

# SECTION : 4F

## ANTILOCK BRAKE 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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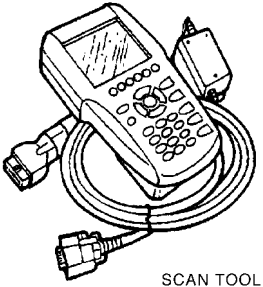
## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
ABS 5.3 Mounting Nuts	15	11	–
Brake Pipe Nuts	22	16	–
Front Wheel Speed Sensor Bolt	8	–	71

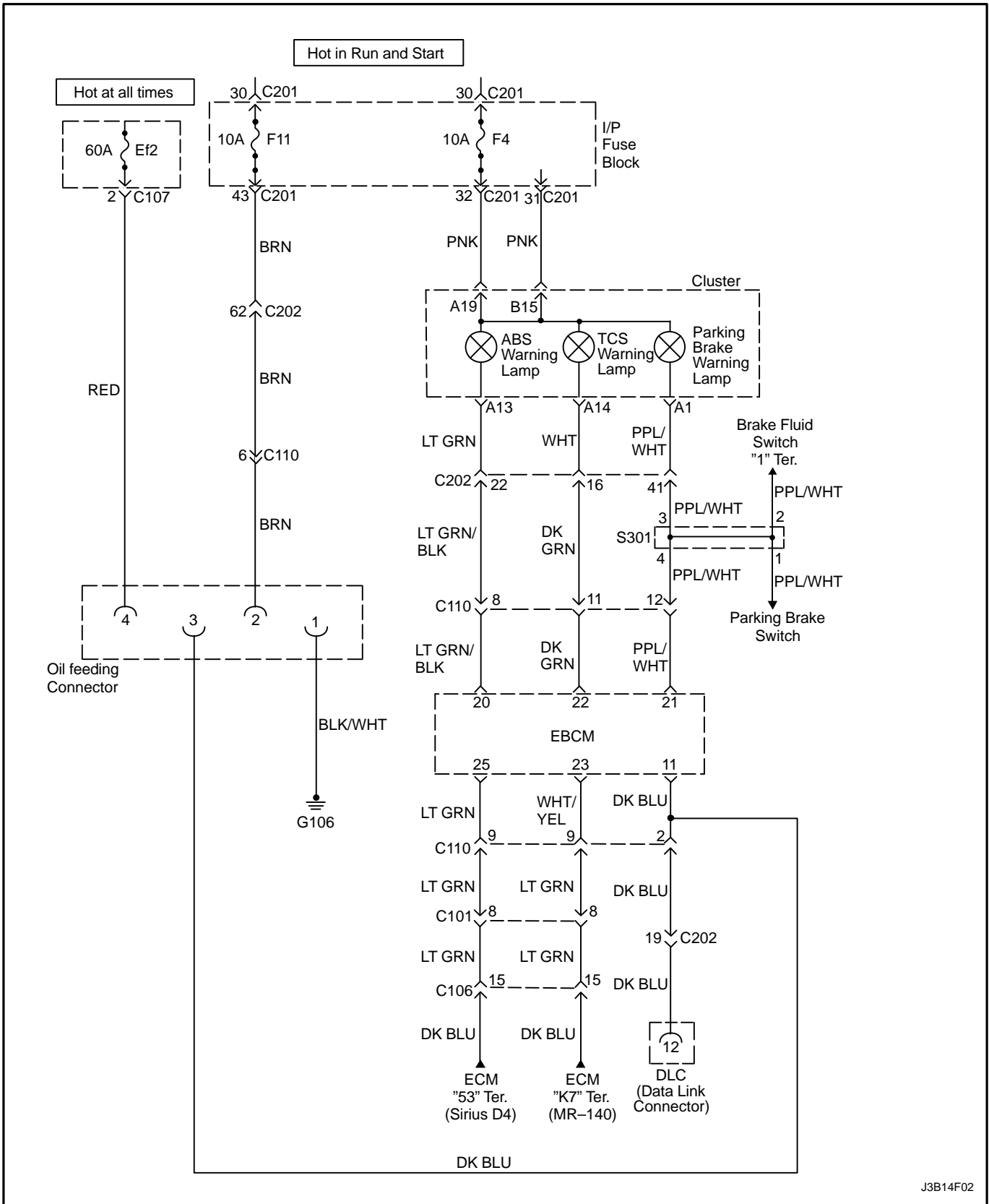
## SPECIAL TOOLS

### SPECIAL TOOLS TABLE

 <p style="text-align: center; margin-top: 5px;">SCAN TOOL</p>	<p>Scan Tool</p>
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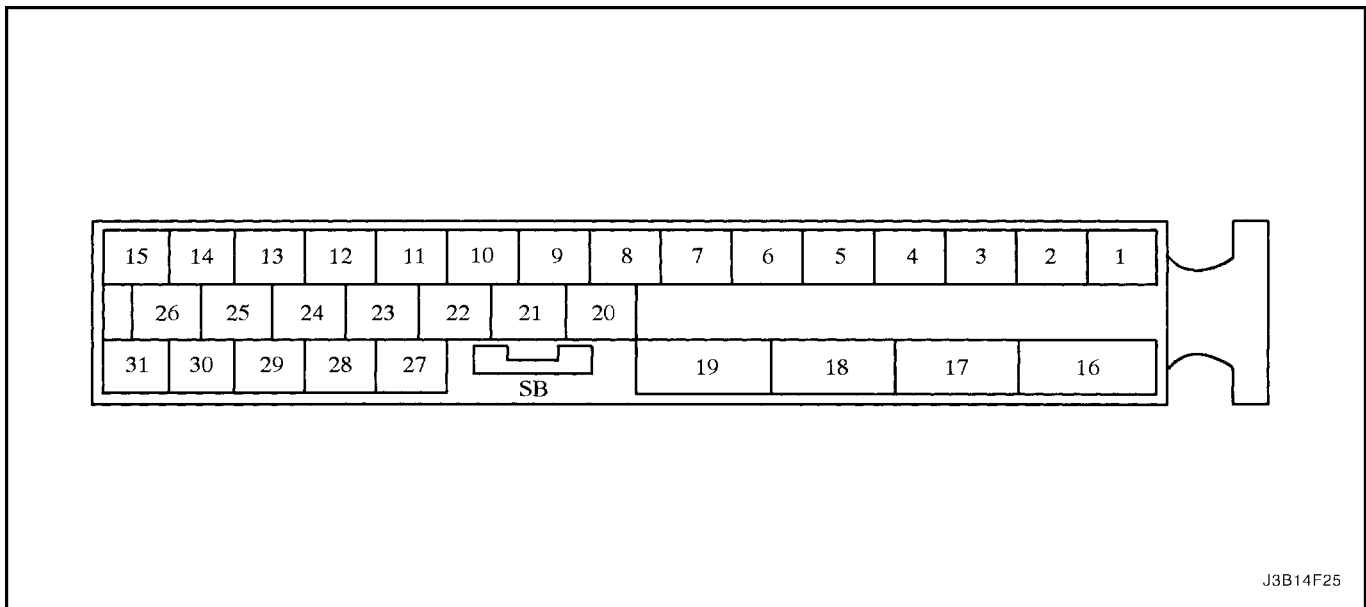


### ABS SYSTEM CIRCUIT (II)



## EBCM CONNECTOR FACE VIEW

### EBCM Connector



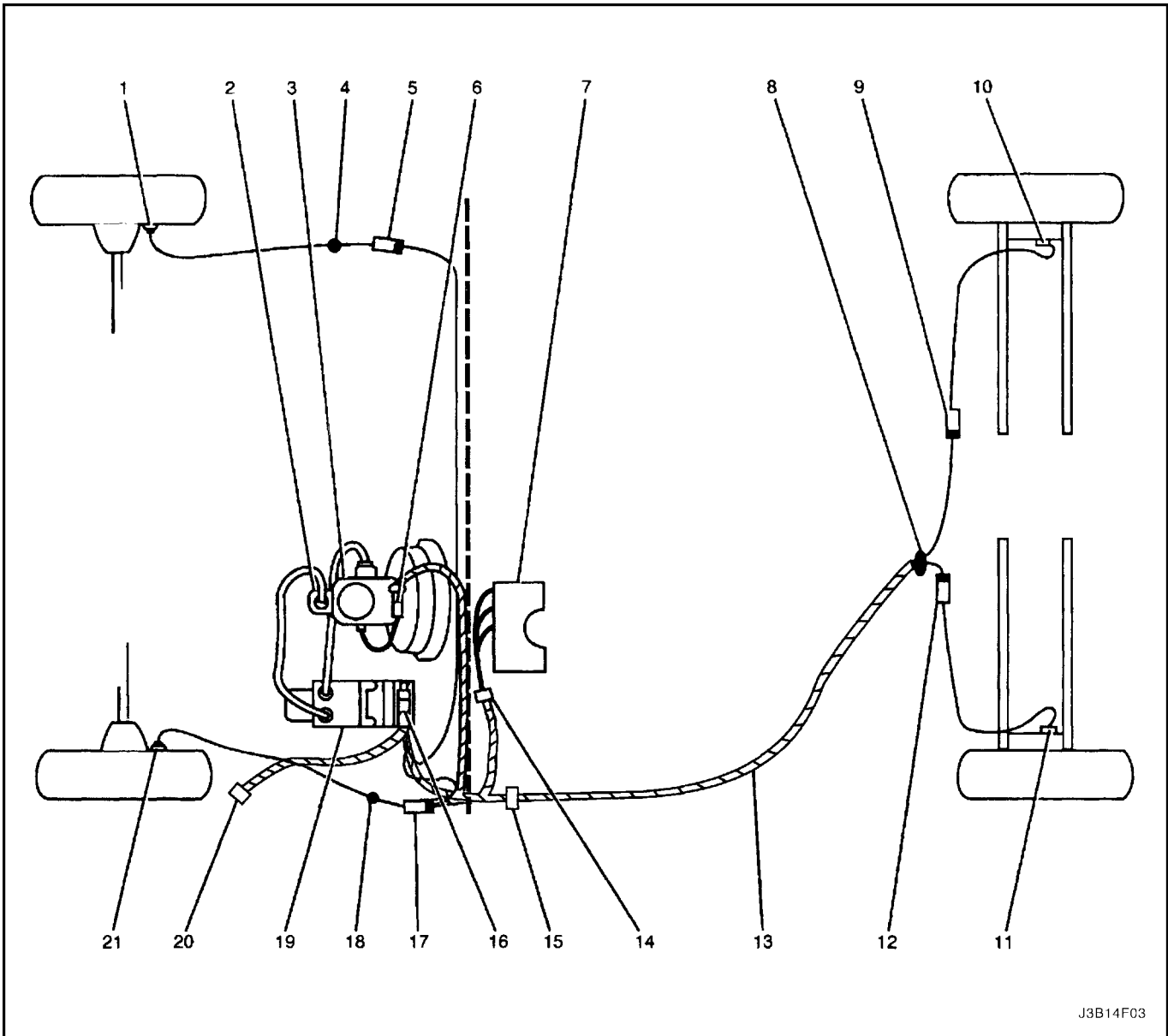
Pin	Color	Circuit
1	WHT	Right Rear Ground
2	BRN	Right Rear Sensor
3	PPL	Right Front Ground
4	–	Not Used
5	YEL	Right Front Sensor
6	WHT	Left Front Ground
7	ORN	Left Front Sensor
8	RED	Left Rear Ground
9	BLK	Left Rear Sensor
10	–	Not Used
11	DK BLU/ WHT	Data Link Connector (DLC)
12	–	Not Used
13	–	Not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

Pin	Color	Circuit
17	RED	Battery
18	RED	Battery
19	BLK/WHT	Instrument Ground
20	LT GRN	ABS Warning Lamp
21	BRN/WHT	EBD Warning Lamp (Parking Brake Lamp)
22	–	Not Used
23	–	Not Used
24	–	Not Used
25	–	WSS Output Signal
26	–	Not Used
27	–	Not Used
28	–	Not Used
29	–	Not Used
30	–	Not Used
31	–	Not Used
SB	–	Shorting Bar

# COMPONENT LOCATOR

## ABS/EBD SYSTEM DRIVE

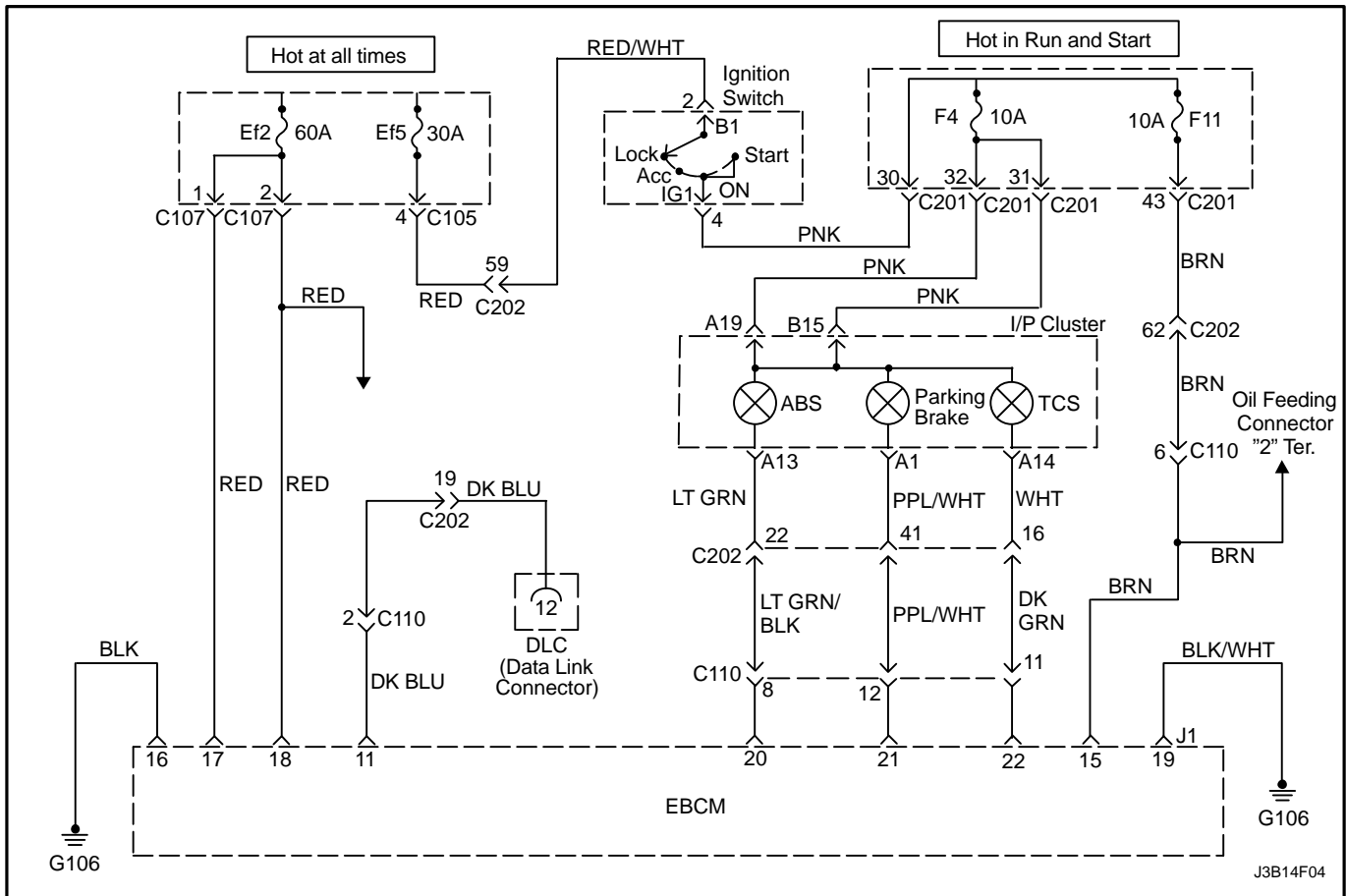
(Left-Hand Drive Shown, Right-Hand Drive Similar)



J3B14F03

- |   |  |
|---|--|
| 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 C202                         |
| 4. Grommet                                  | 15. Connectors C110                        |
| 5. Right Front Wheel Speed Sensor Connector | 16. EBCM Connector                         |
| 6. Brake Fluid Level Switch Connector       | 17. Left Front Speed Sensor Connector      |
| 7. Instrument Cluster                       | 18. Grommet                                |
| 8. Connector C302                           | 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            |  |

# 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/EBD system. Failure to do so may result in the loss of important diagnostic data and may lead to difficulties and time-consuming diagnosis procedures.

