BOOSTED MASTER CYLINDER
(Straight Bore)

Service Instructions

TABLE 1

Model Number	Repair Kit Number	Relief Valve Pressure Setting (power assist section)	
		bar	(PSI)
*02-460-446	02-400-213	23.1	(335)
02-460-456	02-400-213	23.1	(335)
*02-460-488	02-400-242	14.5	(210)
02-460-490	02-400-213	25.3	(367)
02-460-606	02-400-213	25.3	(367)

* Use automatic transmission fluid in master cylinder section.
All models use hydraulic oil in the power assist section.
NOTE: If your product number is not listed , contact ZF Off-Highway Solutions Minnesota Inc. for information.

MASTER CYLINDER SECTION **- Mineral Base Hydraulic Oil**

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

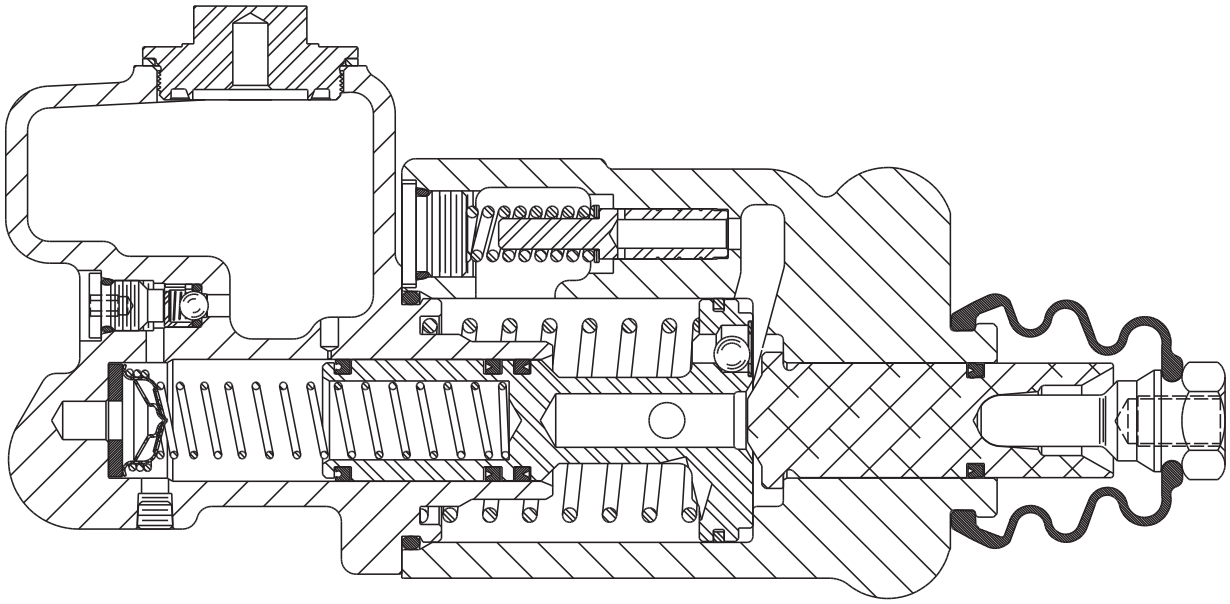

FIGURE 1

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DISASSEMBLY

(Refer to Figures 1 and 2)

1. Remove the master cylinder assembly from the machine by disconnecting necessary fluid lines. Disconnect push rod and remove mounting bolts. Drain fluid from the master cylinder assembly.
2. Separate master cylinder section from power assist section by removing two cap screws (26) and two flat washers (25).
3. When separating the sections, piston (7) and spring (16) should remain with the power assist section.
4. Remove o-ring (17), filler cap (24), and gasket (23) from master cylinder housing (21).
5. Remove spring (18), check valve (19), and seat (20) from master cylinder housing (21).
6. Remove plug (32), cage (30), tapered spring (29), ball (28), and o-ring (27) from master cylinder housing (21). Note direction of tapered spring (29) for reassembly.
7. Remove o-ring (31) from plug (32).
8. Carefully remove spring (16) and piston (7) from power assist housing (3).
9. Remove cups (8, 9, & 10) and piston ring (6) from piston (7). Note direction of cups for reassembly purposes. **NOTE: Be careful not to scratch or mar piston.**
10. Remove plug (15), spring (13), shim(s) (12), and piston (11) from power assist housing (3). Remove o-ring (14) from plug (15). Note the number of shims removed for reassembly purposes.
11. Remove push rod (1) and boot (2) from power assist housing (3).
12. Remove piston (5) from power assist housing (3) through large diameter bore. Remove cup (4) from piston (5).

