

2017 BRAKES

Antilock Brake System - Bolt EV

SPECIFICATIONS

FASTENER SPECIFICATIONS

Single Use Non-Threaded Fasteners/Components

Application
NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>
Brake Pressure Modulator Valve Insulator
Brake Pressure Modulator Valve Insulator Nut
Brake Pressure Modulator Valve Insulator Washer

Reusable Threaded Fastener Tightening Specifications

Application	Specification
	Metric (English)
NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Brake Pipe Fitting	18 N.m (13 lb ft)
Brake Pressure Modulator Valve Bracket Nut	22 N.m (16 lb ft)
Brake Pressure Modulator Valve Front Pipe Fitting	25 N.m (18 lb ft)
Brake Pressure Modulator Valve Insulator Nut	8 N.m (71 lb in)
Brake Pressure Modulator Valve Rear Pipe Fitting	25 N.m (18 lb ft)
Electronic Brake Control Module Bolt	3 N.m (27 lb in)
Front Wheel Speed Sensor Bolt	9 N.m (80 lb in)
Rear Wheel Speed Sensor Bolt	9 N.m (80 lb in)

SCHEMATIC WIRING DIAGRAMS

ANTILOCK BRAKE SYSTEM WIRING SCHEMATICS

Power, Ground, Serial Data and Traction Control Switch

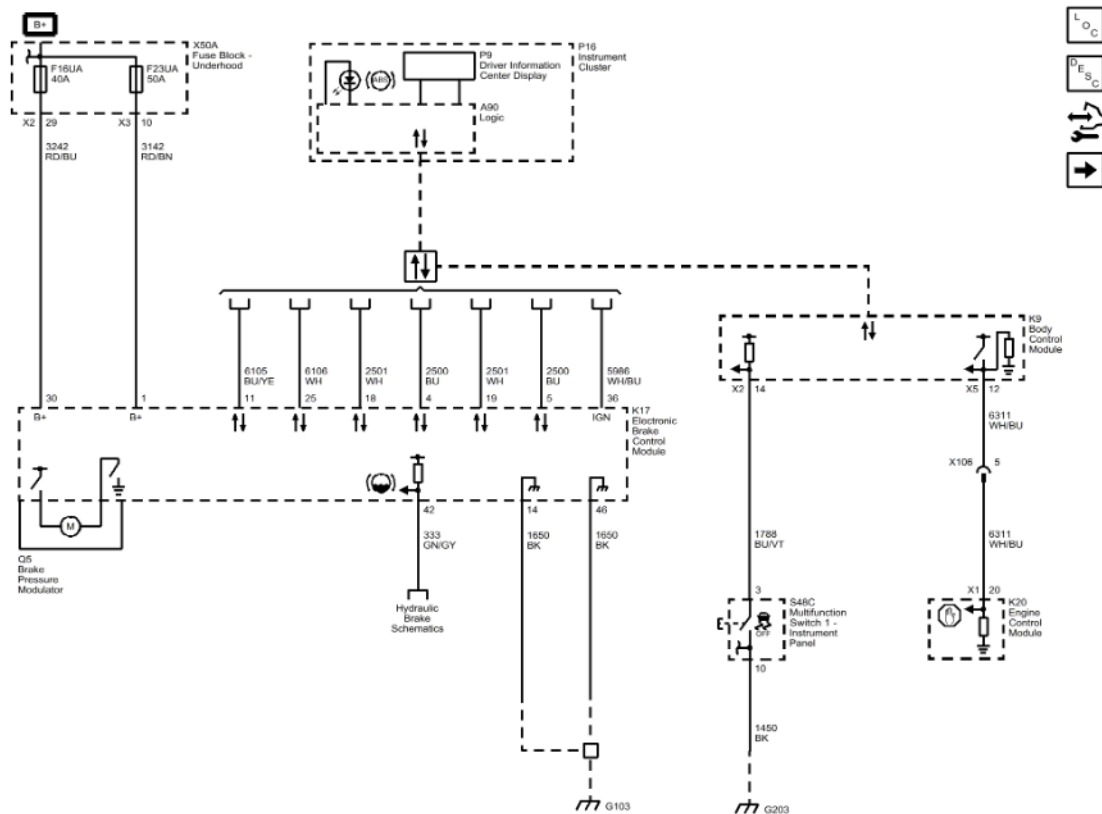


Fig. 1: Power, Ground, Serial Data and Traction Control Switch
Courtesy of GENERAL MOTORS COMPANY

Wheel Speed Sensors

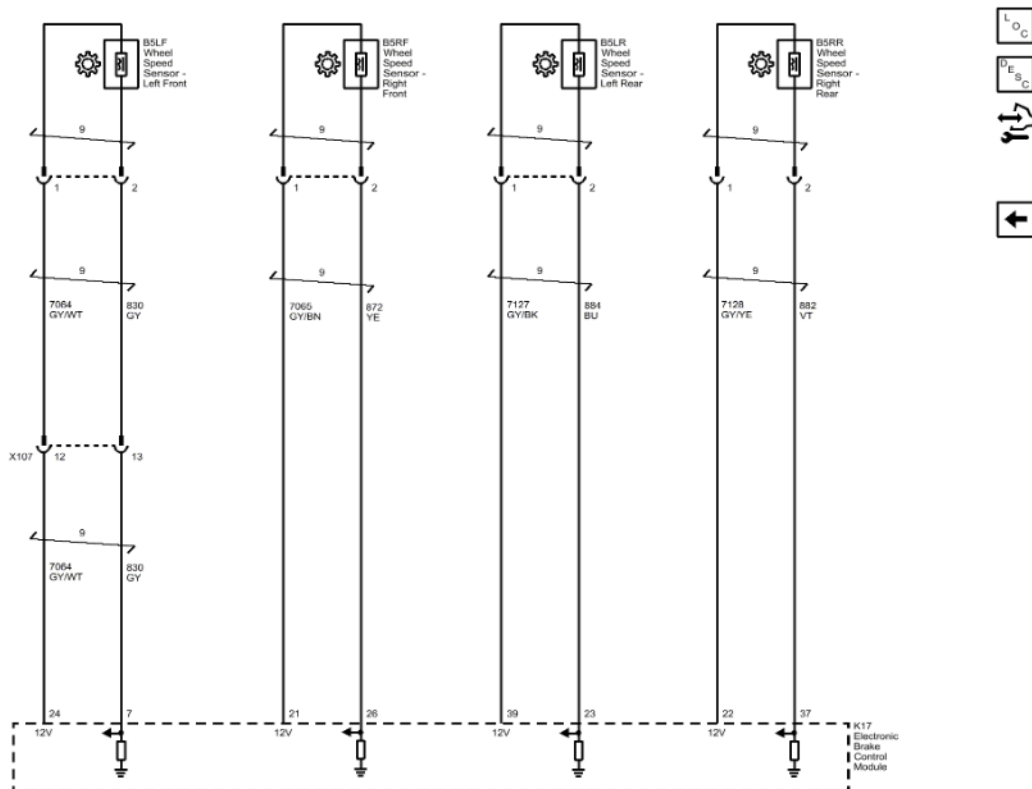


Fig. 2: Wheel Speed Sensors
Courtesy of GENERAL MOTORS COMPANY

DTC B2745: TRACTION CONTROL SWITCH CIRCUIT

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

Traction Control Switch Circuit

For symptom byte information refer to [Symptom Byte List](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Traction Control Switch Signal	B2745 02	1	1	-
Traction Control Switch Ground	-	1	-	-
1. Traction Control Switch Malfunction.				

Circuit/System Description

The body control module monitors the electronic stability control switch. When the electronic stability control switch is pressed once, the body control module will request the electronic brake control module via serial data to disable the traction control. When the electronic stability control switch is pressed and held for five seconds, the body control module will request the electronic brake control module to disable the 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.

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

- When the condition for setting the DTC is no longer present.
- 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

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
 - Traction/stability Control 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 while pressing and releasing the S48C Multifunction Switch 1 - Instrument Panel.
 - **If the parameter does not change**

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

Circuit/System Testing

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

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S48C Multifunction Switch 1 - Instrument Panel. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 10 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Body Control Module, Traction Control Switch parameter is Inactive.
 - **If Active**
 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 3 and ground.
 6. Verify the scan tool Traction Control Switch parameter is Active.
 - **If Inactive**
 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 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K9 Body Control Module.
 - **If Active**
 7. Test or replace the S48C Multifunction Switch 1 - Instrument Panel.

Component Testing

1. Ignition OFF, disconnect the harness connector at the S48C Multifunction Switch 1 - Instrument Panel.
2. Test for infinite resistance between the signal terminal 3 and the ground terminal 10 with the switch in the open position.
 - **If less than infinite resistance**
Replace the S48C Multifunction Switch 1 - Instrument Panel.
 - **If infinite resistance**
3. Test for less than 2 Ω between the signal circuit terminal 3 and the ground terminal 10 with the switch in the closed position.
 - **If 2 Ω or greater**
Replace the S48C Multifunction Switch 1 - Instrument Panel.
 - **If less than 2 Ω**
4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Hazard Warning Switch Replacement](#)
- [Control Module References](#) for Body Control Module or Instrument Cluster replacement, programming and setup.

DTC C0035-C0051: WHEEL SPEED SENSOR CIRCUITS

Diagnostic Instructions

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

DTC Descriptors

DTC C0035

Left Front Wheel Speed Sensor Circuit

DTC C0036

Left Front Wheel Speed Sensor Range Performance

DTC C003A

Front Wheel Speed Sensors Circuits

DTC C0040

Right Front Wheel Speed Sensor Circuit

DTC C0041

Right Front Wheel Speed Sensor Range Performance

DTC C0045

Left Rear Wheel Speed Sensor Circuit

DTC C0046

Left Rear Wheel Speed Sensor Range Performance

DTC C0050

Right Rear Wheel Speed Sensor Circuit

DTC C0051

Right Rear Wheel Speed Sensor Range Performance

For symptom byte information refer to [Symptom Byte List](#)**Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal High - Left Front	C0035 00, C0035 02	C0035 00, C0035 06	C0245 00, C0245 01	C0035 18, C0035 0F, C0035 27
Signal Low - Left Front	C0035 00, C0035 02	C0035 00, C0035 06	C0035 00	C0035 18, C0035 0F, C0035 27
Signal High - Right Front	C0040 00, C0040 02	C0040 00, C0040 06	C0245 00, C0245 01	C0040 18, C0040 0F, C0040 27
Signal Low - Right Front	C0040 00, C0040 02	C0040 00, C0040 06	C0040 00	C0040 18, C0040 0F, C0040 27
Signal High - Left Rear	C0045 00, C0045 02	C0045 00, C0045 06	C0245 00, C0245 01	C0045 18, C0045 0F, C0045 27, C0055 67
Signal Low - Left Rear	C0045 00, C0045 02	C0045 00, C0045 06	C0045 00	C0045 18, C0045 0F, C0045 27, C0055 67
Signal High - Right Rear	C0050 00, C0050 02	C0050 00, C0050 06	C0245 00, C0245 01	C0050 18, C0050 0F, C0050 27, C0055 67
Signal Low - Right Rear	C0050 00, C0050 02	C0050 00, C0050 06	C0050 00	C0050 18, C0050 0F, C0050 27, C0055 67

Component	Condition	DTC Symptom Byte

Component	Condition	DTC Symptom Byte
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 - Incorrect part wheel speed sensor installed - Wheel speed sensor installed on incorrect side of same axle	08, 0F, 27, 29, 66, or 67

Circuit/System Description

Each wheel speed sensor receives ignition voltage through the signal high circuit from the electronic brake control module. Wheel speeds are detected by active wheel speed sensors and encoder rings. The magnetic encoder rings consists of multiple north and south pole pairs surrounding the outer circumference. When the encoder ring rotates and passes by the wheel speed sensor; it generates a sign wave in the wheel speed sensor. The sensor converts the signal to a digital square wave; the square wave values switch between 7mA (Low) and 14mA (High) DC current. As the wheel spins, the module uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

C0035 00 - C0050 00, C0035 18 - C0050 18, or C0035 27 - C0050 27

Ignition ON

C0035 0F - C0050 0F or C0035 5A - C0050 5A

Vehicle speed is greater than 60 km/h (37 MPH).

Conditions for Setting the DTC

C0035 00, C0040 00, C0045 00, or C0050 00

- A short to ground, or open/high resistance on the wheel speed sensor signal high circuit is detected for 0.2 sec.
- A short to voltage, short to ground, or open/high resistance on the wheel speed sensor signal low circuit is detected for 0.2 sec.

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

- An erratic wheel speed sensor signal is detected.

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

- Incorrectly mounted wheel speed sensor.
- Debris on the wheel speed sensor or the tone ring.
- Missing tooth or teeth on the wheel speed sensor tone ring.
- Air gap between the wheel speed sensor and the encoder ring.
- Electrical magnetic interference with the wheel speed sensor harness.

C0035 27, C0040 27, C0045 27, or C0050 27

- Debris on the wheel speed sensor tone ring.
- Missing tooth or teeth on the wheel speed sensor tone ring.
- Air gap between the wheel speed sensor and the encoder ring too large.

C0035 67, C0040 67, C0045 67, or C0050 67

- An incorrect part wheel speed sensor signal is detected.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The traction/stability control indicator turns ON.
- A driver information center message may be displayed.
- The electronic brake control module disables the ABS, the traction control, and the electronic stability program for the duration of the ignition cycle.

Conditions for Clearing the DTC

- When the condition for setting the DTC is no longer present.
- 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 encoder ring for rust or corrosion.
- Inspect the wheel speed sensors and components for the correct parts.
- If two or more wheel speed sensors are inoperative, diagnose each wheel speed sensor individually.
- If symptom code 0F, 27, or 5A is 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.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Drive the vehicle in a straight line at a speed greater than 40 km/h (25 MPH).
2. Verify all scan tool Wheel Speed Sensor parameters are within 1.6 km/h (1 MPH) of each other.
 - **If any parameter is not within 1.6 km/h (1 MPH) of each other.**
Refer to Circuit/System Testing.
 - **If each parameter is within 1.6 km/h (1 MPH) of each other.**
3. All OK.

Circuit/System Testing

1. Inspect the appropriate B5 Wheel Speed Sensor and encoder ring for contamination, metallic particles, physical damage, incorrect installation and the correct component.
 - **If contamination, physical damage, incorrect installation, or the wrong component is diagnosed**
Repair or replace the applicable component.
 - **If no contamination, physical damage, incorrect installation, or the wrong component is not diagnosed**
2. Ignition OFF and all vehicle systems OFF, disconnect the harness connectors at the appropriate B5 Wheel Speed Sensor and the harness connector at the K17 Electronic Brake Control Module, ignition ON.
3. Test for less than 1 V between the K17 Electronic Brake Control Module harness connector terminals listed below and ground:
 - B5LF Wheel Speed Sensor - Left Front - terminal 7 and terminal 24
 - B5LR Wheel Speed Sensor - Left Rear - terminal 23 and terminal 39
 - B5RF Wheel Speed Sensor - Right Front - terminal 26 and terminal 21
 - B5RR Wheel Speed Sensor - Right Rear - terminal 37 and terminal 22
 - **If 1 V or greater**
Repair the short to voltage on the circuit.
 - **If less than 1 V**
4. Ignition OFF.
5. Test for infinite resistance between the K17 Electronic Brake Control Module harness connector terminals listed below and ground:
 - B5LF Wheel Speed Sensor - Left Front - terminal 7 and terminal 24
 - B5LR Wheel Speed Sensor - Left Rear - terminal 23 and terminal 39
 - B5RF Wheel Speed Sensor - Right Front - terminal 26 and terminal 21
 - B5RR Wheel Speed Sensor - Right Rear - terminal 37 and terminal 22
 - **If less than infinite resistance**
Repair the short to ground on the circuit.
 - **If infinite resistance**
6. Test for less than 2 Ω between the B5 Wheel Speed Sensor harness connector terminal 1 and the K17 Electronic Brake Control Module harness connector terminal listed below:
 - B5LF Wheel Speed Sensor - Left Front - terminal 24
 - B5LR Wheel Speed Sensor - Left Rear - terminal 39
 - B5RF Wheel Speed Sensor - Right Front - terminal 21
 - B5RR Wheel Speed Sensor - Right Rear - terminal 22
 - **If 2 Ω or greater**
Repair the open/high resistance in the circuit.
 - **If less than 2 Ω**

7. Test for less than 2 Ω between the B5 Wheel Speed Sensor harness connector terminal 2 and the K17 Electronic Brake Control Module harness connector terminal listed below:

- B5LF Wheel Speed Sensor - Left Front - terminal 7
- B5LR Wheel Speed Sensor - Left Rear - terminal 23
- B5RF Wheel Speed Sensor - Right Front - terminal 26
- B5RR Wheel Speed Sensor - Right Rear - terminal 37
- **If 2 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 2 Ω**

8. Replace the B5 Wheel Speed Sensor.

9. Verify the DTC does not set while operating the vehicle within Conditions for Running the DTC.

- **If the DTC sets**

Replace the K17 Electronic Brake Control Module.

