

2008 BRAKES

Antilock Brake System - LaCrosse

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Brake Apply Sensor Bolt	2.5 N.m	22 lb in
Brake Fluid Pressure Sensor	20 N.m	15 lb ft
Brake Pipe Fittings At Inlet to Brake Pressure Modulator Valve (BPMV)	19 N.m	14 lb ft
Brake Pipe Fittings At Outlet of Brake Pressure Modulator Valve (BPMV)	15 N.m	11 lb ft
Brake Pressure Modulator Valve Bracket Nut	10 N.m	7 lb ft
Brake Pressure Modulator Valve Bracket Nut to Brake Pressure Modulator Valve	12 N.m	8 lb ft
Electronic Brake Traction Control Module (EBTCM) to Brake Pressure Modulator Valve Bolt/Screw	2.9 N.m	26 lb in
Yaw Rate Sensor/Lateral Accelerometer Nuts	25 N.m	18 lb ft

SCHEMATIC AND ROUTING DIAGRAMS

ANTILOCK BRAKE SYSTEM SCHEMatics

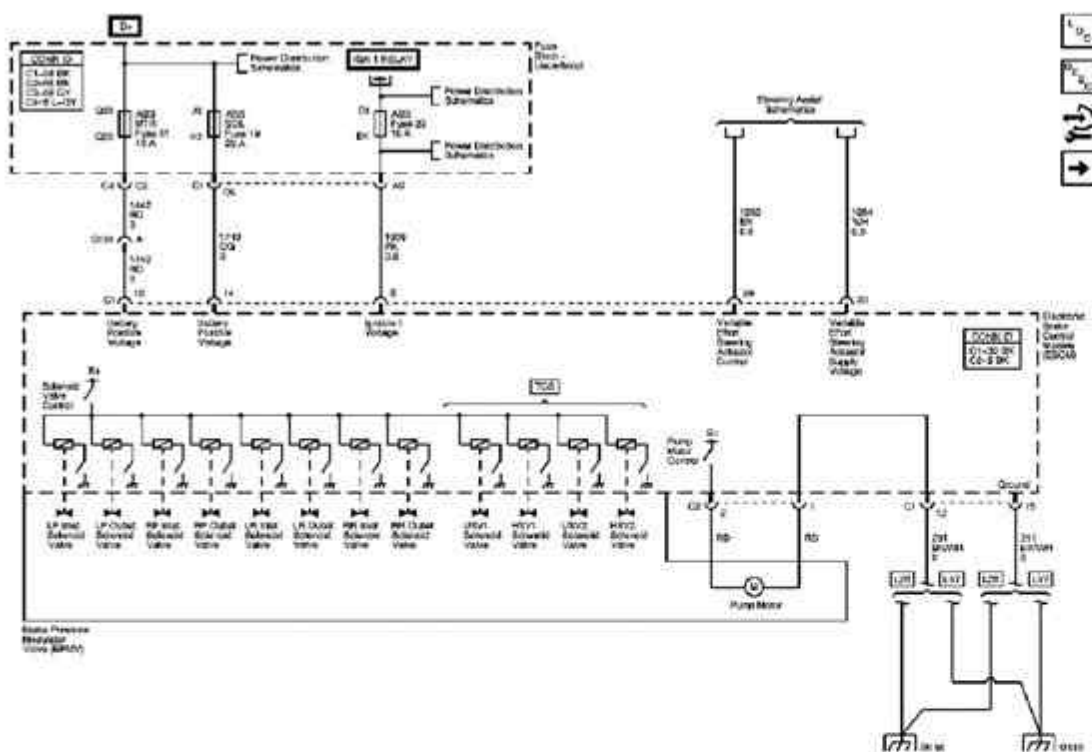


Fig. 1: Power, Ground, and Brake Pressure Modulators Valves Schematic
 Courtesy of GENERAL MOTORS CORP.

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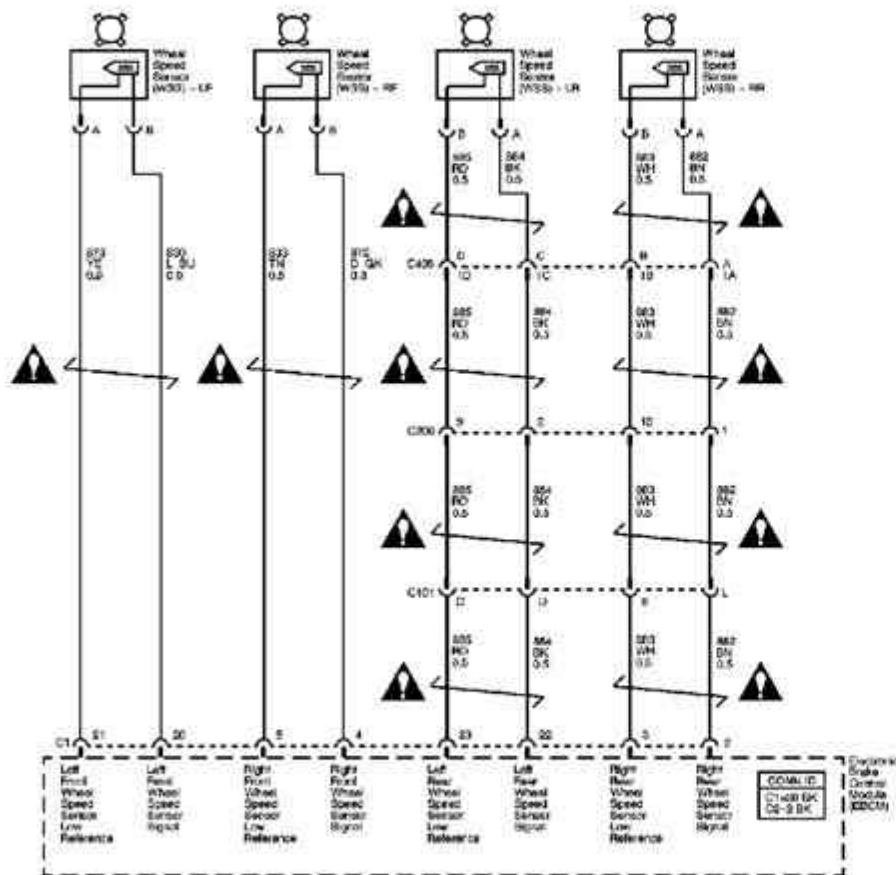


Fig. 4: Wheel Speed Sensors Schematic
 Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC C0035-C0051	C0035: Left Front Wheel Speed Sensor Circuit C0036: Left Front Wheel Speed Sensor Circuit Range/Performance C0040: Right Front Wheel Speed Sensor Circuit C0041: Right Front Wheel Speed Sensor Circuit Range/Performance C0045: Left Rear Wheel Speed Sensor Circuit C0046: Left Rear Wheel Speed Sensor Circuit Range/Performance C0050: Right Rear Wheel Speed Sensor Circuit C0051: Right Rear Wheel Speed Sensor Circuit Range/Performance
DTC C0060-C0095	C0060 00: Left Front ABS Solenoid 1 Circuit Malfunction C0065 00: Left Front ABS Solenoid 2 Circuit Malfunction C0070 00: Right Front ABS Solenoid 1 Circuit Malfunction C0075 00: Right Front ABS Solenoid 2 Circuit Malfunction C0080 00: Left Rear ABS Solenoid 1 Circuit Malfunction C0085 00: Left Rear ABS Solenoid 2 Circuit Malfunction C0090 00: Right Rear ABS Solenoid 1 Circuit Malfunction C0095 00: Right Rear ABS Solenoid 2 Circuit Malfunction
DTC C0110	C0110 00: Pump Motor Circuit
DTC C0121	C0121 00: Valve Relay Circuit
DTC C0131	C0131 00: ABS Pressure Circuit
DTC C0132	C0132 00: ABS Pressure Circuit Range/Performance
DTC C0141-C0156	C0141 00: Left Traction Control System (TCS) Solenoid/Motor Circuit

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	C0146 00: Left Traction Control System (TCS) Solenoid/Motor 2 Circuit C0151 00: Right Traction Control System (TCS) Solenoid/Motor Circuit C0156 00: Right Traction Control System (TCS) Solenoid Circuit
<u>DTC C0161</u>	C0161 00: TCS Brake Switch Circuit
<u>DTC C0186</u>	C0186 00: Lateral Accelerometer Circuit
<u>DTC C0187</u>	C0187: Lateral Accelerometer Circuit Range/Performance
<u>DTC C0196</u>	C0196 00: Yaw Rate Circuit
<u>DTC C0197</u>	C0197: Yaw Rate Circuit Range/Performance
<u>DTC C0236</u>	C0236 00: Traction Control System (TCS) Engine RPM Signal Circuit
<u>DTC C0240</u>	C0240: ECM Traction Control Not Allowed
<u>DTC C0241 or P0856</u>	C0241: Powertrain Control Module (PCM) Indicated Request Torque Malfunction P0856: Traction Control Torque Request Circuit
<u>DTC C0244 or P1689</u>	C0244 00: Pulse Width Modulated (PWM) Delivered Torque P1689: Traction Control Delivered Torque Output Circuit
<u>DTC C0245</u>	C0245 00: Wheel Speed Sensor Frequency Error
<u>DTC C0252</u>	C0252: Vehicle Stability Enhancement System (VSES) Sensors Uncorrected
<u>DTC C0253</u>	C0253: Centering Error
<u>DTC C0710</u>	C0710 00: Steering Position Signal
<u>DTC C0870</u>	C0870 00: Device Voltage Reference Output 1 Circuit
<u>DTC C0875</u>	C0875 00: Device Voltage Reference Input 2 Circuit
<u>DTC U1650</u>	U1650 00: Steering Wheel Sensor CAN Malfunction
<u>DTC U1651</u>	U1651 00: Steering Wheel Sensor Malfunction

DIAGNOSTIC STARTING POINT - ANTILOCK BRAKE SYSTEM

Begin the system diagnosis with **Diagnostic System Check - Vehicle** . The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and their status

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

DIAGNOSTIC TEST DRIVE

When servicing vehicles the vehicle stability enhancement system (VSES), test drives will be necessary to allow all tests to be run, and all system functions to be enabled and exercised. A test drive may also be required to duplicate specific DTCs covered in this section. The diagnostic system check including test drive, should be run when vehicle repairs are complete in order to verify the repair.

The diagnostic test drive will vary for ABS/TCS or VSES problems.

The following is a suggested VSES diagnostic test drive.

1. Read the Diagnostic Aids and the Conditions for Setting the DTC.
2. Reconnect any previously disconnected components.
3. Start the engine.

4. Drive the vehicle under the following conditions for at least 10 minutes. At no times should any unlawful or unsafe maneuvers be performed.
- Highway driving
 - Rough roads
 - Perform turning maneuvers, curved freeway entrance ramp, parking lot maneuvers, and high steering angles, and yaw rates at low speeds.
 - Verify customers concern and duplicate driving conditions.
 - With the engine still running use the scan tool and check for any DTCs. If any DTCs are set, perform the appropriate DTC table.

DTC C0035-C0051

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0035

Left Front Wheel Speed Sensor Circuit

DTC C0036

Left Front Wheel Speed Sensor Circuit Range/Performance

DTC C0040

Right Front Wheel Speed Sensor Circuit

DTC C0041

Right Front Wheel Speed Sensor Circuit Range/Performance

DTC C0045

Left Rear Wheel Speed Sensor Circuit

DTC C0046

Left Rear Wheel Speed Sensor Circuit Range/Performance

DTC C0050

Right Rear Wheel Speed Sensor Circuit

DTC C0051

Right Rear Wheel Speed Sensor Circuit Range/Performance

Diagnostic Fault Information

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Circuit	Short to Ground	Open or High Resistance	Short to Voltage	Signal Performance
Left Front Sensor Signal	C0035 C0036	C0035 C0036	C0035 C0036	C0035 C0036
Left Front Sensor Low Reference	C0035 C0036	C0035 C0036	C0035 C0036	C0035 C0036
Right Front Sensor Signal	C0040 C0041	C0040 C0041	C0040 C0041	C0040 C0041
Right Front Sensor Low Reference	C0040 C0041	C0040 C0041	C0040 C0041	C0040 C0041
Left Rear Sensor Signal	C0045 C0046	C0045 C0046	C0045 C0046	C0045 C0046
Left Rear Sensor Low Reference	C0045 C0046	C0045 C0046	C0045 C0046	C0045 C0046
Right Rear Sensor Signal	C0050 C0051	C0050 C0051	C0050 C0051	C0050 C0051
Right Rear Sensor Low Reference	C0050 C0051	C0050 C0051	C0050 C0051	C0050 C0051

Circuit/System Description

As the wheel spins, the wheel speed sensor produces an AC signal. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed.

Conditions for Running the DTC

C0035, C0040, C0045, C0050

The ignition is ON.

C0036, C0041, C0046, C0051

- The vehicle speed is over 40 km/h (25mph)
- The brake pedal is not pressed.
- The ABS is not active.

Conditions for Setting the DTC

C0035, C0040, C0045, C0050

One of the following conditions exists for 0.02 seconds:

- An open is detected on the wheel speed sensor signal circuit.
- A short to ground is detected on the wheel speed sensor signal circuit.
- A short to voltage is detected on the wheel speed sensor signal circuit.

C0036, C0041, C0046, C0051

All of the following conditions exists for 0.01 seconds:

- The suspect wheel speed sensor equals zero.
- The other wheel speeds are greater than 40 km/h (25mph) for 0.01 seconds.
- The suspect wheel equals zero during drive off, and the other wheels are greater than 18km/h (11mph).

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- A short to ground the wheel speed sensor is shorted to ground
- A deviation of two wheel speed sensors at either side of the vehicle greater than 6km/h (4mph), or at the front axle greater than 10km/h (6mph) for a period of 10 to 20 seconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/traction control system (TCS)/vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- A DTC malfunction will set.
- The ABS indicator turns ON.
- The Stability Off indicator turns ON.
- The Red BRAKE Warning indicator could turn ON.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- A damaged rear wheel speed sensor ring can cause a DTC to set.
- If 2 or more wheel speed sensors are inoperative diagnose each wheel speed sensor individually.

C0035, C0040, C0045, C0050, C0051

If the customer comments that the ABS indicator is ON only during moist environmental conditions: rain, snow, vehicle wash, etc., inspect the wheel speed sensor wiring for signs of water intrusion. If the DTC is not current, clear all DTCs and simulate the effects of water intrusion by using the following procedure:

1. Spray the suspected area with a 5 percent saltwater solution. To create a 5 percent saltwater solution, add 2 teaspoons of salt to 8 fl oz of water (10 g of salt to 200 ml of water).
2. Test drive the vehicle over various road surfaces: bumps, turns, etc., above 40 km/h (25 mph) for at least 30 seconds.
3. Rinse the area thoroughly when completed.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**
- **Connector Repairs**

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

With scan tool installed drive the vehicle in a straight line at a speed greater than 40 km/h (25 mph), all wheel speed sensors should read the same km/h (mph). Verify in scan tool EBCM scan tool data.

Circuit/System Testing

IMPORTANT: It is recommend that Component Testing is performed before Circuit Testing when diagnosing wheel speed sensors.

1. With the ignition OFF, disconnect the EBCM connector.
2. With the ignition ON, measure for 0 volt between the sensor signal circuit terminal or the low reference circuit terminal and ground at the EBCM connector.
 - If over 0 volt, repair short to voltage or shorted together in sensor signal circuit or the low reference circuit.
3. With the ignition OFF, measure for infinite ohms of resistance between the wheel speed sensor signal or the low reference circuit and ground at the EBCM connector.
 - If less than infinite ohms, repair short to ground in the sensor signal or the low reference circuit.
4. Measure for 800-1600 ohms of resistance between the wheel speed sensor signal and low reference circuits at the EBCM connector.
 - If greater than 1600 ohms test for an open/high resistance in the circuit or faulty wheel speed sensor.
 - If less than 800 ohms test for a short between the circuits or faulty wheel speed sensor.
5. If all circuits test normal replace the EBCM.

Component Testing

1. Disconnect the wheel speed sensor connector.
2. With the ignition OFF, measure for 800-1600 ohms of resistance across the wheel speed sensor.
 - If the resistance is not between 800-1600 ohms replace the faulty wheel speed sensor.
3. Spin the wheel, with a scan tool measure the AC voltage across the wheel speed sensor for 100 mv AC or greater.
 - If the AC voltage is less than 100 mv replace the faulty wheel speed sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Front Wheel Bearing and Hub Replacement**
- **Rear Wheel Bearing and Hub Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

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Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors**DTC C0060 00**

Left Front ABS Solenoid 1 Circuit Malfunction

DTC C0065 00

Left Front ABS Solenoid 2 Circuit Malfunction

DTC C0070 00

Right Front ABS Solenoid 1 Circuit Malfunction

DTC C0075 00

Right Front ABS Solenoid 2 Circuit Malfunction

DTC C0080 00

Left Rear ABS Solenoid 1 Circuit Malfunction

DTC C0085 00

Left Rear ABS Solenoid 2 Circuit Malfunction

DTC C0090 00

Right Rear ABS Solenoid 1 Circuit Malfunction

DTC C0095 00

Right Rear ABS Solenoid 2 Circuit Malfunction

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Solenoid Coil Circuit	C0060 00, C0065 00, C0070 00, C0075 00, C0080 00, C0085 00, C0090 00, C0095 00	C0060 00, C0065 00, C0070 00, C0075 00, C0080 00, C0085 00, C0090 00, C0095 00	C0060 00, C0065 00, C0070 00, C0075 00, C0080 00, C0085 00, C0090 00, C0095 00	-

Circuit Description

The inlet and outlet valve solenoid circuits are supplied with battery power when the ignition is in the ON position.

The EBCM controls the valve functions by grounding the circuit when necessary.

Conditions for Running the DTC

- The DTC can set anytime the ignition switch is in the ON position.
- The DTC can set when the vehicle speed is greater than 6 km/h (4 mph) and the brake pedal is not applied.
- The DTC can set when the vehicle speed is greater than 15 km/h (9 mph) and the brake pedal is applied.

Conditions for Setting the DTC

The DTC will set when the EBCM detects one of the following internal to the EBCM only:

- An open in the solenoid coil or circuit.
- A short to ground in the solenoid coil or circuit.
- A short to voltage in the solenoid coil or circuit.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/TCS/VSES/DRP for the duration of the ignition cycle.
- A malfunction DTC will set.
- The ABS indicator turns ON.
- The Stability Off indicator turns ON.
- The Red BRAKE Warning indicator could turn on.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The solenoid valve circuit and the solenoid coil are internal to the EBCM. No part of the solenoid circuit is diagnosable external to the EBCM. The DTC sets when there is a malfunction in the solenoid circuit internal to the EBCM only.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**

- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

DTC C0110

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0110 00

Pump Motor Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open or High Resistance	Short to Voltage	Signal Performance
BPMV Pump Motor Control Signal	C0110 00	C0110 00	-	-
BPMV Pump Motor Ground	-	C0110 00	-	-
EBCM Ground	-	C0110 00	-	-

Circuit/System Description

The electronic brake control module (EBCM) supplies ground to activate the Antilock Brake System (ABS) pump motor. An internal system relay in the EBCM supplies battery positive voltage to the pump motor when the ignition is turned ON. The EBCM monitors pump motor feedback voltage after activation to detect a stalled or binding pump motor. The pump motor is an integral part of the Brake Pressure Modulator Valve (BPMV).

Conditions for Running the DTC

- The ignition switch is in the ON position.
- The system enable relay is ON.
- Initialization is complete.
- The pump motor has been commanded ON, OFF and ON again.

Conditions for Setting the DTC

- Pump motor voltage is not present 60 milliseconds after activation of the pump motor relay.
- Pump motor voltage is present for more than 2.5 seconds with no activation of the pump motor relay.
- Pump motor voltage is not present for more than 40 milliseconds after the pump motor relay is commanded off.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/traction control system (TCS)/vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- The ABS indicator turns ON.
- The Stability OFF indicator turns ON.
- The Red BRAKE Warning indicator could turn on.
- The driver information center (DIC) displays the Service Stability System message.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The pump motor is integral to the brake pressure modulator valve (BPMV). The pump motor is not serviceable.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Testing**

1. Ignition OFF, disconnect the harness connector at the EBCM.
2. Test for less than 1 ohm between the ground circuits listed below and ground.
 - Terminal 12
 - Terminal 15
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify that a test lamp illuminates between the B+ circuits listed below and ground.
 - Terminal 13
 - Terminal 14

- If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance. If the circuit tests normal and the B+ circuit fuse is open, replace the BPMV.
- 4. If all circuits test normal, replace the BPMV and verify DTC does not reset. If the DTC resets replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Brake Pressure Modulator Valve Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0121

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0121 00

Valve Relay Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
EBCM Solenoid Valve Battery Positive Voltage Circuit	C0121 00	C0121 00	-	-

Circuit/System Description

An internal solenoid valve relay in the electronic brake control module (EBCM) supplies battery positive voltage to all solenoid valves. This voltage is referred to as system voltage. The EBCM activates the solenoid valve relay when the ignition is turned ON. Once the solenoid valve relay has been activated, the EBCM supplies ground to actuate individual solenoid valves.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 9 volts.

Conditions for Setting the DTC

- The EBCM commands the solenoid valve relay on and battery voltage is not present at the solenoid valves.
- The EBCM commands the solenoid valve relay off and battery voltage is present at the solenoid valves.

Action Taken When the DTC Sets

- The EBCM disables the ABS/traction control system (TCS)/vehicle stability enhancement system (VSES) dynamic rear proportioning (DRP) for the duration of the ignition cycle.
- The ABS indicator turns ON.

