

BRAKES

Antilock Brake System - Coupe And Wagon

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Pipe Fitting- Brake Pressure Modulator Valve (BPMV) Inlet	32 N.m	24 lb ft
Brake Pipe Fitting- BPMV Outlet	20 N.m	15 lb ft
BPMV Bolt	12 N.m	106 lb in
BPMV Bracket Bolt	12 N.m	106 lb in
BPMV Bracket Nut	12 N.m	106 lb in
Electronic Brake Control Module (EBCM) Screws	5 N.m	44 lb in
Wheel Speed Sensor Bolt- Front and Rear	9 N.m	80 lb in
Yaw Rate Sensor Bolt	9 N.m	80 lb in
Yaw Rate Sensor Nut	9 N.m	80 lb in

SCHEMATIC WIRING DIAGRAMS

ANTILOCK BRAKE SYSTEM WIRING SCHEMATICS

Module Power, Ground, Subsystem Reference

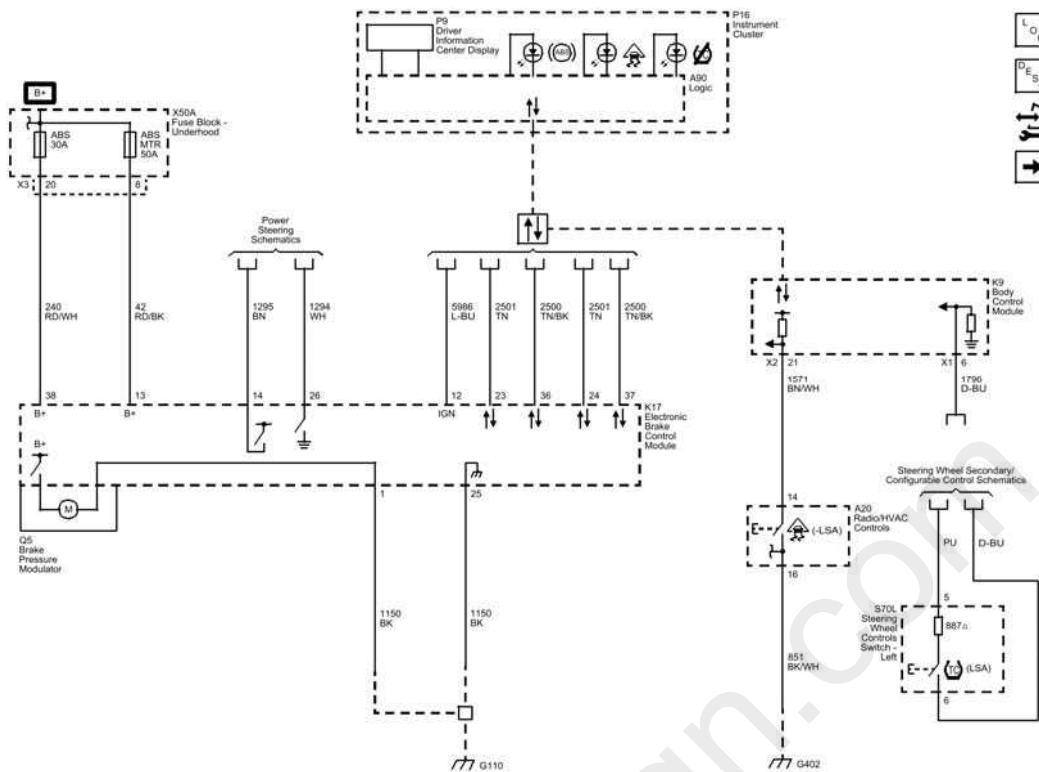


Fig. 1: Module Power, Ground, Subsystem Reference
Courtesy of GENERAL MOTORS COMPANY

Sensors

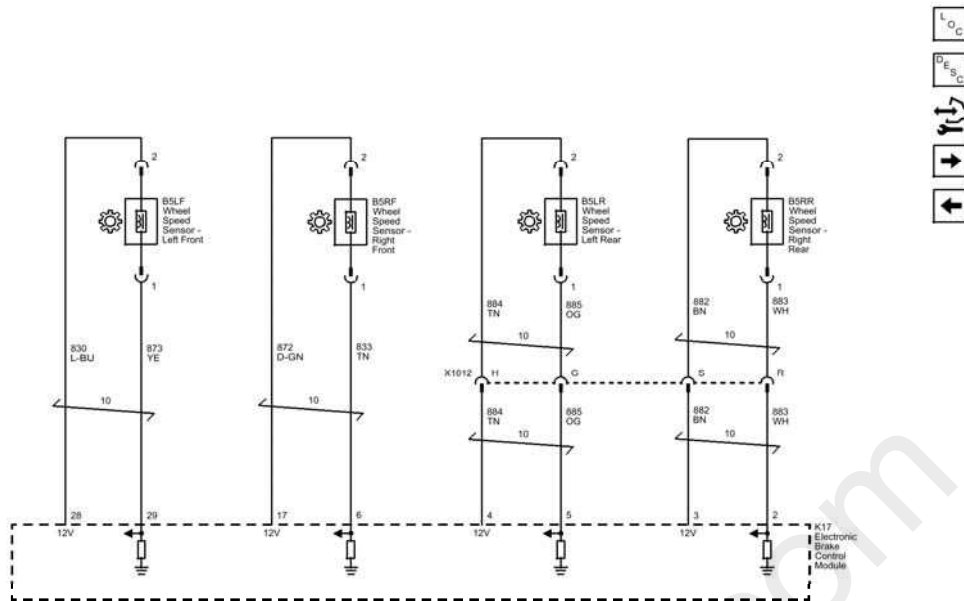


Fig. 2: Sensors

Courtesy of GENERAL MOTORS COMPANY

Stability Control System

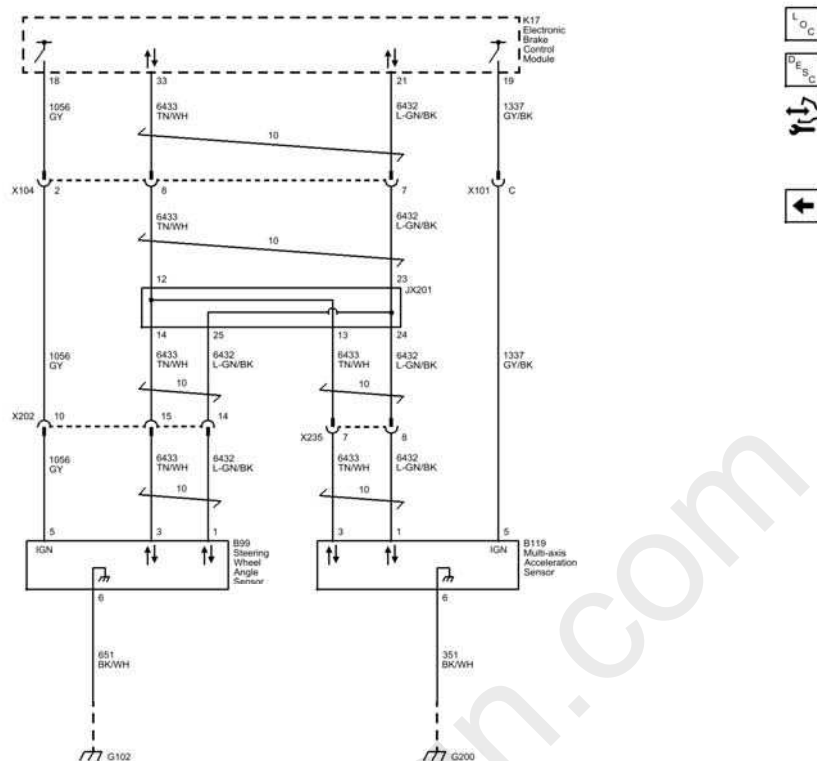


Fig. 3: Stability Control

Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B2745	DTC B2745 02 Traction Control Switch Circuit Short to Ground
DTC C0035-C0050	DTC C0035 02 Left Front Wheel Speed Sensor Circuit Short to Ground DTC C0035 05 Left Front Wheel Speed Sensor Circuit High Voltage/Open DTC C0035 0F Left Front Wheel Speed Sensor Circuit Signal Erratic DTC C0035 18 Left Front Wheel Speed Sensor Circuit Low Signal Amplitude DTC C0040 02 Right Front Wheel Speed Sensor Circuit Short to Ground DTC C0040 05 Right Front Wheel Speed Sensor Circuit High Voltage/Open DTC C0040 0F Right Front Wheel Speed Sensor Circuit Signal Erratic DTC C0040 18 Right Front Wheel Speed Sensor Circuit Low Signal Amplitude DTC C0045 02 Left Rear Wheel Speed Sensor Circuit Short to Ground DTC C0045 05 Left Rear Wheel Speed Sensor Circuit High Voltage/Open DTC C0045 0F Left Rear Wheel Speed Sensor Circuit Signal Erratic DTC C0045 18 Left Rear Wheel Speed Sensor Circuit Low Signal Amplitude DTC C0050 02 Right Rear Wheel Speed Sensor Circuit Short to Ground

	DTC C0050 05 Right Rear Wheel Speed Sensor Circuit High Voltage/Open DTC C0050 0F Right Rear Wheel Speed Sensor Circuit Signal Erratic DTC C0050 18 Right Rear Wheel Speed Sensor Circuit Low Signal Amplitude
<u>DTC C0110</u>	DTC C0110 04 Pump Motor Circuit Open Circuit DTC C0110 03 Pump Motor Circuit Voltage Below Threshold DTC C0110 61 Pump Motor Circuit Actuator Stuck
<u>DTC C0131</u>	DTC C0131 01 ABS Pressure Circuit Short to Battery DTC C0131 06 ABS Pressure Circuit Short to Ground or Open DTC C0131 4B ABS Pressure Circuit Calibration Not Learned DTC C0131 55 ABS Pressure Circuit Expected Number of Transition/Events Exceeded DTC C0131 5A ABS Pressure Circuit Not Plausible DTC C0131 0F ABS Pressure Signal Erratic
<u>DTC C0161</u>	DTC C0161 00 Antilock Brake System (ABS)/Traction Control System (TCS) Brake Sensor Circuit DTC C0161 5A Antilock Brake System (ABS) Brake Switch Circuit Plausibility Failure
<u>DTC C0179</u>	DTC C0179 54 System Thermal Temperature High
<u>DTC C0186, C0196, or C0287</u>	DTC C0186 00 Lateral Accelerometer Circuit DTC C0186 09 Lateral Accelerometer Circuit Rate of Change Above Threshold DTC C0186 0F Lateral Accelerometer Circuit Erratic DTC C0186 55 Lateral Accelerometer Circuit Expected Number of Events Not Reached DTC C0186 1A Lateral Accelerometer Circuit Bias Level Out Of Range DTC C0186 5A Lateral Accelerometer Circuit Plausibility Failure DTC C0186 3B Lateral Accelerometer Circuit Erratic Internal Self Test Failed DTC C0186 75 Lateral Accelerometer Circuit Signal Above Allowable Range DTC C0196 00 Yaw Rate Circuit DTC C0196 09 Yaw Rate Circuit Rate of Change Above Threshold DTC C0196 0F Yaw Rate Circuit Erratic DTC C0196 28 Yaw Rate Circuit Incorrect Frequency DTC C0196 55 Yaw Rate Circuit Expected Number of Events Not Reached DTC C0196 1A Yaw Rate Circuit Bias Level Out Of Range DTC C0196 5A Yaw Rate Circuit Plausibility Failure DTC C0196 3B Yaw Rate Sensor Internal Self Test Failed DTC C0196 75 Yaw Rate Circuit Signal Above Allowable Range DTC C0287 0F Longitudinal Circuit Signal Erratic DTC C0287 3B Longitudinal Circuit Signal Internal Self Test Failed DTC C0287 55 Longitudinal Circuit Signal Expected Number of Events Not Reached DTC C0287 5A Longitudinal Circuit Signal Plausibility Failure
<u>DTC C0201</u>	DTC C0201 04 ABS Enable Relay Contact Open Circuit
<u>DTC C0242 or P0856</u>	DTC C0242 00 ECM Indicated TCS Malfunction DTC C0242 71 ECM Indicated TCS Malfunction, Invalid Serial Data DTC C0242 75 ECM Indicated TCS Malfunction, Signal Above Allowable Range DTC P0856 Traction Control Torque Request Circuit

<u>DTC C0245</u>	DTC C0245 5A Wheel Speed Sensor Plausibility Failure
<u>DTC C0292</u>	DTC C0292 02 VSES Combination Sensor Circuit Short to Ground DTC C0292 07 VSES Combination Sensor Circuit Voltage Above Threshold
<u>DTC C0558</u>	DTC C0558 46 Calibration Data Not Programmed/Learned, vehicle configuration not programmed
<u>DTC C0561</u>	DTC C0561 71 System Disabled Information Stored Invalid Data DTC C0561 72 System Disabled Information Stored Message Counter Incorrect DTC C0561 74 System Disabled Information Stored Bus Signal Checksum Error DTC C0561 FF System Disabled Information Stored Value of Signal Erratic
<u>DTC C0710</u>	DTC C0710 55 Steering Position Signal Expected Number of Transitions/Events Not Reached DTC C0710 4B Steering Position Signal Calibration Not Learned DTC C0710 5A Steering Position Signal Not Plausible DTC C0710 0F Steering Position Signal Erratic

DTC B2745: TRACTION CONTROL SWITCH CIRCUIT SHORT TO GROUND

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle**
- Review **Strategy Based Diagnosis**
- **Diagnostic Procedure Instructions**

DTC Descriptor

DTC B2745 02

Traction Control Switch Circuit Short to Ground

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Traction Control Switch Signal	B2745 02, U0140 71	1	1	-
Traction Control Switch Ground	-	1	-	-
1. Traction Control Switch Inoperative				

Circuit/System Description

When the traction control switch is pressed once, the signal circuit from the BCM is pulled low indicating the stabilitrak competitive mode is commanded. In response to this signal, the BCM sends a serial data message to the electronic brake control module (EBCM) commanding it to disable the traction control system.

When the traction control switch is pressed and held for more than 20 seconds, the BCM sends a serial data

message to the EBCM commanding it to disable the stability control. After the EBCM disables the stability control, it sends a serial data message to the instrument cluster requesting it to turn ON the traction/stability control indicator light.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The BCM detects a short to ground on the signal circuit.

Action Taken When the DTC Sets

The BCM ignores the traction control switch signal input.

Conditions for Clearing the DTC

A current DTC clears when the diagnostic runs and passes.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Observe the scan tool BCM Inputs, Traction Control Switch parameter while pressing the traction control switch. The reading should change between Inactive and Active.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the radio/HVAC control.
2. Test for less than 5 ohms between the ground circuit terminal 16 and ground.
 - If greater than the specified value, test the ground circuit for an open/high resistance.
3. Ignition ON, verify the scan tool BCM Inputs, Traction Control Switch parameter is Inactive.
 - If not the specified value, test the signal circuit terminal 14 for a short to ground. If the circuit tests normal, replace the BCM.
4. Install a 3 A fused jumper wire between the signal circuit terminal 14 and ground.
5. Verify the scan tool Traction Control Switch parameter is Active.
 - If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the BCM.
6. If all circuits test normal, test or replace the radio/HVAC control.

Repair Instructions

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

Control Module References for BCM, radio/HVAC replacement, programming and setup

DTC C0035-C0050: 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 C0035 02

Left Front Wheel Speed Sensor Circuit Short to Ground

DTC C0035 05

Left Front Wheel Speed Sensor Circuit High Voltage/Open

DTC C0035 0F

Left Front Wheel Speed Sensor Circuit Signal Erratic

DTC C0035 18

Left Front Wheel Speed Sensor Circuit Low Signal Amplitude

DTC C0040 02

Right Front Wheel Speed Sensor Circuit Short to Ground

DTC C0040 05

Right Front Wheel Speed Sensor Circuit High Voltage/Open

DTC C0040 0F

Right Front Wheel Speed Sensor Circuit Signal Erratic

DTC C0040 18

Right Front Wheel Speed Sensor Circuit Low Signal Amplitude

DTC C0045 02

Left Rear Wheel Speed Sensor Circuit Short to Ground

DTC C0045 05

Left Rear Wheel Speed Sensor Circuit High Voltage/Open

DTC C0045 0F

Left Rear Wheel Speed Sensor Circuit Signal Erratic

DTC C0045 18

Left Rear Wheel Speed Sensor Circuit Low Signal Amplitude

DTC C0050 02

Right Rear Wheel Speed Sensor Circuit Short to Ground

DTC C0050 05

Right Rear Wheel Speed Sensor Circuit High Voltage/Open

DTC C0050 0F

Right Rear Wheel Speed Sensor Circuit Signal Erratic

DTC C0050 18

Right Rear Wheel Speed Sensor Circuit Low Signal Amplitude

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Wheel Speed Sensor Ignition	C0035 02	C0035 05	-	C0035 0F, C0035 18
Left Front Wheel Speed Sensor Signal	-	-	C0035 05	C0035 0F, C0035 18
Right Front Wheel Speed Sensor Ignition	C0040 02	C0040 05	-	C0040 0F, C0040 18
Right Front Wheel Speed Sensor Signal	-	-	C0040 05	C0040 0F, C0040 18
Left Rear Wheel Speed Sensor Ignition	C0045 02	C0045 05	-	C0045 0F, C0045 18
Left Rear Wheel Speed Sensor Signal	-	-	C0045 05	C0045 0F, C0045 18
Right Rear Wheel Speed Sensor Ignition	C0050 02	C0050 05	-	C0050 0F, C0050 18
Right Rear Wheel Speed Sensor Signal	-	-	C0050 05	C0050 0F, C0050 18

Mechanical Fault Table

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

Circuit/System Description

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

Conditions for Running the DTC

C0035 02-C0050 02

- Ignition ON.
- Ignition voltage is greater than 10 volts.

C0035 05-C0050 05

- Ignition ON.
- Ignition voltage is greater than 10 V.

C0035 18-C0050 18

- Ignition ON.
- Ignition voltage is greater than 10 V.
- No other wheel speed circuit DTCs are set.
- The brake pedal is not pressed.
- Two or more wheel speeds are greater than 0 km/h.

C0035 0F-C0050 0F

- Ignition ON.
- Ignition voltage is greater than 10 V.
- The brake pedal is not pressed.
- A DTC is not set for the other wheel speed circuit on the same axle.

Conditions for Setting the DTC

C0035 02-C0050 02

- A short to ground, open/high resistance is detected on the wheel speed sensor signal circuit.
- Wheel speed sensor power supply is less than 7.6 V.

C0035 05-C0050 05

A short to voltage, short to ground or an open/high resistance is detected on the signal circuit.

C0035 18-C0050 18

- Ignition ON.
- An erratic signal output of the wheel speed sensor is detected.
- Physical damage to the wheel speed sensor or electronic brake control module.
- Debris on the wheel speed sensor or the encoder ring.
- Loose or improperly mounted sensor.

- Air gap between the wheel speed sensor and encoder ring too large.

C0035 0F-C0050 0F

- An erratic signal output of the wheel speed sensor is detected 3 times in 200 milliseconds.
- The electronic brake control module detects a change in wheel speed that exceeds 20 km/h (12 mph) between two 10 millisecond wheel speed samples. This must be detected 3 times in 200 milliseconds.
- A missing wheel speed sensor signal.

Actions Taken when the DTC Sets

- The electronic brake control module disables the antilock brake system (ABS), the traction control and the stabilitrak for the duration of the ignition cycle.
- A driver information center message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- Operate the vehicle at speeds greater than 15 km/h (10 mph) to complete the self test, and the electronic brake control module will turn off the ABS indicator.
- The electronic brake control module clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Diagnostic Aids

- Do not use a magnet to clean the encoder ring.
- Inspect the wheel hub bearing encoder ring for rust or corrosion.
- If two or more wheel speed sensors are inoperative, diagnose each wheel speed sensor individually.
- If the customer comments that the ABS indicator is ON only during moist environmental conditions (rain, snow, vehicle wash, etc.), inspect the wheel speed sensor wiring for signs of water intrusion.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

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

Circuit/System Testing

NOTE: If any of the symptom codes 0F, 18 or 5A are set, refer to the Diagnostic Fault Information table for possible mechanical faults or conditions.

1. Ignition OFF, disconnect the harness connector at the EBCM.
2. Ignition ON, test for less than 1 V between the ignition circuit terminal of the appropriate sensor listed below and ground.
 - Left front sensor circuit terminal 28
 - Right front sensor circuit terminal 17
 - Left rear sensor circuit terminal 4
 - Right rear sensor circuit terminal 3
 - If greater than the specified range, test the ignition circuit for a short to voltage.
3. Test for less than 1 V between the signal circuit terminal of the appropriate sensor listed below and ground.
 - Left front sensor circuit terminal 29
 - Right front sensor circuit terminal 6
 - Left rear sensor circuit terminal 5
 - Right rear sensor circuit terminal 2
 - If greater than the specified range, test the signal circuit for a short to voltage.
4. Ignition OFF, test for infinite resistance between the ignition circuit terminal of the appropriate sensor circuit listed below and ground.
 - Left front sensor circuit terminal 28
 - Right front sensor circuit terminal 17
 - Left rear sensor circuit terminal 4
 - Right rear sensor circuit terminal 3

- If less than the specified value, test the ignition circuit for a short to ground.
- 5. Test for infinite resistance between the following signal circuit terminal of the appropriate sensor circuit listed below and ground.
 - Left front sensor circuit terminal 29
 - Right front sensor circuit terminal 6
 - Left rear sensor circuit terminal 5
 - Right rear sensor circuit terminal 2
- If less than the specified value, test the signal circuit for a short to ground.
- 6. Ignition OFF, disconnect the harness connector at the appropriate wheel speed sensor.
- 7. Test for less than 2 ohms between the appropriate ignition voltage circuit terminals listed below.
 - Left front sensor circuit terminal 28 at the EBCM harness connector and terminal 2 at the wheel speed sensor harness connector.
 - Right front sensor circuit terminal 17 at the EBCM harness connector and terminal 2 at the wheel speed sensor harness connector.
 - Left rear sensor circuit terminal 4 at the EBCM harness connector and terminal 2 at the wheel speed sensor harness connector.
 - Right rear sensor circuit terminal 3 at the EBCM harness connector and terminal 2 at the wheel speed sensor harness connector.
- If greater than the specified range, test the ignition voltage circuit for an open or high resistance.
- 8. Test for less than 2 ohms between the appropriate signal circuit terminals listed below.
 - Left front sensor circuit terminal 29 at the EBCM harness connector and terminal 1 at the wheel speed sensor harness connector.
 - Right front sensor circuit terminal 6 at the EBCM harness connector and terminal 1 at the wheel speed sensor harness connector.
 - Left rear sensor circuit terminal 5 at the EBCM harness connector and terminal 1 at the wheel speed sensor harness connector.
 - Right rear sensor circuit terminal 2 at the EBCM harness connector and terminal 1 at the wheel speed sensor harness connector.
- If greater than the specified range, test the signal circuit for an open or high resistance.
- 9. If all circuits test normal, replace the wheel speed sensor. If the DTC resets, replace the EBCM.

Repair Instructions

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

- **Front Wheel Speed Sensor Replacement (AWD), Front Wheel Speed Sensor Replacement (RWD)**
- **Rear Wheel Speed Sensor Replacement**
- **Control Module References** for EBCM replacement, programming and setup

DTC C0110: 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 C0110 04

Pump Motor Circuit Open Circuit

DTC C0110 03

Pump Motor Circuit Voltage Below Threshold

DTC C0110 61

Pump Motor Circuit Actuator Stuck

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ Terminal 13	C0110 03	C0110 03	-	C0110 61
Ground Terminal 1	-	C0110 04	-	C0110 61
Ground Terminal 25	-	U0121 00	-	C0110 61

Circuit/System Description

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

Conditions for Running the DTC

C0010 03

- Ignition ON.
- The system enable relay is ON.
- System and ignition voltage is above 9 volts.

C0010 04

- Ignition ON.
- The system enable relay is ON.

- System and ignition voltage is above 9 volts.
- The pump motor has been commanded OFF for 2 seconds.

C0010 61

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

Conditions for Setting the DTC

C0110 03

The EBCM detects an open in the pump motor driver or supply when the motor is commanded on and if the motor feedback is below 50% of the system voltage for 10 msec.

C0110 04

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

C0110 61

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

Actions Taken when the DTC Sets

- A driver information center message and/or a warning indicator may be displayed.
- The EBCM disables the ABS, the traction control system and Stabilitrak for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.
- Operate the vehicle at speeds greater than 15 km/h (10 MPH) to complete the self test, and the EBCM will turn off the ABS indicator.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the EBCM. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 ohms between the ground circuits listed below and ground:
 - Terminal 1
 - Terminal 25
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify that a test lamp illuminates between the B+ circuit Terminal 13 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
4. If all circuits test normal, replace the brake pressure modulator valve and verify DTC does not reset. If the DTC resets replace the EBCM.

Repair Instructions

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

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

DTC C0131: ABS PRESSURE 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 C0131 01

ABS Pressure Circuit Short to Battery

DTC C0131 06

ABS Pressure Circuit Short to Ground or Open

DTC C0131 4B

ABS Pressure Circuit Calibration Not Learned

DTC C0131 55

ABS Pressure Circuit Expected Number of Transition/Events Exceeded

DTC C0131 5A

ABS Pressure Circuit Not Plausible

DTC C0131 0F

ABS Pressure Signal Erratic

Circuit/System Description

The electronic brake control module (EBCM) uses input from the brake pressure sensor for more accurate control during a vehicle stability enhancement event. The brake pressure sensor is part of the brake pressure modulator valve.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken when the DTC Sets

- A driver information center message and/or a warning indicator may be displayed.

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

Conditions for Clearing the DTC

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

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify DTC, C0277 or C0890 is not set.
 - If DTC is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Verify the brake pedal position sensor or the brake pedal is not binding causing residual brake pressure to be detected, while the brake lights operate properly.
 - If a condition is found, repair or replace the applicable component.
3. Apply and release the brake pedal. Verify the brake lights operate properly.
 - If the brake lights do not operate properly, refer to **Symptoms - Lighting**
4. Verify DTC, C0131 is not set.
 - If DTC is set, replace the brake pressure modulator valve. If the DTC resets, replace the EBCM

Repair Instructions

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

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

DTC C0161: BRAKE SENSOR CIRCUIT/BRAKE SWITCH CIRCUIT

Diagnostic Instructions

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

DTC Descriptor

DTC C0161 00

Antilock Brake System (ABS)/Traction Control System (TCS) Brake Sensor Circuit

DTC C0161 5A

Antilock Brake System (ABS) Brake Switch Circuit Plausibility Failure

Circuit/System Description

The electronic brake control module (EBCM) detects inputs from the brake pressure sensor, vehicle speed, and a serial data message from the body control module (BCM) that the brake pedal is applied. When the vehicle is stopping the EBCM monitors for the brake pedal is pressed, with the brake pressure increasing and the vehicle is slowing down, or when the vehicle is accelerating, the brake pedal is not pressed and brake pressure is not increasing.

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 volts.

Conditions for Setting the DTC

- The EBCM detects the vehicle speed greater than 8 km/h (5 mph), the brake pedal is Applied for 1 minute, and brake pressure is not increasing.
- The EBCM detects brake pedal is Released and the vehicle speed is decreasing while the brake pressure is increasing.

Actions Taken when the DTC Sets

- The EBCM disables the traction control and Stabilitrak for the duration of the ignition cycle.
- A driver information center message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The warning indicators may remain illuminated after repairs are made until the DTCs are cleared, and the vehicle is operated at speeds greater than 13 km/h (8 mph) for the self test to complete.
- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Diagnostic Aids

The DTC C0161 can set if the brake pedal is applied while accelerating.

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: **Diagnose all other brake light DTCs or Symptoms prior to performing this diagnostic procedure.**

1. Verify DTC U0140, C0277 or C0890 is not set.

- If either of the DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
- 2. Verify the brake pedal position sensor or the brake pedal is not binding causing residual brake pressure to be detected, while the brake lights operate properly.
 - If a condition is found, repair or replace the applicable component.
- 3. Apply and release the brake pedal. Verify the brake lamps operate properly.
 - If the brake lamps do not operate properly, refer to **Symptoms - Lighting** .
- 4. Ignition ON, observe the scan tool EBCM BPP Signal parameter while applying and releasing the brake pedal. The reading should change between Applied and Released.
 - If the parameter does not change between applied and released, refer to **Brake Pedal Position Sensor Calibration** .
- 5. Refer to Diagnostic Aids.

DTC C0179: SYSTEM THERMAL 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 Descriptor

DTC C0179 54

System Thermal Temperature High

Circuit/System Description

The electronic brake control module (EBCM) monitors traction control system (TCS) activation in order to calculate an estimate of the EBCM solenoid valve temperatures. In most cases high solenoid valve temperatures are caused by extended TCS activation. If the EBCM calculates that the solenoid valve temperatures are too high, the EBCM will temporarily suspend the TCS function until the solenoid valves cool.

Conditions for Running the DTC

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

Conditions for Setting the DTC

The estimated solenoid coil temperature reaches 220°C (428°F).

Actions Taken when the DTC Sets

- The EBCM disables the traction control for the duration of the fault.

- A DIC message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Diagnostic Aids

Most occurrences of this DTC are caused by excessive TCS activation or braking.

Reference Information

Schematic Reference

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

NOTE: **Allow brakes to cool down before performing test.**

1. With a scan tool clear the DTC.
2. Test drive the vehicle under normal braking conditions and without causing TCS or ABS activation. Verify DTC C0179 is not set.
 - If the DTC is set, replace the EBCM.

Repair Instructions

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

Control Module References for EBCM replacement, setup, and programming

DTC C0186, C0196, OR C0287: LATERAL ACCELEROMETER/YAW RATE CIRCUIT/LONGITUDINAL 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 C0186 00

Lateral Accelerometer Circuit

DTC C0186 09

Lateral Accelerometer Circuit Rate of Change Above Threshold

DTC C0186 0F

Lateral Accelerometer Circuit Erratic

DTC C0186 55

Lateral Accelerometer Circuit Expected Number of Events Not Reached

DTC C0186 1A

Lateral Accelerometer Circuit Bias Level Out Of Range

DTC C0186 5A

Lateral Accelerometer Circuit Plausibility Failure

DTC C0186 3B

Lateral Accelerometer Circuit Erratic Internal Self Test Failed

DTC C0186 75

Lateral Accelerometer Circuit Signal Above Allowable Range

DTC C0196 00

Yaw Rate Circuit

DTC C0196 09

Yaw Rate Circuit Rate of Change Above Threshold

DTC C0196 0F

Yaw Rate Circuit Erratic

DTC C0196 28

Yaw Rate Circuit Incorrect Frequency

DTC C0196 55

Yaw Rate Circuit Expected Number of Events Not Reached

DTC C0196 1A

Yaw Rate Circuit Bias Level Out Of Range

DTC C0196 5A

Yaw Rate Circuit Plausibility Failure

DTC C0196 3B

Yaw Rate Sensor Internal Self Test Failed

DTC C0196 75

Yaw Rate Circuit Signal Above Allowable Range

DTC C0287 0F

Longitudinal Circuit Signal Erratic

DTC C0287 3B

Longitudinal Circuit Signal Internal Self Test Failed

DTC C0287 55

Longitudinal Circuit Signal Expected Number of Events Not Reached

DTC C0287 5A

Longitudinal Circuit Signal Plausibility Failure

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	U0125	U0125	-	-
Ground	-	U0125	-	-

Circuit/System Description

The yaw rate, lateral acceleration and longitudinal acceleration sensors are combined into one yaw/lateral accelerometer sensor, external to the electronic brake control module (EBCM). The EBCM supplies ignition voltage to the yaw/lateral accelerometer sensor. The yaw/lateral acceleration sensor communicates with the EBCM via serial data. The module activates the stability control function depending on yaw/lateral accelerometer sensor input.

