

2017 BRAKES

Antilock Brake System - Hybrid (HP9) - CT6

SPECIFICATIONS

FASTENER SPECIFICATIONS

Single Use Non-Threaded Fasteners/Components

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>	
Application	
Brake Pedal Retainer	

Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Brake Pipe Fitting - Left Front, Left Rear, Right Front, Right Rear	19 N.m (14 lb ft)
Brake Pressure Modulator Valve Bracket Bolt	9 N.m (80 lb in)
Brake Pressure Modulator Valve Bracket Nut	9 N.m (80 lb in)
Brake Pressure Modulator Valve Low Pressure Brake Pipe Fitting	32 N.m (24 lb ft)
Brake Pressure Modulator Valve Nut	8 N.m (71 lb in)
Brake Pressure Modulator Valve Primary Brake Pipe Fitting	32 N.m (24 lb ft)
Brake Pressure Modulator Valve Secondary Brake Pipe Fitting	32 N.m (24 lb ft)
Electronic Brake Booster Control Module Bolt	22 N.m (16 lb ft)
Electronic Brake Control Module Bolt	3 N.m (27 lb in)
Wheel Speed Sensor Bolt	10 N.m (89 lb in)

SCHEMATIC WIRING DIAGRAMS

ANTILOCK BRAKE SYSTEM WIRING SCHEMATICS

Power, Ground, Serial Data and Subsystem References

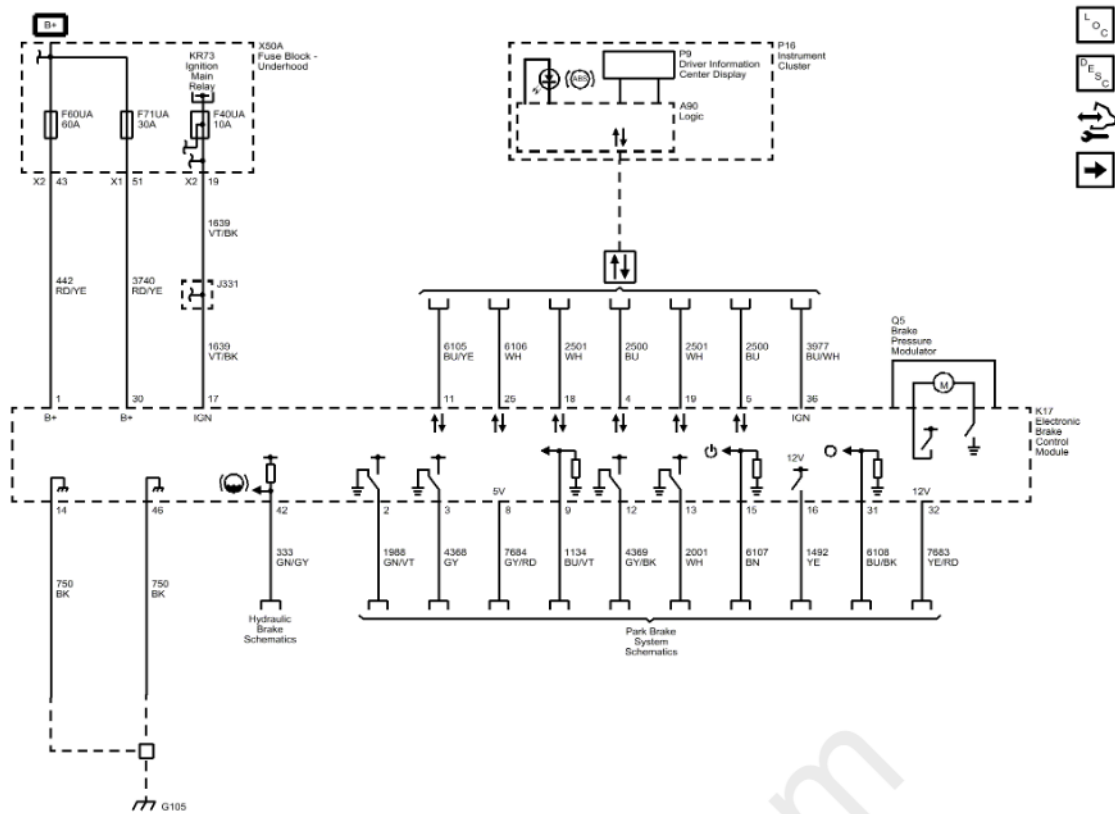


Fig. 1: Power, Ground, Serial Data and Subsystem References
Courtesy of GENERAL MOTORS COMPANY

Wheel Speed Sensors and Traction Control

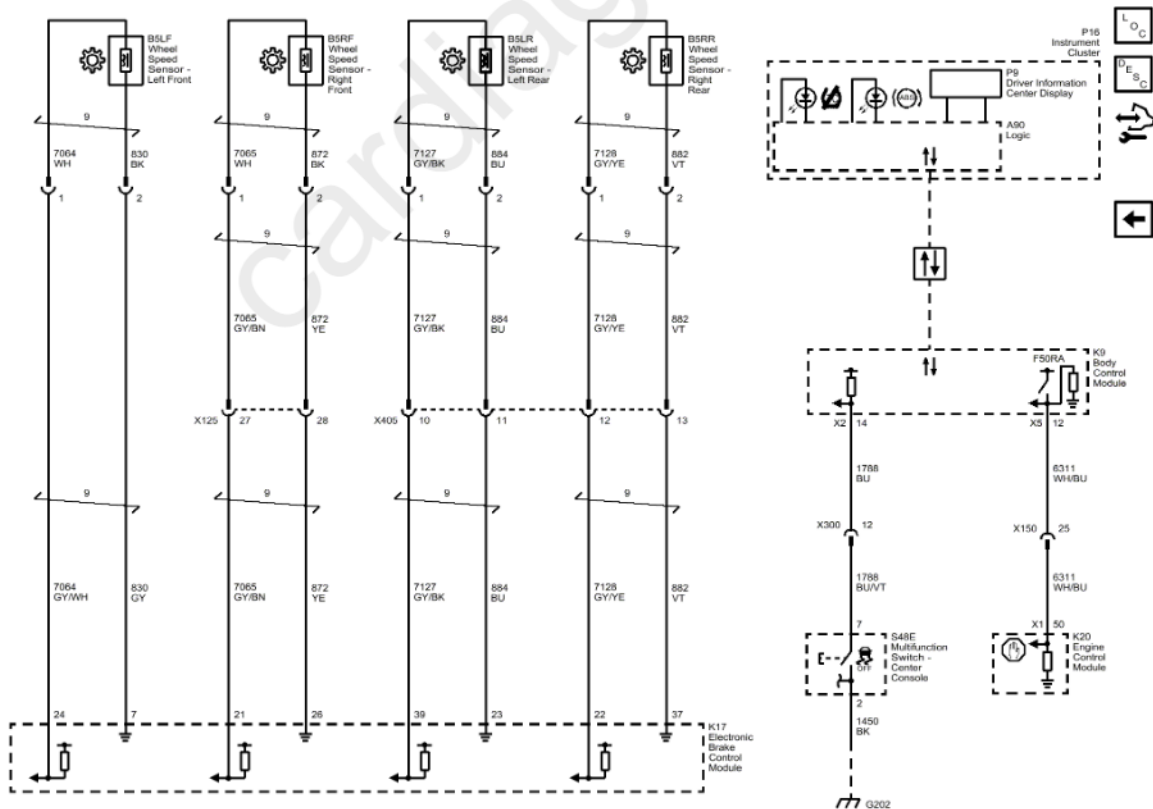


Fig. 2: Wheel Speed Sensors and Traction Control
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

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, P159F 00	1	-
Traction Control Switch Ground	-	1, P159F 00	-	-
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 S, 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 S48E Multifunction Switch.
 - **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 S48E Multifunction Switch. 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 2 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 7 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 S48E Multifunction Switch.

Component Testing

1. Ignition OFF, disconnect the harness connector at the S48E Multifunction Switch.
2. Test for infinite resistance between the signal terminal 7 and the ground terminal 2 with the switch in the open position.
 - **If less than infinite resistance**

Replace the S48E Multifunction Switch.
 - **If infinite resistance**
3. Test for less than 2 Ω between the signal circuit terminal 7 and the ground terminal 2 with the switch in the closed position.
 - **If 2 Ω or greater**

Replace the S48E Multifunction Switch.
 - **If less than 2 Ω**
4. All OK.

Repair Instructions

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

- [Front Floor Console Trim Plate Replacement](#)
- [Control Module References](#) for Control Module or Instrument Cluster replacement, programming and setup.

DTC C0010-C0019, C001C OR C001D: LEFT/RIGHT FRONT/REAR INLET/OUTLET CONTROL

Diagnostic Instructions

- Perform the prior to [Diagnostic System Check - Vehicle](#) 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 C0010

Left Front Inlet Control

DTC C0011

Left Front Outlet Control

DTC C0014

Right Front Inlet Control

DTC C0015

Right Front Outlet Control

DTC C0018

Left Rear Inlet Control

DTC C0019

Left Rear Outlet Control

DTC C001C

Right Rear Inlet Control

DTC C001D

Right Rear Outlet Control

Circuit/System Description

The solenoid valves are integral parts of the brake pressure modulator valve assembly. The brake pressure modulator valve assembly contains an inlet solenoid valve and an outlet solenoid valve for each wheel. The solenoid valves are not engaged during normal system operation. When the ABS, electronic brake force distribution or traction control/stability control operation is required the electronic brake control module turns the required solenoid valves ON.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The electronic brake control module detects a short to ground or open/high resistance on the internal control circuit.

Action Taken When the DTC Sets

- The electronic brake control module disables the ABS, the electronic brake force distribution and the traction control/stability control for the duration of the ignition cycle.
- The ABS warning indicator turns ON.
- The traction control/stability control-active indicator turns ON.
- The brake force distribution 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 and enable the system functions in the next ignition cycle.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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. Vehicle in Service Mode.
2. Verify that DTC C0010, C0011, C0014, C0015, C0018, C0019, C001C or C001D are not set while operating the vehicle under normal driving conditions.
 - **If any of the DTCs are set**
 1. Vehicle 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 the ground circuit terminals listed below and ground:
 - Terminal 14
 - Terminal 46
 - **If 10 Ω or greater**

Repair the open/high resistance in the circuit.
 - **If less than 10 Ω**
 - 3. Replace the Q5 Brake Pressure Modulator
- **If none of the DTCs are 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 C0051: STEERING WHEEL ANGLE SENSOR

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 C0051

Steering Wheel Angle Sensor

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

Circuit/System Description

The steering wheel angle sensor is integrated into the steering gear assembly. The steering wheel angle sensor identifies the position and direction of the steering wheel rotation.

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

Conditions for Running the DTC

Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

C0051 66

The steering wheel angle sensor signal rate of change is too fast greater than 30° .

C0051 4B

The steering wheel angle sensor signal is found to not be calibrated.

C0051 1A

The steering wheel angle sensor signal is above the maximum specification.

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- A Service StabiliTrak message may be displayed on the driver information center.
- A Service Brake Assist message may be displayed on the driver information center.
- A Service Power Steering Drive with Care message may be displayed on the driver information center.
- The electronic brake control module disables the traction control and the electronic stability control for the duration of the ignition cycle.

Conditions for Clearing the DTC

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

Diagnostic Aids

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

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Vehicle in Service Mode.
2. With a scan tool check the Power Steering Control Module for any DTCs.
 - **If any DTCs are present in the Power Steering Control Module**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) in Power Steering Diagnostic Information and Procedures.
 - **If there are no DTCs present in the Power Steering Control Module**
 1. With a scan tool check to see if DTCs U0126, U0130 or U0131 are set.
 - **If DTCs U0126, U0130 or U0131 are set**

Refer to [DTC U0100-U02FF](#)
 - **If DTCs U0126, U0130 and U0131 are not set**
 2. With a scan tool check to see if DTCs DTC C0500-C0504, C0506-C0510, C050A, C050C-C050F or C0512-C0516 are set in the Electronic Brake Control Module
 - **If DTCs C0500-C0504, C0506-C0510, C050A, C050C-C050F or C0512-C0516 are set in the Electronic Brake Control Module**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **If DTCs C0500-C0504, C0506-C0510, C050A, C050C-C050F or C0512-C0516 are not set in the Electronic Brake Control Module**
3. Perform the [Steering Wheel Angle Sensor Centering](#) procedure.
 - **If the Steering Angle Sensor Centering procedure corrected the DTC**

Proceed to step 6
 - **If the Steering Angle Sensor Centering procedure did not correct the DTC**
4. Replace the steering gear assembly
 - **If steering gear assembly replacement corrected the DTC**

Proceed to step 6
 - **If steering gear assembly replacement did not correct the DTC**
5. Replace the K17 Electronic Brake Control Module.
6. All OK

Repair Instructions

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

- [Electric Belt Drive Rack and Pinion Steering Gear Replacement](#)
- [Control Module References](#) for module replacement, programming and setup.

DTC C006B: 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 Descriptor

DTC C006B

Stability System Active Too Long

Circuit/System Description

The electronic brake control module activates the stability system depending on steering angle and multi-axis acceleration sensor input. When the traction control or stability control operation is required the EBCM turns the required solenoid valves ON.

The electronic brake control module receives high speed serial data inputs from the steering angle sensor and multi-axis sensor, that identify the position and direction of the steering wheel rotation as well as vehicle yaw and lateral movement. The electronic brake control module utilizes these signal to calculate the driver intended driving direction.

The steering wheel angle sensor is integrated into the steering gear assembly. The multi-axis sensor is located internally into the inflatable restraint and sensing diagnostic module.

Conditions for Running the DTC

- Ignition ON
- Stability control is active.

Conditions for Setting the DTC

Stability control is active for more than 15 s.

Action Taken When the DTC Sets

- The EBCM disables the traction control and stability control for the duration of the ignition cycle.
- 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 EBCM will turn OFF the indicators and enable the system functions in the next ignition cycle.

Reference Information

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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](#)

Scan Tool Reference

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

Diagnostic Aids

Inspect the serial data circuits and connections at the power steering 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.

Circuit/System Verification

1. Vehicle in Service Mode.
2. With a scan tool check the Power Steering Control Module for any DTCs.
 - **If any DTCs are present in the Power Steering Control Module**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) in Power Steering Diagnostic Information and Procedures.

3. Verify that the steering gear assembly is not incorrectly installed.

- **If the steering gear assembly is installed incorrectly**

Refer to [Electric Belt Drive Rack and Pinion Steering Gear Replacement](#)

- **If the steering gear assembly is installed correctly**

4. Perform the [Steering Wheel Angle Sensor Centering](#) procedure.

- **If the Steering Angle Sensor Centering procedure corrected the DTC**

Proceed to step 7

- **If the Steering Angle Sensor Centering procedure did not correct the DTC**

5. Verify that the inflatable restraint and sensing diagnostic module is installed correctly.

- **If inflatable restraint and sensing diagnostic module is not installed correctly**

Refer to [Airbag Sensing and Diagnostic Module Replacement](#)

- **If inflatable restraint and sensing diagnostic module is installed correctly**

6. Replace the K17 Electronic Brake Control Module.

7. All OK

Repair Instructions

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

- [Electric Belt Drive Rack and Pinion Steering Gear Replacement](#)
- [Control Module References](#) for module replacement, programming and setup.

DTC C0186, C0196 OR C0287: LATERAL/LONGITUDINAL ACCELERATION SENSOR 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 C0186

Lateral Acceleration Sensor Signal

DTC C0196

Yaw Rate Signal

DTC C0287

Longitudinal Acceleration Sensor Signal

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

C0186 00, C0196 00, C0287 00 or C0287 4B

Ignition ON

C0186 5A or C0287 5A

Drive the vehicle straight ahead with constant velocity greater than 30 km/h (18.6 MPH), then turn right and then turn left.

C0196 09, C0196 11 or C0196 5A

Vehicle at standstill for 10 s, then drive the vehicle straight ahead with constant velocity greater than 20 km/h (12.4 MPH).

Conditions for Setting the DTC

C0186 00

- An internal fault in multi-axis acceleration sensor will set this DTC.
- Improperly mounted or loose inflatable restraint sensing and diagnostic module may set this DTC.

C0186 5A

- An internal fault in multi-axis acceleration sensor.
- Improperly mounted or loose inflatable restraint sensing and diagnostic module.
- The lateral acceleration signal is not plausible with the lateral acceleration signal, the steering wheel angle sensor signal and the vehicle speed.

C0196 00

The yaw rate signal is out of the specified range.

C0196 09

The yaw rate signal is changing faster than physically possible.

C0196 11

The yaw rate signal is above the maximum threshold.

C0196 5A

- Improperly mounted or loose inflatable restraint sensing and diagnostic module may set this DTC.
- The yaw rate signal is not plausible with the lateral acceleration signal, the steering wheel angle sensor signal and the vehicle speed.

C0287 00

The longitudinal acceleration signal is out of the specified range.

C0287 4B

The longitudinal acceleration sensor is not calibrated.

C0287 5A

- An internal fault in multi-axis acceleration sensor will set this DTC.
- The longitudinal acceleration signal is not plausible with the vehicle acceleration.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

- **Circuit Testing**
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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. 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 the K36 Inflatable Restraint Sensing and Diagnostic Module is installed correctly.

- **If loose or incorrect installation**

Correct the installation or replace the component.

- **If correct installation**

3. 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**

4. Verify DTC C0186, 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**

5. All OK.

Repair Instructions

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

[Control Module References](#) for Electronic Brake Control Module or Inflatable Restraint Sensing and Diagnostic Module replacement, programming and setup

DTC C0500-C0504, C0506-C0510 OR C0512-C0516: LEFT/RIGHT FRONT/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 Descriptors

DTC C0500

Left Front Wheel Speed Sensor Circuit Open

DTC C0501

Left Front Wheel Speed Sensor Circuit Range Performance

DTC C0502

Left Front Wheel Speed Sensor Short to Ground

DTC C0503

Left Front Wheel Speed Sensor Short to Battery

DTC C0504

Left Front Wheel Speed Sensor Circuit Signal Erratic/Intermittent

DTC C0506

Right Front Wheel Speed Sensor Circuit Open

DTC C0507

Right Front Wheel Speed Sensor Circuit Range Performance

DTC C0508

Right Front Wheel Speed Sensor Short to Ground

DTC C0509

Right Front Wheel Speed Sensor Short to Battery

DTC C050A

Right Front Wheel Speed Sensor Circuit Signal Erratic/Intermittent

DTC C050C

Left Rear Wheel Speed Sensor Circuit Open

DTC C050D

Left Rear Wheel Speed Sensor Circuit Range Performance

DTC C050E

Left Rear Wheel Speed Sensor Short to Ground

DTC C050F

Left Rear Wheel Speed Sensor Short to Battery

DTC C0510

Left Rear Wheel Speed Sensor Circuit Signal Erratic/Intermittent

DTC C0512

Right Rear Wheel Speed Sensor Circuit Open

DTC C0513

Right Rear Wheel Speed Sensor Circuit Range Performance

DTC C0514

Right Rear Wheel Speed Sensor Short to Ground

DTC C0515

Right Rear Wheel Speed Sensor Short to Battery

DTC C0516

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Wheel Speed Sensor Ignition	C0502	C0500	-	C0501, C0504
Left Front Wheel Speed Sensor Signal	C0502	C0500	C0503	C0501, C0504
Right Front Wheel Speed Sensor Ignition	C0508	C0506	-	C0507, C050A
Right Front Wheel Speed Sensor Signal	C0508	C0506	C0509	C0507, C050A
Left Rear Wheel Speed Sensor Ignition	C050E	C050C	-	C050D, C0510
Left Rear Wheel Speed Sensor Signal	C050E	C050C	C050F	C050D, C0510
Right Rear Wheel Speed Sensor Ignition	C0514	C0512	-	C0513, C0516
Right Rear Wheel Speed Sensor Signal	C0514	C0512	C0515	C0513, C0516

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors and encoder rings. The encoder rings consist of permanent magnets located in the hub. As the wheel spins the magnetic encoder ring rotates and passes by the wheel speed sensor head; which generates a sign wave in the wheel speed sensor. 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. The electronic brake control module uses the frequency of the signals to calculate the wheel speeds.

Conditions for Running the DTC

- Vehicle On or Vehicle in Service Mode
- Ignition voltage is greater than 10 V.

Conditions for Setting the DTC

C0500, C0502, C0503, C0506, C0508, C0509, C050C, C050E, C050F, C0512, C0514, C0515

- An open or a high resistance is detected on a wheel speed sensor circuit.
- A short to ground or an open/high resistance is detected on a wheel speed sensor signal circuit.
- A short to voltage is detected on a wheel speed sensor signal circuit.

C0501, C0504, C0507, C050A, C050D, C0510, C0513, C0516

- The tone ring may be demagnetized
- Water intrusion in the wiring harness
- 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 tone ring too large
- Electrical magnetic interference with the wheel speed sensor harness

Actions Taken when the DTC Sets

- The ABS indicator turns ON.
- The traction/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 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.

Diagnostic Aids

- Do not use a magnet to clean the wheel speed sensor magnetic encoder ring.
- Inspect the wheel speed sensor magnetic encoder ring for debris or corrosion.
- 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

Schematic Reference

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Connector End View Reference

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- [Wiring Repairs](#)

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Test drive the vehicle in a straight line at a speed greater than 20 km/h (13 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 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, vehicle in service mode.

2. Test for less than 1 V between the appropriate K17 Electronic Brake Control Module harness connector terminals listed below and ground:

- B5LF Wheel Speed Sensor - Left Front - terminal 24 and terminal 7
- B5LR Wheel Speed Sensor - Left Rear - terminal 39 and terminal 23
- B5RF Wheel Speed Sensor - Right Front - terminal 21 and terminal 26
- B5RR Wheel Speed Sensor - Right Rear - terminal 22 and terminal 37
- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**

3. Vehicle OFF.

4. 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 24 and terminal 7
- B5LR Wheel Speed Sensor - Left Rear - terminal 39 and terminal 23
- B5RF Wheel Speed Sensor - Right Front - terminal 21 and terminal 26
- B5RR Wheel Speed Sensor - Right Rear - terminal 22 and terminal 37
- **If less than infinite resistance**

Repair the short to ground on the circuit.

- **If infinite resistance**

5. 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**

6. 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**

7. Replace the B5 Wheel Speed Sensor.

8. 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**

9. 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 Electronic Brake Control Module replacement, programming and setup.

