General Information

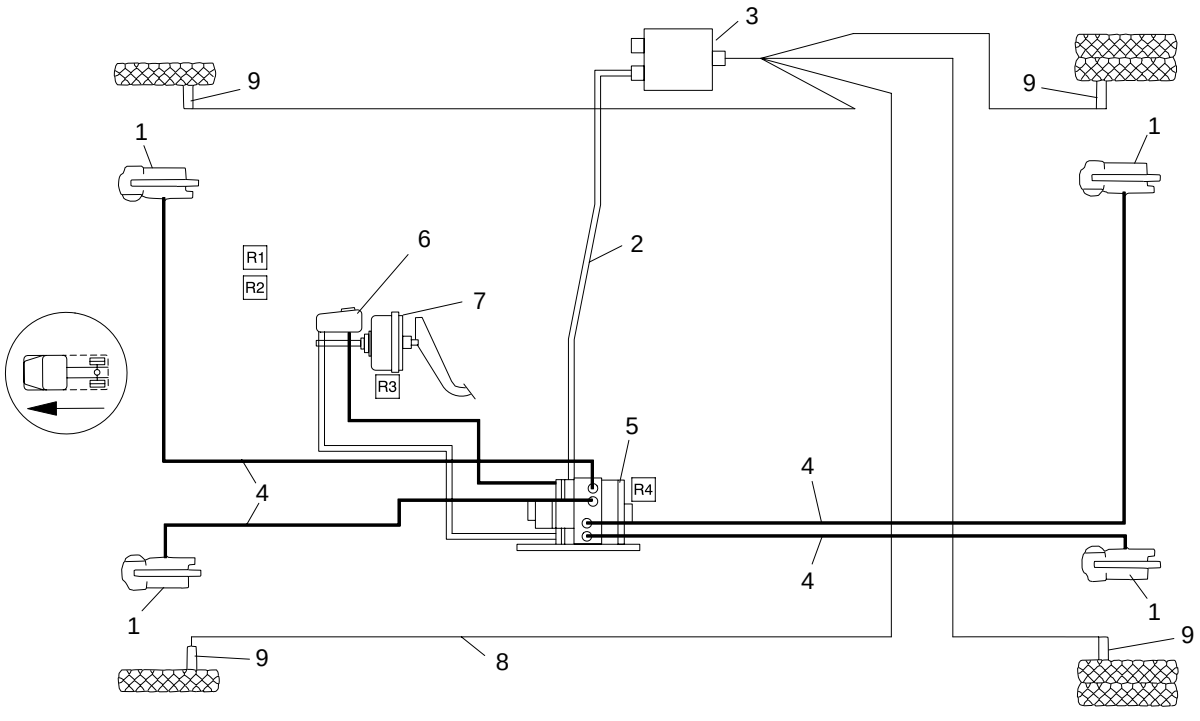
The Meritor WABCO D-Version antilock braking system (ABS) is an electronic wheel-speed monitoring and brake control system that works with the hydraulic brakes to prevent skids. See **Fig. 1**. ABS passively monitors vehicle wheel speed at all times. During normal driving and braking, ABS has no effect. It begins to control braking in a wheel only when it senses the wheel is beginning to lock and skid.

See **Fig. 2** for an illustration of the ECU identification tag. See **Fig. 3** for an illustration of the ECU, which is mounted under the rear crossmember. See **Fig. 4** for an illustration of an ABS modulator valve, which is located inside the left frame rail.

IMPORTANT: When the ignition switch is turned on, the ABS warning light comes on. If all the ABS components are working correctly, the light goes out after about 3 seconds.

During vehicle operation, if the ECU senses a failure in any part of the ABS system (for example, a bad sensor or ABS modulator assembly, short circuit, or corroded tone ring) the ABS warning light comes on. At the same time, the circuit where the failure occurred switches to normal braking action. See **Chapter 6** of the *Saf-T-Liner C2 Driver's Manual* for complete operating instructions.

IMPORTANT: If the ABS warning light and the ATC indicator light do not work as described



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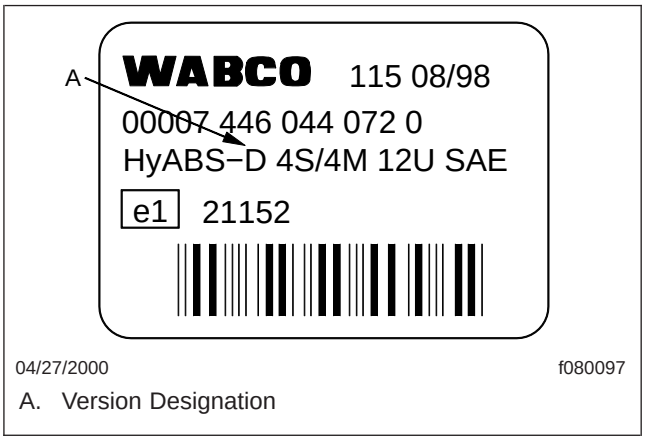
R1. ABS Lamp Relay (in dash)
R2. Stop Lamp Switch Relay (in dash)
R3. Back-Up Pump Relay (at hydraulic booster)
R4. ABS Modulator Pump Relay (on ABS modulator)

1. Brake
2. ECU to ABS modulator signal cable
3. ABS Electronic Control Unit (ECU)
4. Hydraulic Brake Line
5. ABS Modulator Assembly
6. Master Cylinder
7. Hydraulic Booster
8. ABS Sensor Cable
9. Wheel Sensor Assembly

Fig. 1, Hydraulic ABS Components

General Information



A. Version Designation

Fig. 2, ECU Identification Tag

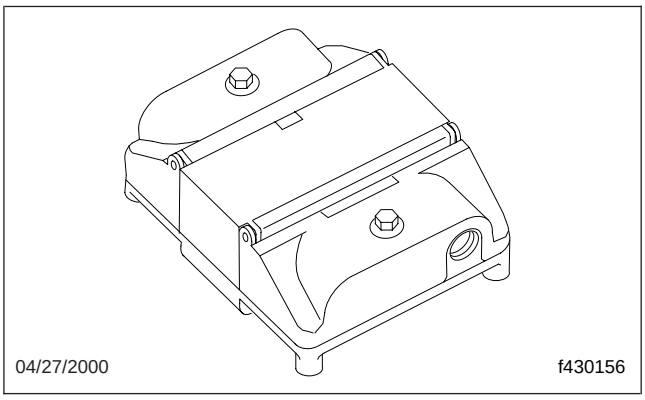


Fig. 3, Frame-Mounted Electronic Control Unit, D-Version

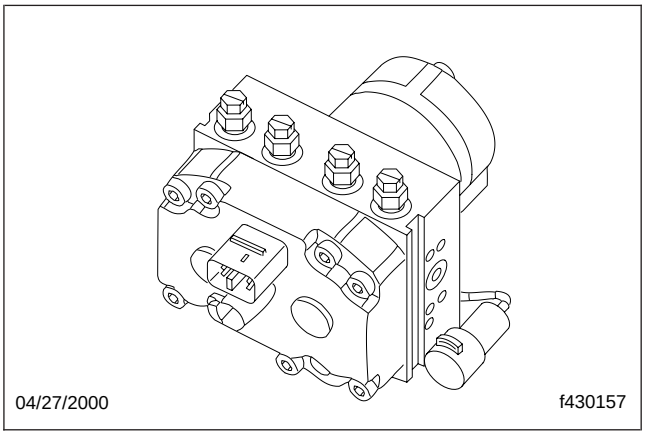


Fig. 4, ABS Modulator Assembly, D-Version

above, find and repair the faulty system as soon as possible. See **Troubleshooting, 300** for fault diagnosis.

IMPORTANT: ABS equipped vehicles operating in regions where especially corrosive ice removal chemicals are used may experience higher than normal brake component corrosion. Severe corrosion of ABS tone rings may cause false wheel speed readings. The false wheel speed readings can cause the ABS warning lamp to come on. Tone rings should be routinely inspected for corrosion. If the ABS warning lamp comes on at any time other than at vehicle start-up, locate and repair the problem immediately.

IMPORTANT: If the ABS warning lamp comes on at any time other than at start-up, there is a problem that must be repaired immediately. Ignoring the ABS lamp is dangerous, and may result in reduced brake performance. This may cause an accident with personal or property damage. Do not ignore the ABS lamp.

The ABS reads from a signal-generating tone ring and sensor on the hub of each ABS-controlled wheel. The sensors transmit vehicle wheel speed information to an electronic control unit (ECU), the electronic "brain" of the ABS. The ECU constantly monitors the wheel sensors, the ABS modulator assembly and the electrical circuitry.

NOTE: Tone rings are also referred to as tooth wheels, ABS exciters, ABS rings and variations of those names. They all refer to toothed or slotted rings on wheel hubs of ABS-equipped vehicles, turning with the wheel. Stationary ABS sensors count the passing teeth or slots to tell the ECU how fast that wheel is turning.

The ECU receives wheel speed signals and compares them with the other ABS wheel speeds and a vehicle reference speed. If it senses that a wheel is about to lock up, the ECU signals the ABS modulator assembly to ease up on braking at that wheel until the danger for skidding is past. This cycle happens several times per second. As this occurs, drivers may feel a rapid pulsation of the brake pedal.

ABS Major Components

Wheel Speed Sensors

When the vehicle is moving, the tone ring teeth on the hub move past the stationary sensors. That generates an AC voltage signal that the sensors transmit to the ECU.

Electronic Control Unit

The ECU, or "brain" of the ABS, is mounted inside the left frame rail, toward the rear of the vehicle. The ECU counts the tone ring teeth on each ABS-equipped wheel as they pass, then signals the ABS modulator valves to control braking on any wheel that is threatening to skid. The hydraulic brake system uses the WABCO D-Version ABS

ABS Modulator Assembly

The ABS modulator assembly is attached to the rear crossmember. Controlled by the ECU, the modulator prevents wheel lockup by adjusting the hydraulic brake fluid pressure. During normal brake applications, hydraulic fluid flows freely through the modulator into the brake caliper.

Within the modulator are inlet and outlet control valves for each sensor-equipped wheel. If the ECU senses a wheel is close to skidding, it reduces brake fluid pressure to that brake caliper. The brake caliper inlet valve closes, blocking fluid delivery to the brake caliper. At the same time, the outlet valve opens, allowing fluid to flow to an accumulator within the module. From the accumulator, a recirculation pump within the module delivers brake fluid back to the master cylinder.

As wheel speed increases, the ABS modulator assembly increases (inlet valve opens and outlet valve closes) or maintains brake pressure until the proper wheel speed is obtained, or until wheel lockup occurs and the control cycle starts again. The driver may feel this sequence as a rapid pulsation in the brake pedal.

Safety Precautions

⚠ WARNING

Breathing brake lining dust could cause lung cancer or lung disease. OSHA has set maximum levels of exposure and requires workers to wear an air purifying respirator approved by NIOSH or MSHA. Wear a respirator at all times when servicing the brakes, starting with removal of the wheels and continuing through assembly.

Because many brake linings contain asbestos, you should know the potential hazards of asbestos and the precautions to be taken. Because medical experts believe that long-term exposure to some non-asbestos fibers could also be a health hazard, also observe the following precautions if servicing non-asbestos brake linings.

NOTE: The vehicle is originally equipped with non-asbestos brake linings.

Exposure to airborne brake lining dust can cause serious and possibly fatal diseases such as asbestosis (a chronic lung disease) and cancer.

During brake servicing, wear an air purifying respirator with high-efficiency filters. The respirator and filter must be approved by NIOSH or MSHA, and worn during all procedures.

OSHA recommends that enclosed cylinders equipped with vacuums and high-efficiency particulate air (HEPA) filters be used during brake repairs. Under this system, the entire brake assembly is placed within the cylinder and the mechanic works on the brake through sleeves attached to the cylinder. Compressed air is blown into the cylinder to clean the assembly, and the dirty air is then removed from the cylinder by the vacuum.

If such an enclosed system is not available, or can’t be used, clean the brake assembly in the open air. During disassembly, carefully place all parts on the floor to minimize creating airborne dust. Using an industrial vacuum cleaner with an HEPA filter system, remove dust from the brake rotors, caliper assemblies, dust shields, and brake pads. After vacuuming, remove any remaining dust using a rag soaked in water and wrung until nearly dry.

⚠ WARNING

Hydraulic brake fluid is hazardous, and can cause blindness if it gets in your eyes. Always wear safety glasses when handling brake fluid or bleeding brake components. Brake fluid may also be a skin irritant. If you get it on your skin, wash it off as soon as possible.

Special care must be taken when disposing of used brake fluid. Put the fluid in a sealed plastic container and label it "Used Brake Fluid." Dispose of it in an approved manner. Check with local and state regulations as to the correct disposal procedure.

Wheel Speed Sensor Replacement

⚠ WARNING

Before working on or around hydraulic brake systems and components, see Safety Precautions 100. Failure to follow prescribed safety procedures may result in personal injury.

