

2004 BRAKES

Anti-Lock Brake System - Vue

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Pipe Fittings at the Brake Pressure Modulator Valve (BPMV)	18 N.m	13 lb ft
Brake Pressure Modulator Assembly Bracket Mounting Bolts	10 N.m	89 lb in
Brake Pressure Modulator Assembly Bracket Mounting Nut	10 N.m	89 lb in
Brake Pressure Modulator Assembly Insulator Nuts	10 N.m	89 lb in
Electronic Brake Control Module (EBCM) to Brake Pressure Modulator Valve (BPMV) Retaining Bolts	3 N.m	27 lb in

SCHEMATIC AND ROUTING DIAGRAMS

ABS SCHEMATIC ICONS

ABS Schematic Icons

Icon	Icon Definition
	<p>IMPORTANT:</p> <p>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.</p> <p>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 :</p> <ul style="list-style-type: none">• The wires must be twisted a minimum of 10 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)



ABS SCHEMATICS

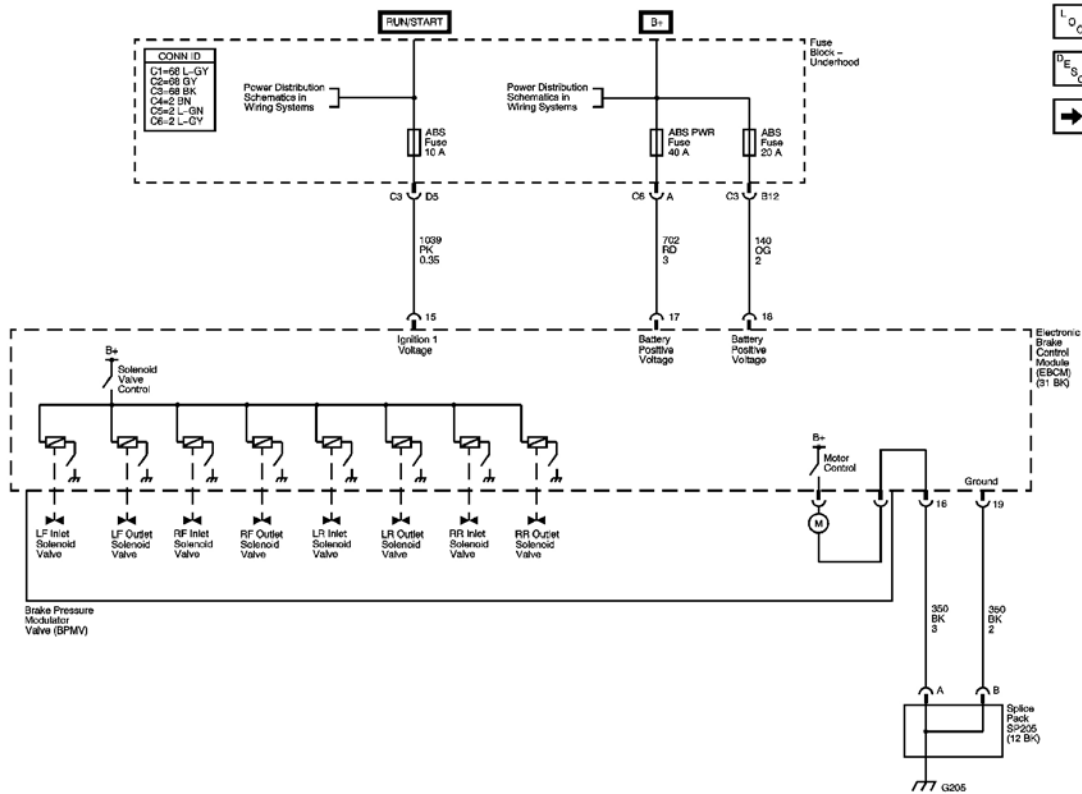


Fig. 1: View Of EBCM Power and Ground Schematic
 Courtesy of GENERAL MOTORS CORP.

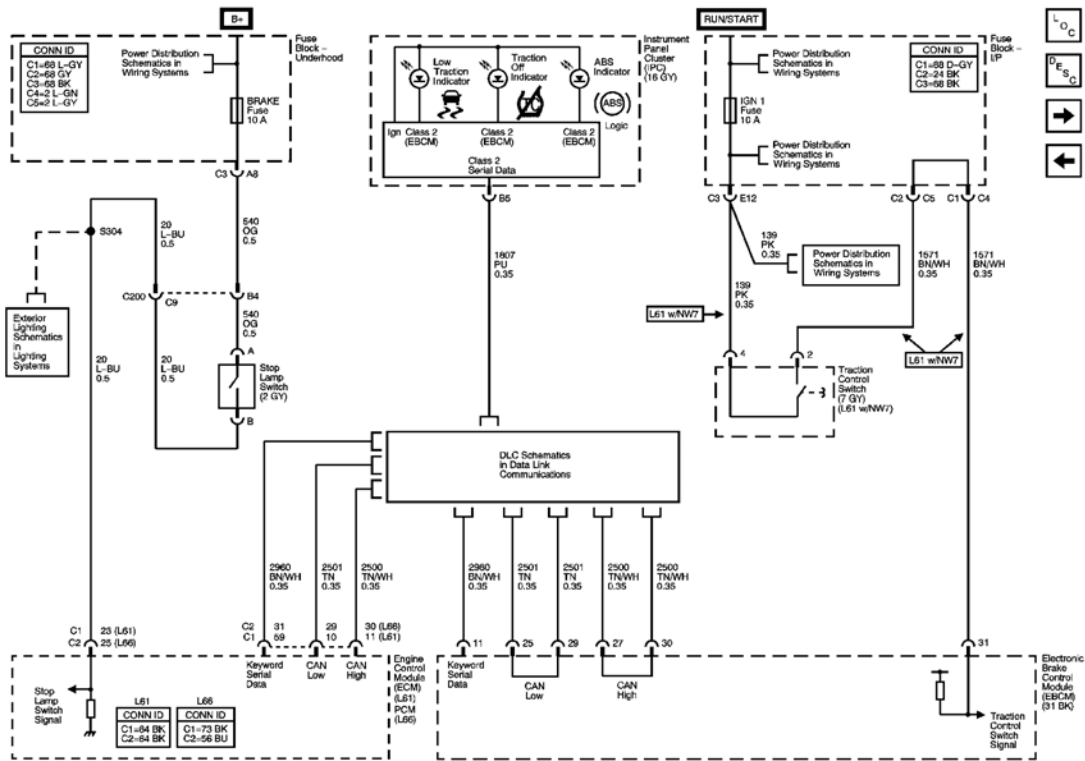


Fig. 2: View Of Indicators and TC Switch Schematic
 Courtesy of GENERAL MOTORS CORP.

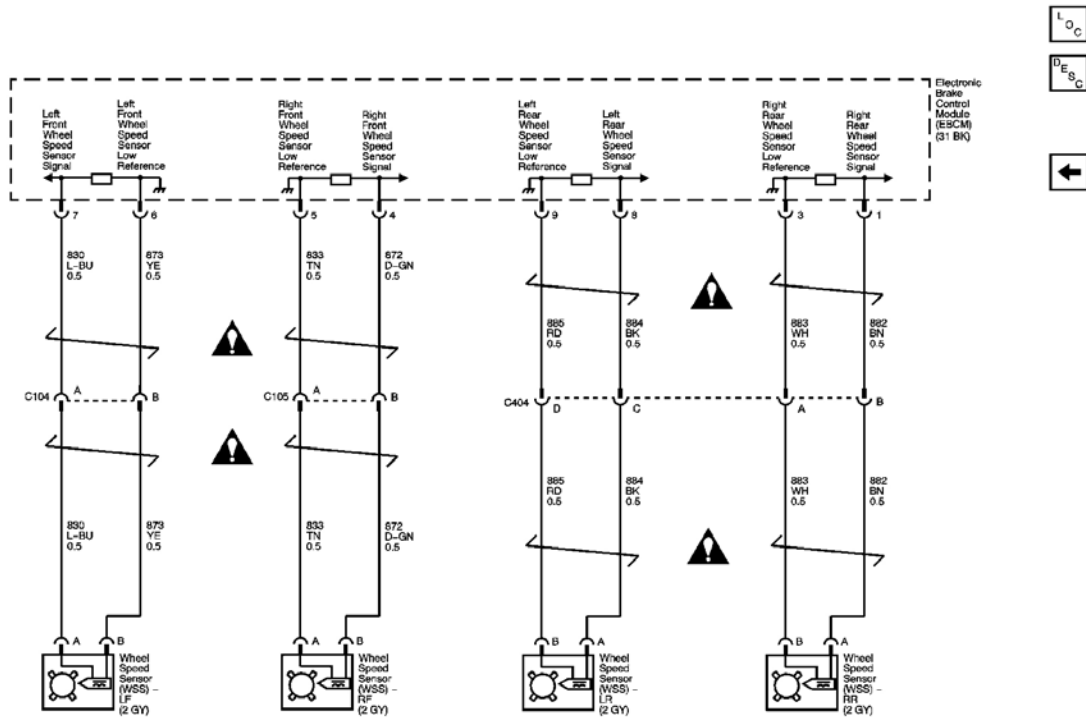


Fig. 3: View Of Wheel Speed Sensors Schematic
 Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

ABS COMPONENT VIEWS

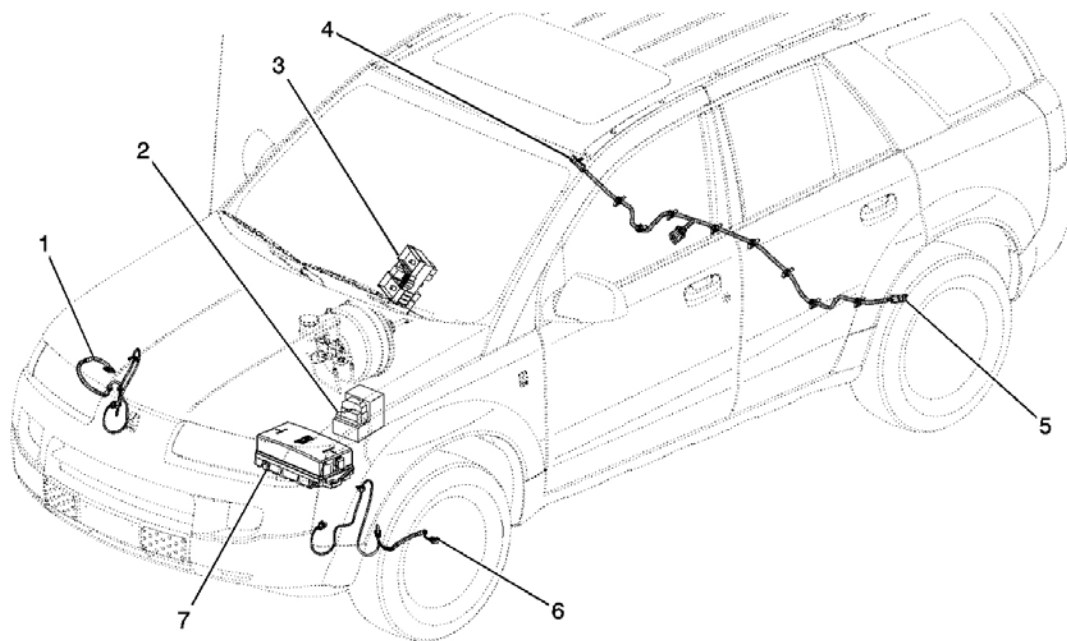


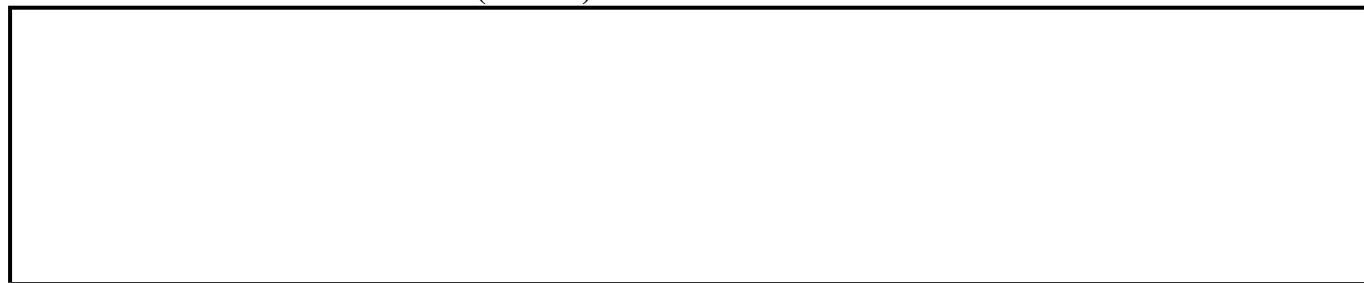
Fig. 4: ABS Component View
 Courtesy of GENERAL MOTORS CORP.

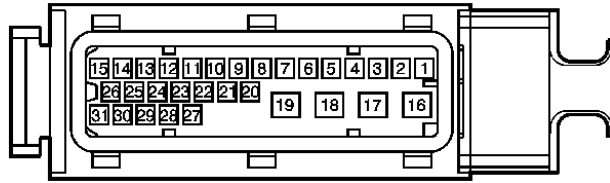
Callouts For Fig. 4 Component View

Callout	Component Name
1	Wheel Speed Sensor (WSS) - RF
2	Electronic Brake Control Module (EBCM)
3	Fuse Block - I/P
4	Wheel Speed Sensor (WSS) - RR
5	Wheel Speed Sensor (WSS) - LR
6	Wheel Speed Sensor (WSS) - LF
7	Fuse Block - Underhood

ABS CONNECTOR END VIEWS

Electronic Brake Control Module (EBCM) Connector End View





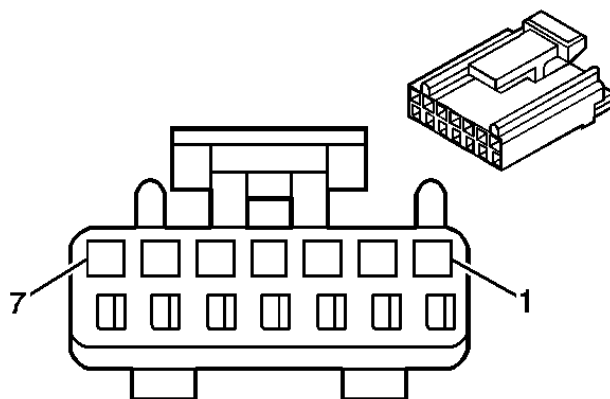
Connector Part Information

- 1928403008
- 31-Way F (BK)

Pin	Wire Color	Circuit Number	Function
1	BN	882	RR WSS Signal
2	-	-	Not Used
3	WH	883	RR WSS Low Reference
4	D-GN	872	RF WSS Signal
5	TN	833	RF WSS Low Reference
6	YE	873	LF WSS Low Reference
7	L-BU	830	LF WSS Signal
8	BK	884	LR WSS Signal
9	RD	885	LR WSS Low Reference
10	-	-	Not Used
11	WH/BK	5043	Keyword Serial Data
12-14	-	-	Not Used
15	PK	1039	Ignition 1 Voltage
16	BK	350	Ground
17	RD	702	Battery Positive Voltage
18	OG	140	Battery Positive Voltage
19	BK	350	Ground
20-24	-	-	Not Used
25	TN	2501	CAN Low
26	-	-	Not Used
27	TN/WH	2500	CAN High
28	-	-	Not Used
29	TN	2501	CAN Low
30	TN/WH	2500	CAN High
31	BN/WH	1571	Traction Control Switch Signal (NW9)

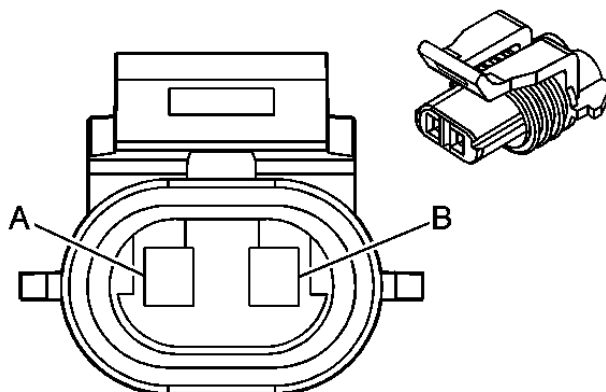
Traction Control Switch (NW9) Connector End View





Connector Part Information		<ul style="list-style-type: none"> • 12065872 • 7-Way F Micro-Pack 100 Series (GY) 	
Pin	Wire Color	Circuit Number	Function
1	-	-	Not Used
2	BN/WH	1571	Traction Control Switch Signal
3	-	-	Not Used
4	PK	139	Ignition 1 Voltage
5	BK	550	Ground
6	GY	8	I/P Lamps Supply Voltage
7	-	-	Not Used

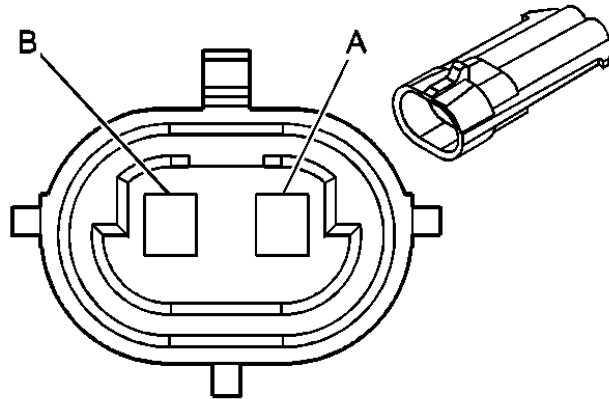
Wheel Speed Sensor (WSS) - LF Connector End View



Connector Part Information		<ul style="list-style-type: none"> • 12052644 	
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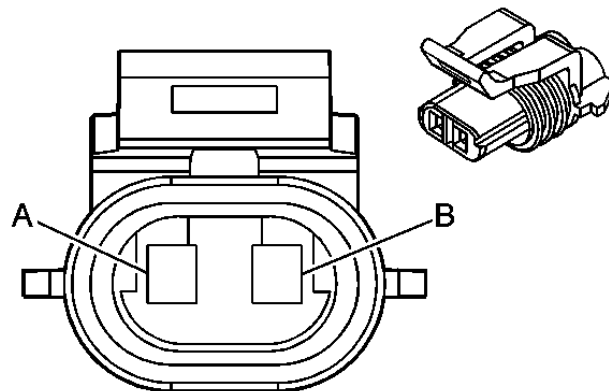
• 2-Way F Metri-Pack 150 Series (GY)			
Pin	Wire Color	Circuit Number	Function
A	L-BU	830	LF WSS Signal
B	YE	873	LF WSS Low Reference

Wheel Speed Sensor (WSS) - LR Connector End View



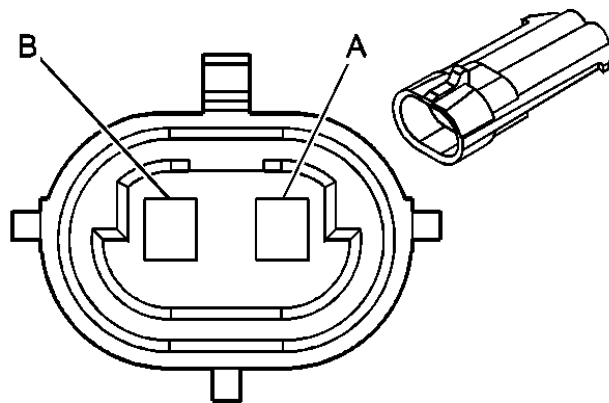
Connector Part Information		• 12162343 • 2-Way M Metri-Pack 150 Series (GY)	
Pin	Wire Color	Circuit Number	Function
A	BK	884	LR WSS Signal
B	RD	885	LR WSS Low Reference

Wheel Speed Sensor (WSS) - RF Connector End View



Connector Part Information		<ul style="list-style-type: none"> • 12052644 • 2-Way F Metri-Pack 150 Series (GY) 	
Pin	Wire Color	Circuit Number	Function
A	TN	833	RF WSS Low Reference
B	D-GN	872	RF WSS Signal

Wheel Speed Sensor (WSS) - RR Connector End View



Connector Part Information		<ul style="list-style-type: none"> • 12162343 • 2-Way M Metri-Pack 150 Series (GY) 	
Pin	Wire Color	Circuit Number	Function
A	BN	882	RR WSS Signal
B	WH	883	RR WSS Low Reference

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - ANTI-LOCK BRAKE SYSTEM

Begin the system diagnosis with **Diagnostic System Check - ABS** . 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.

DIAGNOSTIC SYSTEM CHECK - ABS

Circuit Description

The anti-lock brake system (ABS) Diagnostic System Check is an organized approach to identify problems associated with the electronic brake control module (EBCM). This check must be the starting point for any EBCM complaint, and will direct you to the next logical step in diagnosing the complaint. The EBCM is a very reliable component and is not likely the cause of the malfunction. Most system complaints are linked to faulty wiring, connectors, and occasionally to components. Understanding the ABS system and using the tables correctly will reduce diagnostic time and prevent unnecessary parts replacement.

Diagnostic System Check - ABS

Step	Action	Yes	No
1	Install a scan tool. Does the scan tool power up?	Go to Step 2	Go to <u>Scan Tool Does Not Power Up</u> in Data Link Communications
2	1. Turn ON the ignition, with the engine OFF. 2. Attempt to establish communication with the following control modules: <ul style="list-style-type: none">• Body control module (BCM)• Electronic brake control module (EBCM)• Instrument panel module (IPC)• Powertrain control module (PCM) Does the scan tool communicate with all control modules?	Go to Step 3	Go to <u>Scan Tool Does Not Communicate with Class 2 Device</u> in Data Link Communications
3	Select the display DTCs function on the scan tool for the following control modules: <ul style="list-style-type: none">• Body control module (BCM)• Electronic brake control module (EBCM)• Instrument panel module (IPC)• Powertrain control module (PCM)		

	Does the scan tool display any DTCs?	Go to Step 4	Go to Symptoms - Anti-lock Brake System
4	Does the scan tool display any DTCs which begin with a "U" ?	Go to Scan Tool Does Not Communicate with Class 2 Device in Data Link Communications	Go to Step 5
5	Does the scan tool display any DTCs which begin with a "B"?	Go to Diagnostic Trouble Code (DTC) List in Body Control System	Go to Step 6
6	Does the scan tool display any DTCs which begin with a "P"?	Go to Diagnostic Trouble Code (DTC) List in Engine Electrical	Go to Diagnostic Trouble Code (DTC) List

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
Automated Bleed Procedure	-	Used in order to bleed the ABS hydraulics. Refer to ABS Automated Bleed Procedure .
ABS Telltale Indicator	-	Commands the ABS indicator ON and OFF
LF Inlet Valve Solenoid	-	Commands the solenoid ON and OFF
LF Outlet Valve Solenoid	-	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
LR Inlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF
LR Outlet Valve Solenoid	Solenoid Test	Commands the solenoid ON and OFF
RR Inlet Valve Solenoid	-	Commands the solenoid ON and OFF
RR Outlet Valve Solenoid	-	Commands the solenoid ON and OFF

SCAN TOOL DATA LIST

The electronic brake control module (EBCM) Scan Tool Data Lists contain all the anti-lock brake system related parameters that are available on the scan tool. The parameters in the list are arranged in alphabetical order. The column, "Data List," indicates the location of the parameter within the scan tool menu selections.

