SECTION 4F

ANTILOCK BRAKE SYSTEM

TABLE OF CONTENTS

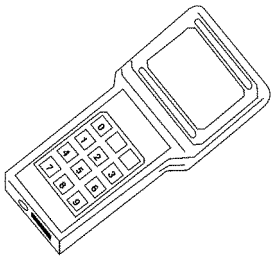
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Bleeder Valve	9	-	80
Brake Pipe Nuts	16	12	-
Front Wheel Speed Sensor Bolt	7.8	-	69
Gear Cover Torx[Head Screws	4	-	35
Gear Nuts	8.5	-	76
Hydraulic Modulator/Motor Pack Assembly Nuts	5	-	44
Motor Pack Torx[Head Screws	4.5	-	40
Solenoid Torx[Head Bolts	4.5	-	40

SPECIAL TOOLS

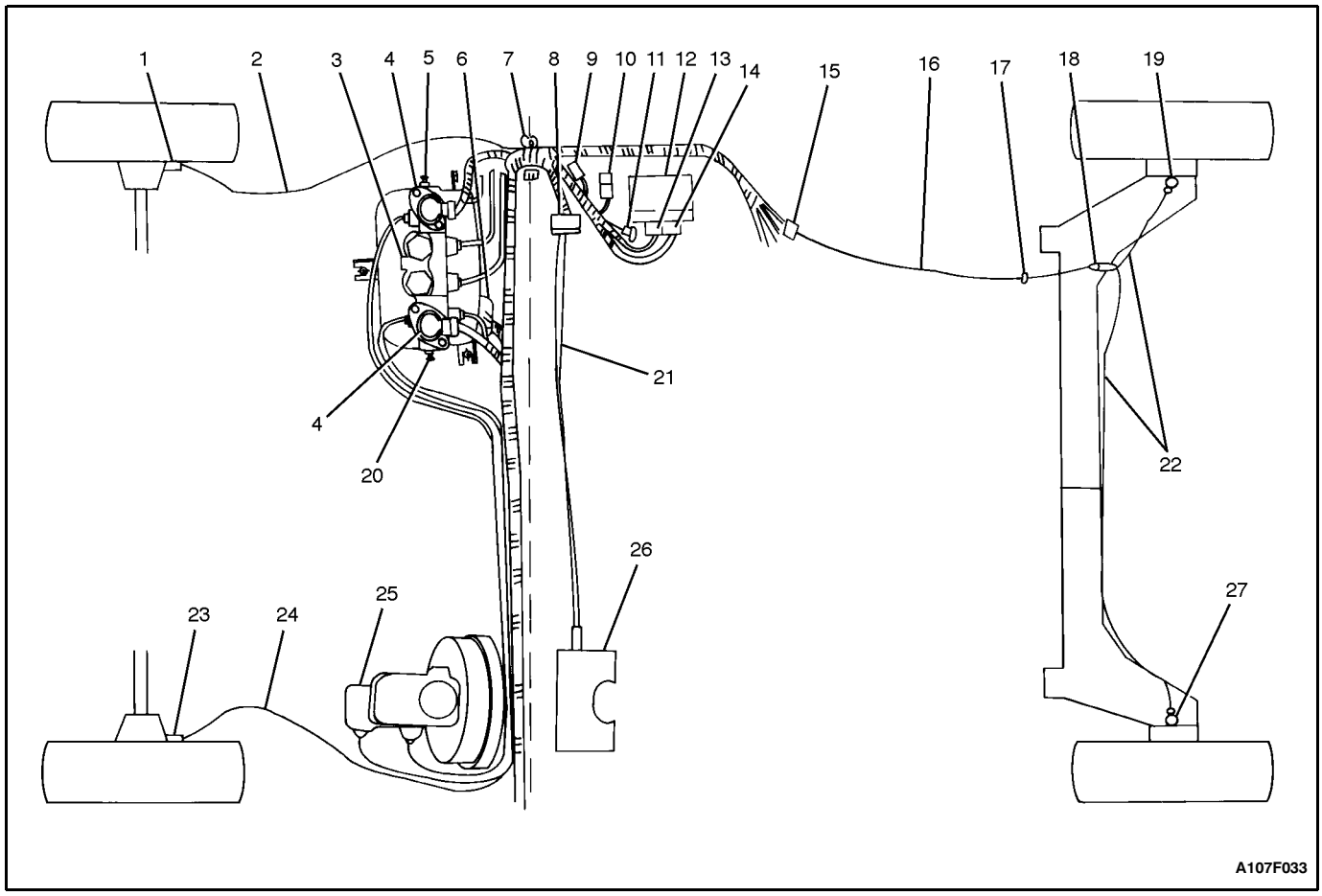
SPECIAL TOOLS TABLE

 A107F057	Scan Tool

COMPONENT LOCATOR

ABS COMPONENT LOCATOR

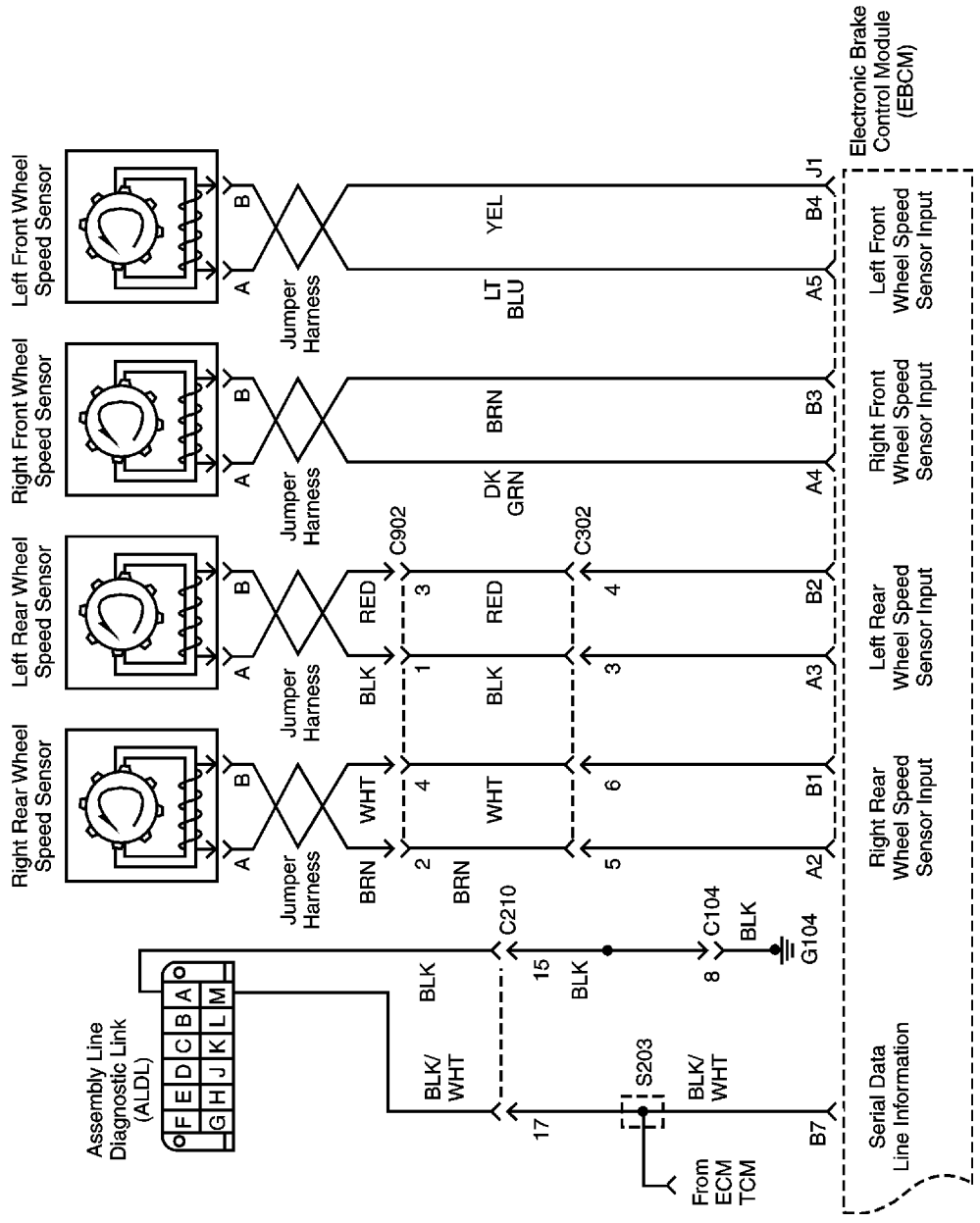
(Left-Hand Drive Shown, Right-Hand Drive Simi8lar)



1 Right Front Wheel Speed Sensor
2 Right Front Wheel Speed Sensor Harness
3 Hydraulic Modulator/Motor Pack Assembly
4 Isolation Solenoid
5 Right-side Hydraulic Modulator Bleeder Valve
6 Motor Pack Electrical Connector
7 ECM/ABS Wiring Harness Pass-through Grommet
8 Connector C210
9 Lamp Driver Module
10 ABS Relay
11 ABS Fuse
12 EBCM
13 EBCM Connector J2
14 EBCM Connector J1
15 Connector C302
16 Floor Wiring Harness
17 Floor Pass-through Grommet
18 Connector C902
19 Right Rear Wheel Speed Sensor
20 Left-side Hydraulic Modulator Bleeder Valve
21 I/P Wiring Harness
22 Rear Wheel Speed Sensor Harness
23 Left Front Wheel Speed Sensor
24 Left Front Wheel Speed Sensor Harness
25 Master Cylinder
26 Instrument Cluster
27 Left Rear Wheel Speed Sensor

SCHEMATIC AND ROUTING DIAGRAMS

ABS CIRCUIT (1 OF 3)