Replacement

NOTE: Wire repairs may require the use of special tools for certain connectors and terminals.

Front Axle

1. Park the vehicle on a level surface and apply the parking brakes. Shut down the engine. Chock the rear tires to prevent vehicle movement.
2. Twist and pull the sensor to remove it from the sensor bracket. See **Fig. 1**.
3. Remove the sensor cable clip from the top cap.
4. Disconnect the sensor cable from the chassis harness.
5. Remove the sensor spring clip from the sensor bracket.

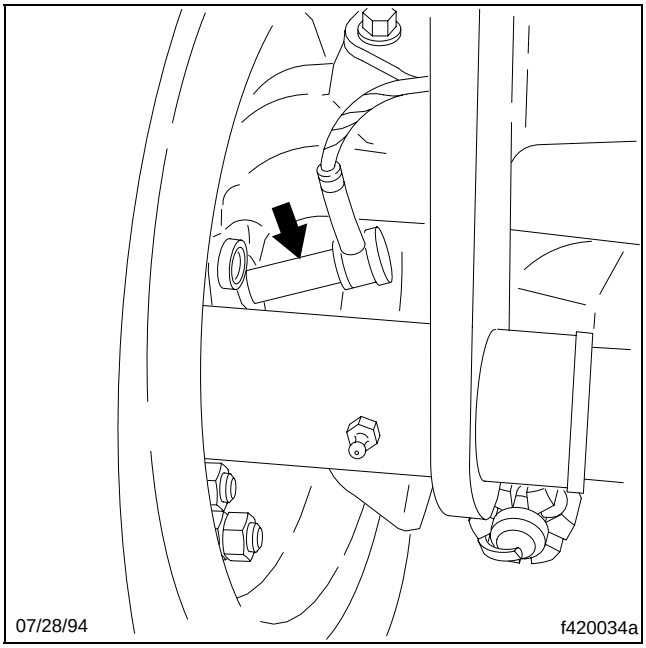


Fig. 1, Remove the Wheel Speed Sensor

6. Connect the sensor cable to the chassis harness.
7. Attach the sensor cable to the steering knuckle top cap.
8. Coat the sensor spring clip and the sensor with Mobil HP, Valvoline EP 633, Penzoil 707L or an equivalent.
9. Press the sensor spring clip into the sensor bracket at the brake spider hole until it stops. Make sure the spring clip tabs are on the inboard side of the vehicle.
10. Press the sensor into the sensor spring clip until it is stopped by the tone wheel.
11. Remove the chocks from the rear tires.

Rear Axle

1. Park the vehicle on a level surface and apply the parking brakes. Shut down the engine. Chock the front tires to prevent vehicle movement.
2. Twist and pull the sensor to remove it from the mounting block in the axle housing.
3. Remove the sensor spring clip.
4. Remove the capscrew that attaches the sensor cable and the hose clamp to the axle tube.
5. Disconnect the sensor cable from the chassis harness.
6. Connect the new sensor cable to the chassis harness.
7. Attach the hose clamp and sensor cable to the axle tube located between the backing plate and the spring plate.
8. Press the sensor spring clip into the mounting block until it stops.
9. Coat the sensor with Mobil HP, Valvoline EP633, Penzoil 707L or an equivalent. Using your hand, push the sensor into the sensor spring clip until it is stopped by the tone wheel.
10. Remove the chocks from the front tires.

ABS Modulator Assembly Removal and Installation

⚠ WARNING

Before working on or around hydraulic brake systems and components, see Safety Precautions 100. Failure to follow prescribed safety procedures may result in personal injury.

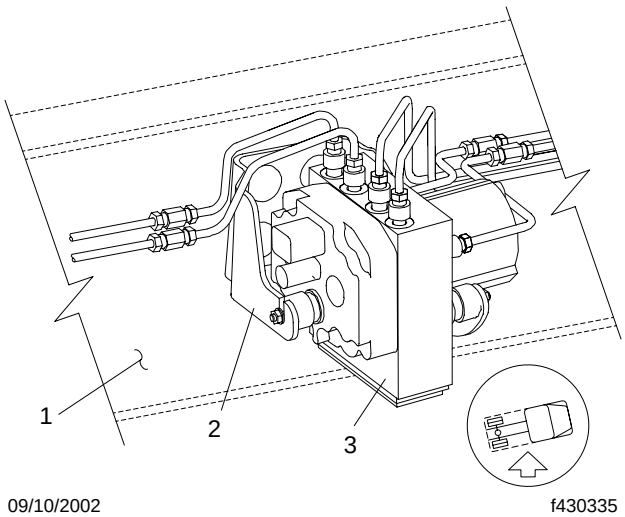
Removal

NOTE: Wire repairs may require the use of special tools for certain connectors and terminals. See **Group 54** for information on special terminals and connectors and on ordering tools for them.

1. Park the vehicle on a level surface and apply the parking brakes. Shut down the engine. Chock the front and rear tires.

NOTE: The ABS modulator valve is located on the driver's-side frame rail directly behind the chassis module (CHM). See **Fig. 1**.

2. Put a container under the modulator to catch leaking brake fluid.
3. Disconnect the wiring from the modulator.



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1. Driver-Side Frame Rail
2. Modulator Mounting Bracket
3. ABS Modulator Valve

Fig. 1, ABS Modulator Assembly Mounting, "D" Version

⚠ CAUTION

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

4. Mark the brake lines for ease of installation. Disconnect the lines.
5. Remove the mounting capscrews, washers and nuts that attach the modulator and bracket assembly to the bracket on the frame rail.
6. Remove the modulator and bracket assembly.

Installation

1. Install the modulator and bracket assembly. Install the mounting capscrews, washers and nuts that attach the modulator and bracket assembly to the bracket on the frame rail. Tighten the modulator and bracket assembly mounting nuts 132 lbf·in (1500 N·cm).
2. Connect the brake lines. Tighten the two small adapters (M10XI) 108 lbf·in (1200 N·cm). Tighten the four large adapters (M12XI) 132 lbf·in (1500 N·cm).
3. Connect the wiring to the modulator.
4. Bleed the brake system following the instructions in **Subject 130**.
5. Remove the chocks from the tires.

⚠ WARNING

Before working on or around hydraulic brake systems and components, see Safety Precautions 100. Failure to follow proper safety procedures may result in personal injury.

Bleeding

⚠ WARNING

Failure to bleed the hydraulic brake system (including power steering 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 properly. This will increase stopping distances and can result in serious personal injury.

Properly discard used hydraulic brake fluid. Used brake fluid will probably be contaminated and can cause damage, loss of braking and consequent serious personal injury.

Automatic transmission fluid (ATF) and brake fluid are incompatible. Use only brake fluid for the master cylinder and brake lines. Use only ATF for the power booster. Never mix these two fluids or serious damage to both hydraulic systems will result. ATF will damage the rubber parts of the ABS modulator, master cylinder, and brake calipers and can cause damage and loss of braking, leading to property damage or serious personal injury.

Always use new, clean brake fluid that meets DOT 3 specifications when bleeding the master cylinder and service brake system. Never reuse brake fluid, and don't use brake fluid containers for any other purpose. Keep brake fluid containers tightly closed to keep new brake fluid clean and dry.

IMPORTANT: Do not let brake fluid touch any painted surfaces; it damages paint. Brake fluid may also damage certain non-metal surfaces. Do not let fluid get on brake pads or rotors.

Pressure Bleeding

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. See **Fig. 1**.

1. Park the vehicle on a level surface and apply the parking brake. Shut down the engine. Chock the rear tires.
2. Open the hood.
3. Connect the pressure bleeder to the brake master cylinder reservoir following the manufacturer's instructions.

⚠ WARNING

Do not exceed 35 psi (241 kPa) at the master cylinder inlet. Exceeding this pressure could result in personal injury and/or vehicle damage.

3.1 Fill the pressure bleeder with new DOT 3 approved brake fluid. Pressurize it according to the manufacturer's instructions.

3.2 Using the supplied adapter, connect the pressure bleeder to either fill port of the master cylinder reservoir.

4. Bleed the hydraulic connections at the rear wheel calipers, starting on the right side.

4.1 Put a wrench on the bleeder fitting at the caliper. Attach a length of clear tubing to

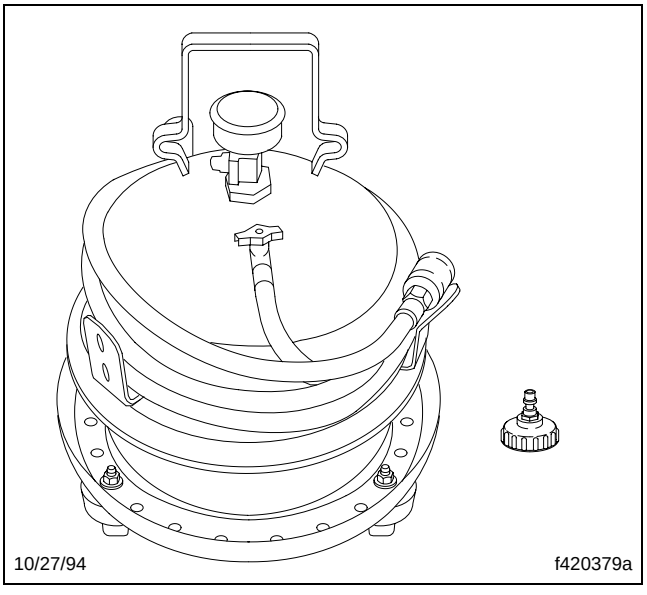


Fig. 1, Pressure Bleeder Kit

Hydraulic System Bleeding

the bleeder fitting. Make sure the tube fits snugly. Submerge the tubing in a container of clean brake fluid. See **Fig. 2**.

4.2 Loosen the bleeder fitting by about a 3/4-turn and let the brake fluid flow out of the fitting until it is free of air bubbles. Tighten the fitting firmly.

4.3 Move to the left rear caliper and repeat steps for bleeding the caliper.

5. If needed, add brake fluid to the master cylinder reservoir.

⚠ WARNING

Do not exceed 35 psi (241 kPa) at the master cylinder inlet. Exceeding this pressure could result in personal injury and/or vehicle damage.

6. Bleed the front wheel brake calipers, starting at the right side.

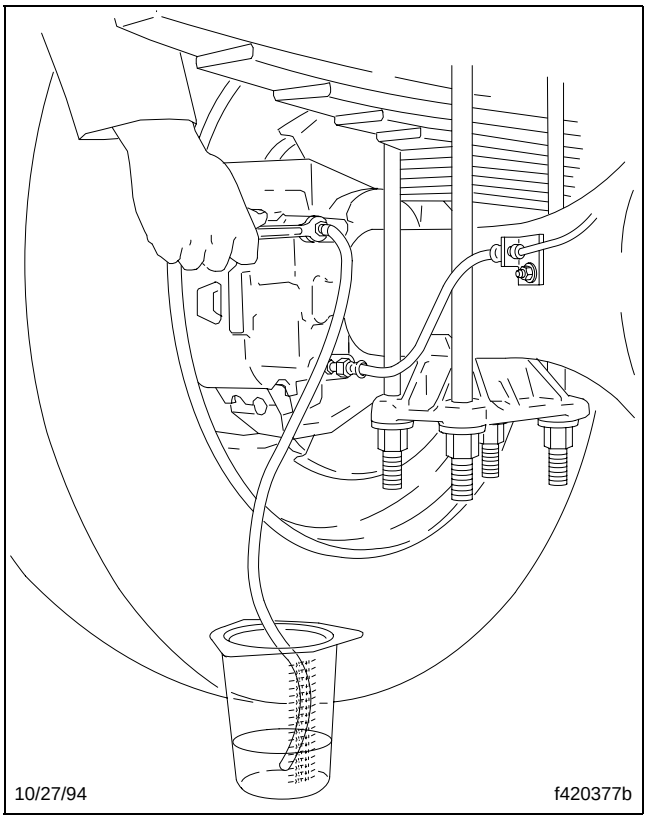


Fig. 2, Bleed the Connections at the Rear Wheel Calipers

6.1 Put a wrench on the bleeder fitting at the caliper. Attach a length of clear tubing to the bleeder fitting. Make sure the tube fits snugly. Submerge the tubing in a container of clean brake fluid. See **Fig. 2**.

6.2 Loosen the bleeder fitting by about a 3/4 turn and let the brake fluid flow out of the fitting until it is free of air bubbles. Tighten the fitting firmly.

6.3 Move to the left front wheel caliper and repeat steps for bleeding the caliper.

7. Check the brake fluid level in both compartments of the reservoir. Add new DOT 3 approved brake fluid if needed.

8. Check the operation of the brakes by depressing the brake pedal several times until if feels firm. The brake pedal should not go all the way down to the floor. If it does, see **Troubleshooting 300**.

