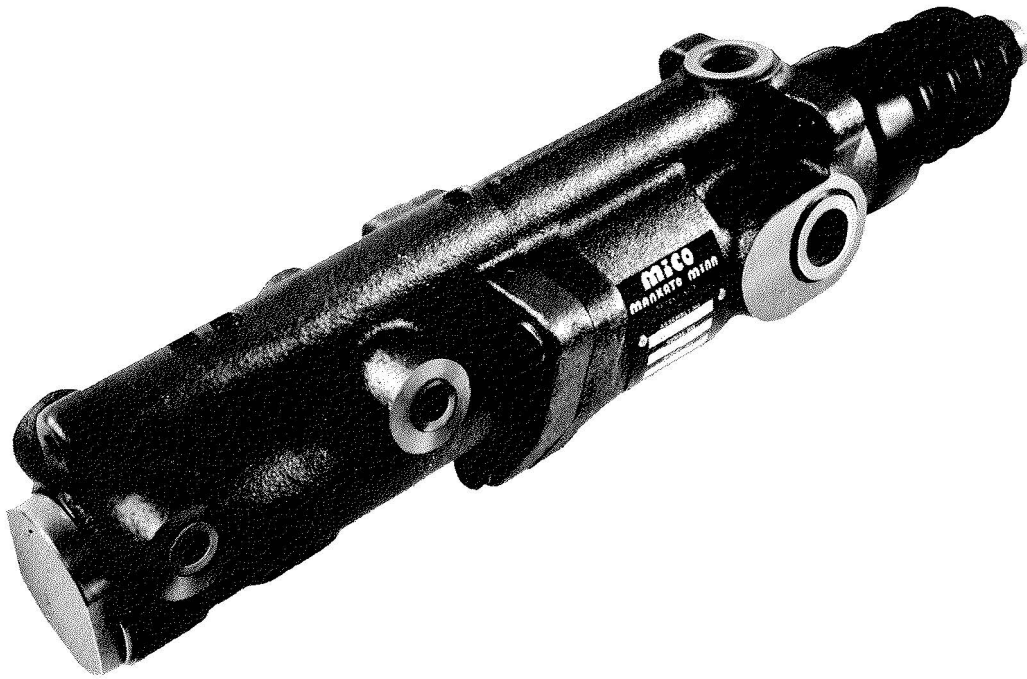


Dual Open Center HYDRAULIC POWER BRAKE VALVE



Service Instructions



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SYSTEM SCHEMATIC (TYPICAL)

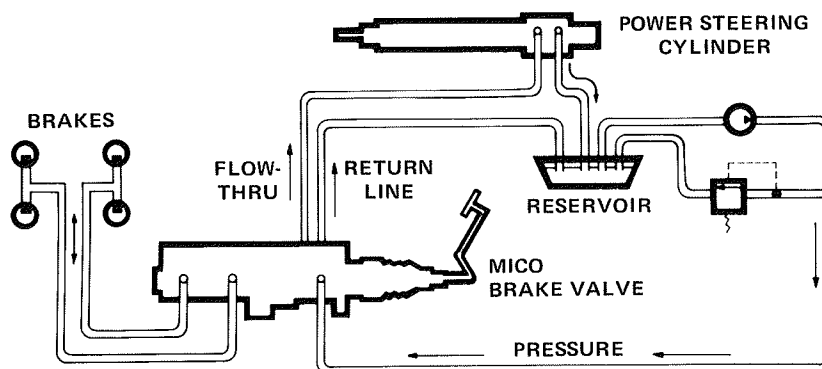


FIGURE 1

REPRESENTATIVE PERFORMANCE DATA

Flow capacity	3-24 gpm
System pressure0-2000 psi
Brake line pressure.0-1500 psi
Master cylinder, bore & stroke	1 5/8" x 1 1/2"
Master cylinder, capacity	3.1 cubic inches total (50/50 split)
Pedal travel with power [†]1.20"
Pedal force with power [†]	56.6 lbs. at 1500 psi brake line pressure
Pedal travel without power [†]10.2" - 11" maximum
Brake line pressure without power* [†]725 psi
*250 lbs. pedal force	[†] 6 to 1 pedal ratio

NOTE: Brake system rubber parts (Buna - N) must be compatible with mineral based hydraulic oil.

DESCRIPTION AND OPERATION OF THE MICO DUAL OPEN CENTER HYDRAULIC POWER BRAKE VALVE

The MICO Dual Open Center Brake Valve will provide split system hydraulic power braking when installed in an open center hydraulic circuit. If a failure should occur in one half of the brake system, the other half will continue to function. It can be used in conjunction with other hydraulic devices such as power steering, also installed in the same circuit. Using a single pump to provide flow and pressure, the brake valve should be installed in the system circuitry, in series, between the pump relief valve and the other hydraulic devices. The entire pump flow is directed thru the brake valve and is available to actuate the downstream devices. The brake valve requires a very small volume of oil for its operation; therefore, it does not interfere with the rest of the circuit, nor does usual actuation of the downstream hydraulic devices affect operation of the brake valve. Full system pressure is always available for operating the rest of the system.

