

## SECTION 4F

# ANTILOCK BRAKE SYSTEM AND TRACTION CONTROL SYSTEM

**CAUTION:** Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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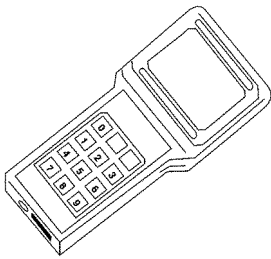
## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb•Ft	Lb•In
ABS 5.3 Mounting Nuts	9	-	80
Brake Pipe Nuts	12	-	106
EBCM Mounting Screws	3	-	27
Front Wheel Speed Sensor Bolt	8	-	71
Rear Wheel Speed Sensor Bolt	8	-	71

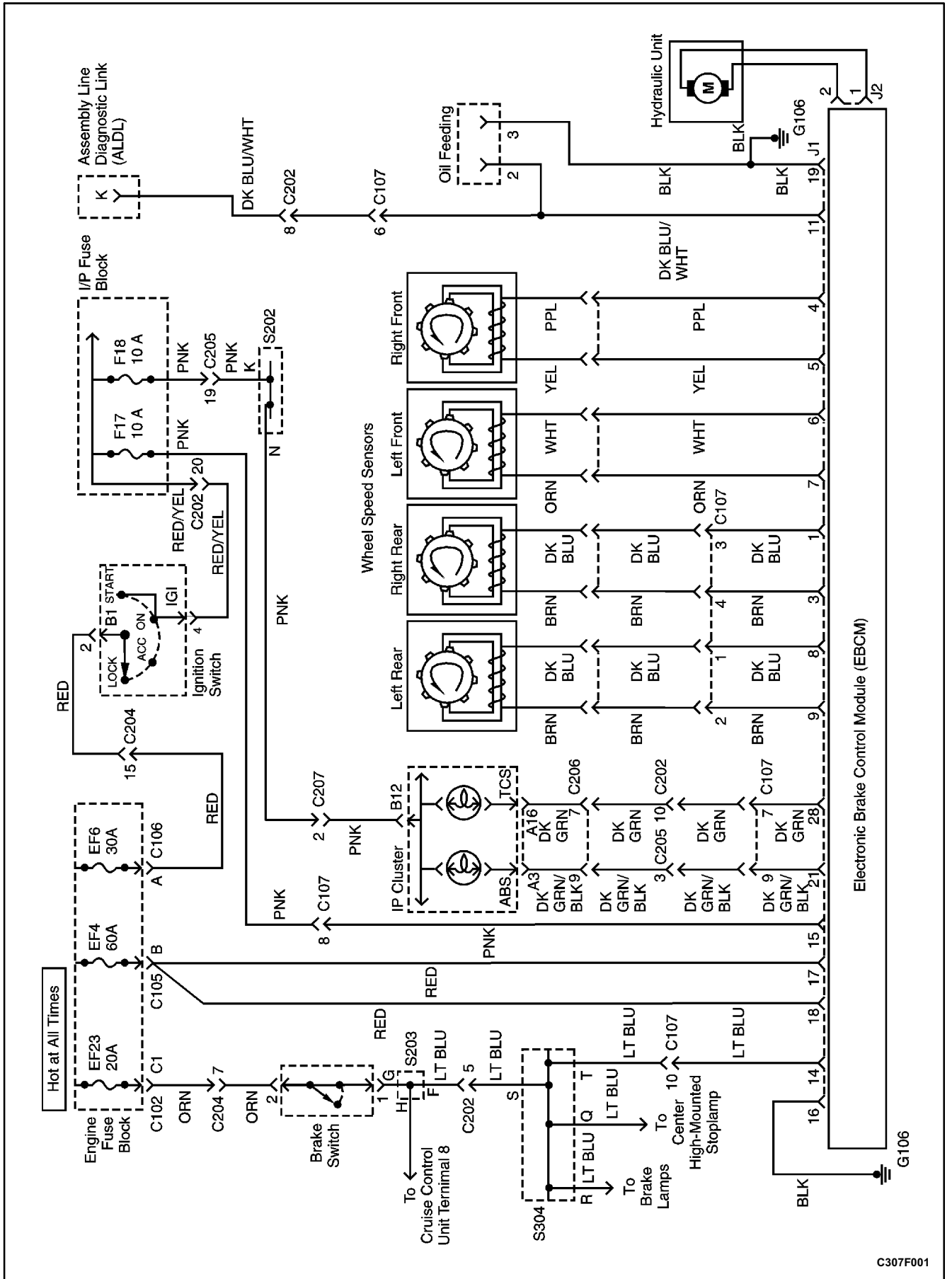
## SPECIAL TOOLS

### SPECIAL TOOLS TABLE

 A107F057	<b>Scan Tool</b>
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# SCHEMATIC AND ROUTING DIAGRAMS

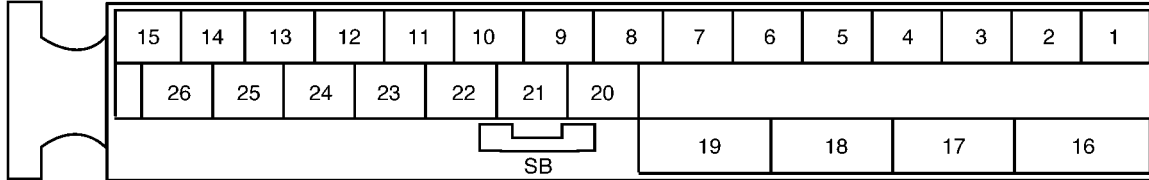
## ABS CIRCUIT



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## EBCM CONNECTOR FACE VIEW (WITHOUT TRACTION CONTROL SYSTEM)

**EBCM Connector J1**



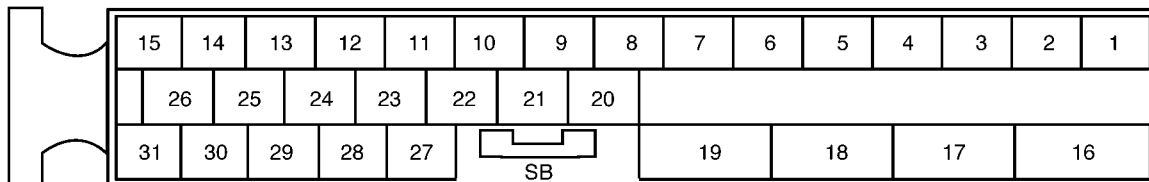
C107F035

Pin	Color	Circuit
1	DK BLU	Right Rear Ground
2	-	Not Used
3	BRN	Right Rear Sensor
4	PPL	Right Front Ground
5	YEL	Right Front Sensor
6	WHT	Left Front Ground
7	ORN	Left Front Sensor
8	DK BLU	Left Rear Ground
9	BRN	Left Rear Sensor
10	-	Not Used
11	DK BLU/WHT	Serial Data Link
12	-	Not Used
13	-	Not Used
14	LT BLU	Brake Light Switch

Pin	Color	Circuit
15	PNK	Switched Ignition
16	BLK	Motor Ground
17	RED	Battery
18	RED	Battery
19	BLK	Instrument Ground
20	-	Not Used
21	DK GRN/BLK	ABS Warning Lamp
22	-	Not Used
23	-	Not Used
24	-	Not Used
25	-	Not Used
26	-	Not Used
SB	-	Shorting Bar

## EBCM CONNECTOR FACE VIEW (WITH TRACTION CONTROL SYSTEM)

### EBCM Connector J1



C107F036

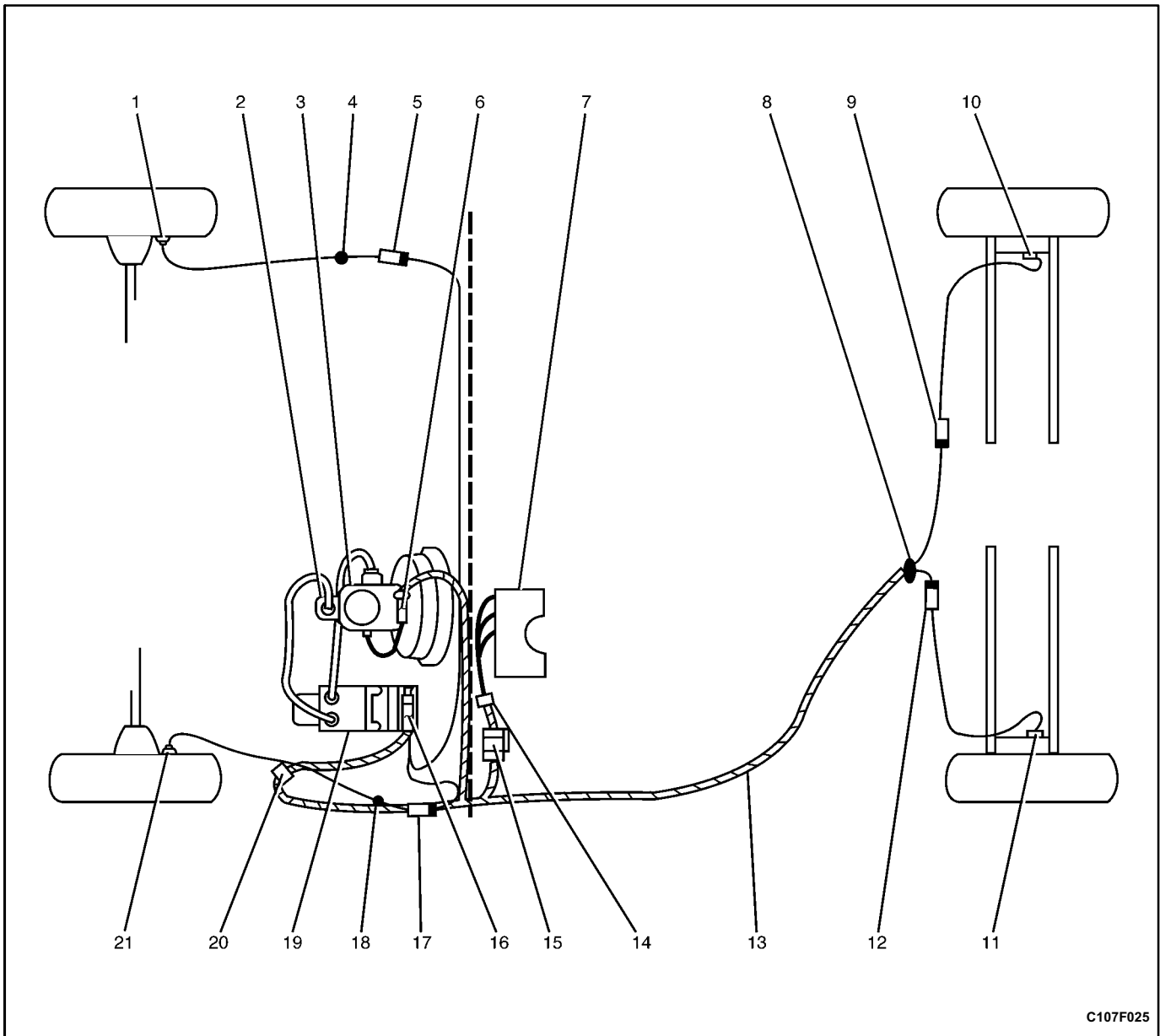
Pin	Color	Circuit
1	DK BLU	Right Rear Ground
2	-	Not Used
3	BRN	Right Rear Sensor
4	PPL	Right Front Ground
5	YEL	Right Front Sensor
6	WHT	Left Front Ground
7	ORN	Left Front Sensor
8	DK BLU	Left Rear Ground
9	BRN	Left Rear Sensor
10	-	Not Used
11	DK BLU/WHT	Serial Data Link
12	-	Not Used
13	-	Not Used
14	LT BLU	Brake Light Switch
15	PNK	Switched Ignition
16	BLK	Motor Ground

Pin	Color	Circuit
17	RED	Battery
18	RED	Battery
19	BLK	Instrument Ground
20	-	Not Used
21	DK GRN/BLK	ABS Warning Lamp
22	-	Not Used
23	-	Not Used
24	-	Not Used
25	-	Not Used
26	-	Not Used
27	-	Not Used
28	DK GRN	TCS Warning Lamp
29	-	Not Used
30	-	Not Used
31	-	Not Used
SB	-	Shorting Bar

# COMPONENT LOCATOR

## ABS AND TCS SYSTEM DRIVE

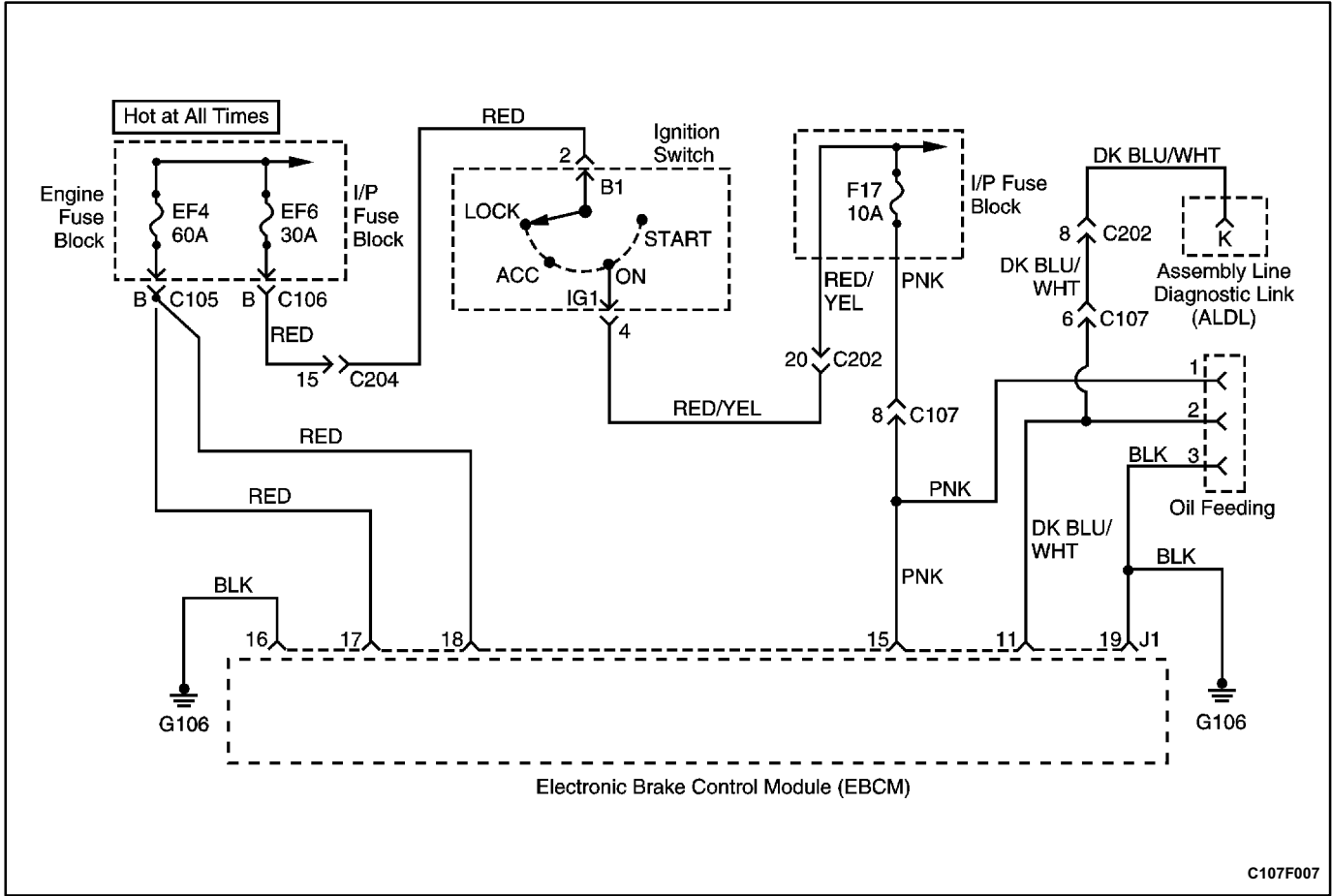
(Left-Hand Drive Shown, Right-Hand Drive Similar)



- |  |   |
|--|---|
| 1 Right Front Wheel Speed Sensor           | 12 Left Rear Wheel Speed Sensor Connector |
| 2 Brake Master Cylinder                    | 13 Body Wiring Harness                    |
| 3 Master Cylinder Reservoir                | 14 Connector C206                         |
| 4 Grommet                                  | 15 Connectors C202, C205                  |
| 5 Right Front Wheel Speed Sensor Connector | 16 EBCM Connector J1                      |
| 6 Brake Fluid Level Switch Connector       | 17 Left Front Speed Sensor Connector      |
| 7 Instrument Cluster                       | 18 Grommet                                |
| 8 Grommet                                  | 19 Hydraulic Modulator with Attached EBCM |
| 9 Right Rear Wheel Speed Sensor Connector  | 20 Connector C107                         |
| 10 Right Rear Wheel Speed Sensor           | 21 Left Front Wheel Speed Sensor          |
| 11 Left Rear Wheel Speed Sensor            |   |

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# DIAGNOSIS



## DIAGNOSTIC CIRCUIT CHECK

The Diagnostic Circuit Check is an organized approach to identifying a problem created by an antilock brake system (ABS) malfunction. It must be the starting point for any ABS complaint diagnosis because it directs the service technician to the next logical step in diagnosing the complaint.

### Diagnostic Process

Perform the following steps in order when servicing the ABS/TCS system. Failure to do so may result in the loss of important diagnostic data and may lead to difficulties and time consuming diagnosis procedures.

1. Perform the tests of the table below.

2. Perform a road test if directed by the table.

- Test drive the vehicle while using the snapshot feature of the scan tool.
- Perform normal acceleration, stopping, and turning maneuvers.
- If this does not reproduce the malfunction, perform an ABS stop or TCS maneuver on a low friction surface such as gravel.

3. Clear the diagnostic trouble codes (DTCs) after all system malfunctions have been corrected.

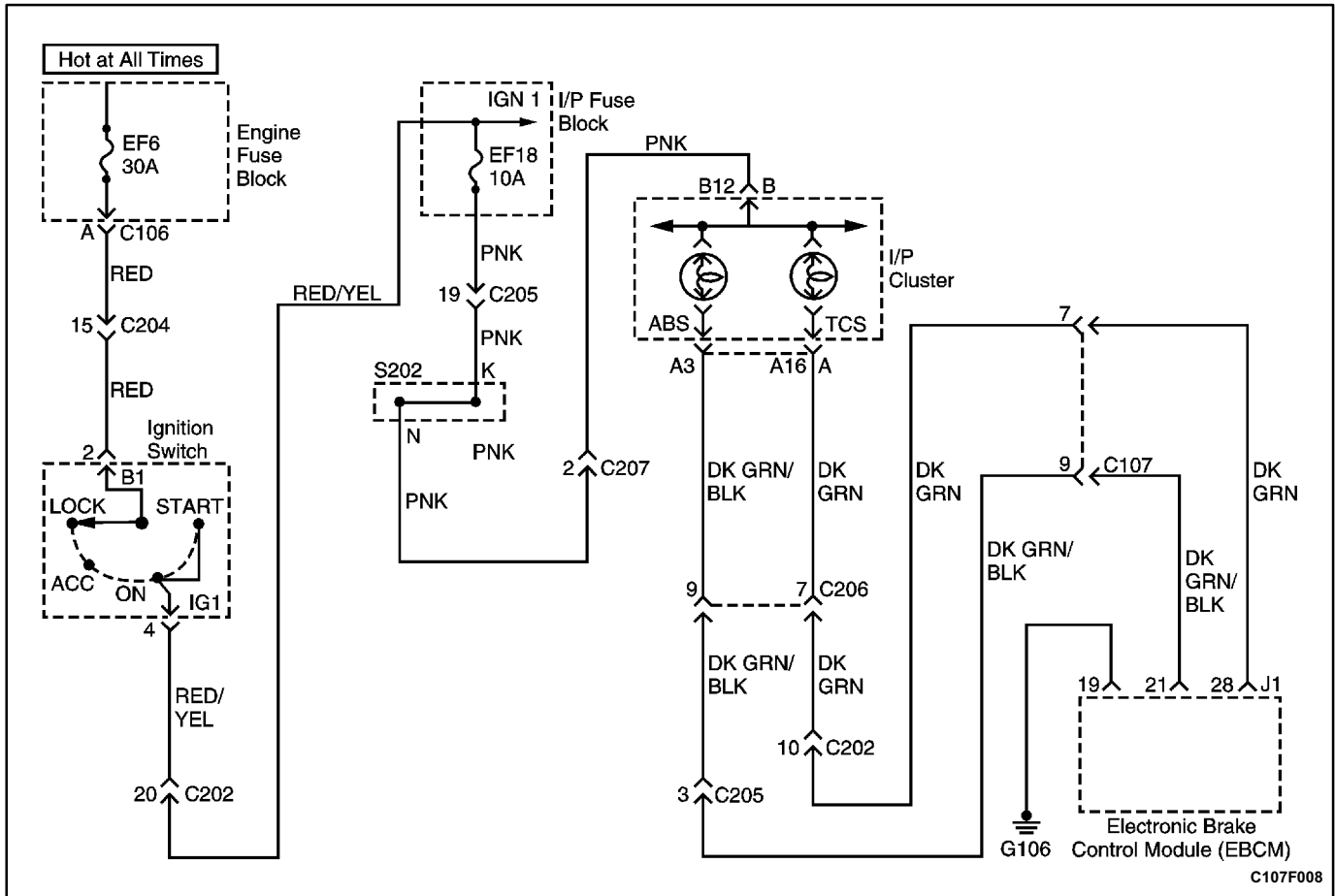
### Diagnostic Circuit Check

Step	Action	Value	Yes	No
1	1. Install the scan tool. 2. Turn ignition switch to ON. 3. Select the Data List mode. Is the scan tool receiving data from the electronic brake control module (EBCM) ?	-	Go to Step 2	Go to Step 7



**Diagnostic Circuit Check (Cont'd)**

Step	Action	Value	Yes	No
2	Check the display. Are there any current DTCs displayed?	-	Refer to the applicable DTC table	Go to Step 3
3	1. Turn the ignition switch to LOCK for 10 seconds. 2. Turn the ignition switch to ON and observe the ABS indicator. Does the indicator light for 2 seconds and then go off?	-	Go to Step 5	Go to Step 4
4	Check the ABS indicator. Did the ABS indicator turn on and stay on?	-	Go to „ABS Indicator Lamp Illuminated Constantly”	Go to „ABS Indicator Lamp Inoperative”
5	Check whether the vehicle is equipped with traction control. Is the vehicle equipped with traction control?	-	Go to Step 6	Go to Step 13
6	1. Turn the ignition switch to LOCK for 10 seconds. 2. Turn the ignition switch to ON and observe the TCS indicator. Does the indicator light for 2 seconds and then go off?	-	Go to Step 13	Go to „Traction Control System Indicator Lamp Inoperative”
7	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM harness connector J1. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage from ground to terminal 15, 17, and 18 of EBCM harness connector J1. Is the voltage within the specified value on each terminal?	11-14 V	Go to Step 8	Go to „Power Supply to Control Module, No DTCs Stored”
8	1. Turn the ignition switch to LOCK. 2. Use a DVM to measure the resistance from the EBCM harness connector J1, terminals 16 and 19 to ground. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 10	Go to Step 9
9	Repair the open in the circuit BLK that failed. Is the repair complete?	-	System OK	-
10	Use a DVM to measure the resistance between terminal 11 of the EBCM harness connector J1 and terminal K of the assembly line diagnostic link (ALDL). Is the resistance below the specified value?	2 Ω	Go to Step 11	Go to Step 12
11	Replace the ABS unit assembly. Is the repair complete?	-	System OK	-
12	Repair the open or high resistance in circuit DK BLU/WHT between terminal 11 of the EBCM harness connector J1 and terminal K of the ALDL jack. Is the repair complete?	-	Go to Step 1	-
13	Perform the road test described above. Are any DTCs set?	-	Go to the table for the DTC	System OK



## ABS INDICATOR LAMP INOPERATIVE

### Circuit Description

Battery voltage is supplied to the ABS warning lamp with the ignition switch in the ON or START positions. The warning lamp can be activated only by the ABS control module internally supplying ground to terminal 21 or by the shorting bar in the ABS module connector J1 when it is disconnected from the module.

### Diagnosis

This procedure checks for a problem in the wiring, a faulty ground, a voltage supply problem, a burned out indicator lamp, or a contact problem in a connector.

### Cause(s)

- A fuse has blown.
- The indicator lamp has burned out.
- There is a corroded or broken connector terminal.
- There is a faulty ground connection.
- There is a broken wire in a wiring harness.
- The EBCM is faulty.

### Test Description

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

- 1 This test checks for any DTCs that may cause the ABS indicator lamp to be inoperative.
- 2 This test verifies an inoperative lamp condition.
- 3 This test checks for voltage on the lamp circuit.
- 4 This begins a series of tests of the circuit from the indicator lamp to the EBCM and ground.
19. This begins a series of tests of the voltage supply circuits that power the indicator lamp.