9. Close and latch the hood.

10. Connect the batteries.

11. Remove the chocks from the rear tires.

12. Repeat step 8. Check for operation of the brakes.

Manual Bleeding

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

IMPORTANT: Do not let the brake master cylinder fluid level get too low during manual bleeding operations. Keep the master cylinder reservoir filled with new DOT 3 approved brake fluid. Failure to keep the brake reservoir filled could result in more air entering the system, making it impossible to effectively bleed the system.

1. Park the vehicle on a level surface and apply the parking brake. Shut down the engine. Chock the rear tires.

2. Open the hood.

3. Disconnect the batteries. The ignition must remain off for the entire bleed procedure.

4. Bleed the master cylinder.

NOTE: In most cases, it will not be necessary to bleed the master cylinder unless the brake fluid

reservoir is dry or after replacement of system components.

4.1 Using a wrench and positioning a rag to absorb leaking brake fluid, loosen the fitting at the rear outlet port on the master cylinder. See **Fig. 3**. Loosen the fitting about one turn.

4.2 Have someone push the brake pedal down slowly by hand to the floor. Brake fluid and any air in the master cylinder will squirt from the fitting.

4.3 *With the brake pedal held down*, tighten the rear hydraulic line fitting firmly.

IMPORTANT: Do not release the brake pedal until the fitting is tightened or more air will get into the system.

4.4 Release the brake pedal.

4.5 Loosen the fitting again and repeat the steps for bleeding as required until no air escapes from the fitting and the brake pedal feels firm.

4.6 Check the fluid level in the master cylinder reservoir. Add new DOT 3 approved brake fluid if needed.

4.7 Using a wrench (and a rag to absorb leaking brake fluid), loosen the fitting at the front outlet port on the master cylinder. See **Fig. 4**. Loosen the fitting about one turn.

4.8 Repeat steps as required for the front outlet port.

4.9 Check the brake fluid level in the master cylinder reservoir. Add new DOT 3 approved brake fluid if needed.

5. Bleed the hydraulic connections at the wheel calipers, starting at the right rear wheel caliper.

5.1 Put a wrench on the bleeder fitting at the caliper. Attach a length of clear tubing to the bleeder fitting. Make sure the tube fits snugly. Submerge the tubing in a container of clean brake fluid. See **Fig. 2**.

5.2 Loosen the bleeder fitting by about a three-quarter turn.

5.3 Have an assistant slowly push the brake pedal to the floor. *With the brake pedal depressed*, tighten the bleeder fitting.

IMPORTANT: Make sure the brake pedal stays depressed while you tighten the fitting. If it is released before you tighten the fitting, more air will get into the system.

5.4 Release the brake pedal. Check the fluid in the tube. If there are air bubbles present, repeat steps as required until the fluid in the tube is completely free of air bubbles.

5.5 Check the brake fluid level in the reservoir. Add new DOT 3 approved brake fluid if needed.

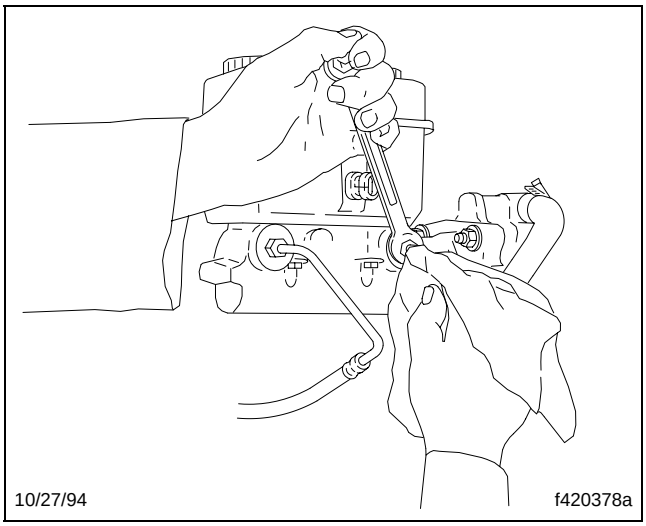


Fig. 3, Loosen the Fitting at the Rear Outlet Port

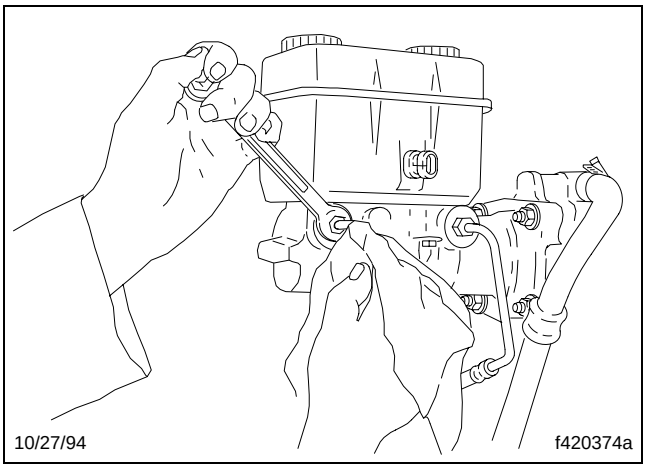


Fig. 4, Loosen the Fitting at the Front Outlet Port

Hydraulic System Bleeding

5.6 Repeat the steps for bleeding the left rear caliper, the right front caliper and the left front caliper.

6. Close and latch the hood.
7. Connect the batteries.
8. Remove the chocks from the rear tires.
9. Check the operation of the brakes by depressing the brake pedal several times until if feels firm. The brake pedal should not go all the way to the floor. If it does, see **Troubleshooting 300**.

⚠ WARNING

Before working on or around hydraulic brake systems and components, see Safety Precautions 100. Failure to do so may result in personal injury.

Voltage Check

NOTE: Along with the following voltage check, the voltage can also be checked using the Meritor WABCO TOOLBOX Software.

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

1. Park the vehicle on a level surface and apply the parking brakes. Shut down the engine. Chock the rear tires to prevent vehicle movement.
2. Turn the ignition on.
3. Check the voltage between Pins 9 and 3, 9 and 2, and 9 and 11 on the black X2 ECU connector.
4. If voltage is not between 9.5 and 14 volts, verify proper wiring connections. Make corrections as required.
5. Remove the chocks from the rear tires.

Sensor Voltage Output Test

IMPORTANT: Sensor output voltage must be at least 0.2 volts AC at 30 rpm.

⚠ 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.

1. Park the vehicle on a level surface and apply the parking brakes. Shut down the engine. Chock the front and rear tires to prevent vehicle movement.
2. Turn the ignition off.
3. To measure voltage at the pins on the sensor connector, disconnect the sensor from the chassis harness.
4. Raise the vehicle off of the ground. Put safety stands under the axle.
5. Rotate the wheel by hand at 30 rpm (1/2 revolution per second).
6. Measure the voltage across the two pins at the sensor connector.
7. If the voltage is not greater than 0.2 volts AC, adjust the sensor and recheck. If the voltage is still not greater than 0.2 volts AC, replace the sensor.
8. Remove the safety stands and lower the vehicle.
9. Remove the chocks from the rear tires.

Sensor Resistance

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

1. Park the vehicle on a level surface and apply the parking brakes. Shut down the engine. Chock the rear tires to prevent vehicle movement.
2. Turn the ignition off.
3. Measure resistance at the sensor connector. Disconnect the sensor from the chassis harness.
4. Measure the resistance across the two pins at the sensor connector.
5. If the measurement is not between 500 and 2000 ohms, replace the sensor.
6. Remove the chocks from the rear tires.

Troubleshooting

Meritor WABCO TOOLBOX Software

Use Meritor WABCO TOOLBOX Software to diagnose antilock brake system (ABS) faults. TOOLBOX provides J1587 fault codes and on-screen information to make the necessary repairs or replacements. TOOLBOX must be used to reset memorized (learned) components. See *Meritor WABCO Maintenance Manual No. 39, Rev. 09/00*. Call Meritor at (800) 535-5560 to order its TOOLBOX software.

ServiceLink

You can also use ServiceLink to read J1587 fault codes, to troubleshoot WABCO hydraulic ABS.

J1587 Fault Codes

J1587 fault codes show both the message identifier (MID) and the system identifier (SID). The MID indicates the the ECU or system with a fault. The MID is 136 for the hydraulic ABS ECU, for instance. The system identifier (SID) indicates the specific faulty component within that system. The failure mode indicator (FMI) identifies the problem within the system component. See **Table 1** for a listing of J1587 fault codes. This table also lists the appropriate troubleshooting table to consult for fault code diagnosis.

Fault Codes		
J1587 Fault Code (MID-SID)	**Description**	**Troubleshooting Table**
136-001	Left Front Wheel Sensor	**Table 4**
136-002	Right Front Wheel Sensor	**Table 5**
136-003	Left Rear Wheel Sensor	**Table 6**
136-004	Right Rear Wheel Sensor	**Table 7**
136-013	Retarder	**Table 8**
136-014	Power	**Table 9**
136-023	ABS Warning Light	**Table 10**
136-030	Recirculation Pump Relay	**Table 11**
136-042	Left Front Inlet Solenoid Valve	**Table 12**
136-043	Right Front Inlet Solenoid Valve	**Table 13**
136-044	Left Rear Inlet Solenoid Valve	**Table 14**
136-045	Right Rear Inlet Solenoid Valve	**Table 15**
136-048	Left Front Outlet Solenoid Valve	**Table 16**
136-049	Right Front Outlet Solenoid Valve	**Table 17**
136-050	Left Rear Outlet Solenoid Valve	**Table 18**
136-051	Right Rear Outlet Solenoid Valve	**Table 19**
136-054	Recirculation Pump	**Table 20**
136-055	ECU	**Table 21**
136-251	Low Voltage	**Table 22**
136-253	Internal Tire Parameter	**Table 23**
136-254	ECU Internal Fault	**Table 24**

Table 1, Fault Codes

ABS Warning Lamp Circuit

The Meritor WABCO hydraulic ABS warning lamp circuit is controlled by wire alone. The databus has no control over it. The ABS lamp circuit contains a relay located in the dash, energized whenever the ignition is turned on. The purpose of this relay is to turn on the ABS warning lamp if the ABS controller becomes disconnected from the vehicle harness.

Turning on the ignition energizes the relay, opening the instrument cluster (circuit 376L) circuit to ground. If the ABS ECU disconnects from the vehicle harness, the relay de-energizes, opening the ground provided by circuit 376L1. This grounds circuit 376L leading to the instrument cluster through the relay. If a fault occurs in the ABS under normal operation, the ABS ECU grounds circuit 376L at pin 8 of the X2 connector, which also grounds the circuit leading to the instrument cluster, and turns on the ABS warning lamp. See **Fig. 1** for ABS lamp relay wiring detail.

Refer to **Fig. 2** to read a warning lamp signal. If faults exist, make the necessary repairs and clear the fault code(s) from the ECU memory.

Figure 3 displays pin locations at the ECU and **Fig. 4** displays pin locations at the ABS modulator valve. **Table 2** and **Table 3** display corresponding circuit-to-pin information.

IMPORTANT: The ignition switch must be off when connecting or disconnecting the ECU.

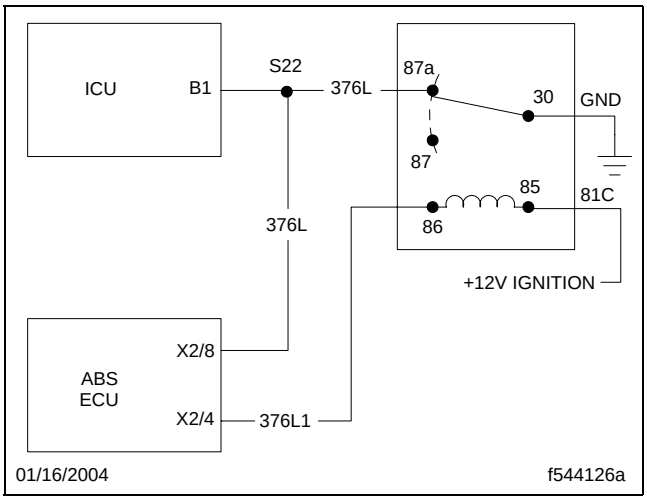
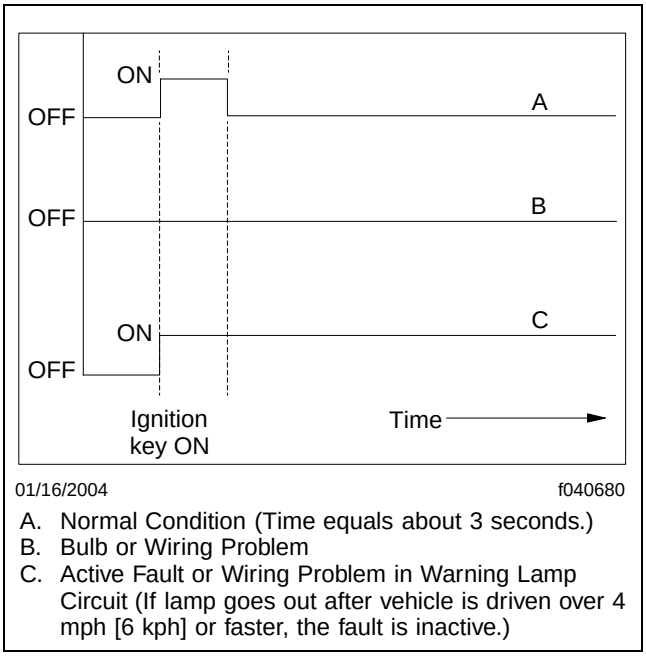


Fig. 1, ABS Lamp Relay Wiring



A. Normal Condition (Time equals about 3 seconds.)
B. Bulb or Wiring Problem
C. Active Fault or Wiring Problem in Warning Lamp Circuit (If lamp goes out after vehicle is driven over 4 mph [6 kph] or faster, the fault is inactive.)