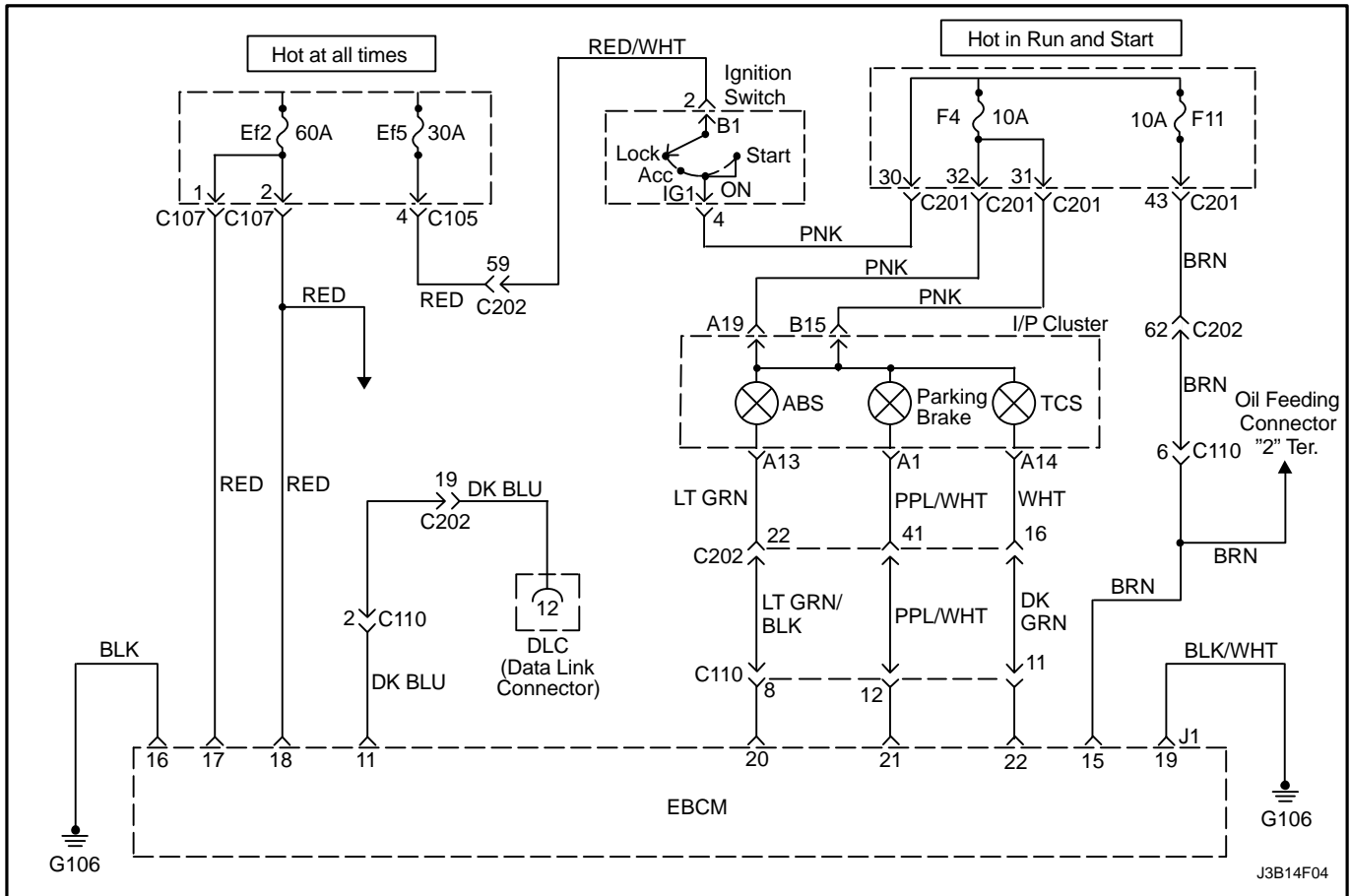
1. Perform the tests of the table below.
2. Perform a road test if directed by the table.
  - Test drive the vehicle while using the snapshot feature of the scan tool.
  - Perform normal acceleration, stopping, and turning maneuvers.
  - If this does not reproduce the malfunction, perform an ABS stop 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(s)	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 6
2	Check the display. Are there any current DTCs displayed?	–	Refer to the applicable DTC table	Go to Step 3

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Step	Action	Value(s)	Yes	No
3	<ol style="list-style-type: none"> <li>1. Turn the ignition switch to LOCK for 10 seconds.</li> <li>2. Turn the ignition switch to ON and observe the ABS indicator.</li> </ol> <p>Does the indicator light for 4 seconds and then go off?</p>	–	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	<p>Check the ABS indicator. Did the ABS indicator turn on and stay on?</p>	–	Go to "ABS Indicator Lamp Illuminated Constantly"	Go to "ABS Indicator Lamp Inoperative"
5	<ol style="list-style-type: none"> <li>1. Turn the ignition switch to LOCK for 10 seconds.</li> <li>2. Turn the ignition switch to ON and observe the parking brake / EBD indicator.</li> </ol> <p>Does the indicator light for 4 seconds and then go off?</p>	–	Go to <i>Step 12</i>	Go to "EBD System Indicator Lamp Inoperative"
6	<ol style="list-style-type: none"> <li>1. Turn the ignition switch to LOCK.</li> <li>2. Disconnect the EBCM harness connector.</li> <li>3. Turn the ignition switch to ON.</li> <li>4. Use a digital voltmeter (DVM) to measure the voltage from ground to terminal 15, 17, and 18 of EBCM harness connector.</li> </ol> <p>Is the voltage within the specified value on each terminal?</p>	11–14 v	Go to <i>Step 7</i>	Go to "Power Supply to Control Module, No DTCs Stored"
7	<ol style="list-style-type: none"> <li>1. Turn the ignition switch to LOCK.</li> <li>2. Use a DVM to measure the resistance from the EBCM harness connector, terminals 16 and 19 to ground.</li> </ol> <p>Is the resistance equal to the specified value?</p>	$\approx 0 \Omega$	Go to <i>Step 9</i>	Go to <i>Step 8</i>
8	<p>Repair the open in the circuit BLK and BLK/WHT that failed. Is the repair complete?</p>	–	System OK	–
9	<p>Use a DVM to measure the resistance between terminal 11 of the EBCM harness connector and terminal 12 of the Data Link Connector (DLC). Is the resistance below the specified value?</p>	2 $\Omega$	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	<p>Replace the ABS unit assembly. Is the repair complete?</p>	–	System OK	–
11	<p>Repair the open or high resistance in circuit DK BLU between terminal 11 of the EBCM harness connector and terminal 12 of the DLC jack. Is the repair complete?</p>	–	Go to <i>Step 1</i>	–
12	<p>Perform the road test described above. Are any DTCs set?</p>	–	Go to the table for the DTC	–



### 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 20 or by the shorting bar in the ABS module connector 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.

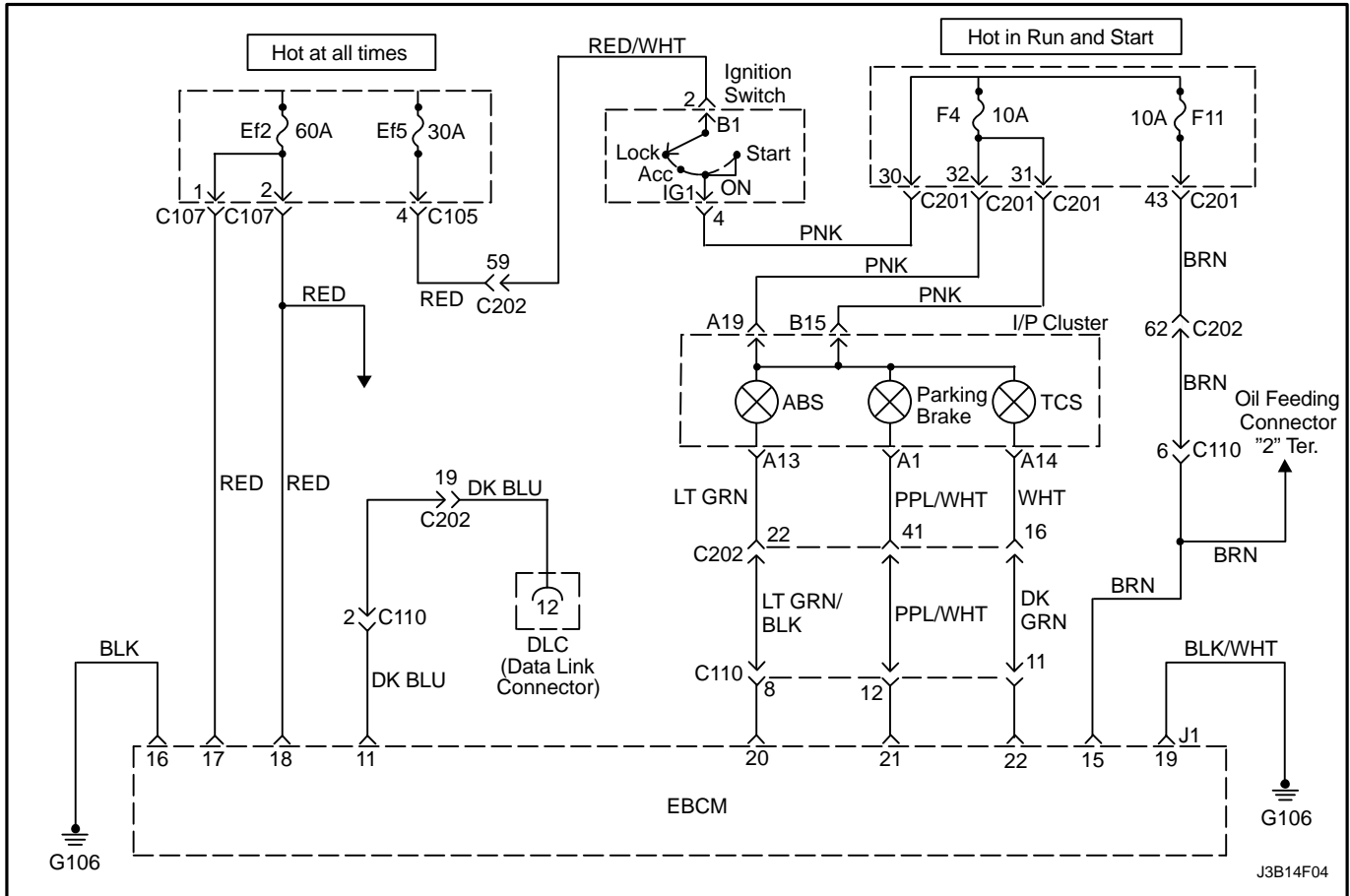
### ABS Indicator Lamp Inoperative

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 4 seconds, then turn off?	–	Go to "Intermittents and Poor Connections"	Go to Step 3

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Step	Action	Value(s)	Yes	No
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 from the electronic brake control module (EBCM). 3. Turn the ignition switch to ON. Does the ABS indicator illuminate?	–	Go to <i>Step 5</i>	Go to <i>Step 8</i>
5	<ul style="list-style-type: none"> <li>Turn the ignition switch to LOCK.</li> <li>Examine terminals 19 and 20 at the EBCM connector on both the ABS wiring harness and on the EBCM.</li> </ul> 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	<ul style="list-style-type: none"> <li>Turn the ignition switch to LOCK.</li> <li>Disconnect the wire from the negative battery terminal.</li> <li>Measure the resistance between the negative battery wire, which is attached to ground, and the shorting bar in the EBCM connector.</li> </ul> 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, 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 <i>Step 11</i>	Go to <i>Step 12</i>
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 A13. 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 A13. Is the repair complete?	–	System OK	–
14	Check the wiring harnesses and the connectors in circuit LT GRN/BLK from the I/P cluster terminal A13 to terminal 20 of the EBCM connector. Does the ohmmeter show the specified value?	∞	Go to <i>Step 15</i>	Go to <i>Step 16</i>
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 and ground G106. Does the ground connection match the specified value?	0 Ω	Go to <i>Step 17</i>	Go to <i>Step 18</i>

Step	Action	Value(s)	Yes	No
17	Replace the ABS unit. Is the repair complete?	–	System OK	–
18	Repair the continuity problem between terminal 19 of the EBCM connector and ground G106. Is the repair complete?	–	System OK	–
19	1. Turn the ignition switch to LOCK. 2. Check fuse F4 in the I/P fuse block. Is this fuse blown?	–	Go to <i>Step 20</i>	Go to <i>Step 21</i>
20	Replace fuse F4. Is the repair complete?	–	System OK	–
21	Check fuse EF5 in the engine fuse block. Is this fuse blown?	–	Go to <i>Step 22</i>	Go to <i>Step 23</i>
22	Replace fuse EF5. 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 <i>Step 25</i>	Go to <i>Step 24</i>
24	1. Check circuit RED between terminal 4 of C105 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 (PNK) of the ignition switch connector. Does the voltage match the specified value?	11–14 v	Go to <i>Step 27</i>	Go to <i>Step 26</i>
26	Replace the ignition switch. Is the repair complete?	–	System OK	–
27	1. Turn the ignition switch to LOCK. 2. Check circuit PNK from terminal 4 of the ignition switch to fuse F4 in the I/P fuse block. Does the ohmmeter show the specified value?	∞	Go to <i>Step 28</i>	Go to <i>Step 29</i>
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 F4 to terminal A19 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	–



## POWER SUPPLY TO CONTROL MODULE, NO DTCS STORED

### Circuit Description

Battery voltage is supplied to the electronic brake control module (EBCM) through fuse F11 in the I/P fuse block, to terminal 15 of the EBCM connector. 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.

### 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.

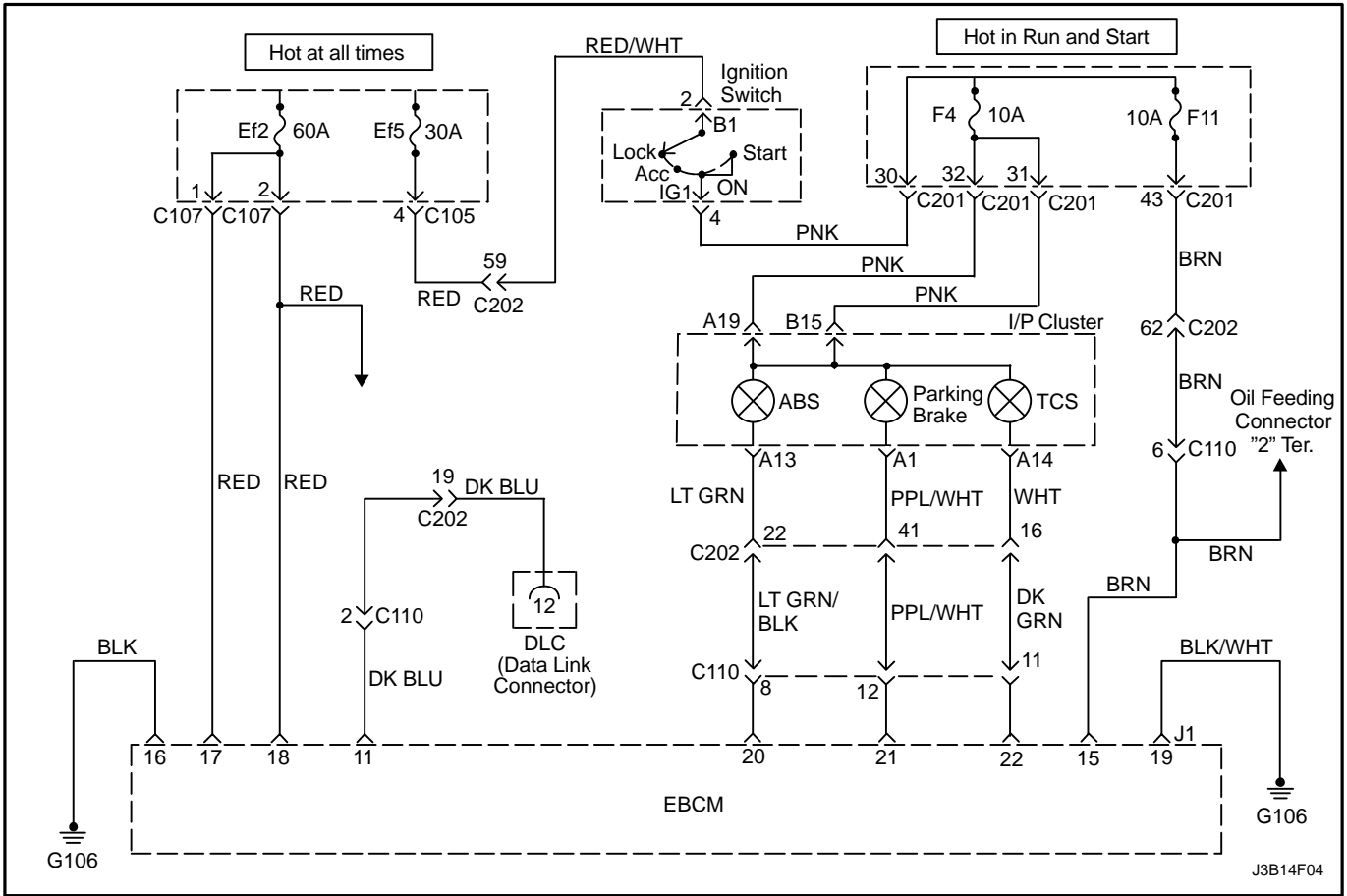
**Power Supply to Control Module, No DTCs Stored**

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 EF2 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 EF2. 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 EF2. 3. Disconnect the ABS connector from the EBCM. 4. Measure the resistance to ground at terminals 17 and 18. Does the ohmmeter show the specified value?	0 $\Omega$	Go to <i>Step 7</i>	Go to <i>Step 25</i>
7	Repair the short to ground in circuit RED between terminal 1 of engine fuse block connector C107 and the ABS harness EBCM connector. Is the repair complete?	–	System OK	–
8	Check fuse EF5 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 EF5. 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 EF5. 3. Disconnect ABS connector 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 12</i>	Go to <i>Step 25</i>
12	1. Examine circuit RED between terminal 4 of engine fuse block connector C105 and terminal 2 of the ignition switch. 2. Examine circuit PNK from terminal 4 of the ignition switch to fuse F11 in the I/P fuse block. 3. Examine circuit PNK from fuse F11 in the I/P fuse block to terminal 15 of the ABS EBCM connector. 4. Repair any short to ground found in the wiring or the ignition switch. Is the repair complete?	–	System OK	–
13	Check fuse F11 in the I/P fuse block. Is the fuse blown?	–	Go to <i>Step 14</i>	Go to <i>Step 18</i>

## 4F – 14 ANTILOCK BRAKE SYSTEM

Step	Action	Value(s)	Yes	No
14	<ol style="list-style-type: none"> <li>1. Replace fuse F11.</li> <li>2. Turn the ignition to ON.</li> </ol> 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	<ol style="list-style-type: none"> <li>1. Turn the ignition to OFF.</li> <li>2. Remove fuse F11.</li> <li>3. Disconnect ABS connector from the EBCM.</li> <li>4. Measure the resistance to ground at terminal 15.</li> </ol> Does the ohmmeter show the specified value?	0 Ω	Go to <i>Step 17</i>	Go to <i>Step 25</i>
17	Repair the short to ground in circuit PNK fuse F11 of the I/P fuse block and terminal 15 of the ABS harness EBCM connector. Is the repair complete?	–	System OK	–
18	<ol style="list-style-type: none"> <li>1. Disconnect the EBCM connector from the EBCM.</li> <li>2. Turn the ignition to ON.</li> <li>3. Check for the presence of battery voltage between ground and terminal 17, and between ground and terminal 18.</li> </ol> Is the voltage within the specified value?	11–14 v	Go to <i>Step 20</i>	Go to <i>Step 19</i>
19	<ol style="list-style-type: none"> <li>1. Turn the ignition switch to OFF.</li> <li>2. Trace the RED wires between terminals 17 and 18 of the EBCM connector to terminal 1 of connector C107 at the engine fuse block.</li> <li>3. Repair the open in this circuit.</li> </ol> Is the repair complete?	–	System OK	–
20	Check the voltage between ground and terminal 15 of the EBCM connector. Is the voltage within the specified value?	11–14 v	Go to <i>Step 22</i>	Go to <i>Step 21</i>
21	<ol style="list-style-type: none"> <li>1. Turn the ignition switch to OFF.</li> <li>2. Trace circuit PNK between terminal 15 of the ABS harness EBCM connector to fuse F11 in the I/P fuse block.</li> <li>3. Trace circuit PNK from fuse F11 of the I/P fuse block to terminal 4 (IG1) of the ignition switch.</li> <li>4. Trace circuit RED from terminal 2 (B1) of the ignition switch to terminal 4 of connector C105 at the engine fuse block and to fuse EF5.</li> <li>5. Repair the open in the wiring or possibly bad connector terminal, defective ignition switch, or blown fuse EF5.</li> </ol> Is the repair complete?	–	System OK	–
22	<ol style="list-style-type: none"> <li>1. Turn the ignition to OFF.</li> <li>2. Check the resistance between ground and terminals 19 and 16 of the EBCM connector.</li> </ol> Does the ohmmeter show the specified value?	0 Ω	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>

<b>Step</b>	<b>Action</b>	<b>Value(s)</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 20.

