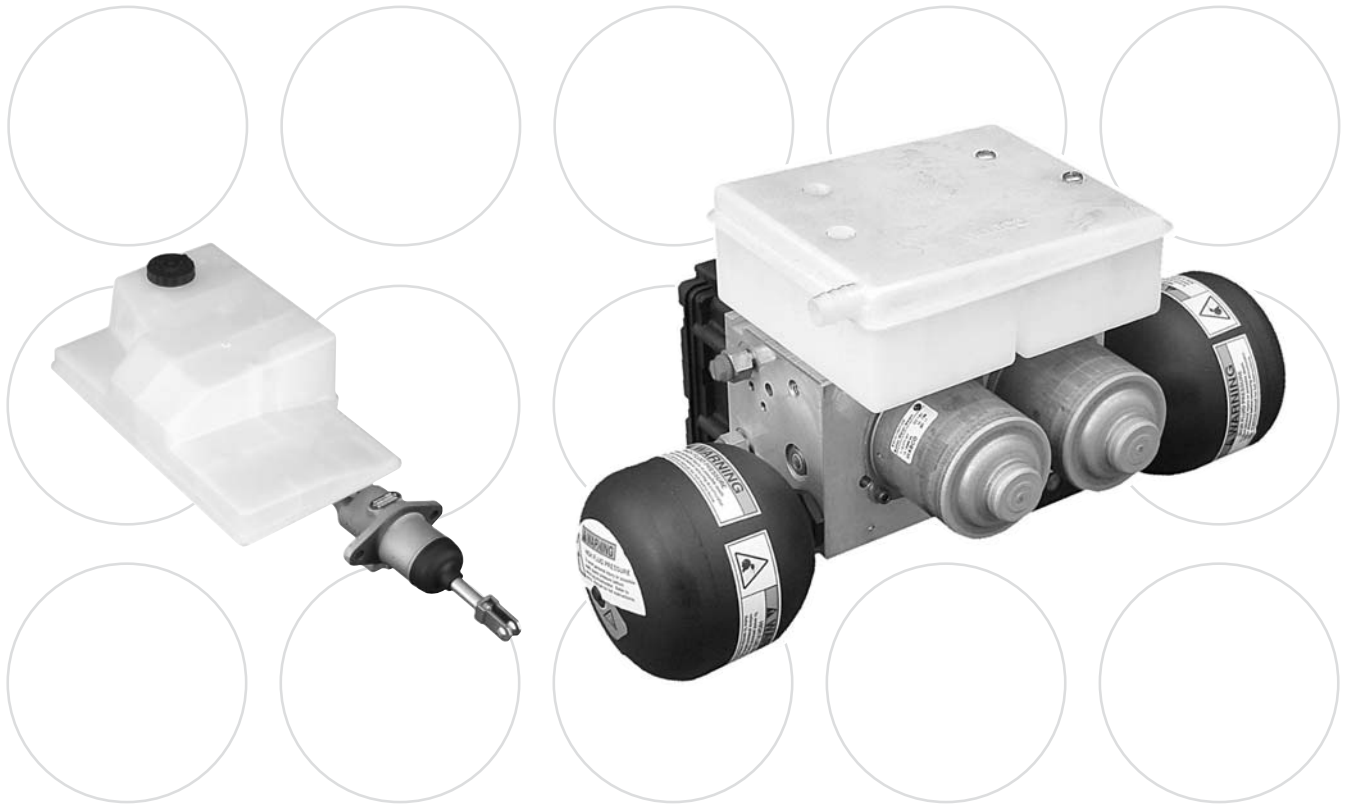


Maintenance Manual MM-0401

## Meritor WABCO Hydraulic Power Brake (HPB) System

Revised 01-11



# Service Notes

## About This Manual

This manual contains maintenance procedures for Meritor WABCO's Hydraulic Power Brake (HPB) system for trucks, tractors and buses.

## Before You Begin

1. Read and understand all instructions and procedures before you begin to service components.
2. 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.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.


## Hazard Alert Messages and Torque Symbols

### WARNING

A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.

### CAUTION

A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.

 This symbol alerts you to tighten fasteners to a specified torque value.

## How to Obtain Additional Maintenance and Service Information

### Publications

Refer to the following publications for more information on servicing Meritor WABCO's Hydraulic Power Brake (HPB) systems.

- Maintenance Manual 38, Hydraulic ABS for Medium-Duty Trucks, Buses and Motor Home Chassis (C Version Hydraulic ABS)
- Maintenance Manual 39, Hydraulic ABS for Medium-Duty Trucks, Buses and Motor Home Chassis (D Version Hydraulic ABS)
- Maintenance Manual MM-0677, Hydraulic Anti-Lock Braking Systems (HABS) for Medium-Duty Trucks, Buses and Motor Home Chassis (E Version Hydraulic ABS)

## On the Web

Visit Literature on Demand at [arvinmeritor.com](http://arvinmeritor.com) to access and order product, service, aftermarket, and warranty literature for ArvinMeritor's truck, trailer and specialty vehicle components. Meritor WABCO publications are also available on our website: [www.meritorwabco.com](http://www.meritorwabco.com)

## ArvinMeritor's Customer Service Center

Call the OnTrac Customer Service Center at 866-OnTrac1 (668-7221).

## Literature on Demand DVD (LODonDVD)

The LODonDVD contains product, service and warranty information for ArvinMeritor and Meritor WABCO products. To order the DVD, visit Literature on Demand at [arvinmeritor.com](http://arvinmeritor.com) and specify TP-0742.

## How to Obtain Tools and Supplies Specified in This Manual

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355 to obtain Meritor tools and supplies.

TOOLBOX™ Software is available from SPX Service Solutions at 1-800-328-6657.

Information contained in this publication was in effect at the time the publication was approved for printing and is subject to change without notice or liability. Meritor WABCO reserves the right to revise the information presented or to discontinue the production of parts described at any time.

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## ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

### Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

### Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS  
CANCER AND LUNG DISEASE HAZARD  
AUTHORIZED PERSONNEL ONLY  
RESPIRATORS AND PROTECTIVE CLOTHING  
ARE REQUIRED IN THIS AREA.

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.
3. Procedures for Servicing Brakes.
  - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
  - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
  - c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.
  - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
  - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

### Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

## NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

### Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

### Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.
2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m<sup>3</sup> as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.
  - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
  - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
  - c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
  - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
  - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

### Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

## Overview

Meritor WABCO's Hydraulic Power Brake (HPB) is a braking and vehicle control system for Business Class trucks, Classes 4 through 7, and buses that are equipped with hydraulic brakes. The HPB system provides the following functions.

- Full power brake performance
- Brake control functions including Anti-Lock Braking System (ABS), Automatic Traction Control (ATC) and Electronic Brake force Distribution (EBD)
- Optional parking brake control

## System Components

The HPB system consists of two main components — the Hydraulic Compact Unit (HCU) and a dual circuit master cylinder. The HPB system is also available with an optional parking brake pressure supply valve. Figure 1.1, Figure 1.2 and Figure 1.3.

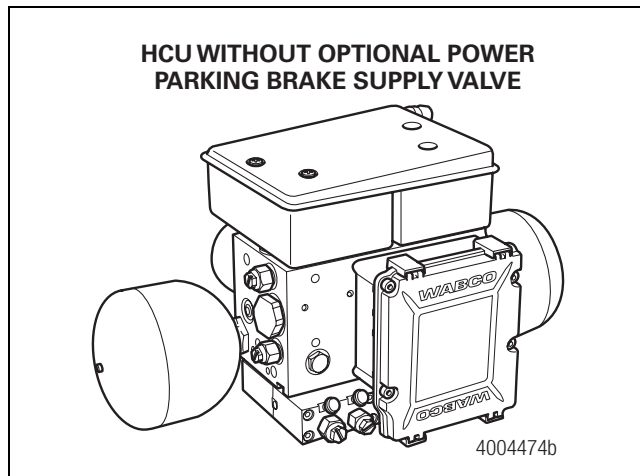


Figure 1.1

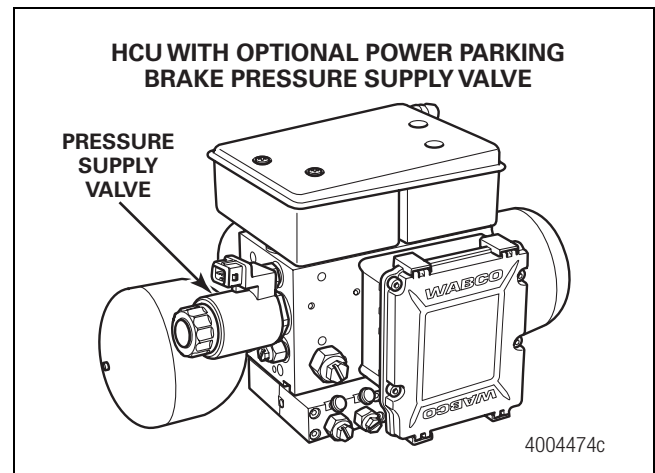


Figure 1.2

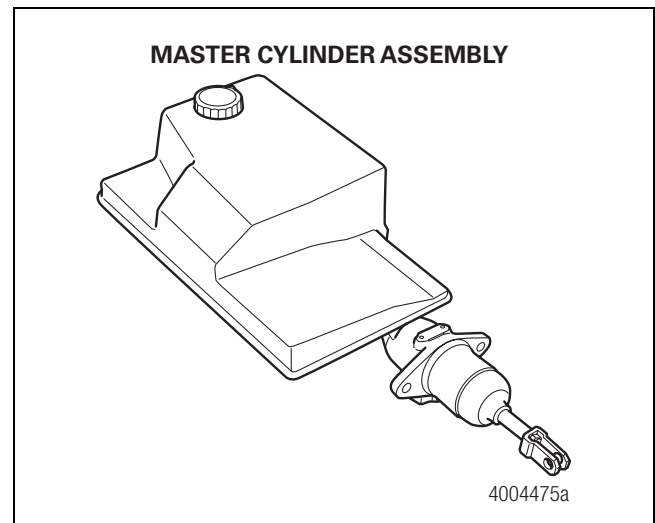


Figure 1.3

## Hydraulic Compact Unit

The HCU consists of an electronic control unit, two independent electric motors driving two piston pumps, two accumulators, a dual circuit fluid reservoir with integrated filters, pressure relief valves, solenoid valves and a dual circuit relay valve. The HCU is mounted to the vehicle frame rail with two brackets. Figure 1.4.

### ⚠ WARNING

**Do not drive the vehicle if a HPB system failure has occurred. Loss of braking ability may occur, resulting in an accident and serious personal injury.**

- The HCU generates the service brake pressure.

# 1 Introduction

- Two pump motors drive the piston pumps to build hydraulic pressure. The pressure is stored in accumulators. The motors are not serviceable. The motors cannot be replaced without replacing the entire HCU.
- The accumulators are two gas-filled hydraulic accumulators. The accumulators store energy supplied by the pumps. Accumulators are sealed at the factory and are non-refillable. Accumulators may be replaced as a set without replacing the entire HCU.
- The ECU processes sensor signals and generates solenoid valve commands to reduce, maintain or increase brake pressure for control function. The ECU constantly monitors the pressure in the accumulators, using one pressure sensor per brake circuit. The ECU may be replaced without replacing the complete HCU.
- The optional pressure supply valve controls the Spring-Applied/Hydraulic Released (SAHR) parking brake. The pressure supply valve is mounted on the HCU. The pressure supply valve may be replaced without replacing the entire HCU.
- The dual circuit HCU reservoir holds the hydraulic brake fluid. (The reservoir may be replaced without replacing the entire HCU.)
- The relay valve is mounted on the bottom of the HCU and may be replaced without replacing the entire HCU.

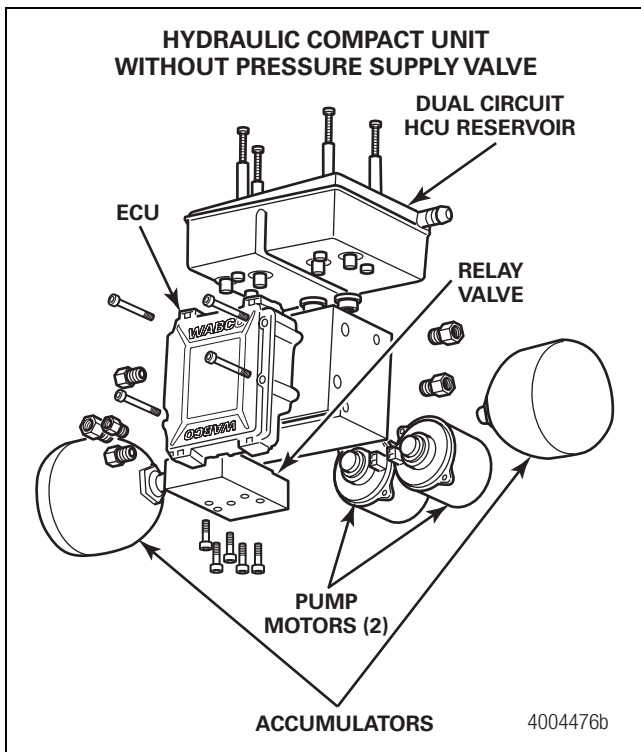


Figure 1.4

## Master Cylinder Assembly

The dual circuit master cylinder in conjunction with a relay valve provides the translation of brake pedal force into hydraulic braking pressure, and sends the driver's demand signal to the HCU.

Figure 1.5.

- The foot brake switch provides brake status to the ECU and eliminates the need for a brake light switch.
- The master cylinder reservoir holds the additional hydraulic brake fluid.
- The fluid level sensor switch monitors fluid level in the master cylinder reservoir.
- The master cylinder reservoir and both master cylinder switches may be replaced without replacing the entire master cylinder.
- The master cylinder cap provided by Meritor WABCO contains a special gore material that allows the reservoir to breathe, and serves as a filter to help prevent contaminants from getting into the reservoir. This is the only cap approved for use with Meritor WABCO HPB.

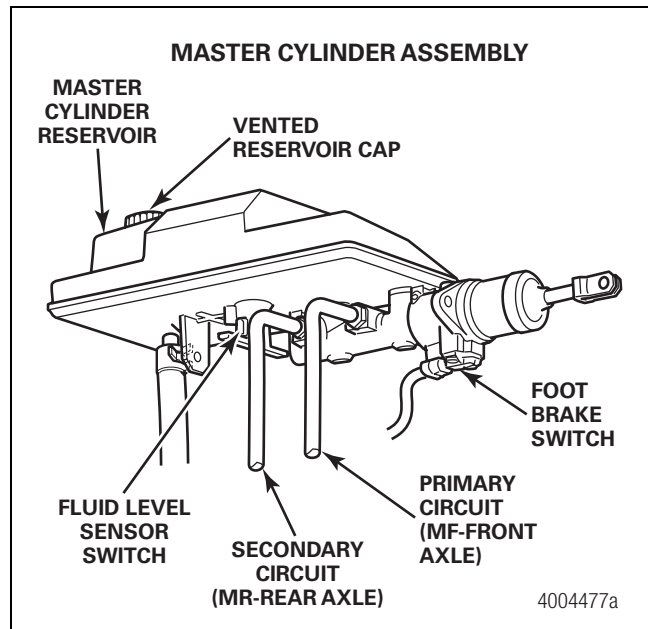


Figure 1.5

## Wheel-End Sensors

A Meritor WABCO wheel speed sensor is installed at each wheel whose speed is to be monitored. These sensors generate electronic signals which are sent to the ECU. A sensor spring clip holds the wheel speed sensor in place. Figure 1.6. The sensor and sensor clip must be lubricated before installation and whenever wheel-end maintenance is performed.

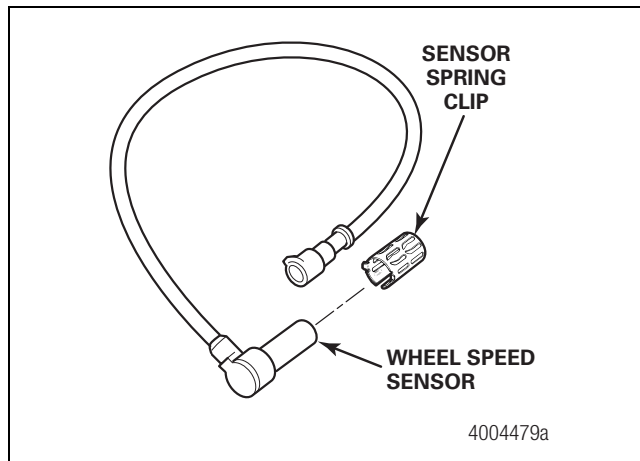


Figure 1.6

## TOOLBOX™ Software

TOOLBOX™ Software is a PC-based diagnostics program required to diagnose HPB system faults. For HPB, version 9.0 or higher is recommended. TOOLBOX™ is available from SPX Service Solutions, 1-800-328-6657. Figure 1.7.

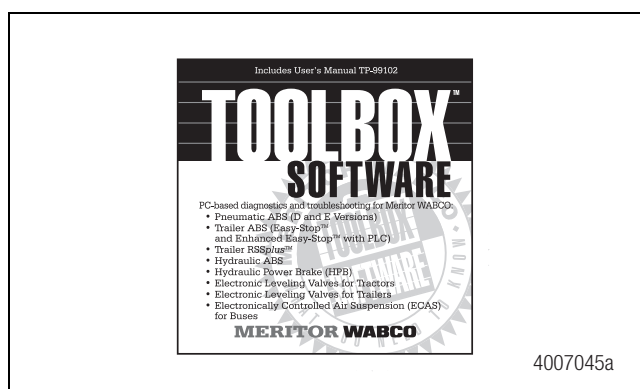


Figure 1.7

## Low Pressure Hose

The Removal and Installation section of this manual contains service information for a low pressure hose which is not produced by Meritor WABCO but is an integral part of the HPB system.

## Spring-Applied Hydraulic Release (SAHR) Parking Brake Canister (Optional)

**NOTE:** The SAHR canister is not produced by Meritor WABCO and is an optional feature. Please consult the OEM for maintenance and service information.

On vehicles equipped with hydraulic parking brakes, the SAHR canister controls the force applied to the parking brake cable. Internal springs are used to apply tension to the parking brake cable, which applies the parking brake. When pressurized brake fluid is routed to the SAHR canister, the hydraulic pressure overcomes the internal springs to relax the parking brake cable, which releases the parking brake. The SAHR parking brake canister is typically located inside the driver's side frame rail, forward of the rear axles.

Vehicles not equipped with hydraulic parking brakes have mechanical parking brakes. Please consult the OEM for maintenance and service information.

## **⚠ WARNING**

**Never drive the vehicle if the parking brake cable is disconnected or if the parking brake system is not operating correctly. Driving the vehicle without a correctly functioning parking brake system can result in an accident and serious personal injury.**

## Parking Brake Switch

The parking brake switch (optional) is a three-position electrical switch (apply, neutral and release). It controls the driver-requested operation of the parking brake.

## How the HPB System Works

Meritor WABCO's hydraulic power braking system provides the energy required to actuate the brakes and control the electronic brake force distribution (EBD), ABS and ATC functions. The HCU is activated each time the ignition is turned on or whenever the driver steps on the brake pedal. If the system is equipped with the optional power park brake, the HCU also supplies the energy to release and control the service and park brakes.

The Meritor WABCO HPB system for trucks is illustrated in Figure 1.8. A complete HPB system layout, with hydraulic brake lines, appears in the Appendix.

# 1 Introduction

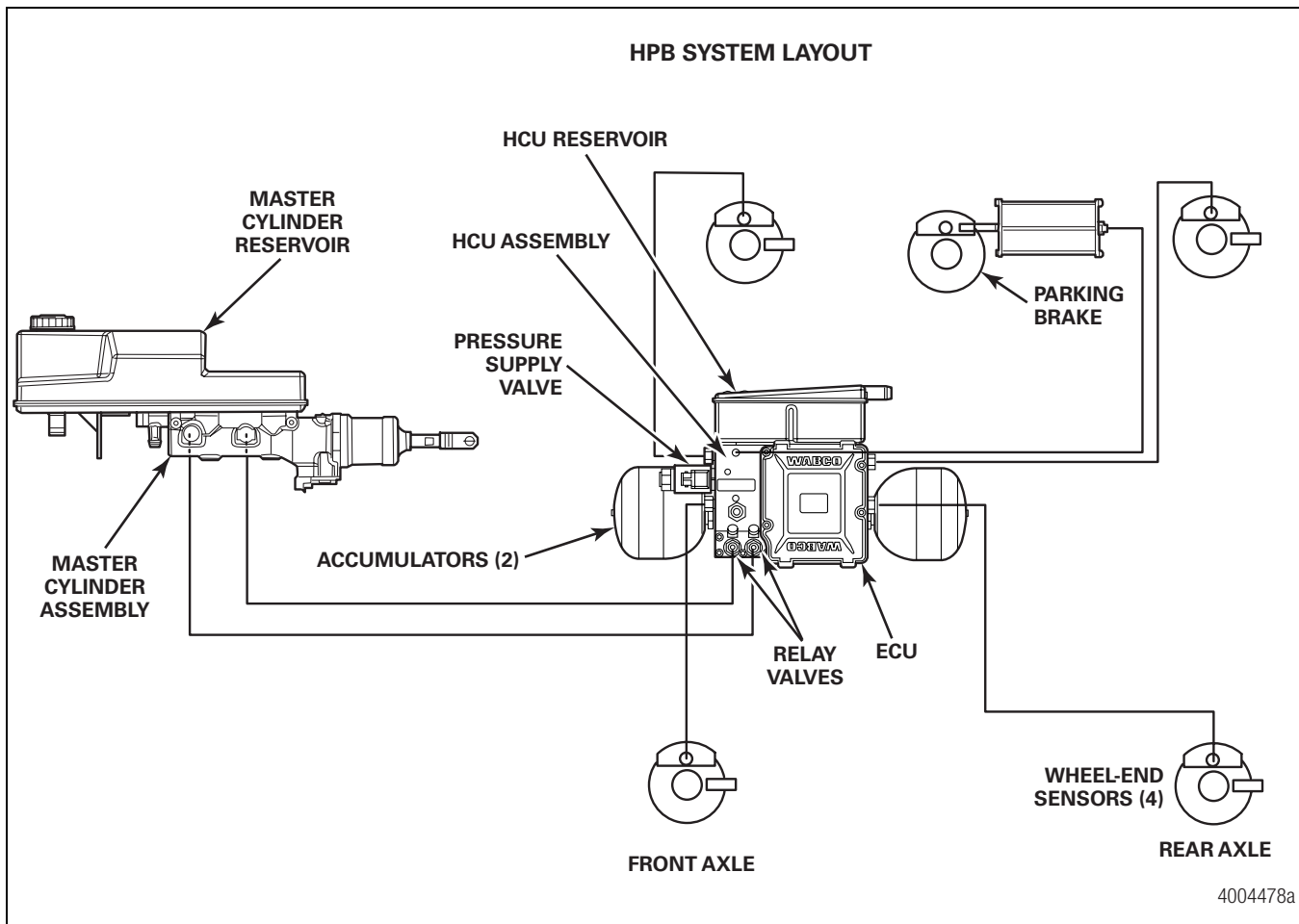


Figure 1.8

## Functional Description

Hydraulic energy is stored in the gas-filled hydraulic accumulators, one for each circuit. When the vehicle's ignition is turned on, internal pumps are activated and fill both accumulators with pressurized hydraulic brake fluid. Two internal sensors, one for each accumulator, measure pressure and the ECU continuously monitors and controls pressure.

During normal operation, the ECU actuates two separate power drivers for the electric motors, keeping the pressure level within the system at desired limits. Two pressure relief valves provide safety against overpressurization.

When the brake pedal is applied, the master cylinder provides a hydraulic signal to the relay valve. Proportional to that signal, the accumulators release pressure to the brake calipers. When the pedal is released, brake fluid returns from the brake calipers to the reservoir, and line pressure is reduced to zero.

For ABS, wheel pressure is individually modulated by eight integrated ABS solenoid valves in the ECU/HCU.

For ATC, the normally closed ATC solenoid valve in the ECU is actuated and hydraulic energy is supplied to the sensed wheel. At the same time, the normally open ATC valve is actuated to prevent fluid flow back into the reservoir. The brake pressure is then modulated by the corresponding ABS solenoid valves.



# HPB Wiring Diagram for Multiplex Vehicles

The Meritor WABCO HPB electronic control unit interface wiring diagram for multiplex vehicles is shown in Figure 2.1.

