Antilock Brake System

Specifications

Fastener Tightening Specifications

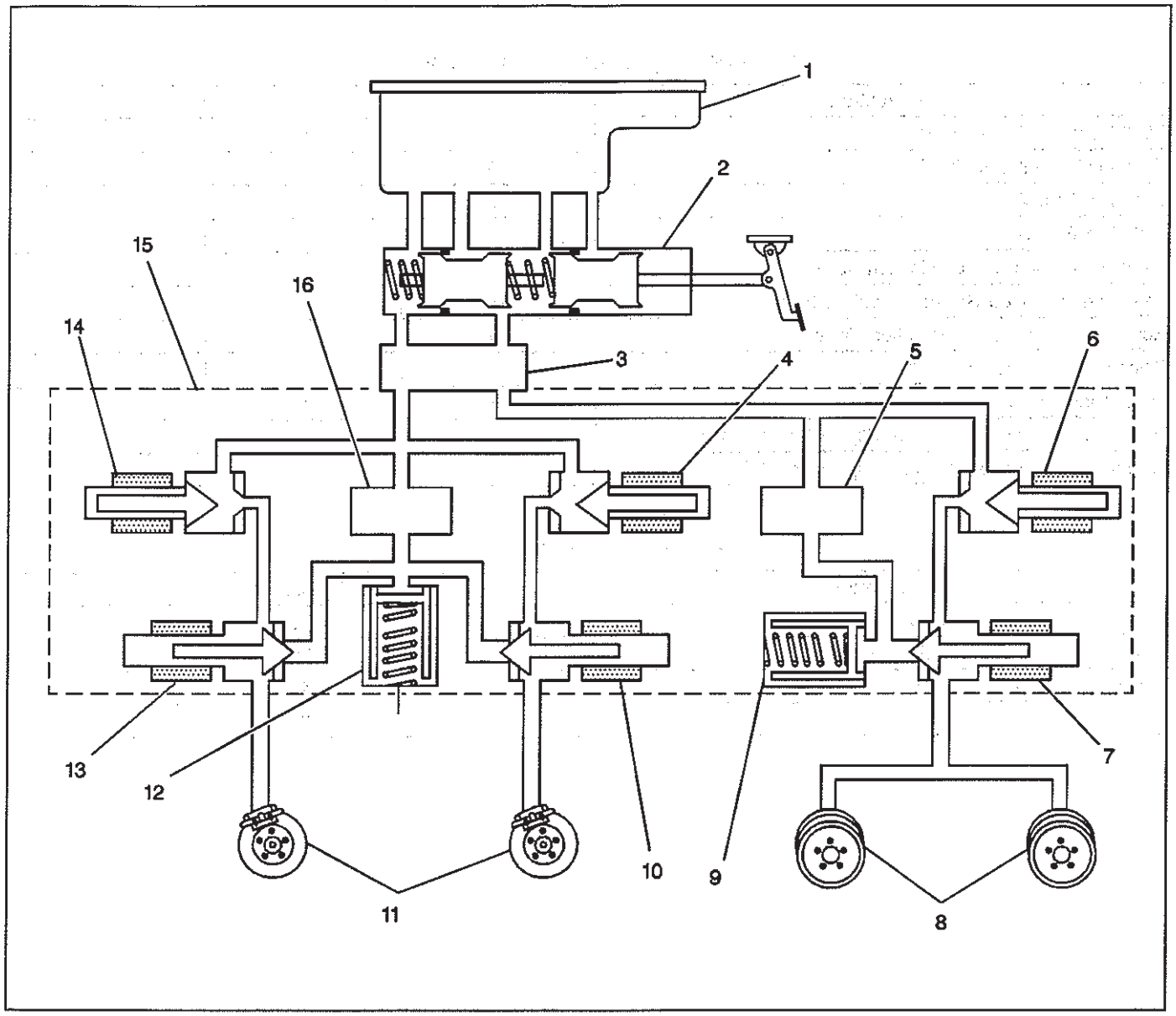
Application	N·m	Lb Ft	Lb In
EBCM Bracket Mounting Bolts	24	18	—
Combination Valve to BPMV	16	12	—
EBCM to BPMV	5	—	39
EHCU to Bracket	9	7	—
Front Brake Line to Combination Valve	24	18	—
Front Wheel Speed Sensor Mounting Bolts	26	19	—
Rear Brake Line to Combination Valve	24	18	—
Splash Shield Mounting Bolts	16	12	—
Tube Adapters to BPMV	31	23	—
Wheel Speed Sensor Harness Clip to Shock Tower	15	11	—
Wheel Speed Sensor Harness Clip to Ball Joint	18	13	—

GM SPO Group Numbers

Application	GM SPO Group Number
Brake Pressure Modulator Valve	4.730
Electronic Brake Control Module	4.720
Stoplamp Switch	2.447
Wheel Speed Sensor	4.710

Schematic and Routing Diagrams

BPMV Hydraulic Flow Chart (Normal Braking Mode)

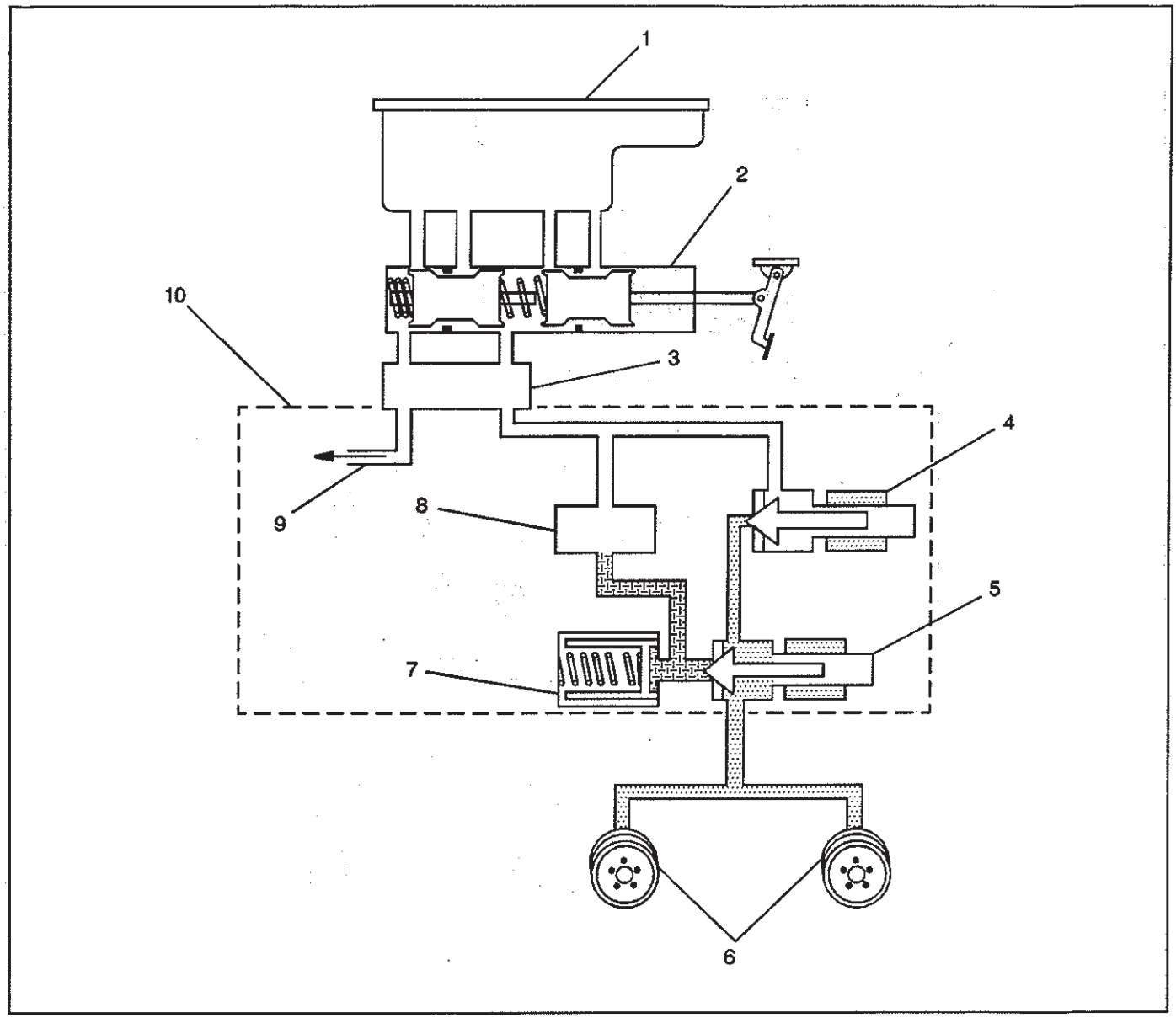


184237

Legend

(1) Master Cylinder Reservoir
(2) Master Cylinder
(3) Combination valve
(4) Right Front Isolation Valve
(5) Rear Pump
(6) Rear Isolation Valve
(7) Rear Dump Valve
(8) Rear Brakes
(9) Rear Accumulator
(10) Right Front Dump Valve
(11) Front Brakes
(12) Front accumulator
(13) Left Front Dump Valve
(14) Left Front Isolation Valve
(15) Brake Pressure Modulator Valve (BPMV)
(16) Front Pump

BPMV Hydraulic Flow Chart (Isolation Mode)

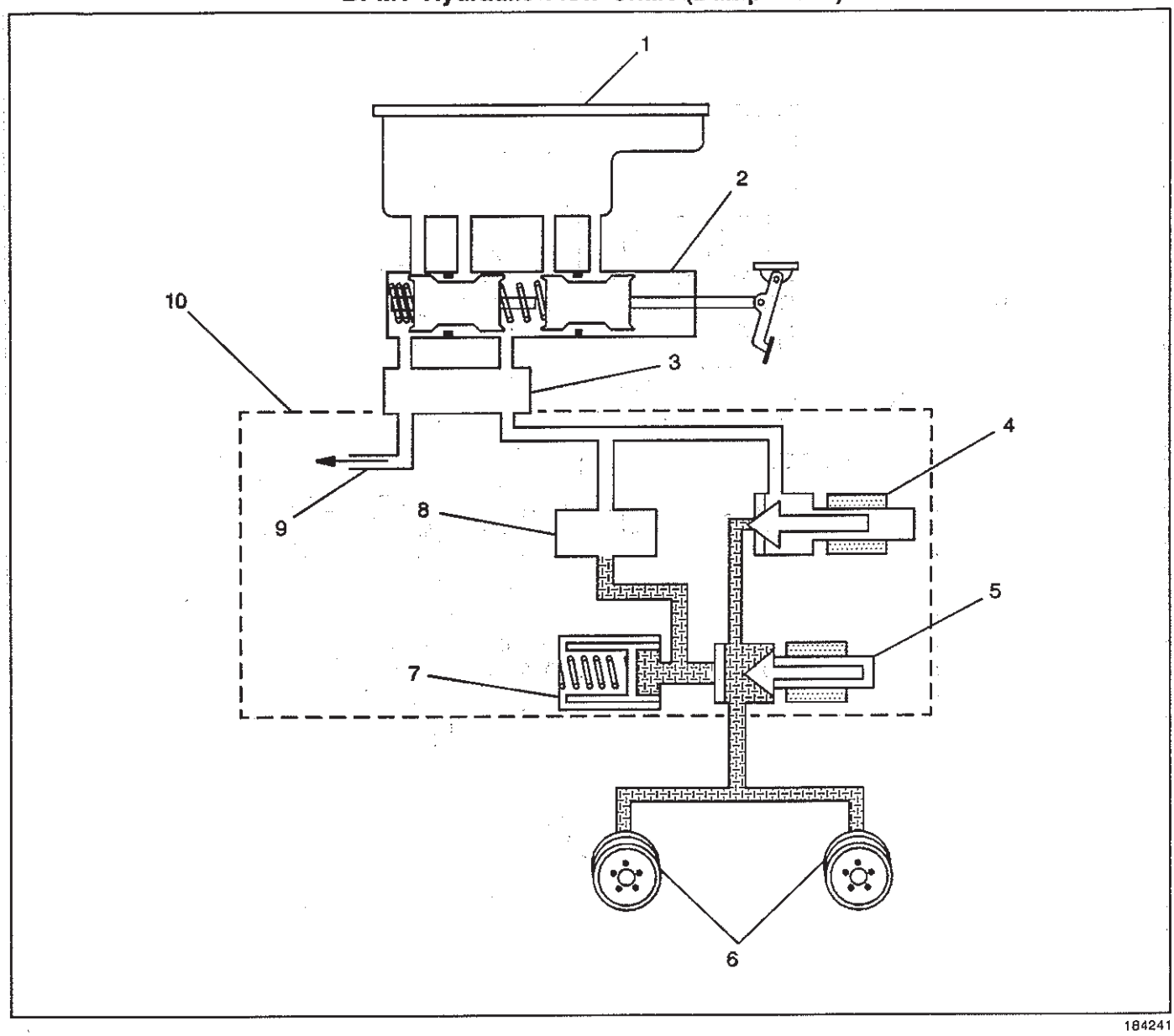


184239

Legend

(1) Master Cylinder Reservoir
(2) Master Cylinder
(3) Combination valve
(4) Rear Isolation Valve
(5) Rear Dump Valve
(6) Rear Wheels
(7) Rear Accumulator
(8) Rear Pump
(9) To Front Channels
(10) Brake Pressure Modulator Valve (BPMV)

BPMV Hydraulic Flow Chart (Dump Mode)

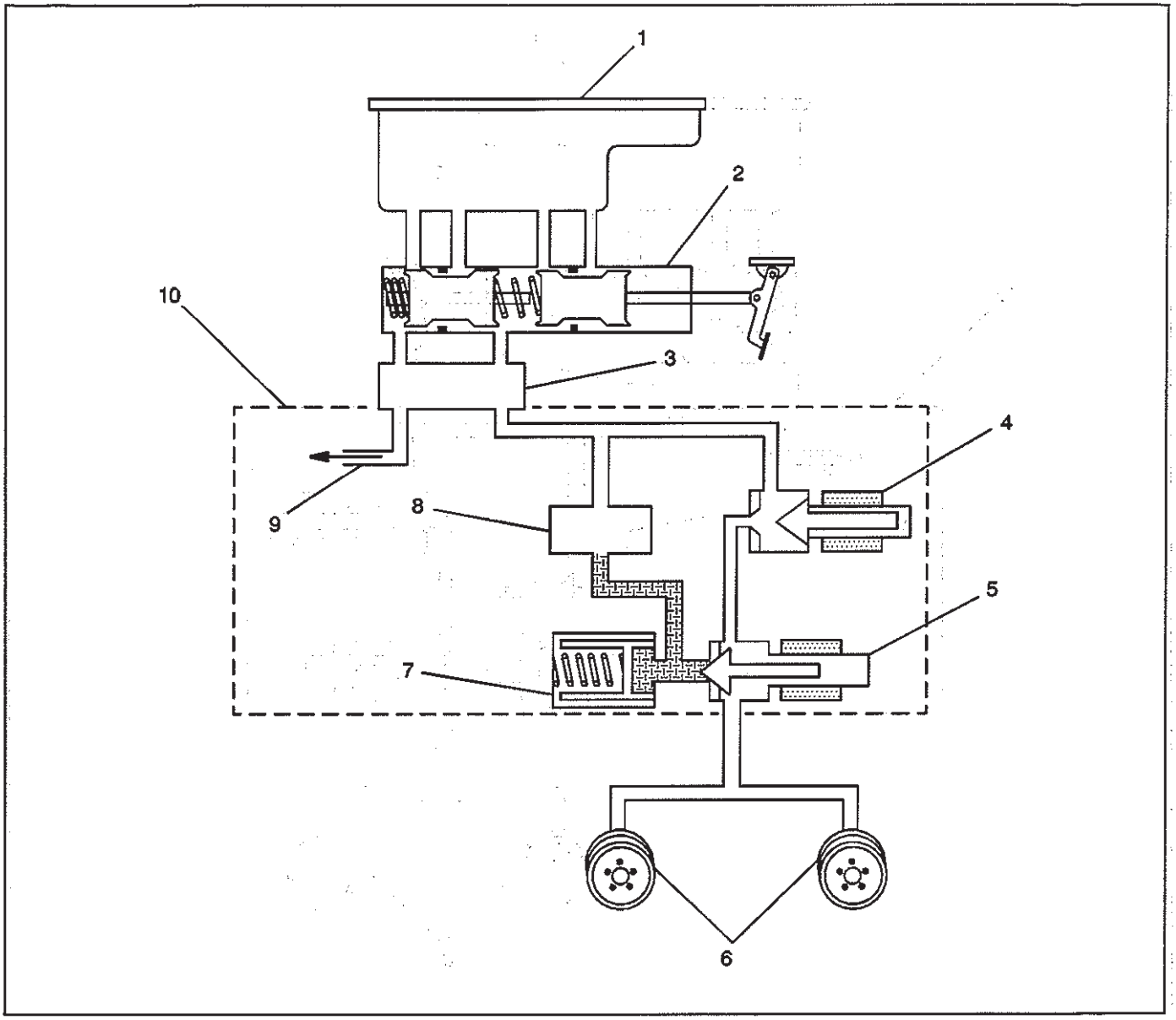


184241

Legend

(1) Master Cylinder Reservoir
(2) Master Cylinder
(3) Combination valve
(4) Rear Isolation Valve
(5) Rear Dump Valve
(6) Rear Wheels
(7) Rear Accumulator
(8) Rear Pump
(9) To Front Channels
(10) Brake Pressure Modulator Valve (BPMV)

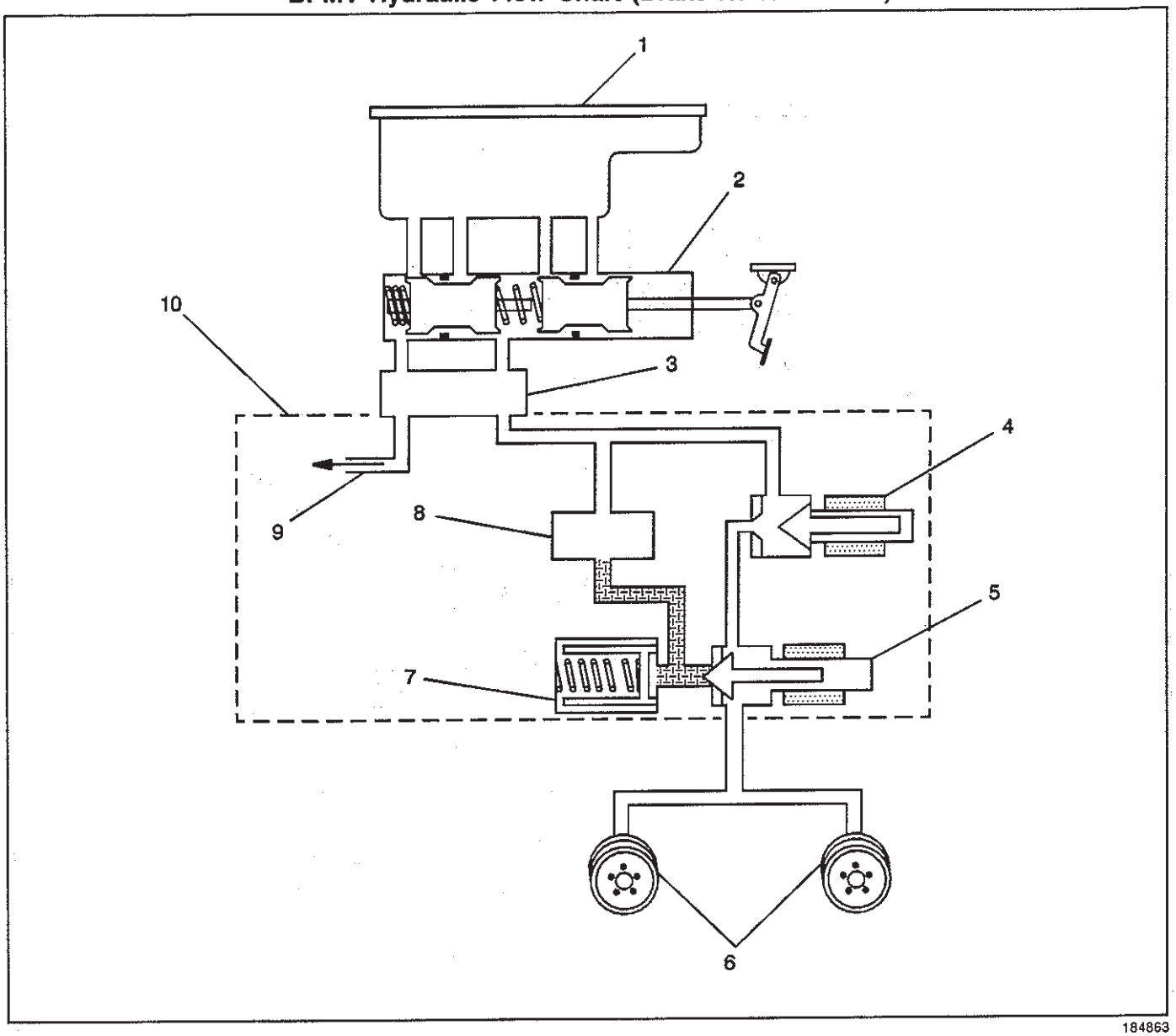
BPMV Hydraulic Flow Chart (Reapply Mode)



Legend

(1) Master Cylinder Reservoir
(2) Master Cylinder
(3) Combination valve
(4) Rear Isolation Valve
(5) Rear Dump Valve
(6) Rear Wheels
(7) Rear Accumulator
(8) Rear Pump
(9) To Front Channels
(10) Brake Pressure Modulator Valve (BPMV)

BPMV Hydraulic Flow Chart (Brake Release Mode)



Legend

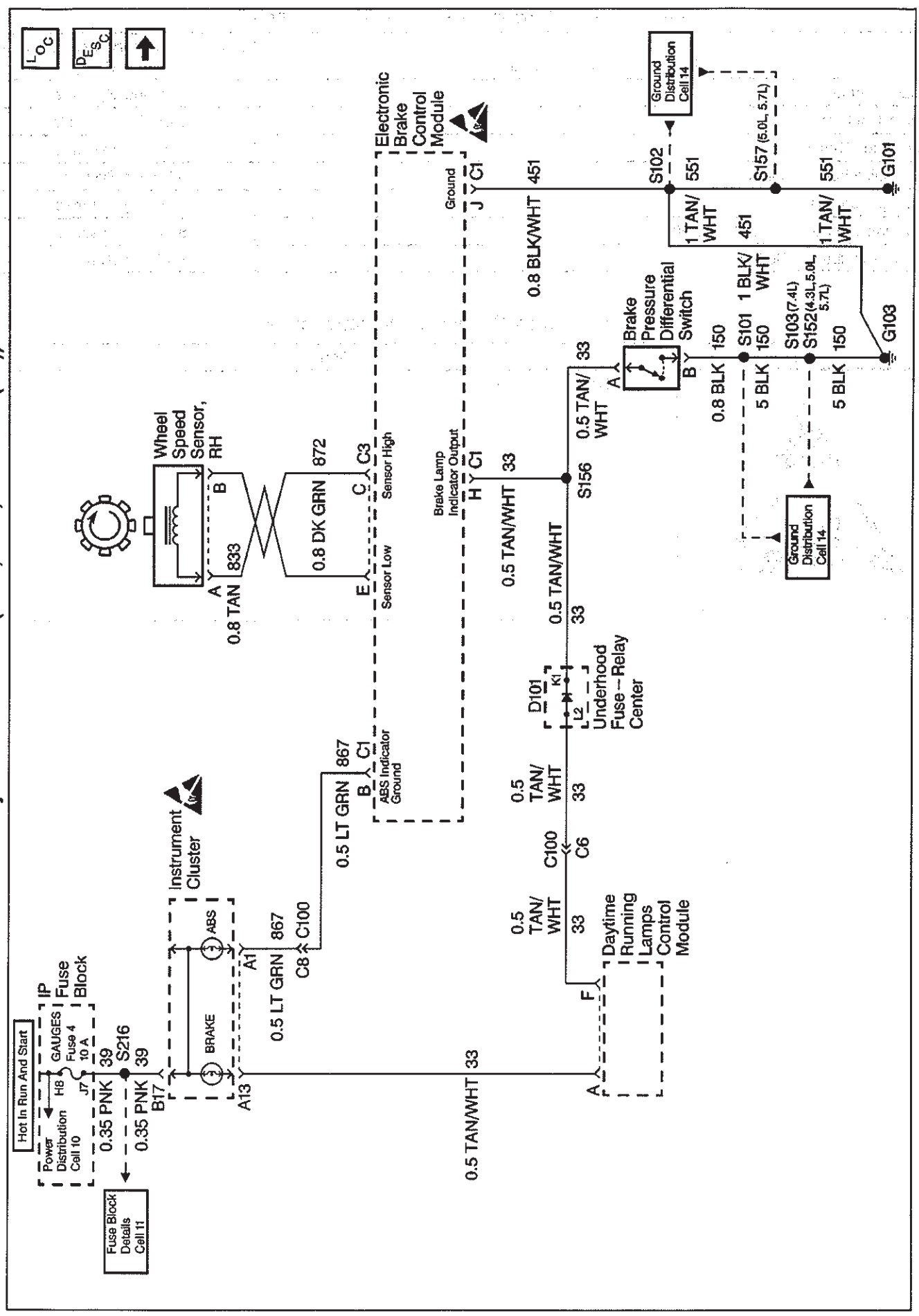
(1) Master Cylinder Reservoir
(2) Master Cylinder
(3) Combination valve
(4) Rear Isolation Valve
(5) Rear Dump Valve
(6) Rear Wheels
(7) Rear Accumulator
(8) Rear Pump
(9) To Front Channels
(10) Brake Pressure Modulator Valve (BPMV)

Antilock Brakes System Schematic References

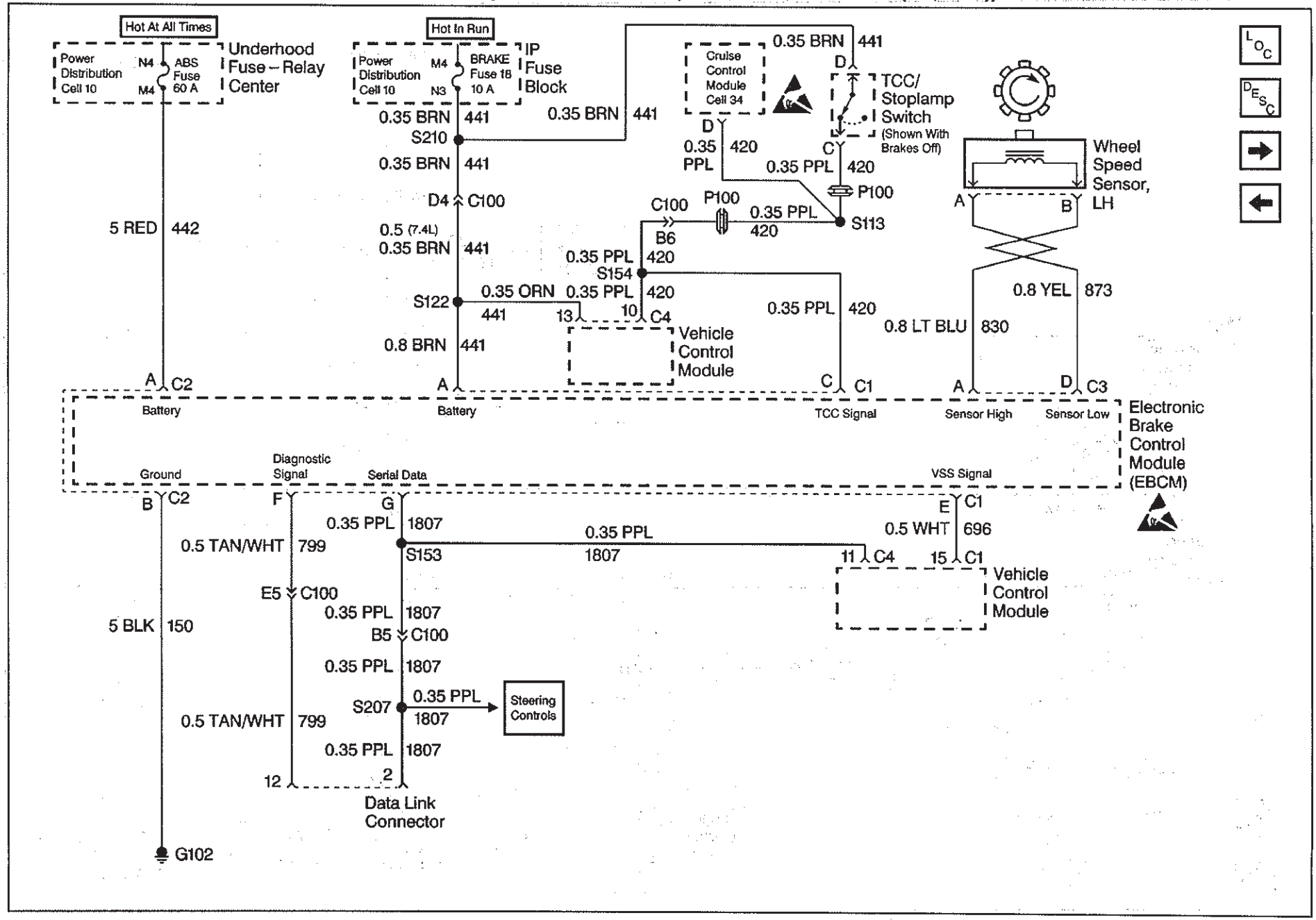
Reference on Schematic	Service Category Type Number - Service Category
Cruise Controls	8-Wiring Systems
Engine Controls	6-Engine Controls
Fuse Block Details Cell-11	8-Wiring Systems
Power Distribution Cell-10	8-Wiring Systems
Steering Controls	Steering Controls
Data Link Connector (DLC) Cell 50	8-Wiring Systems
Ground Distribution Cell-14	8-Wiring Systems

Antilock Brakes System Schematic Icons

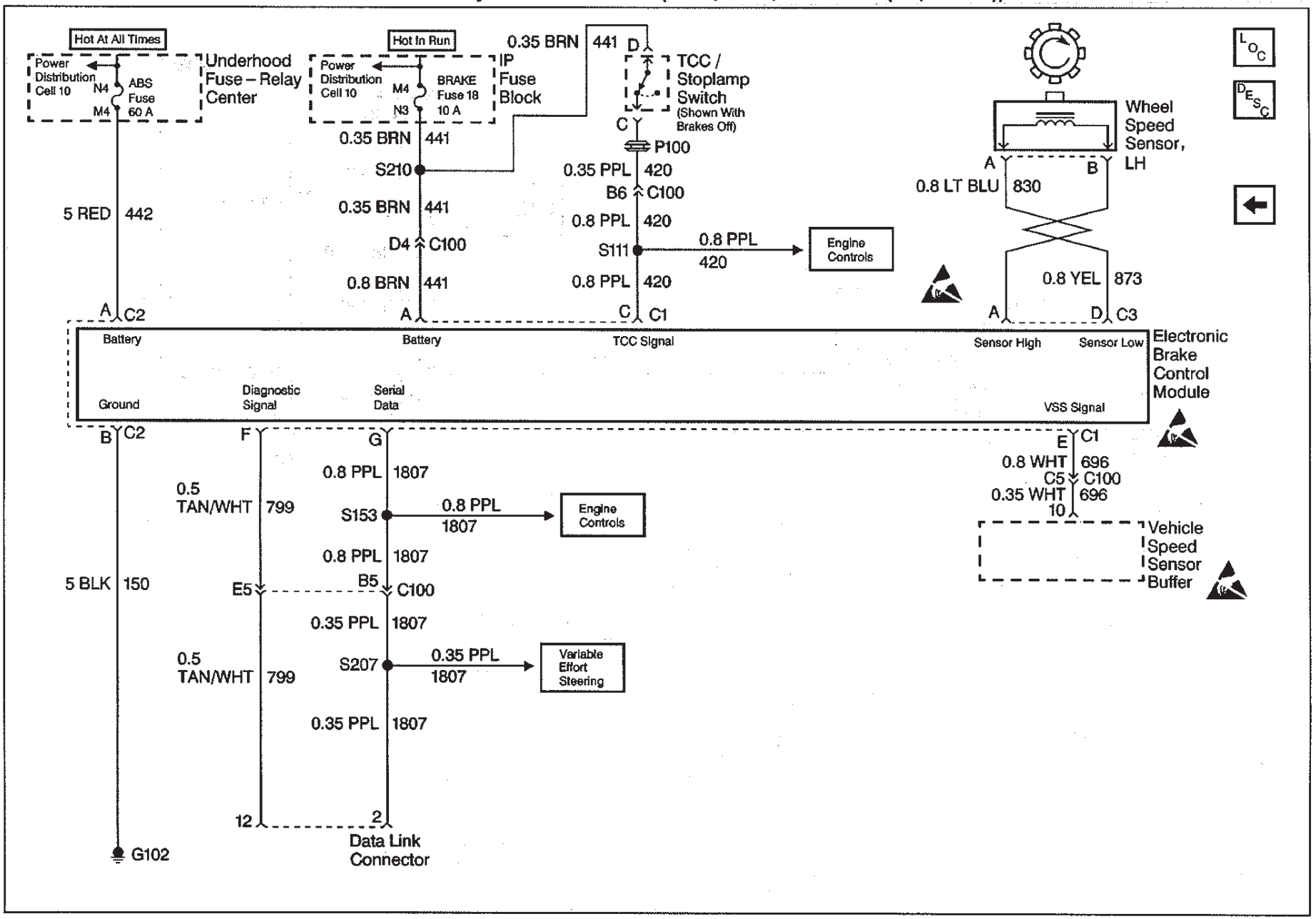
Icon	Icon Definition
 19384	***Notice:*** Refer to *ESD Notice.*