DTC C052B, C052D, C052F, C055B OR C05AE: ABS PUMP MOTOR

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 C052B

ABS Pump Motor Performance

DTC C052D

ABS Pump Motor Supply Control Circuit High

DTC C052F

ABS Pump Motor Supply Circuit

DTC C055B

ABS Pump Motor Supply Circuit Low

DTC C05AE

ABS Pump Motor Calibration Not Learned

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ Terminal 1	P0562, C055B	P0560	-	P0560, C052B
B+ Terminal 30	P0562, C055B	P0560	-	P0560, C052B
Ground Terminal 14	-	P0560	P0563, C052D	P0560, C052B
Ground Terminal 46	-	P0560	P0563, C052D	P0560, C052B

Circuit/System Description

The electronic brake control module monitors two different blocks of memory to determine its capability to control the system shutdown process.

Conditions for Running the DTC

Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

- Keep alive voltage regulator not functional.
- Processor loses complete battery power.
- Battery voltage is under 9 V and the vehicle is not moving.

Action Taken When the DTC Sets

- A warning indicator may be displayed.
- A driver information center message may be displayed.
- The electronic brake control module disables ABS, traction control system and vehicle stability enhancement system for the duration of the drive cycle.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The electronic brake control module clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

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- [Wiring Repairs](#)

Scan Tool Reference

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

Circuit/System Verification

Check to ensure battery shunt is not opened.

Circuit/System Testing

1. Vehicle 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 the ground circuit terminals listed below and ground:
 - Terminal 14
 - Terminal 46
 - **If 10 Ω or greater**
 1. Vehicle 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. Vehicle in Service Mode.
4. Verify that a test lamp illuminates between the B+ circuit terminals listed below and ground.
 - Terminal 1
 - Terminal 30

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Vehicle OFF.
2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**

5. Vehicle in Service Mode.
6. Verify that a test lamp illuminates between the ignition circuit terminal 17 and ground.

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Vehicle OFF.
2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**

7. 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 C0552: LONGITUDINAL ACCELERATION SENSOR PERFORMANCE

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 C0552

Longitudinal Acceleration Sensor Performance

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

Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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ABS 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

Circuit/System Testing

1. Verify the K36 Inflatable Restraint Sensing and Diagnostic Module is installed correctly.
 - **If loose or incorrect installation**
Correct the installation of the component.
 - **If installed correctly**
 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.

Repair Instructions

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

Control Module References for Electronic Brake Control Module or Inflatable Restraint Sensing and Diagnostic Module replacement, programming and setup

DTC C0555-C0558: LEFT/RIGHT FRONT/REAR WHEEL SPEED SENSOR INCORRECT COMPONENT INSTALLED

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 C0555

Left Front Wheel Speed Sensor Incorrect Component Installed

DTC C0556

Right Front Wheel Speed Sensor Incorrect Component Installed

DTC C0557

Left Rear Wheel Speed Sensor Incorrect Component Installed

DTC C0558

Right Rear Wheel Speed Sensor Incorrect Component Installed

Diagnostic Fault Information

Component	Condition	DTC
Wheel Speed Sensor	• Incorrect part sensor installed • Physical damage • Debris on the wheel speed sensor or the encoder ring • Loose or worn wheel bearing • Air gap between the wheel speed sensor and the encoder ring too large • Water intrusion in the wiring harness	C0555, C0556, C0557, C0558

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors and encoder rings. The encoder rings consist of permanent magnets located in the hub. As the wheel spins the magnetic encoder ring rotates and passes by the wheel speed sensor head; which generates a sign wave in the wheel speed sensor. 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. The electronic brake control module uses the frequency of the signals to calculate the wheel speeds.

Conditions for Running the DTC

- Vehicle On or Vehicle in Service Mode
- Ignition voltage is greater than 10 V.

Conditions for Setting the DTC

C0555, C0556, C0557, C0558

- Incorrect part number wheel speed sensor installed
- The tone ring may be demagnetized
- Water intrusion in the wiring harness
- 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 tone ring too large
- Electrical magnetic interference with the wheel speed sensor harness

Actions Taken when the DTC Sets

- The ABS indicator turns ON.

- The traction/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 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.

Diagnostic Aids

- Do not use a magnet to clean the wheel speed sensor magnetic encoder ring.
- Inspect the wheel speed sensor magnetic encoder ring for debris or corrosion.
- If two or more wheel speed sensors are inoperative, diagnose each wheel speed sensor individually.
- If any of the DTCs are set, refer to the Diagnostic Fault Information table for possible mechanical faults or conditions.
- If the customer comments that the ABS indicator is ON only during moist environmental conditions (rain, snow, vehicle wash, etc.), inspect the wheel speed sensor wiring for signs of water intrusion.

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Antilock Brake System Schematics

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- [Wiring Repairs](#)

Scan Tool Reference

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

Circuit/System Verification

1. Test drive the vehicle in a straight line at a speed greater than 20 km/h (13 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 DTCs C0500-C0504, C0506-C0510, C050A, C050C-C050F or C0512-C0516 are not set.
 - **If any listed DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **If none of the listed DTCs are set**
3. 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**

Replace the appropriate B5 Wheel Speed Sensor.
 - **If no contamination, physical damage, incorrect installation or the wrong component is not diagnosed**
4. Replace the K17 Electronic Brake Control Module.

Repair Instructions

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

- [Front Wheel Speed Sensor Replacement](#)
- [Rear Wheel Speed Sensor Replacement](#)
- [Control Module References](#) for Electronic Brake Control Module replacement, programming and setup

DTC C059B OR C0560: LEFT/RIGHT FRONT BRAKE PRESSURE SENSOR MISSING CALIBRATION

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 C059B

Right Front Brake Pressure Sensor Missing Calibration

DTC C0560

Left Front Brake Pressure Sensor Missing Calibration

Circuit/System Description

The brake pressure sensors located in the brake pressure modulator send test pulses to determine if they are calibration with each other.

Conditions for Running the DTC

- Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

This diagnostic detects that the brake pressure module test pulses differ from the nominal value by more than 10%.

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 Service Brake Assist and Service StabiliTrak messages are 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.

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- [Wiring Repairs](#)

Scan Tool Reference

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

Circuit/System Verification

1. Verify the DTC does not set while operating the vehicle under the Conditions for Running the DTC.
 - **If the DTC sets**
 Replace the Q5 Brake Pressure Modulator.
 - **If the DTC does not set**
2. 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 C0571, C0572 OR C0574: BRAKE MASTER CYLINDER PRESSURE SENSOR 1 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 C0571

Brake Master Cylinder Pressure Sensor 1 Circuit Low Voltage

DTC C0572

Brake Master Cylinder Pressure Sensor 1 Circuit High Voltage

DTC C0574

Brake Master Cylinder Pressure Sensor 1 Circuit Performance

Circuit/System Description

The electronic brake control module uses input from the master cylinder pressure sensor for more accurate control during a vehicle stability enhancement system event. The master cylinder pressure sensor is internal to the brake pressure modulator.

Conditions for Running the DTC

- The brake pedal is not applied.
- Ignition voltage is greater than 10 V.
- Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

C0571

A short to ground or open is detected on the sensor signal circuit.

C0572

A short to battery is detected on the sensor signal circuit.

C0574

The master cylinder pressure sensor raw offset is out of specified range.

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 Service Brake Assist and Service StabiliTrak messages are 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.

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Scan Tool Reference

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

Circuit/System Verification

1. Perform a brake hydraulic system test, refer to [Hydraulic Brake System Diagnosis](#) .
 - **If the brake hydraulic system test does not pass**
Repair as necessary.
 - **If the brake hydraulic system tests normal**
2. 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 C0575, C0576 OR C0578: LEFT REAR BRAKE PRESSURE 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 C0575

Left Rear Brake Pressure Sensor Circuit Low Voltage

DTC C0576

Left Rear Brake Pressure Sensor Circuit High Voltage

DTC C0578

Left Rear Brake Pressure Sensor Circuit Performance

Circuit/System Description

The Electronic Brake Control Module detects an issue with the Left Rear Brake Pressure Sensor which is located internally in the Brake Pressure Modulator Valve.

Conditions for Running the DTC

- Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

C0575

The Electronic Brake Control Module detects the Left Rear Brake Pressure Sensor is shorted to ground.

C0576

The Electronic Brake Control Module detects the Left Rear Brake Pressure Sensor is shorted to voltage.

C0578

The Electronic Brake Control Module detects the Left Rear Brake Pressure Sensor is out of the specified value.

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 Service Brake Assist and Service StabiliTrak messages are 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.

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify the DTC does not set while operating the vehicle under the Conditions for Running the DTC.
 - **If the DTC sets**
Replace the Q5 Brake Pressure Modulator.
 - **If the DTC does not set**

2. 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 C05A3, C05A4 OR C10EE: WHEEL SPEED SENSOR

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 C05A3

Wheel Speed Sensor Supply Circuit High

DTC C05A4

Wheel Speed Sensor Supply Circuit Low

DTC C10EE

Wheel Speed Sensor Frequency

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Wheel Speed Sensor Ignition	C0502, C05A4	C0500, C05A3	-	C0501, C0504, C10EE
Left Front Wheel Speed Sensor Signal	C0502	C0500	C0503	C0501, C0504, C10EE
Right Front Wheel Speed Sensor Ignition	C0508, C05A4	C0506, C05A3	-	C0507, C050A, C10EE
Right Front Wheel Speed Sensor Signal	C0508	C0506	C0509	C0507, C050A, C10EE
Left Rear Wheel Speed Sensor Ignition	C050E, C05A4	C050C, C05A3	-	C050D, C0510, C10EE
Left Rear Wheel Speed Sensor Signal	C050E	C050C	C050F	C050D, C0510, C10EE
Right Rear Wheel Speed Sensor Ignition	C0514, C05A4	C0512, C05A3	-	C0513, C0516, C10EE
Right Rear Wheel Speed Sensor Signal	C0514	C0512	C0515	C0513, C0516, C10EE

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors and encoder rings. The encoder rings consist of permanent magnets located in the hub. As the wheel spins the magnetic encoder ring rotates and passes by the wheel speed sensor head; which generates a sign wave in the wheel speed sensor. 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. The electronic brake control module uses the frequency of the signals to calculate the wheel speeds.

Conditions for Running the DTC

- Vehicle On or Vehicle in Service Mode
- Ignition voltage is greater than 10 V.

Conditions for Setting the DTC

C05A3, C05A4

- An open or a high resistance is detected on a wheel speed sensor circuit.
- A short to ground or an open/high resistance is detected on a wheel speed sensor signal circuit.
- A short to voltage is detected on a wheel speed sensor signal circuit.

C10EE

- The tone ring may be demagnetized
- Water intrusion in the wiring harness
- 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 tone ring too large
- Electrical magnetic interference with the wheel speed sensor harness

Actions Taken when the DTC Sets

- The ABS indicator turns ON.
- The traction/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 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.

Diagnostic Aids

- Do not use a magnet to clean the wheel speed sensor magnetic encoder ring.
- Inspect the wheel speed sensor magnetic encoder ring for debris or corrosion.
- 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

Schematic Reference

Antilock Brake System Schematics

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Scan Tool Reference

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

Circuit/System Verification

1. Test drive the vehicle in a straight line at a speed greater than 20 km/h (13 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 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, vehicle in service mode.
2. Test for less than 1 V between the appropriate K17 Electronic Brake Control Module harness connector terminals listed below and ground:
 - B5LF Wheel Speed Sensor - Left Front - terminal 24 and terminal 7
 - B5LR Wheel Speed Sensor - Left Rear - terminal 39 and terminal 23
 - B5RF Wheel Speed Sensor - Right Front - terminal 21 and terminal 26
 - B5RR Wheel Speed Sensor - Right Rear - terminal 22 and terminal 37
 - **If 1 V or greater**
Repair the short to voltage on the circuit.
 - **If less than 1 V**
3. Vehicle OFF.
4. 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 24 and terminal 7
 - B5LR Wheel Speed Sensor - Left Rear - terminal 39 and terminal 23
 - B5RF Wheel Speed Sensor - Right Front - terminal 21 and terminal 26
 - B5RR Wheel Speed Sensor - Right Rear - terminal 22 and terminal 37
 - **If less than infinite resistance**
Repair the short to ground on the circuit.
 - **If infinite resistance**

5. 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**

6. 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 Speed Sensor - Right Rear - terminal 37
- **If 2 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 2 Ω**

7. Replace the B5 Wheel Speed Sensor.

8. 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**

9. 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 Electronic Brake Control Module replacement, programming and setup

DTC C05AD: BRAKE BLENDING SYSTEM PERFORMANCE

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 C05AD

Brake Blending System Performance

Circuit/System Description

The electronic brake control module uses input from the master cylinder pressure sensor for more accurate control during a vehicle stability enhancement system event. The master cylinder pressure

sensor is internal to the brake pressure modulator.

Conditions for Running the DTC

- The brake pedal is not applied.
- Ignition voltage is greater than 10 V.
- Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

An anomaly in brake pressure in the master cylinder or hydraulic lines has been detected.

Action Taken When the DTC Sets

- The ABS indicator turns ON.
- The traction/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 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.

Diagnostic Aids

The diagnostic for DTC C05AD will have you test and inspect the base hydraulic brake system for any issues. The hydraulic brake system must be thoroughly inspected for any bent or kinked brake lines, both metal and rubber. Also the vehicles brake calipers must also be able to slide and apply freely.

Reference Information

Schematic Reference

Antilock Brake System Schematics

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- [Wiring Repairs](#)

Scan Tool Reference

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

Circuit/System Verification

1. Perform a brake hydraulic system test, refer to [Hydraulic Brake System Diagnosis](#) .
 - **If the brake hydraulic system test does not pass**

Repair as necessary.

- If the brake hydraulic system tests normal

2. Replace the K17 Electronic Brake Control Module.

Repair Instructions

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

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

DTC C05B0 OR C05B1: ABS FRONT/REAR HYDRAULIC CIRCUIT LEAK DETECTED

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 C05B0

ABS Front Hydraulic Circuit Leak Detected

DTC C05B1

ABS Rear Hydraulic Circuit Leak Detected

Circuit/System Description

The electronic brake control module uses input from the master cylinder pressure sensor for more accurate control during a vehicle stability enhancement system event. The master cylinder pressure sensor is internal to the brake pressure modulator.

Conditions for Running the DTC

- The brake pedal is applied.
- Ignition voltage is greater than 10 V.
- Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

The Electronic Brake Control Module detects a pressure loss associated to a hydraulic leak.

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 Service Brake Assist and Service StabiliTrak messages are 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.

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Schematic Reference

[Antilock Brake System Schematics](#)

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Perform a brake hydraulic system test, refer to **Hydraulic Brake System Diagnosis** .
 - **If the brake hydraulic system test does not pass**
Repair as necessary.
 - **If the brake hydraulic system tests normal**
2. 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 C05B2: STEERING WHEEL ANGLE SENSOR SIGNAL - YAW RATE SENSOR 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 C05B2

Steering Wheel Angle Sensor Signal - Yaw Rate Sensor Signal Not Plausible

Circuit/System Description

The electronic brake control module receives high speed serial data inputs from the steering angle sensor and multi-axis sensor, that identify the position and direction of the steering wheel rotation as well as vehicle yaw and lateral movement. The electronic brake control module utilizes these signal to calculate the driver intended driving direction.

The steering wheel angle sensor is integrated into the steering gear assembly. The multi-axis sensor is located internally into the inflatable restraint and sensing diagnostic module.

Conditions for Running the DTC

Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

The difference between model yaw rate out of steering angle, model yaw rate out of wheel speeds and measured yaw rate has to be less than 2 deg/s during straight ahead driving and cornering.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

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Scan Tool Reference

Control Module References for scan tool information

Diagnostic Aids

Inspect the serial data circuits and connections at the power steering 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.

Circuit/System Verification

1. Vehicle in Service Mode.
2. With a scan tool check the Power Steering Control Module for any DTCs.
 - **If any DTCs are present in the Power Steering Control Module**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** in Power Steering Diagnostic Information and Procedures.

- **If there are no DTCs are present in the Power Steering Control Module**
3. Verify that the steering gear assembly is not incorrectly installed.
 - **If the steering gear assembly is installed incorrectly**

Refer to **Electric Belt Drive Rack and Pinion Steering Gear Replacement**

- **If the steering gear assembly is installed correctly**

4. Perform the [Steering Wheel Angle Sensor Centering](#) procedure.

- If the Steering Angle Sensor Centering procedure corrected the DTC

Proceed to step 7

- If the Steering Angle Sensor Centering procedure did not correct the DTC

5. Verify that the inflatable restraint and sensing diagnostic module is installed correctly.

- If inflatable restraint and sensing diagnostic module is not installed correctly

Refer to [Airbag Sensing and Diagnostic Module Replacement](#)

- If inflatable restraint and sensing diagnostic module is installed correctly

6. Replace the K17 Electronic Brake Control Module.

7. All OK

Repair Instructions

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

- [Electric Belt Drive Rack and Pinion Steering Gear Replacement](#)
- [Control Module References](#) for module replacement, programming and setup.

DTC C106A OR C106B: 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 C106A

Pump Motor Relay Circuit Low

DTC C106B

Pump Motor Relay Circuit High

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ Terminal 1	C0256 04, C12E6 00	C0256 04, C12E600	-	-
B+ Terminal 30	C0256 04, C12E6 00	C0256 04, C12E6 00	-	-
Ground Terminal 14	-	C056D 00, C12DA00, C12D7 00	-	-
Ground Terminal 46	-	U0129 00, U1833 00	-	-

Circuit/System Description

Battery positive voltage is supplied to the electronic brake control module at all times through a 60 A fuse located in the underhood fuse block. The electronic brake control module uses this voltage to power the pump motor. 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 or the action control system operation is required the electronic brake control module activates the pump motor relay and turns the pump motor ON.

Conditions for Running the DTC

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

Conditions for Setting the DTC

C106A

The electronic brake control module detects the ABS pump motor relay circuit is shorted to ground.

C106B

The electronic brake control module detects the ABS pump motor relay circuit is shorted to voltage.

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 Service Brake Assist and Service StabiliTrak messages are 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.

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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 Testing

1. Vehicle 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 the ground circuit terminals listed below and ground:
 - Terminal 14
 - Terminal 46

- **If 10 Ω or greater**

1. Vehicle 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. Vehicle in Service Mode.

4. Verify that a test lamp illuminates between the B+ circuit terminals listed below and ground.

- Terminal 1
- Terminal 30

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Vehicle OFF.

2. Test for less than 2 Ω in the B+ circuit end to end.

- If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**

5. Vehicle in Service Mode.

6. Verify that a test lamp illuminates between the ignition circuit terminal 17 and ground.

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Vehicle OFF.

2. Test for less than 2 Ω in the ignition circuit end to end.

- If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**

7. 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 C106D-C106F OR C1070: VALVE 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 C106D

Valve Relay Circuit

DTC C106E

Valve Relay Circuit Performance

DTC C106F

Valve Relay Circuit Low

DTC C1070

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ Terminal 1	C0256 04, C12E6 00	C0256 04, C12E6 00	-	-
B+ Terminal 30	C0256 04, C12E6 00	C0256 04, C12E6 00	-	-
Ground Terminal 14	-	C056D 00, C12DA 00, C12D7 00	-	-
Ground Terminal 46	-	U0129 00, U1833 00	-	-

Circuit/System Description

Battery positive voltage is supplied to the electronic brake control module at all times through a 60 A fuse located in the underhood fuse block. The electronic brake control module uses this voltage to power the pump motor. 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 or the action control system operation is required the electronic brake control module activates the pump motor relay and turns the pump motor ON.

Conditions for Running the DTC

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

Conditions for Setting the DTC**C106D**

The electronic brake control module detects the valve relay has not switched ON successfully.

C106E

The electronic brake control module detects the valve relay is exposed to fatal error to avoid damage.

C106F

The electronic brake control module detects the valve relay circuit is shorted to ground.

C1070

The electronic brake control module detects the valve relay circuit is shorted to voltage.

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 Service Brake Assist and Service StabiliTrak messages are 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.

Schematic Reference

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Vehicle 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 the ground circuit terminals listed below and ground:
 - Terminal 14
 - Terminal 46
 - **If 10 Ω or greater**
 1. Vehicle 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. Vehicle in Service Mode.
4. Verify that a test lamp illuminates between the B+ circuit terminals listed below and ground.
 - Terminal 1
 - Terminal 30
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**
5. Vehicle in Service Mode.
6. Verify that a test lamp illuminates between the ignition circuit terminal 17 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates

7. 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 C10AC: BRAKE SYSTEM CALCULATED COMPONENT OVERHEAT

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 C10AC 00

Brake System Calculated Component Overheat

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 500°C (932°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 C10AC 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

Schematic Reference

[Antilock Brake System Schematics](#)

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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 C10AC 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 C10C0 OR C10C4: YAW RATE 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 C10C0 00

Yaw Rate Circuit Performance

DTC C10C4 00

Yaw Rate 1-2 Not Plausible

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

Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

The yaw rate acceleration signal is not plausible with the vehicle acceleration.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Verify the K36 Inflatable Restraint Sensing and Diagnostic Module is installed correctly.

- **If loose or incorrect installation**

Correct the installation of the component.

- **If installed correctly**

1. Perform the **Vehicle Yaw Sensor Learn** .

2. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.
 - If the DTC sets, replace the K36 Inflatable Restraint Sensing and Diagnostic Module.
3. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.
 - If the DTC sets, replace the K17 Electronic Brake Control Module.
 - 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 or Inflatable Restraint Sensing and Diagnostic 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.

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- **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**

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 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

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

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Antilock Brake System Schematics

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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. 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 C112B: ACTIVE BRAKE SYSTEM PERFORMANCE

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 C112B

Active Brake System Performance

Circuit/System Description

The Electronic Brake Control Module detects that there has been no pressure increase for a period of time.

Conditions for Running the DTC

- Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

The Electronic Brake Control Module detects that there has been no pressure increase for a period of time.

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 Service Brake Assist and Service StabiliTrak messages are 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

- Accelerating to 60 KPH and maintaining this speed for 5 s with no pressure increase noted by the electronic brake control module.
- 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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ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify the DTC does not set while operating the vehicle under the Conditions for Running the DTC.
 - **If the DTC sets**

Replace the K17 Electronic Brake Control Module.
 - **If the DTC does not set**
2. 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 C112F: ISOLATION VALVE PERFORMANCE

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 C112F

Isolation Valve Performance

Circuit/System Description

The electronic brake control module calculates and monitors the internal temperature of the brake pressure modulator valves. In most cases the high temperatures are caused by extended traction control activation. If the electronic brake control module calculates that the brake pressure modulator valves temperatures are too high, the electronic brake control module will temporarily suspend the traction control system function until the brake pressure modulator valves cool down.

Conditions for Running the DTC

Vehicle ON or in Service Mode.