Conditions for Running the DTC

Ignition ON.

DTC C0561 71 is not set as a result of a lateral acceleration sensor circuit or internal fault during the current ignition cycle.

Conditions for Setting the DTC

C0186 00, C0186 3B, C0196 00, or C0196 3B

The yaw/lateral accelerometer combination sensor fails an internal self test.

C0186 09

The lateral accelerometer combination changes by more than 550 meters/second per second.

C0186 0F or C0196 0F

The yaw/lateral accelerometer combination sensor is not mounted properly.

C0186 55

The lateral accelerometer combination signal does not change and is locked on a constant value.

C0186 1A

The lateral accelerometer combination bias exceeds 3 meters/second.

C0186 5A

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

C0186 75

The lateral accelerometer combination signal above allowable range.

C0196 09

The yaw rate combination sensor changes by more than 455 degrees/second per second.

C0196 28

The yaw frequency is out of specification.

C0196 39

The yaw rate combination sensor has an internal electronic failure.

C0196 1A

The yaw rate combination bias exceeds 5.7 degrees/second.

C0196 5A

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

C0196 55

The yaw rate combination signal does not change and is locked on a constant value.

C0196 75

The yaw rate combination signal above allowable range.

C0287 0F

The longitudinal combination sensor signal is momentarily implausible or discontinuous.

C0287 55

The longitudinal combination sensor detects fewer than the expected number of transitions.

C0287 3B

The longitudinal combination sensor fails an internal test.

C0287 5A

The longitudinal combination sensor fails two or more input parameters for plausibility.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The vehicle stability enhancement system and traction control system is disabled.
- A driver information center message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Reference Information

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool yaw rate and longitudinal/lateral accelerometer sensor parameter. The reading should be the same on all sensors when driving in a straight line at a constant speed greater than 20 km/h (13 mph), and will vary as the vehicle changes direction.

Circuit/System Testing

1. Verify that DTC U0125, U0126 is not set.
 - o If DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Ignition OFF, disconnect the harness connector at the yaw/lateral accelerometer sensor.
3. Verify the yaw/lateral accelerometer sensor is mounted properly.
 - o If not mounted properly, refer to **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**.
4. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Test for less than 10 ohms between the ground circuit terminal 6 and ground.
 - o If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuits test normal, replace the EBCM.
5. Ignition ON, test for greater than 11 V between the ignition voltage circuit terminal 5 and ground.
 - o If not within the specified range, test the ignition voltage circuit for a short to ground or open/high resistance. If the circuits test normal, replace the EBCM.
6. If all circuits test normal, replace the yaw/lateral accelerometer sensor.

Repair Instructions

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

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

DTC C0201: ABS ENABLE RELAY CONTACT OPEN 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 C0201 04

ABS Enable Relay Contact Open Circuit

Diagnostic Fault Information

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ Terminal 13	C0110 03	C0110 03	-	C0110 61
B+ Terminal 38	U0121 00	U0121 00	-	-
Ground Terminal 1	-	C0110 04	-	C0110 61
Ground Terminal 25	-	U0121 00	-	C0110 61

Circuit/System Description

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

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 volts.
- The solenoid relay is commanded ON.

Conditions for Setting the DTC

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

Actions Taken when the DTC Sets

- A driver information center message and/or a warning indicator may be displayed.
- The EBCM disables the ABS, the traction control system and the StabiliTrak for the duration of the ignition cycle.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.
- Operate the vehicle at speeds greater than 15 km/h (10 MPH) to complete the self test, and the EBCM will turn off the ABS indicator.

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the EBCM.
2. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Test for less than 10 ohms between the ground circuits listed below and ground:
 - Terminal 1
 - Terminal 25
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify that a test lamp illuminates between the B+ circuits listed below and ground:
 - Terminal 13
 - Terminal 38
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
4. If all circuits test normal, replace the EBCM.

Repair Instructions

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

Control Module References for EBCM replacement, programming and setup

DTC C0242 OR P0856: ECM INDICATED TCS MALFUNCTION

Diagnostic Instructions

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

DTC Descriptors

DTC C0242 00

ECM Indicated TCS Malfunction

DTC C0242 71

ECM Indicated TCS Malfunction, Invalid Serial Data

DTC C0242 75

ECM Indicated TCS Malfunction, Signal Above Allowable Range

DTC P0856

Traction Control Torque Request Circuit

Circuit/System Description

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

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 volts.

Conditions for Setting the DTC

The ECM diagnoses a condition preventing the engine control portion of the traction control function and sends a serial data message to the EBCM indicating that torque reduction is not allowed. The ECM will typically set other DTCs and the EBCM will set DTC C0242.

Actions Taken when the DTC Sets

- The EBCM disables the antilock brake system (ABS), traction control and StabiliTrak for the duration of the ignition cycle.
- A DIC message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

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- **Circuit Testing**
- **Wiring Repairs**
- **Connector Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Verify that no DTCs are set in the ECM.

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

DTC C0245: ECM INDICATED TCS MALFUNCTION

Diagnostic Instructions

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

DTC Descriptor

DTC C0245 5A

Wheel Speed Sensor Plausibility Failure

Circuit/System Description

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

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 volts.
- Vehicle must be moving at a speed less than 14.5 km/h (9 mph).
- No wheel speed sensor faults exist.
- Brake is not applied.
- Vehicle is not cornering.
- No wheel spinning is detected.

Conditions for Setting the DTC

Wheel speed differences between one wheel and the others is greater than 25 percent.

Action Taken When the DTC Sets

- The EBCM inhibits Antilock brake system (ABS), traction control system (TCS) and vehicle stability enhancement system (VSES).
- A DIC message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Diagnostic Aids

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

Reference Information

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

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

DTC C0292: COMBINATION 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 C0292 02

VSES Combination Sensor Circuit Short to Ground

DTC C0292 07

VSES Combination Sensor Circuit Voltage Above Threshold

Circuit/System Description

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

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 volts.

Conditions for Setting the DTC

The EBCM detects a short to ground or an open/high resistance on the sensor supply voltage

Actions Taken when the DTC Sets

- The EBCM disables StabiliTrak for the duration of the ignition cycle.
- A DIC message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition ON, verify that DTCs U1826, or U1827 are not set.
 - If any of the DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle**
2. Ignition OFF, disconnect the yaw/lateral acceleration sensor connector.
3. Ignition OFF wait 1 minute, test for less than 10 ohms between the low reference circuit terminal 6 and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the

circuits test normal, replace the EBCM.

4. Ignition ON, test for B+ between the ignition circuit terminal 1 and ground.
 - If less than the specified value, test the ignition circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
5. If all circuits test normal, replace the yaw/lateral accelerometer sensor.

Repair Instructions

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

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

DTC C0558: CALIBRATION DATA

Diagnostic Instructions

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

DTC Descriptor

DTC C0558 46

Calibration Data Not Programmed/Learned, vehicle configuration not programmed

Circuit/System Description

The electronic brake control module (EBCM) must be programmed using SPS.

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 volts.

Conditions for Setting the DTC

The EBCM has not been programmed.

Actions Taken When DTC Sets

A DIC message and/or a warning indicator may be displayed.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Reference Information

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- **Circuit Testing**
- **Connector Repairs**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

Verify that DTC C0558 is not set.

- If the DTC is set, program the EBCM. If the DTC resets, replace the EBCM.

Repair Instructions

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

Control Module References for EBCM replacement, programming and setup

DTC C0561: SYSTEM DISABLED INFORMATION

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 C0561 71

System Disabled Information Stored Invalid Data

DTC C0561 72

System Disabled Information Stored Message Counter Incorrect

DTC C0561 74

System Disabled Information Stored Bus Signal Checksum Error

DTC C0561 FF

System Disabled Information Stored Value of Signal Erratic

Circuit/System Description

The electronic brake control module receives serial data messages from the body control module, engine control module, transmission control module, park brake control module, and steering wheel position sensor which are needed to perform ABS, vehicle stability enhancement or traction control functions.

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 V.

Conditions for Setting the DTC

The EBCM receives an invalid serial data message from another module or component.

Actions Taken when the DTC Sets

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

Conditions for Clearing the DTC

- 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.

Diagnostic Aids

This DTC indicates that there are no problems in the electronic brake control module. The body control module, engine control module, fuel pump control module, and the transmission control module should be checked for a possible fault.

Reference Information

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: The diagnostic for DTC C0561 is covered in six different procedures. To determine which of the six procedures to follow, identify which symptom byte and sub code is set with DTC C0561. The sub code can be found in the scan tool Enhanced Diagnostics Data. Match up the DTC symptom byte and sub code in the table below and perform the procedure listed to the right of the table.

C0561 Symptom Byte	DTC Sub Code	Use Procedure
71	00, 01 or 02	Procedure 1
71 or 72	26	Procedure 2
71	40	Procedure 3
71	CB	Procedure 4
71, 72 or 74	27 or 28	Procedure 5

Circuit/System Testing

Procedure 1

This diagnostic detects invalid serial data from another module which causes the electronic brake control module to deactivate the ABS, the traction control and the electronic stability control.

1. Verify that no DTCs are set in the engine control module, fuel pump control module, body control module, instrument panel cluster or the transmission control module.
 - If DTC is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Use the scan tool to determine which module is transmitting the invalid signal.
3. The module that is transmitting the invalid data should not have any DTCs set.
 - If the module has a DTC set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

Procedure 2

This diagnostic detects invalid serial data from the longitudinal sensor signal to the electronic brake control module.

1. Verify that DTC U1826 or U1827 are not set.
 - If DTC is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Verify that DTC C0561 71 26 is not set.
 - If DTC is set, using the special functions menu on the scan tool, reset the yaw rate sensor.
3. Operate the vehicle under the conditions for setting the DTC, the DTC should not set.
 - If DTC is sets, replace the yaw and lateral accelerometer sensor.

Procedure 3

This diagnostic detects invalid serial data from the traction control switch, brake pedal position sensor or the brake fluid level sensor to the electronic brake control module.

1. Verify that DTC C0267, C0277 or C0890 are not set.
 - If DTC is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Verify that DTC C0561 71 40 is not set.
 - If DTC is set, refer to **Traction Control/Stability Control Indicator Malfunction (With LSA), Traction Control/Stability Control Indicator Malfunction (Without LSA)** for traction control switch diagnosis.

Procedure 4

This diagnostic detects invalid serial data from the instrument panel cluster to the electronic brake control module regarding the traction control switch or the circuit.

1. Verify that DTC C0561 71 CB is not set.
 - If DTC is set, refer to **Traction Control/Stability Control Indicator Malfunction (With LSA), Traction Control/Stability Control Indicator Malfunction (Without LSA)** for traction control switch diagnosis.
2. If no DTCs are set, refer to **Symptoms - Antilock Brake System**.

Procedure 5

This diagnostic detects invalid serial data from the steering wheel position sensor or parking brake control module to the electronic brake control module.

1. Verify that DTC B3794, P0571, P0703, P0710 or no U codes are set.
 - If DTC is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** diagnose all U codes first.
2. If no DTCs are set, refer to **Symptoms - Park Brake** , or **Symptoms - Antilock Brake System**.

Procedure 6

This diagnostic detects invalid serial data from the body control module to the electronic brake control module regarding the brake pedal position sensor or circuit.

1. Verify that DTC C0277 or C0890 is not set.
 - If DTC is set, refer to **DTC C0277 or C0890** .
2. If no DTCs are set, refer to **Symptoms - Lighting** .

Repair Instructions

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

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

DTC C0710: STEERING POSITION 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 C0710 55

Steering Position Signal Expected Number of Transitions/Events Not Reached

DTC C0710 4B

Steering Position Signal Calibration Not Learned

DTC C0710 5A

Steering Position Signal Not Plausible

DTC C0710 0F

Steering Position Signal Erratic

Circuit/System Description

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

Conditions for Running the DTC

- Ignition ON.
- Ignition voltage is greater than 10 volts.
- The vehicle speed is greater than 16 km/h (10 MPH).

Conditions for Setting the DTC

The calculated steering angle does not correlate with the steering wheel position sensor and the yaw rate sensor.

Actions Taken when the DTC Sets

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

Diagnostic Aids

- The car should not pull in either direction causing the steering wheel to be OFF center while driving straight on a level surface.
- Improperly mounted or loose steering wheel position sensor.
- Confirm that all tires are of the proper size and that all are matching brands. Check and adjust all tires to the stated cold air pressure as identified on the tire placard. If a mis-sized or non-matching brand tire is

present, inform the customer that in order for the vehicle stability enhanced system to function normally, tires need to be a uniform size and rolling diameter.

Reference Information

Schematic Reference

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, verify that DTCs U1826, U1827, or C0292 are not set.
 - If any of the DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Perform the steering angle sensor calibration procedure. Refer to **Steering Angle Sensor Centering**.
3. With a scan tool, clear the DTC.
4. Operate the vehicle within the conditions for running the DTC. Verify the DTC does not reset.
 - If the DTC resets, replace the steering wheel position sensor.

Repair Instructions

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

- **Steering Angle Sensor Replacement**
- **Control Module References** for Electronic Brake Control Module replacement, programming and setup

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**
- **Brake Warning Indicator Malfunction**
- **Traction Control/Stability Control Indicator Malfunction (With LSA), Traction Control/Stability Control Indicator Malfunction (Without LSA)**

ABS INDICATOR MALFUNCTION

Diagnostic Instructions

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

Circuit/System Description

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

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - COUPE AND WAGON

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, command the IPC, All Indicators ON and OFF with a scan tool. The ABS warning indicator should turn ON and OFF when changing between the commanded states.
 - If the ABS warning indicator does not turn ON and OFF, replace the IPC.
2. If the ABS warning indicator tests normal, replace the EBCM.

Repair Instructions

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

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

TRACTION CONTROL/STABILITY CONTROL INDICATOR MALFUNCTION (WITH LSA)

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Traction Control Switch Ignition	1	1	-	-
Traction Control Switch Signal	1	1	B3622 07	-
Steering Wheel Control Switch Ignition	B1529 03	1, 2	-	-
Steering Wheel Control Switch Signal	1, 2	1, 2	B3622 07	-
1. The traction control disable function is inoperative. 2. Steering wheel control functions are inoperative.				

Circuit/System Description

The traction control switch for the CTS-V is located on the steering wheel. When the switch is pressed, the signal circuit from the body control module (BCM) is pulled low through a series of resistors indicating the traction control disable command. In response to this signal, the BCM sends a serial data message to the electronic brake control module (EBCM) to disable the traction control system. When the traction control switch is pressed and held for 5 seconds, the BCM sends a serial data message to the EBCM commanding it to disable the stability control. After the EBCM disables the stability control, it sends a serial data message to the instrument cluster requesting it to turn the traction control indicator OFF and turn stability off indicator ON.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - COUPE AND WAGON

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool BCM, SWC Bank 1 Status parameter while pressing the traction control switch. The reading should change between Idle and Switch 6.

- If not the specified value, refer to **Steering Wheel Controls Malfunction** .
- If the reading changes between Idle and Switch 6, the traction control is inoperative, and there are NO other DTCs set, replace the EBCM.

Repair Instructions

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

Control Module References for EBCM replacement, programming and setup

TRACTION CONTROL/STABILITY CONTROL INDICATOR MALFUNCTION (WITHOUT LSA)

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Traction Control Switch Signal	1	2	-	-
Ground	-	2	-	-
1. Traction Control Indicator Always On 2. Traction Control Indicator Inoperative				

Circuit/System Description

The instrument panel cluster illuminates the Stabilitrak indicator during the bulb check or when the electronic brake control module detects a fault and sends a serial data message to the instrument panel cluster commanding the indicator ON.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - COUPE AND WAGON

Description and Operation

ABS Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

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

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the Radio/HVAC Control.
2. Test for less than 5 ohms between the ground circuit terminal 16 and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify the scan tool Traction Control Switch parameter is Inactive.
 - If not the specified value, test the signal circuit terminal 14 for a short to ground. If the circuit tests normal, replace the BCM.
4. Install a 3 A fused jumper wire between the signal circuit terminal 14 and the ground circuit terminal 16. Verify the scan tool Traction Control Switch parameter is Active.
 - If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the BCM.
5. If all circuits test normal, test or replace the traction control switch.

Component Testing

1. Ignition OFF, disconnect the harness connector at the traction control switch.
2. Test for infinite resistance between the signal terminal 14 and the ground terminal 16 with the switch in the open position.

- If not the specified value, replace the traction control switch.
- 3. Test for less than 3 ohms between the signal terminal 14 and the ground terminal 16 with the switch in the closed position.
 - If greater than the specified range, replace the traction control switch.

Repair Instructions

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

- **Instrument Panel Center Compartment Replacement**
- **Control Module References** for BCM replacement, programming and setup

REPAIR INSTRUCTIONS

ANTILOCK BRAKE SYSTEM AUTOMATED BLEED

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

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

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

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

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

Performing the Automated Bleed Procedure

CAUTION: The Auto Bleed Procedure may be terminated at any time during the process by pressing the EXIT button. No further Scan Tool prompts

pertaining to the Auto Bleed procedure will be given. After exiting the bleed procedure, relieve bleed pressure and disconnect bleed equipment per manufacturers instructions. Failure to properly relieve pressure may result in spilled brake fluid causing damage to components and painted surfaces.

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

STEERING ANGLE SENSOR CENTERING

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

- Steering gear replacement
- Steering column replacement
- Steering angle sensor replacement

- Intermediate shaft replacement
- Electronic brake control module (EBCM) replacement
- Collision or other physical damage

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

1. Using the steering wheel, align the front wheels forward.
2. Set the transmission in the PARK position.
3. Turn the ignition switch ON, with the engine OFF.
4. Clear any DTCs that may be set.
5. Select Steering Angle Sensor Centering in the Special Functions list.
6. Press the Reset button or follow the scan tool directions to complete the centering procedure.

ELECTRONIC BRAKE AND TRACTION CONTROL MODULE WITH BRAKE PRESSURE MODULATOR VALVE REPLACEMENT (CTS)

Removal Procedure

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

1. Place the ignition switch in the OFF position.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
4. Remove the washer solvent container fasteners and position the washer solvent container aside to access the electronic brake control module (EBCM). Refer to **Windshield Washer Solvent Container Replacement (Without CE4)** , **Windshield Washer Solvent Container Replacement (With CE4)** .
5. Thoroughly clean the area around the EBCM of all dirt and debris.
6. Release the EBCM electrical connector by pressing the retaining tab and rotating the locking lever forward.

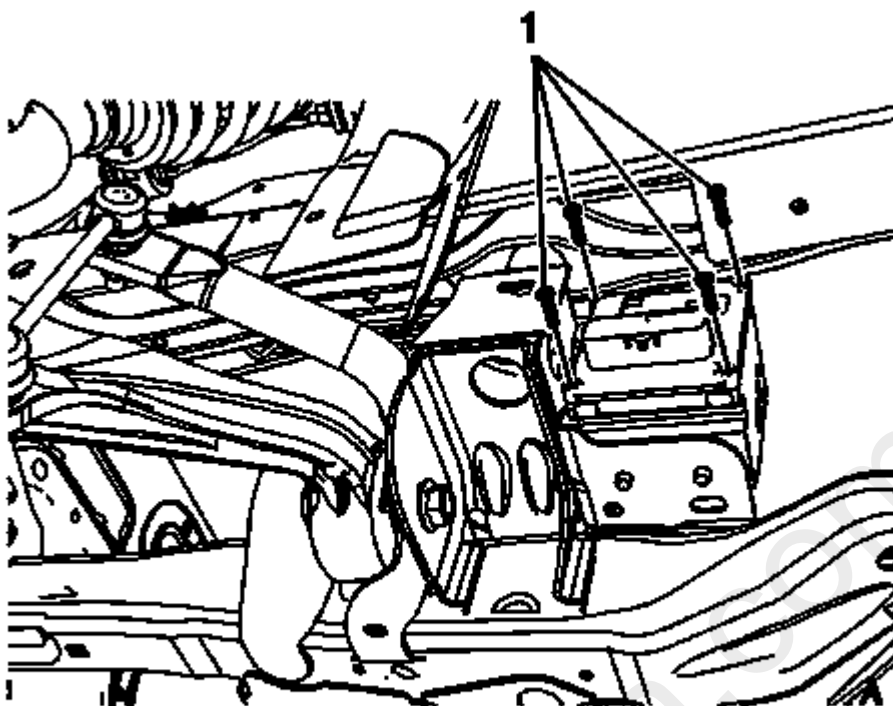


Fig. 4: View of EBCM Electrical Connector and Screws
Courtesy of GENERAL MOTORS COMPANY

7. Remove the EBCM screws (1).

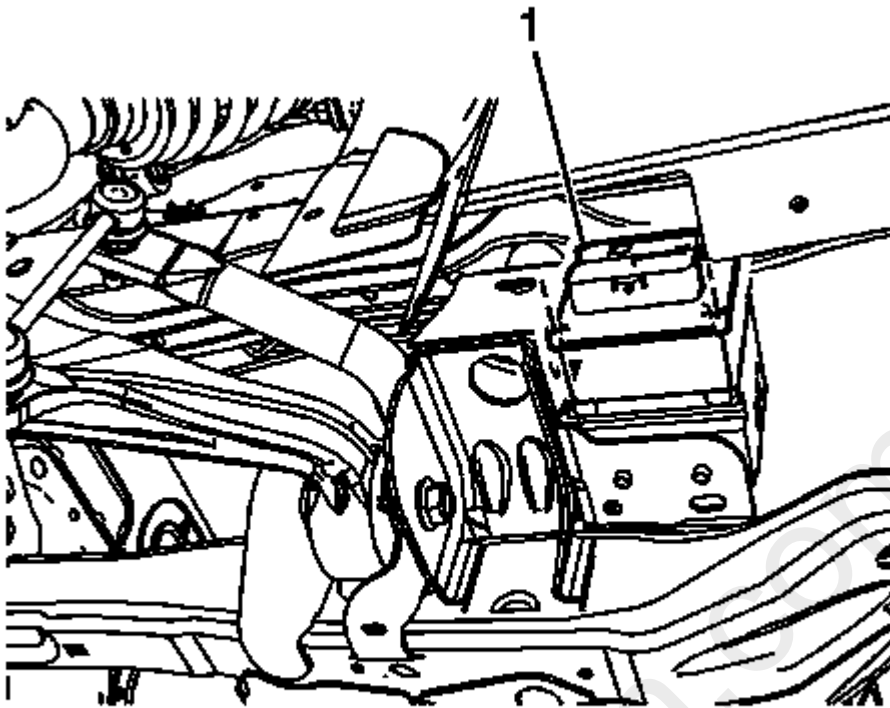


Fig. 5: Identifying BPMV & EBCM
Courtesy of GENERAL MOTORS COMPANY

8. Separate the EBCM (1) from the brake pressure modulator valve (BPMV).

Installation Procedure

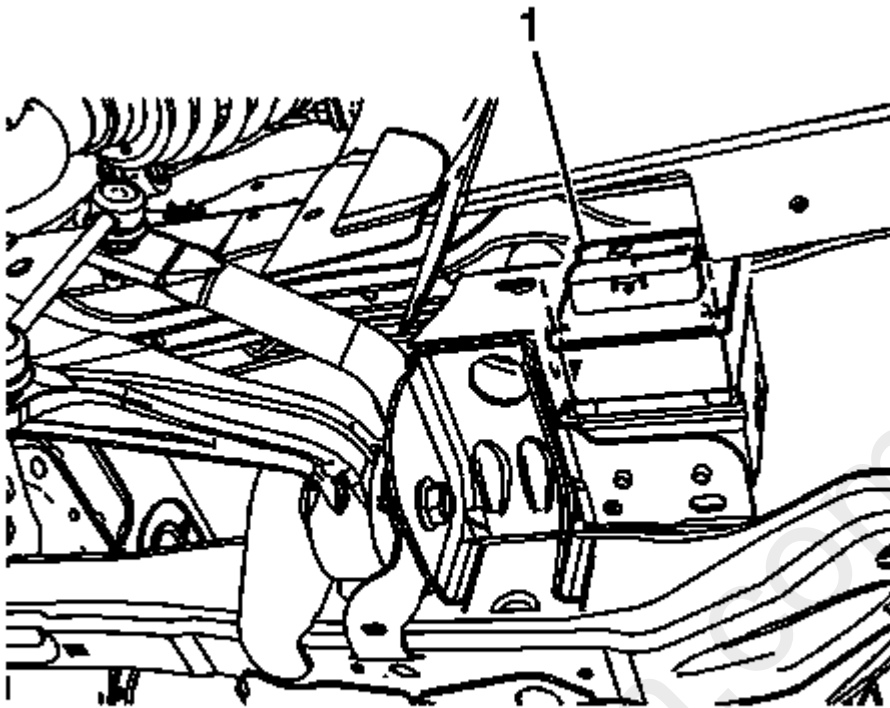


Fig. 6: Identifying BPMV & EBCM
Courtesy of GENERAL MOTORS COMPANY

1. Clean the sealing surfaces of the BPMV and the EBCM.
2. Install the EBCM (1) to the BPMV.

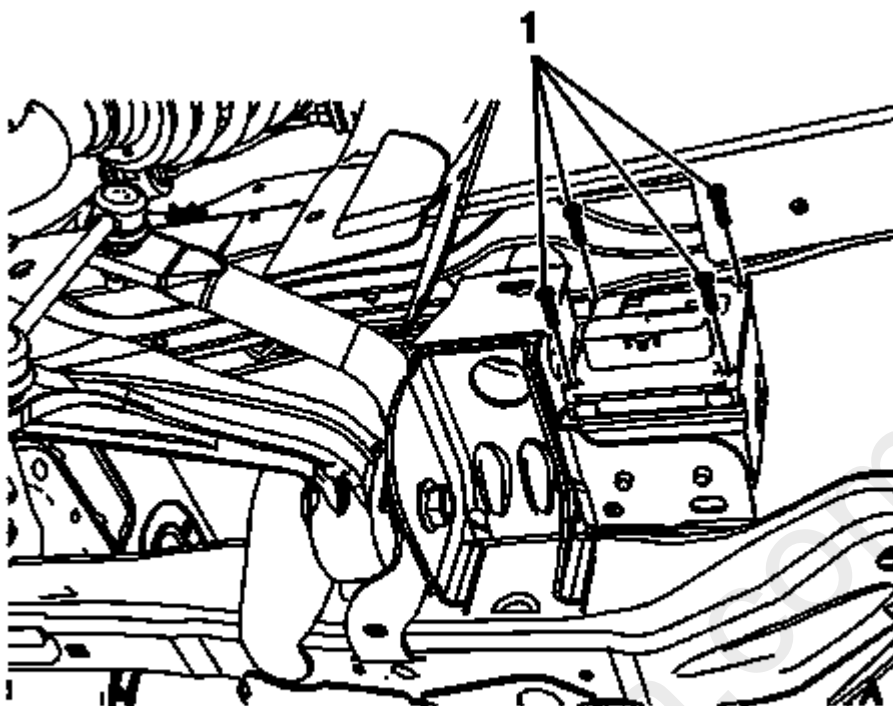


Fig. 7: View of EBCM Electrical Connector and Screws
Courtesy of GENERAL MOTORS COMPANY

3. Install the EBCM screws (1).

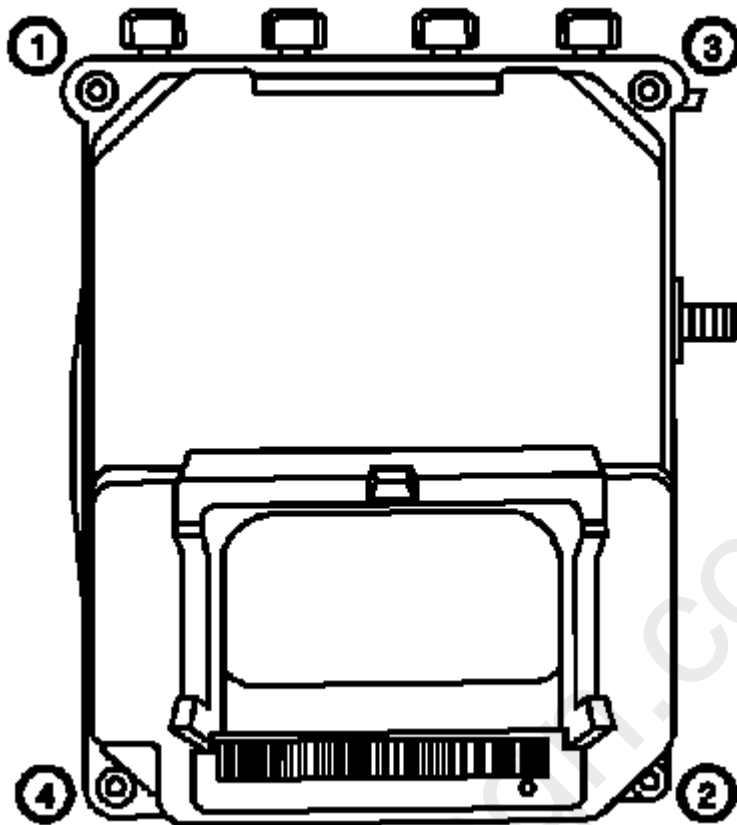


Fig. 8: Installing EBCM To BPMV Screws
 Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

4. Tighten the EBCM screws in the sequence shown (1-4) to 5 N.m (44 lb in).
5. Connect the EBCM electrical connector.
6. Position the washer solvent container and install the fasteners. Refer to Windshield Washer Solvent Container Replacement (Without CE4) , Windshield Washer Solvent Container Replacement (With CE4) .
7. Install the right front wheelhouse liner. Refer to Front Wheelhouse Liner Replacement .
8. Lower the vehicle.
9. If installing a new EBCM, program the EBCM. Refer to Control Module References .
10. Perform the Diagnostic System Check - Vehicle .