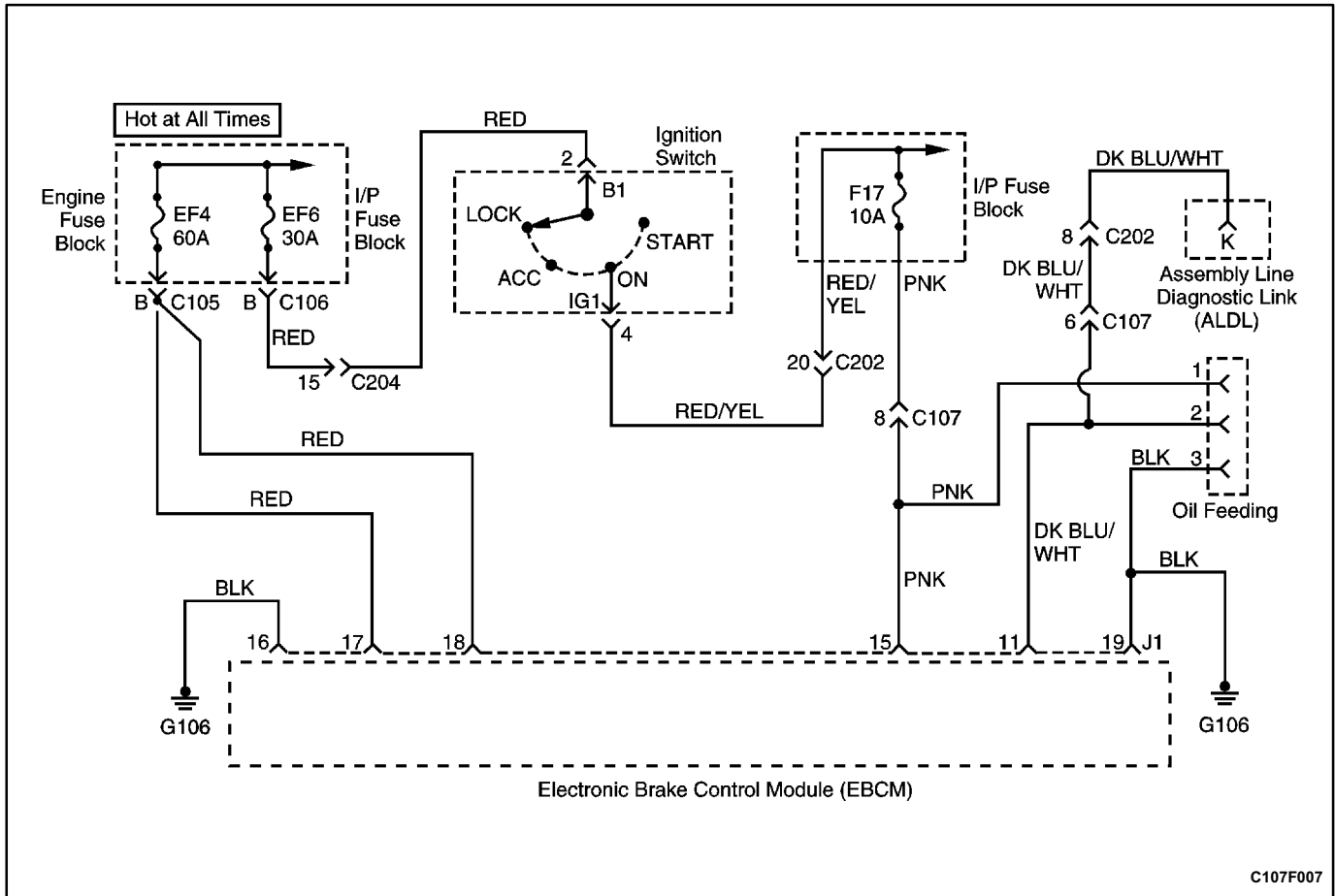
**ABS Indicator Lamp Inoperative**

Step	Action	Value(s)	Yes	No
1	Install the scan tool and check for any DTCs. Is any DTC set?	-	Go to the chart for the DTC	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the scan tool. 3. Turn the ignition switch to ON. 4. Observe the ABS indicator lamp. Does the lamp illuminate for about 2 seconds, then turn off?	-	Go to „Intermittents and Poor Connections”	Go to Step 3
3	With the ignition still ON, observe the oil pressure lamp. Is the oil pressure lamp illuminated?	-	Go to Step 4	Go to Step 19
4	1. Turn the ignition switch to LOCK. 2. Disconnect connector J1 from the electronic brake control module (EBCM). 3. Turn the ignition switch to ON. Does the ABS indicator illuminate?	-	Go to Step 5	Go to Step 8
5	1. Turn the ignition switch to LOCK. 2. Examine terminals 19 and 21 at the EBCM connector J1 on both the ABS wiring harness and on the EBCM. Is there a poor connection at any of these terminals?	-	Go to Step 6	Go to Step 7
6	Repair the faulty terminals or replace the ABS unit as required. Is the repair complete?	-	System OK	-
7	Replace the ABS unit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition switch to LOCK. 2. Disconnect the wire from the negative battery terminal. 3. Measure the resistance between the negative battery wire, which is attached to ground, and the shorting bar in the EBCM connector J1. Does the resistance match the specified value?	0 Ω	Go to Step 10	Go to Step 9
9	Repair the open or high resistance in the circuit from EBCM connector J1, terminal 19 to ground G106. Is the repair complete?	-	System OK	-
10	1. Remove the I/P cluster. 2. Remove and check the ABS indicator bulb. Is the bulb burned out?	-	Go to Step 11	Go to Step 12
11	1. Replace the ABS indicator bulb. 2. Install the I/P cluster. Is the repair complete?	-	System OK	-
12	Check the continuity at the I/P cluster connector terminal A3. Does the ohmmeter show the specified value?	0 Ω	Go to Step 14	Go to Step 13
13	Repair the contact at the I/P cluster connector terminal A3. Is the repair complete?	-	System OK	-

**ABS Indicator Lamp Inoperative (Cont'd)**

Step	Action	Value(s)	Yes	No
14	Check the wiring harnesses and the connectors in circuit DK GRN/BLK from the I/P cluster terminal A3 to terminal 21 of the EBCM connector J1. Does the ohmmeter show the specified value?	$\infty$	Go to Step 15	Go to Step 16
15	Repair the open or high resistance found. Is the repair complete?	-	System OK	-
16	Check for continuity between terminal 19 of the ABS connector J1 and ground G106. Does the ground connection match the specified value?	0 $\Omega$	Go to Step 17	Go to Step 18
17	Replace the ABS unit. Is the repair complete?	-	System OK	-
18	Repair the continuity problem between terminal 19 of the EBCM connector J1 and ground G106. Is the repair complete?	-	System OK	-
19	1. Turn the ignition switch to LOCK. 2. Check fuse F18 in the I/P fuse block. Is this fuse blown?	-	Go to Step 20	Go to Step 21
20	Replace fuse F18. Is the repair complete?	-	System OK	-
21	Check fuse EF6 in the engine fuse block. Is this fuse blown?	-	Go to Step 22	Go to Step 23
22	Replace fuse EF6. Is the repair complete?	-	System OK	-
23	Measure the voltage at terminal 2 of the ignition switch connector by backprobing. Does the voltage match the specified value?	11-14 V	Go to Step 25	Go to Step 24
24	1. Check circuit RED between terminal A of C106 at the engine fuse block and terminal 2 of the ignition switch for continuity. 2. Repair any open or high resistance found. Is the repair complete?	-	System OK	-
25	1. Turn the ignition switch to ON. 2. Backprobe terminal 4 (RED/YEL) of the ignition switch connector. Does the voltage match the specified value?	11-14 V	Go to Step 27	Go to Step 26
26	Replace the ignition switch. Is the repair complete?	-	System OK	-
27	1. Turn the ignition switch to LOCK. 2. Check circuit RED/YEL from terminal 4 of the ignition switch to fuse F18 in the I/P fuse block. Does the ohmmeter show the specified value?	$\infty$	Go to Step 28	Go to Step 29
28	Repair the open or the high resistance. Is the repair complete?	-	System OK	-
29	1. Remove the instrument cluster. 2. Check circuit PNK from fuse F18 to terminal B12 of the I/P cluster connector B. 3. Repair any open or high resistance found in a wiring harness, splice pack, or connector. Is the repair complete?	-	System OK	-

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C107F007

## POWER SUPPLY TO CONTROL MODULE, NO DTCs STORED

### Circuit Description

Battery voltage is supplied to the electronic brake control module (EBCM) through fuse F17 in the I/P fuse block, to terminal 15 of the EBCM connector J1. The voltage is present when the ignition switch is in the ON or START position.

### Diagnosis

This test checks for battery output, proper grounding, blown fuses, a faulty ignition switch, and problems in the circuitry.

### Cause(s)

- The battery is defective.
- There is a defective ground connection.
- A connector is damaged.
- A wire is broken or shorted.
- A fuse is blown.
- The ignition switch is malfunctioning.

### Fail Action

ABS action is disabled during the period of low voltage, and the ABS warning lamp is ON for the remainder of the ignition cycle.

### Test Description

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

1. This step determines whether there is voltage at the battery and the high current source.
7. This step checks for voltage at the ignition 1 source.
11. This step begins the check for voltage at the EBCM end of the ABS harness.
15. This step checks for a defective ground connection.
16. This is a check for a defective EBCM connector.

### Diagnostic Aids

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to do so may result in misdiagnosis, causing part replacement with a reappearance of the malfunction.

**Power Supply to Control Module, No DTCs Stored**

Step	Action	Value(s)	Yes	No
1	Check the voltage at the battery. Is the voltage within the specified value?	11-14 V	Go to <i>Step 3</i>	Go to <i>Step 2</i>
2	Charge or replace the battery as required. Is the repair complete?	-	System OK	-
3	Check fuse EF4 in the engine fuse block. Is the fuse blown?	-	Go to <i>Step 4</i>	Go to <i>Step 8</i>
4	1. Replace fuse EF4. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	Check the ABS function. Is the repair complete?	-	System OK	-
6	1. Turn the ignition to OFF. 2. Remove fuse EF4. 3. Disconnect the ABS connector J1 from the EBCM. 4. Measure the resistance to ground at terminals 17 and 18. Does the ohmmeter show the specified value?	0 Ω	Go to <i>Step 7</i>	Go to <i>Step 25</i>
7	Repair the short to ground in circuit RED between terminal B of engine fuse block connector C105 and the ABS harness EBCM connector J1. Is the repair complete?	-	System OK	-
8	Check fuse EF6 in the engine fuse block. Is the fuse blown?	-	Go to <i>Step 9</i>	Go to <i>Step 13</i>
9	1. Replace fuse EF6. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	Check the ABS function. Is the repair complete?	-	System OK	-
11	1. Turn the ignition to OFF. 2. Remove fuse EF6. 3. Disconnect ABS connector J1 from the EBCM. 4. Measure the resistance to ground at terminal 15. Does the ohmmeter show the specified value?	0 Ω	Go to <i>Step 12</i>	Go to <i>Step 25</i>
12	1. Examine circuit RED between terminal A of engine fuse block connector C106 and terminal 2 of the ignition switch. 2. Examine circuit RED/YEL from terminal 4 of the ignition switch to fuse F17 in the I/P fuse block. 3. Examine circuit PNK from fuse F17 in the I/P fuse block to terminal 15 of the ABS EBCM connector J1. 4. Repair any short to ground found in the wiring or the ignition switch. Is the repair complete?	-	System OK	-
13	Check fuse F17 in the I/P fuse block. Is the fuse blown?	-	Go to <i>Step 14</i>	Go to <i>Step 18</i>

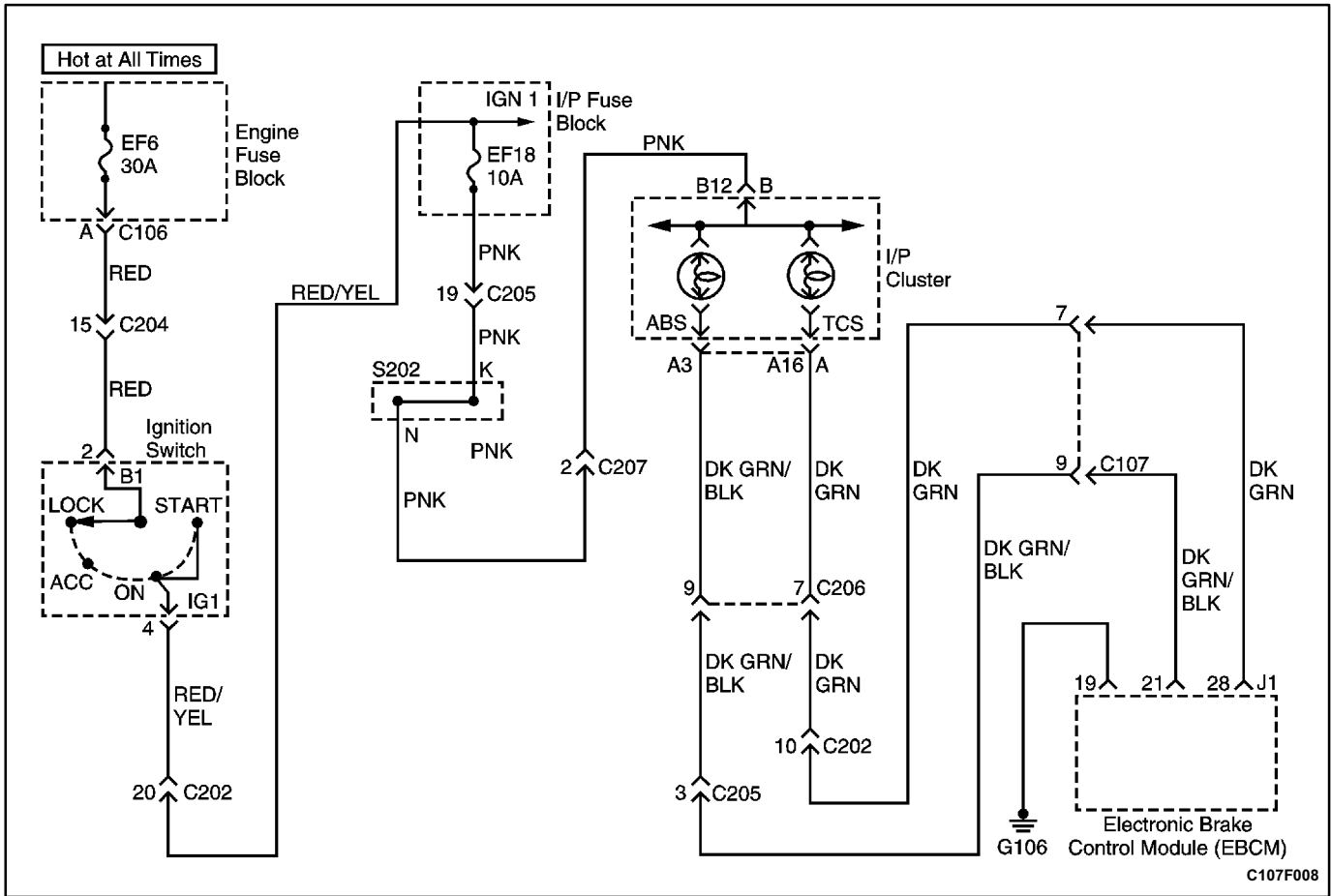
**Power Supply to Control Module, No DTCs Stored (Cont'd)**

Step	Action	Value	Yes	No
14	1. Replace fuse F17. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to <i>Step 16</i>	Go to <i>Step 15</i>
15	Check the ABS function. Is the repair complete?	-	System OK	-
16	1. Turn the ignition to OFF. 2. Remove fuse F17. 3. Disconnect ABS connector J1 from the EBCM. 4. Measure the resistance to ground at terminal 15. Does the ohmmeter show the specified value?	0 $\Omega$	Go to <i>Step 17</i>	Go to <i>Step 25</i>
17	Repair the short to ground in circuit PNK fuse F17 of the I/P fuse block and terminal 15 of the ABS harness EBCM connector J1. Is the repair complete?	-	System OK	-
18	1. Disconnect the EBCM connector J1 from the EBCM. 2. Turn the ignition to ON. 3. Check for the presence of battery voltage between ground and terminal 17, and between ground and terminal 18. Is the voltage within the specified value?	11-14 V	Go to <i>Step 20</i>	Go to <i>Step 19</i>
19	1. Turn the ignition switch to OFF. 2. Trace the RED wires between terminals 17 and 18 of the EBCM connector J1 to terminal B of connector C105 at the engine fuse block. 3. Repair the open in this circuit. Is the repair complete?	-	System OK	-
20	Check the voltage between ground and terminal 15 of the EBCM connector J1. Is the voltage within the specified value?	11-14 V	Go to <i>Step 22</i>	Go to <i>Step 21</i>
21	1. Turn the ignition switch to OFF. 2. Trace circuit PNK between terminal 15 of the ABS harness EBCM connector to fuse F17 in the I/P fuse block. 3. Trace circuit RED/YEL from fuse F17 of the I/P fuse block to terminal 4 (IG1) of the ignition switch. 4. Trace circuit RED from terminal 2 (B1) of the ignition switch to terminal A of connector C106 at the engine fuse block and to fuse EF6. 5. Repair the open in the wiring or possibly bad connector terminal, defective ignition switch, or blown fuse EF6. Is the repair complete?	-	System OK	-
22	1. Turn the ignition to OFF. 2. Check the resistance between ground and terminals 19 and 16 of the EBCM connector J1. Does the ohmmeter show the specified value?	0 $\Omega$	Go to <i>Step 23</i>	Go to <i>Step 26</i>
23	Examine terminals 15, 19, 17, 18, and 16 of the EBCM connector. Is there a defective terminal?	-	Go to <i>Step 24</i>	Go to <i>Step 25</i>



**Power Supply to Control Module, No DTCs Stored (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value</b>	<b>Yes</b>	<b>No</b>
24	Repair the defective terminal or replace the connector or wiring harness as required. Is the repair complete?	-	System OK	-
25	Replace the ABS unit. Is the repair complete?	-	System OK	-
26	Repair the defective ground connection. Is the repair complete?	-	System OK	-



**ABS INDICATOR LAMP ILLUMINATED CONTINUOUSLY, NO DTCs STORED**

**Circuit Description**

Battery voltage is supplied to the ABS warning lamp with the ignition switch in the ON or START position. The warning lamp should be activated only by the ABS control module internally supplying ground to terminal 21.

**Diagnosis**

This procedure checks for a short to ground in the wiring or a defective electronic brake control module (EBCM).

**Cause(s)**

- There is a short to ground in the circuit between the cluster terminal A3 and the EBCM terminal 21.
- The EBCM is faulty.

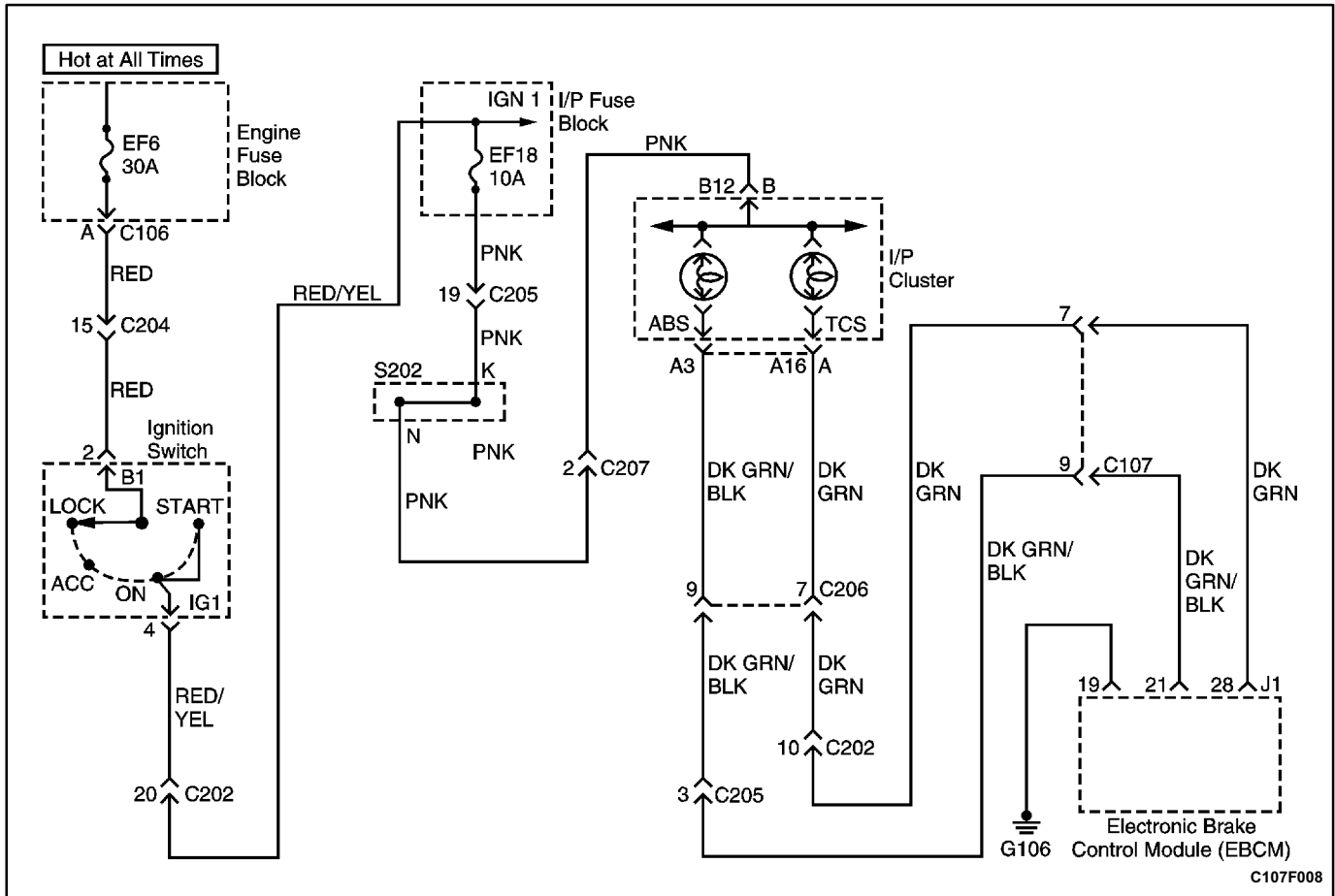
**Test Description**

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

3. This step determines whether the EBCM is faulty.
5. This begins a search for a short to ground in the circuit between the ABS indicator lamp and the EBCM.

**ABS Indicator Lamp Illuminated Continuously, No DTCs Stored**

Step	Action	Value(s)	Yes	No
1	Check the EBCM connector J1. Is it connected properly?	-	Go to Step 3	Go to Step 2
2	Connect the EBCM connector J1. Is the repair complete?	-	System OK	-
3	1. Disconnect the EBCM connector J1. 2. Turn the ignition switch to ON. 3. Use an insulated tool to push the shorting bar in the connector away from terminal 21. Does the ABS indicator lamp go out?	-	Go to Step 4	Go to Step 5
4	Replace the ABS unit. Is the repair complete?	-	System OK	-
5	1. Turn the ignition switch to OFF. 2. Connect the EBCM connector J1. 3. Disconnect connector C107. 4. Turn the ignition switch to ON. Does the ABS indicator lamp illuminate?	-	Go to Step 7	Go to Step 6
6	Repair the short to ground in circuit DK GRN/BLK between connector C107 and the EBCM connector J1. Is the repair complete?	-	System OK	-
7	1. Turn the ignition switch to OFF. 2. Connect connector C107. 3. Disconnect connector C205. 4. Turn the ignition switch to ON. Does the ABS indicator lamp illuminate?	-	Go to Step 9	Go to Step 8
8	Repair the short to ground in circuit DK GRN/BLK between connector C205 and connector C107. Is the repair complete?	-	System OK	-
9	1. Turn the ignition switch to OFF. 2. Connect connector C205. 3. Disconnect connector C206. 4. Turn the ignition switch to ON. Does the ABS indicator lamp illuminate?	-	Go to Step 10	Go to Step 11
10	Repair the short to ground in circuit DK GRN/BLK between I/P cluster connector A and connector C206. Is the repair complete?	-	System OK	-
11	Repair the short to ground in circuit DK GRN/BLK between connector C206 and connector C205. Is the repair complete?	-	System OK	-



## TRACTION CONTROL SYSTEM INDICATOR LAMP INOPERATIVE

### Circuit Description

Battery voltage is supplied to the TCS warning lamp with the ignition switch in the ON or START position. The warning lamp can be activated only by the ABS control module internally supplying ground to terminal 28.

### Diagnosis

This procedure checks for a problem in the wiring, a faulty ground, a voltage supply problem, a burned out indicator lamp, or a contact problem in a connector.

### Cause(s)

- A fuse has blown.
- The indicator lamp has burned out.
- There is a corroded or broken connector terminal.
- There is a faulty ground connection.
- There is a broken wire in a wiring harness.
- The EBCM is faulty.

### Test Description

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

- 1 This test checks for any DTCs that may cause the TCS indicator lamp to be inoperative.
- 2 This test verifies an inoperative lamp condition.
- 3 This test checks for voltage on the lamp circuit.
- 4 This begins a series of tests of the circuit from the indicator lamp to the EBCM and ground.
19. This begins a series of tests of the voltage supply circuits that power the indicator lamp.

**Traction Control System Indicator Lamp Inoperative**

Step	Action	Value(s)	Yes	No
1	Install the scan tool and check for any DTCs. Is any DTC set?	-	Go to the chart for the DTC	Go to <i>Step 2</i>
2	1. Turn the ignition switch to LOCK. 2. Disconnect the scan tool. 3. Turn the ignition switch to ON. 4. Observe the TCS indicator lamp. Does the lamp illuminate for about 2 seconds, then turn off?	-	Go to „Intermittents and Poor Connections”	Go to <i>Step 3</i>
3	With the ignition still ON, observe the oil pressure lamp. Is the oil pressure lamp illuminated?	-	Go to <i>Step 4</i>	Go to <i>Step 19</i>
4	1. Turn the ignition switch to LOCK. 2. Disconnect connector J1 from the EBCM. 3. Connect a jumper from terminal 28 to the grounding bar in the connector. 4. Turn the ignition switch to ON. Does the TCS indicator illuminate?	-	Go to <i>Step 5</i>	Go to <i>Step 8</i>
5	1. Turn the ignition switch to LOCK. 2. Examine terminals 19 and 28 at the EBCM connector J1 on both the ABS wiring harness and on the EBCM. Is there a poor connection at any of these terminals?	-	Go to <i>Step 6</i>	Go to <i>Step 7</i>
6	Repair the faulty terminals or replace the ABS unit as required. Is the repair complete?	-	System OK	-
7	Replace the ABS unit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition switch to LOCK. 2. Disconnect the wire from the negative battery terminal. 3. Measure the resistance between the negative battery wire, which is attached to ground, and the shorting bar in the EBCM connector J1. Does the resistance match the specified value?	0 Ω	Go to <i>Step 10</i>	Go to <i>Step 9</i>
9	Repair the open or high resistance in the circuit from EBCM connector J1, terminal 19 to ground G106. Is the repair complete?	-	System OK	-
10	1. Remove the I/P cluster. 2. Remove and check the TCS indicator bulb. Is the bulb burned out?	-	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	1. Replace the TCS indicator bulb. 2. Replace the I/P cluster. Is the repair complete?	-	System OK	-
12	Check continuity at the I/P cluster connector terminal A16. Does the ohmmeter show the specified value?	0 Ω	Go to <i>Step 14</i>	Go to <i>Step 13</i>
13	Repair the contact at the I/P cluster connector terminal A16. Is the repair complete?	-	System OK	-

## Traction Control System Indicator Lamp Inoperative (Cont'd)

Step	Action	Value	Yes	No
14	Check the wiring harnesses and connectors in circuit DK GRN from the I/P cluster terminal A16 to terminal 28 of the EBCM connector J1. Does the ohmmeter show the specified value?	$\infty$	Go to Step 15	Go to Step 16
15	Repair the open or high resistance found. Is the repair complete?	-	System OK	-
16	Check for continuity between terminal 19 of the ABS connector J1 and ground G106. Does the ground connection match the specified value?	0 $\Omega$	Go to Step 17	Go to Step 18
17	Replace the ABS unit. Is the repair complete?	-	System OK	-
18	Repair the continuity problem between terminal 19 of the EBCM connector J1 and ground G106. Is the repair complete?	-	System OK	-
19	1. Turn the ignition switch to LOCK. 2. Check fuse F18 in the I/P fuse block. Is this fuse blown?	-	Go to Step 20	Go to Step 21
20	Replace fuse F18. Is the repair complete?	-	System OK	-
21	Check fuse EF6 in the engine fuse block. Is this fuse blown?	-	Go to Step 22	Go to Step 23
22	Replace fuse EF6. Is the repair complete?	-	System OK	-
23	Measure the voltage at terminal 2 of the ignition switch connector by backprobing. Is the voltage within the specified value?	11-14 V	Go to Step 25	Go to Step 24
24	1. Check circuit RED between terminal A of C106 at the engine fuse block and terminal 2 of the ignition switch continuity. 2. Repair any open or high resistance found. Is the repair complete?	-	System OK	-
25	1. Turn the ignition switch to ON. 2. Backprobe terminal 4 (RED/YEL) of the ignition switch connector. Is the voltage within the specified value?	11-14 V	Go to Step 27	Go to Step 26
26	Replace the ignition switch. Is the repair complete?	-	System OK	-
27	1. Turn the ignition switch to LOCK. 2. Check circuit RED/YEL from terminal 4 of the ignition switch to fuse F18 in the I/P fuse block. Does the ohmmeter show the specified value?	$\infty$	Go to Step 28	Go to Step 29
28	Repair the open or the high resistance. Is the repair complete?	-	System OK	-
29	1. Remove the I/P cluster. 2. Check circuit PNK from fuse F18 to terminal B12 of the I/P cluster connector B. 3. Repair any open or high resistance found in a wiring harness, a splice pack, or a connector. Is the repair complete?	-	System OK	-

## SELF-DIAGNOSTICS

**Important:** The electronic brake control module (EBCM) turns the valve relay off when a diagnostic trouble code (DTC) is set. The scan tool will indicate that the valve relay is off when it is used to monitor the data list. This is normal and should not be considered a malfunction.

The EBCM performs system selfdiagnostics and can detect and often isolate system malfunctions. When it detects a malfunction, the EBCM sets a DTC that represents the malfunction, turns ON the ABS and/or the TCS indicators in most instances, and may disable the ABS and/or the TCS functions as necessary for the duration of the ignition cycle.

Once each ignition cycle, the EBCM performs an automatic test when the vehicle reaches 2.75 km/h (1.7 mph). In the course of this test, the system cycles each valve solenoid and the pump motor, along with the necessary relays, to check component operation. If the EBCM detects any malfunctions, it will set a DTC as described above.

## DISPLAYING DTCs

### Tools Required

Scan Tool

DTCs can be read through the use of the scan tool.

## CLEARING DTCs

### Tools Required

Scan Tool

The diagnostic trouble codes (DTCs) in the electronic brake control module (EBCM) memory are erased in one of two ways:

- Use the scan tool „Clear DTCs” selection.
- After 249 DTCfree ignition cycles.

These two methods are detailed below. Be sure to verify proper system operation and absence of DTCs when the clearing procedure is completed.

The EBCM will not permit DTC clearing until all DTCs have been displayed. Also, DTCs cannot be cleared by disconnecting the EBCM, disconnecting the battery cables, or turning the ignition switch to LOCK.

## Scan Tool Method

The scan tool can clear ABS/TCS system DTCs using the mass storage cartridge.

1. Install the scan tool and the mass storage cartridge.
2. Select „Fault Memory.”
3. Select „Clear Fault Memory.”

Clearing the fault memory cannot reset a valve relay which was shut down when the fault was recognized. Changes are possible only after the fault has been eliminated and the next ignition cycle has begun.