The MICO Brake Valve provides a single-fluid system using the systems hydraulic oil to operate the brakes. BUNA-N rubber wheel-cylinder cups must be used to prevent swelling.

This valve reduces the braking effort to any required degree depending on pedal ratio. Brake pedal force is directly proportional to brake line pressure, thus giving a sense of feel in the operation of the brakes. Manual braking is always available whenever the hydraulic power system is not functioning. This is accomplished by a mechanical follow through within the brake valve. A longer pedal stroke, usually with increased pedal effort, will be expected when braking in this condition.

The manner in which the hydraulic power brake valve functions will be discussed in the following paragraphs.

Oil from the pump flows through the brake valve and on to the downstream hydraulic unit as indicated (Figure 3). Sections of the valve which are communicated to the return port and the tank when the valve is not operating are shown (Figure 2). The compensating ports (Figure 2) provide for thermal expansion of the oil in the brake lines and the master cylinder.

When force is applied to the brake pedal, this force acts through the PRESSURE REGULATING SPRING

to shift the PRESSURE REGULATING SPOOL restricting the flow of oil at LAND "C" to build up pressure when there is no requirement for pressure to the power steering or other hydraulic device (Figure 3). As the pressure builds up, a small amount of oil flows through the ORIFICE and down through the passage inside the spool to the REACTION CHAMBER (Figure 3). At the same time, oil flows along a groove in the outside diameter of the MANUAL BRAKE ACTUATING SLEEVE into the chamber ahead of the MANUAL BRAKE ACTUATING SLEEVE (Figure 2). Flow to the area ahead of the MANUAL BRAKE ACTUATING SLEEVE moves the PRIMARY MASTER CYLINDER PISTON building up pressure in the PRIMARY SECTION which, in turn, moves the SECONDARY PISTON, building pressure in the SECONDARY SECTION. Pressure in the REACTION CHAMBER moves the SPOOL back a small amount against the PRESSURE REGULATING SPRING, and when the hydraulic pressure balances against the PRESSURE REGULATING SPRING the pressure is controlled to the MAS-

Schematic of Brake Valve in Neutral

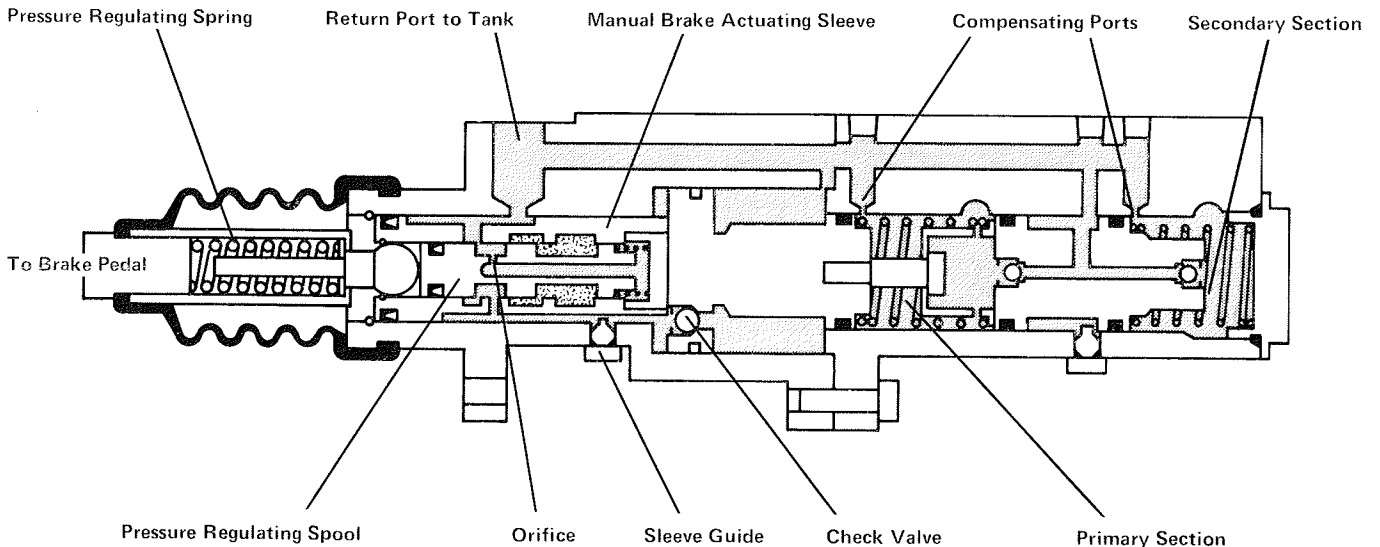
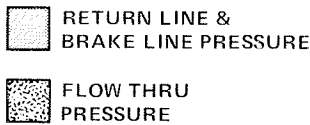