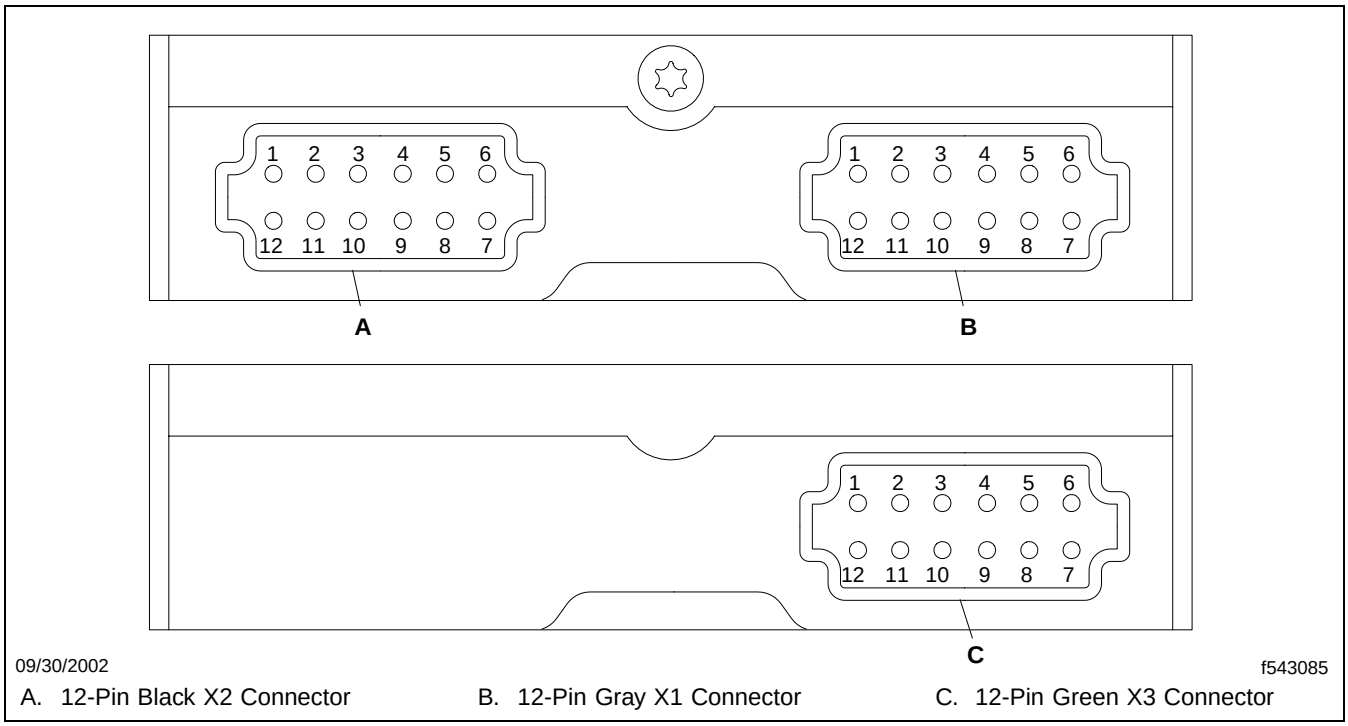
Fig. 2, ABS Warning Lamp Conditions at Ignition ON

Circuit Wire Numbers and Descriptions, "D" Version			
Pin Connector	**Pin Number**	**Vehicle Wire Number**	**WABCO Circuit Description**
12-Pin Gray X1	1	—	Not Used
	2	GND	Ground
	3	378LFI	Left Front Inlet Valve
	4	378RFI	Right Front Inlet Valve
	5	378LRI	Left Rear Inlet Valve
	6	378RRI	Right Rear Inlet Valve
	7	378RRO	Right Rear Outlet Valve
	8	378LRO	Left Rear Outlet Valve
	9	378RFO	Right Front Outlet Valve
	10	378LFO	Left Front Outlet Valve
	11	—	Not Used
	12	—	Not Used
12-Pin Black X2	1	1587–	SAE J1587 (–)
	2	376C	ECU Ignition Supply
	3	376A	ECU Supply/Battery
	4	376L1	Warning Light Relay
	5	—	Not Used
	6	376H	Pump Relay
	7	376R	Retarder Relay
	8	376L	ABS Indicator Light
	9	GND	Ground
	10	376B	Motor Monitor
	11	376A	ECU Supply/Battery
	12	1587+	SAE J1587 (+)

Troubleshooting

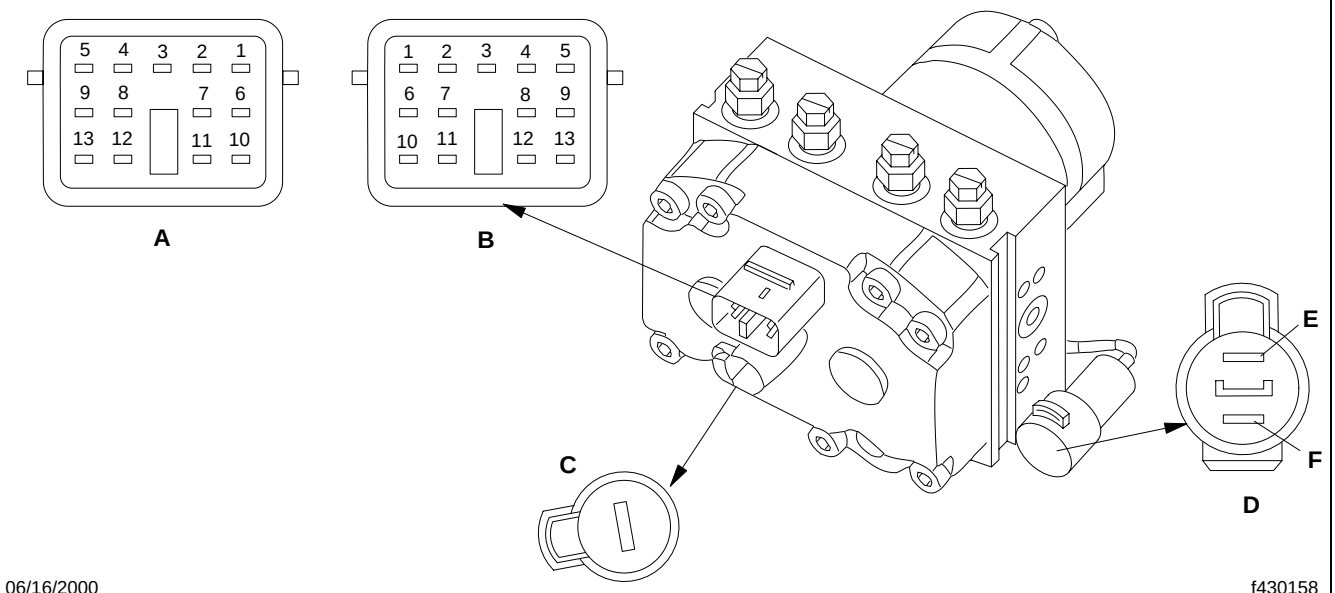
Circuit Wire Numbers and Descriptions, "D" Version			
Pin Connector	**Pin Number**	**Vehicle Wire Number**	**WABCO Circuit Description**
12-Pin Green X3	1	—	Not Used
	2	—	Not Used
	3	377LR+	Left Rear Sensor
	4	377RF–	Right Front Sensor
	5	377LF+	Left Front Sensor
	6	377RR+	Right Rear Sensor
	7	377RR–	Right Rear Sensor
	8	377LF–	Left Front Sensor
	9	377RF+	Right Front Sensor
	10	377LR–	Left Rear Sensor
	11	—	Not Used
	12	—	Not Used

Table 2, Circuit Wire Numbers and Descriptions, "D" Version



A. 12-Pin Black X2 Connector B. 12-Pin Gray X1 Connector C. 12-Pin Green X3 Connector

Fig. 3, ECU Connectors, "D" Version



A. Harness Connector Pinout
B. Modulator Assembly Connector Pinout
C. Main Ground
D. Pump Connector
E. Pin 2, Pump Power
F. Pin 1, Pump Ground

Fig. 4, ABS Modulator Assembly Pin Connectors, "D" Version

If the ABS light does not operate correctly or does not go out about 3 seconds after the ignition is turned on, there is a problem. Check the constant power supply and ignition power supply to the ECU. Check the ECU ground circuits. If no power supply or ground problems are found, check the fault code and repair as necessary. If the warning lamp does not come on at all when the ignition switch is turned on, check the wiring to the warning light and repair or replace the wiring as needed. When checking the warning light:

- Replace the bulb;
- Check for a fault in the warning lamp circuit, use ServiceLink or Meritor PC-based diagnostics;

The ABS system needs between 9.5 and 14 volts.

NOTE: Wire repairs may require the use of special tools for certain connectors and terminals. See **Group 54** for information on special terminals and connectors and ordering tools for them.

See the wiring diagrams in **Specifications 400** when troubleshooting the ABS system. If a fault cannot be repaired or erased from ECU memory, contact your District Service Manager or call Meritor WABCO at 1-800-535-5560.

ABS Modulator Assembly Pin Connectors		
Pin Number	**Vehicle Wire Number**	**Circuit Description**
1	378LRO	Left Rear Outlet Valve
2	378LRI	Left Rear Inlet Valve
3	—	Not Used
4	378RFI	Right Front Inlet Valve
5	378RFO	Right Front Outlet Valve
6	—	Not Used
7	—	Not Used
8	GND	Ground
9	—	Not Used
10	378RRO	Right Rear Outlet Valve
11	378RRI	Right Rear Inlet Valve
12	378LFI	Left Front Inlet Valve
13	378LFO	Left Front Outlet Valve
1	GND	Pump Ground
2	376A	Pump Power

Table 3, ABS Modulator Assembly Pin Connectors

Troubleshooting

Erasing a Fault from the ECU Memory

NOTE: An active fault cannot be erased until it has been corrected.

Use Meritor TOOLBOX or ServiceLink to erase stored faults from ECU memory. Erase all stored faults from the ECU memory after they have been noted and corrected.

Reset Memorized ("Learned") Components

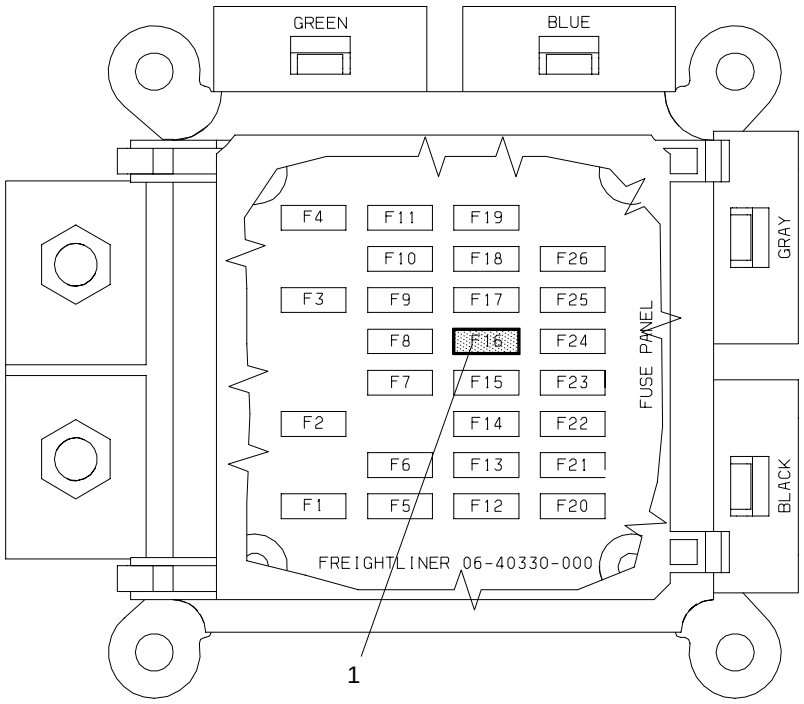
The ECU memorizes whether or not a retarder interrupt circuit is present. Once the ECU has detected a retarder circuit, it expects to see it every time the vehicle is powered up and will monitor the circuit for faults. If the ECU senses a resistance in the retarder circuit, it automatically decides that the retarder circuit exists. If the ECU shows a non-existent engine retarder circuit and is indicating faults, it may actually have detected something such as a multi-meter which was connected to the retarder circuit during testing. Moisture, faulty circuit wiring, or moving an ECU from one vehicle to another can also cause the ECU to mistakenly detect a non-existent retarder circuit. If necessary, use the "Reset Memorized" command in the Meritor TOOLBOX Software to clear the ECU memory of this component. For instructions, see *Meritor WABCO Maintenance Manual No. 39, Rev. 09/00*.

