



# Hydraulic Power Brake (HPB) Installation Instructions

## Master Cylinder Replacement Kit R950056

## Master Cylinder Reservoir Replacement Kit R950055

### Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

#### **⚠ WARNING**

**To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.**

**Release all pressure from the air system before you disconnect any components. Failure to depressurize the system may result in serious personal injury. Depressurization instructions are outlined under Step 6 of Master Cylinder Removal on page 3 of this bulletin.**

**Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.**

### Service Information

Instructions covering the brake bleed procedures, TOOLBOX™ Software programs and testing the installation (test drive) appear in WABCO Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System. You will need MM-0401 to complete the replacement procedures in this bulletin.

### Technical Assistance

For technical assistance or to obtain a copy of Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System, please contact WABCO North America Customer Care at 855-228-3203.

### Access Product and Service Information on Our Website

WABCO technical publications are available on our website:

[www.wabco-na.com](http://www.wabco-na.com)

### Replacement Kits

WABCO replacement kits needed to replace the master cylinder and/or the master cylinder reservoir are shown in the following table.

**Table A: Replacement Kit Ordering Information**

Master Cylinder	R950056
Master Cylinder Assembly	R950056 and R950055 or R955421
Master Cylinder Reservoir	R950055 (bus) R955421 (medium duty)  If replacing the roll pins, replacement kit R950057 is also required.
Roll Pins Only	R950057

Refer to the following table for a description of the contents of each kit.

**Table B: Replacement Kit Contents**

Part Number	Description	Contents
R950056	Master Cylinder Kit	Master cylinder with foot brake switch Two rubber grommets Two roll pins
R950055	Master Cylinder Reservoir Kit (bus)	Master cylinder reservoir with fluid level switch Two rubber grommets Roll pins not included
R955421	Master Cylinder Reservoir Kit (medium duty)	Master cylinder reservoir with fluid level switch Two rubber grommets Roll pins not included
R950057	Roll Pin Kit	Two roll pins

Additional grommets may be purchased from the WABCO Commercial Vehicle Aftermarket sales office. Call WABCO North America Customer Care at 855-228-3203 to order.

The master cylinder and master cylinder reservoir replacement parts are shown in the following illustration. Figure 1.

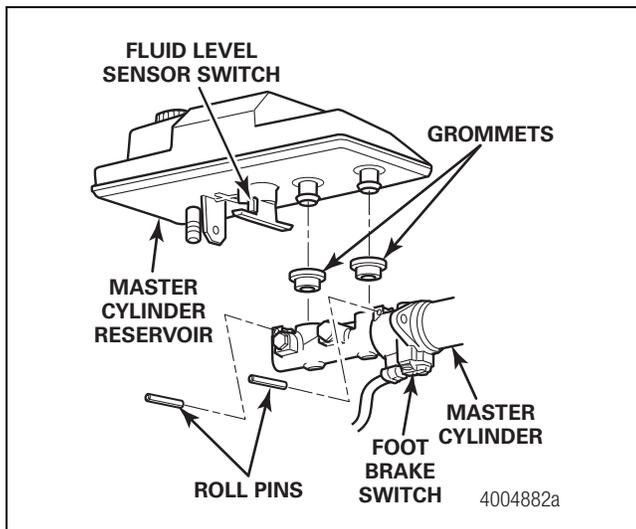


Figure 1

## Master Cylinder Replacement Kits

Before removing the master cylinder assembly or the master cylinder reservoir, verify the component(s) to be replaced:

- Master cylinder and reservoir
- Master cylinder only, reusing reservoir
- Master cylinder reservoir only, reusing master cylinder

Replacement kits specific to each of these three replacements are available from WABCO. Make sure the replacement kit is available **before** you begin the removal.

If the current reservoir is to be reused, you will need to be careful when removing the master cylinder and reservoir assembly from the vehicle, and when you separate the components. If the reservoir is damaged in any way, it is not reusable.

- The master cylinder replacement kit contains a master cylinder with foot brake switch, grommets and roll pins. It does not include the master cylinder reservoir.
- The master cylinder reservoir replacement kit contains a master cylinder reservoir with a fluid level switch and two rubber grommets.

## Component Removal and Installation

### Master Cylinder Replacement Information

#### CAUTION

To avoid damage to the system while working on the brake system, do not apply the foot pedal unless instructed to do so.