FIGURE 2

Brake Valve Actuated – Power Steering in Neutral





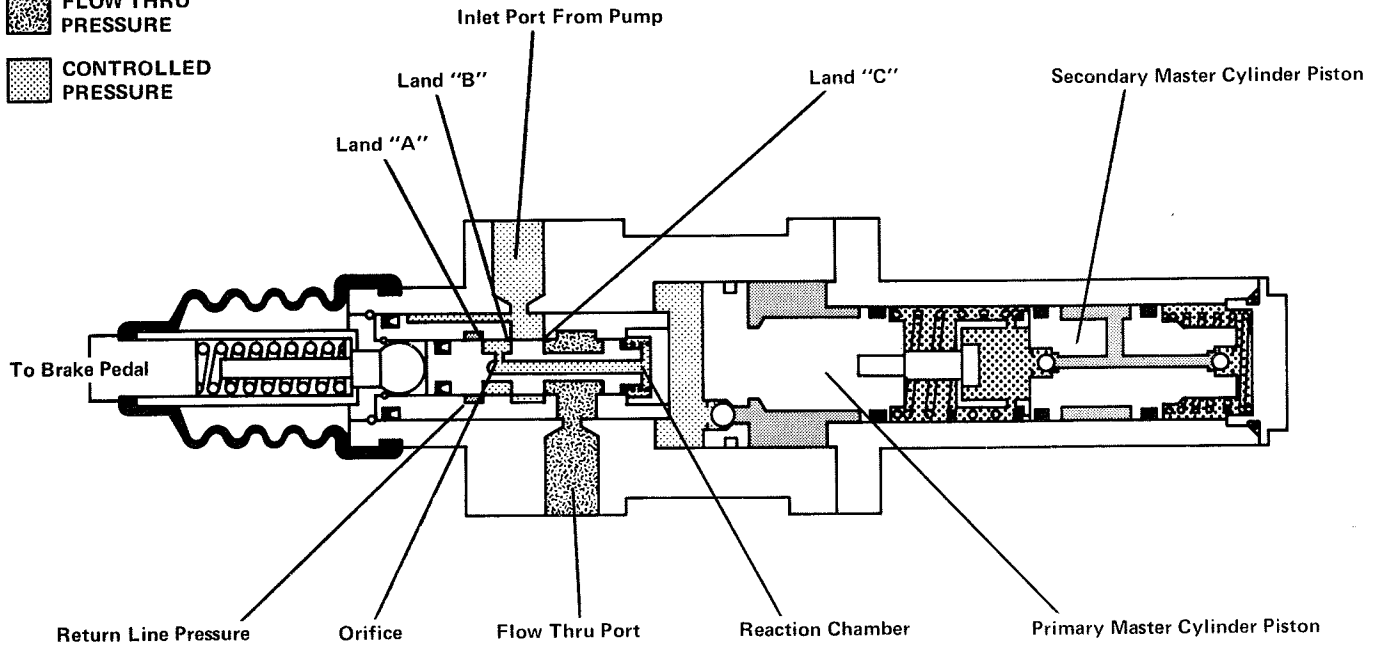
-  RETURN LINE PRESSURE
-  BRAKE LINE PRESSURE
-  FLOW THRU PRESSURE
-  CONTROLLED PRESSURE

