

## ***Hydraulic Brake Systems***

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Mondel Hydraulic Brake Systems Instruction Manual



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**Mondel**

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**Mondel**

## **Installation and Maintenance Instructions**

### **Hydraulic Brake Systems**

#### **SUPPLEMENTS FORMING PART OF THIS MANUAL:**

**DATE OF MANUFACTURE:**

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## **Chapter 1.0: Hydraulic Brake Warnings and Cautions**

**Read and Understand All Warnings And Cautions Printed In This Manual Before Commencing Installation, Adjustment Or Repair**

## **Chapter 5.0: INSTALLATION – Warnings and Cautions**

**Anyone involved in the installation or service of this brake must have:**

- Received specific training.
- Had experience on similar equipment.
- Knowledge of the equipment on which the brake is installed.
- The ability to understand the terminology.
- The ability to understand the diagrams.

**Do not proceed unless technically qualified for the work involved.**

**To avoid introducing contaminants into the system during installation, keep all hose, tube ends, fittings and cylinder ports plugged until just prior to connecting.**

## **Chapter 6.0: FILLING AND BLEEDING - Warnings and Cautions**

**Loss of braking ability can cause injury, death or property damage. Brake fluid on the braking surfaces will cause the brakes to slip. Keep the brake surfaces free of hydraulic fluids.**

## **Chapter 10.0: REPLENISHING FLUID LEVEL – Warnings and Cautions**

**Use only the specified brake fluid to replenish the reservoir. Take care to ensure that spills or leaks are contained or prevented from causing a hazard if the fluid drops beyond the range of easy clean-up.**

## **Chapter 2.0: General Description**

- 2.1: A typical manual hydraulic brake system is illustrated in Fig. 1. The system shown is a single brake, single station type, with remote electric bleed.
- 2.2: Both drum and disc brakes are controlled in a similar manner and use the same hydraulic components.
- 2.3: Operational circuit arrangements covered in this document include:
  - 2.3.(a):** Single brake, single station, with manual bleed. See Fig. 3.
  - 2.3.(b):** Single brake, single station, with remote electric bleed. See Fig. 4.
  - 2.3.(c):** Two brakes, single station, with manual bleed. See Fig. 5.
  - 2.3.(d):** Two brakes, single station, with remote electric bleed. See Fig. 6.
  - 2.3.(e):** Single brake, two stations, with remote electric bleed. See Fig. 7.
  - 2.3.(f):** Two brakes, two stations, with remote electric bleed. See Fig. 8.
- 2.4: Each installation kit includes the components, tubing, and miscellaneous hardware required to complete a normal installation. The slave cylinder is supplied as part of the brake(s) and is only referred to in this bulletin for explanation of the complete hydraulic brake system. For detailed information on the brake(s) see the appropriate bulletin for the brake(s).
- 2.5: All systems are designed primarily for brakes as applied to cranes but can be applied in other applications.
- 2.6: Hydraulic pressure to apply the brake(s) is developed by a pedal operated master cylinder. Force applied to the pedal is converted to hydraulic pressure by the master cylinder.
- 2.7: The hydraulic pressure is transmitted, via the interconnecting hydraulic lines, to each slave cylinder, which in turn, applies the brake(s). The pressure developed by the master cylinder is proportional to the force applied to the pedal. The design of the master cylinder provides a sensitive control, which is infinitely variable between zero force and maximum force as determined by the operator.
- 2.8: The means to purge the hydraulic system of aerated fluid during the initial installation and for regular maintenance or overhauls is required and is referred to as "BLEEDING". Manual bleeding is standard as shown in Fig. 3 and 5.
- 2.9: The remote electric bleed option permits quick, easy bleeding of each branch of the system by one person, usually the operator. Typical brake control systems with remote electric bleed are shown in Fig. 4, 6, 7 and 8.