ASSEMBLY

(Refer to Figures 1 and 2)

⚠ CAUTION

Power Assist Section of the valve uses mineral base hydraulic oil only.

Master Cylinder Section of the valve uses mineral base hydraulic oil or automatic transmission fluid. See TABLE 1.

SEE CAUTION ABOVE FOR THE PROPER FLUID USED IN EACH SECTION. LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN FLUID.

1. Clean all parts thoroughly before assembling.
2. Install new cup (4) on piston (5) and carefully insert in power assist housing (3) through large diameter bore. Note direction of cup. Piston should bottom out on housing.
3. Install push rod (1) and new boot (2) on power assist housing (3).
4. Install new o-ring (14) on plug (15).
5. Install piston (11), shim(s) (12), spring (13) and plug (15) in power assist housing (3). **NOTE: Be sure to install the same number of shims as were removed during disassembly.** Torque plug (15) 47.5-54.3 N·m (35-40 lb·ft).
6. Carefully install new piston ring (6) and new cups (8, 9, & 10) on piston (7). **NOTE: Cups (8, 9, & 10) are located in marked envelopes in the repair kit. See Figure 2b for proper cup replacement location.**
7. Carefully insert piston (7) all the way into power assist housing (3). Install spring (16) into power assist housing (3) over piston (7).
8. Install new o-ring (31) on plug (32).
9. Install new o-ring (27), new ball (28), new tapered spring (29), new cage (30), and plug (32) in master cylinder housing (21). Torque plug (32) 10.9-16.3 N·m (8-12 lb·ft). **NOTE: Be sure tapered spring (29) is properly aligned and in the correct position when cage (30) is installed. Small end of tapered spring (29) must be against ball (28). See Figure 2a.**
10. Install new gasket (23), filler cap (24), and new o-ring (17) on master cylinder housing (21). Torque filler plug 67.8-81.4 N·m (50-60 lb·ft).
11. Install new seat (20), new check valve (19), and spring (18) into master cylinder housing (21).
12. Carefully assemble master cylinder section to power assist section using two flat washers (25) and two cap screws (26). Torque 29.8-33.9 N·m (22-25 lb·ft).
13. Install the brake master cylinder on the machine. Connect the push rod. Connect the fluid lines. Bleed the system according to machine manufacture recommendations or follow the bleeding instructions on page 4. Be sure the master cylinder is functioning properly before moving the machine. **NOTE: All fittings must be inspected for leaks and tightened if leaks occur.**