### 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 A13 and the EBCM terminal 20.
- The EBCM is faulty.

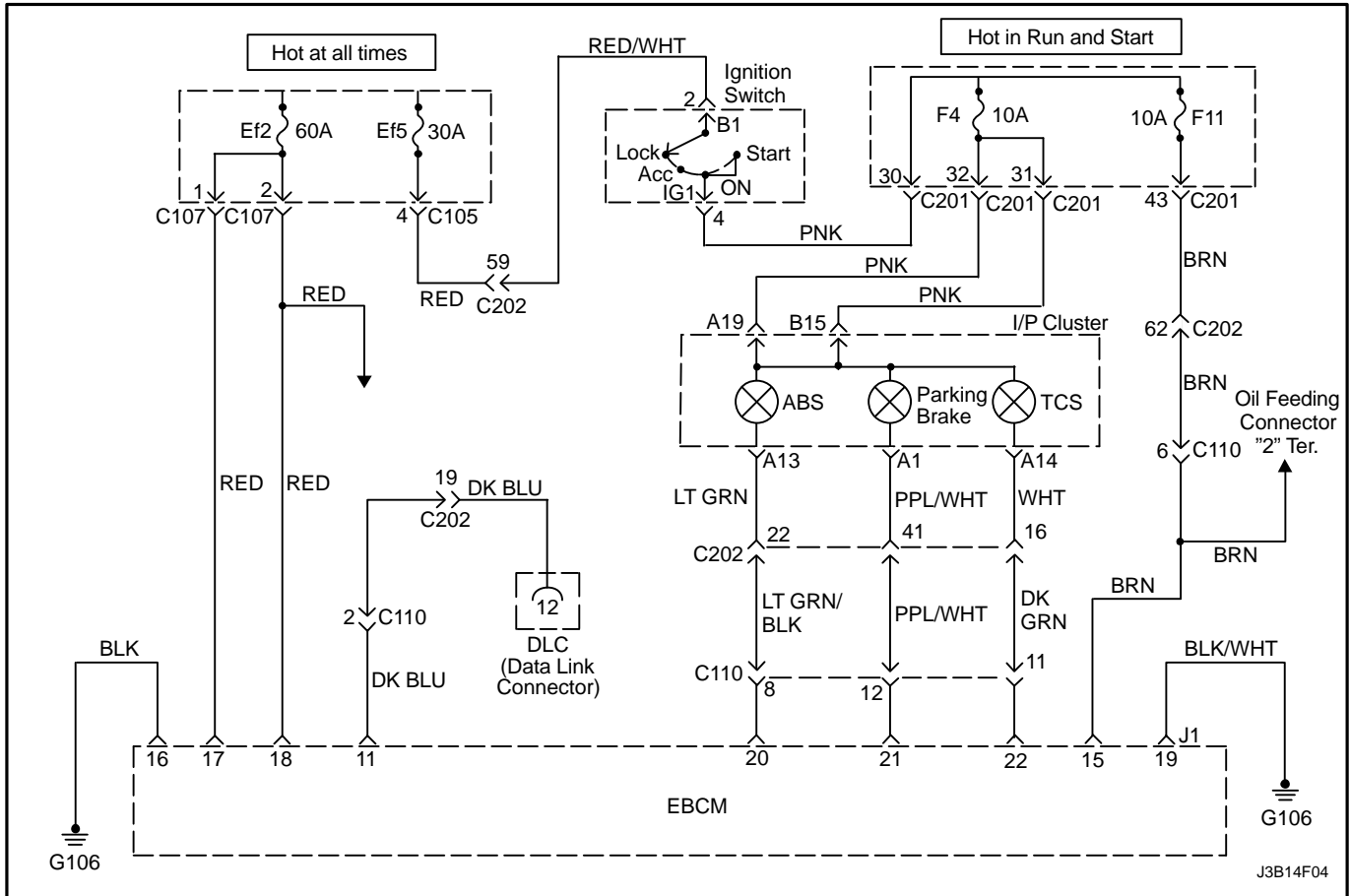
### Test Description

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**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	Check the EBCM connector. Is it connected properly?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
2	Connect the EBCM connector. Is the repair complete?	–	System OK	–
3	<ul style="list-style-type: none"> <li>• Disconnect the EBCM connector.</li> <li>• Turn the ignition switch to ON.</li> <li>• Use an insulated tool to push the shorting bar in the connector away from terminal 20.</li> </ul> Does the ABS indicator lamp go out?	–	Go to <i>Step 4</i>	Go to <i>Step 5</i>
4	Replace the ABS unit. Is the repair complete?	–	System OK	–
5	<ul style="list-style-type: none"> <li>• Turn the ignition switch to OFF.</li> <li>• Connect the EBCM connector.</li> <li>• Disconnect connector C110.</li> <li>• Turn the ignition switch to ON.</li> </ul> Does the ABS indicator lamp illuminate?	–	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	Repair the short to ground in circuit LT GRN between connector C110 and the EBCM connector. Is the repair complete?	–	System OK	–
7	Repair the short to ground in circuit LT GRN between I/P cluster connector A13 and connector C110. Is the repair complete?	–	System OK	–



## ELECTRONIC BRAKE-FORCE DISTRIBUTION (EBD) SYSTEM INDICATOR LAMP INOPERATIVE

### Circuit Description

Battery voltage is supplied to the EBD 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 21.

### 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 EBD 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.

### EBD 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. Release the parking brake fully. 4. Push the brake pedal. 5. Turn the ignition switch to ON. 6. Observe the EBD indicator lamp. Does the lamp illuminate for about 4 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 from the EBCM. 3. Connect a jumper from terminal 21 to the grounding bar in the connector. 4. Turn the ignition switch to ON. Does the EBD indicator illuminate?	–	Go to <i>Step 5</i>	Go to <i>Step 8</i>
5	<ul style="list-style-type: none"> <li>• Turn the ignition switch to LOCK.</li> <li>• Examine terminals 19 and 21 at the EBCM connector on both the ABS wiring harness and on the EBCM.</li> </ul> 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	<ul style="list-style-type: none"> <li>• Turn the ignition switch to LOCK.</li> <li>• Disconnect the wire from the negative battery terminal.</li> <li>• Measure the resistance between the negative battery wire, which is attached to ground, and the shorting bar in the EBCM connector.</li> </ul> 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, terminal 19 to ground G106. Is the repair complete?	–	System OK	–
10	1. Remove the I/P cluster. 2. Remove and check the EBD indicator bulb. Is the bulb burned out?	–	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	1. Replace the EBD 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 A1. Does the ohmmeter show the specified value?	0 Ω	Go to <i>Step 14</i>	Go to <i>Step 13</i>

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Step	Action	Value(s)	Yes	No
13	Repair the contact at the I/P cluster connector terminal A1. Is the repair complete?	–	System OK	–
14	Check the wiring harnesses and connectors in circuit PPL/WHT from the I/P cluster terminal A1 to terminal 21 of the EBCM connector. Does the ohmmeter show the specified value?	$\infty$	Go to <i>Step 15</i>	Go to <i>Step 16</i>
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 and ground G106. Does the ground connection match the specified value?	0 $\Omega$	Go to <i>Step 17</i>	Go to <i>Step 18</i>
17	Replace the ABS unit. Is the repair complete?	–	System OK	–
18	Repair the continuity problem between terminal 19 of the EBCM connector and ground G106. Is the repair complete?	–	System OK	–
19	1. Turn the ignition switch to LOCK. 2. Check fuse F4 in the I/P fuse block. Is this fuse blown?	–	Go to <i>Step 20</i>	Go to <i>Step 21</i>
20	Replace fuse F4. Is the repair complete?	–	System OK	–
21	Check fuse EF5 in the engine fuse block. Is this fuse blown?	–	Go to <i>Step 22</i>	Go to <i>Step 23</i>
22	Replace fuse EF5. 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 <i>Step 25</i>	Go to <i>Step 24</i>
24	1. Check circuit RED between terminal 4 of C105 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 (PNK) of the ignition switch connector. Is the voltage within the specified value?	11–14 v	Go to <i>Step 27</i>	Go to <i>Step 26</i>
26	Replace the ignition switch. Is the repair complete?	–	System OK	–
27	1. Turn the ignition switch to LOCK. 2. Check circuit PNK from terminal 4 of the ignition switch to fuse F4 in the I/P fuse block. Does the ohmmeter show the specified value?	$\infty$	Go to <i>Step 28</i>	Go to <i>Step 29</i>

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
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 F4 to terminal B15 or A19 of the I/P cluster connector A. 3. Repair any open or high resistance found in a wiring harness, splice pack, or 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.

**Important :** For safety reasons it is recommended that the vehicle not be driven with test equipment connected. Exception : for testing of wheel speeds provided the test regulations are met.

The EBCM performs system self-diagnostics 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 EBD indicators in most instances, and may disable the ABS and/or the EBD functions as necessary for the duration of the ignition cycle.

Once each ignition cycle, the EBCM performs an automatic test when the vehicle speed > 6 km/h and the brake pedal is not actuated or when the vehicle speed > 15 km/h and the brake pedal is actuated. 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:

- Use the scan tool "Clear DTCs" selection.

The method is 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 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."

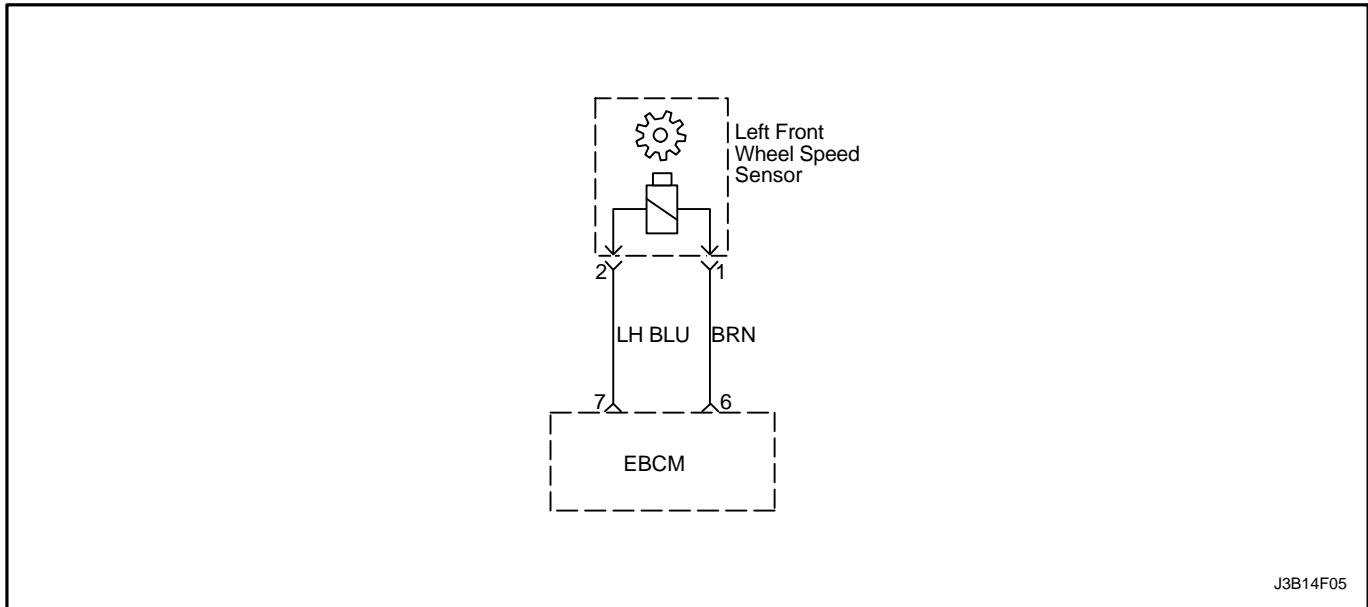
Clearing the fault memory cannot reset a valve relay which was shut down when the fault was recognized. Changes are possible only after the fault has been eliminated and the next ignition cycle has begun.

## 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) C0035

### LEFT FRONT WHEEL SPEED SENSOR CIRCUIT MALFUNCTION

#### 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.
- There is a problem in the toothed ring.
- Wrong installed WSS.
- Wrong sensor signal.
- Signal noise via WSS.

#### Fail Action

ABS action is disabled, and the ABS warning lamp is ON. EBD is enabled. (Refer to the EBD failure matrix in this section).

#### 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.

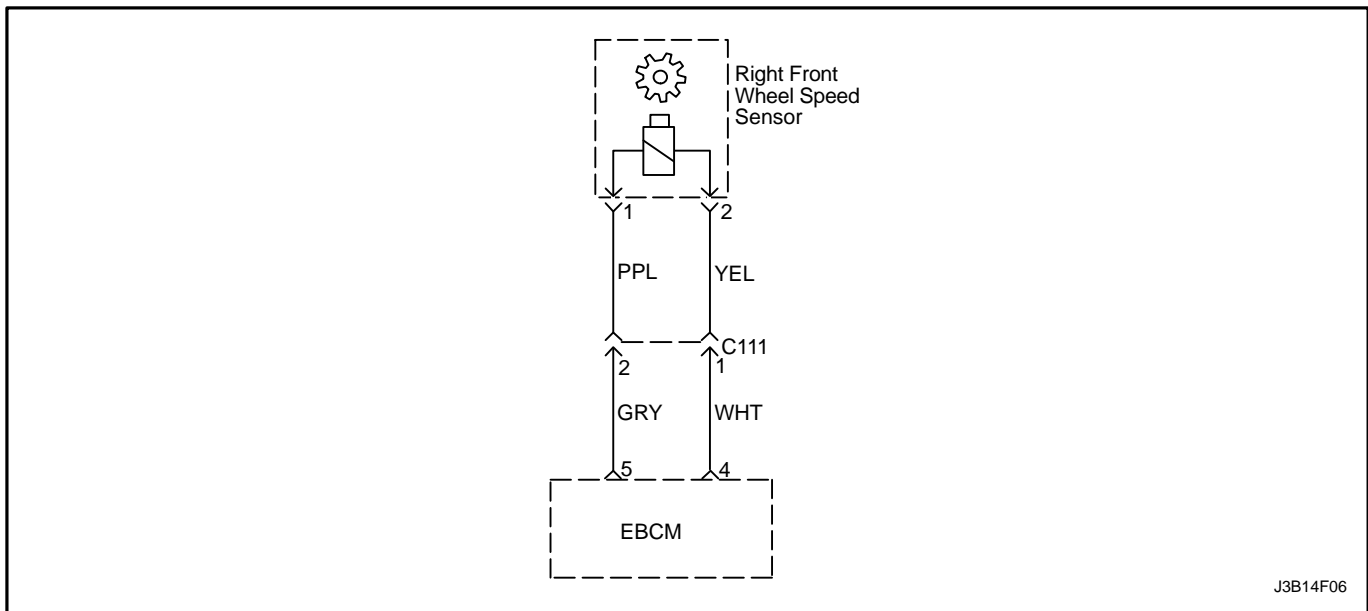
You can use the scan tool to monitor wheel speeds during a road test. Watch the wheel speeds being displayed on the scan tool to see if any of the readings is unusual, such as one sensor varying in speed from the other three, a signal going intermittently high or low, etc. If this does not identify the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

**Important :** If the WSS signal fault input to the EBCM, the ABS warning lamp turns on. As if a sensor signal fault can be removed by the scan tool, the ABS warning lamp doesn't turn off. In order to turn ABS warning lamp off, you should driver a car up to 12 km/h.

**DTC C0035 – Left Front Wheel Speed Sensor Circuit Malfunction**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	Examine the wheel speed sensor. Are there any signs of physical damage?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
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 <i>Step 4</i>	Go to <i>Step 3</i>
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 v	Go to <i>Step 6</i>	Go to <i>Step 5</i>
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 <i>Step 7</i>	Go to <i>Step 8</i>
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 <i>Step 9</i>	Go to <i>Step 10</i>
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 <i>Step 11</i>	Go to <i>Step 12</i>

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
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	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0040

### RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT MALFUNCTION

#### 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.
- There is a problem in the toothed ring.
- Wrong installed WSS.
- Wrong sensor signal.
- Signal noise via WSS.