Use the EBCM Scan Tool Data Lists as directed by a diagnostic table or in order to supplement the diagnostic procedures. Begin all the diagnostic procedures with the anti-lock brake system (ABS) Diagnostic Starting Point. Use the EBCM Scan Tool Data Lists only after the following is determined:

- There is no published DTC procedure nor published symptom procedure for the customer concern.

OR

- The DTC or symptom diagnostic procedure indicated by the diagnostic system check does not resolve the customer concern.

The Typical Data Values are obtained from a properly operating vehicle under the conditions specified in the first row of the Scan Tool Data List table. Comparison of the parameter values from the suspect vehicle with the Typical Data Values may reveal the source of the customer concern.

The ID Information menu is located on the EBCM main screen.

EBCM Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition is ON, engine OFF, and vehicle is stationary			
Battery Voltage	ABS	Volts	11.5 Volts
Brake Switch	ABS	Applied/Released	Released
Left Front Wheel Speed	ABS/TCS	km/h or mph	0
Left Rear Wheel Speed	ABS/TCS	km/h or mph	0
LF Inlet Valve Solenoid	ABS	Active/Inactive	Inactive
LF Outlet Valve Solenoid	ABS	Active/Inactive	Inactive
LR Inlet Valve Solenoid	ABS	Active/Inactive	Inactive
LR Outlet Valve Solenoid	ABS	Active/Inactive	Inactive
LF Valve Solenoid	TCS	Apply/Released	Released
LR Valve Solenoid	TCS	Apply/Released	Released
Pump Motor Relay Command	ABS/TCS	On/Off	Off
Pump Motor Relay Feedback	ABS/TCS	On/Off	Off
RF Inlet Valve Solenoid	ABS	Active/Inactive	Inactive
RF Outlet Valve Solenoid	ABS	Active/Inactive	Inactive
RR Inlet Valve Solenoid	ABS	Active/Inactive	Inactive
RR Outlet Valve Solenoid	ABS	Active/Inactive	Inactive
Right Front Wheel Speed	ABS/TCS	km/h or mph	0
Right Rear Wheel Speed	ABS/TCS	km/h or mph	0
RF Valve Solenoid	TCS	Apply/Released	Released
RR Valve Solenoid	TCS	Apply/Released	Released
Traction Switch	BCM	On/Off	On
Traction Switch LED	BCM	On/Off	On
Valve Relay	ABS/TCS	On/Off	On

SCAN TOOL DATA DEFINITIONS

Data Display/Definitions

The Scan Tool Data Display/Definitions contains a brief description of all the anti-lock brake system (ABS), traction control system (TCS), and vehicle stability enhancement system (VSES) data parameters. The menus available depend on the number and type of system on the vehicle and are listed below in alphanumeric order.

- ABS DATA
- TCS DATA

Battery Voltage

The scan tool displays 0-17 Volts. The scan tool displays the level of ignition voltage at the electronic brake control module (EBCM).

Brake Switch

The scan tool will display Applied or Released depending on the state of the brake switch.

LF Inlet Valve Solenoid Inactive

The scan tool will display Active or Inactive. The scan tool displays the commanded state of the LF inlet solenoid valve.

LF Outlet Valve Solenoid Inactive

The scan tool will display Active or Inactive. The scan tool displays the commanded state of the LF outlet solenoid valve.

Left Front Wheel Speed

The scan tool displays 0-255 km/h (0-158 mph). The scan tool displays the actual speed of the left front wheel.

LF Valve Solenoids

The scan tool will display Apply or Released. The scan tool displays the commanded state of the LF solenoid valve.

Left Rear Wheel Speed

The scan tool displays 0-255 km/h (0-158 mph). The scan tool displays the actual speed of the left rear wheel.

LR Inlet Valve Solenoid Inactive

The scan tool displays Active or Inactive. The scan tool displays the commanded state of the LR inlet solenoid valve.

LR Outlet Valve Solenoid Inactive

The scan tool displays Active or Inactive. The scan tool displays the commanded state of the LR outlet solenoid valve.

LR Valve Solenoids

The scan tool will display Apply or Released. The scan tool displays the commanded state of the LR solenoid valve.

Pump Motor Relay Command

The scan tool displays On or Off. The scan tool displays the commanded state of the pump motor relay.

Pump Motor Relay Feedback

The scan tool displays On or Off. The scan tool displays the feed back state of the pump motor relay.

RF Inlet Valve Solenoid Inactive

The scan tool displays Active or Inactive. The scan tool displays the commanded state of the RF inlet solenoid valve.

RF Outlet Valve Solenoid Inactive

The scan tool displays Active or Inactive. The scan tool displays the commanded state of the RF outlet solenoid valve.

Right Front Wheel Speed

The scan tool displays 0-255 km/h (0-158 mph). The scan tool displays the actual speed of the right front wheel.

RF Valve Solenoids

The scan tool will display Apply or Released. The scan tool displays the commanded state of the RF solenoid valve.

RR Inlet Valve Solenoid Inactive

The scan tool displays Active or Inactive - The scan tool displays the commanded state of the RR inlet

solenoid valve.

RR Outlet Valve Solenoid Inactive

The scan tool displays Active or Inactive - The scan tool displays the commanded state of the RR outlet solenoid valve.

Right Rear Wheel Speed

The scan tool displays 0-255 km/h (0-158 mph). The scan tool displays the actual speed of the right rear wheel.

RR Valve Solenoids

The scan tool will display Apply or Released. The scan tool displays the commanded state of the RR solenoid valve.

Traction Switch

The scan tool displays Pressed or Released. The scan tool will display the state of the Traction Control Switch.

Traction Switch LED

The scan tool will display On or Off depending on the state of the switch (LED) indicator.

Valve Relay

The scan tool will display On/Off depending on the state of the relay.

Valve Relay State

The scan tool will display On/Off depending on the state of the relay.

DIAGNOSTIC TROUBLE CODE (DTC) LIST

Diagnostic Trouble Code (DTC) List

DTC	Description	Modules
<u>DTC B0005</u>	PCM Discrete Input Speed Signal Error	BCM
<u>DTC C0035</u>	Left Front Wheel Speed Circuit Malfunction	EBCM
<u>DTC C0036</u>	LF Wheel Speed Circuit Range/Performance	EBCM
<u>DTC C0040</u>	Right Front Wheel Speed Circuit Malfunction	EBCM
<u>DTC C0041</u>	Right Front Wheel Speed Sensor Circuit Range / Performance (EBCM)	EBCM
<u>DTC C0045</u>	Left Rear Wheel Speed Circuit Malfunction	EBCM

<u>DTC C0046</u>	Left Rear Wheel Speed Sensor Circuit Range/Performance (EBCM)	EBCM
<u>DTC C0050</u>	Right Rear Wheel Speed Circuit Malfunction	EBCM
<u>DTC C0051</u>	LF Wheel Speed Sensor Circuit Range/Performance (EBCM)	EBCM
<u>DTC C0060</u>	Left Front ABS Solenoid #1 Circuit Malfunction	EBCM
<u>DTC C0065</u>	Left Front ABS Solenoid #2 Circuit Malfunction	EBCM
<u>DTC C0070</u>	Right Front ABS Solenoid #1 Circuit Malfunction	EBCM
<u>DTC C0075</u>	Right Front ABS Solenoid #2 Circuit Malfunction	EBCM
<u>DTC C0080</u>	Left Rear ABS Solenoid #1 Circuit Malfunction	EBCM
<u>DTC C0085</u>	Left Rear ABS Solenoid #2 Circuit Malfunction	EBCM
<u>DTC C0090</u>	Right Rear ABS Solenoid #1 Circuit Malfunction	EBCM
<u>DTC C0095</u>	Right Rear ABS Solenoid #2 Circuit Malfunction	EBCM
<u>DTC C0110</u>	Pump Motor Circuit Malfunction	EBCM
<u>DTC C0121</u>	Valve Relay Circuit Malfunction	EBCM
<u>DTC C0161</u>	ABS/TCS Brake Switch Circuit Malfunction	EBCM
<u>DTC C0236</u>	Rear Wheel Speed Signal Circuit Missing	EBCM
<u>DTC C0241</u>	EBCM Control Valve Circuit	EBCM
<u>DTC C0245</u>	Wheel Speed Sensor Frequency Error	EBCM
<u>DTC C0267</u>	Pump Motor Circuit Open/Shorted	BCM
<u>DTC C0550</u>	ECU Malfunction - internal write / checksum malfunction	EBCM
<u>DTC C0896</u>	Electronic Suspension Control (ESC) voltage is outside the normal range of 9 to 15.5 volts	EBCM
<u>DTC U2100</u>	CAN-Bus Communication Malfunction	BCM, EBCM
<u>DTC U2102 or U2103</u>	More Controllers on Bus than Programmed	BCM, EBCM, TCM
<u>DTC U2102 or U2103</u>	Fewer Controllers On Bus Than Programmed	BCM, EBCM, TCM
<u>DTC U2105 To U2199</u>	Class 2 Communication Malfunction	BCM, EBCM, ECM

DIAGNOSTIC TEST DRIVE

When servicing vehicles, the vehicle anti-lock brake system (ABS) and traction control system (TCS), test drives will be necessary to allow all tests to be run, and all system functions to be enabled and exercised. A test drive may also be required to duplicate specific DTCs covered in this section. The diagnostic system check (including test drive) should be run when vehicle repairs are complete in order to verify the repair.

The diagnostic test drive will vary for ABS/TCS problems.

1. Read the Diagnostic Aids and the Conditions for Setting the DTC.
2. Reconnect any previously disconnected components.
3. Start the engine.
4. Drive the vehicle under the following conditions for at least 10 minutes. At no times should any unlawful

or unsafe maneuvers be performed.

- Highway driving.
- Rough roads.
- Verify customer concern and duplicate driving conditions.
- With the engine still running use the scan tool and check for any DTCs. If any DTCs are set, perform the appropriate DTC table.

INITIALIZATION SEQUENCE

The electronic brake control module (ECBM) performs the initialization test once each ignition cycle, when the vehicle speed reaches 15 km/h (9 mph). The initialization sequence cycles each valve solenoid and the pump motor, as well as the necessary relays, to check component operation. If any error is detected, the ECBM will set a DTC. The initialization sequence may be heard and felt while it is taking place, and is considered part of normal operation.

ENHANCED DIAGNOSTICS

History Data

Enhanced diagnostic information is found in the history data function of the scan tool. Enhanced diagnostic information provides the service technician with specific malfunction occurrence information.

The scan tool will display the last 3 DTCs to occur, one at a time. The DTC with the most recent occurrence will be displayed first. Each DTC will include the following:

- The number of drive cycles since the DTC last occurred.
- The number of occurrences for the DTC since the scan tool DTC information was last cleared.

The most recent DTC will also display various data parameters with values from the time of the DTC occurrence.

Diagnostic Strategy

In difficult diagnostic situations use the above information to identify malfunction occurrence trends. Ask question such as the following:

- Did the malfunction only occur once over a large number of drive cycles, indicating an unusual condition present when it occurred?
- Does the malfunction occur infrequently over a large number of drive cycles, indicating that special diagnostic techniques may be required to identify the source of the malfunction?

A malfunction that occurs more frequently increases the odds of finding the cause of the malfunction.

Use the information in order to determine if a DTC is intermittent. Use the information in order to determine if the DTC has not set for long periods of time due to weather changes or a repair prior to this visit.

DTC C0035-C0051

Circuit Description

The wheel speed sensor produces an alternating current signal whose amplitude and frequency vary, depending on the velocity of the wheel. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed.

Conditions for Running the DTC

C0035, C0040, C0045, C0050

The ignition is ON.

C0036, C0041, C0046, C0051

- Vehicle speed is over 40 km/h (25 mph).
- The brake pedal is not pressed.
- The anti-lock brake system (ABS) is not active.

Conditions for Setting the DTC

C0035, C0040, C0045, C0050

One of the following conditions exists for 0.02 seconds:

- The DTC will set if one wheel equals 0 while the other wheel speeds are greater than 40 km/h (25 mph).
- A short to voltage exists in the wheel speed sensor (WSS) in one of the WSS circuits.
- An open exists in the wheel speed sensor signal circuit.
- A short to ground - The wheel speed sensor signal circuit is shorted to ground.

C0036, C0041, C0046, C0051

All of the following conditions exists for 0.02 seconds:

- The DTC will set if one wheel speed is less than 2.75 km/h (1.7 mph), and the other WSS are greater than 40 km/h (25 mph).
- The brake pedal is not pressed.
- DTC C0035, C0040, C0045, and C0050 is not set.
- The DTC will set if there is interference on the wheel speed circuits for 20 seconds with the brake pedal applied or 5 seconds when the brake pedal is not applied.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS and traction control system (TCS) for the duration of the ignition cycle.
- A DTC malfunction will set.
- The ABS telltale turns ON.
- The traction control switch light emitting diode (LED) will turn OFF.

Conditions for Clearing the DTC

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

Diagnostic Aids

C0035, C0040, C0045, C0050

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 354 ml (12 oz) 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. If the DTC returns, replace the suspected wheel speed sensor or repair the wheel speed sensor wiring.
4. Rinse the area thoroughly when completed.

C0036, C0041, C0046, C0051

A possible cause of this DTC is electrical noise on the wheel speed sensor harness wiring. Electrical noise could result from the wheel speed sensor wires being routed to close to high energy ignition system components, such as spark plug wires.

Test Description

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

3: This step tests the wheel speed sensor for the proper resistance value.

4: This step ensures that the wheel speed sensor generates the proper voltage.

DTC C0035-C0051 Circuit

Step	Action	Value(s)	Yes	No
Schematic Reference: <u>ABS Schematics</u>				

Connector End View Reference: ABS Connector End Views

1	Did you perform the anti-lock brake system (ABS) Diagnostic System Check?	-	Go to Step 2	Go to Diagnostic System Check - ABS
2	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Turn ON the ignition. 3. Set up the scan tool snap shot feature to trigger for this DTC. 4. Drive the vehicle at a speed greater than the specified value. <p>Does the scan tool indicate that this wheel speed DTC set?</p>	64 km/h (40 mph)	Go to Step 3	Go to Diagnostic Aids
3	<ol style="list-style-type: none"> 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information. 2. Disconnect the wheel speed sensor connector. 3. Measure the resistance across the wheel speed sensor. <p>Does the resistance measure within the specified range?</p>	800-1700 ohm	Go to Step 4	Go to Step 8
4	<ol style="list-style-type: none"> 1. Spin the wheel. 2. Measure the AC voltage across the wheel speed sensor. <p>Does the AC voltage measure greater than the specified value?</p>	100 mV	Go to Step 5	Go to Step 8
5	<p>Inspect for poor connections at the harness connector of the wheel speed sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	-	Go to Step 10	Go to Step 6
6	<ol style="list-style-type: none"> 1. Disconnect the electronic brake control module (EBCM) harness connector. 2. Connect the digital multimeter (DMM) between the sensor signal and the low reference circuit of the EBCM connector. 3. Test the wheel speed sensor circuits for the following: <ul style="list-style-type: none"> • An open • A short to ground • A short to voltage • Shorted together <p>Refer to Testing for Intermittent Conditions and Poor Connections and Wiring Repairs in Wiring Systems. Did you find and correct the condition?</p>	-	Go to Step 10	Go to Step 7

7	Inspect for poor connections at the harness connector for the EBCM. Refer Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 10	Go to Step 9
8	Replace the wheel speed sensor. Refer to Wheel Bearing/Hub Replacement - Front in Front Suspension and Wheel Bearing/Hub Replacement - Rear in Rear Suspension. Did you complete the replacement?	-	Go to Step 10	-
9	Replace the EBCM. Refer to Electronic Brake Control Module Replacement . Did you complete the repair?	-	Go to Step 10	-
10	<ol style="list-style-type: none"> 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. <p>Does the DTC reset?</p>	-	Go to Step 2	System OK

DTC C0060-C0095

Circuit Description

The inlet and outlet valve solenoid circuits are supplied with battery power when the ignition is in the ON position. The electronic brake control module (EBCM) controls the valve functions by grounding the circuit when necessary.

Conditions for Running the DTC

The DTC can set anytime the ignition switch is in the ON position.

Conditions for Setting the DTC

The DTC will set when the EBCM detects one of the following internal to the EBCM only:

- An open in the solenoid coil or circuit
- A short to ground in the solenoid coil or circuit
- A short to voltage in the solenoid coil or circuit

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the anti-lock brake system (ABS), traction control system (TCS), and dynamic rear proportion (DRP) for the duration of the ignition cycle.
- A malfunction DTC will set.
- The ABS telltale turns ON.

Conditions for Clearing the DTC

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

Diagnostic Aids

The solenoid valve circuit and the solenoid coil are internal to the EBCM. No part of the solenoid circuit is diagnosable external to the EBCM. The DTC sets when there is a malfunction in the solenoid circuit internal to the EBCM only.

Test Description

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

2: This step determines if the DTC is current.

DTC C0060-C0095 Circuit

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>ABS Connector End Views</u>			
1	Did you perform the Diagnostic System Check?	Go to Step 2	Go to Diagnostic System Check - ABS
2	<ol style="list-style-type: none">1. Using a scan tool clear the DTC.2. Remove the scan tool from the data link connector.3. Carefully drive the vehicle above 15 km/h (9 mph) for several minutes.4. Turn the ignition switch to the OFF position.5. Install a scan tool.6. Turn the ignition switch to the ON position, engine off.7. Using the scan tool in Diagnostic Trouble Codes, retrieve current DTCs. <p>Did any one of the DTCs C0060-C0095 reset as a current DTC?</p>	Go to Step 3	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems
3	Replace the EBCM. Refer to Electronic Brake Control Module Replacement . Is the repair complete?	Go to Step 4	-

4	<ol style="list-style-type: none"> 1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specification in the supporting text. 	Go to Step 2	System OK
Does the DTC reset?			

DTC C0110

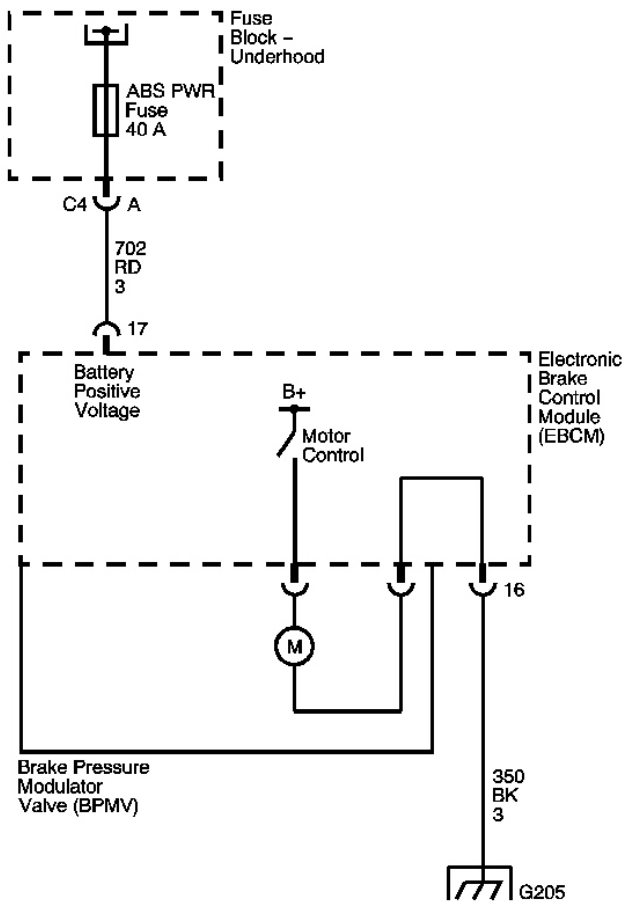


Fig. 5: DTC C0110 Circuit
 Courtesy of GENERAL MOTORS CORP.

Circuit 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 anti-lock brake system (ABS) or traction control system (TCS) operation is required, the EBCM activates the pump motor relay and battery power 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

- Pump motor voltage is not present 100 milliseconds after activation of the pump motor relay.
- Pump motor voltage is present for more than 1 seconds with no activation of the pump motor relay with in 5 seconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS, TCS, and dynamic rear proportion (DRP) for the duration of the ignition cycle.
- A malfunction DTC will set.
- The ABS telltale turns ON.

Conditions for Clearing the DTC

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

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness

- The following conditions may cause an intermittent malfunction:
 - A poor connection
 - Rubbed-through wire insulation
 - A broken wire inside the insulation
- If an intermittent malfunction exists refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

Test Description

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

3: This step tests the pump motor circuits of the BPMV for a short to the housing of the BPMV.

DTC C0110 Circuit

Step	Action	Value (s)	Yes	No
Connector End View Reference:ABS Connector End Views				
1	Did you perform the anti-lock brake system (ABS) Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Disconnect the electronic brake control module (EBCM) harness connector. 2. Test both ground circuits of the EBCM including the EBCM ground for a high resistance or an open. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems. 3. Test the battery positive voltage circuits for an open, high resistance, or a short to ground. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems. Did you find and correct the condition?	-	Go to Step 8	Go to Step 3
3	1. Disconnect the BPMV pump motor connector from the EBCM to gain access to the pump motor circuits. 2. Measure the resistance between each pump motor control circuit and the housing of the BPMV. Does the resistance measure less than the specified value?	5 ohm	Go to Step 4	Go to Step 5
4	Inspect for poor connections at the pump motor connector of the BPMV. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	-	Go to Step 8	Go to Step 6
5	Inspect for poor connections at the harness connector of the EBCM. Refer <u>Testing for Intermittent Conditions and Poor Connections</u> to <u>Connector Repairs</u> and in Wiring Systems.	-	Go to	

	Did you find and correct the condition?		Step 8	Go to Step 7
6	Replace the BPMV. Refer to <u>Brake Modulator Assembly Replacement</u> . Did you complete the repair?	-	Go to Step 8	-
7	Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> . Did you complete the repair?	-	Go to Step 8	-
8	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 2	System OK

DTC C0121

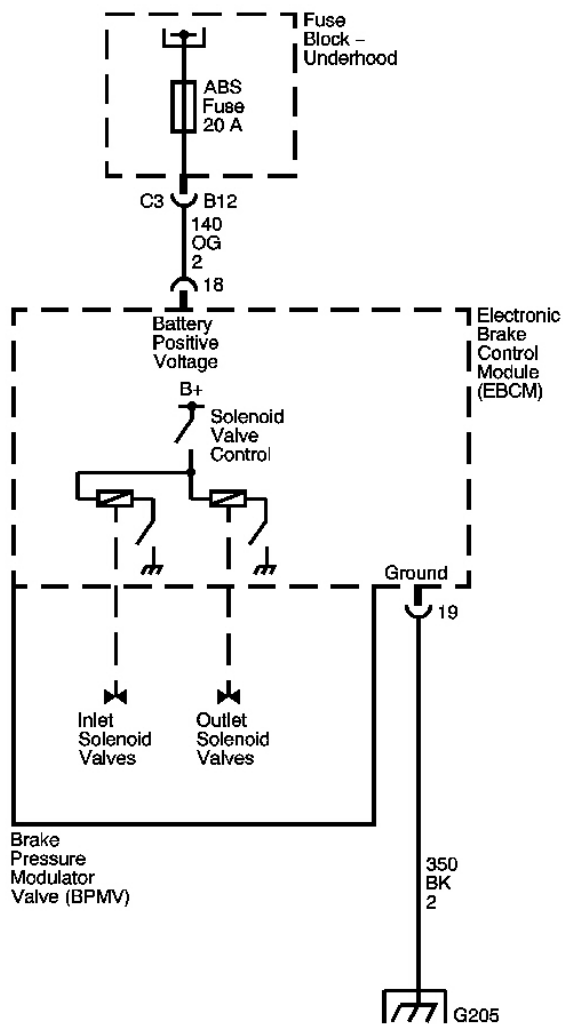


Fig. 6: DTC C0121 Circuit
 Courtesy of GENERAL MOTORS CORP.