- Two people are needed to perform this procedure.
- In some vehicles it may be necessary to move non-HPB system components, such as the air tank, in order to access the HPB part. If this is necessary, refer to the vehicle manufacturer's manual for information before moving the component.
- Bleeding the master cylinder circuit is required during installation of the master cylinder. Bleed procedures appear in Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.
- After installing HPB components or making system repairs, use TOOLBOX™ Software to remove the error code from the ECU memory. Instructions for using TOOLBOX™ Software appear in Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.

**NOTE:** Removing the master cylinder involves removing the master cylinder reservoir. If the old reservoir is going to be installed onto the new master cylinder, care must be taken during the removal process. Do not install a damaged reservoir.

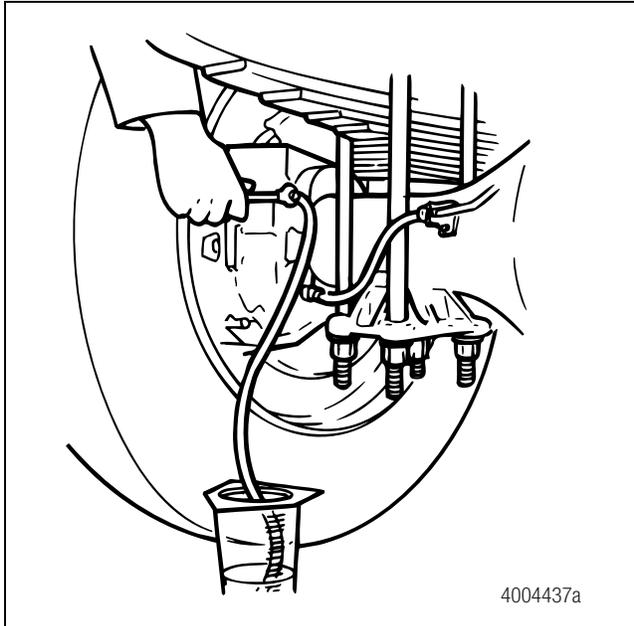
### Master Cylinder Removal

1. Park the vehicle on a level surface. For vehicles with manual parking brakes, apply the parking brakes.
2. Block the front and rear tires to prevent vehicle movement.
3. Disconnect the battery.
4. Use a clean rag to carefully clean the outside of the master cylinder and master cylinder reservoir.

**NOTE:** Both the foot brake switch and the fluid level sensor switch can be replaced without draining the brake fluid. If you are replacing either of these switches, follow the procedures given in this manual.

5. Disconnect the foot brake switch on the master cylinder and the fluid level switch on the master cylinder reservoir.

6. Apply the brake pedal a **minimum** of 30 times to decrease pressure in the system. To ensure the system is depressurized, perform the following check on both the front and rear axles.
  - A. Remove the protective cover from the end of the bleeder fitting on one brake caliper.
  - B. Attach a bleeder bottle hose to the bleeder fitting at the wheel end. Submerge the free end of the bleeder hose into the bleeder bottle. Both the tubing and container must be able to withstand the effects of hydraulic brake fluid.
  - C. Use a wrench to open the bleeder fitting screw. Figure 2.

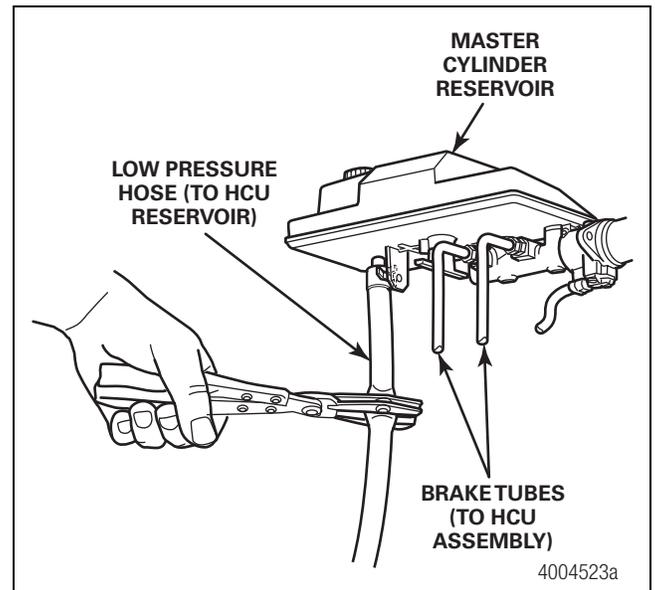


**Figure 2**

- D. Apply and hold the brake pedal down until no more brake fluid runs out. Do not release the brake pedal.
- E. With the brake pedal still applied, use a torque wrench to tighten the bleeder fitting screw.