Antilock Brake System Schematics (PWR, GND, And WSS (RH))
176145
Hot In Run And Start
Power Distribution Cell 10
IP Fuse Block
GAUGES Fuse 4 10 A
H8
J7
0.35 PNK 39
S216
0.35 PNK 39
B17
Fuse Block Details Cell 11
Instrument Cluster
BRAKE
ABS
A13
A1
0.5 LT GRN 867
C8
C100
0.5 LT GRN 867
B C1
ABS Indicator Ground
0.5 TAN/WHT 33
A
F
Daytime Running Lamps Control Module
0.5 TAN/WHT C100 C6 33
D101
K1
L2
Underhood Fuse – Relay Center
0.5 TAN/WHT 33
S156
0.5 TAN/WHT 33
A
Brake Pressure Differential Switch
B
0.8 BLK 150
S101
1 BLK/WHT 150
5 BLK 150
S103 (7.4L)
S152 (4.3L, 5.0L, 5.7L)
5 BLK 150
G103
Ground Distribution Cell 14
Ground Distribution Cell 14
S102
1 TAN/WHT 551
S157 (5.0L, 5.7L)
1 TAN/WHT 551
G101
Brake Lamp Indicator Output
H C1
0.5 TAN/WHT 33
Ground
J C1
0.8 BLK/WHT 451
451
Electronic Brake Control Module
Wheel Speed Sensor, RH
A B
0.8 TAN 833
0.8 DK GRN 872
E C3
Sensor Low
Sensor High

Antilock Brake System Schematics (PWR, GND, And WSS (LH, Gas))



Antilock Brake System Schematics (PWR, GND, And WSS (LH, Diesel))



176151

Component Locator

Antilock Brakes System Components

Name	Location	Locator View	Connector End View	Group No.
Brake Pressure Differential Switch	Part of electronic brake control module, LH frame rail near center of vehicle	Component Location Views in Electrical Diagnosis	*Antilock Brakes System Connector End Views*	—
Data Link Connector (DLC)	Under LH side of IP	Component Location Views in Electrical Diagnosis	Connector End Views in Electrical Diagnosis	—
Daytime Running Lamps Control Module	Under LH side of IP, taped on IP harness	*Antilock Brakes System Component Views*	Connector End Views in Electrical Diagnosis	—
Electronic Brake Control Module (EBCM)	LH frame rail, near center of vehicle	*Antilock Brakes System Component Views*	*Antilock Brakes System Connector End Views*	—
Instrument Cluster	Top LH side of IP	Component Location Views in Electrical Diagnosis	Connector End Views in Electrical Diagnosis	—
IP Fuse Block	LH lower kick panel	Component Location Views in Electrical Diagnosis	Connector End Views in Electrical Diagnosis	—
TCC/Stoplamp Switch	Under brake pedal	Component Location Views in Electrical Diagnosis	*Antilock Brakes System Connector End Views*	—
Underhood Fuse-Relay Center	Engine compartment, LH fender	Component Location Views in Electrical Diagnosis	Connector End Views in Electrical Diagnosis	—
Vehicle Control Module (VCM)	Engine compartment, LH fender	Component Location Views in Electrical Diagnosis	Connector End Views in Electrical Diagnosis	—
Vehicle Speed Sensor Buffer	Below LH side of IP, near steering column	Component Location Views in Electrical Diagnosis	*Antilock Brakes System Connector End Views*	—
Wheel Speed Sensor, LF	At LF wheel	*Antilock Brakes System Component Views*	*Antilock Brakes System Connector End Views*	—
Wheel Speed Sensor, RF	At RF wheel	*Antilock Brakes System Component Views*	*Antilock Brakes System Connector End Views*	—
C100	LH rear of engine compartment at bulk	Component Location Views in Electrical Diagnosis	Connector End Views in Electrical Diagnosis	—

Antilock Brakes System Components (cont'd)

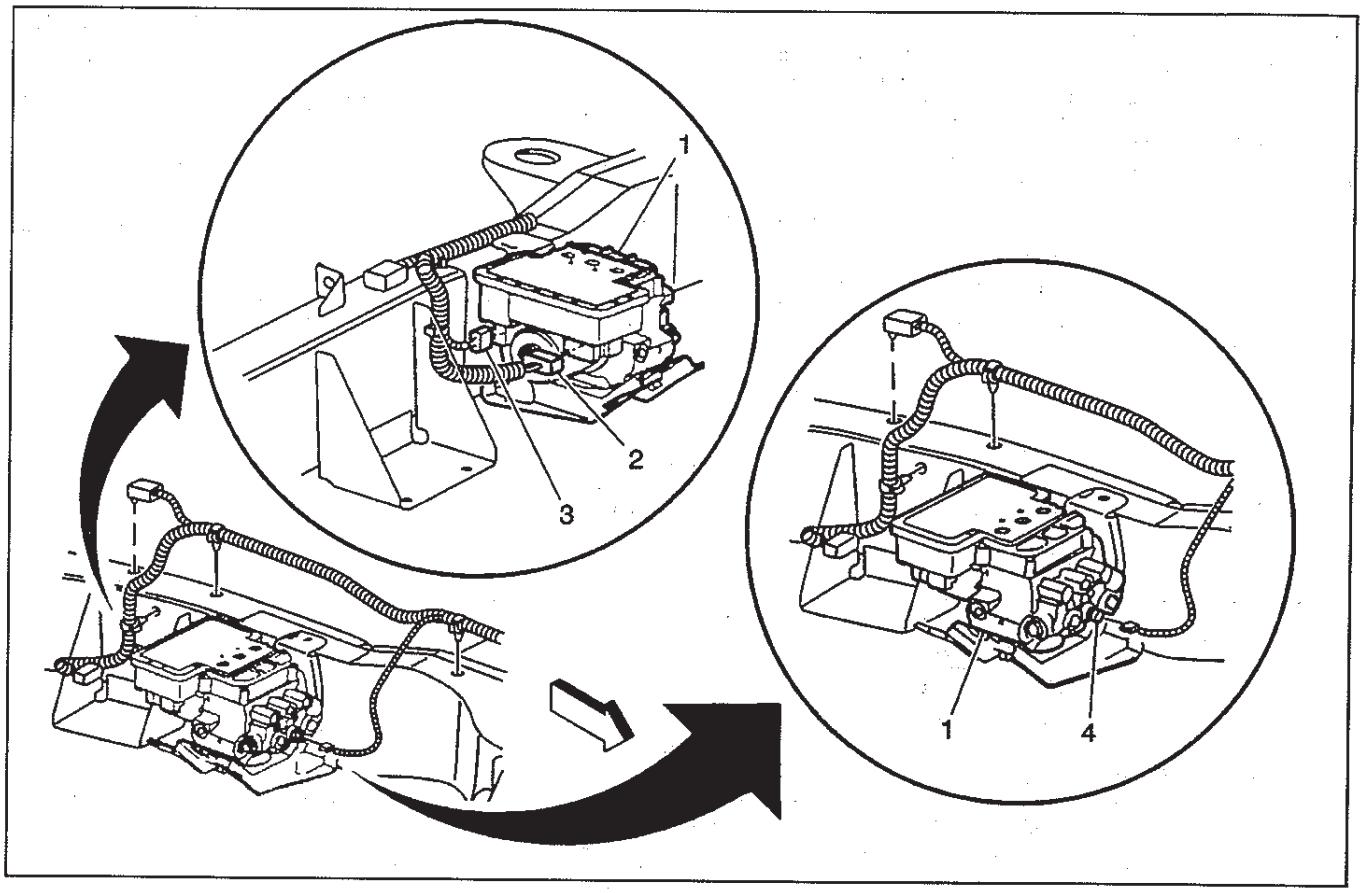
Name	Location	Locator View	Connector End View	Group No.
G101	Engine harness, near thermostat housing	Component Location Views in Electrical Diagnosis	—	—
G102	Engine harness, near generator bracket	Component Location Views in Electrical Diagnosis	—	—
G102 (6.5L)	LH front of engine harness, at generator bracket, near A/C compressor	Component Location Views in Electrical Diagnosis	—	—
G103 (4.3L)	Engine harness, at generator bracket	Component Location Views in Electrical Diagnosis	—	—
G103 (5.0L, 5.7L, 7.4L)	LH front of engine harness, at generator bracket, near A/C compressor	Component Location Views in Electrical Diagnosis	—	—
G103 (6.5L)	Engine harness, at generator bracket	Component Location Views in Electrical Diagnosis	—	—
S101 (4.3L)	Engine harness, approx 20 cm from knock sensor breakout toward EBCM	—	—	—
S101 (5.0L, 5.7L)	Engine harness, approx 10 cm from ignition coil breakout toward fuel injector breakout	—	—	—
S101 (7.4L)	Engine harness, approx 5 cm from generator breakout toward C107 breakout	—	—	—
S101(6.5L)	Engine harness, approx 22 cm from optical fuel temperature sensor breakout toward C100 breakout	—	—	—
S102 (4.3L)	Engine harness, approx 104 cm from underhood fuse-relay center toward A/C compressor breakout	—	—	—
S102 (5.0L, 5.7L)	Engine harness, approx 4 cm from A/C compressor breakout toward MAF sensor breakout	—	—	—
S102 (7.4L)	Engine harness, approx 4 cm from main harness that leads to the A/C compressor breakout toward generator breakout	—	—	—
S102 (6.5L)	Engine harness, approx 4 cm from main harness that leads to the blower motor breakout toward C100 breakout	—	—	—
S103 (7.4L)	Engine harness, approx 4 cm from ECT sensor breakout toward C100	—	—	—
S111	Engine harness, approx 4 cm from main harness breakout that leads to the underhood fuse-relay center and C100 breakouts	-	—	—
S122 (4.3L)	Engine harness, approx 7 cm from G103 breakout toward transmission	—	—	—
S122 (5.0L, 5.7L)	Engine harness, approx 24 cm from A/C compressor breakout toward C100	—	—	—
S122 (7.4L)	Engine harness, approx 8 cm from C100 breakout toward VCM breakout	—	—	—

Antilock Brakes System Components (cont'd)

Name	Location	Locator View	Connector End View	Group No.
S152 (4.3L)	Engine harness, approx 16 cm from fuel injector breakout toward G103 breakout	—	—	—
S152 (5.0L, 5.7L)	Engine harness, approx 4 cm from fuel injector breakout toward G103 breakout	—	—	—
S153 (4.3L)	Engine harness, approx 4 cm from the A/C compressor breakout toward transmission	—	—	—
S153 (5.0L, 5.7L)	Engine harness, approx 8 cm from ignition coil breakout toward transmission	—	—	—
S153 (7.4L)	Engine harness, approx 4 cm from C100 breakout toward EGR sensor breakout	—	—	—
S153 (6.5L)	Engine harness, approx 27 cm from main harness breakout that leads to the underhood fuse-relay center	—	—	—
S154 (4.3L)	Engine harness, approx 98 cm from underhood fuse-relay center toward A/C compressor breakout	—	—	—
S154 (5.0L, 5.7L)	Engine harness, approx 4 cm from the ignition coil breakout toward the transmission	—	—	—
S154 (7.4L)	Engine harness, approx 3 cm from MAF sensor breakout toward the ECT sensor breakout	—	—	—
S156 (4.3L)	Engine harness, approx 14 cm from the knock sensor breakout toward the EBCM	—	—	—
S156 (5.0L, 5.7L)	Engine harness, approx 8 cm from the fuel injector harness breakout toward the ignition coil breakout	—	—	—
S156 (7.4L)	Engine harness, approx 10 cm from A/T ISS sensor breakout toward the fuel injector harness breakout	—	—	—
S156 (6.5L)	Engine harness, approx 4 cm from the brake pressure differential switch breakout toward transmission	—	—	—
S207	IP harness, approx 4 cm into VSSB breakout	—	—	—
S210	IP harness, approx 4 cm into TCC/Stoplamp switch breakout	—	—	—
S216	IP harness, approx 8 cm from C200 breakout toward instrument cluster breakout	—	—	—
S231	IP harness, approx 18 cm from C100 breakout toward park brake warning switch breakout	—	—	—

Antilock Brakes System Component Views

Electronic Brake Control Module

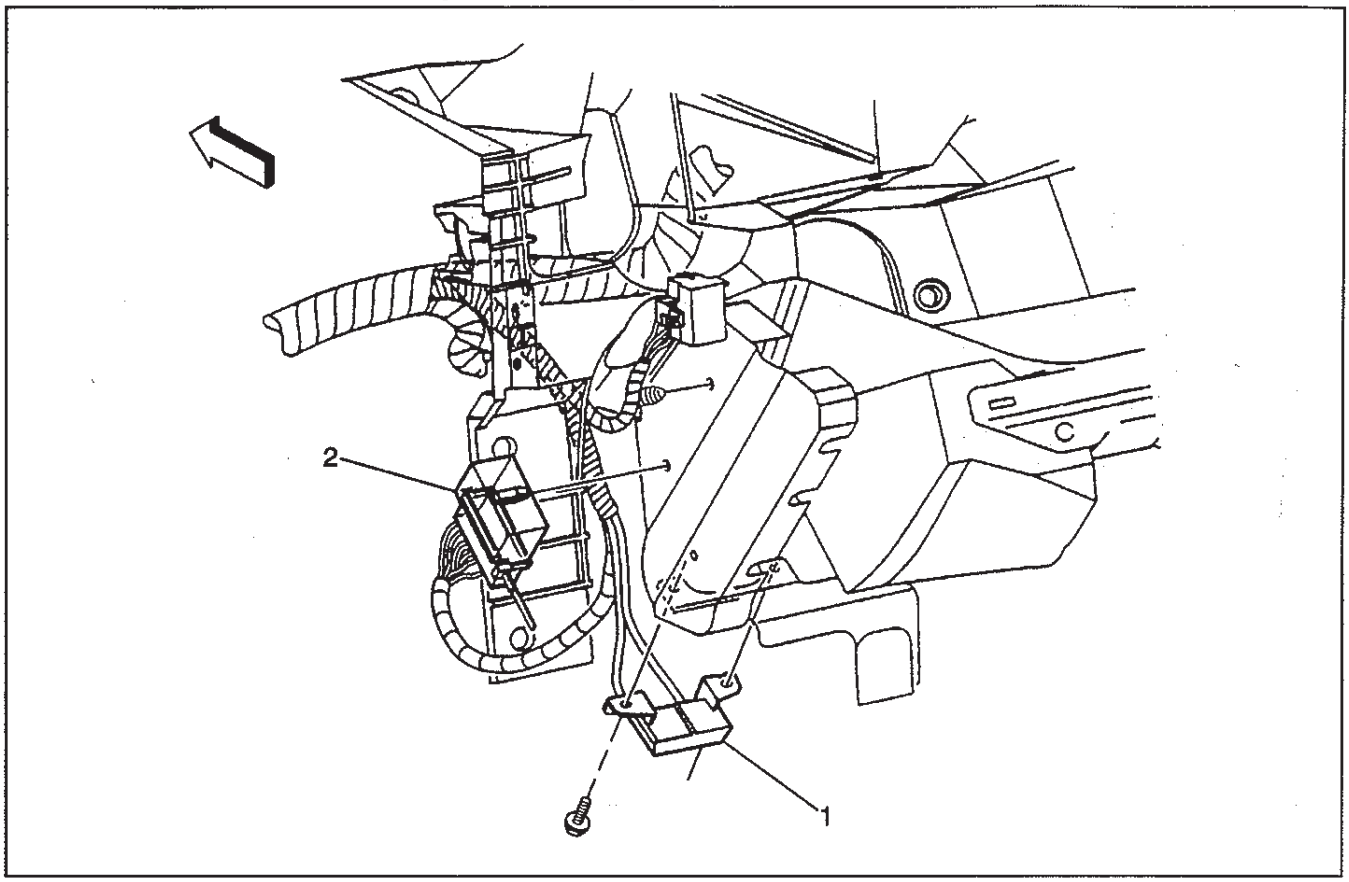


173447

Legend

(1) Electronic Brake Control Module (EBCM)
(2) Ignition Feed (C1)
(3) Battery (C2)
(4) Brake Pressure Differential Switch

Daytime Running Lamp Control Module

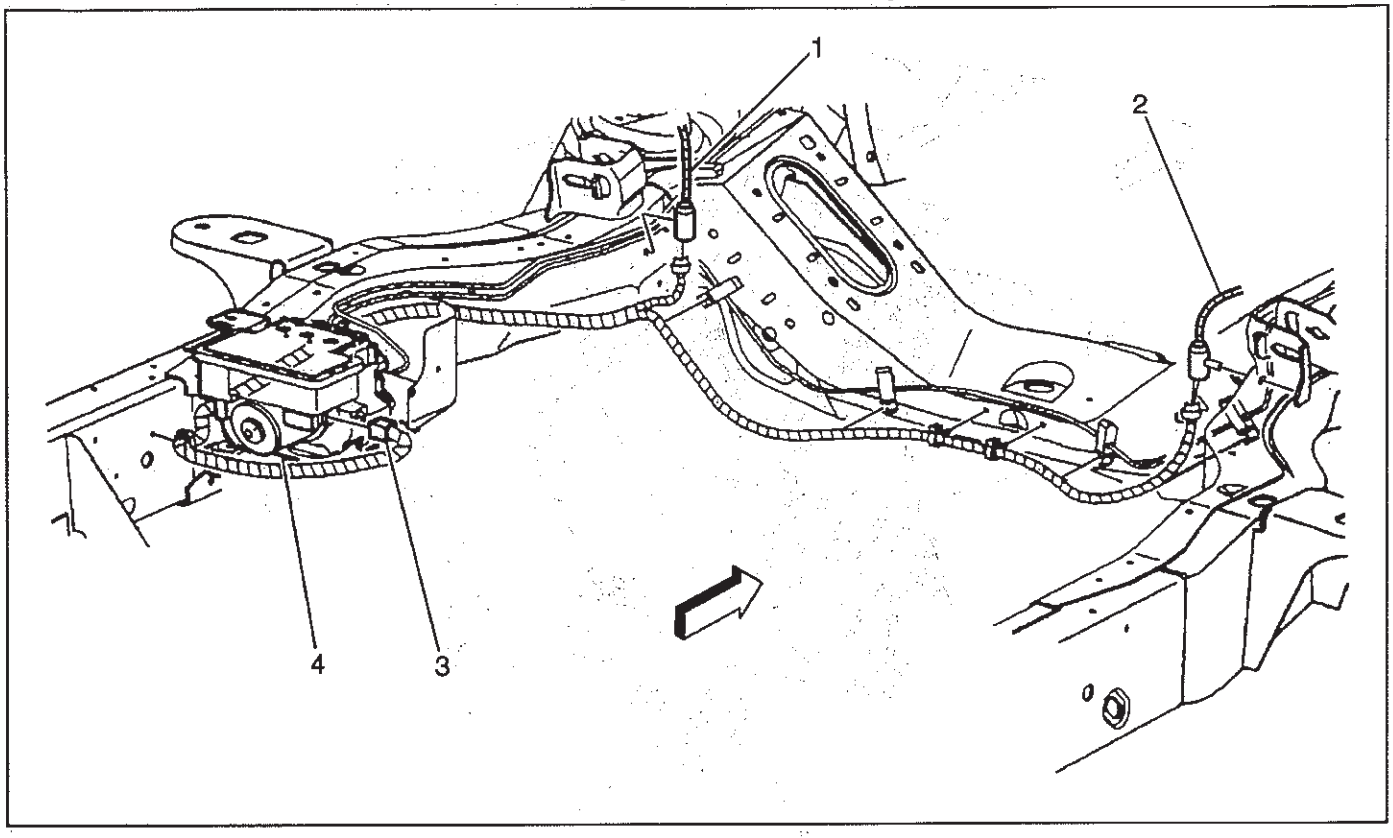


173449

Legend

(1) Data Link Connector (DLC)
(2) Daytime Running Lamp Control Module

Wheel Speed Sensor Wiring



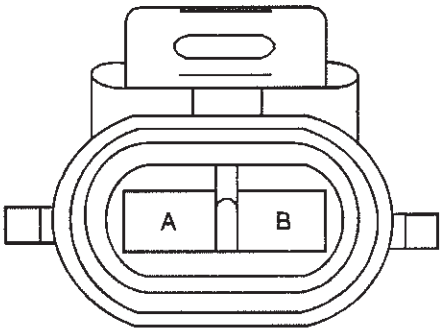
173451

Legend

(1) Wheel Speed Sensor, LF
(2) Wheel Speed Sensor, RF
(3) Connector C3
(4) Electronic Brake Control Module (EBCM)

Antilock Brakes System Connector End Views

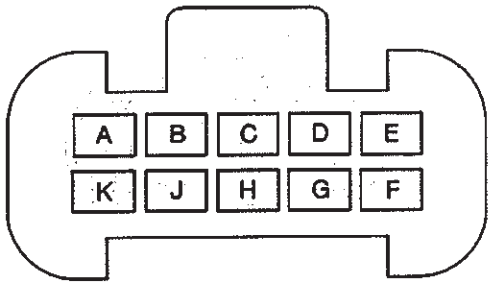
Brake Pressure Differential Switch



35437

Connector Part Information		• 12052646 • ASM 2F M/P 150 (WHITE)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	TAN/WHT	33	Brake Warning Indicator Lamp Output
B	BLK	150	Ground

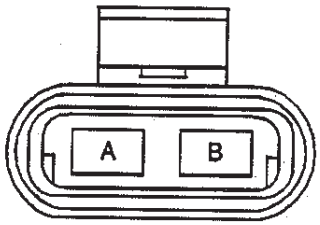
EBCM, Connector C1



62473

Connector Part Information	• 12065425 • ASM 10F M/P 150 (BLACK)					
Pin	**Wire Color**	**Circuit No.**	**Function**	**Component Connector Cavity**	**DTC(s) Affected**	**Possible Symptoms From a Faulty Circuit**
A	BRN	441	Fuse Output - Ignition 3 - Type III Fuse	A	None	No communication with EBCM
B	LT GRN	867	ABS Failure Indicator Lamp Output	B	C0286	No ABS indicator
C	PPL	420	Brake Switch Input	C	C0281	None
D	—	—	Not Used	D	—	Not Used
E	WHT	1827	Vehicle Speed Input	E	C0236, C0237, C0238	ABS indicator lamp turned on
F	TAN/WHT	799	ABS Diagnostic Link (UART)	F	None	No communication with EBCM
G	PPL	1807	Serial Data Signal - (Class 2)	G	None	No communication with EBCM
H	TAN/WHT	33	Brake Warning lamp Output	H	C0288	None
J	BLK	451	Signal Ground	J	None	No communication with EBCM
K	—	—	Not Used	K	—	Not Used

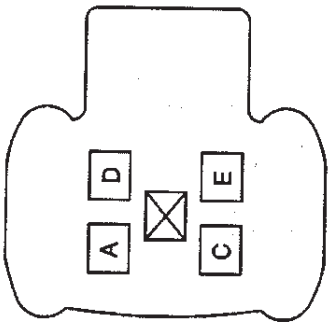
EBCM, Connector C2



62489

Connector Part Information	• 12085030 • ASM 2F M/P 630 P2S (BLACK)					
Pin	Wire Color	Circuit No.	Function	Component Connector Cavity	DTC(s) Affected	Possible Symptoms From a Faulty Circuit
A	RED	442	Fuse Output - Battery - Type II Fuse	A	C0265, C0267	ABS indicator lamp turned on
B	BLK	150	Power Ground	B	C0265, C0267	ABS indicator lamp turned on

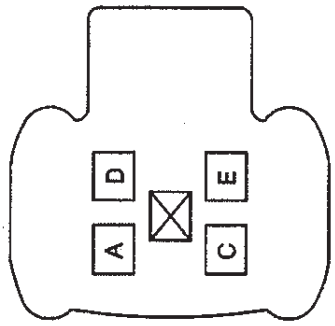
EBCM, Connector C3



68766

Connector Part Information	• ENTER PART NUMBER HERE • ENTER PART DESCRIPTION HERE					
Pin	Wire Color	Circuit No.	Function	Component Connector Cavity	DTC(s) Affected	Possible Symptoms From a Faulty Circuit
A	LT BLU	830	WSS Signal (LF)	A	C0225, C0226, C0227	ABS indicator lamp turned on
C	DK GRN	872	WSS Signal (RF)	C	C0221, C0222, C0223	ABS indicator lamp turned on

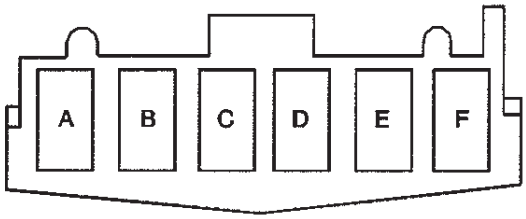
EBCM, Connector C3 (cont'd)



68766

Connector Part Information	• ENTER PART NUMBER HERE • ENTER PART DESCRIPTION HERE					
Pin	Wire Color	Circuit No.	Function	Component Connector Cavity	DTC(s) Affected	Possible Symptoms From a Faulty Circuit
D	YEL	873	WSS Return (LF)	D	C0225, C0226, C0227	ABS indicator lamp turned on
E	TAN	833	WSS Return (RF)	E	C0221, C0222, C0223	ABS indicator lamp turned on

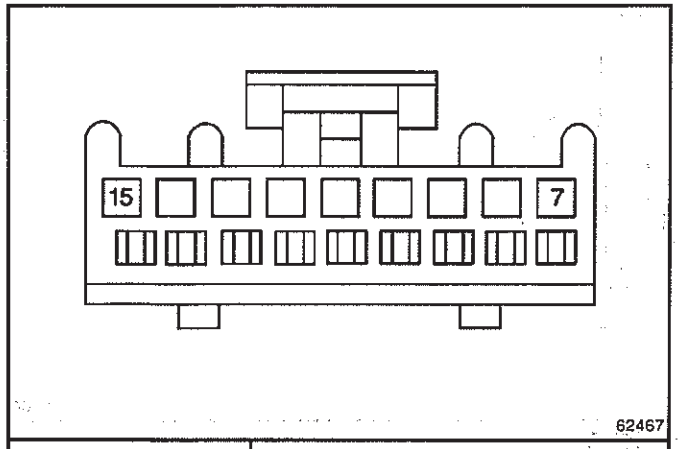
TCC/Stoplamp Switch



62424

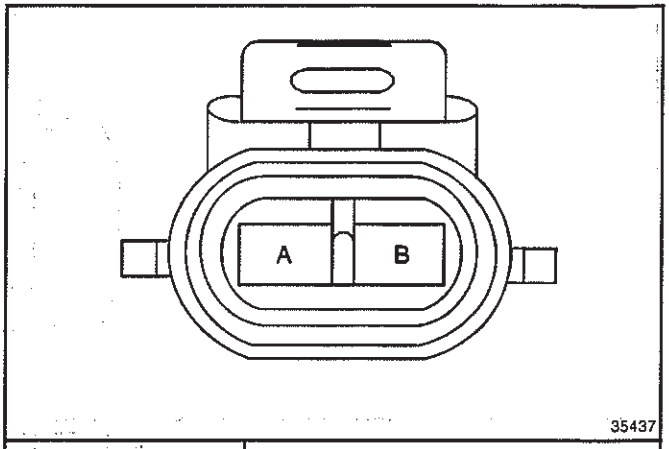
Connector Part Information	• 12040551 • 6F M/P 480 (BLACK)		
Pin	Wire Color	Circuit No.	Function
A	BRN	1135	Brake transmission Shift Interlock SOL Feed
B	LT GRN	275	Trans Mounted Neutral Safty Switch Output
C	PPL	420	Brake Pedal Switch Output (TCC)
D	BLK/WHT	441	Fuse Output - IGN 3 - Type III Fuse
E	WHT	140	Fuse Output - Battery - Type III Fuse
F	WHT	17	Stoplamp Switch Output

Vehicle Speed Sensor (VSSB) Buffer



Connector Part Information	• 12066130 • ASM 9F MIC/P 100 (NATURAL)		
Pin	**Wire Color**	**Circuit No.**	**Function**
7	LT GRN/BLK	822	VSS Return
8	BLK/WHT	451	Ground
9	PNK	39	Fuse Output - Ign 1 - Type III Fuse
10	WHT	696	Brake Control to Cluster SPO Signal
11	—	—	—
12	PPL/WHT	821	Vehicle Speed Sensor Signal
13	BRN	437	Vehicle Speed Signal
14	DK GRN/WHT	817	Vehicle Speed Signal (4000 Pulses Per Mile)
15	DK GRN	389	Vehicle Speed Signal (4000 Pulses Per Mile)

Wheel Speed Sensor



Connector Part Information	• 12052641 • ASM 2F M/P 150 (BLACK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT BLU	830	WSS SIGNAL (LF)
A	TAN	833	WSS SIGNAL (RF)
B	YEL	873	WSS SIGNAL (LF)
B	GK GRN	1872	WSS SIGNAL (RF)

Diagnostic Information and Procedures

Self-Diagnostics

The EBCM performs self-diagnostics of the ABS. The EBCM detects and isolates system failures. When a malfunction is detected, the EBCM sets a corresponding diagnostic trouble code (DTC).

Displaying DTCs

Read DTCs using a *Scan Tool*. No provisions are made for Flash Code DTCs.

Clearing DTCs

Use a *Scan Tool* in order to erase the DTCs in the EBCM memory. Verify proper system operation and absence of DTCs when the clearing procedure completes. The EBCM will not permit DTC clearing until all DTCs have been displayed. Also, DTCs cannot be cleared by unplugging the EBCM, by disconnecting the battery cables, or by turning the ignition OFF.

Intermittents and Poor Connections

Most intermittent faults are caused by a faulty electrical connection or faulty wiring. Occasionally a damaged EBCM can be the cause of an intermittent fault. Refer to Intermittents and Poor Connections in Electrical Diagnosis for a detailed explanation of how to locate and repair intermittent conditions.

Scan Tool Diagnostics

Refer to the Scan Tool Owner's Manual for information about the Scan Tool and the various modes.