● Items included in Repair Kit

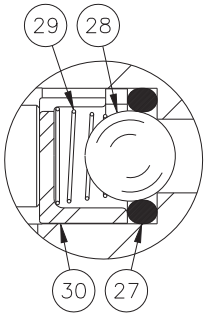

Figure 2a

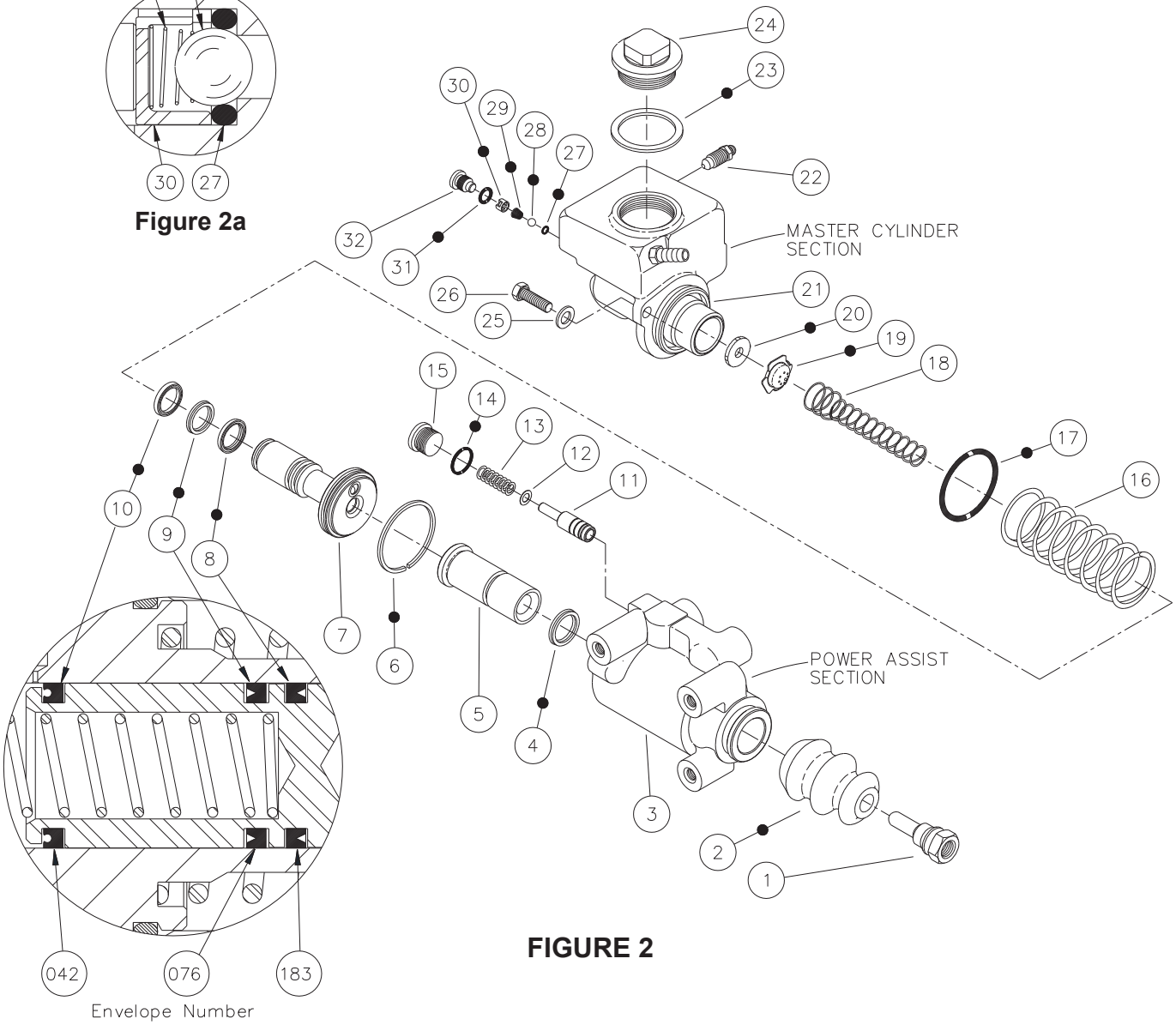

FIGURE 2

Figure 2b

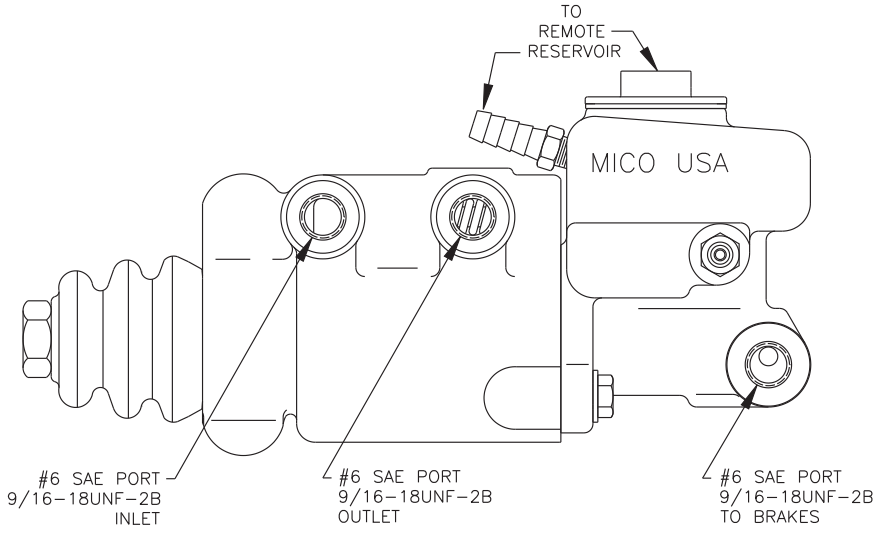

FIGURE 3

BLEEDING INSTRUCTIONS

NOTE

Use only proper fluid specified by the machine manufacture. 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. The remote reservoir must be vented for proper system operation. An unvented remote reservoir will cause an air lock, preventing proper fluid flow.

