BOOSTED MASTER CYLINDER
(Power Assist Section)

Service Instructions

MASTER CYLINDER SECTION - **Automotive Brake Fluid**
- Mineral Base Hydraulic Oil*

POWER ASSIST SECTION - **Mineral Base Hydraulic Oil**

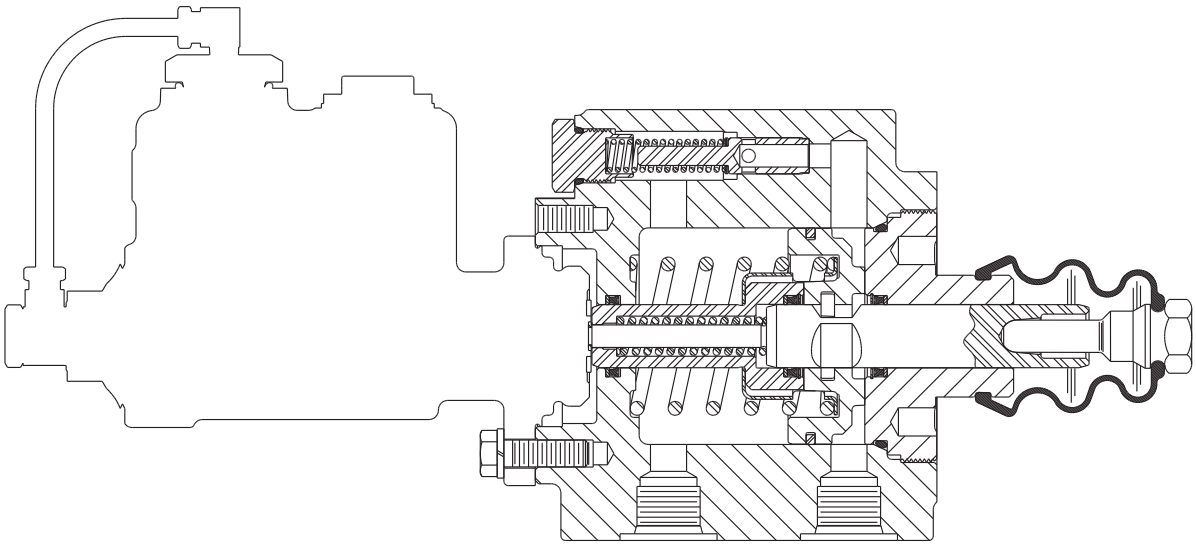

FIGURE 1

This instruction sheet services the Power Assist Section for these model numbers:

02-460-240	02-460-270
02-460-250	02-460-278
02-460-254*	02-460-338*
02-460-262	

NOTE: If your product number is not listed, contact ZF Off-Highway Solutions Minnesota Inc. for information.

TYPICAL SYSTEM SCHEMATIC (This circuit may not apply to your installation)

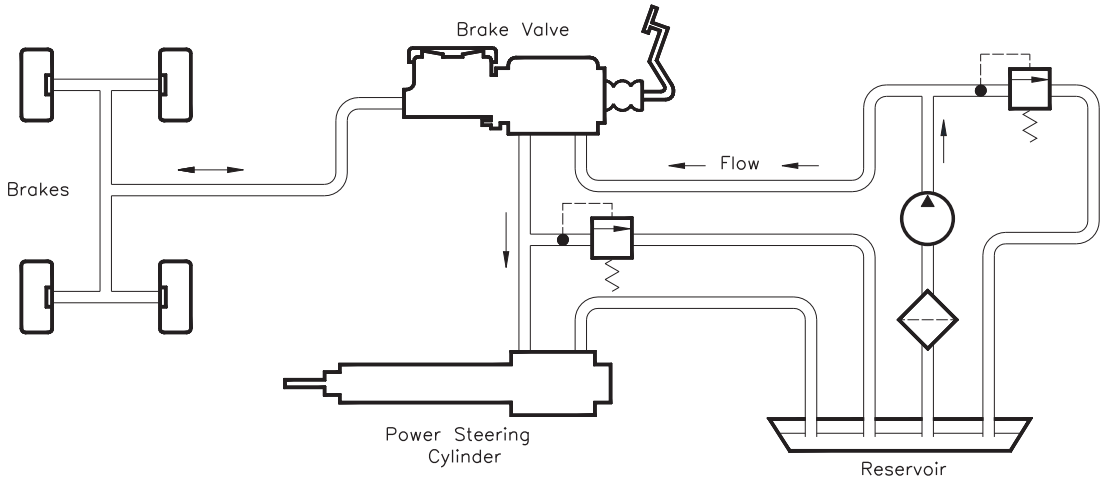

FIGURE 2

REMOVING MASTER CYLINDER FROM THE MACHINE AND SEPARATING SECTIONS

(Refer to Figures 1 and 3)