## Ignition Cycle Default

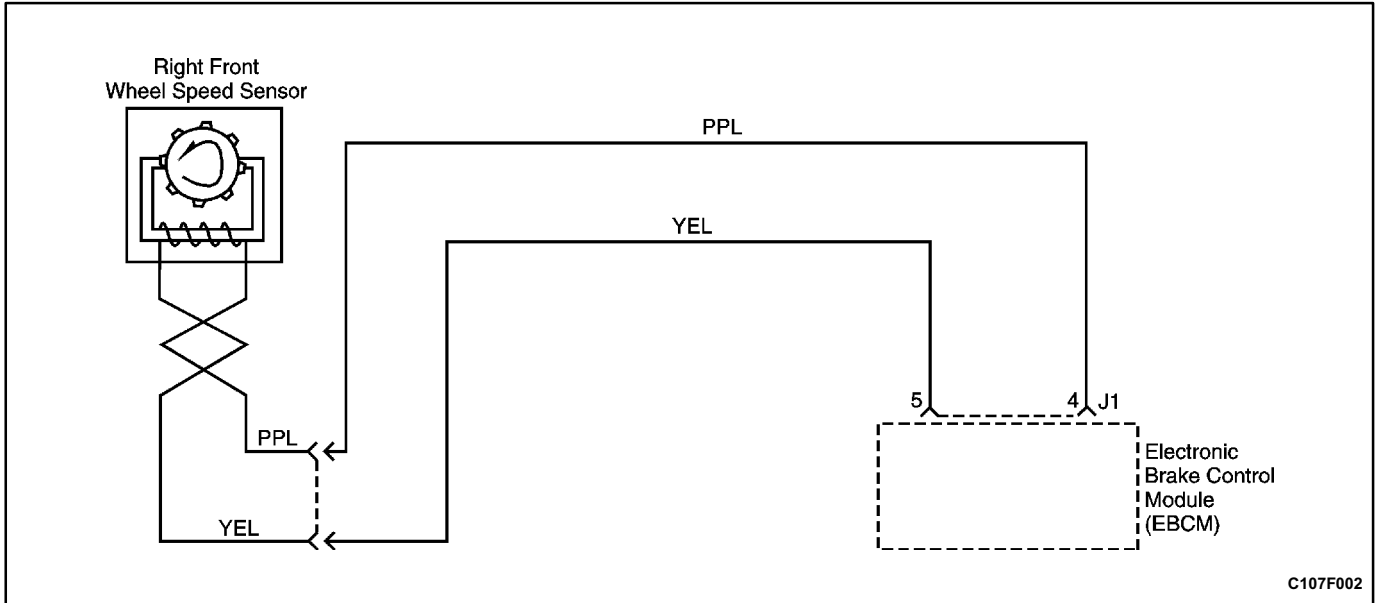
A DTC is erased from memory after 249 ignition cycles without any reappearance of that malfunction.

## INTERMITTENTS AND POOR CONNECTIONS

As with most electronic systems, intermittent malfunctions may be difficult to diagnose accurately. The following is a method to try to isolate an intermittent malfunction, especially in wheel speed circuitry.

If an ABS malfunction occurs, the ABS indicator will illuminate during the ignition cycle in which the malfunction was detected. If it is an intermittent problem which seems to have corrected itself (ABS indicator off), a history DTC will be stored. Also stored will be the history data of the DTC at the time the malfunction occurred. Use the scan tool modular diagnostic system to read ABS history data.

Most intermittents are caused by faulty electrical connections or wiring, although a sticking relay or solenoid can occasionally be at fault.



## DIAGNOSTIC TROUBLE CODE (DTC) 21 RIGHT FRONT WHEEL SPEED SENSOR FAULT

**Circuit Description**

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

**Diagnosis**

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

**Cause(s)**

- The wheel speed sensor is defective or disconnected.
- There is a problem in the wiring.
- There is a problem with a connector.

**Fail Action**

ABS action is disabled, and the ABS warning lamp is ON.

**Test Description**

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

1. This step begins an examination for a defective wheel speed sensor.

6. This step tests the wiring for a short to voltage.
8. This step tests the wiring for a short to ground.
10. This step tests for an open or high resistance in the wiring.

**Diagnostic Aids**

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

You can use the scan tool to monitor wheel speeds during a road test. Watch the wheel speeds being displayed on the scan tool to see if any of the readings is unusual, such as one sensor varying in speed from the other three, a signal going intermittently high or low, etc. If this does not identify the intermittent, wet the speed sensor harness on the underside of the vehicle and perform a road test, monitoring the wheel speeds with the scan tool.

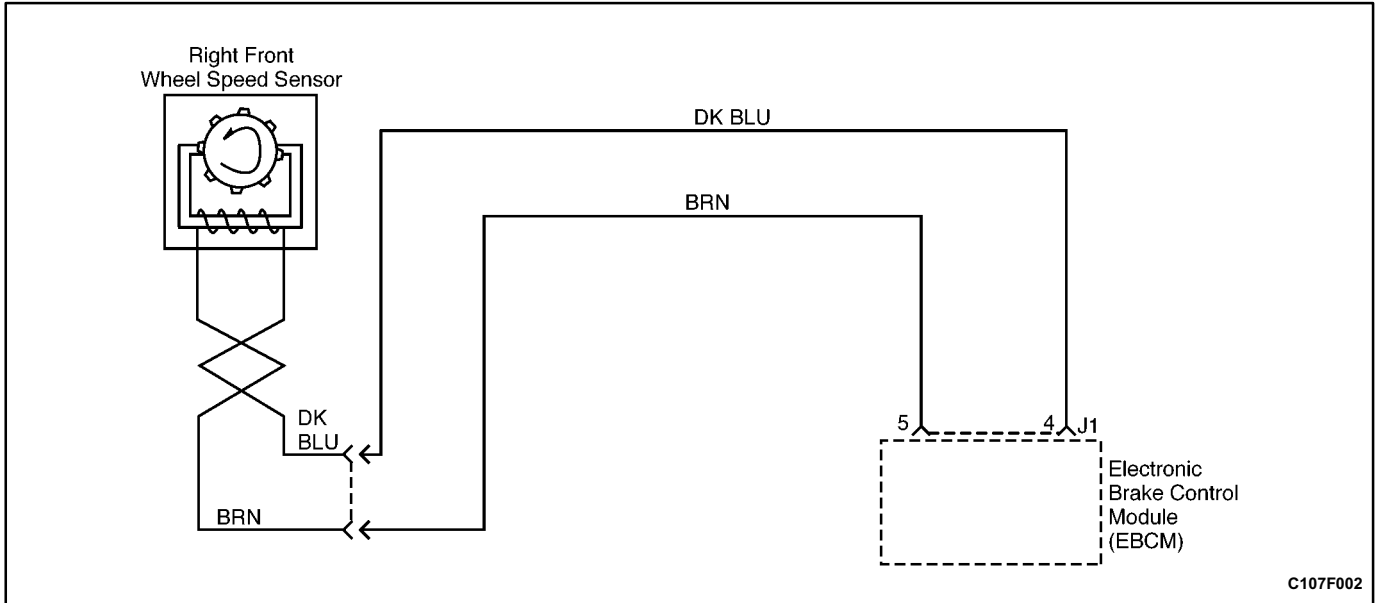
### DTC 21 - Right Front Wheel Speed Sensor Fault

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2



**DTC 21 - Right Front Wheel Speed Sensor Fault (Cont'd)**

Step	Action	Value	Yes	No
2	1. Turn the ignition switch to LOCK. 2. Disconnect the right front wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280-1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the ac millivolt range. 2. Measure the voltage output of between the wheel speed sensor terminals while rotating the wheel about 1 revolution every 2 seconds. Is the output within the specified value?	≈ 120 mV	Go to Step 6	Go to Step 5
5	Replace the speed sensor or the toothed wheel as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 4 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 5 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 4 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the PPL wire. 2. Measure the resistance between terminal 5 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the YEL wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or high resistance in the affected circuit as required. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F002

## DIAGNOSTIC TROUBLE CODE (DTC) 23 RIGHT FRONT WHEEL SPEED SENSOR CONTINUITY FAULT

### Circuit Description

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

### Diagnosis

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

### Cause(s)

- The wheel speed sensor is defective or disconnected.
- There is a problem in the wiring.
- There is a problem with a connector.

### Fail Action

ABS action is disabled, and the ABS warning lamp is ON.

### Test Description

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

1. This step begins an examination for a defective wheel speed sensor.
4. This step tests the wiring for a short to voltage.
6. This step tests the wiring for a short to ground.
8. This step tests for an open or a high resistance in the wiring.

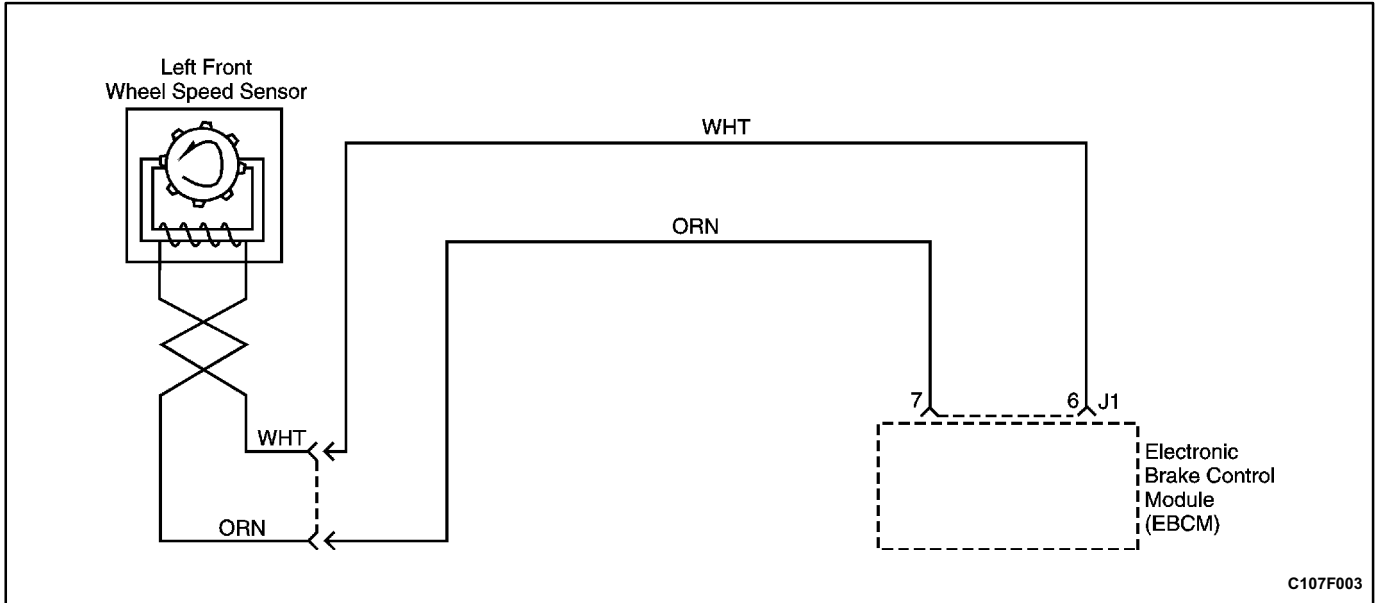
### Diagnostic Aids

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and connectors. Failure to inspect wiring and connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

**DTC 23 - Right Front Wheel Speed Sensor Continuity Fault**

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the right front wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25° C(77° F)?	1280-1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 5	Go to Step 6
5	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
6	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 4 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 5 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 7	Go to Step 8
7	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Measure the resistance between terminal 4 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the PPL wire. 2. Measure the resistance between terminal 5 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the YEL wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 9	Go to Step 10
9	Repair the open or high resistance in the affected circuit as required. Is the repair complete?	-	System OK	-
10	Replace the ABS unit. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 25 LEFT FRONT WHEEL SPEED SENSOR FAULT

**Circuit Description**

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

**Diagnosis**

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

**Cause(s)**

- The wheel speed sensor is defective or disconnected.
- There is a problem in the wiring.
- There is a problem with a connector.

**Fail Action**

ABS action is disabled, and the ABS warning lamp is ON.

**Test Description**

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

1. This step begins an examination for a defective wheel speed sensor.
4. This step tests the wiring for a short to voltage.
6. This step tests the wiring for a short to ground.
8. This step tests for an open or a high resistance in the wiring.

**Diagnostic Aids**

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

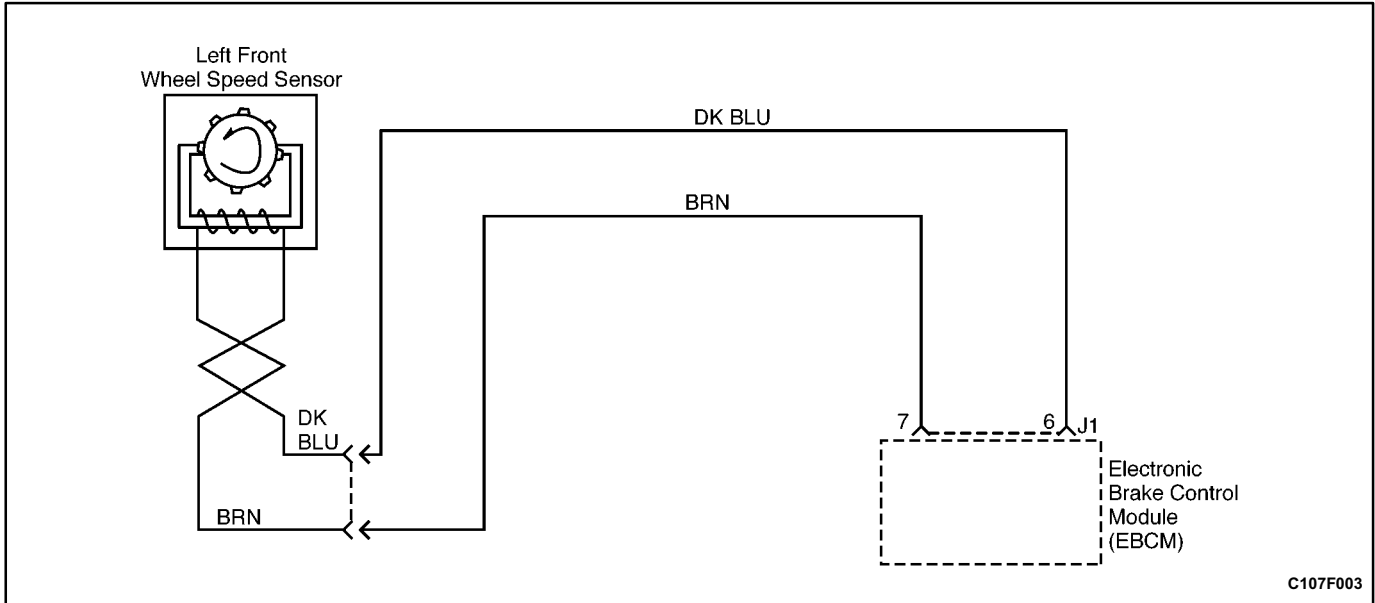
You can use the scan tool to monitor wheel speeds during a road test. Watch the wheel speeds being displayed on the scan tool to see if any of the readings is unusual, such as one sensor varying in speed from the other three, a signal going intermittently high or low, etc. If this does not identify the intermittent, wet the speed sensor harness on the underside of the vehicle and perform a road test, monitoring the wheel speeds with the scan tool.

### DTC 25 - Left Front Wheel Speed Sensor Fault

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2

**DTC 25 - Left Front Wheel Speed Sensor Fault (Cont'd)**

Step	Action	Value(s)	Yes	No
2	1. Turn the ignition switch to LOCK. 2. Disconnect the left front wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	12801920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the ac millivolt range. 2. Measure the voltage output of between the wheel speed sensor terminals while rotating the wheel about 1 revolution every 2 seconds. Is the output within the specified value?	≈ 120 mV	Go to Step 6	Go to Step 5
5	Replace the speed sensor or the toothed wheel as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 6 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 7 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 6 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the WHT wire. 2. Measure the resistance between terminal 7 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the ORN wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or high resistance in the affected circuit as required. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F003

## DIAGNOSTIC TROUBLE CODE (DTC) 27 LEFT FRONT WHEEL SPEED SENSOR CONTINUITY FAULT

### Circuit Description

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

### Diagnosis

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

### Cause(s)

- The wheel speed sensor is defective.
- There is a problem in the wiring.
- There is a problem with a connector.

### Fail Action

ABS action is disabled, and the ABS warning lamp is ON.

### Test Description

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

1. This step begins an examination for a defective wheel speed sensor.
4. This step tests the wiring for a short to voltage.
6. This step tests the wiring for a short to ground.
8. This step tests for an open or a high resistance in the wiring.

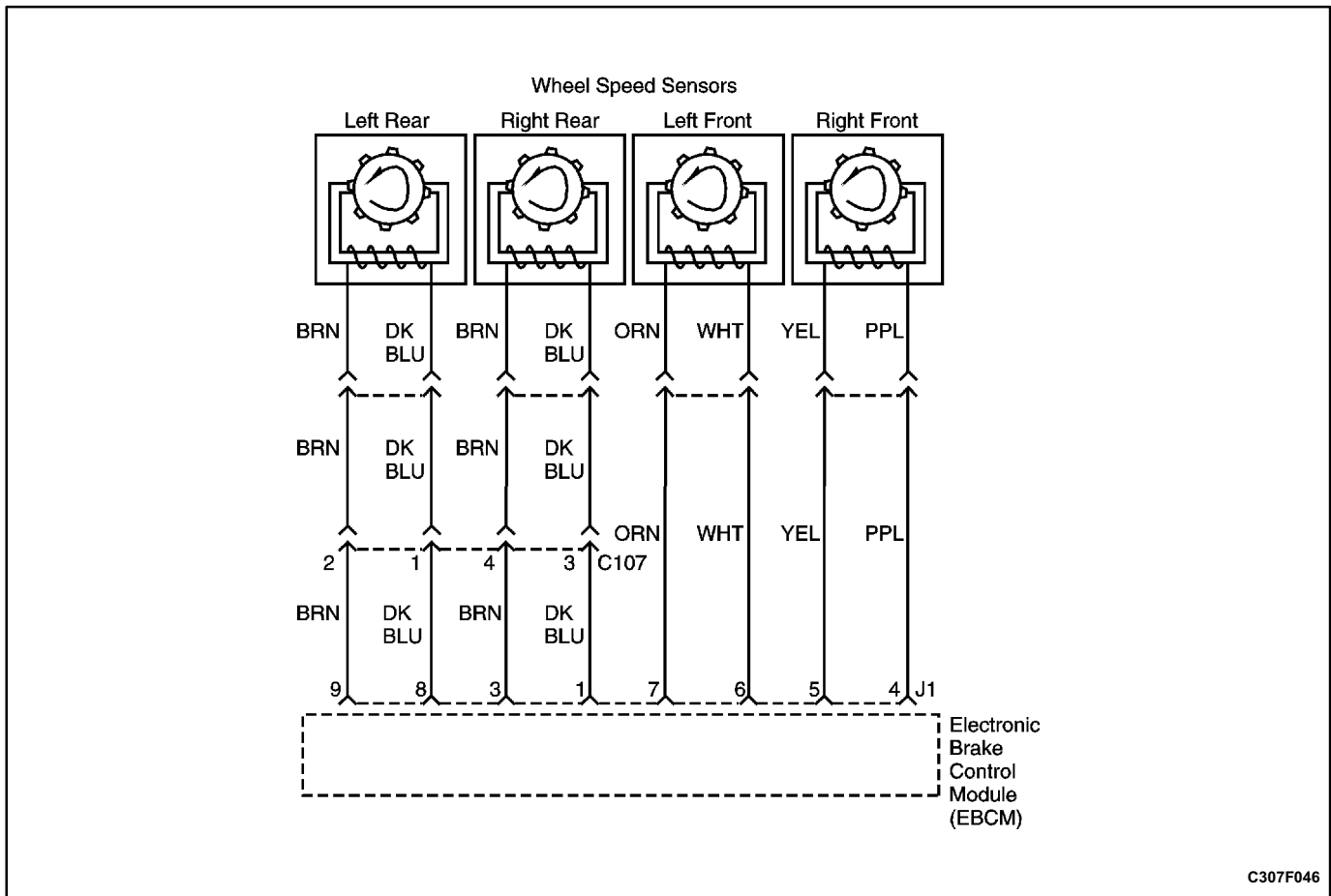
### Diagnostic Aids

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

**DTC 27 - Left Front Wheel Speed Sensor Continuity Fault**

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the left front wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280-1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 5	Go to Step 6
5	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
6	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 6 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 7 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 7	Go to Step 8
7	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Measure the resistance between terminal 6 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the WHT wire. 2. Measure the resistance between terminal 7 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the ORN wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 9	Go to Step 10
9	Repair the open or high resistance in the affected circuit as required. Is the repair complete?	-	System OK	-
10	Replace the ABS unit. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 28 WHEEL SPEED SENSOR FREQUENCY ERROR

### Circuit Description

The toothed wheel generates a voltage pulse as it moves past the wheel speed sensor. Each tooth gap per tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine wheel speed. The voltage generated depends on the air gap between the wheel speed sensor and the toothed wheel, and on the wheel speed.

### Diagnosis

This DTC will set when the EBCM cannot identify which wheel speed sensor is causing the malfunction. It is necessary to check all wheel speed sensors and associated wiring to determine the cause of the DTC.

### Cause(s)

- Incorrect number of teeth on the toothed wheel.
- Damaged or broken teeth on the toothed wheel.
- Discontinuity or short in speed wheel speed sensor wiring.

### Fail Action

Antilock brake system (ABS) action is disabled and the ABS warning lamp is ON.

### Test Description

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

1. This step begins the examination of the front wheel speed sensor sensors.
3. This step checks for a problem with one of the front toothed rings.
5. This step checks the front speed wheel speed sensors.
7. This step checks for shorts in a front wheel speed sensor harness.
9. This step checks for opens in a front wheel speed sensor harness.
11. This step begins a check of the rear wheel speed sensors.
13. This step checks for a problem with one of the rear toothed rings.
15. This step checks the rear wheel speed sensors.
17. This step checks for shorts in a rear wheel speed sensor harness.
19. This step checks for opens in a rear wheel speed sensor harness.

### Diagnostic Aids

DTC 28 may be set by running the scan tool auto test if the throttle angle readings are not updating while in the data list mode. If this is the case, clear the DTCs, disconnect the scan tool, and road test the vehicle to at least 25 km/h (15 mph) to see if the DTC resets.



Check the toothed wheels for any large grooves, gouges, marks, etc. that might influence the tooth's signal at the wheel speed sensor. Also check for a buildup of foreign material in the gaps between teeth in the toothed wheel, this material may cause this malfunction.

A badly worn hub/bearing assembly may cause this malfunction. The wheel speed sensor toothed

wheel air gap may change excessively due to bearing play.

If an improper rear hub assembly or front outer constant velocity joint is installed, one with a toothed wheel containing the incorrect number of teeth, this DTC can set. Be sure that all the toothed wheels have 48 teeth.

**DTC 28 - Wheel Speed Sensor Frequency Error**

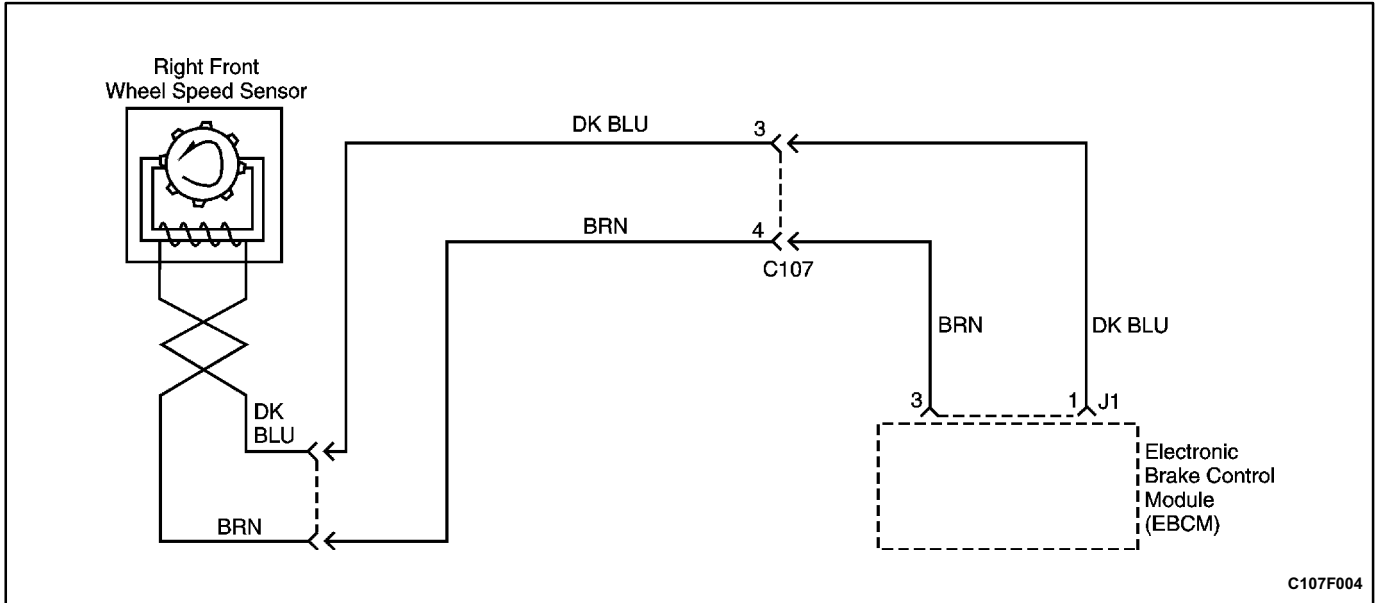
Step	Action	Value(s)	Yes	No
1	Visually inspect the wiring for the front wheel speed sensor sensors. Is there any damage?	-	Go to Step 2	Go to Step 3
2	Repair or replace components as required. Is the repair complete?	-	System OK	-
3	Check that the correct outer constant velocity (CV) joints are installed on the vehicle. They should have speed rings with 48 teeth. Is one of these incorrect?	-	Go to Step 4	Go to Step 5
4	Replace the incorrect outer CV joint with the proper unit. Is the repair complete?	-	System OK	-
5	1. Disconnect the wheel speed sensor harnesses from the wheel speed sensor connectors. 2. Measure the wheel speed sensor resistance at the wheel speed sensor connector terminals. Does the resistance fall within the specified values for both wheel speed sensors?	1280-1920 Ω	Go to Step 7	Go to Step 6
6	Replace the faulty wheel speed sensor. Is the repair complete?	-	System OK	-
7	1. Disconnect ABS control module connector J1. 2. Check each wheel speed sensor harness for a short circuit between its wires with a digital ohmmeter attached to the two terminals at the harness side of the wheel speed sensor connector. 3. Also check each wheel speed sensor harness wire for a short to ground from the connector terminals. Is there any short circuit in either wheel speed sensor harness?	-	Go to Step 8	Go to Step 9
8	Repair the short circuit in the wiring or from a wiring harness to ground. Is the repair complete?	-	System OK	-
9	Check the continuity of the wiring in both front speed wheel speed sensor circuits between the ABS connector J1 and the wheel speed sensor wheel speed sensor connector on each side of the vehicle. ● The left side uses terminals 6 and 7 at the ABS connector J1. ● The right side uses terminals 4 and 5 at the ABS connector J1. Is continuity good for both harnesses?	-	Go to Step 11	Go to Step 10

**DTC 28 - Wheel Speed Sensor Frequency Error (Cont'd)**

Step	Action	Value(s)	Yes	No
10	Repair the discontinuity found in the front wheel speed sensor harness. Is the repair complete?	-	System OK	-
11	1. Visually inspect the wiring for the rear wheel speed sensor wheel speed sensors. 2. Check that the wheel speed sensors are properly mounted and that the retaining bolts are properly tightened. Is there any damage?	-	Go to Step 12	Go to Step 13
12	Repair or replace components as required. Is the repair complete?	-	System OK	-
13	Remove each speed wheel speed sensor from the rear knuckles and inspect the toothed ring through the wheel speed sensor mounting holes. <ul style="list-style-type: none"> <li>● Make sure that the toothed ring has 48 teeth.</li> <li>● Check for any damaged or missing teeth.</li> <li>● Check that the ring is properly positioned under the wheel speed sensor.</li> </ul> Is there any damage or other fault with either speed ring?	-	Go to Step 14	Go to Step 15
14	Replace the rear wheel hub with the proper unit. Is the repair complete?	-	System OK	-
15	1. Disconnect the rear wheel speed sensor harnesses from the wheel speed sensor connectors. 2. Measure the wheel speed sensor resistance at the wheel speed sensor connector terminals. Does the resistance fall within the specified values for both wheel speed sensors?	1280-1920 $\Omega$	Go to Step 17	Go to Step 16
16	Replace the faulty wheel speed sensor. Is the repair complete?	-	System OK	-
17	1. The ABS control module connector J1 should still be disconnected. Disconnect it now if it is not. 2. Check each wheel speed sensor harness for a short circuit between its wires with a digital ohmmeter attached to the two terminals at the harness side of the wheel speed sensor connector. 3. Also check each wheel speed sensor harness wire for a short to ground from the connector terminals. Is there any short circuit in either wheel speed sensor harness?	-	Go to Step 18	Go to Step 19
18	Repair the short circuit in the wiring or from a wire to ground. Is the repair complete?	-	System OK	-

**DTC 28 - Wheel Speed Sensor Frequency Error (Cont'd)**

Step	Action	Value(s)	Yes	No
19	<p>Check the continuity of the wiring in both rear speed wheel speed sensor circuits between the ABS connector J1 and the wheel speed sensor wheel speed sensor connector on each side of the vehicle.</p> <ul style="list-style-type: none"> <li>● The left side uses terminals 8 and 9 at the ABS connector J1.</li> <li>● The right side uses terminals 1 and 3 at the ABS connector J1.</li> </ul> <p>Is continuity good for both harnesses?</p>	-	Go to <i>Step 21</i>	Go to <i>Step 20</i>
20	<p>Repair the discontinuity found in the rear wheel speed sensor wheel speed sensor harness or connector C107.</p> <p>Is the repair complete?</p>	-	System OK	-
21	<p>Replace the ABS unit.</p> <p>Is the repair complete?</p>	-	System OK	-



C107F004

## DIAGNOSTIC TROUBLE CODE (DTC) 31 RIGHT REAR WHEEL SPEED SENSOR FAULT

**Circuit Description**

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

**Diagnosis**

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

**Cause(s)**

- The wheel speed sensor is defective.
- There is a problem in the wiring.
- There is a problem with a connector.