FIGURE 3



Hydraulic System Pressure Equal to Brake Line Pressure




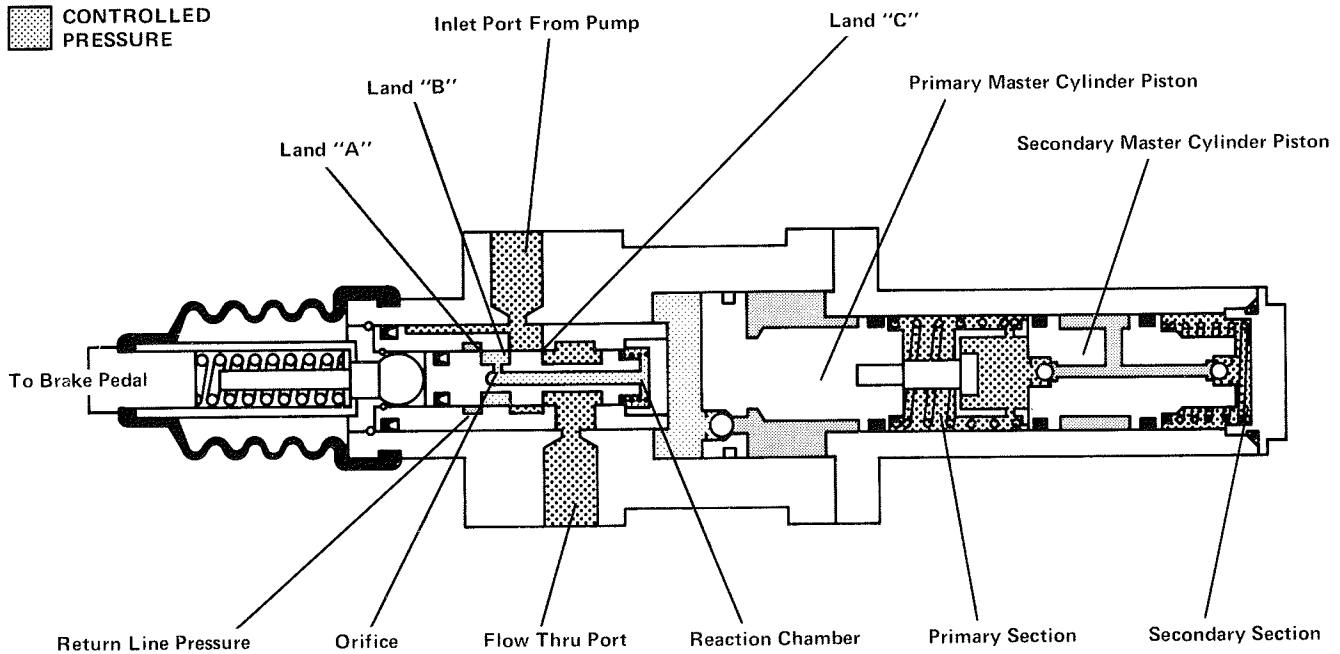
-  RETURN LINE PRESSURE
-  BRAKE LINE PRESSURE
-  CONTROLLED PRESSURE

FIGURE 4



Schematic of Brake Valve in Manual Operation

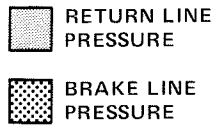
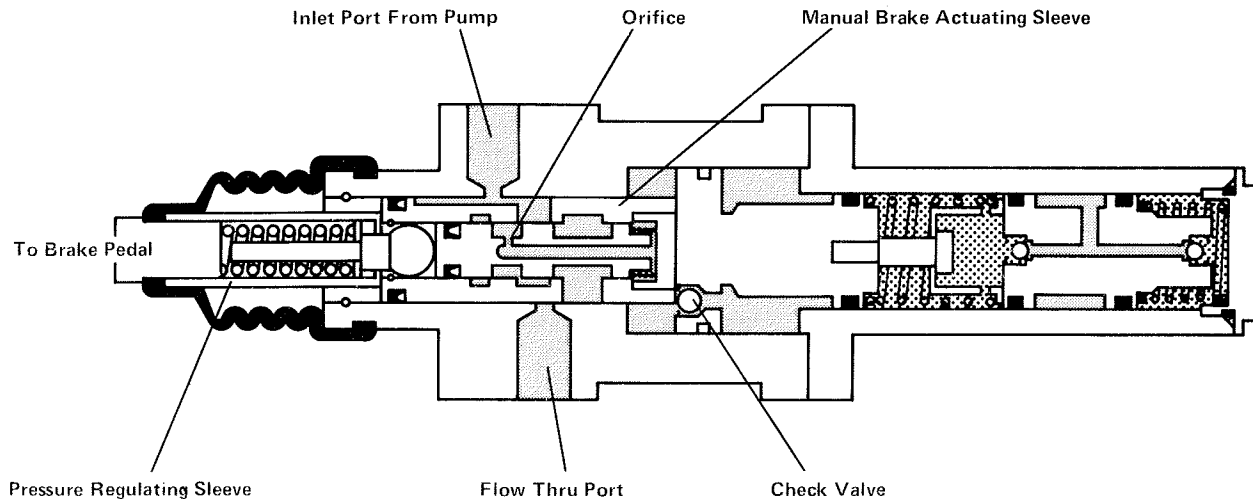


FIGURE 5



TER CYLINDER. The ORIFICE controls the rate of flow to the REACTION CHAMBER; hence, the rate of pressure increase and stability of the pressure regulating spool is controlled. Therefore, system efficiency is maintained since the power brake valve does not momentarily take all of the fluid from the pump. When the pedal effort is released, the spring in the REACTION CHAMBER returns the pressure regulating spool to neutral. This closes LAND "B" to pressure and opens LAND "A" which allows the oil ahead of the spool in the REACTION CHAMBER to flow to the return port as well as the oil ahead of the MANUAL BRAKE ACTUATING SLEEVE. The spring in the SECONDARY SECTION of the MASTER CYLINDER returns the MASTER CYLINDER PISTONS.

In case the downstream power hydraulic system requires a pressure that is equal to or greater than one-half the brake line pressure, the PRESSURE REGULATING SPOOL shifts a minute amount and the pressure is regulated across LAND "A" and LAND "B" (Figure 4).