1. Remove the master cylinder assembly from the machine by disconnecting the necessary fluid lines, disconnecting the push rod, and removing the mounting bolts. Drain fluid from the assembly.
2. Separate the master cylinder section from the power assist section by removing three cap screws and three lock washers. **NOTE: Later designs do not have a spacer.**

CONNECTING SECTIONS AND MOUNTING MASTER CYLINDER ON THE MACHINE

(Refer to Figures 1 and 3)

1. Install the spacer between the two sections (only if used on the original design).
2. Attach master cylinder section to power assist section with three cap screws and three lock washers. Torque the cap screws 29.83-36.61 N·m (22-27 lb·ft).
3. Install the master cylinder assembly on the machine.

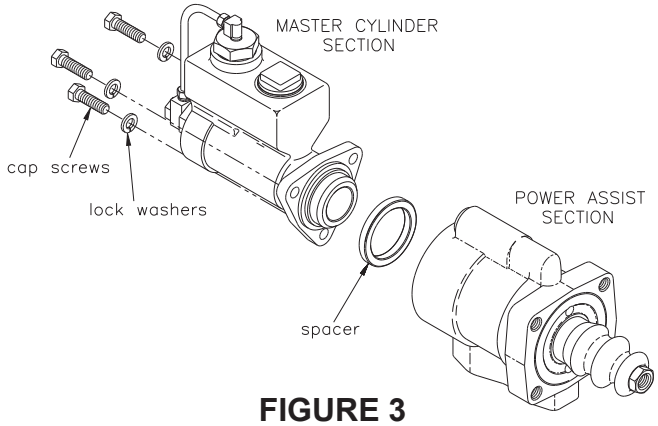

FIGURE 3

Connect the push rod. Connect the fluid lines. Bleed the system of air. Tighten fittings if leaks occur. Make several applications to be sure the master cylinder is working properly. **NOTE: All fittings must be inspected for leaks and tightened if leaks occur.**

NOTE

Some earlier designs of the Power Assist Section used an adjustable relief valve. The later designs are all non-adjustable. Determine which style of relief valve is on the Power Assist Section and follow the appropriate disassembly and assembly procedures.

POWER ASSIST DISASSEMBLY

(Refer to Figures 1 and 5)

1. Drain fluid from unit before disassembling.
2. Remove push rod (1) and boot (2) from Power Assist Section.
3. Loosen end plug (3) using a spanner wrench and remove internal parts assembly (19) from housing (20).
4. Remove spring (18) and retainer (17) from the internal parts assembly.
5. Remove end plug (3) from piston (8). Remove o-ring (4) from end plug (3). Remove retaining ring (7), cup (6), and back-up ring (5) from the bore of end plug (3). Not all models use retaining ring (7). **NOTE: Be careful not to scratch the bore of end plug (3).**
6. Remove piston (10) from piston (8). Remove piston ring (11) from piston (10). **NOTE: Be careful when removing piston ring (11).**
7. Remove retaining ring (16) from piston (8).

⚠ CAUTION

Retaining ring (16) is under tension of spring (9).

8. Remove piston (15) from piston (8). Remove retaining ring (12), cup (13), and back-up ring (14) from the bore of piston (15). Not all models use retaining ring (12). **NOTE: Be careful not to scratch piston (15) bore.**
9. Remove spring (9) from piston (8).
10. Remove cup (21) and back-up ring (22) from housing (20). **NOTE: Be careful not to scratch housing bore when removing cup and back-up ring.**

NON-ADJUSTABLE RELIEF VALVE

11. Remove plug (27) from housing (20).
12. Remove o-ring (26) from end plug (27).
13. Remove spring (25), shim(s) (24), and valve stem (23) from housing (20). Be aware of the number of shim(s) removed for reassembly purposes.

ADJUSTABLE RELIEF VALVE

(Refer to Figure 4)

11. Remove end plug assembly (37) from housing (20). **NOTE: Measure spring recess depth as shown in Figure 4 and record measurement before proceeding.**
12. Remove jam nut (36), lock washer (35), adjusting screw (32), and o-ring (33) from end plug (34).
13. Remove o-ring (30) and back-up ring (31) from adjusting screw (32).
14. Remove spring (29) and valve stem (28) from housing (20).

POWER ASSIST ASSEMBLY

(Refer to Figures 1 and 5)

Use only mineral base hydraulic oil in the power assist section.