Diagnostic System Check (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition to OFF. 2. Remove the Brake Fuse 18. 3. Using the *J 39200*, measure the resistance between the 10-way EBCM connector terminal A and ground. Is the resistance measurement equal to the specified value?	OL	*Go to Step 15*	*Go to Step 14*
11	Observe the ABS indicator lamp. Does the ABS indicator lamp stay on?	—	Go to *ABS Indicator On No DTC Set*	Go to *ABS Indicator Off No DTC Set*
12	Repair open or high resistance in CKT 451. Is the repair complete?	—	*Go to Step 1*	—
13	1. Repair open or high resistance in CKT 441. 2. Check for an open in the Brake Fuse 18. Is the repair complete?	—	*Go to Step 1*	—
14	1. Repair short to ground in CKT 441. 2. Check for an open in the Brake Fuse 18. Is the repair complete?	—	*Go to Step 1*	—
15	Inspect CKT 441 and the 10-way EBCM harness connector for physical damage which may result in a short to ground with the 10-way EBCM harness connector connected to the EBCM. Is there evidence of damage?	—	*Go to Step 16*	*Go to Step 17*
16	Repair the terminals which are damaged. Is the repair complete?	—	*Go to Step 1*	—
17	1. Replace the EBCM. 2. Check for an open in Brake Fuse 18. Is the repair complete?	—	*Go to Step 1*	—

DTC List

DTC	Definition
DTC C0221	*DTC C0221 RF Wheel Speed Sensor Circuit Open*
DTC C0222	*DTC C0222 RF Wheel Speed Signal Missing*
DTC C0223	*DTC C0223 RF Wheel Speed Signal Erratic*
DTC C0225	*DTC C0225 LF Wheel Speed Sensor Circuit Open*
DTC C0226	*DTC C0226 LF Wheel Speed Signal Missing*
DTC C0227	*DTC C0227 LF Wheel Speed Signal Erratic*
DTC C0229	*DTC C0229 Drop Out of Front Wheel Speed Signals*
DTC C0235	*DTC C0235 Rear Wheel Speed Signal Circuit Open*
DTC C0236	*DTC C0236 Rear Wheel Speed Signal Circuit Missing*
DTC C0237	*DTC C0237 Rear Wheel Speed Signal Erratic*
DTC C0238	*DTC C0238 Wheel Speed Mismatch*
DTC C0241	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0242	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0243	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0244	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0245	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0246	*DTC C0241-C0254 EBCM Control Valve Circuit*

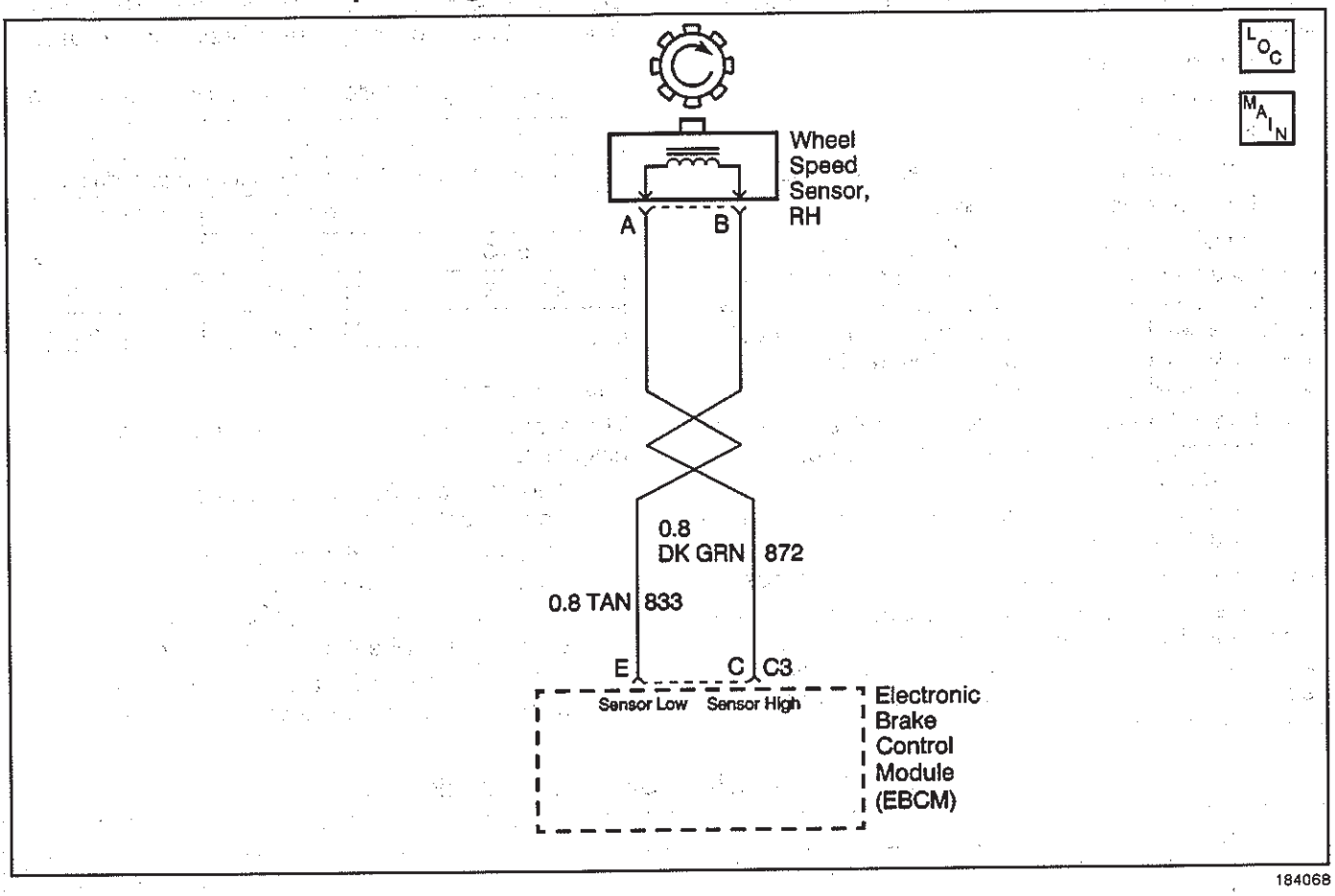
DTC List (cont'd)

DTC	Definition
DTC C0247	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0248	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0251	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0252	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0253	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0254	*DTC C0241-C0254 EBCM Control Valve Circuit*
DTC C0265	*DTC C0265 or C0266 EBCM Relay Circuit*
DTC C0266	*DTC C0265 or C0266 EBCM Relay Circuit*
DTC C0267	*DTC C0267 or C0268 Pump Motor Circuit Open/Shorted*
DTC C0268	*DTC C0267 or C0268 Pump Motor Circuit Open/Shorted*
DTC C0271	*DTC C0271-C0273 EBCM Malfunction*
DTC C0272	*DTC C0271-C0273 EBCM Malfunction*
DTC C0273	*DTC C0271-C0273 EBCM Malfunction*
DTC C0274	*DTC C0269 or C0274 Excessive Dump/Isolation Time*
DTC C0281	*DTC C0281 Brake Switch Circuit*
DTC C0286	*DTC C0286 ABS Indicator Lamp Circuit Shorted to B+*
DTC C0288	*DTC C0288 Brake Warning Lamp Circuit Shorted to B+*

DTC C0221 RF Wheel Speed Sensor Circuit Open (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Reconnect all connectors. 2. Test drive the vehicle above 24 km/h (15 mph). Does the DTC set as a current DTC?	—	*Go to Step 9*	*Go to Step 7*
7	1. Malfunction is intermittent. 2. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. Refer to Diagnostic Aids on the facing page for more information. 3. Perform all necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—
8	Make necessary repairs to the 4-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Repair the open or high resistance in CKT 833 or CKT 872. Is the repair complete?	—	Go to *Diagnostic System Check*	—
11	Replace the wheel speed sensor. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0222 RF Wheel Speed Signal Missing



184068

Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

- The right front wheel speed is less than 6 km/h (4 mph)
- All other wheel speeds are greater than 13 km/h (8 mph)
- No unexpected wheel acceleration/deceleration. Anything that keeps the right front wheel speed sensor low while the vehicle is moving above 13 km/h (8 mph).

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0022 is an Ignition Latched DTC, which indicates that the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

If the customer says that the ABS indicator lamp is on only during humid conditions such as rain, snow, or vehicle wash, then thoroughly inspect all wheel speed sensor circuits for signs of water intrusion. Use the following procedure:

1. Spray the suspected area with a 5% salt water solution (two teaspoons of salt to 12 oz. of water)
2. Drive the vehicle above 24 km/h (15 mph) for at least 30 seconds

If the DTC returns, replace the suspected harness.

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement*.

Resistance of the wheel speed sensor will increase with an increase in sensor temperature. Refer to the following tables for temperature/resistance values.

WSS Temperature vs. Sensor Resistance

°C	°F	Ohms
Temperature vs Resistance Values (Approximate)		
-40 to 4	-40 to 40	1575 to 2420
5 to 43	41 to 110	980 to 2800
44 to 93	111 to 200	2250 to 3280
94 to 150	201 to 302	2750 to 3850

Test Description

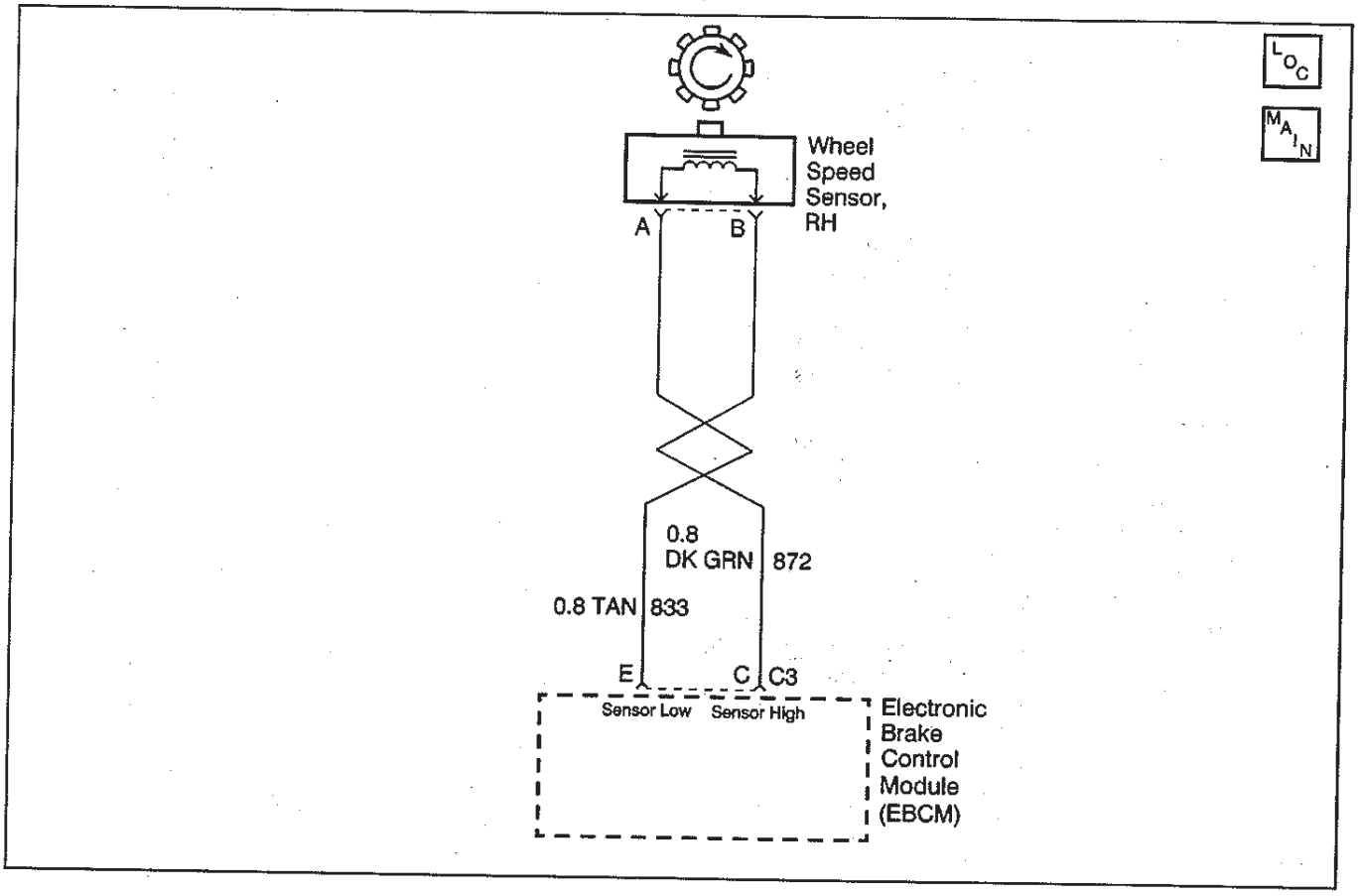
The numbers below refer to the steps in the diagnostic table:

3. This step checks the resistance of the right front wheel speed sensor.
4. This step checks the voltage output of the right front wheel speed sensor.
5. This step checks for a short in the wiring between the wheel speed sensor circuits.
6. This step checks for a short to ground in the right front wheel speed sensor circuits.

DTC C0222 RF Wheel Speed Signal Missing

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Inspect the right front wheel speed sensor, sensor wire and the connectors for signs of damage or corrosion. 3. Inspect the wheel speed sensor and the toothed ring for looseness. Any deviation will affect the wheel speed sensor output signal. 4. Inspect the 4-way EBCM harness connector and harness for signs of damage or corrosion. Can you observe physical damage?	—	*Go to Step 8*	*Go to Step 3*
3	1. Disconnect the right front wheel speed sensor harness connector from the wheel speed sensor. 2. Using a *J 39200*, measure the resistance between terminal A and terminal B of the right front wheel speed sensor connector. Is the resistance measurement within the specified range? (Refer to the table on the previous page for applicable sensor resistance values. The values in these tables are for the temperature of the sensor, not the air temperature.)	—	*Go to Step 4*	*Go to Step 9*
4	1. With the *J 39200* still connected, select the A/C voltage scale. 2. Spin the wheel by hand while observing the voltage reading. Is the voltage measured equal to or greater than the specified value?	100 mV	*Go to Step 5*	*Go to Step 9*

DTC C0221 RF Wheel Speed Sensor Circuit Open



Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

- No output signal from the right front wheel speed sensor for 1.0 second
- Excessive right front wheel speed sensor resistance for 1.0 second

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0021 is a Condition Latched DTC, which indicates that the above actions remain true only as long as the condition persists.

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement*.

Resistance of the wheel speed sensor will increase with an increase in sensor temperature. Refer to the following tables for temperature/resistance values.

WSS Temperature vs. Sensor Resistance

°C	°F	Ohms
Temperature vs Resistance Values (Approximate)		
-40 to 4	-40 to 40	1575 to 2420
5 to 43	41 to 110	1980 to 2800
44 to 93	111 to 200	2250 to 3280
94 to 150	201 to 302	2750 to 3850

Test Description

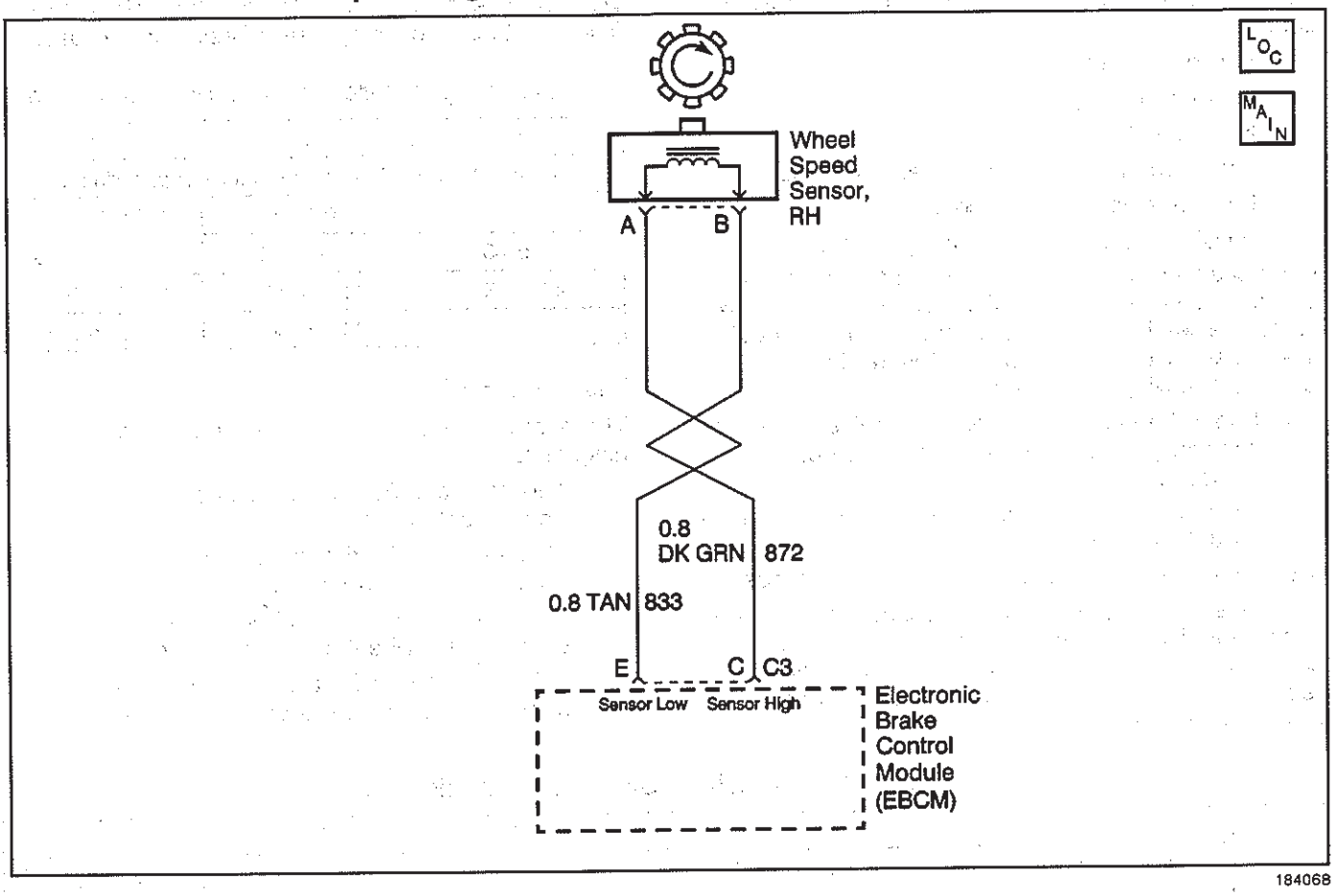
The numbers below refer to the steps in the diagnostic table:

2. This step checks the resistance of the right front wheel speed sensor circuit.
3. This step checks for continuity in the right front wheel speed sensor harness.
4. This step checks the resistance of the right front wheel speed sensor.

DTC C0221 RF Wheel Speed Sensor Circuit Open

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition OFF. 2. Disconnect the 4-way EBCM harness connector. 3. Using a *J 39200*, measure the resistance between terminals C and E of the 4-way EBCM harness connector. Is the resistance measurement within the specified range? (Refer to the tables on the facing page for applicable sensor resistance values. The values in these tables are for the resistance of the sensor, not the air temperature.)	—	*Go to Step 5*	*Go to Step 3*
3	1. Disconnect the right front wheel speed sensor harness connector from the wheel speed sensor. 2. Using a *J 36169-A* connect terminal A and terminal B of the 2-way wheel speed sensor harness connector (chassis harness side). 3. Using a *J 39200*, measure the resistance between terminals C and E of the 4-way EBCM harness connector. Is the resistance measurement within the specified range?	0–2 Ω	*Go to Step 4*	*Go to Step 10*
4	Using a *J 39200*, measure the resistance between terminals A and B of the right front wheel speed sensor connector. Is the resistance measurement within the specified range? (Refer to the tables on the facing page for applicable sensor resistance values. The values in these tables are for the resistance of the sensor, not the air temperature.)	—	*Go to Step 7*	*Go to Step 11*
5	Inspect the 4-way EBCM harness connector for poor terminal contact or corrosion. Does damage or corrosion exist?	—	*Go to Step 8*	*Go to Step 6*

DTC C0222 RF Wheel Speed Signal Missing



184068

Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

- The right front wheel speed is less than 6 km/h (4 mph)
- All other wheel speeds are greater than 13 km/h (8 mph)
- No unexpected wheel acceleration/deceleration. Anything that keeps the right front wheel speed sensor low while the vehicle is moving above 13 km/h (8 mph).

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0022 is an Ignition Latched DTC, which indicates that the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

If the customer says that the ABS indicator lamp is on only during humid conditions such as rain, snow, or vehicle wash, then thoroughly inspect all wheel speed sensor circuits for signs of water intrusion. Use the following procedure:

1. Spray the suspected area with a 5% salt water solution (two teaspoons of salt to 12 oz. of water)
2. Drive the vehicle above 24 km/h (15 mph) for at least 30 seconds

If the DTC returns, replace the suspected harness.

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement*.

Resistance of the wheel speed sensor will increase with an increase in sensor temperature. Refer to the following tables for temperature/resistance values.

WSS Temperature vs. Sensor Resistance

°C	°F	Ohms
Temperature vs Resistance Values (Approximate)		
-40 to 4	-40 to 40	1575 to 2420
5 to 43	41 to 110	980 to 2800
44 to 93	111 to 200	2250 to 3280
94 to 150	201 to 302	2750 to 3850

Test Description

The numbers below refer to the steps in the diagnostic table:

3. This step checks the resistance of the right front wheel speed sensor.
4. This step checks the voltage output of the right front wheel speed sensor.
5. This step checks for a short in the wiring between the wheel speed sensor circuits.
6. This step checks for a short to ground in the right front wheel speed sensor circuits.

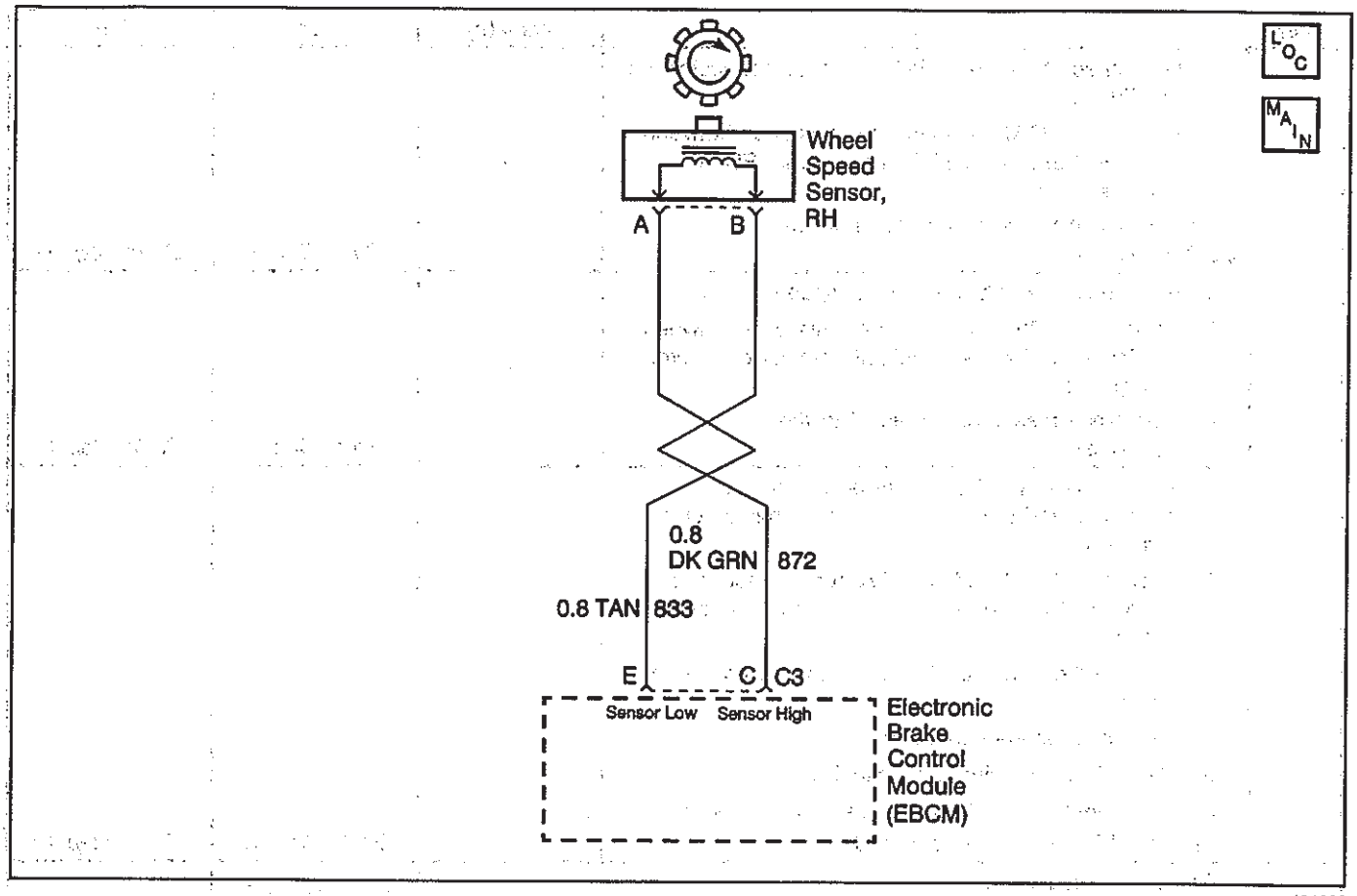
DTC C0222 RF Wheel Speed Signal Missing

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Inspect the right front wheel speed sensor, sensor wire and the connectors for signs of damage or corrosion. 3. Inspect the wheel speed sensor and the toothed ring for looseness. Any deviation will affect the wheel speed sensor output signal. 4. Inspect the 4-way EBCM harness connector and harness for signs of damage or corrosion. Can you observe physical damage?	—	*Go to Step 8*	*Go to Step 3*
3	1. Disconnect the right front wheel speed sensor harness connector from the wheel speed sensor. 2. Using a *J 39200*, measure the resistance between terminal A and terminal B of the right front wheel speed sensor connector. Is the resistance measurement within the specified range? (Refer to the table on the previous page for applicable sensor resistance values. The values in these tables are for the temperature of the sensor, not the air temperature.)	—	*Go to Step 4*	*Go to Step 9*
4	1. With the *J 39200* still connected, select the A/C voltage scale. 2. Spin the wheel by hand while observing the voltage reading. Is the voltage measured equal to or greater than the specified value?	100 mV	*Go to Step 5*	*Go to Step 9*

DTC C0222 RF Wheel Speed Signal Missing (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the 4-way EBCM harness connector from the EBCM. 2. Using a *J 39200*, measure the resistance between terminal C and terminal E of the 4-way EBCM harness connector. Is the resistance measurement equal to the specified value?	OL	*Go to Step 6*	*Go to Step 11*
6	1. Reconnect the right front wheel speed sensor. 2. Using a *J 39200*, measure the resistance between terminal C of the 4-way EBCM harness connector and ground. Is the resistance measurement equal to the specified value?	OL	*Go to Step 7*	*Go to Step 12*
7	1. Inspect the 4-way EBCM harness connector terminal C and terminal E for poor terminal contact or corrosion. 2. Inspect CKT 833 and CKT 872 for damage that could result in a shorted circuit. Repair any evident damage. 3. Replace the terminals if poor contact or corrosion exists. 4. Reconnect all the connectors. 5. Clear all DTCs using the *Scan Tool*. 6. Test drive the vehicle above 24 km/h (15 mph). Does the DTC set as a current DTC?	—	*Go to Step 10*	*Go to Step 13*
8	Make the necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Replace the right front wheel speed sensor. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
11	Repair the short between CKT 833 and CKT 872. Is the repair complete?	—	Go to *Diagnostic System Check*	—
12	Repair the short to ground in CKT 833 or CKT 872. Is the repair complete?	—	Go to *Diagnostic System Check*	—
13	Malfunction is intermittent. 1. Inspect all connectors for damage which may result in high resistance when all components are connected. Refer to Diagnostic aids on the facing page for more information. 2. Repair all damage found. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0223 RF Wheel Speed Signal Erratic



Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

- The average wheel speed for all wheel signals is greater than 40 km/h (25 mph).
- The average right front wheel speed is greater than 40 km/h (25 mph).
- No speed signal input to the EBCM from the right front wheel speed sensor for 15ms. Anything which sudenly prevents (intermittent) the right front wheel speed signal to drop to zero while the vehicle is moving greater than 40 km/h (25 mph).

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0023 is an Ignition Latched DTC, which indicates that the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

If the customer says that the ABS indicator lamp is on only during humid conditions such as rain, snow, or vehicle wash, then thoroughly inspect all wheel speed sensor circuits for signs of water intrusion. Use the following procedure:

1. Spray the suspected area with a 5% salt water solution (two teaspoons of salt to 12 oz. of water)
2. Drive the vehicle above 24 km/h (15 mph) for at least 30 seconds

If the DTC returns, replace the suspected harness.

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement*.

Resistance of the wheel speed sensor will increase with an increase in sensor temperature. Refer to the following tables for temperature/resistance values.

WSS Temperature vs. Sensor Resistance

°C	°F	Ohms
Temperature vs Resistance Values (Approximate)		
-40 to 4	-40 to 40	1575 to 2420
5 to 43	41 to 110	1980 to 2800
44 to 93	111 to 200	2250 to 3280
94 to 150	201 to 302	2750 to 3850

Test Description

The numbers below refer to the steps in the diagnostic table:

2. This step checks the EBCM 4–way connector for looseness, corrosion, etc.
3. This step uses the wheel speed sensor resistance check to help isolate an intermittent connection.
4. This step checks the right front wheel speed sensor for the proper resistance.
5. This step checks for proper mounting and orientation of the right front wheel speed sensor.

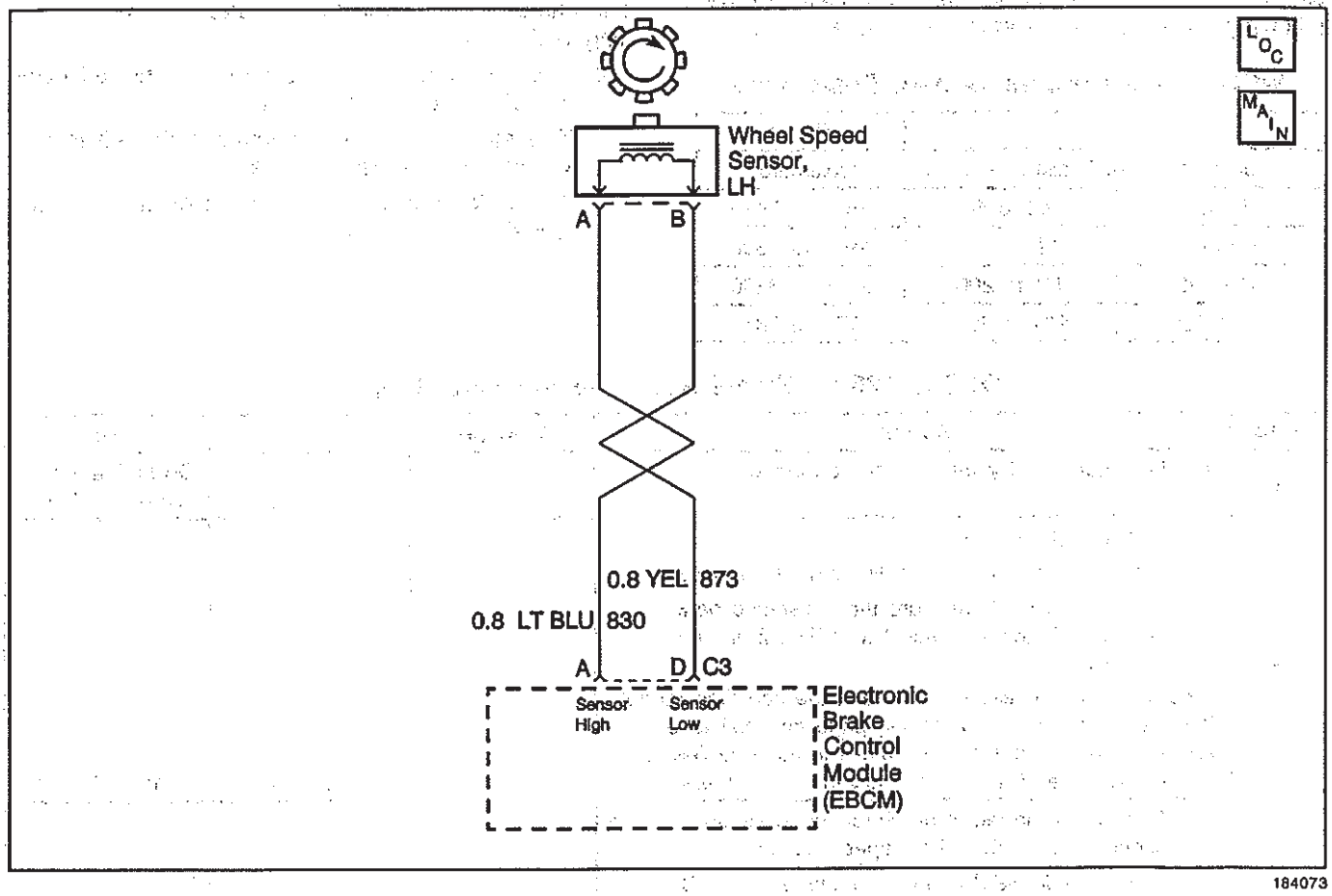
DTC C0223 RF Wheel Speed Signal Erratic

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 4-way EBCM harness connector from the EBCM and inspect for signs of damage or corrosion. 3. Inspect the wheel speed sensor harness and sensor harness connector for signs of damage or corrosion. Are all connections clean and tight?	—	*Go to Step 3*	*Go to Step 6*
3	Using a *J 39200*, measure the resistance between terminals C and E of the 4-way EBCM harness connector. Wiggle the WSS harness in various locations between the sensor and the EBCM while performing this measurement. Is the resistance measurement within the specified range without fluctuation when the harness is wiggled? (Refer to the tables on the previous page for applicable sensor resistance values. The values in these tables are for the temperature of the sensor, not the air temperature.)	—	*Go to Step 5*	*Go to Step 4*

DTC C0223 RF Wheel Speed Signal Erratic (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Disconnect the wheel speed sensor from the wheel speed sensor harness connector. 2. Using a *J 39200*, measure the resistance between terminals A and B of the right front wheel speed sensor. Is the resistance measurement within the specified range? (Refer to the tables on the previous page for applicable sensor resistance values. The values in these tables are for the temperature of the sensor, not the air temperature.)	—	*Go to Step 7*	*Go to Step 8*
5	1. Reconnect all connectors. 2. Remove tire and wheel. Refer to *Wheel Removal (Excessively Tight Wheels).* 3. Remove the hub and rotor. Refer to *Brake Rotor Replacement.* 4. Verify that the front wheel speed sensor is securely mounted and that the tone wheel is in good condition. Is the wheel speed sensor and tone wheel in good condition?	—	*Go to Step 9*	*Go to Step 10*
6	Make necessary repairs to the 4-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
7	Repair the open, high resistance or short in CKTs 833 or 872. Is the repair complete?	—	Go to *Diagnostic System Check*	—
8	Replace the right front wheel speed sensor. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Malfunction is intermittent. 1. Inspect all connectors for damage which may result in high resistance when all components are connected. Refer to Diagnostic aids on the facing page for more information. 2. Repair all damage found. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Make necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0225 LF Wheel Speed Sensor Circuit Open



Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

- No output signal from the left front wheel speed sensor for 1.0 second
- Excessive left front wheel speed sensor resistance for 1.0 second

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0025 is a Condition Latched DTC, which indicates that the above actions remain true only as long as the condition persists.

