

BRAKES

Antilock Brake System - Malibu

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Pipe Fitting- Brake Pressure Modulator Valve Outlet	18 N.m	13 lb ft
Brake Pipe Fitting- Master Cylinder Primary and Secondary Brake Pipe	25 N.m	18 lb ft
Brake Pressure Modulator Valve Assembly Bolt	20 N.m	15 lb ft
Brake Pressure Modulator Valve Assembly Bracket Bolt	10 N.m	89 lb in
Brake Pressure Modulator Valve Assembly Nut	20 N.m	15 lb ft
Electronic Brake Control Module Bolt	3 N.m	26 lb in
Power Steering Wiring Harness Bracket Bolt	9 N.m	80 lb in
Wheel Speed Sensor Bolt	9 N.m	80 lb in
Vehicle Yaw Sensor Nut	9 N.m	80 lb in

SCHEMATIC WIRING DIAGRAMS

ANTILOCK BRAKE SYSTEM WIRING SCHEMATICS

Module Power, Ground, Subsystem References and Brake Applied Signal Wiring Schematics

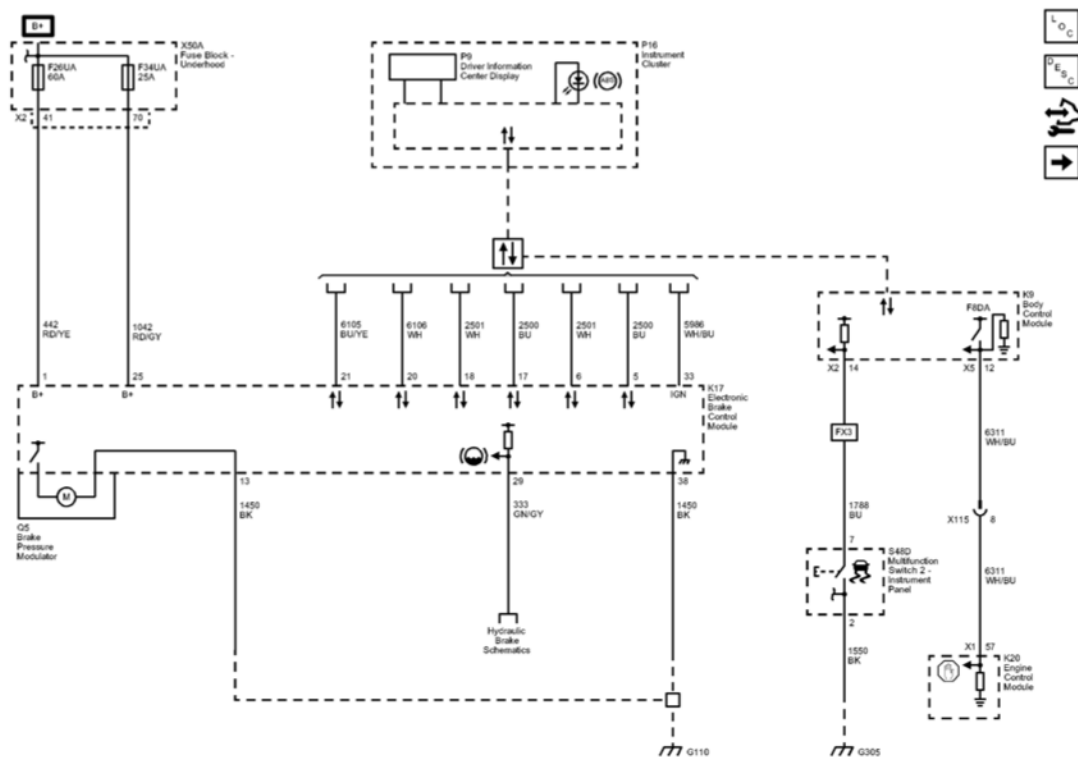


Fig. 1: Module Power, Ground, Subsystem References and Brake Applied Signal Wiring Schematics
 Courtesy of GENERAL MOTORS COMPANY

Wheel Speed Sensors Wiring Schematics

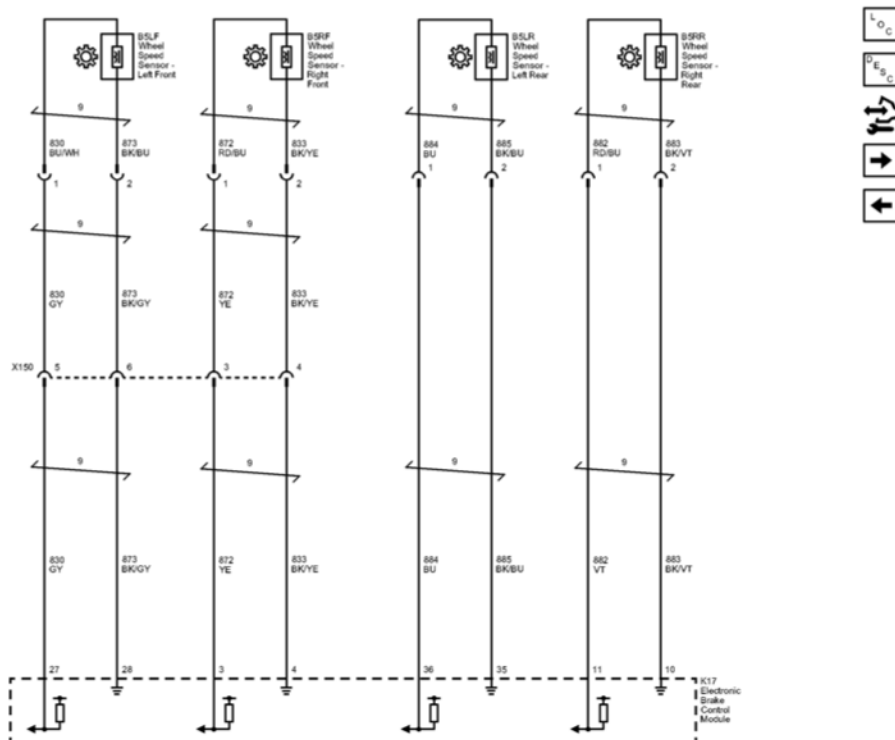


Fig. 2: Wheel Speed Sensors Wiring Schematics
 Courtesy of GENERAL MOTORS COMPANY

Stability Sensors (FX3) Wiring Schematics

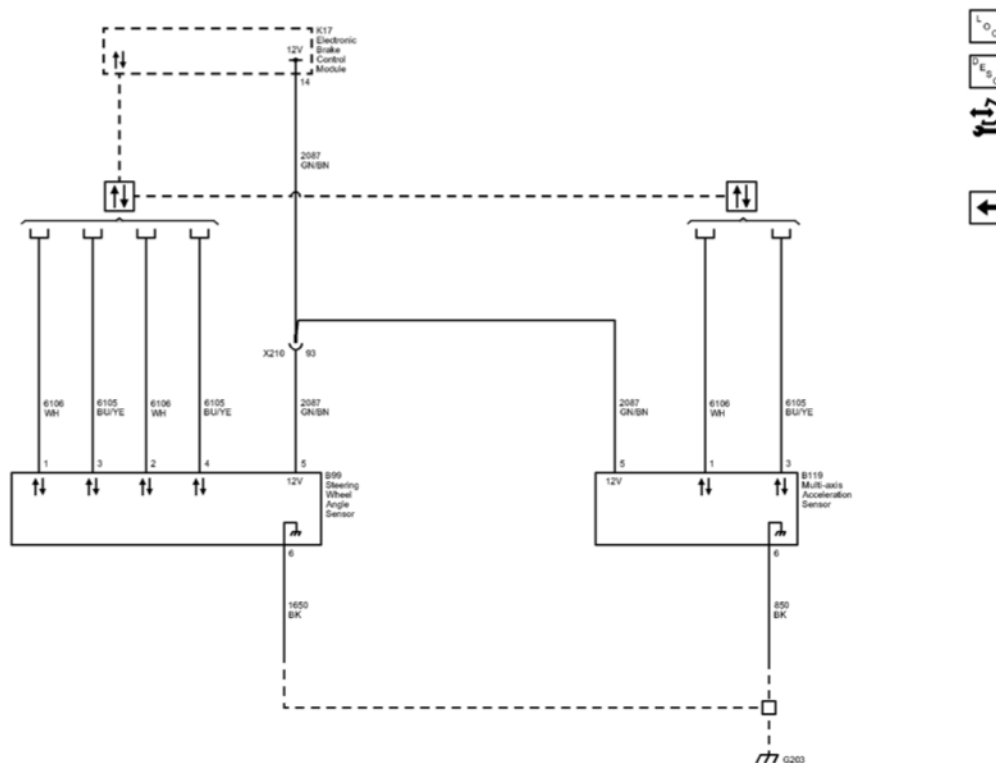


Fig. 3: Stability Sensors (FX3) Wiring Schematics
 Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC B2745</u>	DTC B2745 02 Traction Control Switch Circuit Short to Ground
	DTC C0035 06 Left Front Wheel Speed Sensor Circuit Low Voltage/Open
	DTC C0035 0F Left Front Wheel Speed Sensor Circuit Signal Erratic
	DTC C0035 18 Left Front Wheel Speed Sensor Circuit Low Signal Amplitude
	DTC C0035 5A Left Front Wheel Speed Sensor Circuit Not Plausible
	DTC C0040 06 Right Front Wheel Speed Sensor Circuit Low Voltage/Open
	DTC C0040 0F Right Front Wheel Speed Sensor Circuit Signal Erratic

<u>DTC C0035, C0040, C0045, or C0050</u>	DTC C0040 18 Right Front Wheel Speed Sensor Circuit Low Signal Amplitude DTC C0040 5A Right Front Wheel Speed Sensor Circuit Not Plausible DTC C0045 06 Left Rear Wheel Speed Sensor Circuit Low Voltage/Open DTC C0045 0F Left Rear Wheel Speed Sensor Circuit Signal Erratic DTC C0045 18 Left Rear Wheel Speed Sensor Circuit Low Signal Amplitude DTC C0045 5A Left Rear Wheel Speed Sensor Circuit Not Plausible DTC C0050 06 Right Rear Wheel Speed Sensor Circuit Low Voltage/Open DTC C0050 0F Right Rear Wheel Speed Sensor Circuit Signal Erratic DTC C0050 18 Right Rear Wheel Speed Sensor Circuit Low Signal Amplitude DTC C0050 5A Right Rear Wheel Speed Sensor Circuit Not Plausible
<u>DTC C0110</u>	DTC C0110 06 Pump Motor Circuit Low Voltage/Open DTC C0110 61 Pump Motor Circuit Stuck
<u>DTC C0131</u>	DTC C0131 00 Traction Control System Pressure Circuit Malfunction DTC C0131 4B Traction Control System Pressure Circuit Calibration Not Learned DTC C0131 5A Traction Control System Pressure Circuit Not Plausible
<u>DTC C0161</u>	DTC C0161 5A Antilock Braking System Brake Switch Circuit Not Plausible DTC C0161 71 Antilock Braking System Brake Switch Circuit Invalid Data
<u>DTC C0187, C018B, C0196, C019B, C0287, or C0297</u>	DTC C0187 5A Lateral Acceleration Sensor Signal Not Plausible DTC C018B 5A Lateral Acceleration Sensor Signal Not Plausible DTC C0196 00 Yaw Rate Circuit DTC C0196 5A Yaw Rate Signal Not Plausible DTC C0196 71 Yaw Rate Circuit Invalid Serial Data Received DTC C019B 5A Yaw Rate Signal Not Plausible DTC C0287 00 Longitudinal Acceleration Sensor Circuit DTC C0287 4B Longitudinal Acceleration Sensor Circuit Calibration Not Learned DTC C0287 5A Longitudinal Acceleration Sensor

	Signal Not Plausible DTC C0287 71 Longitudinal Acceleration Sensor Signal Invalid Serial Data Received DTC C0297 4A Lost Communication With Yaw Rate Sensor Checksum Error
<u>DTC C0242 or P0856</u>	DTC C0242 00 Engine Control Module Indicated Traction Control Malfunction DTC P0856 Traction Control Torque Request Signal Message Counter Incorrect
<u>DTC C0245</u>	DTC C0245 00 Wheel Speed Sensor Frequency Malfunction
<u>DTC C0252</u>	DTC C0252 00 Vehicle Stability Control Module Sensors Correlation Malfunction
<u>DTC C0274, C0275, or C0280</u>	DTC C0274 54 Isolation Valve High Temperature DTC C0275 54 Dump Valve High Temperature DTC C0280 54 Stability System Active Too Long
<u>DTC C0558</u>	DTC C0558 4B Calibration Data Calibration Not Learned
<u>DTC C0569</u>	DTC C0569 00 System Configuration Malfunction
<u>DTC C0710</u>	DTC C0710 00 Steering Position Signal Malfunction DTC C0710 42 Steering Position Signal Calibration Not Programmed DTC C0710 71 Steering Position Signal Invalid Data DTC C0710 5A Steering Position Signal Not Plausible
<u>DTC P2548</u>	DTC P2548 Vehicle Dynamics System Torque Request Signal Message Counter Incorrect

DTC B2745

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 B2745 02

Traction Control Switch Circuit Short to Ground

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
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Signal	B2745 02, U0422 71	1	1	-
Ground	-	1	-	-
1. Traction control switch malfunction				

Circuit/System Description

The body control module monitors the signal circuit from the traction control switch. When the traction control switch is pressed once, the body control module will request the electronic brake control module via serial data to disable the traction control. The electronic brake control module will request the instrument cluster via serial data to turn the traction control off indicator ON to notify the driver of the deactivation.

When the traction control switch is pressed and held for five seconds, the body control module will request the electronic brake control module to disable the traction control and the electronic stability control. The electronic brake control module will request the instrument cluster via serial data to turn the traction control off and stability control off indicator ON to notify the driver of the deactivation.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The body control module detects a short to ground on the signal circuit.

Action Taken When the DTC Sets

The body control module ignores the traction control switch signal input.

Conditions for Clearing the DTC

- The DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Body Control Module Traction Control Switch parameter changes between Active and Inactive when pressing and releasing the traction control switch.
 - **If the parameter does not change**

Refer to Circuit/System Testing below.
 - **If the parameter changes**
3. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 ohms between the ground circuit terminal 2 and ground.
 - **If 5 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 5 ohms**
3. Ignition ON.
4. Verify the scan tool Body Control Module Traction Control Switch parameter is Inactive.
 - **If not Inactive**
 1. Ignition OFF, disconnect the X2 harness connector at the K9 Body Control Module.
 2. Test for infinite resistance between the signal circuit terminal 14 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K9 Body Control Module.
 - **If Inactive**

5. Install a 3 A fused jumper wire between the signal circuit terminal 7 and the ground circuit terminal 2.
6. Verify the scan tool Traction Control Switch parameter is Active.
 - **If not Active**
 1. Ignition OFF, disconnect the X2 harness connector at the K9 Body Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K9 Body Control Module.
 - **If Active**
7. Test or replace the S48D Multifunction Switch 2 - Instrument Panel.

Component Testing

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
2. Test for infinite resistance between the signal terminal 7 and the ground terminal 2 with the switch in the open position.
 - **If less than infinite resistance**

Replace the S48D Multifunction Switch 2 - Instrument Panel.
 - **If infinite resistance**
3. Test for less than 2 ohms between the signal terminal 7 and the ground terminal 2 with the switch in the closed position.
 - **If 2 ohms or greater**

Replace the S48D Multifunction Switch 2 - Instrument Panel.
 - **If less than 2 ohms**
4. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Hazard Warning and Accessory Switch Replacement**
- **Control Module References** for Body Control Module replacement, programming and setup

DTC C0035, C0040, 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

DTC C0035 06

Left Front Wheel Speed Sensor Circuit Low Voltage/Open

DTC C0035 0F

Left Front Wheel Speed Sensor Circuit Signal Erratic

DTC C0035 18

Left Front Wheel Speed Sensor Circuit Low Signal Amplitude

DTC C0035 5A

Left Front Wheel Speed Sensor Circuit Not Plausible

DTC C0040 06

Right Front Wheel Speed Sensor Circuit Low Voltage/Open

DTC C0040 0F

Right Front Wheel Speed Sensor Circuit Signal Erratic

DTC C0040 18

Right Front Wheel Speed Sensor Circuit Low Signal Amplitude

DTC C0040 5A

Right Front Wheel Speed Sensor Circuit Not Plausible

DTC C0045 06

Left Rear Wheel Speed Sensor Circuit Low Voltage/Open

DTC C0045 0F

Left Rear Wheel Speed Sensor Circuit Signal Erratic

DTC C0045 18

Left Rear Wheel Speed Sensor Circuit Low Signal Amplitude

DTC C0045 5A

Left Rear Wheel Speed Sensor Circuit Not Plausible

DTC C0050 06

Right Rear Wheel Speed Sensor Circuit Low Voltage/Open

DTC C0050 0F

Right Rear Wheel Speed Sensor Circuit Signal Erratic

DTC C0050 18

Right Rear Wheel Speed Sensor Circuit Low Signal Amplitude

DTC C0050 5A

Right Rear Wheel Speed Sensor Circuit Not Plausible

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Wheel Speed Sensor Ignition	C0035 06	C0035 06	-	C0035 0F, C0035 18, C0035 5A
Left Front Wheel Speed Sensor Signal	C0035 06	C0035 06	C0035 06	C0035 0F, C0035 18, C0035 5A
Right Front Wheel Speed Sensor Ignition	C0040 06	C0040 06	-	C0040 0F, C0040 18, C0040 5A
Right Front Wheel Speed Sensor Signal	C0040 06	C0040 06	C0040 06	C0040 0F, C0040 18, C0040 5A
Left Rear Wheel Speed Sensor Ignition	C0045 06	C0045 06	-	C0045 0F, C0045 18, C0045 5A
Left Rear Wheel Speed Sensor Signal	C0045 06	C0045 06	C0045 06	C0045 0F, C0045 18, C0045 5A
Right Rear Wheel Speed Sensor Ignition	C0050 06	C0050 06	-	C0050 0F, C0050 18, C0050 5A
Right Rear Wheel Speed Sensor Signal	C0050 06	C0050 06	C0050 06	C0050 0F, C0050 18, C0050 5A

Component	Condition	DTC Symptom Bytes
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Wheel Speed Sensor	• Physical damage • Debris on the wheel speed sensor or the encoder ring • Loose or worn wheel bearing • Loose or improperly mounted sensor • Air gap between the wheel speed sensor and the encoder ring too large • Water intrusion in the wiring harness	0F, 18 or 5A
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Circuit/System Description

The wheel speeds are detected by active wheel speed sensors and encoder rings. The encoder ring consists of permanent magnets. Each wheel speed sensor receives ignition voltage from the electronic brake control module and provides an alternating current square wave signal to the electronic brake control module. As the wheel spins, the electronic brake control module uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

C0035 06, C0040 06, C0045 06, and C0050 06

Ignition ON

C0035 0F, C0040 0F, C0045 0F, and C0050 0F

- Ignition ON
- Vehicle speed is greater than 12.9 km/h (8 MPH).

