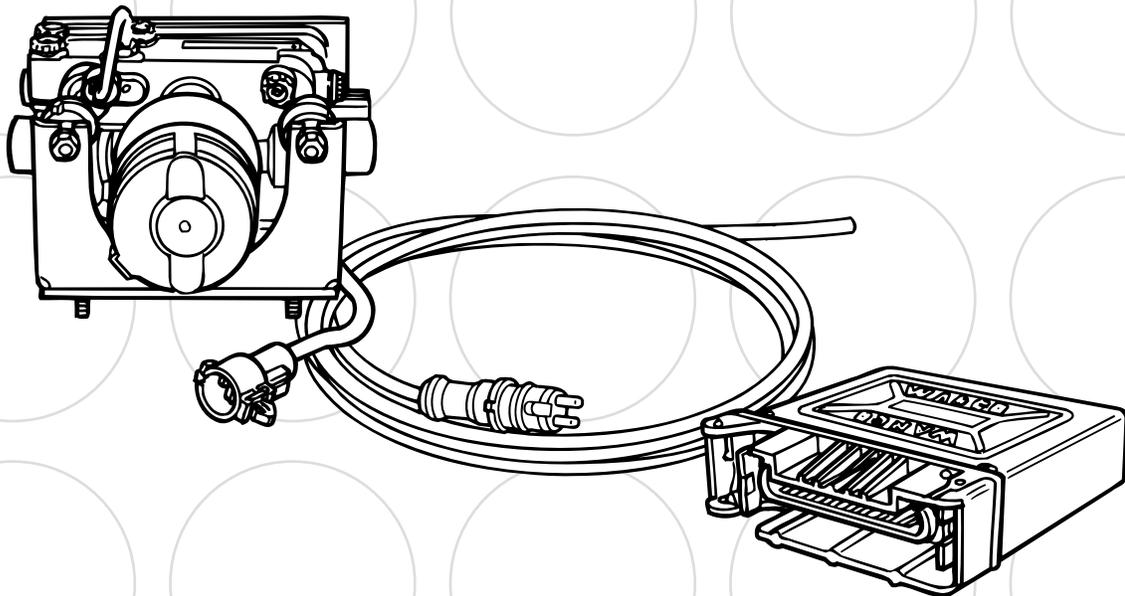


Maintenance Manual 38

Hydraulic ABS for Medium-Duty Trucks, Buses and Motor Home Chassis

Issued 06-98



For C Version Hydraulic ABS ECU Part Numbers:

446 044 040 0

446 044 047 0

446 044 061 0

446 044 062 0

Important Information

This manual contains maintenance procedures for Meritor WABCO's Hydraulic ABS for Medium-Duty Trucks, Buses and Motor Home Chassis. The information contained in this manual was current at time of publication and is subject to change without notice or liability.

You must follow company procedures and understand all procedures and instructions before you begin to service or repair a unit. Some procedures require the use of special tools for safe and correct service. Failure to use special tools when required can cause serious personal injury to service personnel, as well as damage equipment and components.

Meritor WABCO uses the following notations to warn the user of possible safety problems and to provide information that will prevent damage to equipment and components.



WARNING

A WARNING indicates that you must follow a procedure exactly. Otherwise, serious personal injury can occur.



CAUTION

A CAUTION indicates that you must follow a procedure exactly. Otherwise, damage to equipment or components can occur. Serious personal injury can also result, in addition to damaged or malfunctioning equipment or components.

NOTE

A NOTE indicates an operation, procedure or instruction that is important for proper service. A NOTE can also supply information that can help to make service quicker and easier.



TORQUE

This symbol indicates that you must tighten fasteners to specific torque value.

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 discontinue the production of parts described at any time.

 **Asbestos and Non-Asbestos Fibers Warnings**ii

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ASBESTOS FIBER 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 Meritor.

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 asbestos (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.**

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.

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.

- a) 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.
 - b) 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.
 - c) **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 Meritor.

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 medical experts 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/m³ 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, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. 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 Hydraulic Anti-lock Braking System (ABS) is an electronic wheel speed monitoring and control system used on medium-duty trucks, buses and motor home chassis equipped with a hydraulic brake system. This manual covers C Version ABS.

How Hydraulic ABS Works

ABS wheel sensors detect wheel speeds. The sensors generate signals that are transmitted to an Electronic Control Unit (ECU). If the wheels start to lock, the ECU signals the modulator assembly, a control valve assembly, to regulate the brake pressure of each locking wheel.

During an ABS stop, a solenoid valve in the modulator assembly is rapidly pulsed; that is, it opens and closes several times to control the brake pressure. When this occurs, drivers may notice a pulsating of the brake pedal.

An ABS indicator lamp on the vehicle dash alerts the driver to a possible system fault and provides blink code information to diagnose the system.