Circuit Description

The solenoid valve relay supplies power to the solenoid valve coils in the electronic brake control module (EBCM). The solenoid valve relay, located in the EBCM, is activated whenever the ignition switch is in the RUN position and no faults are present. The solenoid valve relay remains engaged until the ignition is turned OFF or a failure is detected.

Conditions for Running the DTC

The ignition switch is in the ON position.

Conditions for Setting the DTC

- DTC C0121 will set anytime the solenoid valve relay is commanded on and the EBCM does not see battery voltage at the solenoid valves.
- DTC C0121 will set anytime the EBCM commands the solenoid valve relay off and battery voltage is still present at the solenoid valves.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the anti-lock brake system (ABS), traction control system (TCS), and dynamic rear proportion (DRP) for the duration of the ignition cycle.
- A malfunction DTC is set.
- The ABS telltale turns ON.

Conditions for Clearing the DTC

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

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- The following conditions may cause an intermittent malfunction:
 - A poor connection
 - Rubbed-through wire insulation
 - A broken wire inside the insulation
- If an intermittent malfunction exists, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- The solenoid valve relay is an integral part of the EBCM and is not serviced separately.

Test Description

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

2: This step determines if the DTC is current.

DTC C0121 Circuit

Step	Action	Yes	No
Connector End View Reference: <u>ABS Connector End Views</u>			
1	Did you perform the Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	<ol style="list-style-type: none">1. Install a scan tool.2. Turn ON the ignition, with the engine OFF.3. Use the scan tool in order to clear the DTCs. Does the DTC reset?	Go to Step 3	Go to Diagnostic Aids
3	<ol style="list-style-type: none">1. Disconnect the electronic brake control module (EBCM) harness connector.2. Test the battery positive voltage circuit for an open, high resistance, or a short to ground. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 5	Go to Step 4
4	Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> . Did you complete the replacement?	Go to Step 5	-
5	<ol style="list-style-type: none">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 2	System OK

DTC C0161

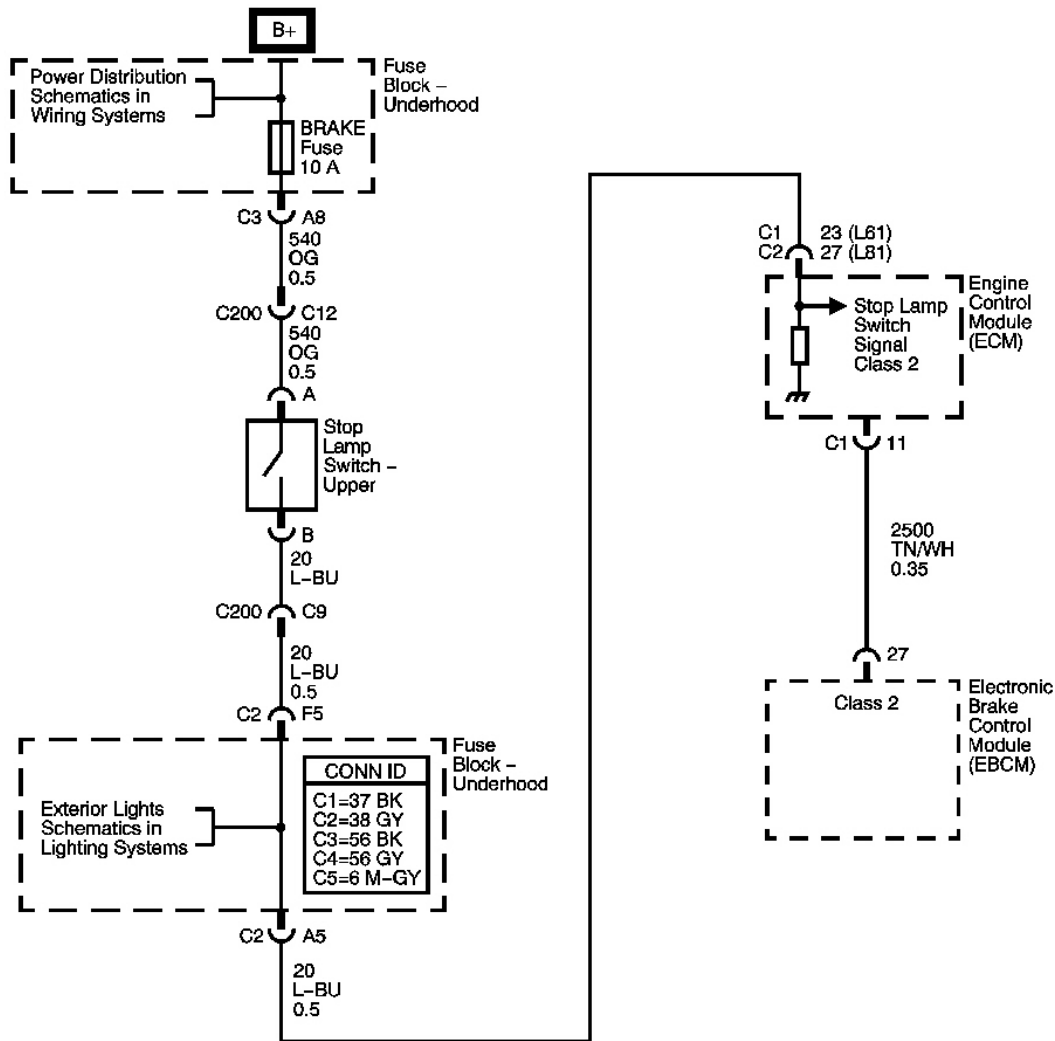


Fig. 7: DTC C0161 Circuit

Courtesy of GENERAL MOTORS CORP.

Circuit Description

The normally-open stop lamp switch supplies battery voltage to the engine control module (ECM) when the brake pedal is pressed. The ECM sends a brake pedal applied serial data message to the electronic brake and traction control module (EBTCM) and to the transmission control module (TCM).

Conditions for Running the DTC

The ignition switch is ON.

Conditions for Setting the DTC

- The EBCM detects an open in the brake signal circuit.
- Both brake lamps are faulty.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- A malfunction DTC will set.
- The EBCM stores this information-only DTC for as long as the condition is present.
- The ABS remains functional.
- The ABS indicator remains OFF.

Conditions for Clearing the DTC

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

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- Possible causes of this DTC are the following conditions:
 - A signal circuit of the stop lamp switch is open.
 - The stop lamp switch is not adjusted properly.
 - Verify proper stop lamp switch operation using the data list of the scan tool. As the brake is applied, the data list displays the stop lamp switch ON within 2.54 cm (1 in) of travel.
 - All brake lamps are open.
 - All brake lamp grounds are open.
 - A circuit has a wiring problem, terminal corrosion, or poor connection.
 - A loose or corroded EBCM ground exists.

- If an intermittent malfunction exists refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

Test Description

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

3: This DTC detects an open stop lamp switch signal circuit from the stop lamp side of the splice pack to the EBCM.

4: The EBCM sources 5 volts on the stop lamp switch signal circuit. This small voltage has a ground path through the stop lamp bulbs. This DTC sets if the path to ground is open.

DTC C0161 Circuit

Step	Action	Yes	No
Connector End View Reference: <u>ABS Connector End Views</u> or <u>Lighting Systems Connector End Views</u> in Lighting Systems			
1	Did you perform the anti-lock brake system (ABS) Diagnostic System Check?	Go to Step 2	Go to Diagnostic System Check - ABS
2	1. Press the brake pedal. 2. With the scan tool, observe the Brake Switch Status parameter in the ABS data list. Does the Brake Switch Status parameter display Applied?	Go to Step 4	Go to Step 3
3	Test the signal circuit of the stop lamp switch for an open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 9	Go to Step 7
4	Press the brake pedal. Are all of the stop lamps OFF?	Go to Step 5	Go to Diagnostic Aids
5	Test the feed circuit of the stop lamps for an open or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 9	Go to Step 6
6	Test the ground circuit of the stop lamps for an open or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 9	Go to Diagnostic Aids
7	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 Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 9	Go to Step 8
8	Replace the EBCM. Refer to Electronic Brake Control Module Replacement . Did you complete the replacement?	Go to Step 9	-
	1. Use the scan tool in order to clear the DTCs.		

9	2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text.	Go to Step 2	System OK
Does the DTC reset?			

DTC C0236

Circuit Description

The controller area network (CAN) serial data circuit is a high speed serial data bus used to communicate information between the engine control module (ECM) and the electronic brake control module (EBCM). The ECM provides the EBCM with engine RPM data via the serial data message. The EBCM uses this information for traction control system (TCS) operation.

The CAN bus circuit is monitored continuously after the ignition switch is turned to the ON position.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The EBCM receives an incorrect engine RPM message 3 seconds after start-up from the ECM.
- The EBCM continuously monitors for invalid data.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The TCS light emitting diode (LED) is turned OFF.
- The EBCM will disable the TCS.
- The anti-lock brake system (ABS) telltale is not illuminated.
- The ABS is not disabled.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- Using a scan tool, clear the DTC function.
- 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:

- Check the ECM DTCs.
- Check the EBCM for any communication DTCs, and diagnose any powertrain or communication DTCs first.
- The EBCM is not receiving the message from the ECM.
- The CAN HI and CAN LO circuits are shorted together.
- The CAN HI and CAN LO circuit is shorted to ground.
- The CAN HI and CAN LO circuit is shorted to voltage.

Test Description

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

2: This step tests for a short to ground between the CAN HI and CAN LO circuits.

3: This step tests the CAN HI and CAN LO circuits for a short together.

4: This step checks to see if the DTC will reset as current.

DTC C0236 Circuit

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u>			
Connector End View Reference: <u>ABS Connector End Views</u>			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to Step 2	Go to Diagnostic System Check - ABS
2	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Disconnect the electronic brake control module (EBCM). 3. Disconnect the engine control module (ECM) connector. 4. Using the digital multimeter (DMM), test the controller area network (CAN) HI and controller area network (CAN) LO circuits for a short to ground between the ECM and the EBCM. Refer to Testing for Short to Ground in Wiring Systems. 	Go to Step 6	Go to Step 3
3	Using the DMM, test the CAN HI and CAN LO circuits between the ECM and the EBCM for being shorted together or shorted to voltage. Refer to Testing for a Short to Voltage in Wiring Systems. Did you find and correct the condition?	Go to Step 6	Go to Step 4
4	<ol style="list-style-type: none"> 1. Use the scan tool in order to clear the DTCs. 2. Test drive the vehicle. Refer to Diagnostic Test Drive . Did DTC C0236 reset?	Go to Step 5	Go to Step 6
5	Replace the EBCM. Refer to Electronic Brake Control Module Replacement .	Go to	

	Did you complete the replacement?	Step 6	-
6	<ol style="list-style-type: none"> 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 2	System OK

DTC C0241

Circuit Description

The controller area network (CAN) serial data circuit is a high speed serial data bus used to communicate information between the engine control module (ECM) and the electronic brake control module (EBCM). Traction control is simultaneously controlled by the ECM and the EBCM. The ECM sends engine torque data via serial data communications to the EBCM. The EBCM uses this message to determine traction control operation.

The CAN bus circuit is monitored continuously after the ignition switch is turned to the ON position.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The EBCM receives an incorrect engine torque message 3 seconds after start-up from the ECM.
- The EBCM continuously monitors for invalid data.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The traction control system (TCS) light emitting diode (LED) is turned OFF.
- The EBCM will disable the TCS.
- The anti-lock brake system (ABS) telltale is not illuminated.
- The ABS is not disabled.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- Using a scan tool, clear the DTC function.
- 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:

- Check the ECM DTCs.
- Check the EBCM for any communication DTCs, and diagnose any powertrain or communication DTCs first.
- The EBCM is not receiving the message from the ECM.
- The CAN HI and CAN LO circuits are shorted together.
- The CAN HI and CAN LO circuit is shorted to ground.
- The CAN HI and CAN LO circuit is shorted to voltage.

Test Description

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

2: This step tests for a short to ground between the CAN HI and CAN LO circuits.

3: This step tests the CAN HI and CAN LO circuits for a short together.

4: This step checks to see if the DTC will reset as current.

DTC C0241 Circuit

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>ABS Connector End Views</u>			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Turn OFF the ignition. 2. Disconnect the EBCM. 3. Disconnect the ECM connector. 4. Using the digital multimeter (DMM), test the controller area network (CAN) HI and controller area network (CAN) LO circuits for a short to ground between the engine control module (ECM) and the electronic brake control module (EBCM). Refer to <u>Testing for Short to Ground</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 6	Go to Step 3
3	Using the DMM, test the CAN HI and CAN LO circuits between the ECM and the EBCM for being shorted together or shorted to voltage. Refer to <u>Testing for a Short to Voltage</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 6	Go to Step 4
4	1. Use the scan tool in order to clear the DTCs. 2. Test drive the vehicle. Refer to <u>Diagnostic Test Drive</u> .	Go to	

	Did DTC C0241 reset?	Step 5	Go to Step 6
5	Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> . Did you complete the replacement?	Go to Step 6	-
6	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 2	System OK

DTC C0245

Circuit Description

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

Conditions for Running the DTC

- The ignition switch is ON.
- The DTC can be set after system initialization.

Conditions for Setting the DTC

- The EBCM detects a deviation between 2 wheel speeds at either side of the vehicle, or at the front or rear axle of greater than 6 km/h (3.75 mph) at a vehicle speed of less than 100 km/h (62 mph).
- The EBCM detects a deviation between 2 wheel speeds at either side of the vehicle, or at the front or rear axle of greater than 6 percent of the vehicle speed at greater than 100 km/h (62 mph).

This DTC will set when the EBCM cannot specifically identify which wheel speed sensor is causing the malfunction. If the EBCM can identify the specific wheel speed sensor causing the malfunction, DTC C0245 will become a history DTC, and the DTC associated with the sensor (DTC C0036, DTC C0041, DTC C0046, DTC C0051) will be set concurrent with DTC C0245.

Diagnose each wheel speed sensor individually.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- A malfunction DTC stores.
- The anti-lock brake system (ABS) and the traction control system (TCS) disable.
- The amber ABS indicator turns ON.
- The traction control switch light emitting diode (LED) turns OFF.

Conditions for Clearing the DTC

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

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- The following conditions may cause an intermittent malfunction:
 - A poor connection
 - Rubbed-through wire insulation
 - A broken wire inside the insulation
- If the customer's comments reflect that the amber ABS/TCS indicator is on only during moist environmental conditions (rain, snow, vehicle wash), inspect all the wheel speed sensor circuitry 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.

Add 2 teaspoons of salt to 12 ounces of water to make a 5 percent saltwater solution.
 2. Test drive the vehicle over various road surfaces (bumps, turns, etc.) above 40 km/h (25 mph) for at least 30 seconds.
 3. If the DTC returns, replace the suspected harness.
- If an intermittent malfunction exists refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

Test Description

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

2: If DTC C0245 is a history code, this step checks if a specific Wheel Speed Circuit Malfunction DTC is set concurrently with DTC C0245.

7: This step checks if the wheel speed sensor harness is routed in close proximity to the spark plug wires.

9: In this step, if the scan tool can record any erroneous wheel speed sensor signals, diagnose that sensor (s) first.

DTC C0245 Circuit

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>ABS Connector End Views</u>			
1	Did you perform the diagnostic system check?	Go to Step 2	Go to Diagnostic System Check - ABS
2	Is the following DTC(s) set concurrently with a history DTC C0245? <ul style="list-style-type: none"> • DTC C0036 • DTC C0041 • DTC C0046 • DTC C0051 	Go to Diagnostic Trouble Code (DTC) List	Go to Step 3
3	Inspect the wheel speed sensor for physical damage. Is physical damage of the wheel speed sensor evident?	Go to Step 4	Go to Step 5
4	Replace the wheel speed sensor. Refer to Wheel Bearing/Hub Replacement - Front in Front Suspension and Wheel Bearing/Hub Replacement - Rear in Rear Suspension. Is the replacement complete?	Go to Step 14	-
5	Inspect the wiring harness for physical damage. Is physical damage of the wiring harness evident?	Go to Step 6	Go to Step 7
6	Repair the wiring harness or connector. Refer to Wiring Repairs or Connector Repairs in Wiring Systems. Is the replacement complete?	Go to Step 14	-
7	Inspect wiring harness for proper routing of the wheel speed sensor harness. Verify that the wheel speed sensor harness is routed away from the spark plug wires. Is the wheel speed sensor harness properly routed?	Go to Step 9	Go to Step 8
8	Reroute the wheel speed sensor harness away from the spark plug wires. Is the reroute complete?	Go to Step 14	-
9	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Turn the ignition switch to the RUN position. 3. Set the scan tool to Snap Shot Auto Trigger mode and monitor the wheel speed sensors. 4. Carefully drive the vehicle above 40 km/h (25 mph) for 		

	several minutes.		
	Did the scan tool trigger on any of the wheel speed sensors?	Go to Step 10	Go to Step 11
10	Note which wheel speed sensor triggered the scan tool. Follow the appropriate Wheel Speed Sensor Malfunction DTC table for the wheel speed sensor that triggered. Refer to <u>Diagnostic Trouble Code (DTC) List</u> . Is the repair complete?	Go to Step 14	-
11	<ol style="list-style-type: none"> 1. Reconnect all previously disconnected components. 2. Using a scan tool clear the DTC. 3. Remove the scan tool from the DLC. 4. Carefully drive the vehicle above 40 km/h (25 mph) for several minutes. 		
	Does the DTC reset as a current DTC?	Go to Step 13	Go to Step 12
12	Malfunction is intermittent. Inspect all connectors and harnesses for damage that may result in an open or high resistance when connected. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> in Wiring Systems. Is the repair complete?	Go to Step 14	-
13	Replace the electronic brake control module (EBCM). Refer to <u>Electronic Brake Control Module Replacement</u> . Is the replacement complete?	Go to Step 14	-
14	<ol style="list-style-type: none"> 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 2	System OK

DTC C0550

Circuit Description

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

Conditions for Running the DTC

The microprocessor runs the program to detect an internal fault when power up is commanded. The only requirements are voltage and ground. This program runs even if the voltage is out of the valid operating range.

Conditions for Setting the DTC

- The control module detects an internal write malfunction.
- The control module detects an internal checksum malfunction.

Action Taken When the DTC Sets

If equipped, the following module specific actions may occur:

- The anti-lock brake system (ABS) telltale turns ON.
- The BRAKE warning telltale turns ON.
- The traction control system (TCS) telltale light emitting diode (LED) turns OFF.

Conditions for Clearing the DTC

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

Diagnostic Aids

- This DTC may be stored as a history DTC without affecting the operation of the module. If stored only as a history DTC and not retrieved as a current DTC, do not replace the module.
- If this DTC is retrieved as both a current and history DTC, replace the module.

DTC C0550 Circuit

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check for the system exhibiting the symptom?	Go to Step 2	Go to Control Module References for the applicable Diagnostic System Check
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Retrieve DTCs. Is DTC retrieved as a current DTC?	Go to Step 3	Go to Diagnostic Aids
3	IMPORTANT: Perform the programming or setup procedure for the module if required. Replace the control module setting the DTC as current. Refer to Control Module References .Did you complete the replacement?	Go to Step 4	-
4	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.	Go to	

DTC C0896

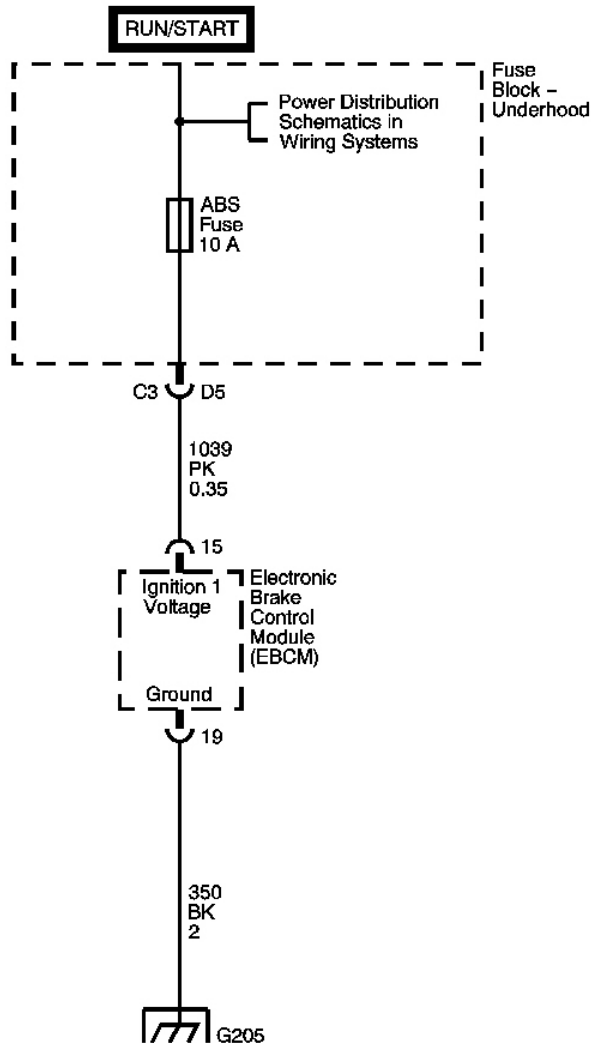


Fig. 8: DTC C0896 Circuit

Courtesy of GENERAL MOTORS CORP.

Circuit Description

The electronic brake control module (EBCM) is required to operate within a specified range of voltage to function properly. During anti-lock brake system (ABS) and traction control system (TCS) operation, there are current requirements that will cause the voltage to drop. Because of this, voltage is monitored out of ABS/TCS

control to indicate a good charging system condition, and also during ABS/TCS control when voltage may drop significantly. The EBCM also monitors for high voltage conditions which could damage the EBCM.

Conditions for Running the DTC

- The ignition switch is ON.
- The DTC can be set after system initialization.

Conditions for Setting the DTC

- The EBCM operating voltage falls below 9.4 volts.
- The EBCM operating voltage rises above 17.4 volts.
- The low voltage or the high voltage is detected for more than 500 milliseconds with the vehicle speed above 6.5 km/h (4 mph).

Action Taken When the DTC Sets

If equipped, the following actions occur:

- A malfunction DTC is stored.
- The ABS telltale turns ON.
- The ABS, TCS and dynamic rear proportion (DRP) are disabled.