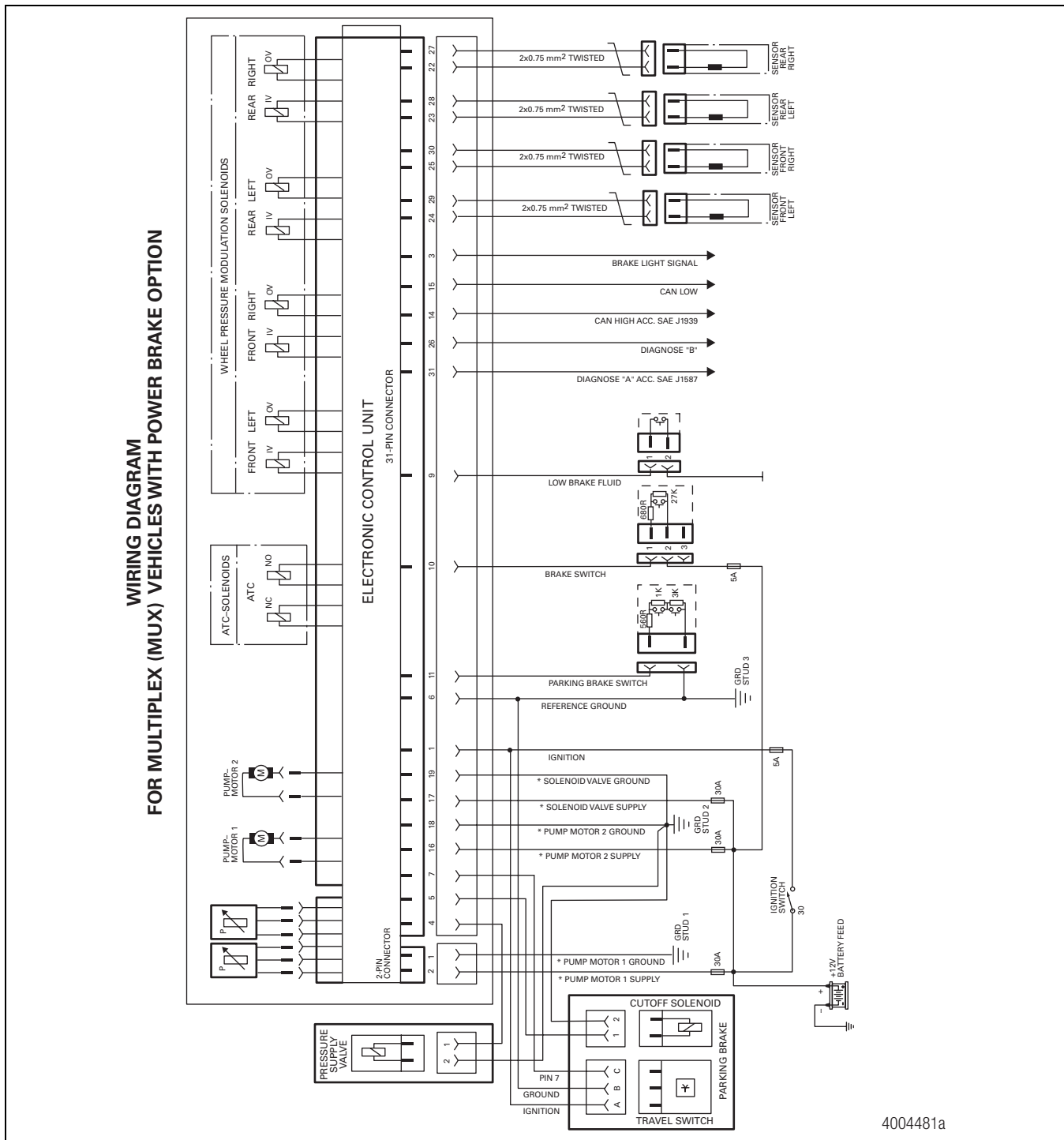


Figure 2.1

## 2 Wiring Diagram

### HPB Connector Diagram for Multiplex Vehicles

The Meritor WABCO HPB electronic control unit interface connector diagram for multiplex vehicles is shown in Figure 2.2.

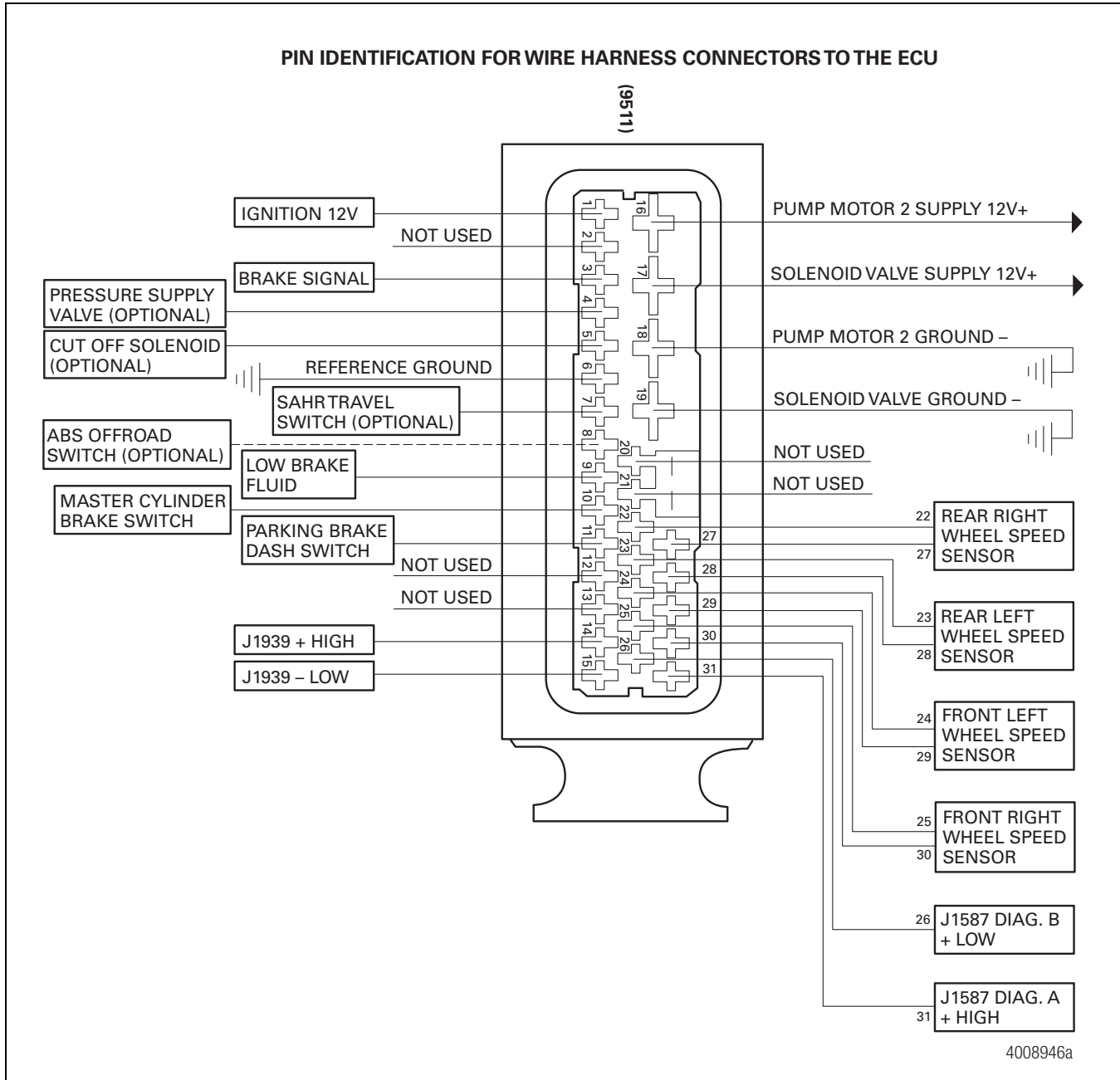


Figure 2.2

## Testing the System

This section contains information for testing the HPB system with TOOLBOX™ Software, and for performing standard component and electrical tests.

### **⚠ WARNING**

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

Exhaust gas contains poison. When testing a vehicle with the engine running, test in a well-ventilated area or route the exhaust hose outside.

To avoid serious personal injury, keep away, and keep test equipment away, from all moving or hot engine parts.

To avoid unwanted vehicle movement when testing, set the parking brake and place the gear selector in NEUTRAL (manual transmission), or PARK (automatic transmission) unless otherwise directed. Failure to do so may result in serious personal injury.

Never drive the vehicle if the parking brake cable is disconnected or if the parking brake system is not operating correctly. Driving the vehicle without a correctly functioning parking brake system can result in an accident and serious personal injury.

Refer to, and follow, the vehicle manufacturer's Warnings, Cautions and service procedures.

## Meritor WABCO TOOLBOX™ Software

Use TOOLBOX™ Software to verify the activation of various system components.

- Turn valves, pump and retarder relay (if available) on and off (Valve Activation Menu)
- Turn indicator lamps on and off (Miscellaneous Output Activation Menu)

**NOTE:** TOOLBOX™ Software must be connected to the vehicle and the vehicle ignition must be ON in order to display information.

**NOTE:** For complete instructions for using this program, refer to the User's Manual, TP-99102. Contact Meritor WABCO at 800-535-5560 for information about TOOLBOX™ Software.

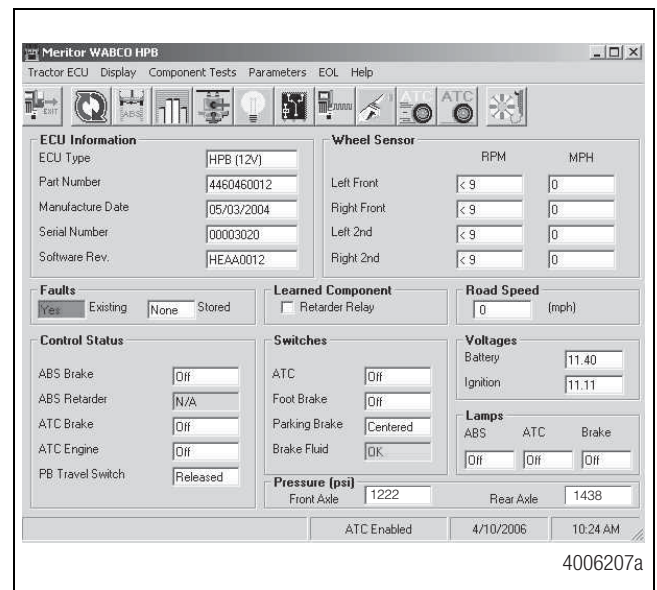
## Hydraulic Power Brake Menus and Toolbars

Select Hydraulic ABS from the TOOLBOX™ *Main Menu*.

TOOLBOX™ senses the type of ECU being used and displays the *HPB Main Screen*.

### Main Screen

This screen provides icons and pull-down menu task selections. It also provides information about the current status of Meritor WABCO HPB. Figure 3.1.



**Figure 3.1**

ECU information is read once from the ECU and does not change. All other information (e.g., wheel sensors, voltages and fault information) is read and updated continuously.

## 3 Troubleshooting and Testing

### Display

Select **Display** from the HPB **Main Screen**. A pull-down menu will appear. Figure 3.2.

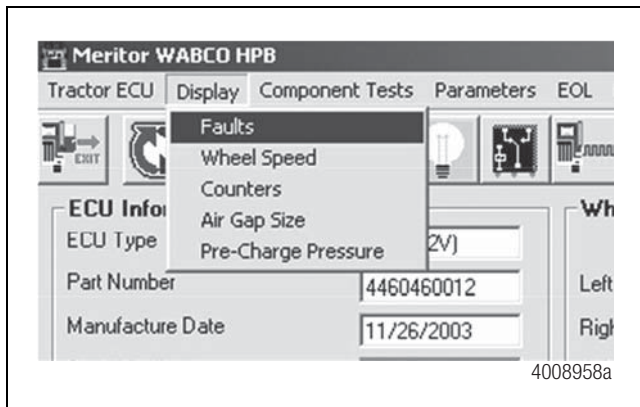


Figure 3.2

### Faults

#### ⚠ WARNING

Do not drive the vehicle if active faults are present. Driving the vehicle with active faults present can result in an accident and serious personal injury.

Select **Faults** to display the **Fault Information** screen. Figure 3.3.

**NOTE:** The **Fault Information** screen is also accessible from the **HPB Main Menu**.

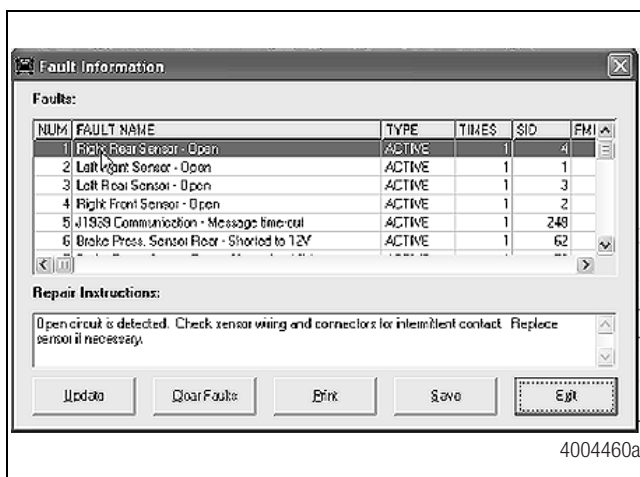


Figure 3.3

The **Fault Information** screen contains a description of each fault, including the type of fault (Active or Stored), SID and FMI number. Repair instructions for the fault appear at the bottom of the screen.

Faults that occur after the screen is displayed will not appear until a screen update is requested. Use the **Update** button at the bottom of the screen to refresh the fault information table and display a new list of faults.

After making any required repairs, use the **Clear Faults** button to clear the fault. Clear each fault as it is repaired. The **Update** button should be used after all faults are repaired. Cycle the ignition after clearing the faults.

**NOTE:** When all faults are cleared, you need to drive the vehicle above 5 mph before the ABS light will go out.

Use the **Save** or **Print** button to save or print the fault information data. Select **Exit** to close this section.

### Wheel Speed

Select **Wheel Speed** to display the **Wheel Speed** screen. Figure 3.4.

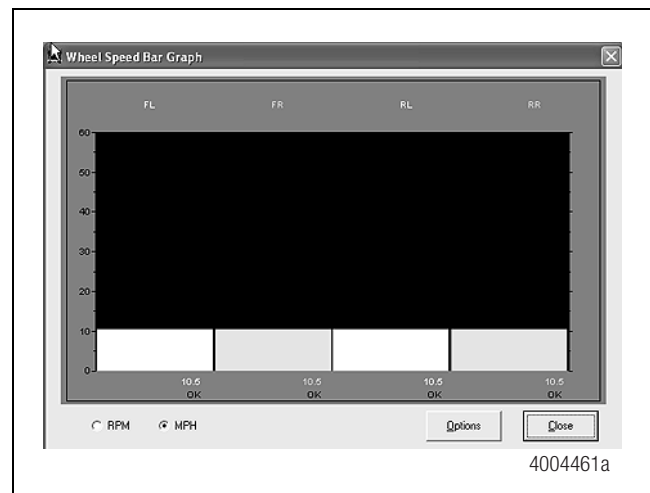


Figure 3.4

Use the **Wheel Speed** screen to verify that sensors are connected at each wheel. Speed at a sensed wheel (FL, FR, RL, RR) indicates sensors are installed, but does not verify correct sensor installation. Wheel speed sensor installation information is available in the Removal and Installation section.

#### Counters

Select **Counters** to display the **Counters** screen. Figure 3.5.

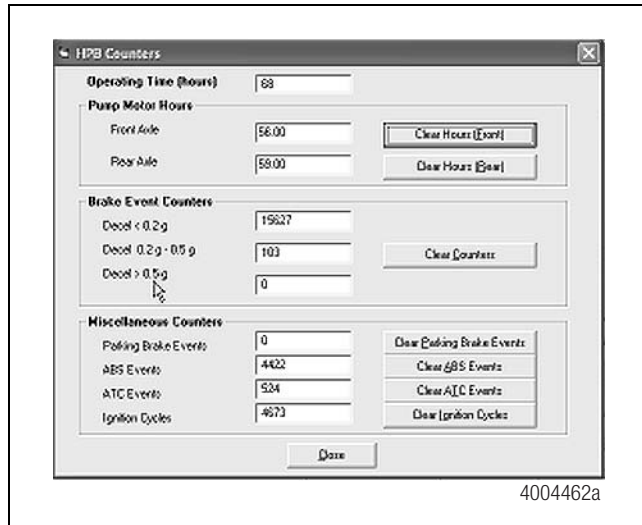


Figure 3.5

The **Counters** screen provides an overview of HPB component performance (pump hours, brake events, etc.) as well as general vehicle activity such as ignition cycles. Occurrences displayed on this screen accumulate until the **Clear** button is selected.

#### Component Tests

Select **Component Tests** from the HPB **Main Screen**. A pull-down menu will appear. Figure 3.6.

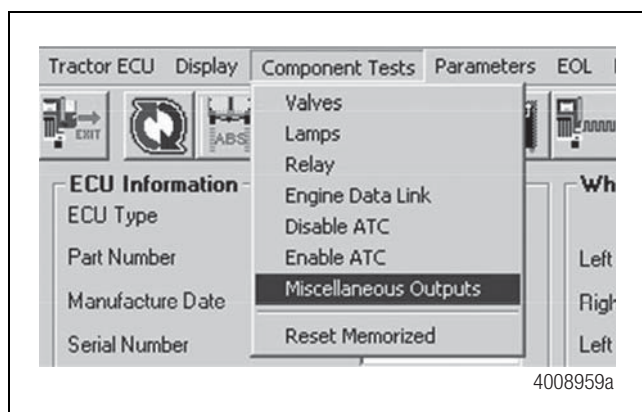


Figure 3.6

#### Valves

Select **Valves** to display the **Valve Activation** test screen. Figure 3.7.

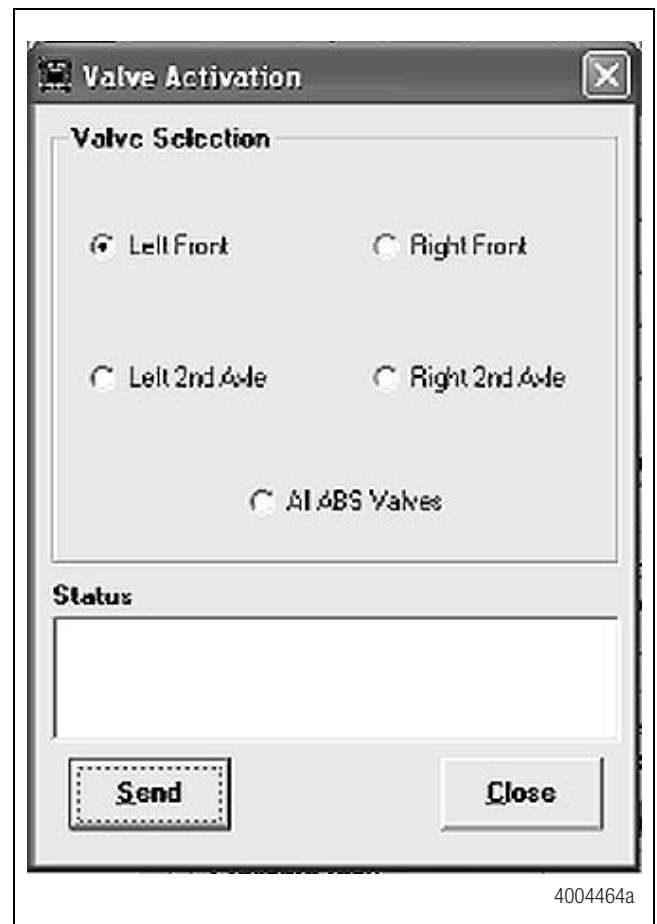


Figure 3.7

The **Valve Activation** test screen lets you activate the HPB valves to check for correct activation and to verify correct brake line installation.

Click on the valve you wish to test, then click the **Send** button to actuate the component. Component activation status appears in the **Status** box field. Select **Close** to exit this screen.

### 3 Troubleshooting and Testing

#### Lamps

Select **Lamps** to display the **Lamp Test** screen. Figure 3.8.

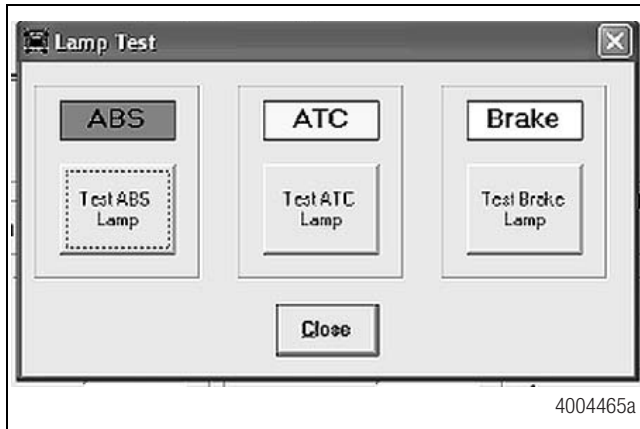


Figure 3.8

As each lamp is tested, check the actual lamp to verify correct operation. Select **Close** to exit this screen.

#### Parking Brake

##### ⚠ WARNING

Park the vehicle on a level surface. Block the front and rear wheels to prevent vehicle movement. Failure to do so can result in unwanted vehicle movement causing serious personal injury.

Select **Parking Brake** to display the **Parking Brake** test screen. Figure 3.9.



Figure 3.9

Select **Release** or **Apply**, then select **Send** to test the parking brake. Select **Close** to exit this screen.

#### Relay (Only on Non-Multiplex Vehicles)

Select **Relay** to display the **Activate Relay** test screen. Figure 3.10.

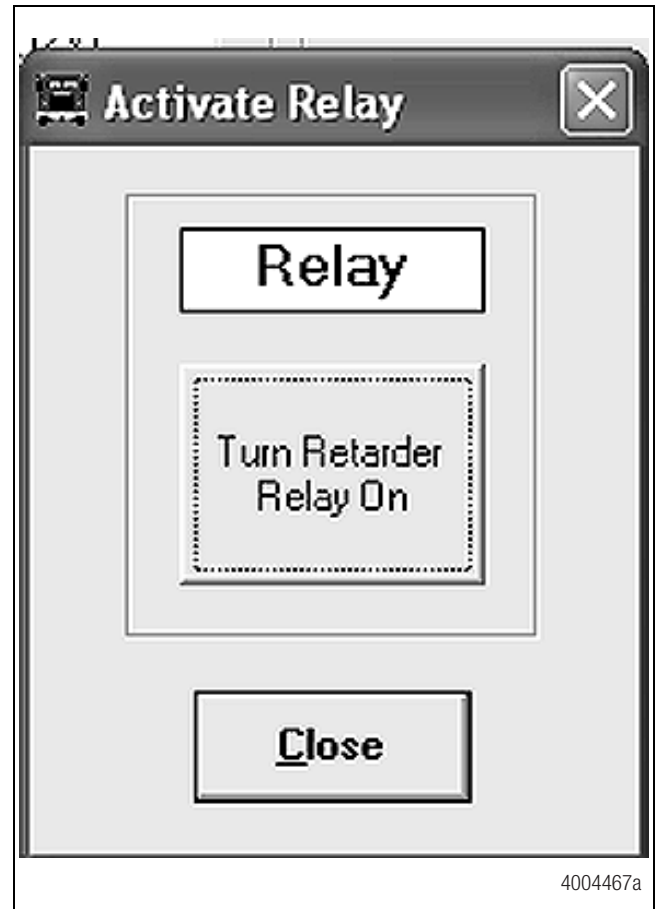
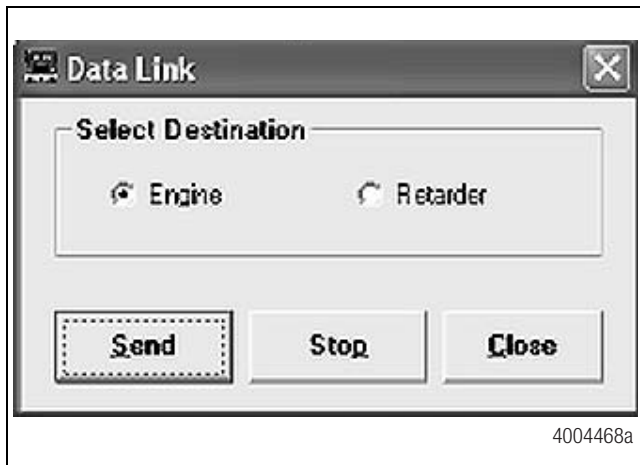


Figure 3.10

This screen allows you to turn the retarder relay on or off. This is helpful in verifying correct operation, installation and wiring of the unit under test. Select **Close** to exit this screen.

#### Engine Data Link

Select **Engine Data Link** to display the **Data Link** test screen. Figure 3.11.



**Figure 3.11**

This screen allows you to send a “limit engine torque” command to the engine or a “disable retarder” command to the retarder.

Select the data link destination (engine or retarder), then select **Send** to test. Use the **Stop** button to end testing. Select **Close** to exit this screen. The vehicle must be running with the engine RPM increased (1000-1500 RPM) in order for this function to work.

#### Disable ATC

Select **Disable ATC** to send a command to the ECU to disable automatic traction control. ATC will remain disabled until the enable command is sent, or until the vehicle ignition is cycled. ATC must be disabled for dynamometer testing.

#### Enable ATC

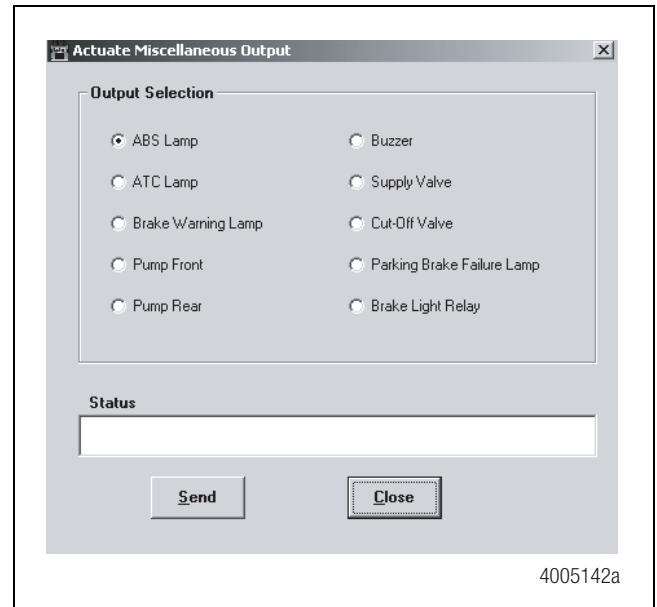
Select **Enable ATC** to send a command to the ECU to enable automatic traction control. This is the normal state of the ECU. Figure 3.6.

**NOTE:** The status bar on the HPB **Main Menu** reflects the current ATC status (enabled, disabled or not available).

#### Miscellaneous Outputs

Select **Miscellaneous Outputs** to display the **Activate Miscellaneous Outputs** test screen. Figure 3.12.

**NOTE:** Use TOOLBOX™ Software to test the following components: Retarder Relay (if available), Brake Light Relay (if available), Supply Valve, Cut-Off Valve, ABS Lamp, Traction Lamp, Brake Warning, Pump Front, Pump Rear, Buzzer.