**Fail Action**

ABS action is disabled, and the ABS warning lamp is ON.

**Test Description**

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

1. This step begins an examination for a defective wheel speed sensor.
6. This step tests the wiring for a short to voltage.
8. This step tests the wiring for a short to ground.
10. This step tests for an open or high resistance in the wiring.

**Diagnostic Aids**

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

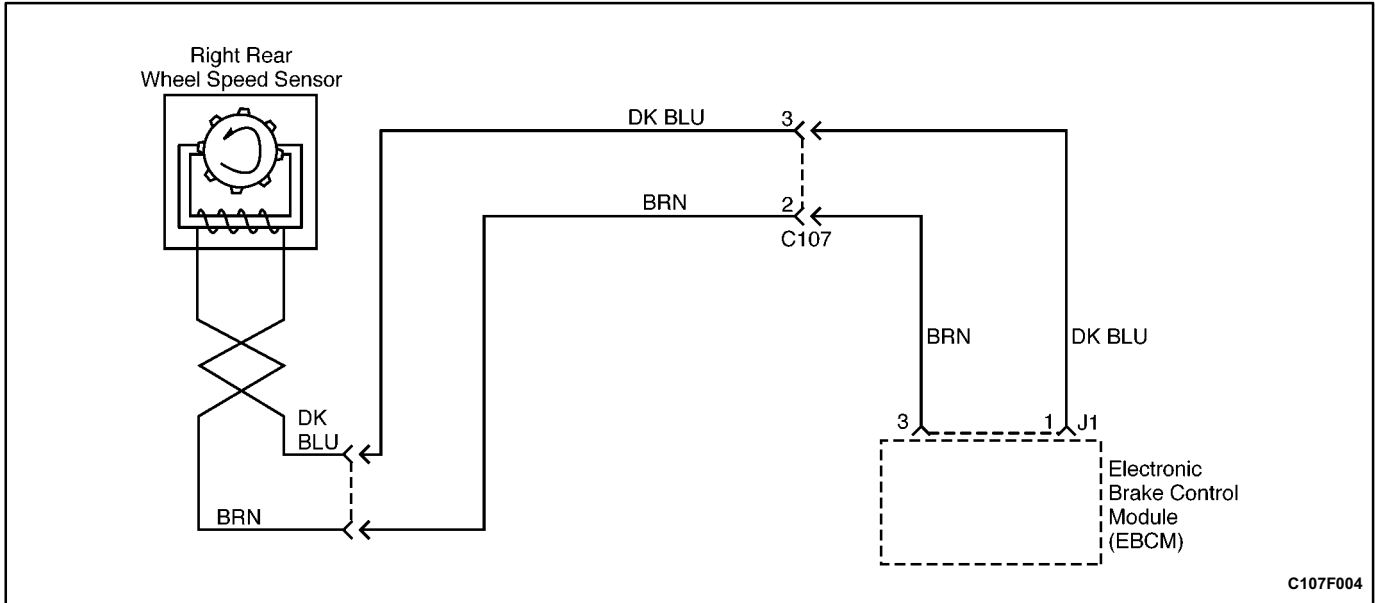
You can use the scan tool to monitor wheel speeds during a road test. Watch the wheel speeds being displayed on the scan tool to see if any of the readings is unusual, such as one sensor varying in speed from the other three, a signal going intermittently high or low, etc. If this does not identify the intermittent, wet the speed sensor harness on the underside of the vehicle and perform a road test, monitoring wheel speeds with the scan tool.

### DTC 31 - Right Rear Wheel Speed Sensor Fault

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2

**DTC 31 - Right Rear Wheel Speed Sensor Fault (Cont'd)**

Step	Action	Value(s)	Yes	No
2	1. Turn the ignition switch to LOCK. 2. Disconnect the right rear wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280-1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the ac millivolt range. 2. Measure the voltage output of between the wheel speed sensor terminals while rotating the wheel about 1 revolution every 2 seconds. Is the output within the specified value?	≈ 120 mV	Go to Step 6	Go to Step 5
5	Replace the speed sensor or the toothed wheel as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 1 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 3 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 1 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the DK BLU wire. 2. Measure the resistance between terminal 3 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the BRN wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or high resistance in the affected circuit as required. Be sure to check terminals 3 and 4 of connector C107. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 33 RIGHT REAR WHEEL SPEED SENSOR CONTINUITY FAULT

### Circuit Description

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

### Diagnosis

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

### Cause(s)

- The wheel speed sensor is defective.
- There is a problem in the wiring.
- There is a problem with a connector.

### Fail Action

ABS action is disabled, and the ABS warning lamp is ON.

### Test Description

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

1. This step begins an examination for a defective wheel speed sensor.
4. This step tests the wiring for a short to voltage.
6. This step tests the wiring for a short to ground.
8. This step tests for an open or a high resistance in the wiring.

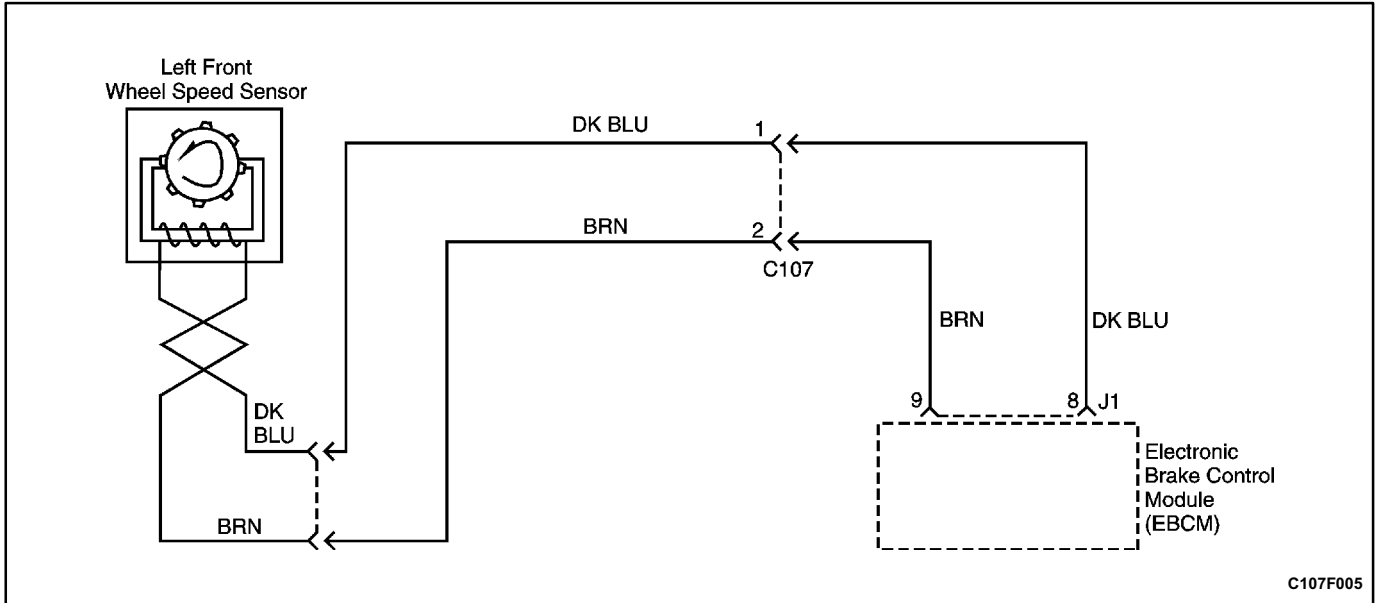
### Diagnostic Aids

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

**DTC 27 - Right Rear Wheel Speed Sensor Continuity Fault**

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the right rear wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280 1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 5	Go to Step 6
5	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
6	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 1 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 3 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 7	Go to Step 8
7	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Measure the resistance between terminal 1 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the DK BLU wire. 2. Measure the resistance between terminal 3 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the BRN wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 9	Go to Step 10
9	Repair the open or high resistance in the affected circuit as required. Be sure to check terminals 3 and 4 of connector C107. Is the repair complete?	-	System OK	-
10	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F005

## DIAGNOSTIC TROUBLE CODE (DTC) 35 LEFT REAR WHEEL SPEED SENSOR FAULT

### Circuit Description

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

### Diagnosis

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

### Cause(s)

- The wheel speed sensor is defective.
- There is a problem in the wiring.
- There is a problem with a connector.

### Fail Action

ABS action is disabled, and the ABS warning lamp is ON.

### Test Description

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

1. This step begins an examination for a defective wheel speed sensor.
6. This step tests the wiring for a short to voltage.
8. This step tests the wiring for a short to ground.
10. This step tests for an open or a high resistance in the wiring.

### Diagnostic Aids

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

You can use the scan tool to monitor wheel speeds during a road test. Watch the wheel speeds being displayed on the scan tool to see if any of the readings is unusual, such as one sensor varying in speed from the other three, a signal going intermittently high or low, etc. If this does not identify the intermittent, wet the speed sensor harness on the underside of the vehicle and perform a road test, monitoring wheel speeds with the scan tool.

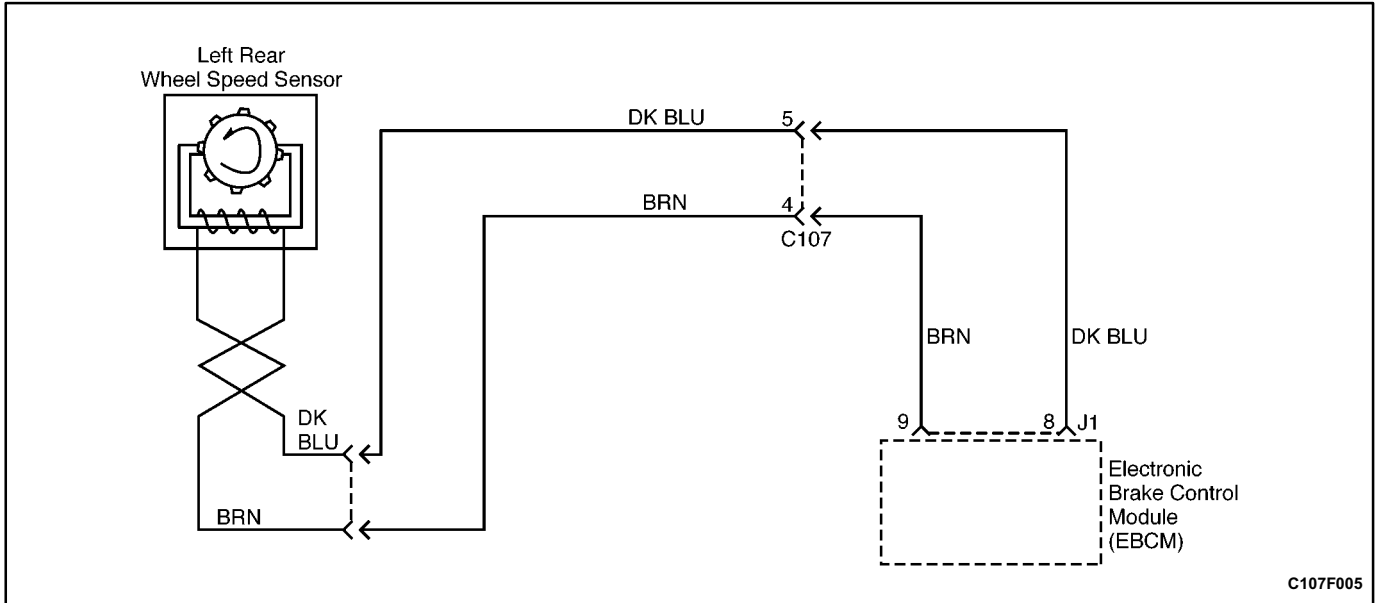
### DTC 35 - Left Rear Wheel Speed Sensor Fault

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2



**DTC 35 - Left Rear Wheel Speed Sensor Fault (Cont'd)**

Step	Action	Value(s)	Yes	No
2	1. Turn the ignition switch to LOCK. 2. Disconnect the left rear wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280-1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the ac millivolt range. 2. Measure the voltage output of between the wheel speed sensor terminals while rotating the wheel about 1 revolution every 2 seconds. Is the output within the specified value?	≈ 120 mV	Go to Step 6	Go to Step 5
5	Replace the speed sensor or the toothed wheel as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 8 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 9 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 8 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the DK BLU wire. 2. Measure the resistance between terminal 9 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the BRN wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or the high resistance in the affected circuit as required. Be sure to check terminals 1 and 2 of connector C107. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F005

## DIAGNOSTIC TROUBLE CODE (DTC) 37 LEFT REAR WHEEL SPEED SENSOR CONTINUITY FAULT

### Circuit Description

The toothed wheel generates a voltage pulse as it moves past the sensor. Each tooth gap tooth series on the wheel generates the pulses. The electronic brake control module (EBCM) uses the frequency of these pulses to determine the wheel speed. The voltage generated depends on the air gap between the sensor and the toothed wheel, and on the wheel speed.

### Diagnosis

This procedure checks for a malfunctioning wheel speed sensor, a short to ground or to voltage in the wiring, or a contact problem in a connector.

### Cause(s)

- The wheel speed sensor is defective.
- There is a problem in the wiring.
- There is a problem with a connector.

### Fail Action

ABS action is disabled, and the ABS warning lamp is ON.

### Test Description

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

1. This step begins an examination for a defective wheel speed sensor.
4. This step tests the wiring for a short to voltage.
6. This step tests the wiring for a short to ground.
8. This step tests for an open or high resistance in the wiring.

### Diagnostic Aids

Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

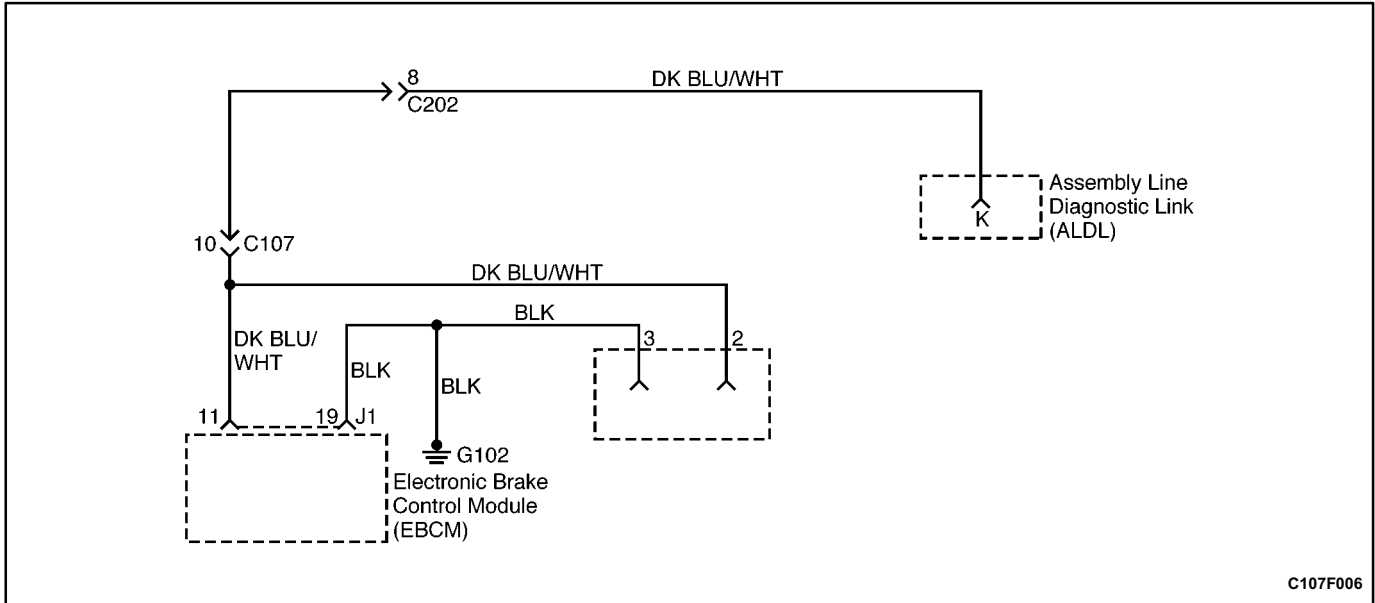
**DTC 37 - Left Rear Wheel Speed Sensor Continuity Fault**

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the left rear wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280-1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 5	Go to Step 6
5	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
6	1. Turn the ignition switch to LOCK. 2. Measure the resistance to ground from terminal 8 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 9 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 7	Go to Step 8
7	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Measure the resistance between terminal 8 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the DK BLU wire. 2. Measure the resistance between terminal 9 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the BRN wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 9	Go to Step 10
9	Repair the open or high resistance in the affected circuit as required. Be sure to check terminals 1 and 2 of connector C107. Is the repair complete?	-	System OK	-
10	Replace the ABS unit. Is the repair complete?	-	System OK	-



**DTC 41/42 - Right Front Inlet and Outlet Valve Solenoid Fault**

Step	Action	Value(s)	Yes	No
1	1. Raise and suitably support the vehicle at the corner being tested. 2. Turn the ignition switch to ON. 3. Install the scan tool to the assembly line diagnostic link (ALDL) and select „Wheel front right” to begin the solenoid tests at that wheel. This will test both the inlet and the outlet valves. 4. When the scan tool indicates „Pressure hold,” depress and hold the brake pedal until the end of the test. 5. Have an assistant attempt to rotate the wheel. Can the wheel be rotated?	-	Go to Step 2	Go to Step 6
2	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure increase,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated now?	-	Go to Step 6	Go to Step 3
3	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure release on,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated?	-	Go to Step 4	Go to Step 6
4	1. Release brake pedal pressure when the scan tool indicates „Pressure release off.” 2. Clear all DTCs. 3. Road test the vehicle. Does the DTC set again?	-	Go to Step 6	Go to Step 5
5	1. Check the wiring harness and the connector terminals for an intermittent problem. 2. Repair any problem found. Is the repair complete?	-	System OK	-
6	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F006

## DIAGNOSTIC TROUBLE CODE (DTC) 43/44 RIGHT FRONT PRIME LINE AND TRACTION CONTROL SYSTEM (TCS) PILOT VALVE FAULT

### Circuit Description

The solenoid valve coil circuits are supplied with power from the battery when the valve relay is energized. Switched ground is provided by the electronic brake control module (EBCM) to each coil.

### Diagnosis

This procedure checks whether the right front TCS valves are functioning.

### Cause(s)

- A solenoid coil is open or shorted.

### Fail Action

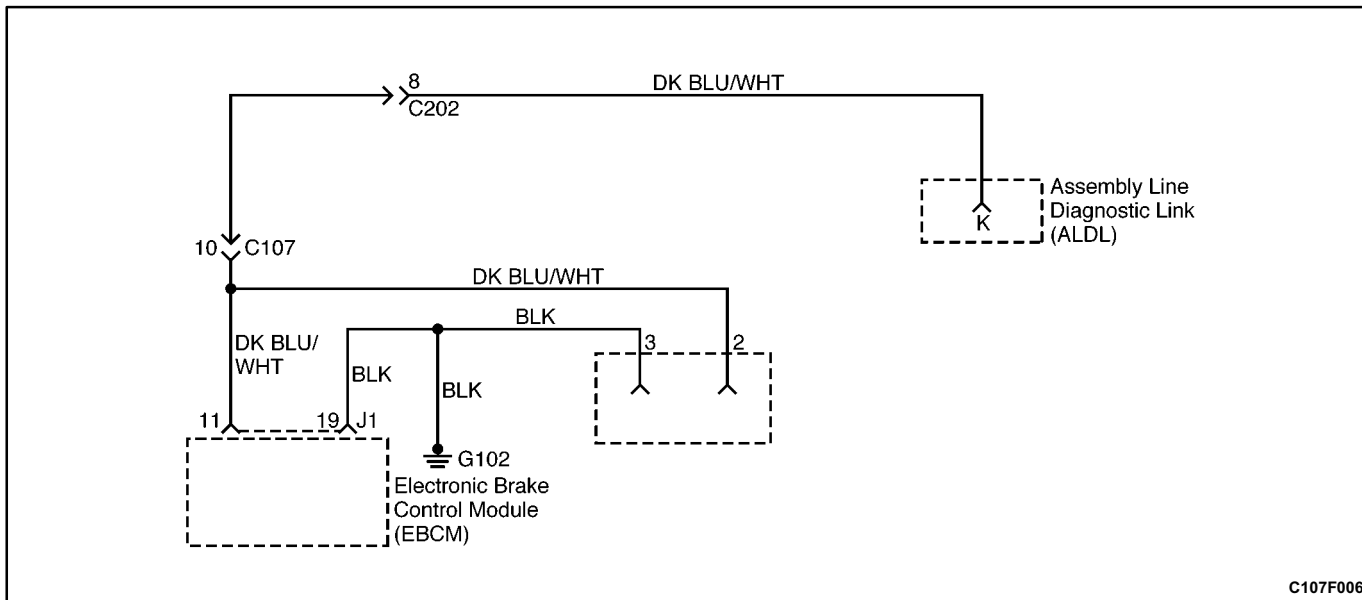
Antilock brake system (ABS) is disabled, and the ABS warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

### DTC 43/ 44 - Right Front Prime Line and TCS Pilot Valve Fault

Step	Action	Value(s)	Yes	No
1	1. Raise and suitably support the vehicle at the corner being tested. 2. Turn the ignition switch to ON. <b>Important:</b> Do not step on the brake pedal at any time during this test. 3. Install the scan tool to the assembly line diagnostic link (ALDL). 4. Select the ABD function and „Wheel front right” to begin the solenoid tests at that wheel. This will test both the prime and pilot valves. 5. When the scan tool indicates a pressure increase, attempt to rotate the wheel. Can the wheel be rotated?	-	Go to Step 6	Go to Step 2
2	When the scan tool indicates, that the prime valve was switched OFF, attempt to rotate the wheel again. Can the wheel be rotated now?	-	Go to Step 6	Go to Step 3
3	When the scan tool indicates that the pilot valve and the pump motor were switched OFF, attempt to rotate the wheel again. Can the wheel be rotated?	-	Go to Step 4	Go to Step 6

**DTC 43/ 44 - Right Front Prime Line and TCS Pilot Valve Fault (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
4	1. Clear all the DTCs. 2. Road test the vehicle. Does the DTC set again?	-	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	1. Check the wiring harness and connector terminals for an intermittent problem. 2. Repair any problem found. Is the repair complete?	-	System OK	-
6	Replace the ABS unit. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 45/46 LEFT FRONT INLET AND OUTLET VALVE SOLENOID FAULT

### Circuit Description

The solenoid valve coil circuits are supplied with power from the battery when the valve relay is energized. Switched ground is provided by the electronic brake control module (EBCM) to each coil.

### Diagnosis

This procedure checks whether the left front inlet and outlet valves are functioning.

### Cause(s)

- A valve has failed.
- A solenoid coil is open or shorted.

### Fail Action

ABS is disabled, and the ABS warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

### Test Description

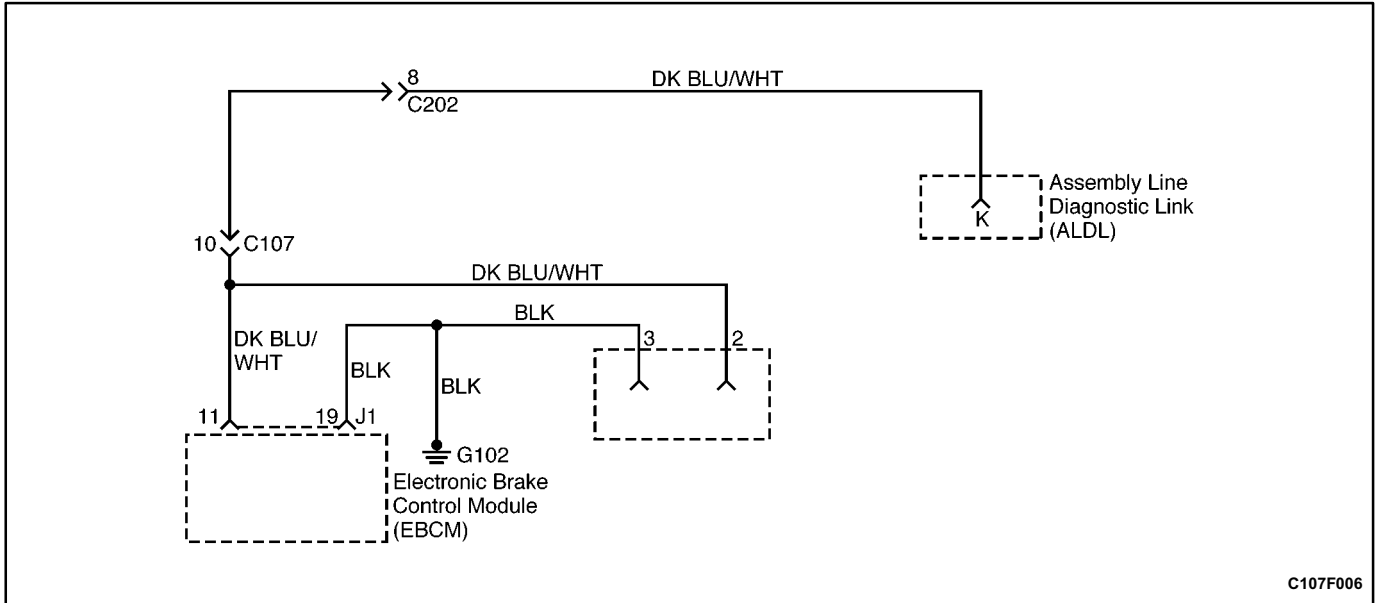
The number(s) below refer to step(s) on the diagnostic table.

1. This step begins the test of the inlet valve.
3. This step tests the outlet valve.



**DTC 45/46- Left Front Inlet and Outlet Valve Solenoid Fault**

Step	Action	Value(s)	Yes	No
1	1. Raise and suitably support the vehicle at the corner being tested. 2. Turn the ignition switch to ON. 3. Install the scan tool to the assembly line diagnostic link (ALDL) and select „Wheel front left” to begin the solenoid tests at that wheel. This will test both the inlet and the outlet valves. 4. When the scan tool indicates „Pressure hold,” depress and hold the brake pedal until the end of the test. 5. Have an assistant attempt to rotate the wheel. Can the wheel be rotated?	-	Go to Step 2	Go to Step 6
2	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure increase,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated now?	-	Go to Step 6	Go to Step 3
3	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure release on,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated?	-	Go to Step 4	Go to Step 6
4	1. Release brake pedal pressure when the scan tool indicates „Pressure release off.” 2. Clear all DTCs. 3. Road test the vehicle. Does the DTC set again?	-	Go to Step 6	Go to Step 5
5	1. Check the wiring harness and connector terminals for an intermittent problem. 2. Repair any problem found. Is the repair complete?	-	System OK	-
6	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F006

## DIAGNOSTIC TROUBLE CODE (DTC) 47/48 LEFT FRONT PRIME LINE AND TRACTION CONTROL SYSTEM (TCS) PILOT VALVE FAULT

### Circuit Description

The solenoid valve coil circuits are supplied with power from the battery when the valve relay is energized. Switched ground is provided by the electronic brake control module (EBCM) to each coil.

### Diagnosis

This procedure checks whether the left front TCS valves are functioning.

### Cause(s)

- A solenoid coil is open or shorted.