If the pressure required by the brake valve is lower than that required by the power steering, the power steering will not normally interfere

with the operation of the brake (Figure 4).

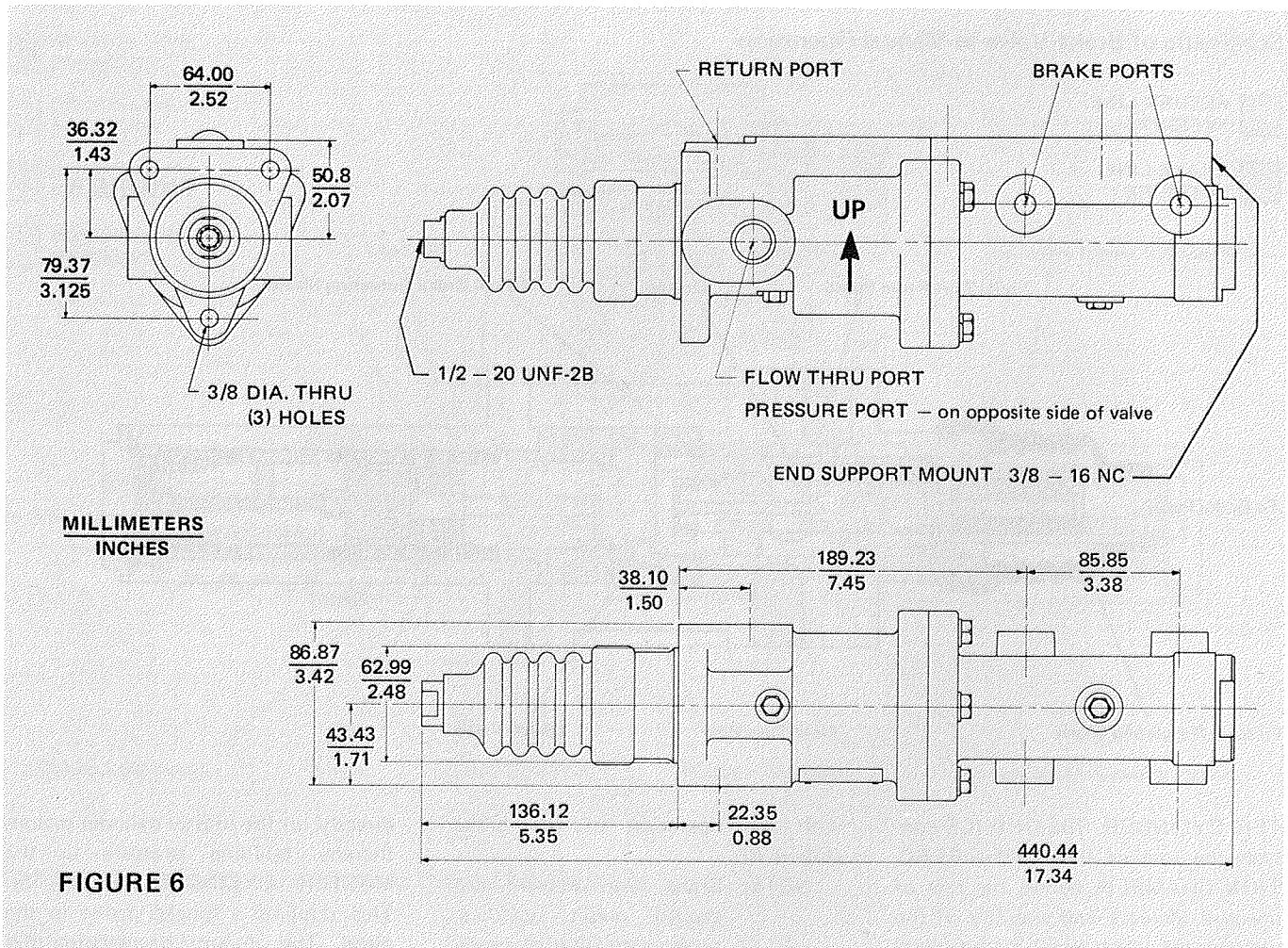
NOTE: Brake line pressure can exceed preset specifications in the unusual condition of a simultaneous brake application and sudden elevation of the steering pressure above that value.

In the standard MICO Open Center Valve, the pressure in the REACTION CHAMBER and ahead of the PRIMARY MASTER CYLINDER PISTON is equal to one-half of the brake line pressure. To accomplish this, the area of the PRIMARY MASTER CYLINDER PISTON is twice the area of the MASTER CYLINDER. Therefore, any pressure that is applied to the MASTER CYLINDER PISTON will be multiplied by two to determine the master cylinder pressure. The pressure regulating spring can be factory set to normally limit brake line pressure regardless of system pressure.