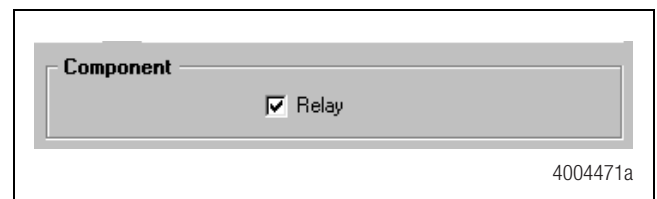
**Figure 3.12**

This screen provides a check of several HPB components, as well as a way to check either inlet or outlet activity of the valves, pump or retarder relay.

Highlight the component you wish to test, then select the **Send** button to actuate the component. Component activation status appears in the **Status Box** field. Select **Close** to exit this screen.

#### Reset Memorized

Select **Reset Memorized** to display the **Learned Component** screen. Figure 3.13.



**Figure 3.13**

## 3 Troubleshooting and Testing

Relay is an automatic default and cannot be de-selected. It indicates the ECU has memorized the installed retarder relay. Once the ECU has seen a retarder, it expects to see it every time the vehicle is powered up.

### Standard Testing

#### Test Equipment: Volt-Ohm Meter (VOM)

Use of a VOM with automatic polarity sensing is recommended. This eliminates the concern of the polarity of the meter leads during voltage measurements.

### System Requirements and Component Tests

#### Tire Size Range

##### WARNING

For correct hydraulic ABS operation, front and rear tire sizes must be within 16% of each other. Do not use a tire size range that exceeds 16%. Failure to do so may cause reduced braking force and result in serious personal injury.

Calculate the tire size with the following equation:

$$\% \text{ Difference} = \left\{ \frac{\text{RPM Steer}}{\text{RPM Drive}} - 1 \right\} \times 100$$

RPM = tire revolutions per mile

##### CAUTION

When troubleshooting or testing the ABS, be careful not to damage the connector terminals. If connector terminals are damaged, they must be replaced.

#### Voltage Check

Voltage must be between 10 and 16 volts for the 12-volt hydraulic ABS to function correctly.

Check the voltage as follows.

1. Turn the ignition ON.
2. Check for correct voltage:

##### 31-Pin Harness:

- Pins 1 and 6 for ignition and ground
- Pins 16 and 18 for pump motor 2

- Pins 17 and 19 for the solenoid valve

##### 2-Pin Power Connector:

- Pins 2 and 1 for pump motor 1

If voltage is not between 10 and 16 volts, verify the wiring connections. Make corrections as required. Use care when removing connections to prevent damage.

### Standard Component Testing

#### Indicator Lamps

If the indicator lamps do not come on after the ignition is turned on, or it comes on but does not go out after three seconds, check all ABS fuses or circuit breakers and replace if necessary. After checking the indicator lamps, make repairs as necessary.

#### Sensor Adjustment

On steering axles, the sensor is typically accessible on the in-board side of the steering knuckle.

On drive axles, the sensor is typically accessible on the in-board side of the rear axle spindle.

To adjust the sensor, push the sensor in until it contacts the tooth wheel.

- Do not pry or push sensors with sharp objects.
- Sensors will self-adjust during wheel rotation.

**NOTE:** No gap is allowed at installation. During normal operation, a gap not to exceed 0.04-inch (1.02 mm) is allowed.

### Vehicle Test Drive

After replacing an HPB component, use TOOLBOX™ Software to ensure there are not active faults, then test drive the vehicle as follows:

1. Turn 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:



## 3 Troubleshooting and Testing

- Most 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.
- If the ABS and ATC lamps do not go off within 3 seconds after turning the ignition ON, the system is looking for a wheel speed test. Drive the vehicle at speeds of 5-10 mph (8-16 km/h). The ABS and ATC lamps will then go off if the system is O.K.
- If the ABS and ATC lamps do not go off after the vehicle reaches a speed of 5-10 mph (8-16 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.

### **WARNING**

**Do not drive the vehicle if active faults are present. Driving the vehicle with active faults present can result in an accident and serious personal injury.**

3. Drive the vehicle for a short distance. Make gentle brake applications to verify brake performance.

## 4 Removal and Installation

### 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.

Park the vehicle on a level surface. For vehicle equipped with manual parking brakes, apply the parking brakes. Ensure that the ignition is turned off. Block the front and rear wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.

Release all air from the air systems before you remove any components. Pressurized air can cause serious personal injury.

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.

Thoroughly clean the area around the HCU fittings before beginning the removal procedure to avoid contaminating the system. As hoses and brake lines are removed, plug all open ports and lines. Contamination may cause loss of braking force or brake failure, and result in serious personal injury.

#### CAUTION

The HPB hydraulic power brake system is a complex device that provides optimum efficiency and operation. If the system sustains damage, or a component malfunctions and requires replacement, the replacement procedures provided by Meritor WABCO must be followed exactly with the associated steps performed in the order presented.

Hydraulic brake fluid is a caustic substance. Contact with the hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid contact brake pads, shoes, rotors or discs.

Before disposing of used components, verify the warranty status. Contact OnTrac Customer Service Center at 866-OnTrac1 (668-7221) for instructions.

### Removal

#### Hydraulic Compact Unit

#### 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 serious personal injury.

**NOTE:** The following general guidelines are provided to facilitate the safe removal of the HCU from the vehicle.

- Two people are needed to perform this procedure.
  - For the HCU drain procedure in Step 11, TOOLBOX™ Software version 9.0 or higher is required. If you do not have this version of TOOLBOX™ Software, please contact the ArvinMeritor Customer Service Center for additional information.
  - 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.
  - HPB systems may include automatic parking brakes. If your vehicle is equipped with manual parking brakes, refer to the manual parking brake procedures. To determine the type of parking brake on the vehicle, refer to the vehicle specification sheet.
  - Bleed the brake and master cylinder circuits. Bleed procedures appear in Section 5 of this manual.
  - 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 Section 3 of this manual.
1. Park the vehicle on a level surface. Apply the parking brake. Ensure that the ignition is turned OFF.
  2. Block the front and rear tires to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.

## 4 Removal and Installation

3. Disconnect the battery.
4. Use a clean rag to carefully clean the surface of the HCU and the surrounding area.
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 4.1.

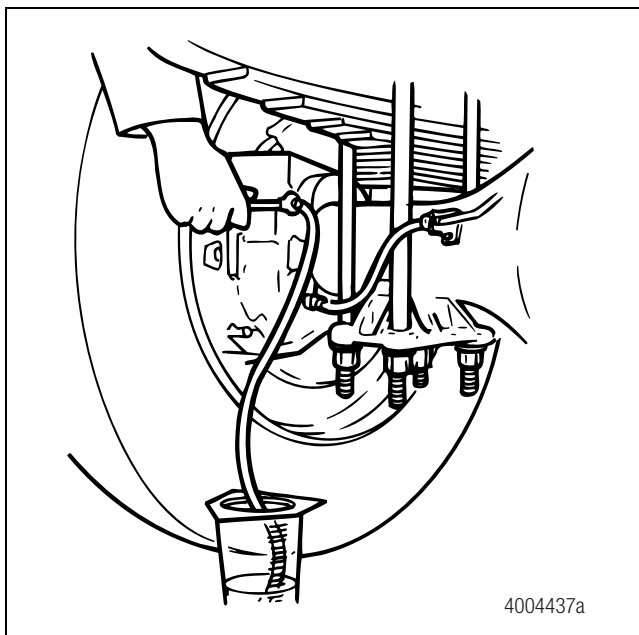


Figure 4.1

- 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 the torque value specified by the component manufacturer.
6. Repeat Steps A-E for the second axle.

**NOTE:** Be careful not to damage the HCU reservoir inlet when attaching the pinch clamp. If damaged, it will need to be replaced.

7. Attach hose clamp pliers to the low pressure hose at the HCU reservoir inlet. Clamp the rubber hose at least 3 inches (76 mm) away from the entrance to the HCU reservoir. Use care to avoid damage to the plastic reservoir nipple inside the hose. Figure 4.2.

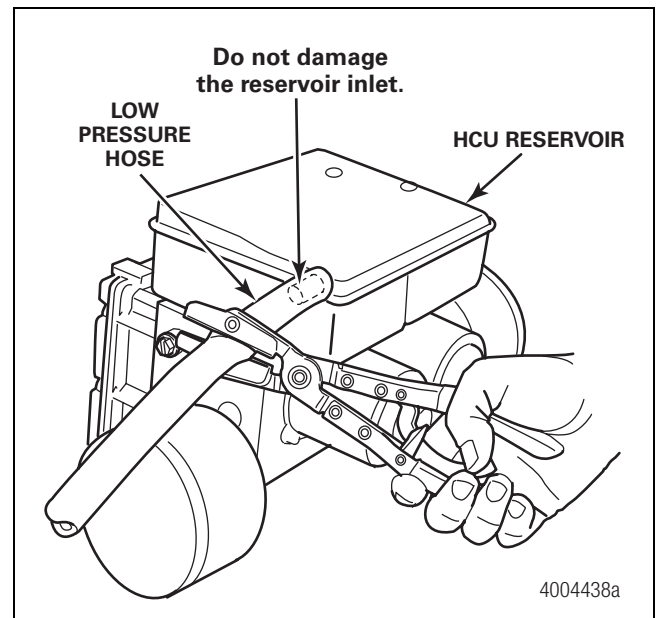


Figure 4.2

8. Loosen the two support brackets and any retaining hardware that holds the middle section of the low pressure hose to the chassis. The bolts must be loose enough to allow movement of the hose during the HCU removal.
9. 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.
10. Disconnect the low pressure hose from the HCU reservoir. Plug both the low pressure hose and the HCU reservoir inlet to prevent system contamination.
11. Before removing the HCU assembly from the vehicle, drain the fluid from the HCU reservoir. To do this:
  - A. Reconnect the battery.
  - B. Attach a bleeder bottle to one wheel end at the **front** axle.

## 4 Removal and Installation

- C. Connect the vehicle to a computer that has TOOLBOX™ Software, version 9.0 or higher, installed.
- D. From the HPB Main Menu, select **EOL** to enable the End of Line test. The pull-down option, **Drain Reservoir**, will appear. Click on **Drain Reservoir** to start the drain procedure. Figure 4.3.

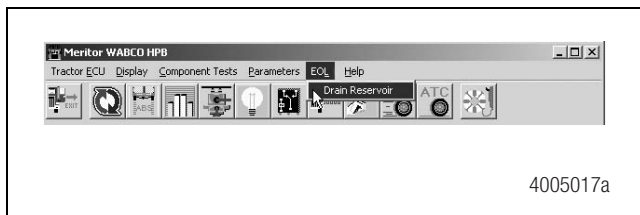


Figure 4.3

- E. Open the bleeder screw.
  - F. Apply and hold the brake pedal down until no more fluid runs out.
  - G. Tighten the bleeder screw.
- Attach a bleeder bottle to one wheel end at the **rear** axle.  
Repeat Steps D-G for the rear axle.
12. Disconnect the battery.
  13. Disconnect the brake lines from the HCU. There are at least six brake lines; seven if the system is equipped with power parking brakes. Plug the brake lines and ports on the HCU to prevent system contamination. Mark the brake lines to ensure correct positioning during reassembly.
  14. Open the latches on the two-pin power connector and the 31-pin harness attached to the ECU. After the latch is released, remove the connectors from the ECU. Figure 4.4.

If the vehicle is equipped with hydraulic parking brakes, disconnect the pressure supply valve electrical connector on the HCU. Refer to the Parking Brake Pressure Supply Valve removal and installation procedures in this section.

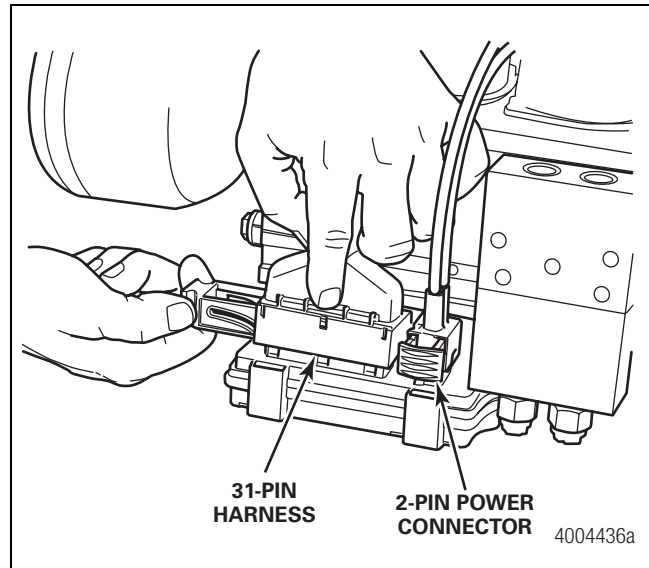


Figure 4.4

**NOTE:** If space does not permit removing the HCU with the mounting brackets attached, skip Step 15 and proceed to Step 16.

15. While supporting the HCU, loosen and remove the four nuts (two per side) that hold the HCU mounting brackets to the frame rail of the vehicle. Remove the HCU, with mounting brackets attached, from the vehicle. Figure 4.5.

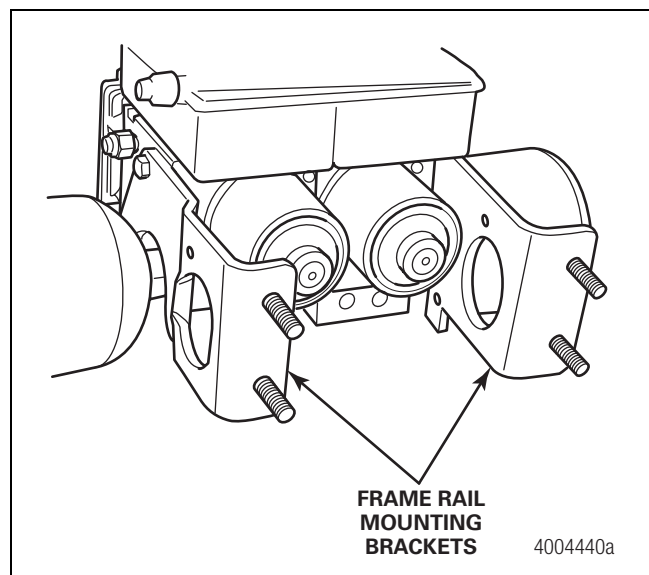


Figure 4.5

## 4 Removal and Installation

16. Loosen and remove the two bolts that hold the HCU to the front mounting bracket. Then, loosen and remove the two bolts that hold the HCU to the rear mounting bracket.
17. Remove the mounting brackets from the HCU.
18. Examine the four bushings inside the brackets for potential deformations. Replace if necessary.
19. Verify the warranty status. If the HCU is under warranty, return it to Meritor WABCO.

### Installation

#### Hydraulic Compact Unit

##### **CAUTION**

The replacement HCU is pre-charged with brake fluid to ensure successful bleeding. To prevent fluid loss, do not remove the protective caps until you are ready to connect the brake lines. Damage to components can result.



**NOTE:** Before installation, the replacement HCU must be fitted with the HCU reservoir. Refer to the HCU reservoir installation information in this section.

**NOTE:** Meritor WABCO recommends that you install the replacement HCU in the same location as the old one.

**NOTE:** Bleeding the master cylinder, brake caliper and spring-applied/hydraulic release (SAHR) circuits is required during installation of the HCU. Refer to Section 5.

**NOTE:** Examine the four bushings inside the brackets for potential deformations before attaching the HCU to the brackets. Replace if necessary.

**NOTE:** If space does not permit installing the HCU with the mounting brackets attached, perform Step 2 first, then perform Step 1.

1. Ensure that the ignition is off and the battery is disconnected.
2. Position the HCU between the mounting brackets. While supporting the HCU, install the four replacement bolts that attach the HCU to the mounting brackets. Tighten the bolts to 32-34 ft-lb (43-46 N•m). 
3. Attach the two mounting brackets to the frame rail of the vehicle. Tighten the nuts to 79.7-99.6 ft-lb (108-135 N•m). 

4. Connect the brake lines. Remove the protective cover before attaching the line. Check the line markers to ensure correct installation on the HCU. Figure 4.6 and Figure 4.7.
  - Four lines leading to the wheel ends
  - Two lines leading to the master cylinder
  - One line leading to the parking brake (if equipped)

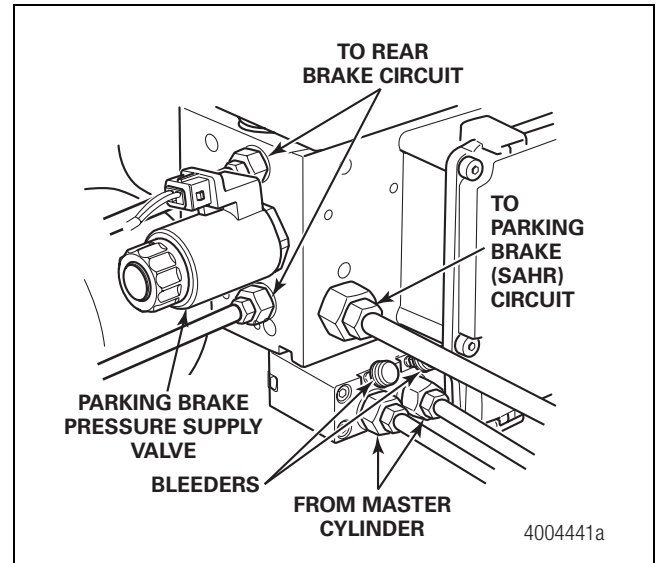


Figure 4.6

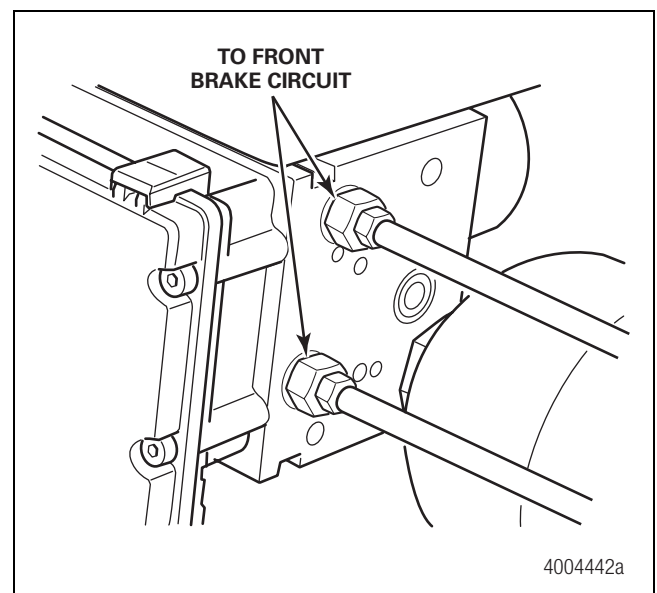


Figure 4.7

## 4 Removal and Installation

5. Connect the low pressure hose from the master cylinder reservoir to the HCU reservoir and secure the connection with a hose clamp. Once the connection is secure, remove the pinch clamp installed during the removal of the old HCU.
6. Tighten the two support brackets (hose clamps) that secure the low pressure hose to the vehicle chassis.
7. Fill the brake system with new brake fluid from a sealed container until the fluid level in the master cylinder reservoir stabilizes at the Max mark. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specifications sheet to determine which fluid to use.

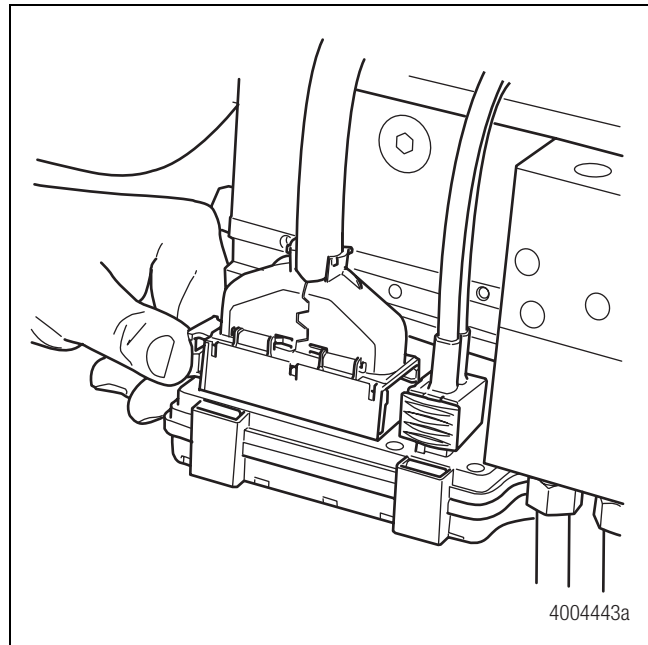
**NOTE:** Temporarily open one caliper bleeder screw or the SAHR bleeder screw, if applicable, to expedite the filling process. The open bleeder screw facilitates the expelling of the air from the system. Close the bleeder screw when filling is complete.

### WARNING

**Electrical connectors must be correctly installed with the latch pushed in to lock the connection to prevent them from coming loose or disconnecting. Failure to securely connect and correctly latch the connectors could result in loss of braking functions during vehicle operation. Serious personal injury can result.**

8. Attach the 31-pin harness and then the two-pin power connector to the ECU. Push the latch into position to lock the connection. Figure 4.8.

If the vehicle is equipped with a hydraulic parking brake, attach the pressure supply valve connector. Refer to the Parking Brake Pressure Supply Valve removal and installation procedures in this section.



**Figure 4.8**

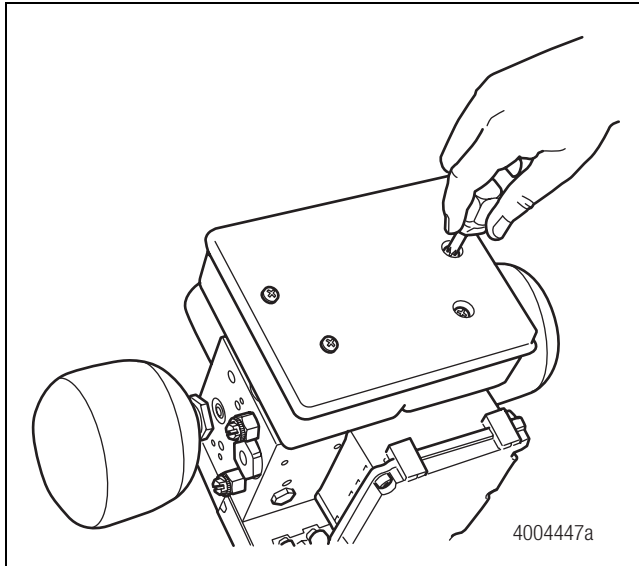
9. Proceed with pressure filling and bleeding the brake caliper circuits, and the SAHR circuit, if applicable. Refer to Section 5 for procedures.

## Removal

### HCU Reservoir

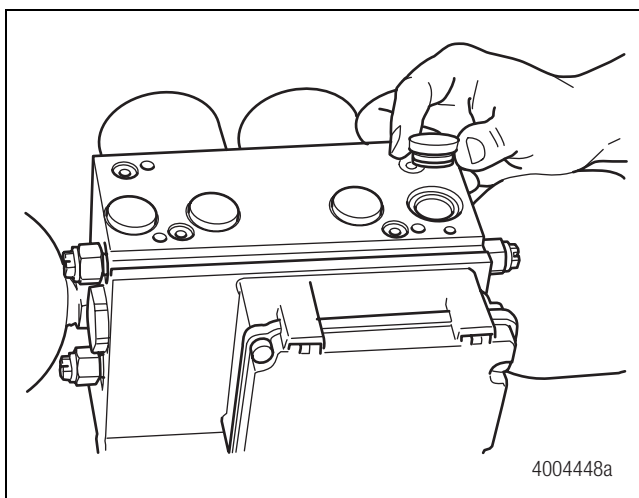
**NOTE:** The removal of the entire HCU assembly is necessary in order to remove the HCU reservoir. Refer to the hydraulic compact unit removal procedure in this section.

1. Remove the HCU assembly from the vehicle. Refer to the hydraulic compact unit removal procedure in this section.
2. Inspect the area between the body of the HCU and the HCU reservoir to ensure the area is free from any dirt or other contaminants. Clean if necessary. Do not allow any contaminants to enter the HCU ports.
3. Use a number 4 Phillips-head screwdriver to remove the four HCU reservoir mounting screws. Then, remove the reservoir from the HCU. Figure 4.9.



**Figure 4.9**

4. Verify the warranty status. If the reservoir is under warranty, return it to Meritor WABCO.
5. Remove the old rubber grommets from the four ports. Do not allow any dirt or other contaminants from these grommets to enter the HCU ports. If contaminated, the unit must be replaced.
6. Seal the HCU reservoir ports. Figure 4.10.



**Figure 4.10**

7. With the ports plugged, clean the top of the HCU.

## Installation

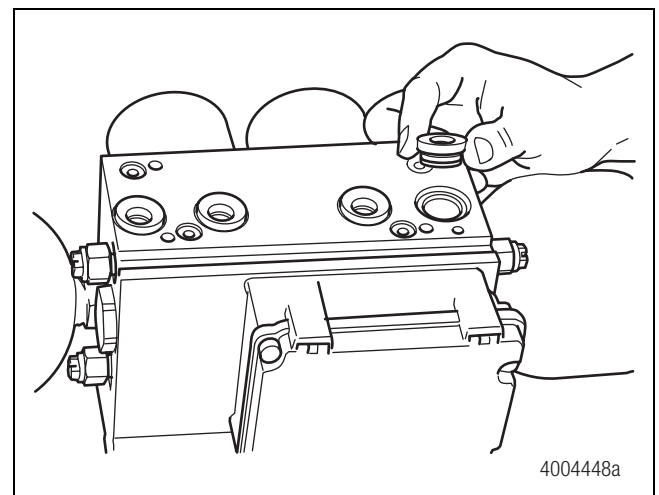
### HCU Reservoir

#### **⚠ WARNING**

To ensure correct assembly, use only the four seals and four screws included in the HCU reservoir replacement kit. Do not reuse the seals or screws from the old reservoir. Failure to do so may cause reduced braking force and result in serious personal injury.

**NOTE:** Bleeding the master cylinder, brake caliper and spring-applied/hydraulic release (SAHR) circuits is required during installation of the HCU. Refer to Section 5.