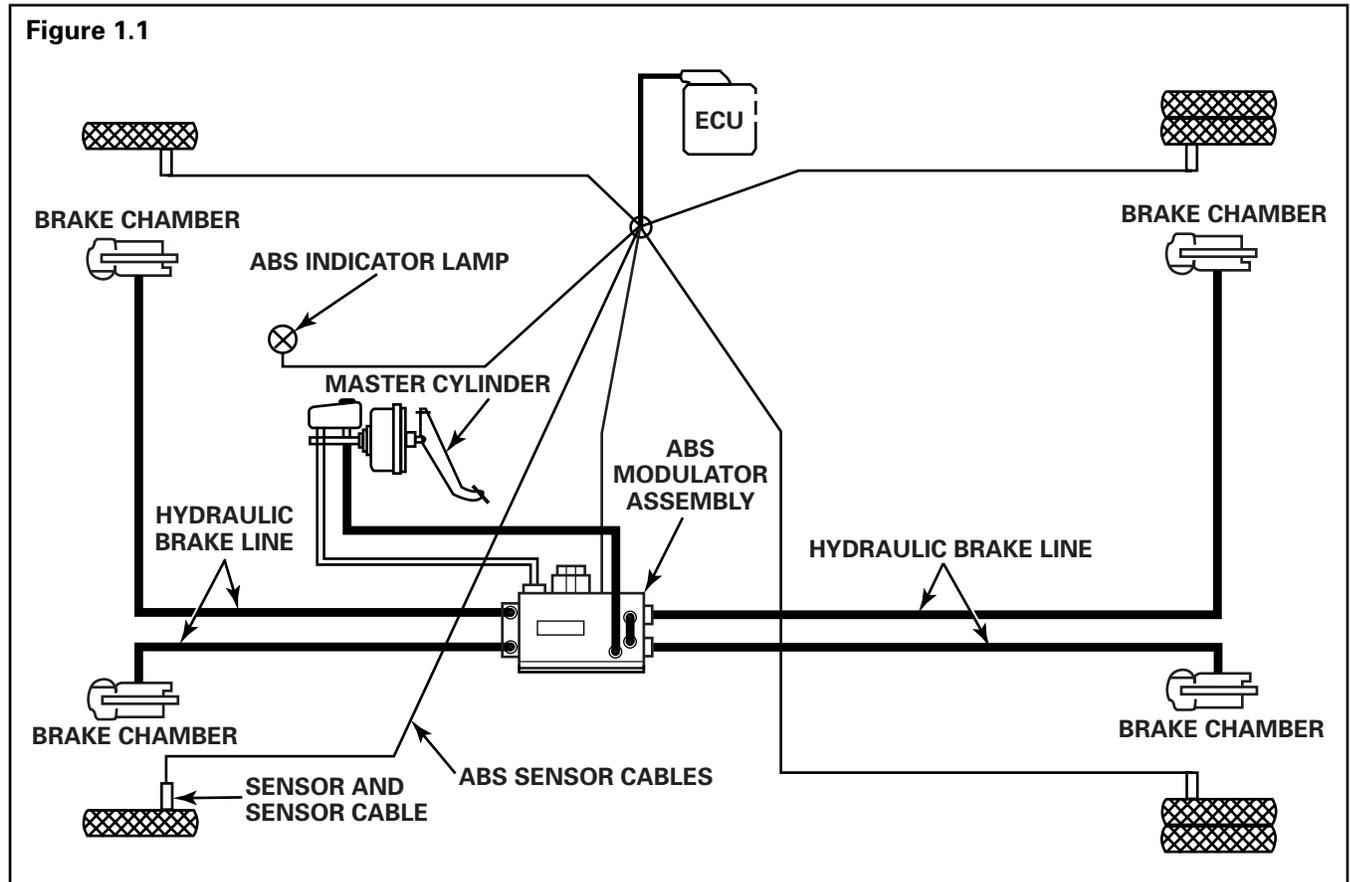
NOTE

It is important not to ignore this indicator lamp. If indicator lamp comes on during trip, drivers may complete their trip and are instructed to have their vehicles serviced as soon as possible.

In the unlikely event of an ABS system malfunction, the ABS in the affected wheel will be disabled and will return to normal braking. The other sensed wheels will retain their ABS function.

System Layout

A typical Meritor WABCO Hydraulic ABS system is illustrated below. **Figure 1.1.**



Section 1 Introduction

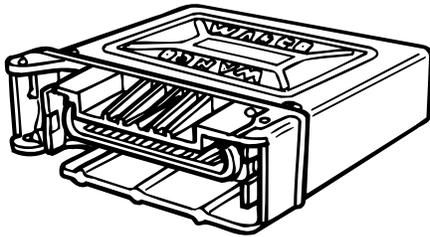
MERITOR WABCO

System Components

The following components make up the Meritor WABCO Hydraulic ABS.

Electronic Control Unit (ECU)

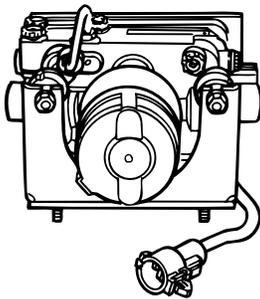
Figure 1.2



- Processes sensor signals and generates solenoid valve commands to reduce, maintain or reapply brake pressure.
- Mounting locations vary, depending upon the vehicle. Refer to the vehicle specifications for the exact location.

Modulator Assembly

Figure 1.3

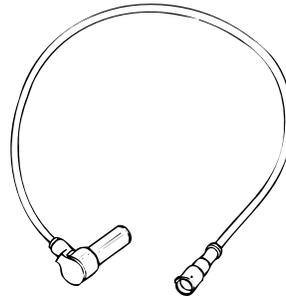


- Houses the ABS solenoid control valves (one inlet valve and one outlet valve per wheel), a pump motor and two accumulators.
- Contains brake fluid and must be handled with appropriate care. It should not be exposed to impact loads, excessive vibrations or compressed air blown into the hydraulic ports.

Sensors

Sensor with Molded Socket

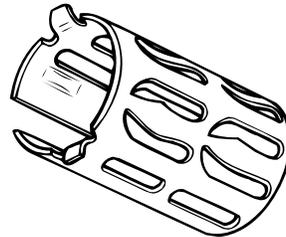
Figure 1.4



- Measures the speed of a tooth wheel rotating with the vehicle wheel.
- Produces an output voltage proportional to wheel speed.

Sensor Spring Clip

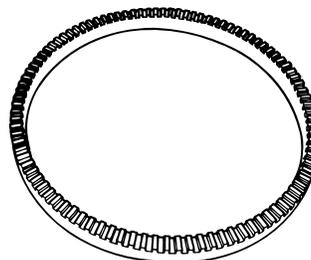
Figure 1.5



- Holds the wheel speed sensor in close proximity to the tooth wheel.

Tooth Wheel

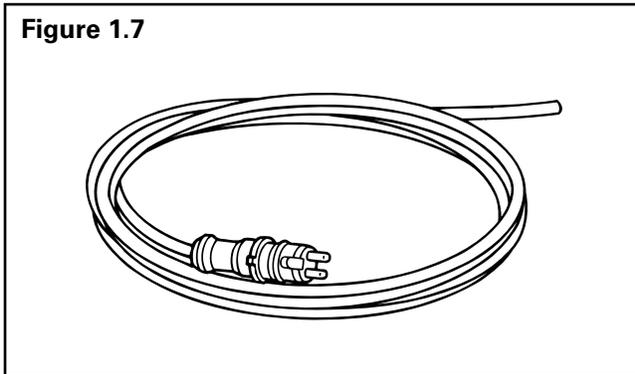
Figure 1.6



- A machined ring mounted to the machined surface on the hub of each ABS-monitored wheel.

Sensor Extension Cables

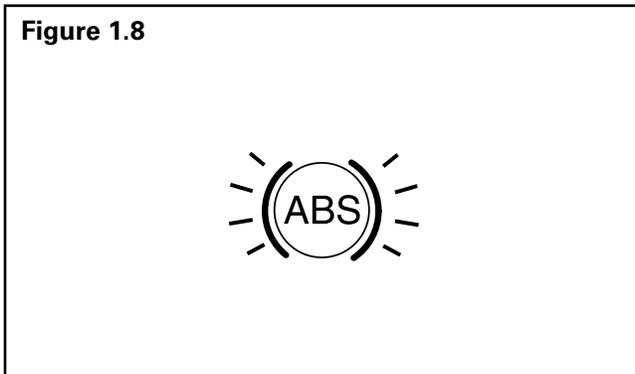
Figure 1.7



- Two-wire cable with molded-on connector.
- Connect the wheel speed sensor to the ECU.

ABS Indicator Lamp

Figure 1.8

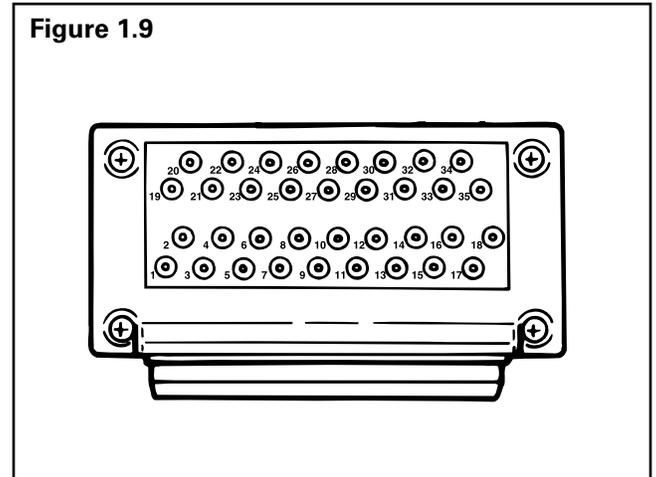


- Located on vehicle dash.
- It alerts drivers to a possible system fault; and
- Used by service personnel to display blink codes.
- ABS indicator lamp is not provided by Meritor WABCO.