### Fail Action

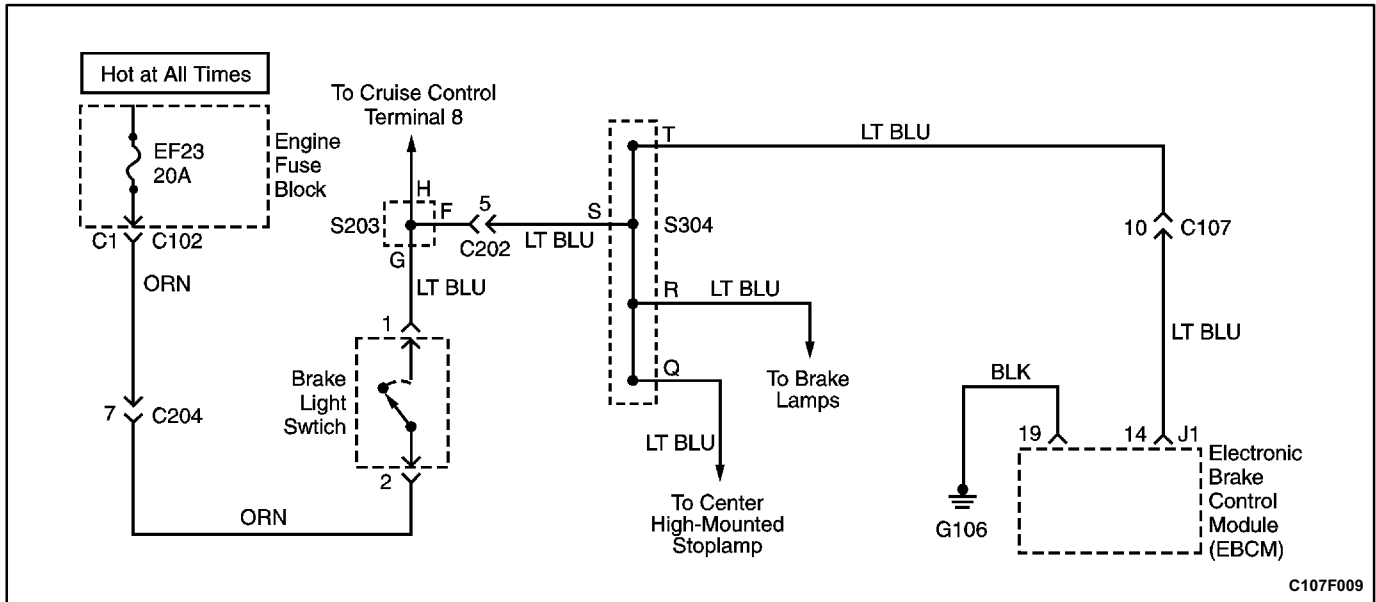
Antilock brake system (ABS) is disabled, and the ABS warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

### DTC 47/48 - Left Front Prime Line and TCS Pilot Valve Fault

Step	Action	Value(s)	Yes	No
1	1. Raise and suitably support the vehicle at the corner being tested. 2. Turn the ignition switch to ON. <b>Important:</b> Do not step on the brake pedal at any time during this test. 3. Install the scan tool to the assembly line diagnostic link (ALDL). 4. Select the TCS function and wheel front left to begin the solenoid tests at that wheel. This will test both the prime and pilot valves. 5. When the scan tool indicates a pressure increase, attempt to rotate the wheel. Can the wheel be rotated?	-	Go to Step 6	Go to Step 2
2	When the scan tool indicates that the prime valve was switched OFF, attempt to rotate the wheel again. Can the wheel be rotated now?	-	Go to Step 6	Go to Step 3
3	When the scan tool indicates that the pilot valve and the pump motor were switched OFF, attempt to rotate the wheel again. Can the wheel be rotated?	-	Go to Step 4	Go to Step 6

**DTC 47/48 - Left Front Prime Line and TCS Pilot Valve Fault (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
4	1. Clear all the DTCs. 2. Road test the vehicle. Does the DTC set again?	-	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	1. Check the wiring harness and connector terminals for an intermittent problem. 2. Repair any problem found. Is the repair complete?	-	System OK	-
6	Replace the ABS unit. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 50 BRAKE LIGHT SWITCH (BLS) FAULT

### Circuit Description

When the brake pedal is depressed, the contacts on the brake light switch close to illuminate the brake lights. Battery voltage is also applied to terminal 14 of the electronic brake control module (EBCM), which signals the ABS controller that the brakes are applied and ABS may be needed. Without this, signals from a wheel speed sensor that may indicate need for ABS intervention are questionable. When the brake pedal is not depressed, the EBCM terminal 14 is grounded through the brake lights.

### Diagnosis

This procedure will check whether there is no output or constant output from the brake light switch and will determine the cause as a faulty switch or a problem in the circuitry.

### Cause(s)

- The ground connection or the positive connection at the EBCM has failed.
- There is an open, short to ground, or short to positive in the vehicle wiring.
- The brake light switch has failed.

### Fail Action

The system records a DTC 50. ABS operation is not disabled.

### Test Description

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

1. This simple test will isolate the problem to the fuse brake light switch splice 304 area or the splice 304 EBCM area.
3. This is the first step in identifying an open, a short to ground, a short to voltage, or a faulty brake light switch.
11. This step begins the process of finding an open, a defective connector, or a faulty EBCM.

### Diagnostic Aids

Inspect wiring and connectors carefully and thoroughly. Failure to do so could result in misdiagnosis, causing part replacement with reappearance of the malfunction.

### DTC 50 - Brake Light Switch (BLS) Fault

Step	Action	Value(s)	Yes	No
1	Step on the brake pedal. Do the brake lights come on at all?	-	Go to Step 2	Go to Step 3
2	Remove your foot from the brake pedal. Do the lights stay on continuously?	-	Go to Step 8	Go to Step 11

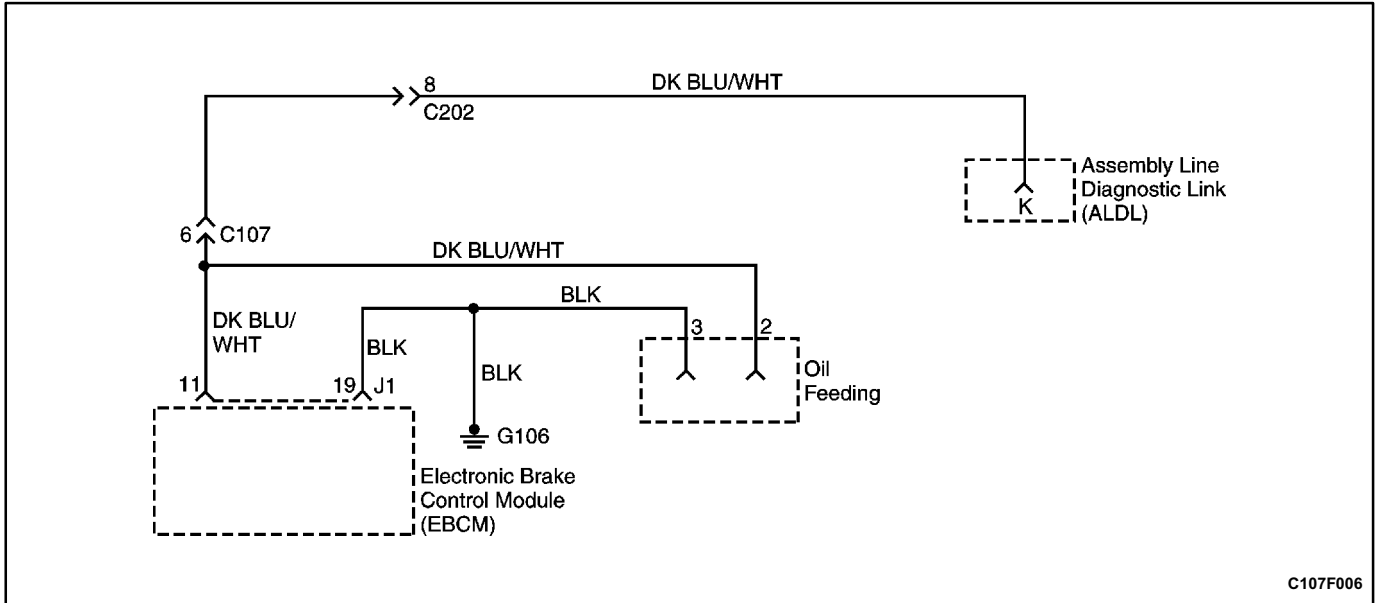
**DTC 50 - Brake Light Switch (BLS) Fault (Cont'd)**

Step	Action	Value(s)	Yes	No
3	Check fuse EF23 in the engine compartment fuse block. Is fuse EF23 blown?	-	Go to Step 4	Go to Step 6
4	1. Replace fuse EF23. 2. Check the new fuse. Does the new fuse blow?	-	Go to Step 5	Go to Step 7
5	1. Repair the short to ground in the brake light circuitry. 2. Install a new fuse EF23. Is the repair complete?	-	System OK	-
6	Repair the open in the brake light switch circuit ORN from terminal C1 of connector C102 at the engine fuse block to the brake light switch, circuit LT BLU from the brake light switch through splice S203 and terminal 5 of connector C202 to splice S304, or a defective brake light switch. Is the repair complete?	-	System OK	-
7	Check for functioning of the brake lights and the ABS system. Is the repair complete?	-	System OK	-
8	Check the brake light switch on the brake pedal. Is the switch faulty?	-	Go to Step 9	Go to Step 10
9	Repair the brake light switch. Is the repair complete?	-	System OK	-
10	Repair the short to positive in the circuit LT BLU between the brake light switch, splice S304, the brake lights, the center highmounted stoplamp, and the ABS wiring harness connector at the EBCM terminal 14. Is the repair complete?	-	System OK	-
11	1. Disconnect the EBCM connector. 2. Use a digital voltmeter (DVM) to measure voltage between pins 14 and 19 of the ABS harness connector at the EBCM. 3. Have an assistant step on the brake pedal. Does the DVM indicate the specified value?	11-14 V	Go to Step 13	Go to Step 12
12	1. Examine the connection between the ABS harness connector and the EBCM connector terminals 14 and 19. 2. Examine the connection at terminal 10 of connector C107. 3. Examine the wiring of circuit LT BLU between splice S304 and terminal 14 of the ABS EBCM connector for an open condition. 4. Examine the wiring between ground G106 and terminal 19 of the ABS EBCM connector. 5. Repair the broken wire or the defective connector terminal, or replace the connector, the wiring harness as required. Is the repair complete?	-	System OK	-

**DTC 50 - Brake Light Switch (BLS) Fault (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
13	Check the interface between the ABS EBCM connector and the EBCM. Is there a poor connection at terminal 14 or 19?	-	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	Repair the connector or replace the wiring harness or the ABS unit as required. Is the repair complete?	-	System OK	-
15	Replace the ABS unit. Is the repair complete?	-	System OK	-

**BLANK**



## DIAGNOSTIC TROUBLE CODE (DTC) 51/52 RIGHT REAR INLET AND OUTLET VALVE SOLENOID FAULT

### Circuit Description

The solenoid valve coil circuits are supplied with power from the battery when the valve relay is energized. Switched ground is provided by the electronic brake control module (EBCM) to each coil.

### Diagnosis

This procedure checks whether the right rear inlet and outlet valves are functioning.

### Cause(s)

- A valve has failed.
- A solenoid coil is open or shorted.

### Fail Action

ABS is disabled, and the ABS warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

### Test Description

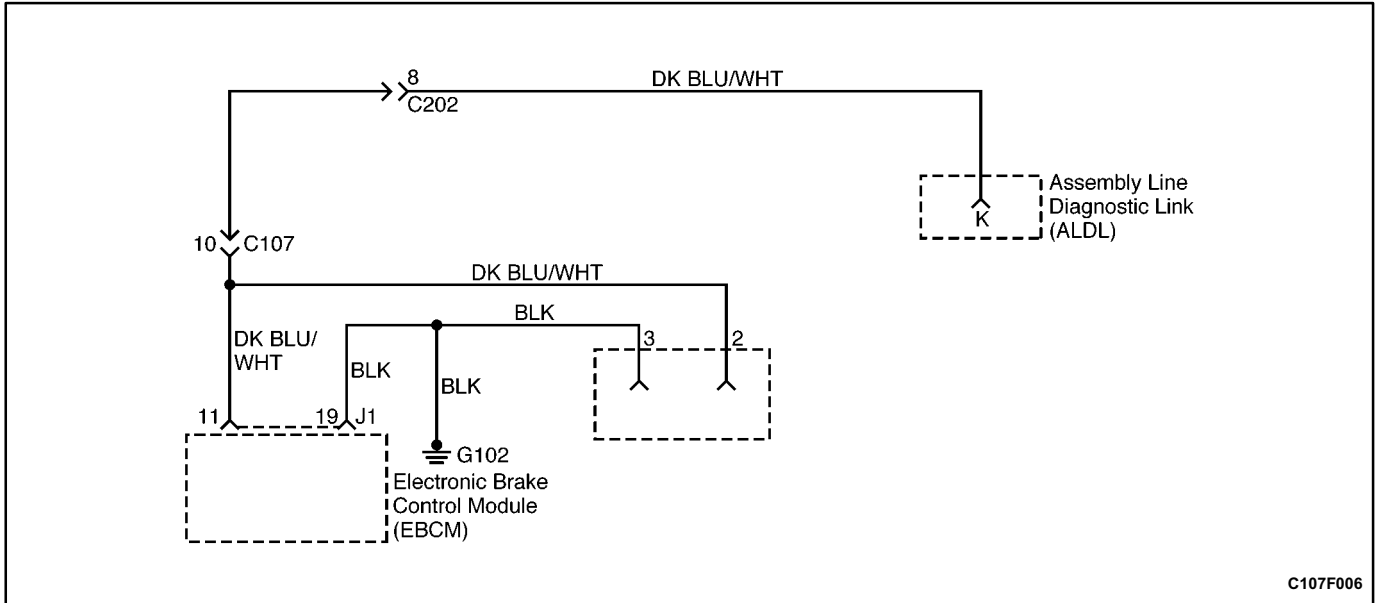
The number(s) below refer to step(s) on the diagnostic table.

1. This begins the test of the inlet valve.
3. This tests the outlet valve.



**DTC 51/52 - Right Rear Inlet and Outlet Valve Solenoid Fault**

Step	Action	Value(s)	Yes	No
1	1. Raise and suitably support the vehicle at the corner being tested. 2. Turn the ignition switch to ON. 3. Install the scan tool to the assembly line diagnostic link (ALDL) and select „Wheel rear right” to begin the solenoid tests at that wheel. This will test both the inlet and the outlet valves. 4. When the scan tool indicates „Pressure hold,” depress and hold the brake pedal until the end of the test. 5. Have an assistant attempt to rotate the wheel. Can the wheel be rotated?	-	Go to Step 2	Go to Step 6
2	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure increase,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated now?	-	Go to Step 6	Go to Step 3
3	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure release on,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated?	-	Go to Step 4	Go to Step 6
4	1. Release brake pedal pressure when the scan tool indicates „Pressure release off.” 2. Clear all DTCs. 3. Road test the vehicle. Does the DTC set again?	-	Go to Step 6	Go to Step 5
5	1. Check the wiring harness and the connector terminals for an intermittent problem. 2. Repair any problem found. Is the repair complete?	-	System OK	-
6	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F006

## DIAGNOSTIC TROUBLE CODE (DTC) 55/56 LEFT REAR INLET AND OUTLET VALVE SOLENOID FAULT

### Circuit Description

The solenoid valve coil circuits are supplied with power from the battery when the valve relay is energized. Switched ground is provided by the electronic brake control module (EBCM) to each coil.

### Diagnosis

This procedure checks whether the left rear inlet and outlet valves are functioning.

### Cause(s)

- A valve has failed.
- A solenoid coil is open or shorted.

### Fail Action

ABS is disabled, and the ABS warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

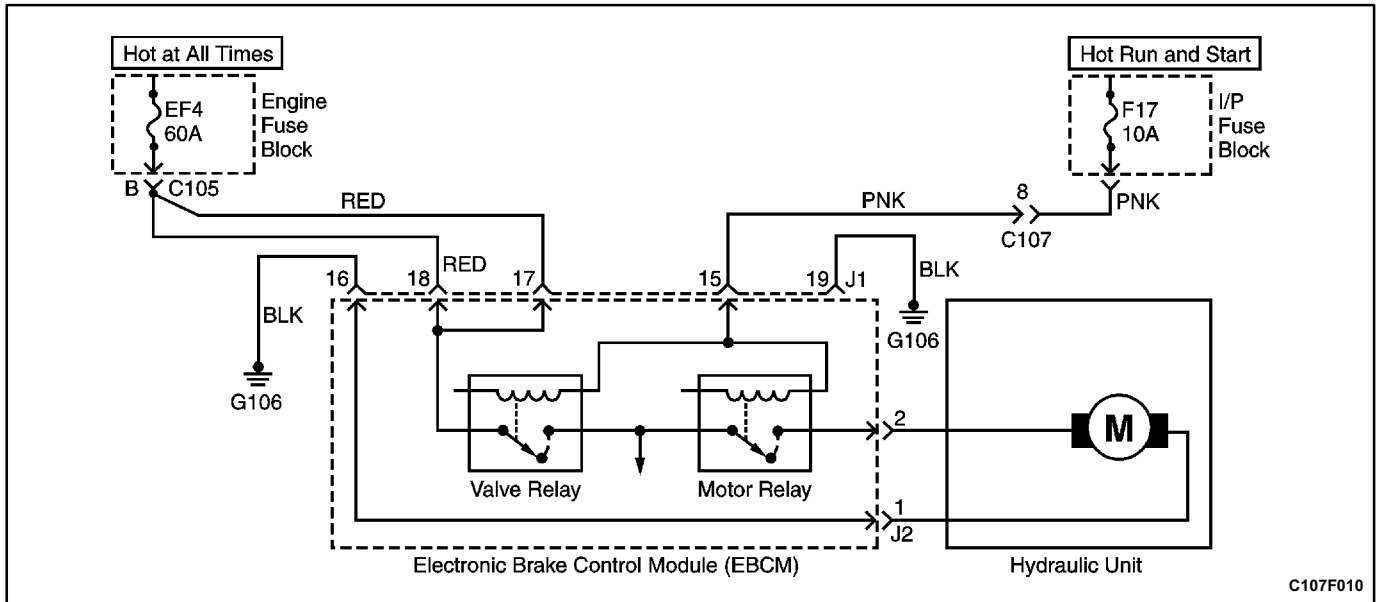
### Test Description

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

1. This begins the test of the inlet valve.
3. This tests the outlet valve.

**DTC 55/56 - Left Rear Inlet and Outlet Valve Solenoid Fault**

Step	Action	Value(s)	Yes	No
1	1. Raise and suitably support the vehicle at the corner being tested. 2. Turn the ignition switch to ON. 3. Install the scan tool to the assembly line diagnostic link (ALDL) and select „Wheel rear left” to begin the solenoid tests at that wheel. This will test both the inlet and the outlet valves. 4. When the scan tool indicates „Pressure hold,” depress and hold the brake pedal until the end of the test. 5. Have an assistant attempt to rotate the wheel. Can the wheel be rotated?	-	Go to Step 2	Go to Step 6
2	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure increase,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated now?	-	Go to Step 6	Go to Step 3
3	1. Maintain pressure on the brake pedal. 2. When the scan tool indicates „Pressure release on,” have an assistant attempt to rotate the wheel again. Can the wheel be rotated?	-	Go to Step 4	Go to Step 6
4	1. Release brake pedal pressure when the scan tool indicates „Pressure release off.” 2. Clear all DTCs. 3. Road test the vehicle. Does the DTC set again?	-	Go to Step 6	Go to Step 5
5	1. Check the wiring harness and the connector terminals for an intermittent problem. 2. Repair any problem found. Is the repair complete?	-	System OK	-
6	Replace the ABS unit. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 61 PUMP MOTOR OR PUMP MOTOR RELAY FAULT

### Circuit Description

When the electronic brake control module (EBCM) grounds the pump motor relay, it closes and provides battery voltage to the pump motor if the valve relay is closed. The EBCM senses the voltage applied to the pump motor to verify motor operation.

### Diagnosis

This DTC sets when the EBCM detects B+ without motor relay activation or if the EBCM does not detect B+ after motor relay activation.

### Cause(s)

- There is a faulty terminal in pump motor connector J2.
- There is a faulty terminal in EBCM connector J1.
- There is a problem in the ABS wiring harness.
- There is high resistance in the chassis ground.
- The EBCM is defective.
- There is a problem in the wiring from pump motor connector J2 to the motor.

### Fail Action

ABS is disabled, and the ABS warning lamp is ON.

### Test Description

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

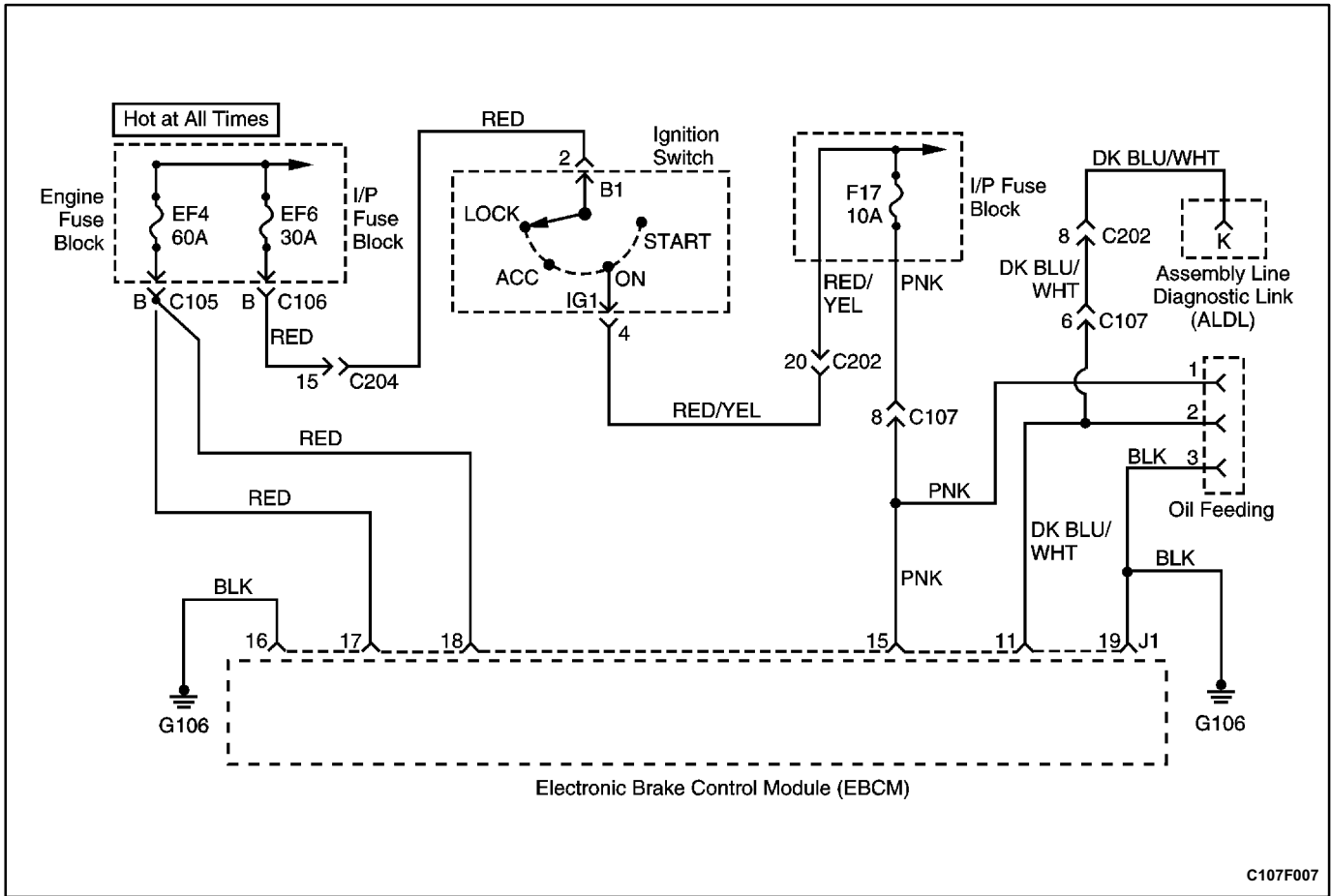
1. This step checks for connector damage.
3. This step checks for a poor ground connection.
7. This step checks for a possible problem with the motor connector at the ABS unit.

### Diagnostic Aids

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to do so may result in misdiagnosis, causing part replacement with reappearance of the malfunction.

**DTC 61 - Pump Motor or Pump Motor Relay Fault**

Step	Action	Value(s)	Yes	No
1	1. Disconnect connector J1 from the EBCM. 2. Examine terminal 16 on the harness connector and on the EBCM connector. Is the terminal damaged or corroded?	-	Go to Step 2	Go to Step 3
2	Repair or replace the terminal, the connector, the wiring harness, or the EBCM as required. Is the repair complete?	-	System OK	-
3	Measure the resistance from terminal 16 of the harness connector J1 to a good chassis ground. Is the resistance equal to the specified value?	$\approx 0 \Omega$	Go to Step 7	Go to Step 4
4	Measure the resistance at the chassis ground connection G106. Is the resistance equal to the specified value?	$\approx 0 \Omega$	Go to Step 6	Go to Step 5
5	Repair the connection at chassis ground G106. Is the repair complete?	-	System OK	-
6	Repair the open or the high resistance in the harness between terminal 16 of connector J1 and the ground lug, or replace the ABS wiring harness. Is the repair complete?	-	System OK	-
7	1. Remove the ABS unit from the vehicle. 2. Disconnect connector J2 and examine the terminals. Is there any sign of damage or corrosion that would prevent a good ground contact?	-	Go to Step 8	Go to Step 9
8	Repair or replace the defective terminal, connector, or ABS unit as required. Is the repair complete?	-	System OK	-
9	Replace the ABS unit. Is the repair complete?	-	System OK	-



C107F007

## DIAGNOSTIC TROUBLE CODE (DTC) 63 VALVE RELAY CIRCUIT FAULT

### Circuit Description

When the ABS is active, the valve relay provides voltage to actuate the solenoid valves. The valves do not use this voltage unless the ABS control module provides the ground for each solenoid coil.

DTC 63 will set if the valve relay voltage is low or if the relay supply line is at 12 volts when the ABS control module is not requesting it. This DTC will also set if the ABS control module detects three or more solenoid valve circuits are open or shorted during the selftest.

### Diagnosis

This procedure checks whether there is a poor ground connection for the electronic brake control module (EBCM).

### Cause(s)

- A connector terminal is corroded.
- The wiring harness is damaged.
- The ground terminal is not conducting properly.
- The EBCM is defective.

### Fail Action

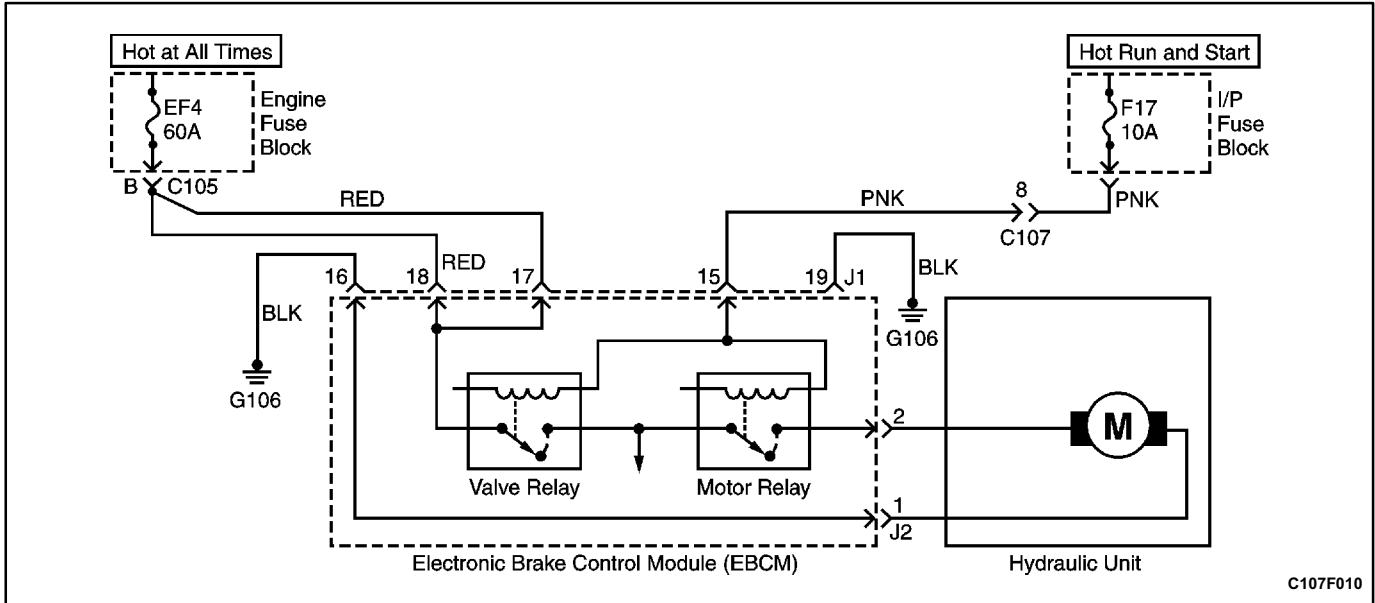
ABS/TCS is disabled, and the ABS warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the control module will enable the system at the next ignition cycle and set a history DTC 63.

