

2008 Isuzu Ascender LS

2008 BRAKES Antilock Brake System - Ascender, Envoy & Trailblazer

2008 BRAKES

Antilock Brake System - Ascender, Envoy & Trailblazer

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
BPMV to Bracket	11 N.m	97 lb in
Bracket Mounting Bolts	20 N.m	15 lb ft
Brake Lines to Fittings	25 N.m	18 lb ft
EBCM to BPMV	3 N.m	26 lb in
Front Wheel Speed Sensor Mounting Bolt	18 N.m	13 lb ft
Rear Wheel Speed Sensor Mounting Bolt	18 N.m	13 lb ft
Steering Knuckle to Front Hub/Bearing Mounting Bolts	180 N.m	133 lb ft
Yaw/Lateral Sensor	10 N.m	89 lb in

SCHEMATIC & ROUTING DIAGRAMS

ANTILOCK BRAKE SYSTEM SCHEMATICS

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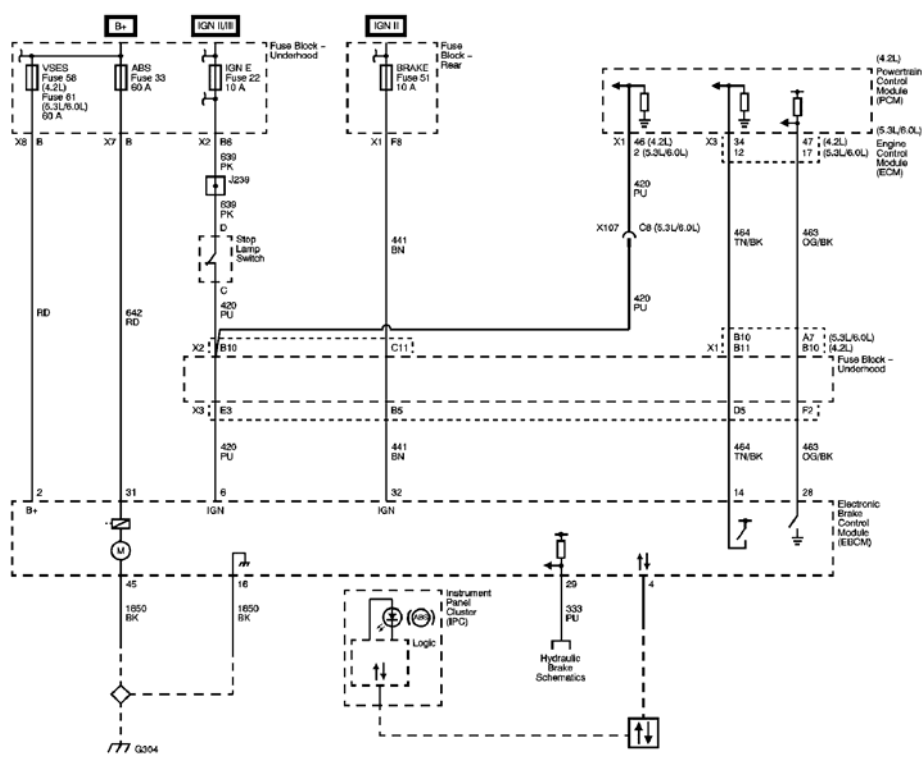


Fig. 1: EBCM Power Ground, Serial Data, Indicator & Signal Circuits Schematic
Courtesy of GENERAL MOTORS CORP.

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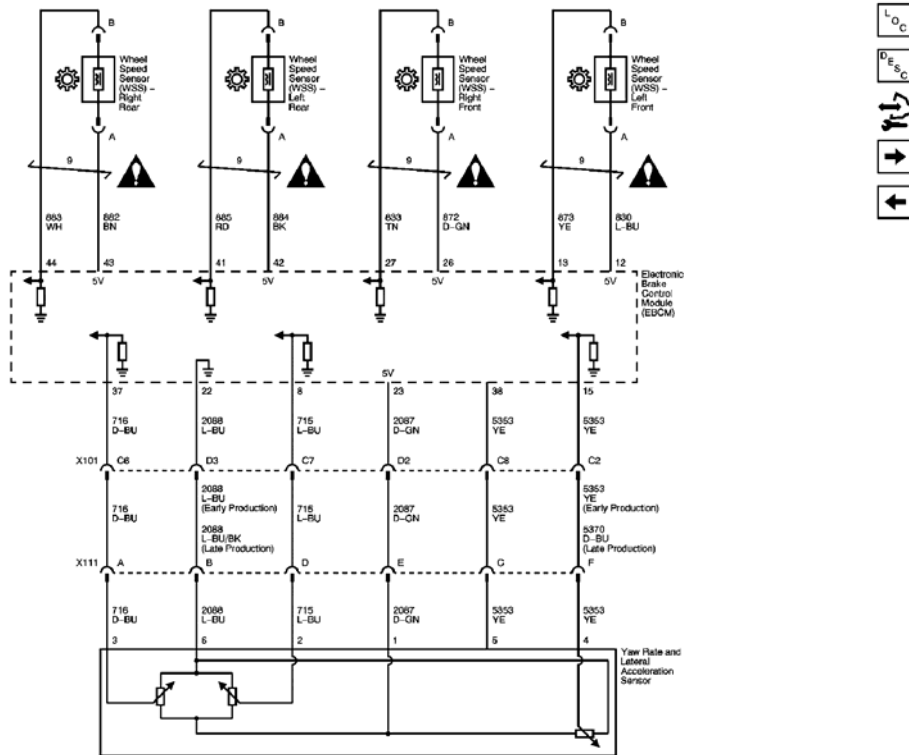


Fig. 2: Wheel Speed Sensors & Yaw Rate/Lateral Acceleration Sensor Schematic
 Courtesy of GENERAL MOTORS CORP.

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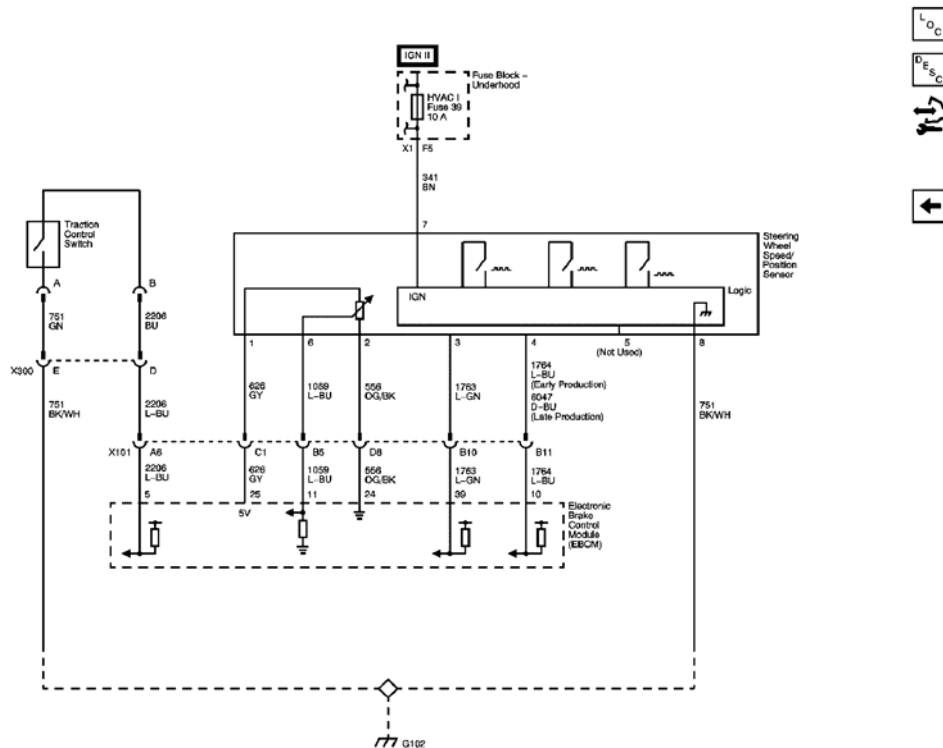


Fig. 3: Steering Wheel Speed/Position Sensor & Traction Control Switch Schematic
 Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION & PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC C0035 or C0040</u>	C0035 00: Left Front Wheel Speed Sensor Circuit C0035 5A: Left Front Wheel Speed Sensor Circuit Erratic Signal C0040 00: Right Front Wheel Speed Sensor Circuit C0040 5A: Right Front Wheel Speed Sensor Circuit Erratic Signal
<u>DTC C0045 or C0050</u>	C0045 00: Left Rear Wheel Speed Sensor Circuit C0045 5A: Left Rear Wheel Speed Sensor Circuit Erratic Signal C0050 00: Right Rear Wheel Speed Sensor Circuit C0050 5A: Right Rear Wheel Speed Sensor Circuit Erratic Signal
<u>DTC C0110</u>	C0110 04: Pump Motor Circuit Open Circuit C0110 61: Pump Motor Circuit Actuator Stuck
<u>DTC C0131</u>	C0131 00: ABS Pressure Circuit No Additional Information
<u>DTC C0161</u>	C0161 00: TCS Brake Switch Circuit
<u>DTC C0186</u>	C0186: Lateral Accelerometer Circuit

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<u>DTC C0196</u>	C0196 00: Yaw Rate Circuit No Additional Information C0196 28: Yaw Rate Circuit Incorrect Frequency
<u>DTC C0201</u>	C0201: Antilock Brake System (ABS) Enable Relay Contact Circuit
<u>DTC C0240</u>	C0240 00: Powertrain Control Module (PCM) Traction Control Not Allowed
<u>DTC C0241 or P0856</u>	C0241: Powertrain Control Module (PCM) Indicated Requested Torque Malfunction P0856: Traction Control Torque Request Circuit
<u>DTC C0244 or P1689</u>	C0244: Pulse Width Modulated (PWM) Delivered Torque P1689: Traction Control Delivered Torque Output Circuit
<u>DTC C0245</u>	C0245: Wheel Speed Sensor Frequency Error
<u>DTC C0283</u>	C0283 00: Mode Switch Circuit Malfunction
<u>DTC C0287</u>	C0287 00: Longitudinal Accelerometer Circuit C0287 11: Longitudinal Accelerometer Circuit Above Maximum Threshold C0287 3B: Longitudinal Accelerometer Circuit Internal Self-test Failed C0287 5A: Longitudinal Accelerometer Circuit Plausibility Failure
<u>DTC C0290 or C0292</u>	C0292: VSES Combination Sensor Circuits
<u>DTC C0455</u>	C0455: Front Steering Position Sensor Circuit
<u>DTC C0550</u>	C0550 00: Electronic Control Unit (ECU) Performance
<u>DTC C0558</u>	C0558: Calibration Data Not Programmed/Learned

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.

DTC C0035 OR C0040

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

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DTC C0035 00

Left Front Wheel Speed Sensor Circuit

DTC C0035 5A

Left Front Wheel Speed Sensor Circuit Erratic Signal

DTC C0040 00

Right Front Wheel Speed Sensor Circuit

DTC C0040 5A

Right Front Wheel Speed Sensor Circuit Erratic Signal

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Sensor Signal Circuit	C0035 00	C0035 00	-	C0035 5A
Left Front Sensor Low Reference Circuit	C0035 00	C0035 00	C0035 00	C0035 5A
Right Front Sensor Signal Circuit	C0040 00	C0040 00	-	C0040 5A
Right Front Sensor Low Reference Circuit	C0040 00	C0040 00	C0040 00	C0040 5A

Circuit/System Description

The wheel speed sensor receives ignition voltage from the electronic brake control module (EBCM) and provides a DC square wave signal back to the module. As the wheel spins, the EBCM uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

C0035 00 or C0040 00

- The ignition is ON.
- Ignition voltage is greater than 9.5 volts.

C0035 5A or C0040 5A

- The ignition is ON.
- Ignition voltage is greater than 9.5 volts.
- The brake pedal is not pressed.

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- A DTC is not set for the other wheel speed circuit on the same axle.

Conditions for Setting the DTC

- An erratic signal output of the wheel speed sensor is detected.
- A short to ground, open/high resistance is detected on the wheel speed sensor signal circuit.
- A short to voltage, short to ground or an open/high resistance is detected on the low reference circuit.
- Wheel speed sensor power supply is less than 7.6 volts.
- A missing wheel speed sensor signal

Action Taken When the DTC Sets

- The EBCM disables the Antilock Brake System (ABS)/Traction Control System (TCS) and VSES for the duration of the ignition cycle.
- The electronic brake distribution (EBD) does not function optimally.
- The ABS indicator turns ON.
- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.

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

If 2 or more wheel speed sensors are inoperative diagnose each wheel speed sensor individually.

C0035 5A, 00 or C0040 5A, 00

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
- 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 Wheel Speed Sensor parameter. The reading should be the same speed on all sensors when driving in a straight line at a speed greater than 20 km/h (13 mph).

Circuit/System Testing

IMPORTANT: It is recommended that Component Testing is performed before Circuit Testing when diagnosing wheel speed sensors because the module will default and does not supply voltage to the sensor when the DTC is set. Performing Circuit Testing with EBCM connector disconnected and key on will cause U codes to set. Clear DTCs after performing the test.

1. Ignition OFF, disconnect the harness connector at the EBCM.
2. Ignition ON, test for 0 volts between the low reference circuit terminals of the appropriate sensor listed below and ground.
 - LF Sensor circuit terminal 29
 - RF Sensor circuit terminal 6
 - If not the specified value, test the low reference circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
3. Test for 0 volts between the signal circuit terminals of the appropriate sensor listed below and ground.
 - LF Sensor circuit terminal 28
 - RF Sensor circuit terminal 17

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- If not the specified value, test the signal circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
- 4. Ignition OFF, test for infinite resistance between the low reference terminals of the appropriate sensor listed below and ground.
 - LF Sensor circuit terminal 29
 - RF Sensor circuit terminal 6
 - If not the specified value, test the low reference circuit for a short to ground. If the circuit tests normal, test or replace the wheel speed sensor.
- 5. Test for infinite resistance between the following signal circuit terminals of the appropriate sensor listed below and ground.
 - LF Sensor circuit terminal 28
 - RF Sensor circuit terminal 17
 - If not the specified value, test the signal circuit for a short to ground. If the circuit tests normal, test or replace the wheel speed sensor.
- 6. If all circuits test normal, replace the EBCM.

Component Testing

1. Ignition OFF, disconnect the harness connector at the wheel speed sensor.
2. Connect a test lamp between B+ and the wheel speed sensor signal circuit terminal B.
3. Test for 4-8 mA on the low reading between the low reference terminal A and ground when spinning the wheel very slow.
 - If not within the specified range, replace the wheel speed sensor.
4. Test for 12-16 mA on the high reading between the low reference terminal A and ground when spinning the wheel very slow.
 - If not within the specified range, replace the wheel speed sensor.

Repair Procedures

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

Control Module References for EBCM replacement, setup, and programming

DTC C0045 OR C0050

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

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DTC C0045 00

Left Rear Wheel Speed Sensor Circuit

DTC C0045 5A

Left Rear Wheel Speed Sensor Circuit Erratic Signal

DTC C0050 00

Right Rear Wheel Speed Sensor Circuit

DTC C0050 5A

Right Rear Wheel Speed Sensor Circuit Erratic Signal

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Rear Sensor Signal Circuit	C0045 00	C0045 00	C0045 00	C0045 5A
Left Rear Sensor Low Reference Circuit	-	C0045 00	-	C0045 5A
Right Rear Sensor Signal Circuit	C0050 00	C0050 00	C0050 00	C0050 5A
Right Rear Sensor Low Reference Circuit	-	C0050 00	-	C0050 5A

Circuit/System Description

The wheel speed sensor receives ignition voltage from the electronic brake control module (EBCM) and provides a DC square wave signal back to the module. As the wheel spins, the EBCM uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

C0045 00 or C0050 00

- The ignition is ON.
- Ignition voltage is greater than 9.5 volts.

