BOOSTED MASTER CYLINDER

(ring seal design and sliding piston design)

Service Instructions

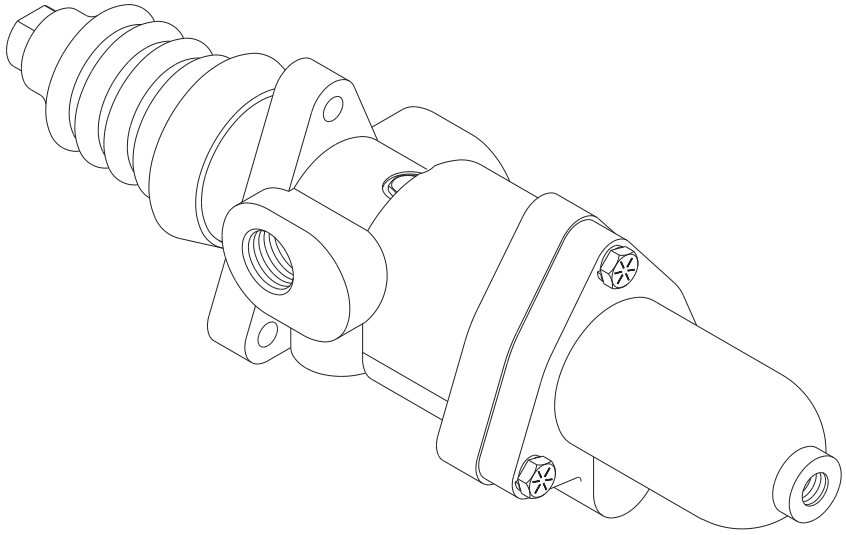

TABLE 1

Model Number	Repair Kit Number	Uses Check Valve	See Pages	Model Number	Repair Kit Number	Uses Check Valve	See Pages
06-460-522	06-459-010	No	2 and 3	06-460-678	06-459-010	No	2 and 3
06-460-642	06-459-020	Yes	4 and 5	06-460-682	06-459-010	No	2 and 3
06-460-654	06-460-010	No	2 and 3	06-460-684	06-459-020	Yes	4 and 5
06-460-656	06-459-020	Yes	2 and 3	06-460-688	06-459-010	No	2 and 3
06-460-658	06-459-020	Yes	2 and 3	06-460-690	06-459-010	No	2 and 3
06-460-660	06-459-020	Yes	2 and 3	06-461-642	06-459-010	No	4 and 5
06-460-662	06-459-020	Yes	2 and 3	06-461-656	06-459-010	No	2 and 3
06-460-666	06-459-020	Yes	2 and 3	06-461-658	06-459-010	No	2 and 3
06-460-668	06-459-010	No	2 and 3	06-461-660	06-459-010	No	2 and 3
06-460-670	06-459-010	No	2 and 3	06-461-666	06-459-010	No	2 and 3
06-460-672	06-459-010	No	2 and 3	06-461-674	06-459-010	No	2 and 3
06-460-674	06-459-020	Yes	2 and 3	06-461-684	06-459-010	No	4 and 5
06-460-676	06-459-010	No	2 and 3				

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

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Form No. 81-460-047 Revised 2004-10-11

www.mico.com

MODELS:

06-460-522	**06-460-668**	**06-460-688**
06-460-654	**06-460-670**	**06-460-690**
06-460-656	**06-460-672**	**06-461-656**
06-460-658	**06-460-674**	**06-461-568**
06-460-660	**06-460-676**	**06-461-660**
06-460-662	**06-460-678**	**06-461-666**
06-460-666	**06-460-682**	**06-461-674**

⚠ CAUTION

Be sure the machine is in a safe and controlled state before attempting any servicing.

Disassembly

(Refer to Figure 1)

1. Remove boot (1) and pressure regulating spring assembly (2).

NOTE

Pressure regulating spring assembly has been set at the factory and should never be disassembled, readjusted, or interchanged with another valve.