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement.*

Resistance of the wheel speed sensor will increase with an increase in sensor temperature. Refer to the following tables for temperature/resistance values.

WSS Temperature vs. Sensor Resistance

°C	°F	Ohms
Temperature vs Resistance Values (Approximate)		
-40 to 4	-40 to 40	1575 to 2420
5 to 43	41 to 110	1980 to 2800
44 to 93	111 to 200	2250 to 3280
94 to 150	201 to 302	2750 to 3850

Test Description

The numbers below refer to the steps in the diagnostic table:

2. This step checks the resistance of the left front wheel speed sensor circuit.
3. This step checks for continuity in the left front wheel speed sensor harness.
4. This step checks the resistance of the left front wheel speed sensor.

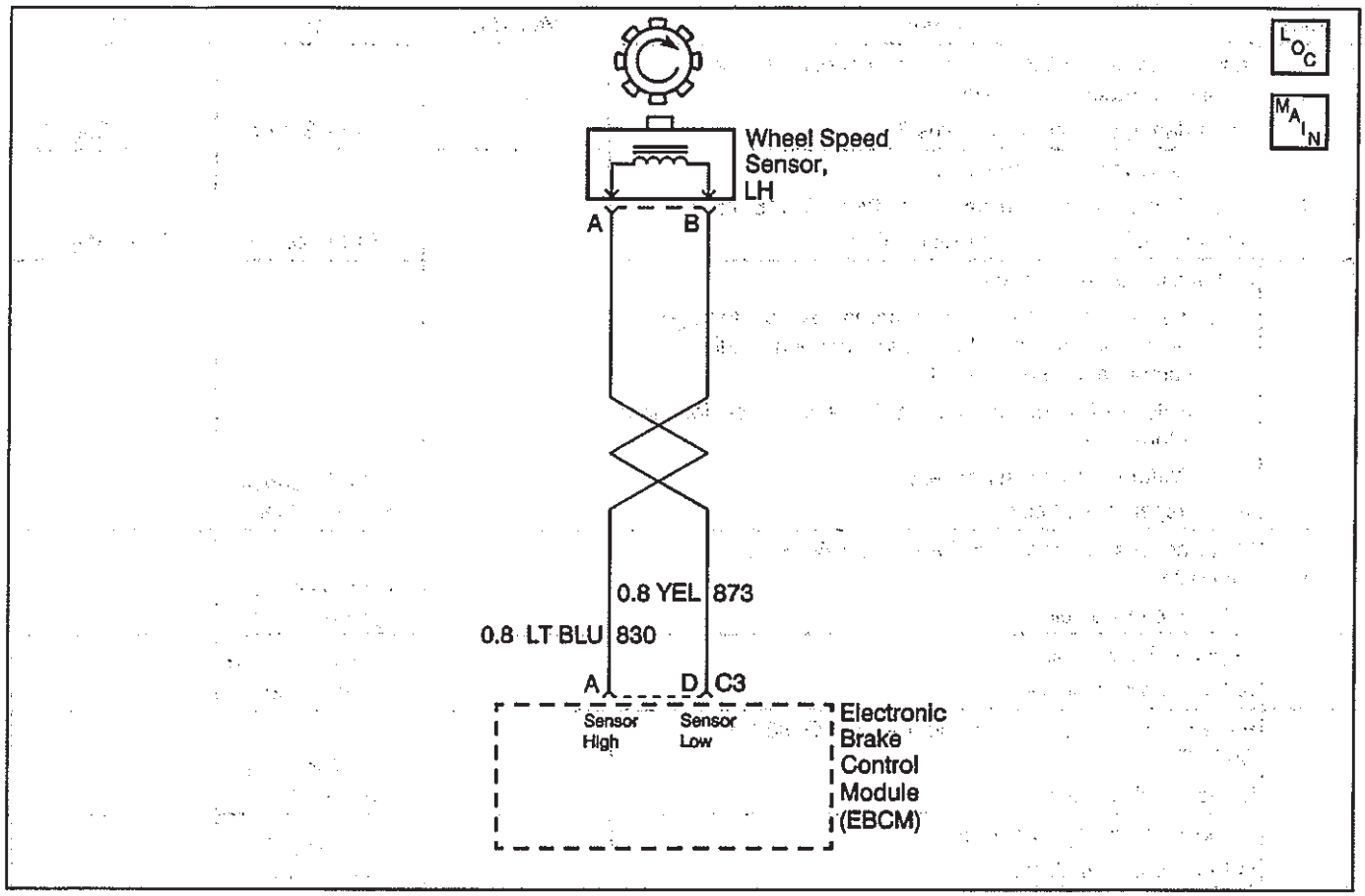
DTC C0225 LF Wheel Speed Sensor Circuit Open

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition OFF. 2. Disconnect the 4-way EBCM harness connector. 3. Using a *J 39200*, measure the resistance between terminals D and A of the 4-way EBCM harness connector. Is the resistance measurement within the specified range? (Refer to the tables on the facing page for applicable sensor resistance values. The values in these tables are for the resistance of the sensor, not the air temperature.)	—	*Go to Step 5*	*Go to Step 3*
3	1. Disconnect the left front wheel speed sensor harness connector from the wheel speed sensor. 2. Using a *J 36169-A* connect terminals A and B of the 2-way wheel speed sensor harness connector (chassis harness side). 3. Using a *J 39200*, measure the resistance between terminals D and A of the 4-way EBCM harness connector. Is the resistance measurement within the specified range?	0–2 Ω	*Go to Step 4*	*Go to Step 10*
4	Using a *J 39200*, measure the resistance between terminals A and B of the left front wheel speed sensor connector. Is the resistance measurement within the specified range? (Refer to the tables on the facing page for applicable sensor resistance values. The values in these tables are for the resistance of the sensor, not the air temperature.)	—	*Go to Step 7*	*Go to Step 11*

DTC C0225 LF Wheel Speed Sensor Circuit Open (cont'd)

Step	Action	Value(s)	Yes	No
5	Inspect the 4-way EBCM harness connector for poor terminal contact or corrosion. Does damage or corrosion exist?	—	*Go to Step 8*	*Go to Step 6*
6	1. Reconnect all connectors. 2. Test drive the vehicle above 24 km/h (15 mph). Does the DTC set as a current DTC?	—	*Go to Step 9*	*Go to Step 7*
7	Malfunction is intermittent. 1. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. Refer to Diagnostic Aids on the facing page for more information. 2. Perform all necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—
8	Make necessary repairs to the 4-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Repair the open or high resistance in CKT 830 or CKT 873. Is the repair complete?	—	Go to *Diagnostic System Check*	—
11	Replace the wheel speed sensor. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0226 LF Wheel Speed Signal Missing



184073

Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

- The left front wheel speed is less than 6 km/h (4 mph)
- All other wheel speeds are greater than 13 km/h (8 mph)
- No unexpected wheel acceleration/deceleration. Anything that keeps the left front wheel speed sensor low while the vehicle is moving above 13 km/h (8 mph).

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0026 is an Ignition Latched DTC, which indicates that the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

If the customer says that the ABS indicator lamp is on only during humid conditions such as rain, snow, or vehicle wash, then thoroughly inspect all wheel speed sensor circuits for signs of water intrusion. Use the following procedure:

1. Spray the suspected area with a 5% salt water solution (two teaspoons of salt to 12 oz. of water)
2. Drive the vehicle above 24 km/h (15 mph) for at least 30 seconds

If the DTC returns, replace the suspected harness.

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement*.

Resistance of the wheel speed sensor will increase with an increase in sensor temperature. Refer to the following tables for temperature/resistance values.

WSS Temperature vs. Sensor Resistance

°C	°F	Ohms
Temperature vs Resistance Values (Approximate)		
-40 to 4	-40 to 40	1575 to 2420
5 to 43	41 to 110	1980 to 2800
44 to 93	111 to 200	2250 to 3280
94 to 150	201 to 302	2750 to 3850

Test Description

The numbers below refer to the steps in the diagnostic table:

3. This step checks the resistance of the left front wheel speed sensor.
4. This step checks the voltage output of the left front wheel speed sensor.
5. This step checks for a short in the wiring between the wheel speed sensor circuits.
6. This step checks for a short to ground in the left front wheel speed sensor circuit.

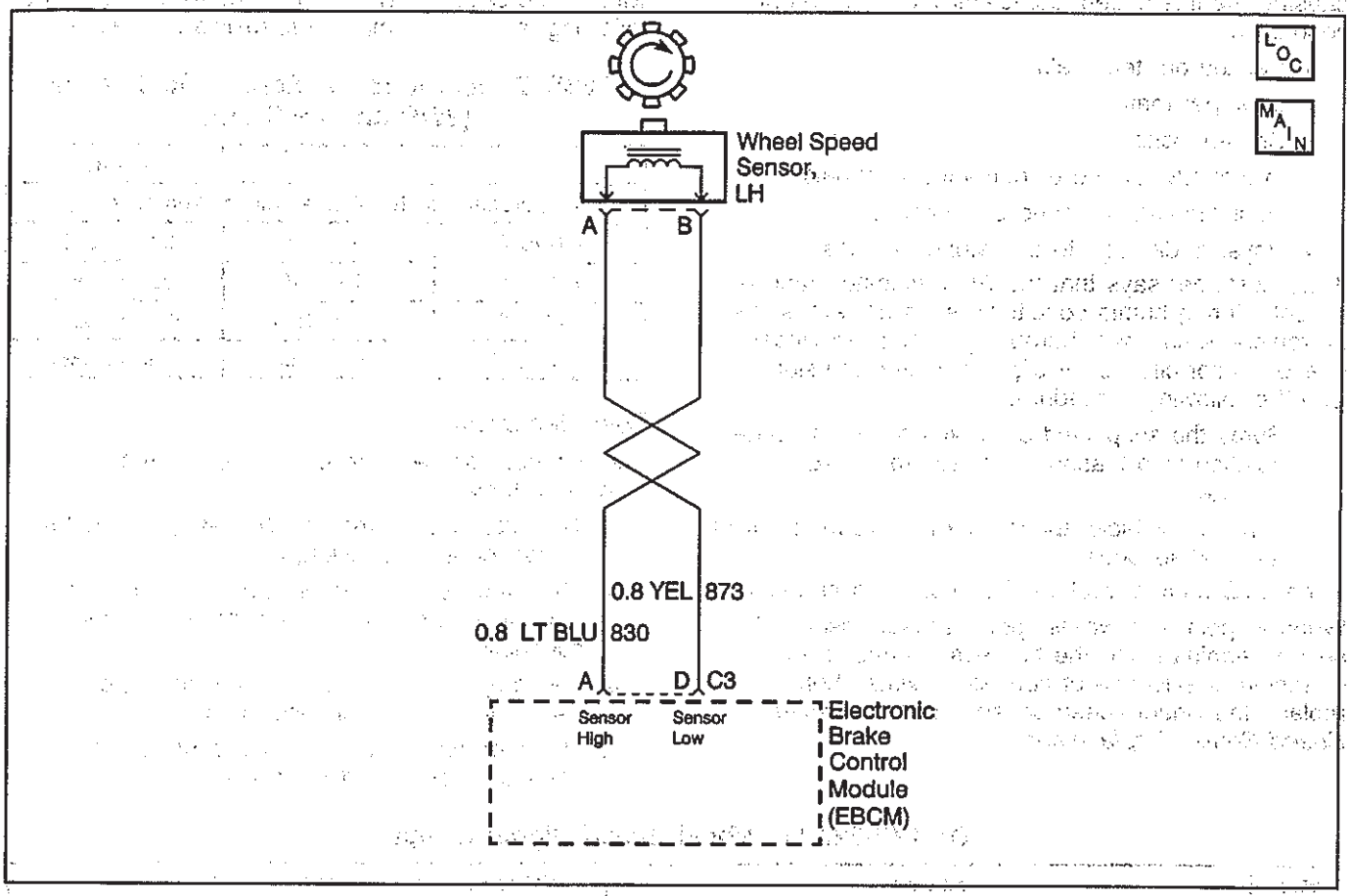
DTC C0226 LF Wheel Speed Signal Missing

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Inspect the left front wheel speed sensor, sensor wire and the connectors for signs of damage or corrosion. 3. Inspect the wheel speed sensor and the toothed ring for looseness. Any deviation will affect the wheel speed sensor output signal. 4. Inspect the 4-way EBCM harness connector and harness for signs of damage or corrosion. Can you observe physical damage?	—	*Go to Step 8*	*Go to Step 3*
3	1. Disconnect the left front wheel speed sensor harness connector from the wheel speed sensor. 2. Using a *J 39200*, measure the resistance between terminals A and B of the left front wheel speed sensor connector. Is the resistance measurement within the specified range? (Refer to the table on the previous page for applicable sensor resistance values. The values in these tables are for the temperature of the sensor, not the air temperature.)	—	*Go to Step 4*	*Go to Step 9*

DTC C0226 LF Wheel Speed Signal Missing (cont'd)

Step	Action	Value(s)	Yes	No
4	1. With the *J 39200* still connected, select the A/C voltage scale. 2. Spin the wheel by hand while observing the voltage reading. Is the voltage measured equal to or greater than the specified value?	100 mV	*Go to Step 5*	*Go to Step 9*
5	1. Disconnect the 4-way EBCM harness connector from the EBCM. 2. Using a *J 39200*, measure the resistance between terminals D and A of the 4-way EBCM harness connector. Is the resistance measurement equal to the specified value?	OL	*Go to Step 6*	*Go to Step 11*
6	1. Reconnect the left front wheel speed sensor. 2. Using a *J 39200*, measure the resistance between terminal D of the 4-way EBCM harness connector and ground. Is the resistance measurement equal to the specified value?	OL	*Go to Step 7*	*Go to Step 12*
7	1. Inspect the 4-way EBCM harness connector terminal D and terminal A for poor terminal contact or corrosion. 2. Inspect CKT 830 and CKT 873 for damage that could result in a shorted circuit. Repair any evident damage. 3. Replace the terminals if poor contact or corrosion exists. 4. Reconnect all the connectors. 5. Clear all DTCs using the *Scan Tool*. 6. Test drive the vehicle above 24 km/h (15 mph). Does the DTC set as a current DTC?	—	*Go to Step 10*	*Go to Step 13*
8	Make the necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Replace the left front wheel speed sensor. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
11	Repair the short between CKT 830 and CKT 873. Is the repair complete?	—	Go to *Diagnostic System Check*	—
12	Repair the short to ground in CKT 873. Is the repair complete?	—	Go to *Diagnostic System Check*	—
13	Malfunction is intermittent. 1. Inspect all connectors for damage which may result in high resistance when all components are connected. Refer to Diagnostic aids on the facing page for more information. 2. Repair all damage found. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0227 LF Wheel Speed Signal Erratic



Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

- The average wheel speed for all wheel signals is greater than 40 km/h (25 mph).
- The average left front wheel speed is greater than 40 km/h (25 mph).
- No speed signal input to the EBCM from the left front wheel speed sensor for 15ms. Anything which sudenly prevents (intermittent) the left front wheel speed signal to drop to zero while the vehicle is moving greater than 40 km/h (25 mph).

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0027 is an Ignition Latched DTC, which indicates that the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

If the customer says that the ABS indicator lamp is on only during humid conditions such as rain, snow, or vehicle wash, then thoroughly inspect all wheel speed sensor circuits for signs of water intrusion. Use the following procedure:

1. Spray the suspected area with a 5% salt water solution (two teaspoons of salt to 12 oz. of water)
2. Drive the vehicle above 24 km/h (15 mph) for at least 30 seconds

If the DTC returns, replace the suspected harness.

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement.*

Resistance of the wheel speed sensor will increase with an increase in sensor temperature. Refer to the following tables for temperature/resistance values.

WSS Temperature vs. Sensor Resistance (2WD and 4WD only)

°C	°F	Ohms
Temperature vs Resistance Values (Approximate)		
-40 to 4	-40 to 40	1575 to 2420
5 to 43	41 to 110	1980 to 2800
44 to 93	111 to 200	2250 to 3280
94 to 150	201 to 302	2750 to 3850

Test Description

The numbers below refer to the steps in the diagnostic table:

2. This step checks the EBCM 4–way connector for looseness, corrosion, etc.
3. This step uses the wheel speed sensor resistance check to help isolate an intermittent connection.
4. This step checks the left front wheel speed sensor for the proper resistance.
5. This step checks for proper mounting and orientation of the left front wheel speed sensor.

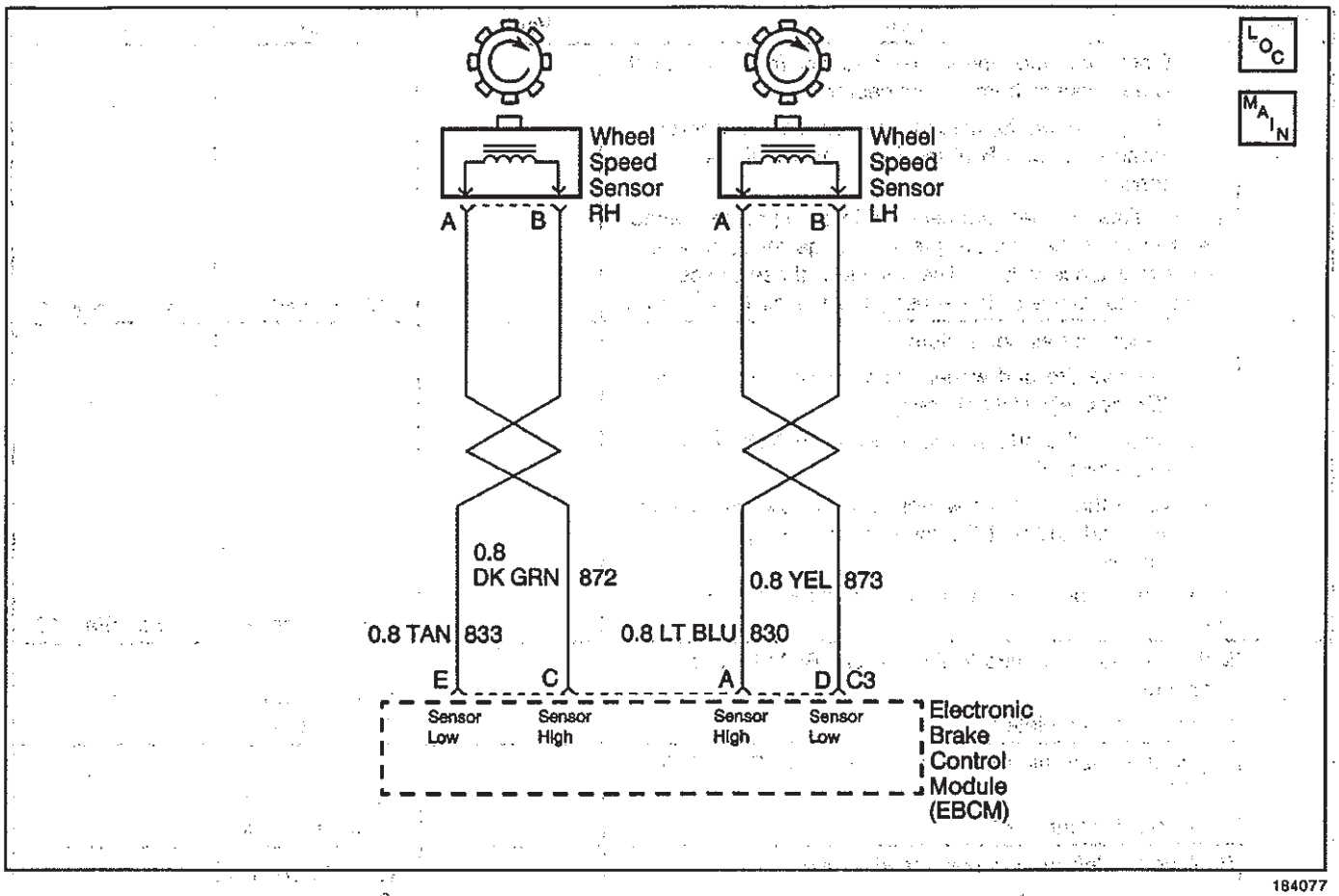
DTC C0227 LF Wheel Speed Signal Erratic

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 4-way EBCM harness connector from the EBCM and inspect for signs of damage or corrosion. 3. Inspect the wheel speed sensor harness and sensor harness connector for signs of damage or corrosion. Are all connections clean and tight?	—	*Go to Step 3*	*Go to Step 6*
3	Using a *J 39200,* measure the resistance between terminals D and A of the 4-way EBCM harness connector. Wiggle the WSS harness in various locations between the sensor and the EBCM while performing this measurement. Is the resistance measurement within the specified range without fluctuation when the harness is wiggled? (Refer to the tables on the previous page for applicable sensor resistance values. The values in these tables are for the temperature of the sensor, not the air temperature.)	—	*Go to Step 5*	*Go to Step 4*

DTC C0227 LF Wheel Speed Signal Erratic (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Disconnect the wheel speed sensor from the wheel speed sensor harness connector. 2. Using a *J 39200*, measure the resistance between terminals A and B of the left front wheel speed sensor. Is the resistance measurement within the specified range? (Refer to the tables on the previous page for applicable sensor resistance values. The values in these tables are for the temperature of the sensor, not the air temperature.)	—	*Go to Step 7*	*Go to Step 8*
5	1. Reconnect all connectors. 2. Remove tire and wheel. Refer to *Wheel Removal (Excessively Tight Wheels).* 3. Remove the hub and rotor. Refer to *Brake Rotor Replacement.* 4. Verify that the front wheel speed sensor is securely mounted and that the tone wheel is in good condition. Is the wheel speed sensor and tone wheel in good condition?	—	*Go to Step 9*	*Go to Step 10*
6	Make necessary repairs to the 4-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
7	Repair the open, high resistance or short in CKTs 830 or 873. Is the repair complete?	—	Go to *Diagnostic System Check*	—
8	Replace the left front wheel speed sensor. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Malfunction is intermittent. 1. Inspect all connectors for damage which may result in high resistance when all components are connected. Refer to Diagnostic aids on the facing page for more information. 2. Repair all damage found. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Make necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0229 Drop Out of Front Wheel Speed Signals



Circuit Description

The wheel speed sensor coil emits an electromagnetic field. A toothed ring on the wheel passes by the wheel speed sensor and disrupts this electromagnetic field. The disruption in the field causes the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the speed of the wheel. The amplitude of the wheel speed signal is also directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap.

Conditions for Setting the DTC

EBCM losing both front wheel speed signals when the vehicle is at speeds over 19 km/h (12 mph) (brake released), or 32 km/h (20 mph) (brake applied).

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0029 is an Ignition Latched DTC, which indicates that the above conditions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

When inspecting a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion. If evidence of corrosion exists, then replace the wheel speed sensor. Refer to *Wheel Speed Sensor Replacement*.

Test Description

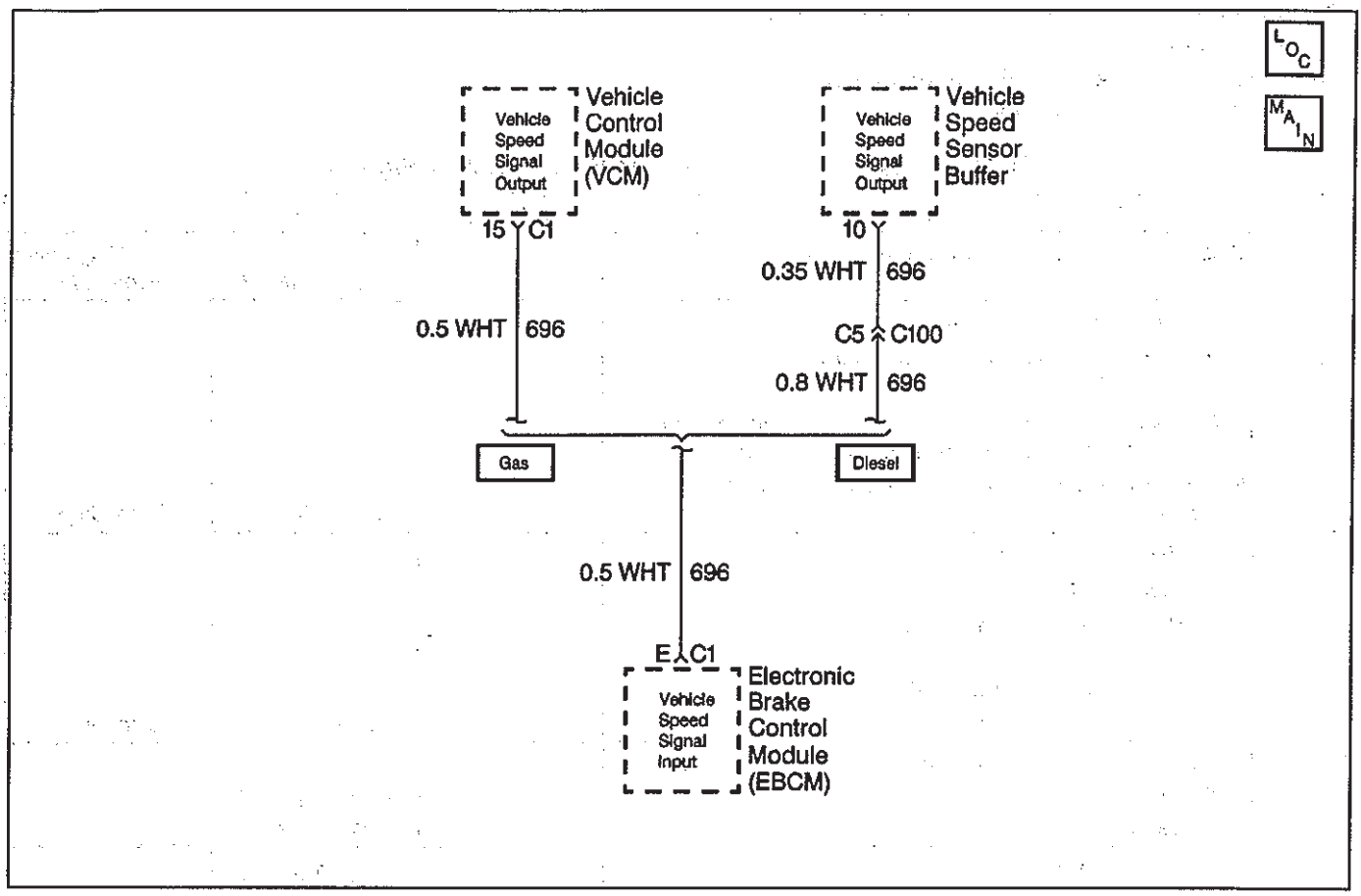
The numbers below refer to the numbers on the diagnostic chart.

2. This step checks the EBCM 4-way connector for looseness, corrosion, etc.

DTC C0229 Drop Out of Front Wheel Speed Signals

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 4-way EBCM harness connector from the EBCM. 3. Inspect the 4-way EBCM harness connector and harness for signs of damage or corrosion. Is the harness OK and are all the connections clean and tight?	—	*Go to Step 3*	*Go to Step 4*
3	1. Reconnect all connectors. 2. Clear DTC. 3. Road test vehicle at speeds above 24 km/h (15 mph). 4. Use the scan tool to read the DTCs. Did the DTC C0029 set?	—	*Go to Step 5*	*Go to Step 6*
4	Make necessary repairs to the 4-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
5	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
6	Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. Refer to diagnostic aids on facing page for more information. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0235 Rear Wheel Speed Signal Circuit Open



184084

Circuit Description

The EBCM receives the rear wheel speed signal from the Vehicle Control Module (VCM). The rear wheel speed signal originates from the Vehicle Speed Sensor (VSS) which is connected to the VCM. When the vehicle is not moving, the VCM will have 12 VDC present on the circuit. The EBCM checks for this votage when the vehicle is not moving.

Conditions for Setting the DTC

EBCM not seeing the correct voltage level from the VCM at startup.

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0035 is a Conition Latched DTC, which indicates that the above actions are true until the condition is cleared.

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

This DTC can be set by a faulty EBCM or a fault in CKT 696.

If the voltage readings are low or varying, the battery or charging system could be the cause. Check these areas before replacing any components. In addition, any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

Test Description

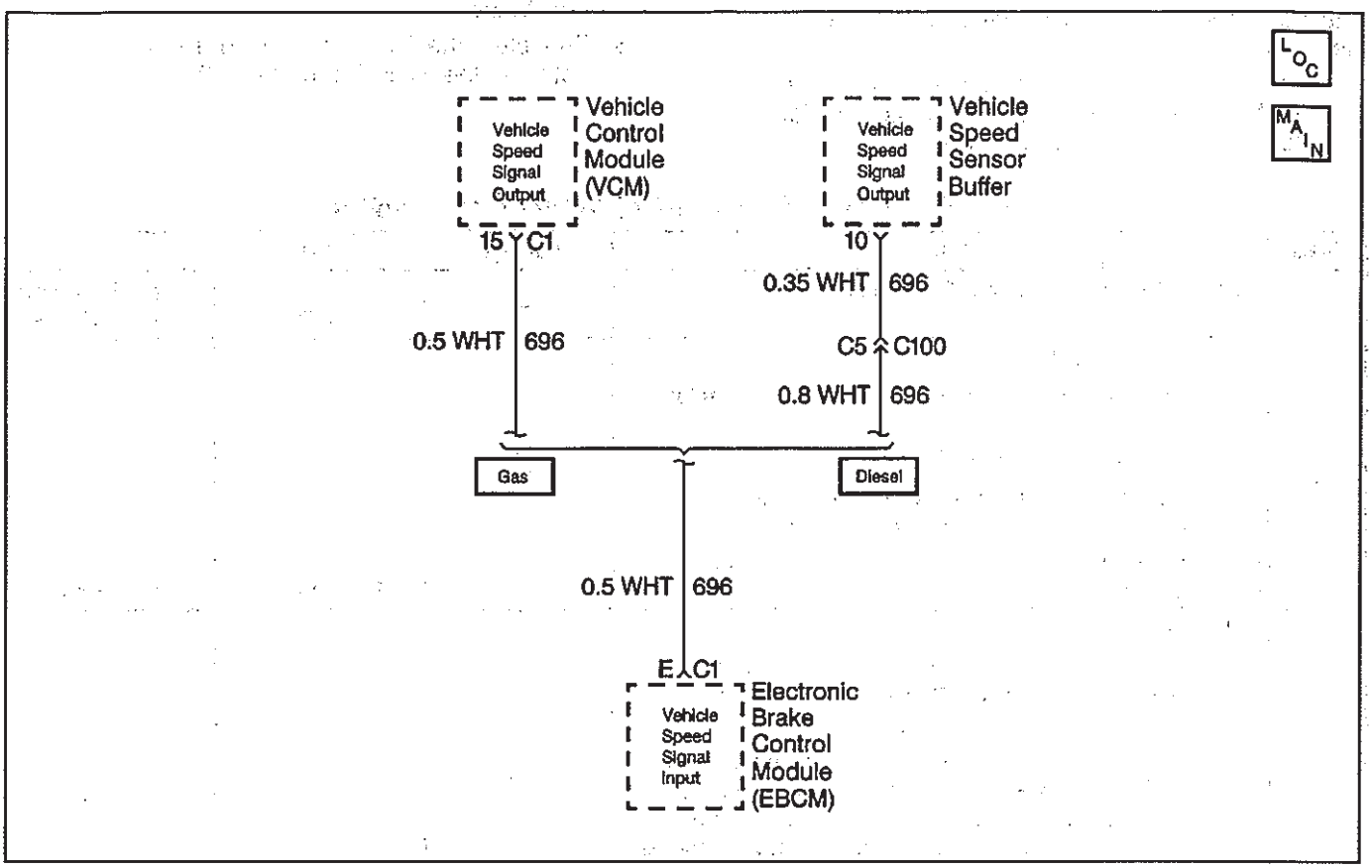
The numbers below refer to the steps in the diagnostic table:

2. This step uses the voltage output from the VCM (gas) or Vehicle Speed Sensor Buffer (diesel) to check the 1827 CKT.
3. This step checks the 1827 CKT for proper resistance.
5. This step checks for a short in the wiring between the ECBM and the PCM.