**Figure 1**

**Manual Hydraulic System  
Single Brake, Single-Station System with Remote Electric Brake**

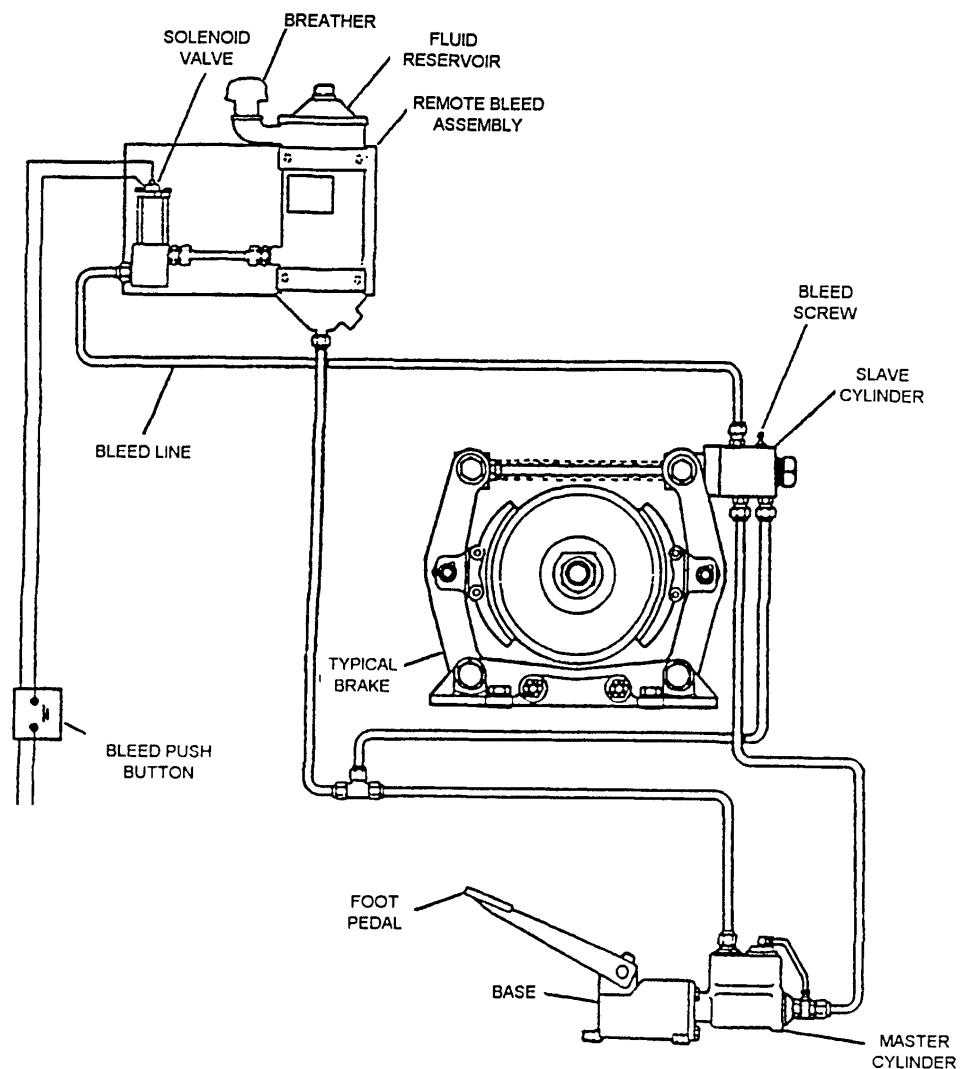


Figure 3

Single Brake, Single Station System with Manual Bleed

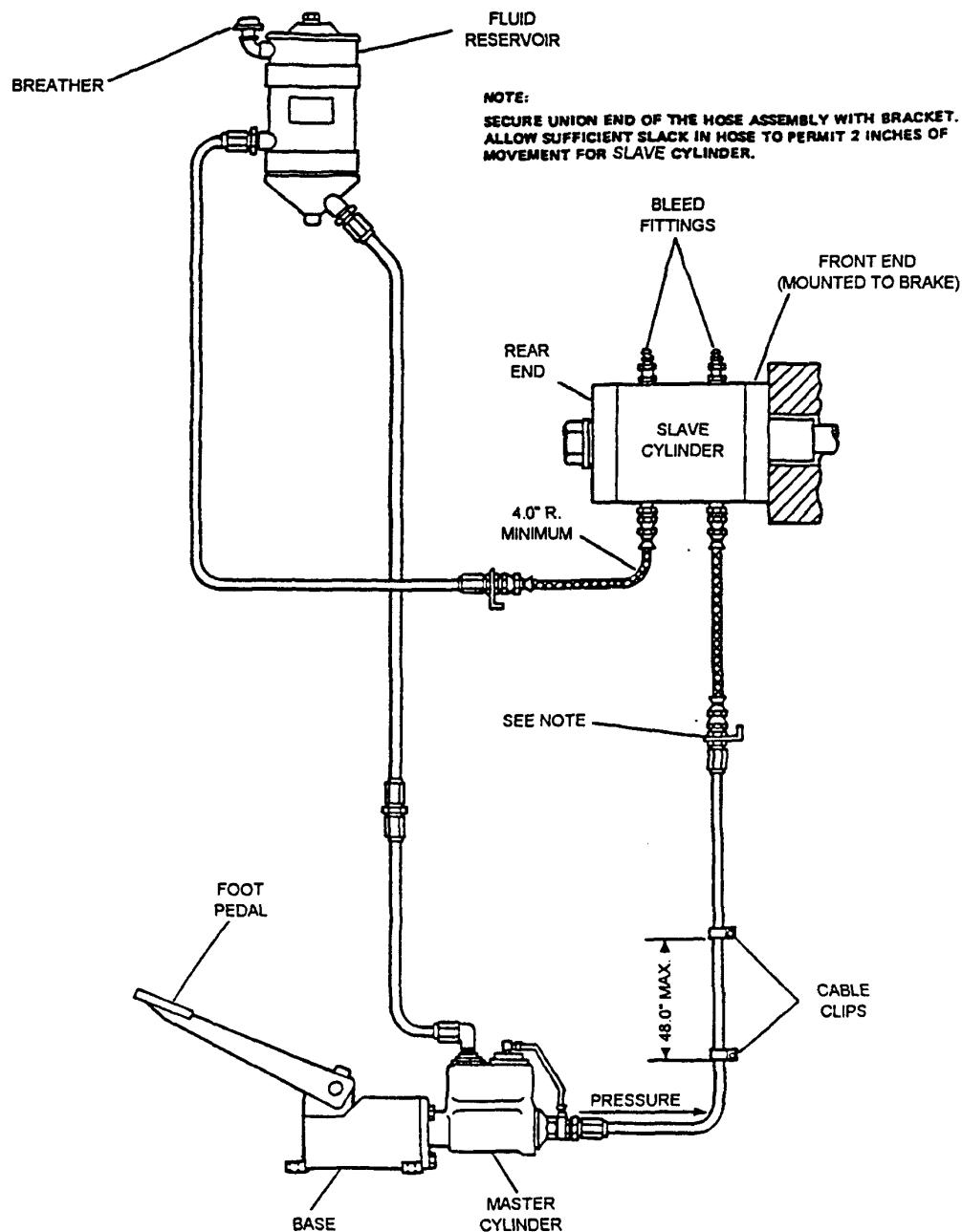
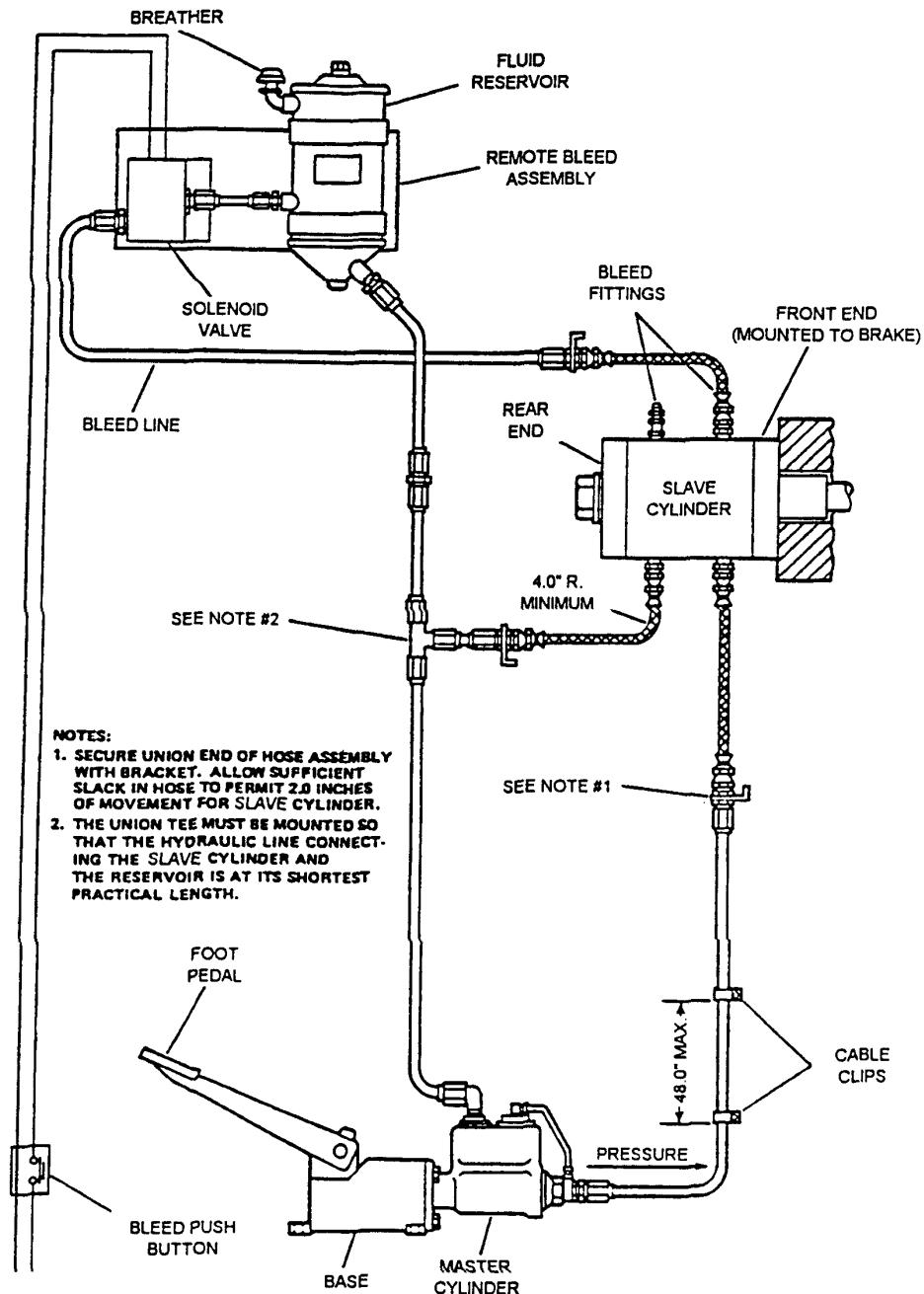
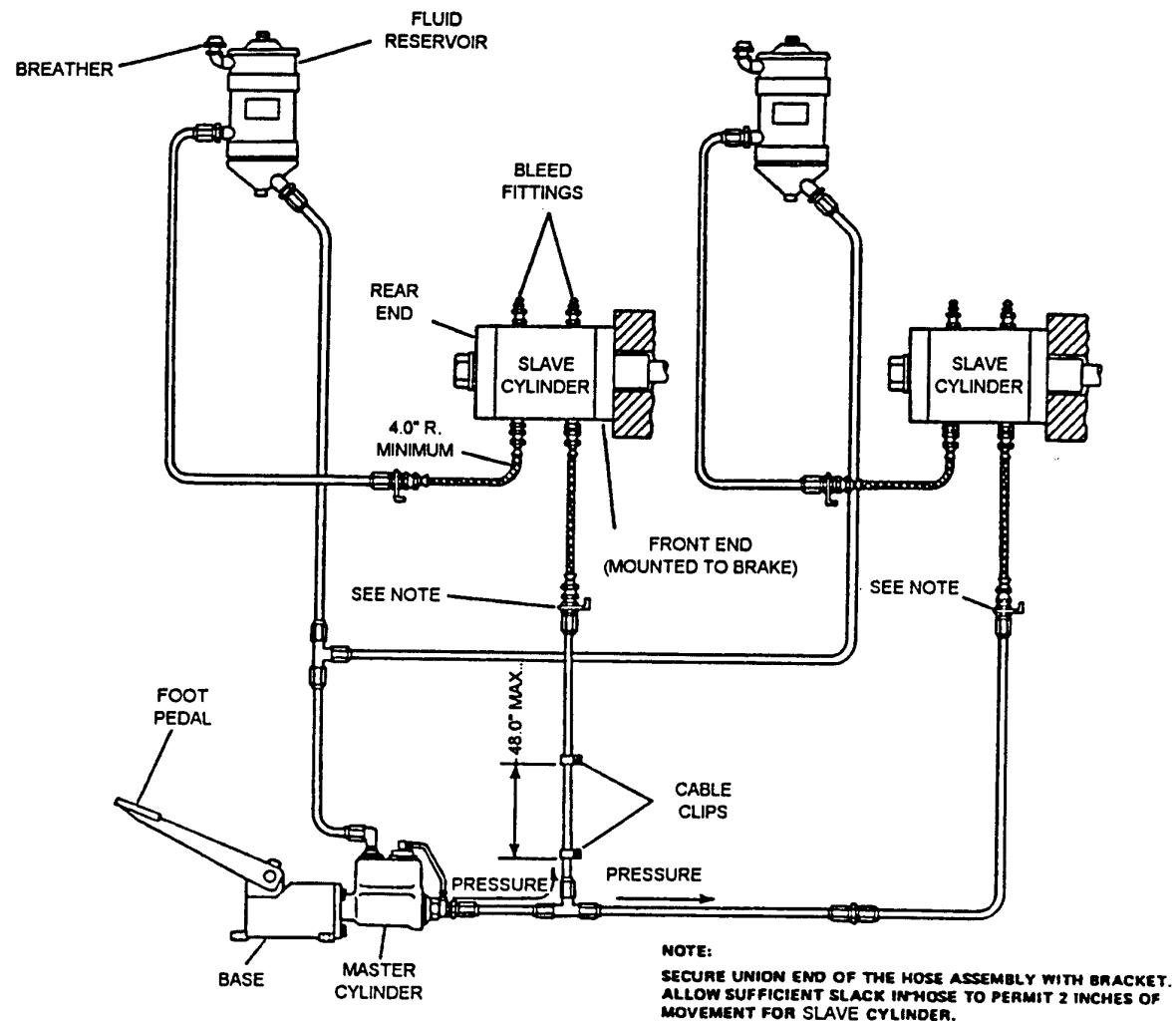