- **If the DTC does not set**

10. All OK.

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 control module replacement, programming and setup.

DTC C0055: REAR WHEEL SPEED SENSOR CIRCUIT

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 C0055

Rear Wheel Speed Sensor Circuit

For symptom byte information refer to [Symptom Byte List](#)

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors. Each wheel speed sensor receives a 12 V reference voltage from the electronic brake control module (EBCM) and provides an alternating current square wave signal to the EBCM. As the wheel spins, the EBCM uses the frequency of the square wave signal to calculate the wheel speed. The EBCM sends the wheel speed information as a high speed controller area network (CAN) serial data message.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

A supervised periodic message that includes the wheel speed serial data has not been received.

Action Taken When the DTC Sets

Specific subsystems will not function or operate in degraded mode.

Conditions for Clearing the DTC

A current DTC clears when the diagnostic runs and passes.

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

Diagnostic Aids

This DTC can be set due to an incorrect part wheel speed sensor installed.

Circuit/System Verification

Ignition ON, observe the scan tool EBCM Wheel Speed Sensor parameters. The reading should be the same speed on all sensors when driving in a straight line at a speed greater than 20 km/h (13 MPH).

1. Drive the vehicle in a straight line at a speed greater than 40 km/h (25 MPH).
2. Verify all scan tool Wheel Speed Sensor parameters are within 1.6 km/h (1 MPH) of each other.
 - **If any parameter is not within 1.6 km/h (1 MPH) of each other.**

Refer to Circuit/System Testing.

- **If each parameter is within 1.6 km/h (1 MPH) of each other.**
3. All OK.

Circuit/System Testing

1. Ignition ON.
2. Verify that DTC C0035, C0040, C0045, or C0050 is not set in the EBCM.
 - **If any listed DTC is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** to diagnose that DTC prior to this diagnostic.

- **If any listed DTC is not set**
3. Replace the K17 Electronic Brake Control Module.
 4. Verify the DTC does not set while operating the vehicle under the Conditions for Running the DTC.

- **If the DTC sets**

Replace the module that set the DTC.

- **If the DTC does not set**

5. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for control module replacement, programming and setup

DTC C005A: SIMULTANEOUS MALFUNCTION OF BOTH WHEEL SPEED SENSORS ON ONE AXLE

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 C005A

Simultaneous Malfunction of Both Wheel Speed Sensors on One Axle

For symptom byte information refer to [Symptom Byte List](#)

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 module uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

- Vehicle in Service Mode or Vehicle ON
- Ignition voltage is greater than 10 V.
- Two wheel speeds are greater than 5 km/h (3 MPH).

Conditions for Setting the DTC

Simultaneous dropout of both wheel speed sensors on the same axle.

Actions Taken when the DTC Sets

- The ABS indicator turns ON.
- The red brake indicator turns ON.
- The traction control/stability control indicator turns ON.
- The Service Brake Assist and Service StabiliTrak messages are displayed on the driver information center.
- The electronic brake control module disables the antilock brake system, the dynamic rear proportioning, the traction control system and the electronic stability program for the duration of the drive cycle.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive 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 Verification

1. Ignition on.
2. Verify that DTC C005A is not set.
 - **If the DTC is set**
Refer to DTC C0035-C0051.
 - **If the DTC is not set**
3. All OK.

DTC C0110: PUMP MOTOR CIRCUIT

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 C0110

Pump Motor Circuit

For symptom byte information refer to Symptom Byte List

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	C0110 03	C0110 00	C0110 07	C0110 39, C0110 59
Ground	-	C0110 00	-	-

Component	Condition	DTC

Component	Condition	DTC
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 electronic stability control operation is required, the module activates the pump motor relay and turns the pump motor on.

Conditions for Running the DTC

C0110 00

- Ignition ON
- The pump motor is commanded ON.

C0110 03, or C0110 07

- Ignition ON
- Vehicle speed is greater than 30 km/h (18.6 MPH) for 7 s.

C0110 39, C0110 59, or C0110 61

- Ignition ON
- Vehicle speed is greater than 60 km/h (37.3 MPH) for 5 s.

Conditions for Setting the DTC

C0110 00

An open/high resistance is detected on the pump motor switch circuit.

C0110 03

Low voltage is detected in the pump motor circuit.

C0110 07

A short to voltage is detected on the pump motor ground circuit.

C0110 39

A shorted circuit is detected in the pump motor circuit.

C0110 59

The pump motor is overheating.

C0110 61

- The pump motor is mechanically blocked.
- The pump motor is actuated but no generated motor voltage is detected.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The red brake indicator turns ON.
- The traction/stability control indicator turns ON.

- The driver information center may display a message.
- The electronic brake control module disables the ABS, the traction control and the stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

- When the condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Reference Information

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Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the ABS pump motor turns On and Off when commanding the ABS Motor On and Off with a scan tool.
 - **If the pump motor does not turn On and Off**
Refer to Circuit/System Testing.
 - **If the pump motor turns On and Off**
3. All OK.

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 min for all vehicle systems to power down.
2. Test for less than 10 Ω between ground circuit terminal 14 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
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, remove the test lamp.
2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance the in the circuit.
 - If less than 2 Ω , 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, remove the test lamp.
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 Q5 Brake Pressure Modulator.

- **If the test lamp illuminates**

5. Replace the Q5 Brake Pressure Modulator.
6. 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**

7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for Control Module replacement, programming and setup.

DTC C0115: PUMP MOTOR STUCK

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 C0115 61

Pump Motor Stuck

Diagnostic Fault Information

Component	Condition	DTCs
Pump Motor	• Wear • Damage • Lock	C0115 61

Circuit/System Description

The pump motor is an integral part of the brake pressure modulator valve, 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

- Ignition ON.
- Vehicle speed is greater than 60 km/h (37.3 MPH) for 5 s.

Conditions for Setting the DTC

- The pump motor is mechanically blocked.
- The pump motor is actuated but no generated motor voltage is detected.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The red brake indicator turns ON.
- The traction/stability control indicator turns ON.
- The driver information center may display a message.
- The electronic brake control module disables the ABS, the traction control and the 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 electronic brake control module will turn Off the indicators in the next ignition cycle.

Diagnostic Aids

DTC C0115 61 may set due to extended operation of the ABS, traction control, or the stability control system. Review with the customer the conditions under which the DTC set.

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 C0110 is not set.
 - **If DTC C0110 is set**
Refer to [DTC C0110](#).
 - **If DTC C0110 is not set**

3. Verify that DTC C0115 does not set while driving the vehicle under normal braking conditions.

- **If DTC C0115 sets**

Replace the Q5 Brake Pressure Modulator.

- **If DTC C0115 does not set**

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement](#)
- [Control Module References](#) for Control Module replacement, programming and setup.

DTC C0116: PUMP MOTOR RELAY CIRCUIT

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 C0116

Pump Motor Relay Circuit

For symptom byte information refer to [Symptom Byte List](#) .

Diagnostic Fault Information

Component	Condition	DTCs
Pump motor relay	• Wear • Damage • Lock	C0116

Circuit/System Description

The pump motor is an integral part of the brake pressure modulator valve assembly, 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, traction control or 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

Ignition ON.

Conditions for Setting the DTC

- The pump motor relay has an internal failure
- The pump motor relay voltage is greater than threshold.

Action Taken When the DTC Sets

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

- The traction control/stability control-active indicator turns ON.

Conditions for Clearing the DTC

- A current DTC clears when the diagnostic runs and passes.
- The electronic brake control module will turn OFF the indicators in the next ignition cycle.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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Electrical Information Reference

- Circuit Testing
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- 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 C0110 is not set.

- **If DTC C0110 is set**

Refer to DTC C0110 to diagnose that DTC prior to this diagnostic.

- **If DTC C0110 is not set**

3. Replace the K17 Electronic Brake Control Module.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

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

DTC C0121: VALVE RELAY CIRCUIT 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.

DTC Descriptor

DTC C0121

Valve Relay Circuit Malfunction

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	C0121 00	C0121 00	-	-
Ground	-	C0121 00	-	-

Circuit/System Description

The valve relay is an integral part of the electronic brake control module (EBCM), while the solenoid valves are integral to the brake pressure modulator valve assembly. The valve relay is engaged during normal system operation and provides voltage to the solenoid valves. When the ABS control operation is required, the EBCM controls the solenoid valves by providing ground to the active solenoid valves.

Conditions for Running the DTC

- Vehicle speed is greater than 6 km/h (4 MPH) with the brake pedal not applied.
- OR
- Vehicle speed is greater than 15 km/h (9 MPH) and the brake pedal is not actuated.

Conditions for Setting the DTC

- The EBCM is requesting valve activation and the relay output voltage is low.
- The EBCM is not requesting valve activation and the relay output voltage is B+.
- The EBCM detects 3 or more solenoid valve circuits are open or shorted during the self-test.
- A malfunction exists within the EBCM.

Action Taken When the DTC Sets

- The EBCM disables the ABS for the duration of the ignition cycle.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

- A current DTC clears when the diagnostic runs and passes.
- The EBCM will turn OFF the indicator and enable the system functions in the next ignition cycle.

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

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

[Control Module References](#) for scan tool information

Circuit/System Verification

Ignition ON, command the ABS Solenoid Valves On and Off with the scan tool. The solenoid valves should turn ON and OFF.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module (EBCM).
2. Test for less than 5 Ω between the ground circuit terminals listed below:
 - Ground circuit terminal 14 and ground.
 - Ground circuit terminal 46 and ground.
 - **If greater than 5 Ω**

Test/repair the ground circuit for an open/high resistance.

- **If less than 5 Ω**

Replace the K17 Electronic Brake Control Module

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for EBCM replacement, setup and programming

DTC C0131: TRACTION CONTROL SYSTEM PRESSURE CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0131

Traction Control System Pressure Circuit

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

For an overview of the component/system, refer to: [ABS Description and Operation](#)

Circuit	Description
B+ - Terminal 1	The output circuit is switched from ground to 12 V to activate the component.
Ground - Terminal 14	Grounded through the control module.

Component	Description
Q5 Brake Pressure Modulator	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.

Component	Description
K17 Electronic Brake Control Module	When ABS, traction control or stability control operation is required, the electronic brake control module activates the pump motor.

Conditions for Running the DTC

- Engine Running - Gasoline/Diesel
- Propulsion Active - Hybrid/EV
- Slowly press and release the brake pedal.

Conditions for Setting the DTC

C0131 00

Brake Pedal Pressure Signal Invalid or Erratic

C0131 1A

Brake Pressure Sensor=Out Of Range

C0131 3B

Brake Pressure Sensor=Not Calibrated

C0131 5A

- Brake Pressure Sensor=Out Of Range
- Brake Pedal Pressure Signal Invalid or Erratic
- Brake Pressure=Not Plausible

Actions Taken When the DTC Sets

- Traction/Stability Control Indicator=ON
- The EBCM disables the ABS, traction control, stability control and hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive malfunction-free ignition cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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- [Circuit Testing](#)
- [Connector Repairs](#)
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- [Wiring Repairs](#)

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Apply the brake pedal.
3. Verify the function: The stop lamps, also known as brake lamps, are activated when the driver applies the vehicle's brakes.
 - **If the function is NOT executed as expected**

Refer to: [Symptoms - Lighting](#)

- **If the function is executed as expected**
4. Verify DTC C0131 is not set.
 - **If DTC C0131 is set**
 1. Calibrate the brake pressure modulator valve pressure sensor.
 2. Verify the DTC does not set.
 - If the DTC sets - Replace the component: K17 Electronic Brake Control Module & Q5 Brake Pressure Modulator
 - If the DTC is not set
 - 3. All OK.
 - **If the DTC is not set**
 5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC C0161: ANTILOCK BRAKING SYSTEM BRAKE SWITCH CIRCUIT

Diagnostic Instructions

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

DTC Descriptor

DTC C0161

Antilock Braking System Brake Switch Circuit

For symptom byte information, refer to [Symptom Byte List](#)

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 stability event.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

- The electronic brake control module detects four accelerations from standstill to a vehicle speed greater 40 km/h (26 MPH) without any brake pedal position signal changes.

- The electronic brake control module detects the vehicle speed is greater than 20 km/h (13 MPH), the brake pedal is applied for six minutes, and brake pressure is less than 15 bar (218 PSI).

Conditions for Clearing the DTC

A current DTC clears when the diagnostic runs and passes.

Action Taken When the DTC Sets

No actions are taken

Diagnostic Aids

This DTC may set if the brake pedal is applied while accelerating.

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Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC C0277 or C0890 is not set.
 - **If either DTC is set**
Refer to **DTC C0277 or C0890** .
 - **If either DTC is not set**
3. Verify the brake pedal position sensor or the brake pedal is not binding causing residual brake pressure to be detected, while the brake lights operate properly.
 - **If a condition is found**
Repair or replace the applicable component.
 - **If a condition is not found**
4. Verify the scan tool Electronic Brake Control Module Brake Pedal Applied parameter changes between Yes and No while applying and releasing the brake pedal.
 - **If the parameter does not change between Yes and No**
Refer to **Symptoms - Lighting** .
 - **If the parameter changes between Yes and No**

DTC C0179: BRAKE SYSTEM CALCULATED COMPONENT OVERHEAT PROTECTION TIME-OUT

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 C0179 59

Brake System Calculated Component Overheat Protection Time-Out

Circuit/System Description

The electronic brake control module monitors how often the traction control or the stability control system activates in order to calculate an estimate of the front brake discs temperature. In most cases the high temperatures are caused by extended traction control activation. If the electronic brake control module calculates that the front brake components temperatures are too high, the electronic brake control module will temporarily suspend the traction control system function until the front brake discs cool down.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The electronic brake control module detects the calculated temperature of the brake components is higher than 500Â°C (932Â°F).

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free ignition cycles have occurred.

Diagnostic Aids

DTC C0179 does not indicate a malfunction has occurred. This DTC indicates there was excessive ABS, traction control or stability control activation that caused the high temperatures.

Reference Information

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Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

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

1. Allow the brakes to cool down before performing test.
2. Verify that no other DTCs are set.

- **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If no other DTCs are set**

3. Verify DTC C0179 does not set while driving the vehicle under normal braking conditions.

- **If the DTC sets**

Replace the K17 Electronic Brake Control Module.

- **If the 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 replacement, programming, and setup

DTC C0186, C018B, C0196, C019B, C027E, OR C0287: LATERAL/LONGITUDINAL ACCELERATION SENSOR SIGNAL/YAW RATE SIGNAL

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 C0186

Lateral Acceleration Sensor Signal (Electronic Brake Control Module)

DTC C018B

Lateral Acceleration Sensor Signal (Multi-axis Acceleration Sensor Module)

DTC C0196

Yaw Rate Signal (Electronic Brake Control Module)

DTC C019B

DTC C027E

Longitudinal Acceleration Sensor Signal (Multi-axis Acceleration Sensor Module)

DTC C0287

Longitudinal Acceleration Sensor Signal (Electronic Brake Control Module)

For symptom byte information refer to [Symptom Byte List](#)

Circuit/System Description

The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one multi-axis acceleration sensor, internal to the inflatable restraint sensing and diagnostic module. 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 the multi-axis acceleration sensor input. The inflatable restraint sensing and diagnostic module uses the multi-axis acceleration sensor to determine if the vehicle is in a roll over or near collision incident.

Conditions for Running the DTC

- Ignition ON begins the initialization of the brake system power-up self test.
- Drive the vehicle at speeds greater than 16 km/h (10 MPH) to complete the active brake system test.

Conditions for Setting the DTC

C0186 00 or C018B 5A

The lateral acceleration signal is out of the specified range.

C0186 5A

The lateral acceleration signal is not plausible with the yaw rate signal, steering angle signal and vehicle speed.

C0186 71

- The electronic brake control module received an invalid lateral acceleration signal.
- An open/high resistance is detected on the multi-axis acceleration ground circuit.
- A short to ground or open/high resistance is detected on the multi-axis acceleration ignition circuit.

C0196 00 or C019B 5A

The yaw rate signal is out of the specified range.

C0196 5A

- The yaw rate signal offset is out of the specified range.
- The yaw rate signal is not plausible with the lateral acceleration signal, the steering angle signal and the vehicle speed.

C0196 71

- A short to ground or open/high resistance is detected on the ignition circuit.
- The electronic brake control module received an invalid lateral acceleration signal.
- An open/high resistance is detected on the multi-axis acceleration ground circuit.