1. Inspect the top of the HCU to ensure it is clean and free from debris or other contaminants.
2. Remove the plugs from the reservoir ports on the HCU.
3. Install the four new black rubber grommets from the replacement kit into the ports on the top of the HCU. Figure 4.11.



**Figure 4.11**

4. Use new, clean brake fluid from a sealed container to lubricate the reservoir grommets. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
5. Position the reservoir on the HCU and verify orientation: The mounting screw holes must line up and the inlet port for the low pressure hose must face the front of the HCU. Figure 4.12.

## 4 Removal and Installation

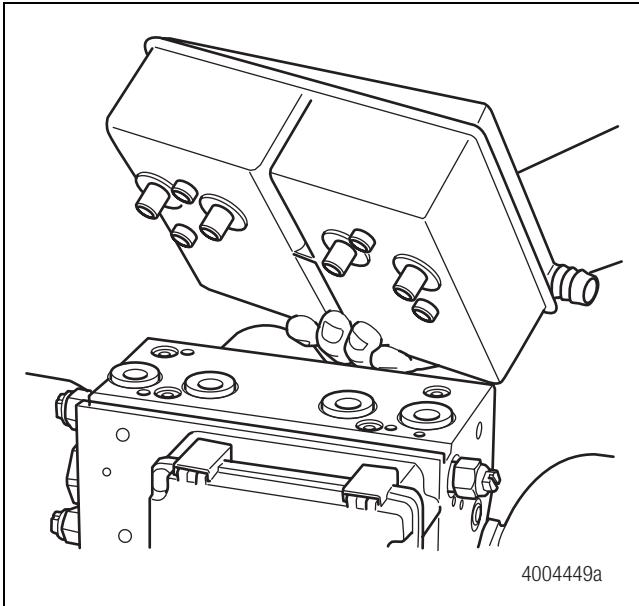


Figure 4.12

6. Install the new reservoir by pressing it carefully and completely into the grommets in the ports. Figure 4.13.

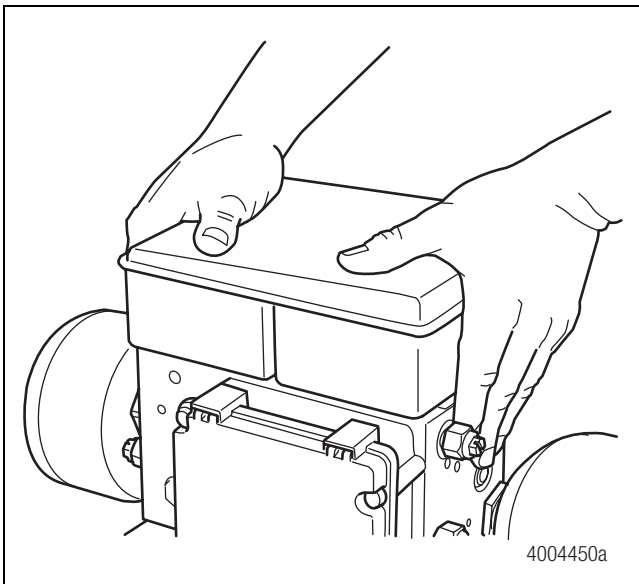



Figure 4.13

7. Use the four new mounting screws to attach the reservoir to the HCU. Using a number 4 Phillips-head screwdriver, tighten the screws to 43-60 in-lb (5-7 N•m). 
8. Reinstall the HCU assembly on the vehicle. Refer to the hydraulic compact unit installation procedure in this section.

## Removal

### HCU Accumulators

#### 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. For vehicle equipped with manual parking brakes, apply the parking brakes. Block the front and rear wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.

Release all air from the air systems before you remove any components. Pressurized air can cause serious personal injury.

It is possible for the removed accumulator to retain an internal pressure of up to 1087 psi. To eliminate any removed accumulator from posing a safety hazard, depressurize the accumulator and disable its pressure chamber.

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.

Thoroughly clean the area around the HCU fittings before beginning the removal procedure to avoid contaminating the system. As hoses and brake lines are removed, plug all open ports and lines. Contamination may cause loss of braking force or brake failure, and result in serious personal injury.



## 4 Removal and Installation

### CAUTION

The HPB hydraulic power brake system is a complex device that provides optimum efficiency and operation. If the system sustains damage, or a component malfunctions and requires replacement, the vehicle owner is strongly advised to contact the nearest dealer for professional assistance and repair. If location and circumstances prevent consulting the dealer, and components must be replaced, the replacement procedures provided by Meritor WABCO must be followed exactly with the associated steps performed in the order presented.

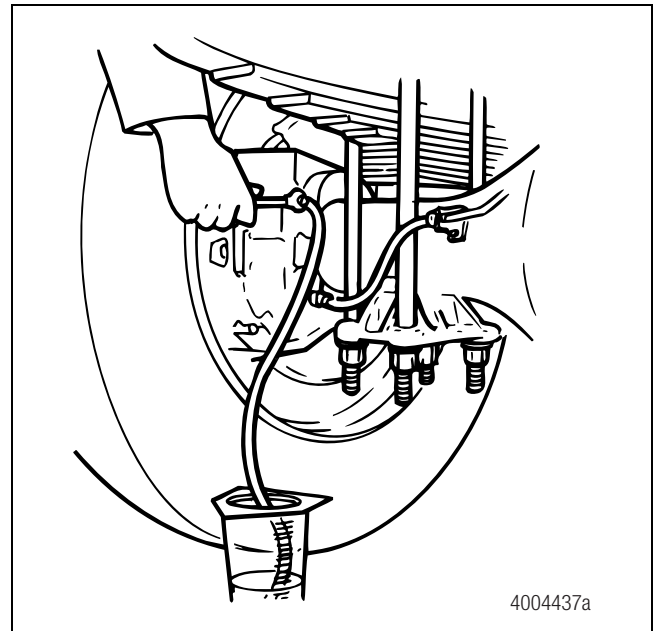
Hydraulic brake fluid is a caustic substance. Contact with the hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid contact brake pads, shoes, rotors or discs.

**NOTE:** The following general guidelines are provided to facilitate the safe removal of the accumulators from the HPB.

- Accumulators are precharged with gas pressure to 1087 psi and have a limited shelf life. When replacing an accumulator, note and record the expiration date of the replacement accumulator.
- Used accumulators **must** be depressurized before disposal. Follow Steps 10A-10D to perform this procedure.
- Meritor WABCO recommends replacing both accumulators at the same time.
- It is not necessary to remove the entire HCU to replace the accumulators.
- Replacing the accumulators does not require any brake bleed procedures.
- **Accumulators still under warranty must be returned without depressurizing. Drilling accumulators will void the warranty.**
- Two people are needed to perform this procedure.
- After installing HBP components or making system repairs, use TOOLBOX™ Software to remove the error code from the ECU memory. Instructions for using TOOLBOX™ Software appear in Section 3 of this manual.

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. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
3. Disconnect the battery.
4. Use a clean rag to carefully wipe the surface of the HCU and the surrounding area.
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 4.14.

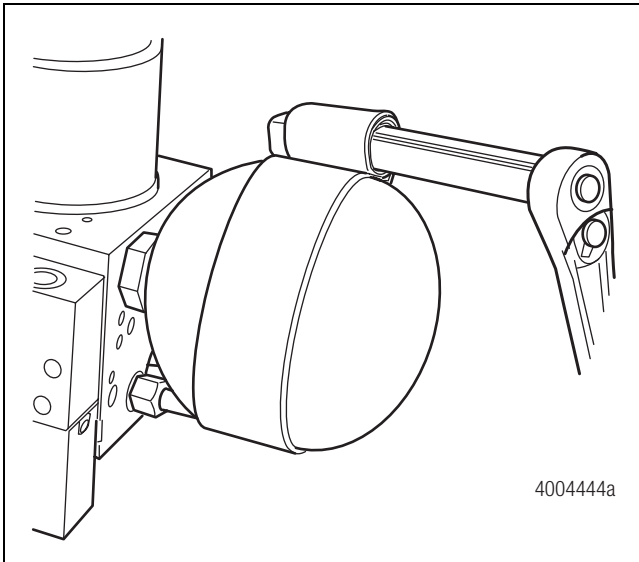


**Figure 4.14**

- 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 the torque value specified by the component manufacturer.

## 4 Removal and Installation

6. Repeat Steps A-E for the second axle.
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. Use a strap wrench to remove the accumulator. The accumulator has a right-hand thread. Figure 4.15.



**Figure 4.15**

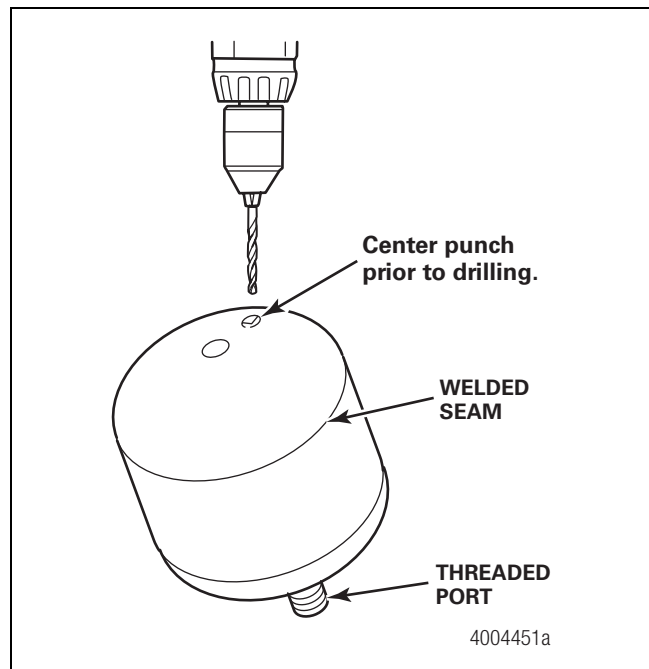
9. Use a clean rag to clean the counterbore on the HCU. Inspect the counterbore to ensure that the O-ring seal was removed. Plug the counterbore to prevent contamination from entering the HCU.
10. Determine the warranty status of the accumulators. If the accumulators are under warranty, do not perform Step 11 (depressurizing the accumulators). Return the accumulators to Meritor WABCO. If the accumulators are not under warranty, the accumulators **MUST** be depressurized before disposal (Step 11).

### **⚠ WARNING**

A slight hissing sound may be heard when the wall of the accumulator is pierced. Metal shavings may be blown away from the hole during this procedure. Wear protective goggles, not glasses, to protect the eyes.

11. Use the following steps to depressurize the accumulator and disable the internal pressure chamber before disposing of the accumulators. Figure 4.16.

- A. Securely position the accumulator on a drill press table. Use a vise or clamp that will allow the accumulator to be correctly positioned. The drilling point will be on the opposite side of the welded seam from the threaded port.
- B. Center punch the accumulator.
- C. Use a 3 mm or 1/8-inch drill bit to slowly and carefully drill approximately 1/2-inch (12.7 mm) into the accumulator. Figure 4.16.



**Figure 4.16**

- D. After releasing the internal pressure, correctly dispose of the accumulator.
  - Repeat Steps A-D to depressurize the second accumulator.

### Installation

#### HCU Accumulators

##### **⚠ WARNING**

Failure to bleed the system whenever any hydraulic system fitting is loosened or disconnected will allow air to remain in the system. This will prevent the hydraulic pressure in the brake system from rising enough to apply the brakes correctly. This will cause the stopping distance to increase and can result in serious personal injury.

Correctly discard hydraulic brake fluid that is removed from the brake system. Hydraulic brake fluid that is removed can be contaminated and, if used, can cause damage, loss of braking and serious personal injury.

Use only the type of hydraulic brake fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic brake fluid. The incorrect hydraulic brake fluid will damage the rubber parts of the brake caliper and can cause damage, loss of braking and serious personal injury.

A new accumulator is precharged to a pressure of 1087 psi. Do not puncture or pierce the accumulator. Puncturing or piercing the accumulator may result in personal injury or death.

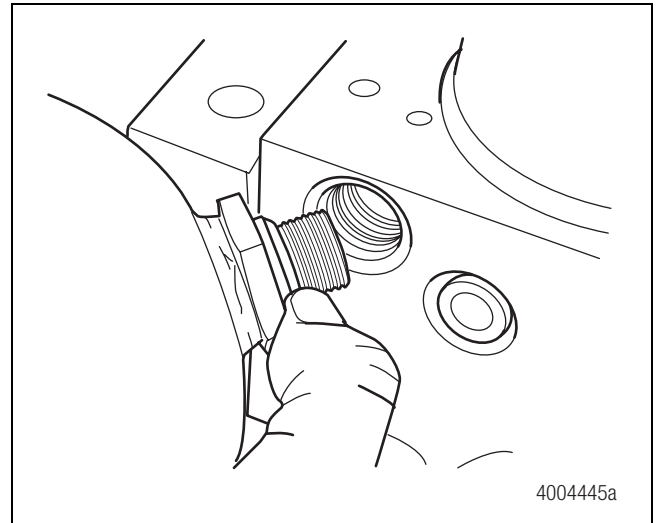
**NOTE:** Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.

##### **⚠ CAUTION**

Hydraulic brake fluid is a caustic substance. Contact with hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid get on brake pads, shoes, rotors or disks.

1. Remove the plug from the accumulator counterbore on the HCU. Clean the counterbore and the surrounding area. The old accumulator O-rings should have been removed from the counterbore during removal of the accumulators. Verify that the O-ring was removed.
2. Use clean brake fluid from a sealed container to lubricate the O-ring on the new accumulator. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.

3. Place the new accumulator and O-ring into the counterbore. After positioning, use a torque wrench with a strap wrench attachment to tighten to 43.4-50 ft-lb (60-70 N•m). Do not overtighten. Figure 4.17. **ⓘ**



**Figure 4.17**

4. Repeat Steps 1-3 to replace the second accumulator.
5. Check the fluid level in the master cylinder reservoir. Fluid level should be at the MAX mark. If not, fill the 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.

**NOTE:** Never add fluid above the MAX mark regardless of the state of the accumulator.

6. Connect the battery.
7. Turn the ignition to ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.

If the HCU pump motors fail to deliver a sufficient amount of fluid, the ECU module will control the HCU pump motors in a self priming procedure. The HCU pump motors should stop within three minutes, with the brake warning light and the buzzer OFF. If there are problems building pressure after bleeding and powering up the system, increase the pressure setting of the pressure bleeder equipment to 29-40 psi (2-2.75 bar), and cycle the ignition off for 10 seconds, then back on.

## 4 Removal and Installation

**NOTE:** Pressure should be left on the system during the first key-on (attempt to build pressure).

8. When the pumps stop running and the system is fully charged, the fluid level in the master cylinder reservoir should be between MIN and MAX marks.
9. Check the accumulator connections for leaks. If there are no leaks, go to Step 11.

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. Figure 4.18.

- 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 the torque value specified by the component manufacturer.

- Repeat Steps A-E for the second axle.

10. After making the repairs, check the fluid level in the master cylinder reservoir to make sure it is at the MAX mark when both accumulators are fully depleted. Refill as necessary, using only the recommended DOT 3 or DOT 4 hydraulic brake fluid, as described above. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.

**NOTE:** Never add fluid above the MAX mark regardless of the state of the accumulator.

11. Use TOOLBOX™ Software to cancel the diagnostic code for the accumulator. Refer to Section 3 for TOOLBOX™ instructions.
12. Perform the Deplete Accumulators function two times. Refer to the procedure in this section.
13. Remove the wheel blocks.
14. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

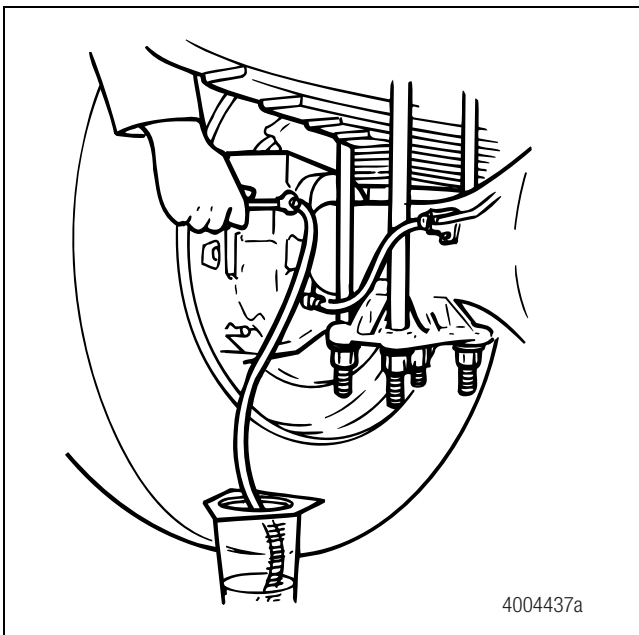


Figure 4.18

### Removal

#### Electronic Control Unit (ECU)

##### **⚠ 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. For vehicle equipped with manual parking brakes, apply the parking brakes. Block the front and rear wheels to prevent vehicle movement. Failure to do so can result in unwanted vehicle movement causing serious personal injury.

Release all air from the air systems before you remove any components. Pressurized air can cause serious personal injury.

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**

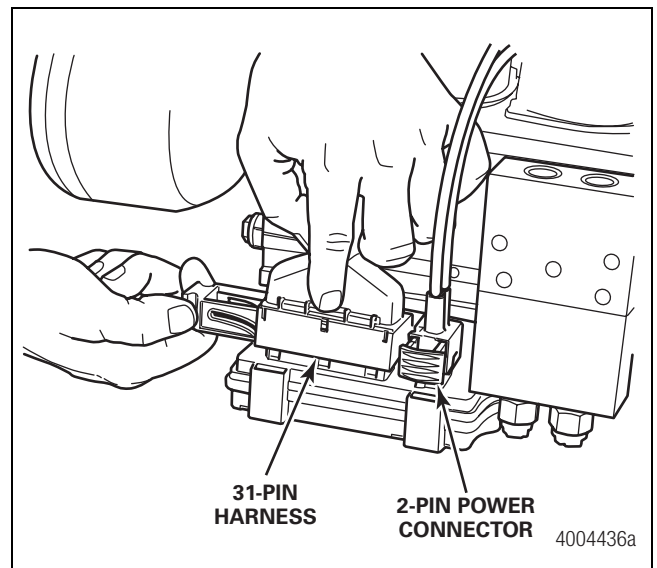
The HPB hydraulic power brake system is a complex device that provides optimum efficiency and operation. If the system sustains damage, or a component malfunctions and requires replacement, the replacement procedures provided by Meritor WABCO must be followed exactly with the associated steps performed in the order presented.

Hydraulic brake fluid is a caustic substance. Contact with the hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid contact brake pads, shoes, rotors or discs.

**NOTE:** Do not open the ECU. Opening the ECU to gain access to the internal components will void the warranty.

**NOTE:** The following general guidelines are provided to facilitate the safe removal of the ECU module from the HCU assembly.

- It is not necessary to remove the entire HCU to replace the Electronic Control Unit (ECU).
  - After replacing the ECU, new system parameters must be entered. Refer to Section 3 of this manual for parameter entry procedures.
  - When only the ECU is replaced, bleeding the system is not necessary.
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. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
  3. Disconnect the battery.
  4. Use a clean rag to carefully wipe the surface of the HCU and the surrounding area.
  5. Open the latches on the two-pin power connector and the 31-pin harness attached to the ECU. After the latch is released, remove the connectors from the ECU. Figure 4.19.



**Figure 4.19**

6. Use a 4 mm Allen wrench to loosen and remove the four mounting screws that attach the ECU module to the HCU. Remove the screws in the sequence shown. Figure 4.20.

## 4 Removal and Installation

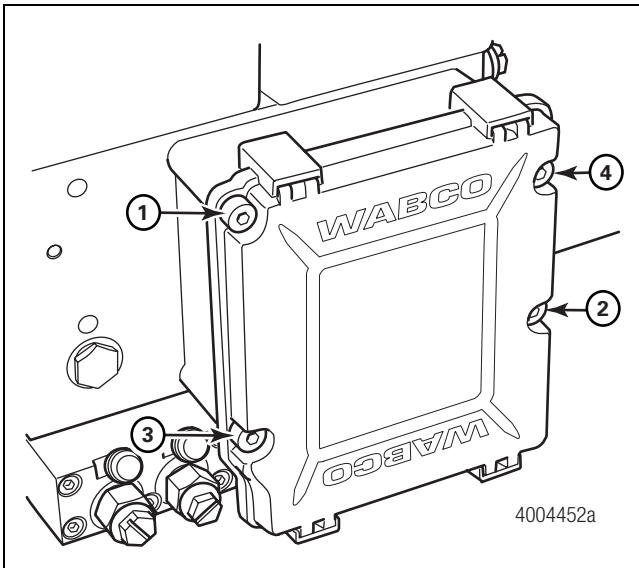


Figure 4.20

7. Carefully remove the ECU by lifting straight out. To avoid damaging the HCU, do not twist the ECU during removal. Determine the warranty status of the ECU. If the ECU is under warranty, return it to Meritor WABCO. If it is not under warranty, discard the used ECU.

### ⚠ CAUTION

Do not touch the pressure sensor connectors. The connectors are sensitive and can be damaged by static electrical shock.

8. Use a clean rag to carefully clean the area around the valves formerly covered by the ECU. Do not touch the two pressure sensor connectors. Figure 4.21.

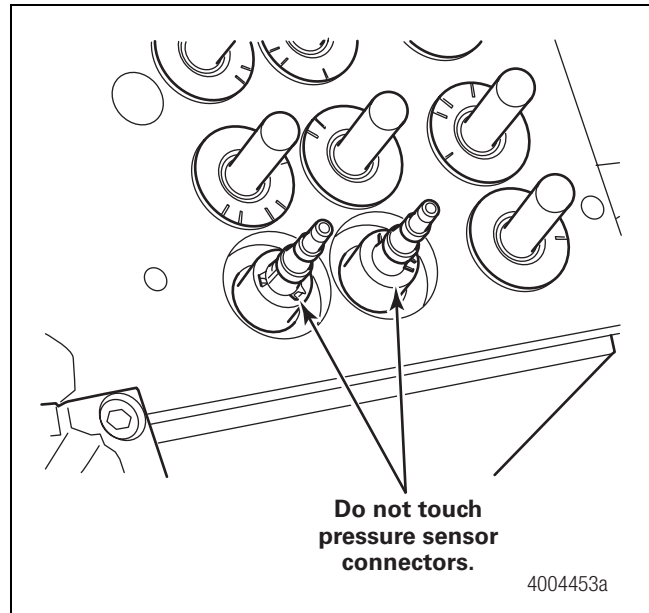


Figure 4.21

9. Remove and discard the orange seals from the two pressure sensors. Do not touch the two pressure sensor connectors.

## Installation

### Electronic Control Unit (ECU)

### ⚠ CAUTION

Do not touch the pressure sensor connectors. The connectors are sensitive and can be damaged by static electrical shock.

1. Remove the replacement orange seals from the ECU replacement kit. Install the seals onto the replacement ECU.

### ⚠ CAUTION

Excessive force in positioning the ECU onto the HCU will damage the ECU housing. Do not force the ECU into position. Use a gentle, even pressure when positioning the ECU.

2. Position the ECU onto the HCU valves. Apply gentle pressure to seat the ECU. Motor connectors must achieve full depth into the housing. The gap between the HCU and ECU must not exceed 0.08-inch (2 mm). Figure 4.22.

## 4 Removal and Installation

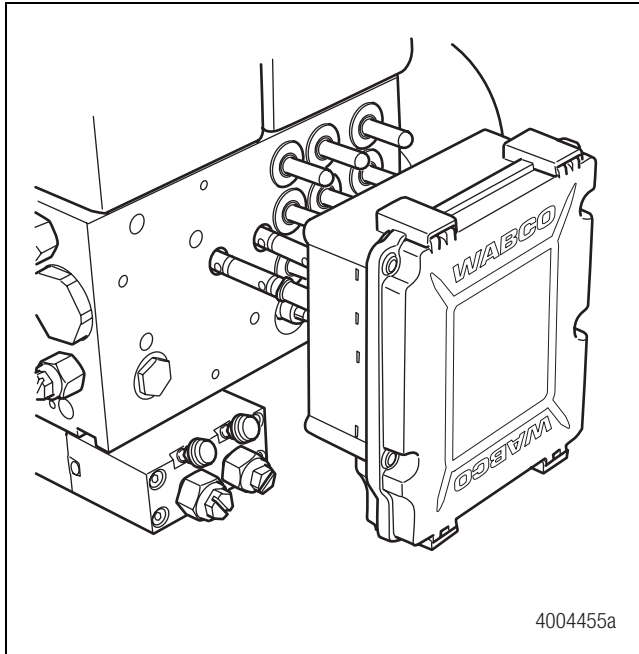



Figure 4.22

3. Use a 4 mm Allen wrench to tighten the four mounting screws that attach the ECU to the HCU. Tighten to 14 in-lb (1.5 N•m). Do not exceed this torque. The metal sleeves on the ECU housing must rest flat on the body of the HCU. Tighten the screws using the correct sequence. Figure 4.23. 

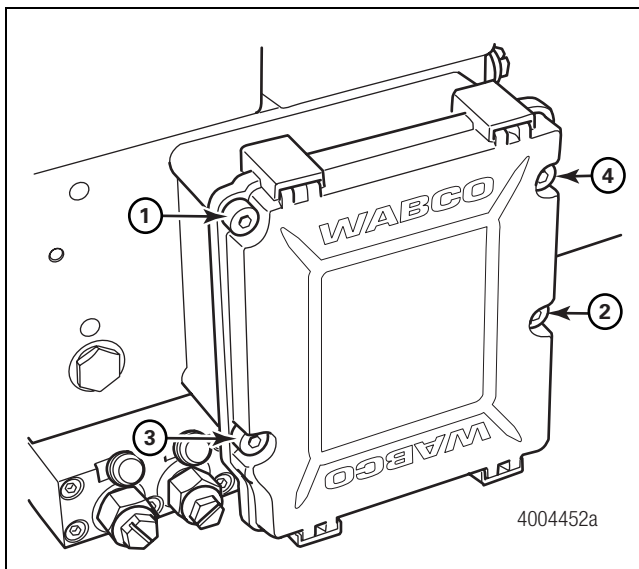



Figure 4.23

4. When the ECU is correctly installed with the metal sleeves flat on the HCU, tighten the bolts to 21-30 in-lb (2.5-3.5 N•m). 