C0045 5A or C0050 5A

- The ignition is ON.
- Ignition voltage is greater than 9.5 volts.
- The brake pedal is not pressed.

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- A DTC is not set for the other wheel speed circuit on the same axle.

Conditions for Setting the DTC

- An erratic signal output of the wheel speed sensor is detected.
- A short to voltage, open or ground is detected on the wheel speed sensor signal circuit.
- A open or short to ground in the wheel speed sensor circuit supply voltage.
- Wheel speed sensor power supply is less than 7.6 volts.
- A missing wheel speed sensor signal

Action Taken When the DTC Sets

- The EBCM disables the Antilock Brake System (ABS)/Traction Control System (TCS)/Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The electronic brake distribution (EBD) does not function optimally.
- The ABS indicator turns ON.
- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.

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

If 2 or more wheel speed sensors are inoperative diagnose each wheel speed sensor individually.

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 50 km/h (31 mph) for at least 20 seconds.
3. If the DTC returns, replace the suspected wheel speed sensor or repair the wheel speed sensor wiring.
4. 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
- 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 Wheel Speed Sensor parameter. The reading should be the same speed on all sensors when driving in a straight line at a speed greater than 20 km/h (13 mph).

Circuit/System Testing

IMPORTANT: It is recommended that Component Testing is performed before Circuit Testing when diagnosing wheel speed sensors because the module will default and does not supply voltage to the sensor when the DTC is set. Performing Circuit Testing with EBCM connector disconnected and key on will cause U codes to set. Clear DTCs after performing the test.

1. Ignition OFF, disconnect the harness connector at the EBCM.
2. Ignition ON, test for 0 volts between the low reference circuit terminals of the appropriate sensor listed below and ground.
 - LR Sensor circuit terminal 5
 - RR Sensor circuit terminal 2
 - If not the specified value, test the low reference circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
3. Test for 0 volts between the signal circuit terminals of the appropriate sensor listed below and ground.
 - LR Sensor circuit terminal 4
 - RR Sensor circuit terminal 3

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- If not the specified value, test the signal circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
- 4. Ignition OFF, test for infinite resistance between the low reference terminals of the appropriate sensor listed below and ground.
 - LR Sensor circuit terminal 5
 - RR Sensor circuit terminal 2
 - If not the specified value, test the low reference circuit for a short to ground. If the circuit tests normal, test or replace the wheel speed sensor.
- 5. Test for infinite resistance between the following signal circuit terminals of the appropriate sensor listed below and ground.
 - LR Sensor circuit terminal 4
 - RR Sensor circuit terminal 3
 - If not the specified value, test the signal circuit for a short to ground. If the circuit tests normal, test or replace the wheel speed sensor.
- 6. If all circuits test normal, replace the EBCM.

Component Testing

1. Ignition OFF, disconnect the harness connector at the wheel speed sensor.
2. Connect a test lamp between B+ and the wheel speed sensor signal circuit terminal B.
3. Test for 4-8 mA on the low reading between the low reference terminal A and ground when spinning the wheel very slow.
 - If not within the specified range, replace the wheel speed sensor.
4. Test for 12-16 mA on the high reading between the low reference terminal A and ground when spinning the wheel very slow.
 - If not within the specified range, replace the wheel speed sensor.

Repair Procedures

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

Control Module References for EBCM replacement, setup, and programming

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

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DTC C0110 04

Pump Motor Circuit Open Circuit

DTC C0110 61

Pump Motor Circuit Actuator Stuck

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.

Conditions for Running the DTC

C0110 04

- System and ignition voltage is above 10.5 volts.
- The system enable relay is ON.
- The pump motor has been commanded OFF for 2.5 seconds.

C0110 61

- The ignition is ON.
- The system enable relay is ON.
- The pump motor has been commanded ON, OFF and ON again.

Conditions for Setting the DTC

C0110 04

The EBCM detects an open in the pump motor circuit when the feedback voltage remains greater than 0.75 volt for more than 50 msec.

C00110 61

The pump motor continues to rotate briefly after activation creating a feedback voltage. The EBCM sets the code if the measured feedback voltage indicates a binding or stalled pump motor.

Action Taken When the DTC Sets

- 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.

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- The Traction Control indicator turns 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

Circuit/System Testing

1. Ignition OFF, disconnect the EBCM harness connector and connect a test lamp between the battery positive voltage circuit terminal going to the ABS pump motor, and to ground.
2. Ignition ON, verify that the test lamp illuminates.
 - If the test lamp does not illuminate, repair the open or high resistance in the battery positive voltage circuit.

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3. Connect a test lamp between the battery positive voltage circuit and pump motor ground circuit at the EBCM connector, verify that the test lamp illuminates.
 - If the test lamp does not illuminate, repair the open or high resistance in the pump motor ground circuit.
4. Ignition OFF, remove the EBCM from the BPMV.
5. Inspect the EBCM to BPMV connector for conditions such as damage, corrosion, or presence of brake fluid.
 - If connector corrosion or damage is evident, replace BPMV and/or EBCM as necessary.
 - If brake fluid is present, replace both BPMV and EBCM.
6. Connect the EBCM harness to the EBCM with the BPMV still separated.
7. Connect a test lamp between the pump motor circuits, internal EBCM side.
8. Ignition ON, use the scan tool to perform the Pump Motor Test.
 - If test lamp illuminates replace the BPMV.
 - If test lamp does not illuminate 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 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 No Additional Information

Circuit/System Description

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

Conditions for Running the DTC

- The ignition is ON.

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- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

- Brake signal does not correlate to pressure signal.
- Signal is erratic and changes faster than physically allowed.

Action Taken When the DTC Sets

- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.

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.

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 EBCM

Circuit/System Testing

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1. Apply and release brake pedal. Verify brake lamps operate properly.
 - If brake lamps do not operate properly, refer to **Symptoms - Lighting Systems** .
2. Replace EBCM/brake pressure modulator valve (BPMV) assembly.

Repair Procedures

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

Brake Pressure Modulator Valve Replacement for BPMV assembly 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

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 a 5-volt reference circuit and a low reference circuit. The IPM supplies the 5-volt reference to the BPP.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 16 km/h (10 mph).
- The ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

- 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

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- The EBCM disables the Traction Control System (TCS) and Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The Traction Control indicator turns ON.
- The driver information center (DIC) displays Service Stability System message.
- The Antilock Brake System (ABS) remains functional.

Conditions for Clearing the MIL/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 00 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

Circuit/System Verification

With the ignition ON, use a scan tool to display DTCs for the body control module (BCM).

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- If DTC C0277 is present, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
- If no DTCs are present, go to Diagnostic Aids.

Repair Procedures

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

DTC C0186

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 C0186

Lateral Accelerometer Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5-Volt Reference	C0292 00	C0292 00	C0292 00	-
Yaw Rate Sensor Signal	C0196 00	C0196 00	C0196 00	-
Lateral Accelerometer Signal	C0186 00	C0186 00	C0186 00	-
Low Reference	C0186 00 C0196 00	C0186 00 C0196 00	C0186 00 C0196 00	C0196 28
Yaw Rate Frequency (diagnostic) Signal	C0196 28	C0196 28	C0196 28	-
Longitudinal Accelerometer Sensor Signal	-	-	-	-

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

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The ignition is ON.

Conditions for Setting the DTC

- Lateral acceleration does not change when reducing speed from 30 km/h to 0 km/h and the condition occurs 16 times in a row.
- 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.

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

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

Scan Tool Reference

Control Module References for EBCM

Circuit/System Testing

1. If DTC C0292 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 of resistance between the low reference circuit terminal 6 and ground.
 - If greater than 1 ohm, test the low reference circuit terminal 6 and the EBCM ground circuit terminal 16 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 2, 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.
 - If all circuits test normal, replace the yaw and lateral acceleration sensor, and clear the yaw rate sensor offset value in the EBCM.
 - 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 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 Descriptors

DTC C0196 00

Yaw Rate Circuit No Additional Information

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DTC C0196 28

Yaw Rate Circuit Incorrect Frequency

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5-Volt Reference	C0292 00	C0292 00	C0292 00	-
Yaw Rate Sensor Signal	C0196 00	C0196 00	C0196 00	-
Lateral Accelerometer Signal	C0186 00	C0186 00	C0186 00	-
Low Reference	C0186 00 C0196 00	C0186 00 C0196 00	C0186 00 C0196 00	-
Yaw Rate Frequency Signal (diagnostic)	C0196 28	C0196 28	C0196 28	C0196 28
Longitudinal Accelerometer Sensor Signal	-	-	-	-

Circuit/System 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 yaw motion by applying differential braking to the wheels.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

C0196 00

- The vehicle speed has reached at least 15 km/h (9 mph) from a stop more three times during the same ignition cycle. Then during the time the vehicle is stationary, the yaw rate signal value is more than 7 deg/sec for 2 seconds.
- When vehicle speed is more than 25 km/h (16 mph) in a turn the difference between the yaw rate, steering angle, lateral acceleration, and wheel speed sensor values are not correlated three consecutive times.
- Yaw rate changes greater than 20 deg/sec in 6 ms 4 times in 1 second.
- The yaw/lateral combination sensor fails an internal self test.

C0196 28

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The yaw frequency measured is not between 13400.0-14600.0 Hz for more than 200 msec.

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.

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

- If DTC C0292 is set, diagnose that DTC first.
- If the yaw and lateral accelerometer 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 EBCM

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Circuit/System Testing

C0196 00

1. Inspect the yaw rate sensor for proper and secure mounting.
2. Ignition OFF, disconnect the yaw rate sensor/lateral accelerometer connector.
3. Ignition OFF, test for less than 1 ohm of resistance between the low reference circuit terminal 6 and ground.
 - If greater than 1 ohm, remove the EBCM connector and test for less than 1 ohm of resistance between the low reference terminal 22 and ground terminal 16 of the EBCM. If less than 1 ohm, then repair the low reference circuit or the EBCM ground circuit for a short to voltage or an open/high resistance. If greater than 1 ohm then replace the EBCM.
4. Test the yaw rate sensor signal circuit terminal 3, the lateral accelerometer signal circuit terminal 2, 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.
 - If all circuits test normal, replace the yaw and lateral acceleration sensor, and clear the yaw rate sensor offset value in the EBCM.
 - If the DTC sets again after replacing the yaw rate sensor/lateral accelerometer, replace the EBCM.

C0196 28

1. If DTC C0196 00 is also set as current then diagnose that DTC first.
2. Ignition OFF, disconnect the yaw and lateral acceleration sensor connector.
3. Measure the resistance between the yaw rate frequency circuit terminal 4 and ground.
 - If the resistance is outside 4.5k +/- 2k ohms, remove the EBCM connector and measure the resistance between terminals 9 and 16 on the EBCM. If the measured resistance is outside 4.5k +/- 2k ohms, then replace the EBCM. Otherwise test the yaw rate diagnostic circuit terminal 4 for an open circuit or short to ground. This includes all bulkhead and splice connectors in the harness between the EBCM and the sensor.
 - If the yaw rate diagnostic circuit tests normal, replace the yaw and lateral acceleration sensor, and clear the yaw rate sensor DTCs in the EBCM.
4. If the DTC sets again, 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 C0201

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 C0201

Antilock Brake System (ABS) Enable Relay Contact Circuit

Circuit/System Description

The solenoid relay, located within the electronic brake control module (EBCM), supplies battery voltage to all of the valve solenoids.

Conditions for Running the DTC

- Ignition voltage is greater than 9.5 volts.
- The solenoid relay is commanded ON.

Conditions for Setting the DTC

- The EBCM detects an open in the battery positive voltage circuit to the solenoid valve relay.
- The EBCM detects a stuck open solenoid valve relay or an open circuit between the solenoid valve relay and solenoid valves.

Action Taken When the DTC Sets

- The EBCM disables the Antilock Brake System (ABS)/Traction Control System (TCS)/dynamic rear proportion (DRP)/Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The ABS indicator turns ON.
- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the SERVICE ABS/TRACTION message.
- The DIC displays the PANIC BRAKE ASSIST message.

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.

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 EBCM**Circuit/System Verification**

With the scan tool, access the ABS special functions menu and perform the ABS Motor test. The pump motor should function and no DTCs should be set.

Circuit/System Testing

1. Test for an open or a short to ground in the solenoid valve battery positive voltage circuit terminal. Verify no open or a short to ground is found.
 - If open or a short to ground is found repair circuit.
2. Replace the EBCM/brake pressure modulator valve (BPMV) assembly.

Repair Procedures

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

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

DTC C0240**Diagnostic Instructions**

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

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- 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 00

Powertrain Control Module (PCM) Traction Control Not Allowed

Circuit/System Description

The 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.
- Engine is running at a speed greater than 450 RPM for 5 to 20 seconds.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- The EBCM disables the TCS until the DTC becomes a history DTC.
- The traction control off indicator turns ON.
- Engine torque reduction is disabled.
- The message center displays the service stability system or stability disable message.

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 in the PCM.
- DTC C0240 may set due to engine overheating, throttle actuator control failure, loss of ignition timing control by the PCM/ECM.
- If DTC P0856 has not set, refer to **Diagnostic System Check - Vehicle** in order to identify other possible causes of DTC C0240.

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Reference Information

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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 Requested Torque Malfunction

DTC P0856

Traction Control Torque Request Circuit

Circuit Description

The electronic brake control module (EBCM) and the powertrain control module (PCM) simultaneously control

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the Traction Control System (TCS). The EBCM sends a Requested Torque message via a pulse width modulated (PWM) signal to the PCM. The duty cycle of the signal is used to determine how much engine torque the EBCM is requesting the PCM to deliver. Normal values are between 10 and 90 percent duty cycle. The signal should be at 90 percent when traction control is not active and at lower values during traction control activations. The PCM supplies the pull up voltage that the EBCM switches to ground to create the signal.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

C0241

The EBCM has detected an open, short to power or short to ground on the requested torque signal circuit.

P0856

One of the following conditions exists:

- The PCM detects that requested torque signal is out of the valid range.
- The PCM does not receive the requested torque signal.

Action Taken When the DTC Sets

When the DTC sets the TCS can not reduce engine torque, however the brake intervention portion of the TCS System remains operational.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and you used the scan tool Clear DTC function.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.
- The PCM automatically clears the history DTC when a current DTC is not detected in 40 consecutive warm-up cycles.

Diagnostic Aids

Check for poor or intermittent connections of the EBCM and the PCM. 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

Repair Procedures

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

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

Pulse Width Modulated (PWM) Delivered Torque

DTC P1689

Traction Control Delivered Torque Output Circuit

Circuit Description

The electronic brake control module (EBCM) and the powertrain control module (PCM) simultaneously control the traction control system (TCS). The PCM sends a Delivered Torque message via a pulse width modulated (PWM) signal to the EBCM. The duty cycle of the signal is used to determine how much engine torque the

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PCM is delivering. Normal values are between 10 and 90 percent duty cycle. The EBCM supplies the pull up voltage that the PCM switches to ground to create the signal.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

C0244

The EBCM has detected an open, short to power or short to ground on the delivered torque signal circuit.

P1689

One of the following conditions exists:

- The PCM detects that delivered torque signal is out of the valid range.
- The PCM does not receive the delivered torque signal.

Action Taken When the DTC Sets

When the DTC sets the TCS cannot reduce engine torque, however the brake intervention portion of the TCS system remains operational.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and you used the scan tool Clear DTC function.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.
- The PCM automatically clears the history DTC when a current DTC is not detected in 40 consecutive warm-up cycles.

Diagnostic Aids

Check for poor or intermittent connections of the EBCM and the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Reference Information

Schematic Reference

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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

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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

Wheel Speed Sensor Frequency Error

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 8 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.

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- 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.

Action Taken When the DTC Sets

- Antilock Brake System (ABS), Traction Control System (TCS) and Vehicle Stability Enhancement System (VSES) are inhibited.
- The ABS indicator turns 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

- Faulty wheel speed sensor will not set this DTC.
- A vehicle using a space saver spare will not set this code.