Conditions for Clearing the DTC

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

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- The following conditions may cause an intermittent malfunction:

- A poor connection
- Rubbed-through wire insulation
- A broken wire inside the insulation
- If an intermittent malfunction exists, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems for further diagnosis.

Test Description

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

2: This step checks if the voltage is above the maximum of the range.

4: Step 4 checks if the voltage is below the minimum of the range.

6: This step checks for the integrity of the ground circuit.

DTC C0896 Circuit

Step	Action	Value (s)	Yes	No
Connector End View Reference:ABS Connector End Views				
1	Did you perform the Diagnostic System Check?	-	Go to Step 2	Go to Diagnostic System Check - ABS
2	1. Turn all the accessories off. 2. Install a scan tool. 3. Start the engine. 4. Use the scan tool to monitor the ignition battery voltage parameter in the electronic brake control module (EBCM) Data List, while running the engine at approximately 2000 RPM. Is the monitored battery voltage within the specified range?	9.4-17.4 V	Go to Step 4	Go to Step 3
3	Use a digital multimeter (DMM) to measure the voltage between the battery positive terminal and ground. Is the voltage within the specified range?	0-17.4 V	Go to Step 5	Go to Symptoms - Engine Electrical in Engine Electrical
4	Continue to monitor the battery voltage with the scan tool while running the engine at approximately 2000 RPM. Is the monitored battery voltage within the specified range?	0-9.4 V	Go to Step 6	Go to Step 5
5	1. Turn the ignition switch to the OFF position. 2. Disconnect the scan tool if still connected. 3. Test drive the vehicle above 6.5 km/h (4 mph). Did DTC C0896 reset?	-	Go to Step 10	Go to Diagnostic System Check - ABS
	1. Turn the ignition switch to the OFF position. 2. Disconnect the EBCM connector.			

6	3. Use a DMM to measure the resistance between the connector terminal 4 and a good ground. Is the resistance within the specified range?	0-5 ohm	Go to Step 8	Go to Step 7
7	Repair open or high resistance in the ground circuit. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Is the repair complete?	-	Go to Step 11	-
8	1. Turn the ignition switch to the RUN position. 2. Use a DMM to measure the voltage between terminal 18 and 4. Is the voltage within the specified range?	Above 9.4 V	Go to Step 9	Go to Symptoms - Engine Electrical in Engine Electrical
9	1. Turn the ignition switch to the OFF position. 2. Reconnect the EBCM connector. 3. Disconnect the scan tool if the scan tool is still connected. 4. Test drive the vehicle above 6 km/h (3.5 mph). Did DTC C0896 reset?	-	Go to Step 10	Go to Step 11
10	Replace the EBCM. Refer to Electronic Brake Control Module Replacement . Is the repair complete?	-	Go to Step 11	-
11	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 2	System OK

SYMPTOMS - ANTI-LOCK BRAKE SYSTEM

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

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

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the anti-lock brake system (ABS).

Refer to **Checking Aftermarket Accessories** in Wiring Systems.

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the master cylinder reservoir for the proper fluid level.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

Symptom List

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

- **ABS Active Indicator Always On**
- **ABS Active Indicator Inoperative**
- **Traction Control Indicator Always On (L61 Engine W/NW7 Only)**
- **Traction Control Indicator Inoperative (L61 Engine W/NW7 Only)**

ABS ACTIVE INDICATOR ALWAYS ON

Circuit Description

The instrument panel cluster (IPC) turns the ABS Indicator on during the IPC bulb check for approximately 3 seconds when the ignition switch is turned to the ON position. If the electronic brake control module (EBCM) sets a diagnostic trouble code (DTC) the EBCM sends a class 2 message to the body control module (BCM) and the BCM sends a class 2 message to the IPC to command the anti-lock brake system (ABS) indicator ON.

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- The following conditions may cause an intermittent malfunction:
 - A poor connection
 - Rubbed-through wire insulation

- A broken wire inside the insulation
- If an intermittent malfunction exists refer to **Inducing Intermittent Fault Conditions** in Wiring Systems.

Test Description

The number(s) below refer to the step numbers on the diagnostic table.

2: Confirm if the scan tool can turn ON and OFF, all indicator lamps on the instrument cluster.

4: Verify if the circuits going to the instrument cluster or the cluster is at fault.

ABS Active Indicator Always On

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>Body Control System Connector End Views</u> in Body Control Systems or <u>Instrument Panel, Gages, and Console Connector End Views</u> in Instrument Panel, Gages, and Console			
1	Did you perform the Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	<ol style="list-style-type: none"> Using a scan tool, select the brake control module (BCM), Special Functions mode. Select Output Control, Solenoid Test. Select the anti-lock brake system (ABS) Telltale Indicator. In the ABS Telltale test mode you can turn the instrument panel indicators ON or OFF. <p>All indicators will turn ON when commanded on.</p> <p>Does the ABS indicator turn on then OFF?</p>	Go to Step 3	Go to Step 4
3	Replace the electronic brake control module (EBCM). Refer to <u>Electronic Brake Control Module Replacement</u> . Is the replacement complete?	Go to <u>Diagnostic System Check - ABS</u>	-
4	<ol style="list-style-type: none"> Disconnect the instrument cluster and connect a test light across the appropriate power and ground terminals. With the test light OFF, repair the open in power or ground circuit to cluster With the test light ON, check the connector for poor connection to cluster. 		

4. If OK, replace the instrument cluster. Refer to <u>Instrument Panel Cluster (IPC) Replacement</u> in Instrument Panel, Gages, and Console.	Go to <u>Diagnostic System Check - ABS</u>	-
Is the instrument cluster replacement complete?		

ABS ACTIVE INDICATOR INOPERATIVE

Circuit Description

The instrument panel cluster (IPC) turns the ABS indicator on during the IPC bulb check for approximately 3 seconds when the ignition switch is turned to the ON position. If the electronic brake control module sets a diagnostic trouble code (DTC) the EBCM sends a class 2 message to the body control module (BCM) and the (BCM) sends a class 2 message to the IPC to command the ABS indicator on.

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- The following conditions may cause an intermittent malfunction:
 - A poor connection
 - Rubbed-through wire insulation
 - A broken wire inside the insulation
- If an intermittent malfunction exists refer to **Inducing Intermittent Fault Conditions** in Wiring Systems.

Test Description

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

2: Confirm if the scan tool can turn on and off all the indicator lamps in the instrument cluster.

4: Verify if the circuits going to the instrument cluster or the cluster is at fault.

ABS Active Indicator Inoperative

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Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>Body Control System Connector End Views</u> in Body Control Systems or <u>Instrument Panel, Gages, and Console Connector End Views</u> in Instrument Panel, Gages, and Console			
1	Did you perform the Diagnostic System Check?	Go to Step 2	Go to Diagnostic System Check - ABS
2	<ol style="list-style-type: none"> 1. Using a scan tool, select the Brake Control Module, Special Functions mode, Output Control. 2. Select Solenoid Test. 3. Select ABS Telltale Indicator. 4. In the ABS Telltale Test mode you can turn the instrument panel indicators ON or OFF. <p>All indicators will turn ON when commanded on.</p> <p>Does the ABS Indicator turn on then off?</p>	Go to Step 3	Go to Step 4
3	Replace the ABS module. Refer to Electronic Brake Control Module Replacement . Is the replacement complete?	Go to Diagnostic System Check - ABS	-
4	<ol style="list-style-type: none"> 1. Disconnect the instrument cluster and connect a test light across the appropriate power and ground terminals. 2. With the test light OFF, repair the open in power or ground circuit to cluster. 3. With the test light ON, check the connector for poor connection to the cluster. 4. If OK, replace the instrument cluster. Refer to Instrument Panel Cluster (IPC) Replacement in Instrument Panel, Gages, and Console. <p>Is the instrument cluster replacement complete?</p>	Go to Diagnostic System Check - ABS	-

TRACTION CONTROL INDICATOR ALWAYS ON (L61 ENGINE W/NW7 ONLY)

Circuit Description

The TRAC OFF indicator is controlled by the instrument cluster via class 2 serial data messages from the EBCM. When the body control module (BCM) sees the traction control switch input grounded through the momentary traction control switch, it sends a class 2 message to the EBCM that tells the EBCM that the traction control switch has been pressed. The EBCM then disables traction control and sends a message to the instrument cluster to turn the TRAC OFF indicator ON. Each time the ignition is cycled from OFF to ON, the traction control system is enabled.

The following conditions will cause the TRAC OFF indicator to illuminate:

- The EBCM has disabled the TCS due to a DTC.
- The driver manually disabling the TCS via the traction control switch.
- The instrument cluster bulb check. When the ignition switch is turned to ON, the TRAC OFF indicator will turn on for approximately 3 seconds and then turn OFF.

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- The following conditions may cause an intermittent malfunction:
 - A poor connection
 - Rubbed-through wire insulation
 - A broken wire inside the insulation
- If an intermittent malfunction exists refer **Inducing Intermittent Fault Conditions** in Wiring System for further diagnosis.

Traction Control Indicator Always On (L61 Engine W/NW7 Only)

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>ABS Connector End Views</u> or <u>Body Control System Connector End Views</u>			
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the Traction Switch parameter in the Body Control Module data display, inputs. 4. Activate the traction control switch.	Go to <u>Testing for Intermittent Conditions and Poor Connections</u> in	

	Does the Traction Switch parameter change state?	Wiring Systems	Go to Step 3
3	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Disconnect the traction control switch connector. 3. Connect a fused jumper from the signal circuit of the traction control switch harness connector to a good ground. 4. Turn ON the ignition, with the engine OFF. 5. With a scan tool, observe the Traction Switch parameter. <p>Does the scan tool display Active ?</p>	Go to Step 5	Go to Step 4
4	<p>Test the signal circuit of the traction control switch for an open or high resistance. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	Go to Step 10	Go to Step 6
5	<p>Test the ground circuit of the traction control switch for an open or high resistance. Refer to and <u>Testing for Continuity</u> in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	Go to Step 10	Go to Step 7
6	<p>Inspect for poor connections at the harness connector of the body control module (BCM). Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	Go to Step 10	Go to Step 8
7	<p>Inspect for poor connections at the harness connector of the traction control switch. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	Go to Step 10	Go to Step 9
8	<p>Replace the body control module (BCM). Refer to <u>Body Control Module Replacement</u> in Body Control System.</p> <p>Did you complete the replacement?</p>	Go to Step 10	-
9	<p>Replace the traction control switch. Refer to <u>Traction Control Switch Replacement</u> in Steering Wheel and Column - Tilt.</p> <p>Did you complete the replacement?</p>	Go to Step 10	-
10	<p>Operate the system in order to verify the repair.</p> <p>Did you correct the condition?</p>	System OK	Go to Step 2

TRACTION CONTROL INDICATOR INOPERATIVE (L61 ENGINE W/NW7 ONLY)

Circuit Description

The TRAC OFF indicator is controlled by the instrument cluster via class 2 serial data messages from the EBCM. When the body control module (BCM) sees the traction control switch input grounded through the momentary traction control switch, it sends a class 2 message to the EBCM that tells the EBCM that the traction control switch has been pressed. The EBCM then disables traction control and sends a message to the instrument cluster to turn the TRAC OFF indicator ON. Each time the ignition is cycled from OFF to ON, the traction control system is enabled.

The following conditions will cause the TRAC OFF indicator to illuminate:

- The EBCM has disabled the TCS due to a DTC.
- The driver manually disabling the TCS via the traction control switch.
- The instrument cluster bulb check. When the ignition switch is turned to ON, the TRAC OFF indicator will turn on for approximately 3 seconds and then turn OFF.

Diagnostic Aids

- It is very important that a thorough inspection of the wiring and connectors be performed. Failure to carefully and fully inspect wiring and connectors may result in misdiagnosis, causing part replacement with reappearance of the malfunction.
- Thoroughly inspect any circuitry that may be causing the complaint for the following conditions:
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wiring connections
 - Physical damage to the wiring harness
- The following conditions may cause an intermittent malfunction:
 - A poor connection
 - Rubbed-through wire insulation
 - A broken wire inside the insulation
- If an intermittent malfunction exists refer to **Inducing Intermittent Fault Conditions** in Wiring Systems for further diagnosis.

Traction Control Indicator Inoperative (L61 Engine W/NW7 Only)

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>ABS Connector End Views</u> or <u>Body Control System Connector End Views</u>			
1	Did you perform the ABS Diagnostic System Check?		Go to <u>Diagnostic System Check -</u>

		Go to Step 2	<u>ABS</u>
2	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the Traction Switch parameter in the Body Control Module data display, Inputs. <p>Does the scan tool display Inactive?</p>	Go to Step 3	Go to Step 4
3	<ol style="list-style-type: none"> 1. Activate the traction control switch. 2. With the scan tool, observe the Traction Switch parameter. <p>Does the Traction Switch parameter change state?</p>	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems	Go to Step 4
4	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Disconnect the traction control switch connector. 3. Turn ON the ignition, with the engine OFF. 4. With a scan tool, observe the Traction Switch parameter. <p>Does the scan tool display Inactive?</p>	Go to Step 7	Go to Step 5
5	<p>Test the signal circuit of the traction control switch for a short to ground. Refer to and Testing for Short to Ground in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	Go to Step 10	Go to Step 6
6	<p>Inspect for poor connections at the harness connector of the body control module (BCM). Refer to Testing for Intermittent Conditions and Poor Connections and Wiring Repairs in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	Go to Step 10	Go to Step 8
7	<p>Inspect for poor connections at the harness connector of the traction control switch. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	Go to Step 10	Go to Step 9
8	<p>Replace the body control module (BCM). Refer to Body Control Module Replacement in Body Control System.</p> <p>Did you complete the replacement?</p>	Go to Step 10	-
9	<p>Replace the traction control switch. Refer to Traction Control Switch Replacement</p> <p>Did you complete the replacement?</p>	Go to Step 10	-
10	<p>Operate the system in order to verify the repair.</p>		

REPAIR INSTRUCTIONS

ABS AUTOMATED BLEED PROCEDURE

CAUTION: Refer to Brake Fluid Irritant Caution in Cautions and Notices.

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

IMPORTANT: Before performing the anti-lock brake system (ABS) Automated Bleed Procedure, first perform a manual or pressure bleed of the base brake system. Refer to Hydraulic Brake System Bleeding (Manual) or Hydraulic Brake System Bleeding (Pressure) in Hydraulic Brakes. The automated bleed procedure is recommended when one of the following conditions exist:

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

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

Automated Bleed Procedure

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

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Remove all 4 tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
3. Inspect the brake system for leaks and visual damage. Refer to Symptoms - Hydraulic Brakes in

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

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT

Removal Procedure

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

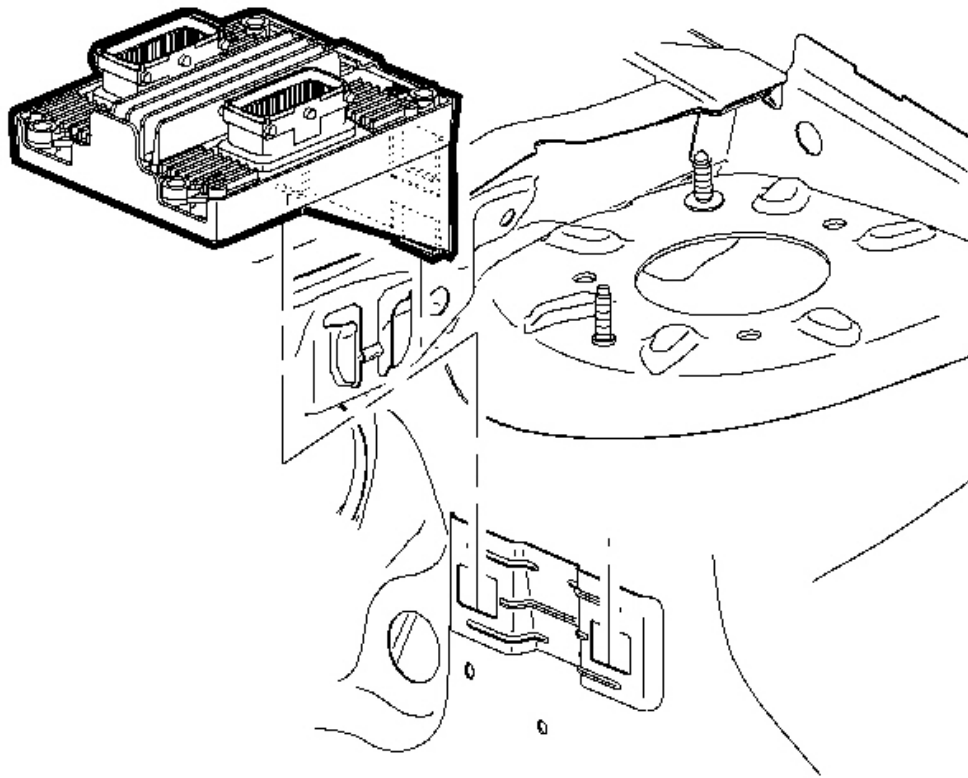


Fig. 9: View Of Electronic Brake Control Module
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission control module (TCM), if equipped, from the mounting bracket and position aside.

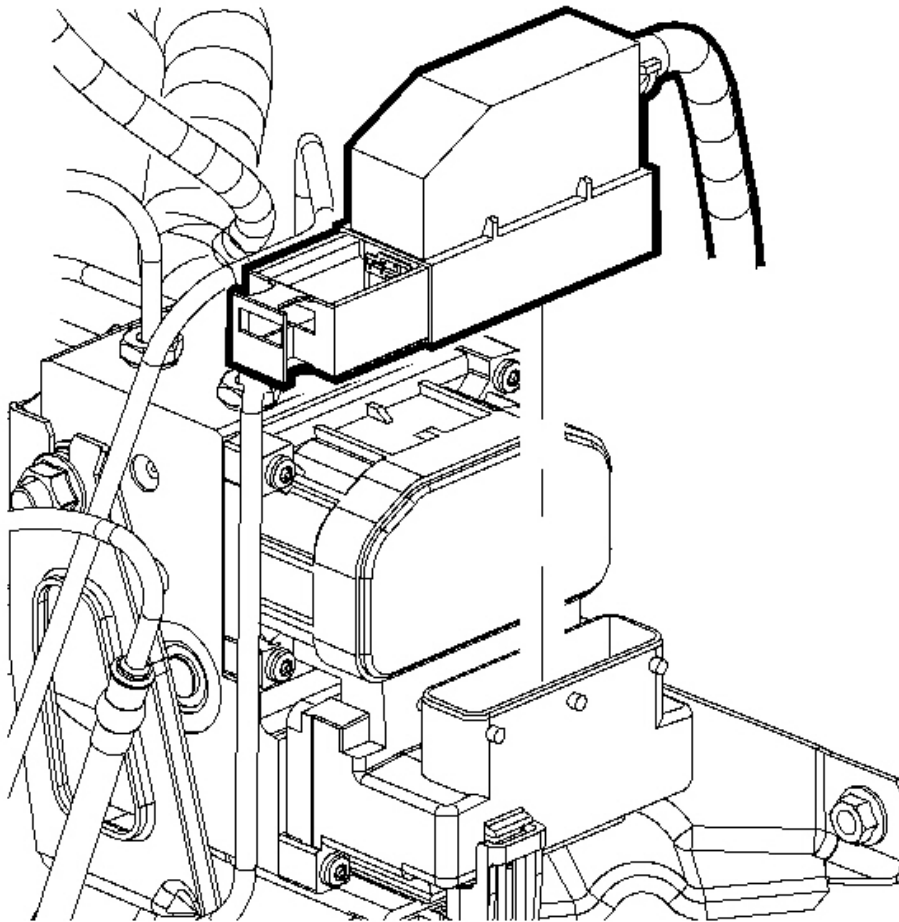


Fig. 10: Disconnecting/Connecting Electrical Connector From Electronic Brake Control Module (EBCM)

Courtesy of GENERAL MOTORS CORP.

2. Turn the ignition switch to the OFF position.
3. Clean the electronic brake control module (EBCM) to brake pressure modulator valve (BPMV) area of any accumulated dirt and foreign material.
4. Disconnect the electrical connector from the EBCM.

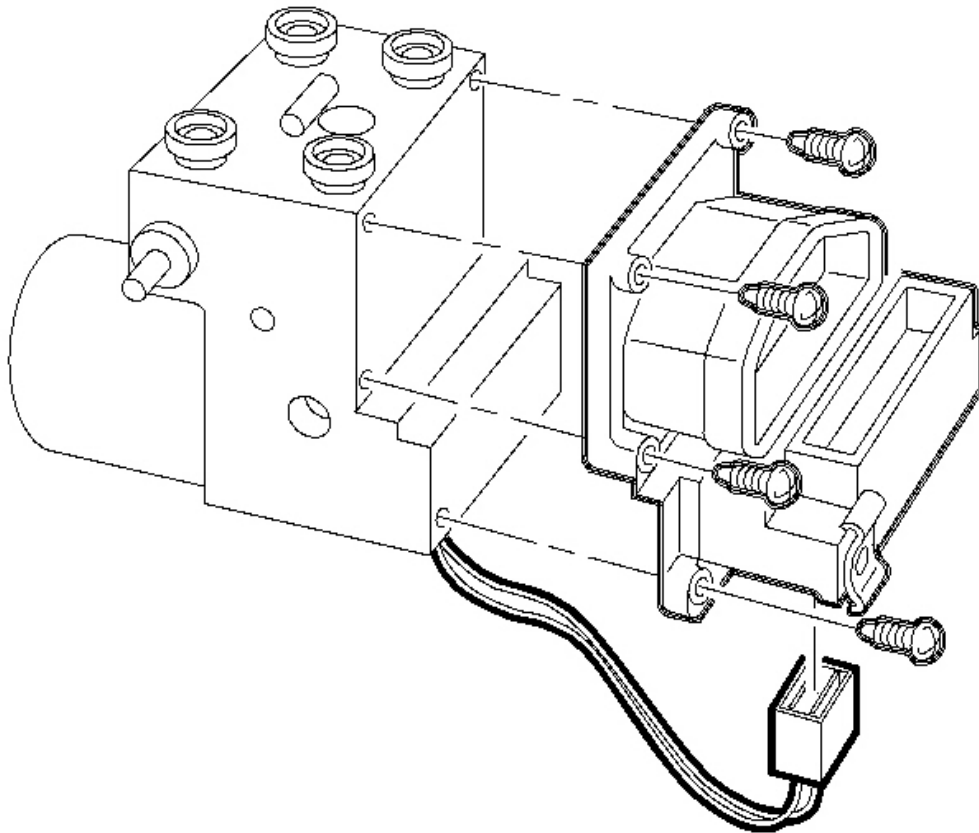


Fig. 11: Disconnecting/Connecting Pump Motor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the pump motor electrical connector.
6. Remove the EBCM attaching screws.
7. Separate the EBCM from the BPMV by carefully pulling apart.

