BOOSTED MASTER CYLINDER
(straight bore)

Service Instructions

TABLE 1

Model Number	Repair Kit Number	Relief Valve Pressure (power assist section)		Model Number	Repair Kit Number	Relief Valve Pressure (power assist section)	
		bar	(PSI)			bar	(PSI)
* 02-460-444	02-400-212	23.1	(335)	02-460-662	02-400-212	19.0	(275)
02-460-454	02-400-212	23.1	(335)	02-460-666	02-400-212	19.0	(275)
02-460-652	02-400-212	19.0	(275)	* 02-461-446	02-400-229	23.1	(335)

* Use automatic transmission fluid in the master cylinder section.

NOTES: 1. All models use mineral base hydraulic oil in the power assist section.
2. If your product number is not listed, contact ZF Off-Highway Solutions Minnesota Inc. for information.

MASTER CYLINDER SECTION **- Mineral Base Hydraulic Oil - Automatic Transmission Fluid***

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

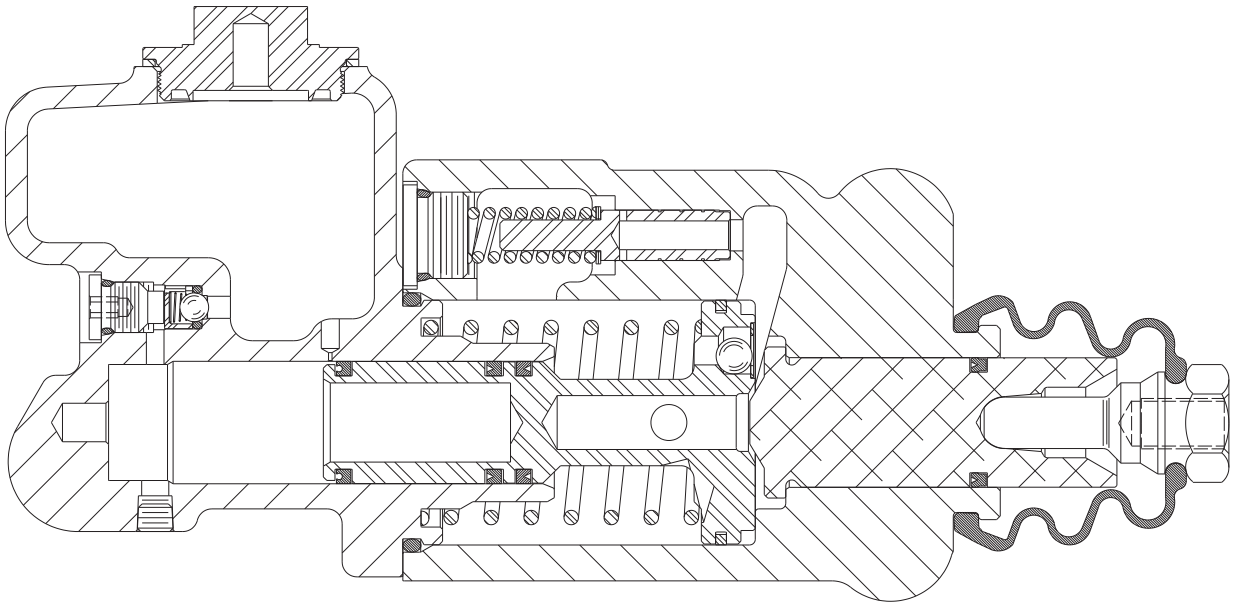

FIGURE 1
(02-460-444 shown)

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Form No. 81-460-172 Revised 2017-06-30

NOTE

This literature services various models of this master cylinder design. The components shown in Figures 1 through 3 may appear different than what is found in your brake.

DISASSEMBLY

(Refer to Figures 1 and 2)

1. Remove the brake valve from the machine by disconnecting the necessary fluid lines. Disconnect the push rod and remove the mounting bolts. Drain fluid from the assembly.
2. Separate the master cylinder section from power assist section by removing two cap screws (25) and two flat washers (24).
3. When separating sections, remove o-ring (17), spring (18), and retainer (19). Piston (7) and spring (16) should remain with the power assist section. **NOTE: Not all models use spring (18) or retainer (19).**
4. **For model numbers 02-460-662 and 02-460-666:** Remove filler cap (34), gasket (33), standpipe (32), and gasket (22) from master cylinder housing (20). See Figure 2c.
   For all other model numbers: Remove filler cap (23) and gasket (22) from master cylinder housing (20).
5. Remove plug (31), cage (29), tapered spring (28), ball (27), and o-ring (26) from master cylinder housing (20). Note direction of tapered spring (28) for reassembly.
6. Remove o-ring (30) from plug (31).
7. Carefully remove spring (16) and piston (7) from power assist housing (3).
8. Remove cups (8, 9, & 10) and piston ring (6) from piston (7). Note the direction of cups for reassembly purposes. **NOTE: Be careful not to scratch or mar piston.**
9. 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.
10. Remove push rod (1) and boot (2) from power assist housing (3).
11. 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 valve uses mineral base hydraulic oil only.