Optional Test Equipment

The **Meritor WABCO test adaptor** helps service and troubleshoot the ABS system.

Figure 1.9



General Maintenance Information

There is no regularly scheduled maintenance required for Meritor WABCO C Version Hydraulic ABS. However, ABS does not change current vehicle maintenance requirements. For example, it is important that vehicle fluid levels be properly maintained.

Diagnostics and Testing

Diagnostics

- Blink Code Diagnostics to identify system faults

Recommended Test Equipment

- Volt-ohm meter
- Meritor WABCO 35-pin Test Adaptor

System Wiring Information

Wiring may vary, according to the vehicle. Refer to the vehicle specifications for specific wiring diagrams. A typical Meritor WABCO 4S/4M Hydraulic ABS wiring diagram appears at the end of this section.

Blink Code Diagnostics

Definitions

ABS Indicator Lamp: This lamp, located on the vehicle dash, serves two purposes:

1. Alerts drivers or service personnel to a possible fault in the hydraulic ABS, as follows:

IF . . . the ABS indicator lamp comes on briefly then goes OFF when the ignition is turned ON there are no active or stored faults in the hydraulic ABS

IF . . . ABS indicator lamp comes on and **stays on** AFTER the ignition is turned ON
and

The vehicle is driven in excess of 4 mph (6 km/h) ➔ **There may be an active fault in the hydraulic ABS**

IF . . . ABS indicator lamp comes on and stays on

and

Goes OFF after the vehicle is driven in excess of 4 mph (6 km/h) ➔ **There may be a stored fault in the hydraulic ABS**

2. Displays diagnostic blink codes for easy servicing.

Blink Code: A series of blinks or flashes that describe a particular ABS system condition. (See **Table B** for blink code identification.)

Blink Code Diagnostics: The ability of the Meritor WABCO ECU to sense faults in the ABS system and to define these faults via blink codes.

Blink Code Switch: A switch that activates blink code diagnostic capabilities. Usually, it is mounted under the dash or on the steering column. Refer to the vehicle specifications for type and location.

Clearing Fault Codes: The process of erasing faults from the ECU memory bank.

Fault Code: An ABS condition (fault) detected and stored in memory by the Meritor WABCO ECU and displayed by blink code. System faults may be **Active** or **Stored**.

Active Fault: A condition that currently exists in the ABS system; for example, a sensor circuit malfunction on the left front steering axle. An active fault **must be repaired before you can display additional faults**. Once an active fault has been repaired, it becomes a stored fault.

Stored Fault: A condition that caused the system to register a fault, but **is not currently active**. For example, a loose wire that corrected itself. A stored fault can also be an active fault that has been corrected (see Active Fault).

Table A describes the method of distinguishing between active and stored faults and explains how to clear them.

Section 2

Troubleshooting and Testing

MERITOR WABCO

Using Blink Code Diagnostics

Follow the steps listed in **Table A** to use blink code diagnostics:

Table A — Identifying C-Version Hydraulic Blink Codes

	Response	Status	Action
Step 1 Turn ignition key ON . Do not turn engine on. Turn Blink Code Switch ON .	ABS indicator lamp does not come on.	<ul style="list-style-type: none"> Loose or burned out bulb Voltage not within acceptable range (9.5 to 14 volts DC) 	<ul style="list-style-type: none"> Repair or replace lamp bulb. Measure voltage, check connections. Make necessary repairs.
	ABS indicator lamp comes on briefly then goes out. After a pause, one long and one short flash (the 4S/4M system identification code) is displayed.	→	Check ABS indicator lamp to see if the 1-1 code continues.
	IF 1-1 code continues	System OK	No further action required.
	IF 1-1 is followed by a new blink code	System faults exist	Go to Step 2.
Step 2 Repair fault	→	→	<ul style="list-style-type: none"> Find blink code on Table B* Determine if fault is active or stored. To do this, turn off the blink code switch and let the blink code complete its cycle. Turn off the ignition. Then, repeat Step 1. <ul style="list-style-type: none"> If the same code is displayed, it is an active fault. Turn off the ignition and repair the new fault. If a new code is displayed, it is a stored fault. Go to Step 3.
Step 3 Clear fault Repeat Step 1 to display blink code.	ABS indicator lamp displays blink code		<ul style="list-style-type: none"> While the blink code is flashing, turn off blink code switch and ignition. Turn the ignition back on. The ABS indicator will display one long flash and one short flash, then repeat the fault code. This will happen once, then the lamp will remain on until the ignition is turned off. This indicates the fault has been cleared.

* If you receive a blink code that is not identified in **Table B**, contact the Meritor Customer Support Center at 800-535-5560.

Using Blink Code Diagnostics, Continued

NOTE

Meritor WABCO recommends using the Meritor WABCO test adaptor and a volt-ohm meter to obtain these measurements.

Use the information in **Table B**, Meritor WABCO C Version Hydraulic ABS Fault Codes, to identify a fault, check for proper volt or ohm measurements and repair the fault.

1. Identify and record the blink code. Blink codes are identified in Columns **1** and **2**.
2. Measure the pins indicated. Pin locations to be tested are listed in Column **3**.
3. Compare the measurement received against the correct volt or ohm measurement listed in Column **4**.
4. Follow the instructions listed in Column **5**.

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
1-1	System OK			
2-0	Internal ECU fault	—	—	Replace ECU.
2-1	Internal ECU fault	—	—	Replace ECU.
2-2	Recirculation pump operates continuously (pump does not switch off).	11 and 27 30 and 27	0 volts	Check the recirculation pump wiring, the pump relay and the wiring connections. Repair or replace as required.
2-3	Recirculation pump does not operate (pump does not switch on).	9 and 11 27 and 30	12 volts DC Turn Ignition ON	Check the recirculation pump wiring, the pump relay and fuse and pump connections. Repair or replace as required.
2-4	Recirculation pump motor locked.	Link pins 9 and 11	Turn Ignition ON	Excessive current failure. If pump does not run when pins are linked, replace modulator assembly.
2-5	Erratic wheel speed			Check for tire size mismatch or tooth wheel difference. Check sensor, sensor cable and connector for intermittent contact. Make necessary repairs.

Section 2

Troubleshooting and Testing

MERITOR WABCO

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
2-6	Brake light switch failure	10, 25 and 27	12 volts DC with brakes applied	Check brake light switch wiring and ECU connector. Repair as required.
2-7	Continuous power to ECU with ignition off.	9 and 27	0 volts 0 ohms to chassis ground	Check for proper wiring connections. Repair as required.
2-8	No voltage to ABS solenoid valves.	1, 9, 19 and 27 Link pins 8 and 9	12 volts DC Turn Ignition ON	Check the valve relay, fuse and wiring. Repair or replace as required.
2-9	Inlet valve supervision time exceeded.	—	—	Check voltage for normal function. Clear fault.
2-10	Modulator assembly ground reference interrupted.	31 and 27	0 ohms	Repair or replace wiring as required.
2-11	Excessive recirculation pump cycle time.	—	—	Check recirculation pump function. Clear fault.
2-12	Right front wheel speed signal is weak.	17 and 34	Greater than .2 volts AC at 30 RPM	Check sensor adjustment. Check for excessive wheel bearing endplay. Adjust as necessary.
2-13	Left rear wheel speed signal is weak.	18 and 35		
2-14	Left front wheel speed signal is weak.	15 and 32		
2-15	Right rear wheel speed signal is weak.	16 and 33		