C027E 5A

The longitudinal acceleration signal is not plausible.

C0287 4B

The longitudinal acceleration sensor is not calibrated.

C0287 5A

The longitudinal acceleration signal is not plausible with the vehicle speed.

C0287 71

- An open/high resistance is detected on the multi-axis acceleration ground circuit.
- The electronic brake control module received an invalid longitudinal acceleration signal.
- A short to ground or open/high resistance is detected on the multi-axis acceleration ignition circuit.

Action Taken When the DTC Sets

- The traction control Off indicator turns ON.
- The traction/stability control indicator turns ON.
- A Traction Control Off message may be displayed.
- A Service Stabilitrak message may be displayed.
- 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

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Verify DTC B101D is not set current or history in the K36 Inflatable Restraint Sensing and Diagnostic Module.

- **If DTC B101D is set current or history in the K36 Inflatable Restraint and Sensing Diagnostic Module**

Replace the K36 Inflatable Restraint Sensing and Diagnostic Module.

- **If DTC B101D is not set current or history in the K36 Inflatable Restraint and Sensing Diagnostic Module**

2. Verify DTC C0186, C0196, or C0287 is not set in the K36 Inflatable Restraint Sensing and Diagnostic Module.

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

Perform the [Vehicle Yaw Sensor Learn](#).

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

3. Verify DTC C0187, C0196, or C0287 is not set in the K17 Electronic Brake Control Module.

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

1. Replace the K36 Inflatable Restraint Sensing and Diagnostic Module.

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 none of the DTCs are set**

4. 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 C0245: WHEEL SPEED SENSOR FREQUENCY

Diagnostic Instructions

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

DTC Descriptor

DTC C0245

Wheel Speed Sensor Frequency

For symptom byte information refer to [Symptom Byte List](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal High - Left Front	C0035 00	C0035 00	C0245 00	-
Signal High - Right Front	C0040 00	C0040 00	C0245 00	-
Signal High - Left Rear	C0045 00	C0045 00	C0245 00	-
Signal High - Right Rear	C0050 00	C0050 00	C0245 00	-

Component	Condition	DTC Symptom Byte

Component	Condition	DTC Symptom Byte
Wheel Speed Sensor	Wheel speed sensor incorrectly mounted	66

Circuit/System Description

Each wheel speed sensor receives ignition voltage through the signal high circuit from the electronic brake control module. Wheel speeds are detected by active wheel speed sensors and encoder rings. The magnetic encoder rings consists of multiple north and south pole pairs surrounding the outer circumference. When the encoder ring rotates and passes by the wheel speed sensor; it generates a sign wave in the wheel speed sensor. The sensor converts the signal to a digital square wave; the square wave values switch between 7mA (Low) and 14mA (High) DC current. As the wheel spins, the module uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

- DTC C0035, C0040, C0045, or C0050 is not present.
- Vehicle speed is between 20 km/h (13 MPH) and 50 km/h (31 MPH).
- While driving a curve with a yaw-rate of 3 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}$ per second for greater than 9 s.

Conditions for Setting the DTC

- A short to voltage on any one of the wheel speed sensor ignition circuits.
- A electrical magnetic interference with the wheel speed sensor harness.
- Difference between the fastest and slowest wheel speed is greater than 6 km/h (4 MPH).
- If two or more wheel speed sensor faults are detected without the ABS warning lamp being turned ON.
- The electronic brake control module cannot determine a specific wheel speed sensor signal because of electrical interference.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The traction control Off indicator turns ON.
- The stability control Off indicator turns ON.
- The traction/stability control indicator turns ON.
- The driver information center displays the Service StabiliTrak message.
- The electronic brake control module disables the ABS, the traction control, and the stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

- When the condition for setting the DTC is no longer present.
- 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.
- Check for electrical magnetic interference with the wheel speed sensor harness.
- If two or more wheel speed sensors are inoperative, diagnose each wheel speed sensor individually.
- If the customer comments that the ABS indicator is ON only during moist environmental conditions (rain, snow, vehicle wash, etc.), inspect the wheel speed sensor wiring for signs of water intrusion.

Reference Information

[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. 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. Ignition ON.
 - 3. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.
 - If the DTC set, replace the K17 Electronic Brake Control Module.
 - If the DTC does not set
 - 4. All OK.
 - **If all tires are of uniform size and matching brand**
3. Refer to Circuit/System Testing.

[Circuit/System Testing](#)

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
2. Test for less than 1 V between the K17 Electronic Brake Control Module harness connector terminals listed below and ground:
 - B5LF Left Front Wheel Speed Sensor - terminal 7
 - B5RF Right Front Wheel Speed Sensor - terminal 26
 - B5LR Left Rear Wheel Speed Sensor - terminal 23
 - B5RR Right Rear Wheel Speed Sensor - terminal 37
 - **If 1 V or greater**

Repair the short to voltage on the circuit.

- If less than 1 V

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 C0274: ISOLATION VALVE

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

Isolation Valve

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

- 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.

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

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- **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 C0186, C0187, C0196, C0287, 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 is 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.

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

DTC C0280: STABILITY SYSTEM ACTIVE TOO LONG

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 C0280

Stability System Active Too Long

For symptom byte information, refer to **Symptom Byte List**

Circuit/System Description

The solenoid valves are integral parts of the brake pressure modulator valve. The brake pressure modulator valve contains an isolation solenoid valve and a dump solenoid valve for each wheel and a traction/ stability control supply solenoid valve and 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 valves ON.

Conditions for Running the DTC

- Ignition ON
- Vehicle speed is greater than 22 km/h (13.7 MPH).

Conditions for Setting the DTC

Calculated solenoid valve temperature is greater than threshold.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The traction/stability control indicator turns ON.
- A driver information center message may be displayed.
- 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.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Diagnostic Aids

This DTC may set due to extended operation of the ABS, the traction control or the stability control system.

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Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Testing

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

1. Ignition ON.
2. Verify that DTC C0186, C0196, C0287, 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 modulator valve to cool down to ambient temperature, ignition ON.
4. Verify the DTC does not set while driving the vehicle under normal braking conditions.
 - **If the DTC sets**
 1. Replace the Q5 Brake Pressure Modulator.
 2. Verify DTC C0280 does not set while driving the vehicle under normal braking conditions.
 - If the DTC does set, replace the K17 Electronic Brake Control Module.
 - If the DTC does not set.
 3. All OK.
 - **If the DTC does not set**
5. 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 C0561: SYSTEM DISABLED INFORMATION STORED

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C0561

System Disabled Information Stored

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

For an overview of the component/system, refer to: [ABS Description and Operation](#)

Circuit	Description
B+ - Terminal 1	The output circuit is switched from ground to 12 V to activate the component.
Low Reference	Grounded through the control module.

Component	Description

Component	Description
K17 Electronic Brake Control Module	The control module K17 can increase and decrease the brake pressure on all 4 wheels individually in order to fulfill these functions: • Antilock Braking • Traction Control • Vehicle Stability Control The control module K17 can also influence the following control modules to limit the amount of produced torque: • K20 Engine Control Module • K71 Transmission Control Module

Conditions for Running the DTC

- Engine Running - Gasoline/Diesel
- Propulsion Active - Hybrid/EV

Conditions for Setting the DTC

K17 Electronic Brake Control Module=Invalid Data Received - More than 10 times.

Actions Taken When the DTC Sets

- ABS Indicator Control=ON
- Traction/Stability Control Indicator=ON
- The EBCM disables the ABS, traction control, stability control and hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive malfunction-free ignition cycles.

Diagnostic Aids

Diagnose other DTCs first.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC C0561 is not set.
 - **If any of the DTCs are set**
 1. Program the control module:K17 Electronic Brake Control Module
 2. Verify DTC C0561 is not set.
 - If the DTC sets - Replace the component:K17 Electronic Brake Control Module
 - If no DTC is set
 3. All OK.
 - **If the DTC is not set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC C0569: SYSTEM CONFIGURATION

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

System Configuration

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 is not set.
 - **If the DTC is set**
 1. Reprogram the K17 Electronic Brake Control Module. Refer to [Control Module References](#) .
 2. Verify DTC C0569 is not set.
 - If the DTC is set, replace the K17 Electronic Brake Control Module.
 - If the DTC is not set
 3. All OK.
 - **If the DTC 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 C10EA: POWERTRAIN CONTROL MODULE INDICATED REQUESTED TORQUE

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 C10EA

Powertrain Control Module Indicated Requested Torque

Circuit/System Description

The electronic brake control module and the engine control module simultaneously control the regenerative braking. When certain engine control module DTCs are set, the engine control module will not be able to perform the regenerative braking. A serial data message is sent to the electronic brake control module indicating that regenerative braking is not allowed.

Conditions for Running the DTC

- Vehicle in Service Mode.
- The ignition voltage is greater than 10 V.

Conditions for Setting the DTC

The engine control module diagnoses a condition preventing the engine control portion of the regenerative braking function and sends a serial data message to the electronic brake control module indicating that regenerative braking is not allowed.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The MIL indicator may be on or flashing.
- The traction control/stability control indicator turns ON.
- The Service StabiliTrak message is displayed on the driver information center.
- The electronic brake control module disables the ABS, the traction control system and the electronic stability program for the duration of the drive cycle.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive 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. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C10EA.
 - **If any other DTCs are set**

- **If no other DTCs are set**

3. Replace the K20 Engine Control Module.

4. Verify that DTC C10EA does not set while operating the vehicle under the Conditions for Running the DTC. You may also operate the vehicle under the conditions that you observed from the Freeze Frame/Failure Records data.

- **If DTC C10EA sets**

Replace the K17 Electronic Brake Control Module.

- **If DTC C10EA does 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 C10EB: ENGINE CONTROL MODULE INDICATED TRACTION CONTROL

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 C10EB

Engine Control Module Indicated Traction Control

Circuit/System Description

The electronic brake control module and the engine control module simultaneously control the traction control. 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

- Vehicle in Service Mode.
- The ignition voltage is greater than 10 V.

Conditions for Setting the DTC

The engine control module diagnoses a condition preventing the engine control portion of the 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 ABS indicator turns ON.
- The MIL indicator may be on or flashing.
- The traction control/stability control indicator turns ON.
- The Service StabiliTrak message is displayed on the driver information center.
- The electronic brake control module disables the ABS, the traction control system and the electronic stability program for the duration of the drive cycle.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive 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. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C10EB.
 - **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 C10EB does not set while operating the vehicle under the Conditions for Running the DTC. You may also operate the vehicle under the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If DTC C10EB sets**

Replace the K17 Electronic Brake Control Module.
 - **If DTC C10EB does 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 C1200: POWERTRAIN SENSED BRAKE PEDAL INFORMATION MESSAGE COUNTER INCORRECT

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 C1200

Powertrain Sensing Brake Pedal Information Message Counter Incorrect

Circuit/System Description

The body control module monitors the brake pedal position sensor and sends a serial data message to the both the electronic brake control module and engine control modules when the brake pedal is applied. The engine control module compares the correlation between the brake pedal positions and the brake control brake pedal position sensor to sense the driver's application of the brake pedal.

Conditions for Running the DTC

- Vehicle ON
- The brake pedal is applied.
- The ignition voltage is greater than 10 V.
- The accelerator pedal position is greater than 20 %.

Conditions for Setting the DTC

The brake pedal position sensor signal is not applied while the brake control brake pedal position sensor indicates the brake pedal is applied.

Action Taken When the DTC Sets

A driver information center message and/or a warning indicator will not be displayed.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive cycles have occurred.

Diagnostic Aids

- DTC C1200 may set if the brake pedal is applied while accelerating.
- Check the Engine Control Module for any accelerator pedal DTCs and correct them first before diagnosing this DTC.

Reference Information

Schematic Reference

- [Antilock Brake System Schematics](#)
- [Exterior Lights 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](#)

[Circuit/System Verification](#)

1. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C1200.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **If no other DTCs are not set**
3. Verify the brake pedal position sensor or the brake pedal is not binding causing residual brake pressure to be detected.
 - **If a condition is found**
Repair or replace the applicable component.
 - **If a condition is not found**
4. Verify the scan tool electronic brake control module Brake Pedal Position Sensor Signal parameter changes between Applied and Released when applying and releasing the brake pedal.
 - **If the parameter does not change**
Refer to [Symptoms - Lighting](#) .
 - **If the parameter changes**
5. Replace the K17 Electronic Brake Control Module.

[Repair Instructions](#)

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for Electronic Brake Control Module replacement, programming and setup

DTC C124F OR C1250-C1254: LATERAL/LONGITUDINAL ACCELERATION SENSOR CIRCUIT

[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 C124F

Lateral Acceleration Sensor Circuit Low Voltage

DTC C1250

Lateral Acceleration Sensor Circuit High Voltage

DTC C1251

Lateral Acceleration Sensor Performance

DTC C1252

DTC C1253

Longitudinal Acceleration Sensor Circuit High Voltage

DTC C1254

Longitudinal Acceleration Sensor Performance

For symptom byte information refer to [Symptom Byte List](#) .

Circuit/System Description

The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one multi-axis acceleration sensor, internal to the inflatable restraint sensing and diagnostic module. The multi-axis acceleration sensor communicates with the electronic brake control module and trans control module via serial data. The electronic brake control module activates the stability control function depending on the multi-axis acceleration sensor input. The inflatable restraint sensing and diagnostic module uses the multi-axis acceleration sensor to determine if the vehicle is in a roll over or near collision incident. The transmission control module sets these DTCs.

Conditions for Running the DTC

Vehicle speed is greater than 16 km/h (10 MPH).

Conditions for Setting the DTC

The transmission control module detects a fault that prevents it from performing a hill hold start assist function.

Action Taken When the DTC Sets

- The air bag indicator turns ON.
- The traction/stability control indicator turns ON.
- The electronic brake control module disables the stability control and the hill hold 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.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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

[Control Module References](#) for scan tool information

Circuit/System Verification

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

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **If no other DTCs are set**
3. Replace the K71 Transmission Control Module.
4. Verify that 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**
5. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for Electronic Brake Control Module or Transmission Control Module replacement, programming, and setup

DTC C1284 OR C1285: BRAKE ASSIST INFORMATION MESSAGE COUNTER INCORRECT

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 C1284

Brake Assist Information 1 Message Counter Incorrect

DTC C1285

Brake Assist Information 2 Message Counter Incorrect

Circuit/System Description

The brake assist data is delivered from the brake booster control module to the electronic brake control module (EBCM) via serial data.

Conditions for Running the DTC

- Vehicle in Service Mode.
- The ignition voltage is greater than 10 V.

Conditions for Setting the DTC

The electronic brake control module detects that the brake assist signal value is not a continuous successor of the previous value.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The MIL indicator may be on or flashing.
- The traction control/stability control indicator turns ON.
- The Service StabiliTrak message is displayed on the driver information center.
- The electronic brake control module disables the ABS, the traction control system and the electronic stability program for the duration of the drive cycle.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive cycles have occurred.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

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

Scan Tool Reference

[Control Module References](#) for scan tool information

Diagnostic Aids

Inspect the brake booster control module for any DTCs.

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C1284 or C1285.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **If no other DTCs are set**
3. Replace the K17 Electronic Brake Control Module.

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

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 C1286

Commanded Axle Torque Message Counter Incorrect

Circuit/System Description

The commanded axle torque data is delivered from the engine control module (ECM) to the electronic brake control module (EBCM) via serial data.

Conditions for Running the DTC

- Vehicle in Service Mode.
- The ignition voltage is greater than 10 V.

Conditions for Setting the DTC

The electronic brake control module detects that the commanded axle torque signal value is not a continuous successor of the previous value.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The MIL indicator may be on or flashing.
- The traction control/stability control indicator turns ON.
- The Service StabiliTrak message is displayed on the driver information center.
- The electronic brake control module disables the ABS, the traction control system and the electronic stability program for the duration of the drive cycle.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive cycles have occurred.

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**

[Control Module References](#) for scan tool information

Diagnostic Aids

Inspect the engine control module, hybrid powertrain control modules, and drive motor control modules for any DTCs.

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C1286.
 - **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If no other DTCs are set**
3. Replace the K17 Electronic Brake Control Module.

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 C1287: REGENERATIVE BRAKING AXLE TORQUE ACHIEVED MESSAGE COUNTER INCORRECT

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 C1287

Regenerative Braking Axle Torque Achieved Message Counter Incorrect

Circuit/System Description

The regenerative braking axle torque data is delivered from the hybrid powertrain control module to the electronic brake control module (EBCM) via serial data.

Conditions for Running the DTC

- Vehicle in Service Mode.
- The ignition voltage is greater than 10 V.