C0035 18, C0040 18, C0045 18, and C0050 18

- Ignition ON
- Vehicle speed is greater than 6 km/h (3.7 MPH).

C0035 5A, C0040 5A, C0045 5A, and C0050 5A

- Ignition ON
- Vehicle speed is greater than 1.5 km/h (0.9 MPH).

Conditions for Setting the DTC

C0035 06, C0040 06, C0045 06, or C0050 06

- A short to ground or open/high resistance is detected on the wheel speed sensor ignition circuit.
- A short to voltage, short to ground, or open/high resistance is detected on the wheel speed sensor signal circuit.

C0035 0F, C0040 0F, C0045 0F, or C0050 0F

An erratic wheel speed sensor signal is detected.

C0035 18, C0040 18, C0045 18, or C0050 18

A missing wheel speed sensor signal is detected.

C0035 5A, C0040 5A, C0045 5A, or C0050 5A

The difference between fastest and slowest wheel speed is greater than 50%.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The traction/stability control indicator turns ON.
- The electronic brake control module disables the ABS, the traction control, the hill start assist and the electronic stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

- Do not use a magnet to clean the encoder ring.
- Inspect the wheel hub bearing encoder ring for rust or corrosion.
- If two or more wheel speed sensors are inoperative, diagnose each wheel speed sensor individually.
- If any of the symptom byte codes 0F, 18 or 5A are set, refer to the Diagnostic Fault Information table for possible mechanical faults or conditions.
- 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.
- A technician may find that all four wheel speed sensor DTCs C0035, C0040, C0045 and C0050 are set with symptom byte 06. The ABS, traction/stability indicators may be ON. A condition has been found that when a single wheel speed sensor DTC sets repeatedly it may trigger all four wheel speed sensors to set.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Test drive the vehicle at speeds greater than 15 km/h (10 MPH).
2. Verify all scan tool Wheel Speed Sensor parameters are within 4 km/h (2.5 MPH) of each other.
 - **If any parameter is not within 4 km/h (2.5 MPH) of each other**

Refer to Circuit/System Testing below.

- **If each parameter is within 4 km/h (2.5 MPH) of each other**
3. Verify DTC C0035, C0040, C0045, or C0050 is not set.
 - **If any of the DTCs are set**

Diagnose each wheel speed sensor individually, refer to Circuit/System Testing below.

- **If none of the DTCs are set**
4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate B5 Wheel Speed Sensor, ignition ON.
2. Test for greater than 11 V between the ignition circuit terminal 1 and ground.
 - **If 11 V or less**
 1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the ignition circuit end to end.

- If 2 ohms or greater, repair the open/high resistance in the circuit.
- If less than 2 ohms, replace the K17 Electronic Brake Control Module.

○ **If greater than 11 V**

3. Install a 3 A fused jumper wire at the ignition circuit terminal 1, ignition ON.
4. Verify the scan tool Wheel Speed Sensor parameter changes while rapidly tapping the fused jumper wire to the signal circuit terminal 2.
 - **If the parameter does not change**
 1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 5. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K17 Electronic Brake Control Module.
 - **If the parameter changes**
5. Replace the B5 Wheel Speed Sensor.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Front Wheel Speed Sensor Replacement**
- **Rear Wheel Speed Sensor Replacement**
- **Control Module References** for Electronic Brake Control Module replacement, programming and setup

DTC C0110

Diagnostic Instructions

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

DTC Descriptors

DTC C0110 06

Pump Motor Circuit Low Voltage/Open

DTC C0110 61

Pump Motor Circuit Stuck

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	C0110 06	C0110 06	-	C0110 61
Ground Terminal 13	-	C0110 06	-	C0110 61
Ground Terminal 38	-	U0121	-	-

Component	Condition	DTCs
Pump Motor	• Wear • Damage • Lock	C0110 61

Circuit/System Description

The pump motor is an integral part of the brake pressure modulator, while the pump motor relay is integral to the electronic brake control module. The pump motor relay is not engaged during normal system operation. When the ABS, the traction control or the stability control operation is required, the electronic brake control module activates the pump motor relay and turns the pump motor ON.

Conditions for Running the DTC

Engine running.

Conditions for Setting the DTC

C0110 06

- An open/high resistance is detected on the pump motor ground circuit.
- A short to ground or an open/high resistance is detected on the pump motor B+ circuit.

C0110 61

A faulty pump motor is detected.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The red Brake Warning indicator turns ON.

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the ABS, the traction control, and the electronic stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

- A current DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the K17 Electronic Brake Control Module. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 ohms between the ground circuit terminals listed below and ground:
 - Terminal 13
 - Terminal 38
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.

- If 2 ohms or greater, repair the open high/resistance in the circuit.
- If less than 2 ohms, repair open high/resistance in the ground connection.
- **If less than 10 ohms**
- 3. Ignition ON.
- 4. Verify that a test lamp illuminates between the B+ circuit terminal 1 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the B+ circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K17 Electronic Brake Control Module.
 - **If the test lamp illuminates**
- 5. Replace the K17 Electronic Brake Control Module with Brake Pressure Modulator.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

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

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 Descriptors

DTC C0131 00

Traction Control System Pressure Circuit Malfunction

DTC C0131 4B

Traction Control System Pressure Circuit Calibration Not Learned

DTC C0131 5A

Traction Control System Pressure Circuit Not Plausible

Circuit/System Description

The electronic brake control module monitors the brake pressure sensor which is integral to the brake pressure modulator. The body control module monitors the brake pedal position sensor signal when the brake pedal is applied and sends a serial data message to the electronic brake control module indicating the brake pedal position. The electronic brake control module compares the brake pressure to the brake pedal position and uses this information for vehicle stability control.

Conditions for Running the DTC

- The engine is running.
- The brake pedal has been applied and released.

Conditions for Setting the DTC

C0131 00

The electronic brake control module detects the brake pressure is out of the specified range.

C0131 4B

The electronic brake control module detect the brake pressure sensor is not calibrated.

C0131 5A

- The brake pressure is not plausible with the brake pedal position sensor signal.
- The brake pressure is not plausible with the vehicle acceleration or deceleration.
- The electronic brake control module detects an invalid or erratic brake pressure.

Action Taken When the DTC Sets

- A message and/or indicator may be displayed.
- The traction/stability control indicator turns ON if equipped with electronic stability control.
- The electronic brake control module disables the ABS, the traction and the electronic stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

This DTC may set if the electronic brake control module is loosely attached to the hydraulic unit. The fasteners should be checked for proper torque.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C0131 is not set.
 - **If the DTC is set**
 1. Ignition ON.
 2. Perform the **Brake Pressure Modulator Valve Pressure Sensor Calibration**.
 3. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.
 - If the DTC sets, replace the K17 Electronic Brake Control Module with Brake Pressure Modulator.
 - If the DTC does not set.
 - 4. All OK.
 - **If the DTC is not set**

3. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

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

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 Descriptors

DTC C0161 5A

Antilock Braking System Brake Switch Circuit Not Plausible

DTC C0161 71

Antilock Braking System Brake Switch Circuit Invalid Data

Circuit/System Description

When the brake pedal is applied, the body control module sends a serial data message to the electronic brake control module in reference to the brake pedal positions. The electronic brake control module compares the correlation between the brake pedal position and the amount of brake pressure it senses from the brake pressure sensor, which is internal to the brake pressure modulator. It uses this information to control the vehicle during an electronic stability control event.

Conditions for Running the DTC

- Ignition ON.
- DTC C0131 is not present.

Conditions for Setting the DTC

- The electronic brake control module detects the brake pedal is not applied and the brake pressure is greater than 1500 kPa (218 psi) for 2 s.
- The electronic brake control module detects the vehicle speed is greater than 16 km/h (10 MPH), the

brake pedal is applied for 122 s, and the brake pressure is less than 620 kPa (90 psi).

Action Taken When the DTC Sets

- A message and/or indicator may be displayed.
- The electronic brake control module disables the ABS, the traction control and the electronic stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

- A current DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

- Diagnose all other stop lamp DTCs or symptoms prior to performing this diagnostic procedure.
- DTC C0161 may set if the brake pedal is applied while accelerating, such as two footed driving.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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ABS Description and Operation

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.

2. Verify that DTC C0277 or C0890 is not set.

- **If either DTC is set**

Refer to **DTC C0277 or C0890** .

- **If the DTC is not set**

3. Verify the B22 Brake Pedal Position Sensor or the brake pedal are not binding causing residual brake pressure to be detected.

- **If a condition is found**

Repair or replace the appropriate component.

- **If a condition is not found**

4. Verify the scan tool Electronic Brake Control Module Brake Pedal Position Sensor parameter changes between Inactive and Active while applying and releasing the brake pedal.

- **If the parameter does not change**

Refer to **Symptoms - Lighting** .

- **If the parameter changes**

5. All OK, refer to Diagnostic Aids.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

DTC C0187, C018B, C0196, C019B, C0287, OR C0297

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 C0187 5A

Lateral Acceleration Sensor Signal Not Plausible

DTC C018B 5A

Lateral Acceleration Sensor Signal Not Plausible

DTC C0196 00

Yaw Rate Circuit

DTC C0196 5A

Yaw Rate Signal Not Plausible

DTC C0196 71

Yaw Rate Circuit Invalid Serial Data Received

DTC C019B 5A

Yaw Rate Signal Not Plausible

DTC C0287 00

Longitudinal Acceleration Sensor Circuit

DTC C0287 4B

Longitudinal Acceleration Sensor Circuit Calibration Not Learned

DTC C0287 5A

Longitudinal Acceleration Sensor Signal Not Plausible

DTC C0287 71

Longitudinal Acceleration Sensor Signal Invalid Serial Data Received

DTC C0297 4A

Lost Communication With Yaw Rate Sensor Checksum Error

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12 V Reference	U0125, U0126	U0125, U0126	-	-
Ground	-	U0125	-	-

Circuit/System Description

The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one multi-axis acceleration sensor, external to the electronic brake control module. The electronic brake control module supplies a 12 V reference voltage to the multi-axis acceleration sensor. The multi-axis acceleration sensor communicates with the electronic brake control module via serial data. The electronic brake control module

activates the stability control function depending on multi-axis acceleration sensor input.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

C0187 5A

- The lateral acceleration sensor offset is out of specified range.
- An Internal fault in multi-axis acceleration sensor will set this DTC.
- Improperly mounted or loose multi-axis acceleration sensor may set this DTC.
- The lateral acceleration sensor signal is not plausible with the yaw rate sensor signal, steering angle sensor signal and vehicle speed.

C018B 5A

The lateral acceleration sensor signal is out of specified range.

C0196 5A and C0196 71

- The yaw rate sensor offset is out of specified range.
- An Internal fault in multi-axis acceleration sensor will set C0196 5A.
- Improperly mounted or loose multi-axis acceleration sensor may set this DTC.
- The yaw rate sensor signal is not plausible with the lateral acceleration sensor signal, steering angle sensor signal and vehicle speed.

C0196 00 or C019B 5A

The yaw rate sensor signal is out of specified range.

C0287 00

The longitudinal acceleration sensor is out of specified range.

C0287 71

The electronic brake control module received an invalid longitudinal acceleration sensor signal.

C0287 4B

The longitudinal acceleration sensor calibration has not been learned.

C0287 5A

- An Internal fault in multi-axis acceleration sensor will set this DTC.
- Improperly mounted or loose multi-axis acceleration sensor may set this DTC.
- The longitudinal acceleration sensor signal is not plausible with the vehicle acceleration.

C0297 4A

Invalid serial data received from multi-axis acceleration sensor.

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- The electric brake control module disables the stability control and hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- A current DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

A condition may result in a stored history DTC U0121 in the Multi-Axis Acceleration Sensor Module this is considered a normal condition. Do not attempt to repair or replace any parts.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition ON
2. Verify that DTC C0287 4B is not set.
 - **If the DTC is set**

Perform the **Vehicle Yaw Sensor Learn**.

- **If the DTC is not set**
3. Verify the B119 Multi-axis Acceleration Sensor is installed correctly.
 - **If loose or incorrect installation**

Correct the installation of the component.
 - **If installed correctly**
 4. Ignition OFF, scan tool disconnected, and all vehicle systems OFF, disconnect the harness connector at the B119 Multi-axis Acceleration Sensor. It may take up to 2 minutes for all vehicle systems to power down.
 5. Test for less than 10 ohms between the ground circuit terminal 6 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
 6. Ignition ON.
 7. Verify a test lamp illuminates between the 12 V reference circuit terminal 5 and ground.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, disconnect the harness connector at the B99 Steering Wheel Angle Sensor and the K17 Electronic Brake Control Module.
 2. Test for infinite resistance between the 12 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the 12 V reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K17 Electronic Brake Control Module.
 - **If the test lamp illuminates**
 8. Replace the B119 Multi-axis Acceleration Sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Vehicle Yaw Sensor Replacement
- Control Module References for Electronic Brake Control Module replacement, programming and setup

DTC C0242 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 C0242 00

Engine Control Module Indicated Traction Control Malfunction

DTC P0856

Traction Control Torque Request Signal Message Counter Incorrect

Circuit/System Description

When traction control is active, the electronic brake control module sends a serial data message to the engine control module requesting torque reduction. When certain engine control module DTCs are set, the engine control module will not be able to perform the torque reduction for traction control. A serial data message is sent to the electronic brake control module indicating that traction control is not allowed.

Conditions for Running the DTC

Engine running

Conditions for Setting the DTC

The engine control module detects a fault that prevents it from performing a traction control function and sends a serial data message to the electronic brake control module indicating that torque reduction is not allowed.

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the traction control and the stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that no other DTCs are set except for C0242 or P0856.
 - **If any other DTCs are set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

- **If no other DTCs are set**
3. Replace the K20 Engine Control Module.
 4. Verify that DTC C0242 or P0856 does not set while operating the vehicle within the Conditions for Running the DTC.
 - **If DTC C0242 or P0856 is set**

Replace the K17 Electronic Brake Control Module.

- If DTC C0242 or P0856 is not set

5. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for Electronic Brake Control Module or Engine Control Module replacement, programming and setup

DTC C0245

Diagnostic Instructions

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

DTC Descriptor

DTC C0245 00

Wheel Speed Sensor Frequency Malfunction

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors. Each wheel speed sensor receives ignition voltage from the electronic brake control module and provides an alternating current square wave signal to the electronic brake control module. As the wheel spins, the electronic brake control module uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

- Brake is not applied.
- Vehicle is not cornering.
- Vehicle speed is greater than 14 km/h (9 MPH).
- DTC C0035, C0040, C0045, or C0050 is not present.

Conditions for Setting the DTC

Wheel speed differences between one wheel and the others is greater than 20 percent.

Action Taken When the DTC Sets

- A message may be displayed.
- The ABS indicator turns ON.

- The red Brake warning indicator turns ON.
- The traction/stability control indicator turns ON.
- The electronic brake control module disables the ABS, the traction control, the electronic stability control and the hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- A current DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that all tires have the proper air pressure.

○ **If not the proper air pressure**

Adjust all tire air pressures to the stated cold air pressure as identified on the tire placard or specification.