ELECTRONIC BRAKE AND TRACTION CONTROL MODULE WITH BRAKE PRESSURE MODULATOR VALVE REPLACEMENT (CTS-V)

Removal Procedure

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

1. Place the ignition switch in the OFF position.
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
3. Remove the right front wheelhouse liner. Refer to Front Wheelhouse Liner Replacement .
4. Remove the washer solvent container fasteners and position the washer solvent container aside to access the electronic brake control module (EBCM). Refer to Windshield Washer Solvent Container Replacement (Without CE4) , Windshield Washer Solvent Container Replacement (With CE4) .
5. Thoroughly clean the area around the EBCM of all dirt and debris.
6. Release the EBCM electrical connector by pressing the retaining tab and rotating the locking lever forward.

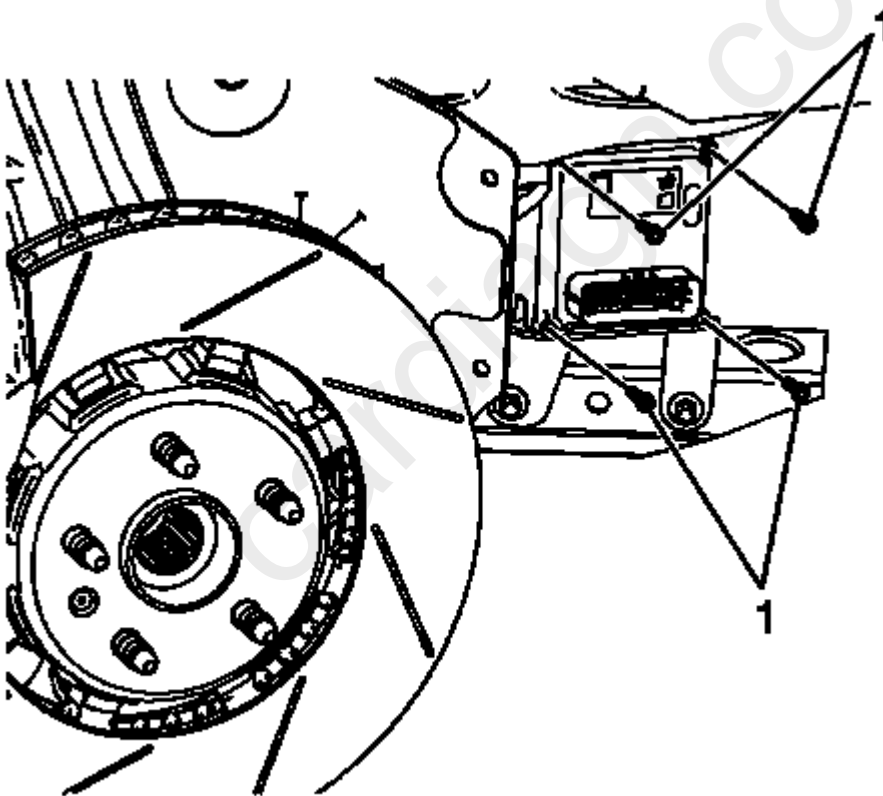


Fig. 9: Identifying EBCM Screws
Courtesy of GENERAL MOTORS COMPANY

7. Remove the EBCM screws (1).

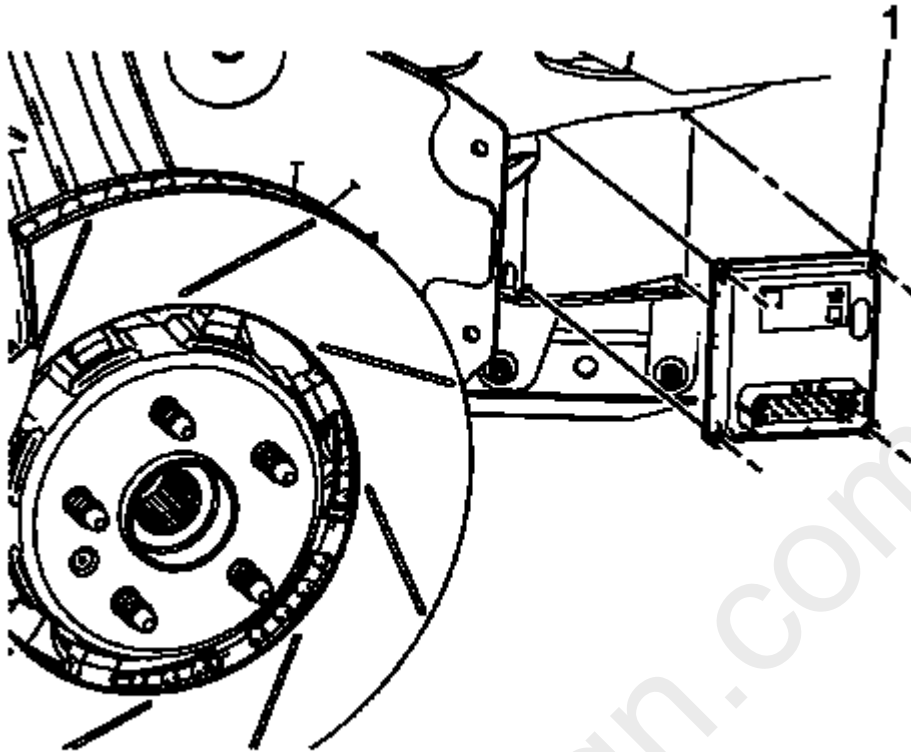


Fig. 10: View Of EBCM & Brake Pressure Modulator Valve
Courtesy of GENERAL MOTORS COMPANY

8. Separate the EBCM (1) from the brake pressure modulator valve (BPMV).

Installation Procedure

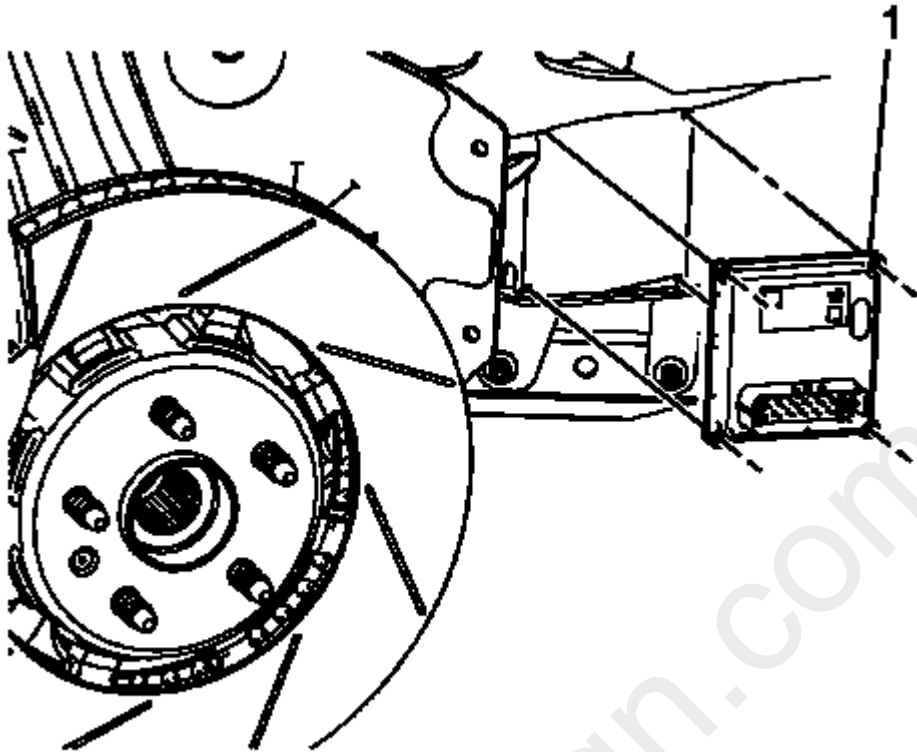


Fig. 11: View Of EBCM & Brake Pressure Modulator Valve
Courtesy of GENERAL MOTORS COMPANY

1. Clean the sealing surfaces of the BPMV and the EBCM.
2. Install the EBCM (1) to the BPMV.

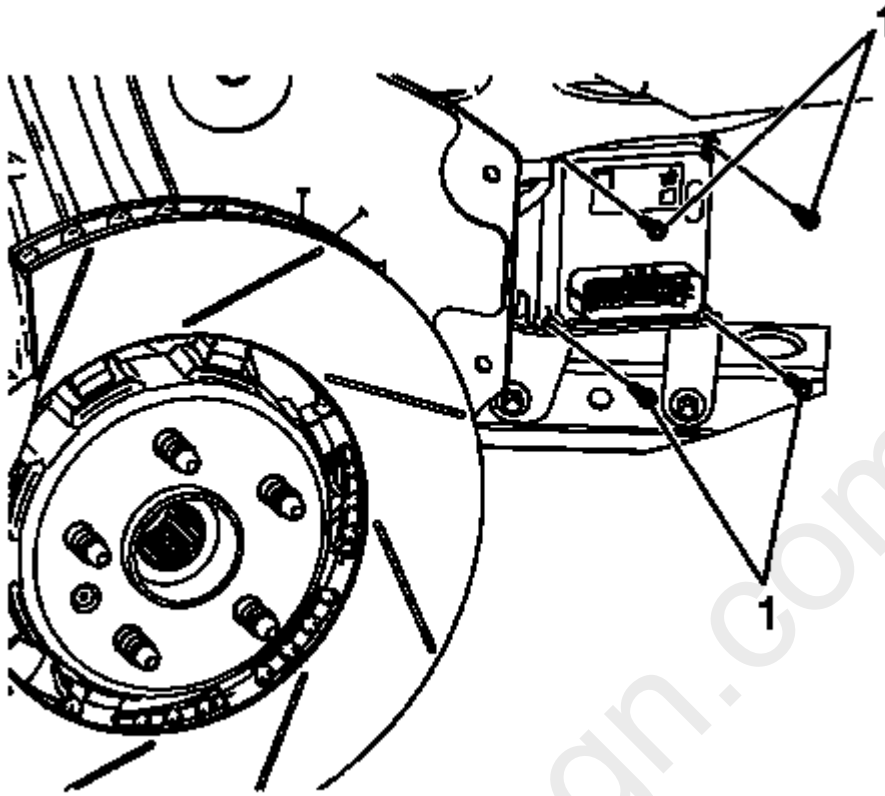


Fig. 12: Identifying EBCM Screws
 Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Install the EBCM screws (1) and tighten in a cross pattern to 5 N.m (44 lb in).
4. Connect the EBCM electrical connector.
5. Position the washer solvent container and install the fasteners. Refer to Windshield Washer Solvent Container Replacement (Without CE4) , Windshield Washer Solvent Container Replacement (With CE4) .
6. Install the right front wheelhouse liner. Refer to Front Wheelhouse Liner Replacement .
7. Lower the vehicle.
8. If installing a new EBCM, program the EBCM. Refer to Control Module References .
9. Perform the Diagnostic System Check - Vehicle .

BRAKE PRESSURE MODULATOR VALVE REPLACEMENT (CTS)

Removal Procedure

WARNING: Refer to Brake Fluid Irritant Warning .

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

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

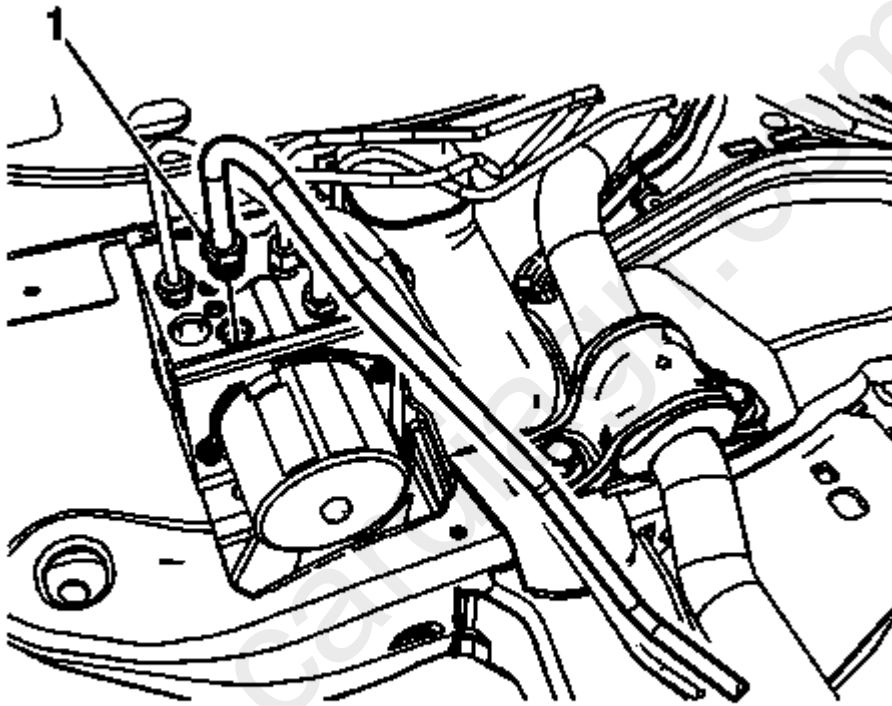


Fig. 13: View of Pressure Modulator Valve (BPMV) Inlet Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

1. Place the ignition switch in the OFF position.
2. Remove the RH front compartment sight shield. Refer to Front Compartment Sight Shields Replacement .
3. Thoroughly clean the area around the EBCM of all dirt and debris.
4. Disconnect the secondary brake pressure modulator valve (BPMV) inlet brake pipe fitting (1).

Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.

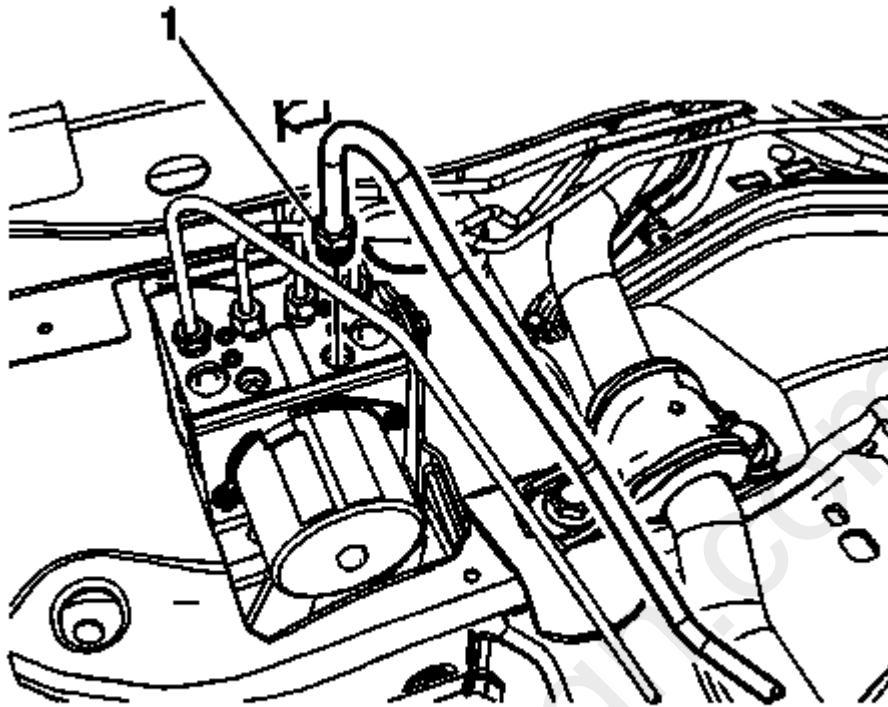


Fig. 14: Identifying Primary BPMV Inlet Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the primary BPMV inlet brake pipe fitting (1).

Cap the brake pipe fitting and plug the BPMV inlet port to prevent brake fluid loss and contamination.

6. Remove the electronic brake control module (EBCM). Refer to **Electronic Brake and Traction Control Module with Brake Pressure Modulator Valve Replacement (CTS)**.

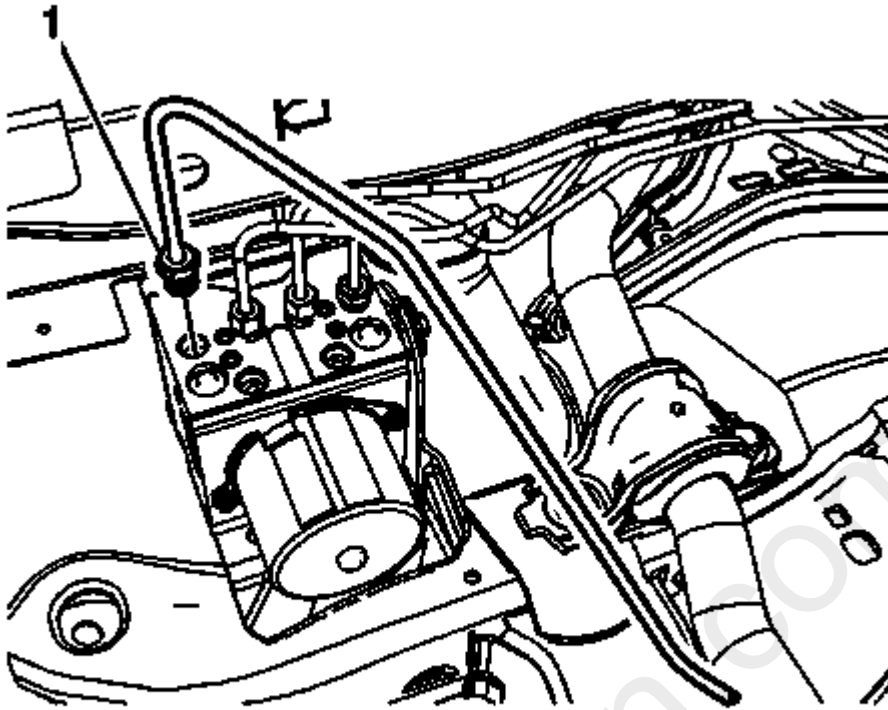


Fig. 15: Identifying LF Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

7. Disconnect the LF brake pipe fitting (1).

Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.

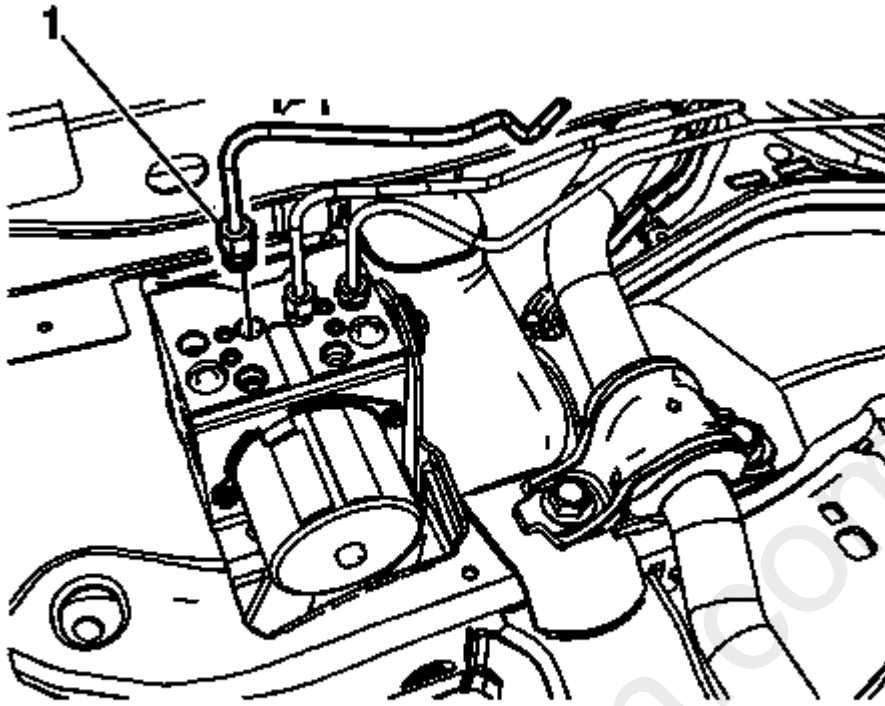


Fig. 16: View of RR Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the RR brake pipe fitting (1).

Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.

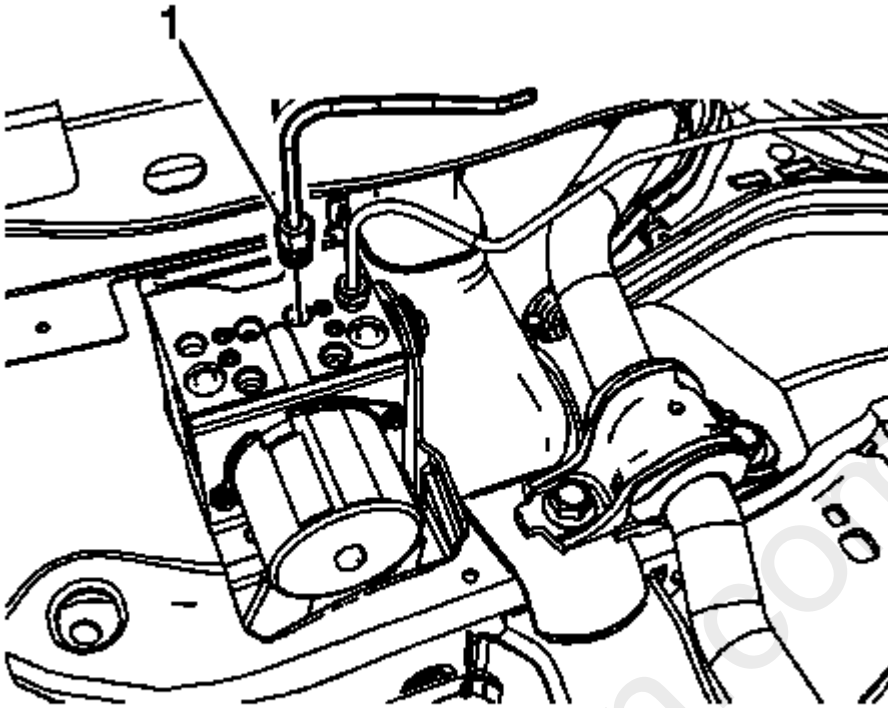


Fig. 17: View of LR Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

9. Disconnect the LR brake pipe fitting (1).

Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.

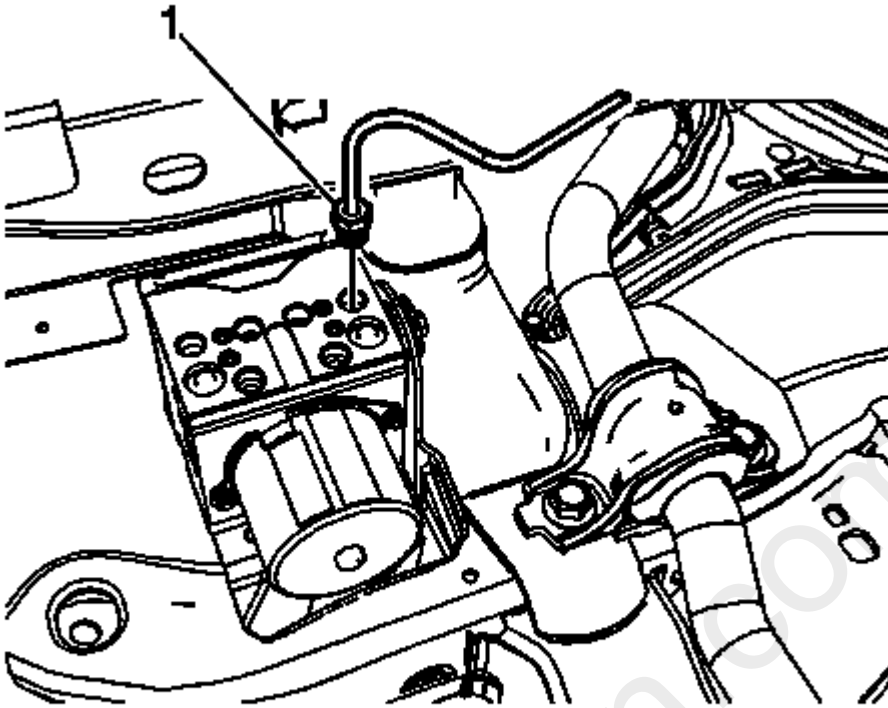


Fig. 18: Identifying RF Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

10. Disconnect the RF brake pipe fitting (1).

Cap the brake pipe fitting and plug the BPMV outlet port to prevent brake fluid loss and contamination.

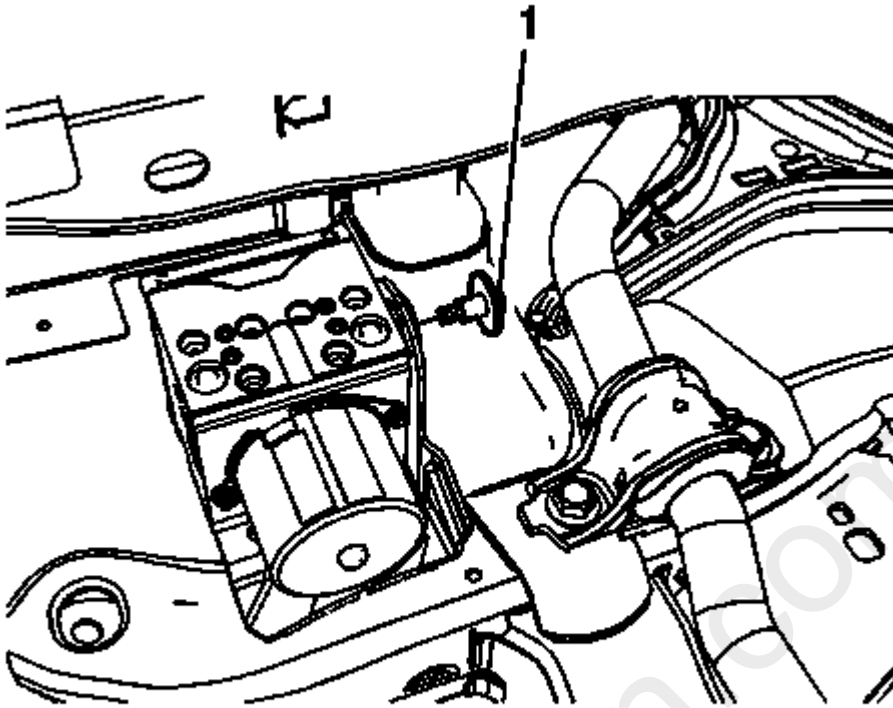


Fig. 19: Identifying BPMV Bolt
Courtesy of GENERAL MOTORS COMPANY

11. Remove the BPMV bolt (1).

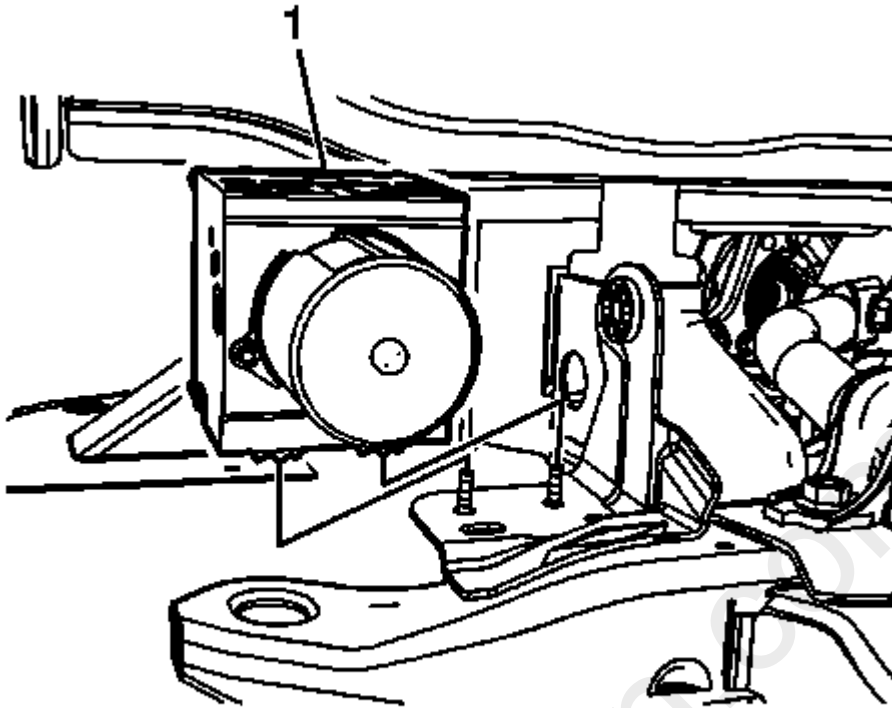


Fig. 20: View of BPMV
Courtesy of GENERAL MOTORS COMPANY

12. Remove the BPMV (1).

Installation Procedure

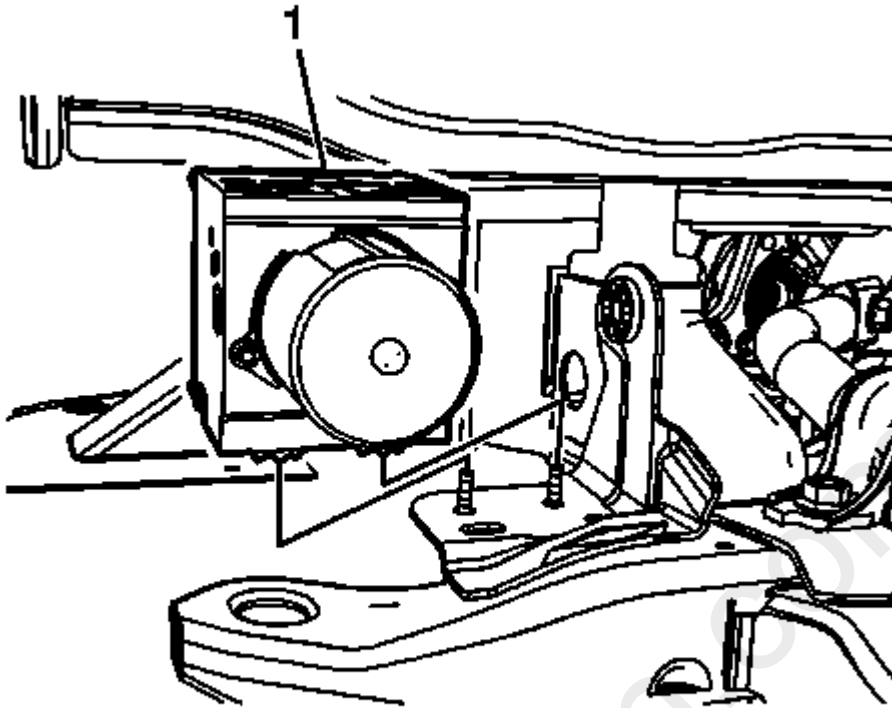


Fig. 21: View of BPMV

Courtesy of GENERAL MOTORS COMPANY

1. Install the BPMV (1).

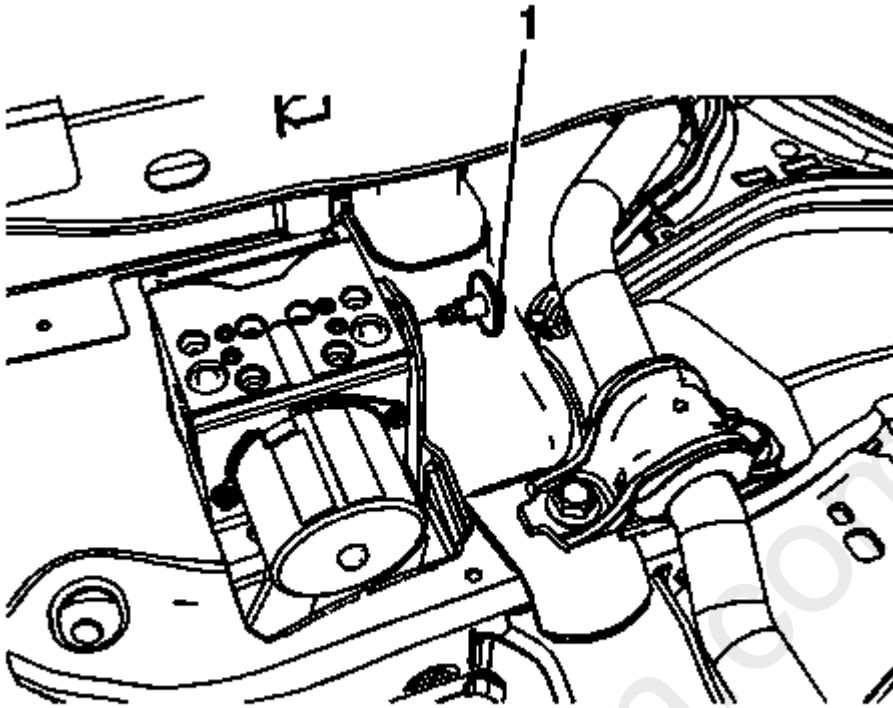


Fig. 22: Identifying BPMV Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Install the BPMV bolt (1) and tighten to 12 N.m (106 lb in).