Conditions for Setting the DTC

The electronic brake control module detects that the regenerative braking axle torque signal value is not a continuous successor of the previous value.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The MIL indicator may be on or flashing.
- The traction control/stability control indicator turns ON.
- The Service StabiliTrak message is displayed on the driver information center.

- The electronic brake control module disables the ABS, the traction control system and the electronic stability program for the duration of the drive cycle.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive cycles have occurred.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

[Control Module References](#) for scan tool information

Diagnostic Aids

Inspect the engine control module, hybrid powertrain control modules, and drive motor control modules for any DTCs.

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C1287.

- **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If no other DTCs are set**

3. Replace the K17 Electronic Brake Control Module.

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 P0856: TRACTION CONTROL TORQUE REQUEST CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0856

Traction Control Torque Request Circuit

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

For an overview of the component/system, refer to: [ABS Description and Operation](#)

Circuit	Description
B+ - Terminal 1	The output circuit is switched from ground to 12 V to activate the component.
Low Reference	Grounded through the control module.

Component	Description
K20 Engine Control Module	The control module contains a microprocessor used to process input data to control outputs. The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
K17 Electronic Brake Control Module	The control module K17 can increase and decrease the brake pressure on all 4 wheels individually in order to fulfill these functions: • Antilock Braking • Traction Control • Vehicle Stability Control The control module K17 can also influence the following control modules to limit the amount of produced torque: • K20 Engine Control Module • K71 Transmission Control Module

Conditions for Running the DTC

- Engine Running - Gasoline/Diesel
- Propulsion Active - Hybrid/EV

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

- Traction/Stability Control Indicator=ON
- The EBCM disables the ABS, traction control, stability control and hill start assist for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The conditions for setting the DTC no longer exist.

- A history DTC will clear after 40 consecutive malfunction-free ignition cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Verify there are no other DTCs set, except for DTC P0856.

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

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **If no other DTCs are set**

2. Replace the component: K20 Engine Control Module

3. Under normal operating conditions: Verify that no DTCs are set.

- **If the DTC sets**

Replace the component: K17 Electronic Brake Control Module

- **If no DTC is set**

4. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P15F8: AUTOMATIC BRAKING ENGINE TORQUE REQUEST SIGNAL MESSAGE COUNTER INCORRECT

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 P15F8

Automatic Braking Engine Torque Request Signal Message Counter Incorrect

Circuit/System Description

The electronic brake control module and the engine control module simultaneously control the vehicle performance. During a automatic brake event 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 P15F8 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 P15F8 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 P15F8 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 P15F8.
 - **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If only DTC P15F8 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

DTC P15FD: WHEEL SPEED SENSOR MESSAGE SEQUENCE INCORRECT

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 P15FD

Wheel Speed Sensor Message Sequence Incorrect

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors. Each wheel speed sensor receives a 12 V reference voltage from the electronic brake control module (EBCM) and provides an alternating current square wave signal to the EBCM. As the wheel spins, the EBCM uses the frequency of the square wave signal to calculate the wheel speed. The EBCM sends the wheel speed information as a high speed controller area network (CAN) serial data message.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

A supervised periodic message that includes the wheel speed serial data has not been received.

Action Taken When the DTC Sets

Specific subsystems will not function or operate in degraded mode.

Conditions for Clearing the DTC

A current DTC clears when the diagnostic runs and passes.

Reference Information

Schematic Reference

[Antilock Brake System Schematics](#)

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

Diagnostic Aids

- This DTC can be set due to an incorrect part wheel speed sensor installed.
- Inspect the wheel encoder ring for rust or corrosion.
- 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.

Circuit/System Verification

Ignition ON, observe the scan tool EBCM Wheel Speed Sensor parameters. The reading should be the same speed on all sensors when driving in a straight line at a speed greater than 20 km/h (13 MPH).

Circuit/System Testing

1. Ignition ON.
2. Verify that DTC C0035, C0040, C0045, or C0050 is not set in the EBCM.
 - **If any listed DTC is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** to diagnose that DTC prior to this diagnostic.

- **If any listed DTC is not set**
3. Replace the K17 Electronic Brake Control Module.
 4. Verify the DTC does not set while operating the vehicle under the Conditions for Running the DTC.
 - **If the DTC sets**
Replace the module that set the DTC.
 - **If the DTC does not set**
 5. All OK.

Repair Instructions

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

Control Module References for control module replacement, programming and setup

DTC P1B12: DRIVER INTENDED BRAKING TORQUE SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

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

DTC Descriptor

DTC P1B12

Driver Intended Braking Torque Signal Message Counter Incorrect

Circuit/System Description

The electronic brake control module provides brake pedal position information to the engine control module, via the serial data circuit. The engine control module monitors a series of 16 rolling counts, with each count assigned a value, when the engine control module determines that too many of the counts have an incorrect value, the engine control module sets DTC P1B12.

Conditions for Running the DTC

- The propulsion system is active.
- DTC P1B12 runs continuously when the above condition is met.

Conditions for Setting the DTC

The engine control module detects that 10 of the 16 rolling counts have an incorrect value.

Action Taken When the DTC Sets

DTC P1B12 is a Type C DTC.

Conditions for Clearing the DTC

DTC P1B12 is a Type C DTC.

Diagnostic Aids

- DTC P1B12 is an informational DTC.
- Verify the electronic brake control module and engine control module contain the latest calibrations.
- Diagnose all other engine control module DTCs prior to DTC P1B12.
- Find out from the customer the conditions under which the DTC was set. This information may help duplicate the concern like the specific number of brake pedal applies in a row prior to the fault 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](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Verify that no other DTCs are set except for DTC P1B12 is set.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **If no other DTCs are set**
2. Replace the K17 Electronic Brake Control Module.
3. Verify the DTC P1B12 does not set while operating the vehicle within the Conditions for Running the DTC.
 - **If only DTC P1B12 is set**
Replace the K20 Engine Control Module.
 - **If the DTC does not set**
4. All OK.

[Repair Instructions](#)

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[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](#)
- [Brake Warning 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**

- 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
Traction Control Switch Signal	B2745 02	1	1	-
Traction Control Switch Ground	-	1	-	-
1. Traction Control Switch Malfunction.				

Circuit/System Description

The instrument cluster illuminates the traction/stability control indicator, traction control off indicator and 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 electronic stability control switch. When the electronic stability control switch is pressed once, the body control module will request the electronic brake control module via serial data to disable the traction control. When the electronic stability control switch is pressed and held for five seconds, the body control module will request the electronic brake control module to disable the 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
 - Traction/stability Control 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 while pressing and releasing the S48C Multifunction Switch 1 - Instrument Panel.
 - **If the parameter does not change**
Refer to Circuit/System Testing.
 - **If the parameter changes**
4. All OK.

Circuit/System Testing

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

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S48C Multifunction Switch 1 - Instrument Panel. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 10 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Body Control Module, Traction Control Switch parameter is Inactive.
 - **If Active**
 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 3 and ground.
6. Verify the scan tool Traction Control Switch parameter is Active.

- **If Inactive**

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 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K9 Body Control Module.

- **If Active**

7. Test or replace the S48C Multifunction Switch 1 - Instrument Panel.

Component Testing

1. Ignition OFF, disconnect the harness connector at the S48C Multifunction Switch 1 - Instrument Panel.
2. Test for infinite resistance between the signal terminal 3 and the ground terminal 10 with the switch in the open position.

- **If less than infinite resistance**

Replace the S48C Multifunction Switch 1 - Instrument Panel.

- **If infinite resistance**

3. Test for less than 2 Ω between the signal circuit terminal 3 and the ground terminal 10 with the switch in the closed position.

- **If 2 Ω or greater**

Replace the S48C Multifunction Switch 1 - Instrument Panel.

- **If less than 2 Ω**

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Hazard Warning 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](#) . 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. Refer to [Battery Inspection/Test](#) .
6. Install a scan tool.
7. Place the Power button in Service Only Mode.
8. With the scan tool, establish communications with the ABS system. Select Control Functions. Select Automated Bleed from the Control Functions menu.
9. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
10. Following the directions given on the scan tool, pressure bleed the base brake system. Refer to [Hydraulic Brake System Bleeding](#) .
11. Follow the scan tool directions until the desired brake pedal height is achieved.
12. 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](#) .
13. When the desired pedal height is achieved, press the brake pedal to inspect for firmness.
14. Install the tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#) .
15. Lower the vehicle.
16. Remove the scan tool.
17. Inspect the brake fluid level. Refer to [Master Cylinder Reservoir Filling](#) .
18. Road test the vehicle while inspecting that the pedal remains high and firm.

STEERING WHEEL ANGLE SENSOR CENTERING

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

- Wheel alignment
- Steering gear replacement
- Steering column replacement
- Collision or other physical damage
- Power steering control module replacement

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

1. Using the steering wheel, align and center the front wheels forward.
2. Apply the parking brake, or set the transmission in Park.
3. Install the scan tool to the data link connector.
4. Vehicle in Service Mode.
5. With the scan tool select the Power Steering Control Module.
6. Select the Steering Wheel Angle Sensor Centering under Configuration/Reset Functions list.
7. Follow the scan tool directions to complete the learn procedure.
8. With the scan tool select the Electronic Brake Control Module.
9. Select the Steering Wheel Angle Sensor Centering under Configuration/Reset Functions list.
10. Follow the scan tool directions to complete the learn procedure.
11. Clear any DTCs that may be set.
12. Vehicle OFF.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT

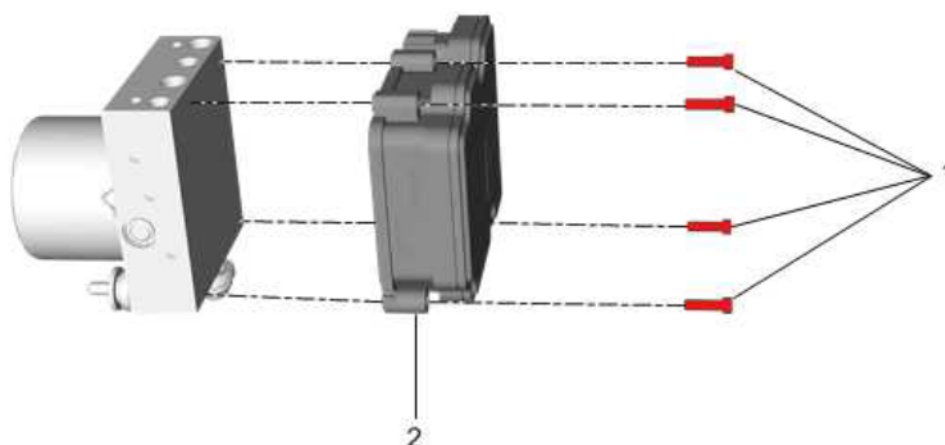


Fig. 3: Electronic Brake Control Module

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
WARNING: <u>Brake Fluid Irritant Warning</u>	
CAUTION: <u>Brake Fluid Effects on Paint and Electrical Components Caution</u>	
CAUTION: Always connect or disconnect the wiring harness connector from the EBCM/EBTCM with the ignition switch in the OFF position. Failure to observe this precaution could result in damage to the EBCM/EBTCM.	
Preliminary Procedure <u>Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement</u>	
1	Electronic Brake Control Module Bolt (Qty: 2) CAUTION: <u>Fastener Caution</u> Tighten 3 N.m (27 lb in)
2	Electronic Brake Control Module Procedure 1. Program the electronic brake control module. <u>Control Module References</u> 2. Bleed the brake system. <u>Hydraulic Brake System Bleeding</u> 3. Calibrate the brake pressure modulator valve pressure sensor. <u>Brake Pressure Modulator Valve Pressure Sensor Calibration</u>

ELECTRONIC BRAKE CONTROL MODULE WITH BRAKE PRESSURE MODULATOR VALVE REPLACEMENT

Removal Procedure

WARNING: Brake Fluid Irritant Warning

CAUTION: Brake Fluid Effects on Paint and Electrical Components Caution

CAUTION: Always connect or disconnect the wiring harness connector from the EBCM/EBTCM with the ignition switch in the OFF position. Failure to observe this precaution could result in damage to the EBCM/EBTCM.

WARNING: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure includes the following steps:

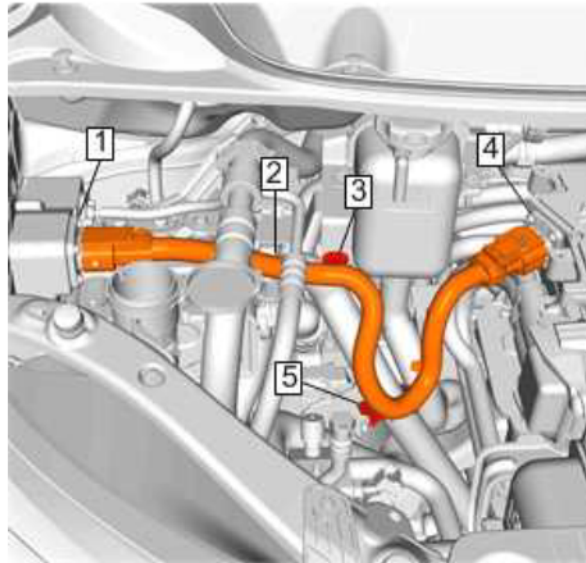
- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Before working on any high voltage system, be sure to wear the following Personal Protection Equipment:

- Safety glasses with appropriate side shields when within 15 meters (50 feet) of the vehicle, either indoors or outdoors.
- Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors.
 - Visually and functionally inspect the gloves before use.
 - Wear the Insulation gloves with leather protectors at all times when working with the high voltage battery assembly, whether the system is energized or not.

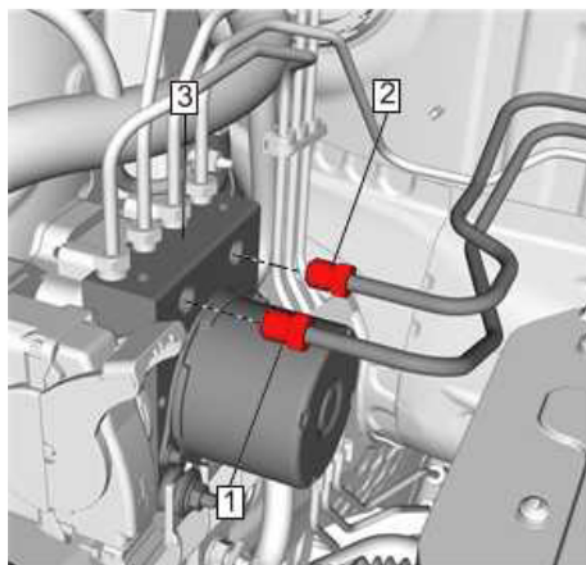
Failure to follow the procedures may result in serious injury or death.

1. Disable the high voltage system. [High Voltage Disabling](#)
2. Remove the radiator surge tank bolts and reposition the heater surge tank from the heater surge tank bracket with the hoses connected. [Heater Coolant Surge Tank Replacement](#)



[Fig. 4: Drive Motor Battery Positive and Negative Cable](#)
Courtesy of GENERAL MOTORS COMPANY

3. Remove Drive Motor Battery Positive and Negative Cable (1) [Drive Motor Battery Positive and Negative Cable Replacement](#)



[Fig. 5: Brake Pressure Modulator Valve Front Pipe Fitting](#)
Courtesy of GENERAL MOTORS COMPANY

NOTE: Cap the brake pipe fittings to prevent brake fluid loss and contamination.

4. Remove Brake Pressure Modulator Valve Front Pipe Fitting (1) @Brake Pressure Modulator Valve (3)
5. Remove Brake Pressure Modulator Valve Rear Pipe Fitting (2) @Brake Pressure Modulator Valve (3)

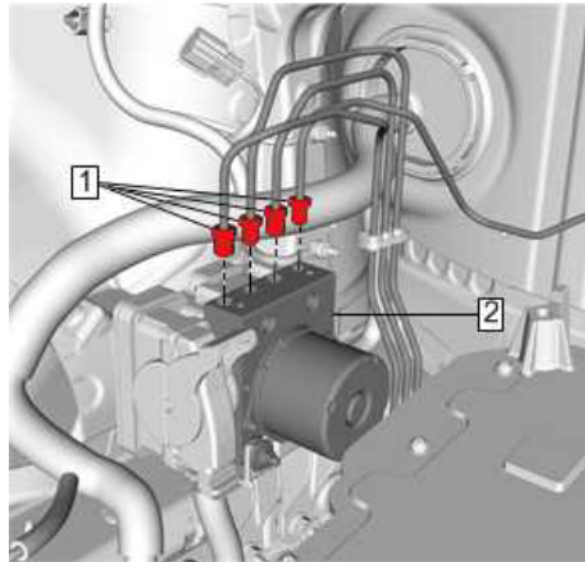


Fig. 6: Brake Pressure Modulator Valve And Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

NOTE: Cap the brake pipe fittings to prevent brake fluid loss and contamination.