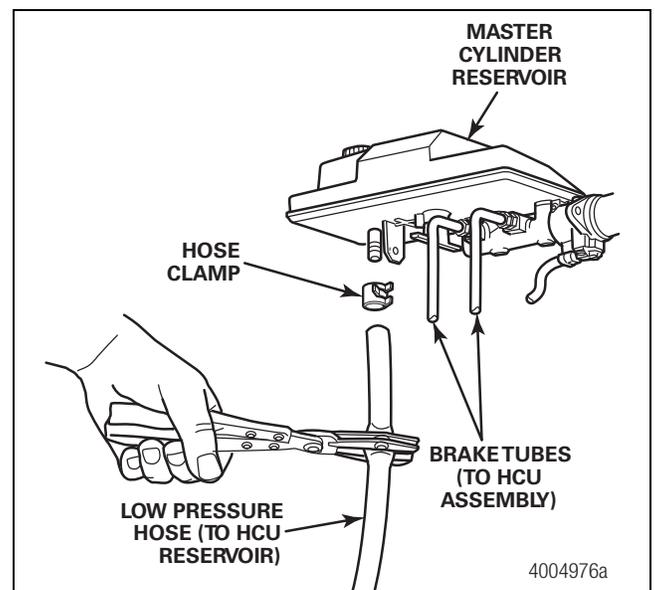
Repeat Steps A-E for the second axle.

7. Attach a pinch clamp to the low pressure hose near the outlet of the master cylinder reservoir. Do not damage the reservoir outlet. Figure 3.



**Figure 3**

8. To help prevent brake fluid from damaging the vehicle or floor paint, or from seeping into the ground, position a container beneath the work area to collect any drained or spilled brake fluid.
9. Remove the hose clamp.
10. Disconnect the low pressure hose from the master cylinder reservoir. All of the fluid coming out of the master cylinder reservoir, approximately one gallon (3.4 liters), should drain into the container. Remove the cap from the master cylinder reservoir to improve the draining process. Plug the low pressure hose to prevent system contamination. Figure 4.



**Figure 4**

**NOTE:** Some brake fluid may remain in protected areas of the master cylinder reservoir.

11. When the reservoir is empty, replace the cap on the master cylinder reservoir and plug the reservoir outlet to prevent any excess fluid from spilling during removal.
12. Disconnect the two brake tubes from the master cylinder. Plug the brake tubes and the master cylinder ports to protect them from contamination. Figure 5.