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

Circuit/System Verification

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

Repair Procedures

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

DTC C0283

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 C0283 00

Mode Switch Circuit Malfunction

Circuit Description

The mode switch is a momentary-contact, normally-open switch that can be used to disable the vehicle stability enhancement system (VSES). The mode switch is directly monitored by the electronic brake control module (EBCM). Each time the mode switch is pressed, the VSES enabled/disabled status changes. When VSES is disabled, the EBCM sends serial data messages to the instrument panel cluster (IPC) to turn ON the stability indicator.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The EBCM detects low voltage on the traction control switch signal circuit for 8 seconds.

Action Taken When the DTC Sets

- The EBCM disables the VSES.
- The stability indicator turns ON.

Conditions for Clearing the DTC

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The DTC clears automatically from Current status when the fault is corrected. Use a scan tool to clear the DTC from history status.

Diagnostic Aids

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction

Reference Information

Schematic Reference

Antilock Brake System Schematics

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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

Circuit/System Verification

Traction control can be disabled/enabled when the traction control switch is pressed and released.

Circuit/System Testing

1. Turn OFF the ignition for 5 seconds, then turn ON the ignition and wait at least 60 seconds.
 - If DTC C0283 does not reset, go to Diagnostic Aids
2. Turn the ignition OFF. Disconnect the traction control switch harness connector. Turn the ignition ON and wait at least 60 seconds.
 - If DTC C0283 does not reset, replace the traction control switch.
 - If the DTC C0283 resets, check the TCS/mode switch signal circuit for a short to ground or replace the BCM.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for EBCM/BPMV replacement, setup, and programming

DTC C0287**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using the 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 C0287 00**

Longitudinal Accelerometer Circuit

DTC C0287 11

Longitudinal Accelerometer Circuit Above Maximum Threshold

DTC C0287 3B

Longitudinal Accelerometer Circuit Internal Self-test Failed

DTC C0287 5A

Longitudinal Accelerometer Circuit Plausibility Failure

Circuit/System Description

The electronic brake control module (EBCM) supplies 5 V to the yaw-rate sensor assembly reference circuit and a ground through the yaw-rate sensor low reference circuit, which is shared with the steering angle sensor. The EBCM, yaw-rate sensor assembly and steering angle sensor share a common 12 V supply voltage circuit.

The yaw-rate sensor produces signal output voltage that corresponds to the vehicle rotation around its vertical axis.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The EBCM detects a fault in the yaw-rate signal voltage output

Action Taken When the DTC Sets

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- The EBCM disables ESP for the duration of the ignition cycle.
- The ABS warning lamp, the ABS warning icon and the Trac-Off icon activates.

Conditions for Clearing the DTC

- The condition for setting 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.

Reference Information

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Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

With scan tool installed, clear the DTCs then drive the vehicle in a straight line at a speed greater than 15 km/h (9 mph). If the DTC did not set as a current DTC see diagnostic aids.

Circuit/System Testing

1. Ignition OFF, disconnect the yaw-rate/lateral accelerometer connector.
2. Test the yaw-rate/lateral sensor reference voltage circuit for a short to voltage, short to ground, an open or high resistance.
 - If the reference voltage circuit did not test normal, repair the circuit.
3. Test the yaw/lateral sensor ground circuit for an open or high resistance.
 - If the reference ground circuit did not tests normal, repair the circuit.

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4. Test the yaw/lateral sensor CAN HI and LO circuit for a short to voltage, short to ground, an open or high resistance.
 - If the yaw/lateral CAN HI and LO circuits did not test normal repair the circuit.
5. Ignition ON, test the yaw/lateral sensor reference voltage circuit for 5 volts, and the ground circuit for an open or high resistance.
 - If the yaw/lateral 5 volt reference and ground circuits test normal replace the yaw/lateral sensor.
 - If the yaw/lateral 5 volt reference and ground circuits did not test normal 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 C0290 OR C0292

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 C0292

VSES Combination Sensor Circuits

Circuit/System Description

The electronic brake control module (EBCM) supplies a reference voltage of 5 volts to the yaw rate sensor/lateral acceleration sensor and the steering angle sensor. The sensor supply voltage is monitored via an internal feedback circuit to the EBCM microprocessor.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

The EBCM detects that the sensor supply voltage is less than 4.75 volts or greater than 5.25 volts for 30 milliseconds.

Action Taken When the DTC Sets

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- The EBCM turns OFF the 5-volt reference circuit, until the ignition is cycled.
- The EBCM disables the traction control system (TCS)/vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- The driver information center (DIC) displays the Service Stabilitrak message.

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

If the yaw and lateral accelerometer sensor is disconnected, DTCs will set and the EBCM will not provide 5-volt reference.

Reference Information

Schematic Reference

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- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for EBCM

Circuit/System Testing

1. Ignition OFF, disconnect the yaw rate and lateral acceleration sensor connector.
2. Ignition OFF, test for less than 1 ohm of resistance between the low reference circuit terminal 6 and ground.
 - If greater than 1 ohm, test the low reference circuit terminal 6 and the EBCM ground circuit terminal 16 for a short to voltage or an open/high resistance. If the circuits test normal, replace the EBCM.

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3. Test the lateral accelerometer signal circuit terminal 2, 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.
 - If all circuits test normal, replace the yaw rate sensor/lateral acceleration sensor, and clear the yaw rate sensor offset value in the EBCM.
 - If the DTC sets again after replacing the yaw rate sensor/lateral acceleration sensor, 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 C0455

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 C0455

Front Steering Position Sensor Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Steering Angle Sensor 12-Volt Reference Circuit	C0455	C0455	C0455	-
Steering Angle Sensor Signal Circuit	C0455	C0455	C0455	-
Low Reference Circuit	-	C0455	-	-

Circuit/System Description

The steering angle sensor supplies input circuits to the electronic brake control module (EBCM) from the Phase A and Phase B, the Index Pulse Phase C circuits, and 1 Analog signal circuit for steering wheel angle. The analog signal is used along with the index pulse to calibrate the steering angle sensor (SAS). The SAS position is then determined by Phase A and Phase B signals. The 2 input signals Phase A and Phase B are approximately 90 degrees out of phase. Once calibrated, the EBCM dynamically interprets the relationship between the Phase A and Phase B inputs, and determines the position of the steering wheel and the direction of the steering wheel rotation.

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Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 9.5 volts.

Conditions for Setting the DTC

- Opens, short to ground, or voltage on the analog signal circuits.
- The calculated steering angle from the steering angle sensor does not correlate with the steering angle calculated from the yaw rate.

Action Taken When the DTC Sets

- The EBCM disables the Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The driver information center (DIC) displays the Service Stability System message.
- The Antilock Brake System (ABS) remains functional.
- The VSES Caution indicator turns ON.

Conditions for Clearing the DTC

- The condition for 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

- 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 EBCM

Circuit/System Verification

With scan tool installed, clear the DTCs. Turn the steering wheel through its full range and back to straight ahead to center SAS. Using a scan tool, observe the Steering Wheel position parameter changes smoothly while turning steering wheel through the entire range. Correlate zero reading with wheels in the straight ahead position. Drive the vehicle through a variety of maneuvers turning to the left, and to the right and straight at a speed greater than 20 km/h (13 mph).

- If the DTC did not set as a current DTC see diagnostic aids.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the SAS.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 2 and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, test for 11.8-12.2 volts between the 12-volt reference circuit terminal 1 and ground.
 - If less than the specified range, test the 12-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
4. Test for 11.8-12.2 volts between the 12-volt reference circuit terminal 1 and the signal circuit terminal 6.
 - If less than the specified range, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
5. Ignition OFF, reconnect the SAS.
6. Disconnect the EBCM harness connector.
7. Test for infinite resistance between the signal circuit pin 6 and ground.
 - If less than the specified range, test the signal circuit for a short to ground.
8. Disconnect the SAS.
9. Reconnect the EBCM harness connector.
10. Ignition ON, test voltage of phase A phase B, and phase C. verify that the reading is battery positive voltage for each of the three phases.

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- If not the specified value, test the phase A phase B, and phase C circuits for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
11. Ignition OFF, reconnect the SAS. Turn the ignition ON. Using the scan tool, rotate the steering wheel and observe the SAS. Verify the sensor sweeps through the entire range while monitoring the steering wheel as it rotates in degrees from the input signals between circuit phase A and the signal circuit phase B. The rotation in degrees should vary between phase A and phase B without any spikes or dropouts.
- If not within the specified range or is erratic, replace the steering angle sensor.
12. If the sensor test normal, 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 C0550

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 C0550 00

Electronic Control Unit (ECU) Performance

Circuit/System Description

The electronic brake control module (EBCM) detects an internal malfunction.

Conditions for Running the DTC

The ignition switch is in the ON position.

Conditions for Setting the DTC

An internal EBCM malfunction exists.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The antilock brake system (ABS) and vehicle stability enhancement system (VSES) are disabled.

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- TCS is degraded.
- The ABS/TCS indicators turn ON.
- The red BRAKE Warning indicator turns ON.

Conditions for Clearing the DTC

- The condition for 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

Verify DTC C0550 is not current.

- If DTC C0550 is current, 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 C0558

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 C0558

Calibration Data Not Programmed/Learned

Circuit/System Description

The electronic brake control module (EBCM) must be calibrated.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

The EBCM has not been calibrated.

Actions Taken When DTC Sets

- The EBCM disables the ABS and the TCS for the duration of the ignition cycle.
- 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 electronic brake control module (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

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

Scan Tool Reference

Control Module References for Scan Tool information.

Circuit/System Verification

Calibrate the EBCM. Refer to **Control Module References** .

Repair Procedures

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

Control Module References for EBCM calibration

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 description and 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 ABS. Refer to **Checking Aftermarket Accessories** .

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- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

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**
- **StabiliTrak Indicator Malfunction**

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**

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

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit Verification

Ignition ON, observe the ABS indicator to turn ON then OFF during the IPC bulb test.

Circuit/System Testing

Ignition On, with a scan tool command the Scan Tool IPC display test ON and OFF. The ABS indicator should turn ON and OFF.

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

Repair Procedures

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

Control Module References for EBCM or IPC replacement, setup, and programming

STABILITRAK 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 Description

The instrument panel cluster (IPC) illuminates the stabilitrak indicator during the IPC bulb check or when the electronic brake control module (EBCM) sends a serial data message to the IPC commanding the indicator ON.

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 Verification**

Ignition ON, observe the Stabilitrak indicator to turn ON then OFF during the IPC bulb test.

Circuit/System Testing

Ignition On, with a scan tool command the Scan Tool IPC display test ON and OFF. The Stabilitrak indicator should turn ON and OFF.

- If the Stabilitrak indicator does not turn ON and OFF, replace the IPC.

Repair Procedures

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

Control Module References for EBCM or IPC replacement, setup, and programming

TRACTION OFF 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 Low Traction indicator is controlled by the instrument cluster via serial data messages from the electronic brake control module (EBCM). When the traction control system (TCS) is active for 0.5 second, the EBCM

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commands the instrument cluster to flash the Low Traction indicator.

The electronic brake control module (EBCM) sends a serial data message to the instrument panel cluster (IPC) to illuminate the Traction Control indicator when the EBCM has disabled the traction control system (TCS) due to a DTC. The Traction Control indicator will also turn ON during the instrument cluster bulb check. When the ignition switch is turned to ON, the Traction Control 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 EBCM and IPC

Circuit/System Verification

1. Turn OFF the ignition for 5 seconds.
2. Turn ON the ignition, with a scan tool, select instrument panel special functions Display Test. Command the instrument panel lamps ON. Verify the traction control off lamp illuminates for at least 2 seconds and then turns off.

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.

Ignition OFF for 5 seconds, Ignition ON, observe that the traction off indicator functions by illuminating for 2 seconds then turns OFF.

- If the traction OFF indicator does not illuminate, with the scan tool, select instrument panel special functions Display Test. Command the instrument panel lamps ON and OFF. Verify the TC lamp turns ON and OFF.
- If the TC warning lamp does not turn OFF, replace the IPC.
- If the TC warning lamp does turn OFF, replace the EBCM.

Repair Procedures

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

Control Module References for EBCM or IPC replacement, setup, and programming

REPAIR INSTRUCTIONS

ANTILOCK BRAKE SYSTEM AUTOMATED BLEED PROCEDURE

Two - Person Procedure

IMPORTANT:

- **Use the two-person bleed procedure under the following conditions:**
 - **Installing a new Electro-Hydraulic Control Unit (EHCU) or new Brake Pressure Modulator Valve (BPMV).**
 - **Air is trapped in the valve body.**
- **Do not drive the vehicle until the brake pedal feels firm.**
- **Do not reuse brake fluid that is used during bleeding.**
- **Use the vacuum, the pressure and the gravity bleeding procedures only for base brake bleeding.**

1. Raise the vehicle in order to access the system bleed screws.
2. Bleed the system at the right rear wheel first.
3. Install a clear hose on the bleed screw.
4. Immerse the opposite end of the hose into a container partially filled with clean DOT 3 brake fluid.
5. Open the bleed screw 1/2 to 1 full turn.
6. Slowly depress the brake pedal. While the pedal is depressed to its full extent, tighten the bleed screw.
7. Release the brake pedal and wait 10-15 seconds for the master cylinder pistons to return to the home position.
8. Repeat the previous steps for the remaining wheels. The brake fluid which is present at each bleed screw should be clean and free of air.
9. This procedure may use more than a pint of fluid per wheel. Check the master cylinder fluid level every four to six strokes of the brake pedal in order to avoid running the system dry.

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10. Press the brake pedal firmly and run the Scan Tool Automated Bleed Procedure. Release the brake pedal between each test.
11. Bleed all four wheels again using Steps 3-9. This will remove the remaining air from the brake system.
12. Evaluate the feel of the brake pedal before attempting to drive the vehicle.
13. Bleed the system as many times as necessary in order to obtain the appropriate feel of the pedal.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT

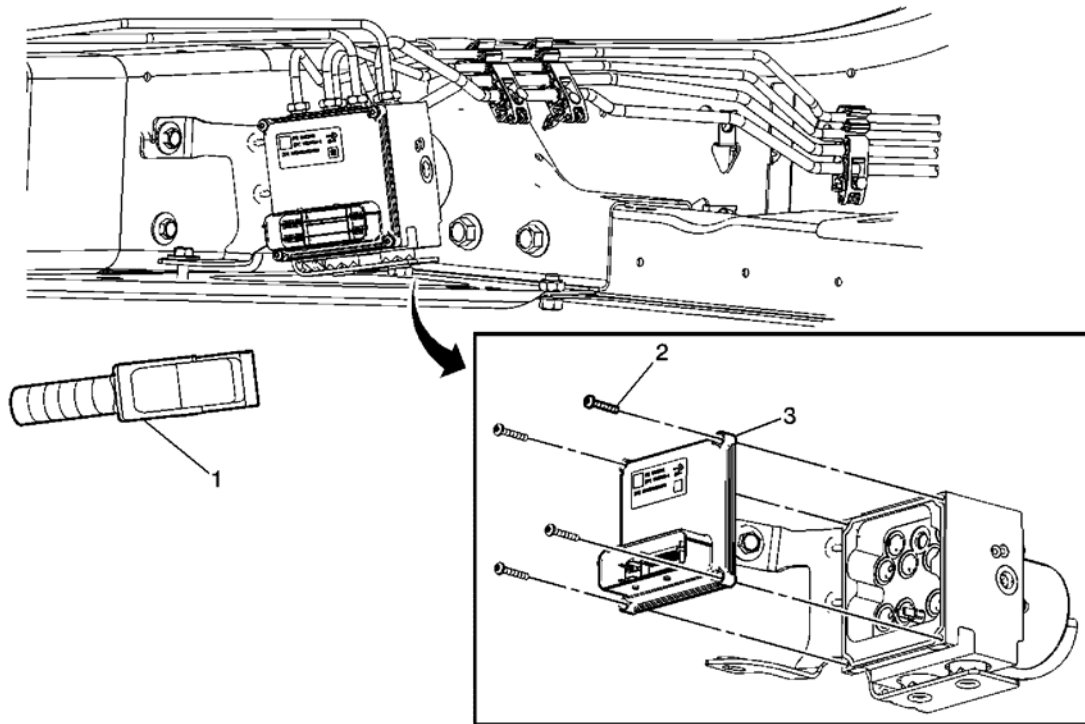


Fig. 4: Identifying Electronic Brake Control Module Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures: Raise the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
1	Electronic Brake Control Modulator (EBCM) Electrical Connector Tip: Clean the dirt and debris from around the EBCM before disconnecting the electrical connector.
2	Screw (Qty: 4) NOTE: Refer to <u>Fastener Notice</u> .