Figure 4

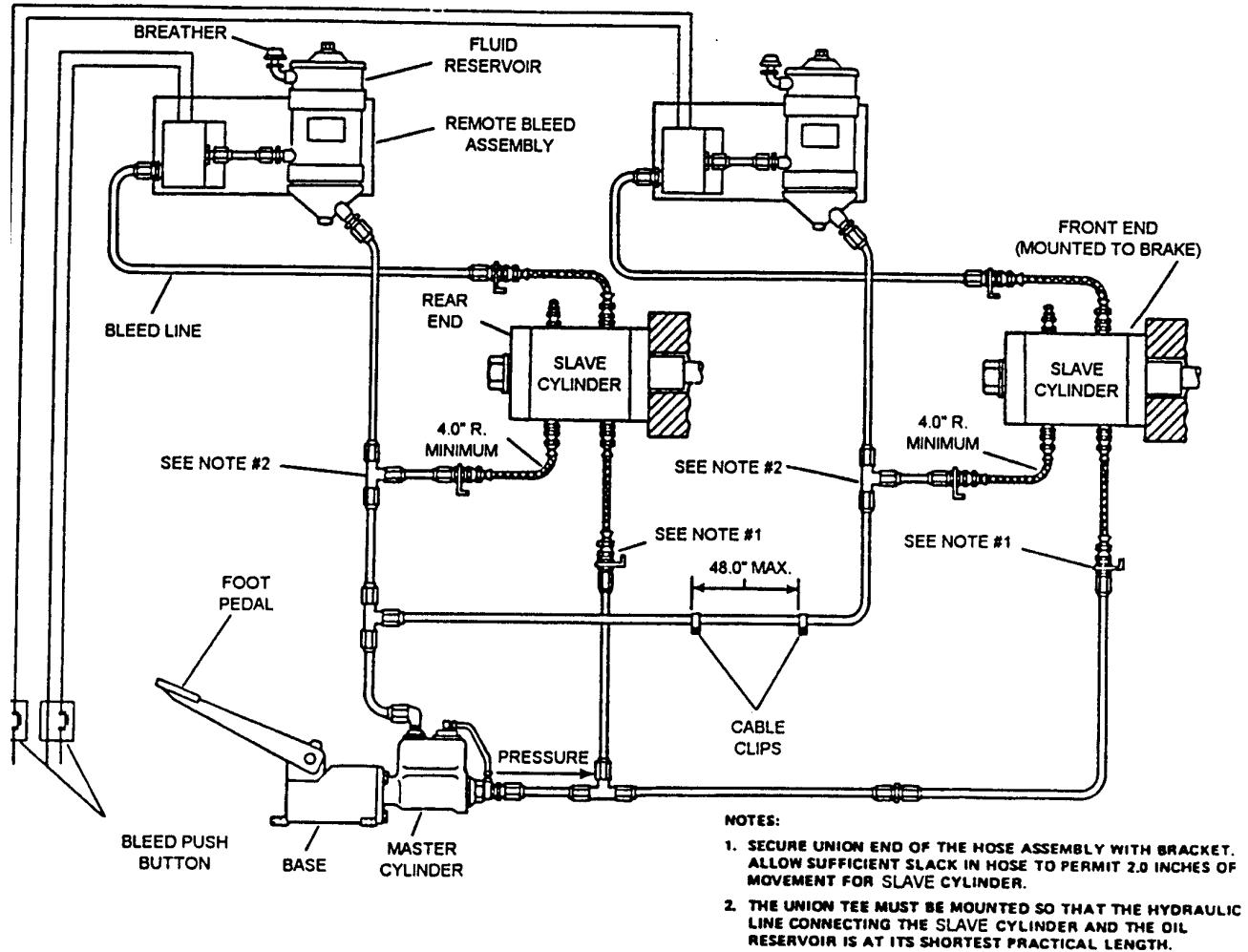
Single Brake, Single Station System with Remote Electric Bleed