### Diagnostic Aids

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to do so may result in misdiagnosis, causing part replacement with reappearance of the malfunction.

**DTC 63 - Valve Relay Circuit Fault**

Step	Action	Value(s)	Yes	No
1	1. Use a scan tool to clear all DTCs. 2. Road test the vehicle. Does DTC 63 set again?	-	Go to Step 3	Go to Step 2
2	1. Check all system wiring harness connectors and terminals, especially the EBCM, for any problem that could cause an intermittent condition. 2. Repair any intermittent problem found. Is the repair complete?	-	System OK	-
3	1. Disconnect ABS harness connector J1 from the EBCM. 2. Examine terminal 19 on the harness connector and the EBCM connector. Is there damage or corrosion at terminal 19?	-	Go to Step 5	Go to Step 4
4	Repair the terminal or the connector, or replace the ABS harness or ABS unit as required. Is the repair complete?	-	System OK	-
5	Measure the resistance from terminal 19 of the harness connector J1 to a good chassis ground. Is the resistance equal to the specified value?	$\approx 0 \Omega$	Go to Step 6	Go to Step 7
6	Replace the ABS unit. Is the repair complete?	-	System OK	-
7	Measure the resistance from terminal 19 of the harness connector J1 to the ground lug at G106. Is the resistance equal to the specified value?	$\approx 0 \Omega$	Go to Step 8	Go to Step 9
8	Repair the chassis connection at the ground lug. Is the repair complete?	-	System OK	-
9	Repair the open or the high resistance in the ABS harness, or replace the harness as required. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 65 PUMP FAULT LONG TERM (TCS ONLY)

### Fail Action

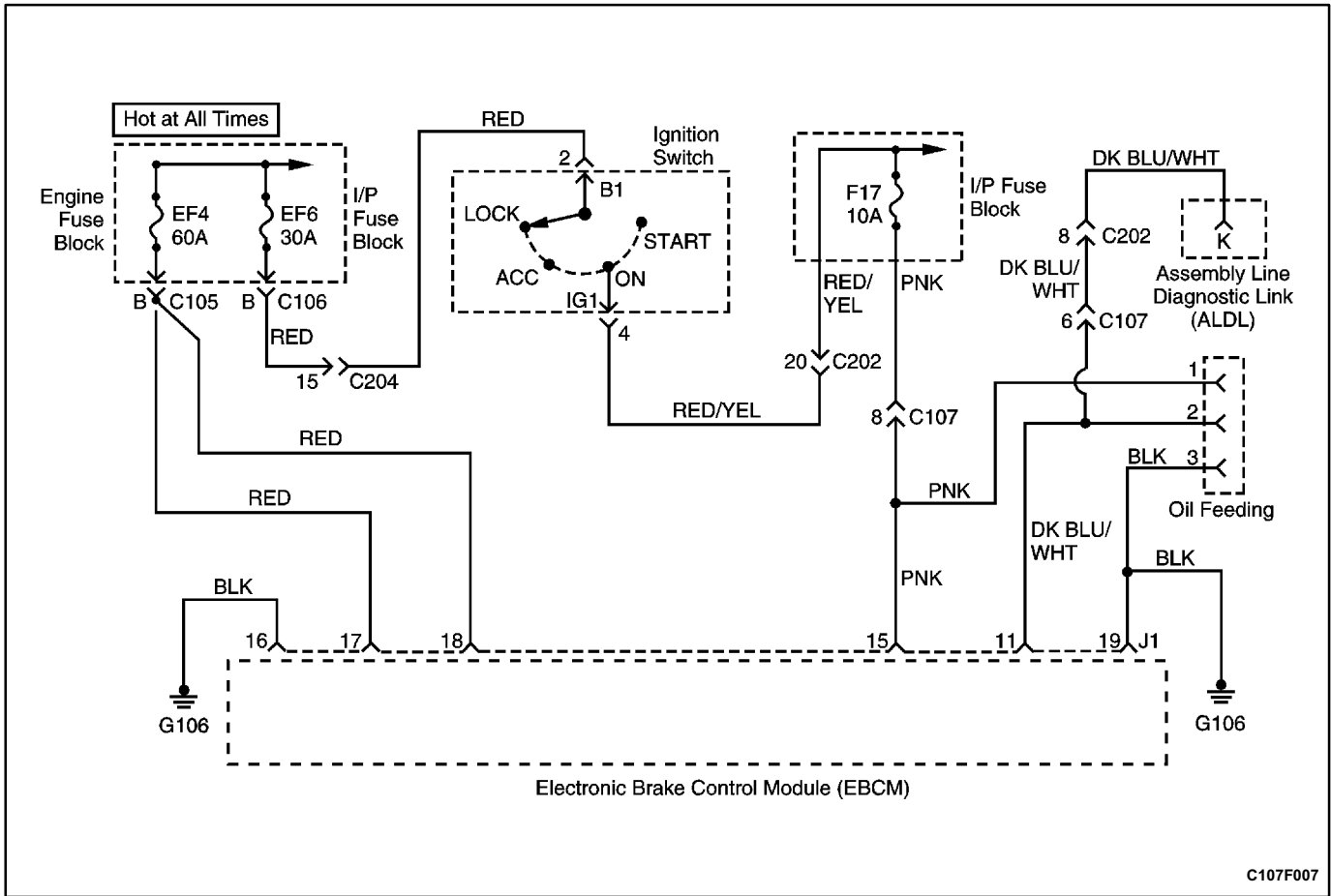
The antilock brake system (ABS) warning lamp is turned ON and the ABS is disabled for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

### Diagnosis

There is no diagnostic procedure for this problem. If DTC65 is set, replace the ABS unit.



**BLANK**



C107F007

## DIAGNOSTIC TROUBLE CODE (DTC) 71 ABS CONTROL MODULE INTERNAL FAULT

### Circuit Description

The ABS control module performs various diagnostic checks on itself. If it finds a problem, it sets DTC 71.

### Diagnosis

This procedure checks whether there is a poor ground connection for the electronic brake control module (EBCM).

### Cause(s)

- A connector terminal is corroded.
- The EBCM is malfunctioning.

### Fail Action

ABS is disabled, and the ABS warning lamp is turned ON. If the failure is intermittent, the control module will enable the system at the next ignition cycle and will store a history DTC 71.

### Test Description

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

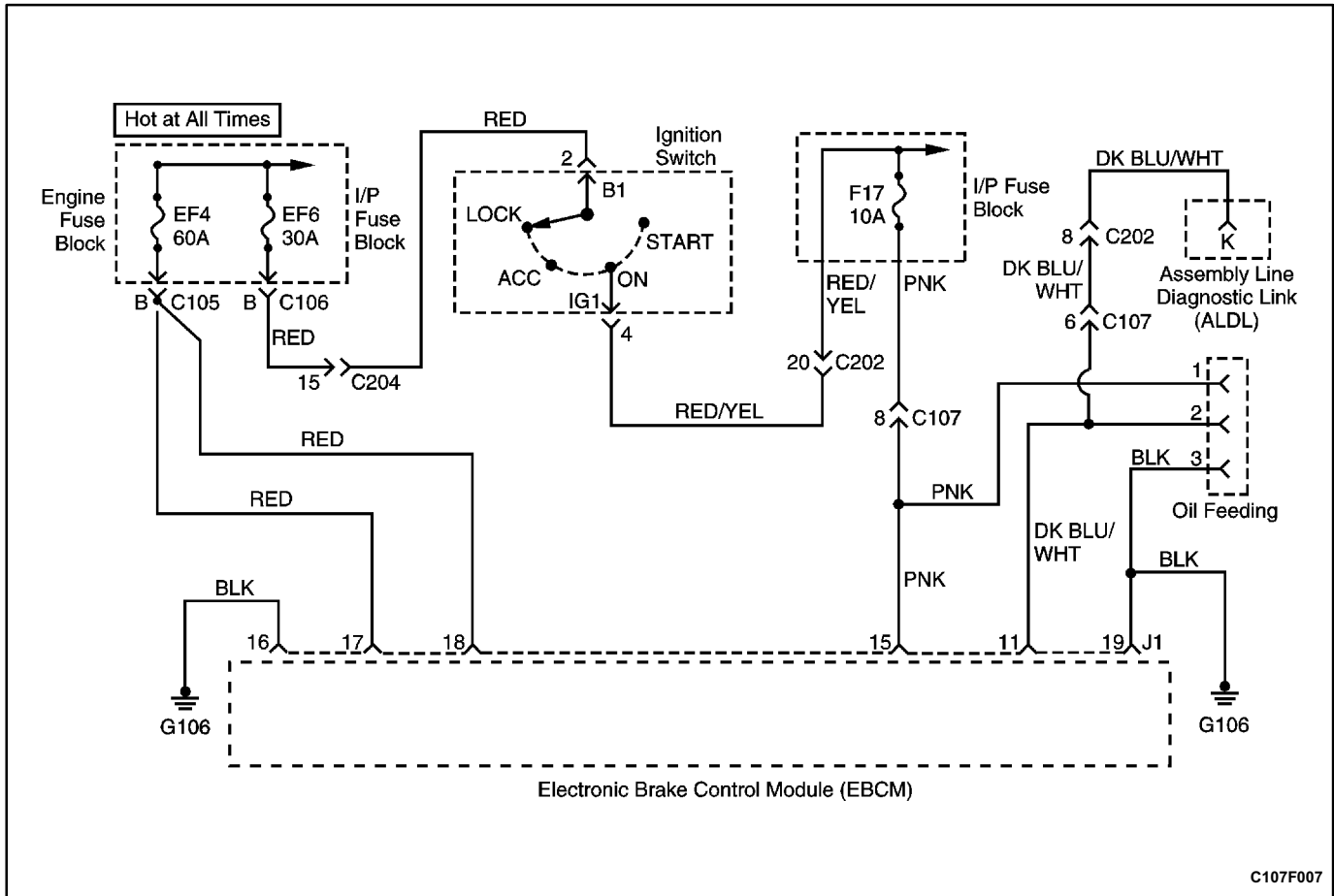
3. This step begins the testing for a poor voltage or ground connection.

### Diagnostic Aids

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

**DTC 71 - ABS Control Module Internal Fault**

Step	Action	Value(s)	Yes	No
1	Use the scan tool to determine if any other DTCs are set. Are other DTCs set?	-	Go to the tables for the other DTCs	Go to <i>Step 2</i>
2	Clear all DTCs and road test the vehicle. Does DTC 71 set again?	-	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	1. Check all wiring harness connectors and terminals, especially those at the EBCM, for any condition that could cause an intermittent. 2. Repair any problems found. Is the repair complete?	-	System OK	-
4	1. Turn the ignition switch to OFF. 2. Disconnect EBCM connector J1. 3. Turn the ignition switch to ON. 4. Measure the voltage between ground and terminals 15, 17, and 18 of the EBCM harness connector J1. Is the voltage equal to the specified value?	11-14 V	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	1. Check the voltage supply and the ground connections to the EBCM. 2. Repair any open or high resistance found. Is the repair complete?	-	System OK	-
6	Check the EBCM connector J1 for any ineffective terminals. Are there any problems?	-	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	Repair any connector problem found. Is the repair complete?	-	System OK	-
8	Clear all DTCs and road test the vehicle. Does DTC 71 set again?	-	Go to <i>Step 9</i>	System OK
9	Replace the ABS unit. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 85 LOW VOLTAGE FAULT

### Circuit Description

Proper operation of the electronic brake control module (EBCM) requires a certain minimum voltage. The EBCM monitors the ignition feed circuit to determine if the voltage falls below a minimum level.

### Diagnosis

This test checks for battery output, proper grounding, blown fuses, faulty ignition switch, and problems in the circuitry.

### Cause(s)

- The battery is defective.
- There is a defective ground connection.
- A connector is damaged.
- A wire is broken or shorted.
- A fuse is blown.
- The ignition switch is malfunctioning.

### Fail Action

ABS action is disabled during the period of low voltage, and the ABS warning lamp is ON for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC 85.

### Test Description

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

1. This step determines whether there is voltage at the battery and at the high current source.
7. This step checks for voltage at the ignition 1 source.
11. This step begins the check for voltage at the EBCM end of the ABS harness.
15. This step checks for a defective ground connection.
16. This is a check for a defective EBCM connector.

### Diagnostic Aids

It is very important to perform a thorough inspection of the wiring and the connectors. Failure to do so may result in misdiagnosis, causing part replacement with a reappearance of the malfunction.

**DTC 85 - Low Voltage Fault**

Step	Action	Value(s)	Yes	No
1	Check the voltage at the battery. Is the voltage within the specified value?	11-14 V	Go to Step 3	Go to Step 2
2	Charge or replace the battery as required. Is the repair complete?	-	System OK	-
3	Check fuse EF4 in the engine fuse block. Is the fuse blown?	-	Go to Step 4	Go to Step 7
4	1. Replace fuse EF4. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to Step 5	Go to Step 6
5	1. Turn the ignition to OFF. 2. Trace the RED wires in the ABS wiring harness from terminal B of C105 at the engine fuse block to terminals 17 and 18 of the EBCM connector J1. 3. Repair any short circuit found along this path. Is the repair complete?	-	System OK	-
6	1. Turn the ignition switch to OFF. 2. Install the scan tool. 3. Clear all DTCs. 4. Road test the vehicle. Does DTC 85 reset?	-	System OK	-
7	Check fuse F17 in the I/P fuse block. Is the fuse blown?	-	Go to Step 8	Go to Step 11
8	1. Replace fuse F17. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to Step 9	Go to Step 10
9	1. Turn the ignition to OFF. 2. Trace the PNK wire from fuse F17 to terminal 8 of connector C107, and from there to terminal 15 of the EBCM connector J1. 3. Repair any short circuit found along this path. Is the repair complete?	-	System OK	-
10	1. Turn the ignition switch to OFF. 2. Install the scan tool. 3. Clear all DTCs. 4. Road test the vehicle. Does DTC 85 reset?	-	System OK	-
11	1. Disconnect the EBCM connector J1 from the EBCM. 2. Turn the ignition to ON. 3. Check for the presence of battery voltage between ground and terminal 17, and between ground and terminal 18. Is the voltage within the specified value?	11-14 V	Go to Step 13	Go to Step 12
12	1. Turn the ignition switch to OFF. 2. Trace the orange wires between terminals 17 and 18 of the EBCM connector J1 to terminal B of connector C105 at the engine fuse block. 3. Repair the open in this circuit. Is the repair complete?	-	System OK	-

## DTC 85 - Low Voltage Fault (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check the voltage between ground and terminal 15 of the EBCM connector J1. Is the voltage within the specified value?	11-14 V	Go to <i>Step 17</i>	Go to <i>Step 14</i>
14	1. Turn the ignition switch to OFF. 2. Check fuse EF6 in the engine fuse block. Is the fuse blown?	-	Go to <i>Step 15</i>	Go to <i>Step 16</i>
15	Replace fuse EF6. Is the repair complete?	-	System OK	-
16	1. Examine circuit PNK between terminal 15 of the EBCM connector J1 to terminal 8 of connector C107, to F17 in the I/P fuse block. 2. Examine the RED/YEL wire from the I/P fuse block to terminal 20 of connector C202, and from there to terminal 4 (IG1) of the ignition switch. 3. Examine the RED wire from terminal 2 (B1) of the ignition switch to terminal 15 of connector C204 to terminal A of connector C106 at the engine fuse block. 4. Repair the open in the wiring or possibly bad connector terminal, or defective ignition switch. Is the repair complete?	-	System OK	-
17	1. Turn the ignition to OFF. 2. Check the resistance between ground and terminals 16 and 19 of the ABS harness EBCM connector. Is the resistance equal to the specified value?	0 $\Omega$	Go to <i>Step 18</i>	Go to <i>Step 20</i>
18	Examine terminals 15, 16, 17, 18, and 19 of the EBCM connector. Is there a defective terminal?	-	Go to <i>Step 19</i>	Go to <i>Step 21</i>
19	Repair the defective terminal or replace the connector or wiring harness as required. Is the repair complete?	-	System OK	-
20	Repair the defective ground connection. Is the repair complete?	-	System OK	-
21	1. Install the scan tool. 2. Clear all DTCs. 3. Road test the vehicle. Does DTC 85 set again?	-	Go to <i>Step 22</i>	Go to <i>Step 23</i>
22	Replace the ABS unit. Is the repair complete?	-	System OK	-
23	1. Examine the wiring harness and connectors for causes of intermittent problems. 2. Repair any intermittent problem found. Is the repair complete?	-	System OK	-

# MAINTENANCE AND REPAIR

## ON-VEHICLE SERVICE

### SERVICE PRECAUTIONS

**Caution:** Brake fluid may irritate eyes and skin. In case of contact, take the following actions:

- Eye contact - rinse thoroughly with water.
- Skin contact - wash with soap and water.
- Ingestion - consult a physician immediately.

**Caution:** To help avoid personal injury due to poor braking, DO NOT tap into the vehicle's brake system to operate a trailer brake system.

**Notice:** When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring threadlocking compound will be called out. The correct torque values must be used when installing fasteners that require them. If the above procedures are not followed, parts or system damage could result.

**Notice:** Use only DOT 3 equivalent hydraulic brake fluid. The use of DOT 5 (silicone) brake fluid is not recommended. Reduced brake performance or durability may result.

**Notice:** Avoid spilling brake fluid on any of the vehicle's painted surfaces, wiring, cables, or electrical connectors. Brake fluid will damage paint and electrical connections. If any fluid is spilled on the vehicle, flush the area with water to lessen the damage.

### Computer System Service Precautions

Take care to avoid electronic brake control module (EBCM) circuit overloading. In testing for opens or shorts, do not ground or apply voltage to any circuit unless instructed to do so by the diagnostic procedure. Test circuits only with a high impedance multimeter. Never remove or apply power to any control module with the ignition switch in the ON position. Always turn the ignition to the OFF position before removing or connecting battery cables, fuses, or connectors.

### General Service Precautions

- Disconnect the EBCM connector before performing any vehicle welding work using an electric arc welder.
- Do not attempt to disassemble any component designated as nonserviceable. The hydraulic modulator and the EBCM can be separated from each other and replaced separately but cannot be serviced. They have no replaceable parts, and there is no access to the components they contain.

## BLEEDING SYSTEM

Replacement modulators are shipped already filled and bled. In normal procedures requiring removal of the modulator, such as to replace the EBCM, air will not enter the modulator, and normal bleeding will be all that is needed. For this procedure, refer to *Section 4A, Hydraulic Brakes*.

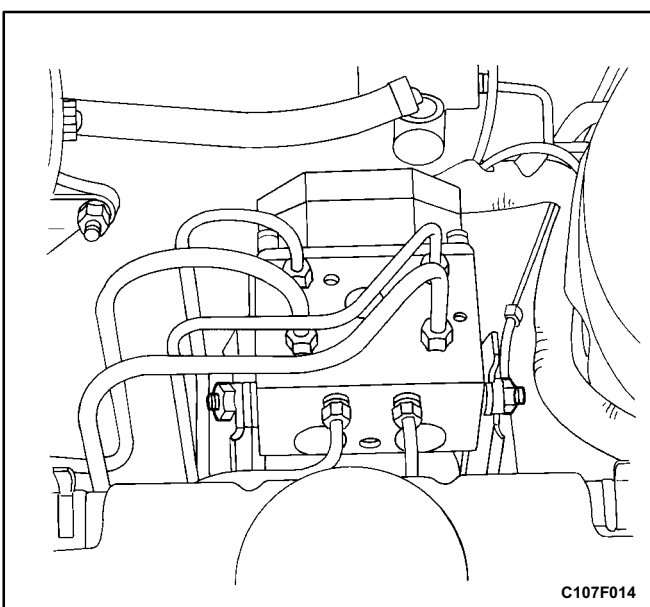
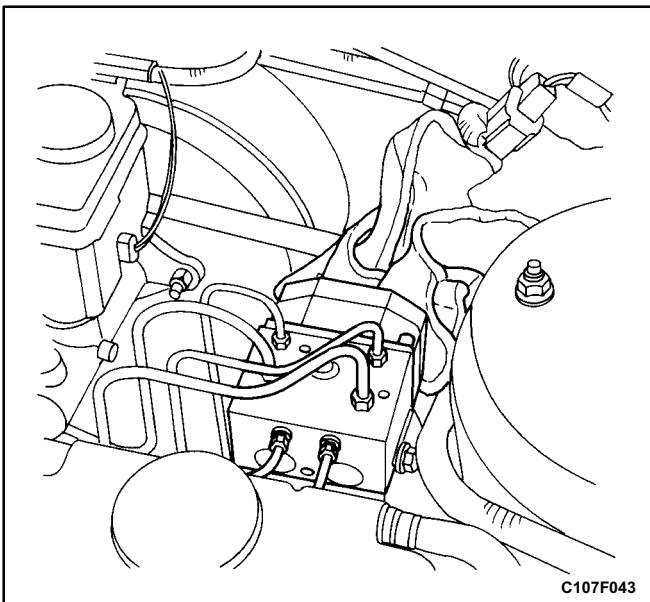
If air enters the hydraulic modulator, or if an unfilled modulator is installed, use the brake bleeding program in the scan tool to bleed the modulator. Manual bleeding of the hydraulic modulator is not possible.

## ABS 5.3 ASSEMBLY

(Left-Hand Drive Shown, Right-Hand Drive Similar)

### Removal Procedure

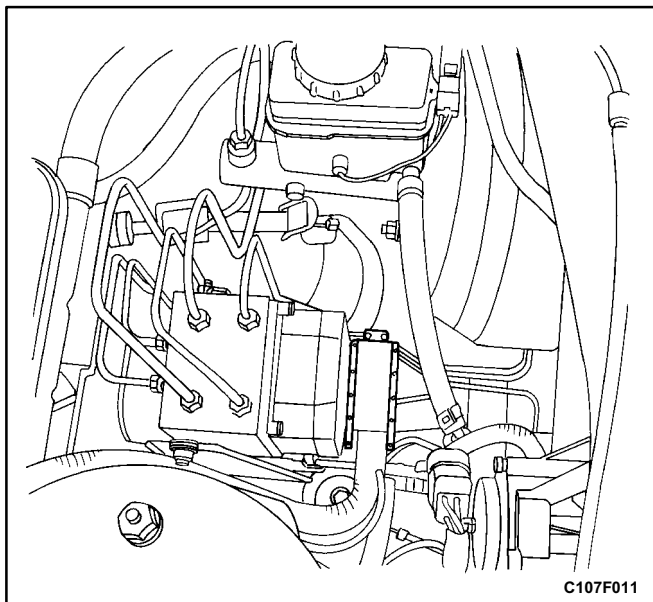
1. Disconnect the negative battery cable.
2. Disconnect the 26 or 31 pin ABS wiring harness connector J1 from its socket on the EBCM.
3. Cover the connector and the socket with shop cloths to protect them from brake fluid.



**Notice:** Take care not to allow air into the hydraulic unit or into the brake pipes from the master cylinder. If air gets into the hydraulic unit, it will require a bleeding procedure using a scan tool programmed for the ABS 5.3 system. As long as no air enters the hydraulic unit, a simple bleeding procedure is all the system will require.

4. Remove the brake pipes from the hydraulic unit. It may be necessary to loosen the brake pipe nuts on the master cylinder to allow for moving those pipes out of the way.
5. Loosen the mounting nuts on the hydraulic unit.
6. Move the brake pipes aside far enough to allow for lifting the ABS 5.3 unit out of the mounting bracket.
7. Tighten the brake pipe nuts on the master cylinder to avoid leaking brake fluid.
8. Cap the brake pipes.





### Installation Procedure

1. Insert the ABS 5.3 hydraulic unit into its mounting bracket and install the nuts.

#### Tighten

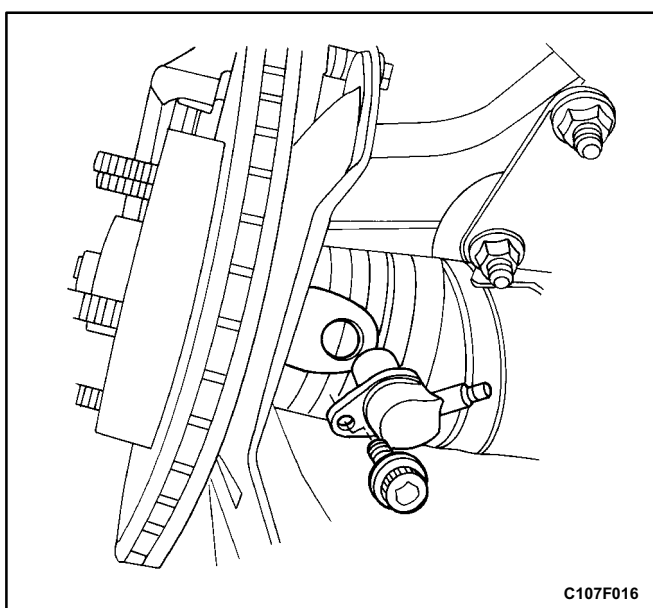
Tighten the ABS 5.3 mounting nuts to 9 N•m (80 lb•in).

2. Remove the screw plugs and install all of the hydraulic brake pipes.

#### Tighten

Tighten the brake pipe nuts to 12 N•m (106 lb•in).

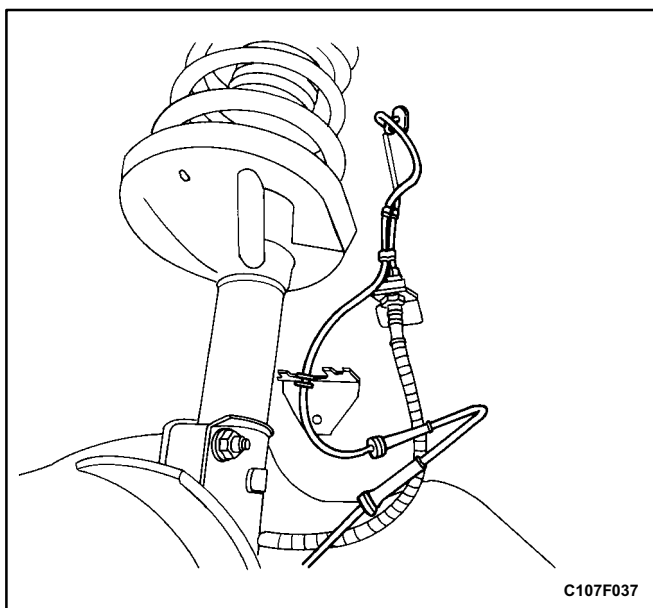
3. Connect the 26 or 31 pin wiring harness connector J1.
4. Connect the negative battery cable.
5. Bleed the hydraulic system. Refer to *Section 4A, Hydraulic Brakes*.



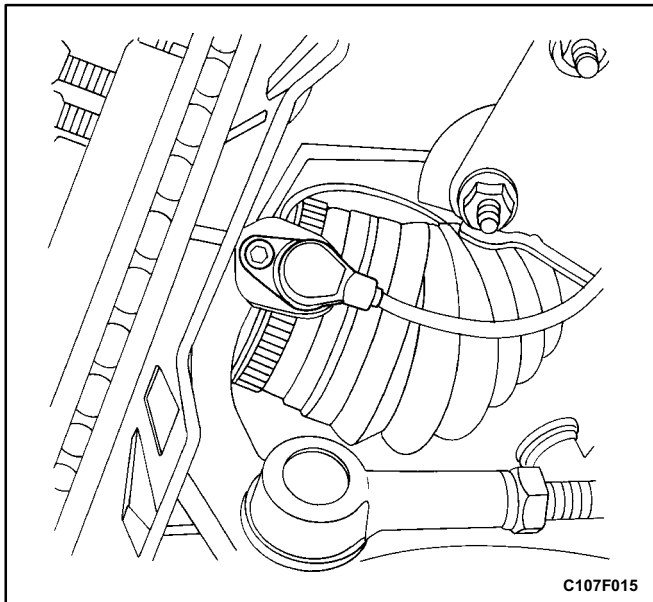
## FRONT WHEEL SPEED SENSOR

### Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the front wheel speed sensor electrical connector.
3. Raise and suitably support the vehicle.
4. Remove the wheel. Refer to *Section 2E, Tires and Wheels*.
5. Turn the steering wheel to expose the speed sensor. It is located at the rear of the steering knuckle near the tie rod end.
6. Remove the bolt and the front wheel speed sensor from the steering knuckle.



7. Free the feedthrough grommet for the speed sensor harness and the hydraulic pipe from the strut tower. Remove the speed sensor harness from it so that the connector can pass through the hole in the strut tower.
8. Free the sensor harness from the grommet holders and the clamps and pull it through the fender.