#### Fail Action

ABS action is disabled, and the ABS warning lamp is ON. EBD is enabled. (Refer to the EBD failure matrix in this section)

#### 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.

**Important :** If the WSS signal fault input to the EBCM, the ABS warning lamp turns on. As if a sensor signal fault can be removed by the scan tool, the ABS warning lamp doesn't turn off. In order to turn ABS warning lamp off, you should drive a car up to 12 km/h.

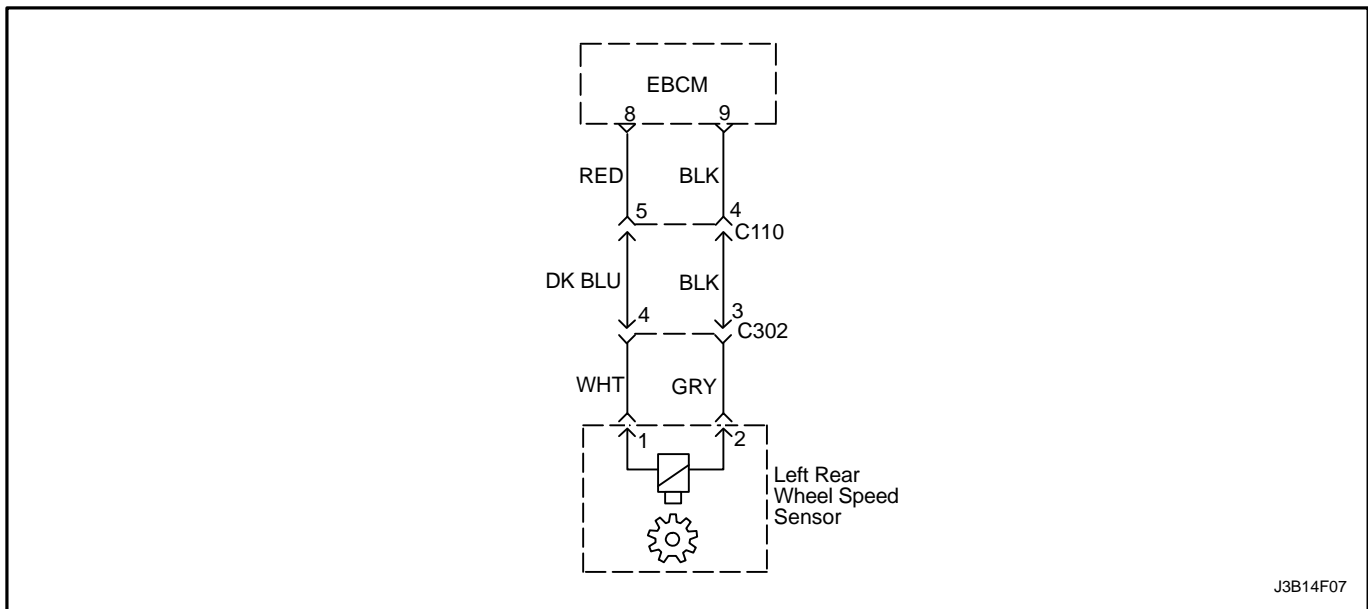
**DTC C0040 – Right Front Wheel Speed Sensor Circuit Malfunction**

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
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 <i>Step 4</i>	Go to <i>Step 3</i>
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 v	Go to <i>Step 6</i>	Go to <i>Step 5</i>
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 <i>Step 7</i>	Go to <i>Step 8</i>
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 <i>Step 9</i>	Go to <i>Step 10</i>
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 WHT wire. 2. Measure the resistance between terminal 5 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the GRY wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to <i>Step 11</i>	Go to <i>Step 12</i>

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<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
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	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0045

### LEFT REAR WHEEL SPEED SENSOR CIRCUIT MALFUNCTION

#### 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.
- There is a problem in the toothed ring.
- Wrong installed WSS.
- Wrong sensor signal.
- Signal noise via WSS.

#### Fail Action

ABS action is disabled, and the ABS warning lamp is ON. EBD is enabled. (Refer to the EBD failure matrix in this section)

#### 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.

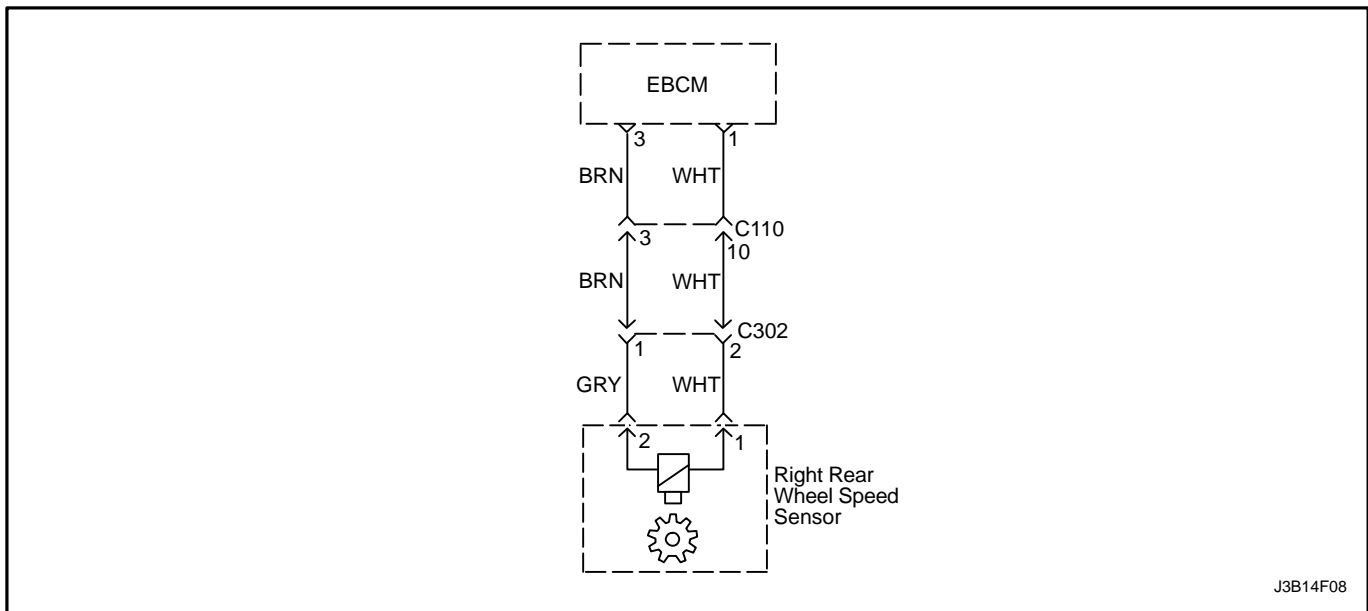
You can use the scan tool to monitor wheel speeds during a road test. Watch the wheel speeds being displayed on the scan tool to see if any of the readings is unusual, such as one sensor varying in speed from the other three, a signal going intermittently high or low, etc. If this does not identify the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

**Important :** If the WSS signal fault input to the EBCM, the ABS warning lamp turns on. As if a sensor signal fault can be removed by the scan tool, the ABS warning lamp doesn't turn off. In order to turn ABS warning lamp off, you should drive a car up to 12 km/h.

**DTC C0045 – Left Rear Wheel Speed Sensor Circuit Malfunction**

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
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 the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280–1920 Ω	Go to <i>Step 4</i>	Go to <i>Step 3</i>
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 v	Go to <i>Step 6</i>	Go to <i>Step 5</i>
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 <i>Step 7</i>	Go to <i>Step 8</i>
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 <i>Step 9</i>	Go to <i>Step 10</i>
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 RED wire. 2. Measure the resistance between terminal 9 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the BLK wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to <i>Step 11</i>	Go to <i>Step 12</i>

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
11	Repair the open or the high resistance in the affected circuit as required. Be sure to check terminals 5 and 4 of connector C110 and terminal 3 and 4 of connector C302. Is the repair complete?	–	System OK	–
12	Replace the ABS unit. Is the repair complete?	–	System OK	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0050

### RIGHT REAR WHEEL SPEED SENSOR CIRCUIT MALFUNCTION

#### 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.
- There is a problem in the toothed ring.
- Wrong installed WSS.
- Wrong sensor signal.
- Signal noise via WSS.

#### Fail Action

ABS action is disabled, and the ABS warning lamp is ON. EBD is enabled. (Refer to the EBD failure matrix in this section)

#### 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.

**Important :** If the WSS signal fault input to the EBCM, the ABS warning lamp turns on. As if a sensor signal fault can be removed by the scan tool, the ABS warning lamp doesn't turn off. In order to turn ABS warning lamp off, you should drive a car up to 12 km/h.

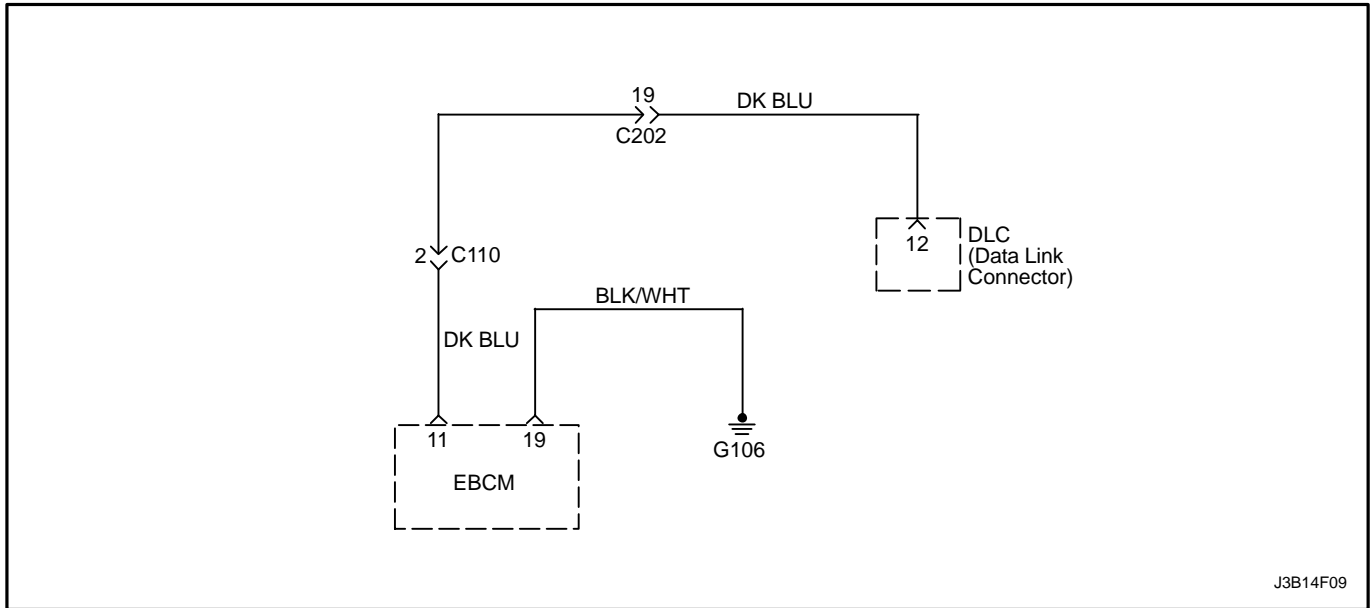
**DTC C0050 – Right Rear Wheel Speed Sensor Circuit Malfunction**

Step	Action	Value(s)	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
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 the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25°C (77°F)?	1280–1920 Ω	Go to <i>Step 4</i>	Go to <i>Step 3</i>
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 v	Go to <i>Step 6</i>	Go to <i>Step 5</i>
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 <i>Step 7</i>	Go to <i>Step 8</i>
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 2 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to <i>Step 9</i>	Go to <i>Step 10</i>
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 WHT wire. 2. Measure the resistance between terminal 2 at the harness EBCM connector and the harness wheel speed sensor connector terminal connected to the GRY wire. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to <i>Step 11</i>	Go to <i>Step 12</i>

## 4F – 34 ANTILOCK BRAKE SYSTEM

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<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
11	Repair the open or high resistance in the affected circuit as required. Be sure to check terminals 3 and 10 of connector C110 and terminals 1 and 2 of connector C302. Is the repair complete?	–	System OK	–
12	Replace the ABS unit. Is the repair complete?	–	System OK	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0060/C0065 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. EBD is disabled. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

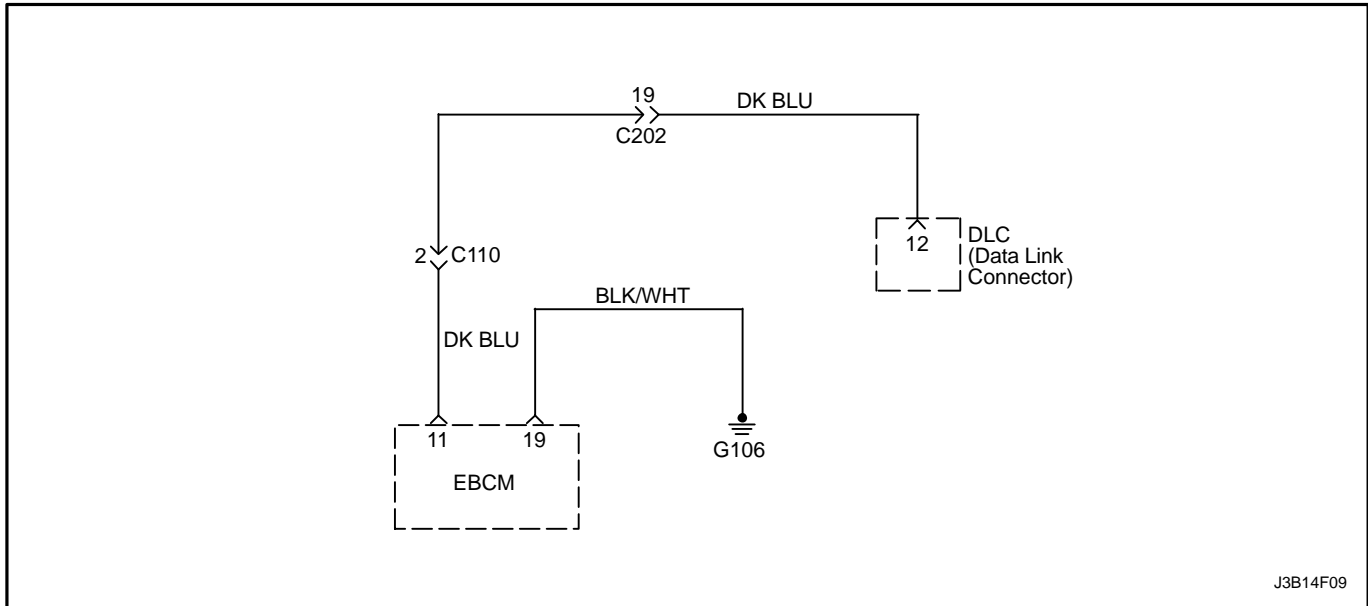
### Test Description

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 C0060/C0065 – 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 Data Link Connector (DLC) 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 <i>Step 2</i>	Go to <i>Step 6</i>
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 <i>Step 6</i>	Go to <i>Step 3</i>
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 <i>Step 4</i>	Go to <i>Step 6</i>
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 <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) C0070/C0075 RIGHT 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 right front inlet and outlet valves are functioning.

### Cause(s)

- 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. EBD is disabled. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

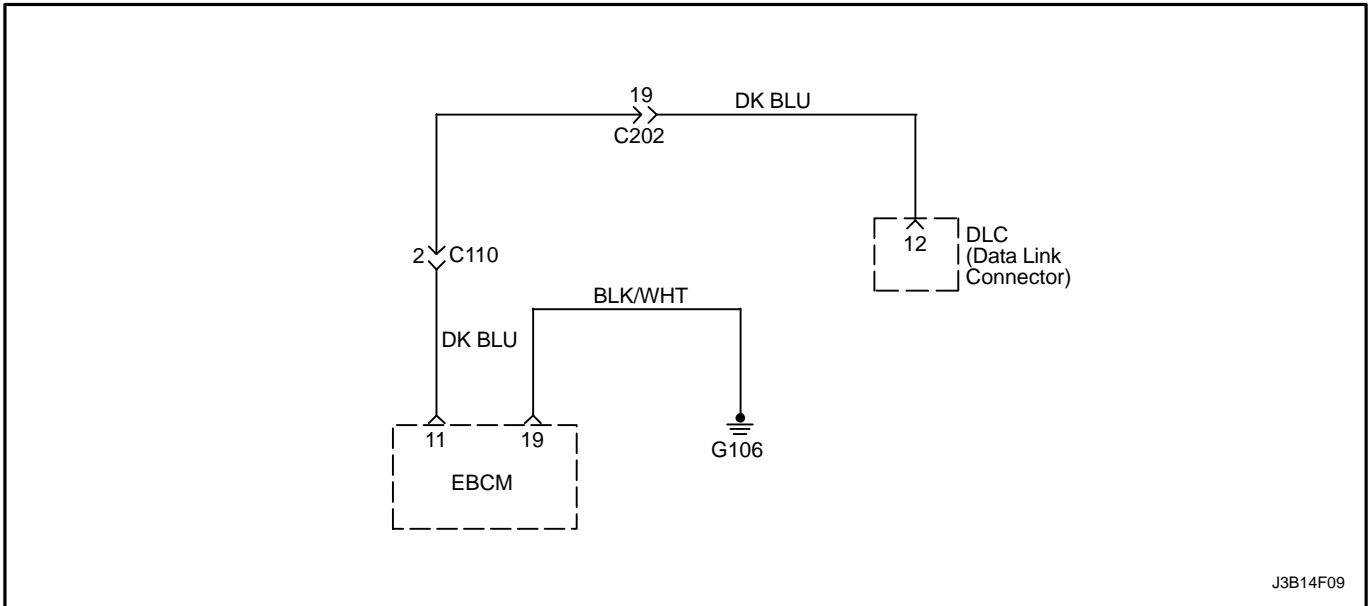
### Test Description

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 C0070/C0075 – 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 Data Link Connector (DLC) 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 <i>Step 2</i>	Go to <i>Step 6</i>
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 <i>Step 6</i>	Go to <i>Step 3</i>
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 <i>Step 4</i>	Go to <i>Step 6</i>
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 <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) C0080/C0085 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. EBD is disabled. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

