing all pressure from the system.

3. Verify that the accumulator end caps are installed flush with the body and the gas valve is secured tightly.

4. Remove the gas valve guard (14) and cap (11).

5. Turn the gas chuck stem or "T" handle (on the charging assembly) completely out (counter-clockwise).

NOTES:
1. The equipment required for checking or changing system pressure is contained in Figure 1.
2. It is strongly recommended that a regulator be installed on the high pressure nitrogen bottle that is used as a supply source. The regulator should be adjusted to release maximum pressure only slightly above that required by the component or system being charged.

6. Install the gas chuck swivel nut onto the gas valve and, using a suitable wrench, torque to 10 to 15 in-lb. (1.1 to 1.7 Nm).

⚠ CAUTION

Do not loop or twist the hose as it will stiffen when gas pressure is released from the nitrogen bottle.

7. Close the bleeder screw on the charge equipment.

8. Turn the gas chuck "T" handle clockwise until it reaches end of travel. This will depress the core in the accumulator gas valve.

9. Read the pressure indicated on the pressure gauge.

a. If the pressure is less than that listed in the appropriate test procedure, open the nitrogen bottle control valve slightly and allow the accumulator to fill slowly. Shut off the valve when the gauge indicates the desired pressure.

b. If the pressure is greater than that listed in the appropriate test procedure, open the bleeder valve on the charging equipment (typically below the gauge and opposite the gas valve) slightly, for a brief moment, then close to release the extra pressure.

⚠ WARNING

Escaping nitrogen may be cold enough to cause personal injury if it comes into contact with the skin. Care must be taken to avoid direct contact between the gas and any part of the body.

⚠ WARNING

Do not attempt to reduce accumulator precharge pressure by directly depressing the valve core, as high pressure may rupture the rubber valve seat. Instead, use the charging assembly, and use the bleeder screw.

NOTE: *If large quantities of nitrogen are added or removed from the accumulator during this process, it is recommended that the accumulator temperature be allowed to stabilize prior to taking final pressure measurements. This may be done by allowing the system to set idle 10 to 15 minutes after adding or removing gas.*

10. When charging is complete, turn the "T" handle completely out (counter-clockwise) until it reaches the stop. Open the bleeder valve to allow entrapped pressure to escape.

11. Loosen the swivel nut and remove the assembly. Hold the gas valve to prevent it from coming loose.

⚠ WARNING

Never loosen the swivel nut from the gas valve without first turning the "T" handle completely out and opening the bleeder valve.

12. Install the cap (torque to 10 to 15 in.-lb. (1.1 to 1.7 Nm) and gas valve guard.

NOTE: *The procedures are similar for checking or releasing the precharge pressure. The seals should be replaced when a continuing change in the precharge pressure is detected. As the pressure losses are observed, begin a program of frequent checking as a guide to how soon seal replacement must be made. In this manner, maintenance can be planned ahead without the need for any emergency repairs. Do not continue t operate a truck with leaky or damaged accumulators.*

13. Start the truck engine, allow the accumulators to

recharge with hydraulic oil, and check system operation.

14. Remove the charging kit from the supply bottle, cap and store each properly.

REMOVAL

The accumulators may be removed from the truck as follows:

1. Drain all hydraulic pressure from the accumulators and entire system as outlined in system procedures in Section 5 - Hydraulic System.

2. Drain all gas precharge pressure as outlined in the procedures in Maintenance and Adjustment.

3. Remove the precharging assembly from the accumulator.

4. Unscrew the gas valve (part way) until gas begins to escape through the safety hole drilled through the side of the gas valve.

⚠WARNING

Escaping nitrogen may be cold enough to cause personal injury if it comes into contact with the skin. Care must be taken to avoid direct contact between the gas and any part of the body.

5. After all pressure is drained, remove the gas valve.

6. Remove the hydraulic connection to the accumulator. Cap all openings, and label each to aid in installation.

7. Remove the capscrews that secure the accumulators to the mounting bracket.

8. Lift the accumulator(s) clear of the mounting bracket.

NOTE: *The threaded holes in the top end cap may be used as a means of attachment for lifting. An appropriate sling around the body may also be used.*

DISASSEMBLY (Figure 2)

The accumulator may be disassembled as follows:

1. Verify that the gas valve has been removed. If it is still installed, verify that all of the gas has been released as outlined in the procedures in Maintenance and Adjustment.

⚠WARNING

Deep vise marks, scratches, or distortions of the outer tube may cause stress concentrations in the tube under high pressure. Such concentrations may eventually cause component leakage or failure.

2. Set the accumulator horizontal and secure with a strap wrench or vice, gripping over the hydraulic end cap.

3. Install capscrews in the threaded holes in the removable gas end cap (11).

⚠WARNING

Always remove the gas cap, the end cap containing the gas charging valve, first.

4. Remove the cap by using a long bar and carefully "prying" on the capscrews installed for this purpose.

5. Inspect, then remove, the seal ring (3) and back-up ring (2) from the end cap.

6. Remove the hydraulic end cap (1) and rings (2 and 3) in a manner similar to that used to remove the gas end cap.

7. Remove the piston (5) by carefully tapping on the oil end with a wooden dowel as it is guided out of the body. Extra care should be taken to prevent damage to the piston or the seals on the threads.

IMPORTANT: *Never try to remove the piston by applying compressed air to the opposite end.*

8. Inspect, then remove the T seals (6) from the piston (5).

NOTE: To remove the seals from the piston (4), lift the ring with a small, smooth screwdriver or similar tool. Move the tool around the piston several times while using the other hand to work the ring off the piston.

INSPECTION AND REPAIR

The accumulator may be serviced as follows:

1. Thoroughly clean all metal parts in solvent and dry with compressed air.

2. Clean the bore of the body (4) and piston (5) with a

clean lintless cloth soaked in clean solvent.

NOTE: *The bore and piston must be clean of any particles visible, or detectable to the touch.*

3. Inspect the piston for evidence of cracks, burrs (especially around seal ring grooves), for damage. Repair or replace as required.

4. Inspect the condition and check the operation of the two check spring and ball assemblies (7 and 8, respectively) on the piston assembly.

5. Using a light, examine the body bore for scratches or scoring. Inspect the end caps for damaged threads or burrs on O-ring grooves. Minor nicks, scratches or light scoring of the body bore can be removed by using crocus cloth. Dress the bore until all apparent imperfections have been removed.

5. Inspect the seal rings. If damaged, determine the cause and correct before proceeding. They should all be replaced at each disassembly.

NOTE: *The piston "rides" on the seal rings and does not touch the accumulator bore.*

ASSEMBLY

The accumulator may be assembled as follows:

1. Coat all seals and internal parts with clean hydraulic fluid compatible with that used in the truck's hydraulic system.

2. Install the T seals (6) on the piston (5).

NOTE: *The rings may have to be stretched slightly to install. Once installed they should be allowed to relax to their original size for several minutes. This relaxation can be quickened by cooling. However, make sure all moisture residue is removed prior to continuing assembly and that the seals are straight, not twisted.*

3. Install the piston assembly in the bore of the body (1). The hollow side of the piston should be directed toward the gas end.

NOTES:
1. The piston must go into the bore exactly square and very slowly, as the seal ring will move if done slowly, but may be damaged if forced quickly. The piston will fit snug. Do not let the seal rings "drag" on the threads.
2. Use a hammer and a wooden dowel or block to tap the piston into place until all of piston is at least 2 inches (50 mm) below the beginning of the honed bore. Keep force against the piston while tapping the seals through the bore chamfer, otherwise the piston will bounce back, damaging the seals. Cover the port opening to keep out dirt.

4. Install a seal ring (2) and back up ring (3) on the gas end cap (11). Lubricate the seal ring with hydraulic oil. Install onto the body and tighten until the O-ring forms a seal and "tightens".

NOTES:
1. Exercise care not to "drag" the seal rings over the threads when installing.
2. The cap should "bottom out" on the body. Be careful not to over-tighten.

5. Install a new seal ring (2) and back-up ring (3) on the hydraulic end cap (12) and install in a manner similar to the gas end cap.

6. Install the gas valve (13).

8. Install the gas valve cover and guard (14).

INSTALLATION

The accumulators may be installed as follows:

1. Position the accumulator in the mounting bracket.

NOTE: *The threaded holes in the gas end cap may be used as a means of attachment for lifting. An appropriate sling around the body may also be used.*

2. Install the mounting hardware.

3. Secure the unit in place with capscrews and washers.

4. Install the hydraulic connections to the accumulator.

5. Precharge the gas side of the accumulator as outlined in the instructions in the procedures in Maintenance and Adjustment.

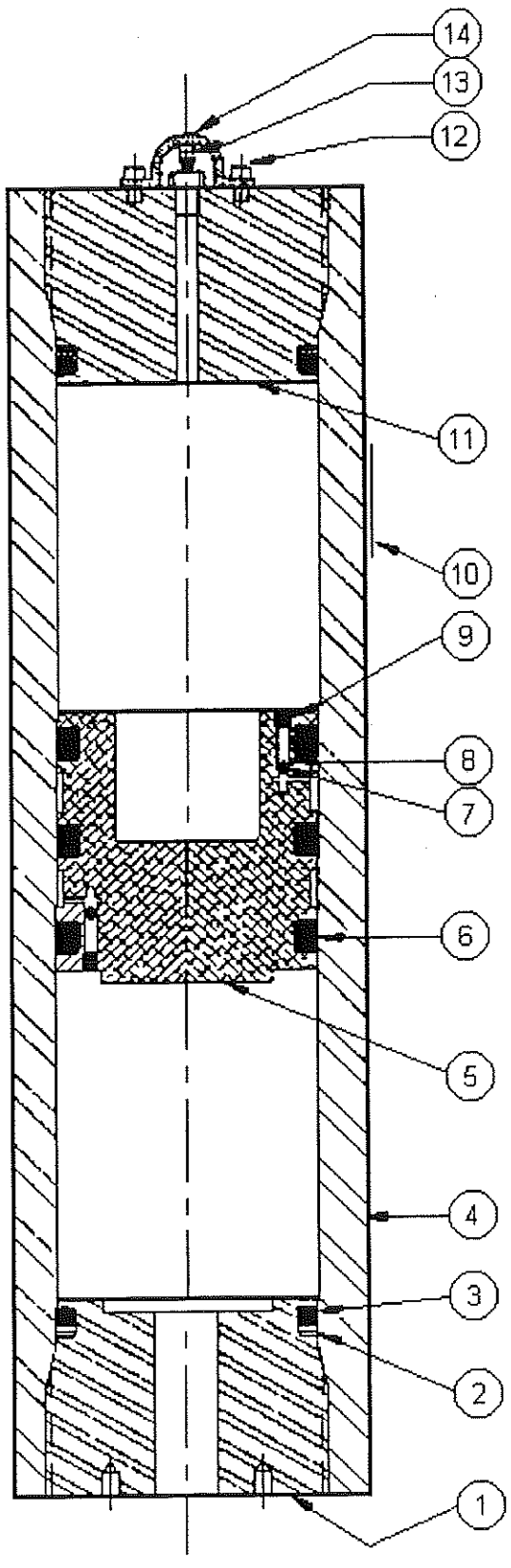
6. Install the gas valve cap.

7. Start the truck engine and allow the systems to pressurize or charge normally. Inspect for evidence of leakage or damage.

8. Bleed all entrapped air or contamination from each

of the systems as outlined in the procedures in Section 5 - Hydraulic System.

9. Test the system operation as outline in the procedures in Section 5 - Hydraulic System.



KEY 55506	
01.	Hydraulic End Cap
02.	Back-up Ring
03.	End Cap Seal
04.	Body
05.	Piston Assembly
06.	Piston T-Seal Rings
07.	Check Valve Ball
08.	Check Valve Spring
09.	Check Valve Screw
10.	Instruction Plate
11.	Gas End Cap
12.	Capscrews
13.	Gas Valve
14.	Gas Valve Guard

FIGURE 2 - ACCUMULATOR ASSEMBLY

STEERING ORBITAL VALVE (HAND PUMP)

DESCRIPTION AND LOCATION

The steering orbital valve is a cylindrical hydraulic device mounted on the lower end of the steering column in front of the cab.

OPERATION

As the steering wheel is turned, the end of the steering shaft turns a splined coupler located in the end of the orbital valve. The turning of the coupler causes the device to act like a pump and directs the flow of the hydraulic fluid. The fluid flows to an amplifier where the pressure is increased and directed along to the steering cylinders. The cylinders react to the pressure changes encountered thereby turning the wheel in the appropriate direction.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Inspect the unit for evidence of wear, leakage, or damage. Repair of replace as required.

2. Check the operation of the unit for evidence of binding or other improper operation. Repair or replace as required.

REMOVAL

The steering orbital valve may be removed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction brake system.

2. Drain or relieve all pressure as outlined in the instructions in Section 5 - Hydraulic System before loosening any lines.

⚠WARNING

Never loosen any pressurized lines or components. Always drain or relieve all pressure first.

3. Disconnect the hydraulic lines from steering valve, making sure to note the routing and orientation of each. Install clean plugs and caps on all openings. Label each to aid in installation.

4. Remove the sets of capscrews, washers, and lockwashers from the valve mounting bracket.

5. Remove the capscrew, etc. securing the valve to the end of the steering column. Remove the valve.

DISASSEMBLY (Figure 1)

The valve may be disassembled as follows:

NOTE: *Cleanliness is extremely important when repairing a steering control unit. Work in a clean area if possible. Before disconnecting the lines, clean port area of unit thoroughly. Use a wire brush to remove foreign material and debris from around exterior joints of the unit. Use a clean solvent, such as Stoddard, to clean entire unit.*

1. Clamp the unit in vise, gerotor or meter end up. Clamp lightly on the edges of the port face side (up to a maximum of 1 inch (25 mm). Use protective material on vise jaws. Do no over tighten the jaws as this could result in distortion of the housing.

2. Remove capscrews (1) from end cap (2).

3. Remove end cap (2).

4. Remove seal (3) from the gerotor or metering section (4).

5. Remove gerotor (4). Be careful not to drop the star like gear in the center.

6. Remove seal (3).

7. Remove the drive spacer assembly (5).

8. Remove drive (7).

9. Remove the housing from the vise.

10. Carefully remove the springs (27), anti-cavitation retaining plug (28), and check ball (26) from the bolt holes by tipping the housing (8).

11. Place the housing, gerotor end down, on a clean soft cloth to protect surface finish.

12. Using a thin bladed screwdriver, carefully pry the retaining ring (19) from the groove. Be careful not to

damage the ring groove.

13. Lift the spool and sleeve assembly up just far enough to free the gland bushing from the housing. Remove the seal assembly.

14. Remove the seals (15, 16, and 17) from the seal gland bushing (18).

15. Use a thin bladed screwdriver to pry dust seal (16) from the seal gland bushing. Be careful not to damage the bushing.

16. Remove the two bearing races (13) and the needle thrust bearing (14) from spool and sleeve assembly.

13. Tip the housing onto the port face. Remove the spool and control sleeve assembly (9) from the fourteen hole end of housing.

NOTE: *Avoid binding the spool and sleeve in the housing. Rotate the spool and sleeve slowly while removing it from the housing.*

14. Push pin (11) from spool and sleeve assembly.

15. Remove centering springs (12) from spool (9) carefully by hand.

INSPECTION AND REPAIR

The unit may be serviced as follows:

1. Clean all mating surfaces.

2. Replace any parts that have scratches or burrs that could cause leakage.

3. Clean all metal parts in clean solvent. Blow dry with air. Do not wipe dry with cloth or paper towel because lint or other matter can get into the hydraulic system and cause damage. Do not use grit, or try to file or grind steering control unit parts.

NOTE: *Lubricate all seals (with exception of new quad ring seal) with a clean petroleum jelly, such as Vaseline. Do not use excessive lubricant on seals for meter section. Replace all old seals with new seals whenever unit is disassembled.*

ASSEMBLY

The unit may be assembled as follows:

1. Assemble the spool and sleeve of the control sleeve assembly (9) carefully so that the centering spring slots line up at the same end. Apply a light film of clean oil to OD of spool. Rotate the spool while sliding the parts together. Because of close tolerances between the spool and sleeve, do not force when rotating the parts together. Be careful not to burr the spool and test for free rotation. The spool should rotate smoothly in the sleeve with finger tip force applied at the spline end.

2. Align the spring slots of the spool and sleeve, then stand the parts on a bench. Insert a spring installation tool (Figure 2) through the spring slots of both ports. Position the centering springs (12) (2 sets of 4 each) on the bench so that the extended edge is down and the center section is together. In this position, insert one end of the entire spring set into the spring installation tool, as shown in Figure 3. If no tool is available, see NOTE below for alternate installation instructions.

3. Compress the expanded end of the centering spring set and push into the spool and sleeve assembly. Keep pressure on the spring ends when withdrawing installation tool, push forward on the springs at the same time.

4. Center the spring set in the spring slots. Seat the springs (12) down evenly and flush with the upper surface of the spring and sleeve.

NOTE: *Carefully follow these instructions when installing center springs without the aid of a spring installation tool.*

a. Insert 1 centering spring, with the extended edge down, in the spring slot of the spool (raise the spool from the sleeve slightly for more spring clearance).

b. Insert 1 centering spring opposite the spring located in the slot of the spool. Make sure center section of both springs are together, and that the extended edge of the springs are down.

c. Push 1 set of 3 centering springs between the 2 springs in the spool, as shown in Figure 3.

d. Push remaining set of 3 centering springs opposite the 4 centering springs in spool.

e. Push the spool into the sleeve until the springs seat is flush the with top and sides of sleeve.

5. Install pin (11) through the spool and sleeve assembly until the pin becomes flush at both sides of sleeve.

KEY	55445
01.	Torx Capscrew
02.	End Cap
03.	Seal
04.	Gerotor
05.	Spacer
06.	Spacer Plate
07.	Drive
08.	Housing
09.	Control Sleeve
10.	Control Spool
11.	Centering Pin
12.	Centering Spring kit
13.	Baring Race
14.	Needle Thrust Bearing
15.	Seal (1.86 in (47.2 mm) ID)
16.	Seal (1 in. (25.4 mm) ID)
17.	Seal (1.46 in. (37.1 mm) ID)
18.	Seal Gland Bushing
19.	Retaining Ring
20.	Check Ball Retainer
21.	Check Ball
22.	Check Ball Seat
23.	Seal (0.30 in. (7.6 mm) ID)
24.	Seal (0.36 in. (9.1 mm) ID)
25.	Set Screw
26.	Check Ball
27.	Spring
28.	Anti Cavitation Retaining Plug

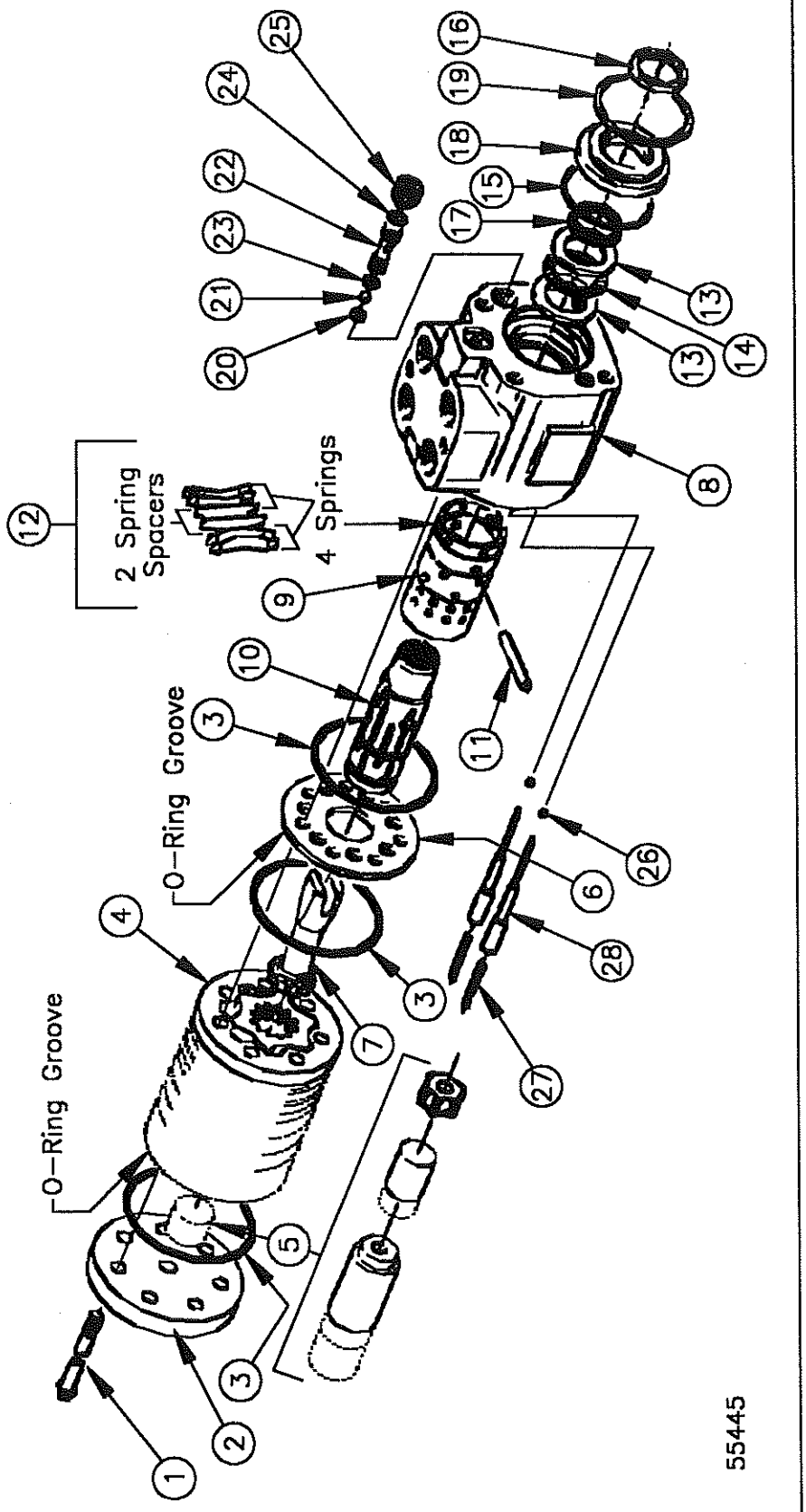


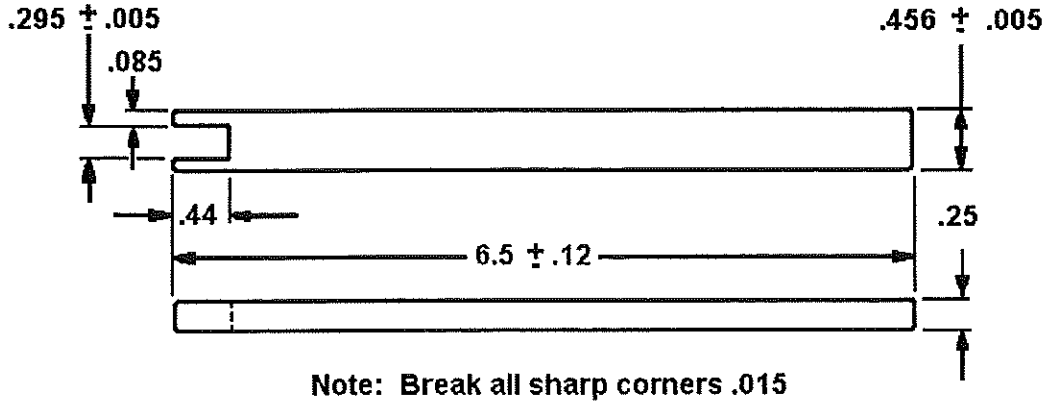
FIGURE 1 - STEERING ORBITAL VALVE ASSEMBLY

Tools required for disassembly and reassembly:

2 Screwdrivers (4" - 6" long, 1/8" flat blade)
1/2 " socket (12 point)
Breaker bar wrench
Torque wrench (90 foot pound capacity)
Plastic hammer or rubber hammer
Tru-Arc Retaining Ring Ratchet Pliers (S-6500)

The following tool isn't necessary for disassembly and reassembly, but is extremely helpful.

Spring installation tool



Note: Break all sharp corners .015

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FIGURE 2 - DISASSEMBLY/ASSEMBLY TOOL

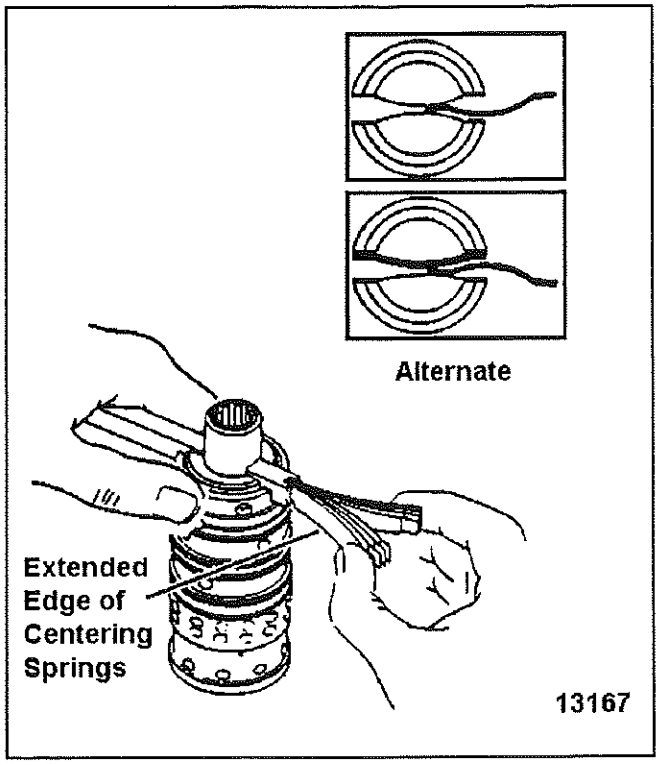


FIGURE 3 - SPRING INSTALLATION

6. Position the spool and sleeve assembly so the splined end of spool enters gerotor (meter) end of housing first.

⚠ CAUTION

Be extremely careful that the spool and sleeve don't tilt out of position while inserting in housing. Lubricate the OD of the sleeve. Push parts gently into place with slight rotation. Keep the pin horizontal. Move the spool assembly entirely within the housing bore until the parts are flush at the meter end of housing. Do not pull the spool assembly beyond this point to prevent the cross pin from dropping into the discharge groove of the housing. With the spool assembly in this flush position, check for free rotation within the housing by turning with light finger force at the splined end.

7. Place housing (8) on a clean lint free cloth. Install 2 bearing races (13) and the needle thrust bearing (14).

8. Install the dust seal (16). The smooth side of dust seal must face down toward seal gland bushing.

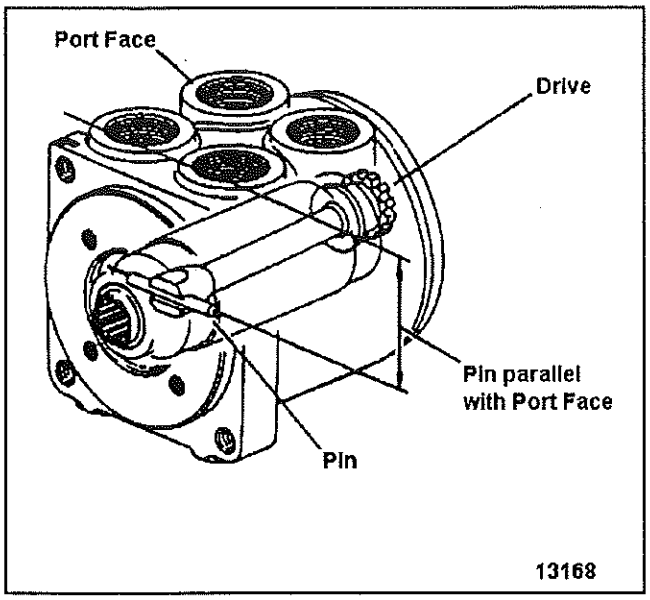


FIGURE 4 - DRIVE INSTALLATION

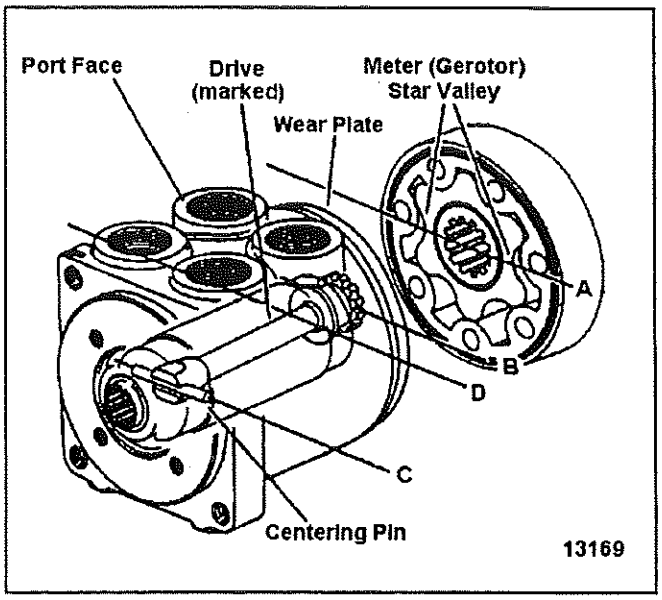


FIGURE 5 - METER INSTALLATION

9. Install the dry quad ring seal. Seat the seal in place with your finger. Do not use any seal that falls freely into place.

10. Install 1-13/16 inch (46 mm) diameter O-ring (13) seal.

11. Install seal gland bushing (18) over the spool end with a twisting motion. Tap the bushing into the housing with a rubber hammer. Make sure the bushing is flush against the bearing race.

12. Using a True-Arc retaining ring ratchet pliers (S-6500) or equivalent, install retaining ring (19) in the housing. After installing the ring, tap slightly to properly seat the ring in the groove.

13. Clamp the housing in a vise as before. Clamp lightly on the edges of the mounting area. Do not over-tighten the jaws. Install 4-3/4 in. (120 mm) diameter seals (3) in the housing.

NOTE: *Check to ensure that the spool and sleeve are flush or slightly below the meter end of the housing. Clean the upper surface of the housing by wiping with the palm of clean hand. Clean each of the flat surfaces of the meter end parts in a similar way when ready for reassembly. Do not use a cloth or paper towel to clean surfaces.*

14. Rotate the spool and sleeve assembly until pin is parallel with the port face as shown in Figure 4. Install the drive, making sure to engage the drive with the pin.

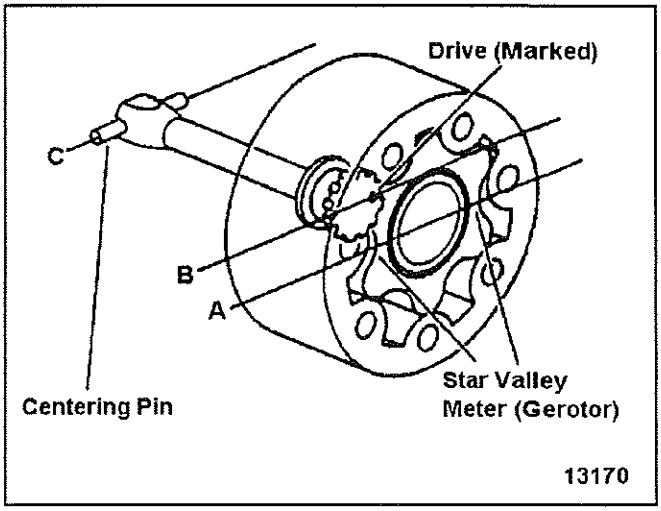


FIGURE 6 - METER HOUSING INSTALLATION

To assure proper alignment, mark one of the two drive tooth slots that are parallel with slot in the end of drive as shown in Figure 6.

15. Install the wear plate (6).

16. Install the 2.9 inch (73 mm) diameter O-ring seal (3) on the meter face.

17. With the seal side of meter down, install the meter on the drive. If the star has a counterbore, install the counterbore facing the end cap.

NOTE: *The timing mark you make on the drive must fall on the parallel line between any 2 meter star valleys. Note the parallel relationships of the reference*

lines A, B, C and D in Figures 5 and 6. Align the bolt holes without disengaging the meter from the drive. Be careful when adjusting the meter on the housing, as excessive turning of the meter may disrupt the seal between the meter and the housing.

18. Install 2.9 inch (73 mm) diameter seal in meter.

19. Install end cap on meter and align the holes. Be careful not to disrupt seal from the meter.

20. Install 7 dry capscrews in end cap. Pre-tighten screw to 150 inch pounds (17 Nm), then torque screws to 225 to 275 inch pounds (25 to 30 Nm) as shown in Figure 7.

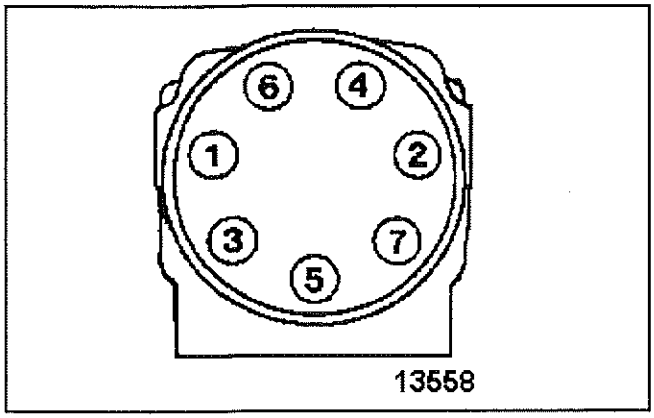


FIGURE 7 - TORQUE SEQUENCE

INSTALLATION

The steering orbital valve may be installed as follows:

1. Install the valve onto the end of the steering column. Do not tighten the mounting capscrews.

2. Install the sets of capscrews, washers, and lockwashers to secure the valve to the mounting bracket. Again do not tighten the capscrews.

3. Turn the steering wheel back and forth several times to allow the components to seek alignment.

4. Tighten the capscrews installed in steps 1 and 2.

5. Repeat step 3, again checking for binding. If noted, loosen the capscrews and repeat steps 3 and 4.

6. Reconnect the hydraulic hoses to the capscrews as removed.

7. Start the engine and test the system operation as outlined in the instructions in Section 5 - Hydraulic System.

STEERING FLOW AMPLIFIER VALVE

DESCRIPTION AND LOCATION

The steering flow amplifier valve increases the amount of flow of the hydraulic fluid in the steering system in order to operate the steering cylinders and turn the wheels of the truck. It is located on the frame in front of the front axle behind the left wheel.

OPERATION

The control of the system is based on a principle of flow amplification, in which a limited, or pilot, flow from the steering control or orbital valve is used to control the operation of a main control or amplifier valve that actually regulates system flow to the steering cylinders.

When the steering wheel is held stationary (considered the neutral position whether the vehicle is traveling straight or being controlled during a turn):

1. The supply of oil from the filters is routed across the integral priority valve in the flow amplifier.

2. The directional valve remains in the centered position. In this mode, any pressure surges induced by road conditions (e.g. when striking a hole in the road) are absorbed by the integral shock valves in the flow amplifier instead of being transmitted to the steering control unit.

When the steering control valve is activated (by movement of the steering wheel) to change the position of the vehicle's front wheels:

1. A pressure signal is passed to the flow amplifier's priority valve.

2. The priory valve shifts changing the path of the oil to the steering control unit.

3. The directional valve is then shifted, allowing the required flow to reach the pressure control/amplifier valve assembly. The amount and speed of the input signals controls the magnitude of the spools' movements. The pilot and main flows are then merged and directed to the appropriate ports in the steering cylinders.

Stopping movement of the steering wheel returns the valve to the previously outlined stationary position.

Amplification occurs in the pressure control/amplifier valve. As the pressure in the chambers increase, flow is regulated in an amount proportionate to the area of the holes in the various portions of the spool.

The return oil is controlled by the directional valve. In an overrun condition (in which the vehicle wheels try to cause steering movements more severe than the operator's inputs) the directional valve automatically throttles the flow of this return oil to maintain stable control of the cylinders.

Steering kick back is controlled by the system requirement that the pressure in the pilot port chamber of the pressure control/amplifier valve must exceed that in the main chambers for the movement of the valve.

As in the neutral or stationary mode, the shock valves prevent pressure surges in the cylinders themselves. Suction valve provisions are also incorporated to prevent cavitation.

On some models, a separate counter pressure valve is provided to ensure a constant proper charge to the suction valves. On others, the normal back pressure in the system handles this function.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance of the steering flow amplifier valve should include:

1. Visually inspect the unit for leaks from the housing or from the hoses.

2. Verify that the hydraulic oil is clean and of good quality.

3. Test the operation of the system as outlined in the instructions in Section 5 - Hydraulic System.

REMOVAL

The steering flow amplifier valve may be removed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Release all hydraulic pressure from the system as outlined in the system procedures in Section 5 - Hydraulic System.

3. Disconnect all hoses, making sure to note their routing and position.

4. Cap or plug all open ports or fittings and keep them as free from contaminants as possible.

5. Remove the capscrews securing the valve to the bracket.

6. Remove the valve from the bracket and move to a suitable working environment.

DISASSEMBLY (Figure 1)

NOTE: *Mark the endplates in a dissimilar manner to properly identify them later during assembly. Note their orientation. Note the characteristics of the springs during removal in order to identify them properly later during assembly. Keep components of the subassemblies separated from one another.*

The steering flow amplifier valve may be disassembled as follows:

NOTE: *Cleanliness is extremely important when working on any steering unit. Work in a clean area if possible. Before beginning disassembly thoroughly clean the exterior of the valve and the repair area. Use a wire brush and clean solvents to remove foreign material and debris.*

1. Clamp in a holding fixture or vice. Use protective material on the jaws and do not over-tighten.

2. Remove the capscrews and washers holding the flanges to the valve. Remove the flanges and the hose adapters.

3. Remove the other hose fittings.

4. Unscrew the top middle plug (38). Then remove the small spring, ball, piston, and large spring which form the counter pressure valve assembly (39) on models so equipped. Note the location and orientation of each as they are removed.

5. Unscrew the other top plug (20). Unscrew the pressure relief valve (19) and take out the washer (6).

6. Moving to the end cover near the PP-connection, unscrew and remove the screws (11 and 13) and washers (12 and 14). Remove the end cover (15).

7. Remove the stop (23) and springs (29 and 30).

8. Remove the spring (40).

9. Remove the plate (18) and 6 O-rings (1 and 2).

10. Remove the spring guide (24).

11. Moving to the end cover near the LS-connection, unscrew and remove the screws (11 and 13) and washers (12 and 14).

12. Remove the end cover (15).

13. Remove the stops (23) and springs (29 and 28).

14. Remove the spring guide (24).

15. Remove the plate (17) and 4 O-rings (1 and 2).

16. Remove the spring guide (24).

17. Remove the directional spool (44) from the housing (9).

18. Remove the amplifier spool (42) from the housing (9).

19. Remove the priority valve spool (43) from the housing (9).

20. Unscrew the orifice (36) in the LS-connection.

21. Pry the throttle check valves (10) out of each end of the housing with a screwdriver.

22. While holding the directional spool (44) with a mandrel, unscrew the orifice (37) from each end of the spool.

23. While holding the amplifier spool (42), carefully remove the spring ring (part of item 42) from the recess with a small screwdriver.

NOTE: *Avoid damage to the spring ring.*

24. Carefully guide the spring ring back.

25. Gently press the pin out holding the plug in the end of the spool.

26. Remove the plug and spring from inside the spool.

27. Using a mandrel in the pin hole, unscrew the check valve.

NOTE: *Avoid damaging the spool surface.*

28. Using a mandrel in the pin hole of the plug, unscrew the orifice (35).

INSPECTION AND REPAIR

The disassembled components of the flow amplifier valve may be serviced as follows:

1. Clean all parts carefully with low aromatic kerosene.

2. Replace all gaskets and sealing washers.

3. Inspect all other parts carefully for evidence of wear or damage. Repair or replace as required.

ASSEMBLY

The flow amplifier valve may be assembled as follows:

1. Install the orifice (35) in the plug of the amplifier spool (42). Torque to 45 +/- 10 in-lb (5 +/- 1 Nm).

2. Install the check valve (10) in the spool. Torque to 175 +/- 25 in-lb (20 +/- 3 Nm). Remember to install the O-ring (8).

3. Assemble the shock/suction valve as follows:

NOTE: *If it is necessary to disassemble the flow amplifier shock valve, a pre-set valve should be ordered from Unit Rig.*

a. Guide the spring with the cone into the housing.

b. Install the adjustment screw.

c. Install the spool.

d. Install the spring.

e. Install the pilot valve with the O-ring. Torque to 175 +/- 45 in-lb (20 +/- 5 Nm).

f. Install the housing.

g. Install the spring.

h. Install the disc.

i. Install the locknut. Torque to 135 +/- 20 in-lb (15 +/-2 Nm).

j. Contact Unit Rig for adjustment.

⚠WARNING

Do not attempt to reassemble a shock valve. Improper adjustment of the shock valve could lead to component damage.

4. The check valve may be assembled as follows:

a. Install the ball.

b. Install the spring and plug. Torque to 45 +/- 10 in-lb (5 +/-1 Nm)

5. The amplifier spool (42) may be assembled as follows:

a. Install the orifice into the plug. Torque to 45 +/- 10 in-lb. (5 +/- 1 Nm).

b. Install the check valve (step 3). Torque to 175 +/ - 25 in-lb (10+/-3 Nm).

c. Install the inner spool in the correct position.

d. Guide the inner spool into place.

e. Install the pin.

f. Install the spring ring with the ring in the recess end away from the pin holes.

g. Install the spring plug and pin at the other end.

h. Push the spring ring into position. Position the ring in the recess end away from the pin holes.

6. Assemble the priority valve spool (43) as follows;

a. Install the throttle check valves.

b. Torque each to 90 +/- 25 in-lb (10 +/- 3 Nm).

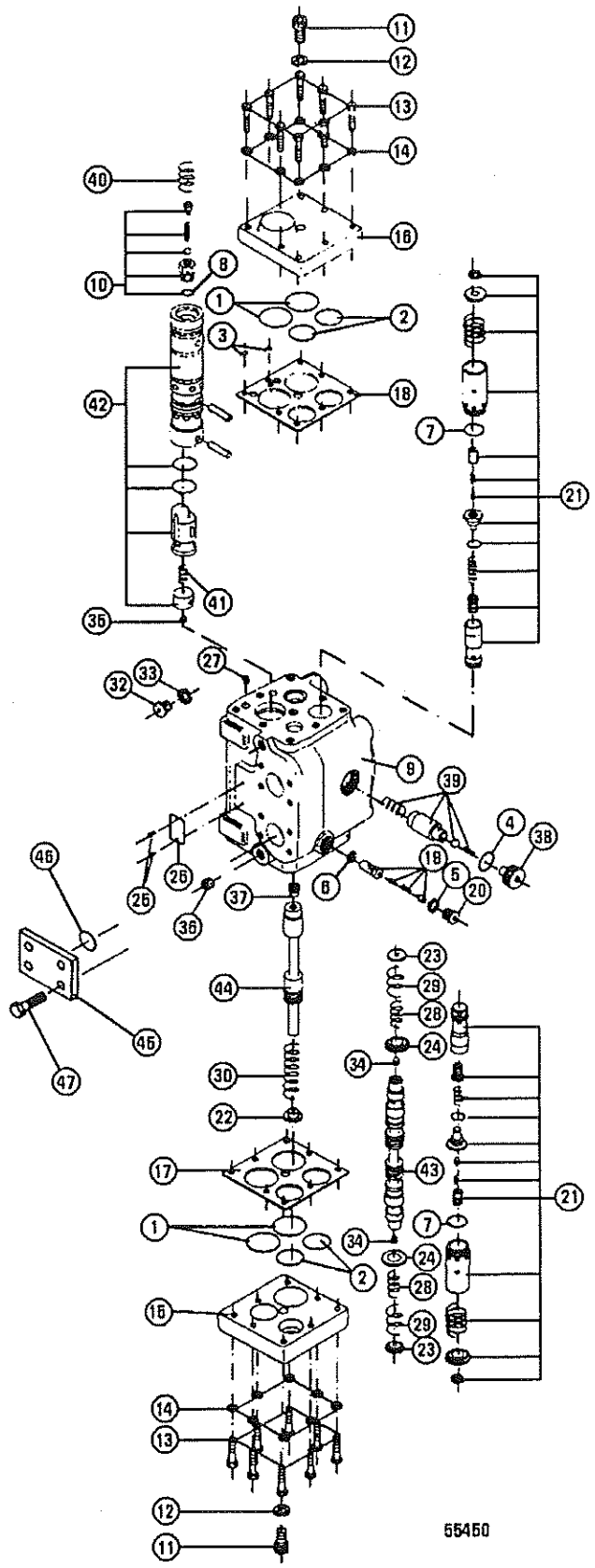
7. Assemble the directional spool assembly (44) as follows:

a. Install the orifices (34).

b. Torque each to 45 +/- 10 in-lb (5 +/- 1 Nm).

8. Install the orifice and throttle check valves as follows:

a. Install the orifice (27) into the housing (9). Torque to 45 +/- 10 in-lb (5 +/- 1 Nm).



KEY	
01.	O-ring
02.	O-ring
03.	O-ring
04.	O-ring
05.	Washer
06.	Washer
07.	O-ring
08.	O-ring
09.	Housing
10.	Check Valve
11.	Screw
12.	Spring Washer
13.	Screw
14.	Spring Washer
15.	End Cover
16.	End Cover
17.	Plate
18.	Plate
19.	Relief Valve
20.	Plug
21.	Shock and Suction Valve
22.	Stop
23.	Stop
24.	Spring Guide
25.	Drive Screw
26.	Nameplate
27.	Orifice
28.	Spring
29.	Spring
30.	Spring
31.	Not Used
32.	Plug
33.	Washer
34.	Orifice
35.	Orifice
36.	Orifice
37.	Orifice
38.	Plug
39.	Counter Pressure Valve (On Models so Equipped)
40.	Spring
41.	Spring
42.	Amplifier Spool Assembly
43.	Priority Valve Spool Assembly
44.	Directional Valve Spool Assembly
45.	Blanking Plate
46.	O-ring
47.	Capscrew

FIGURE 1 - STEERING FLOW AMPLIFIER VALVE

b. Install the orifice (36) into the LS connection. Torque to 90 +/- 25 in-lb (10 +/- 3 Nm).

c. Install the throttle check valve into the PP connection. Torque to 90 +/- 25 in-lb (10 +/- 3 Nm).

9. Guide the shock valve (21) with the O-ring in and secure it by hand.

10. Assemble the pressure relief valve as follows:

a. Guide the adjustment screw, spring, and cone up and into the cartridge.

b. Screw the adjusting screw in far enough that the hex key fully engages.

11. Drop the washer (6) in the hole in the top of the housing (9) for the pressure relief valve.

12. Install the pressure relief valve assembly (19) in the housing and torque to 265 +/- 25 in-lb (30 +/- 3 Nm).

13. Install the plug (20) with the washer (5). Torque to 530 +/- 45 in-lb (60 +/- 5 Nm).

14. On models equipped with a counter pressure valve (39):

a. Install the spring in the piston using Vaseline or equivalent to hold in place. Then fit the assembled piston and spring in the housing.

b. Allow the ball to drop down.

c. Install the spring in the plug with Vaseline.

15. Install the assembled plug and spring into the housing and torque to 220 +/- 25 in-lb (25 +/- 3 Nm). Remember to install the O-ring (4).

16. Install the directional (44) and priority valve spools (43).

NOTE: *Spring control must be placed in correct position against LS-connection.*

17. Install the spring on the priority valve spool.

NOTE: *The spring installs in end of the housing located next to the LS-connection.*

18. Install the amplifier spool (42) into the housing. The orifice must be placed in the end nearest the LS-connection.

19. Move to the PP-connection end of the housing and install the spring with Vaseline on the amplifier spool.

20. Install the spring guide (24) on the end of the directional spool (44) lubricated with Vaseline.

21. Install the large and small springs (29 and 28), lubricated with Vaseline, on the end of the directional spool (44).

22. If desired to assist in the assembly process, install the guide screws into the housing.

23. Install the 4 large and 2 small O-rings into the plate (18).

24. Install the smaller stop in the recessed hole, which covers the directional spool, in the endplate with Vaseline.

25. Place plate (18) and endplate (16) in position.

26. Install the center screw (11) with lockwasher (12). Then fit the rest of the screws (13) and washers (14). Torque the center screw to 710 +/- 90 in-lb (80 +/- 10 Nm). Torque the rest of the screws to 220 +/- 45 in-lb (25 +/- 5 Nm).

27. Move to the end of the housing next to the LS-connection. Install the previously used guide screws, if desired.

28. Install the spring guide (24) on end of the directional spool with Vaseline.

29. Install the large and small springs (29 and 28), lubricated with Vaseline, on the end of the directional spool.

30. Install the thicker stop for the priority valve spool (43), lubricated with Vaseline, in the endplate cover.

31. Install the thinner stop for the directional spool with Vaseline in the endplate cover.

32. Install the 4 larger and 2 smaller O-rings in the plate (17). Place the plate and endplate (15) in position.

33. Fit the large center screw (11) with lockwasher (12). Then fit the rest of the screws (13) and washers (14). Torque the center screw to 710 +/- 90 in-lb (80 +/- 10 Nm). Torque the rest of the screws to 220 +/- 45 in-lb (25 +/- 5 Nm).

34. Install the hose fittings, adapters, and flanges on the valve.

INSTALLATION

The assembled flow amplifier valve may be installed as follows:

NOTE: *It may be necessary to fit some of the hoses prior to mounting the valve on the bracket.*

1. Mount the valve to the bracket with the capscrews and washers. Tighten evenly to the proper torque to avoid component damage.

2. Install the hoses to the proper locations. Torque all hoses as outlined in the information in Section 10 - Miscellaneous.

3. Test and adjust the component's and system's operation as outlined in the system's procedure in Section 5 - Hydraulic System.

STEERING CYLINDER

DESCRIPTION AND LOCATION (Figure 2)

The steering cylinders are two-way hydraulic cylinders mounted on the front axle. The base end of the cylinder is attached to the front axle beam through a self-aligning bushing assembly. The rod end is attached to the steering arm on the ends of the axle assembly with a separate clevis assembly through a self-aligning bushing in the steering arm.

NOTES:

1. Several different versions of the cylinder have been built, each with internal improvements over its predecessor. These are outlined in detail in this module. Be sure to properly identify the version that is being serviced and review the updates available whenever servicing the internal components of any cylinder. Externally they all appear the same.

2. Later versions of the system (and earlier trucks so modified) used an expander or segmented pin assembly to secure the base of the steering cylinder to the front axle assembly.

OPERATION

Pressurized oil from the flow amplifier valve enters the steering cylinders through inlet ports at either the base or the rod end. Fluid at the other end is routed back to the steering manifold. The pressure differential on the sides of the piston cause the cylinder to extend or retract. This movement causes the required movement in the steering arm assemblies.

For a detailed description of the steering system, refer to the information in Section 5 - Hydraulic System.

For detailed information on the remainder of the steering linkage components, refer to the information in Section 7 - Running Gear.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Clean both cylinders, associated linkage, and hydraulic hoses. Inspect for wear, leakage and damage. Repair or replace as required.

2. Verify that all cylinder mounting components are installed and in good repair, and are properly lubricated. Repair or replace as required.

a. On trucks equipped with an expander pin, verify that both of the capscrews securing the expanders are properly torqued and that there is no evidence of rotation or wear in the pin assembly or self aligning bushing bore.

(1) If either of the capscrews or the pin assemblies is found to be loose, the assembly should be disassembled, inspected and repaired.

(2) Then the capscrews should be reinstalled and torqued as outlined in the instructions in Installation in this material.

b. On trucks equipped with the straight pins, verify that the pins, nuts, and related hardware are properly installed and secured.

(1) There should be no evidence of rotation or wear in the pin assembly or self-aligning bushing bore.

(2) If found, the assembly should be disassembled, inspected, repaired and then re-assembled as outlined in the instructions for Installation in this material.

3. Bleed any air from the cylinders as follows:

⚠WARNING

Since the truck engine must be running to perform this adjustment, be sure the truck is parked in a SAFE POSITION with the park brakes appropriately set prior to beginning maintenance. Also be sure never to place yourself in a dangerous position near moving parts.

a. Start the engine and allow to fully charge the accumulator system.

b. Rotate the steering wheel from the full right to the full left positions and back until the entire steering system is free of air.

c. Stop the engine.

REMOVAL (Figures 2 and 3)

The steering cylinders may be removed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Release steering pressure as outlined in the procedures in Section 5 - Hydraulic System.

NOTE: *Use manual drain valve in the steering manifold to verify that all pressure has been released.*

⚠ DANGER

The steering system is a high pressure system. Release all pressure before disconnecting any lines.

3. Disconnect the hydraulic hoses. Label each to ensure proper installation. Install clean plugs in all openings.

4. Disconnect lubrication lines (if so equipped).

5. Support the cylinder so that it cannot move and will allow for easy removal.

6. Remove the capscrews, hardened flatwashers, pin retainer, grease seals, and pin from the clevis assembly on the rod end of the cylinder.

7. Remove the pin assembly securing the cylinder base to the axle as follows:

a. On trucks equipped with expander pin assemblies (Figure 2):

(1) Remove the capscrew (38), flatwasher (37), and retainer (36) securing the pin assembly (35).

(2) Remove the capscrew (24), expander washer (23), and expander sleeve (22) from the lower portion of the pin assembly (35).

NOTE: *It may be necessary to wait until the pin is removed to remove the expander sleeve (22). If it does not release and must wait to be removed, provide some means of preventing its falling out and becoming damaged.*

(3) Loosen, but do not remove, upper capscrew (24).

(4) Carefully move pin assembly to allow the upper and lower expander sleeves (22) to release, then remove all of the pin assembly components.

(5) Remove the bearing spacer (21).

b. On trucks equipped with the straight pin/nut assembly (Figure 3):

(1) Remove the cotter pin (23), hardened flatwashers (22), slotted nut (20).

(2) Remove the bearing spacers (21) and the steering pin (19).

8. Remove the steering cylinder(s).

DISASSEMBLY (Figures 1A, B, and C unless otherwise indicated)

The steering cylinders may be disassembled as follows:

1. Clamp the body in a bench vise.

2. Remove the yoke from rod end as follows: (Figure 2, this step only)

a. Loosen the capscrews (13) and locknuts (14) to release the locking effect on the yoke assembly.

b. Using an appropriate wrench to keep the piston rod from turning, slowly unscrew the yoke from the rod assembly.

3. Remove the button head capscrews (21) and lockwashers (22).

4. Using a suitable tool, unscrew and remove the retainer (6) from the end of the outer tube assembly (1).

5. Remove the bearing assembly (5) from the outer tube assembly.

6. Remove piston and rod assembly from the outer tube assembly.

7. Remove socket head capscrew (20) from the piston nut (4).

8. Remove the piston nut (4) from the assembly.

9. Remove socket head capscrew (20) from the side of the piston assembly.

10. Unscrew the piston (3) from the rod (2).

11. Inspect and remove all wear rings, seals, and backup rings from various components.

INSPECTION AND REPAIR

The disassembled cylinders may be serviced as follows

1. Clean all metal components with clean solvent. Dry with compressed air.

2. Inspect the components for excessive wear, scoring, scratches. Repair or replace as required.

Critical dimensions include: (84092A, C, E, and K cylinder components)
Cylinder bore (item 1): 6.000 +0.003/-0.000 inches
Piston OD (item 3): 5.975 +/- 0.001 inches
Piston rod OD (item 2): 3.495/3.4945 inches

3. Inspect the condition of the self-aligning bushing in the end of the outer body tube. If required it may be replaced as follows: (Figures 2 or 3, Section C-C)

a. Remove the internal retaining ring.

b. Remove the self-aligning bushing assembly by a suitable means.

c. Inspect the condition of the bushing bore in the outer tube assembly. It should be free of damage and in good repair. Remove any burrs or nicks.

d. Install the new bushing assembly, securing with internal snap ring.

4. Inspect the removed seals, wiper rings, etc. noting any damage or abnormal appearances. If found, determine the cause and correct prior to beginning the reassembly process.

IMPORTANT: *It is recommended that all seals and O-rings be discarded and replaced with new components during each assembly.*

ASSEMBLY (Figures 1A, B, C, and D)

NOTE: *There are four separate versions of the cylinder assembly that are covered here.*
1. P/N 84092A was the original configuration and is illustrated in Figure 1A.
2. P/N 84092C was an improved configuration and is illustrated in Figure 1B.
3. P/N 84092E (and earlier cylinders modified per UR Engineering Bulletin EB1348 to this configuration) is a further improved configuration and is illustrated in Figure 1C.
4. P/N 84092K is a configuration with integrated seals and a one-piece stuffing box. It is illustrated in Figure 1D.
Always determine the configuration of the cylinder being serviced and verify that the correct parts are available before beginning assembly of the cylinder.

The steering cylinders may be assembled as follows:

1. Clamp outer tube assembly (1) in vise in a manner not to cause distortion or damage.

2. Lubricate all O-rings and seals with hydraulic oil compatible with that in the truck's hydraulic system.

3. Replace the O-ring seal (17) between the piston (3) and the piston rod (2).

4. Using the standard procedures for installing Loctite, cover the threads on the piston (3) and piston rod (2) with Loctite 271 or equivalent. Assemble the two components and torque to 1470 to 1770 ft-lb (1995 to 2400 Nm).

5. Using Loctite 242 or equivalent, install the bronze plug (19) and the socket-head capscrew (20) into the side of the piston (3) to secure on the piston rod (2). Torque to 21 to 25 ft-lb (28 to 34 Nm).

6. Using Loctite 271, install the piston nut (4) onto the piston assembly. Torque to 300 ft-lb (405 Nm), minimum.

7. Using Loctite 242 or equivalent, install the socket-head capscrew (20) into the top of the piston nut (4) to secure the nut on the piston. Torque to 21 to 25 ft-lb (28 to 34 Nm).

8. Install piston wear rings (14) and seal and seal expander (15 and 16) onto the piston (3).

NOTE: *The seal expander is not used with the 89052K configuration.*

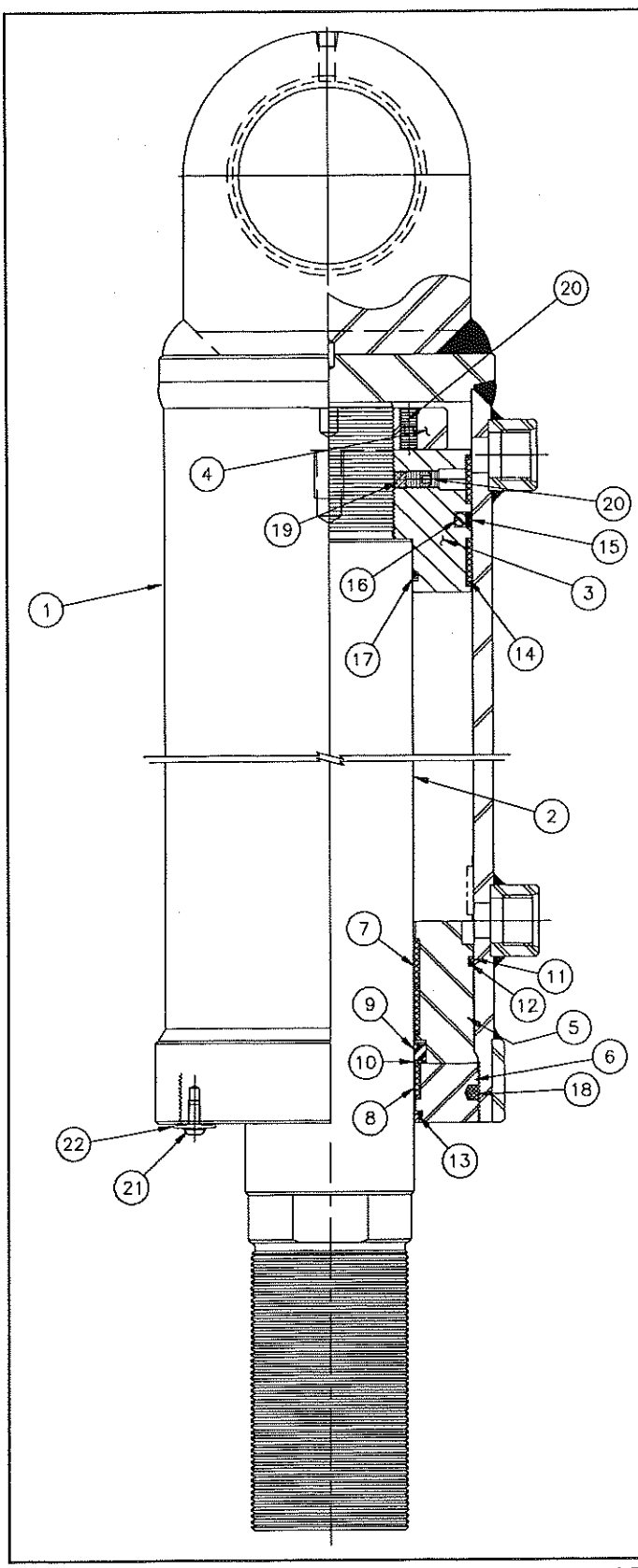
9. Install the rod wear ring (7), U cup seal (9), and back-up ring (10) into the ID of the bearing assembly (5).

NOTE: *On P/N 84092E and P/N 84092K cylinders (Figures 1C and 1D):*
1. Make sure to install item 9 and not item 8. They appear similar, but are different. The seal will not function properly if they are installed in the wrong groove.
2. It is extremely important to have the lip of the seal (9) toward the inside of the cylinder.

10. Install the O-ring (11) and back-up ring (12) into the groove in the OD of the bearing.

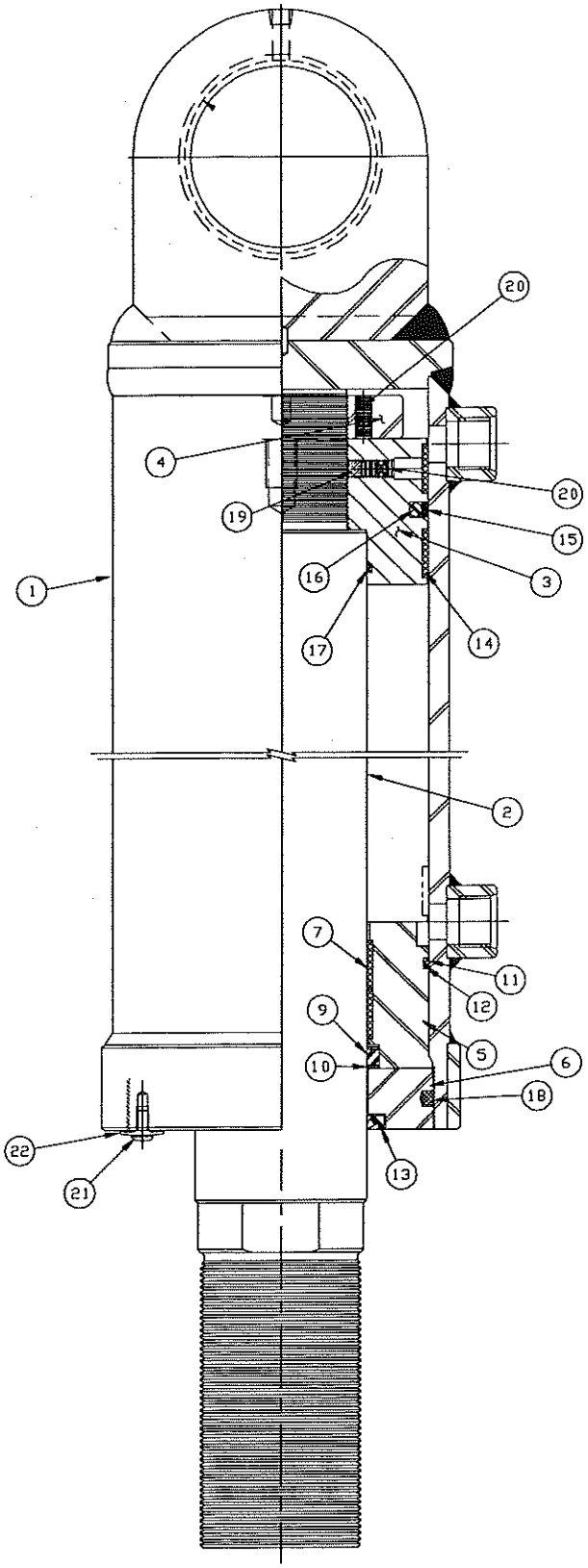
11. Lubricate the cylinder bore and the outside of the piston and bearing assemblies with hydraulic oil compatible with that in the truck's hydraulic system.

12. Using a seal compressor or other suitable tool and



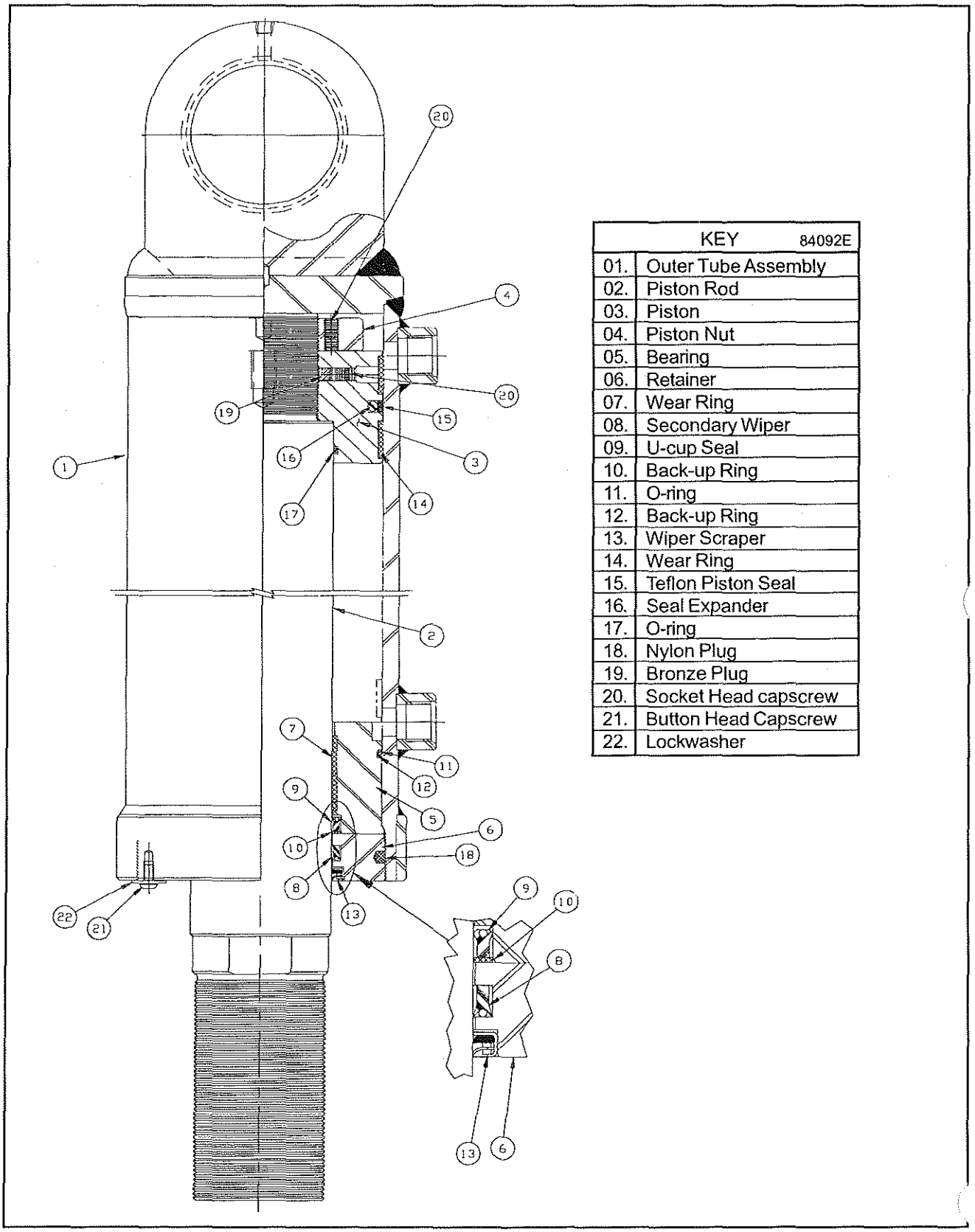
KEY	84092A
01.	Outer Tube Assembly
02.	Piston Rod
03.	Piston
04.	Piston Nut
05.	Bearing
06.	Retainer
07.	Wear Ring
08.	Wear Ring
09.	U-cup Seal
10.	Back-up Ring
11.	O-ring
12.	Back-up Ring
13.	Rod Wiper
14.	Wear Ring
15.	Teflon Piston Seal
16.	Seal Expander
17.	O-ring
18.	Nylon Plug
19.	Bronze Plug
20.	Socket Head Capscrew
21.	Button Head Capscrew
22.	Lockwasher

FIGURE 1A - STEERING CYLINDER ASSEMBLY (PART NUMBER 84092A)



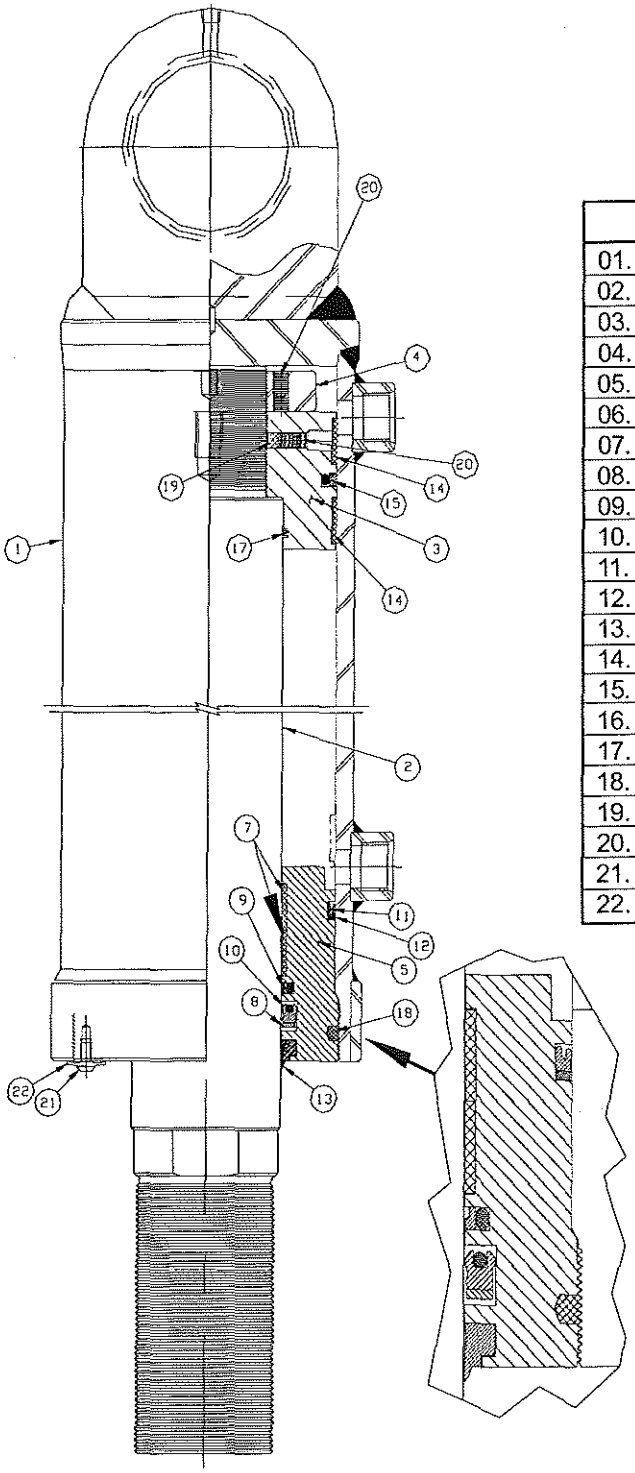
KEY	84092C
01.	Outer Tube Assembly
02.	Piston Rod
03.	Piston
04.	Piston Nut
05.	Bearing
06.	Retainer
07.	Wear Ring
08.	Not Used
09.	U-cup Seal
10.	Back-up Ring
11.	O-ring
12.	Back-up Ring
13.	Rod Wiper
14.	Wear Ring
15.	Teflon Piston Seal
16.	Seal Expander
17.	O-ring
18.	Nylon Plug
19.	Bronze Plug
20.	Socket Head Capscrew
21.	Button Head Capscrew
22.	Lockwasher

FIGURE 1B - STEERING CYLINDER ASSEMBLY (PART NUMBER 84092C)



KEY 84092E	
01.	Outer Tube Assembly
02.	Piston Rod
03.	Piston
04.	Piston Nut
05.	Bearing
06.	Retainer
07.	Wear Ring
08.	Secondary Wiper
09.	U-cup Seal
10.	Back-up Ring
11.	O-ring
12.	Back-up Ring
13.	Wiper Scraper
14.	Wear Ring
15.	Teflon Piston Seal
16.	Seal Expander
17.	O-ring
18.	Nylon Plug
19.	Bronze Plug
20.	Socket Head capscrew
21.	Button Head Capscrew
22.	Lockwasher

FIGURE 1C - STEERING CYLINDER ASSEMBLY (PART NUMBER 84092E)



KEY 84092E	
01.	Outer Tube Assembly
02.	Piston Rod
03.	Piston
04.	Piston Nut
05.	Bearing
06.	Not Used
07.	Wear Ring
08.	Secondary Wiper
09.	U-cup Seal
10.	Back-up Ring
11.	O-ring
12.	Back-up Ring
13.	Wiper Scraper
14.	Wear Ring
15.	Teflon Piston Seal
16.	Not Used
17.	O-ring
18.	Nylon Plug
19.	Bronze Plug
20.	Socket Head capscrew
21.	Button Head Capscrew
22.	Lockwasher

FIGURE 1D - STEERING CYLINDER ASSEMBLY (PART NUMBER 84092K)

exercising care not to damage the seals on the threads or other components, carefully install the piston/rod assembly into the tube.