6. Remove Brake Pipe Fitting (1) @Brake Pressure Modulator Valve (2)

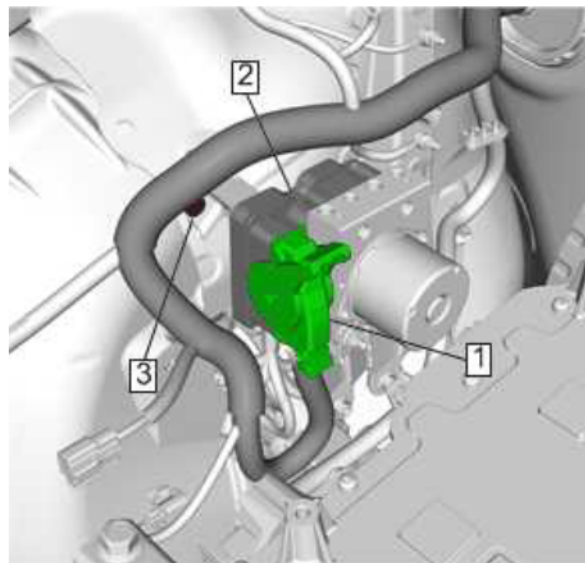


Fig. 7: Electrical Connector And Electronic Brake Control Module
Courtesy of GENERAL MOTORS COMPANY

7. Disconnect Electrical Connector (1) @Electronic Brake Control Module (2)
8. Remove Body Wiring Harness Clip (3) @Brake Pressure Modulator Valve Bracket

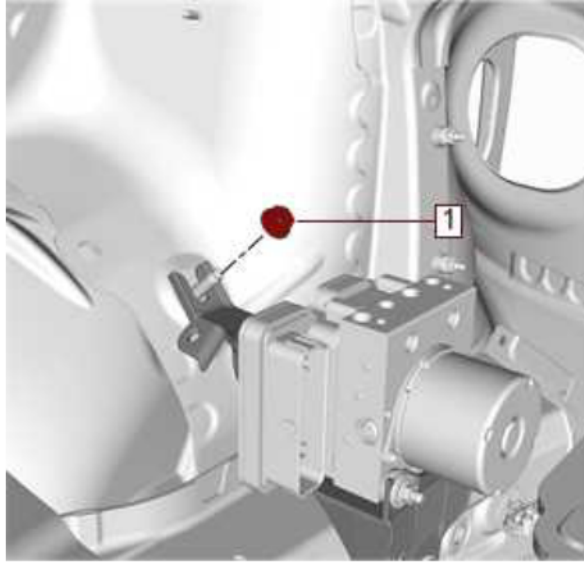


Fig. 8: Brake Pressure Modulator Valve Bracket Nut
 Courtesy of GENERAL MOTORS COMPANY

9. Remove Brake Pressure Modulator Valve Bracket Nut (1) @Front Wheel House Panel

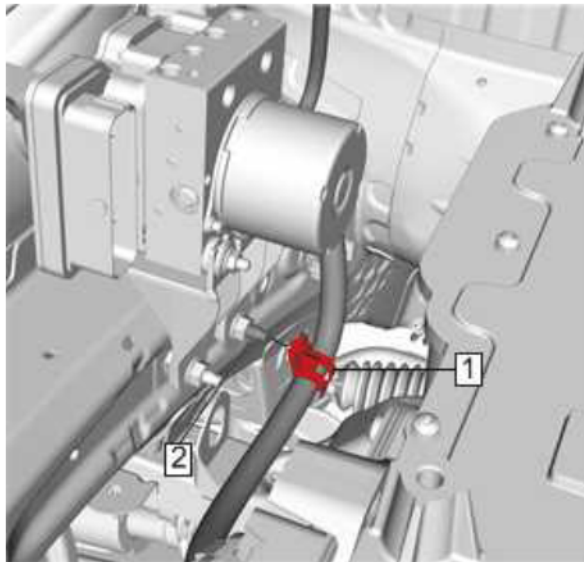


Fig. 9: Body Wiring Harness Clip And Electronic Brake Control Module Stud Bolt
 Courtesy of GENERAL MOTORS COMPANY

10. Remove Body Wiring Harness Clip (1) @Electronic Brake Control Module Stud Bolt (2)

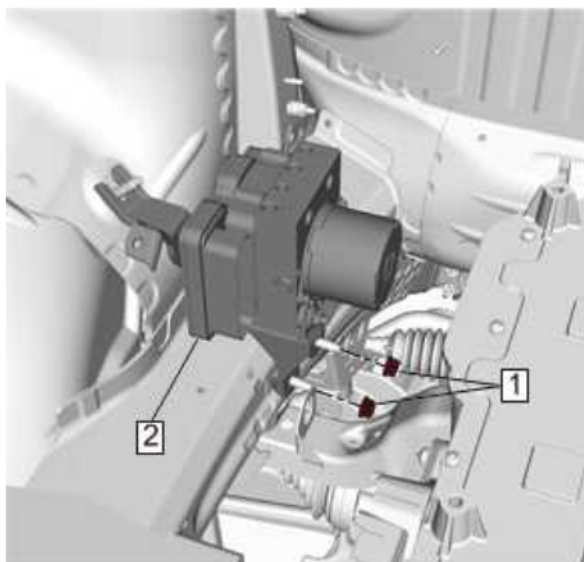


Fig. 10: Brake Pressure Modulator Valve Bracket Nut
 Courtesy of GENERAL MOTORS COMPANY

11. Remove Brake Pressure Modulator Valve Bracket Nut (1) @Front Compartment Inner Side Rail
12. Remove Electronic Brake Control Module with Brake Pressure Modulator Valve and Bracket Assembly (2) @Vehicle

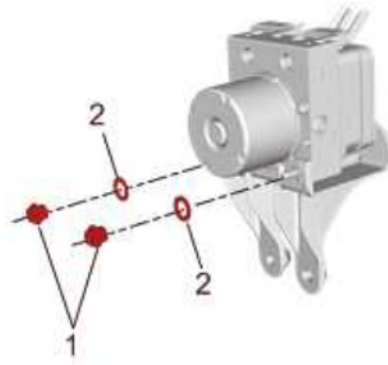


Fig. 11: Brake Pressure Modulator Valve Insulator Nut
Courtesy of GENERAL MOTORS COMPANY

13. Remove Brake Pressure Modulator Valve Insulator Nut (1) and DISCARD
14. Remove Brake Pressure Modulator Valve Insulator Washer (2) and DISCARD

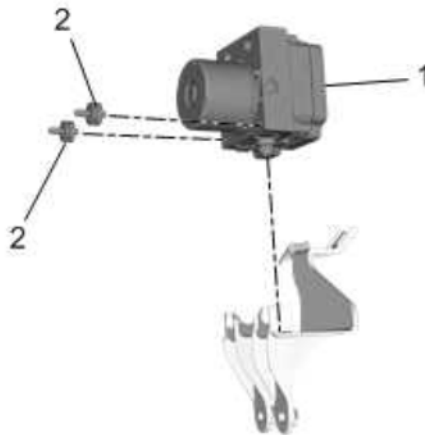


Fig. 12: Electronic Brake Control Module with Brake Pressure Modulator Valve
Courtesy of GENERAL MOTORS COMPANY

15. Remove Electronic Brake Control Module with Brake Pressure Modulator Valve (1) @Brake Pressure Modulator Valve Bracket
16. Remove Brake Pressure Modulator Valve Insulator (2) and DISCARD

Installation Procedure

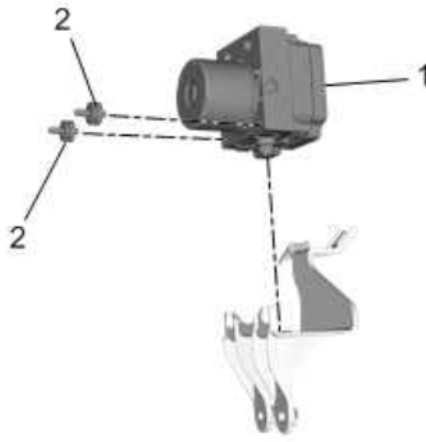


Fig. 13: Electronic Brake Control Module with Brake Pressure Modulator Valve
Courtesy of GENERAL MOTORS COMPANY

1. Install New Brake Pressure Modulator Valve Insulator (2)
2. Install Electronic Brake Control Module with Brake Pressure Modulator Valve (1) @Brake Pressure Modulator Valve Bracket

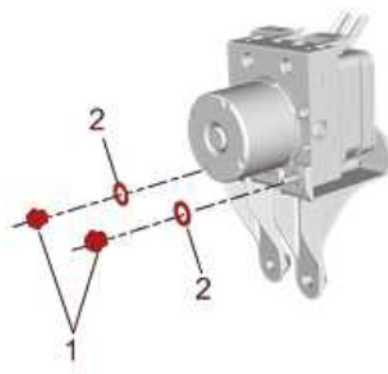


Fig. 14: Brake Pressure Modulator Valve Insulator Nut
Courtesy of GENERAL MOTORS COMPANY

3. Install Brake Pressure Modulator Valve Insulator Washer (2)
4. Install Brake Pressure Modulator Valve Insulator Nut (1)

CAUTION: Fastener Caution

5. Brake Pressure Modulator Valve Insulator Nut (1) - Tighten 8 N.m (71 lb in)

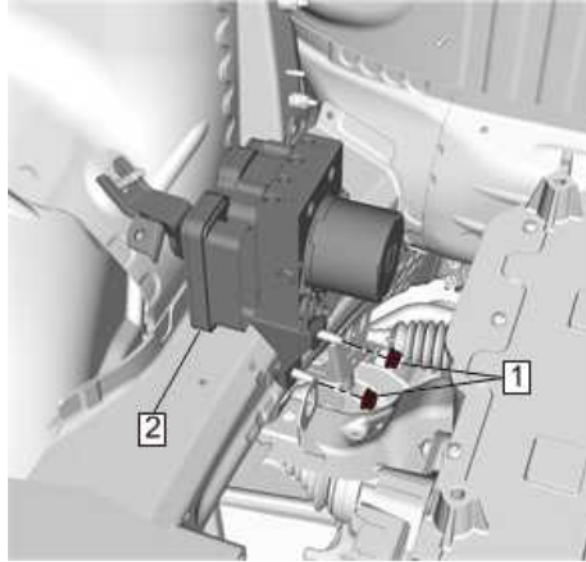


Fig. 15: Brake Pressure Modulator Valve Bracket Nut
 Courtesy of GENERAL MOTORS COMPANY

6. Install Electronic Brake Control Module with Brake Pressure Modulator Valve and Bracket Assembly (2) @Vehicle
7. Install Brake Pressure Modulator Valve Bracket Nut (1) @Front Compartment Inner Side Rail and tighten 22 N.m (16 lb ft)

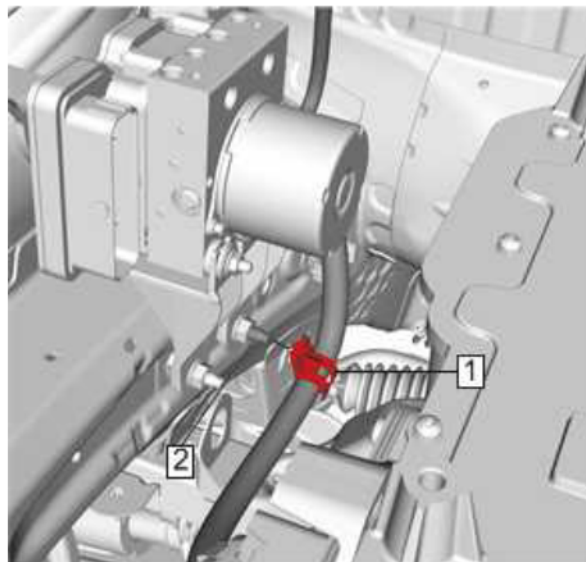


Fig. 16: Body Wiring Harness Clip And Electronic Brake Control Module Stud Bolt
 Courtesy of GENERAL MOTORS COMPANY

8. Install Body Wiring Harness Clip (1) @Electronic Brake Control Module Stud Bolt (2)

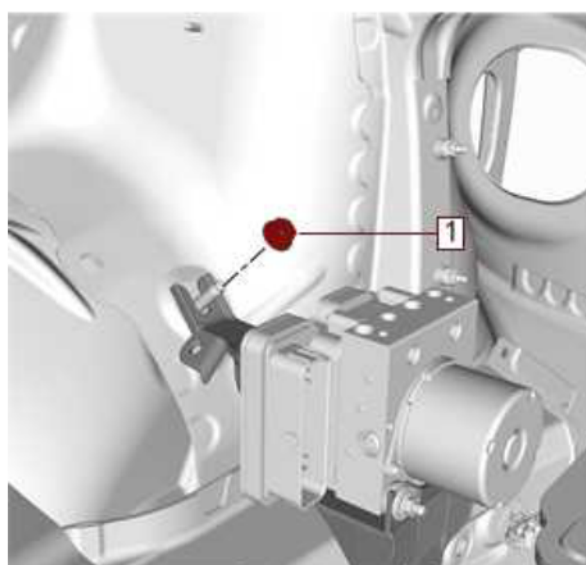


Fig. 17: Brake Pressure Modulator Valve Bracket Nut
Courtesy of GENERAL MOTORS COMPANY

9. Install Brake Pressure Modulator Valve Bracket Nut (1) @Front Wheel House Panel and tighten 22 N.m (16 lb ft)

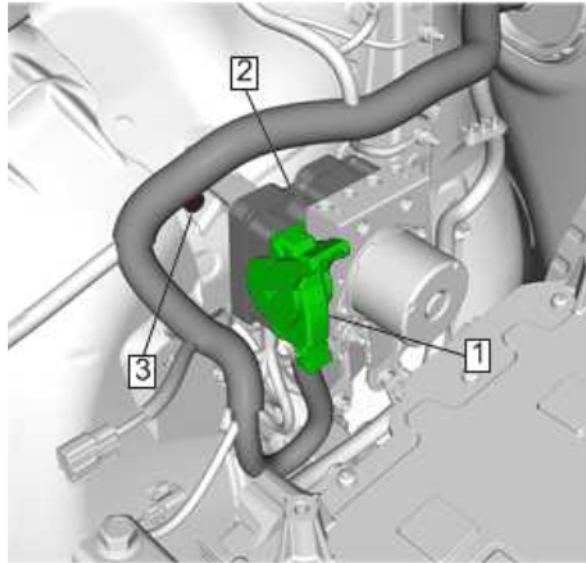


Fig. 18: Electrical Connector And Electronic Brake Control Module
Courtesy of GENERAL MOTORS COMPANY

10. Install Body Wiring Harness Clip (3) @Brake Pressure Modulator Valve Bracket
11. Connect Electrical Connector (1) @Electronic Brake Control Module (2)

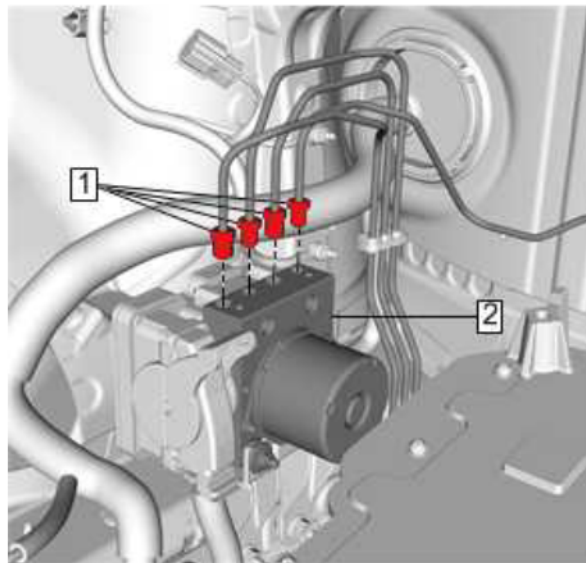


Fig. 19: Brake Pressure Modulator Valve And Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

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

12. Install Brake Pipe Fitting (2) @Brake Pressure Modulator Valve (3) and tighten 18 N.m (13 lb ft)

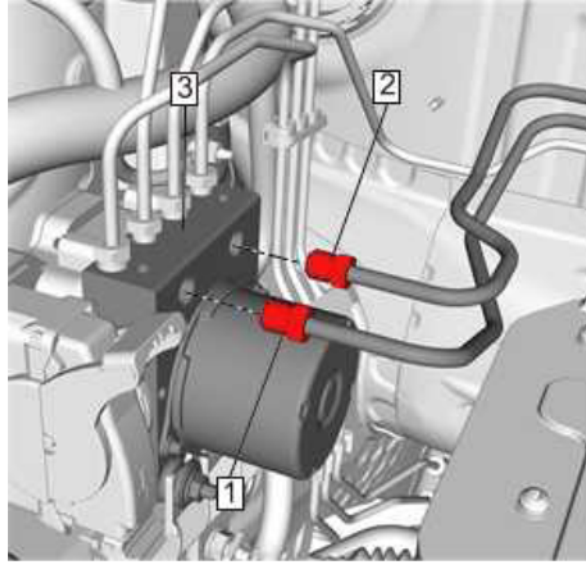


Fig. 20: Brake Pressure Modulator Valve Front Pipe Fitting
 Courtesy of GENERAL MOTORS COMPANY

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

NOTE: Make sure that the electronic brake control module is fully seated into the grommets after the brake pipes are tightened.