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
3-0	Open circuit between ECU and right front inlet solenoid valve or wiring.	6 and 27	6.5 to 7.5 ohms	Check electrical resistance of affected valve wiring to ground at ECU connector and at modulator assembly plug. Repair wiring or replace modulator assembly as required.
3-1	Open circuit between ECU and right front outlet solenoid valve or wiring.	7 and 27	3.1 to 4.1 ohms	
3-2	Open circuit between ECU and left front inlet solenoid valve or wiring.	23 and 27	6.5 to 7.5 ohms	
3-3	Open circuit between ECU and left front outlet solenoid valve or wiring.	24 and 27	3.1 to 4.1 ohms	
3-4	Open circuit between ECU and right rear inlet solenoid valve or wiring.	4 and 27	6.5 to 7.5 ohms	
3-5	Open circuit between ECU and right rear outlet solenoid valve or wiring.	5 and 27	3.1 to 4.1 ohms	
3-6	Open circuit between ECU and left rear inlet solenoid valve or wiring.	21 and 27	6.5 to 7.5 ohms	
3-7	Open circuit between ECU and left rear outlet solenoid valve or wiring.	22 and 27	3.1 to 4.1 ohms	
3-8	Open circuit between ECU and recirculation pump relay.	9 and 11 9 and 30	12 volts DC Turn Ignition ON	If pump does not run, check wiring from pin 11.

Section 2

Troubleshooting and Testing

MERITOR WABCO

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
4-0	Open circuit to ground between ECU and the right front inlet solenoid valve or wiring.	6 and 27	6.5 to 7.5 ohms	Check electrical resistance of affected valve wiring to ground at ECU connector and at modulator assembly plug. Repair wiring or replace modulator assembly as required.
4-1	Open circuit to ground between ECU and the right front outlet solenoid valve or wiring.	7 and 27	3.1 to 4.1 ohms	
4-2	Open circuit to ground between ECU and the left front inlet solenoid valve or wiring.	23 and 27	6.5 to 7.5 ohms	
4-3	Open circuit to ground between ECU and the left front outlet solenoid valve or wiring.	24 and 27	3.1 to 4.1 ohms	
4-4	Open circuit to ground between ECU and the right rear inlet solenoid valve or wiring.	4 and 27	6.5 to 7.5 ohms	
4-5	Open circuit to ground between ECU and the right rear outlet solenoid valve or wiring.	5 and 27	3.1 to 4.1 ohms	
4-6	Open circuit to ground between ECU and the left rear inlet solenoid valve or wiring.	21 and 27	6.5 to 7.5 ohms	

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
4-7	Open circuit to ground between ECU and the left rear outlet solenoid valve or wiring.	22 and 27	3.1 to 4.1 ohms	Check electrical resistance of affected valve wiring to ground at ECU connector and at modulator assembly plug. Repair wiring or replace modulator assembly as required.
4-8	Open circuit to ground between ECU and the recirculation pump relay.	11 or 30 and 27	Open circuit	Check wiring to pump relay and pump connector through pump. Repair wiring or replace pump as required.
4-12	Right front wheel speed sensor open circuit.	17 and 34	500 to 2000 ohms	Check electrical resistance of affected sensor and wiring at ECU connector and at harness plugs. Repair wiring or replace sensor as required.
4-13	Left rear wheel speed sensor open circuit.	18 and 35		
4-14	Left front wheel speed sensor open circuit.	15 and 32		
4-15	Right rear wheel speed sensor open circuit.	16 and 33		
5-0	Open circuit to battery between ECU and the right front inlet solenoid valve or wiring.	6 and 9	6.5 to 7.5 ohms 0 volts	Check electrical resistance of affected valve wiring to ground at ECU connector and at modulator assembly plug. Check voltages at wiring harness including connectors. Repair wiring or replace as required.
5-1	Open circuit to battery between ECU and the right front outlet solenoid valve or wiring.	7 and 9	3.1 to 4.1 ohms 0 volts	
5-2	Open circuit to battery between ECU and the left front inlet solenoid valve or wiring.	23 and 9	6.5 to 7.5 ohms 0 volts	

Section 2

Troubleshooting and Testing

MERITOR WABCO

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes and Tests

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
5-3	Open circuit to battery between ECU and the left front outlet solenoid valve or wiring.	24 and 9	3.1 to 4.1 ohms 0 volts	Check electrical resistance of affected valve wiring to ground at ECU connector and at modulator assembly plug. Check voltages at wiring harness including connectors. Repair wiring or replace as required.
5-4	Open circuit to battery between ECU and the right rear inlet solenoid valve or wiring.	4 and 9	6.5 to 7.5 ohms 0 volts	
5-5	Open circuit to battery between ECU and the right rear outlet solenoid valve or wiring.	5 and 9	3.1 to 4.1 ohms 0 volts	
5-6	Open circuit to battery between ECU and the left rear inlet solenoid valve or wiring.	21 and 9	6.5 to 7.5 ohms 0 volts	
5-7	Open circuit to battery between ECU and the left rear outlet solenoid valve or wiring.	22 and 9	3.1 to 4.1 ohms 0 volts	
5-8	Open circuit to battery between ECU and the recirculation pump relay.	30 and 11	0 volts	Check wiring harness between ECU and relay and pump ground connections. Repair or replace wiring as required.

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
5-12	Right front wheel speed signal is erratic.	17 and 34	Greater than .2 volts AC at 30 RPM	Check for damaged or incorrect tone wheel, sensor adjustment, excessive hub tone wheel runout, excessive wheel bearing endplay and tire size mismatch. Repair or replace as required.
5-13	Left rear wheel speed signal is erratic.	18 and 35		
5-14	Left front wheel speed signal is erratic.	15 and 32		
5-15	Right rear wheel speed signal is erratic.	16 and 33		
6-0	Short circuit between the right front inlet solenoid valve or wiring.	6 and 4 6 and 5 6 and 7 6 and 21 6 and 22 6 and 23 6 and 24	Open circuit	Check electrical resistance of affected valves and wiring at ECU connector and at modulator assembly plug. Repair or replace wiring as required. Modulator assembly should be replaced if short is internal. NOTE Blink Code for both affected valves will be stored in ECU memory.
6-1	Short circuit between the right front outlet solenoid valve or wiring.	7 and 4 7 and 5 7 and 6 7 and 21 7 and 22 7 and 23 7 and 24	Open circuit	

Section 2

Troubleshooting and Testing

MERITOR WABCO

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
6-2	Short circuit between the left front inlet solenoid valve or wiring.	23 and 4 23 and 5 23 and 6 23 and 7 23 and 21 23 and 22 23 and 24	Open circuit	<p>Check electrical resistance of affected valves and wiring at ECU connector and at modulator assembly plug. Repair or replace wiring as required.</p> <p>Replace modulator assembly if short is internal.</p> <p>NOTE <i>Blink Code for both affected valves will be stored in ECU memory.</i></p>
6-3	Short circuit between the left front outlet solenoid valve or wiring.	24 and 4 24 and 5 24 and 6 24 and 7 24 and 21 24 and 22 24 and 23	Open circuit	
6-4	Short circuit between the right rear inlet solenoid valve or wiring.	4 and 5 4 and 6 4 and 7 4 and 21 4 and 22 4 and 23 4 and 24	Open circuit	
6-5	Short circuit between the right rear outlet solenoid valve or wiring.	5 and 4 5 and 6 5 and 7 5 and 21 5 and 22 5 and 23 5 and 24	Open circuit	
6-6	Short circuit between the left rear inlet solenoid valve or wiring.	21 and 4 21 and 5 21 and 6 21 and 7 21 and 22 21 and 23 21 and 24	Open circuit	