Tighten: 3 N.m (26 lb in)

Electronic Brake Control Modulator (EBCM)

Tip:

3

1. A slight amount of force may be necessary to separate the EBCM from the brake pressure modulator valve (BPMV). DO NOT pry on the EBCM.
2. After separating the EBCM from the BPMV, cover the BPMV with a lint-free towel to prevent it from becoming contaminated.
3. Care should be used when installing the EBCM to the BPMV to avoid damage to the internal components.
4. Program the EBCM. Refer to **Electronic Brake Control Module Programming and Setup** .

BRAKE PRESSURE MODULATOR VALVE REPLACEMENT

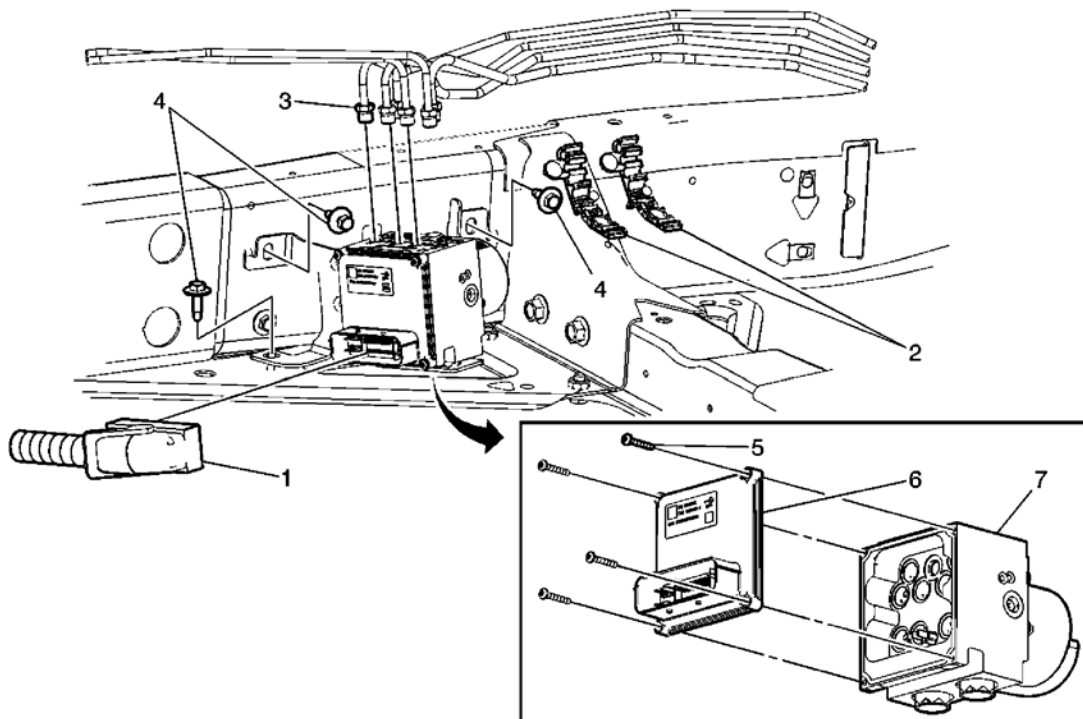


Fig. 5: Identifying Brake Pressure Modulator Valve Components
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
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CAUTION:

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

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CAUTION:

Refer to Brake Fluid Irritant Caution .

Preliminary Procedures: Raise the vehicle. Refer to Lifting and Jacking the Vehicle .

1	Electronic Brake Control Module (EBCM) Electrical Connector
2	Retaining Clip
3	<p>Fitting (Qty: 6)</p> <p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Tip:</p> <ol style="list-style-type: none">1. Before removing the brake pipes from the ABS module, clean all dirt and debris from the ABS module.2. Cap or plug the brake pipes to prevent contamination of the brake system and fluid leaks. <p>Tighten: 25 N.m (18 lb ft)</p>
4	<p>Bolt (Qty: 3)</p> <p>Tighten: 20 N.m (15 lb ft)</p>
5	<p>Screw (Qty: 4)</p> <p>Tighten: 3 N.m (26 lb in)</p>
6	<p>Electronic Brake Control Module (EBCM)</p> <p>Tip: Avoid brake fluid contact with electrical connectors and brake pressure modulator valve (BPMV) cavity. Wipe away brake fluid with a clean shop cloth prior to installing the EBCM.</p>
7	<p>Brake Pressure Modulator Valve (BPMV)</p> <p>Tip: Bleed the brake system. Refer to <u>Hydraulic Brake System Bleeding (Manual)</u> or <u>Hydraulic Brake System Bleeding (Pressure)</u> .</p>

BRAKE PRESSURE MODULATOR VALVE BRACKET REPLACEMENT

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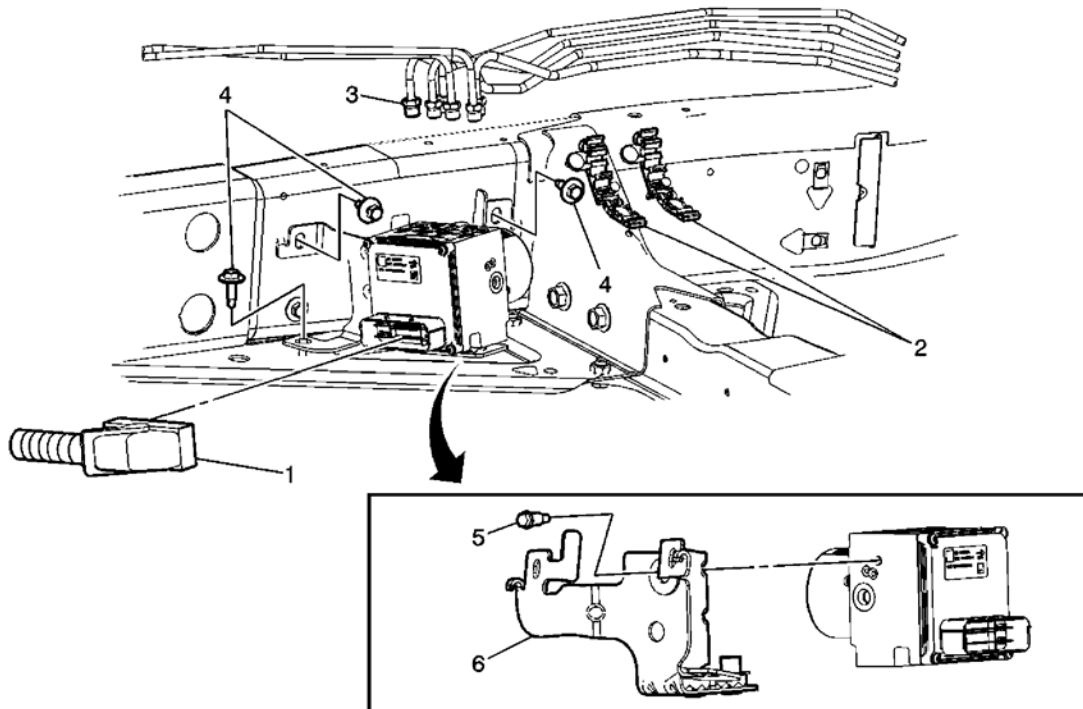


Fig. 6: Identifying Brake Pressure Modulator Valve Bracket Components
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
<p>CAUTION: Refer to <u>Brake Fluid Irritant Caution</u> .</p>	
<p>Preliminary Procedures: Raise the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .</p>	
1	Brake Pressure Modulator Valve (BPMV) Electrical Connector
2	Clip Tip: Before working on the brake pipes, release the locking tab on the retaining clip.
3	Fitting (Qty: 6) NOTE: Refer to <u>Fastener Notice</u> . Tip: <ol style="list-style-type: none"> 1. Before removing the brake pipes from the ABS module, clean all dirt and debris from the ABS module. 2. Cap or plug the brake pipes to prevent contamination of the brake system and fluid leaks.

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	3. Bleed the brake system. Refer to <u>Antilock Brake System Automated Bleed Procedure</u> .
	Tighten: 25 N.m (18 lb ft)
4	Bolt (Qty: 3) Tighten: 20 N.m (15 lb ft)
5	Bolt Tighten: 11 N.m (97 lb in)
6	BPMV Mounting Bracket

WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

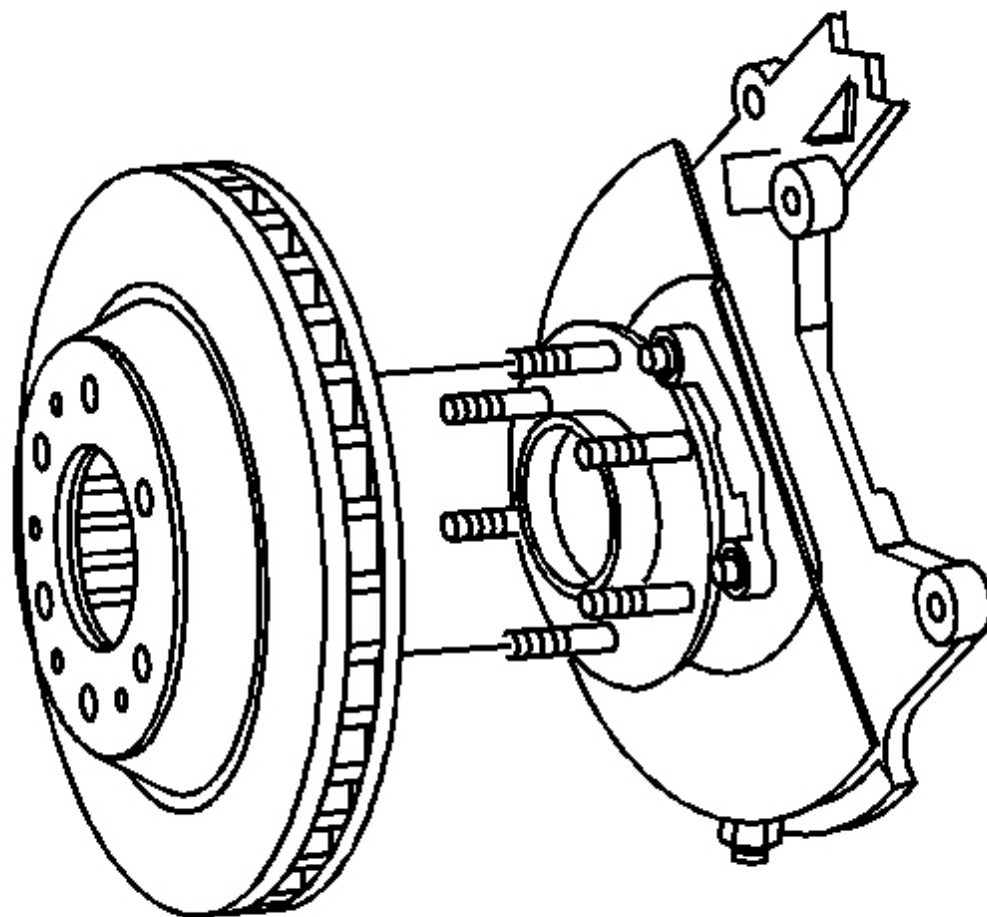


Fig. 7: View of Brake Rotor

Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove tire and wheel. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the brake rotor. Refer to **Front Brake Rotor Replacement** .

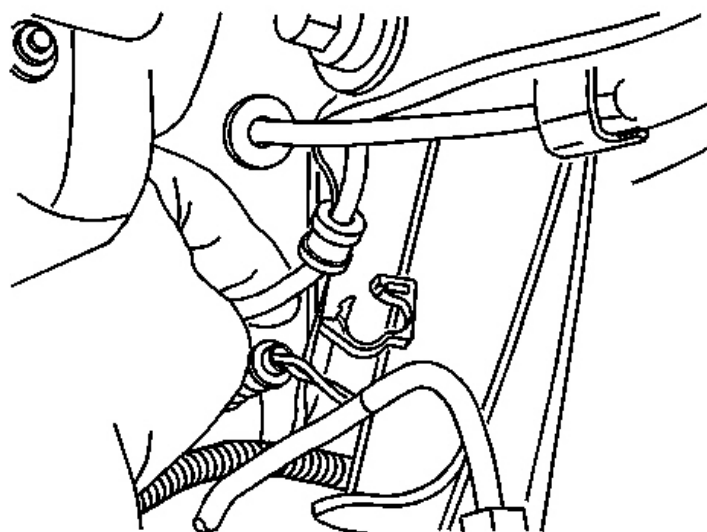
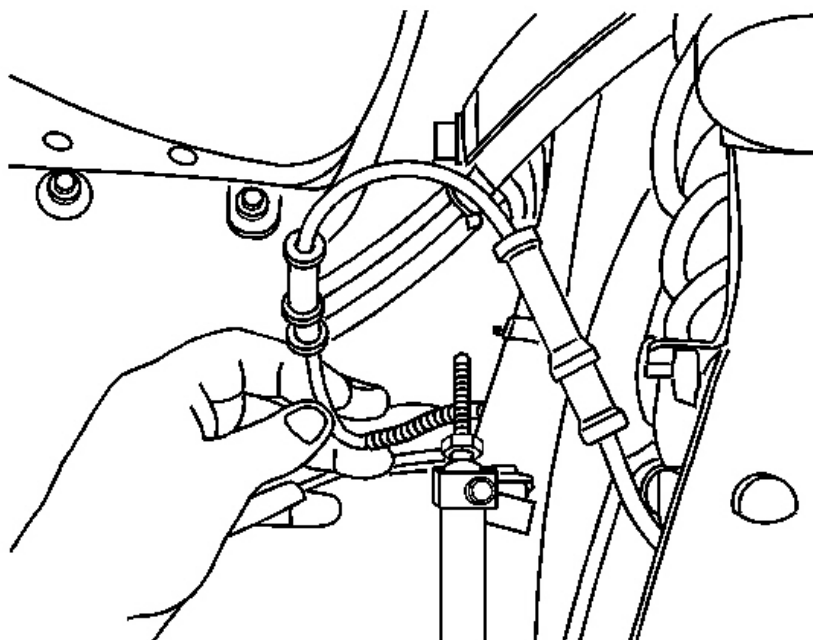


Fig. 8: Identifying Wheel Speed Sensor Wiring Harness
Courtesy of GENERAL MOTORS CORP.

