2007 BRAKES

Antilock Brake System - Avalanche, Escalade, Suburban, Tahoe & Yukon

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Pipe Fittings	18 N.m	13 lb ft
BPMV Bracket Bolts	22 N.m	16 lb ft
BPMV Mounting Bolt (W/O JL4)	10 N.m	89 lb in
BPMV Mounting Nuts	9 N.m	80 lb in
EBCM to BPMV Screws	3 N.m	27 lb in
Wheel Speed Sensor Bolt (Front)	18 N.m	13 lb ft
Wheel Speed Sensor Bolt (Rear)	13 N.m	115 lb in
Yaw Rate Sensor/Lateral Accelerometer Nut	7 N.m	62 lb in

SCHEMATIC AND ROUTING DIAGRAMS

ANTILOCK BRAKE SYSTEM SCHEMATIC ICONS

Antilock Brake System Schematic Icons

Icon	Icon Definition
	IMPORTANT: **Twisted-pair wires provide an effective shield that helps protect sensitive electronic components from electrical interference. If the wires were covered with shielding, install new shielding.** **In order to prevent electrical interference from degrading the performance of the connected components, you must maintain the proper specification when making any repairs to the twisted-pair wires shown :** • **The wires must be twisted a minimum of 9 turns per 31 cm (12 in) as measured anywhere along the length of the wires.** • **The outside diameter of the twisted wires must not exceed 6.0 mm (0.25 in).**

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ANTILOCK BRAKE SYSTEM SCHEMATICS

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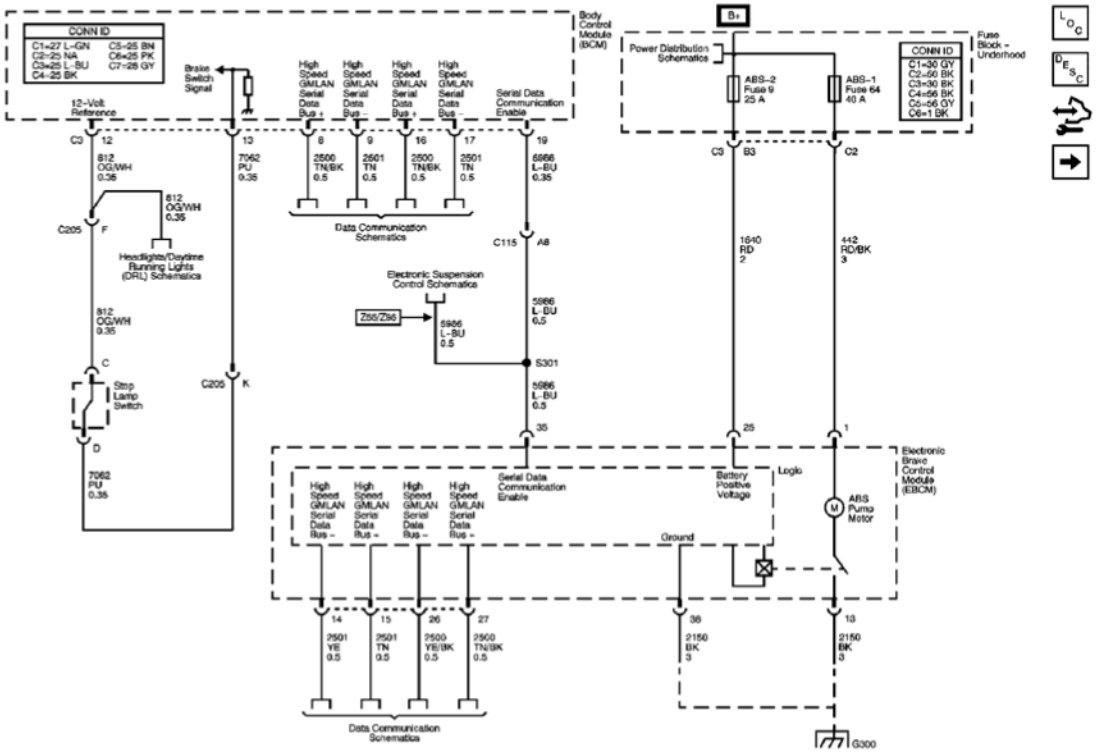


Fig. 1: Module Power, Ground, & Serial Data, Pump Motor & Brake Switch Schematic
Courtesy of GENERAL MOTORS CORP.

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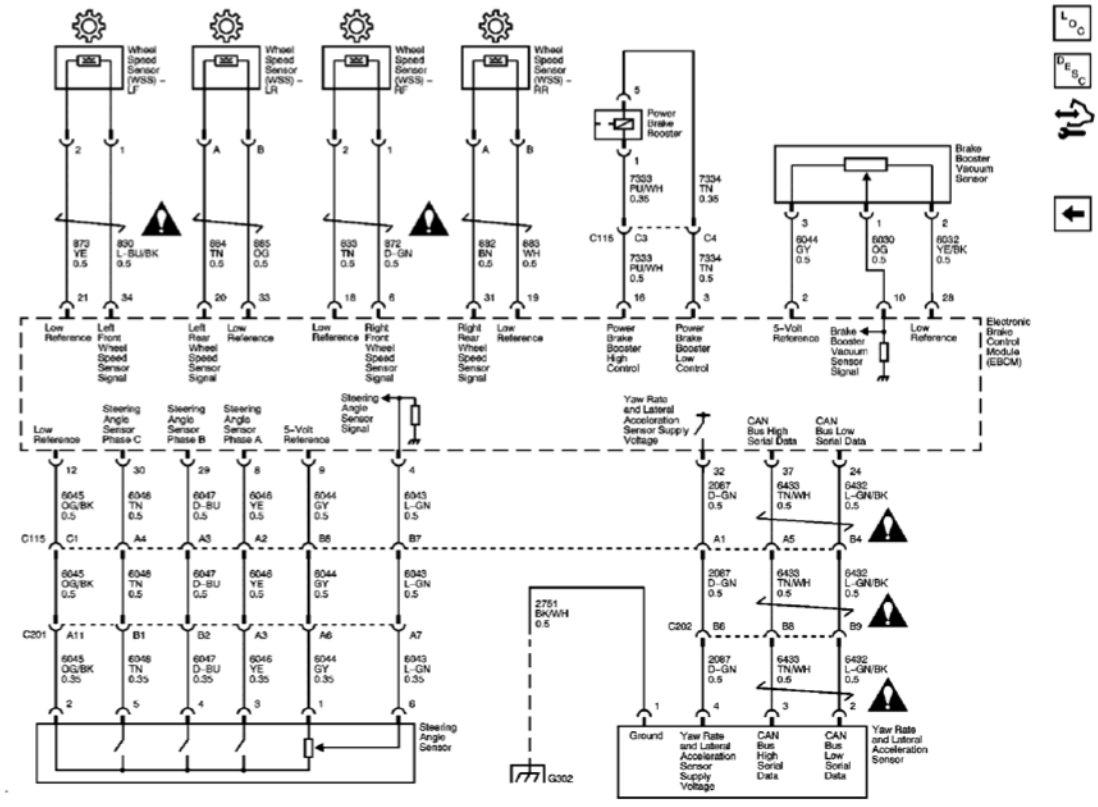


Fig. 2: Sensors Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

ANTILOCK BRAKE SYSTEM COMPONENT VIEWS

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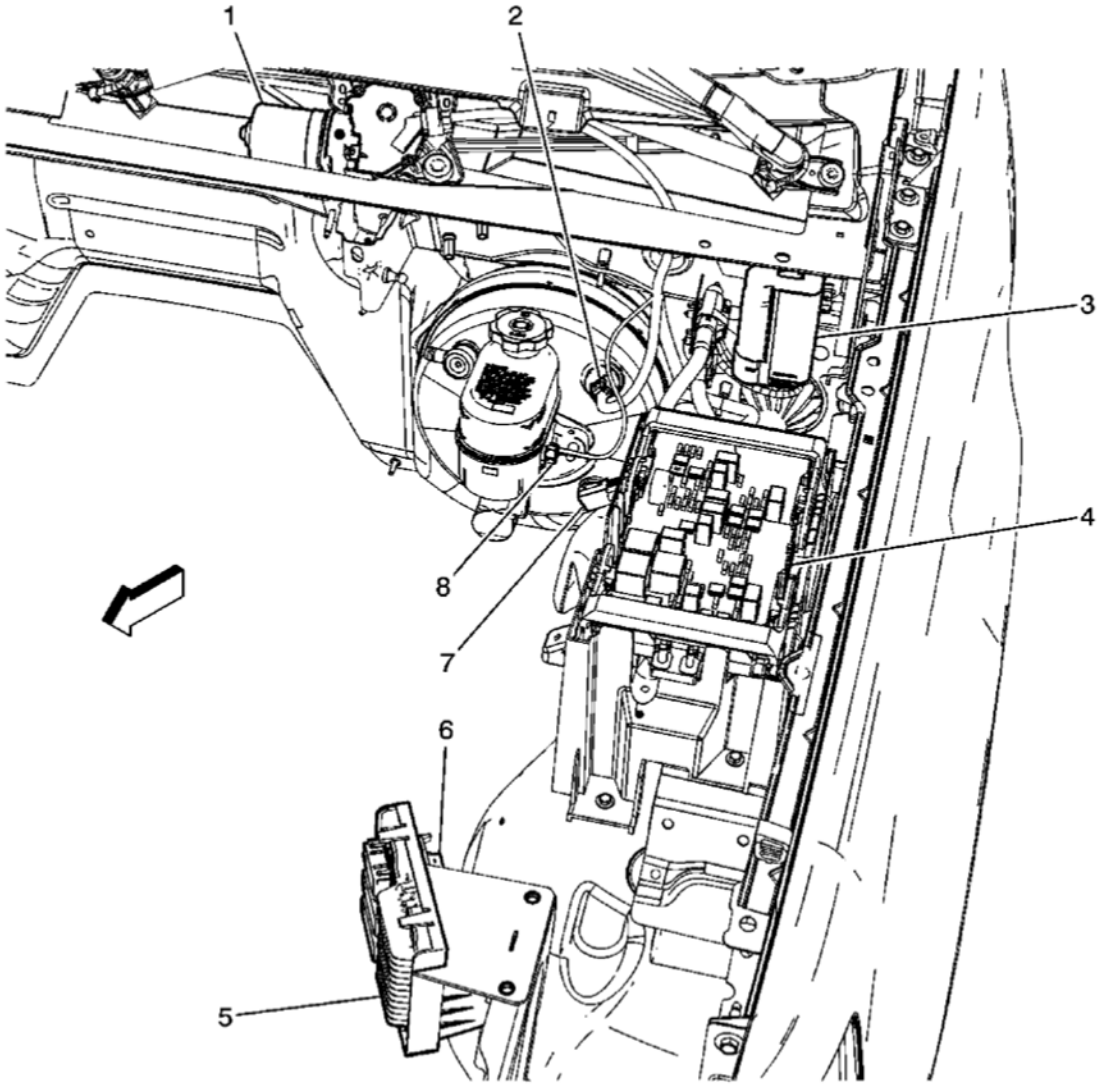


Fig. 3: Left Side of the Engine Compartment
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	Windshield Wiper Motor
2	Power Brake Booster
3	Windshield Washer Solvent Heater
4	Fuse Block - Underhood
5	Engine Control Module (ECM)
6	Transmission Control Module (TCM)
7	Brake Booster Vacuum Sensor
8	Brake Fluid Level Switch

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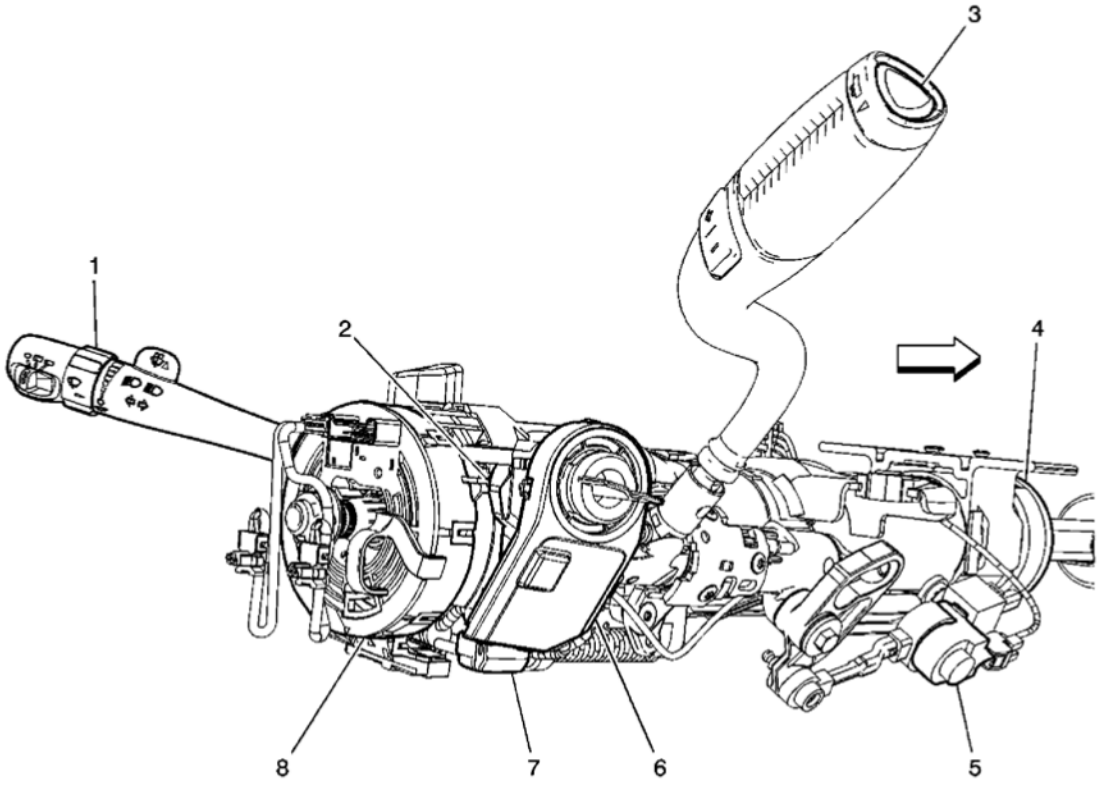


Fig. 4: Steering Column Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Turn Signal Multifunction Switch
2	Ignition Lock Cylinder
3	Tow/Haul Switch
4	Steering Angle Sensor
5	Shift Interlock Solenoid
6	Theft Deterrent Control Module
7	Ignition Switch
8	Inflatable Restraint Steering Wheel Module Coil

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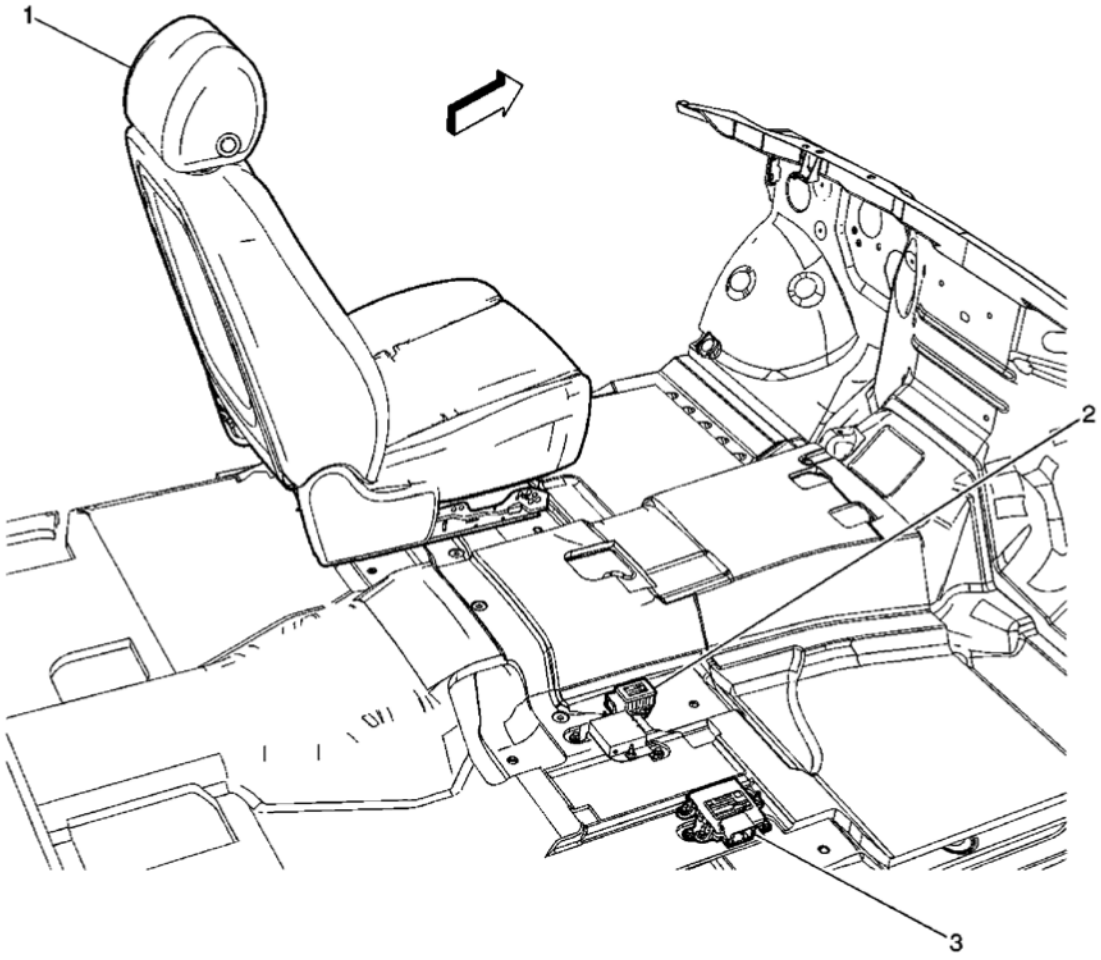


Fig. 5: Under the Front Passenger Seat
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Front Drivers Seat
2	YAW Rate and Lateral Acceleration Sensor
3	Object Alarm Module (UD7)
4	Rear View Camera Image Display Module (UVC)

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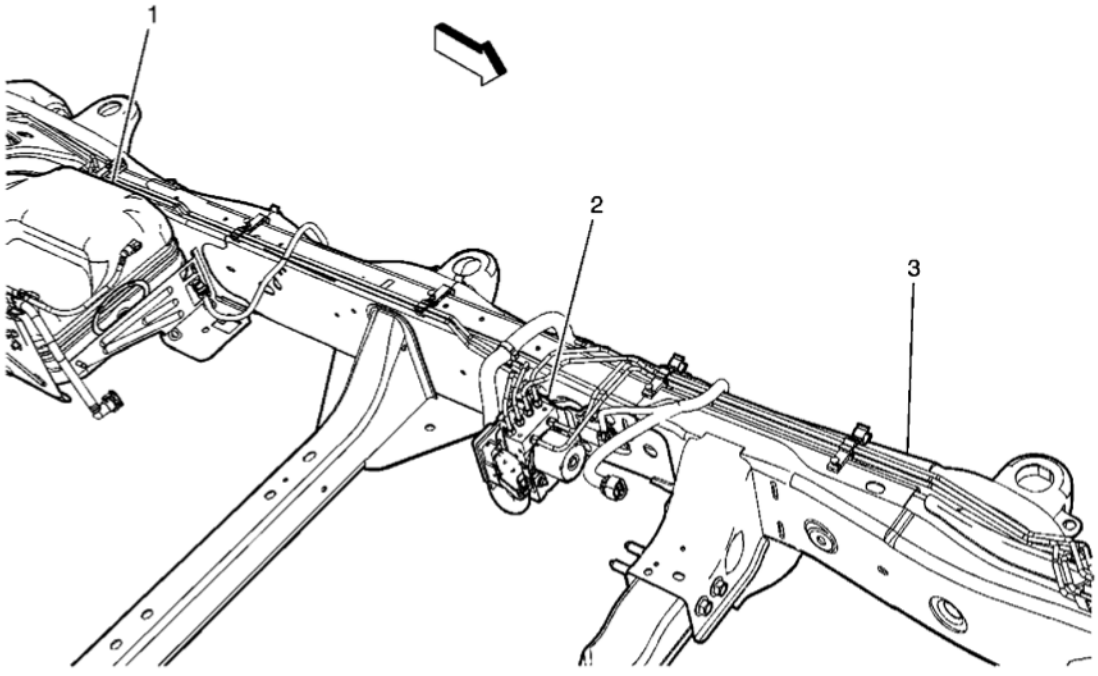


Fig. 6: Left Side Frame and Underbody
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	Gas Tank
2	Electronic Brake Control Module (EBCM)
3	Chassis

ANTILOCK BRAKE SYSTEM CONNECTOR END VIEWS

Brake Booster Vacuum Sensor

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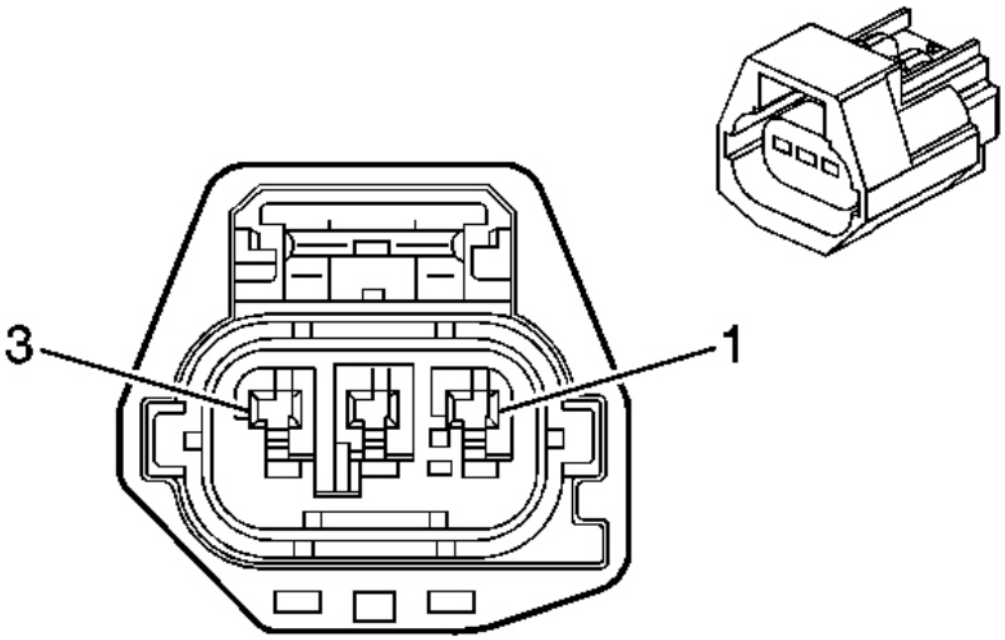


Fig. 7: Brake Booster Vacuum Sensor Connector End View
Courtesy of GENERAL MOTORS CORP.

Brake Booster Vacuum Sensor Connector Parts Information

Connector Part Information

- OEM: 10769084
- Service: 19115666
- Description: 3-Way F 3P 1.5mm YESC Series (GY)

Terminal Part Information

- Terminal/Tray: 7116-4102-08/9
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094430/J-35616-2A (GY)

Brake Booster Vacuum Sensor Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	OG	6030	Brake Vacuum Sensor Signal
2	YE/BK	6032	Low Reference

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3	GY	6044	5-Volt Reference

Electronic Brake Control Module (EBCM)(10 Series)

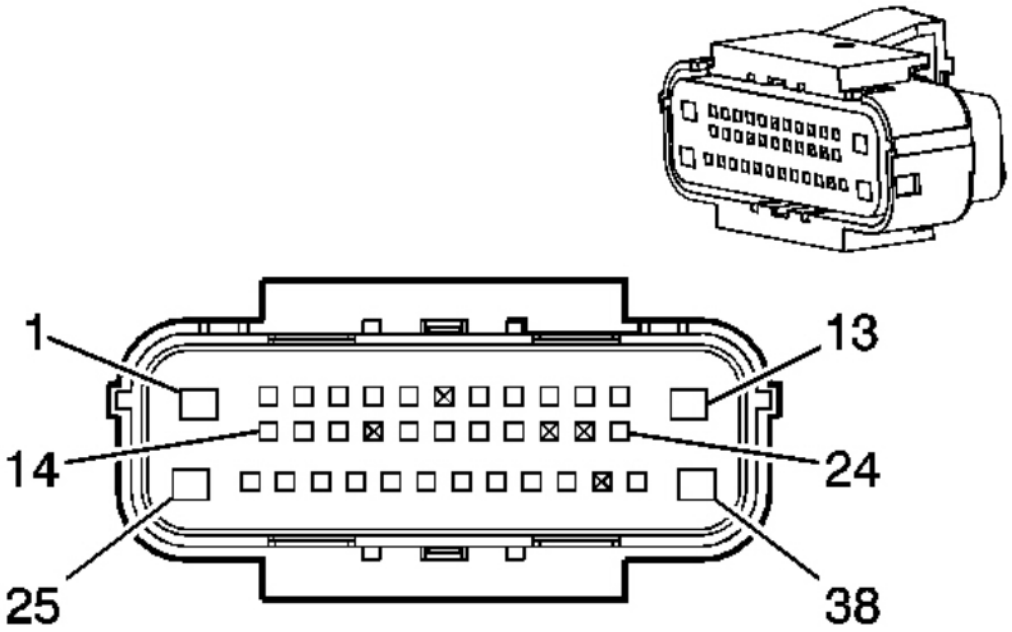


Fig. 8: Electronic Brake Control Module (EBCM)(10 Series) Connector End View
Courtesy of GENERAL MOTORS CORP.

Electronic Brake Control Module (EBCM)(10 Series) Connector Parts Information

Connector Part Information

- OEM: 13531176
- Service: 19115671
- Description: 38-Way F Receptacle 0.64 2.8 Series, Sealed (BK)

Terminal Part Information

- Pins: 1, 13, 25, 38
- Terminal/Tray: 15304720/19
- Core/Insulation Crimp: 4/5
- Release Tool/Test Probe: 15315247/J-35616-4A (PU)

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- Pins: 2-12, 14-24, 26-37
- Terminal/Tray: 15304719/19
- Core/Insulation Crimp: E/5
- Release Tool/Test Probe: 15315247/J-35616-4A (PU)

Electronic Brake Control Module (EBCM)(10 Series) Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	RD/BK	442	Battery Positive Voltage
2	GY	6044	Steering Angle Sensor 5-Volt Reference
3	TN/BK	7334	Active Booster Solenoid Control Low
4	L-GN	6043	Steering Angle Sensor Signal
5	-	-	Not Used
6	D-GN	872	Right Front Wheel Speed Sensor Signal
7	-	-	Not Used
8	YE	6046	Steering Angle Sensor Phase A
9	GY	6044	Steering Angle Sensor 5-Volt Reference
10	OG	6030	Brake Vacuum Sensor Signal
11	D-GN/WH	817	Vehicle Speed Signal
12	OG/BK	6045	Steering Angle Sensor Low Reference
13	BK	2150	Ground
14	YE	2501	High Speed GMLAN Serial Data Bus-
15	TN	2501	High Speed GMLAN Serial Data Bus-
16	PU/WH	7333	Active Booster Solenoid Control High
17	-	-	Not Used
18	GY/WH	7065	Wheel Speed Sensor Supply Voltage Right Front
19	GY/BK	7128	Wheel Speed Sensor Supply Voltage Right Rear
20	TN	884	Left Rear Wheel Speed Sensor Signal
21	GY/WH	7064	Wheel Speed Sensor Supply Voltage Left Front
22-23	-	-	Not Used
24	L-GN/BK	6432	CAN Bus Low Serial Data
25	RD	1640	Battery Positive Voltage
26	YE/BK	2500	High Speed GMLAN Serial Data Bus+
27	TN/BK	2500	High Speed GMLAN Serial Data Bus+
28	YE/BK	6032	Brake Vacuum Sensor Low Reference
29	D-BU	6047	Steering Angle Sensor Phase B
30	TN	6048	Steering Angle Sensor Phase C
31	BN	882	Right Rear Wheel Speed Sensor Signal
			Steering Wheel Position Sensor 5-Volt

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32	D-GN	2087	Reference
33	GY/BK	7127	Wheel Speed Sensor Supply Voltage Left Rear
34	L-BU/BK	830	Left Front Wheel Speed Sensor Signal
35	L-BU	5986	Serial Data Communication Enable
36	-	-	Not Used
37	TN/WH	6433	CAN Bus High Serial Data
38	BK	2150	Ground

Electronic Brake Control Module (EBCM)(20 Series)

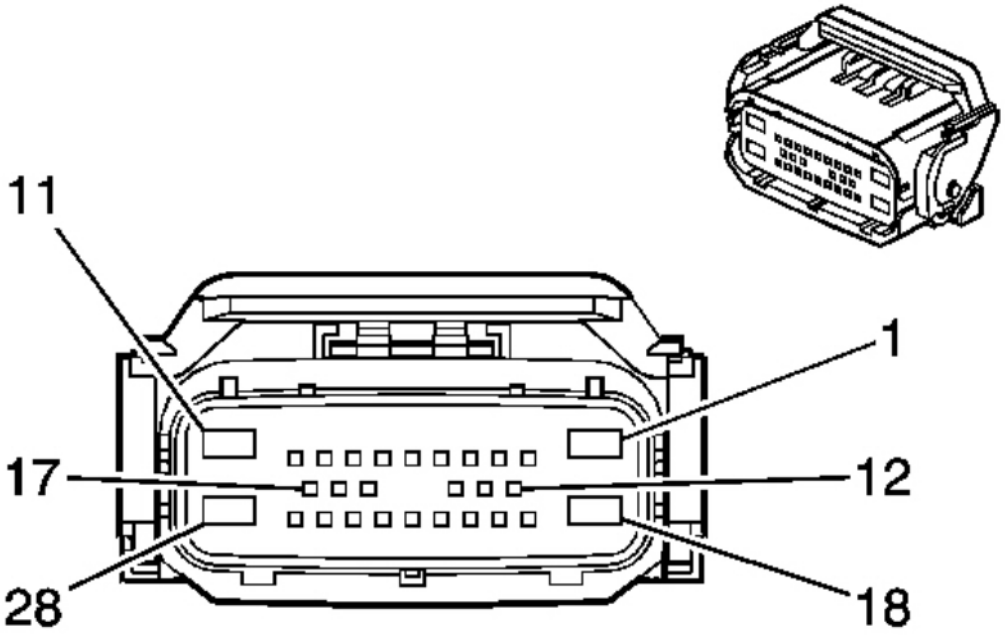


Fig. 9: Electronic Brake Control Module (EBCM)(20 Series) Connector End View
Courtesy of GENERAL MOTORS CORP.

Electronic Brake Control Module (EBCM)(20 Series) Connector Parts Information

Connector Part Information

- OEM: 15491267
- Service: 19149286
- Description: 28-Way F Kaizen 0.64 Series (BK)

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Terminal Part Information

- Pins: 2-10, 12-17, 19-27
- Terminal/Tray: 7116-3703-02/14
- Core/Insulation Crimp: 9/9
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

- Pins: 1, 11, 18, 28
- Terminal/Tray: 7116-4142-02/10
- Core/Insulation Crimp: Pin 1: A/3
- Core/Insulation Crimp: Pins 11, 18, 28: D/3
- Release Tool/Test Probe: 12094430/J-35616-42 (RD)

Electronic Brake Control Module (EBCM)(20 Series) Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	RD/BK	442	Battery Positive Voltage
2	YE/BK	2500	High Speed GMLAN Serial Data Bus+
3	TN/BK	2500	High Speed GMLAN Serial Data Bus+
4-10	-	-	Not Used
11	BK	2150	Ground
12	YE	2501	High Speed GMLAN Serial Data Bus-
13	TN	2501	High Speed GMLAN Serial Data Bus-
14	D-GN/WH	817	Vehicle Speed Signal
15	GY/WH	7064	Wheel Speed Sensor Supply Voltage Left Front
16	L-BU/BK	830	Left Front Wheel Speed Sensor Signal
17	-	-	Not Used
18	RD	1742	Battery Positive Voltage
19	L-BU	5986	Serial Data Communication Enable
20	YE/BK	1827	Vehicle Speed Signal
21-25	-	-	Not Used
26	GY/WH	7065	Wheel Speed Sensor Supply Voltage Right Front
27	D-GN	872	Right Front Wheel Speed Sensor Signal
28	BK	2150	Ground

Power Brake Booster

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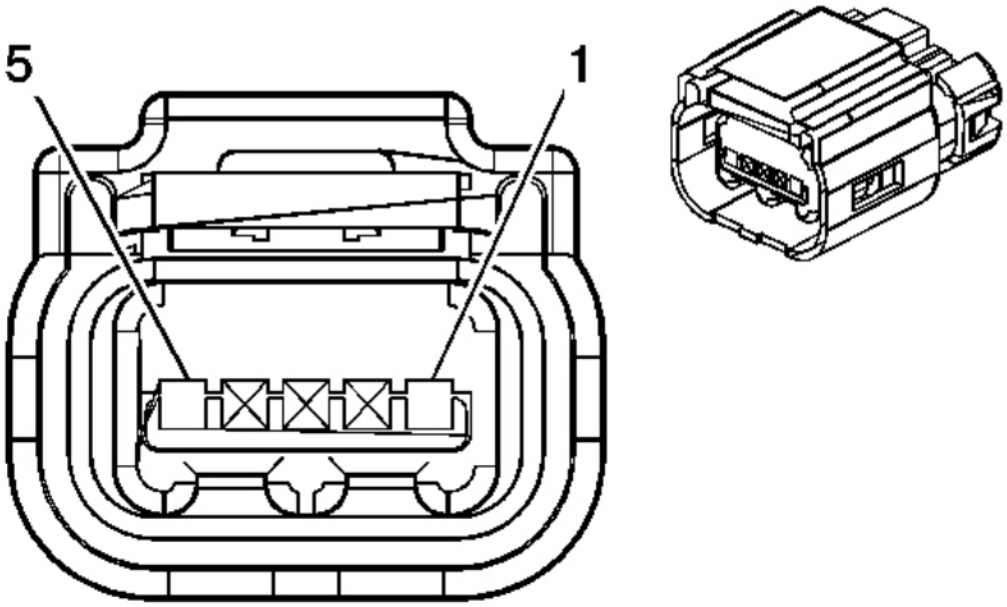


Fig. 10: Power Brake Booster Connector End View
Courtesy of GENERAL MOTORS CORP.