Using Blink Code Diagnostics, Continued

Table B — Meritor WABCO C Version Hydraulic ABS Blink Codes

Ignition Key ON to Determine ABS Blink Code Fault		Ignition Key OFF to Test System (except where noted)		
1	2	3	4	5
Fault Code	Problem Area	Pin Locations To Be Tested	Correct Volt and Ohm Meter Readings	Action Required
6-7	Short circuit between the left rear outlet solenoid valve or wiring.	22 and 4 22 and 5 22 and 6 22 and 7 22 and 21 22 and 23 22 and 24	Open circuit	Check electrical resistance of affected valves and wiring at ECU connector and at modulator assembly plug. Repair or replace wiring as required. Replace modulator assembly if short is internal. NOTE <i>Blink Code for both affected valves will be stored in ECU memory.</i>
6-8	Short circuit to battery between solenoid valve and recirculation pump relay.	11 and 27	0 volts	Check wiring harness at ECU connector to pump relay. Check ECU. Repair or replace as required.
6-12	Right front wheel speed signal is missing.	17 and 34	Greater than .2 volts AC at 30 RPM	Check for missing or incorrect tone wheel, sensor adjustment, excessive wheel bearing endplay and tire size mismatch.
6-13	Left rear wheel speed signal is missing.	18 and 35		
6-14	Left front wheel speed signal is missing.	15 and 32		
6-15	Right rear wheel speed signal is missing.	16 and 33		

Section 2

Troubleshooting and Testing

Testing the System

WARNINGS

- ⚠ *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.*

NOTES

- *Refer to, and follow, the vehicle manufacturer's Warnings, Cautions and Service Procedures.*
- *When testing, set the parking brake and place the gear selector in NEUTRAL (manual transmission) or PARK (automatic transmission) unless otherwise directed.*

Test Equipment

Use the Meritor WABCO Test Adaptor and a standard volt-ohm meter to troubleshoot C Version Hydraulic ABS. These tools are described below.

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.

The receptacles in the test adaptor accept the tips of standard VOM cables. These tips are approximately 0.08-inch (2 mm) in diameter.

Meritor WABCO Test Adaptor

The Meritor WABCO test adaptor lets you access the 35 pins in the connector that attaches the harness to the ECU.

Test Adaptor pin assignments are listed in **Table C – PIN Numbers and Descriptions**. Use the diagram in **Figure 2.1** to identify pin locations on the 35-pin connector.

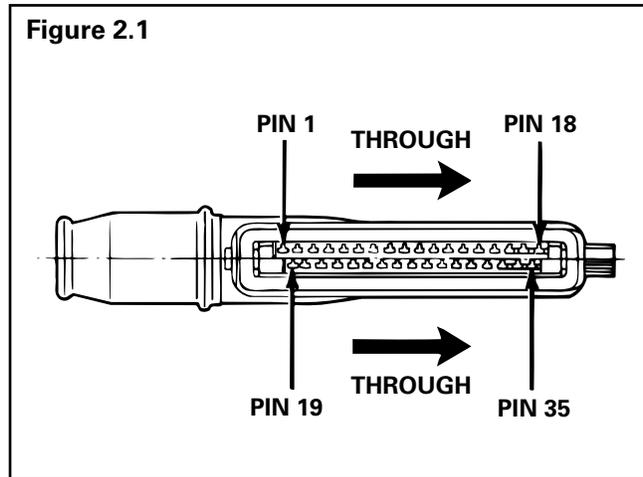


Table C — PIN Numbers and Descriptions

PIN Number	WABCO Circuit Description	PIN Number	WABCO Circuit Description
1	ECU	19	ECU
2	Not used	20	Not used
3	Not used	21	Left rear inlet valve
4	Right rear inlet valve	22	Left rear outlet valve
5	Right rear outlet valve	23	Left front inlet valve
6	Right front inlet valve	24	Left front outlet valve
7	Right front outlet valve	25	Brake light input
8	Valve relay	26	ABS indicator lamp
9	ECU ignition supply	27	ECU ground
10	Brake light input	28	Not used
11	Recirculation pump relay	29	Not used
12	Not used	30	Recirculation pump control/ power
13	Diagnostic interface	31	Modulator assembly ground sensing
14	Diagnostic interface/blink code activation	32	Left front sensor
15	Left front sensor	33	Right rear sensor
16	Right rear sensor	34	Right front sensor
17	Right front sensor	35	Left rear sensor
18	Left rear sensor		

Section 2

Troubleshooting and Testing

MERITOR WABCO

Test Procedure

To use the Meritor WABCO Test Adaptor, follow these steps:

1. Identify the fault code and problem area (see **Table B**).
2. Turn vehicle ignition OFF. It is important you turn the ignition OFF to avoid damaging the test adaptor.
3. Disconnect the 35-pin harness connector from the ECU.
4. Insert the test adaptor into the 35-pin harness connector.
5. Check **Table C** to determine which adaptor pins to test with the VOM.
6. Set the VOM to the appropriate scale.
7. Take measurement and write it down.
8. Compare measurement with the desired measurement value listed in **Table B**.
9. Disconnect the test adaptor from the harness and reconnect the harness to the ECU.
10. Repair or replace wiring or components as necessary.
11. Make sure the ABS is functional; road test the vehicle if necessary.

System Requirements and Component Tests

Tire Size Range

For proper hydraulic ABS operation, front and rear tire sizes must be within 7.5% of each other. If this tire size range is exceeded without electronically modifying the ECU, the system performance can be affected and the ABS indicator lamp can illuminate.

Contact the Meritor WABCO Customer Support Center at 800-535-5560 if you plan a tire size difference greater than 7.5%.

Calculate the tire size with the following equation:

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

RPM = tire revolutions per mile



CAUTION

When troubleshooting or testing the ABS system, do not damage the connector terminals.

Voltage Check

Voltage must be between 9.5 and 14 volts for the 12-volt hydraulic ABS to function properly.

Check voltage as follows:

1. Turn ignition ON.
2. Check for proper voltage between pins 27 and 26 and 27 and 9.

If voltage is not between 9.5 and 14 volts, verify proper wiring connections. Make corrections as required.

ABS Indicator Lamp

If the ABS indicator lamp does 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. Check the wiring to the ABS diagnostic switch and the indicator lamp and repair or replace the wiring as required. When checking the indicator lamp, follow these steps:

1. Check voltage potential at the lamp socket.
2. Check continuity of the wires to the socket.
3. Replace the bulb.

ABS Diagnostic Switch

When testing the ABS Diagnostic switch, use the wiring diagram in **Figure 2.2** at the end of this section and perform the following steps:

1. Check the resistance between the terminals while cycling the switch.
2. Check the continuity of the wires to the switch (pins 13 and 27 and 14 and 27).

Sensor Adjustment

NOTES

- *On steering axles, the sensor is accessible on the in-board side of the steering knuckle.*
- *On drive axles, the drum assembly may have to be pulled to gain access to the sensor.*

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 allowable at installation. During normal operation a gap not to exceed 0.04-inch is allowable.