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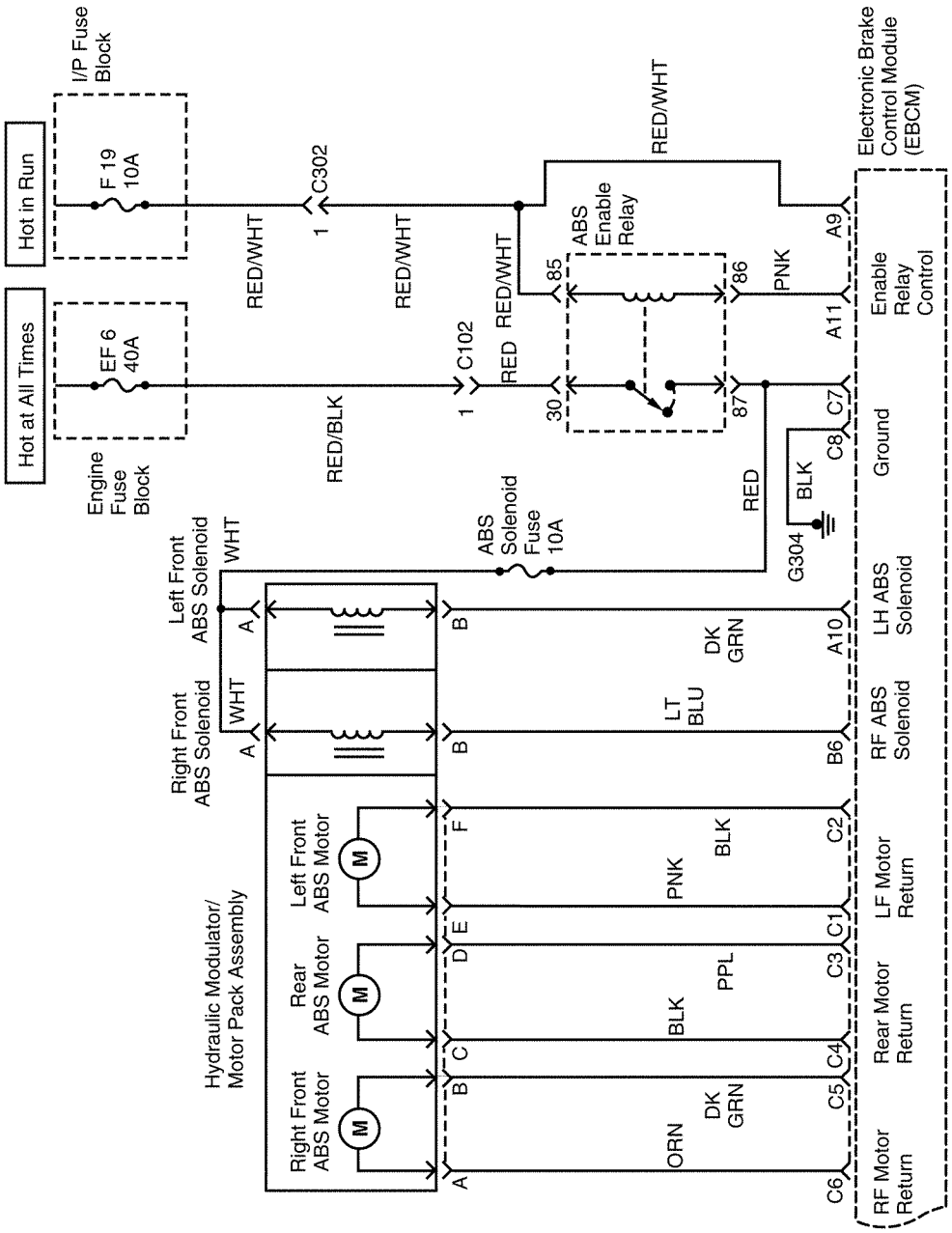
ABS CIRCUIT (2 OF 3)



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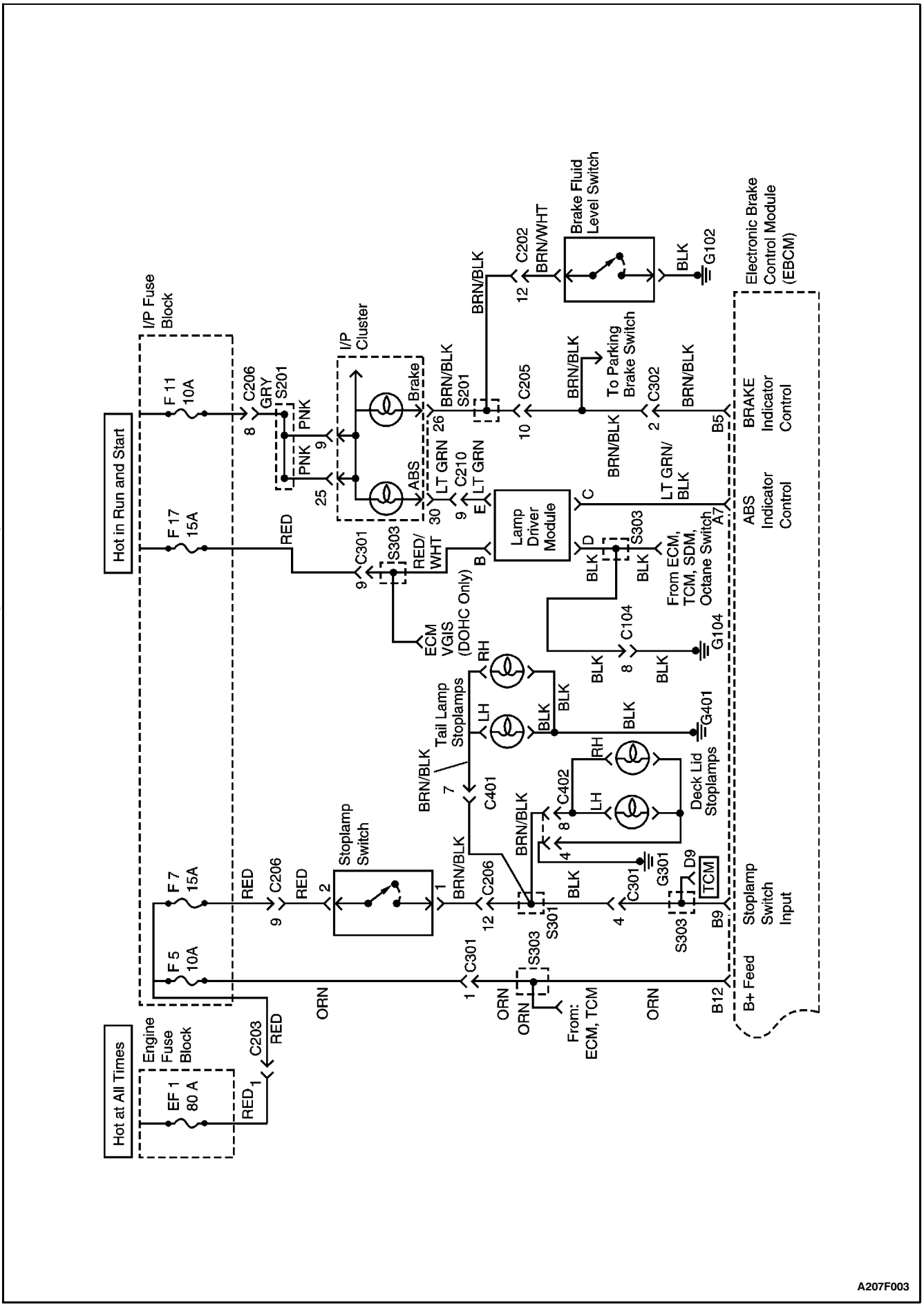
ABS CIRCUIT (3 OF 3)

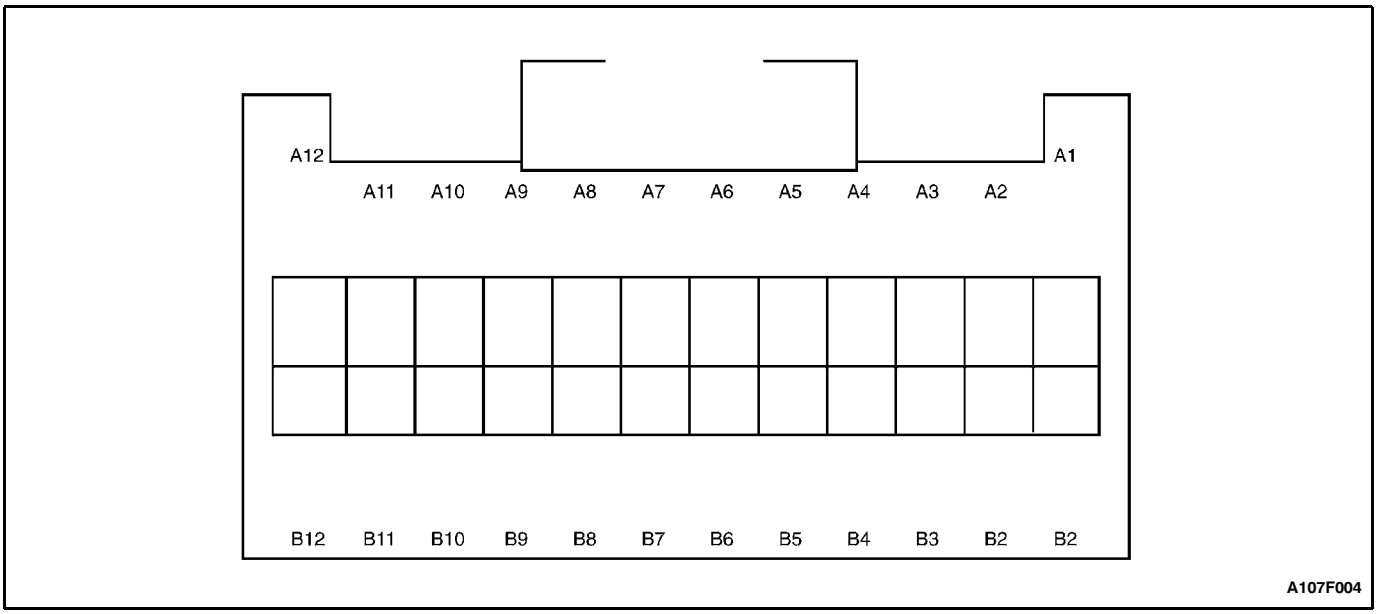


VISUAL IDENTIFICATION

EBCM CONNECTOR FACE VIEW (1 OF 2)

Terminals are identified as they appear from the wire entry end of the harness connector.