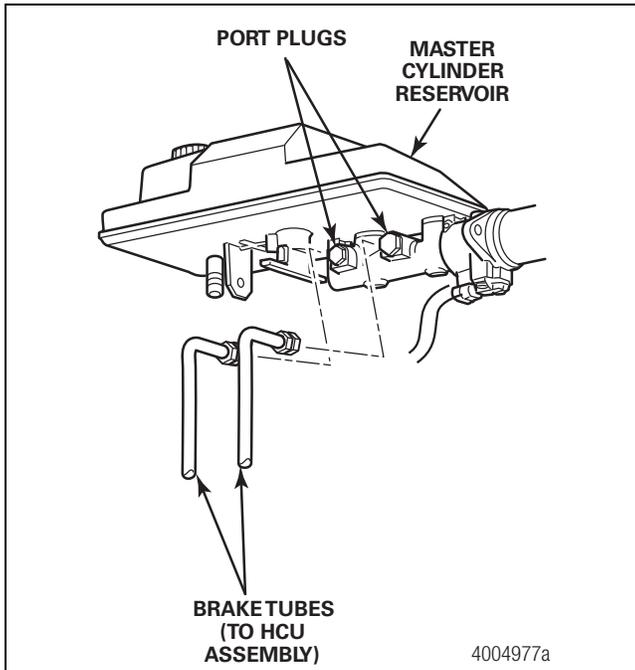


Figure 5

13. Disconnect the master cylinder pushrod clevis pin from the brake pedal. Figure 6.

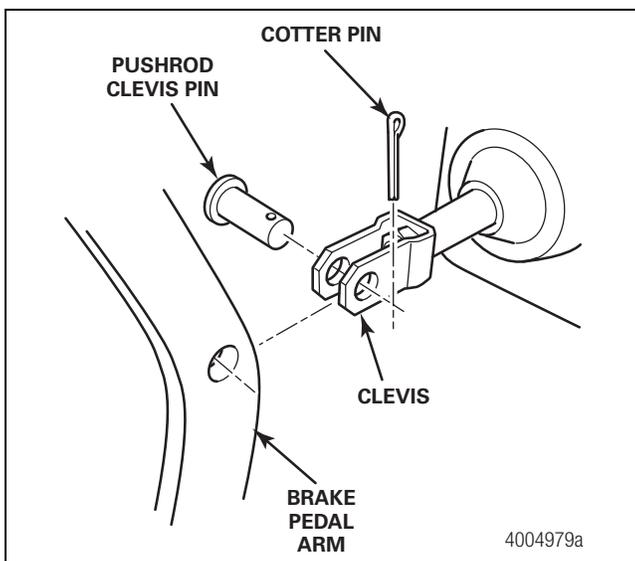


Figure 6

14. Loosen and remove the two nuts that hold the master cylinder assembly to the bracket on the fire wall. Remove the master cylinder and master cylinder reservoir assembly from the vehicle.
15. If the master cylinder reservoir is undamaged and is going to be reused, follow these steps to remove the undamaged reservoir from the old master cylinder.
  - A. Remove the nut from the front bolt. Use a punch to drive out the two roll pins. Do not damage the roll pins if they are to be used again.
  - B. Lift the reservoir off the master cylinder.
  - C. Pour any fluid remaining in the reservoir into a suitable container.
  - D. Plug the reservoir outlet ports to prevent contamination to the system.
16. Verify the warranty status. If the master cylinder is under warranty, return it to WABCO.

### Master Cylinder Installation

1. Attach the original or replacement reservoir to the new master cylinder, as follows.
    - A. Install two new rubber grommet seals into the inlet ports of the master cylinder. Use new brake fluid from a sealed container to lubricate the seals. Use DOT 3 or DOT 4 brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
    - B. Install the original or replacement reservoir by carefully pressing it fully into the grommet seals.
- NOTE:** If using old roll pins, inspect them for damage. Do not use damaged roll pins. Contact WABCO North America Customer Care at 855-228-3203 to order a new roll pin kit.
- C. Install the roll pins. Drive the pins through the holes in the master cylinder boss and the reservoir mounting tab holes. Support the back of the tabs as you install each pin. Figure 7.
  - D. Install the nut on the front bolt.

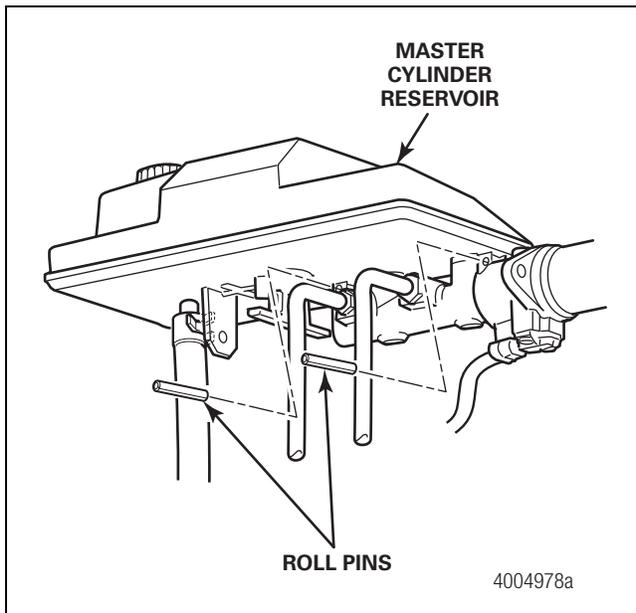


Figure 7

- Use the two mounting nuts included in the replacement kit to attach the master cylinder assembly to the bracket on the fire wall. Tighten the bolts to 50 lb-ft (70 N•m).

**⚠ WARNING**

Failure to correctly install the clevis pin as described may result in damage to the pushrod, abnormal brake pedal feel and/or loss of brakes during vehicle operation.

- Connect the master cylinder pushrod clevis pin to the pedal assembly. The clevis pin must be installed into the same hole on the brake pedal as it was before the old master cylinder was removed. Secure the cotter pin. Figure 8.