- A malfunction DTC is set.
- The stability OFF indicator turns ON.
- The red BRAKE warning indicator could turn ON

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The solenoid valve relay is integral to the EBCM. The relay is not serviceable.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Testing**

Clear the DTC. Cycle the ignition OFF and ON. Operate the vehicle. Verify that DTC C0121 does not reset.

- If DTC C0121 resets, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM replacement, setup, and programming**DTC C0131****Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0131 00**

ABS Pressure Circuit

Circuit/System Description

The electronic brake control module (EBCM) uses input from the brake pedal position sensor for more accurate control during a Vehicle Stability Enhancement System (VSES) event.

Conditions for Running the DTC

- System Voltage is above 9 volts.
- DTC C0870 is not set.
- The ignition is ON.
- The vehicle speed is greater than 40 km/h (24 mph).

Conditions for Setting the DTC

- Voltage at the pressure sensor signal output to the EBCM falls outside the 0.25-4.75 voltage range for more than 100 milliseconds.
- Brake signal does not correlate to pressure signal.
- Signal is erratic and changes faster than physically allowed.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/traction control system (TCS)/VSES for the duration of the ignition cycle.
- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.
- A malfunction DTC will set.
- The ABS indicator turns ON.
- The stability OFF indicator turns OFF.
- The red BRAKE warning indicator could turn ON.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference**

Component Connector End Views**Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

1. Verify that DTC C0277, C0297, or B3445 is not set.
 - o If any of the DTCs are set, refer to
2. Ignition ON, observe the scan tool BPP parameter while applying and releasing the brake pedal. The reading should change between Applied and Released.
 - o If the parameter does not change between applied and release, replace the BPMV and verify DTC does not reset. If DTC reset, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Brake Pressure Modulator Valve Replacement**.
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0132**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0132 00**

ABS Pressure Circuit Range/Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Brake Pressure Sensor Signal	C0132	-	C0132	-
Brake Pressure Sensor 5-Volt Reference Circuit	C0132	C0132	C0132	-

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Brake Pressure Sensor Ground Circuit	-	C0132	-	-
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Circuit Description

During calibration of the offset of the pressure sensor signal, the pressure sensor signal offset value must be in the range of 1-15 Bar (1-434 psi).

The pressure sensor is also monitored for sensitivity via a correlation between estimated vehicle deceleration and the pressure sensor signal. This is monitored over the course of numerous straight line non antilock brake system (ABS) braking stops.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

- The sensor signal offset value is out of range for more than 1 second.
- The brake pedal is not applied.
- The ABS pump is not ON.
- The brake pressure sensor sensitivity is outside a predetermined range.
- The brake pressure sensor indicates low brake fluid pressure, and the brake pedal position sensor indicates brakes applied.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The electronic brake control module (EBCM) disables the ABS/traction control system (TCS)/vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- A malfunction DTC will set.
- The ABS indicator turns ON.
- The Stability Off indicator turns ON.
- The red BRAKE warning indicator could turn ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- Using a scan tool.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- A malfunctioning pressure sensor
- A malfunctioning EBCM
- Test the brake pedal position sensor (BPPS) for proper operation, and adjustment. Check the BPPS for DTCs. An improperly adjusted BPPS will set the DTC.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, verify the scan tool BPMV pressure signal sensor offset value in ABS scan tool data must be in the range of 1-15 Bars.

Circuit/System Testing

1. Ignition OFF, disconnect the EBCM harness at the Brake Fluid Pressure Sensor.
2. Ignition OFF, with a DMM test for less than 5.0 ohms between the Brake Fluid Pressure Sensor low reference circuit terminal 1 and ground.
 - If greater than the specified range, with the DMM test the low reference circuit terminal 3 for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, with a DMM test for 0.25-4.75 volts between the Brake Fluid Pressure Sensor 5-volt reference circuit terminal 3 and ground.
 - If less than the specified range, with the DMM test the 5-volt reference circuit terminal 3 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the 5-volt reference circuit terminal 3 for a short to voltage. If the circuit tests normal, replace the EBCM.
4. With the DMM, verify the Brake Fluid Pressure Sensor signal circuit terminal 2 range is less than 0.25 volts.
 - If greater than the specified value, test the signal circuit terminal 2 for a short to voltage. If the circuit tests normal, replace the EBCM.
5. Install a 3A fused jumper wire between the Brake Fluid Pressure Sensor signal circuit terminal 2 and the Brake Fluid Pressure Sensor 5-volt reference circuit terminal 3. With a DMM, verify the voltage value is greater than 4.75 volts.
 - If less than the specified value, test the signal circuit terminal 2 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
6. If all circuits test normal, test or replace the Brake Fluid Pressure Sensor.

Component Testing

1. Install a 3A fused jumper wire between the Brake Fluid Pressure Sensor 5-volt reference terminal 3 and 5 volts. Install a jumper wire between the low reference circuit terminal 1 and ground.
2. Sweep the sensor through the entire range while monitoring the resistance between the signal circuit terminal 2 and the low reference circuit terminal 1. The voltage should vary between 0.25-4.75 volts without any spikes or dropouts.
 - o If not within the specified range or is erratic, replace the Brake Fluid Pressure Sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Brake Fluid Pressure Sensor Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0141-C0156**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors**DTC C0141 00**

Left Traction Control System (TCS) Solenoid/Motor Circuit

DTC C0146 00

Left Traction Control System (TCS) Solenoid/Motor 2 Circuit

DTC C0151 00

Right Traction Control System (TCS) Solenoid/Motor Circuit

DTC C0156 00

Right Traction Control System (TCS) Solenoid Circuit

Circuit/System Description

The isolation and prime valve solenoid circuits are supplied with battery power when ignition is in the ON position. The EBCM controls the valve functions by grounding the circuit when necessary.

Conditions for Running the DTC

- The ignition is ON.
- The DTC can be set after system initialization.

Conditions for Setting the DTC

The DTC will set when the EBCM detects one of the following internal to the EBCM only:

- An open in the solenoid coil or circuit.

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- A short to ground in the solenoid coil or circuit.
- A short to voltage in the solenoid coil or circuit.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The electronic brake control module (EBCM) disables the ABS/traction control system (TCS)/vehicle stability enhancement system (VSES)/dynamic rear proportion (DRP) for the duration of the ignition cycle.
- A malfunction DTC is set.
- The ABS indicator turns ON.
- The Stability Off indicator turns ON.
- The red BRAKE warning indicator could turn ON.

Conditions for Clearing the MIL/DTC

- The condition for the DTC is no longer present.
- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.

Diagnostic Aids

The solenoid valve circuit and the solenoid coil are internal to the EBCM. No part of the solenoid circuit is diagnosable external to the EBCM. The DTC sets when there is a malfunction in the solenoid circuit internal to the EBCM only.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

If the DTC or DTCs is set, program the EBCM refer to Control Module References . If the DTC or DTCs resets, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM replacement, setup, and programming

DTC C0161**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0161 00**

TCS Brake Switch Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open or High Resistance	Short to Voltage	Signal Performance
EBCM Class 2 Serial Data Signal Circuit	C0161 00	C0161 00	C0161 00	-

Circuit/System Description

The brake pedal position (BPP) sensor is an input to the body control module (BCM). The BCM then sends a serial data message to the electronic brake control module (EBCM) and other electronic control modules. The BPP sensor is a potentiometer type sensor with 3 circuits: a 10-volt reference circuit, a low reference circuit and a brake apply sensor signal circuit. The BCM supplies the 10-volt reference to the BPPS. Varying the level of application of the brake pedal changes the BPPS voltage range from less than 1 volt to greater than 9 volts through the BPPS signal circuit. When the conditions for running this DTC are met, the BCM will use the brake fluid pressure sensor to determine if the predicted operating range of the BPPS voltage is correct. If the BCM detects the BPPS voltage is out of the predicted range, the BCM will send a class 2 message to the EBCM to set DTC C0161. The EBCM will set a DTC C0131 or C0132 for a brake fluid pressure sensor fault. The BCM will set DTC C0277, C0278, or C0283, and C0870.

Conditions for Running the DTC

- The ignition is ON.
- The DTC can be set after system initialization.
- The ignition voltage is greater than 9 volts.

Conditions for Setting the DTC

- The BCM detects a failure in the BPPS system.
- The brake pedal is sensed as applied during moderate to high vehicle acceleration.
- With the vehicle decelerating, the brake pedal is sensed as released and the master cylinder pressure is greater than 90 psi.

Action Taken When the DTC Sets

- The EBCM disables the traction control system (TCS) and vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- The Traction Control and ABS indicators turn ON.
- The driver information center (DIC) displays Service Stability System message.
- A malfunction DTC will set.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The DTC C0161 can be set if the vehicle has been driven with the brake applied during acceleration.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

1. Verify that DTC C0277, C0297, or B3445 is not set.
 - If any of the DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle**.
2. Ignition ON, observe the scan tool EBCM BPP parameter while applying and releasing the brake pedal. The reading should change between Applied and Released.
 - If the parameter does not change between applied and release, replace the BPMV and verify DTC does not reset. If DTC reset, replace the EBCM.

DTC C0186**Diagnostic Instructions**

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- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0186 00

Lateral Accelerometer Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12-Volt Reference	C0186 00	C0186 00	-	C0186 5A
Low Reference	-	C0186 00	C0186 00	C0186 5A
CAN Bus High Serial Data	C0186 00	C0186 00	C0186 00	C0186 5A
CAN Bus Low Serial Data	C0186 00	C0186 00	C0186 00	C0186 5A

Circuit/System Description

The lateral accelerometer and the yaw rate sensors are combined into one sensor external to the electronic brake control module (EBCM). The vehicle stability enhancement system (VSES) uses the lateral accelerometer input when calculating the desired yaw rate. The usable output voltage range for the lateral accelerometer is 0.25-4.75 volts.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The yaw/lateral combination sensor fails an internal self test.
- Ignition voltage to the yaw/lateral combination sensor is less than 9.5 volts.
- Communication is lost between the EBCM and the yaw/lateral combination sensor.

Action Taken When the DTC Sets

- The EBCM turns OFF the 5-volt reference circuit, until the ignition is cycled.
- The driver information center (DIC) displays the Service Stabilitrak message.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- If the yaw and lateral acceleration sensor is disconnected, DTCs will set and the EBCM will not provide 5-volt reference.
- The yaw rate and lateral accelerometer sensors are located in one unit and cannot be serviced separately.
- A poor ground connection for the EBCM may cause this DTC to set.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

With a scan tool verify the VSES Failed scan tool data display in the EBCM VSES scan tool data. The data should display YES for the VSES Failed data display.

Circuit/System Testing

1. If DTC C0252 is set, diagnose that DTC first.
2. Ignition OFF, disconnect the yaw and lateral acceleration sensor connector.
3. Ignition OFF, test for less than 1 ohm between the circuit terminal 6 and ground.
 - o If greater than 1 ohm, test the low reference circuit terminal 6 and the EBCM ground circuit terminal 18 for a short to voltage or an open/high resistance. If the circuits test normal, replace the EBCM.
4. Test the lateral accelerometer signal circuit terminal 5, the 5 volt reference circuit terminal 1, and the low reference circuit terminal 6 for an open/high resistance or a short to voltage or ground.
 - o If all circuits test normal, replace the yaw and lateral acceleration sensor, and clear the yaw rate sensor offset value in the EBCM.
 - o If the DTC sets again after replacing the yaw and lateral acceleration sensor, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0187**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0187**

Lateral Accelerometer Circuit Range/Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Yaw and Lateral Accelerometer Sensor Signal Circuit	-	-	-	C0187

Circuit Description

The vehicle stability enhancement system (VSES) uses the lateral accelerometer input when calculating the desired yaw rate. The usable output voltage range for the lateral accelerometer 0.25-4.75 volts. The scan tool will report zero lateral acceleration as 2.5 volts with no sensor bias present.

The lateral accelerometer sensor bias compensates for sensor mounting alignment errors and electronic signal errors.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

- A reference lateral acceleration from the data of the yaw rate sensor, wheel speed sensors, and steering angle sensor is used to test the lateral accelerometer signal. If during stable driving conditions, the lateral accelerometer signal becomes larger than 0.26 g, the electronic brake control module (EBCM) controller will disregard the signal so that a false EBCM intervention is prevented. A malfunction is detected if this condition continues for more than 2 seconds.
- Under normal driving conditions, the long time filtered driving direction is straight ahead. The long time filtered lateral accelerometer value is called the offset. If the offset value is higher than 0.23 g, a malfunction is detected. Malfunction time depends on driving distance, vehicle speed and the amount of malfunctioning lateral accelerometer signal.
- The lateral accelerometer signal is limited to an electrical stop of 1.8 g. If the lateral accelerometer signal is greater than 1.5 g for more than 500 milliseconds, a malfunction is detected.
- At a standstill, the range of the lateral accelerometer signal is less than 0.7 g. If the lateral accelerometer signal is greater than 0.7 g at standstill, a malfunction is detected.
- Lateral accelerometer signal cannot change rapidly under normal driving conditions. If the lateral accelerometer signal is changing faster than 55 g per second, a malfunction is detected.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the traction control system (TCS)/VSES for the duration of the ignition cycle.

- A malfunction DTC will set.
- The antilock brake system (ABS) indicator turns ON.
- The Stability Off indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- Using a scan tool

Diagnostic Aids

IMPORTANT: Perform the steering angle sensor centering procedure after the diagnostic system check-vehicle is performed. Refer to Steering Angle Sensor Centering.

- Find out from the customer under what condition was the DTC set. This information will help to duplicate the failure.
- Check the vehicle for proper alignment. The car should not pull in either direction while driving straight on a level surface.
- During diagnosis, park the vehicle on a level surface.
- Check for malfunctioning EBCM and lateral accelerometer.
- The snapshot function on the scan tool can help find an intermittent DTC.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References for Scan Tool Information****Circuit/System Verification**

Ignition ON, verify the scan tool Lateral Acceleration G value in the scan tool VSES scan tool data. If the specified value displays one of the following, a malfunction has occurred:

- Under normal driving conditions, the long time filtered driving direction is straight ahead. The longtime filtered lateral accelerometer value is called the offset. The offset value is higher than 0.23 g.
- The lateral accelerometer signal is limited to an electrical stop of 1.8 g. Verify the lateral accelerometer is not greater than 1.5 g for more than 500 milliseconds.
- During stable driving conditions, the lateral accelerometer signal becomes larger than 0.26 g for more than 2 seconds.
- At standstill, the range of the lateral accelerometer signal is greater than 0.7 g.
- Lateral accelerometer signal cannot change rapidly under normal driving conditions. The lateral accelerometer signal is changing faster than 55 g per second.

Circuit/System Testing

1. Ignition OFF, disconnect the EBCM harness connector at the Yaw and Lateral Accelerometer Sensor.
2. Ignition OFF, with a DMM test for less than 5.0 ohms of resistance between the Vehicle Yaw and Lateral Accelerometer Sensor low reference circuit terminal 6 and ground.
 - If greater than the specified range, with the DMM test the low reference circuit terminal 6 for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, with a DMM test for 2.3-2.7 volts between the Yaw and Lateral Accelerometer Sensor lateral accelerometer signal circuit terminal 5 and ground.
 - If less than the specified range, with the DMM test the lateral accelerometer signal circuit terminal 5 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the lateral accelerometer signal circuit terminal 5 for a short to voltage. If the circuit tests normal, replace the EBCM.
4. Ignition ON, with a DMM test for 2.3-2.7 volts between the Yaw and Lateral Accelerometer Sensor yaw rate signal circuit terminal 4 and ground.
 - If less than the specified range, with the DMM test the yaw rate signal circuit terminal 4 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the yaw rate signal circuit terminal 4 for a short to voltage. If the circuit tests normal, replace the EBCM.
5. With the DMM, verify the Vehicle Yaw and Lateral Accelerometer Sensor test control signal circuit terminal 2 range is less than 0.25 volts.
 - If greater than the specified value, test the signal circuit terminal 2 for a short to voltage. If the circuit tests normal, replace the EBCM.
6. Install a 3A fused jumper wire between the Yaw and Lateral Accelerometer Sensor signal circuit terminal 2 and the Yaw and Lateral Accelerometer Sensor 5-volt reference circuit terminal 3. With a DMM, verify the voltage value is greater than 4.75 volts.
 - If less than the specified value, test the signal circuit terminal 2 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
7. If all circuits test normal, test or replace the Yaw and Lateral Accelerometer Sensor.

Component Testing

1. Install a 3A fused jumper wire between the Yaw and Lateral Accelerometer Sensor 5-volt reference terminal 1 and 5 volts. Install a jumper wire between the low reference circuit terminal 6 and ground.
2. Sweep the sensor through the entire range while monitoring the resistance between the signal circuit terminal 5 and the low reference circuit terminal 6. The voltage should vary between 0.25-4.75 volts without any spikes or dropouts.
 - If not within the specified range or is erratic, replace the Yaw and Lateral Accelerometer Sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Diagnostic Test Drive**
- **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**
- **Steering Angle Sensor Centering**
- **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0196

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0196 00

Yaw Rate Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Yaw Rate Sensor Signal Circuit	C0196 00	C0196 00	C0196 00	-
Yaw Rate Sensor Signal 5-Volt Reference	1	1	1	-
Yaw Rate Sensor Ground	1	C0196 00	-	-
Yaw/Lateral Acceleration Sensor Ignition Voltage	-	1	-	-
1. Circuit Inoperative				

Circuit Description

The vehicle stability enhancement system (VSES) is activated by the electronic brake control module (EBCM) calculating the desired yaw rate and comparing it to the actual yaw rate input. The desired yaw rate is calculated from measured steering wheel position, vehicle speed, and lateral acceleration. The difference between the desired yaw rate and actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. If the yaw rate error becomes too large, the EBCM will attempt to correct the vehicle's yaw motion by applying differential braking to the wheels.

To correct for oversteer, differential braking is used on the left front or right front wheel brake. To correct for understeer, differential braking is used on the left rear or right rear wheel brake.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

The EBCM performs different tests to detect a DTC condition. A malfunction is detected when the yaw rate sensor

signal input voltage is less than 0.225 volts or greater than 4.775 volts for more than 100 milliseconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the traction control system (TCS)/VSES for the duration of the ignition cycle.
- A malfunction DTC will set.
- The antilock brake system (ABS) indicator turns ON.
- The Stability Off indicator turns ON.
- The red BRAKE indicator could turn ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- Using a scan tool

Diagnostic Aids

The following conditions may cause a malfunction:

- Open in the yaw rate signal circuit
- Short to ground in the yaw rate signal circuit
- Short to voltage in the yaw rate signal circuit
- Open in the yaw rate ground circuit
- Open in ignition voltage circuit
- Malfunctioning vehicle yaw/lateral accelerometer sensor
- Malfunctioning EBCM

Reference Information**Schematic Reference**

- [Antilock Brake System Schematics](#)
- [Power Distribution Schematics](#)

Connector End View Reference**Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the EBCM harness connector at the Yaw and Lateral Accelerometer Sensor.
2. Ignition OFF, with a DMM test for less than 5.0 ohms between the Vehicle Yaw and Lateral Accelerometer Sensor ground circuit terminal 6 and ground.
 - If greater than the specified range, with the DMM test the low reference circuit terminal 6 for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, with a DMM test for 0.225-4.775 volts between the Yaw and Lateral Accelerometer Sensor lateral accelerometer signal circuit terminal 5 and ground.
 - If less than the specified range, with the DMM test the lateral accelerometer signal circuit terminal 5 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the lateral accelerometer signal circuit terminal 5 for a short to voltage. If the circuit tests normal, replace the EBCM.
4. Ignition ON, with a DMM test for 0.225-4.775 volts between the Yaw and Lateral Accelerometer Sensor yaw rate signal circuit terminal 4 and ground.
 - If less than the specified range, with the DMM test the yaw rate signal circuit terminal 4 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the yaw rate signal circuit terminal 4 for a short to voltage. If the circuit tests normal, replace the EBCM.
5. Ignition ON, with the DMM, test for battery voltage at the Vehicle Yaw and Lateral Accelerometer Sensor Ignition 1 terminal 3 circuit and the ground circuit terminal 6.
 - If less than the specified value, test the ignition circuit terminal 3 for a open/high resistance. If the circuit tests normal, replace the EBCM.
6. Install a 3A fused jumper wire between the Yaw and Lateral Accelerometer Sensor signal circuit terminal and the Yaw and Lateral Accelerometer Sensor Volt reference circuit terminal 3. With a DMM, verify the voltage range is 2-3 volts.
 - If less than the specified value, test the 5-volt reference circuit terminal 3 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified value, test the 5-volt reference circuit terminal 3 for a short to voltage. If the circuit tests normal, replace the EBCM.
7. If all circuits test normal, test or replace the Yaw and Lateral Accelerometer Sensor.

Component Testing

1. Install a 3A fused jumper wire between the Yaw and Lateral Accelerometer Sensor Volt reference terminal 1 and 5 volts. Install a jumper wire between the low reference circuit terminal 6 and ground.
2. Sweep the sensor through the entire range while monitoring the resistance between the signal circuit terminal 5 and the low reference circuit terminal 6. The voltage should vary between 0.25-4.75 volts without any spikes or dropouts.
 - If not within the specified range or is erratic, replace the Yaw and Lateral Accelerometer Sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**
- **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement**

- **Control Module References** for EBCM replacement, setup, and programming

DTC C0197**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0197**

Yaw Rate Circuit Range/Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Yaw Rate Sensor Signal	-	-	-	C0197
Yaw and Lateral Accelerometer Sensor Ground	-	1	-	-
Lateral Accelerometer Sensor Signal	1	1	-	-
1. Circuit inoperative				

Circuit Description

The electronic brake control module (EBCM) triggers a yaw rate sensor test every 40 milliseconds and switches the sensor into test mode. The EBCM sends a test signal to the sensor via the test circuit. When the test is run, the measured yaw rate from the sensor to the EBCM must be in the range of 25 degrees per second that is greater or less than 7 degrees per second. At standstill, the vehicle yaw rate is zero. The yaw rate signal at standstill is called the offset. If calibration at standstill is not possible, a quick calibration during driving is done. The measured yaw rate is calibrated to a calculated reference yaw rate signal. Yaw rate sensor sensitivity is estimated by comparison of the reference yaw rate and the measured yaw rate during cornering.