Conditions for Setting the DTC

The electronic brake control module detects the calculated temperature of the brake pressure modulator valves is higher than 195°C (383°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 C112F 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

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 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 C112F 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 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 Sensed 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

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- [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 C1203: INVALID DATA RECEIVED FROM INTEGRATED CHASSIS CONTROL MODULE

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 C1203

Invalid Data Received From Integrated Chassis Control Module

Circuit/System Description

The electronic shift braking request data is delivered from the chassis 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 electronic shift braking request signal value is not a continuous successor of the previous value.

Action Taken When the DTC Sets

The DTC is stored in memory. No indicators or service messages are 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.

Reference Information

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- [Wiring Repairs](#)

Scan Tool Reference

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

Diagnostic Aids

Inspect the chassis control module for any DTCs.

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C1203.

- **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 C124C-C124E OR C1269: LEFT/RIGHT FRONT/REAR WHEEL SPEED SENSOR INCORRECT MOUNTING

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 C124C

Left Front Wheel Speed Sensor Incorrect Mounting

DTC C124D

Right Front Wheel Speed Sensor Incorrect Mounting

DTC C124E

Left Rear Wheel Speed Sensor Incorrect Mounting

DTC C1269

Right Rear Wheel Speed Sensor Incorrect Mounting

Diagnostic Fault Information

Component	Condition	DTC

Component	Condition	DTC
Wheel Speed Sensor	• Loose or improperly mounted sensor • Physical damage • Debris on the wheel speed sensor or the encoder ring • Loose or worn wheel bearing • Air gap between the wheel speed sensor and the encoder ring too large • Water intrusion in the wiring harness	C0555, C0556, C0557, C0558

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors and encoder rings. The encoder rings consist of permanent magnets located in the hub. As the wheel spins the magnetic encoder ring rotates and passes by the wheel speed sensor head; which generates a sign wave in the wheel speed sensor. 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. The electronic brake control module uses the frequency of the signals to calculate the wheel speeds.

Conditions for Running the DTC

- Vehicle On or Vehicle in Service Mode
- Ignition voltage is greater than 10 V.

Conditions for Setting the DTC

C124C, C124D, C124E, C1269

- Loose or improperly mounted sensor
- The tone ring may be demagnetized
- Water intrusion in the wiring harness
- 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 tone ring too large
- Electrical magnetic interference with the wheel speed sensor harness

Actions Taken when the DTC Sets

- The ABS indicator turns ON.
- The traction/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 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.

Diagnostic Aids

- Do not use a magnet to clean the wheel speed sensor magnetic encoder ring.
- Inspect the wheel speed sensor magnetic encoder ring for debris or corrosion.
- If two or more wheel speed sensors are inoperative, diagnose each wheel speed sensor individually.

- If any of the DTCs are set, refer to the Diagnostic Fault Information table for possible mechanical faults or conditions.
- If the customer comments that the ABS indicator is ON only during moist environmental conditions (rain, snow, vehicle wash, etc.), inspect the wheel speed sensor wiring for signs of water intrusion.

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Scan Tool Reference

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

Circuit/System Verification

1. Test drive the vehicle in a straight line at a speed greater than 20 km/h (13 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 DTCs C0500-C0504, C0506-C0510, C050A, C050C-C050F or C0512-C0516 are not set.
 - **If any listed DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **If none of the listed DTCs are set**
3. 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**
Replace the appropriate B5 Wheel Speed Sensor.
 - **If no contamination, physical damage, incorrect installation or the wrong component is not diagnosed**
4. Replace the K17 Electronic Brake Control Module.

Repair Instructions

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

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

DTC C1251: LATERAL ACCELERATION SENSOR PERFORMANCE

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 C1251

Lateral Acceleration Sensor Performance

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

Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

The yaw rate acceleration signal is not plausible with the vehicle acceleration.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

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- [Wiring Repairs](#)

Scan Tool Reference

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

Circuit/System Testing

1. Verify the K36 Inflatable Restraint Sensing and Diagnostic Module is installed correctly.

- **If loose or incorrect installation**

Correct the installation of the component.

- **If installed correctly**

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

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

- If the DTC sets, replace the K36 Inflatable Restraint Sensing and Diagnostic Module.

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

- If the DTC sets, replace the K17 Electronic Brake Control Module.
- 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 or Inflatable Restraint Sensing and Diagnostic Module replacement, programming and setup.

DTC C1259: POWERTRAIN AUTOMATIC BRAKING REQUEST 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 C1259

Powertrain Automatic Braking Request Message Counter Incorrect

Circuit/System Description

The automatic braking request signal 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 automatic braking request 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

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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 C1259.

- **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 C1268: ACCELERATOR PEDAL OVERRIDE ACTIVE 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 C1268

Accelerator Pedal Override Active Message Counter Incorrect

Circuit/System Description

The accelerator pedal position 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 accelerator pedal position 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

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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 C1268.
 - **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 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.

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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

DTC C1286: COMMANDED AXLE TORQUE 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 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.

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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 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.

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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 C1288: AUTONOMOUS BRAKING ACCELERATOR ACTUAL POSITION STATUS 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 C1288

Autonomous Braking Accelerator Actual Position Status Message Counter Incorrect

Circuit/System Description

The autonomous braking accelerator actual position 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 autonomous braking accelerator actual position 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.

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Scan Tool Reference

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 C1288.

- **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 C1289: CHARGING SYSTEM PARK BRAKE AUTONOMOUS APPLY REQUEST 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 C1289

Charging System Park Brake Autonomous Apply Request Message Counter Incorrect

Circuit/System Description

The charging system park brake autonomous apply request data is delivered from the Hybrid Powertrain Control Module 2 (VICM) 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 charging system park brake autonomous apply 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

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 vehicle integration control modules for any DTCs.

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C1289.

- **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 C1445: SYSTEM DISABLED INFORMATION STORED TEMPERATURE HIGH

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 C1445 54

Circuit/System Description

The electronic brake control module receives data from other modules; engine control module, body control module, 14 V accessory power module, hybrid powertrain control module 1 and hybrid powertrain control module 2. The multi-axis acceleration sensor and the steering wheel angle sensor are needed to perform brake control functions. The module must ensure that all serial data and sensor inputs are properly received and learned.

Conditions for Running the DTC

- Ignition voltage is greater than 10 V.
- Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

DTC C1445 54

This diagnostics detects an over temperature condition with one of the twelve solenoids due to an extended ABS, traction control and vehicle stability event lasting more than 45 seconds.

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 Service Brake Assist and Service StabiliTrak messages are displayed on the driver information center.
- The electronic brake control module disables the ABS, 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

- It may take two Vehicle ON cycles to clear this 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

- Check for hydraulic leaks, air in the brake system or incorrect brake bleed.
- Excessive traction control event for greater than 45 seconds.

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](#)

DTC C1445 54

1. Verify DTC C1445 54 does not set while operating the vehicle under normal driving conditions.

NOTE: This diagnostic detects an over temperature condition with 1 of the 12 solenoids due to an extended ABS, traction control and vehicle stability event lasting more than 45 seconds. This does not indicate a failure with the Electronic Brake Control Module.

- If the DTC sets

Replace the K17 Electronic Brake Control Module.

- If the DTC does not set

2. 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 C144B: ELECTRONIC CONTROL UNIT SOFTWARE

[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 C144B

Electronic Control Unit Software

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

[Circuit/System Description](#)

The electronic brake control module determines that the electronic park brake portion of the module is programmed incorrectly.

[Conditions for Running the DTC](#)

- Vehicle ON or Vehicle in Service Mode.

[Conditions for Setting the DTC](#)

The electronic brake control module is not properly programmed.

[Action Taken When the DTC Sets](#)

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

- The Service Brake Assist and Service StabiliTrak messages are displayed in 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.

Diagnostic Aids

A newly replaced electronic brake control module can set one or more DTC on its initial vehicle in service mode 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. Vehicle in Service Mode.
2. Verify that DTC C144B is not set

- **If the DTC is set**

Program the K17 Electronic Brake Control Module. Refer to **Electronic Brake Control Module Programming and Setup (With HP9)** .

1. Verify the DTC does not reset.
 - If the DTC resets, replace the K17 Electronic Brake Control Module.
 - If the DTC does not reset

2. All OK

- **If the DTC does 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 C158F OR C1590-C1592: TRACTION CONTROL FRONT/REAR PRIME/ISOLATION SOLENOID VALVE 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 C158F

Traction Control Front Prime Solenoid Valve Circuit

DTC C1590

Traction Control Front Isolation Solenoid Valve Circuit

DTC C1591

Traction Control Rear Prime Solenoid Valve Circuit

DTC C1592

Traction Control Rear Isolation Solenoid Valve Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ Terminal 1	C0256 04, C12E6 00	C0256 04, C12E6 00	-	-
B+ Terminal 30	C0256 04, C12E6 00	C0256 04, C12E6 00	-	-
Ground Terminal 14	-	C056D 00, C12DA 00, C12D7 00	-	-
Ground Terminal 46	-	U0129 00, U1833 00	-	-

Circuit/System Description

The traction control prime (fill) and isolation (return) solenoid valves are located internally to the brake pressure modulator. The electronic brake control module activates the valve relay to supply voltage to the valve solenoids. This voltage is referred to as the system voltage. The electronic brake control module activates individual valve solenoids by grounding the valve solenoid control circuits. This verification is used to perform hydraulic checks at the normally open base brake valve, the front hydraulic circuit and the block.

Conditions for Running the DTC

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

Conditions for Setting the DTC

C158F

The electronic brake control module detects a general failure with the front hydraulic traction control circuit fill valve.

C1590

The electronic brake control module detects a general failure with the front hydraulic traction control circuit isolation valve.

C1591

The electronic brake control module detects a general failure with the rear hydraulic traction control circuit fill valve.

C1592

The electronic brake control module detects a general failure with the rear hydraulic traction control circuit isolation valve.

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 Service Brake Assist and Service StabiliTrak messages are 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 Testing

1. Vehicle 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 the ground circuit terminals listed below and ground:
 - Terminal 14
 - Terminal 46
 - **If 10 Ω or greater**

1. Vehicle 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. Vehicle in Service Mode.
4. Verify that a test lamp illuminates between the B+ circuit terminals listed below and ground.
 - Terminal 1
 - Terminal 30
 - **If the test lamp does not illuminate and the circuit fuse is good**
1. Vehicle OFF.
2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**
5. Vehicle in Service Mode.
6. Verify that a test lamp illuminates between the ignition circuit terminal 17 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
1. Vehicle OFF.
2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**
7. 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 C1594: ADAPTIVE CRUISE CONTROL BRAKING REQUEST - ACCELERATOR PEDAL POSITION NOT PLAUSIBLE

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 C1594

Adaptive Cruise Control Braking Request - Accelerator Pedal Position Not Plausible

Circuit/System Description

Adaptive cruise control is allowed via serial data inputs from various modules to the active safety control module. The adaptive cruise control braking request signal is delivered from the active safety 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 adaptive cruise control braking request 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](#)

Scan Tool Reference

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

Diagnostic Aids

- Inspect the active safety control module for any DTCs.
- Inspect the engine control module for any DTCs, specifically for accelerator pedal DTCs.

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that no other DTCs are set except for C1594.

- **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 P0560, P0562 OR P0563: SYSTEM VOLTAGE

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 P0560

System Voltage

DTC P0562

System Low Voltage

DTC P0563

System High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ Terminal 1	P0562	P0560	-	P0560
B+ Terminal 30	P0562	P0560	-	P0560
Ground Terminal 14	-	P0560	P0563	P0560
Ground Terminal 46	-	P0560	P0563	P0560

Circuit/System Description

The electronic brake control module monitors two different blocks of memory to determine its capability to control the system shutdown process.

Conditions for Running the DTC

Vehicle ON or Vehicle in Service Mode.

Conditions for Setting the DTC

- Keep alive voltage regulator not functional.
- Processor loses complete battery power.
- Battery voltage is under 9 V and the vehicle is not moving.

Action Taken When the DTC Sets

- A warning indicator may be displayed.
- A driver information center message may be displayed.
- The electronic brake control module disables ABS, traction control system and vehicle stability enhancement system for the duration of the drive cycle.

Conditions for Clearing the DTC

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

- The electronic brake control module clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

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

Check to ensure battery shunt is not opened.

Circuit/System Testing

1. Vehicle 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 the ground circuit terminals listed below and ground:
 - Terminal 14
 - Terminal 46
 - **If 10 Ω or greater**
 1. Vehicle 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. Vehicle in Service Mode.
4. Verify that a test lamp illuminates between the B+ circuit terminals listed below and ground.
 - Terminal 1
 - Terminal 30
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**
5. Vehicle in Service Mode.
6. Verify that a test lamp illuminates between the ignition circuit terminal 17 and ground.

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Vehicle OFF.
2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance or the short to ground 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 illuminates**
7. 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 P05FF: BRAKE PRESSURE SENSOR AND BRAKE PEDAL POSITION SENSOR CORRELATION

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 P05FF

Brake Pressure Sensor and Brake Pedal Position Sensor Correlation

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	-	-	-	P05FF
Brake Control Brake Pedal Position Sensor Circuit 1 Terminal 2	-	-	-	P05FF
Brake Control Brake Pedal Position Sensor Circuit 2 Terminal 4	-	-	-	P05FF
Low Reference	-	-	-	P05FF

Circuit/System Description

The electronic brake control module uses inputs from the electronic brake control brake pedal position sensor to determine when the brake is applied and how much force is used. The electronic brake control module monitors when the drivers foot is on the brake and locks the offset. The offset is locked when three out of the four inputs indicate the brake pedal is applied. The four inputs are brake pedal travel 1, brake pedal travel 2, master cylinder pressure sensor and the brake pedal position sensor. These inputs are used to determine the driver's braking intent which is used to the control amount of pressure applied to the wheels.

The brake pedal position sensor is serviced as part of the brake booster control module.

Conditions for Running the DTC

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

Conditions for Setting the DTC

- The electronic brake control module detects the brake pressure is high when the electronic brake control pedal position sensor is reading low travel.
- The electronic brake control module detects the brake pressure is low when the electronic brake control pedal position sensor is reading high travel.

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 Service Brake Assist and Service StabiliTrak messages are 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

NOTE: The 12 V battery must be able to maintain a charge during this brake sensor performance procedure. It is recommended that a charger/maintainer or equivalent be used to maintain proper battery voltage during this procedure.

1. Vehicle in Service Mode with the transmission in PARK.
2. Perform the Electronic Brake Control Module Learn procedure with a scan tool.

NOTE: Do not depress the brake pedal during the Electronic Brake Control Module Learn.

3. Vehicle ON, apply and release the brake pedal.

NOTE: To ensure the complete brake modulator and high pressure

accumulator pressure relief procedure is allowed to occur; the brake controller must see 1 pedal apply with the propulsion system enabled, followed by a proper shutdown without applying the brake pedal.

4. Vehicle OFF, without applying the brake pedal.

NOTE: Vehicle OFF, without applying the brake pedal ensure the brake modulator and high pressure accumulator pressure relief occurs. This process will take approximately 1-3 minutes.

5. Remove the remote keyless entry transmitter and close all of the vehicle doors. Wait approximately 1-3 minutes until the brake modulator and the high pressure accumulator pressure relief is complete and the vehicle powers down.

6. Vehicle in Service Mode, brakes not applied.

7. Verify the scan tool parameters listed below are within the specified range:

- Brake Controls Brake Pedal Position Sensor 5 V Supply Voltage - Between 4.75-5.25 V.
- Brake Controls Brake Pedal Position Sensor Circuit 1 - Between 1.4-1.7 V
- Brake Controls Brake Pedal Position Sensor Circuit 2 - Between 58-78%
- **If any parameter is not within the specified range**

Refer to Circuit/System Testing.

- **If all parameters are within the specified range**

8. Verify the scan tool parameters listed below are less the specified range:

- Brake Master Cylinder Pressure Sensor - Less than 100 kPa (15 psi)
- Brake Pressure Sensor - Less than 100 kPa (15 psi)
- High Pressure Accumulator Sensor - Less than 800 kPa (116 psi)
- **If any parameter is greater than the specified range**

Replace the Q5 Brake Pressure Modulator.

- **If all parameters are less than the specified range**

9. Perform a brake hydraulic system test, refer to [Hydraulic Brake System Diagnosis](#) .

- **If the brake hydraulic system test does not pass**

Repair as necessary.

- **If the brake hydraulic system tests normal**

10. Replace the Q5 Brake Pressure Modulator.

11. 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**

12. All OK.

Circuit/System Testing

1. Perform the brake hydraulic check, refer to [Hydraulic Brake System Diagnosis](#) .

2. Vehicle OFF, disconnect the harness connector at the B201 Brake Control Brake Pedal Position Sensor.

3. Test for less than 5 Ω between the low reference circuit terminal 3 and ground.

- **If 5 Ω or greater**

1. Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K17 Electronic Brake Control Module.
- **If less than 5 Ω**
4. Vehicle in Service Mode.
5. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
 - **If less than 4.8 V**
 1. Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
 2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K17 Electronic Brake Control Module.
 - **If greater than 5.2 V**
 1. Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, vehicle in service mode.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K17 Electronic Brake Control Module.
 - **If between 4.8-5.2 V**
6. Verify the scan tool Brake Controls Brake Pedal Position Sensor Circuit 1 parameter is less than 1 V.
 - **If 1 V or greater**
 1. Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, vehicle in service mode.
 2. Test for less than 1 V between the signal circuit terminal 2 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K17 Electronic Brake Control Module.
 - **If less than 1 V**
7. Install a 3 A fused jumper wire between the signal circuit terminal 2 and the 5 V reference circuit terminal 1.
8. Verify the scan tool Brake Controls Brake Pedal Position Sensor Circuit 1 parameter is greater than 4.5 V.
 - **If 4.5 V or less**
 1. Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
 2. Test for infinite resistance between the signal circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 K17 Electronic Brake Control Module.
 - **If greater than 4.5 V**
9. Verify the scan tool Brake Controls Brake Pedal Position Sensor Circuit 2 parameter is greater than 80%.
 - **If 80% or less**

1. Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
2. Test for infinite resistance between the signal circuit terminal 4 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K17 Electronic Brake Control Module.
- **If greater than 80%**
10. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the low reference circuit terminal 3.
11. Verify the scan tool Brake Controls Brake Pedal Position Sensor Circuit 2 is less than 10%.
 - **If 10% or greater**
 1. Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, vehicle in service mode.
 2. Test for less than 1 V between the signal circuit terminal 4 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Vehicle OFF.
 4. 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 K17 Electronic Brake Control Module.
 - **If less than 10%**
12. Replace the K177 Brake Booster Control Module.

Repair Instructions

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

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

DTC P0601-P0604, P0606, P060B OR P062F: CONTROL MODULE MEMORY

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](#) provide an overview of each diagnostic category.

DTC Descriptors

DTC P0601

Control Module Read Only Memory Performance

DTC P0602

Control Module - Calibration Set Not Programmed

DTC P0603

Control Module Long Term Memory Reset

DTC P0604

Control Module Random Access Memory Performance

DTC P0606

Control Module Processor Performance

DTC P060B

DTC P062F

Control Module Long Term Memory Performance

Circuit/System Description

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

Conditions for Running the DTC

- Vehicle ON or Vehicle in Service Mode.
- Ignition voltage is between 8 V and 16 V.

Conditions for Setting the DTC

The EBCM detects an internal failure or incomplete programming for more than 10 s.

Action 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 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

Diagnostic Aids

Low voltage or a momentary loss of power or ground to the EBCM may cause a DTC to set. Verify the following:

- The battery cables are clean and tight and the battery is fully charged.
- The EBCM ground circuits do not have an open or high resistance.
- The EBCM power circuits do not have an open, short to ground or high resistance.

Circuit/System Verification

1. Vehicle in Service Mode, clear the DTC information with a scan tool.
2. Verify no other DTCs are set.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.
 - **If no other DTCs are set**
3. Verify DTC P0602 is not set.
 - **If the DTCs is set**
 1. Program the K17 Electronic Brake Control Module. Refer to [Control Module References](#).
 2. Verify DTC P0602 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 none of the DTCs are set**
4. Verify DTC P0601, P0603, P0604, P0606 or P062F is not set.
 - **If any of the DTCs are set**
Replace the K17 Electronic Brake Control Module.
 - **If none of the DTCs are 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 P0856: TRACTION CONTROL TORQUE REQUEST 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 P0856

Traction Control Torque Request Circuit

Circuit/System Description

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

Conditions for Running the DTC

Engine running.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- The traction/stability control indicator turns ON.
- The electronic brake control module disables the traction control and 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 indicator in the next ignition 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 Testing

1. Verify that no other DTCs are set except for P0856.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **If only DTC P0856 is set**
2. Replace the K20 Engine 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 K17 Electronic Brake 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 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

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 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**

- **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.

DTC P215A: VEHICLE SPEED-WHEEL SPEED CORRELATION

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 P215A

Vehicle Speed-Wheel Speed Correlation

Diagnostic Fault Information

Component	Condition	DTC
Wheel Speed Sensor	• Loose or improperly mounted sensor • Physical damage • Debris on the wheel speed sensor or the encoder ring • Loose or worn wheel bearing • Air gap between the wheel speed sensor and the encoder ring too large • Water intrusion in the wiring harness • Incorrect wheel/tire combination	C0555, C0556, C0557, C0558, P215A

Circuit/System Description

The wheel speeds are detected by active wheel speed sensors and encoder rings. The encoder rings consist of permanent magnets located in the hub. As the wheel spins the magnetic encoder ring rotates and passes by the wheel speed sensor head; which generates a sign wave in the wheel speed sensor. 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. The electronic brake control module uses the frequency of the signals to calculate the wheel speeds.

Conditions for Running the DTC

- Vehicle On or Vehicle in Service Mode
- Ignition voltage is greater than 10 V.

Conditions for Setting the DTC

P215A

- Loose or improperly mounted sensor
- The tone ring may be demagnetized
- Water intrusion in the wiring harness
- 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 tone ring too large
- Electrical magnetic interference with the wheel speed sensor harness

Actions Taken when the DTC Sets

- The ABS indicator turns ON.
- The traction/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 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.

Diagnostic Aids

- Do not use a magnet to clean the wheel speed sensor magnetic encoder ring.
- Inspect the wheel speed sensor magnetic encoder ring for debris or corrosion.
- If two or more wheel speed sensors are inoperative, diagnose each wheel speed sensor individually.
- If any of the DTCs are set, refer to the Diagnostic Fault Information table for possible mechanical faults or conditions.
- If the customer comments that the ABS indicator is ON only during moist environmental conditions (rain, snow, vehicle wash, etc.), inspect the wheel speed sensor wiring for signs of water intrusion.
- An incorrect wheel and tire size or mounting issue may also cause DTC P215A to set.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

ABS Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs

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

Scan Tool Reference

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

Circuit/System Verification

1. Test drive the vehicle in a straight line at a speed greater than 20 km/h (13 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 DTCs C0500-C0504, C0506-C0510, C050A, C050C-C050F or C0512-C0516 are not set.
 - **If any listed DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **If none of the listed DTCs are set**
3. 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**
Replace the appropriate B5 Wheel Speed Sensor.
 - **If no contamination, physical damage, incorrect installation or the wrong component is not diagnosed**
4. Replace the K17 Electronic Brake Control Module.