○ **If the proper air pressure**

2. Verify that all tires are of uniform size and matching brand.

- **If not of uniform size or matching brand**

1. Replace the mis-sized or non-matching brand tire.
2. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.
 - If the DTC is set, replace the K17 Electronic Brake Control Module.
 - If the DTC does not set.

3. All OK.

- **If all tires are of uniform size and matching brand**

3. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for electronic brake control module replacement, programming and setup

DTC C0252

Diagnostic Instructions

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

DTC Descriptor

DTC C0252 00

Vehicle Stability Control Module Sensors Correlation Malfunction

Circuit/System Description

The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one multi-axis acceleration sensor. The electronic brake control module controls the stability control by monitoring the inputs of the yaw rate sensor, the lateral acceleration sensor, and the steering wheel angle sensor. The readings are compared to an internal calibrated value so it knows if the vehicle is having an instability condition to activate the stability control.

Conditions for Running the DTC

The vehicle is operated at a speed greater than 13 km/h (8 MPH).

Conditions for Setting the DTC

When the vehicle is driven in a straight line the multi-axis acceleration sensor, the steering wheel angle sensor,

and the vehicle speed correlation is not recognized after a distance of 2.5 km (1.5 mi).

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the traction control, the stability control and the hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- A current DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

- An improperly mounted or loose multi-axis acceleration sensor
- The car should not pull in either direction causing the steering wheel to be off center while driving in a straight line on a level surface.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C0187, C018B, C0196, C019B, C0287, C0297, or C0710 is not set.
 - **If any of the DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- **If none of the DTCs are set**
3. Replace the B119 Multi-axis Acceleration Sensor.
 4. Ignition ON.
 5. Verify DTC C0252 does not set while operating the vehicle within the Conditions for Running the DTC.
 - **If the DTC is set**
 1. Replace the B99 Steering Wheel Angle Sensor.
 2. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.
 - If the DTC sets, replace the K17 Electronic Brake Control Module.
 - If the DTC does not set
 3. All OK.
 - **If the DTC is not set**
 6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Vehicle Yaw Sensor Replacement**
- **Steering Angle Sensor Replacement**

Control Module References for Electronic Brake Control Module replacement, programming and setup

DTC C0274, C0275, OR C0280

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 C0274 54

Isolation Valve High Temperature

DTC C0275 54

Dump Valve High Temperature

DTC C0280 54

Stability System Active Too Long

Circuit/System Description

The solenoid valves are integral parts of the brake pressure modulator. The brake pressure modulator contains an isolation solenoid valve and a dump solenoid valve for each wheel. A traction/stability control supply solenoid valve and a isolation solenoid valve for each brake circuit. The solenoid valves are not engaged during normal system operation. When the ABS, the traction control or the stability control operation is required the electronic brake control module turns the required solenoid ON.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

The calculated solenoid valve temperature is greater than the threshold.

Action Taken When the DTC Sets

C0274 54 or C0275 54

- The ABS indicator turns ON.
- The traction/stability control indicator turns ON.
- The electronic brake control module disables the ABS, the traction control, the stability control and the hill start assist for the duration of the ignition cycle.

C0280 54

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Diagnostic Aids

DTCs may set due to extended operation of the ABS, the traction control or the stability control.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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

NOTE: Since most occurrences of this DTC are caused by excessive ABS or traction control usage, review with the customer the conditions under which the DTC set.

1. Ignition ON.
2. Verify that DTC C0187, C018B, C0196, C019B, or C0710 is not set.
 - **If any of the DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- **If none of the DTCs are set**
3. Ignition OFF, allow the hydraulic brake pressure modulator to cool down to ambient temperature.
 4. Ignition ON.
 5. Verify that DTC C0274 54, C0275 54, or C0280 54 are not set while driving the vehicle within normal braking conditions.
 - **If any of the DTCs are set**

Replace the K17 Electronic Brake Control Module with Brake Pressure Modulator.

- **If none of the DTCs are set**

6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

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

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 4B

Calibration Data Calibration Not Learned

Circuit/System Description

The electronic brake control module receives serial data messages from other modules. The electronic brake control module must be configured with the Vehicle Identification Number (VIN), configuration data and vehicle options. If not properly configured after installation, the electronic brake control module may set a DTC.

The internal fault detection is handled inside the control module. No external circuits are involved.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The electronic brake control module is not programmed.

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the traction control, the stability control and the hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

A current DTC clears when the diagnostic runs and passes.

Diagnostic Aids

A newly replaced electronic brake control module can set one or more DTC on its initial ignition ON cycle.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C0558 4B is not set.
 - **If DTC C0558 4B is set**
 1. Program the K17 Electronic Brake Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the K17 Electronic Brake Control Module.
 - If the DTC does not set
 3. All OK.
 - **If DTC C0558 4B is not set**
3. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for Electronic Brake Control Module replacement, programming and setup

DTC C0569

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 C0569 00

System Configuration Malfunction

Circuit/System Description

The electronic brake control module receives serial data messages from other modules. The electronic brake control module must be configured with the Vehicle Identification Number (VIN), configuration data and vehicle options. If not properly configured after installation, the electronic brake control module may set a DTC.

The internal fault detection is handled inside the control module. No external circuits are involved.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

The electronic brake control module is not programmed.

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the traction control, the stability control and the hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The DTC clears when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

A newly replaced electronic brake control module can set one or more DTCs on its initial ignition ON cycle.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC C0569 00 is not set.
 - **If DTC C0569 00 is set**
 1. Program the K17 Electronic Brake Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the K17 Electronic Brake Control Module.
 - If the DTC does not set.
 - 3. All OK.
 - **If DTC C0569 00 is not set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

Control Module References for Electronic Brake Control Module replacement, programming and setup

DTC C0710

Diagnostic Instructions

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

DTC Descriptors

DTC C0710 00

Steering Position Signal Malfunction

DTC C0710 42

Steering Position Signal Calibration Not Programmed

DTC C0710 71

Steering Position Signal Invalid Data

DTC C0710 5A

Steering Position Signal Not Plausible

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12 V Reference	U0125, U0126	U0125, U0126	-	-
Ground	-	U0125, U0126, C0710 5A	-	-

Circuit/System Description

The steering wheel angle sensor receives a 12 V reference voltage from the electronic brake control module. The electronic brake control module receives serial data inputs from the steering wheel angle sensor identifying the position and direction of the steering wheel rotation. The module utilizes this signal to calculate the driver intended driving direction.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

C0710 00

The steering angle signal is invalid.

C0710 42

The steering wheel angle sensor is not calibrated.

C0710 5A

- No steering angle signal
- The steering angle signal is not plausible with the yaw rate signal.
- The steering wheel angle sensor offset is out of the specified range.

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the traction control, the stability control and the hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The DTC clears the DTC when the diagnostic runs and passes.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

- Improperly mounted or loose steering wheel angle sensor.
- The car should not pull in either direction causing the steering wheel to be off center while driving in a straight line on a level surface.
- Confirm that all tires are of the proper size and that all are matching brands. Check and adjust all tires to the stated cold air pressure as identified on the tire placard. If a mis-sized or non-matching brand tire is present, inform the customer that in order for the vehicle stability enhanced system to function normally, tires need to be a uniform size and rolling diameter.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Steering Column Position parameter corresponds to the actual steering position as the steering wheel is constantly turned through its entire range of motion between -500° and +500°.
 - **If the parameter does not correspond with the steering wheel position or the reading is erratic**

Refer to Circuit/System Testing below.
 - **If the parameter reading corresponds with the steering wheel position**
3. All OK.

Circuit/System Testing

1. Ignition ON.
2. Verify that DTC U0125 or U0126 is not set.
 - **If DTC U0125 or U0126 is set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
 - **If DTC U0125 or U0126 is not set**
3. Verify that DTC C0710 42 or C0710 5A is not set.
 - **If DTC C0710 42 or C0710 5A is set**

Perform the Steering Angle Sensor Centering.
 - **If DTC C0710 42 or C0710 5A is not set**
4. Verify the B99 Steering Wheel Angle Sensor is installed correctly.
 - **If loose or incorrect installation**

Correct the installation or replace the component.

- **If correct installation**

5. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B99 Steering Wheel Angle Sensor. It may take up to 2 minutes for all vehicle systems to power down.

6. Test for less than 10 ohms between the ground circuit terminal 6 and ground.

- **If 10 ohms or greater**

1. Ignition OFF.

2. Test for less than 2 ohms in the ground circuit end to end.

- If 2 ohms or greater, repair the open/high resistance in the circuit.

- If less than 2 ohms, repair the open/high resistance in the ground connection.

- **If less than 10 ohms**

7. Ignition ON.

8. Verify a test lamp illuminates between the 12 V reference circuit terminal 5 and ground.

- **If the test lamp does not illuminate**

1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.

2. Test for infinite resistance between the 12 V reference circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.

- If infinite resistance

3. Test for less than 2 ohms in the 12 V reference circuit end to end.

- If 2 ohms or greater, repair the open/high resistance in the circuit.

- If less than 2 ohms, replace the K17 Electronic Brake Control Module.

- **If the test lamp illuminates**

9. Replace the B99 Steering Wheel Angle Sensor.

10. Ignition ON.

11. Verify that DTC C0710 42 or C0710 5A is not set.

- **If either of the DTCs are set**

Replace the K17 Electronic Brake Control Module.

- **If none of the DTCs are set**

12. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Steering Angle Sensor Replacement**

- **Control Module References** for Electronic Brake Control Module replacement, programming and setup

DTC P2548

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 P2548

Vehicle Dynamics System Torque Request Signal Message Counter Incorrect

Circuit/System Description

The electronic brake control module and the engine control module simultaneously control the vehicle performance launch. During a performance launch the electronic brake control module sends a serial data message to the engine control module requesting torque reduction. If the engine control module receives corrupt data from the electronic brake control module, DTC P2548 will set in the engine control module. The engine control module then sends a serial data message to the electronic brake control module that torque reduction is not allowed.

Conditions for Running the DTC

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

Conditions for Setting the DTC

The engine control module detects a corrupted data message from the electronic brake control module.

Action Taken When the DTC Sets

- The ABS remains functional.
- DTC P2548 is a Type B DTC.
- The traction Off indicator turns ON.
- The traction/stability control indicator turns ON.
- The Service Stabilitrak message may be displayed on the driver information center.

Conditions for Clearing the DTC

DTC P2548 is a Type B DTC.

Diagnostic Aids

Inspect the serial data circuits and connections at the engine control module and the electronic brake control module. They should be free from sources of electromagnetic interference and the connections should be clean

and tight.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Verify that no other DTCs are set except for DTC P2548.

- **If any other DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- **If only DTC P2548 is set**

2. Replace the K17 Electronic Brake Control Module.
3. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.
 - **If DTC sets**

Replace the K20 Engine Control Module.

- **If DTC does not set**

4. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for Electronic Brake Control Module and Engine Control Module replacement, programming and setup

SYMPTOMS - ANTILOCK BRAKE SYSTEM

NOTE: **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** .
- 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**
- **Traction Control/Stability Control 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 cluster turns the ABS indicator ON for 5 s after the ignition is turned ON, or when the electronic

brake control module detects a fault it sends a serial data message to the instrument cluster commanding the indicator ON.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that no DTCs are set.
 - **If any DTCs are set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

- **If no DTCs are set**
3. Verify the Instrument Cluster ABS indicator turns ON and OFF when commanding the All Indicators ON and OFF with a scan tool.
 - **If ABS indicator does not turn ON and OFF**

Replace the P16 Instrument Cluster.

- **If the ABS indicator turns ON and OFF**
4. Verify the ABS indicator turns OFF 5 s after the ignition is turned ON.

- If the ABS indicator does not turn OFF

Replace the K17 Electronic Brake Control Module.

- If the ABS indicator turns OFF

5. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for electronic brake control module or instrument cluster replacement, programming and setup

TRACTION CONTROL/STABILITY CONTROL 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.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B2745 02, U0422 71	1	1	-
Ground	-	1	-	-
1. Traction control switch malfunction				

Circuit/System Description

The instrument cluster illuminates the traction/stability control indicator, the traction control off indicator and the stability control off indicator for five seconds after the ignition is turned ON. When the electronic brake control module detects a fault it sends a serial data message to the instrument cluster commanding the traction/stability control indicator ON.

The body control module monitors the signal circuit from the traction control switch. When the traction control switch is pressed once, the body control module sends a serial data message to the electronic brake control module to disable the traction control system and turn the traction control off indicator ON to notify the driver of the deactivation. When the traction control switch is pressed and held for five seconds, the body control module will request the electronic brake control module to disable the traction control and the electronic stability control. The electronic brake control module will request the instrument cluster to turn the traction control off and stability control off indicator ON to notify the driver of the deactivation.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the Instrument Cluster indicators listed below turn ON and OFF when commanding the All Indicators ON and OFF with a scan tool.
 - Traction control off indicator
 - Stability control off indicator
 - **If any indicator does not turn ON and OFF**

Replace the P16 Instrument Cluster.
 - **If all indicators turn ON and OFF**
3. Verify the scan tool Body Control Module Traction Control Switch parameter changes between Active and Inactive when pressing and releasing the traction control switch.
 - **If the parameter does not change**

Refer to Circuit/System Testing below.
 - **If the parameter changes**
4. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before Circuit/System Testing.**

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 ohms between the ground circuit terminal 2 and ground.
 - **If 5 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 5 ohms**
3. Ignition ON.
4. Verify the scan tool Body Control Module Traction Control Switch parameter is Inactive.
 - **If not Inactive**
 1. Ignition OFF, disconnect the X2 harness connector at the K9 Body Control Module.
 2. Test for infinite resistance between the signal circuit terminal 14 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K9 Body Control Module.
 - **If Inactive**
5. Install a 3 A fused jumper wire between the signal circuit terminal 7 and the ground circuit terminal 2.
6. Verify the scan tool Traction Control Switch parameter is Active.
 - **If not Active**
 1. Ignition OFF, disconnect the X2 harness connector at the K9 Body Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V.
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K9 Body Control Module.
 - **If Active**
7. Test or replace the S48D Multifunction Switch 2 - Instrument Panel.

Component Testing

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
2. Test for infinite resistance between the signal circuit terminal 7 and the ground terminal 2 with the switch in the open position.
 - **If less than infinite resistance**

Replace the S48D Multifunction Switch 2 - Instrument Panel.

- **If infinite resistance**

3. Test for less than 2 ohms between the signal terminal 7 and the ground terminal 2 with the switch in the closed position.

- **If 2 ohms or greater**

Replace the S48D Multifunction Switch 2 - Instrument Panel.

- **If less than 2 ohms**

4. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Hazard Warning and Accessory Switch Replacement**
- **Control Module References** for Body Control Module or Instrument Cluster replacement, programming and setup

REPAIR INSTRUCTIONS

ANTILOCK BRAKE SYSTEM AUTOMATED BLEED

WARNING: Refer to **Brake Fluid Irritant Warning** .

CAUTION: Refer to **Brake Fluid Effects on Paint and Electrical Components Caution** .

NOTE: Before performing the ABS Automated Bleed Procedure, first perform a pressure bleed of the base brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** , **Hydraulic Brake System Bleeding (Pressure)** . The automated bleed procedure is recommended when one of the following conditions exist:

- Base brake system bleeding does not achieve the desired pedal height or feel
- Extreme loss of brake fluid has occurred
- Air ingestion is suspected in the secondary circuits of the brake modulator assembly

The ABS Automated Bleed Procedure uses a scan tool to cycle the system solenoid valves and run the pump in order to purge any air from the secondary circuits. These circuits are normally closed off, and are only opened

during system initialization at vehicle start up and during ABS operation. The automated bleed procedure opens these secondary circuits and allows any air trapped in these circuits to flow out toward the brake corners.

Performing the Automated Bleed Procedure

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

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Remove all four tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation .
3. Inspect the brake system for leaks and visual damage. Repair or replace components as needed.
4. Lower the vehicle.
5. Inspect the battery state of charge.
6. Install a scan tool.
7. Turn the ignition ON, with the engine OFF.
8. If the vehicle is equipped with push button start, place the ignition in Service Only Mode.
 - Do not apply the brake pedal.
 - Press and hold the ignition mode switch for a minimum of 5 seconds.
 - Release the ignition mode switch when the switch indicator illuminates green.
9. With the scan tool, establish communications with the ABS system. Select Control Functions. Select Automated Bleed from the Control Functions menu.
10. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
11. Following the directions given on the scan tool, pressure bleed the base brake system. Refer to Hydraulic Brake System Bleeding (Manual) , Hydraulic Brake System Bleeding (Pressure) .
12. Follow the scan tool directions until the desired brake pedal height is achieved.
13. If the bleed procedure is aborted, a malfunction exists. Perform the following steps before resuming the bleed procedure:
 - If a DTC is detected, refer to Diagnostic Trouble Code (DTC) List - Vehicle , and diagnose the appropriate DTC.
 - If the brake pedal feels spongy, perform the conventional brake bleed procedure again. Refer to Hydraulic Brake System Bleeding (Manual) , Hydraulic Brake System Bleeding (Pressure) .
14. When the desired pedal height is achieved, press the brake pedal to inspect for firmness.
15. Lower the vehicle.
16. Remove the scan tool.
17. If the vehicle is equipped with push button start, remove the vehicle from Service Only Mode.
 - Do not apply the brake pedal.