13. Install the secondary wiper seal (8) and wiper scraper seal (13) in the ID of the retainer (5 or 6).

NOTES:
1. This instruction is predominately for P/N 84092E and P/N 84092K cylinders (Figures 1C and 1D). Earlier configurations are installed as shown in Figures 1A and B.
2. On the P/N 84092E and P/N 84092K cylinders (Figures 1C and 1D)
a. Make sure to install item 8 and not item 9. They appear similar, but are different. The seal will not function properly if they are installed in the wrong groove.
3. It is extremely important to have the lip of the secondary wiper seal (8) toward the outside of the cylinder.
4. Install the wiper scraper (13) flush with the edge of the retainer (5 or 6). Do not install into the bottom of the groove.

14. Install the nylon plug into the OD of the retainer (5 or 6).

15. Install the boot assembly (20, 21, and 22) on the cylinder rod (Figure 2).

16. Install the retainer (6) onto the outer tube assembly, tightening until secure. Secure with the button head capscrews (21) and lockwashers (22). Torque to 8 to 12 ft-lb (10 to 16 Nm).

NOTE: *This is not used with the 84092K configuration.*

17. Install the yoke assembly on the rod end as follows: (Figure 2)

a. Using an appropriate wrench to keep the piston rod from turning, slowly screw the yoke onto the rod assembly as far as possible.

b. Install and tighten the capscrews (13) and locknuts (14) to secure the locking effect on the yoke assembly.

INSTALLATION (Figures 2 and 3)

The steering cylinders may be installed as follows:

1. Install the cylinder onto the axle with the bearing spacers above and below. Secure in position to allow proper pin installation.

2. Secure the base of the steering cylinder to the axle mounts as follows:

a. On trucks equipped with expander pin assembly (Figure 2):

(1) Lubricate the pin (19) and the expander sleeves (22) with bearing grease to ease installation.

(2) Insert the pin portion of the pin assembly (19) into the bore.

(3) Install the expander sleeves (22) (properly oriented) into the bores and onto the pin.

(4) Install the special expander washers (23) and capscrews (24) onto the upper and lower ends of the pin. Hand tighten each only at this time.

(5) Torque the upper and lower capscrew assemblies in 50 ft-lb (68 Nm) increments to a final torque of 370 ft-lb (500 Nm). This is necessary to maintain an equal clearance between the washers (23) and the mounting lugs on both ends of the pin assembly.

IMPORTANT:
1. The expander washers (23) should never come in contact with the pivot lug. If this does occur, loosen both of the capscrews and repeat the tightening sequence from step (4).
2. If either of the expander washers (23) comes in contact with the lug, the system is out of specification or an incorrect sleeve or component is being used.

NOTE: *A 36 mm socket will be required to tighten the M24 capscrews.*

b. On trucks equipped with conventional pin/nut assembly (Figure 3):

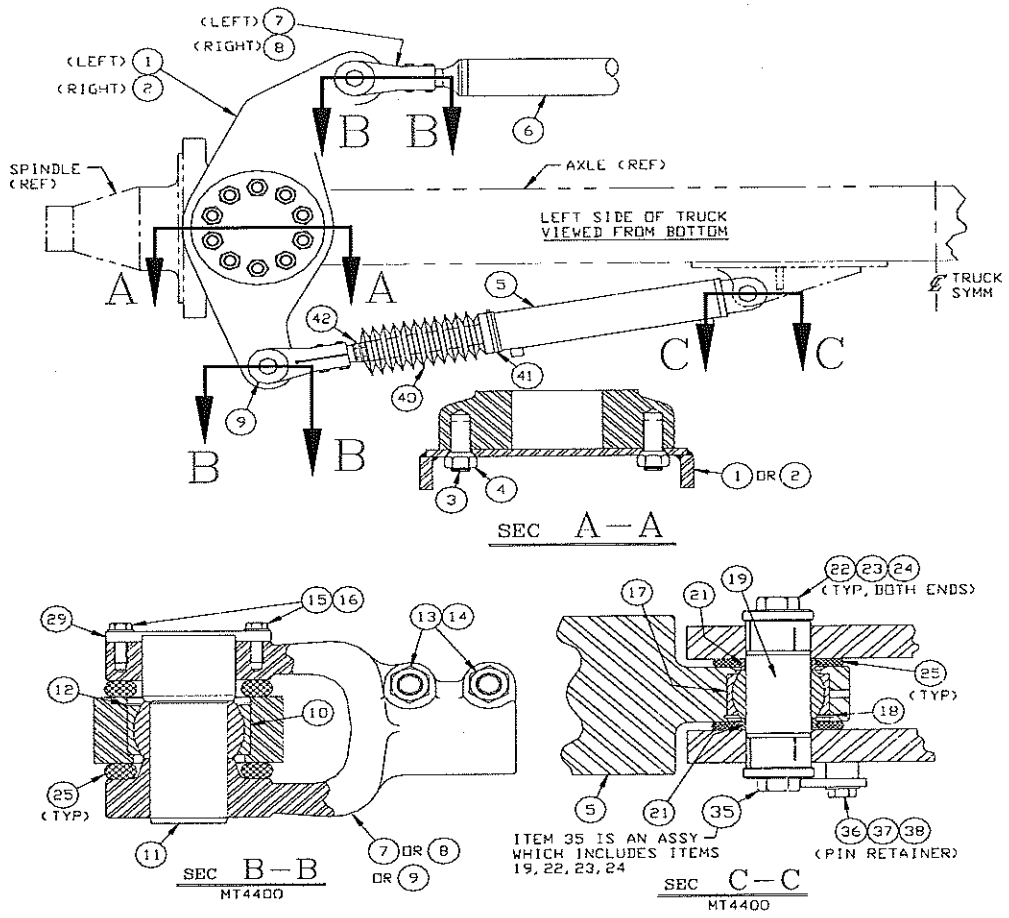
(1) Secure the cylinder assembly to the axle with the steering pin (19), hardened flatwasher (22) and slotted nut (20).

(2) Tighten the nut to secure, but not enough to displace or bend the mounting arms on the axle.

(3) Secure with cotter pin (23) when complete.

3. Install grease seals above and below the bushing.

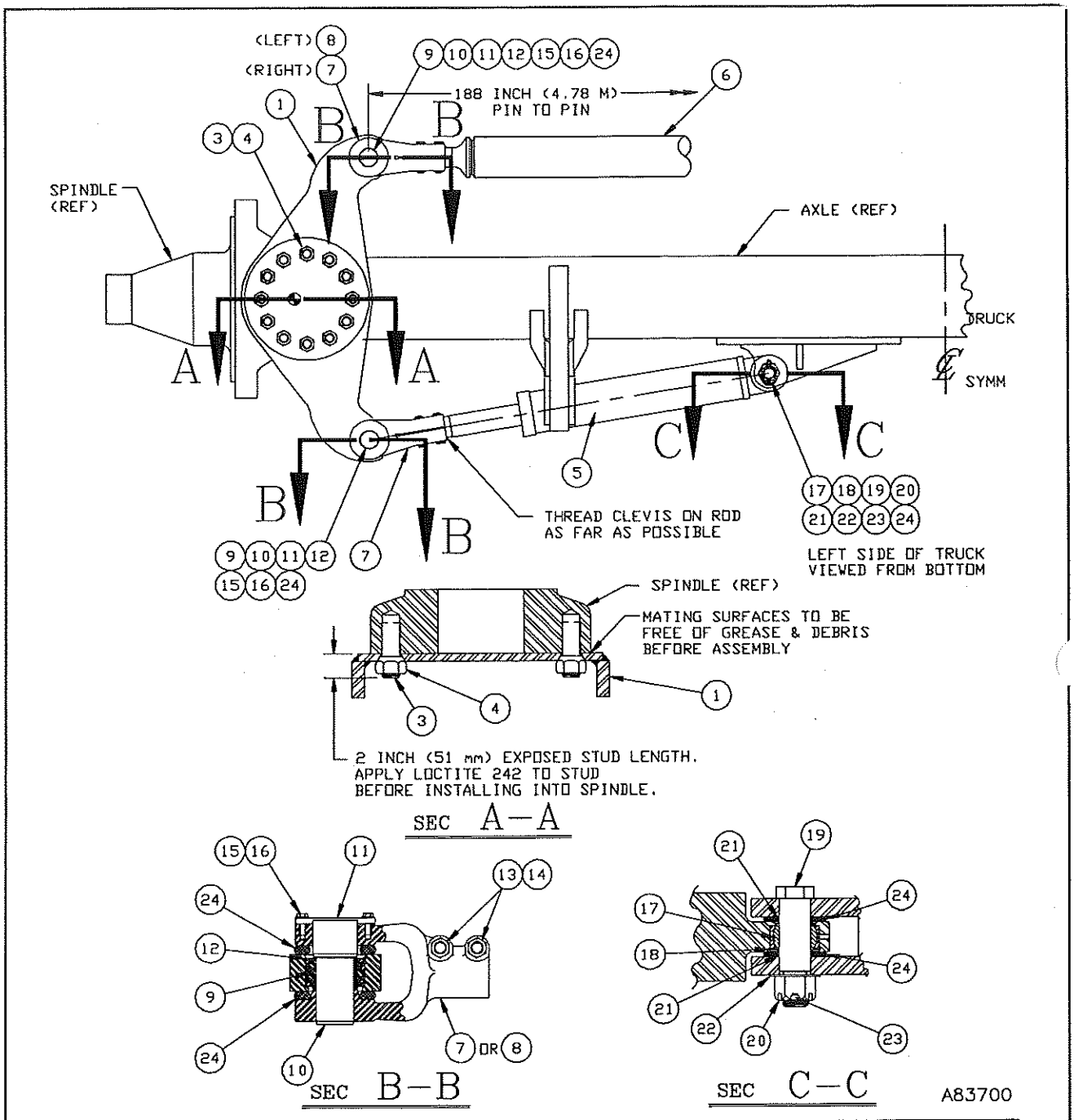
4. Inspect the self-aligning bushing in the steering arm. If worn or damaged, it may be replaced as follows:



KEY MHA86052

01.	Steering Arm	13.	Capscrew	25.	Grease Seal
02.	Steering Arm	14.	Locknut	26.	– 28. Not Used
03.	Stud (Grade 8)	15.	Capscrew	29.	Pin Retainer
04.	Taper Nose Nut (Grade 8)	16.	Hardened Flatwasher	30.	– 34. Not Used
05.	Steering Cylinder	17.	Self-Aligning Bushing	35.	Expander Pin Assembly
06.	Tie Rod	18.	Retaining Ring (Internal)		(Includes items 19, 22, 23, and 24)
07.	Steering Yoke (LH Threads)	19.	Expander Pin	36.	Expander Pin Retainer
08.	Steering Yoke (RH Threads)	20.	Not Used	37.	Flatwasher
09.	Steering Yoke	21.	Bearing Spacer	38.	Capscrew
10.	Self Aligning Bushing	22.	Expander Sleeve	40.	Boot
11.	Expander Pin	23.	Expander Washer	41.	Clamp, Hose
12.	Retaining Ring (Internal)	24.	Capscrew (Metric)	42.	Hose Clamp

FIGURE 2 - STEERING COMPONENT INSTALLATION ASSEMBLY – EXPANDER PIN CONFIGURATION (MHA86052)



KEY					A83700A
1.	STEERING ARM	9.	SELF ALIGNING BUSHING	17.	SELF ALIGNING BUSHING
2.	NOT USED	10.	PIN	18.	RETAINING RING (INTERNAL)
3.	STUD (GRADE 8)	11.	PIN RETAINER	19.	PIN
4.	TAPER NOSE NUT	12.	RETAINING RING (INTERNAL)	20.	SLOTTED NUT
5.	STEERING CYLINDER	13.	CAPSCREW	21.	BEARING SPACER
6.	TIE ROD	14.	LOCKNUT	22.	HARDENED FLATWASHER
7.	STEERING YOKE (R.H. THREADS)	15.	CAPSCREW	23.	COTTER PIN
8.	STEERING YOKE (L.H. THREADS)	16.	HARDENED FLATWASHER	24.	GREASE SEAL

FIGURE 3 - STEERING COMPONENT INSTALLATION ASSEMBLY – STRAIGHT PIN/NUT CONFIGURATION (A83700)

a. Remove the internal retaining ring.

b. Remove the self-aligning bushing assembly by a suitable means.

c. Inspect the condition of the bushing bore in the outer tube assembly. It should be free of damage and in good repair. Remove any burrs or nicks.

d. Install the new bushing assembly, securing with internal snap ring.

5. Install the yoke assembly on the steering arm as follows:

a. Install steering pin, securing with pin retainer. Secure the retainer with capscrews and hardened flatwashers.

b. Install the grease seals above and below the self-aligning bushing.

6. Properly lubricate all steering components before use.

7. Connect all hydraulic hoses and lubrication lines (if so equipped).

8. Bleed entrapped air as outlined under Maintenance and Adjustment in this module.

9. Check the entire system for leaks.

10. Check the front wheel toe-in adjustment as outlined in the instructions in Section 7 - Running Gear in this manual.

11. On trucks equipped with the expander pin assembly:

a. Recheck the upper and lower capscrew torque. Retorque if required.

IMPORTANT: *This retorque is an essential part of the installation.*

b. Install the pin retainer (36), secured with capscrew (38) and flatwasher (37) on the bottom of the pin assembly. The retainer should be as close as possible to the capscrew.

HYDRAULIC FILTERS

DESCRIPTION AND LOCATION
(Figure 1)

Several high pressure filters are included in the truck's hydraulic systems to remove contamination and improve the operation and service life of the system components.

1. Dump System - two filter assemblies (one on the outlet supply from each section of the dump pump assembly) and are located on the left side of the main frame in front of the hydraulic tank.

2. Steering System - single assembly (on the outlet supply from the steering pump assembly) located on the left side of the main frame with the dump filters.

OPERATION

Pressurized oil from the pump assemblies enters the filter inlet and is routed through the inlet, into the center of the element. After passing through the element, it exits through the outlet port.

A relief or by-pass, valve is installed in each filter assembly that limits the maximum differential pressure through the element to 50 +/- 5 psi (345 +/- 35 kPa) in conditions such as with cold oil or a plugged to over-restrictive filter element.

A separate by-pass indicator is included that monitors the differential pressure through the element and reports it. Standard is a mechanical indicator that is "read" on the exterior of the filter assembly head. Also available as an option is an electoral switch that operates a cab mounted warning indicator system. Both of these systems are designed to activate when the differential pressure through the element has reached a level which soon will allow the by-pass valve to open.

⚠ CAUTION

Continued operation of the filters with the differential indicators activated can allow unfiltered oil to flow around the element and through the remainder of the system. This will result in damage to the system and its components.

MAINTENANCE AND ADJUSTMENT
(Figure 1)

Periodic maintenance should include the following:

1. Inspect the filter assemblies, connections, and hoses for leakage or damage. Repair or replace as required.

NOTES:
1. The filters do not normally require special attention between servicing intervals except for periodic monitoring of the differential warning devices.
2. If external leakage is noted, replace the seals at the location of the leak. For bowl seal leaks, replace the O-ring (7) and back-up ring (8), with the back-up ring (8) as shown in the illustration.
3. If the leakage persists, check the sealing surfaces for scratches or cracks. Replace any damaged or defective components.

2. With the hydraulic oil at operating temperature (e.g. greater than 120° F (49° C)) and all controls in their "neutral" position (e.g. steering and brakes released, Dump Controller lever in "Float" position).

a. Check the position of the mechanical indicator. Depress the red indicator button if extended.

b. Start the engine.

c. Accelerate the engine to rated speed and hold.

d. Verify that:

TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
Excess bypassing of oil	Oil cold	Oil will bypass more at low temperature. Check when at normal operating temperatures.
	Element plugged or damaged	Repair or replace as required.

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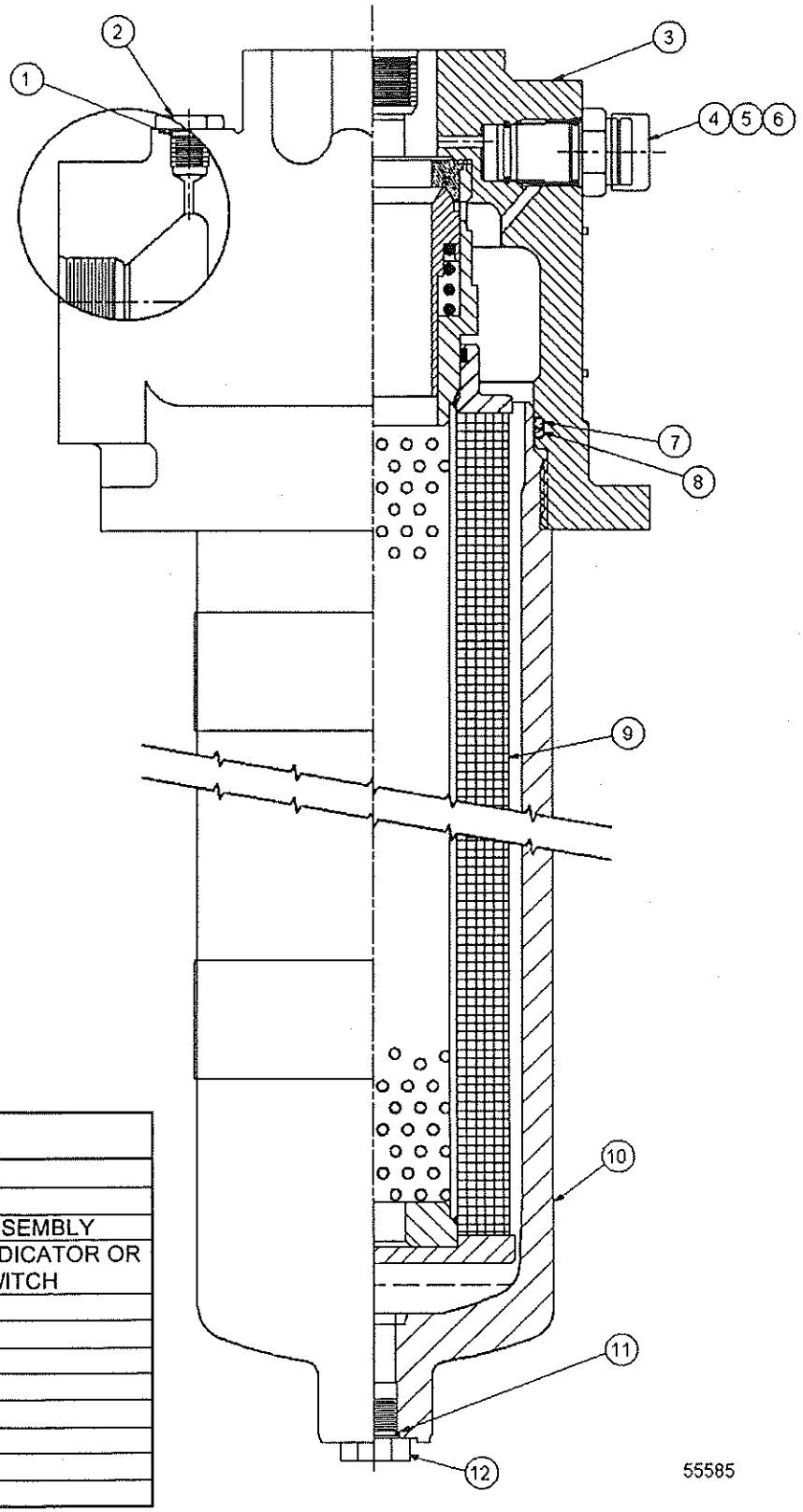


KEY	
1.	O-RING
2.	PLUG
3.	FILTER HEAD ASSEMBLY
4.	MECHANICAL INDICATOR OR ELECTRICAL SWITCH
5.	O-RING
6.	O-RING
7.	O-RING
8.	BACK-UP RING
9.	ELEMENT
10.	BOWL
11.	O-RING
12.	DRAIN PLUG

FIGURE 1 - FILTER ASSEMBLY

(1) On filters equipped with the mechanical indicators, the indicator remains in the depressed state.

(2) On filters equipped with the electrical indicators, the indicator light remains off.

NOTE: *These indicators are designed to show that the differential pressure through the element has reached a level that has or will soon allow the oil to by-pass the filtering medium and not properly filter the impurities.*

e. Slow the engine to low idle speed and stop.

CHANGING THE FILTER ELEMENT

The filter elements may be changed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Drain all hydraulic pressure from the truck's accumulators and release the pressure in the hydraulic reservoir as outlined in the instruction for operating those systems.

⚠WARNING

Failure to release all stored pressure in the system before beginning to service the filter assembly could result in explosive loss of fluid, damage to the equipment, and possible personal injury.

⚠WARNING

The oil in the hydraulic system typically operates at a high temperature. Extra care should be taken when draining this oil to avoid contact with the skin or clothing.

3. Install a drain pan securely under the filter assembly being serviced.

4. Open the filter bleed plug (2) 1-1/2 turns and allow any entrapped pressure to escape.

5. Remove the drain plug (12), and allow the oil to drain completely from the bowl (10).

6. Temporarily reinstall and tighten the drain plug (12) and bleed plug (2). Do not over tighten.

7. Unscrew (counter-clockwise) the bowl (10) from the head assembly (3) and remove.

NOTE: *It may be necessary to use a correct size wrench on the hexagon at the base of the filter bowl (10) to loosen the bowl initially.*

8. Remove the element (9) and seal rings (7 and 8).

9. Carefully inspect the surface for visible contamination or damage. Normally no contamination or particles should be seen, but if there are some present it may be an early warning of system component breakdown and can indicate potential failures.

10. Discard the filter element (9) and its seal rings (7 and 8). The filter element is not cleanable. Any attempt to clean the element can result in degradation of the filtering medium and allow contaminated fluid to flow through the filter element.

⚠WARNING

Do not attempt to clean or re-use any element or seal.

11. Inspect and remove all remaining O-rings and back-up rings including those on the plugs.

12. Clean the bowl (10) and filter head assembly (3) with clean solvent. Inspect for evidence of wear, leakage, or damage. Repair or replace as required.

13. Lubricate all new O-rings, back-up rings, and threads on the filter bowl (10) with clean hydraulic oil of the same specification of that in the truck's hydraulic system. Install all of these seal rings in their proper position as shown in the illustration.

14. Lubricate the element O-ring with clean hydraulic oil of the same specification of that in the truck's hydraulic system. Install a new element (9) straight onto the nipple in the head assembly (3).

NOTE: *While pushing up on the bottom of the element with sufficient force, a definite slight sudden movement of the element should be felt as the seals properly "seat" over the relief valve in the head assembly. If this is not felt, check to make sure that the element is properly seated.*

IMPORTANT: *Failure to seat will allow hydraulic fluid to by-pass the filter element and not be adequately filtered to assist in properly protecting the system and its components.*

15. Install the bowl (10) onto the head assembly (3).

Screw the bowl onto the head assembly until it bottoms out. Do not over tighten, as O-ring sealing is not improved.

⚠WARNING

Do not use a pipe wrench, hammer, or any tool other than a suitable wrench to tighten the bowl to the head assembly.

16. Install the drain plug (12) with a new O-ring (11).

17. Start the engine, and allow the hydraulic system to operate and check for leaks.

18. If air is entrapped in the system, bleed as instructed in Section 5 - Hydraulic System.

19. Once the hydraulic oil is again at operating temperatures, verify the condition of the filter as outlined previously in these instructions.

IMPORTANT: *A contaminated system can quickly plug a new filter element, especially when equipped with silt removal grade media. It may require one or two initial element changes to stabilize element life.*

SERVICE

Normal service requirements other than the periodic replacement of filter elements include the replacement of leaky seals, or the repair of damaged components, or connections.

NOTE: *When replacing a mechanical indicator or electrical differential pressure switch (4), new O-rings (5 and 6) should be installed and the switch tightened to a final torque of 40 ft-lbs (54 Nm).*

DUMP CYLINDERS

DESCRIPTION AND LOCATION

The dump cylinders are two-stage, double-acting, hydraulic cylinders. The cylinders are mounted with the rod end attached to the frame and the base end to the dump body.

OPERATION

The dump cylinders raise and lower the dump body.

The cylinders are positioned so that they lift the front of the dump body, which pivots at the rear. The oil is directed into and out of each cylinder through a pair of ports on the piston rod (lower) end of the cylinder.

To raise the body (extend the cylinders), the hydraulic oil is directed from the dump valve into the extend port of each cylinder. The oil moves up the center tube pressurizing the first and second stage pistons of each cylinder, causing the cylinders to extend. The first and second stages extend together until the first stage bottoms out. The second stage then extends out from the first stage. The oil from the rod end of the cylinder flows out through the retract lines in the center tubes, exits through the retract port, and returns to the hydraulic tank through the dump valve.

In the lower or retraction cycle, the pressurized oil is routed into the cylinders retract ports, up the center tube passage to the rod end of the cylinders. The second stage retracts first, followed by the first stage. The oil from the base end of the cylinder exits through the extend port and to the tank through the dump valve.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps.

1. Clean each dump cylinder, especially any contamination from the rod and cylinder tube.

2. Inspect for wear, leakage, or damage. Repair or replace as required.

3. Verify that the cylinder connections to the frame and dump body are lubricated, secured properly, and free of damage.

4. If the cylinder seals are suspected of bypassing, the by-pass flow may be measured as follows:

a. With the dump body resting on the body pads, park the truck in a SAFE POSITION. It must be secured by means other than the friction brake system.

b. Stop the engine and allow the system to release all entrapped pressure. Verify that the Dump Controller lever is in the Float position.

c. Remove the hose from the extend port side of the cylinder to be tested where it connects to the dump valve.

d. Place the end of the hose in a clean empty container.

e. Start the truck engine and once operating, accelerate to rated speed.

f. Move the Dump Controller lever to the Lower or "Power Down" position and hold. Maintain for 30 seconds.

g. Return the Dump Controller lever to the detented Float position.

h. Measure the fluid captured from the cylinder.

(1) For new cylinders, it should be less than one-half gallon (1.9 liters).

(2) For used cylinders it should be less than one and one-half gallons (5.7 liters).

NOTE: *Flows in excess of these levels (for 30 second test) indicate excessive seal by-pass is occurring and service is recommended.*

i. Reinstall the hose on cylinder.

j. Bleed entrapped air before returning to service.

REMOVAL (Figure 2)

NOTE: *It is recommended that the cylinders be removed and serviced in pairs. Note the direction that the extend and retract ports face on the cylinder, so that the cylinder will be installed in the same position.*

The dump cylinders may be removed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction brake system.

2. Drain the system or relieve all pressure before loosening any lines. Place the Dump Controller lever in the Float position.

⚠ WARNING

Never loosen any pressurized lines or components. Always drain the system, or relieve all pressure first.

3. Close the hydraulic fluid supply valve at the hydraulic tank.

4. Disconnect the hydraulic lines from the cylinder. Label each to ensure proper reassembly. Install clean caps and plugs on all open fittings.

NOTE: *The dump body may have to be blocked up slightly to allow clearance for the dump cylinder to be removed.*

5. Secure the cylinder in place with the shipping brackets, a chain, or equivalent.

6. Remove capscrew assembly (7, 8, and 9), upper plate cap (6), and upper pivot pin (4).

7. Remove capscrew assembly (7, 8, and 9), lower plate cap (6), pin (4), and spacers (5).

NOTE: *It may be necessary to use a puller.*

8. Remove the cylinder.

⚠ CAUTION

Use care to prevent the cylinder from extending during removal.

DISASSEMBLY (Figure 1)

The cylinder may be disassembled as follows:

1. Position the cylinder horizontally in a clean work area of sufficient size to allow for easy access and disassembly.

2. Remove lockwire (23) and drilled head capscrews (21) securing the packing gland (22).

3. Remove the 1st and 2nd stage subassembly from the body tube.

4. Remove the snap ring (4) in the groove on the 1st stage rod.

5. Remove the retainer ring (5).

6. Install the assembly ring tool (not shown) in the snap ring groove.

NOTE: *The assembly ring (tool) is a device used to "fill" the snap ring groove during the installation and removal of the pistons. This ring creates a temporary "smooth surface" with the cylinder bore, which allows the seals to pass over without damage. Failure to use this tool could allow the piston seals to expand in the groove and the cylinder to "seize".*
1. A metal version has been made by modifying a snap or retaining ring of the proper external dimensions, by machining the internal diameter to the internal diameter of the cylinder bore.
2. A alternative method that has been successfully used entails inserting a 2-377 size O-ring (either 90 duro buna or polyurethane) into the grove and coating liberally with an O-ring lubricant or equivalent.

7. Remove the lockwire and socket head capscrews securing the piston assembly (10) to the 1st stage rod (11).

8. Remove the piston assembly (10).

9. Remove the assembly ring (tool).

10. Remove the wear ring (6) and piston seal (7).

11. Remove the second stage rod assembly from first stage.

12. Remove the rod seals (18, 19, and 20) from the first stage assembly.

13. Remove the packing gland (22) from the first stage rod (11).

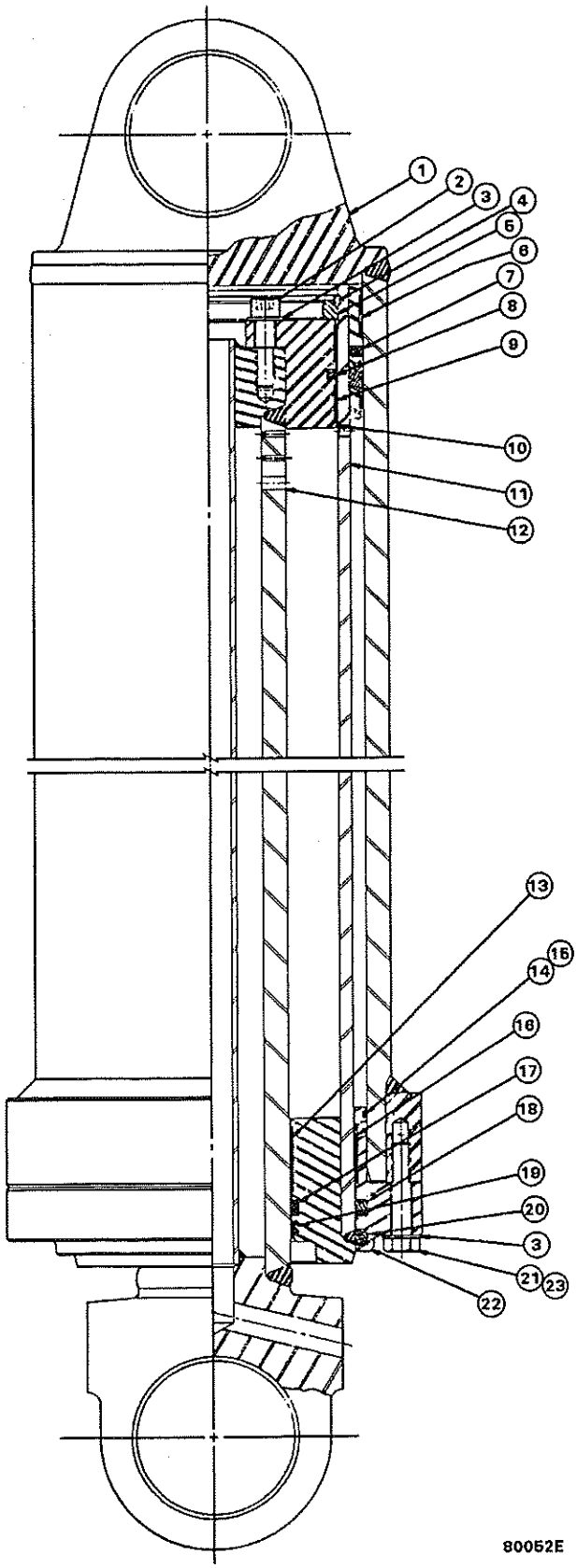
14. Remove the wear rings (13), rod seals (17 and 19), and O-ring seal and back up ring (14 and 15) from the packing gland.

15. Remove any remaining parts.

INSPECTION AND REPAIR

The cylinder may be serviced as follows:

1. Clean all metal components with solvent (especially seat and ring grooves and other passages). Inspect for scoring wear or damage. Repair or replace as required.



KEY 80052E	
01.	Body
02.	Socket Head Capscrew
03.	Hardened Flatwasher
04.	Snap Ring
05.	Retaining Ring
06.	Piston Wear Ring
07.	Piston Seal
08.	Piston Seal
09.	Piston Wear Ring
10.	Piston
11.	1st Stage Rod Assembly
12.	2nd Stage Rod Assembly
13.	Rod Wear Ring
14.	O-ring
15.	Back-up Ring
16.	Rod Wear Ring
17.	Rod Seal
18.	Rod Seal
19.	Rod Seal
20.	Rod Seal
21.	Drilled Head Capscrew
22.	Packing Gland
23.	Safety Wire

FIGURE 1 - DUMP CYLINDER

2. Inspect all seals and wear rings for evidence of damage, then discard.

3. Inspect all threaded components for evidence of damage. Repair or replace as required.

4. Inspect the mounting bushings and retainers for evidence of wear or damage. Repair or replace as required.

ASSEMBLY (Figure 1)

IMPORTANT: *It is recommended that all gasket seals be replaced each time the cylinder is disassembled.*

NOTE: *Prior to assembly coat each surface and/or seal with hydraulic oil compatible with that in the system in which it will operate.*

The cylinder may be assembled as follows:

1. Assemble the packing gland:

a. Install the O-ring seal (14) with back-up ring (15).

b. Install the rod seals (17 and 19) with the sealing lips outward (to act as wiper rings).

c. Install the wear rings (13).

d. Lube the seals and wear rings in the packing gland and the end of the first stage rod (11) with hydraulic oil, or lubricant mixture compatible with the oil to be used in the unit's hydraulic system.

2. Install the packing gland (22) on the first stage rod (11). Slide on several inches (mm) past the end.

NOTE: *The gland should not bind on the rod in any position.*

3. Assemble the first stage rod assembly as follows:

a. Install the rod seals (20) in the rod assembly.

b. Install the rod seal (19).

c. Install the rod seal (18) with the sealing lips outward to act as a wiper ring.

d. Lube the seals and wear rings with hydraulic oil or lubricant mixture compatible with the oil to be used in the truck's hydraulic system.

4. Carefully install the second stage rod assembly into the center of the first stage using care not to damage the components.

5. Assemble the piston as follows:

a. Install the piston seal (7) on the piston (10).

b. Install the wear ring (6).

c. Install the assembly ring (discussed in Disassembly) in the snap ring groove in the first stage rod.

d. Lube the seals and wear rings with the hydraulic oil or lubricant mixture compatible with the oil to be used in the truck's hydraulic system.

6. Install the piston assembly (10) onto the 1st stage rod (11). Use the two of the socket head capscrews (2) and hardened flatwashers (3) (inserted 180° apart) to draw the piston (10) against the second stage rod (12).

NOTE: *Use care not to allow the seals to bind during assembly.*

7. Remove the piston assembly ring from the first stage rod groove.

8. Install the remaining socket head capscrews/hardened flatwashers. Torque to 280-290 ft-lbs (280-290 Nm) in stages of 100, 200 and 280-290 ft-lbs (135, 265, and 380-390 Nm) using a criss-cross or "X" pattern.

9. Lockwire the socket head capscrews in pairs.

10. Install the retainer ring (5) against the piston.

11. Install the snap ring (4) in the groove in the first stage rod.

12. Lube the piston seals in the chamber on tube and the piston seals and bearings and wear rings with the hydraulic oil or lubricant mixture compatible with the oil to be used in the truck's hydraulic system.

13. Install the 1st and 2nd stage subassembly in the body (1).

14. Install the drilled head capscrews (21) and hardened flatwashers (3). Torque to 280-290 ft-lbs (380-390 Nm) in stages of 100, 200, and 280-290 ft-lbs (135, 265, and 380-390 Nm) using a criss-cross or "X" pattern. Lockwire in pairs when complete.

15. If removed, install the self aligning bushings (2, Figure 2) the upper and lower mounting positions and secure with retainer rings (3, Figure 2).

16. If possible, proof test the cylinder to 3000 psi (20 000 kPa) as outlined in the instructions in Maintenance and Adjustment in this module.

17. If the cylinder is not being installed immediately plug all ports with push in split flange plugs or bolted cover plates and coat bearings to prevent corrosion.

INSTALLATION (Figure 2)

The cylinder may be installed as follows:

1. Inspect the upper and lower mounting pins for evidence of wear or damage. Repair or replace as required.

2. Inspect the upper and lower mounting brackets/bushings for evidence of wear or damage. Repair or replace as required.

3. Secure the cylinder with a chain or other suitable means to prevent it from extending when lifted.

4. Lift the cylinder into position on the lower pivot pin with the larger or extend port to rear and the flat side of the body toward the frame.

5. Install the lower pin (4) with spacers (5) on each side. Secure with the capscrews (7), lockwasher (8), flatwasher (9), and plate cap (6).

6. Remove the chain securing the cylinder retracted. Extend the cylinder until the upper yoke is in position between the dump body flanges. Install the pin (4) and secure with capscrew (7), lockwasher (8), flatwasher (9), and cap plate (6).

7. Connect the hydraulic hoses.

8. Bleed the entrapped air from the cylinder as follows:

a. Start the truck and operate at low idle.

b. Move the Dump Controller lever to Lower and hold for several seconds.

c. Move the lever to Raise and allow the body to lift.

d. Move lever to Lower, release and allow the body to float down until it rests on the frame.

e. Repeat steps b through d in 2 ft (0.7 m) increments until all air is purged from the system.

f. Refill the hydraulic reservoir.

9. Test the operation of the dump system as outlined in Section 5 - Hydraulic System.

KEY	A84148
01.	Dump Cylinder
02.	Self Aligning Bushing
03.	Internal Retaining Ring
04.	Pin
05.	Bearing Spacer
06.	Cap Plate
07.	Capscrew
08.	Lockwasher
09.	Flatwasher
10.	Nut *
11.	Locknut *
12.	Flatwasher *
13.	Stud *
14.	Clamp *
15.	Block *

* For shipment and maintenance use only.

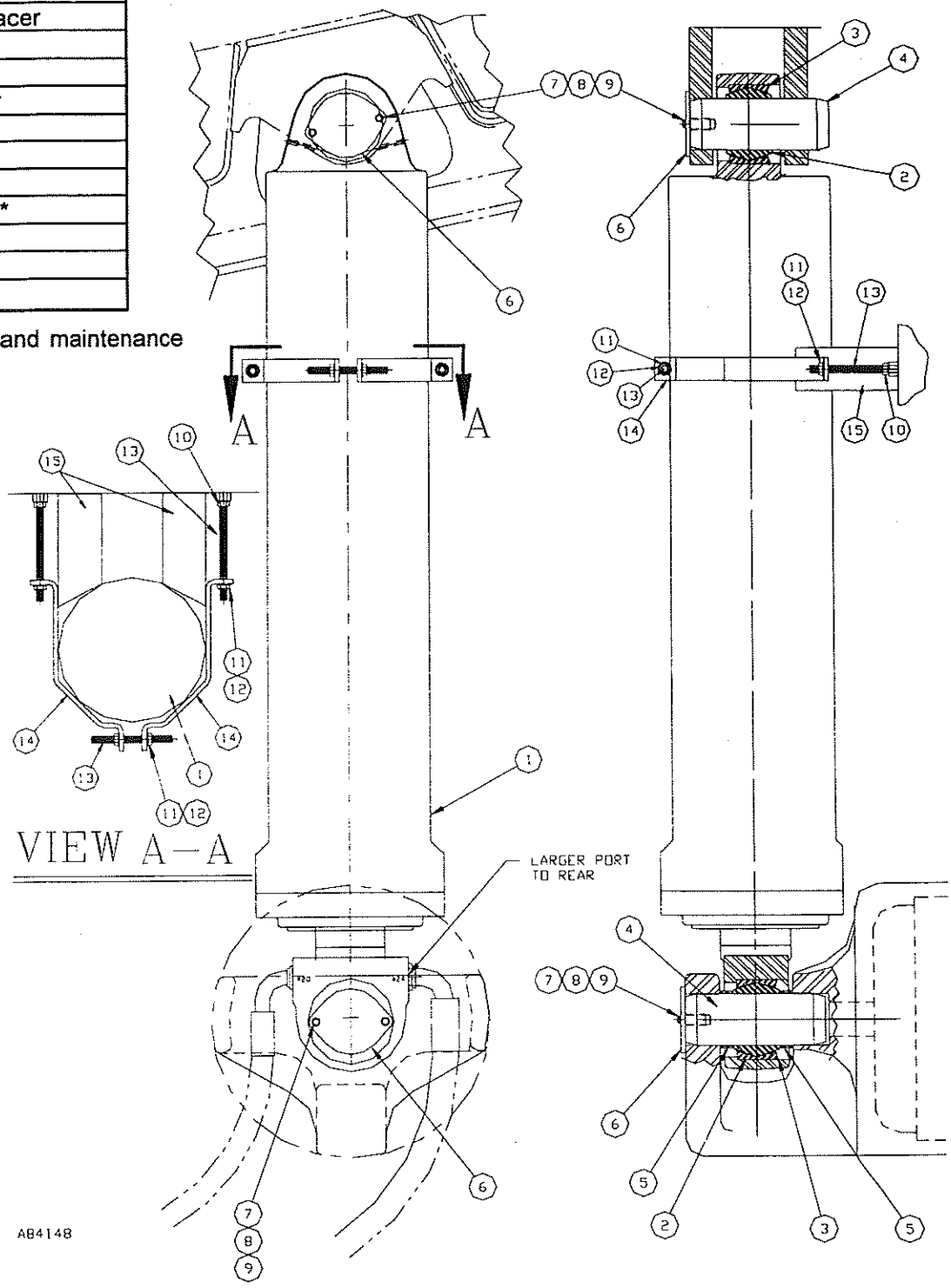


FIGURE 2 - DUMP CYLINDER INSTALLATION

HYDRAULIC TANK

DESCRIPTION AND LOCATION

The hydraulic tank is the round, vertically mounted tank mounted on the left side of the trucks main frame between the front and rear tires.

OPERATION

The hydraulic tank holds approximately 155 gallons (585 liters) of hydraulic oil. Glass plugs allow the relative fluid level to be seen externally without removing any covering. A separate pressurization system uses externally provided air pressure to maintain a constant 10 psi (70 kPa) pressure as the fluid level in the tank changes. A pressure regulator is installed to prevent the build up of excessive pressure during normal operation.

Filling of the tank is through a remote mounted central service or quick fill assembly and passes the fluid through either a separate filter assembly or the truck's dump system filters before routing to the tank.

NOTE: *The tank is grounded to the truck frame to add additional safety and durability.*

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following:

1. Inspect the exterior of the tank for evidence of damage or leakage. Repair or replace as required.

2. Inspect the mounts and brackets. They should be secure and in general good repair. Adjust, repair, or replace as required.

3. Inspect the cap on the fill ports. It should seal sufficiently to prevent contamination from entering. Repair or replace as required.

4. Inspect the inlet strainers on the fill port. It should be free of contamination and in general good repair. Repair or replace as required.

5. Inspect all inlet and outlet lines and ports. They should be free of damage and in general good repair. Repair or replace as required.

6. Periodically inspect the inside of the tank for evidence of rust, dust, or other contamination. Flush the tanks and clean as required if evidence of contamination is found.

REMOVAL

The hydraulic tank may be removed as follows:

1. Empty the contents of the tank into the appropriate cleaned containers. This may be accomplished by use of a transfer pump or other suitable device. Plugs and/or drain cocks are provided in the bottom of each tank to allow for final draining.

IMPORTANT: *Check the fluid level in the tank prior to beginning the emptying procedure and make the appropriate provisions for the large volumes of fuel that will be transferred.*

2. Disconnect and cap or plug all lines attached to the tank. Label all hoses removed to assist in later reconnection.

3. Disconnect all wires connected to the tank.

4. Disconnect the ground strap.

5. Support the tank so the weight is removed from the mounting brackets. Secure so that it cannot move when the brackets are released.

6. Remove all remaining capscrews, etc. securing the straps around the tank. Separate the straps.

7. Remove the tank from the truck.

8. If necessary, remove the mounting bracket and strap assembly from the main frame.

DISASSEMBLY

The tank assembly may be disassembled as follows:

1. Remove all fill ports and strainer assemblies.

2. Remove all clean-out port covers.

3. Remove all internal strainers, filters, and other material.

INSPECTION AND REPAIR

The disassembled tank may be inspected as follows:

1. Inspect all threads on ports or plugs for damage. Repair or replace as required.

2. Inspect all exterior and interior surfaces for evidence of corrosion, or damage. Clean, repair, or replace as required.

3. Inspect all welds and mounting brackets for evidence of damage. Repair or replace as required.

4. Inspect the mounted brackets for evidence of wear or damage. Repair or replace as required.

5. Inspect the mounting pads for evidence of wear, damage, and hardening or other deterioration. Replace as required.

ASSEMBLY

The tank may be assembled as follows:

IMPORTANT: *Always use new gaskets and gasket sealer during assembly.*

1. Verify that the internal surfaces and components are free of contamination.

2. Install all switches, valves, and other miscellaneous equipment removed.

3. Install the clean out port covers using care to tighten and torque all of the capscrews sequentially and evenly in small stages to ensure proper sealing.

4. Install the inlet and outlet manifolds and attached hardware.

NOTES:
1. Install the check valve assembly (5) in the return manifold (4) with the slotted screws located vertically.
2. Install the diffuser (9) in the return manifold with the open area toward the outside of the tank.
3. Install the butterfly valve in the suction manifold assembly with the external pivot mounted vertically at the bottom.
4. Install both the suction and return manifolds (10 and 4) securely with the capscrews (2) and flatwashers (3) following the tightening sequence shown in the illustration. The capscrews shown are to be tightened in this sequence to torques of 8, then 15, and finally 23 ft-lbs (11, 20, and 31 Nm).

5. Install the fill port/strainer assemblies and tighten sufficiently to form a firm seal. Verify that the rubber seal material on the cover forms a good seal.

NOTE: *It is recommended that thread sealant be applied to all pipe threads.*

INSTALLATION

The hydraulic tank may be installed as follows:

1. If removed, install the brackets and securing straps on the frame mounts using the appropriate mounting hardware.

NOTES:
1. It is generally considered easier to install the brackets, straps, and tank separately.
2. The tank saddle must be completely flush with the mounting bracket saddle.

2. Separate the straps as required.

3. Lift the tank carefully and position on the straps. Verify that the ports are properly oriented.

4. Move the straps around the tank and secure with the capscrews and mounting hardware. Use self-locking nuts to secure.

NOTE: *Tighten the capscrews sufficiently to secure the tanks. Do not over-tighten, as damage to the tank or straps may result.*

5. Connect all wiring to the tank.

6. Connect all hoses removed from the tank.

7. Connect the ground strap making sure to make solid connections at both ends.

8. Fill the tank with the appropriate filtered hydraulic oil using the required filtering transfer device.

9. Test all systems as outlined in the instructions in Section 5 - Hydraulic System.

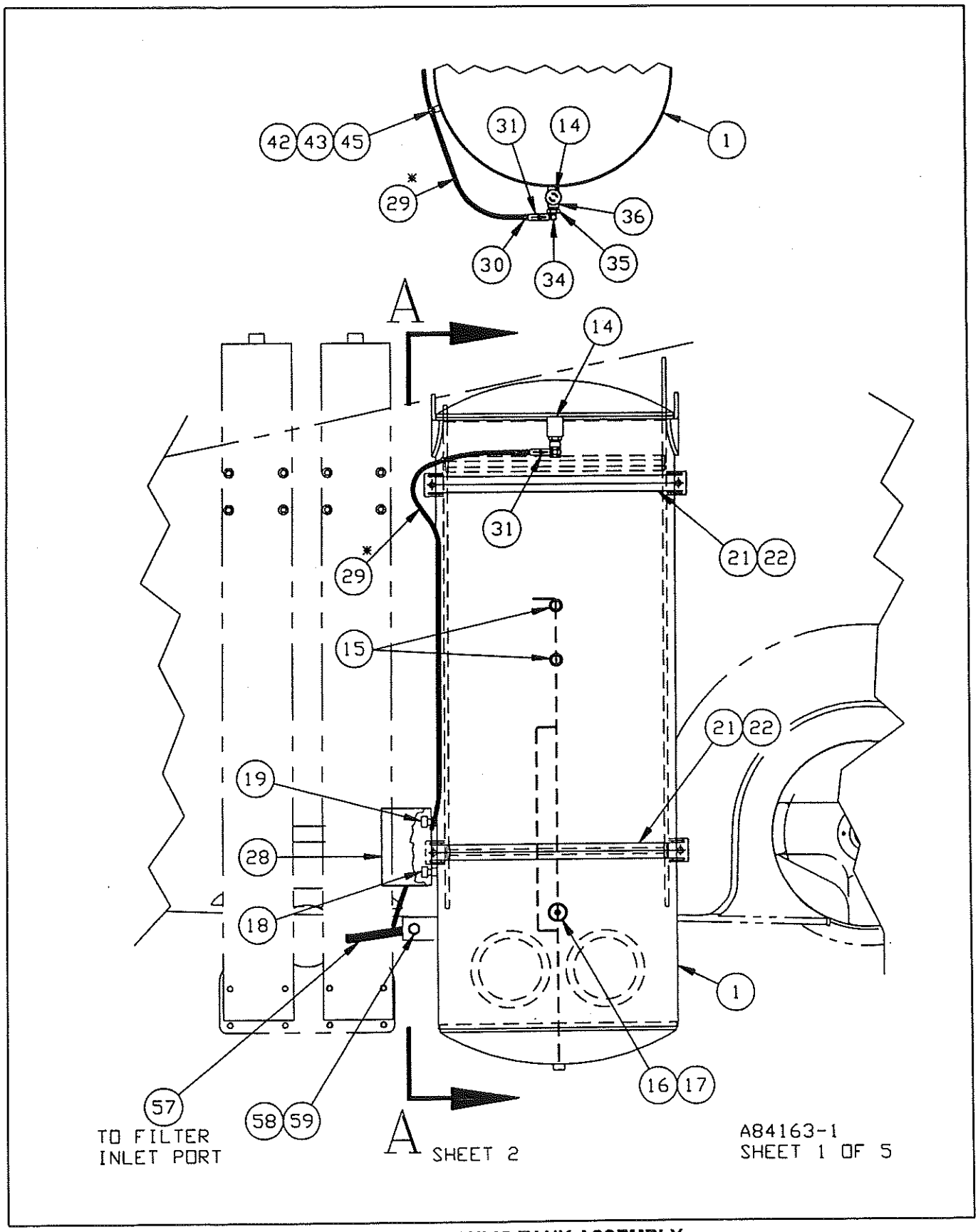


FIGURE 1 - HYDRAULIC TANK ASSEMBLY

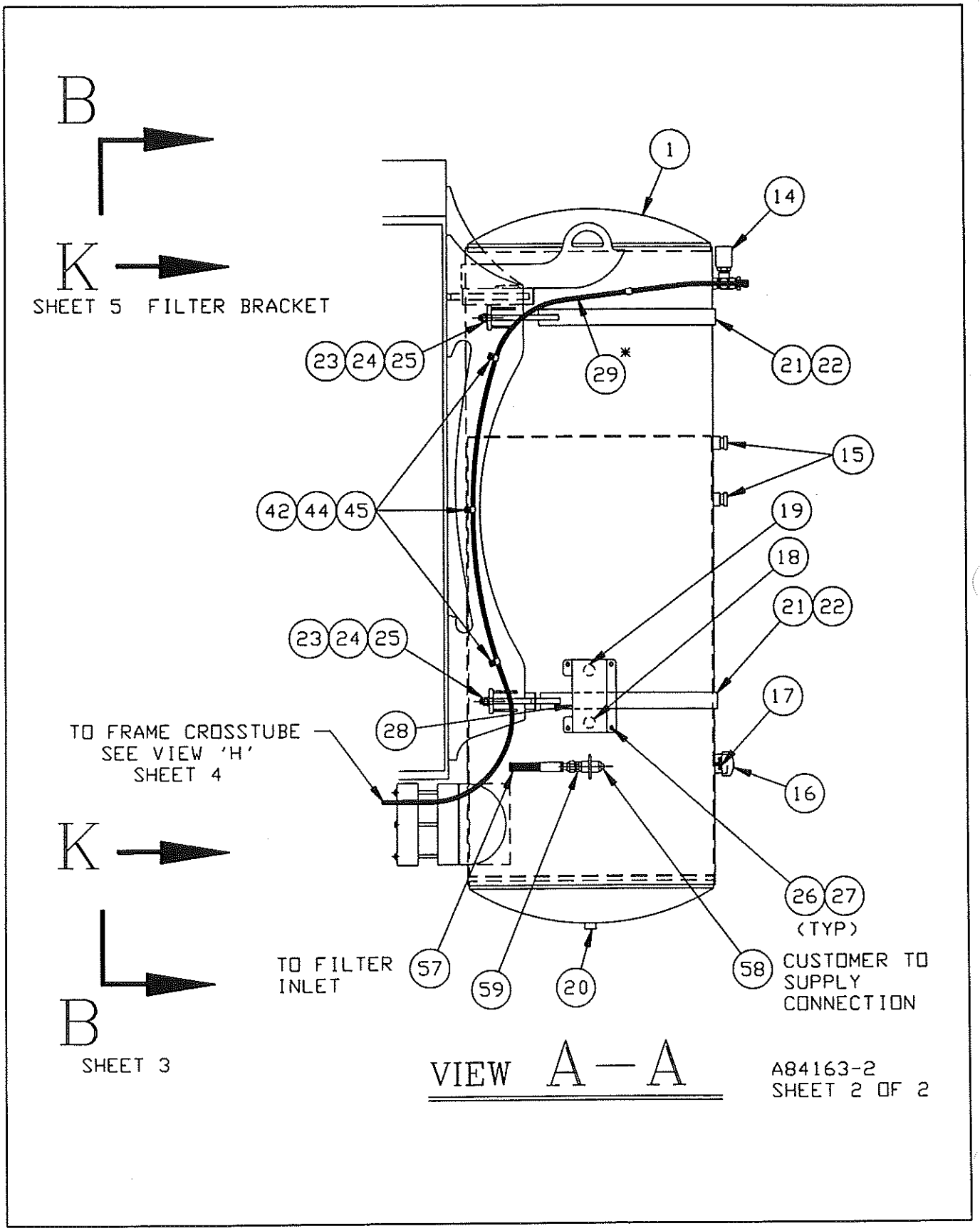


FIGURE 1 - HYDRAULIC TANK ASSEMBLY - CONTINUED

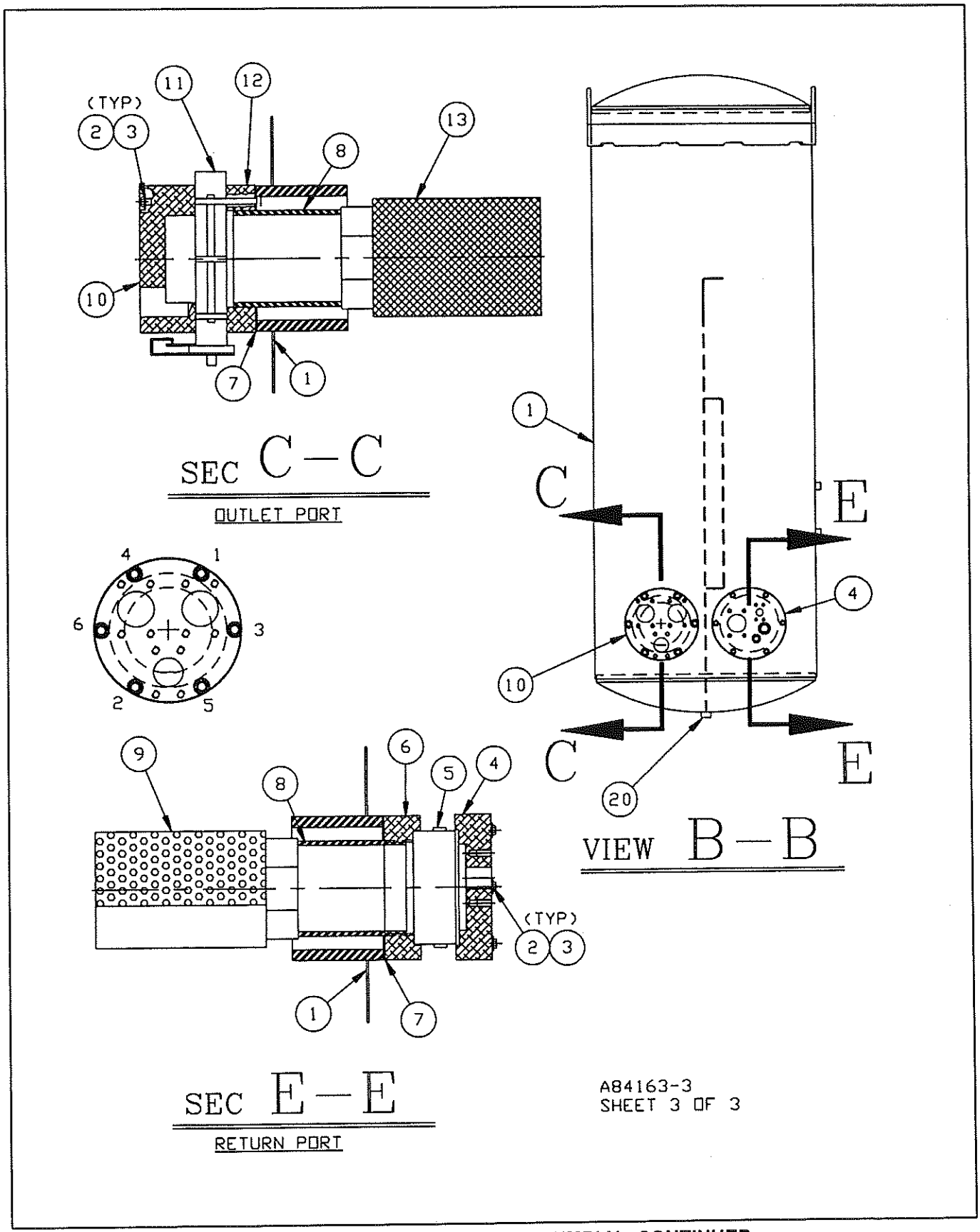
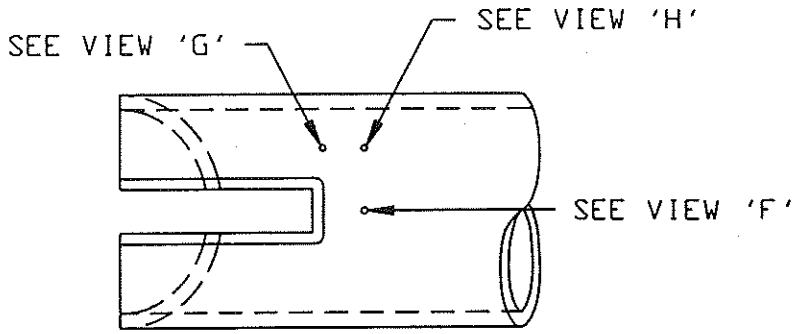
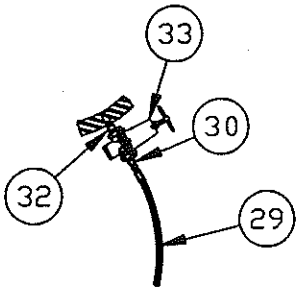


FIGURE 1 - HYDRAULIC TANK ASSEMBLY - CONTINUED

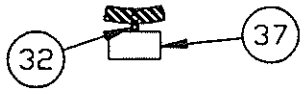


PRESSURIZATION CONNECTIONS

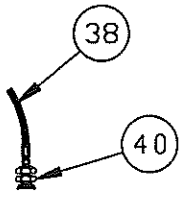
FRONT OF TRUCK



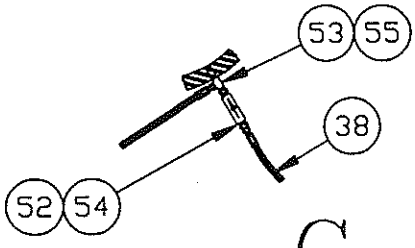
VIEW H



VIEW F



VIEW J



VIEW G

A84163-4
SHEET 4 OF 5

FIGURE 1 - HYDRAULIC TANK ASSEMBLY - CONTINUED

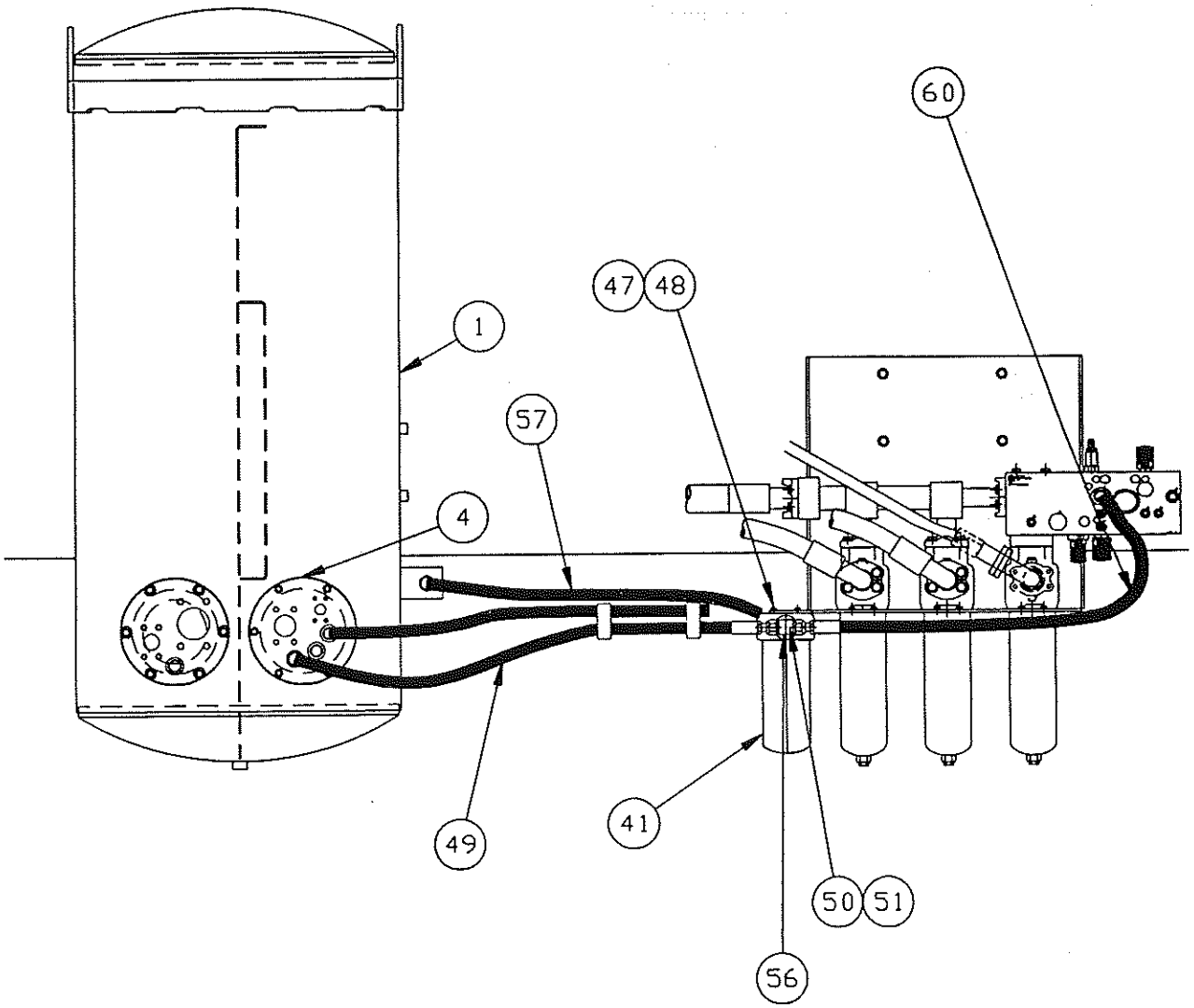


FIGURE 1 - HYDRAULIC TANK ASSEMBLY - CONTINUED

KEY					A84163
01.	Hydraulic Tank	24.	Lockwasher	47.	Capscrew
02.	Capscrew	25.	Nut	48.	Flatwasher
03.	Flatwasher	26.	Capscrew	49.	Hose Assembly
04.	Return Manifold	27.	Flatwasher	50.	Reducer Adapter
05.	Check Valve Insert	28.	Switch Cover	51.	Adapter Fitting
06.	Manifold Spacer	29.	Hose Assembly	52.	Adapter Fitting
07.	Flange Gasket	30.	Straight Adapter	53.	Adapter Fitting
08.	Pipe Nipple	31.	Check Valve	54.	Check Valve
09.	Return Diffuser	32.	Adapter Fitting	55.	Pipe Tee
10.	Suction Manifold	33.	Air Pressure Regulator	56.	Straight Adapter
11.	Butterfly Valve	34.	Nipple Adapter	57.	Hose Assembly
12.	Manifold Spacer	35.	Reducer Bushing	58.	Pipe Plug
13.	Suction Strainer	36.	Pipe Tee	59.	Adapter Fitting
14.	Vacuum Release Valve	37.	Automatic Drain Valve	60.	Hose Assembly
15.	Liquid Level Sight Plug	38.	Hose Assembly	61.	Plug
16.	Pipe Cap	39.	Not Used	62.	Pipe Nipple
17.	Drain Cock	40.	Adapter Fitting	63.	Elbow
18.	Temperature Switch	41.	Adapter Fitting	64.	Adapter Fitting
19.	Oil Level Sensor	42.	Cushion Clamp	65.	Filter Element
20.	Pipe Plug	43.	Capscrew	66.	Bushing
21.	Tank Strap	44.	Nut	67.	Plug
22.	Neoprene Rubber	45.	Lockwasher		
23.	Flatwasher	46.	Clamp Support Assembly		

HYDRAULIC PUMP DRIVE ASSEMBLY

DESCRIPTION AND LOCATION

The hydraulic pump drive assembly is the propeller shaft device mounted from the rear of the main traction alternator to the hydraulic pump assembly.

OPERATION

The assembly transfers the power required to operate the hydraulic dump and steering pump assembly from the output shaft adapter on the rear of the main traction alternator.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Verify that all components are secure and all mounting bolts are tight.

2. Visually inspect that the universal joint bearings remain lubricated as required to maintain smooth operation. Repair or replace as required.

3. Visually inspect the large pump mounting bracket, especially the isolation mounting pads for guidance or looseness, deterioration, or damage. Repair or replace as required.

4. Verify that the proper dimension between the pump bracket front surface (non pump mounting face) and the face of the pump drive adapter (on the rear of the main traction alternator) is maintained. If not, adjust all brackets as outlined in the Installation instructions at the end of this module.

5. Measure the vertical distance between the horizontal centerlines of the driveshaft's front and rear bearings. It should be 3/16 inch (4.6 mm). If not, adjust as outlined in the Installation instructions at the end of this module.

REMOVAL (Figure 2)

The driveshaft may be removed from the unit (without removing the pump) as follows:

1. Loosen (but do not remove) the capscrews and hardened flatwashers (15 and 17) securing the pump mounting bracket (8) to the pump platform (7).

2. Slide the pump assembly rearwards slowly (while still supporting the driveshaft (4)) until the pump drive splines are clear of the driveshaft.

3. Remove the capscrews securing the driveshaft to the alternator.

4. Remove the driveshaft and scavenger blower drive sheave (if so equipped).

DISASSEMBLY (Figure 1)

The driveshaft may be disassembled as follows:

1. Remove the capscrews (6, Figure 2) securing the splined slip yoke (5, Figure 2) to the driveshaft.

2. Remove the internal snap rings that secure the individual bearing crosses on the universal joint to be replaced.

3. Following normal shop safety practices and using the appropriate presses, remove the bearing caps from the shaft and yoke assemblies.

IMPORTANT: *It is recommended to support the driveshaft components to prevent distortion during the removal process. If the bearings are difficult to remove, use extra care not to distort or damage the shaft components.*

4. Remove the center cross assembly.

INSPECTION AND REPAIR

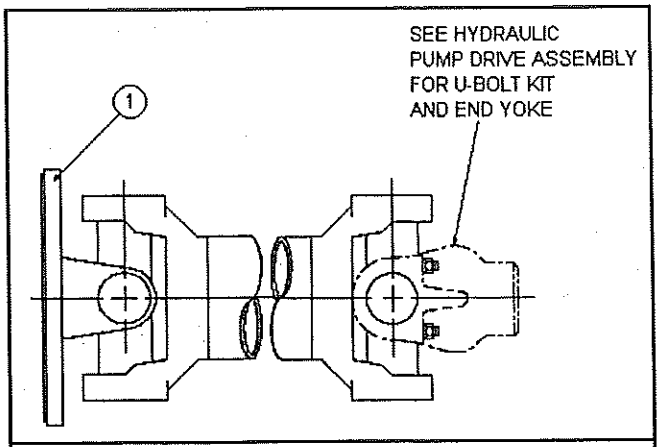
The disassembled driveshaft may be inspected as follows:

1. Clean all metal parts in solvent and dry with compressed air.

2. Inspect for evidence of wear, damage, or leakage. Repair or replace as required.

NOTE: *If the base shaft assembly is damaged, it should be repaired, straightened, or replaced, then rebalanced.*

3. Review the removed bearing assemblies to determine their probable cause of malfunctioning. If other than normal wear over an extended period of time, repair or replace other components as required.



KEY	
01.	Yoke Flange

FIGURE 1 - DRIVESHAFT ASSEMBLY (84202A)

ASSEMBLY

The driveshaft may be assembled as follows:

1. Carefully remove the bearing cap assemblies from the ends to be installed. Use extra care not to allow the bearing needles to become dislodged from their operating position or contaminated.

2. Secure the remaining bearing caps to prevent their unwanted separation from the cross assembly.

3. Following normal shop safety practices and using the appropriate presses, install the bearing caps into the shaft or yoke assembly from the outside, pressing inward until the caps are sufficiently inserted to clear the internal retaining ring groove.

IMPORTANT: *It is recommended to support the driveshaft components to prevent distortion during the installation process. If the bearings are difficult to install, use extra care not to distort or damage the shaft components.*

4. Secure the caps with the retaining rings provided.

5. Repeat steps 1 through 3 on the remaining bearing cap assemblies.

6. Install the splined slip yoke (5, Figure 2) to the driveshaft, securing with capscrews (6, Figure 2). Tighten to 32 to 27 ft.-lbs. (43 to 50 Nm).

INSTALLATION

The driveshaft may be installed as follows:

1. Verify the following are smooth and free of knicks and in general good repair:

a. Alternator shaft drive face and/or sheave mounting surfaces on units equipped with a belt driven cooling system air scavenger blower.

b. Flange end of driveshaft.

c. Splined end of driveshaft.

d. Pump drive splines.

2. Grease the pump shaft and yoke spline to improve installation ease.

3. Verify the lip seal (3) is installed in the pump bracket (8).

4. Install the flanged end on the driveshaft (with the sheave, if so equipped) onto the alternator drive face on the rotor shaft. Torque the capscrews to 32 to 37 ft-lbs (43 to 50 Nm).

5. If not already done, loosen the capscrews (15) and slide the pump assembly as far rearward on the platform (7) as possible.

6. Slide the pump assembly forward and align the splines on the pump with those on the driveshaft yoke.

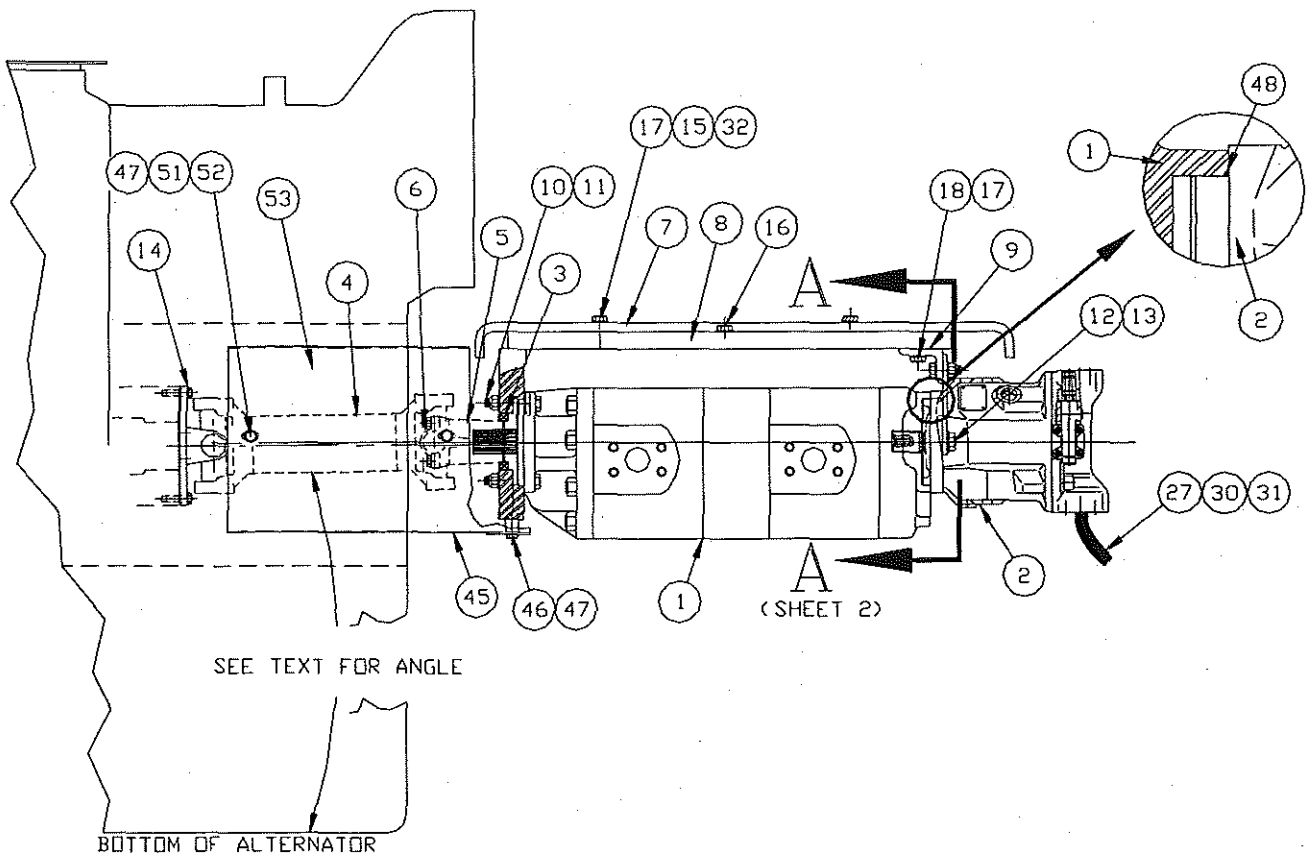
7. Once aligned, gently slide the pumps forward until the pumps will not move. Then move the pumps rearward 3/16 inch (4.6 mm).