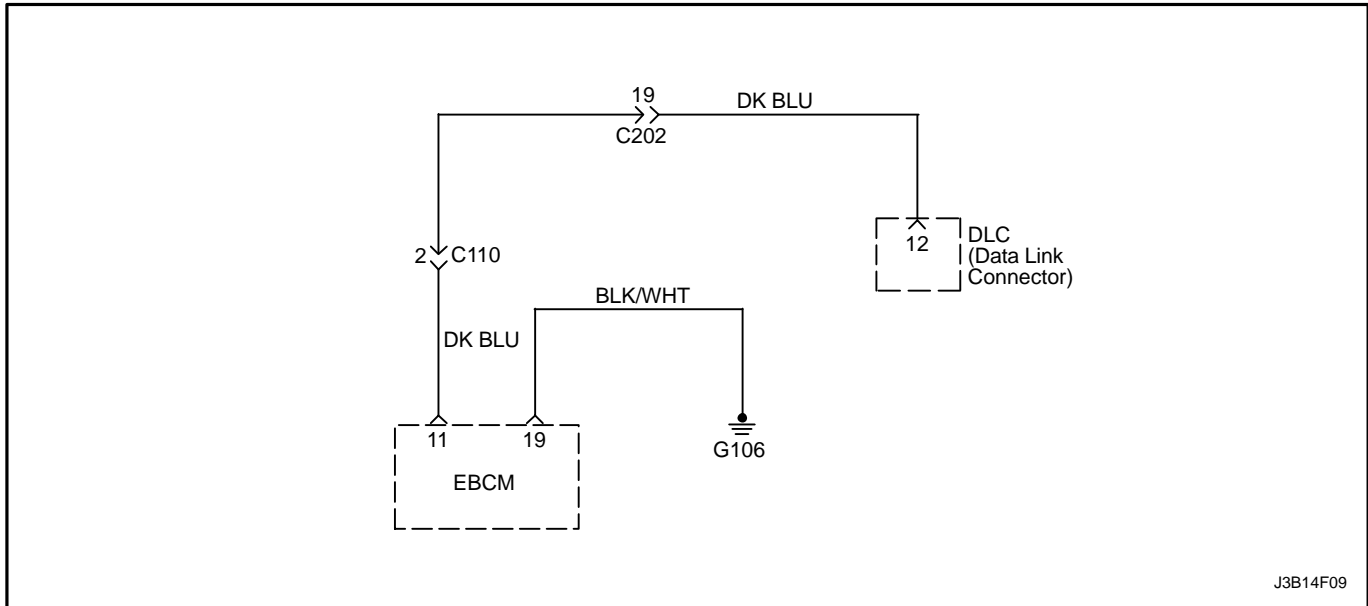
### Test Description

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 C0080/C0085 – Left Rear Inlet and Outlet Valve Solenoid Fault**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	<ol style="list-style-type: none"> <li>1. Raise and suitably support the vehicle at the corner being tested.</li> <li>2. Turn the ignition switch to ON.</li> <li>3. Install the scan tool to the Data Link Connector (DLC) and select "Wheel rear left" to begin the solenoid tests at that wheel. This will test both the inlet and the outlet valves.</li> <li>4. When the scan tool indicates "Pressure hold," depress and hold the brake pedal until the end of the test.</li> <li>5. Have an assistant attempt to rotate the wheel.</li> </ol> Can the wheel be rotated?	–	Go to <i>Step 2</i>	Go to <i>Step 6</i>
2	<ol style="list-style-type: none"> <li>1. Maintain pressure on the brake pedal.</li> <li>2. When the scan tool indicates "Pressure increase," have an assistant attempt to rotate the wheel again.</li> </ol> Can the wheel be rotated now?	–	Go to <i>Step 6</i>	Go to <i>Step 3</i>
3	<ol style="list-style-type: none"> <li>1. Maintain pressure on the brake pedal.</li> <li>2. When the scan tool indicates "Pressure release on," have an assistant attempt to rotate the wheel again.</li> </ol> Can the wheel be rotated?	–	Go to <i>Step 4</i>	Go to <i>Step 6</i>
4	<ol style="list-style-type: none"> <li>1. Release brake pedal pressure when the scan tool indicates "Pressure release off."</li> <li>2. Clear all DTCs.</li> <li>3. Road test the vehicle.</li> </ol> Does the DTC set again?	–	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	<ol style="list-style-type: none"> <li>1. Check the wiring harness and connector terminals for an intermittent problem.</li> <li>2. Repair any problem found.</li> </ol> Is the repair complete?	–	System OK	–
6	Replace the ABS unit. Is the repair complete?	–	System OK	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0090/C0095 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. EBD is disabled. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC.

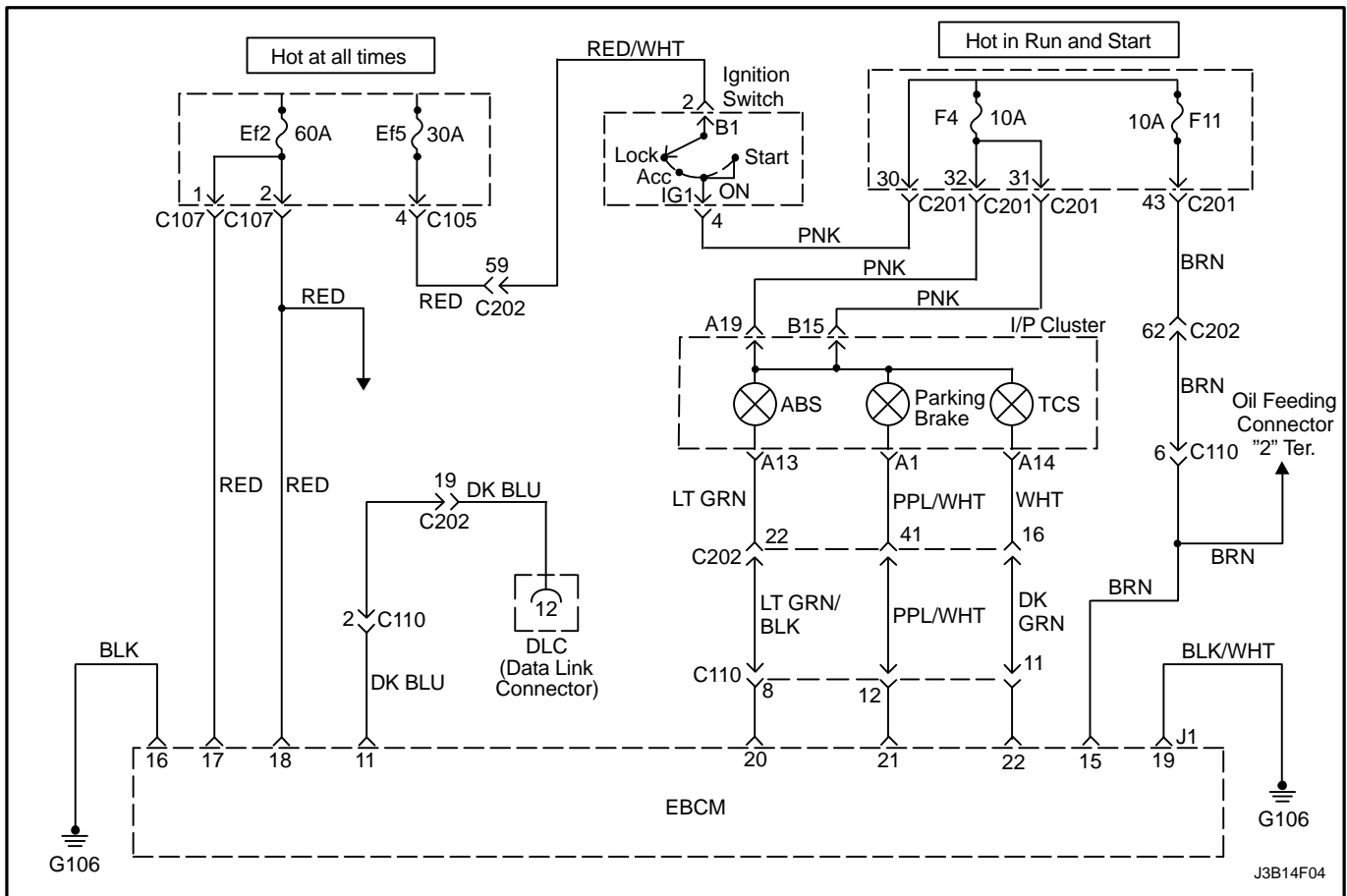
### Test Description

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 C0090/C0095 – 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 Data Link Connector (DLC) 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 <i>Step 2</i>	Go to <i>Step 6</i>
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 <i>Step 6</i>	Go to <i>Step 3</i>
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 <i>Step 4</i>	Go to <i>Step 6</i>
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 <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) C0110

### PUMP MOTOR CIRCUIT MALFUNCTION

#### 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.
- There is a faulty terminal in EBCM connector.
- 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 to the motor.

#### Fail Action

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

#### Test Description

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

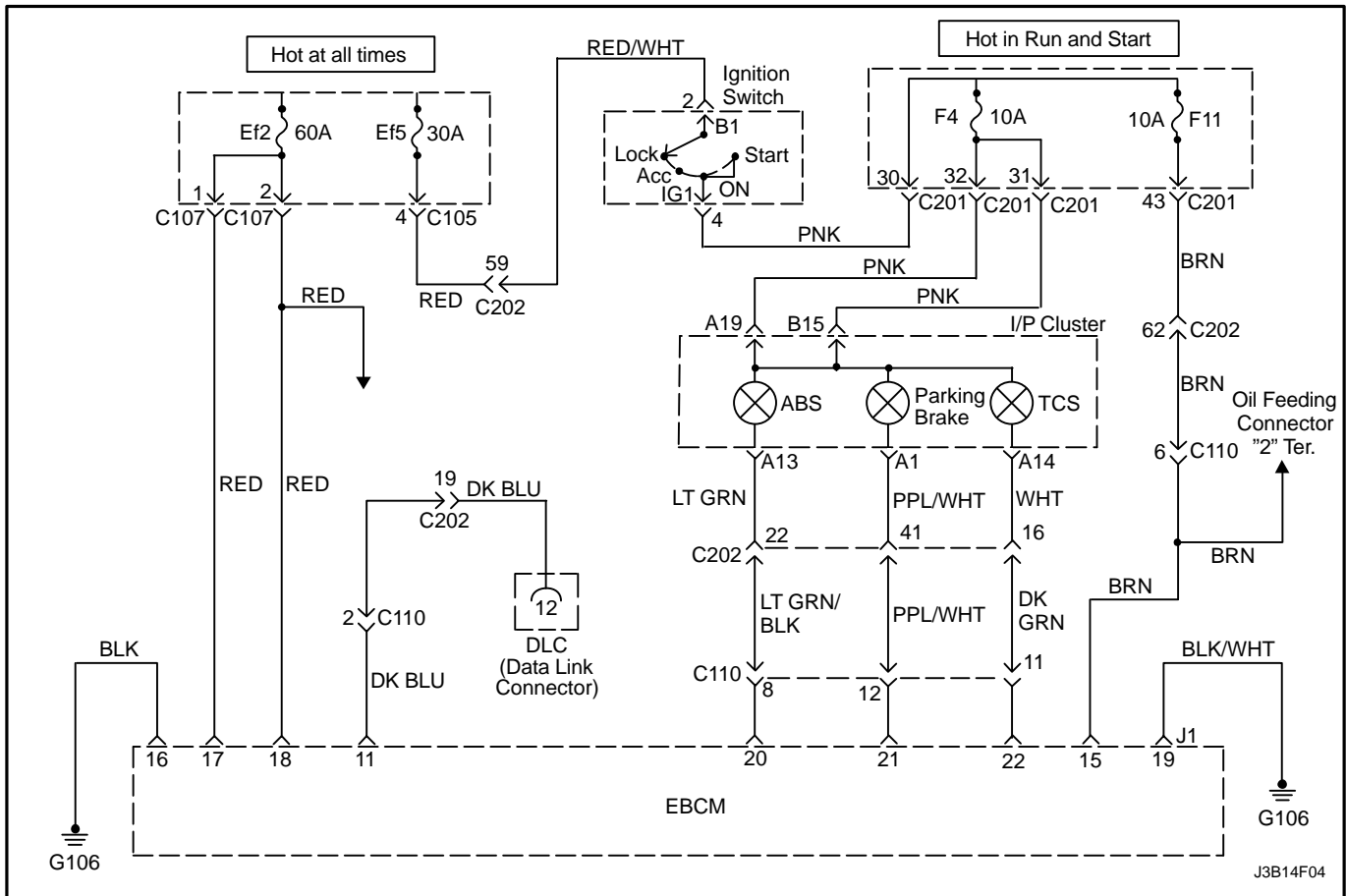
1. This step checks for connector damage.
3. This step checks for a poor ground connection.
7. This step checks for a possible problem with the motor connector at the ABS unit.

#### 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 C0110 – Pump Motor Circuit Malfunction**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	1. Disconnect connector from the EBCM. 2. Examine terminal 16 on the harness connector and on the EBCM connector. Is the terminal damaged or corroded?	–	Go to <i>Step 2</i>	Go to <i>Step 3</i>
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 to a good chassis ground. Is the resistance equal to the specified value?	$\approx 0 \Omega$	Go to <i>Step 7</i>	Go to <i>Step 4</i>
4	Measure the resistance at the chassis ground connection G106. Is the resistance equal to the specified value?	$\approx 0 \Omega$	Go to <i>Step 6</i>	Go to <i>Step 5</i>
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 <i>Step 8</i>	Go to <i>Step 9</i>
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	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0121 VALVE RELAY CIRCUIT MALFUNCTION

### 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 C0121 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 self-test.

### 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

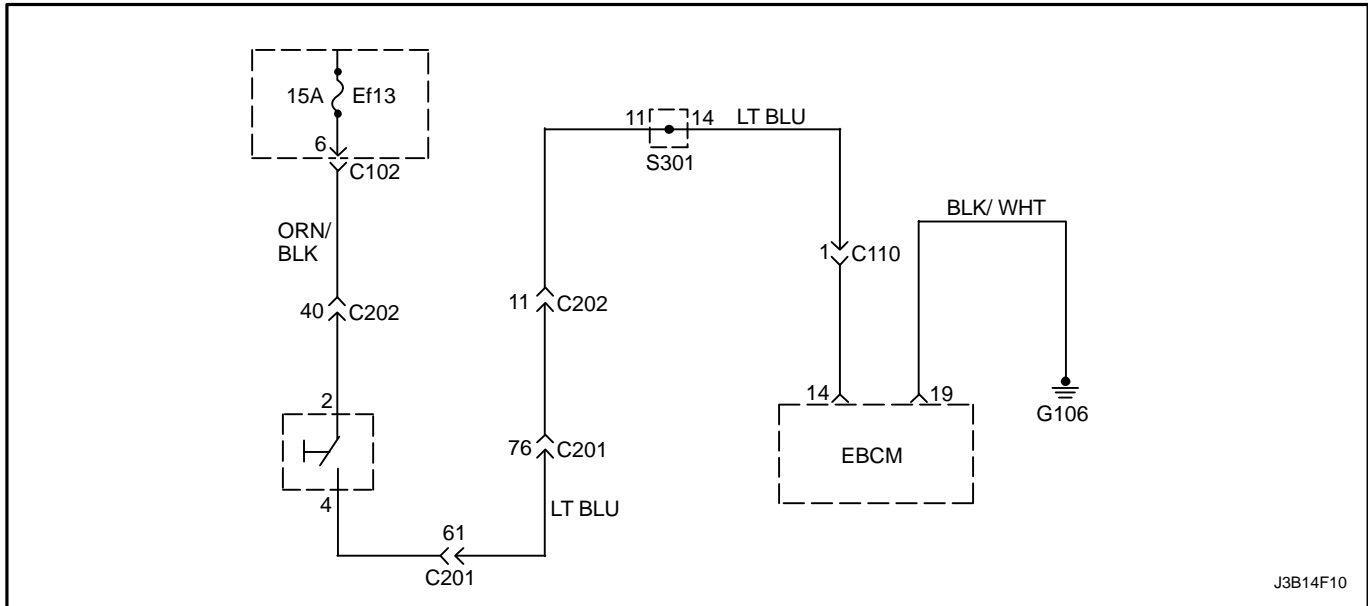
ABS/EBD is disabled, and the ABS / EBD warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the control module will enable the system at the next ignition cycle and set a history DTC C0121.

### 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 C0121 – Valve Relay Circuit Malfunction**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	1. Use a scan tool to clear all DTCs. 2. Road test the vehicle. Does DTC C0121 set again?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
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 <i>Step 4</i>	Go to <i>Step 5</i>
4	Repair the terminal or the connector, or replace the ABS harness or ABS unit as required. Is the resistance equal to the specified value?	–	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 <i>Step 6</i>	Go to <i>Step 7</i>
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 <i>Step 8</i>	Go to <i>Step 9</i>
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	–



J3B14F10

## DIAGNOSTIC TROUBLE CODE (DTC) C0161 ABS BRAKE SWITCH CIRCUIT MALFUNCTION

### 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 C0161. ABS and EBD operation is enabled and ABS / EBD warning lamp don't turn on.

### 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 301 area or the splice 301–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.