Power Brake Booster Connector Parts Information

Connector Part Information

- OEM: 13509356
- Service: 19149287
- Description: 2-Way F Kaizen 0.64 Series, Sealed (BK)

Terminal Part Information

- Terminal/Tray: 7116-4618-02/14
- Core/Insulation Crimp: P/P
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

Power Brake Booster Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	PU/WH	7333	Power Brake Booster High Control
2-4	-	-	Not Available
5	TN	7334	Power Brake Booster Low Control

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Steering Angle Sensor

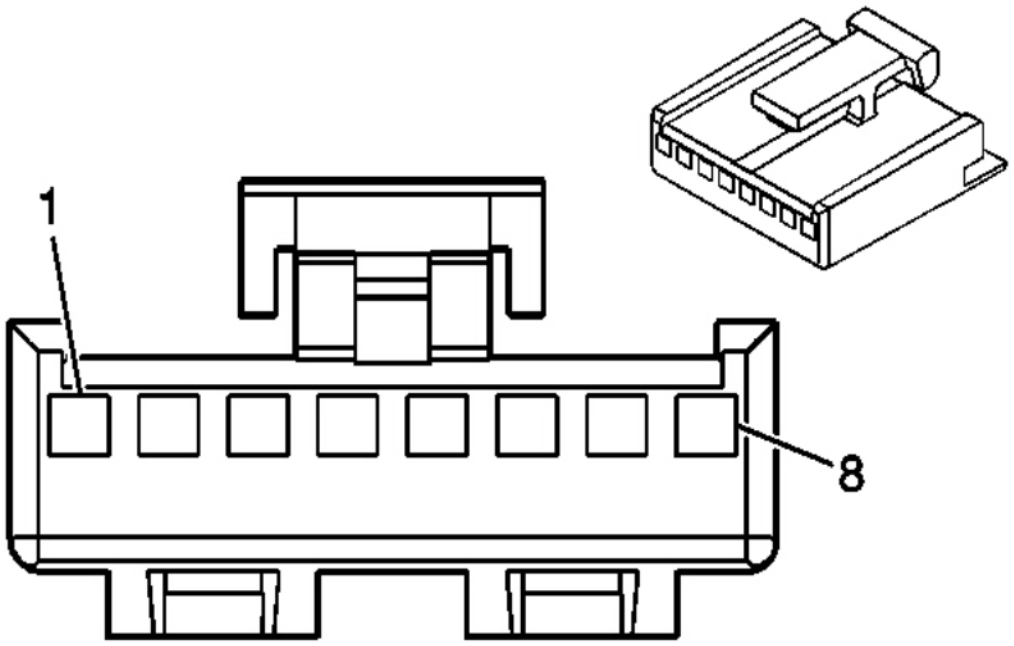


Fig. 11: Steering Angle Sensor Connector End View
Courtesy of GENERAL MOTORS CORP.

Steering Angle Sensor Connector Parts Information

Connector Part Information

- OEM: 12052444
- Service: 12101874
- Description: 8-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Terminal/Tray: TBD
- Core/Insulation Crimp: TBD
- Release Tool/Test Probe: TBD

Steering Angle Sensor Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	GY	6044	5-Volt Reference

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2	OG/BK	6045	Low Reference
3	YE	6046	Steering Angle Sensor Phase A
4	D-BU	6047	Steering Angle Sensor Phase B
5	TN	6048	Steering Angle Sensor Phase C
6	L-GN	6043	Steering Angle Sensor Signal
7-8	-	-	Not Used

Traction Control/Rear Object Detection Switch (Z75)

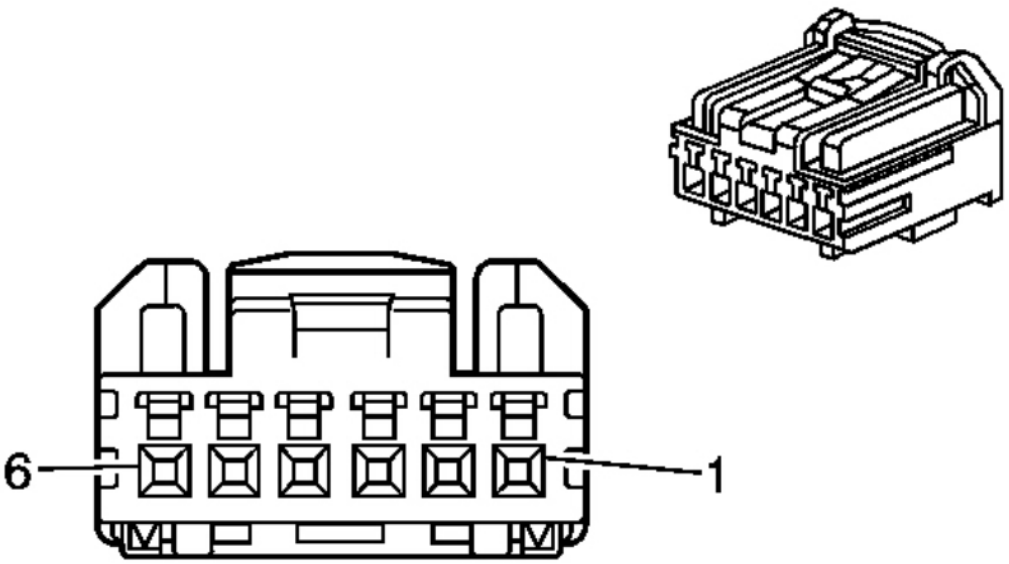


Fig. 12: Traction Control/Rear Object Detection Switch (Z75) Connector End View
Courtesy of GENERAL MOTORS CORP.

Traction Control/Rear Object Detection Switch (Z75) Connector Parts Information

Connector Part Information

- OEM: 15488869
- Service: 19115655
- Description: 6-Way F HCM Series (BK)

Terminal Part Information

- Terminal/Tray: SHCM-A03T-P025/20
- Core/Insulation Crimp: J/J

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- Release Tool/Test Probe: 12094429/J-35616-64B (L-BU)

Traction Control/Rear Object Detection Switch (Z75) Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	L-BU	1788	Traction Control Switch Signal
2	GY	2555	Rear Park Assist Disable Signal
3	BN	5852	Rear Park Assist LED Disable Signal
4	PU/WH	6816	Indicator Dimming Control
5	BK	1850	Ground
6	YE	6817	LED Backlight Dimming Control

Wheel Speed Sensor (WSS)- LF (20 Series)

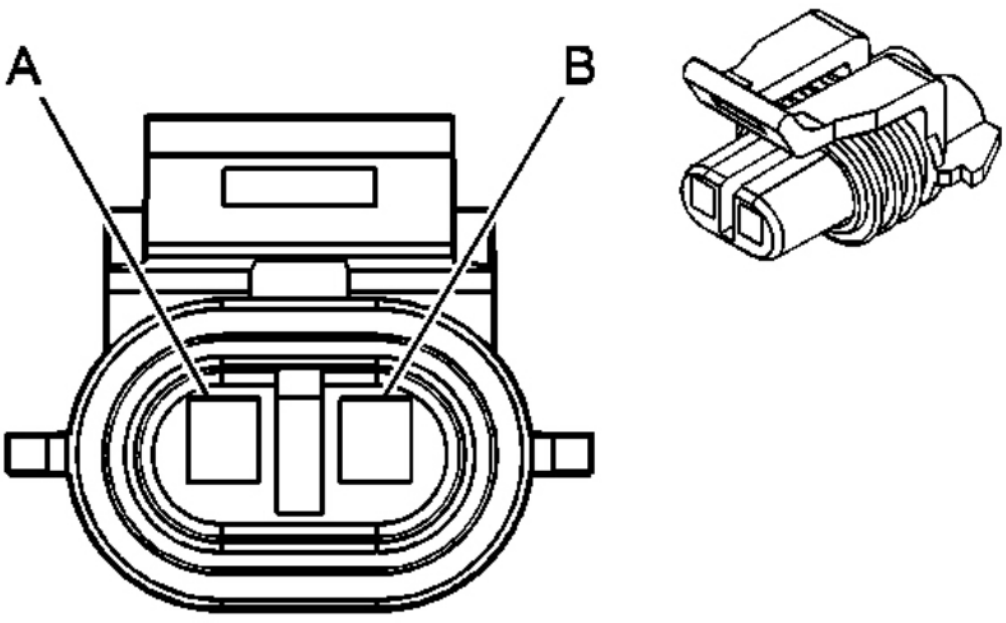


Fig. 13: Wheel Speed Sensor (WSS)- LF (20 Series) Connector End View
Courtesy of GENERAL MOTORS CORP.

Wheel Speed Sensor (WSS)- LF (20 Series) Connector Parts Information

Connector Part Information

- OEM: 12052641

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- Service: 12102747
- Description: 2-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Wheel Speed Sensor (WSS)- LF (20 Series) Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	L-BU/BK	830	Left Front Wheel Speed Sensor Signal
B	GY/WH	7064	Wheel Speed Sensor Supply Voltage Left Front

Wheel Speed Sensor (WSS)- LF (10 Series)

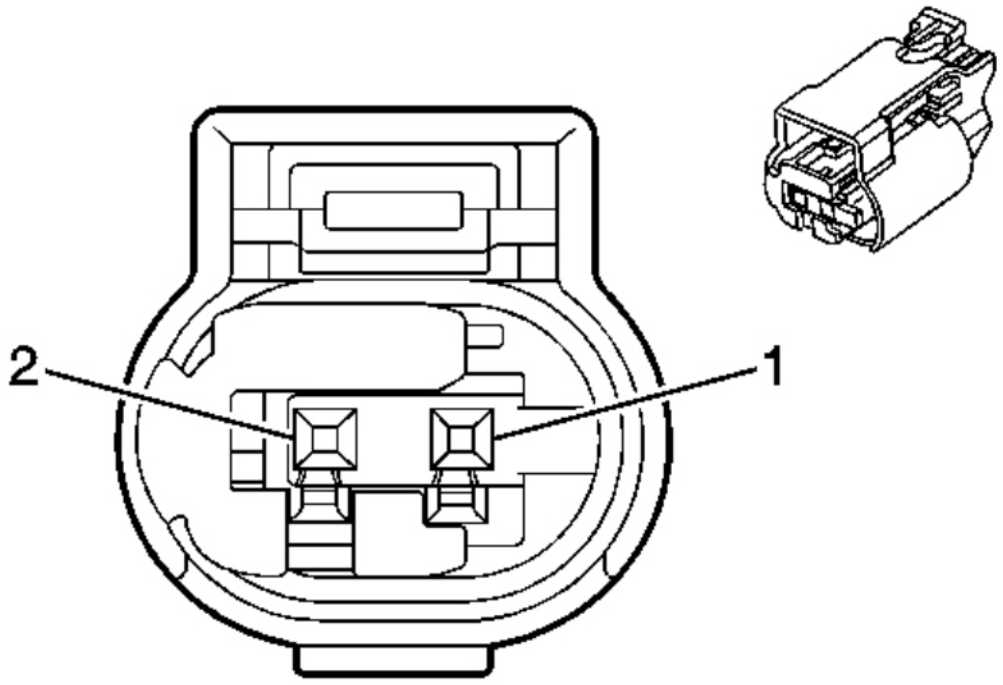


Fig. 14: Wheel Speed Sensor (WSS)- LF (10 Series) Connector End View
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Wheel Speed Sensor (WSS)- LF (10 Series) Connector Parts Information

Connector Part Information

- OEM: 13531640
- Service: 19149296
- Description: 2-Way F Clean Body Series, Sealed (BK)

Terminal Part Information

- Terminal/Tray: See Catalog
- Core/Insulation Crimp: TBD
- Release Tool/Test Probe: TBD

Wheel Speed Sensor (WSS)- LF (10 Series) Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	L-BU/BK	830	Left Front Wheel Speed Sensor Signal
2	GY/WH	7064	Wheel Speed Sensor Supply Voltage Left Front

Wheel Speed Sensor (WSS)- LR

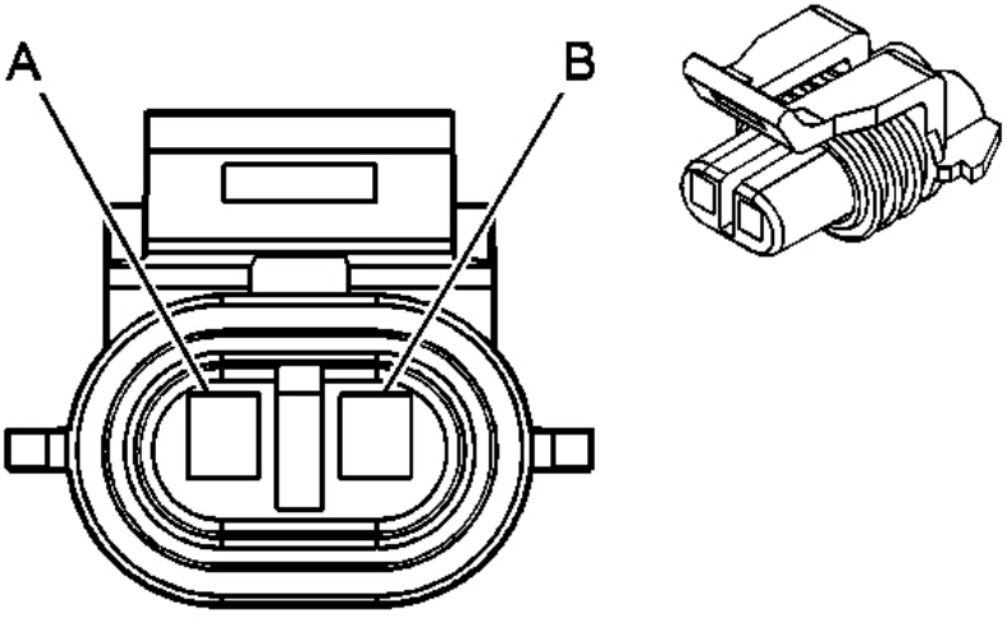


Fig. 15: Wheel Speed Sensor (WSS)- LR Connector End View

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Courtesy of GENERAL MOTORS CORP.

Wheel Speed Sensor (WSS)- LR Connector Parts Information

Connector Part Information

- OEM: 12052641
- Service: 12102747
- Description: 2-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Wheel Speed Sensor (WSS)- LR Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	TN	884	Left Rear Wheel Speed Sensor Signal
B	GY/BK	7127	Wheel Speed Sensor Supply Voltage Left Rear

Wheel Speed Sensor (WSS)- RF (20 Series)

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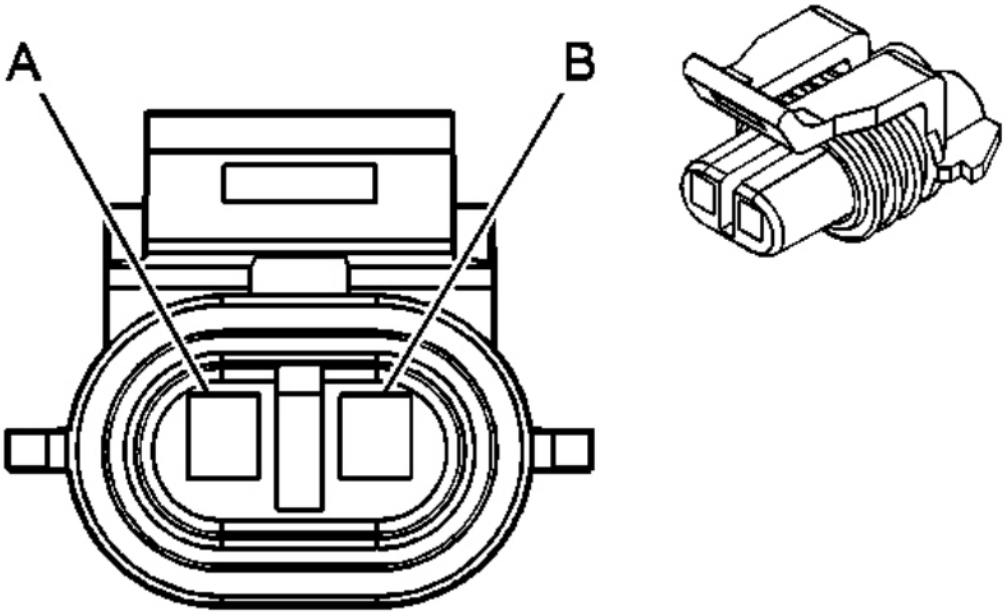


Fig. 16: Wheel Speed Sensor (WSS)- RF (20 Series) Connector End View
Courtesy of GENERAL MOTORS CORP.

Wheel Speed Sensor (WSS)- RF (20 Series) Connector Parts Information

Connector Part Information

- OEM: 12052641
- Service: 12102747
- Description: 2-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Wheel Speed Sensor (WSS)- RF (20 Series) Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	D-GN	872	Right Front Wheel Speed Sensor Signal
B	GY/WH	7065	Wheel Speed Sensor Supply Voltage Right Front

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Wheel Speed Sensor (WSS)- RF (10 Series)

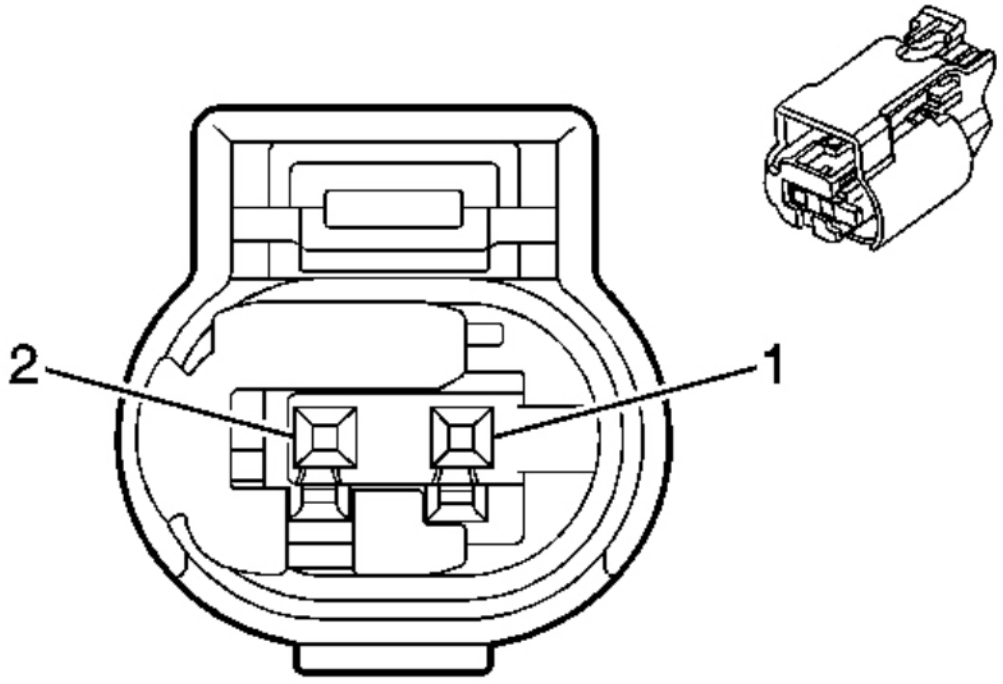


Fig. 17: Wheel Speed Sensor (WSS)- RF (10 Series) Connector End View
Courtesy of GENERAL MOTORS CORP.

Wheel Speed Sensor (WSS)- RF (10 Series) Connector Parts Information

Connector Part Information

- OEM: 13531640
- Service: 19149296
- Description: 2-Way F Clean Body Series, Sealed (BK)

Terminal Part Information

- Terminal/Tray: See Catalog
- Core/Insulation Crimp: TBD
- Release Tool/Test Probe: TBD

Wheel Speed Sensor (WSS)- RF (10 Series) Connector Terminal Identification

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Pin	Wire Color	Circuit No.	Function
1	D-GN	872	Right Front Wheel Speed Sensor Signal
2	GY/WH	7065	Wheel Speed Sensor Supply Voltage Right Front

Wheel Speed Sensor (WSS)- RR

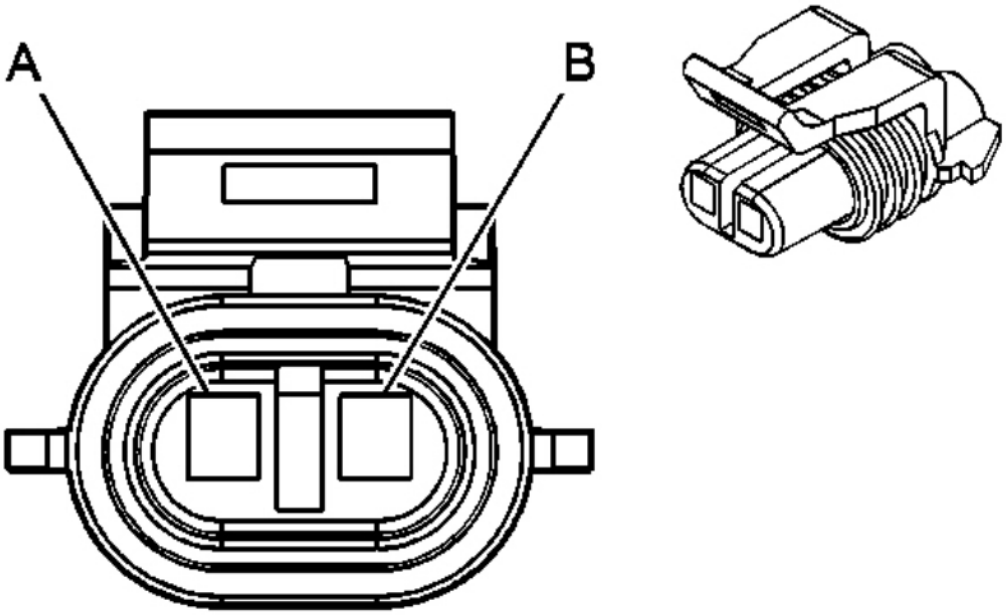


Fig. 18: Wheel Speed Sensor (WSS)- RR Connector End View
Courtesy of GENERAL MOTORS CORP.

Wheel Speed Sensor (WSS)- RR Connector Parts Information

Connector Part Information

- OEM: 12052641
- Service: 12102747
- Description: 2-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

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Wheel Speed Sensor (WSS)- RR Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	BN	882	Right Rear Wheel Speed Sensor Signal
B	GY/BK	7128	Wheel Speed Sensor Supply Voltage Right Rear

Yaw Rate and Lateral Acceleration Sensor

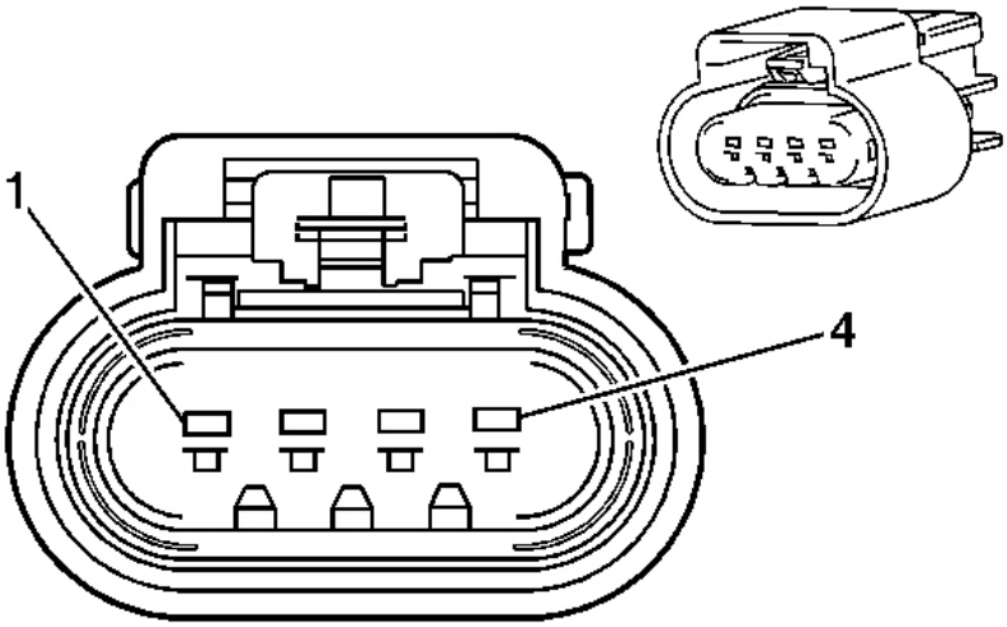


Fig. 19: Yaw Rate & Lateral Acceleration Sensor Connector End View
Courtesy of GENERAL MOTORS CORP.

Yaw Rate & Lateral Acceleration Sensor Connector Parts Information

Connector Part Information

- OEM: 10756595
- Service: 88953370
- Description: 4-Way F Quadlock Micro Sealed (BK)

Terminal Part Information

- Terminal/Tray: 962885-5/15
- Core/Insulation Crimp: 6/6

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- Release Tool/Test Probe: 12094429/J-35616-64B (L-BU)

Yaw Rate and Lateral Acceleration Sensor Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	BK/WH	2751	Ground
2	L-GN/BK	6432	CAN Bus Low Serial Data
3	TN/WH	6433	CAN Bus High Serial Data
4	D-GN	2087	Yaw Rate and Lateral Acceleration Sensor Supply Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC C0055 or P0609 (Over 8600 GVW)	Rear Wheel Speed Sensor Circuit
DTC C0035 or C0040	Front Wheel Speed Sensor Circuit
DTC C0045 or C0050	Rear Wheel Speed Sensor Circuit
DTC C0110 (Equal to or under 8600 GVW)	Pump Motor Circuit
DTC C0110 (Over 8600 GVW)	Pump Motor Circuit
DTC C0131	ABS Pressure Circuit
DTC C0161 (Equal to or Under 8600 GVW)	Antilock Brake System (ABS) Brake Switch/Sensor Circuit
DTC C0161 (Over 8600 GVW)	Antilock Brake System (ABS)/Traction Control System (TCS) Brake Switch
DTC C0186	Lateral Accelerometer Circuit
DTC C0196	Yaw Rate Circuit
DTC C0201 (Equal to or under 8600 GVW)	Antilock Brake System (ABS) Enable Relay Contact Circuit
DTC C0201 (Over 8600 GVW)	Antilock Brake System (ABS) Enable Relay Contact Circuit
DTC C0242	Electronic control module (ECM) Indicated TCS Malfunction
DTC C0245 (Equal to or Under 8600 GVW)	Wheel Speed Sensor Frequency Error
DTC C0245 (Over 8600 GVW)	Wheel Speed Sensor Frequency Error
DTC C0252	VSES Sensor Uncorrelated
DTC C0253	Centering Error

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DTC C0299	Brake Booster Performance
DTC C0455	Front Steering Position Sensor Circuit
DTC C0550	Electronic Control Unit (ECU) Performance
DTC C0561	System Disabled Information Stored invalid serial data received
DTC C0569	System Configuration Error
DTC C0710	Steering Position Signal
DTC C0774	Low Tire Pressure System Performance
DTC C1100 or C1101	Brake Booster Vacuum Sensor Performance

DIAGNOSTIC STARTING POINT - ANTILOCK BRAKE SYSTEM

Begin the system diagnosis with **Diagnostic System Check - Vehicle** .The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and their status

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
ABS Motor Test	-	Used in order to command the ABS pump motor On or Off.
Automated Bleed Procedure	-	Used in order to bleed ABS hydraulics. Refer to **Antilock Brake System Automated Bleed Procedure (W/JL4)** or **Antilock Brake System Automated Bleed Procedure (W/O JL4)**
LF Inlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF.
LF Outlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF.
LR Inlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF.
LR Outlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF.
RF Inlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF.
RF Outlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF.

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RR Inlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF.

SCAN TOOL DATA LIST

EBCM Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition is ON, engine OFF, and vehicle is stationary			
ABS Active	ABS	Yes/No	No
ABS Failed	ABS/TCS	On/Off	Off
Battery Voltage Signal	ABS/TCS/VSES	Applied/Released	Released
Brake Fluid Level Status	ABS	OK/Low	OK
Brake Pressure Sensor Input	ABS	Volts	Varies
BPP Signal	ABS	Applied/Released	Released
Delivered Torque	TCS	%	Varies
DRP Active	ABS	Yes/No	No
DRP Disabled	ABS	Yes/No	No
Engine Drag Control Failed	ABS	Yes/No	No
HBB Calibration Status	ABS	Fail/Applied	Applied
Lateral Accelerometer Signal	VSES	Voltage	2.5 Volts
LF Wheel Speed Sensor	ABS/TCS	km/h or mph	0
LF Inlet Solenoid Command	ABS	Active/Inactive	Inactive
LF Outlet Solenoid Command	ABS	Active/Inactive	Inactive
LR Wheel Speed Sensor	ABS/TCS	km/h or mph	0
LR Inlet Solenoid Command	ABS	Active/Inactive	Inactive
LR Outlet Solenoid Command	ABS	Active/Inactive	Inactive
Panic Brake Assist Failed	ABS	Yes/No	No
Pump Motor Command Voltage	ABS	Voltage	Varies
Requested Torque	TCS	%	Varies
RF Inlet Solenoid	ABS	Active/Inactive	Inactive
RF Outlet Solenoid	ABS	Active/Inactive	Inactive
RF Wheel Speed Sensor	ABS/TCS	km/h or mph	0
RR Inlet Solenoid Command	ABS	Active/Inactive	Inactive

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RR Outlet Solenoid Command	ABS	Active/Inactive	Inactive
RR Wheel Speed Sensor	ABS/TCS	km/h or mph	0
Steering Wheel Position	VSES	Degrees	Varies
TCS Failed	TCS	Yes/NO	No
VSES Active	VSES	Yes/No	No
VSES Failed	VSES	Yes/No	No
Yaw Rate Sensor	VSES	Volts	Varies

SCAN TOOL DATA DEFINITIONS

The ABS scan tool data definitions contain a brief description of all ABS related parameters available on the scan tool. The parameters available on the scan tool are listed below in alphanumeric order.

ABS Active

The scan tool displays Yes/No. The scan tool displays No when a when not active.

ABS Failed

The scan tool displays On/Off. The scan tool displays Off when a when not active.

Battery Voltage Signal

The scan tool displays 0-18 Volts. The scan tool displays approximately 12 Volts when the ignition is ON.

Brake Fluid Level Status

The scan tool displays 0-18 Volts. The scan tool displays approximately 12 Volts when the ignition is ON.

Brake Pressure Sensor Input

The scan tool displays 0-5 Volts. The scan tool displays approximately 1.5 Volts when the ignition is ON.

Brake Pedal Position Signal (BPP)

The scan tool displays Applied/Released. The scan tool indicates Released when the brake is not applied.

Delivered Torque

The scan tool displays 0-100 percent. The scan tool displays the duty cycle of the Delivered Torque PWM signal. The duty cycle of the signal is used to transmit how much engine torque the PCM is delivering. Normal values are between 10 and 90 percent duty cycle.

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DRP Active

The scan tool will display Yes/No depending on the state of the DRP.

DRP Disabled

The scan tool will display Yes/No depending on the state of the DRP.

Engine Drag Control Failed

The scan tool will display Yes/No depending on the state of traction of the tires and engine RPM.

HBB Calibration Status

The scan tool will display Failed or Applied. The scan tool displays Applied when the calibration is complete.

Lateral Accelerometer Signal

The scan tool will display 0-5 Volts. The scan tool displays approximately 2.5 volts when the ignition is ON, and the vehicle is stationary.

Ignition Voltage Signal

The scan tool displays 0-18 Volts. The scan tool displays approximately 12 Volts when the ignition is ON.

LF Wheel Speed Sensor

The scan tool displays 0-327 km/h (0-204 mph). The scan tool displays 0 km/h (0 mph) when the vehicle is not moving or is moving at speeds less than or equal to 0 km/h (0 mph).

LR Wheel Speed Sensor

The scan tool displays 0-327 km/h (0-204 mph). The scan tool displays 0 km/h (0 mph) when the vehicle is not moving or is moving at speeds less than or equal to 0 km/h (0 mph).

LF Outlet Valve Command

The scan tool displays Active/Inactive. The scan tool displays Active when the left front Outlet valve solenoid is commanded on.

LR Outlet Valve Command

The scan tool displays Active/Inactive. The scan tool displays Active when the left front Outlet valve solenoid is commanded on.

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Panic Brake Assist Failed

The scan tool will display Yes/No depending on the state of traction of the tires and engine RPM.

Pump Motor Command Voltage

The scan tool will display Voltage when the pump motor is active.

Requested Torque

The scan tool displays 0-10 percent. The scan tool displays the duty cycle of the Requested Torque PWM signal. The duty cycle of the signal is used to transmit how much engine torque the EBCM is requested.

RF Outlet Valve Command

The scan tool displays Active/Inactive. The scan tool displays Active when the right front Outlet valve solenoid is commanded on.

RF Inlet Valve Command

The scan tool displays Active/Inactive. The scan tool displays Active when the right front Inlet valve solenoid is commanded on.

RF Wheel Speed Sensor

The scan tool displays 0-327 km/h (0-204 mph). The scan tool displays 0 km/h (0 mph) when the vehicle is not moving or is moving at speeds less than or equal to 0 km/h (0 mph).

RR Wheel Speed Sensor

The scan tool displays 0-327 km/h (0-204 mph). The scan tool displays 0 km/h (0 mph) when the vehicle is not moving or is moving at speeds less than or equal to 0 km/h (0 mph).

RR Outlet Valve Command

The scan tool displays Active/Inactive. The scan tool displays Active when the right front Inlet valve solenoid is commanded on.

RR Inlet Valve Command

The scan tool displays Active/Inactive. The scan tool displays Active when the right front Inlet valve solenoid is commanded on.

Steering Wheel Position

The scan tool will display Steering Angle Sensor. The scan tool will display the signal received from the Steering Angle Sensor.