DTC C0235 Rear Wheel Speed Signal Circuit Open

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM harness connector from the EBCM. 3. Turn the ignition to RUN. 4. Using a *J 39200*, measure the voltage at terminal E of the 10-way EBCM harness connector. Is the voltage measurement equal to or greater than the specified value?	10V	*Go to Step 4*	*Go to Step 3*
3	1. Turn the ignition to OFF. 2. Disconnect the VCM harness connector C1 for gas vehicles or the Vehicle Speed Sensor Buffer harness connector for diesel vehicles. 3. Using a *J 39200*, measure the resistance between the EBCM 10-way connector terminal E and the VCM harness connector C1 terminal 15 for gas vehicles or the Vehicle Speed Sensor Buffer harness connector terminal 10 for diesel vehicles. Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 5*	*Go to Step 8*
4	1. Turn the ignition to OFF. 2. Reconnect all connectors. 3. Turn the ignition to RUN. 4. Using a *Scan Tool*, clear DTCs. 5. Test drive the vehicle above 24 km/h (15 mph). 6. Use a *Scan Tool* to read DTCs. Did DTC set?	—	*Go to Step 6*	*Go to Step 7*
5	Using the *J 39200*, measure the resistance between the EBCM 10-way connector terminal E and ground. Is the resistance measurement within the specified range?	OL	Refer to Engine Controls for Vehicle Speed Sensor Diagnosis	*Go to Step 9*
6	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
7	Malfunction is intermittent. 1. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. 2. Refer to Diagnostic Aids on the facing page for more information. 3. Perform all necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—
8	Repair the open in CKT 696. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Repair short to ground in CKT 696. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0236 Rear Wheel Speed Signal Circuit Missing



184084

Circuit Description

The EBCM receives the rear wheel speed signal from the Vehicle Control Module (VCM) for gas engine vehicles or the Vehicle Speed Sensor Buffer for diesel engine vehicles. The rear wheel speed signal originates from the Vehicle Speed Sensor (VSS) which is connected to the VCM (gas) or the Vehicle Speed Sensor Buffer (diesel).

Conditions for Setting the DTC

EBCM losing the rear wheel speed signal for at least 5 seconds while the vehicle is moving above 13 km/h (8 mph) with the brake pedal released.

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0236 is an Ignition Latched DTC, which indicates that the above actions are true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

This malfunction can be caused by a malfunction in the EBCM, VCM (gas) Vehicle Speed Sensor Buffer (diesel), VSS or a fault in CKT 821, 822 or 1827.

In addition, any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

If the customer says that the ABS indicator lamp is on only during humid conditions such as rain, snow, or vehicle wash, then thoroughly inspect the suspected circuits for signs of water intrusion. Use the following procedure:

1. Spray the suspected area with a 5% salt water solution (two teaspoons of salt to 12 oz. of water)
2. Drive the vehicle above 24 km/h (15 mph) for at least 30 seconds

If the DTC returns, replace the suspected harness.

Test Description

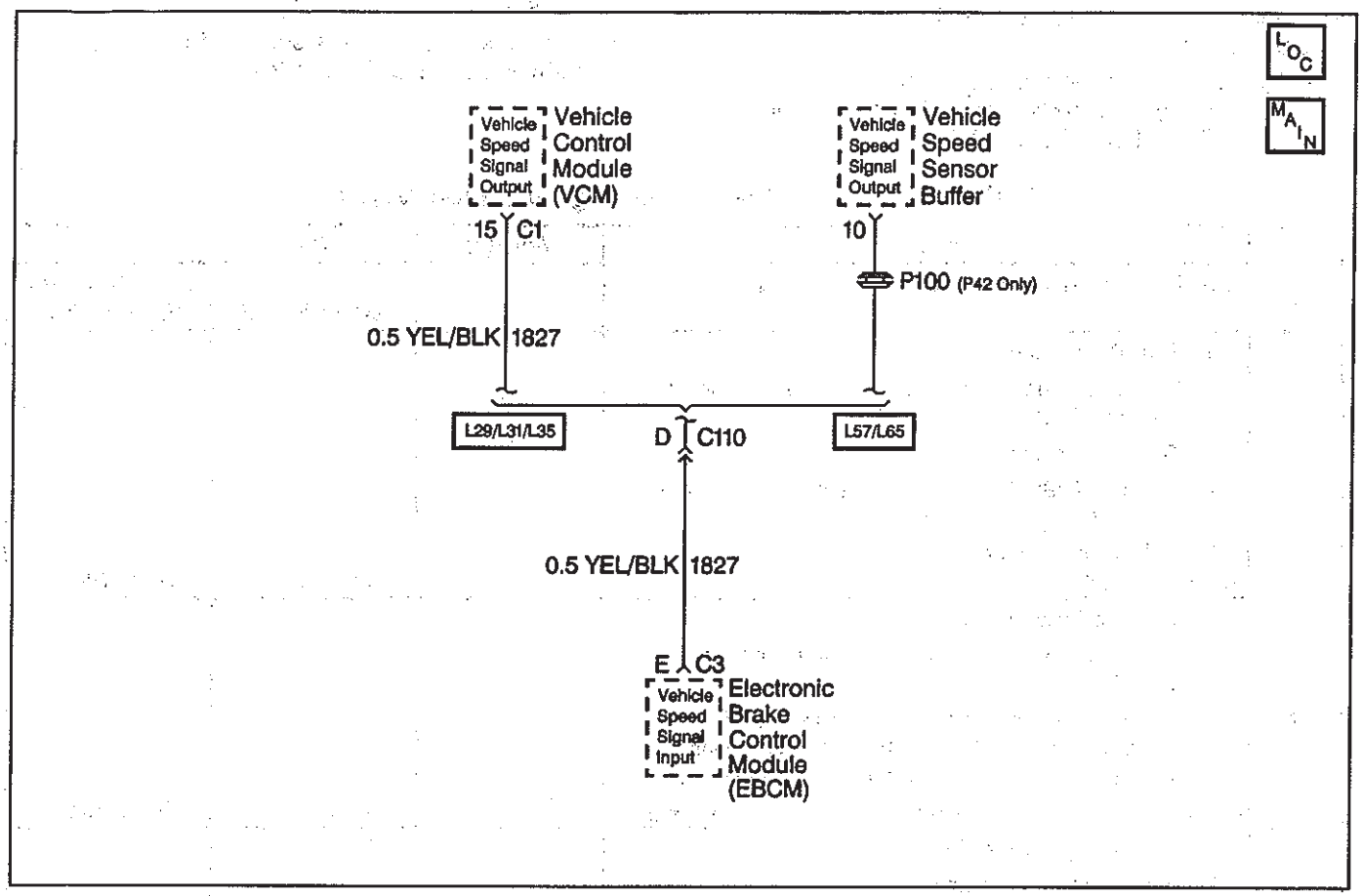
The numbers below refer to the steps in the diagnostic table:

2. This step uses the voltage output from the VCM (gas) or Vehicle Speed Sensor Buffer (diesel) to check the 1827 CKT.
3. This step checks the 1827 CKT for proper resistance.
5. This step checks for a short in the wiring between the ECBM and the VCM.

DTC C0236 Rear Wheel Speed Signal Circuit Missing

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM harness connector from the EBCM. 3. Turn the ignition to RUN. 4. Using a *J 39200*, measure the voltage at terminal E of the 10-way EBCM harness connector. Is the voltage measurement equal to or greater than the specified range?	10V	*Go to Step 4*	*Go to Step 3*
3	1. Turn the ignition to OFF. 2. Disconnect the VCM harness connector C1 from the VCM. 3. Using a *J 39200*, measure the resistance from terminal E of the 10-way EBCM harness connector to terminal 10 of the VCM harness connector C1. Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 5*	*Go to Step 8*
4	1. Turn the ignition to OFF. 2. Reconnect all connectors. 3. Turn the ignition to RUN. 4. Using a *Scan Tool*, clear DTCs. 5. Test drive the vehicle above 24 km/h (15 mph). 6. Use a *Scan Tool* to read DTCs. Did DTC C0236 set?	—	*Go to Step 6*	*Go to Step 7*
5	Using the *J 39200*, measure the resistance from terminal E of the 10-way EBCM harness connector to ground. Is the resistance measurement within the specified range?	OL	Refer to Engine Controls for Vehicle Speed Sensor Diagnosis	*Go to Step 9*
6	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
7	Malfunction is intermittent. 1. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. 2. Refer to Diagnostic Aids on the facing page for more information. 3. Perform all necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—
8	Repair the open in CKT 696. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Repair short to ground in CKT 696. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0237 Rear Wheel Speed Signal Erratic



191492

Circuit Description

The EBCM receives the rear wheel speed signal from the Vehicle Control Module (VCM). The rear wheel speed signal originates from the Vehicle Speed Sensor (VSS) which is connected to the VCM.

Conditions for Setting the DTC

- EBCM seeing the rear speed signal line drop out and return. This malfunction can be caused by a malfunction in the VSS, or a fault in CKT 821, 822 or 1827.
- The EBCM attempts to detect an erratic rear speed signal every 5 milliseconds. If the rear speed signal is missing for greater than 15 milliseconds while a vehicle speed greater than 32 k/mh (20 mph) with brake applied, or 20 k/mh (12 mph) with brake released a DTC C0037 will set. At this point the DTC will be condition latched. This means that the ABS system will be disabled and the ABS indicator lamp stays on as long as the condition exists. If the erratic DTC is set 3 consecutive times during the same ignition cycle, the DTC will set as an ignition latched DTC. This means that the ABS system will be disabled and the ABS indicator lamp stays on until the ignition is turned off; even if the fault goes away.

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0037 initially sets as a condition latched code. This means that the ABS system will be disabled and the ABS indicator lamp stays on as long as the condition exists. If the erratic DTC is set 3 consecutive times during the same ignition cycle, the DTC will set as an ignition latched DTC. This means that the ABS system will be disabled and the ABS indicator lamp stays on until the ignition is turned off; even if the fault goes away.

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

This DTC can be set by a malfunction in the VSS, or a fault in CKT 821, 822 or 696.

In addition, any of the following conditions may cause an intermittent malfunction:

- A poor connection
- Wire insulation that is rubbed through
- A wire breaks inside the insulation

Thoroughly check any circuitry that is suspected of causing the intermittent 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

Test Description

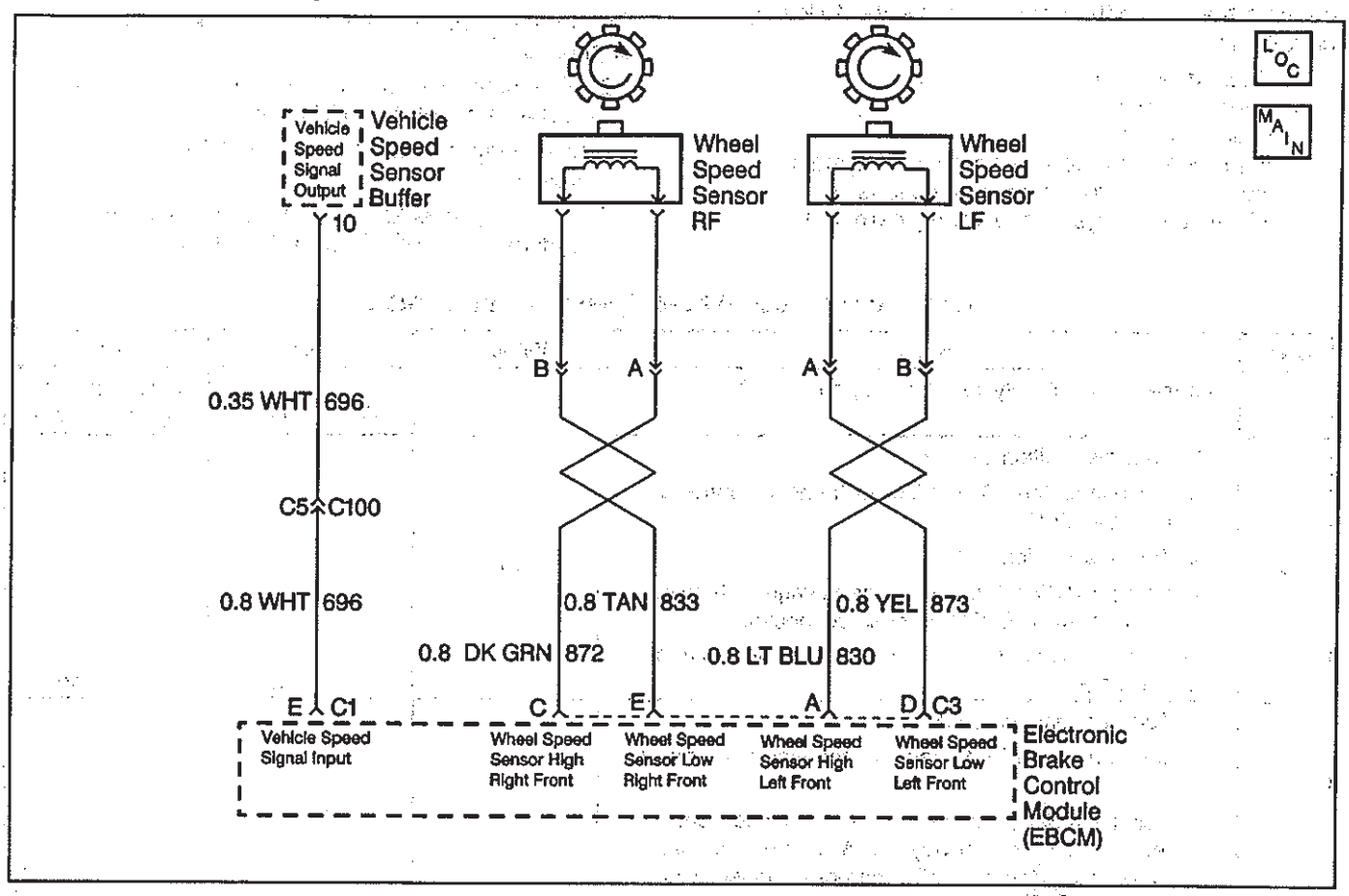
The numbers below refer to the steps in the diagnostic table:

2. This step uses the voltage output from the VCM to check the 1827 CKT.
3. This step checks the 1827 CKT for proper resistance.
5. This step checks for a short in the wiring between the ECBM and the VCM.

DTC C0237 Rear Wheel Speed Signal Erratic

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM harness connector from the EBCM. 3. Turn the ignition to RUN. 4. Using a *J 39200*, measure the voltage at terminal E of the 10-way EBCM harness connector. Is the voltage measurement equal to or greater than the specified range?	10V	*Go to Step 4*	*Go to Step 3*
3	1. Turn the ignition to OFF. 2. Disconnect the VCM harness connector C1 from the VCM. 3. Using a *J 39200*, measure the resistance from terminal E of the 10-way EBCM harness connector to terminal 10 of the VCM harness connector C1. Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 5*	*Go to Step 8*
4	1. Turn the ignition to OFF. 2. Reconnect all connectors. 3. Turn the ignition to RUN. 4. Using a *Scan Tool*, clear DTCs. 5. Test drive the vehicle above 24 km/h (15 mph). 6. Use a *Scan Tool* to read DTCs. Did DTC C0237 set?	—	*Go to Step 6*	*Go to Step 7*
5	Using the *J 39200*, measure the resistance from terminal E of the 10-way EBCM harness connector to ground. Is the resistance measurement within the specified range?	OL	Refer to Engine Controls for Vehicle Speed Sensor Diagnosis	*Go to Step 9*
6	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
7	Malfunction is intermittent. 1. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. 2. Refer to Diagnostic Aids on the facing page for more information. 3. Perform all necessary repairs. Is the repair complete?	—	Go to *Diagnostic System Check*	—
8	Repair the open in CKT 696. Is the repair complete?	—	Go to *Diagnostic System Check*	—
9	Repair short to ground in CKT 696. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0238 Wheel Speed Mismatch



Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal. The frequency and amplitude of the sinusoidal (AC) voltage signal are proportional to the wheel speed. The amplitude of the wheel speed signal is directly related to the distance between the wheel speed sensor coil and the toothed ring. This distance is referred to as the air gap. The EBCM can detect wheel speed signal malfunctions as they happen. An error in reported wheel speed can be compensated for by the EBCM up to a point. The error compensation will allow the EBCM to continue to function normally instead of setting a DTC. If the wheel speed mismatch increases beyond that point, the EBCM will set a DTC.

Conditions for Setting the DTC

- Any wheel speed differing from the vehicle speed by greater than 10%.
- The vehicle speed is greater than 40 km/h (25 mph)
- No unexpected wheel acceleration: anything that generates consistent differences between the wheel speed signals

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTC C0238 is an Ignition Latched DTC, which indicates the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

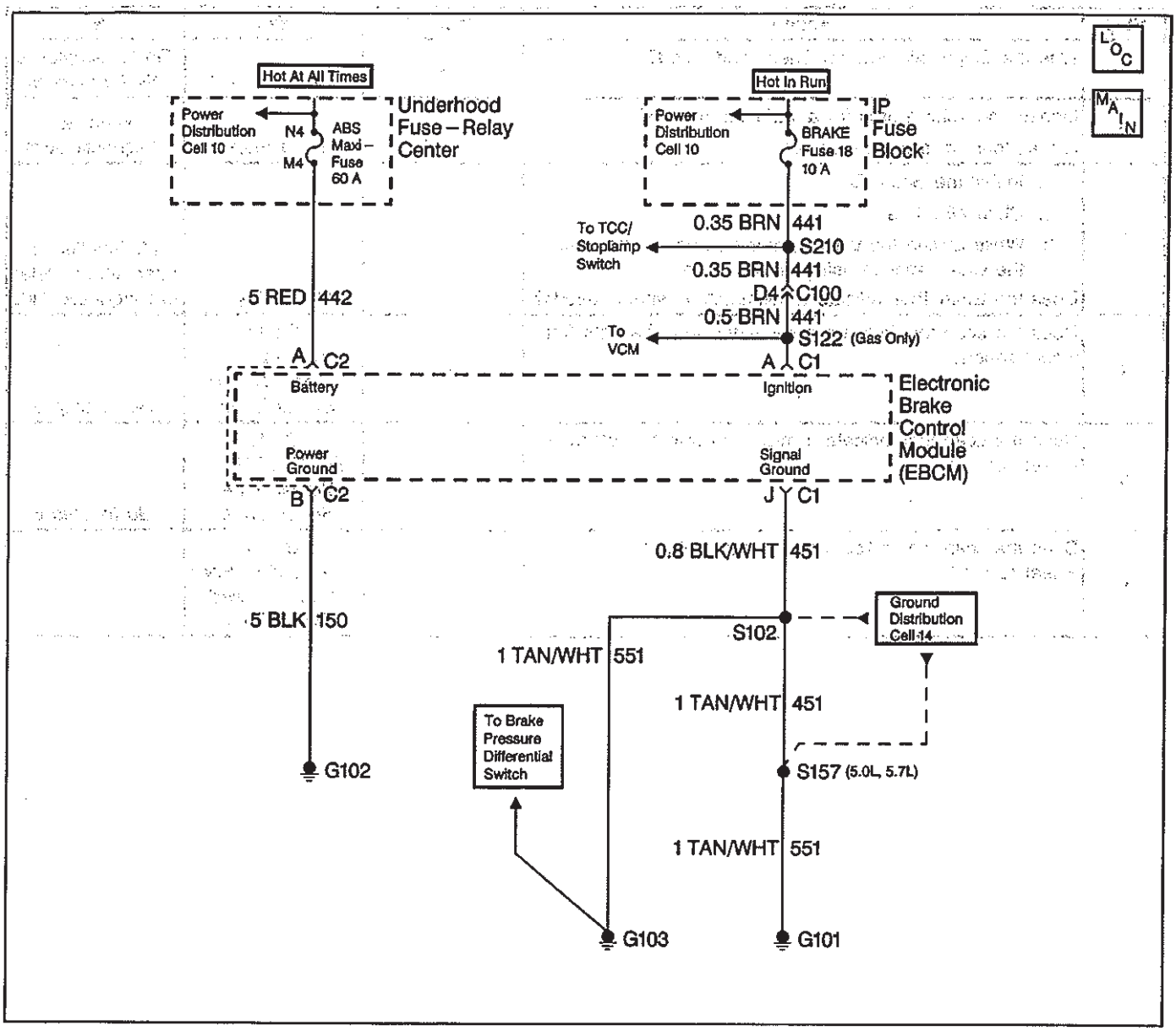
Diagnostic Aids

Installing significantly different tires on the vehicle usually sets a DTC C0238.

DTC C0238 Wheel Speed Mismatch

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	Inspect the vehicle tires for a variation in tire size Are all four tire sizes the same?	—	*Go to Step 3*	Refer to Diagnostic Aids
3	1. Install the *Scan Tool.* 2. Clear all DTCs. 3. While driving the vehicle, monitor and compare all the wheel speeds using the *Scan Tool.* Does the Scan Tool indicate a mismatch in wheel speeds?	—	*Go to Step 4*	Malfunction is intermittent. Refer to Diagnostic Aids
4	Does the scan tool indicate a mismatch with the right front wheel speed?	—	Go to *DTC C0223 RF Wheel Speed Signal Erratic*	*Go to Step 5*
5	Does the scan tool indicate a mismatch with the left front wheel speed?	—	Go to *DTC C0227 LF Wheel Speed Signal Erratic*	*Go to Step 6*
6	Does the scan tool indicate a mismatch with the rear wheel speed?	—	Go to *DTC C0237 Rear Wheel Speed Signal Erratic*	—

DTC C0241-C0254 EBCM Control Valve Circuit



184106

Circuit Description

The EBCM microprocessor will ground the indicated solenoid coil (RF dump/isolation, LF dump/isolation, or Rear dump/isolation) circuit to energize the solenoid coil whenever the solenoid valve is needed. Refer to ABS Braking Mode in *ABS System Operation*. The magnetic force created by the solenoid coil will close the isolation valve.

Conditions for Setting the DTC

Open Circuit

- The ABS bulb check is complete
- Low voltage exists on the EBCM solenoid driver circuit when high voltage is expected (the solenoid is not energized)

Shorted Circuit

- The ABS bulb check is complete
- High voltage is present on the EBCM solenoid driver circuit when the voltage is expected to be low (solenoid energized).

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTCs C0241–C0258 are Ignition Latched DTCs, which indicates the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

This DTC usually sets because of an open/shorted solenoid coil within the EBCM. The solenoid coil is located within the BPMV and is not serviceable. If the test does not repair the DTC, then replace the EBCM.

If this DTC sets with other DTCs, check for the following conditions:

- A poor EBCM power or signal ground
- A poor EBCM power or ignition feed

Test Description

The numbers below refer to the steps in the diagnostic table:

3. This step determines the resistance of the power ground circuit.
4. This step determines the battery voltage available to the EBCM.
7. This step determines the resistance of the signal ground circuit.
8. This step determines the ignition voltage available to the EBCM.

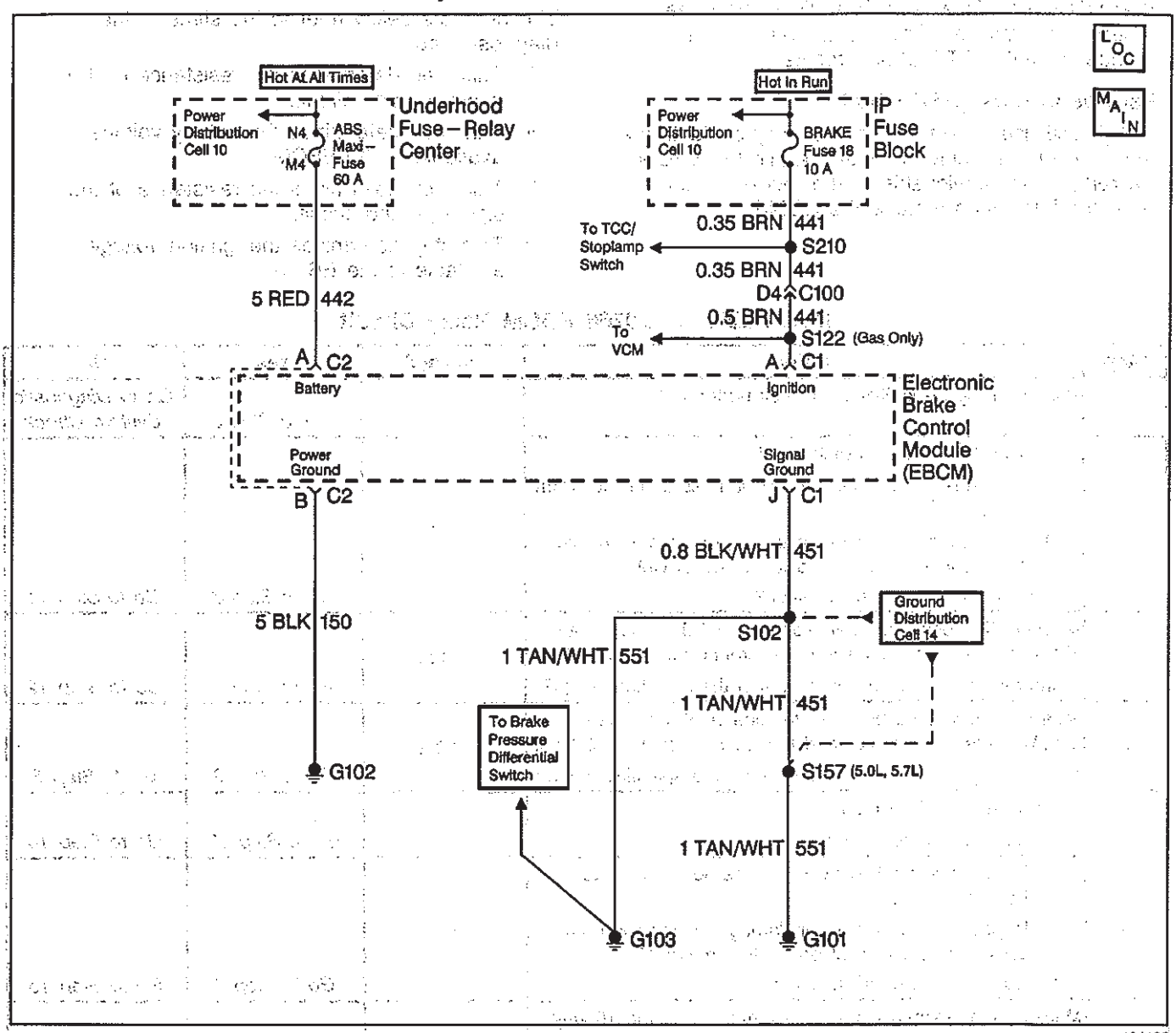
DTC C0241-C0254 EBCM Control Valve Circuit

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition switch to OFF. 2. Disconnect the 2-way EBCM harness connector from the EBCM. 3. Inspect the connector for damage or corrosion that could cause a loss of power to the EBCM. Is the connector in good condition?	—	*Go to Step 3*	*Go to Step 11*
3	Measure the resistance between terminal B of the 2-way EBCM harness connector and the ground using a *J 39200.* Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 4*	*Go to Step 12*
4	Measure the voltage between terminal A of the 2-way EBCM harness connector and the ground using a *J 39200.* Is the voltage equal to or greater than the specified value?	10.0 V	*Go to Step 6*	*Go to Step 5*
5	Inspect the 60A ABS fuse. Is the 60A ABS fuse open?	—	*Go to Step 13*	*Go to Step 14*
6	1. Disconnect the 10-way EBCM harness connector from the EBCM. 2. Inspect the connector for damage or corrosion that could cause a loss of power to the EBCM. Is the connector in good condition?	—	*Go to Step 7*	*Go to Step 15*
7	Measure the resistance between terminal J of the 10-way EBCM harness connector and the ground using a *J 39200.* Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 8*	*Go to Step 16*
8	1. Turn the ignition to RUN. 2. Measure the voltage between terminal A of the 10-way EBCM harness connector and the ground using a *J 39200.* Is the voltage equal to or greater than the specified value?	10.0 V	*Go to Step 10*	*Go to Step 9*
9	Inspect the 10-amp BRAKE fuse. Is the fuse open?	—	*Go to Step 17*	*Go to Step 18*

DTC C0241-C0254 EBCM Control Valve Circuit (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect the 10-way and 2-way EBCM harness connectors for poor terminal contact or corrosion. 2. Inspect CKT 442, CKT 150, CKT 441 and CKT 451 for damage that could result in an intermittent open circuit. 3. Repair any evident damage. 4. Replace the terminals if poor contact or corrosion exists. 5. Reconnect all the connectors. 6. Clear all DTCs using the *Scan Tool*. 7. Test drive vehicle above the 16 km/h (10 mph) Does the DTC set as a current DTC?	—	*Go to Step 19*	Malfunction is intermittent. Refer to Diagnostic Aids
11	Repair the 2-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
12	Repair the open or the high resistance in the CKT 150. Is the repair complete?	—	Go to *Diagnostic System Check*	—
13	Repair the short to ground in the CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
14	Repair the open or the high resistance in the CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
15	Repair the 10-way EBCM harness connector. Is the repair complete?		Go to *Diagnostic System Check*	—
16	Repair the open or the high resistance in the CKT 451. Is the repair complete?		Go to *Diagnostic System Check*	—
17	Repair the short to ground in the CKT 441. Is the repair complete?		Go to *Diagnostic System Check*	—
18	Repair the open or the high resistance in the CKT 441. Is the repair complete?		Go to *Diagnostic System Check*	—
19	Replace the EBCM. Is the repair complete?		Go to *Diagnostic System Check*	—

DTC C0265 or C0266 EBCM Relay Circuit



184106

Circuit Description (DTC C0065)

The pump motor relay supplies power to all six solenoid coils (three isolation solenoid coils and three dump solenoid coils) and the motor when the ABS is required. The relay and the six solenoid coils are located within the EBCM.

Conditions for Setting the DTC (DTC C0065)

- The EBCM microprocessor commands the relay on
- Low voltage exists on all six solenoid driver circuits when high voltage is expected (the solenoid is not energized)

Conditions for Setting the DTC (DTC C0066)

- The ABS bulb check is complete
- High voltage exists on the pump motor driver circuit when all are expected to be low (the relay is not commanded on)

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTCs C0065 and C0066 are Ignition Latched DTCs, which indicates that the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids (DTC C0065)

DTC C0065 usually sets because of an open relay coil or non-closable relay contacts. The relay is located within the EBCM. The relay is not serviceable. If the test does not repair the DTC, then replace the EBCM.

If DTC C0065 appears with other DTCs repair the other DTCs first. Clear all DTCs. Then run three function tests with the *Scan Tool*. Refer to this diagnostic chart if DTC C0065 resets.

Diagnostic Aids (DTC C0066)

DTC C0066 usually sets when the relay contacts are stuck closed. The relay is located within the EBCM. The relay is not serviceable. If the test does not repair the DTC, then replace the EBCM.

Test Description

The numbers below refer to the steps in the diagnostic table:

3. This step determines the resistance of the power ground circuit.
4. This step determines the battery voltage available to the EBCM.
7. This step determines the resistance of the signal ground circuit.
8. This step determines the ignition voltage available to the EBCM.