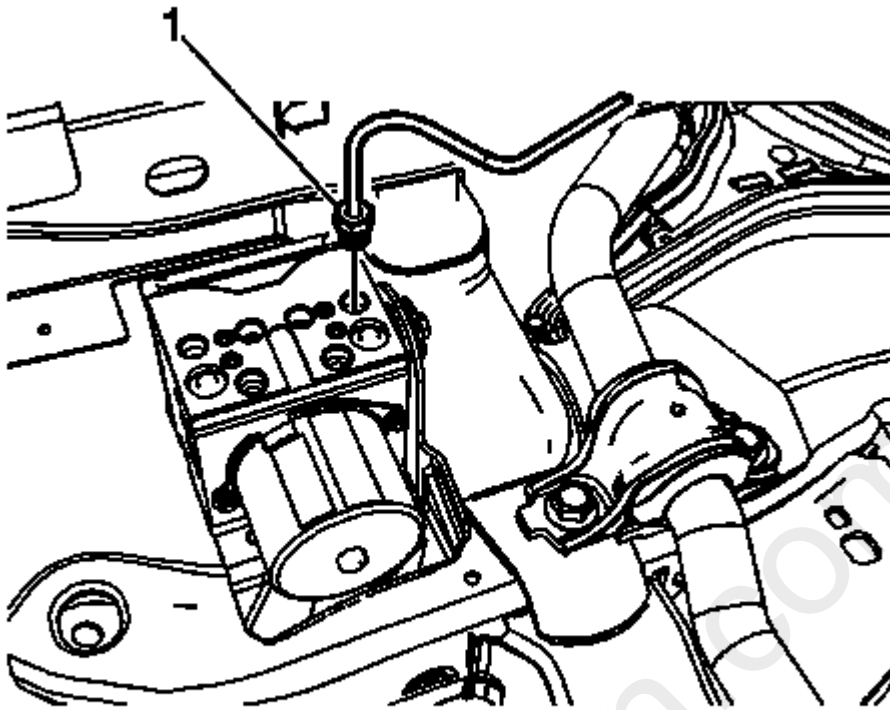


Fig. 23: Identifying RF Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

3. Connect the RF brake pipe fitting (1) and tighten to 20 N.m (15 lb ft).

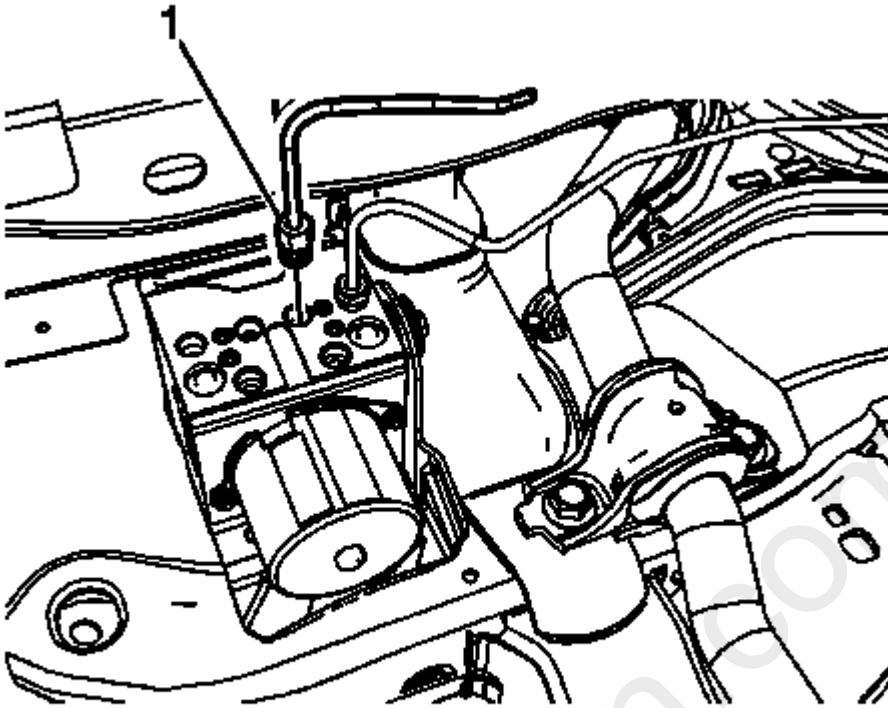


Fig. 24: View of LR Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

4. Connect the LR brake pipe fitting (1) and tighten to 20 N.m (15 lb ft).

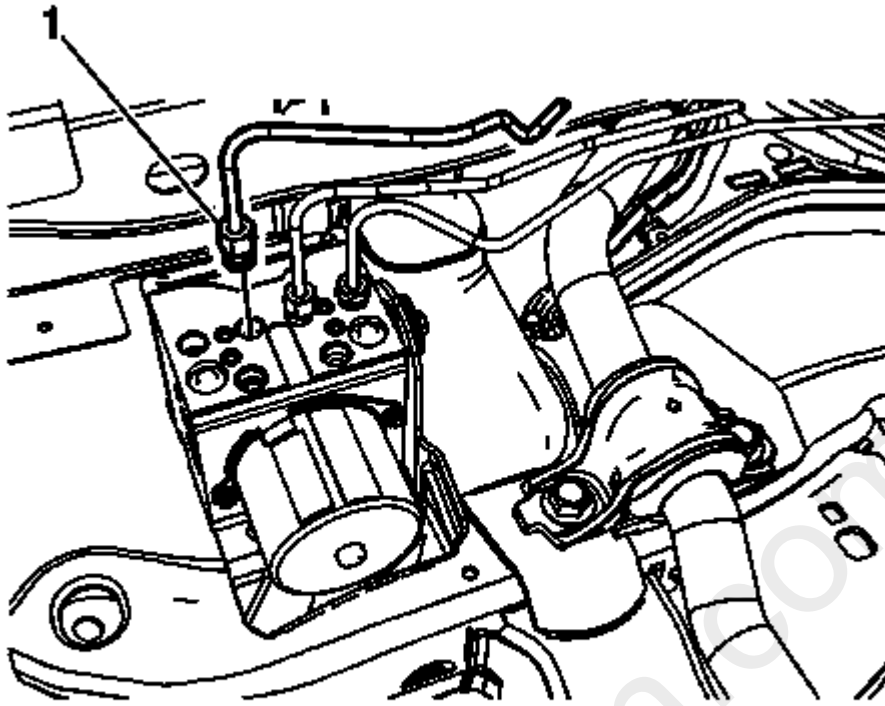


Fig. 25: View of RR Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

5. Connect the RR brake pipe fitting (1) and tighten to 20 N.m (15 lb ft).

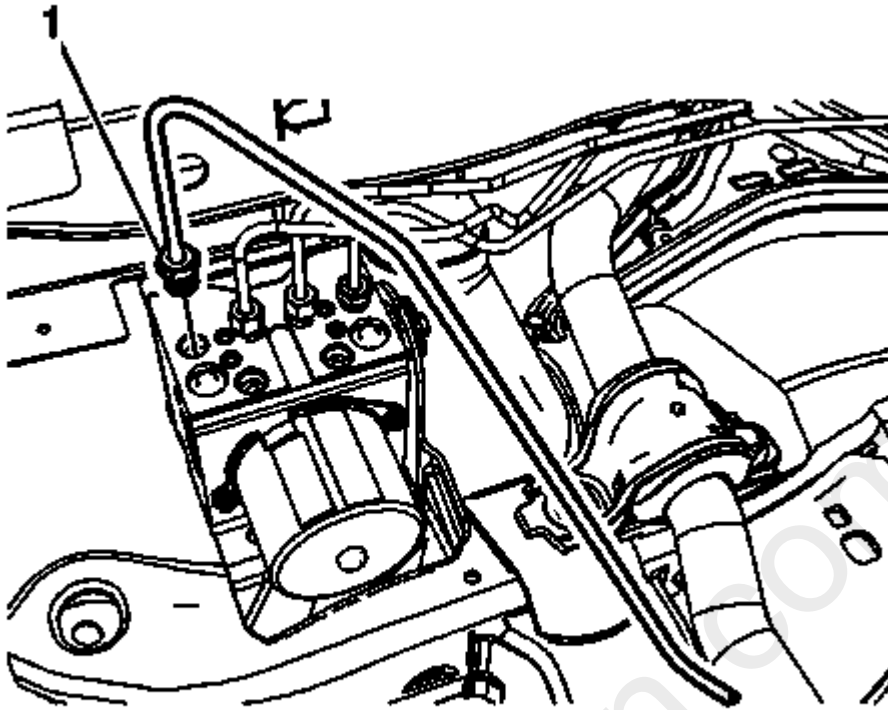


Fig. 26: Identifying LF Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

6. Connect the LF brake pipe fitting (1) and tighten to 20 N.m (15 lb ft).
7. Install the electronic brake control module (EBCM). Refer to **Electronic Brake and Traction Control Module with Brake Pressure Modulator Valve Replacement (CTS)**.

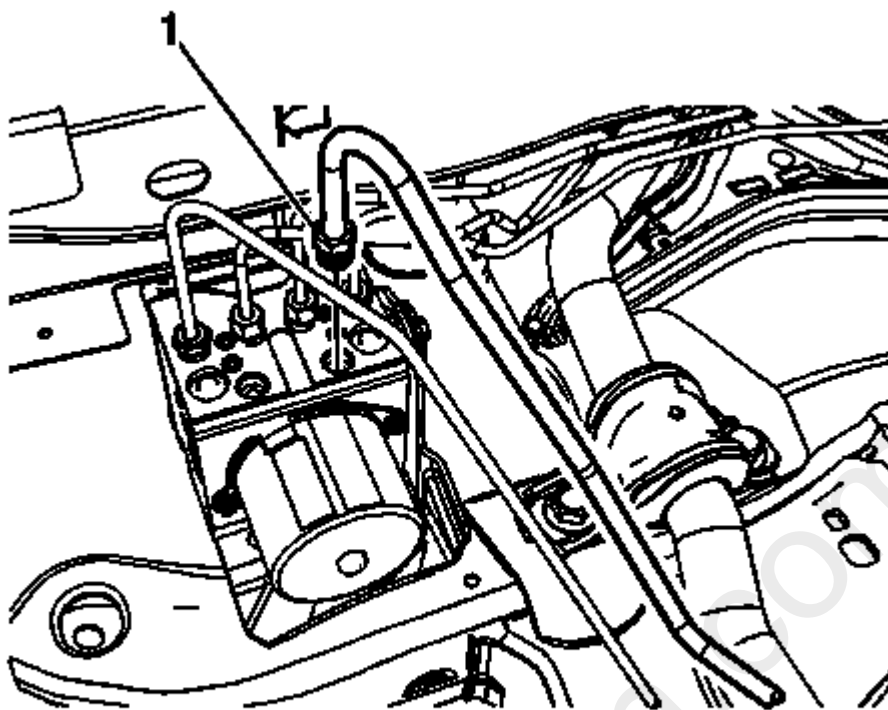


Fig. 27: Identifying Primary BPMV Inlet Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

8. Connect the primary BPMV inlet brake pipe fitting (1) and tighten to 32 N.m (24 lb ft).

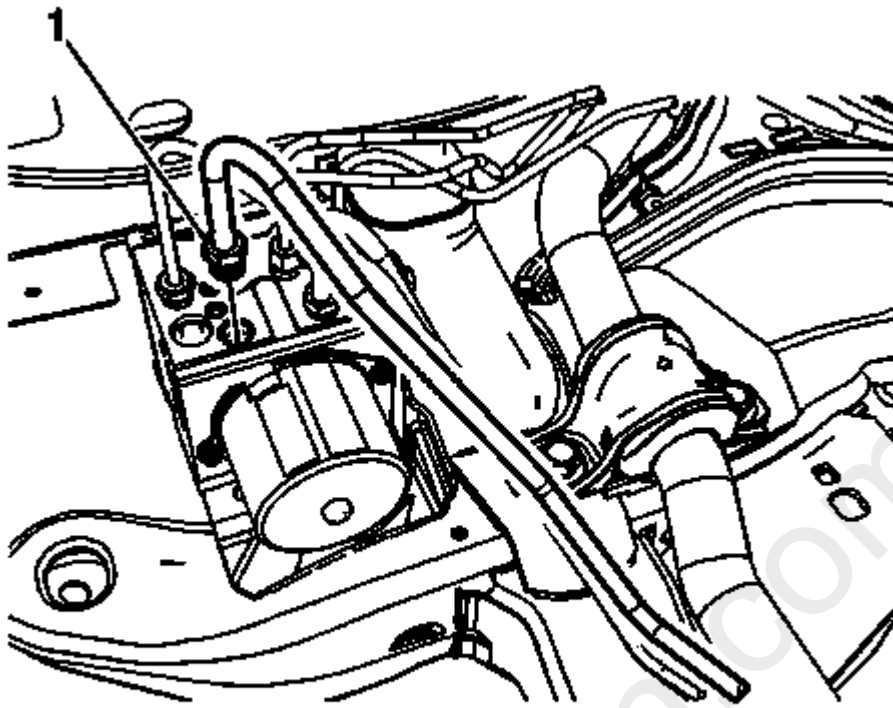


Fig. 28: View of Pressure Modulator Valve (BPMV) Inlet Brake Pipe Fitting
Courtesy of GENERAL MOTORS COMPANY

9. Connect the secondary BPMV inlet brake pipe fitting (1) and tighten to 32 N.m (24 lb ft).
10. Install the RH front compartment sight shield. Refer to **Front Compartment Sight Shields Replacement** .
11. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** , **Hydraulic Brake System Bleeding (Pressure)** .
12. Perform the **Antilock Brake System Automated Bleed**.
13. Perform the **Diagnostic System Check - Vehicle** .

BRAKE PRESSURE MODULATOR VALVE REPLACEMENT (CTS-V)

Removal Procedure

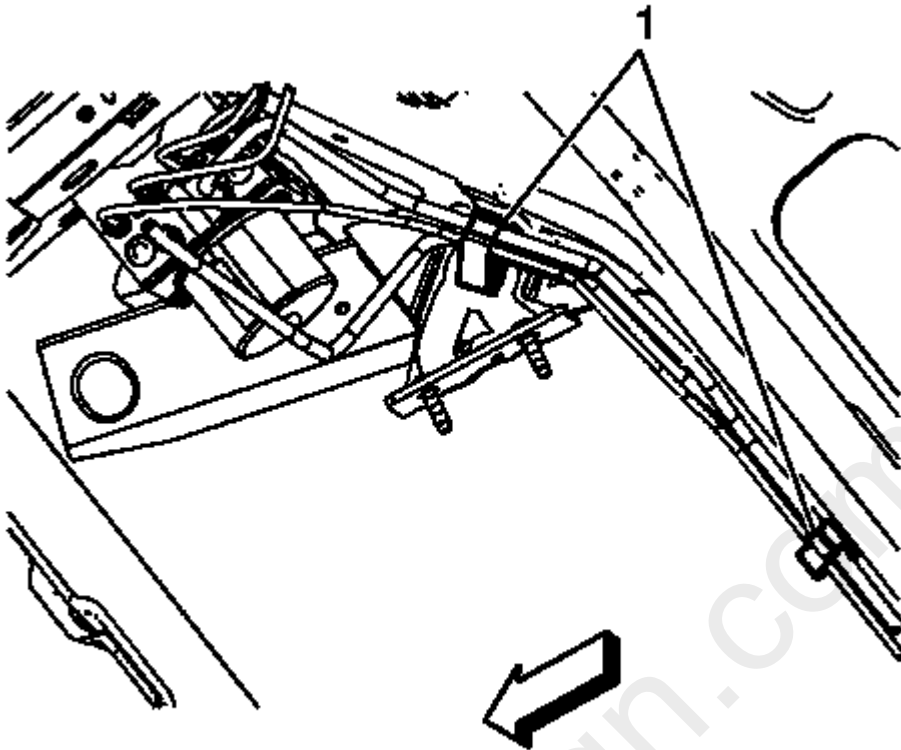


Fig. 29: Locating Vehicle Front Frame Brake Clips
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Brake Fluid Irritant Warning .

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

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

1. Place the ignition switch in the OFF position.
2. Remove the front compartment sight shield. Refer to Front Compartment Sight Shields Replacement .
3. Release the brake clips from the vehicle front frame (1).
4. Thoroughly clean the area around the electronic brake control module (EBCM) and the brake pressure modulator valve (BPMV) of all dirt and debris.

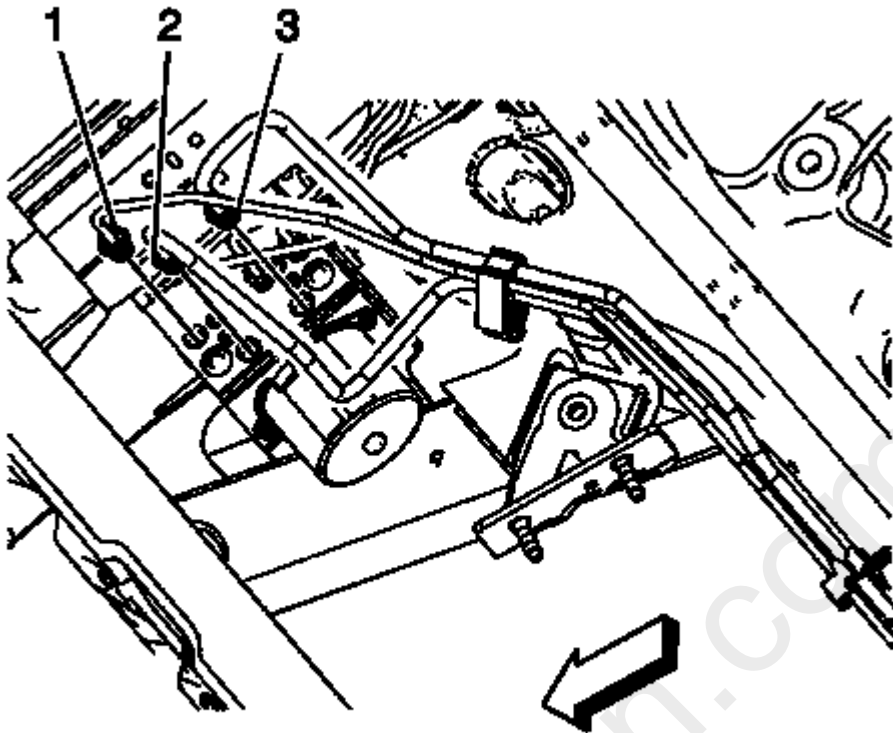


Fig. 30: Identifying Brake Pipe Fittings
Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the brake pipes to the BPMV to ensure correct installation.

5. Disconnect the left front (1), master cylinder primary (2), and master cylinder secondary (3) brake pipe fittings from the BPMV.

Cap the brake pipe fittings and plug the BPMV inlet and outlet ports to prevent brake fluid loss and contamination.

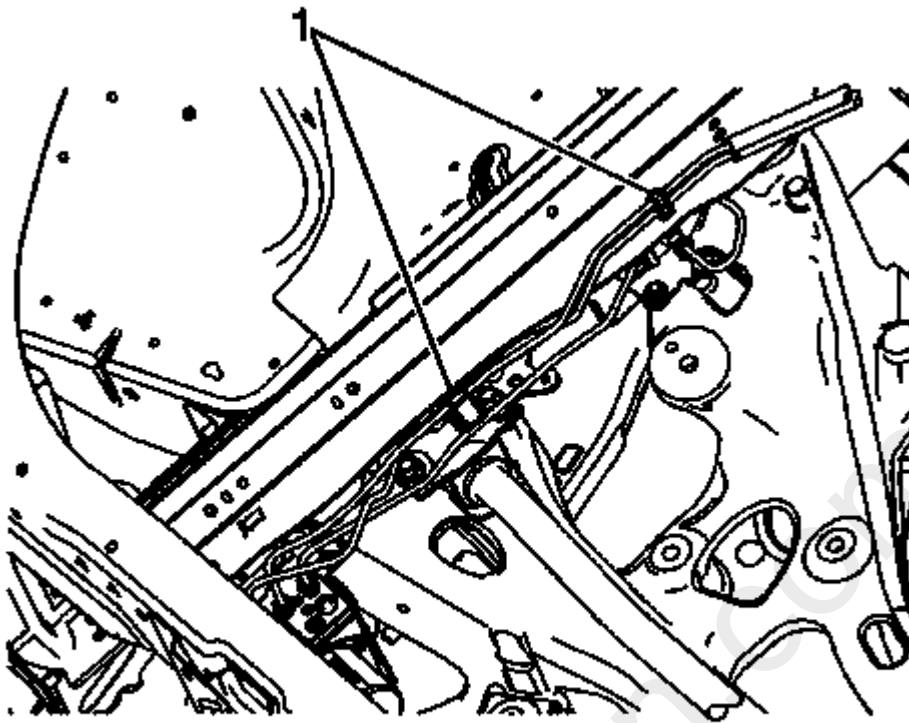


Fig. 31: Identifying Right Side Engine Compartment Side Rail Brake Pipe Clips
Courtesy of GENERAL MOTORS COMPANY

6. Release the brake pipe clips (1) from the right side engine compartment side rail.

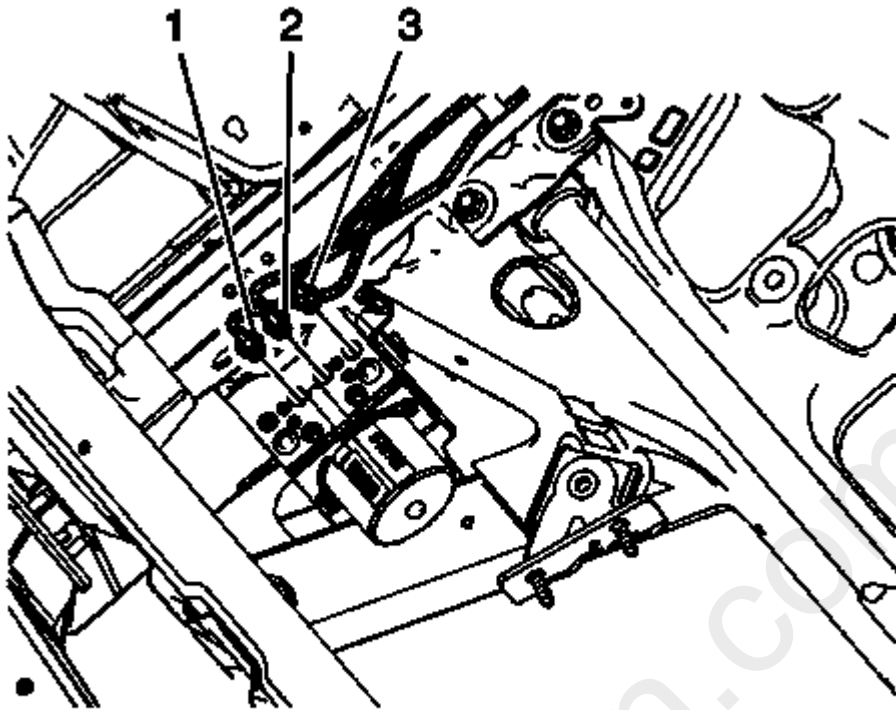


Fig. 32: Identifying Right Rear, Left Rear, And Right Front Brake Pipe Fittings
Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the brake pipes to the BPMV to ensure correct installation.

7. Disconnect the right rear (1), left rear (2), and the right front (3) brake pipe fittings from the BPMV.

Cap the brake pipe fittings and plug the BPMV outlet ports to prevent brake fluid loss and contamination.

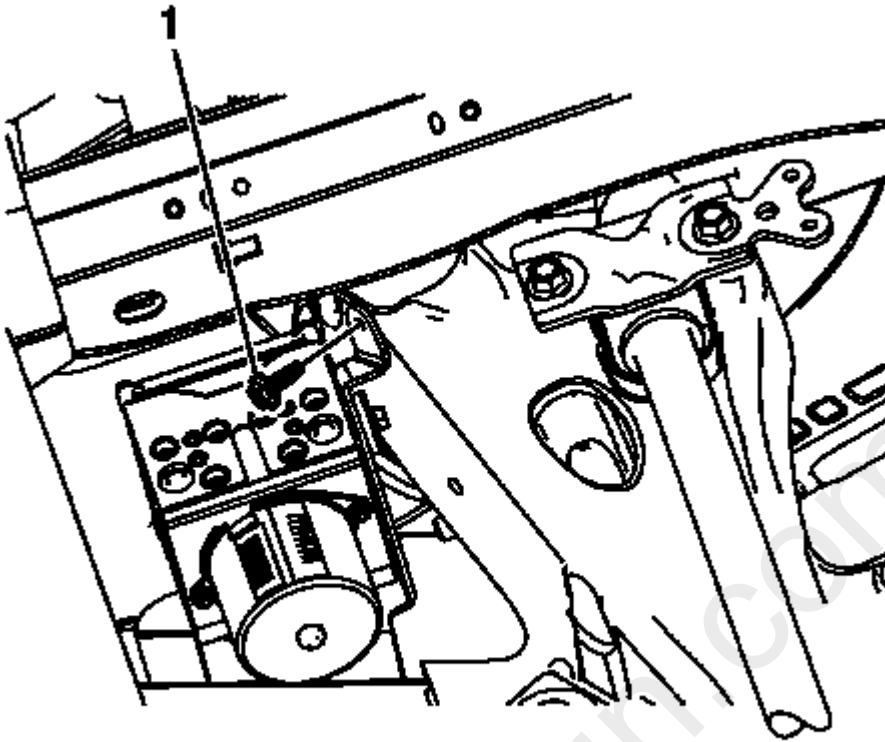


Fig. 33: Identifying BPMV Assembly Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Remove the BPMV assembly bracket bolt (1).
9. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
10. Remove the front air deflector. Refer to **Front Air Deflector Replacement** .
11. Remove the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
12. Remove the washer solvent container fasteners and position the washer solvent container aside. Refer to **Windshield Washer Solvent Container Replacement (Without CE4)** , **Windshield Washer Solvent Container Replacement (With CE4)** .