- Press the ignition mode switch once and release.
 - The ignition mode switch will no longer be illuminated.
 - The vehicle may be started normally.
18. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
 19. Inspect the brake fluid level. Refer to **Master Cylinder Reservoir Filling** .
 20. Road test the vehicle while inspecting that the pedal remains high and firm.

STEERING ANGLE SENSOR CENTERING

WARNING: An inaccurate or not centered steering angle sensor could limit the operation of the electric power steering (EPS) and result in personal injury.

For vehicles WITHOUT electronic stability control program and INTERNAL Steering Angle Sensor

Refer to the Steering Angle Centering procedure in **Power Steering Control Module Calibration** .

For vehicles WITH electronic stability control program and EXTERNAL Steering Angle Sensor

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

- Wheel alignment
- Steering gear replacement
- Steering column replacement
- Steering angle sensor replacement
- Collision or other physical damage
- Electronic brake control module (EBCM) replacement

The external steering angle sensor centering procedure can be completed with a scan tool using the following steps:

1. Using the steering wheel, align the front wheels forward.
2. Apply the parking brake, or set the transmission in the Park.
3. Install the scan tool to the data link connector.
4. Ignition ON, engine OFF
5. Select Steering Wheel Angle Sensor Reset in the Steering Wheel Angle Sensor Module Configuration/Reset Functions list.
6. Follow the scan tool directions to complete the reset procedure.
7. Select Steering Wheel Angle Sensor Learn in the Steering Wheel Angle Sensor Module Configuration/Reset Functions list.

8. Follow the scan tool directions to complete the learn procedure.
9. Select Steering Wheel Angle Sensor Learn in the Electronic Brake Control Module Configuration/Reset Functions list.
10. Follow the scan tool directions to complete the learn procedure.
11. If the vehicle is equipped with electronic power steering, perform the Software Endstop Learning procedure. Refer to **Power Steering Control Module Calibration** .
12. Clear any DTCs that may be set.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT

Removal Procedure

WARNING: Refer to **Brake Fluid Irritant Warning** .

CAUTION: Refer to **Brake Fluid Effects on Paint and Electrical Components Caution** .

1. Remove the electronic brake and traction control module with brake pressure modulator valve assembly. Refer to **Electronic Brake and Traction Control Module with Brake Pressure Modulator Valve Replacement**.

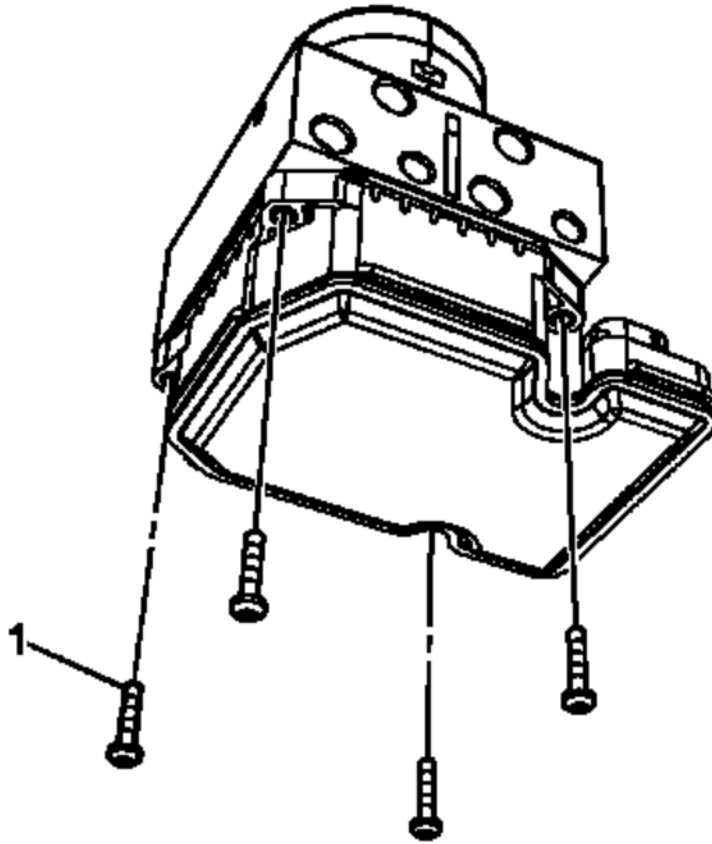


Fig. 4: Electronic Brake Control Module (EBCM) And Bolts
Courtesy of GENERAL MOTORS COMPANY

2. Remove the electronic brake control module (EBCM) bolts (1),

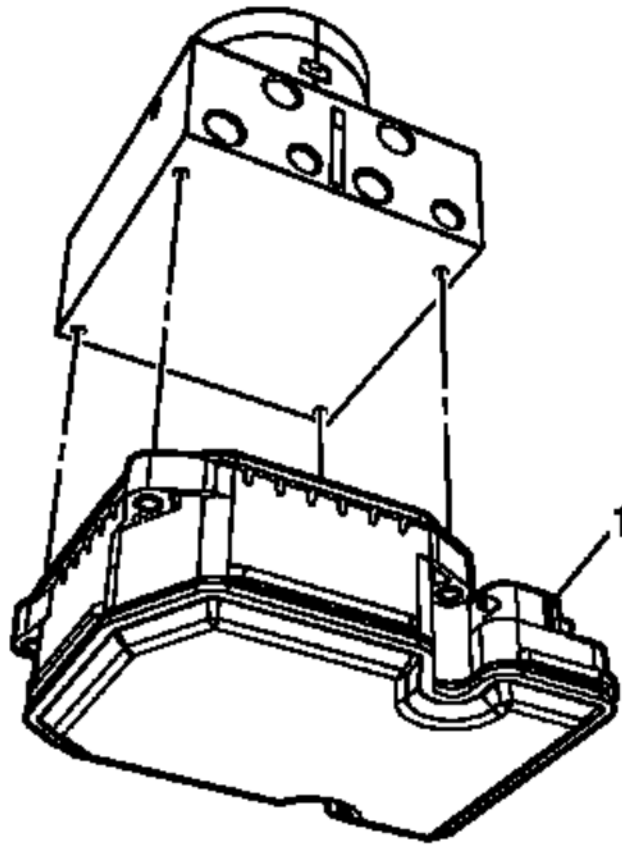


Fig. 5: EBCM And Brake Pressure Modulator Valve (BPMV)
Courtesy of GENERAL MOTORS COMPANY

3. Carefully separate the EBCM (1) from the brake pressure modulator valve (BPMV).

NOTE: Do not pry the components apart.

4. Clean the sealing surfaces of the EBCM and the brake pressure modulator valve with denatured alcohol and allow to dry.

Installation Procedure

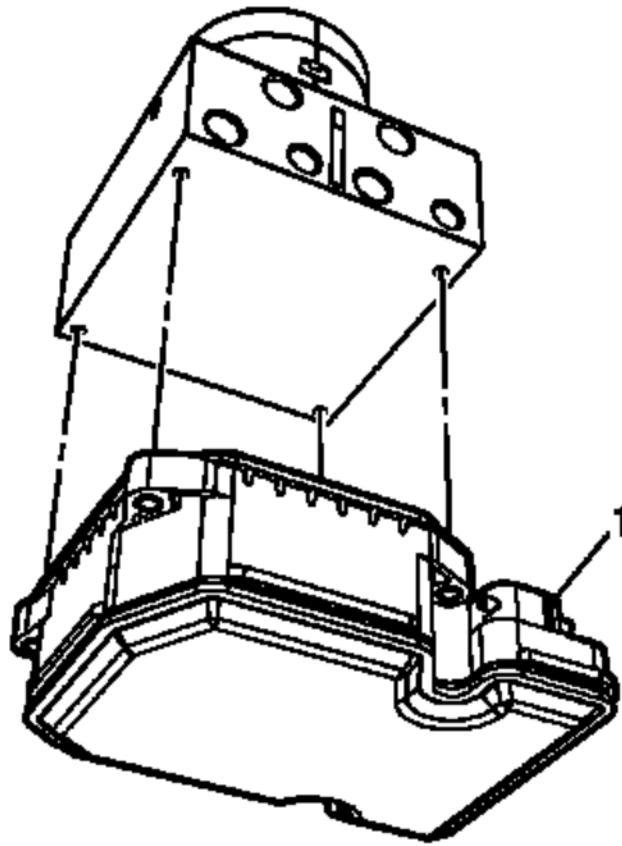


Fig. 6: EBCM And Brake Pressure Modulator Valve (BPMV)
Courtesy of GENERAL MOTORS COMPANY

1. Install the EBCM (1) to the BPMV.

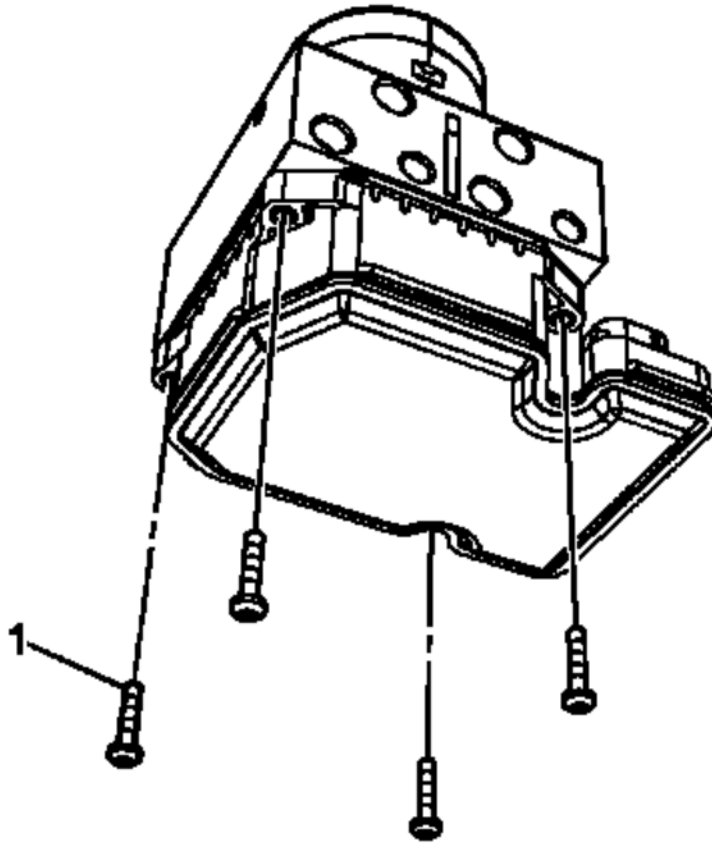


Fig. 7: Electronic Brake Control Module (EBCM) And Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Install the EBCM bolts (1) and tighten to 3 N.m (26 lb in),
3. Install the electronic brake and traction control module with brake pressure modulator valve assembly. Refer to **Electronic Brake and Traction Control Module with Brake Pressure Modulator Valve Replacement**.
4. Program the EBCM. Refer to **Control Module References** .

ELECTRONIC BRAKE AND TRACTION CONTROL MODULE WITH BRAKE PRESSURE MODULATOR VALVE REPLACEMENT

Removal Procedure

WARNING: Refer to Brake Fluid Irritant Warning .

CAUTION: Refer to Brake Fluid Effects on Paint and Electrical Components Caution .

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

1. Remove the battery tray. Refer to Battery Tray Replacement .
2. Disconnect the brake fluid level sensor electrical connector.
3. Without draining the coolant and without disconnecting the hoses, remove and position aside the radiator surge tank. Refer to Radiator Surge Tank Replacement (LUK) , Radiator Surge Tank Replacement (LCV) , Radiator Surge Tank Replacement (LTG) .
4. Thoroughly clean the electronic brake control module (EBCM) to brake pressure modulator valve (BPMV) area of any accumulated dirt and debris.
5. Disconnect the EBCM electrical connector.

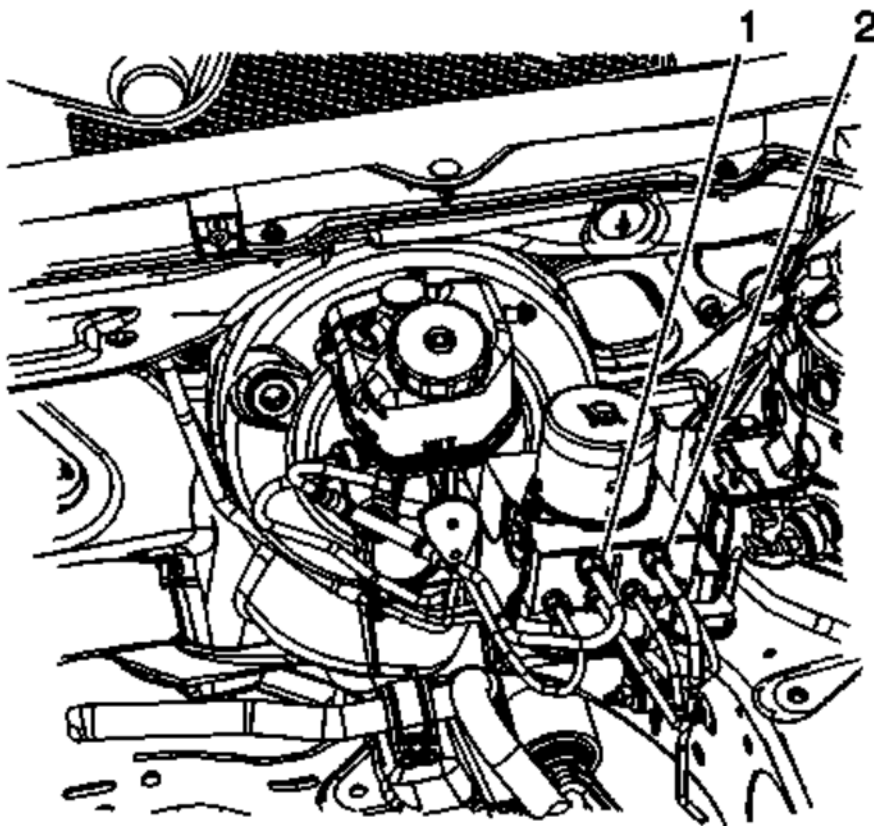


Fig. 8: Master Cylinder Primary Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the master cylinder primary brake pipe fitting (1).

7. Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.
8. Disconnect the master cylinder secondary brake pipe fitting (2).
9. Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.

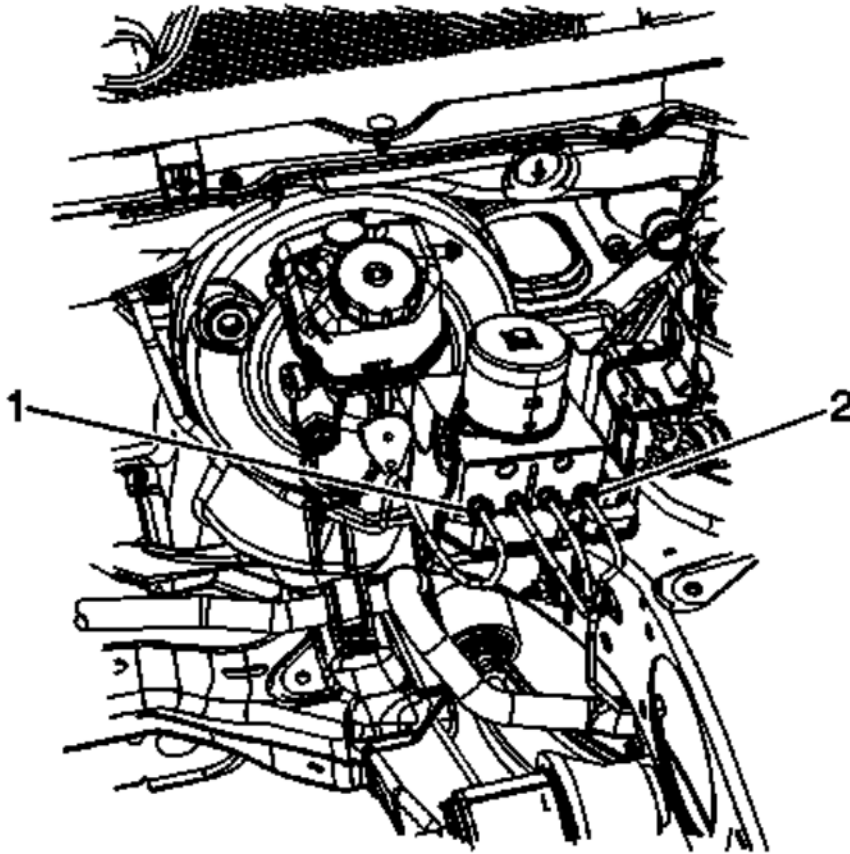


Fig. 9: Right Front Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

10. Disconnect the right front brake pipe fitting (1).
11. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.
12. Disconnect the left front brake pipe fitting (2).
13. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.