2. Separate end cap (22) from housing (13) by removing cap screws (26) and lock washers (25). Remove gasket (14). **NOTE: End cap (22) is under spring (20) tension.**
3. Remove piston assembly (19), spring (20), and check valve (21) from end cap (22). **NOTE: Not all models use check valve (21). See TABLE 1.**
4. Remove seal (17) and o-ring (18) from piston assembly (19).
5. Remove plug (24) from end cap (22). Remove o-ring (23) from plug (24).
6. Remove plug (11) from housing (13). Remove o-ring (12) from plug (11).
7. Remove retaining ring (8) from housing (13).
8. Remove sleeve (10) by pulling on push rod (4). Remove cup (9). from sleeve (10).
9. Remove piston (16) from housing (13). Remove piston ring (15) from piston (16).
10. Carefully remove retaining ring (3) from sleeve (10). **NOTE: Be careful not to scratch or mar sleeve bore.**
11. Remove push rod (4), spool (6), and spring (7) from sleeve (10). Remove cup (5) from spool (6).

Assembly

(Refer to Figure 1)

NOTE

Clean and inspect all components for damage or excessive wear and replace as necessary. If spool (6), sleeve (10), or housing (13) bore are damaged or worn, the entire assembly must be replaced. These parts are manufactured as a matched set and are not interchangeable.

1. Install new cup (9) on sleeve (10) and new cup (5) on spool (6). Note direction of cups (5 & 9). See Figure 1a.
2. Install spring (7) and spool (6) in sleeve (10). Note direction of spool (6).
3. Install push rod (4) and new retaining ring (3) in sleeve (10). **NOTE: Be careful not to scratch or mar sleeve (10) bore.**
4. Install new o-ring (12) on plug (11). Install plug (11) in housing (13) and torque 10.9-13.6 N·m (8-10 lb·ft).
5. Carefully install sleeve (10) into housing (13). Be sure groove in sleeve (10) engages plug (11). Install retaining ring (8) in housing (13).
6. Install new piston ring (15) on piston (16) and install piston (16) in housing (13).
7. Install new o-ring (18) and new seal (17) on piston assembly (19).
8. Install new check valve (21), spring (20), and new piston assembly (19) in end cap (22). **NOTE: Be sure check valve (21) is properly positioned in end cap (22). Not all models use check valve (21). See TABLE 1.**
9. Install new o-ring (23) on plug (24). Install plug (24) in end cap (22) and torque 10.9-13.6 N·m (8-10 lb·ft).
10. Place new gasket (14) on mounting face of end cap (22). Assemble end cap (22) and components therein to housing (13) using lock washers (25) and cap screws (26). Torque cap screws (26) 27.1-29.8 N·m (20-22 lb·ft).
11. Install pressure regulating spring assembly (2) on push rod (4). Install new boot (1) into groove on housing (13) and groove on pressure regulating spring assembly (2).
12. Refer to BLEEDING SECTION to continue.