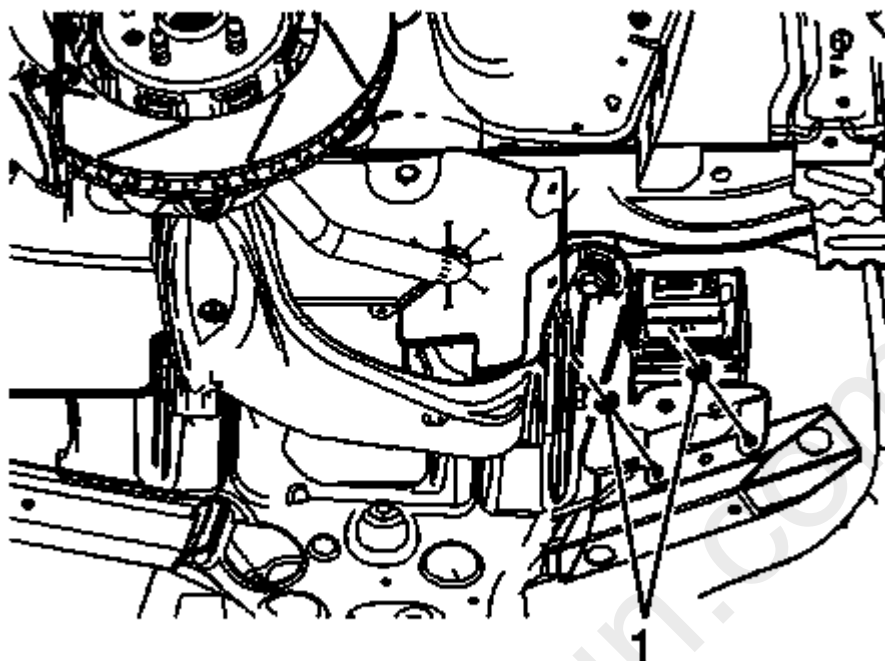


Fig. 34: Identifying BPMV Bracket Nuts
Courtesy of GENERAL MOTORS COMPANY

13. Disconnect the electronic brake control module (EBCM) electrical connector
14. Remove the BPMV bracket nuts (1).

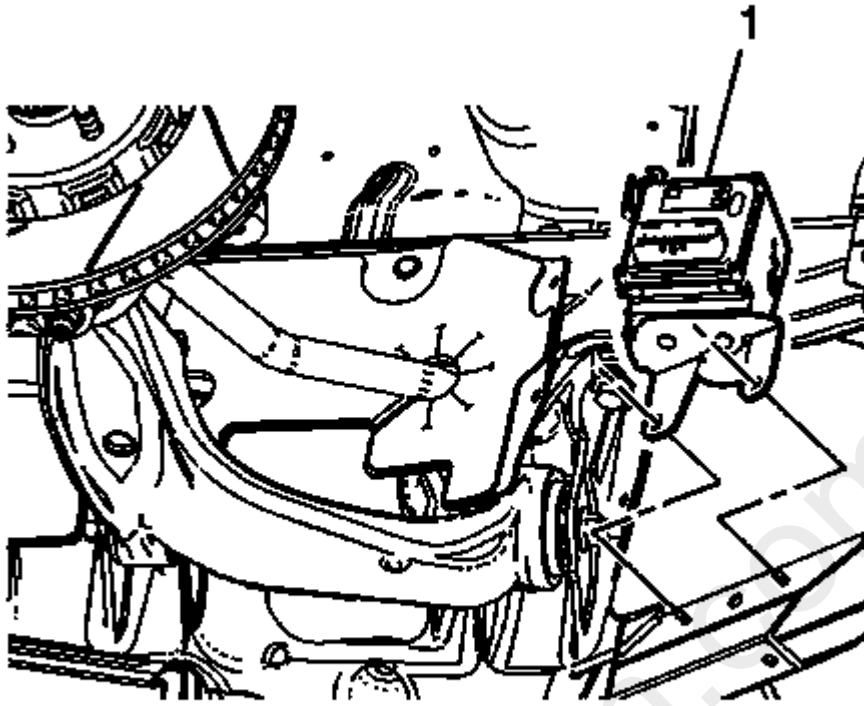


Fig. 35: Identifying BPMV & Bracket Assembly
Courtesy of GENERAL MOTORS COMPANY

15. Remove the BPMV and bracket assembly (1).

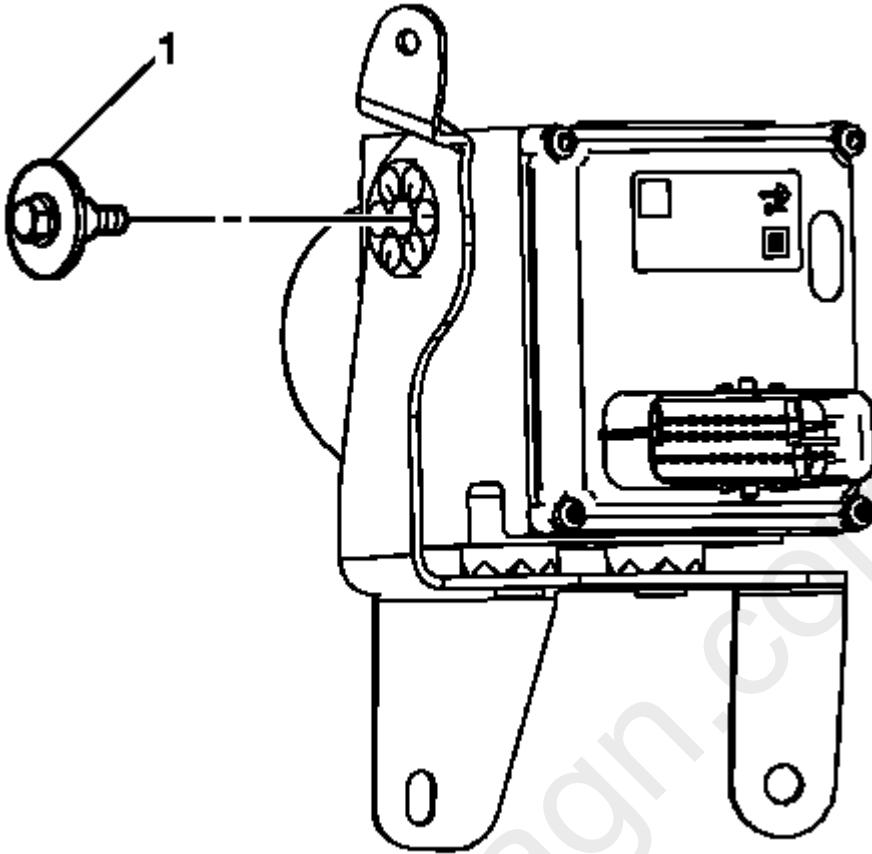


Fig. 36: Identifying BPMV Bolt
Courtesy of GENERAL MOTORS COMPANY

16. Remove the BPMV bolt (1).

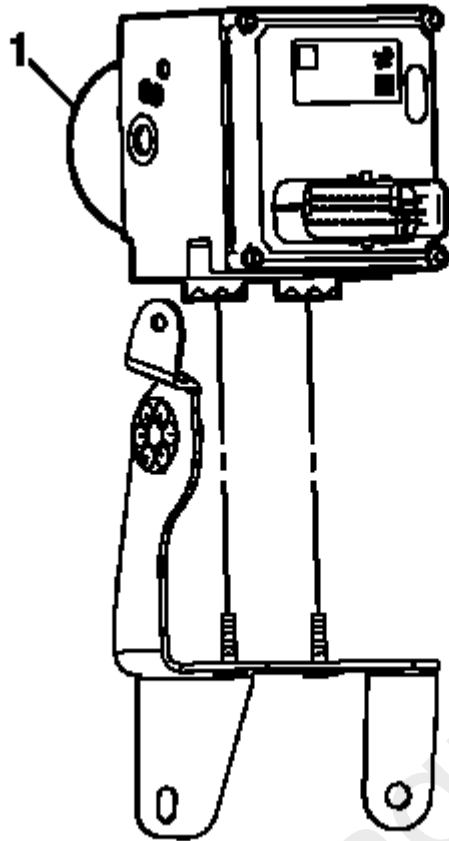


Fig. 37: Identifying BPMV

Courtesy of GENERAL MOTORS COMPANY

17. Remove the BPMV (1) from the bracket.
18. If installing a new BPMV, remove the EBCM. Refer to **Electronic Brake and Traction Control Module with Brake Pressure Modulator Valve Replacement (CTS-V)**.

Installation Procedure

1. If installing a new BPMV, install the EBCM. Refer to **Electronic Brake and Traction Control Module with Brake Pressure Modulator Valve Replacement (CTS-V)**.

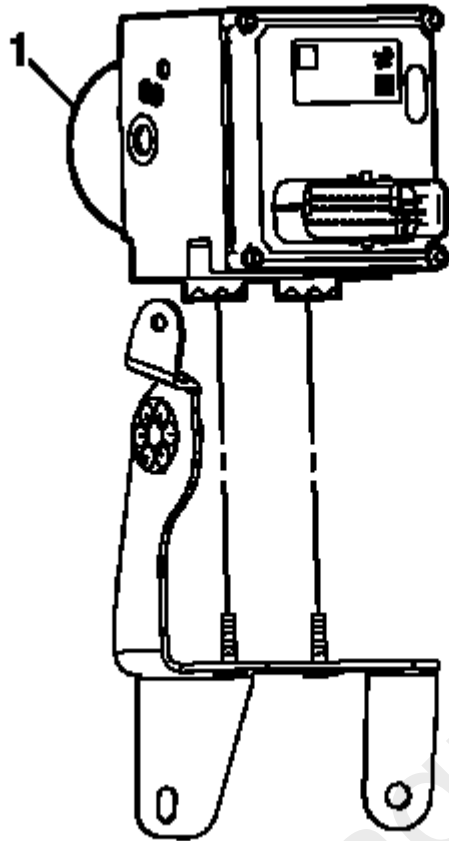


Fig. 38: Identifying BPMV

Courtesy of GENERAL MOTORS COMPANY

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

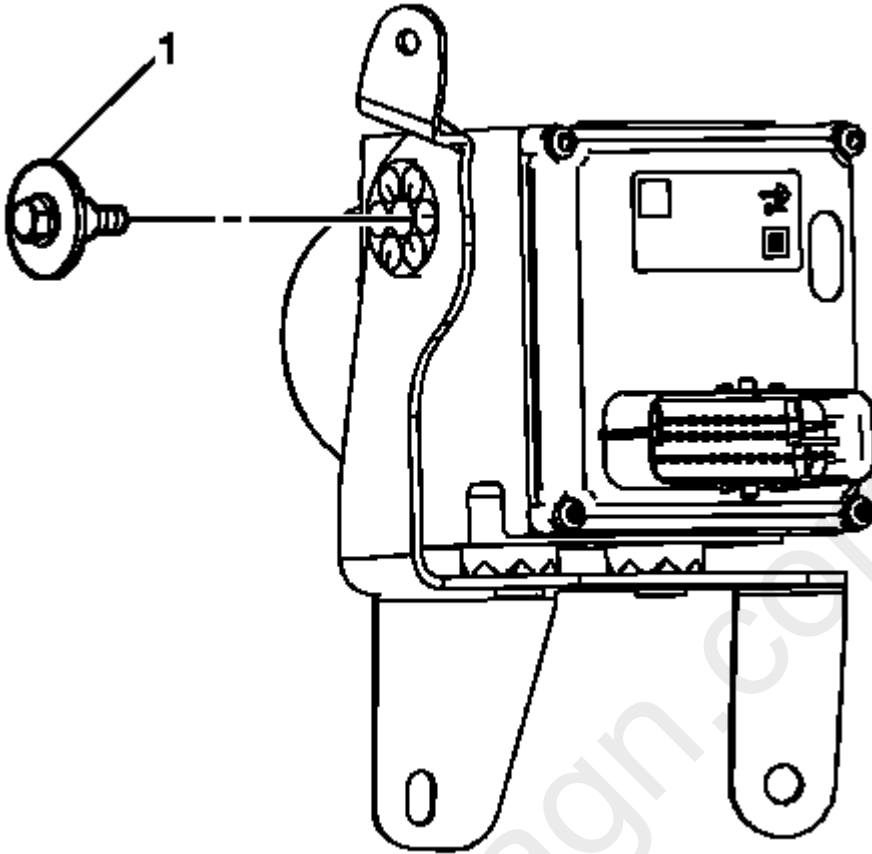


Fig. 39: Identifying BPMV Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Install the BPMV bolt (1) and tighten to 12 N.m (106 lb in).

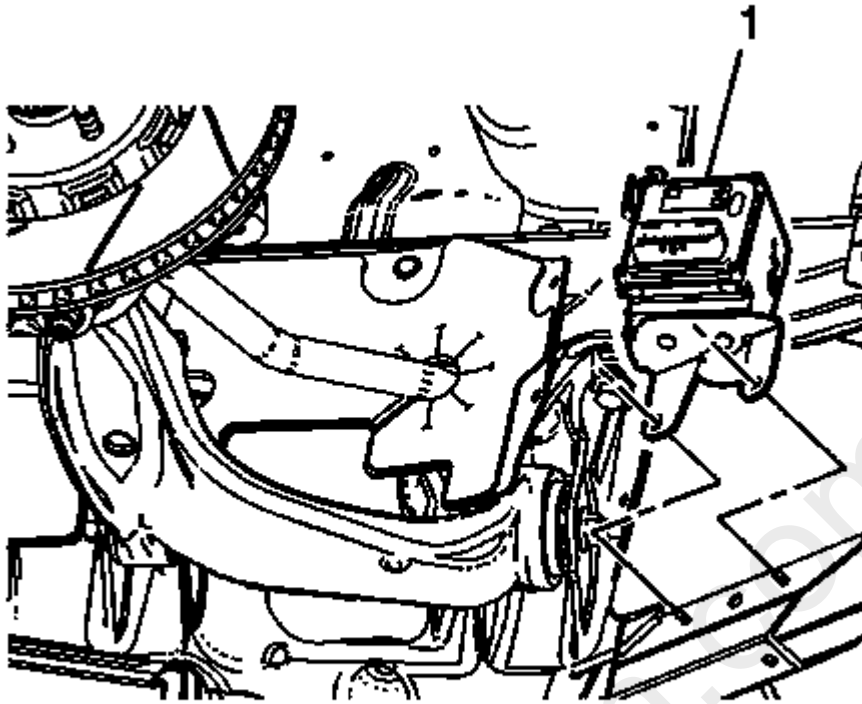


Fig. 40: Identifying BPMV & Bracket Assembly
Courtesy of GENERAL MOTORS COMPANY

4. Install the BPMV and bracket assembly (1).

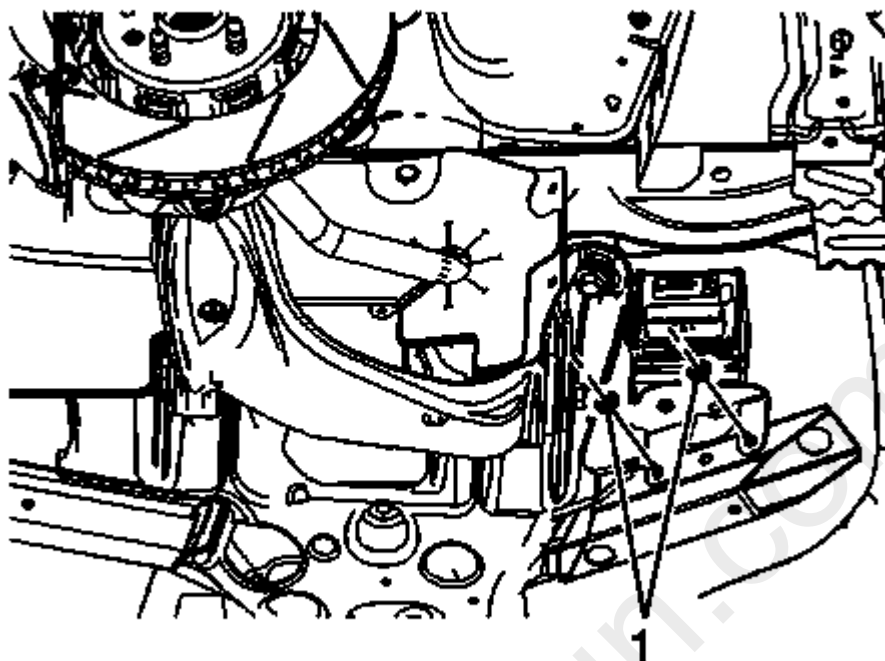


Fig. 41: Identifying BPMV Bracket Nuts
Courtesy of GENERAL MOTORS COMPANY

5. Install the BPMV bracket nuts (1) and tighten to 12 N.m (106 lb in).
6. Connect the electronic brake control module (EBCM) electrical connector
7. Position the washer solvent container and install the fasteners. Refer to **Windshield Washer Solvent Container Replacement (Without CE4)** , **Windshield Washer Solvent Container Replacement (With CE4)** .
8. Install the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
9. Install the front air deflector. Refer to **Front Air Deflector Replacement** .
10. Lower the vehicle.

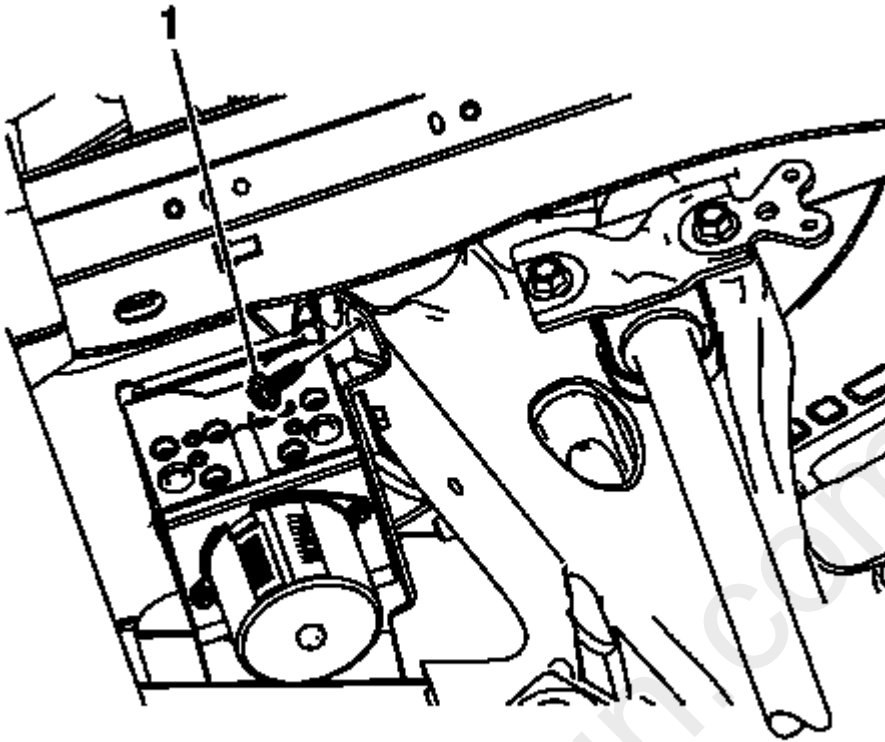


Fig. 42: Identifying BPMV Assembly Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

11. Install the BPMV assembly bracket bolt (1) and tighten to 12 N.m (106 lb in).

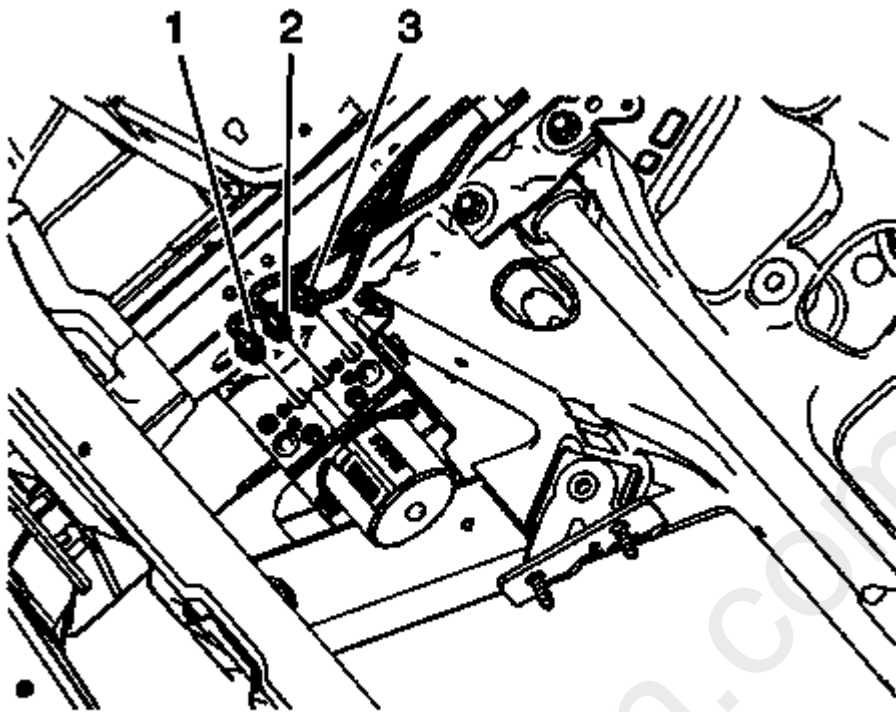


Fig. 43: Identifying Right Rear, Left Rear, And Right Front Brake Pipe Fittings
Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the brake pipes to the BPMV to ensure correct installation.

12. Connect the right rear (1), left rear (2), and the right front (3) brake pipe fittings from the BPMV and tighten to 20 N.m (15 lb ft).

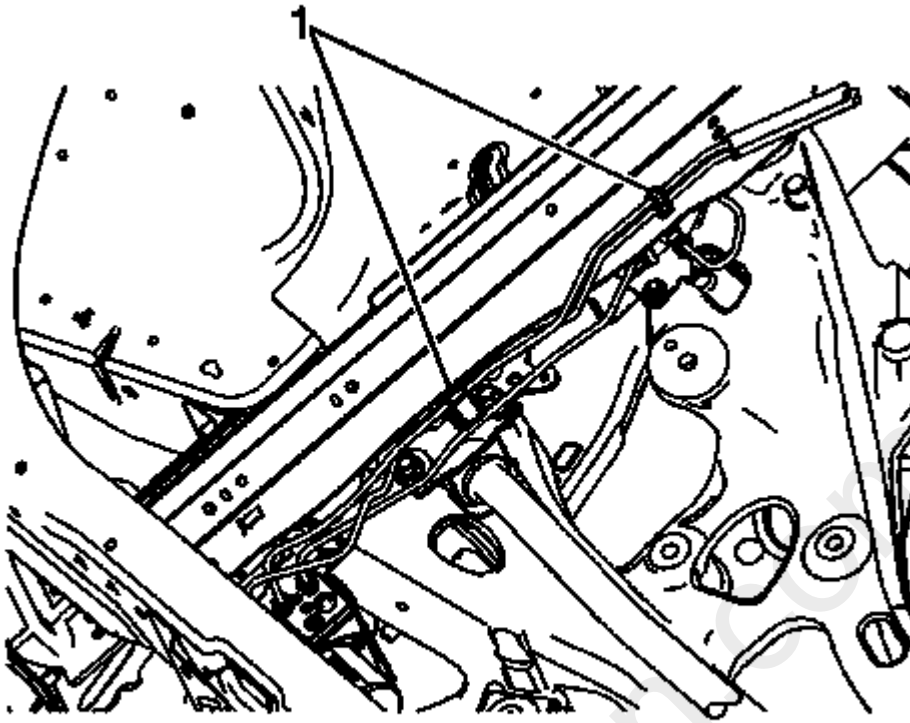


Fig. 44: Identifying Right Side Engine Compartment Side Rail Brake Pipe Clips
Courtesy of GENERAL MOTORS COMPANY

13. Install the brake pipes to the brake pipe clips (1) on the right side engine compartment side rail.

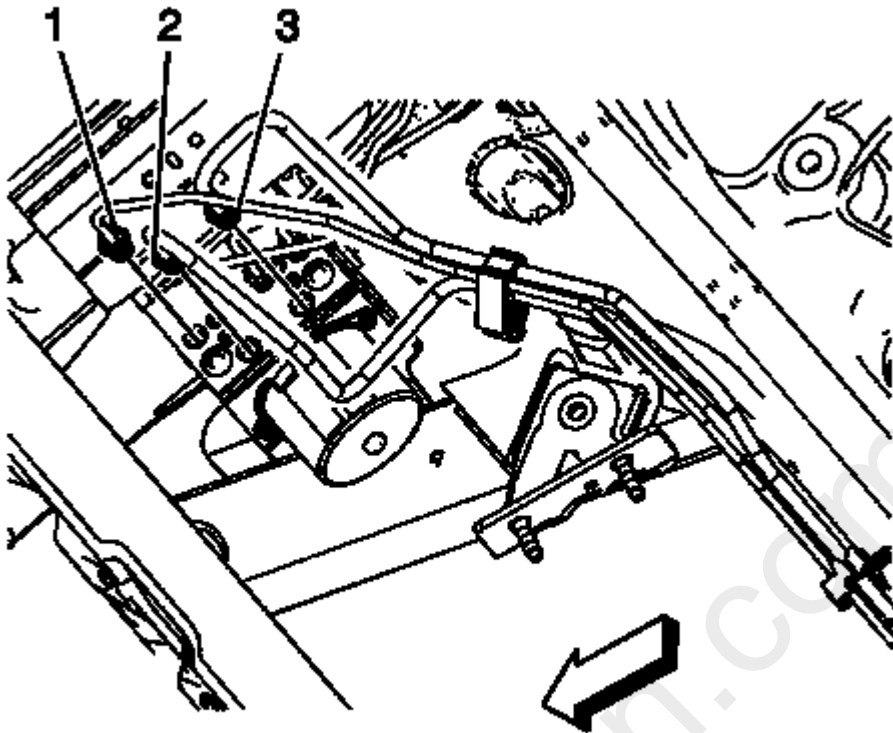


Fig. 45: Identifying Brake Pipe Fittings
Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the brake pipes to the BPMV to ensure correct installation.

14. Connect the left front (1) brake pipe fitting to the BPMV and tighten to 20 N.m (15 lb ft).
15. Connect the master cylinder primary (2), and master cylinder secondary (3) brake pipe fittings to the BPMV and tighten to 32 N.m (24 lb ft).

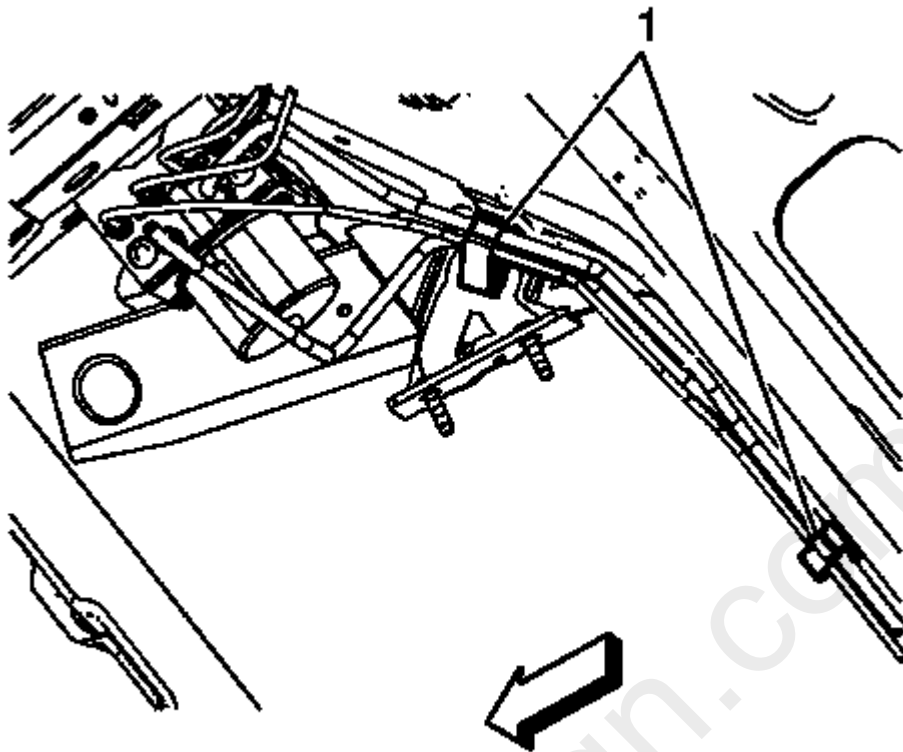


Fig. 46: Locating Vehicle Front Frame Brake Clips
Courtesy of GENERAL MOTORS COMPANY

16. Install the brake pipes to the brake pipe clips on the vehicle front frame (1).
17. Install the front compartment sight shield. Refer to **Front Compartment Sight Shields Replacement** .
18. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** , **Hydraulic Brake System Bleeding (Pressure)** .
19. Perform the **Antilock Brake System Automated Bleed**.
20. Perform the **Diagnostic System Check - Vehicle** .

BRAKE PRESSURE MODULATOR VALVE BRACKET REPLACEMENT

Removal Procedure

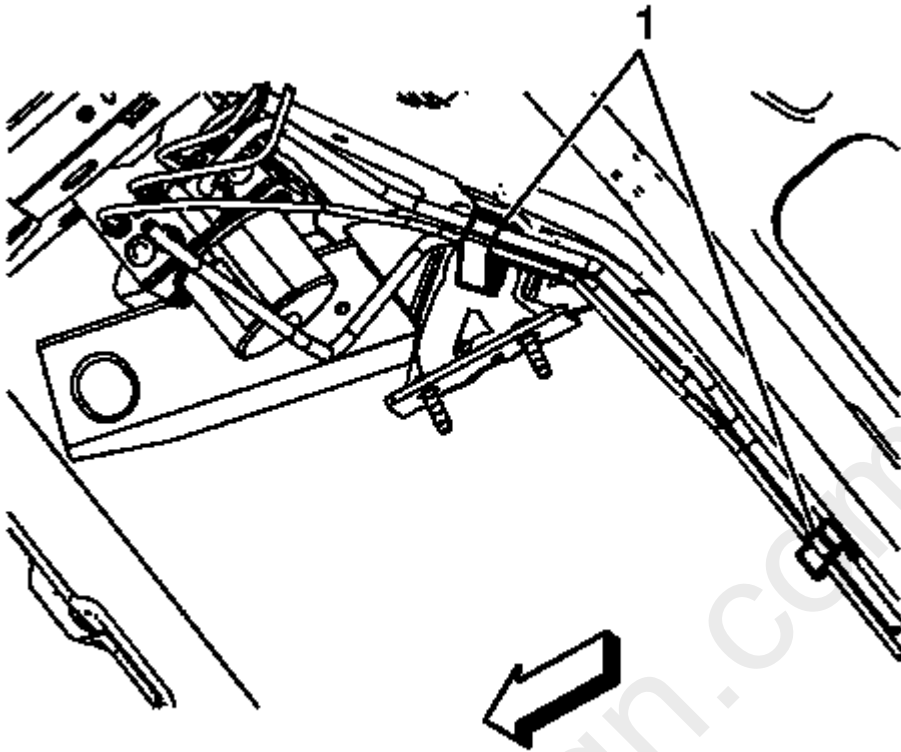


Fig. 47: Locating Vehicle Front Frame Brake Clips
Courtesy of GENERAL MOTORS COMPANY

1. Place the ignition switch in the OFF position.
2. Remove the front compartment sight shield. Refer to **Front Compartment Sight Shields Replacement** .
3. Release the brake clips from the vehicle front frame (1).