Repair Instructions

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

- [Front Wheel Speed Sensor Replacement](#)
- [Rear Wheel Speed Sensor Replacement](#)
- [Control Module References](#) for Electronic Brake Control Module replacement, programming and setup

DTC P2299: BRAKE PEDAL POSITION/ACCELERATOR PEDAL POSITION INCOMPATIBLE

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 P2299

Brake Pedal Position/Accelerator Pedal Position Incompatible

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 P2299 may set if the brake pedal is applied while accelerating.
- Diagnose all other stop lamp DTCs or Symptoms prior to performing this diagnostic procedure.

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 P2299.

- 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

SYMPTOMS - ANTILOCK BRAKE SYSTEM

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

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

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the ABS. Refer to [Checking Aftermarket Accessories](#) .
- Inspect the easily accessible or visible system components, for obvious damage or conditions, which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to [Testing for Intermittent Conditions and Poor Connections](#) .

Symptom List

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

- [ABS Indicator Malfunction](#)
- [Traction Control/Stability Control Indicator Malfunction](#)

ABS INDICATOR MALFUNCTION

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.

- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

Circuit/System Description

The instrument cluster turns ON the ABS indicator for 5 seconds after Vehicle in Service Mode or when the electronic brake control module detects a fault and 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. Vehicle in Service Mode.
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 seconds after the ignition is turned ON.
 - **If the ABS indicator does not turn OFF**
Replace the K17 electronic brake control module.
 - **If the ABS indicator turns OFF**
5. All OK.

Repair Instructions

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

[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.

Circuit Description

The instrument cluster illuminates the traction/stability control 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.

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

When the ignition is turned ON, the traction/stability control indicator lamp should illuminate, then after 5 seconds it should turn OFF.

1. Vehicle in Service Mode.
2. Verify the instrument cluster traction/stability control indicator turns ON and OFF when commanding the All Indicators ON and OFF with a scan tool.
 - **If the indicator does not turn ON and OFF**

Replace the P16 Instrument Cluster.
 - **If the indicator turns ON and OFF**
3. All OK.

Repair Instructions

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

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

REPAIR INSTRUCTIONS

CONNECTOR RECONNECTION - WHEEL SPEED SENSOR

Special Tools

EL-35616 Terminal Test Probe Kit

For equivalent regional tools, refer to [Special Tools](#).

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Loose, corroded or painted terminal stud/fastener
- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- A terminal not seated all the way into the connector body
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.
- Wiring which has been pinched, cut or its insulation rubbed through may cause an intermittent open or short as the bare area touches other wiring or parts of the vehicle.
- Wiring that comes in contact with hot or exhaust components
- Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to [Testing for Electrical Intermittents](#) for test procedures to detect intermittent open, high resistance, short to ground and short to voltage conditions.
- Refer to [Scan Tool Snapshot Procedure](#) for advanced intermittent diagnosis and Vehicle Data Recorder operation.

Testing for Terminal Fretting

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease / lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor

connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals and connector body.
3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses and any intermediate connections between the voltage source and the module/component. A test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) and [Power Distribution Schematics](#).
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point (screw or stud). Inspect the connections at the component and in splice packs, where applicable. Operate the

component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) and [Ground Distribution Schematics](#) .

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection or high electrical load
 - Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to [Checking Aftermarket Accessories](#) .
- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:
 - A new service control module is installed.
 - A control module from another vehicle is installed.
 - Revised software/calibration files have been released for this vehicle.
- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to [Control Module References](#) for replacement, setup and programming.

NOTE: **DO NOT re-program the control module with the SAME software/calibration files that are already present in the control**

module. This is not an effective repair for any type of concern.

ANTILOCK BRAKE SYSTEM AUTOMATED BLEED

WARNING: Refer to [Brake Fluid Irritant Warning](#) .

CAUTION: Refer to [Brake Fluid Effects on Paint and Electrical Components Caution](#) .

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

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

The ABS Automated Bleed Procedure uses a scan tool to cycle the system solenoid valves and run the pump in order to purge any air from the secondary circuits. These circuits are normally closed off and are only opened during system initialization at vehicle start up and during ABS operation. The automated bleed procedure opens these secondary circuits and allows any air trapped in these circuits to flow out toward the brake corners.

Performing the Automated Bleed Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .

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.

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

- If a DTC is detected, refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) and diagnose the appropriate DTC.
 - If the brake pedal feels spongy, perform the conventional brake bleed procedure again. Refer to [Hydraulic Brake System Bleeding \(Manual\) Hydraulic Brake System Bleeding \(Pressure\)](#).
14. When the desired pedal height is achieved, press the brake pedal to inspect for firmness.
 15. Lower the vehicle.
 16. Remove the scan tool.
 17. If the vehicle is equipped with push button start, remove the vehicle from Service Only Mode.
 - Do not apply the brake pedal.
 - Press the ignition mode switch once and release.
 - The ignition mode switch will no longer be illuminated.
 - The vehicle may be started normally.
 18. Install the tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#).
 19. Inspect the brake fluid level. Refer to [Master Cylinder Reservoir Filling](#).
 20. Road test the vehicle while inspecting that the pedal remains high and firm.

STEERING 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
- Electronic brake 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

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.

1. Place the ignition switch in the OFF position.
2. Engine Wiring Harness Fuse Block Bracket Â» Remove - **Engine Wiring Harness Fuse Block Bracket Replacement**
3. Thoroughly clean the electronic brake control module (EBCM) to brake pressure modulator valve (BPMV) area of any accumulated dirt and debris.
4. Disconnect the EBCM electrical connector.
5. Brake Pressure Modulator Valve Primary Brake Pipe Fitting (1)Â» Disconnect

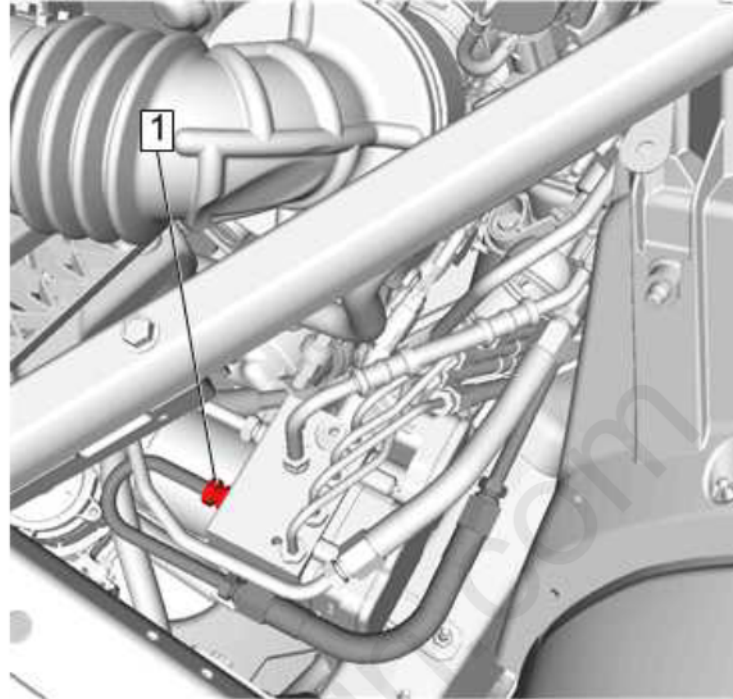


Fig. 3: Brake Pressure Modulator Valve Primary Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

6. Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.
7. Electronic Brake Control Module Bolt (1)Â» Remove [2x]

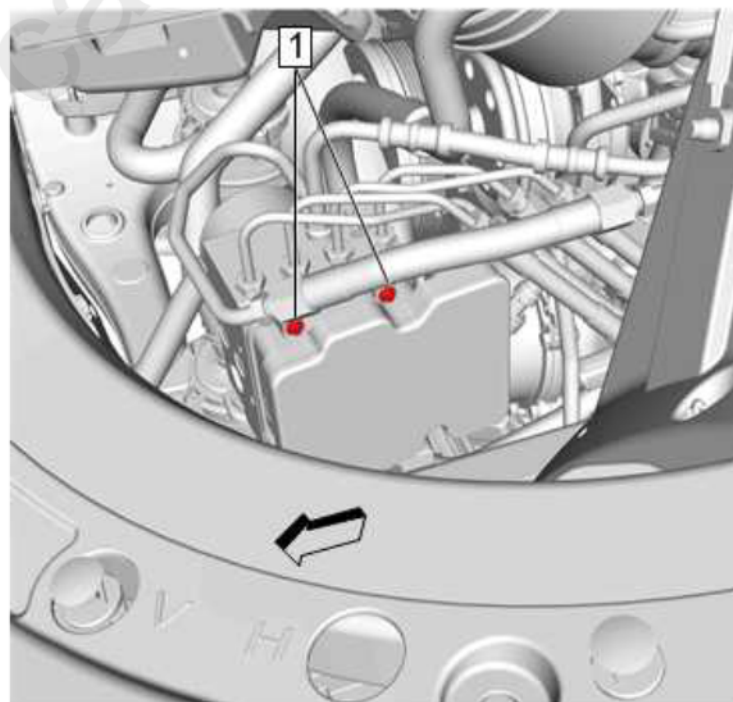


Fig. 4: Electronic Brake Control Module Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Electronic Brake Control Module (1) A» Remove

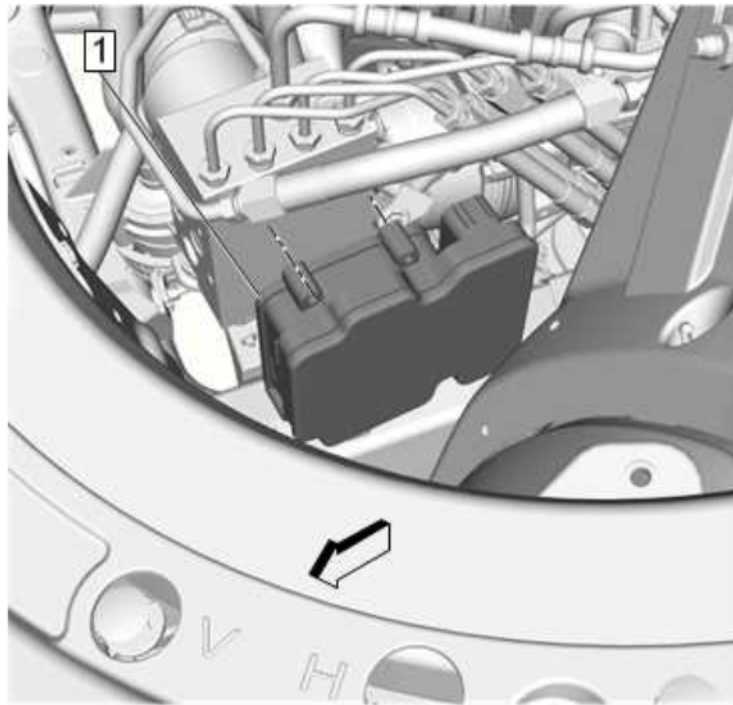


Fig. 5: Electronic Brake Control Module
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Electronic Brake Control Module (1) A» Install

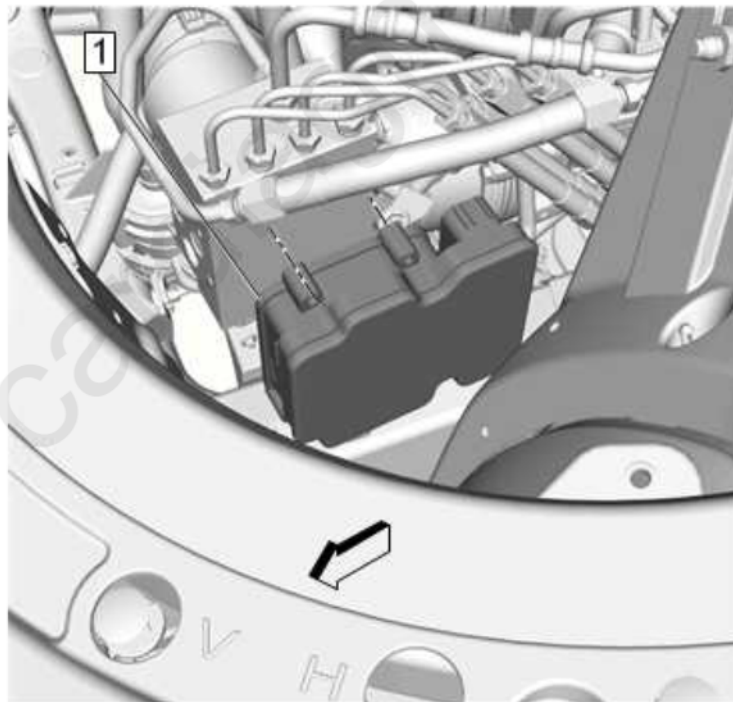


Fig. 6: Electronic Brake Control Module
Courtesy of GENERAL MOTORS COMPANY

2. Electronic Brake Control Module Bolt (1) A» Install and tighten 3 N.m (27 lb in) [2x]

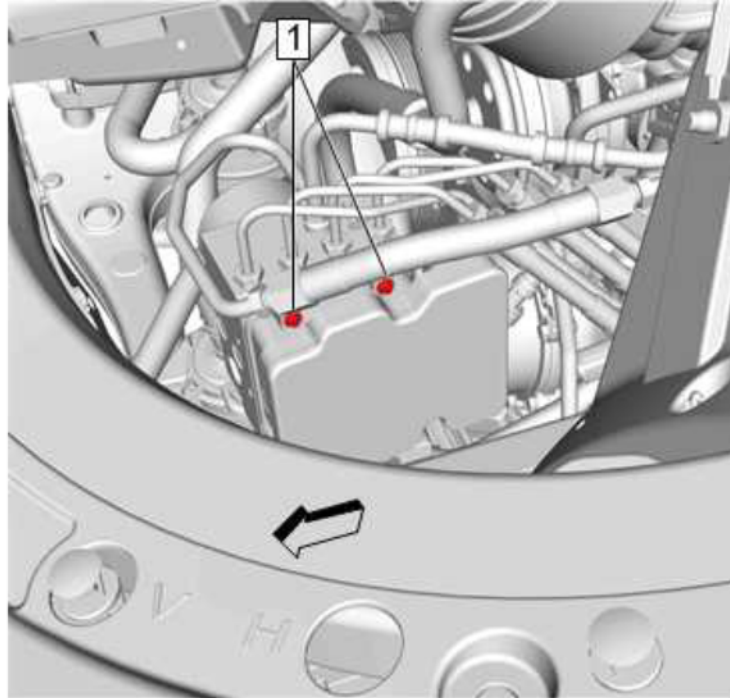


Fig. 7: Electronic Brake Control Module Bolt
 Courtesy of GENERAL MOTORS COMPANY

CAUTION: Fastener Caution

3. Brake Pressure Modulator Valve Primary Brake Pipe Fitting (1) » Install and tighten 32 N.m (24 lb ft)

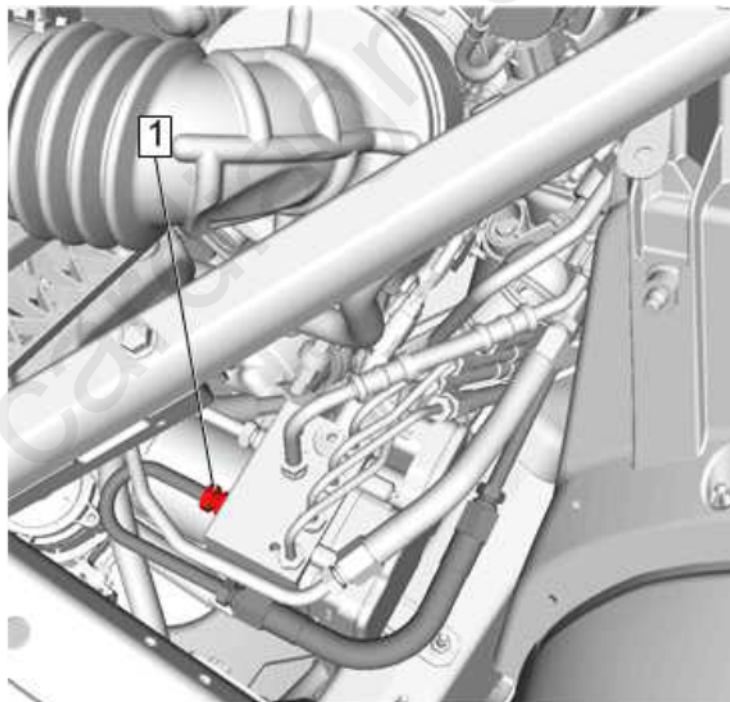


Fig. 8: Brake Pressure Modulator Valve Primary Brake Pipe Fitting
 Courtesy of GENERAL MOTORS COMPANY

4. Connect the EBCM electrical connector.
5. Bleed the brake system. Refer to Antilock Brake System Automated Bleed
6. Engine Wiring Harness Fuse Block Bracket » Install - Engine Wiring Harness Fuse Block Bracket Replacement
7. Program the EBCM. Refer to Control Module References
8. Center the steering angle sensor. Refer to Steering Wheel Angle Sensor Centering

ELECTRONIC BRAKE BOOSTER CONTROL MODULE REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Fluid Irritant Warning](#) .

CAUTION: Refer to [Brake Fluid Effects on Paint and Electrical Components Caution](#) .

CAUTION: Do not lift or carry the electric brake booster by the input rod, electrical connectors or master cylinder reservoir. Failure to follow these steps may damage the electric brake booster.

CAUTION: If there is no brake fluid in the master cylinder, remove one of the brake booster fuses before applying the brake pedal. Failure to do so may damage the electric brake booster.

1. Place the ignition switch in the OFF position.
2. Remove one of the electronic brake booster control module fuses from the engine compartment fuse block.
3. Instrument Panel Lower Trim Panel Insulator - Left Side» Remove - [Instrument Panel Lower Trim Panel Insulator Replacement - Left Side](#)
4. Brake Pedal Retainer (1) @ Brake Pedal (2)» Release

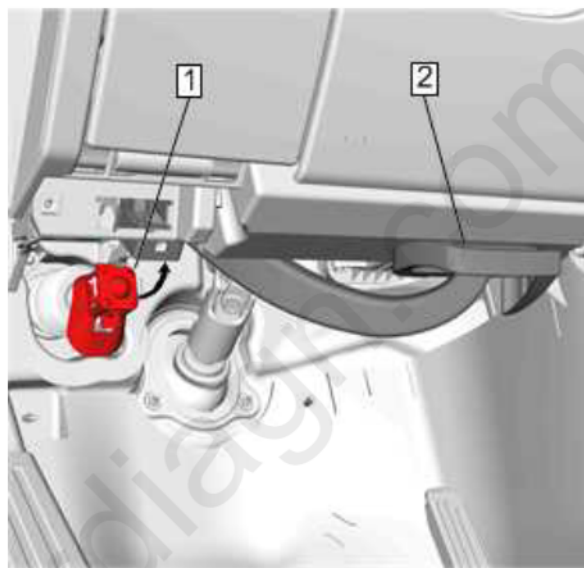


Fig. 9: Brake Pedal Retainer

Courtesy of GENERAL MOTORS COMPANY

NOTE: Pull the brake pedal rearward to disconnect the retainer.

5. Brake Pedal Retainer» Remove and DISCARD
6. Brake Master Cylinder (1)» Remove - [Master Cylinder Replacement \(With HP9\)](#)

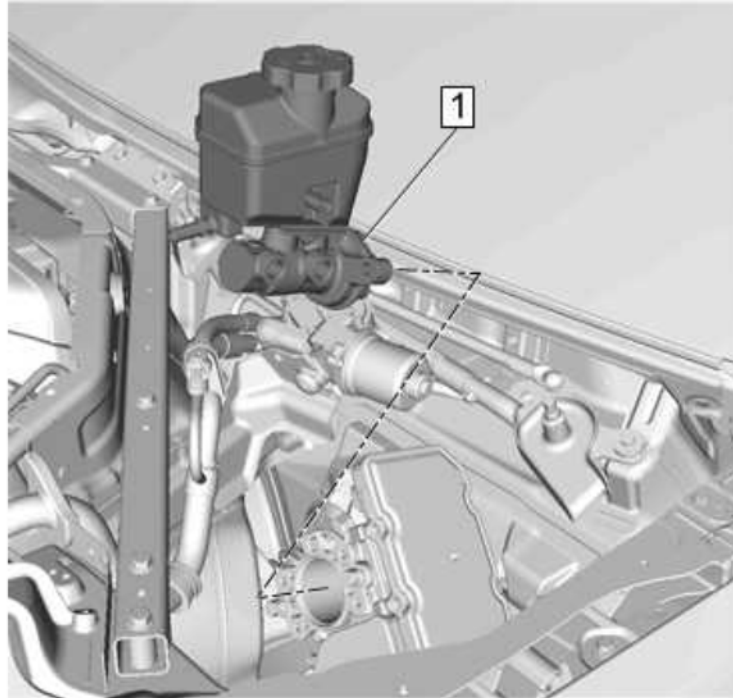


Fig. 10: Brake Master Cylinder

Courtesy of GENERAL MOTORS COMPANY

7. Disconnect the electronic brake booster control module electrical connectors.
8. Electronic Brake Booster Control Module Bolt (1) » Loosen [2x]

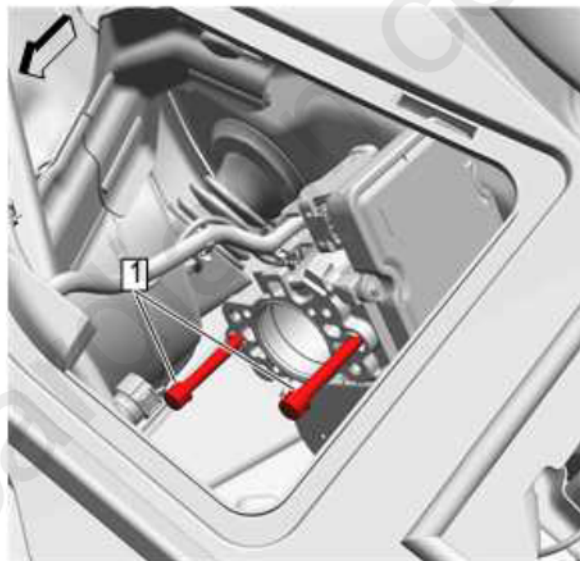


Fig. 11: Electronic Brake Booster Control Module Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: Support the electronic brake booster control module while fully loosening the bolts.