4. Remove the wheel speed sensor wiring harness retainers.

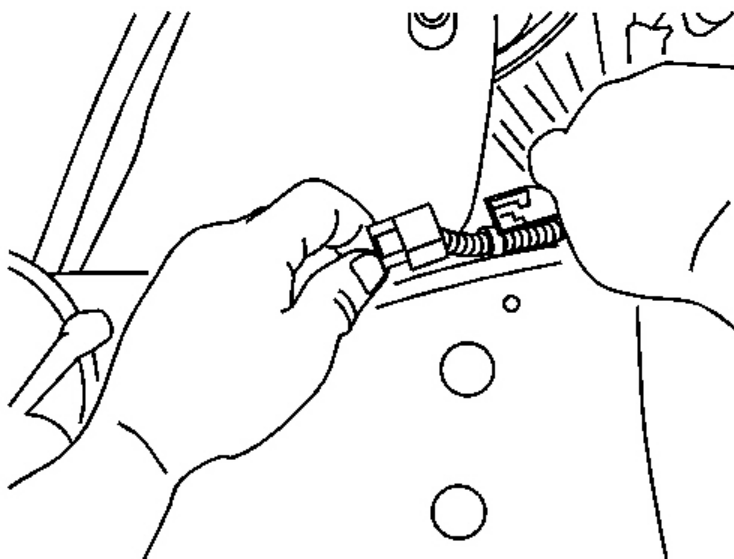
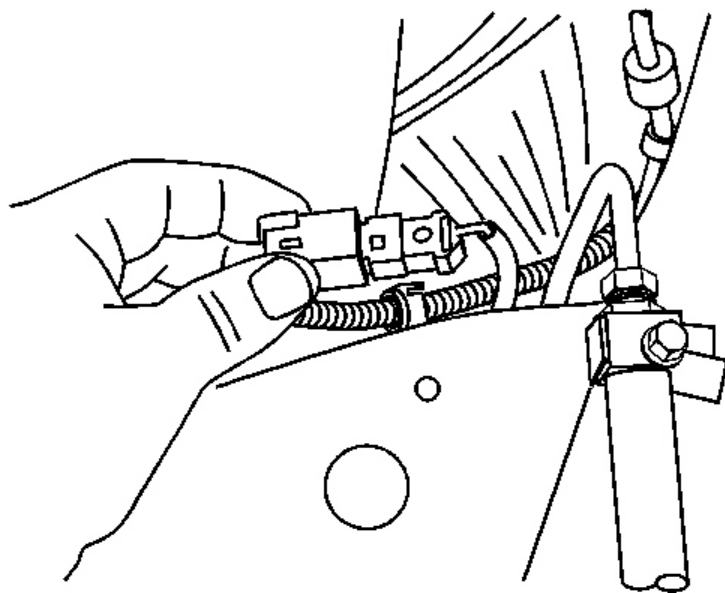


Fig. 9: Locating Connector
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the wheel speed sensor electrical connector.

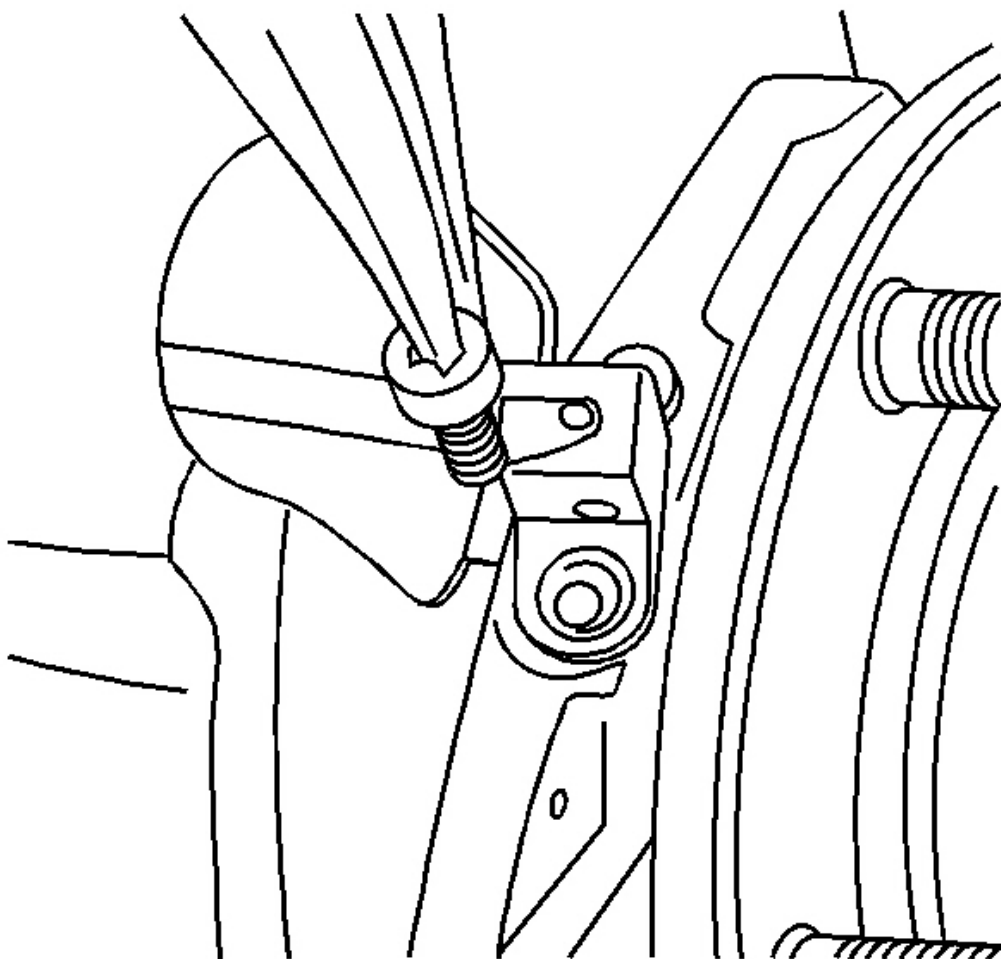


Fig. 10: Removing/Installing Sensor Mounting Screw
Courtesy of GENERAL MOTORS CORP.

6. Remove the sensor mounting screw.

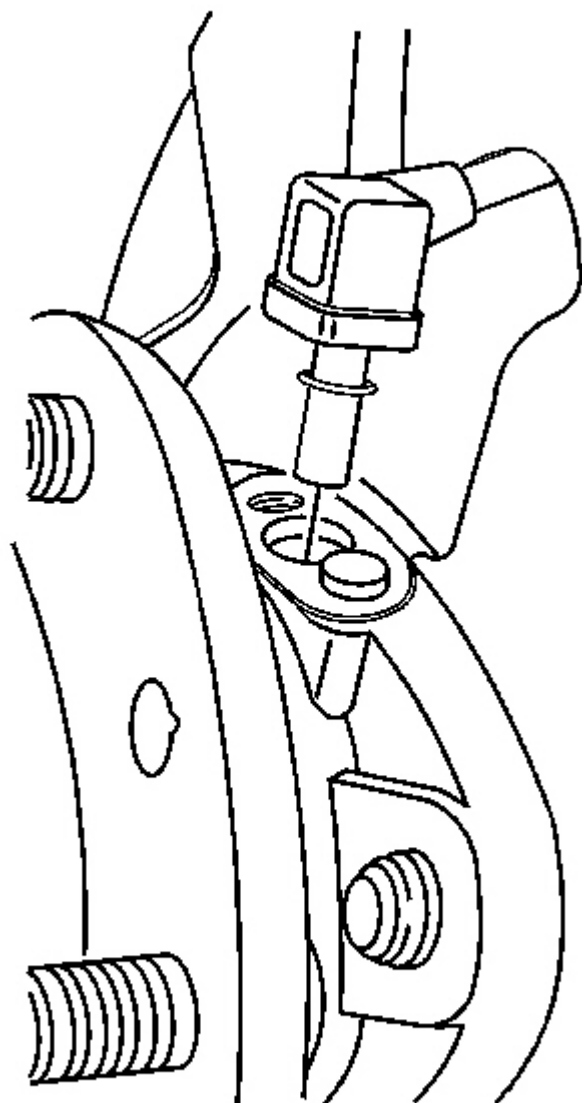


Fig. 11: View of Sensor

Courtesy of GENERAL MOTORS CORP.

NOTE: Carefully remove the sensor by pulling it straight out of the bore. DO NOT use a screwdriver, or other device. Prying will cause the sensor body to break off in the bore.

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NOTE: Do not attempt to remove the stainless steel shim from the bearing assembly. The shim is permanently attached. If the shim is damaged or bent, replace the bearing assembly. Failure to comply will result in diminished sensor and ABS performance.

IMPORTANT: The wheel speed sensor mounts into a bore that leads to the center of the sealed bearing. Use caution when cleaning or working around the bore. Do not contaminate the lubricant inside the sealed bearing. Failure to do so can lead to premature bearing failure.

7. Remove wheel speed sensor from hub and bearing assembly.

Installation Procedure

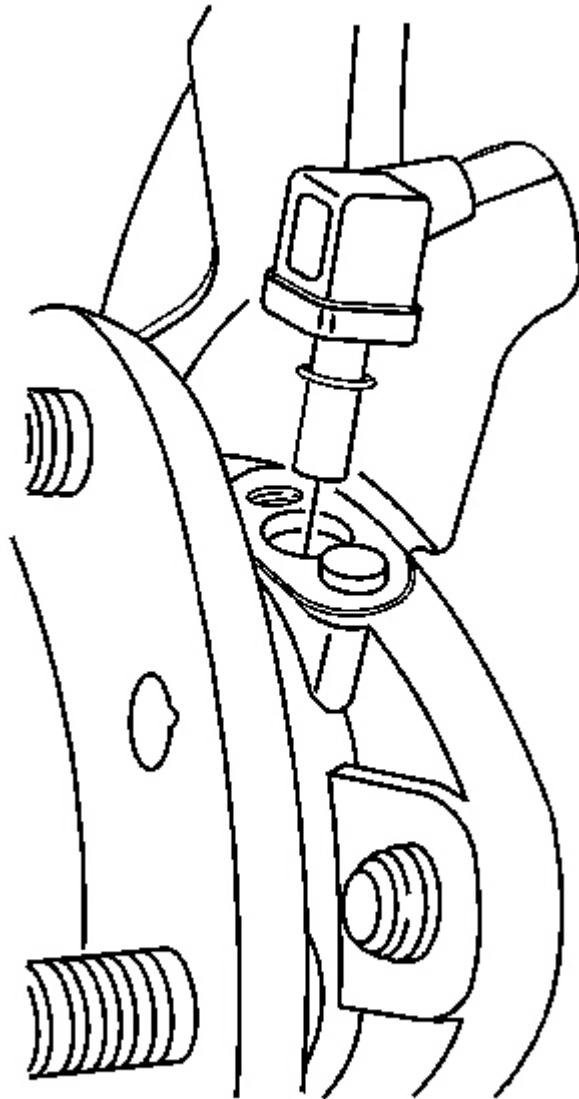


Fig. 12: View of Sensor

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The new speed sensor will have a new O-ring. Dispose of the old O-ring. Lubricate the new O-ring lightly with bearing grease prior to installation. You may also lubricate the sensor just above and below the new O-ring. **DO NOT** lubricate the bore.

1. Install the speed sensor into the hub and bearing assembly.

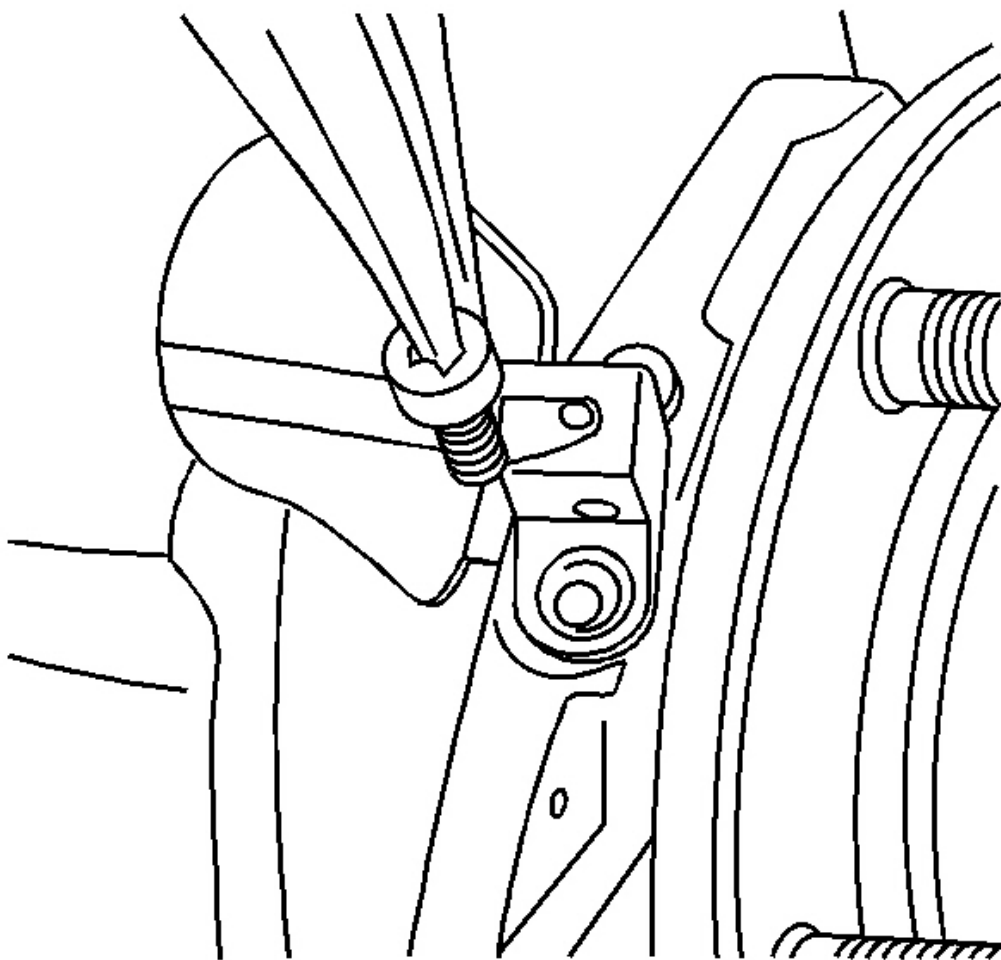


Fig. 13: Removing/Installing Sensor Mounting Screw
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Install the speed sensor mounting screw.

Tighten: Tighten the speed sensor mounting screw to 18 N.m (13 lb ft).

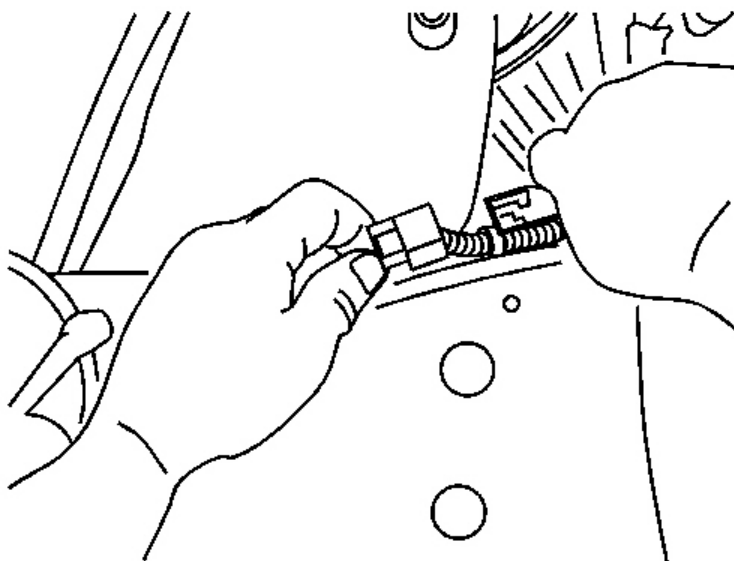
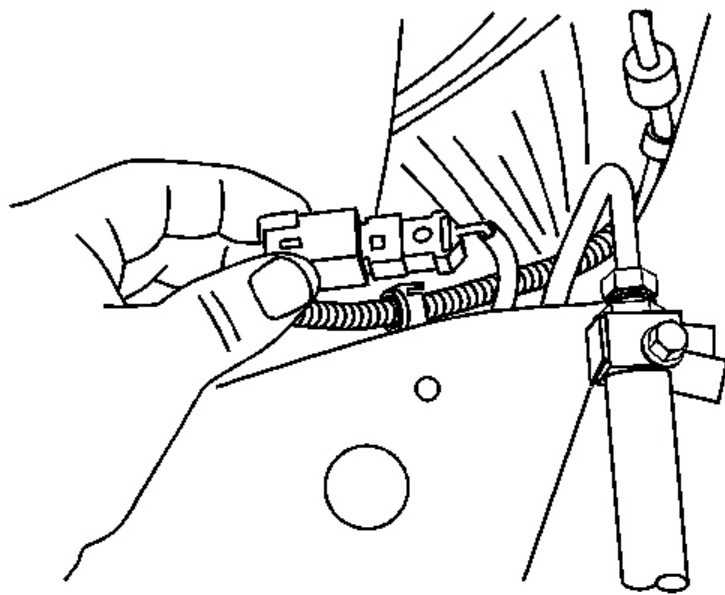


Fig. 14: Locating Connector
Courtesy of GENERAL MOTORS CORP.