● Items included in Repair Kit
✻ Not used in all models, see TABLE 1

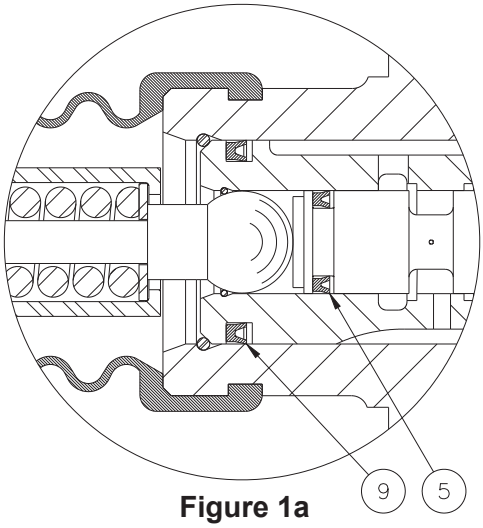

Figure 1a

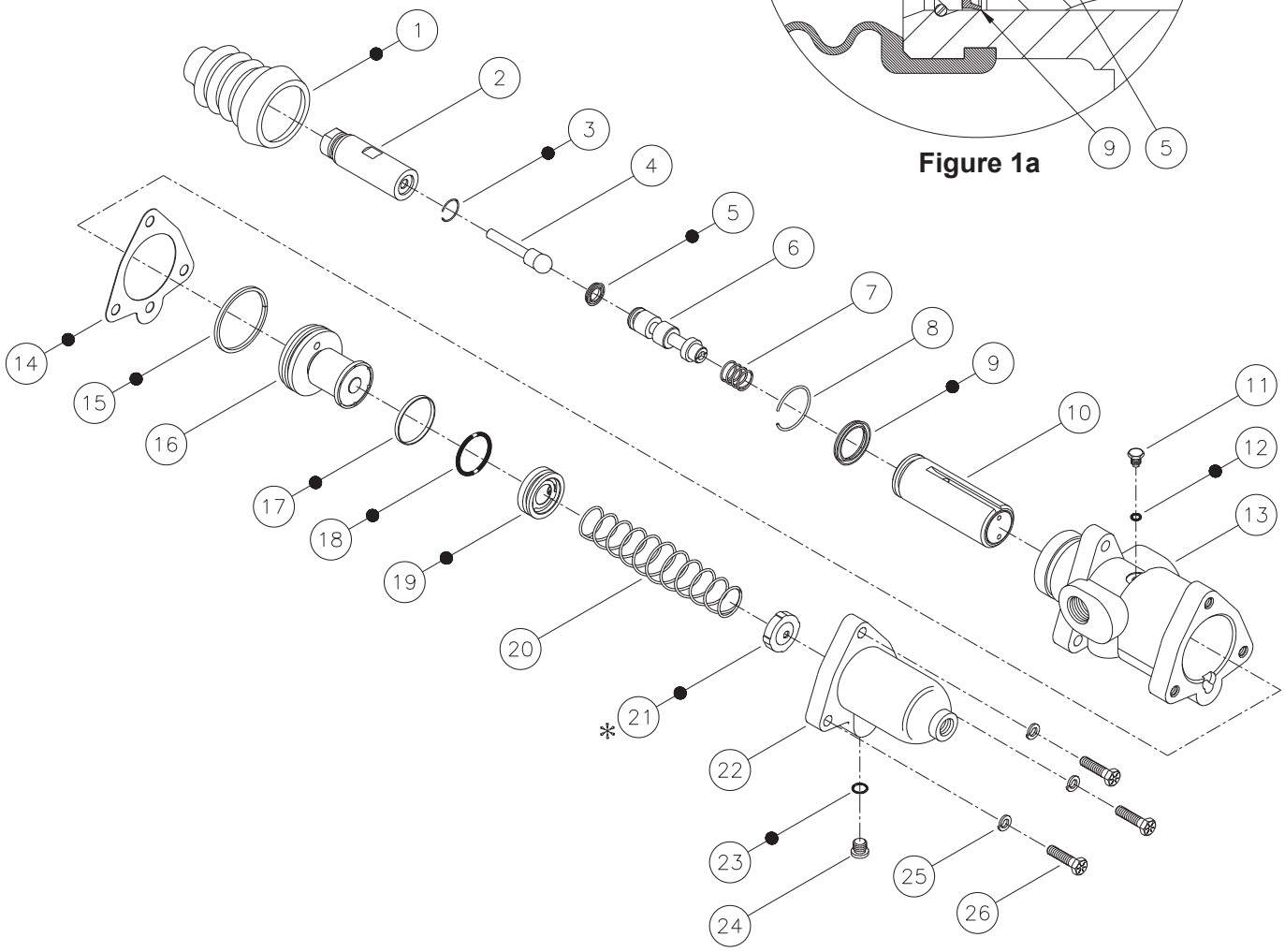

FIGURE 1

MODELS:
06-460-642
06-460-684
06-461-642
06-461-684

⚠ CAUTION

Be sure the machine is in a safe and controlled state before attempting any servicing.