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembling.
2. Install new cup (21) and new back-up ring (22) in housing (20). Note direction of cup (21).
3. Install new back-up ring (5), new cup (6), and new retaining ring (7) in end plug (3). Not all models use retaining ring (7). Note direction of cup (6).
4. Install spring (9) on piston (8).
5. Install new back-up ring (14), new cup (13), and new retaining ring (12) in piston (15). Note direction of cup (13). Not all models use retaining ring (12). **NOTE: Be careful not to mar piston (15) bore.**
6. Install piston (15) over spring (9) and piston (8).
7. Install new retaining ring (16) on piston (8).
8. Install new piston ring (11) on piston (10). **NOTE: Be careful when installing piston ring (11).**
9. Install piston (10) on piston (8). Note direction of piston (10).
10. Install new o-ring (4) on end plug (3).
11. Install end plug (3) on piston (8).
12. Install retainer (17) over piston (15) and install spring (18) over retainer (17).
13. Install internal parts assembly (19) into housing (20) bore. Use a spanner wrench to torque end plug (3) 40.68-54.24 N·m (30-40 lb·ft).
14. Install new boot (2) on end plug (3) and install push rod (1) into boot.

● Items included in Repair Kit

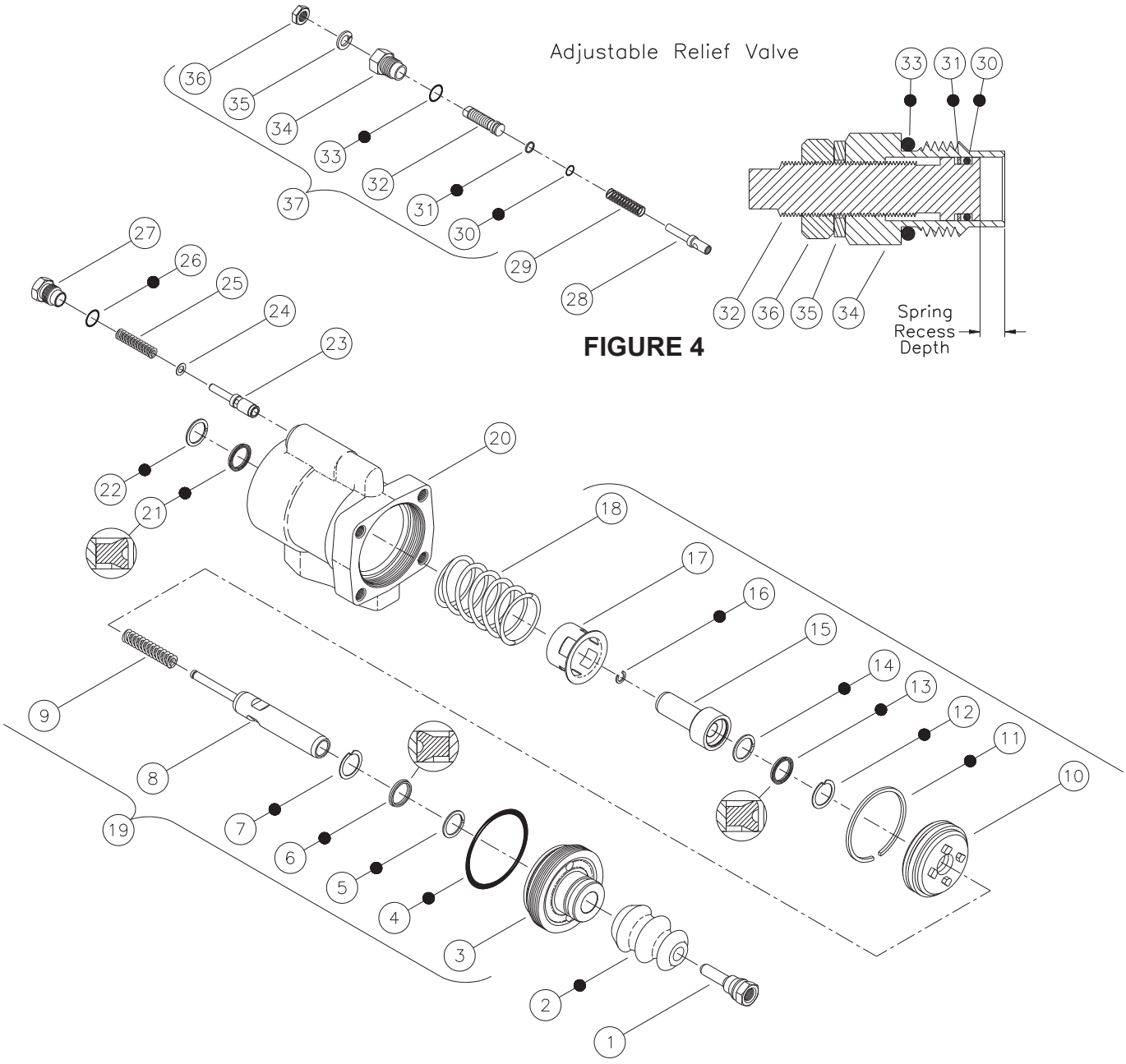

FIGURE 4

FIGURE 5

NON-ADJUSTABLE RELIEF VALVE

15. Install valve stem (23), shim(s) (24), and spring (25) in housing (20). Install the same number of shim(s) (24) as were removed. **NOTE: Valve stem (23) must move freely in housing bore.**
16. Install new o-ring (26) on end plug (27). Install end plug (27) in housing and torque 40.7-54.2 N·m (30-40 lb·ft).