3. Reconnect the wheel speed sensor electrical connector.

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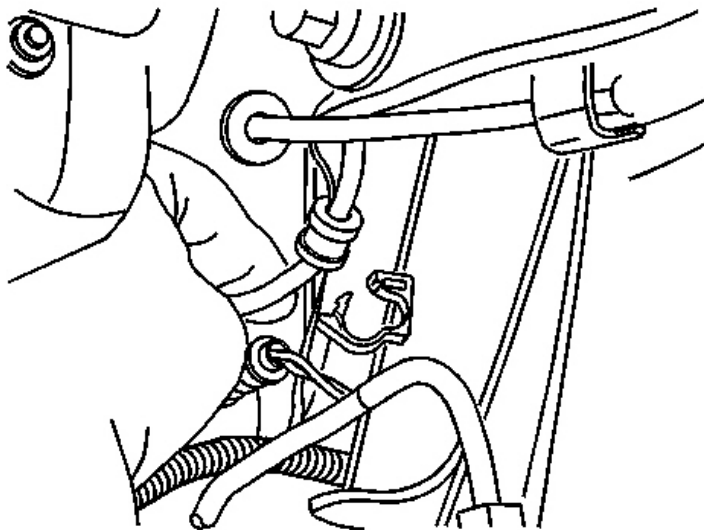
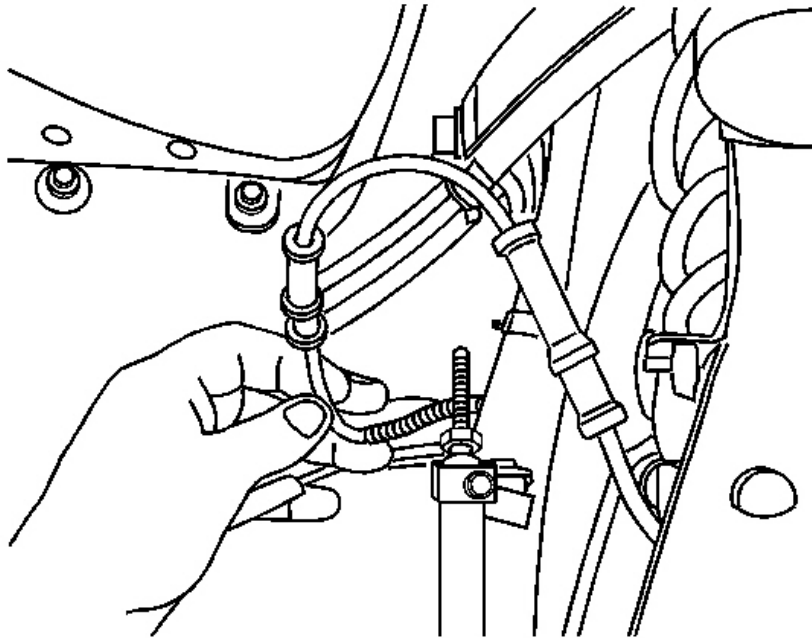


Fig. 15: Identifying Wheel Speed Sensor Wiring Harness
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The new speed sensor has new mounting clips already installed on the

wire. **DO NOT** reuse the old clips.

4. Install wheel speed sensor wiring harness to the frame and control arm.

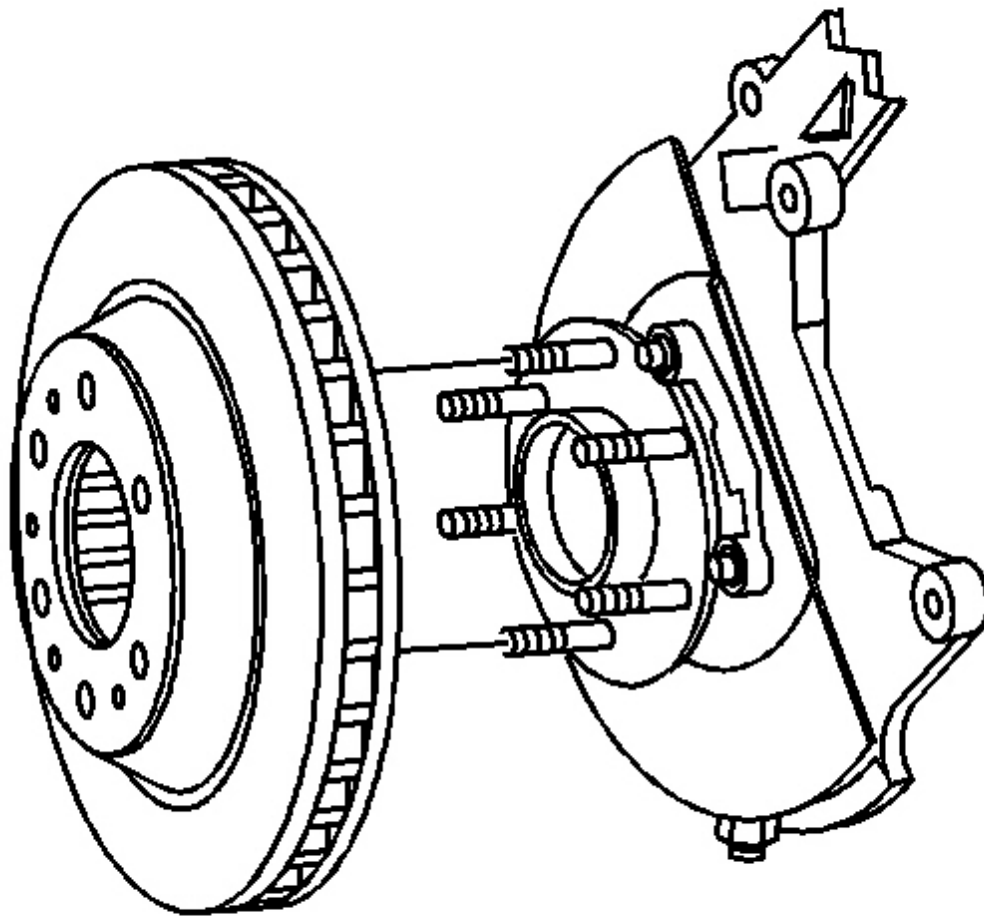


Fig. 16: View of Brake Rotor
Courtesy of GENERAL MOTORS CORP.

5. Install the brake rotor. Refer to **Front Brake Rotor Replacement** .
6. Install tire and wheel. Refer to **Lifting and Jacking the Vehicle** .

REAR WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

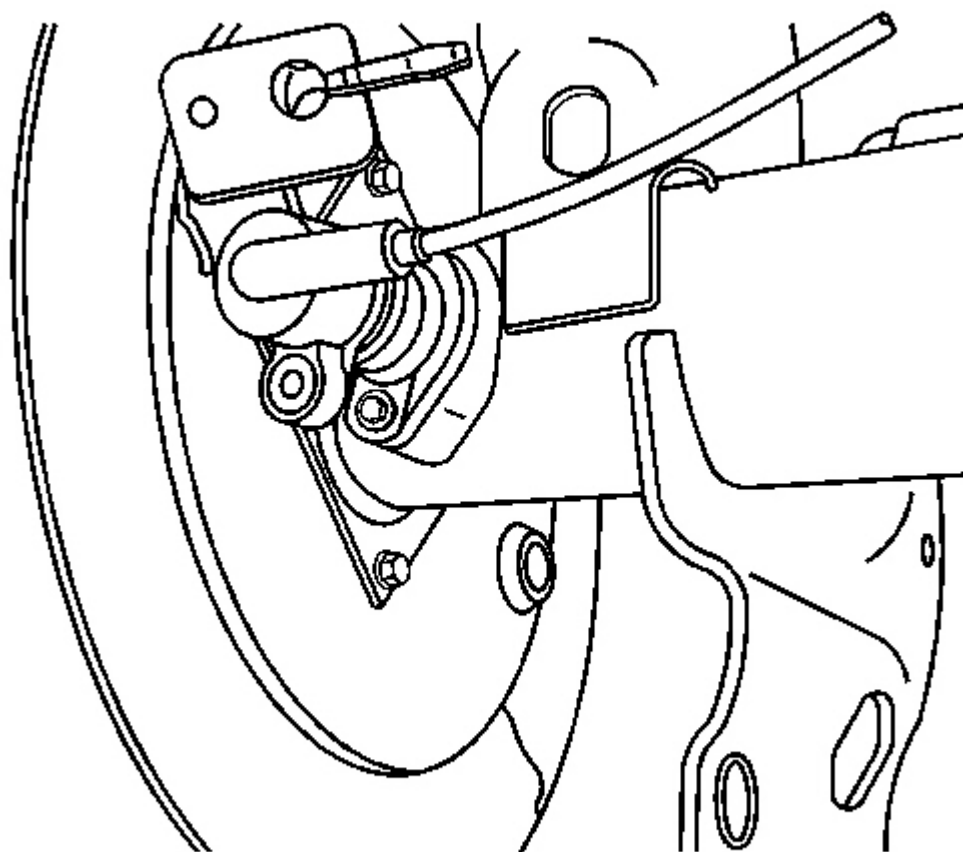


Fig. 17: View Of Rear Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Disconnect the electrical connector.
3. Remove the wheel speed sensor retaining bolt.
4. Remove the wheel speed sensor.

Installation Procedure

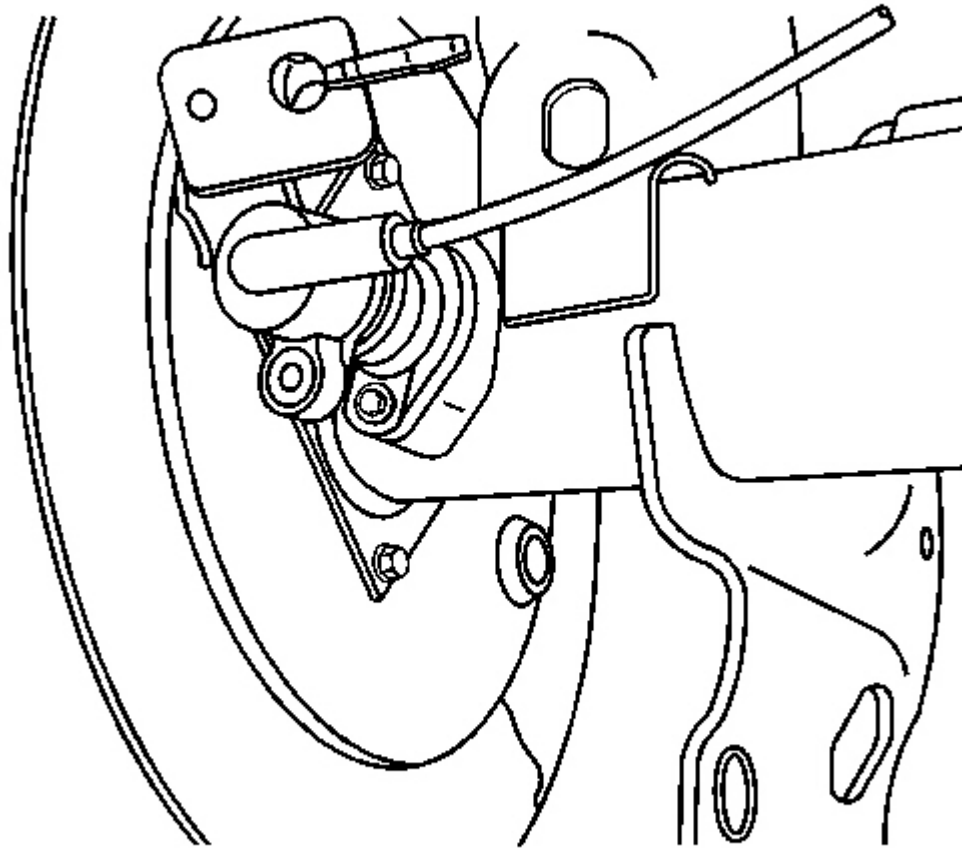


Fig. 18: View Of Rear Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

1. Ensure the sensor and sensor boss (face and inner diameter) are clean and free of any debris and/or metal chips.
2. Place a small amount of axle lube inside the sensor boss inner diameter to ensure the seal is properly lubricated and does not roll over when installed.
3. Insert the wheel speed sensor into the hole using equal pressure to seat the sensor squarely on the sensor boss face.

NOTE: Refer to Fastener Notice .

4. Align the sensor with the bolt hole and install the wheel speed sensor retaining bolt.

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Tighten: Tighten the wheel speed sensor retaining bolt to 13 N.m (115 lb in).

5. Connect the electrical connector.
6. Lower the vehicle.
7. Perform a low speed test to ensure the wheel speed sensor is functioning properly:
 1. Start the engine and allow it to idle.
 2. Verify the ABS indicator or the traction assist indicator remains illuminated.
 3. If the ABS indicator or the traction assist indicator remains illuminated, DO NOT proceed to drive the vehicle until it is diagnosed and repaired. Check the wheel speed sensor electrical connector to ensure it is not damaged and is installed properly. If the lamp remains illuminated, refer to **Symptoms - Antilock Brake System**.
 4. Select a smooth, dry, clean, and level road or large lot that is as free of traffic and obstacles as possible.
 5. Drive the vehicle and maintain a speed of at least 16 km/h (10 mph) for at least 5 seconds.
 6. Stop the vehicle and check to see if the ABS indicator or the traction assist indicator is illuminated.
 7. If an indicator is illuminated, refer to **Diagnostic Starting Point - Antilock Brake System**.

REAR WHEEL SPEED SENSOR RING REPLACEMENT

Tools Required

- **J 8092** Driver Handle. See **Special Tools**.
- **J 21128** Axle Pinion Oil Seal Installer. See **Special Tools**.
- **J 23690** Bearing Installer. See **Special Tools**.
- **J 2619-01** Slide Hammer. See **Special Tools**.
- **J 45857** Tone Wheel and/or Bearing Remover. See **Special Tools**.
- **J 45860** Tone Ring Installer. See **Special Tools**.

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the rear wheel speed sensor. Refer to **Rear Wheel Speed Sensor Replacement**.
4. Remove the rear axle housing cover. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)** .
5. Remove the axle shaft. Refer to **Rear Axle Shaft Replacement** .