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TCS Active

The scan tool will display Yes or No depending on the state of the Traction Control.

TCS Failed

The scan tool will display Yes or No depending on the state of the Traction Control

VSES Active

The scan tool displays Yes or No. The scan tool displays Yes when VSES is active, and No when VSES is inactive.

VSES Failed

The scan tool will display Yes or No depending on the state of the ABS indicator.

Yaw Rate Sensor

The scan tool will display Volts, depending on the angle of the vehicle.

HYDRAULIC BRAKE BOOSTER CALIBRATION

Hydraulic Brake Booster Calibration

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

For vehicles under 8600 GVWR, the EBCM calibrates itself to the Brake Booster Vacuum Sensor to learn specific engine vacuum and braking characteristics of the vehicle.

If the "Power Brake Booster" activates excessively or if excessive effort of the brake pedal is consistently required, HBB calibration may be needed. To perform the HBB calibration, perform the following steps:

1. Transmission in Park, engine running.
2. With scan tool connected to the vehicle, check for any DTCs. If there are any DTCs current, diagnose and correct DTCs before proceeding.
3. Apply throttle pedal to attain 3000 RPM
4. Release throttle pedal.
5. Apply and hold brake pedal firmly for approximately 1 second, release brake pedal. Perform this step 3 times. The entire sequence of steps 3 through 5 (consisting of one throttle apply and three brake pedal applies) should take place within 7 seconds.
6. With the scan tool, navigate to the "data display" for the EBCM and observe the "HBB Calibration Status" parameter. It should display "complete/success" If not, repeat HBB Calibration.

DTC C0055 OR P0609 (OVER 8600 GVW)

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DTC Descriptors

DTC C0055 00

Rear Wheel Speed Sensor Circuit

DTC C0055 5A

Rear Wheel Speed Sensor Circuit Erratic Signal

Diagnostic Fault Information

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

DTC C0055 or P0609 (Over 8600 GVW)

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Rear Wheel Speed Sensor Signal	C0055 00	C0055 00	C0055 00	C0055 5A

Circuit/System Description

The electronic control module (ECM) converts the data from the vehicle speed sensor to a 128K pulses/mile signal. The electronic brake control module (EBCM) uses the vehicle speed signal from the ECM in order to calculate the rear wheel speed.

Conditions for Running the DTC

C0055 00

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

C0055 5A

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

C0055 00

- An open is detected on the rear wheel speed sensor signal circuit.
- A short to ground is detected on the rear wheel speed sensor signal circuit.

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- A short to voltage is detected on the rear wheel speed sensor signal circuit.

C0055 5A

The EBCM detects an erratic rear wheel speed signal.

Action Taken When the DTC Sets

- The EBCM disables the Antilock Brake System (ABS)/Traction Control System (TCS) for the duration of the ignition cycle.
- The electronic brake distribution (EBD) does not function optimally.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

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

C0055 5A, 00

If the customer comments that the ABS indicator is ON only during moist environmental conditions: rain, snow, vehicle wash, etc., inspect the wheel speed sensor wiring for signs of water intrusion. If the DTC is not current, clear all DTCs and simulate the effects of water intrusion by using the following procedure:

1. Spray the suspected area with a 5 percent saltwater solution. To create a 5 percent saltwater solution, add 2 teaspoons of salt to 8 fl oz of water (10 g of salt to 200 ml of water).
2. Test drive the vehicle over various road surfaces: bumps, turns, etc., above 40 km/h (25 mph) for at least 30 seconds.
3. Rinse the area thoroughly when completed.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for a voltage signal from the PCM.

4: This step tests for a missing or erratic vehicle speed signal from the PCM. An assistant may be required to perform this test.

DTC C0055 or P0609 (Over 8600 GVW)

Step	Action	Values	Yes	No

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Schematic Reference:
Connector End View Reference:

1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle at a speed greater than the specified value. Does the DTC set?	13 km/h (8 mph)	Go to **Step 3**	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Disconnect from the electronic brake control module (EBCM), the harness connector containing the vehicle speed signal circuit. 3. Turn ON the ignition. 4. Use a DMM in order to measure the DC voltage between the vehicle speed signal circuit and a good ground. Does the voltage measure greater than the specified value?	10 V	Go to **Step 4**	Go to **Step 7**
4	1. Raise and support the vehicle. Refer to. 2. Place the transmission in neutral (N). 3. Set up the DMM in order to measure the DC voltage between the vehicle speed signal circuit and a good ground. 4. Slowly spin the rear wheels by hand for at least 30 seconds and while ensuring the driveshaft is rotating, observe the DMM. Does the voltage measure within the specified range for the entire time that the driveshaft is rotating?	5-7 V	Go to **Step 5**	Go to **Step 7**
5	Inspect for poor connections at the harness connector of the EBCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 6**
	IMPORTANT: **Following EBCM replacement, use the scan tool to perform the Tire Size Calibration**			

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6	**procedure.** Replace the EBCM. Refer to **Control Module References** .Did you complete the replacement?	-	Go to **Step 10**	-
7	Test the vehicle speed signal circuit for an open, a short to ground, or a short to voltage. Refer to **Circuit Testing** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 8**
8	Inspect for poor connections at the harness connector of the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 9**
9	**IMPORTANT:** **Perform the setup procedure for the PCM.** Replace the PCM. Refer to **Control Module References** .Did you complete the replacement?	-	Go to **Step 10**	-
10	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 3**	System OK

DTC C0035 OR C0040

DTC Descriptors

DTC C0035 00

Left Front Wheel Speed Sensor Circuit

DTC C0035 5A

Left Front Wheel Speed Sensor Circuit Erratic Signal

DTC C0040 00

Right Front Wheel Speed Sensor Circuit

DTC C0040 5A

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Right Front Wheel Speed Sensor Circuit Erratic Signal

Diagnostic Fault Information

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

DTC C0035 or C0040

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

Circuit/System Description

The wheel speed sensor receives a 12-volt power supply voltage from the electronic brake control module (EBCM) and provides an output signal to the EBCM. As the wheel spins, the wheel speed sensor sends the EBCM a DC square wave signal. The EBCM uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

C0035 00 - C0040 00

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

C0035 5A - C0040 5A

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

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

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Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

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

C0035 5A, 00 - C0040 5A, 00

If the customer comments that the ABS indicator is ON only during moist environmental conditions: rain, snow, vehicle wash, etc., inspect the wheel speed sensor wiring for signs of water intrusion. If the DTC is not current, clear all DTCs and simulate the effects of water intrusion by using the following procedure:

1. Spray the suspected area with a 5 percent saltwater solution. To create a 5 percent saltwater solution, add 2 teaspoons of salt to 8 fl oz of water (10 g of salt to 200 ml of water).
2. Test drive the vehicle over various road surfaces: bumps, turns, etc., above 40 km/h (25 mph) for at least 30 seconds.
3. Rinse the area thoroughly when completed.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

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Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

With scan tool installed drive the vehicle in a straight line at a speed greater than 8 km/h (5 mph), all wheel speed sensors should read the same miles per hour.

Circuit/System Testing

Note: It is recommend that Component Testing is performed before Circuit Testing when diagnosing wheel speed sensors.

Note: Performing Circuit Testing with EBCM connector disconnected and key on will cause U codes to set. Clear DTCs after performing the test.

1. Ignition OFF, disconnect the EBCM connector. With the EBCM connector disconnected and the ignition ON, measure for 0 volts between the wheel speed sensor signal circuit or the wheel speed sensor low reference circuit and ground at the EBCM connector.
    - If over 0 volt, repair short to voltage in the wheel speed sensor signal circuit or the wheel speed sensor supply voltage circuit.
2. With the ignition OFF and the wheel speed sensor harness disconnected, Measure for infinite ohms of resistance between ground and the wheel speed sensor signal and the wheel speed sensor low reference circuit from the EBCM connector.
    - If less than infinite ohms, repair short to ground in the sensor signal or the low reference circuit.
3. Measure for infinite ohms of resistance between the wheel speed sensor signal circuit and the wheel speed low reference circuit at the EBCM connector.
    - If less than infinite ohms, repair short between the wheel speed sensor signal circuit and the wheel speed sensor low reference circuit.
    - If all circuits test normal replace the suspect wheel speed sensor.

Component Testing

1. Ignition OFF, disconnect the wheel speed sensor connector. Connect a 12 volt test light from B+ to the positive side of the wheel speed sensor connect terminal, and the other wheel speed connector terminal to a DMM positive lead and the other lead to ground. The DMM is set on the mA display.
    - If the reading is below 4 mA replace the wheel speed sensor.

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2. At the wheel speed sensor. Set-up a DMM to measure current flow (mA/A). Spin the wheel very slowly. Measure for 4-8 mA on the low reading and 12-16 mA on the high reading.
   - If the low amperage output of the wheel speed sensor signal circuit is below 4 mA or above 8 mA replace the wheel speed sensor.
   - If the high amperage output of the wheel speed sensor signal circuit is below 12 mA or above 16 mA replace the wheel speed sensor.

Repair Procedures

- **Front Wheel Speed Sensor Replacement**
- **Control Module References** for EBCM

Repair Verification

Diagnostic Repair Verification

DTC C0045 OR C0050

DTC Descriptors

DTC C0045 00

Left Rear Wheel Speed Sensor Circuit

DTC C0045 5A

Left Rear Wheel Speed Sensor Circuit Erratic Signal

DTC C0050 00

Right Rear Wheel Speed Sensor Circuit

DTC C0050 5A

Right Rear Wheel Speed Sensor Circuit Erratic Signal

Diagnostic Fault Information

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

DTC C0045 or C0050

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

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Right Rear Sensor Signal Circuit	C0050 00	C0050 00	C0050 00	C0050 5A
Right Rear Sensor Low Reference Circuit	-	C0050 00	-	C0050 5A

Circuit/System Description

The wheel speed sensor receives a 12-volt power supply voltage from the electronic brake control module (EBCM) and provides an output signal to the EBCM. As the wheel spins, the wheel speed sensor sends the EBCM a DC square wave signal. The EBCM uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

C0045 00 - C0050 00

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

C0045 5A - C0050 5A

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

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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- The condition for setting the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

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

If the customer comments that the ABS indicator is ON only during moist environmental conditions: rain, snow, vehicle wash, etc., inspect the wheel speed sensor wiring for signs of water intrusion. If the DTC is not current, clear all DTCs and simulate the effects of water intrusion by using the following procedure:

1. Spray the suspected area with a 5 percent saltwater solution. To create a 5 percent saltwater solution, add 2 teaspoons of salt to 8 fl oz of water (10 g of salt to 200 ml of water).
2. Test drive the vehicle over various road surfaces, bumps, turns, etc., above 50 km/h (31 mph) for at least 20 seconds.
3. If the DTC returns, replace the suspected wheel speed sensor or repair the wheel speed sensor wiring.
4. Rinse the area thoroughly when completed.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

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With scan tool installed drive the vehicle in a straight line at a speed greater than 20 km/h (13 mph), all wheel speed sensors should read the same speed.

Circuit/System Testing

Note: It is recommend that Component Testing is performed before Circuit Testing when diagnosing wheel speed sensors.

Note: Performing Circuit Testing with EBCM connector disconnected and key on will cause U codes to set. Clear DTCs after performing the test.

1. Ignition OFF, disconnect the EBCM connector. With the EBCM connector disconnected and the ignition ON, measure for 0 volts between the wheel speed sensor signal circuit or the wheel speed sensor low reference circuit and ground at the EBCM connector.
    - If over 0 volt, repair short to voltage in the wheel speed sensor signal circuit or the wheel speed sensor supply voltage circuit.
2. With the ignition OFF and the wheel speed sensor harness disconnected, Measure for infinite ohms of resistance between ground and the wheel speed sensor signal and the wheel speed sensor low reference circuit from the EBCM connector.
    - If less than infinite ohms, repair short to ground in the sensor signal or the low reference circuit.
3. Measure for infinite ohms of resistance between the wheel speed sensor signal circuit and the wheel speed low reference circuit at the EBCM connector.
    - If less than infinite ohms, repair short between the wheel speed sensor signal circuit and the wheel speed sensor low reference circuit.
    - If all circuits test normal replace the suspect wheel speed sensor.

Component Testing

1. Ignition OFF, disconnect the wheel speed sensor connector. Connect a 12 volt test light from B+ to the positive side of the wheel speed sensor connect terminal, and the other wheel speed connector terminal to a DMM positive lead and the other lead to ground. The DMM is set on the mA display.
    - If the reading is below 4 mA replace the wheel speed sensor.
2. At the wheel speed sensor, Set-up a DMM to measure current flow (mA/A). Spin the wheel very slowly. Measure for 4-8 mA on the low reading and 12-16 mA on the high reading.
    - If the low amperage output of the wheel speed sensor signal circuit is below 4 mA or above 8 mA replace the wheel speed sensor.
    - If the high amperage output of the wheel speed sensor signal circuit is below 12 mA or above 16 mA replace the wheel speed sensor.

Repair Procedures

- **Front Wheel Speed Sensor Replacement**
- **Control Module References** for EBCM

Repair Verification

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Diagnostic Repair Verification

DTC C0110 (EQUAL TO OR UNDER 8600 GVW)

DTC Descriptor

DTC C0110 00

Pump Motor Circuit

Diagnostic Fault Information

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

Circuit/System Description

The pump motor is an integral part of the brake pressure modulator valve (BPMV), 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 Antilock Brake System (ABS) or Traction Control System (TCS) operation is required the EBCM activates the pump motor relay and ground circuit is provided to the pump motor.

Conditions for Running the DTC

- The ignition switch is in the ON position.
- Initialization is complete.

Conditions for Setting the DTC

- The EBCM motor drive circuit detects a short to battery positive, or open ground circuit, and a continuously on or off motor.
- The pump motor continues to rotate briefly after activation creating a feedback voltage. The EBCM sets the code if the measured feedback voltage indicates a binding or stalled pump motor.

Action Taken When the DTC Sets

- The EBCM disables the ABS/TCS/VSES for the duration of the ignition cycle.
- The ABS indicator turns ON.
- The Traction Control and VSES indicators turn ON.
- The Traction Control and Stabilitrack displayed on the DIC.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

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Diagnostic Aids

The pump motor is integral to the BPMV. The pump motor is not serviceable. Inspect the power and ground circuits proper connections.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the EBCM.
2. Test for less than 1.0 ohm of resistance from ground circuit terminal 38 and ground.
   - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Test for less than 1.0 ohm of resistance from ground circuit terminal 13 and ground.
   - If greater than the specified range, test the ground circuit for an open/high resistance.
4. Ignition ON, verify that a test lamp illuminates between the B+ circuit terminal 1 and ground.
   - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
5. Verify that a test lamp illuminates between the B+ circuit terminal 25 and ground.
   - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
6. If all circuits test normal, test or replace the BPMV and EBCM assembly.

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Repair Procedures

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

- **Brake Pressure Modulator Valve Replacement (W/JL4)** or **Brake Pressure Modulator Valve Replacement (W/O JL4)**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0110 (OVER 8600 GVW)

Circuit Description

Ground is continuously supplied to the low side of the Antilock Brake System (ABS) pump motor. The electronic brake control module (EBCM) activates the ABS pump by supplying battery voltage to the high side of the motor.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0110 Pump Motor Circuit

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The EBCM detects an open pump motor circuit, a shorted pump motor, or a seized pump motor or ABS pump.

Action Taken When the DTC Sets

- The EBCM disables the ABS.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

The Conditions for Setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

Separate the EBCM from the brake pressure modulator valve (BPMV) in order to inspect for corrosion or any other condition that may cause a poor connection at the pump motor connector. Refer to **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)** and **Testing for Intermittent Conditions and Poor Connections** . If severe corrosion or other damage exists, the BPMV or the EBCM may need to be replaced.

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DTC C0110 (Over 8600 GVW)

Step	Action	Yes	No
Schematic Reference: Antilock Brake System Schematics **Connector End View Reference: Antilock Brake System Connector End Views**			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle** in Vehicle DTC Information
2	Use a scan tool in order to clear the DTCs. Does the DTC reset?	Go to **Step 3**	Go to Diagnostic Aids
3	1. Separate the electronic brake control module (EBCM) from the brake pedal modulator valve (BPMV). Refer to **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**. 2. Inspect for poor connections at the pump motor connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 5**	Go to **Step 4**
4	**IMPORTANT:** **Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure.** 1. Replace the EBCM, refer to **Control Module References** for replacement, setup, and programming. 2. Replace the BPMV, refer to **Brake Pressure Modulator Valve Replacement (W/JL4)** or **Brake Pressure Modulator Valve Replacement (W/O JL4)**. Did you complete the replacements?	Go to **Step 5**	-
5	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to **Step 3**	System OK

DTC C0131

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DTC Descriptors

DTC C0131 00

ABS Pressure Circuit

DTC C0131 5A

Pressure Circuit calibration not learned

Diagnostic Fault Information

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

DTC C0131

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Brake Pressure Sensor Signal Circuit	C0131 00	C0131 00	C0131 00	C0131 5A

Circuit/System Description

The electronic brake control module (EBCM) uses input from the brake pressure sensor for more accurate control during a vehicle stability enhancement system (VSES) event.

Conditions for Running the DTC

- The ignition switch is in the ON position.
- Ignition voltage is greater than 9.5 volts.

Conditions for Setting the DTC

- Internal pressure sensor line fault.
- Pressure signal does not correlate to estimated Pressure over time.
- Brake Signal does not correlate to Pressure Signal.
- Signal is erratic and changes faster than physically allowed.

Action Taken When the DTC Sets

- The EBCM disables the antilock brake system (ABS)/traction control system/(TCS) and vehicle stability enhancement system/(VSES) for the duration of the ignition cycle.
- The ABS/TCS and stabilitrak indicator turns ON.
- The Service Traction Control, and stabilitrak displayed on the DIC.

Conditions for Clearing the DTC

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- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The brake fluid pressure sensor is integral to the BPMV/EBCM. The brake fluid pressure sensor is not serviceable.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

With scan tool installed, clear the DTCs then drive the vehicle in a straight line at a speed greater than 20 km/h (13 mph). If the DTC did not set as a current DTC see diagnostic aids.

Circuit/System Testing

1. Apply and release brake pedal. Verify brake lamps operate properly. If brake lamps do not operate properly, refer to**Symptoms - Lighting Systems** .
2. Test the stop lamp supply voltage circuit for a short to voltage, short to ground, an open or high resistance.

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- If the stop lamp circuit tests normal, replace the EBCM/BPMV assembly.

Repair Procedures

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

- **Brake Pressure Modulator Valve Replacement (W/JL4)** or **Brake Pressure Modulator Valve Replacement (W/O JL4)**
- **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**
- **Control Module References** for EBCM replacement, setup, and programming

DTC C0161 (EQUAL TO OR UNDER 8600 GVW)

DTC Descriptor

DTC C0161 00

Antilock Brake System (ABS) Brake Switch/Sensor Circuit

Diagnostic Fault Information

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

DTC C0161 (Equal to or Under 8600 GVW)

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Antilock Brake System (ABS) Brake Switch/Sensor Circuit	C0161 00	C0161 00	C0161 00	-

Circuit/System Description

The brake switch informs the electronic brake control module (EBCM) when the brake is depressed. The brake switch is normally closed, supplying 12 volts to the EBCM when the brake is released. When the brake pedal is pressed, voltage on the torque converter clutch (TCC) brake switch signal circuit is 0 volts.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 16 km/h (10 mph).
- The ignition voltage is greater than 9.5 volts.

Conditions for Setting the DTC

- The throttle is applied.

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- The brake pedal is sensed as applied for 60 seconds.
- The vehicle speed is greater than 11 km/h (7 mph).
- Master cylinder pressure is less than 5 bar (73 psi).

Action Taken When the DTC Sets

- The EBCM disables the Traction Control System (TCS) and vehicle stability enhancement system VSES for the duration of the ignition cycle.
- The Traction Control and Stabilitrack displayed on the DIC.
- The TCS and VSES indicator illuminates.
- The ABS indicator illuminates, and ABS remains functional.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The DTC C0161 00 can be set if the brake switch is applied while driving the vehicle.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

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Scan Tool Data List for EBCM

Circuit/System Verification

With scan tool installed, clear the DTCs then drive the vehicle in a straight line at a speed greater than 20 km/h (13 mph). If the DTC did not set as a current DTC see diagnostic aids.

Circuit/System Testing

1. Apply and release brake pedal. Verify brake lamps operate properly. If brake lamps do not operate properly, refer to **Symptoms - Lighting Systems** .
2. Test the stop lamp supply voltage circuit for a short to voltage, short to ground, an open or high resistance.
    - If the stop lamp circuit tests normal, replace the replace the stop lamp switch assembly.

Repair Verification

Diagnostic Repair Verification

DTC C0161 (OVER 8600 GVW)

Circuit Description

The brake switch informs the electronic brake control module (EBCM) when the brake is depressed. The brake switch is normally closed, supplying 12 volts to the EBCM when the brake is released. When the brake pedal is pressed, voltage on the torque converter clutch (TCC) brake switch signal circuit is 0 volts.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0161 Antilock Brake System (ABS)/Traction Control System (TCS) Brake Switch

Conditions for Running the DTC

Any of the following conditions may cause the diagnostic trouble code (DTC) to run.

- The vehicle accelerates from 0 km/h (0 mph) to a speed greater than 56 km/h (35 mph).
- The vehicle experiences an ABS event involving all hydraulic circuits.

Conditions for Setting the DTC

Any of the following conditions may cause the DTC to set.

- Voltage on the TCC brake switch signal circuit is always low.
- Voltage on the TCC brake switch signal circuit is always high.

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Action Taken When the DTC Sets

The EBCM stores this information-only DTC for as long as the condition is present.

Conditions for Clearing the DTC

The Conditions for Setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Intermittent Conditions and Poor Connections** , **Connector Repairs** , **Testing for Electrical Intermittents** and to.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step tests for a shorted stop lamp switch.
5: This step tests for an open stop lamp switch.

DTC C0161 (Over 8600 GVW)

Step	Action	Yes	No
Schematic Reference: Antilock Brake System Schematics			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle** in Vehicle DTC Information
2	1. Install a scan tool. 2. Select the 4WAL 3 Sensor Data Display function. 3. Observe the Brake Switch Status on the scan tool. Does the scan tool display OFF?	Go to **Step 3**	Go to **Step 5**
3	1. Apply the brake. 2. Observe the Brake Switch Status on the scan tool. Does the scan tool display ON?	Go to Diagnostic Aids	Go to **Step 4**
4	1. Turn OFF the ignition. 2. Disconnect the stop lamp switch. Refer to **Stop Lamp Switch Replacement (Adjustable Pedal)** or **Stop Lamp Switch Replacement (Non-Adjustable Pedal)** . 3. Turn ON the ignition. 4. Observe the Brake Switch Status on the scan tool.		

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	Does the scan tool display ON?	Go to **Step 9**	Go to **Step 7**
5	1. Turn OFF the ignition. 2. Disconnect the stop lamp switch. Refer to **Stop Lamp Switch Replacement (Adjustable Pedal)** or **Stop Lamp Switch Replacement (Non-Adjustable Pedal)** . 3. Connect a fused jumper wire between the ignition 3 voltage circuit and the torque converter clutch (TCC) brake switch signal circuit at the stop lamp switch harness connector. Refer to **Using Fused Jumper Wires** . 4. Turn ON the ignition. 5. Observe the Brake Switch Status on the scan tool. Does the scan tool display OFF?	Go to **Step 9**	Go to **Step 6**
6	Test the ignition 3 voltage circuit and the TCC brake switch signal circuit for an open or a short to ground. Refer to **Circuit Testing** and to **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 12**	Go to **Step 8**
7	Test the TCC brake switch signal circuit for a short to voltage. Refer to **Circuit Testing** and to **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 12**	Go to **Step 8**
8	Inspect for poor connections at the harness connector of the electronic brake control module (EBCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** . Did you find and correct the condition?	Go to **Step 12**	Go to **Step 10**
9	Inspect for poor connections at the harness connector of the stop lamp switch. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** . Did you find and correct the condition?	Go to **Step 12**	Go to **Step 11**
10	Replace the EBCM. Refer to **Control Module References** for replacement, setup and programming. Did you complete the replacement?	Go to **Step 12**	-
11	Replace the stop lamp switch. Refer to **Stop Lamp Switch Replacement (Adjustable Pedal)** or **Stop Lamp Switch Replacement (Non-Adjustable Pedal)** . Did you complete the replacement?	Go to **Step 12**	-
12	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting		

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	text. Does the DTC reset?	Go to **Step 2**	System OK

DTC C0186

DTC Descriptors

DTC C0186 00

Lateral Accelerometer Circuit

DTC C0186 5A

Lateral Accelerometer Circuit Erratic

Diagnostic Fault Information

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

DTC C0186

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Lateral Accelerometer Supply Voltage Circuit	C0186 00	C0186 00	C0186 00	-
Lateral Accelerometer CAN Bus High Circuit	C0186 00	C0186 00	C0186 00	C0186 5A
Lateral Accelerometer CAN Bus Low Circuit	C0186 00	C0186 00	C0186 00	C0186 5A
Lateral Accelerometer Ground Circuit	-	C0186 00	-	-

Circuit/System Description

The lateral accelerometer and the yaw rate sensors are combined into one sensor external to the electronic brake control module (EBCM). The vehicle stability enhancement system (VSES) uses the lateral accelerometer input when calculating the desired yaw rate. The usable output signal is a serial data signal controller area network (CAN) high and CAN low serial data circuits.

Conditions for Running the DTC

The ignition switch is in the ON position.

Conditions for Setting the DTC

- The yaw/lateral combination sensor fails an internal self test.
- Communication is lost between the EBCM and the yaw/lateral combination sensor.

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Action Taken When the DTC Sets

One or more of the following actions may occur:

- The Vehicle Stability Enhancement System (VSES) is disabled.
- Traction control system (TCS) is disabled.
- The TCS/VSES indicators turn ON.
- The driver information center (DIC) displays the Service Traction Control, and or Service Stabilitrak message.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Possible causes of this DTC are as follows:

CAN HI and CAN LO circuits shorted together

CAN HI or CAN LO circuit shorted to ground

CAN HI or CAN LO circuit shorted to voltage

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

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- **Wiring Repairs**

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

With scan tool installed, clear the DTCs then drive the vehicle in a straight line at a speed greater than 20 km/h (13 mph). If the DTC did not set as a current DTC see diagnostic aids.

Circuit/System Testing

1. Ignition OFF, disconnect the yaw rate/lateral accelerometer connector.
2. Test the yaw rate/lateral sensor reference voltage circuit for a short to voltage, short to ground, an open or high resistance.
    - If the reference voltage circuit did not tests normal, repair the circuit.
3. Test the yaw/lateral sensor ground circuit for an open or high resistance.
    - If the reference ground circuit did not tests normal, repair the circuit.
4. Test the yaw/lateral sensor CAN HI and LO circuit for a short to voltage, short to ground, an open or high resistance.
    - If the yaw/later CAN HI and LO circuits did not test normal repair the circuit.
5. Ignition ON, test the yaw/lateral sensor reference voltage circuit for 12 volts, and the ground circuit for an open or high resistance.
    - If the yaw/later 12-volt reference and ground circuits test normal replace the yaw/lateral sensor.

- If the yaw/later 12-volt reference and ground circuits did not test normal replace the EBCM.

Repair Procedures

Yaw Rate Sensor/Lateral Accelerometer Replacement

Control Module References for EBCM

Repair Verification

Diagnostic Repair Verification

DTC C0196

DTC Descriptors

DTC C0196 00

Yaw Rate Circuit

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DTC C0196 5A

Yaw Rate Circuit Erratic

Diagnostic Fault Information

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

DTC C0196

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Yaw Rate Supply Voltage Circuit	C0196 00	C0196 00	C0196 00	-
Yaw Rate CAN Bus High Circuit	C0196 00	C0196 00	C0196 00	C0196 5A
Yaw Rate CAN Bus Low Circuit	C0196 00	C0196 00	C0196 00	C0196 5A
Yaw Rate Ground Circuit	-	C0196 00	-	-

Circuit/System Description

The lateral accelerometer and the yaw rate sensors are combined into one sensor external to the electronic brake control module (EBCM). The vehicle stability enhancement system (VSES) uses the lateral accelerometer input when calculating the desired yaw rate. The usable output signal is a serial data signal CAN high and CAN low serial data circuits.

Conditions for Running the DTC

The ignition switch is in the ON position.

Conditions for Setting the DTC

- The yaw/lateral combination sensor fails an internal self test.
- Communication is lost between the EBCM and the yaw/lateral combination sensor.
- The correlation error between the yaw/lateral combination sensor and steering angle sensor.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The Vehicle Stability Enhancement System (VSES) is disabled.
- Traction control system (TCS) is disabled.
- The TCS/VSES indicators turn ON.
- The driver information center (DIC) displays the Service Traction Control, and or Service Stabilitrak message.

Conditions for Clearing the DTC

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- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Possible causes of this DTC are as follows:

CAN HI and CAN LO circuits shorted together

CAN HI or CAN LO circuit shorted to ground

CAN HI or CAN LO circuit shorted to voltage

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

With scan tool installed, clear the DTCs then drive the vehicle in a straight line at a speed greater than 20 km/h (13 mph). If the DTC did not set as a current DTC see diagnostic aids.

Circuit/System Testing

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1. Ignition OFF, disconnect the yaw rate/lateral accelerometer connector.
2. Test the yaw rate/lateral sensor reference voltage circuit for a short to voltage, short to ground, an open or high resistance.
   - If the reference voltage circuit did not test normal, repair the circuit.
3. Test the yaw/lateral sensor ground circuit for an open or high resistance.
   - If the reference ground circuit did not test normal, repair the circuit.
4. Test the yaw/lateral sensor CAN HI and LO circuit for a short to voltage, short to ground, an open or high resistance.
   - If the yaw/later CAN HI and LO circuits did not test normal repair the circuit.
5. Ignition ON, test the yaw/lateral sensor reference voltage circuit for 12 volts, and the ground circuit for an open or high resistance.
   - If the yaw/later 12-volt reference and ground circuits test normal replace the yaw/lateral sensor.

- If the yaw/later 12-volt reference and ground circuits did not test normal replace the EBCM.

Repair Procedures

Diagnostic Repair Verification for EBCM

Repair Verification

Diagnostic Repair Verification

DTC C0201 (EQUAL TO OR UNDER 8600 GVW)

DTC Descriptor

DTC C0201 00

Antilock Brake System (ABS) Enable Relay Contact Circuit

Diagnostic Fault Information

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

DTC C0201 (Equal to or under 8600 GVW)

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Antilock Brake System (ABS) Enable Relay Contact Circuit	C0201 00	C0201 00	C0201 00	

Circuit/System Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

One or more of the following conditions exists:

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

Action Taken When the DTC Sets

- The EBCM disables the antilock brake system (ABS)/traction control system (TCS)/dynamic rear proportion (DRP) for the duration of the ignition cycle.
- The ABS indicator turns ON.
- The Traction Control indicator turns ON.
- The red brake warning indicator turns ON.
- The driver information center (DIC) displays the SERVICE BRAKE SYSTEM/TRACTION SYSTEM message.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

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Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List

Circuit/System Verification

With scan tool installed, clear the DTCs then drive the vehicle in a straight line at a speed greater than 20 km/h (13 mph). If the DTC did not set as a current DTC see diagnostic aids.

Circuit/System Testing

1. Test for an open or a short to ground in the battery positive voltage circuit to the EBCM. Verify no open or a short to ground is found.
2. Test the EBCM ground circuit, an open or high resistance.
    - If an open or a short to ground is found, repair the circuit.
3. Replace the EBCM assembly.

Repair Procedures

IMPORTANT: Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for EBCM replacement, setup, and programming.

DTC C0201 (OVER 8600 GVW)

Circuit Description

The system relay, located within the electronic brake control module (EBCM), supplies battery voltage to all of the valve solenoids and to the ABS pump motor. When the relay contacts close, the EBCM monitors the voltage supplied to the valve solenoids and compares this voltage to monitored ignition voltage.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0201 Antilock Brake System (ABS) Enable Relay Contact Circuit

Conditions for Running the DTC

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The ignition is ON.

Conditions for Setting the DTC

The EBCM detects that the voltage supplied to the valve solenoids is less than 80 percent of monitored ignition voltage for 50 milliseconds.

Action Taken When the DTC Sets

- The EBCM disables the ABS/DRP.
- The ABS indicator turns ON.
- The brake warning indicator turns ON.

Conditions for Clearing the DTC

The Conditions for Setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

Refer back to the diagnostic table, steps 3-7, if this DTC continues to set intermittently.

Test Description

The number below refers to the step number on the diagnostic table.

3: A shorted ABS pump motor may damage the contacts within the system relay. It is imperative that the steps in the table be followed to prevent damage to a replacement EBCM.

DTC C0201 (Over 8600 GVW)

Step	Action	Values	Yes	No
Schematic Reference: Antilock Brake System Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle** in Vehicle DTC Information
2	1. Use a scan tool in order to clear the DTCs. 2. Use the scan tool in order to perform an ABS Function Test. Does the DTC set?	-	Go to **Step 3**	Go to Diagnostic Aids
	1. Separate the electronic brake control module (EBCM) from the brake pressure l modulator valve (BPMV). Refer to			

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3	**Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**. 2. Use a DMM in order to measure the resistance across the ABS pump motor. Does the resistance measure within the specified range?	0.3-1.0 ohms	Go to **Step 4**	Go to **Step 6**
4	Use a DMM in order to measure the resistance between the high side of the pump motor and a good ground. Does the resistance measure less than the specified value?	0L	Go to **Step 6**	Go to **Step 5**
5	Replace the EBCM. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 7**	-
6	**IMPORTANT:** **Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure.** 1. Replace the EBCM, refer to **Control Module References** for replacement, setup, and programming. 2. Replace the BPMV, refer to **Brake Pressure Modulator Valve Replacement (W/JL4)** or **Brake Pressure Modulator Valve Replacement (W/O JL4)**. Did you complete the replacements?	-	Go to **Step 7**	-
7	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 3**	System OK

DTC C0242

DTC Descriptor

DTC C0242 00

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Electronic control module (ECM) Indicated TCS Malfunction

Diagnostic Fault Information

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

DTC C0242

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
System Disabled Information Stored Invalid Serial Data Received	-	-	-	C0242 00

Circuit/System Description

The electronic brake control module (EBCM) and the electronic control module (ECM) simultaneously control the traction control. The EBCM sends a serial data message to the ECM requested 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

The ignition switch is in the ON position.