Steering angle centering is the process by which the EBCM calibrates the steering sensor output so that the output reads zero when the steering wheel is centered. The vehicle stability enhancement system (VSES) steering angle sensor centering process is performed manually.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

A malfunction is detected if one or more of the following conditions exist:

- The yaw rate sensor signal is out of range for 220-420 milliseconds.
- The yaw rate sensor signal at standstill, which is called the offset, is outside the allowed range that is greater or less than 8 degrees per second.
- The sensor sensitivity which is estimated by comparing the reference yaw rate and the measured yaw rate during cornering, is outside a predetermined range.

- The yaw rate is changing at a rate greater than 6-23 degrees per second per 40 milliseconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the traction control system (TCS)/VSES for the duration of the ignition cycle.
- A malfunction DTC is set.
- The antilock brake system (ABS) indicator turns ON.
- The Stability Off indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- Using a scan tool

Diagnostic Aids

IMPORTANT: Perform the steering angle sensor centering procedure after the diagnostic system check-vehicle is performed. Refer to Steering Angle Sensor Centering.

The following conditions may cause a malfunction:

- Malfunctioning lateral accelerometer
- Malfunctioning EBCM

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References for Scan Tool Information****Circuit/System Verification**

Drive vehicle above 40 km/h (25 mph), verify the scan tool Yaw Rate Sensor %/sec value in the scan tool VSES scan tool data. The specified value should change the display at a rate greater than 6-23 degrees per second per 40 milliseconds.

Circuit/System Testing

1. Ignition OFF, disconnect the EBCM harness connector at the Yaw and Lateral Accelerometer Sensor.
2. Ignition OFF, with a DMM test for less than 5.0 ohms of resistance between the Vehicle Yaw and Lateral Accelerometer Sensor ground circuit terminal 6 and ground.
 - If greater than the specified range, with the DMM test the low reference circuit terminal 6 for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, with a DMM test for 2.3-2.7 volts between the Yaw and Lateral Accelerometer Sensor lateral accelerometer signal circuit terminal 5 and ground.
 - If less than the specified range, with the DMM test the lateral accelerometer signal circuit terminal 5 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the lateral accelerometer signal circuit terminal 5 for a short to voltage. If the circuit tests normal, replace the EBCM.
4. Ignition ON, with a DMM test for 2.3-2.7 volts between the Yaw and Lateral Accelerometer Sensor yaw rate signal circuit terminal 4 and ground.
 - If less than the specified range, with the DMM test the yaw rate signal circuit terminal 4 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the yaw rate signal circuit terminal 4 for a short to voltage. If the circuit tests normal, replace the EBCM.
5. If all circuits test normal, test or replace the Yaw and Lateral Accelerometer Sensor.

Component Testing

1. Install a 3A fused jumper wire between the Yaw and Lateral Accelerometer Sensor yaw rate sensor signal terminal 4 and 5 volts. Install a jumper wire between the ground circuit terminal 6 and ground.
2. Sweep the sensor through the entire range while monitoring the resistance between the signal circuit terminal 5 and the low reference circuit terminal 6. The voltage should vary between 2.3-2.7 volts without any spikes or dropouts.
 - If not within the specified range or is erratic, replace the Yaw and Lateral Accelerometer Sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**
- **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0236

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0236 00

Traction Control System (TCS) Engine RPM Signal Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
EBCM Speed Signal Circuit	C0236 00	C0236 00	C0236 00	-

Circuit/System Description

The RPM signal circuit provides the EBCM with an indication of engine RPM to help determine TCS control methods and rates when a TCS event takes place.

Conditions for Running the DTC

- The ignition is ON, Engine ON.
- After 2 seconds starting, and if there is a undervoltage condition.

Conditions for Setting the DTC

The EBCM does not receive an RPM input signal after 1 second, after the engine has been started.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The electronic brake control module (EBCM) disables the antilock brake system (ABS)/traction control system (TCS)/vehicle stability enhancement system (VSES)/dynamic rear proportion (DRP) for the duration of the ignition cycle.
- A malfunction DTC is set.
- The traction control system (TCS) is disabled.

Conditions for Clearing the MIL/DTC

- The condition for the DTC is no longer present in the last 100 ignition cycles and no DTCS have been detected.
- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.

Diagnostic Aids

- Perform a thorough inspection of the PCM, ECM, and EBCM connector X1 wiring. Watching for poor terminal contact, the presence of corrosion, and damaged terminals. Perform a thorough inspection of the connectors. Failure to carefully and fully inspect the wiring and the connectors may result in misdiagnosis. Misdiagnosis causes part replacement with the malfunction still present.
- Ensure both the PCM or ECM connector X1 and the EBCM connector are properly retained when connected or reconnected.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference**

Component Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Engine ON, check the engine speed RPM in VSES scan tool data, vary the engine RPM with the throttle while observing the instrument panel (I/P) tachometer. The I/P tachometer should change with engine speed RPM. If the I/P tach does not work correctly, replace the PCM or ECM. Refer to **Control Module References** .

Circuit/System Testing

1. Ignition OFF, disconnect connector X1 from the powertrain control module (PCM) terminal or engine control module (ECM). Disconnect connector X1 from the electronic brake control module (EBCM).
2. Test for less than 5 ohms on the engine speed signal circuit, terminal 11 of the EBCM and ground.
 - o If greater than the specified value, test the signal circuit terminal 11 for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Test for infinite resistance between the engine speed signal circuit terminal 11 of the EBCM and ground.
 - o If not the specified value, test the engine speed signal circuit terminal 11 for a short to ground.
4. Ignition ON, test for 2 volts on the engine speed signal circuit terminal 11 of the EBCM
 - o If greater than the specified value, test the signal circuit terminal 11 for a short to voltage. If the circuit tests normal, replace the EBCM.

Repair Procedures

Control Module References for EBCM, PCM, or ECM replacement, setup, and programming

Repair Verification

1. Verify all connectors are reconnected.
2. With the scan tool, clear the DTC.
3. Disconnect the scan tool from the data link connector (DLC).
4. Engine ON, test for DTC C0236 to reset.
 - o If the DTC or DTCs is set, program the EBCM refer to **Control Module References** . If the DTC or DTCs resets, replace the EBCM.

DTC C0240

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0240**

ECM Traction Control Not Allowed

Circuit/System Description

The engine control module (ECM) or powertrain control module (PCM), monitors various parameters and will not allow traction control system (TCS) operation if any parameter falls outside a specified range.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 9 volts.

Conditions for Setting the DTC

The ECM or PCM sends a class 2 serial data message to the electronic brake control module (EBCM) indicating that torque reduction is temporarily not allowed.

Action Taken When the DTC Sets

- A DTC C0240 is stored.
- The EBCM disables the TCS/vehicle stability enhancement system (VSES), until the DTC becomes a history DTC.
- The traction control off indicator turns ON.
- The antilock brake system (ABS) remains functional.
- The Stability off indicator is turned ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

This DTC indicates that there are no problems in the ABS or TCS. Diagnose any DTCs that are set in the ECM or PCM.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views**

Description and Operation

ABS Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for Scan Tool Information

DTC C0241 OR P0856

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0241

Powertrain Control Module (PCM) Indicated Request Torque Malfunction

DTC P0856

Traction Control Torque Request Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
ECM/PCM Requested Torque Signal Circuit	C0241	P0856	C0241	-

Circuit Description

The EBCM and the powertrain control module PCM or engine control module ECM simultaneously control the traction control. The EBCM sends a Requested Torque message via pulse width modulated (PWM) signal to the PCM/ECM to deliver. Normal values are between 10 and 90 percent duty cycle. The signal should be at least 90 percent when traction control is not active and at lower values during traction control activations. The PCM/ECM supplies the pull up voltage that the EBCM switches to ground to create the signal.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The PCM/ECM diagnoses the requested torque PWM signal circuit and sends a class 2 serial data message to the

EBCM indicating a fault is present. A fault exists in the circuit if the PCM/ECM detects one of the following conditions:

- The requested torque PWM signal is less than 5 percent duty cycle or greater than 95 percent duty cycle.
- The requested torque PWM signal is not present for 10 seconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/TCS/VSES/DRP for the duration of the ignition cycle.
- A malfunction DTC will set.
- The ABS indicator turns ON.
- The Stability Off indicator turns ON.
- The antilock brake system (ABS) remains functional.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Check both the EBCM, PCM, and ECM grounds, ensuring that each ground is clean and torqued to the proper specification.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References for Scan Tool Information****Circuit/System Verification**

Engine ON, verify the scan tool Torque Request signal parameter in the PCM or ECM scan tool data list.

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- The specified value should be less than 100 percent.

Circuit/System Testing

1. Disconnect the harness connector terminal 27 (ECM) or terminal 25 (PCM) at the EBCM.
2. Ignition ON, test for 4.7 - 4.8 volts between the requested torque signal circuit Connector C2 terminal 15 (ECM) or Connector C1 terminal 15 (PCM) and ground.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the PCM/ECM.
 - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the PCM/ECM.
3. If all circuits test normal, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM, PCM, or ECM replacement, setup, or programming

DTC C0244 OR P1689

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0244 00

Pulse Width Modulated (PWM) Delivered Torque

DTC P1689

Traction Control Delivered Torque Output Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Pulse Width Modulated (PWM) Delivered Torque Signal Circuit	C0244 00	C0244 00	C0244 00	-
Traction Control Delivered Torque Signal Circuit	P1689	P1689	P1689	-

Circuit Description

Traction control is simultaneously controlled by the electronic brake control module (EBCM) and the powertrain control module (PCM)/engine control module (ECM). The PCM/ECM sends DELIVERED TORQUE message via a Pulse Width Modulated (PWM) signal to the PCM/ECM confirming the delivered torque level for proper Traction Control system operation. The EBCM supplies the pull up voltage.

Conditions for Running the DTC

- The ignition is ON.
- The DTC can be set after system initialization.

Conditions for Setting the DTC

A malfunction is detected if one of the following conditions exist:

DTC C0244 can be set anytime when ignition voltage is present. A malfunction exists if the PWM signal is out of range or no signal is received for a period of 2 seconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the TCS/VSES for the duration of the ignition cycle.
- A malfunction DTC will set.
- The Traction Control Off is turned on. The ABS remains functional.
- The Stability Off indicator is turned on.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present. The DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- Inspect the grounds of both the PCM/ECM and the EBCM, ensuring each ground is clean and torqued to the proper specification.
- It is important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- If an intermittent malfunction exists refer to **Checking Aftermarket Accessories**.
- possible causes for DTC C0244 to set:
 - Open in the Torque delivered Control circuit.
 - Torque Delivered Control circuit shorted to ground or voltage.
 - Communication frequency problem.
 - Communication duty cycle problem.
 - Torque Delivered Control circuit has a wiring problem, terminal corrosion, or poor connections.
 - EBCM not receiving information from the PCM/ECM.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation**

ABS Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Engine ON, observe the scan tool delivered torque signal duty cycle from the PCM/ECM to the EBCM in the PCM or ECM scan tool data list. The displayed value should be 90 percent.

Circuit/System Testing

Ignition ON, with a DMM test for battery voltage of the delivered torque signal circuit between the EBCM and the PCM/ECM and ground.

- If less than the specified range, test the delivered torque signal circuit for an open/high resistance, and short to ground. If the circuit tests normal, replace the EBCM.
- If greater than the specified range, test the delivered torque signal circuit for a short to voltage. If the circuit tests normal, replace the PCM/ECM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM, PCM or ECM replacement, setup, and programming

DTC C0245

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0245 00

Wheel Speed Sensor Frequency Error

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Wheel Speed Sensor Frequency Circuit	-	-	-	C0245 00

Circuit/System Description

As the wheel spins, the wheel speed sensor produces an AC signal. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 9 volts.
- Vehicle must be moving at a speed less than 14.5 km/h (9 mph).
- No wheel speed sensor faults exist.
- Brake is not applied.
- Vehicle is not cornering.
- No wheel spinning is detected.

Conditions for Setting the DTC

- Wheel speed differences between one wheel and the others is greater than 25 percent.
- This DTC will set when the EBCM cannot specifically identify which wheel speed sensor (WSS) is causing the malfunction. If the EBCM can identify the specific WSS causing the malfunction, DTC C0245 will become a history DTC, and the DTC associated with the sensor DTC C0036, C0041, C0046, C0051, or DTC C0056 will be set concurrent with DTC C0245.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- Antilock brake system (ABS), traction control system (TCS) and vehicle stability enhancement system (VSES) are inhibited.
- The ABS indicator turns ON.
- The Stability OFF indicator turns ON.
- The red BRAKE warning indicator turns ON.
- A malfunction DTC will set.

Conditions for Clearing the MIL/DTC

- The condition for the DTC is no longer present.
- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.

Diagnostic Aids

- Faulty wheel speed sensor will not set this DTC.
- A vehicle using a space saver spare will not set this code.
- If the customers comments reflect that the amber ABS/TCS indicator is on only during moist environmental conditions (rain, snow, vehicle wash), inspect all the wheel speed sensor circuitry for signs of water intrusions. If the DTC is not current, clear all DTCs and simulate the effects of water intrusion by using the following procedure:
 1. Spray the suspected area with a five percent saltwater solution. Add 2 teaspoons of salt to 12 ounces of water to make five percent saltwater solution.
 2. Test drive the vehicle over various road surfaces (bumps, turns, etc.) above 40 km/h (25 mph) for at least 30 seconds.
 3. If the DTC returns, replace the suspected harness.

If an intermittent malfunction exists refer to **Testing for Intermittent Conditions and Poor Connections** .

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

Inspect for one tire that has improper air pressure or improper size.

DTC C0252**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0252**

Vehicle Stability Enhancement System (VSES) Sensors Uncorrected

Circuit/System Description

The electronic brake control module (EBCM) controls the vehicle stability enhancement system (VSES) by monitoring the inputs of the yaw rate/lateral accelerometer sensor, and steering wheel angle sensor. The readings are compared to an internal calibrated value so it knows if the vehicle is having an instability condition to activate the VSES. When the readings indicate a VSES event is occurring longer than 10 seconds is not possible under normal conditions. The yaw/lateral sensor is a combination sensor in one component.

Conditions for Running the DTC

- The steer angle has been centered.
- The VSES is active.
- The direction, understeer or oversteer, of the yaw rate error has not changed.

- The lateral acceleration is less than 0.5 grams.

Conditions for Setting the DTC

One of the following conditions occur:

- The VSES is engaged for 10 seconds with the yaw rate error always in either understeer or oversteer. Under this condition, this DTC will set by itself.
- The yaw rate error is greater than 10 degrees/second for 5 seconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the antilock brake system (ABS)/traction control system (TCS)/VSES and for the duration of the ignition cycle.
- A malfunction DTC will set.
- The ABS indicator turns ON.
- The Stability Off indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- Using a scan tool

Diagnostic Aids

IMPORTANT: It is important to check the wiring harness connections to the following items:

- EBCM
- Brake pressure sensor
- Steering angle sensor
- Yaw/lateral accelerometer sensor
- LF wheel speed sensor (WSS)
- RF WSS
- LR WSS
- RR WSS
- During diagnosis, park the vehicle on a level surface.
- Inspect the vehicle for proper alignment. The car should not pull in either direction while driving straight on a level surface.
- Find out from the customer the conditions under which the DTC was set. This information will help to duplicate the failure.
- The Snapshot function on the scan tool can help find an intermittent DTC.

Reference Information**Schematic Reference****Antilock Brake System Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Verify that DTC C0186, C0196, C0253, or C0710 is not set.

- If any of the DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle .

Repair Procedures

Diagnostic Test Drive

Repair Verification

Ignition ON, observe the ABS DTCS function in EBCM VSES scan tool data display.

- Does any DTC other than DTC C0252 reset. Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
- Does DTC C0252 reset, refer to Diagnostic Test Drive.

DTC C0253

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DTC Descriptor

DTC C0253

Centering Error

Circuit/System Description

The electronic brake control module (EBCM) receives serial data message inputs from the steering wheel position sensor identifying the position and direction of the steering wheel rotation.

Conditions for Running the DTC

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- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

If the steering angle sensor controller area network (CAN) message or the EBCM indicates an uncentered sensor

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/traction control system (TCS)/vehicle stability enhancement system (VSES) and for the duration of the ignition cycle.
- A malfunction DTC will set.
- The ABS indicator turns ON.
- The Stability indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Perform the steering angle sensor centering procedure.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC C0186, C0196, C0252, or C0710 is not set.
 - If any of the DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. With the scan tool perform the Steering Angle Sensor Centering, refer to **Steering Angle Sensor Centering**.
3. Operate the vehicle within the conditions for setting, and verify the DTC does not reset.

- If the DTC sets, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Diagnostic Test Drive**
- **Steering Angle Sensor Centering**
- **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0710

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0710 00

Steering Position Signal

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Steering Angle Sensor Ignition Voltage Circuit	1	1	-	-
Steering Angle Sensor Ground	C0710 00	C0710 00	-	-
Steering Angle Sensor Communication Signal Bus+	C0710 00	C0710 00	C0710 00	-
Steering Angle Sensor Communication Signal Bus-	C0710 00	C0710 00	C0710 00	-
1. Circuit Inoperative				

Circuit/System Description

The electronic brake control module (EBCM) receives CAN message inputs from the steering wheel position sensor identifying the position and direction of the steering wheel rotation.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 9 volts.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

A malfunction is detected if one or more of the following conditions exist:

- The steering angle sensor detects an internal malfunction and sends a controller area network (CAN) message

to the EBCM.

- If the offset value is higher than 15 degrees, a malfunction is detected. Malfunction time depends on driving distance, vehicle speed, and the amount of malfunctioning steering angle signal.
- Rapid changes of the steering angle sensor signal cannot occur under normal driving conditions. If the signal change is higher than 2,000 degrees per second or steering angle acceleration is higher than 37,500 degrees per second squared, a malfunction is detected.
- A reference steering angle signal based on a vehicle model is used to check the actual steering angle. If the measured steering angle varies from the reference steering angle by more than a predetermined value, a malfunction is detected.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the traction control system (TCS)/vehicle stability enhancement system (VSES) and for the duration of the ignition cycle.
- A malfunction DTC will set.
- The Stability Off indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Perform the steering angle sensor centering procedure.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. With the scan tool perform the Steering Angle Sensor Centering.
2. Verify the DTC does not reset.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the steering angle sensor.
2. Test for less than 1 ohm between the low reference circuit terminal 1 and ground.
 - If greater than the specified range, test for an open/high resistance in the ground circuit. If the circuit tests normal, replace the EBCM.
3. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal 2 and ground.
 - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
4. Ignition OFF, disconnect the harness connector at the EBCM.
5. Ignition ON, test for 0 volts between the communication circuit connector X1 terminal 19 and ground.
 - If greater than the specified value, test the communication circuit for a short to voltage.
6. Test for 0 volts between the communication circuit connector X1 terminal 11 and ground.
 - If greater than the specified value, test the communication circuit for a short to voltage.
7. Ignition OFF, test for infinite resistance between the communication circuit connector X1 terminal 19 and ground.
 - If not the specified value, test the communication circuit for a short to ground.
8. Test for infinite resistance between the communication circuit connector X1 terminal 11 and ground.
 - If not the specified value, test the communication circuit for a short to ground.
9. Test for less than 1 ohm between the communication circuit connector X1 terminal 19 and terminal 3.
 - If greater than the specified range, test the communication circuit for an open/high resistance.
10. Test for less than 1 ohm between the communication circuit connector X1 terminal 11 and terminal 4.
 - If greater than the specified range, test the communication circuit for an open/high resistance.
11. Test for infinite resistance between the communication circuit connector X1 terminal 19 and the communication circuit connector X1 terminal 11.
 - If not the specified value, test the communication circuits for a short together.
12. If all circuits test normal, replace the steering angle sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0870**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0870 00**

Device Voltage Reference Output 1 Circuit

Diagnostic Fault Information

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Brake Pressure Sensor Signal	C0870 00	-	C0870 00	-
Brake Fluid Pressure Sensor 5-Volt Reference Circuit	C0870 00	C0870 00	C0870 00	-
Brake Fluid Pressure Sensor Ground Circuit	-	C0870 00	-	-

Circuit Description

The brake pressure sensor reference voltage is monitored for an over or under voltage condition.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

A malfunction is detected if the supply voltage is above 5.6 volts or below 4.4 volts for more than 60 milliseconds.

Action Taken When the DTC Sets

- A malfunction DTC is set.
- The ABS, traction control system (TCS) and vehicle stability enhancement system (VSES) are disabled.
- The ABS, SERVICE VEHICLE SOON and Stability Off lamp indicators are ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- Using a scan tool.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Possible causes of this DTC are the following conditions:

- An open in the pressure sensor supply voltage circuit.
- A short to ground in the pressure sensor supply voltage circuit.
- A short to B+ in the pressure sensor supply voltage circuit.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation**

ABS Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool.