Sensor Output Voltage Test

Sensor output voltage must be at least 0.2 volts AC at 30 rpm. Test the sensor output voltage as follows:

1. Turn ignition OFF.
2. Disconnect the ECU (see wiring diagram at the end of this section).



WARNING

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 can result.

3. Put blocks under the front and rear tires to stop the vehicle from moving.
4. Raise the vehicle off the ground. Put safety stands under the axle.
5. Rotate wheel by hand at 30 rpm (1/2 revolution per second).
6. Measure the voltage at the pins indicated in **Table D**.

Table D — Sensor Check Pins

Sensor	Pins
Left Front	15 and 32
Right Front	17 and 34
Left Rear	18 and 35
Right Rear	16 and 33

Sensor Resistance

The sensor circuit resistance must be between 500 and 2000 ohms. Measure resistance at the sensor connector, or at the pins on the ECU connector, as follows:

1. Turn ignition OFF.
2. To measure resistance at the pins on ECU connector, disconnect the ECU connector from the ECU.

To measure resistance at the sensor connector, disconnect the sensor from the sensor extension cable.

3. Measure output at the pins indicated in **Table D**, Sensor Check Pins.

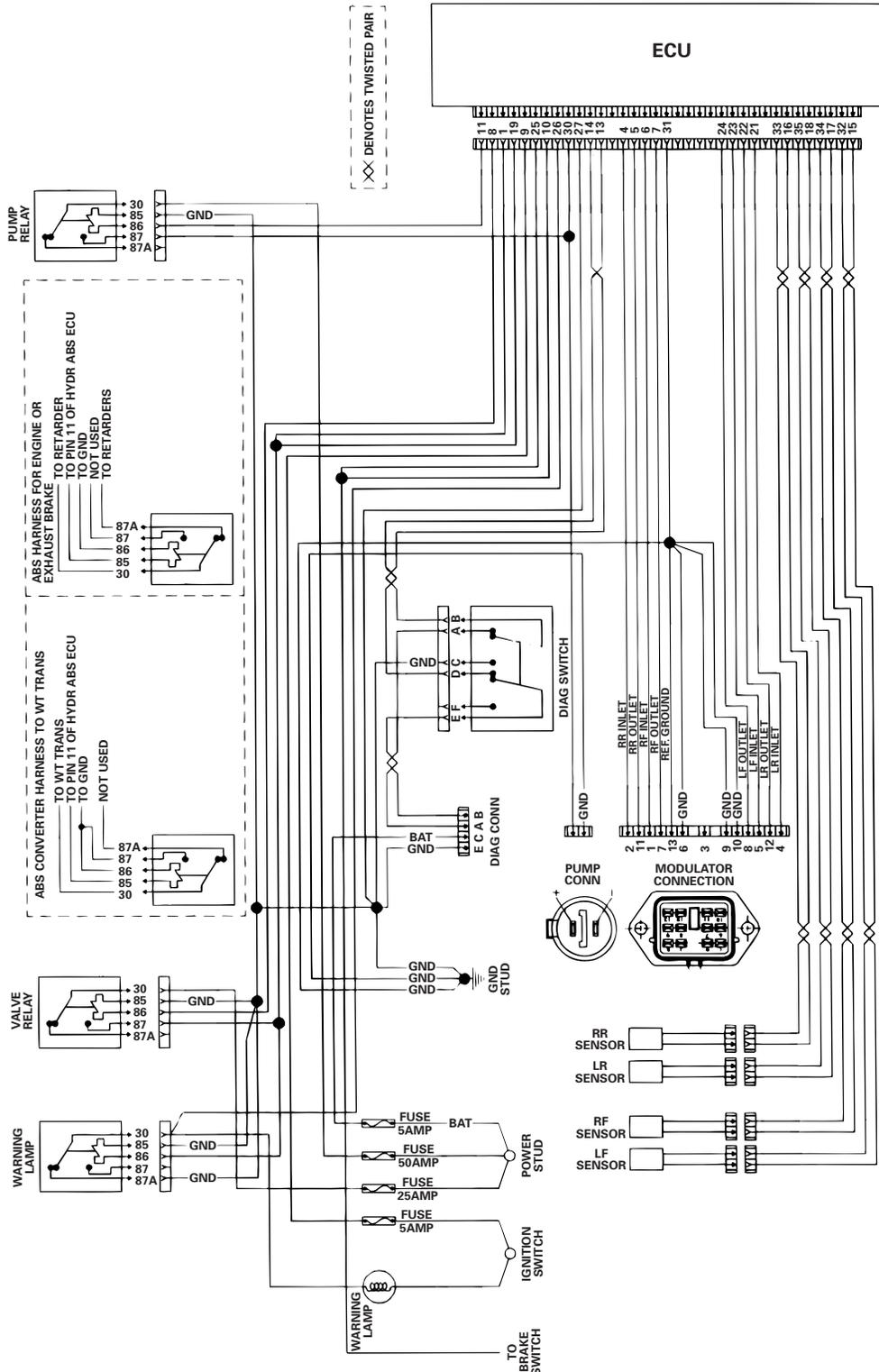
If measurement is not between 500 and 2000 ohms, replace the sensor.

Section 2 Troubleshooting and Testing

MERITOR WABCO

Figure 2.2

Meritor WABCO 4S/4M C Version Hydraulic ABS Wiring Diagram



Component Removal and Installation

Sensors

Sensor Lube 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° to 300°F (-40° to 150°C).

Wheel Speed Sensor Replacement — Front Axle

Wheel Speed Sensor Removal — Front Axle

WARNINGS

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

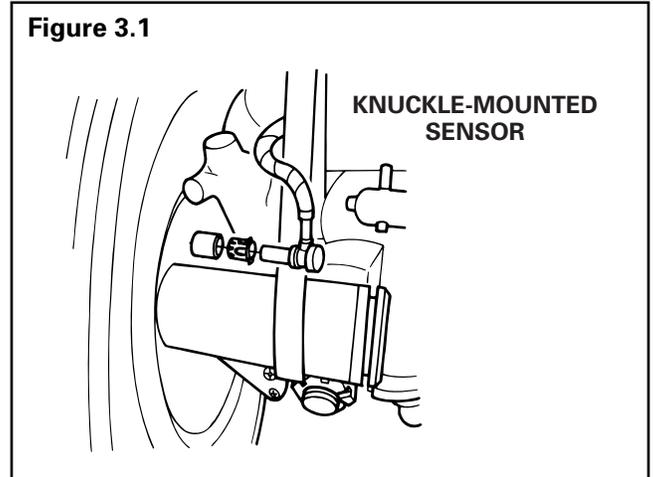
⚠ Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

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

⚠ To avoid damage to the electrical system or ABS components, when welding on an ABS-equipped vehicle disconnect the power connector from the ECU

1. Apply the parking brakes. Chock the rear tires to prevent vehicle movement.
If necessary, raise the front tires off the ground. Put safety stands under the axle.
2. Disconnect the fasteners that hold the sensor cable to 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 3.1.



Wheel Speed Sensor Installation — Front Axle

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. Make sure 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

Make sure the sensor cable is supported by tie wraps every 12 inches and that excess cable is properly bundled and stored in the sub frame.
Figure 3.2.

7. Remove the blocks and safety stands.

NOTE

Before putting the vehicle back into service, perform a voltage output check to ensure proper installation. See Sensor Output Voltage Test in Section 2.