Power Distribution Module

The main power distribution module (PDM) is mounted in the engine compartment on the left front quarter fender. See **Fig. 5** for the location of Fuse 16, ABS constant battery power. See **Group 54** for complete PDM information.

Bulk Head Module

The Bulkhead Module (BHM) is the primary module of the vehicle electrical system, and controls the operation of the other multiplex modules in the system and a variety of other vehicle components either directly or indirectly.



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1. Fuse 16, ABS Constant Battery Power

Fig. 5, Power Distribution Module

ABS ignition power is located at pin B1/P on the BHM (see **Fig. 6**). For more information about the BHM, see **Section 54.01**.

Troubleshooting Tables

⚠ CAUTION

Tone ring corrosion can cause sensor fault codes. Tone rings should be routinely inspected for corrosion, especially in regions where corrosive ice removal chemicals are used on the roads.

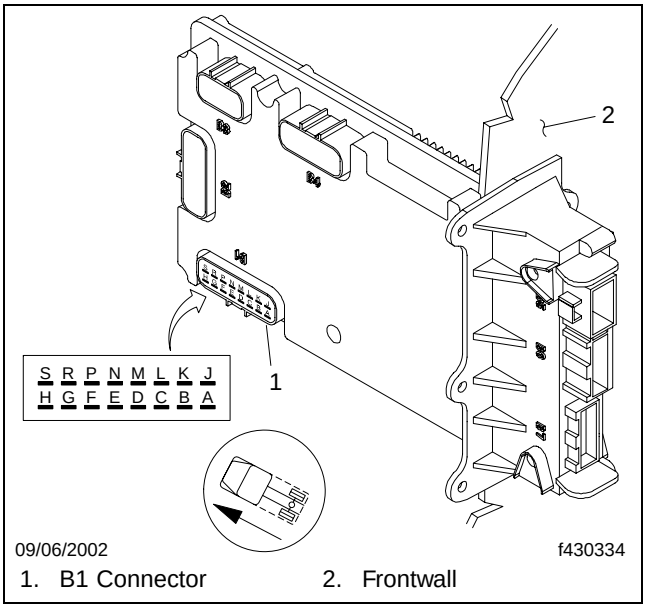

Fig. 6, Bulkhead Module (BHM)

J1587 Fault 136-001 Left Front Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	001	01	Incorrect sensor air gap	1. Adjust the sensor. Check the AC voltage across Pins 5 and 8 of the green X3 ECU connector (circuits 377LF+ and 377 LF–) while rotating the left front wheel 30 rpm.	Voltage greater than 0.2 VAC	Sensor adjustment solved the problem. Clear the stored faults and drive the vehicle 4 mph (6 km/h).
					Voltage less than 0.2 VAC	Check for excessive wheel bearing end play. Repair as necessary.
136	001	02	Intermittent open circuit or incorrect sensor resistance NOTE: This SAE J1587 fault code can also be caused by incorrect or mixed tire size. Also see test 4.	2. Measure the resistance across Pins 5 and 8 of the green X3 ECU connector (Circuits 377LF– and 377 LF+).	Resistance reading between 900 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377LF+ and 377LF– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 3.
				3. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377LF+ and 377LF–). Repair as necessary. Go to Test 4.
						Replace the wheel sensor.

Troubleshooting

J1587 Fault 136-001 Left Front Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	001	05	Open circuit	5. Measure the resistance across Pins 5 and 8 of the green X3 ECU connector (Circuits 377LF– and 377LF+).	Resistance reading between 500 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377LF+ and 377LF– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 6.
				6. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377LF+ and 377LF–). Repair as necessary.
					Resistance reading below 500 or above 2000 ohms	Replace the wheel sensor.
135	001	13	Incorrect tire size			Check for mixed tire sizes or more than 20% tire size variation. Correct as necessary.

Table 4, J1587 Fault 136-001 Left Front Wheel Sensor

J1587 Fault 136-002 Right Front Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	002	01	Incorrect sensor air gap	1. Adjust the sensor. Check the AC voltage across Pins 4 and 9 of the green X3 ECU connector (circuits 377RF+ and 377RF–) while rotating the right front wheel 30 rpm.	Voltage greater than 0.2 VAC	Sensor adjustment solved the problem. Clear the stored faults and drive the vehicle 4 mph (6 km/h).
					Voltage less than 0.2 VAC	Check for excessive wheel bearing end play. Repair as necessary.

J1587 Fault 136-002 Right Front Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	002	02	Intermittent open circuit or incorrect sensor resistance	2. Measure the resistance across Pins 4 and 9 of the green X3 ECU connector (circuits 377RF– and 377RF+).	Resistance reading between 500 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377RF+ and 377RF– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 3.
				3. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377RF+ and 377RF–). Repair as necessary.
					Resistance reading below 500 or above 2000 ohms	Replace the wheel sensor.
136	002	05	Open circuit	4. Measure the resistance across Pins 4 and 9 of the green X3 ECU connector (circuits 377RF– and 377RF+).	Resistance reading between 500 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377RF+ and 377RF– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 5.
				5. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377RF+ and 377RF–). Repair as necessary.
					Resistance reading below 500 or above 2000 ohms	Replace the wheel sensor.
136	002	13	Incorrect tire size			Check for mixed tire sizes or more than 20% difference in tire sizes. Correct as necessary.

Table 5, J1587 Fault 136-002 Right Front Wheel Sensor

Troubleshooting

J1587 Fault 136-003 Left Rear Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	003	01	Incorrect sensor air gap	1. Adjust the sensor. Check the AC voltage across Pins 3 and 10 of the green X3 ECU connector (circuits 377LR+ and 377LR–) while rotating the left rear wheel 30 rpm.	Voltage greater than 0.2 VAC	Sensor adjustment solved the problem. Clear the stored faults and drive the vehicle 4 mph (6 km/h).
					Voltage less than 0.2 VAC	Check for excessive wheel bearing end play. Repair as necessary.
136	003	02	Intermittent open circuit or incorrect sensor resistance	2. Measure the resistance across Pins 3 and 10 of the green X3 ECU connector (circuits 377LR– and 377LR+).	Resistance reading between 500 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377LR+ and 377LR– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 3.
				3. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377LR+ and 377LR–). Repair as necessary.
					Resistance reading below 500 or above 2000 ohms	Replace the wheel sensor.

J1587 Fault 136-003 Left Rear Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	003	05	Open circuit	4. Measure the resistance across Pins 3 and 10 of the green X3 ECU connector (circuits 377LR– and 377LR+).	Resistance reading between 500 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377LR+ and 377LR– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 5.
				5. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377LR+ and 377LR–). Repair as necessary.
					Resistance reading below 500 or above 2000 ohms	Replace the wheel sensor.
136	003	13	Incorrect tire size			Check for mixed tire sizes or more than 20% tire size variation. Correct as necessary.

Table 6, J1587 Fault 136-003 Left Rear Wheel Sensor

J1587 Fault 136-004 Right Rear Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	004	01	Incorrect sensor air gap	1. Adjust the sensor. Check the AC voltage across Pins 6 and 7 of the green X3 ECU connector (circuits 377RR+ and 377RR–) while rotating the right rear wheel 30 rpm.	Voltage greater than 0.2 VAC	Sensor adjustment solved the problem. Clear the stored faults and drive the vehicle 4 mph (6 km/h).
					Voltage less than 0.2 VAC	Check for excessive wheel bearing end play. Repair as necessary.

Troubleshooting

J1587 Fault 136-004 Right Rear Wheel Sensor						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	004	02	Intermittent open circuit or incorrect sensor resistance	2. Measure the resistance across Pins 6 and 7 of the green X3 ECU connector (circuits 377RR– and 377RR+).	Resistance reading between 500 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377RR+ and 377RR– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 3.
				3. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377RR+ and 377RR–). Repair as necessary.
					Resistance reading below 500 or above 2000 ohms	Replace the wheel sensor.
136	004	05	Open circuit	4. Measure the resistance across Pins 6 and 7 of the green X3 ECU connector (circuits 377RR– and 377RR+).	Resistance reading between 500 and 2000 ohms	Check for intermittent, loose or poor connections in circuits 377RR+ and 377RR– and repair as necessary. If the problem persists, suspect the ECU is at fault.
					Resistance reading below 500 or above 2000 ohms	Go to Test 5.
				5. Disconnect the sensor at the sensor connector. Measure the resistance at the sensor connector (on the sensor side).	Resistance reading between 500 and 2000 ohms	Check the wiring between the ECU and the wheel sensor (circuits 377RR+ and 377RR–). Repair as necessary.
					Resistance reading below 500 or above 2000 ohms	Replace the wheel sensor.
136	004	13	Incorrect tire size			Check for mixed tire sizes or more than 20% tire size variation. Correct as necessary.

Table 7, J1587 Fault 136-004 Right Rear Wheel Sensor

J1587 Fault 136-013 Retarder						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	013	03	Short to power	1. Disconnect the black X2 connector at the ECU. Disconnect the retarder relay. With the ignition ON, measure the voltage between Pin 7 of the black X2 ECU connector and a good chassis ground.	Voltage zero	Check for an intermittent short to power in circuit 376R. If okay, ECU may be at fault.
					Voltage not zero	Check for a short to power in circuit 376R. Repair as necessary.
136	013	05	Open circuit	2. Disconnect the black X2 connector at the ECU. Disconnect the retarder relay. Measure the resistance between Pin 7 of the black X2 ECU connector and relay connector cavity that corresponds to pin 85 of the relay.	Resistance less than 1 ohm	Check relay coil resistance (should be 60-85 ohms). If okay, check circuit 81C (power to relay coil) for open. Repair as necessary.
					Resistance more than 1 ohm	Repair open in circuit 376R.
136	013	06	Short to ground	3. Disconnect the black X2 connector at the ECU. Disconnect the retarder relay. Measure the resistance between pin 7 of the X2 connector and a good chassis ground.	Resistance is less than 10 ohms	Check circuit 376R for short to ground. Repair as necessary.
					Resistance is much greater than 10 ohms	Check for intermittent short to ground in circuit 376R. If okay, ECU may be at fault.

Table 8, J1587 Fault 136-013 Retarder

J1587 Fault 136-014 Power						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	014	03	Voltage supplied to ECU with ignition OFF	1. Check for voltage backfeeding to ECU with the ignition off, especially to pins 7/X2 and 10/X2.	Voltage at either pin	Repair as necessary.
					No voltage	Check ABS ECU
136	014	04	No voltage supplied to ECU with ignition ON	2. With the ignition ON, measure the voltage between Pin 3 of the black X2 ECU connector and a good chassis ground. Repeat between pin 11 and ground.	Voltage between 9.5 and 14 volts at both pins.	Check circuit 376A for an intermittent open circuit. If the problem persists, suspect the ECU is at fault.
					Voltage below 9.5 volts at one or both pins.	Check circuit 376A for an open circuit and check Fuse F16. Repair as necessary.

Table 9, J1587 Fault 136-014 Power

Troubleshooting

J1587 Fault 136-023 ABS Warning Light						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	023	05	Open circuit or low current	1. Disconnect the black X2 connector from the ECU. Turn the ignition ON.	ABS light illuminates	Check circuit 376L for open circuit between splice S22 and X2/8 at the ABS connector. Repair as necessary.
					ABS light does not illuminate	Check the bulb and wire (circuit 376L between splice S22 and ICU pin B1. If okay, replace the ICU.