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 a DTC and the EBCM will set this DTC.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The EBCM disables the traction control system (TCS)/vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- The Traction Control and Active Handling indicator turns ON.
- The ABS/TCS indicators turn ON.
- The ABS remains functional.

Conditions for Clearing the MIL/DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

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Schematic Reference

Antilock Brake System Schematics

Engine Controls Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Engine Control Module Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Engine Control Module Description

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for ECM

Circuit/System Verification

DTC C0242 will set as result of the ECM detects a malfunction and then causes traction control (TCS) shut down, until the malfunction has been corrected.

- Review Powertrain Symptoms list.

1. Perform Diagnostic System Check-Vehicle.
    - Diagnose any other Vehicle DTCs before attempting diagnosis of C0242.
2. With Tech 2, view "Signals" Data Display list under EBCM.
3. Refer to appropriate module for diagnosing any "invalid" signals.
4. If no invalid signals are present, view "Signal Fault" data in "Enhanced DTC Data"
5. Refer to appropriate module for diagnosing that invalid message data.
6. Do not replace the EBCM due to this DTC fault.

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Repair Procedures

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

Symptoms - Engine Controls

DTC C0245 (EQUAL TO OR UNDER 8600 GVW)

DTC Descriptor

DTC C0245 00

Wheel Speed Sensor Frequency Error

Diagnostic Fault Information

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

DTC C0245 (Equal to or Under 8600 GVW)

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Wheel Speed Sensor Frequency Error	-	-	-	C0245 00

Circuit/System Description

The wheel speed sensor receives a 12-volt power supply voltage from the electronic brake control module (EBCM) and provides an output signal to the EBCM. As the wheel spins, the wheel speed sensor sends the EBCM a DC square wave signal. The EBCM uses the frequency of the square wave signal to calculate the wheel speed.

Conditions for Running the DTC

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

- Antilock Brake System (ABS), Traction Control System (TCS) and Vehicle Stability Enhancement

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System (VSES) are disabled for the remainder of the ignition cycle.
- The ABS and Stabilitrak indicator turns ON.
- The service Traction Control and Stabilitrak displays on the DIC.

Conditions for Clearing the DTC

- The DTC becomes history when the conditions for setting the DTC are no longer present.
- The history DTC clears after 100 malfunction-free ignition cycles.
- The EBCM receives a clear code command from the scan tool.

Diagnostic Aids

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

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

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

Repair Procedures

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

DTC C0245 (OVER 8600 GVW)

Circuit Description

The wheel speed sensor receives a 5-volt power supply voltage from the electronic brake control module (EBCM) and provides an output signal to the EBCM. As the wheel spins, the wheel speed sensor sends the EBCM a DC square wave signal. The EBCM uses the frequency of the square wave signal to calculate the wheel speed.

DTC Descriptor

This diagnostic procedure supports the following DTCs:

- DTC C0245 Wheel Speed Sensor Frequency Error
- DTC C0078 Wheel Speed Sensor Frequency Error (PHT)

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 8 km/h (4 mph).
- No brake application or deceleration is detected.
- No wheel slip is detected.
- No turning maneuvers are detected.

Conditions for Setting the DTC

- At least one wheel speed sensor signal is 15 percent less than or greater than other wheel speed sensor signals.
- All of the Conditions for Running and Setting the DTC are present for a cumulative time of 3 minutes during a single ignition cycle.

Action Taken When the DTC Sets

- The EBCM disables the ABS/traction control system (TCS)/vehicle stability enhancement system (VSES)/dynamic rear proportion (DRP).
- The ABS indicator turns ON.
- The traction off indicator turns ON.
- The message center displays the service stability system message.
- The brake warning indicator turns ON.

Conditions for Clearing the DTC

- The DTC becomes history when the conditions for setting the DTC are no longer present.

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- The history DTC clears after 100 malfunction-free ignition cycles.
- The EBCM receives a clear code command from the scan tool.

Diagnostic Aids

Operating the vehicle with a tire that has very low air pressure may set this DTC.

DTC C0245 (Over 8600 GVW)

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	Inspect all of the tires on the vehicle to ensure that all of the tires are of equal size. Did you find and correct the condition?	Go to **Step 4**	Go to **Step 3**
3	Inspect the wheel speed sensors and tone rings for damage, incorrect application, or incorrect installation. Did you find and correct the condition?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Use a scan tool in order to clear the DTCs. 2. Turn OFF the ignition for 5 seconds. 3. Turn ON the ignition. 4. Operate the vehicle for at least 3 minutes within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to **Step 2**	System OK

DTC C0252

DTC Descriptor

DTC C0252 00

VSES Sensor Uncorrelated

Diagnostic Fault Information

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

DTC C0252

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
VSES Sensor Uncorrelated	-	-	-	C0252 00

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Circuit/System Description

The vehicle stability enhancement system (VSES) is activated by the electronic brake control module (EBCM) and calculates the desired yaw rate and comparing it to the actual yaw rate input. The desired yaw rate is calculated from measured steering wheel position, vehicle speed, and lateral acceleration. The difference between the desired yaw rate and actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. If the yaw rate error becomes to large, the EBCM will attempt to correct the vehicle's yaw motion by applying differential braking to the left or right front wheel.

Conditions for Running the DTC

- The steer angle has been centered.
- The VSES is active.
- The direction (understeer or oversteer) of the yaw rate error has not changed.
- The centered lateral acceleration value is less than 0.5 g.
- The yaw rate error is less than 6 degrees/second.
- The side slip error is greater than 1.8 meters/second*second.

Conditions for Setting the DTC

One of the following conditions exists:

- The DTC sets when VSES is engaged for 10 seconds with the yaw rate error always in either understeer or oversteer.
- The yaw rate error is greater then 10 degrees/second for 5 seconds, and the yaw has not changed and the lateral acceleration is less than 0.5 g.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The EBCM disables the ABS/TCS/VSES for the duration of the ignition cycle.
- The ABS and VSES indicators illuminate.
- The driver information center (DIC) displays the Service Traction Control and Stabilitrak message.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The following conditions can cause this concern:

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- Improper steering alignment.
- An open, a short to ground, or a short to voltage.
- An internal lateral accelerometer failure.
- An EBCM internal failure.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

Clear DTC, test drive vehicle under normal driving conditions.

- Verify DTC resets.

Circuit/System Testing

1. Ignition OFF, disconnect the yaw rate sensor/lateral accelerometer and the steering wheel position sensor connectors.
2. Ignition ON, measure for 4.8-5.2 volts at SAS sensor 5-volt reference circuit or battery positive reference at the yaw rate sensor and ground.
   - If over 5.2 volts, test each 5-volt reference circuit for a short to voltage. If the circuits tests normal, replace the EBCM.

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- If the SAS sensor is under 4.8 volts, test each 5-volt reference circuit for short to ground. If the circuits tests normal, replace the EBCM.
- If the SAS sensor over 5.2 volts, test each 5-volt reference circuit for a short to voltage. If the circuits tests normal, replace the EBCM.
- If the yaw rate sensor is under battery positive voltage, test each 12-volt reference circuit for short to ground. If the circuits tests normal, replace the EBCM.

Repair Procedures

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

Control Module References for EBCM

Repair Verification

Diagnostic Repair Verification

DTC C0253

DTC Descriptor

DTC C0253 00

Centering Error

Diagnostic Fault Information

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

DTC C0253

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Centering Error	-	-	-	C0253 00

Circuit/System Description

The usable output voltage range for the lateral accelerometer and yaw rate sensors is 0.25-4.75 volts. The scan tool will report zero lateral acceleration or yaw rate as 2.5 volts with no sensor bias present. The sensor bias compensates for sensor mounting alignment errors, electronic signal errors, temperature changes, and manufacturing differences.

Conditions for Running the DTC

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

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Conditions for Setting the DTC

- The calculated steering angle from the steering wheel position sensor does not correlate with the steering angle calculated from the yaw rate.
- The vehicle has been driven for 10 minutes without completing steer angle centering.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The antilock brake system (ABS) and vehicle stability enhancement system (VSES) are disabled.
- TCS is degraded.
- The driver information center (DIC) displays the Service Stability System message.
- The antilock brake system (ABS) /traction control system (TCS) remains functional.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

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Circuit/System Testing

NOTE: If DTC C0710 is set diagnose it before performing this diagnostic.

1. Ignition OFF, disconnect the harness connector at the steering angle sensor (SAS).
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 2 and ground.
   - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 1 and ground.
   - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
4. Test for 4.8-5.2 volts between the 5-volt reference circuit terminal 1 and the signal circuit terminal 6.
   - If less than the specified range, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
5. Ignition OFF, reconnect the SAS.
6. Disconnect the EBCM harness connector.
7. Test for infinite resistance between the signal circuit pin 4 and ground.
   - If less than the specified range, test the signal circuit for a short to ground.
8. Disconnect the SAS.
9. Reconnect the EBCM harness connector.
10. Ignition ON, test voltage of phase A phase B, and phase C. verify that the reading is battery positive voltage for each of the three phases.
    - If not the specified value, test the phase A phase B, and phase C circuits for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
11. Ignition OFF, reconnect the SAS. Turn the ignition ON. Turn the steering wheel through its full range and back to straight ahead to center the SAS. Using the scan tool, observe the steering wheel position. The parameter changes smoothly while turning the steering wheel through the entire range and correlate to zero reading with the wheels in a straight ahead position.
    - If the steering wheel position parameter does not change, replace the SAS.
    - If the steering wheel position parameter change, replace the EBCM.

Repair Procedures

Perform the **Diagnostic System Check - Vehicle** after completing the diagnostic procedure.

Control Module References for EBCM

Repair Verification

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Diagnostic Repair Verification

DTC C0299

DTC Descriptor

DTC C0299 00

Brake Booster Performance

Diagnostic Fault Information

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

DTC C0299

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Power Brake Booster High Control Circuit	C0299 00	C0299 00	C0299 00	-
Power Brake Booster Low Control Circuit	-	C0299 00	C0299 00	-

Circuit/System Description

The electronic brake control module (EBCM) provides a bi-directional power and ground circuits to the power brake booster actuator. The power brake booster actuator converts electrical inputs into a mechanical force to apply the brake pedal push rod to assist in driver brake pedal effort.

Conditions for Running the DTC

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

Conditions for Setting the DTC

- An open is detected on the high or low power brake booster actuator circuits.
- A short to ground is detected on the high power brake booster actuator circuit.
- A short to voltage is detected on the high power brake booster actuator circuit.
- A short together in the high and low circuits is detected in the power brake booster actuator circuit.

Action Taken When the DTC Sets

One or more of the following actions may occur:

The red BRAKE Warning indicator turns ON.

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Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

DTC C0299 will set as result of power brake booster actuator or circuit failure, test for power and ground circuits to the EBCM.

- Repair the power or ground circuits.

Circuit/System Testing

IMPORTANT: It is recommend that Component Testing is performed before Circuit Testing when diagnosing the power brake booster actuator.

1. Ignition OFF, disconnect the 2 way harness connector at the power brake booster actuator.
2. Test for less than 25.0 ohm of resistance between the ground circuit terminal 5 and ground.

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- If greater than 25.0 ohm, test the ground circuit for an open/high resistance.

3. Connect a test lamp between the control circuit terminal 1 and the ground circuit terminal 5.
4. Command the Active Brake Booster to ON and OFF with a scan tool.
   - If the test lamp remains OFF during the commands, test for a short to ground or an open/high resistance on either control circuit. If the circuits test normal, replace the EBCM.
   - If the test lamp is always ON, test the control circuits for a short to battery positive. If the circuit tests normal, replace the electronic brake control module (EBCM).
5. If all circuits test normal, test or replace the vacuum brake booster assembly.

Component Testing

1. Ignition OFF, disconnect the harness connector at the power brake booster actuator.
2. Test for infinite ohms of resistance between the control terminal 1 and ground of the power brake booster actuator.
   - If less than infinite ohms, replace the vacuum brake booster assembly.
3. Test for 3 ohms of resistance between each terminal at the power brake booster actuator.

- If the test is infinite resistance, replace the vacuum brake booster assembly.

Repair Procedures

Perform the **Diagnostic System Check - Vehicle** After completing the diagnostic procedure.

- **Control Module References** for EBCM replacement, setup, and programming
- **Vacuum Brake Booster Replacement**

Repair Verification

Diagnostic Repair Verification

DTC C0455

DTC Descriptor

DTC C0455 00

Front Steering Position Sensor Circuit

Diagnostic Fault Information

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

DTC C0455

	Short to	Open/High	Short to	Signal

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Circuit	Ground	Resistance	Voltage	Performance
Steering Angle Sensor 5-Volt Reference Circuit	C0455 00	C0455 00	C0455 00	-
Steering Angle Sensor Signal Circuit	C0455 00	C0455 00	C0455 00	-
Low Reference Circuit	-	C0455 00	-	-

Circuit/System Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- During diagnosis, park the vehicle on a level surface.
- Inspect the vehicle for proper alignment. The car should not pull in either direction while driving straight

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on a level surface.

- Find out from the customer the conditions under which the DTC was set. This information will help to duplicate the failure.
- The snapshot function on the scan tool can help find an intermittent DTC.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

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

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

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the SAS.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 2 and ground.
    - If greater than the specified range, test the low reference circuit for an open/high resistance. If the

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circuit tests normal, replace the EBCM.

3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 1 and ground.
   - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
4. Test for 4.8-5.2 volts between the 5-volt reference circuit terminal 1 and the signal circuit terminal 6.
   - If less than the specified range, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
5. Ignition OFF, reconnect the SAS.
6. Disconnect the EBCM harness connector.
7. Test for infinite resistance between the signal circuit pin 4 and ground.
   - If less than the specified range, test the signal circuit for a short to ground.
8. Reconnect the EBCM harness connector.
9. Turn the ignition ON. Turn the steering wheel through its full range and back to straight ahead to center the SAS. Using the scan tool, observe the steering wheel position. The parameter changes smoothly while turning the steering wheel through the entire range and correlate to zero reading with the wheels in a straight ahead position.
   - If the steering wheel position parameter does not change, replace the SAS.
   - If the steering wheel position parameter change, replace the EBCM.

Repair Procedures

- **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**
- **Control Module References** for EBCM replacement, setup, and programming

Repair Verification

Diagnostic Repair Verification

DTC C0550

DTC Descriptor

DTC C0550 00

Electronic Control Unit (ECU) Performance

Diagnostic Fault Information

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

DTC C0550

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Electronic Control Unit (ECU) Performance	-	-	-	C0550 00

Circuit/System Description

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

Conditions for Running the DTC

The ignition switch is in the ON position.

Conditions for Setting the DTC

An internal EBCM malfunction exists.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The antilock brake system (ABS) and vehicle stability enhancement system (VSES) are disabled.
- TCS is degraded.
- The ABS/TCS indicators turn ON.
- The red BRAKE Warning indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

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ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

DTC C0550 will set as result of internal (EBCM) circuit failure.

- Replace the EBCM.

Repair Procedures

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

Control Module References for EBCM

Repair Verification

Diagnostic Repair Verification

DTC C0561

DTC Descriptor

DTC C0561 71

System Disabled Information Stored invalid serial data received

Diagnostic Fault Information

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

DTC C0561

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
System Disabled Information Stored	-	-	-	C0561 71

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Invalid Serial Data Received				

Circuit/System Description

The electronic brake control module (EBCM) receives messages from other modules over GMLAN which are needed to perform antilock brake system (ABS), vehicle stability enhancement system (VSES), or traction control system (TCS) functions

Conditions for Running the DTC

- The ignition switch is in the ON position.
- Ignition voltage is greater than 9.5 volts.

Conditions for Setting the DTC

The EBCM receives an invalid message from another module over GMLAN which causes EBCM to deactivate ABS,VSES, TCS, etc

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The EBCM disables the ABS/TCS/VSES for the duration of the ignition cycle.
- The dynamic rear proportioning (DRP) may be disabled and the Brake Warning indicator may turn ON.
- The Stability Caution indicator turns ON.
- The driver information center (DIC) displays the SERVICE STAB SYS message.
- The DIC displays the TRACTION FAILED message

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

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ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

1. Perform Diagnostic System Check-Vehicle.
   - Diagnose any other Vehicle DTCs before attempting diagnosis of C0561.
2. With Tech 2, view "Signals" Data Display list under EBCM.
3. Refer to appropriate module for diagnosing any "invalid" signals.
4. If no invalid signals are present, view "Signal Fault" data in "Enhanced DTC Data"
5. Refer to appropriate module for diagnosing that invalid message data.
6. Do not replace the EBCM due to this DTC fault.

Repair Verification

Diagnostic Repair Verification

DTC C0569

DTC Descriptor

DTC C0569 00

System Configuration Error

Diagnostic Fault Information

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

DTC C0569

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
System Disabled Information Stored Invalid Serial Data Received	-	-	-	C0569 00

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Circuit/System Description

The electronic brake module (EBCM) receives a GMLAN message from each of the network modules. Each module contains its own unique identification (Id) code that must be learned into the EBCMs memory. Once all the IDs have been learned and vehicle speed is 25 mph, or greater, the EBCM continuously compares Ids in the GMLAN message to its learned Ids to determine if all the network modules are present.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The EBCM has not undergone the programming procedure.

Action Taken When the DTC Sets

The driver information center (DIC) displays the SERVICE ABS warning message.

Conditions for Clearing the DTC

A current DTC will clear when the EBCM has undergone the setup procedure.

Diagnostic Aids

A newly replaced EBCM will set DTC C0569 on its initial ignition ON cycle.

Reference Information

Scan Tool Reference

Scan Tool Data List

Special Tools Required

J-46079 Tire Pressure Monitor Diagnostic Tool

Repair Procedures

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

Electronic Brake Control Module Programming and Setup

DTC C0710

DTC Descriptors

DTC C0710 00

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Steering Position Signal

DTC C0710 5A

Steering Position Signal Circuit Malfunction

Diagnostic Fault Information

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

DTC C0710

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Steering Angle Sensor 5-Volt Reference Circuit	C0710 00	C0710 00	C0710 00	-
Steering Angle Sensor Signal Circuit	C0710 00	C0710 00	C0710 00	-
Low Reference Circuit	-	C0710 00	-	-
Steering Angle Sensor Phase A Circuit	C0710 00	C0710 00	C0710 00	C0710 5A
Steering Angle Sensor Phase B Circuit	C0710 00	C0710 00	C0710 00	C0710 5A

Circuit/System Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- The EBCM disables the vehicle stability enhancement system (VSES) for the duration of the ignition cycle.

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- The driver information center (DIC) displays the Service Stability System message.
- The Antilock Brake System (ABS) remains functional.
- The VSES Caution indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- During diagnosis, park the vehicle on a level surface.
- Inspect the vehicle for proper alignment. The car should not pull in either direction while driving straight on a level surface.
- Find out from the customer the conditions under which the DTC was set. This information will help to duplicate the failure.
- The snapshot function on the scan tool can help find an intermittent DTC.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

Scan Tool Data List for EBCM

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Circuit/System Verification

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

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

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the SAS.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 2 and ground.
   - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 1 and ground.
   - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
4. Test for 4.8-5.2 volts between the 5-volt reference circuit terminal 1 and the signal circuit terminal 6.
   - If less than the specified range, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
5. Ignition OFF, reconnect the SAS.
6. Disconnect the EBCM harness connector.
7. Test for infinite resistance between the signal circuit pin 4 and ground.
   - If less than the specified range, test the signal circuit for a short to ground.
8. Disconnect the SAS.
9. Reconnect the EBCM harness connector.
10. Ignition ON, test voltage of phase A phase B, and phase C. verify that the reading is battery positive voltage for each of the three phases.
    - If not the specified value, test the phase A phase B, and phase C circuits for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
11. Ignition OFF, reconnect the SAS. Turn the ignition ON. Turn the steering wheel through its full range and back to straight ahead to center the SAS. Using the scan tool, observe the steering wheel position. The parameter changes smoothly while turning the steering wheel through the entire range and correlate to zero reading with the wheels in a straight ahead position.
    - If the steering wheel position parameter does not change, replace the SAS.
    - If the steering wheel position parameter change, replace the EBCM.

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Repair Procedures

- **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**
- **Control Module References** for EBCM replacement, setup, and programming

Repair Verification

Diagnostic Repair Verification

DTC C0774

DTC Descriptor

DTC C0774

Low Tire Pressure System Performance

Diagnostic Fault Information

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

DTC C0774

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Low Tire Pressure System Performance	-	-	-	C0774

Circuit Description

The tire pressure monitor (TPM) system has 4 radio frequency (RF) transmitting pressure sensors inside each wheel/tire assembly. If a sensor detects a low tire pressure, the DIC will display the CHECK TIRE PRESSURE, and the Electronic Brake Control Module (EBCM) will receive a serial data message that a DTC C0774 has set. The Vehicle Stability Enhancement System (VSES) will compensate for the low tire pressure with a calibration change to low tire present. Review the TPM for diagnostics for C0774.

Conditions for Running the DTC

Vehicle speed is 32 km/h (20 mph), or greater for 1 minutes.

Conditions for Setting the DTC

- The TPM detects a tire pressure difference in 1 tire of 8.2 kPa (1.2 psi) higher or lower than the other 3.
- The EBCM will receive a serial data message that a DTC C0774 has set.

Actions Taken When the DTC Sets

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- A DTC C0774 is stored in memory.
- The VSES system compensates for low tire pressure.

Conditions for Clearing the DTC

- A current DTC will clear when the TPM system is reset.
- A history DTC will clear after 100 consecutive malfunction free ignition cycles from when the TPM system has been reset.

Diagnostic Aids

- A possible cause of this DTC could be a low tire pressure in one of the four tires.
- Review the tire pressure monitoring (TPM) system check for more information. Refer to **Diagnostic System Check - Tire Pressure Monitoring**

Repair Procedures

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

DTC C1100 OR C1101

DTC Descriptor

DTC C1100 00

Brake Booster Vacuum Sensor Performance

Diagnostic Fault Information

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

DTC C1100 or C1101

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Brake Booster Vacuum 5-Volt Reference Circuit	C1100 00	C1100 00	C1100 00	-
Signal Circuit	C1100 00	C1100 00	C1100 00	-
Low Reference Circuit	-	C1100 00	-	-

Circuit/System Description

The electronic brake control module (EBCM) provides a power 5-volt reference to the brake booster vacuum sensor. The brake booster vacuum sensor converts the change in vacuum levels in the brake booster into a voltage signal. This signal is sent to the EBCM. The voltage signal ranges, from 0.13 to 3.30 volts depending on vacuum levels. The low reference is the return side of the sensor to ground.

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Conditions for Running the DTC

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

Conditions for Setting the DTC

- Voltage at the brake booster sensor signal output to the EBCM falls outside the 0.13 to 3.30 volts range for more than 200 milliseconds.
- The power 5-volts reference is shorted to ground or battery positive.

Action Taken When the DTC Sets

One or more of the following actions may occur:

The red BRAKE Warning indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation (8600 GVW or Less) or **ABS Description and Operation (Over 8600 GVW)**

Electrical Information Reference

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

Scan Tool Reference

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Scan Tool Data List for EBCM

Circuit/System Verification

DTC C1100 will set as result of power brake booster vacuum sensor or circuit failure, test for power and ground circuits to the EBCM.

- Repair the power or ground circuits.

Circuit/System Testing

1. Ignition OFF, disconnect the 3 way harness connector at the brake booster vacuum sensor.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 2 and ground.
   - If greater than 1.0 ohm, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
3. Ignition ON, test for 4.5 - 5.3 volts between the 5-volt reference circuit terminal 3 and ground.
   - If less than 4.5 volts, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater than 5.3 volts, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
4. Test for 4.5 - 5.3 volts between the 5-volt reference circuit terminal 3 and the signal circuit terminal 1.
   - If less than the specified range, test the signal circuit for an open/high resistance. If the circuit tests normal, replace the EBCM.
   - If greater specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the EBCM.
5. If all circuits test normal, test or replace the brake booster vacuum sensor.

Repair Procedures

Perform the **Diagnostic System Check - Vehicle** after completing the diagnostic procedure.

Control Module References after completing the diagnostic procedure.

Repair Verification

Diagnostic Repair Verification

SYMPTOMS - ANTILOCK BRAKE SYSTEM

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

1. **Perform the ABS Diagnostic System Check before using the symptom tables in order to verify that all of the following are true:**
   - **There are no DTCs set.**

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- **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 (8600 GVW or Less) or ABS Description and Operation (Over 8600 GVW).**

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 **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 Always On**
- **ABS Indicator Inoperative**
- **Stability System Caution Indicator Always On**
- **Stability System Caution Indicator Inoperative**

ABS INDICATOR ALWAYS ON

Circuit Description

The instrument panel cluster (IPC) illuminates the ABS indicator by supplying ground to the lamp. The electronic brake control module (EBCM) sends serial data messages to the IPC to command the indicator ON or OFF.

Diagnostic Aids

The malfunction must be present during diagnosis in order to prevent unnecessary parts replacement. Always begin diagnosis with **Diagnostic System Check - Vehicle** .

Test Description

The number below refers to the step number on the diagnostic table.

3: This step tests if the IPC is able to turn OFF the ABS indicator.

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ABS Indicator Always On

Step	Action	Yes	No
IMPORTANT: **An ECE 13 response may cause the ABS indicator to remain ON when no DTCs are set. It is necessary to verify that ECE 13 is not causing the ABS indicator to remain illuminated, prior to performing this diagnostic. Refer to ABS Description and Operation (8600 GVW or Less) or ABS Description and Operation (Over 8600 GVW) for a complete description of the ECE 13 response.**			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate for approximately 2 seconds and then turn OFF?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Select the Instrument Panel Cluster Special Functions menu on the scan tool. 2. Select Lamp Tests. 3. Command the IPC indicator lamps OFF. Does the ABS indicator turn OFF?	Go to **Step 5**	Go to **Step 4**
4	Replace the instrument panel cluster (IPC). Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	Go to **Step 6**	-
5	Replace the electronic brake control module (EBCM). Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	Go to **Step 6**	-
6	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate for approximately 2 seconds and then turn OFF?	System OK	Go to **Step 3**

ABS INDICATOR INOPERATIVE

Circuit Description

The instrument panel cluster (IPC) illuminates the ABS indicator by supplying ground to the lamp. The electronic brake control module (EBCM) sends class 2 serial data messages to the IPC in order to command the indicator ON or OFF.

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Diagnostic Aids

Replace the Instrument Panel Cluster if the ABS indicator intermittently fails to operate during the bulb check.

Test Description

The number below refers to the step number on the diagnostic table.

2: This step tests if the IPC is able to illuminate the ABS indicator, during the bulb check.

ABS Indicator Inoperative

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate?	Go to Diagnostic Aids	Go to **Step 3**
3	Replace the instrument panel cluster (IPC). Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	Go to **Step 4**	-
4	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate?	System OK	Go to **Step 3**

STABILITY SYSTEM CAUTION INDICATOR ALWAYS ON

Circuit Description

The instrument panel cluster (IPC) illuminates the stability system caution indicator during the IPC bulb check or when the electronic brake control module (EBCM) sends a serial data message to the IPC commanding the indicator ON. The stability system caution indicator is used to indicate when the vehicle stability enhancement system (VSES) is disabled.

During aggressive driving conditions which repeatedly activate the VSES or traction control system (TCS), one or more of the solenoid coils may become overheated. The stability system caution indicator is displayed at this time and the EBCM disables all VSES/TCS brake pressure applications in an attempt to decrease the solenoid temperatures. Coil temperatures are estimated by the EBCM based on ambient temperature and monitored solenoid activation and may not coincide with actual solenoid temperatures. The stability system caution indicator turns OFF and normal VSES/TCS activity resumes when the EBCM determines that the solenoids

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have cooled sufficiently.

Diagnostic Aids

The VSES solenoid coils may overheat during aggressive driving, causing the VSES to be disabled temporarily.

A medium-low brake fluid level in the master cylinder reservoir may cause the stability system caution indicator to be illuminated during stopping or turning maneuvers. This condition will also cause the red brake warning indicator to turn ON. Ensure the master cylinder reservoir has an adequate brake fluid level.

If the stability system caution indicator turns ON due to any of the above conditions, no diagnosis or repair of the VSES is required.

Stability System Caution Indicator Always On

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	Turn ON the ignition and observe the stability system caution indicator. Does the stability system caution indicator remain illuminated after the instrument panel cluster (IPC) bulb check is completed?	Go to **Step 3**	Go to Diagnostic Aids
3	Observe the brake warning indicator on the IPC. Is the brake warning indicator always ON?	Go to **Brake Warning Indicator Always On**	Go to **Step 4**
4	1. Select the Instrument Panel Cluster Special Functions menu on the scan tool. 2. Select Lamp Tests. 3. Command the IPC indicator lamps OFF. Does the stability system caution indicator turn OFF?	Go to **Step 5**	Go to **Step 6**
5	**IMPORTANT:** **Following the electronic brake control module (EBCM) replacement, perform the set-up procedure for the EBCM and use the scan tool to perform the Tire Size Calibration procedure.** Replace the EBCM. Refer to **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**.Did you complete the replacement?	Go to **Step 7**	-
	IMPORTANT: **Perform the set-up procedure for the IPC.**		

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6	Replace the IPC. Refer to **Instrument Cluster Replacement (Cadillac)** or **Instrument Cluster Replacement (Except Cadillac)** .Did you complete the replacement?	Go to **Step 7**	-
7	1. Use the scan tool to clear all DTCs from all modules. 2. Turn OFF the ignition for 5 seconds. 3. Turn ON the ignition and observe the stability system caution indicator. Does the stability system caution indicator remain illuminated after the IPC bulb check is completed?	Go to **Step 3**	System OK

STABILITY SYSTEM CAUTION INDICATOR INOPERATIVE

Circuit Description

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

Diagnostic Aids

Replace the IPC if the stability system caution indicator intermittently fails to illuminate during the bulb check.

Test Description

The number below refers to the step number on the diagnostic table.

2: This step tests if the IPC is able to illuminate the stability system caution indicator during the bulb check.

Stability System Caution Indicator Inoperative

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the stability system caution indicator. Does the stability system caution indicator illuminate?	Go to Diagnostic Aids	Go to **Step 3**
3	Replace the instrument panel cluster (IPC). Refer to **Instrument Cluster Replacement (Cadillac)** or		-

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	Instrument Cluster Replacement (Except Cadillac) . Did you complete the replacement?	Go to **Step 4**	
4	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the stability system caution indicator. Does the stability system caution indicator illuminate?	System OK	Go to **Step 3**

BRAKE PRESSURE MODULATOR VALVE HYDRAULIC TESTING (OVER 8600 GVW)

Mechanical failures within the brake pressure modulator valve (BPMV) may cause improper operation of the ABS/dynamic rear proportion (DRP)/traction control system (TCS)/vehicle stability enhancement system (VSES) as well as possibly causing DTCs to set. The following diagnostic tests have been developed for use in diagnosing these concerns. Perform only the tests which apply for the DTC or symptom you are diagnosing.

Dump and Isolation Valve Testing

Pressure Dump Test Procedure

1. Apply the parking brake fully.
2. Start the engine and allow the engine to idle.
3. Select the desired Dump Valve Solenoid Test on the scan tool.
4. Apply the brake and maintain steady pressure on the brake pedal.
5. Command the solenoid ON and verify that the brake pedal drops to the floor.

Wheel Isolation Test Procedure

1. Apply the parking brake fully.
2. Start the engine and allow the engine to idle.
3. Select the desired Isolation Valve Solenoid Test on the scan tool.
4. Apply the brake with very light pressure, only enough to open the brake switch.
5. Command the solenoid ON and then immediately apply firm and steady pressure to the brake pedal.
6. The electronic brake control module (EBCM) automatically de-energizes the solenoid after about 5 seconds. When this occurs, verify that the brake pedal drops about 2.2 cm (1 in).

Brake Pressure Application Testing (W/JL4)

IMPORTANT: Before performing the following tests, perform all of the isolation valve tests described in the wheel isolation test procedure. A malfunctioning isolation valve may cause pressure to be applied to multiple wheels, instead of to just one wheel as commanded.
If the brake being tested fails to apply, does not hold for the full 9 second period, or releases slowly after the 9 second hold, the TC Isolation Valve Test

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has failed.

TC Isolation Valve Test Procedure

1. Turn OFF the ignition.
2. Disconnect the brake switch harness connector.
3. Raise the vehicle so that all 4 wheels are about 15 cm (6 in) off of the floor. Refer to **Lifting and Jacking the Vehicle** .
4. Ensure that the park brake is released.
5. Turn ON the ignition.
6. Ensure that the transmission is in neutral (N).
7. Select the VSES Special Functions menu on the scan tool.
8. Select either the Left Front Brake Apply or the Right Front Brake Apply, whichever wheel has the most convenient access for you.
9. Press the Apply key on the scan tool.
10. Listen for the precharge pump to activate for approximately 2 seconds.
11. Immediately verify brake activation at the wheel by attempting to turn the wheel by hand.
12. Continue attempting to turn the wheel by hand and ensure the wheel remains locked for 9 seconds after the precharge pump turns OFF.
13. Verify that the brake releases quickly when the 9 second pressure hold is terminated.
14. Select either the Left Rear Brake Apply or the Right Rear Brake Apply, whichever wheel has the most convenient access for you.
15. Repeat steps 11, 12, and 13 for the rear wheel being tested.
16. Turn OFF the ignition.
17. Reconnect the brake switch harness connector.

REPAIR INSTRUCTIONS

ANTILOCK BRAKE SYSTEM AUTOMATED BLEED PROCEDURE (W/JL4)

NOTE: **When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.**

NOTE: **Refer to Brake Fluid Effects on Paint and Electrical Components Notice in Cautions and Notices.**

IMPORTANT: The base hydraulic brake system must be bled before performing this

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automated bleeding procedure. If you have not yet performed the base hydraulic brake system bleeding procedure, refer to Hydraulic Brake System Bleeding (Manual) or Hydraulic Brake System Bleeding (Pressure) in Hydraulic Brakes before proceeding.