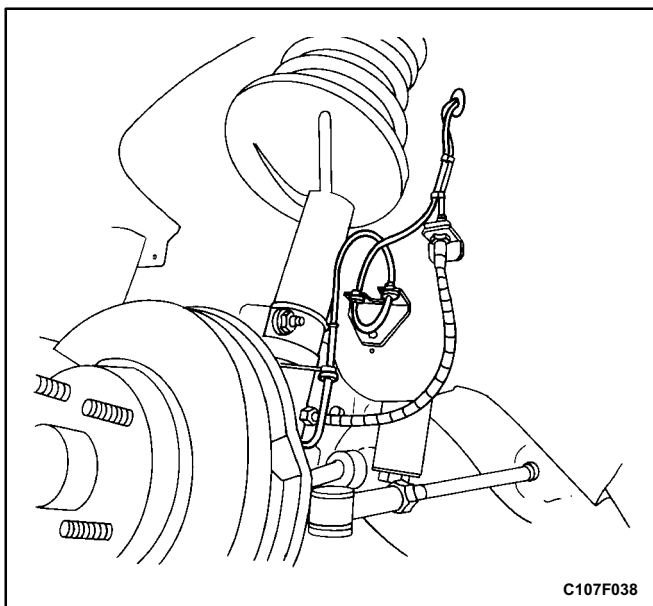


### Installation Procedure

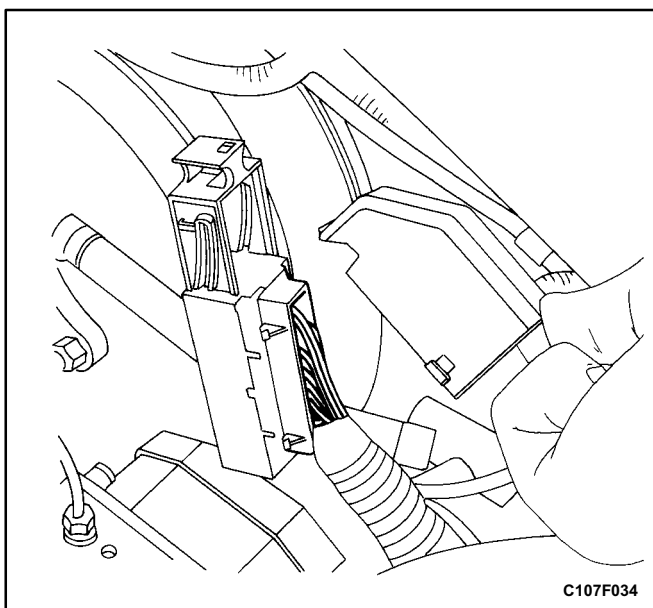
1. Install the front wheel speed sensor to the steering knuckle. Secure it with the bolt.

### Tighten

Tighten the front wheel speed sensor bolt to 8 N•m (71 lb•in).



2. Feed the sensor harness into the engine compartment, insert it into the grommet, and secure the grommet into the hole in the strut tower.
3. Secure the harness into the grommet holders and the clamps under the fender.
4. Replace the wheel. Refer to *Section 2E, Tires and Wheels*.
5. Lower the vehicle.
6. Connect the front wheel speed sensor electrical connector.
7. Connect the negative battery cable.

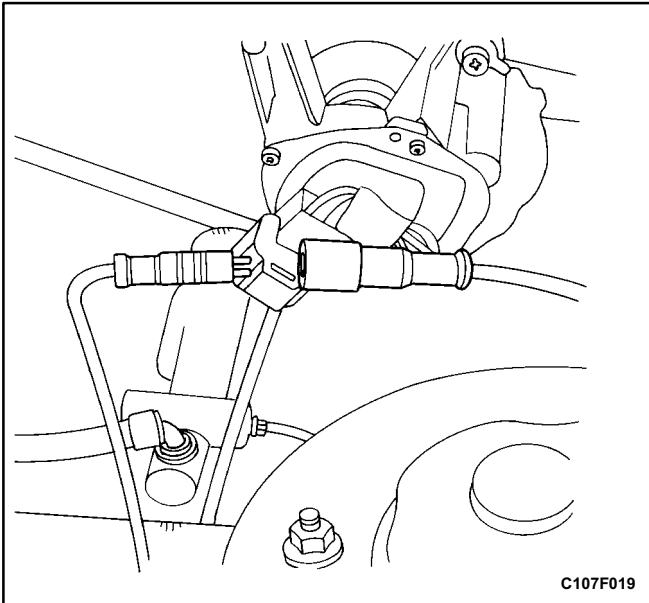


### FRONT WHEEL SPEED SENSOR JUMPER HARNESS

(Left-Hand Drive Shown, Right-Hand Drive Similar)

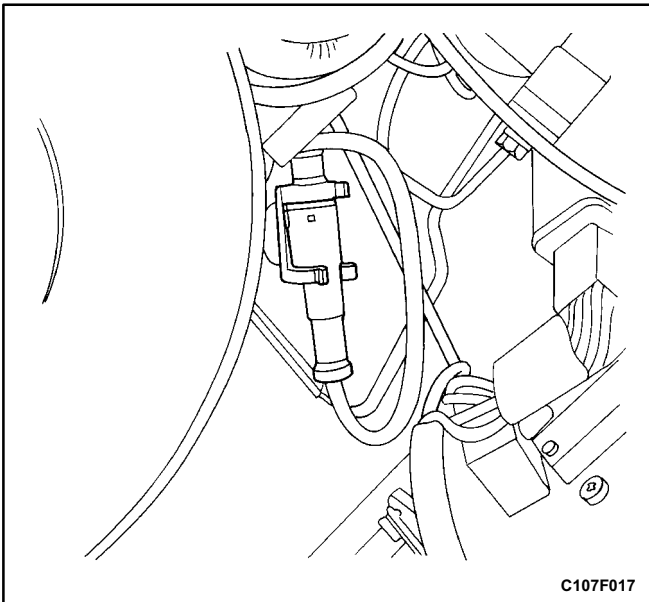
### Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect connector J1 from the EBCM.
3. Remove the appropriate terminals from connector J1:
  - Right side - terminals 4 (PRL) and 5 (YEL).
  - Left side - terminals 6 (WHT) and 7 (ORN).



C107F019

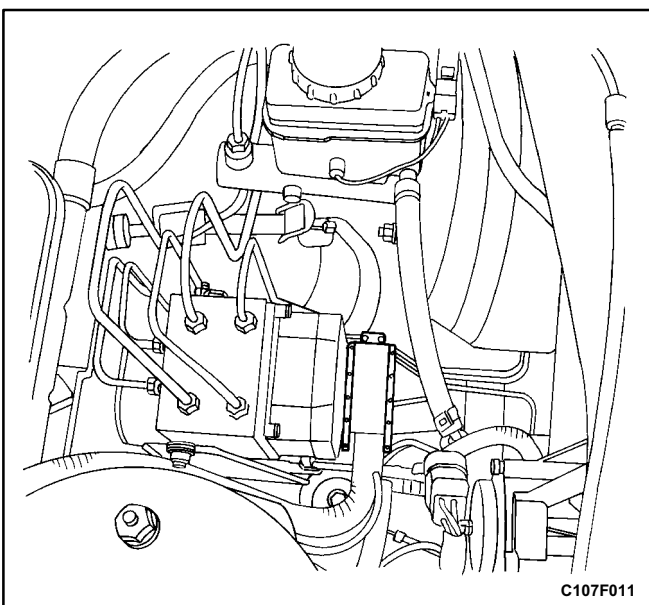
4. Both speed sensor harnesses break out of the ABS wiring harness just beyond the ABS connector J1. The right side speed sensor harness crosses the top of the fire wall to the right side fender area. The left side speed sensor harness goes directly to the left side fender area.
5. Free the speed sensor harness from the wiring harness.
6. Remove the front wheel speed sensor electrical connector from the retaining clamps and disconnect the harness from the sensor connector.



C107F017

### Installation Procedure

1. Install the front wheel speed sensor jumper harness.
2. Connect the front wheel speed sensor electrical connector and secure it into the clamps.



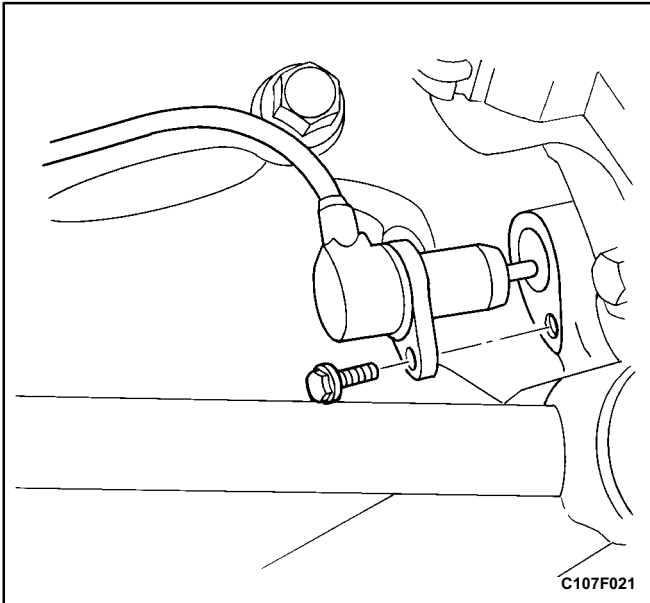
C107F011

3. Replace the jumper harness into the wiring harness.
4. Insert the terminals into connector J1 as they had been removed:
  - Right side - terminals 4 (PPL) and 5 (YEL).
  - Left side - terminals 6 (WHT) and 7 (ORN).
5. Connect EBCM connector J1.
6. Connect the negative battery cable.

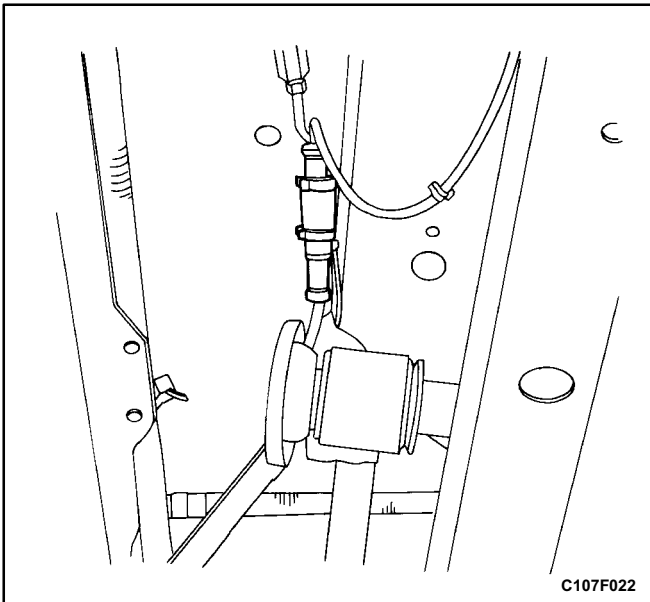
## REAR WHEEL SPEED SENSOR

### Removal Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the bolt and the rear wheel speed sensor from the rear knuckle.



4. Remove the speed sensor cable grommets from their clamps.
5. Remove the speed sensor cable from the clamps securing it to the hydraulic pipe.
6. Remove the speed sensor cable connector from its clamps and disconnect the speed sensor cable from the harness.

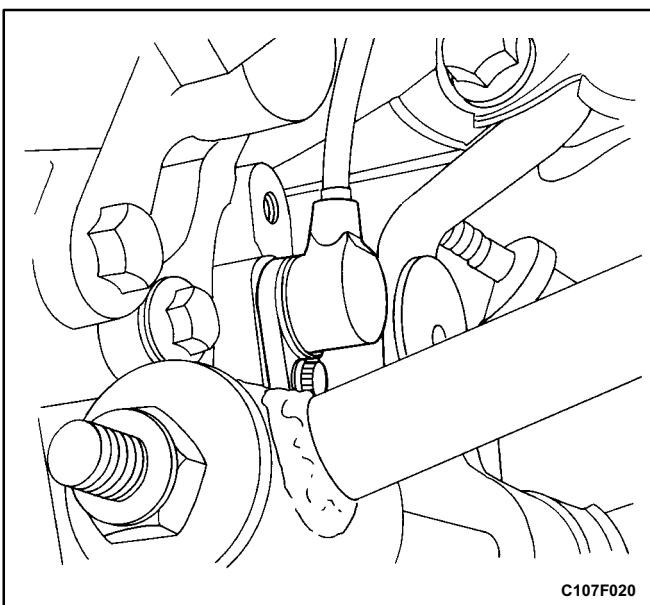


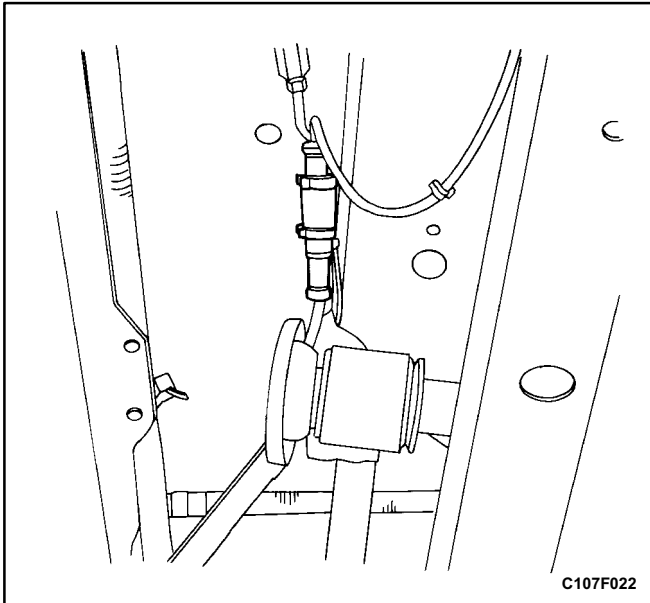
### Installation Procedure

1. Install the rear wheel speed sensor to the rear knuckle. Secure it with the bolt.

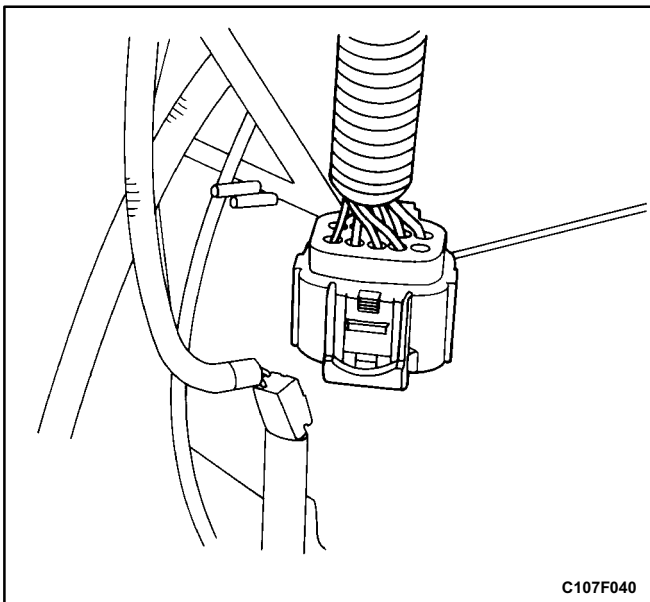
#### Tighten

Tighten the rear wheel speed sensor bolt to 8 N•m (71 lb•in).





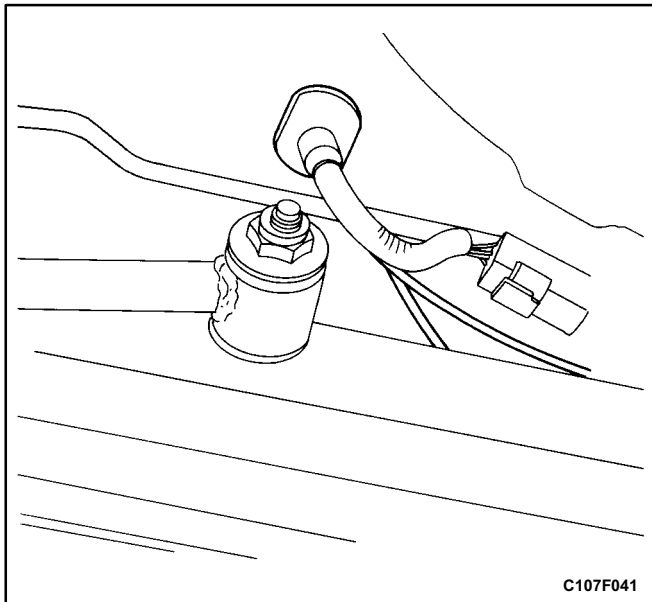
2. Connect the rear wheel speed sensor electrical connector.
3. Secure the speed sensor cable into its clamps on the hydraulic pipe.
4. Secure the speed sensor cable grommets into their clamps inside the fender well.
5. Lower the vehicle.
6. Connect the negative battery cable.



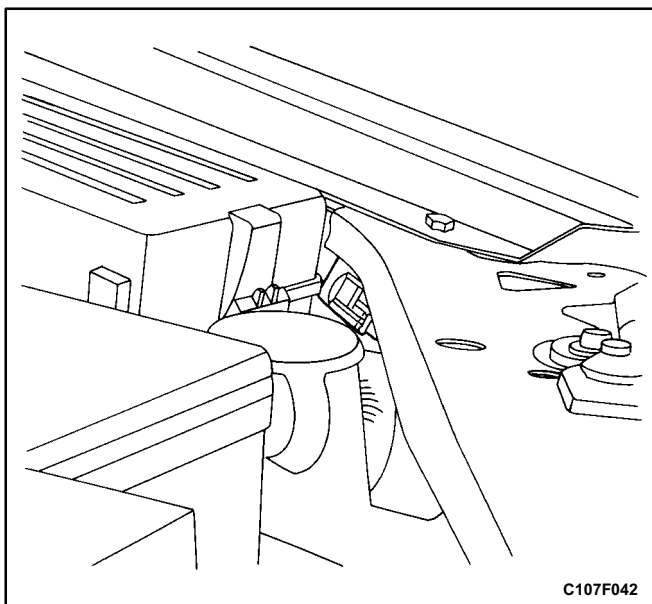
## REAR WHEEL SPEED SENSOR JUMPER HARNESS

### Removal Procedure

1. Remove the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the left front wheel. Refer to *Section 2E, Tires and Wheels*.
4. Remove the wheel well splash shield inside the left front wheel arch to expose the body wiring harness where it enters the engine compartment. Refer to *Section 9R, Body Front End*.
5. Disconnect the body harness from the ABS harness at connector C107. This is forward of the left front wheel arch, between the engine fuse block and the wheel arch.
6. Pull the body harness end of C107 into the wheel arch area and remove the DK BLU/BRN pair of speed sensor wires appropriate for the harness being replaced.

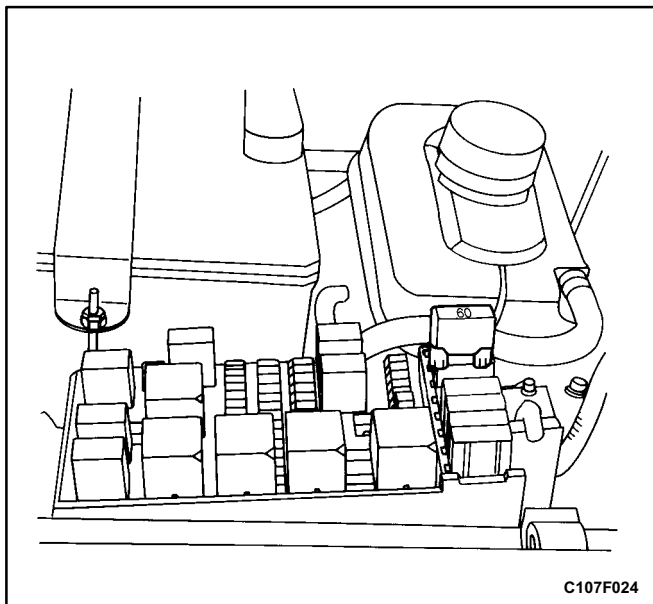


7. Open the body harness cover enough to free the speed sensor harness being replaced.
8. Lower the vehicle.
9. Expose the body harness inside the vehicle body and free the speed sensor harness being replaced.
10. Open the trunk, uncover the spare tire compartment, remove the tape from the feedthrough grommet, and free the speed sensor harness from the body harness.
11. Raise and suitably support the vehicle.
12. Disconnect the speed sensor cable from the sensor harness cable being replaced.
13. Remove the tape sealing the wiring harness and the rear speed sensor harnesses to the grommet passing them through the floor of the vehicle.
14. Pull the harness being replaced through the grommet.



### Installation Procedure

1. Pass the harness through the grommet in the floor.
2. Connect the new wheel speed sensor harness to the wheel speed sensor.
3. Secure the connector in its clamp.
4. Adjust the cable length and tape the grommet opening under the vehicle.
5. Lower the vehicle.
6. Tape the grommet opening inside the vehicle.
7. Pass the harness through the grommet and on into the engine compartment.
8. Install terminals onto the harness wires and insert the new terminals into the appropriate cavities of connector C107.
9. Reconnect connector C107 to the ABS harness.
10. Secure the new speed sensor harness into the body wiring harness.
11. Replace the wheel well splash shield. Refer to *Section 9R, Body Front End*.
12. Replace the left front wheel. Refer to *Section 2E, Tires and Wheels*.
13. Lower the vehicle.
14. Connect the negative battery cable.

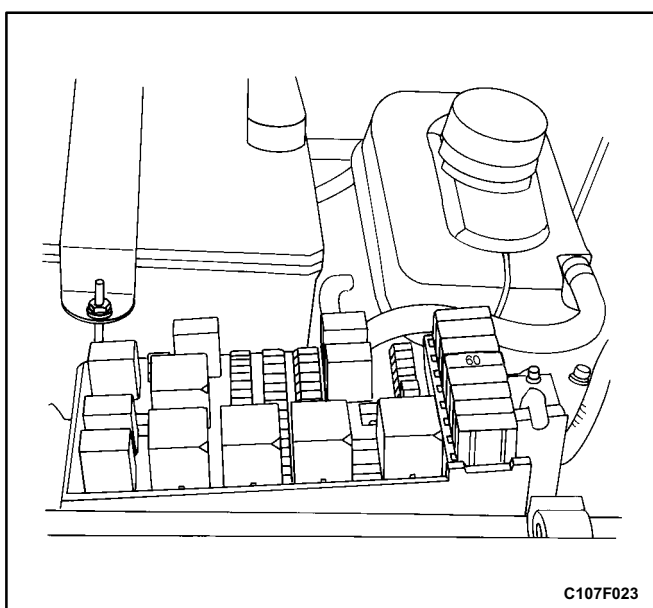


## SYSTEM FUSE

### Removal Procedure

The ABS system fuse, EF4, is located in the engine fuse block. Counting from the surge tank toward the fender, it is the fourth system fuse in the row at the strut tower end of the fuse block.

1. Disconnect the negative battery cable.
2. Remove the system fuse from its socket.



### Installation Procedure

1. Install a new 60 amp system fuse into the socket.
2. Connect the negative battery cable.

## INDICATORS

The indicator lamps associated with ABS operation are part of the instrument cluster. Refer to *Section 9E, Instrumentation/Driver Information*, for removal and replacement details.

## GENERAL DESCRIPTION AND SYSTEM OPERATION

### BASIC KNOWLEDGE REQUIRED

Before using this section, it is important that you have a basic knowledge of the following items. Without this knowledge, it will be difficult to use the diagnostic procedures contained in this section.

- Basic Electrical Circuits - You should understand the basic theory of electricity and know the meaning of voltage, current (amps), 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 know how to use a test light and how to bypass components to test circuits using fused jumper wires. You should be familiar with a digital multimeter. You should be able to measure voltage, resistance, and current, and be familiar with the controls and how to use them correctly.

### ABS SYSTEM COMPONENTS

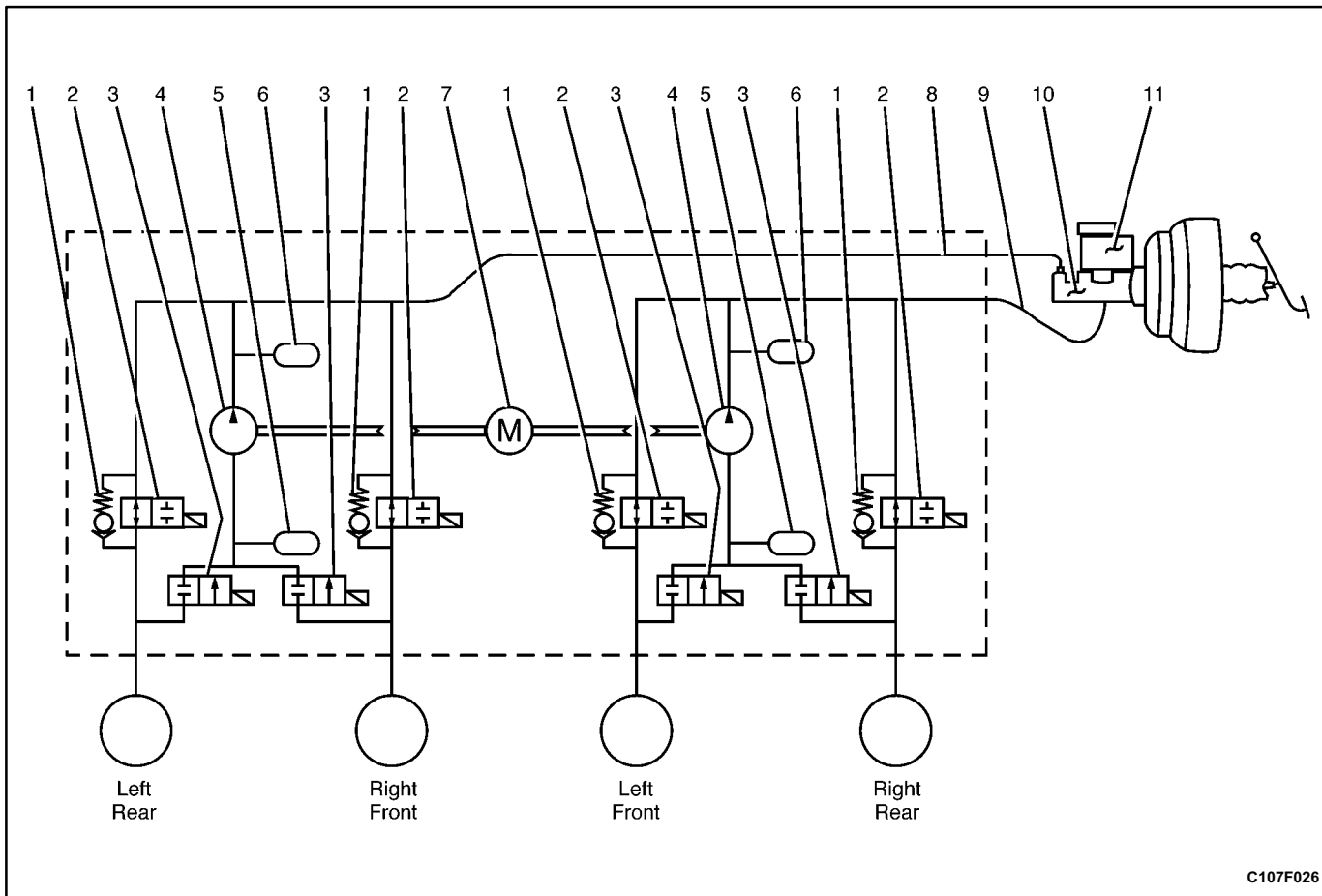
The ABS 5.3 Antilock Braking System (ABS) consists of a conventional hydraulic brake system plus antilock components. The conventional brake system includes a vacuum booster, master cylinder, front disc brakes, rear leading/trailing drum brakes, interconnecting hydraulic brake pipes and hoses, brake fluid level sensor and the BRAKE indicator.

The ABS components include a hydraulic unit, an electronic brake control module (EBCM), two system fuses, four wheel speed sensors (one at each wheel), interconnecting wiring, the ABS indicator, and the rear disk brakes. See „ABS Component Locator” in this section for the general layout of this system.

The hydraulic unit with the attached EBCM is located between the surge tank and the fire wall on the left side of the vehicle.

The basic hydraulic unit configuration consists of hydraulic check valves, two solenoid valves for each wheel, a hydraulic pump, and two accumulators. The hydraulic unit controls hydraulic pressure to the front calipers and rear wheel cylinders by modulating hydraulic pressure to prevent wheel lockup.