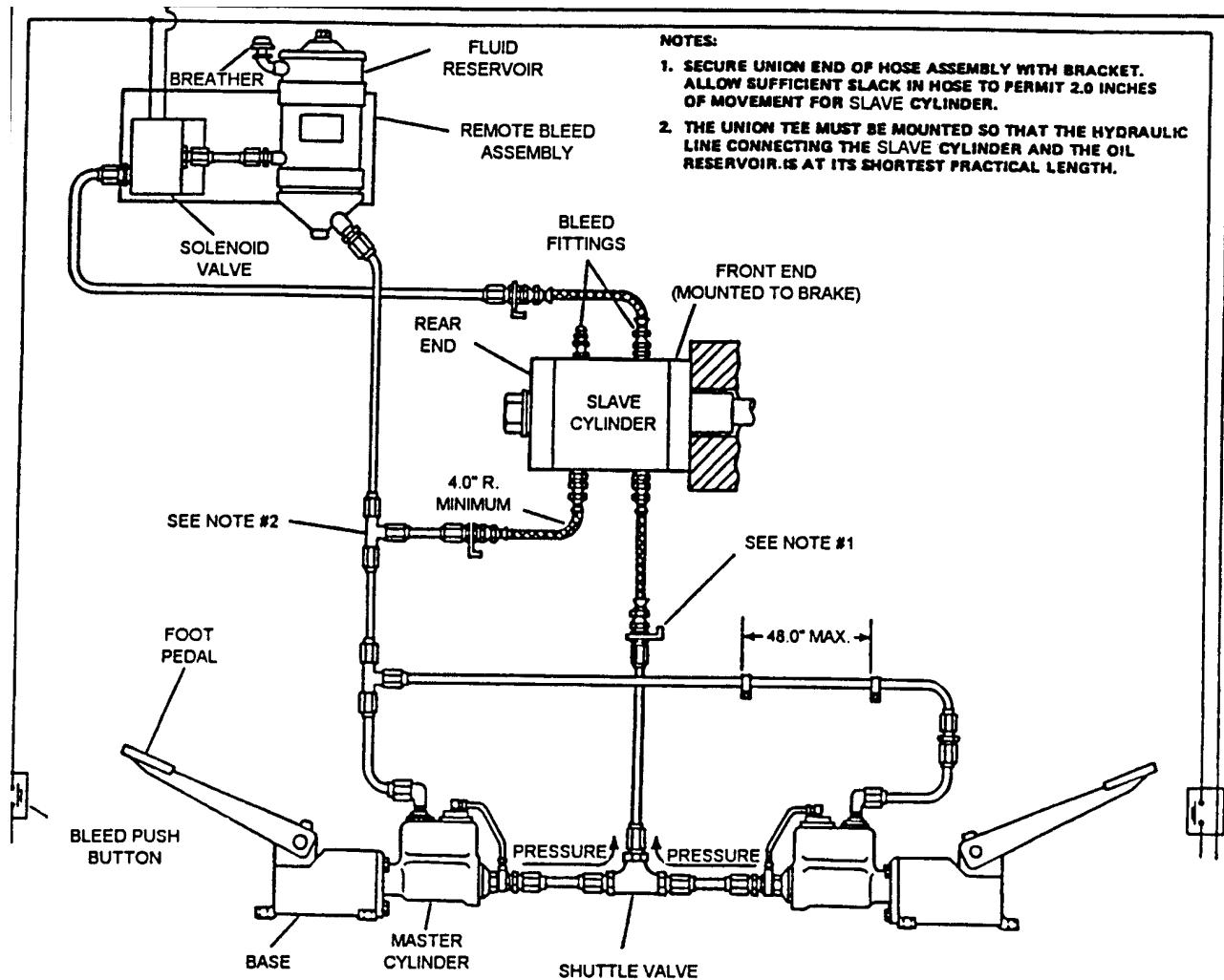
**Figure 5**  
**2 Brakes, Single Station System with Manual Bleed**