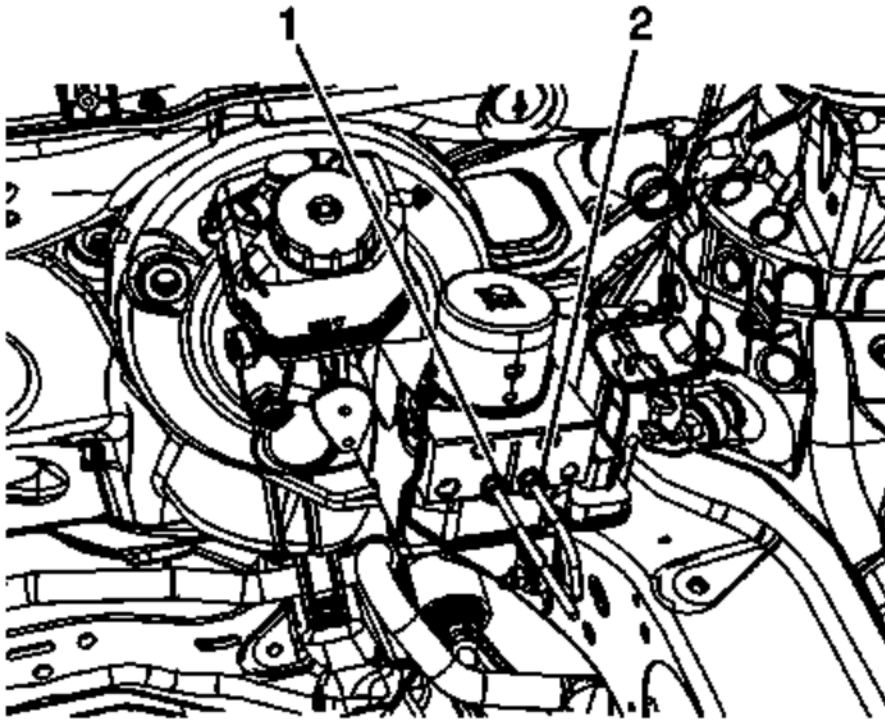


Fig. 10: Left Rear Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

14. Disconnect the left rear brake pipe fitting (1).
15. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.
16. Disconnect the right rear brake pipe fitting (2).
17. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.
18. If equipped with electronic power steering, remove the bolt and position aside the electronic power steering wiring harness and bracket assembly.

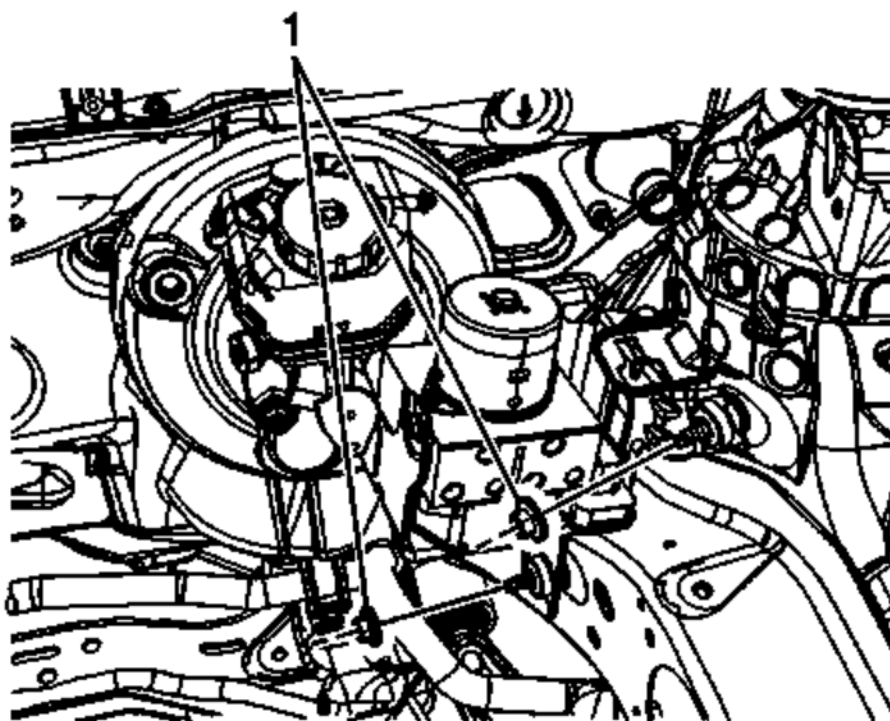


Fig. 11: Brake Pressure Modulator Valve Assembly Nuts
Courtesy of GENERAL MOTORS COMPANY

19. Remove the electronic brake and traction control module with brake pressure modulator valve assembly nuts (1).

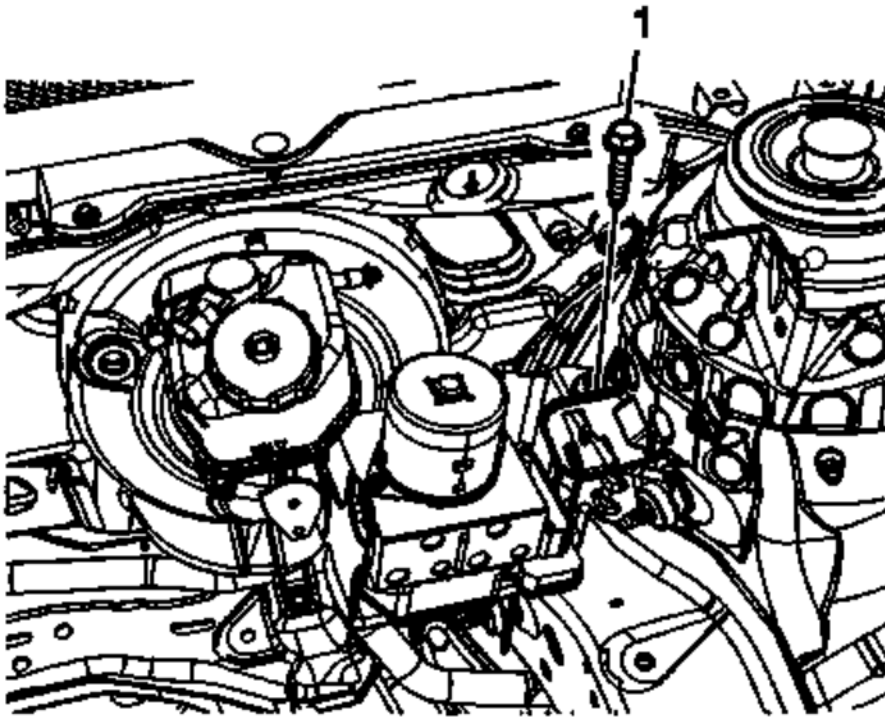


Fig. 12: Brake Pressure Modulator Valve Assembly Bolt
Courtesy of GENERAL MOTORS COMPANY

20. Remove the electronic brake and traction control module with brake pressure modulator valve assembly bolt (1).
21. Remove the electronic brake and traction control module with brake pressure modulator valve assembly.

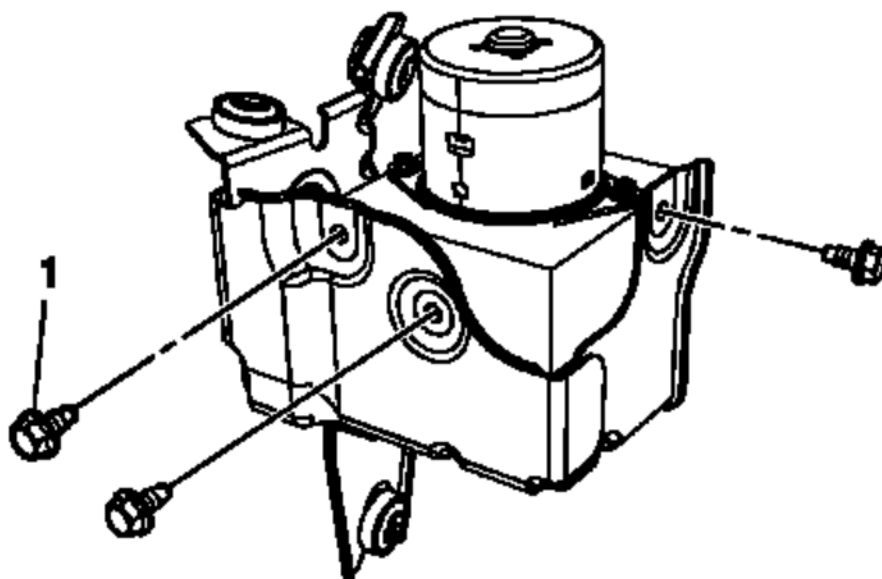


Fig. 13: Electronic Brake And Traction Control Module, Assembly Bracket And Bolts
Courtesy of GENERAL MOTORS COMPANY

22. Remove the electronic brake and traction control module with brake pressure modulator valve assembly bracket bolts (1).
23. Remove the EBCM. Refer to **Electronic Brake Control Module Replacement**.

Installation Procedure

1. Install the EBCM. Refer to **Electronic Brake Control Module Replacement**.

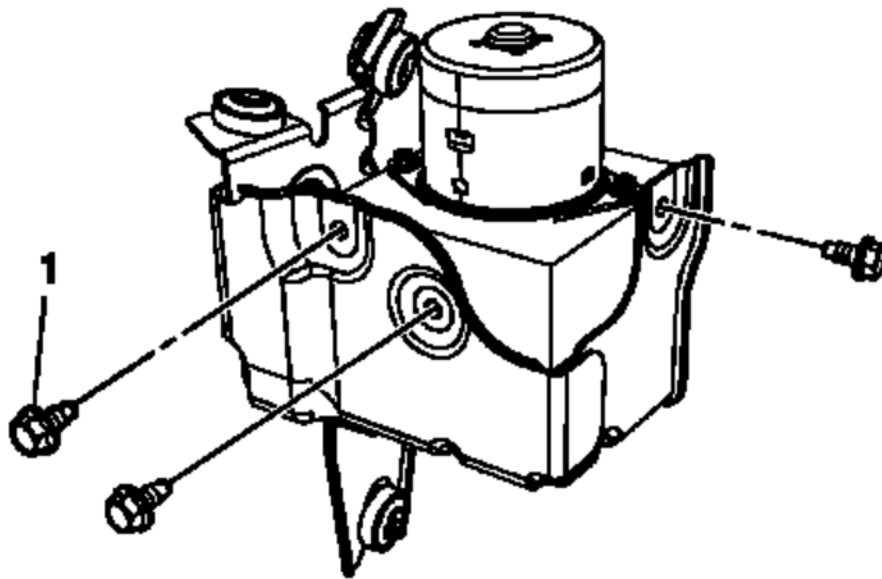


Fig. 14: Electronic Brake And Traction Control Module, Assembly Bracket And Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Install the brake pressure modulator valve assembly bracket bolts (1) and tighten to 10 N.m (89 lb in).

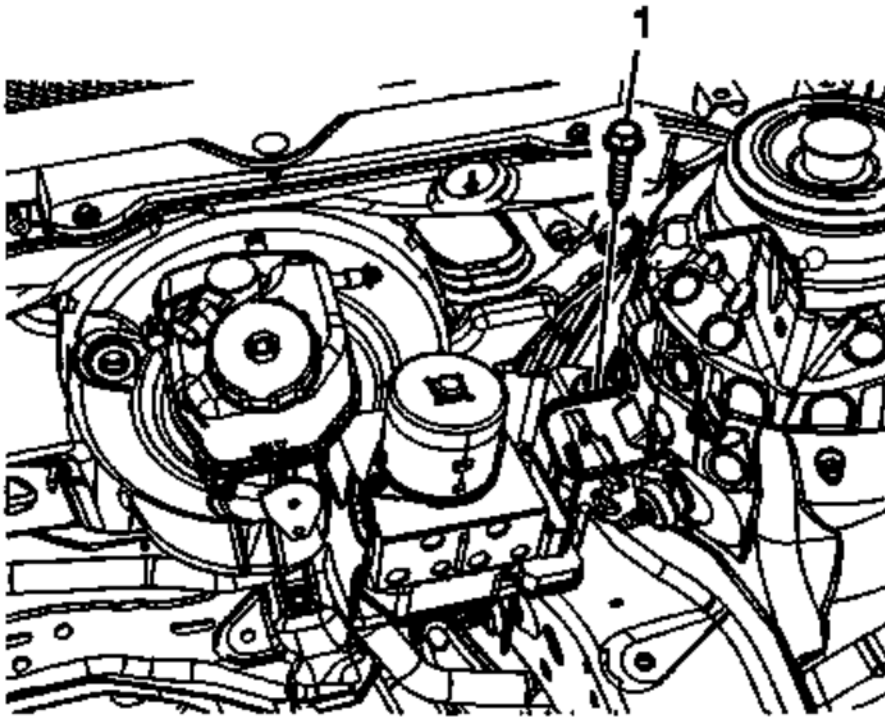


Fig. 15: Brake Pressure Modulator Valve Assembly Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Install the brake pressure modulator valve assembly.
4. Install the brake pressure modulator valve assembly bolt (1) and tighten to 20 N.m (15 lb ft).

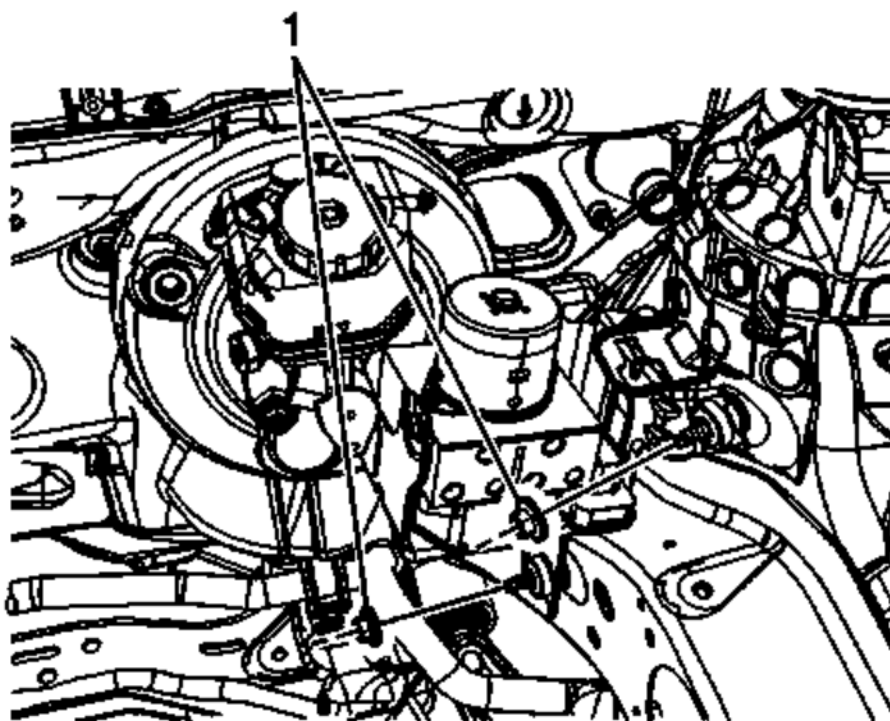


Fig. 16: Brake Pressure Modulator Valve Assembly Nuts
Courtesy of GENERAL MOTORS COMPANY

5. Install the brake pressure modulator valve assembly nuts (1) and tighten to 20 N.m (15 lb ft).

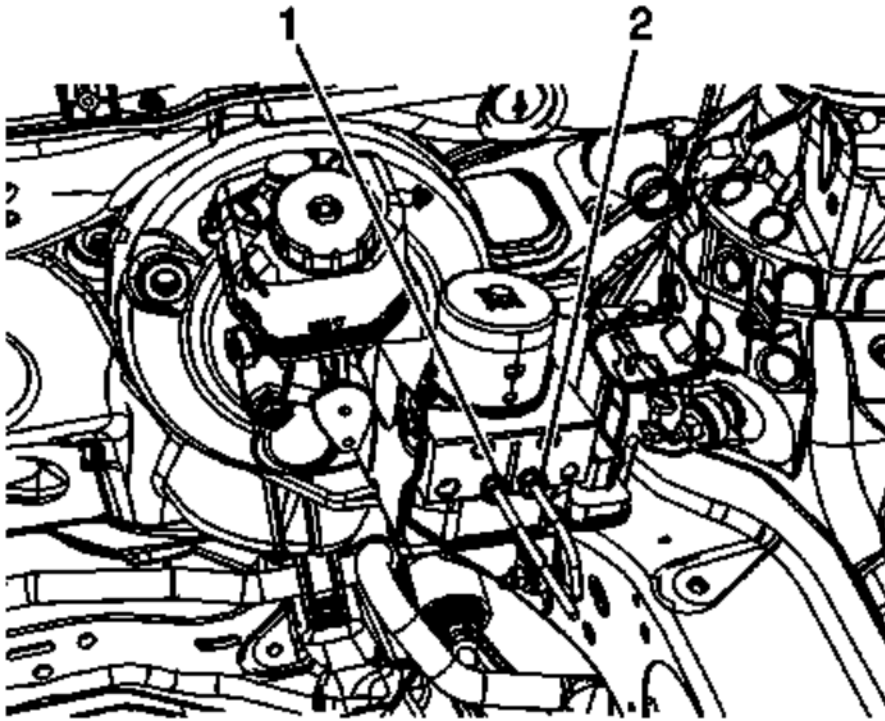


Fig. 17: Left Rear Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

6. Install the left rear brake pipe fitting (1) and tighten to 18 N.m (13 lb ft).
7. Install the right rear brake pipe fitting (2) and tighten to 18 N.m (13 lb ft).