EBCM Connector J1

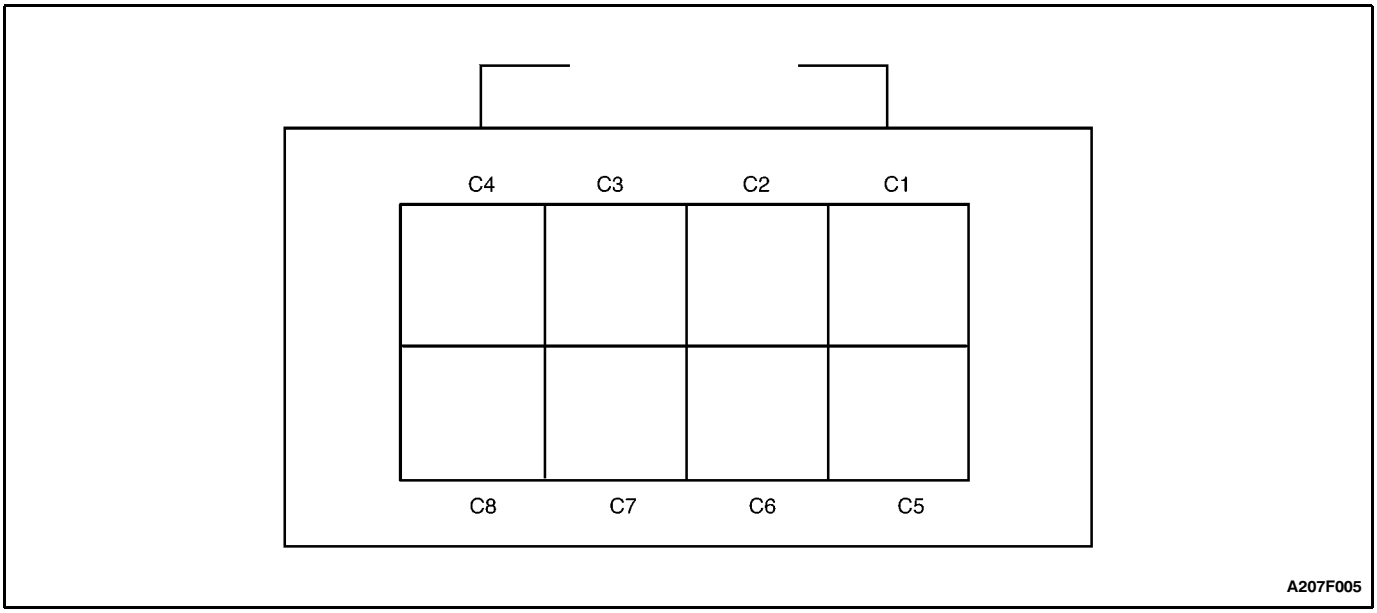


Pin	Signal Name	Color	Circuit
A1	-	-	Not Used
A2	RRWSHI	BRN	Right Rear Wheel Speed High
A3	LRWSHI	BLK	Left Rear Wheel Speed High
A4	RFWSHI	DK GRN	Right Front Wheel Speed High
A5	LFWSHI	LT BLU	Left Front Wheel Speed High
A6	-	-	Not Used
A7	ABSWARN	LT GRN/BLK	ABS Warning Indicator
A8	-	-	Not Used
A9	IGN	RED/WHT	Ignition
A10	LFABSOL	LT GRN	Left Front ABS Isolation Solenoid
A11	ENRELAY	PPL	ABS Enable Relay
A12	-	-	Not Used
B1	RRWSLO	WHT	Right Rear Wheel Speed Low
B2	LRWSLO	RED	Left Rear Wheel Speed Low
B3	RFWSLO	BRN	Right Front Wheel Speed Low
B4	LFWSLO	YEL	Left Front Wheel Speed Low
B5	BRAKETT	BRN/BLK	Brake Tell Tale
B6	REABSOL	DK GRN	Right Front ABS Isolation Solenoid
B7	SDLUART	BLK/WHT	Serial Data Link, UART
B8	-	-	Not Used
B9	BRAKESW	BRN/BLK	Brake Switch
B10	-	-	Not Used
B11	-	-	Not Used
B12	BATT	ORN	Battery

EBCM CONNECTOR FACE VIEW (2 OF 2)

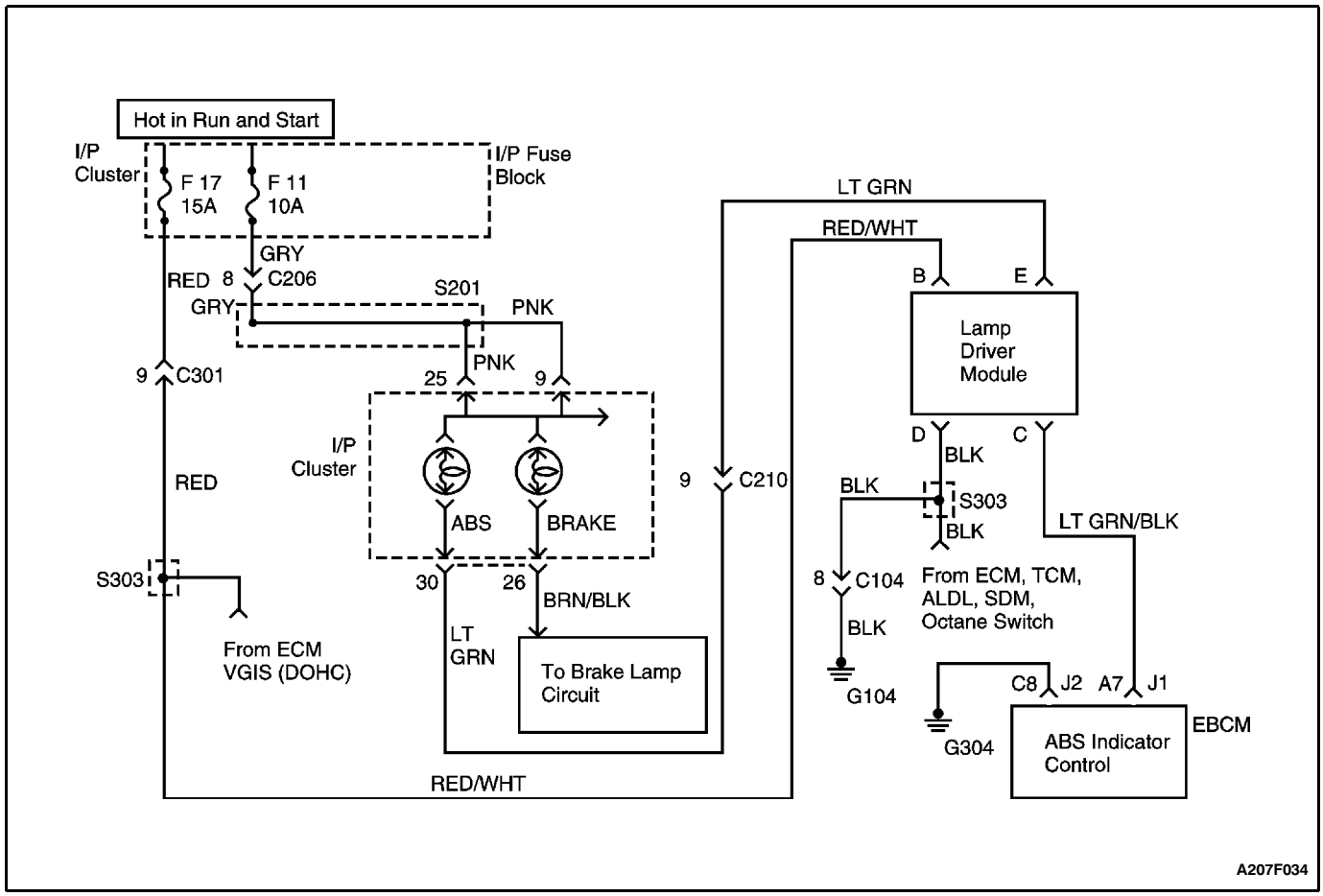
Terminals are identified as they appear from the wire entry end of the harness connector.

EBCM Connector J2



PIN	SIGNAL NAME	COLOR	CIRCUIT
C1	LFMOTLO	PNK	Left Front Motor Low
C2	LFMOTHI	BLK	Left Front Motor High
C3	RAMOTHI	PPL	Rear Axle Motor High
C4	RAMOTLO	BLK	Rear Axle Motor Low
C5	RFMOTHI	DK GRN	Right Front Motor High
C6	RFMOTLO	ORN	Right Front Motor Low
C7	SWBATT	RED	Battery Feed Through Relay
C8	GND	BLK	Negative Battery Terminal

DIAGNOSIS



ABS (AMBER) INDICATOR ON CONSTANTLY, NO DTCS STORED

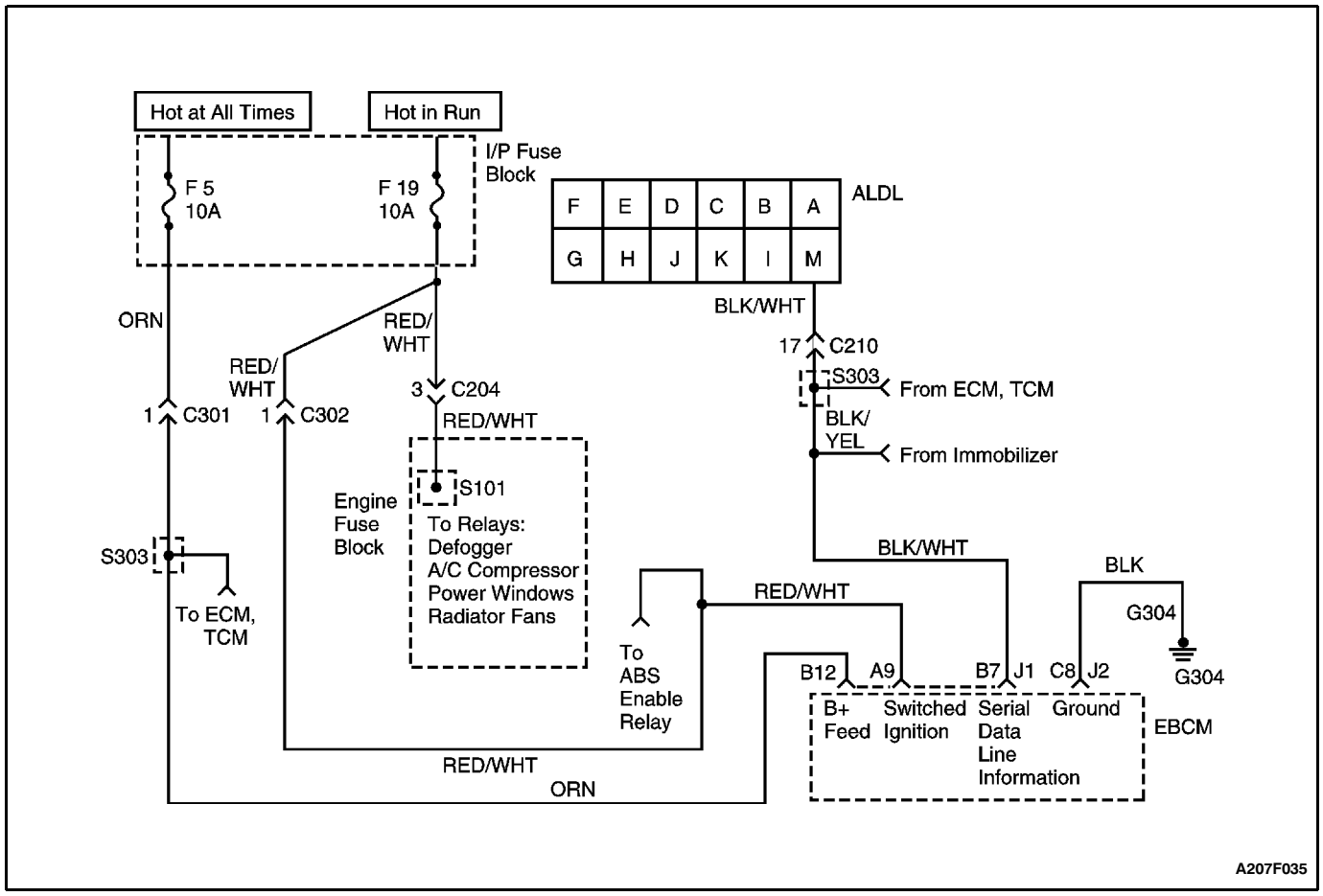
Important: Complete the Diagnostic Circuit Check before using this table.