Table 10, J1587 Fault 136-023 ABS Warning Light

J1587 Fault 136-030 Recirculation Pump Relay						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	030	03	Relay shorted to power	1. Disconnect the black X2 ECU connector. With the ignition ON, measure the voltage between Pin 6 and a good chassis ground.	Voltage zero	If the problem persists, suspect the ECU is at fault.
					Voltage not zero	circuit 376H is shorted to power. Repair as necessary.
136	030	05	Relay open circuit	2. Disconnect the black X2 ECU connector. Measure the resistance between Pin 6 and a good chassis ground.	Resistance between 50 and 200 ohms	If the problem persists, suspect the ECU is at fault.
					Resistance below 50 or above 200 ohms	Check the relay coil, relay coil ground circuit, and circuit 376H for an open circuit. Repair as necessary.
136	030	06	Relay short to ground	3. Disconnect the black X2 ECU connector. Measure the resistance between Pin 6 and a good chassis ground.	Resistance between 50 and 200 ohms	If the problem persists, suspect the ECU is at fault.
					Resistance below 50 or above 200 ohms	Check circuit 376H for a short to ground. Repair as necessary.
136	030	07	Pump relay sticks, pump continues to run when ECU deactivates the relay NOTE: The problem may be intermittent and a new relay may be required to correct the fault.	4. If the fault is active, disconnect the black X2 connector from the ECU. With the ignition ON, check to see if the recirculation pump is running.	Pump OFF	The ABS pump relay (located in the chassis harness, near the ABS valve) may be intermittently sticking. Try a new relay and verify that the problem is solved.
					Pump ON	The ABS pump relay (located in the chassis harness, near the ABS valve) is sticking. Replace the relay.

Table 11, J1587 Fault 136-030 Recirculation Pump Relay

J1587 Fault 136-042 Left Front Inlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	042	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 3 and 2 of the gray X1 ECU connector (circuits 378LFI and GND).	Resistance reading 6.5±0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve) NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.		Resistance reading not 6.5±0.5 ohms	Go to Test 2.
				2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378LFI between modulator connector Pin 12 and connector Pin 3 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378LFI.
				5. With the modulator valve connector removed, measure the resistance across Pins 2 and 8 on the modulator connector.	Resistance reading 6.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 6.5±0.5 ohms	Replace the modulator valve.

Table 12, J1587 Fault 136-042 Left Front Inlet Solenoid Valve

Troubleshooting

J1587 Fault 136-043 Right Front Inlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	043	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 4 and 2 of the gray X1 ECU connector (circuits 378RFI and GND).	Resistance reading 6.5±0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve) NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.		Resistance reading not 6.5±0.5 ohms	Go to Test 2.
				2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378RFI between modulator connector Pin 4 and connector Pin 4 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378RFI.
				5. With the modulator valve connector removed, measure the resistance across Pins 4 and 8 on the modulator connector.	Resistance reading 6.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 6.5±0.5 ohms	Replace the modulator valve.

Table 13, J1587 Fault 136-043 Right Front Inlet Solenoid Valve

J1587 Fault 136-044 Left Rear Inlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	044	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 5 and 2 of the gray X1 ECU connector (circuits 378LRI and GND).	Resistance reading 6.5±0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve)		Resistance reading not 6.5±0.5 ohms	Go to Test 2.
			NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.	2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378LRI between modulator connector Pin 2 and connector Pin 5 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378LRI.
				5. With the modulator valve connector removed, measure the resistance across Pins 2 and 8 on the modulator connector.	Resistance reading 6.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 6.5±0.5 ohms	Replace the modulator valve.

Table 14, J1587 Fault 136-044 Left Rear Inlet Solenoid Valve

Troubleshooting

J1587 Fault 136-045 Right Rear Inlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	045	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 6 and 2 of the gray X1 ECU connector (circuits 378RRI and GND).	Resistance reading 6.5±0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve)		Resistance reading not 6.5±0.5 ohms	Go to Test 2.
			NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.	2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378RRI between modulator connector Pin 11 and connector Pin 6 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378RRI.
				5. With the modulator valve connector removed, measure the resistance across Pins 1 and 8 on the modulator connector.	Resistance reading 6.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 6.5±0.5 ohms	Replace the modulator valve.

Table 15, J1587 Fault 136-045 Right Rear Inlet Solenoid Valve

J1587 Fault 136-048 Left Front Outlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	048	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 10 and 2 of the gray X1 ECU connector (circuits 378LFO and GND).	Resistance reading 3.5±0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve)		Resistance reading not 3.5±0.5 ohms	Go to Test 2.
			NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.	2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378LFO between modulator connector Pin 13 and connector Pin 10 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378LFO.
				5. With the modulator valve connector removed, measure the resistance across Pins 1 and 8 on the modulator connector.	Resistance reading 3.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 3.5±0.5 ohms	Replace the modulator valve.

Table 16, J1587 Fault 136-048 Left Front Outlet Solenoid Valve

Troubleshooting

J1587 Fault 136-049 Right Front Outlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	049	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 9 and 2 of the gray X1 ECU connector (circuits 378RFO and GND).	Resistance reading 3.5 ± 0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve)		Resistance reading not 3.5±0.5 ohms	Go to Test 2.
			NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.	2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378RFO between modulator connector Pin 5 and connector Pin 9 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378RFO.
				5. With the modulator valve connector removed, measure the resistance across Pins 5 and 8 on the modulator connector.	Resistance reading 3.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 3.5±0.5 ohms	Replace the modulator valve.

Table 17, J1587 Fault 136-049 Right Front Outlet Solenoid Valve

J1587 Fault 136-050 Left Rear Outlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	050	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 8 and 2 of the gray X1 ECU connector (circuits 378LRO and GND).	Resistance reading 3.5±0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve)		Resistance reading not 3.5±0.5 ohms	Go to Test 2.
			NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.	2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378LRO between modulator connector Pin 10 and connector Pin 7 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378LRO.
				5. With the modulator valve connector removed, measure the resistance across Pins 1 and 8 on the modulator connector.	Resistance reading 3.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 3.5±0.5 ohms	Replace the modulator valve.

Table 18, J1587 Fault 136-050 Left Rear Outlet Solenoid Valve

Troubleshooting

J1587 Fault 136-051 Right Rear Outlet Solenoid Valve						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	051	03	Shorted to power (outlet valve)	1. Measure the resistance across Pins 7 and 2 of the gray X1 ECU connector (circuits 378RRO and GND).	Resistance reading 3.5±0.5 ohms	Check for intermittent wiring connections. If the wiring is OK, suspect the ECU is at fault.
		05	Open circuit (outlet valve)			
		06	Shorted to ground (outlet valve)		Resistance reading not 3.5±0.5 ohms	Go to Test 2.
			NOTE: Check for an open circuit in the wiring between the ECU and the modulator valve. Check the ground circuit to the modulator valve.	2. Check the ground circuit by measuring the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance reading close to zero	Go to Test 3.
					Resistance reading not close to zero.	Check and repair the ground circuit.
				3. With the modulator valve connector removed, measure the resistance between Pin 8 on the modulator connector and a good chassis ground.	Resistance reading close to zero.	Go to Test 4.
					Resistance reading not close to zero.	Check the modulator ground circuit; repair as necessary.
				4. Measure the resistance in circuit 378RRO between modulator connector Pin 1 and connector Pin 8 on the gray X1 ECU connector.	Resistance reading close to zero.	Go to Test 5.
					Resistance reading not close to zero.	Repair circuit 378RRO.
				5. With the modulator valve connector removed, measure the resistance across Pins 1 and 8 on the modulator connector.	Resistance reading 3.5±0.5 ohms	Repeat Tests 1 through 5. The problem may be intermittent. If the wiring is OK, suspect the ECU is at fault.
					Resistance reading not 3.5±0.5 ohms	Replace the modulator valve.

Table 19, J1587 Fault 136-051 Right Rear Outlet Solenoid Valve

J1587 Fault 136-054 Recirculation Pump						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	054	03	Recirculation pump on without being activated by ECU NOTE: In this case the ECU is sensing voltage on the pump monitor circuit (Pin 10 of the black X2 connector) when the pump relay was not activated by the ECU (Pin 6 of the black X2 connector).	1. Remove the black X2 connector from the ECU. With the ignition ON, measure the voltage between Pin 10 and a good chassis ground.	Voltage zero	Check the ECU and verify the fault.
					Voltage not zero	Go to Test 2.
				2. Remove the ABS pump relay and repeat Test 1.	Voltage zero	Check the ABS pump relay. It may be sticking or shorted.
					Voltage not zero	Check for a short to power in circuit 376B causing the pump to run when it should not be. Repair as necessary.
136	054	04	Recirculation pump does not switch on when activated by the ECU NOTE: In this case the ECU does not sense voltage on the pump monitor circuit (Pin 10 of the black X2 ECU connector) when the pump relay was activated by the ECU (Pin 6 of the black X2 ECU connector).	3. Remove the black X2 connector from the ECU. With the ignition ON, link Pins 6 and 3 while measuring the voltage between Pin 10 and a good chassis ground. The pump should run (do not hold for more than 1 minute).	Voltage between 9.5 and 14 volts	Check for intermittent connections in circuit 376B and check the ABS pump relay for intermittent operation. Repair as necessary.
					Voltage below 9.5 or above 14 volts	Check circuit 376A and check ABS pump relay. Repair as necessary.
136	054	07	Recirculation pump sticks or is locked NOTE: In this case, the ECU senses high current on the pump monitor circuit (Pin 10 of the black X2 ECU connector) indicating the pump motor is locked.	4. Remove the black X2 connector from the ECU. With the ignition ON, momentarily link Pins 6 and 3. The pump should run (do not hold for more than 1 minute).	Pump runs	Repeat the test to verify. If the fault persists, suspect a problem with the ECU.
					Pump does not run	Replace the recirculation pump.

Table 20, J1587 Fault 136-054 Recirculation Pump

NOTE: The ABS pump relay is located near the ABS modulator valve on the left frame rail.

Troubleshooting

J1587 Fault 136-055 ECU						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	055	02	Reference to ground interrupted	1. With the ignition OFF, measure the voltage between Pin 2 of the gray X1 ECU connector (circuit GND) and a good chassis ground.	Voltage zero volts	Go to Test 2.
					Voltage not zero volts	Check the ground circuit for a short to positive voltage.
				2. Measure the resistance between Pin 2 of the gray X1 ECU connector and a good chassis ground.	Resistance near zero ohms	Check the ECU ground circuit (GND) for an intermittent or loose connection. Check ground Splice S10. If the problem persists, suspect the ECU is at fault.
					Resistance above zero ohms	Check the ECU ground circuit (GND). Repair as necessary.

Table 21, J1587 Fault 136-055 ECU

J1587 Fault 136-251 Low Voltage						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	251	03	Voltage too high NOTE: Voltage to the ABS ECU must be between 9.5 and 14 volts to function properly.	1. Disconnect the black X2 ECU connector. Start the engine and run it at governed speed while measuring the voltage between Pins 3 and 9.	Voltage between 9.5 and 14 volts	Check the electrical system. If the problem persists, suspect the ECU is at fault.
					Voltage below 9.5 or above 14 volts	Check the batteries and charging system for malfunction. Repair as necessary.
136	251	04	Low voltage to ABS solenoid valves NOTE: Voltage to the ABS ECU must be between 9.5 and 14 volts to function properly.	2. Disconnect the black X2 ECU connector. Start the engine and run it at idle while measuring the voltage between Pins 3 and 9 of the black X2 ECU connector.	Voltage between 9.5 and 14 volts	Verify that the batteries were not drained or the charging system was not overloaded when the fault occurred. If the problem persists, suspect the ECU is at fault.
					Voltage below 9.5 or above 14 volts	Check the batteries and charging system for malfunction. Repair as necessary.

Table 22, J1587 Fault 136-251 Low Voltage

J1587 Fault 136-253 Internal Tire Parameter						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	253	02	Incorrect internal tire parameter	—	—	Contact Meritor WABCO (1-800-535-5560).

Table 23, J1587 Fault 136-253 Internal Tire Parameter

J1587 Fault 136-254 ECU Internal Fault						
MID	**SID**	**FMI**	**Problem**	**Test**	**Test Result**	**Action**
136	254	12	Internal ECU Fault	—	—	Replace the ECU.

Table 24, J1587 Fault 136-254 ECU Internal Fault

For a full view of the hydraulic ABS wiring diagram, see **Fig. 1**.

- For a detailed partial view of wiring at the ABS ECU, see **Fig. 2**.
- See **Fig. 3** for wiring at the ABS modulator and wheel sensors.

For a full view of hydraulic ABS pump, relay and dash wiring, see **Fig. 4**.

- For detailed partial views of ABS hydraulic pump, relay and dash wiring, see **Fig. 5** and **Fig. 6**.

For manual transmission hydraulic ABS lockout wiring, see **Fig. 7**.