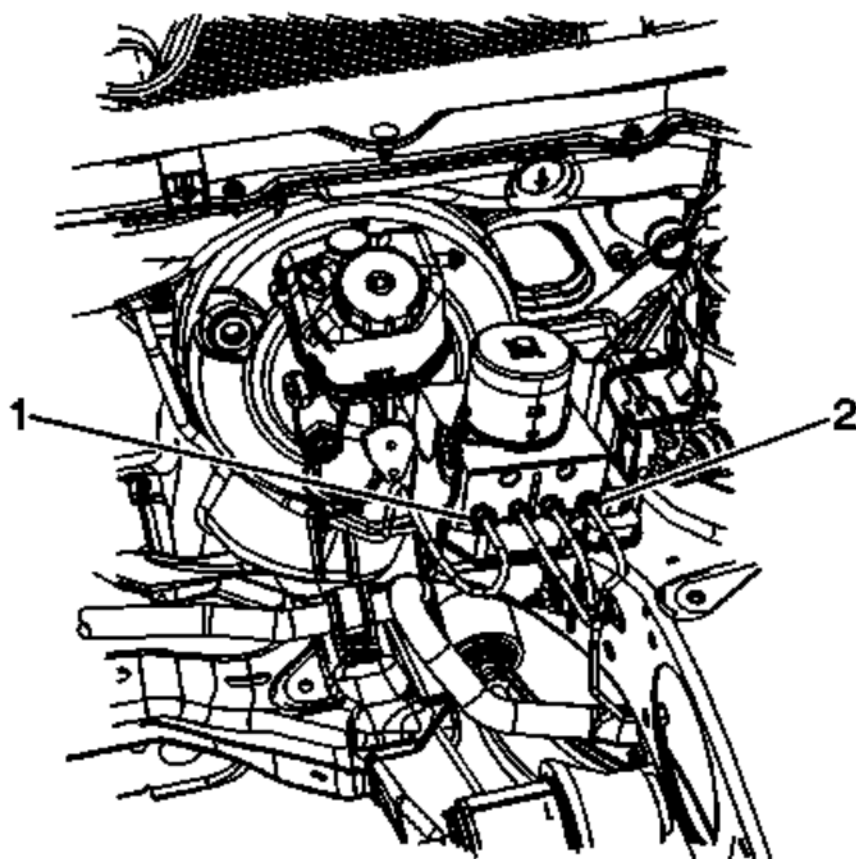


Fig. 18: Right Front Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

8. Install the right front brake pipe fitting (1) and tighten to 18 N.m (13 lb ft).
9. Install the left front brake pipe fitting (2) and tighten to 18 N.m (13 lb ft).

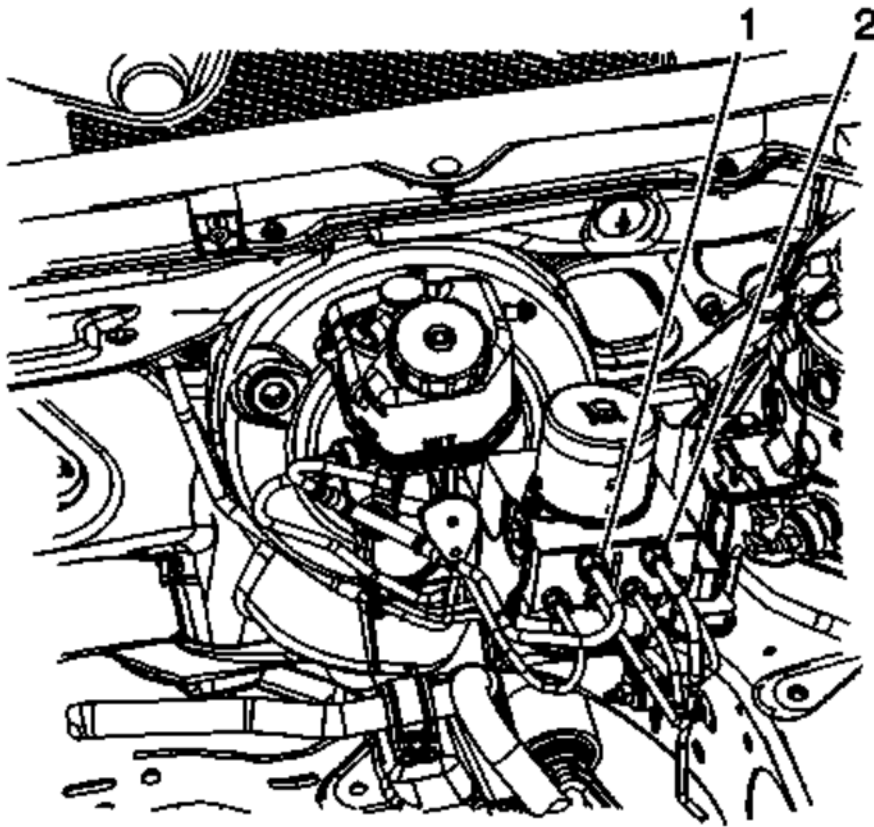


Fig. 19: Master Cylinder Primary Brake Pipe Fitting
 Courtesy of GENERAL MOTORS COMPANY

10. Install the master cylinder primary brake pipe fitting (1) and tighten to 25 N.m (18 lb ft).
11. Install the master cylinder secondary brake pipe fitting (2) and tighten to 25 N.m (18 lb ft).
12. If equipped with electronic power steering, position the power steering wiring harness and bracket assembly to the master cylinder body.
13. If equipped with electronic power steering, install the power steering wiring harness bracket bolt and tighten to 9 N.m (80 lb in).
14. Connect the EBCM electrical connector.
15. Install the radiator surge tank. Refer to **Radiator Surge Tank Replacement (LUK)** , **Radiator Surge Tank Replacement (LCV)** , **Radiator Surge Tank Replacement (LTG)** .
16. Connect the brake fluid level sensor electrical connector.
17. Install the battery tray. Refer to **Battery Tray Replacement** .
18. Program the EBCM. Refer to **Control Module References** .
19. Bleed the antilock brake system. Refer to **Antilock Brake System Automated Bleed**.
20. Perform the **Diagnostic System Check - Vehicle** .
21. Calibrate the brake pedal position sensor.
22. Center the steering angle sensor. Refer to **Steering Angle Sensor Centering**.

BRAKE PRESSURE MODULATOR VALVE PRESSURE SENSOR CALIBRATION

The brake pressure sensor does not require calibration often. Calibration of the brake pressure sensor might be required after certain service procedures are performed. Some of these procedures are as follows:

- Electronic brake control module (EBCM) replacement.
- Brake pressure modulator valve assembly replacement

The Brake Pressure Sensor Calibration procedure can be completed with a scan tool using the following steps:

1. Apply the parking brake, or set the transmission in the P position.
2. Release the brake pedal.
3. Install the scan tool to the data link connector.
4. Ignition ON, engine OFF
5. Select Brake Pressure Sensor Calibration in the EBCM Configuration/Reset Functions list.
6. Follow the scan tool directions to complete the calibration procedure.
7. Clear any DTCs that may be set.

FRONT WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

WARNING: Refer to Brake Dust Warning .

1. Raise and support 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. Clean the wheel speed sensor mounting area on the steering knuckle of any accumulated dirt and debris.

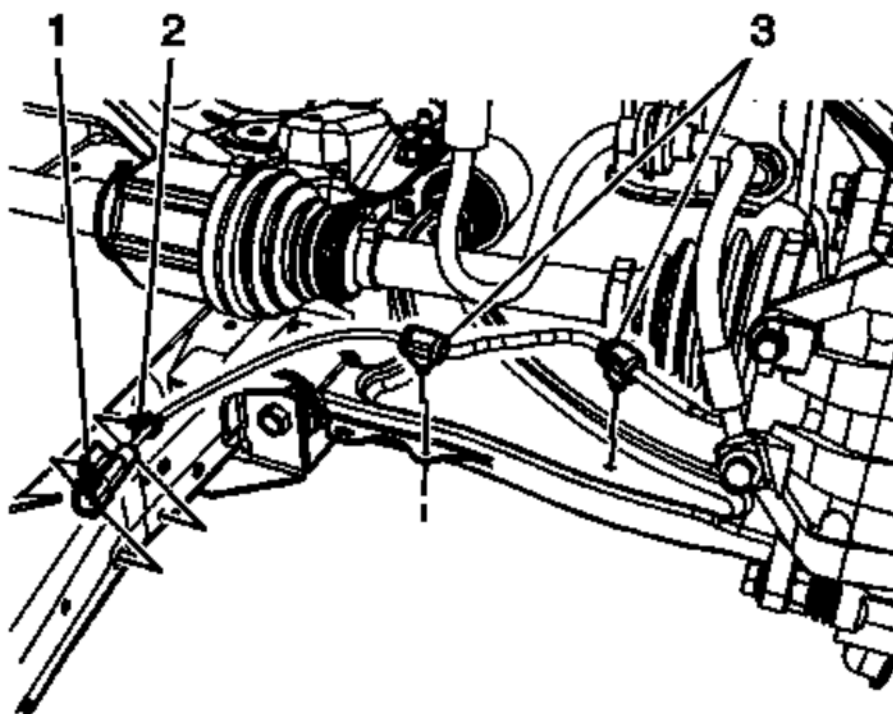


Fig. 20: Wheel Speed Sensor Electrical Connector & Harness Clips
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the wheel speed sensor electrical connector (1) and release the connector from the frame.
5. Release the harness clip (2) from the frame.
6. Release the harness clips (3) from the lower control arm.

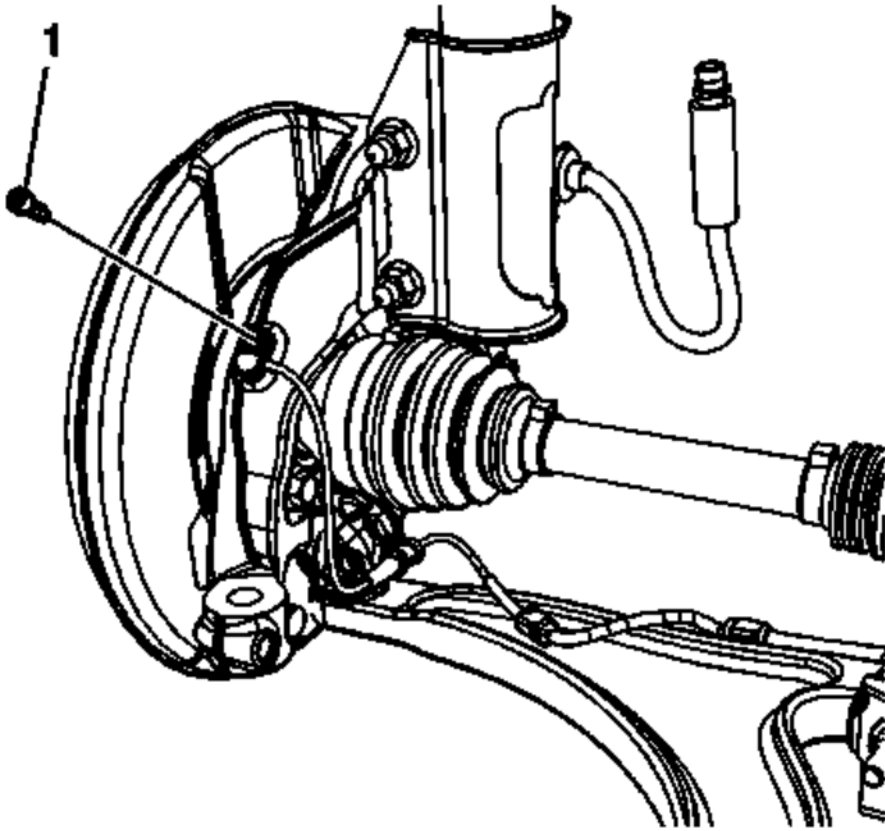


Fig. 21: Wheel Speed Sensor Bolt

Courtesy of GENERAL MOTORS COMPANY

7. Remove any accumulated dirt and debris from the surrounding the wheel speed sensor.
8. Remove the wheel speed sensor bolt (1).

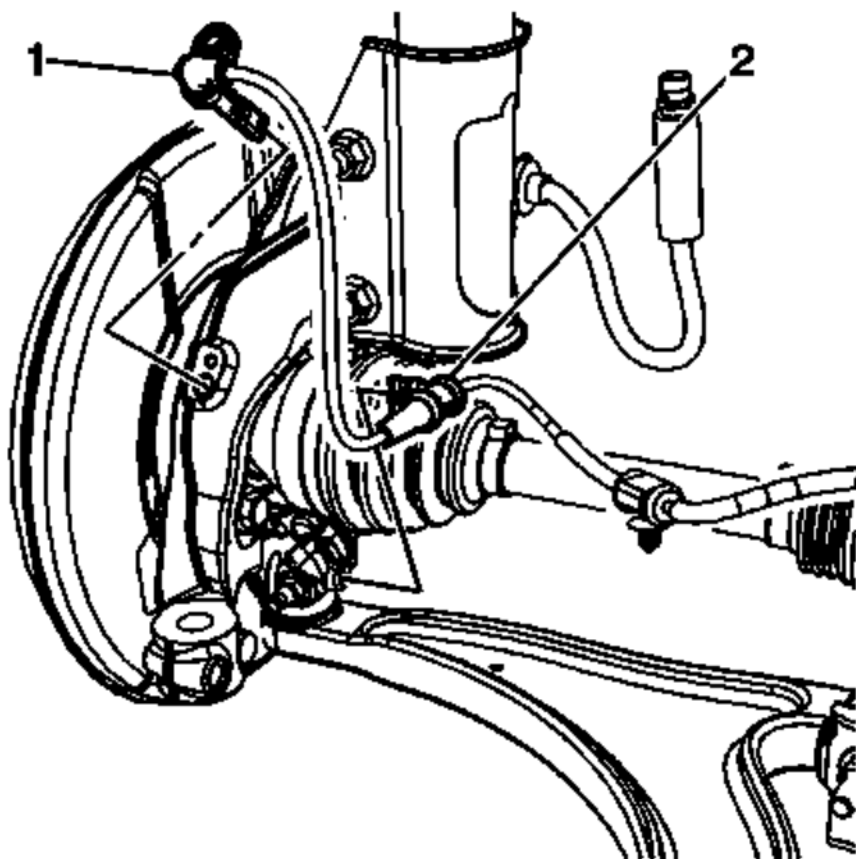


Fig. 22: Wheel Speed Sensor And Harness Clip
Courtesy of GENERAL MOTORS COMPANY

9. Remove the wheel speed sensor (1) from the steering knuckle.
10. Release the harness clip (2) from the steering knuckle and remove the wheel speed sensor.