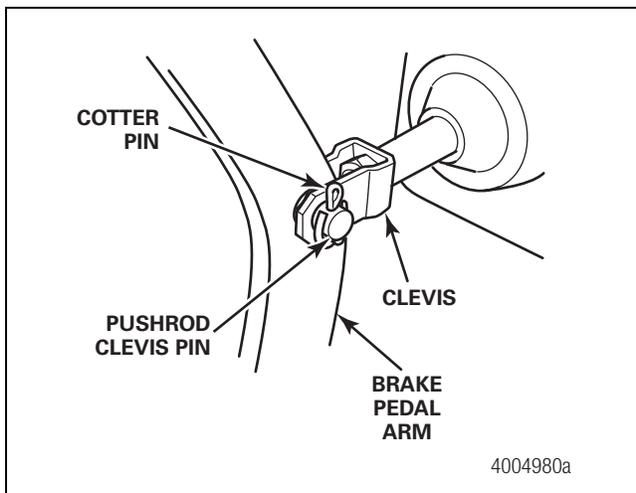


Figure 8

- Connect the brake tubes to the master cylinder. Tighten the fittings to 10.8-14.4 lb-ft (15-20 N•m).
- Connect the low pressure hose to the master cylinder reservoir and secure the connection with a hose clamp.
- Remove the pinch clamp from the low pressure hose.
- Connect the foot brake switch on the master cylinder and the fluid level sensor switch under the reservoir. Figure 9.

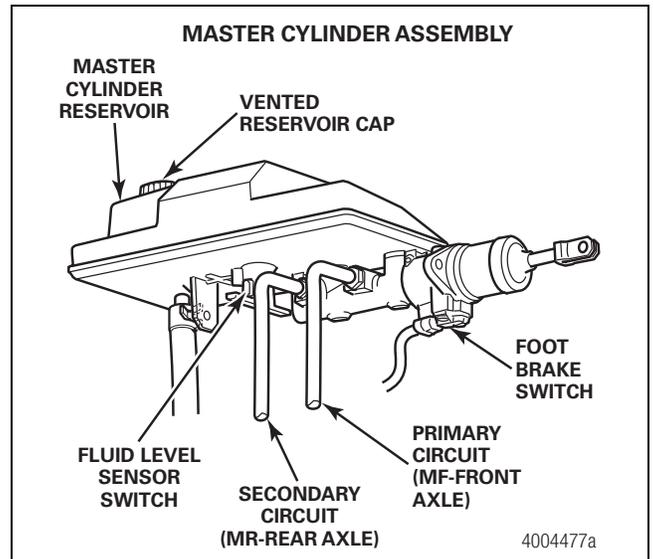


Figure 9

- Fill the master cylinder reservoir to the MAX mark with new brake fluid from a sealed container. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
- Bleed the master cylinder circuit. Refer to Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.
- Connect the battery.
- Turn the ignition ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.
- Depress the brake pedal rapidly four times to activate both HCU pump motors.
- After the pumps stop running, fill the master cylinder reservoir to the MAX mark with new brake fluid from a sealed container. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.

14. Check the system for leaks. If there are no leaks, go to Step 16.

If there are leaks, depressurize the system before making the necessary repairs. Use the following procedure to depressurize the system.

- Apply the brake pedal a **minimum** of 30 times to decrease pressure in the system. To ensure that the system is depressurized, perform the following check on both the front and rear axles:
    - A. Remove the protective cover from the end of the bleeder fitting on one brake caliper.
    - B. Attach a bleeder bottle hose to the bleeder fitting at the wheel end. Submerge the free end of the bleeder hose into the bleeder bottle. Both the tubing and container must be able to withstand the effects of hydraulic brake fluid.
    - C. Use a wrench to open the bleeder fitting screw. Refer to Figure 2.
    - D. Apply and hold the brake pedal down until no more brake fluid runs out. Do not release the brake pedal.
    - E. With the brake pedal still applied, use a torque wrench to tighten the bleeder fitting screw to 34.7-39 lb-in (4-4.5 N•m). 
      - Repeat Steps A-E for the second axle.
15. After making the repairs, check the fluid level in the master cylinder reservoir to make sure it is at the MAX mark. Refill as necessary, using only the recommended DOT 3 or DOT 4 hydraulic brake fluid, as described above.
  16. Use TOOLBOX™ Software to clear the diagnostic code for the master cylinder. Refer to Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System for TOOLBOX™ instructions.
  17. Remove the wheel blocks.
  18. Test drive the vehicle. Refer to the vehicle test drive procedure in this bulletin.