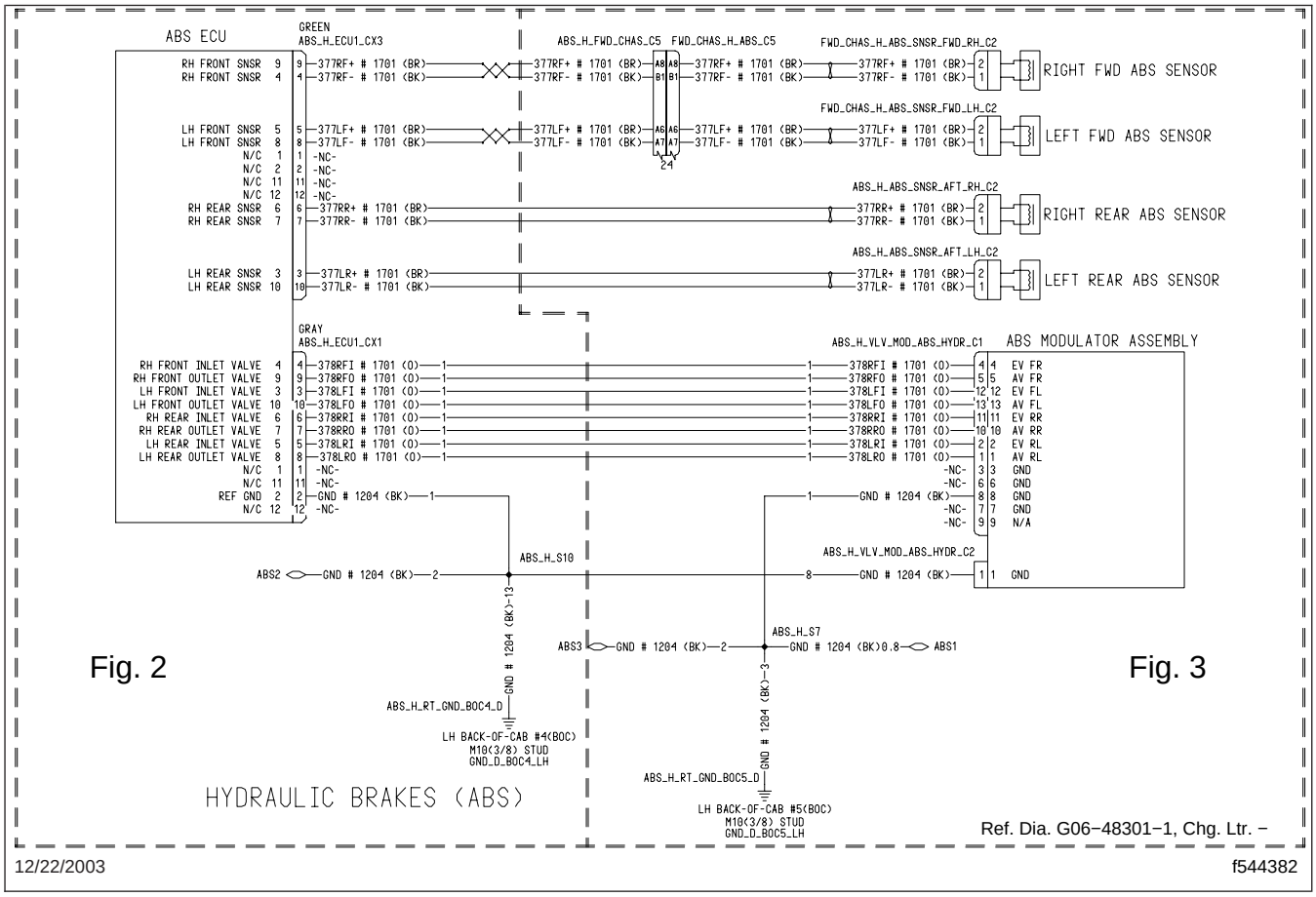

Fig. 1, Wiring Diagram, ABS Wheel Sensor and Modulator Assembly (full view)

Specifications

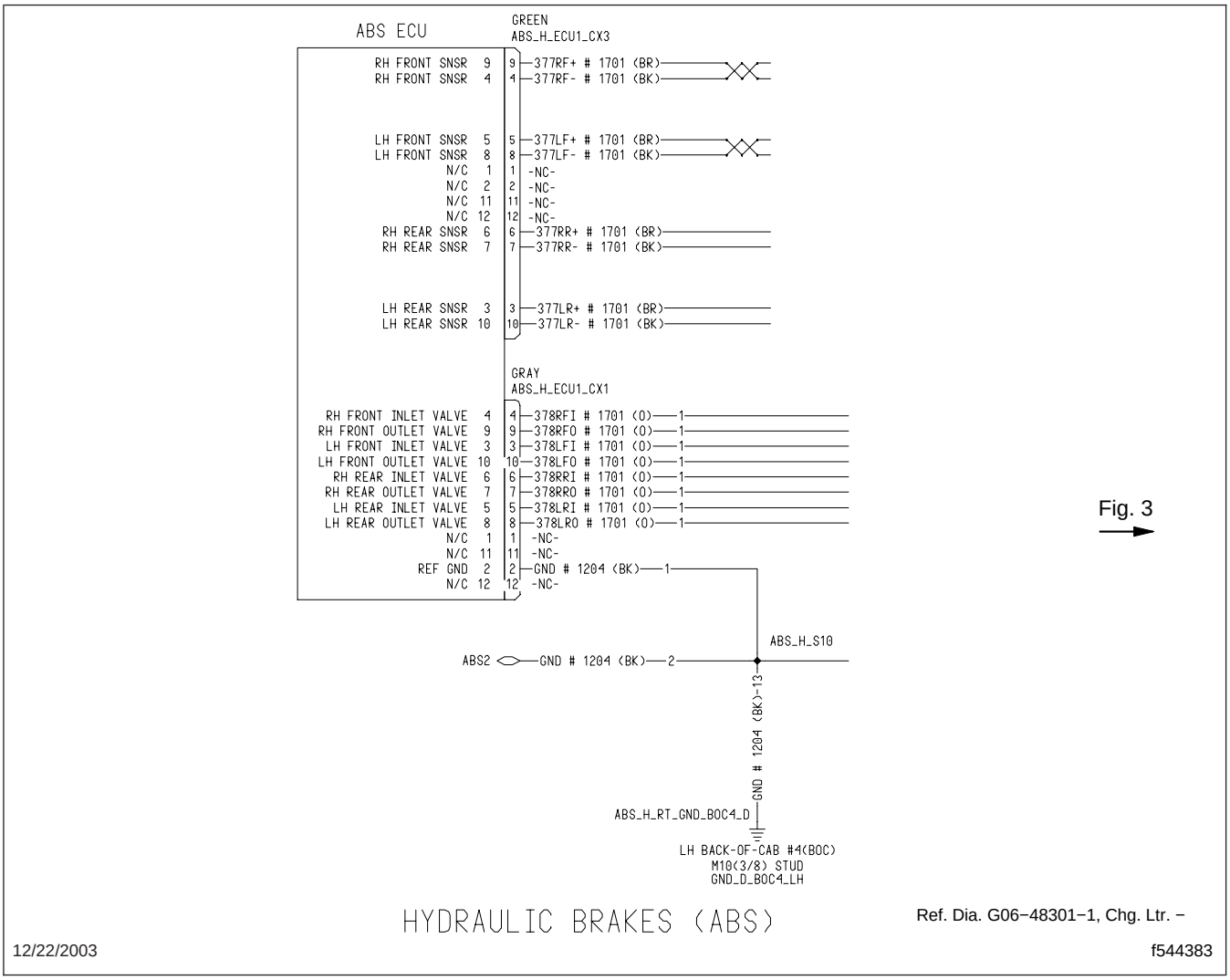

Fig. 3

Fig. 2, Wiring Diagram, ABS Wheel Sensor and Modulator Assembly (partial view)

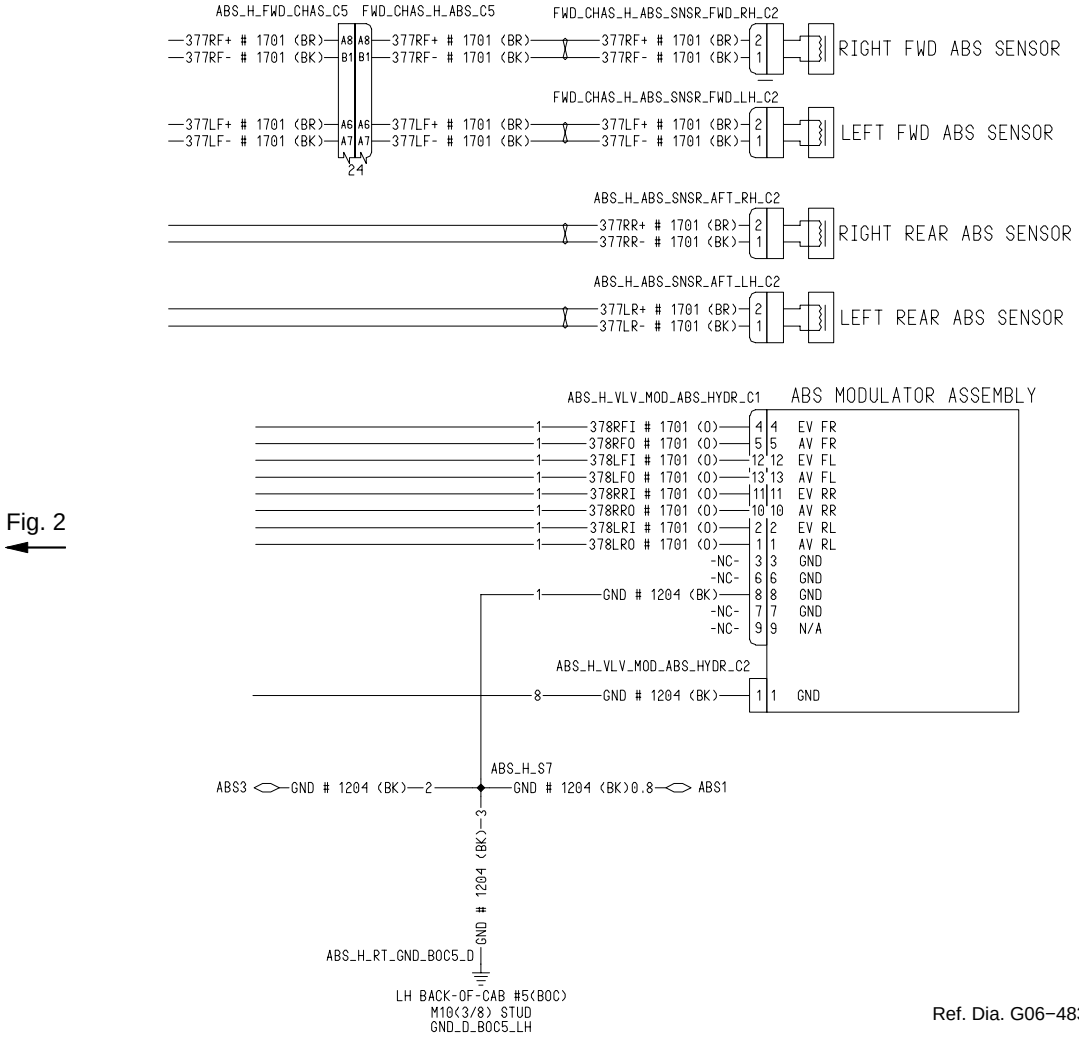

Fig. 2

Fig. 3, Wiring Diagram, ABS Wheel Sensor and Modulator Assembly (partial view)