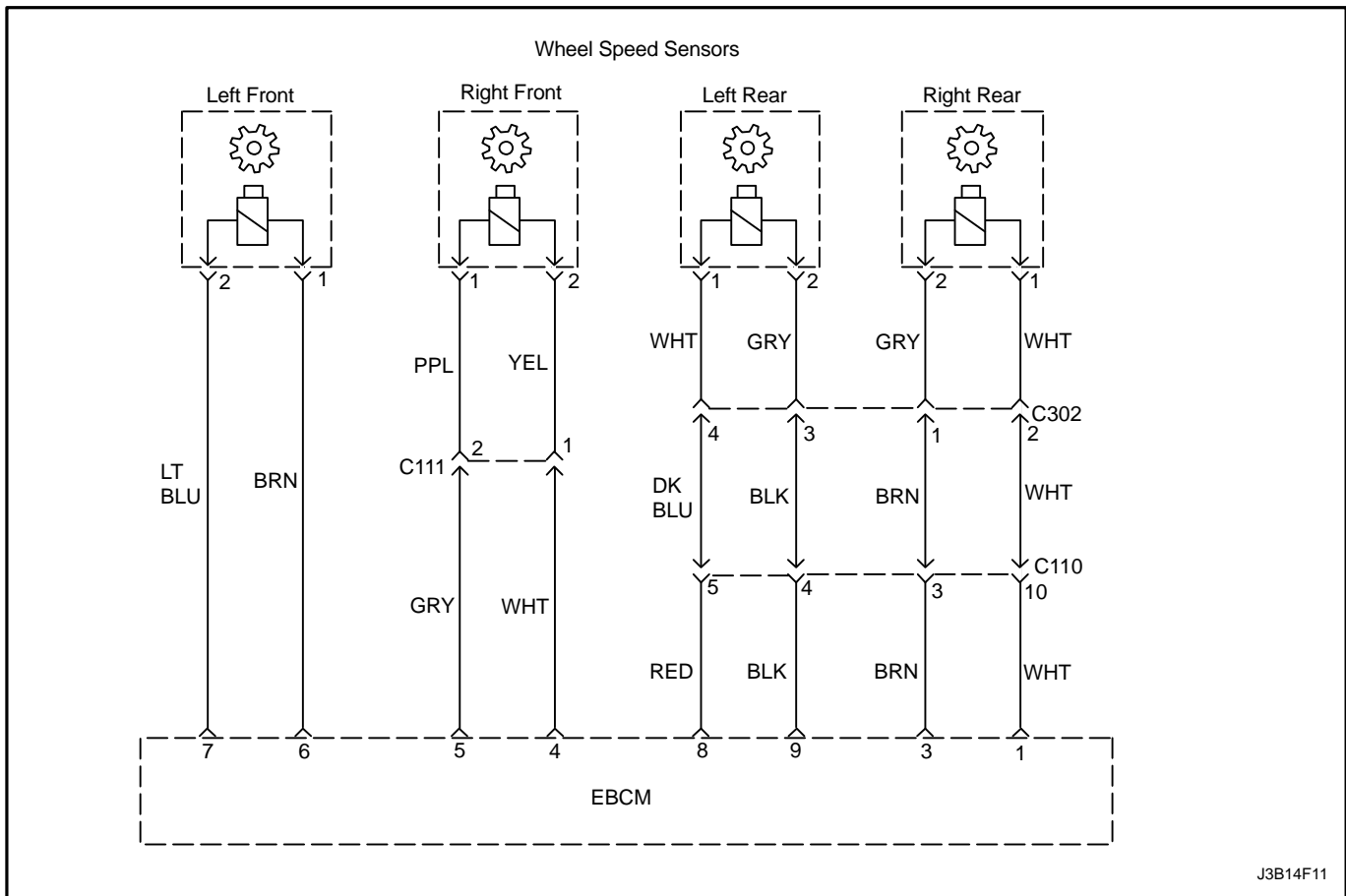
### Diagnostic Aids

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

**DTC C0161 – ABS Brake Switch Circuit Malfunction**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	Step on the brake pedal. Do the brake lights come on at all?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
2	Remove your foot from the brake pedal. Do the lights stay on continuously?	–	Go to <i>Step 8</i>	Go to <i>Step 11</i>
3	Check fuse EF13 in the engine compartment fuse block. Is fuse EF13 blown?	–	Go to <i>Step 4</i>	Go to <i>Step 6</i>
4	1. Replace fuse EF13. 2. Check the new fuse. Does the new fuse blow?	–	Go to <i>Step 5</i>	Go to <i>Step 7</i>
5	1. Repair the short to ground in the brake light circuitry. 2. Install a new fuse EF13. Is the repair complete?	–	System OK	–
6	Repair the open in the brake light switch circuit ORN/BLK from terminal 6 of connector C102 at the engine fuse block to the brake light switch and circuit LT BLU from terminal 11 of splice S301. 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 <i>Step 9</i>	Go to <i>Step 10</i>
9	Repair the brake light switch. Is the repair complete?	–	System OK	–
10	Repair the short to positive in the circuit YEL between the brake light switch, splice S301, the brake lights, the center high-mounted 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 <i>Step 13</i>	Go to <i>Step 12</i>

Step	Action	Value(s)	Yes	No
12	1. Examine the connection between the ABS harness connector and the EBCM connector terminals 14 and 19. 2. Examine the connection at terminal 1 of connector C110. 3. Examine the wiring of circuit LT BLU between splice S301 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	–
13	Check the interface between the ABS EBCM connector and the EBCM. Check the interface between the ABS EBCM connector and the EBCM.	–	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	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0245

### 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-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 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 sensors.
3. This step checks for a problem with one of the front toothed rings.
5. This step checks the front 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 C0245 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 12 km/h (7 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-to-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 the front and the rear toothed wheel have 47 and 29 teeth.

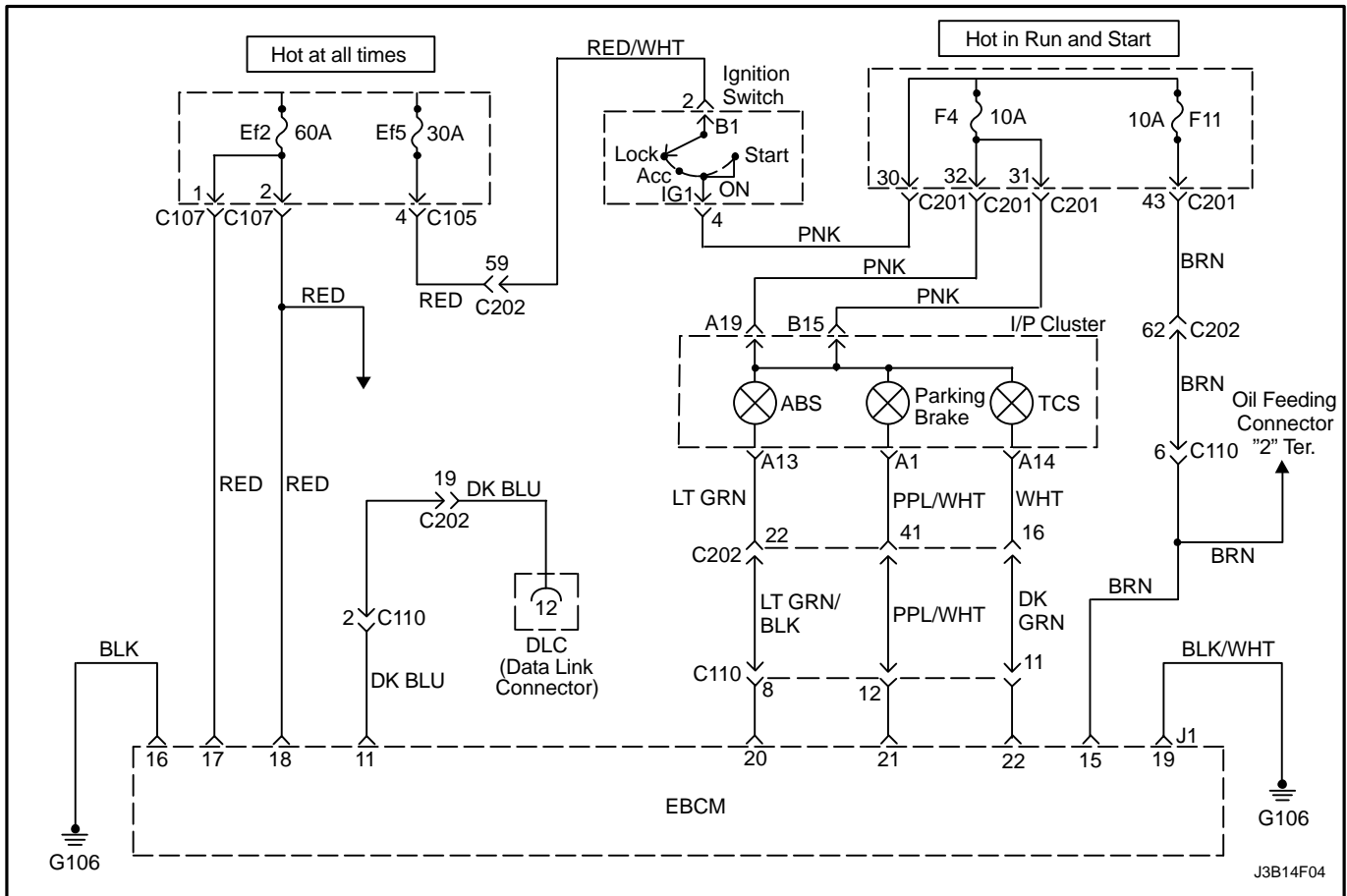
**DTC C0245 – Wheel Speed Sensor Frequency Error**

Step	Action	Value(s)	Yes	No
1	Visually inspect the wiring for the front wheel speed sensors. Is there any damage?	–	Go to <i>Step 2</i>	Go to <i>Step 3</i>
2	Check that the correct outer constant velocity (CV) joints are installed on the vehicle. The front speed rings have 47 teeth and the rear speed rings have 29 teeth. Is the repair complete?	–	System OK	–
3	Check fuse EF2 in the engine fuse block. Is one of these incorrect?	–	Go to <i>Step 4</i>	Go to <i>Step 5</i>
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 <i>Step 7</i>	Go to <i>Step 6</i>
6	Replace the faulty wheel speed sensor. Is the repair complete?	–	System OK	–
7	1. Disconnect ABS control module connector. 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 <i>Step 8</i>	Go to <i>Step 9</i>
8	Repair the short circuit in the wiring or from a wiring harness to ground. Is the repair complete?	–	System OK	–

## 4F – 52 ANTILOCK BRAKE SYSTEM

Step	Action	Value(s)	Yes	No
9	<p>Check the continuity of the wiring in both front wheel speed sensor circuits between the ABS connector and the wheel speed sensor wheel speed sensor connector on each side of the vehicle.</p> <ol style="list-style-type: none"> <li>1. The left side uses terminals 6 and 7 at the ABS connector.</li> <li>2. The right side uses terminals 4 and 5 at the ABS connector.</li> </ol> <p>Is continuity good for both harnesses?</p>	–	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	<p>Repair the discontinuity found in the front wheel speed sensor harness.</p> <p>Is the repair complete?</p>	–	System OK	–
11	<ol style="list-style-type: none"> <li>1. Visually inspect the wiring for the rear wheel speed sensors.</li> <li>2. Check that the wheel speed sensors are properly mounted and that the retaining bolts are properly tightened.</li> </ol> <p>Is there any damage?</p>	–	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	<p>Repair or replace components as required.</p> <p>Is the repair complete?</p>	–	System OK	–
13	<p>Remove each wheel speed sensor from the rear knuckles and inspect the toothed ring through the wheel speed sensor mounting holes.</p> <ol style="list-style-type: none"> <li>1. Check for any damaged or missing teeth.</li> <li>2. Check that the ring is properly positioned under the wheel speed sensor.</li> </ol> <p>Is there any damage or other fault with either speed ring?</p>	–	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	<p>Replace the rear wheel hub with the proper unit.</p> <p>Is the repair complete?</p>	–	System OK	–
15	<ol style="list-style-type: none"> <li>1. Disconnect the rear wheel speed sensor harnesses from the wheel speed sensor connectors.</li> <li>2. Measure the wheel speed sensor resistance at the wheel speed sensor connector terminals.</li> </ol> <p>Does the resistance fall within the specified values for both wheel speed sensors?</p>	1280–1920 $\Omega$	Go to <i>Step 17</i>	Go to <i>Step 16</i>
16	<p>Replace the faulty wheel speed sensor.</p> <p>Is the repair complete?</p>	–	System OK	–
17	<ol style="list-style-type: none"> <li>1. The ABS control module connector should still be disconnected. Disconnect it now if it is not.</li> <li>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.</li> <li>3. Also check each wheel speed sensor harness wire for a short to ground from the connector terminals.</li> </ol> <p>Is there any short circuit in either wheel speed sensor harness?</p>	–	Go to <i>Step 18</i>	Go to <i>Step 19</i>

Step	Action	Value(s)	Yes	No
18	Repair the short circuit in the wiring or from a wire to ground. Is the repair complete?	–	System OK	–
19	Check the continuity of the wiring in both rear wheel speed sensor circuits between the ABS connector and the wheel speed sensor wheel speed sensor connector on each side of the vehicle. 1. The left side uses terminals 8 and 9 at the ABS connector. 2. The right side uses terminals 1 and 3 at the ABS connector. Is continuity good for both harnesses?	–	Go to <i>Step 21</i>	Go to <i>Step 20</i>
20	Repair the discontinuity found in the rear wheel speed sensor wheel speed sensor harness or connector C110. Is the repair complete?	–	System OK	–
21	Replace the ABS unit. Is the repair complete?	–	System OK	–



## DIAGNOSTIC TROUBLE CODE (DTC) C0550 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 C0550.

### 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.

EBD is disabled. If the failure is intermittent, the control module will enable the system at the next ignition cycle and will store a history DTC C0550.

### Test Description

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

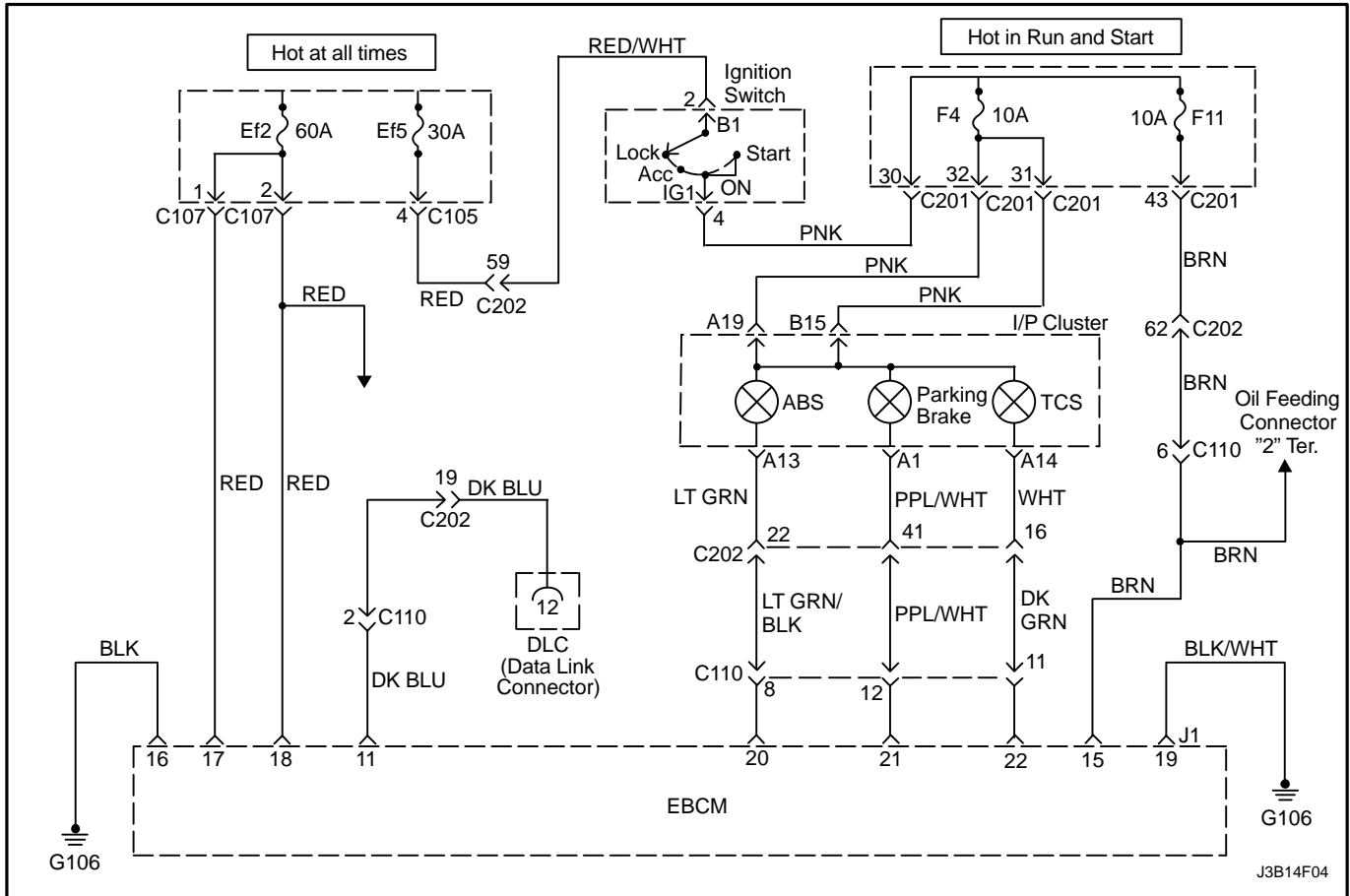
3. This step begins the testing for a poor voltage or ground connection.

### 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 C0550 – ABS Control Module Internal Fault**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
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 C0550 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 C0550 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) C0800 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 C0800.