Circuit/System Testing

1. Ignition OFF, disconnect the EBCM harness connector at the brake fluid pressure sensor.
2. Ignition OFF, with a DMM test for less than 5.0 ohms between the brake fluid pressure sensor low reference circuit terminal 1 and ground.
 - If greater than the specified range, with the DMM test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, with a DMM test for 4.4-5.6 volts between the brake fluid pressure sensor 5-volt reference circuit terminal 3 and ground.
 - If less than the specified range, with the DMM test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
4. With the DMM, verify the brake pressure sensor signal range is less than 4.4 volts.
 - If greater than the specified value, test the signal circuit terminal 2 for a short to voltage. If the circuit tests normal, replace the EBCM.
5. Install a 3A fused jumper wire between the brake fluid pressure sensor signal circuit terminal 2 and the brake fluid pressure sensor 5-volt reference circuit terminal 3. With a DMM verify the voltage value is greater than 5.6 volts.
 - If less than the specified value, test the signal circuit terminal 2 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
6. If all circuits test normal, test or replace the brake fluid pressure sensor.

Component Testing

1. Install a 3A fused jumper wire between the brake fluid pressure sensor 5-volt reference terminal 3 and 5 volts. Install a jumper wire between the low reference terminal 1 and ground.
2. Sweep the sensor through the entire range while monitoring the resistance between the signal circuit terminal 2 and the low reference circuit terminal 1. The voltage should vary between 4.4-5.6 volts without any spikes or dropouts.
 - If not within the specified range or is erratic, replace the brake fluid pressure sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

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- **Brake Fluid Pressure Sensor Replacement**
- **Control Module References** for BCM or EBCM replacement, setup, and programming

DTC C0875

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0875 00

Device Voltage Reference Input 2 Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Yaw and Lateral Acceleration Sensor Signal	C0875 00	-	C0875 00	-
Yaw and Lateral Acceleration Sensor 5-Volt Reference	C0875 00	C0875 00	C0875 00	-
Yaw and Lateral Acceleration Sensor Ground	-	C0875 00	-	-

Circuit Description

The yaw rate sensor reference voltage is monitored for an over or under voltage condition.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

A malfunction is detected if the supply voltage is above 2.9 volts or below 2.1 volts for more than 200 milliseconds.

Action Taken When the DTC Sets

- A malfunction DTC is set.
- The traction control system (TCS) and vehicle stability enhancement system (VSES) are disabled.
- The SERVICE VEHICLE SOON and Stability Off lamp indicators are ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- Using a scan tool.

- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Possible causes of this DTC are the following conditions:

- An open in the yaw rate sensor supply voltage circuit.
- A short to ground in the yaw rate sensor supply voltage circuit.
- A short to B+ in the yaw rate sensor supply voltage circuit.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Testing**

1. Ignition OFF, disconnect the EBCM harness connector at the Yaw and Lateral Acceleration Sensor.
2. Ignition OFF, with a DMM test for less than 5.0 ohms of resistance between the Yaw and Lateral Acceleration Sensor low reference circuit terminal 6 and ground.
 - If greater than the specified range, with the DMM test the low reference terminal 6 circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, with a DMM test for 2.1-2.9 volts between the Yaw and Lateral Acceleration Sensor 5-volt reference circuit terminal 1 and ground.
 - If less than the specified range, with the DMM test the 5-volt reference circuit terminal 1 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
 - If greater than the specified range, with the DMM test the 5-volt reference circuit terminal 1 for a short to voltage. If the circuit tests normal, replace the EBCM.
4. With the DMM, verify the Yaw and Lateral Acceleration Sensor signal circuit terminal 4 range is less than 2.1 volts.
 - If greater than the specified value, test the signal circuit terminal 2 for a short to voltage. If the circuit tests normal, replace the EBCM.

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5. Install a 3A fused jumper wire between the Yaw and Lateral Acceleration Sensor signal circuit terminal 2 and the Yaw and Lateral Acceleration Sensor 5-volt reference circuit terminal 3. With a DMM verify the voltage value is greater than 2.9 volts.
 - o If less than the specified value, test the signal circuit terminal 2 for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
6. If all circuits test normal, test or replace the Yaw and Lateral Acceleration Sensor.

Component Testing

1. Install a 3A fused jumper wire between the Yaw and Lateral Acceleration Sensor 5-volt reference terminal 1 and 5 volts. Install a jumper wire between the low reference terminal 6 and ground.
2. Sweep the sensor through the entire range while monitoring the resistance between the signal circuit terminal 4 and the low reference circuit terminal 6. The voltage should vary between 2.1-2.9 volts without any spikes or dropouts.
 - o If not within the specified range or is erratic, replace the Yaw and Lateral Acceleration Sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC U1650

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC U1650 00

Steering Wheel Sensor CAN Malfunction

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
High Speed GM LAN Serial Data Bus+ (between the EBCM and the steering angle sensor)	U1650 00	-	U1650 00	-
High Speed GM LAN Serial Data Bus- (between the EBCM and the steering angle sensor)	U1650 00	-	U1650 00	-

Circuit Description

The controller area network (CAN) serial data circuit is a high speed serial data bus used to communicate information between the steering angle sensor and the electronic brake control module (EBCM). When the ignition switch is turned to the ON position, the module and the steering angle sensor begin to transmit data between each other.

The CAN bus circuit is monitored continuously after the ignition switch is turned to the ON position.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

Line Interruptions are detected by the CAN message monitor.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the traction control system (TCS)/vehicle stability enhancement system (VSES) and for the duration of the ignition cycle.
- A malfunction DTC will set.
- The Stability indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Possible causes of this DTC are as follows:

- CAN HI and CAN LO circuits shorted together
- CAN HI or CAN LO circuit shorted to ground
- CAN HI or CAN LO circuit shorted to voltage

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information

Circuit/System Verification

IMPORTANT: With a DMM, test the GM LAN Bus+ and GM LAN Bus- circuits between the EBCM and the steering angle sensor for being shorted together, shorted to voltage, and shorted to ground.

1. With the scan tool perform the Steering Angle Sensor Centering procedure in EBCM VSES scan tool special functions.
 - o If the steering angle sensor procedure is not successful, test or replace the steering angle sensor.
2. If DTC U1650 resets, test or replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Diagnostic Test Drive**
- **Steering Angle Sensor Centering**
- **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

DTC U1651

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC U1651 00

Steering Wheel Sensor Malfunction

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
High Speed GM LAN Serial Data Bus+ CAN HI Circuit (between the EBCM and the steering angle sensor)	-	U1651 00	-	-
High Speed GM LAN Serial Data Bus- CAN LO Circuit (between the EBCM and the steering angle sensor)	-	U1651 00	-	-
Steering Angle Sensor Ignition Circuit	-	1	-	-
Steering Angle Sensor Ground Circuit	-	1	-	-
1. Steering Angle Sensor Malfunction				

Circuit Description

The electronic brake control module (EBCM) monitors the received messages from the steering angle sensor for corruption or for missing messages.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 40 km/h (25 mph).

Conditions for Setting the DTC

The EBCM receives a corrupt or a missing message after 100 milliseconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the traction control system (TCS)/vehicle stability enhancement system (VSES) and for the duration of the ignition cycle.
- A malfunction DTC will set.
- The Stability Off indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Possible causes of this DTC are as follows:

- An open in the CAN HI or CAN LO circuit
- An open in the ignition circuit
- An open in the ground circuit
- Malfunctioning steering angle sensor
- Malfunctioning EBCM

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

IMPORTANT: With a DMM, test the following circuits for possible malfunction:

- GM LAN Bus+ CAN HI and GM LAN Bus- CAN LO circuits between the EBCM and the steering angle sensor for an open.
 - Steering angle sensor ground circuit for an open.
 - Steering angle sensor ignition circuit for an open.
1. With the scan tool perform the Steering Angle Sensor Centering procedure in EBCM VSES scan tool special functions.
 - If the steering angle sensor procedure is not successful, test or replace the steering angle sensor.
 2. Test drive the vehicle. Refer to **Diagnostic Test Drive**
 - If DTC U1651 resets, test or replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Diagnostic Test Drive**
- **Steering Angle Sensor Centering**
- **Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement**
- **Control Module References** for EBCM replacement, setup, and programming

SYMPTOMS - ANTILOCK BRAKE SYSTEM

IMPORTANT: The following steps must be completed before using the symptom tables.

1. Perform the **Diagnostic System Check - Vehicle** before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to **ABS Description and Operation**.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the antilock brake system. Refer to **Checking Aftermarket Accessories**.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the master cylinder reservoir for the proper brake fluid level.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections**.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **ABS Indicator Malfunction**
- **Traction Off Indicator Malfunction**

- **Stability System Disabled Indicator Always On**

ABS INDICATOR MALFUNCTION**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The instrument panel cluster (IPC) illuminates the antilock brake system (ABS) indicator by supplying ground to the lamp. The electronic brake control module (EBCM) sends a serial data messages to the IPC, in order to command the indicator ON or OFF.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

Ignition ON, command the ABS indicator in scan tool IPC scan tool data ON and OFF. Verify the ABS indicator lamp turns ON and OFF as commanded.

Circuit/System Testing**IMPORTANT: Diagnose all vehicle DTCs before using this diagnostic.**

With the scan tool, select instrument panel special functions Lamp Test. Command the instrument panel warning lamps OFF.

- If the ABS warning lamp does not turn OFF, replace the IPC.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for IPC replacement, setup, and programming

STABILITY SYSTEM DISABLED INDICATOR ALWAYS ON**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
EBCM Ground Circuit	1	-	-	-
1. VSES and TCS inoperative				

Circuit Description

The stability system disable indicator is controlled by the instrument cluster via class 2 serial data messages from the electronic brake control module (EBCM). When the instrument cluster sees a class 2 message from the EBCM that tells the instrument panel cluster (IPC) that the stability system is malfunctioning, the EBCM then disables vehicle stability enhancement system (VSES) and traction control system (TCS) and sends a message to the instrument cluster to turn the stability system disable indicator always on and TCS indicators ON. Each time the ignition is cycled from OFF to ON, the VSES is enabled:

The following conditions will cause the VSES/TCS indicators to illuminate:

- The EBCM has disabled the VSES/TCS due to a DTC.
- The instrument cluster bulb check-When the ignition switch is turned to ON, the VSES/TCS indicators will turn ON for approximately 3 seconds and then turn OFF.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****ABS Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

1. Ignition ON, command the scan tool IPC display test ON and OFF. The StabiliTrak indicator should turn ON and OFF.
 - o If the indicator does not turn ON and OFF, replace the IPC.
2. Observe the scan tool BCM Traction Control Switch parameter while pressing and releasing the traction control switch. The reading should change between Active and Inactive.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the traction control switch.
2. Test for less than 1 ohm between the ground circuit terminal A and ground.
 - o If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify the scan tool Traction Control Switch parameter is Inactive.
 - o If not the specified value, test the signal circuit terminal C for a short to ground. If the circuit tests normal, replace the BCM.
4. Install a 3A fused jumper wire between the signal circuit terminal C and the ground circuit terminal 3. Verify the scan tool Traction Control Switch parameter is Active.
 - o If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the BCM.
5. If all circuits test normal, test or replace the traction control switch.

Component Testing

1. Ignition OFF, disconnect the harness connector at the traction control switch.
2. Test for infinite resistance between the signal terminal A and the ground terminal C with the switch in the open position.
 - o If not the specified value, replace the traction control switch.
3. Test for less than 3 ohms between the signal terminal A and the ground terminal C with the switch in the closed position.
 - o If greater than the specified range, replace the traction control switch.

Repair Procedures

- **Electronic Traction Control Switch Replacement**
- **Control Module References** for BCM or IPC replacement, setup, and programming

Repair Verification

Ignition OFF for 5 seconds, Ignition ON, observe that the ABS, TCS, and Low Traction indicators function by illuminating for 3 seconds then turns OFF. This is the bulb self test that operates upon every ignition key start cycle.

TRACTION OFF INDICATOR MALFUNCTION**Diagnostic Instructions**

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- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Traction Control Switch (TCS) Signal Circuit	1	2	-	-
Traction Control Switch (TCS) Ground Circuit	-	2	-	-
1. TCS OFF IPC switch indicator bulb always ON 2. TCS OFF IPC switch indicator bulb inoperative				

Circuit Description

The TRAC OFF indicator is controlled by the instrument cluster via class 2 serial data messages from the electronic brake control module (EBCM). When the body control module (BCM) sees the traction control switch input grounded through the momentary traction control switch, it sends a class 2 message to the EBCM that tells the EBCM that the traction control switch has been pressed. The EBCM then disables traction control and sends a message to the instrument cluster to turn the TRAC OFF indicator ON. Each time the ignition is cycled from OFF to ON, the traction control system is enabled.

The following conditions will cause the TRAC OFF indicator to illuminate:

- The EBCM has disabled the traction control system (TCS) due to a DTC.
- The driver manually disabling the TCS via the traction control switch
- The instrument cluster bulb check-When the ignition switch is turned to ON, the TRAC OFF indicator will turn ON for approximately 3 seconds and then turn OFF.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information**Circuit/System Verification**

Ignition ON, observe the scan tool EBCM VSES active data display parameter while pressing the IP TCS switch the reading should change between scan tool YES/NO switch value and YES/NO switch value.

Circuit/System Testing

IMPORTANT: Diagnose all vehicle DTCs before using this diagnostic.
The malfunction must be present during diagnosis in order to prevent unnecessary parts replacement.

1. Ignition OFF, disconnect the BCM harness at the traction control switch (TCS).
2. Ignition ON, verify that a test lamp illuminates between the traction control switch signal circuit terminal C and ground.
 - If the test lamp does not illuminate, test the TCS control circuit for a short to ground or an open/high resistance. If the circuit tests normal and the control circuit fuse is open, test the signal circuit terminal C for a short to ground.
3. Verify the scan tool BCM TCS switch data display parameter is Released value.
 - If not the specified value, test the signal circuit terminal C for a short to voltage. If the circuit tests normal, replace the body control module (BCM).
4. Install a 3A fused jumper wire between the TCS switch signal circuit terminal C and ground. Verify the scan tool BCM TCS switch data display is Pressed value.
 - If not the specified value, test the signal circuit terminal C for an open/high resistance. If the circuit tests normal, replace the BCM.
5. If all circuits test normal, test or replace the traction control TCS switch.

Component Testing

1. Ignition OFF, disconnect the BCM harness connector at the TCS switch control circuit terminal C.
2. Test for infinite resistance between the TCS switch signal circuit terminal C and ground with the TCS switch in the Released or open position.
 - If not the specified value, replace the TCS switch.
3. Test for less than 5 ohms between the TCS switch control circuit terminal C and ground with the TCS switch in the Pressed or closed position.
 - If greater than the specified range, replace the TCS switch.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for BCM replacement, setup, and programming
- **Electronic Traction Control Switch Replacement**

REPAIR INSTRUCTIONS**ANTILOCK BRAKE SYSTEM AUTOMATED BLEED PROCEDURE****Bleeding the ABS System**

CAUTION: Refer to Brake Fluid Irritant Caution .

NOTE: Refer to **Brake Fluid Effects on Paint and Electrical Components Notice** .

Perform a manual or pressure bleeding procedure. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** . If the desired brake pedal height results are not achieved, perform the automated bleed procedure below.

The procedure cycles the system valves and runs the pump in order to purge the air from the secondary circuits normally closed off during normal base brake operation and bleeding. The automated bleed procedure is recommended when air ingestion is suspected in the secondary circuits, or when the BPMV has been replaced.

Automated Bleed Procedure

NOTE: The Auto Bleed Procedure may be terminated at any time during the process by pressing the EXIT button. No further Scan Tool prompts pertaining to the Auto Bleed procedure will be given. After exiting the bleed procedure, relieve bleed pressure and disconnect bleed equipment per manufacturers instructions. Failure to properly relieve pressure may result in spilled brake fluid causing damage to components and painted surfaces.

1. Raise the vehicle on a suitable support. Refer to **Lifting and Jacking the Vehicle** .
2. Remove all four tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
3. Inspect the brake system for leaks and visual damage. Refer to **Brake Fluid Loss** or **Symptoms - Hydraulic Brakes** . Repair or replace as needed.
4. Inspect the battery state of charge. Refer to **Battery Inspection/Test** .
5. Install a scan tool.
6. Turn ON the ignition, with the engine OFF.
7. With the scan tool, establish communications with the EBCM. Select Special Functions. Select Automated Bleed from the Special Functions menu.
8. Bleed the base brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** .
9. Follow the scan tool directions until the desired brake pedal height is achieved.
10. If the bleed procedure is aborted, a malfunction exists. Perform the following steps before resuming the bleed procedure:
 - If a DTC is detected, refer to **Diagnostic System Check - Vehicle** .
 - If the brake pedal feels spongy, perform the conventional brake bleed procedure again. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** .
11. When the desired pedal height is achieved, press the brake pedal in order to inspect for firmness.
12. Remove the scan tool.
13. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
14. Inspect the brake fluid level. Refer to **Master Cylinder Reservoir Filling** .
15. Road test the vehicle while inspecting that the pedal remains high and firm.

STEERING ANGLE SENSOR CENTERING

The steering angle sensor does not require centering often. Centering of the steering angle sensor might be required after certain service procedures are performed. Some of these procedures are as follows:

- Steering gear replacement
- Steering column replacement

- Steering angle sensor replacement
- Intermediate shaft replacement
- Antilock brake system (ABS) controller replacement
- Collision or other physical damage
- Engine cradle replacement

The steering angle sensor centering procedure can be preformed with a scan tool in the automated center procedure by the following:

1. Using the steering wheel, align the front wheels forward.
2. Set the transmission in the park position.
3. Install the scan tool to the data link connector (DLC).
4. Turn the ignition switch ON, with the engine OFF.
5. Select ABS/traction control system (TCS)/vehicle stability enhancement system (VSES), special function output test, and automated centering procedure.
6. Follow the scan tool directions to complete the automated centering procedure.
7. Clear any DTCs that may be set. Perform the Diagnostic System Check to verify no current DTCs. Refer to **Diagnostic System Check - Vehicle**.
8. Centering of the steering angle sensor is complete.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT

Removal Procedure

CAUTION: Refer to **Brake Fluid Irritant Caution**.

NOTE: Refer to **Brake Fluid Effects on Paint and Electrical Components Notice**.

NOTE: To prevent equipment damage, never connect or disconnect the wiring harness connection from the EBCM with the ignition switch in the ON position.

1. Turn the ignition switch to the OFF position.
2. Remove the fuel injector sight shield, 3.8L engine only. Refer to **Fuel Injector Sight Shield Replacement**.
3. Remove the front fender upper diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement**.
4. Remove the air cleaner intake duct. Refer to **Air Cleaner Inlet Duct Replacement** for the 3.8L engine or **Air Cleaner Inlet Duct Replacement** for the 3.6L (LY7) engine.

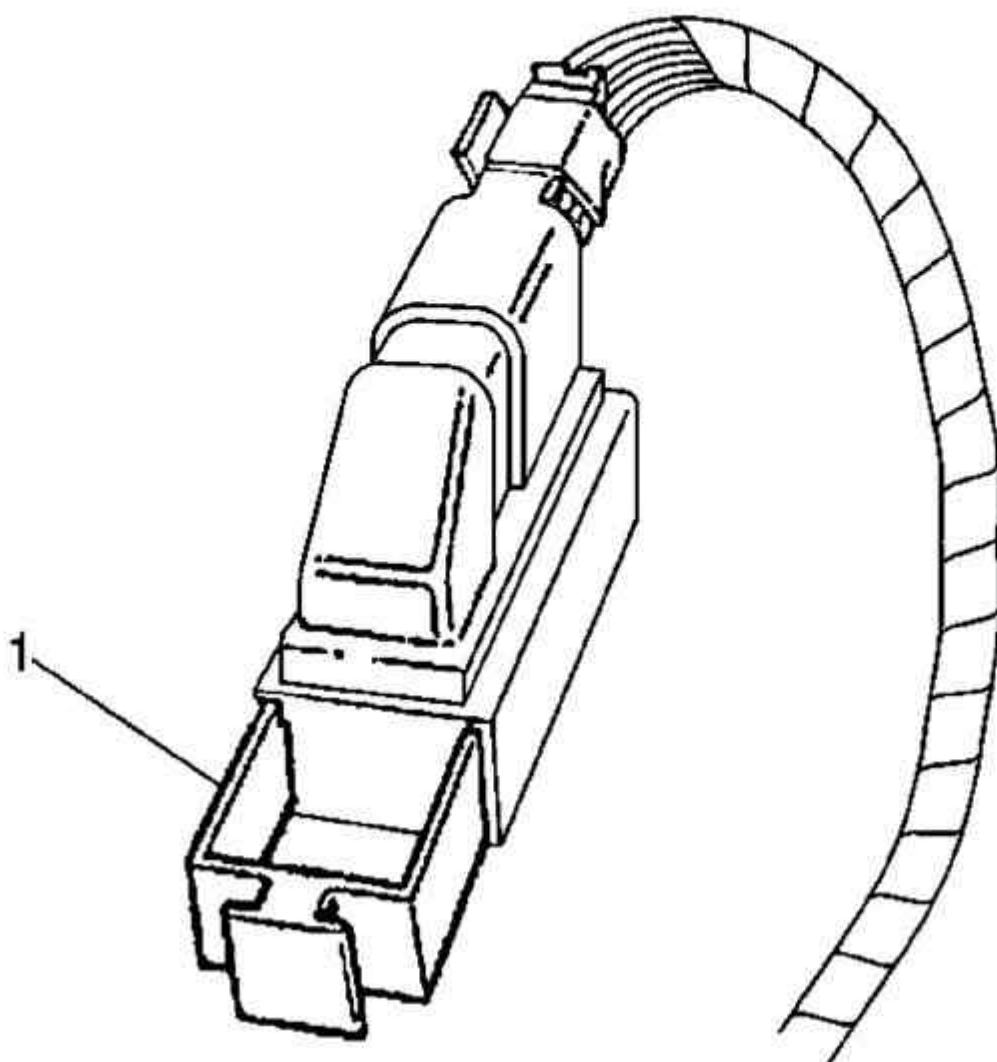


Fig. 5: Identifying EBCM Harness Connector
Courtesy of GENERAL MOTORS CORP.