ABS (Amber) Indicator On Constantly, No DTCs Stored

Step	Action	Value(s)	Yes	No
1	Use the scan tool to command the ABS (amber) indicator OFF. Is the indicator off?	-	Go to "Intermittents and Poor Connections"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM harness connector J1. 3. Turn the ignition switch to ON. 4. Connect a jumper wire to ground and to probe terminal A7 of the EBCM harness connector J1. Does the ABS indicator go off?	-	Go to Step 3	Go to Step 7
3	Inspect the EBCM harness connector J1 terminal A7 for a poor contact. Is the contact good?	-	Go to Step 5	Go to Step 4

ABS (Amber) Indicator On Constantly, No DTCs Stored (Cont'd)

Step	Action	Value(s)	Yes	No
4	Repair the contact. Is the repair complete?	-	System OK	-
5	1. Reconnect all of the connectors. 2. Turn the ignition switch to ON. Does the ABS indicator still stay ON?	-	Go to Step 6	System OK
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	1. Turn the ignition switch to LOCK. 2. Remove fuse F17. 3. Turn the ignition switch to ON. 4. Measure the voltage between terminal A7 of the EBCM harness connector J1 and ground. Is this voltage less than the specified value?	1 v	Go to Step 9	Go to Step 8
8	Repair the short to B+ in circuit LT GRN/BLK between terminal A7 of the EBCM harness connector J1 and terminal C of the lamp driver module. Is the repair complete?	-	System OK	-
9	1. Turn the ignition switch to LOCK. 2. Reinstall fuse F17. 3. Disconnect the lamp driver module from the harness. 4. Turn the ignition switch to ON. Is the ABS indicator off?	-	Go to Step 11	Go to Step 10
10	Repair the short to ground in circuit LT GRN between terminal E of the lamp driver module and terminal 30 of the instrument cluster. Is the repair complete?	-	System OK	-
11	1. Turn the ignition switch to LOCK. 2. Use a digital voltmeter (DVM) to measure the resistance from EBCM harness connector J1, terminal A7 to lamp driver module harness connector terminal C. Is this resistance less than the specified value?	2 W	Go to Step 12	Go to Step 13
12	1. Reconnect all connections. 2. Turn the ignition switch to ON. Does the ABS indicator still remain ON?	-	Go to Step 6	System OK
13	Check for an open in circuit LT GRN/BLK between terminal A7 of the EBCM harness connector J1 and terminal C of the lamp driver module. Is there an open present?	-	Go to Step 14	Go to Step 15
14	Repair the open in circuit LT GRN/BLK between terminal A7 of EBCM harness connector J1 and terminal C of the lamp driver module. Is the repair complete?	-	System OK	-
15	Replace the lamp driver module. Is the repair complete?	-	System OK	-



ABS (AMBER) INDICATOR ON INTERMITTENTLY, NO DTCS STORED

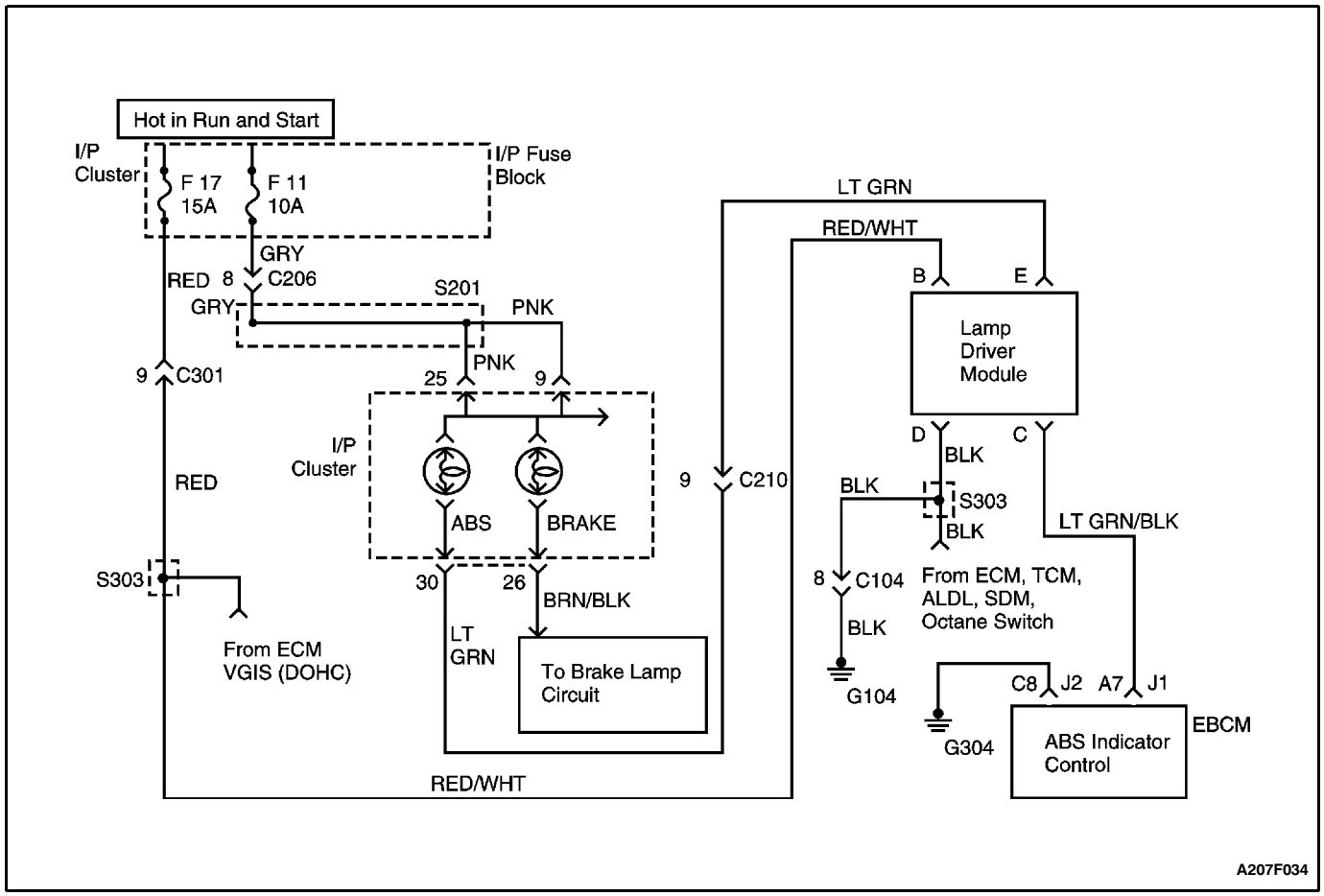
Important: Complete the Diagnostic Circuit Check before using this table.

ABS (Amber) Indicator On Intermittently, No DTCs Stored

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Connect a test light to ground and to probe terminal B12 of the EBCM harness connector J1. 4. Observe the test light while moving the wire harness and the connectors. Does the test light remain on steadily?	-	Go to Step 2	Go to Step 5
2	Check for a proper connection at terminal 1 of connector C301 between the ECM/ABS harness and the floor harness. Is this connection in good condition?	-	Go to Step 3	Go to Step 4
3	Repair the intermittent connection in circuit ORN between the EBCM harness terminal B12 and fuse F5 of the I/P fuse block. Is the repair complete?	-	System OK	-

ABS (Amber) Indicator On Intermittently, No DTCs Stored (Cont'd)

Step	Action	Value(s)	Yes	No
4	Repair the poor connection at terminal 1 of connector C301. Is the repair complete?	-	System OK	-
5	1. Connect a test light between ground and the EBCM harness connector J1, terminal A9. 2. Turn the ignition switch to ON and observe the test light while moving the wire harness and the connectors. Does the test light remain on steadily?	-	Go to "Intermittents and Poor Connections"	Go to Step 6
6	Repair the intermittent connection in circuit RED/WHT between terminal A9 of the EBCM harness connector J1 and fuse F19 of the I/P fuse block. Is the repair complete?	-	System OK	-



ABS (AMBER) INDICATOR OFF CONSTANTLY, NO DTCS STORED

Important: Complete the Diagnostic Circuit Check before using this table.

ABS (Amber) Indicator Off Constantly, No DTCs Stored

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Select Lamp Test on the scan tool and command the ABS indicator ON. Is the ABS indicator ON?	-	Go to "Intermittents and Poor Connections"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the lamp driver module (LDM) from the harness connector. 3. Turn the ignition switch to ON. 4. Use a fused jumper to connect terminal E of the LDM connector to ground. Is the ABS indicator ON?	-	Go to Step 3	Go to Step 10
3	1. Turn the ignition switch to LOCK. 2. Use a digital voltmeter (DVM) to measure the resistance between terminal D of the LDM harness connector and ground. Is the resistance below the specified value?	2 W	Go to Step 5	Go to Step 4
4	Repair the open in circuit BLK from terminal D of the lamp driver module to ground. Is the repair complete?	-	System OK	-

ABS (Amber) Indicator Off Constantly, No DTCs Stored (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal B of the LDM harness connector and chassis ground. Is this voltage less than the specified value?	10 v	Go to Step 6	Go to Step 7
6	Repair the open or high resistance in circuit RED/WHT between terminal B of the lamp driver module and fuse F17 of the I/P fuse block. Is the repair complete?	-	System OK	-
7	Check for a short to ground in circuit LT GRN/BLK between terminal A7 of the EBCM harness connector J1 and terminal C of the lamp driver module. Is there a short?	-	Go to Step 8	Go to Step 9
8	Repair the short to ground in circuit LT GRN/BLK between terminal A7 of the EBCM harness connector J1 and terminal C of the lamp driver module. Is the repair complete?	-	System OK	-
9	Replace the LDM. Is the repair complete?	-	System OK	-
10	1. Turn the ignition switch to LOCK. 2. Disconnect the I/P cluster harness connector C. 3. Use a DVM to measure the resistance between terminal E of the LDM connector and terminal 30 of the I/P cluster harness connector. Is this resistance below the specified value?	2 W	Go to Step 14	Go to Step 11
11	Inspect terminal 9 of connector C210 between the ECM/ABS harness and the I/P harness for proper connection. Is this connection in good condition?	-	Go to Step 13	Go to Step 12
12	Repair the connection at terminal 9 of connector C210. Is the repair complete?	-	System OK	-
13	Repair the open or high resistance in circuit LT GRN between terminal E of the lamp driver connector and terminal 30 of the I/P cluster harness connector. Is the repair complete?	-	System OK	-
14	Inspect the ABS indicator bulb. Is the bulb open?	-	Go to Step 15	Go to Step 16
15	Replace the ABS indicator bulb. Is the repair complete?	-	System OK	-
16	1. Turn the ignition switch to ON. 2. Connect a test light between ground and terminal E of the LDM harness connector. Is the test light on?	-	Go to Step 17	Go to Step 20
17	Examine circuit LT GRN between terminal E of the lamp driver connector and terminal 30 of the I/P cluster harness connector for a short to B+. Was a short found?	-	Go to Step 18	Go to Step 19
18	Repair the short to B+ on circuit LT GRN between terminal E of the lamp driver connector and terminal 30 of the I/P cluster harness connector. Is the repair complete?	-	System OK	-

ABS (Amber) Indicator Off Constantly, No DTCs Stored (Cont'd)

Step	Action	Value(s)	Yes	No
19	Replace the Lamp Driver Module. Is the repair complete?	-	System OK	-
20	1. Turn the ignition switch to LOCK. 2. Reconnect the LDM connector and the I/P cluster connector C. 3. Turn the ignition switch to ON. Does the ABS indicator come on for 3 seconds then go off?	-	Go to "Intermittents and Poor Connections"	Go to Step 21
21	Replace the EBCM. Is the repair complete?	-	System OK	-

SELF-DIAGNOSTICS

Tools Required

Scan Tool

The EBCM contains sophisticated on-board diagnostics that, when accessed with a scan tool, are designed to identify the source of any system malfunction as specifically as possible, including whether the malfunction is intermittent. There are 53 DTCs to assist with diagnosis.