Section 3

Component Replacement

MERITOR WABCO

Wheel Speed Sensor Replacement — Rear Axle

Wheel Speed Sensor Removal — Rear Axle

1. Apply the parking brake. Chock the front tires to prevent vehicle movement.
2. Raise the rear tires off of the ground. Put safety stands under the axle.
3. If the rear tire and brake drum 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; then, remove the brake drum.

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.

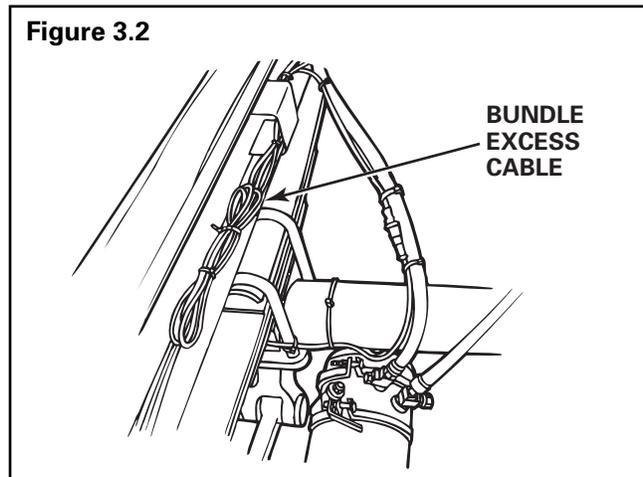
Wheel Speed Sensor Installation — Rear Axle

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

NOTE

Make sure the sensor cable is supported by tie wraps every 12 inches and that excess cable is properly bundled and stored in the sub frame. Figure 3.2.

Figure 3.2



6. Replace the tire and drum if required, remove the safety stands, lower the vehicle and remove the chocks from the front tires.

NOTE

Before putting the vehicle back into service, perform a voltage output check to ensure proper installation. See Sensor Output Voltage Test in Section 2.

Modulator Assembly

Modulator Assembly Removal

CAUTION

The modulator assembly contains hydraulic brake fluid, a caustic substance. Remove the valve carefully so that fluid does not leak and cause skin irritation or damage to components.

1. Apply the parking brakes. Chock the front and rear tires to prevent vehicle movement.
2. Place a container under the modulator assembly to catch leaking brake fluid.
3. Disconnect the electrical harness connectors from the modulator assembly.
4. Mark the brake lines for ease of installation. Disconnect the lines from the modulator assembly.
5. Remove the three mounting capscrews, washers and nuts that attach the modulator assembly and bracket assembly to vehicle.

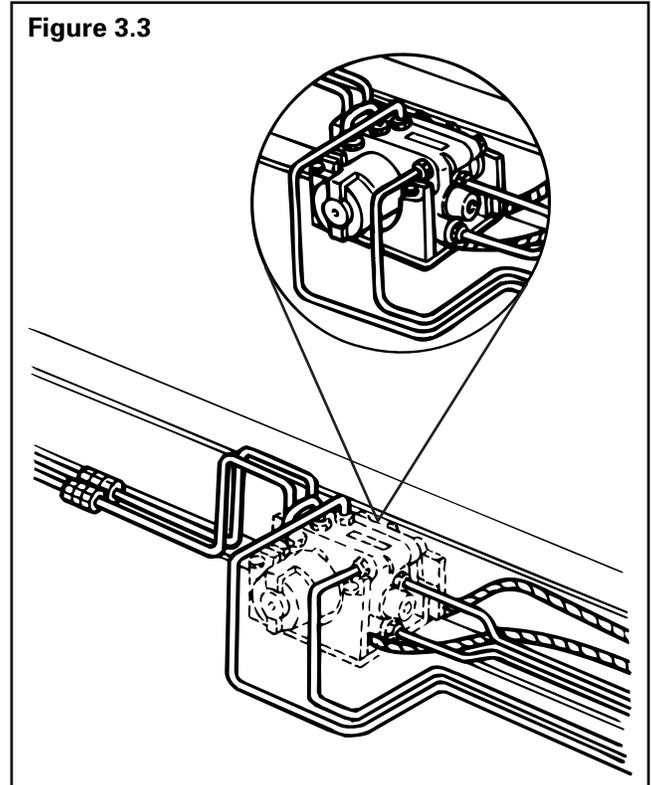
NOTE

Whenever any hydraulic system fitting is loosened or disconnected the entire system must be bled to remove any air that may have entered.

6. Remove the modulator assembly and bracket.

Modulator Assembly Installation

1. Position the modulator assembly and bracket in place on the vehicle. **Figure 3.3.**



2. Tighten the three mounting nuts to 132 lb-in (15 N•m). 
3. Connect and tighten brake line connections to 108 lb-in (12 N•m). 
4. Bleed the brake system, per the following instructions.
5. Connect the electrical harnesses to the modulator assembly.

Section 3

Component Replacement

MERITOR WABCO

Brake Bleeding Procedure

WARNINGS

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

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

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

CAUTION

Do not let brake fluid touch any painted surfaces, as it will remove the paint. Brake fluid may also damage certain non-metal surfaces. Do not let fluid get on brake pads, shoes, rotors, or drums.

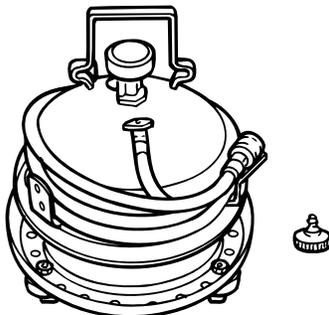
Bleeding the Brake System

Pressure Bleeding

NOTE

Pressure bleeding is the preferred method for bleeding the service brake system. It requires the use of a special pressure bleeder kit, consisting of a tank, pressure pump and valve, gauge, tubing and adapter. These are available from a number of manufacturers and include instructions for use. Figure 3.4.

Figure 3.4



1. Apply the parking brake and chock the tires.
2. Connect the pressure bleeder to the brake master cylinder reservoir, following the manufacturer's instructions.

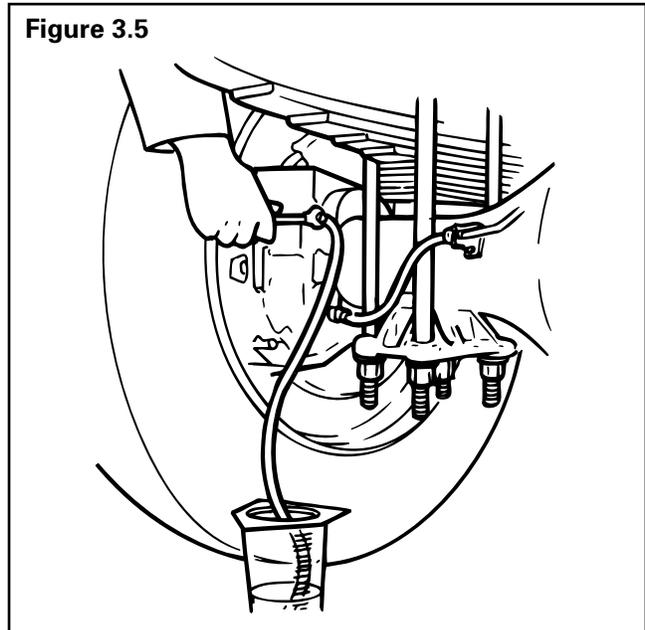
- a. Fill the pressure bleeder with a new DOT-approved brake fluid specified by the O.E.M., then pressurize it according to the manufacturer's instructions.
- b. Use the adapter supplied with the kit to connect the pressure bleeder to the rear compartment of the master cylinder reservoir.