Installation Procedure

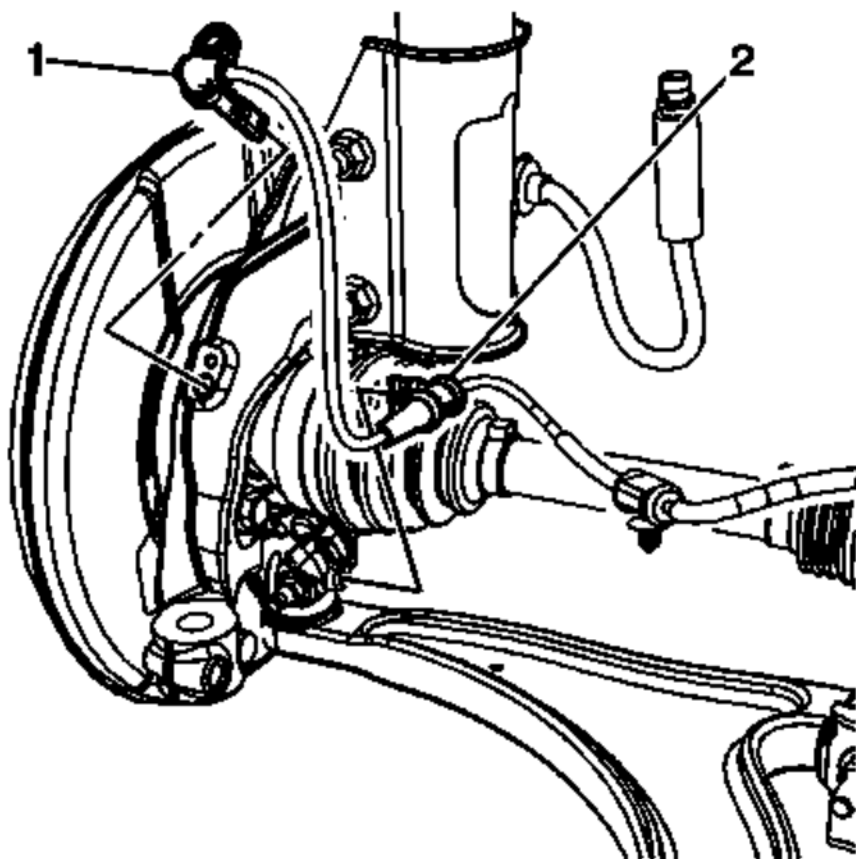


Fig. 23: Wheel Speed Sensor And Harness Clip
Courtesy of GENERAL MOTORS COMPANY

1. Install the wheel speed sensor (1) to the steering knuckle.
2. Install the harness clip (2) to the steering knuckle.

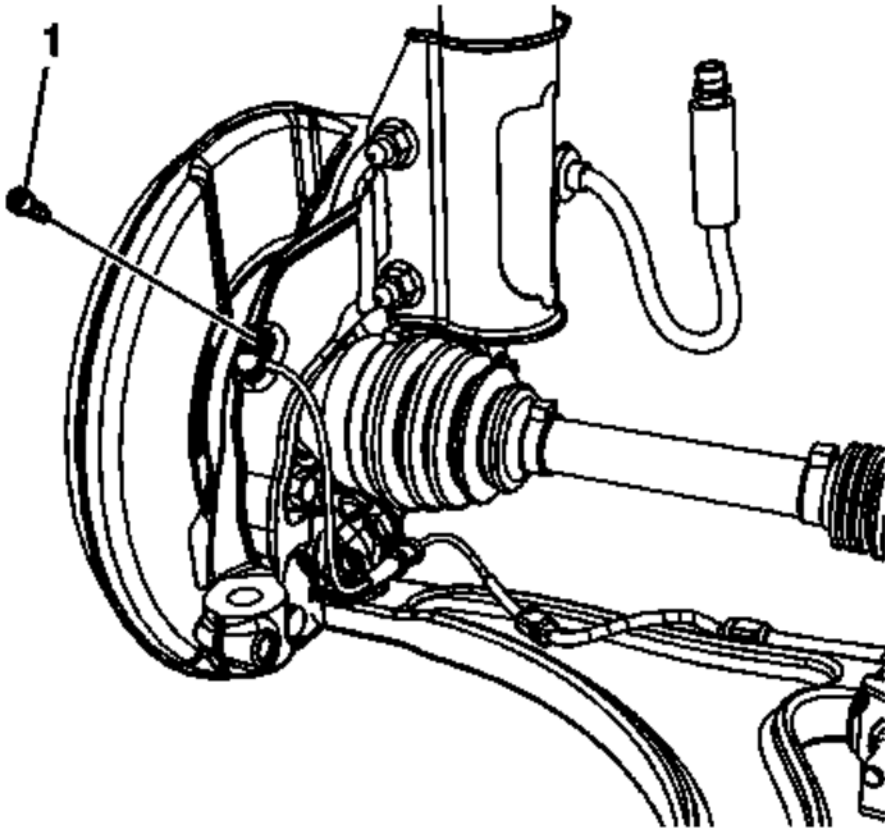


Fig. 24: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Install the wheel speed sensor bolt (1) and tighten to 9 N.m (80 lb in).

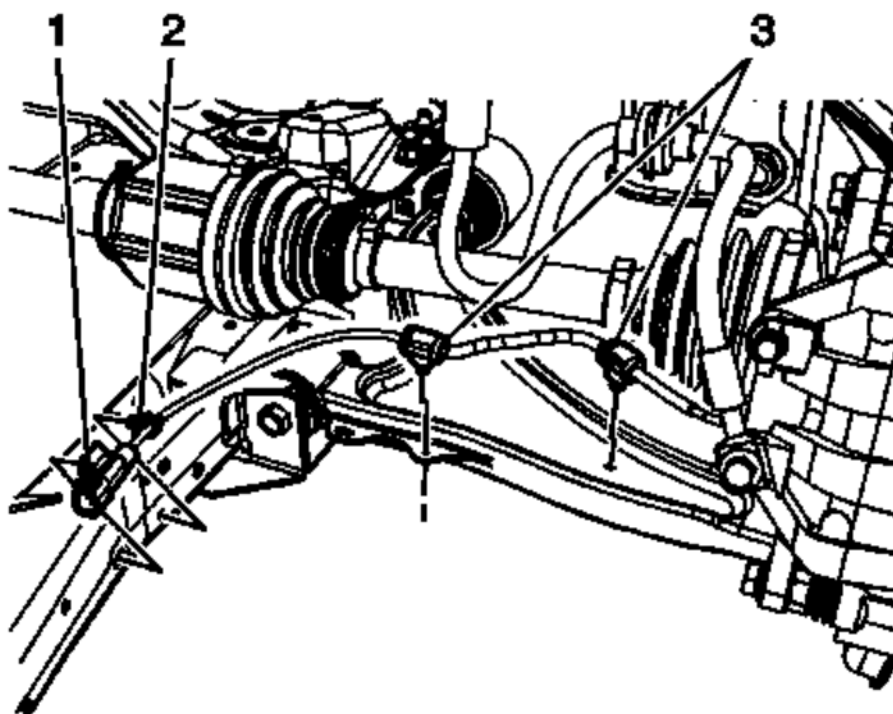


Fig. 25: Wheel Speed Sensor Electrical Connector & Harness Clips
Courtesy of GENERAL MOTORS COMPANY

4. Connect the wheel speed sensor electrical connector (1) and secure the connector to the frame.
5. Install the harness clip (2) to the frame.
6. Install the harness clips (3) to the lower control arm.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
8. Perform the **Diagnostic System Check - Vehicle** .

REAR WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

WARNING: Refer to **Brake Dust Warning** .

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the rear tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the rear wheelhouse panel liner. Refer to **Rear Wheelhouse Liner Replacement** .

4. Clean the wheel speed sensor mounting area on the suspension knuckle of any accumulated dirt and debris.

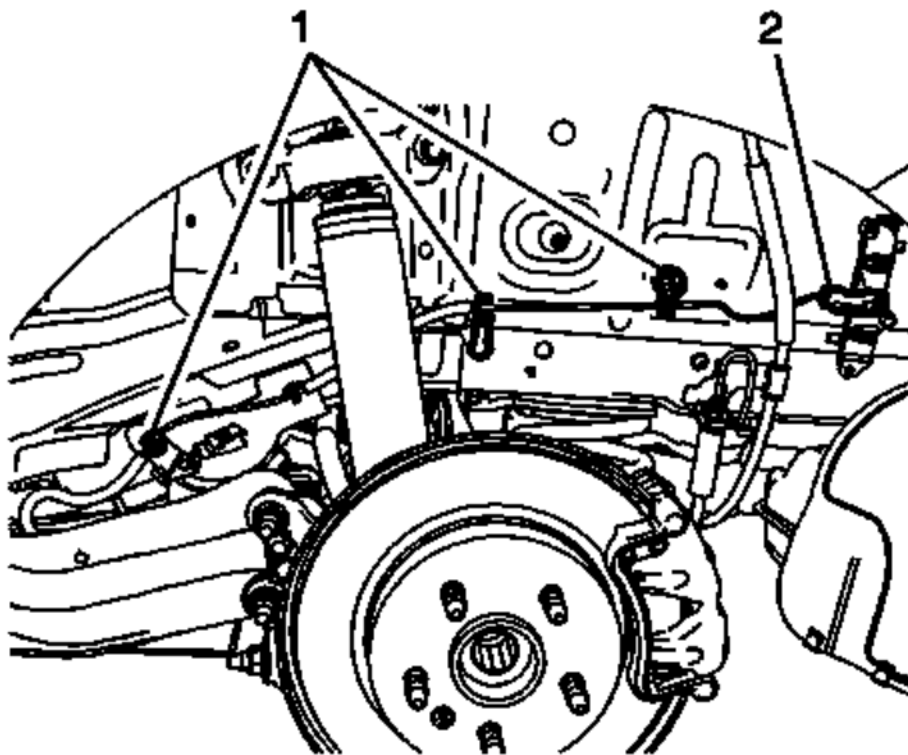


Fig. 26: Wheel Speed Sensor Harness Clips
Courtesy of GENERAL MOTORS COMPANY

5. Release the wheel speed sensor harness clips (1) from the wheelhouse panel.
6. Disconnect the wheel speed sensor harness electrical connector (2) and release the connector retainer from the bracket on the wheelhouse panel.

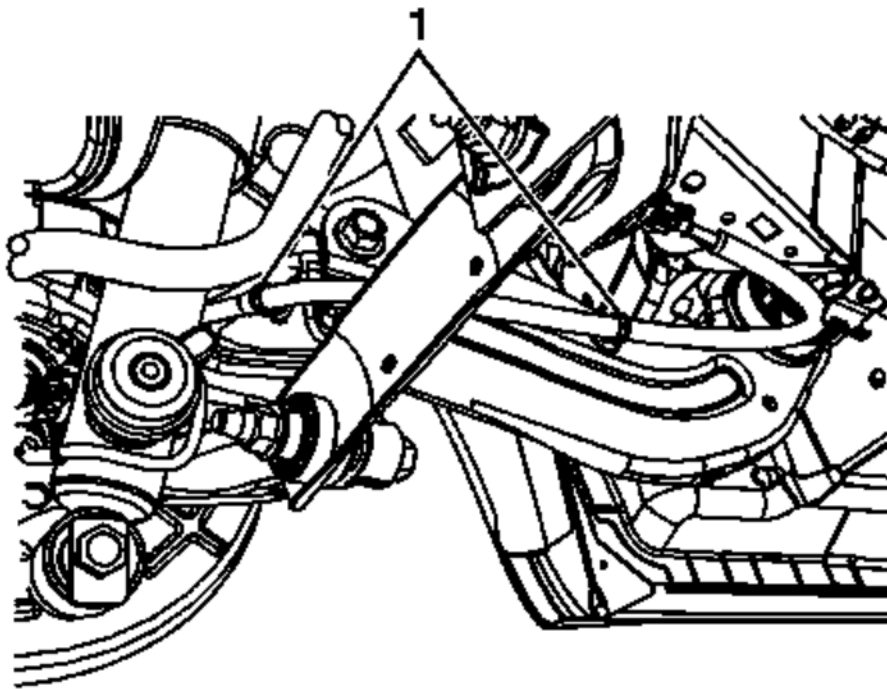


Fig. 27: Wheel Speed Sensor Harness Clips And Rear Suspension Bracket
Courtesy of GENERAL MOTORS COMPANY

7. Release the wheel speed sensor harness clips (1) from the rear suspension bracket.

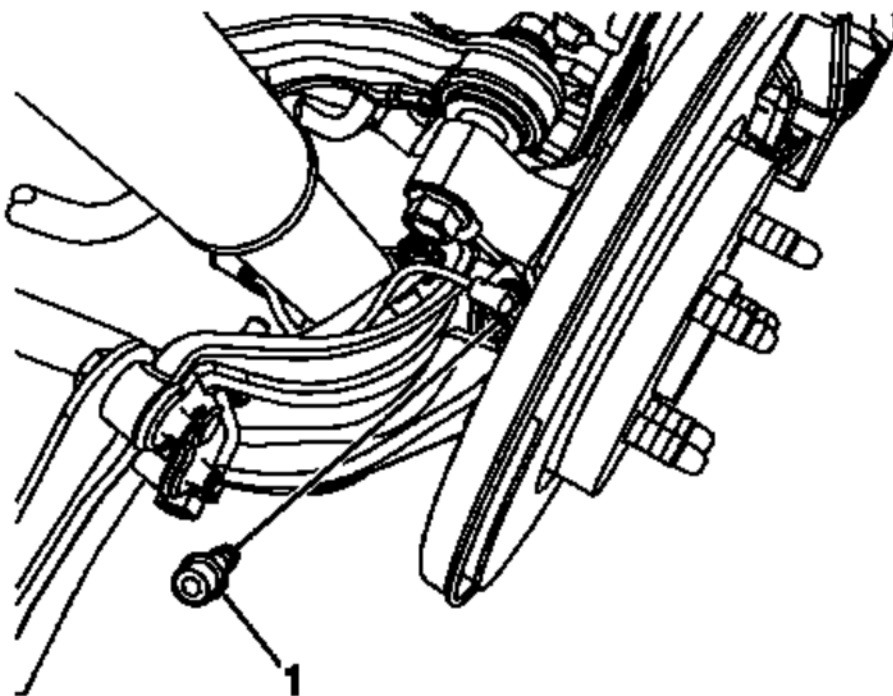


Fig. 28: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Remove the wheel speed sensor bolt (1).
9. Remove the wheel speed sensor from the rear suspension knuckle.

Installation Procedure

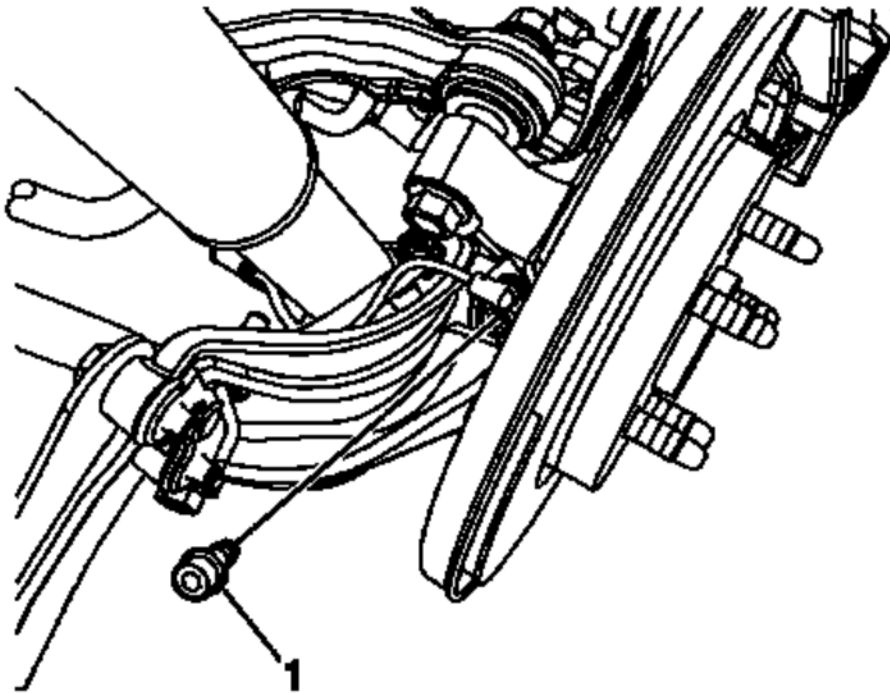


Fig. 29: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

1. Install the wheel speed sensor to the rear suspension knuckle.

CAUTION: Refer to Fastener Caution .