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

SEE CAUTION ABOVE FOR PROPER FLUID USED IN EACH SECTION. LUBRICATE ALL RUBBER COMPONENTS FROM THE 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 2a 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 (28) on plug (29).
9. Install new o-ring (26), new ball (27), new tapered spring (28), new cage (29), and plug (31) in master cylinder housing (20). Torque plug (31) 10.9-16.3 N·m (8-12 lb·ft). **NOTE: Be sure tapered spring (28) is properly aligned and in the correct position when cage (29) is installed. Small end of tapered spring (28) must be against ball (27). See Figure 2b.**
10. **For model numbers 02-460-662 and 02-460-666:** Install new gasket (22) and standpipe (32). Torque standpipe 67.8-81.3 N·m (50-60 lb·ft). Install new gasket (33) and filler cap (34) and finger tighten filler cap. See Figure 2c.
    For all other model numbers: Install new gasket (22) and filler cap (23) and finger tighten filler cap.
11. Install retainer (19) and spring (18) in master cylinder housing (20). Install new o-ring (17) on master cylinder housing (20). **NOTE: Not all models use spring (18) or retainer (19).**
12. Carefully assemble master cylinder section to power assist section using two flat washers (24) and two cap screws (25). Torque 29.8-33.9 N·m (22-25 lb·ft).
13. Install the master cylinder on the machine and connect the fluid lines. Connect the push rod. Fill reservoir and bleed the system of air, see BLEEDING INSTRUCTIONS on page 4.