13. Install Brake Pressure Modulator Valve Rear Pipe Fitting (2) @Brake Pressure Modulator Valve (3) and tighten 25 N.m (18 lb ft)
14. Install Brake Pressure Modulator Valve Front Pipe Fitting (1) @Brake Pressure Modulator Valve (3) and tighten 25 N.m (18 lb ft)

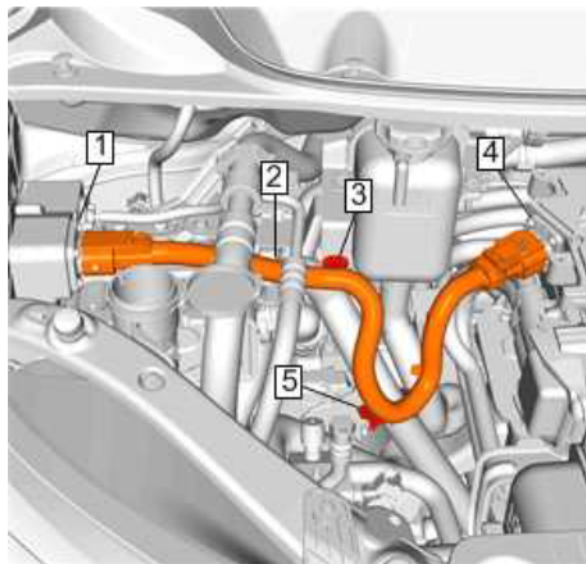


Fig. 21: Drive Motor Battery Positive and Negative Cable
 Courtesy of GENERAL MOTORS COMPANY

15. Install Drive Motor Battery Positive and Negative Cable (1) [Drive Motor Battery Positive and Negative Cable Replacement](#)
16. Install the heater surge tank to the heater surge tank bracket. [Heater Coolant Surge Tank Replacement](#)
17. Enable the high voltage system. [High Voltage Enabling](#)
18. Program the electronic brake control module. [Electronic Brake Control Module Programming and Setup](#)

19. Bleed the brake system. [Hydraulic Brake System Bleeding](#)
20. Calibrate the brake pressure modulator valve pressure sensor. [Brake Pressure Modulator Valve Pressure Sensor Calibration](#)

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/Vehicle in Service Mode
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.

BRAKE PRESSURE MODULATOR VALVE BRACKET REPLACEMENT

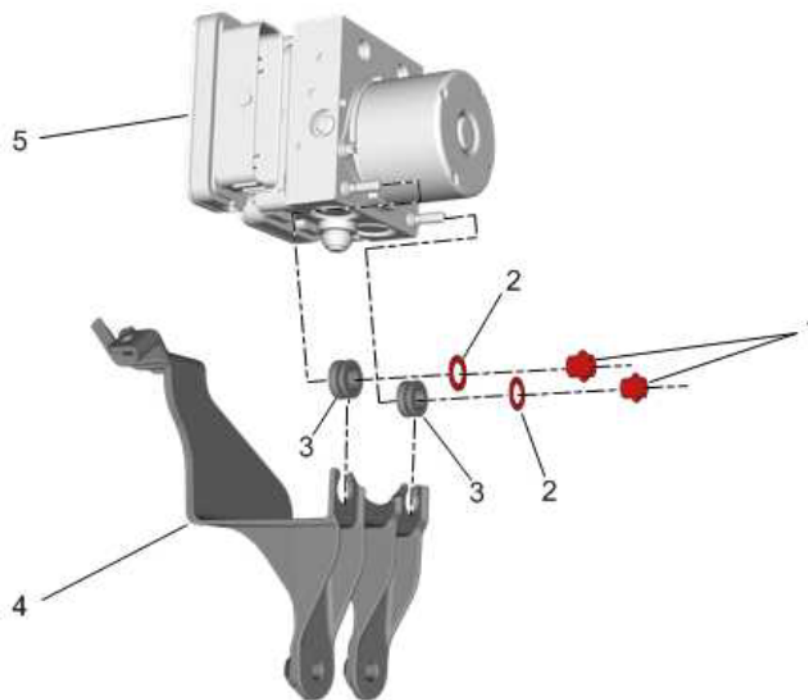


Fig. 22: Brake Pressure Modulator Valve Bracket
Courtesy of GENERAL MOTORS COMPANY

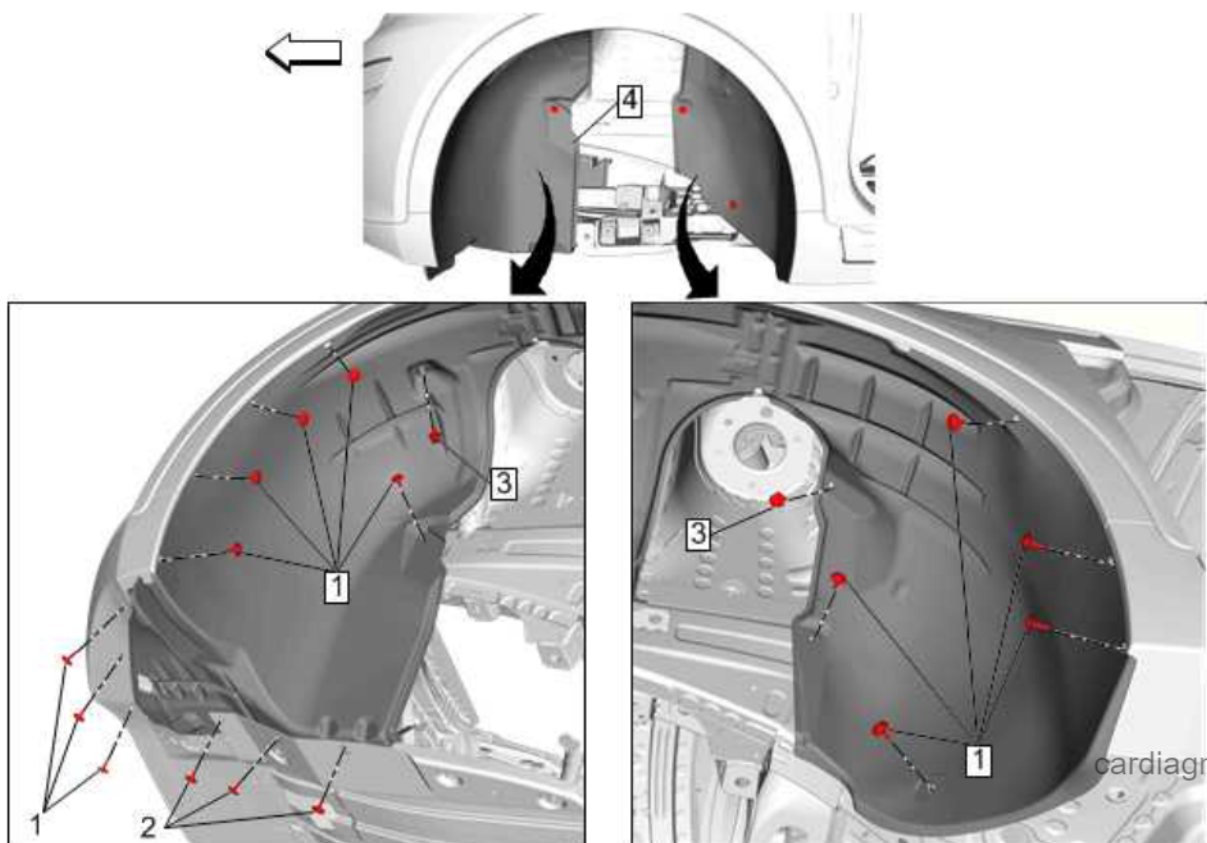
Callout	Component Name
Preliminary Procedure	
Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement	

Callout	Component Name
1	Brake Pressure Modulator Valve Insulator Nut (Qty: 2) Procedure 1. Remove and DISCARD the nuts. 2. Install the NEW nuts. CAUTION: <u>Fastener Caution</u> Tighten 8 N.m (71 lb in)
2	Brake Pressure Modulator Valve Insulator Washer (Qty: 2) Procedure 1. Remove and DISCARD the washers. 2. Install the NEW washers.
3	Brake Pressure Modulator Valve Insulator (Qty: 2) Procedure 1. Remove and DISCARD the Insulators. 2. Install the NEW Insulators.
4	Brake Pressure Modulator Valve Bracket
5	Electronic Brake Control Module with Brake Pressure Modulator Valve

FRONT WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)
2. Remove the front tire and wheel assembly. [Tire and Wheel Removal and Installation](#)



3. Remove Front Wheelhouse Liner (3)**Front Wheelhouse Liner Replacement**

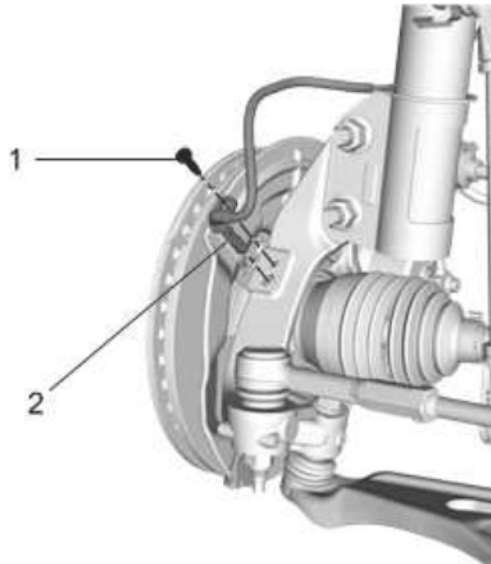


Fig. 24: Front Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Remove Front Wheel Speed Sensor Bolt (1) @Steering Knuckle
5. Remove Front Wheel Speed Sensor (2) @Steering Knuckle

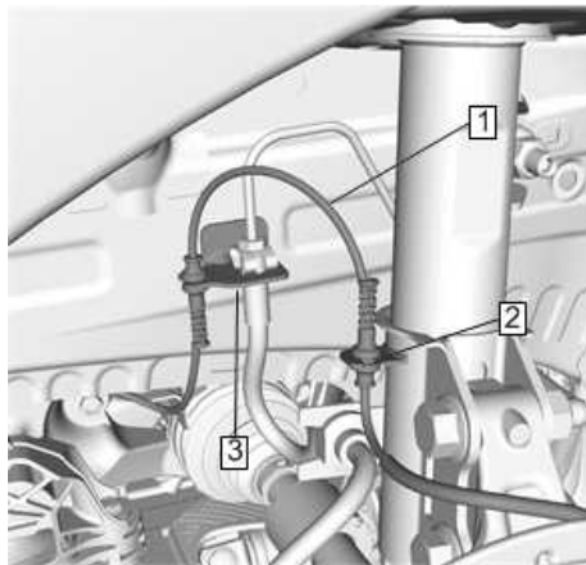


Fig. 25: Front Wheel Speed Sensor Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

6. Unclip Front Wheel Speed Sensor Wiring Harness (1)Front Suspension Strut Mounted Bracket (2)
7. Unclip Front Wheel Speed Sensor Wiring Harness(1)Front Compartment Side Rail Mounted Bracket (3)

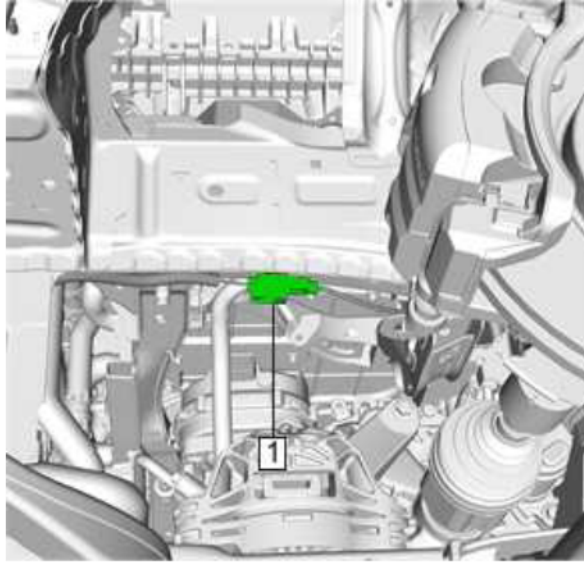


Fig. 26: Front Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

8. Disconnect Front Wheel Speed Sensor Electrical Connector (1) @Forward Lamp Wiring Harness
9. Remove Front Wheel Speed Sensor@Vehicle

Installation Procedure

1. Front Wheel Speed Sensor@Vehicle - Install

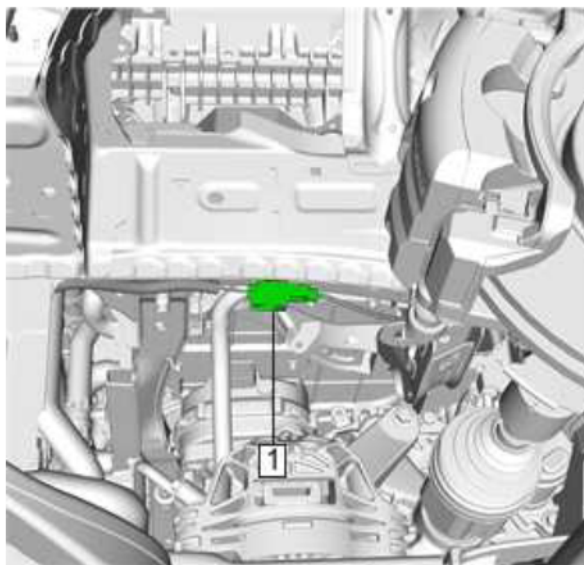


Fig. 27: Front Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

2. Connect Front Wheel Speed Sensor Electrical Connector (1) @Forward Lamp Wiring Harness

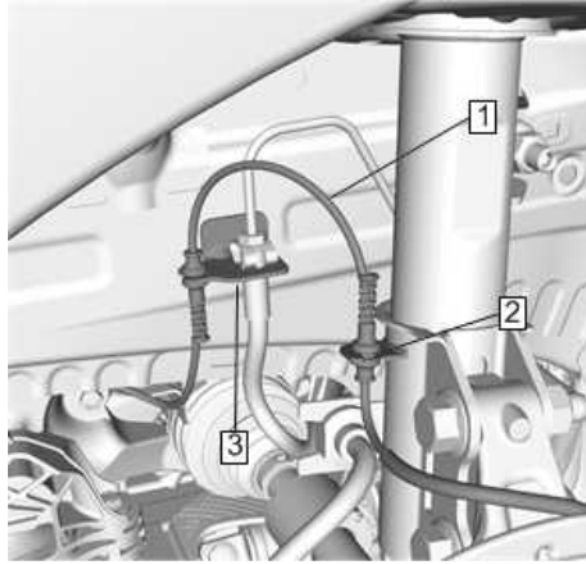


Fig. 28: Front Wheel Speed Sensor Wiring Harness

Courtesy of GENERAL MOTORS COMPANY

3. Install Front Wheel Speed Sensor Wiring Harness(1)Front Compartment Side Rail Mounted Bracket (3)
4. Install Front Wheel Speed Sensor Wiring Harness(1)Front Suspension Strut Mounted Bracket (2)