### 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 C0800 – Low Voltage Fault**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
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 EF2 in the engine fuse block. Is the fuse blown?	–	Go to <i>Step 4</i>	Go to <i>Step 7</i>
4	1. Replace fuse EF2. 2. Turn the ignition to ON. Does the fuse blow again?	–	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	1. Turn the ignition to OFF. 2. Trace the RED wires in the ABS wiring harness from terminal 1 of C107 at the engine fuse block to terminals 17 and 18 of the EBCM connector. 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 C0800 reset?	–	System OK	–
7	Check fuse F11 in the I/P fuse block. Is the fuse blown?	–	Go to <i>Step 8</i>	Go to <i>Step 11</i>
8	1. Replace fuse F11. 2. Turn the ignition to ON. Does the fuse blow again?	–	Go to <i>Step 9</i>	Go to <i>Step 10</i>
9	1. Turn the ignition to OFF. 2. Trace the BRN wire from fuse F11 to terminal 43 of connector C201, from terminal 62 of connector C202 to terminal 6 of connector C110, and from there to terminal 15 of the EBCM connector. 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 C0800 reset?	–	System OK	–
11	1. Disconnect the EBCM connector 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 13</i>	Go to <i>Step 12</i>

## 4F – 58 ANTILOCK BRAKE SYSTEM

Step	Action	Value(s)	Yes	No
12	<ol style="list-style-type: none"> <li>Turn the ignition switch to OFF.</li> <li>Trace the orange wires between terminals 17 and 18 of the EBCM connector to terminal 1 of connector C107 at the engine fuse block.</li> <li>Repair the open in this circuit.</li> </ol> Is the repair complete?	–	System OK	–
13	Check the voltage between ground and terminal 15 of the EBCM connector. Is the voltage within the specified value?	11–14 v	Go to <i>Step 17</i>	Go to <i>Step 14</i>
14	<ol style="list-style-type: none"> <li>Turn the ignition switch to OFF.</li> <li>Check fuse EF5 in the engine fuse block.</li> </ol> Is the fuse blown?	–	Go to <i>Step 15</i>	Go to <i>Step 16</i>
15	Replace fuse EF5. Is the repair complete?	–	System OK	–
16	<ol style="list-style-type: none"> <li>Examine circuit BRN between terminal 15 of the EBCM connector to terminal 6 of connector C110 to terminal 62 of C202, to F11 in the I/P fuse block.</li> <li>Examine the PNK wire from the I/P fuse block to terminal 4 (IG1) of the ignition switch.</li> <li>Examine the RED wire from terminal 2 (B1) of the ignition switch to terminal 59 of connector C202 to terminal 4 of connector C105 at the engine fuse block.</li> <li>Repair the open in the wiring or possibly bad connector terminal, or defective ignition switch.</li> </ol> Is the repair complete?	–	System OK	–
17	<ol style="list-style-type: none"> <li>Turn the ignition to OFF.</li> <li>Check the resistance between ground and terminals 16 and 19 of the ABS harness EBCM connector.</li> </ol> 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	<ol style="list-style-type: none"> <li>Install the scan tool.</li> <li>Clear all DTCs.</li> <li>Road test the vehicle.</li> </ol> Does DTC C0800 set again?	–	Go to <i>Step 23</i>	Go to <i>Step 22</i>
22	<ol style="list-style-type: none"> <li>Examine the wiring harness and connectors for causes of intermittent problems.</li> <li>Repair any intermittent problem found.</li> </ol> Is the repair complete?	–	System OK	–
23	Replace the ABS unit. Is the repair complete?	–	System OK	–

## DIAGNOSTIC TROUBLE CODE (DTC) C0931

### OVERHEATED

**DTC Description**

The brake can be overheated when the TCS controls the brake system to reduce the velocity of driving wheel. At this moment, the EBCM calculates the brake application time and frequency and shows the warning sign of overheated driving wheel to the driver.

**Cause(s)**

- EBCM show the driving wheel temperature over 400 °C.

**Fail Action**

TCS dose not functioning when the DTC C0931 is detected.

# 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 thread-locking 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

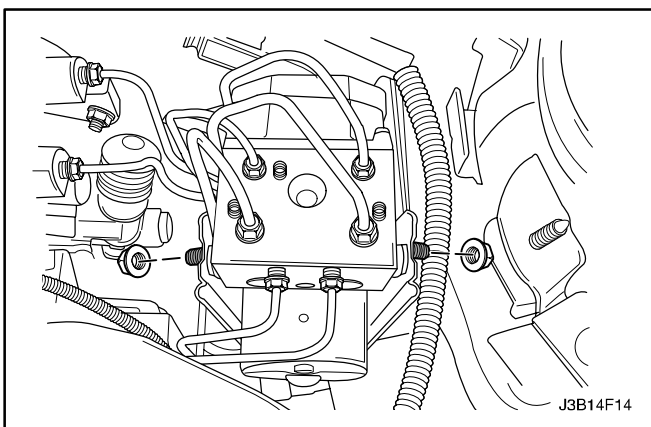
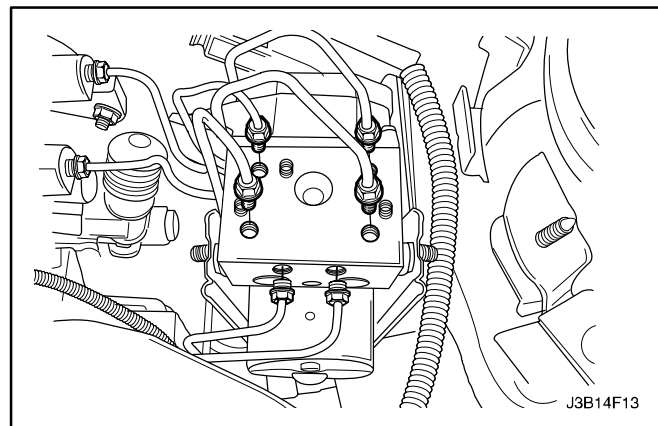
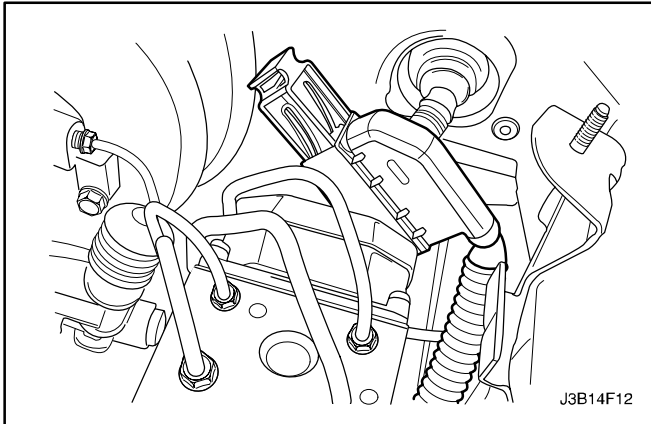
Take care to avoid electronic brake control module (EBCM) circuit overloading. In testing for opens or shorts, do not ground or apply voltage to any circuit unless instructed to do so by the diagnostic procedure. Test circuits only with a high-impedance multimeter. Never remove or apply power to any 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 31-pin ABS wiring harness connector 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

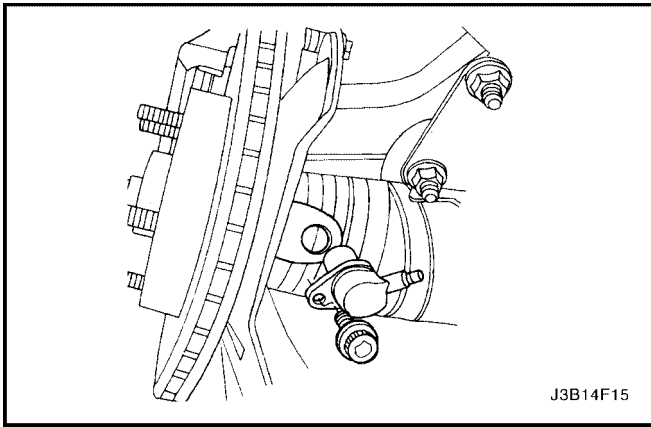
Tighten the ABS 5.3 mounting nuts to 15 N•m (11 lb-ft).

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

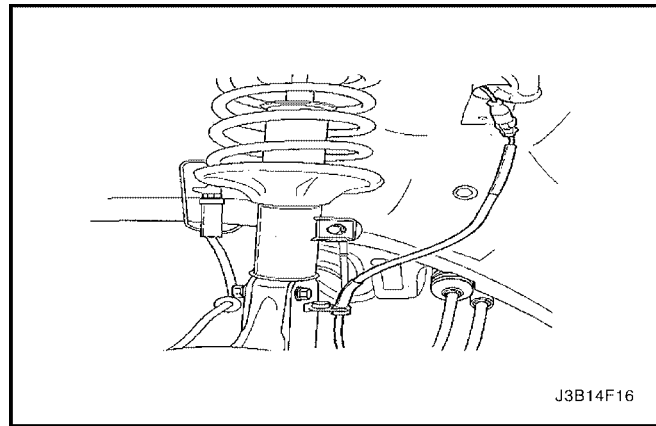
#### Tighten

Tighten the brake pipe nuts to 22 N•m (16 lb-ft).

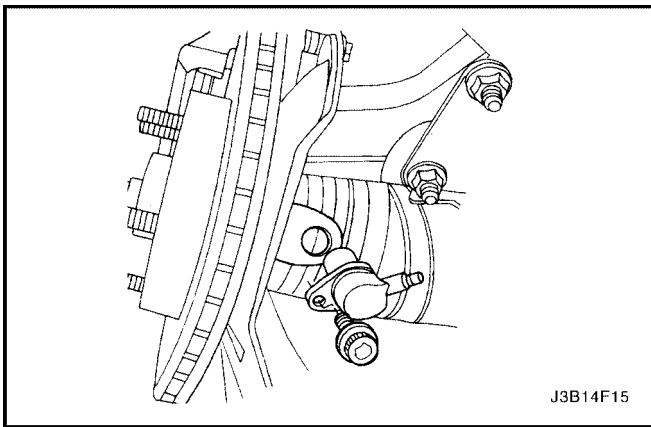
3. Connect the 31-pin wiring harness connector J1.
4. Connect the negative battery cable.
5. Bleed the hydraulic system. Refer to *Section 4A, Hydraulic Brakes*.



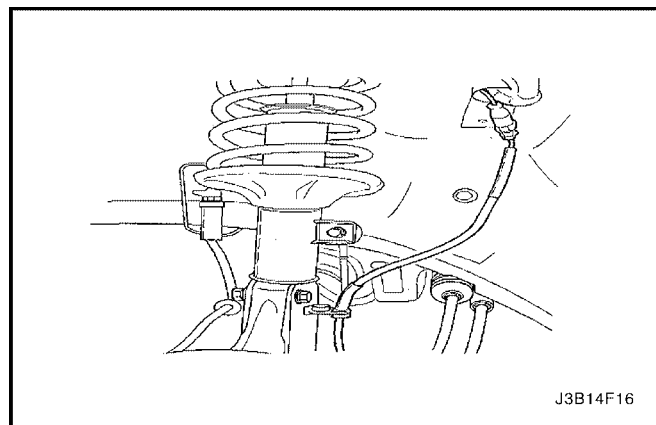
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J3B14F16



J3B14F15



J3B14F16

## FRONT WHEEL SPEED SENSOR

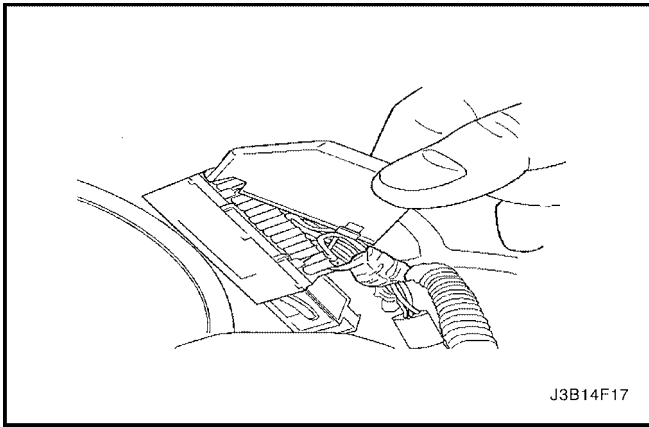
### Removal Procedure

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. Install 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.

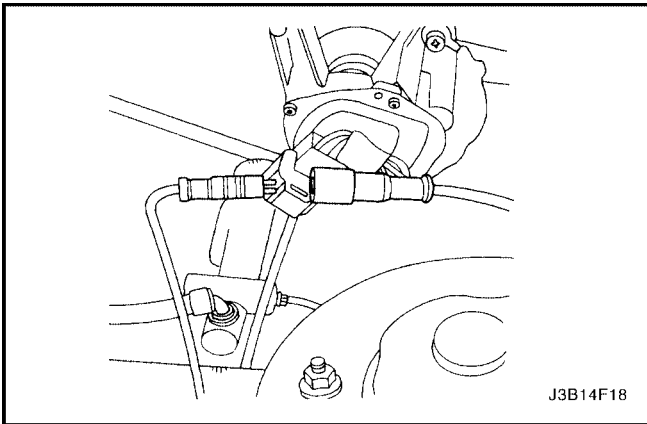


## FRONT WHEEL SPEED SENSOR JUMPER HARNESS

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

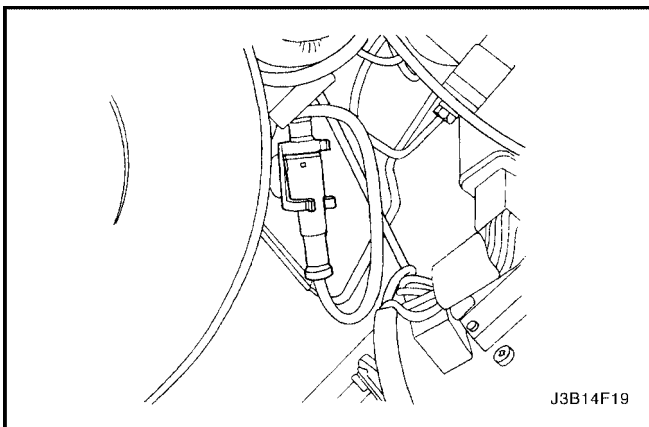
### Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect connector from the EBCM.
3. Remove the appropriate terminals from connector:
  - Right-side – terminals 4 (WHT) and 5 (GRY).
  - Left-side – terminals 6 (BRN) and 7 (LT BLU).
4. Both speed sensor harnesses break out of the ABS wiring harness just beyond the ABS connector. 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.

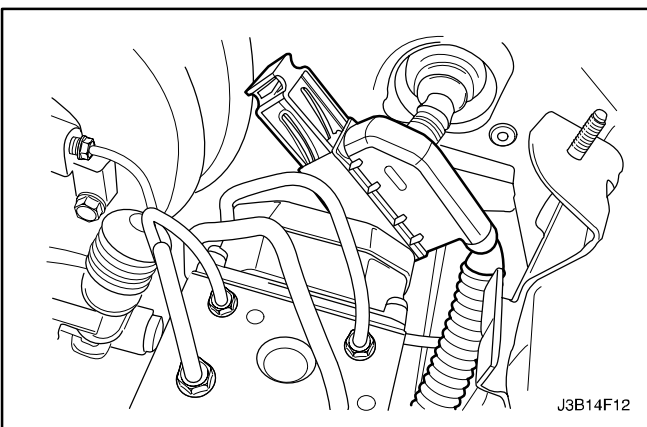


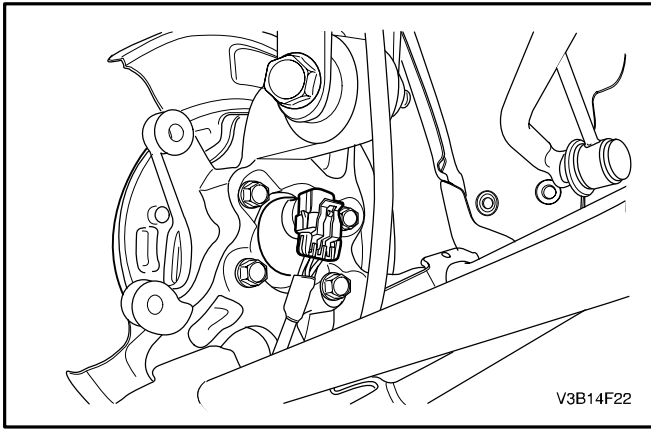
### Installation Procedure

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



3. Replace the jumper harness into the wiring harness.
4. Insert the terminals into connector as they had been removed:
  - Right-side – terminals 4 (WHT) and 5 (GRY).
  - Left-side – terminals 6 (BRN) and 7 (LT BLU).
5. Connect EBCM connector.
6. Connect the negative battery cable.

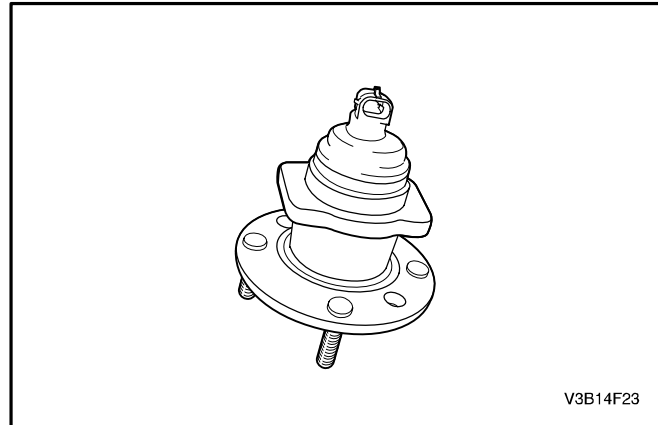




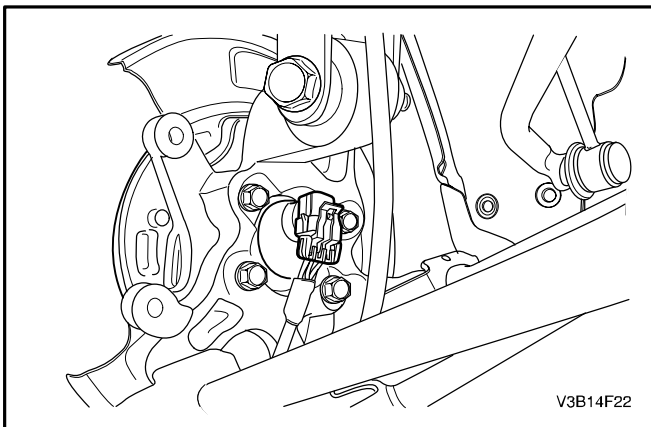
## REAR WHEEL SPEED SENSOR

### Removal Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Disconnect the rear wheel speed sensor electrical connector.