Installation Procedure

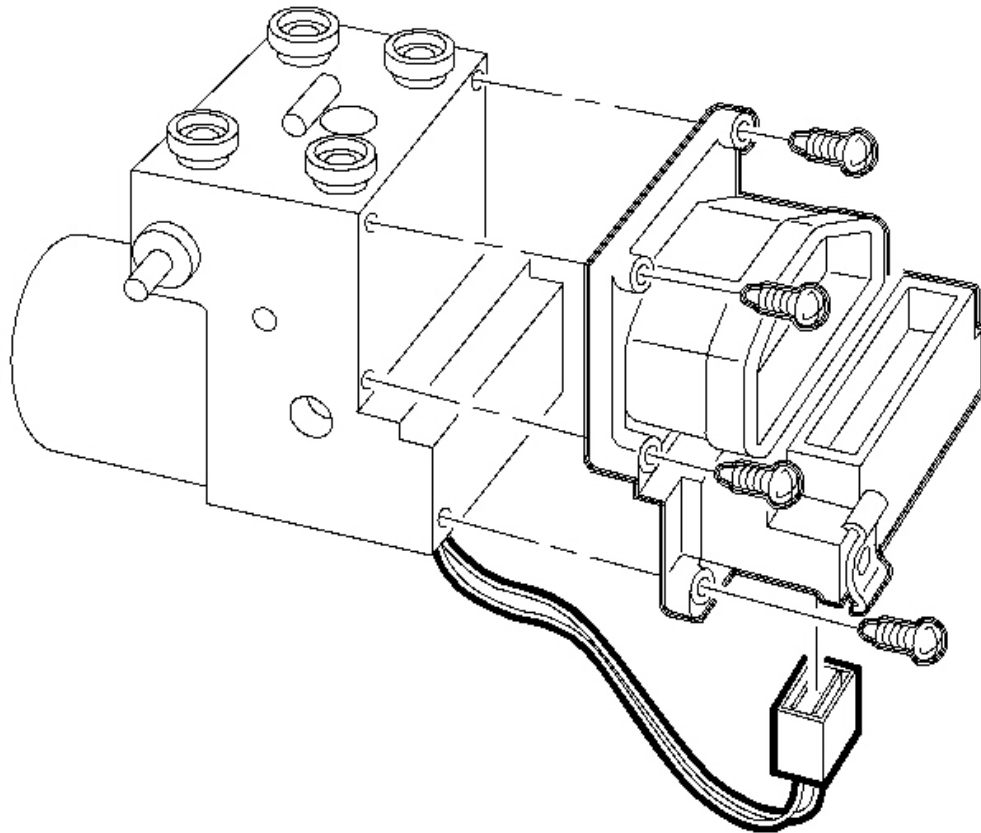


Fig. 12: Disconnecting/Connecting Pump Motor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Clean the sealing surface of the BPMV, with denatured alcohol and a clean shop cloth.
2. Install the EBCM to the BPMV.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the EBCM-to-BPMV attaching screws. Tighten the bolts in a cross pattern.

Tighten: Tighten the bolts to 3 N.m (27 lb in).

4. Connect the pump motor electrical connector.

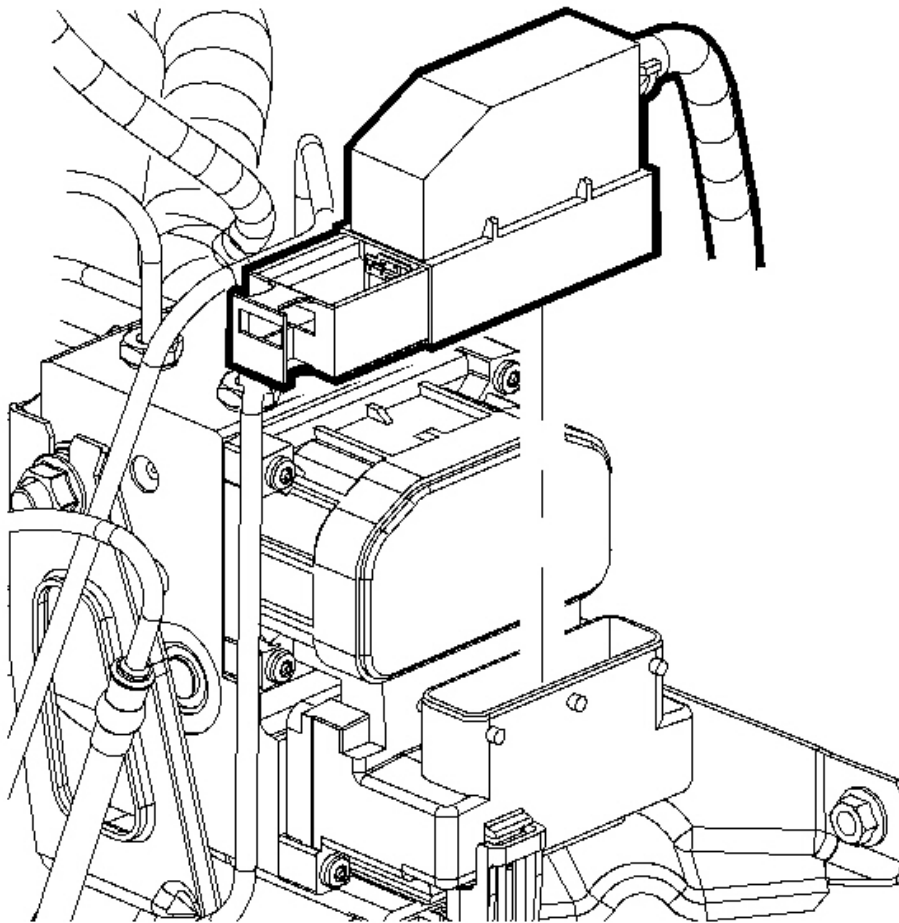


Fig. 13: Disconnecting/Connecting Electrical Connector From Electronic Brake Control Module (EBCM)

Courtesy of GENERAL MOTORS CORP.

5. Connect the electrical connector to the EBCM.

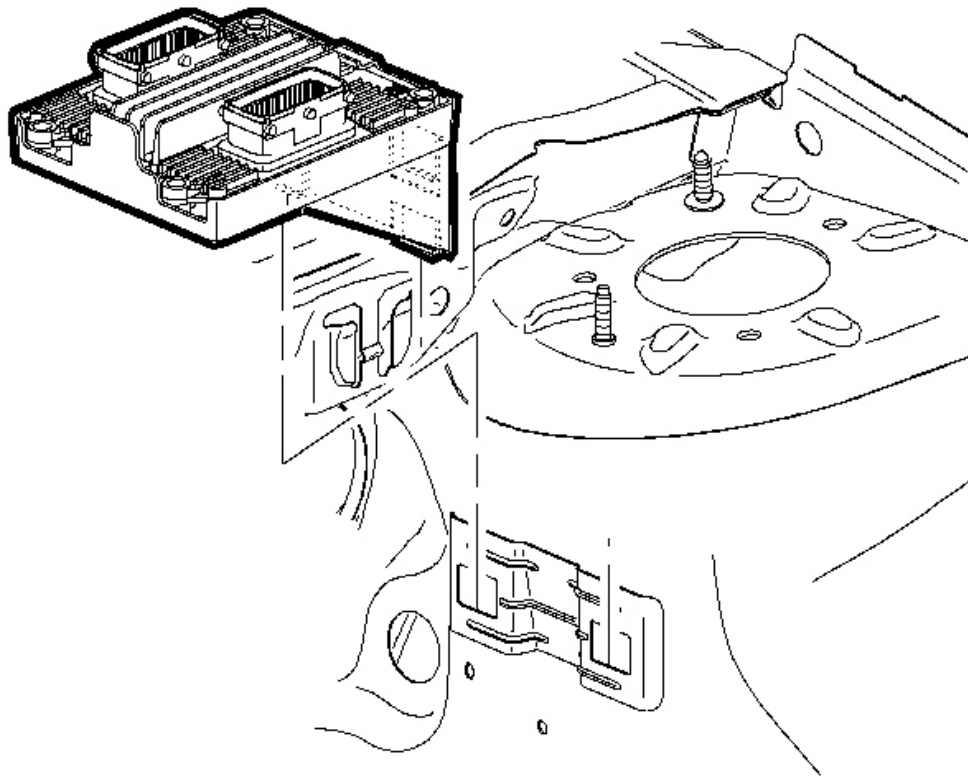


Fig. 14: View Of Electronic Brake Control Module
Courtesy of GENERAL MOTORS CORP.

6. Reposition the TCM, if equipped, to the mounting bracket.
7. Turn the ignition switch to the ON position. DO NOT start engine.
8. Perform the **Diagnostic System Check - ABS** .

BRAKE MODULATOR ASSEMBLY REPLACEMENT

CAUTION: Refer to Brake Fluid Irritant Caution in Cautions and Notices.

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

Removal Procedure

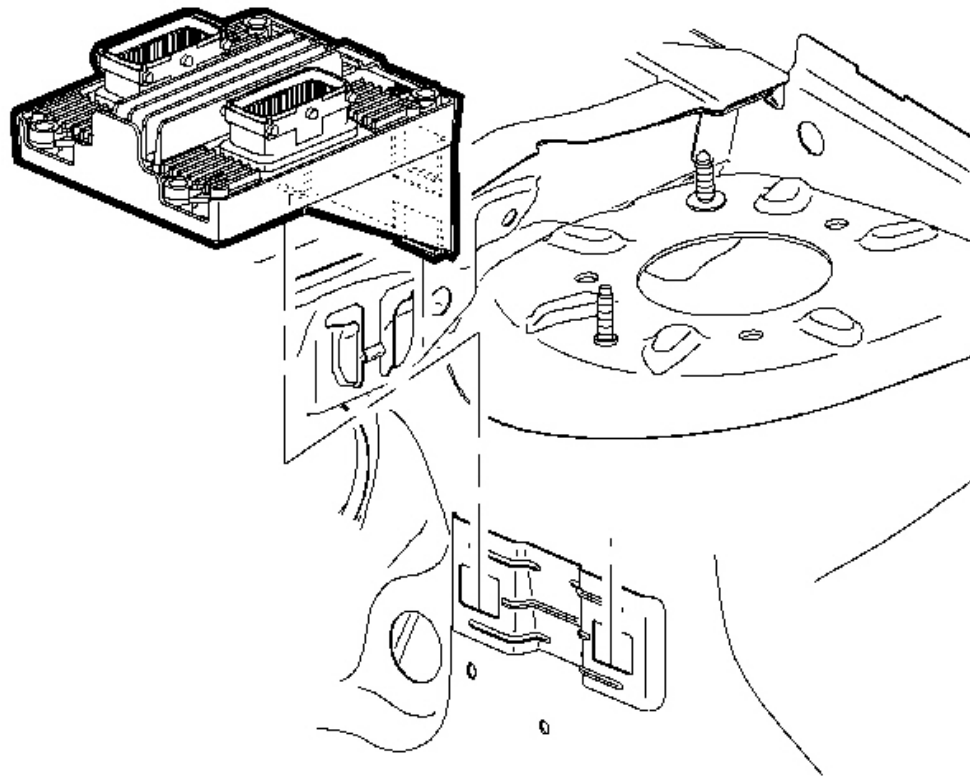


Fig. 15: View Of Electronic Brake Control Module
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition switch to the OFF position.
2. Remove the transmission control module (TCM), if equipped, from the mounting bracket and position aside.

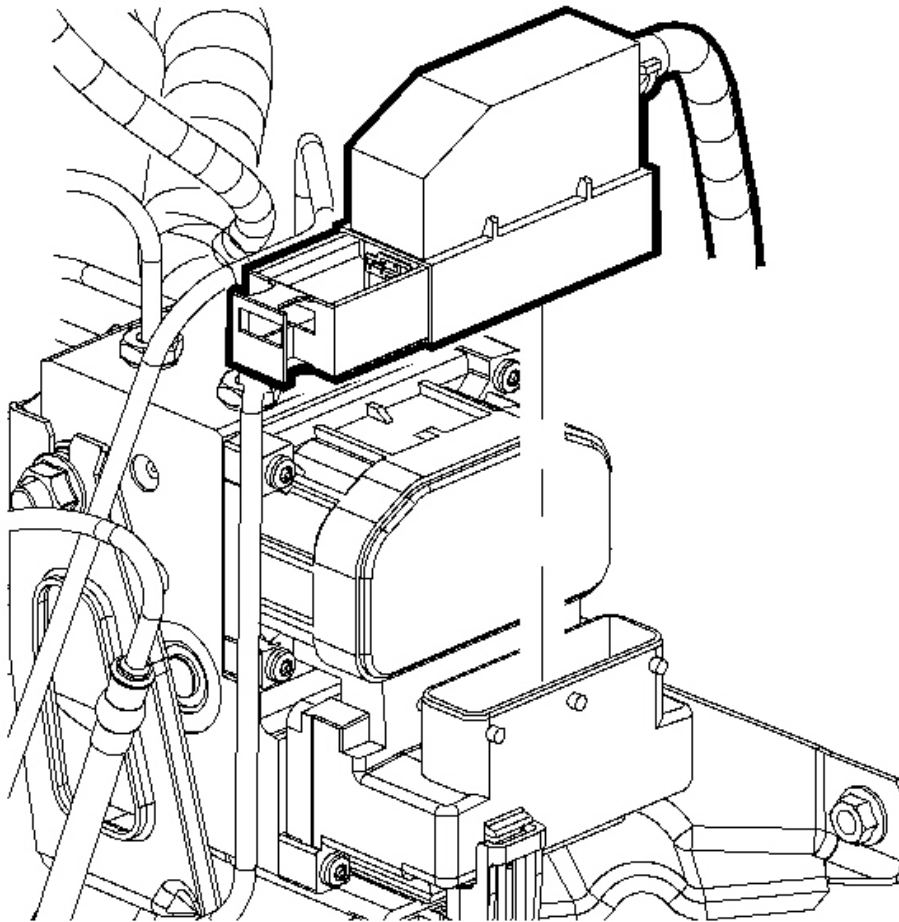


Fig. 16: Disconnecting/Connecting Electrical Connector From Electronic Brake Control Module (EBCM)

Courtesy of GENERAL MOTORS CORP.

3. Clean the brake modulator assembly pipe fitting areas of any accumulated dirt and foreign material.
4. Disconnect the electrical connector from the electronic brake control module (EBCM).

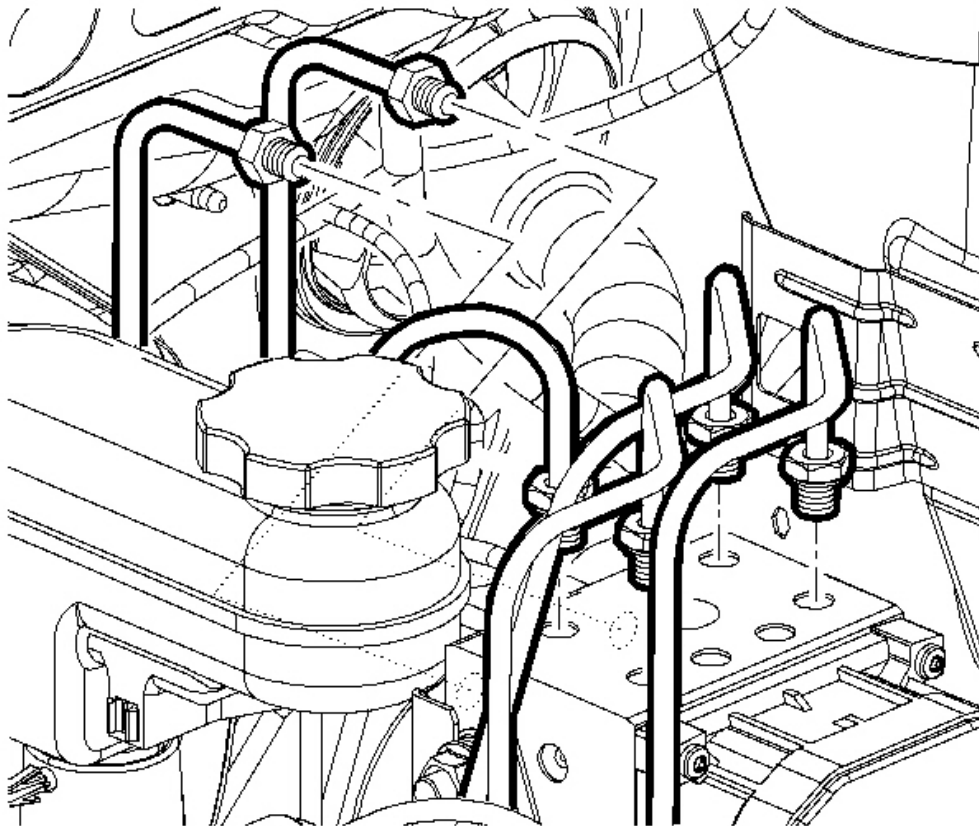


Fig. 17: Removing/Installing Plugs From Master Cylinder Ports On The Modulator Assembly
Courtesy of GENERAL MOTORS CORP.

5. Place a shop towel under the brake modulator assembly to catch any brake fluid loss.

IMPORTANT: Prior to disconnecting the brake pipes from the anti-lock brake system (ABS) modulator assembly, note the locations of the brake pipes to the valve assembly, to aid during installation.

6. Disconnect the caliper and wheel cylinder brake pipes from the brake pressure modulator valve (BPMV).
7. Cap the brake pipe ends to prevent brake fluid loss and contamination.
8. Disconnect the master cylinder brake pipes from the BPMV.

9. Cap the brake pipe ends to prevent brake fluid loss and contamination.
10. Plug the modulator brake pipe openings to prevent brake fluid loss and contamination.

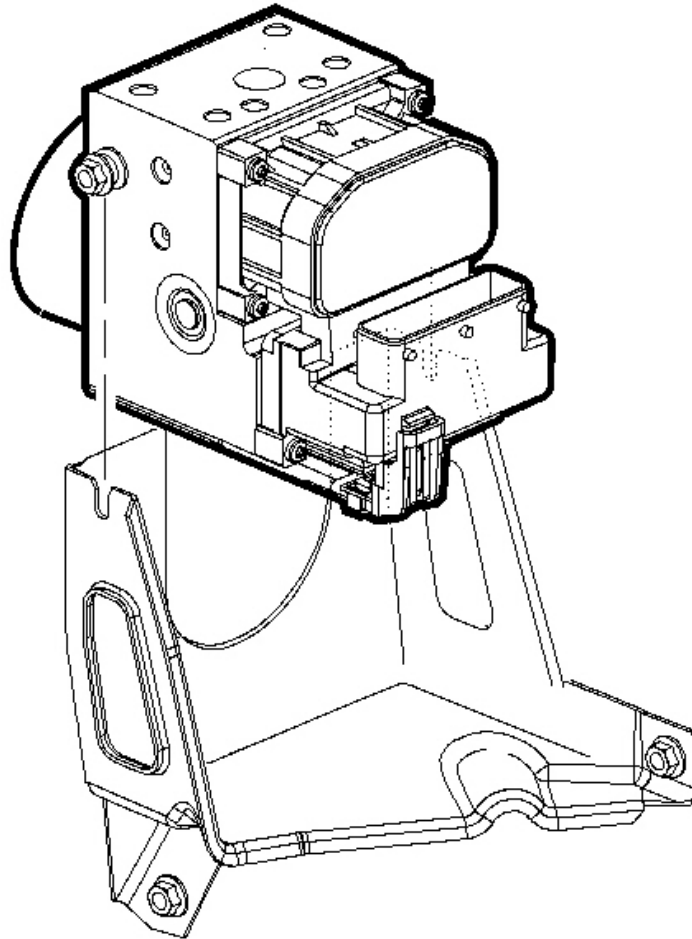


Fig. 18: Removing/Installing Brake Modulator Assembly To The Bracket
Courtesy of GENERAL MOTORS CORP.

11. Loosen the 2 insulator nuts on the brake pressure modulator valve assembly.
12. Remove the brake modulator assembly from modulator bracket by pulling straight up.

Installation Procedure

IMPORTANT: When installing a new brake modulator assembly, do NOT remove the shipping

plugs from the pipe ports until after installation into the vehicle.

1. Install the brake modulator assembly to the modulator bracket.

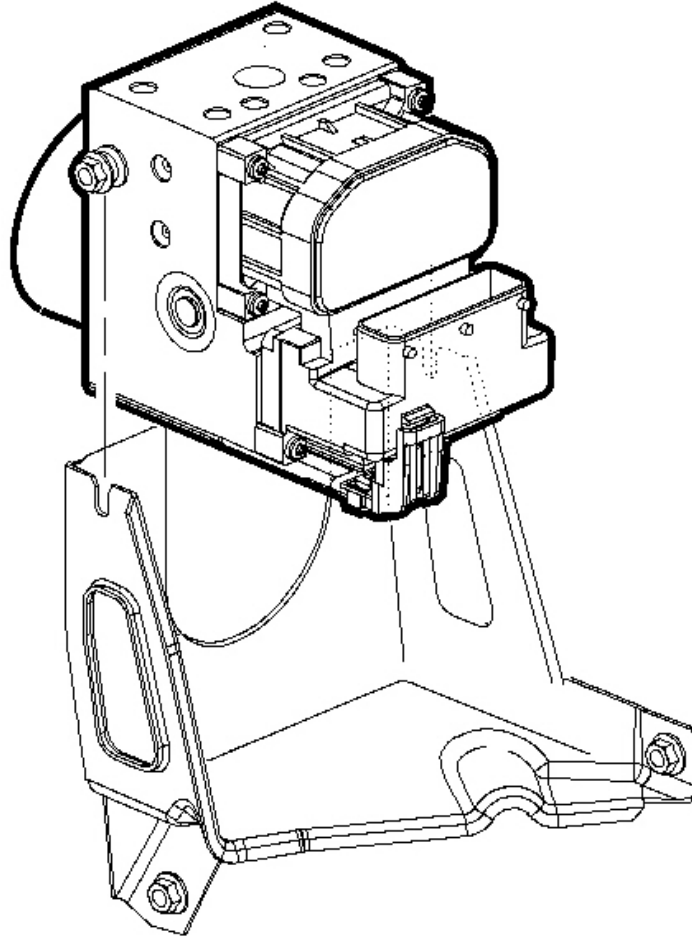


Fig. 19: Removing/Installing Brake Modulator Assembly To The Bracket
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Tighten the 2 brake pressure modulator assembly insulator nuts.

Tighten: Tighten the nuts to 20 N.m (15 lb ft).