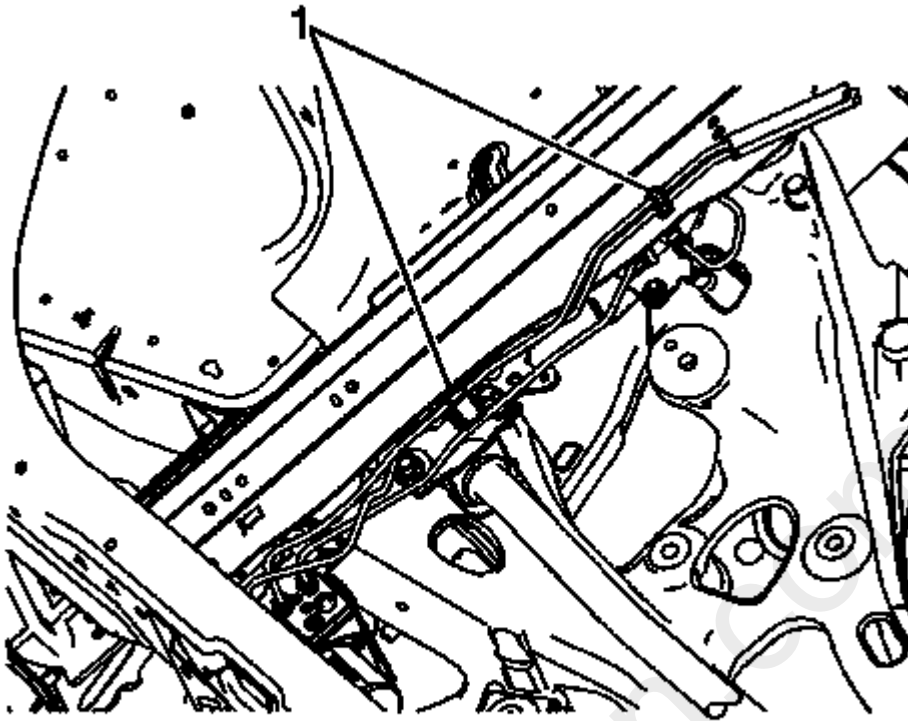


Fig. 48: Identifying Right Side Engine Compartment Side Rail Brake Pipe Clips
Courtesy of GENERAL MOTORS COMPANY

4. Release the brake pipe clips (1) from the right side engine compartment side rail.

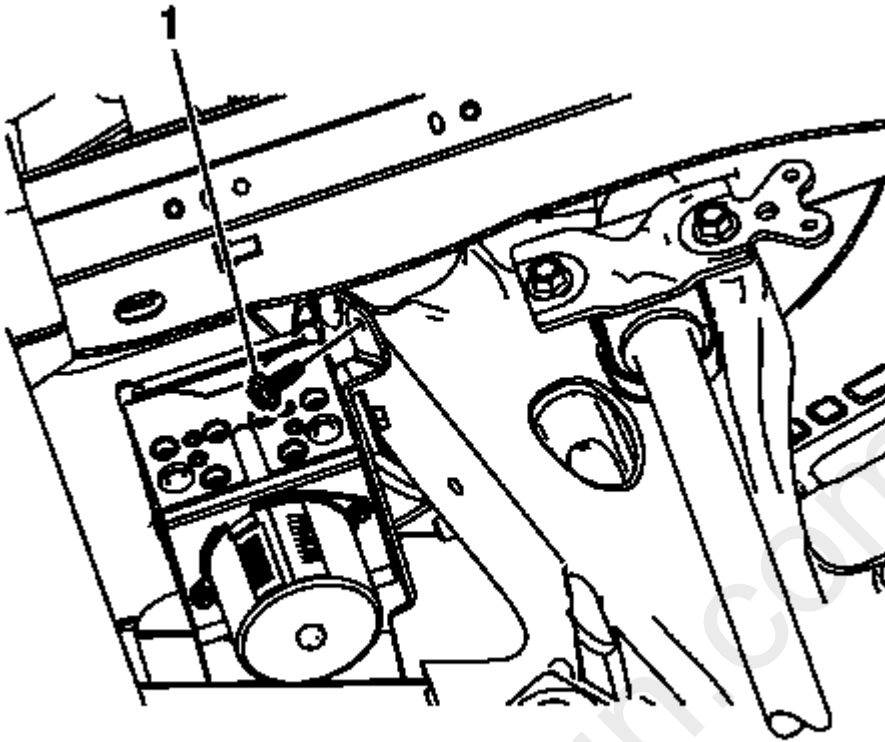


Fig. 49: Identifying BPMV Assembly Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Remove the brake pressure modulator valve (BPMV) assembly bracket bolt (1).
6. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
7. Remove the front air deflector. Refer to **Front Air Deflector Replacement** .
8. Remove the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
9. Remove the washer solvent container fasteners and position the washer solvent container aside. Refer to **Windshield Washer Solvent Container Replacement (Without CE4)** , **Windshield Washer Solvent Container Replacement (With CE4)** .

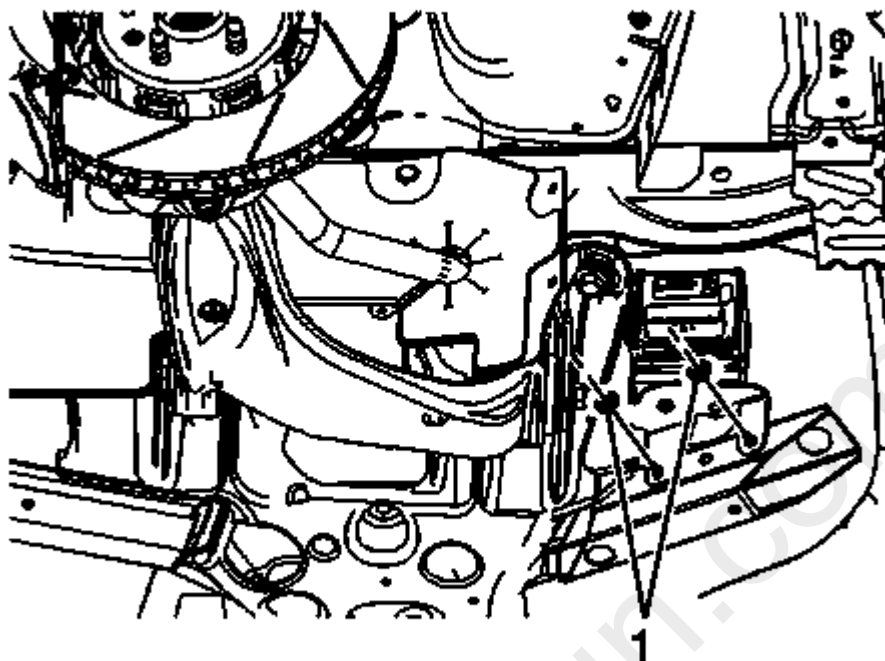


Fig. 50: Identifying BPMV Bracket Nuts
Courtesy of GENERAL MOTORS COMPANY

10. Remove the BPMV bracket nuts (1).
11. Carefully lift the BPMV assembly from the bracket studs.

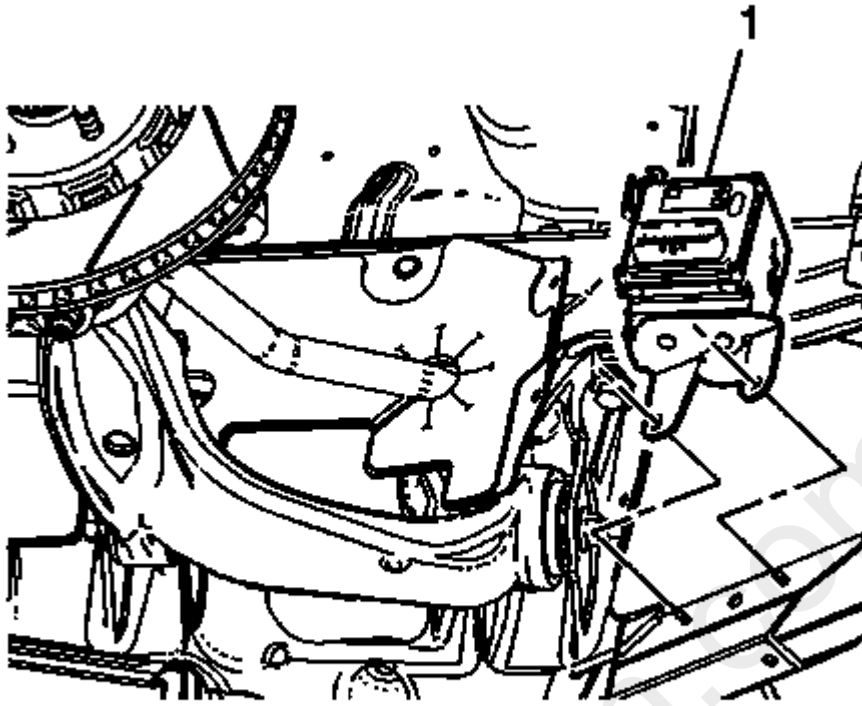


Fig. 51: Identifying BPMV & Bracket Assembly
Courtesy of GENERAL MOTORS COMPANY

12. Carefully lift the BPMV and bracket assembly (1) from the studs on the vehicle frame to access the BPMV bolt.

Support the BPMV with heavy mechanics wire or equivalent.

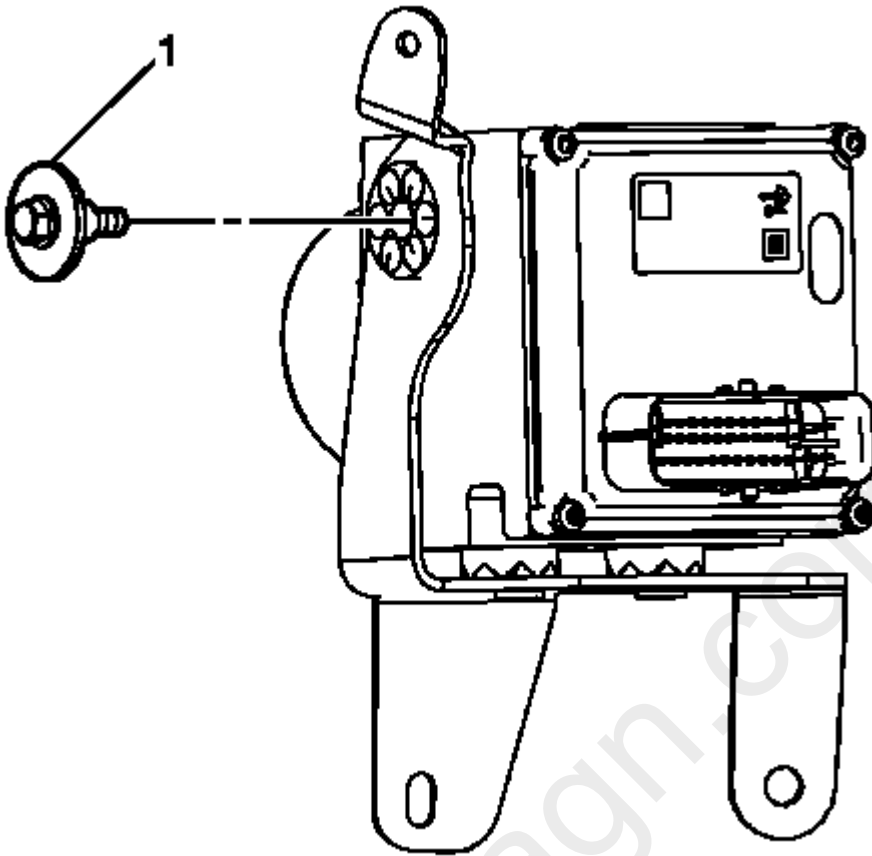


Fig. 52: Identifying BPMV Bolt
Courtesy of GENERAL MOTORS COMPANY

13. Remove the BPMV bolt (1).

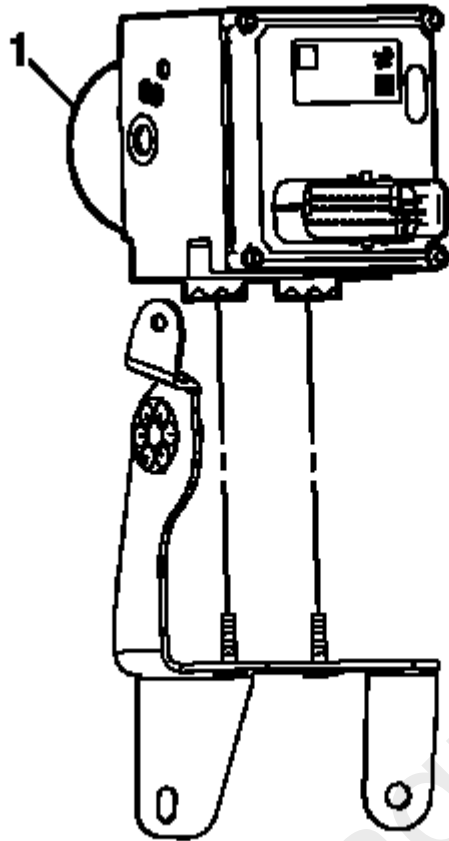


Fig. 53: Identifying BPMV
Courtesy of GENERAL MOTORS COMPANY

14. Remove the BPMV bracket from the BPMV (1).
15. Inspect the BPMV bracket insulator for damage and replace, if necessary.

Installation Procedure

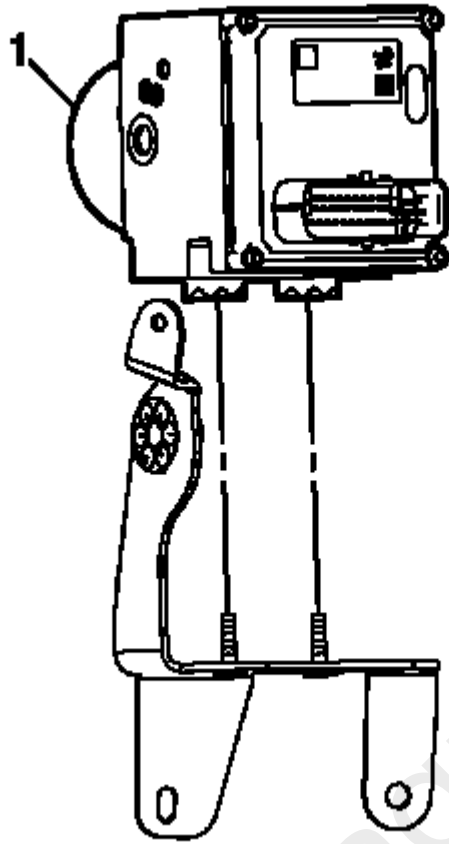


Fig. 54: Identifying BPMV

Courtesy of GENERAL MOTORS COMPANY

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

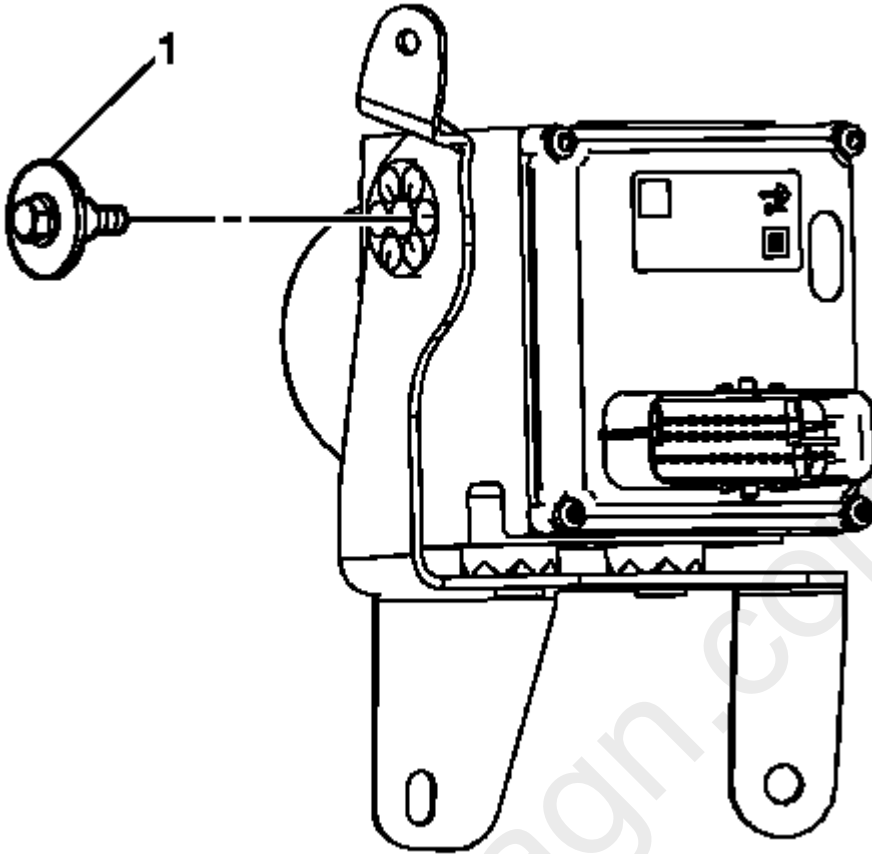


Fig. 55: Identifying BPMV Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Install the BPMV bolt (1) and tighten to 12 N.m (106 lb in).

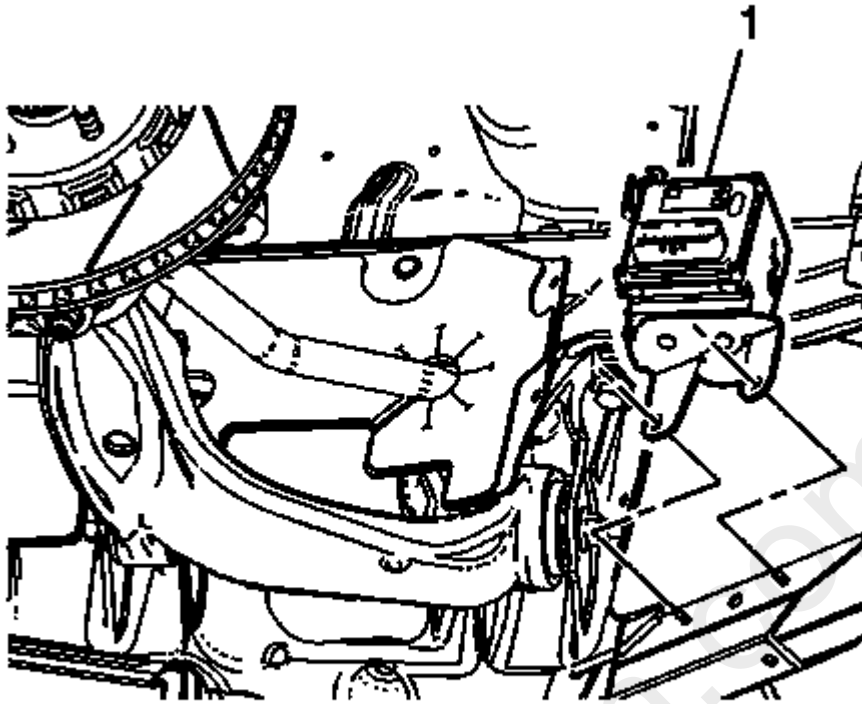


Fig. 56: Identifying BPMV & Bracket Assembly
Courtesy of GENERAL MOTORS COMPANY

3. Install the BPMV and bracket assembly (1).

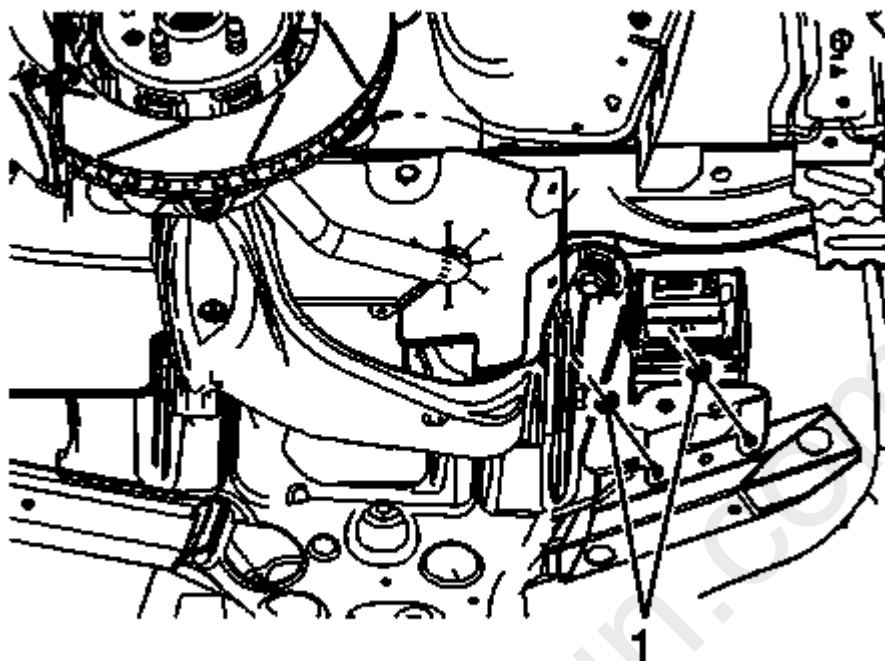


Fig. 57: Identifying BPMV Bracket Nuts
Courtesy of GENERAL MOTORS COMPANY

4. Install the BPMV bracket nuts (1) and tighten to 12 N.m (106 lb in).
5. Position the washer solvent container and install the fasteners. Refer to **Windshield Washer Solvent Container Replacement (Without CE4)** , **Windshield Washer Solvent Container Replacement (With CE4)** .
6. Install the front air deflector. Refer to **Front Air Deflector Replacement** .
7. Install the right front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
8. Lower the vehicle.

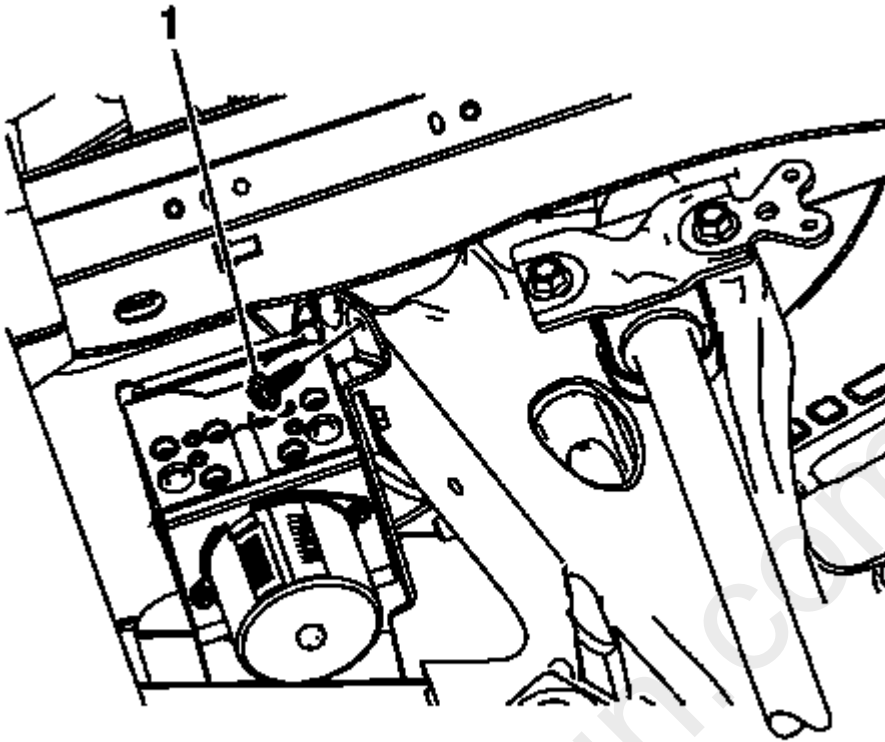


Fig. 58: Identifying BPMV Assembly Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

9. Install the BPMV assembly bracket bolt (1) and tighten to 12 N.m (106 lb in).

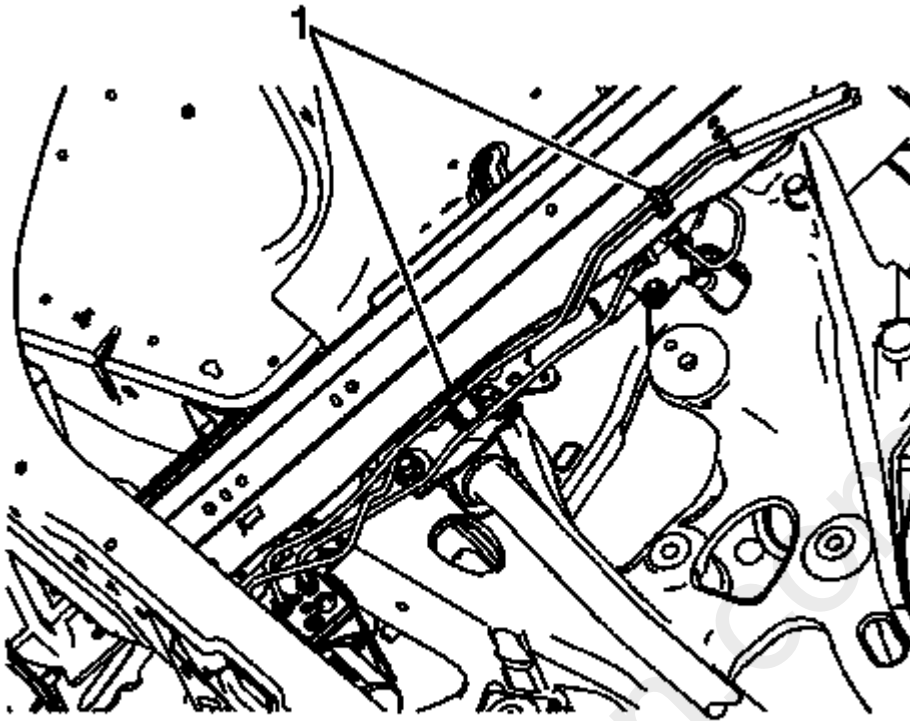


Fig. 59: Identifying Right Side Engine Compartment Side Rail Brake Pipe Clips
Courtesy of GENERAL MOTORS COMPANY

10. Install the brake pipes to the brake pipe clips (1) on the right side engine compartment side rail.

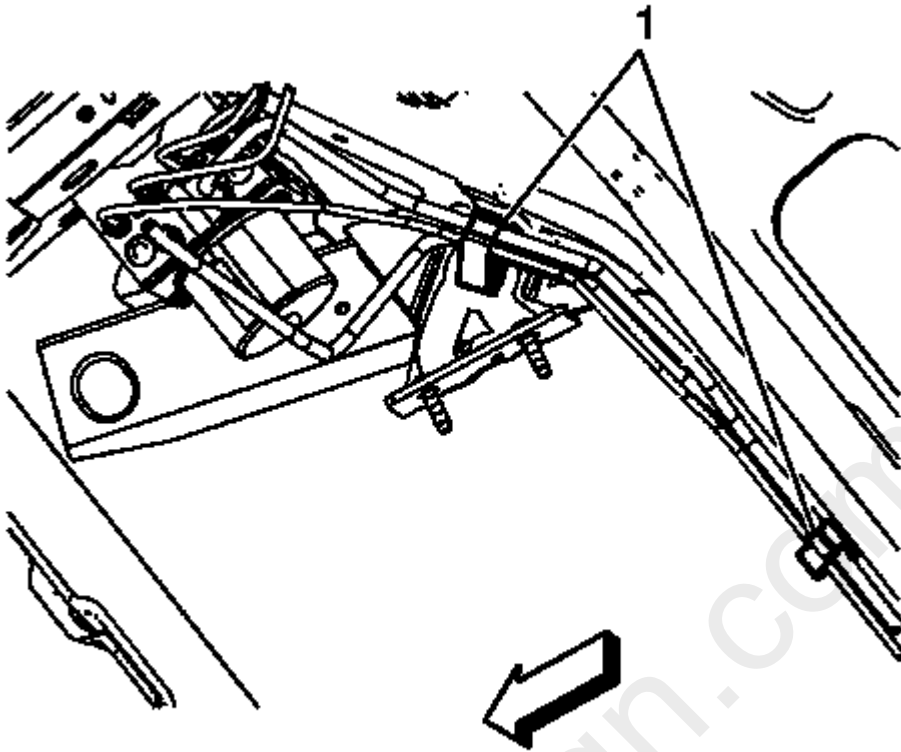


Fig. 60: Locating Vehicle Front Frame Brake Clips
Courtesy of GENERAL MOTORS COMPANY

11. Install the brake pipes to the brake pipe clips on the vehicle front frame (1).
12. Install the front compartment sight shield. Refer to **Front Compartment Sight Shields Replacement** .

FRONT WHEEL SPEED SENSOR REPLACEMENT (AWD)

Removal Procedure

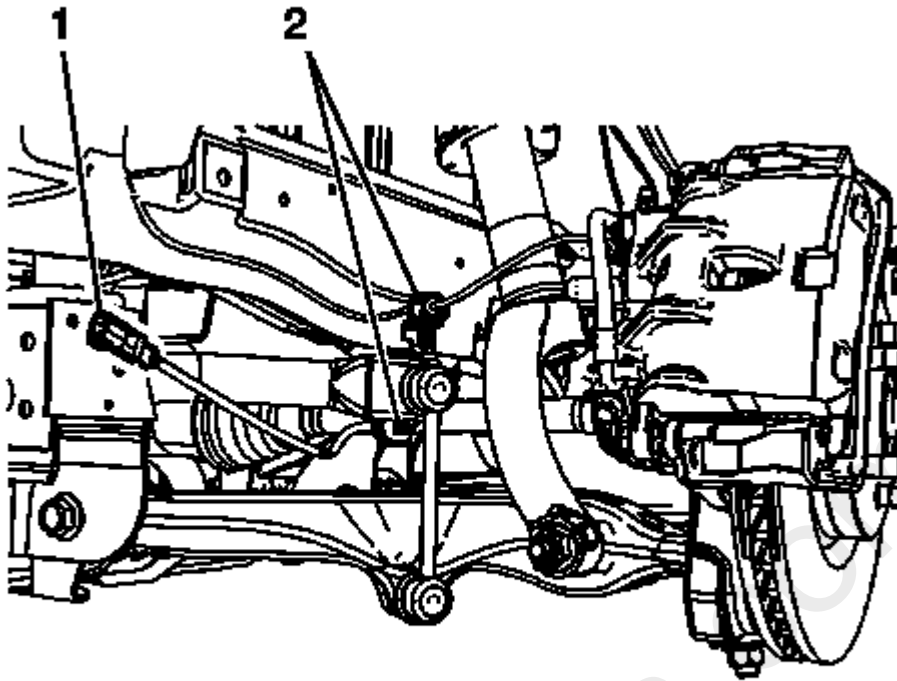


Fig. 61: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Brake Dust Warning .

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation .
3. Disconnect the wheel speed sensor electrical connector (1).
4. Remove the wheel speed sensor wire harness clips (2) from the stabilizer bar bracket.