5. Disengage the locking tab (1) from the electronic brake control module (EBCM) harness connector.
6. Disconnect the EBCM harness connector.
7. Remove any dirt/debris from the assembly.

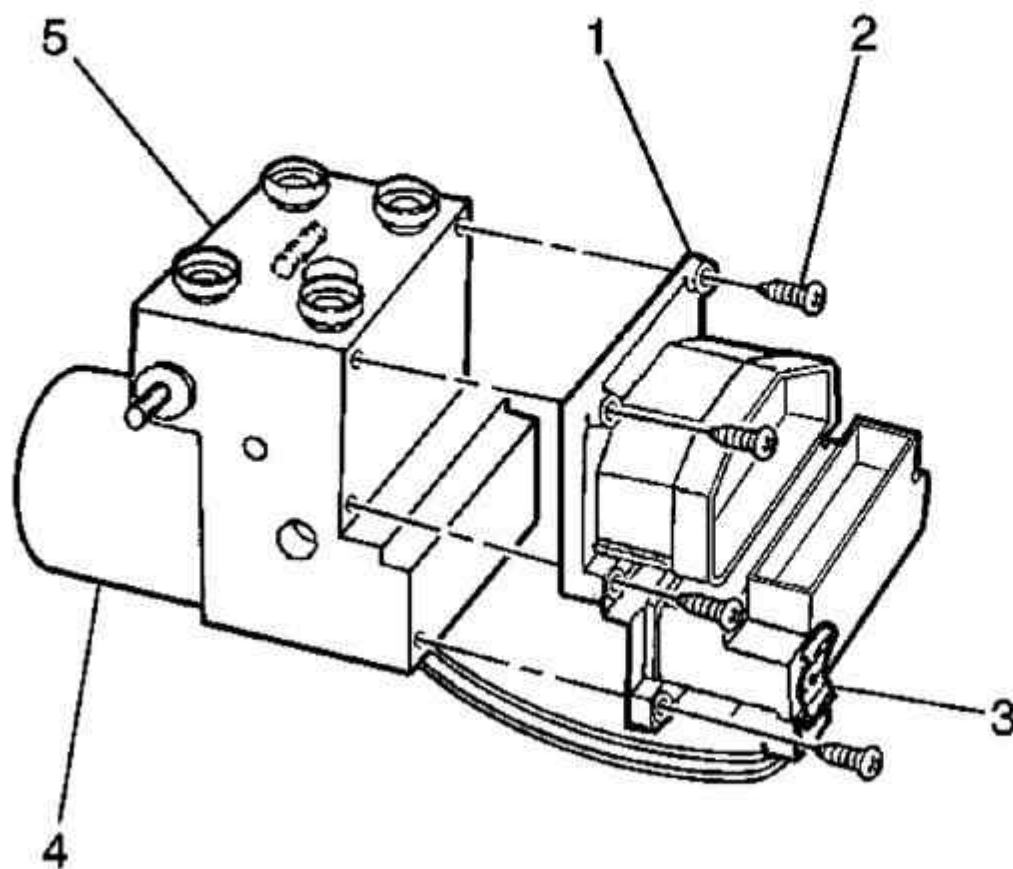


Fig. 6: View Of EBCM To BPMV Screws
Courtesy of GENERAL MOTORS CORP.

8. Remove the 6 EBCM to brake pressure modulator valve (BPMV) retaining bolt/screws.

IMPORTANT: Do not pry apart using a tool. Be careful not to damage BPMV surface.

IMPORTANT: Care must be taken not to damage the solenoid valves when the EBCM is removed from the BPMV.

9. Separate the EBCM (1) from the BPMV (4) by gently pulling apart until separated.
10. Disconnect the pump motor connector (3) at the bottom of the EBCM.

Installation Procedure

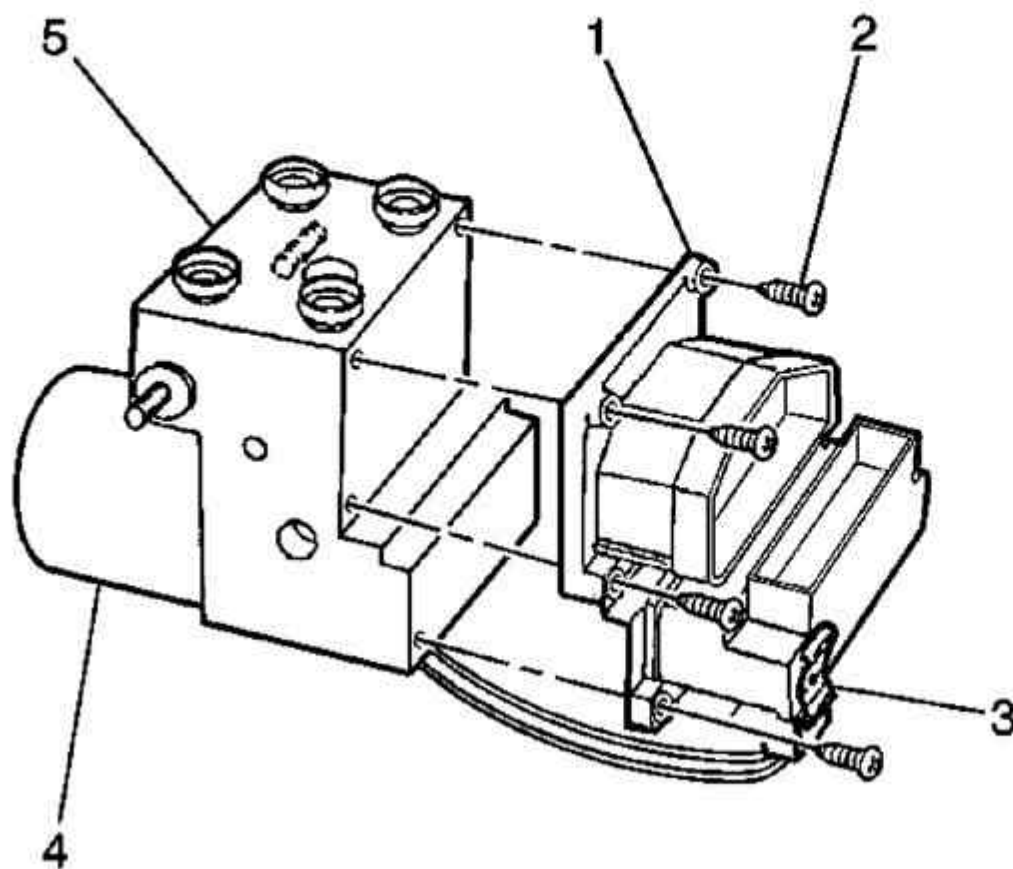


Fig. 7: View Of EBCM To BPMV Screws
Courtesy of GENERAL MOTORS CORP.

1. Connect the pump motor connector (3) to the bottom of the EBCM.
2. Install the EBCM (1) to the BPMV (4).

NOTE: Refer to Fastener Notice .

3. Install the 6 EBCM to BPMV retaining bolt/screws (2).

Tighten: Tighten the retaining bolt/screws to 2.9 N.m (26 lb in).

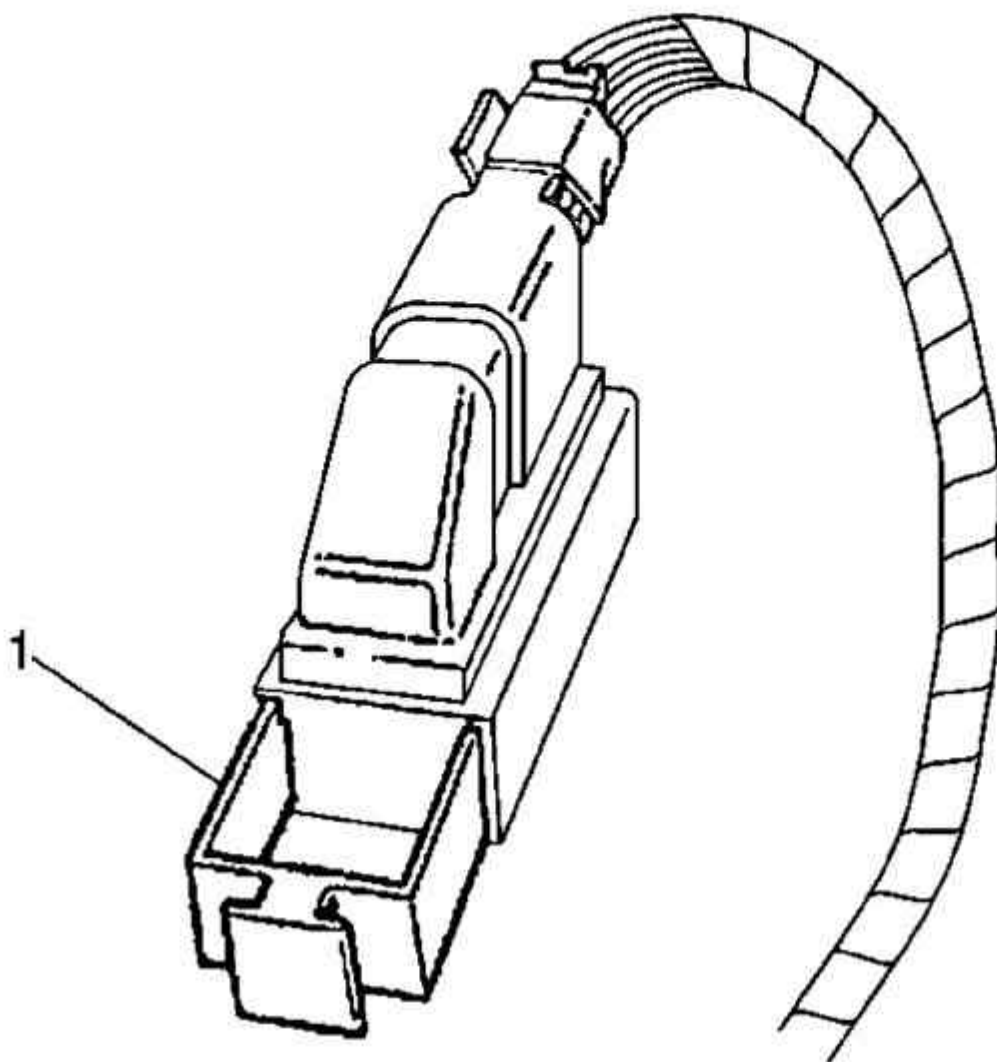


Fig. 8: Identifying EBCM Harness Connector
Courtesy of GENERAL MOTORS CORP.

4. Connect the EBCM harness connector.
5. Reengage the locking tab (1) to the EBCM harness connector.
6. Install the air cleaner intake duct. Refer to **Air Cleaner Inlet Duct Replacement** for the 3.8L engine or **Air Cleaner Inlet Duct Replacement** for the 3.6L (LY7) engine.
7. Install the front fender upper diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement**.
8. Install the fuel injector sight shield, 3.8L engine only. Refer to **Fuel Injector Sight Shield Replacement**.
9. Turn the ignition switch to the RUN position, do not start engine.
10. Perform the **Diagnostic System Check - Vehicle**.
11. Refer to **Control Module References** for programming and setup information.

BRAKE PRESSURE MODULATOR VALVE REPLACEMENT

Removal Procedure

CAUTION: Refer to **Brake Fluid Irritant Caution**.

CAUTION: For safety reasons, the Brake Pressure Modulator Valve (BPMV) must not be repaired; the complete unit must be replaced. With the exception of the EBCM/EBTCM, no screws may be loosened. If screws are loosened, it will not be possible to get the brake circuits leak-tight and personal injury may result.

NOTE: Refer to Brake Fluid Effects on Paint and Electrical Components Notice .

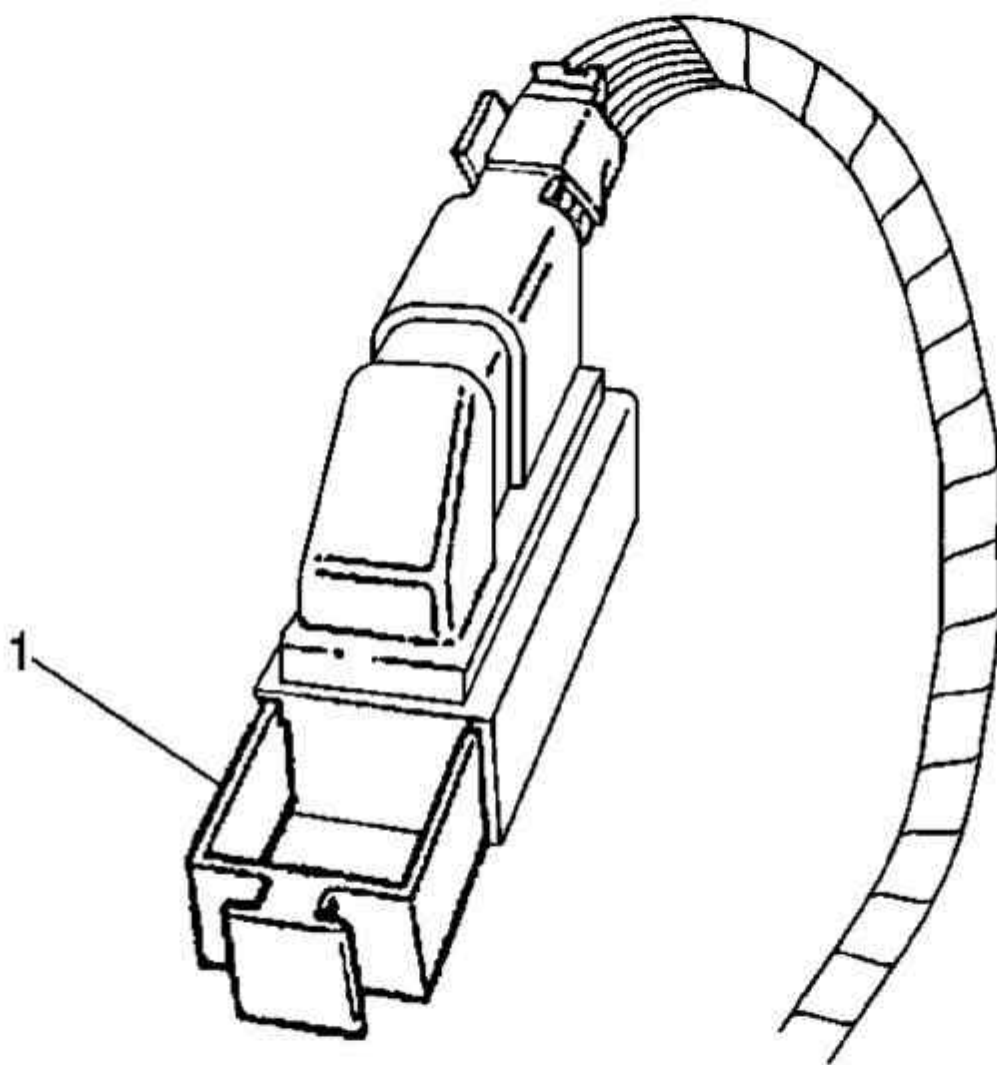


Fig. 9: Identifying EBCM Harness Connector
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition switch to the OFF position.
2. Pull out lock tab (1) from electronic brake control module (EBCM) harness connector.
3. Disconnect the EBCM harness connector.

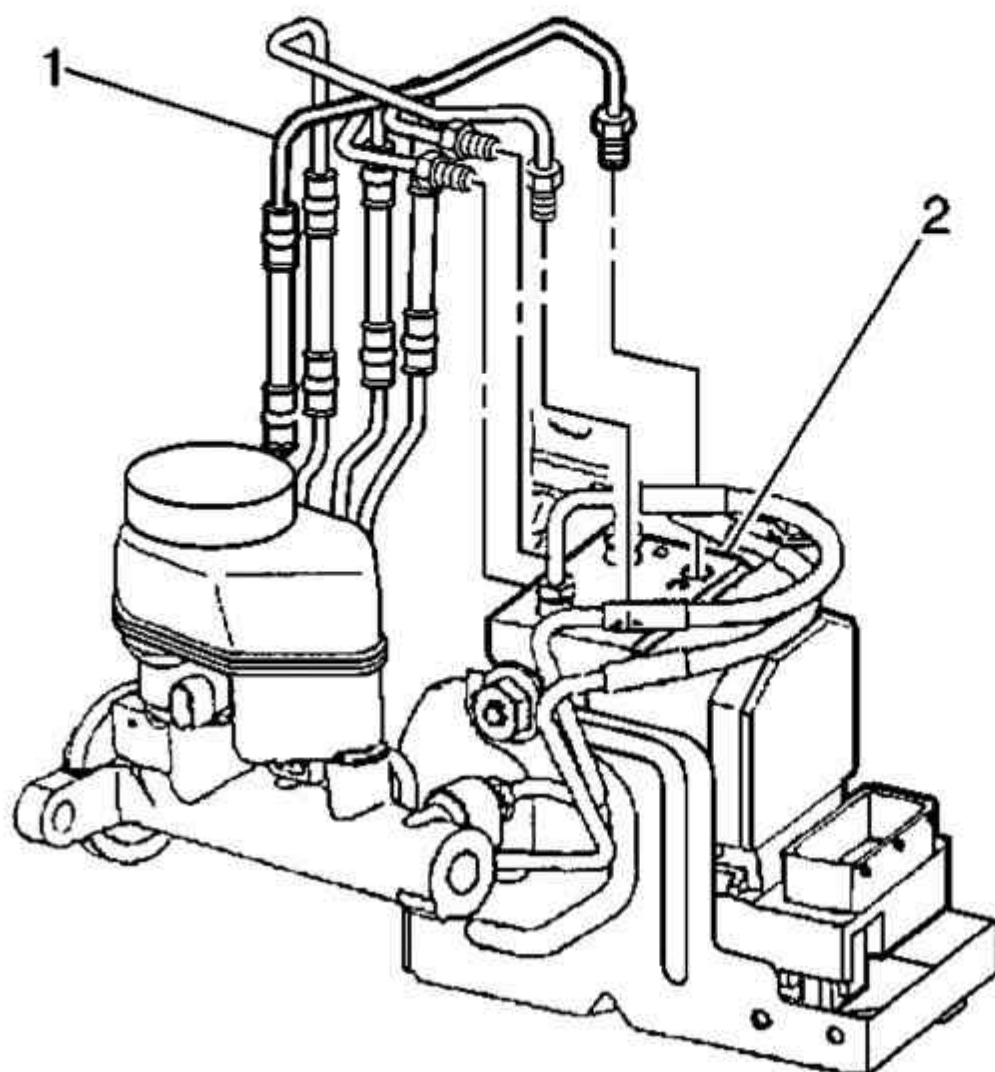


Fig. 10: Identifying Wheel Cylinder Brake Pipes & BPMV
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Note the locations of the brake pipes in order to aid installation.

4. Disconnect the wheel cylinder brake pipes (1) from the BPMV (2).

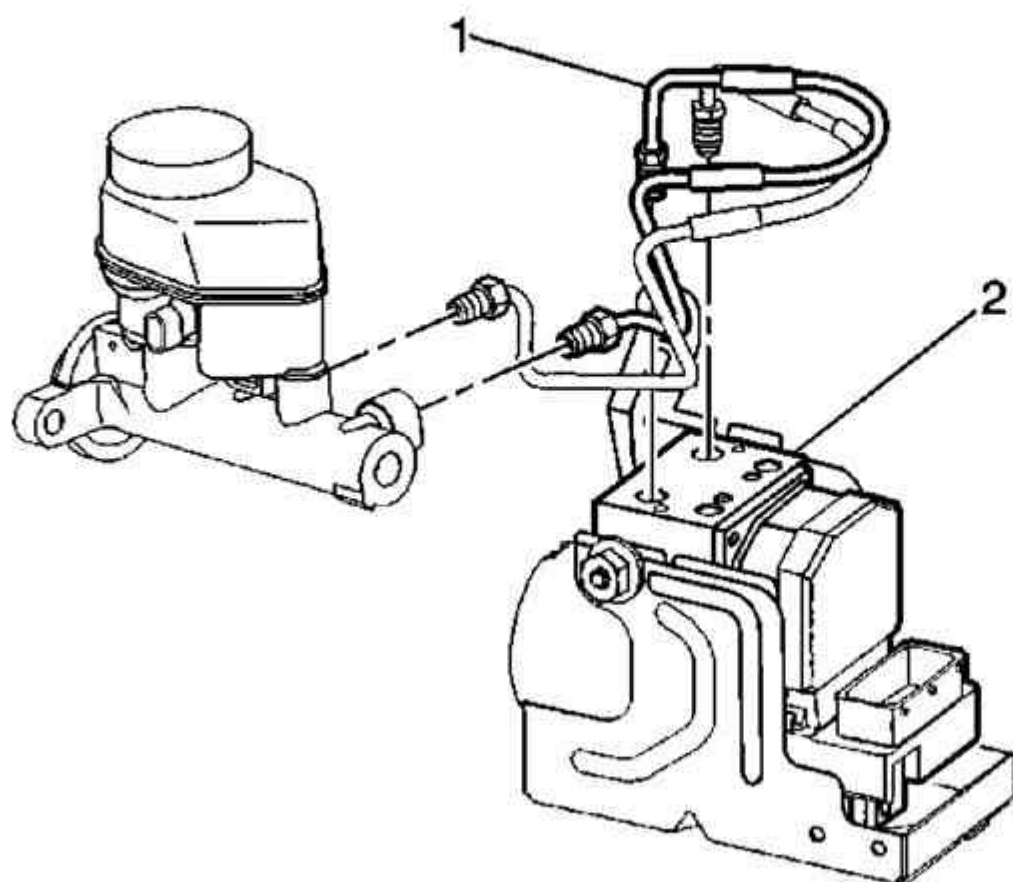


Fig. 11: Identifying Master Cylinder Brake Pipes & BPMV
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the master cylinder brake pipes (1) from the BPMV (2).