Disassembly

(Refer to Figure 2)

1. Remove boot (1) and pressure regulating spring assembly (2).

NOTE

Pressure regulating spring assembly has been set at the factory and should never be disassembled, readjusted, or interchanged with another valve.

2. Separate end cap (23) from housing (5) by removing cap screws (27) and lock washers (26). Remove gasket (7). **NOTE: End cap (23) is under spring (21) tension.**
3. Remove piston assembly (20), spring (21), and check valve (22) from end cap (23). **NOTE: Not all models use check valve (22). See TABLE 1.**
4. Remove seal (18) and o-ring (19) from piston assembly (20).
5. Remove plug (25) from end cap (23). Remove o-ring (24) from plug (25).
6. Remove plug (3) from housing (5). Remove o-ring (4) from plug (3).
7. Remove assembly (6) from housing (5).
8. Carefully remove retaining ring (8) from sleeve/piston (15). **NOTE: Be careful not to scratch or mar sleeve bore.**
9. Remove push rod (9), spool (11), and spring (12) from sleeve/piston (15). Remove cup (10) from spool (11).
10. Remove end plug (17) from sleeve/piston (15). Remove o-ring (16) from end plug (17).
11. Remove piston ring (14) and cup (13) from sleeve/piston (15).

Assembly

(Refer to Figure 2)

NOTE

Clean and inspect all components for damage or excessive wear and replace as necessary. If spool (11), sleeve/piston (15), or housing (5) bore are damaged or worn, the entire assembly must be replaced. These parts are manufactured as a matched set and are not interchangeable.

1. Install new cup (13) on sleeve/piston (15) and new cup (10) on spool (11). Note direction of cups (10 & 13). See Figure 2a.
2. Install new piston ring (14) on sleeve/piston (15).
3. Install new o-ring (16) on end plug (17). Install end plug (17) in sleeve/piston (15) and torque 10.9-13.6 N·m (8-10 lb·ft).
4. Install spring (12) and spool (11) in sleeve/piston (15). Note direction of spool (11).
5. Install push rod (9) and new retaining ring (8) in sleeve/piston (15). **NOTE: Be careful not to scratch or mar sleeve/piston (15) bore.**
6. Carefully install assembly (6) into housing (5). Be sure groove in sleeve/piston (15) aligns with plug (3) hole.
7. Install new o-ring (4) on plug (3). Install plug (3) in housing (5) and torque 10.9-13.6 N·m (8-10 lb·ft). Be sure plug is aligned with groove in sleeve/piston (15).
8. Install new o-ring (19) and new seal (18) on piston assembly (20).
9. Install new check valve (22), spring (21), and new piston assembly (20) in end cap (23). **NOTE: Be sure check valve (22) is properly positioned in end cap (23). Not all models use check valve (22). See TABLE 1.**
10. Install new o-ring (24) on plug (25). Install plug (25) in end cap (23) and torque 10.9-13.6 N·m (8-10 lb·ft).
11. Place new gasket (7) on mounting face of end cap (23). Assemble end cap (23) and components therein to housing (5) using lock washers (26) and cap screws (27). Torque cap screws (27) 27.1-29.8 N·m (20-22 lb·ft).
12. Install pressure regulating spring assembly (2) on push rod (9). Install new boot (1) into groove on housing (5) and groove on pressure regulating spring assembly (2).
13. Refer to BLEEDING SECTION to continue.