NOTE: *When properly adjusted there should be approximately 3/16 inch (4.6 mm) forward and 2-1/2 inch (64 mm) aft adjustment.*

8. Check the angle of the driveshaft relative to parallel with the bottom of the alternator and compare it to the data in Table 1 (+/- 1/2°) and instructions outlined in Figure 1.

TABLE 1 - DRIVESHAFT ALIGNMENT	
MODEL	**ANGLE**
MT3600B/3700B (with smaller steering pump)	1-1/2°
MT3600B/3700B (with larger steering pump)	2°
MT4400/260AC	2°

13872



KEY A85186

01.	Double Dump Pump Assembly	18.	Capscrew	35.	Hose Clamp Bracket
02.	Steering Piston Pump	19.	Capscrew (Grade 8)	36.	Clamp Halves
03.	Seal	20.	Support Bracket	37.	Clamp Cap Plate
04.	Pump Driveshaft	21.	Capscrew	38.	Capscrew
05.	Slip Yoke	22.	Locknut	39.	Clamp Halves or Clamp Plate Assy.
06.	Strap and Bolt Kit	23.	Rubber Mounting Block	40.	Through Item 44. - Not Used
07.	Pump Platform	24.	Bushing	45.	Driveline Guard
08.	Pump Bracket	25.	Mounting Washer	46.	Capscrew (Grade 8)
09.	Pump Tail Support Bracket	26.	Hardened Flatwasher	47.	Flatwasher
10.	Locknut	27.	Hose Assembly	48.	O-ring
11.	Capscrew (Grade 8)	28.	Hose Assembly	49.	Capscrew
12.	Capscrew (Grade 8)	29.	Hose Assembly	50.	Clamp Halves
13.	Lockwasher	30.	Flange Kit	51.	Locknut
14.	Capscrew (Grade 8)	31.	Flange Kit	52.	Capscrew
15.	Capscrew (Grade 8)	32.	(Cab) Mounting Washer	53.	Upper Driveline Guard
16.	Capscrew	33.	Not Used		
17.	Hardened Flatwasher	34.	Not Used		

FIGURE 2 - HYDRAULIC PUMP DRIVE ASSEMBLY (A85186, SHEET 1 OF 3)

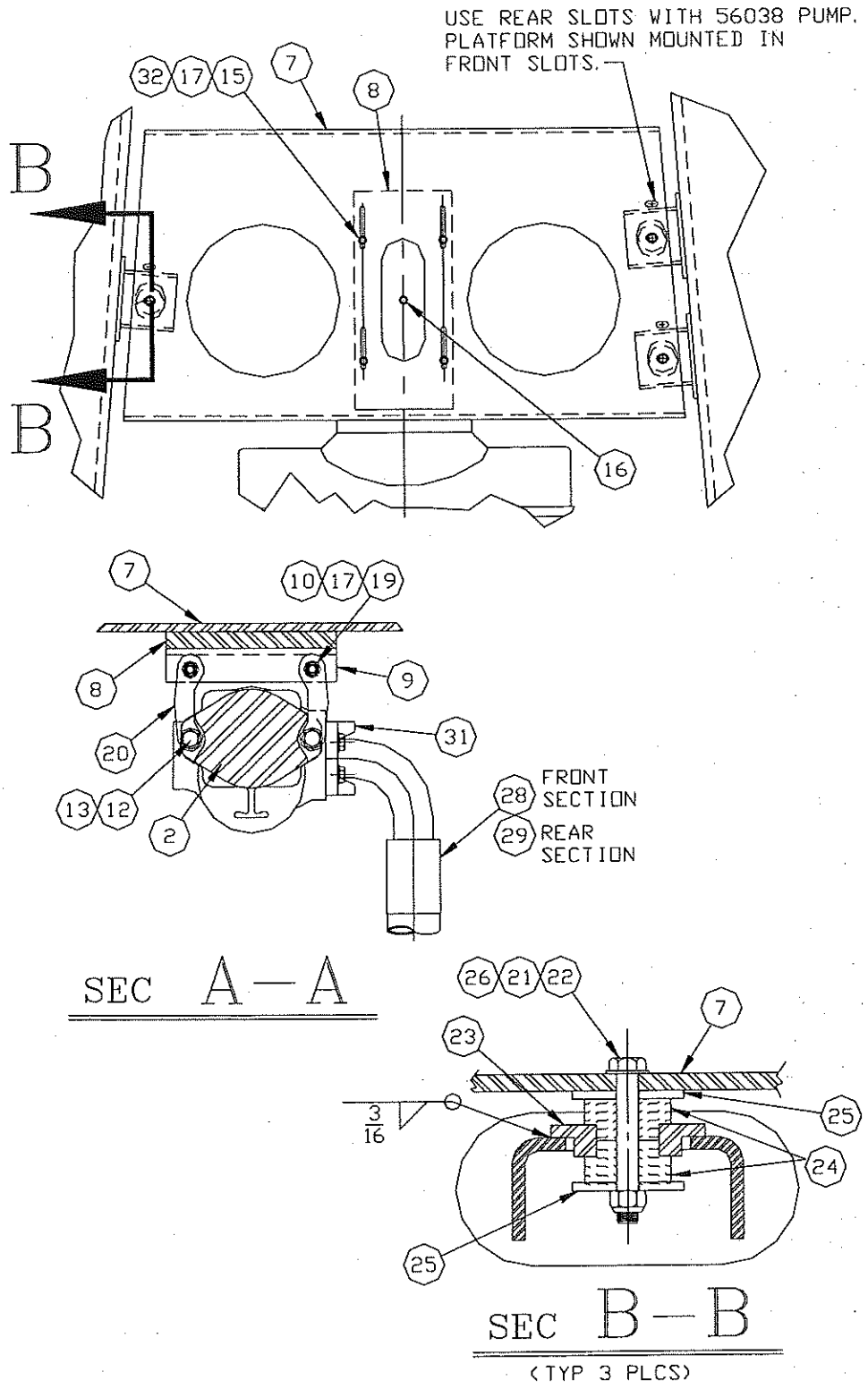
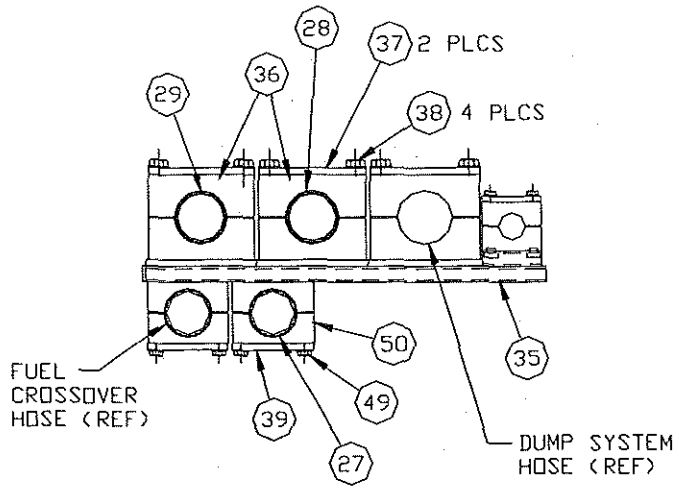
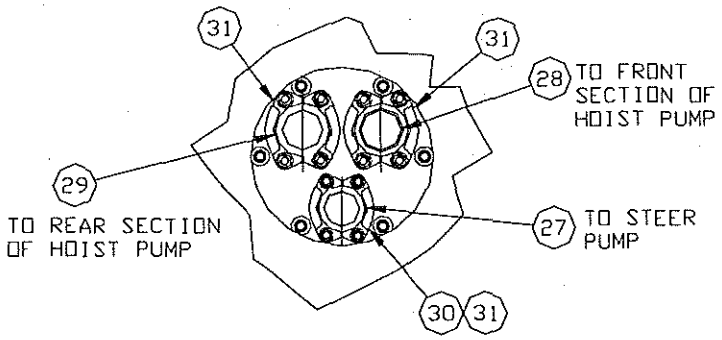


FIGURE 2 - HYDRAULIC PUMP DRIVE ASSEMBLY (A85186, SHEET 2 OF 3)



HOSE SUPPORT ASSEMBLY



SUCTION PORTS ON
HYDRAULIC TANK

FIGURE 2 - HYDRAULIC PUMP DRIVE ASSEMBLY (A85186, SHEET 3 OF 3)

NOTES: *The use of an electronic or precision protractor or equivalent is recommended to obtain this dimension.*

9. Secure the pump assembly with the capscrews (15) and hardened flatwashers (17).

10. Fill the grease cavity, using the grease fitting inside of the driveshaft U-joint.

NOTE: *When properly installed, there should be approximately 3/8 inch (9.5 mm) forward adjustment and approximately 2-1/2 inches (64 mm) aft adjustment.*

BRAKE MANIFOLD ASSEMBLY

DESCRIPTION AND LOCATION

The brake manifold assembly is a rectangular shaped metal valve with several external poppets and multiple hose connections ports. It is generally mounted inside the hydraulic components box.

OPERATION

The brake manifold serves as a centralized assembly to provide the following provisions:

1. Park brake solenoid valves

a. Park brake solenoid valve - dual coil, latching type, electric solenoid valve that controls the flow of pressurized oil to the park brake system to allow the brakes to be applied or released.

b. Park brake shut-off valve - electric solenoid/check valve assembly that prevents the flow of oil to the system except when the solenoid is energized. The system is wired to allow this only to occur when the operator is holding the Park Brake Switch in the Release position.

2. Load brake solenoid - electric solenoid valve cartridge that control the flow of pressurized oil to the load brake system to allow the rear brake service calipers to be applied or released.

3. Auto apply solenoid (optional) - electric solenoid valve cartridge that control the flow of pressurized oil to the load brake system to cause the rear brake service calipers to apply if the system supply pressure decreases to less than a predetermined level.

4. Accumulator drains

a. Manual - cartridge assembly with either a manual pull type valve assembly (spring loaded to the closed position) or a needle type valve that provide a means of manually releasing any pressure remaining in the brake accumulator.

b. Automatic/Manual - on early production manifolds and trucks, there was an electric solenoid valve cartridge assembly that controlled the flow of oil from the rear brake accumulator system to the tank caused the rear (and thus the supply) accumulators to drain each time the truck's Master Switch was turned Off. An externally controlled manual drain provision was incorporated into this cartridge.

5. Low brake pressure switch - electric switch assembly that monitors the system supply pressure (accumulator pressure) and causes a cab dash Low Brake Pressure indicator to light.

6. Park brake pressure switch - electric switch assembly that monitors the park brake system pressure and causes a cab dash Park Brake indicator to light if the pressure decreases to a level at which the park brake calipers will apply.

7. Auto apply pressure switch – available electric switch assembly that monitors the brake system supply pressure and causes a cab dash auto apply solenoid to shift and automatically apply the trucks rear service brakes if the pressure decreases to the level that the park brakes will apply.

8. Internal pressure reducing valve (if so equipped) – a cartridge assembly installed in an internal port designed to limit the maximum pressure available to the park brake system calipers.

There are a number of ports on the manifold including:

1. (AL) port - not used at this time.

2. Rear brake accumulator (RBA) port - outlet pressure to the rear brake accumulator.

3. Supply brake accumulator (SBA) port - outlet pressure to the supply brake accumulator.

4. Pressure (P) port - inlet pressure from the steering manifold assembly.

5. Test station supply (TSS) port - outlet pressure to the gauge monitoring the supply brake accumulator pressure.

6. Front brake accumulator (FBA) port - outlet pressure to the front brake accumulator.

7. Test station front (TSF) port - mounting port for the quick disconnect fitting that monitors the pressure in the front brake accumulator.

8. Brake switch (BS) port - mounting port for the low brake pressure switch.

9. Auto apply switch (AAS) port - mounting port for the optional auto apply pressure switch.

10. Park brake (PB) port - outlet pressure to the wheelmotor mounted park brake assemblies.

11. Park brake switch (PBS) port - mounting port for the Park Brake Pressure switch.

12. Park brake supply (PBS) port - outlet pressure to the gauge monitoring the pressure in the park brake supply system.

13. Brake valve front (BVF) port - outlet port to the front brake control section of the brake (controller) valve.

14. Pilot valve (PV) port - outlet pressure to the cab mounted brake pilot valve assembly.

15. Load brake (LB) port - outlet pressure to the load brake shuttle valve and the load brake application system.

16. Pilot valve tank (PVT) port - return pressure from the pilot valve assembly.

17. Brake valve tank (BVT) port - return pressure from the brake (controller) valve assembly.

18. Drain (DR) port - outlet port from the manifold assembly to the main hydraulic reservoir. The back pressure of this flow is reduced by the operation of the venturi assembly.

19. Brake accumulator drain (BAD) port - outlet ports for the manifold mounted manual brake accumulator drain valves to the main hydraulic system reservoir.

20. Auto apply (AA) port - outlet port to the optional auto apply shuttle valve and remainder of the control function.

21. Test station rear (TSR) port - mounting port for the quick disconnect fitting that monitors the pressure in the rear brake accumulator.

22. Brake valve rear (BVR) port - outlet port for the rear brake control section of the brake (controller) valve.

Pressurized hydraulic oil from the steering manifold assembly enters the brake manifold through the "P" port.

The pressurized oil is routed to the three brake accumulators, which are plumbed with check valves in the manifold to maintain independence between the front and rear brake systems. Spring loaded, normally closed, drain valves are included to allow the front or rear brake accumulator to be drained of hydraulic pressure during maintenance. The supply accumulator drains through either the front or rear drain system, depending upon their release rates and pressures.

NOTE: *On early production manifolds and trucks, a 24 Vdc solenoid valve (with a manual drain provision) was provided to drain the rear brake accumulator each time the Master Switch was turned Off.*

The low brake pressure switch monitors the pressure in the brake supply accumulator, which will be equal to the front or rear brake accumulators (whichever is lower) and causes a dash mounted indicator to light when the pressure in this accumulator is less than 2100 psi (14 480 kPa).

If so equipped, the auto apply switch also monitors the brake supply accumulator pressure. When it is less than 1400 psi (9 655 kPa), the switch closes to supply power to the auto apply solenoid, which opens and supplies pressurized oil to the automatic brake application system.

The load brake solenoid (controlled by a cab mounted switch) controls the flow of oil to the load brake shuttle valve and then on to the rear service brakes.

The park brake solenoid valve provides a flow of oil to apply and release the wheelmotor mounted park brake calipers. The park brake shut-off valve prevents the flow through the system except when the solenoid is energized, typically when the Park Brake switch is in the Release position.

The pressure regulator or reducing cartridge (if so equipped) limits the maximum pressure available to operate the park brake caliper assemblies, when this is desired or required.

Detailed information on each of these systems is included in the system information in Section 5 - Hydraulic System.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance of the manifold should include the following:

1. Inspect the valve for evidence of leakage or damage. Repair or replace as required.

2. Test the operation of the functions of the manifold as outlined in the instructions for the dump, steering and brake systems in Section 5 - Hydraulic System.

REMOVAL

The manifold may be removed from the truck as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Drain all pressure in the system as outlined in the procedures on system operation and testing in Section 5 - Hydraulic System. This includes both the steering and brake system accumulators.

⚠WARNING

Always release all hydraulic pressure in the system before loosening or removing any hydraulic lines.

3. Disconnect all hydraulic fittings from the valve. Cap or plug all openings. Label each to aid in installation.

4. Remove the capscrews that secure the valve to the mounting bracket.

. Remove the valve.

DISASSEMBLY (Figures 1A and B)

NOTE: *Figure 1A represents a brake manifold without an internal park brake pressure regulator or reducing valve that does. Figure 1B represents brake manifolds that incorporate this function with an internal mounted cartridge assembly.*

The manifold may be disassembled as follows:

NOTE: *During the disassembly and repair procedures, it is always a recommended practice to carefully note the specific installation and orientation of components before and as they are removed to aid in proper reassembly.*

1. Remove the load brake solenoid valve cartridge assembly (3).

2. Remove check valve cartridge assemblies (4, 8, and 13).

3. Remove the needle or button manual drain valve cartridge assemblies (5 and 14).

4. Remove the park brake shut-off valve cartridge assembly (6).

5. Remove the park brake solenoid valve assembly (2).

6. Remove the O-ring plugs, using care to note the location from which they were removed to aid in the reassembly.

7. Remove the park brake regulator or pressure reducing cartridge (11. Figure 1B), if so equipped.

8. Remove the plug valve or auto apply solenoid cartridge (if so equipped).

9. Remove the low brake pressure and park brake pressure switches (not shown) and any other remaining hardware.

INSPECTION AND REPAIR

The manifold components may be serviced as follows:

1. Inspect, then remove and discard all used O-rings when new ones are included in the new seal kit. Evidence of damage to the ring should be investigated for cause as it may indicate problems in other areas. It is recommended that all O-rings and seals are replaced each time removed to ensure proper valve sealing and operation.

2. Clean all parts thoroughly with clean solvent and dry with compressed air. Do not use rags or solvents that will leave a residue.

3. Remove any indicated burrs or high spots from any surfaces. Re-clean if required.

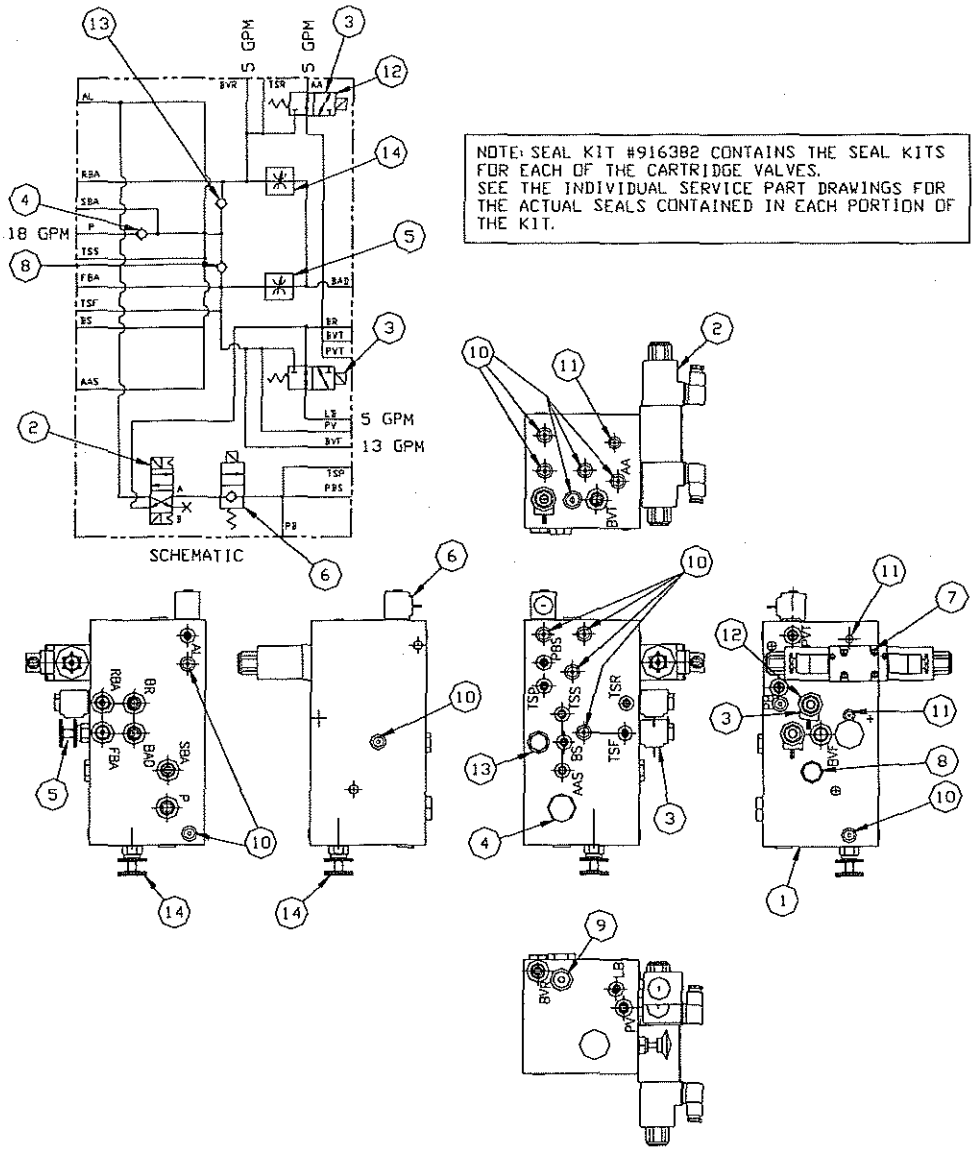
4. Inspect the valve body (1) and all other components for evidence of wear or damage. Particular attention should be paid to the bores, mating surfaces, and thread areas. If found to be significant the assembly must be replaced.

5. Test the operation of all solenoid valves by carefully applying 24 Vdc power and ground to the appropriate coil leads. Repair or replace as required. Torque the new coils to 4 to 6 ft-lbs. (5 - 8 Nm).

NOTE: *Separate instructions on the dual coil park brake solenoid valve are contained in Section 5 - Hydraulic System in this manual.*

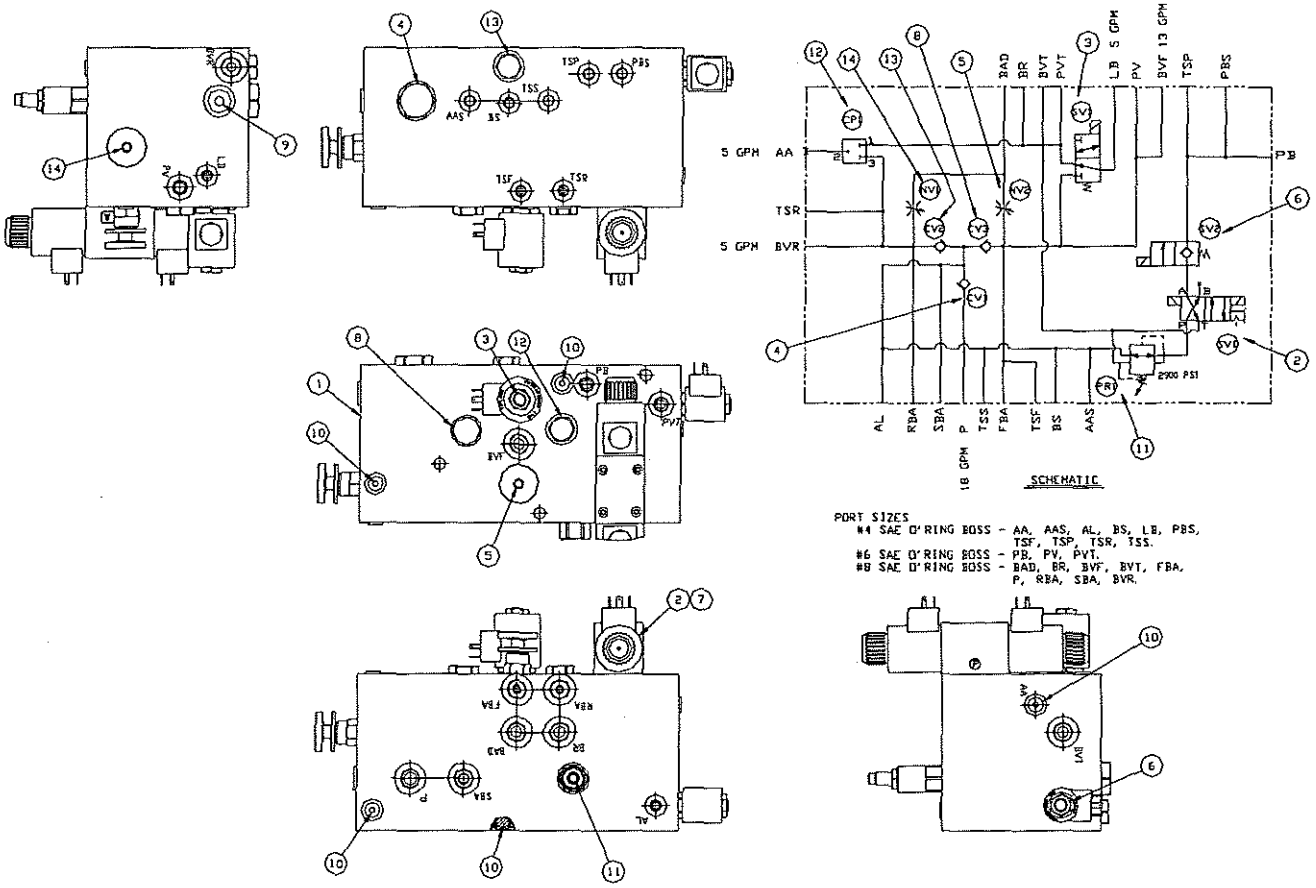
ASSEMBLY (Figure 1 unless listed otherwise)

The manifold may be assembled as follows:



KEY	84767A
01.	Manifold Body
02.	Park Brake Solenoid Valve Assembly
03.	Load Brake Solenoid Valve Cartridge Assembly
04.	Check Valve Cartridge Assembly
05.	Manual Drain Valve Cartridge Assembly
06.	Park Brake Shut-off Solenoid Valve Cartridge Assemblies
07.	Socket Head Capscrew
08.	Check Valve Cartridge Assembly
09.	#8 O-ring Plug
10.	#4 O-ring Plug
11.	#2 O-ring Plug
12.	O-ring Plug Cartridge
13.	Check Valve Cartridge Assembly
14.	Manual Drain Valve Cartridge Assembly (See Note on drawing.)

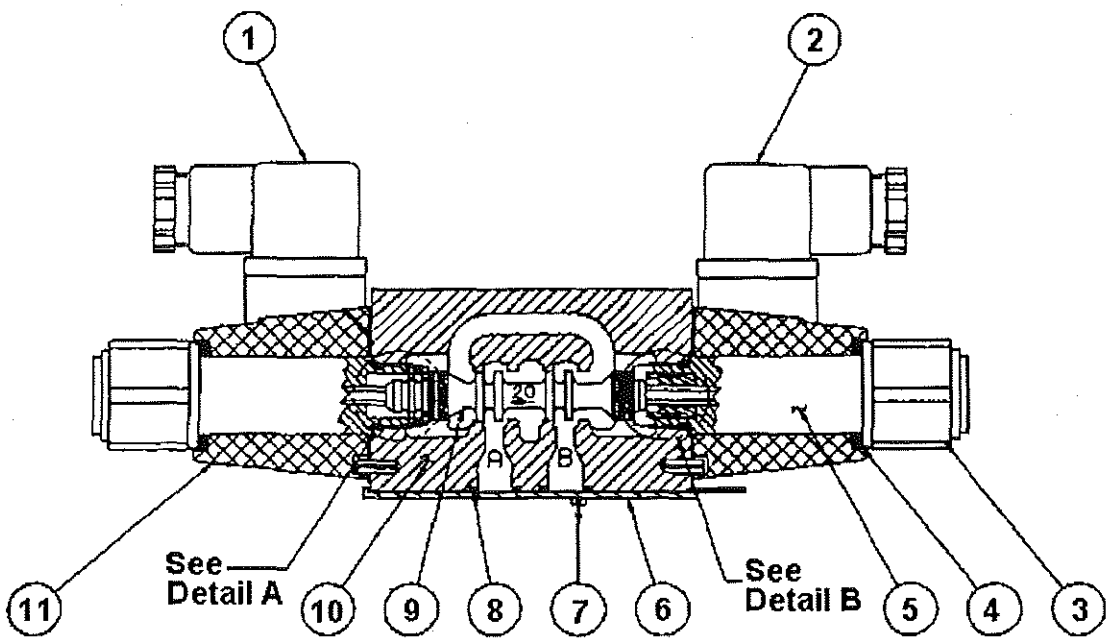
FIGURE 1A - BRAKE MANIFOLD ASSEMBLY – WITHOUT PARK BRAKE PRESSURE REGULATOR

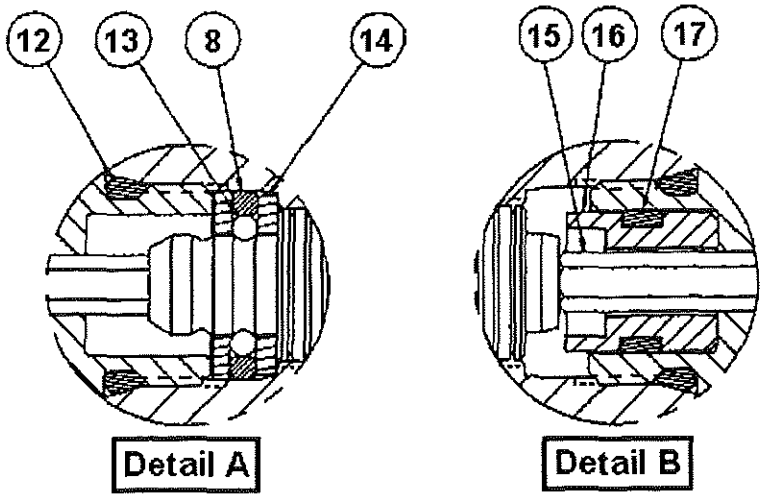


KEY	85605A
01.	Manifold Body
02.	Park Brake Solenoid Valve Assembly
03.	Load Brake Solenoid Valve Cartridge Assembly
04.	Check Valve Cartridge Assembly
05.	Needle Valve Cartridge Drain Assembly
06.	Park Brake Shut-off Solenoid Valve Cartridge Assemblies
07.	Socket Head Capscrew
08.	Check Valve Cartridge Assembly
09.	#8 O-ring Plug
10.	#4 O-ring Plug
11.	Park Brake Pressure Regulator Cartridge Assembly
12.	Valve Plug Cartridge Assembly
13.	Check Valve Cartridge Assembly
14.	Needle Valve Cartridge Drain Assembly

FIGURE 1B - BRAKE MANIFOLD ASSEMBLY – INCORPORATING PARK BRAKE PRESSURE REGULATOR

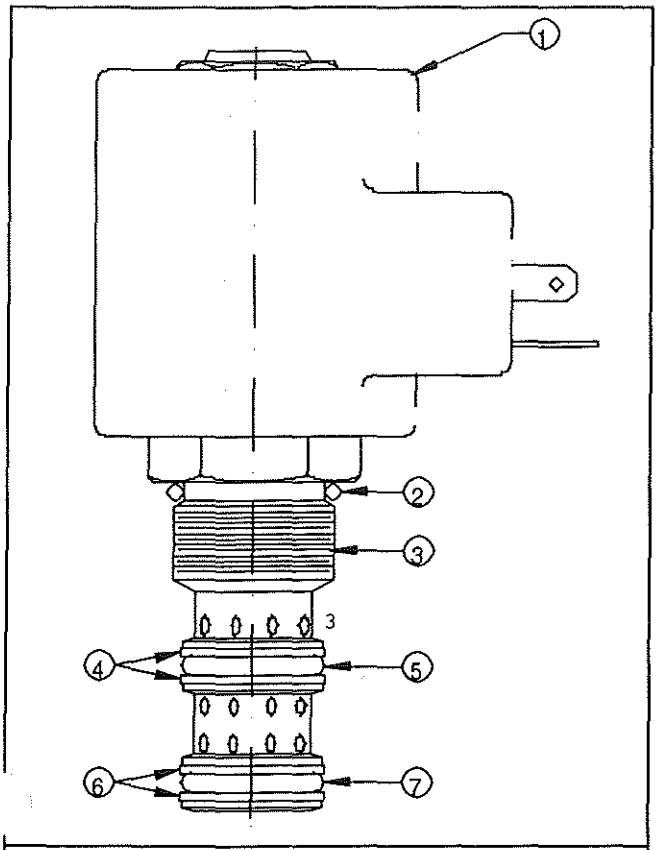
KEY					56074
01.	Black Plug	07.	Roll Pin	13.	Ball
02.	Gray Plug	08.	O-ring	14.	Ball Clamp
03.	Coil Retainer	09.	Spool	15.	Push Rod
04.	Coil Seal	10.	Body	16.	Spool Stop
05.	Tube	11.	Coil	17.	O-ring
06.	Shipping Plate (Remove for operation)	12.	O-ring		





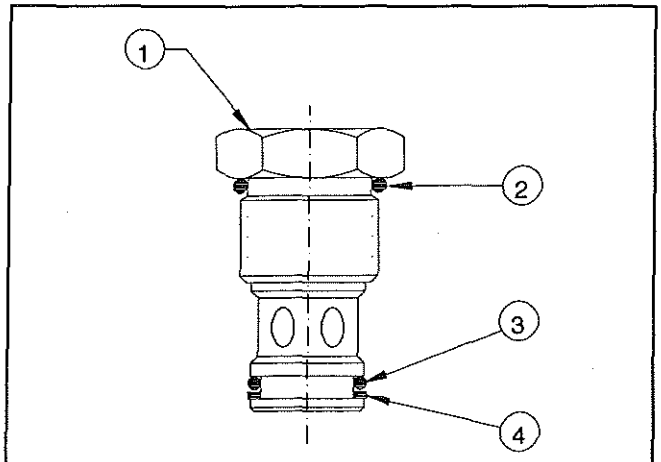
NOTE: There are two coil assemblies included in each valve. The listed quantities of components are per valve not each coil assembly.

FIGURE 2 - PARK BRAKE SOLENOID VALVE ASSEMBLY



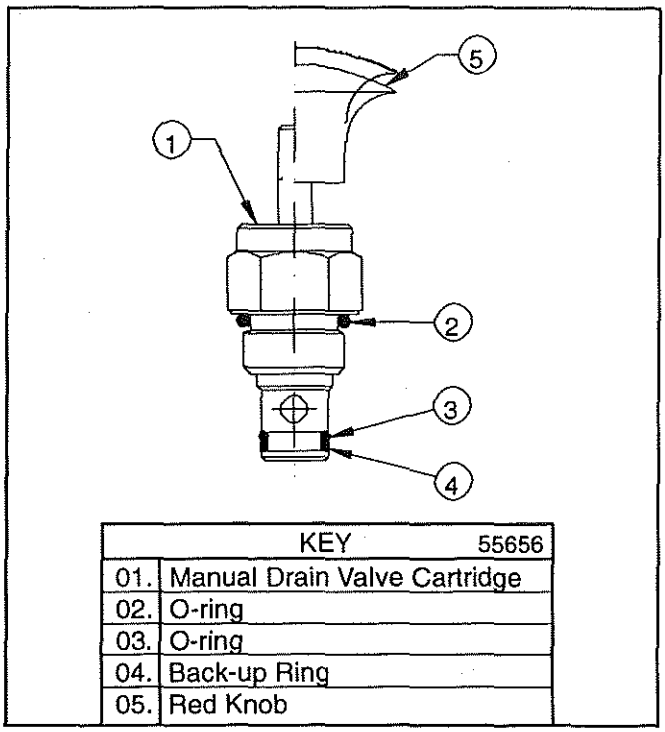
KEY			56081
01.	24 Vdc Coil	05.	O-ring
02.	O-ring	06.	Back-up Ring
03.	Solenoid Valve Cartridge	07.	O-ring
04.	Back-up Ring		

FIGURE 3 - LOAD BRAKE VALVE CARTRIDGE ASSEMBLY



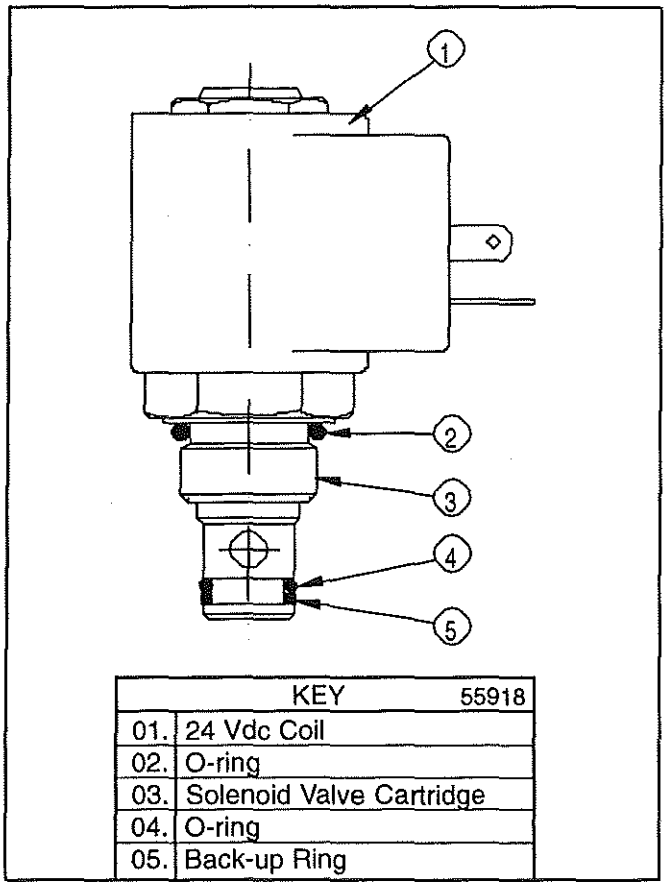
KEY			55644
01.	Check Valve Cartridge	03.	O-ring
02.	O-ring	04.	Back-up Ring

FIGURE 4 - CHECK VALVE CARTRIDGE ASSEMBLY



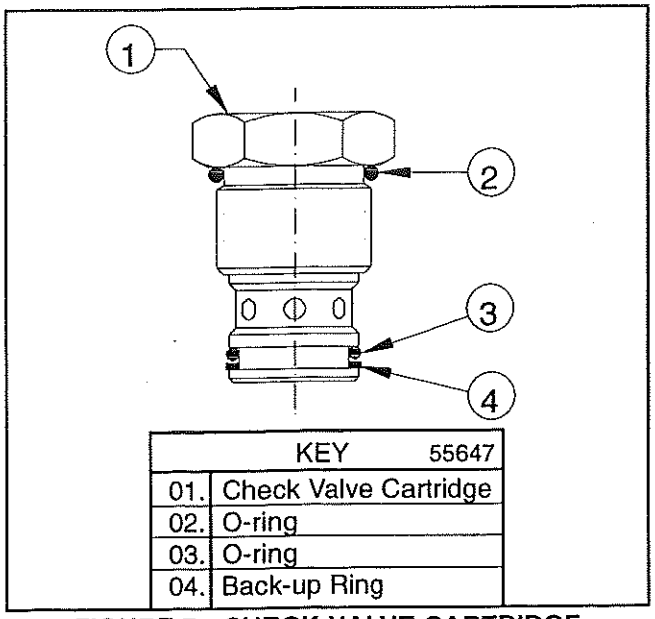
KEY		55656
01.	Manual Drain Valve Cartridge	
02.	O-ring	
03.	O-ring	
04.	Back-up Ring	
05.	Red Knob	

FIGURE 5 - MANUAL DRAIN VALVE CARTRIDGE ASSEMBLY



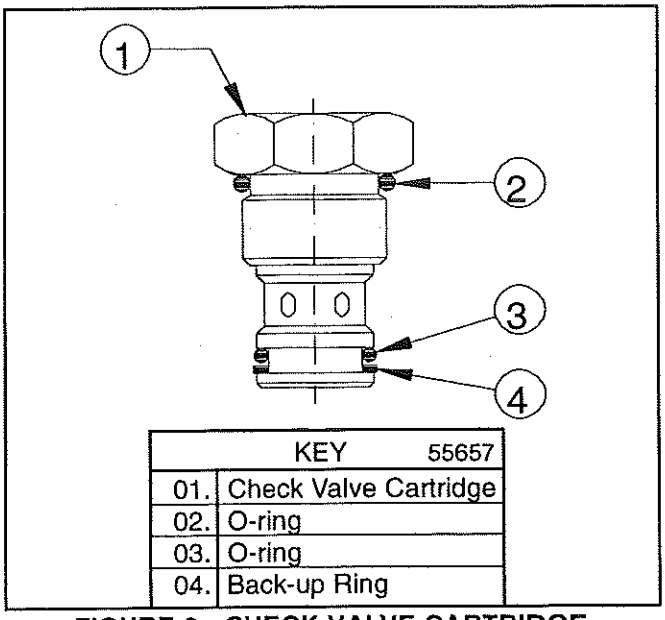
KEY		55918
01.	24 Vdc Coil	
02.	O-ring	
03.	Solenoid Valve Cartridge	
04.	O-ring	
05.	Back-up Ring	

FIGURE 6 - PARK BRAKE SHUT-OFF VALVE CARTRIDGE ASSEMBLY



KEY	55647
01.	Check Valve Cartridge
02.	O-ring
03.	O-ring
04.	Back-up Ring

FIGURE 7 - CHECK VALVE CARTRIDGE



KEY	55657
01.	Check Valve Cartridge
02.	O-ring
03.	O-ring
04.	Back-up Ring

FIGURE 8 - CHECK VALVE CARTRIDGE

NOTE: *If the solenoid coils are removed during their installation process, torque the new coils to 4 to 6 ft-lbs. (5 to 8 Nm).*

1. Check that all parts are clean and free of defects.

2. Install the O-rings and back-up rings on all components as shown in the applicable illustrations (Figures 2 through 10).

NOTE: *Items 11 and 12 in Figure 1B should install in a manner similar to their corresponding items in Figure 1A.*

3. Lubricate all O-rings and bores and threads in the valve body with clean hydraulic fluid compatible with that used in the truck's hydraulic system.

4. Install the O-ring plugs (items 9 through 11). Torque as outlined in the procedures in Section 10 - Miscellaneous.

NOTE: *If the manifold is equipped integral pressure regulating or reducing valve and plug valve cartridges (items 11 and 12, Figure 1B), they should be installed and torqued to 20 ft.-lbs. (27Nm)*

5. Install the cartridge valve plug or auto-apply solenoid cartridge assembly (if so equipped). Torque to 20 ft-lbs. (27 Nm).

6. Install the check valve cartridge assembly (8). Torque to 25 ft-lbs. (33 Nm).

7. Install the check valve cartridge assembly (13). Torque to 20 ft-lbs. (27 Nm).

8. Install the park brake shut-off solenoid cartridge assembly (6). Torque to 20 ft-lbs. (27 Nm).

9. Install the needle or pushbutton manual drain valve cartridge assemblies (5 and 14). Torque to 20 ft-lbs. (27 Nm).

NOTE: *Where applicable, install the automatic/manual accumulator drain solenoid valve assembly (14). Torque to 20 ft-lbs. (27 Nm).*

10. Install the check valve cartridge assembly (4). Torque to 35 ft-lbs. (47 Nm).

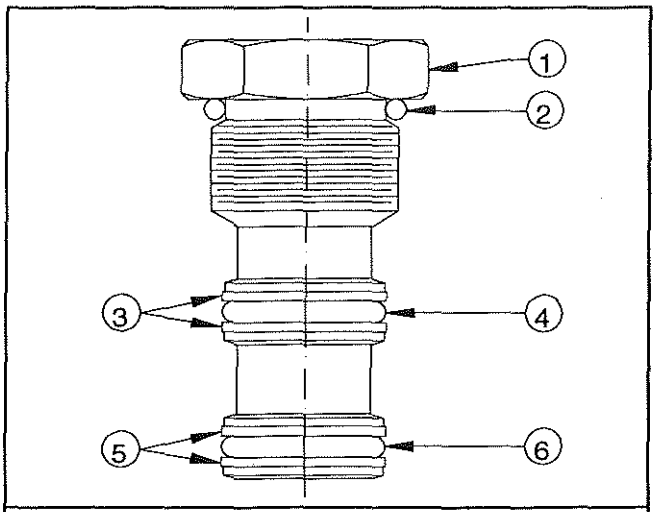
11. Install the load brake solenoid valve cartridge assembly (3). Torque to 25 ft-lbs. (33 Nm).

12. Install the park brake solenoid valve assembly (2). Torque to 20 ft-lbs. (27 Nm).

13. Install the low brake pressure and park brake pressure switches (not shown) and any other remaining hardware. Torque each as outlined in the instructions in Section 10 - Miscellaneous.

14. Install caps on all open ports.

15. Clean and prepare for installation.



KEY			56082
01.	Plug Valve Cartridge	04.	O-ring
02.	O-ring	05.	Back-up Ring
03.	Back-up Ring	06.	O-ring

FIGURE 9 - PLUG VALVE CARTRIDGE

INSTALLATION

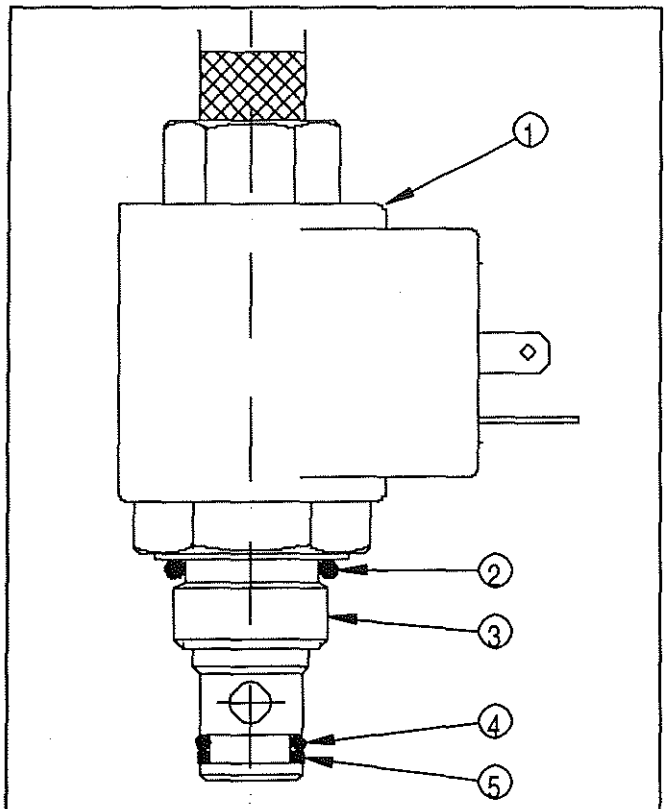
e manifold may be installed as follows:

1. Install the valve on the mounting brackets. Secure with the appropriate capscrews and related hardware.

2. Connect all hydraulic lines and electrical wires. Torque each connection as outlined in the instructions in Section 10 - Miscellaneous.

3. Bleed and test all systems as outlined in the procedures for the dump, steering, and brake systems in Section 5 - Hydraulic System.

NOTE: *Entrapped air should be bled from all three systems.*



KEY			55972
01.	24 Vdc Solenoid Coil	04.	O-ring
02.	O-ring	05.	Back-up Ring
03.	Cartridge Valve		

FIGURE 10 - AUTOMATIC/MANUAL ACCUMULATOR DRAIN ASSEMBLY (WHERE APPLICABLE)

HYDRAULIC SCAVENGER BLOWER SYSTEM

DESCRIPTION AND LOCATION

The hydraulic scavenger blower system consists of the following components:

1. Flow control valve - preset hydraulic valve mounted near the steering manifold.

2. Hydraulic motor - gear type motor assembly attached to the blower assembly mounted on the top of the pump platform.

3. Check valve - spring operated valve mounted on the return line to the hydraulic system near the steering manifold.

OPERATION (Figure 1)

Each electric drive truck incorporates into its design a system of pressurizing and moving significant amounts of air for the purpose of cooling the various electrical components. Detailed information on this system is contained in the information on alternator and wheel motor cooling in Section 4 - Power Package in this manual.

On some trucks, an auxiliary cleaning system is available to assist in pre-cleaning this air flow to minimize the ingestion of contamination into the electrical system components. In this system, a panel of Donaldson Dynaclone ducts, similar to those used in the Donaldson engine air cleaner assemblies, is installed behind the control box. As the air is pulled through these ducts, it is forced to swirl and the resulting centrifugal force causes much of the debris and dirt particles to be separated from the air flow. An independent "scavenger blower" draws a separate air flow along the tube area and exhausts the separated material out through its blower output.

One method of driving the scavenger blower system is with a hydraulic motor. In this system, a portion of the flow from the steering and brake supply system is diverted from its normal path. This flow is directed to a gear type hydraulic motor attached to the scavenger blower wheel.

The inlet flow passes through a flow regulator that limits the maximum amount of oil diverted. This regulator both controls the amount of flow diverted and the speed at which the motor and blower wheel operate.

The outlet flow passes through a spring loaded check valve, installed to provide a back pressure of approximately 65 psi (250 kPa) as well as prohibit reverse op-

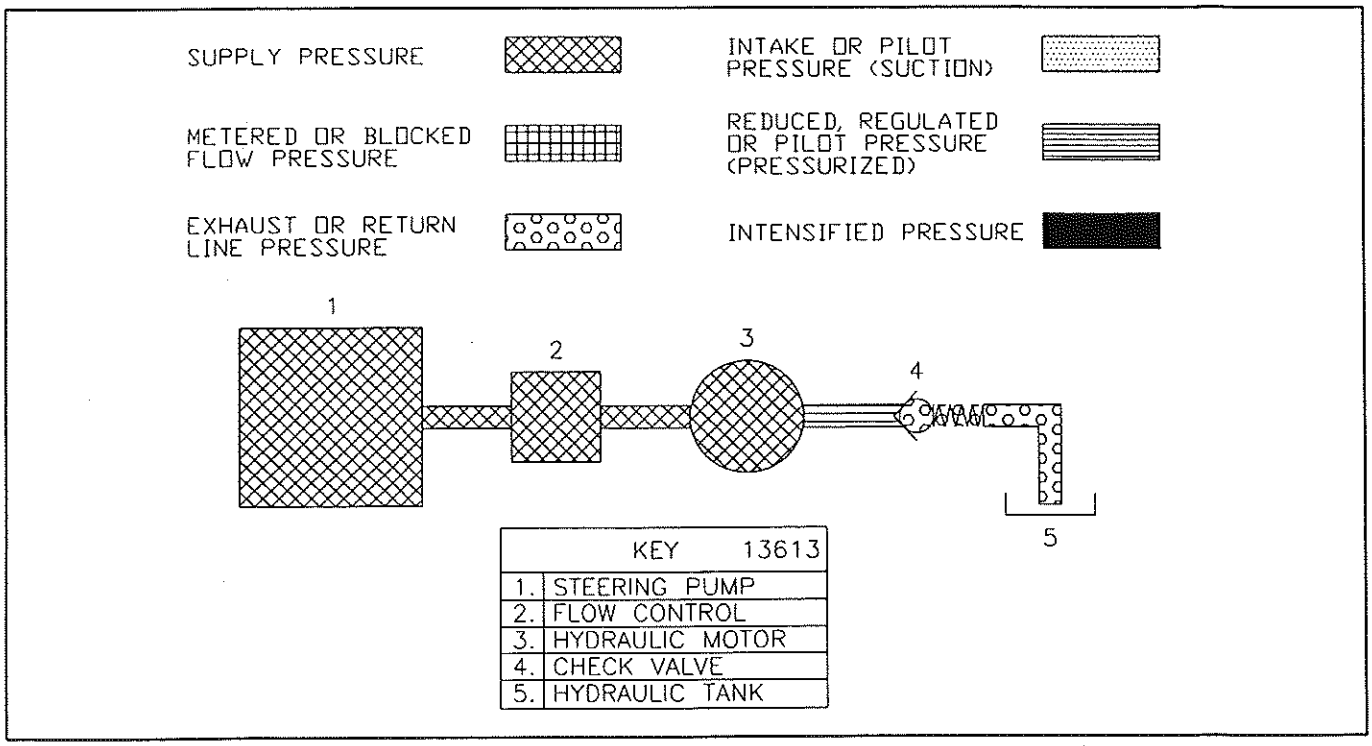


FIGURE 1 - HYDRAULIC SCAVENGER BLOWER SYSTEM OPERATION

eration of the blower assembly under possible adverse conditions. The purpose of the back pressure is to better control blower speeds and prevent "overrun" during the time in which the engine is decelerating (thus lowering the hydraulic flow available) while the inertia of the spinning motor and blower wheel combination tend to want to remain at the higher speeds.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Inspect all hoses and lines for evidence of damage or leakage. All hoses should be secured properly and torqued as per the instructions in Section 10 - Miscellaneous. Repair or replace as required.

2. Inspect each assembly component for evidence of wear, damage, or leakage.

3. Test the operation of the system as outlined in the operation test.

OPERATION TEST

IMPORTANT: *Prior to beginning this test, the steering system must be properly tested and adjusted.*

NOTE: *The equipment in this system is preset and is not considered field adjustable. It should be replaced if not operating correctly.*

1. With the engine off and the motor and blower stopped, find a location suitable for monitoring the speed (rpm) of the blower wheel. Typically this may be done by carefully removing the inlet to the blower from the air precleaner assembly and the use of a strobe tachometer or similar device.

Use extreme care to ensure that all personnel and equipment are clear of driveshafts, pumps, motors, blowers, and other rotating equipment.

2. Start the engine and allow to run at low idle speed.

3. Verify that the blower wheel speed is less than 3300 rpm.

4. While monitoring the blower wheel speed, accelerate the engine to rated speed and hold.

5. Verify that:

a. The blower wheel speeds up at an even rate approximately proportional to the change in engine speed. It should not accelerate in uneven bursts.

b. The maximum blower wheel speed is less than 3300 rpm.

NOTE: *The probable cause of overspeeding of the motor and blower wheel combination is an improperly operating flow control regulator, which should be preset to allow a maximum of 4 gpm (15 liters/min.). It should be removed and tested if thought to be malfunctioning.*

6. While monitoring the blower wheel speed, slow the engine to low idle speed and hold.

7. Verify that:

a. The blower wheel slows at an even rate approximately proportional to the change in engine speed. It should not decelerate in uneven bursts.

b. The maximum blower wheel speed is less than 3300 rpm.

8. Stop the engine.

9. Verify that the blower wheel stops in less than 5 seconds.

10. Remove the strobe tachometer or other device and reinstall any equipment removed for testing.

SERVICE

Repair or replace any component found leaking, damaged, or not operating properly.

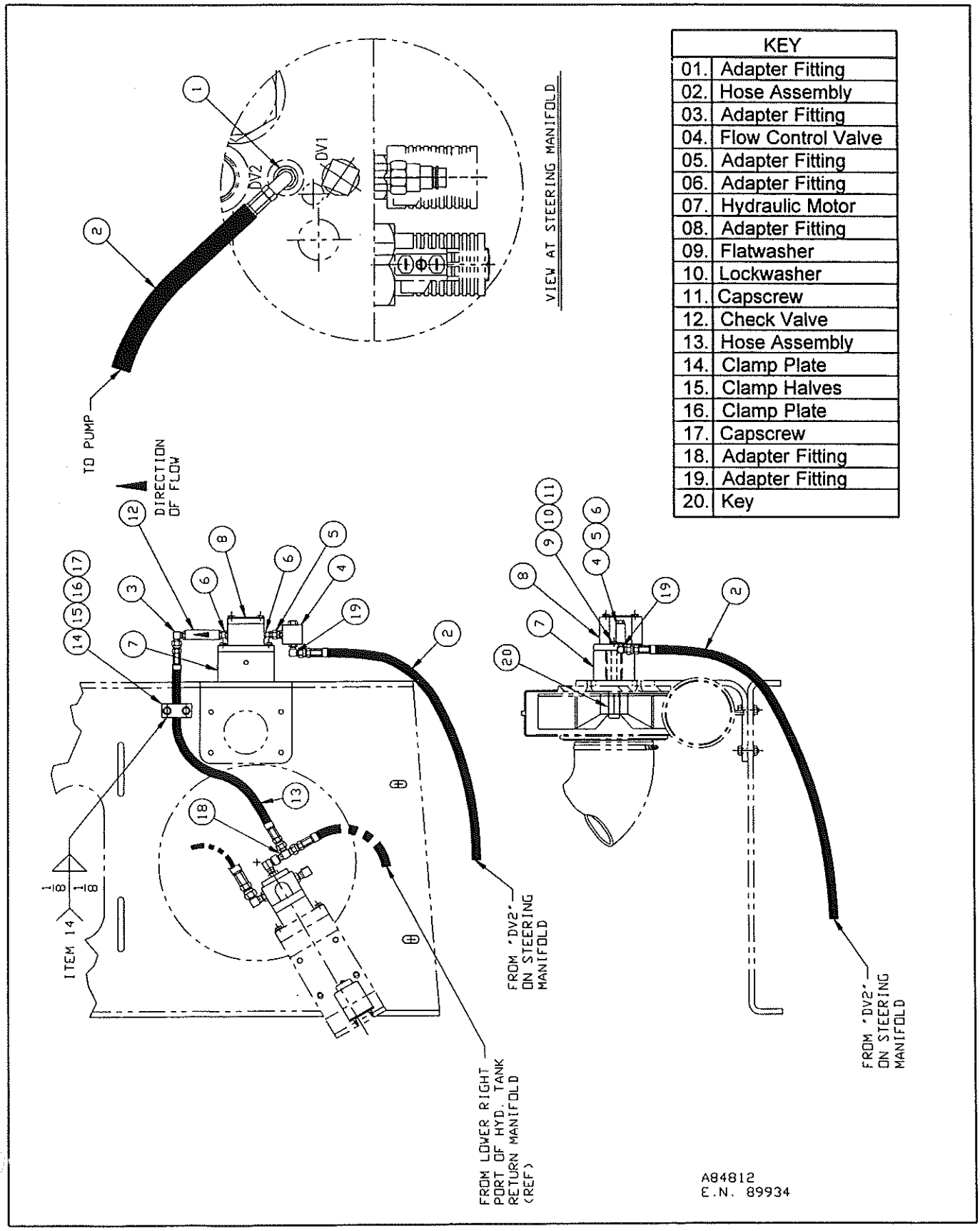


FIGURE 2 - HYDRAULIC SCAVENGER BLOWER MOTOR SYSTEM

PARK BRAKE SOLENOID VALVE

DESCRIPTION AND LOCATION

The park brake solenoid valve is a double coiled, two position, detented solenoid valve. It is mounted on the brake manifold in the hydraulic components box on the superstructure behind the cab.

There have been two versions of the valve used:

1. In early production installations, the valve can be identified by metal nuts retaining the solenoid coils.

2. On later production versions (and trucks modified with the later production valve), it may be identified by fiber nuts retaining the solenoid coils.

NOTES:
1. The two versions of the valve are fit and functionally interchangeable, but they are from different suppliers and the coils and other operating components are not compatible. Be sure to identify the version in question prior to servicing either form of the valve.
2. The later production valves are of a design that has limited servicing capability outside of cleaning and replacement of the electric coils.

OPERATION

The park brake solenoid valve controls the flow of hydraulic fluid into and out of the park brake system.

The valve is a four-way, two-position, double-coil electric solenoid operated valve. This type of valve is designed to remain in one of two detented positions until the energizing of the coil at the opposite end causes it to shift to the other position.

This provides the control of flow either from the supply source (in the brake manifold) to the caliper assemblies or from the calipers to the hydraulic tank.

NOTE: *Provision has been made to allow the valve to be manually shifted by external means if necessary. This may be done by inserting a punch or similar tool into contact with the push rod assembly in the tube/coil assembly on the appropriate end of the valve, then pushing it to its other detented position. This may take some effort, particularly when the system is pressurized. Make sure that the spool is in one of its detented positions at all times.*

Typically an electric park brake shut-off solenoid valve assembly is installed on the outlet to prevent the flow from continuing should a leak develop downstream of the park brake solenoid valve.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance of the manifold should include the following:

1. Inspect the valve for evidence of leakage or damage. Repair or replace as required.

2. Test the operation of the valve as outlined in the instructions for the brake systems in Section 5 - Hydraulic System.

REMOVAL

The park brake solenoid valve may be removed from the truck as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Drain all pressure in the system as outlined in the procedures on system operation and testing in Section 5 - Hydraulic System. This includes both the steering and brake system accumulators.

⚠WARNING

Always release all hydraulic pressure in the system before loosening or removing any hydraulic lines.

3. Disconnect all electrical connections from the valve. Cap or plug all openings. Label each to aid in installation.

4. Remove the capscrews which secure the valve to the mounting bracket.

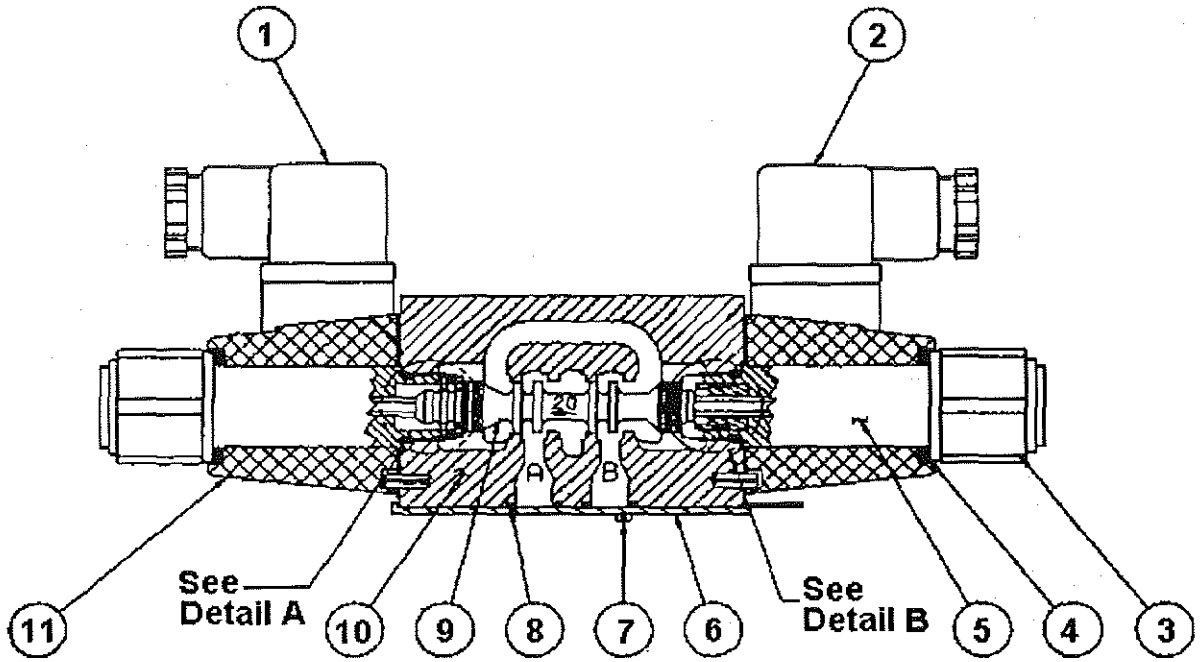
5. Remove the valve.

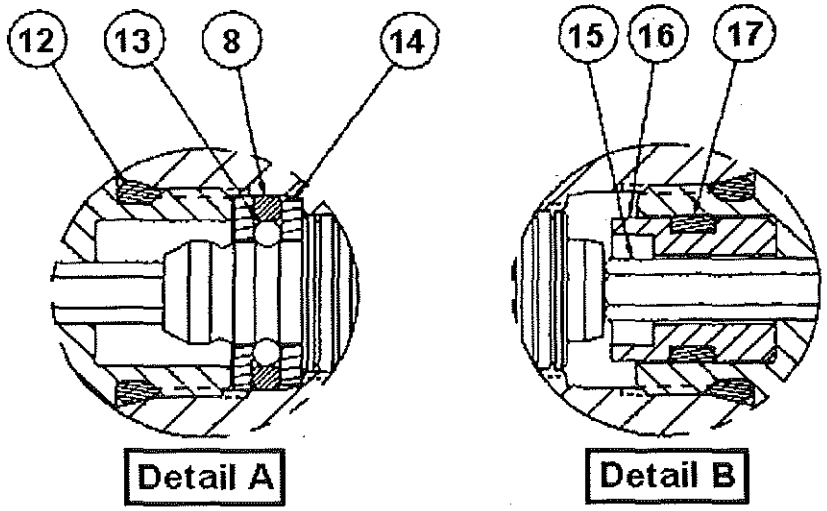
DISASSEMBLY

The park brake solenoid valve may be disassembled as follows:

1. Early production version valves: (See Figure 1)

a. Remove the two coil retainer nuts (3) from both ends of the valve.





NOTE: There are two coil assemblies included in each valve. The listed quantities of components are per valve not each coil assembly.

KEY 56074

01.	Black Plug	07.	Roll Pin	13.	Ball
02.	Gray Plug	08.	O-ring	14.	Ball Clamp
03.	Coil Retainer	09.	Spool	15.	Push Rod
04.	Coil Seal	10.	Body	16.	Spool Stop
05.	Tube	11.	Coil	17.	O-ring
06.	Shipping Plate (Remove for operation)	12.	O-ring		

FIGURE 1 - PARK BRAKE SOLENOID VALVE ASSEMBLY – EARLY PRODUCTION VERSION (56074)

b. Remove the two coil assemblies (11) from the tube/ body assembly.

c. Remove the two tube and spool stop assemblies from the body.

d. Remove the detent assembly (ball clamps (14), O- ring (8) and ball (13)) from one end of the spool assembly.

e. Remove the spool assembly from the body taking care not to damage the spool or body.

f. Remove the other detent assembly from the spool as outlined in step d.

g. Remove the spool stop (16) from the tube assemblies.

h. Inspect then discard all O-rings and seals.

2. Later production versions: (See Figure 2)

a. Remove the two coil retainer nuts from both ends of the valve.

b. Remove the two coil assemblies (1) from the body assembly (2).

c. Carefully remove the internal spool if required.

INSPECTION AND REPAIR

The disassembled components may be serviced as follows:

1. Inspect, then remove and discard all O-rings that are included in the new seal kit. Evidence of damage to the ring should be investigated for cause as it may indicate problems in other areas. It is recommended that all O-rings and seals be replaced each time removed to ensure proper valve sealing and operation.

2. Clean all parts thoroughly with clean solvent and dry with compressed air. Do not use rags or solvents that will leave a residue.

3. Remove any indicated burrs or high spots from any surfaces. Re-clean if required.

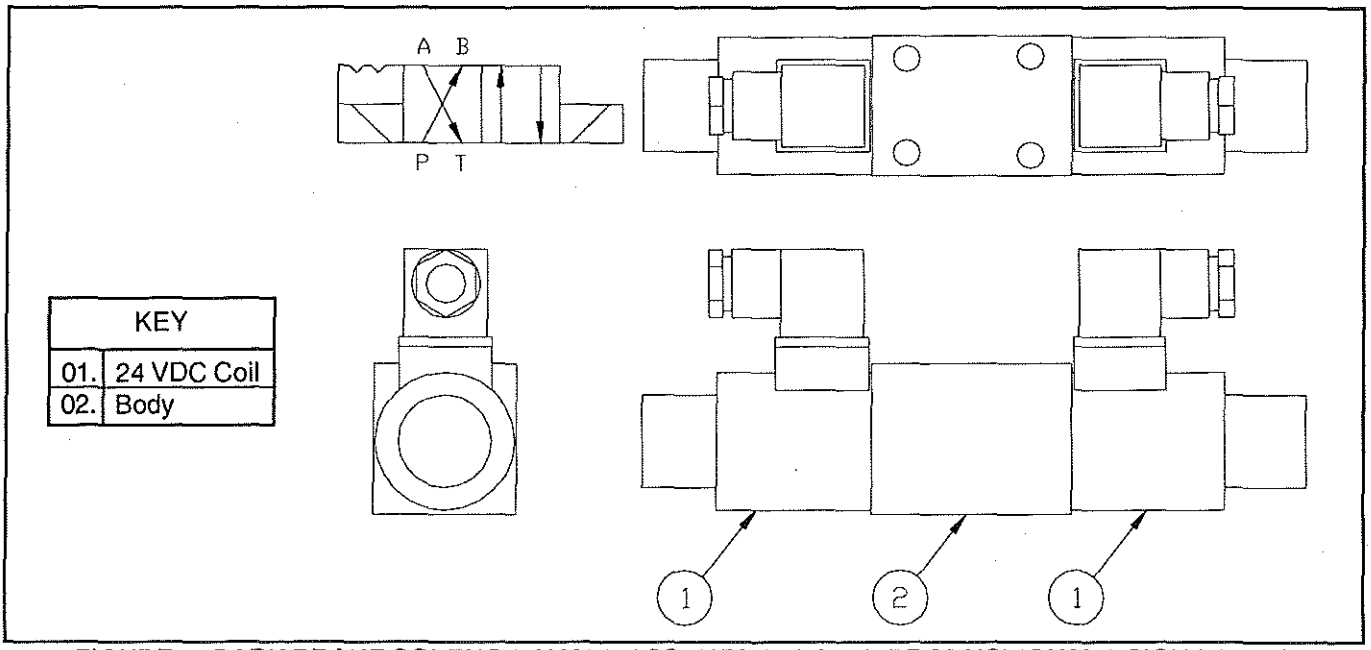
4. Inspect the valve body and all other components for evidence of wear or damage. Particular attention should be paid to the bores, mating surfaces, and thread areas. If found to be significant, the entire assembly must be replaced.

5. Test the operation of all solenoid valves by carefully applying 24 Vdc power and ground to the appropriate coil leads. Repair or replace as required.

ASSEMBLY

The park brake solenoid valve may be assembled as follows:

1. Earlier production versions: (See Figure 1)



KEY	
01.	24 VDC Coil
02.	Body

FIGURE 2 - PARK BRAKE SOLENOID VALVE ASSEMBLY – LATER PRODUCTION VERSION (57060)

a. Check that all parts are clean and free of defects.

b. Lubricate all O-rings, and bores and threads in the valve body with clean hydraulic fluid compatible with that used in the truck's hydraulic system.

c. Install the O-rings (12) on both of the coil assemblies (11).

d. Install the O-rings (17) on and push rod (15) in both of the spool stops (16).

e. Install the spool stop assemblies in each of the tube assemblies (5).

f. Install the spool assembly in to the body (10).

g. Install the ball clamps (14), ball (13), and O-ring (8), as shown on each end of the spool assembly.

NOTE: *Make sure that the inner clamp halves are secure against the shoulder in the bore of the body and that the O-ring (8) and clamp halves (14) secure the ball (13) in position.*

h. Install one of the tube and spool stop assemblies onto the body, making sure that the push rod (15) contacts the end of the spool. Tighten the tube assembly to 180 inch-lbs (20 Nm).

NOTE: *During assembly use care not to allow the detent assembly to move from its installed position.*

i. Install coil (11) on the tube body assembly aligning the alignment pin in the body with the hole in the coil. Secure with coil retainer nut (3), tightened to 27 inch-lbs (3 Nm) final torque.

j. Repeat steps h and i with the other end of the assembly.

k. Using a small punch or similar tool move the spool back and forth within the bore checking the smoothness of operation and the positive locking and releasing of the two detent assemblies.

l. Cap or cover all openings to maintain component cleanliness.

2. Later production valves: (See Figure 2)

a. Check that all parts are clean and free of defects.

b. Lubricate all O-rings, and bores and threads in the valve body with clean hydraulic fluid compatible with that used in the truck's hydraulic system.

c. If removed, carefully reinstall the spool assembly into the body.

d. Install coil assembly (1) on the body assembly (2), aligning as required. Secure with coil retainer nut, tightened as required.

e. Repeat with the coil (1) on the other end.

f. Using a small punch or similar tool move the spool back and forth within the bore checking the smoothness of operation and the positive locking and releasing of the two detent assemblies.

g. Cap or cover all openings to maintain component cleanliness.

INSTALLATION

The park brake solenoid valve may be installed as follows:

1. Install the valve on the brake manifold assembly as shown in the instructions for the manifold in Section 5 - Hydraulic System. Tighten the valve to a final torque of:

a. Early production valves: 20 ft-lb (27 Nm).

b. Later production valves: 5 ft-lb (7 Nm).

2. Connect all electrical wires.

3. Bleed and test all systems as outlined in the procedures for the brake system (particularly the park brake system) in Section 5 - Hydraulic System.

NOTE: *Entrapped air should be bled from all parts of the brake systems.*

DUMP PUMP

DESCRIPTION AND LOCATION

The dump pumps are the larger tandem gear pumps mounted in series with the smaller steering piston pump assembly. The pumps are mounted on a special bracket assembly between the main frame rails, just in front of and above the nose cone receiver.

OPERATION

The pump assembly operates in two basic configurations:

The oil supply for the pumps is drawn through the inlet ports from the reservoir and is routed internally to the pump inlet chambers between the pump gears. As the gears turn, they cause the oil to pressurize and direct it to the outlet chambers. There it exits the pump through the outlet ports. Wear plates are incorporated into the housing to provide increased sealing capacity and rebuilding capability.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

NOTE: *The pumps themselves require no internal maintenance or adjustment beyond periodic verification of the pumps ability to maintain required pressures and flows.*

1. Verify that all components are secure and all mounting bolts are tight.

2. Inspect the pumps for evidence of wear, leakage, or damage. Repair or replace as required.

3. Visually inspect the large pump mounting bracket, especially the isolation mounting pads for evidence of looseness, deterioration, or damage. Repair or replace as required.

4. Verify that the proper distance between the pump bracket front surface (non pump mounting face) and the face of the pump drive adapter (on the rear of the main traction alternator) is maintained. If not, adjust all brackets as outlined in the Installation instructions at the end of this module.

5. Measure the vertical distance between the horizontal centerlines of the driveshaft's front and rear bearings. It should be 3/16 inch (4.6 mm). If not, adjust as outlined in the Installation instructions at the end of this module.

6. Test the operation of the pumps as outlined in the dump system testing instructions in Section 5 - Hydraulic System.

REMOVAL (Figure 2)

The triple pumps assembly may be removed as follows:

1. Park the truck in SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Shut off the oil supply to the pumps by closing the valve on the supply line (near the reservoir tank) or other approved method.

3. Remove the inlet and outlet hoses from the pumps.

4. Install a 1/2 inch NC threaded eye bolt in the threaded hole in the center of the pump bracket accessible through the cut out in the large mounting bracket.

5. Install a suitable lifting point directly above the pumps (e.g. weld eye to dump body, crane, etc.).

6. Install a come-along or equivalent means to the attachment points in steps 4 and 5 and tighten until only a small amount of slack remains in the device.

NOTE: *Provisions should be made for lowering the pumps to the floor, a distance in excess of 6 feet (2 meters). The combined weight of the pumps is approximately 400 lbs. (180 kgs) plus the weight of the mounting bracket.*

7. Remove the capscrews (15) and hardened flatwashers (17) securing the pump mounting bracket (8) to the pump platform (7). Use care to prevent fore and aft movement.

8. Slide the pump assembly rearwards slowly (while supporting the driveshaft) until the pump drive splines are out of the driveshaft.