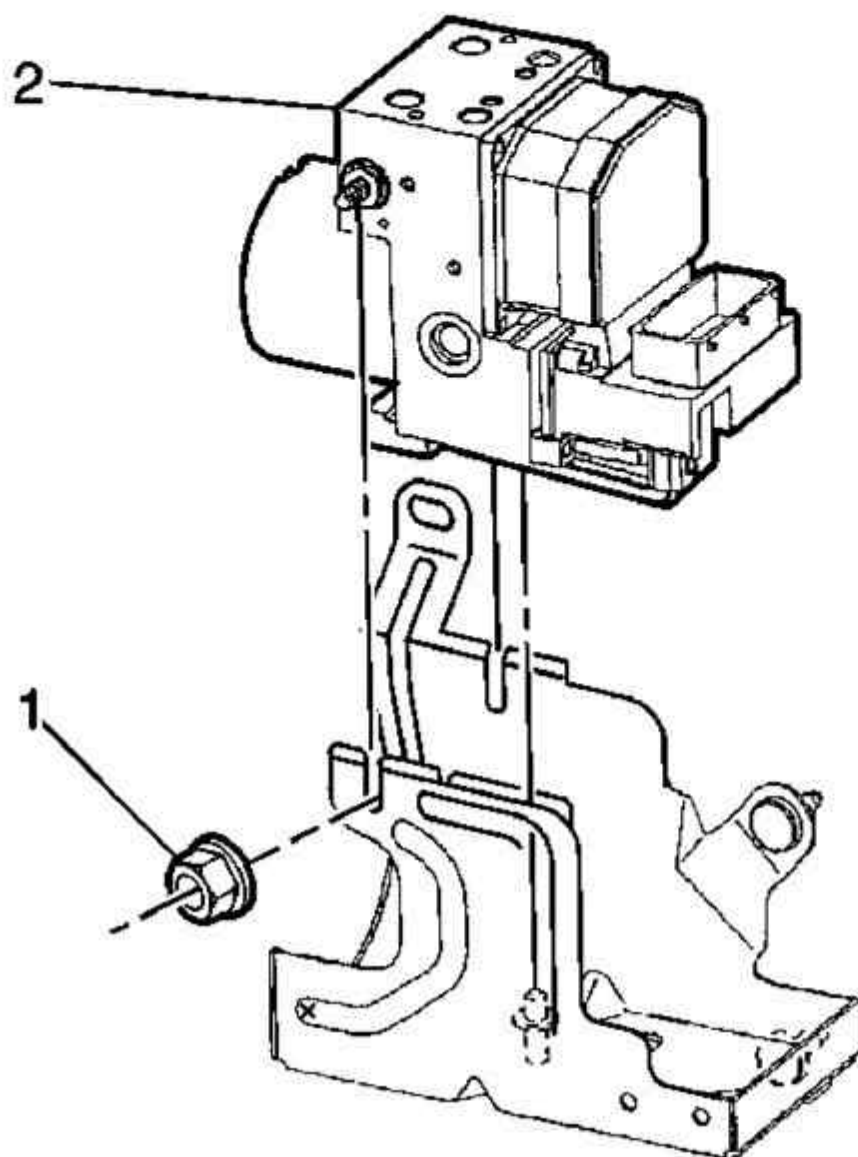


Fig. 12: Identifying BPMV Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

6. Remove the 2 nuts (1) that connect the BPMV to the BPMV bracket.

NOTE: When removing the brake pressure modulator valve, protect the vehicle exterior from possible brake fluid spillage. Brake fluid can cause damage to painted surfaces.

7. Remove the BPMV (2) and EBCM as an assembly from the vehicle.
8. Remove EBCM if replacing the BPMV only. Refer to Electronic Brake Control Module Replacement.

Installation Procedure

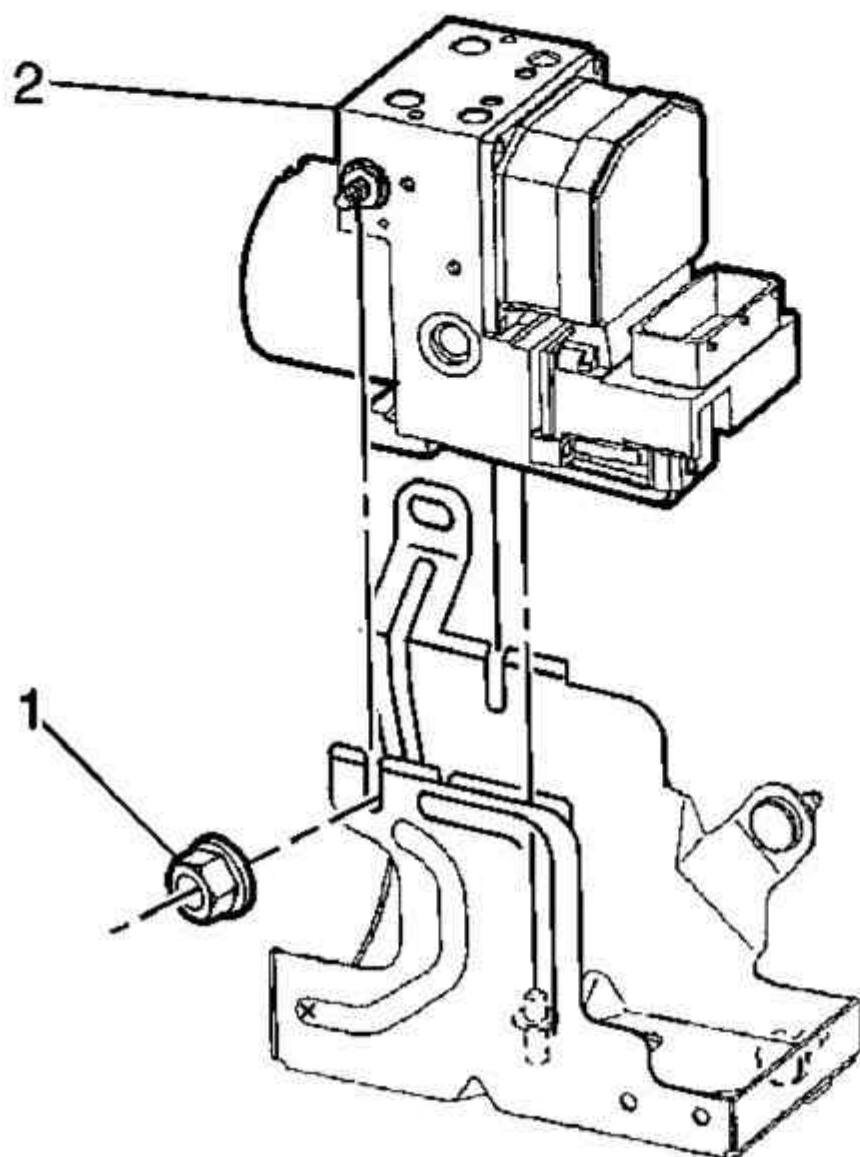


Fig. 13: Identifying BPMV Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install EBCM if replacing the BPMV only. Refer to **Electronic Brake Control Module Replacement**.
2. Install BPMV (2) and EBCM as an assembly into the BPMV bracket. Align the flats of the studs on the BPMV with the BPMV bracket.

NOTE: Refer to **Fastener Notice** .

3. Install the 2 BPMV to BPMV bracket nuts (1).

Tighten: Tighten the 2 BPMV to BPMV bracket nuts to 12 N.m (8 lb ft).

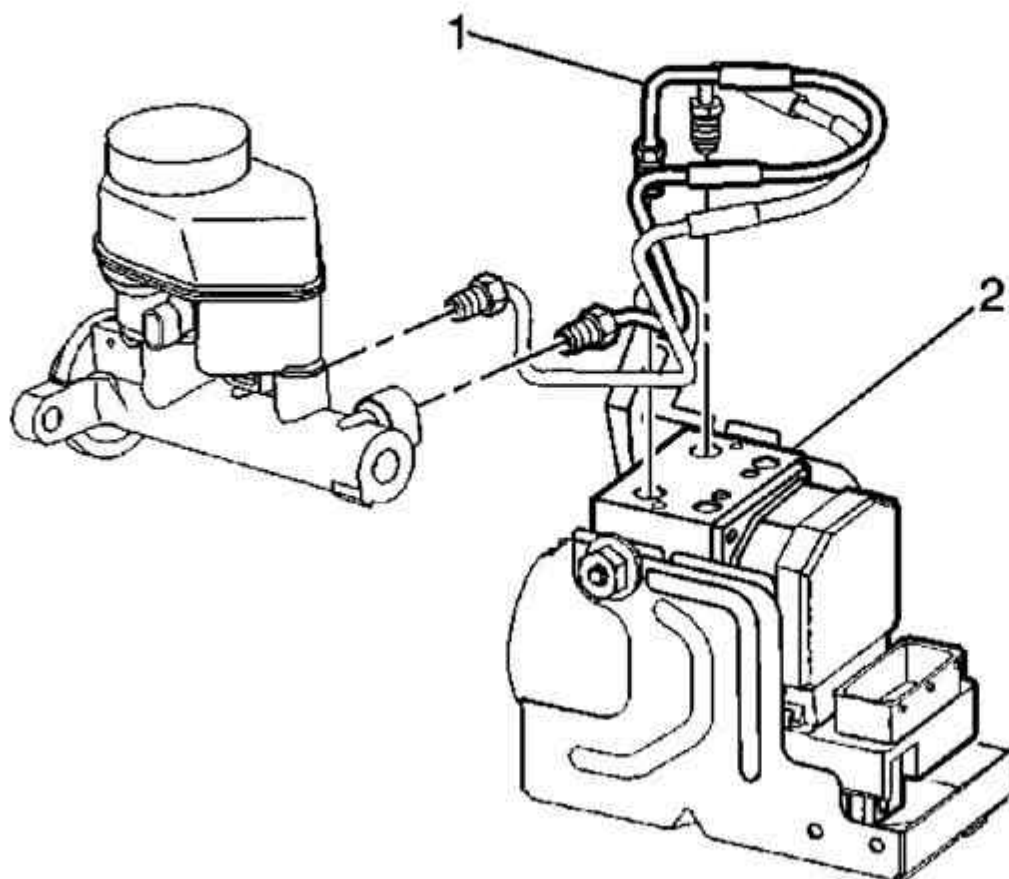


Fig. 14: Identifying Master Cylinder Brake Pipes & BPMV
Courtesy of GENERAL MOTORS CORP.

CAUTION: Make sure brake pipes are correctly connected to brake pressure modulator valve. If brake pipes are switched by mistake, wheel lockup will occur and personal injury may result. The only two ways this condition can be detected are by using a Scan Tool or by doing an Antilock stop.

IMPORTANT: If a new BPMV is being installed, remove the shipping plugs from the valve openings in the compartment during the next step.

IMPORTANT: Use the locations noted during removal.

4. Install the master cylinder brake pipes (1) on the BPMV (2).

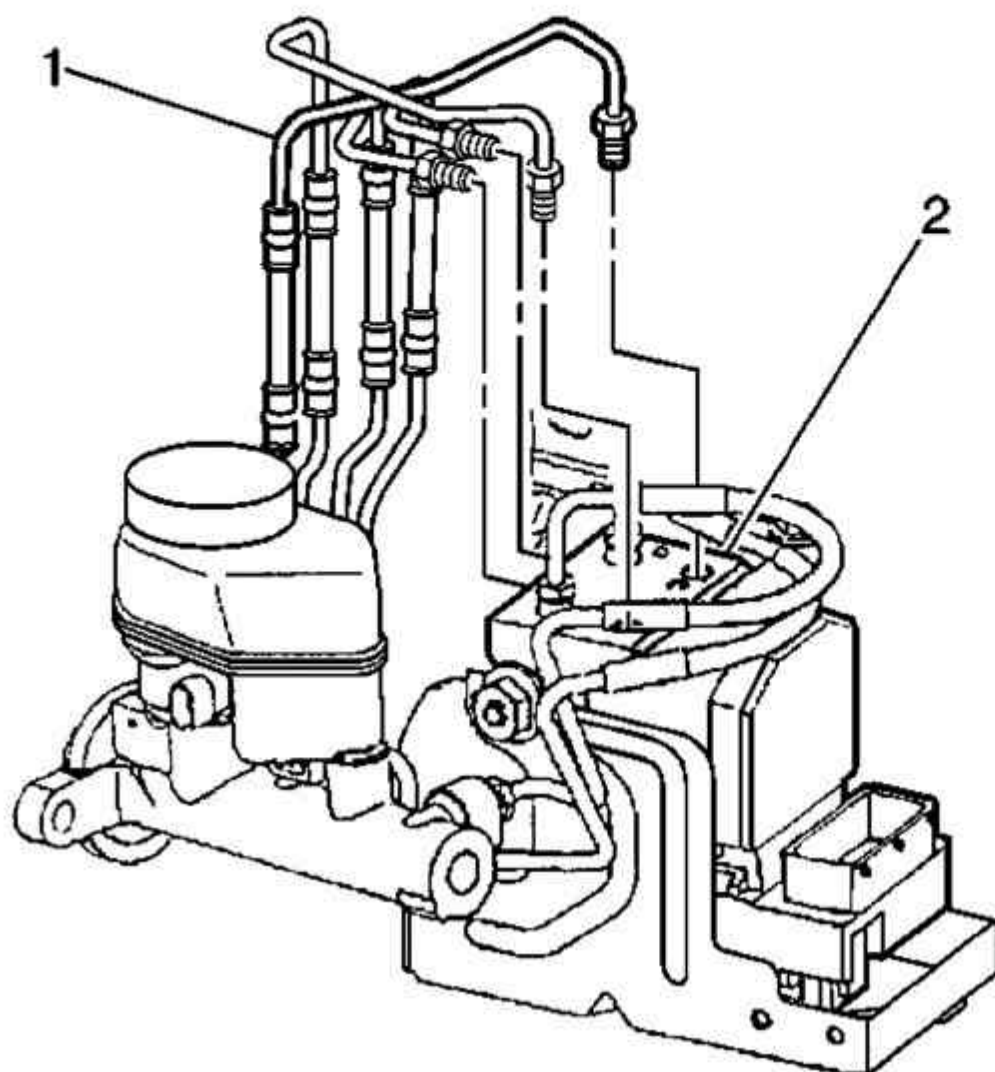


Fig. 15: Identifying Wheel Cylinder Brake Pipes & BPMV
Courtesy of GENERAL MOTORS CORP.

5. Install the wheel cylinder brake pipes (1) on the BPMV (2).

Tighten: Tighten all of the brake pipe fittings to 15 N.m (11 lb ft).

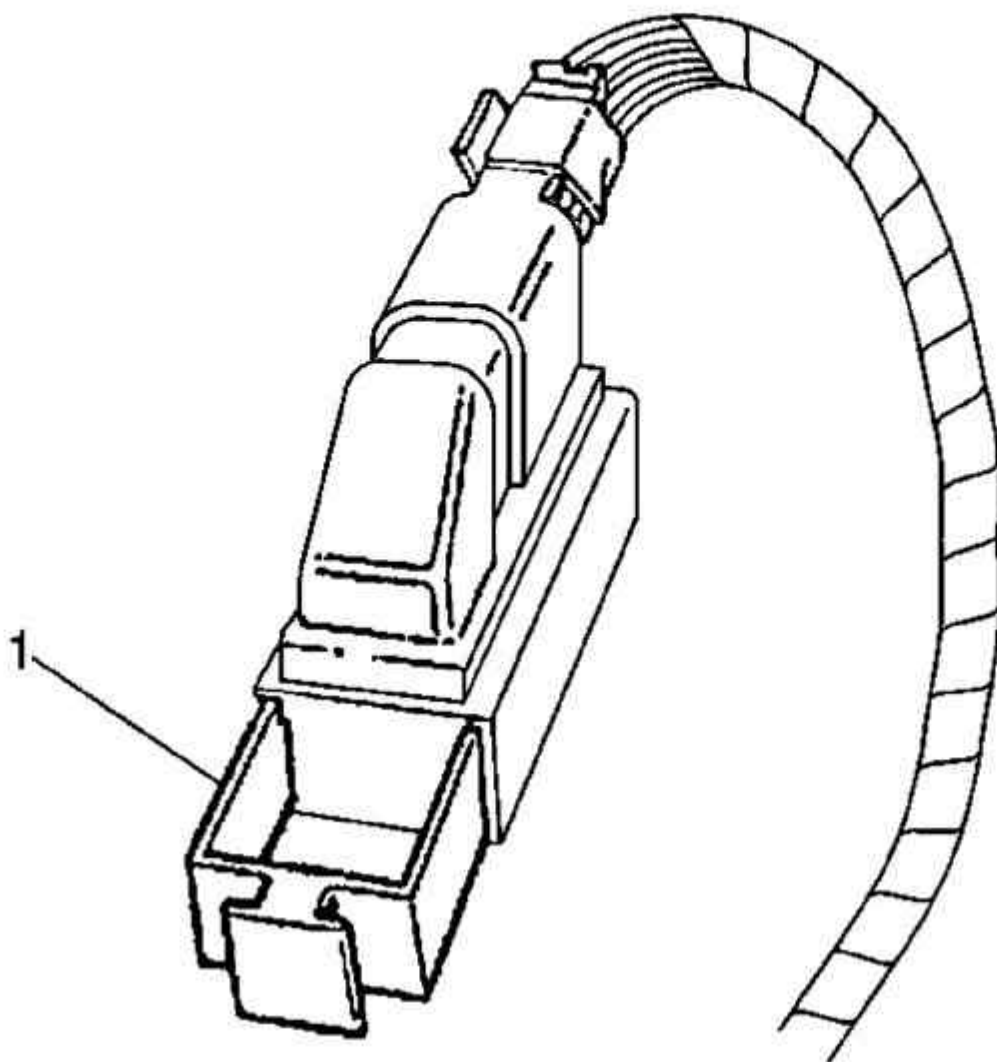


Fig. 16: Identifying EBCM Harness Connector
Courtesy of GENERAL MOTORS CORP.

6. Connect the EBCM harness connector. Push in lock tab (1).
7. Fill and bleed the brake hydraulic system. Refer to Hydraulic Brake System Bleeding (Manual) or Hydraulic Brake System Bleeding (Pressure).
8. Turn the ignition switch to the RUN position, engine off.
9. Perform the Diagnostic Trouble Code (DTC) List - Vehicle.

BRAKE FLUID PRESSURE SENSOR REPLACEMENT

Removal Procedure

IMPORTANT: The area around the electronic brake control module (EBCM) must be free from loose dirt to prevent contamination of disassembled ABS components.

1. Thoroughly clean all contaminants from around the EBCM.

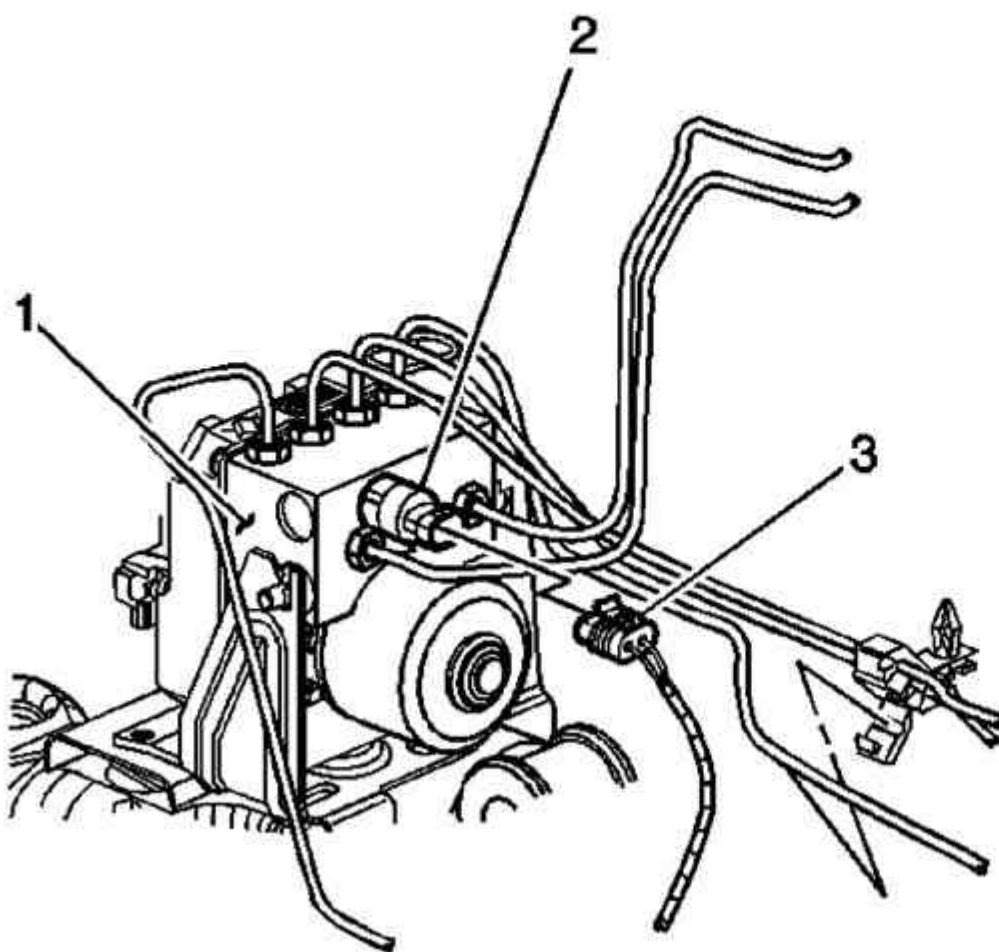


Fig. 17: View Of Brake Fluid Pressure Sensor & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the brake fluid pressure sensor electrical connector (3) from the brake fluid pressure sensor (2).
3. Remove the brake fluid pressure sensor (2) from the EBCM (1).