● Items included in Repair Kit
✻ Not used in all models, see TABLE 1

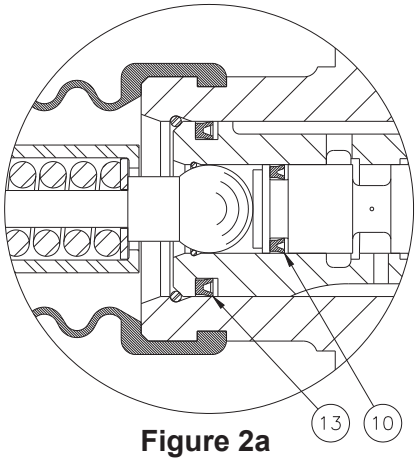

Figure 2a

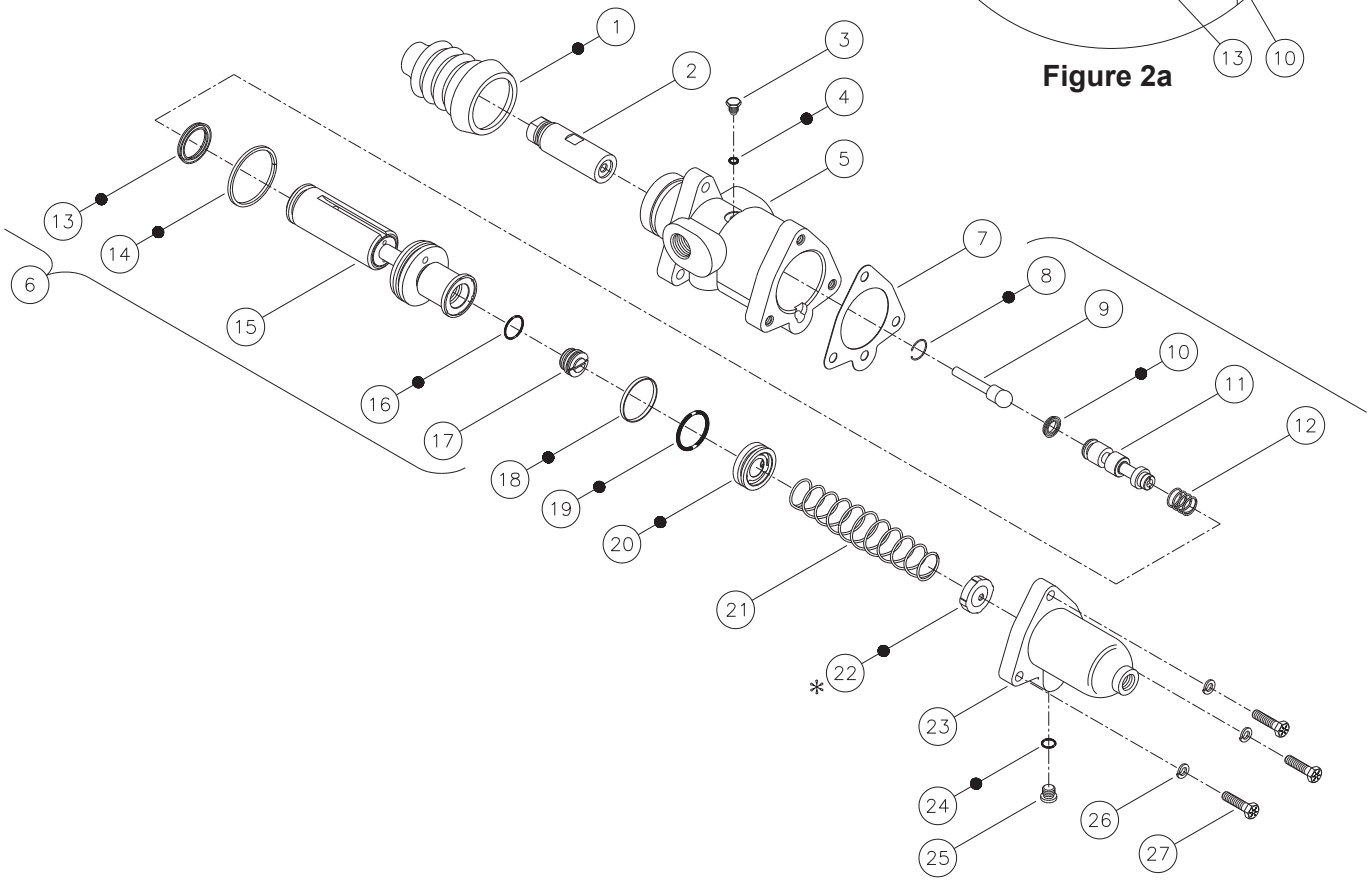

FIGURE 2

BLEEDING SECTION

The Open Center Power Brake Valve and remaining brake system are sometimes difficult to bleed. The difficulty arises when the hydraulic oil used does not flow easily through lines and small holes by means of gravity. Generally, to effectively remove air, oil must be forced into the brake valve master cylinder cavity and the rest of the system.

⚠ CAUTION

Be sure the machine is in a safe and controlled state before bleeding the brake system.

Manual and pressure bleeding are two methods of bleeding a brake system. It is recommended to use one of these two methods of bleeding the open center power brake valve and the rest of the brake system.

NOTE

Be sure brake valve is installed properly and brakes adjusted correctly before beginning bleeding procedures.

Manual Bleeding Procedures

1. Start engine and allow enough time to pass for the system to become filled and thoroughly flushed with oil.
2. With engine still running, one person can stroke the brake pedal while another person opens and closes the brake bleeder screws.
3. Only on the down stroke of the brake pedal, open bleeder screw on the brake closest to brake valve first. When all flow stops from bleeder, close it and allow pedal to return to rest.
4. Wait at least 30 seconds and repeat the process until all air has been expelled from that brake. Then go on to the next closest brake bleeder and repeat process until all brakes have been bled.
5. Stop engine and depress brake pedal. Pedal should be hard, not spongy, and fairly high. If pedal is too spongy and/or travels too far, repeat bleeding process.
6. It is a characteristic of the brake valve to kick the pedal back when actuated if system is not bled with engine running.