This valve will act as a manual brake master cylinder, in the event of failure in the hydraulic circuit supplying power to it. The PRESSURE REGULATING SLEEVE contacts the MANUAL BRAKE ACTUATING SLEEVE which, in turn, pushes

directly on the master cylinder piston, thereby building pressure in the MASTER CYLINDER (Figure 5). This requires a longer stroke in the pedal. The amount of pressure that can be generated in the brake lines in manual operation is proportional to the pedal ratio and the effort which the operator is able to exert on the pedal. In most cases, the operator is not able to build as much pressure in the brake line as can be done in power operations. The ports from the pump are restricted when the valve is actuated manually; however, as soon as the engine is started, hydraulic pressure will push the MANUAL BRAKE ACTUATING SLEEVE back against the retaining ring which contains it and the valve again functions with power. This is rather an abrupt action when the engine is started, causing the brake pedal to return to its power mode position, and it is suggested that the brakes not be applied manually when starting the engine.

If a failure should occur in either the PRIMARY or SECONDARY SECTION of the MASTER CYLINDER due to a brake malfunction, the failed piston will immediately bottom out and allow the other portion of the MASTER CYLINDER to function normally.



MILLIMETERS
INCHES

FIGURE 6

SPECIFICATIONS CHART

Part Number	Brake Ports	Pressure Port	Flow Thru Port	Return Port	Brake Line Pressure
06-460-510	1/2-20 UNF	7/8-14 UNF-SAE No. 10	7/8-14 UNF-SAE No. 10	7/8-14 UNF-SAE No. 10	1500 PSI \pm 50 PSI

INSTALLATION INSTRUCTIONS

NOTE: This unit does not include an internal residual check valve. If such a device is necessary for your application, it should be installed externally, inline.

1. Mount MICO Dual Open Center Power Brake Valve on vehicle and complete push rod and pedal hook-up. NOTE: It is important that the system reservoir be mounted above the brake valve, or that the return line have a vertical drain spout section of one foot directly above the valve.
2. The pedal assembly must have its own return spring. DO NOT rely on the internal spring in the valve for this function.
3. Pedal should be adjusted to allow 1/32" clearance between pressure regulating rod and actuator.
4. Bleed system (see bleeding instructions on page 10).
5. Be sure all hydraulic fittings are tight and visually check system for leaks with power applied.

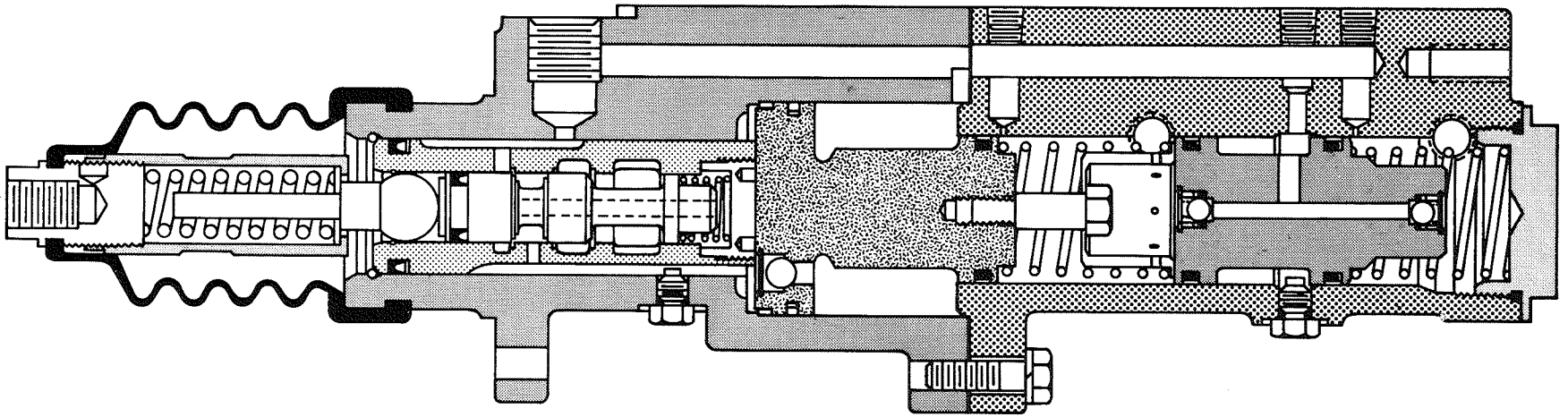


FIGURE 7

Disassembly

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

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

2. Remove end cap (item 41) from housing-2 (item 19).

CAUTION: End cap is under tension of spring (item 39).