## Master Cylinder Reservoir Replacement Information

### **WARNING**

**The full power brake system is a pressurized system that achieves pressures of up to 2320 psi. This pressure is not reduced by switching the ignition off or removing battery power. Prior to servicing this system, the depressurization procedures must be performed exactly as presented. Failure to depressurize the system may result in personal injury or death.**

### **CAUTION**

**To avoid damage to the system while working on the brake system, do not apply the foot pedal unless instructed to do so.**

**NOTE:** It is not necessary to remove the complete master cylinder assembly when replacing the reservoir.

- Two people are needed to perform this procedure.
- In some vehicles it may be necessary to move non-HPB system components, such as the air tank, in order to access the HPB part. If this is necessary, refer to the vehicle manufacturer's manual for information before moving the component.
- Bleeding the master cylinder circuit is required during installation of the master cylinder reservoir. Bleed procedures appear in Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.
- After installing HPB components or making system repairs, use TOOLBOX™ Software to remove the error code from the ECU memory. Instructions for using TOOLBOX™ Software appear in Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.

## Master Cylinder Reservoir Removal

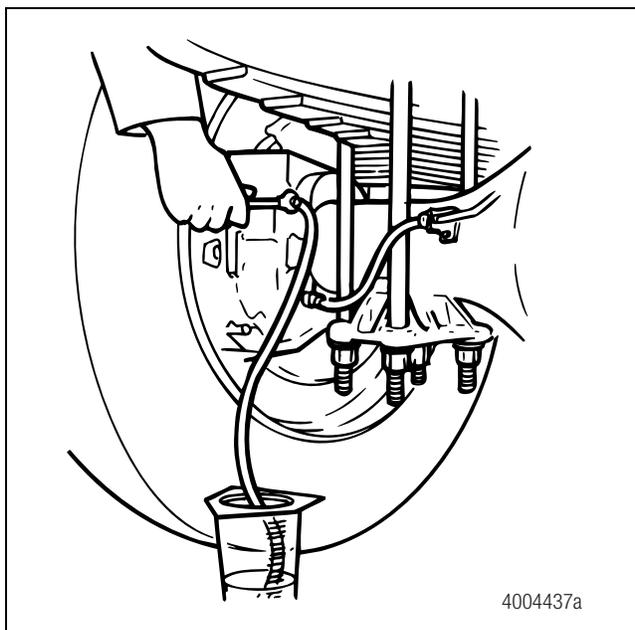
### **WARNING**

**To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.**

**Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.**

1. Park the vehicle on a level surface. For vehicles with manual parking brakes, apply the parking brakes.
2. Block the front and rear tires to prevent vehicle movement.
3. Disconnect the battery.

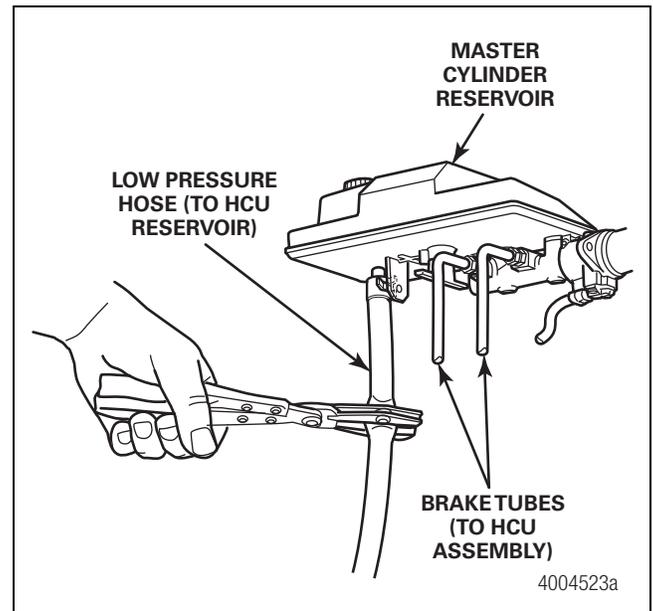
4. Use a clean rag to carefully clean the outside of the master cylinder and master cylinder reservoir.
5. Apply the brake pedal a **minimum** of 30 times to decrease pressure in the system. To ensure the system is depressurized, perform the following check on both the front and rear axles.
  - A. Remove the protective cover from the end of the bleeder fitting on one brake caliper.
  - B. Attach a bleeder bottle hose to the bleeder fitting at the wheel end. Submerge the free end of the bleeder hose into the bleeder bottle. Both the tubing and container must be able to withstand the effects of hydraulic brake fluid.
  - C. Use a wrench to open the bleeder fitting screw. Figure 10.