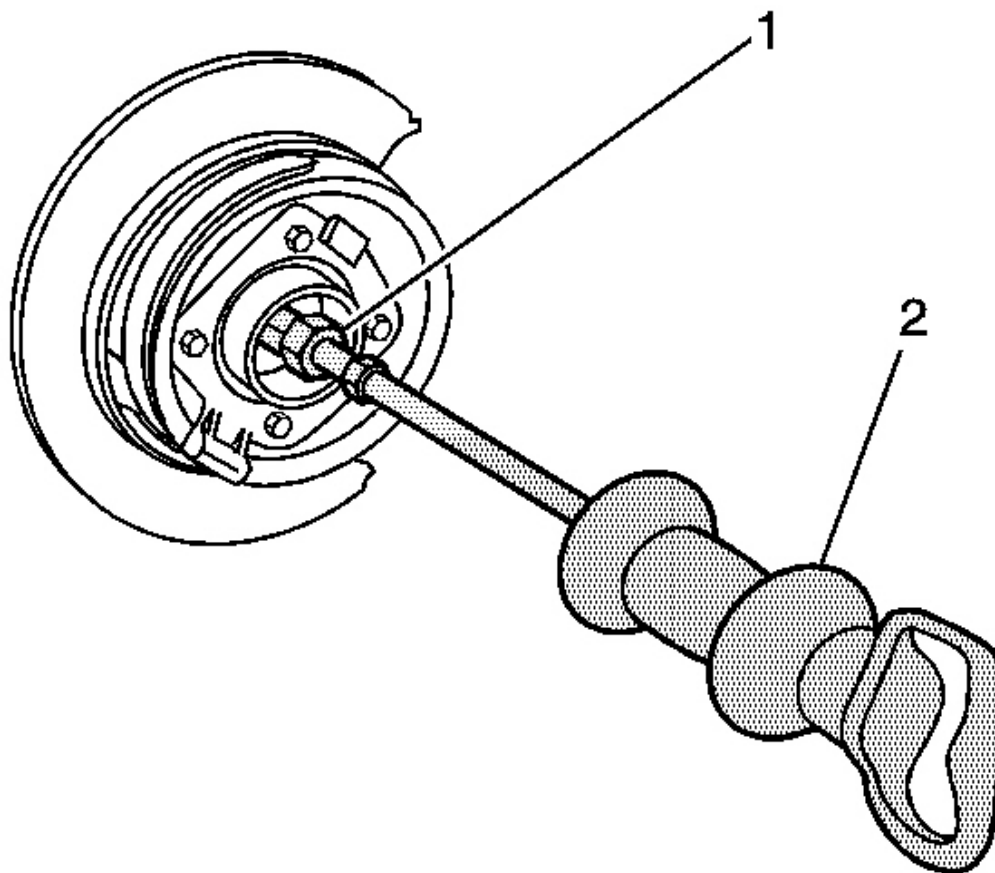


Fig. 19: View Of Wheel Speed Sensor Ring, Axle Housing & Removal Tool
Courtesy of GENERAL MOTORS CORP.

6. Remove the axle shaft seal, the bearing and the wheel speed sensor ring from the axle housing using the **J 45857** (1) and the **J 2619-01** (2). See **Special Tools**.

Installation Procedure

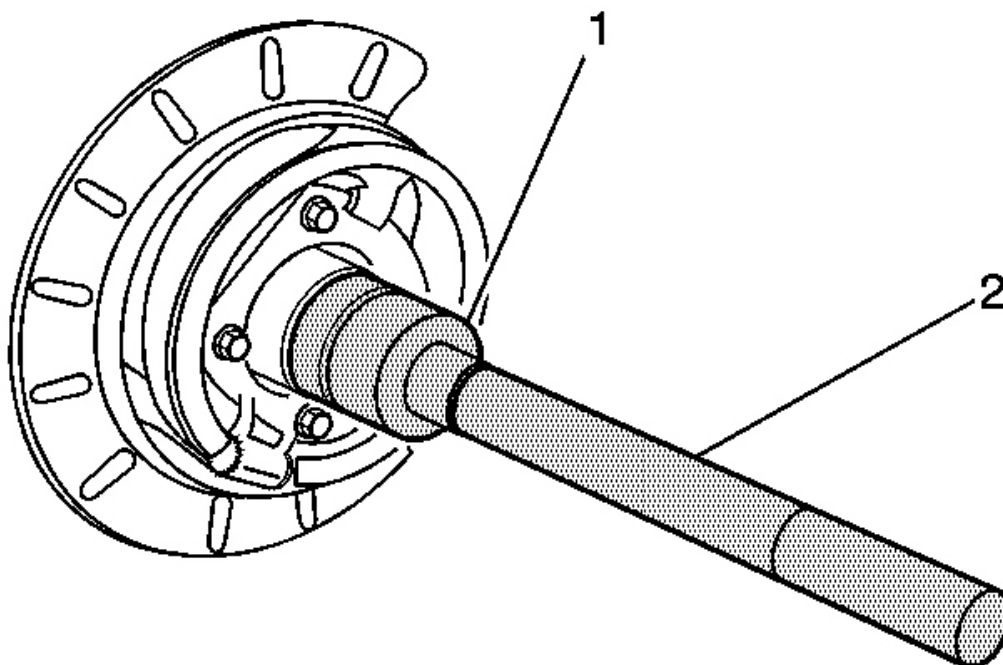


Fig. 20: View Of J 45860 & J 8092 Wheel Speed Sensor Ring Installation Tools
Courtesy of GENERAL MOTORS CORP.

1. Install the wheel speed sensor ring using the **J 45860** (1) and the **J 8092** (2). See **Special Tools**.
2. Drive the wheel speed sensor ring into the axle housing until the tool bottoms against the tube.

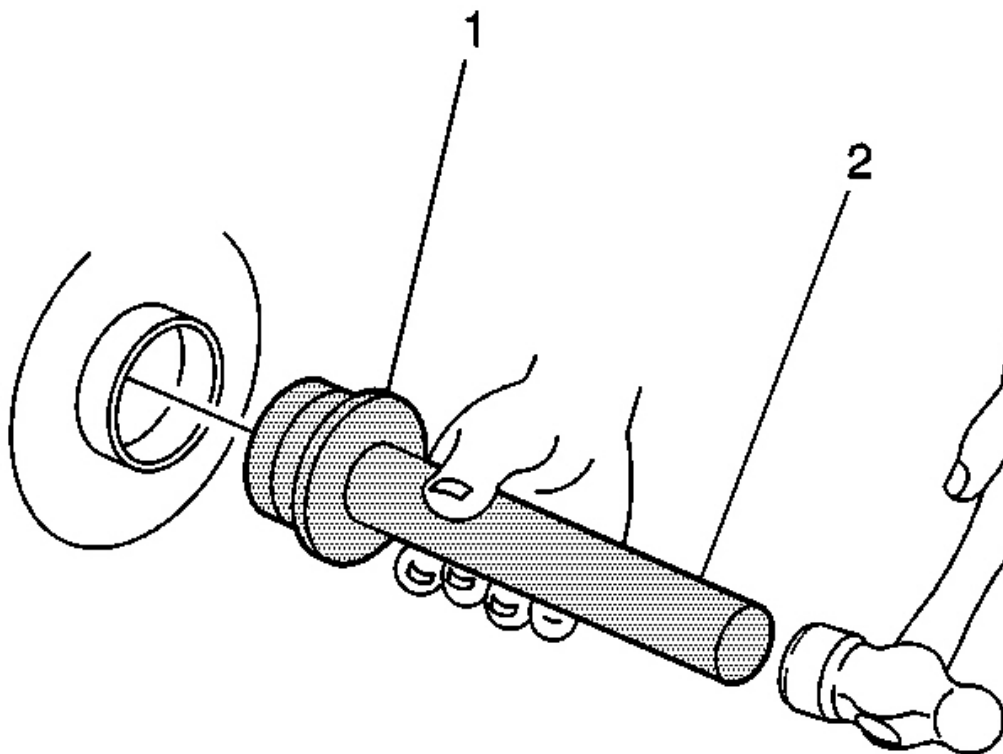


Fig. 21: Installing The Axle Shaft Bearing Using J 23690 Or J 29709 & J 8092
Courtesy of GENERAL MOTORS CORP.

3. Install the axle shaft bearing using the **J 23690** (1) and the **J 8092** (2). See **Special Tools**.
4. Drive the axle shaft bearing into the axle housing until the tool bottoms against the tube.

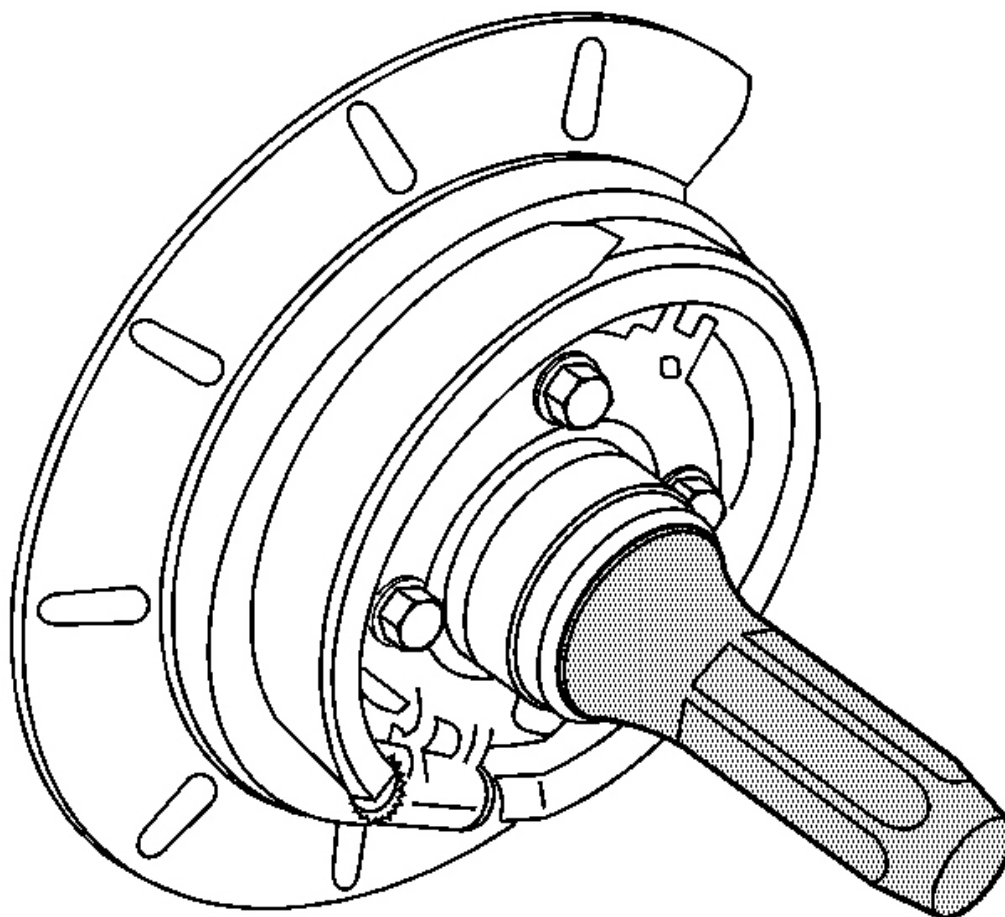


Fig. 22: View Of Axle Shaft Seal & J 21128
Courtesy of GENERAL MOTORS CORP.

5. Install the axle shaft seal using the **J 21128** . See **Special Tools**.
6. Drive the tool into the bore until the axle shaft seal bottoms flush with the tube.
7. Install the axle shaft. Refer to **Rear Axle Shaft Replacement** .
8. Install the rear axle housing cover. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)** .
9. Install the rear wheel speed sensor. Refer to **Rear Wheel Speed Sensor Replacement**.
10. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
11. Fill the rear axle. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)** .
12. Lower the vehicle.

VEHICLE YAW SENSOR WITH VEHICLE LATERAL ACCELEROMETER REPLACEMENT

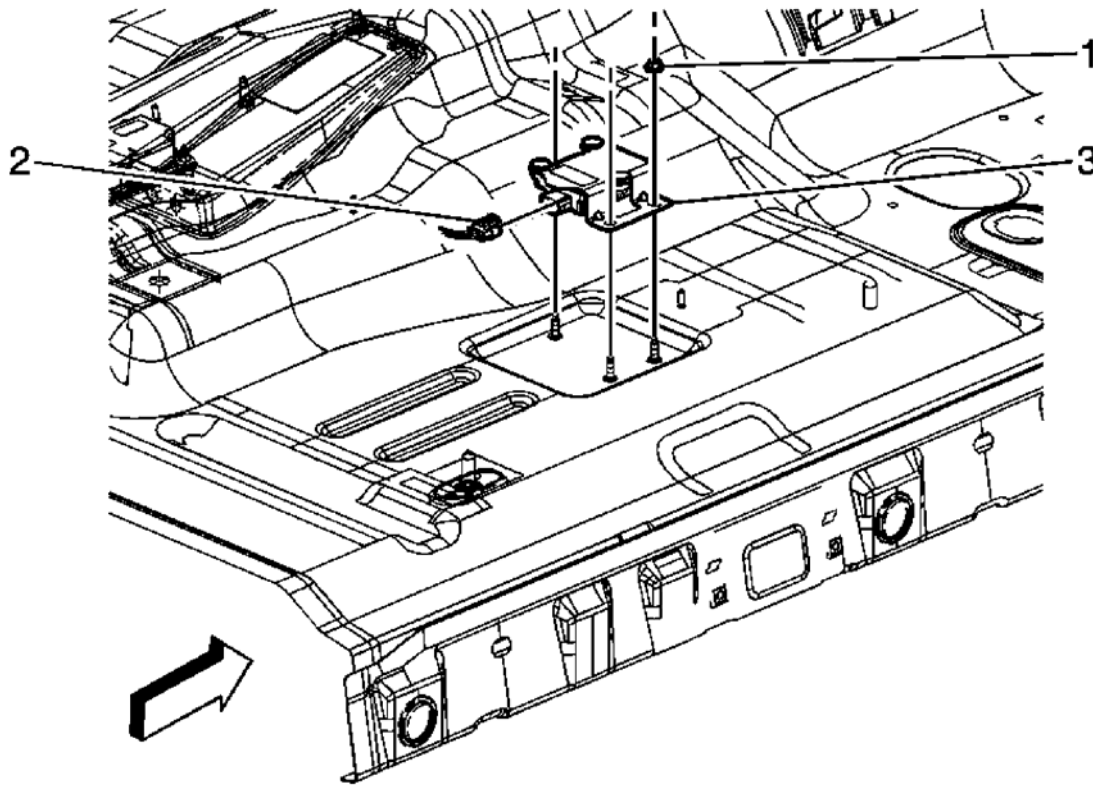


Fig. 23: Locating Yaw Rate Sensor/Lateral Accelerometer
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
NOTE: Refer to <u>Fastener Notice</u> .	
Fastener Tightening Specifications: Refer to <u>Fastener Tightening Specifications</u> . Preliminary Procedure: Remove the seat. Refer to <u>Front Seat Replacement - Bucket</u> .	
1	Nut (Qty: 3) Tighten: 10 N.m (89 lb in)
2	Connector
3	Sensor

DESCRIPTION & OPERATION

ABS DESCRIPTION & OPERATION

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Vehicles with RPO JL4 are equipped with an EBC 445V ABS/DRP/TCS/VSES module.

This module provides the following vehicle performance enhancement systems.

- Antilock Brake System (ABS)
- Dynamic Rear Proportioning (DRP)
- Traction Control System (TCS)
- 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 internal to the EBCM. The system relay is energized when the ignition is ON. The system relay supplies battery positive voltage to the valve solenoids and to the ABS pump motor. This voltage is referred to as system voltage.
- Solenoids-The solenoids are commanded ON and OFF by the EBCM to operate the appropriate valves in the brake pressure modulator valve (BPMV).
- Longitudinal accelerometer-The EBCM uses the longitudinal accelerometer to determine the actual straight-line acceleration of the vehicle.
- BPMV-The BPMV uses a 4-circuit configuration to control hydraulic pressure to each wheel independently.

The BPMV contains the following components.

- ABS pump motor and pump
- Four isolation valves
- Four dump valves
- Two TC isolation valves
- Two TC supply valves
- A master cylinder pressure sensor
- A front low-pressure accumulator
- A rear low-pressure accumulator
- Wheel speed sensors (WSS)-As the wheels spin, toothed rings interrupt magnetic fields in the wheel speed sensors. This causes each wheel speed sensor to generate an AC signal. The EBCM uses these AC signals to calculate the wheel speed. Any imperfections in the toothed ring, such as a missing or damaged tooth, can cause an inaccurate WSS signal.
- Traction control switch-VSES and the engine torque reduction function of TCS are manually disabled by pressing and holding the traction control switch for at least 5 seconds. These functions can be re-enabled with a quick press and release of the TC switch.
- Lateral accelerometer-The EBCM uses the lateral accelerometer to determine the sideways acceleration

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of the vehicle. The lateral accelerometer is packaged with the yaw rate sensor as a single component.