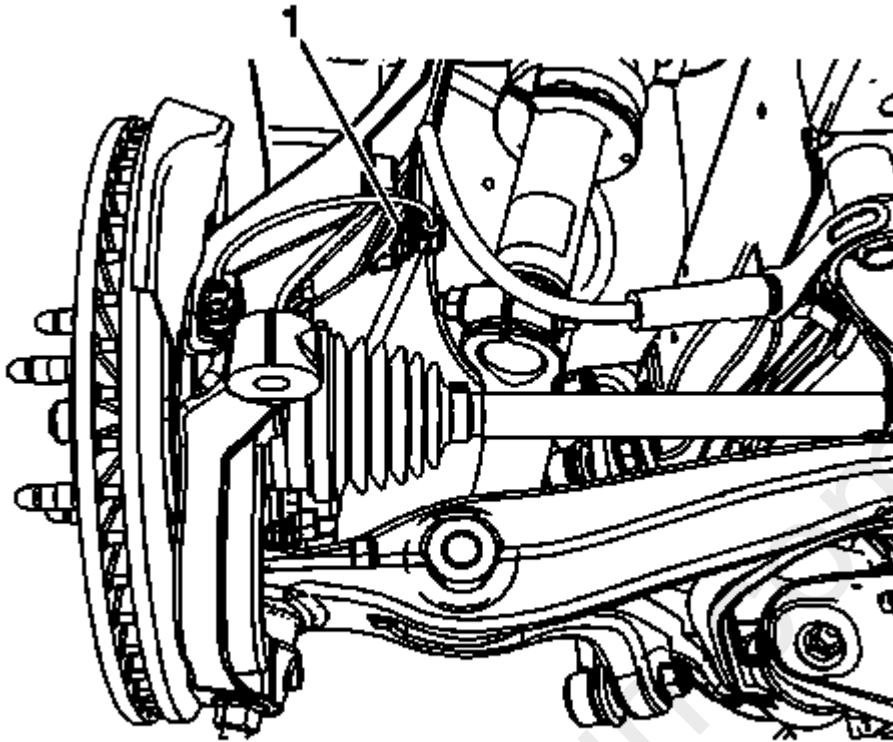


Fig. 62: View of Wheel Speed Sensor Wire Harness Clip
Courtesy of GENERAL MOTORS COMPANY

5. Remove the wheel speed sensor wire harness clip (1) from the steering knuckle.

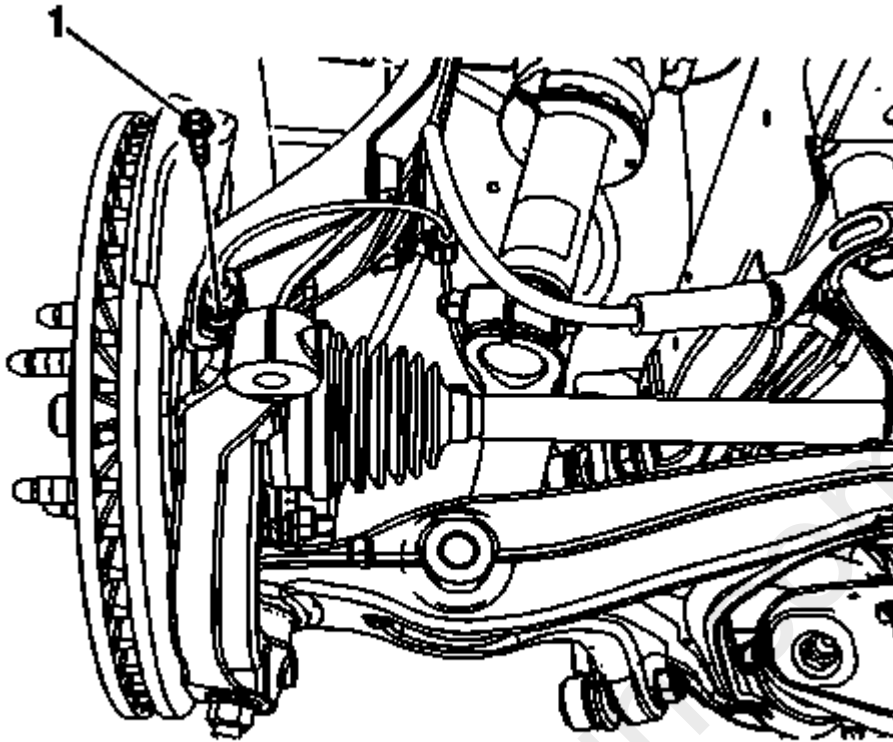


Fig. 63: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Thoroughly clean the wheel speed sensor mounting area of the steering knuckle of any dirt and debris.
7. Remove the wheel speed sensor bolt (1).

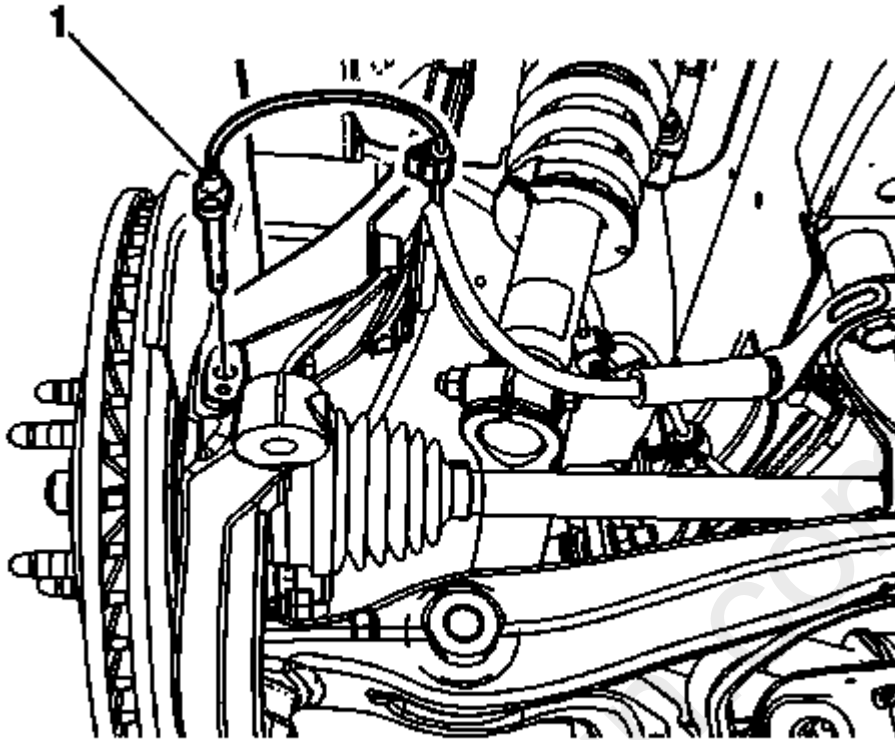


Fig. 64: Wheel Speed Sensor

Courtesy of GENERAL MOTORS COMPANY

8. Remove the wheel speed sensor (1) from the steering knuckle.

Installation Procedure

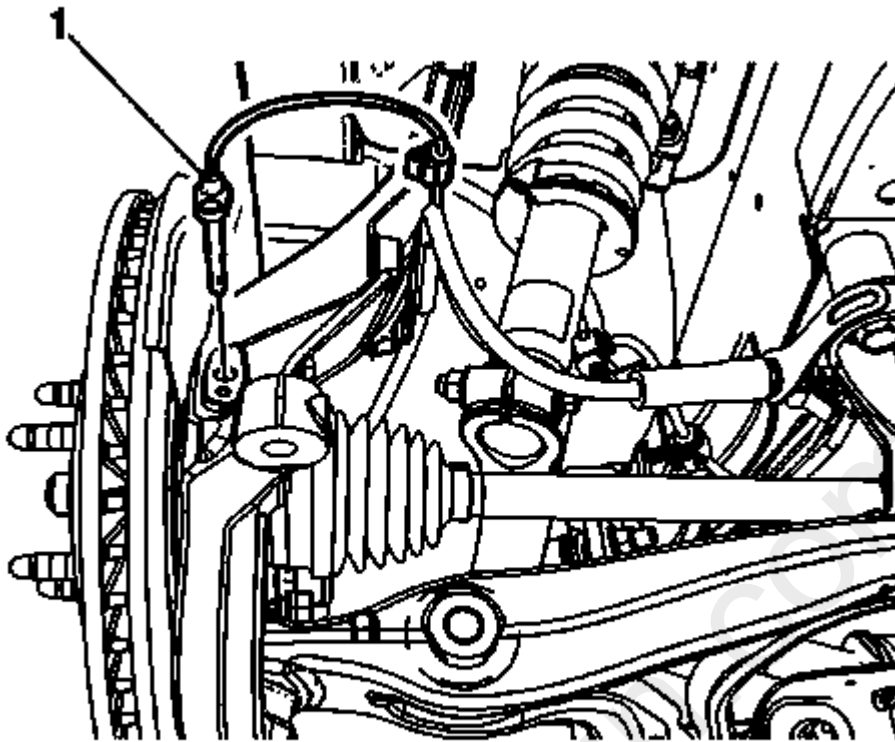


Fig. 65: Wheel Speed Sensor

Courtesy of GENERAL MOTORS COMPANY

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

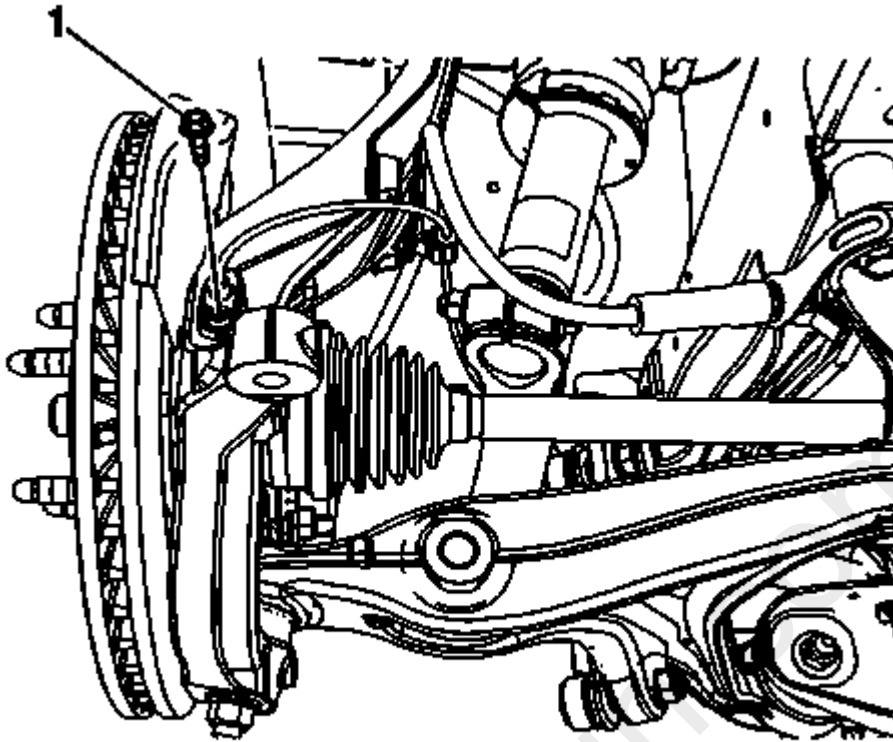


Fig. 66: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

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

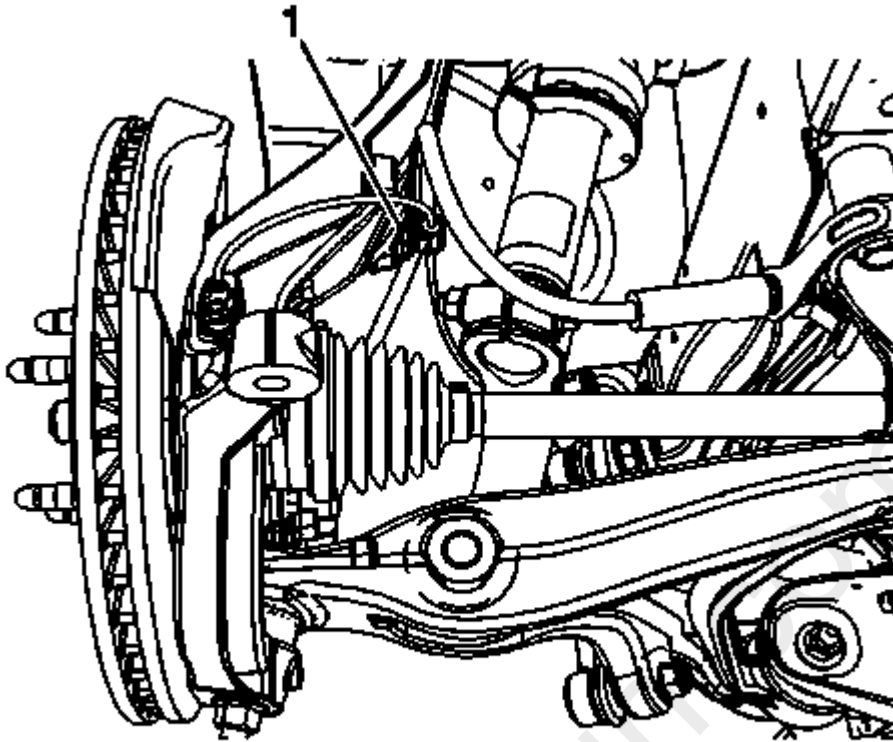


Fig. 67: View of Wheel Speed Sensor Wire Harness Clip
Courtesy of GENERAL MOTORS COMPANY

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

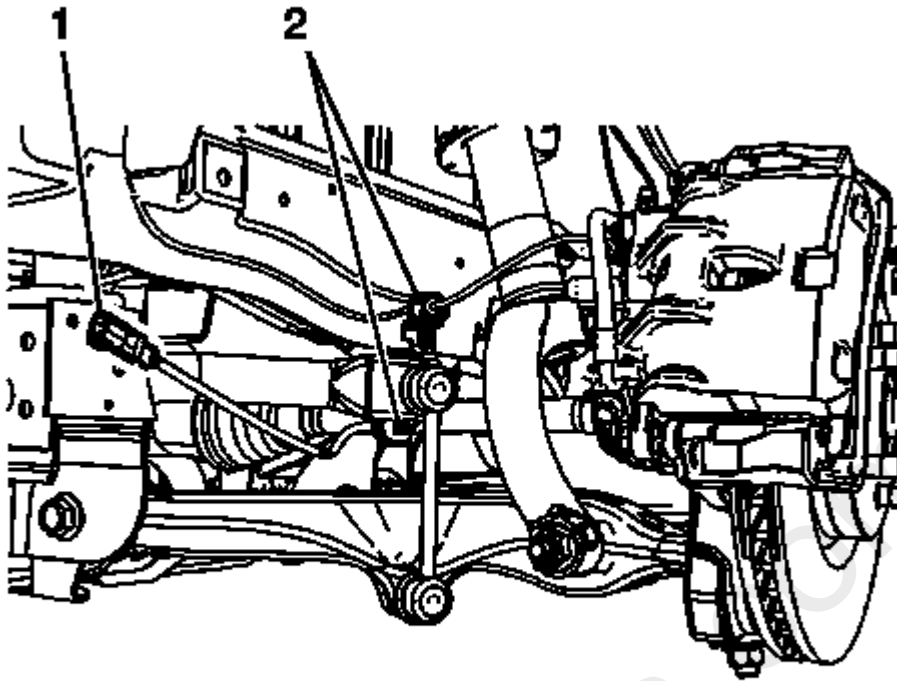


Fig. 68: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

4. Connect the wheel speed sensor electrical connector (1).
5. Install the wheel speed sensor wire harness clips (2) to the stabilizer bar bracket.
6. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .

FRONT WHEEL SPEED SENSOR REPLACEMENT (RWD)

Removal Procedure

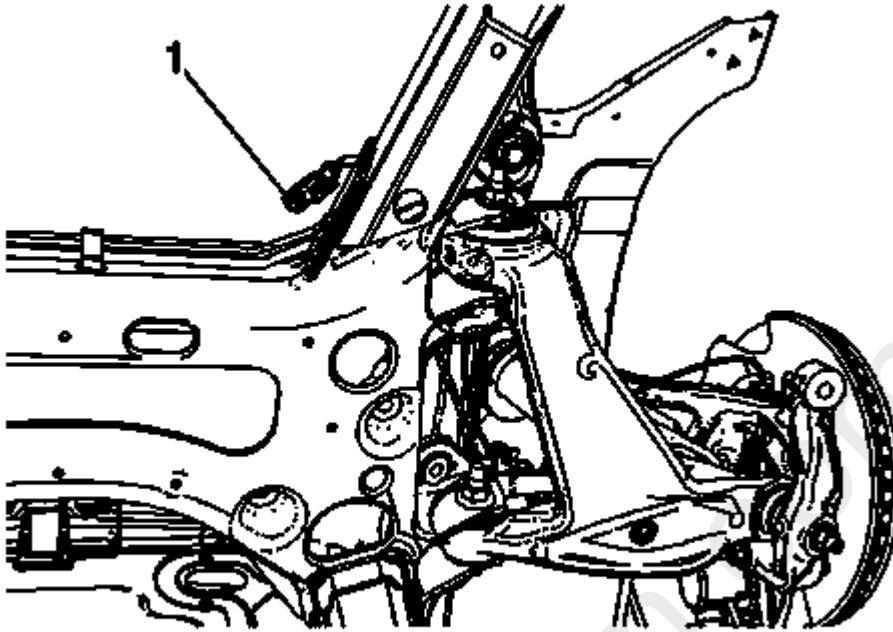


Fig. 69: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Brake Dust Warning .

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation .
3. Disconnect the wheel speed sensor electrical connector (1).

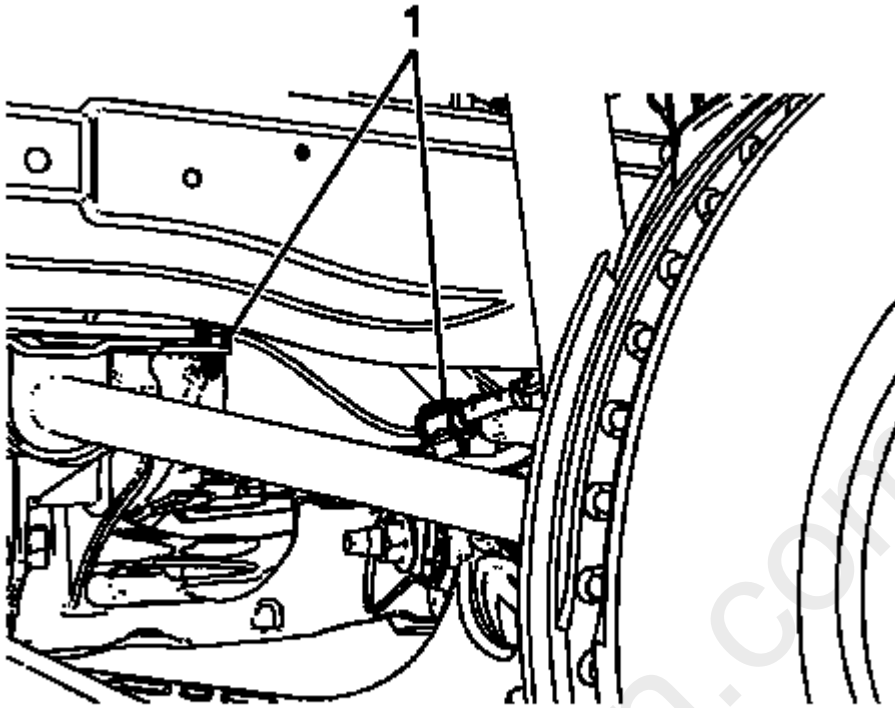


Fig. 70: Identifying Wheel Speed Sensor Wire Harness Clips
Courtesy of GENERAL MOTORS COMPANY

4. Remove the wheel speed sensor wire harness clips (1) from the vehicle frame.

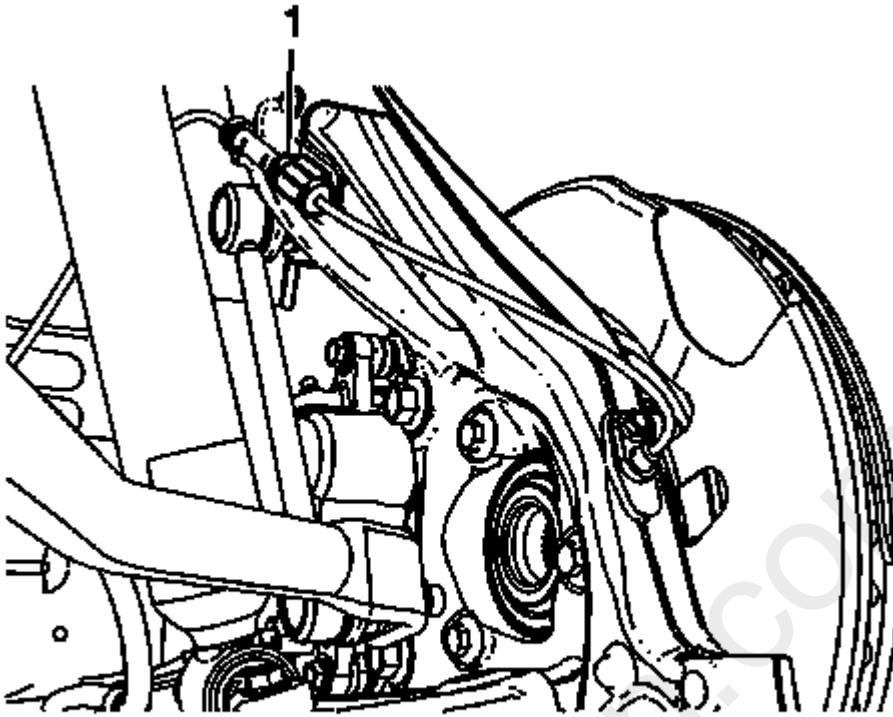


Fig. 71: Identifying Wheel Speed Sensor Wire Harness Clip
Courtesy of GENERAL MOTORS COMPANY

5. Remove the wheel speed sensor wire harness clip (1) from the steering knuckle.

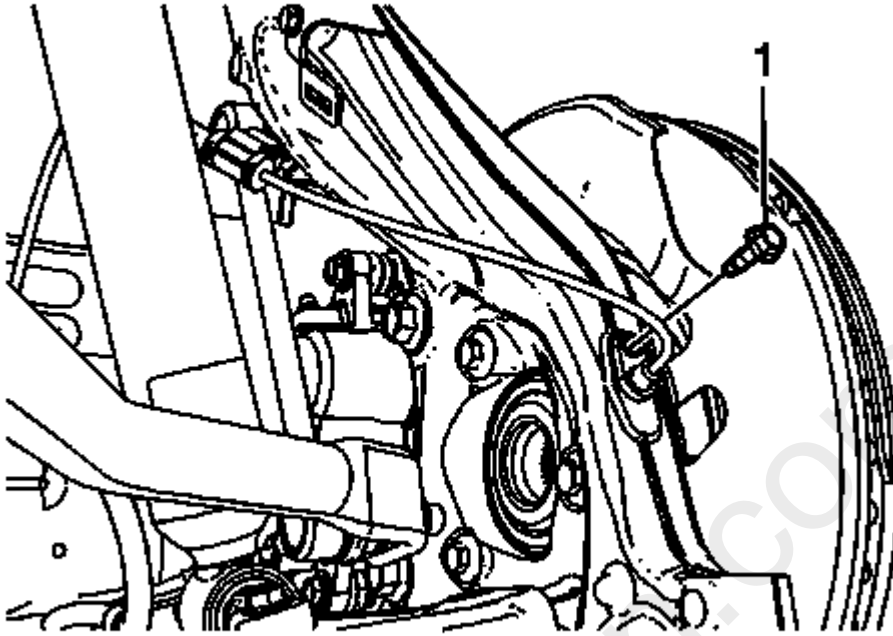


Fig. 72: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Thoroughly clean the wheel speed sensor mounting area of the steering knuckle of any dirt and debris.
7. Remove the wheel speed sensor bolt (1).

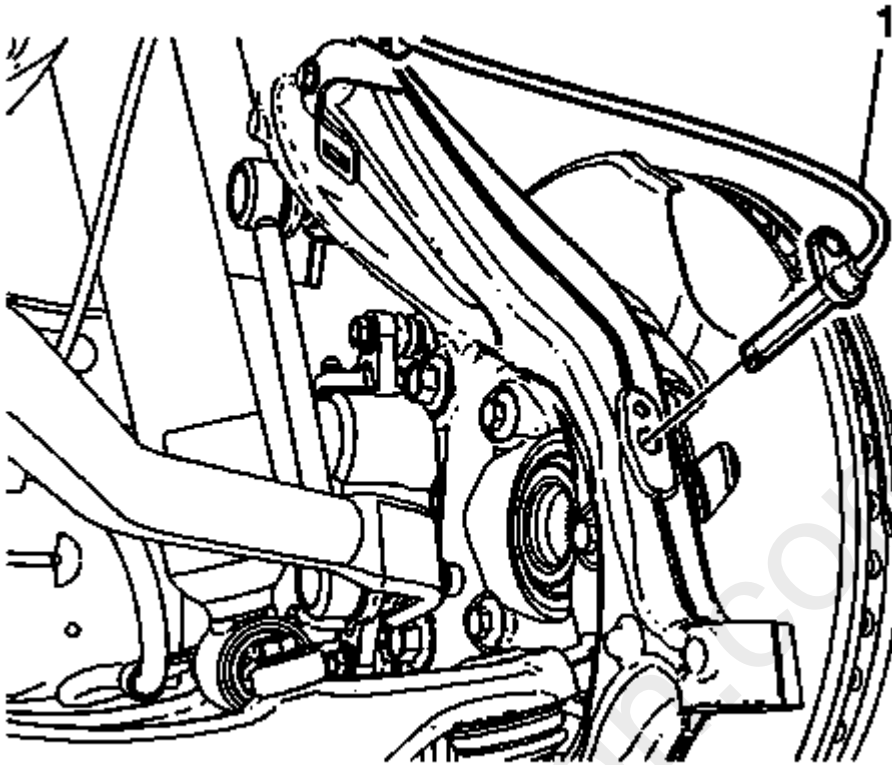


Fig. 73: Wheel Speed Sensor

Courtesy of GENERAL MOTORS COMPANY

8. Remove the wheel speed sensor (1) from the steering knuckle.

Installation Procedure

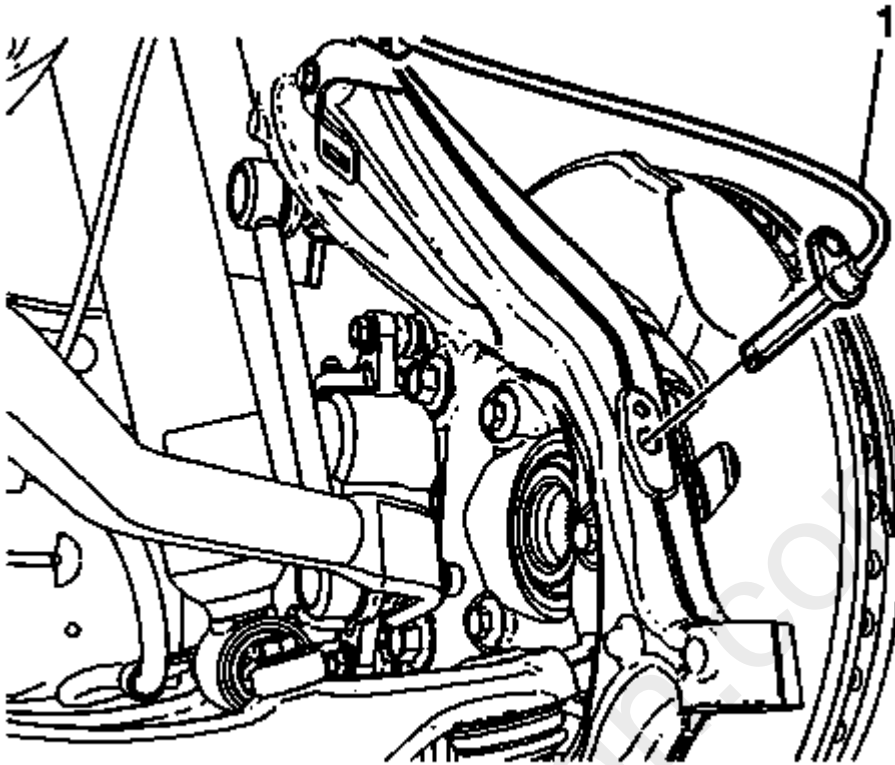


Fig. 74: Wheel Speed Sensor

Courtesy of GENERAL MOTORS COMPANY

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

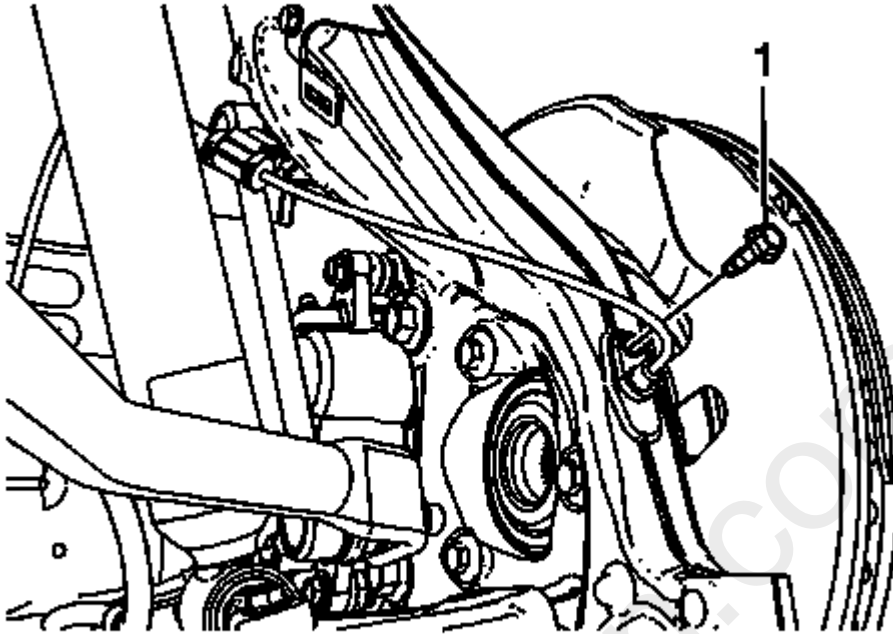


Fig. 75: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

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

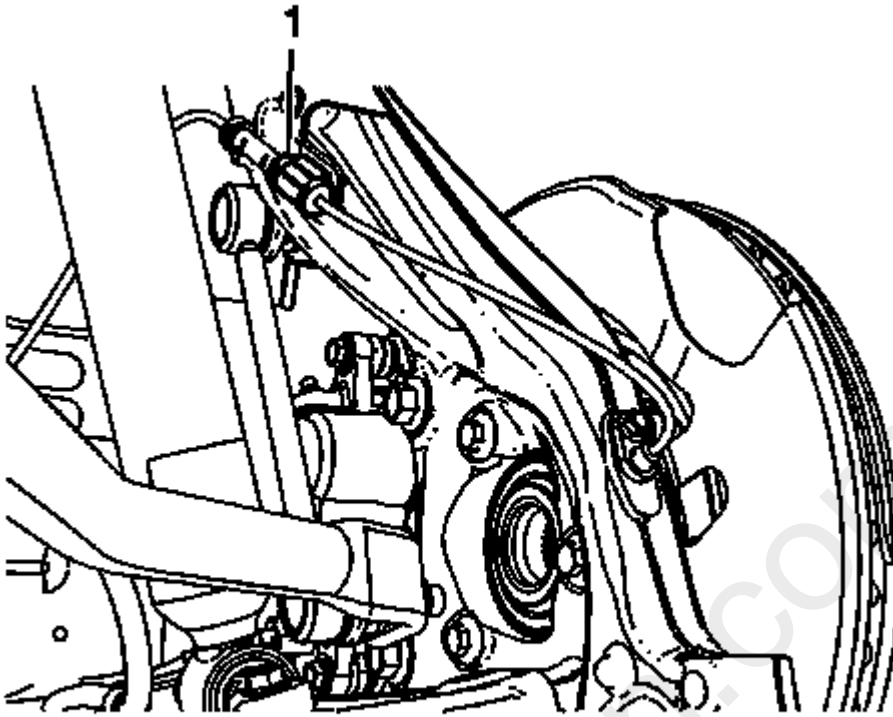


Fig. 76: Identifying Wheel Speed Sensor Wire Harness Clip
Courtesy of GENERAL MOTORS COMPANY