**Figure 10**

- D. Apply and hold the brake pedal down until no more brake fluid runs out. Do not release the brake pedal.
  - E. With the brake pedal still applied, use a torque wrench to tighten the bleeder fitting screw.

Repeat Steps A-E for the second axle.
6. Attach a pinch clamp to the low pressure hose near the outlet to the master cylinder reservoir. Do not damage the reservoir outlet. Figure 11.



**Figure 11**

7. To help prevent brake fluid from damaging the vehicle or floor paint, or from seeping into the ground, position a container beneath the work area to collect any drained or spilled brake fluid.
8. Remove the hose clamp.
9. Disconnect the low pressure hose from the master cylinder reservoir. All of the fluid coming out of the master cylinder reservoir, approximately one gallon (3.4 liters), should drain into the container. Remove the cap from the master cylinder reservoir to improve the draining process. Plug the low pressure hose to prevent system contamination.
10. Remove the reservoir from the master cylinder assembly, as follows.
  - A. Disconnect the fluid level switch.
  - B. Remove the nut from the front bolt. Use a punch to drive out the two roll pins.
  - C. Lift the reservoir off the master cylinder.
  - D. Plug the reservoir outlet ports to prevent contamination to the system.
  - E. Pour any remaining fluid into a suitable container.
  - F. Close the reservoir outlet ports to prevent spillage.
11. Verify the warranty status. If the master cylinder reservoir is under warranty, return it to WABCO.

## Master Cylinder Reservoir Installation

### **⚠ WARNING**

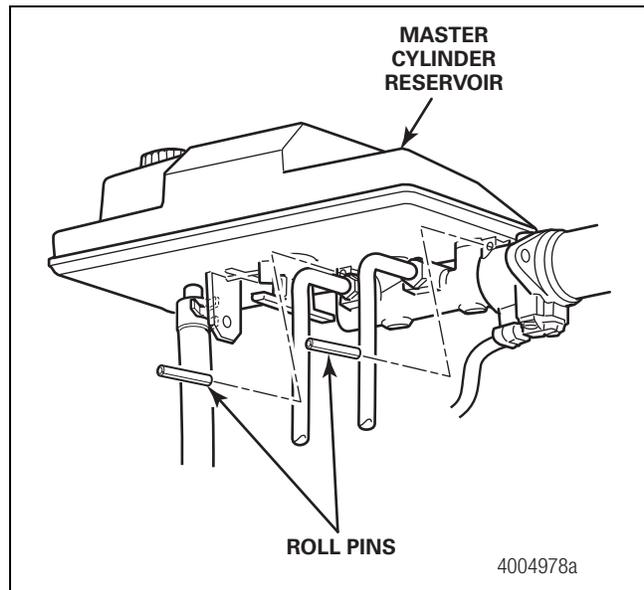
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

### **⚠ CAUTION**

Do not install a damaged reservoir. A damaged reservoir will result in loss of hydraulic brake fluid which can lead to loss of HPB function.

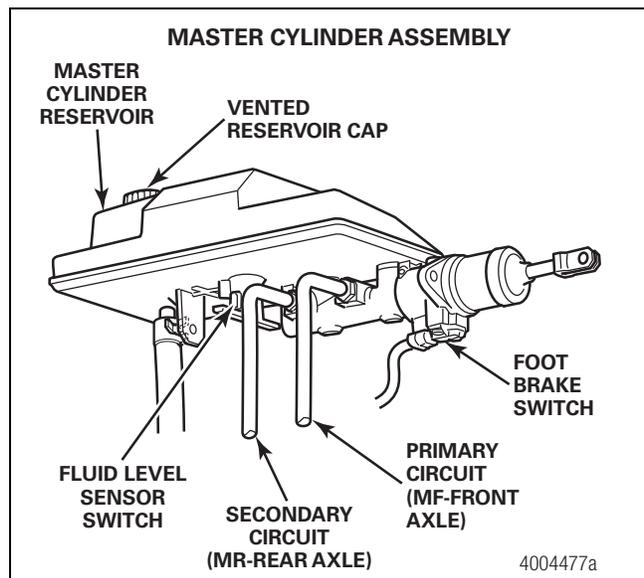
- Two people are needed to perform this procedure.
- In some vehicles it may be necessary to move non-HPB system components, such as the air tank, in order to access the HPB part. If this is necessary, refer to the vehicle manufacturer's manual for information before moving the component.
- Bleeding the master cylinder circuit is required during installation of the master cylinder reservoir. Bleed procedures appear in Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.
- After installing HPB components or making system repairs, use TOOLBOX™ Software to remove the error code from the ECU memory. Instructions for using TOOLBOX™ Software appear in Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.