2. Install the wheel speed sensor bolt (1) and tighten to 9 N.m (80 lb in).

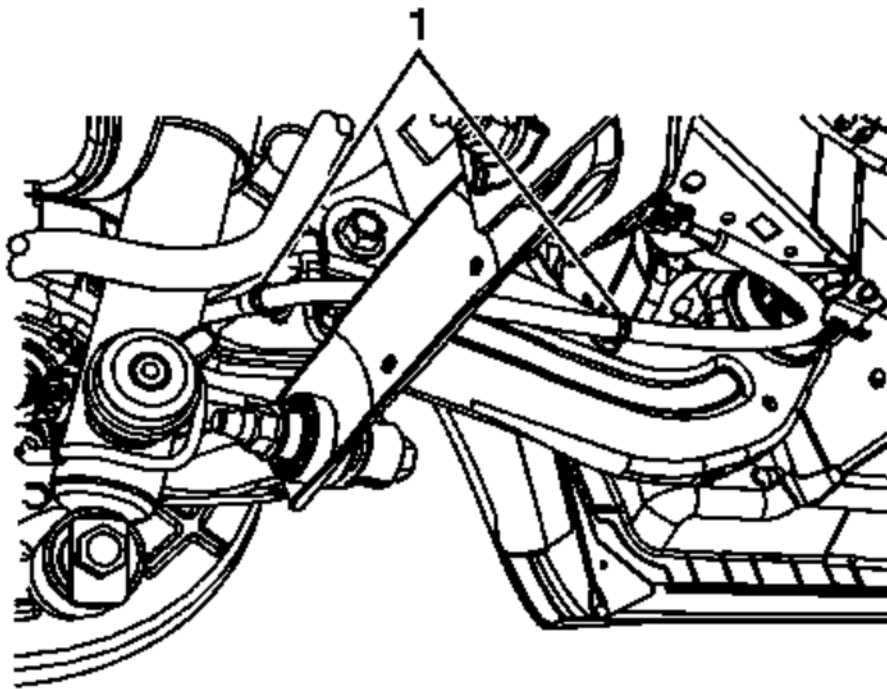


Fig. 30: Wheel Speed Sensor Harness Clips And Rear Suspension Bracket
Courtesy of GENERAL MOTORS COMPANY

3. Install the wheel speed sensor harness clips (1) to the rear suspension bracket.

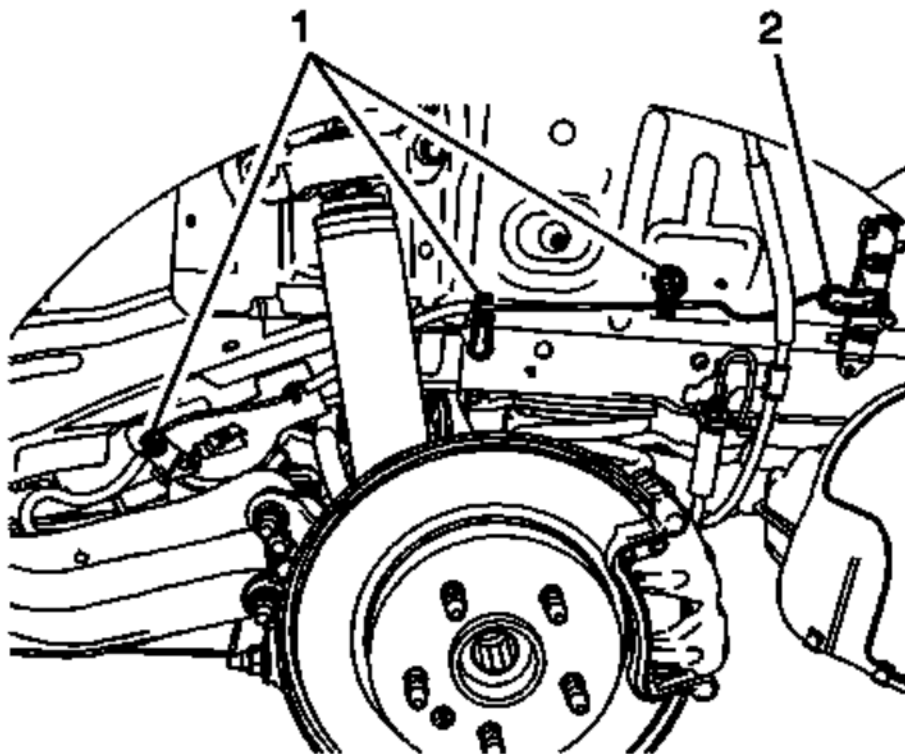


Fig. 31: Wheel Speed Sensor Harness Clips
Courtesy of GENERAL MOTORS COMPANY

4. Install the wheel speed sensor harness clips (1) to the wheelhouse panel.
5. Connect the wheel speed sensor harness electrical connector (2) and install the connector retainer to the bracket on the wheelhouse panel.
6. Install the rear wheelhouse panel liner. Refer to **Rear Wheelhouse Liner Replacement** .
7. Install the rear tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
8. Perform the **Diagnostic System Check - Vehicle** .

VEHICLE YAW SENSOR LEARN

The Yaw Rate Sensor Learn procedure can be completed with a scan tool using the following steps:

1. Place vehicle on a level surface
2. Apply the parking brake, or set the transmission in the P position.
3. Install the scan tool to the data link connector.
4. Ignition ON, engine OFF
5. Select Yaw Rate Sensor Reset in the Multi-axis Acceleration Sensor Module Configuration/Reset Functions list.

6. Follow the scan tool directions to complete the calibration procedure.
7. Select Yaw Rate Sensor Learn in the Multi-axis Acceleration Sensor Module Configuration/Reset Functions list.
8. Follow the scan tool directions to complete the calibration procedure.
9. Select Yaw Rate Sensor Learn in the EBCM Configuration/Reset Functions list.
10. Follow the scan tool directions to complete the calibration procedure.
11. Clear any DTCs that may be set.

VEHICLE YAW SENSOR REPLACEMENT

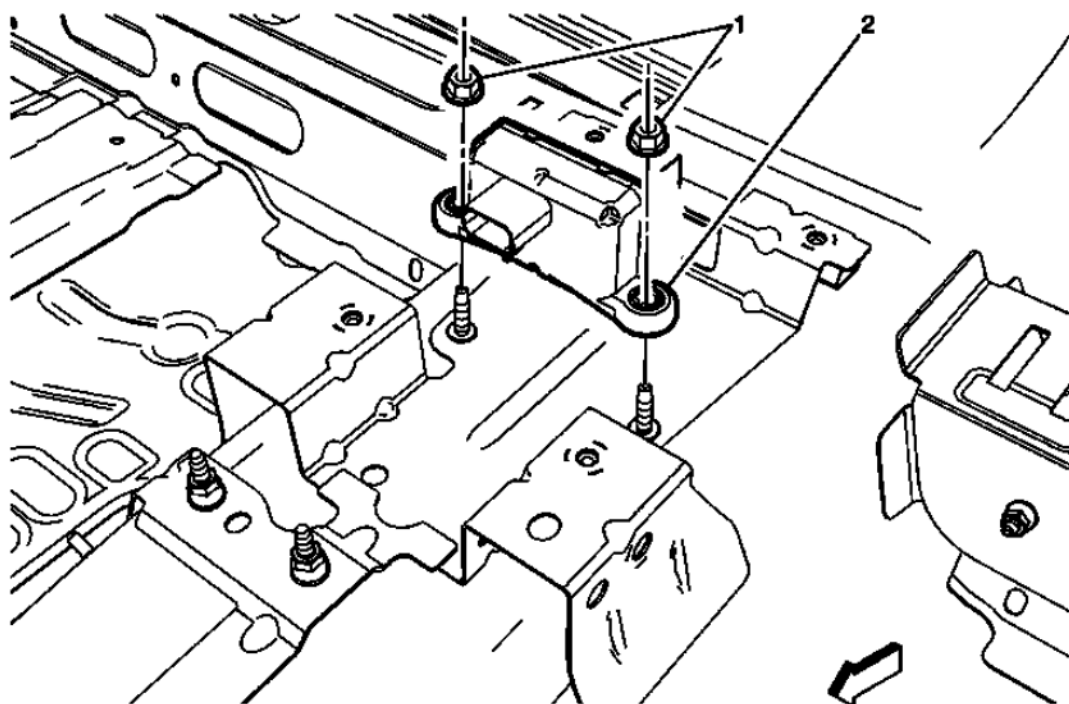


Fig. 32: Vehicle Yaw Sensor
Courtesy of GENERAL MOTORS COMPANY

Vehicle Yaw Sensor Replacement

Callout	Component Name
Preliminary Procedure Remove the front floor console. Refer to Front Floor Console Assembly Replacement .	
1	Vehicle Yaw Sensor Nut (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten

	9 N.m (80 lb in)
2	Vehicle Yaw Sensor Procedure 1. Disconnect the electrical connector. 2. After the installation is complete, perform the vehicle yaw learn. Refer to <u>Vehicle Yaw Sensor Learn</u>.

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION

This vehicle is equipped with a TRW EBC450 brake system. The electronic brake control module and the brake pressure modulator are serviced separately. The brake pressure modulator uses a four circuit configuration to control hydraulic pressure to each wheel independently.

Depending on options, the following vehicle performance enhancement systems are provided.

- Antilock brake system (ABS)
- Traction control
- Stability control
- Dynamic rear proportioning
- Hill start assist
- Cornering brake control
- Hydraulic brake assist
- Trailer stability assist

Antilock Brake System

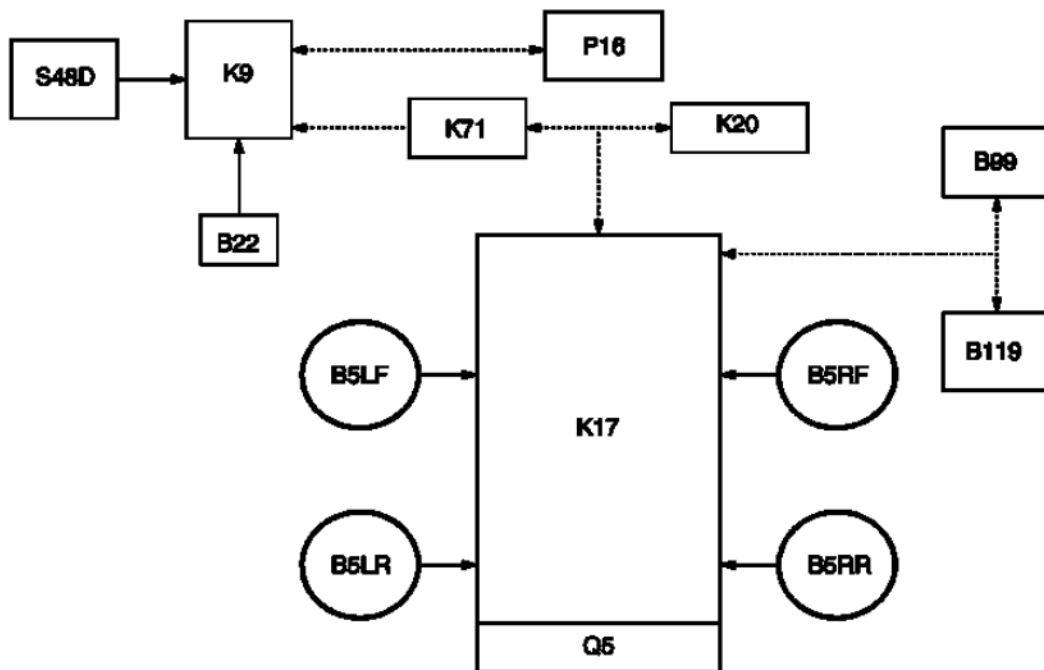


Fig. 33: Antilock Brake System Wiring Diagram
 Courtesy of GENERAL MOTORS COMPANY

Solid Line - Hard Wire I/O
Dash Line - Serial Data

B5LF	Left Front Wheel Speed Sensor
B5LR	Left Rear Wheel Speed Sensor
B5RF	Right Front Wheel Speed Sensor
B5RR	Right Rear Wheel Speed Sensor
B22	Brake Pedal Position Sensor
B99	Steering Wheel Angle Sensor
B119	Multi-axis Acceleration Sensor
K9	Body Control Module
K17	Electronic Brake Control Module
K20	Engine Control Module
K71	Transmission Control Module
P16	Instrument Cluster
Q5	Brake Pressure Modulator
S48D	Multifunction Switch 2 - Instrument Panel

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

- Electronic brake control module - The electronic brake control module controls the system functions and detects failures. It supplies voltage to the solenoid valves and pump motor.

- Brake pressure modulator - The brake pressure modulator contains the following components:
 - Hydraulic pump with pump motor
 - Four isolation valves
 - Four dump valves
 - Two traction control/stability control supply valves
 - Two traction control/stability control isolation valves
 - Pressure sensor
 - High pressure accumulator
 - Low pressure accumulator
- Body control module monitors the brake pedal position sensor signal when the brake pedal is applied and sends a serial data message to the electronic brake control module indicating the brake pedal position.
- Brake pedal position sensor is used to sense the action of the driver application of the brake pedal. The sensor provides an analog voltage signal that will increase as the brake pedal is applied. The electronic brake control module monitors the brake pressure sensor which is integral to the brake pressure modulator.
- Multi-axis acceleration sensor - The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one multi-axis acceleration sensor, external to the electronic brake control module. The electronic brake control module receives serial data message inputs from the yaw rate, lateral acceleration and longitudinal acceleration sensor and activates stability control and hill start assist function depending on multi-axis acceleration sensor input.
- Steering wheel angle sensor - The electronic brake control module receives serial data message inputs from the steering angle sensor. The steering angle sensor signal is used to calculate the desired yaw rate.
- Traction control switch - Traction control and stability control are manually disabled or enabled by pressing the traction control switch.
- Wheel speed sensors - The electronic brake control module supplies a 12 V reference voltage to each wheel speed sensor. As the wheel spins, the wheel speed sensor produces an alternating current square wave signal. The electronic brake control module uses the frequency of the square wave signal to calculate the wheel speed.

Antilock Brake System (ABS)

When wheel slip is detected during a brake application, an ABS event occurs. During ABS 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 ABS 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 responds to wheel speed sensor inputs and attempts to prevent wheel slip. These pedal pulsations are present only during ABS 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 ABS braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping. These noises and pedal pulsations are considered normal during ABS 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 electronic brake control module 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 electronic brake control module 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.

Pressure Increase

After the wheel slip is corrected, a pressure increase occurs. The electronic brake control module 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.

Traction Control

When drive wheel slip is noted, the electronic brake control module will enter traction control mode.

First, the electronic brake control module requests the engine control module (ECM) to reduce the amount of torque to the drive wheels via a serial data message. The ECM reduces torque to the drive wheels and reports the amount of delivered torque.

If the engine torque reduction does not reduce drive wheel slip, the electronic brake control module will actively apply the brakes on the slipping drive wheel. During traction control braking, hydraulic pressure in each drive wheel circuit is controlled to prevent the drive wheels from slipping. The electronic brake control module commands the pump motor and appropriate solenoid valves ON and OFF to apply brake pressure to the slipping wheel.

Traction control can be manually disabled or enabled by pressing the traction control switch.

Stability Control

Stability control provides added stability during aggressive maneuvers. Yaw rate is the rate of rotation about the vehicle's vertical axis. The stability control is activated when the electronic brake control module 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 electronic brake control module using the following inputs:

- Steering wheel position
- Vehicle speed
- Lateral acceleration

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 electronic brake control module attempts to correct the vehicle's yaw motion by applying brake pressure to one or more of the wheels. The amount of applied brake pressure varies, depending on the correction required. The engine torque may be reduced also, if it is necessary to slow the vehicle while maintaining stability.

Stability control activations generally occur in turns during aggressive driving. When braking during stability control activation, the brake pedal may pulsate.

Stability control can be manually disabled or enabled by pressing the traction control switch for 5 s.

Dynamic Rear Proportioning

The dynamic rear proportioning is a control system that replaces the mechanical proportioning valve. Under certain driving conditions the electronic brake control module will reduce the rear wheel brake pressure by commanding the appropriate solenoid valves ON and OFF.

Hill Start Assist

The hill start assist allows the driver to launch his vehicle without a roll back while he is moving his foot from the brake pedal to the accelerator pedal. The electronic brake control module calculates the brake pressure, which is needed to hold the vehicle on an incline and locks that pressure for a certain time by commanding the appropriate solenoid valves ON and OFF when the brake pedal is released. Hill start assist is activated when the electronic brake control module determines that the driver wishes to move his vehicle up-hill, either backwards or forwards.

The following inputs are used for hill start assist feature:

- Brake switch
- Brake pressure
- Longitudinal acceleration
- Engine torque
- Reverse gear information
- Clutch switch
- Accelerator pedal position
- Vehicle speed

Cornering Brake Control

Cornering brake control is a slip control function that is intended to improve the vehicle's lateral/yaw stability during combined braking and cornering situations.

The electronic brake control module will reduce the brake pressure to the inside wheels by commanding the appropriate solenoid valves ON and OFF.

Hydraulic Brake Assist

The hydraulic brake assist function is designed to support the driver in emergency braking situations.

The electronic brake control module receives inputs from the brake pressure sensor. When the electronic brake control module senses an emergency braking situation, the electronic brake control module will actively increase the brake pressure to a specific maximum.

Trailer Stability Assist

The trailer stability assist will detect any vehicle yaw instability, caused by an attached trailer. When instability is detected, the electronic brake control module attempts to correct the vehicle's yaw motion by applying brake pressure to one or more of the wheels. The engine torque may be reduced also, if it is necessary to slow down the vehicle.

Driver Information Indicators

Brake Warning Indicator

The instrument cluster turns the brake warning indicator ON when the following occurs:

- The instrument cluster performs the bulb check.
- The electronic brake control module detects a faulty pump motor, solenoid valves, an internal hardware failure or a too high or too low battery voltage and sends a serial data message to the instrument cluster requesting illumination.
- The body control module (BCM) detects that the parking brake is engaged. The instrument cluster receives a serial data message from the BCM requesting illumination.

ABS Indicator

The instrument cluster turns the ABS indicator ON when the following occurs:

- The instrument cluster performs the bulb check.
- The electronic brake control module detects a malfunction which disables the ABS and sends a serial data message to the instrument cluster requesting illumination.

Traction Control/Stability Control Active Indicator

The instrument cluster turns the traction control/stability control-active indicator ON when the following occurs:

- The instrument cluster performs the bulb check.
- The ABS system is in traction control or stability control mode.

- The electronic brake control module detects a traction control/stability control disabling malfunction and sends a serial data message to the instrument cluster requesting illumination.

Traction Control Off Indicator

The instrument cluster turns the traction control off indicator ON when the following occurs:

- The instrument cluster performs the bulb check.
- The driver manually disables the traction control by pressing the traction control switch. The electronic brake control module sends a serial data message to the instrument cluster requesting illumination.

Stability Control Off Indicator

The instrument cluster turns the stability control off indicator ON when the following occurs:

- The instrument cluster performs the bulb check.
- The driver manually disables the stability control by pressing the traction control switch. The electronic brake control module sends a serial data message to the instrument cluster requesting illumination.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	EL 35616-F J 35616 Terminal Test Kit