1. Install a scan tool to the vehicle.
2. Start the engine and allow the engine to idle.
3. Using the scan tool, begin the automated bleed procedure.
4. Follow the instructions on the scan tool to complete the automated bleed procedure. Apply the brake pedal when instructed by the scan tool.
5. Turn the ignition OFF.
6. Remove the scan tool from the vehicle.
7. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
8. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** in Hydraulic Brakes.
9. With the ignition OFF, apply the brakes 3-5 times, or until the brake pedal becomes firm, in order to deplete the brake booster power reserve.
10. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.
11. If the brake pedal feels spongy, repeat the automated bleeding procedure. If the brake pedal still feels spongy after repeating the automated bleeding procedure inspect the brake system for external leaks. Refer to **Brake System External Leak Inspection** in Hydraulic Brakes.
12. Turn the ignition key ON, with the engine OFF; check to see if the brake system warning lamp remains illuminated.
13. If the brake system warning lamp remains illuminated, DO NOT allow the vehicle to be driven until it is diagnosed and repaired. Refer to **Symptoms - Hydraulic Brakes** in Hydraulic Brakes.
14. Drive the vehicle to exceed 13 km/h (8 mph) to allow ABS initialization to occur. Observe brake pedal feel.
15. If the brake pedal feels spongy, repeat the automated bleeding procedure until a firm brake pedal is obtained.

ANTILOCK BRAKE SYSTEM AUTOMATED BLEED PROCEDURE (W/O JL4)

NOTE: **When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.**

NOTE: **Refer to Brake Fluid Effects on Paint and Electrical Components Notice in**

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Cautions and Notices.

IMPORTANT: This procedure may be performed on all vehicles EXCEPT those equipped with option code JL4, Vehicle Stability Enhancement System (VSES).

IMPORTANT: The base hydraulic brake system must be bled before performing this automated bleeding procedure. If you have not yet performed the base hydraulic brake system bleeding procedure, refer to Hydraulic Brake System Bleeding (Manual) or Hydraulic Brake System Bleeding (Pressure) in Hydraulic Brakes before proceeding.

1. Install a scan tool to the vehicle.
2. Start the engine and allow the engine to idle.
3. Depress the brake pedal firmly and maintain steady pressure on the pedal.
4. Using the scan tool, begin the automated bleed procedure.
5. Follow the instructions on the scan tool to complete the automated bleed procedure. Release the brake pedal between each test sequence.
6. Turn the ignition OFF.
7. Remove the scan tool from the vehicle.
8. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
9. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** in Hydraulic brakes.
10. With the ignition OFF, apply the brakes 3-5 times, or until the brake pedal becomes firm, in order to deplete the brake booster power reserve.
11. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.
12. If the brake pedal feels spongy, repeat the automated bleeding procedure. If the brake pedal still feels spongy after repeating the automated bleeding procedure inspect the brake system for external leaks. Refer to **Brake System External Leak Inspection** in Hydraulic Brakes.
13. Turn the ignition key ON, with the engine OFF; check to see if the brake system warning lamp remains illuminated.
14. If the brake system warning lamp remains illuminated, DO NOT allow the vehicle to be driven until it is diagnosed and repaired. Refer to **Symptoms - Hydraulic Brakes** in Hydraulic Brakes.
15. Drive the vehicle to exceed 13 kph (8 mph) to allow ABS initialization to occur. Observe brake pedal feel.
16. If the brake pedal feels spongy, repeat the automated bleeding procedure until a firm brake pedal is obtained.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT (W/JL4)

Removal Procedure

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CAUTION: Refer to Brake Fluid Irritant Caution .

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

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove all dirt and debris from the electronic brake control module (EBCM) and the brake pressure modulator valve (BPMV) before loosening or removing any of the components.

IMPORTANT: DO NOT reuse the EBCM to BPMV screws. Install NEW screws.

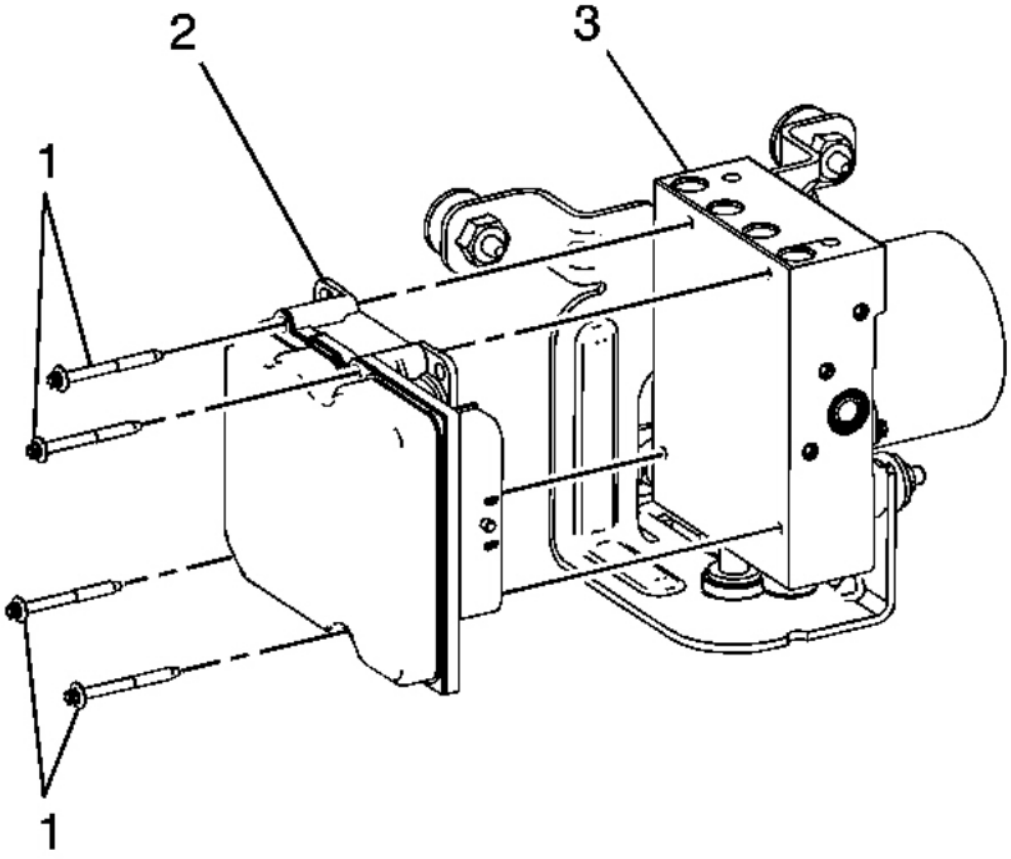


Fig. 20: View Of EBCM, BPMV & Screws
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3. Using denatured alcohol, clean the EBCM (2) and the BPMV (3).
4. Disconnect the EBCM electrical connector.
5. Remove and discard the EBCM to BPMV screws (1).
6. Carefully pull the EBCM (2) from the BPMV (3).
7. Remove the EBCM to BPMV gasket.

Installation Procedure

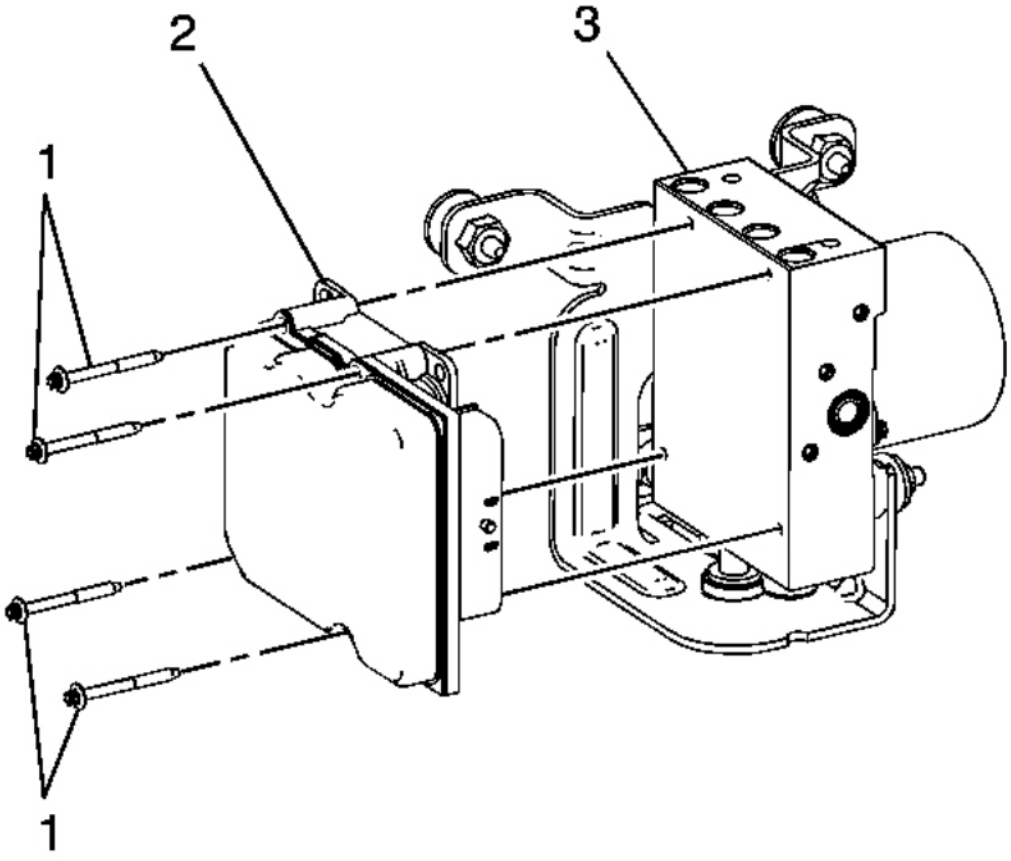


Fig. 21: View Of EBCM, BPMV & Screws
Courtesy of GENERAL MOTORS CORP.

1. Position the gasket to the BPMV (3).
2. Position the EBCM (2) to the BPMV (3).

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IMPORTANT: Make sure the EBCM is properly aligned to the BPMV, including the brake pressure switch. Do not force the components together.

3. Push the EBCM squarely onto the BPMV.

NOTE: Refer to Fastener Notice .

4. Install 4 new EBCM to BPMV screws (1).

Tighten: Tighten the screws in a X pattern to 3 N.m (27 lb in).

5. Connect the EBCM electrical connector.
6. If installing a replacement EBCM, program the replacement EBCM. Refer to **Control Module References** .
7. Bleed the BPMV. Refer to **Antilock Brake System Automated Bleed Procedure (W/JL4)** or **Antilock Brake System Automated Bleed Procedure (W/O JL4)**.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT (W/O JL4)

Removal Procedure

CAUTION: Refer to Brake Fluid Irritant Caution .

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

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove all dirt and debris from the electronic brake control module (EBCM) and the brake pressure modulator valve (BPMV) before loosening or removing any of the components.

IMPORTANT: DO NOT reuse the EBCM to BPMV screws. Install NEW screws.

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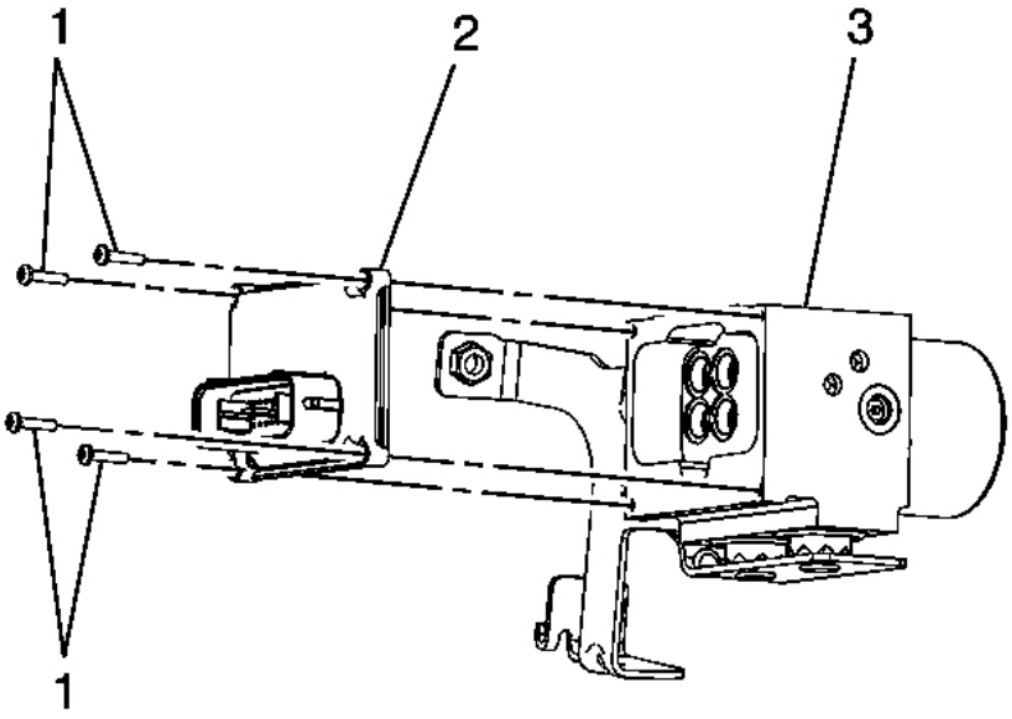


Fig. 22: View Of EBCM, BPMV & Screws
Courtesy of GENERAL MOTORS CORP.

3. Using denatured alcohol, clean the EBCM (2) and the BPMV (3).
4. Disconnect the EBCM electrical connector.
5. Remove and discard the EBCM to BPMV screws (1).
6. Carefully pull the EBCM (2) from the BPMV (3).

Installation Procedure

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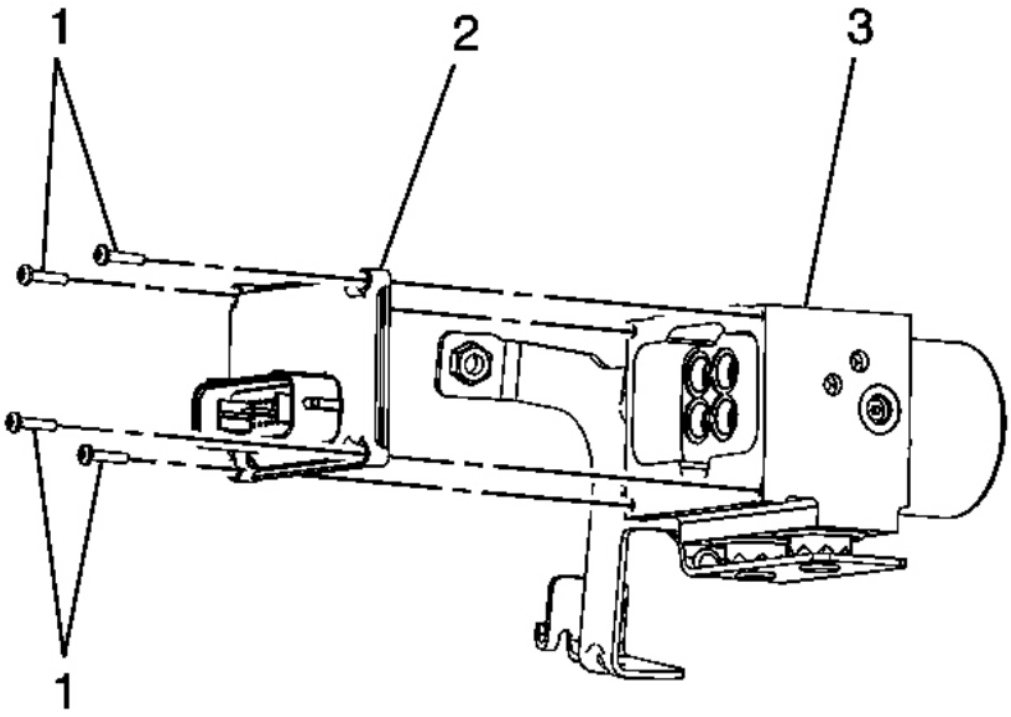


Fig. 23: View Of EBCM, BPMV & Screws
Courtesy of GENERAL MOTORS CORP.

1. Position the EBCM (2) to the BPMV (3).

NOTE: **Refer to Fastener Notice .**

2. Install 4 new EBCM to BPMV screws (1).

Tighten: Tighten the screws in an X pattern to 3 N.m (27 lb in).

3. Connect the EBCM electrical connector.
4. If installing a replacement EBCM, program the replacement EBCM. Refer to **Control Module References** .
5. Bleed the BPMV. Refer to **Antilock Brake System Automated Bleed Procedure (W/JL4)** or **Antilock Brake System Automated Bleed Procedure (W/O JL4)**.

BRAKE PRESSURE MODULATOR VALVE REPLACEMENT (W/JL4)

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Removal Procedure

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

CAUTION: Refer to Brake Fluid Irritant Caution .

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

IMPORTANT: Cap the brake pipes to prevent brake fluid loss and contamination.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Clean all dirt and debris from the BPMV assembly and the brake pipe fittings.
3. Disconnect the electronic brake control module (EBCM) electrical connector.

IMPORTANT: Note the location of the brake pipes to the BPMV for proper installation.

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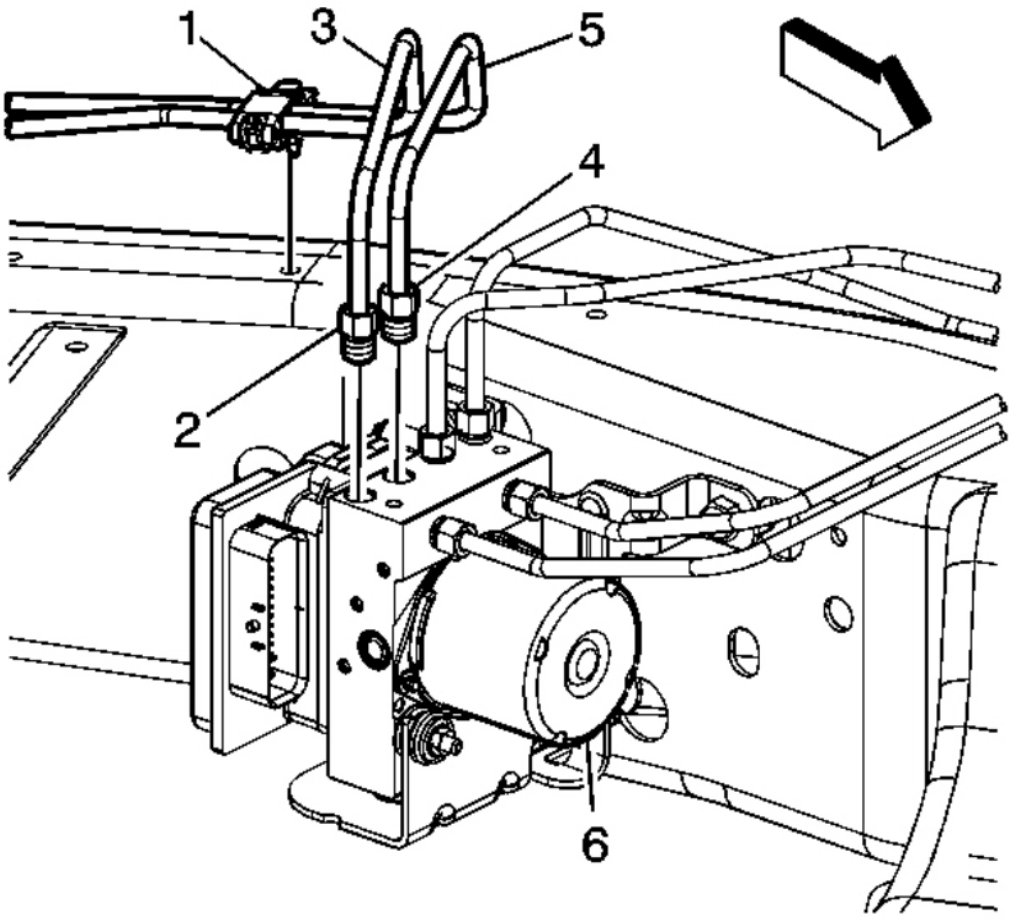


Fig. 24: View Of BPMV & Components
Courtesy of GENERAL MOTORS CORP.

4. Release the brake pipe retaining clip (1) from the frame.
5. Disconnect the rear brake pipe fittings (2) and (4) from the BPMV (6).
6. Remove the rear brake pipes (3) and (5) from the BPMV (6).

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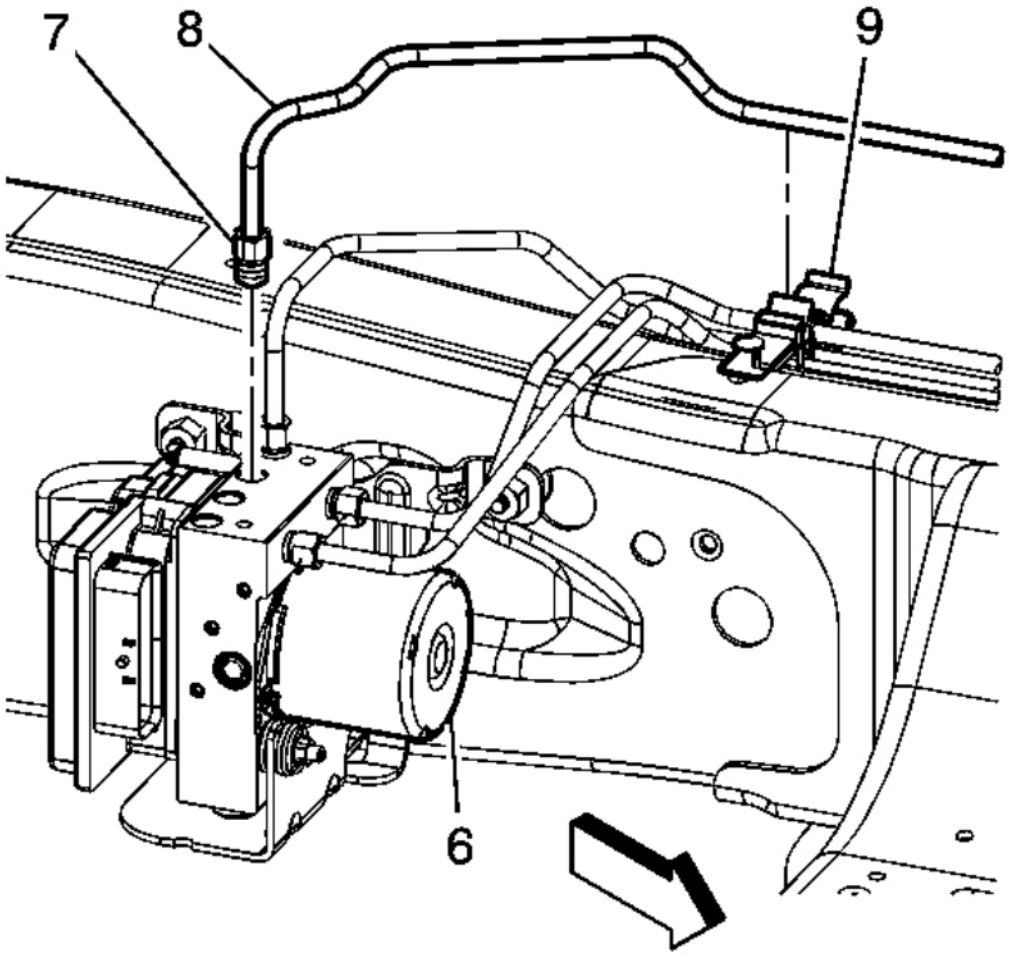


Fig. 25: View Of BPMV & Components
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the front brake pipe fitting (7) from the BPMV (6).
8. Remove the front brake pipe (8) from the BPMV (6) and the retaining clip (9).

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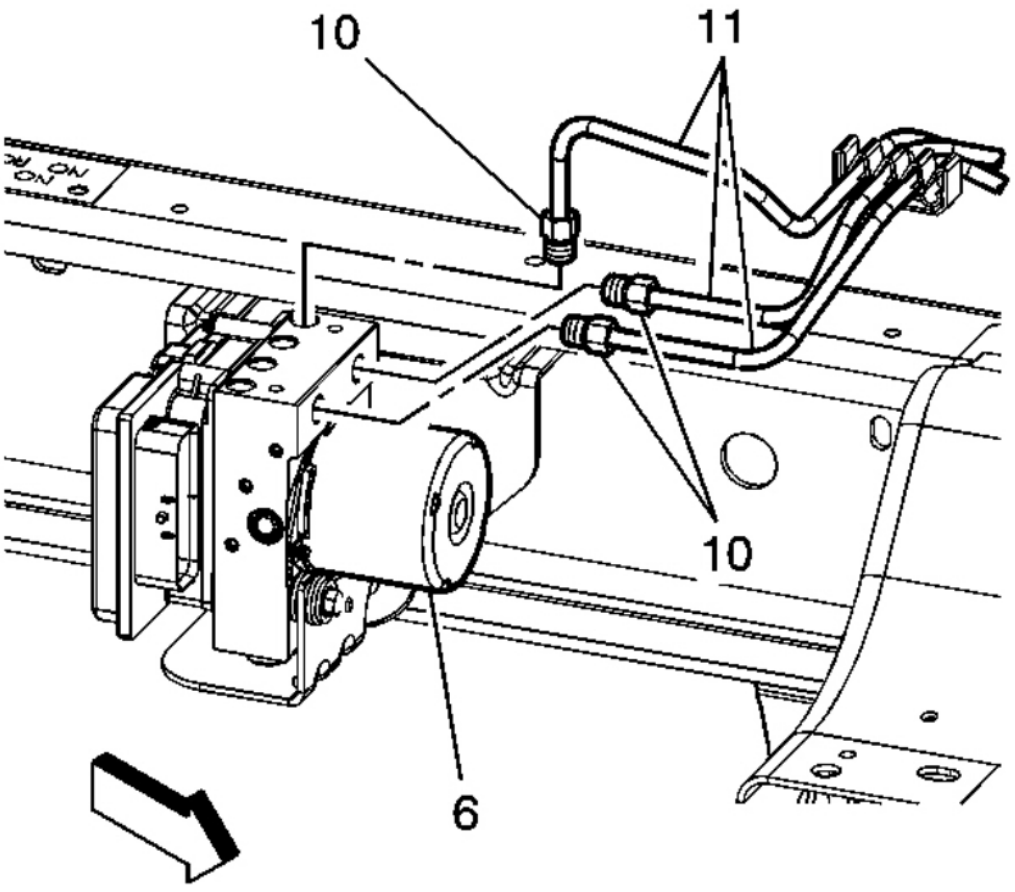


Fig. 26: View Of Front Brake Pipes & Fittings
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the front brake pipe fittings (10) from the BPMV (6).
10. Remove the front brake pipes (11) from the BPMV (6).

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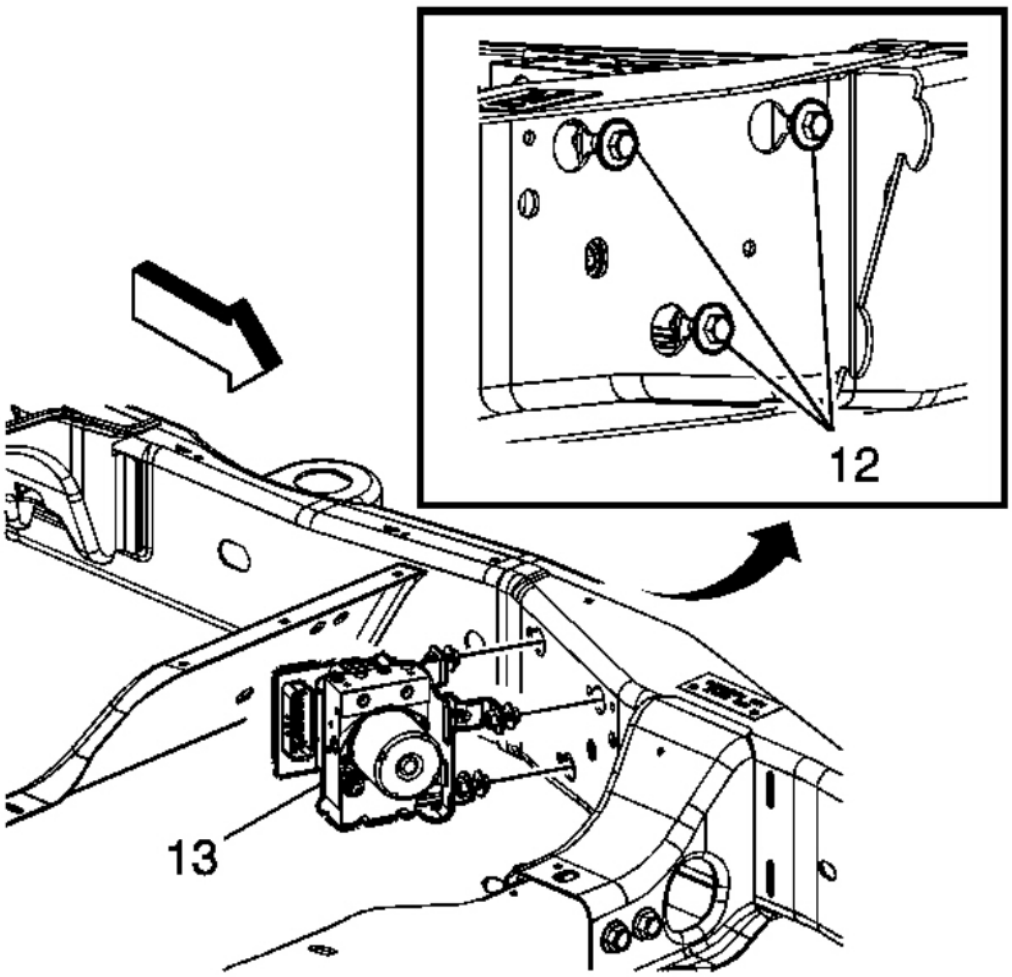


Fig. 27: View Of BPMV & Bracket Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: It is not necessary to remove the BPMV bracket bolts.

11. Loosen the BPMV bracket bolts.
12. Slide the BPMV and bracket assembly toward the front of the vehicle and remove the assembly from the vehicle frame.
13. If necessary, remove the EBCM from the BPMV. Refer to **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**.

IMPORTANT: DO NOT pry against the accumulator piston caps on the bottom of the

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BPMV.

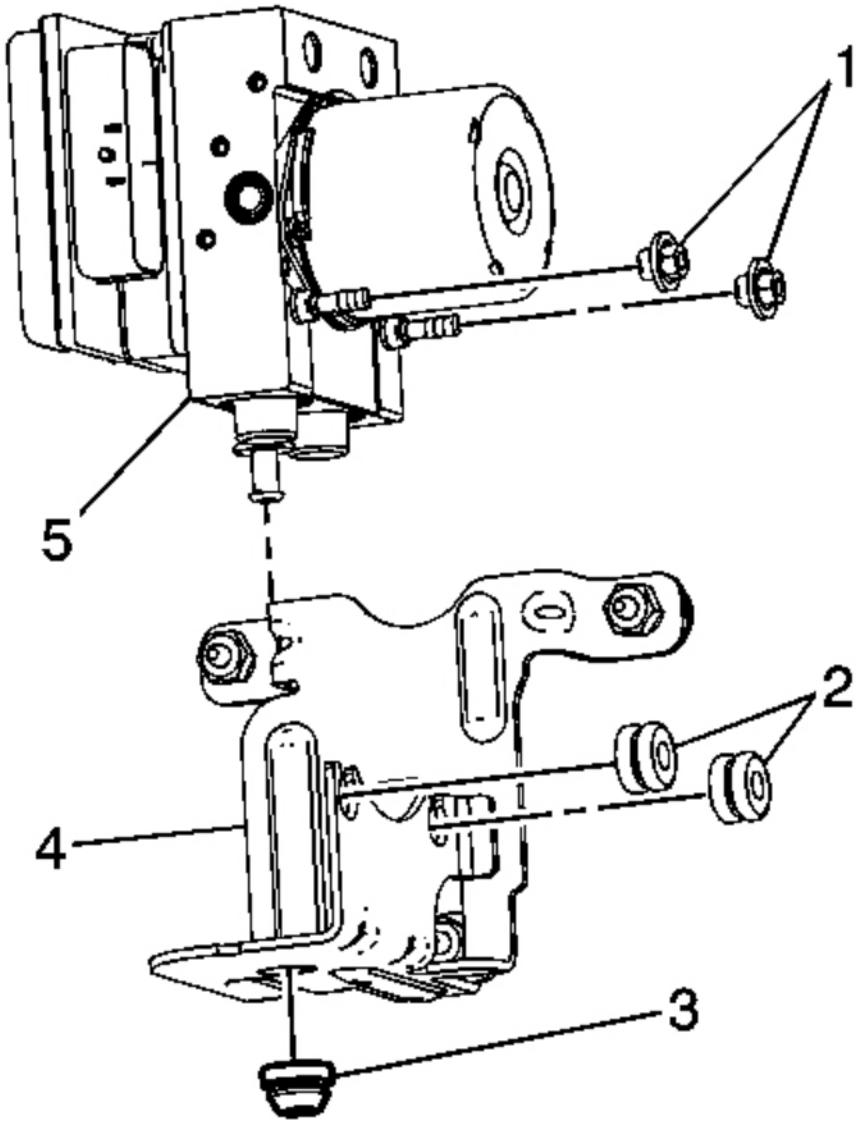


Fig. 28: View Of BPMV, Mounting Nuts & Grommets
Courtesy of GENERAL MOTORS CORP.

14. If removing the BPMV bracket (4) from the BPMV (5), loosen the BPMV mounting nuts (1).
15. Carefully lift the BPMV from the bracket to release the front grommets (2)

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16. Release the BPMV from the lower grommet (3).