● Items included in Repair Kit
✻ Not used in all models

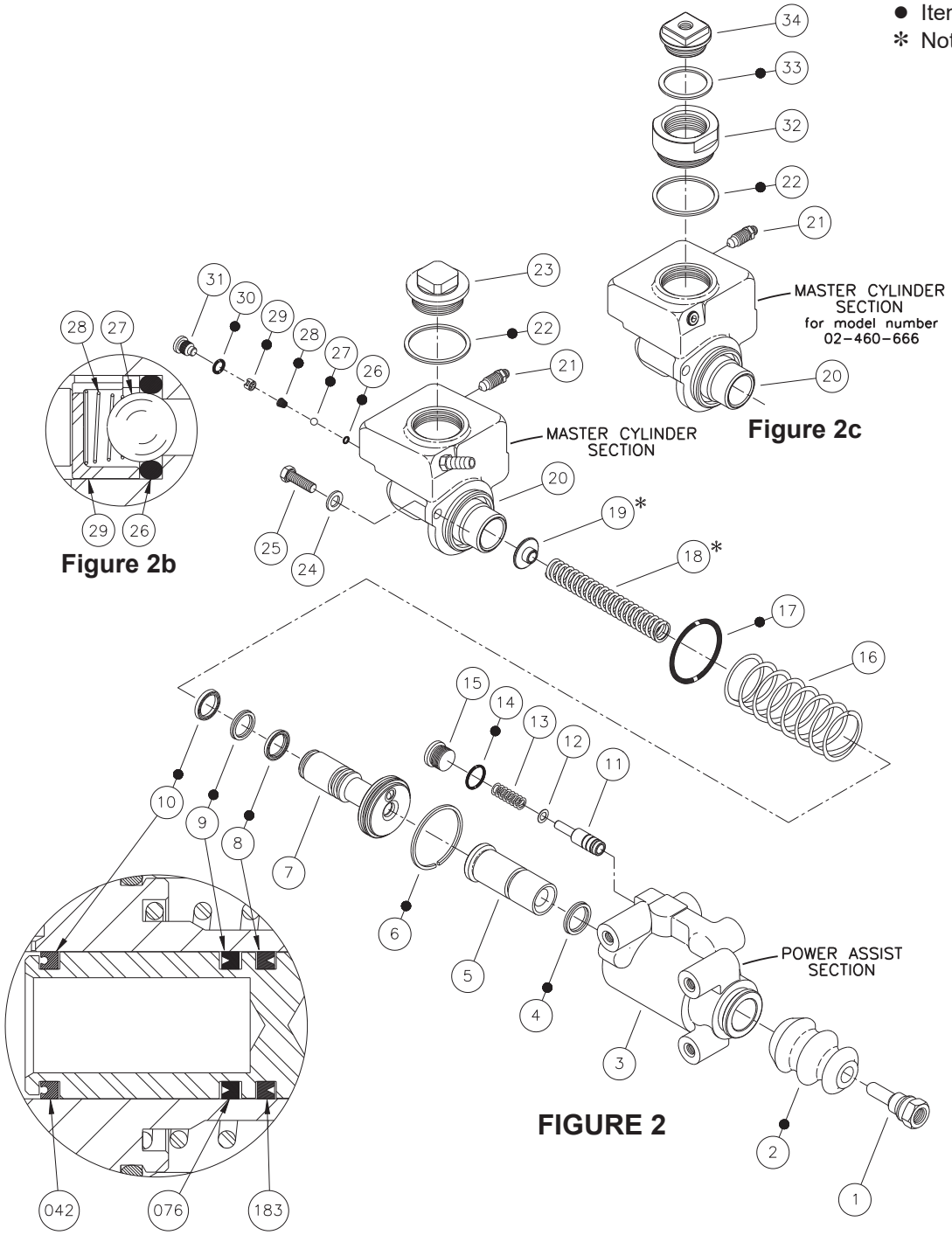

Figure 2b

Figure 2c

Figure 2a

FIGURE 2

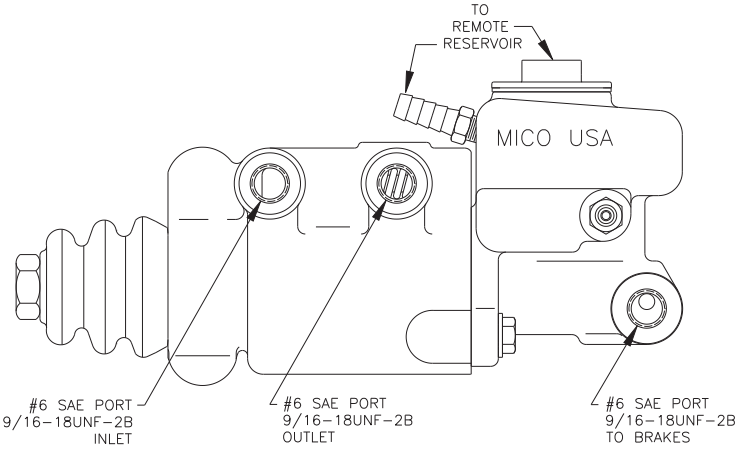

FIGURE 3

BLEEDING INSTRUCTIONS

NOTE

Use only proper fluid specified by the machine manufacture. Never reuse fluid that has been drained from the system. Be sure to maintain a proper level of fluid in the reservoir during and after the entire bleeding process. The remote reservoir must be vented to allow proper system operation. Unvented remote reservoir will cause an air lock, preventing proper fluid flow.

Pressure Bleeding Instructions

1. Remove master cylinder filler cap and completely fill master cylinder reservoir with proper fluid. Fill slowly to prevent air entrapment in reservoir.
2. **For model numbers 02-460-652 and 02-460-666:** Install the master cylinder filler cap and torque 33.9-47.5 N·m (25-35 lb·ft).
   For all other model numbers: Install the master cylinder filler cap and torque 67.8-81.4 N·m (50-60 lb·ft).
3. Be certain all fittings are tight to avoid leaking.
4. DO NOT DEPRESS BRAKE PEDAL.
5. Fill remote reservoir with proper fluid. Fill slowly to prevent air entrapment.
6. Connect pressure bleeder to remote reservoir. Recommended bleeding pressure is 2.07 bar (30 PSI) maximum. **NOTE: Be sure to use the correct pressure bleeder for the type 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 bleeder screw.
9. Continue to the next bleeder screw and so on. At each point when air bubbles disappear close bleeder screw. Allow enough oil to pass through bleeder screw to ensure remote air pockets have been purged form the system.
10. Remove pressure bleeder.
11. Open bleeder screw on master cylinder. Depress the brake pedal to actuate the master cylinder. This will remove any residual air. Tighten bleeder screw before permitting the pedal to return.
12. Fill the remote reservoir to the proper fluid level. Depress the pedal several times to be sure the master cylinder is working properly. If the pedal feels spongy, check the system for leaks and repeat the bleeding process. **NOTE: All fittings must be inspected for leaks and tightened if leaks occur.**

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. **For model numbers 02-460-652 and 02-460-666:** When oil begins to leak from the master cylinder filler cap, torque the filler cap 33.9-47.5 N·m (25-35 lb·ft).
   For all other model numbers: When oil begins to leak from the master cylinder filler cap, torque the filler cap 33.9-47.5 N·m (25-35 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 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 form 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 to be sure the master cylinder is working properly. If the pedal feels spongy, check the system for leaks and repeat the bleeding process. **NOTE: All fittings must be inspected for leaks and tightened if leaks occur.**

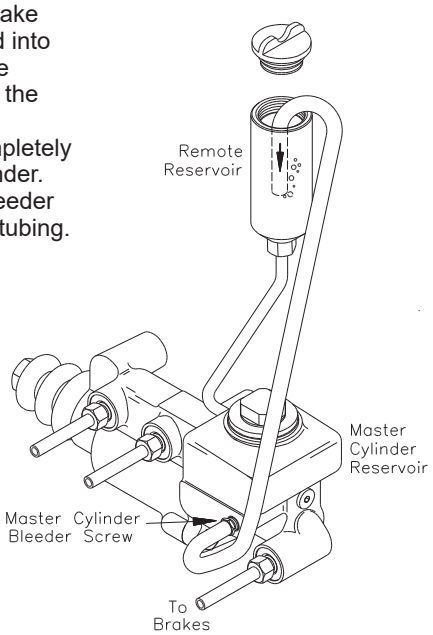

FIGURE 4