When using the scan tool with the ABS VI, the last DTC is specifically identified, and specific ABS data is stored at the time of this malfunction. Also, in addition to the last DTC set, there is information about the first three DTCs set. Using the scan tool, each input and output can be monitored, thus enabling malfunction confirmation and repair verification. Manual control of components and automated functional tests are also available when using the scan tool. Details of many of these functions are contained in the following sections.

DISPLAYING DTCS

Tools Required

Scan Tool

DTCs can be read through the use of the scan tool. There are no provisions for "Flash Code" diagnostics.

CLEARING DTCS

Tools Required

Scan Tool

The DTCs in the EBCM memory are erased in one of two ways:

1. Scan tool "Clear DTCs" selection.
2. After 100 DTC free drive cycles.

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

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

Ignition Cycle Default

If no DTC occurs for 100 drive cycles (a drive cycle occurs when the ignition switch is turned to ON and the vehicle is driven faster than 16 km/h (10 mph), any existing DTCs are cleared from the EBCM memory. This is not an acceptable method for clearing ABS DTCs.

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 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. The scan tool modular diagnostic system must be used 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.

SCAN TOOL DIAGNOSTICS

Tools Required

Scan Tool

Enhanced Diagnostics

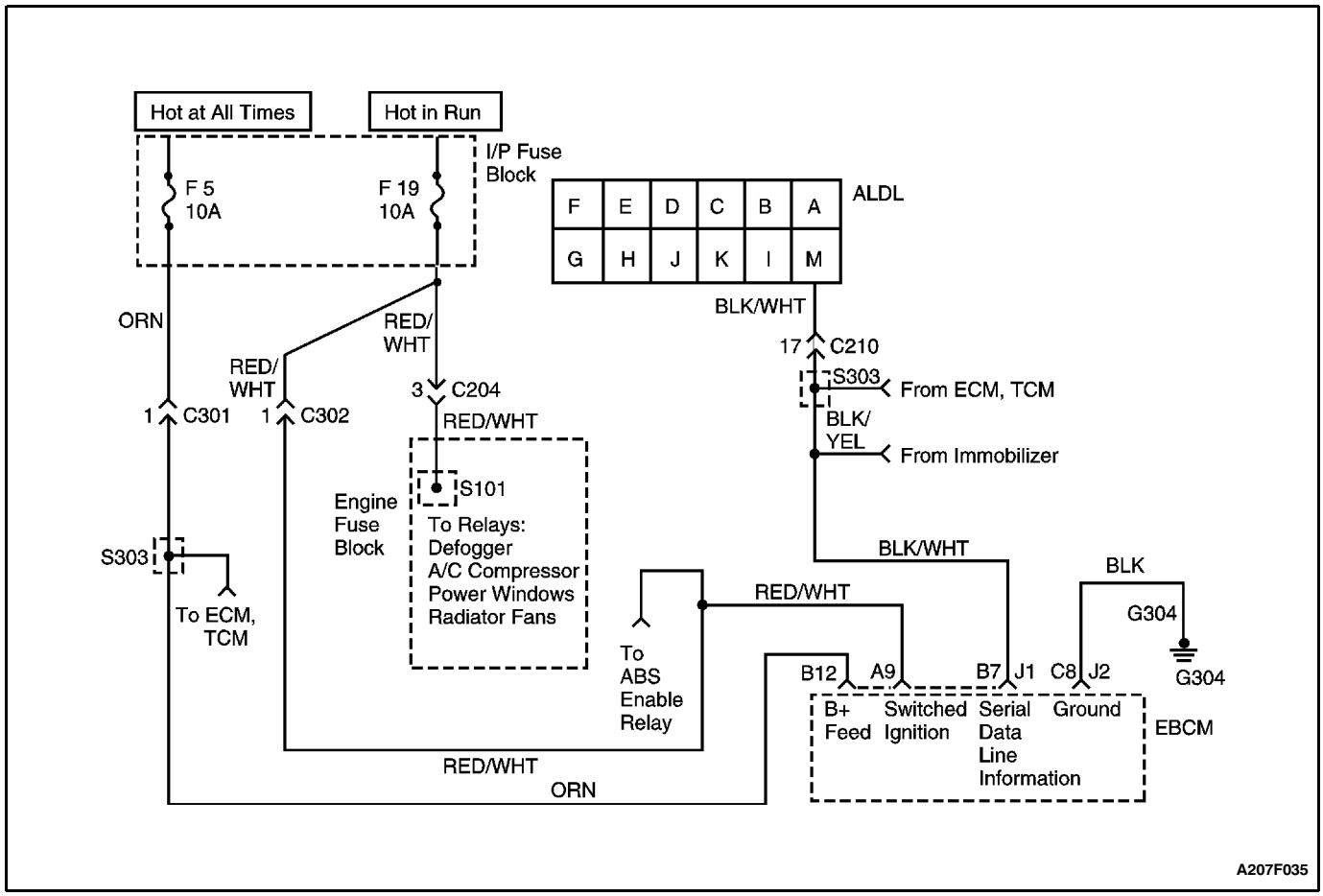
Enhanced diagnostic information, found in the CODE HISTORY function of the scan tool, is designed to provide the service technician with specific malfunction occurrence information. For each of the first three DTCs and the very last DTC stored, data is stored to identify the specific DTC, the number of occurrences, and the number of drive cycles since the malfunction first and last occurred. A normal drive cycle consists of starting the engine, driving the vehicle over 16 km/h (10 mph), and turning the ignition OFF. These first three DTCs are also stored in the order of occurrence. The order in

which the first three DTCs occurred can be useful in determining if a previous malfunction, such as an intermittent open in a wheel speed sensor circuit which later becomes completely open. However, if a malfunction is present, the drive cycle counter will increase by turning the ignition switch to ON and LOCK.

During difficult diagnosis situations, this information can be used to identify malfunction occurrence trends. Does the malfunction occur more frequently now than it did during the last customer visit? Did the malfunction only occur once over a large number of driving cycles, indicating an unusual condition present when it occurred? Does the malfunction occur infrequently over a large number of drive cycles, indicating that special diagnosis techniques may be required to identify the source of the malfunction?

If, for example, a malfunction occurred in one out of 20 drive cycles, the malfunction is intermittent and has not recurred for 19 drive cycles. This malfunction may be difficult or impossible to duplicate and may have been caused by a severe vehicle impact (such as a large pot hole or a speed bump at high speed) that momentarily opened an electrical connector or caused unusual vehicle suspension movement. Problem resolution is unlikely, and the problem may never recur (check diagnostic aids provided for that DTC). If, for example, the malfunction occurred in three out of 15 drive cycles, the odds of finding the cause are still not good, but you know how often it occurs. You can determine whether or not the malfunction is becoming more frequent based on an additional or past customer visit if the source of the problem cannot or could not be found. If the malfunction occurred 10 out of 20 drive cycles, the odds of finding the cause are very good.

By using the additional malfunction data, you can also determine if a malfunction is randomly intermittent or if it has not recurred for long periods of time due to weather changes or a repair prior to this visit. For example, if a DTC occurred 10 out of 20 drive cycles but has not recurred since, a significant environmental change or repair may have occurred 10 drive cycles ago. A repair may not be necessary if customer information can confirm a recent repair. If no repair was made, the service technician can focus on diagnosis techniques used to locate difficult-to-recreate problems.



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.

The Scan Data listed in the table may be used after completing the Diagnostic Circuit Check and finding the on-board diagnostics functioning properly and diagnostic trouble codes (DTCs) displayed.

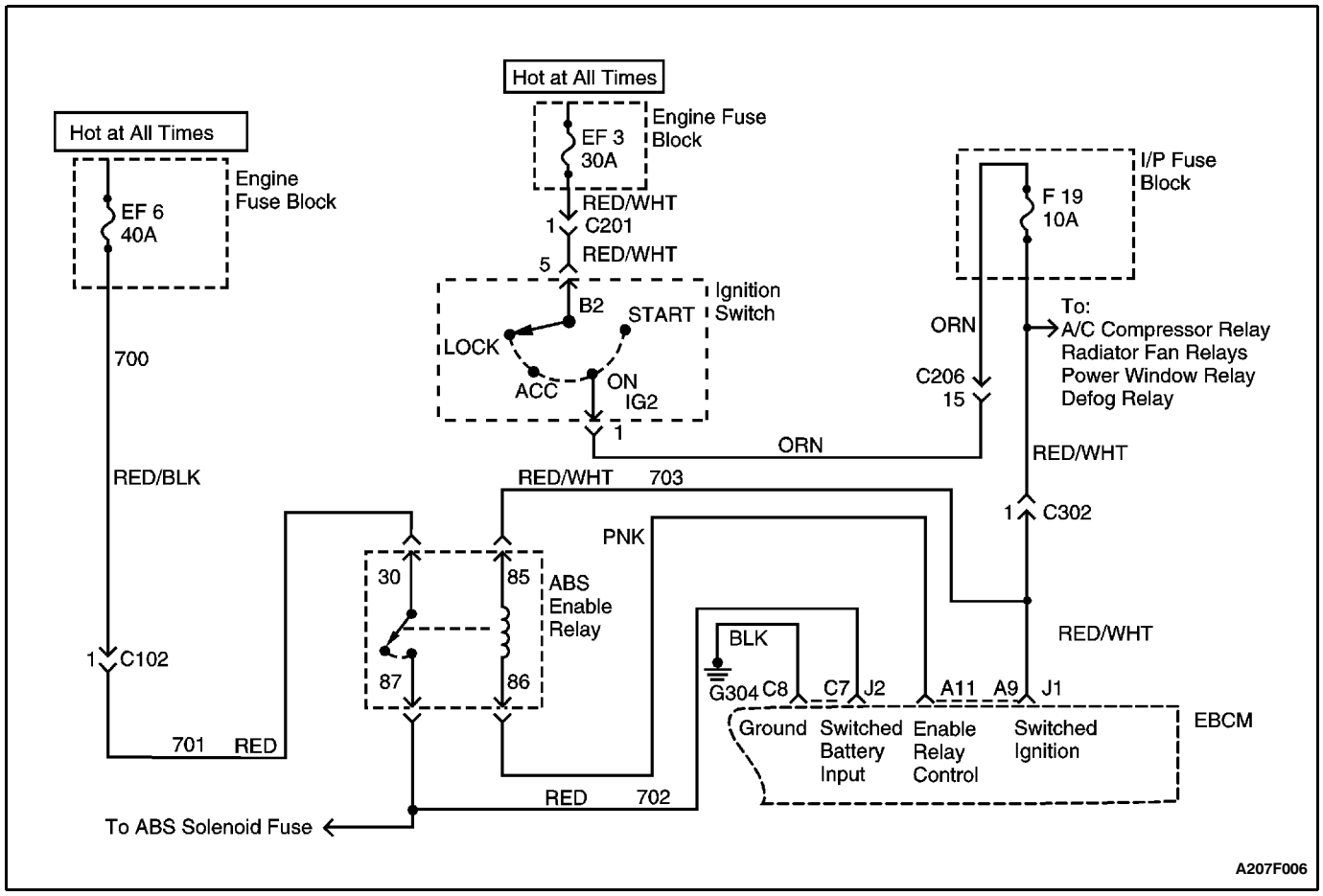
Notice: Do not use a scan tool that displays faulty data. This can result in misdiagnosis and unnecessary parts replacement. Report that problem to the manufacturer.