Pressure Bleeding Procedure

1. Refer to Figure 5. Install a small BLEEDER BY-PASS LINE as shown. A 1/4 inch size line or hose is sufficient.
2. Start engine and allow enough time to pass for the system to become filled and thoroughly flushed with oil.
3. It is necessary to develop between 3.5-13.8 bar (50-200 PSI) at the inlet to brake valve. A method to throttle the oil will be needed if the system does not already have a secondary hydraulic device downstream from the brake valve. THIS PRESSURE SHOULD BE HELD THROUGHOUT THE BLEEDING PROCESS AND SHOULD NOT EXCEED 17.2 bar (250 PSI).
4. DO NOT STEP ON THE BRAKE PEDAL DURING THIS BLEEDING PROCESS.
5. Oil will now be forced directly into the brake line by the pump and fill the brake valve master cylinder cavity. This may take a minute or two.
6. Continue to hold the bleed pressure while bleeding each brake starting with the line and brake closest to the brake valve.
7. Allow a sufficient amount of fluid to pass at brake bleeder screw to insure all air is removed from each bleeder point.
8. Continue this method until all brakes and lines are bled.
9. When all brakes are bled and fittings tight, release the 3.5-13.8 bar (50-200 PSI) pressure and SHUT OFF ENGINE.
10. Remove the bleeder by-pass line and plug the connections. Be sure not to lose fluid or ingest air at the brake line connection when removing bleeder by-pass line.
11. With engine off, step on brake pedal. It should be fairly high and hard. If a spongy pedal is felt, the system still contains air. If pedal strokes downward too far, check and readjust brakes and repeat bleeding process.
12. When the pedal is satisfactory, restart engine and actuate brake pedal several times to be sure brake valve is working properly. Inspect all fittings for leaks and tighten if leaks occur.