NOTE

Some master cylinders have only one reservoir.

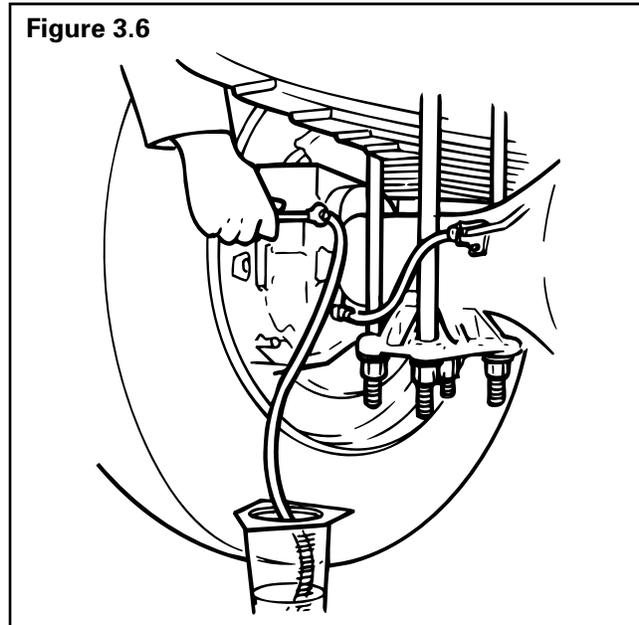
3. Bleed the hydraulic system at the rear wheel brakes, starting on the right side.
 - a. Put a wrench on the bleeder fitting at the brake actuator, then attach a length of clear tubing to the bleeder fitting. Make sure the tube fits snugly.
 - b. Submerge the tubing in a container of clean brake fluid. **Figure 3.5.**

Figure 3.5



Pressure Bleeding, Continued

- c. Loosen the bleeder fitting until the fluid begins to flow (about 3/4 turn). Let the brake fluid flow out of the fitting until it is free of air bubbles. **Figure 3.6.**



- d. Tighten the fitting firmly.
 - e. Move to the left rear brake actuator and repeat preceding steps for bleeding the brake system.
4. Disconnect the pressure bleeder for the rear compartment of the master cylinder reservoir, then connect it to the front compartment of the reservoir.

NOTE

Some master cylinders have only one reservoir.

5. Bleed the hydraulic system at the front wheel brakes, starting on the right side.
 - a. Put a wrench on the bleeder fitting at the brake actuator, then attach a length of clear tubing to the bleeder fitting. Make sure the tubing fits snugly.
 - b. Submerge the tubing in a container of clean brake fluid.
 - c. Loosen the bleeder fitting about 3/4 turn.
 - d. Let the brake fluid flow out of the fitting until it is free of air bubbles.
 - e. Tighten the fitting firmly.
 - f. Move to the left front brake actuator and repeat preceding steps for bleeding the brake system.
6. Disconnect the pressure bleeder for the front compartment of the master cylinder reservoir and check the brake fluid level in both compartments of the reservoir. Add a new DOT-approved brake fluid specified by the O.E.M. if needed.
7. Check the operation of the brakes by depressing the brake pedal several times, until it feels firm. The brake pedal should feel firm and not go all the way down to the floor.

If it does not feel firm and continues to go all the way down to the floor, refer to the vehicle hydraulic brake system manual to determine and repair the problem.
8. Remove wheel chocks.

Section 3

Component Replacement

MERITOR WABCO

Manual Bleeding

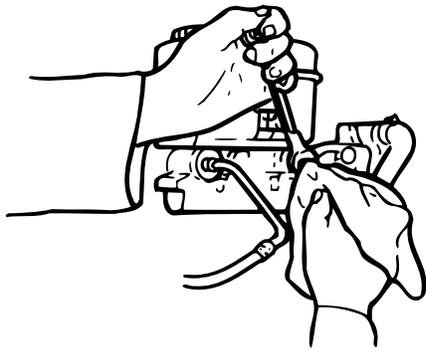
If you do not have pressure bleeding equipment, you can use the following manual bleeding procedure.

CAUTION

Do not let the brake master cylinder fluid level get too low during the bleeding operation. Keep the master cylinder reservoir filled with a new, DOT-approved brake fluid specified by the O.E.M. Failure to keep the brake reservoir filled could result in more air entering the system making it impossible to effectively bleed the system.

1. Apply the parking brake and chock the tires.
2. Bleed the master cylinder.
 - a. Using a wrench and a rag to absorb leaking brake fluid, loosen the fitting at the rear outlet port on the master cylinder until the fluid begins to flow (about 3/4 turn). **Figure 3.7.**

Figure 3.7



- b. Push the brake pedal down slowly by hand until it reaches the floor. Brake fluid and any air in the master cylinder will exit through the fitting.
 - c. With the brake pedal held down, tighten the rear hydraulic line fitting firmly.

NOTE

Do not release the brake pedal until the fitting has been tightened or more air will get into the system.

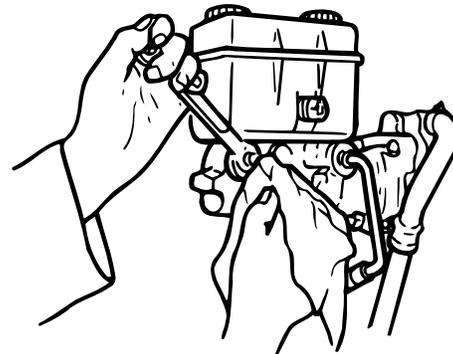
- d. Release the brake pedal.
 - e. Loosen the fitting again and repeat steps for bleeding the master cylinder as required until no air escapes from the fitting.

NOTE

Pedal will not feel firm if air is somewhere else in the system.

- f. Check level of the rear compartment of the reservoir. Add a new DOT-approved brake fluid specified by the O.E.M. as needed.
 - g. Using a wrench and a rag to absorb leaking brake fluid, loosen the fitting at the front outlet port on the master cylinder about 3/4 turn. **Figure 3.8.**

Figure 3.8



- h. Repeat Steps b through f to bleed the front outlet port.
 - i. Check level of the front compartment of the reservoir, then add a new DOT-approved brake fluid specified by the O.E.M. as needed.

Manual Bleeding, Continued

3. Bleed the hydraulic system at the rear wheel brakes, starting on the right side.
 - a. Put a wrench on the bleeder fitting at the brake actuator, then attach a length of clear tubing to the bleeder fitting. Make sure the tube fits snugly.
 - b. Submerge the tubing in a container of clean brake fluid. See **Figure 3.6**.
 - c. Loosen the bleeder fitting about 3/4-inch.
 - d. Slowly push the brake pedal to the floor. With the brake pedal depressed, tighten the bleeder fitting.

NOTE

Do not release the brake pedal until the fitting has been tightened or more air will get into system.

- e. Release the brake pedal. Check the fluid in the tube to determine if air bubbles are present.
 - f. Repeat as required until the fluid in the tube is completely free of air bubbles, as shown in **Figure 3.6**.
 - g. Check the brake fluid level in the reservoir. Add a new DOT-approved brake fluid specified by the O.E.M. if needed.
4. Repeat steps for bleeding the hydraulic brake system for:
 - Left rear brake
 - Right front brake
 - Left front brake
5. Remove the wheel chocks.

Meritor WABCO

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