Diagnostic Circuit Check

Step	Action	Value(s)	Yes	No
1	1. Verify that all ABS connectors are connected properly. 2. Install the scan tool. 3. Turn the ignition switch to ON. 4. Select the Data List mode. Is the scan tool receiving data from the EBCM?	-	Go to Step 2	Go to Step 7
2	Check the display. Are there any current DTCs displayed?	-	Go to the applicable DTC table	Go to Step 3
3	1. Turn the ignition switch to LOCK for 10 seconds. 2. Turn the ignition switch to ON and observe the ABS indicator. Does the indicator light for 3 seconds and then go off?	-	Go to Step 4	Go to Step 5

Diagnostic Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
4	Check for history DTCs. Are any history DTCs present?	-	Go to "Scan Tool Diagnostics"	Go to "Hydraulic Functional Control"
5	Check the ABS indicator. Did the ABS indicator turn on and stay on?	-	Go to "ABS Indicator On Constantly"	Go to Step 6
6	Check the ABS indicator. Did the ABS indicator remain off through the entire procedure?	-	Go to "ABS Indicator Off Constantly"	Go to "ABS Indicator On Intermittently"
7	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM harness connector J1. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage from ground to terminal B12, then A9 of EBCM harness connector J1. Is the voltage greater than the specified value on each terminal?	10 v	Go to Step 9	Go to Step 8
8	Repair the open or short to ground in the circuit that did not indicate the specified voltage. Is the repair complete?	-	System OK	-
9	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM harness connector J2. 3. Use a DVM to measure the resistance from the EBCM harness connector J2, terminal C8, to ground. Is the resistance below the specified value?	2 W	Go to Step 11	Go to Step 10
10	Repair the open in circuit BLK between terminal D of the EBCM harness connector J2 and ground G304 next to the EBCM. Is the repair complete?	-	System OK	-
11	Use a DVM to measure the resistance between terminal B7 of the EBCM harness connector J1 and terminal M of the ALDL. Is the resistance below the specified value?	2 W	Go to Step 12	Go to Step 13
12	Replace the EBCM. Is the repair complete?	-	System OK	-
13	Check for a proper connection at terminal 17 of connector C210. Is this connection in good condition?	-	Go to Step 15	Go to Step 14
14	Repair the bad connection. Is the repair complete?	-	System OK	-
15	Repair the open in circuit BLK/WHT between terminal B7 of EBCM harness connector J1 and terminal M of the ALDL jack.	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A014
ABS ENABLE RELAY CONTACT CIRCUIT OPEN

Circuit Description

Ignition voltage is supplied through terminal 6 of the ABS enable relay socket. The EBCM then is able to energize the pull-in coil by completing the ground circuit at pin A11 of the EBCM. The magnetic field created closes the ABS enable relay contacts and supplies battery voltage and current to the EBCM, which supplies power to the motors.

Diagnosis

This test checks for continuity in the switched battery circuit to the EBCM. A fault exists if for 0.056 seconds the switched battery voltage falls below 7.5 volts and the ignition voltage is greater than 10.6 volts while the controller output for the relay coil is less than 3.4 volts.

Cause(s)

- **There is a blown fuse (from the battery to the relay contacts).**
- **Relay contacts are malfunctioning.**
- **There is high resistance in a connector terminal or the wiring.**
- **There is an open circuit in the switched battery voltage wire.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The brake warning lamp is turned on only if the rear piston is not at the top of the bore. This could cause degradation of the base brakes.

Test Description

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

2. **This step checks to see if the EBCM is sensing battery voltage at connector J2, terminal C7.**
3. **This step checks for improper operation of the ABS enable relay and the related circuitry.**
4. **This step checks for excessive resistance in the switched battery input circuitry.**
5. **This step checks for excessive resistance in the B+ feed circuit.**

10. This step determines if the malfunction is due to a poor connection.
12. This step determines if the malfunction is due to the EBCM.
14. This step checks for excessive resistance in the ABS enable relay control circuitry.
15. This step checks for improper battery voltage.
16. This step checks for an open in the B+ feed circuit.
17. This step checks for an open in the switched battery input circuit.
18. This step checks for improper operation of the ABS enable relay.
26. This step checks for excessive resistance in the ignition switch ON feed (Fuse F19) circuit.
27. This step checks for excessive resistance in the ABS enable relay coil.
28. This step checks for excessive resistance in the ABS enable relay control circuit between the relay and the EBCM .
29. This step checks for excessive resistance in the ABS enable relay control circuit between the relay and the I/P harness connector.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

Vibration, Temperature Effects

1. Check for vibration effects by performing the relay test function of the scan tool.
2. Use the scan tool to command the relay ON.
3. Monitor the relay voltage while lightly tapping the top and the sides of the relay.
4. Replace the relay if the voltage changes significantly.

If DTC A014 only occurs when the vehicle is initially started in cold ambient conditions (temperature less than 0°C / 32°F), replace the relay.

DTC A014 - ABS Enable Relay Contact Circuit Open

Step	Action	Value(s)	Yes	No
1	Check the DTC code history. Is DTC A016 also present in history?	-	Go to "DTC A016"	Go to Step 2
2	1. Turn the ignition switch to ON. 2. Using the scan tool, select Data List and observe the ABS battery voltage. Is the voltage above the specified value?	10 v	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect both EBCM harness connectors. 3. Connect a fused jumper between ground and terminal A11 of the EBCM harness connector J1. 4. Turn the ignition switch to ON. 5. Use a digital voltmeter (DVM) to measure the voltage between ground and the EBCM harness connector J2, terminal C7. Is the voltage above the specified value?	10 v	Go to Step 4	Go to Step 14
4	1. Turn the ignition switch to LOCK. 2. Disconnect the jumper used in Step 3. 3. Unplug the ABS Enable Relay from the harness connector. 4. Use a DVM to measure the resistance between terminal 8 of the ABS enable relay harness connector and terminal C7 of EBCM harness connector J2. Is the resistance below the specified value?	2 W	Go to Step 5	Go to Step 9

DTC A014 - ABS Enable Relay Contact Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the positive and the negative battery cables. 2. Use a DVM to measure the resistance between the positive battery cable terminal and terminal 2 of the ABS enable relay harness connector. Is the resistance below the specified value?	2 W	Go to Step 10	Go to Step 6
6	Inspect the system fuse, EF6, in the engine compartment fuse block. Is the fuse in good condition?	-	Go to Step 7	Go to Step 8
7	Repair the open or high resistance in circuit RED-RED/BLK between terminal 2 of the ABS relay socket and system fuse EF6. Is the repair complete?	-	System OK	-
8	Replace the system fuse, EF6, in the engine compartment fuse block. Is the repair complete?	-	System OK	-
9	Repair the high resistance in circuit RED between terminal 8 of the ABS relay socket and terminal C7 of EBCM connector J2. Is the repair complete?	-	System OK	-
10	1. Inspect the ABS enable relay and harness connector for a poor connection. 2. Inspect the positive battery cable terminal for a poor connection. Do you see evidence of a poor terminal contact or a poor connection?	-	Go to Step 11	Go to Step 12
11	Repair any terminals that exhibit poor contact or repair connection integrity if poor contact exists at a battery terminal. Is the repair complete?	-	System OK	-
12	1. Reconnect all of the connectors. 2. Turn the ignition switch to ON. Does DTC A014 reset?	-	Go to Step 13	Go to "Diagnostic Aids"
13	Replace the EBCM. Is the repair complete?	-	System OK	-
14	1. Turn the ignition switch to LOCK. 2. Disconnect the I/P harness connector C302. 3. Use a DVM to measure the resistance between terminal 1 of connector C302, and terminal A11 of EBCM harness connector J1. Is the resistance less than the specified value when measured at approximately 24°C (75°F)?	95 W	Go to Step 15	Go to Step 27
15	Use a DVM to measure the voltage between the positive and the negative battery terminals. Is the voltage greater than the specified value?	10 v	Go to Step 16	Go to Step 20
16	1. Unplug the ABS enable relay from the harness connector. 2. Use a DVM to measure the voltage between ABS enable relay harness connector terminal 2 and ground. Is the voltage above the specified value?	10 v	Go to Step 17	Go to Step 21