Pressure Bleeding Instructions

1. Remove master cylinder filler cap and completely fill the master cylinder reservoir with proper fluid. Fill slowly to prevent air entrapment in the reservoir.
2. Replace the master cylinder filler cap and tighten with a wrench. Torque filler cap 67.8-81.4 N·m (50-60 lb·ft).
3. Be certain all fittings are tight to avoid leaking.
4. DO NOT DEPRESS THE BRAKE PEDAL.
5. Fill the remote reservoir with proper fluid. Fill slowly to prevent air entrapment.
6. Connect the pressure bleeder to the remote reservoir. Recommended bleeding pressure is 2.07 bar (30 PSI) maximum. **NOTE: Be sure to use the correct pressure bleeder for the type of fluid used in the system.**
7. Open the bleeder screw on the master cylinder. Close bleeder screw when air bubbles have ceased.
8. Open the bleeder screw closest to the master cylinder outlet. Most of the air contained in the system will escape by this route. Close the bleeder screw.
9. Continue to the next bleeder screw and so on. At each point when air bubbles disappear close the bleeder screw. Allow enough oil to pass through the bleeder screw to ensure that remote air pockets have been purged from the system.
10. Remove the pressure bleeder.
11. Open the bleeder screw on the master cylinder. Depress the brake pedal to actuate the master cylinder. This will will remove any residual air. Tighten the bleeder screw before allowing the pedal to return.
12. Fill the remote reservoir to the proper fluid level. Depress the pedal several times. If the pedal feels spongy, check the system for leaks and repeat the bleeding process.

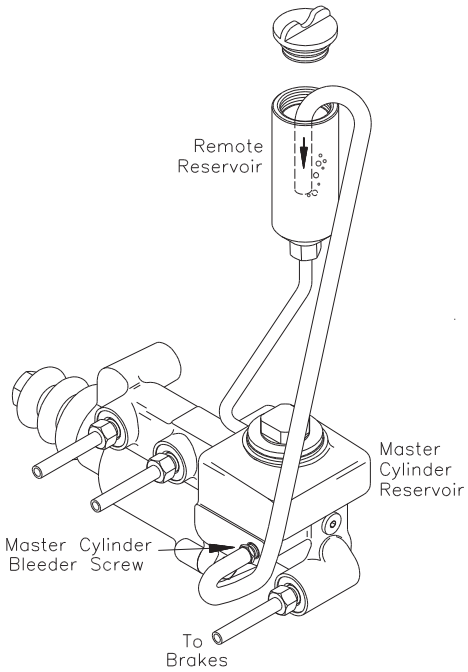

FIGURE 4

Manual Bleeding Instructions

(Refer to Figure 4)

1. Fill the remote reservoir with clean system fluid.
2. Loosen the filler cap on the top of the master cylinder reservoir just enough to allow air to escape.
3. Keep the remote reservoir full while oil fills the master cylinder reservoir.
4. While oil is filling the master cylinder reservoir, open the master cylinder bleeder screw.
5. Allow sufficient time for oil to fill the master cylinder.
6. When oil is visible at the master cylinder bleeder screw, close it.
7. When oil begins to leak from the master cylinder filler cap, tighten the filler cap and torque with a wrench to 67.8-81.4 N·m (50-60 lb·ft).
8. Connect one end of a piece of plastic tubing, 3/8 O.D. x 1/4 I.D., to the master cylinder bleeder screw and place the other end of the tubing below fluid level in the remote reservoir.
9. Open the master cylinder bleeder screw and fully depress the brake pedal. Air and oil will be forced into the remote reservoir. Close the bleeder screw before allowing the brake pedal to return.
10. Repeat this process until the air is completely removed from the master cylinder.
11. Tighten the master cylinder bleeder screw and remove the plastic tubing.
12. Bleed the remaining air from the system by depressing the pedal and opening the bleeder screw closest to the master cylinder outlet. Allow enough oil to pass through bleeder screw to ensure that remote air pockets have been purged from the system. Close the bleeder screw before allowing the brake pedal to return. Continue to the next closest bleeder screw and so on.
13. Depress the brake pedal and open the master cylinder bleeder screw. This will remove residual air at the master cylinder after bleeding the entire system. Close the bleeder screw before allowing the brake pedal to return.
14. Fill the remote reservoir to the proper fluid level. Depress the pedal several times. If the pedal feels spongy, check the system for leaks and repeat the bleeding process.