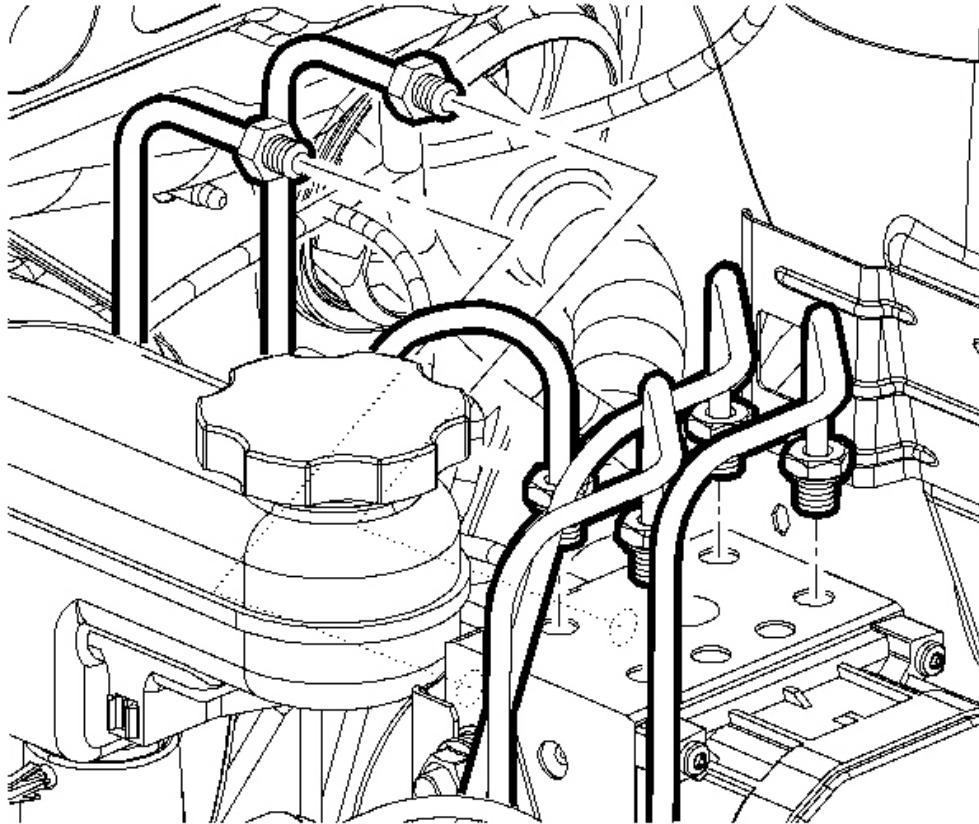


Fig. 20: Removing/Installing Plugs From Master Cylinder Ports On The Modulator Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove the caps from the master cylinder brake pipe ends.
4. Remove the plugs from the master cylinder ports on the modulator assembly.
5. Connect the master cylinder brake pipes to the modulator assembly, in the same location as removed.
6. Tighten the brake pipe fittings at the brake pressure modulator valve (BPMV).

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

7. Remove the caps from the caliper and wheel cylinder brake pipe ends.
8. Remove the plugs from the caliper and wheel cylinder ports on the modulator assembly.

9. Connect the caliper and wheel cylinder brake pipes to the modulator assembly, in the same location as removed.
10. Tighten the brake pipe fittings at the BPMV.

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

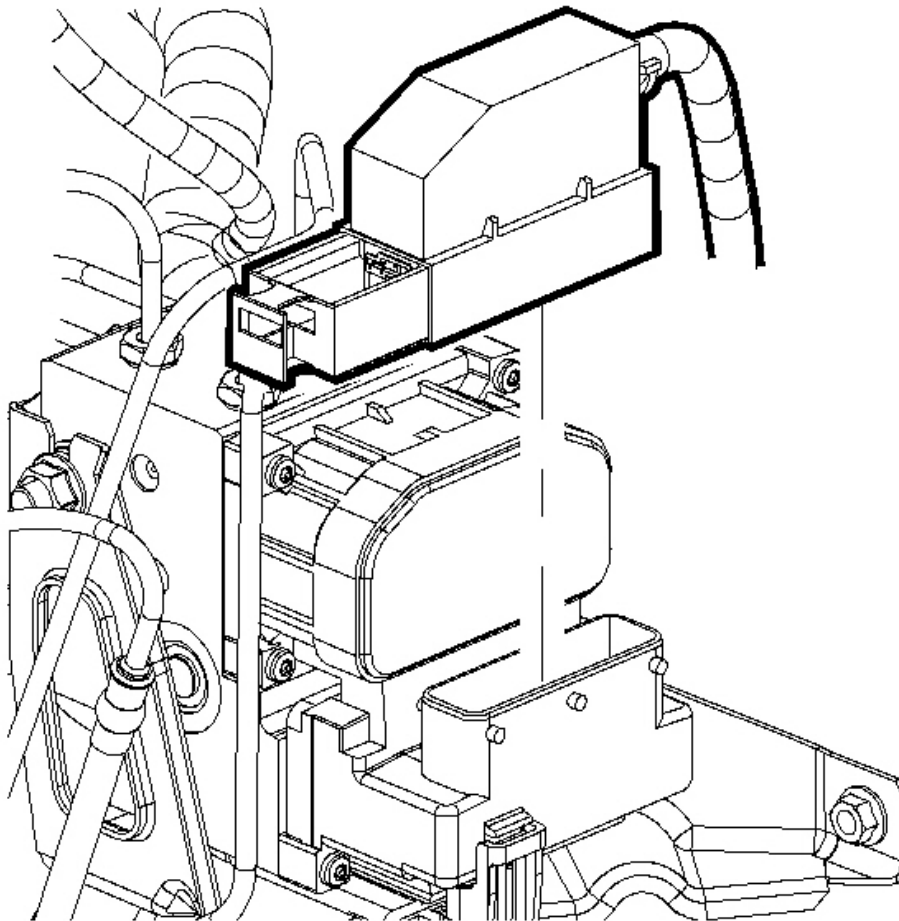


Fig. 21: Disconnecting/Connecting Electrical Connector From Electronic Brake Control Module (EBCM)
Courtesy of GENERAL MOTORS CORP.

11. Connect the electrical connector to the EBCM.

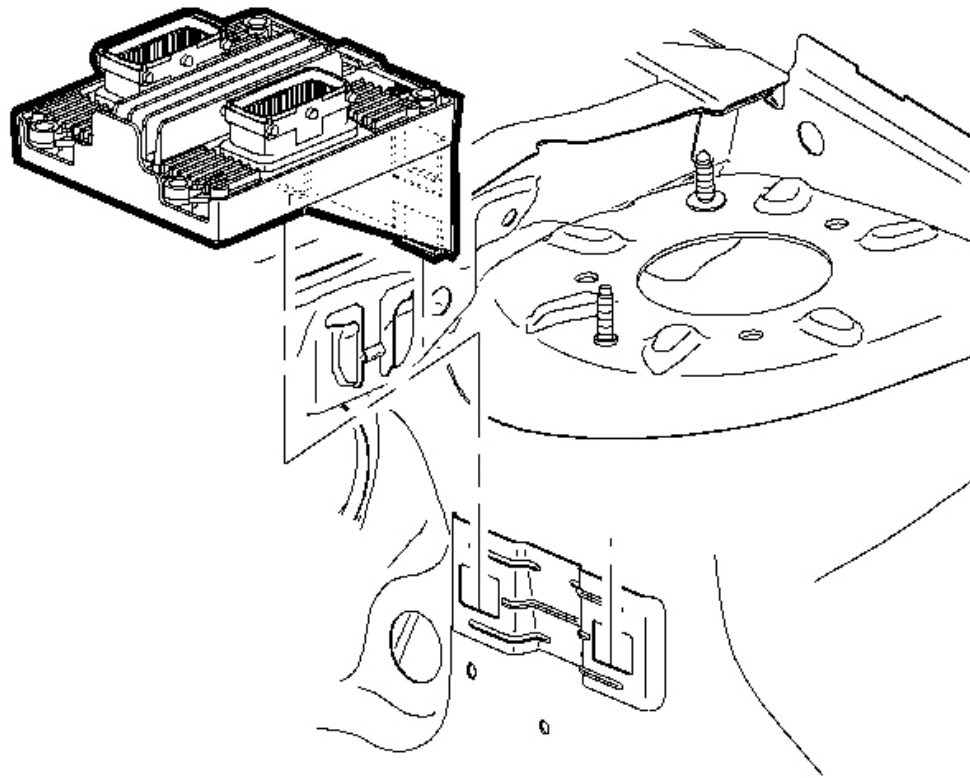


Fig. 22: View Of Electronic Brake Control Module
Courtesy of GENERAL MOTORS CORP.

12. Reposition the TCM, if equipped, to the mounting bracket.
13. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** .
14. Turn the ignition switch to the ON position. DO NOT start engine.
15. Perform the **Diagnostic System Check - ABS** .
16. Observe the feel of the brake pedal after performing the diagnostic system check. If the pedal now feels spongy, air may have been in the secondary circuit of the brake modulator assembly, which may have been introduced into the primary circuit. If the pedal feels spongy, perform the **ABS Automated Bleed Procedure** .

17. Remove the shop towel and discard into an approved container.

BRAKE PRESSURE MODULATOR VALVE (BPMV) BRACKET REPLACEMENT

Removal Procedure

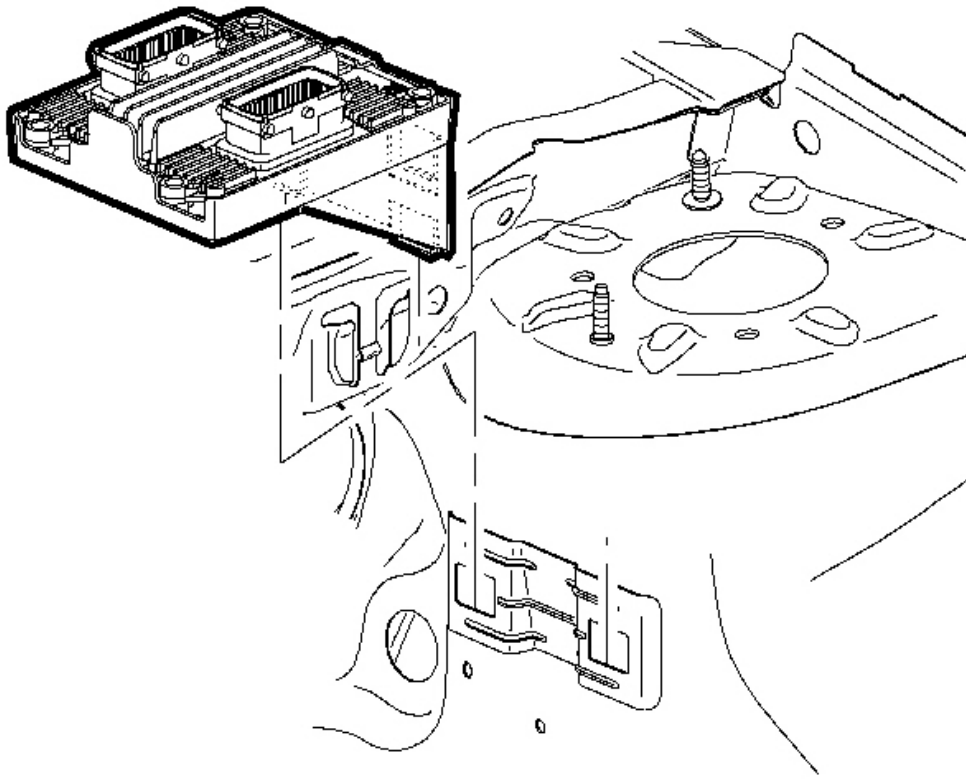


Fig. 23: View Of Electronic Brake Control Module
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission control module (TCM), if equipped, from the mounting bracket and position aside.

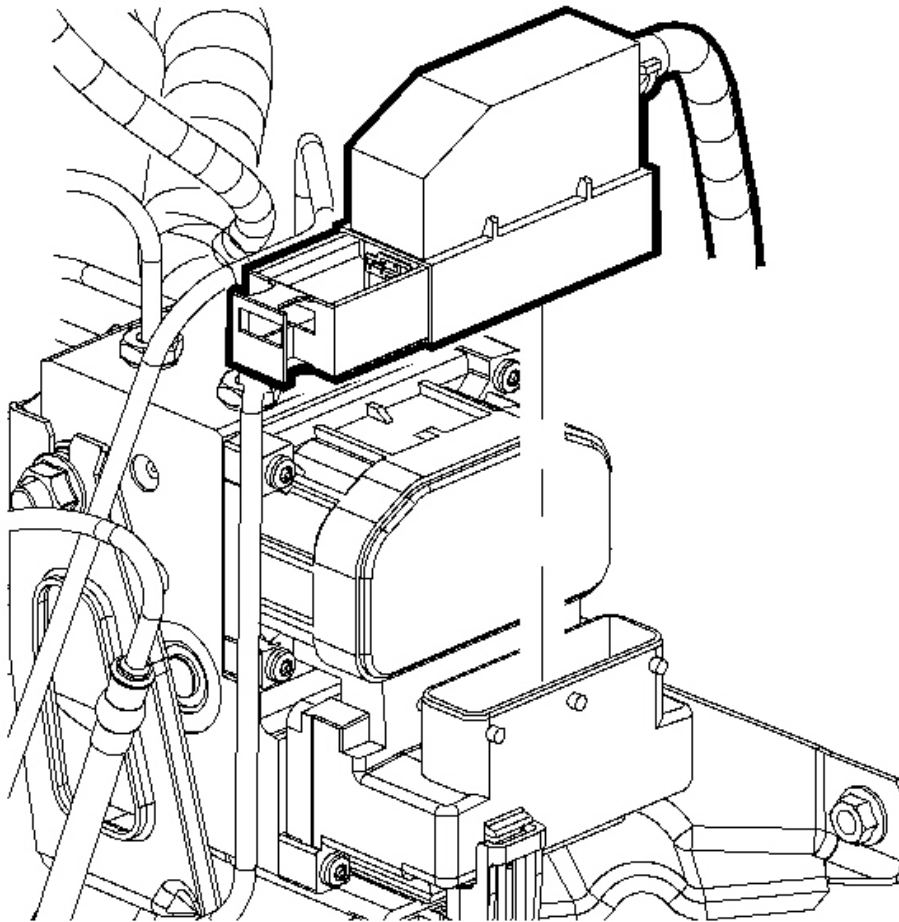


Fig. 24: Disconnecting/Connecting Electrical Connector From Electronic Brake Control Module (EBCM)

Courtesy of GENERAL MOTORS CORP.

2. Turn the ignition switch to the OFF position.
3. Disconnect the electronic brake control module (EBCM) electrical connector.

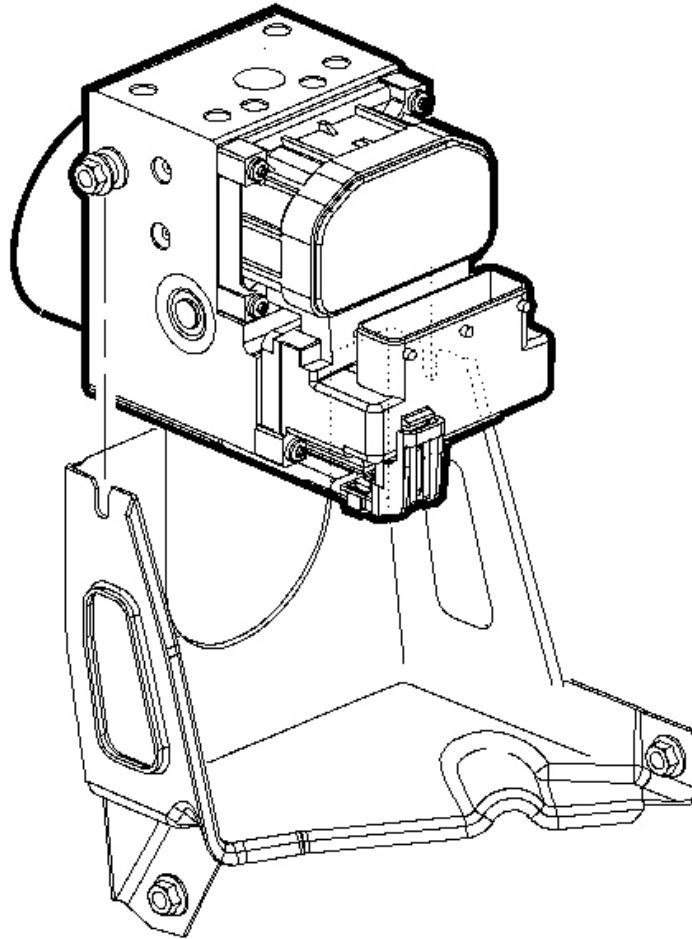


Fig. 25: Removing/Installing Brake Modulator Assembly To The Bracket
Courtesy of GENERAL MOTORS CORP.

4. Loosen the 2 insulator nuts on the brake pressure modulator valve (BPMV) assembly.
5. Carefully lift the brake modulator assembly just enough to clear the bracket, then support the assembly.

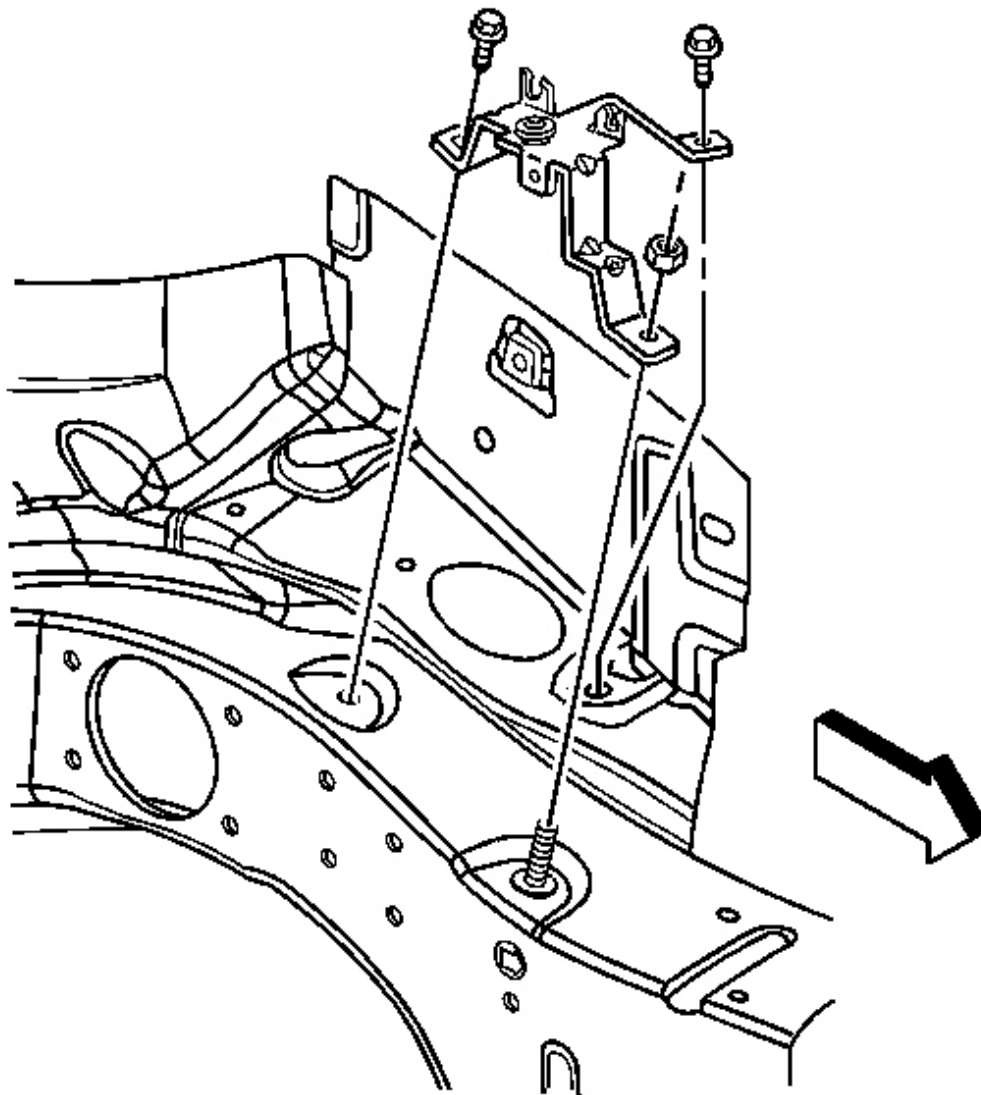


Fig. 26: Removing/Installing BPMV Assembly Bracket To The Vehicle
Courtesy of GENERAL MOTORS CORP.

6. Remove the brake pressure modulator assembly bracket mounting bolts.
7. Remove the bracket from the vehicle.

Installation Procedure

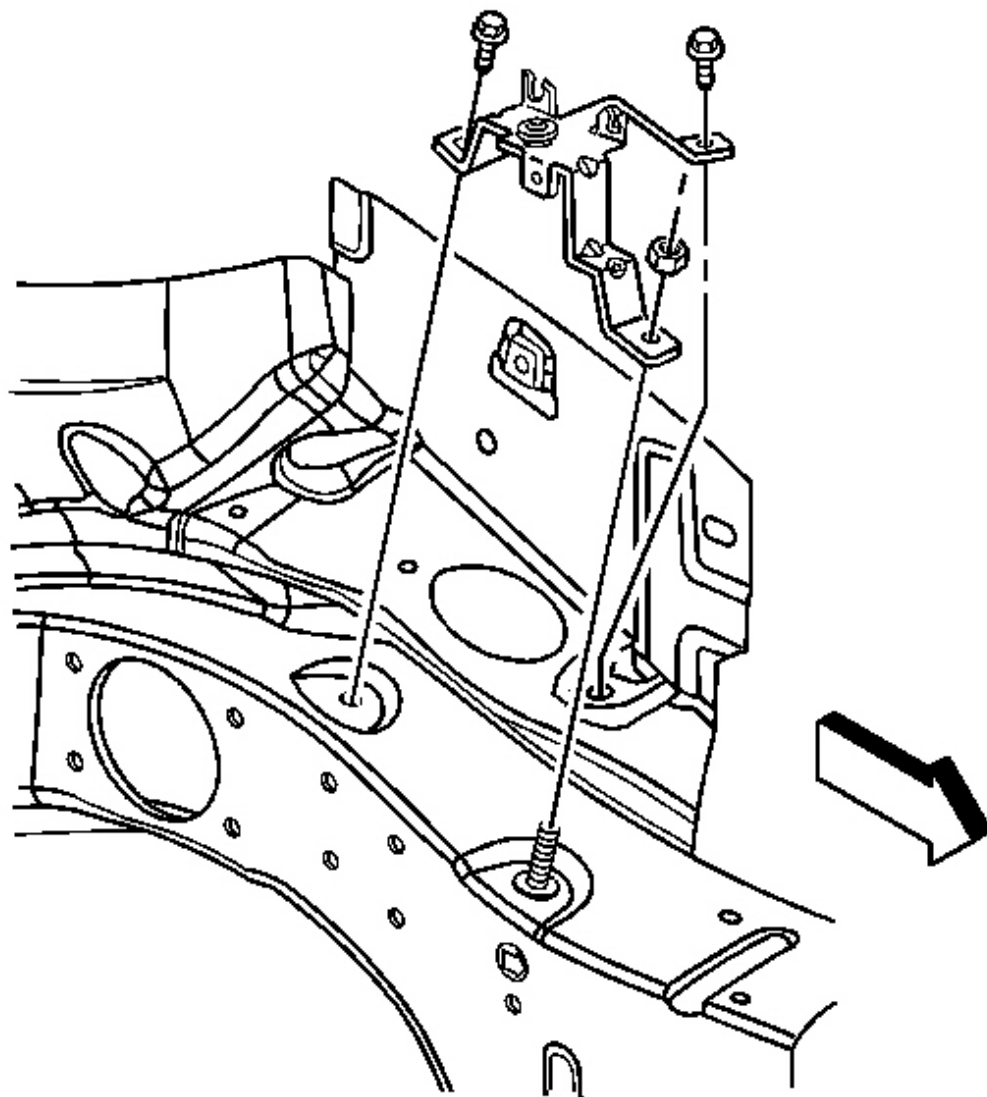


Fig. 27: Removing/Installing BPMV Assembly Bracket To The Vehicle
Courtesy of GENERAL MOTORS CORP.