Installation Procedure

1. If removed, install the EBCM. Refer to **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**.

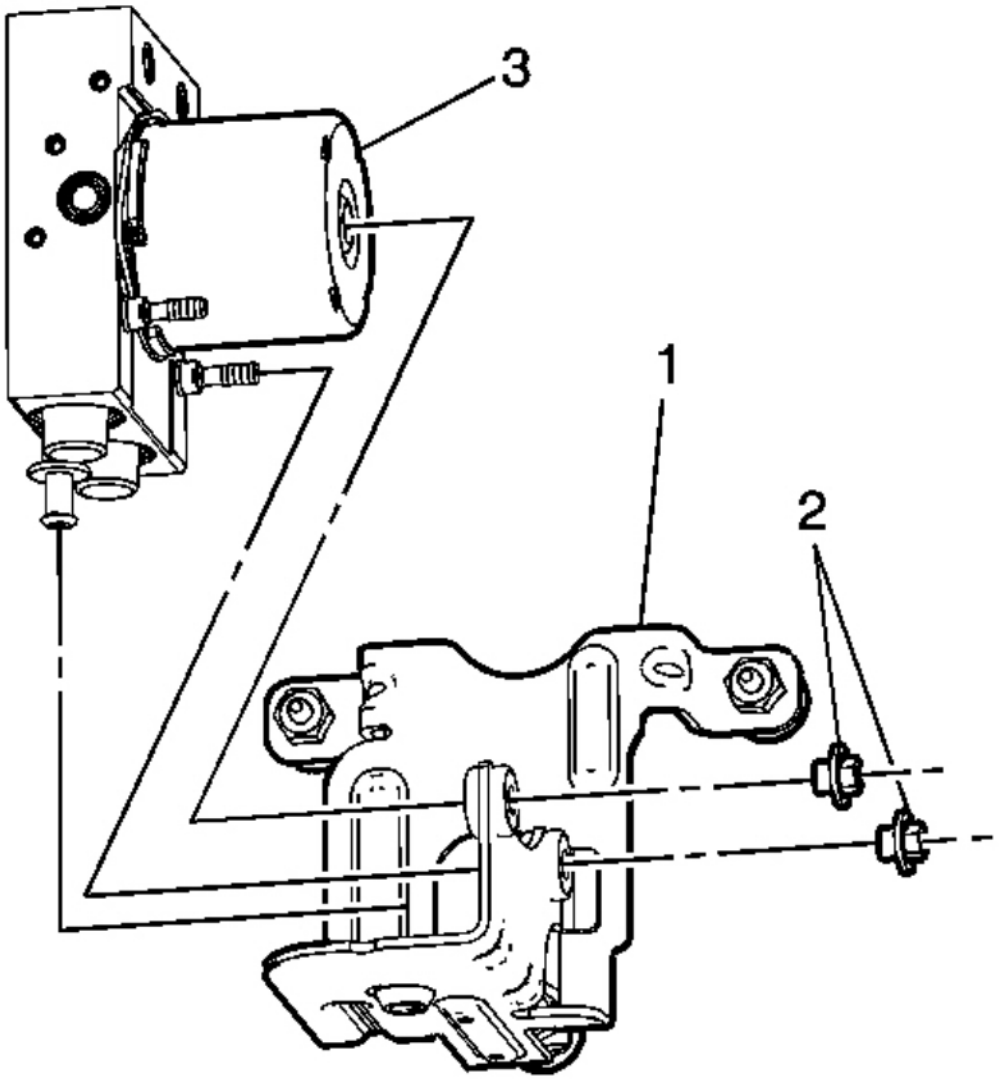


Fig. 29: View Of BPMV, Mounting Nuts & Grommets
Courtesy of GENERAL MOTORS CORP.

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2. Position the BPMV (3) to the mounting bracket (1).

NOTE: **Refer to Fastener Notice .**

3. Install the retaining nuts (2) to the BPMV (3).

Tighten: Tighten to 9 N.m (80 lb in).

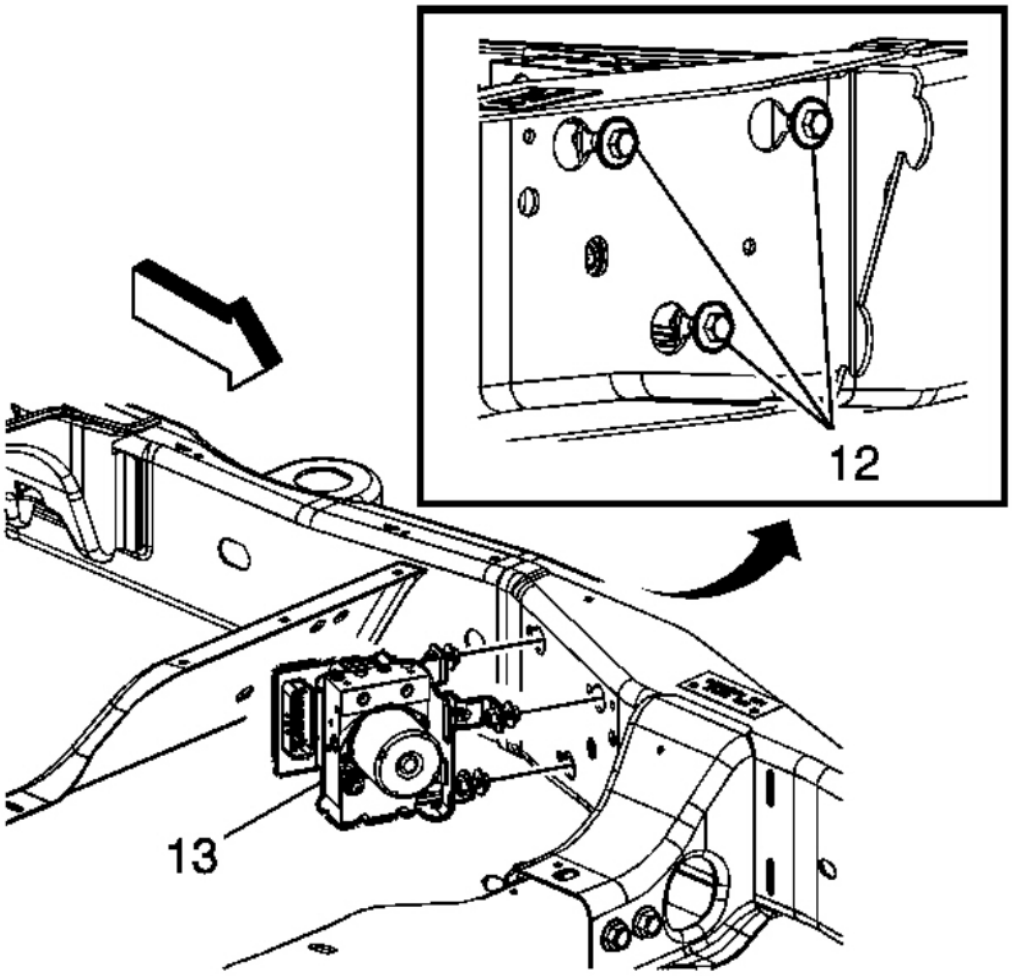


Fig. 30: View Of BPMV & Bracket Assembly
Courtesy of GENERAL MOTORS CORP.

4. Position the BPMV and bracket assembly (13) to the frame.

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5. Slide the BPMV assembly toward the rear of the vehicle.
6. Install the BPMV bracket bolts (12).

Tighten: Tighten the bolts to 22 N.m (16 lb in).

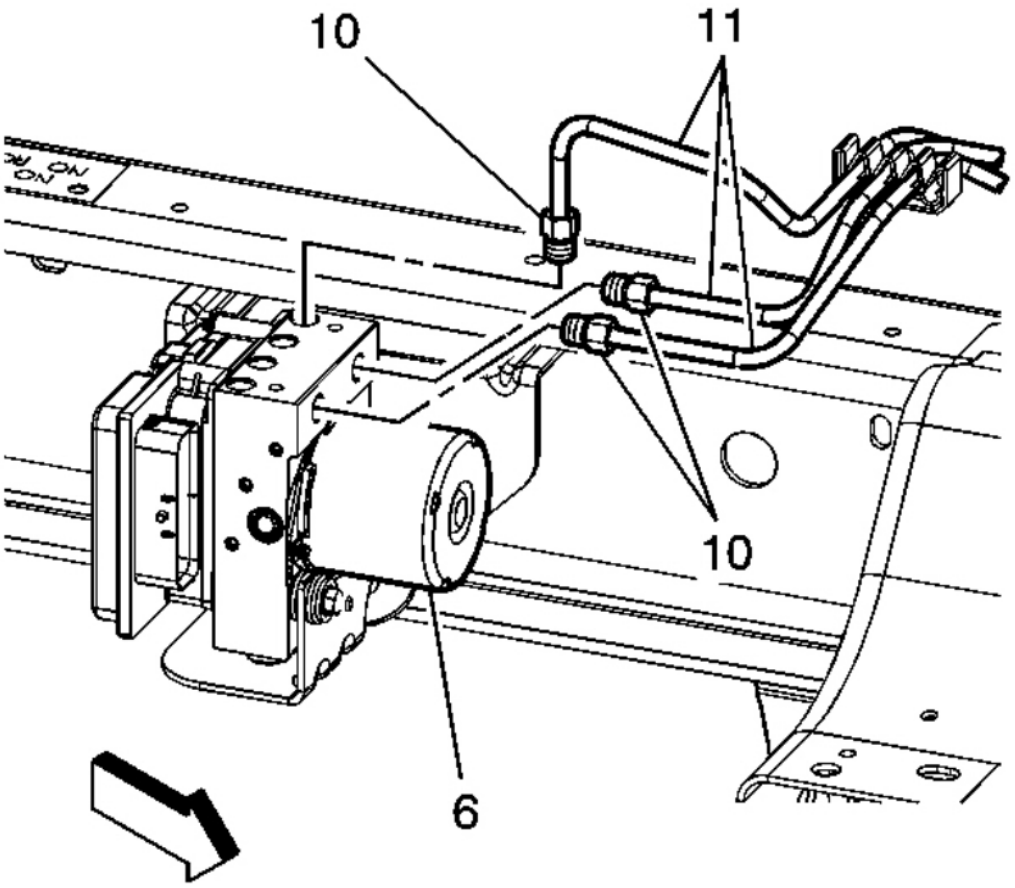


Fig. 31: View Of Front Brake Pipes & Fittings
Courtesy of GENERAL MOTORS CORP.

7. Position the front brake pipes (11) to the BPMV (6).
8. Install the front brake pipe fittings (10).

Tighten: Tighten the fittings to 18 N.m (13 lb ft).

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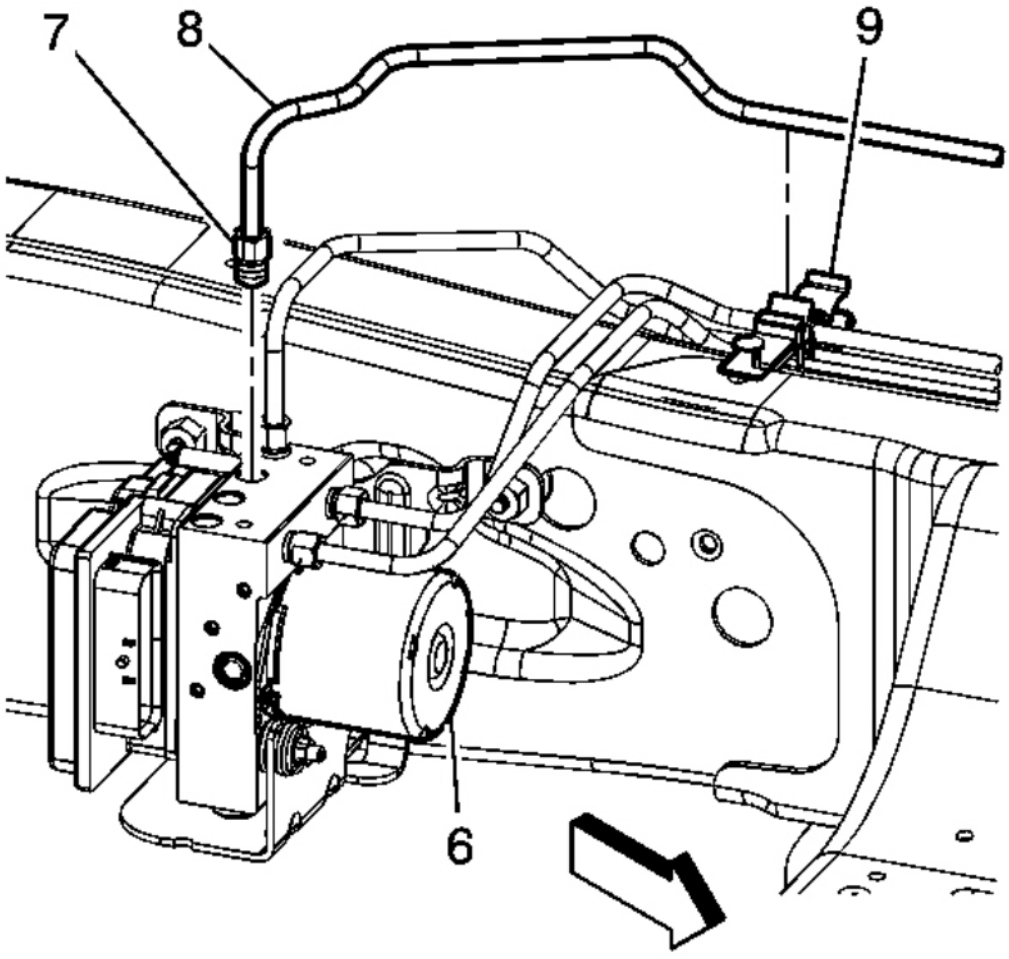


Fig. 32: View Of BPMV & Components
Courtesy of GENERAL MOTORS CORP.

9. Position the front brake pipe (8) to the BPMV.
10. Install the front brake pipe fitting (7).

    Tighten: Tighten the fitting to 18 N.m (13 lb ft).

11. Position the retaining clip (9) to the frame.

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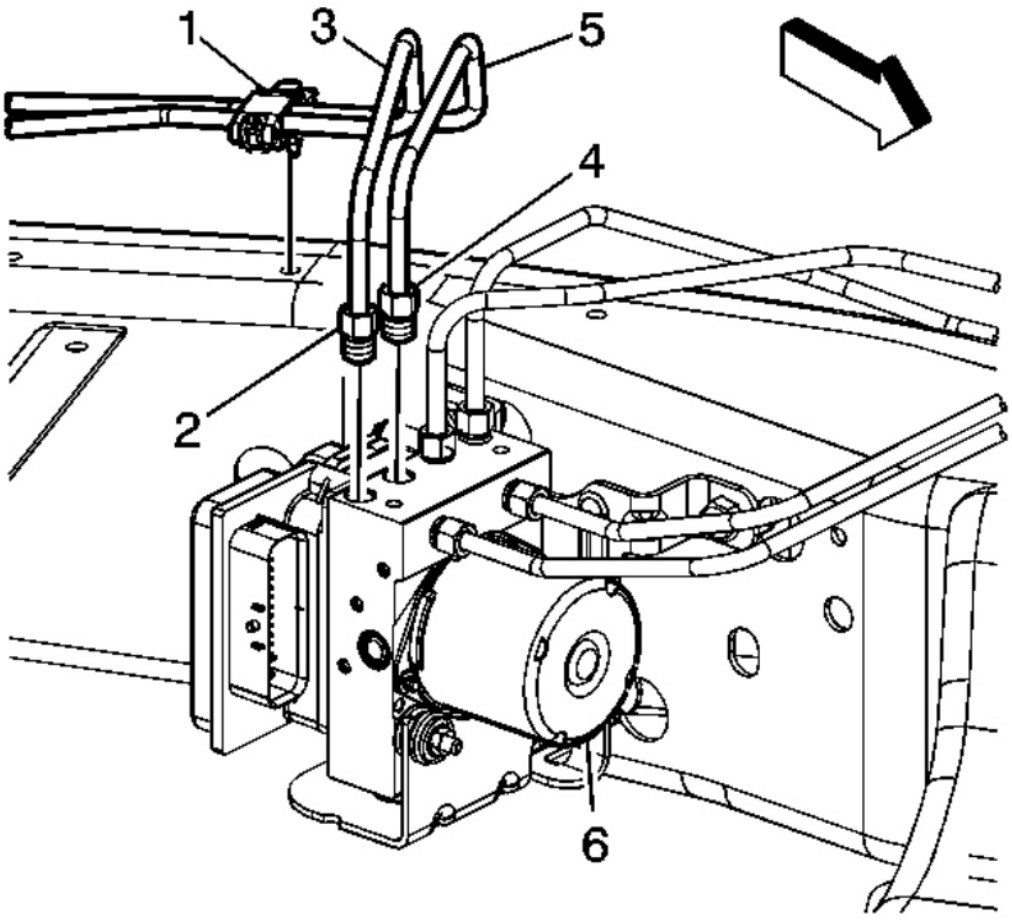


Fig. 33: View Of BPMV & Components
Courtesy of GENERAL MOTORS CORP.

12. Position the rear brake pipes (3) and (5) to the BPMV (6).
13. Install the rear brake pipe fittings (2) and (4).

    Tighten: Tighten the fittings to 18 N.m (13 lb ft).

14. Position the retaining clip (1) to the frame.
15. Connect the EBCM electrical connector.
16. Bleed the BPMV. Refer to **Antilock Brake System Automated Bleed Procedure (W/JL4)** or **Antilock Brake System Automated Bleed Procedure (W/O JL4)**.

BRAKE PRESSURE MODULATOR VALVE REPLACEMENT (W/O JL4)

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Removal Procedure

CAUTION: Refer to Brake Fluid Irritant Caution .

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

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

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Clean all dirt and debris from the brake pressure modulator valve (BPMV) assembly and the brake pipe fittings.
3. Disconnect the electronic brake control module (EBCM) electrical connector.

IMPORTANT: Note the location of the brake pipes to the BPMV for proper installation.

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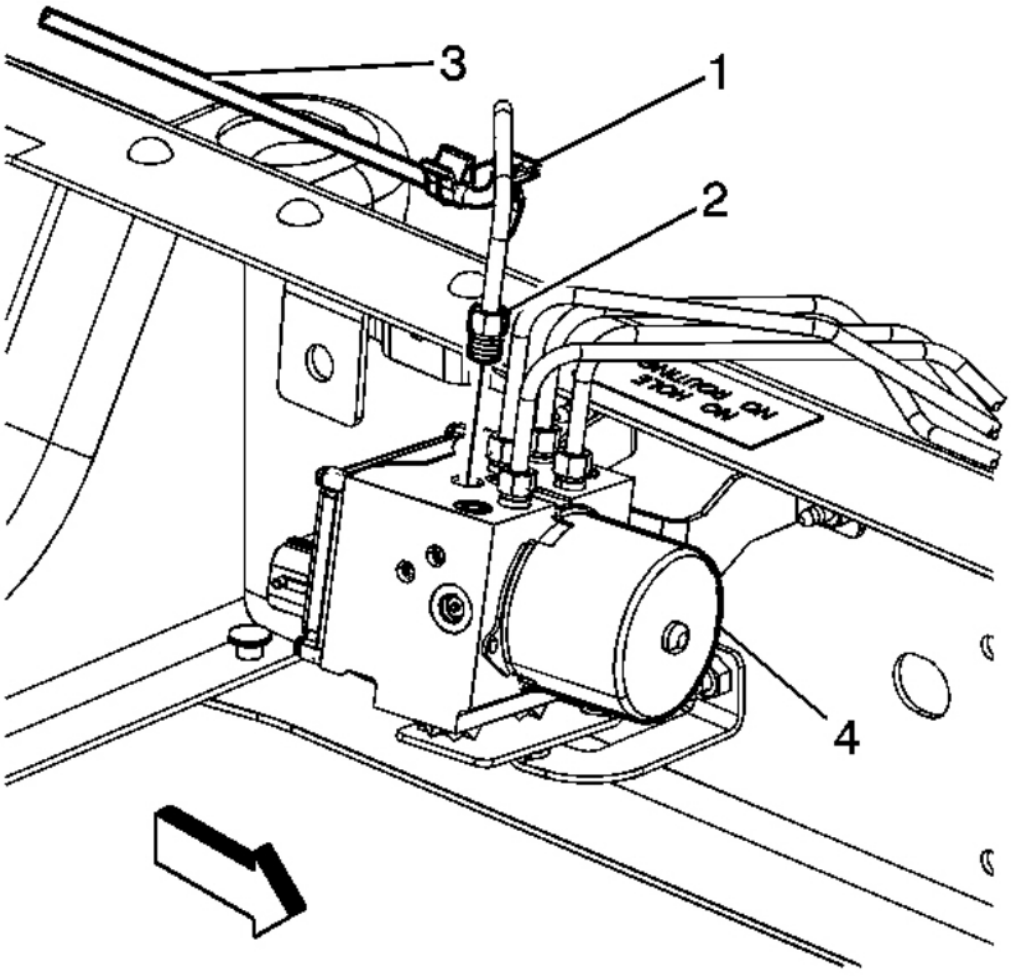


Fig. 34: View Of Rear Brake Pipe, Brake Pipe Fitting & Retaining Clip
Courtesy of GENERAL MOTORS CORP.

4. Release the brake pipe retaining clip (1) from the frame.
5. Disconnect the rear brake pipe fitting (2) from the BPMV (4).
6. Remove the rear brake pipe (3) from the BPMV (4).

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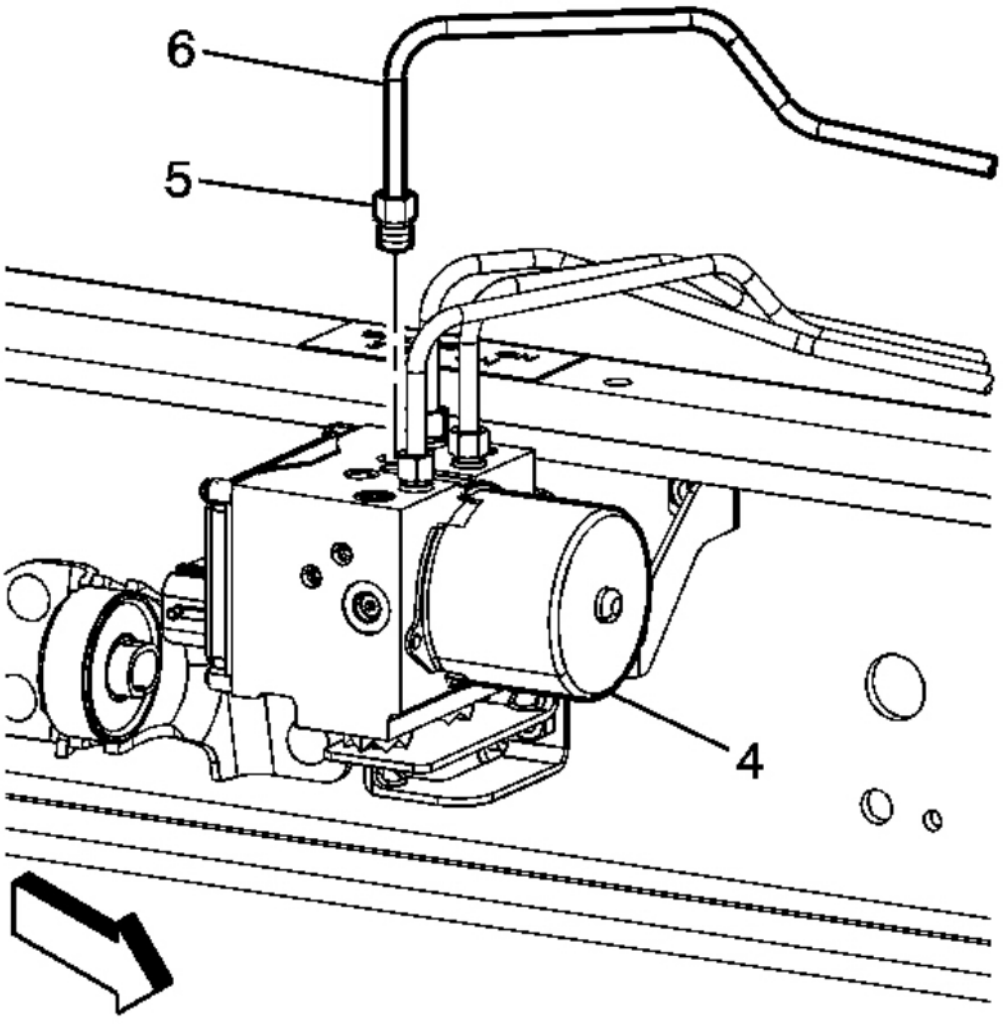


Fig. 35: View Of Front Brake Pipe Fitting & Pipe
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the front brake pipe fitting (5) and remove the front brake pipe (6).

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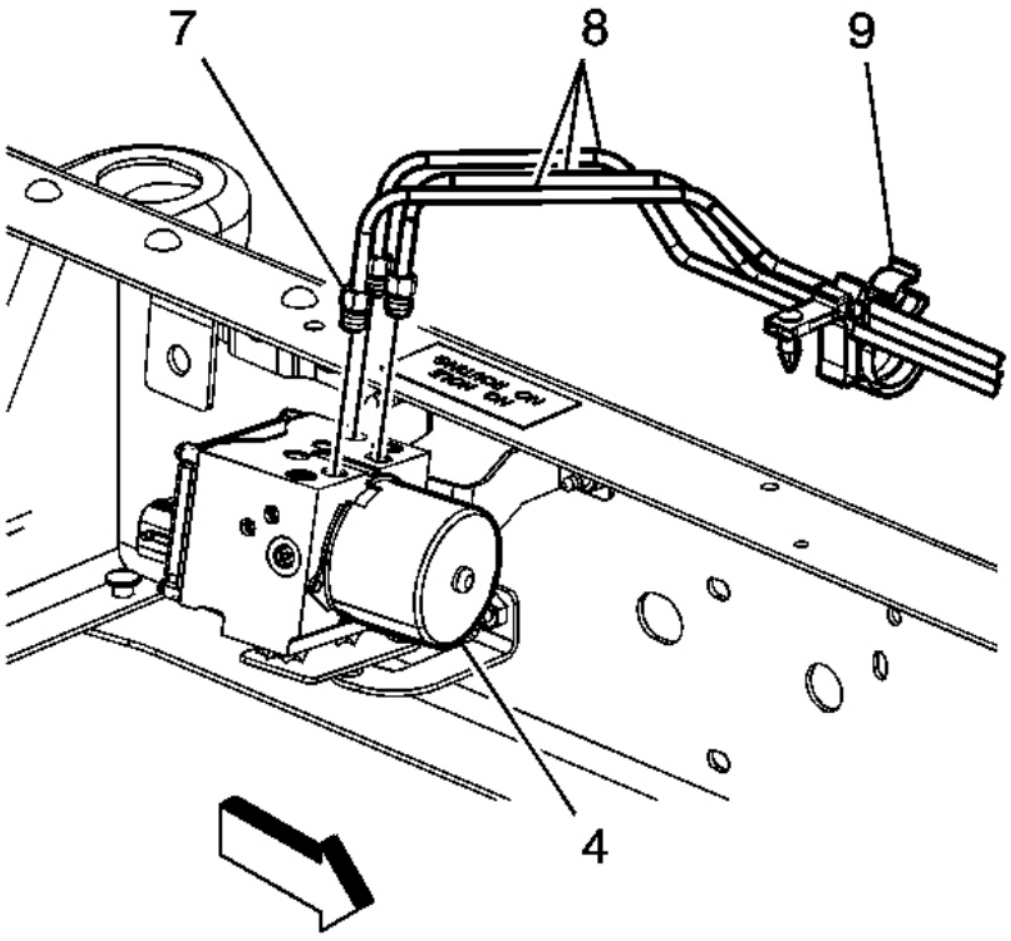


Fig. 36: View Of Front Brake Pipes, Fittings & Frame Retainer
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the front brake pipe fittings (7).
9. Remove the front brake pipes (8) and the frame retainer (9).

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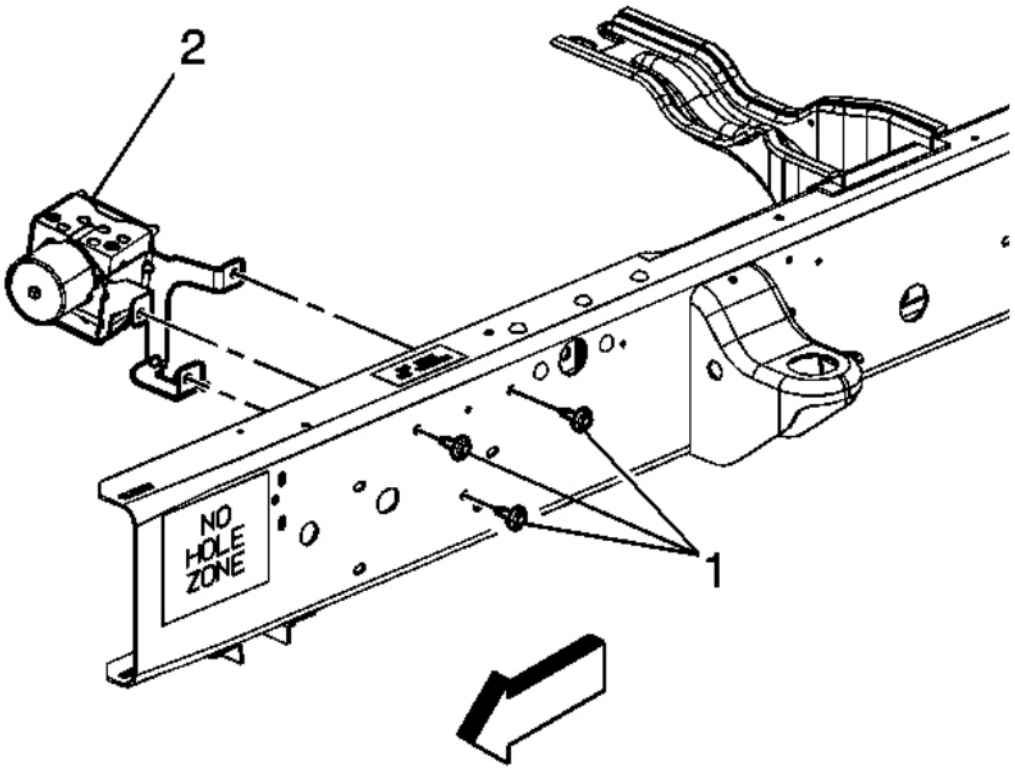


Fig. 37: View Of BPMV Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the BPMV bracket bolts (1).
11. Remove the BPMV.
12. If necessary, remove the EBCM. Refer to **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**.

IMPORTANT:

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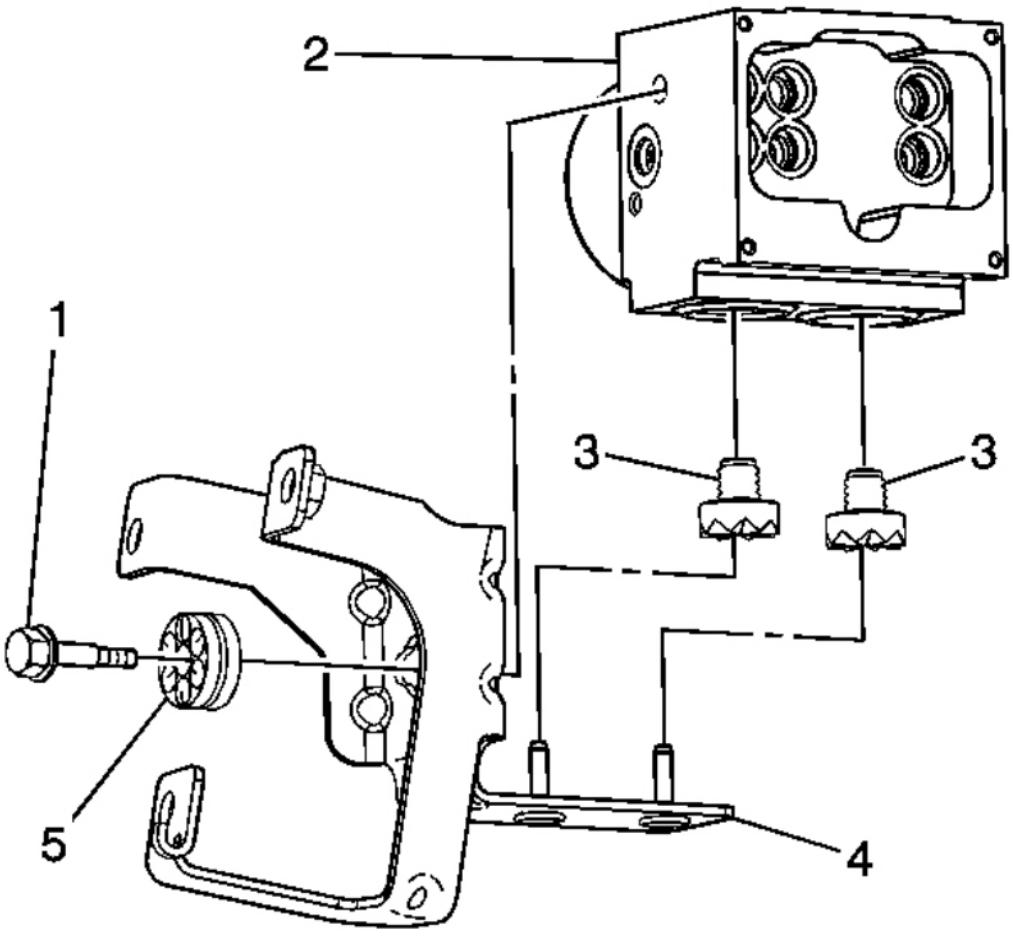


Fig. 38: View Of BPMV Bracket & Components
Courtesy of GENERAL MOTORS CORP.

13. If removing the BPMV bracket from the BPMV, remove the BPMV mounting bolt (1).
14. Lift the BPMV from the mounting bracket.
15. Remove the grommets from the BPMV and the bracket.

Installation Procedure

1. If removed, install the EBCM. Refer to **Electronic Brake Control Module Replacement (W/JL4)** or **Electronic Brake Control Module Replacement (W/O JL4)**.