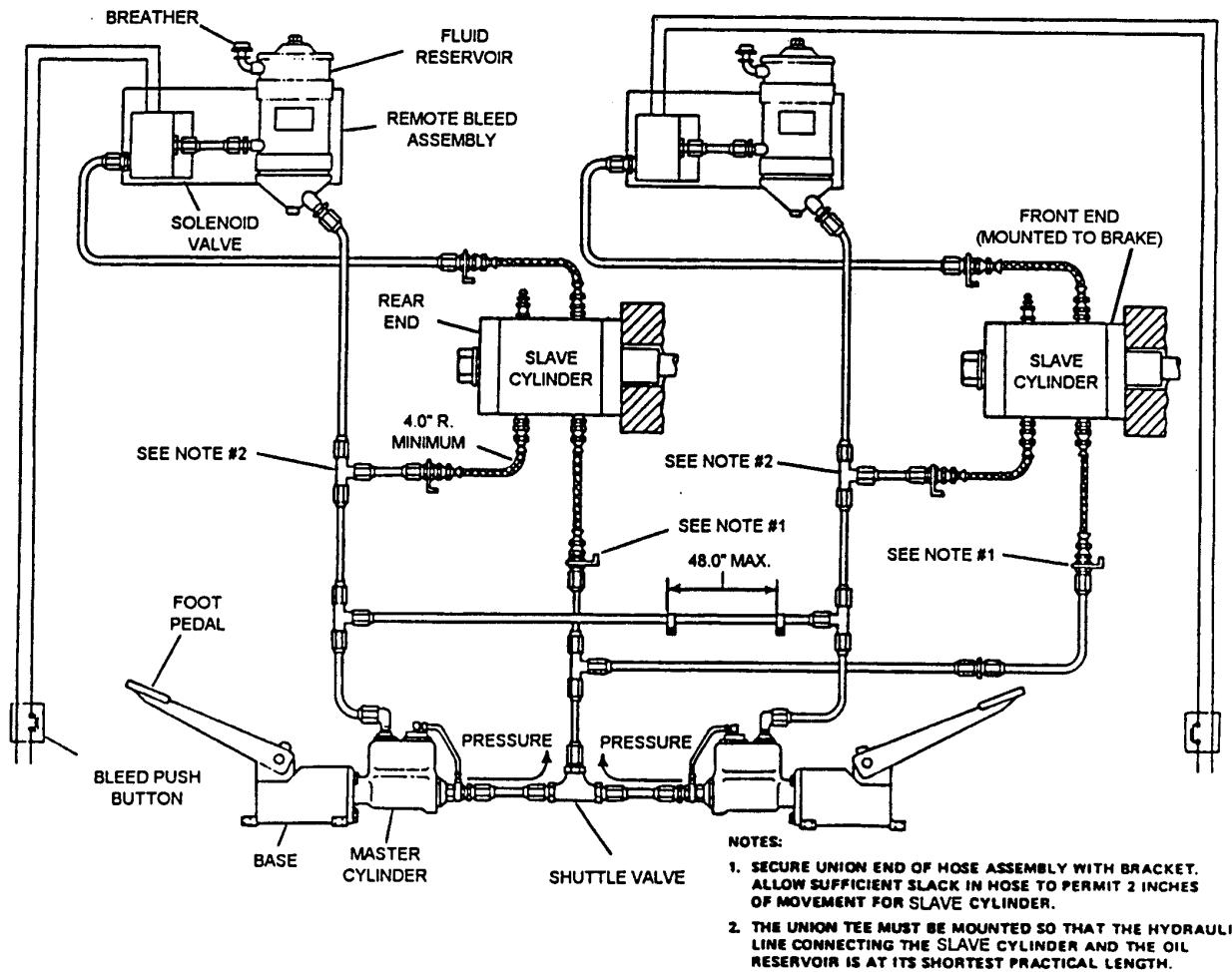
**Figure 6**  
**2 Brakes, Single Station System with Remote Electric Bleed**



**Figure 7**  
**Single Brake, Two Station System with Remote Electric Bleed**



**Figure 8**  
**Two Brakes, Two Station System with Remote Electric Bleed**



### **Chapter 3.0: Application Limits**

3.1: The Mondel manual hydraulic brake system has the following application limits:

**3.1.(a):** The maximum length of pressurized tubing one way from master cylinder to slave cylinder must not exceed 150 feet (45 meters).

**3.1.(b):** In a two brake, single station system the maximum length of pressurized tubing one way from master cylinder to each slave cylinder must not exceed 150 feet (45 meters).

**3.1.(c):** Unless authorized by Magnetek the maximum brake size for a manually operated, single brake, single brake system is one AISE 19" dia. shoe brake, or one AISE 24" dia. disc brake.

**3.1.(d):** Unless authorized by Magnetek the maximum brake size for a manually operated, two brake, single brake system is two AISE 16" dia. shoe brakes or two AISE 21" dia. disc brakes.

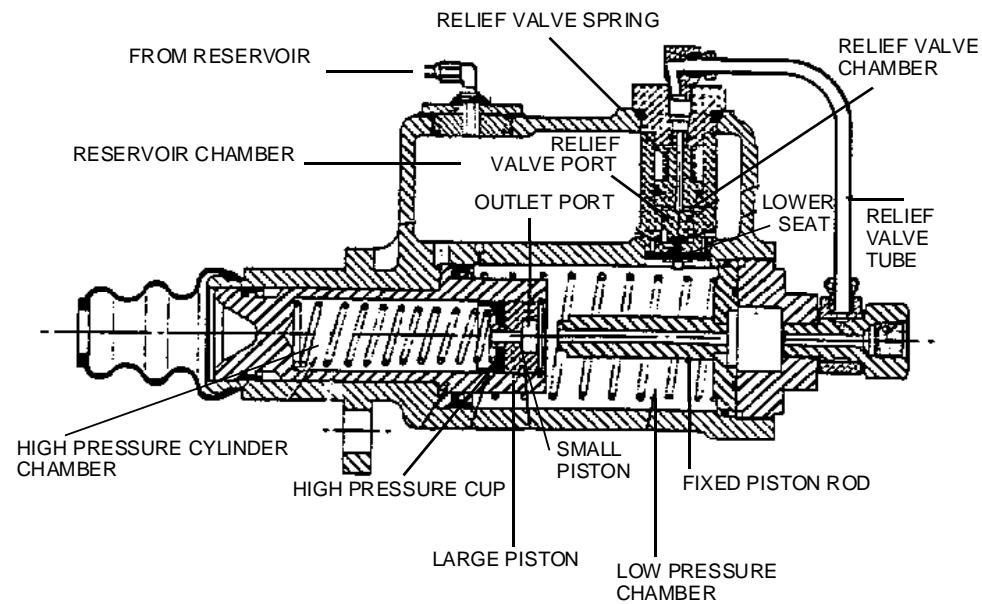
**3.1.(e):** Consult Magnetek for "BRAKETRONIC" systems for arrangements other than described in paragraphs 3.1.(c) and 3.1.(d).

3.2: To ensure compatibility with seals, boots and other critical components – use DOT 4 or equivalent fluid.