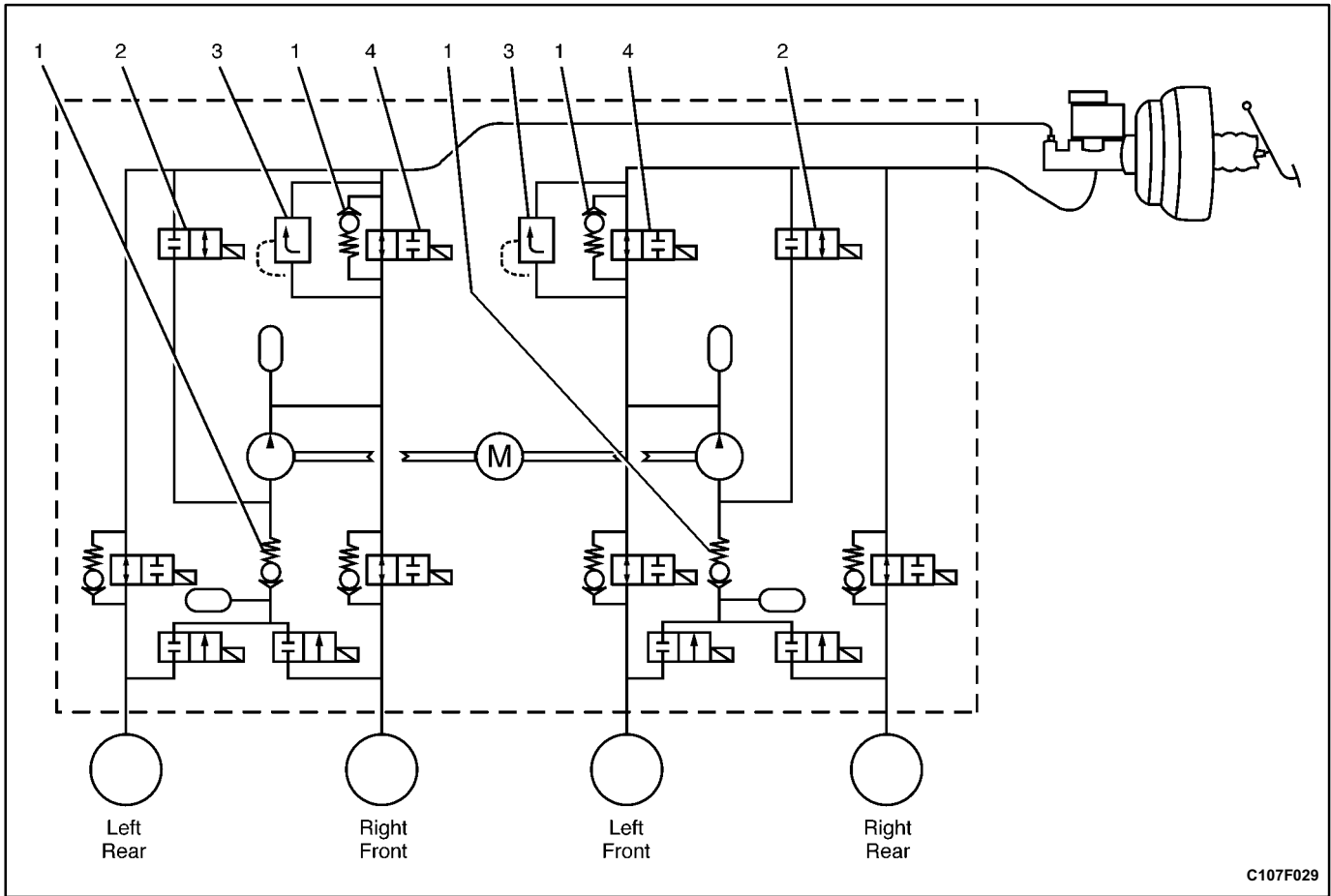
C107F026

- 1 Check Valve
- 2 Inlet Valve
- 3 Outlet Valve
- 4 Pump
- 5 Accumulator
- 6 Damper

- 7 Pump Motor
- 8 Hydraulic Circuit 2
- 9 Hydraulic Circuit 1
- 10 Master Cylinder
- 11 Master Cylinder Reservoir

Units equipped with TCS add two more valves for each drive wheel for the purpose of applying the brake to a wheel that is slipping. This is done with pressure from the hydraulic pump in the unit. There is also a TCS

indicator lamp on the instrument panel to alert the driver to the fact that the TCS system is active. The components identified in the drawing are those added to the basic ABS 5.3 system to provide traction control.



C107F029

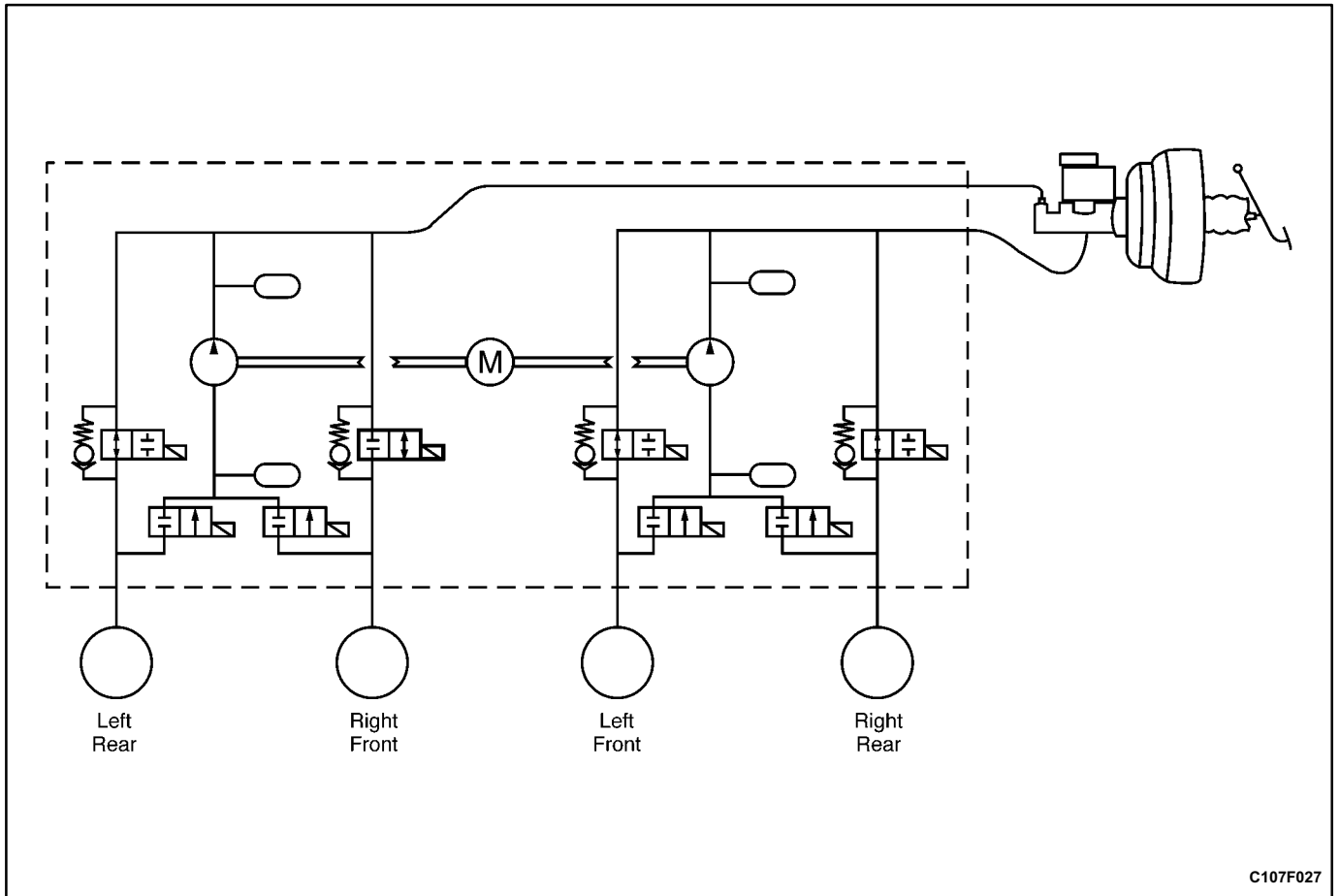
- 1 Nonreturn Valve
- 2 Prime Valve

- 3 Pressure Relief Valve
- 4 Pilot Valve

Nothing in the hydraulic unit or the EBCM is serviceable. In the event of any failure, the entire ABS unit with attached EBCM must be replaced. For more information, refer to „Base Braking Mode” and „Antilock Braking Mode” in this section.

### BASE BRAKING MODE

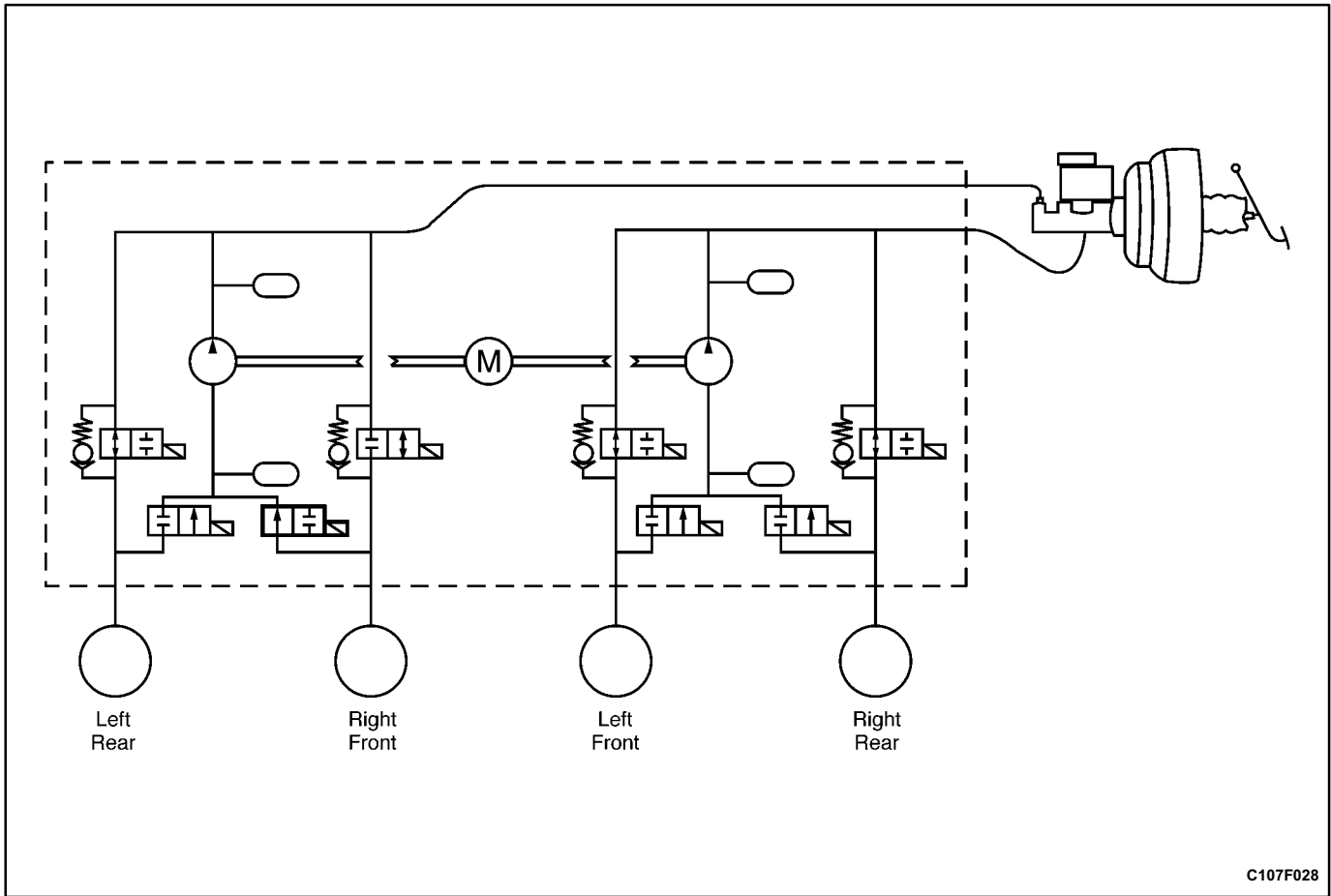
The baseline braking mode of the ABS 5.3 system used in this vehicle is a diagonal split system. In this system, one master cylinder circuit supplies pressure to the right front and the left rear brakes; the other circuit supplies pressure to the left front and the right rear brakes. All valves in the hydraulic modulator are in their normal, nonenergized positions as shown in the drawings found in „ABS System Components” in this section.



C107F027

## ANTILOCK BRAKING MODE

If a wheel speed sensor detects a wheel locking up, the electronic brake control module (EBCM) closes the normally open inlet valve for the brake on that wheel to prevent adding more hydraulic pressure to that brake. The illustration shows this for the right front brake.



C107F028

If the wheel locking tendency continues, the EBCM releases the hydraulic pressure at that brake by opening the outlet valve for that wheel.

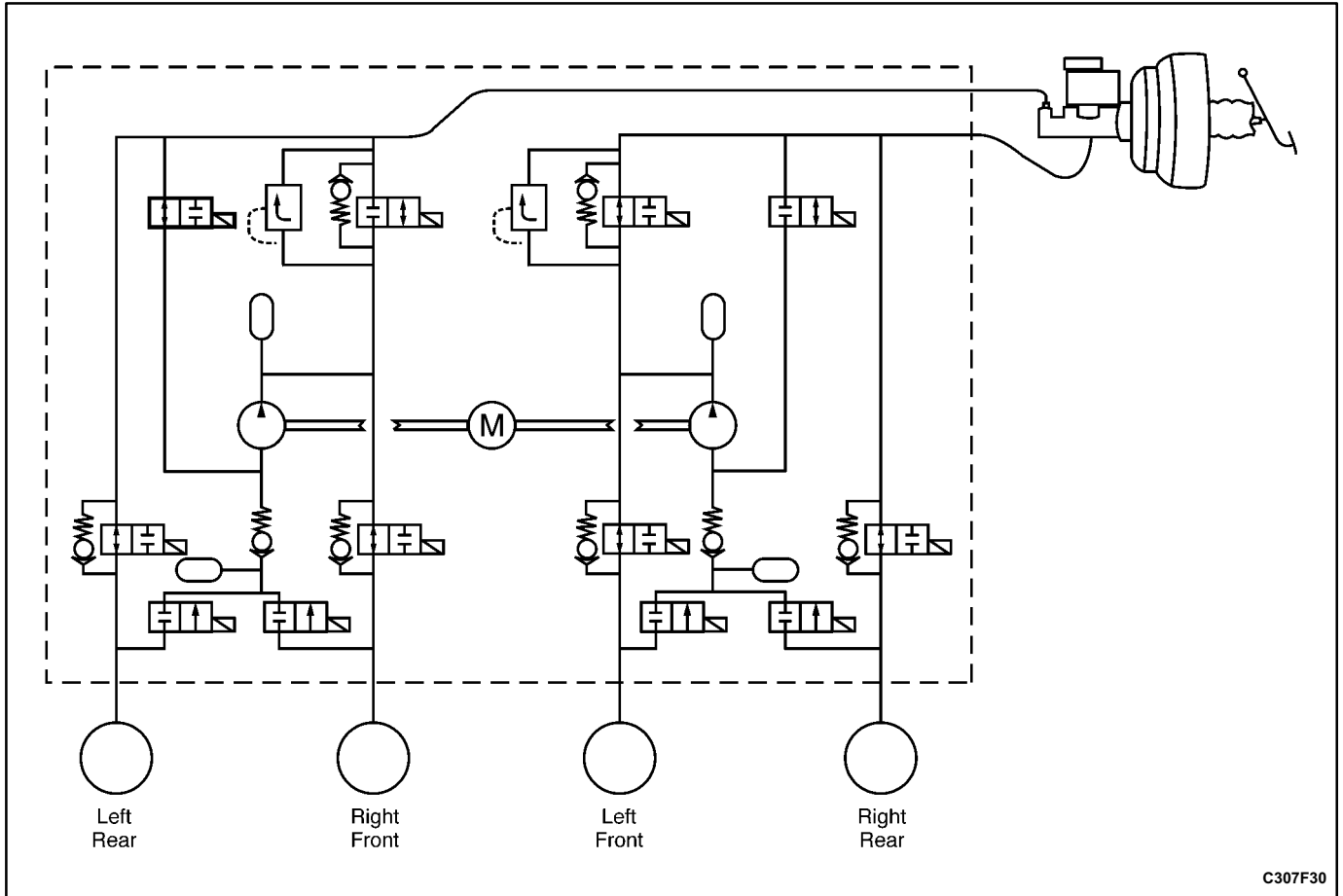
These inlet and outlet valves at the wheels operate the same way in a TCS system. The additional TCS valves do not operate for the ABS function.

### TRACTION CONTROL MODE

The Automatic Brake Differential form of traction control (TCS) used in this system operates by brake application to the drive wheel which is losing traction. This transfers torque to the wheel that has traction. It is available only at low speed (<40 km/h [25 mph]). When the TCS is active, The TCS indicator lamp in the instrument cluster will be blinking.

The TCS will operate when a wheel speed sensor detects a wheel spin situation with one of the drive

wheels. The electronic brake control module (EBCM) closes the normally open pilot valve to isolate the affected drive wheel brake from the master cylinder and from the rear wheel brake channel. The EBCM also turns on the pump and opens the prime valve to apply pressure to the brake at the wheel that is spinning. The following figures show action at the right front wheel only.

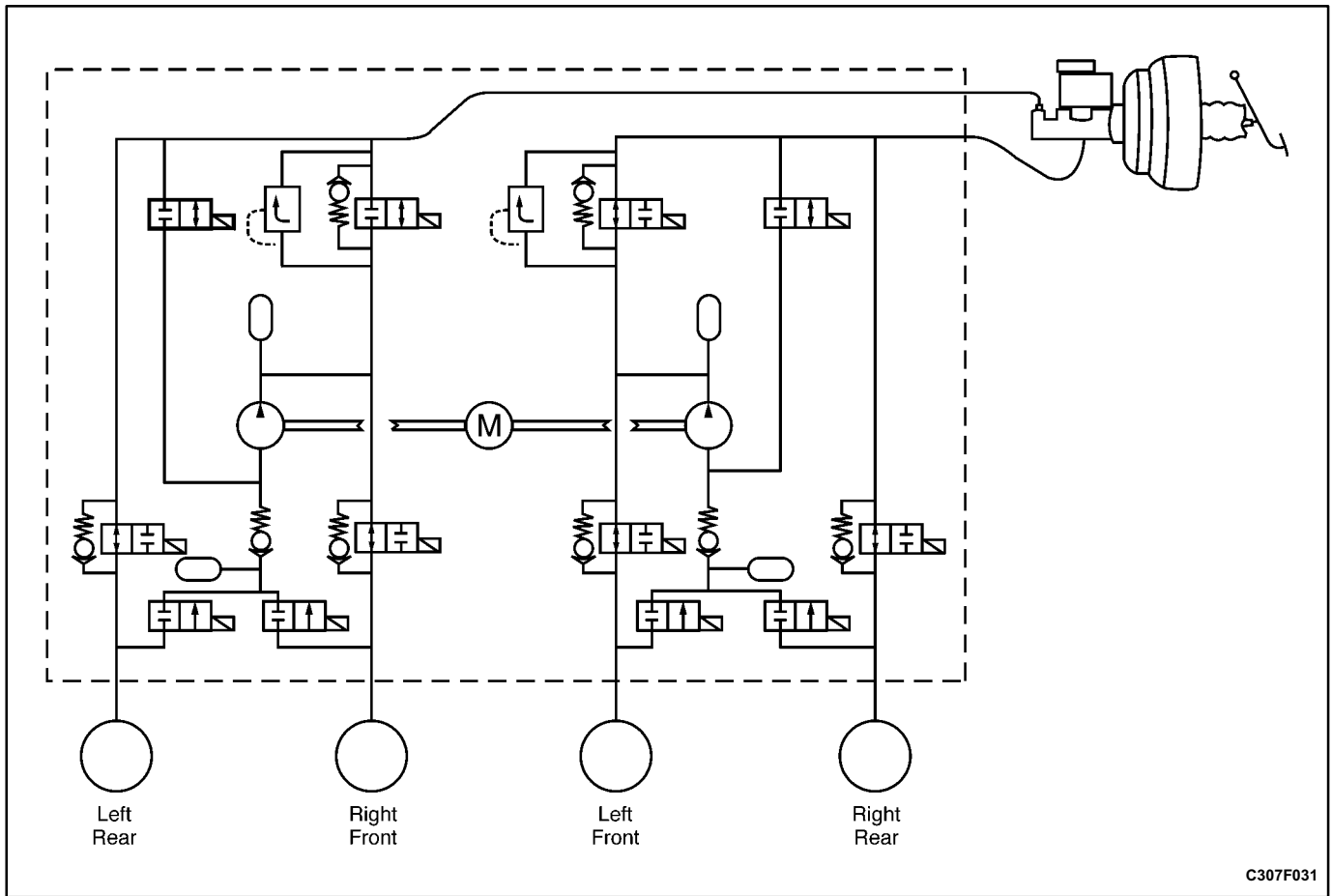


C307F30

# 4F - 86 ANTILOCK BRAKE SYSTEM AND TRACTION CONTROL SYSTEM

When the wheel spin condition is under control, the EBCM closes the prime valve for the wheel that was spinning to avoid additional braking at that wheel. The

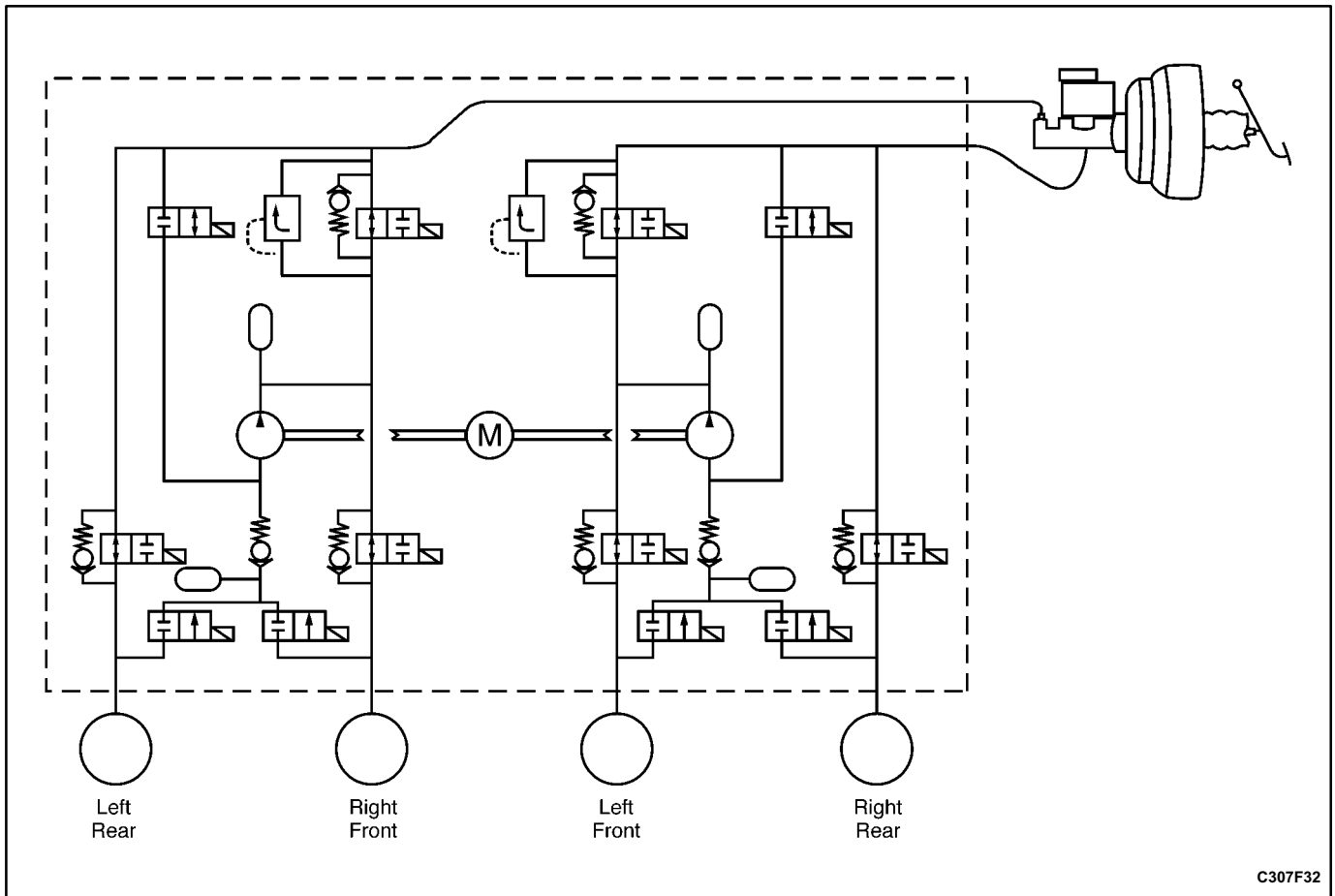
pressure relief valves will allow the excess hydraulic fluid being pumped to return to the master cylinder.



C307F031

When the wheel speed tendency is no longer detected, the EBCM turns off the pump and opens the pilot valve

to release the braking pressure, returning the system to its normal configuration.



C307F32

## TIRES AND ABS/TCS

### Replacement Tires

Tire size is important for proper performance of the ABS/TCS system. Replacement tires should be the same size, load range, and construction as the original tires. Replace tires in axle sets and only with tires of the same tire performance criteria (TPC) specification number. Use of any other size or type may seriously affect the ABS/TCS operation.

## ELECTRONIC BRAKE CONTROL MODULE (EBCM)

**Notice:** There is no serviceable or removable PROM. The EBCM must be replaced as an assembly.

The EBCM is attached to the hydraulic unit in the engine compartment. The controlling element of ABS 5.3 is a microprocessorbased EBCM. Inputs to the system include the four wheel speed sensors, the stoplamp switch, the ignition switch, and the unswitched battery voltage. There is an output to a bidirectional serial data link, located in pin K of the assembly line diagnostic link (ALDL), for service diagnostic tools and assembly plant testing.

The EBCM monitors the speed of each wheel. If any wheel begins to approach lockup and the brake switch is closed (brake pedal depressed), the EBCM controls the solenoids to reduce brake pressure to the wheel approaching lockup. Once the wheel regains traction, brake pressure is increased until the wheel again begins to approach lockup. This cycle repeats until either the vehicle comes to a stop, the brake pedal is released, or no wheels approach lockup.

Additionally, the EBCM monitors itself, each input (except the serial data link), and each output for proper operation. If it detects any system malfunction, the EBCM will store a DTC in nonvolatile memory (DTCs will not disappear if the battery is disconnected). Refer to „Self Diagnostics” in this section for more detailed information.

## FRONT WHEEL SPEED SENSORS

The front wheel speed sensors are of a variable reluctance type. Each sensor is attached to the steering knuckle, close to a toothed ring. The result, as teeth pass by the sensor, is an ac voltage with a frequency proportional to the speed of the wheel. The magnitude of the voltage and frequency increase with increasing

speed. The sensor is not repairable, nor is the air gap adjustable.

### **FRONT WHEEL SPEED SENSOR RINGS**

The toothed ring mentioned above is pressed onto the wheelside (outer) constant velocity joint. Each ring contains 48 equally spaced teeth. Exercise care during service procedures to avoid prying or contacting this ring. Excessive contact may cause damage to one or more teeth. If the ring is damaged, the wheelside constant velocity joint must be replaced.

### **REAR WHEEL SPEED SENSORS AND RINGS**

The rear wheel speed sensors operate in the same manner as the front wheel speed sensors. They incorporate a length of flexible harness with the connector attached to the end of the harness. The rear wheel speed rings are incorporated into the hub assemblies and cannot be replaced separately, but require replacement of the rear hub/bearing assembly.

### **VALVE RELAY AND PUMP MOTOR RELAY**

The valve relay and the motor pump relay are located inside the electronic brake control module (EBCM) and are not replaceable. If one should fail, replace the EBCM.

### **WIRING HARNESS**

The wiring harness is the mechanism by which the electronic brake control module (EBCM) is electrically connected to power and to ground, to the wheel speed sensors, the fuses, the switches, the indicators, and the serial communications port. The components, considered part of the wiring harness, are the wires that provide electrical interconnection, and connectors (terminals, pins, contacts, or lugs) that provide an electrical/mechanical interface from the wire to a system component.

### **INDICATORS**

The electronic brake control module (EBCM) continuously monitors itself and the other ABS components. If the EBCM detects a problem with the system, the amber ABS indicator will light continuously to alert the driver to the problem. An illuminated ABS indicator indicates that the ABS system has detected a problem that affects the operation of ABS. No antilock braking will be available. Normal, non-antilock brake performance will remain. In order to regain ABS braking ability, the ABS must be serviced.

The red BRAKE indicator will be illuminated when the system detects a low brake fluid level in the master cylinder or when the parking brake switch is closed (the parking brake is engaged).

When the vehicle is equipped with traction control (TCS), there is also a TCS indicator which the EBCM will illuminate when the traction control system is active.