1. Attach the replacement reservoir to the new master cylinder, as follows.
  - A. Install the new rubber grommets in the two inlet ports of the master cylinder. Use new brake fluid from a sealed container to lubricate the seals. Use DOT 3 or DOT 4 brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
  - B. Install the original or replacement reservoir by carefully pressing it fully into the grommets.
  - C. Install the two new roll pins from the replacement kit. Drive the pins through the holes in the master cylinder boss and the reservoir mounting tab holes. Support the back of the tabs as you install each pin. Figure 12.
  - D. Install the nut on the front bolt.



**Figure 12**

2. Connect the low pressure hose to the reservoir.
3. Remove the pinch clamp from the low pressure hose.
4. Connect the fluid level switch on the master cylinder reservoir. Figure 13.



**Figure 13**

5. Fill the master cylinder reservoir to the MAX mark with new brake fluid from a sealed container. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.

6. Bleed the master cylinder circuit. Follow the instructions for bleeding the master cylinder circuit that appear in Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System.
7. Connect the battery.
8. Turn the ignition ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.
9. Verify the fluid level is above the MIN mark. If not, add new brake fluid. Use only DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
10. Depress the brake pedal rapidly four times to activate both HCU pump motors.
11. When the pumps stop running, fill the master cylinder reservoir to the MAX mark with new brake fluid from a sealed container. Use only DOT 3 or DOT 4 brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
12. Check the system for leaks. If there are no leaks, go to Step 15.

If there are leaks, depressurize the system before making the necessary repairs. Use the following procedure to depressurize the system.

- Apply the brake pedal a **minimum** of 30 times to decrease pressure in the system. To ensure that the system is depressurized, perform the following check on both the front and rear axles:
  - A. Remove the protective cover from the end of the bleeder fitting on one brake caliper.
  - B. Attach a bleeder bottle hose to the bleeder fitting at the wheel end. Submerge the free end of the bleeder hose into the bleeder bottle. Both the tubing and container must be able to withstand the effects of hydraulic brake fluid.
  - C. Use a wrench to open the bleeder fitting screw. Refer to Figure 10.
  - D. Apply and hold the brake pedal down until no more brake fluid runs out. Do not release the brake pedal.
  - E. With the brake pedal still applied, use a torque wrench to tighten the bleeder fitting screw.
    - Repeat Steps A-E for the second axle.

13. After making the repairs, check the fluid level in the master cylinder reservoir to make sure it is at the MAX mark. Refill as necessary, using only the recommended DOT 3 or DOT 4 hydraulic brake fluid.
14. Use TOOLBOX™ Software to cancel the diagnostic code for the master cylinder reservoir. Refer to Maintenance Manual MM-0401, WABCO Hydraulic Power Brake (HPB) System for TOOLBOX™ instructions.
15. Remove the wheel blocks.
16. Test drive the vehicle. Refer to the vehicle test drive procedure which follows.

## Vehicle Test Drive Procedure

After replacing an HPB component, test drive the vehicle as follows:

1. Turn the ignition ON.
 

**NOTE:** Depending on the vehicle, the ATC lamp may be labeled differently and some vehicles may not have an ATC lamp. Refer to the vehicle specification sheet for label designation.
2. Check the vehicle dash lamps:
  - All of the dash lamps for HPB come on briefly (approximately three seconds) for a bulb check, then go off. This indicates the system is O.K.
  - ABS and ATC lamps do not go off. The system is looking for wheel speed. Drive the vehicle at speeds of 10-15 mph (16-24 km/h). The ABS and ATC lamps will go off. This indicates the system is O.K.
  - ABS and ATC lamps do not go off after the vehicle reaches a speed of 10-15 mph (16-24 km/h). This indicates there is a system fault. Perform vehicle diagnostics and make all of the necessary repairs, including appropriate bleed procedures, before returning the vehicle to service.
3. Drive the vehicle for a short distance. Make gentle brake applications to verify brake performance.

Notes



# **WABCO**

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