9. Lower the pump to the ground.

10. Remove the rear or tail pump support bracket (9).

11. Remove the capscrews (11) and locknuts (10) securing the pump assembly to the mounting bracket (8).

12. Remove the pump.

DISASSEMBLY (Figure 1)

Prior to beginning disassembly of the pump:

1. Clean the work area of dirt, grease, foreign material or other items which might contaminate the pump.

2. Clean the unit thoroughly with a solvent. Remove all sharp edges from splines, drill points, keyways and end of shaft. Mark the adapter and cover/housing sections to ensure correct reassembly.

3. To aid in disassembly and reassembly, the pump should be retained in some manner. For example, a steel plate bolted to and extending over the edge of a work bench will suffice. The plate should have a hole large enough for the adapter flange pilot to drop through, and two holes in the adapter flange. The pump can now be firmly fixed to the plate by bolts. This is especially helpful in removal and torquing of capscrews.

The pump may be disassembled as follows:

1. Remove the steering pump section from the rear of the pump assembly as follows: (Figure 2)

a. Remove the capscrews (12) and lockwashers (13) securing the rear piston pump assembly (2) to the dump pump sections (1).

b. Carefully separate the two pump sections, making sure that the splined shafts and couplers are not damaged.

⚠ CAUTION

Do not attempt to pry the pumps apart with a screwdriver or other means. They should be separated by tapping with a soft-faced hammer.

NOTE: *For detailed information on servicing the steering pump assembly, refer to the instructions in Section 5 - Hydraulic System.*

NOTE: *The remaining steps reference Figure 1 unless otherwise indicated.*

2. With a grease pencil, ink marker or other suitable marking tool, mark each housing cover on the parting line in a manner that will allow for reassembly in the same position.

NOTE: *These marks will be used to assist in matching parts for reassembly of the pumps.*

3. Clamp the pump assembly in a vise with the shaft end up.

NOTE: *Use clean wooden blocks or other soft material to protect the machined surfaces (particularly the port faces) from damage.*

4. Clean the driveshaft extension and remove any burrs or other damage. This will prevent damage to the seal lips.

5. Remove the nuts (23) and washers (20) securing flange (1) to the pump body assembly.

6. Remove the flange (1). If the flange does not move easily, use a plastic hammer or wooden mallet and tap the edges of the flange to loosen it.

7. Remove the O-ring (12).

8. Grasp and lift the front drive gear shaft (5) to dislodge the top pressure plate (8) with it while holding the pressure plate face against the gear with your fingers.

NOTE: *If the pressure plate hangs during removal, do not force or bend the plate. Tap lightly with a plastic hammer to drive the plate back down into position and start the removal process over.*

9. Remove the pressure plate from the drive gear. Inspect and discard the seal strips.

NOTE: *Lift the plates straight up off of the shaft.*

NOTE: *When disassembling the pumps sections, the parts should be laid out in a group and in the same order removed.*

10. Lift the idler gear (7) straight up out of the bore of the body.

11. Remove the bottom pressure plate (9) as follows:

a. Insert an expandable bearing puller into the shaft bore of the plate.

b. Tighten until it is secure on the plate.

c. Apply a light forward and back force to the puller handle and dislodge the plate.

NOTE: *If a bearing puller is not available:*
1. Grind a screwdriver shape on the short end of an Allen wrench.

2. Insert the ground end of the wrench into the shaft bore and lift the plate up.
3. Move the wrench to the opposite bore of the plate and lift up.
4. Repeat this action until the plate has been dislodged.

12. Grasping through the bore holes, lift the plate straight up and out.

NOTE: *Use extreme care in removing the plate. Do not pry or attempt to force it out. If the plate binds in place, move it up and down until it is free, then lift it out.*

13. Lift the front body (2) straight up and off of the studs and dowels.

NOTE: *If the body is bound on a dowel, use a plastic hammer or wooden mallet and tap around the body to loosen it.*

14. Remove the splined coupling (21) from the rear driveshaft.

15. Lift the bearing plate (3) off.

NOTE: *It may be necessary to tap the plate lightly with the mallet to loosen it from the dowels.*

16. Repeat steps 6 through 16 for the bottom section of the pump.

17. Repeat again for the removal of the adapter plate (4) if required.

18. Remove the capscrews (29), and O-ring (14).

19. Inspect and remove all remaining seals and components.

INSPECTION AND REPAIR

The disassembled pump may be serviced as follows:

1. Clean all metal parts in solvent and dry with compressed air. Inspect for evidence of wear, damage, cracks, or leakage. Repair or replace as required.

2. Inspect gear bores. Normal gear track-in on the suction side of the body is approximately 0.005 inch (0.127 mm) but should not exceed 0.015 inches (0.38 mm).

a. If the track-in burr rolled over the OD of the bottom pressure plate, remove the burr using a sharp knife. Blow clear with compressed air to remove all loose chips and other material.

b. Replace the body if the groove is too deep or the gear bores look as if they had been sand blasted.

NOTE: *Due to the hydraulic loading of the gears, the cut will start on the suction side of the body and will continue about one-third of the way around the gear bore. It should be smooth and with no deep grooves or scratches.*

3. Discard any pressure or wear plates that show excessive wear on the bronze side. Also discard the plates if deep, curved wear marks or evidence of contamination abrasive wear, cavitation damage, or heat discoloration are visible.

4. Discard the gear assemblies if:

a. The shaft journals show excessive wear or pitting, especially on the journals, sides, or face of the gear, or at the point where the drive gear rotates on the lip seal.

NOTE: *Journal wear is excessive if contamination has caused the journal surface to lose their mirror "finish" and appear as a "sanded" or scratched surface.*

b. The gear OD is under 3.177 inches (80.7 mm).

c. The gear teeth show excessive wear.

d. The gear face is scored or cracked.

e. The driveshaft spines or keyways are badly worn.

5. If the bearings are worn beyond the gray Teflon into the bronze material, it is recommended that the complete flange or housing be replaced. Replacing a bearing in an old component is not recommended.

NOTE: *In the event of bearing failure, verify that the gears have not cut a track in the housing deeper than 0.015 inches (0.38 mm). If they have the housing must also be replaced, typically causing replacement of the entire pump.*

If, however, a bearing must be replaced, it may be done as follows:

a. Place the body in a vise. Clamp on the sides of the body using cardboard to prevent marring by the vise.

b. Using a 3/8 inch end mill on a Bridgeport or drill press,

(1) Align and center the body to allow the cutting to begin at the center of the bearing opposite the split in the bushing.

(2) Move into the bearing wall and make cuts until through the bearing shell.

IMPORTANT: *Do not cut into the bore wall.*

c. Grip the bearing with vise grips and remove by squeezing the parts together and using a twisting motion.

d. After removal, wash the parts in solvent and remove any burrs that may have occurred.

e. Coating the bearing OD and bore ID with Loctite 609 or equivalent.

f. Using a suitable press and tooling, press the bearing into place until they protrude above the surface 0.220 to 0.230 inches (5.6 to 5.8 mm).

IMPORTANT:
1. The split in the bearing must point toward the dowel of the vertical centerline.
2. Use extreme care not to tilt the bearing relative to the bore.

g. Remove all residue from the bearing area.

6. Replace the seals in the pump flange as follows:

a. Lay the flange plate on a work bench or other suitable work surface. Face the pilot down and protect the machined surfaces from dents or scratches by using a piece of clean wood, heavy cardboard, or other suitable material between the plate and the work surface.

b. With a 1/4 inch (7 mm) punch or a screwdriver with the tip bent, insert through the drive bearing and inner seal until against the edge of the outer seal case. Tap at 3 locations around the seal case driving the seal out of the bore.

NOTE: *Use extra caution not to scratch or damage the bore or bearing surfaces or their end projections.*

c. Turn the flange over with the pilot face up, and using a suitable tool, remove the snap ring (16).

d. Remove the inner seal (17) as outlined in step b. above.

e. After the seals are out:

(1) Thoroughly clean the bore with solvent.

(2) Inspect the bore for scratches or gouges that might interfere with the installation of the new seal.

NOTE: *If found, the bore can be smoothed with No. 400 Emery paper (only). Clean the bore after the smoothing process is complete.*

(3) Clean and prepare a suitable seal press ring or plug and two small pieces of wood, 8 to 10 inches (200 to 250 mm) long for use when installing the new seals.

NOTE: *The following procedures are outlined for use with a vise, but they can be adapted to the use of a press if an appropriate one is available.*

(4) Coat the seal OD and flange bore with a light coat of sealant (Permatex No. 3 or equivalent).

(5) Open the vise jaws wide enough to accept the combined thickness dimensions of the flange, wood blocks and the press ring or plug.

(6) Place the two wooden blocks flat against the fixed jaw of the vise.

(7) Place the flange plate against the blocks in such a position that the bearing projections are between the blocks and are clear of the vise jaw.

(8) Position the inner seal (17) so that the garter spring enters the bore first.

(9) Place the press ring in position, centered above the seal.

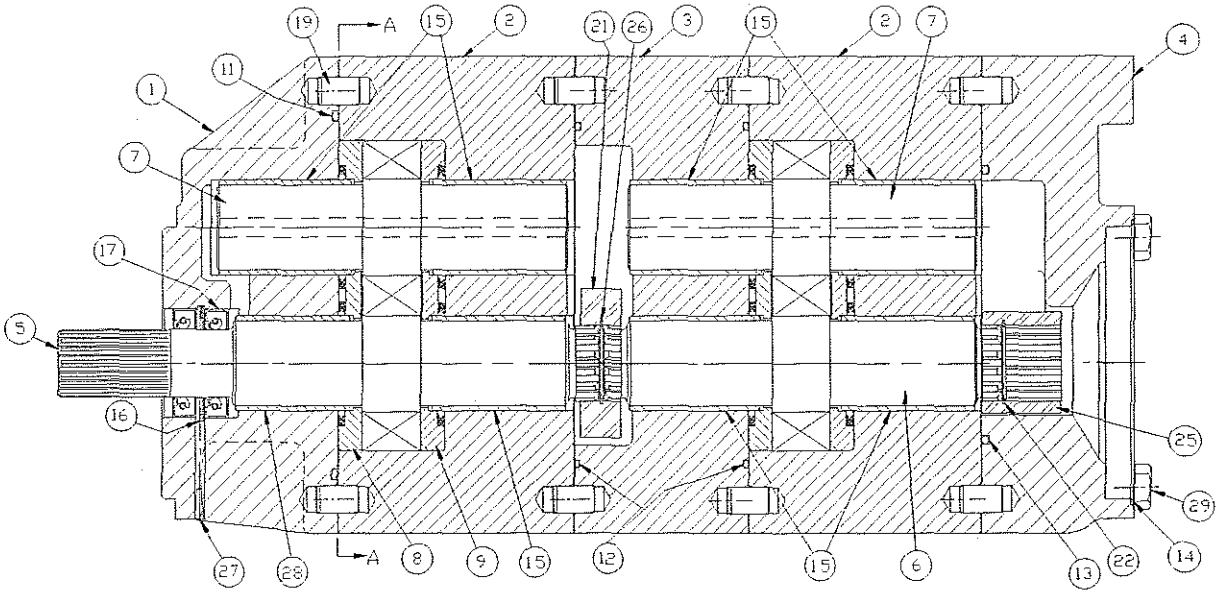
(10) While making sure that the seal stays centered and true with the bore, start applying pressure with the vise. Continue applying the pressure until the seal just clears the snap ring groove in the bore (0.711 inches (18 mm) deep from the pilot face).

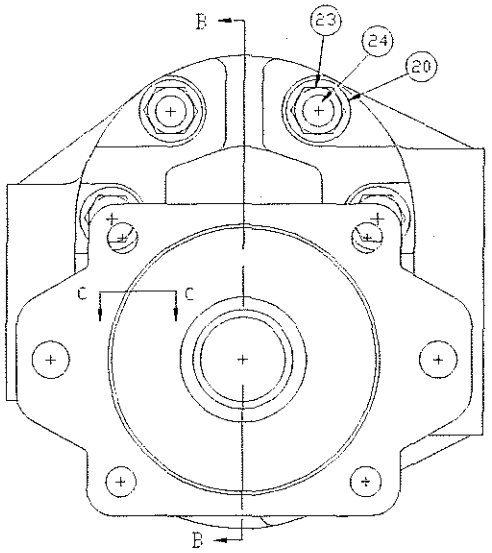
(11) Open the vise and remove the press ring.

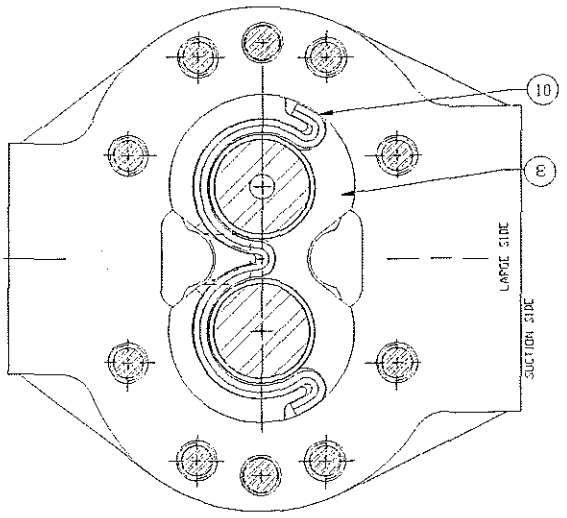
(12) Install the snap ring (16) in it's groove in the bore so that the weep hole is directly over the gap in the snap ring.

NOTE: *Make sure that the snap ring is seated properly in the groove and is properly oriented before proceeding.*

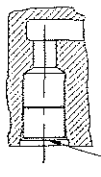
(13) Repeat steps 5 through 12 with the outer seal (17) to a depth of 0.150 inches (3.8 mm) from the pilot face.







SECTION A-A



SECTION C-C

KEY 56090

01.	Flange	09.	Bottom Pressure Plate	17.	Seal	25.	Coupling
02.	Body	10.	Sealing Strip	18.	Plug	26.	Snap Ring
03.	Bearing Plate	11.	O-ring	19.	Dowels	27.	Plug
04.	Adapter Plate	12.	O-ring	20.	Washer	28.	Journal Bearing
05.	Front Drive Gear	13.	O-ring	21.	Coupling	29.	Capscrew
06.	Rear Drive Gear	14.	O-ring	22.	Snap Ring		
07.	Idler Gear	15.	Journal Bearing	23.	Nut		
08.	Top Pressure Plate	16.	Snap Ring	24.	Stud		

FIGURE 1 - DUMP PUMP ASSEMBLY (56090)

(14) Install a new "weep-hole" plug (27) in the 3/16 inch (4.7 mm) drilled hole at the outer surface of the flange.

(15) Remove the flange plate assembly from the vise.

(16) Wash clean in solvent and allow to dry.

ASSEMBLY

IMPORTANT:
1. Prior to reassembly, all parts should be deburred by sanding or stoning; washed in a solvent, wiped with a clean lint free cloth and, if available, dried with compressed air.
2. All seals should be replaced each time the pump is assembled.

The pump may be assembled as follows: (Figure 1)

1. Verify that all parts are clean and dry.

2. Place the rear pump body (2) with the adapter plate (4) installed on the work area, oriented so that the matching marks made during disassembly are facing you.

NOTES:
1. If new components are being installed, make sure that the side facing you is the same as the side marked on the old component.
2. Observe that the body has a wide and a narrow boss. The side having the wide boss is always the suction side.

3. Coat the inner bore of the body with clean hydraulic oil compatible with that in the truck's hydraulic system.

4. Install the bottom pressure plate (9) in the suction side in the bottom of the body with the rounded edge down.

NOTE: *There is a difference in the pressure plates. The one for this location has the radius on the outer edge that mates with the bottom of the gear bore.*

5. Install the new pressure balance seal strips into the grooves in the back of the plates, using heavy grease to hold in place.

NOTE: *There are two strips installed per groove.*

6. With the bronze side facing up and the rounded trap slots toward the discharge side of the body, slide the pressure plate (9) down into the gear bores until it rests firmly on the bottom of the pump body.

NOTE: *Do not force the plate down the gear bores. If the plate binds on the way down, move it back and forth carefully until it slides freely into position.*

7. Coat the rear drive gear journal and faces (6) with clean hydraulic oil compatible with that in the truck's hydraulic system.

8. With the splined end up, install the drive gear in the bore nearest the mark that was made during disassembly.

9. Coat the rear idler gear (7) with clean hydraulic oil compatible with that in the truck's hydraulic system.

10. Install the rear idler gear in the bore opposite the drive gear.

11. Install the dowels in the body.

12. Rotate the rear set of gears until the point of a tooth on the drive gear is in line with the center of the dowel in the body that is nearest the drive gear.

IMPORTANT: *This step establishes the proper timing of these gears with the front set of gears. They must remain in this position until all remaining parts have been assembled.*

13. Install the upper pressure plate (8) with the grooves up.

IMPORTANT: *The pumps have a trap relief on the surface facing the gear. The plate should be assembled so that the trap is off-centered toward the outlet or discharge port side of the pump.*

14. Install the pressure balance seal strips in the plate (9) as outlined previously.

15. Lay the bearing plate so that the side faces upward that has the bearing extending out of the bore.

16. Install the mating O-ring (12) in the surface groove. Use clean, heavy grease to secure it in the groove temporarily.

17. With the O-ring facing down, and the mark made during disassembly facing you, slide the bearing plate down on the shaft until contact is made with the dowels.

18. Keeping the bearing plate oriented properly with the

dowels, tap the plate gently with a plastic hammer or wooden mallet until the O-ring rests firmly against the pump body.

19. Install the spline coupling (21) with snap ring.

20. Lubricate the threads on the studs (24) and screw the studs into place until they are snug.

21. Install the O-ring (12) and dowels (19) in the bearing plate (3).

22. With the gear bores turned up and the matching marks facing you, slide the front pump body (2) down on the studs until it rests firmly on the O-ring in the bearing plate.

23. Install the dowels (19) in the body (2).

24. Coat the inner bore of the body with clean hydraulic oil compatible with that in the truck's hydraulic system.

25. Install the bottom pressure plate (9) in the suction side in the bottom of the body with the rounded edge down.

NOTE: *There is a difference in the pressure plates. The one for this location has the radius on the outer edge that mates with the bottom of the gear bore.*

26. Install the new pressure balance seal strips into the grooves in the back of the plates, using heavy grease to hold in place.

NOTE: *There are two strips installed per groove.*

27. With the bronze side facing up and the rounded trap slots toward the discharge side of the body, slide the pressure plate (9) down into the gear bores until it rests firmly on the bottom of the pump body.

NOTE: *Do not force the plate down the gear bores. If the plate binds on the way down, move it back and forth carefully until it slides freely into position.*

28. With the long end of the front drive gear (5) facing up, slide the gear down into the splined coupling. Before engaging the shaft spline into the coupling, rotate the shaft until the valley between the two gear teeth is lined up with the center of the dowel nearest to the gear.

NOTE: *If the spline will not enter the coupling without the valley being off-center with the dowels, lift the shaft slightly and rotate it to the nearest valley and try again. Continue to do this until the combination of valley and spline are found that will allow the valley to be centered with the dowel. This is to properly time the gears in the front section with those in the rear section.*

29. Install the idler gear (7).

NOTE: *Make sure that the bronze side of the plate faces down and the traps face the discharge side of the body.*

30. Install the pressure balance seal strips in the plate (9) as outlined previously.

31. Install the mating O-ring (11) in the surface groove on the flange plate. Use clean, heavy grease to secure it in the groove temporarily.

32. Coat the splines on the driveshaft extension with heavy grease.

NOTE: *This is to prevent damage to the seal lips as the flange plate and seals are installed. Check the driveshaft for sharp edges. If necessary, use a seal guide or tape to protect the seal lips.*

33. With the O-ring in the flange plate facing down, slide the flange plate (1) down over the studs and shafts until the plate makes contact with the pump body.

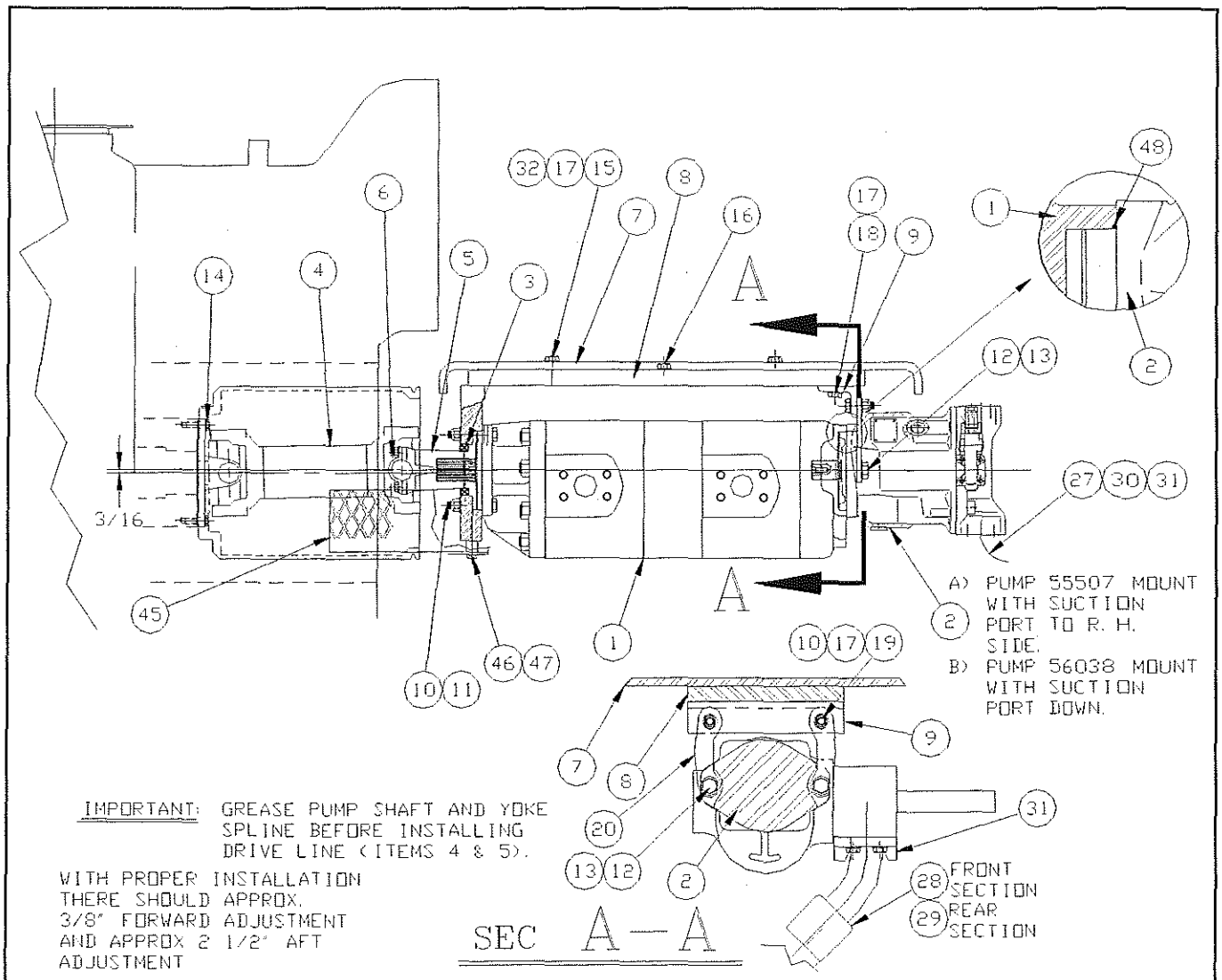
34. Tap gently into place with a plastic hammer or wooden mallet.

IMPORTANT: *If the flange stops approximately 1/8 inch (3.2 mm) short, the journal bearings in the flange may have caught the pressure balance strips. Do not force into position. Lift the flange and position the seal strips away from the journal using a small screwdriver in the middle and ends until the flange drops into place without force. Do not drive the flange on with a hammer or the seal strips may be damaged.*

35. Lubricate the threads and install the washers (20) and nuts (23) on two opposite studs. Tighten in a crossing pattern in even increments to a final torque of 160 to 175 ft-lbs. (215 to 240 Nm).

36. Using an appropriate tool, turn the driveshaft. The movement of the shaft should be tight, but it should turn freely with a maximum of 5 to 10 ft-lbs. (7 to 14 Nm) of torque.

NOTE: *If this does not occur, disassemble the pump and examine the parts for burrs or foreign material causing a build-up or interference between the parts.*



KEY A84203

01.	Tandem Gear Pump Assembly	17.	Hardened Flatwasher	33.	Not Used
02.	Steering Piston Pump	18.	Capscrew	34.	Not Used
03.	Seal Assembly	19.	Capscrew (Grade 8)	35.	Hose Clamp Brackets
04.	Pump Driveshaft	20.	Support Bracket	36.	Clamp Halves
05.	Slip Yoke	21.	Capscrew	37.	Clamp Cap Plate
06.	Strap and Bolt Kit	22.	Locknut	38.	Capscrew
07.	Pump Platform	23.	Rubber Mounting Block	39.	Clamp Halves
08.	Pump Bracket	24.	Bushing	40.	Clamp Cap Plate
09.	Pump Tail Support Bracket	25.	Mounting Washer	41.	Capscrew
10.	Locknut	26.	Hardened Flatwasher	42.	Not Used
11.	Capscrew (Grade 8)	27.	Hose Assembly	43.	Not Used
12.	Capscrew (Grade 8)	28.	Hose Assembly	44.	Not Used
13.	Lockwasher	29.	Hose Assembly	45.	Driveline Guard
14.	Capscrew (Grade 8)	30.	Flange Kit	46.	Capscrew
15.	Capscrew	31.	Flange Kit	47.	Flatwasher
16.	Capscrew	32.	Not Used	48.	O-ring

FIGURE 2 - HYDRAULIC PUMP INSTALLATION (A84203, SHEET 1 OF 2)

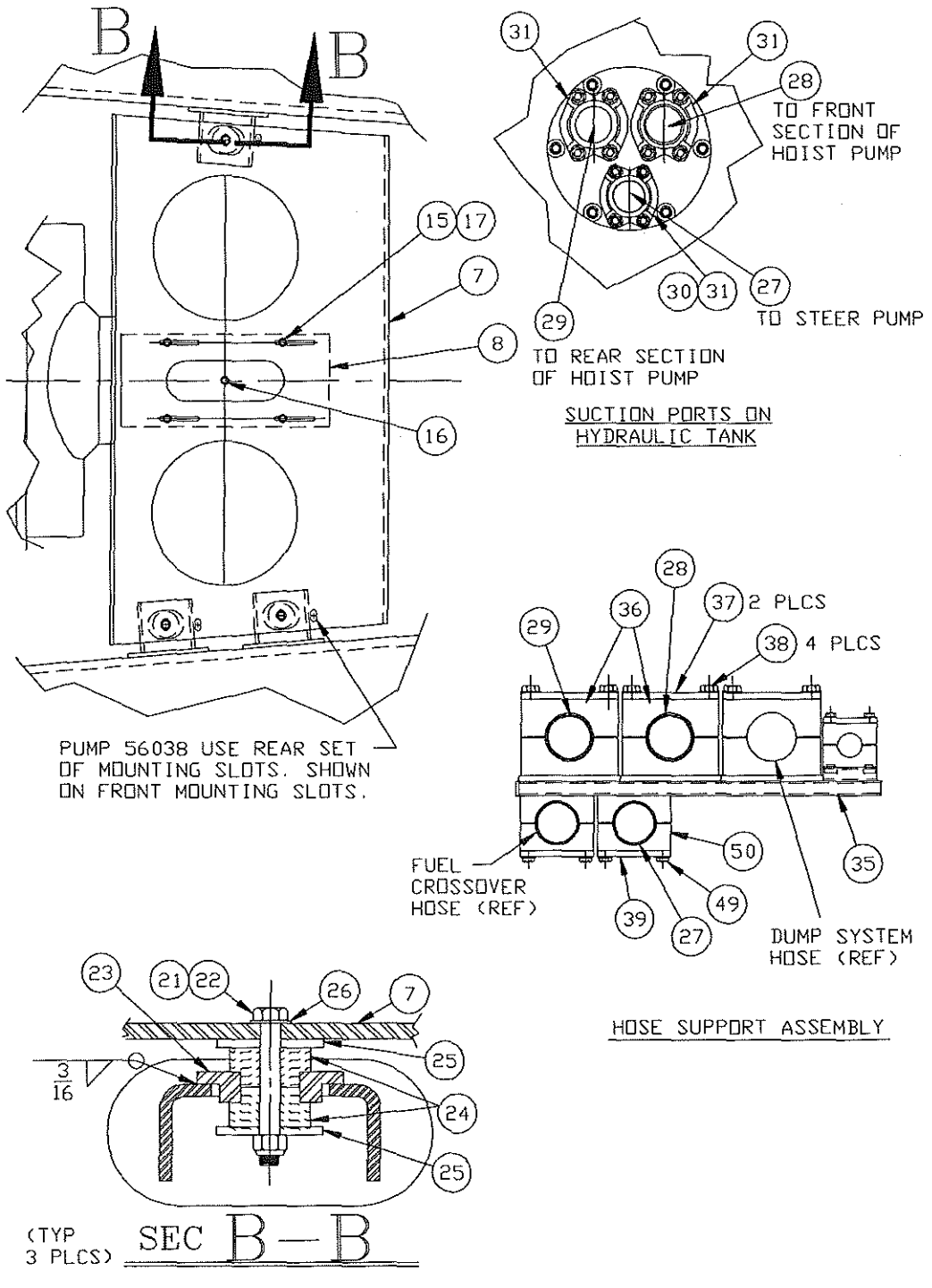


FIGURE 2 - HYDRAULIC PUMP INSTALLATION (A84203, SHEET 2 OF 2)

37. If removed, install plug (18) in the discharge side of the flange, below the surface. (See Figure 1, Section C-C.)

38. Install the steering pump on the rear transition plate as outlined in the instructions in Section 5 - Hydraulic System.

INSTALLATION (Figure 2)

The pumps may be installed as follows:

1. Install the pump assembly on the pump bracket (8) with capscrews (11) and locknuts (10).

2. Install the rear or tail support bracket (9) and supports with the appropriate capscrew on the pumps.

3. Install the lip seal (3) on the front side of the pump bracket.

4. Check the installation of the large pump platform (7). Verify that all mounts are tight and in good repair.

5. Install a 1/2 inch NC threaded eye bolt in the top center of the pump bracket.

6. Position the pump assembly under the truck and route the come-along or other suitable lifting device down through the opening in the center of the upper bracket.

7. Raise the pumps into place and loosely secure with the capscrews and hardened flatwashers.

NOTE: *Do not install the driveshaft at this time.*

8. Slide the bracket fore and aft as required to obtain the required distance between the front edge of the upper bracket and the face of the drive on the rear of the alternator.

If this dimension is not available, it will be necessary to adjust as follows:

a. Remove the mounting hardware securing the bracket to the frame.

b. Remove the weld securing the bushing mounting block to the mount. Grind all surfaces smooth to prevent binding.

c. Repeat steps 4 through 7 adjusting the bushing mounting block fore and aft to obtain the required dimension.

d. Tack weld the block in place.

e. Remove the pump bracket assembly and finish weld the bushing in place.

9. Reinstall the pump bracket assembly.

10. Verify the 3/16 inch (4.6 mm) vertical distance between the horizontal centerlines of the front drive face and the pump drive spline. If not held, use mounting washers to obtain this dimension with the mounting bolts tight.

11. Install the driveshaft as outlined in the instructions in Section 5 - Hydraulic System.

12. Remove the lifting eye bolt from the pump bracket.

13. Install the inlet and outlet hoses on the pumps and secure in place.

14. Re-establish flow from the reservoir to the pumps.

15. Start the engine and let operate at low idle until all air is purged from pumps. Bleed all entrapped air from the system as described in instructions for the individual components.

16. Test pump operation by rechecking individual system operation and test procedures in Section 5 - Hydraulic System.

STEERING MANIFOLD ASSEMBLY

DESCRIPTION AND LOCATION

The steering manifold assembly is a rectangular shaped metal valve with several external poppets and multiple hose connection ports. It is generally mounted on a bracket above the steering hydraulic filter.

NOTE: *In later production manifolds, a flow control valve has been installed that regulates the flow to the venturi in the brake return line to reduce the back pressure in that line. On early production manifolds this provision was externally mounted separately.*

OPERATION

The steering manifold serves as a centralized assembly to provide the following provisions:

1. Accumulator drain solenoid - electric solenoid cartridge that automatically causes the remaining hydraulic pressure in the steering accumulator to be released when the Master Switch is switched Off.

2. Manual accumulator drain - cartridge assembly which contains a manual pull-type valve, spring loaded to the closed position that provides a means of manually releasing any pressure remaining in the steering accumulators.

3. Low steering pressure switch - electric switch assembly that monitors the system supply pressure (accumulator pressure) and causes a cab dash Low Steering Pressure indicator to light.

4. Manual power supply pressure switch - electric switch assembly that monitors the system supply pressure (accumulator pressure) and controls the automatic operation of the available manual power supply system's 24 Vdc pump assembly.

5. High pressure or "Clippard" relief valve - mechanical relief valve designed to reduce high pressure surges in the accumulator supply system.

6. Flow control cartridge (where so equipped) - controls the flow of oil through the brake return venturi system to regulate the pressure reduction function of the system.

There are several ports in the manifold including:

1. Steering system (LSP) port - mounting port for the Low Steering Pressure switch.

2. Flow restriction (FR) port (where applicable) - outlet source from the flow control cartridge in the manifold (when installed).

3. Pressure (P) port - inlet source of pressure from the pump filter assembly.

4. Test steering supply (TSP) port - provides a test port location for the steering supply system.

5. Power supply (PS) port - inlet source from the manual power supply assembly.

6. Manual power supply switch (MSP) port - mounting port for the switch that controls the automatic functions of the available manual power supply system.

7. Brake system supply (BRK) port - outlet port to supply pressurized fluid flow to the brake system through the brake manifold.

8. Steering system (TSR) port - outlet port to supply pressure to the flow amplifier valve.

9. Test steering accumulator (TSA) port - outlet port to the pressure gauge in the superstructure mounted hydraulic component box.

10. Accumulator (A1 and A2) ports - outlet ports to the steering accumulators.

11. Tank (T) port - outlet port returning the oil to the reservoir tank.

Pressurized hydraulic oil from the steering pump enters the manifold through the P port. The high pressure (or "clippard") relief valve reduces the pressure surges in the system. Typically these are the result of changes in the outlet flow from the variable displacement, pressure-compensating piston steering pump.

When the truck's Master Switch is turned off, the oil pressure stored in the steering accumulators is allowed to drain back to the hydraulic reservoirs through the accumulator drain solenoid cartridge. A cab mounted delay timer maintains the required 24 Vdc power to the solenoid for a preset period of time to allow the accumulators to drain fully. An orifice is installed to minimize pressure surges in the system during this drain operation.

On later production manifolds, the brake return venturi flow control valve was incorporated into the manifold.

Previously it was installed on its own manifold assembly.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance of the manifold should include the following:

1. Inspect the valve for evidence of leakage or damage. Repair or replace as required.

2. Test the operation of the functions of the manifold as outlined in the instructions for the dump, steering, and brake systems in Section 5 - Hydraulic System.

REMOVAL

The manifold may be removed from the truck as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Drain all pressure in the system as outlined in the procedures on system operation and testing in Section 5 - Hydraulic System. This includes both the steering and brake system accumulators.

⚠WARNING

Always release all hydraulic pressure in the system before loosening or removing any hydraulic lines.

3. Disconnect all hydraulic fittings from the valve. Cap or plug all openings. Label each to aid in installation.

4. Remove the capscrews that secure the valve to the mounting bracket.

5. Remove the valve.

DISASSEMBLY (Figures 1 and 2)

The manifold may be disassembled as follows:

NOTES:
1. During the disassembly and repair procedures, it is always a recommended practice to carefully note the specific installation and orientation of components before and as they are removed to aid in proper reassembly.
2. Item numbers are the same on both versions unless otherwise noted.

1. Remove check valve cartridge (4).

2. Remove the accumulator drain solenoid cartridge (2) and orifice disk (6, Figure 1).

3. Remove the relief valve cartridge (3)

4. Remove the flow control cartridge (5, Figure 1)

5. Remove the O-ring plugs using care to note the location from which they were removed to aid in the reassembly.

INSPECTION AND REPAIR

The manifold components may be serviced as follows:

1. Inspect, then remove and discard all of the previously used O-rings that have replacements included in the new seal kit. Evidence of damage to the ring should be investigated for cause as it may indicate problems in other areas. It is recommended that all O-rings and seal be replaced each time removed to ensure proper valve sealing and operation.

2. Clean all parts thoroughly with clean solvent and dry with compressed air. Do not use rags or solvents that will leave a residue.

3. Remove any indicated burrs or high spots from any surfaces. Re-clean if required.

4. Inspect the valve body and all other components for evidence of wear or damage. Particular attention should be paid to the bores, mating surfaces, and thread areas. If found to be significant the assembly must be replaced.

5. Test the operation of all solenoid valves by carefully applying 24 Vdc power and ground to the appropriate coil leads. Repair or replace as required. Torque the coils to 4 to 6 ft-lbs. (5 to 8 Nm).

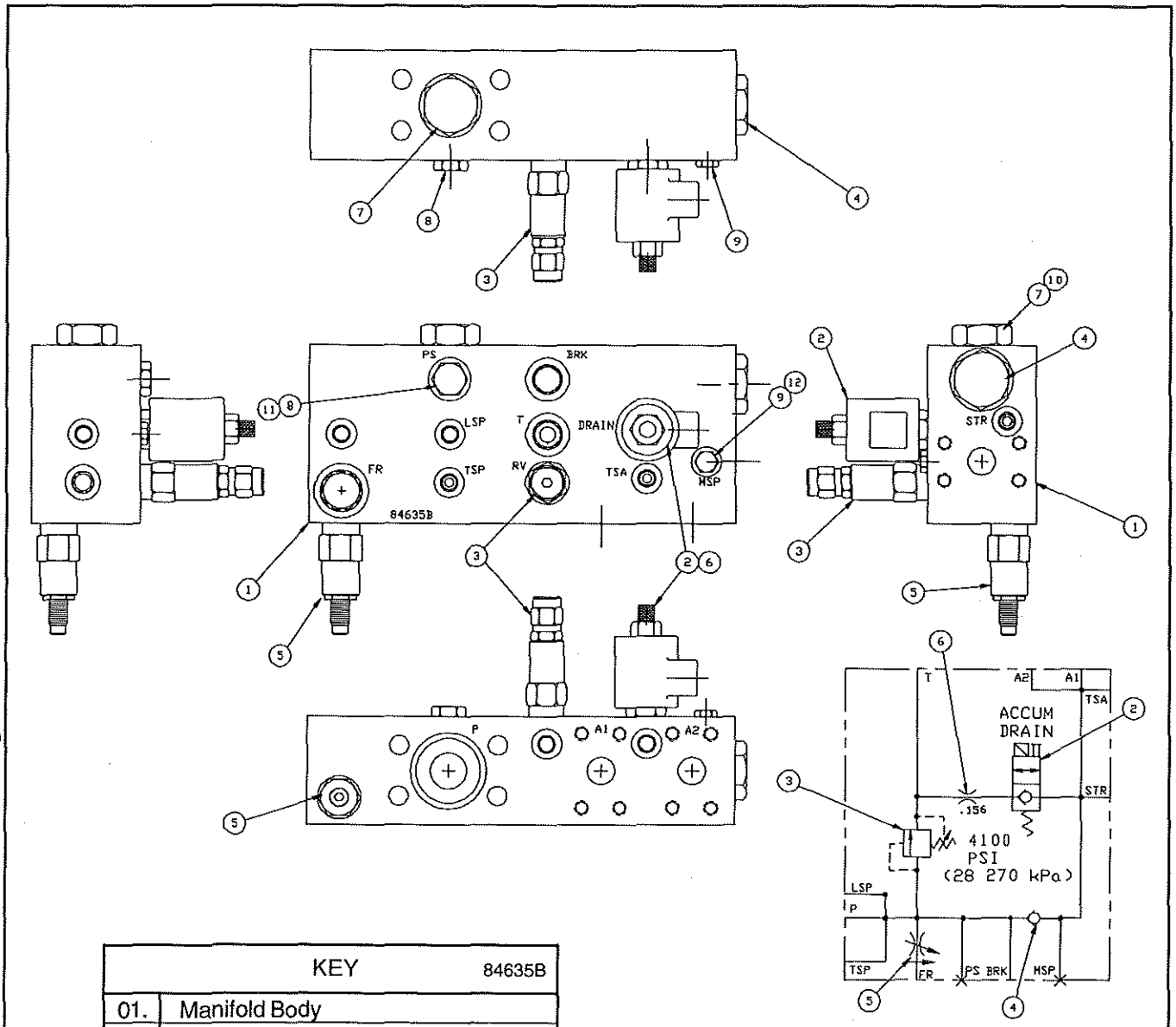
NOTE: *Inspect the electrical connectors for evidence of corrosion or damage. Clean, repair, or replace as required.*

ASSEMBLY (Figures 1 and 2 except where indicated)

The manifold may be assembled as follows:

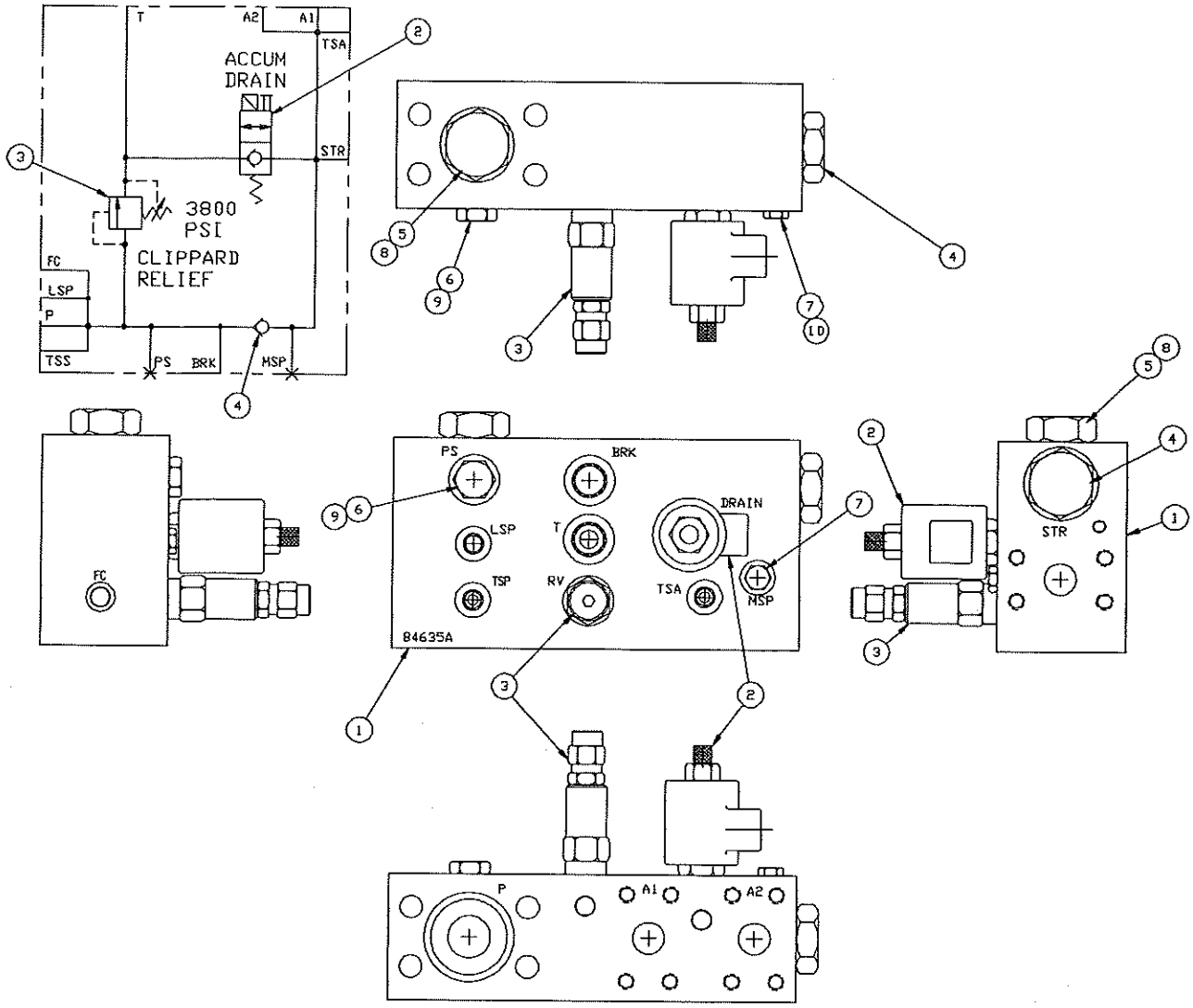
NOTE: *Item numbers are the same on both versions unless otherwise noted.*

1. Check that all parts are clean and free of defects.



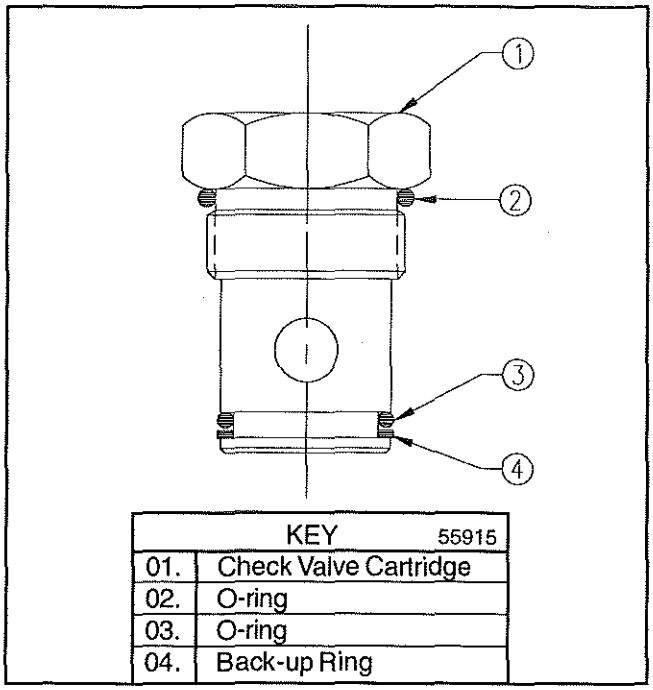
KEY	84635B
01.	Manifold Body
02.	Solenoid Cartridge Valve Assembly
03.	Relief Cartridge Valve Assembly
04.	Check Valve Cartridge Assembly
05.	Flow Control Cartridge Assembly
06.	Orifice Disc (0.156 inch)
07.	#16 O-ring Boss Plug
08.	#8 O-ring Boss Plug
09.	#4 O-ring Boss Plug
10.	#16 O-ring
11.	#8 O-ring
12.	#4 O-ring

FIGURE 1 - STEERING MANIFOLD ASSEMBLY
- LATER PRODUCTION WITH THE INTEGRAL FLOW CONTROL VALVE



KEY	84635A
01.	Manifold Body
02.	Solenoid Cartridge Valve Assembly
03.	Relief Cartridge Valve Assembly
04.	Check Valve Cartridge Assembly
05.	#16 O-ring Boss Plug
06.	#8 O-ring Boss Plug
07.	#4 O-ring Boss Plug
08.	#16 O-ring
09.	#8 O-ring
10.	#4 O-ring

FIGURE 2 - STEERING MANIFOLD ASSEMBLY
- EARLIER PRODUCTION WITHOUT THE INTEGRAL FLOW CONTROL VALVE



KEY 55915	
01.	Check Valve Cartridge
02.	O-ring
03.	O-ring
04.	Back-up Ring

FIGURE 3 - CHECK VALVE CARTRIDGE ASSEMBLY

2. Install the O-rings and back-up rings on all components as shown in the applicable illustrations (Figures 3 through 6).

3. Lubricate all O-rings and bores and threads in the valve body with clean hydraulic fluid compatible with that used in the truck's hydraulic system.

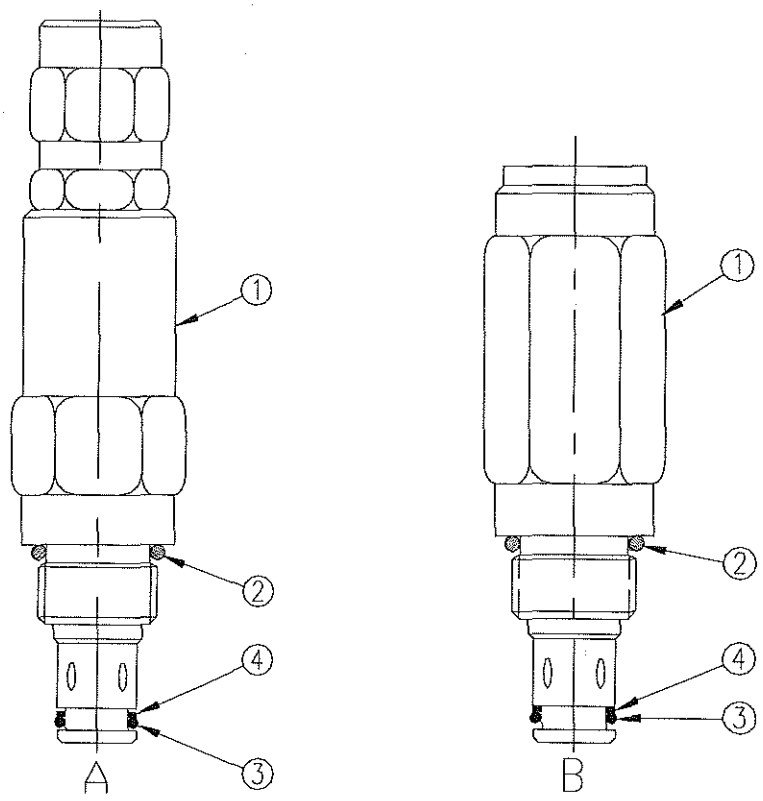
4. Install the O-ring plugs and torque as outlined in the procedures in Section 10 - Miscellaneous.

5. Install the large orifice disk and accumulator drain solenoid cartridge (2). Torque the cartridge to 25 ft-lb (35 Nm).

6. Install the check valve cartridge (4). Torque the cartridge to 50 ft-lb (70 Nm).

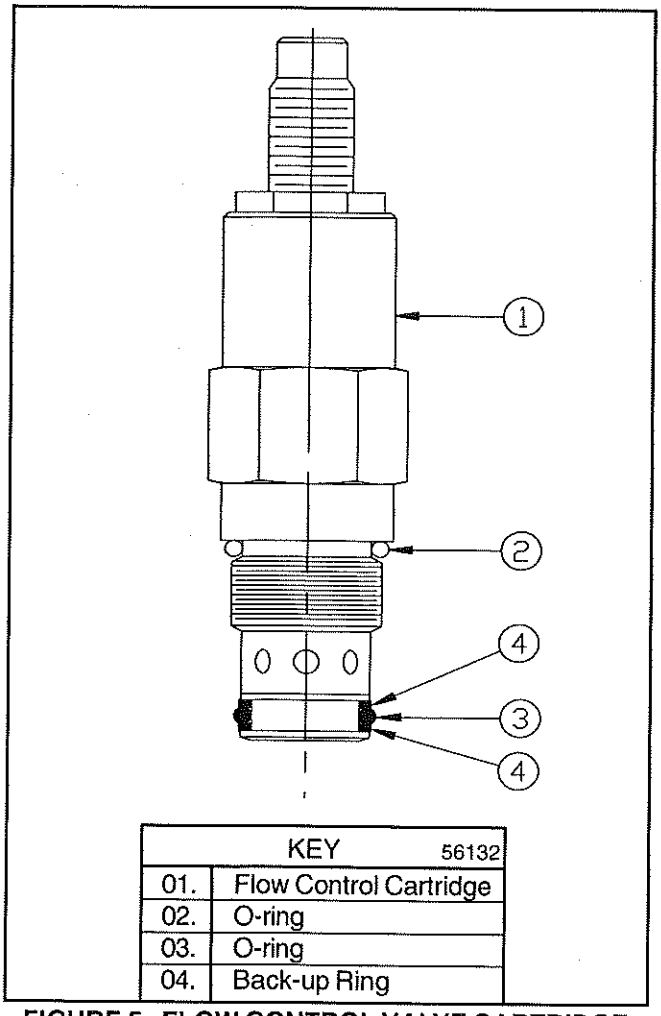
7. Install the relief valve cartridge (3). Torque the cartridge to 20 ft-lb (27 Nm).

KEY 55914	
01.	Relief Valve Cartridge
02.	O-ring
03.	O-ring
04.	Back-up Ring



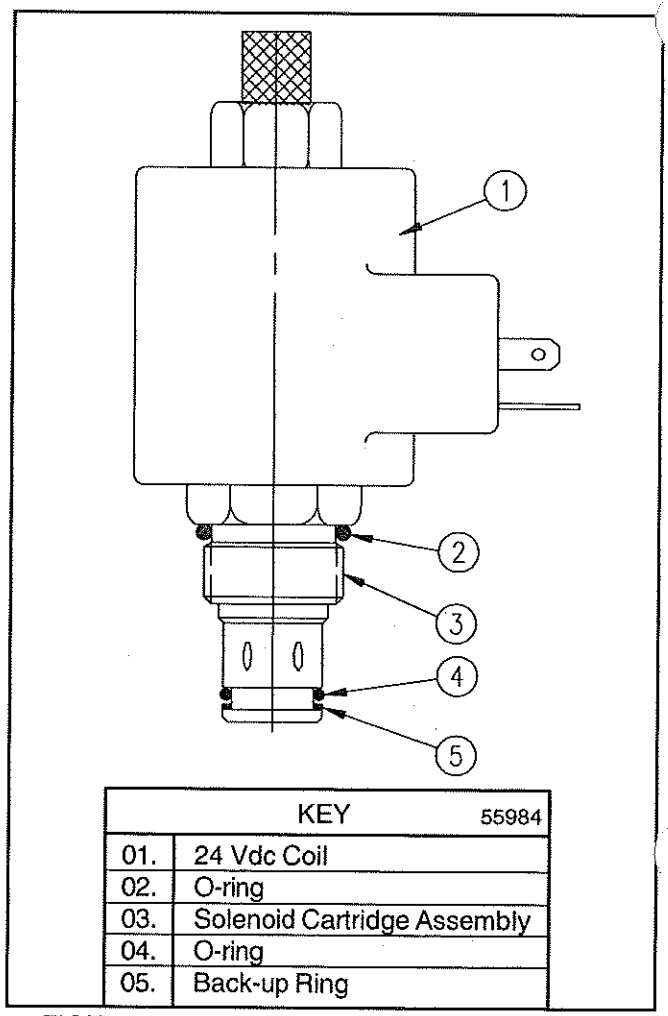
NOTE: Either **A** or **B** version is acceptable.

FIGURE 4 - RELIEF VALVE CARTRIDGE ASSEMBLY



KEY	56132
01.	Flow Control Cartridge
02.	O-ring
03.	O-ring
04.	Back-up Ring

FIGURE 5 - FLOW CONTROL VALVE CARTRIDGE ASSEMBLY



KEY	55984
01.	24 Vdc Coil
02.	O-ring
03.	Solenoid Cartridge Assembly
04.	O-ring
05.	Back-up Ring

FIGURE 6 - ACCUMULATOR DRAIN SOLENOID VALVE CARTRIDGE ASSEMBLY

8. Install the flow control valve cartridge (5, Figure 1) (where equipped). Torque the cartridge to 20 ft-lb (27 Nm).

9. Install caps on all open ports.

INSTALLATION

The manifold may be installed as follows:

1. Install the valve on the mounting brackets. Secure with the appropriate capscrews and related hardware.

2. Connect all hydraulic lines and electrical wires. Torque each connection as outlined in the instructions in Section 10 - Miscellaneous.

NOTE: *Use RTV to seal the electrical connectors to prevent moisture from entering.*

3. Bleed and test all systems as outlined in the procedures for the dump, steering, and brake systems in Section 5 - Hydraulic System.

NOTE: *Entrapped air should be bled from all three systems.*

ACCUMULATORS

DESCRIPTION AND LOCATION

The accumulators are heavy metal cylinders with one removable and one fixed or welded end or head. They are identified by the large gas valve and protective cover on the lower or gas end.

NOTE: *There are two versions of the accumulators. Earlier versions incorporated wear bands and T-seals as shown in Figure 2. Later versions used a different seal arrangement and a primary seal with two back up rings as shown in Figure 3. Different pistons are required with each type of seal configuration. It is important to determine which configuration the accumulator has and to reinstall the correct type seals.*

The accumulators are mounted together on the superstructure near the hydraulic component box.

OPERATION

The accumulators store energy, oil under pressure. They serve several distinct functions in this application.

1. They act as a ready source of pressurized oil to the system, including a reserve in the case of restricted or inadequate flow from the supplying pumps.

2. They also allow the system to maintain a more constant pressure by absorbing high or low pressure surges.

The accumulator used operates on the sliding piston principle. One end is precharged (pressurized) with dry nitrogen gas. The other end is plumbed directly into the system supply lines. A sliding multi-ringed piston separates the oil from the gas charge.

With no oil in the fluid end, the precharged gas end holds the piston against the fluid end cap. As pressurized oil enters the fluid end, it causes the piston to move, compressing the gas. As oil is removed to assist in meeting the system flow demands, the compressed gas moves the piston back down the cylinder. In this accumulator the pressure in the hydraulic and gas sides are always equal.

MAINTENANCE AND ADJUSTMENT

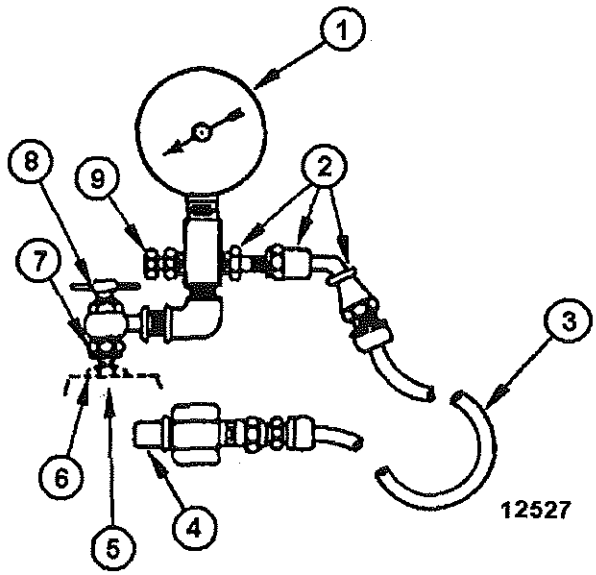
Periodic maintenance should include the following steps:

1. Inspect the accumulator cylinders and connecting hardware for evidence of leakage, damage, or wear. Repair or replace as required.

2. Check the precharge pressure level of the gas in the gas end of the accumulator as outlined in the procedure entitled Precharging the Accumulator in these instructions to the pressure defined in the system test procedures in Section 5 - Hydraulic System in this manual.

Recharge as instructed. Frequent recharging indicates the need to service the unit (replace the seals).

NOTE: *Worn piston seals may allow the gas to enter the hydraulic oil in the system. The addition of this gas to the oil would adversely affect system operation (possibly including spotty or uneven system performance and "spongy" or unsteady operation) similar to operation with air or other gases in the system. If gas does transfer, it is important to properly "bleed" all entrapped contaminants from the oil prior to placing the truck into service.*



KEY	12527
1.	PRESSURE GAUGE
2.	HIGH PRESSURE FITTINGS
3.	HOSE ASSEMBLY
4.	CONNECTION TO NITROGEN BOTTLE
5.	ACCUMULATOR
6.	ACCUMULATOR GAS VALVE
7.	SWIVEL NUT
8.	GAS CHECK STEM
9.	BLEEDER VALVE

FIGURE 1 - ACCUMULATOR PRECHARGING EQUIPMENT

PRECHARGING THE ACCUMULATOR (Figures 1, 2 and 3)

The accumulators should be precharged as follows: (Figure 1 unless otherwise identified.)

IMPORTANT: *The supply cylinder must be of the type that vaporizes the nitrogen when it is withdrawn. Do not charge with liquid nitrogen or any other gas.*

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction and park brake systems.

2. Drain all hydraulic pressure from each of the accumulators by pulling all valves and holding until indications that all pressure is released are noted (typically the "noise" of the released pressurized oil stops). Release the valve(s).

⚠ DANGER

Never loosen any line or begin any activity without first releasing all pressure from the system.

3. Verify that the accumulator end caps are installed flush with the body and the gas valve is secured tightly.

4. Remove the gas valve guard (12) and cap. (Figures 2 and 3)

5. Turn the gas chuck stem or "T" handle (on the charging assembly) completely out (counter-clockwise).

NOTES:
1. The equipment required for checking or changing system pressure is contained in Figure 1.
2. It is strongly recommended that a regulator be installed on the high pressure nitrogen bottle that is used as a supply source. The regulator should be adjusted to release maximum pressure only slightly above that required by the component or system being charged.

6. Install the gas chuck swivel nut (7) onto the gas valve and, using a suitable wrench, torque to 10 to 15 in-lb. (1.1 to 1.7 Nm).

⚠ CAUTION

Do not loop or twist the hose, as it will stiffen when gas pressure is released from the nitrogen bottle.

7. Close the bleeder screw valve (9) on the charge equipment.

8. Turn the gas check stem or "T" handle clockwise until it reaches the end of its travel. This will depress the core in the accumulator gas valve.

9. Read the pressure indicated on the pressure gauge.

a. If the pressure is less than that listed in the appropriate test procedure, open the nitrogen bottle control valve slightly and allow the accumulator to fill slowly. Shut off the valve when the gauge indicates the desired pressure.

b. If the pressure is greater than that listed in the appropriate test procedure, open the bleeder valve on the charging equipment (typically below the gauge and opposite the gas valve) slightly, for a brief moment, then close to release the extra pressure.

⚠ WARNING

Escaping nitrogen may be cold enough to cause personal injury if it comes into contact with the skin. Care must be taken to avoid direct contact between the gas and any part of the body.

⚠ WARNING

Do not attempt to reduce accumulator precharge pressure by directly depressing the valve core, as high pressure may rupture the rubber valve seat. Instead, use the charging assembly, and use the bleeder valve.

NOTE: *If large quantities of nitrogen are added or removed from the accumulator during this process, it is recommended that the accumulator temperature be allowed to stabilize prior to taking final pressure measurements. This may be done by allowing the system to set idle 10 to 15 minutes after adding or removing gas.*

10. When charging is complete, turn the gas check stem or "T" handle (8) completely out (counter-clockwise) until it reaches the stop. Open the bleeder valve (9) to allow entrapped pressure to escape.

11. Loosen the swivel nut (7) and remove the assembly. Hold the accumulator's gas valve to prevent it from coming loose.

⚠ WARNING

Never loosen the swivel nut (7) from the gas valve without first turning the gas check stem or "T" handle (8) completely out and opening the bleeder valve (9).

12. Install the cap, torqued to 10 to 15 in.-lb. (1.1 to 1.7 Nm). Install the gas valve guard (12) (Figures 2 and 3).

NOTE: *The procedures are similar for checking or releasing the precharge pressure. The seals should be replaced when a continuing change in the precharge pressure is detected. As the pressure losses are observed, begin a program of frequent checking as a guide to how soon seal replacement must be made. In this manner, maintenance can be planned ahead without the need for any emergency repairs. Do not continue to operate a truck with leaky or damaged accumulators.*

13. Start the truck engine, allow the accumulators to recharge with hydraulic oil, and check system operation.

14. Remove the charging kit from the supply bottle, cap and store each properly.

REMOVAL

The accumulators may be removed from the truck as follows:

1. Drain all hydraulic pressure from the accumulators and entire system as outlined in system procedures in Section 5 - Hydraulic System.

2. Drain all gas precharge pressure as outlined in the procedures in Maintenance and Adjustment.

3. Remove the precharging assembly from the accumulator.

4. Unscrew the gas valve (part way) until any remaining gas begins to escape. Wait until all gas is exhausted before continuing.

⚠WARNING

Escaping nitrogen may be cold enough to cause personal injury if it comes into contact with the skin. Care must be taken to avoid direct contact between the gas and any part of the body.

5. After all pressure is drained, remove the gas valve.

6. Remove the hydraulic connection to the accumulator. Allow any oil to drain into an appropriate container. Cap all openings, and label each to aid in installation.

7. Remove the capscrews that secure the accumulators to the mounting bracket.

8. Lift the accumulator(s) clear of the mounting bracket.

NOTE: *The threaded holes in the top end cap may be used as a means of attachment for lifting. An appropriate sling around the body may also be used.*

DISASSEMBLY (Figures 2 and 3)

The accumulator may be disassembled as follows:

1. Verify that the gas valve has been removed. If it is still installed, verify that all of the gas and hydraulic oil has been released as outlined in the procedures in Maintenance and Adjustment.

⚠WARNING

Deep vise marks, scratches, or distortions of the outer tube may cause stress concentrations in the tube under high pressure. Such concentrations may eventually cause component leakage or failure.

2. Set the accumulator horizontal and secure with a strap wrench or vise, gripping over the hydraulic end cap.

3. Install capscrews in the threaded holes in the removable gas end cap (6).

⚠WARNING

Always remove the gas cap, the end cap containing the gas charging valve, first.

4. Remove the cap by using a long bar and carefully "prying" on the capscrews installed for this purpose.

5. Inspect then remove, the seal ring (7) and back up ring (8) from the end cap.

6. Remove the piston assembly by carefully tapping on the oil end with a wooden dowel through the oil hole in the fixed end as it is guided out of the body. Extra care should be taken to prevent damage to the piston or the seals on the threads of the cylinder body.

IMPORTANT: *Never try to remove the piston by applying compressed air to the opposite end.*

7. Inspect, then remove the seals and rings from the piston (2).

IMPORTANT: *There are two versions of the accumulators. Earlier versions incorporated wear bands and T-seals as shown in Figure 2. Later versions used a*

different seal arrangement and a primary seal with two back up rings as shown in Figure 3. Different pistons are required with each type of seal configuration. It is important to determine which configuration the accumulator has and to reinstall the correct type seals.

NOTE: *To remove the seals from the piston (2), lift the seal ring with a small, smooth screwdriver or similar tool. Move the tool around the piston several times while using the other hand to "work" each of the rings off the piston.*

8. On earlier version accumulators, inspect then remove the wear bands (3) from the piston (2).

INSPECTION AND REPAIR

The accumulator may be serviced as follows:

1. Thoroughly clean all metal parts in solvent and dry with compressed air.

2. Clean the bore of the cylinder body (1) and piston (2) with a clean, lintless cloth soaked in clean solvent.

NOTE: *The bore and piston must be clean of any particles visible, or detectable to the touch.*

3. Inspect the piston for evidence of cracks, burrs (especially around seal ring grooves), for damage. Also inspect for damage due to "bottoming" on the end cap. Repair or replace as required.

4. Using a light, examine the body bore for scratches or scoring. Inspect the end caps for damaged threads or burrs on O-ring grooves. Minor nicks, scratches or light scoring of the body bore can be removed by using crocus cloth. Dress the bore until all apparent imperfections have been removed.

5. Inspect the seal rings. If damaged, determine the cause and correct before proceeding. They should all be replaced at each disassembly.

IMPORTANT: *There are two versions of the accumulators. Earlier versions incorporated wear bands and T-seals as shown in Figure 2. Later versions used a different seal arrangement and a primary seal with two back up rings as shown in Figure 3. Different pistons are required with each type of seal configuration. It is important to determine which configuration the accumulator has and to reinstall the correct type seals. The piston must be changed if the later type of seal is to be used in an accumulator originally equipped with the earlier type of seal.*

NOTE: *The piston "rides"' on the seal rings and does not touch the accumulator bore.*

ASSEMBLY

The accumulator may be assembled as follows:

1. Coat all seals and internal parts with clean hydraulic fluid compatible with that used in the truck's hydraulic system.

2. Install the primary seals on the piston (2) as shown in Figures 2 and 3.

IMPORTANT: *There are two versions of the accumulators. Earlier versions incorporated wear bands and T-seals as shown in Figure 2. Later versions used a different seal arrangement and a primary seal with two back up rings as shown in Figure 3. Different pistons are required with each type of seal configuration. It is important to determine which configuration the accumulator has and to reinstall the correct type seals. The piston must be changed if the later type of seal is to be used in an accumulator originally equipped with the earlier type of seal.*

NOTES:
1. The rings may have to be stretched slightly to install. Once installed they should be allowed to relax to their original size for several minutes. Cooling can quicken this relaxation. However, make sure all moisture residue is removed prior to continuing assembly and that the seals are straight, not twisted.
2. Exercise special care not to "pinch" or distort the back up rings.

3. Install the wear bands or other seals on the piston (2) oriented as shown in Figures 2 and 3.

4. Install the piston assembly in the bore of the cylinder body (1). The larger hollow side of the piston should be directed toward the gas end.

NOTES:
1. The piston must go into the bore exactly square and very slowly, as the seal ring will move if done slowly, but may be damaged if forced quickly. The piston will fit snug. Do not let the seal rings "drag" on the threads.
2. Use a hammer and a wooden dowel or block to tap the piston into place until all of piston is at least 2 inches (50 mm) below the beginning of the honed bore. Keep force against the piston while tapping the seals through the bore chamfer, otherwise the piston will bounce back, damaging the seals. Cover the port opening to keep out dirt.

KEY 56297			
01.	Cylinder Body	07.	End Cap O-ring Seal
02.	Piston	08.	Back-up Ring
03.	Piston Wear Band	09.	Gas Valve Guard Spacer
04.	Piston T-Seal Ring	10.	Capscrews
05.	Instruction Plate	11.	Gas Valve
06.	Gas End Cap	12.	Gas Valve Guard

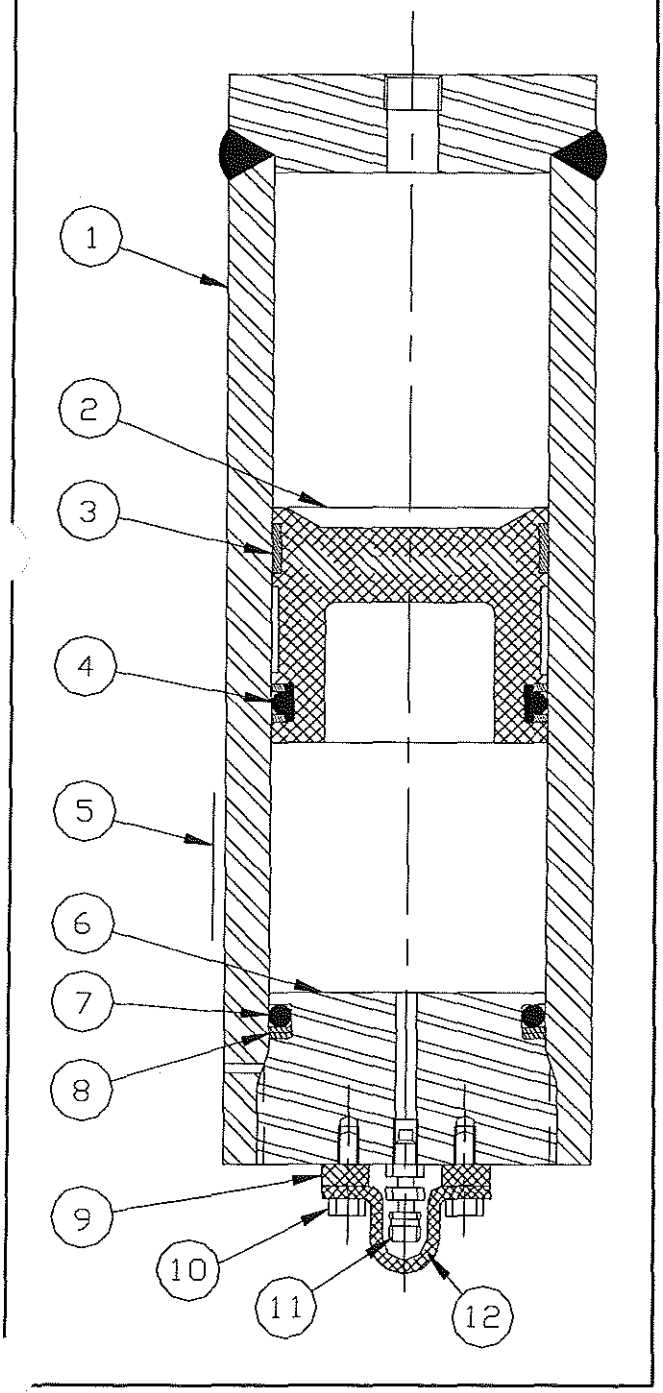


FIGURE 2 - ACCUMULATOR ASSEMBLY – EARLIER VERSION

KEY 56597			
1.	Cylinder Body	07.	End Cap O-ring Seal
2.	Piston	08.	Back-up Ring
3.	Piston Seals	09.	Gas Valve Guard Spacer
4.	Back-up Ring, Piston	10.	Capscrews
5.	Primary Piston Seal	11.	Gas Valve
6.	Gas End Cap	12.	Gas Valve Guard

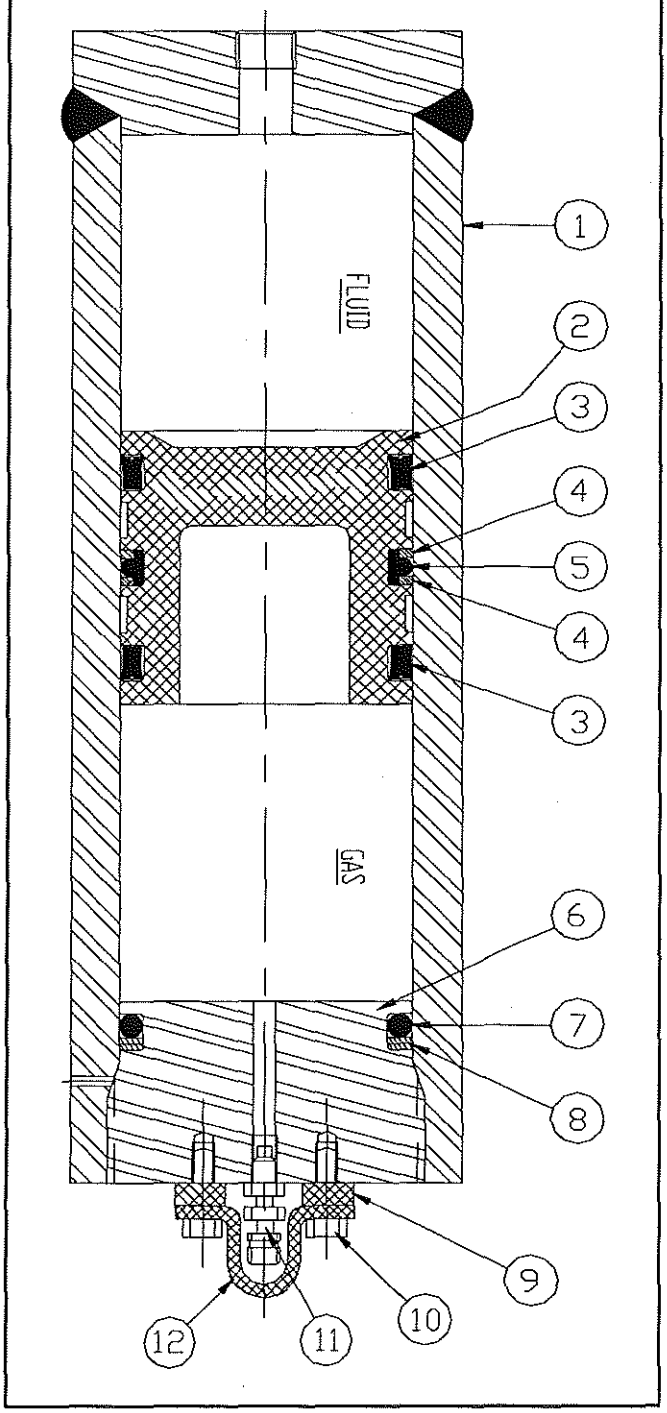


FIGURE 3 - ACCUMULATOR ASSEMBLY – LATER VERSION

5. Install a seal ring (7) and back up ring (8) on the gas end cap (6). Lubricate the seal ring with hydraulic oil. Install onto the body and tighten until the O-ring forms a seal and "tightens". Do not over tighten as this may damage the seal assembly.