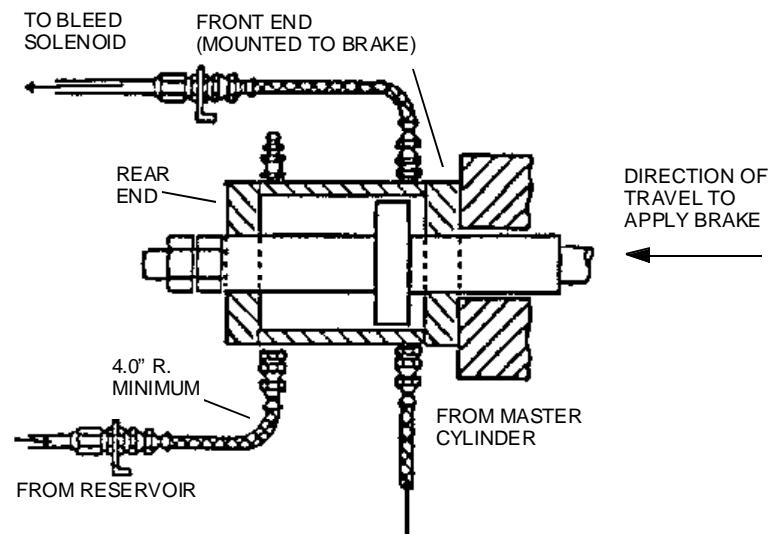
## **Chapter 4.0: Major Elements**

- 4.1: **MASTER CYLINDER ASSEMBLY:** The complete assembly consists of the master cylinder, a foot pedal, a mounting base, and the operating linkage. The pedal and the shaft on which it is mounted are splined allowing some measure of adjustment to suit the operator.
- 4.1.(a):** The master cylinder is a two-stage unit, containing a large diameter piston and a smaller diameter piston. See Fig. 2a. The large diameter piston displaces a substantial volume of fluid with a relatively small amount of foot pedal travel. This large volume of fluid is forced out through the passage in the fixed piston rod to the slave cylinder and quickly moves the shoes or pads into contact with the wheel or disc. Resistance to further travel causes the system pressure to increase as determined by the force that the operator applies to the pedal.
- 4.1.(b):** At a predetermined pressure, the relief valve lifts off its lower seat, venting the low-pressure chamber into the reservoir chamber. The high-pressure cup flares out and seals against the walls of the high-pressure cylinder chamber. The small piston is now against the end of the fixed piston rod, and continued movement of the large piston effectively shortens the length of the high-pressure cylinder chamber.
- 4.1.(c):** Pressure in this chamber increases as volume decreases, and is transmitted through the fixed piston rod passage and out to the slave cylinder. Due to the smaller area of the piston, the pressure developed with a given amount of foot pedal force is much greater than the pressure developed by the large piston.
- 4.1.(d):** In summary, the large diameter piston rapidly moves the brake shoes or pads into contact with the brake wheel or disc while using minimum pedal travel. The small piston develops high pressure for positive braking.
- 4.2: **SLAVE CYLINDER(S):** The slave cylinder on each brake provides the mechanical force from which the braking torque is obtained.
- 4.2.(a):** The slave cylinder, and inter-connecting hoses are normally supplied as part of the brake(s). The slave cylinder kit includes the hose assembly brackets and the manual bleed nipples.

**Figure 2A**  
**Master Cylinder (Typical)**



**Figure 2B**  
**Slave Cylinder (Typical)**



**4.2.(b):** For mechanical reasons the slave cylinders are double acting, although operating pressure is only applied at the front side of the cylinder (nearest the brake). Provision is made in both the manual and remote electric bleed systems to maintain the rear end of each slave cylinder filled with fluid. This ensures lubrication and that contaminant and corrosive atmosphere do not enter the cylinder when the piston retracts. The fluid for this purpose is taken from the supply line connecting from the reservoirs to the master cylinder.

**4.2.(c):** To aid in understanding the hydraulic operation a sketch of a typical slave cylinder is shown in Fig. 2B.

**4.2.(d):** During operation, fluid under pressure is supplied by the master cylinder and transmitted to each slave cylinder. The force resulting from the hydraulic pressure applied to the effective piston area results in a brake torque predetermined for the application. The resulting brake effort is therefore proportional to the pedal force applied.

**4.2.(e):** A means to bleed or purge the pressure applied circuit of aerated or contaminated fluid, requires porting on the slave cylinder to allow the fluid under pressure to pass through the slave cylinder through a local bleed screw, or be connected to a solenoid valve when the optional remote electric bleed valve is fitted.

**4.2.(f):** In order to force fluid through the entire pressure circuit and to ensure all air is forced out of the cylinder, the bleed ports must always be installed at the uppermost side of the slave cylinder.

4.3: **MANUAL BLEED:** Is supplied unless the remote electric bleed option is specifically ordered.

**4.3.(a):** The manual bleed reservoir(s) must be located as high as practical, always at a higher elevation than the master cylinder. To simplify bleeding, the reservoir should also be located at a higher elevation than any slave cylinders.

**4.3.(b):** Both bleed nipples must be mounted on the highest ports on each slave cylinder. The bleed nipple closest to the brake serves the working pressure circuit while the outer bleed nipple is used to bleed the rear (non-active) side of the cylinder. Note that the outer bleed nipple is common to both the manual and remote electric bleed options.

4.4: **REMOTE ELECTRIC BLEED (OPTIONAL):** Consists of fluid reservoir(s), solenoid-operated valve(s) and push button to operate each valve.

**4.4.(a):** Each reservoir and its related solenoid-valve are self contained on a common panel, which must be located at an elevation higher than the slave cylinder it serves and also at a higher elevation than the master cylinder.

**4.4.(b):** The "BLEED" push button(s) should be installed convenient to the operator while able to actuate the master cylinder pedal.

**4.4.(c):** Pressing a "BLEED" push button, energizes the coil in the related solenoid valve, causing the normally closed valve to open, allowing passage of fluid under pressure from the master cylinder through the valve to the reservoir.

**4.4.(d):** While the solenoid is energized and the valve open, stepping on the master cylinder pedal forces fluid through the valve to the reservoir, but only on the down stroke. If the pedal is released while the valve is open, the pedal return spring will cause the master cylinder to draw aerated fluid back through the solenoid valve. **This can be prevented by releasing the push button before allowing the pedal to return.**

**4.4.(e):** Releasing the “BLEED” push button de-energizes the solenoid valve coil allowing the valve to close. Providing all pockets of air and aerated fluid have been purged from the pressurized parts of the hydraulic circuit, pressing the master cylinder then develops pressure in the slave cylinder to apply the brake.

**4.4.(f):** Aerated fluid will settle out while in the reservoir and the tiny bubbles of air will come to the surface and be vented through the reservoir breather.

## **Chapter 5.0: Installation**

- 5.1: Install each brake, which comes from the factory, with its slave cylinder already installed. To aid in understanding the operation, a sectioned sketch of a typical slave cylinder is shown in Fig. 2B.

**5.1.(a):** Detailed installation instructions for the particular brake and its slave cylinder are supplied with each brake and are not covered in this manual.

- 5.2: The master cylinder assembly must be securely mounted in a location convenient to the operator.

**5.2.(a):** If required the angle of the pedal can be adjusted as follows:

**5.2.(a).(i):** Remove the snap ring retaining the foot pedal on the splined shaft.

**5.2.(a).(ii):** Remove the foot pedal and re-install it on the splined shaft at the desired angle. Replace the snap ring and ensure that the necessary pedal stroke is available. Note that the foot pedal may be mounted on either side of the base.

- 5.3: In the MANUAL BLEED SYSTEM, the reservoir must be mounted in a vertical position, with the breather at the top.

**5.3.(a):** It must also be located at a higher elevation than the master cylinder with as short a run length as practical to ensure the inlet port is kept charged with fluid.

**5.3.(b):** The bottom of the reservoir must always be above the level of its related slave cylinder to ensure that the rear end of the slave cylinder remains filled with fluid.

- 5.4: With the (OPTIONAL) REMOTE ELECTRIC BLEED SYSTEM, each reservoir and its related solenoid valve are pre-assembled on a sub-panel.

**5.4.(a):** Within each sub-panel the outlet port of the solenoid valve is connected to the reservoir.

**5.4.(b):** Install each sub-panel as near as practical to its associated brake. The reservoir must be vertical, at the highest point in the hydraulic system, and with the breather at the top. The bottom of the reservoir must be above the elevation of its related slave cylinder to ensure that the rear end of the cylinder remains filled with fluid.

**5.4.(c):** Where two reservoirs are required, they must be installed at the same elevation, otherwise fluid may overflow at the lower one.

**5.4.(d):** Where two reservoirs are required, the master cylinder supply line from each reservoir, should be run to a centrally mounted "TEE" fitting and from there to the master cylinder. This is recommended to minimize fluid build-up in the reservoir closest to the brake being bled.