9. Electronic Brake Booster Control Module (1) » Remove

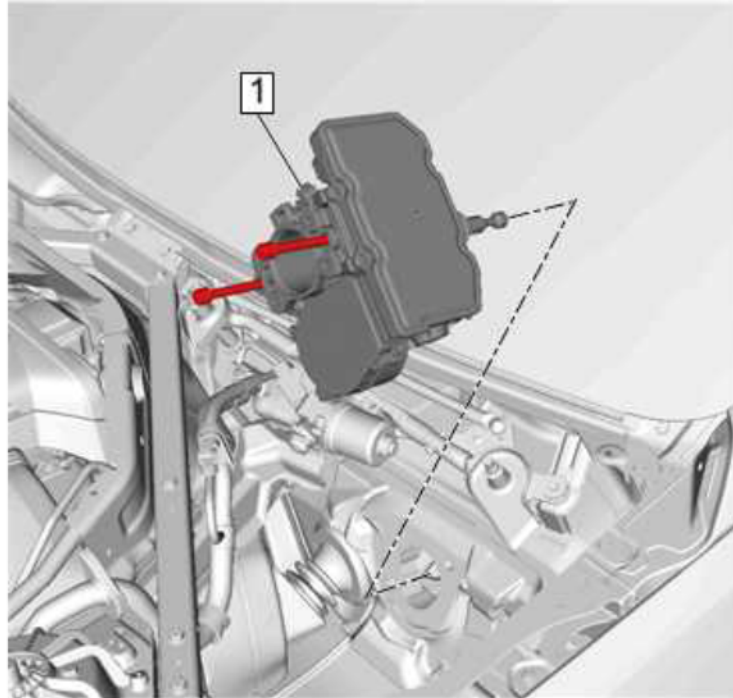


Fig. 12: Electronic Brake Booster Control Module
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Electronic Brake Booster Control Module (1)» Install

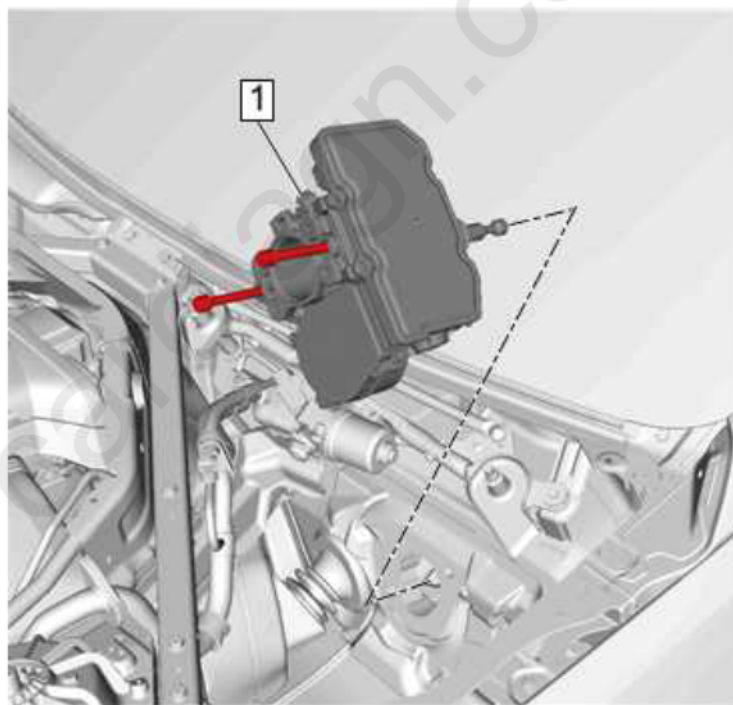


Fig. 13: Electronic Brake Booster Control Module
Courtesy of GENERAL MOTORS COMPANY

2. Electronic Brake Booster Control Module Bolt (1)» Install and tighten [2x] 22 N.m (16 lb ft)

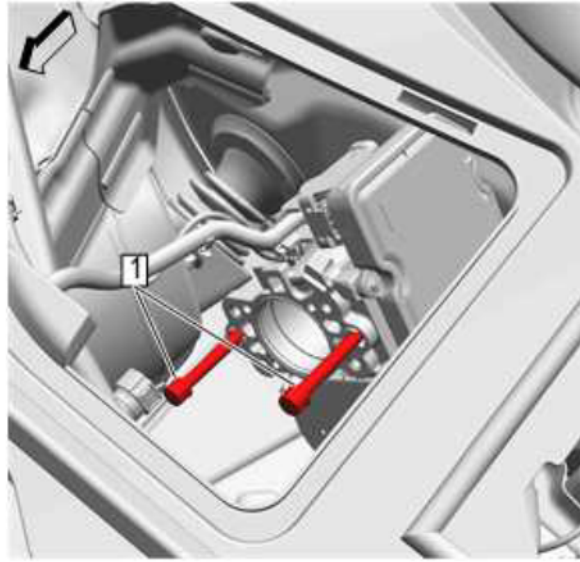


Fig. 14: Electronic Brake Booster Control Module Bolts

Courtesy of GENERAL MOTORS COMPANY

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

NOTE: Support the electronic brake booster control module while tightening the bolts.

3. Connect the electronic brake booster control module electrical connectors.
4. Brake Pedal Retainer (1)» Install NEW

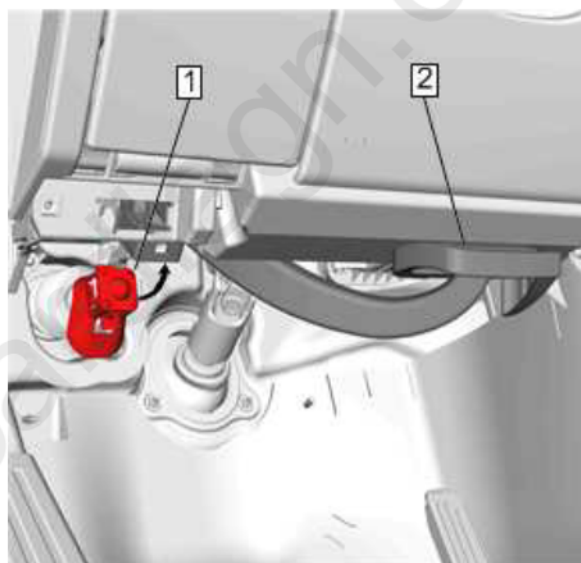


Fig. 15: Brake Pedal Retainer

Courtesy of GENERAL MOTORS COMPANY

5. Brake Pedal (2)» Secure
6. Brake Master Cylinder (1)» Install - [Master Cylinder Replacement \(With HP9\)](#)

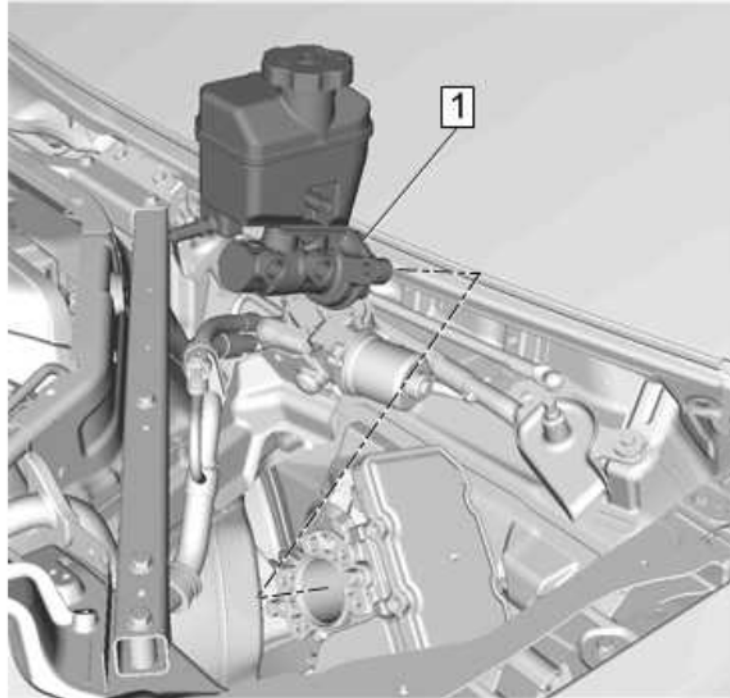


Fig. 16: Brake Master Cylinder

Courtesy of GENERAL MOTORS COMPANY

7. Install the electronic brake booster control module fuse to the engine compartment fuse block.
8. Bleed the hydraulic brake system. Refer to [Hydraulic Brake System Bleeding \(Manual\)](#)
[Hydraulic Brake System Bleeding \(Pressure\)](#)
9. Program and calibrate the electronic brake booster control module. Refer to [Control Module References](#)

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.

1. Place the ignition switch in the OFF position.
2. Engine Wiring Harness Fuse Block Bracket» Remove - [Engine Wiring Harness Fuse Block Bracket Replacement](#)
3. Thoroughly clean the electronic brake control module (EBCM) to brake pressure modulator valve (BPMV) area of any accumulated dirt and debris.
4. Disconnect the EBCM electrical connector.
5. Brake Pressure Modulator Valve Primary Brake Pipe Fitting (1)» Disconnect

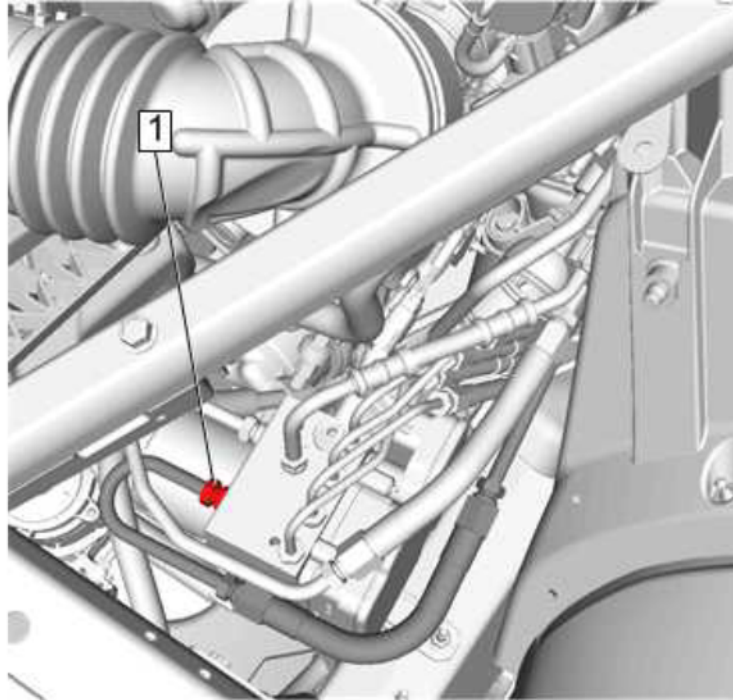


Fig. 17: Brake Pressure Modulator Valve Primary Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

6. Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.
7. Brake Pressure Modulator Valve Secondary Brake Pipe Fitting (1)» Disconnect

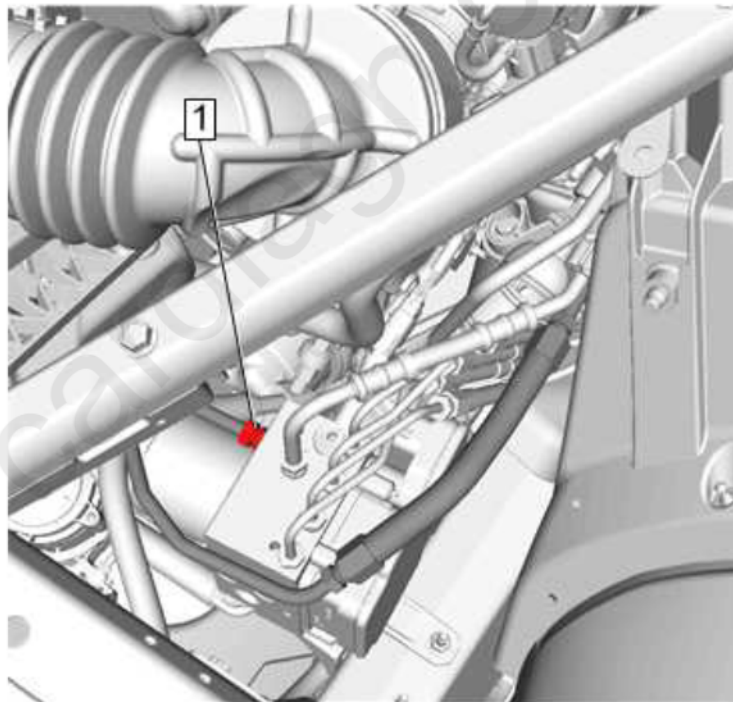


Fig. 18: Brake Pressure Modulator Valve Secondary Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

8. Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.
9. Brake Pressure Modulator Valve Low Pressure Brake Pipe Fitting (1)» Disconnect

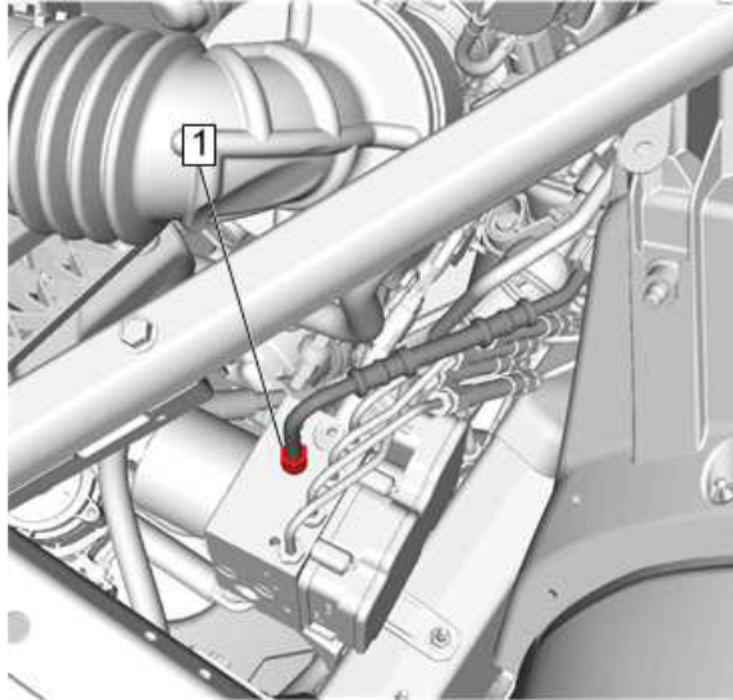


Fig. 19: Brake Pressure Modulator Valve Low Pressure Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

10. Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.
11. Brake Pipe Fitting (Left Front) (1) » Disconnect

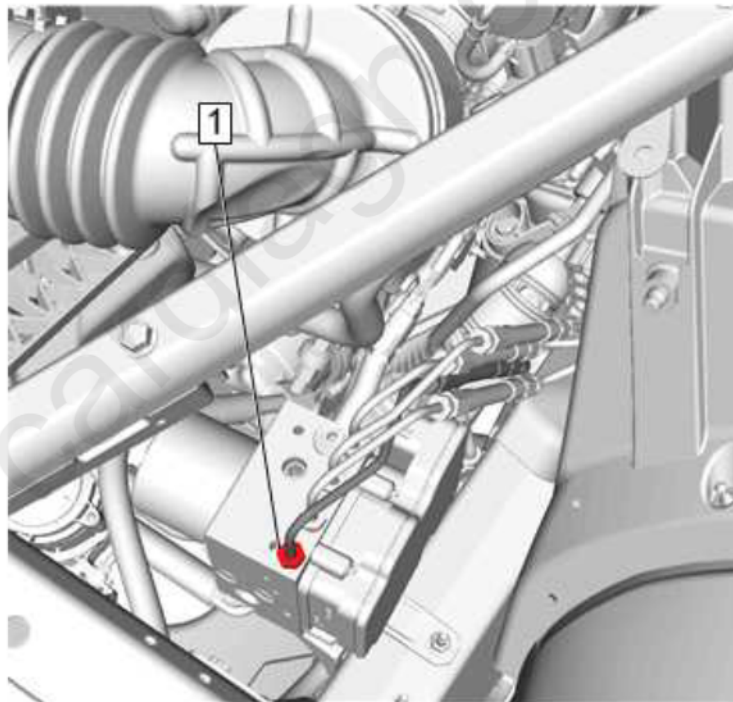


Fig. 20: Brake Pipe Fitting (Left Front)
Courtesy of GENERAL MOTORS COMPANY

12. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.
13. Brake Pipe Fitting (Right Front) (1) » Disconnect

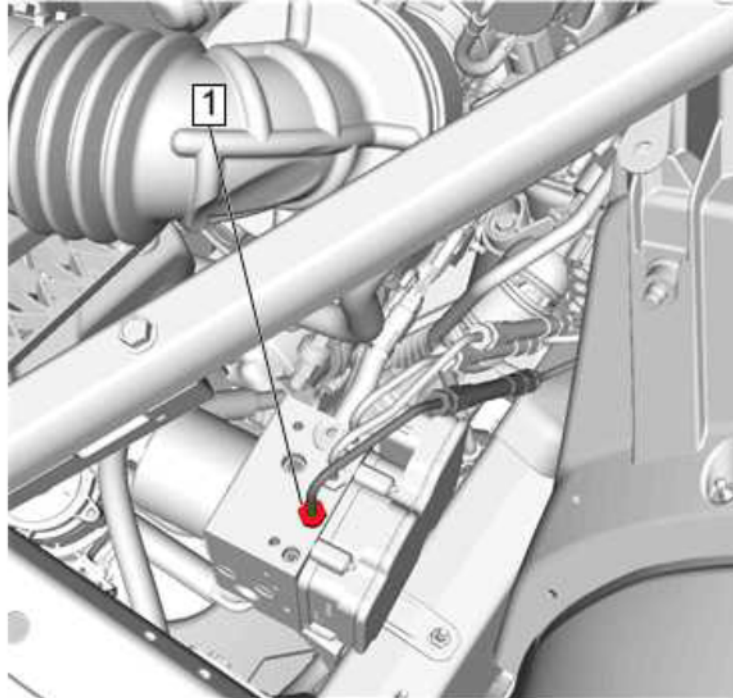


Fig. 21: Brake Pipe Fitting.(Right Front)

Courtesy of GENERAL MOTORS COMPANY

14. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.
15. Brake Pipe Fitting (Left Rear) (1)» Disconnect

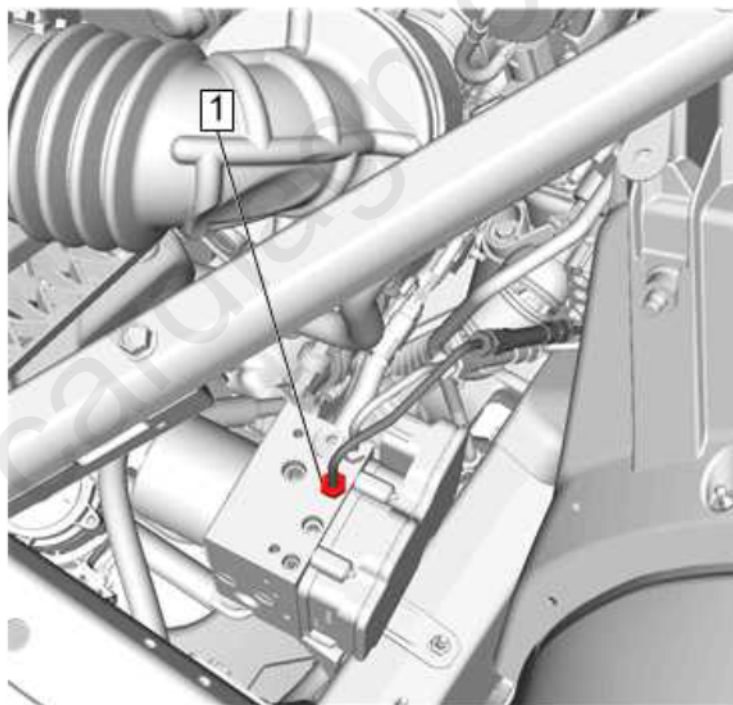


Fig. 22: Brake Pipe Fitting.(Left Rear)

Courtesy of GENERAL MOTORS COMPANY

16. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.
17. Brake Pipe Fitting (Right Rear) (1)» Disconnect

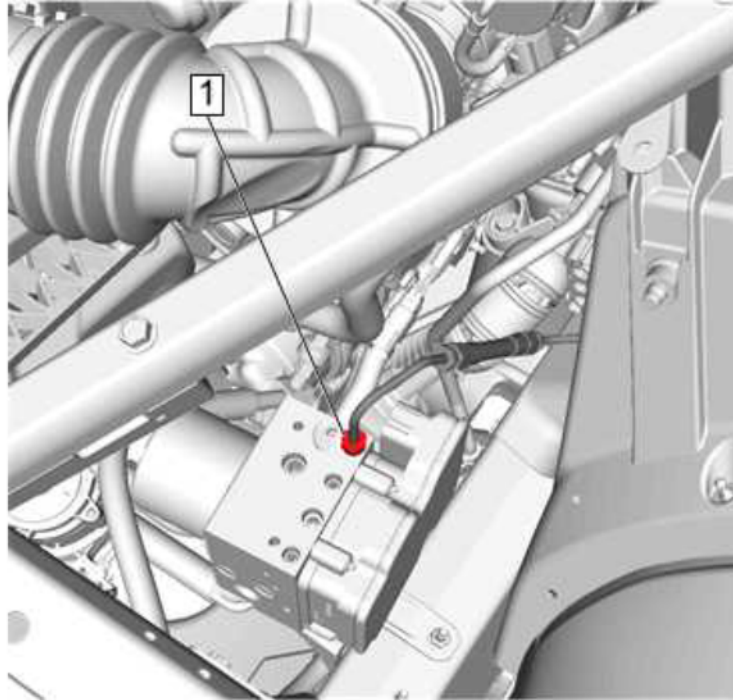


Fig. 23: Brake Pipe Fitting (Right Rear)

Courtesy of GENERAL MOTORS COMPANY

18. Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.
19. Brake Pressure Modulator Valve Bracket Nut (1) » Remove