Specifications

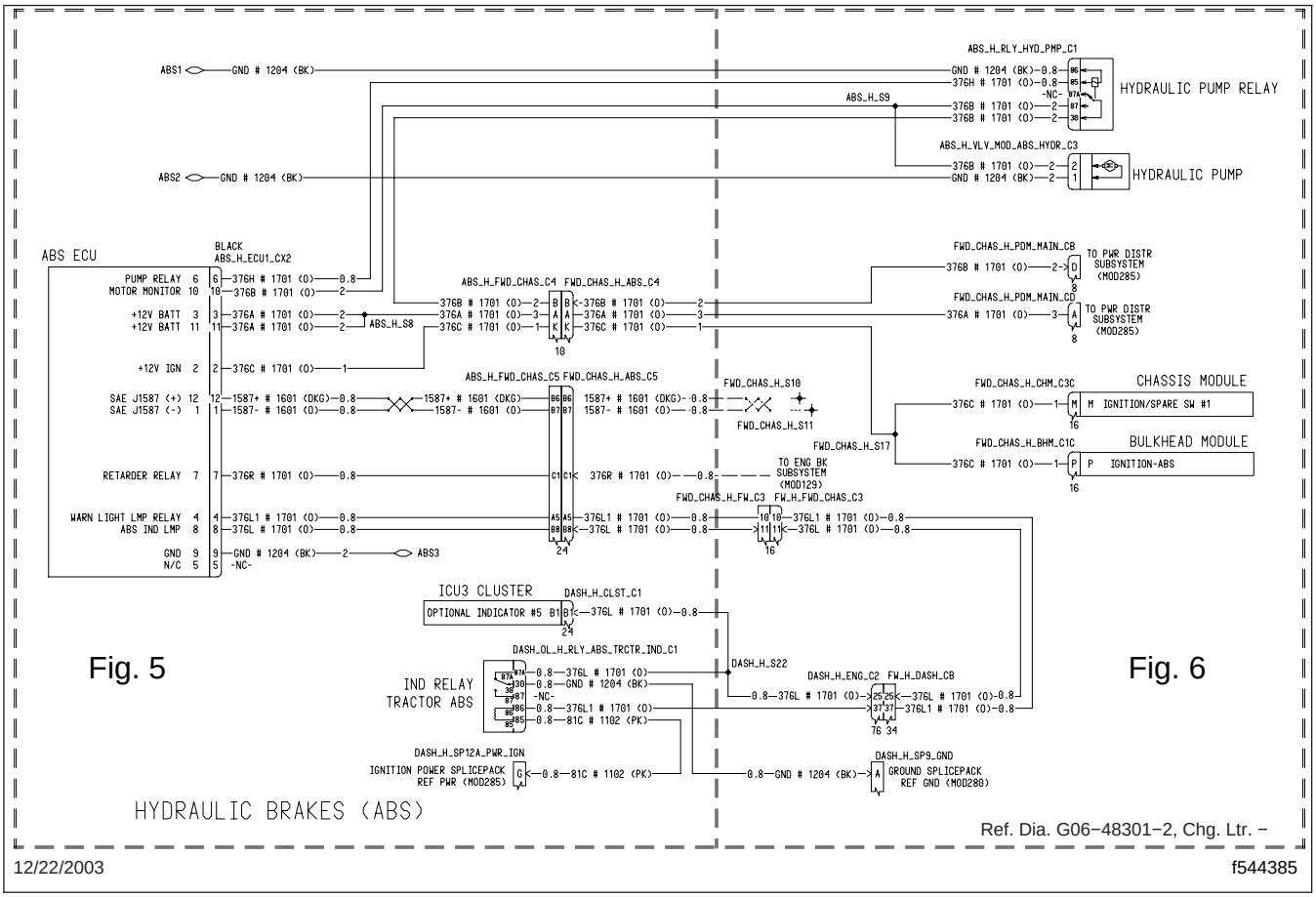

Fig. 5

Fig. 6

Fig. 4, Wiring Diagram, ABS Relays and Dash Wiring (full view)

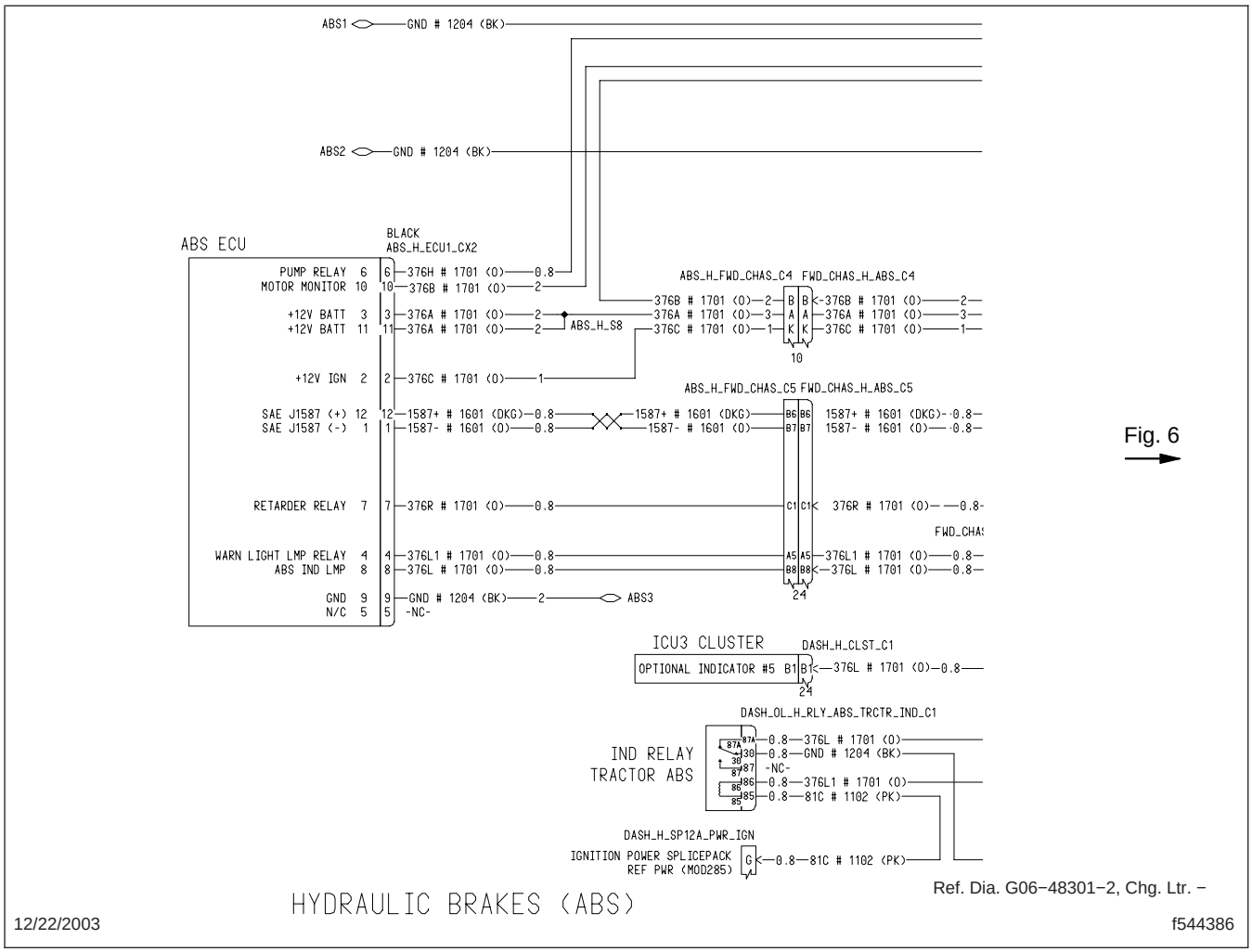

Fig. 6

Ref. Dia. G06−48301−2, Chg. Ltr. −

Fig. 5, Wiring Diagram, ABS Relays and Dash Wiring (partial view)

Specifications

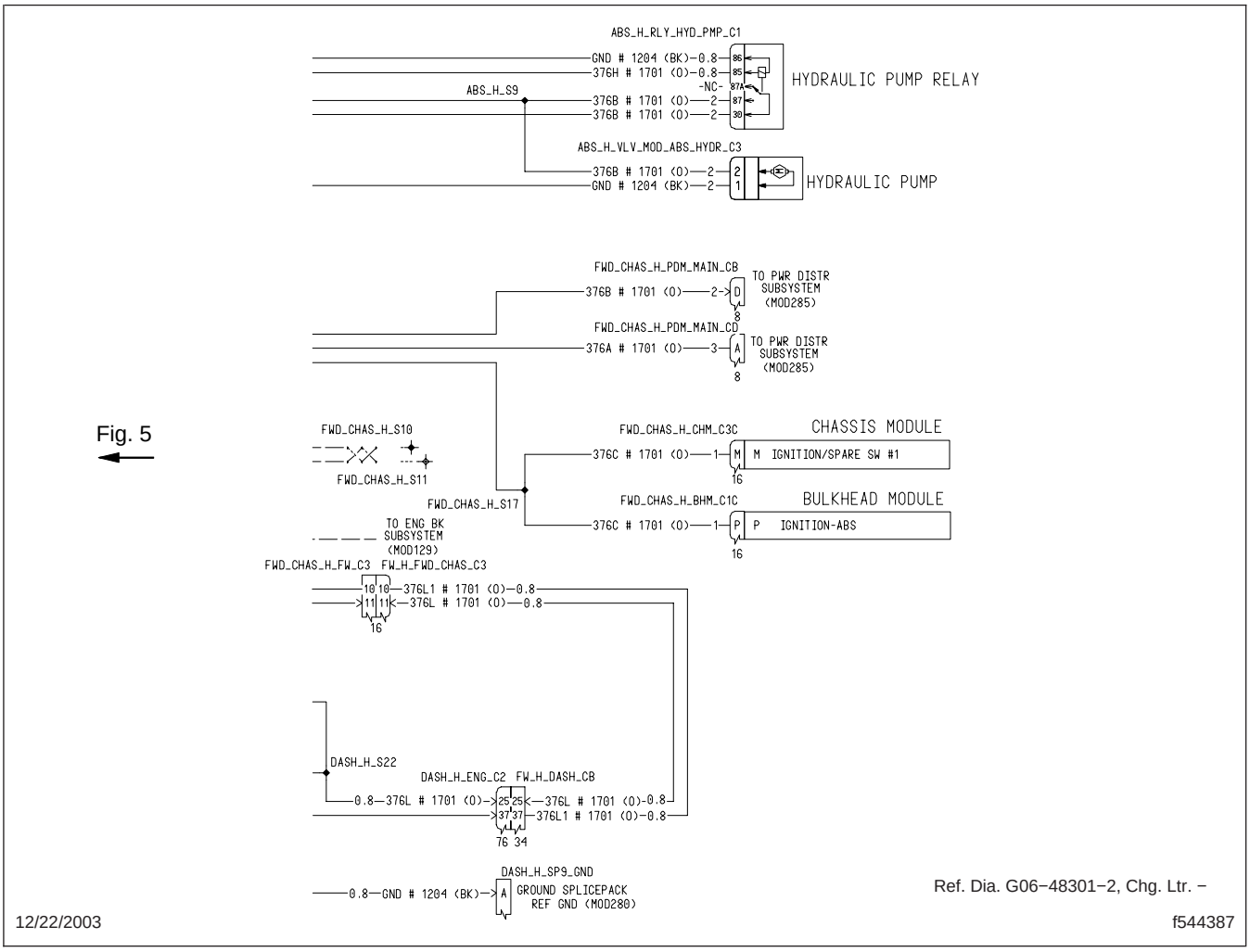

Fig. 5

Ref. Dia. G06−48301−2, Chg. Ltr. −

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Fig. 6, Wiring Diagram, ABS Relays and Dash Wiring (partial view)

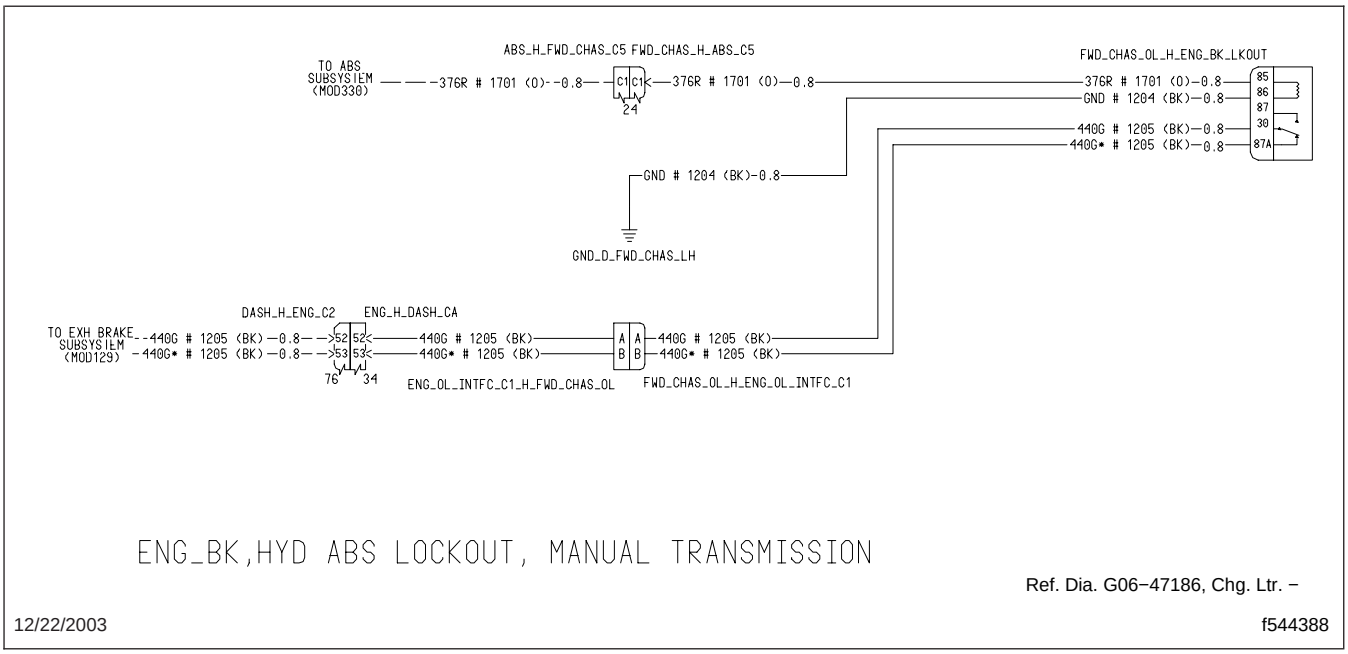

Fig. 7, Manual Transmission ABS Lockout Wiring