### WARNING

Electrical connectors must be correctly installed with the latch pushed in to lock the connection to prevent them from coming loose or disconnecting. Failure to securely connect and correctly latch the connectors could result in loss of braking functions during vehicle operation. Serious personal injury can result.

5. Attach the 31-pin harness and then the two-pin power connector to the ECU. Push the latch into position to lock the connection. Figure 4.24.

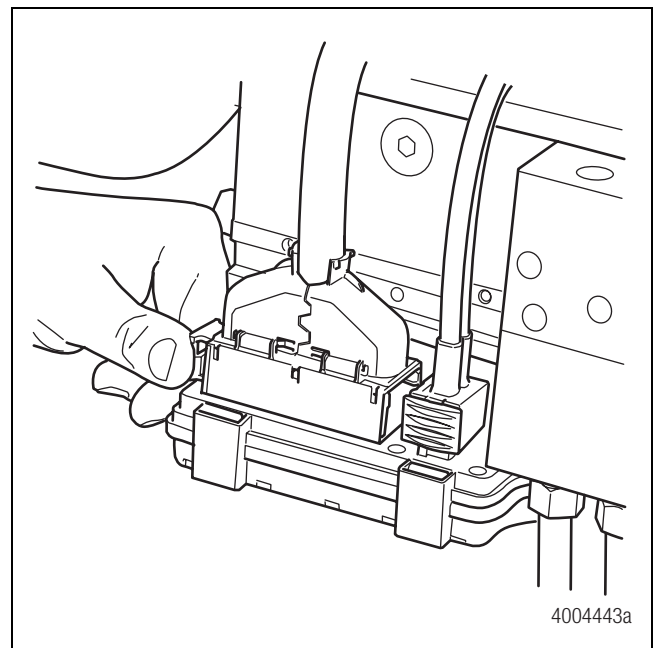


Figure 4.24

6. Connect the battery.

**NOTE:** Refer to the vehicle specification sheet for HPB system parameter values and parameter entry information.

7. Use TOOLBOX™ Software to enter the HPB system parameters.
8. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## 4 Removal and Installation

### Removal

#### Hydraulic Compact Unit (HCU) Relay Valve

1. Wear safe eye protection.
2. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
3. Disconnect the battery.
4. 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.
  - 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 close the bleeder fitting screw.
5. Use a torque wrench to tighten the bleeder fitting screw to the torque value specified by the component manufacturer.
6. Repeat Step 4 and Step 5 for the other axle.
7. Use hose clamp pliers to clamp the rubber hose at least three-inches (76 mm) away from the entrance to the HCU reservoir. Use care to avoid damage to the plastic reservoir nipple inside the hose. Figure 4.25.

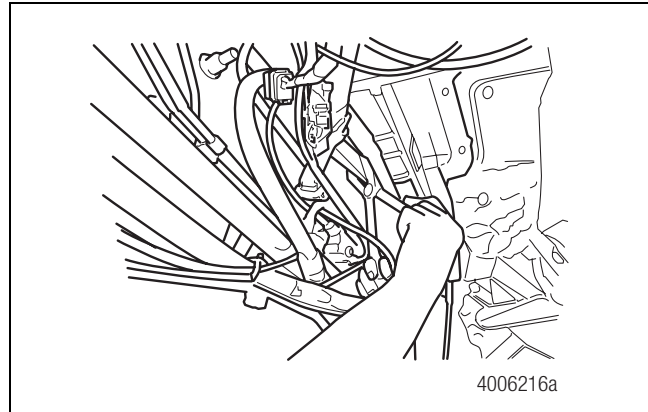


Figure 4.25

**NOTE:** Avoid bending or kinking the brake lines while disconnecting and handling other components.

8. Disconnect the two master cylinder brake lines from the relay valve. Plug the two lines to prevent contamination.
9. Use a 4 mm socket wrench to loosen and remove the five Allen-head screws that secure the relay valve to the hydraulic compact unit (HCU). Figure 4.26.

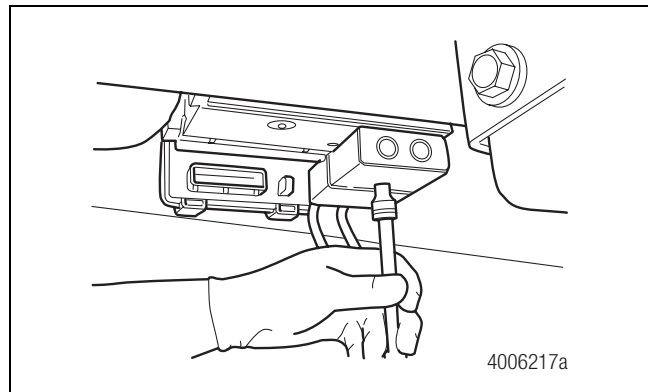


Figure 4.26

10. Carefully lower and remove the relay valve.
11. Remove and discard the rubber-coated seal plate. **Do not reuse this plate.** During installation, use the new seal plate included with the relay valve replacement kit. Figure 4.27.



## 4 Removal and Installation

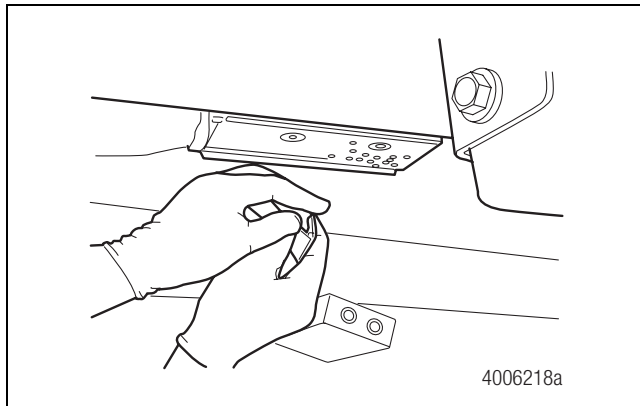


Figure 4.27

12. Use denatured alcohol and lint-free rags to clean the valve mounting surface. Ensure there is no rubber sticking to the HCU. Do not allow rubber or other debris to fall into the HPB bore holes. Figure 4.28.

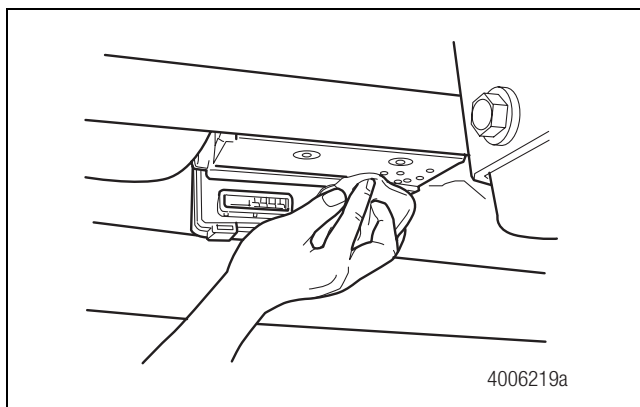


Figure 4.28

### Installation

#### Hydraulic Compact Unit (HCU) Relay Valve

1. Place a screw into the center mounting hole of the relay valve. Use a hex-head socket tool for positioning. Place the new relay valve seal onto the relay valve using the screw to align the seal. The orientation should match Figure 4.29. Position the relay valve against the HCU. Thread the screw into the HCU.

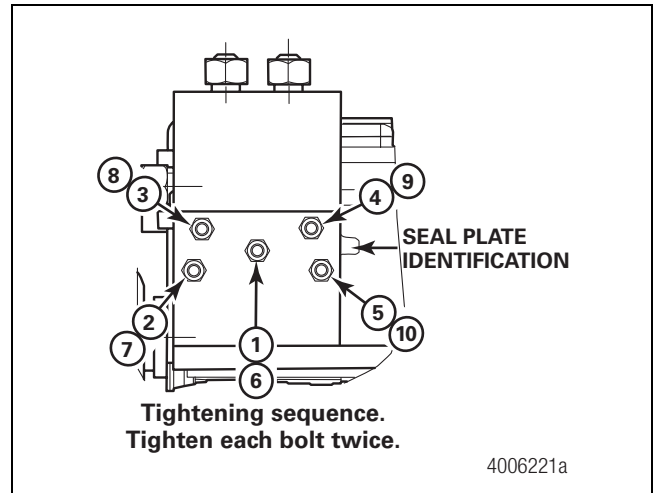



Figure 4.29

2. Place the remaining four screws into the mounting holes on the relay valve. Hand tighten all five screws.
3. Use a torque wrench to tighten all five screws to 71 in-lb (8 N•m) following the numbered sequence illustrated in Figure 4.29. 
4. Attach the master cylinder brake lines. Remove the hose clamp from the low pressure hose.
5. Fill the brake system with new brake fluid from a sealed container until the fluid level in the master cylinder reservoir stabilizes at the MAX mark. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specifications sheet to determine which fluid to use.

**NOTE:** Temporarily open one caliper bleeder screw or the SAHR bleeder screw, if applicable, to expedite the filling process. The open bleeder screw facilitates the expelling of the air from the system. Close the bleeder screw when filling is complete.

6. Proceed with pressure filling and bleeding the master cylinder circuit. Refer to Section 5 for procedures.
7. Proceed with pressure filling and bleeding the brake caliper circuits, and the SAHR circuit if applicable. Refer to Section 5 for procedures.

## 4 Removal and Installation

### Removal

#### Hydraulic Compact Unit (HCU) Pump

Before removing the pump, ensure the replacement pump is readily accessible.

1. Wear safe eye protection.
2. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
3. Disconnect the battery.
4. 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.
  - 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 close the bleeder fitting screw.
5. Use a torque wrench to tighten the bleeder fitting screw to the torque value specified by the component manufacturer.
6. Repeat Step 4 and Step 5 for the other axle.
7. Use hose clamp pliers to clamp the rubber hose at least three-inches (76.2 mm) away from the entrance to the HCU reservoir. Use care to avoid damage to the plastic reservoir nipple inside the hose. Figure 4.30.

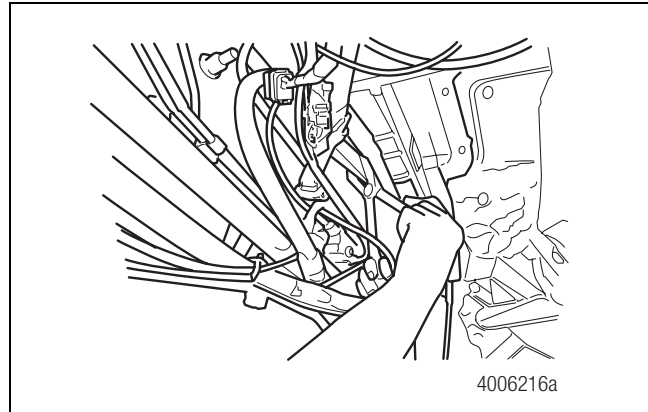


Figure 4.30

**NOTE:** Avoid bending or kinking the brake lines while disconnecting and handling other components.

8. For a rear axle pump, proceed to Step 9. For a front axle pump, carefully remove the relay valve from the HCU to gain access to the pump. **Do not kink or bend the brake lines while removing the relay valve.**
9. Prepare the replacement pump. Lubricate both pump O-rings with brake fluid. Actuate the pump several times by depressing the spring-loaded pump button by hand. The initial force required to actuate the pump and depress the pump button may be high at first. However, after the first actuation, the force should be reduced.
10. Use a 6 mm hex-head socket wrench to remove the pump retaining plug from the HCU cavity. To minimize fluid spill, keep the replacement pump within reach and prepared for installation. Figure 4.31.

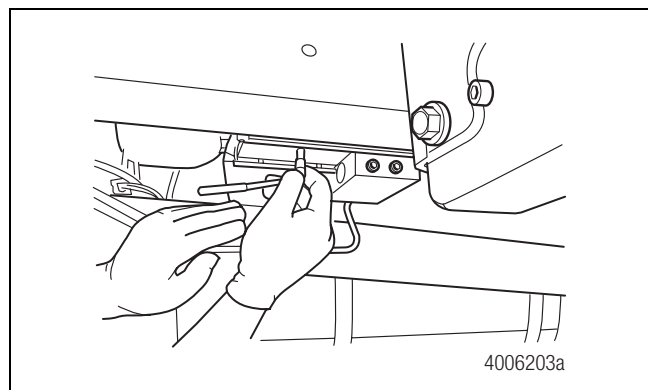


Figure 4.31

### CAUTION

Use care when removing the pump to prevent damage to the O-rings.

- Use needle nose pliers with a good grip to remove the pump from the bore. Use care to prevent damage to the O-rings. Avoid sliding the needle nose pliers on the pump. This can produce metal filings or contaminants which can enter the pump bore. Do not leave any foreign material in the pump bore. Figure 4.32.

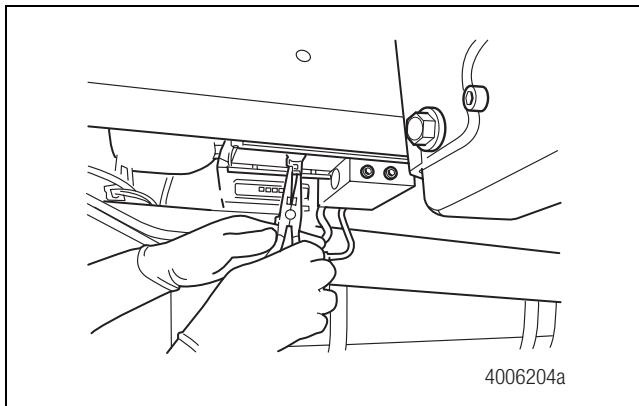


Figure 4.32

- Inspect the bore holes to verify that no foreign material such as rubber, rag lint or metal filings have entered the bore holes. If necessary, remove foreign material with a lint-free swab.
- Install the replacement pump. Refer to the installation procedure. **If you are replacing both pumps, do not remove the second pump before installing the first replacement pump.**

## Installation

### Hydraulic Compact Unit (HCU) Pump

### CAUTION

Use care when installing the pump to prevent damage to the O-rings.

- Use light hand pressure to slowly seat the pump into the bore. Use care not to damage the O-rings. Figure 4.33.

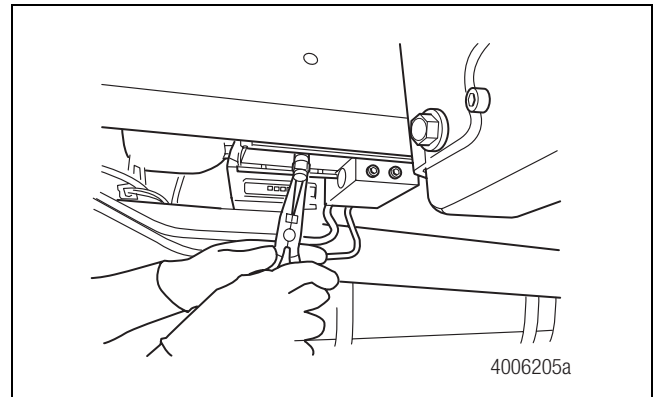



Figure 4.33

- Insert the pump retaining plug into the threaded hole. Use a 6 mm hex-head socket wrench to tighten the plug to  $195 \pm 18$  in-lb ( $22 \pm 2$  N•m). Figure 4.34. 

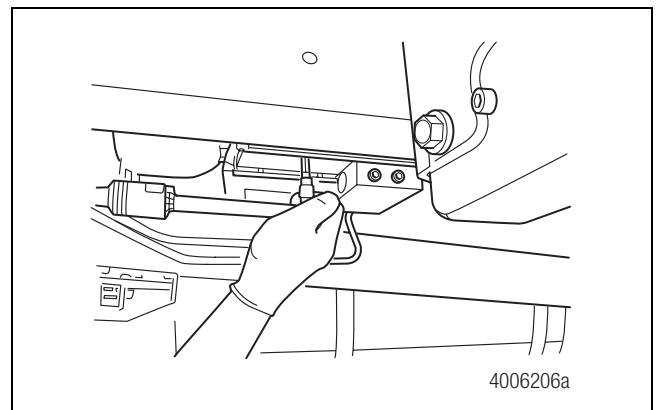


Figure 4.34

- Repeat the procedure for removing and installing the second pump (if replacing both pumps).
- If the front axle pump was replaced, install the relay valve. Refer to TP-0672, Hydraulic Compact Unit (HCU) Pump Relay Valve Replacement, for the correct procedures.
- Remove the hose clamp from the rubber hose.
- Proceed with pressure filling and bleeding the master cylinder circuit. Refer to Section 5 for procedures.
- Proceed with pressure filling and bleeding the brake caliper circuits, and the SAHR circuit if applicable. Refer to Section 5 for procedures.

## 4 Removal and Installation

### Removal

#### Master Cylinder Replacement Information

Before removing the master cylinder assembly or the master cylinder reservoir, verify the components 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 Meritor 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 travel 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 four rubber grommets.

#### Master Cylinder

##### 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 Section 5 of this manual.
- 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 Section 3 of this manual.

**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 not to damage the reservoir. Do not install a damaged reservoir.

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. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
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 4.35.

## 4 Removal and Installation

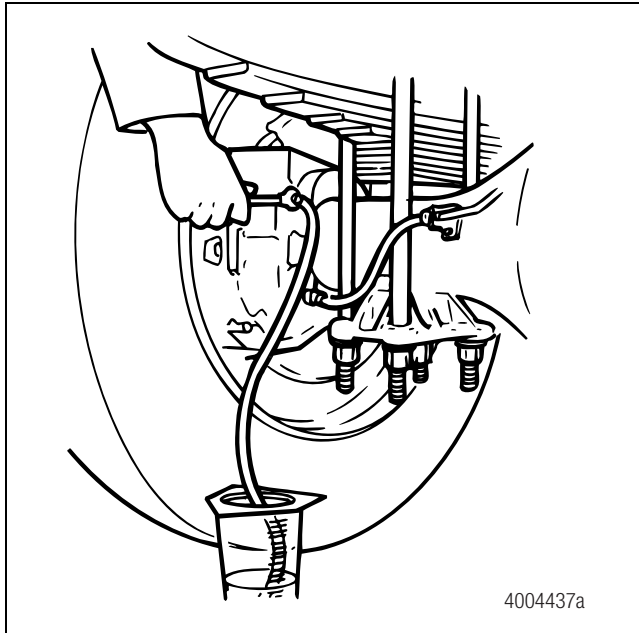


Figure 4.35

- 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 the torque value specified by the component manufacturer.

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 4.36.

**NOTE:** Be careful not to damage the HCU reservoir outlet when attaching the pinch clamp. If damaged, it will need to be replaced.

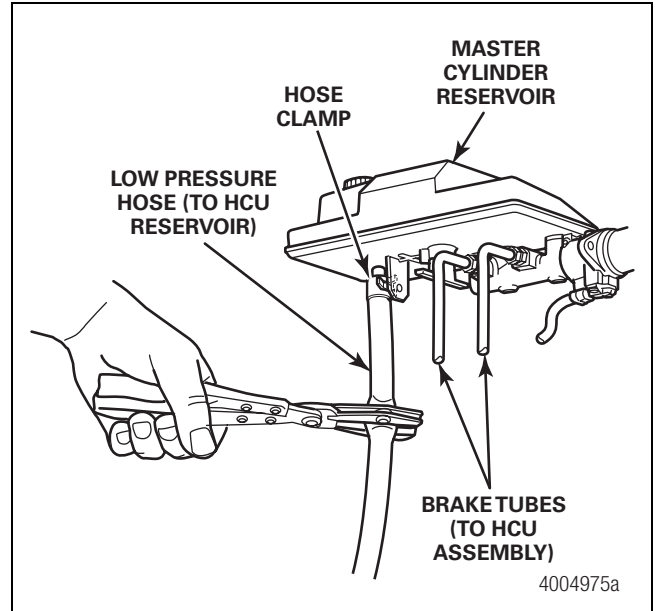


Figure 4.36

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 4.37.

## 4 Removal and Installation

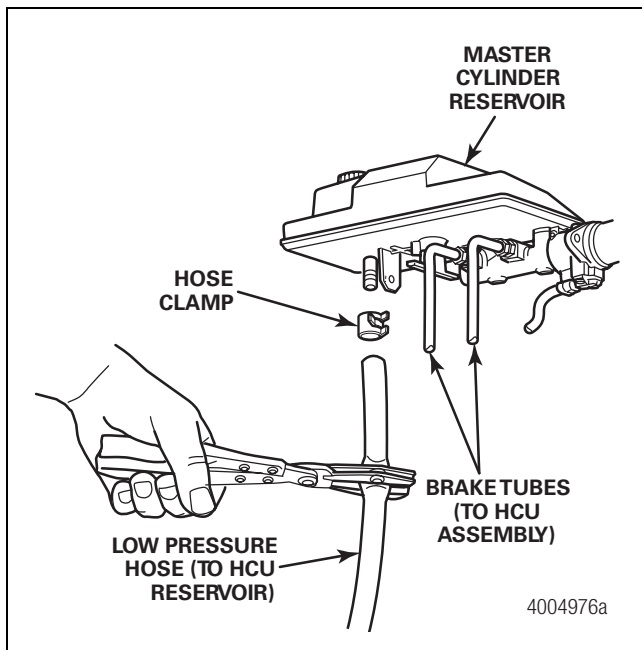


Figure 4.37

**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 4.38.

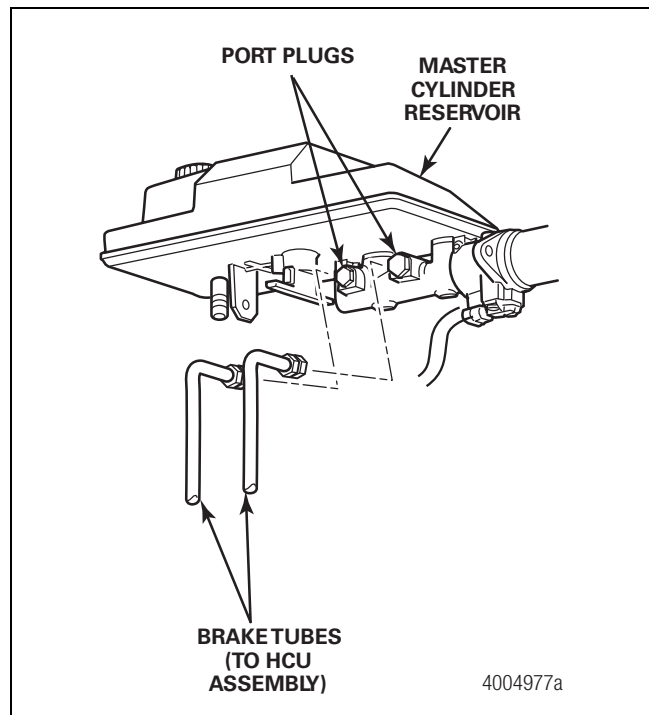


Figure 4.38

13. Disconnect the master cylinder pushrod clevis pin from the brake pedal. Figure 4.39.

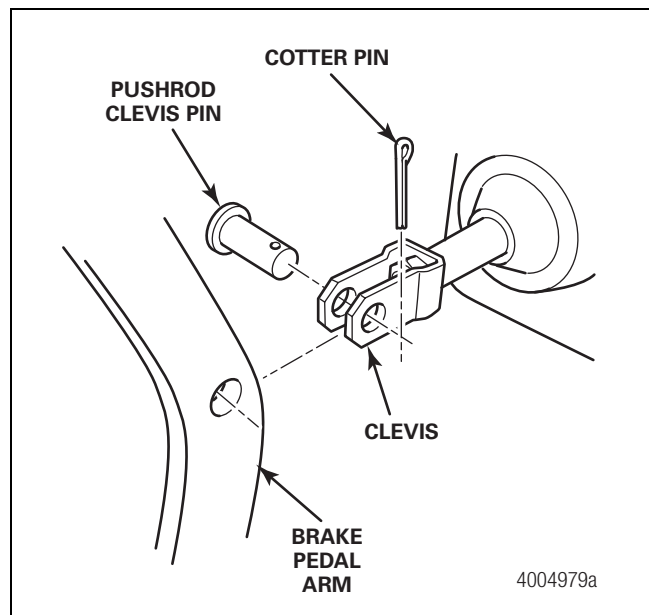


Figure 4.39

## 4 Removal and Installation

14. Loosen and remove the two bolts 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. Use care and support the tabs while you drive out the pins.
  - 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 Meritor WABCO.

### Installation

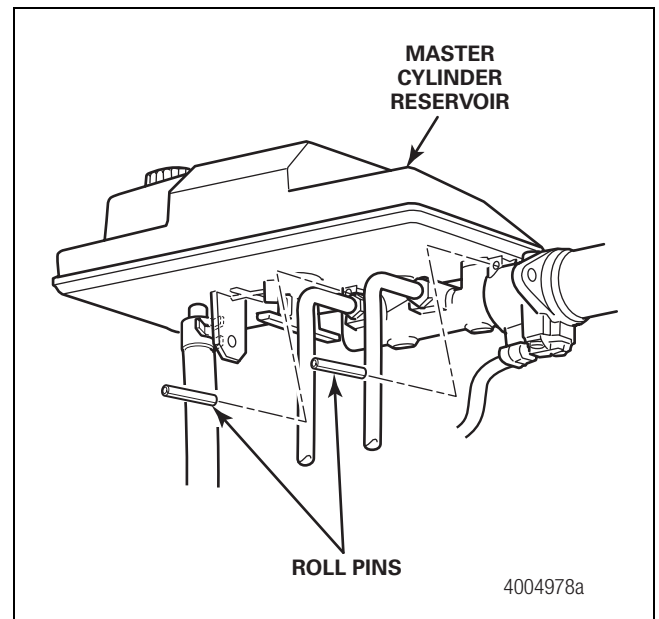
#### Master Cylinder

##### **WARNING**


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

- 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 Section 5 of this manual.
  - 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 Section 3 of this manual.
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 grommets.
- C. Install 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 4.40.
- D. Install the nut on the front bolt.