- Master cylinder pressure sensor-The master cylinder pressure sensor is located within the BPMV. The master cylinder pressure sensor uses a 5-volt reference and generates an output signal proportionate to the hydraulic fluid pressure which is present in the front brake circuit at the master cylinder.
- Yaw rate sensor-The EBCM uses the yaw rate sensor to determine the rate of rotation along the vehicle's vertical axis. The yaw rate sensor is packaged with the lateral accelerometer as a single component.
- Steering wheel position sensor-The EBCM receives several inputs from the steering wheel position sensor. Three digital square wave signal inputs are wired directly to the EBCM harness connector, however, only signals A and B are used or monitored. The failure of the index pulse signal does not effect VSES function. The EBCM also monitors an analog steering wheel position sensor signal. Battery voltage is supplied to the digital portion of the steering wheel position sensor by the ignition 1 circuit. The analog portion of the steering wheel position sensor is supplied a 5-volt reference from the EBCM.

Antilock Brake System (ABS)

When wheel slip is detected during a brake application, an ABS event occurs. 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. The ABS does not, 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 electronic brake control module (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. The typical ABS activation sequence is as follows.

Pressure Hold

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

Pressure Decrease

If a pressure hold does not correct the wheel slip condition, a pressure decrease occurs. The EBCM decreases the pressure to individual wheels during deceleration when wheel slip occurs. The isolation valve is closed and the dump valve is opened. The excess fluid is stored in the accumulator until the pump can return the fluid to the master cylinder or fluid reservoir.

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Pressure Increase

After the wheel slip is corrected, a pressure increase occurs. The EBCM increases the pressure to individual wheels during deceleration in order to reduce the speed of the wheel. The isolation valve is opened and the dump 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 enhances the hydraulic proportioning function of the mechanical proportioning valve in the base brake system. The DRP control system is part of the operation software in the electronic brake control module (EBCM). The DRP uses active control with existing ABS in order to regulate the vehicle's rear brake pressure.

Traction Control System (TCS)

Traction is maintained by limiting the amount of torque produced by the drivetrain and also by applying brake pressure to slipping wheels during acceleration. This causes power to transfer through the driveline to wheels which are not slipping. The transfer case used on 4-wheel drive vehicles equipped with vehicle stability enhancement system (VSES) does not contain a viscous coupling and therefore allows the front and rear drive shafts to turn at substantially different speeds. This front to rear differential must be kept within acceptable parameters by the VSES. The 2 methods of traction control are performed as follows.

Engine Torque Reduction

The electronic brake control module (EBCM) uses a 5-volt pulse width modulated (PWM) signal to request that the powertrain control module (PCM) reduce the amount of torque to the drive wheels. The PCM reduces torque to the drive wheels by retarding spark timing and commanding the throttle actuator control. The PCM uses a 12-volt PWM signal to report to the EBCM the amount of torque that is being delivered to the drive wheels. Engine torque reduction is mostly used to reduce vehicle speed during VSES events and during traction control system (TCS) events when the brakes are in danger of being overheated or when the driven wheels are slipping at the same rate. Engine torque reduction can be disabled by pressing the traction control switch.

Brake Pressure Application

The EBCM uses brake pressure application to control traction by transferring torque through the driveline to wheels which are not slipping. The ABS pump motor and appropriate valve solenoids are commanded ON and OFF to apply brake pressure to the slipping wheels. Brake pressure application is used in an attempt to maintain equal WSS signals at the driven wheels.

The EBCM does not allow excessive brake pressure application due to the fact that the solenoid coils or the brakes may become overheated, damaging the EBCM or reducing the driver's ability to stop the vehicle. Estimated coil and brake temperatures are determined by a calculation in the EBCM software. Overheated solenoid coils cause all brake pressure application to become disabled and the stability system disabled message to be displayed. Overheated brakes cause brake pressure application during TCS events to disable, yet the VSES remains functional and as long as the engine torque reduction is enabled, there is no indication to the driver when this occurs and no DTC sets.

Vehicle Stability Enhancement System (VSES)

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The vehicle stability enhancement system (VSES) provides added stability during aggressive maneuvers. Yaw rate is the rate of rotation about the vehicle's vertical axis. The VSES is activated when the electronic brake control module (EBCM) determines that the desired yaw rate does not match the actual yaw rate as measured by the yaw rate sensor.

The desired yaw rate is calculated by the EBCM using, primarily, the following inputs.

- The position of the steering wheel
- The speed of the vehicle
- The lateral, or sideways acceleration of the vehicle

The difference between the desired yaw rate and the actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. When a yaw rate error is detected, the EBCM attempts to correct the vehicle's yaw motion by applying brake pressure to one or more of the wheels. The amount of brake pressure which is applied varies, depending on the correction required. The engine torque may be reduced also, if it is necessary to slow the vehicle while maintaining stability.

VSES activations generally occur in turns during aggressive driving. When braking during VSES activation, the pedal may pulsate. The brake pedal pulsates at a higher frequency during VSES activation than during ABS activation.

System Pre-Fill

This vehicle is equipped with a 4-wheel disc brake system. Disc brake calipers are designed so that when hydraulic pressure is not being applied, the caliper piston lip seal causes the piston to retract, creating measurable clearance between the brake pads and the rotor. Since a small amount of brake fluid must be delivered to the calipers before any actual braking occurs, the vehicle stability enhancement system (VSES) uses system pre-fill to prevent delayed brake application and enhance system performance. If the electronic brake control module (EBCM) determines that a brake application is likely to be needed, the ABS pump motor runs momentarily to take up any clearances between the brake pads and the rotor. By monitoring the master cylinder pressure sensor feedback signal, the EBCM can determine when the brake pads are contacting the rotor. The EBCM then holds this small amount of pressure in the system. A VSES brake application may or may not occur after pre-fill is complete. If the EBCM determines that a brake application is no longer pending, the pre-fill pressure is released and the VSES system returns to the normal, monitoring state. The reason that we must understand system pre-fill is that pre-fill may lead to customer concerns. Any time the ABS pump motor is active, the motor draws a large amount of current, and may cause the vehicle lighting systems to dim noticeably. When ABS activity occurs, most drivers understand that this activity is the cause of noises and dimming lights. Likewise, when an actual VSES event occurs, the Stability System Active message is displayed, which helps drivers understand why these other conditions occur. Since pre-fill is not an actual VSES event, but preparation for a pending event, no message is displayed. Also, system noise during pre-fill is very minimal. A customer may become concerned with what is perceived to be an electrical problem, due to the intermittent dimming lights, when, in fact, no malfunction exists and the condition is normal.

Power-up Self-Test

The electronic brake control module (EBCM) is able to detect many malfunctions whenever the ignition is ON. However, certain failures cannot be detected unless active diagnostic tests are performed on the components.

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Shorted solenoid coil or motor windings, for example, cannot be detected until the components are commanded ON by the EBCM. Therefore, a power-up self-test is required at the beginning of each ignition cycle to verify correct operation of components before the various control systems can be enabled. The EBCM performs the first phase of the power-up self-test when the ignition is first turned ON. The system relay, solenoids and the ABS pump motor are commanded ON and OFF to verify proper operation and the EBCM verifies the ability to return the system to base braking in the event of a failure. The master cylinder pressure sensor performs a self-test by sending a series of specific voltage signals to the EBCM, each for a predetermined amount of time. This phase of the power-up self-test may be heard by the driver, depending on how soon the engine is cranked and started after turning ON the ignition. The second phase of the power-up self-test begins when the vehicle is driven at a speed greater than 16 km/h (10 mph) and the EBCM has not detected any traction control system (TCS)/vehicle stability enhancement system (VSES) related malfunctions thus far. During this phase, the ABS pump is tested to verify the ability to build adequate pressure to perform brake pressure application during certain TCS and VSES events. When the brake switch indicates that the brake is not applied and the master cylinder pressure is detected as being low, the EBCM proceeds with the test. The EBCM isolates all of the wheels by closing the 4 isolation valves. The ABS pump is then commanded ON while the EBCM monitors the master cylinder pressure sensor input. The ABS pump must build approximately 248 kPa (36 psi) of hydraulic pressure within 1 second or the test is failed. If the EBCM uses brake pressure application to perform TCS or VSES prior to the second phase of the power-up self-test, the ABS pump is tested at this time and the second phase of the test is not required. Due to the fact that all of the wheels are isolated during the second phase of the test, the test must be aborted if the brake is applied while the test is being performed. Occasionally, the driver may detect this by experiencing a momentary hard pedal.

VSES Sensors Initialization

The vehicle stability enhancement system (VSES) sensors values may vary slightly due to differences in temperature, sensor mounting, connector resistances, manufacturing, etc. Since the VSES is a very sensitive and precise control system, it is imperative that the electronic brake control module (EBCM) be able to accurately equate a given sensor voltage with an actual unit of measurement. For example, the yaw rate signal of one vehicle may be 2.64 volts at +18.0 deg/sec yaw rate while the yaw rate signal of another vehicle may be 2.64 volts at +17.5 deg/sec yaw rate. Therefore, at the beginning of each ignition cycle, the EBCM must perform an initialization procedure to observe how the VSES sensors are correlated with each other and also to determine what each sensor value is when the applicable unit of measurement equals 0. This voltage is referred to as the sensor bias voltage. Although some activation of the VSES system may occur if required to prior to full initialization, the system does not give optimum performance until the sensors are fully initialized.

The following VSES sensors require initialization.

- The yaw rate sensor
- The lateral accelerometer
- The longitudinal accelerometer
- The master cylinder pressure sensor
- The steering wheel position sensor

When the vehicle speed is greater than 25 km/h (15 mph), full sensor initialization must occur during 3 km (1.8 mi) of driving or 1 km (0.6 mi) of straight and stable driving, whichever occurs first. Although an attempt at initialization may fail due to driving conditions, such as driving on a very winding road, failed initialization is

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usually caused by a sensor bias voltage which is not within an acceptable range. Often, a DTC sets soon after a failed initialization attempt. The stability system not ready indicator illuminates when sensor initialization fails.

ECE 13 Response

The electronic brake control module (EBCM) illuminates the ABS indicator when a malfunction which disables ABS is detected. Usually, the ABS indicator is turned OFF during the following ignition cycle unless the fault is detected during that ignition cycle. However, the setting of a wheel speed sensor related DTC causes the ABS indicator to remain illuminated during the following ignition cycle until the vehicle is operated at a speed greater than 13 km/h (8 mph). This allows the EBCM to verify that no malfunction exists, before turning OFF the ABS indicator. This reaction occurs even if the ABS indicator turns OFF when the scan tool is used to clear the DTCs. When repairing these vehicles, it is important to ensure that the ECE 13 response has occurred and that the ABS indicator does not illuminate after returning the vehicle to the customer. It is also important to verify that ECE 13 is not the cause of an ABS indicator which is illuminated when no DTCs are set, before attempting to diagnose other possible causes.

Driver Information Indicators & Messages

The following indicators are used to inform the driver of several different factors.

Brake Warning Indicator

The instrument panel cluster (IPC) illuminates the brake warning indicator when the following occurs.

- The body control module (BCM) detects that the park brake is engaged. The IPC receives a serial data message from the BCM requesting illumination. The brake warning indicator flashes at a rate of approximately twice per second when the park brake is engaged.
- The electronic brake control module (EBCM) detects a low brake fluid condition or a base brake pressure differential and sends a serial data message to the IPC requesting illumination.
- The IPC performs the bulb check.
- The EBCM detects an ABS-disabling malfunction which also disables dynamic rear proportioning (DRP) and sends a serial data message to the IPC requesting illumination.

ABS Indicator

The IPC illuminates the ABS indicator when the following occurs.

- The EBCM detects an ABS-disabling malfunction and sends a serial data message to the IPC requesting illumination.
- The IPC performs the bulb check.
- The IPC detects a loss of serial data communication with the EBCM.
- A DTC is set during the previous ignition cycle which requires an ECE 13 response at the beginning of the current ignition cycle. The EBCM sends a serial data message to the IPC requesting illumination.

Traction Off Indicator

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The IPC illuminates the traction off indicator when the following occurs.

- The EBCM disables engine torque reduction due to a malfunction and sends a serial data message to the IPC requesting illumination.
- The IPC performs the bulb check.
- The driver manually disables VSES and engine torque reduction by pressing the traction control switch. The EBCM sends a serial data message to the IPC requesting illumination.
- The IPC flashes the traction off indicator if wheel slip is detected while engine torque reduction and brake pressure application are both disabled.

Service Brake System Message

The service brake system message is displayed whenever the red brake warning indicator is illuminated.

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.

Stability SYS 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 request this display.

Stability SYS Ready Message

The message center displays the stability system ready message when the system has initialize.

Stability SYS Disabled Message

The message center displays the stability system disabled message when one or more of the following conditions exists.

- The transfer case is shifted into 4 LO. The EBCM sends a serial data message to the IPC requesting illumination
- The driver manually disables the VSES and engine torque reduction by pressing the traction control switch. The EBCM sends a serial data message to the IPC requesting illumination.
- The estimated temperature of any solenoid coil exceeds an acceptable limit. The EBCM sends a serial data message to the IPC requesting this display
- The EBCM detects a failed brake switch. The EBCM sends a serial data message to the IPC requesting this display. A DTC sets when this condition exists.
- The powertrain control module (PCM) is not able to perform engine torque reduction. The EBCM sends a serial data message to the IPC requesting illumination. DTCs set when this condition exists.
- The EBCM detects that the brake fluid level is low or a base brake pressure differential exists. These two conditions are not distinguishable by the EBCM. The EBCM sends a serial data message to the IPC requesting this display.

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- VSES sensor initialization time is excessive. The EBCM sends a serial data message to the IPC requesting this display.
- Serial data communication between the EBCM and any of several other control modules is interrupted. The EBCM sends a serial data message to the IPC requesting this display or the IPC displays the message when communication with the EBCM is interrupted.
- The PCM is not able to perform engine torque reduction. The EBCM sends a serial data message to the IPC requesting this display. DTCs set when this condition exists.
- The EBCM detects an excessively low or excessively high ignition voltage. The EBCM sends a serial data message to the IPC requesting this display.

Traction Active Message


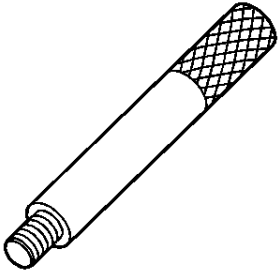
The drive information center displays the traction active message when engine torque reduction or brake pressure application is required to maintain traction. The EBCM sends a serial data message to the IPC requesting this display.

Traction SYS LIMITED

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

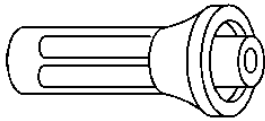
SPECIAL TOOLS & EQUIPMENT

SPECIAL TOOLS

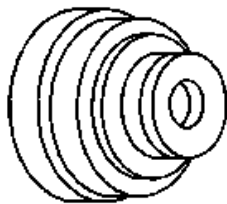
Illustration	Tool Number/ Description
	J 2619-01 Slide Hammer
	J 8092 Driver Handle

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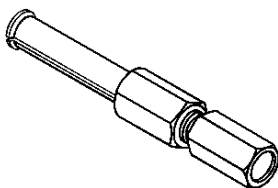
J 21128
Axle Pinion Oil Seal Installer



J 23690
Bearing Installer



J 39700
100-Pin Breakout Box



J 45857
Tone Wheel and/or Bearing Remover

J 45860
Tone Ring Installer

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