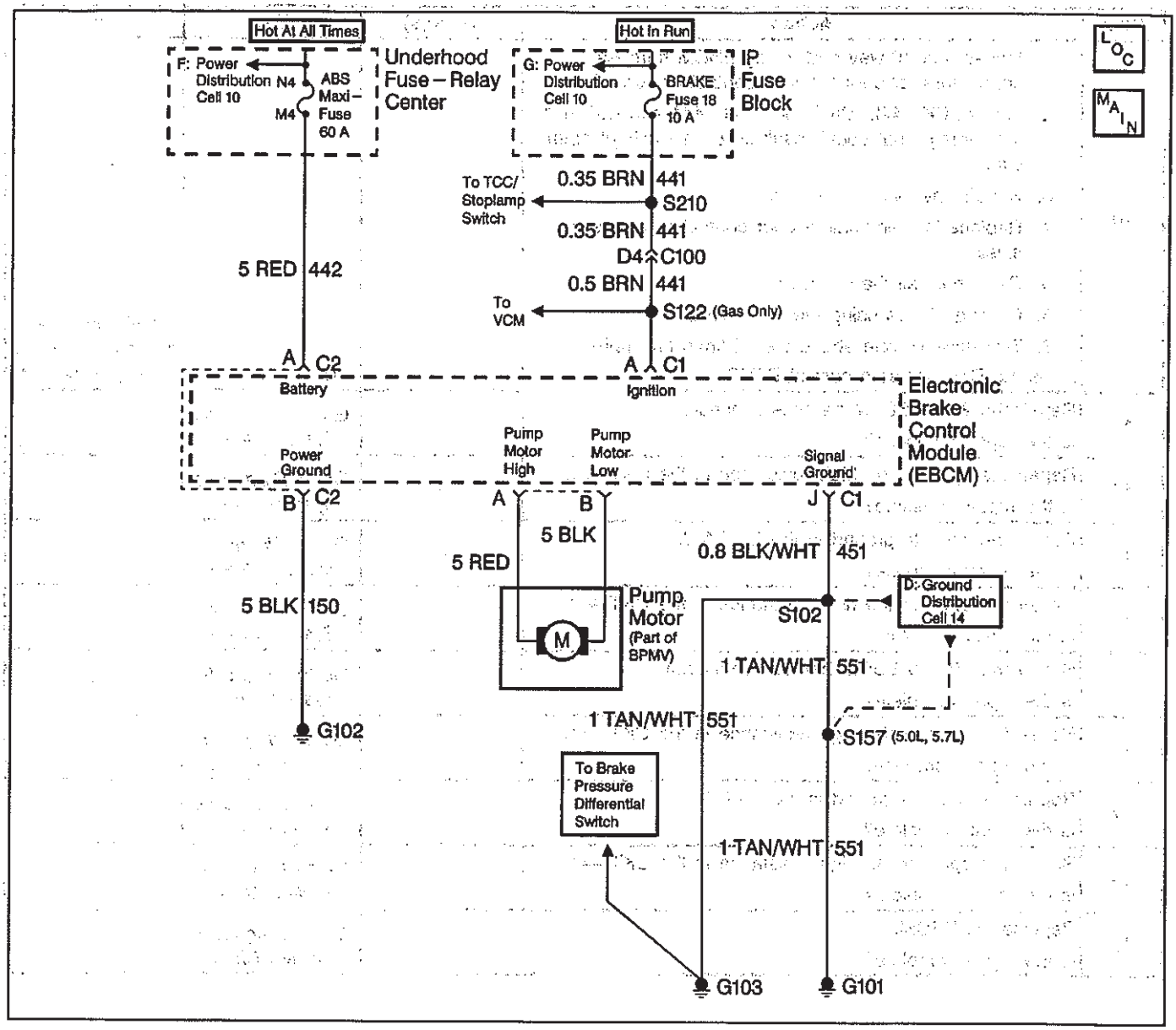
DTC C0265 or C0266 EBCM Relay Circuit

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition switch to OFF. 2. Disconnect the 2-way EBCM harness connector from the EBCM. 3. Inspect the connector for damage or corrosion that could cause a loss of power to the EBCM. Is the connector in good condition?	—	*Go to Step 3*	*Go to Step 11*
3	Measure the resistance between terminal B of the 2-way EBCM harness connector and the ground using a *J 39200*. Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 4*	*Go to Step 12*
4	Measure the voltage between terminal A of the 2-way EBCM harness connector and the ground using a *J 39200*. Is the voltage equal to or greater than the specified value?	10.0 V	*Go to Step 6*	*Go to Step 5*
5	Inspect the 60A ABS fuse. Is the 60A ABS fuse open?	—	*Go to Step 13*	*Go to Step 14*
6	1. Disconnect the 10-way EBCM harness connector from the EBCM. 2. Inspect the connector for damage or corrosion that could cause a loss of power to the EBCM. Is the connector in good condition?	—	*Go to Step 7*	*Go to Step 15*
7	Measure the resistance between terminal J of the 10-way EBCM harness connector and the ground using a *J 39200*. Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 8*	*Go to Step 16*
8	1. Turn the ignition to RUN. 2. Measure the voltage between terminal A of the 10-way EBCM harness connector and the ground using a *J 39200*. Is the voltage equal to or greater than the specified value?	10.0 V	*Go to Step 10*	*Go to Step 9*
9	Inspect the 10-amp BRAKE fuse. Is the fuse open?	—	*Go to Step 17*	*Go to Step 18*

DTC C0265 or C0266 EBCM Relay Circuit (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect the 10-way and 2-way EBCM harness connectors for poor terminal contact or corrosion. 2. Inspect CKT 442, CKT 150, CKT 441 and CKT 451 for damage that could result in an intermittent open circuit. 3. Repair any evident damage. 4. Replace the terminals if poor contact or corrosion exists. 5. Reconnect all the connectors. 6. Clear all DTCs using the *Scan Tool*. 7. Test drive vehicle above the 16 km/h (10 mph) Does the DTC set as a current DTC?	—	*Go to Step 19*	Malfunction is intermittent. Refer to Diagnostic Aids
11	Repair the 2-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
12	Repair the open or the high resistance in the CKT 150. Is the repair complete?	—	Go to *Diagnostic System Check*	—
13	Repair the short to ground in the CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
14	Repair the open or the high resistance in the CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
15	Repair the 10-way EBCM harness connector. Is the repair complete?		Go to *Diagnostic System Check*	—
16	Repair the open or the high resistance in the CKT 451. Is the repair complete?		Go to *Diagnostic System Check*	—
17	Repair the short to ground in the CKT 441. Is the repair complete?		Go to *Diagnostic System Check*	—
18	Repair the open or the high resistance in the CKT 441. Is the repair complete?		Go to *Diagnostic System Check*	—
19	Replace the EBCM. Is the repair complete?		Go to *Diagnostic System Check*	—

DTC C0267 or C0268 Pump Motor Circuit Open/Shorted



Circuit Description

The pump motor circuit is integral to the BPMV. The EBCM microprocessor energizes the relay within the EBCM in order to supply the battery voltage to the high side of the pump motor. The EBCM microprocessor grounds the low side of the pump motor when activation of the pump motor is required.

Conditions for Setting the DTC (C0067)

- The EBCM internal relay is on
- The pump motor is off
- Low voltage is present from the low side of the pump motor when high voltage is expected

Conditions for Setting the DTC (C0068)

- Vehicle speed is 13 km/h (8 mph)
- The EBCM internal relay is on
- The pump motor is commanded ON and then OFF
- High voltage exists from the low side of the pump motor for 100 ms when the voltage is expected to be low

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTCs C0067/C0068 are ignition latched DTCs, which indicates that the above actions remain true until the ignition switch is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Important: Reset the J 39200 test leads to zero prior to making any resistance measurements. Refer to the J 39200 in the user's manual.

The pump motor is integral with the BPMV. Do not service the pump motor separately. A poor power/ground connection at the 2-way EBCM connector or the 2-way motor harness from the EBCM to the pump motor can cause a DTC C0067. A seized pump motor, shorted pump motor windings or a poor power/ground at the 2-way EBCM connector can cause a DTC C0068. Replace the EBCM or the BPMV if the following tests show that the pump motor EBCM internal circuits have failed.

Test Description

The numbers below refer to the steps in the diagnostic table:

3. This step checks for an open pump motor circuit. The pump motor circuit resistance should not be above the 0.3 ohms. Reset the *J 39200* test leads to zero prior to making this low resistance measurement.
5. This step determines the resistance of the EBCM ground circuit.
7. This step determines the ignition voltage available to the EBCM.

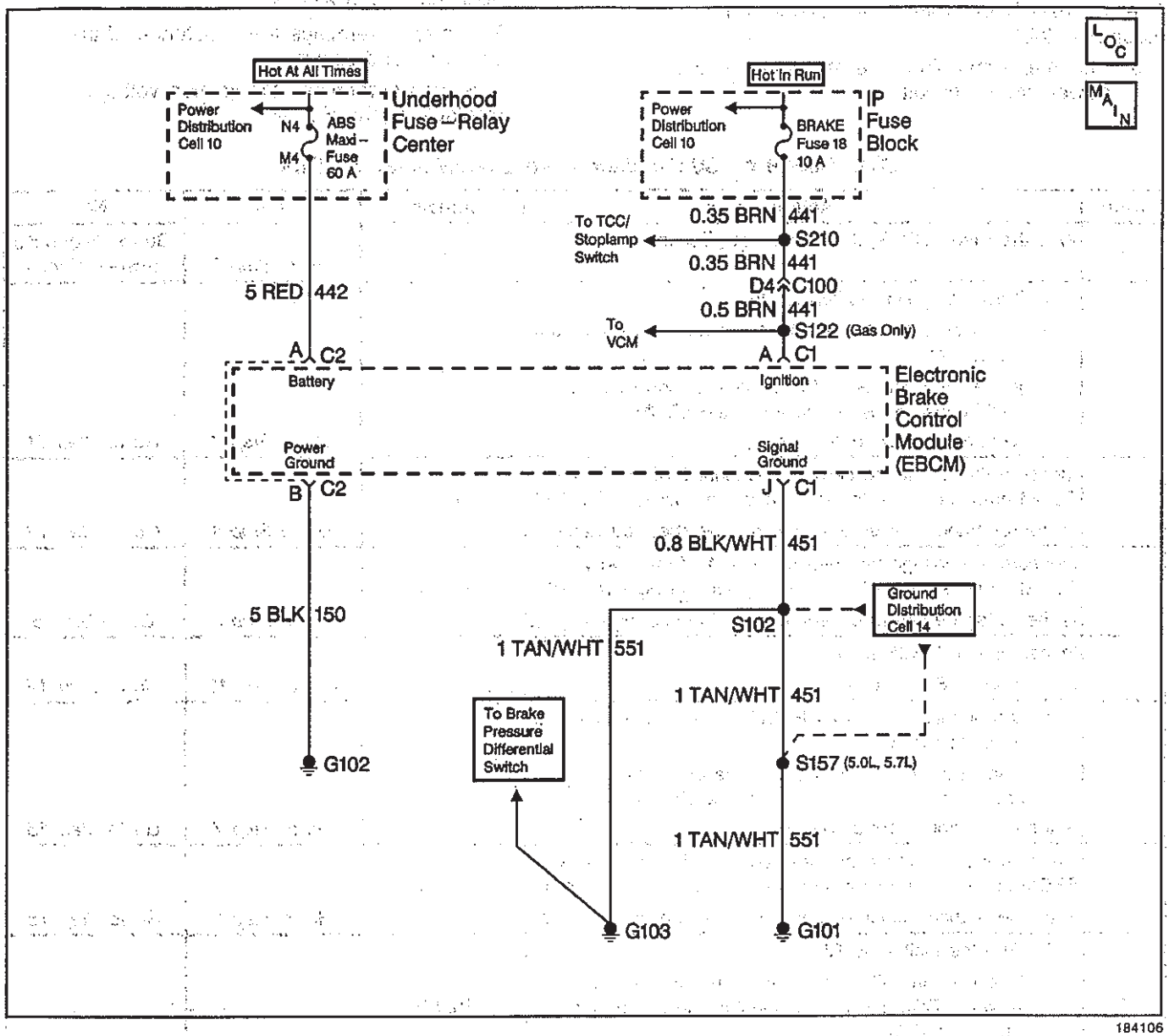
DTC C0267 or C0268 Pump Motor Circuit Open/Shorted

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 2-way pump motor pigtail connector from the EBCM. 3. Inspect the connector and the wiring for damage or corrosion that could result in an open circuit between the pump motor and the EBCM. Is the connector and the wiring in good condition?	—	*Go to Step 3*	*Go to Step 10*
3	Measure the resistance between terminal A and terminal B of the 2-way pump motor pigtail connector using a *J 39200*. Reset the *J 39200* test leads to zero prior to making this resistance measurement. Is the resistance within the specified range?	0.1-0.3Ω	*Go to Step 4*	*Go to Step 15*
4	1. Turn the ignition to OFF. 2. Disconnect the 2-way EBCM harness connector from the EBCM. 3. Inspect the connector for damage or corrosion that could cause a loss of power to the EBCM. Is the connector in good condition?	—	*Go to Step 5*	*Go to Step 9*
5	Measure the resistance between terminal B of the 2-way EBCM harness connector and the ground using a *J 39200*. Is the resistance within the specified range?	0-2Ω	*Go to Step 6*	*Go to Step 11*
6	1. Turn the ignition to RUN. 2. Measure the voltage between terminal A of the 2-way EBCM harness connector and the ground using a *J 39200*. Is the voltage equal to or greater than the specified value?	10.0 V	*Go to Step 8*	*Go to Step 7*
7	Inspect the 60-amp ABS fuse. Is this fuse open?	—	*Go to Step 13*	*Go to Step 14*

DTC C0267 or C0268 Pump Motor Circuit Open/Shorted (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Inspect the 2-way EBCM harness connector for poor terminal contact or corrosion. 2. Inspect CKT 442 and CKT 150 for damage that could result in an open circuit. 3. Repair any evident damage. 4. Replace the terminals if poor contact or corrosion exists. 5. Reconnect all the connectors. 6. Clear all the DTCs using the *Scan Tool*. 7. Test drive vehicle above 16 km/h (10 mph). Does the DTC set as a current DTC?	—	*Go to Step 12*	Malfunction is intermittent. Refer to Diagnostic Aids
9	Repair the 2-way EBCM harness connector if necessary. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Repair the 2-way pump motor pigtail connector or wiring if necessary. Is the repair complete?	—	Go to *Diagnostic System Check*	—
11	Repair the open or the high resistance in the CKT 150.	—	Go to *Diagnostic System Check*	—
12	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
13	Repair short to ground in CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
14	Repair the open or the high resistance in CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
15	Replace the BPMV. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0269 or C0274 Excessive Dump/Isolation Time



Circuit Description

The EBCM microprocessor grounds the isolation coil to energize and close the isolation valve. This will prevent any additional brake pressure applied by the driver from reaching the wheel. Further increases in brake pressure will be prohibited. Each isolation valve is closed independently to isolate each wheel.

Conditions for Setting the DTC

Isolation time (pressure hold) exceeds 120 seconds.

Action Taken When the DTC Sets

- The ABS indicator lamp turns on
- The ABS disables

DTCs C0074 is and ignition latched DTC, which indicates that the above actions remain true until the ignition switch is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

Repair any other DTCs first. Then perform the Function Test of the scan tool in order to ensure proper operation of the ABS.

Test Description

The numbers below refer to the steps in the diagnostic table:

3. This step determines the resistance of the power ground circuit.
4. This step determines the battery voltage available to the EBCM.
7. This step determines the resistance of the signal ground circuit.
8. This step determines the ignition voltage available to the EBCM.

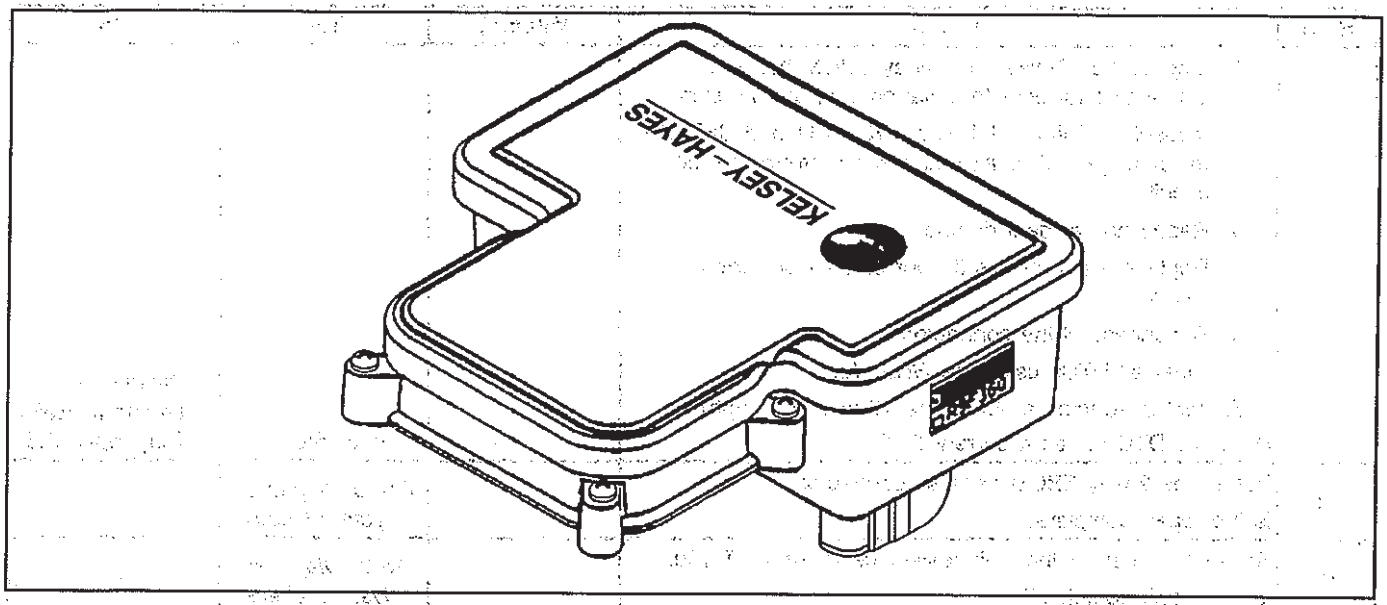
DTC C0269 or C0274 Excessive Dump/Isolation Time

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition switch to OFF. 2. Disconnect the 2-way EBCM harness connector from the EBCM. 3. Inspect the connector for damage or corrosion that could cause a loss of power to the EBCM. Is the connector in good condition?	—	*Go to Step 3*	*Go to Step 11*
3	Measure the resistance between terminal B of the 2-way EBCM harness connector and the ground using a *J 39200.* Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 4*	*Go to Step 12*
4	Measure the voltage between terminal A of the 2-way EBCM harness connector and the ground using a *J 39200.* Is the voltage equal to or greater than the specified value?	10.0 V	*Go to Step 6*	*Go to Step 5*
5	Inspect the 60A ABS fuse. Is the 60A ABS fuse open?	—	*Go to Step 13*	*Go to Step 14*
6	1. Disconnect the 10-way EBCM harness connector from the EBCM. 2. Inspect the connector for damage or corrosion that could cause a loss of power to the EBCM. Is the connector in good condition?	—	*Go to Step 7*	*Go to Step 15*
7	Measure the resistance between terminal J of the 10-way EBCM harness connector and the ground using a *J 39200.* Is the resistance measurement within the specified range?	0–2Ω	*Go to Step 8*	*Go to Step 16*
8	1. Turn the ignition to RUN. 2. Measure the voltage between terminal A of the 10-way EBCM harness connector and the ground using a *J 39200.* Is the voltage equal to or greater than the specified value?	10.0 V	*Go to Step 10*	*Go to Step 9*
9	Inspect the 10-amp BRAKE fuse. Is the fuse open?	—	*Go to Step 17*	*Go to Step 18*

DTC C0269 or C0274 Excessive Dump/Isolation Time (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect the 10-way and 2-way EBCM harness connectors for poor terminal contact or corrosion. 2. Inspect CKT 442, CKT 150, CKT 441 and CKT 451 for damage that could result in an intermittent open circuit. 3. Repair any evident damage. 4. Replace the terminals if poor contact or corrosion exists. 5. Reconnect all the connectors. 6. Clear all DTCs using the *Scan Tool*. 7. Test drive vehicle above the 16 km/h (10 mph) Does the DTC set as a current DTC?	—	*Go to Step 19*	Malfunction is intermittent. Refer to Diagnostic Aids
11	Repair the 2-way EBCM harness connector. Is the repair complete?	—	Go to *Diagnostic System Check*	—
12	Repair the open or the high resistance in the CKT 150. Is the repair complete?	—	Go to *Diagnostic System Check*	—
13	Repair the short to ground in the CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
14	Repair the open or the high resistance in the CKT 442. Is the repair complete?	—	Go to *Diagnostic System Check*	—
15	Repair the 10-way EBCM harness connector. Is the repair complete?		Go to *Diagnostic System Check*	—
16	Repair the open or the high resistance in the CKT 451. Is the repair complete?		Go to *Diagnostic System Check*	—
17	Repair the short to ground in the CKT 441. Is the repair complete?		Go to *Diagnostic System Check*	—
18	Repair the open or the high resistance in the CKT 441. Is the repair complete?		Go to *Diagnostic System Check*	—
19	Replace the EBCM. Is the repair complete?		Go to *Diagnostic System Check*	—

DTC C0271-C0273 EBCM Malfunction



175132

Circuit Description

The EBCM initializes a self-test when the ignition is turned to the RUN position. This internal self-test verifies that all ABS circuitry is operating correctly.

Conditions for Setting the DTC

Any condition within the EBCM which causes a memory error will set the DTC.

Action Taken When the DTC Sets

- The ABS indicator lamp is turned on
- The ABS is disabled

These DTCs are Permanent Latched DTCs, which indicates that the above actions remain true until the DTC is cleared using a *Scan Tool*.

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

DTCs C0071–C0073 are EBCM internal diagnosis trouble codes. Replace the EBCM if these tests show that the EBCM circuitry has failed.

Test Description

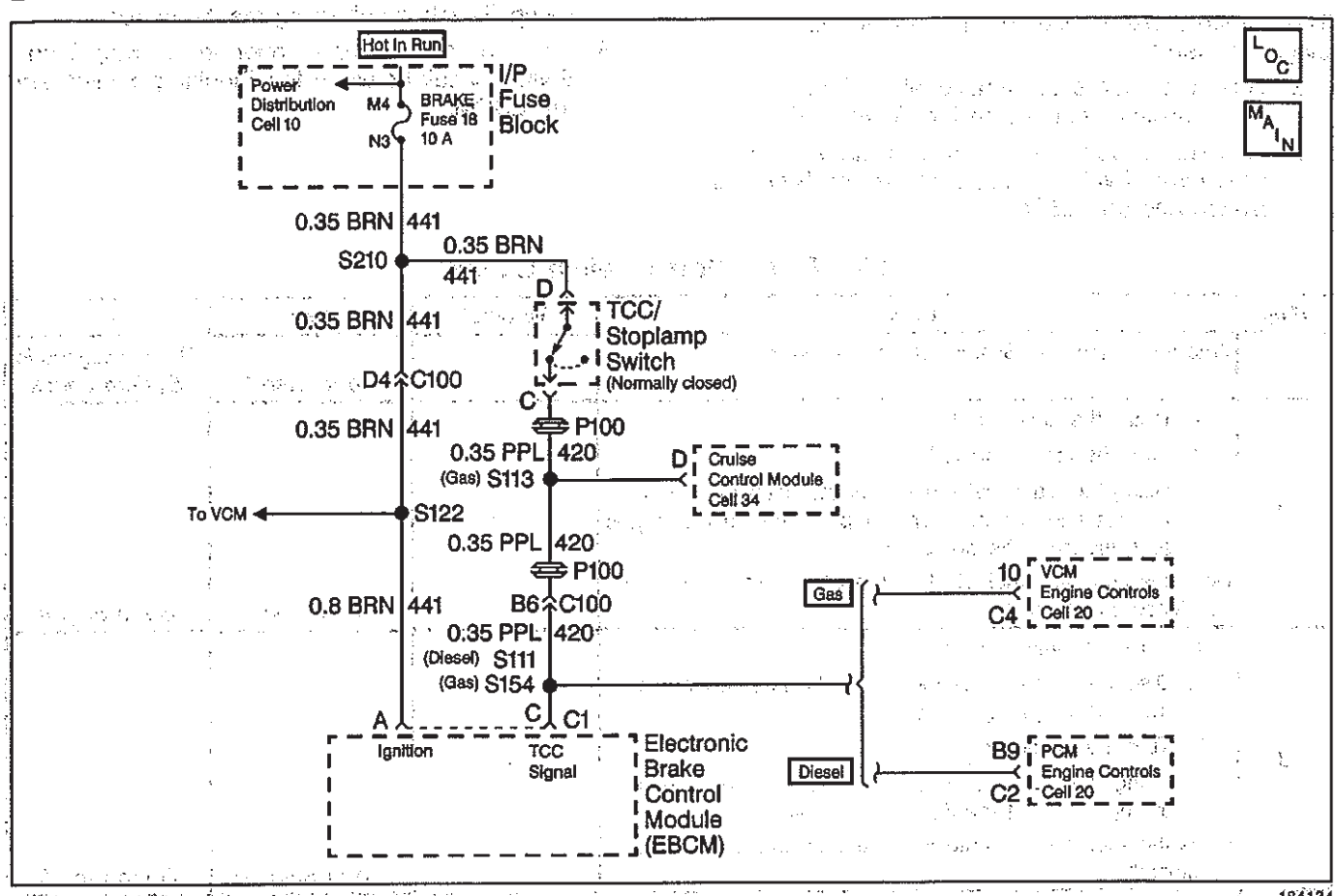
The numbers below refer to the steps in the diagnostic table:

2. This step checks if the EBCM will Clear DTCs.
3. This step checks if the DTC was set previously.

DTC C0271-C0273 EBCM Malfunction

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	Install the *Scan Tool* and attempt to clear the DTCs. Did the DTCs clear?	—	*Go to Step 3*	*Go to Step 4*
3	Check the history DTCs and the data. Was this the first time the DTC has set?	—	Refer to Diagnostic Aids on facing page	*Go to Step 4*
4	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0281 Brake Switch Circuit



184134

Circuit Description

The Stop Lamp Switch is normally closed. With the ignition in the RUN position and the brake pedal not depressed, the EBCM will have ignition voltage present at terminal C of the 10–way connector. When the brakes are applied, the ignition voltage present at the EBCM will be zero.

Conditions for Setting the DTC

- The vehicle is above 15 mph
- The Stop Lamp Switch never switches during the condition above

Action Taken When the DTC Sets

- DTC C0081 is advisory code only
- The ABS indicator lamp will not be illuminated
- The ABS will not be disabled

DTC C0081 is an Ignition Latched DTC, which indicates that the above actions remain true until the ignition is turned to OFF (even if the cause of the DTC is intermittent).

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

DTC C0081 can be set by a faulty Stop Lamp Switch, misadjusted Stop Lamp Switch or damage in CKT 420 or CKT 441.

Thoroughly check any circuitry that is suspected of causing the intermittent 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

Test Description

The numbers below refer to the steps in the diagnostic table:

2. This step checks the functionality of the Stop Lamp Switch circuit using the *Scan Tool.*
3. This step checks for a short to voltage in the Stop Lamp Switch circuit between the Stoplamp Switch and the EBCM.
4. This step checks the functionality of the Stop Lamp Switch circuit using the *Scan Tool.*
5. This step checks for an open in the Stop Lamp Switch circuit between the Stoplamp Switch and the EBCM.

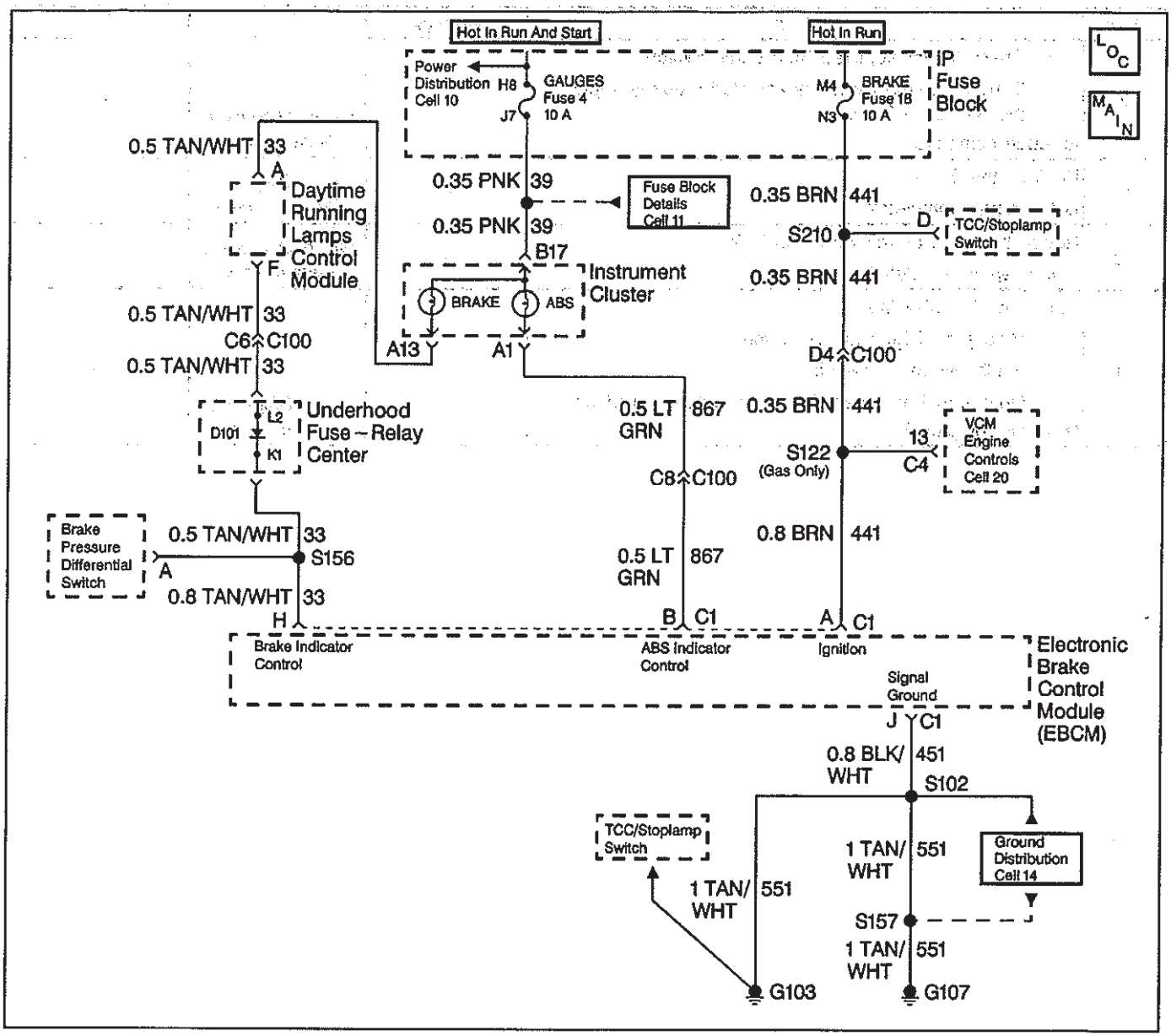
DTC C0281 Brake Switch Circuit

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Install the *Scan Tool.* 2. Turn the ignition to RUN. 3. Using the Data List function of the scan tool, check the operation of the Stop Lamp Switch while applying and releasing the brake pedal. Does the scan tool indicate that the Stop Lamp Switch to be closed constantly?	—	*Go to Step 3*	*Go to Step 4*
3	1. Turn the ignition to OFF. 2. Disconnect the Stoplamp Switch harness connector from the Stoplamp Switch. 3. Turn the ignition to RUN 4. Using the Data List function of the scan tool, check the operation of the Stop Lamp Switch. Does the scan tool indicate that the Stop Lamp Switch to be closed?	—	*Go to Step 10*	*Go to Step 8*
4	Does the scan tool indicate that the Stop Lamp Switch to be open constantly?	—	*Go to Step 5*	*Go to Step 7*
5	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM connector from the EBCM. 3. Turn the ignition to RUN. 4. Using a *J 39200,* measure the voltage between terminal C of the 10-way EBCM harness connector and ground. Is the voltage measured equal to or greater than the specified range?	10.0 V	*Go to Step 6*	*Go to Step 11*
6	1. Turn the ignition to OFF. 2. Reconnect all connectors. 3. Turn the ignition to RUN. 4. Install the *Scan Tool,* 5. Using the Data List function of the scan tool, check the operation of the Stop Lamp Switch. Does the scan tool indicate that the Stop Lamp Switch to be open constantly while applying and releasing the brake pedal.	—	*Go to Step 9*	*Go to Step 7*
7	Malfunction is intermittent. Refer to Diagnostic Aids. Repair all damage found. Is repair compete?	—	Go to *Diagnostic System Check*	—

DTC C0281 Brake Switch Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check for misadjusted Stop Lamp Switch. 2. If the Stoplamp Switch is adjusted properly, replace the Stoplamp Switch. Is repair complete?	—	Go to *Diagnostic System Check*	—
9	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
10	Repair the short to voltage in CKT 420. Is the repair complete?	—	Go to *Diagnostic System Check*	—
11	Check for the following: • Misadjusted Stop Lamp Switch • Faulty Stoplamp switch • Open circuit between Stoplamp switch and EBCM Is repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0286 ABS Indicator Lamp Circuit Shorted to B+



184055

Circuit Description

The amber ANTILOCK indicator lamp is supplied ignition voltage through the GAUGE fuse. The indicator is normally on unless the EBCM switches the indicator off (normal mode). This logic ensures that the indicator will be illuminated if there is an open in CKT 867 or a faulty EBCM.