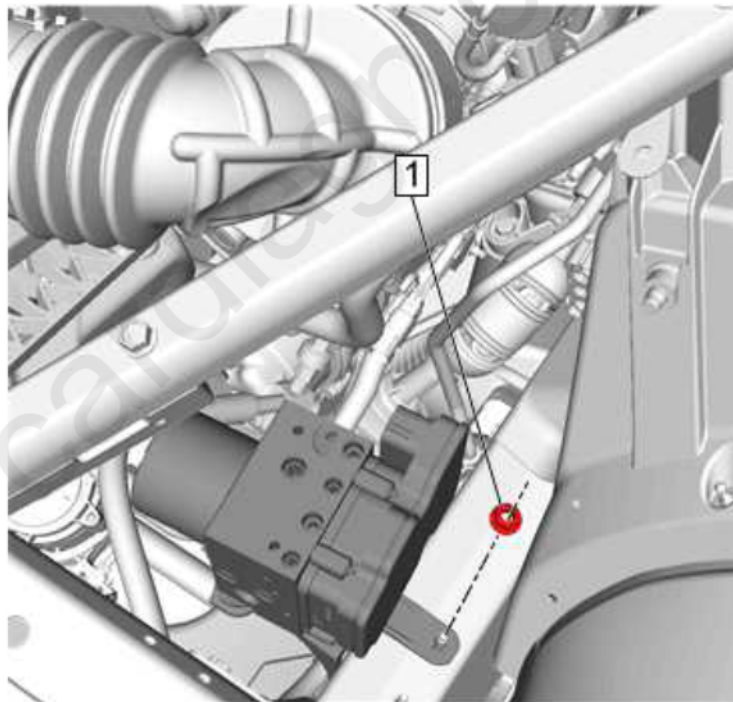


Fig. 24: Brake Pressure Modulator Valve Bracket Nut

Courtesy of GENERAL MOTORS COMPANY

20. Brake Pressure Modulator Valve Bracket Bolt (1) » Loosen

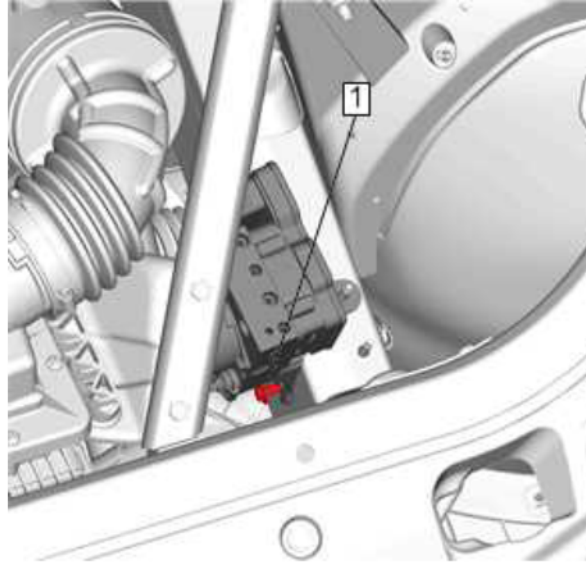


Fig. 25: Brake Pressure Modulator Valve Bracket Bolt
 Courtesy of GENERAL MOTORS COMPANY

21. Brake Pressure Modulator Valve Bracket Bolt (1) » Loosen

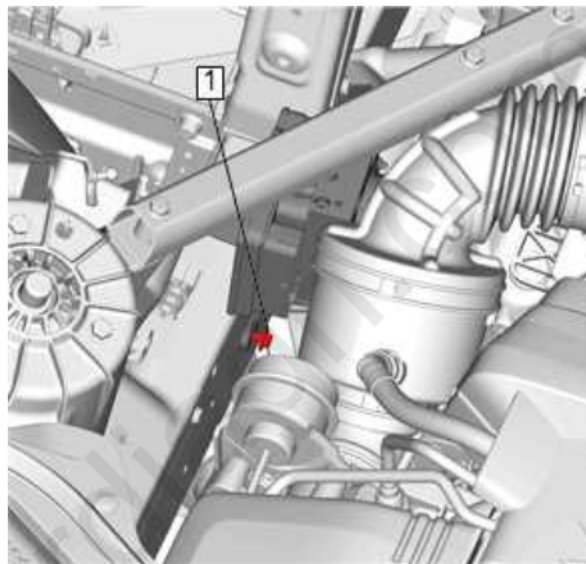
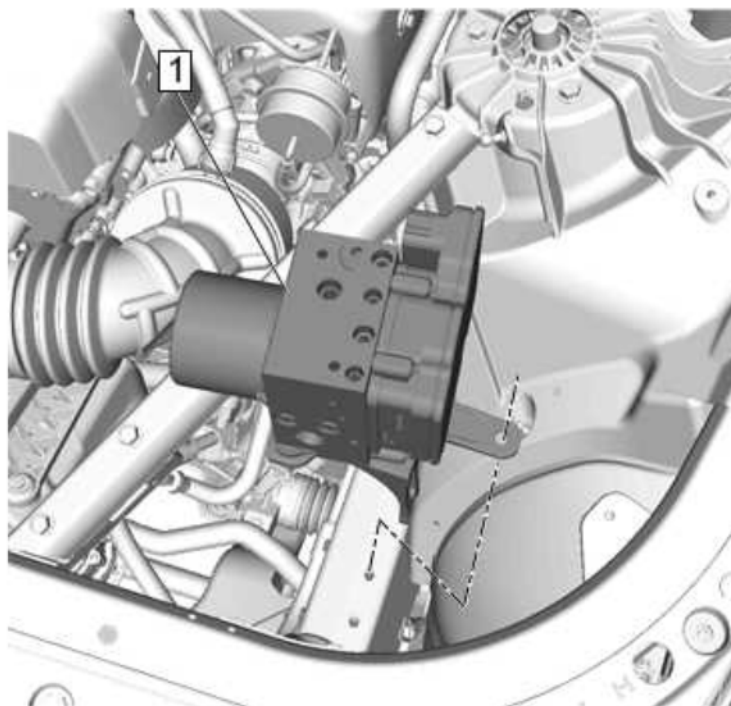


Fig. 26: Brake Pressure Modulator Valve Bracket Bolt
 Courtesy of GENERAL MOTORS COMPANY

22. Brake Pressure Modulator Valve Assembly (1) » Remove



Installation Procedure

1. Brake Pressure Modulator Valve Assembly (1)» Install

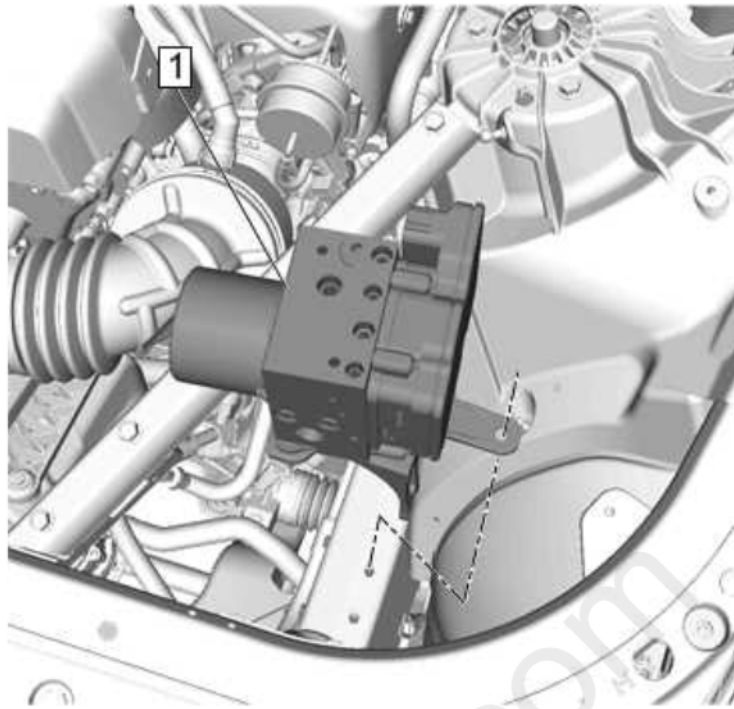


Fig. 28: Brake Pressure Modulator Valve Assembly.
Courtesy of GENERAL MOTORS COMPANY

2. Brake Pressure Modulator Valve Bracket Bolt (1)» Install and tighten 9 N.m (80 lb in)

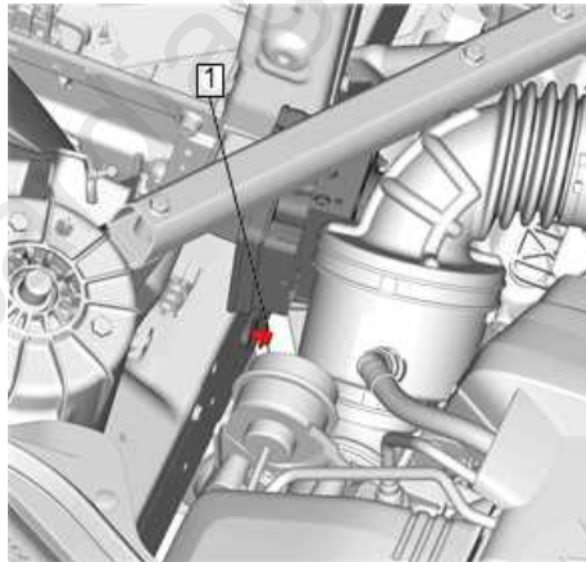


Fig. 29: Brake Pressure Modulator Valve Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: **Fastener Caution**

3. Brake Pressure Modulator Valve Bracket Bolt (1)» Install and tighten 9 N.m (80 lb in)

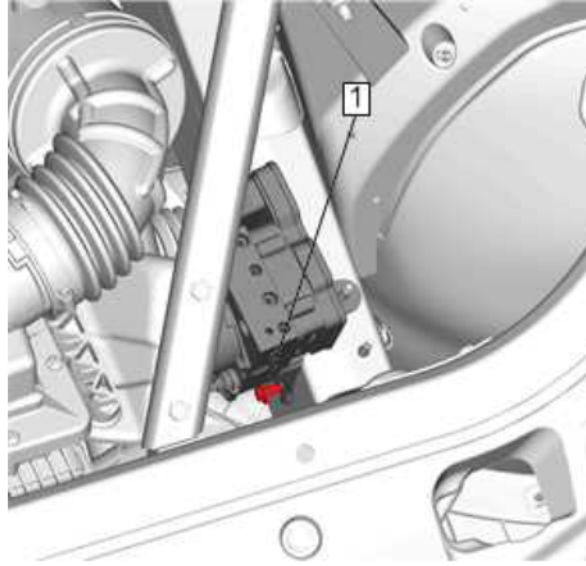


Fig. 30: Brake Pressure Modulator Valve Bracket Bolt
 Courtesy of GENERAL MOTORS COMPANY

4. Brake Pressure Modulator Valve Bracket Nut (1) » Install and tighten 9 N.m (80 lb in)

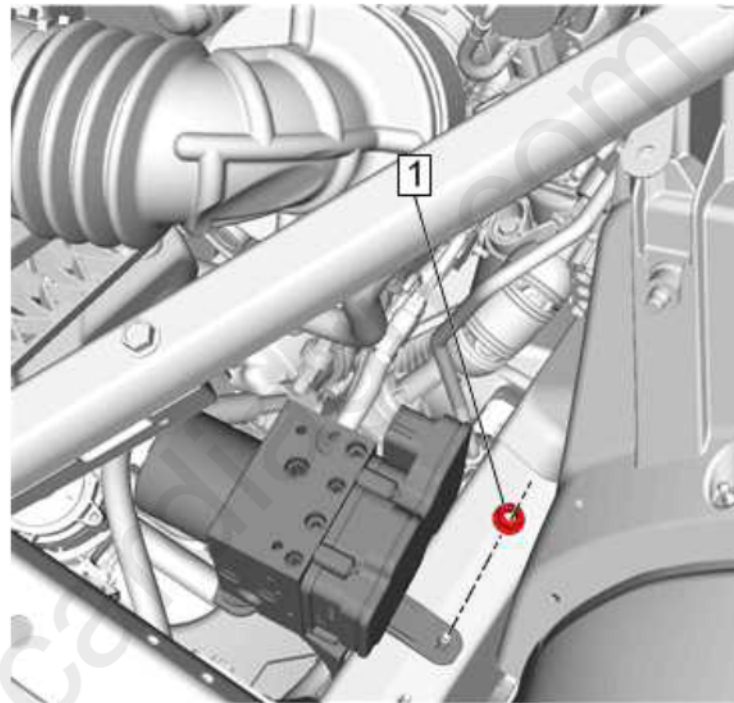


Fig. 31: Brake Pressure Modulator Valve Bracket Nut
 Courtesy of GENERAL MOTORS COMPANY

5. Brake Pipe Fitting (Right Rear) (1) » Install and tighten 19 N.m (14 lb ft)

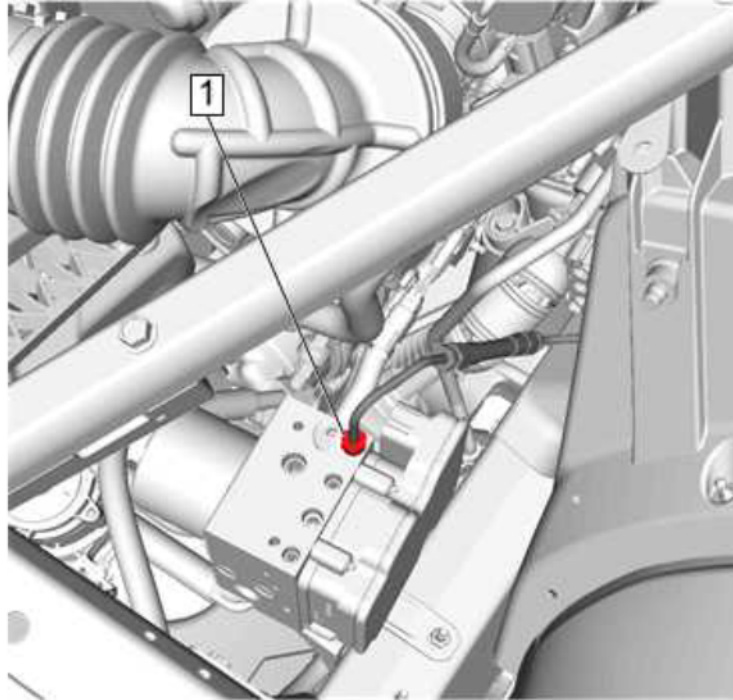


Fig. 32: Brake Pipe Fitting (Right Rear)

Courtesy of GENERAL MOTORS COMPANY

6. Brake Pipe Fitting (Left Rear) (1) » Install and tighten 19 N.m (14 lb ft)

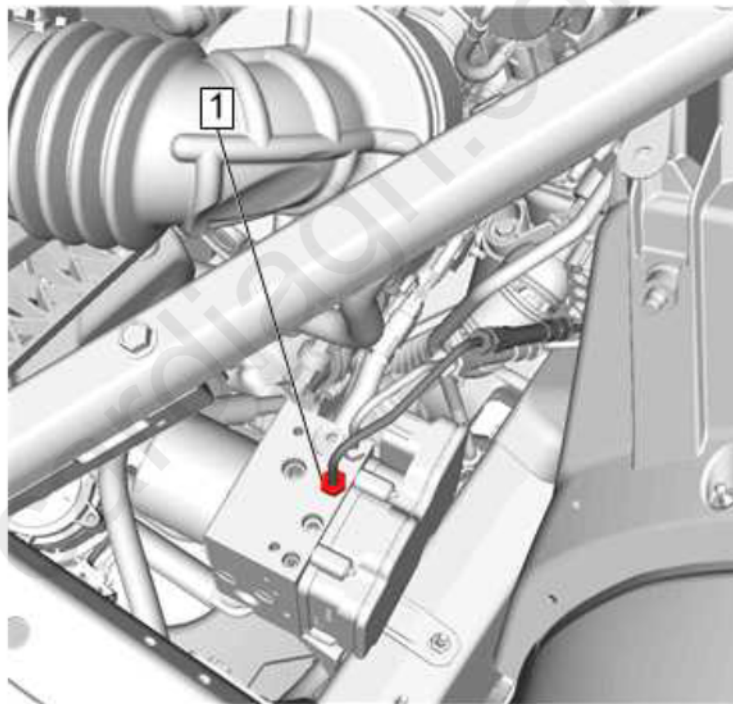


Fig. 33: Brake Pipe Fitting (Left Rear)

Courtesy of GENERAL MOTORS COMPANY

7. Brake Pipe Fitting (Right Front) (1) » Install and tighten 19 N.m (14 lb ft)

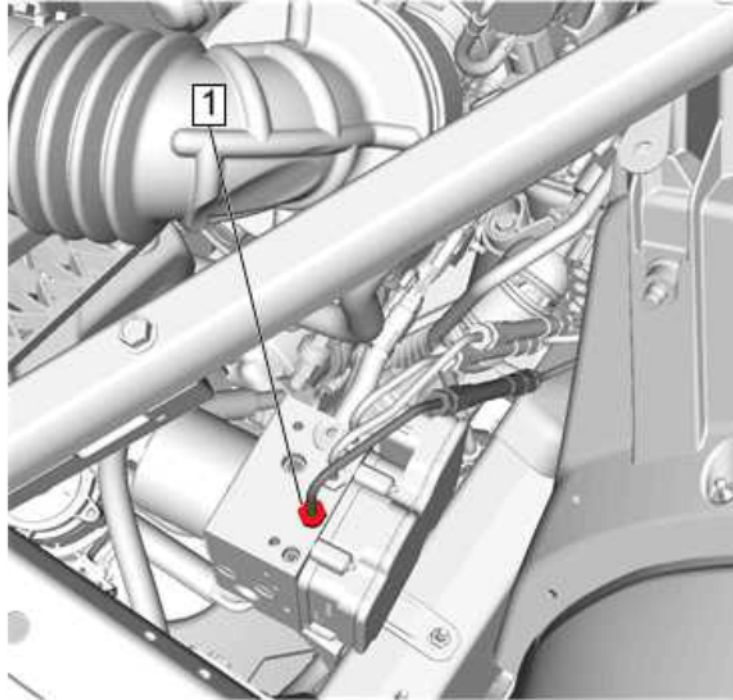


Fig. 34: Brake Pipe Fitting (Right Front)

Courtesy of GENERAL MOTORS COMPANY

8. Brake Pipe Fitting (Left Front) (1) » Install and tighten 19 N.m (14 lb ft)

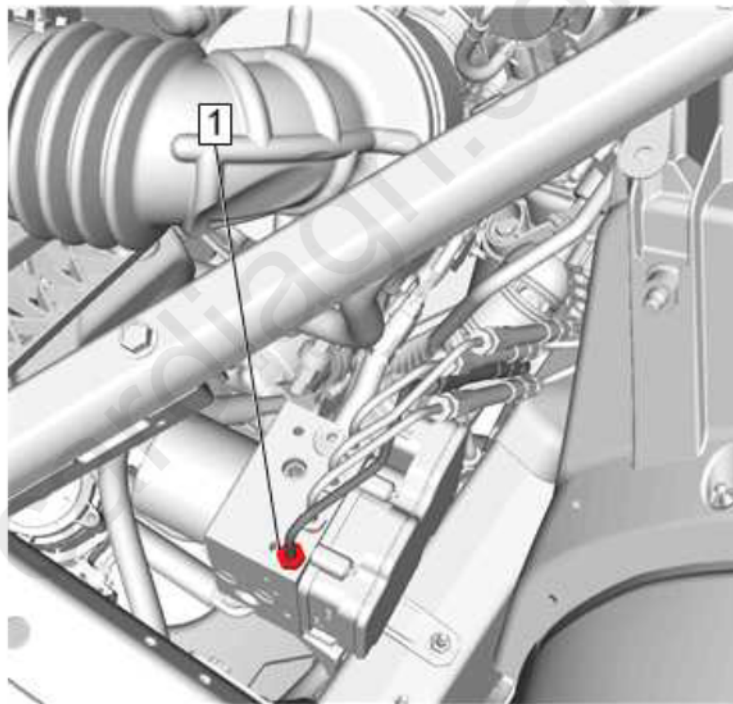


Fig. 35: Brake Pipe Fitting (Left Front)

Courtesy of GENERAL MOTORS COMPANY

9. Brake Pressure Modulator Valve Low Pressure Brake Pipe Fitting (1) » Install and tighten 32 N.m (24 lb ft)

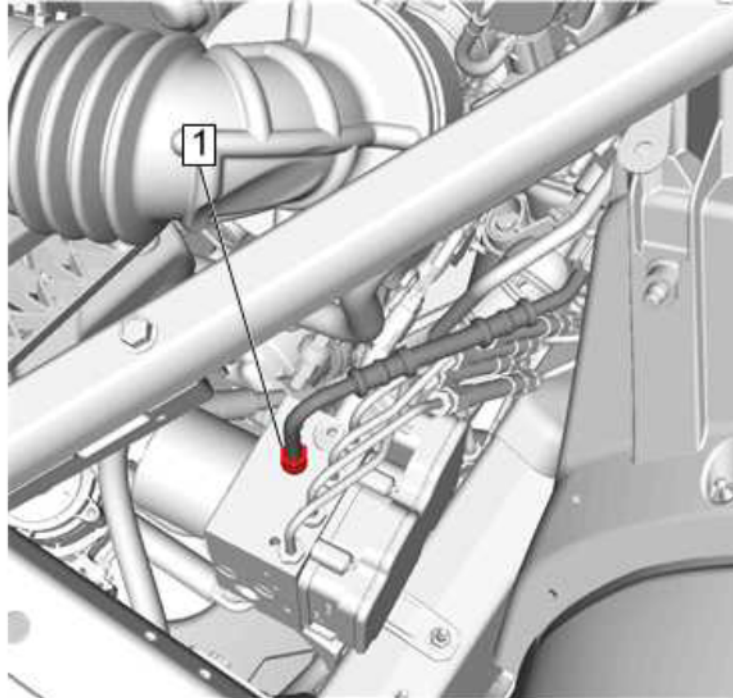


Fig. 36: Brake Pressure Modulator Valve Low Pressure Pipe Fitting
 Courtesy of GENERAL MOTORS COMPANY