NOTES:
1. Exercise care not to "drag" the seal rings over the threads when installing.
2. The cap should "bottom out" on the body. Be careful not to over-tighten.

6. Install the gas valve (11).

7. Install the gas valve cover and guard (12) with spacer (9). Secure with capscrews (10).

INSTALLATION

The accumulators may be installed as follows:

1. Position the accumulator in the mounting bracket.

NOTE: *The threaded holes in the gas end cap may be used as a means of attachment for lifting. An appropriate sling around the body may also be used.*

2. Install the mounting hardware.

3. Secure the unit in place with capscrews and washers.

4. Install the hydraulic connections to the accumulator.

5. Precharge the gas side of the accumulator as outlined in the instructions in the procedures in Maintenance and Adjustment.

6. Install the gas valve cap.

7. Start the truck engine and allow the systems to pressurize or charge normally. Inspect for evidence of leakage or damage.

8. Bleed all entrapped air or contamination from each of the systems as outlined in the procedures in Section 5 - Hydraulic System.

9. Test the system operation as outlined in the procedures in Section 5 - Hydraulic System.

HYDRAULIC SYSTEM

DESCRIPTION AND LOCATION

The hydraulic system provides power and assist for the steering, dumping, and brake systems as well as a number of lesser systems. Refer to the individual systems or component modules for detailed information.

OPERATION

The hydraulic oil supply is drawn from the hydraulic reservoir (tank) to the pump assembly. The pumps develop the pressure and flow demanded by the individual systems. The oil is routed back to the reservoir after it completes the cycle in the system.

The reservoir is maintained at a relatively constant pressure of 5 to 10 psi (35 to 70 kPa) at all times during normal operation using the internal pressure created through the operation of the truck's hydraulic system. A relief valve preset at 10 psi (70 kPa) prevents the pressure from exceeding this level.

On some trucks, a hydraulic oil cooler system is included assist in maintenance of cooler temperatures in the ydraulic system. Detailed information on this system, its operation, maintenance, and testing is included in the information on the Dump System in Section 5 – Hydraulic System of the appropriate Mechanical Manual.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance of the hydraulic system should include the following:

1. Test the operation of the dump, steering, brake, and any other hydraulic systems as outlined in the instructions in Section 5 - Hydraulic System.

2. Inspect the systems and each of the components for evidence of leakage, wear, or damage. Refer to the individual system or component modules in Section 5 - Hydraulic System for detailed information.

3. Check the oil level in the hydraulic tank. To verify the proper operating level it should be checked as follows:

a. With the engine and Master Switch both Off, check the oil level in the sight plugs.

(1) At a minimum, it should be above the level indicated by the bottom or low level plug.

(2) If not at this minimum level, add sufficient amounts of the oil through the quick disconnect/prefiltering system on the truck to obtain this level.

b. Start the engine and allow to run at low idle speed.

c. Allow all system accumulators in the steering and brake systems to fully reach operating pressure.

d. Recheck the oil level. If it has disappeared below the lower sight plug (with the dump body in the fully lowered position) it may be necessary to refill as outlined previously prior to continuing this procedure.

NOTE: *This is especially true if the operating systems have been drained or not refilled since previous servicing.*

e. Operate each of the systems through sufficient cycles so that all air is bled from each system.

f. With the dump body fully lowered and resting on the truck frame, the steering in straight ahead position and all brakes released, stop the engine, but leave the Master Switch ON.

g. Recheck the oil level sight plugs. If the level is not to the full level, refill as outlined previously in these instructions. Be sure to leave the Master Switch ON for the entire filling process.

NOTES:
1. Since a relief valve assembly regulates the pressure in the tank, it is not necessary to relieve entrapped pressure in the tank before adding hydraulic oil.
2. Operation of the truck with the oil level between the full and low levels when measured as indicated is permissible, but filling fully at this time will provide increased system capacity.
3. Do not overfill the tank above the full sight plug.

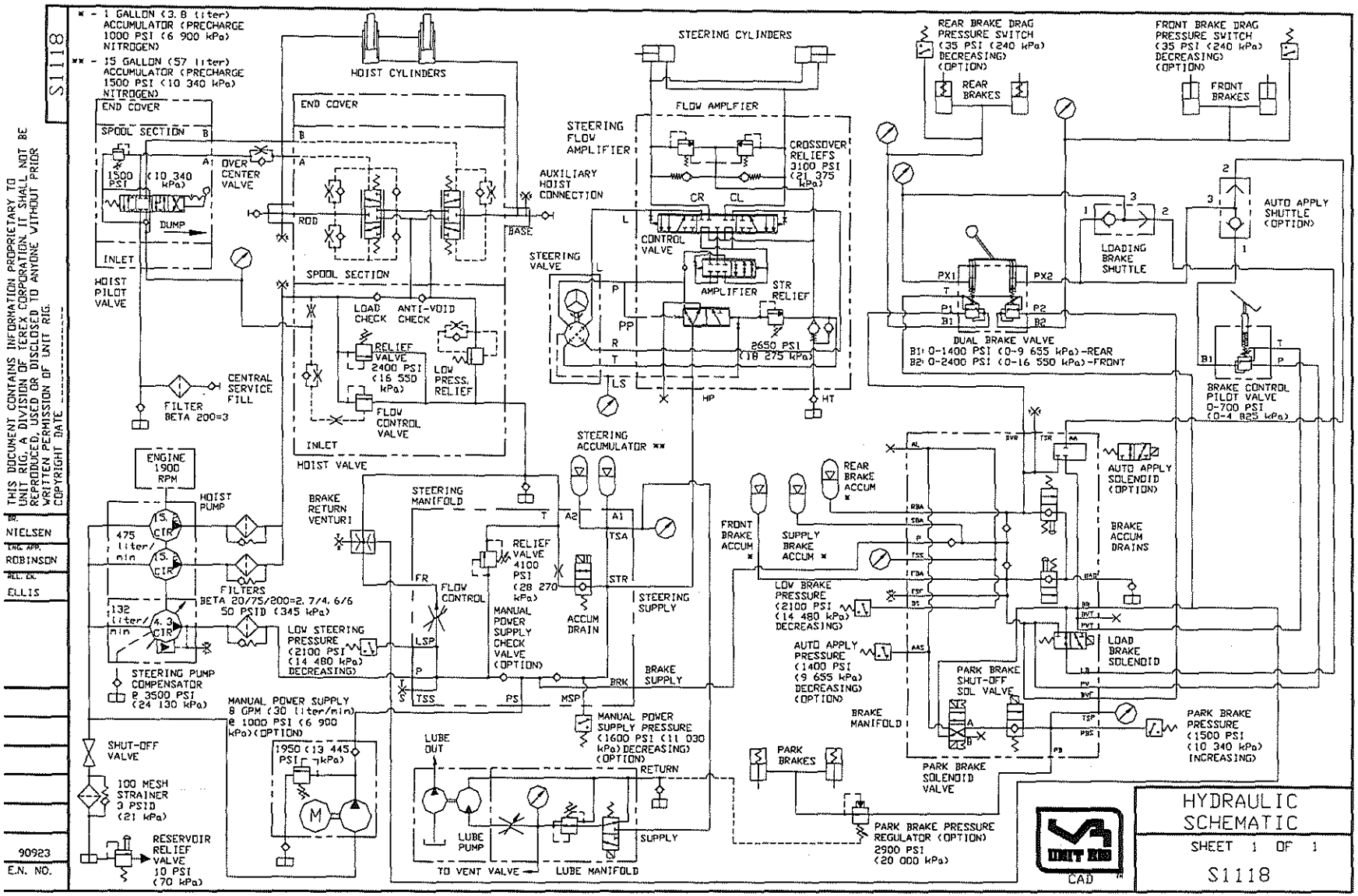


FIGURE 1 - HYDRAULIC SYSTEM SCHEMATIC –
TRUCKS NOT EQUIPPED WITH HYDRAULIC OIL COOLERS

M1755

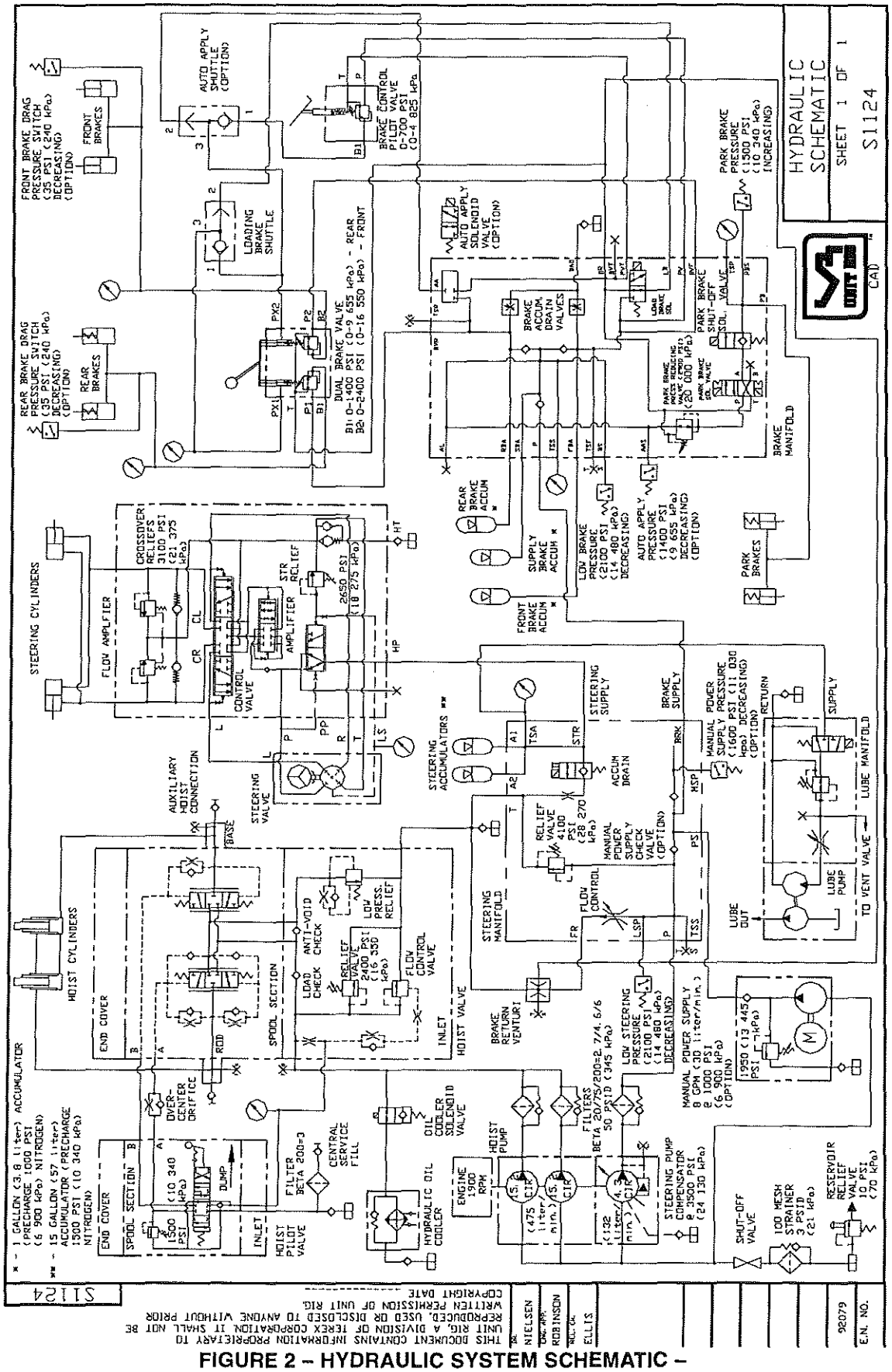


FIGURE 2 – HYDRAULIC SYSTEM SCHEMATIC – TRUCKS EQUIPPED WITH HYDRAULIC SYSTEM OIL COOLERS

HYDRAULIC STEERING SYSTEM

DESCRIPTION AND LOCATION

Components in the steering system include:

1. Steering pump - variable displacement, pressure compensating piston pump assembly comprising the rear section of the triple hydraulic pump assembly attached to a frame mounted bracket.

2. Hydraulic filter - pressure filter assembly with replaceable cartridge element mounted on the inside of the frame on the driver's side near the hydraulic tank.

3. Steering accumulators - long, slender piston type accumulator mounted in front of the hydraulic tank.

4. Steering orbital valve - cylindrical valve attached to the base end of the steering column behind the access panel in front of the cab.

5. Steering system flow amplifier - rectangular valve mounted inside the front frame rail, in front of the front axle assembly.

6. Steering cylinders - double acting hydraulic cylinders mounted on the front of the front axle assembly.

7. Steering manifold - multi-valve, metal manifold with externally mounted cartridges, mounted on top of the steering system hydraulic filter.

8. Manual power supply pump - 24 Vdc electric motor driven hydraulic pump mounted on the pump mounting platform. It is intended to be used for pressurizing the steering and brake systems during maintenance purposes (such as towing a disabled truck) only.

9. Pressure switches - typically diaphragm type pressure switches located as follows:

a. Low Steering Pressure (LSP) - mounted on the steering manifold. This switch warns the operator of decreased pressure in the steering system that results in diminished steering performance.

b. Manual Power Supply Pressure (MPSP) - mounted on the steering manifold. This switch controls the automatic operation of the manual power supply pump under specific operating conditions.

OPERATION

The hydraulic steering system consists of two subsystems, supply and operation, which perform together to control the operation of the steering system.

SUPPLY

Hydraulic oil to supply the system is drawn from the hydraulic reservoir into the steering pump assembly. The pump is a piston type pump with a moveable swashplate that is controlled in a pressure-compensating mode. In this configuration, the pump swashplate stroke is controlled from 0 to maximum displacement per revolution to provide a flow sufficient to maintain constant pressure of 3500 psi (24 130 kPa) in the system accumulators. The output of the pump is routed to the accumulators through a high pressure oil filter and steering manifold and on to the steering and brake accumulators, which are kept at a "constant state of charge". The majority of operating time, the steering pump output will equal the steering demands without depleting the accumulator reserves.

OPERATION

The control of the system is based on a principle of flow amplification, in which a limited or pilot flow from the steering valve is used to control the operation of the flow amplifier valve that regulates system flow to the steering cylinders.

When the steering wheel is held stationary (considered the neutral position whether the vehicle is traveling straight or being controlled during a turn):

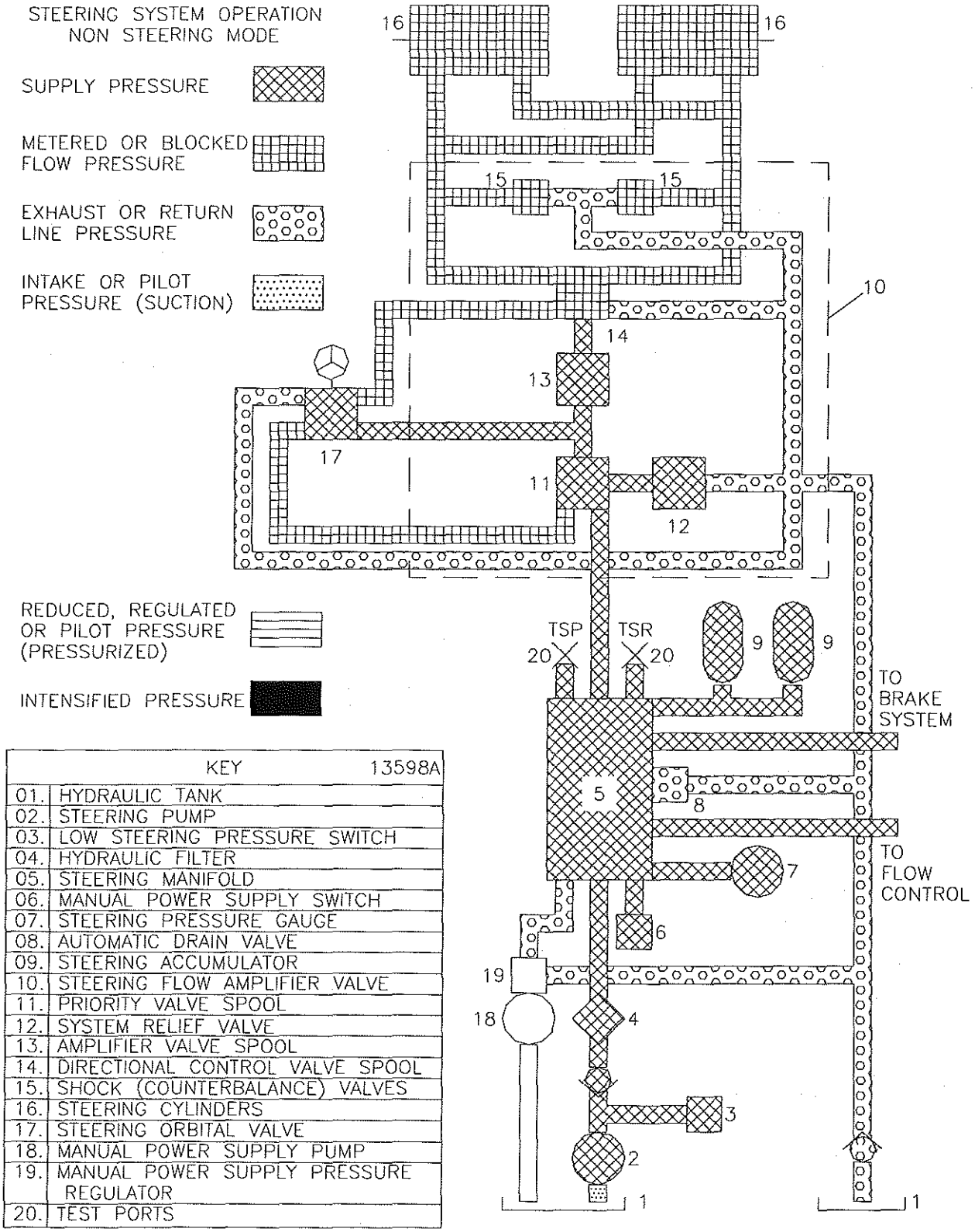
1. The supply of oil from the steering pump is routed across the integral priority valve in the flow amplifier.

2. The directional control valve remains in the centered position. In this mode, any pressure surges induced by road conditions (e.g. when striking a hole in the road) are absorbed by the integral shock valves in the flow amplifier instead of being transmitted to the steering control unit, non-reactive steering.

When the steering valve is activated (by movement of the steering wheel) to change the position of the vehicle's front wheels:

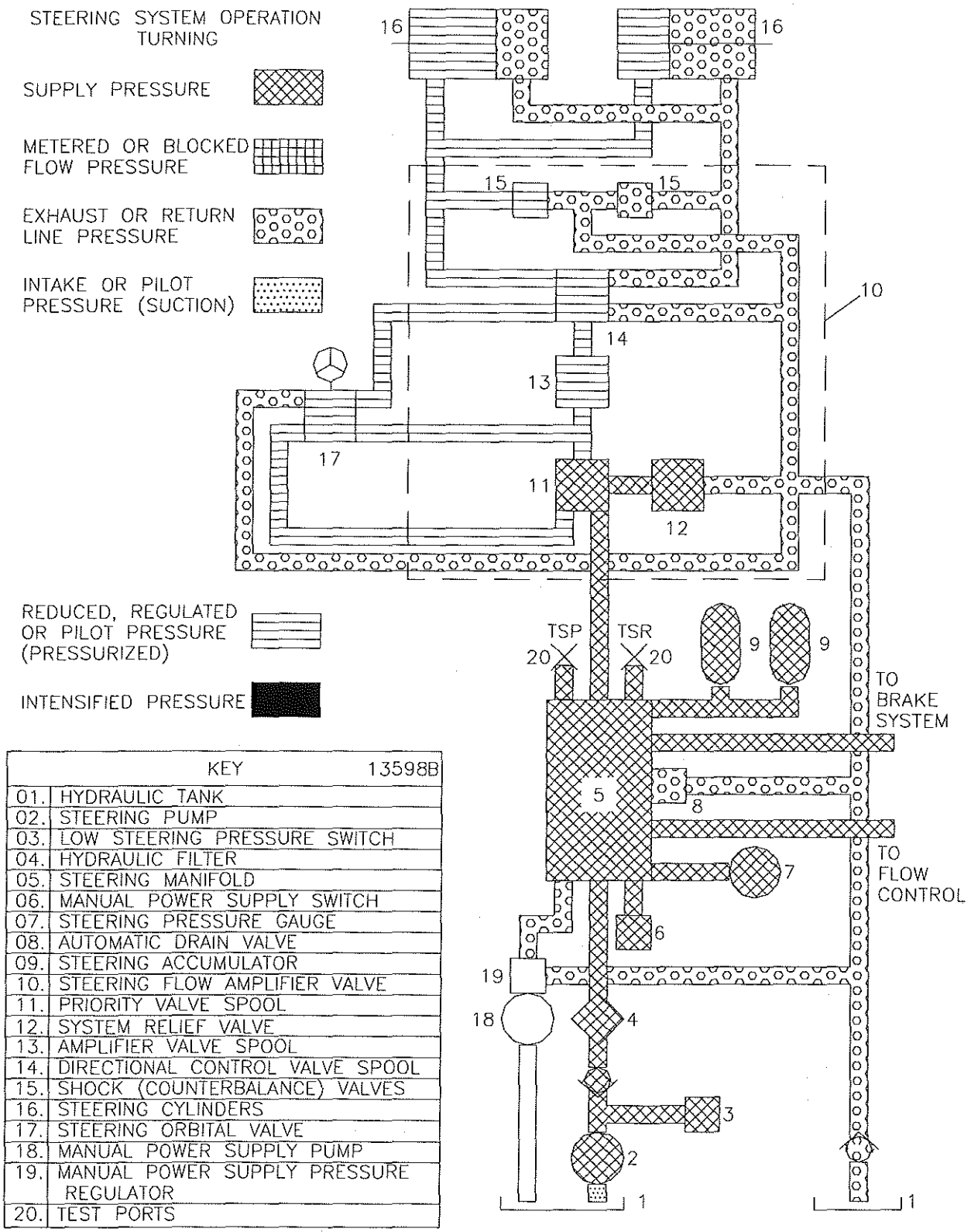
1. A load sense signal is passed from the steering valve to the flow amplifier's priority valve.

2. The priority valve shifts changing the path of the oil



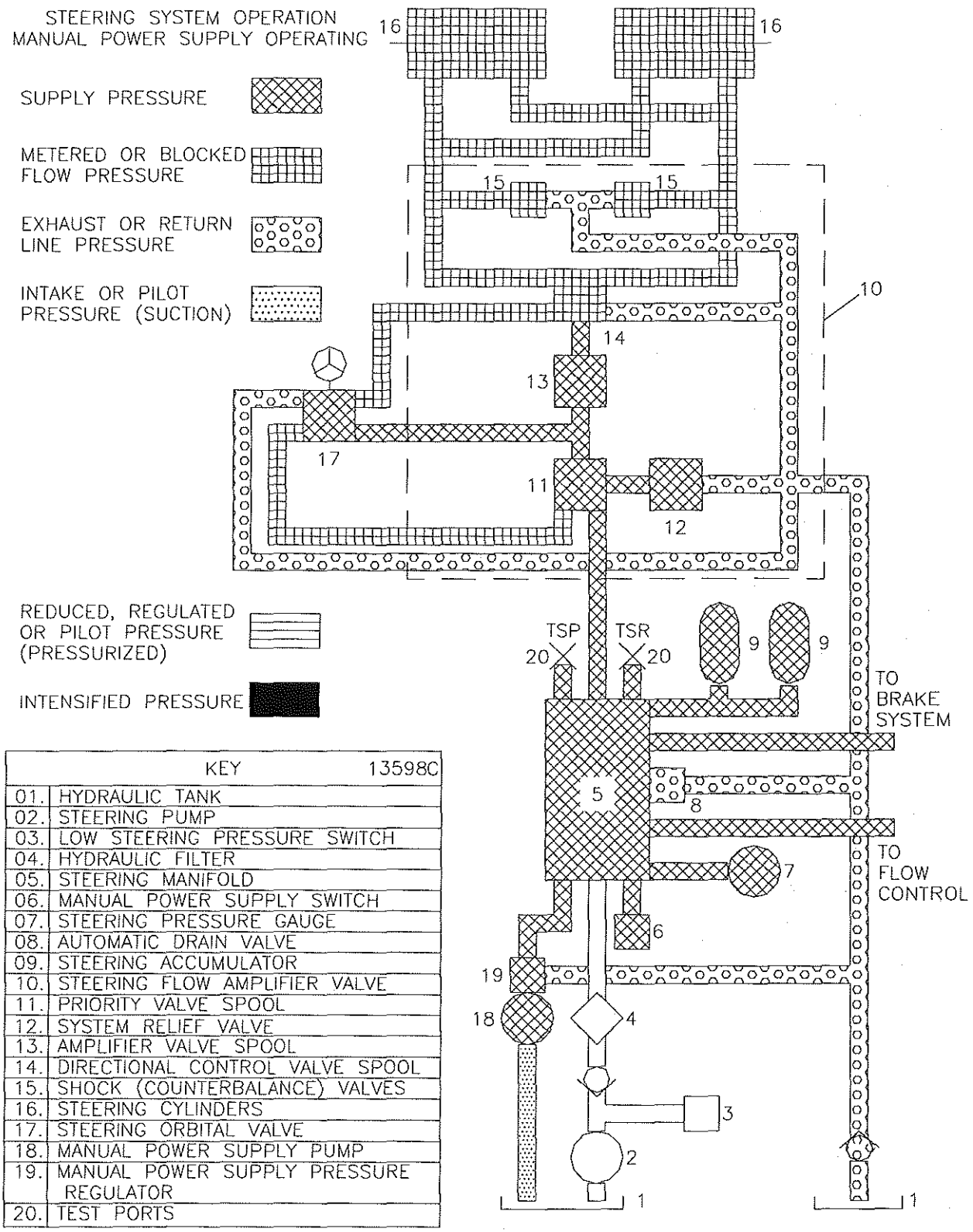
KEY	13598A
01.	HYDRAULIC TANK
02.	STEERING PUMP
03.	LOW STEERING PRESSURE SWITCH
04.	HYDRAULIC FILTER
05.	STEERING MANIFOLD
06.	MANUAL POWER SUPPLY SWITCH
07.	STEERING PRESSURE GAUGE
08.	AUTOMATIC DRAIN VALVE
09.	STEERING ACCUMULATOR
10.	STEERING FLOW AMPLIFIER VALVE
11.	PRIORITY VALVE SPOOL
12.	SYSTEM RELIEF VALVE
13.	AMPLIFIER VALVE SPOOL
14.	DIRECTIONAL CONTROL VALVE SPOOL
15.	SHOCK (COUNTERBALANCE) VALVES
16.	STEERING CYLINDERS
17.	STEERING ORBITAL VALVE
18.	MANUAL POWER SUPPLY PUMP
19.	MANUAL POWER SUPPLY PRESSURE REGULATOR
20.	TEST PORTS

FIGURE 1 - STEERING SYSTEM OPERATION - NON STEERING MODE (13598A)



KEY	13598B
01.	HYDRAULIC TANK
02.	STEERING PUMP
03.	LOW STEERING PRESSURE SWITCH
04.	HYDRAULIC FILTER
05.	STEERING MANIFOLD
06.	MANUAL POWER SUPPLY SWITCH
07.	STEERING PRESSURE GAUGE
08.	AUTOMATIC DRAIN VALVE
09.	STEERING ACCUMULATOR
10.	STEERING FLOW AMPLIFIER VALVE
11.	PRIORITY VALVE SPOOL
12.	SYSTEM RELIEF VALVE
13.	AMPLIFIER VALVE SPOOL
14.	DIRECTIONAL CONTROL VALVE SPOOL
15.	SHOCK (COUNTERBALANCE) VALVES
16.	STEERING CYLINDERS
17.	STEERING ORBITAL VALVE
18.	MANUAL POWER SUPPLY PUMP
19.	MANUAL POWER SUPPLY PRESSURE REGULATOR
20.	TEST PORTS

FIGURE 2 - STEERING SYSTEM OPERATION - TURNING (13598B)



KEY	13598C
01.	HYDRAULIC TANK
02.	STEERING PUMP
03.	LOW STEERING PRESSURE SWITCH
04.	HYDRAULIC FILTER
05.	STEERING MANIFOLD
06.	MANUAL POWER SUPPLY SWITCH
07.	STEERING PRESSURE GAUGE
08.	AUTOMATIC DRAIN VALVE
09.	STEERING ACCUMULATOR
10.	STEERING FLOW AMPLIFIER VALVE
11.	PRIORITY VALVE SPOOL
12.	SYSTEM RELIEF VALVE
13.	AMPLIFIER VALVE SPOOL
14.	DIRECTIONAL CONTROL VALVE SPOOL
15.	SHOCK (COUNTERBALANCE) VALVES
16.	STEERING CYLINDERS
17.	STEERING ORBITAL VALVE
18.	MANUAL POWER SUPPLY PUMP
19.	MANUAL POWER SUPPLY PRESSURE REGULATOR
20.	TEST PORTS

FIGURE 3 - STEERING SYSTEM OPERATION - MANUAL POWER SUPPLY OPERATING (13598C)

supply to the directional control valve portion of the steering control unit.

3. The directional valve is then shifted allowing the required flow to reach the amplifier valve assembly. The amount and speed of the input signal controls the magnitude of the spool's movement. The pilot and main flows are then merged and directed to the appropriate ports in the steering cylinders.

Stopping movement of the steering wheel returns the valve to the previously outlined stationary position.

Amplification occurs in the amplifier valve. As the pressure in the chambers increase, flow is regulated in an amount proportionate to the area of the holes in the various portions of the spool.

The directional control valve controls the return oil. In an overrun condition (in which the vehicle wheels try to cause steering movements more severe than the operator's inputs) the directional control valve automatically throttles the flow of this return oil to maintain stable control of the cylinders.

Steering "kick back" is controlled by the system requirement that the pressure in the port chamber of the amplifier valve must exceed that in the main chambers for the movement of the valve.

As in the neutral or stationary mode, the shock valves prevent pressure surges in the cylinders themselves. Suction valve provisions are also incorporated to prevent cavitation. To ensure a constant proper charge to the suction valves, a separate counter pressure valve is provided.

For detailed information of the remaining mechanical components in the steering assembly, refer to the information in Section 7 - Running Gear.

In conditions in which the output of the steering pump is not sufficient to handle the immediate total steering demands, the appropriate accumulators supply the required oil.

A manual power supply is available to provide assistance in steering a disabled truck (e.g. maintenance, engine problems or during towing). In this system, a 24 Vdc motor/pump combination draws fluid from the system reservoir and provides it directly to the steering and brake accumulators. Activation of this system is made either manually by means of a cab dash mounted control switch or automatically if the truck speed is above approximately 3 mph (5 km/hr) and the steering accumulator pressure decreases to less than a preset pressure.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following:

1. Inspect each component in the steering system for evidence of leakage, damage, or wear. Repair or replace as required.

2. Inspect all hydraulic hoses for damage or wear. Verify that they are secure from moving parts and chaffing and that all connections are properly torqued per the instructions in Section 10 - Miscellaneous.

3. Test the operation of the system as outlined in the procedures later in this section.

HYDRAULIC STEERING SYSTEM OPERATIONAL CHECK-OUT

The steering system should be periodically tested as follows:

Prior to Engine Start

1. Verify that the rear wheels are chocked or that the truck is parked in a SAFE POSITION and secured by means other than its friction or park brake system.

2. Verify that the front wheels are not chocked and all equipment and personnel are clear of the area in which the tires will move while turning.

3. Verify that all hose fittings are tightened to the torque specifications contained in Section 10 - Miscellaneous.

4. Verify that the trucks hydraulic tank is filled to the proper level with approved hydraulic oil.

5. Verify that the valve in the pump suction line is open.

6. Verify that all equipment is installed and secured in place in the steering linkage assembly.

7. If the engine is to be operated prior to hydraulic testing:

a. Steering manifold

(1) On manifolds equipped with the automatic or solenoid valve assemblies, this may be done by rotating the manual override button on the solenoid 180° and allowing the button to come out.

(2) On manifolds equipped with the manually operated needle valve assemblies, this may be done by turning the valve counter-clockwise to open and allow the oil to return to the reservoir.

NOTE: *These drain valves must be closed prior to moving the truck or beginning any testing on the steering and/or brake system.*

b. Brake manifold

(1) Remove the manual drain valve from the manifold.

(2) Install an appropriate O-ring boss plug in its place.

NOTE: *This plug must be removed and replaced by the appropriate manual drain valve assembly prior to moving the truck or beginning any testing on the steering and/or brake system.*

8. Verify the nitrogen gas precharge pressures in the accumulators are as follows:

a. Steering (2 large) - 1450 to 1550 psi (9 995 to 10 685 kPa).

b. Brakes (3 smaller) - 950 to 1050 psi (6 555 to 7 245 kPa).

Follow the procedures outlined in the instructions for each style accumulator in Section 5 - Hydraulic System.

NOTE: *The accumulators must be fully drained of all hydraulic pressure prior to checking gas pressure. This may be done by pulling the manual drain valve in the steering and brake manifolds to relieve the pressure in the systems.*

9. Locate the following pressure gauges in the hydraulic component box on the superstructure:

a. Steering accumulator pressure.

b. Steering system or valve pressure.

10. High pressure ("clippard") relief valve adjustment:

NOTE: *The relief valves are shipped from the factory preset. They should not be adjusted unless they have been taken apart for some reason. The internal components are not serviced separately and the valve assembly should be replaced as a complete unit if servicing is required.*

If adjustment is necessary:

a. Loosen the locking nut on the high pressure relief valve.

b. Slowly turn the adjusting screw inward until the screw stops or "bottoms" in its travel.

c. Turn the adjusting screw outward 1 full turn and lock in position with the locking nut.

11. Install a 0 - 5000 psi (0 - 35 000 kPa) pressure gauge on the quick disconnect fittings at the following locations:

a. The TSS or TSP port on the steering manifold.

12. If not previously tested, verify that the hydraulic reservoir is properly pressurized to 10 +/- 1 psi (70 +/- 7 kPa).

13. Verify that the valve in the hydraulic pump suction line is open.

14. If the truck has been sitting idle for an extended period of time or the steering pump or system has been drained since the last time the truck was started, fill the case drain on the steering pump with approved hydraulic oil.

15. Using the appropriate means for the electrical propulsion installed, disable the truck's propulsion system to prevent its operation when the Shifter is moved to the forward or reverse position.

16. Install a voltmeter to monitor the operation of the steering accumulator drain solenoid in the steering manifold.

Main Steering System Test and Adjustment

The steering system may be tested as follows:

1. Reconnect and properly torque all hoses previously removed.

2. Check the pressure in the steering system as follows:

a. Turn the Master Switch On.

b. Start the engine and allow to run at low idle speed.

c. Verify that at approximately 2100 psi (14 480 kPa) the Low Steering Pressure indicator goes out.

NOTE: *This is an approximation test at this point. More detailed final testing will be done later.*

d. Verify that the steering accumulator pressure reading on the gauge in the component box increases slowly to 3450 to 3550 psi (23 790 to 24 480 kPa), then stabilizes.

NOTE: *If the pressure is not correct:*
1. Check all other pressures and determine the cause for the incorrect pressure.
2. Only after determining that the problem is an incorrectly adjusted steering pump compensator, adjust as outlined in the Unit Rig Mechanical Manual.

e. With the engine still at low idle speed, turn the steering wheel back and forth repeatedly. Count the number of revolutions of the steering wheel. The normal is approximately 5-1/2 turns lock-to-lock.

f. Discontinue the steering wheel movement and verify that the steering accumulator pressure returns to 3450 to 3550 psi (23 790 to 24 480 kPa).

g. Verify that the oil level in the hydraulic reservoir remains at normal operating levels. Stop the engine and refill the reservoir if required to obtain this level.

h. Record the pressure reading.

3. Steering system relief valve adjustment:

a. Accelerate the engine to rated speed and hold.

b. Turn the steering wheel for a left or right turn until it "stops".

c. Verify that the pressure on the gauge in the component box marked "Steering Valve" is:

2600 to 2700 psi (17 930 to 18 620 kPa).

d. Release the steering wheel.

e. Verify that the pressure returns to approximately 0 psi (kPa).

f. Slow the engine to low idle speed.

g. If the pressure is not at this level, the flow amplifier valve may be adjusted as follows:

(1) Remove the cover of the top on the relief valve in the steering flow amplifier valve.

(2) Using the appropriate metric hex head "Allen" wrench, turn the adjustment screw inward (to raise the pressure) or outward (to lower the pressure).

NOTE: *One full revolution of the adjustment screw equals approximately 550 psi (3 790 kPa).*

(3) Accelerate the engine to rated speed and read the pressure. Verify that the pressure is:

2600 to 2700 psi (17 930 to 18 620 kPa).

(4) Repeat steps (1) - (3) until the proper pressure is obtained.

(5) Slow the engine to low idle speed.

(6) Secure the adjustment screw and replace the cap.

(7) Record the final pressure.

h. Accelerate the engine to rated speed and cycle the steering by turning back and forth throughout the travel 3 additional times. Slow the engine to low idle speed.

NOTE: *If the steering wheel continues to turn or "freewheel" when turned by the operator with low to moderate force (with the bellcranks against the stops), it is an indication that the pressure setting of the shock valves internal to the flow amplifier is too low. If this occurs, contact Unit Rig for adjustment or replacement information.*

i. Stop the engine.

Low Steering Pressure Switch Operation Test

1. Verify that:

a. The Low Steering indicator is not illuminated.

b. The truck Shifter is in the Neutral position.

c. There is no external speed input signal to the truck propulsion control system.

2. Slowly turn the steering wheel from side to side while monitoring the Low Steering Pressure indicator and steering pressure gauge connected to the test port on the outlet of the steering pump.

3. Verify that the truck's manual power supply system does not activate.

4. Verify that at 2050 to 2150 psi (14 135 to 14825 kPa) the Low Steering Pressure indicator illuminates.

NOTE: *On some pressure gauge assemblies, it may be difficult to accurately read this low pressure as it is decreasing. The primary intent is to verify that the indicator lights before the pressure decreases to 0 psi (kPa).*

5. Verify that the truck's manual power supply system does not activate.

6. Stop the movement of the steering wheel.

7. Record the actuation pressure.

Manual Power Supply System Test

Test the operation of the available manual power supply system as follows:

1. If required, raise the truck until the front tires are clear of the floor and block securely in this position.

2. Verify that there is no speed signal input present in the electric drive system's control panel.

3. With the engine stopped, turn the steering wheel back and forth until the pressure in the steering accumulators is less than 1750 psi (12 650 kPa).

4. Pull the Manual Steering Pump switch out to activate the system.

5. Verify this pressure increases then stabilizes at 1925 to 1975 psi (13 275 to 13 620 kPa) before the pump stalls or the pump's internal relief valve activates.

a. If the pressure is too high or low, it may be adjusted by means of the adjusting screw on the pump's relief valve. Secure the screw with the locking nut when the adjustment is complete.

b. If the motor stalls prior to obtaining this pressure, check the condition of the batteries, 24 Vdc circuitry, and pump/motor assembly.

6. Push the Manual Supply System Switch in to deactivate the pump assembly.

NOTE: *This is not a continuous duty motor assembly and should not be operated continuously for extended periods of time.*

7. On trucks equipped with the available automatic activation feature for the manual supply system:

a. Provide a condition that will simulate the truck's movement in operation (closing the normally open contacts on the speed relay) by either:

(1) Using a laptop computer, follow the normal control system procedures to cause the anti-reversal (AR) function to activate, or;

(2) Installing a jumper wire on the appropriate contacts on the speed relay that control the signal voltage.

NOTE: *Typically this is from terminal 30 to terminal 87 on the relay, but it is recommended that the proper schematics be reviewed to verify the correct locations.*

b. Turn the steering wheel back and forth slowly while monitoring the steering accumulator pressure.

c. Verify that at 1520 to 1680 psi (10 480 to 11 585 kPa):

(1) The pump activates and begins supplying oil to the system.

(2) The indicator light in the center of the Manual Power Supply Switch is on.

d. Temporarily discontinue turning the steering wheel.

e. Verify that at 1850 +/- 80 psi (12 750 +/- 550 kPa):

(1) The pump stops operating.

(2) The indicator light in the center of the Manual Power Supply Switch is off.

f. Repeat steps b through e as required.

g. Again using a laptop computer, follow the normal control system procedures to cause the anti-reversal (AR) function to deactivate or remove the jumper installed.

NOTE: *This is not a continuous duty motor assembly and should not be operated continuously for extended periods of time.*

Testing Steering Accumulator Drain Systems

Test the steering accumulator automatic pressure drain valve as follows:

1. Turn the Master Switch Off.

2. Verify that the steering accumulator pressure gauge (in the hydraulic component box) pressure reading decreases rapidly as the accumulator drains to the tank through the solenoid valve in the steering manifold.

3. Verify that the steering accumulator pressure decreases to approximately 0 psi (kPa).

4. Verify that the power to the drain valve coil switches off automatically (voltmeter returns to 0 volts) after approximately 150 seconds.

5. Remove the voltmeter.

Test the operation of the steering accumulator manual pressure drain valve as follows:

1. Turn the Master Switch On.

2. Start the engine.

3. Allow the pressure in the accumulator to rise until it exceeds 1500 psi (10 340 kPa), then stop the engine.

4. Pull the manual accumulator drain valve in the steering manifold to open.

5. Verify that the pressure in the steering accumulator decreases to 0 psi (kPa).

6. Release the manual drain valve to close.

Test complete

1. Install all covers removed.

2. Remove all blocking and lower the truck to the ground.

SERVICE

See individual component modules for detailed service information.

KEY					A85180
001.	Steering Flow Amplifier Valve	039.	Locknut	106.	Not Used
002.	Steering Orbital Valve	040.	Accumulator Mounting Bracket	107.	Clamp Support Assembly
003.	Steering Manifold Assembly	041.	Adapter Fitting	108.	Clamp Support Assembly
004.	Steering Accumulator	042.	Flatwasher	109.	Not Used
005.	Hydraulic Filter Assembly	043.	Capscrew	110.	Not Used
006.	Valve Bracket	044.	Hose Assembly	111.	Tube Clamp
007.	Capscrew	045.	Hose Assembly	112.	Tube Clamp
008.	Lockwasher	046.	Adapter Fitting	113.	Through Item 115. Not Used
009.	Capscrew	047.	Hose Assembly	116.	Hose Bracket
010.	Lockwasher	048.	Not Used	117.	Through Item 119. Not Used
011.	Socket Head Capscrew	049.	Hose Assembly	120.	Clamp Halves
012.	Lockwasher	050.	Flange Fitting	121.	Clamp Cap Plate
013.	Plug	051.	Not Used	122.	Capscrew
014.	Adapter Fitting	052.	Adapter Fitting	123.	Through Item 141. Not Used
015.	Adapter Fitting	053.	Plug	142.	Adapter Fitting
016.	Adapter Fitting	054.	Through Item 059. Not Used	143.	Through Item 150. Not Used
017.	Adapter Fitting	060.	Hose Assembly	151.	Locknut
018.	Adapter Fitting	061.	Hose Assembly	152.	Not Used
019.	Clamp Support Assembly	062.	Adapter Fitting	153.	Adapter Fitting
020.	Hose Assembly	063.	Pressure Gauge	154.	Hose Assembly
021.	Hose Assembly	064.	Capscrew	155.	Not Used
022.	Hose Assembly	065.	Adapter Fitting	156.	Hose Assembly
023.	Hose Assembly	066.	O-ring	157.	Clamp Support Assembly
024.	Hose Assembly	067.	Capscrew	158.	Through Item 160. Not Used
025.	Hose Assembly	068.	Pressure Switch	161.	Capscrew, Grade 8
026.	Flange Fitting	069.	Test Coupling	162.	Tube Clamp
027.	Hose Assembly	070.	Quick Connector	163.	Cushion Clamp
028.	Flange Fitting	071.	Not Used	164.	Clamp Support Assembly
029.	Hose Assembly	072.	Nameplate	165.	Adapter Fitting
030.	Hose Assembly	073.	Nameplate	166.	Angle Clip
031.	Adapter Fitting	074.	Through Item 079. Not Used	167.	Adapter Fitting
032.	Adapter Fitting	080.	Hardened Flatwasher	168.	Adapter Fitting
033.	Hose Assembly	081	Through Item 100. Not Used	169.	Cushion Clamp
034.	Hose Assembly	101.	Capscrew	170.	Adapter Fitting
035.	Hose Assembly	102.	Capscrew	171.	Adapter Fitting
036.	Hose Assembly	103.	Flatwasher	172.	Not Used
037.	Adapter Fitting	104.	Not Used	173.	Adapter Spacer
038.	Flange Fitting	105.	Clamp Support Assembly		

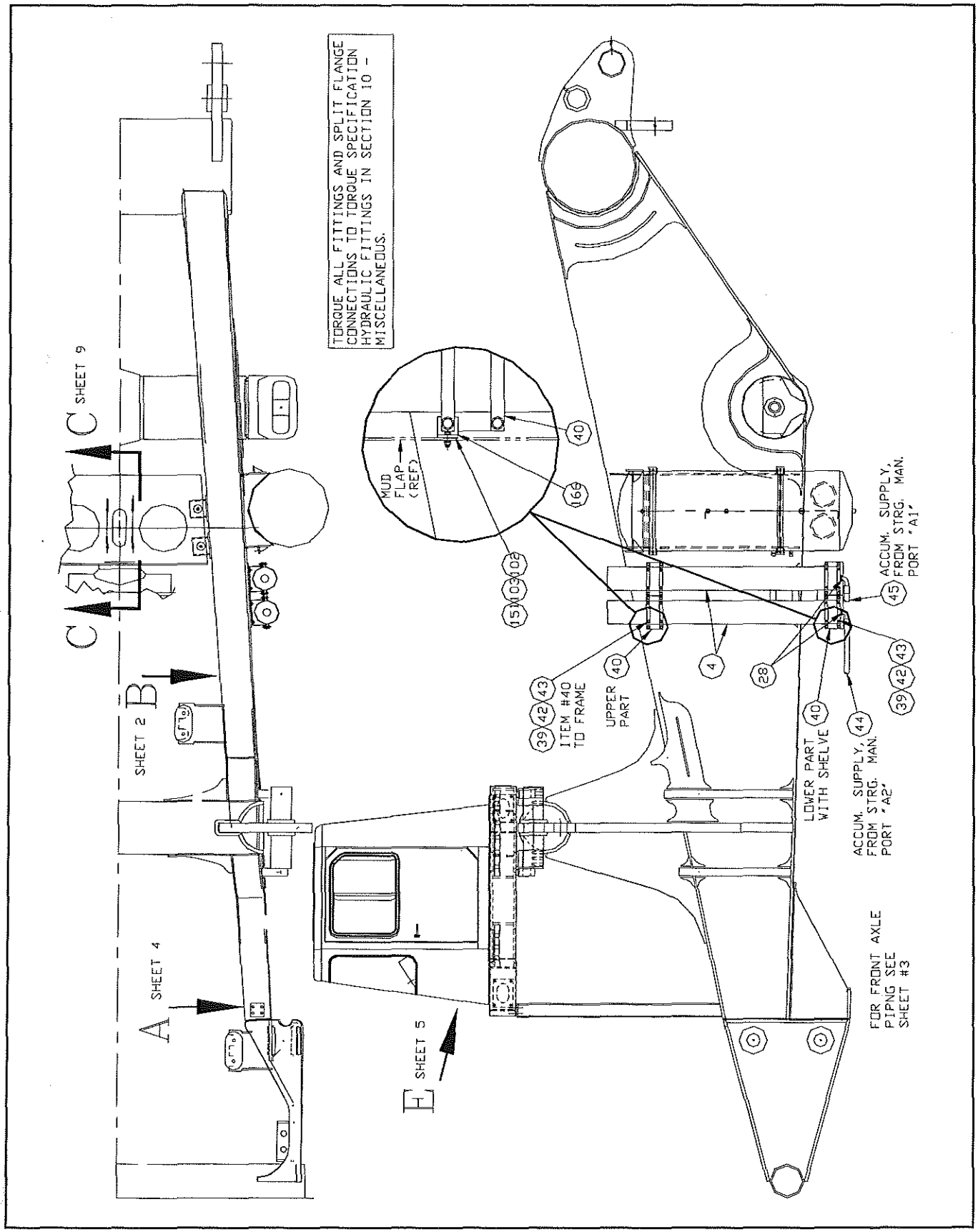


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 1 OF 9)

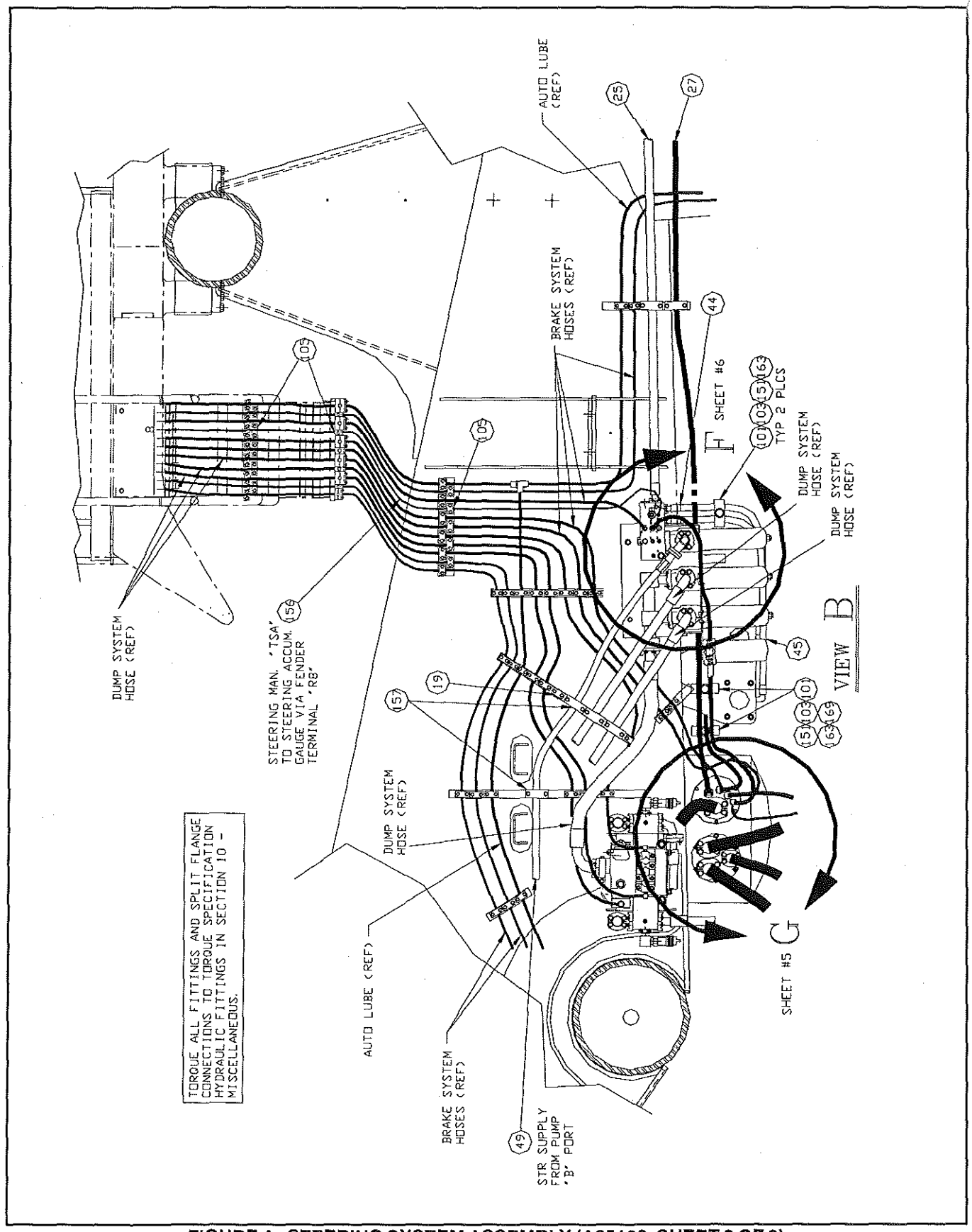


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 2 OF 9)

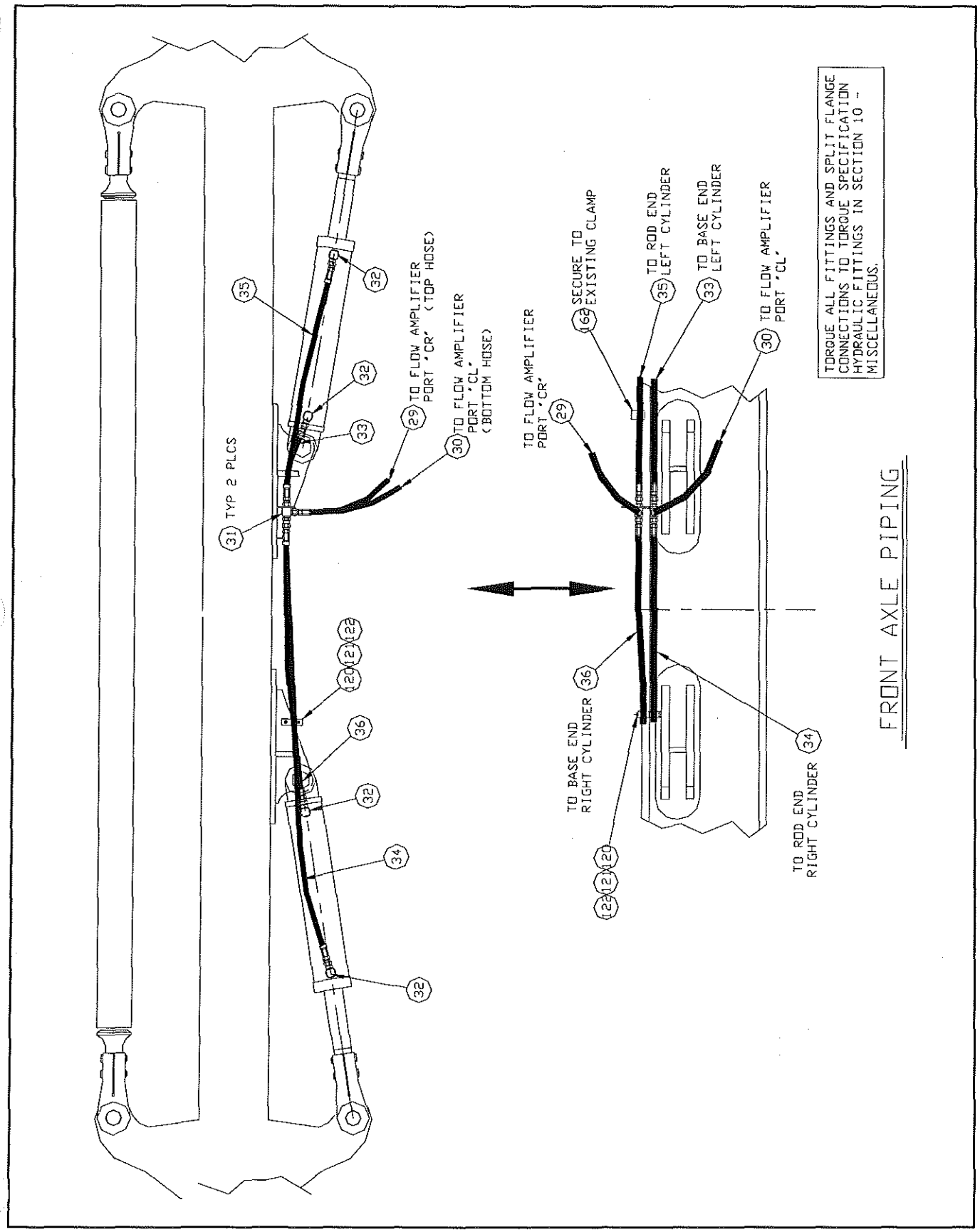


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 3 OF 9)

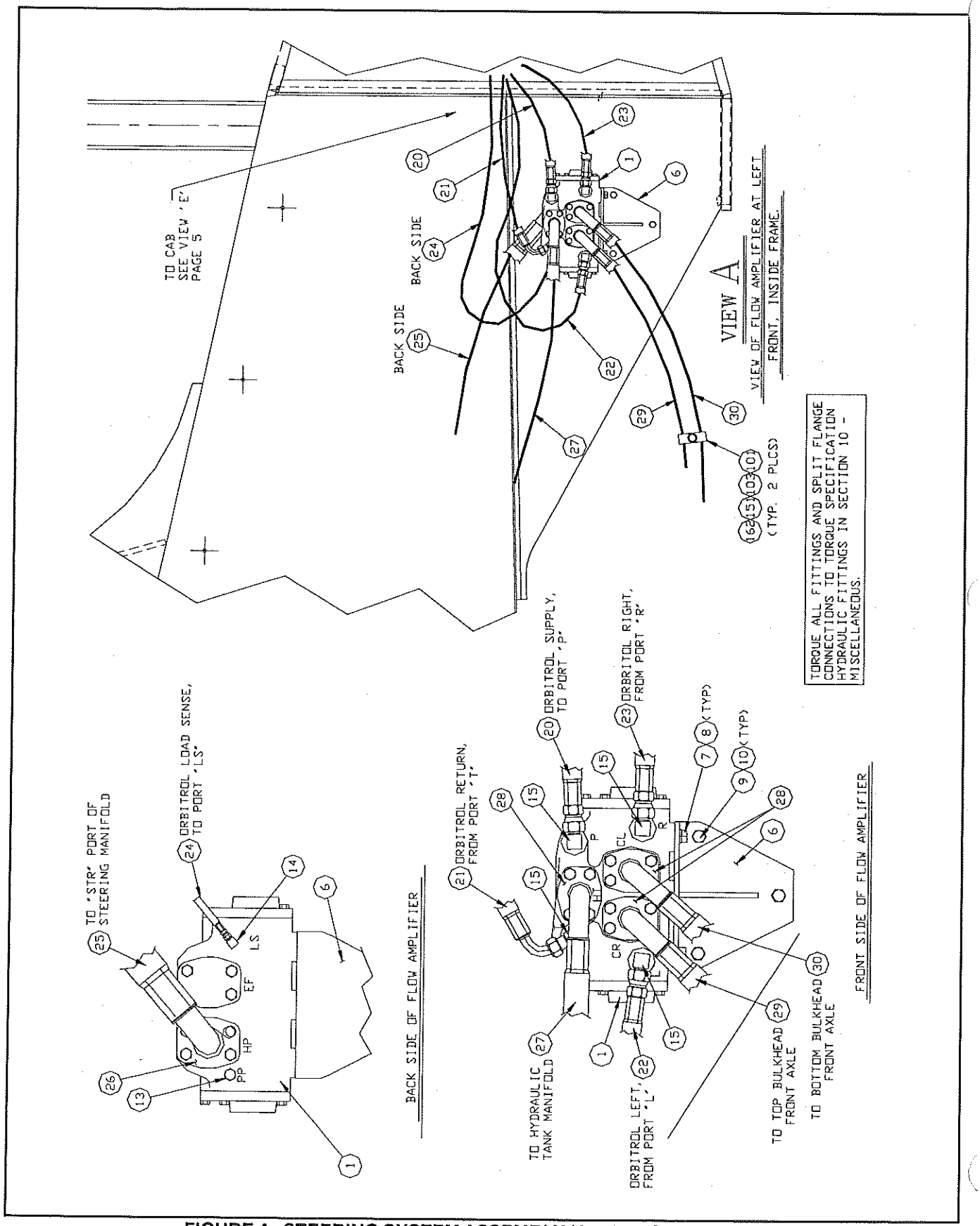


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 4 OF 9)

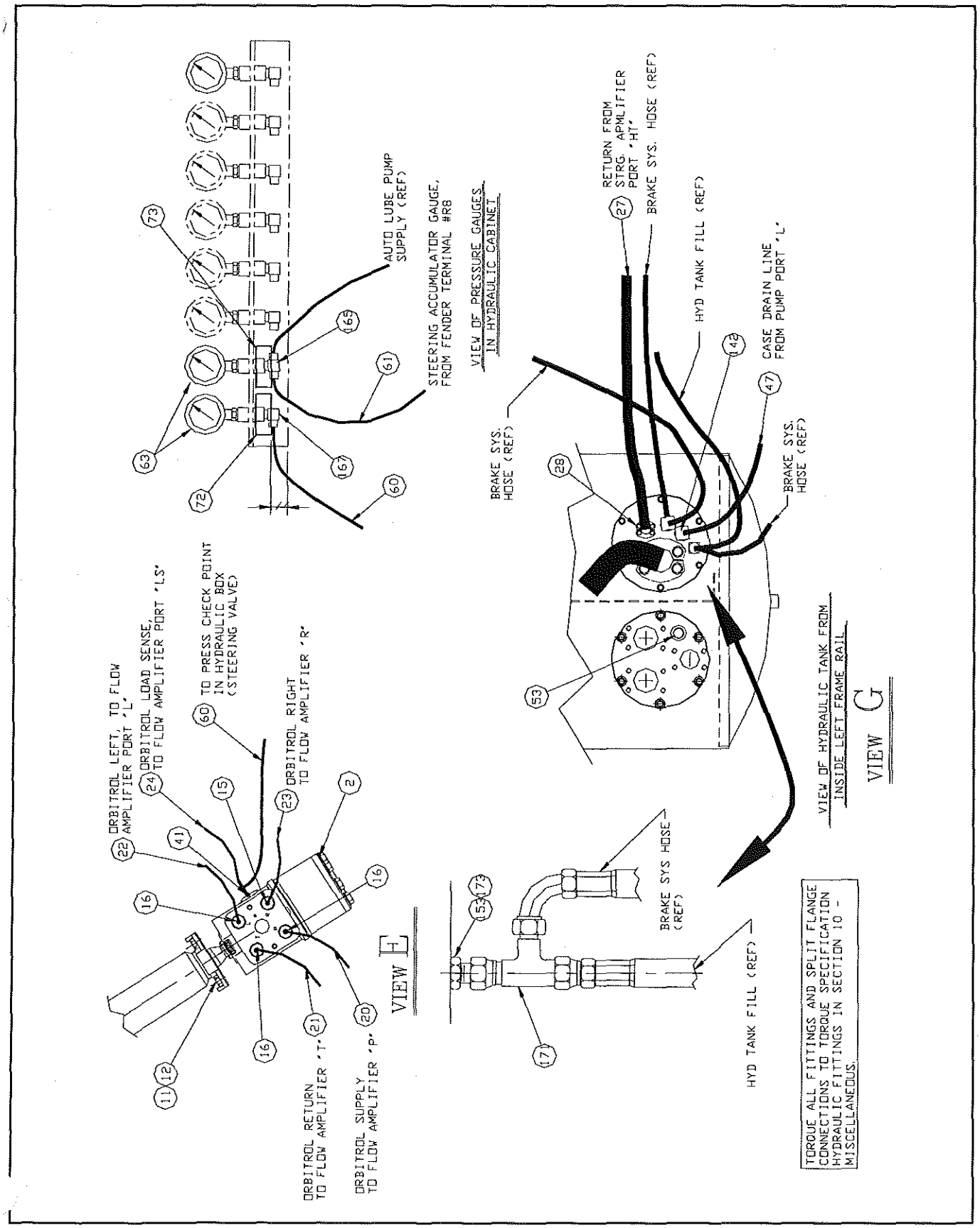


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 5 OF 9)

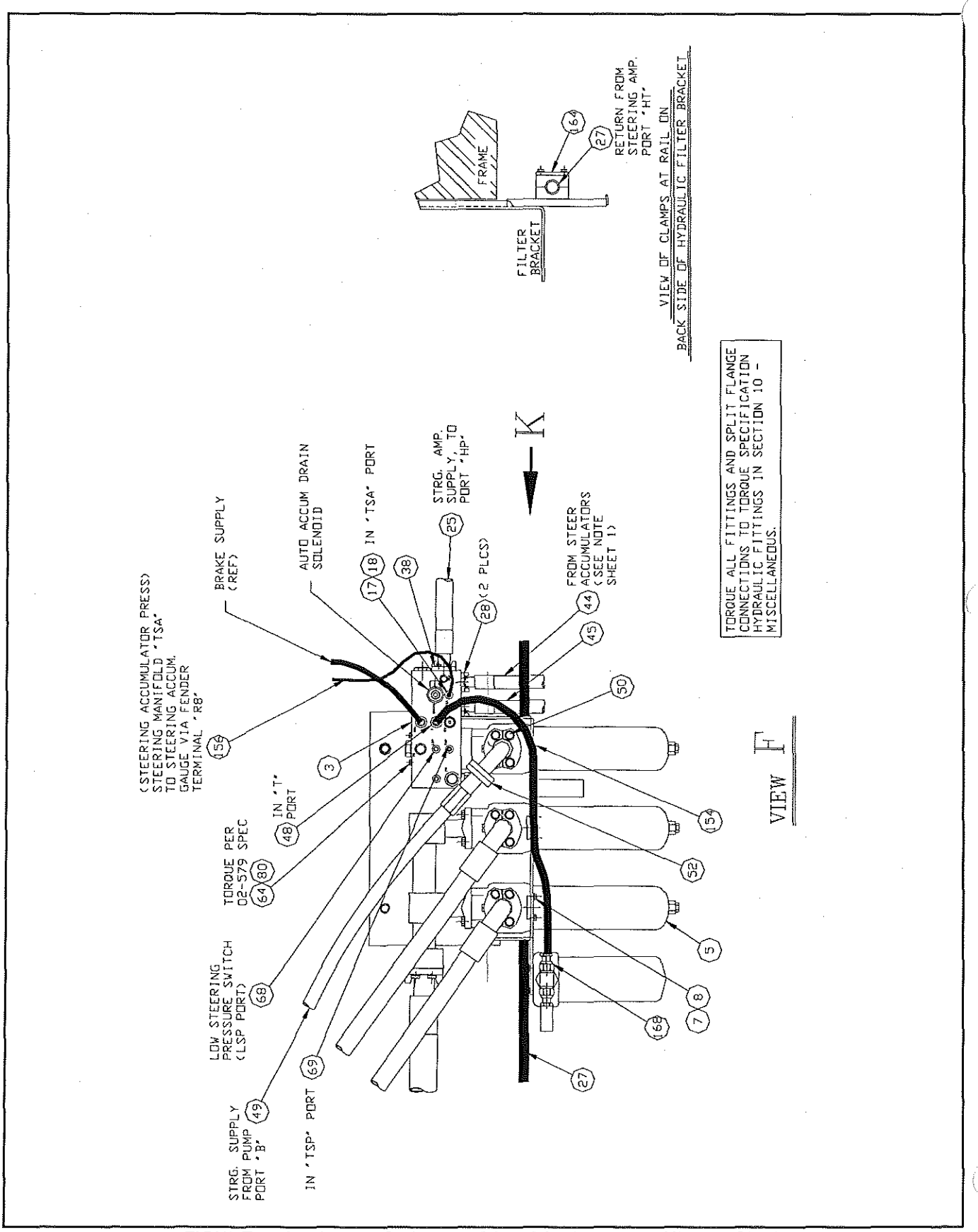


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 6 OF 9)

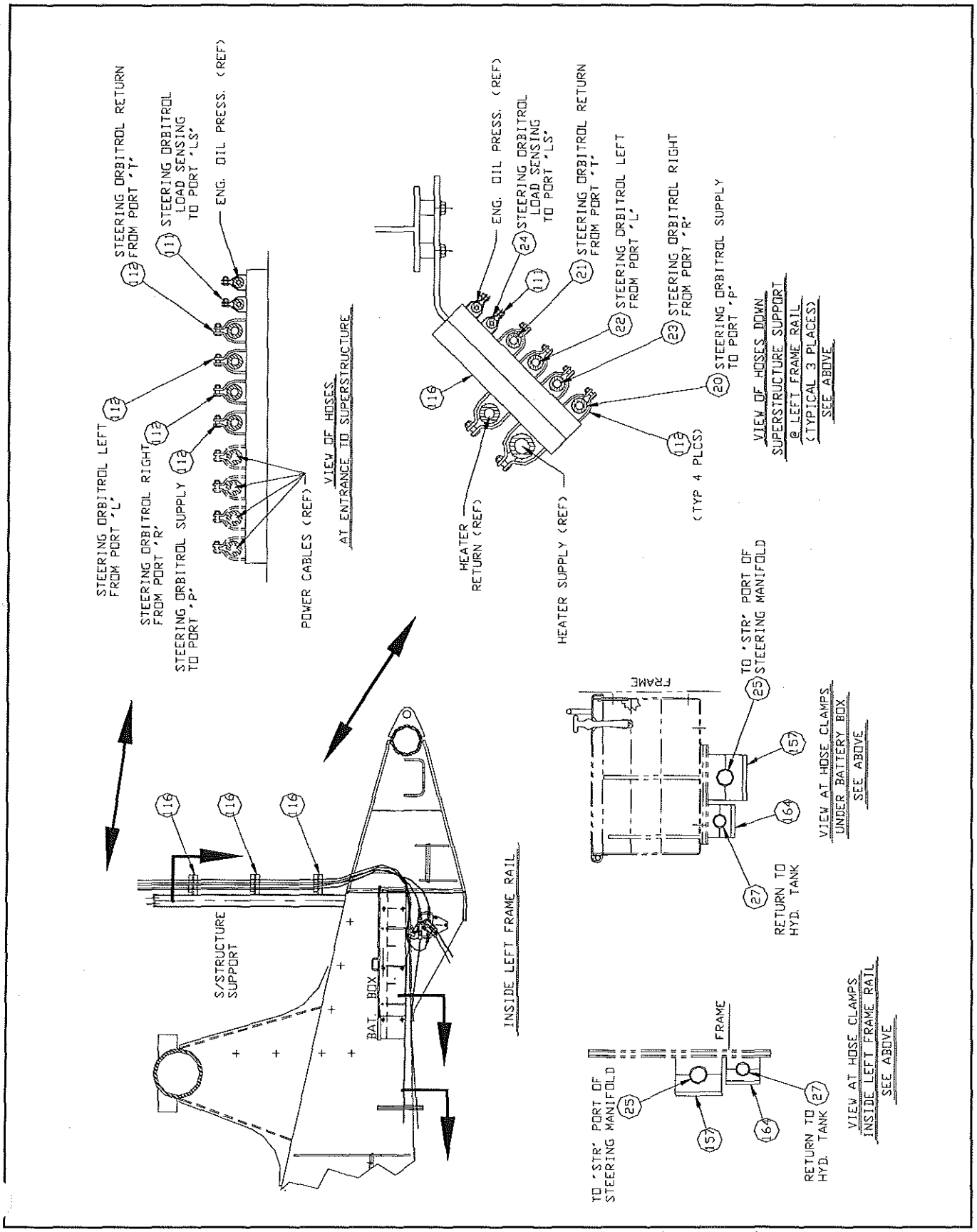


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 7 OF 9)

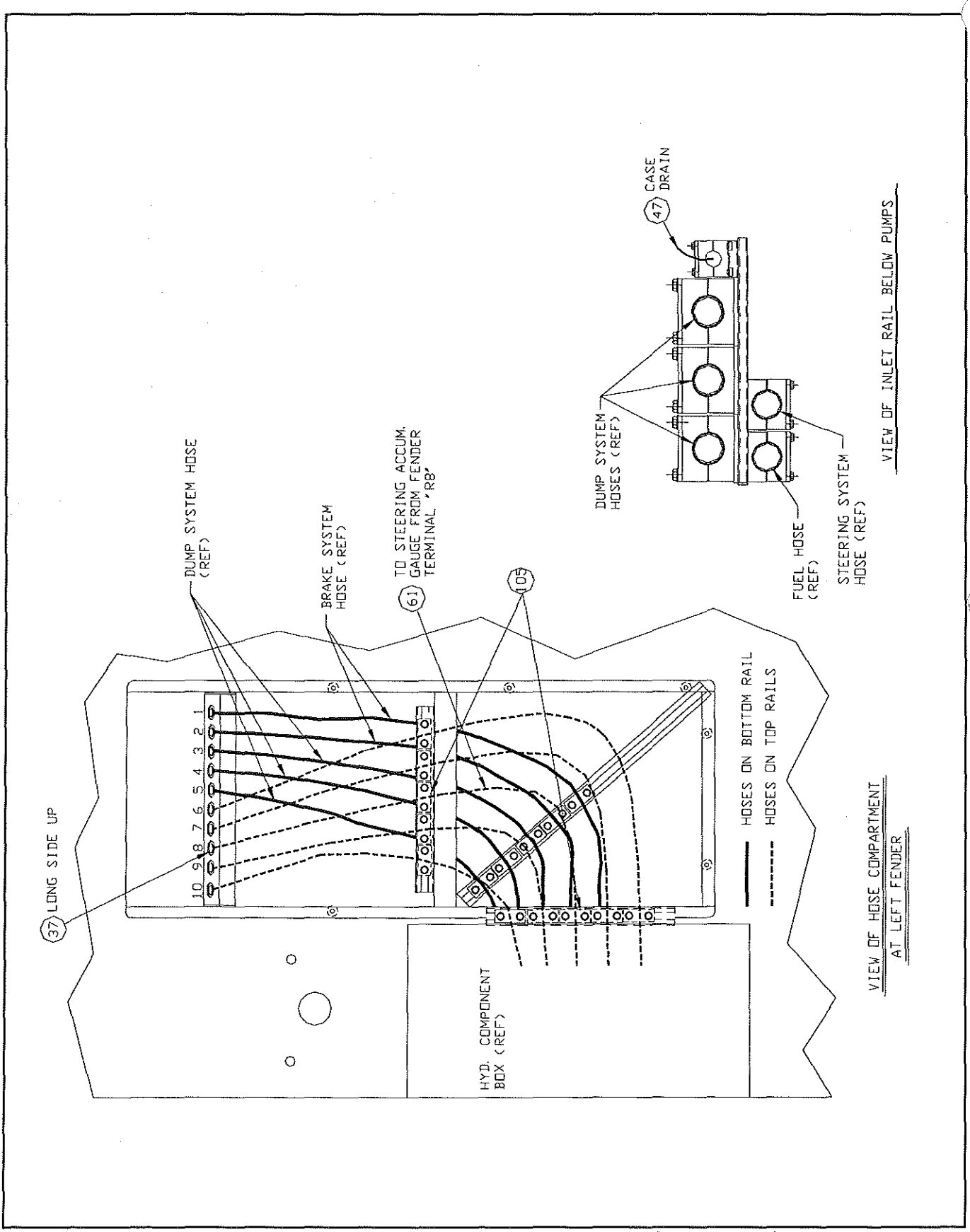


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 8 OF 9)

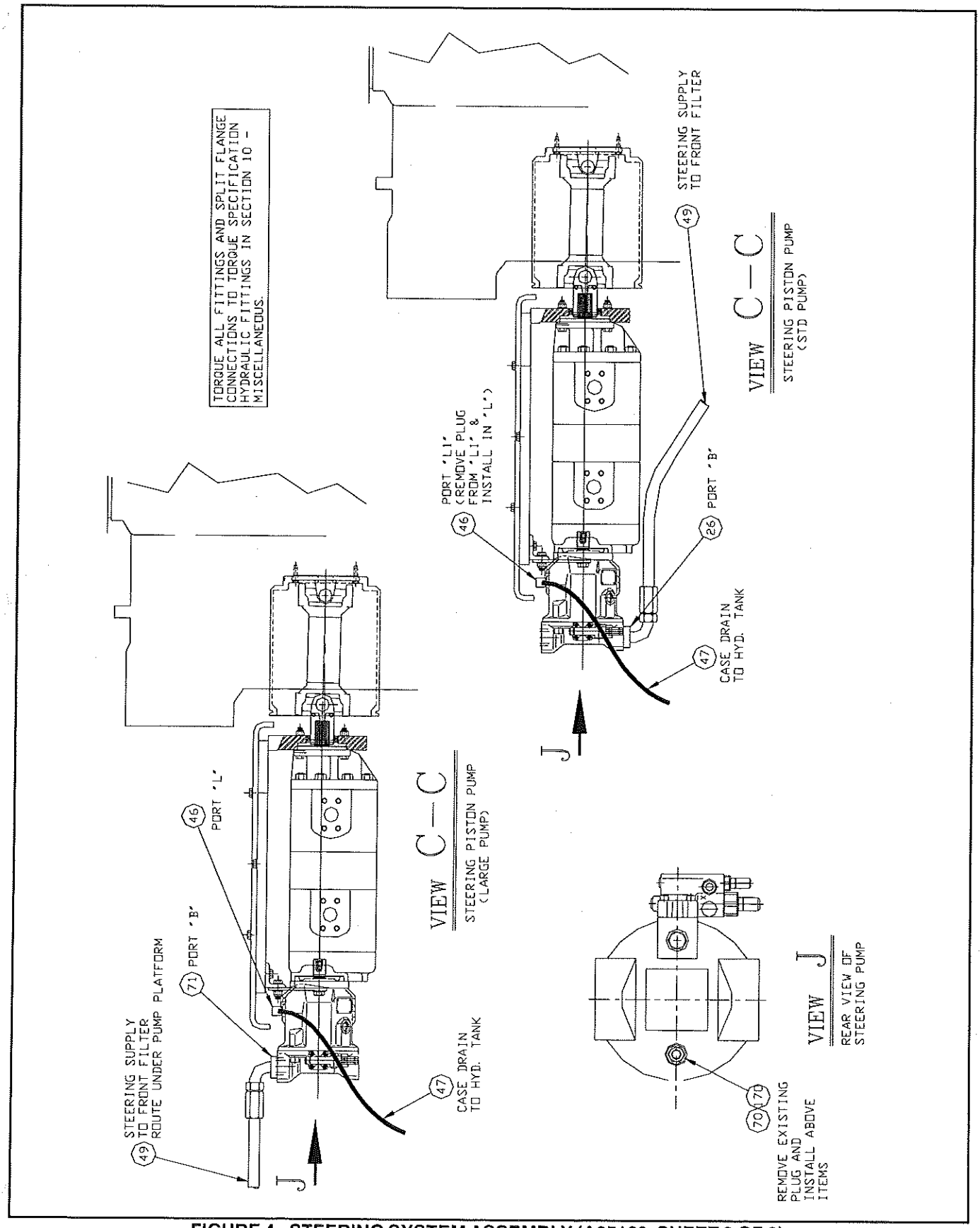


FIGURE 4 - STEERING SYSTEM ASSEMBLY (A85180, SHEET 9 OF 9)

HYDRAULIC DUMP SYSTEM

DESCRIPTION AND LOCATION

Components in the dump system include:

1. Dump pump - one dump pump with two gear sections mounted on the pump mounting platform, part of a multiple pump assembly.