3. Remove spring (item 39) from housing-2 (item 19).
4. Separate housing-1 (item 11) and housing-2 (item 19) by removing lockwashers (item 22) and bolts (item 23). Remove gasket (item 14).
5. Remove plug (item 21) from housing-2 (item 19) and o-ring (item 20) from plug.
6. Remove piston (item 31) from housing-2 (item 19).
7. Remove ring seals (items 24 & 38) and o-rings (items 25 & 37) from piston (item 31).
8. Remove snap ring (item 26), cage (item 27), tapered spring (item 28), ball (item 29), and o-ring (item 30) from piston (item 31).
9. Repeat step 8 for items 32 thru 36.
10. Remove piston assembly (item 16) from housing-1 (item 11).
11. Remove piston ring (item 15), ring seal (item 18) and o-ring (item 17) from piston assembly (item 16).
12. Remove plug (item 13) from housing-1 (item 11) and o-ring (item 12) from plug.
13. Remove retaining ring (item 8) from housing-1 (item 11).
14. Remove sleeve assembly (item 10) by pulling on push rod (item 4). Remove cup (item 9) from sleeve assembly.
15. Remove retaining ring (item 3) carefully with a small flat tool. Do not scratch bore of sleeve assembly (item 10).

16. Remove push rod (item 4), spool (item 6) and spring (item 7) from sleeve assembly (item 10). Remove cup (item 5) from spool (item 6).

Assembly

1. Install new cup (item 9) on sleeve (item 10) and new cup (item 5) on spool (item 6).

CAUTION: Lips on cups (items 5 & 9) should be away from ends of spool (item 6) and sleeve (item 10).

2. Place spring (item 7) in sleeve assembly (item 10).
3. Install spool (item 6) in sleeve assembly (item 10). Note direction of spool.
4. Install push rod (item 4) in sleeve assembly (item 10) and secure it with new retaining ring (item 3).
5. Install new o-ring (item 12) on plug (item 13) and install in housing-1 (item 11).
6. Carefully install sleeve assembly (item 10) into housing-1 (item 11).

CAUTION: Make sure that groove on sleeve will engage plug (item 13).

- Install retaining ring (item 8).
7. Install new piston ring (item 15), new o-ring (item 17) and new ring seal (item 18) on piston assembly (item 16).
8. Install piston assembly (item 16) in housing-1 (item 11). Note direction of piston assembly.
9. Install new o-ring (item 30), ball (item 29), tapered spring (item 28), cage (item 27) and new snap ring (item 26) in piston (item 31). Make sure small end of tapered spring (item 28) is against ball (item 29).
10. Repeat step 9 for items 32 thru 36.
11. Install new o-rings (items 25 & 37) and new ring seals (items 24 & 38) on piston (item 31).

12. Carefully install piston (item 31) into housing-2 (item 19). Note direction of piston.

CAUTION: Make sure that piston is installed far enough into housing bore so as to engage plug (item 21).

13. Install new o-ring (item 20) on plug (item 21) and install in housing-2 (item 19).
14. Place new gasket (item 14) on mounting face of housing-1 (item 11) and carefully assemble housing sections.

CAUTION: Care must be taken so as not to damage ring seal (item 18) during assembly of housing sections.

15. Install lockwashers (item 22) and bolts (item 23). Torque 16 to 18 ft. lbs.
16. Install spring (item 39) in housing-2 (item 19).
17. Install new o-ring (item 40) on end cap (item 41) and install in housing-2 (item 19).