10. Brake Pressure Modulator Valve Secondary Brake Pipe Fitting (1)» Install and tighten 32 N.m (24 lb ft)

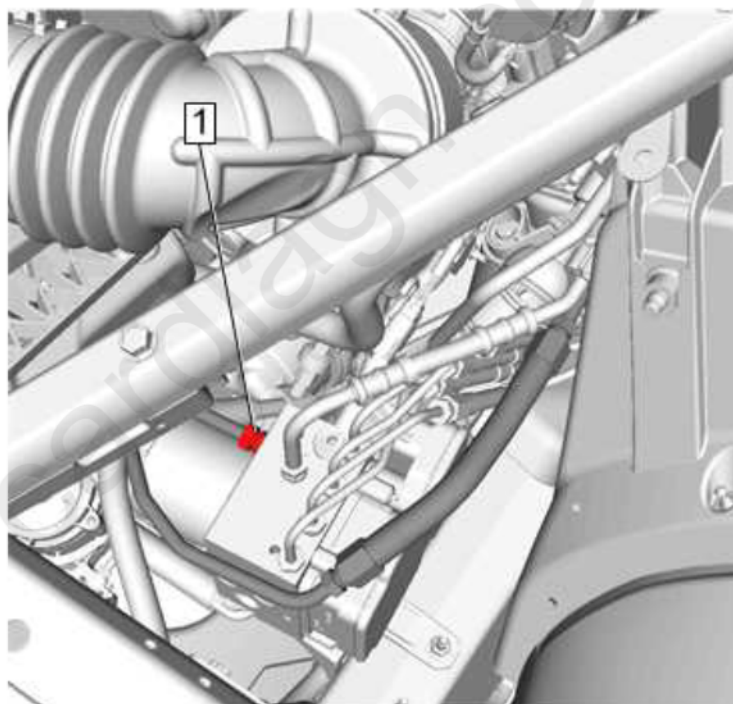


Fig. 37: Brake Pressure Modulator Valve Secondary Brake Pipe Fitting
 Courtesy of GENERAL MOTORS COMPANY

11. Brake Pressure Modulator Valve Primary Brake Pipe Fitting (1)» Install and tighten 32 N.m (24 lb ft)

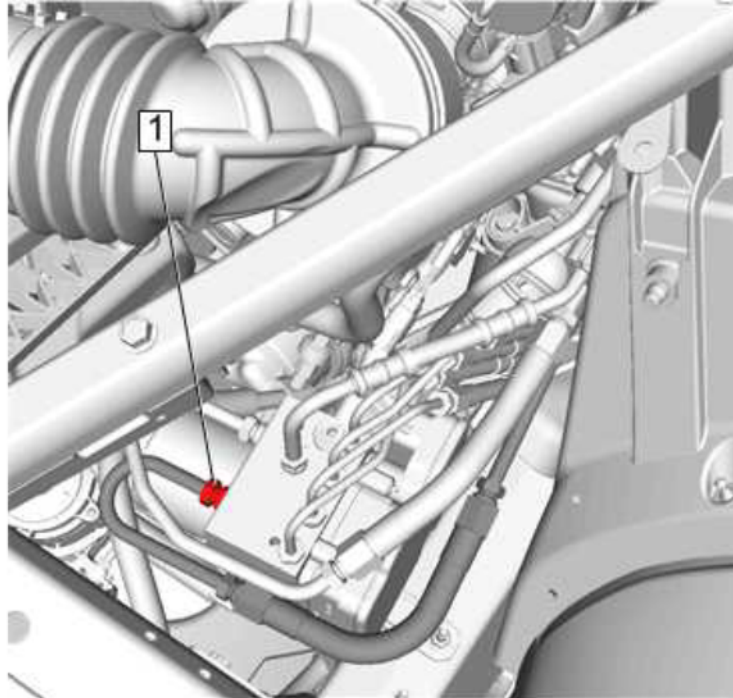


Fig. 38: Brake Pressure Modulator Valve Primary Brake Pipe Fitting
 Courtesy of GENERAL MOTORS COMPANY

12. Connect the EBCM electrical connector.
13. Bleed the brake system. Refer to [Antilock Brake System Automated Bleed](#)
14. Engine Wiring Harness Fuse Block Bracket» Install - [Engine Wiring Harness Fuse Block Bracket Replacement](#)
15. Program the EBCM. Refer to [Control Module References](#)
16. Center the steering angle sensor. Refer to [Steering Wheel Angle Sensor Centering](#)

BRAKE PRESSURE MODULATOR VALVE BRACKET REPLACEMENT

Removal Procedure

1. Brake Pressure Modulator Valve (1)» Remove - [Brake Pressure Modulator Valve Replacement](#)

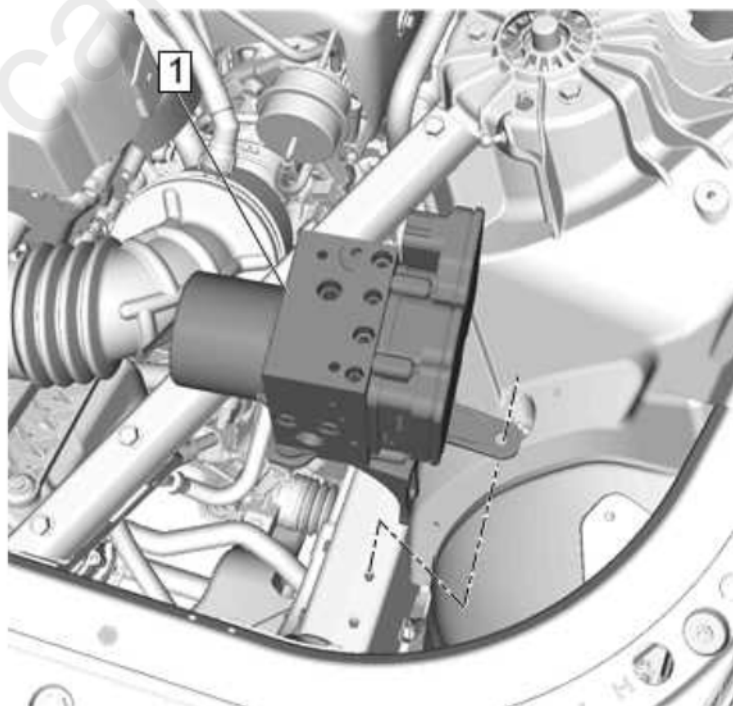


Fig. 39: Brake Pressure Modulator Valve Assembly
 Courtesy of GENERAL MOTORS COMPANY

2. Brake Pressure Modulator Valve Nut (1)» Remove

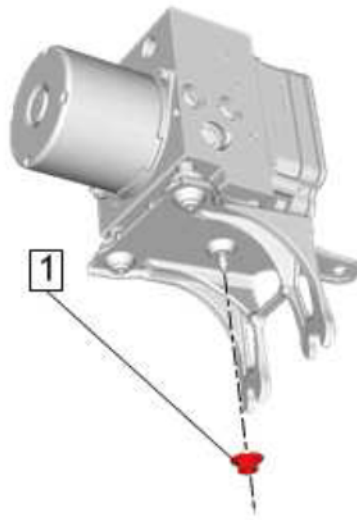


Fig. 40: Brake Pressure Modulator Valve Nut
 Courtesy of GENERAL MOTORS COMPANY

3. Brake Pressure Modulator Valve Bracket (1)» Remove



Fig. 41: Brake Pressure Modulator Valve Bracket
 Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Brake Pressure Modulator Valve Bracket (1)» Install



Fig. 42: Brake Pressure Modulator Valve Bracket

Courtesy of GENERAL MOTORS COMPANY

NOTE: A small amount of denatured alcohol may be used to ease assembly.

2. Brake Pressure Modulator Valve Nut (1)» Install and tighten 8 N.m (71 lb in)

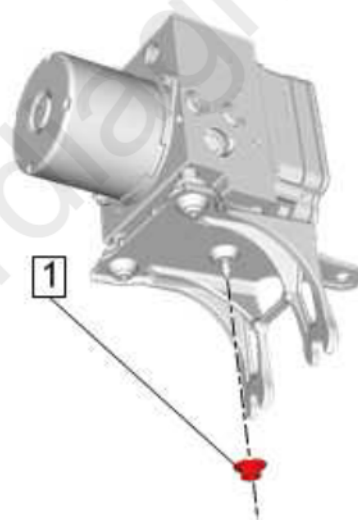


Fig. 43: Brake Pressure Modulator Valve Nut

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Fastener Caution

3. Brake Pressure Modulator Valve (1)» Install - [Brake Pressure Modulator Valve Replacement](#)

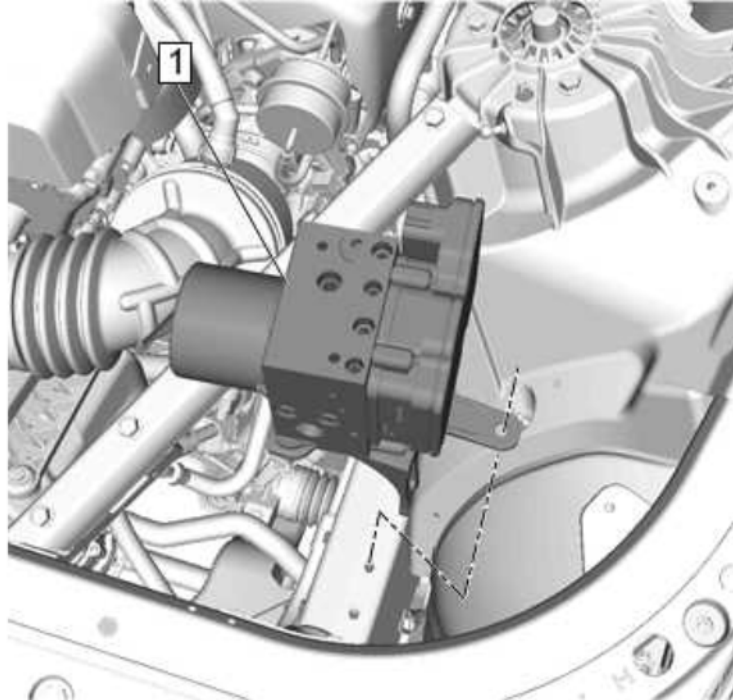


Fig. 44: Brake Pressure Modulator Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

FRONT WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

WARNING: Brake Dust Warning

1. **Front Wheelhouse Liner Replacement** » Remove
2. Wheel Speed Sensor Electrical Connector (1) » Disconnect

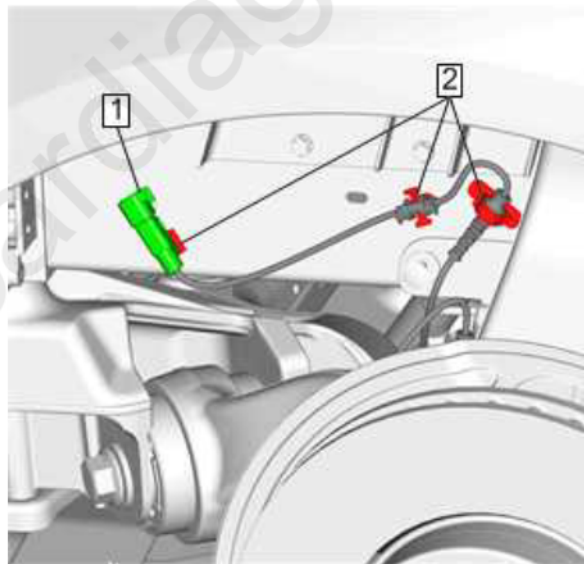


Fig. 45: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

3. Retainer (2) @ Side Rail » Release [3x]
4. Retainer (1) @ Steering Knuckle » Release

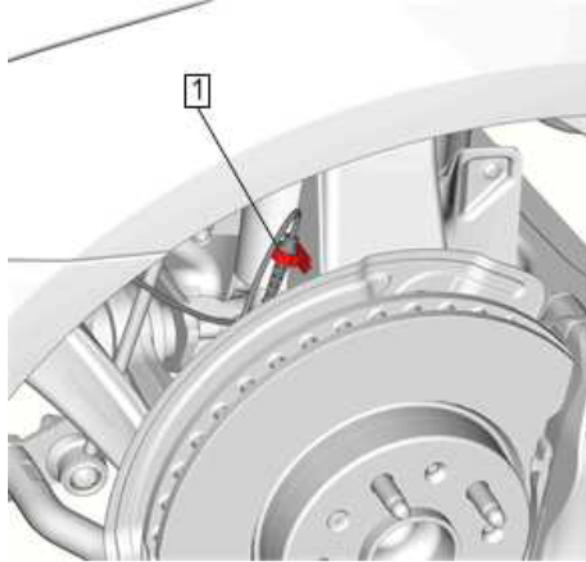


Fig. 46: Retainer

Courtesy of GENERAL MOTORS COMPANY

5. Wheel Speed Sensor Bolt (1) » Remove

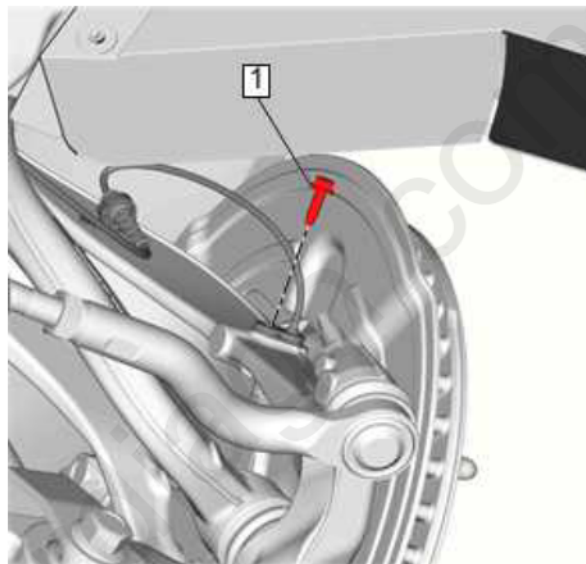


Fig. 47: Wheel Speed Sensor Bolt

Courtesy of GENERAL MOTORS COMPANY

6. Wheel Speed Sensor (1) » Remove

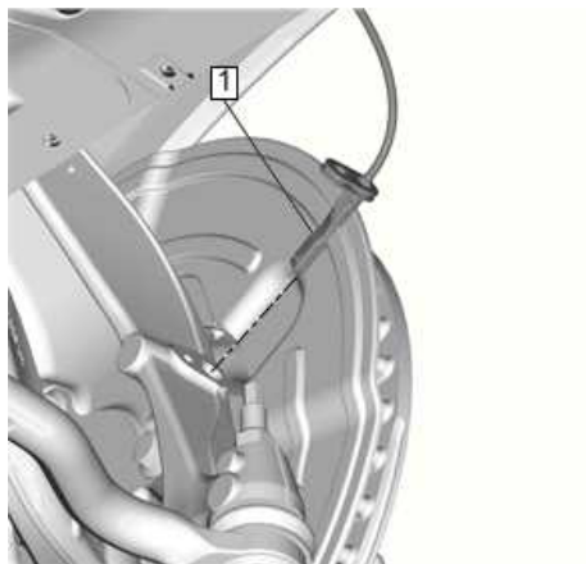


Fig. 48: Wheel Speed Sensor

Courtesy of GENERAL MOTORS COMPANY

1. Wheel Speed Sensor (1) » Install

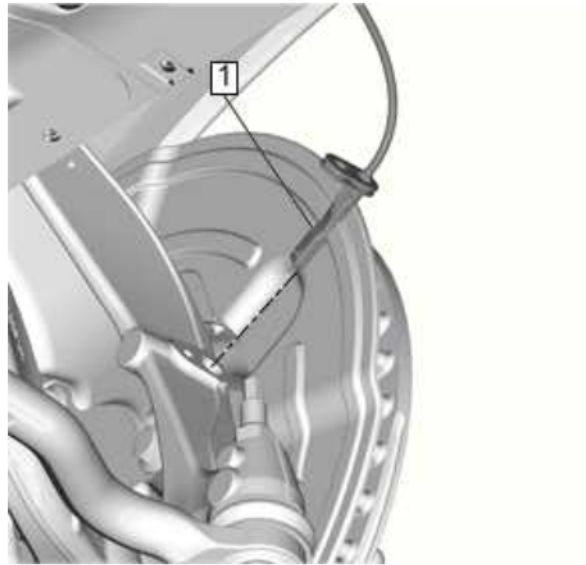


Fig. 49: Wheel Speed Sensor

Courtesy of GENERAL MOTORS COMPANY

2. Wheel Speed Sensor Bolt (1) » Install and tighten 10 N.m (89 lb in)

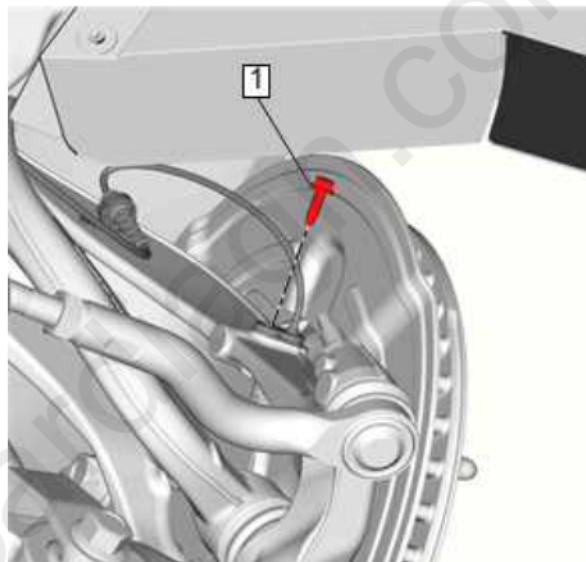


Fig. 50: Wheel Speed Sensor Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Fastener Caution

3. Retainer (1) @ Steering Knuckle » Secure

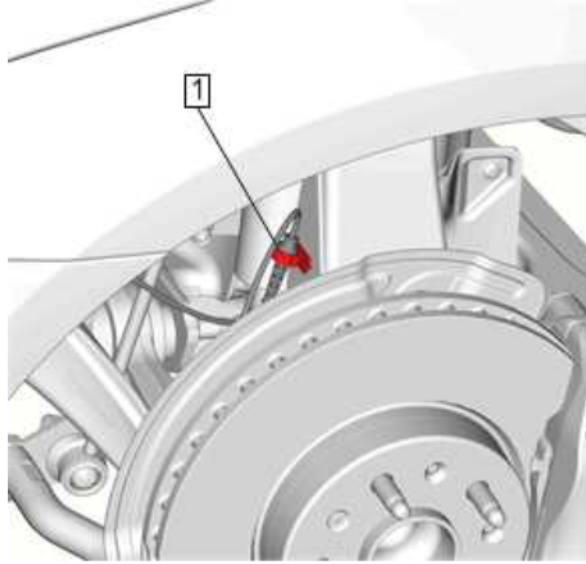


Fig. 51: Retainer

Courtesy of GENERAL MOTORS COMPANY

4. Wheel Speed Sensor Electrical Connector (1) » Connect

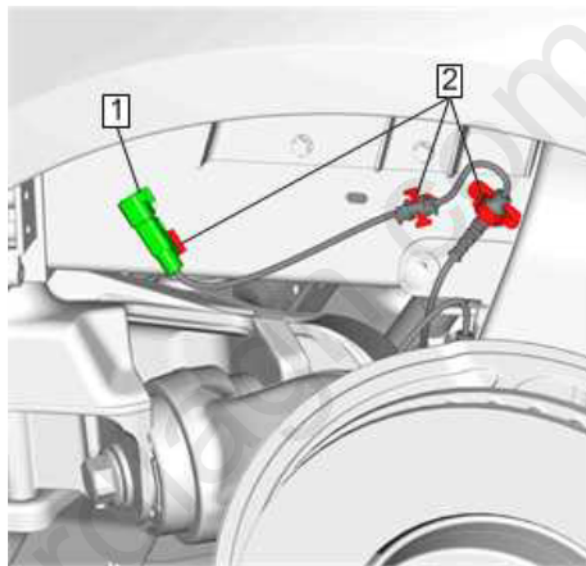


Fig. 52: Wheel Speed Sensor Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

5. Retainer (2) @ Side Rail » Secure [3x]
6. **Front Wheelhouse Liner Replacement** » Install
7. Verify the repair is complete. Refer to **Diagnostic Repair Verification**

REAR WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

WARNING: Brake Dust Warning

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle**
2. **Tire and Wheel Removal and Installation** » Remove
3. Wheel Speed Sensor Electrical Connector (1) » Disconnect

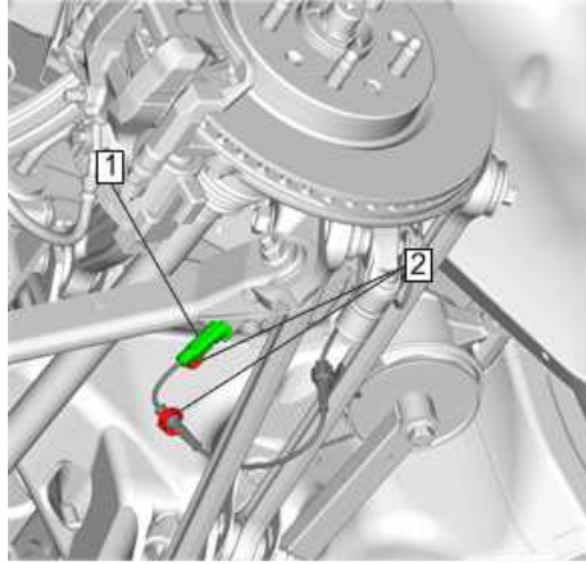


Fig. 53: Wheel Speed Sensor Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

- 4. Retainer (2) @ Rear Cradle» Release [2x]
- 5. Retainer (1) @ Rear Toe Link» Release [2x]