1. Install the BPMV assembly bracket to the vehicle.

NOTE: Refer to **Fastener Notice** in **Cautions and Notices**.

2. Install the brake pressure modulator assembly bracket mounting bolts and nut.

Tighten: Tighten the bolts and nut to 10 N.m (89 lb in).

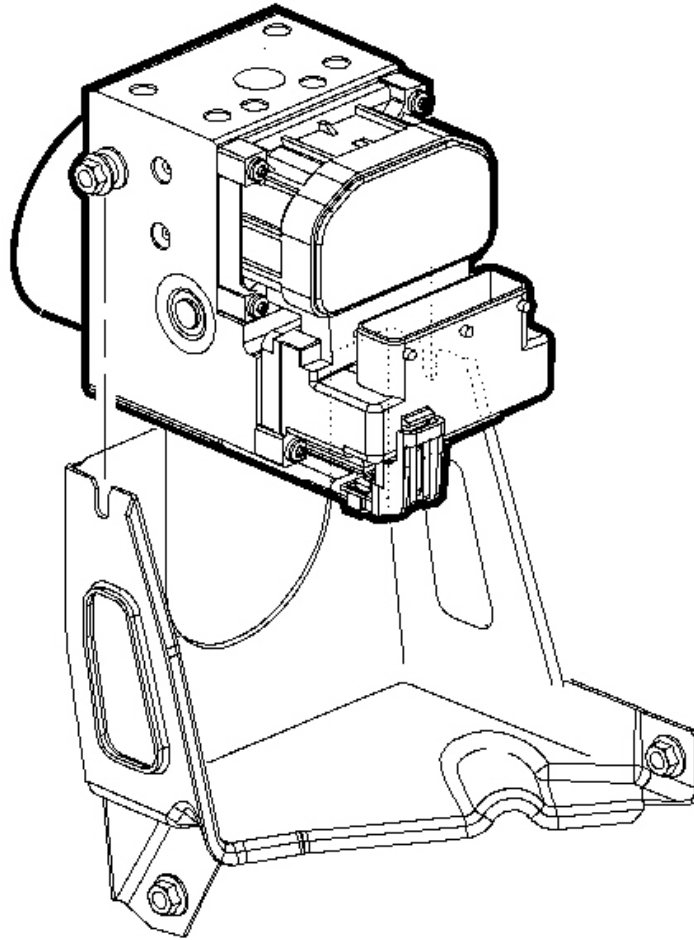


Fig. 28: Removing/Installing Brake Modulator Assembly To The Bracket
Courtesy of GENERAL MOTORS CORP.

3. Install the brake modulator assembly to the bracket.
4. Tighten the 2 brake pressure modulator assembly insulator nuts.

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

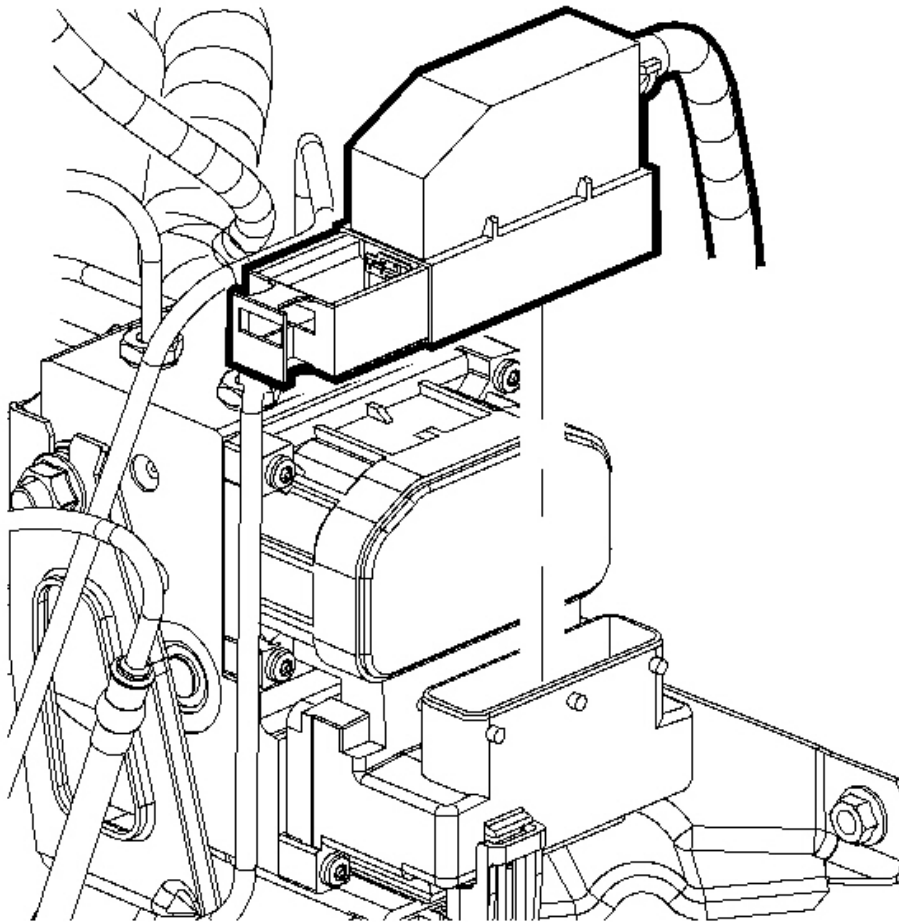


Fig. 29: Disconnecting/Connecting Electrical Connector From Electronic Brake Control Module (EBCM)
Courtesy of GENERAL MOTORS CORP.

5. Connect the EBCM electrical connector.

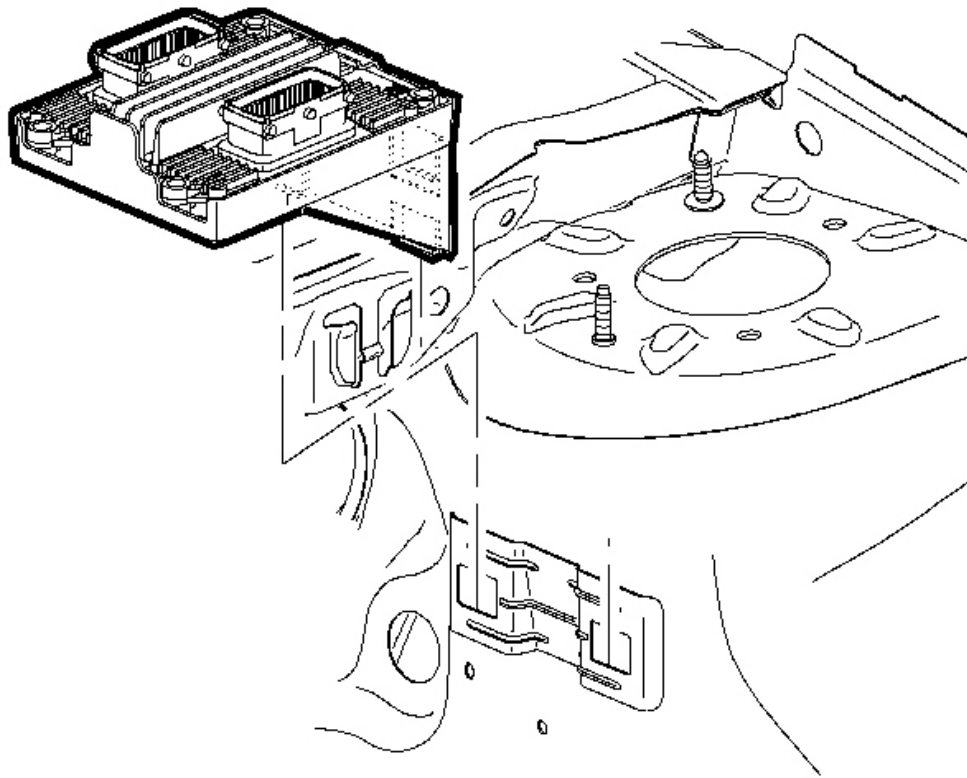


Fig. 30: View Of Electronic Brake Control Module
Courtesy of GENERAL MOTORS CORP.

6. Reposition the TCM, if equipped, to the mounting bracket.

WHEEL SPEED SENSOR REPLACEMENT - FRONT

Removal Procedure

1. Raise and support 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 brake rotor. Refer to **Brake Rotor Replacement** in Disc Brakes.

4. Disconnect the wheel speed sensor electrical connector.

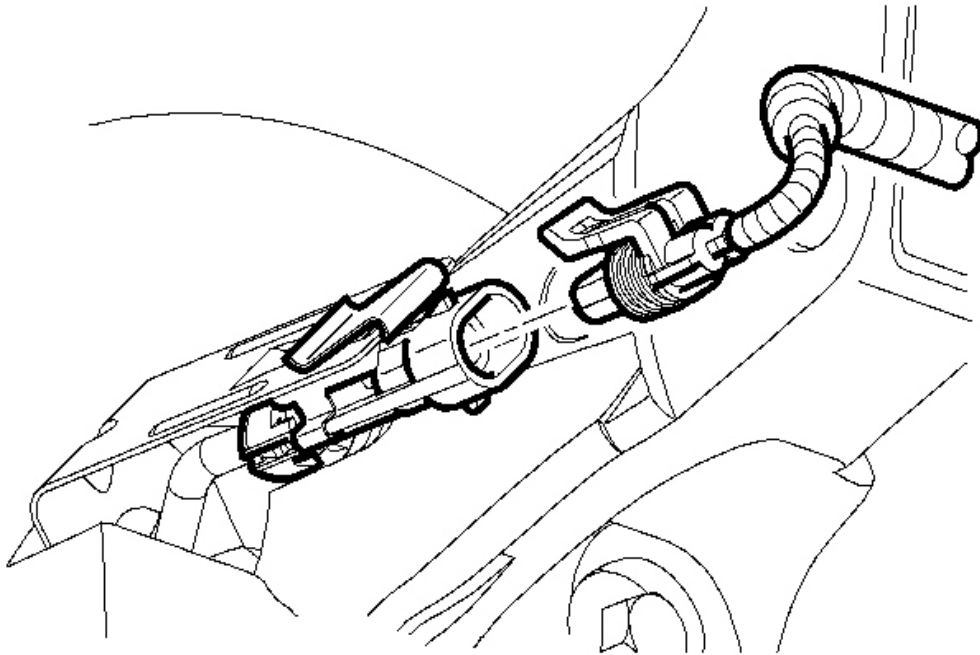


Fig. 31: View Of Front Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

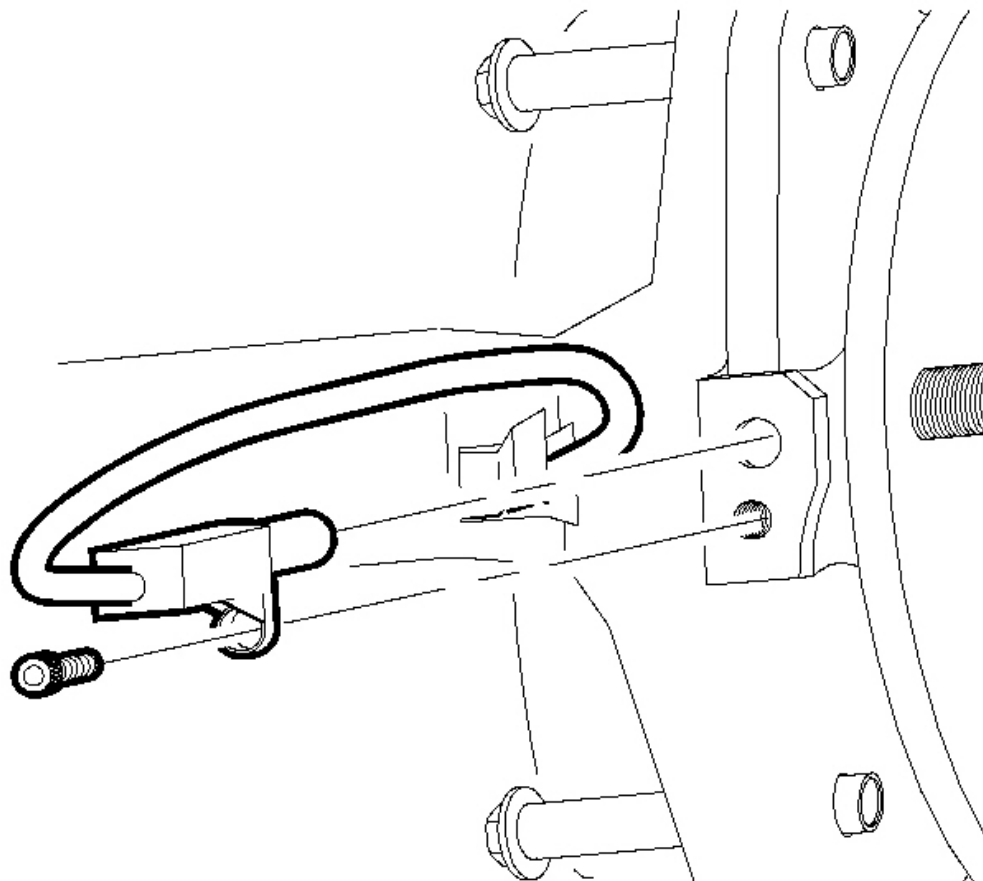


Fig. 32: Removing/Installing Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

5. Remove the wheel speed sensor bolt.
6. Remove the wheel speed sensor.

Installation Procedure

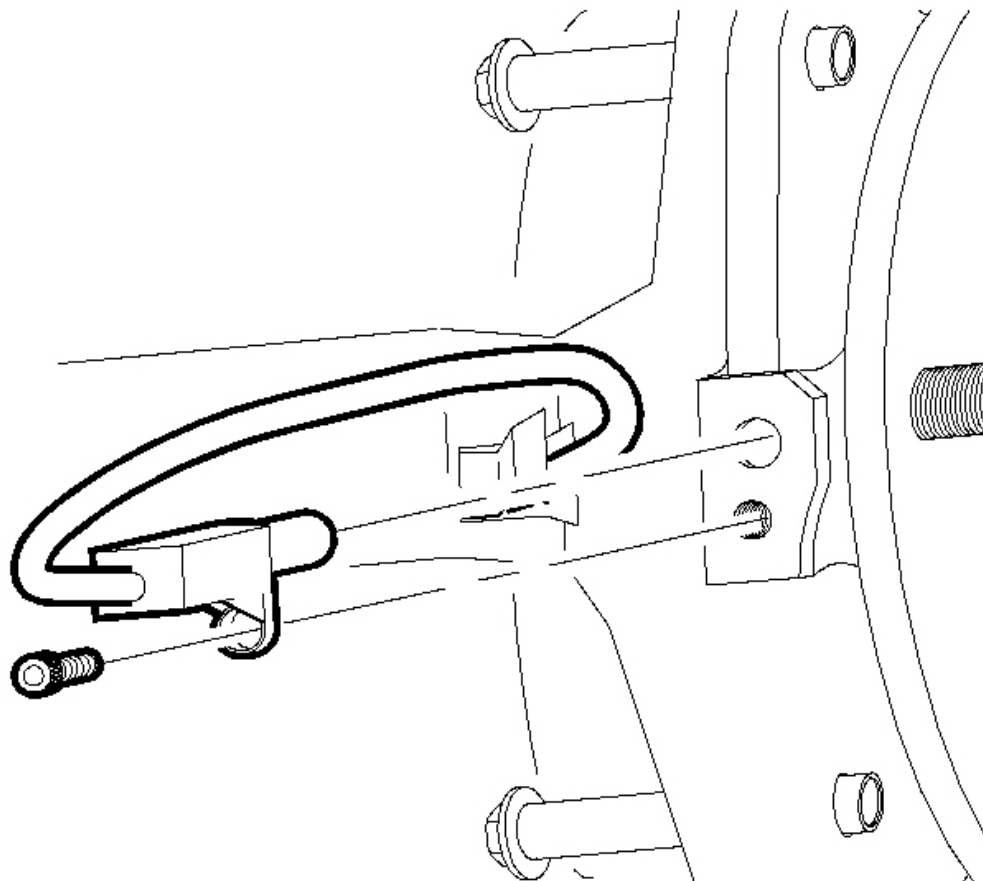


Fig. 33: Removing/Installing Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

1. Install the wheel speed sensor to the wheel bearing/hub assembly.

NOTE: Refer to **Fastener Notice** in **Cautions and Notices**.

2. Install the wheel speed sensor mounting bolt.

Tighten: Tighten the bolt to 8 N.m (71 lb in).

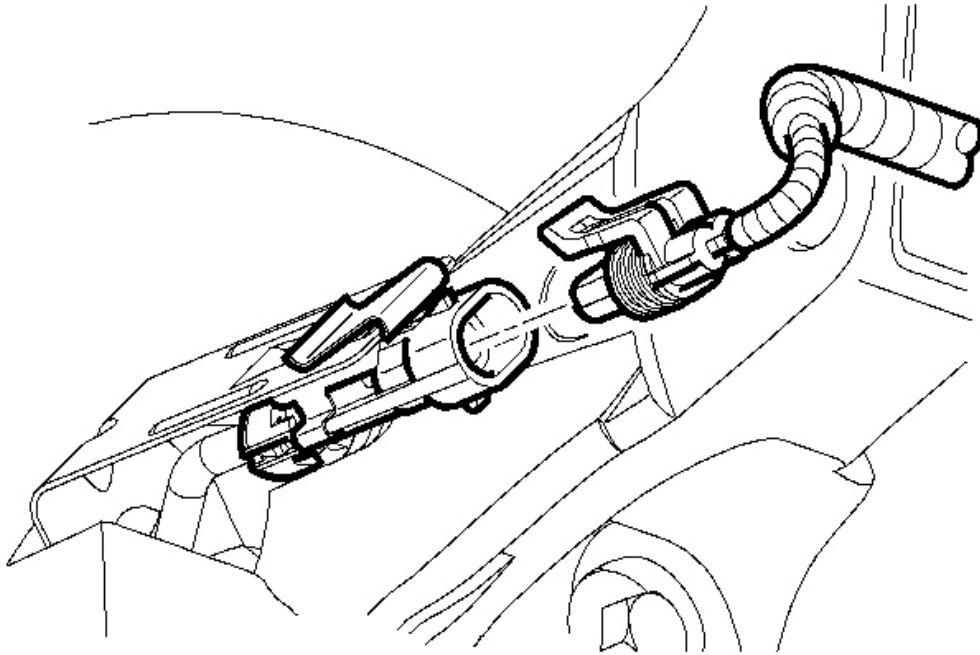


Fig. 34: View Of Front Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

3. Connect the wheel speed sensor electrical connector.
4. Install the brake rotor. Refer to **Brake Rotor Replacement** in Disc Brakes.
5. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
6. Lower the vehicle.

WHEEL SPEED SENSOR REPLACEMENT - REAR

Removal Procedure

1. Raise and support 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 brake shoes. Refer to **Brake Shoe Replacement** in Drum Brakes.
4. Disconnect the wheel speed sensor electrical connector.

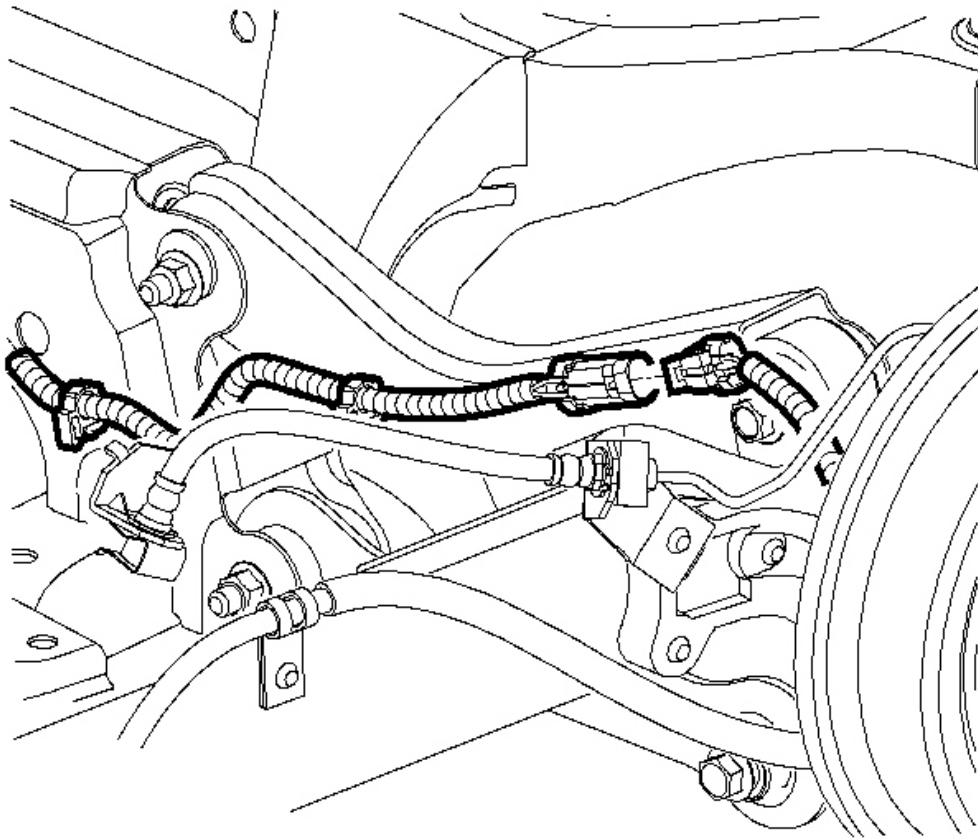


Fig. 35: Disconnecting/Connecting Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

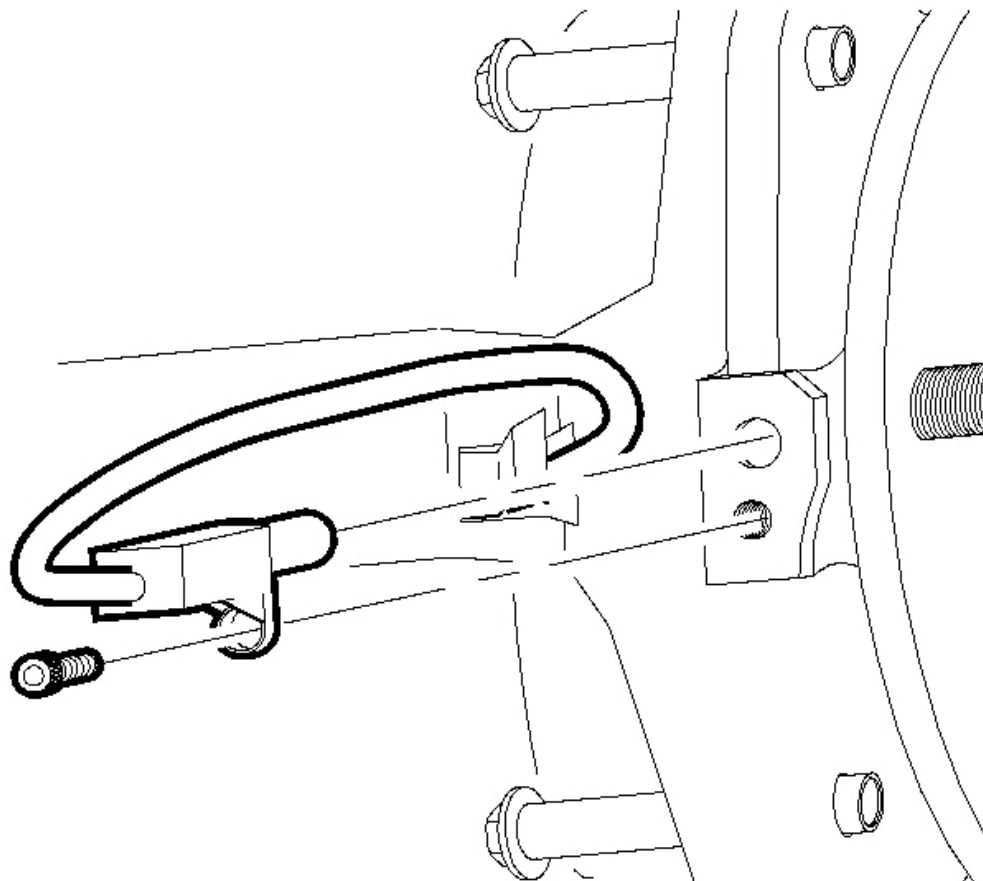


Fig. 36: Removing/Installing Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