BLEEDING SCHEMATIC

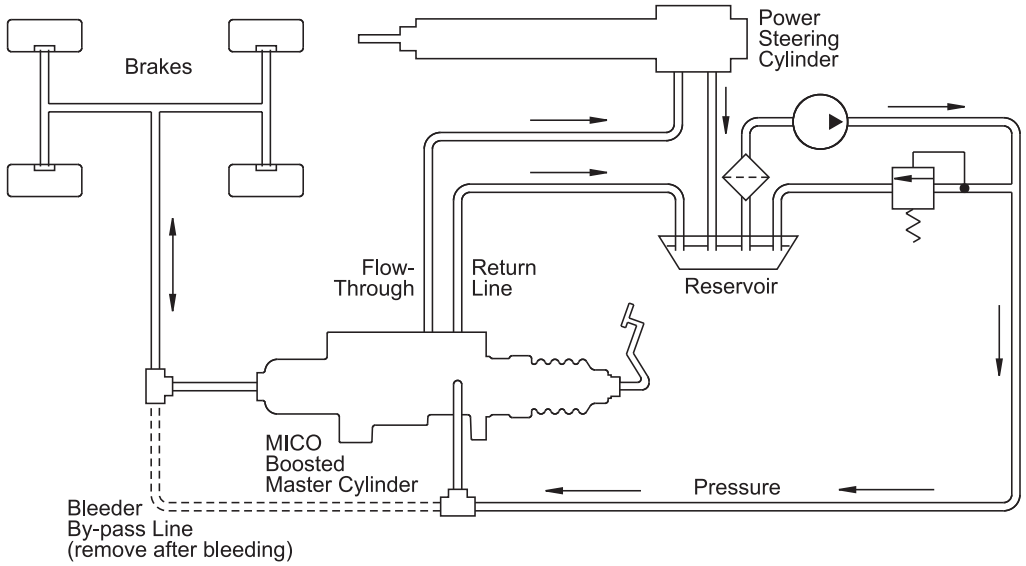

FIGURE 5

SERVICE DIAGNOSIS

With Engine Off –

PEDAL GOES TO FLOOR

1. Brake not adjusted
1. Check adjustment
2. Air in system
2. Bleed brakes
3. Inoperative brakes
3. Check brakes
4. Blown hydraulic line
4. Check brake line
5. Worn out primary cup
5. Check by making sure brakes are properly adjusted, in good operating condition, and system is well bled. If pedal continues to go to the floor, service the brake valve.

SPONGY PEDAL

1. Air in system
1. Bleed brakes

PEDAL IS FIRM BUT STOPS TOO NEAR FLOOR

1. Brakes out of adjustment
1. Adjust brakes
2. Inoperative brakes
2. Check for wear
3. Displacement problem
3. Wheel cylinders too large for valve to handle properly. Consider alternate braking valve.

PEDAL IS FIRM BUT BRAKING IS INADEQUATE TO STOP VEHICLE IN EVENT OF ENGINE FAILURE

1. Pedal ratio too small
1. Increase pedal ratio
2. Brakes inoperative
2. Check brakes for wear or oily brakes

With Engine Running –

PEDAL GOES DOWN PART WAY THEN BOUNCES BACK

1. Insufficient flow from pump
1. Check and fill reservoir
2. Small volume from pump at idle
2. Crack throttle and recheck
3. Brakes not adjusted
3. Check adjustment
4. Air in system
4. Bleed system

NO POWER STEERING OR OTHER DOWNSTREAM HYDRAULIC ACTION AT ANY TIME

1. Hydraulic lines crossed
1. Recheck circuit
2. No hydraulic action at any time
2. Check and fill reservoir. Check relief valve setting on pump. Check for proper rotation at pump, v-belt, sheared keys, etc.

NO OR SLOW POWER STEERING WITH BRAKES APPLIED

1. Recheck relief valve on pump for proper setting
2. Check and fill reservoir
3. Check and tighten pump belt if necessary