ADJUSTABLE RELIEF VALVE

(Refer to Figure 4)

15. Install valve stem (28) and spring (29) in housing (20).
16. Install new back-up ring (31) and new o-ring (30) on adjusting screw (32).
17. Install new o-ring (33) on end plug (34).
18. Assemble adjusting screw (32), lock washer (35), and jam nut (36). **NOTE: Set the adjustment screw (32) to the spring recess depth recorded during disassembly.**
19. Install end plug assembly (37) in housing (20) and torque 40.7-54.2 N·m (30-40 lb·ft).

BLEEDING PROCEDURES

NOTE

Use only proper fluid specified by the machine manufacturer. Never reuse fluid that has been drained from the system. Be sure that you maintain a high level of fluid in the reservoir during and after the entire bleeding process.

PRESSURE BLEEDING INSTRUCTIONS

1. Master Cylinder must be mounted to power assist section.
2. Fill reservoir with proper fluid.
3. Be certain all fittings are tight to avoid leaking.
4. DO NOT DEPRESS PEDAL.
5. Connect pressure bleeder into reservoir adapter. Recommended bleeding pressure is 2.07 bar (30 PSI) maximum. **NOTE: Make sure to use correct pressure bleeder for type fluid used in the system.**
6. Open bleeder screw closest to master cylinder outlet. Most of the air contained in the system will escape by this route. Close bleeder screw.
7. Continue to the next bleeder screw and so on. At each point when air bubbles disappear close bleeder screw.
8. Remove pressure bleeder.
9. Open bleeder screw at master cylinder. Actuate cylinder to remove any residual air. Tighten bleeder screw before permitting pedal to return.
10. Actuate pedal several times. If pedal is spongy, check for system leaks and repeat bleeding process.
11. Fill reservoir to within 12.7 mm (0.50 in) of top. Install filler cap and torque 33.9-40.7 N·m (25-30 lb·ft).

BENCH BLEEDING INSTRUCTIONS

(Refer to Figure 6)

1. This process can be done in a bench vise or on the machine with master cylinder mounted to power assist section.
2. Remove master cylinder filler cap assembly.
3. Connect a length of tubing to an outlet port and immerse the other end below the fluid level in the master cylinder reservoir. Keep reservoir fluid within 12.7 mm (0.50 in) of inside reservoir top.
4. Actuate master cylinder piston with a smooth object large enough to hold the small internal piston from coming out. Slowly stroke and release master cylinder piston 34.9-38.1 mm (1.38-1.50 in). Repeat until air bubbles in reservoir have ceased.
5. Remove tubing. This should be done quickly so the loss of fluid will be minimized.
6. If cylinder was bench bled in a vise, it must now be attached securely to the power assist section and mounted on machine. Finish all plumbing connections before continuing to step 7.
7. Bleed remaining air from system by depressing brake pedal and opening bleeder fitting closest to the master cylinder. Close bleeder fitting before brake pedal is released. Continue to next bleeder port. In all cases the bleeder fittings must be closed before the brake pedal is released or air will be pulled in through the bleeder and ingest unwanted air in the system.
8. Fill reservoir to within 12.7 mm (0.50 in) of top. Install filler cap and torque 33.9-40.7 N·m (25-30 lb·ft).
9. Be sure all fittings are tight to avoid any leaking.
10. Depress pedal several times. If the brake pedal feels spongy, check for system leaks and repeat bleeding process.

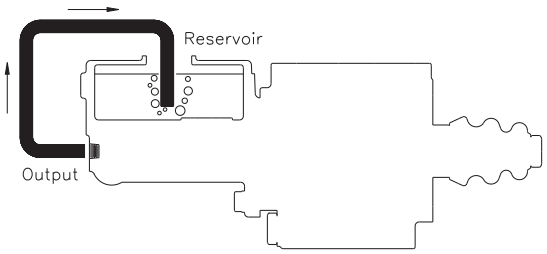

FIGURE 6

ZF Off-Highway Solutions Minnesota Inc.
1911 Lee Boulevard / North Mankato, MN U.S.A. 56003
Tel: +1 507 625 6426 **Fax:** +1 507 625 3212