DTC A014 - ABS Enable Relay Contact Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
17	Use a DVM to measure the resistance between ABS enable relay harness connector terminal 8 and terminal C7 of the EBCM harness connector J2. Is the resistance below the specified value?	2 W	Go to Step 18	Go to Step 23
18	1. Use a jumper wire to connect ABS enable relay terminal 86 to ground. 2. Use a fused jumper wire to connect ABS enable relay terminal 85 to B+. 3. Use a DVM to measure the resistance between ABS enable relay terminals 30 and 87. Is the resistance below the specified value?	2 W	Go to Step 24	Go to Step 19
19	Replace the ABS enable relay. Is the repair complete?	-	System OK	-
20	Correct the low voltage condition. Is the repair complete?	-	System OK	-
21	Check the system fuse, EF6, in the engine compartment fuse block. Is the fuse in good condition?	-	Go to Step 22	Go to Step 34
22	Repair the open in circuit RED-RED/BLK between terminal 2 on the ABS relay socket and system fuse EF6. Is the repair complete?	-	System OK	-
23	Repair the open in circuit RED between terminal 8 of the ABS relay socket and terminal C7 of the EBCM connector J2. Is the repair complete?	-	System OK	-
24	1. Disconnect the ignition switch harness connector. 2. Use a DVM to measure the resistance between the ignition switch harness connector terminal 1 (IG2), ORN, and terminal 1 of connector C302. Is the resistance below the specified value?	2 W	Go to Step 25	Go to Step 26
25	1. The malfunction is due to a poor connection. 2. Check for poor terminal contacts: • Between the ABS enable relay and the harness connector. • At terminal 1 of connector C302. • Between the ignition switch harness connector and the ignition switch. 3. Replace terminals that exhibit poor terminal contact. Is the repair complete?	-	System OK	-
26	1. Check the ignition ON feed path for high resistance • From terminal 1 (IG2), ORN, of the ignition switch harness connector to terminal 15 of connector C206. • From terminal 15 of C206, ORN, to fuse F19. • From fuse F19, RED/WHT, to terminal 1 of connector C302. 2. Repair any source of high resistance found. Is the repair complete?	-	System OK	-

DTC A014 - ABS Enable Relay Contact Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
27	1. Disconnect the ABS enable relay from the harness connector. 2. Use a DVM to measure the resistance between ABS enable relay terminal 85 and 86. Is the resistance less than the specified value when measured at approximately 24°C (75°F)?	95 W	Go to Step 28	Go to Step 31
28	Use a DVM to measure the resistance between terminal 4 of the ABS enable relay harness connector and terminal A11 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 29	Go to Step 32
29	Use a DVM to measure the resistance between terminal 6 of the ABS enable relay harness connector and terminal 1 of connector C 302. Is the resistance below the specified value?	2 W	Go to Step 30	Go to Step 33
30	1. Check for a poor terminal contact between the ABS enable relay and the harness connector. 2. Replace the terminals that exhibit poor terminal contact. Is the repair complete?	-	System OK	-
31	Replace the ABS enable relay. Is the repair complete?	-	System OK	-
32	Repair high resistance in circuit PNK between terminal 4 of the ABS enable relay harness connector and terminal A11 of the EBCM harness connector J1. Is the repair complete?	-	System OK	-
33	Repair the high resistance in circuit RED/WHT between terminal 6 of the ABS enable relay harness connector and terminal 1 of connector C 302. Is the repair complete?	-	System OK	-
34	Replace ABS system fuse EF6. Is the repair complete?	-	System OK	-

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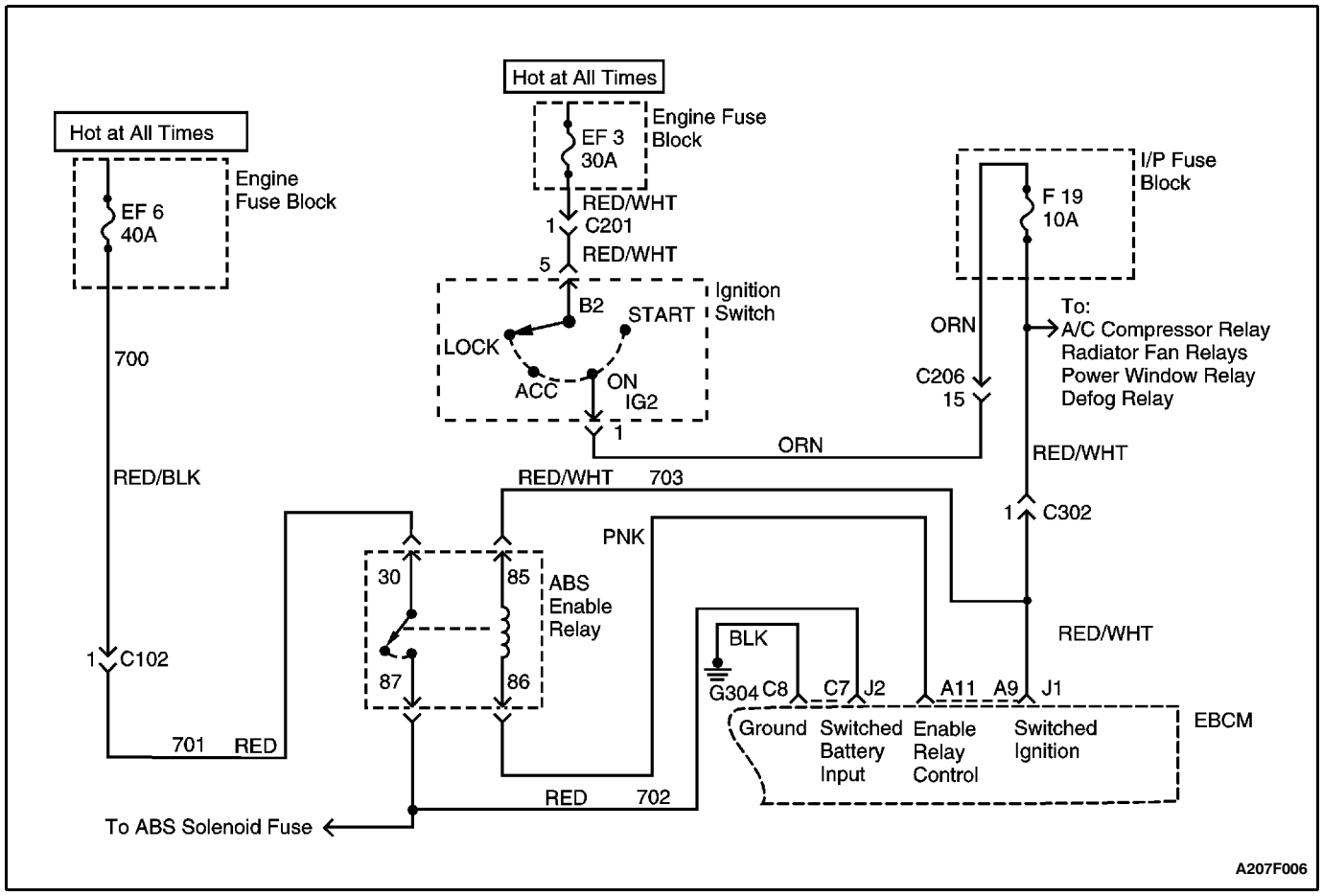


DIAGNOSTIC TROUBLE CODE (DTC) A015
ABS ENABLE RELAY CIRCUIT SHORTED TO BATTERY OR ALWAYS CLOSED

Circuit Description

Ignition voltage is supplied through terminal 6 of the ABS enable relay socket. The EBCM then is able to energize the pull-in coil by completing the ground circuit at pin A11 of the EBCM. The magnetic field created closes the ABS enable relay contacts and supplies battery voltage and current to the EBCM, which supplies power to the motors.

Diagnosis

This test determines a situation in which switched battery power is present at the EBCM when the relay is de-energized due to an ABS failure. A fault exists if for 4 seconds the switched battery voltage is greater than 4.5 volts. This code may accompany the following codes:

A058 LF Motor (high side) short to battery.

A063 RF Motor (high side) short to battery.

A064 RA Motor (high side) short to battery.

A077 LF Solenoid short to battery.

A081 RF Solenoid short to battery.

This is due to the electrical connection of the above circuits to the relay. If code A015 is detected along with the above codes, troubleshoot the above codes first.

Cause(s)

- There are malfunctioning relay contacts (contacts are closed all the time).
- A solenoid or motor circuit has shorted to battery.
- A short to battery is present on the switched battery circuit.
- The EBCM is faulty.

Fail Action

Set history code.

A DTC A015 is stored. The ABS is not disabled, but the ABS indicator will flash to indicate that a malfunction exists.

Test Description

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

1. This step indicates that the EBCM is capable of controlling the ABS enable relay as commanded.
2. This step checks for voltage at terminal C7 of the EBCM harness connector J2. If voltage is present, the malfunction exists in the ABS enable relay and/or its circuitry.

3. This test checks for a short to ground in the ABS enable relay control circuit.
4. This step checks for a short to voltage in circuit RED.
5. This step identifies if the EBCM is malfunctioning.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

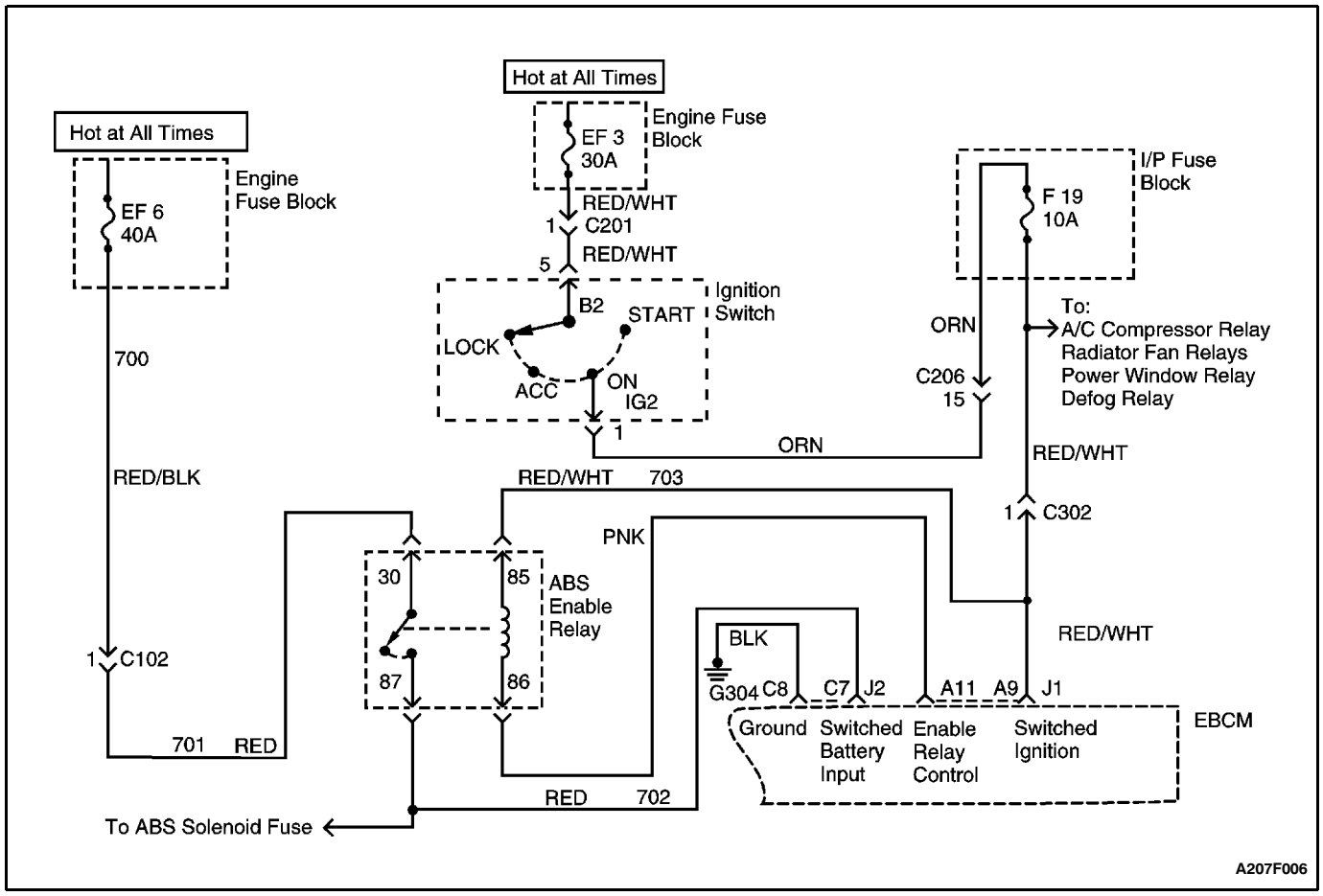
The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A015 - ABS Enable Relay Circuit Shorted to Battery or Always Closed