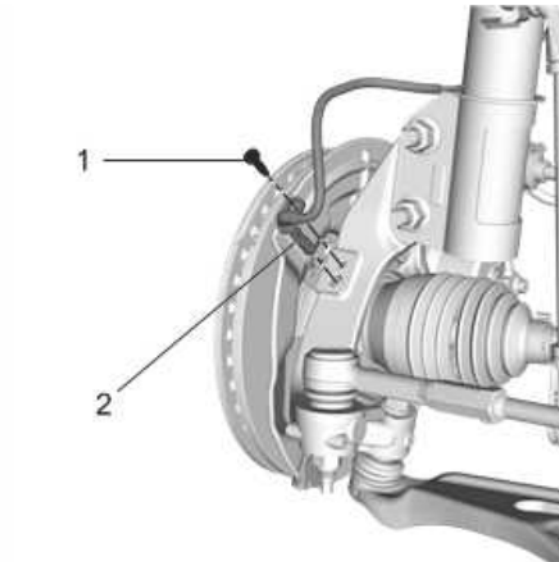


Fig. 29: Front Wheel Speed Sensor Bolt

Courtesy of GENERAL MOTORS COMPANY

5. Install Front Wheel Speed Sensor (2) @Steering Knuckle

CAUTION: Fastener Caution

6. Install Front Wheel Speed Sensor Bolt (1) @Steering Knuckle and tighten 9 N.m (80 lb in)

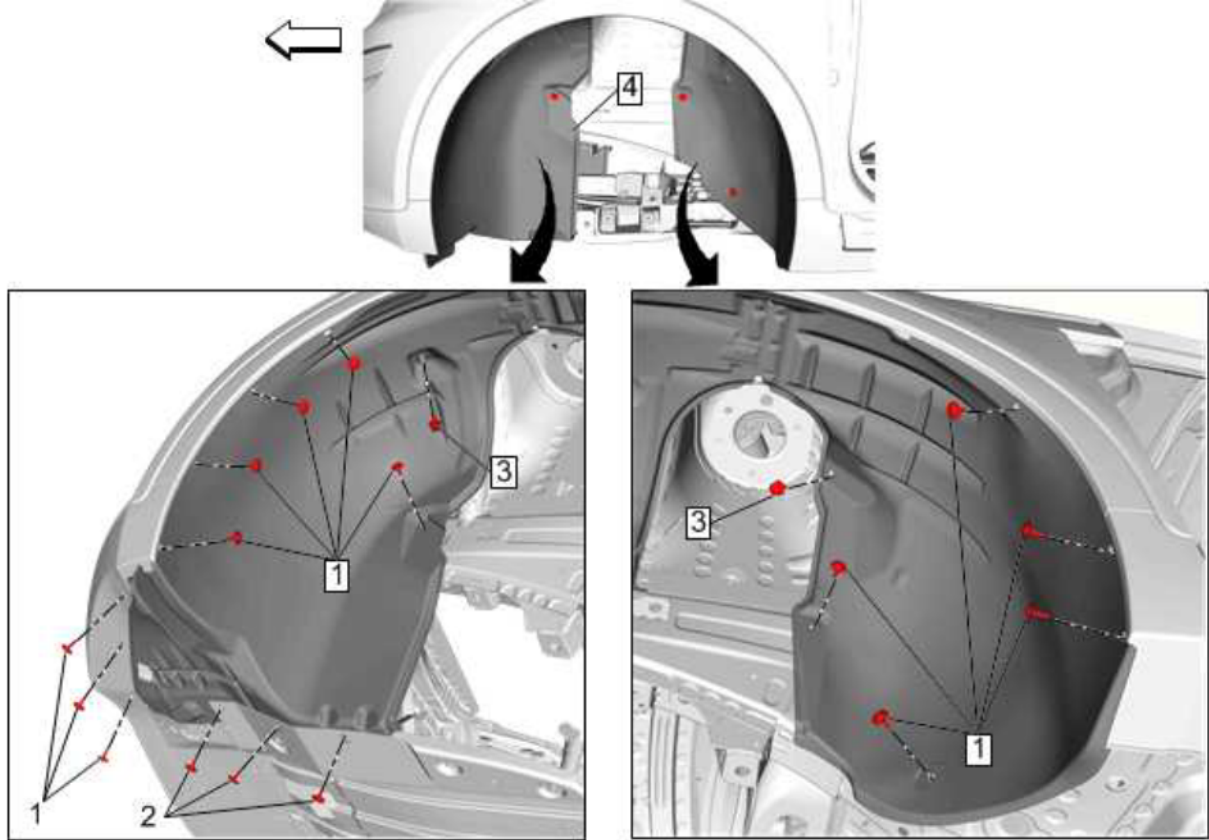


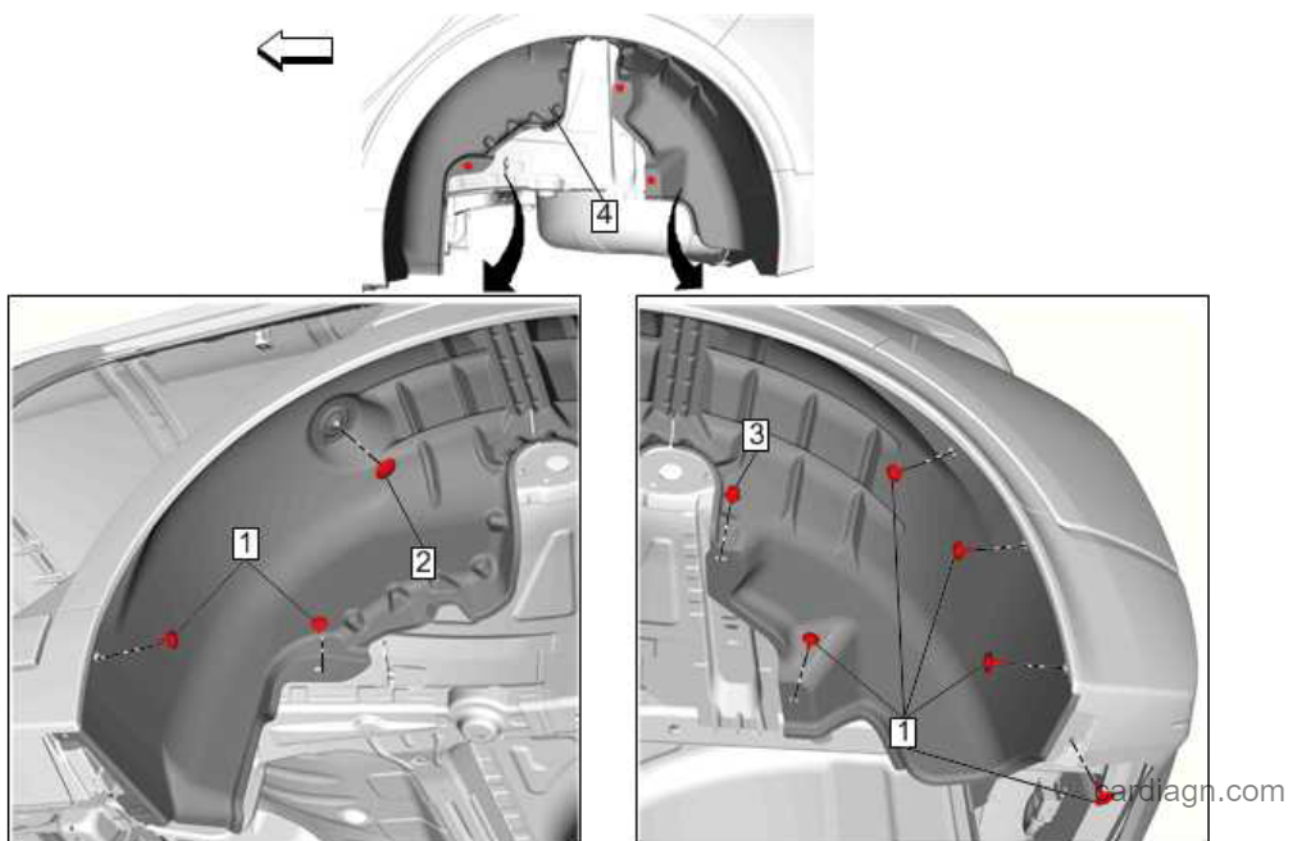
Fig. 30: Front Wheelhouse Liner
 Courtesy of GENERAL MOTORS COMPANY

7. Install Front Wheelhouse Liner (3) **Front Wheelhouse Liner Replacement**
8. Install the front tire and wheel assembly. **Tire and Wheel Removal and Installation**
9. Lower the vehicle.

REAR WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. **Lifting and Jacking the Vehicle**
2. Remove the rear tire and wheel assembly. **Tire and Wheel Removal and Installation**



3. Remove Rear Wheelhouse Liner (4)**Rear Wheelhouse Liner Replacement**

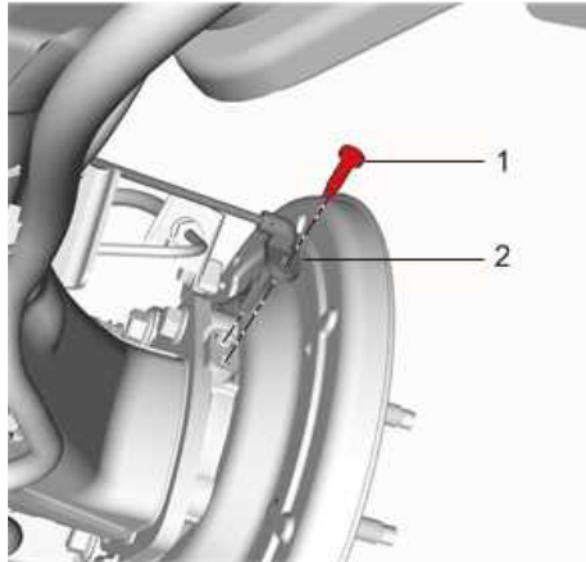


Fig. 32: Rear Wheel Speed Sensor And Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Remove Rear Wheel Speed Sensor Bolt (1) @Rear Brake Caliper Mount Plate
5. Remove Rear Wheel Speed Sensor (2) @Rear Brake Caliper Mount Plate

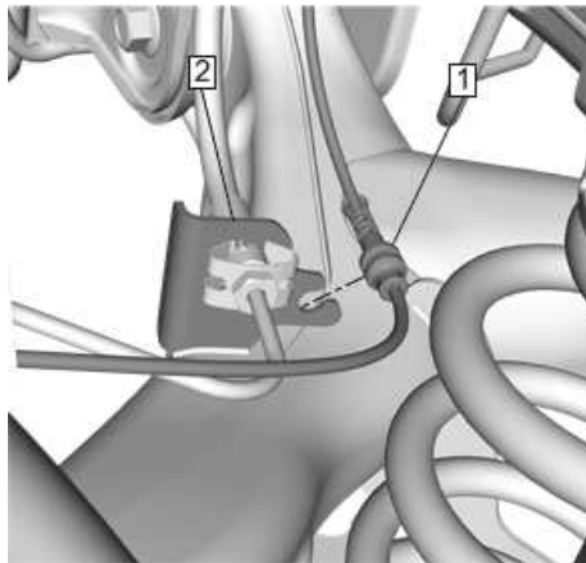


Fig. 33: Rear Wheel Speed Sensor Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

6. Unclip Rear Wheel Speed Sensor Wiring Harness (1) @Rear Axle Mounted Bracket (2)

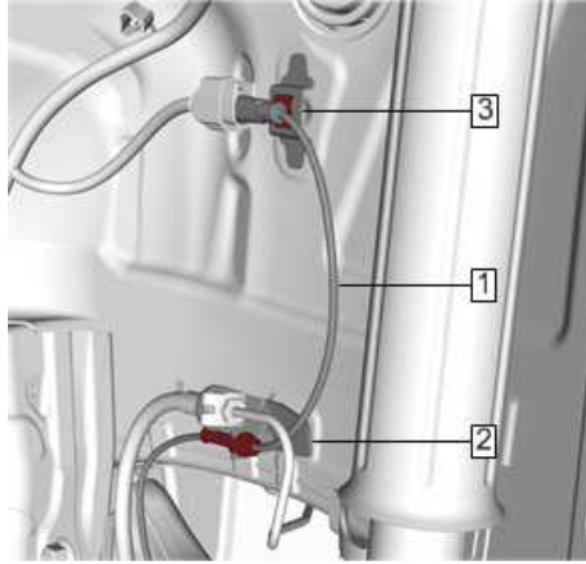


Fig. 34: Wheel Speed Sensor Wiring Harness

Courtesy of GENERAL MOTORS COMPANY

7. Unclip Rear Wheel Speed Sensor Wiring Harness (1) @Underbody Rear Side Rail Mounted Bracket (2)
8. Unclip Rear Wheel Speed Sensor Wiring Harness (1) @Rear Wheelhouse Panel Mounted Bracket (3)

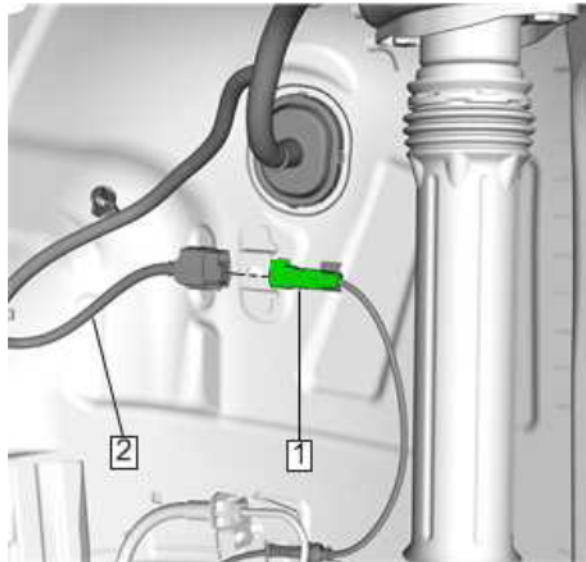


Fig. 35: Wheel Speed Sensor Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

9. Disconnect Rear Wheel Speed Sensor Electrical Connector (1) @Body Wiring Harness (2)
10. Remove Rear Wheel Speed Sensor@Vehicle

Installation Procedure

1. Install Rear Wheel Speed Sensor@Vehicle

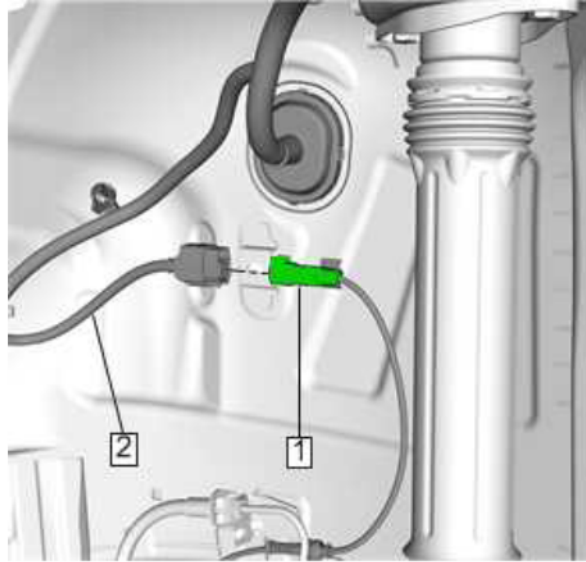


Fig. 36: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

2. Connect Rear Wheel Speed Sensor Electrical Connector (1) @Body Wiring Harness (2)

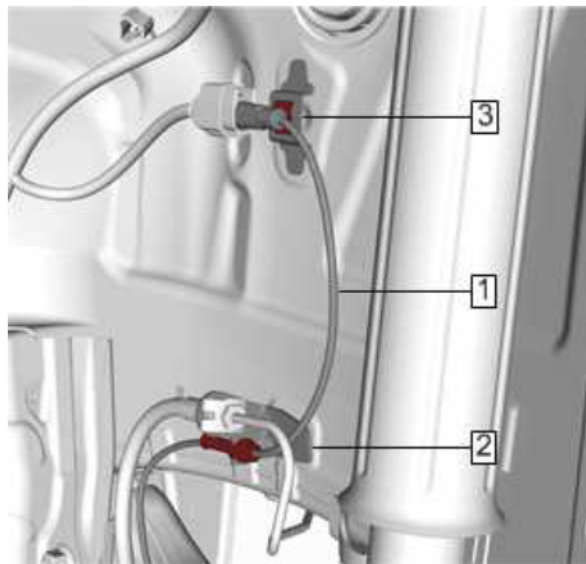


Fig. 37: Wheel Speed Sensor Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

3. Install Rear Wheel Speed Sensor Wiring Harness (1) @Rear Wheelhouse Panel Mounted Bracket (3)
4. Install Rear Wheel Speed Sensor Wiring Harness (1) @Underbody Rear Side Rail Mounted Bracket (2)

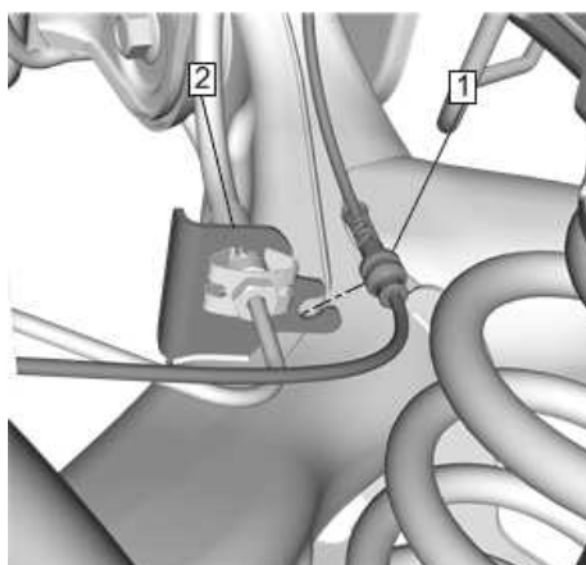


Fig. 38: Rear Wheel Speed Sensor Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

5. Install Rear Wheel Speed Sensor Wiring Harness (1) @Rear Axle Mounted Bracket (2)

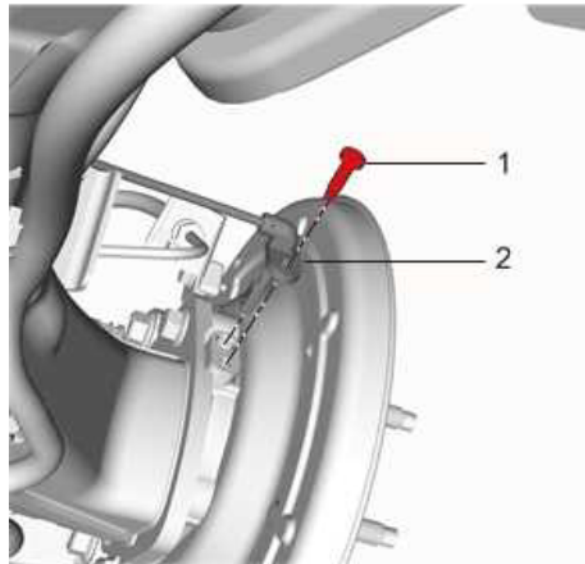


Fig. 39: Rear Wheel Speed Sensor And Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Install Rear Wheel Speed Sensor (2) @Rear Brake Caliper Mount Plate

CAUTION: Refer to [Fastener Caution](#) .