2. Dump cylinders - one mounted on each side of the truck.

3. Dump pilot valve - located in the hydraulic cabinet on the superstructure behind the cab.

4. Dump control valve - mounted on left lower frame assembly.

5. Filters - two separate bowl assemblies located on left inside the lower main frame in dump pump outlet line - one for each dump pump section.

6. Auxiliary dumping connections - quick disconnect style couplings typically mounted on the main dump control valve.

7. Hydraulic oil cooler system – oil-to-air cooling condenser and related control equipment.

a. The oil cooler is mounted in front of the radiator, behind the front grille assembly.

b. The controlling solenoid cartridge valve is mounted above the dump system filters on the left inside of the lower main frame.

c. The controlling electric relay valve is mounted with other relay valves on the moveable panel in the lower right corner of the cab dash.

d. The switches controlling the operation of the relay and cartridge valve are mounted on the dump pilot valve assembly identified previously.

OPERATION

The dump system is used to control operation of the dump body. The pressurized hydraulic oil not only moves the body through the dump cylinders, but also is used to pilot control the dump system components.

PUMP OPERATION

The dump system is used to control the operation of the dump body. Hydraulic pressure, provided by the dump pump, is used to assist in component control as well as the raising of the dump body.

RAISE

To raise the dump body, the operator moves the Dump Control lever to the Raise position and holds. This mechanically positions the pilot valve to the raise position, which in turn hydraulically positions the spools in the main valve.

In the Raise position:

1. Pressurized oil from the pumps (regulated to a maximum of 2400 psi (116 550 kPa) by an internal relief valve in the inlet portion of the main valve) is routed through the load check valves, to the extend ports on the dump cylinders, causing the cylinder to extend.

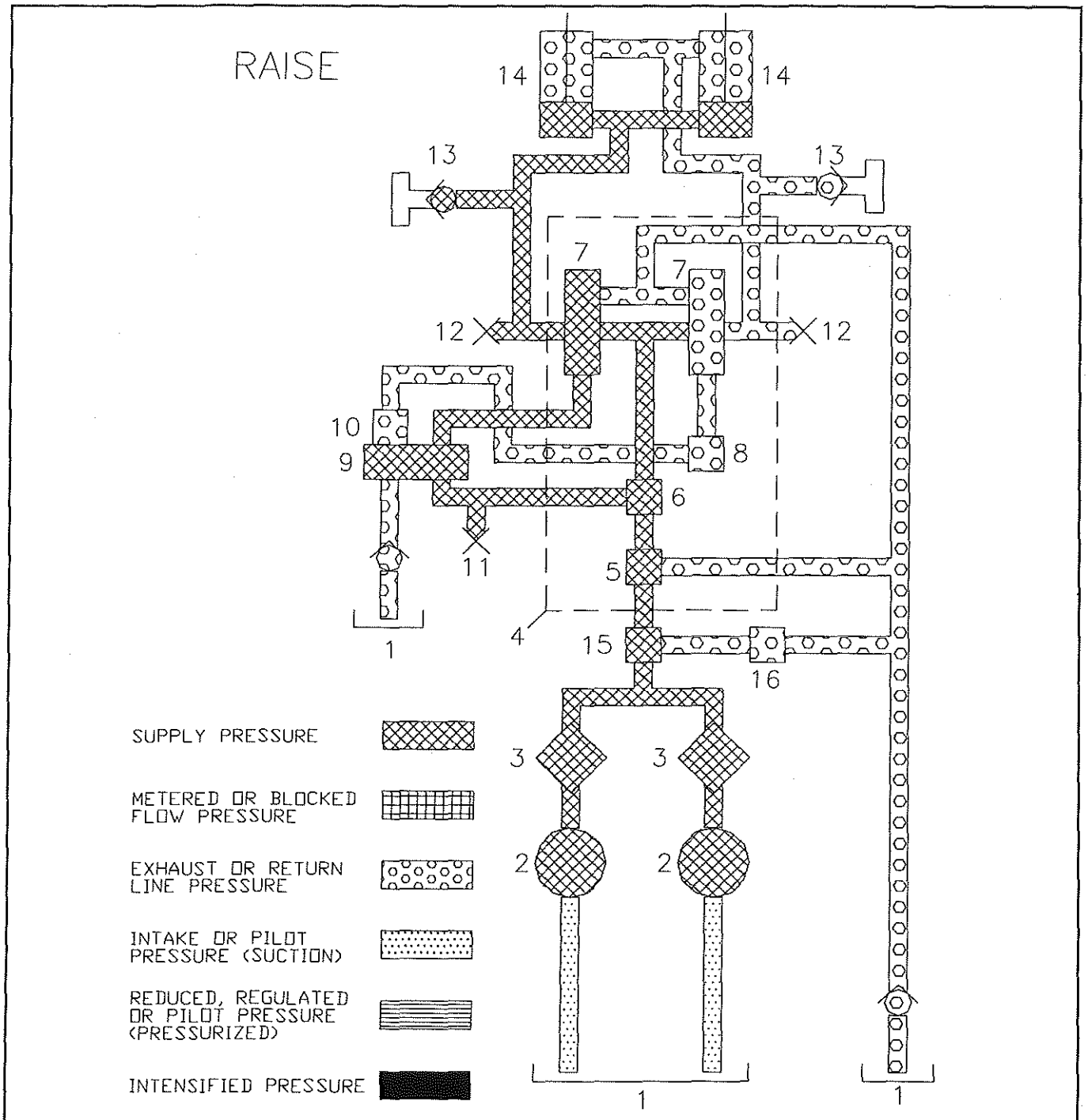
2. Low pressure return oil from the retract ports is routed through the valve back to tank. A anti-void or low pressure relief valve maintains an approximate 40 to 50 psi (275 to 345 kPa) back pressure in this side of the system to maintain some seal pressure and reduce the ingestion of air and other contaminates past the seals.

When the body rises to its overcenter point (at which hydraulic pressure is no longer required to continue raising the body), the main spools begin to try to shift positions. The unidirectional orifice (in the pilot line outlet from the retract side spool) limits this movement, allowing the main spool to move only to a restricted flow position. This control of the return flow allows the now pressurized return flow to control extension of the cylinders.

NOTES:

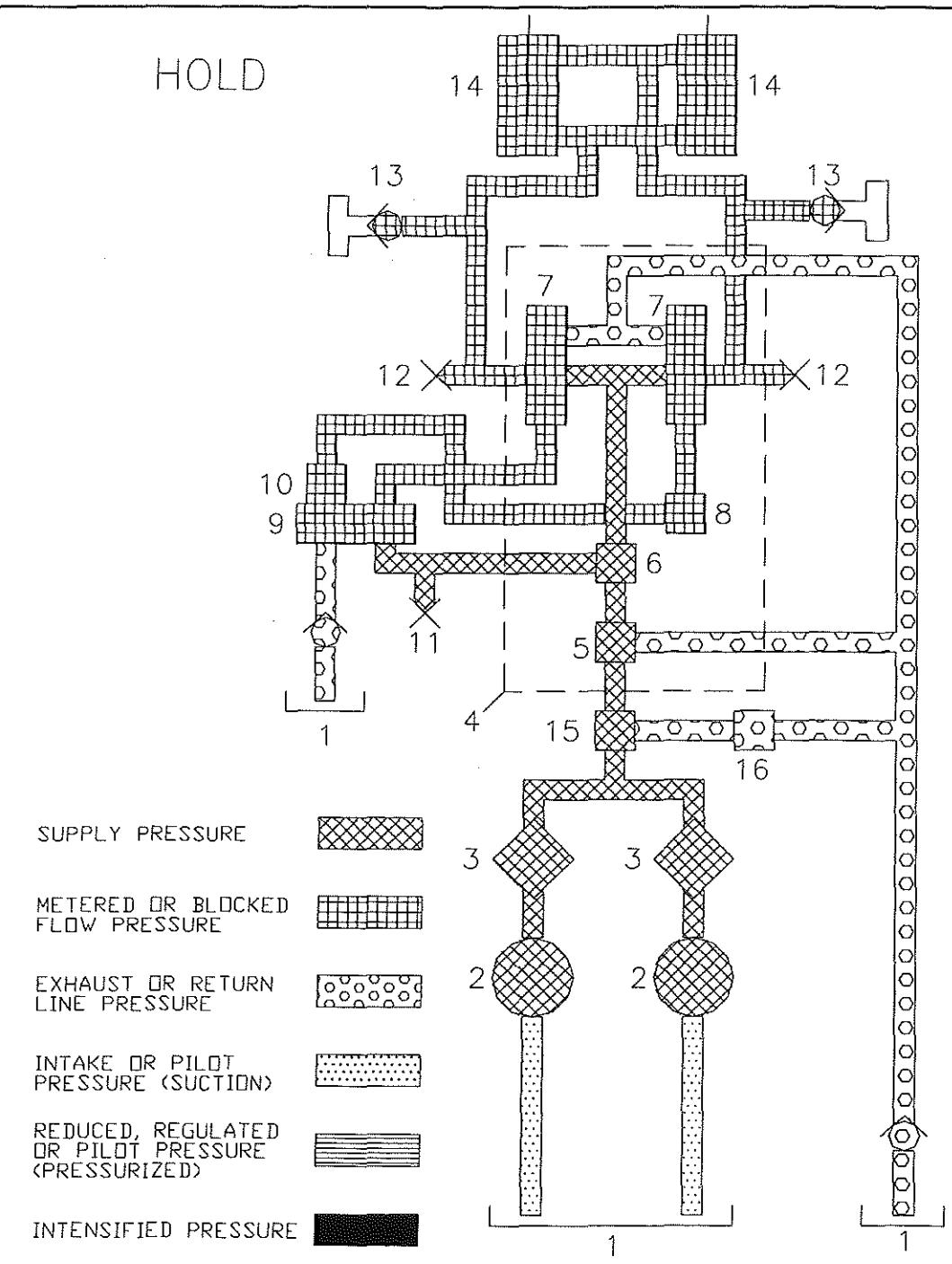
1. Overcenter provisions are included on these trucks even though the dump bodies themselves do not travel overcenter. This is because movement of the material in the body toward the rear during the dumping cycle causes an "effective overcenter" condition that would result in the dump body reacting just as if it had actually gone overcenter.

2. Oil flow is diverted from the hydraulic oil cooler assembly when the dump controller lever is in the Raise position.



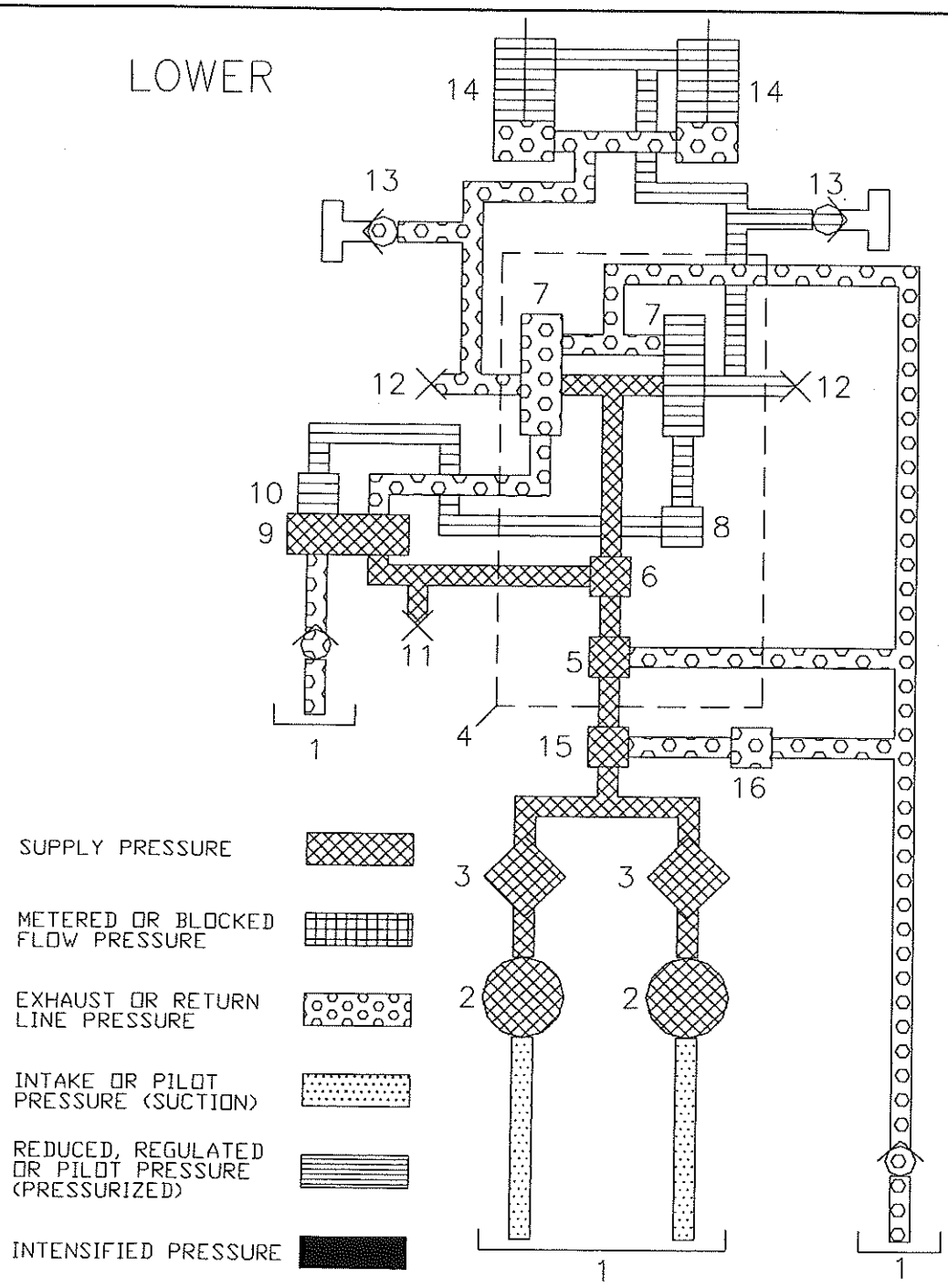
KEY			13642A
01.	HYDRAULIC TANK	09.	DUMP PILOT VALVE
02.	DUMP PUMPS	10.	PRESSURE RELIEF VALVE
03.	HYDRAULIC FILTER	11.	SYSTEM PRESSURE GAUGE
04.	DUMP CONTROL VALVE	12.	TEST PORTS
05.	MAIN PRESSURE RELIEF VALVE	13.	AUXILIARY DUMP CONNECTIONS
06.	FLOW CONTROL RELIEF VALVE	14.	DUMP CYLINDERS
07.	CONTROL SPOOLS	15.	HYDRAULIC OIL COOLER SOLENOID VALVE
08.	OVERCENTER CONTROL ORIFICE	16.	HYDRAULIC OIL COOLER

FIGURE 1 - DUMP SYSTEM OPERATION - RAISE



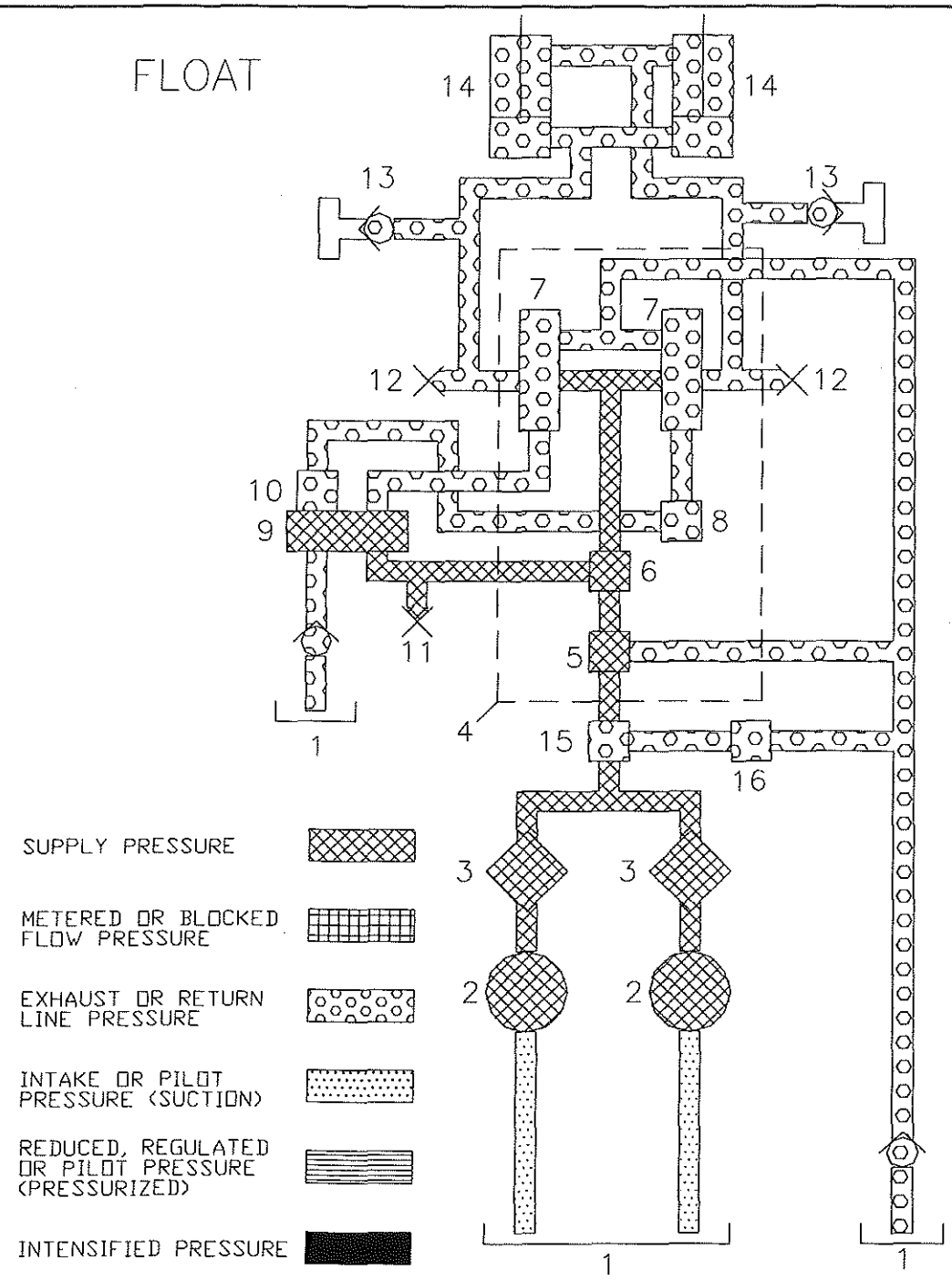
KEY			13642B
01.	HYDRAULIC TANK	09.	DUMP PILOT VALVE
02.	DUMP PUMPS	10.	PRESSURE RELIEF VALVE
03.	HYDRAULIC FILTER	11.	SYSTEM PRESSURE GAUGE
04.	DUMP CONTROL VALVE	12.	TEST PORTS
05.	MAIN PRESSURE RELIEF VALVE	13.	AUXILIARY DUMP CONNECTIONS
06.	FLOW CONTROL RELIEF VALVE	14.	DUMP CYLINDERS
07.	CONTROL SPOOLS	15.	HYDRAULIC OIL COOLER SOLENOID VALVE
08.	OVERCENTER CONTROL ORIFICE	16.	HYDRAULIC OIL COOLER

FIGURE 2 - DUMP SYSTEM OPERATION - HOLD



KEY			13642C
01.	HYDRAULIC TANK	09.	DUMP PILOT VALVE
02.	DUMP PUMPS	10.	PRESSURE RELIEF VALVE
03.	HYDRAULIC FILTER	11.	SYSTEM PRESSURE GAUGE
04.	DUMP CONTROL VALVE	12.	TEST PORTS
05.	MAIN PRESSURE RELIEF VALVE	13.	AUXILIARY DUMP CONNECTIONS
06.	FLOW CONTROL RELIEF VALVE	14.	DUMP CYLINDERS
07.	CONTROL SPOOLS	15.	HYDRAULIC OIL COOLER SOLENOID VALVE
08.	OVERCENTER CONTROL ORIFICE	16.	HYDRAULIC OIL COOLER

FIGURE 3 - DUMP SYSTEM OPERATION - LOWER



KEY			13642D
01.	HYDRAULIC TANK	09.	DUMP PILOT VALVE
02.	DUMP PUMPS	10.	PRESSURE RELIEF VALVE
03.	HYDRAULIC FILTER	11.	SYSTEM PRESSURE GAUGE
04.	DUMP CONTROL VALVE	12.	TEST PORTS
05.	MAIN PRESSURE RELIEF VALVE	13.	AUXILIARY DUMP CONNECTIONS
06.	FLOW CONTROL RELIEF VALVE	14.	DUMP CYLINDERS
07.	CONTROL SPOOLS	15.	HYDRAULIC OIL COOLER SOLENOID VALVE
08.	OVERCENTER CONTROL ORIFICE	16.	HYDRAULIC OIL COOLER

FIGURE 4 – DUMP SYSTEM OPERATION - FLOAT

HOLD

To stop movement of the dump body (either raising or lowering) the operator must move the Dump Control lever to the Hold position. The pilot valve flow is detented causing the control valve spools to block flow from both sides of the cylinder pistons. This effectively holds the dump body in the desired position.

NOTES:
1. The oil from the dump pump is directed back to the reservoir tank by the pilot and control valves.
2. Oil flow is diverted from the hydraulic oil cooler assembly when the dump controller lever is in the Hold position.

LOWER

To lower the dump body, the operator moves the Dump Control to the Lower position and holds. This mechanically positions the pilot valve to the lower or "power down" position, which in turn hydraulically positions the spools in the main valve.

In the Lower position:

1. Pressurized oil from the pumps (regulated to maximum of 2400 psi (16 550 kPa) by an internal relief valve in the inlet portion of the main valve) is routed through the load check valves, to the retract ports on the dump cylinders, causing the cylinder to retract.

A separate relief valve in the pilot valve assembly limits the maximum pressure in the Lower mode to 1500 psi (10 340 kPa). This is to limit the rate of return of oil from the cylinders to the tank in the power down mode, reducing any possible system problems caused by the potentially high return flow rates.

2. Low pressure return oil from the extend ports is routed through the valve back to tank. An anti-void or low pressure relief valve maintains an approximate 40 to 50 psi (275 to 345 kPa) back pressure in this side of the system to maintain some seal pressure and reduce the ingestion of air and other contaminants past the seals.

NOTE: *Oil flow is diverted from the hydraulic oil cooler assembly when the dump controller lever is in the Lower position.*

FLOAT

Once the dump body is lowered more than approximately 1/2 of its total travel, the operator moves the Dump Control lever to the detented Float position. This resulting valve flow positions the main control spools to direct the flow from the pump and both sides of the cylinder piston. The oil flow rate through the valve regulates the lowering until the dump body is resting on the dump body pads on the frame. At this point, the cylinders are carrying no load and are not pressurized—a desired condition for haulage operation.

⚠ CAUTION

Hold the Dump Control lever in the Lower position only until the dump body is approximately one-half the way down. To continue to power the dump body down will result in the dump body's striking the frame at a relatively high rate of speed. With the control in the Float position, the dump body will settle onto the frame.

IMPORTANT: *The Dump Control lever and dump valve must be in the Float position at all times the truck is in operation. On some trucks a pressure switch will not allow truck propulsion with the valve not in the float position and hydraulic pressure trapped in the lines.*

The Dump Control lever is detented in the Hold and Float positions only. It must be held in the Raise or Lower position. Releasing the Dump Control lever from the Raise position will permit it to move and remain in the Hold position, while releasing the lever from the Lower position to move and remain in the Float position. All other movement must be made manually.

NOTE: *The system is designed to provide infinite positioning of the spool, directly controlled by movement of the Dump Control lever. This enables the operator to maintain precise control of the dump body movement.*

Optional provisions are available which allow the dump body to be raised or lowered by means of an external source, typically another truck's dump system, if the normal pump system is unable to provide required pressure and flow. In this mode, the disabled truck's control valve is placed in the Hold position, blocking off the normal supply and control circuit and the external sources supply controls the operation of the dump cylinders and body.

A dump system/separate loading brake interlock system is available as an option to prevent the raising of the dump body until the truck's load brake is activated.

NOTE: *The system is designed to provide infinite metering of the dump control valve in the raise and lower*

modes, which directly controls movement of the dump body. This enables the operator to maintain precise control of dump body movement.

When the Dump Controller lever is moved to the Float position, a timer is activated. At a preset time interval (typically 45 seconds), the timer activates a cab mounted relay. This causes a solenoid valve to open and to allow the flow of oil, diverted from the dump system, to flow through the oil cooler assembly. The flow is maintained as long as the Dump Controller lever remains in the Float position.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Inspect all hoses and lines for evidence of damage or leakage. All hoses should be secured properly and properly torqued as outlined in the procedures in Section 10 - Miscellaneous. Repair or replace as required.

2. Inspect each assembly component for evidence of wear, damage, or leakage.

Test the operation of the system as outlined in the operation test.

OPERATION TEST

The operation of the system may be tested as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction brake system.

2. Stop the engine and allow the system to release all entrapped pressure. Verify that the Dump Controller lever is in the Float position.

3. Verify that the steering system has been properly tested and adjusted.

4. Verify that all hoses and fittings are tightened per the procedures in Section 10 - Miscellaneous.

5. Verify that the trucks hydraulic tank is filled to the proper level with approved hydraulic oil.

6. If not previously tested, verify that the hydraulic reservoir is properly pressurized as follows:

a. Install a source of clean, dry compressed air, regulated to 10 psi (70 kPa) on the inlet to the hydraulic tank.

b. Install a 0 to 50 psi (0 - 350 kPa) pressure gauge on to the outlet line from the pressure regulator on the hydraulic tank to the tank itself. Fittings may need to be provided.

c. Turn on the air supply to the crossmember, verifying that it does not exceed 10 psi (70 kPa).

d. Verify that the pressure to the hydraulic tank is 10 +/- 1 psi (70 +/- 7 kPa). If not, check the operation of the hydraulic tank relief valve.

e. When complete, remove the equipment installed.

f. Repressurize the hydraulic tank to 10 +/- 1 psi (70 +/- 7 kPa).

7. If the truck has been sitting idle for an extended period of time or the steering pump or system has been drained since the last time the truck was started, fill the case drain on the steering pump with approved hydraulic oil.

8. Using the appropriate means for the electrical propulsion system installed, disable the truck's propulsion system to prevent its operation when the Shifter is moved to the forward or reverse position.

9. Test the high pressure relief valve and hydraulic oil cooler system operation as follows:

a. Verify that the Shifter is in Neutral and the engine is operating at low idle speed.

b. If any work has been done on the dump system or its components or the condition of the system is unknown, raise and lower the dump body through several cycles to bleed all entrapped air from the system. Do not "force" the cylinders at either end of travel.

NOTE: *To improve this process, it is recommended that the:*
1. Dump body is raised in 2 to 3 ft. (0.6 to 0.9 m) increments.
2. Dump Controller lever is held in the Lower or "power-down" position until the dump body is within 2 to 3 ft. (0.6 to 0.9 m) of the frame.

c. During this cycling exercise, verify that the:

(1) LED light on the switch on the dump control pilot valve is on in the Raise, Hold, and Lower positions.

(2) No oil flows through the oil cooler assembly.

c. Raise the dump body to its fully raised position.

d. While holding the Dump Controller lever in the Raise position, verify that:

(1) The dump system pressure (on the cabinet mounted gauge) is 2350 to 2450 psi (16 205 to 16 895 kPa). If not, readjust as outlined in the information on the dump control valve in Section 5 - Hydraulic System.

e. Release the Dump Controller lever, allowing it to return to the detented Hold position.

f. Move the Dump Controller lever to the Lower position and allow the dump body to lower until it is resting on the dump body pads.

g. While holding the Dump Controller lever in the Lower position, verify that:

(1) The dump system pressure (on the cabinet mounted gauge) is 1450 to 1550 psi (10 010 to 10 685 kPa). If not, readjust as outlined in the information on the dump control valve in Section 5 - Hydraulic System.

h. Raise and lower the dump body through its entire operating range (with the engine operating at rated speed) for 5 complete cycles.

10. Test the system circulating pressure and hydraulic oil cooler system operation as follows:

a. Stop the engine.

b. Install a 0 to 200 psi (0 to 1 400 kPa) gauge at the inlet to the dump valve. Additional fittings may be required.

c. Verify that the:

(1) Shifter is in N (Neutral) position.

(2) The Load and/or Park brake is applied or other provisions have been made to ensure that the trucks propulsion system is temporarily disabled, even if the Shifter is in the F (Forward) or R (Reverse) positions.

(3) Verify that the Dump Controller lever is in the detented Float position.

d. Start the truck engine.

e. Verify that the indicated circulation or system pressure at the dump valve inlet does not exceed 40 psi (275 kPa). Record indicated pressure.

f. Accelerate the engine to rated speed and hold.

g. Verify that the indicated circulation or system pressure at the dump valve inlet does not exceed 80 psi (550 kPa). Record indicated pressures.

h. Slow the engine to low idle speed.

i. Verify that on trucks equipped with a hydraulic oil cooler assembly:

(1) LED light on the switch on the dump control pilot valve is off.

(2) After a delay of approximately 45 seconds, oil flows freely through the oil cooler assembly.

NOTES:

1. It may be necessary to move the Dump Controller lever to the Hold or Lower for a moment and then back to the Float position to properly test the delay function.

2. If the pilot-float proximity switch is removed or must be readjusted this may be done as follows:

a. Adjust the top of the switch to 3/32 inch (2.28 mm) from the washer.

b. With the pilot valve in the float position, adjust the top of the washer to align with the centerline of the switch.

c. If necessary, slightly adjust the height of the washer or switch distance to allow the switch to operate as outlined.

j. Stop the engine.

k. Turn the Master Switch off.

11. Reconnect the wires removed to temporarily disable propulsion.

12. Test complete.

a. Remove the pressure gauge at the dump valve inlet.

b. Remove the pressure gauges on the steering manifold and install dust caps on all quick disconnect fittings.

c. Close the cover on the hydraulic components box.

JSE OF AUXILIARY DUMP PROVISIONS

If the provisions for raising or lowering the dump body using an external power source are required, they may be used as follows:

NOTES:

1. For purposes of this procedure, it is assumed that the power source is a "helper" truck, configured in a manner similar to the disabled truck. If another supply and control source is used, the procedure must be modified to reflect the changes involved. In either case, it is important that:

a. The hydraulic oil in the two systems be compatible, preferably of the same formulation.

b. The relief pressure settings in the "helper" truck be adjusted to at least the same pressure level as those in the "disabled" truck to allow for maximum lifting requirements.

c. The relief pressure of the relief valve on the pilot control valve of the "helper" truck must be adjusted to the same pressure as the main dump system pressure in the "disabled" truck. Since the "helper" truck is in the Lower position to raise the dump body on the "disabled" truck, not increasing this pressure will not allow full system pressure to be provided to the "disabled" truck, possibly preventing the raising of the dump body. Detailed information is included in the procedures in Maintenance and Adjustment in this module. Remember to properly reset the pilot valve relief before placing the "helper" truck back into normal operation.

2. To connect the trucks, two jumper hoses, with connectors and dust covers on each end compatible with those on the truck, must be supplied. The hoses should be of sufficient size and pressure ratings to handle the system pressures involved, and of an adequate length to allow ease of connection.

1. Verify that the level of hydraulic oil in the "helper" truck is near full.

2. Move the Dump Controller levers in both the "disabled" and "helper" trucks to the Hold position.

NOTES:

1. It may be necessary to move the Dump Controller lever on the truck to the Float position to relieve any residual pressure remaining on the couplings. Be sure that the dump bodies are resting on the frame or are secured in position to prevent movement before the control is moved to the Float position.

If the dump control valves in both trucks are placed in the Float position when the jumper hoses are in place, oil can flow from one truck to the other. If the trucks are parked on a slope, the oil could transfer to the lower truck.

3. Verify the Shifter in both the "disabled" and "helper" trucks is in the N (Neutral) position.

4. Cross connect the two jumper hoses between quick disconnect fittings installed near the dump valves on the "disabled" and "helper" trucks. This means connect the coupling on the extend port side of the dump valve on one truck to the retract port side of the other truck. The remaining hose should be installed on the other two couplings.

NOTE: *This is done so that the dump body on the "helper" truck does not move during movement of the body on the "disabled" truck.*

5. To raise the body, move the Dump Controller lever in the "helper" truck, to the Lower or Power Down position and hold. The rate of lift should be kept at a low, controlled level with the material dumping at a moderate rate.

NOTE: *When the Dump Controller lever is released on the "helper" truck, it will automatically go to the detented Float position. If allowed to remain in this position, the partially loaded dump body may lower at a rapid rate. Therefore, if it is desired to stop the raising of the dump body during the dumping cycle, the Dump Controller lever in the "helper" truck must be moved manually to the Hold position.*

6. To lower the dump body, move the Dump Controller lever on the "helper" truck to the Raise position. The Dump Controller lever should be held in this position until the dump body approaches the frame and then moved to the Float position. The engine on the "helper" truck should remain at low idle and the rate of descent should be maintained at a low, controlled level to minimize impact of the body and cylinders during the movement.

NOTE: *If sufficient pressure is required during the lowering of the "disabled" truck's body, an empty body on the "helper" truck may begin to rise. This movement should be monitored for safety reasons, but is normal.*

7. Because of the possibility that oil might transfer from one truck to the other during this process, the hydraulic oil level in both of the trucks should be checked after both of the bodies are down. Adjust the oil levels as needed before proceeding.

NOTE: *The pressurized hydraulic tank has no external breather provisions, so excess oil cannot escape.*

8. With the dump bodies both completely lowered to the frame, verify that both Dump Controller levers are in the Hold position.

9. Remove the jumper hoses and reinstall the protective caps and plugs. It may be necessary to move one or both Dump Controller levers to the Float position to relieve any residual pressure in the jumper lines or fittings.

10. Readjust the relief valve in the pilot control valve on the "helper" truck as outlined in Maintenance and Adjustment, if it was adjusted previously.

SERVICE

Refer to the modules of the individual components for service information.

KEY					A85183
001.	Dump Valve	040.	Pilot Valve Clevis	084.	Hose Assembly
002.	Not Used	041.	Hex Nut	085.	Hose Assembly
003.	Capscrew	042.	- 046. Not Used	086.	Hose Assembly
004.	Hardened Flatwasher	047.	Adapter Fitting	087.	Hose Assembly
005.	Locknut	048.	- 053. Not Used	088.	Hose Assembly
006.	Not Used	054.	Clamp Cap Plate	089.	Hose Assembly
007.	Not Used	055.	Capscrew	090.	Hose Assembly
008.	Not Used	056.	Controller Cable	091.	Hose Assembly
009.	Hydraulic Pressure Filter	057.	Capscrew	092.	Hose Assembly
010.	Filter Brackets	058.	Flatwasher	093.	Hose Assembly
011.	Filter Manifold	059.	Cable Control Bracket	094.	Tube Assembly
012.	Flatwasher	060.	Not Used	095.	Not Used
013.	Capscrew	061.	Capscrew	096.	Tube Assembly
014.	Lockwasher	062.	Not Used	097.	- 101. Not Used
015.	Flange Fitting	063.	Adapter Fitting	102.	Adapter Fitting
016.	Flange Fitting	064.	Adapter Fitting	103.	– 109. Not Used
017.	Lockwasher	065.	Not Used	110.	Clamp Support Assembly
018.	Capscrew	066.	Not Used	111.	Clamp Support Assembly
019.	O-ring	067.	Not Used	112.	Clamp Support Assembly
020.	Dump Valve Manifold	068.	Not Used	113.	Clamp Bracket
021.	Capscrew (Grade 8)	069.	Adapter Fitting	114.	Cushion Clamp
022.	Female Quick Coupling	070.	Not Used	115.	Hardened Flatwasher
023.	Dust Plug	071.	Adapter Fitting	116.	Chain
024.	– 028. Not Used	072.	Roll Pin	117.	Capscrew
029.	Flange Fitting	073.	Capscrew	118.	Flatwasher
030.	Flange Fitting	074.	Lockwasher	119.	Locknut
031.	Test Coupling	075.	Pressure Gauge	120.	Clamp Bracket
032.	Quick Connector	076.	Adapter Fitting	121.	Clamp Support Assembly
033.	Not Used	077.	Control Cable	122.	Clamp Support Assembly
034.	Adapter Fitting	078.	Harness Seal	123.	Not Used
035.	Adapter Fitting	079.	Return Tube	124.	Orifice Plate
036.	Not Used	080.	Hose Assembly	125.	Not Used
037.	Pilot Control Valve	081.	Hose Assembly	126.	Capscrew (Grade 8)
038.	Adapter Fitting	082.	Hose Assembly		
039.	Clamp Halves	083.	Hose Assembly		

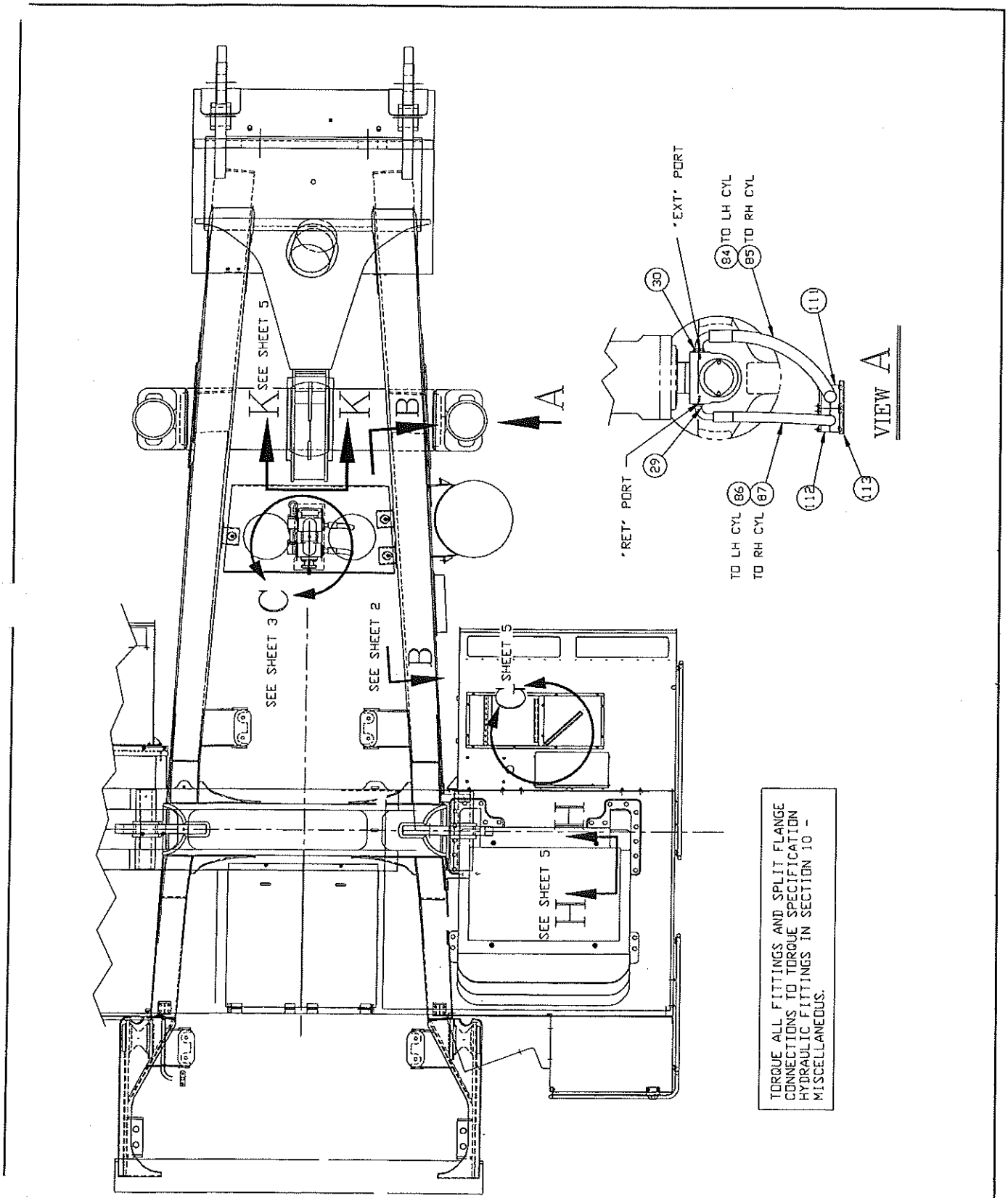


FIGURE 5 - DUMP SYSTEM ASSEMBLY (A85183 SHEET 1 OF 6)

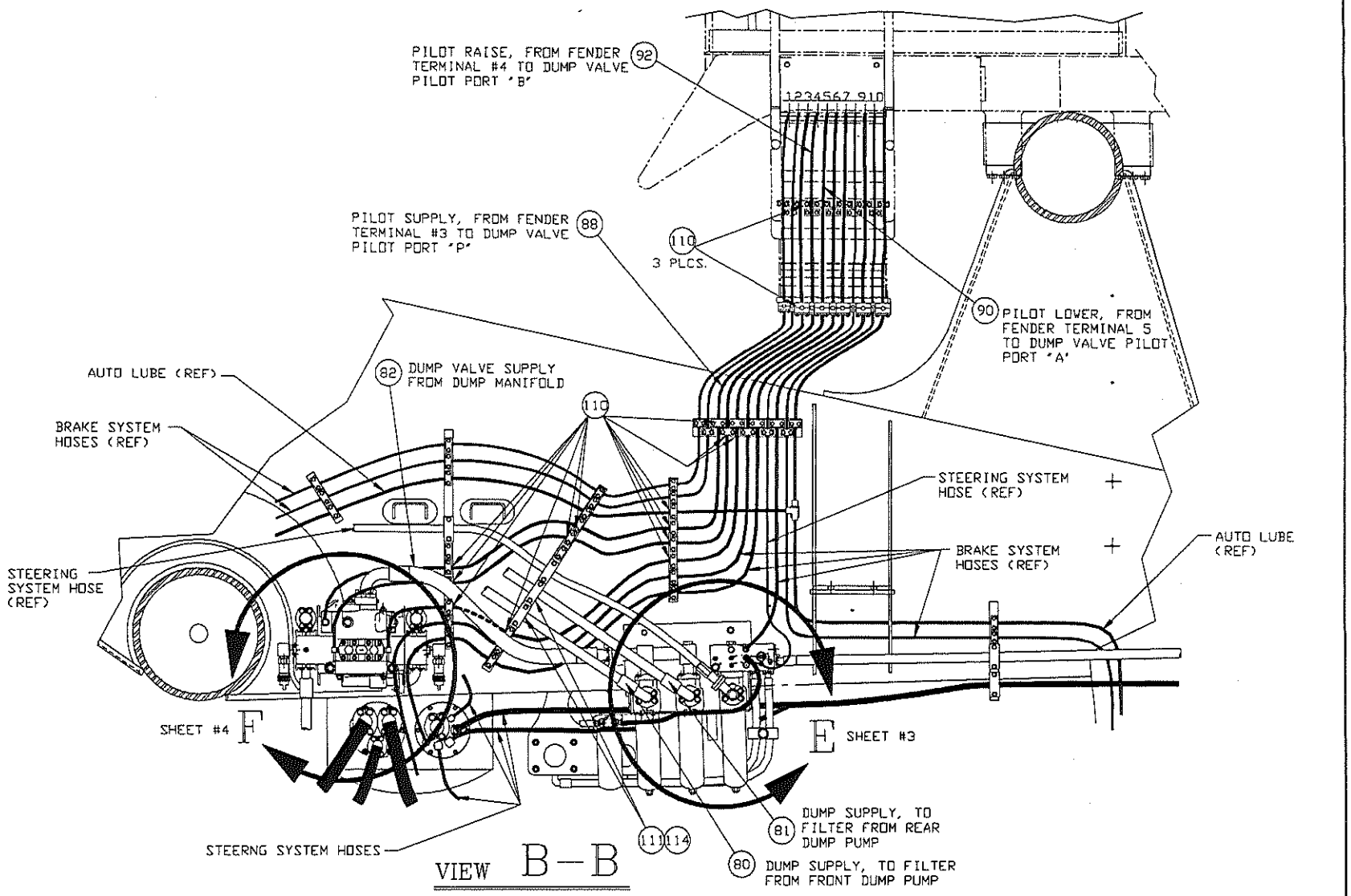


FIGURE 5 - DUMP SYSTEM ASSEMBLY (A85183 SHEET 2 OF 6)

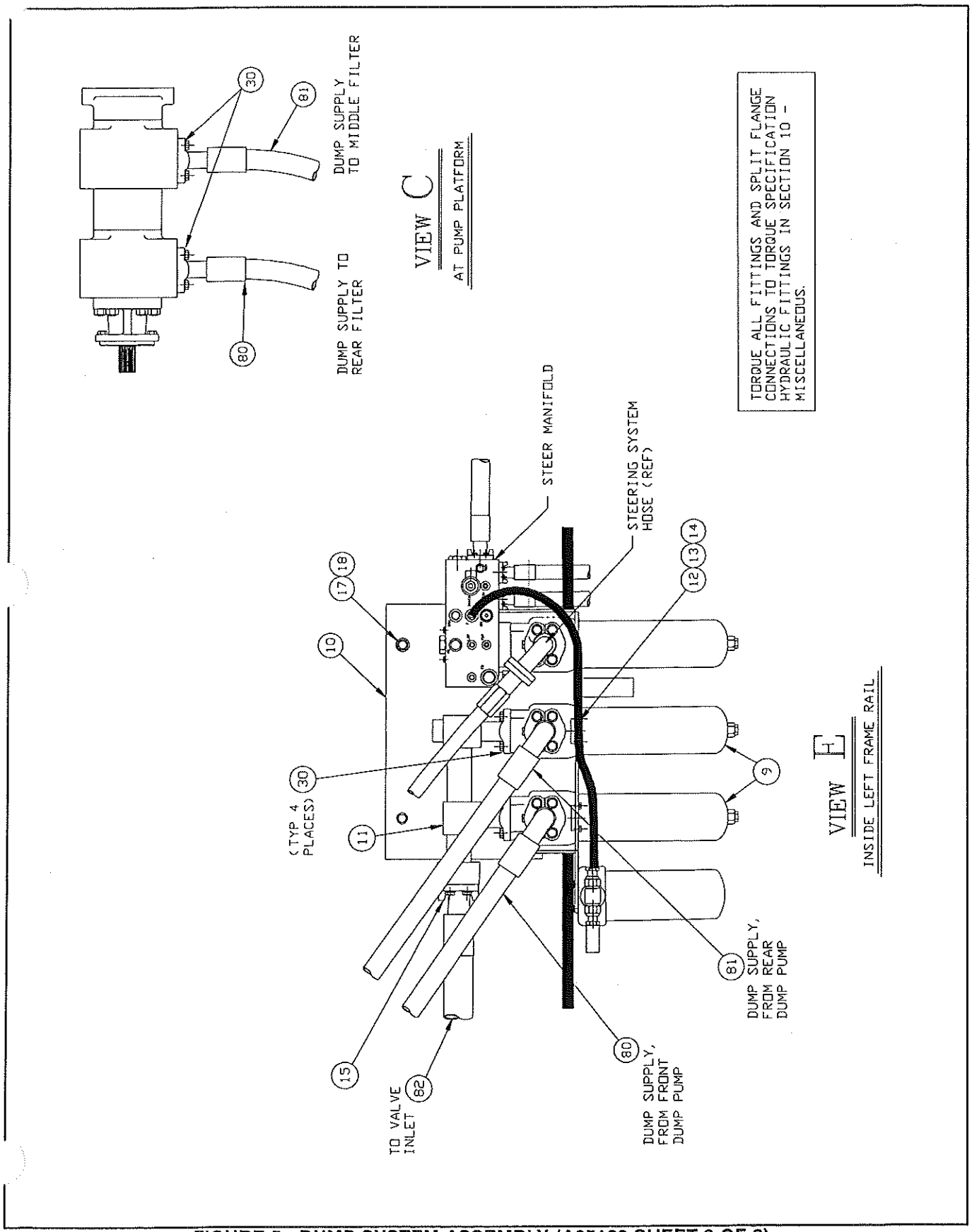


FIGURE 5 - DUMP SYSTEM ASSEMBLY (A85183 SHEET 3 OF 6)

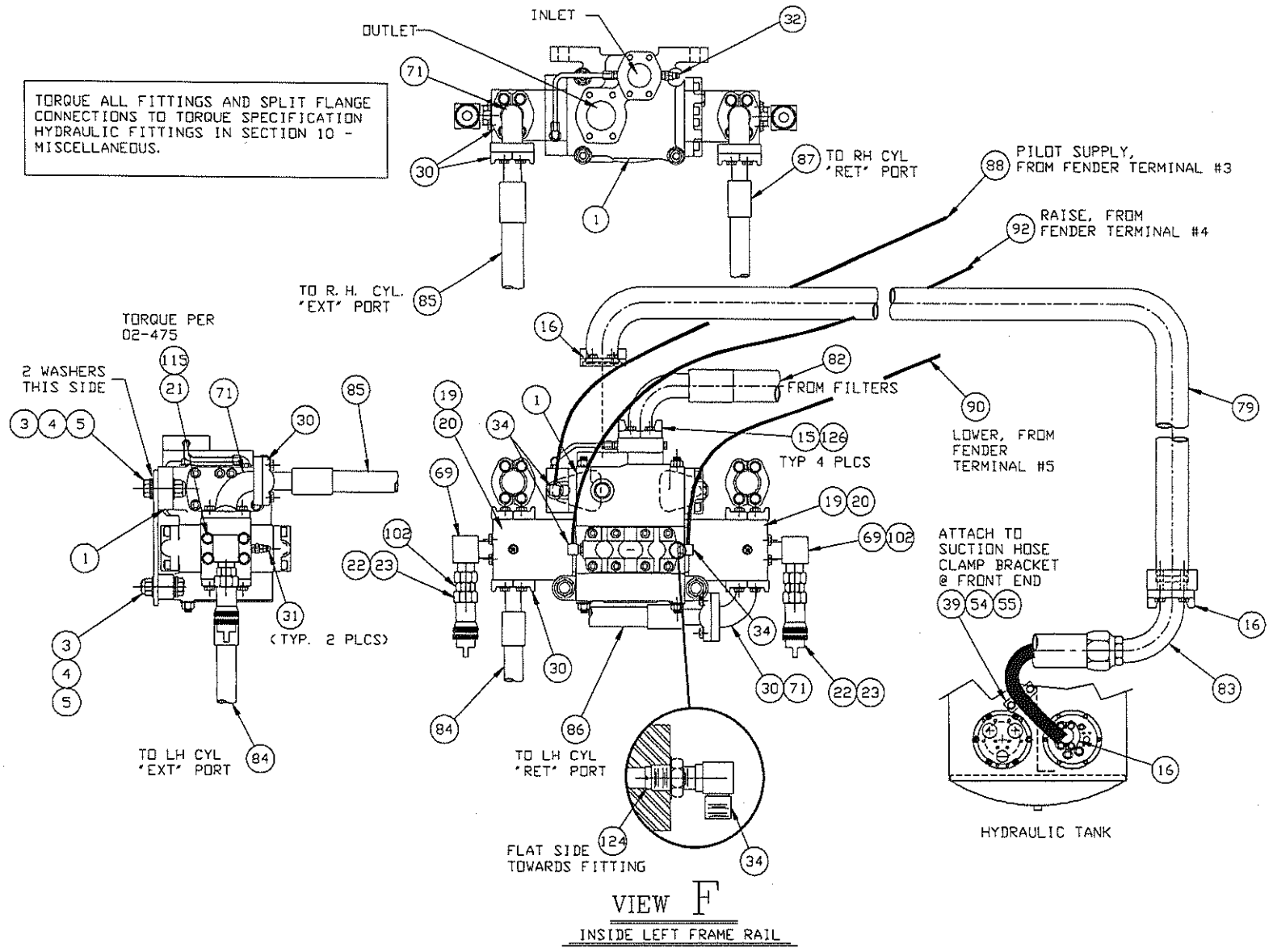


FIGURE 5 - DUMP SYSTEM ASSEMBLY (A85183 SHEET 4 OF 6)

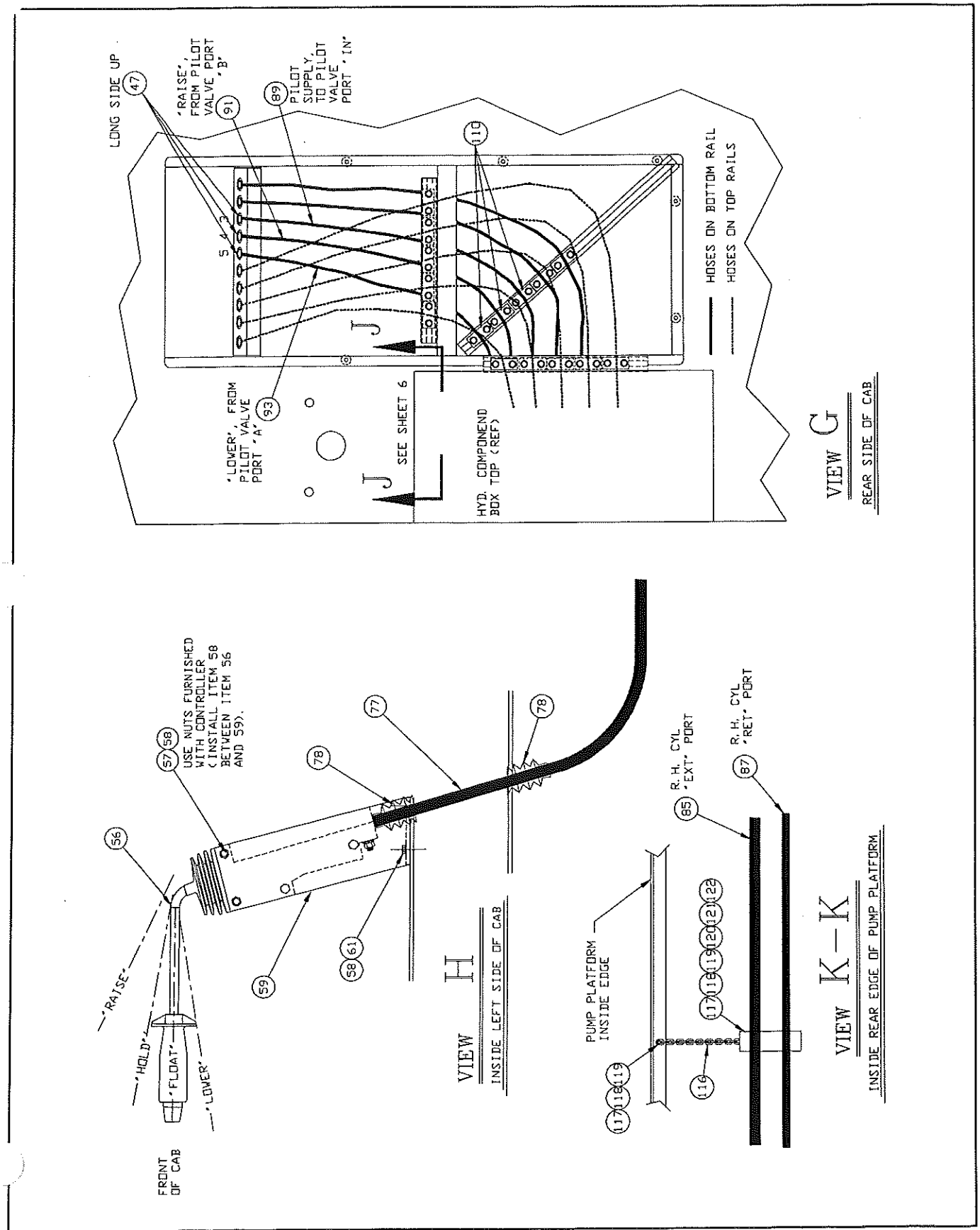


FIGURE 5 - DUMP SYSTEM ASSEMBLY (A85183 SHEET 5 OF 6)

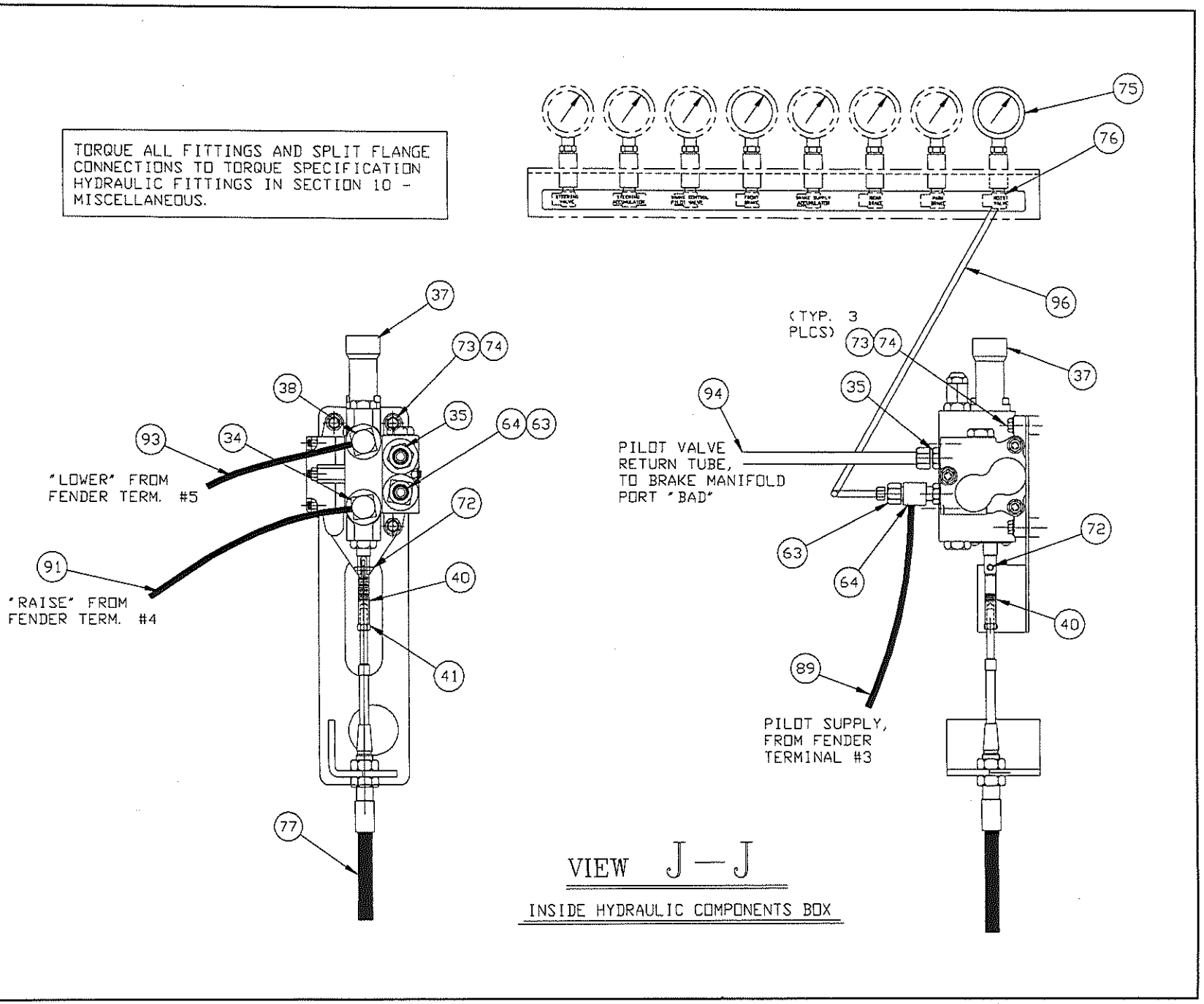
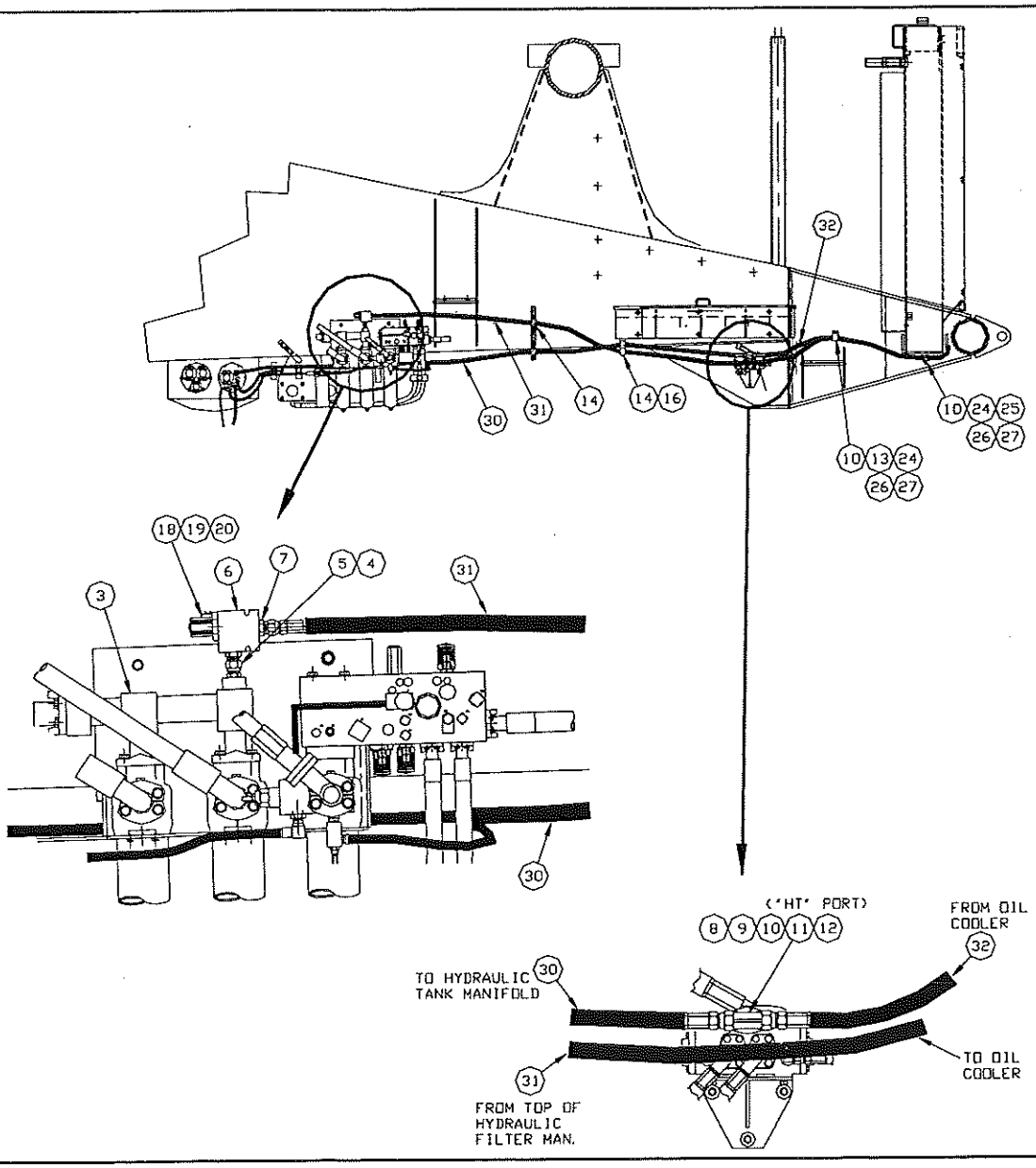


FIGURE 5 - DUMP SYSTEM ASSEMBLY (A85183 SHEET 6 OF 6)



KEY A85399

01.	Oil Cooler	15.	Weld Clamp Plate	29.	Not Used
02.	Adapter Fitting	16.	Capscrew	30.	Hose Assembly
03.	Hydraulic Filter Manifold	17.	Timing Module	31.	Hose Assembly
04.	Adapter Fitting	18.	DIN (Electrical) Connector	32.	Hose Assembly
05.	Adapter Fitting	19.	Gasket	33.	Sensor Bracket
06.	Solenoid Cartridge Valve	20.	Grip	34.	Proximity Switch Assembly
07.	Adapter Fitting	21.	Capscrew	35.	Washer
08.	Adapter Flange	22.	Oil Cooler Bracket	36.	Locknut
09.	O-ring	23.	Locknut	37.	Nut
10.	Lockwasher	24.	Flatwasher	38.	Relay
11.	Socket Head Capscrew	25.	Bolting Pad	39.	Machine Screw
12.	Adapter Fitting	26.	Cushion Clamp	40.	Nut
13.	Bolting Pad	27.	Capscrew		
14.	Clamp Support Assembly	28.	Not Used		

FIGURE 6 – HYDRAULIC OIL COOLER ASSEMBLY (A85399, SHEET 1 OF 2)

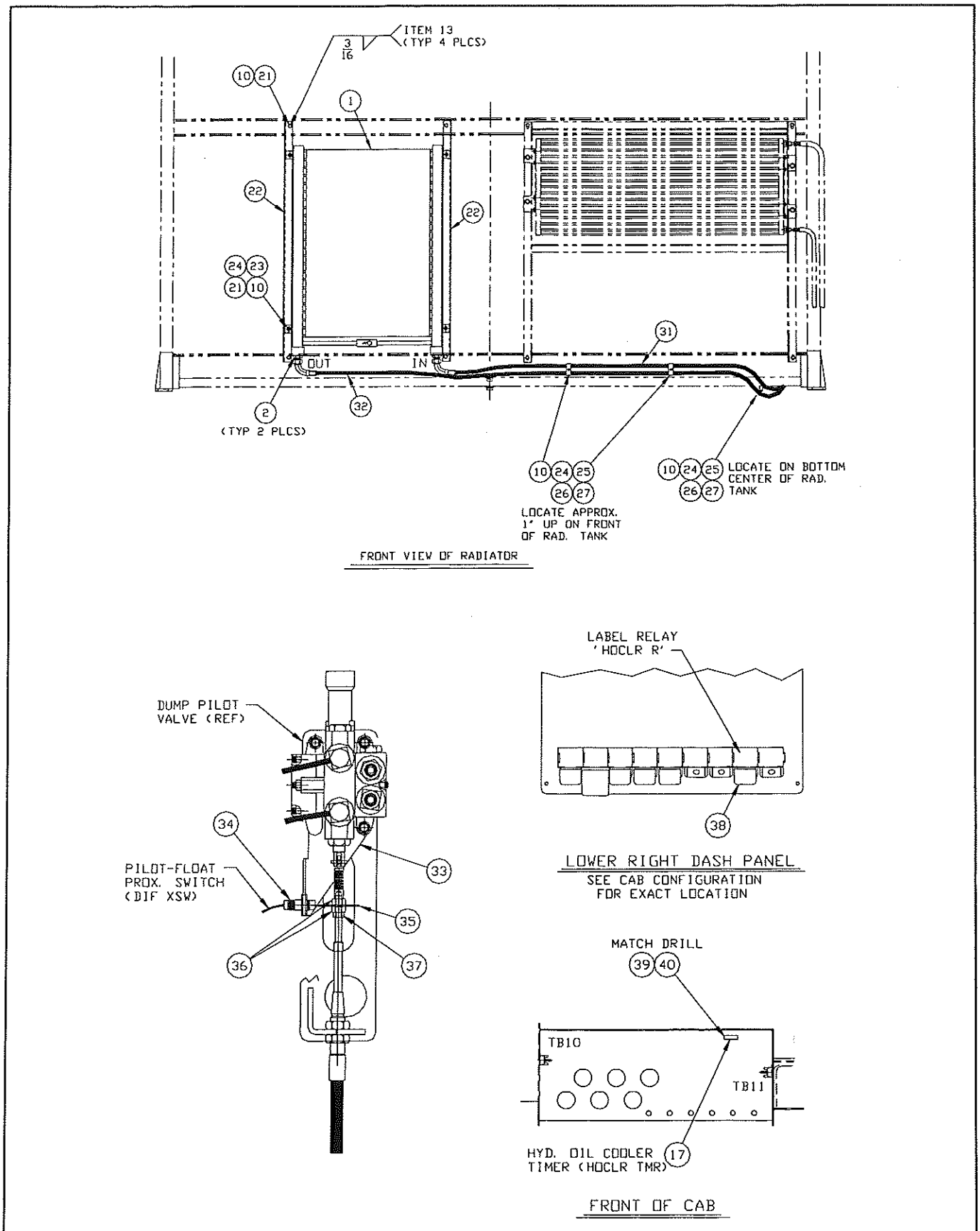


FIGURE 6 – HYDRAULIC OIL COOLER ASSEMBLY (A85399, SHEET 2 OF 2)

MANUAL POWER SUPPLY PUMP

DESCRIPTION AND LOCATION

The manual power supply pump is a 24 Vdc electrically operated (motored) hydraulic gear pump. It is typically mounted on the top of the hydraulic pump mounting bracket, inside the frame rails and behind the main traction alternator.