**Figure 4.40**

2. 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 ft-lb (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.

3. 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 4.41.

## 4 Removal and Installation

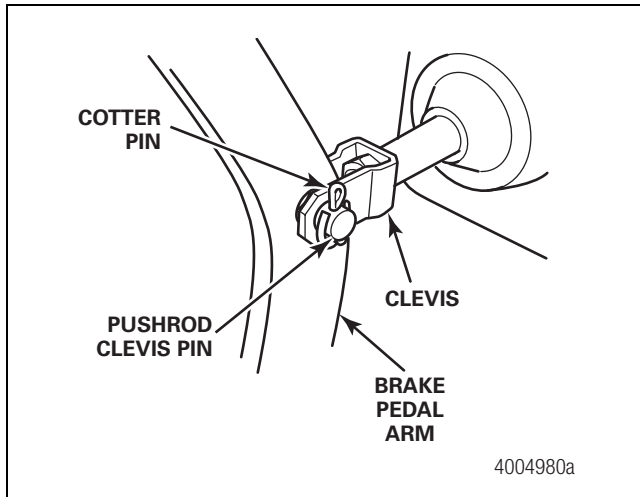


Figure 4.41

4. Connect the brake tubes to the master cylinder. Tighten the fittings to 10.8-14.4 ft-lb (15-20 N•m).
5. Connect the low pressure hose to the master cylinder reservoir and secure the connection with a hose clamp.
6. Remove the pinch clamp from the low pressure hose.
7. Connect the foot brake switch on the master cylinder and the fluid level sensor switch under the reservoir. Figure 4.42.

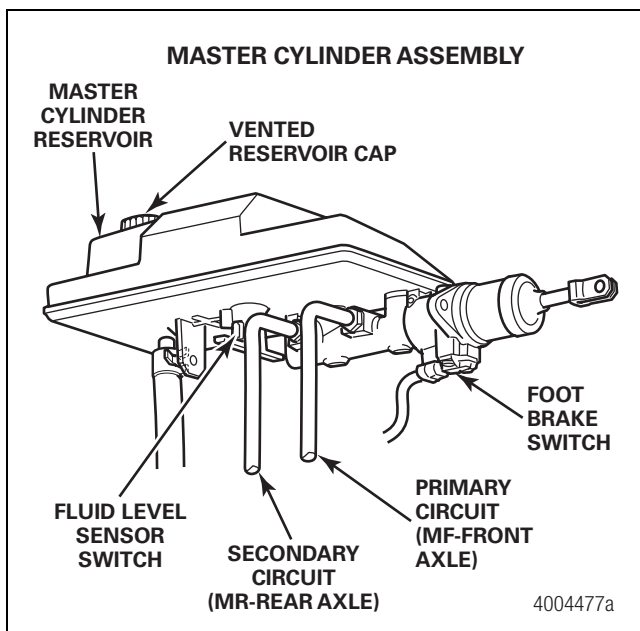


Figure 4.42

8. Bleed the master cylinder circuit. Refer to Section 5.

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.
10. Connect the battery.
11. Turn the ignition ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.

If the HCU pump motors fail to deliver a sufficient amount of fluid, the ECU module will control the HCU pump motors in a self priming procedure. The HCU pump motors should stop within three minutes, with the brake warning light and the buzzer OFF. If there are problems building pressure after bleeding and powering up the system, increase the pressure setting of the pressure bleeder equipment to 29-40 psi (2-2.75 bar), and cycle the ignition off for 10 seconds, then back on.

**NOTE:** Pressure should be left on the system during the first key-on (attempt to build pressure).

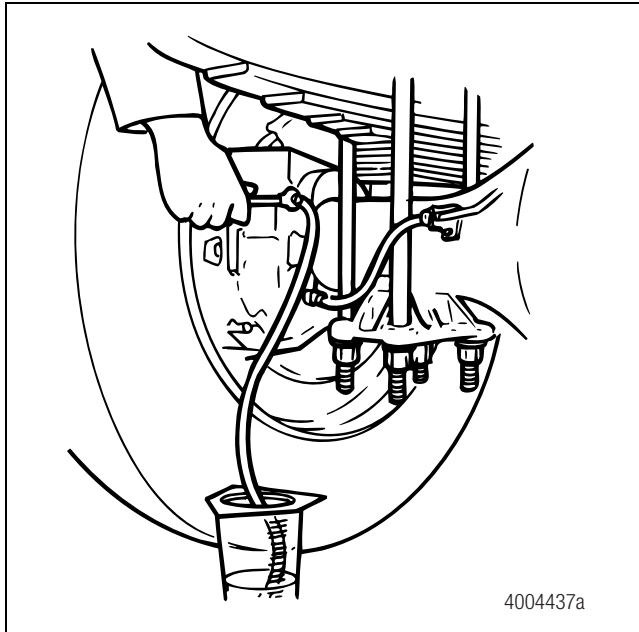
12. Depress the brake pedal rapidly four times to activate both HCU pump motors.
13. After the pumps stop running and the system is completely charged, the brake fluid level in the master cylinder reservoir should be between the MIN and MAX marks. Adjust if necessary. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.
14. Check the system for leaks. If there are no leaks, go to Step 17.

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

- Remove the two maxi-fuses for the pump motors or disconnect the battery.
- 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 open 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 4.43.



**Figure 4.43**

- 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 the torque value specified by the component manufacturer.
  - 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. Reinstall the two maxi-fuses for the pump motors or reconnect the battery.
17. Use TOOLBOX™ Software to clear the diagnostic code for the master cylinder. Refer to Section 3 for TOOLBOX™ instructions.
18. Remove the wheel blocks.

19. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## Removal

### Master Cylinder Reservoir

#### **⚠ 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 Section 5 of this manual.
- 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 Section 3 of this manual.

#### **⚠ WARNING**

**Park the vehicle on a level surface. For vehicles with manual parking brakes, apply the parking brakes. Block the front and rear tires to prevent vehicle movement. Failure to do so can result in unwanted vehicle movement causing serious personal injury.**

1. Park the vehicle on a level surface. For vehicles with manual parking brakes, apply the parking brakes.

## 4 Removal and Installation

2. Block the front and rear tires to prevent vehicle movement. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
3. Remove the two maxi-fuses for the pump motors or 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 to the torque value specified by the component manufacturer. Figure 4.44.

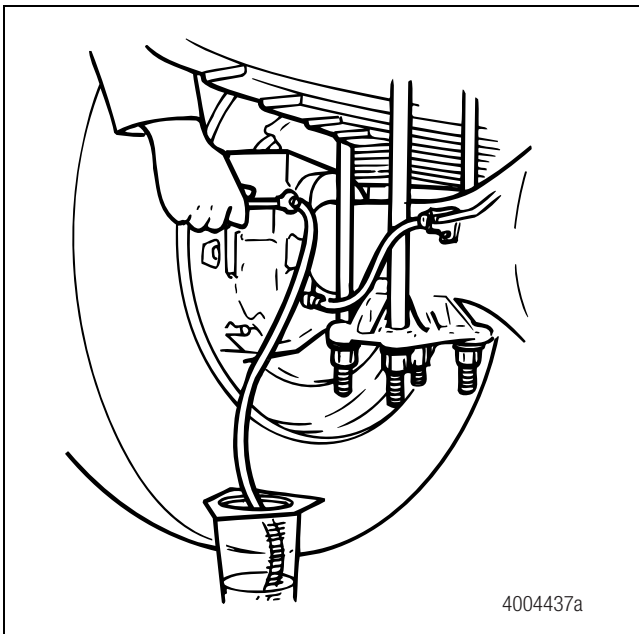


Figure 4.44

- 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 4.45.

**NOTE:** Be careful not to damage the HCU reservoir outlet when attaching the pinch clamp. If damaged, it will need to be replaced.

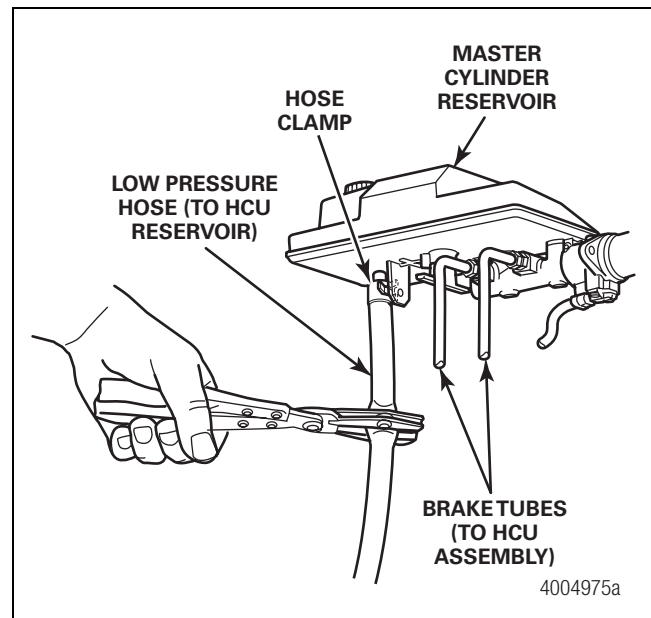


Figure 4.45

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 from the low pressure hose.
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.

## 4 Removal and Installation

- 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 container that can withstand the effects of brake fluid.
  - 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 Meritor WABCO.

### Installation

#### Master Cylinder Reservoir

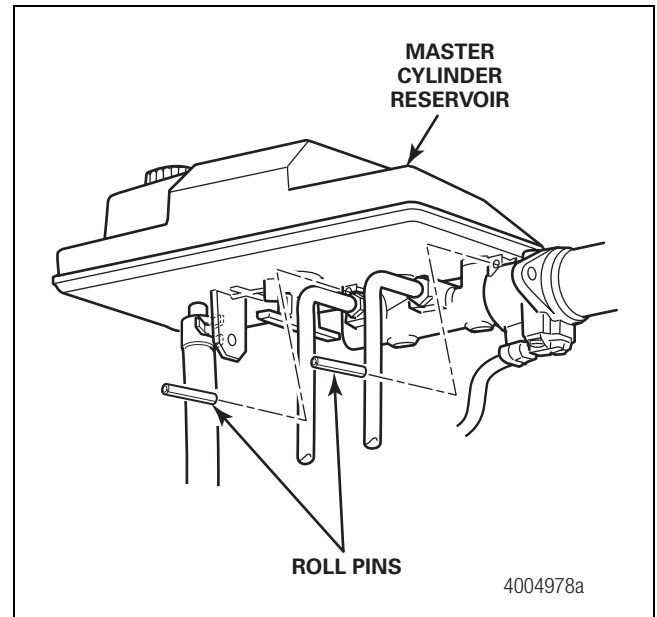
##### **⚠ WARNING**

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

Do not install a damaged reservoir. A damaged reservoir will result in loss of hydraulic brake fluid which can lead to loss of braking force. Serious personal injury can result.

- 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 Section 5 of this manual.
  - 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 Section 3 of this manual.
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 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 4.46.
- D. Install the nut on the front bolt.



**Figure 4.46**

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 4.47.

## 4 Removal and Installation

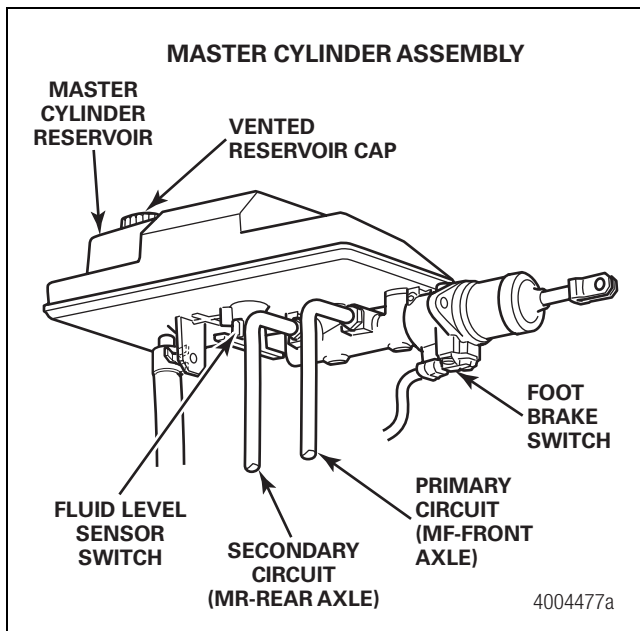


Figure 4.47

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 Section 5 of this manual.
7. After bleeding, ensure that the fluid level in the master cylinder is at the MAX mark. If brake fluid in the reservoir is above or below the MAX mark, remove or add brake fluid as necessary until the MAX mark level is achieved. Never add fluid above the MAX mark.
8. Install the two maxi fuses or connect the battery.
9. Turn the ignition ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.

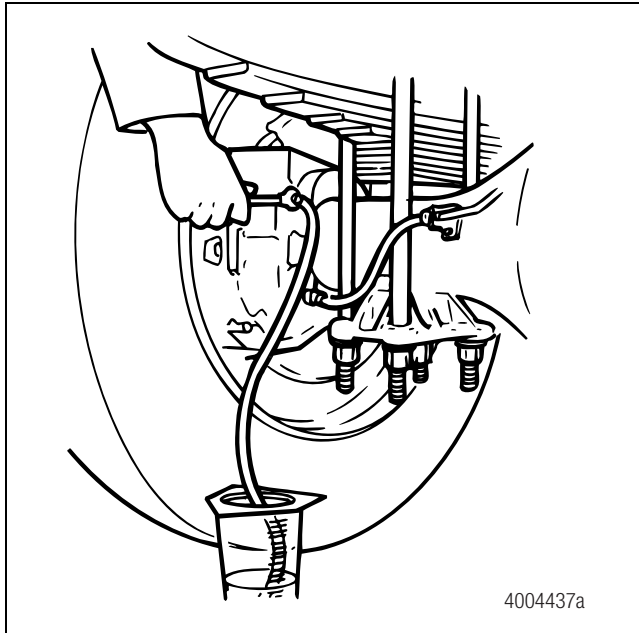
If the HCU pump motors fail to deliver a sufficient amount of fluid, the ECU module will control the HCU pump motors in a self priming procedure. The HCU pump motors should stop within three minutes, with the brake warning light and the buzzer OFF. If there are problems building pressure after bleeding and powering up the system, increase the pressure setting of the pressure bleeder equipment to 29-40 psi (2-2.75 bar), and cycle the ignition off for 10 seconds, then back on.

**NOTE:** Pressure should be left on the system during the first key-on (attempt to build pressure).

10. Depress the brake pedal rapidly four times to activate both HCU pump motors.
11. With the system fully charged, the brake fluid level will be between the MIN and MAX marks on the master cylinder reservoir. Adjust if necessary. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.
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.

- Remove the two maxi-fuses for the pump motors or disconnect the battery.
- 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 to the torque value specified by the component manufacturer. Figure 4.48.



**Figure 4.48**

- 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 with new brake fluid from a sealed container. Use only the recommended DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
  14. Reinstall the two maxi-fuses for the pump motors or reconnect the battery.
  15. Use TOOLBOX™ Software to cancel the diagnostic code for the master cylinder reservoir. Refer to Section 3 for TOOLBOX™ instructions.
  16. Remove the wheel blocks.
  17. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## Removal

### Master Cylinder Foot Brake Switch

#### ⚠ WARNING

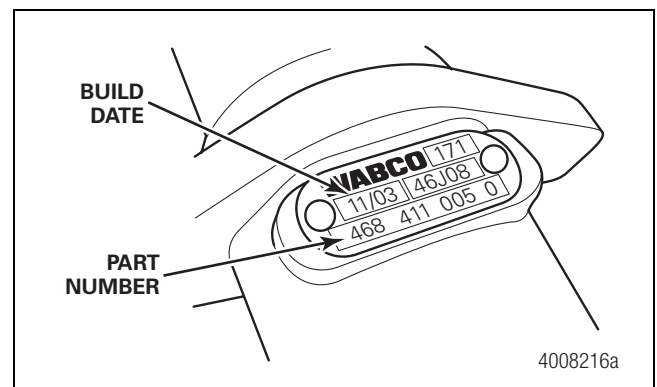
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

1. Park the vehicle on a level surface.
2. Apply the parking brake and block the wheels. Failure to do so can cause unwanted vehicle movement resulting in serious personal injury.
3. Disconnect the foot brake switch.
4. Remove the two machine screws securing the foot brake switch to the base of the master cylinder.
5. Remove the foot brake switch.
6. Remove and discard the paper gasket (models built prior to 2006) from the master cylinder, or O-ring (models built in 2006 and after) from the foot brake switch.
7. Verify the warranty status. If the switch is under warranty, return it to Meritor WABCO.

## Installation


### Master Cylinder Foot Brake Switch

If the master cylinder tag displays a build date prior to 01.01.2006 as shown on the tag in Figure 4.49, replace the entire master cylinder with the current design used in vehicles built after 01.01.2006.



**Figure 4.49**

## 4 Removal and Installation

1. Clean the surface of the master cylinder base and install the O-ring seal on the foot brake switch.
2. Install the foot brake switch to the base of the master cylinder. Tighten the two screws to 26.5-35.4 in-lb (3-4 N•m).  Figure 4.50.

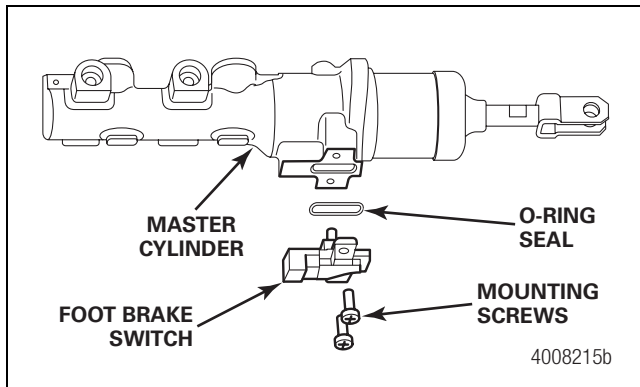


Figure 4.50

3. Connect the foot brake switch.
4. Remove the safety stands and wheel blocks.
5. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## Removal

### Master Cylinder Fluid Level Sensor Switch

#### WARNING

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.
2. Apply the parking brake and block the wheels.
3. Remove the electrical connector from the fluid level sensor.
4. Squeeze the tabs together to remove the fluid level sensor from its mounting location on the master cylinder reservoir.
5. Verify the warranty status. If the switch is under warranty, return it to Meritor WABCO.

## Installation

### Master Cylinder Fluid Level Sensor

1. Install the fluid level sensor in the same direction as the switch you removed. Figure 4.51.

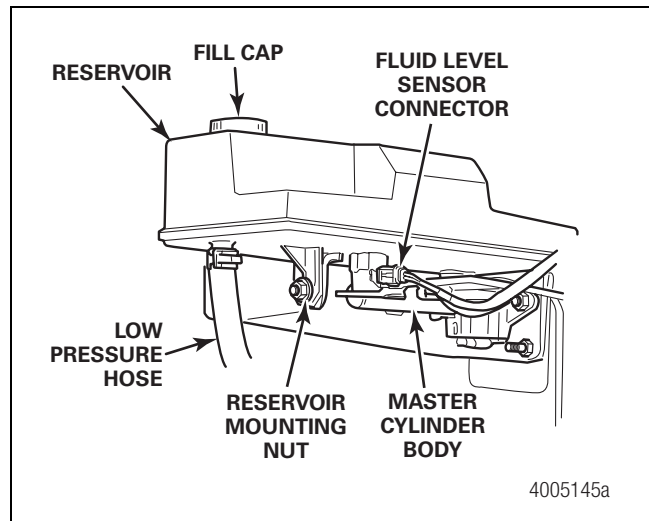


Figure 4.51

2. Connect the fluid level sensor connector.
3. Remove the safety stands and wheel blocks.
4. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## Removal

### Parking Brake Pressure Supply Valve

#### 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.

**NOTE:** It is not necessary to remove the entire HCU assembly from the vehicle when replacing the parking brake valve.

- 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 SAHR circuit is required during installation of the parking brake pressure supply valve. Bleed procedures appear in Section 5 of this manual.
- 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 Section 3 of this manual.

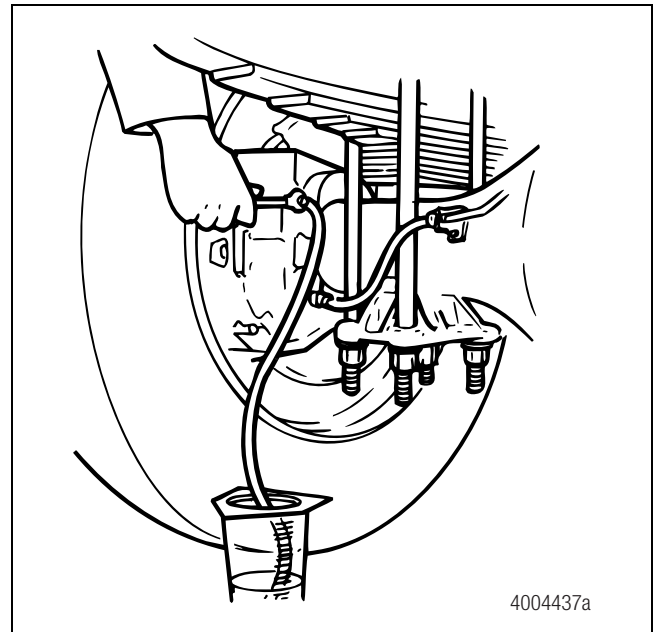
### **⚠ WARNING**

**Park the vehicle on a level surface. Block the front and rear tires to prevent vehicle movement. Failure to do so can result in unwanted vehicle movement causing serious personal injury.**

1. Park the vehicle on a level surface.
2. Block the front and rear tires to prevent vehicle movement. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
3. Disconnect the battery.
4. Use a clear rag to carefully wipe the surface of the HCU and the surrounding area.

**NOTE:** For convenience, Step 5 may be performed one axle at a time.

5. 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 to the torque value specified by the component manufacturer. Figure 4.52.



**Figure 4.52**

- 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. Disconnect the electrical connection from the parking brake pressure supply valve.
  7. Attach a pinch clamp to the low pressure hose at the HCU reservoir. Figure 4.53.

**NOTE:** Be careful not to damage the HCU reservoir inlet when attaching the pinch clamp. If damaged, it will need to be replaced.

## 4 Removal and Installation

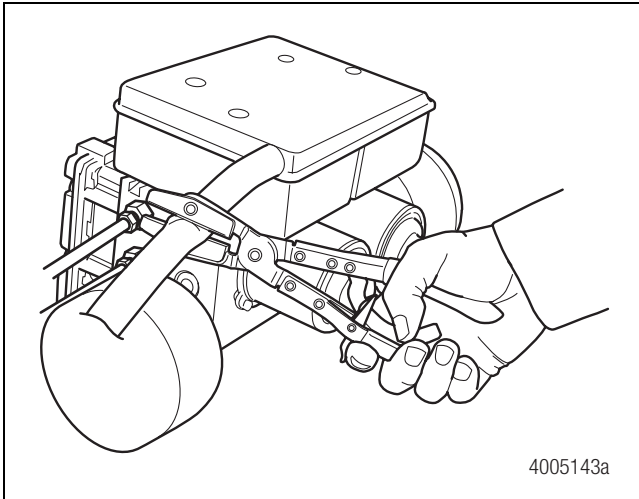


Figure 4.53

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. Unscrew the black plastic nut by hand from the pressure supply valve. Remove the coil and O-ring. Figure 4.54.

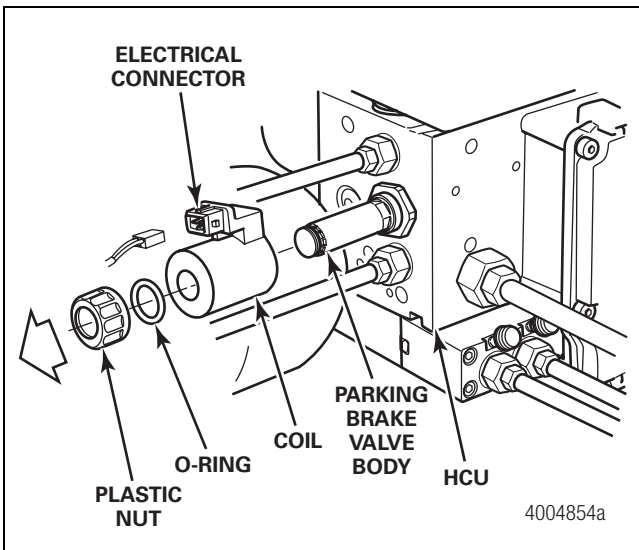


Figure 4.54

**NOTE:** Do not use a 17 mm wrench to remove the pressure supply valve. The Snap-On Tool specified in Step 10 must be used.

10. Use a socket, Snap-On Tools part number A121, to remove the pressure supply valve from the hydraulic compact unit. Figure 4.55.

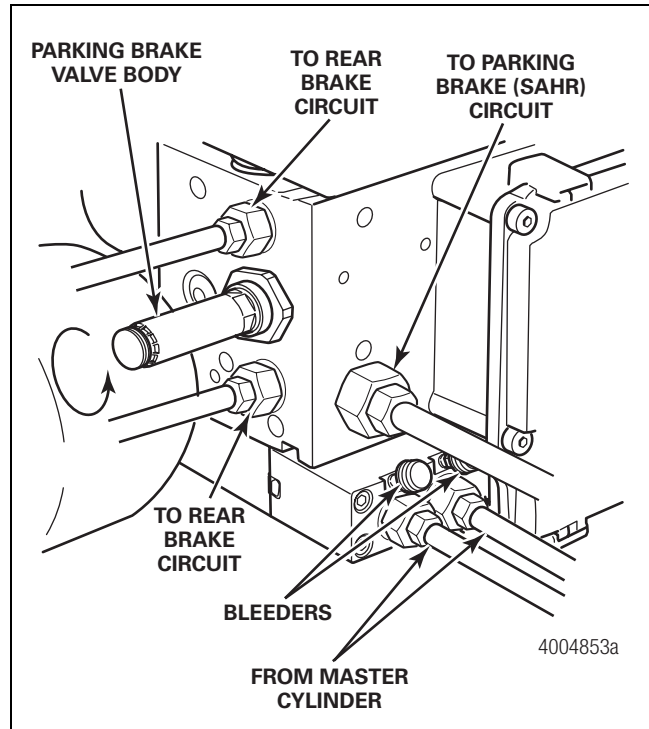


Figure 4.55

11. Plug the open port to prevent contaminants from entering the system.
12. Verify the warranty status. If the pressure supply valve is under warranty, return it to Meritor WABCO.