Installation Procedure

NOTE: Refer to Fastener Notice .

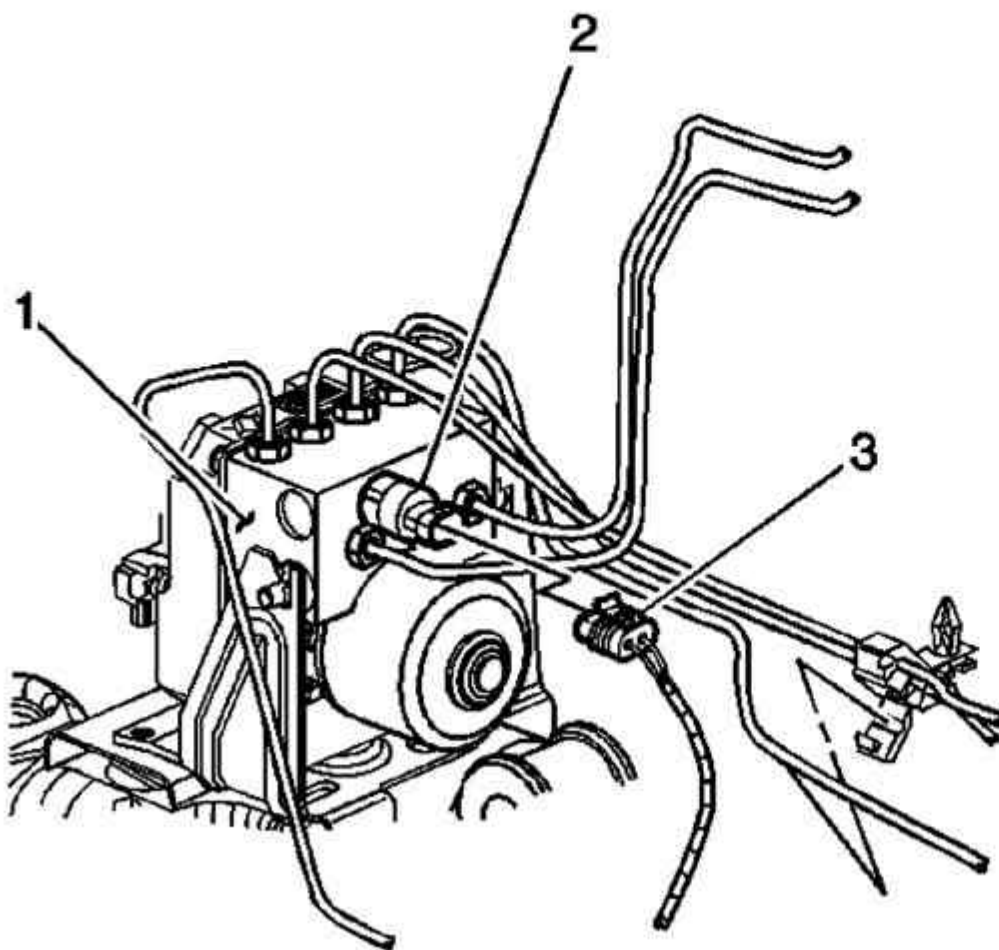


Fig. 18: View Of Brake Fluid Pressure Sensor & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Install the brake fluid pressure sensor (2) to the EBCM (1).

Tighten: Tighten the brake fluid pressure sensor to 20 N.m (15 lb ft).

2. Connect the brake fluid pressure sensor electrical connector (3) to the brake fluid pressure sensor (2).
3. Fill and bleed the hydraulic brake system. Refer to Master Cylinder Reservoir Filling and Hydraulic Brake System Bleeding (Manual) or Hydraulic Brake System Bleeding (Pressure) .
4. Perform the Auto Bleed Procedure. Refer to Antilock Brake System Automated Bleed Procedure.
5. Perform the ABS Diagnostic System Check. Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

BRAKE PRESSURE MODULATOR VALVE BRACKET REPLACEMENT

Removal Procedure

CAUTION: Refer to Brake Fluid Irritant Caution .

NOTE: Refer to Brake Fluid Effects on Paint and Electrical Components Notice .

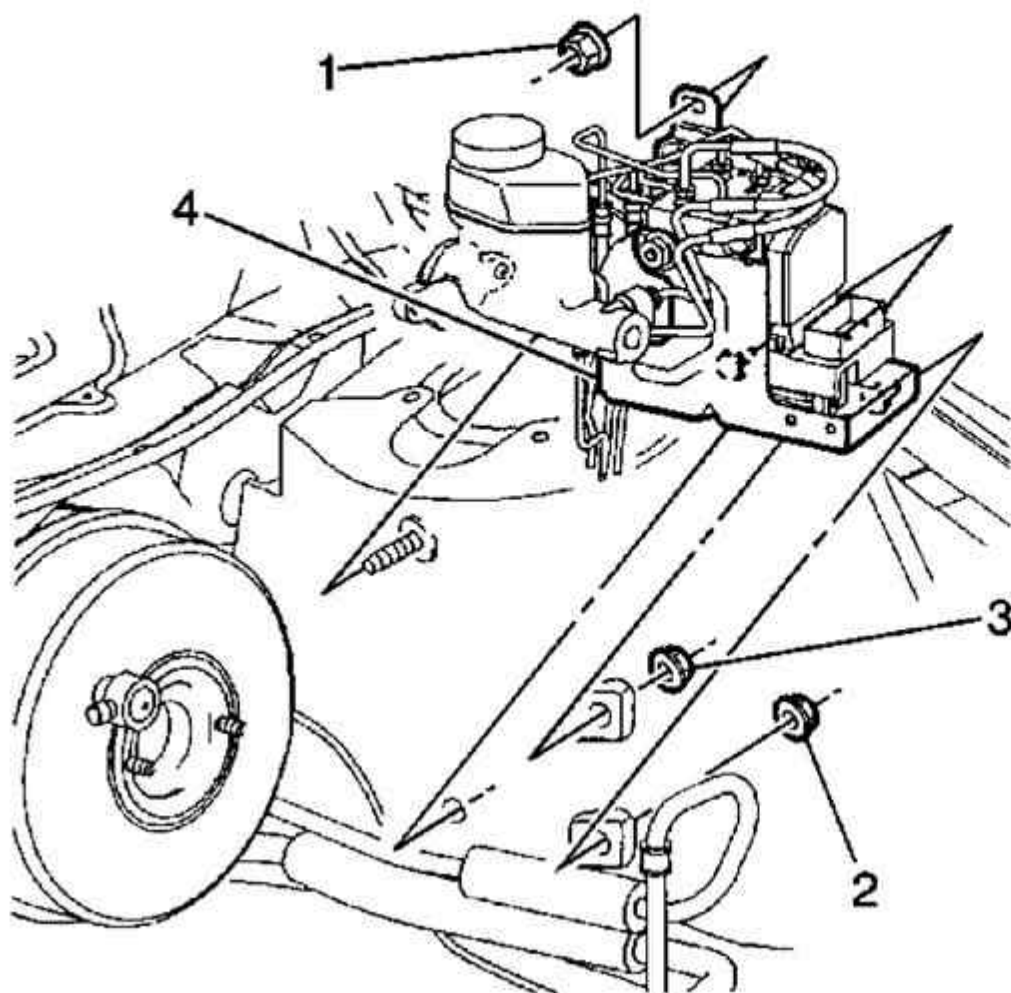


Fig. 19: View Of BPMV Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition switch to the OFF position.
2. Remove brake pressure modulator valve (BPMV) and electronic brake control module (EBCM) as an assembly from the BPMV bracket. Refer to **Brake Pressure Modulator Valve Replacement**.
3. Remove the 3 BPMV bracket nuts (1, 2, 3) attaching the BPMV bracket (4) to the wheel housing.
4. Remove the BPMV bracket (4) from the vehicle.

Installation Procedure

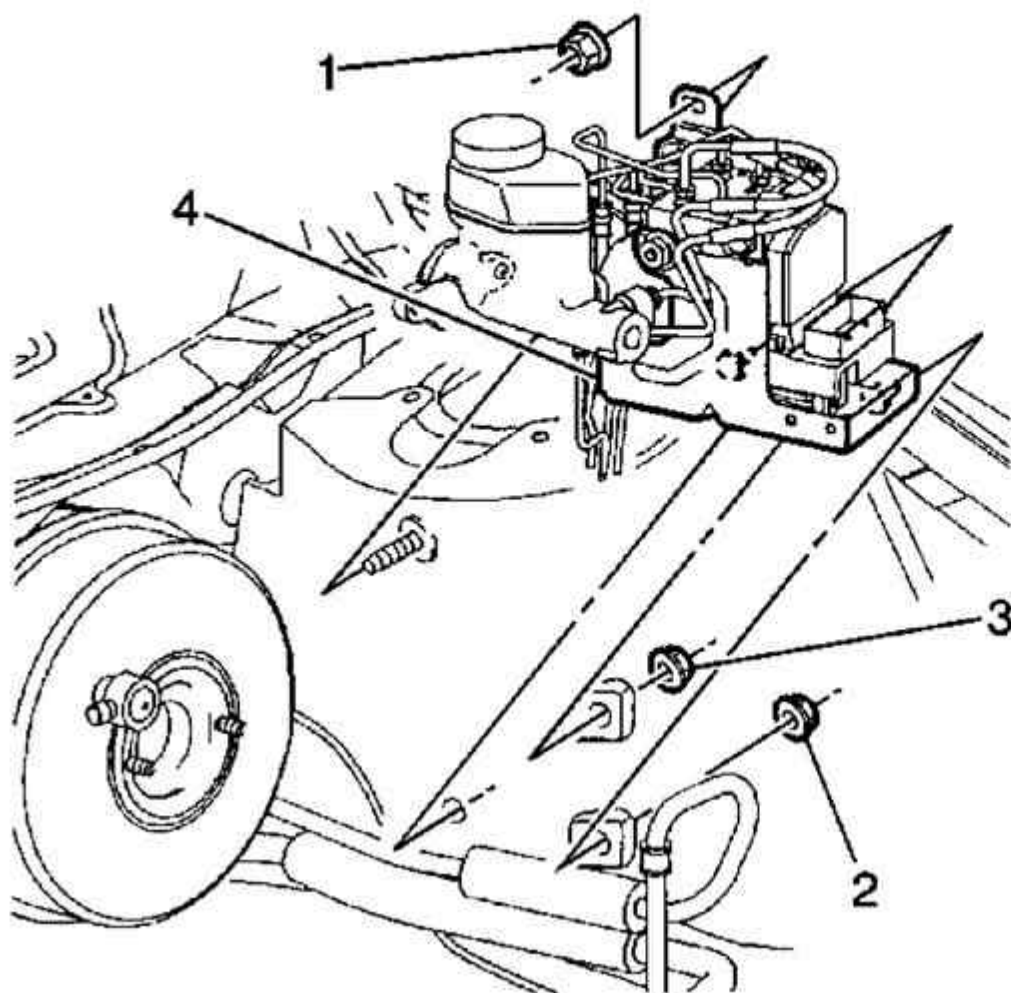


Fig. 20: View Of BPMV Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the BPMV bracket (4) to the wheel house.

NOTE: Refer to Fastener Notice .

2. Install the 3 BPMV bracket nuts (1, 2, 3) to the studs on the BPMV bracket (4).

Tighten: Tighten the 3 BPMV bracket nuts to 10 N.m (7 lb ft).

3. Install the BPMV and EBCM as an assembly to the BPMV bracket. Refer to Brake Pressure Modulator Valve Replacement.
4. Turn the ignition switch to the RUN position.
5. Perform the Diagnostic Trouble Code (DTC) List - Vehicle .

ELECTRONIC TRACTION CONTROL SWITCH REPLACEMENT

The traction control switch is part of the Driver Information Center. Refer to Driver Information Display Switch Replacement for the replacement procedure.

VEHICLE YAW SENSOR WITH VEHICLE LATERAL ACCELEROMETER REPLACEMENT

Removal Procedure

1. Turn OFF the ignition.
2. Remove the front floor center console. Refer to Front Floor Console Replacement.

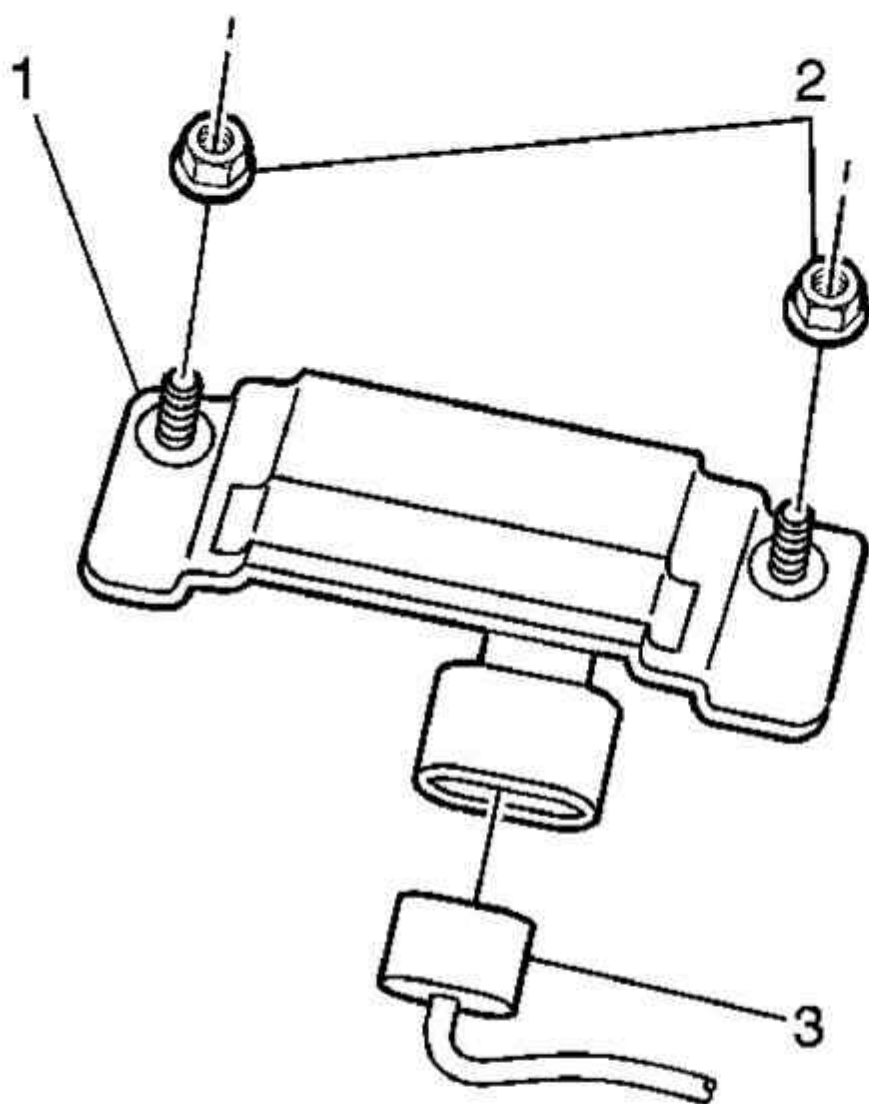


Fig. 21: View Of Yaw Rate Sensor/Lateral Accelerometer & Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

3. Remove the 2 yaw rate sensor/lateral accelerometer mounting nuts (2).

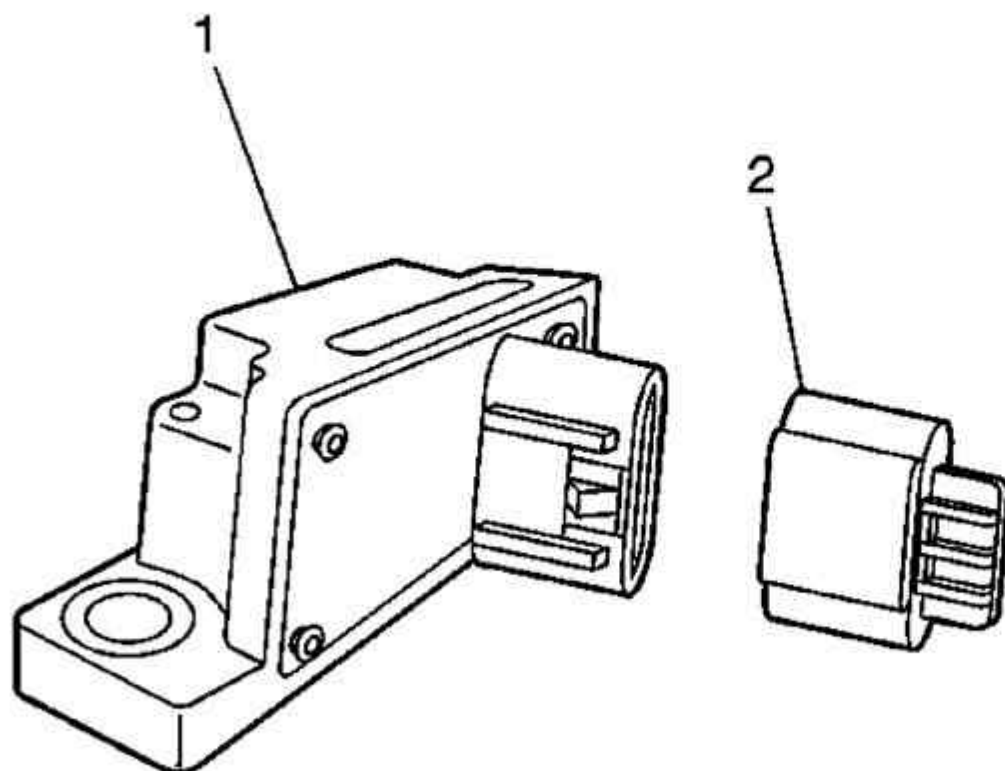


Fig. 22: View Of Yaw Rate Sensor/Lateral Accelerometer & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the yaw rate sensor/lateral accelerometer electrical connector (2) from the yaw rate sensor/lateral accelerometer.
5. Remove the yaw rate sensor/lateral accelerometer (1).

Installation Procedure

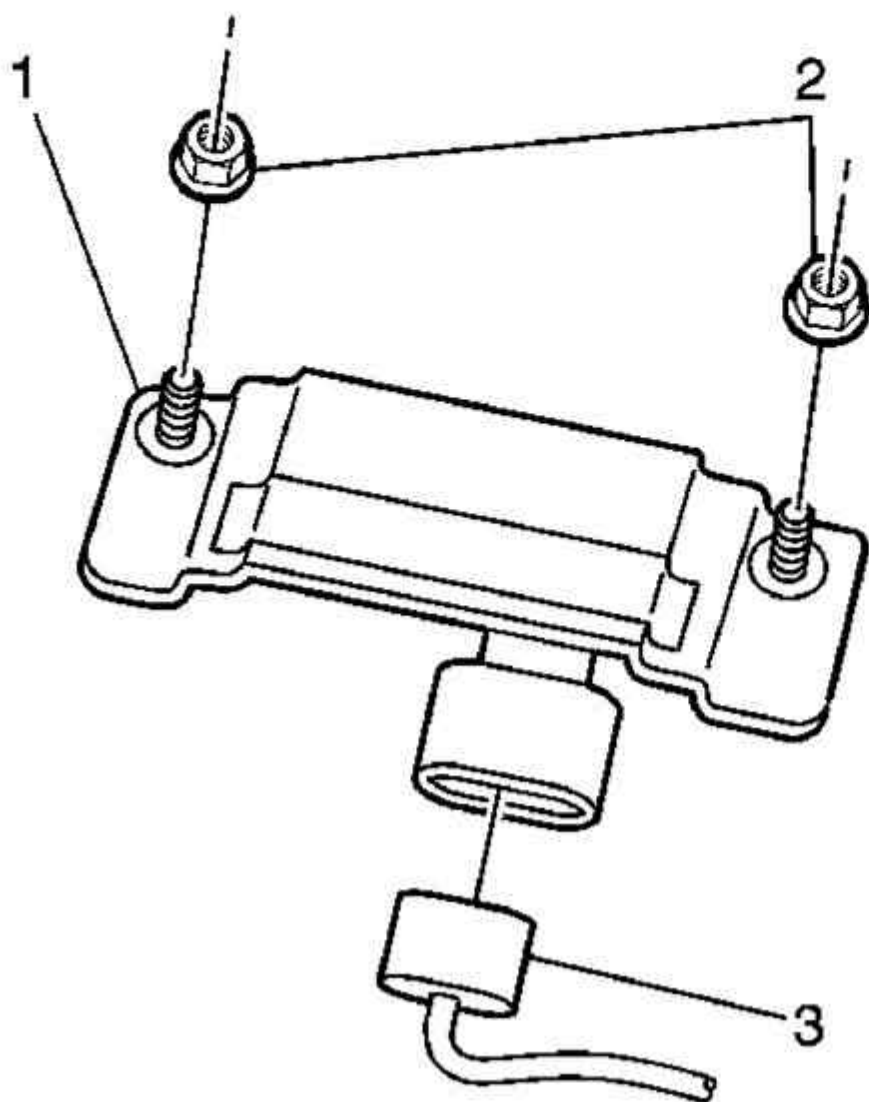


Fig. 23: View Of Yaw Rate Sensor/Lateral Accelerometer & Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the yaw rate sensor/lateral accelerometer (1).

NOTE: Refer to Fastener Notice .

2. Install the 2 yaw rate sensor/lateral accelerometer nuts (2).

Tighten: Tighten the yaw rate sensor/lateral accelerometer mounting nuts to 25 N.m (18 lb ft).