4. Remove the rear hub unit from the knuckle assembly, because the wheel speed sensor is not serviceable separately.



### Installation Procedure

1. Install the rear hub unit to the knuckle assembly.  
**Tighten**  
Tighten the rear hub unit to the knuckle assembly to 65 N•m (48 lb–ft).
2. Connect the rear wheel speed sensor electrical connector.

# 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, the EBD indicator (which is connected to the parking lamp) and the rear disk brakes. See "ABS Component Locator" in this section for the general layout of this system.

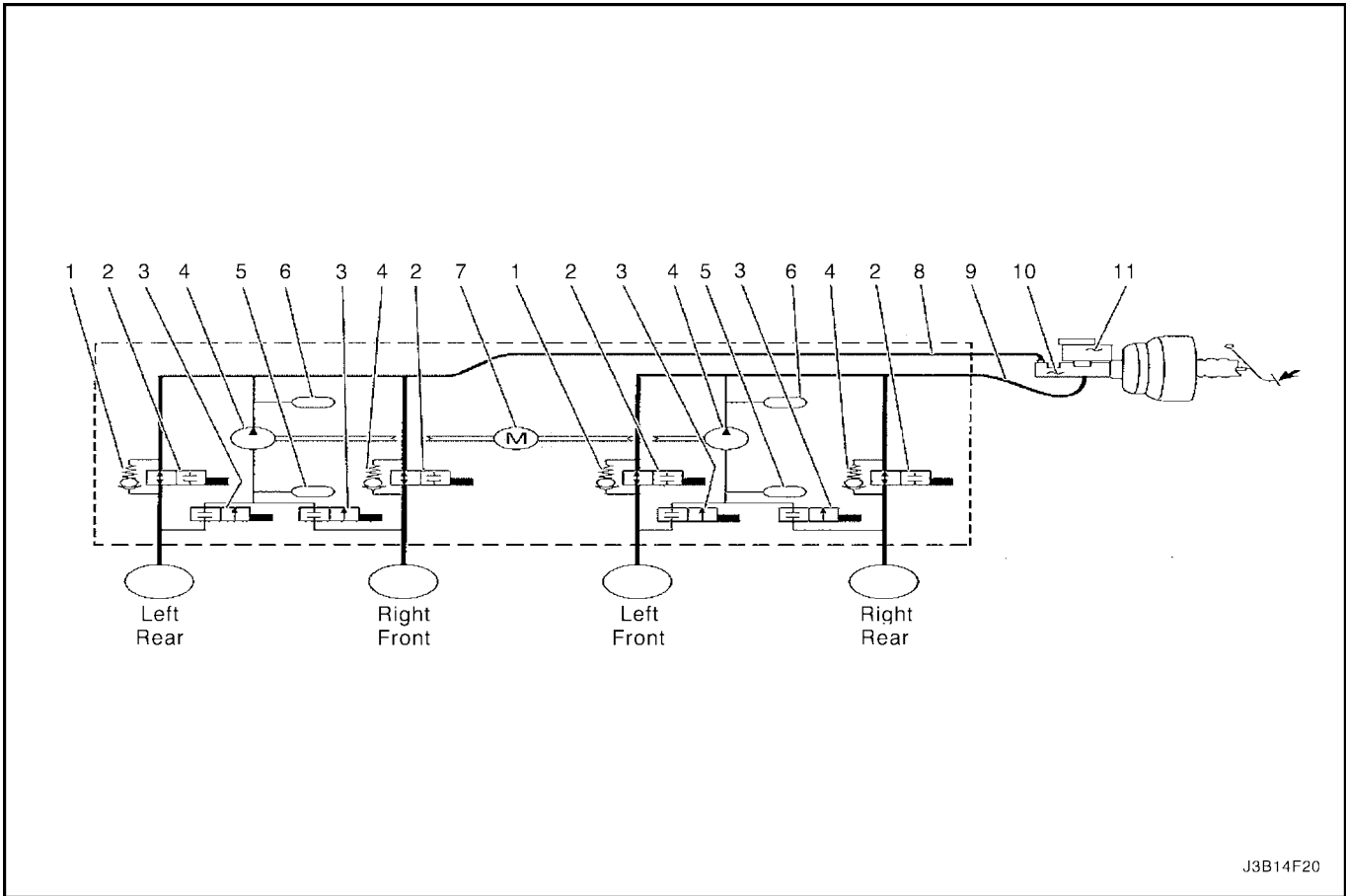
The hydraulic unit with the attached EBCM is located between the surge tank and the fire wall on the left side of the vehicle.

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

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, non-energized positions as shown in the drawings found in "ABS System Components" in this section.

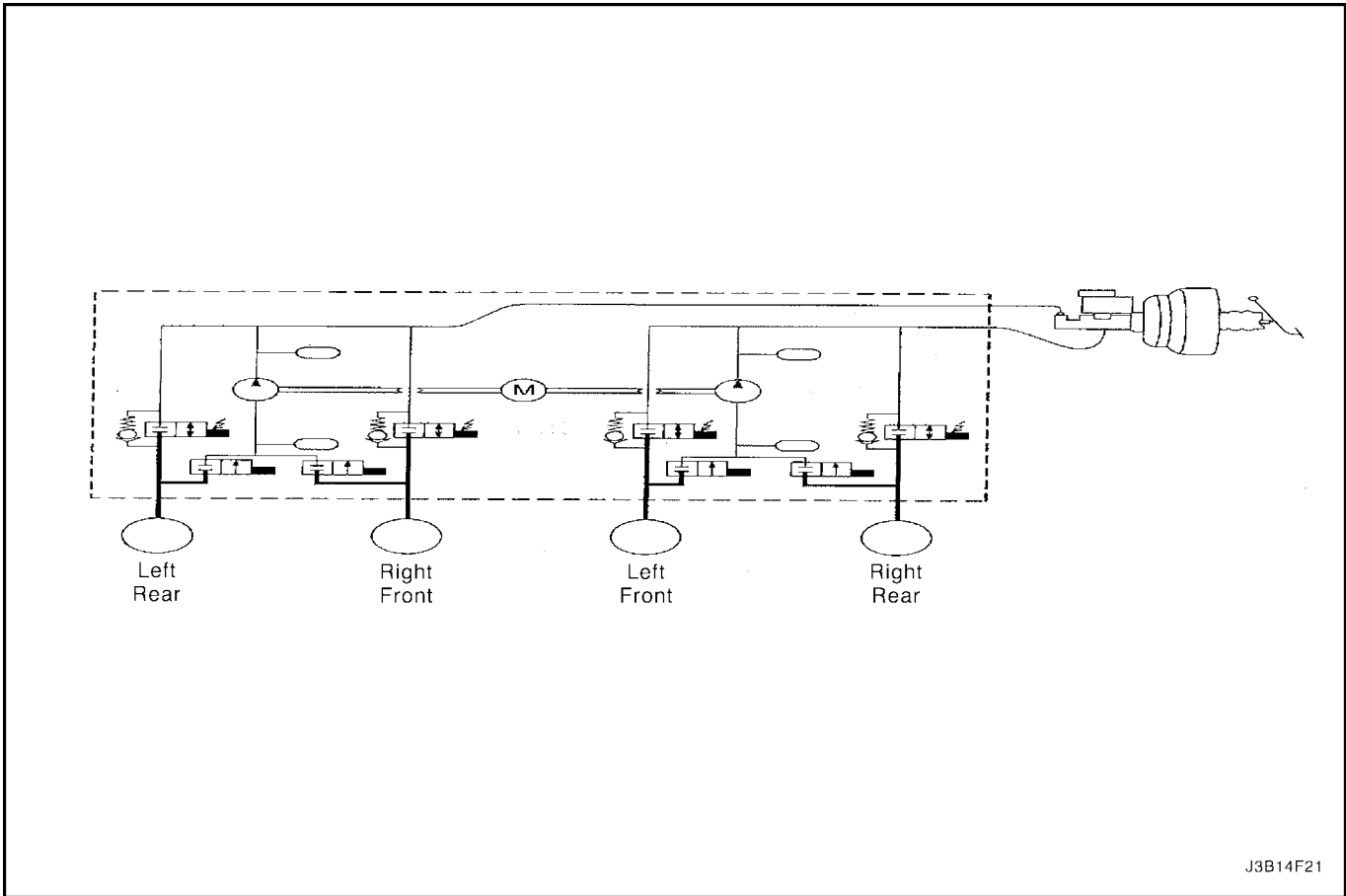


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- |                 |                               |
|-----------------|-------------------------------|
| 1. Check Valve  | 7. Pump Motor                 |
| 2. Inlet Valve  | 8. Hydraulic Circuit 2        |
| 3. Outlet Valve | 9. Hydraulic Circuit 1        |
| 4. Pump         | 10. Master Cylinder           |
| 5. Accumulator  | 11. Master Cylinder Reservoir |
| 6. Damper       |                               |

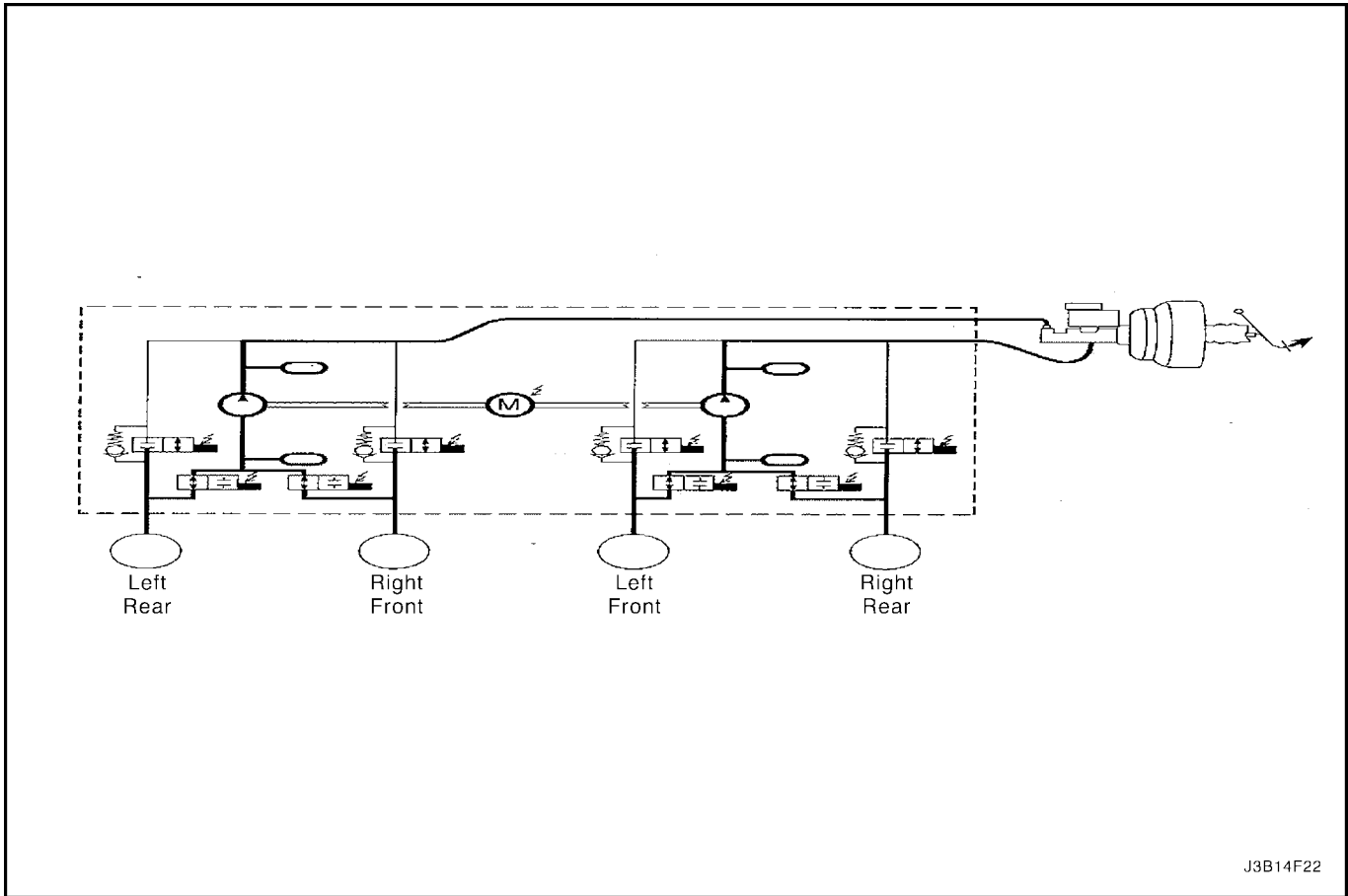
### ANTILOCK BRAKING MODE – APPLY

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.



### ANTILOCK BRAKING MODE – HOLD

The illustration shows this for the right front brake.



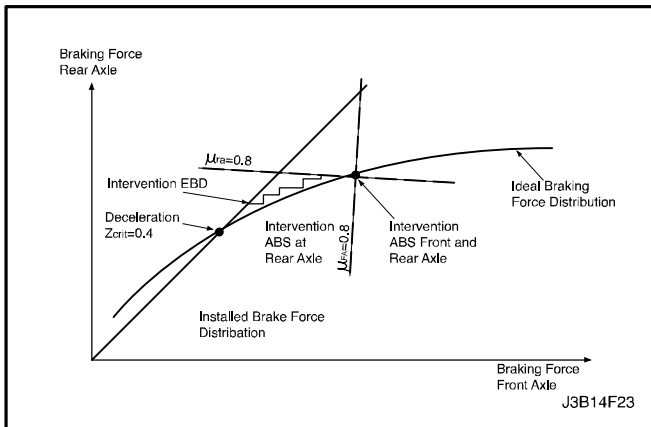
## ANTILOCK BRAKING MODE – RELEASE

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

## EBD (ELECTRONIC BRAKE FORCE DISTRIBUTION) SYSTEM

As an add-on logic to the ABS base algorithm, EBD works in a range in which the intervention thresholds for ABS control are not reached yet.

EBD ensures that the rear wheels are sensitively monitored for slip with respect to the front axle. If slip is detected, the inlet valves for the rear wheels are switched to pressure hold to prevent a further increase in pressure at the rear-wheel brakes, thus electronically reproducing a pressure-reduction function at the rear-wheel brakes.



## THE BENEFITS OF EBD

- Elimination of conventional proportioning valve.
- EBD utilizes the existing rear axle wheel speed sensor to monitor rear wheel slip.
- Based on many variables in algorithm a pressure hold, increase and/or decrease pulsetrain may be triggered at the rear wheels insuring vehicle stability.
- Vehicle approaches the ideal brake force distribution. (front to rear)
- Constant brake force distribution during vehicle lifetime.
- EBD function is monitored via ABS safety logic. (conventional proportioning valves are not monitorable)
- "Keep alive" function.

## ELECTRONIC BRAKE-FORCE DISTRIBUTION (EBD) FAILURE MATRIX

**ELECTRONIC BRAKE-FORCE DISTRIBUTION (EBD) FAILURE MATRIX**

		ABS and EBD Disabled	ABS Disabled, EBD Enabled	ABS and EBD Enabled	Not Possible
Mini Spare Wheel	Correction	▨	▨	▨	▨
	Interruption	▨	▨	▨	✕
VR	Sticking	▨	▨	▨	✕
MR	Failure	▨	▨	▨	✕
PM	Failure	▨	▨	▨	✕
BLS	BLS-Failure	▨	▨	▨	✕
<-Reversible	2 WSS-Failures	▨	▨	▨	▨
	WSS-Failures Low-Frequency	▨	▨	▨	▨
	WSS-Failures High-Frequency	▨	▨	▨	▨
	WSS-Failures NON-OHM(FDFP)	▨	▨	▨	▨
WSS	WSS-Failures OHM	▨	▨	▨	▨
*1)Thresholds Hardware Depended	Over-Voltage >17,4V	✕	▨	▨	▨
	LOW Voltage < 6.9V <-Reversible	✕	▨	▨	▨
Power-Supply *1)	LOW Voltage 9.4V > U Z>6.9V	✕	▨	▨	▨
Second Failure	Reversible -> Low Voltage 9.4V > Uz > 6.9V	▨	▨	▨	▨
	Wheel Speed Sensor	▨	▨	▨	▨
	OHM	▨	▨	▨	▨
	NON-OHM (FDFP)	▨	▨	▨	▨
	2 WSS - Failures	▨	▨	▨	▨
	High - Frequency	▨	▨	▨	▨
	Reversible ->	▨	▨	▨	▨
	Brake Light Switch	▨	▨	▨	▨
	Motor-Relay	▨	▨	▨	▨
	Pump-Motor	▨	▨	▨	▨
Valve-Relay	▨	▨	▨	▨	

**First Failure**  
That always leads to keep alive function

## TIRES AND ABS/EBD

### Replacement Tires

Tire size is important for proper performance of the ABS 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 operation.

## TIRES AND ABS/EBD

**Notice :** There is no serviceable or removable EEPROM. 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 microprocessor-based 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 bi-directional serial data link, located in pin K of Data Link Connector (DLC) 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 (EEPROM) (DTCs will not disappear if the battery is disconnected). Refer to "Self Diagnostics" in this section for more detailed information.

## FRONT WHEEL SPEED SENSOR

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 wheel-side (outer) constant velocity joint. Each ring contains 47 equally spaced teeth. Exercise care during service procedures to avoid prying or contacting this ring. Ex-

cessive contact may cause damage to one or more teeth. If the ring is damaged, the wheel-side constant velocity joint must be replaced.

## REAR WHEEL SPEED SENSOR 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) or EBD system is disabled.

**WARNING : EBD INDICATOR LAMP WIRING IS CONNECTED TO THE PARKING BRAKE LAMP. IF THE PARKING BRAKE LAMP IS TURNED ON WHEN YOU DRIVING, CHECKING ON WHETHER THE PARKING BRAKE LEVER IS ENAGED OR THE BRAKE FLUID LEVEL IS LOW. IF THE SYSTEM HAS NO PROBLEM, THE EBD SYSTEM IS WORKING IMPROPERLY. THE EBD SYSTEM MUST BE SERVICED.**