Conditions for Setting the DTC

- High voltage is present on the ABS indicator lamp control circuit when low voltage is expected (lamp is turned on)
- Anything that keeps the ABS indicator lamp circuit high when the lamp is expected to be on

Action Taken When the DTC Sets

- The ABS is not disabled.
- The EBCM will use the red BRAKE warning lamp to alert the driver of an ABS malfunction.

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

DTC C0086 typically sets because of a shorted ABS indicator lamp. Yet DTC C0086 can also set because of a short to voltage in the wiring between the ABS indicator lamp and the EBCM.

Test Description

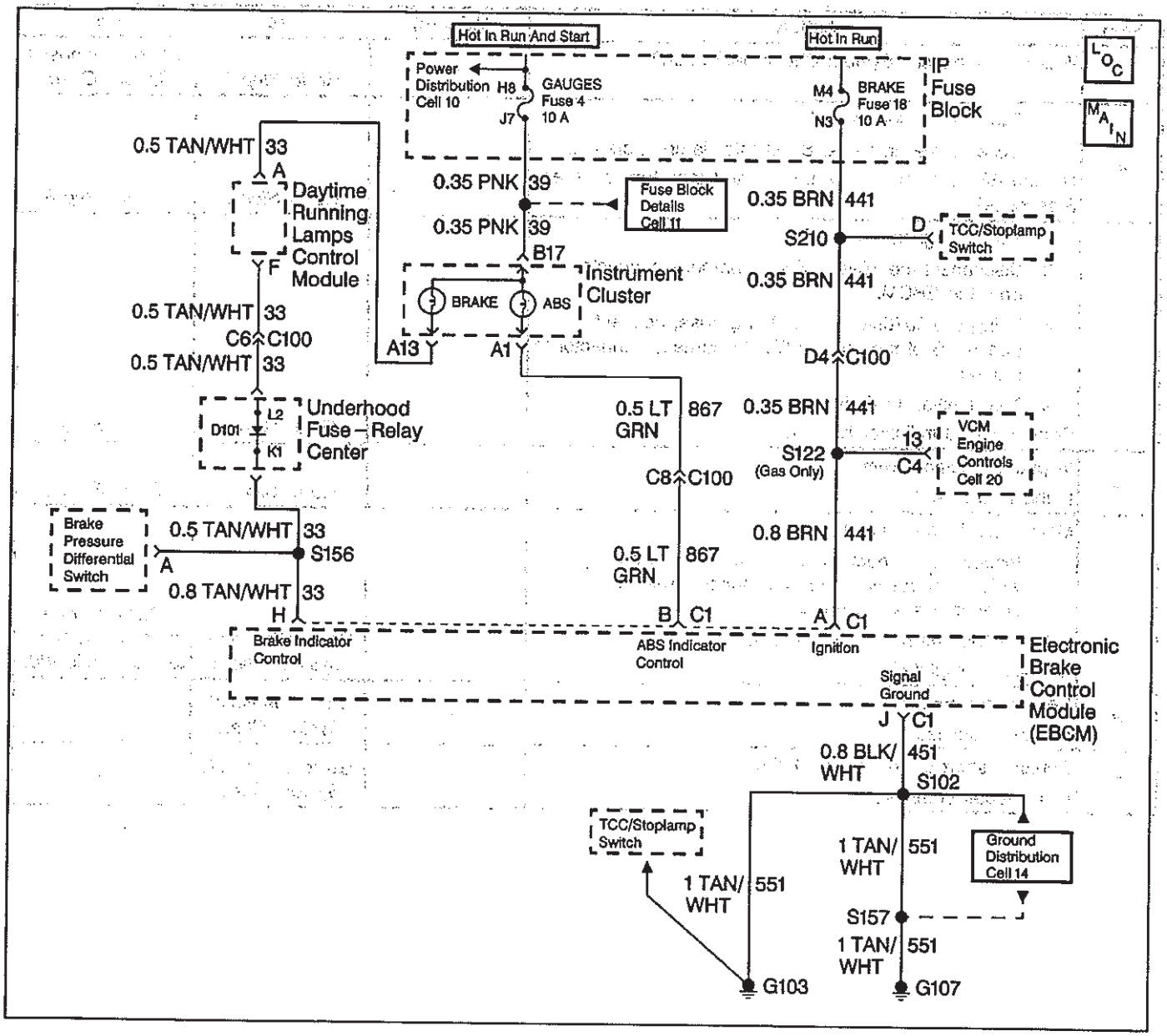
The numbers below refer to the steps in the diagnostic table:

2. This step checks for normal operation of the ABS indicator lamp.
3. This step turns off the ABS indicator lamp with a *J 36169-A*.

DTC C0286 ABS Indicator Lamp Circuit Shorted to B+

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to RUN. 2. Observe the amber ABS indicator lamp operation. Did the ABS indicator lamp turn on and then turn off after 3 seconds?	—	*Go to Step 5*	*Go to Step 3*
3	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM harness connector from the EBCM. 3. Using a *J 36169-A* with a 3 amp fuse, connect terminal B of the 10-way EBCM harness connector to ground. 4. Turn ignition to RUN. Does the ABS indicator lamp turn on?	—	*Go to Step 6*	*Go to Step 4*
4	Inspect the jumper wire fuse. Is the fuse open?	—	*Go to Step 7*	*Go to Step 5*
5	Malfunction is intermittent. 1. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. 2. Perform all necessary repairs. Is Repair complete?	—	Go to *Diagnostic System Check*	Malfunction is intermittent. Refer to Diagnostic Aids
6	Replace the EBCM. Is repair complete?	—	Go to *Diagnostic System Check*	—
7	Repair a short to voltage in CKT 867. Is the repair complete?	—	Go to *Diagnostic System Check*	—

DTC C0288 Brake Warning Lamp Circuit Shorted to B+



184055

Circuit Description

The red BRAKE warning lamp is supplied ignition voltage through the GAUGE fuse. The BRAKE warning lamp can be illuminated by the EBCM, Brake Pressure Differential Switch or by the Park Brake Switch.

Conditions for Setting the DTC

- High voltage is present on the BRAKE warning lamp circuit when the circuit is expected to be low (lamp commanded on by the EBCM)
- Anything that keeps the Brake warning lamp circuit high when the lamp is supposed to be illuminated (such as a short to voltage on CKT 33)

Action Taken When the DTC Sets

No action taken, the ABS is not disabled.

Conditions for Clearing the DTC

- Repair the conditions responsible for setting the DTC
- Use the *Scan Tool* Clear DTCs function

Diagnostic Aids

DTC C0088 is usually set by a short to voltage in the wiring between the brake warning lamp and the EBCM.

Test Description

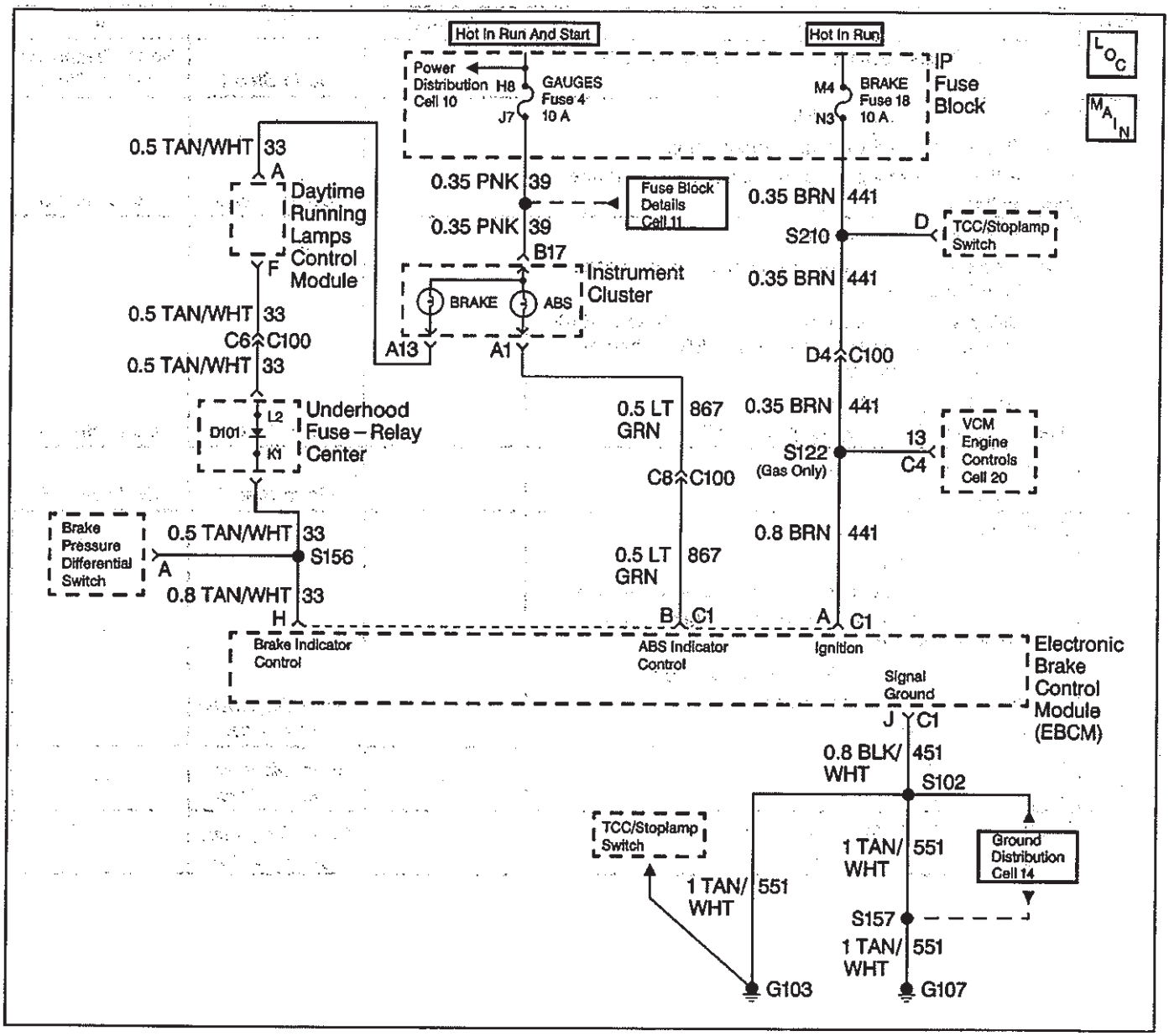
The numbers below refer to the steps in the diagnostic table:

2. Determines if the BRAKE warning lamp circuit is operating properly when controlled by the EBCM.
3. Determines if the BRAKE warning lamp circuit is operating properly without the EBCM.

DTC C0288 Brake Warning Lamp Circuit Shorted to B+

Step	Action	Value(s)	Yes	No
1	Was the ABS Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to RUN. 2. Observe the red BRAKE warning lamp. Did the BRAKE warning lamp turn on and then off after three seconds?	—	*Go to Step 5*	*Go to Step 3*
3	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM harness connector from the EBCM. 3. Using a 3 amp fused jumper wire, such as J 36169, connect terminal H of the 10-way EBCM harness connector to ground. 4. Turn the ignition to RUN. Does the BRAKE warning lamp turn on?	—	*Go to Step 6*	*Go to Step 4*
4	Inspect the Jumper wire Fuse Is the fuse open?	—	*Go to Step 7*	*Go to Step 5*
5	Malfunction is intermittent, Perform the following: • Inspect all connectors and harnesses for damage which may result in a short to voltage when all components are connected. • Refer to Diagnostic Aids on facing page. • Perform all necessary repairs. Is repair complete?	—	Go to *Diagnostic System Check*	—
6	Replace the EBCM. Is repair complete	—	Go to *Diagnostic System Check*	—
7	Repair a short to voltage in CKT 33. Is repair complete?	—	Go to *Diagnostic System Check*	—

ABS Indicator Off No DTC Set



184055

Circuit Description

The EBCM controls the ABS indicator lamp illumination by supplying a ground to the EBCM 10-way terminal B. When the vehicle is started or the ignition is turned to the RUN position, the ABS indicator should illuminate for three seconds and turn off.

Diagnostic Aids

If the ABS indicator lamp is off constantly with no DTCs set, an open circuit is present between the instrument panel cluster and the EBCM, the GAUGES fuse is open or an open is present between the Fuse Block and the Instrument Panel Cluster.

Test Description

The numbers below refer to the steps in the diagnostic table:

2. This step manually (with fused jumper) turns on the ABS indicator lamp.
5. This step checks for a short to ground in CKT 39.
7. This step checks for an open in CKT 867.
8. This step checks for ignition voltage at the instrument cluster.

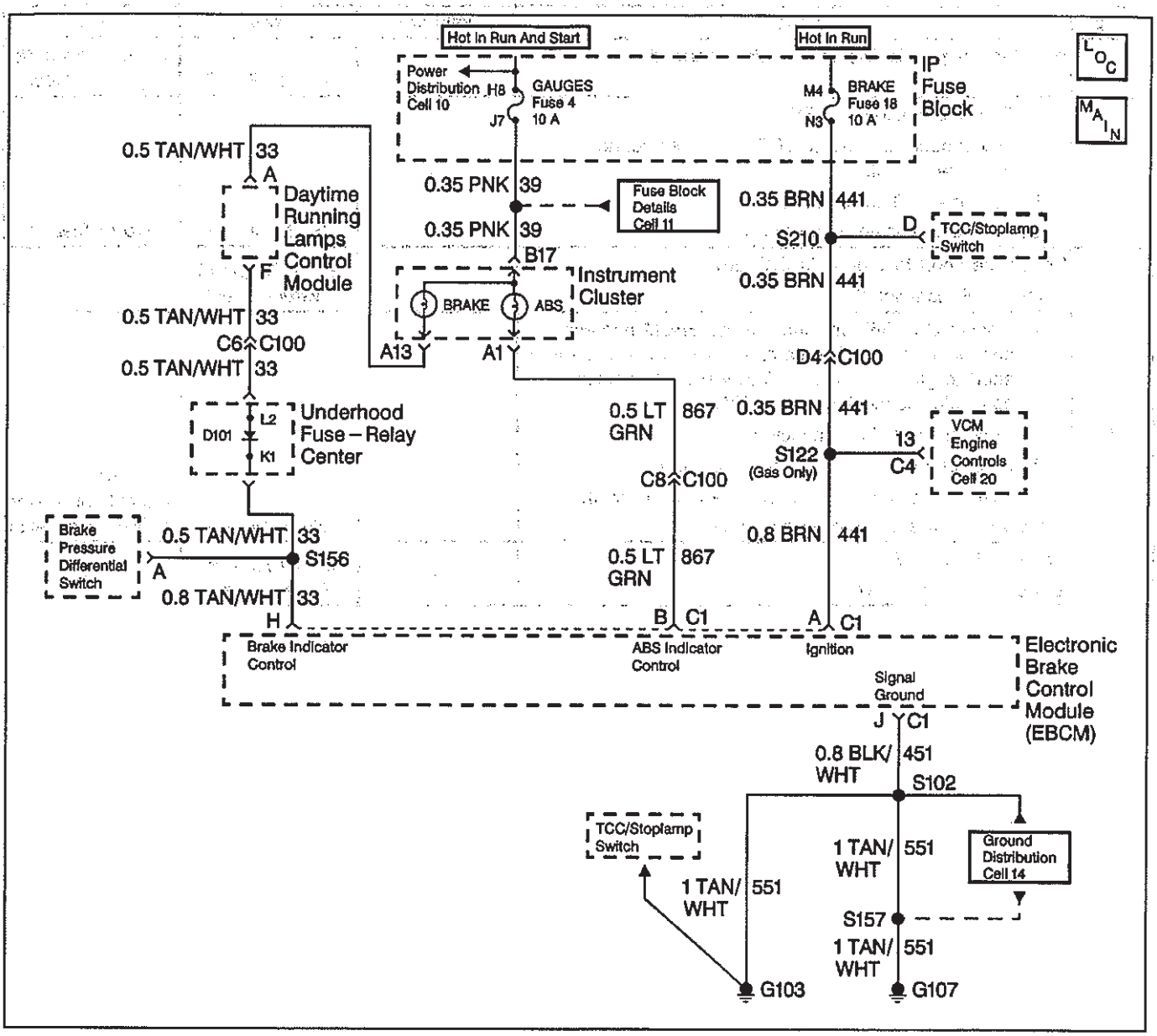
ABS Indicator Off No DTC Set

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM harness connector from the EBCM. 3. Using the *J 36169-A* Fused Jumper Wire with a 3 amp fuse, connect terminal B of the 10-way EBCM harness connector to ground. 4. Turn the ignition to RUN. Does the ABS indicator lamp turn on?	—	*Go to Step 9*	*Go to Step 3*
3	Inspect the *J 36169-A* Fused Jumper Wire fuse. Is the fuse open?	—	*Go to Step 11*	*Go to step 4*
4	Inspect the GAUGES Fuse. Is the fuse open?	—	*Go to Step 5*	*Go to Step 6*
5	1. Turn the ignition to OFF. 2. Replace the GAUGES Fuse. 3. Disconnect the Instrument Cluster harness connector from the instrument cluster. 4. Turn the ignition to RUN. 5. Remove and inspect the 10 amp GAUGES Fuse. Is the GAUGES Fuse open?	—	*Go to Step 15*	*Go to Step 6*
6	Remove and inspect the ABS indicator lamp. Refer to Instrument Cluster. Is the ABS indicator lamp open?	—	*Go to Step 12*	*Go to Step 7*
7	1. Turn the ignition to OFF. 2. Using the *J 39200*, measure the resistance between the 10-way EBCM connector terminal B and the Instrument Cluster Terminal A1 Is the resistance measurement within the specified range?	0-2Ω	*Go to Step 8*	*Go to Step 13*
8	1. Turn the ignition to RUN 2. Using the *J 39200*, measure the voltage between the Instrument Cluster terminal B17 and ground Is the voltage measurement equal to or greater than the specified value?	10 V	Refer to Instrument Cluster Diagnosis	*Go to Step 14*

ABS Indicator Off No DTC Set (cont'd)

Step	Action	Value(s)	Yes	No
9	1. Inspect the 10-way EBCM harness connector for poor terminal contact or corrosion. Inspect CKT 867 for damage which may result in an open circuit. 2. Reconnect all the connectors. 3. Test drive the vehicle above 16 km/h (10 mph). Is the ABS indicator lamp off constantly?	—	*Go to Step 10*	Malfunction is intermittent. Refer to Diagnostic Aids
10	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—
11	Repair the short to voltage in CKT 867. Is the repair complete?	—	Go to *Diagnostic System Check*	—
12	Replace the ABS indicator lamp. Is the repair complete?	—	Go to *Diagnostic System Check*	—
13	Repair the open or the high resistance in CKT 867. Is the repair complete?	—	Go to *Diagnostic System Check*	—
14	Repair the open in CKT 39. Refer to Wiring Systems Cell 10. Is the repair complete?	—	Go to *Diagnostic System Check*	—
15	Repair the short to ground in CKT 39. Refer to Wiring Systems Cell 10. Is the repair complete?	—	Go to *Diagnostic System Check*	—

ABS Indicator On No DTC Set



184055

Circuit Description

The EBCM controls the ANTILOCK indicator lamp illumination by supplying a ground to terminal B. When the vehicle is started or the ignition is turned to the RUN position, the ANTILOCK indicator should illuminate for three seconds and turn off.

Diagnostic Aids

If the ANTILOCK indicator lamp is on always with no DTCs set (never turns off after three seconds with the vehicle started or with the ignition switch in the RUN position), there is a short to ground in CKT 867 between the instrument cluster and the EBCM or the EBCM is internally shorted to ground.

Test Description

The numbers below refer to the steps in the diagnostic table:

2. This step checks for a short to ground in CKT 867.

ABS Indicator On No DTC Set

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Diagnostic System Check*
2	1. Turn the ignition to OFF. 2. Disconnect the 10-way EBCM harness connector from the EBCM. 3. Turn the ignition to RUN. Does the ABS indicator lamp turn on?	—	*Go to Step 3*	*Go to Step 4*
3	Repair the short to ground in CKT 867. Is the repair complete?	—	Go to *Diagnostic System Check*	—
4	1. Inspect CKT 867 and the 10-way EBCM harness connector for physical damage which may result in a short to ground with the 10-way EBCM harness connector connected to the EBCM. 2. Reconnect all the connectors. 3. Clear all the DTCs using the scan tool. 4. Test drive the vehicle above 16 km/h (10 mph). Is the ABS indicator lamp on constantly?	—	*Go to Step 5*	Malfunction is intermittent. Refer to Diagnostic Aids
5	Replace the EBCM. Is the repair complete?	—	Go to *Diagnostic System Check*	—

Repair Instructions

ABS Bleed Procedure

Important:

- Use the two-person bleed procedure under the following conditions:
  - Installing a new Electro-Hydraulic Control Unit (EHCU) or new Brake Pressure Modulator Valve (BPMV).
  - Air is trapped in the valve body
- Do not drive the vehicle until the brake pedal feels firm.
- Do not reuse brake fluid that is used during bleeding.
- Use the vacuum, the pressure and the gravity bleeding procedures only for base brake bleeding.

Two Person Procedure

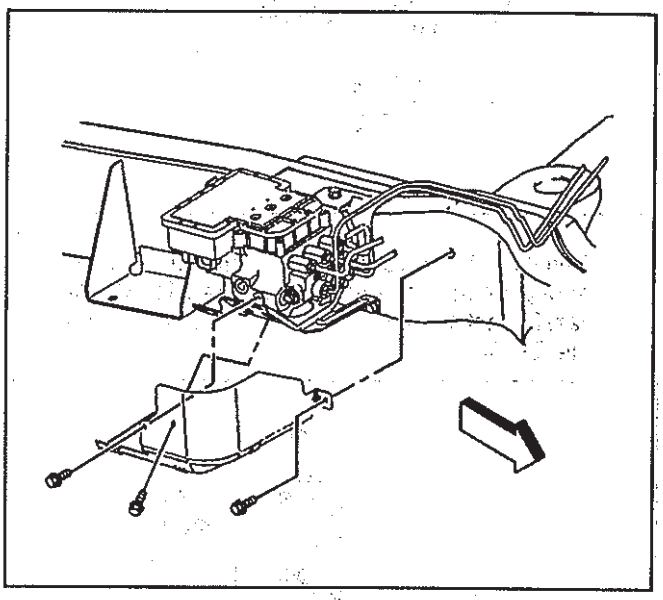
1. Raise the vehicle in order to access the system bleed screws.
2. Bleed the system at the right rear wheel first.
3. Install a clear hose on the bleed screw.
4. Immerse the opposite end of the hose into a container partially filled with clean DOT 3 brake fluid.
5. Open the bleed screw 1/2 to one full turn.
6. Slowly depress the brake pedal. While the pedal is depressed to its full extent, tighten the bleed screw.
7. Release the brake pedal and wait 10–15 seconds for the master cylinder pistons to return to the home position.
8. Repeat the previous steps for the remaining wheels. The brake fluid which is present at each bleed screw should be clean and free of air.
9. This procedure may use more than a pint of fluid per wheel. Check the master cylinder fluid level every four to six strokes of the brake pedal in order to avoid running the system dry.
10. Press the brake pedal firmly and run the *Scan Tool* Automated Bleed Procedure four times. Release the brake pedal between each test.
11. Bleed all four wheels again using Steps 3–9. This will remove the remaining air from the brake system.
12. Evaluate the feel of the brake pedal before attempting to drive the vehicle.
13. Bleed the system as many times as necessary in order to obtain the appropriate feel of the pedal.

Electronic Brake Control Module Replacement

Removal Procedure

Important: After installation, calibrate the new EBCM to the tire size that is appropriate to the vehicle. Refer to Tire Size Calibration portion of *ABS System Description*.

1. Negative Battery Cable. Refer to *Battery Disconnect Caution*.
2. Raise vehicle and properly support.



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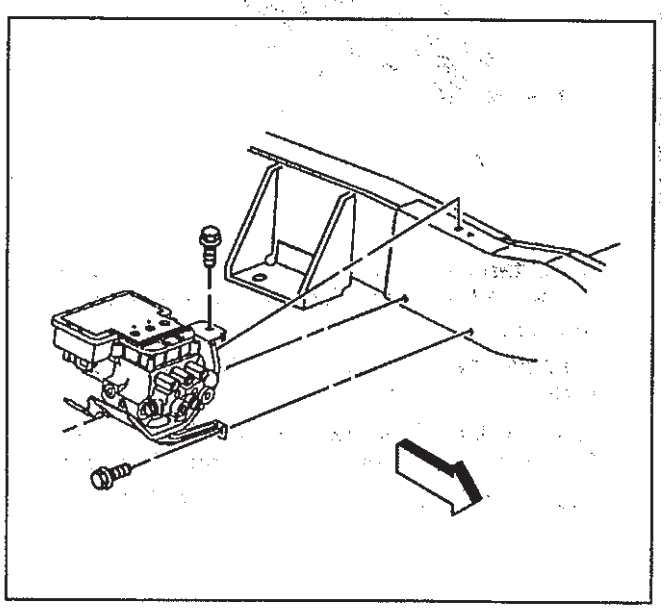
3. Remove the three EHCU (1) shield bolts and shield.
4. Disconnect the four electrical connectors from EBCM.



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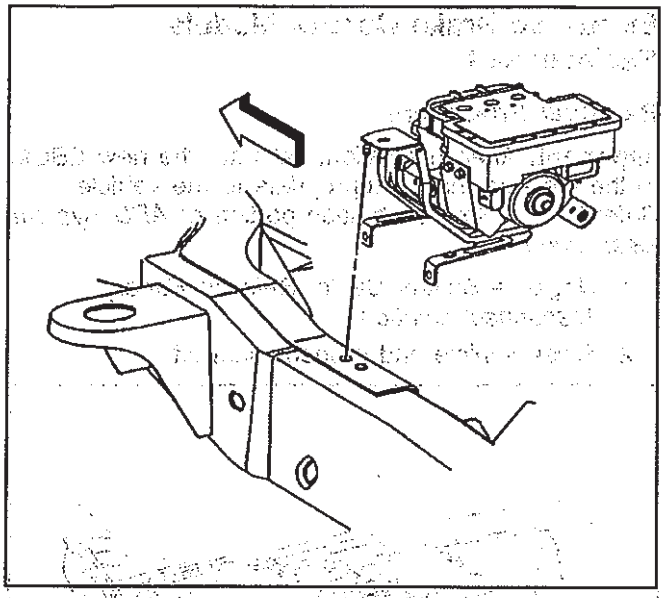
5. Remove the three bolts (1) that fasten the EHCU bracket to the frame.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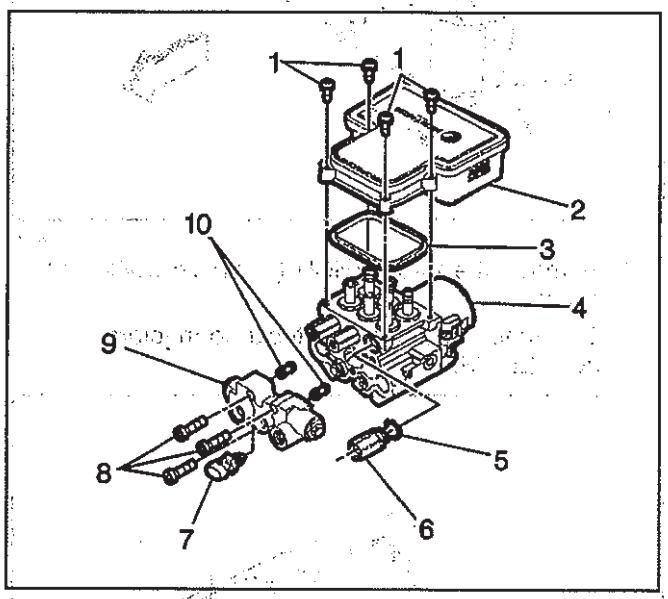
6. Remove the EHCU from the frame allowing enough clearance to access the EBCM. Be careful not to bend the brake pipes attached to the EHCU.



184187

Important: Do not use a tool to pry the EBCM or the BPMV. Excessive force will damage the EBCM.

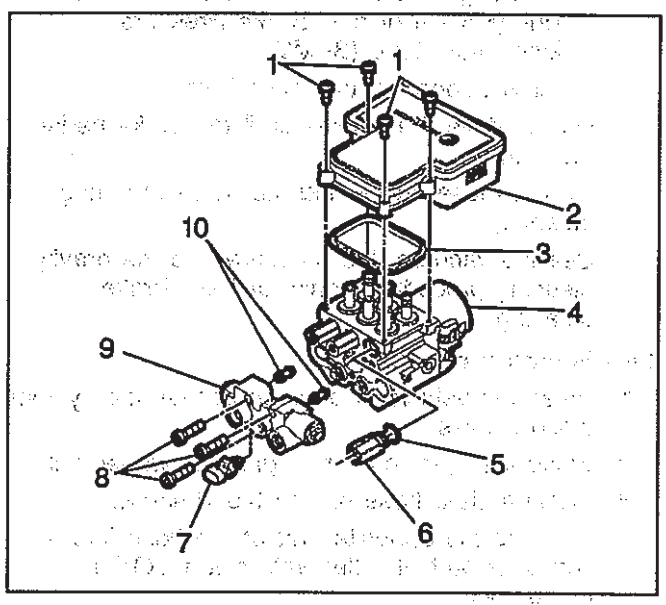
7. Remove the four T-25 Torx® bolts (1) that fasten the EBCM to the BPMV.

   Remove the EBCM (2) from the BPMV (4). Removal may require a light amount of force.
8. Clean the BPMV with a clean, dry cloth.

Installation Procedure

Important: If the EBCM mounting bolts are corroded or damaged, do not reuse the old mounting bolts. Install new EBCM mounting bolts with the new EBCM.

Important: Do not use RTV or any other type of sealant on the EBCM gasket or mating surfaces.