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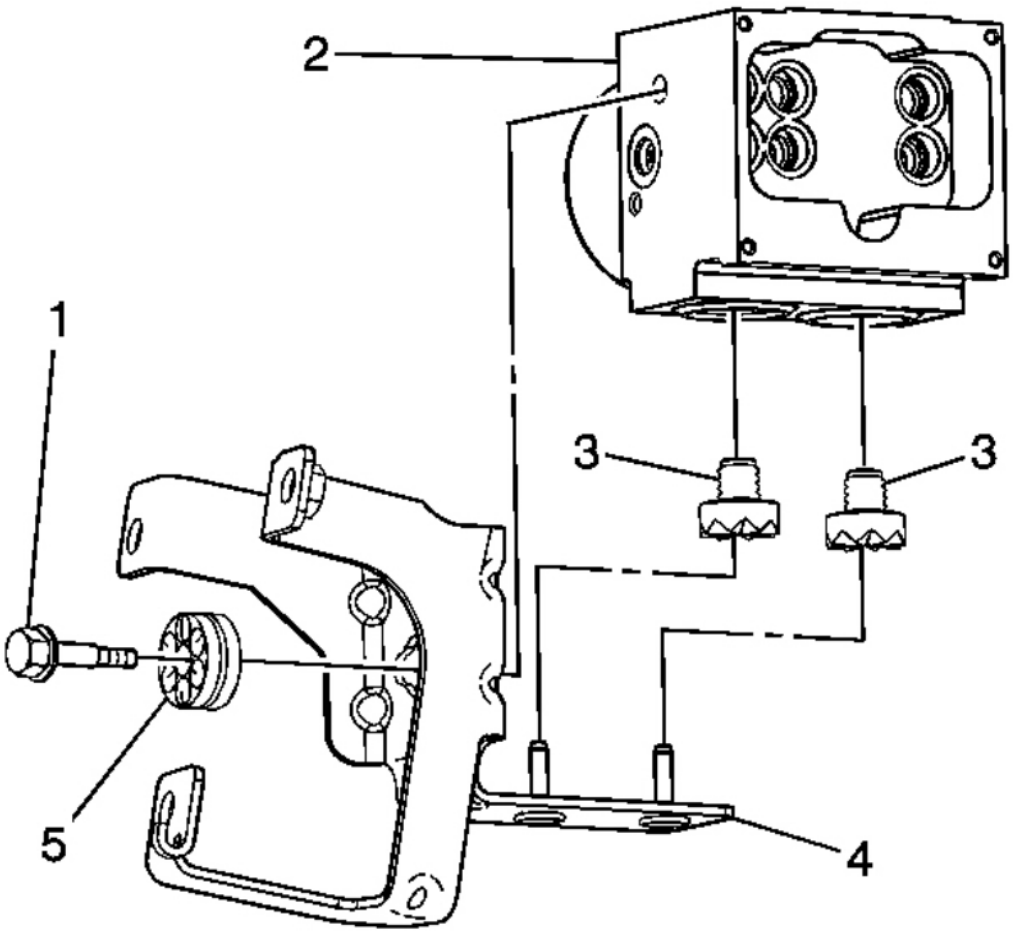


Fig. 39: View Of BPMV Bracket & Components
Courtesy of GENERAL MOTORS CORP.

2. If removed, install the bottom grommets (3) to the BPMV (2).
3. Install the side grommet (5) to the BPMV bracket.
4. Install the BPMV (2) on the mounting bracket.
5. Install the retaining bolt (1) to the BPMV (4).

NOTE: **Refer to Fastener Notice .**

Tighten: Tighten the bolt to 10 N.m (89 lb in).

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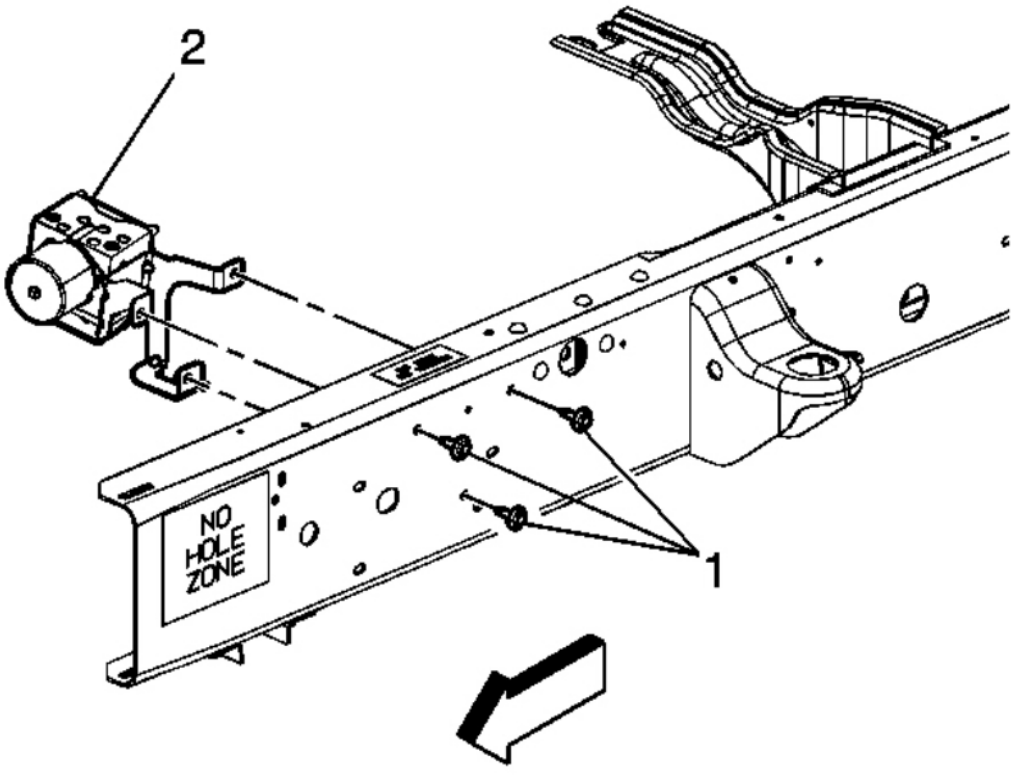


Fig. 40: View Of BPMV Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Position the BPMV (2) to the frame.
7. Install the BPMV bracket bolts (1).

Tighten: Tighten the bolts (1) to 22 N.m (16 lb ft).

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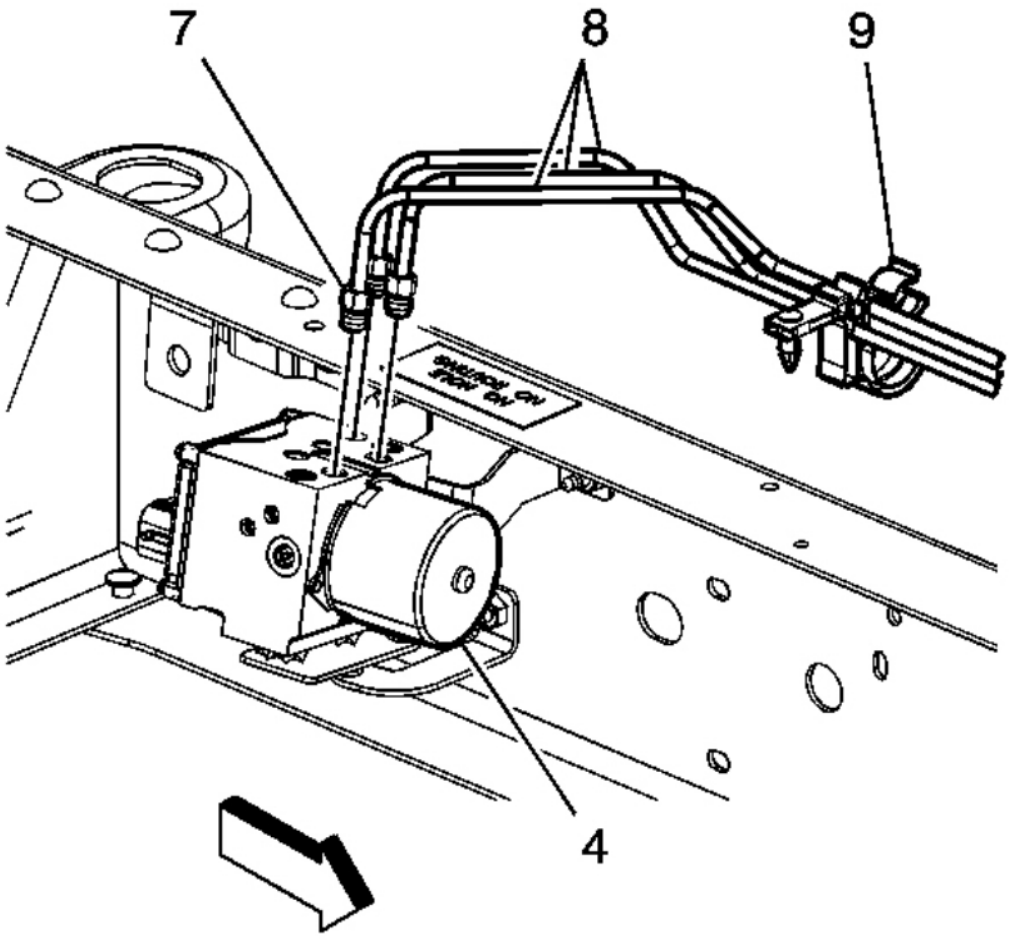


Fig. 41: View Of Front Brake Pipes, Fittings & Frame Retainer
Courtesy of GENERAL MOTORS CORP.

8. Position the brake pipes (8) to the BPMV (4) and secure the retaining clip (9).
9. Install the brake pipe fittings (7).

Tighten: Tighten the fittings to 18 N.m (13 lb ft).

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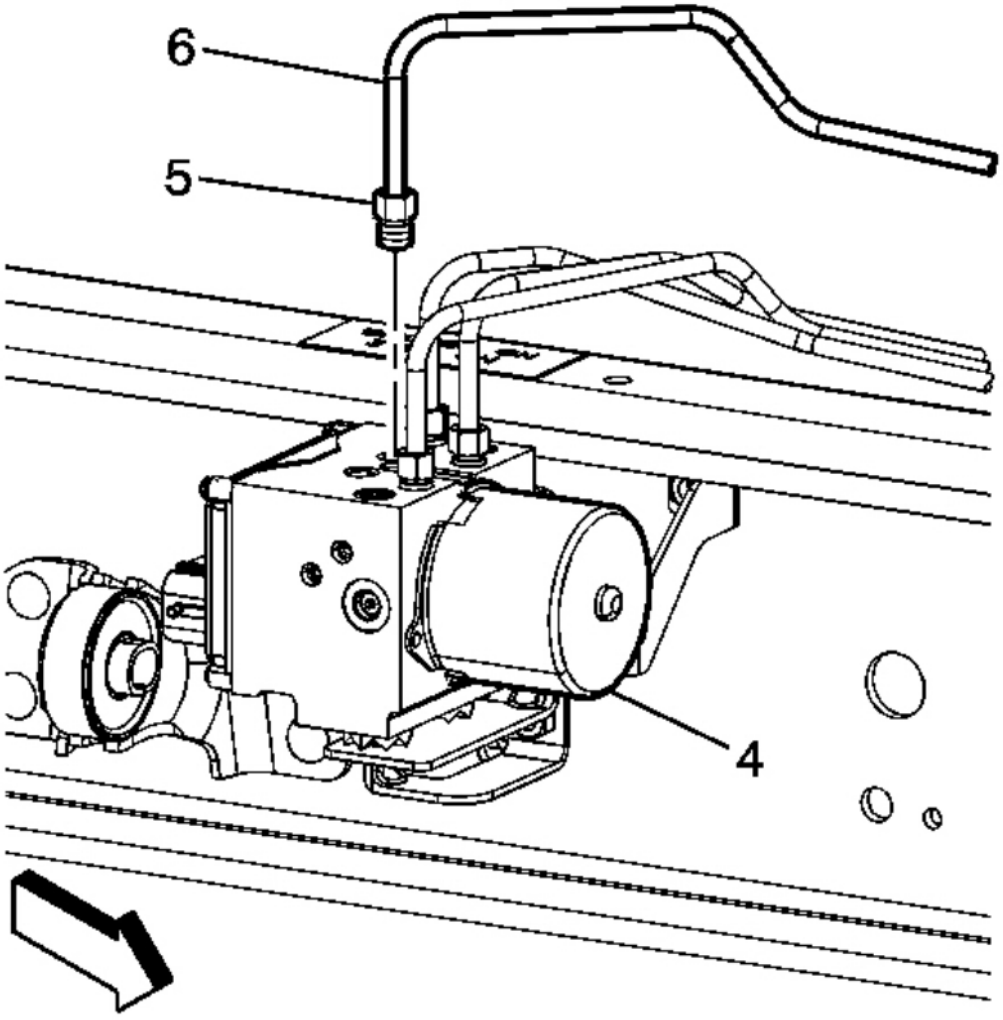


Fig. 42: View Of Front Brake Pipe Fitting & Pipe
Courtesy of GENERAL MOTORS CORP.

10. Position the front brake pipe (6) to the BPMV (4).
11. Install the brake pipe fitting (5).

Tighten: Tighten the fitting to 18 N.m (13 lb ft).

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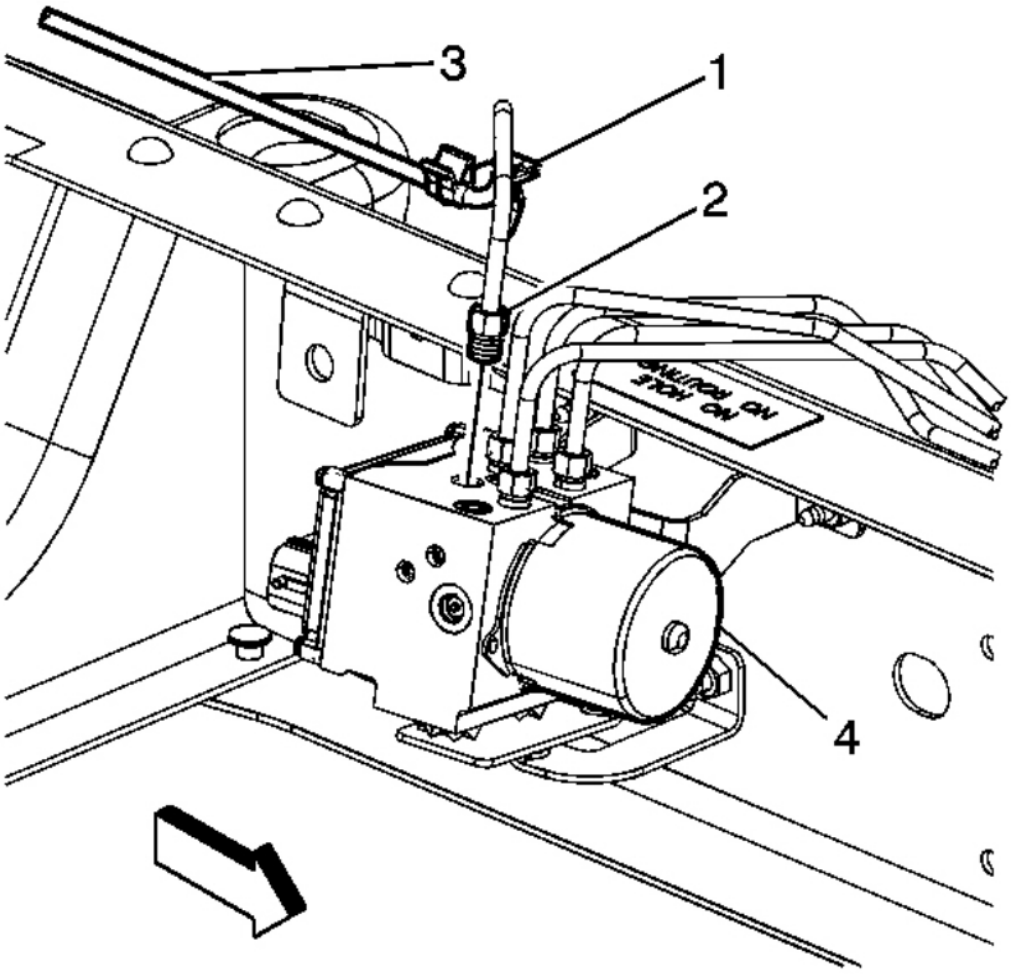


Fig. 43: View Of Rear Brake Pipe, Brake Pipe Fitting & Retaining Clip
Courtesy of GENERAL MOTORS CORP.

12. Position the rear brake pipe (3) to the BPMV (4) and secure the clip (1).
13. Install the brake pipe fitting (2).

    Tighten: Tighten the fitting to 18 N.m (13 lb ft).

14. Connect the EBCM electrical connector.
15. Bleed the BPMV. Refer to **Antilock Brake System Automated Bleed Procedure (W/JL4)** or **Antilock Brake System Automated Bleed Procedure (W/O JL4)**.

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FRONT WHEEL SPEED SENSOR REPLACEMENT

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

Removal Procedure

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 front disc brake rotor. Refer to **Front Brake Rotor Replacement (1500 Series)** or **Front Brake Rotor Replacement (2500 Series)** .

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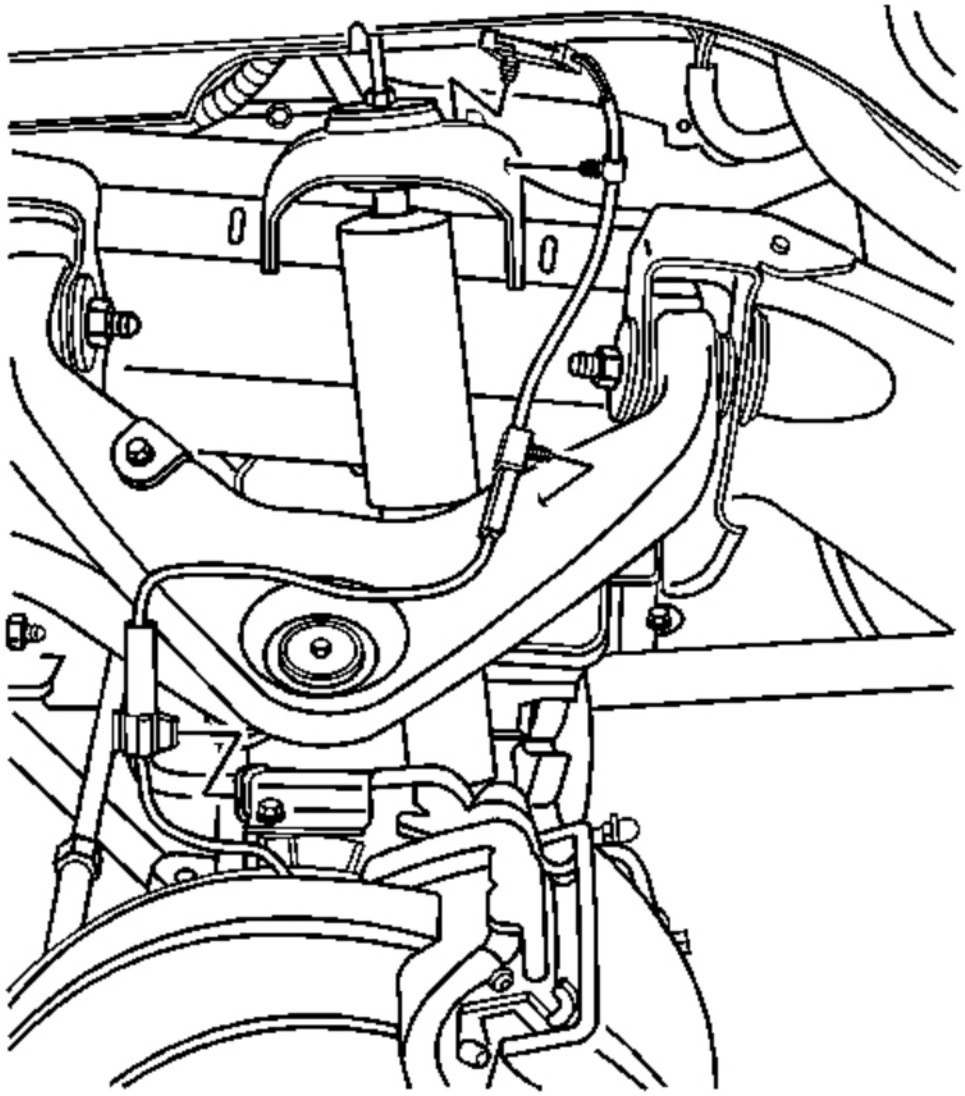


Fig. 44: View Of Wheel Speed Sensor Cable And Connectors
Courtesy of GENERAL MOTORS CORP.

4. Remove the wheel speed sensor (WSS) cable mounting clip from the steering knuckle.
5. Remove the WSS cable mounting clip from the upper control arm.
6. Remove the WSS cable mounting clip from the frame attachment point.
7. Disconnect the WSS cable electrical connector.

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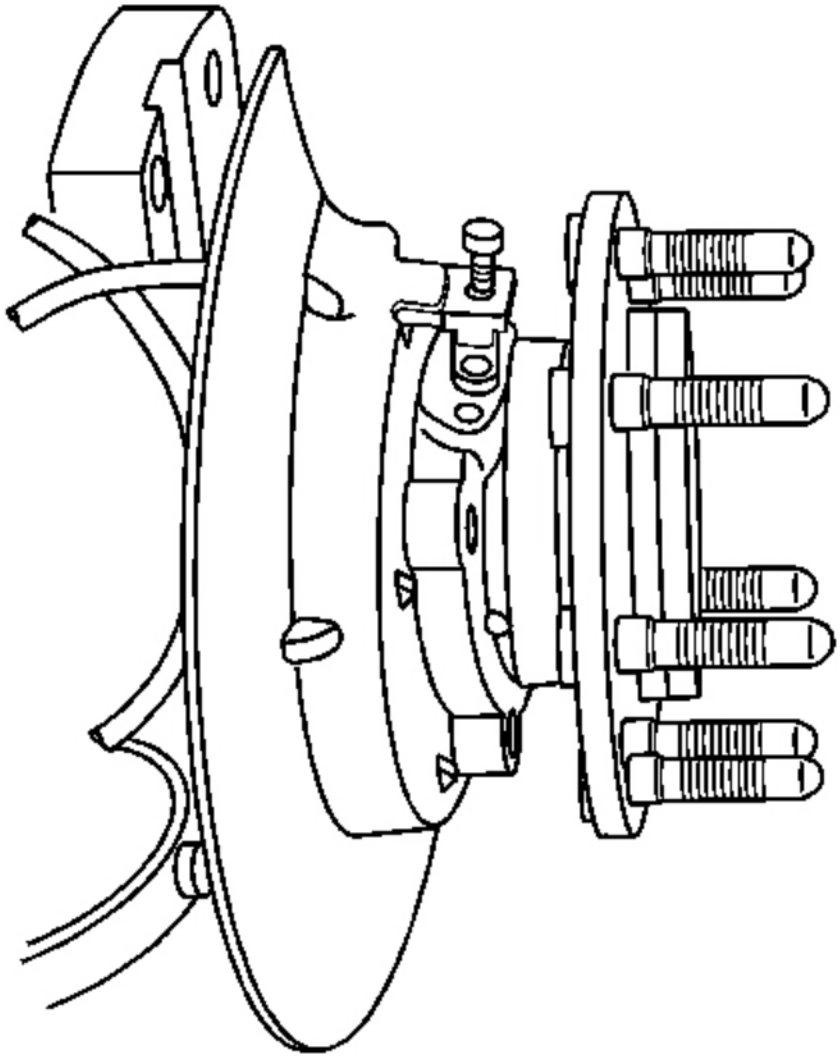


Fig. 45: View Of Wheel Speed Sensor Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the WSS mounting bolt.

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

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9. Remove the WSS from the hub/bearing assembly.

Installation Procedure

1. Plug the WSS bore to prevent debris from falling into the hub.
2. Using a wire brush or equivalent, clean the WSS mounting surface on the hub to remove any rust or corrosion.

IMPORTANT: Use the lubricant supplied in the WSS kit. Do not substitute another type of grease.

3. Apply a thin layer of lubricant to the hub surface and the WSS O-ring prior to installation.
4. Install the WSS into the hub/bearing assembly. Ensure that the WSS is seated fully against the hub.

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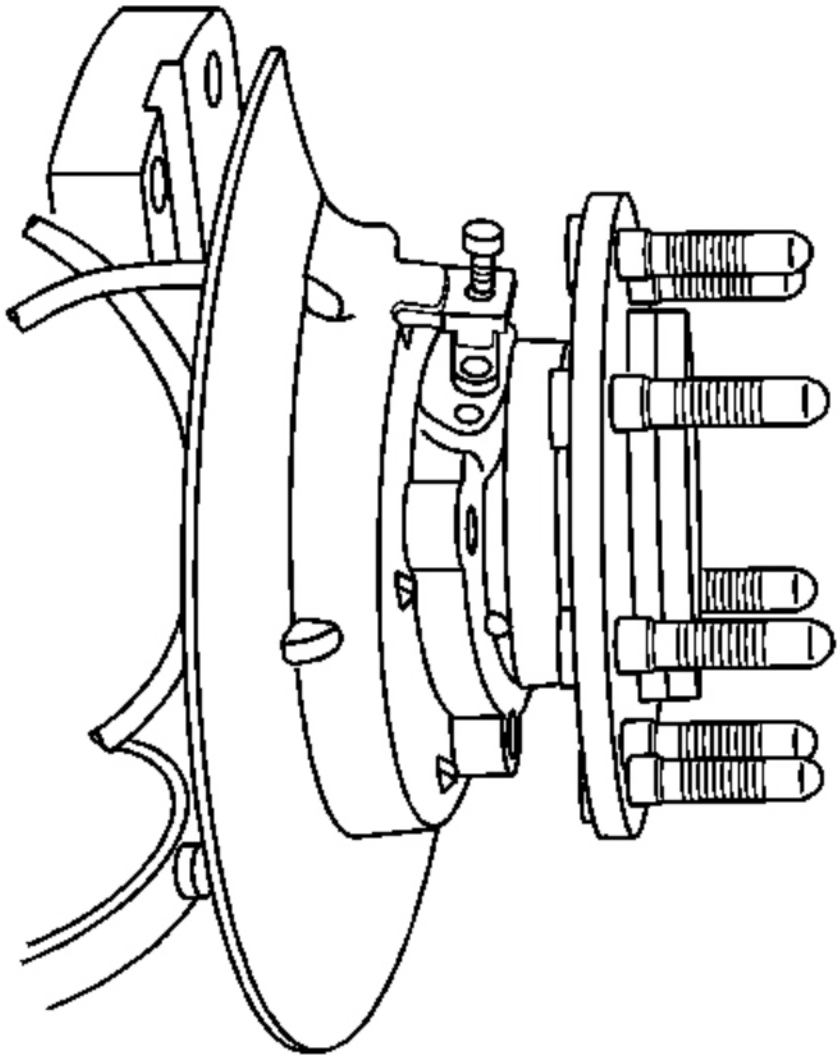


Fig. 46: View Of Wheel Speed Sensor Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

5. Install the WSS mounting bolt.

   Tighten: Tighten the WSS mounting bolt to 18 N.m (13 lb ft).

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IMPORTANT: Make sure the WSS cable is properly routed, the wire is not twisted and all clips are secure. Do not allow the wire to contact surrounding vehicle components.

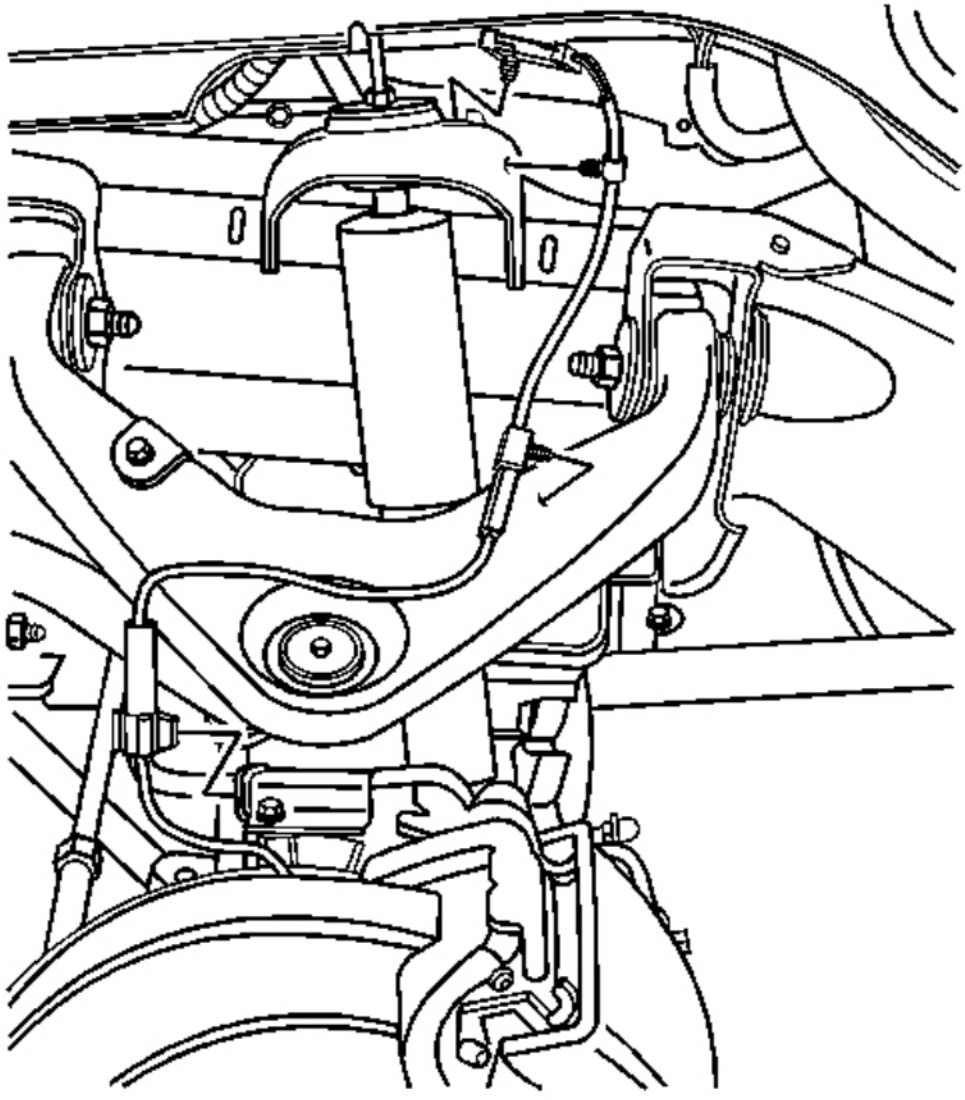


Fig. 47: View Of Wheel Speed Sensor Cable And Connectors
Courtesy of GENERAL MOTORS CORP.

6. Install the WSS cable mounting clip to the knuckle.

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7. Install the WSS cable mounting clip to the upper control arm.
8. Install the WSS cable mounting clip to the frame attachment point.
9. Connect the WSS cable electrical connector.
10. Install the front disc brake rotor. Refer to **Front Brake Rotor Replacement (1500 Series)** or **Front Brake Rotor Replacement (2500 Series)** .
11. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
12. Perform the diagnostic system check. Refer to **Diagnostic System Check - Vehicle** .

REAR WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

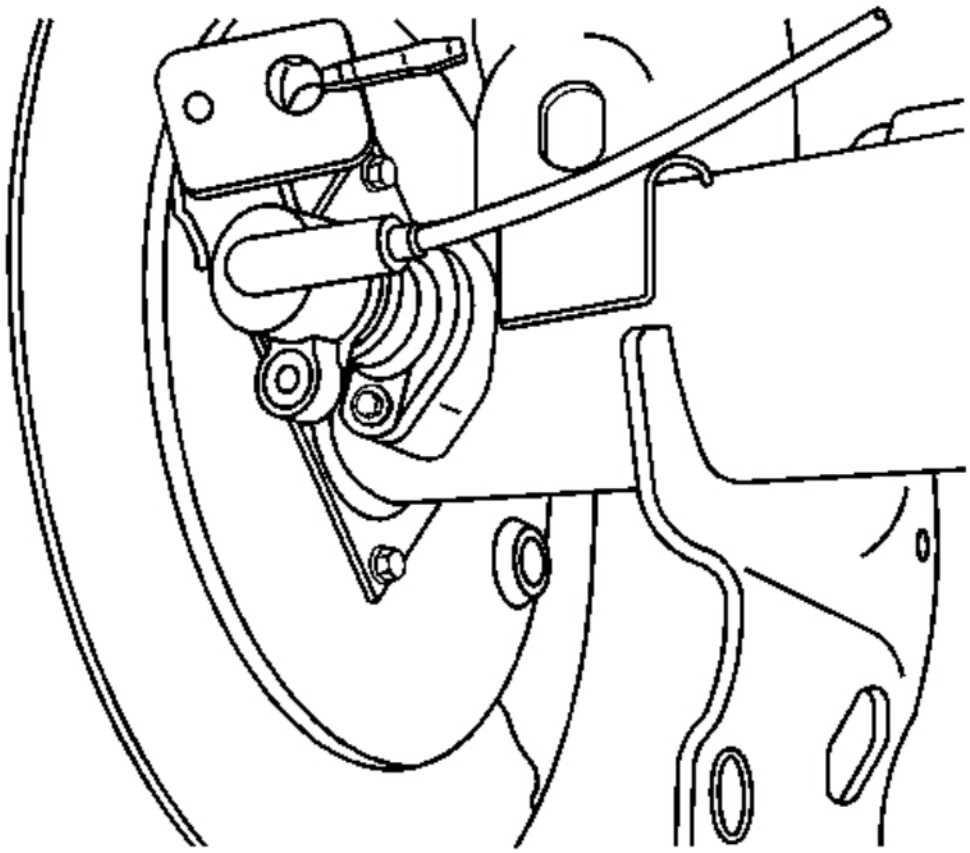


Fig. 48: View Of Rear Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

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1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Disconnect the electrical connector.
3. Remove the wheel speed sensor retaining bolt.
4. Release the wheel speed sensor wiring harness from the retainers.
5. Remove the wheel speed sensor.