## Installation

### Parking Brake Pressure Supply Valve

#### ⚠ 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.

- Two people are needed to perform this procedure.



## 4 Removal and Installation

- 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 SAHR circuit is required during installation of the parking brake pressure supply valve. Bleed procedures appear in Section 5 of this manual.
- 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 Section 3 of this manual.

### ⚠ CAUTION

When installing the new parking brake pressure supply valve assembly, be careful not to damage the valve body O-rings and filter screens.

**NOTE:** To help prevent leakage, the three O-rings and two filter screens must be in place.

1. Remove the coil from the new pressure supply valve. Figure 4.56.

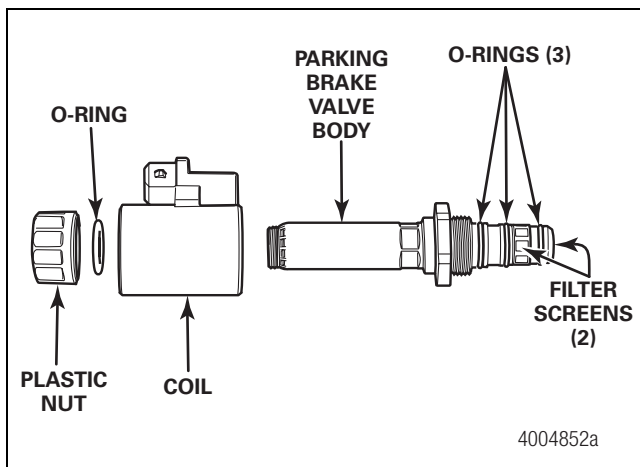


Figure 4.56

2. Use a clean rag to carefully clean the outside of the hydraulic compact unit.
3. Use new, clean lubricant to lubricate the O-rings on the new parking brake valve. Use only DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.

4. Position the new pressure supply valve onto the hydraulic compact unit. Use a socket, Snap-On Tools part number A121, to tighten the valve to 27-34 ft-lb (40-50 N•m). Figure 4.57.

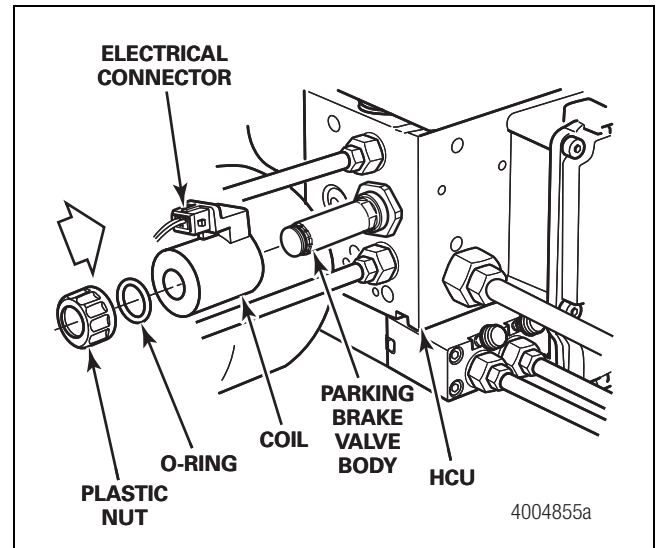


Figure 4.57

5. Place the coil, O-ring and plastic nut onto the pressure supply valve. Use a 12-point socket wrench to tighten the black plastic nut to 26.5 in-lb (3 N•m).
6. Attach the electrical connector to the parking brake valve. Figure 4.57.
7. Remove the pinch clamp from the low pressure hose.
8. Fill the master cylinder reservoir to the MAX mark with new brake fluid from a sealed container. Use only DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
9. Connect the battery.
10. Turn the ignition switch ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.
11. Bleed the spring-applied/hydraulic release (SAHR) parking brake circuit. Follow the instructions for bleeding the SAHR circuit that appears in Section 5 of this manual.

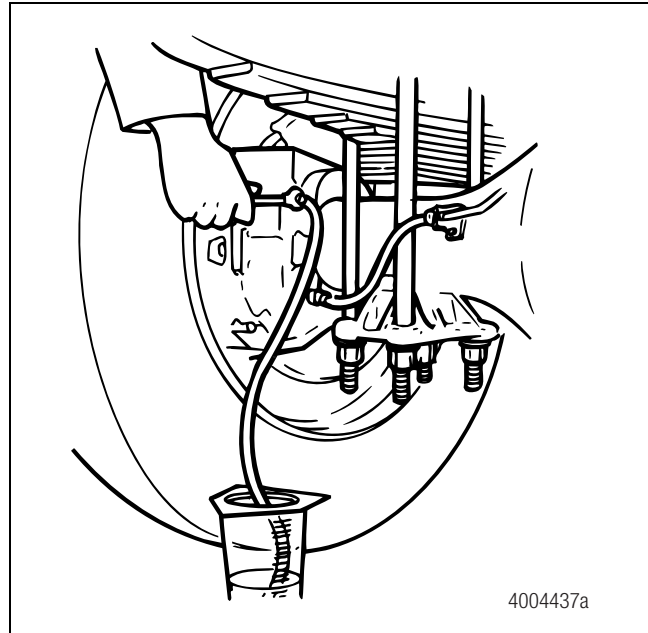
## 4 Removal and Installation

12. After bleeding the SAHR circuit, ensure that the brake fluid level in the master cylinder reservoir is at the MAX mark. If the brake fluid in the reservoir is above or below the MAX mark, remove or add brake fluid as necessary until the MAX mark level is achieved. Never add fluid above the MAX mark. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.
13. 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 procedures to depressurize the system.

- Remove the two maxi-fuses for the pump motors or disconnect the battery.
- 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. Figure 4.58.



**Figure 4.58**

- 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 the torque value specified by the component manufacturer.
    - Repeat Steps A-E for the second axle.
14. 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 with new clean brake fluid from a sealed container. Use only the recommended DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
  15. Reinstall the two maxi-fuses for the pump motors or reconnect the battery.
  16. Use TOOLBOX™ Software to cancel the diagnostic code for the pressure supply valve. Refer to Section 3 for TOOLBOX™ instructions.
  17. Remove the wheel blocks.
  18. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## Removal

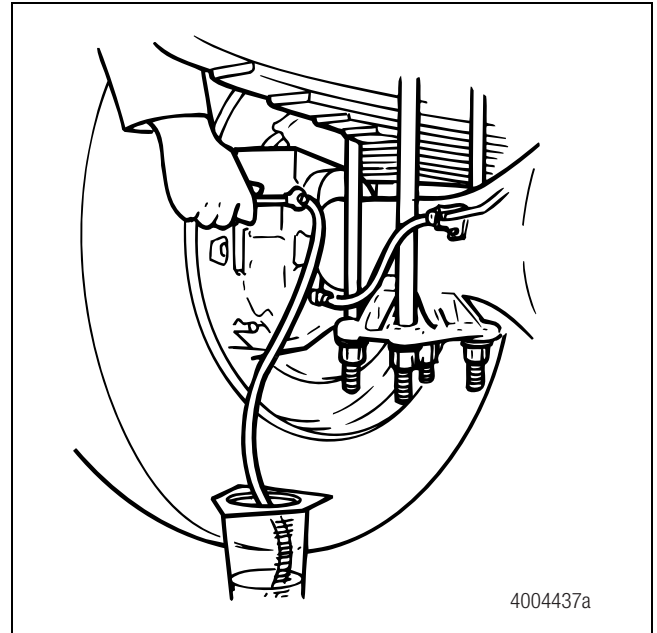
### Low Pressure Hose

#### ⚠ 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.

**NOTE:** Meritor WABCO does not manufacture low pressure hoses. Refer to the vehicle manufacturer for specific installation and service information. The following removal and installation procedures are included to assist you in servicing Meritor WABCO's HPB system.

1. Park the vehicle on a level surface.
2. Block the front and rear tires to prevent vehicle movement. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
3. Disconnect the battery.
4. Use a clean rag to carefully wipe the surface of the HCU and the 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 4.59.



**Figure 4.59**

- 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 the torque value specified by the component manufacturer.
- Repeat Steps A-E for the second axle.
6. Attach a pinch clamp to the low pressure hose near the outlet of the master cylinder reservoir. Do not damage the reservoir outlet. Figure 4.60.

**NOTE:** Be careful not to damage the HCU reservoir outlet when attaching the pinch clamp. If damaged, it will need to be replaced.

## 4 Removal and Installation

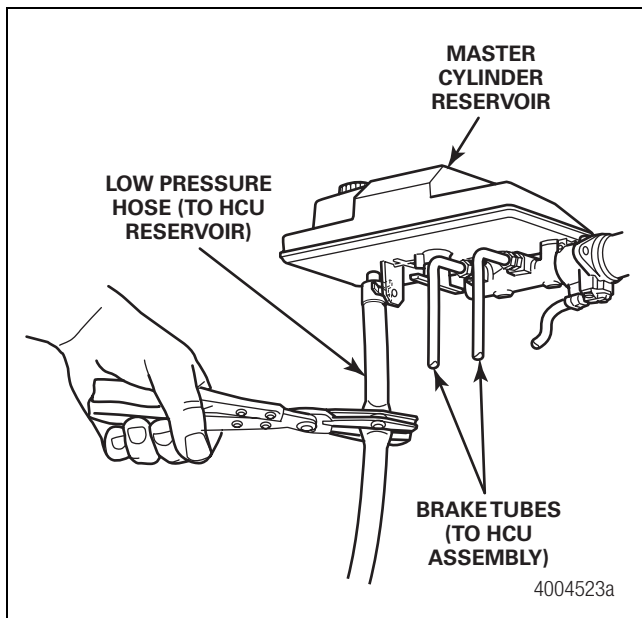


Figure 4.60

7. Remove the clamps that hold the middle section of the low pressure hose to the chassis. Note the position of the clamps for installation of the new hose.
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 and remove the hose from the master cylinder reservoir.  
**NOTE:** Some brake fluid may remain in protected areas of the master cylinder reservoir.
10. Remove the cap from the master cylinder reservoir to assist draining. 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. Approximately one gallon (3.4 liters) should drain into the container.
11. Remove the hose clamp and remove the hose from the HCU.
12. Remove the "P" clamps and remove the hose from the vehicle.

## Installation

### Low Pressure Hose

- When replacing the low pressure hose, bleeding the system is not necessary.
- To help prevent contamination of the system, keep the hose ends sealed until you are ready to connect them.

1. Remove the plug from the HCU reservoir.
2. Remove the plugs from the ends of the new hose.

**NOTE:** When installing the hose clamps that hold the middle portion of the low pressure hose to the vehicle, use the same location as was used for the original installation.

3. Attach the new hose to the HCU reservoir and master cylinder reservoir. Reuse the "P" clamps to attach the middle portion of the hose to the vehicle frame. Make sure the new hose does not contact any sharp edges or hot components.
4. Fill the master cylinder reservoir with new brake fluid from a sealed container. The fluid level must be at the MAX mark. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.
5. Connect the battery.
6. Turn the ignition ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.
7. Turn the ignition OFF and disconnect the battery.
8. Apply the brake pedal a **minimum** of 30 times to decrease pressure in the system. This will purge any trapped air from the hose.
9. After the fluid level is stabilized, ensure the fluid level in the master cylinder reservoir is at the MAX mark. If the brake fluid in the reservoir is above or below the MAX mark, remove or add fluid as necessary until the MAX mark level is achieved. Never add fluid above the MAX mark. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.
10. Connect the battery.
11. Turn the ignition ON. The HCU pump motors will start up and fill the accumulators. Approximate running time is 45 seconds.
12. Pump the brakes rapidly four times to activate both HCU pump motors. After the pumps stop, the brake fluid will be between the MIN and MAX marks on the master cylinder reservoir.

## 4 Removal and Installation

13. 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.

- Remove the two maxi-fuses for the pump motors or disconnect the battery.
- 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. Figure 4.61.

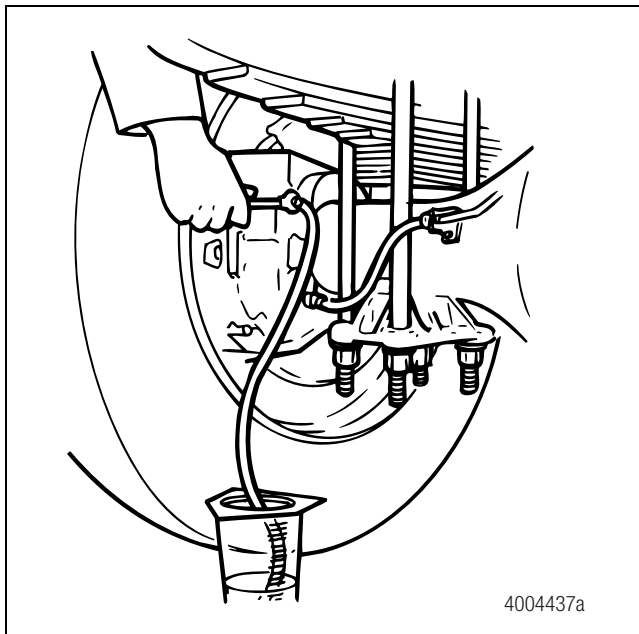


Figure 4.61

- 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 the torque value specified by the component manufacturer.

- Repeat Steps A-E for the second axle.

14. 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. Never add fluid above the MAX mark.
15. Reinstall the two maxi-fuses for the pump motors or reconnect the battery.
16. Remove the wheel blocks.
17. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## Lubrication

### Wheel Speed Sensor Specification

Meritor WABCO specifications call for a sensor lubricant with the following characteristics.

Lube must be mineral oil-based and contain molydisulfide. It should have excellent anti-corrosion and adhesion characteristics and be capable of continuous function in a temperature range of  $-40^{\circ}$  to  $300^{\circ}\text{F}$  ( $-40^{\circ}$  to  $150^{\circ}\text{C}$ ).

- Lubricants approved for use on Meritor WABCO sensors and spring clips are:
  - Mobilith SHC-220 (Mobil)
  - TEK 662 (Roy Dean Products)
  - Staburags NBU 30 PTM (Klüber Lubrication)
  - Valvoline EP 633
  - Klüberplex BE 31-512 (Klüber Lubrication)
  - Urethyn-EZ (Fuchs Lubritech)
  - Unirex N3 (ESSO)
  - ECO-Li-Plus (BPW)
  - Molykote P40 (Dow Corning)
  - Moly-Fortified Multi-Purpose Grease (Ford) (Valvoline/USA)

## 4 Removal and Installation

### Removal

#### Front Axle Wheel Speed Sensor

##### **⚠ WARNING**

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. Apply the parking brakes. Block the rear tires to prevent the vehicle from moving.

If necessary, raise the front tires off the ground. Place safety stands under the axle.

2. Disconnect the fasteners that hold the sensor cable to the other components.
3. Disconnect the sensor cable from the chassis harness.
4. Remove the sensor from the sensor holder. Twist and pull the sensor to remove it from the sensor bracket. **Do not pull on the cable.** Figure 4.62.

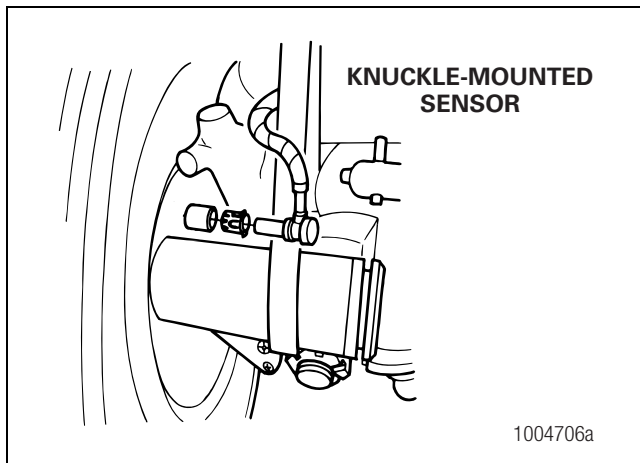


Figure 4.62

5. Remove the sensor spring clip. Figure 4.63.

**NOTE:** When replacing the wheel speed sensor, the sensor spring clip must also be replaced.

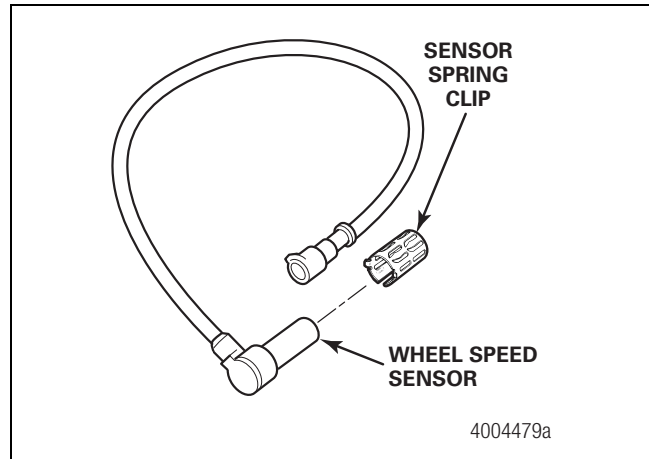


Figure 4.63

### Installation

#### Front Axle Wheel Speed Sensor

1. Connect the sensor cable to the chassis harness.
2. Install the fasteners used to hold the sensor cable in place.
3. Apply a Meritor WABCO-recommended lubricant to the sensor spring clip and sensor.
4. Install the sensor spring clip. Verify that the spring clip tabs are on the inboard side of the vehicle.
5. With the tabs on the inboard side, push the sensor spring clip into the bushing in the steering knuckle until the clip stops.
6. Push the sensor completely into the sensor spring clip until it contacts the tooth wheel.

**NOTE:** After installation, there should be no gap between the sensor and the tooth wheel. During normal operation, a gap of up to 0.04-inch (1.016 mm) is allowable.

##### **⚠ CAUTION**

**Overtightening the tie wraps may damage the cables.**

7. Fasten the sensor cable with tie wraps every 12 inches. Do not overtighten the tie wraps. Correctly bundle and store any excess cable in the sub-frame. Figure 4.64.

## 4 Removal and Installation

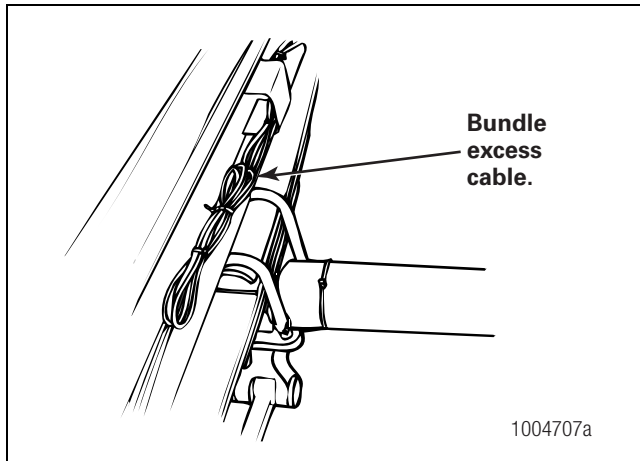


Figure 4.64

8. Remove the blocks and safety stands.
9. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

### Removal

#### Rear Axle Wheel Speed Sensor

##### **⚠ WARNING**

**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. Apply the parking brake. Block the front tires to prevent vehicle movement.
2. Raise the rear tires off the ground. Place safety stands under the axle.
3. If the rear tire must be removed to gain access to the sensor, release the parking brake to release the brake shoe.

Remove the wheel and tire assembly from the axle.

4. Remove the sensor from the mounting block in the axle housing. Use a twisting motion if necessary. **Do not pull on the cable.**
5. Disconnect the sensor cable from the chassis harness.
6. Remove the sensor cable from any cable clamps or clips.
7. Remove the sensor spring clip from the sensor bracket.

**NOTE:** When replacing the wheel speed sensor, the sensor spring clip must also be replaced.

### Installation

#### Rear Axle Wheel Speed Sensor

1. Connect the new sensor cable to the chassis harness.
2. Apply a Meritor WABCO-recommended lubricant to the spring clip.
3. Press the sensor spring clip into the sensor bracket, located on the rear axle, until it stops. Verify that the tabs are on the inboard side.
4. Apply a Meritor WABCO-recommended lubricant to the sensor.
5. Push the sensor completely into the spring clip until it contacts the tooth wheel.

**NOTE:** After installation, there should be no gap between the sensor and the tooth wheel. During normal operation, a gap of up to 0.04-inch (1.016 mm) is allowable.

6. Reattach the sensor cable to the cable clamps or clips.

##### **⚠ CAUTION**

**Overtightening the tie wraps may damage the cables.**

7. Fasten the sensor cable with tie wraps every 12 inches. Do not overtighten the tie wraps. Correctly bundle and store excess cable in the sub-frame. Figure 4.64.
8. Use TOOLBOX™ Software to remove the error code from the ECU memory.
9. Replace the tire and remove the safety stands. Lower the vehicle and remove the blocks from the front tires.
10. Test drive the vehicle. Refer to the test drive procedure in Section 3 of this manual.

## 5 Brake Bleeding Procedures

### Hazard Alert Messages

The following brake bleeding procedures explain how to bleed the hydraulic power brake system during installation, or in the event of air in the brake system.

When performing bleed procedures, 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.

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.

Failure to bleed the system whenever any hydraulic system fitting is loosened or disconnected will allow air to remain in the system. This will prevent the hydraulic pressure in the brake system from rising enough to apply the brakes correctly. This will cause the stopping distance to increase and can result in serious personal injury.

Never reuse hydraulic brake fluid that has been removed from a vehicle. Hydraulic brake fluid that has been removed can be contaminated and can cause damage, loss of braking and serious personal injury. Always discard hydraulic brake fluid in accordance with applicable environmental requirements.

Use only the type of hydraulic brake fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic brake fluid. The incorrect hydraulic brake fluid will damage the rubber parts of the brake caliper and can cause damage, loss of braking and serious personal injury.

Do not let the brake master cylinder fluid get below the minimum level during the bleeding operation. Keep the master cylinder reservoir filled with new DOT-approved brake fluid, as specified by the original equipment manufacturer. Failure to keep the brake reservoir level above minimum could result in more air entering system, making it impossible to effectively bleed the system.

Never add fluid above the MAX mark on the HPB master cylinder reservoir regardless of the charging state of the accumulators. When the system is totally or partially depressurized during service or overnight parking, fluid stored in the accumulators is returned to the master cylinder reservoir. If the reservoir was previously filled above the MAX mark, a fluid spill could occur when these conditions exist. Overfilling the master cylinder reservoir may cause damage to the cap and other components, resulting in impaired braking performance and could result in an accident and serious personal injury.

#### **CAUTION**

Hydraulic brake fluid is a caustic substance. Contact with hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid get on brake pads, shoes, rotors or disks.

Observe the following when working on the braking system.

#### **WARNING**

Prior to working on the braking system, all bleeder screws and the master cylinder cap must be cleaned thoroughly; cleanliness of fluid and areas around the service points have to be maintained. Do not use mineral oil-based fluid for this cleaning. Using mineral oil-based fluid can contaminate brake fluid and could damage the interior of the components and cause a system malfunction. Cover all electrical connectors near the bleeder screws carefully to make certain that no brake fluid enters the terminals or plugs. Failure to do so may cause loss of braking resulting in serious personal injury.

**NOTE:** After removing a component or disconnecting a brake tube connection, block off ports and brake tubes with appropriate plugs to prevent the ingress of dirt and unnecessary loss of fluid.

Use only new specified brake fluid from a sealed container to refill the system. Refer to the specification on the Master Cylinder (MC) reservoir or in the vehicle service manual.

If a lubricant is required to aid assembly, use only the specified brake fluid from a sealed container. Do not use any other assembly lubricant.



## 5 Brake Bleeding Procedures

During bleeding procedures, brake fluid level must not be allowed to fall below the MIN mark on the master cylinder reservoir. The master cylinder reservoir should be regularly checked and filled to the MAX mark.

Perform the bleeding procedure exactly as described in the instructions. Perform the reservoir top-off procedure, when bleeding is complete. Refer to technical publication TP-09121, Filling the Hydraulic Power Brake (HPB) Master Cylinder Reservoir, for instructions on filling the master cylinder. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

After completing all desired brake service operations, test the braking system for function and check for leakage.

Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specification sheet to determine which fluid to use.

### Brake Bleeding Procedures

The pressure-assisted brake bleeding procedures described here may be used with any fill and bleed equipment capable of filling the system and creating pressure in the master cylinder reservoir.

#### WARNING

**Meritor WABCO does not approve using manual bleeding procedures. Manual bleeding procedures could result in loss of braking, resulting in serious personal injury.**

### Pressure Bleed Procedures

#### Master Cylinder Circuit

1. Park the vehicle on a level surface. Apply the parking brake and block the wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
2. Turn the ignition OFF and remove the two 30-amp Maxi fuses for the brake system motors. Refer to the vehicle manufacturer's specifications to determine where the fuses are located.
3. Connect the diagnostic laptop to the diagnostic connector located in the cab, under the instrument panel. Set the ignition key to ON and open the TOOLBOX™ Software program.
4. Deplete pressure in the accumulators. There are two ways of depressurizing the system as follows.

- A. Fully depress the brake pedal a minimum of 30 times. The pressure in each brake circuit can be monitored using the TOOLBOX™ Software. Ensure that the pressure in each accumulator is at 0 psi.
- B. While fully depressing the brake pedal, select the Deplete Accumulators function from the TOOLBOX™ Software EOL pull-down menu. The pedal must remain fully depressed during the entire process, until the TOOLBOX™ Software displays the completion message. Ensure that the pressure in both accumulators is reading zero on the diagnostic main screen then release the brake pedal.