OPERATION

The manual power supply pump is designed to provide flow to the steering and brake systems in place of the main engine driven steering pump if the pump is unable maintain the operating pressure levels in the accumulators. If this condition develops, the electric motors are either manually (using the manual switch) or automatically (pressure switch interlocked through the Shifter) energized, powering the hydraulic pumps.

NOTE: *This supply of pressurized oil for auxiliary steering and braking (for control in the event of the loss of flow while the truck is moving) is from the accumulators in each system. The Manual Power Supply System is designed to partially recharge the accumulators to allow for limited steering and braking as in towing or during maintenance.*

Oil enters the pump from a line direct from the hydraulic reservoir, independent of the main engine driven pumps, with only a coarse suction screen included to minimize ingestion of large contaminants. Inside the pump the oil enters the inlet chamber and is pressurized by the movement of the gears. It then exits through the outlet chamber and port, passing through an integral relief valve (limiting maximum pressures) and independent check valves (which prevent back flow when the pump is not in use). It then is routed to the steering system manifold for distribution to the steering and brake systems.

NOTE: *There are two separate pump assemblies outlined in these procedures:*
1. The early version incorporated a self-contained relief valve assembly.
2. The later version is identified by a cartridge relief valve mounted in separate block assembly on the hydraulic pump assembly.
Always determine the version being worked on before servicing this component.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following:

1. Clean all dirt and other contaminants from the assembly.

2. Inspect for evidence of leakage, wear, or damage to the pump or related components. Especially inspect the condition of the motor brushes, commutator, and related parts. Repair or replace as required.

3. Check the operation of the pump both manually and automatically as outlined in the test instructions in Section 5 - Hydraulic System.

REMOVAL (Figure 2)

The pump may be removed as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Stop the hydraulic fluid supply at the reservoir.

3. Disconnect the 24 Vdc power source from the batteries.

4. Disconnect the hydraulic lines to the pumps. Cap or plug all openings. Label each to aid in installation.

⚠WARNING

Release all hydraulic pressure from the system before loosening or removing any lines.

5. Remove any remaining cables or hoses.

6. Remove the capscrews securing the pump to the mount.

7. Remove the pump assembly.

DISASSEMBY (Figures 1A, B and C)

Prior to beginning disassembly of the pump:

NOTE: *There are two separate pump assemblies outlined in these procedures:*
1. The early version incorporated a self-contained relief valve assembly.
2. The later version is identified by a cartridge relief valve mounted in separate block assembly on the hydraulic

pump assembly.
Always determine the version being worked on before servicing this component.

1. Clean the work area of dirt, grease, foreign material or other items that might contaminate the pump.

2. Clean the unit thoroughly with a solvent. Remove all sharp edges from splines, drill points, keyways and end of shaft. Mark the adapter and cover/housing sections to ensure correct reassembly.

3. To aid in disassembly and reassembly, the pump should be retained in some manner. For example, a steel plate bolted to and extending over the edge of a work bench will suffice. The plate should have a hole large enough for the adapter flange pilot to drop through and two holes in the adapter flange. The pump can now be firmly fixed to the plate by bolts. This is especially helpful in removal and installation and checking of the torque of capscrews.

The earlier version pump may be disassembled as follows: (Figure 1A)

1. Remove the capscrews and lockwashers securing the hydraulic pump section to the electric motor and separate.

⚠ CAUTION

Do not attempt to pry the pumps apart with a screwdriver or other means. They should be separated by tapping with a soft-faced hammer.

2. Remove the capscrews (2 and 3) and lockwashers (4 and 5) securing the sections of the pump together.

3. Separate the housing cover (6), gear plate (9), and body assembly (15) by one of the following methods:

a. Use a gear puller.

b. Remove the two capscrews 180° apart, leaving the two engaged approximately three or four threads. Lay the pump on its side and tap the capscrews with a soft head hammer until the housing and adapter separate. Remove the capscrews.

⚠ CAUTION

Do not attempt to pry sections apart with a screwdriver or similar tool, as such action can damage machined sealing surfaces.

NOTE: *Make an index mark before removal to ensure that during reassembly the gears will be in the same position.*

IMPORTANT: *Separate and identify each of the components as removed so that they can be reinstalled in the same location if reused during assembly.*

4. Remove the square key (18) from the driveshaft (17).

5. Remove the drive and driven or idler gear assemblies from the pump assembly.

6. Remove capscrew (26) and plate (25).

7. Remove the seal (24) and O-ring (22).

8. Remove the retaining rings (19), washers (20), and ball bearing (21) from the driveshaft (17).

9. If required, remove the drive gear (12) and woodruff key (13) from the driveshaft (17).

10. If required, remove the retainer rings (10), idler gear (11), and woodruff key (13) from the idler shaft (14).

11. Remove the needle bearing (16) from the body assembly (15) using a suitable puller.

12. Remove the needle bearings (7) from the cover assembly using a suitable puller.

The later version pump may be disassembled as follows: (Figures 1B and C)

1. Remove the nuts and washers securing the electric motor (1, Figure 1B) and hydraulic pump (2, Figure 1C) sections.

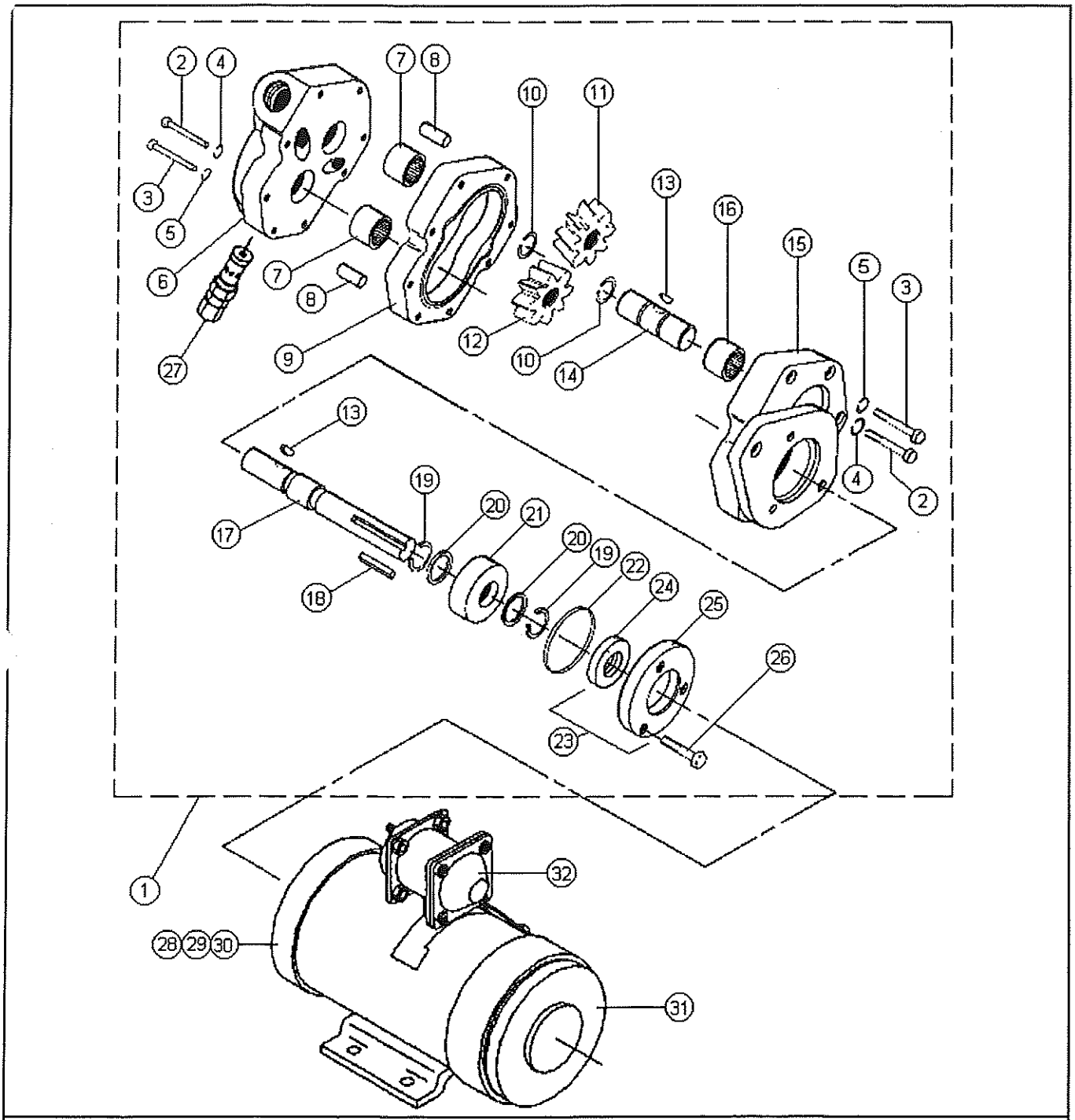
2. Carefully separate the two pump sections, making sure that the splined shafts and couplers are not damaged.

⚠ CAUTION

Do not attempt to pry the pumps apart with a screwdriver or other means. They should be separated by tapping with a soft-faced hammer.

NOTE: *The remaining steps reference Figure 1C unless otherwise indicated.*

3. With a grease pencil, ink marker or other suitable marking tool, mark each housing cover on the parting



KEY 51049

01.	Hydraulic Pump Assembly	09.	Gear Plate	17.	Driveshaft	25.	Plate
02.	Capscrew	10.	Retaining Ring	18.	Square Key	26.	Capscrew
03.	Capscrew	11.	Idler Gear	19.	Retaining Ring	27.	Relief Valve
04.	Lockwasher	12.	Drive Gear	20.	Washer	28.	Adapter Plate
05.	Lockwasher	13.	Woodruff Key	21.	Ball Bearing	29.	Capscrew
06.	Cover Assembly	14.	Idler Shaft	22.	O-ring	30.	Lockwasher
07.	Needle Bearing	15.	Body Assembly	23.	Pilot Plate Assembly	31.	Pump Motor
08.	Dowel Pin	16.	Needle Bearing	24.	Seal	32.	Motor Solenoid

FIGURE 1A - EARLIER VERSION MANUAL POWER SUPPLY PUMP ASSEMBLY

line in a manner that will allow for reassembly in the same position.

NOTE: *These marks will be used to assist in matching parts for reassembly of the pumps.*

4. Clamp the pump assembly in a vise with the shaft end up.

NOTE: *Use clean wooden blocks or other soft material to protect the machined surfaces (particularly the port faces) from damage.*

5. Clean the driveshaft extension and remove any burrs or other damage. This will prevent damage to the seal lips.

6. Remove the capscrews (5) and washers (12) securing flange (1) to the pump body assembly.

7. Remove the flange (1). If the flange does not move easily, use a plastic hammer or wooden mallet and tap the edges of the flange with a plastic hammer to loosen it.

8. Grasp and lift the drive gear shaft (3) to dislodge the top pressure plate (6) with it while holding the pressure plate face against the gear with your fingers.

NOTE: *If the pressure plate hangs during removal, do not force or bend the plate. Tap lightly with a plastic hammer to drive the plate back down into position and start the removal process over.*

9. After noting the installation and orientation, remove the pressure plate from the drive gear. Inspect and discard the seal strips and back up rings.

NOTE: *Lift the plates straight up off of the shaft.*

NOTE: *When disassembling the pump sections, the parts should be laid out in a group and in the same order removed.*

10. Lift the idler gear (4) straight up out of the bore of the body.

11. Remove the bottom pressure plate (7) as follows:

a. Insert an expandable bearing puller into the shaft bore of the plate.

b. Tighten until it is secure on the plate.

c. Apply a light forward and back force to the puller handle and dislodge the plate.

NOTE: *If a bearing puller is not available:*
1. Grind a screwdriver shape on the short end of an Allen wrench.
2. Insert the ground end of the wrench into the shaft bore and lift the plate up.
3. Move the wrench to the opposite bore of the plate and lift up.
4. Repeat this action until the plate has been dislodged.

d. Grasping through the boreholes, lift the plate straight up and out.

NOTE: *Use extreme care in removing the plate. Do not pry or attempt to force it out. If the plate binds in place, move it up and down until it is free, and then lift it out.*

12. Inspect and remove all remaining seals and components.

INSPECTION AND REPAIR

The pump may be serviced as follows:

1. Clean all metal parts in solvent and dry with compressed air. Inspect for evidence of wear, damage, or leakage. Repair or replace as required.

2. Discard any seal plates with score marks, heavy wear pattern, or that show erosion marks.

3. Discard the gear assemblies if:

a. The shaft journals show excessive wear or pitting.

b. The gear teeth show excessive wear.

c. The gear face is scored or cracked.

d. The driveshaft splines or keyways are badly worn.

e. The width of the gears is worn down more than 0.020 inch (0.5 mm).

4. Measure the clearance between the gear housing and gear teeth. This cover/housing and/or gear should be replaced if the clearance exceeds 0.010 inch (0.25 mm).

5. Visually examine the bearings for evidence of spalling of the rollers and fracture of the stamped cages. Check

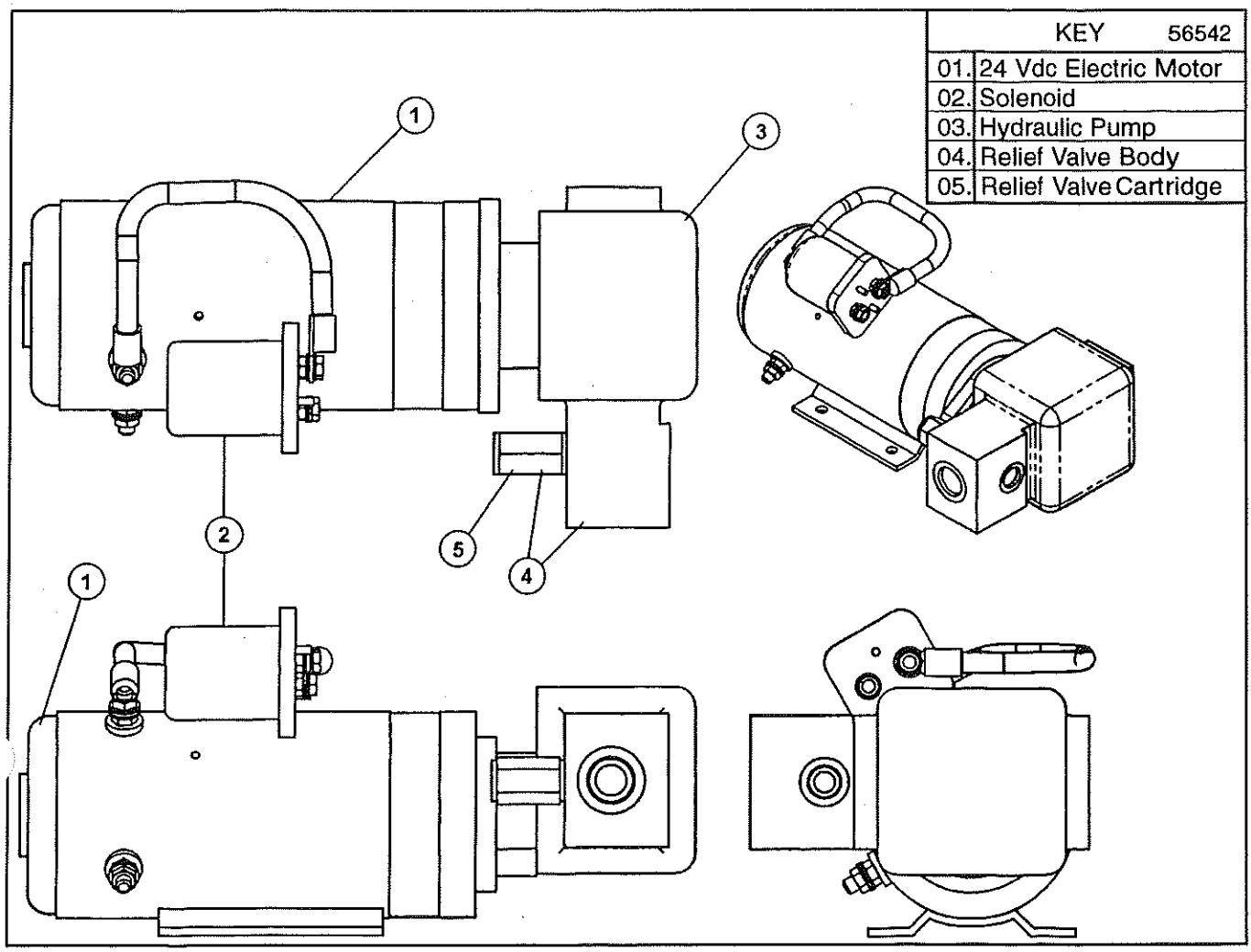


FIGURE 1B – LATER VERSION MANUAL POWER SUPPLY PUMP ASSEMBLY

the roughness of the outer race by sliding the rollers around the periphery of the cage. Any of these defects would be reason for replacement. The bearings should all be replaced at the same time.

6. Remove and inspect the relief valve assembly from the cover or block assembly assembly. Replace if rebuilding the pump assembly.

ASSEMBLY

The earlier version pump may be assembled as follows: (Figure 1A)

1. Install the needle bearings (7) into the cover assembly using a suitable press or driver.

2. Install the needle bearing (16) into the body assembly (15) using a suitable press or driver.

3. If removed, install the retainer rings (10), idler gear (11), and woodruff key (13) onto the idler shaft (14).

4. If removed, install the drive gear (12) and woodruff key (13) onto the driveshaft (17).

5. Install the retaining rings (19), washers (20), and ball bearing (21) onto the driveshaft (17).

6. Install the seal (24) and O-ring (22).

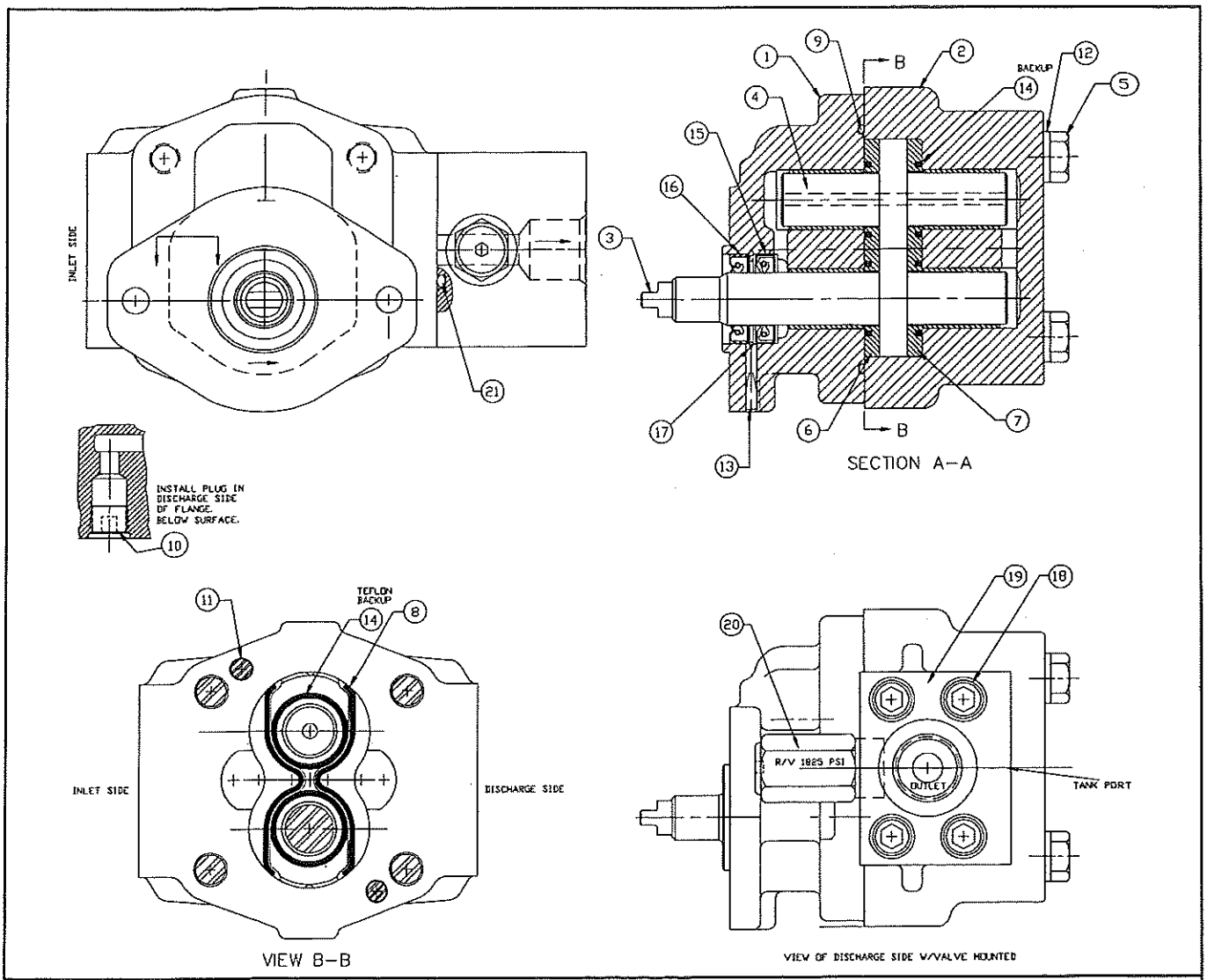
7. Install capscrew (26) and plate (25).

8. Install the drive and driven or idler gear assemblies into the pump assembly.

NOTE: *When the original gears are reused, make sure to align the index marks made during disassembly.*

9. Install the square key (18) onto the driveshaft (17).

10. Align and assemble the housing cover (6), gear



KEY					2003766
01.	Flange	08.	Sealing Strip	15.	Seal
02.	Body	09.	O-ring	16.	Seal
03.	Drive Gear	10.	Plug	17.	Snap Ring
04.	Idler Gear	11.	Dowels	18.	Capscrew
05.	Capscrews	12.	Washer	19.	Relief Valve Block
06.	Top Pressure Plate	13.	Plug	20.	Relief Valve Cartridge
07.	Bottom Pressure Plate	14.	Teflon Back-up Ring	21.	O-ring

FIGURE 1C - HYDRAULIC PUMP ON LATER VERSION ASSEMBLY

plate (9), and body assembly (15).
Secure together with capscrews (2 and 3) and lockwashers (4 and 5).

11. Install the relief valve assembly (27).

12. Mate and secure the hydraulic pump to the electric motor assembly.

The later version manual power supply pumps may be assembled as follows: (Figure 1C)

IMPORTANT:

1. Prior to reassembly, all parts should be deburred by sanding or stoning; washed in a solvent, wiped with a clean lint free cloth and, if available, dried with compressed air.

2. All seals should be replaced each time the pump is assembled.

1. Verify that all parts are clean and dry.

2. Place the body (2) installed on the work area, oriented so that the matching marks made during disassembly are facing you.

NOTES:
1. If new components are being installed, make sure that the side facing you is the same as the side marked on the old component.
2. Observe that the body has a wide and a narrow boss. The side having the wide boss is always the suction side.

3. Coat the inner bore of the body with clean hydraulic oil compatible with that in the truck's hydraulic system.

4. Install the bottom pressure plate (7) in the suction side in the bottom of the body with the rounded edge down.

NOTE: *There is a difference in the pressure plates. The one for this location has the radius on the outer edge that mates with the bottom of the gear bore.*

5. Install the new pressure balance seal strips (8) into the grooves in the back of the plates, using heavy grease to hold in place. Install the Teflon back up rings (14) as shown.

6. With the bronze side facing up and the rounded trap slots toward the discharge side of the body, slide the pressure plate (7) down into the gear bores until it rests firmly on the bottom of the pump body.

NOTE: *Do not force the plate down the gear bores. If the plate binds on the way down, move it back and forth carefully until it slides freely into position.*

7. Coat the drive gear (3) with clean hydraulic oil compatible with that in the truck's hydraulic system.

8. With the long splined end up, install the drive gear (3) into the bore nearest the mark that was made during disassembly.

9. Coat the idler gear (4) with clean hydraulic oil compatible with that in the truck's hydraulic system.

10. Install the idler gear (4) in the bore opposite the drive gear.

11. Install the dowels (11) in the body if removed.

12. Install the top pressure plate (6) with the grooves up.

IMPORTANT: *The pumps have a trap relief on the surface facing the gear. The plate should be assembled so that the trap is off-centered toward the outlet or discharge port side of the pump.*

13. Install the pressure balance seal strips (8) and Teflon back up rings (14) in the plate as outlined previously.

14. Lubricate the threads on the capscrews (5) and install with washers (12) into the body (2).

15. Install the seals (15 and 16) secured by the snap ring (17) into the body.

16. Install the mating O-ring (9) in the surface groove on the flange plate. Use clean, heavy grease to secure it in the groove temporarily.

17. Coat the splines on the driveshaft extension with heavy grease.

NOTE: *This is to prevent damage to the seal lips as the flange plate and seals are installed. Check the driveshaft for sharp edges. If necessary, use a seal guide or tape to protect the seal lips.*

18. With the O-ring in the flange plate facing down, slide the flange plate (1) down over the studs and shafts until the plate makes contact with the pump body.

19. Tap gently into place with a plastic hammer or wooden mallet.

IMPORTANT: *If the flange stops the flange may have caught the pressure balance strips. Do not force into position. Lift the flange and position the seal strips away from the journal using a small screwdriver in the middle and ends until the flange drops into place without force. Do not drive the flange on with a hammer or the seal strips may be damaged.*

20. Tighten the capscrews (5) in a crossing pattern in even increments to a final torque of 75 ft-lbs. (100 Nm).

21. Using an appropriate tool, turn the driveshaft. The movement of the shaft should be tight, but it should turn freely with a maximum of 5 to 10 ft-lbs. (7 to 14 Nm) of torque.

NOTE: *If this does not occur, disassemble the pump and examine the parts for burrs or foreign material caus-*

ing a build-up or interference between the parts.

22. If removed, remount the valve assembly onto the pump assembly.

23. Re-install the hydraulic pump (3, Figure 1B) assembly onto the electric motor assembly (1, Figure 1B) and secure.

INSTALLATION

The manual supply pump assembly may be installed as follows:

1. Place the pump assembly in position and secure with the mounting bolts.

2. Reconnect all hoses to the assembly.

3. Reconnect all 24 Vdc wires/cables.

4. Open the hydraulic fluid supply to the pump.

5. Bleed and test pump/system operation as outlined in the test instructions for the Steering System in Section 5 - Hydraulic System.

6. Install the cover over the pump.

KEY	A85187
01.	Motor Driven Pump
02.	Flatwasher
03.	Capscrew
04.	Locknut
05.	Adapter Fitting
06.	Pipe Coupling
07.	Adapter Fitting
08.	Check Valve
09.	Adapter Fitting
10.	Hose Assembly
11.	Hose Assembly
12.	Hose Assembly
13.	Adapter Fitting
14.	Adapter Fitting
15.	Adapter Fitting
16.	Adapter Fitting
17.	Clamp Halves
18.	Pressure Switch
19.	Connector Fitting
20.	Grip
21.	Gasket
22.	Adapter Fitting
23.	Cartridge Check Valve
24.	Pushbutton Switch
25.	24 Vdc Relay
26.	Diode Assembly*
27.	Electrical Terminal*
28.	Electrical Terminal*
29.	Electrical Terminal*
30.	Electrical Terminal*
31.	Electrical Terminal*
32.	Electrical Wire*
33.	Power Cable*
* Items are not shown on the drawing.	

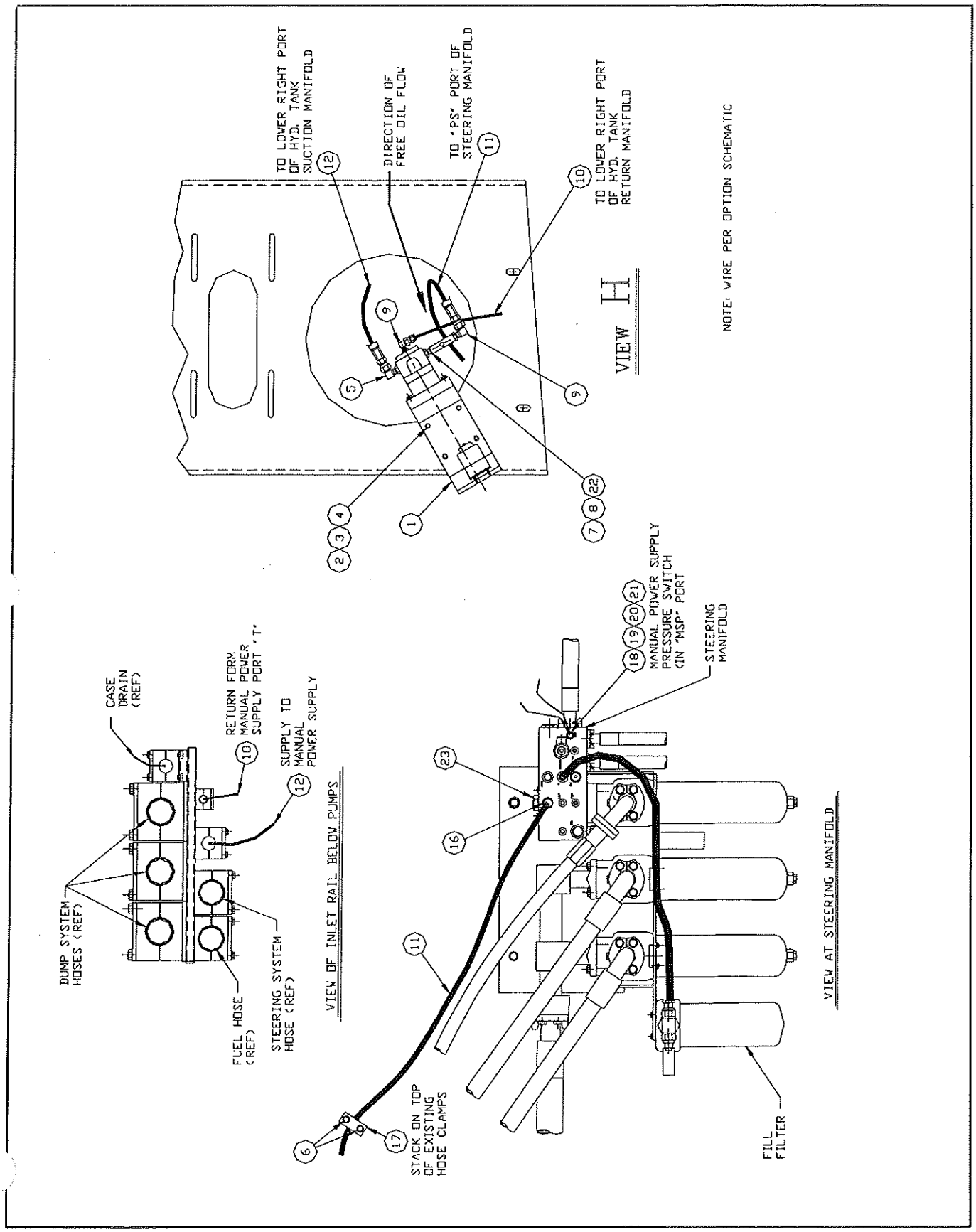
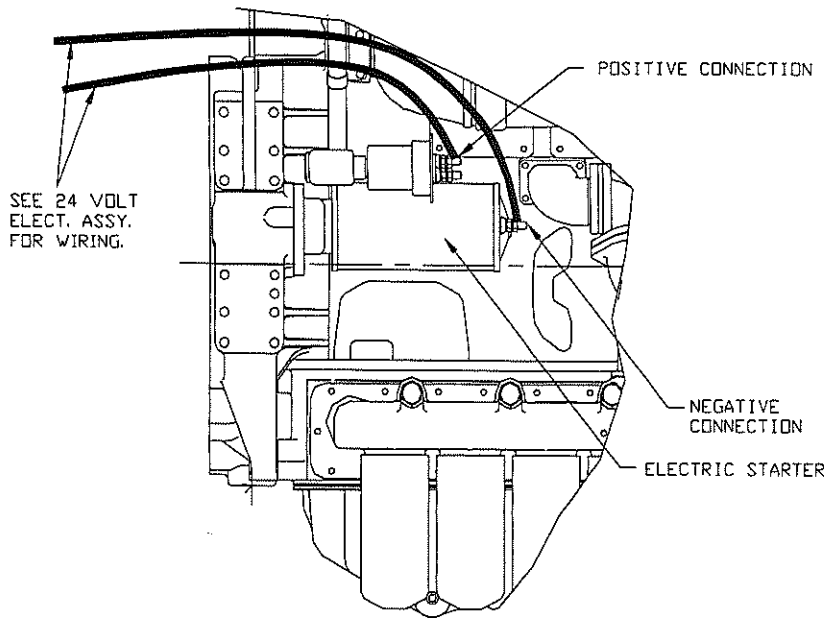
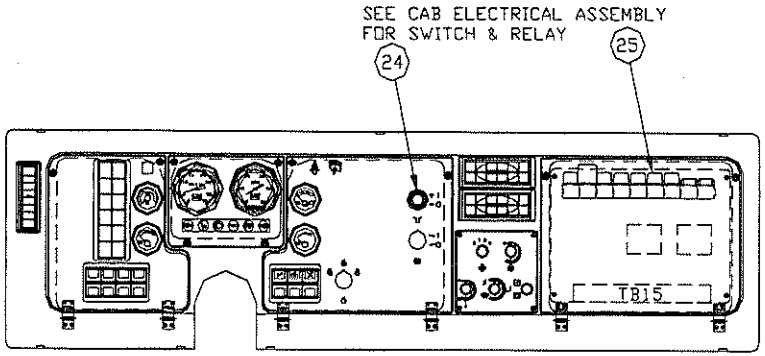


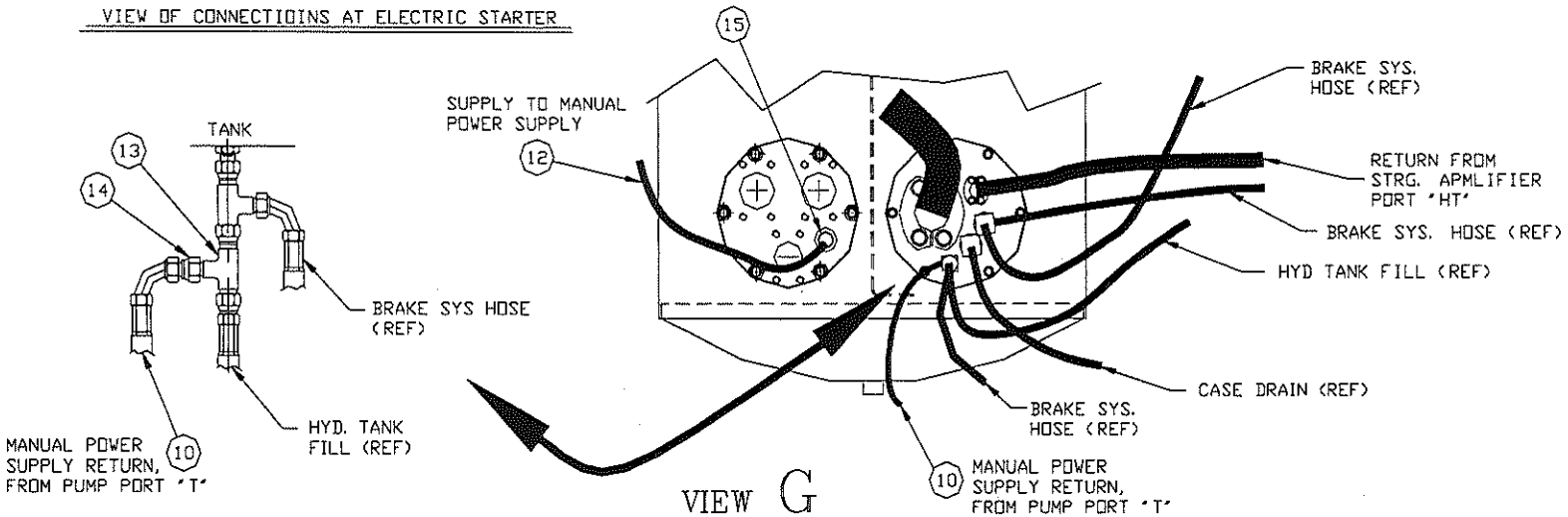
FIGURE 2 – MANUAL POWER SUPPLY PUMP SYSTEM (A85187)



VIEW OF CONNECTIOINS AT ELECTRIC STARTER



VIEW OF SWITCH & RELAY AT DASH



VIEW G

VIEW OF HYDRAULIC TANK FROM
INSIDE LEFT FRAME RAIL

FIGURE 2 – MANUAL POWER SUPPLY PUMP SYSTEM (A85187 CONTINUED)

HYDRAULIC BRAKE SYSTEM

DESCRIPTION AND LOCATION

The hydraulic brake system consists of the following components:

1. Hydraulic fluid supply - the brake system receives its supply of pressurized fluid from the steering system pump and filter.

2. Brake manifold - aluminum manifold installed in the hydraulic component box on the superstructure behind the cab.

3. Accumulator drain valves - located in the brake manifold, which allow hydraulic pressure stored in the brake accumulator system to be released. The valves are for manual operation only.

NOTES:
1. On early production manifolds and trucks, the valve for the rear brake accumulator contains both a 24 Vdc electric solenoid and manual provisions. It was intended to drain the accumulators when the truck's Master Switch was turned Off.
2. On late version trucks, a needle valve assembly was installed that must be manually opened or closed to release the accumulator pressure.

4. Accumulators - piston-type storage devices mounted on the rear of the hydraulic components box on the superstructure behind the cab.

5. Pressure switches - diaphragm-type switches to monitor various systems.

a. Low brake pressure.

b. Brake drag - front and rear - (optional).

c. Auto(matic) brake application (auto apply) (optional).

d. Park brake pressure.

6. Brake pilot valve - spool type valve mounted on the brake pedal in the cab.

7. Brake control valves - dual spool valve mounted in the hydraulic components box on the superstructure behind the cab.

8. Brake calipers - caliper assemblies mounted on the front axle assemblies and rear wheelmotors.

9. Auto(matic) apply solenoid - solenoid valve cartridge in the brake manifold which applies the brakes automatically, if supply pressure drops below preset level.

10. Load brake solenoid valve - solenoid valve cartridge in the brake manifold which applies the rear brakes only when activated by a cab mounted switch.

11. Park brake solenoid valve - dual coil electric solenoid, detented valve mounted on the brake manifold that control the flow of pressurized oil to and from the park brake system.

NOTE: *Detailed information on this valve is contained in Section 5 - Hydraulic System.*

12. Park brake shut-off valve - electric solenoid operated check valve cartridge in the brake manifold that limits the flow of oil to the park brake calipers except when energized.

13. Park brake pressure reducing valve - separate mechanical assembly used to limit the maximum pressure to the park brake caliper assemblies.

NOTE: *On earlier version trucks, this valve was external to the system. On later version trucks, it was incorporated into the brake circuit manifold.*

14. Steering manifold - metal manifold mounted above the steering filter, supplying oil to the brake system.

15. Venturi and flow control assembly - control valve assembly mounted to a port in the side of the steering manifold, that creates a reduced pressure on the return flow from the brake assembly to prevent the brakes from "dragging".

16. Modulated hand brake valve - mechanical lever and cable assembly that operates the brake control valve in the hydraulic components box with a cab center console mounted lever.

17. Load brake switch - cab console mounted electrical switch that controls the operation of the load brake solenoid valve.

18. Park brake switch - cab dash mounted electrical switch that controls the operation of the park brake apply and release solenoid valves.

19. Park brake assembly - separate caliper or piston assembly mounted on the rear disc brakes.

OPERATION (Figures 1 through 6)

The hydraulic brake system consists of two subsystems, supply and operation, which perform together to control the operation of the brake caliper assemblies.

SUPPLY

Hydraulic oil is drawn from the hydraulic reservoir into the steering pump assembly. The pump is a piston type pump with a moveable swashplate that is controlled in a pressure compensating mode. In this configuration, the pump stroke is controlled from 0 to maximum displacement per revolution to provide a flow sufficient to maintain constant pressure of approximately 3500 psi (24 130 kPa) in the system accumulators. The output of the pump is routed through a high pressure oil filter and steering manifold.

It then passes through the brake manifold and on to the brake accumulators, which are kept at a "constant state of charge". The brake manifold splits to the separate front and rear brake accumulators, which supply their respective brake systems.

NOTE: *The three accumulators (supply, front, and rear) are plumbed independently so that the supply accumulator provides support to either the front or rear accumulator.*

A low brake pressure switch is included to activate a cab warning indicator if the pressure in the supply brake accumulator decreases to a predetermined minimum level.

OPERATION

When the operator depresses the Brake pedal a pilot pressure, proportionate to the amount the pedal is depressed, is routed to the front and rear pilot ports on the brake control valve. This pilot pressure causes the spools in the brake control valve to shift, metering the operating pressure allowed to the individual caliper assemblies.

Release of the pedal causes the pilot pressure to decrease to 0 psi (kPa). This releases the caliper operating pressure.

NOTE: *A separate venturi and flow control system is incorporated into the steering manifold that creates a reduced pressure in the brake return line. This reduced pressure allows the return oil to have minimal back pressure, in spite of the 10 psi (70 kPa) pressure maintained in the truck's hydraulic tank.*

A proximity switch on the pilot valve and separate relay assembly is used to operate the truck brake lights.

When the modulated hand brake system is operated, moving the lever in the cab operates a push-pull cable with a lever on the end, which mechanically depresses the spools in the brake control valve. This results in application of the brake calipers in a manner similar to that used in brake pedal operation. Releasing the lever reverses the procedure and releases the brake calipers.

NOTES:

1. The brake control valve outputs are factory preset to regulate the front and rear brake pressure independently.

2. A separate switch and relay system allows for:

a. Operation of a cab warning indicator.

b. Interrupts propulsion enabling circuitry (AS circuit).

c. Operates the truck's stop lights.

3. The modulated hand brake lever is spring loaded to the Release position. The brakes remain applied only when the lever is in the Activated position and held.

A load brake assembly provides a method of applying or releasing the rear brake only. This system is designed to be used during the loading or dumping portions of the cycle, is controlled through a manual switch located on the cab console.

When the Load Brake switch is activated (or moved to the Apply position) pressurized oil is routed from the brake manifold to the pilot port for the rear brake spool in the brake control valve through the Load Brake Shuttle valve. This causes only the rear brakes to apply fully. Moving the switch to the Release position discontinues the pilot pressure and releases the brakes.

An optional auto apply (automatic actuation) feature is available to activate the brakes in conditions where the supply system pressure decreases to a predetermined pressure. At this pressure, a pressure switch activates the auto apply solenoid valve, piloting the brake control valve through the Auto Apply shuttle valve. This causes the brake control valve to provide maximum system pressure to the caliper assemblies, stopping the truck. This application is not modulated, and should be used in emergency situations only.

A Brake Drag Warning option is available to provide cab warning indications in the event of residual pressure remaining in the brake control circuitry (when all the brakes are fully released), causing the calipers to remain partially applied.

KEY			13612A
01.	BRAKE MANIFOLD	16.	REAR BRAKE CALIPERS
02.	LOW BRAKE PRESSURE SWITCH	17.	BRAKE DRAG PRESSURE SWITCHES
03.	AUTO APPLY PRESSURE SWITCH	18.	PARK BRAKE PRESSURE REDUCING VALVE/REGULATOR (IF SO EQUIPPED)
04.	BRAKE SYSTEM PRESSURE GAUGE		
05.	BRAKE ACCUMULATORS	A.	EXTERNAL MOUNTED
06.	MANUAL ACCUMULATOR DRAIN VALVES	B.	INTEGRAL (MANIFOLD) MOUNTED
07.	AUTO APPLY SOLENOID VALVE	19.	PARK BRAKE SOLENOID VALVE
08.	LOAD BRAKE SOLENOID VALVE	20.	PARK BRAKE SHUT-OFF VALVE
09.	LOAD BRAKE SHUTTLE VALVE	21.	PARK BRAKE PRESSURE SWITCH
10.	AUTO APPLY SHUTTLE VALVE	22.	PARK BRAKE SYSTEM PRESSURE GAUGE
11.	BRAKE PILOT VALVE	23.	PARK BRAKE CALIPERS
12.	BRAKE CONTROLLER VALVE	24.	HYDRAULIC TANK
13.	FRONT BRAKE PRESSURE GAUGE	25.	BRAKE SYSTEM REAR PILOT PRESSURE GAUGE
14.	REAR BRAKE PRESSURE GAUGE	26.	FLOW CONTROL
15.	FRONT BRAKE CALIPERS	27.	VENTURI

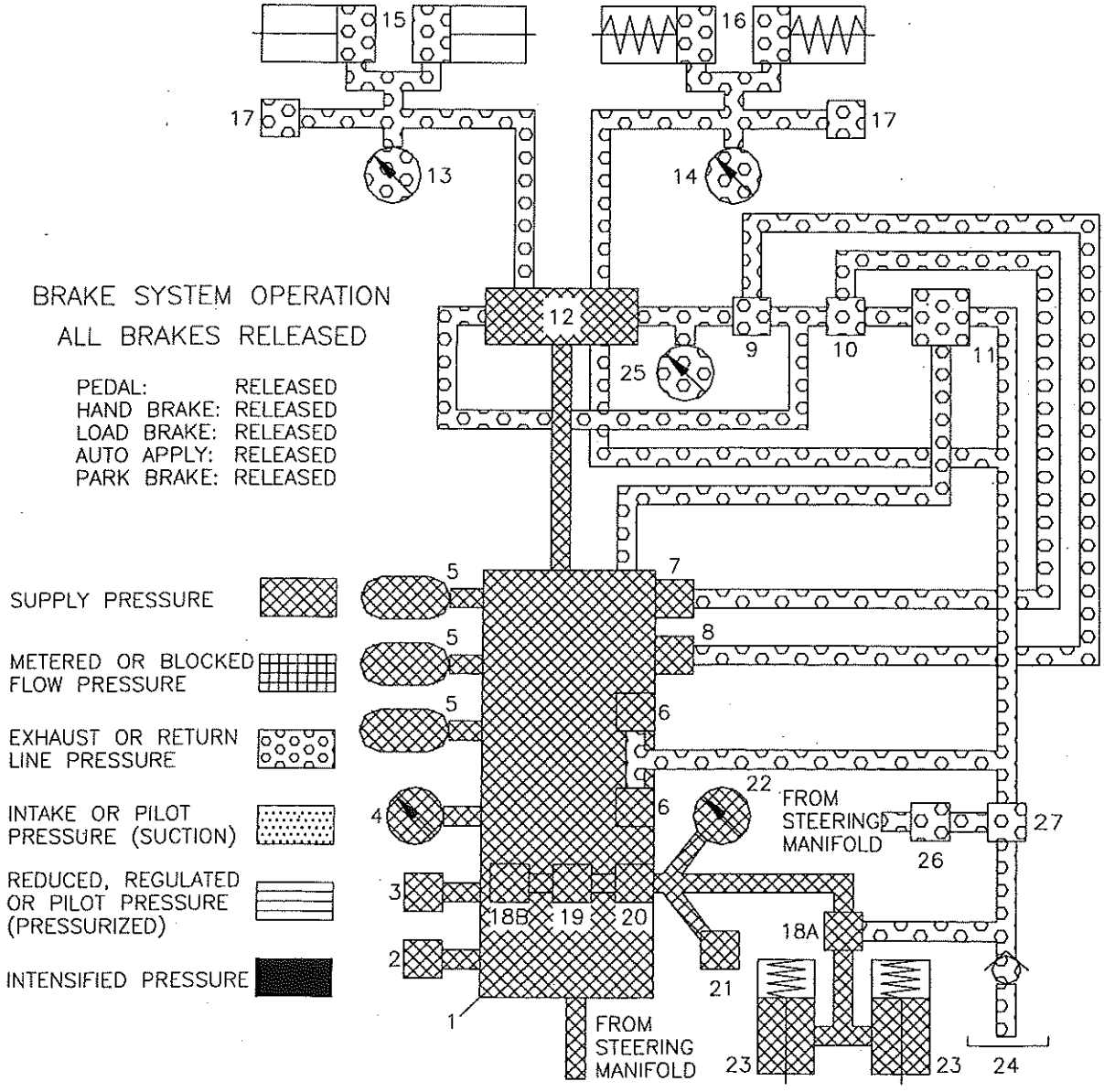


FIGURE 1 - BRAKE SYSTEM OPERATION - ALL BRAKES RELEASED

KEY			13612B
01.	BRAKE MANIFOLD	16.	REAR BRAKE CALIPERS
02.	LOW BRAKE PRESSURE SWITCH	17.	BRAKE DRAG PRESSURE SWITCHES
03.	AUTO APPLY PRESSURE SWITCH	18.	PARK BRAKE PRESSURE REDUCING VALVE/REGULATOR (IF SO EQUIPPED)
04.	BRAKE SYSTEM PRESSURE GAUGE	A.	EXTERNAL MOUNTED
05.	BRAKE ACCUMULATORS	B.	INTEGRAL (MANIFOLD) MOUNTED
06.	MANUAL ACCUMULATOR DRAIN VALVES	19.	PARK BRAKE SOLENOID VALVE
07.	AUTO APPLY SOLENOID VALVE	20.	PARK BRAKE SHUT-OFF VALVE
08.	LOAD BRAKE SOLENOID VALVE	21.	PARK BRAKE PRESSURE SWITCH
09.	LOAD BRAKE SHUTTLE VALVE	22.	PARK BRAKE SYSTEM PRESSURE GAUGE
10.	AUTO APPLY SHUTTLE VALVE	23.	PARK BRAKE CALIPERS
11.	BRAKE PILOT VALVE	24.	HYDRAULIC TANK
12.	BRAKE CONTROLLER VALVE	25.	BRAKE SYSTEM REAR PILOT PRESSURE GAUGE
13.	FRONT BRAKE PRESSURE GAUGE	26.	FLOW CONTROL
14.	REAR BRAKE PRESSURE GAUGE	27.	VENTURI
15.	FRONT BRAKE CALIPERS		

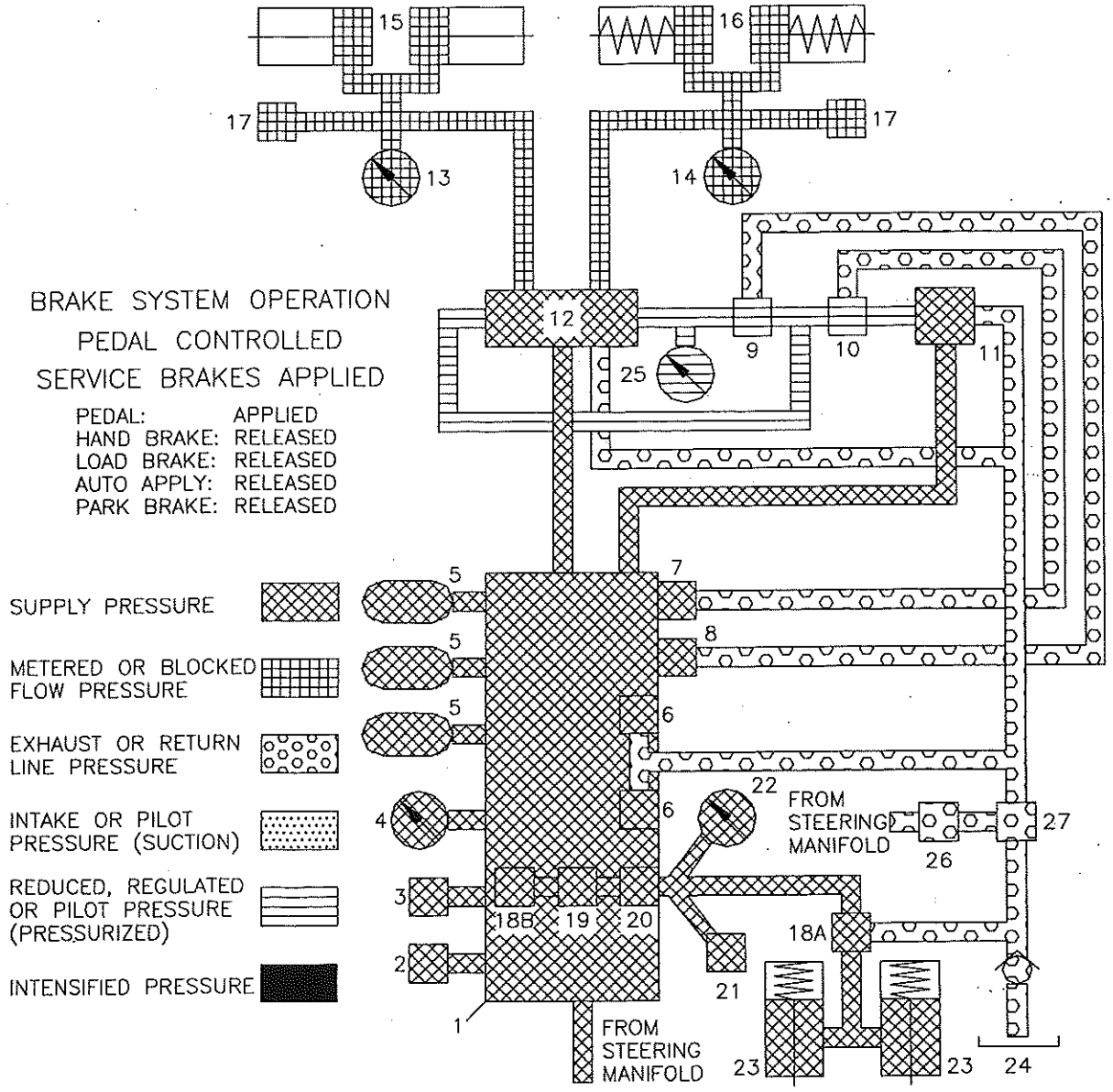


FIGURE 2 - BRAKE SYSTEM OPERATION - PEDAL CONTROLLED SERVICE BRAKES APPLIED

KEY			13612C
01.	BRAKE MANIFOLD	16.	REAR BRAKE CALIPERS
02.	LOW BRAKE PRESSURE SWITCH	17.	BRAKE DRAG PRESSURE SWITCHES
03.	AUTO APPLY PRESSURE SWITCH	18.	PARK BRAKE PRESSURE REDUCING VALVE/REGULATOR (IF SO EQUIPPED)
04.	BRAKE SYSTEM PRESSURE GAUGE		
05.	BRAKE ACCUMULATORS	A.	EXTERNAL MOUNTED
06.	MANUAL ACCUMULATOR DRAIN VALVES	B.	INTEGRAL (MANIFOLD) MOUNTED
07.	AUTO APPLY SOLENOID VALVE	19.	PARK BRAKE SOLENOID VALVE
08.	LOAD BRAKE SOLENOID VALVE	20.	PARK BRAKE SHUT-OFF VALVE
09.	LOAD BRAKE SHUTTLE VALVE	21.	PARK BRAKE PRESSURE SWITCH
10.	AUTO APPLY SHUTTLE VALVE	22.	PARK BRAKE SYSTEM PRESSURE GAUGE
11.	BRAKE PILOT VALVE	23.	PARK BRAKE CALIPERS
12.	BRAKE CONTROLLER VALVE	24.	HYDRAULIC TANK
13.	FRONT BRAKE PRESSURE GAUGE	25.	BRAKE SYSTEM REAR PILOT PRESSURE GAUGE
14.	REAR BRAKE PRESSURE GAUGE	26.	FLOW CONTROL
15.	FRONT BRAKE CALIPERS	27.	VENTURI

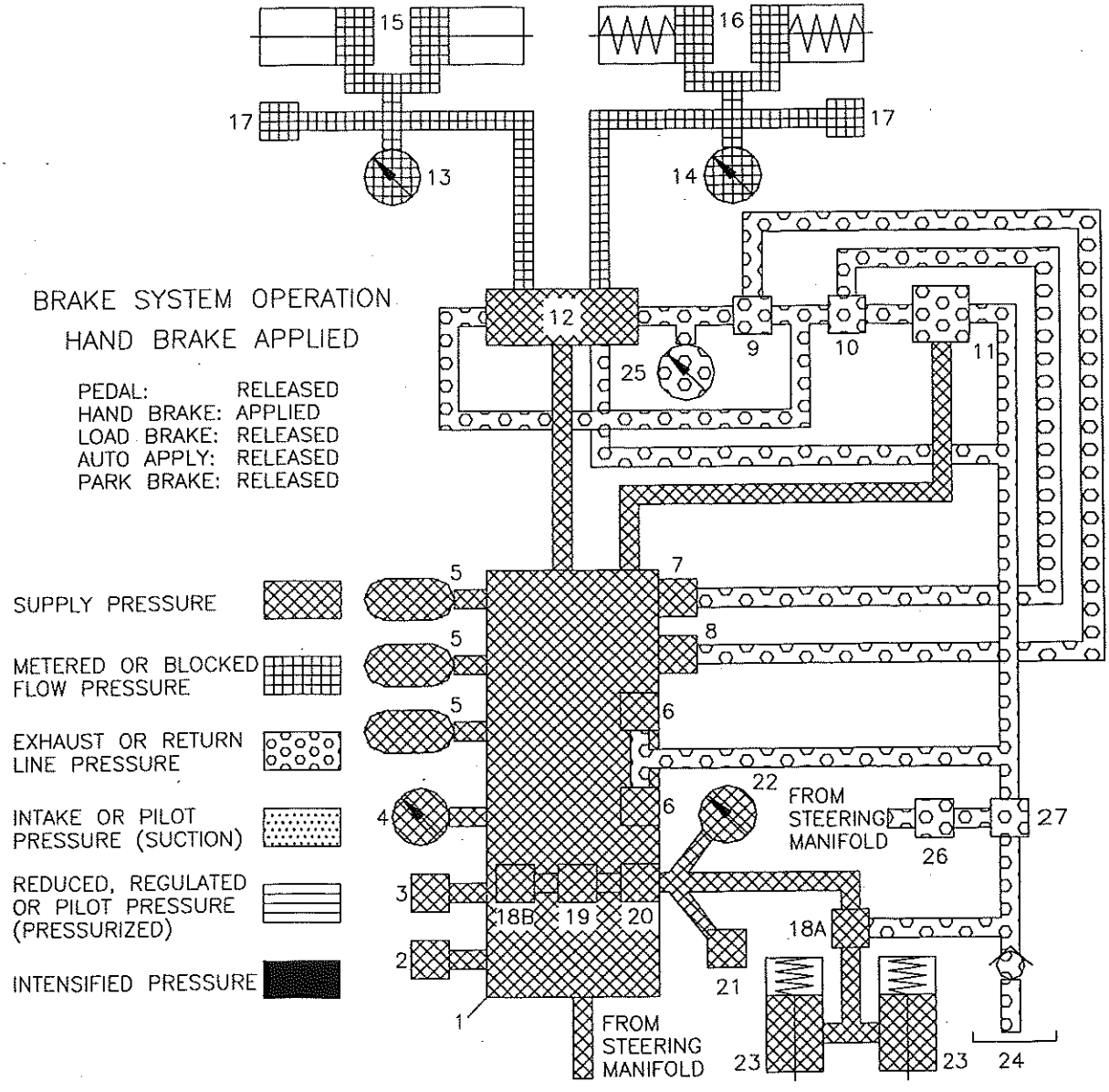


FIGURE 3 - BRAKE SYSTEM OPERATION - HAND BRAKE APPLIED

KEY			13612D
01.	BRAKE MANIFOLD	16.	REAR BRAKE CALIPERS
02.	LOW BRAKE PRESSURE SWITCH	17.	BRAKE DRAG PRESSURE SWITCHES
03.	AUTO APPLY PRESSURE SWITCH	18.	PARK BRAKE PRESSURE REDUCING VALVE/REGULATOR (IF SO EQUIPPED)
04.	BRAKE SYSTEM PRESSURE GAUGE		
05.	BRAKE ACCUMULATORS	A.	EXTERNAL MOUNTED
06.	MANUAL ACCUMULATOR DRAIN VALVES	B.	INTEGRAL (MANIFOLD) MOUNTED
07.	AUTO APPLY SOLENOID VALVE	19.	PARK BRAKE SOLENOID VALVE
08.	LOAD BRAKE SOLENOID VALVE	20.	PARK BRAKE SHUT-OFF VALVE
09.	LOAD BRAKE SHUTTLE VALVE	21.	PARK BRAKE PRESSURE SWITCH
10.	AUTO APPLY SHUTTLE VALVE	22.	PARK BRAKE SYSTEM PRESSURE GAUGE
11.	BRAKE PILOT VALVE	23.	PARK BRAKE CALIPERS
12.	BRAKE CONTROLLER VALVE	24.	HYDRAULIC TANK
13.	FRONT BRAKE PRESSURE GAUGE	25.	BRAKE SYSTEM REAR PILOT PRESSURE GAUGE
14.	REAR BRAKE PRESSURE GAUGE	26.	FLOW CONTROL
15.	FRONT BRAKE CALIPERS	27.	VENTURI

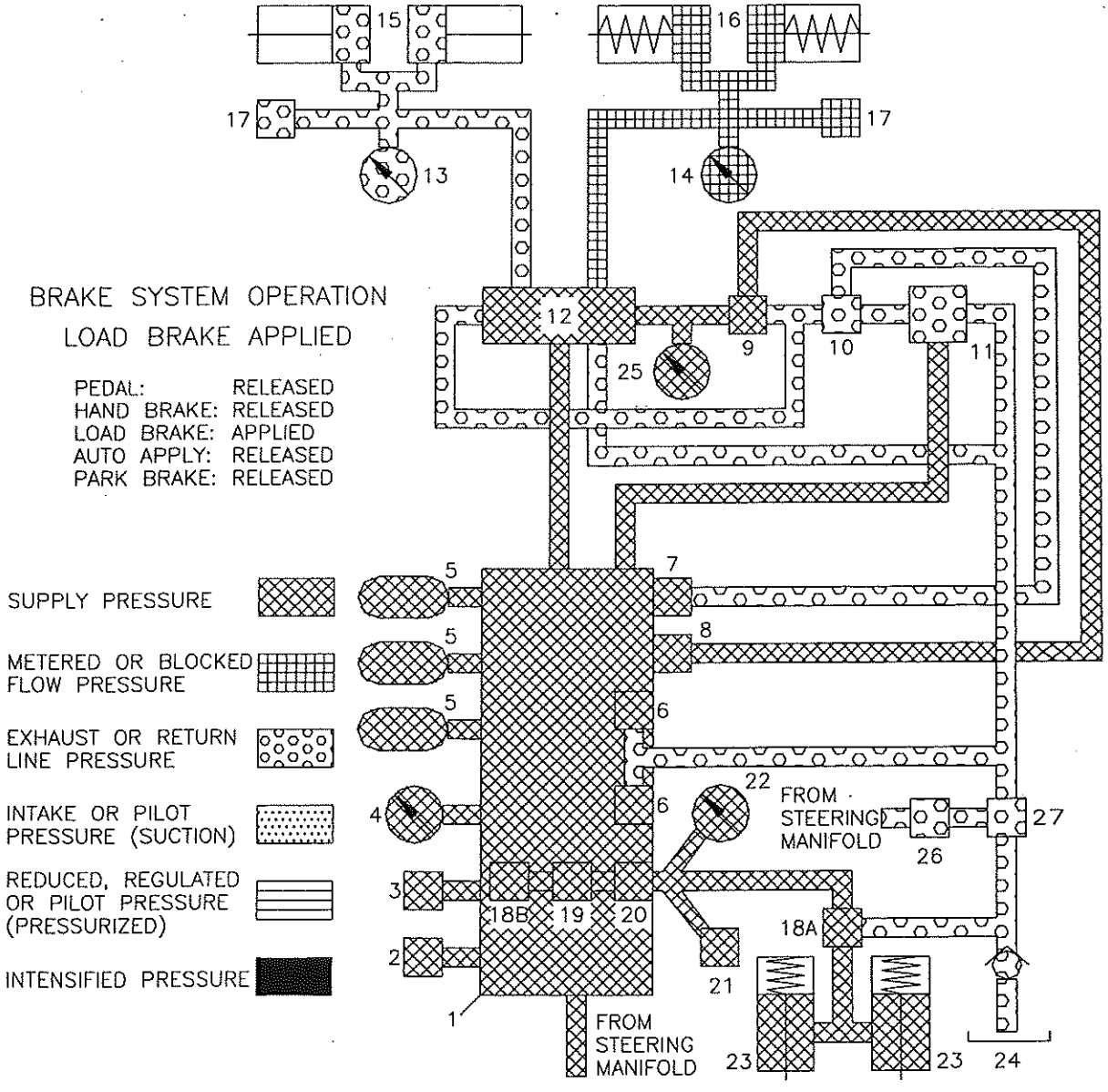


FIGURE 4 - BRAKE SYSTEM OPERATION - LOAD BRAKE APPLIED

KEY			13612E
01.	BRAKE MANIFOLD	16.	REAR BRAKE CALIPERS
02.	LOW BRAKE PRESSURE SWITCH	17.	BRAKE DRAG PRESSURE SWITCHES
03.	AUTO APPLY PRESSURE SWITCH	18.	PARK BRAKE PRESSURE REDUCING VALVE/REGULATOR (IF SO EQUIPPED)
04.	BRAKE SYSTEM PRESSURE GAUGE		
05.	BRAKE ACCUMULATORS	A.	EXTERNAL MOUNTED
06.	MANUAL ACCUMULATOR DRAIN VALVES	B.	INTEGRAL (MANIFOLD) MOUNTED
07.	AUTO APPLY SOLENOID VALVE	19.	PARK BRAKE SOLENOID VALVE
08.	LOAD BRAKE SOLENOID VALVE	20.	PARK BRAKE SHUT-OFF VALVE
09.	LOAD BRAKE SHUTTLE VALVE	21.	PARK BRAKE PRESSURE SWITCH
10.	AUTO APPLY SHUTTLE VALVE	22.	PARK BRAKE SYSTEM PRESSURE GAUGE
11.	BRAKE PILOT VALVE	23.	PARK BRAKE CALIPERS
12.	BRAKE CONTROLLER VALVE	24.	HYDRAULIC TANK
13.	FRONT BRAKE PRESSURE GAUGE	25.	BRAKE SYSTEM REAR PILOT PRESSURE GAUGE
14.	REAR BRAKE PRESSURE GAUGE	26.	FLOW CONTROL
15.	FRONT BRAKE CALIPERS	27.	VENTURI

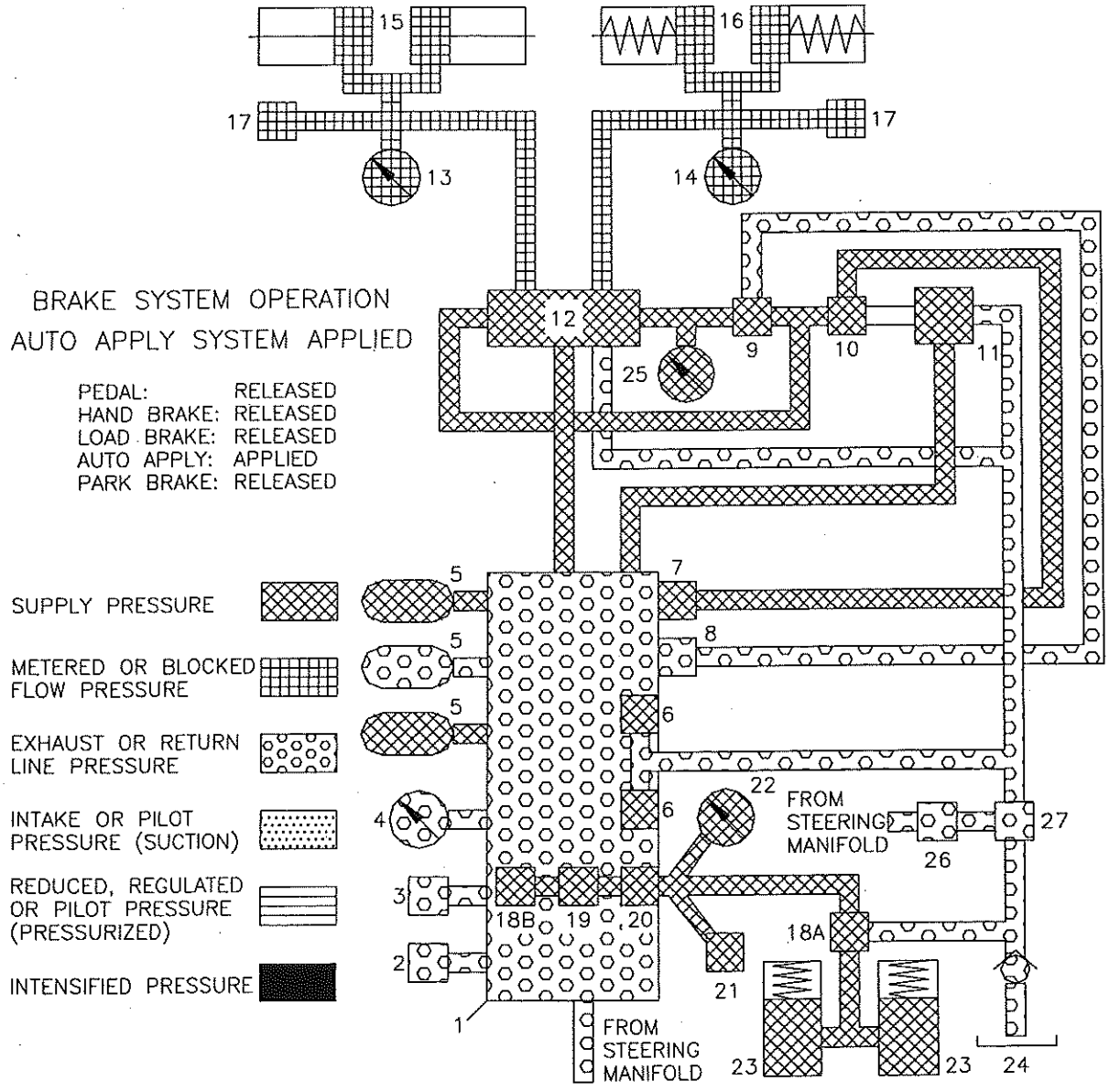


FIGURE 5 - BRAKE SYSTEM OPERATION - AUTO APPLY SYSTEM APPLIED

KEY			13612F
01.	BRAKE MANIFOLD	16.	REAR BRAKE CALIPERS
02.	LOW BRAKE PRESSURE SWITCH	17.	BRAKE DRAG PRESSURE SWITCHES
03.	AUTO APPLY PRESSURE SWITCH	18.	PARK BRAKE PRESSURE REDUCING VALVE/REGULATOR (IF SO EQUIPPED)
04.	BRAKE SYSTEM PRESSURE GAUGE	A.	EXTERNAL MOUNTED
05.	BRAKE ACCUMULATORS	B.	INTEGRAL (MANIFOLD) MOUNTED
06.	MANUAL ACCUMULATOR DRAIN VALVES	19.	PARK BRAKE SOLENOID VALVE
07.	AUTO APPLY SOLENOID VALVE	20.	PARK BRAKE SHUT-OFF VALVE
08.	LOAD BRAKE SOLENOID VALVE	21.	PARK BRAKE PRESSURE SWITCH
09.	LOAD BRAKE SHUTTLE VALVE	22.	PARK BRAKE SYSTEM PRESSURE GAUGE
10.	AUTO APPLY SHUTTLE VALVE	23.	PARK BRAKE CALIPERS
11.	BRAKE PILOT VALVE	24.	HYDRAULIC TANK
12.	BRAKE CONTROLLER VALVE	25.	BRAKE SYSTEM REAR PILOT PRESSURE GAUGE
13.	FRONT BRAKE PRESSURE GAUGE	26.	FLOW CONTROL
14.	REAR BRAKE PRESSURE GAUGE	27.	VENTURI
15.	FRONT BRAKE CALIPERS		

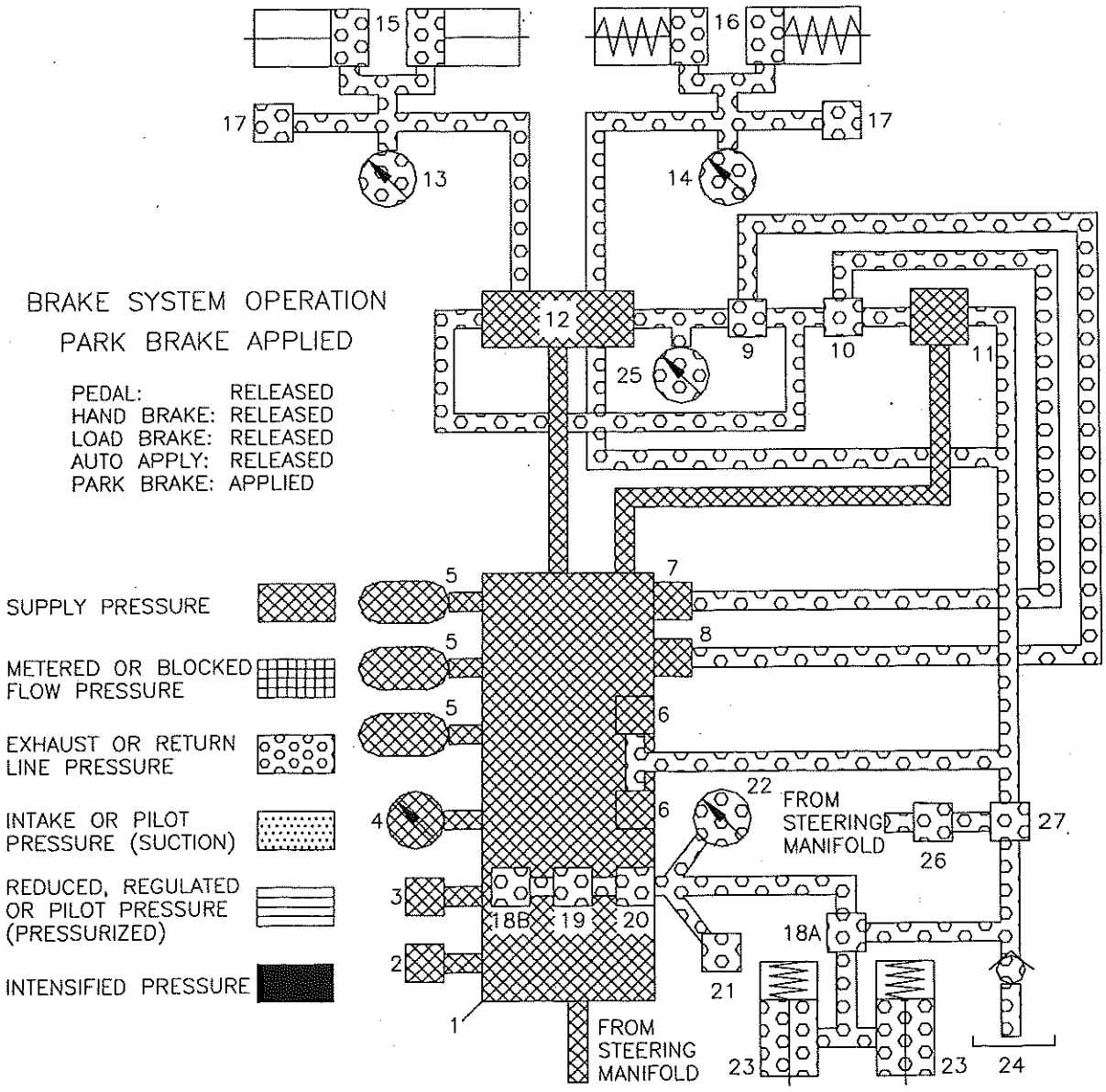


FIGURE 6 - BRAKE SYSTEM OPERATION - PARK BRAKES APPLIED

The park brake system is used to assist in securing the truck when parked for long periods of time with the engine shut off, or when the operator leaves the cab or the truck unattended. The basic park brake assembly is mechanically (spring) applied and hydraulically released.