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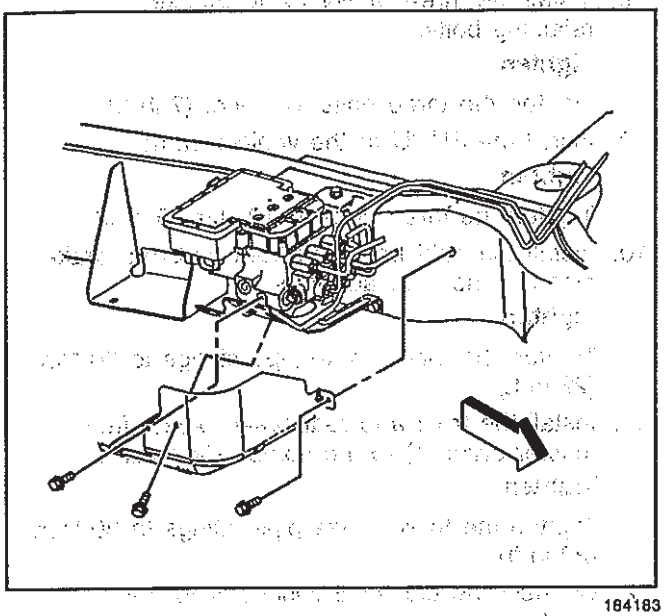
1. Install EBCM (2) to BPMV (4).
2. Install the four EBCM bolts (1).
   Tighten
   Tighten the four bolts to 5 N.m (39 lb in) in an X-pattern.
   Notice: Refer to *Fastener Notice* in Cautions and Notices.
3. Connect the four electrical connectors to the EBCM.
4. Install the EHCU Shield.
   Tighten
   Tighten the three bolts to 12 N.m (8 lb ft).
5. Lower the vehicle
6. Connect the negative battery cable.
7. Revise the tire calibration using the *Scan Tool.*
8. Return to Diagnostic System Check. Refer to *Diagnostic System Check.*

Brake Pressure Modulator Valve Replacement

Removal Procedure

1. Negative Battery Cable. Refer to *Battery Disconnect Caution.*
2. Raise vehicle and properly support.



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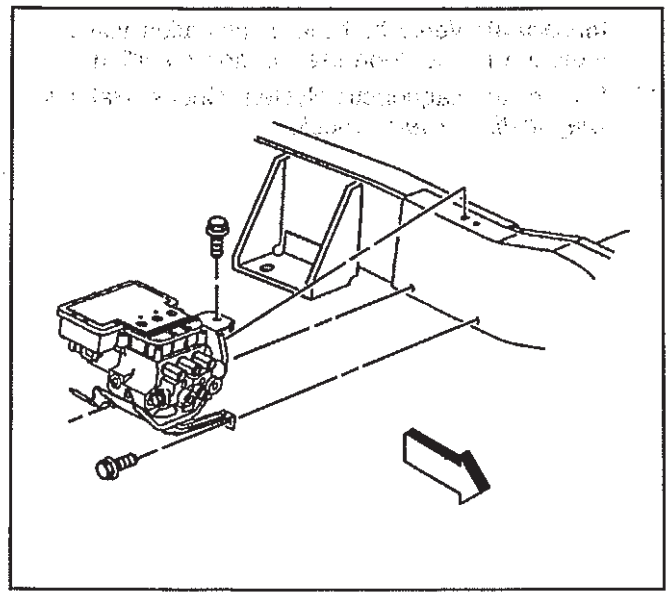
3. Remove the three EHCU (1) shield bolts and shield.
4. Disconnect the four electrical connectors from EBCM.
5. Disconnect the electrical connector from the combination valve.
6. Remove the front and rear brake pipes (from master cylinder) from the combination valve.
7. Remove the right front, left front and rear brake pipes from the tube adapters.



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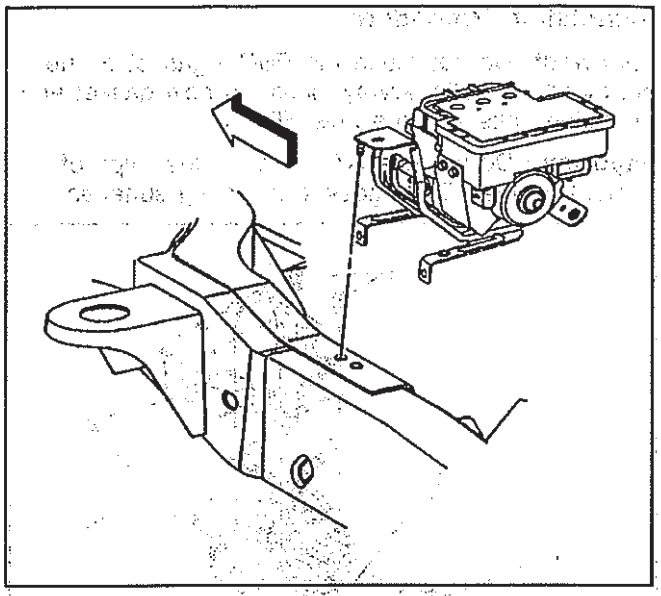
8. Remove the three bolts (1) that fasten the EHCU bracket to the frame.



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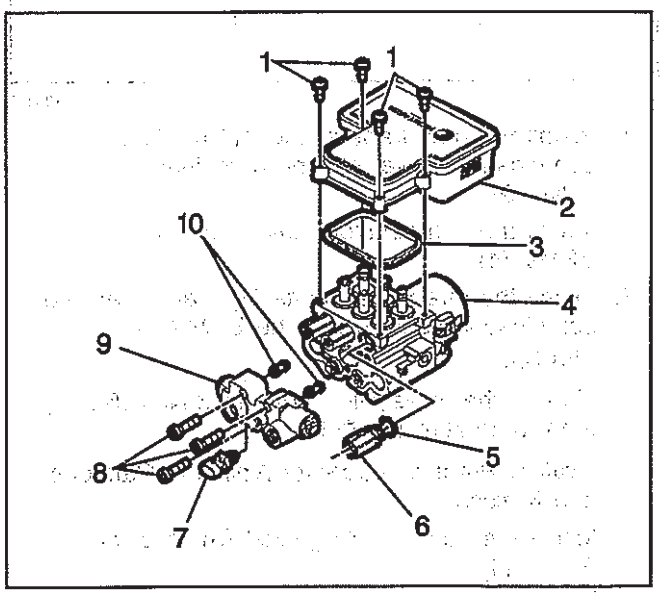
9. Remove the EHCU from the frame.
10. Remove the three bolts retaining the BPMV (4) form the bracket.



184187

Important: Do not use a tool to pry the EBCM or the BPMV. Excessive force will damage the EBCM.

11. Remove the four T-25 Torx® bolts (1) that fasten the EBCM to the BPMV.

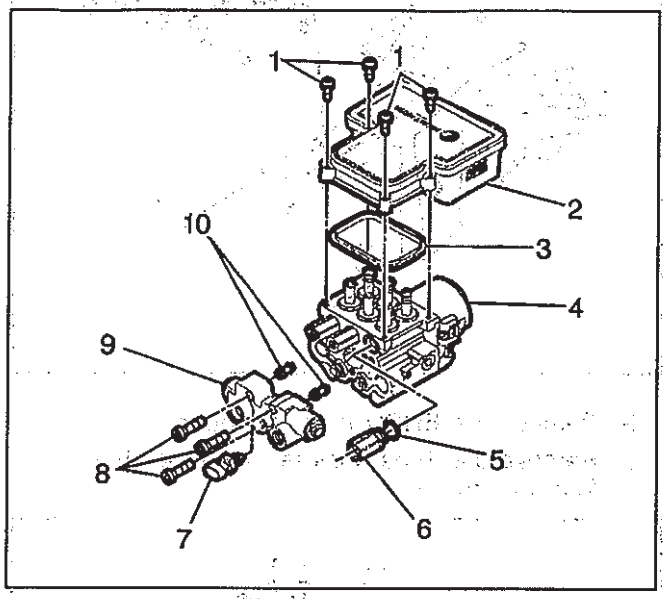
    Remove the EBCM (2) from the BPMV (4). Removal may require a light amount of force.
12. Remove the three allen bolts (8) from the combination valve.
13. Remove the combination valve (9).
14. Remove the two transfer tubes (10).

    Important: Do not reuse the transfer tubes. Always instal new transfer tubes.

Installation Procedure

Important: Do not reuse the EBCM gasket or the old mounting bolts. Always install a new gasket and mounting bolts with the new EBCM.

Important: Do not use RTV or any other type of sealant on the EBCM gasket or mating surfaces.



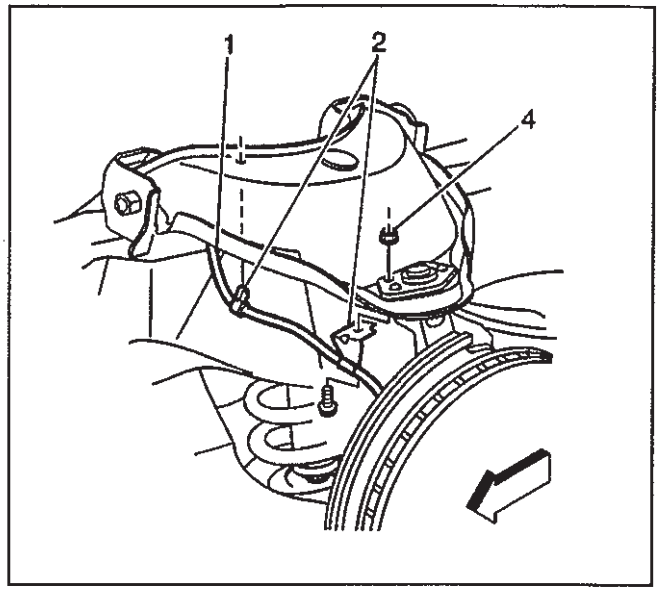
184187

1. Install the new transfer tubes(10) into the combination valve into the combination valve (9).
2. Install the combination valve onto the BPMV (4).
3. Install the three allen bolts (8) that fasten the combination valve (9) to the BPMV (4).
   Tighten
   Tighten the three allen bolts to 8 N.m (6 lb ft), then to 16 N.m (12 lb ft).
   Notice: Refer to *Fastener Notice* in Cautions and Notices.
4. Install the new EBCM gasket (3) onto the BPMV (4).
   Inspect
   Insure gasket allignment is correct.
5. Install EBCM (2) onto BPMV (4).
6. Install the four new EBCM bolts (1).
   Tighten
   Tighten the four bolts to 5 N.m (39 lb in) in an X-pattern.
7. Install BPMV (4) to bracket.
8. Install the three BPMV (4) to bracket retaining bolts.
   Tighten
   Tighten the three bolts to 9 N.m (7 lb ft).
9. Install the EHCU to the vehicle frame.
   Tighten
   Tighten the three bolts to 12 N.m (9 lb ft).
10. Install the right front, left front and rear brake pipes to the tube adapters.
    Tighten
    Tighten the three brake pipe fittings to 30 N.m (22 lb ft).
11. Install the front and rear brake pipes (from master cylinder) to the combination valve.
    Tighten
    Tighten the three brake pipe fittings to 30 N.m (22 lb ft).
12. Connect the electrical connector to the combination valve.
13. Connect the four electrical connectors to the EBCM.
14. Install the EHCU Shield.
    Tighten
    Tighten the three bolts to 12 N.m (8 lb ft).
15. Lower the vehicle
16. Connect the negative battery cable.
17. Bleed the brake system. Refer to *ABS Bleed Procedure.*
    Important: Verify that the combination valve metering rod is depressed during bleeding.
18. Returrn to Diagnopstic System Check. Refer to *Diagnostic System Check.*

Wheel Speed Sensor Replacement

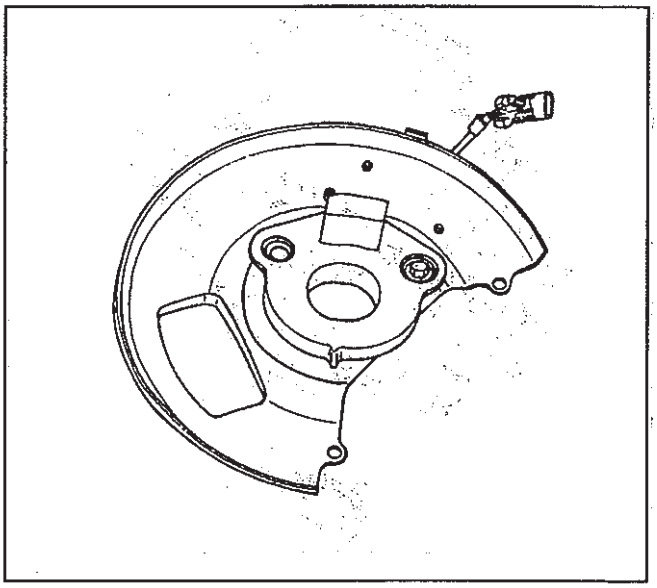
Removal Procedure

1. Raise and support vehicle.
2. Remove the tire and wheel. Refer to *Wheel Removal (Excessively Tight Wheels)*.
3. Remove the brake caliper. Refer to *Brake Caliper Replacement*.
4. Remove the hub and rotor. Refer to *Brake Rotor Replacement*.
5. Remove wheel speed sensor electrical connector.
6. Remove bolt (4) and washer at the shock tower.
7. Remove the snap-in clip (4) on upper control arm (light duty only).
8. Remove the bolt and nut (3) at the ball joint.



184210

9. Remove wheel speed sensor harness clip rivet. Use a 3/16 inch drill bit to remove the rivet.
10. Remove the clip from the wheel speed sensor wire. Save the clips for the replacement sensor.
11. Remove the two wheel speed sensor mounting bolts.
12. Remove the wheel speed sensor and splash shield assembly.
13. Remove the splash shield gasket.
14. Clean the gasket and knuckle surfaces thoroughly with a clean dry cloth.


184204

Installation Procedure

1. Install splash shield gasket.
2. Install wheel speed sensor and splash shield.
3. Install two splash shield mounting bolts.

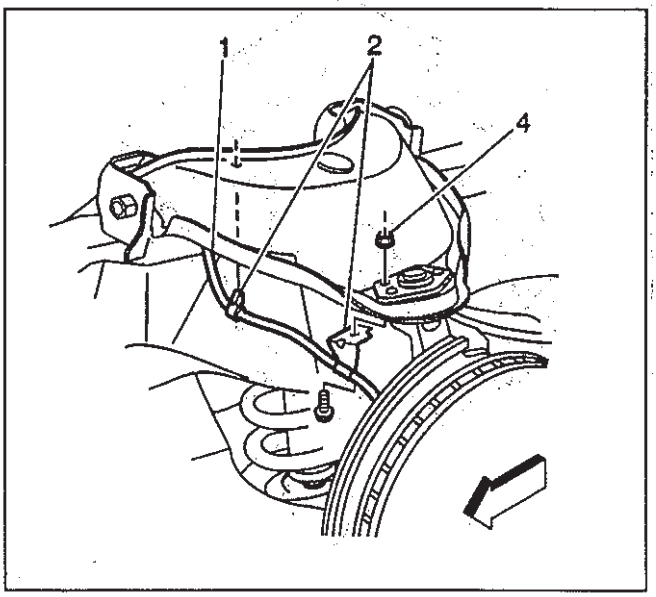
   Tighten

   Tighten splash shield mounting bolts to 16 N·m (12 lb ft.)

   Notice: Refer to *Fastener Notice* in Cautions and Notices.
4. Install two wheel speed sensor mounting bolts.

   Tighten

   Tighten wheel speed sensor mounting bolts to 26 N·m (12 lb ft)
5. Install wheel speed sensor harness clip 3/16 inch rivet.



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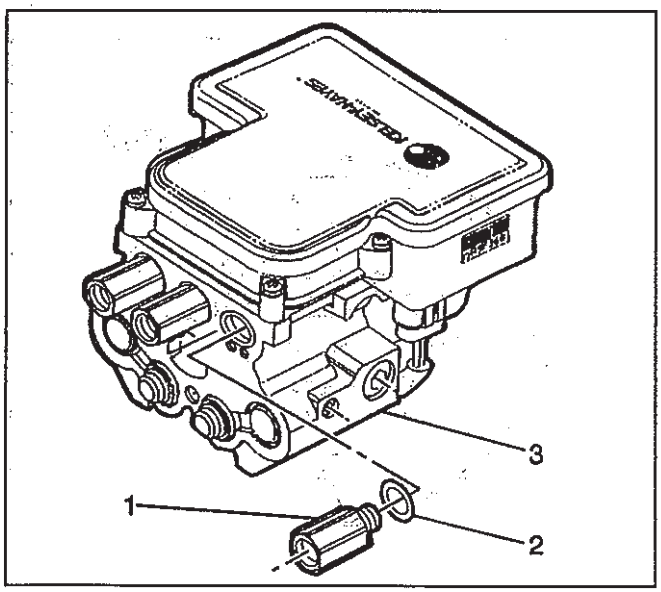
6. Install the harness clips to the wheel speed sensor wire. Locate the clip directly centered over the white paint mark on the wheel speed sensor cable.
7. Install the harness clip at the ball joint.
8. Install the harness snap-in clip at the upper control arm (light duty only).
9. Install the harness clip at the shock tower.
   Tighten
   Tighten wheel speed sensor harness clip bolt to 15 N·m (11 lb ft)
10. Install the hub and rotor. Refer to *Brake Rotor Replacement.*
11. Install brake caliper. Refer to *Brake Caliper Replacement.*
12. Install tire and wheel. Refer to *Wheel Removal (Excessively Tight Wheels)*

Tube Adapter Replacement

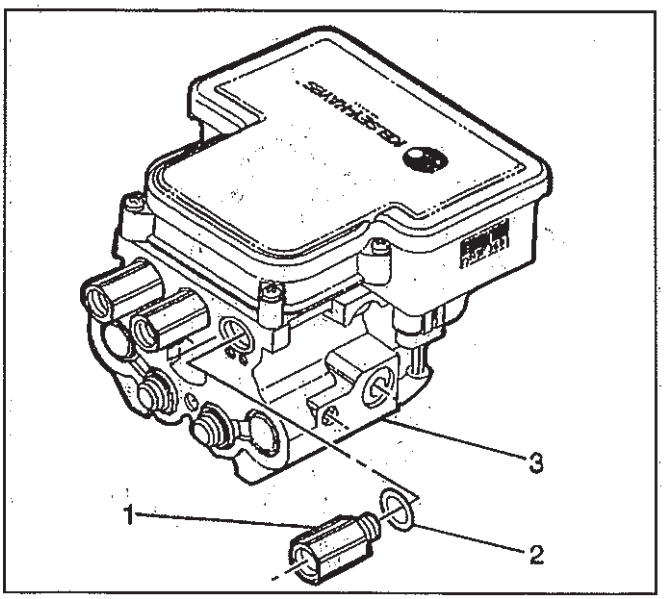
Removal Procedure

Important: If you must remove more than one tube adapter at one time, stamp the BPMV with a number (1, 2 or 3) in order to indicate the number of grooves cut into the tube adapters. This procedure will aid proper reassembly.

1. Raise the vehicle and properly support.
2. Remove the three EHCU shield bolts and shield.
3. Remove the appropriate brake line from the tube adapter.
4. Remove the tube adapter (1).



184211



184211

Installation Procedure

1. Install the new tube adapter (1).
   Tighten
   Tighten the tube adapter to 31 N·m (23 lb ft).
   Notice: Refer to *Fastener Notice* in Cautions and Notices.
2. Install the brake line.
   Tighten
   Tighten the brake line to 30 N·m (22 lb ft).
3. Install the three EHCU shield bolts and shield.
   Tighten
   Tighten the EHCU shield bolts to 12 N·m (8 lb ft).
   Notice: Refer to *Fastener Notice* in Cautions and Notices.
4. Bleed the system. Refer to *ABS Bleed Procedure.*

Description and Operation

Service Precautions

When working on this system, observe the following precautions:

- Before welding on the vehicle with an electric welding unit, complete the following steps:
  - Turn the ignition switch OFF.
  - Disconnect the EBCM connectors.
- Do not use a fast charger for starting the engine.
- Disconnect the negative battery cable when fast charging. Refer to *Battery Disconnect Caution* in Cautions and Notices.
- Never disconnect the battery from the vehicle electrical system while the engine is running.
- Connect all wiring harness connectors securely.
- Proper speed sensor wiring, routing and retaining are necessary in order to prevent false signals due to electrical noise. You can achieve proper system operation only by restoring the system to its original condition.

  When servicing the ABS, note the routing, position, mounting and locations of the following items:
  - All components
  - The wiring
  - The connectors
  - The clips
  - The brackets
  - The brake pipes

Follow the above mentioned precautions when working on ABS. Familiarize yourself with ABS and it relationships with other components on the vehicle.

Abbreviations and Definitions

4WAL: Four Wheel Antilock
BPMV: Brake Pressure Modulator Valve
CKT: Circuit
DLC: Data Link Connector
DMM: Digital Multimeter
DTC: Diagnostic Trouble Code
DUMP: Dump Valve
EBCM: Electronic Brake Control Module
EHCU: Electro-Hydraulic Control Unit
Infinite: Open Circuit/Unmeasurably High Resistance
ISO: Isolation Valve
LPA: Low Pressure Accumulator
OL: Open Circuit/Unmeasurably High Resistance
AWD: All Wheel Drive
2WD: Two Wheel Drive
4WD: Four Wheel Drive
VSS: Vehicle Speed Sensor
WSS: Wheel Speed Sensor

The EHCU is the entire ABS assembly, including the BPMV, the EBCM and combination valve. The BPMV is defined as the hydraulic control (lower) portion of the EHCU. It includes the internal control valves, the electric motor and the pumps. The EBCM is the electronic control (upper) portion of the EHCU. The EBCM mounts to the top of the BPMV. The EBCM is housed in aluminum with a black plastic top.

Basic Knowledge Required

You must have a basic knowledge of the following items before using this section. Without this basic knowledge, you will have difficulties using the diagnostic procedures contained in this section.

If you need a review of basic electrical troubleshooting, see the introduction to Electrical Diagnosis. Electrical Diagnosis also contains information on the basic use of circuit testing tools. Additionally, General Motors Service Training offers courses in electrical and electronic service.

Basic Electrical Circuits

You should understand the basic electrical theory. You should also know the meaning of basic electrical concepts and measurement: voltage (volts), current (amperes) and resistance (ohms). You should understand what happens in a circuit with an open or shorted wire. You should be able to read and understand a wiring diagram.

Use of Circuit Testing Tools

You should be familiar with the high impedance Digital Multimeter (DMM) *J 39200*. You should be familiar with the meter controls and how to use them correctly. You should be able to measure voltage, resistance and current. You should also know how to use jumper wires to bypass components in order to test circuits.

ABS System Description

Electro-Hydraulic Control Unit

The Electro-Hydraulic Control Unit (EHCU) is located in the left hand side of the engine compartment. The EHCU assembly includes the Electronic Brake Control module (EBCM) and the Brake Pressure Modulator Valve (BPMV). The EHCU regulates hydraulic pressure in the brake system during an antilock stop.

Electronic Brake Control Module

The Electronic Brake Control Module (EBCM) is part of the EHCU. The EBCM is the electronic portion of the EHCU. The major function of the EBCM is to control the BPMV. Inputs to the EBCM include the following items:

- Three wheel speed sensors
- Stop Lamp Switch
- Differential pressure
- Ignition switch voltage
- Unswitched battery voltage

Outputs of the EBCM include the following items:

- Three isolation solenoids (internal to the EHCU)
- Three dump solenoids (internal to the EHCU)
- The amber ABS indicator lamp
- The red BRAKE warning lamp
- The pump motor

A diagnostic serial data line (ABS only) is also used for diagnostic service tools and assembly plant testing.

The EBCM monitors the speed of each wheel. If any wheel approaches lockup, the EBCM controls the solenoids (isolation solenoid and dump solenoid) in order to reduce brake pressure to the wheel approaching lockup. Once the wheel regains traction, brake pressure is increased until the wheel again approaches lockup. This cycle repeats until either the vehicle comes to a stop, the brake is released, or the wheel is no longer approaching lockup. The EBCM also runs self diagnostics in order to check for any system malfunctions. Refer to *Self-Diagnostics*. If the EBCM detects a malfunction with the system, the ECBM will illuminate the amber ABS indicator in order to alert the driver of a malfunction.

Brake Pressure Modulator Valve
The Brake Pressure Modulator Valve (BPMV) is part of the EHCU. The BPMV is the hydraulic portion of the EHCU. The EBCM controls the BPMV. The BPMV is split into the following three hydraulic channels:

- Left front
- Right front
- Rear

Each channel has an isolation valve and a dump valve. The front channels share a low pressure accumulator, attenuator, and a pump. The rear channel shares use of the pump, but uses it's own low pressure accumulator and attenuator.

Wheel Speed Sensors
The front Wheel Speed Sensors (WSS) are a magnetic coil/pickup type. Each WSS produces an AC voltage signal which is transmitted to the EBCM in order to indicate how fast the wheel is turning. The speed of the wheel is directly proportional to the frequency and amplitude of the wheel speed signal.

Wheel Speed Sensor Tone Wheels
Each Wheel Speed Sensor uses a tone wheel in order to produce an AC voltage signal. Tone wheels are metal rings with teeth on the outside diameter. The AC voltage is produced as the teeth pass through the magnetic field of the WSS pole piece. The tone wheels are attached to the rotor or the drum. Any imperfections in the tone rings, such as a broken tooth or a missing tooth, can cause an inaccurate wheel speed signal.

Tire Size Calibration
The EBCM accepts wheel speed signals from several different sizes of tire and wheel combinations. All vehicles are preprogrammed from the factory with the proper tire size calibration. Whenever you replace the EBCM or change the tire size, you must reset the tire size calibration in the EBCM using *Scan Tool*. Once programmed, this calibration will remain, even if the battery is disconnected or if the EBCM is removed from the vehicle.

ABS System Operation

ABS Indicator Lamp Operation
The system uses an amber ABS indicator lamp in the instrument cluster in order to show system operation and malfunctions.

Normal Lamp Operation
A bulb check occurs each time the ignition switch is turned to the RUN position. The ANTILOCK and BRAKE lamps should turn on, remain on for about two seconds, then turn off. The ABS indicator lamp also indicates system malfunctions. When the EBCM detects a malfunction in the system, the EBCM turns the ANTILOCK and sometimes the BRAKE lamp on. The lamp may remain on or turn off depending on the malfunction. In order to determine the specific cause of the malfunction, refer to the ABS Diagnostic System Check.

Tires and ABS
Correct tire size, proper inflation, accurate alignment and even wear are needed for good brake performance. These items are essential for proper ABS performance.

Spare Tire
Use of the spare tire supplied with the vehicle will not affect the performance of the system.

Replacement Tires
If the replacement tires are not the same size as the original tires, you must change the tire size calibration within the EBCM using a *Scan Tool*. Refer to Tire Size Calibration portion of ABS System Description. Failure to change the tire calibration when replacing the original tires with a different size tire can affect the performance of the ABS.

Self-Tests
The ABS performs the following two system self-tests:

- The first self-test is performed when the ignition is turned to RUN. Both the ABS indicator lamp and the BRAKE warning lamp will turn on for 3 seconds, then they will turn off. This test confirms correct operation of the EBCM and the lamps. If one of the lamps remains on, either the ABS or the base brake system will require service.
- The second self-test is performed when the vehicle reaches a speed of greater than 3 mph. At this time the internal EBCM relay, six solenoid coils and BPMV pump motor are cycled and checked for shorts/opens. The BPMV pump will make a slight sound when this function occurs.

Normal Braking Mode
Refer to Normal Braking Mode in *BPMV Hydraulic Flow Chart*.

During normal braking, pressure is applied through the brake pedal. Fluid travels from the master cylinder (2), through the combination valve (3) and into the BPMV (15). Once in the BPMV, the fluid travels through the normally-open isolation valves (4, 6 and 14), through the normally-closed dump valves (7, 10 and 13) and out into the brakes 8 and 11).

During normal braking, the pumps (5 and 16) are not turned on. The low pressure accumulators and attenuators (9 and 12) are empty. Only residual pressure is stored in these accumulators and attenuators.

The EBCM constantly monitors wheel speed sensor inputs for rapid deceleration. If the ABS becomes disabled for any reason, the driver will always have base brakes. The normally-open isolation valves and normally-closed dump valves will remain in these positions in order to allow normal fluid pressure to the wheels.

ABS will not operate without wheel slip. The vehicle must be going at least 13 km/h (8 mph) in order to begin ABS operation.

ABS Braking Mode

The ABS will monitor the three-wheel speed sensors and control the hydraulic pressure changes at each wheel until the vehicle has come to a complete stop or until the driver has released the brake pedal. The system operates through the following process:

1. Pressure isolation/maintain
2. Pressure decrease
3. Pressure increase
4. Brake release (fluid return)

Sequence Of Events

1. With the vehicle at 13 km/h (8 mph) or greater, the driver depresses the brake pedal.
2. The wheel speed begins to decrease as the master cylinder pressure and brake pressure increase.
3. As the wheel speed continues to decrease from vehicle speed, the normally-open isolation valve for the affected channel closes to stop additional pressure to the wheel. The master cylinder pressure continues to increase as the driver depresses the pedal, but the wheel brake pressure is now limited to the ABS system pressure.
4. When the EBCM determines that the wheel is about to lock-up, the normally-closed dump valve opens. This bleeds off some of the pressure at the wheel cylinder (or caliper) in order to allow the wheel to return to a speed closer to the speed of the vehicle.
5. The dump valve is again closed and the isolation valve remains closed in order to allow the wheel speed to completely recover from the lock-up.
6. Once the vehicle has recovered from the lock-up tendency, the isolation valve is momentarily pulsed open in order to allow the master cylinder pressure and pump pressure to reach the brakes. This controlled pressure rise continues until the wheel is at optimum brake output or until the brake pressure is brought up to master cylinder output pressure. The ABS allows the brake fluid to flow to the wheel, build pressure and try to force another departure, repeating Step 3 through Step 6. The following paragraphs describe the various modes in detail.

Isolation Mode (Pressure Maintain)

Refer to Isolation Mode in *BPMV Hydraulic Flow Chart.*

Isolation will occur when the driver applies excessive braking for the given road conditions, causing the wheels to decelerate at a rate which exceeds the vehicle's capability.

If the information from the wheel speed sensors indicate excessive wheel deceleration (imminent lock-up), the first step in the antilock sequence is to isolate the brake pressure being applied by the driver.

The EBCM applies a voltage to the isolation coil in order to close the isolation valve (4). This will prevent any additional brake pressure applied by the driver from reaching the wheel. With the isolation valve closed, further increases in brake pressure from the driver will be prohibited.

Dump Mode (Pressure Decrease)

Refer to Dump Mode in *BPMV Hydraulic Flow Chart.*

Once the pressure is isolated, it must be reduced in order to get the wheels rolling once again. Reducing pressure is accomplished by dumping a portion of the brake fluid pressure into a low pressure accumulator (LPA).

The EBCM energizes the dump valve coil(s) in order to open the dump valve (5), allowing fluid from the wheels to be dumped into the LPA (6). Very short activation pulses open and close the dump valve passageway in order to control this action. Brake pressure is lowered at the wheel and allows the affected wheel to begin rolling again.

The fluid taken from the wheels forces a spring back. The fluid is stored in the LPA at approximately 1034 kPa (150 psi). A portion of the fluid also primes the pump (3) so it can begin building reapply pressure. The dump valves are opened independently in order to control the deceleration of the wheel.

Reapply Mode (Pressure Increase)

Refer to Reapply Mode in *BPMV Hydraulic Flow Chart.*

The reapply sequence is initiated in order to obtain optimum braking at each wheel. The isolation valve (4) is momentarily pulsed open in order to allow the master cylinder (2) and pump (3) pressure to reach the brakes. This controlled pressure rise continues until the wheel is at optimum brake output or until the brake pressure is brought up to the master cylinder output pressure.

If more pressure is required, more fluid is drawn from the master cylinder and applied to the brakes. The driver will feel pedal pulsations or pedal drop. This is normal and expected when in the antilock mode.

As fluid is reapplied, the wheels begin to slow down at the optimum rate. If the wheels approach imminent lock-up again, the module will isolate, dump and reapply. These control cycles (isolation, dump and reapply) occur in millisecond intervals, allowing several cycles to occur each second.

Brake Release

At the end of the antilock stop, when the driver releases the brake pedal, the motor will remain on for a short time in order to help drain any fluid left in the LPA. As the fluid drains back into the system, the spring force in the LPA pushes the piston to the home position. The isolation valve is turned off and fluid returns through the isolation orifice.

Special Tools and Equipment

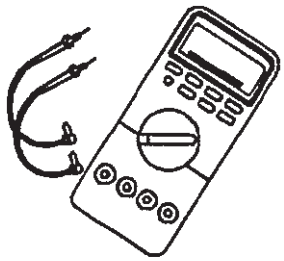
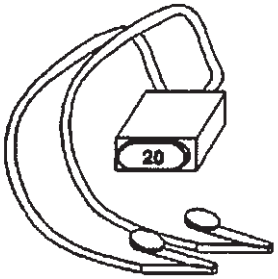
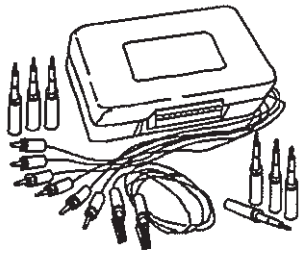
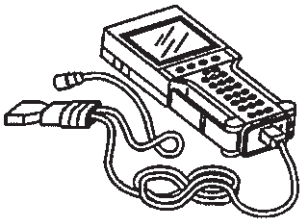
Illustration	Tool Number/ Description
 3430	J 39200 Digital Multi-Meter
 1025	J 36169 Fused Jumper Wire

Illustration	Tool Number/ Description
 11799	J 35616 Connector Adapter Test Kit
 39438	Tech 2 Scan Tool

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