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

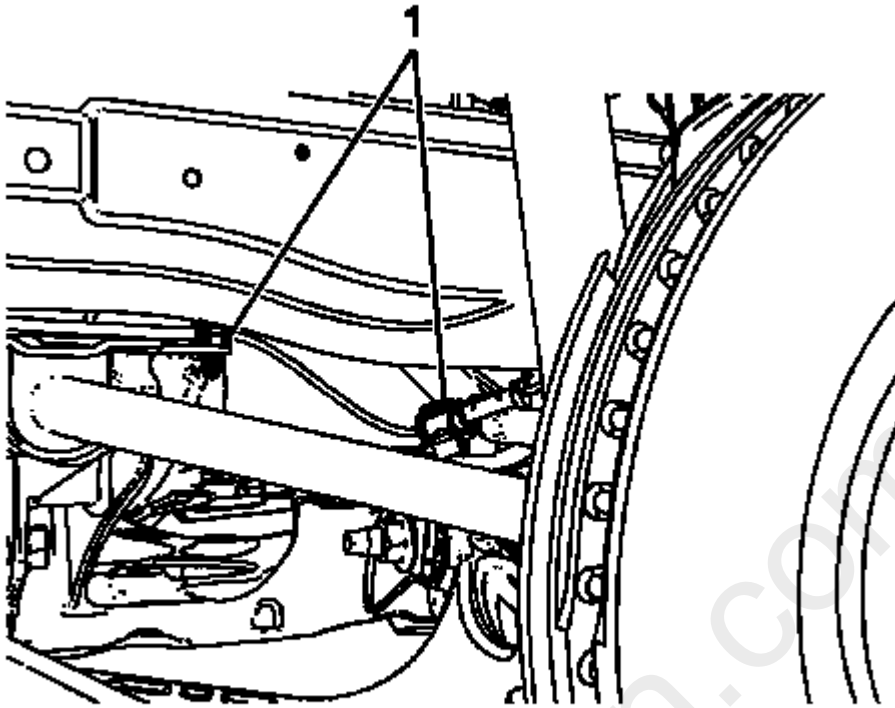


Fig. 77: Identifying Wheel Speed Sensor Wire Harness Clips
Courtesy of GENERAL MOTORS COMPANY

4. Install the wheel speed sensor wire harness clips (1) to the vehicle frame.

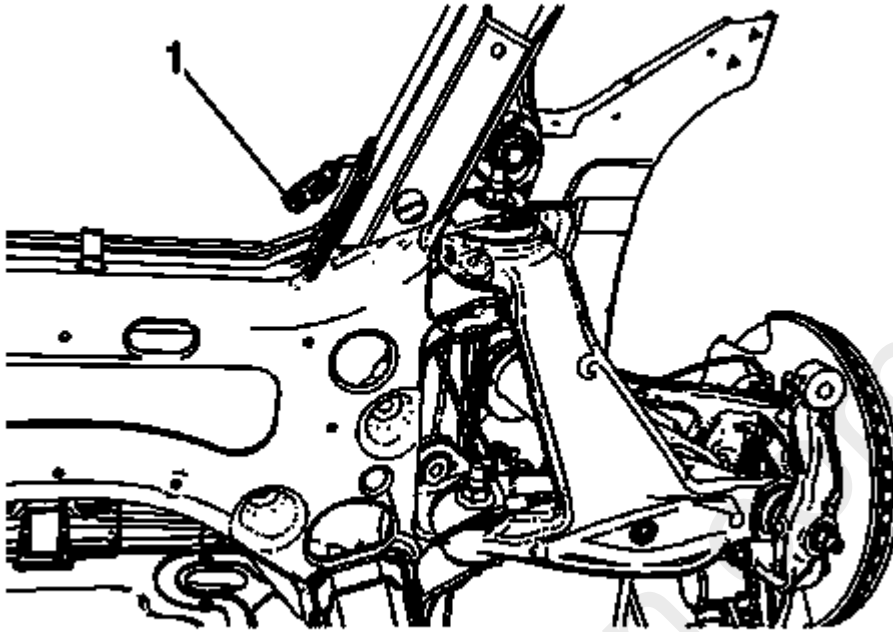


Fig. 78: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

5. Connect the wheel speed sensor electrical connector (1).
6. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .

REAR WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

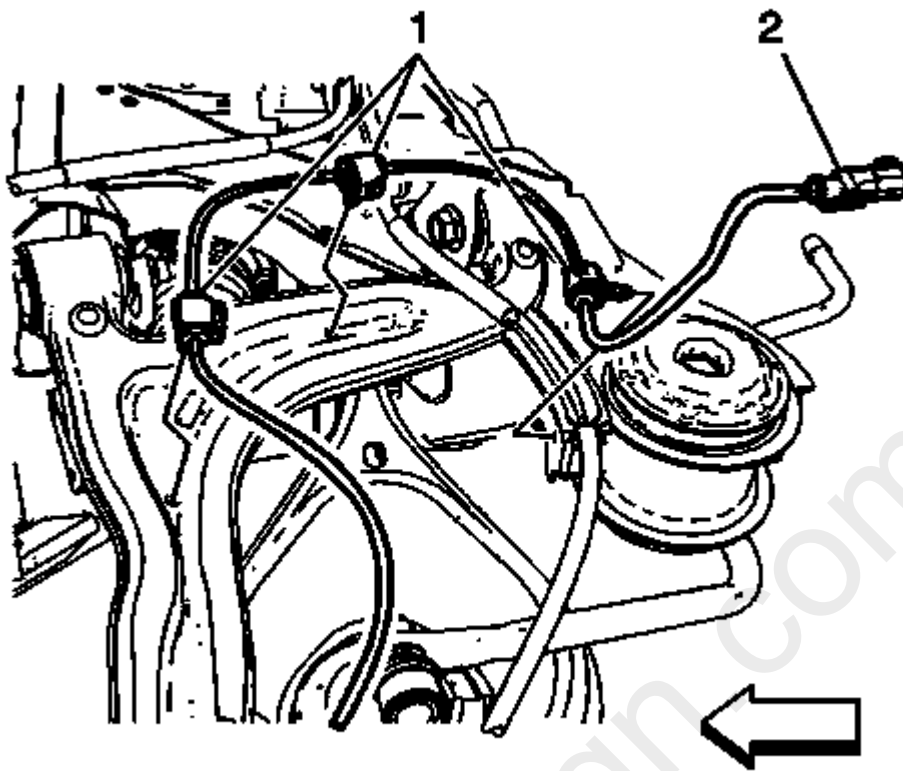


Fig. 79: Wheel Speed Sensor Wire Harness Clips
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Brake Dust Warning .

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation .
3. Remove the wheel speed sensor wire harness clips (1) from the upper control arm and vehicle frame.
4. Disconnect the wheel speed sensor electrical connector (2).

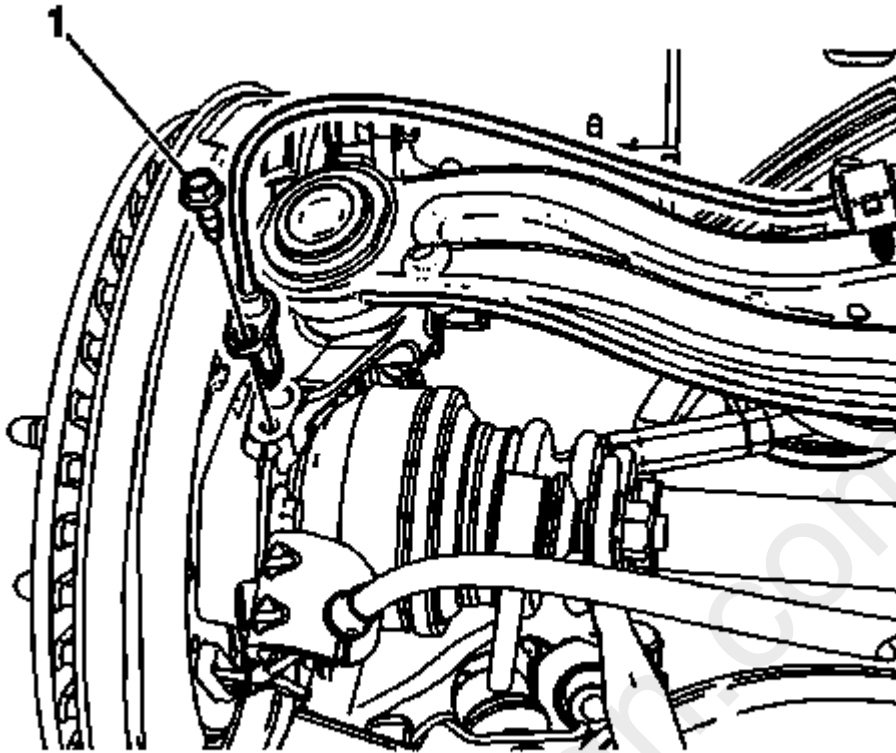


Fig. 80: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Thoroughly clean the wheel speed sensor mounting area of the suspension knuckle of any dirt and debris.
6. Remove the wheel speed sensor bolt (1) and the wheel speed sensor.

Installation Procedure

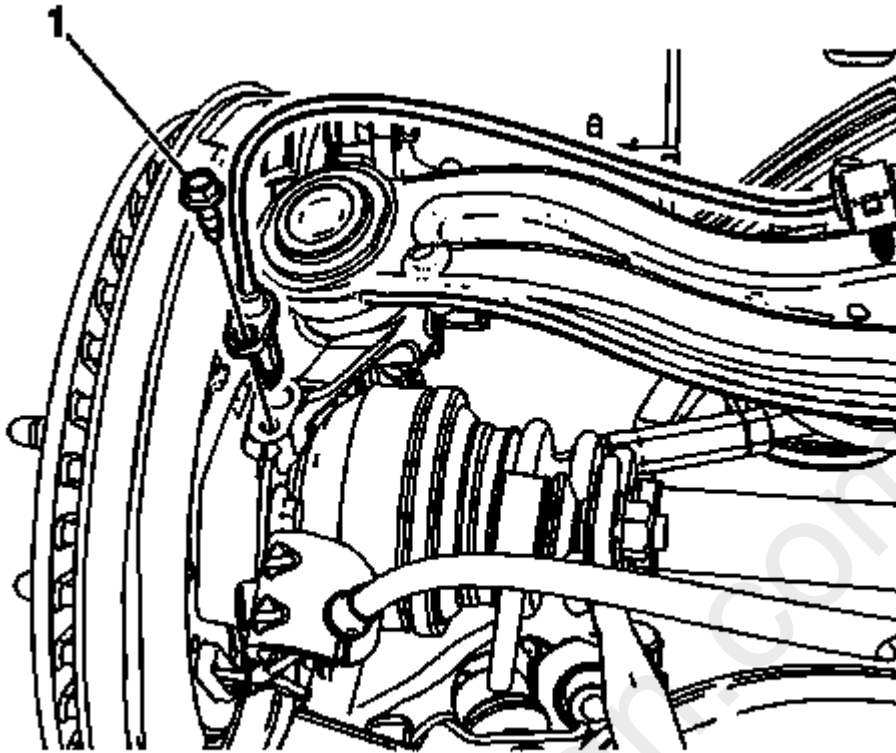


Fig. 81: Wheel Speed Sensor Bolt
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

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

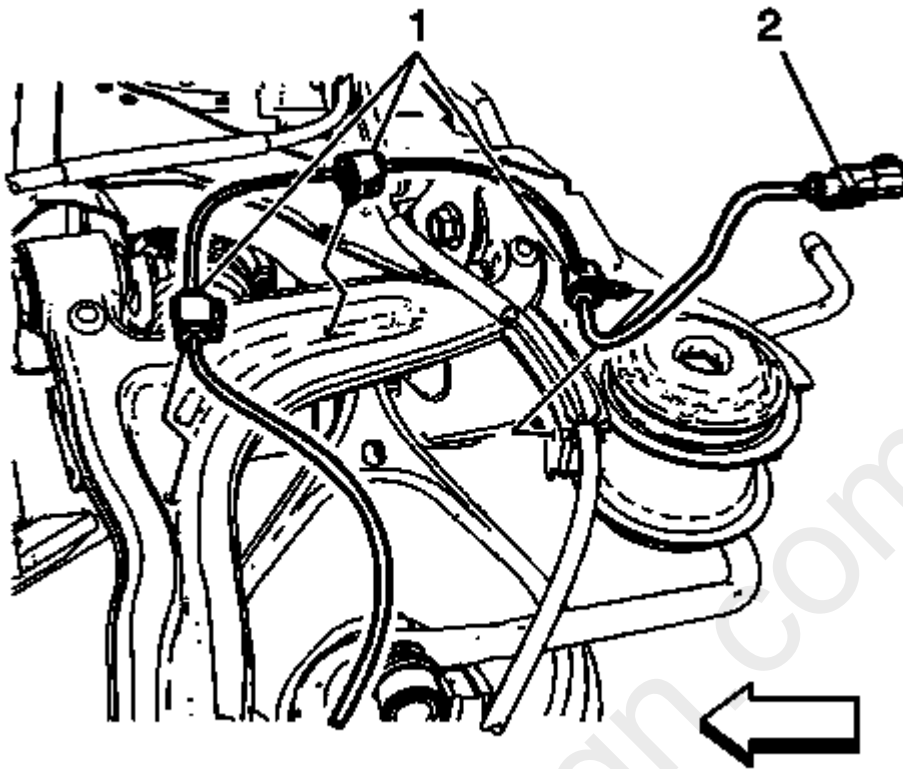


Fig. 82: Wheel Speed Sensor Wire Harness Clips
Courtesy of GENERAL MOTORS COMPANY

2. Install the wheel speed sensor wire harness clips (1) to the upper control arm and vehicle frame.
3. Connect the wheel speed sensor electrical connector (2).
4. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .

VEHICLE YAW SENSOR WITH VEHICLE LATERAL ACCELEROMETER REPLACEMENT

Removal Procedure

1. Turn the ignition switch OFF.
2. Remove the front floor console. Refer to **Front Floor Console Replacement (Right Hand Drive)** , **Front Floor Console Replacement (Left Hand Drive)** .
3. Disconnect the vehicle yaw sensor with vehicle lateral accelerometer electrical connector.

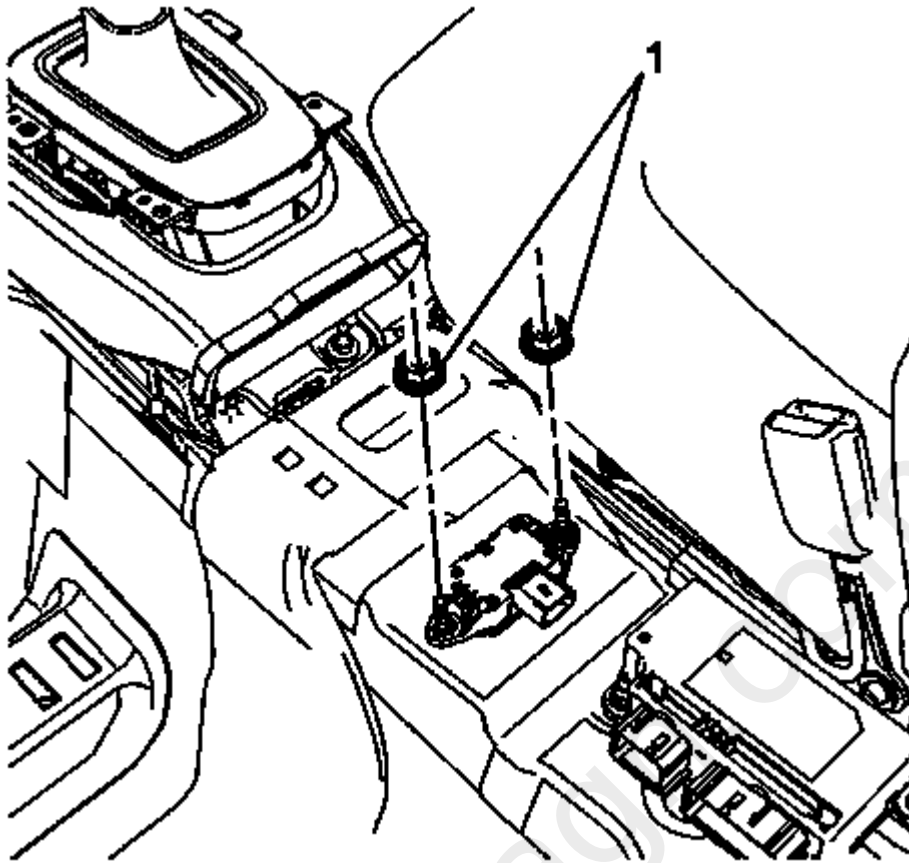


Fig. 83: Vehicle Lateral Accelerometer Nuts
Courtesy of GENERAL MOTORS COMPANY

4. Remove the vehicle yaw sensor with vehicle lateral accelerometer nuts (1).

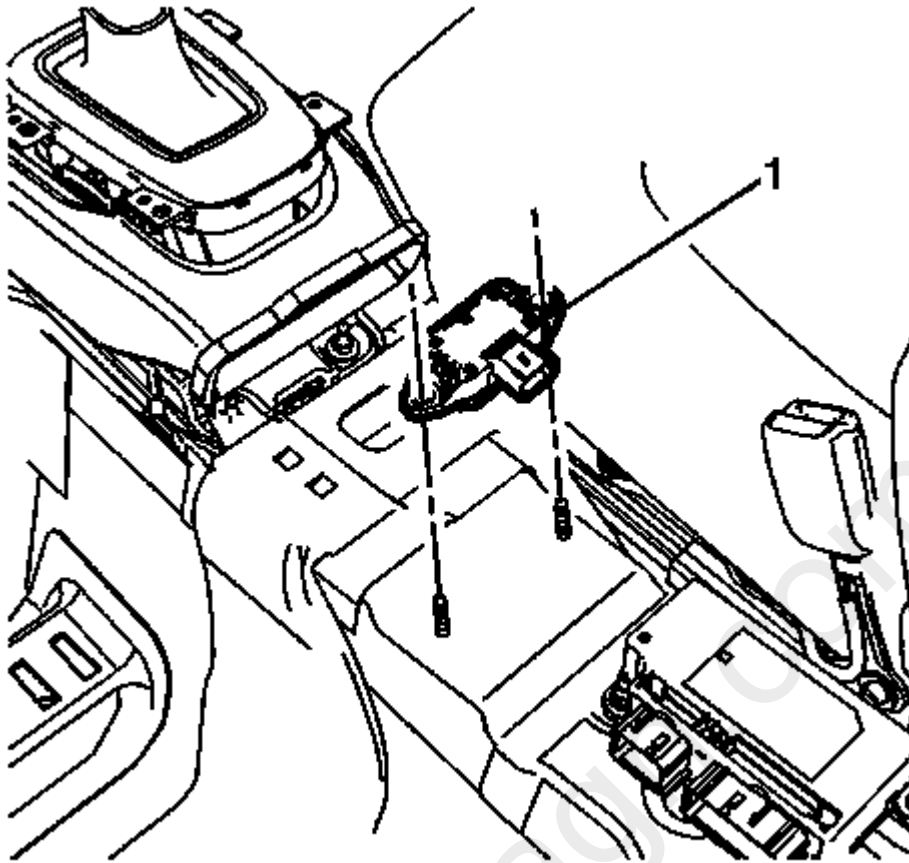


Fig. 84: Vehicle Lateral Accelerometer
Courtesy of GENERAL MOTORS COMPANY

5. Remove the vehicle yaw sensor with vehicle lateral accelerometer (1).

Installation Procedure

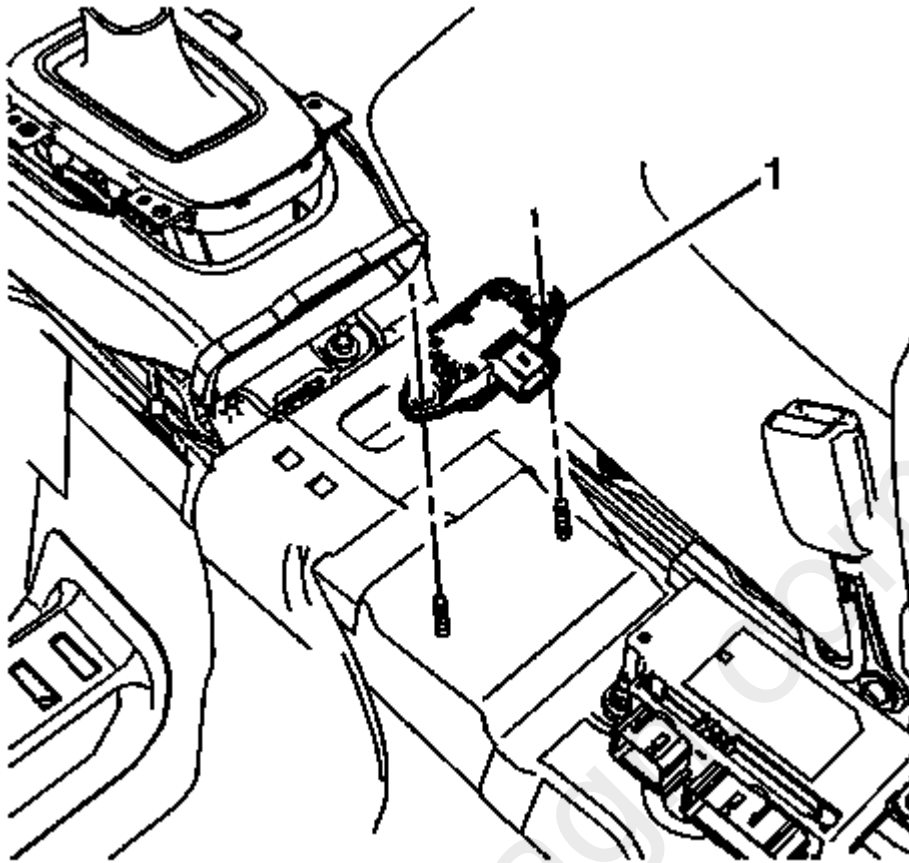


Fig. 85: Vehicle Lateral Accelerometer
Courtesy of GENERAL MOTORS COMPANY

1. Install the vehicle yaw sensor with vehicle lateral accelerometer (1).

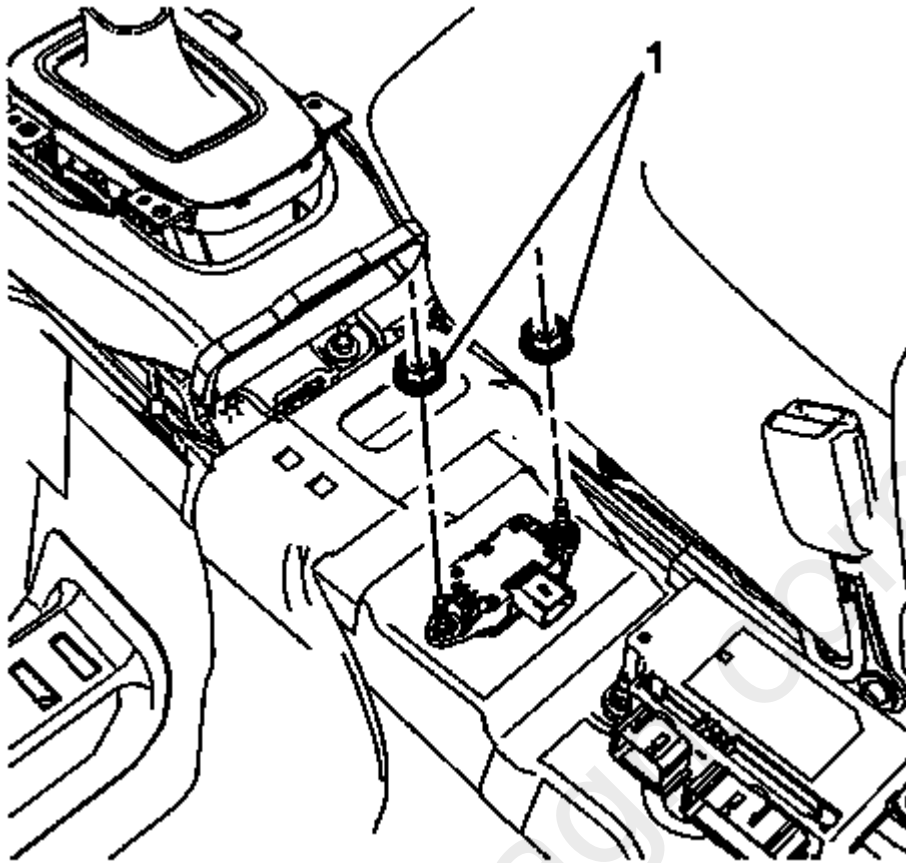


Fig. 86: Vehicle Lateral Accelerometer Nuts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Install the vehicle yaw sensor with vehicle lateral accelerometer nuts (1) and tighten to 9 N.m (80 lb in).
3. Connect the vehicle yaw sensor with vehicle lateral accelerometer electrical connector.
4. Install the front floor console. Refer to **Front Floor Console Replacement (Right Hand Drive)** , **Front Floor Console Replacement (Left Hand Drive)** .
5. Install a scan tool to the vehicle.
6. Using the special functions menu on the scan tool, reset the vehicle yaw sensor with vehicle lateral accelerometer.
7. Perform the **Diagnostic System Check - Vehicle** .

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION

This vehicle is equipped with the TRW 440 V antilock braking system.

The vehicle is equipped with the following braking systems:

- Antilock Brake System (ABS)
- Engine Drag Control (EDC)
- Dynamic Rear Proportioning (DRP)
- Traction Control System (TCS)
- Vehicle Electronic Stability (VES) (W/JL4)

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

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

The EBCM contains the following components:

- System relay-The system relay is energized when the ignition is ON and no ABS DTCs are present. It supplies battery positive voltage to the solenoid valves and pump motor.
- Vent tube-The vent tube, located in the EBCM connector, is an opening to the internal cavity of the EBCM. It allows ventilation of the EBCM internals.
- Brake pressure modulator valve (BPMV)-The BPMV contains the hydraulic valves and pump motor that are controlled electrically by the EBCM. The BPMV uses a 4 circuit configuration with a diagonal split. The BPMV directs fluid from the reservoir of the master cylinder to the left front and right rear wheels and fluid from the other reservoir to the right front and left rear wheels. The diagonal circuits are hydraulically isolated so that a leak or malfunction in one circuit will allow continued braking ability on the other.

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

The BPMV contains the following components:

- Pump motor
- Inlet valves (one per wheel)
- Outlet valves (one per wheel)
- Master cylinder isolation valves (one per drive wheel)
- Prime valves (one per drive wheel)
- Active wheel speed sensors (WSS)-EBCM sends an ignition voltage signal to each wheel speed sensor. As the wheel spins, the wheel speed sensor produces a square wave DC signal voltage. The wheel speed sensor increase the signal frequency as the wheel speed increases, but does not increase the signal amplitude.
- Traction control switch-The TCS is manually disabled or enabled using the traction control switch.
- The EBCM uses the brake apply sensors as an indication that the brake pedal is applied.

- Lateral accelerometer sensor (w/JL4)-The EBCM uses the lateral accelerometer sensor as an indication of the lateral acceleration of the vehicle.
- Yaw rate sensor (w/JL4)-The EBCM uses the yaw rate sensor as an indication of the yaw rate of the vehicle.
- Steering wheel position sensor (SWPS) (w/JL4)-The EBCM uses the SWPS as an indication of the position and rotation of the steering wheel.

Initialization Sequence

The EBCM performs 1 initialization test each ignition cycle. The initialization of the EBCM occurs when 1 set of the following conditions occur:

Both of the following conditions occur:

- The EBCM detects that there is a minimum of 500 RPM from the ECM via a serial data message.
- The brake apply sensor switch is not applied.

OR

Both of the following conditions occur:

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

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

The initialization sequence cycles each solenoid valve and the pump motor, as well as the necessary relays, for approximately 1.5 seconds to check component operation. The EBCM sets a DTC if any error is detected. The initialization sequence may be heard and felt while it is taking place, and is considered part of normal system operation.

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

Antilock Brake System

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

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

noises may be heard as the tires approach slipping. These noises and pedal pulsations are considered normal during antilock operation.

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

Pressure Hold

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

Pressure Decrease

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

Pressure Increase

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

Dynamic Rear Proportioning (DRP)

The dynamic rear proportioning (DRP) is a control system that replaces the hydraulic proportioning function of the mechanical proportioning valve in the base brake system. The DRP control system is part of the operation software in the EBCM. The DRP uses active control with existing ABS in order to regulate the vehicle's rear brake pressure.

The red brake warning indicator is illuminated when the dynamic rear proportioning function is disabled.

Engine Drag Control (EDC)

When the driver releases the throttle, and the drag from the engine overcomes the frictional force between the tire and the road, EDC becomes active.

The EBCM sends a torque request signal to the ECM, which increases the torque at the wheels. This stabilizes the wheels by reducing the slip at the driven wheels.

When EDC is active, the driven wheels are controlled to a target below the non-driven wheels.

Traction Control System (TCS)

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

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

If the engine torque reduction does not eliminate drive wheel slip, the EBCM will actively apply the drive wheel brakes. During traction control braking, hydraulic pressure in each drive wheel circuit is controlled to prevent the drive wheels from slipping. The master cylinder isolation valve closes in order to isolate the master cylinder from the rest of the hydraulic system. The prime valve then opens in order to allow the pump to accumulate brake fluid in order to build hydraulic pressure for braking. The drive wheel inlet and outlet solenoid valves then open and close in order to perform the following functions:

- Pressure hold
- Pressure increase
- Pressure decrease

ABS Indicator

The instrument panel cluster (IPC) illuminates the Antilock Brake System (ABS) indicator when the following occurs:

- The electronic brake control module (EBCM) detects a malfunction with the antilock brake system. The IPC receives a serial data message from the EBCM requesting illumination.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 5 seconds.
- The IPC detects a loss of serial data communications with the EBCM.

Traction Control System Indicator

TRAC OFF

The instrument panel cluster (IPC) illuminates the TRAC OFF indicator when the following occurs:

- The electronic brake control module (EBCM) inhibits the traction control system due to a malfunction in the traction control system. The IPC receives a serial data message from the EBCM requesting illumination.
- The body control module (BCM) detects that the traction control switch has been pressed (signal circuit is low). The BCM sends a serial data message to the EBCM in order to disable traction control. The IPC receives a serial data message from the EBCM requesting illumination. The BCM sends a serial data message to the radio in order to activate an audible warning.

Vehicle Electronic Stability (VES)

The vehicle electronic stability enhancement system (VES) adds an additional level of vehicle control to the EBCM.

Yaw rate is the rate of rotation about the vehicle's vertical axis. The VES 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 from the following parameters:

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

The difference between the desired yaw rate and the actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. If the yaw rate error becomes too large, the EBCM attempts to correct the vehicle's yaw motion by applying differential braking to the appropriate wheel. The amount of differential braking applied to the left or right front wheel is based on both the yaw rate error and side slip rate error.

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

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

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