NOTE: *The Load or Hand Brake controls must be fully applied to Apply or Release the park brakes.*

In normal operation, to release the park brakes (supply pressure to the calipers); the operator moves the Park Brake switch to the Release position and holds for a minimum of two (2) seconds. This electrically shifts the park brake release solenoid valve to the open position, allowing oil to flow through. The park brake shut-off valve is also energized at this time, allowing the flow to by-pass the internal check valve portion of the cartridge and to flow to the caliper assemblies.

NOTES:
1. On trucks equipped with an integral park brake pressure reducing valve in the brake system manifold, the pressure is reduced on all brake configurations.
2. On earlier version trucks equipped with Carlisle (Goodrich) park brake calipers, either full or reduced system pressure may be provided depending whether an external park brake pressure reducing valve was provided in the system.
3. On earlier version trucks equipped with Arvin/Meritor (Rockwell/Goodyear) park brake calipers, a separate external pressure reducing valve was provided with the system.

The pressurized hydraulic fluid from the brake system then goes to the:

1. Calipers - causing them to release.

2. Pressure switch - causing it to switch, which turns the dash mounted indicator light off and completing the AS circuit path through the switch.

When the calipers are released (and the indicator is off) the operator releases the Park Brake switch. This allows the spring loaded park brake shut-off valve to shift to the check position prohibiting further flow to the caliper assemblies.

To apply the park brake, the operator moves Park Brake switch to the Apply position and holds for a minimum of two (2) seconds. This electrically shifts the park brake solenoid valve to the apply position allowing the trapped oil in the system to exhaust to tank. This release of fluid causes:

1. The calipers to apply.

2. The pressure switch to shift which turns the indicator light off and interrupts the AS circuit.

NOTE: *When the park brakes are applied, releasing the Park Brake switch does not affect their status.*

In the event of fluid loss in the system during operation (e.g. hose damage, etc.):

1. The park brake release solenoid valve check feature prevents additional oil to the calipers, preventing undesirable leakage.

2. The system pressure switch interrupts propulsion and provides a warning indicator on the dash to light.

Operation in dynamic retarding will not be affected.

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following steps:

1. Inspect all hoses and lines for evidence of damage or leakage. All hoses should be secured properly and torqued as per the instructions in Section 10 - Miscellaneous. Repair or replace as required.

2. Inspect each assembly component for evidence of wear, damage, or leakage.

3. Test the operation of the system as outlined in the operation test.

4. Check the operation of the hand brake system. If found difficult to move, adjust as in the indicated procedures.

OPERATION TEST

IMPORTANT: *Prior to beginning this test, the steering system must be properly tested and adjusted.*

Prior to engine start-up:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the friction brake system. Verify that the front wheels are not chocked and all equipment and personnel are clear of the area in which the tires will move while turning.

2. Release all entrapped pressure in the system.

3. Verify that all hose fittings are torqued per the procedures in Section 10 - Miscellaneous.

4. Verify that the truck's hydraulic tank is filled to the proper level with approved filtered hydraulic oil.

5. Verify that the valve in the hydraulic pump suction line is open.

6. Verify the nitrogen gas precharge pressures in the accumulators are as follows:

a. Brakes (3 smaller) - 950 to 1050 psi (6 555 to 7 245 kPa)

Follow the procedures outlined in the instructions for each style accumulator as outlined in the instructions in Section 5 - Hydraulic System.

NOTE: *The accumulator must be fully drained of all hydraulic pressure prior to checking gas pressure. This may be done by pulling the manual drain valves located on the brake manifold in the hydraulic components box on the superstructure.*

7. Verify that the gauges, mounted in the hydraulic components box on the superstructure are all operational.

8. Pressurize the hydraulic tank to 10 +/- 1 psi (70 +/- 7 kPa).

9. Verify that if the pump has not been previously run, the steering pump case drain has been filled.

10. Using the appropriate means for the electrical propulsion system installed, disable the truck's propulsion system to prevent its operation when the Shifter is moved to the forward or reverse position.

TEST AND ADJUSTMENTS

The operation of the hydraulic brake system may be tested as follows:

Accumulator Supply System

1. Reconnect and torque all hoses previously removed as outlined in the procedures in Section 10 - Miscellaneous.

2. Check the pressure in the brake accumulator supply system as follows:

a. Turn the Master Switch on.

b. Start the engine and allow to run at low idle speed.

c. Verify that at approximately 2100 psi (14 480 kPa) the Low Brake Pressure indicator goes out.

NOTE: *This is an approximation test at this point. More detailed final testing will be done later.*

d. Verify that the Supply Accumulator Pressure increases slowly to 3450 to 3550 psi (23 790 to 24 480 kPa), then stabilizes.

e. With the engine still at low idle speed, fully depress and release the Brake pedal repeatedly.

f. Verify that the supply pressure remains at 3450 to 3550 psi (23 790 to 24 480 kPa).

g. Record the pressure reading.

Bleeding the Service Brake System

Air may be removed from the service brake system as follows:

NOTE: *Prior to beginning the bleeding procedure, consult the appropriate assembly drawings for the correct bleeder port that should be used in this installation, usually the highest points. Also it is recommended that a hose be used to direct oil away from the discs and linings into a catch can.*

1. With the engine still at low idle speed, fully depress the Brake pedal and hold.

2. Verify that the system pressures do not exceed 2500 psi (17 240 kPa) on the front and 1500 psi (10 340 kPa) on the rear brake system gauges. If the pressures do exceed these limits, immediately release the Brake Pedal. Reapply partially and repeat this procedure.

3. Slowly and carefully open each bleeder valve and allow the oil to flow until it is free of air bubbles. Close each valve tightly when complete. Repeat for each service brake caliper assembly both front and rear.

IMPORTANT: *Remember when opening each bleeder valve that considerable pressure may be built up behind it and as a result oil may squirt out rapidly. It is best to open each valve with a slow, steady motion.*

4. Release the Brake pedal when the process is complete.

Bleeding the Park Brake System

Air may be removed from the park brake system as follows:

NOTE: *The instructions for the use of the hose catch can and the opening of the bleeder valves outlined for the service brake calipers also apply for the park brake calipers.*

1. Move the Park Brake switch to the "Released" position and hold.

2. Bleed each park brake assembly in a manner similar to that used on the service brake calipers.

3. Release the Park Brake switch.

4. Move the Load Brake switch to the Release position.

Brake Pedal Control System Adjustment

The service brake pedal may be tested and adjusted as follows:

1. Fully depress the Brake pedal and hold. Verify that the:

a. Foot brake pilot pressure (measured on the Load Brake gauge) is:

675 to 725 psi (4 655 to 5 000 kPa).

b. Front brake pressure is:

2300 to 2500 psi (15 860 to 17 240 kPa).

c. Rear brake caliper pressure is:

1350 to 1450 psi (9 310 to 10 000 kPa)

d. Stop or brake lights are lit.
Rear of truck
On top of the cab (if option installed)

2. Release the Brake pedal. Verify that the:

a. Pilot, front, and rear brake pressures return to 0 psi (kPa).

b. Stop or brake lights are off.

3. If the pressures found are not within the desired range, but are both too high or too low, it will be necessary to adjust the pilot pressure signal to the front and rear brake valve spools. This may be done as follows:

a. Release the Brake pedal.

b. Stop the truck engine.

c. Drain all pressure from the brake accumulators, using the manual accumulator drain valves.

d. Remove the Brake pedal and actuator assembly by loosening the locking nuts and washers securing the U-bolts to the assembly and removing the pivot pin.

e. Loosen the setscrew securing the adjusting collar to the threads on the plunger.

f. Move the adjusting collar counter-clockwise (or toward the ends of the threads) to raise the pressure or clockwise (or to the non-threaded portion of the plunger) to lower the pressure.

NOTE: *Fine adjustments may require turning the valve in increments of as little as 1/8th turn.*

g. Retest the pressure as before. Installing the pivot pin and using a flat screwdriver or equivalent as a lever will allow you to depress the actuator without reinstalling the pedal/cam assembly.

h. Secure the collar by re-tightening the setscrew to 25 to 30 inch-lb. (2.8 to 3.4 Nm).

i. Reinstall the pedal/cam assembly to the spool section.

j. Repeat the above steps until the adjustment is complete.

k. Apply and release the brakes a number of times. Verify that the pressure settings do not change. If they do, repeat the above process as required.

NOTE: *When the assembly is new or has been serviced, it is not uncommon for the pressures to decrease slightly due to the "seating" effect of the components.*

4. Release the Brake pedal. Verify that the:

a. Front and rear brake pressures return to 0 psi (kPa).

b. Stop or brake lights are all off.

5. If the pressure of either the front or rear system is too high or too low, but the other system and the pilot pressures are within tolerances, the appropriate individual spool on the brake control valve should be adjusted in an manner similar to that used to adjust the brake pilot valve.

6. If pressure remains in the system with the pedal released, adjust the pedal return stop behind the pedal assembly and retest.

7. Record the final pressure found - applied and released.

Brake System Pressure Release System

The front brake release system pressure vacuum may be tested as follows:

1. Stop the engine.

2. Release all pressure in the hydraulic tank.

3. Connect a 0 to 10 psi (0 to 70 kPa) pressure gauge (or equivalent) on the special quick disconnect fitting on the return to the hydraulic tank assembly.

4. Pressurize the hydraulic tank to 10 +/- 1 psi (70 +/- 7 kPa).

5. Start the engine. When acceptable, accelerate the engine to 1900 rpm and hold.

6. Verify that the pressure on the gauge is 1 +/- 0.5 psi (7 +/- 3 kPa). If not adjust the flow controls to obtain this final setting.

NOTE: *This is with the oil at normal operating temperatures. At other oil temperatures, this pressure will vary.*

7. Slow the engine to low idle speed and stop.

8. Release all pressure in the hydraulic tank.

9. Remove the low pressure gauge.

10. Pressurize the hydraulic tank to 10 +/- 1 psi (70 +/- 7 kPa).

Brake Drag System Test

The optional Brake Drag Monitoring System may be tested as follows:

NOTE: *This test is for the system that incorporates a 6 second delay before the indicators light in response to an indicated brake drag condition.*

1. Verify that the brake accumulators are at or near full charge.

2. Verify that the Brake pedal, Hand, and Load brake systems are all released.

3. Remove the wire from the appropriate ground to disable the Brake Drag Relay.

4. Apply the Hand Brake only.

5. Press the Press-to-Test or lamp Check switch on the overhead panel and hold.

6. Verify that both the front and rear Brake Drag Indicators light after an approximate 6 second delay.

7. Release the Press-to-Test or Lamp Check switch.

8. Verify that the Brake Drag indicators are no longer lit.

Hand Brake System Adjustment

The operation of the Hand Brake System may be tested as follows:

1. Fully apply the Hand Brake and hold. Verify that the:

a. Front and rear brake system pressures are as follows:

Front: 2300 to 2500 psi (15 860 to 17 240 kPa)
Rear: 1350 to 1450 psi (9 310 to 10 000 kPa)

b. Hand Brake indicator is lit.

2. Release the Hand Brake. Verify that the:

a. Front and rear brake pressures return to 0 psi (kPa).

b. Hand Brake indicator is off.

3. If the pressures found are not within the normal operating ranges:

a. Release the Hand Brake.

b. If both the front and rear systems must be increased or decreased, adjust single adjustment screw on the bracket on the controller valve as required.

c. If only the front or rear system requires adjustment, the individual spools should be adjusted as outlined in the instructions for the brake pedal controlled system earlier in this procedure.

NOTE: *This may affect normal previously adjusted brake pedal system operating pressures and should not be done unless absolutely necessary.*

d. Reapply the Hand Brake and retest.

e. If adjustments are made, retest the pedal controlled system.

f. Secure the adjustment screw with jam nut when the adjustment is completed.

g. Record the final pressures.

4. Verify that the hand brake switch is adjusted to cause the indicator on the control to light as the handle nears the detented "fully applied" position (last 1/3 of the travel) and is off the remainder of lever travel.

Load Brake System Testing

The operation of the load brake system may be tested as follows:

1. Verify that the Brake pedal and Hand Brake system are released.

2. Move the Load Brake switch to the Apply position.

3. Verify that the:

a. Front brake pressure remains a 0 psi (kPa).

b. Rear brake pressure increase to 1350 to 1450 psi 9 310 to 10 000 kPa).

c. Load Brake indicator lights.

4. Move the Load Brake switch to the Release position.

5. Verify that the:

a. Front and rear brake pressures return to 0 psi (kPa).

b. Load Brake indicator turns off.

Park Brake System Testing

The operation of the park brake system may be tested as follows:

1. Verify that the park brake calipers are all in their released position and that the pressure to the system calipers is:

2850 to 2950 psi (19 650 to 20 350 kPa).

NOTES:

1. This pressure is for all caliper configurations that either:

a. Employ an integral park brake reducing valve in the brake system manifold, or;

b. Incorporate Arvin/Meritor (Rockwell/Goodyear) park brake calipers, or;

c. Incorporate Carlisle (Goodrich) park brake calipers and were equipped with a separate, external park brake pressure reducing valve.

2. On trucks with the Carlisle (Goodrich) park brake calipers not including the separate, external park brake caliper the pressure range is 3450 to 3550 psi (23 790 to 24 480 kPa).

2. If the park brake system pressure is not in this operating range, and the truck is equipped with an integral pressure reducing valve in the manifold, it may be adjusted as follows:

a. Fully apply the Hand or Load brake, and then apply the park brakes.

b. Verify that the park brake system operating pressure is 0 psi (kPa).

c. Loosen the locking nut securing the adjusting screw on the pressure reducing valve.

d. Turn the adjusting screw inward (to raise the pressure) or outward (to lower the pressure) as required to obtain the desired pressure.

NOTE: *The pressure will increase or decrease approximately 280 psi (5 400 kPa) for each full revolution of the adjusting screw.*

e. Release the park brake calipers and retest as outlined in step 1.

f. Adjust as outlined in step 2 and retest until the proper system pressure is obtained.

g. Once testing and adjustment is complete, secure the valve's adjusting screw with the locknut.

3. With the Hand Brake, Load Brake, and Brake pedal released, move the Park Brake switch to the Apply position, hold for a minimum of two seconds, and then release. Verify that the:

a. Park brake calipers remain released.

b. Park brake system pressure remains as outlined in step 1.

c. Park Brake indicator on the control is not lit.

4. Fully apply the Load Brake.

5. Move the Park Brake switch to the Apply position,

hold for a minimum of two seconds, and then release. Verify that the:

a. Park brake calipers apply.

b. Park brake system pressure is 0 psi (kPa).

c. The Park Brake indicator on the control lights.

6. Release the Load Brake.

7. Move the Park Brake switch to the Release position, hold for a minimum of two seconds, and then release. Verify that the:

a. Park brake calipers remain applied.

b. Park brake system pressure remains 0 psi (kPa).

c. Park Brake indicator on the control remains lit.

8. Apply the Load Brake.

9. Move the Park Brake switch to the Release position, hold for a minimum of two seconds, and then release. Verify that the:

a. Park brake calipers are released.

b. Park brake system pressure is again at the pressure outlined in step 1.

c. Park Brake indicator on the control is not lit.

10. Stop the truck engine.

11. Using the same equipment used to bleed the brake calipers, slowly open one of the park brake caliper bleeders. Verify that the:

a. Oil flows briefly then stops, verifying the operation of the Park Brake release solenoid valve.

b. Park Brake indicator comes on when the park brake system pressure decreases to less than 1450 to 1550 psi (10 000 to 10 690 kPa).

12. Close the caliper bleed screw.

13. Record the switch actuation pressure.

14. Start the engine and allow to operate at low idle speed. Bleed any entrapped air from the caliper tested.

15. Release the park brakes.

16. Stop the engine.

Low Brake Pressure Switch Test

The operation of the low brake pressure monitoring system may be tested as follows:

1. Repeatedly apply and release the Brake pedal to decrease the hydraulic pressure in the accumulators.

2. Verify that the Low Brake Pressure indicator lights when the pressure decreases to 2050 to 2150 psi (14 135 to 14 825 kPa) on the gauge monitoring the supply accumulator pressure. Record this pressure.

NOTE: *The brakes must be applied slowly as the accumulator pressure approaches the set point in order to adequately verify the pressure switch setting.*

Optional Auto Apply System Test

The operation of the optional auto-apply system may be tested as follows:

1. Continue to apply and release the Brake pedal while monitoring the Brake Supply Accumulator Pressure and the front and rear brake system delivery pressures.

2. Verify that at 1350 to 1450 psi (9 310 to 10 000 kPa) pressure in the supply accumulator, the auto apply feature activates. This may be documented by the fact that the pressure on the brake systems do not return to "0" psi (kPa) when the pedal is released.

3. Record the actuation pressure.

4. Discontinue the pedal apply and release cycling.

Testing Brake Accumulator Drain Systems

Test the operation of the manual drain valves as follows:

1. Verify that there is pressure in the supply accumulator. If not start the engine and allow the system accumulators to recharge.

2. Open the rear brake accumulator drain valve. This may be done by opening the needle valve assembly or by pulling out the button and holding as applicable to the system.

3. Verify that the pressure in the supply accumulator decreases to 0 psi (kPa).

4. Close the drain valve as required.

5. Restart the engine and allow the accumulator system to recharge.

6. Repeat steps 2 through 5 with the front brake accumulator drain valve.

On truck's so equipped, test the brake accumulator automatic pressure drain valve as follows:

1. Automatic function.

a. Verify that there is pressure in the supply accumulator. If not start the engine and allow the system accumulators to recharge.

b. Turn the Master Switch Off.

c. Verify that the brake system supply accumulator pressure gauge (in the hydraulic component box) pressure readings decrease rapidly as the accumulator drains to the tank through the solenoid valve in the brake manifold.

d. Verify that the brake system supply accumulator pressure decreases to approximately 0 psi (kPa).

e. Verify that the power to the drain valve coil switches off automatically (voltmeter returns to 0 volts) after approximately 150 seconds.

f. Remove the voltmeter.

2. Manual operation

a. Turn the Master Switch on.

b. Start the engine.

c. Allow the pressure in the accumulator to rise until it exceeds 1500 psi (10 340 kPa), then stop the engine.

d. Rotate the manual override button on the automatic drain solenoid valve in the brake system 180° and allow the button to come out.

e. Verify that the pressure in the brake system supply accumulator decreases to 0 psi (kPa).

f. Reset the manual override by rotating the button 180° and pushing the button into its detented position.

Propulsion System Interlock Testing

Verify the operation of the propulsion interlocks as follows:

NOTE: *To properly test the system the:*
1. Truck's 24 volt and propulsion electrical systems must be installed and operational.
2. Engine should be off to prevent accidental movement and to ease in determining operation.
3. Brakes should all be released.

IMPORTANT: *It may be necessary to discontinue testing and restart the engine during this test to maintain adequate pressure to operate the brakes.*

1. Move the Shifter to the Forward position.

2. Depress the Throttle pedal. Verify that the contactors pick up and sequence.

3. Release the Throttle pedal. Verify that the contactors drop out.

4. Fully apply the Hand Brake lever and hold.

5. Depress the Throttle pedal. Verify that the contactors do not pick up.

6. Release the Throttle pedal.

7. Apply the Park Brakes.

8. Depress the Throttle pedal. Verify that the contactors do not pick up.

9. Release the Throttle pedal.

10. Release the Hand Brake lever. (Park brake remains applied.)

11. Depress the Throttle pedal. Verify that the contactors do not pick up.

12. Release the Throttle pedal.

13. Apply the Hand Brake.

14. Release the Park Brake and then release the Hand Brake.

15. Depress the Throttle pedal. Verify that the contactors pick up and sequence.

16. Release the Throttle pedal. Verify that the contactors drop out.

17. Apply the Load Brake system.

18. Depress the Throttle pedal. Verify that the contactors do not pick up.

19. Release the Throttle pedal.

20. Release the Load brake system.

21. Depress the Throttle pedal. Verify that the contactors pick up and sequence.

22. Release the Throttle pedal. Verify that the contactors drop out.

23. Install the covers removed on the hydraulic components box.

24. Install the wheelmotor covers.

SERVICE

For detailed service information, refer to the individual component modules in Section 5 - Hydraulic System.

KEY					A85184
001.	Brake Pilot Valve	048.	Cushion Clamp	104.	Tube Assembly
002.	Brake Controller Valve	049.	through item 051. - Not Used	105.	Tube Assembly
003.	Adapter Fitting	052.	Clamp Support Assembly	106.	Tube Assembly
004.	Control Lever	053.	Not Used	107.	Not Used
005.	Capscrew	054.	Capscrew	108.	Hose Assembly
006.	Lockwasher	055.	through item 057. - Not Used	109.	Tube Assembly
007.	Locknut	058.	Adapter Fitting	110.	Tube Assembly
008.	Adapter Fitting	059.	through item 061. - Not Used	111.	through item 114. - Not Used
009.	Lockwasher	062.	Adapter Fitting	115.	Hose Assembly
010.	Input Lever	063.	through item 067. - Not Used	116.	Not Used
011.	Capscrew (Grade 8)	068.	Adapter Fitting	117.	Hose Assembly
012.	Adapter Fitting	069.	Not Used	118.	Hose Assembly
013.	Locknut	070.	Capscrew	119.	Tube Assembly
014.	Cotter Pin	071.	Cushion Clamp	120.	Tube Assembly
015.	Flatwasher	072.	through item 074. - Not Used	121.	Tube Assembly
016.	Machine Screw	075.	Control Cable Clevis	122.	Not Used
017.	Not Used	076.	Load Brake Push-button Switch	123.	Not Used
018.	Toothed Lockwasher	077.	Switch Plate	124.	Tube Assembly
019.	Nut	078.	Shuttle Valve	125.	Hose Assembly
020.	Grip	079.	Capscrew	126.	Not Used
021.	Adapter Fitting	080.	Adapter Fitting	127.	Tube Assembly
022.	Conduit Locknut	081.	Adapter Fitting	128.	Tube Assembly
023.	Not Used	082.	Not Used	129.	Not Used
024.	Not Used	083.	Not Used	130.	Hose Assembly
025.	Brake Manifold Assembly	084.	Flatwasher	131.	Hose Assembly
026.	Low Brake Pressure Switch	085.	Mounting Kit	132.	Hose Assembly
027.	Not Used	086.	Adapter Fitting	133.	Hose Assembly
028.	Adapter Fitting	087.	Not Used	134.	Hose Assembly
029.	Adapter Fitting	088.	Not Used	135.	Hose Assembly
030.	Not Used	089.	Hydraulic Components Box	136.	Hose Assembly
031.	Brake Accumulator	090.	Accumulator Bracket	137.	Hose Assembly
032.	Flatwasher	091.	Rod	138.	Hose Assembly
033.	Capscrew	092.	Locknut	139.	Not Used
034.	Flatwasher	093.	Not Used	140.	Nameplate
035.	Park Brake Pressure Switch	094.	Pressure Gauge	141.	through item 144. - Not Used
036.	through item 040. - Not Used	095.	Adapter Fitting	145.	Adapter Fitting
041.	Adapter Fitting	096.	Brake Control Cable Assembly	146.	Adapter Fitting
042.	Not Used	097.	through item 100. - Not Used	147.	Adapter Fitting
043.	Clamp Support Assembly	101.	Hose Assembly	148.	Adapter Fitting
044.	through item 046. - Not Used	102.	Hose Assembly	149.	Adapter Fitting
047.	Capscrew	103.	Hose Assembly	150.	Hose Assembly

151.	Hose Assembly	163.	Plug	175.	Adapter Fitting
152.	Hose Assembly	164.	Adapter Fitting	176.	Not Used
153.	Hose Assembly	165.	Adapter Fitting	177.	Adapter Fitting (If required)
154.	Hose Assembly	166.	Clamp Support Assembly	178.	Pressure Reducing Valve (If required)
155.	Hose Assembly	167.	Adapter Fitting	179.	Hose Assembly (If required)
156.	Adapter Fitting	168.	Tube Assembly	180.	Adapter Fitting (If required)
157.	Plug	169.	Venturi Fitting	181.	Not Used
158.	Venturi Fitting	170.	Quick Coupling	182.	Not Used
159.	Test Coupling	171.	Not Used	183.	Adapter Fitting
160.	O-ring	172.	Adapter Fitting	184.	Hose Assembly
161.	O-ring	173.	Adapter Fitting	185.	Adapter Fitting (If required)
162.	Adapter Fitting	174.	Adapter Fitting		

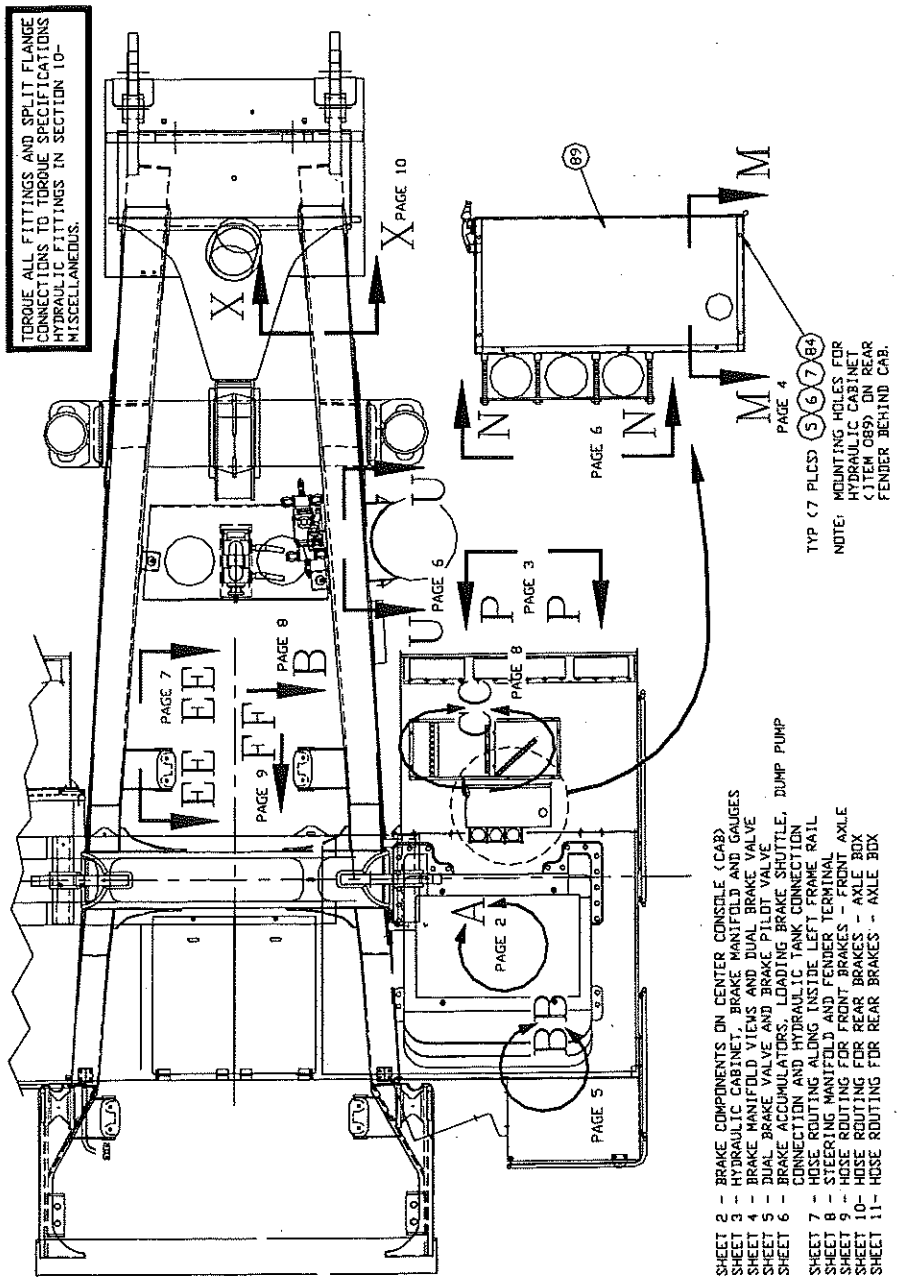


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 1 OF 11)

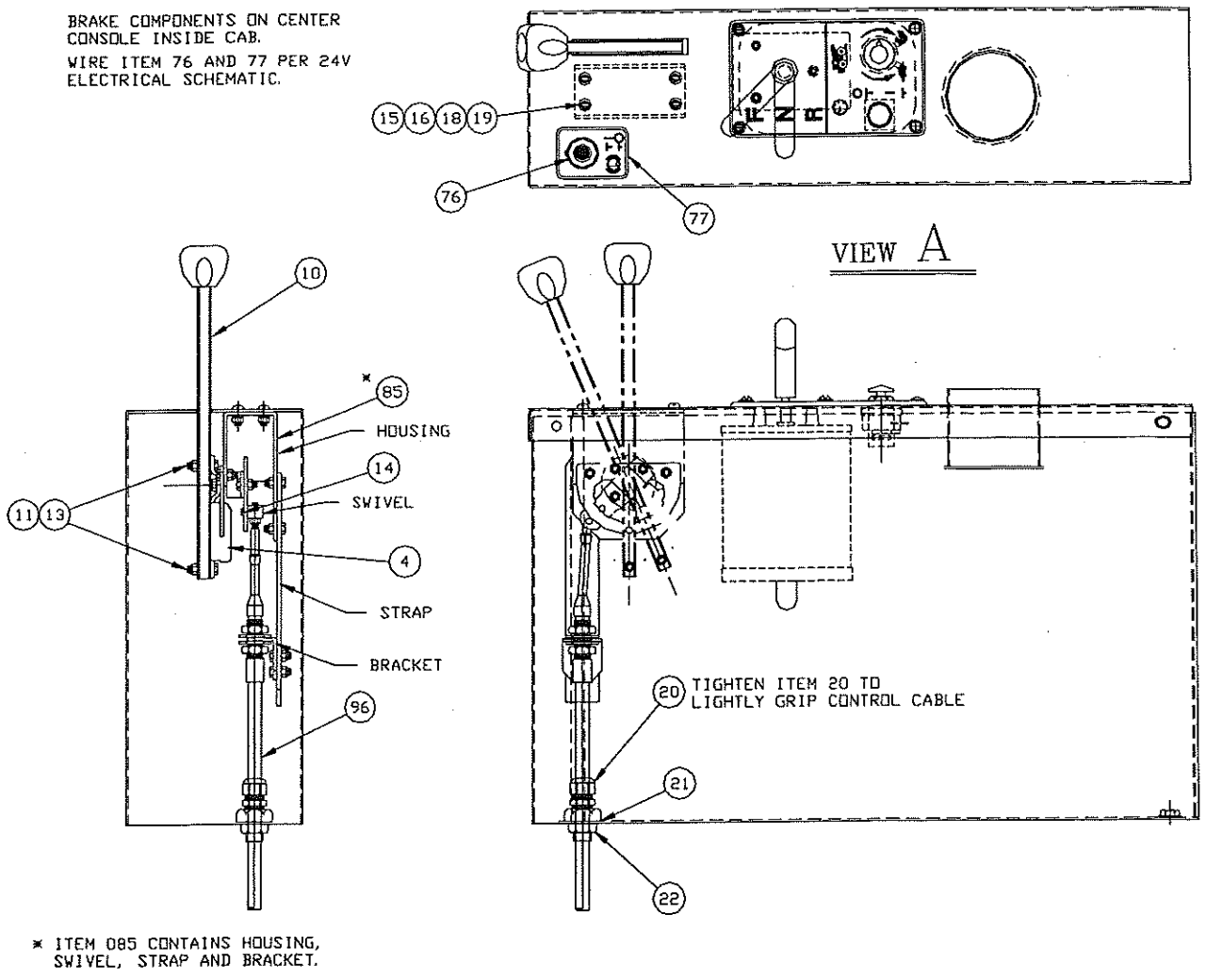


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 2 OF 11)

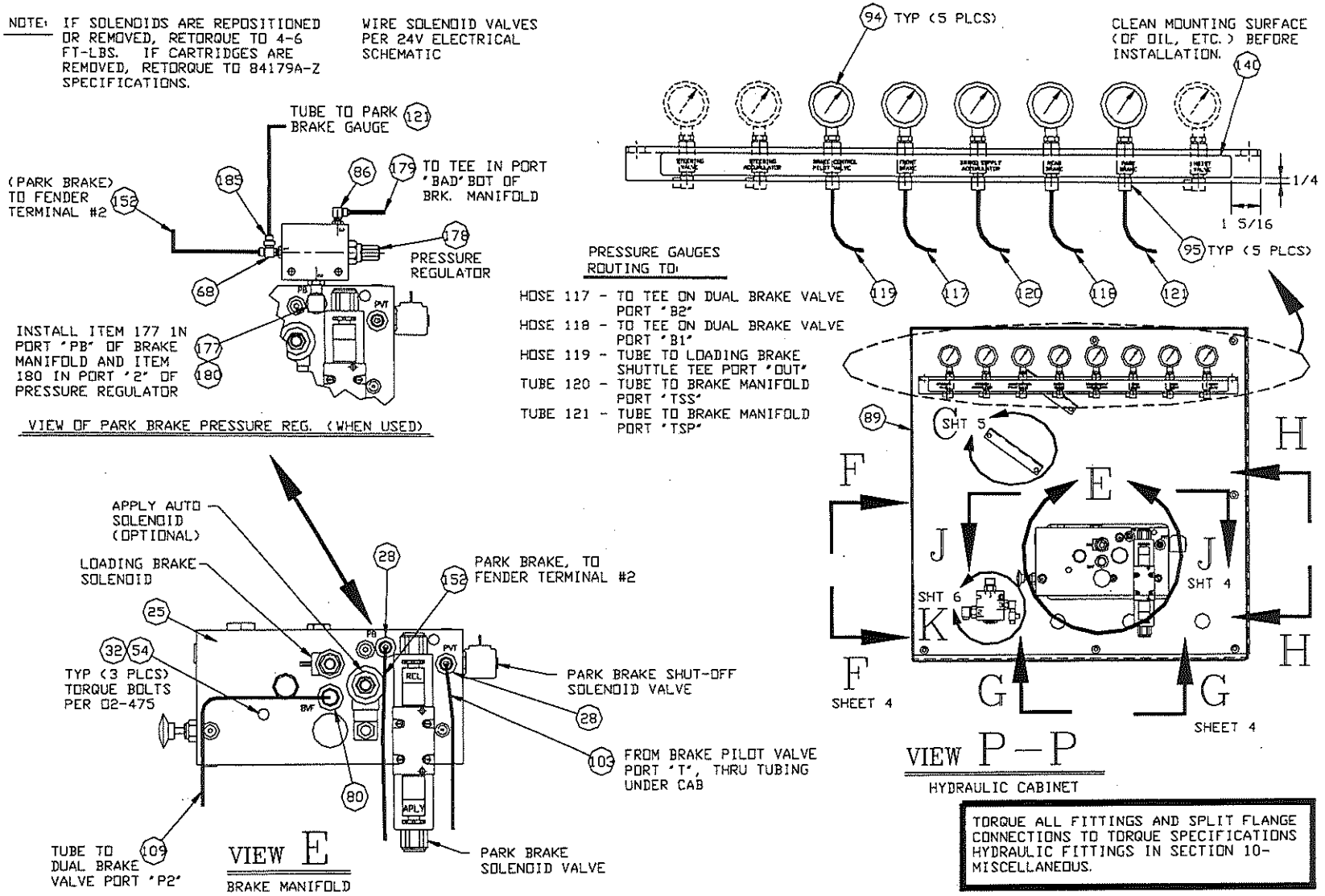


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 3 OF 11)

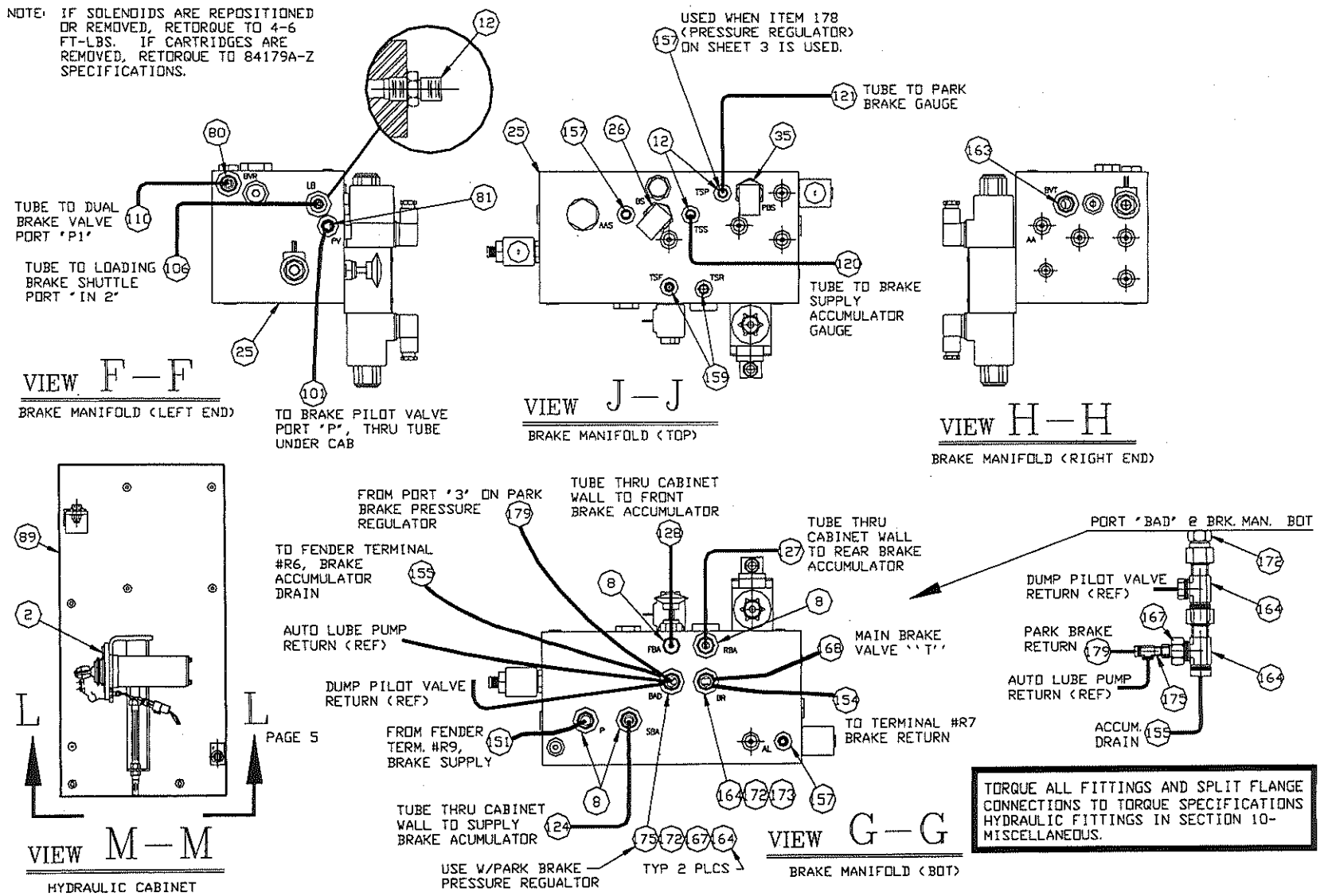


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 4 OF 11)

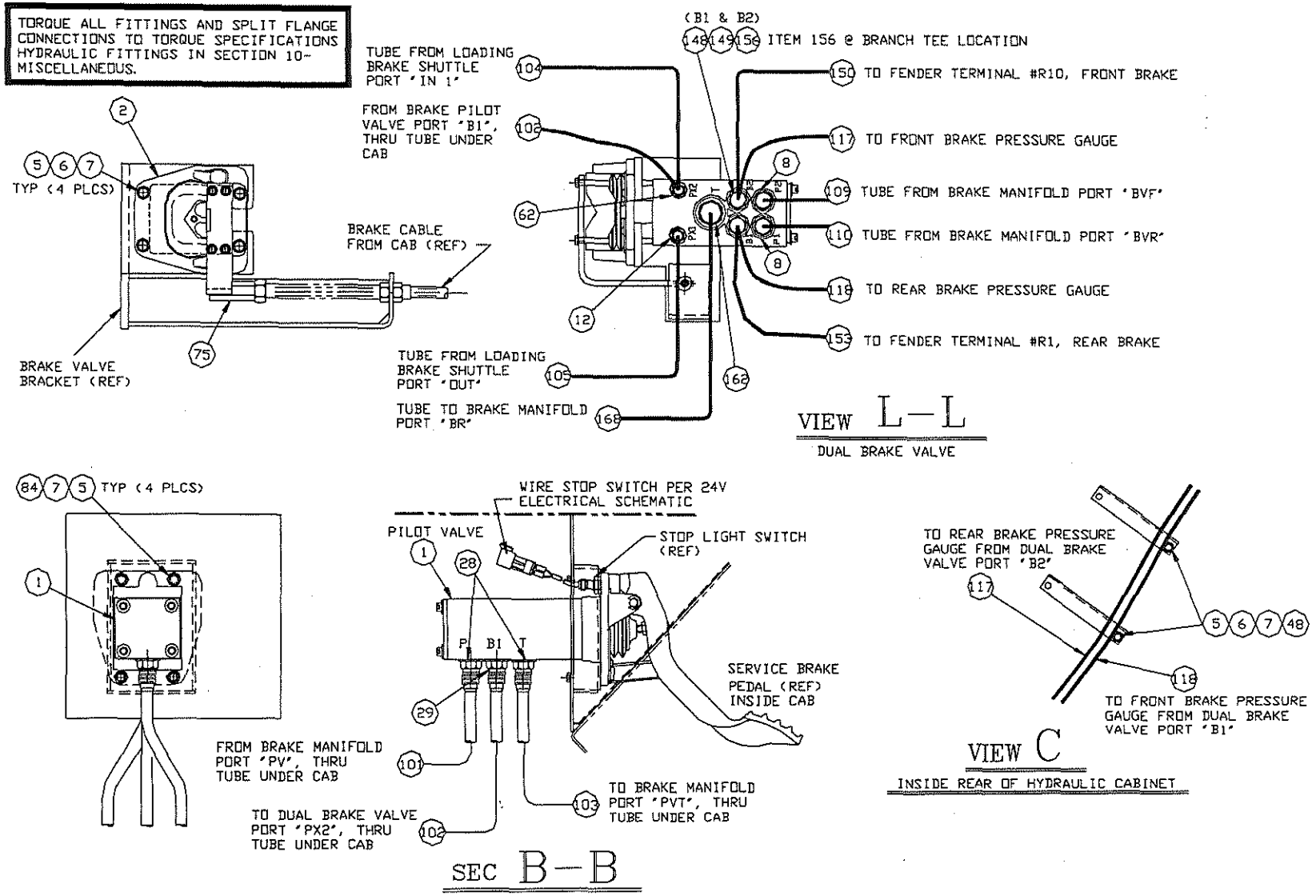
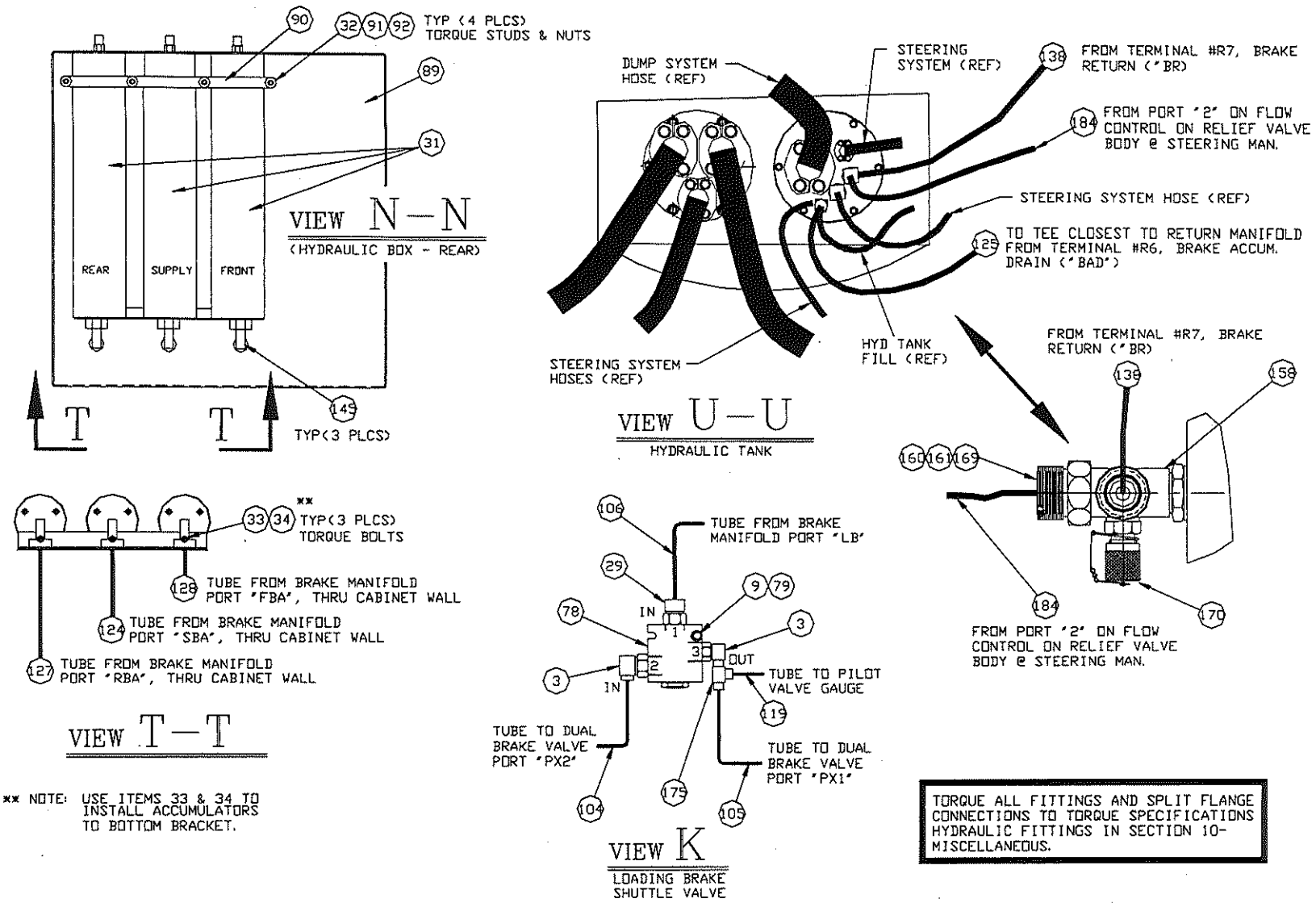


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 5 OF 11)

FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 6 OF 11)



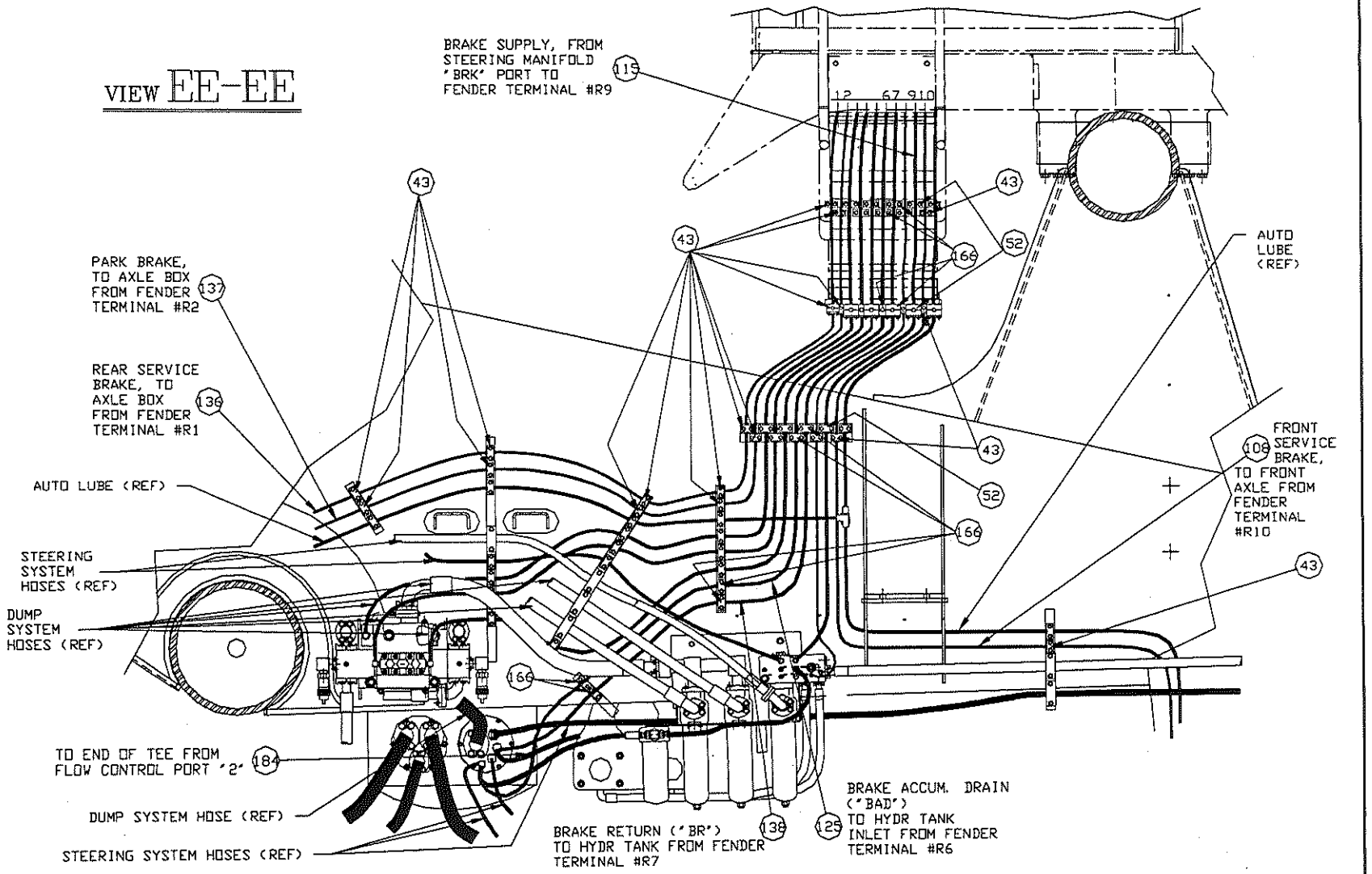


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 7 OF 11)

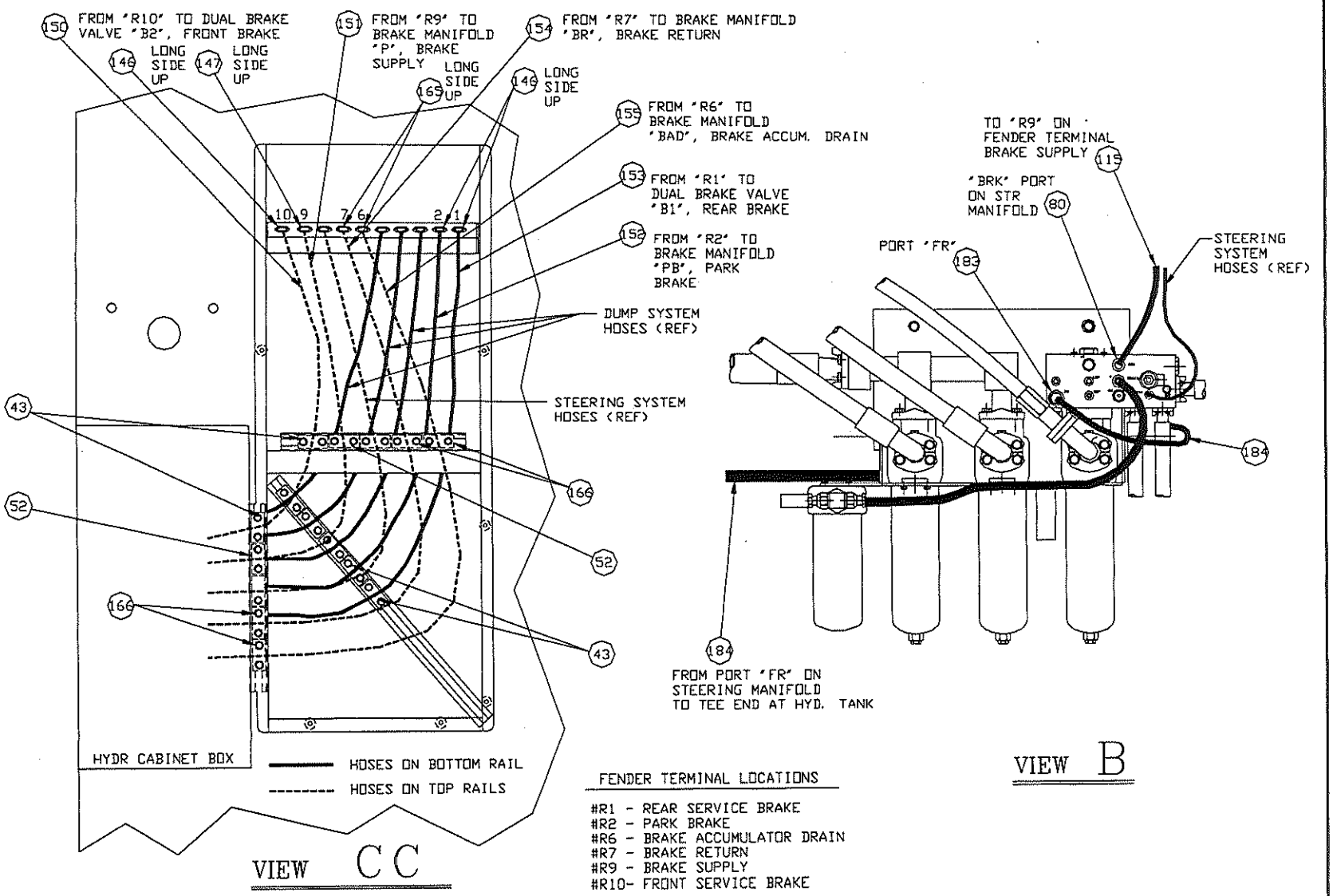


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 8 OF 11)

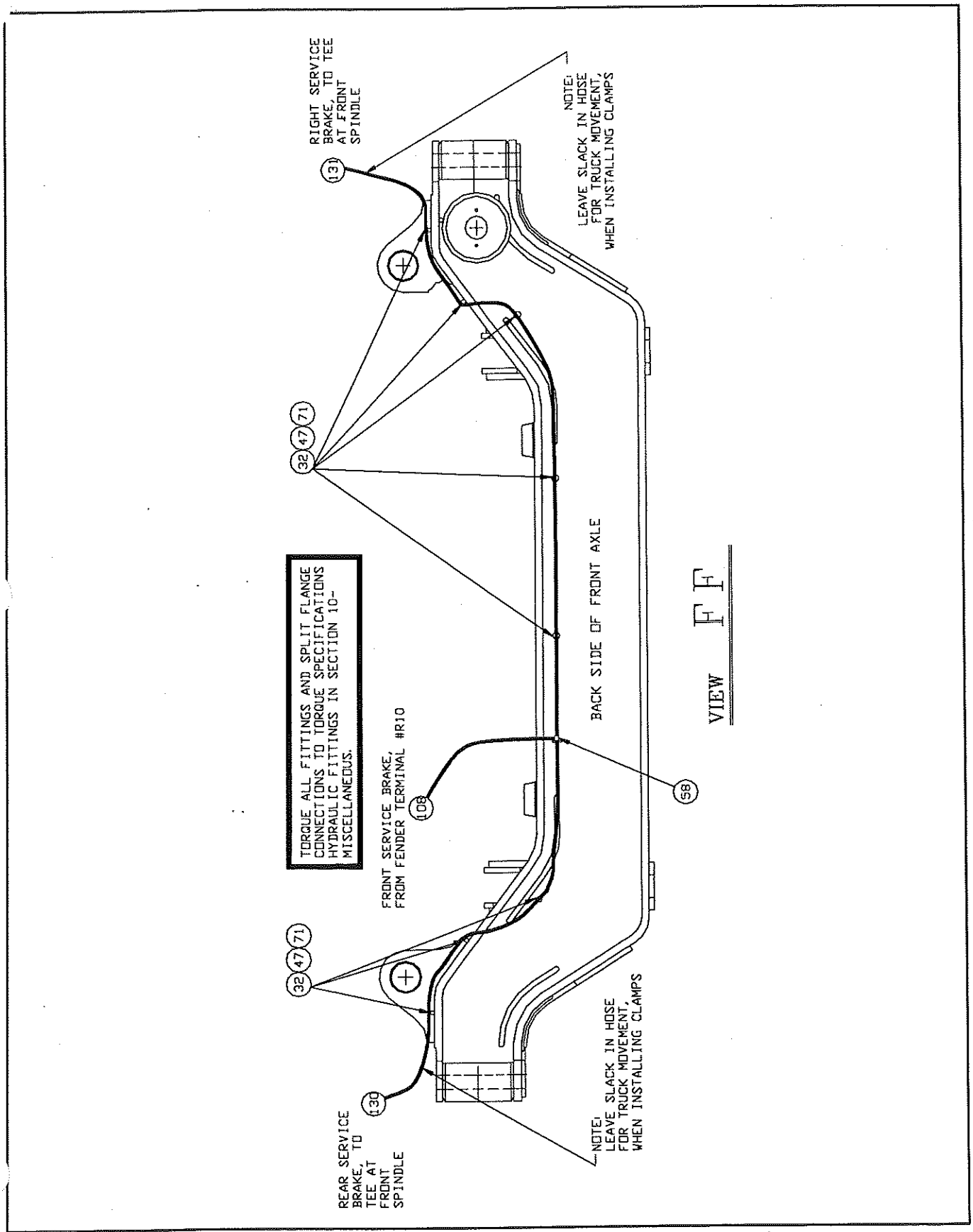


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 9 OF 11)

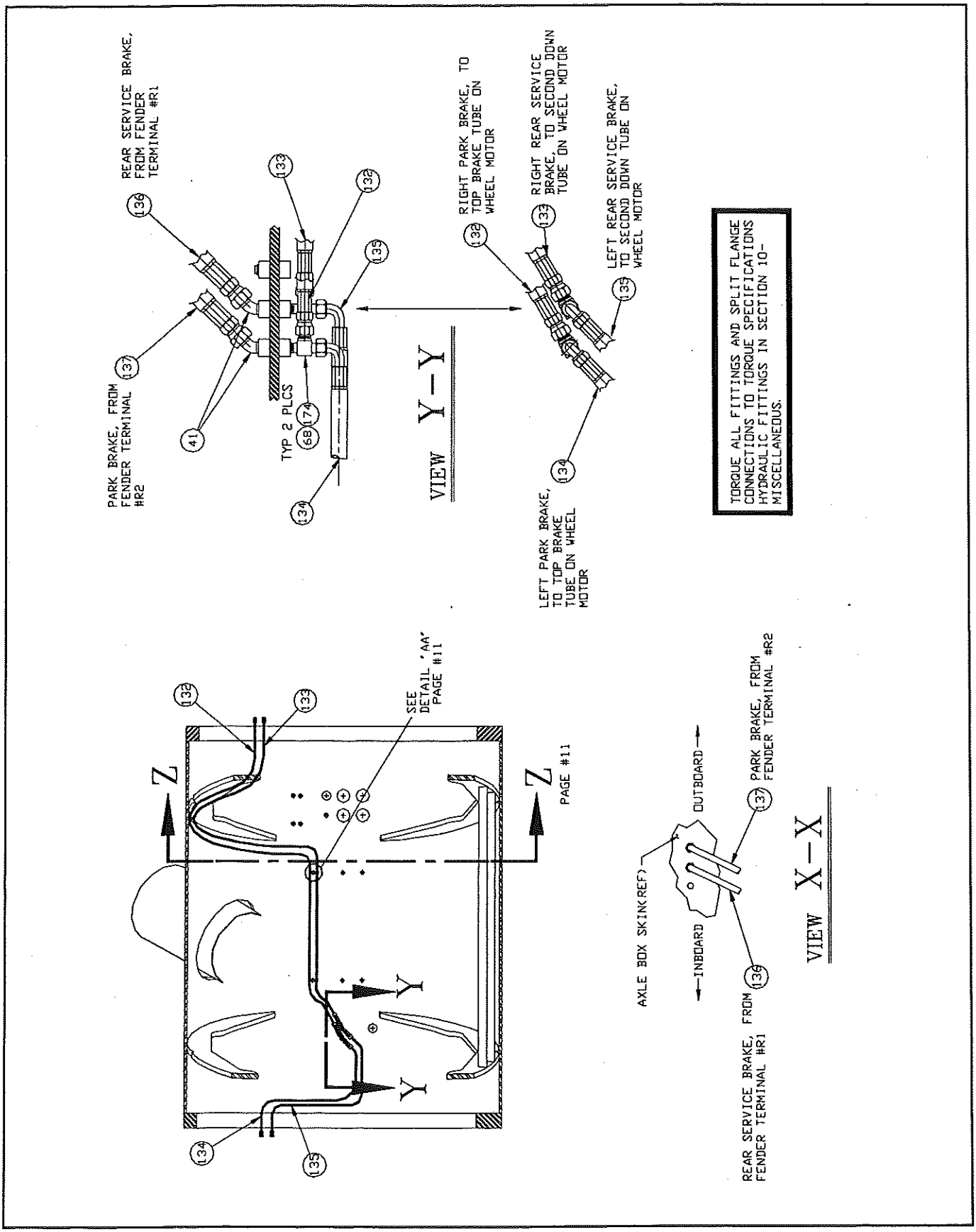


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 10 OF 11)

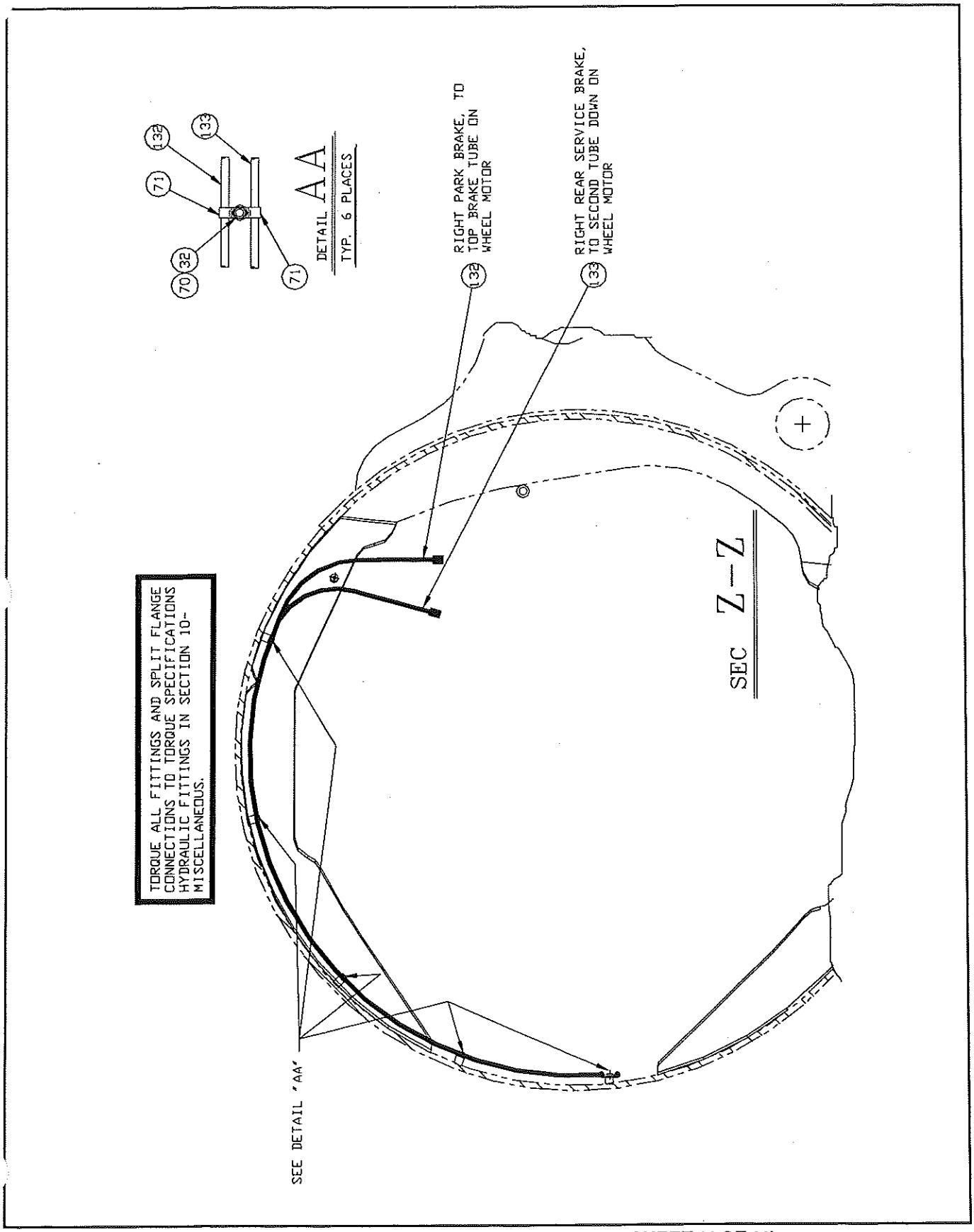


FIGURE 7 - BRAKE SYSTEM ASSEMBLY (A85184, SHEET 11 OF 11)

SHUTTLE VALVE

DESCRIPTION AND LOCATION (Figure 1)

The shuttle valve is a ball type metal valve used to control the movement of hydraulic fluid.

It is typically mounted in the hydraulic components box on the superstructure behind the cab.

OPERATION (Figure 1)

The shuttle valve provides a means of automatically selecting between two input sources with a single, common output.

The valve consists of a single ball placed between two check seats.

Pressurized fluid enters through both the input ports (identified as 1 and 2). When one of the input lines is pressurized, the internal check ball is forced against the opposite seat, blocking that inlet and providing a flow path to the outlet port.

NOTE: *The outlet flow is always from the source of the highest pressure.*

MAINTENANCE AND ADJUSTMENT

Periodic maintenance should include the following:

1. Inspect the valve, and associated components for evidence of damage or leakage. Repair or replace as required.

2. If problems are noted with the operation of the valve, remove, disassemble, and clean. Replace seals and check the condition of the check ball and seats. Repair or replace as required.

REMOVAL

The shuttle valve may be removed from the truck as follows:

1. Park the truck in a SAFE POSITION. It must be secured by means other than the truck's friction brake system.

2. Drain all pressure in the system as outlined in the procedures on system operation and testing in Section 5 - Hydraulic System. This includes both the steering and brake system accumulators.

⚠WARNING

Always release all hydraulic pressure in the system before loosening or removing any hydraulic lines.

3. Disconnect all hydraulic fittings from the valve. Cap or plug all openings. Label each to aid in installation.

4. Remove the capscrews that secure the valve to the mounting bracket.

5. Remove the valve.

DISASSEMBLY (Figure 1)

The shuttle valve may be disassembled as follows:

NOTE: *During the disassembly and repair procedures, it is always a recommended practice to carefully note the specific installation and orientation of components before and as they are removed to aid in proper reassembly.*

1. Clean all oil, dirt and other contamination from the exterior of the valve.

2. Using the appropriate wrench, loosen the lock nut (3) from the body (1).

3. Again using the appropriate tool, loosen and remove the cartridge assembly from the body (1).

4. Remove the O-ring plugs using care to note the location from which they were removed to aid in the reassembly.

INSPECTION AND REPAIR (Figure 1)

The manifold components may be serviced as follows:

1. Inspect, then remove and discard all of the previously used O-rings that have replacements included in the new seal kit. Evidence of damage to the ring should be investigated for cause as it may indicate problems in other areas. It is recommended that all O-rings and seals be replaced each time removed to ensure proper valve sealing and operation.

2. Clean all parts thoroughly with clean solvent and dry with compressed air. Do not use rags or solvents that will leave a residue.

3. Remove any indicated burrs or high spots from any surfaces. This is especially true of the check ball and the "check seats" in the inner portion of the cartridge assembly. Repair, replace, or re-clean as required.

4. Inspect the valve body and all other components for evidence of wear or damage. Particular attention should be paid to the bores, mating surfaces, and thread areas. If found to be significant, the assembly must be replaced.

ASSEMLY (Figure 1)

The shuttle valve may be assembled as follows

1. Check that all parts are clean and free of defects.

2. Install the O-rings and back-up rings on all components as shown.

3. Lubricate all O-rings and bores in the valve body with clean hydraulic fluid compatible with that used in the truck's hydraulic system.

4. Install the check ball (7) into position in the cartridge.

5. Install the lower portion of the cartridge. Tighten securely, but use care not to over tighten as the seal is provided by the seal rings and not the mating surfaces.

6. Apply thread lock compound to the threads on the upper portion of the cartridge (2) as appropriate.

7. Install the cartridge assembly into the body using care not to damage the seals. . Tighten securely, but use care not to over tighten as the seal provided by the seal rings and not the mating surfaces.

8. Install the lock nut (3). Using the appropriate tools to hold the cartridge assembly and to tighten the lock nut (3), tighten the lock nut to a final torque of 575 inch-lb (65 Nm).

INSTALLATION

The shuttle valve may be installed as follows:

1. Install the valve. Secure as required.

2. Connect all hydraulic lines. Torque each connection as outlined in the instructions in Section 10 - Miscellaneous.

3. Bleed and test all systems as outlined in the procedures for the dump, steering, and brake systems in Section 5 - Hydraulic System.

NOTE: *Entrapped air should be bled from all three systems.*

KEY 56152	
01.	Body
02.	Cartridge
03.	Lock Nut
04.	O-ring
05.	Back-up Ring
06.	O-ring
07.	Check Ball
08.	O-ring
09.	Back-up Ring
10.	Back-up Ring
11.	O-ring

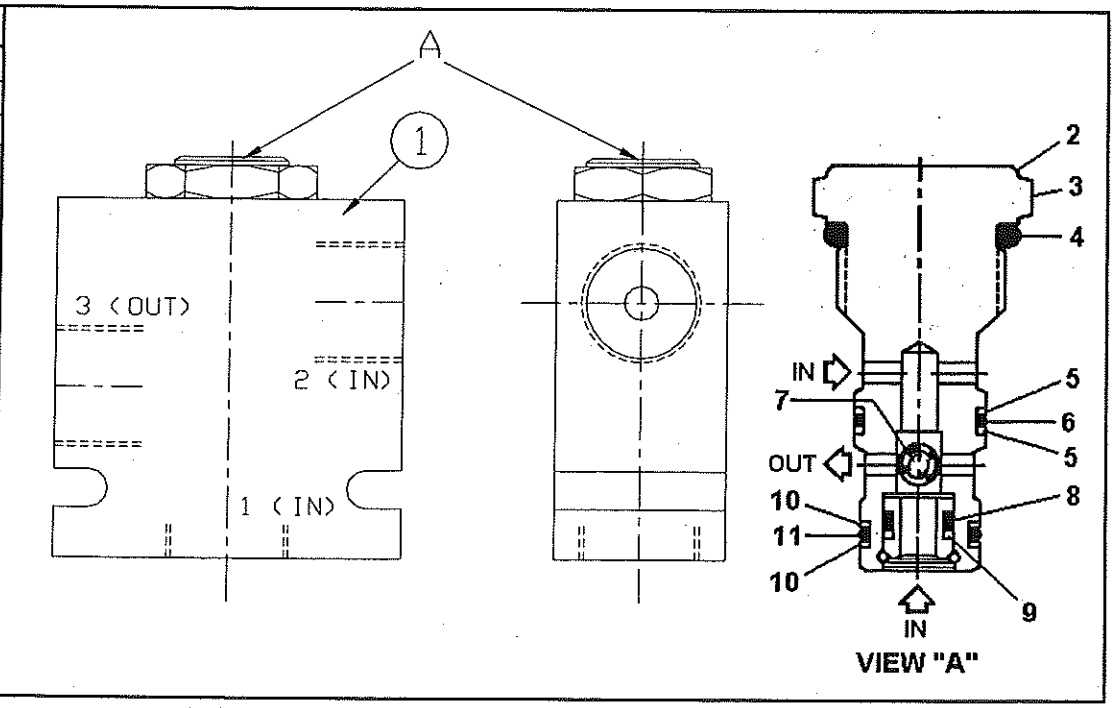


FIGURE 1 – SHUTTLE VALVE (56152)