- 5.5: Install the remote electric "**bleed**" push button convenient to the operator, to permit operation of the "**bleed**" push button and the master cylinder in the required sequence.

**5.5.(a):** In systems with multiple brakes, a separate push button is required for each solenoid valve. Connect the push button and the related solenoid valve to a suitable supply, in accordance with local electrical codes. Verify the power to the solenoid valve.

- 5.6: Install the interconnecting tubing and hoses only when all brake system components are rigidly fixed in place.

**5.6.(a):** Keep all dust plugs and protective caps in place until immediately prior to making the connections at those points.

**5.6.(b):** Check all tubing, hoses, and fittings for the presence of foreign matter before installing them. If foreign matter is present, clean these components with compressed air and then flush with clean brake fluid of the type specified for use with the brake system.

**5.6.(c):** Check all tubing, hoses, and fittings for completeness and plan the routing as follows:

**5.6.(c).(i):** Use 371 flare JIC fittings at all connections.

**5.6.(c).(ii):** Installed tubing must be straight and must slope upward toward the slave cylinder(s) and reservoir(s). Use continuous lengths tubing where practical, with a minimum number of smooth, non-restrictive-bends. Avoid the use of elbows and unions if possible. Tubing must be routed in such a manner that coils do not exist anywhere. (Air pockets form in coils, making bleeding very difficult).

**5.6.(c).(iii):** Use tube unions only for splicing and where necessary to facilitate dismantling of the crane.

**5.6.(c).(iv):** Support tubing with suitable clips installed at uniform intervals of 48 inches (maximum).

**5.6.(c).(v):** When laying out the line between the master cylinder and the slave cylinder, leave sufficient slack in the flexible hose, at the brake, to allow for **2 inches** of movement at each slave cylinder.

**5.6.(c).(vi):** As noted in **Fig. 3 through 8**, the minimum bend radius for either hose at the slave cylinder is **4 inches**.

**5.6.(c).(vii):** All fittings must be tight to exclude air and prevent leakage, but must not be tightened to the point of distortion.

## **Chapter 6.0: Filling and Bleeding**

- 6.1: **FILLING THE SYSTEM:** Can begin after thoroughly checking the interconnecting tubing and hoses for conformity with the appropriate diagram, and checking that all fittings are intact, secured and that the system is free of contaminants.
- 6.1.(a):** Use only fluid meeting the requirement of Mondel as previously specified. Other fluids may not be compatible with the seals used within the system and may, cause rapid deterioration of critical components.
- 6.1.(b):** Remove the reservoir cover and fill to approximately 80% of its capacity with the specified fluid. Replace the reservoir cover. If the system is equipped with two reservoirs, fill both to the same 80% level.
- 6.2: **BLEEDING THE SYSTEM:** Is an operation required to purge the hydraulic system of compressible air pockets which can inhibit effective braking in single brake systems and cause unequal braking in multiple brake installations. The object of the cycle described is to force a slug of fluid under pressure through the circuit to each brake slave cylinder in order to purge the pressure lines of aerated fluid. If multiple brakes are operated from a single master cylinder bleeding or purging will not be complete until all brakes are bled in sequence.
- 6.3: To ensure only non-aerated fluid enters the pressurized portion of the hydraulic circuit, it is recommended to bleed the rear end of each slave cylinder where it branches off the master cylinder charging line as a first step.
- 6.4: The purpose of maintaining fluid in the rear of each slave cylinder is to ensure slave cylinder lubrication and prevent internal corrosion.
- 6.5: Refer to the hydraulic circuit for the actual installation Fig. 3 – 8, specifically the portion of the circuit between the reservoir and the master cylinder and particularly the branch to the rear end of each slave cylinder. Gravity will provide the necessary flow to accomplish bleeding this portion of the circuit.
- 6.5.(a):** The rear end of each slave cylinder can be filled and bled as follows:
- 6.5.(a).(i):** Slip the bleeder hose, over the bleed screw nipple at the rear end of the slave cylinder. Insert the other end of the hose into a clean container. Note it is essential that the bleed screw is uppermost to ensure all air is displaced by fluid gravitating from the reservoir.
- 6.5.(a).(ii):** Loosen the bleed screw one full turn and leave it open until clean fluid begins to flow from the hose.
- 6.5.(a).(iii):** Close the bleeder screw and remove the hose. The rear end of the slave cylinder is now filled with fluid.
- 6.5.(a).(iv):** If the hydraulic installation serves multiple brakes, repeat the procedure for each slave cylinder bleeding before continuing.
- 6.5.(a).(v):** Top up the reservoir fluid level to 80% capacity.
- 6.6: For MANUAL BLEED (STANDARD) SYSTEMS – refer to the hydraulic circuit for the actual installation, specifically the pressurized portion of the circuit between the master cylinder and the slave cylinder, up to and including the front end bleed screw on each slave cylinder.
- 6.6.(a):** The front end of each slave cylinder can be bled as follows:
- 6.6.(a).(i):** Step on the master cylinder pedal with up to 10lb. force.

**6.6(a).(ii):** Slip the bleeder hose, over the nipple of the bleed screw at the front end of the slave cylinder. Insert the other end of the bleeder hose, into a clean container. Open the front end “BLEED” screw approximately one turn and allow fluid under pressure, caused by the force applied to the pedal, to be ejected through the bleed screw into the container. Maintain pressure on the pedal even when no further pedal travel is possible.

**6.6.(a).(iii):** Close the bleed screw while still maintaining pedal pressure.

**6.6.(a).(iv):** Release the pedal and allow it to return to the full extreme of the available stoke.

**6.6.(a).(v):** Repeat the process for each slave cylinder in sequence until a solid stop is felt at step “(a).(i)” of the above procedure. Periodically monitor and replenish the reservoir fluid level as required, to ensure that it is never less than 30% full.

**6.6.(a).(vi):** If a spongy feel persists, check the system for leaks or hidden air pockets.

6.7: **REMOTE ELECTRIC BLEED (OPTIONAL).** Refer to the hydraulic circuit for the actual installation Fig. 4, 6, 7 and 8, specifically the pressurized portion of the circuit, between the master cylinder through the front end of the slave cylinder up to and including the remote electric bleed solenoid valve.

**6.7.(a):** The front end of each slave cylinder can be bled as follows:

**6.7.(a).(i):** Step on the master cylinder pedal with up to 40lb. force.

**6.7.(a).(ii):** Operate the “BLEED” push button (only one where multiple brakes are involved), while maintaining pedal pressure.

**6.7.(a).(iii):** Release the “BLEED” push button while still maintaining pedal pressure.

**6.7.(a).(iv):** Release the pedal and allow it to return to the full extreme of the available stoke.

**6.7.(a).(v):** Repeat the process for each branch “BLEED” push button in sequence until a solid stop is felt at step “(a).(i)” of the above procedure. Periodically monitor and replenish the reservoir fluid level as required to ensure that it is never less then 30% full.