● Items included in Repair Kit 06-459-021

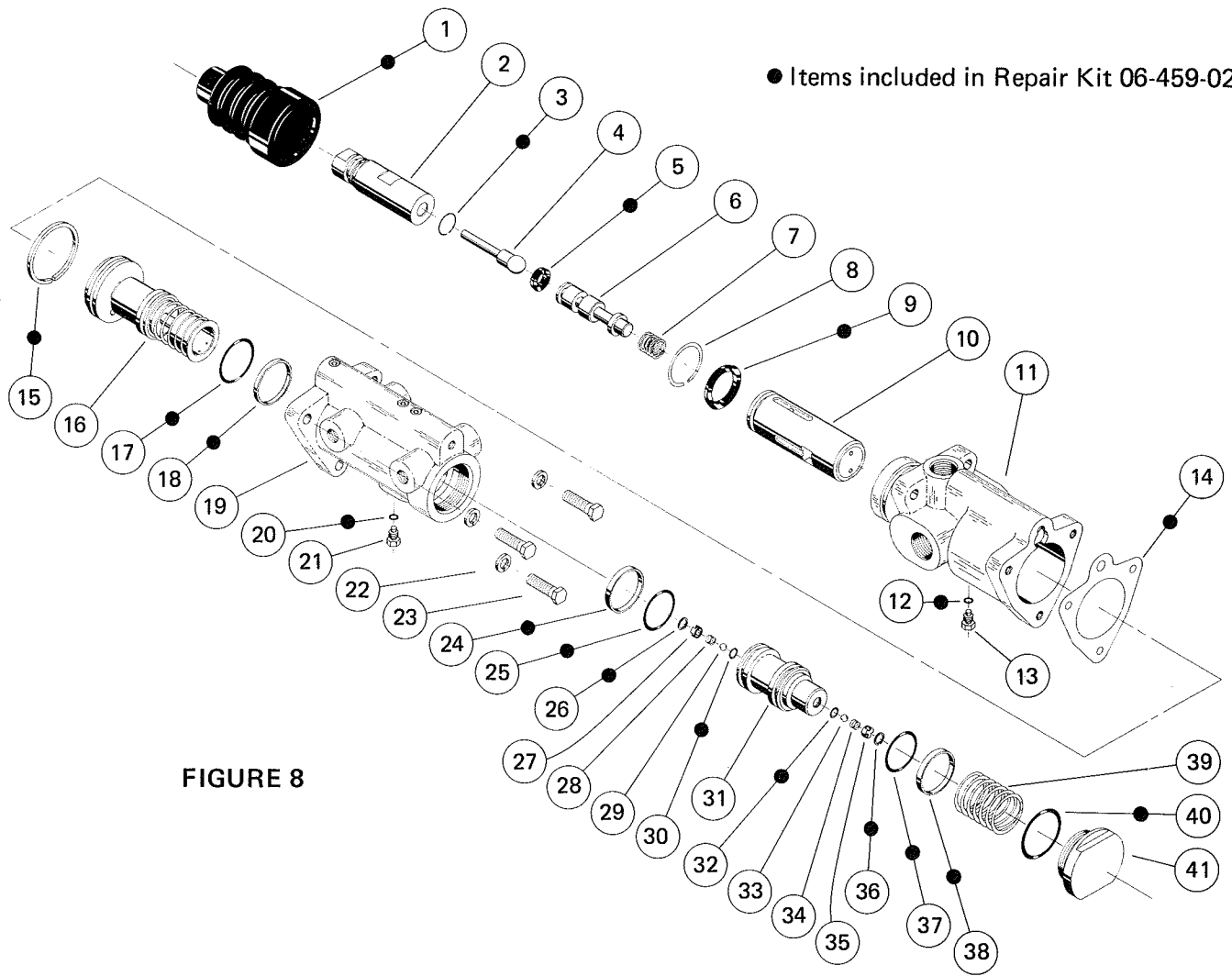


FIGURE 8

MODEL NO.
06-460-510

REPAIR KIT
06-459-021

PARTS LIST

ITEM DESCRIPTION

- 1 ● BOOT
- 2 PRESSURE REGULATING SPRING ASSEMBLY
- 3 ● RETAINING RING
- 4 PUSH ROD
- 5 ● CUP
- 6 SPOOL
- 7 SPRING
- 8 RETAINING RING
- 9 ● CUP
- 10 SLEEVE ASSEMBLY
- 11 HOUSING-1
- 12 ● O-RING
- 13 PLUG

ITEM DESCRIPTION

- 14 ● GASKET
- 15 ● PISTON RING
- 16 PISTON ASSEMBLY
- 17 ● O-RING
- 18 ● RING SEAL
- 19 HOUSING-2
- 20 ● O-RING
- 21 PLUG
- 22 LOCKWASHERS
- 23 BOLTS
- 24 ● RING SEAL
- 25 ● O-RING
- 26 ● SNAP RING
- 27 CAGE

ITEM DESCRIPTION

- 28 TAPERED SPRING
- 29 BALL
- 30 ● O-RING
- 31 PISTON
- 32 ● O-RING
- 33 BALL
- 34 TAPERED SPRING
- 35 CAGE
- 36 ● SNAP RING
- 37 ● O-RING
- 38 ● RING SEAL
- 39 SPRING
- 40 ● O-RING
- 41 END CAP

GENERAL SERVICE DIAGNOSIS

With Engine Off —

PEDAL GOES PARTIALLY OR COMPLETELY TO FLOOR

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

PEDAL IS FIRM BUT STOPS TOO NEAR FLOOR

1. Brakes out of adjustment
1. Adjust brakes
2. Defective 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 defective
2. Check brakes for wear or oily brakes

SPONGY PEDAL

1. Air in system
1. Bleed 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, vee 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

BLEEDING

The MICO Tandem 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: Make sure the machine is in a safe and controlled state before attempting any servicing including bleeding the brake system.

Manual and pressure bleeding are two methods of bleeding a brake system. MICO recommends using one of these two methods of bleeding the Tandem

Open Center Power Brake Valve and the rest of the brake system.

CAUTION: 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 9. Install a small BLEEDER BY-PASS LINE as shown. A 1/4" 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 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 250 PSI. IF NEEDED, USE A PRESSURE

REDUCING VALVE IN BLEEDER BY-PASS LINE.

4. DO NOT STEP ON THE BRAKE PEDAL DURING THIS BLEEDING PROCESS.
5. Oil will now be forced directly into the brake lines by the pump and fill the brake valve master cylinder cavities. 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 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. Now check for leaks.