5. Remove the wheel speed sensor bolt.
6. Remove the wheel speed sensor through the drum brake backing plate.

Installation Procedure

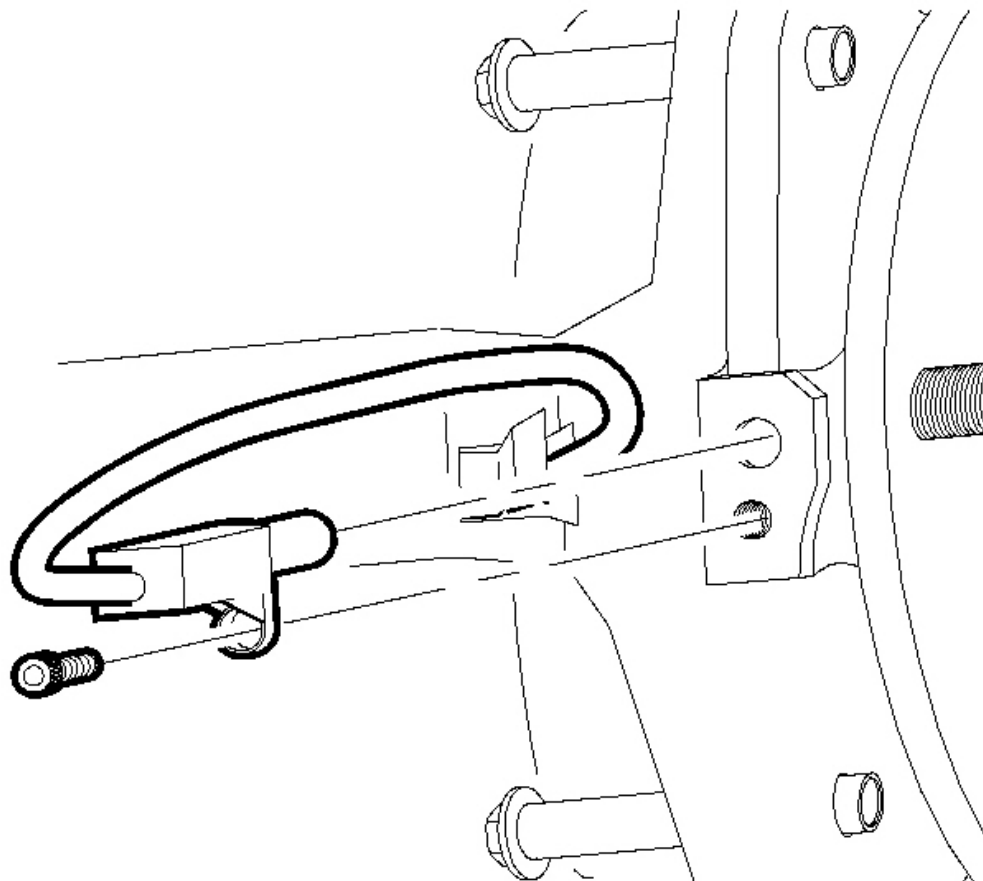


Fig. 37: Removing/Installing Wheel Speed Sensor
Courtesy of GENERAL MOTORS CORP.

1. Install the wheel speed sensor through the drum brake backing plate to the wheel bearing/hub assembly.
2. Seat the wheel speed sensor harness grommet into the backing plate.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the wheel speed sensor mounting bolt.

Tighten: Tighten the bolt to 8 N.m (71 lb in).

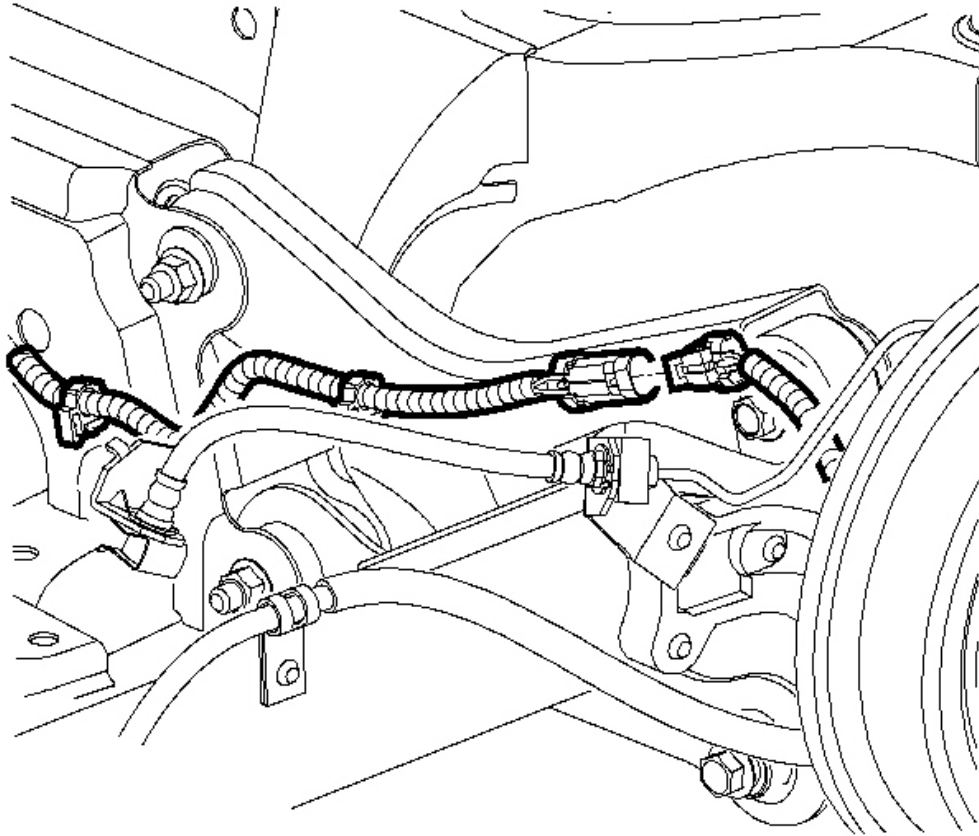


Fig. 38: Disconnecting/Connecting Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Connect the wheel speed sensor electrical connector.
5. Install the brake shoes. Refer to **Brake Shoe Replacement** in Drum Brakes.
6. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
7. Lower the vehicle.

TRACTION CONTROL SWITCH REPLACEMENT

Removal Procedure

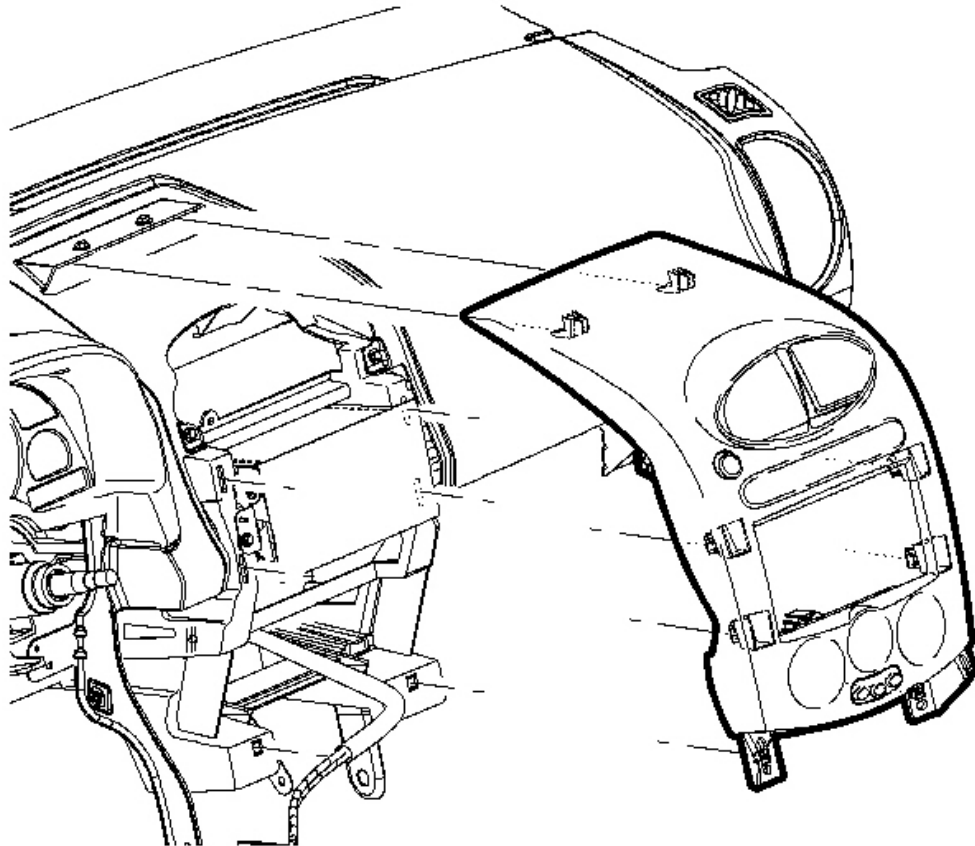


Fig. 39: View Of Traction Control Switch
Courtesy of GENERAL MOTORS CORP.

1. Remove the instrument panel (I/P) trim bezel. Refer to **Trim Bezel Replacement - Center** in Instrument Panel, Gages and Console.

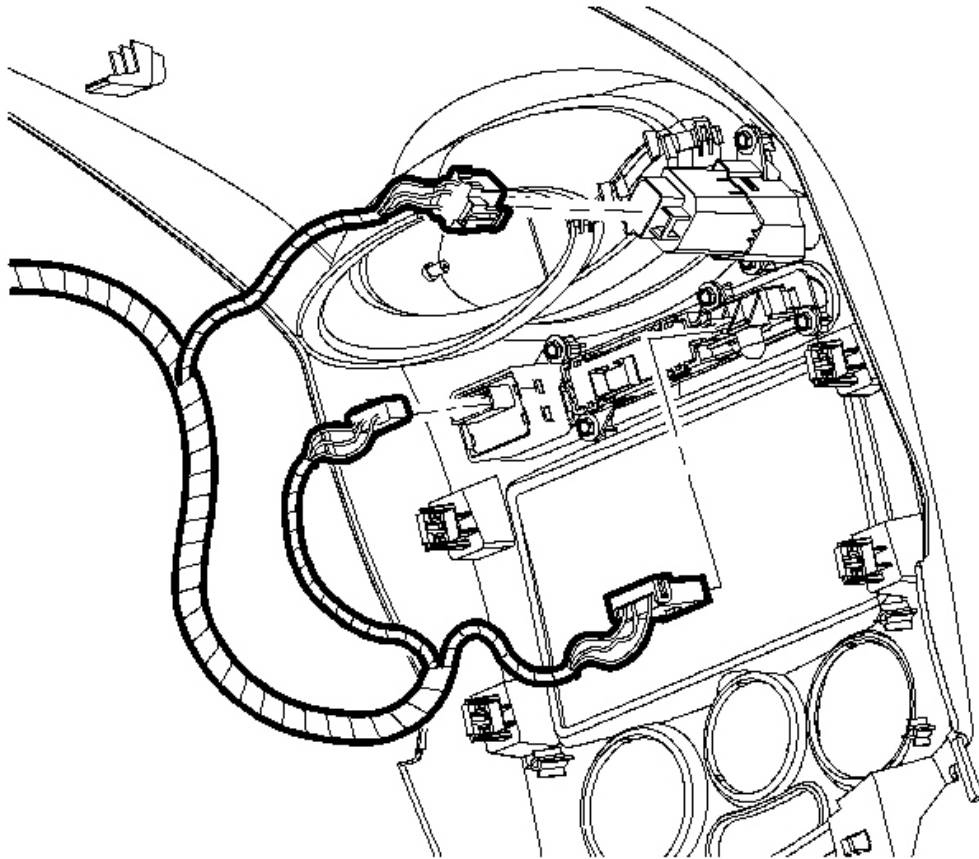


Fig. 40: Removing/Installing Traction Control Switch To The Trim Bezel
Courtesy of GENERAL MOTORS CORP.

2. Carefully release the retaining tabs and remove the traction control switch from the trim bezel.

Installation Procedure

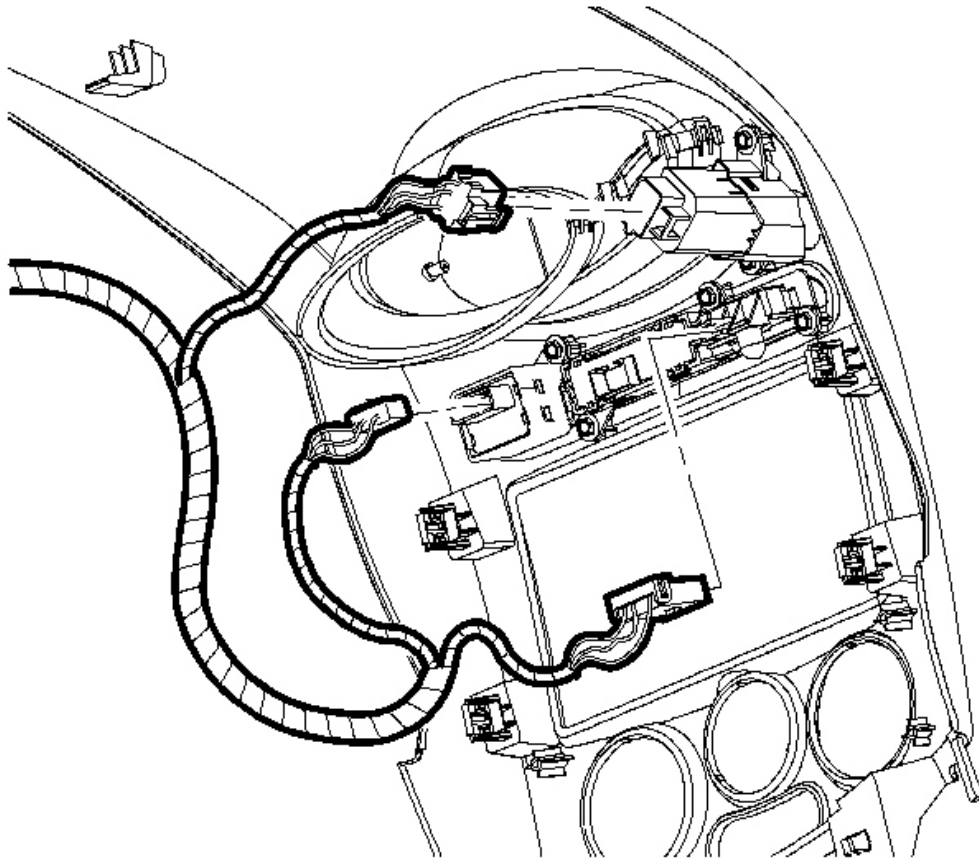


Fig. 41: Removing/Installing Traction Control Switch To The Trim Bezel
Courtesy of GENERAL MOTORS CORP.

1. Install the traction control switch to the trim bezel. Ensure that the retaining tabs are fully engaged.

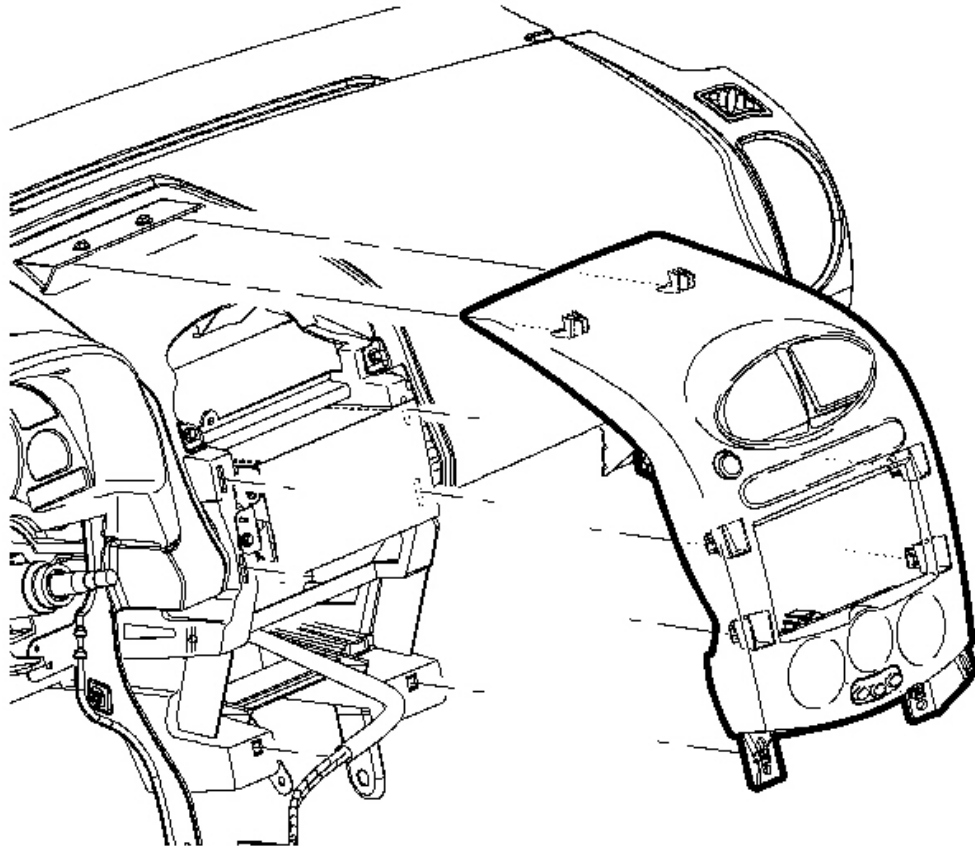


Fig. 42: View Of Traction Control Switch
Courtesy of GENERAL MOTORS CORP.

2. Install the instrument panel (I/P) trim bezel. Refer to **Trim Bezel Replacement - Center** in Instrument Panel, Gages and Console.

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION

The purpose of the Anti-lock Brake System (ABS) is to minimize wheel slip during heavy braking. The ABS performs this function by monitoring the speed of each wheel and controlling the brake fluid pressure to each wheel independently during an braking event. This allows the driver to maintain directional stability while

minimizing stopping distance.

Valve Assembly (BPMV)

The valve assembly provides brake fluid pressure modulation for each of the individual wheel circuits, as required, during an ABS/TCS event. During an ABS event, the valve assembly can maintain or reduce brake fluid pressure that is applied by the master cylinder. The valve assembly cannot increase pressure beyond what is applied by the master cylinder (driver). The valve assembly contains a motor-driven pump, ABS inlet and outlet valves, as well as TCS prime and isolation valves. With exception of the ABS control module (EBTCM), the valve assembly is not serviceable and should never be disassembled.

The valve assembly is an addition to the four-circuit diagonally-split hydraulic system found on vehicles without ABS.

ABS Control Module (EBTCM)

The ABS control module monitors the speed of each wheel to detect wheel slip. If wheel slip is detected, the module commands the appropriate valve positions in the valve assembly to modulate brake pressure in some or all of the hydraulic circuits. This action prevents wheel slip and provides optimum braking. In addition, the ABS control module performs a continuous diagnostic routine to detect malfunctions. If the module detects an electrical malfunction, it can disable ABS/TCS/DRP, illuminate the appropriate telltale and store a Diagnostic Trouble Code (DTC).

The ABS control module contains a solenoid for each ABS/TCS valve it operates and a relay for the solenoid circuit and pump motor circuit respectively. The relays and solenoids are not serviceable.

ABS Operation

During an ABS event, the ABS control module will control the hydraulic pressure in the individual wheel circuits to prevent any wheel from slipping. The control module can decrease or hold hydraulic pressure by energizing the appropriate valve solenoid. A rapid pulsation is felt in the brake pedal and a ticking or popping noise can be heard as control module commands valve solenoids in response to wheel speed changes.

When the ABS control module detects wheel slip, it holds pressure by closing both the inlet valve from the master cylinder and the outlet valve. If pressure hold is not enough to control wheel slip, the ABS control module releases pressure by opening the outlet valve and allowing some pressure bleed-off into the accumulator. The accumulator stores this fluid until the motor-driven pump returns fluid to the master cylinder.

The control module opens the inlet valve to allow master cylinder pressure to the wheel circuits again when no wheel slip is detected.

Traction Control System (TCS)

The Traction Control System (TCS) compares front wheel speeds to rear wheel speeds to determine if drive wheels lose traction. The TCS activates when drive wheel speed exceeds speed of non-drive wheels by a calibrated value. This allows the driver to maintain acceleration and directional stability while accelerating on low traction surfaces.

The TCS limits wheel slip during acceleration when one or more of the drive wheels lose traction. The brake switch must be off for TCS to operate.

The ABS control module monitors wheel speed output and compares drive wheel to non-drive wheel values to detect wheel slip. During a TCS event, the ABS control module sends a requested torque value to the ECM/TCM (L81) or PCM (L61). The ECM/TCM or PCM initiates an engine torque reduction routine to slow down the drive wheels. This routine consists of ignition timing reduction, fuel injector cut-off and transmission shift control. The ECM/PCM also sends a torque delivered value to the ABS control module. If the engine management routine is insufficient to achieve the desired wheel speed, the ABS control module will then use the TCS isolation valves and prime valves to slow down the drive wheels. The isolation valves close to isolate the wheel circuit from the master cylinder and the prime valves open to allow the motor-driven pump to access master cylinder fluid so it can build pressure to apply the desired brake.

If the ABS control module detects a malfunction, it will disable TCS and will command the BCM to turn the TRAC LED Off. The driver can also disable TCS, if desired, by depressing the TRAC switch. When the driver depresses the TRAC switch, the ABS control module will disable TCS and will command the BCM to turn the TRAC LED Off.

Dynamic Rear Proportioning (DRP)

Dynamic Rear Proportioning (DRP) is an electronic brake proportioning feature that replaces the mechanical proportioning valve in the base brake system. DRP uses existing ABS components to regulate the vehicle's rear brake pressure and provide optimum front-rear brake balance in all braking situations.