**6.7.(a).(vi):** If a spongy feel persists, check the system for leaks or hidden air pockets.

6.8: On completion of the hydraulic installation, test the integrity of circuit by applying approximately 150lb. force to the pedal while monitoring for leaks.

## ***Chapter 7.0: Operational Check***

7.1: Following installation and bleeding of the system, perform the following operational checks:

**7.1.(a):** With no pressure applied to the foot pedal, each brake wheel or disc should be free to rotate. The running clearance between the brake shoes or pads and the wheel or disc should be equal and as specified for the particular brake.

**7.1.(a).(i):** Apply approximately 10 – 20lb. force at the foot pedal and check that the brake shoes or pads move positively into contact with the brake wheel or disc.

**7.1.(a).(ii):** Release the foot pedal and verify that the brake shoes or pads retract.

## **Chapter 8.0: Maintenance**

- 8.1: **GENERAL MAINTENANCE.** The following should always be kept in mind when working on the hydraulic system:

**8.1.(a):** Tolerances of working parts in hydraulic systems are very close. Even small amounts of dirt or foreign material in the fluid can cause unnecessary component wear, or may block small passages within the master cylinder. Every precaution must be taken to ensure absolute cleanliness of the system components and fluid.

**8.1.(b):** Whenever the system is drained, the system should be flushed and then refilled with new brake fluid of the type originally used.

**8.1.(c):** All containers and funnels used for brake fluid must be clean. Use a funnel with a 200 mesh screen for filling the reservoir.

**8.1.(d):** Never mix fluids of different types or brands.

**8.1.(e):** Whenever the hydraulic system component failure gives reason to believe there are metal particles or other foreign material in the system, drain and flush the entire system. Refill the system with clean brake fluid.

**8.1.(f):** All hydraulic connections must be kept tight to prevent leakage.

**8.1.(g):** When removing any hydraulic component, be sure to cap the hydraulic lines and plug the ports of the removed component.

**8.1.(h):** Be sure to replace any lost brake fluid after completing the installation of a repaired component.

**8.1.(i):** It is good maintenance practice to check the adjustment of a brake that does not appear to operate properly, and also to check the master cylinder pedal linkage before removing any item from the brake system for repairs. Poor adjustment is a more likely cause of trouble than is a defective assembly.

### ***Chapter 9.0: Inspection***

- 9.1: The only periodic inspections required of the hydraulic system are to check the fluid level in the reservoir on a weekly basis, and to check the system tubing semi-annually to ensure that it is firmly anchored and has not sagged or is not otherwise out of position. The need for bleeding, the existence of leaks, component deterioration, etc., will show up during normal operation of the system. It is the operator's responsibility to report such conditions to his superior or other designated party.

### ***Chapter 10.0: Replenishing Fluid Level***

- 10.1: The fluid level in the reservoir should be maintained at 80% of reservoir capacity. When it is necessary to add fluid, take all reasonable precautions to prevent the introduction of contaminants into the reservoir or the container from which the new fluid is poured. Strain the new fluid through a 200 mesh screen. Use DOT 4 or equivalent fluid. Do not mix different types or brands of fluid.

## **Chapter 11.0: System Troubleshooting**

11.1: **Table 1** – Lists possible problems that could occur in the hydraulic system, along with symptoms and possible remedies.

**NOTICE:** THE POSSIBLE CAUSES FOR EACH TROUBLE SYMPTOM ARE NOT LISTED IN STRICT ORDER OF PROBABILITY AND THEREFORE DO NOT NEED TO BE CHECKED IN THE ORDER LISTED.

**Table 1**

**Troubleshooting the Hydraulic System**

SYMPTOM	POSSIBLE CAUSE	REMEDY
Excessive pedal travel (effective stroke diminished).	1. Brake requires adjustment.	Adjust the brake, replace the shoe or pad assemblies if necessary.
	2. Excessive clearance between the push rod and the secondary piston in the master cylinder.	Adjust to obtain 1/32" clearance without pressure on the foot pedal.
	3. Relief valve inside the master cylinder defective.	Replace the master cylinder assembly and return to factory for overhaul.
	4. Defective bleed solenoid valve, push button, or wiring (remote bleed systems only).	Determine exact cause through systematic check. Replace solenoid valve or push button if defective.
	5. Leak in the line between the master cylinder and the slave cylinder.	Locate and correct the leak.
	6. Defective slave cylinder.	Replace the slave cylinder.
	7. Defective master cylinder	Replace the master cylinder.
	8. Excessive wear in the master cylinder linkage.	Replace the pins and/or bushings as required.
Spongy pedal.	1. Low fluid level, allowing air to be drawn into the system.	Fill the reservoir to the correct level (80% of capacity). Determine the cause of fluid loss and bleed the system.
	2. Air trapped in the pressure circuit.	Bleed the system as described under the topic, Filling and Bleeding the System.
	3. Leak in the line between the master cylinder and the slave cylinder.	Locate and eliminate the leak.
	4. Lines not sloping toward the slave cylinder.	Re-arrange line to avoid entrapped air.
Gradual pedal loss during brake applications.	1. Leak in the line between the master cylinder and the slave cylinder.	Locate and correct the leak.
	2. Defective master cylinder.	Replace the master cylinder.
	3. Defective slave cylinder.	Replace the slave cylinder.
	4. Defective bleed solenoid valve.	Clean or replace solenoid valve.
Brake will not release.	1. Defective slave or master cylinder.	Disconnect the pressure line at the slave cylinder. If the brake releases, the master cylinder is defective; if not, the slave cylinder is defective. Replace components as necessary.
	2. Defective return spring in master cylinder.	Replace pedal return spring in master cylinder assembly.
	3. Defective brake release spring.	Replace or adjust the brake release spring as applicable. Refer to brake manual.
	4. Brake mechanism defective.	Refer to brake manual.

### ***Chapter 12.0: Part Replacement***

- 12.1: If any component of the system requires replacement, remove and replace it with a new part of the same type. The removal and installation procedures in these cases are relatively straightforward. Some judgment is required to determine whether or not the reservoir must be drained, before removing a particular part. The system must be bled following replacement of any part.

**NOTICE:** UNDER NO CIRCUMSTANCES SHOULD FIELD REPAIR OF THE MASTER CYLINDER BE ATTEMPTED. A SPARE UNIT SHOULD BE KEPT ON HAND TO SUBSTITUTE FOR A DAMAGED UNIT. RETURN THE DAMAGED UNIT TO MAGNETEK FOR OVERHAUL. THE DESIGN OF THIS MASTER CYLINDER IS SUCH THAT REBUILD SHOULD BE ACCOMPLISHED ONLY BY EXPERIENCED TECHNICIANS, WORKING IN A CLEAN ENVIRONMENT.

### ***Chapter 13.0: Storage***

- 13.1: Prior to shipping, steps are taken to preserve the components for shipment. The master cylinder is lubricated using brake fluid and the hoses attached and plugged. All tubing ends, hose ends, and ports etc. are plugged or capped. These measures are also adequate to preserve the components in storage for a reasonable length of time in the event that the system or component is not installed immediately.
- 13.2: When withdrawing components from storage, look for signs of corrosion, physical damage, or other possible defects. Do not use a component if its condition is doubtful.