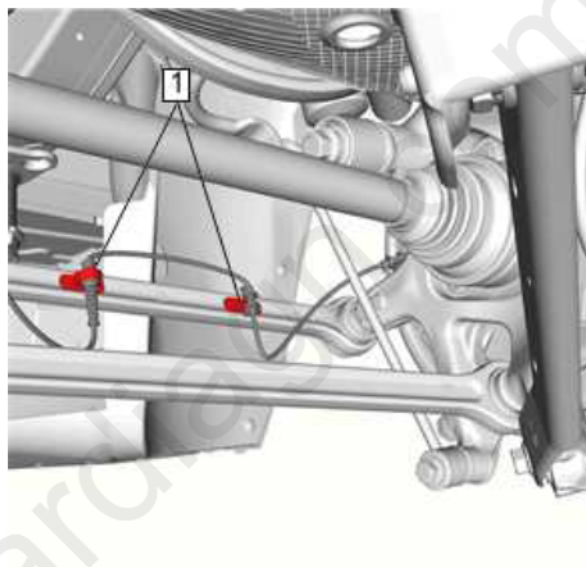


Fig. 54: Retainer And Rear Toe Link
 Courtesy of GENERAL MOTORS COMPANY

- 6. Retainer (1) @ Knuckle» Release

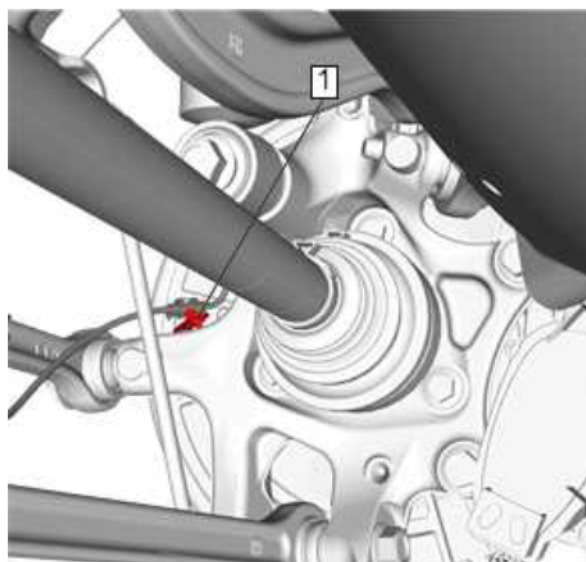


Fig. 55: Retainer And Knuckle
 Courtesy of GENERAL MOTORS COMPANY

7. Wheel Speed Sensor Bolt (1)» Remove

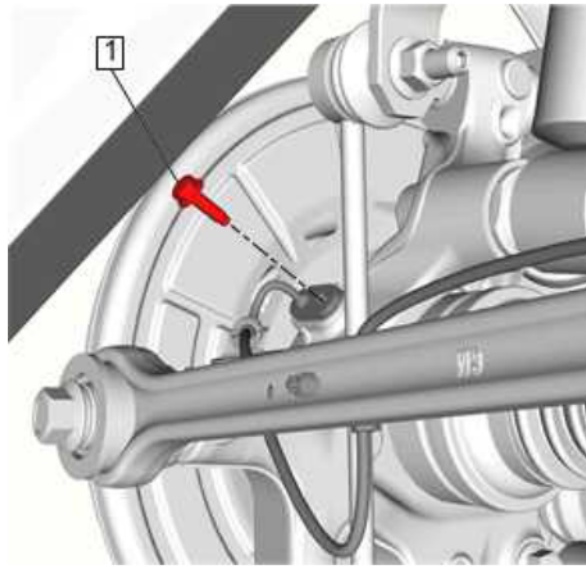


Fig. 56: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Wheel Speed Sensor (1)» Remove

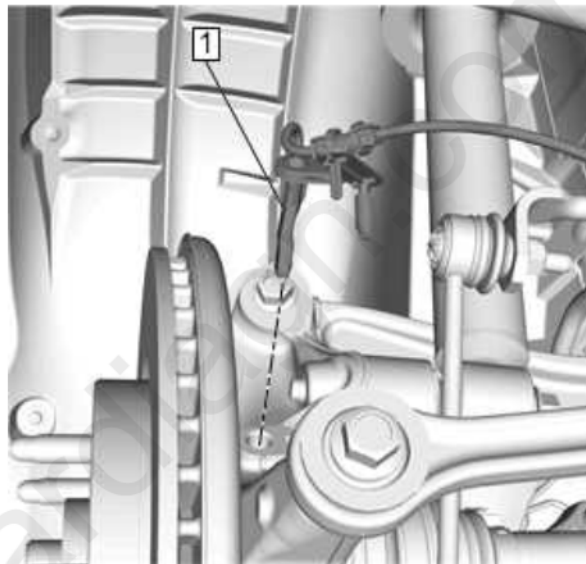


Fig. 57: Wheel Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Wheel Speed Sensor (1)» Install

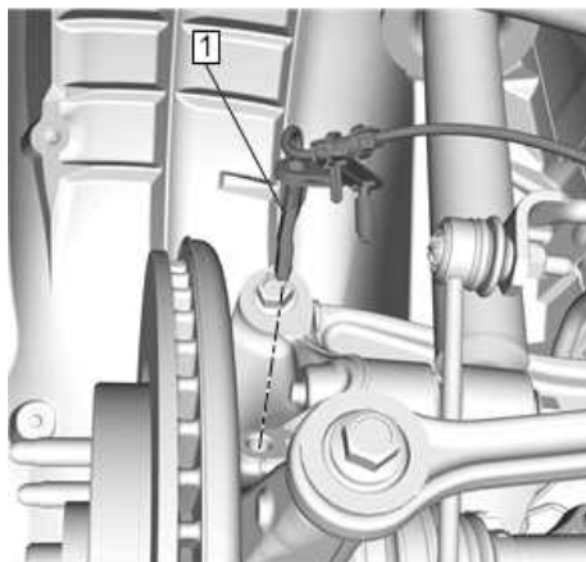


Fig. 58: Wheel Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

2. Wheel Speed Sensor Bolt (1)» Install and tighten 10 N.m (89 lb in)

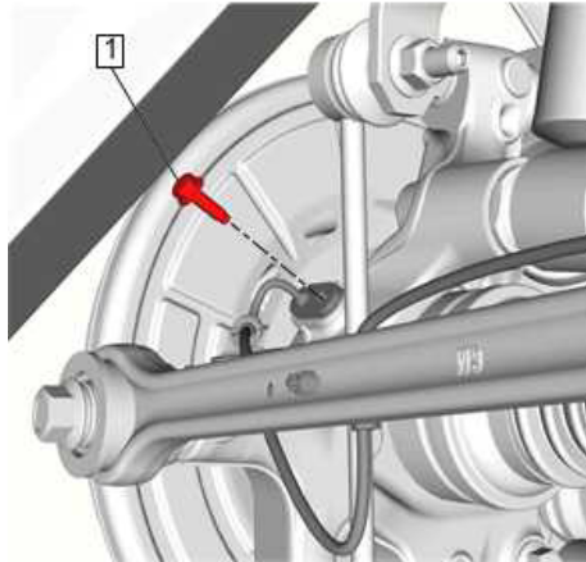


Fig. 59: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Fastener Caution

3. Retainer (1) @ Knuckle» Secure

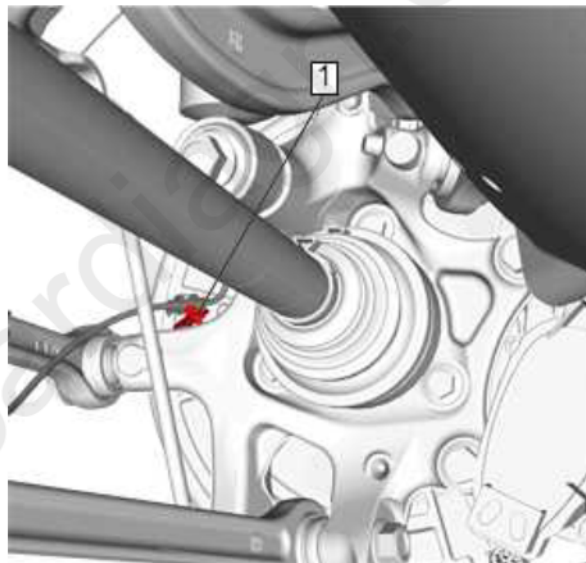


Fig. 60: Retainer And Knuckle
Courtesy of GENERAL MOTORS COMPANY

4. Retainer (1) @ Rear Toe Link» Secure [2x]

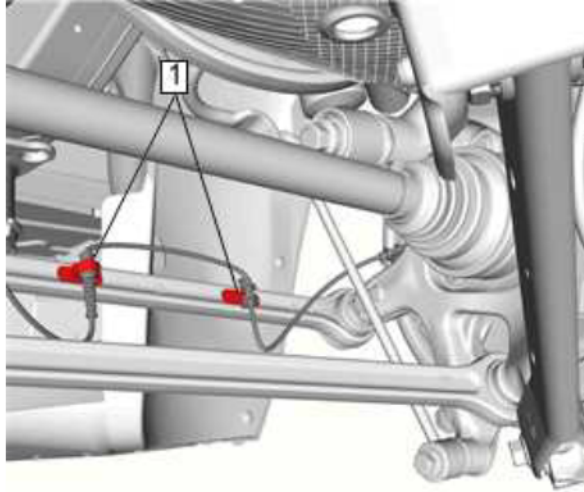


Fig. 61: Retainer And Rear Toe Link

Courtesy of GENERAL MOTORS COMPANY

5. Wheel Speed Sensor Electrical Connector (1) » Connect

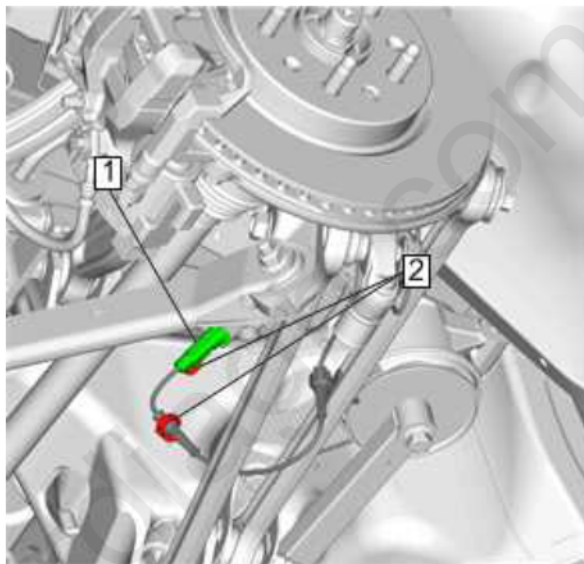


Fig. 62: Wheel Speed Sensor Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

6. Retainer (2) @ Rear Cradle » Secure [2x]
7. **Tire and Wheel Removal and Installation** » Install
8. Verify the repair is complete. Refer to **Diagnostic Repair Verification**

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, engine OFF.

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

This vehicle is equipped with a Bosch ABS/SCB/TC/VSC module.

This module provides the following vehicle performance enhancement systems:

- Antilock Brake System (ABS)
- Electric Parking Brake (EBP apply and EPB release (automatic))
- Extended Hill Start Assist (EHSA)
- Regenerative Braking (in conjunction with the Eboost module)
- Electronic Brake Distribution
- Traction Control (TC)
- Vehicle Stability Control (VSC)

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

- Electronic brake control module (EBCM)-The EBCM controls the system functions and detects failures.

The EBCM contains the following components:

- System relay-The system relay is internal to the EBCM. The system relay is energized when the power button is placed in ON/RUN or a remote function actuation (RFA) commands remote START. The system relay supplies battery positive voltage to the valve solenoids and to the ABS pump motor. This voltage is referred to as system voltage.
- Solenoids-The solenoids are commanded ON and OFF by the EBCM to operate the appropriate valves in the brake pressure modulator valve.
- Brake pressure modulator valve-The brake pressure modulator valve uses a 4-circuit configuration to control hydraulic pressure to each wheel independently.

The brake pressure modulator valve contains the following components:

- ABS pump motor and pump
- Isolation valves
- Dump valves
- Electronic hydraulic control unit
- Steering angle sensor--The EBCM receives serial data message inputs from the steering angle sensor. The steering angle sensor signal is used to calculate the desired yaw rate. The steering angle sensor is mounted internally to the electric power steering gear.
- Traction control switch--Traction control and stability control are manually disabled or enabled by pressing the traction control switch.
- Multi-axis acceleration sensor--The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one multi-axis acceleration sensor. The EBCM receives serial data message inputs from the yaw rate, lateral acceleration and longitudinal acceleration sensor and activates stability control depending on multi-axis acceleration sensor input.

Depending on vehicle options, the vehicle multi-axis sensor may be installed internal to the inflatable restraint sensing diagnostic module, separately externally or a combination of both. Confirm with vehicle RPO codes and schematics.

- Wheel speed sensors-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 (EBCM) and provides a DC square wave signal back to the module. As the wheel spins, the EBCM uses the frequency of the square wave signal to calculate the wheel speed.
- Electronic park brake motors- Controlled by the EBCM and attached to each rear caliper.

General Antilock Brake Operation

General Operation

The Bosch ESPheV Hydraulic Unit and iBooster work in conjunction to provide both friction and regenerative braking. The iBooster Brake Booster assembly works very similarly to a standard vacuum booster, except brake boost is provided by an electric motor instead of engine vacuum. When the driver applies the brake pedal the iBooster and master cylinder delivers fluid to the ESPheV unit. The ESPheV unit then balances the friction and regenerative braking via a series of valves and a low pressure fluid line that is connected to the brake fluid reservoir. The ESPheV unit can move fluid to and from the reservoir via this low pressure line to meet the drivers braking demand with friction that cannot be achieved via regenerative braking. In order to balance the brake pedal feel of the driver, the iBooster braking support force is changed to match the brake fluid pressure in the system. When there is no regenerative braking possible (i.e. standstill), the separation valve inside the ESPheV is closed and the master cylinder only supplies brake fluid to the front axle. The rear axle braking demand is supplied by the ESP pump pulling fluid from the reservoir.

A pressure transducer on the primary master cylinder circuit (Master Cylinder Pressure), a pedal travel sensor on the input piston assembly and the brake switch are inputs into the electronic control unit. These inputs are used to determine the driver's braking intent which is used to control the torque applied to the wheels.

Base Brakes (Friction Braking)

The braking torque applied to the wheels in proportion to the driver's braking intent is achieved with a combination of regenerative braking from the powertrain and hydraulically applied friction braking controlled by the electro-hydraulic control unit. The friction braking achieved by the electro-hydraulic control unit controlling a combination of valves and ESP Pump Motor Duty in a way that moves fluid in and out of the wheels via the low pressure line connected to the brake fluid reservoir. The Bosch ESPheV system is designed to be used with a Bosch iBooster in order to achieve seamless driver brake pedal feel.

Base Brake Valves (No Valve Action)

The Separation Valve (SV) and Pressure Control Relief (PCR) Valves are open and closed respectively when they are not being controlled. In this state the brake fluid delivered by the master cylinder is sent directly to the wheels. This mode is used during a failsafe state to ensure proper friction braking and during the first apply of a new vehicle power cycle for diagnostics.

Base Brake Valves (Regenerative Braking)

When regenerative braking is available from the electric powertrain, the ESPheV unit will try to utilize this as much as possible. It does this by leaving the SV valve open and opening the PCR valve to return the brake fluid in the system to the brake fluid reservoir. If the regenerative braking is not able to met the driver brake demand, the fluid can be reintroduced into the system by the ABS Pump pulling fluid from the reservoir. In order to match the driver brake pedal feel with the amount of fluid in the brake system, the iBooster support force is adjusted to match the expected feel.

Base Brake Valves (No Regenerative Braking)

When there is no regenerative braking available, i.e. vehicle is at standstill or very low speed, the SV valve will close with a driver brake apply. The SV valve closing diverts all the fluid from the master cylinder to the front brakes. The rear brake fluid will be pulled from the brake fluid reservoir via the low pressure line by the ABS Pump.

Electronic Brake Control Feature Descriptions

Antilock Braking System

The ABS system includes one hydraulic modulator that is capable of performing ABS and Electronic Brake force Distribution (EBD) functions. The ABS monitors wheel speeds and other select vehicle parameters. The ABS and EBD operations shall meet the brake balance requirements defined by four regions of friction utilization and Z critical parameter in the base brake SSTS. The EBD shall balance brake forces both longitudinally and laterally at full speed range. This function shall improve vehicle stability during normal braking by means of all corners brake pressure control without the use of a conventional mechanical proportioning valve(s). In addition, the included sub-functions (such as split coefficient yaw control and Cornering Brake Control - CBC) have to reduce unwanted yawing while braking in any condition (straight-line as well as any cornering). When braking on straight line homogeneous road surface the EBD shall provide optimum front and rear brake balance and control the rear brakes with equal pressure. During braking in a turn or steering while braking the EBD shall provide appropriate side-to-side brake proportioning through CBC to optimize vehicle deceleration and meet vehicle stability specified in ABS vehicle performance requirements. The ECU and relays are integral to the hydraulic modulator.

Straight Line Stability (SLS)

SLS is used when vehicles exhibit excess yaw during straight line non-ABS or threshold, brake applies. Vehicles with short wheelbases often exhibit this behavior. Straight Line Stability control shall have the capability to adjust front and rear brake corner pressures to assist the driver to maintain intended straight line vehicle path.

Enhanced Corner Brake Control (ECBC)

Enhanced Corner Brake Control shall have the ability to detect vehicle path deviation during very slight cornering maneuvers. Corner Brake Control may not engage in these maneuvers because the turn is not big enough. Also, ECBC shall integrate EBD and CBC to control both front and rear inner wheels to maintain vehicle stability.

Panic Brake Assist (PBA)

PBA detects that the driver intent is to stop the vehicle as quickly as possible, but does not apply sufficient brake pressure to do so. The feature will detect this driver intent then actively apply brake pressure to maximum pressure, thus activating the ABS system and stopping the vehicle as quickly as possible.

Hydraulic Fade Compensation (HFC)

The Hydraulic Fade Compensation (HFC) function detects a fading brake condition and activates the ESC modulator to increase the brake pressure above current master cylinder pressure from the driver apply. Once activated, HFC will drive all wheels into ABS. Built on a brake disc/pad temperature model, brake pressure and deceleration rate, brake pressure will be added to the already applied pressure from the driver. This increases the total brake pressure in the system and enhancing stopping distance in fading situations. The driver will experience fading brakes while using low or medium brake pedal force application. The HFC will activate only during high brake pedal force application.

Engine Drag Control (EDC)

This feature is designed to mitigate drop-throttle-oversteer. During maximum cornering while applying throttle, the vehicle could exhibit oversteer when the driver quickly releases the throttle. This feature will slowly reduce the engine torque in order to maintain vehicle stability.

Engine Torque Steer Control

Engine Torque Steer Control uses engine torque reductions to minimize torque steer. This is a pre-emptive engine torque reduction used on vehicles that exhibit excessive torque steer during large accelerator pedal inputs. This feature will also improve the Intersection maneuver (standing launch with 90 deg turn) performance.

Extended Hold Hill Start Assist (EHSA)

Extended Hold Hill Start Assist is a feature that will hold the vehicle while on a grade, to prevent the vehicle from rolling down the hill. This feature will activate the Electronic Park Brake under driver exist scenarios.

Dynamic Braking with Electronic Park Brake

Dynamic Braking with the Electronic Park Brake (EPB) provides autonomous braking when the EPB switch is pressed when the vehicle is in motion. With the use of this feature, if the EPB switch is pressed while the vehicle is moving, the EBCM will apply braking at all 4 corners until the vehicle is stopped, then the EPB will apply and EBCM will release pressure

Reduced Boost Ratio During ABS (RBR)

On brake by wire systems, it is possible to reduce the amount of pressure applied by the system upstream of the wheel valves to improve ABS wheel control on low mu surfaces. This in essence reduces the amount of driver applied pressure when low mu ABS is detected. The overall goal of this feature is to improve ABS feel.

EV Powerhop and Powertrain Mount Control

Powerhop is defined as an oscillation of the driven wheels due to acceleration on high coefficient surfaces. This wheel oscillation causes the vehicle to bounce resulting in driver discomfort, failure of driveline components and potentially other damage to the vehicle. Powertrain Mount Resonance is also related to wheel oscillation. With the TCS feature "ON", power hop shall be detected using wheel speed sensor signals. With the TCS feature "OFF", the EBCM and ECM shall be required to mitigate power hop. If the vehicle is exhibiting this signature, the traction control system will attenuate powerhop by reducing engine torque and applying brake pressure.

Vehicle Stability Control

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

The desired yaw rate is calculated by the EBCM using the following inputs:

- Steering wheel position
- Vehicle speed
- Lateral acceleration

The difference between the desired yaw rate and the actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. When a yaw rate error is detected, the EBCM attempts to correct the vehicle's yaw motion by applying brake pressure to one or more of the wheels. The amount of applied brake pressure varies, depending on the correction required.

Power-up Self-Test

The electronic brake control module (EBCM) is able to detect many malfunctions whenever the ignition is ON. However, certain failures cannot be detected unless active diagnostic tests are performed on the components. Shorted solenoid coil or motor windings, for example, cannot be detected until the components are commanded ON by the EBCM. Therefore, a power-up self-test is required at the beginning of each ignition cycle to verify correct operation of components before the various control systems can be enabled. The EBCM performs the power-up self-test when the ignition is first turned ON. The system relay, solenoids and the antilock brake system (ABS) pump motor are commanded ON and OFF to verify proper operation and the EBCM verifies the ability to return the system to base braking in the event of a failure. The power-up self-test may be heard by the driver, depending on how soon the engine is cranked and started after turning ON the ignition.

Driver Information Indicators

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

Brake Warning Indicator

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

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

ABS Indicator

The instrument panel cluster illuminates the ABS indicator when the following occurs:

- The electronic brake control module (EBCM) detects an ABS-disabling malfunction and sends a serial data message to the instrument panel cluster requesting illumination.
- The instrument panel cluster performs the bulb check.
- The instrument panel cluster detects a loss of serial data communication with the EBCM.
- A DTC is set during the previous ignition cycle which requires a United Nations Economic Commission for Europe regulation number 13 (ECE 13) response at the beginning of the current ignition cycle. The EBCM sends a serial data message to the instrument panel cluster requesting illumination.

Traction Control/Stability Control Indicator

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

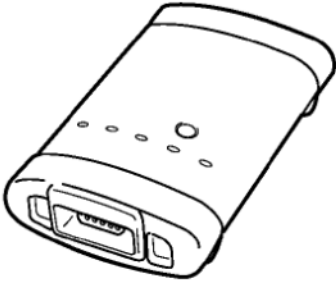
- The electronic brake control module (EBCM) detects an ABS/TC/VSC-disabling malfunction and sends a serial data message to the instrument panel cluster requesting illumination.
- The instrument panel cluster performs the bulb check.
- The instrument panel cluster detects a loss of serial data communication with the EBCM.
- A DTC is set during the previous ignition cycle which requires a United Nations Economic Commission for Europe regulation number 13 (ECE 13) response at the beginning of the current ignition cycle. The EBCM sends a serial data message to the instrument panel cluster requesting illumination.
- The EBCM is actively controlling propulsive torque or brake torque due to a loss of traction or vehicle stability event.
- The TC/VSC system has been manually disabled by the vehicle operator.

United Nations Economic Commission for Europe Regulation Number 13 (ECE 13) Response

The electronic brake control module (EBCM) illuminates the antilock brake system (ABS) indicator when a malfunction which disables ABS is detected. Usually, the ABS indicator is turned OFF during the following ignition cycle unless the fault is detected during that ignition cycle. However, the setting of a wheel speed sensor related DTC may cause the ABS indicator to remain illuminated during the following ignition cycle until the vehicle is operated at a speed greater than 13 km/h (8 mph) or, occasionally, 64 km/h (40 mph), depending on which DTC sets. This allows the EBCM to verify that no malfunction exists, before turning OFF the ABS indicator. It is important to verify that United Nations Economic Commission for Europe regulation number 13 (ECE 13) is not the cause of an ABS indicator which is illuminated when no DTCs are set, before attempting to diagnose other possible causes.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description
	EL 35616-F J 35616 Terminal Test Kit
	EL 47955 J 2534 Multi Diagnostic Interface MDI