7.

8. Rear Wheel Speed Sensor Bolt (1) @Rear Brake Caliper Mount Plate - Tighten 9 N.m (80 lb in)

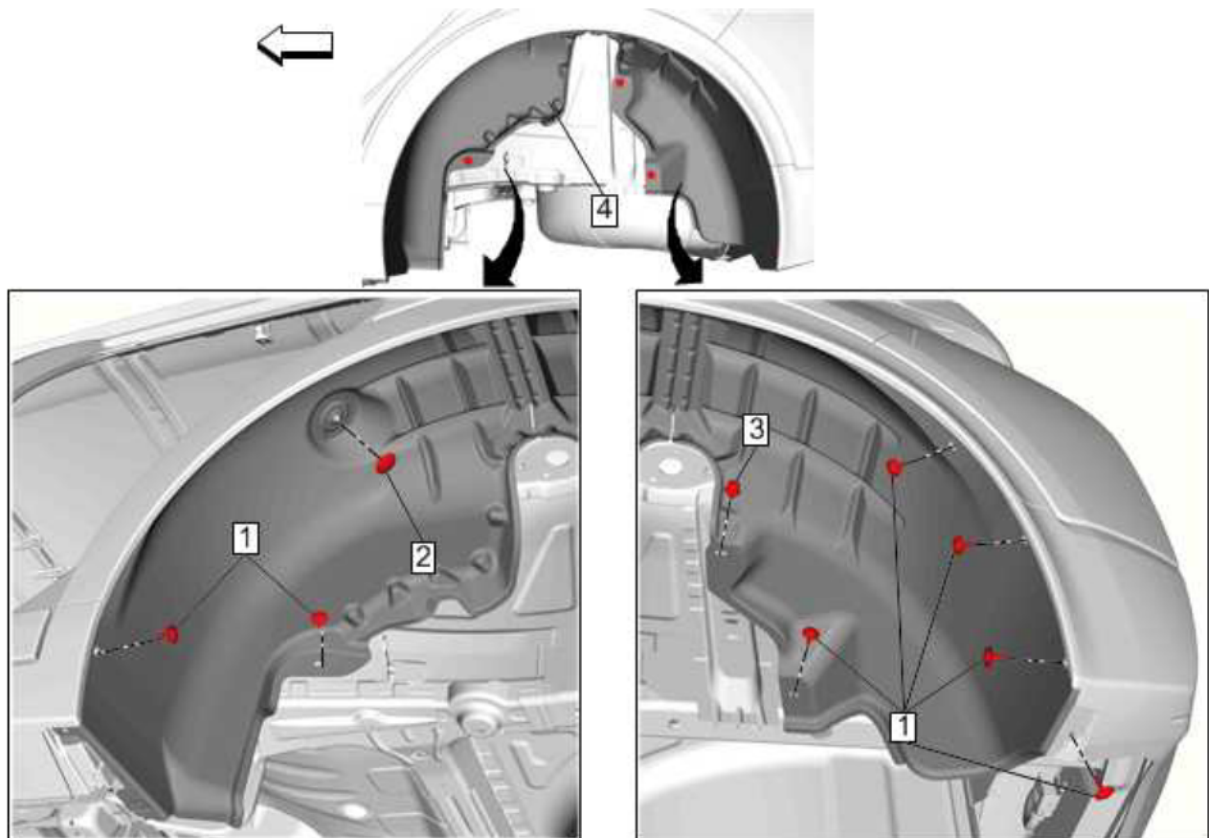


Fig. 40: Rear Wheelhouse Liner
Courtesy of GENERAL MOTORS COMPANY

9. Install Rear Wheelhouse Liner (4)[Rear Wheelhouse Liner Replacement](#)
10. Install the rear tire and wheel assembly. [Tire and Wheel Removal and Installation](#)
11. Lower the vehicle.

VEHICLE YAW SENSOR LEARN

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

- Yaw Rate Sensor replacement
- Electronic Brake Control Module replacement
- Inflatable Restraint Sensing and Diagnostic Module replacement

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 Park position.
3. Install the scan tool to the data link connector.
4. Ignition ON/Vehicle in Service Mode.
5. Select Yaw Rate Sensor Learn in the Electronic Brake Control Module Configuration/Reset Functions list.
6. Follow the scan tool directions to complete the calibration procedure.
7. Clear any DTCs that may be set.

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION

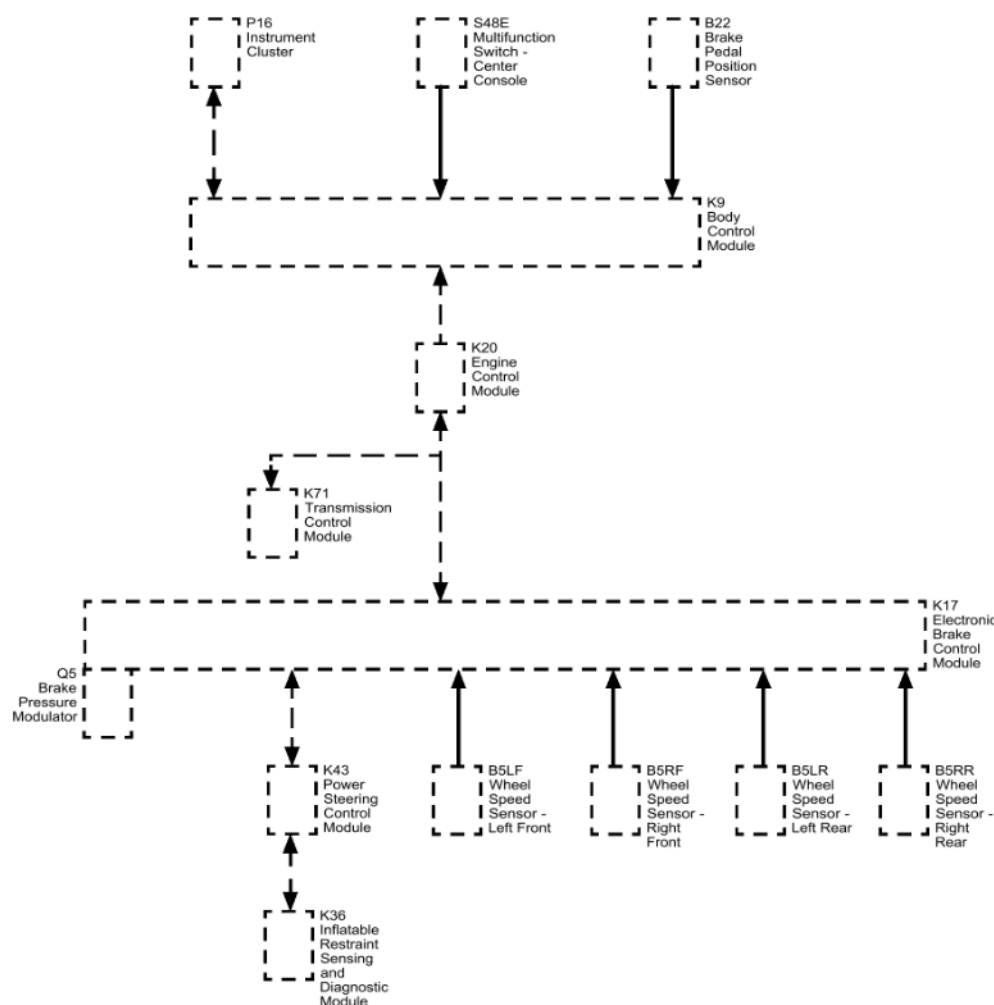


Fig. 41: ABS Description and Operation Block Diagram

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
B22	B22 Brake Pedal Position Sensor
S48E	S48E Multifunction Switch - Center Console
P16	P16 Instrument Cluster
K9	K9 Body Control Module
K20	K20 Engine Control Module
K71	K71 Transmission Control Module
K17	K17 Electronic Brake Control Module
Q5	Q5 Brake Pressure Modulator
K43	K43 Power Steering Control Module
B5LF	B5LF Wheel Speed Sensor - Left Front
B5RF	B5RF Wheel Speed Sensor - Right Front
B5LR	B5LR Wheel Speed Sensor - Left Rear
B5RR	B5RR Wheel Speed Sensor - Right Rear
K36	K36 Inflatable Restraint Sensing and Diagnostic Module

NOTE: EBCM terminal pin locations may differ between different RPO option brake systems.

This vehicle is equipped with a Bosch ABS 9.0 brake system. The electronic brake control module and the brake pressure modulator valve are serviced separately. The brake pressure modulator valve uses a four circuit configuration to control hydraulic pressure to each wheel independently. Vehicles built with option RPO FX3 will feature stability enhancement.

The following vehicle performance enhancement systems are provided.

- ABS
- Brake Assist
- Electronic Brake Distribution
- Electronic stability control
- Hill start assist
- Traction control system

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 valve - The brake pressure modulator valve contains the hydraulic valves and pump motor that are controlled electrically by the electronic brake control module. The brake pressure modulator uses a four circuit configuration with a diagonal split. The brake pressure modulator directs fluid from the reservoir of the master cylinder to the left front and right rear wheels and fluid from the other reservoir to the right front and left rear wheels. The diagonal circuits are hydraulically isolated so that a leak or malfunction in one circuit will allow continued braking ability on the other.

The brake pressure modulator contains the following components:

- Brake pressure sensor
- Four inlet valves (one per wheel)
- Four outlet valves (one per wheel)
- Pump motor
- Two traction/stability control supply valves
- Two traction/stability control isolation valves
- Body control module monitors the brake pedal position sensor signal when the brake pedal is applied and sends a high speed serial data message to the electronic brake control module indicating the brake pedal position.

- Brake pressure sensor is used to sense the action of the driver application of the brake pedal. The sensor provides an 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.
- Instrument cluster - The instrument cluster displays the vehicle speed based on the information from the engine control module. The engine control module sends the vehicle speed information via a high speed serial data to the body control module. The body control module then sends the vehicle speed information via a low speed serial data to the instrument cluster in order to display the vehicle speed, either in kilometers or miles, based on the vehicle requirements.
- Multi-axis acceleration sensor - The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one multi-axis acceleration sensor, internal to the inflatable restraint sensing and diagnostic 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 hold start assist function depending on multi-axis acceleration sensor input.
- Multifunction switch - The traction control switch is a multifunction momentary switch. The body control module monitors the signal circuit from the traction control switch and sends a high speed serial data message to the electronic brake control module indicating the switch position. The traction control and stability control are manually disabled or enabled by pressing the traction control switch.
- Steering 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.
- Transmission control module - The electronic brake control module receives high speed serial data message inputs from the transmission control module indicating the gear position of the transmission for hill start assist functions.
- Wheel speed sensors - This vehicle is equipped with unique directional wheel speed sensors that can detect wheel direction as well as zero wheel speed. The wheel speed sensors are Active sensors that receive a 12 V power supply voltage from the electronic brake control module and provides an output signal to the module. As the wheel spins, the wheel speed sensor sends the electronic brake control module a DC square wave signal. The electronic brake control module uses the frequency of the square wave signal to calculate the wheel speed.

Power-Up-Self Test

The electronic brake control module is able to detect many malfunctions whenever the ignition is ON. However, certain failures cannot be detected unless active diagnostic tests are performed on the components. Shorted solenoid coil or motor windings, for example, cannot be detected until the components are commanded ON by the electronic brake control module. Therefore, a power-up self-test is performed to verify correct operation of system components. The electronic brake control module performs the first phase of the power-up self-test when the ignition is first turned ON. This phase consists of internal self-testing of the electronic brake control module along with electrical checks of system sensors and circuits.

Initialization Sequence

The initialization sequence cycles each solenoid valve and the pump motor, as well as the necessary relays, for approximately forty milliseconds to check component operation. The active test is initiated by the electronic brake control module at the start of the ignition cycle and the speed of the fastest wheel exceeds 16 km/h (10 MPH). If a fault condition is detected the electronic brake control module sets a DTC.

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

Pressure Decrease

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

Pressure Increase

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

Brake Assist

The 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.

Electronic Brake Distribution

The electronic brake distribution function is designed to support the driver in emergency braking situations.

The electronic brake distribution is a control system that enhances the hydraulic proportioning function of the mechanical proportioning valve in the base brake system. The electronic brake distribution control system is part of the operation software in the electronic brake control module. The electronic brake distribution uses active control with existing ABS in order to regulate the vehicle's rear brake pressure.

Electronic Stability Control (RPO FX3)

The electronic stability control adds an additional level of vehicle control to the electronic brake control module.

Yaw rate is the rate of rotation about the vehicles vertical axis. The electronic 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 from the following parameters:

- The speed of the vehicle
- The position of the steering wheel
- The lateral acceleration of the vehicle

The difference between the desired yaw rate and the actual yaw rate is the yaw rate error, which is a measurement of over steer or under steer. If the yaw error becomes too large, the electronic brake control module attempts to correct the vehicles yaw rate motion by applying differential braking to the appropriate wheel. The amount of differential braking applied to the left or right front wheel is based on both the yaw rate error and side slip rate error.

The electronic stability control activations generally occur during aggressive driving, in turns or on bumpy roads without much use of the accelerator pedal. When braking during electronic stability control activation, the pedal pulsations feel different than the ABS pedal pulsations. The brake pedal pulsates at a higher frequency during vehicle stability enhancement system activation.

Hill Start Assist

When stopped on a hill, the hill start assist feature prevents the vehicle from rolling before driving off, whether facing uphill or downhill by holding the brake pressure during the transition between when the driver releases the brake pedal and starts to accelerate. The electronic brake control module calculates the brake pressure, which is needed to hold the vehicle on an incline or grade greater than 5% and locks that pressure for up to two seconds by commanding the appropriate solenoid valves ON and OFF when the brake pedal is released. The stop lamps will stay illuminated during the hill start assist operation even though the brake pedal is released, this is considered normal operation.

The hill start assist feature is determined by the electronic brake control module using the following inputs:

- Accelerator pedal position
- Brake pedal position sensor
- Brake pressure
- Clutch switch, if equipped
- Engine torque
- Longitudinal acceleration
- Multi-axis acceleration sensor
- Transmission gear information
- Vehicle speed

Traction Control System

When drive wheel slip is noted while the brake is not applied, the electronic brake control module will enter traction control mode.

First, the electronic brake control module requests the engine control module to reduce the amount of torque to the drive wheels via the serial data. The engine control module reduces torque to the drive wheels by retarding spark timing and turning off fuel injectors. The engine control module reports the amount of torque delivered to the drive wheels via the serial data circuit.

- Pressure hold
- Pressure increase
- Pressure decrease

Driver Information Indicator

ABS Warning Indicator

The instrument cluster turns the ABS warning 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.

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 fault and sends a serial data message to the instrument cluster requesting illumination.
- The body control module detects that the park brake is engaged. The body control module sends a serial data message to the instrument cluster requesting illumination.

Traction/Stability Active Control Indicator

The instrument cluster turns the traction/stability active control system 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 occurring 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 electronic stability control by pressing and holding the traction control switch for five seconds. The electronic brake control module sends a serial data message to the instrument cluster requesting illumination.

Traction/Stability Control Indicator

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

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