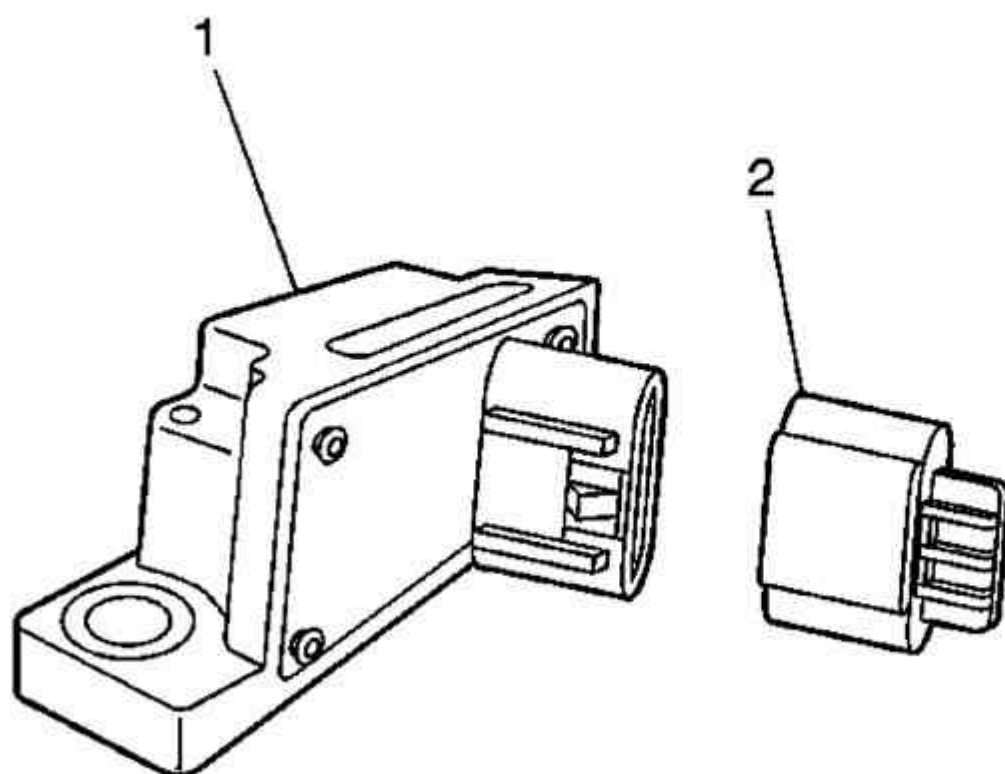


Fig. 24: View Of Yaw Rate Sensor/Lateral Accelerometer & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the yaw rate sensor/lateral accelerometer electrical connector (2) to the yaw rate sensor/lateral accelerometer (1).
4. Install the front floor center console. Refer to **Front Floor Console Replacement**.
5. Perform the ABS Diagnostic System Check. Refer to **Diagnostic System Check - Vehicle**.

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION

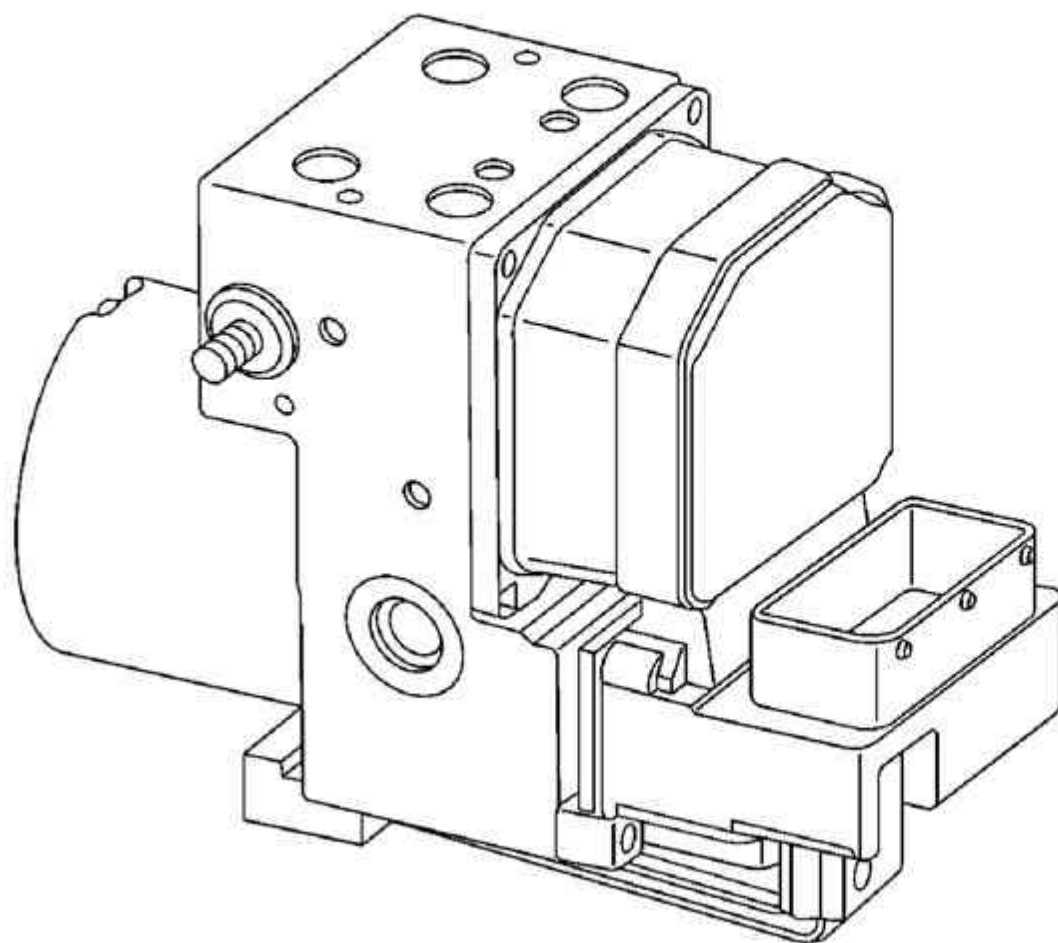


Fig. 25: Identifying BPMV & EBCM
Courtesy of GENERAL MOTORS CORP.

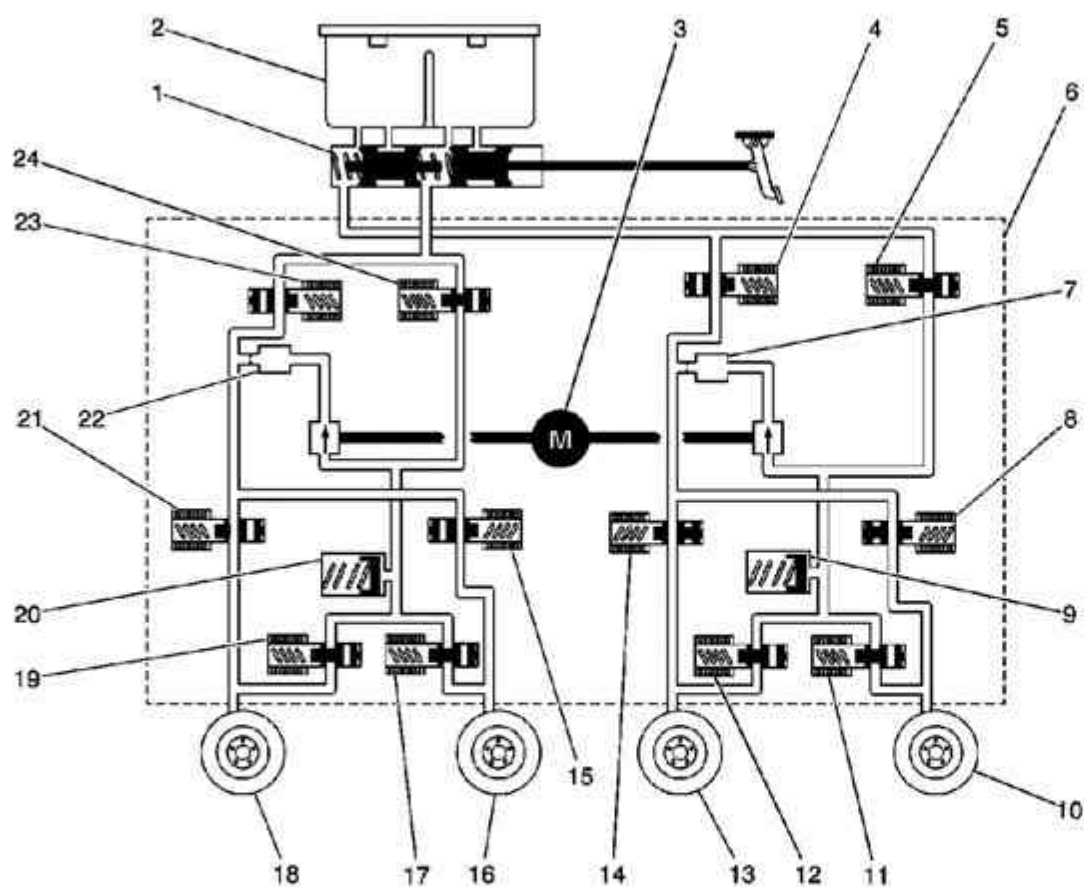


Fig. 26: Identifying BPMV Hydraulic Flow

Courtesy of **GENERAL MOTORS CORP.**

Callout	Component Name
1	Master Cylinder
2	Master Cylinder Reservoir
3	Pump
4	Left Front Master Cylinder Isolation Valve
5	Left Front Prime Valve
6	Brake Pressure Modulator Valve (BPMV)
7	Damper
8	Right Rear Inlet Valve
9	Accumulator
10	Right Rear Brake
11	Right Rear Outlet Valve
12	Left Front Outlet Valve
13	Left Front Brake
14	Left Front Inlet Valve
15	Left Rear Inlet Valve
16	Left Rear Brake
17	Left Rear Outlet Valve
18	Right Front Brake
19	Right Front Outlet Valve
20	Accumulator
21	Right Front Inlet Valve
22	Damper
23	Right Front Master Cylinder Isolation Valve
24	Right Front Prime Valve

This vehicle is equipped with the BOSCH 5.3 antilock braking system.

The vehicle is equipped with the following braking systems:

- Antilock Brake System (ABS)
- Dynamic Rear Proportioning (DRP)
- Traction Control System (ETS) (w/NW7)
- Traction Control System (TCS) (w/NW9)
- Vehicle stability enhancement system (VSES)

The following components are involved in the operation of the above systems:

- Electronic Brake Control Module (EBCM)-The EBCM controls the system functions and detects failures.

The EBCM contains the following components:

- System Relay-The system relay is energized when the ignition is ON and no ABS DTCs are present. It supplies battery positive voltage to the solenoid valves and pump motor.
 - Vent Tube-The vent tube, located in the EBCM, is an opening to the internal cavity of the EBCM. It allows ventilation of the EBCM internals.
- Brake Pressure Modulator Valve (BPMV)-The BPMV contains the hydraulic valves and pump motor that are

controlled electrically by the EBCM. The BPMV uses a 4 circuit configuration with a diagonal split. The BPMV directs fluid from the reservoir of the master cylinder to the left front and right rear wheels and fluid from the other reservoir to the right front and left rear wheels. The diagonal circuits are hydraulically isolated so that a leak or malfunction in one circuit will allow continued braking ability on the other.

IMPORTANT: There is a rubber isolator located under the BPMV and on the mounting studs. The rubber isolators protect the BPMV and the EBCM from vehicle vibrations.

The BPMV contains the following components:

- Pump Motor
- Inlet Valves, one per wheel
- Outlet Valves, one per wheel
- Master Cylinder Isolation Valves (w/NW9), one per drive wheel
- Prime Valves (w/NW9), one per drive wheel
- Wheel Speed Sensors (WSS)-As the wheel spins, the wheel speed sensor produces an AC signal. The EBCM uses this AC signal to calculate wheel speed. The wheel speed sensors are replaceable only as part of the wheel hub and bearing assemblies.
- Traction Control Switch (w/NW9)-The TCS is manually disabled or enabled using the traction control switch.
- Brake Pedal Position Sensor-The body control module BCM uses the BPPS as an indication that the brake pedal is applied, and sends a brake apply class 2 signal to the EBCM.
- Lateral Accelerometer Sensor (w/JL4)-The EBCM uses the lateral accelerometer sensor as an indication of the lateral acceleration of the vehicle.
- Yaw Rate Sensor (w/JL4)-The EBCM uses the yaw rate sensor as an indication of the yaw rate of the vehicle.
- Steering Wheel Position Sensor (SWPS) (w/JL4)-The EBCM uses the SWPS as an indication of the position and rotation of the steering wheel.
- Brake Pressure Sensor (w/JL4)-The EBCM uses the brake pressure sensor for more accurate control during a VSES event.

Initialization Sequence

The EBCM performs one initialization test each ignition cycle. The initialization of the EBCM occurs when one set of the following conditions occur:

Both of the following conditions occur:

- The EBCM receives that there is a minimum of 500 RPM from the PCM via class 2 serial data message.
- The brake pedal is not applied.

OR

Both of the following conditions occur:

- The vehicle speed is greater than 16 km/h (10 mph).
- The brake pedal is applied.

The initialization sequence may also be commanded with a scan tool.

The initialization sequence cycles each solenoid valve and the pump motor, as well as the necessary relays for approximately 1.5 seconds to check component operation. The EBCM sets a DTC if any error is detected. The

initialization sequence may be heard and felt while it is taking place, and is considered part of normal system operation.

The EBCM defines a drive cycle as the completion of the initialization sequence.

Antilock Brake System

When wheel slip is detected during a brake application, the ABS enters antilock mode. During antilock braking, hydraulic pressure in the individual wheel circuits is controlled to prevent any wheel from slipping. A separate hydraulic line and specific solenoid valves are provided for each wheel. The ABS can decrease, hold, or increase hydraulic pressure to each wheel brake. The ABS cannot, however, increase hydraulic pressure above the amount which is transmitted by the master cylinder during braking.

During antilock braking, a series of rapid pulsations is felt in the brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as the EBCM responds to wheel speed sensor inputs and attempts to prevent wheel slip. These pedal pulsations are present only during antilock braking and stop when normal braking is resumed or when the vehicle comes to a stop. A ticking or popping noise may also be heard as the solenoid valves cycle rapidly. During antilock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping. These noises and pedal pulsations are considered normal during antilock operation.

Vehicles equipped with ABS may be stopped by applying normal force to the brake pedal. Brake pedal operation during normal braking is no different than that of previous non-ABS systems. Maintaining a constant force on the brake pedal provides the shortest stopping distance while maintaining vehicle stability.

Pressure Hold

The EBCM closes the inlet valve and keeps the outlet valve closed in order to isolate the system when wheel slip occurs. This holds the pressure steady on the brake so that the hydraulic pressure does not increase or decrease.

Pressure Decrease

The EBCM decreases the pressure to individual wheels during a deceleration when wheel slip occurs. The inlet valve is closed and the outlet valve is opened. The excess fluid is stored in the accumulator until the return pump can return the fluid to the master cylinder.

Pressure Increase

The EBCM increases the pressure to individual wheels during a deceleration in order to reduce the speed of the wheel. The inlet valve is opened and the outlet valve is closed. The increased pressure is delivered from the master cylinder.

Dynamic Rear Proportioning (DRP)

The Dynamic Rear Proportioning (DRP) is a control system that replaces the hydraulic proportioning function of the combination valves in the base brake system. The DRP control system is part of the operation software in the EBCM. The DRP uses active control with existing ABS in order to regulate the vehicle rear brake pressure.

Traction Control System (TCS) (NW7)

The tracking control system (TCS) compares front wheel speeds to rear wheel speeds to determine if drive wheels lose traction. The TCS activates when drive wheel speed exceeds speed of non-drive wheels by a calibrated value. This allows the driver to maintain acceleration and directional stability while accelerating on low traction surfaces.

The TCS limits wheel slip during acceleration when one or more of the drive wheels lose traction. The brake switch must be off for TCS to operate.

During a traction event, the EBCM sends a requested torque value to the PCM over the serial data link. The PCM initiates an engine torque reduction routine to slow down the drive wheels. This routine consists of ignition spark timing reduction, fuel injector cut-off and transmission shift control. The PCM also sends a torque delivered value to the EBCM over the serial data link.

If the EBCM detects a malfunction, it will disable TCS and will command the BCM to turn the TCS Off indicator On. The driver can also disable TCS, if desired by pressing the TCS switch.

Traction Control System (TCS) (NW9)

The TCS is designed to limit wheel slip during acceleration when one or more of the drive wheels are accelerating too rapidly. Traction control will not have any effect on vehicle operation until the electronic brake control module (EBCM) detects one or both of the front wheels rotating faster than the rear wheels. The TCS accomplishes this by two methods, engine torque reduction and brake intervention. The two methods are used together to control wheel slip during acceleration. Both methods are described below.

Vehicle Stability Enhancement System (VSES)

The Vehicle Stability Enhancement System (VSES) is also known as the Stabilitrak Plus system, and the instrument cluster indicator lamp is labeled Stability Off. The VSES consists of a yaw/lateral accelerometer sensor, a steering angle sensor, and a brake pressure sensor working in conjunction with the EBCM.

The yaw rate sensor and lateral accelerometer sensor are both in the same module and use a reference voltage of 5 volts. The lateral accelerometer sensor operating range is 1.5 g resulting in an output range of 2.5-4.75 volts. The yaw rate sensor range is 75 degrees/seconds, resulting in a signal proportional output of 0.25-4.75 volts. Zero yaw rate is 2.5 volts. The yaw/lateral accelerometer sensor is located inside the center console, between the automatic transaxle gear selector and the console storage compartment.

The steering angle sensor sends dual CAN signals to the EBCM. The EBCM determines steering wheel position and rotation using these signals. The steering angle sensor is located in the lower left hand side of the I/P, on the bottom of the steering column.

The brake pressure sensor uses a reference voltage of 5 volts. The sensor operating range is 0.25-4.75 volts. The EBCM uses input from the brake pressure sensor for more accurate control during a VSES event.

MAGNASTEER

The Variable Effort Steering system, MAGNASTEER incorporates a controller into the EBCM. The EBCM receives inputs from wheel speed sensors. The EBCM processes this information and controls the amount of current to the MAGNASTEER actuator to vary the rate of input torque required at the steering gear. A DTC is stored in the EBCM for a MAGNASTEER malfunction. A MAGNASTEER DTC C0450 will not cause the ABS or TRAC OFF indicators to go on. Refer to **Variable Effort Steering System Description and Operation**.

ABS Indicator

The IPC illuminates the ABS indicator when the following occurs:

- The electronic brake control module (EBCM) detects a malfunction with the antilock brake system. The IPC receives a class 2 message from the EBCM requesting illumination.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.
- The IPC detects a loss of class 2 communications with the EBCM.

Service ABS System

The message center displays the service ABS system message when any one of many ABS-disabling DTCs is set.

The EBCM sends a serial data message to the driver information center (DIC) requesting this display.

Stability Off Indicator

The IPC illuminates the Stability Off indicator when the electronic brake control module (EBCM) detects a malfunction in the vehicle stability enhancement system (VSES). The IPC receives a class 2 message from the EBCM requesting illumination of both the VSES indicator and the TRAC OFF indicator. The EBCM disables both the vehicle dynamic system and the traction control system.

Brake Warning Indicator

The IPC illuminates the brake indicator when the following occurs:

- The body control module (BCM) detects that the park brake is engaged. The IPC receives a class 2 message from the BCM requesting illumination. If the vehicle is shifted out of park with the park brake engaged, the BCM activates an audible warning.
- The IPC detects a low brake fluid condition (signal circuit is low).
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.

Traction Control System Indicator(s)**Service Traction System Message**

The drive information center displays the service traction system message when any one of many ABS-disabling DTCs is set. The EBCM sends a serial data message to the driver information center (DIC) requesting this display.

Traction Control Active Message

The drive information center displays the traction active message when engine torque reduction or brake pressure application is required to maintain traction. The EBCM sends a serial data message to the driver information center (DIC) requesting this display.

Traction Control Off Message

The drive information center traction control off indicator when the following occurs.

- The EBCM disables engine torque reduction due to a malfunction and sends a serial data message to the driver information center (DIC) requesting illumination.
- The driver manually disables TCS and engine torque reduction by pressing the traction control switch. The EBCM sends a serial data message to the IPC requesting illumination.

Stability Control System Indicator(s)**Stability Control Active Message**

The message center displays the stability system active message when a TCS or VSES event occurs. The EBCM sends a serial data message to the IPC requesting this display.

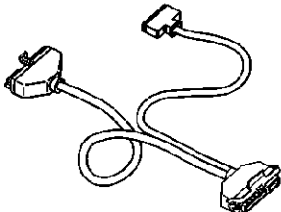
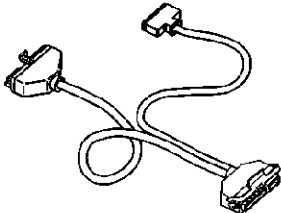
Stability Control Off Message

The message center displays the service stability system message when any one of many VSES-disabling DTCs is set. The EBCM sends a serial data message to the IPC requesting this display.

Service Stability System Message

The message center displays the service stability system message when any one of many VSES-disabling DTCs is set. The EBCM sends a serial data message to the IPC requesting this display.

SPECIAL TOOLS AND EQUIPMENT**SPECIAL TOOLS**

Illustration	Tool Number/Description
	J 39700 Breakout Box
	J 39700-25 Breakout Box Adapter
	J 39700-530 Cable Adapter

2008 Buick LaCrosse CXL
2008 BRAKES Antilock Brake System - LaCrosse

2008 Buick LaCrosse CXL
2008 BRAKES Antilock Brake System - LaCrosse

2008 Buick LaCrosse CXL
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