Installation Procedure

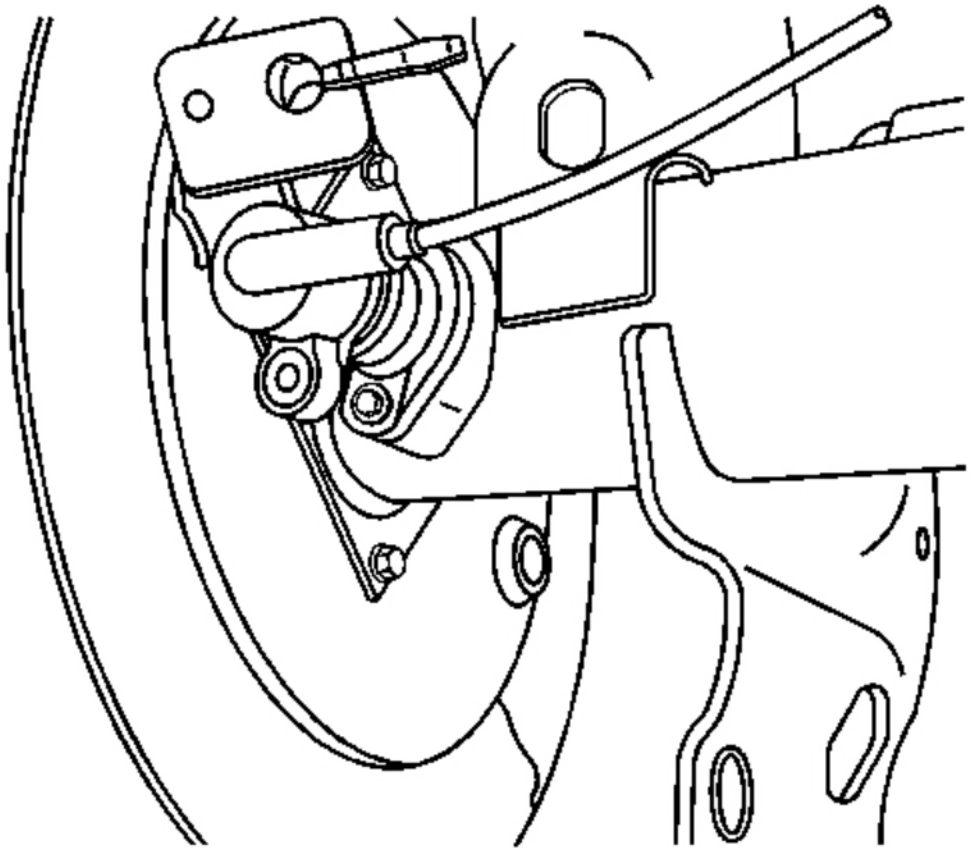


Fig. 49: View Of Rear Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

1. Using a twisting motion, install the wheel speed sensor until fully seated.

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NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the wheel speed sensor retaining bolt.

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

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

WHEEL SPEED SENSOR RING REPLACEMENT - REAR

Tools Required

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

Removal Procedure

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

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Replacement (9.5 HD Axle) in Rear Drive Axle.

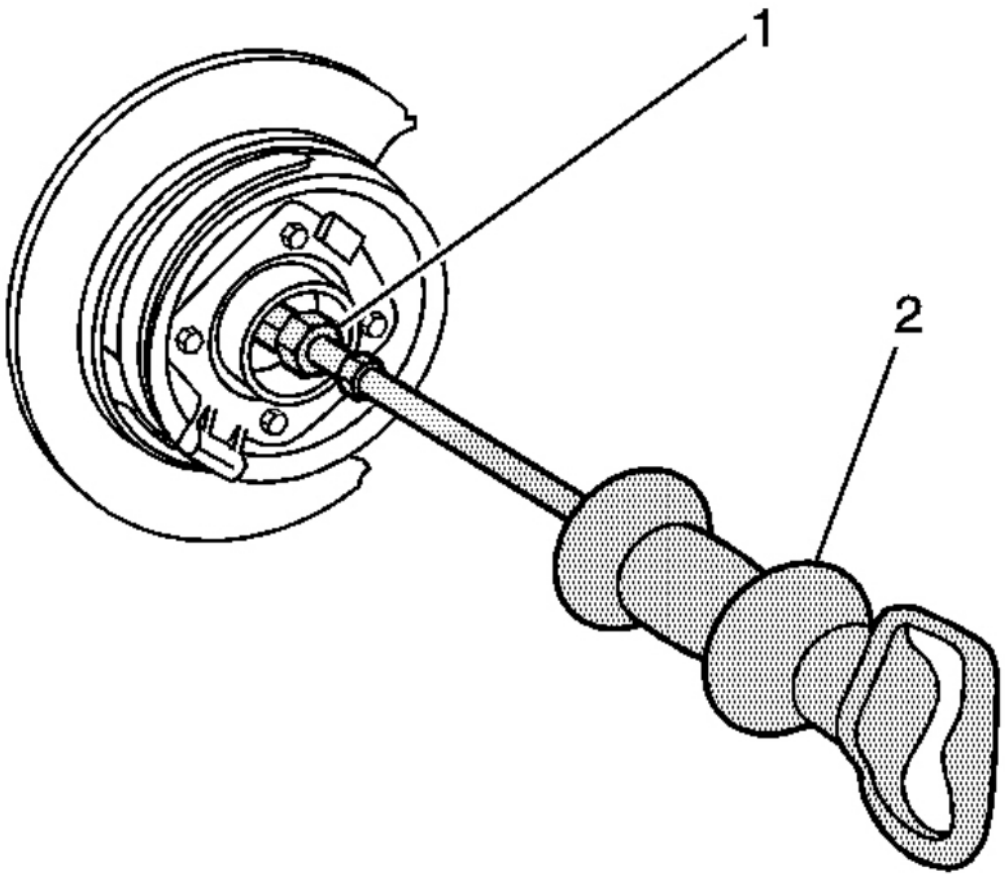


Fig. 50: Removing Axle Shaft Seal & Bearing Using J 45857 & J 2619-01
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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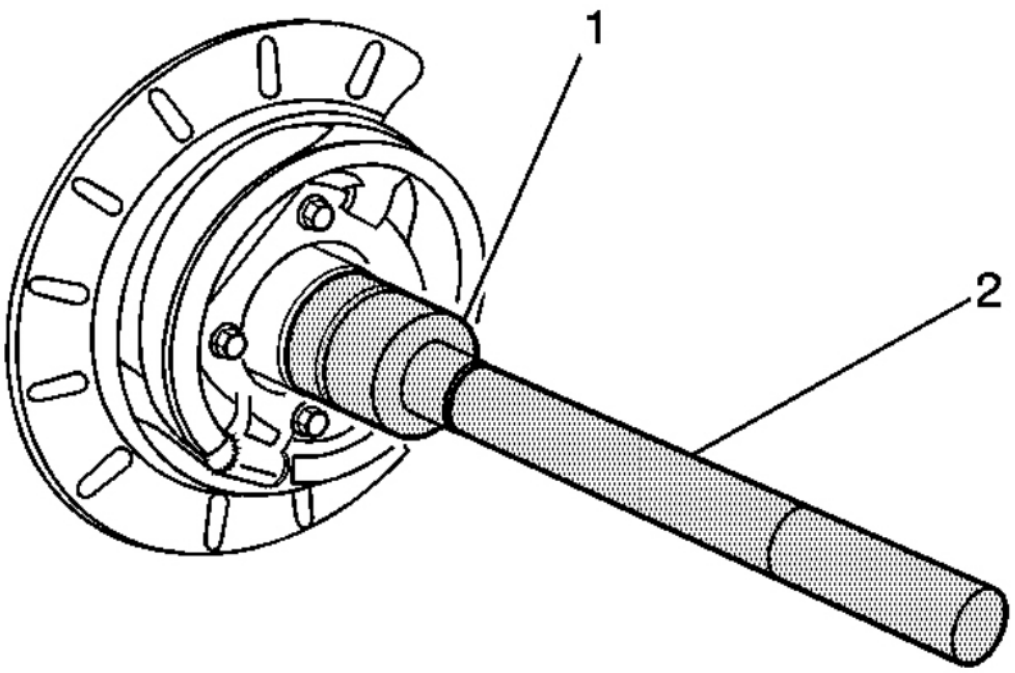


Fig. 51: Installing Wheel Speed Sensor Ring Using J 45860 & J 8092
Courtesy of GENERAL MOTORS CORP.

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

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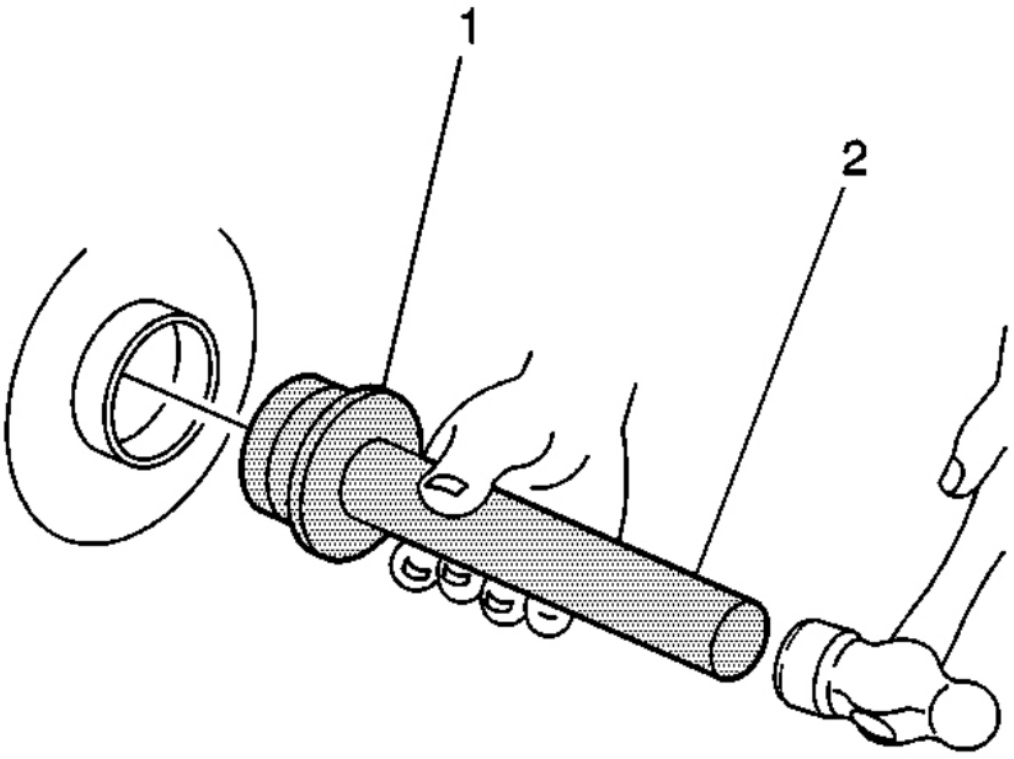


Fig. 52: Installing The Axle Shaft Bearing Using J 23690 Or J 29709 & J 8092
Courtesy of GENERAL MOTORS CORP.

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

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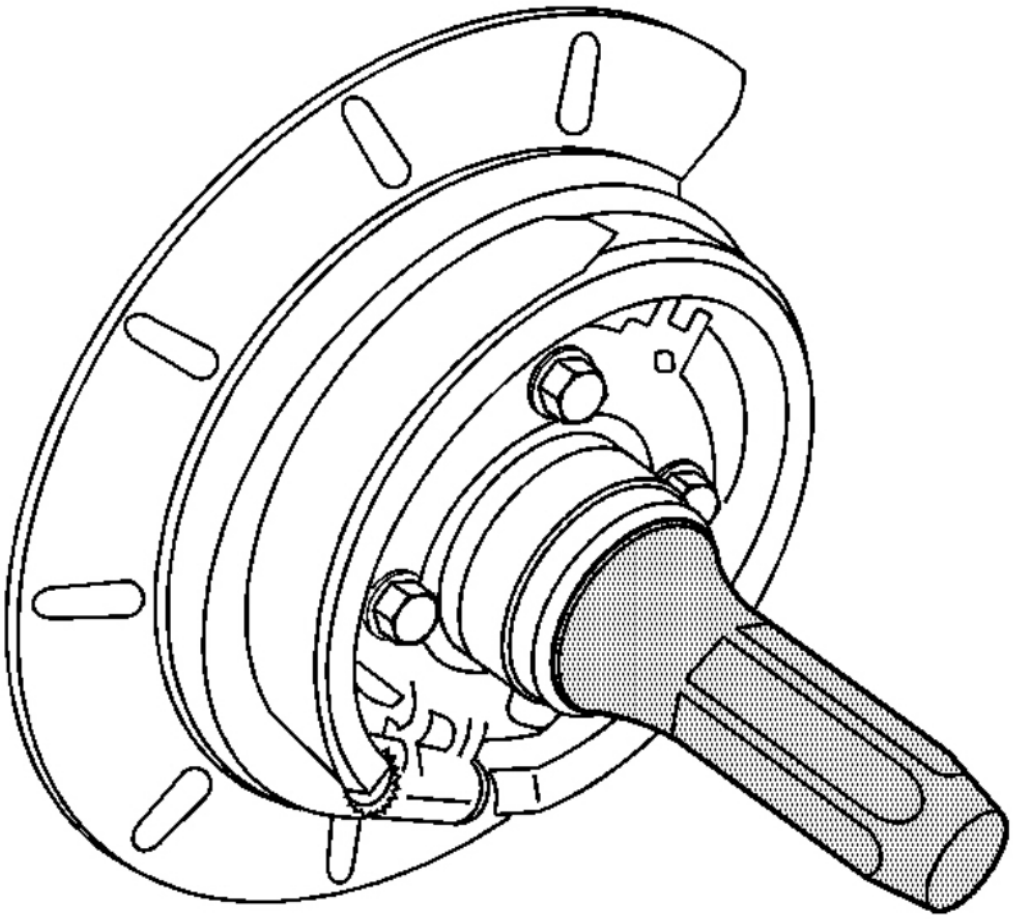


Fig. 53: Installing Axle Shaft Seal Using J 21128
Courtesy of GENERAL MOTORS CORP.

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

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Replacement - Rear Drive Axle (9.5 Inch LD Axle) or **Lubricant Replacement - Rear Drive Axle (9.5 Inch HD Axle)** in Rear Drive Axle.

12. Lower the vehicle.

TRACTION CONTROL SWITCH REPLACEMENT

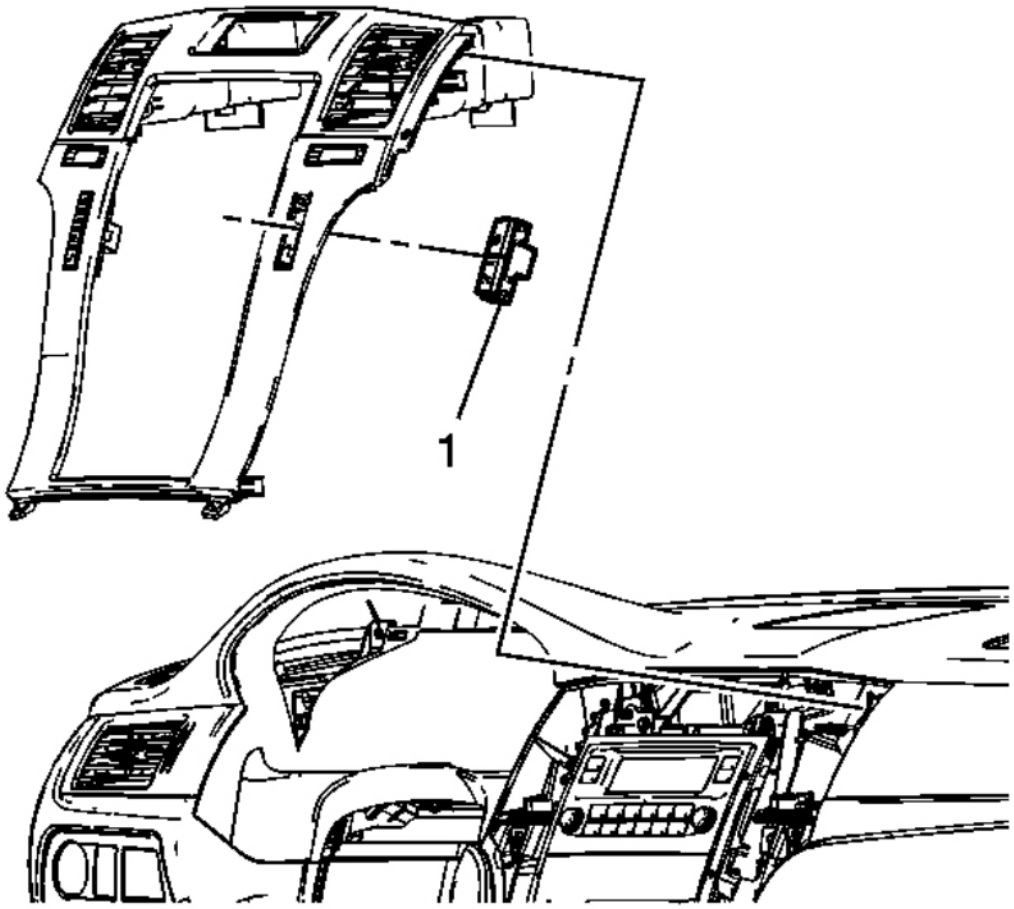


Fig. 54: View Of Traction Control Switch
Courtesy of GENERAL MOTORS CORP.

Traction Control Switch Replacement

Callout	Component Name
Preliminary Procedure: Remove the instrument panel (I/P) accessory trim panel. Refer to **Instrument Panel Accessory Trim Plate Replacement (Cadillac)** or **Instrument Panel Accessory Trim Plate Replacement (Except**	

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Cadillac) .	
1	Traction Control Switch **Tip:** • Disconnect the electrical connector. • Use a small pocket screwdriver to release the locking tabs on the switch.

YAW RATE SENSOR/LATERAL ACCELEROMETER REPLACEMENT

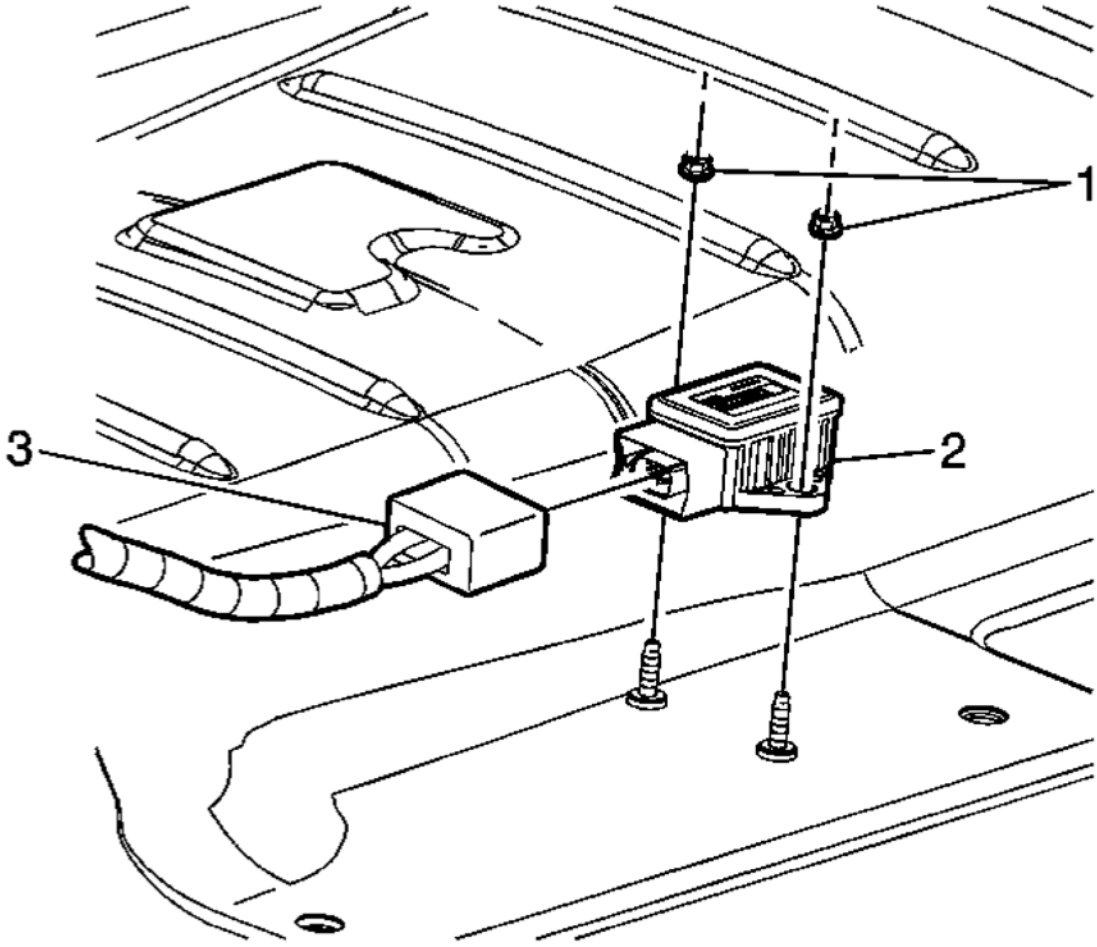


Fig. 55: View Of Yaw Sensor, Electrical Connector & Retaining Nuts
Courtesy of GENERAL MOTORS CORP.

Yaw Rate Sensor/Lateral Accelerometer Replacement

Callout	Component Name
Preliminary Procedures: Remove the passenger seat. Refer to **Front Seat Replacement - Bucket** .	
	Yaw Sensor Retaining Nuts (Qty: 2)

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1	**NOTE:** **Refer to Fastener Notice .** **Tighten:** 7 N.m (62 lb in) **Tip:** Pull back the carpet to gain access to the yaw sensor.
2	Yaw Sensor
3	Yaw Sensor Electrical Connector

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION (8600 GVW OR LESS)

This vehicle is equipped with a Bosch ABS/EBD/TCS/VSES brake system. The electronic brake control module (EBCM) and the brake pressure modulator valve (BPMV) is serviced separately. The BPMV uses a 4 circuit configuration to control hydraulic pressure to each wheel independently.

The following vehicle performance enhancement systems are provided.

- Antilock Brake System (ABS)
- Electronic Brake Distribution (EBD)
- Power Brake Booster Solenoid Vacuum Supply
- Traction Control System (TCS)
- Vehicle Stability Enhancement System (VSES)

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

- ABS pump motor-The ABS pump motor is part of the brake pressure modulator valve. The ABS pump motor is active during ABS, VSES and base brake power assist functions.
  - System relays-There are two system relays internal to the EBCM. The solenoid relay is energized when the ignition is ON. The ABS pump motor relay supplies a ground path to the ABS pump motor when the EBCM commands the ABS pump motor on. The system relays are non serviceable.
  - Solenoids-The solenoids are commanded ON and OFF by the EBCM to operate the appropriate valves in the brake pressure modulator valve (BPMV).
- Brake booster solenoid-The Power Brake Booster is solenoid operated, and applies a mechanical force to brake master cylinder push rod to aid in brake pedal effort.
- Brake booster vacuum sensor-The Brake Booster Vacuum Sensor is a input to EBCM, and operates the ABS pump motor to precharge the brake system.
- Brake pressure modulator valve (BPMV)-The BPMV uses a 4-circuit configuration to control hydraulic pressure to each wheel independently.

  The BPMV contains the following components:

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  - ABS pump motor and pump
  - Four inlet valves
  - Four outlet valves
  - Two TC isolation valves
  - Two TC supply valves
  - A master cylinder pressure sensor
  - A front low-pressure accumulator
  - A rear low-pressure accumulator
- Lateral accelerometer-The EBCM uses the lateral accelerometer to determine the sideways acceleration of the vehicle. The lateral accelerometer is packaged with the yaw rate sensor as a single component.
- Master cylinder pressure sensor-The master cylinder pressure sensor is located within the BPMV. The master cylinder pressure sensor uses a 5-volt reference and generates an output signal proportionate to the hydraulic fluid pressure which is present in the front brake circuit at the master cylinder.
- Power brake booster solenoid-Assist unit creates vacuum for the brake booster in case of a vacuum loss or low vacuum to the brake booster. The power brake booster Solenoid is active during increased brake booster assist, and base brake power assist functions.
- Steering wheel position sensor-The EBCM receives several inputs from the steering wheel position sensor. Three digital square wave signal inputs and one analog signal input are wired directly to the EBCM harness connector. The EBCM uses the signals A and B for determining position movement and uses the analog and index signals to determine absolute center. All signals are monitored for plausibility to each other. The sensor is provided ground and 5-volt power directly from the EBCM.
- Traction control switch-VSES and the engine torque reduction function of TCS are manually disabled or enabled by pressing the traction control switch.
- Wheel speed sensors (WSS)-EBCM sends a 12-volt reference 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 increases the signal frequency as the wheel speed increases, but does not increase the signal amplitude.
- Yaw rate sensor-The EBCM uses the yaw rate sensor to determine the rate of rotation along the vehicle's vertical axis. The yaw rate sensor is packaged with the lateral accelerometer as a single component.

Antilock Brake System (ABS)

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

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

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

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

Pressure Hold

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

Pressure Decrease

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

Pressure Increase

After the wheel slip is corrected, a pressure increase occurs. The EBCM increases the pressure to individual wheels during deceleration in order to reduce the speed of the wheel. The isolation valve is opened and the dump valve is closed. The increased pressure is delivered from the master cylinder.

Electronic Brake Distribution (EBD)

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

Brake Pressure Application

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

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

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Vehicle Stability Enhancement System (VSES)

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

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

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

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

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

Power-Up Self-Test

The electronic brake control module (EBCM) is able to detect many malfunctions whenever the ignition is ON. However, certain failures cannot be detected unless active diagnostic tests are performed on the components. Shorted solenoid coil or motor windings, for example, cannot be detected until the components are commanded ON by the EBCM. Therefore, a power-up self-test is required at the beginning of each ignition cycle to verify correct operation of components before the various control systems can be enabled. The EBCM performs the first phase of the power-up self-test when the ignition is first turned ON. The system relay, solenoids and the ABS pump motor are commanded ON and OFF to verify proper operation and the EBCM verifies the ability to return the system to base braking in the event of a failure. The master cylinder pressure sensor performs a self-test by sending a series of specific voltage signals to the EBCM, each for a predetermined amount of time. This phase of the power-up self-test may be heard by the driver, depending on how soon the engine is cranked and started after turning ON the ignition. The second phase of the power-up self-test begins when the vehicle is driven at a speed greater than 12 km/h (7.5 mph) and the EBCM has not detected any traction control module (TCS)/vehicle stability enhancement system (VSES) related malfunctions thus far. When the brake switch indicates that the brake is not applied and the master cylinder pressure is detected as being low, the EBCM proceeds with the test. The EBCM isolates all of the wheels by closing the 4 isolation valves. Due to the fact that all of the wheels are isolated during the second phase of the test, the test must be aborted if the brake is applied while the test is being performed. Occasionally, the driver may detect this by experiencing a momentary hard pedal.

VSES Sensors Initialization

The vehicle stability enhancement system (VSES) sensors values may vary slightly due to differences in

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

The following VSES sensors require initialization:

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

When the vehicle speed is greater than 25 km/h (15 mph), full sensor initialization must occur during 3 km (1.8 mi) of driving or 1 km (0.6 mi) of straight and stable driving, whichever occurs first. Although an attempt at initialization may fail due to driving conditions, such as driving on a very winding road, failed initialization is usually caused by a sensor bias voltage which is not within an acceptable range. Often, a DTC sets soon after a failed initialization attempt. The message center displays the stability system disabled message when sensor initialization fails.

ECE 13 Response

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

Active Vacuum Booster

The power brake booster assist unit creates mechanical force for the brake booster in case of a vacuum loss or low vacuum to the brake booster. The power brake booster system consists of:

- The sensor circuits and pressure sensor
- The check valve manifold
- The vacuum solenoid valve

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The Power Brake Booster is solenoid operated, and applies a mechanical force to brake master cylinder push rod to aid in brake pedal effort.

The Brake Booster Vacuum Sensor is a input to EBCM, and operates the ABS pump motor to precharge the brake system.

Driver Information Indicators and Messages

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

Brake Warning Indicator

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

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

ABS Indicator

The IPC illuminates the ABS indicator when the following occurs.

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

Traction Control Off Indicator

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

- The EBCM disables engine torque reduction due to a malfunction and sends a serial data message to the IPC requesting illumination.
- The driver manually disables VSES and engine torque reduction by pressing the traction control switch. The EBCM sends a serial data message to the IPC requesting illumination.

Service Brake Booster Message

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

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Stabilitrak Off Message

The message center displays the stabilitrak off message when one or more of the following conditions exists.

- The transfer case is shifted into 4 LO. The EBCM sends a serial data message to the IPC requesting illumination.
- The driver manually disables the VSES and engine torque reduction by pressing the traction control switch. The EBCM sends a serial data message to the IPC requesting illumination.
- The estimated temperature of any solenoid coil exceeds an acceptable limit. The EBCM sends a serial data message to the IPC requesting this display.
- The EBCM detects a failed brake switch. The EBCM sends a serial data message to the IPC requesting this display. A DTC sets when this condition exists.
- VSES sensor initialization time is excessive. The EBCM sends a serial data message to the IPC requesting this display.
- Serial data communication between the EBCM and any of several other control modules is interrupted. The EBCM sends a serial data message to the IPC requesting this display or the IPC displays the message when communication with the EBCM is interrupted.
- The PCM is not able to perform engine torque reduction. The EBCM sends a GMLAN message to the IPC requesting this display. DTCs set when this condition exists.
- The EBCM detects an excessively low or excessively high ignition voltage. The EBCM sends a GMLAN message to the IPC requesting this display.

Service Stabilitrak Message

The message center displays the service stability system message when any one of many VSES-disabling DTCs is set. The EBCM sends a serial data message to the IPC requesting this display.

Service Traction Control Message

The message center displays the service traction control system message when any one of many traction control - disabling DTCs is set. The EBCM sends a serial data message to the IPC requesting this display.

ABS DESCRIPTION AND OPERATION (OVER 8600 GVW)

This vehicle is equipped with an EBC 345 ABS/EBD module.

This module provides the following vehicle performance enhancement systems.

- Antilock Brake System (ABS)
- Electronic Brake Distribution (EBD)

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.

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The EBCM contains the following components.

  - System relay - The system relay is internal to the EBCM. The system relay is energized when the ignition is ON. The system relay supplies battery positive voltage to the valve solenoids and to the ABS pump motor. This voltage is referred to as system voltage.
  - Solenoids - The solenoids are commanded ON and OFF by the EBCM to operate the appropriate valves in the brake pressure modulator valve (BPMV).
- Brake pressure modulator valve (BPMV) - The BPMV uses a 3-circuit configuration to control hydraulic pressure to each front wheel independently, and to the rear wheels as a pair.

  The BPMV contains the following components.

  - ABS pump motor and pump
  - Three isolation valves
  - Three dump valves
  - A front low-pressure accumulator
  - A rear low-pressure accumulator
- Wheel speed sensors (WSS)-EBCM sends a 5-volt reference voltage signal to each front wheel speed sensor. As the wheel spins, the wheel speed sensor produces a square wave DC signal voltage. The wheel speed sensor increases the signal frequency as the wheel speed increases, but does not increase the signal amplitude.

Antilock Brake System (ABS) Operation

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

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

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

Pressure Hold

The EBCM closes the isolation valve and keeps the dump valve closed in order to isolate the slipping wheel

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when wheel slip occurs. This holds the pressure steady on the brake so that the hydraulic pressure does not increase or decrease.

Pressure Decrease

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

Pressure Increase

After the wheel slip is corrected, a pressure increase occurs. The EBCM increases the pressure to individual wheels during deceleration in order to reduce the speed of the wheel. The isolation valve is opened and the dump valve is closed. The increased pressure is delivered from the master cylinder.

Electronic Brake Distribution (EBD) Operation

The electronic brake distribution (EBD) is a control system that replaces the hydraulic proportioning function of the mechanical proportioning valve in the base brake system. The EBD control system is part of the operation software in the electronic brake control module (EBCM). The EBD uses active control with existing antilock brake system (ABS) in order to regulate the vehicle rear brake pressure.

Power-up Self-Test

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

ECE 13 Response

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

Driver Information Indicators and Messages

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

Brake Warning Indicator

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

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

ABS Indicator

The IPC illuminates the ABS indicator when the following occurs.

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

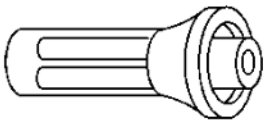
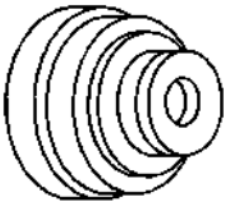
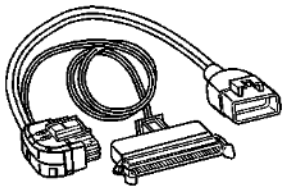
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

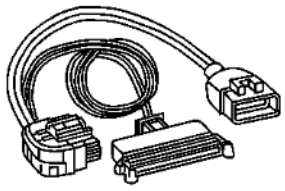
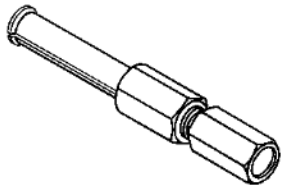
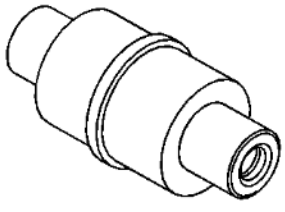
Special Tools

Illustration	Tool Number/ Description
	J 8092 Driver Handle

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	J 21128 Axle Pinion Oil Seal Installer
	J 23690 Bearing Installer
	J 2619-01 Slide Hammer
	J 39700 100-Pin Breakout Box
	J 39700-325 Breakout Box Adapter

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	J 39700-650 Adapter Cable
	J 45857 Tone Wheel and/or Bearing Remover
	J 45860 Tone Ring Installer

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