5. Turn the ignition OFF.
6. Verify that the brake fluid level in the master cylinder reservoir is not below MIN level.

**NOTE:** During bleeding procedures, brake fluid level must not be allowed to fall below the MIN mark on the master cylinder reservoir. The master cylinder reservoir should be regularly checked and filled to the MAX mark with new specified brake fluid from a sealed container. Do not add fluid above the MAX mark.

7. Prepare the pressure bleeder device according to the instructions provided with the equipment.  
**NOTE:** The pressurized fill and bleed equipment used can be either "air over fluid" or "fluid over air" type.
8. Install a suitable adapter from the fill and bleed equipment to the master cylinder reservoir filler neck. Verify that the adapter and bleed equipment are securely tightened onto the master cylinder reservoir filler neck.
9. Remove the rubber caps from the two relay valve bleeder screws located on the hydraulic control unit (HCU). Figure 5.1.

## 5 Brake Bleeding Procedures

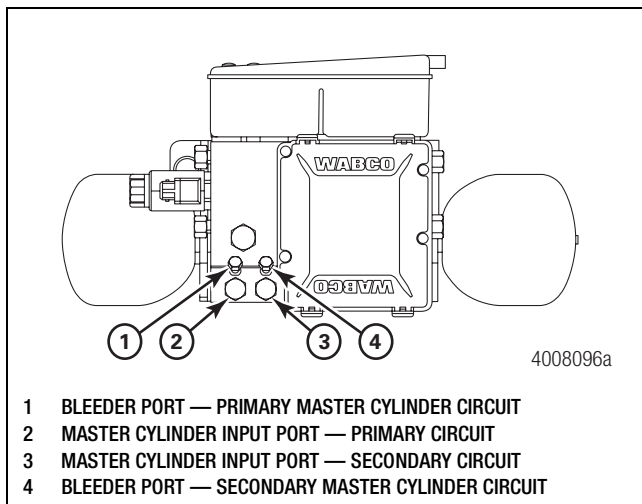


Figure 5.1

10. Fit the bleeder hose onto one relay valve bleeder screw located on the hydraulic compact unit.
11. Submerge the free end of the bleeder hose into the partially filled bleed bottle.
12. Apply 35 psi (2.4 bar) of pressure from the fill and bleed equipment to the master cylinder reservoir.
13. Open one of the relay valve bleeder screws until the fluid begins to flow (about 3/4 turn). Allow the fluid to run until 8.5 ounces (250 cc) has been collected. Take note of the fluid level in the bottle before starting.
14. When no further air bubbles enter the bleed bottle, close the bleeder screw. Remove the bleeder hose and tighten the bleeder screw to 35.4 to 39.8 lb-in (4 to 4.5 Nm).

**NOTE:** Verify the fluid level in the master cylinder reservoir. During bleeding procedures, the brake fluid must not be allowed to fall below the MIN mark on the master cylinder reservoir. The master cylinder reservoir should be regularly checked during the bleeding procedures and filled to the MAX mark.

15. Repeat Steps 13 and 14 with the second bleeder screw.
16. Ensure that the brake fluid level in the master cylinder reservoir is at the MAX mark. If the brake fluid in the reservoir is above or below the MAX mark, remove or add fluid as necessary until the MAX mark level is achieved. Never add fluid above the MAX mark. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.

17. If brake caliper circuit bleeding is required, refer to the procedure in this section.
18. If brake caliper circuit bleeding is NOT required, install the two 30-amp pump motor fuses and turn the ignition ON with 35 psi (2.4 bar) pressure applied to the master cylinder reservoir. The HCU pump motors will start up automatically and fill the accumulators. Approximate running time is 45 seconds. The brake light and buzzer will turn OFF.
19. Release the pressure from the master cylinder reservoir.
20. Remove the bleed equipment.
21. Install the master cylinder reservoir cap.
22. Using the diagnostic laptop and the TOOLBOX™ Software program, clear all the inactive fault codes.

**NOTE:** If faults remain, they should be diagnosed prior to releasing the vehicle to service.

23. Turn the ignition OFF and disconnect the diagnostic laptop from the diagnostic connector.
24. Check the system for external leaks.
25. Remove the wheel blocks.

### Brake Caliper Circuit

**NOTE:** If you are bleeding the front calipers, it is critical that you bleed the SAHR circuit also, if equipped.

1. Park the vehicle on a level surface. Apply the parking brake and block the wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
2. Turn the ignition OFF and remove the two 30-amp Maxi fuses for the brake system motors. Refer to the vehicle manufacturer's specifications to determine where the fuses are located.
3. Connect the diagnostic laptop to the diagnostic connector located in the cab, under the instrument panel. Set the ignition key to ON and open the TOOLBOX™ Software program.
4. Deplete pressure in the accumulators. There are two ways of depressurizing the system as follows.

## 5 Brake Bleeding Procedures

- A. Fully depress the brake pedal a minimum of 30 times. The pressure in each brake circuit can be monitored using the TOOLBOX™ Software. Ensure that the pressure in each accumulator is at 0 psi.
- B. While fully depressing the brake pedal, select the Deplete Accumulators function from the TOOLBOX™ Software EOL pull-down menu. The pedal must remain fully depressed during the entire process, until the TOOLBOX™ Software displays the completion message. Ensure that the pressure in both accumulators is reading zero on the diagnostic main screen then release the brake pedal.

5. Turn the ignition OFF.
6. Verify that the brake fluid level in the master cylinder reservoir is not below MAX level.

**NOTE:** During bleeding procedures, brake fluid level must not be allowed to fall below the MIN mark on the master cylinder reservoir. The master cylinder reservoir should be regularly checked and filled to the MAX mark with new specified brake fluid from a sealed container.

7. Prepare the pressure bleeder device according to the instructions provided with the equipment.
8. Install a suitable adapter from the fill and bleed equipment to the master cylinder reservoir filler neck. Verify that the adapter and bleed equipment are securely tightened onto the master cylinder reservoir filler neck.

**NOTE:** If all wheel ends are to be bled, use the following bleeding order: right rear, left rear, right front, left front.

9. Fit the bleeder hose onto the caliper bleeder screw at one wheel end.
10. Submerge the free end of the bleeder hose into the bleed bottle.
11. Apply 35 psi (2.4 bar) of pressure from the fill and bleed equipment to the master cylinder reservoir.
12. Open one caliper bleeder screw until fluid begins to flow (3/4 turn). Allow the fluid to run until 8.5 ounces (250 cc) has been collected. Take note of the fluid level in the bottle before starting. Figure 5.2.

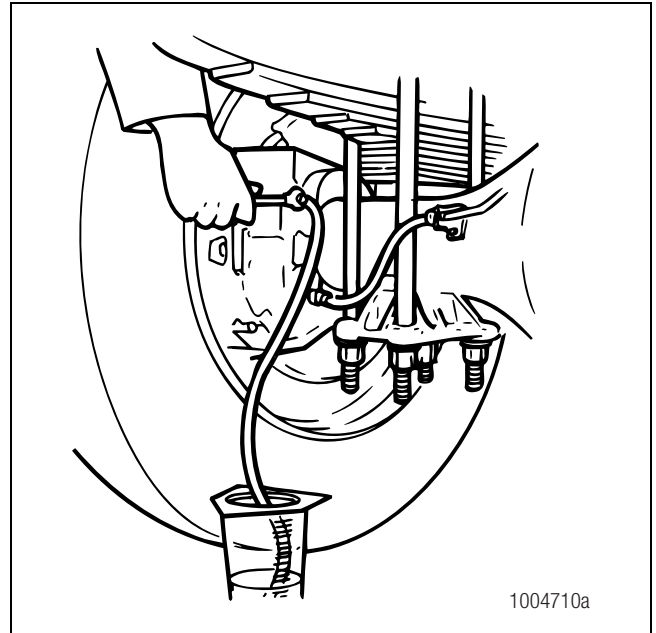


Figure 5.2

13. If no further air bubbles enter the bleed bottle, close the bleeder screw. Remove the bleeder hose and tighten the bleeder screw to the torque value specified by the component manufacturer.

**NOTE:** Refer to the vehicle manufacturer's specifications for specific information about bleeding the calipers. Some calipers have multiple bleeder screws and require removal of the wheels and tires to access the bleeder screws. Each bleeder screw must be bled.

**NOTE:** Verify the fluid level in the master cylinder reservoir. During bleeding procedures, the brake fluid must not be allowed to fall below the MIN mark on the master cylinder reservoir. The master cylinder reservoir should be regularly checked during the bleeding procedures and filled to the MAX mark.

14. Repeat Steps 9-13 with the other calipers in the specified order.
15. If the vehicle is equipped with a power parking brake – SAHR canister, then bleed the SAHR circuit now using Steps 9-13 of the Spring-Applied/Hydraulic-Release (SAHR) Parking Brake Circuit pressure bleed procedure in this section.

## 5 Brake Bleeding Procedures

16. Ensure that the brake fluid level in the master cylinder reservoir is at the MAX mark. If the brake fluid in the reservoir is above or below the MAX mark, remove or add fluid as necessary until the MAX mark level is achieved. Never add fluid above the MAX mark. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.
17. Install the two 30-amp pump motor fuses and turn the ignition ON with 35 psi (2.4 bar) of pressure applied to the master cylinder reservoir. The HCU pump motors will start up automatically and fill the accumulators. Approximate running time is 45 seconds. The brake light and buzzer will turn OFF.
18. Release the pressure from the master cylinder reservoir.
19. Remove the bleed equipment.
20. Install the master cylinder reservoir cap.
21. Using the diagnostic laptop and the TOOLBOX™ program, while fully holding the brake pedal depressed, select the Deplete Accumulators function from the TOOLBOX™ Software EOL pull-down menu. The pedal must remain fully depressed during the entire process, until the TOOLBOX™ Software displays the dialog box that will indicate the completion of the function. Ensure that the pressure in both accumulators is reading zero on the diagnostic main screen, then release the brake pedal.

**NOTE:** The DEplete ACCUMULATORS function performs a cycle of releasing the pressure and charging the pressure back up in each brake circuit. This cycle helps clear air from the HCU into the reservoir.

22. Repeat Step 21 two times.
23. Using the diagnostic laptop and the TOOLBOX™ Software program, clear all the inactive fault codes.  
  
**NOTE:** If faults remain, they should be diagnosed prior to releasing the vehicle to service.
24. Turn ignition OFF and disconnect the diagnostic laptop from the diagnostic connector.
25. Check the system for external leaks.
26. Remove wheel blocks.

### Spring-Applied/Hydraulic Release Parking Brake Circuit

#### WARNING

Before bleeding the circuit, you must disconnect the parking brake cable from the spring-applied/hydraulic release (SAHR) canister. This is to ensure that the SAHR piston achieves the full stroke and forces most of the fluid volume out of the SAHR canister, thus moving potential entrapped air into the bleeder screw area. Refer to the vehicle manufacturer instructions for how to disconnect the parking brake cable.

The parking brake cable must be reconnected before operating the vehicle. Never drive the vehicle if the parking brake cable is disconnected or the parking brake system is not operating correctly. Driving the vehicle without a correctly functioning parking brake system can result in an accident and serious personal injury.

1. Park the vehicle on a level surface. Apply the parking brake and block the wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
2. Turn the ignition OFF and remove the two 30-amp Maxi fuses for the brake system motors. Refer to the vehicle manufacturer's specifications to determine where the fuses are located.
3. Connect the diagnostic laptop to the diagnostic connector located in the cab, under the instrument panel. Set the ignition key to ON and open the TOOLBOX™ Software program.
4. Deplete pressure in the accumulators. There are two ways of depressurizing the system as follows.
  - A. Fully depress the brake pedal a minimum of 30 times. The pressure in each brake circuit can be monitored using the TOOLBOX™ Software. Ensure that the pressure in each accumulator is at 0 psi.
  - B. While fully depressing the brake pedal, select the Deplete Accumulators function from the TOOLBOX™ Software EOL pull-down menu. The pedal must remain fully depressed during the entire process, until the TOOLBOX™ Software displays the completion message. Ensure that the pressure in both accumulators is reading zero on the diagnostic main screen then release the brake pedal.
5. Turn the ignition OFF.

## 5 Brake Bleeding Procedures

6. Verify that the brake fluid level in the master cylinder reservoir is not below MAX level.

**NOTE:** During bleeding procedures, brake fluid level must not be allowed to fall below the MIN mark on the master cylinder reservoir. The master cylinder reservoir should be regularly checked during bleeding procedures and filled to the MAX mark with new specified brake fluid from a sealed container.

7. Prepare the pressure bleeder device according to the instructions provided with the equipment.  
**NOTE:** The pressurized fill and bleed equipment used can be either “air over fluid” or “fluid over air” type.
8. Install a suitable adapter from the fill and bleed equipment to the master cylinder reservoir filler neck. Verify that the adapter and bleed equipment are securely tightened onto the master cylinder reservoir filler neck.

9. Fit the bleeder hose onto the bleeder screw on the SAHR chamber.
10. Submerge the free end of the bleeder hose into the bleed bottle.
11. Apply 35 psi (2.4 bar) of pressure from the fill and bleed equipment to the master cylinder.
12. Open the SAHR bleeder screw until fluid begins to flow (3/4 turn). Allow the fluid to run until 8.5 ounces (250 cc) has been collected. Take note of the fluid level in the bottle before starting.
13. If no further air bubbles enter the bleed bottle, close the bleeder screw. Remove the bleeder hose and tighten the bleeder screw to specified torque. Refer to the vehicle manufacturer’s specifications for the correct torque value.
14. Ensure that the brake fluid level in the master cylinder reservoir is at the MAX mark. If the brake fluid in the reservoir is above or below the MAX mark, remove or add fluid as necessary until the MAX mark level is achieved. Never add fluid above the MAX mark. Refer to Section 6 for detailed instructions on how to correctly fill the master cylinder reservoir.
15. Install the two 30-amp pump motor fuses and turn the ignition ON with 35 psi (2.4 bar) of pressure applied to the master cylinder reservoir. The HCU pump motors will start up automatically and fill the accumulators. Approximate running time is 45 seconds. The brake light and buzzer will turn OFF.

16. Release the pressure from the master cylinder reservoir.
17. Remove the bleed equipment.

18. Install the master cylinder reservoir cap.
19. Connect the parking brake cable to the SAHR canister. Refer to the vehicle manufacturer’s instructions for how to connect and correctly adjust the parking brake cable. Verify correct application and release at the parking brake.
20. Using the diagnostic laptop and the TOOLBOX™ Software program, clear all the inactive fault codes.
21. Turn ignition OFF and disconnect the diagnostic laptop from the diagnostic connector.
22. Check the system for external leaks.
23. Remove wheel blocks.

### Changing Hydraulic Brake Fluid

1. Park the vehicle on a level surface. Apply the parking brake and block the wheels to prevent the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
2. Turn the ignition OFF and remove the two 30-amp Maxi fuses for the brake system motors. Refer to the vehicle manufacturer’s specifications to determine where the fuses are located.
3. Connect the diagnostic laptop to the diagnostic connector located in the cab, under the instrument panel. Set the ignition key to ON and open the TOOLBOX™ Software program.
4. Deplete pressure in the accumulators. There are two ways of depressurizing the system as follows.
  - A. Fully depress the brake pedal a minimum of 30 times. The pressure in each brake circuit can be monitored using the TOOLBOX™ Software. Ensure that the pressure in each accumulator is at 0 psi.
  - B. While fully depressing the brake pedal, select the Deplete Accumulators function from the TOOLBOX™ Software EOL pull-down menu. The pedal must remain fully depressed during the entire process, until the TOOLBOX™ Software displays the completion message. Ensure that the pressure in both accumulators is reading zero on the diagnostic main screen then release the brake pedal.
5. Turn the ignition OFF.
6. Prepare the pressure bleeder device according to the instructions provided with the equipment.

## 5 Brake Bleeding Procedures

**NOTE:** The pressurized bleed equipment used for this drain procedure must be the “air over hydraulic” type.

7. Install a suitable adapter from the fill and bleed equipment to the master cylinder reservoir filler neck. Verify that the adapter and bleed equipment are securely tightened onto the master cylinder reservoir filler neck.
8. Apply 35 psi (2.4 bar) of pressure from the fill and bleed equipment to the master cylinder.
9. Fit the bleeder hose onto the caliper bleeder screw at one wheel end.
10. Submerge the free end of the bleeder hose into the bleed bottle.
11. Open the bleeder screw until fluid begins to flow (3/4 turn). Allow the fluid to run until the circuit is completely drained and no more fluid comes out.
12. Close the bleeder screw.
13. Repeat Steps 8-12 for:
  - A. the remaining calipers,
  - B. the two relay bleeder screws, and
  - C. the SAHR bleeder screw, if equipped
14. Release the pressure from the master cylinder reservoir.
15. Remove the bleed equipment.
16. Fill the master cylinder reservoir up to the MAX mark with new specified brake fluid from a sealed container. Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle manufacturer’s specifications to determine which fluid to use.

**NOTE:** You can speed up the filling process by opening the bleeder screw of one of the rear calipers. This will allow better brake fluid flow into the system by expelling the air through the bleeder screw. Close the bleeder screw when no further air is exiting the bleeder screw.

17. Bleed the master cylinder circuit using the master cylinder bleeding procedure in this section.
18. Bleed the rest of the brake system using the brake caliper circuit bleeding procedure and the SAHR circuit bleeding procedure, if applicable, in this section.

## Leak Check Procedure for Meritor WABCO HPB System

### Check the HPB System for Brake Fluid Leaks

#### With Pressure Removed:

1. Park the vehicle on a level surface. For vehicles with manual parking brakes, apply the parking brake. Block the wheels to keep the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
2. Deplete system pressure. Refer to the appropriate section in this manual for instructions.
3. Inspect the entire hydraulic brake system including brake lines and line fitting connections for the presence of brake fluid damage or other evidence of a leak.
  - If a leak is identified, perform the following.
    - A. Clean and dry the entire area.
    - B. Determine the source of the leak.
    - C. Make the necessary repairs.
4. If the hydraulic system is compromised by exposure to air, it is necessary to bleed the affected circuit. Refer to the appropriate section in this manual.

#### With Pressure Applied:

If there was no evidence of a leak when the system was checked with the pressure removed, apply pressure to the system and recheck for leaks. Two people are required to perform this check.

1. With the vehicle parked on a level surface, depress the brake pedal and hold to deliver brake pressure to the calipers.
2. Inspect the entire hydraulic brake system including brake lines and line fitting connections for the presence of brake fluid damage or other evidence of a leak.
  - If a leak is identified, perform the following.
    - A. Clean and dry the entire area.
    - B. Determine the source of the leak.
    - C. Deplete system pressure. Refer to the appropriate section in this manual for instructions.
    - D. Make the necessary repairs.

3. If the hydraulic system is compromised by exposure to air, it is necessary to bleed the affected circuit. Refer to the appropriate section in this manual.

### System Test

After all necessary repairs have been made and the system has been bled, verify the hydraulic circuits are connected correctly. Two people are required to perform this test.

1. Park the vehicle on a level surface.
2. Block the front tires to keep the vehicle from moving. Failure to do so can result in unwanted vehicle movement causing serious personal injury.
3. Raise the rear wheels. Place supports under the rear axle.
4. Depress the brake pedal. Attempt to turn the rear wheels one at a time. They should not move with the brakes applied.
5. Connect the vehicle to a PC with TOOLBOX™ Software installed. Use TOOLBOX™ Software to activate the solenoid valves for the left rear wheel. You should be able to turn this wheel by hand when the solenoids activate. Repeat this check for the right rear wheel. Go to Step 6.
6. Remove the axle stands from under the rear axle to lower the vehicle.
7. Remove the blocks from the front tires and place them in front of the rear tires.
8. Raise the front tires. Place supports under the front axle.
9. Repeat Steps 4 and 5.
10. Remove the axle stands from under the front axle to lower the vehicle.
11. Make any necessary repairs. If any plumbing changes were made, bleed the system again.

## 6 Appendix

### Warning Lamps

Indicator Lamp	Lamp Status	System Condition Being Indicated	Recommendation
BRAKE/BRAKE PRESSURE  Note: Indicator differs by model year	STEADY ON and buzzer on	Half brake system failure. One of the two brake circuits is not generating pressure or is not generating pressure at the proper rate. Braking force from the Hydraulic Power Brake may be reduced or impaired. Use Parking Brake if necessary.	Immediately find a location to safely park the vehicle. When safely off the road and stopped, turn off ignition and ensure the vehicle transmission is in the park position. Apply Parking Brake. Do not drive until the failure has been repaired.
	FLASHING or STEADY ON* and buzzer on (* depending on model)	Full brake system failure. Both brake circuits are not generating pressure or are not generating pressure at the proper rate. Braking force from the Hydraulic Power Brake may be reduced or impaired. Use Parking Brake if necessary.	Immediately find a location to safely park the vehicle. When safely off the road and stopped, turn off ignition and ensure the vehicle transmission is in the park position. Apply Parking Brake. Do not drive until the failure has been repaired.
	OFF	System pressures are in normal operating range.	—
BRAKE FLUID	STEADY ON	Low brake fluid level in the Master Cylinder Reservoir. Braking force from the Hydraulic Power Brake may be reduced or impaired. Use parking brake if necessary.	Immediately find a location to safely park the vehicle. When safely off the road and stopped, turn off ignition and ensure the vehicle transmission is in the park position. Apply Parking Brake. Do not drive until the failure has been repaired.
	OFF	Brake fluid level detected in the Master Cylinder is at or above MIN mark.	—
ABS	STEADY ON	An ABS related fault has been detected by the ECU. The advantages provided by ABS may not be fully available	Have vehicle repaired as soon as possible.
	OFF	No ABS related faults detected.	—
TRAC CTRL	STEADY ON	A Traction Control related fault has been detected – OR- A Traction Control event is occurring due to spinning wheels and the system is operating correctly.	If the lamp remains on for over 10 seconds, there is a high likelihood of a fault in the traction control system. Have vehicle repaired as soon as possible.
	FLASHING	Mud and Snow mode was selected using the traction control switch (switch indicator lit)	—
	OFF	ATC is operating correctly, the Mud and Snow mode has not been selected and the vehicle is not experiencing an ATC event.	—
PARK BRAKE	STEADY ON	Park Brake is applied.	—
	OFF	Park Brake is not applied.	—
SERVICE PARK BRAKE	FLASHING/ STEADY ON	A Park Brake related fault has been detected by the ECU. Braking force from Park Brake may be reduced or impaired.	Immediately find a location to safely park the vehicle. When safely off the road and stopped, turn off ignition and ensure the vehicle transmission is in the park position. Apply Parking Brake. Do not drive until the failure has been repaired.
	OFF	No Park Brake related faults detected.	—



## Filling the Hydraulic Power Brake (HPB) Master Cylinder Reservoir

### **⚠ WARNING**

Before you service the Hydraulic Power Brake (HPB) system, you must perform the depressurization procedures exactly as presented. The HPB system is a pressurized system that reaches levels of up to 2,320 psi (160 bar). This pressure is not reduced by switching the ignition off or removing battery power. If you do not depressurize the system, serious personal injury or death can result.

Never add fluid above the MAX mark regardless of the charging state of the accumulators. When the system is totally or partially depressurized during service or overnight parking, fluid stored in the accumulators is returned to the master cylinder reservoir. If the reservoir was previously filled above the MAX mark, a fluid spill could occur when these conditions exist. Overfilling the master cylinder reservoir may cause damage to the cap and other components, resulting in poor braking performance and serious personal injury.

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

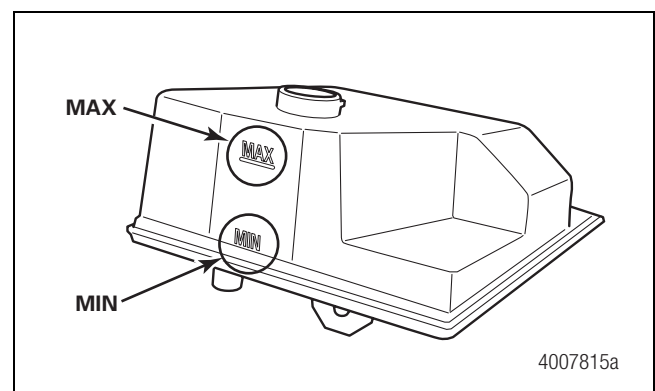
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

1. Ensure vehicle is on a level surface and apply the parking brake.
2. Block the wheels to prevent the vehicle from moving.
3. Set the ignition key to OFF and remove the two 30-amp fuses that provide power to the brake system motors. The fuses are in the fuse panel located on the engine side of the cowl.
4. Remove master cylinder cap.
5. Connect a laptop computer containing TOOLBOX™ Software to the diagnostic connector.
6. Turn the ignition key to ON and start the TOOLBOX™ Software.
7. Depressurize the system as follows:
  - A. Depress the brake pedal a minimum of 30 times.

- B. Use the EZ-TECH® and TOOLBOX™ Software to verify that pressure at both accumulators is at 0 psi.

During this process, brake fluid will return to the master cylinder reservoir from the accumulators. Monitor the reservoir fluid level to ensure it does not overflow.

8. Turn the ignition key to OFF.
9. With the accumulator pressure decreased, verify that the brake fluid level is at the MAX mark on the master cylinder reservoir. If brake fluid in the reservoir is above or below the MAX mark, remove or add brake fluid as necessary until the MAX mark level is achieved. If brake fluid needs to be added, ensure that it is from a clean, sealed container. Never add fluid above the MAX mark.
10. Reinstall the 30-amp motor fuses and turn the ignition ON. Both motors will start running until both circuits reach the cut-off pressure at approximately 2000 psi (138 bar).
11. Monitor the pressure in each circuit using the TOOLBOX™ Software.
12. When both motors stop, ensure that the pressure level in each circuit reached the cut-off level. This will decrease the brake fluid level in the master cylinder reservoir.
13. With the system completely charged, the brake fluid level will be between the MIN and MAX marks on the master cylinder reservoir. Figure 6.1.



**Figure 6.1**

**Meritor WABCO Vehicle Control Systems**

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