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Use the relay test function of the scan tool scanner to command the ABS enable relay OFF. Does the scan tool indicate that the ABS enable relay is OFF and the battery voltage is less than the specified value?	5 v	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect both EBCM connectors. 3. Turn the ignition switch to ON. 4. Measure the voltage between ground and terminal C7 of the EBCM harness connector J2. Is the voltage less than the specified value?	2 v	Go to Step 5	Go to Step 3
3	Measure the voltage between terminal A11 of the EBCM harness connector J1 and B+. Is the voltage less than the specified value?	2 v	Go to Step 4	Go to Step 7
4	1. Turn the ignition switch to LOCK. 2. Unplug the ABS enable relay. 3. Turn the ignition switch to ON. 4. Measure the voltage between ground and terminal C7 of the EBCM harness connector J2. Is the voltage less than the specified value?	2 v	Go to Step 8	Go to Step 9
5	1. Turn the ignition switch to LOCK. 2. Reconnect both EBCM connectors. 3. Turn the ignition switch to ON. 4. Clear any DTCs with the scan tool scanner. 5. Use the scan tool relay test function to command the ABS enable relay OFF. Does the scan tool indicate that the ABS enable relay is OFF and the battery voltage is less than the specified value?	5 v	Go to "Diagnostic Aids"	Go to Step 6
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit PNK. Is the repair complete?	-	System OK	-
8	Replace the ABS enable relay. Is the repair complete?	-	System OK	-
9	Repair the short to voltage in circuit RED. Is the repair complete?	-	System OK	-

After the diagnosis is complete, clear all DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving above 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A016
ABS ENABLE RELAY COIL CIRCUIT OPEN

Circuit Description

Ignition voltage is supplied through terminal 6 of the ABS enable relay socket. The EBCM then is able to energize the pull-in coil by completing the ground circuit at pin A11 of the EBCM. The magnetic field created closes the ABS enable relay contacts and supplies battery voltage and current to the EBCM, which supplies power to the motors.

Diagnosis

This test detects an open in the enable relay coil circuit. If for 0.056 seconds the enable relay input voltage to the controller falls below 7.5 volts while the controller output for the enable relay is less than 3.4 volts, a fault exists.

Cause(s)

- **The enable relay coil is open.**
- **An open exists within the enable relay coil circuit.**
- **There is high resistance in the connector terminal or wiring.**
- **The driver circuit in the EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The brake warning lamp is turned on only if the rear piston is not at the top of the bore. This could cause degradation of the base brakes.

Test Description

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

1. **This step indicates if the EBCM is capable of controlling the ABS enable relay as commanded.**
2. **This step ensures that there is continuity through the pull-in coil of the relay.**
3. **This step checks to ensure that voltage is available to the pull-in coil of the relay.**
4. **This step checks for continuity in circuit PNK.**
5. **This step ensures that the DTC was not set due to a poor connection.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A016 - ABS Enable Relay Coil Circuit Open

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Use the relay test function of the scan tool scanner to command the ABS enable relay ON. Does the scan tool indicate that the ABS enable relay is ON and the battery voltage is above the specified value?	10 v	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal A11 of the EBCM harness connector J1. Is the voltage above the specified value?	10 v	Go to Step 5	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the ABS enable relay. 3. Turn the ignition switch to ON. 4. Use a DVM to measure the voltage between ground and terminal 6 of the ABS enable relay harness connector. Is the voltage above the specified value?	10 v	Go to Step 4	Go to Step 7
4	Use a DVM to measure the resistance between terminal A11 of the EBCM harness connector J1 and terminal 4 of the ABS enable relay harness connector. Is the resistance below the specified value?	2 W	Go to Step 9	Go to Step 10
5	1. Turn the ignition switch to LOCK. 2. Inspect terminal A11 of the EBCM connector J1 for poor contact. 3. Reconnect all of the connectors. 4. Turn the ignition switch to ON. Does DTC reset?	-	Go to Step 6	Go to "Diagnostic Aids"
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	1. Check fuse F19. 2. Check for a poor connection at terminal 1 of connector C302. Are fuse F19 and the connection in good condition?	-	Go to Step 8	Go to Step 11
8	Repair the open or high resistance in circuit RED/WHT. Is the repair complete?	-	System OK	-

DTC A016 - ABS Enable Relay Coil Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the ABS enable relay. Is the repair complete?	-	System OK	-
10	Repair the open in circuit PNK. Is the repair complete?	-	System OK	-
11	Replace fuse F19 or repair the poor connection. Is the repair complete?	-	System OK	-

After the diagnosis is complete, clear all DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving above 16 km/h (10 mph), and then turning off the ignition.

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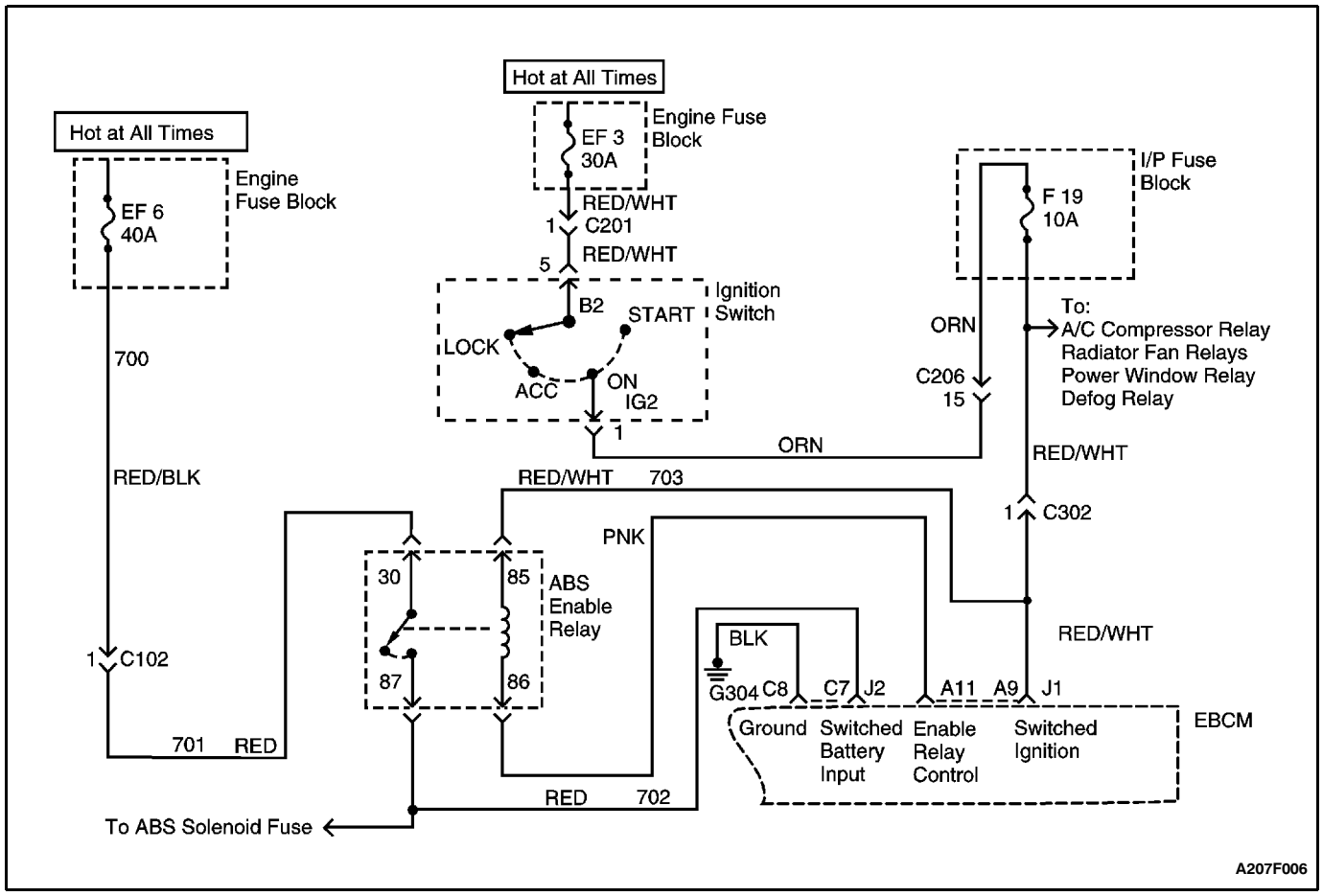


DIAGNOSTIC TROUBLE CODE (DTC) A017
ABS ENABLE RELAY COIL CIRCUIT SHORTED TO GROUND

Circuit Description

Ignition voltage is supplied through terminal 6 of the ABS enable relay socket. The EBCM then is able to energize the pull-in coil by completing the ground circuit at pin A11 of the EBCM. The magnetic field created closes the ABS enable relay contacts and supplies battery voltage and current to the EBCM, which supplies power to the motors.

Diagnosis

This test determines a situation in which switched battery power is greater than 7.5 volts at the EBCM for at least 4 seconds after the relay is de-energized and the relay coil is shorted to ground. The relay coil is considered shorted to ground when the coil circuit voltage at the controller is less than 4.5 volts.

Cause(s)

- **The relay coil circuit is shorted to ground.**
- **The EBCM driver circuit is malfunctioning.**

Fail Action

This sets a history code.

Test Description

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

1. **This step indicates if the EBCM is capable of controlling the ABS enable relay as commanded.**
2. **This checks to ensure the ABS enable relay or control circuit PNK is not shorted to ground.**
3. **This test determines whether the fault is due to a short to ground in circuit PNK or a faulty ABS enable relay.**
4. **This step ensures that the DTC was not set due to a poor connection.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

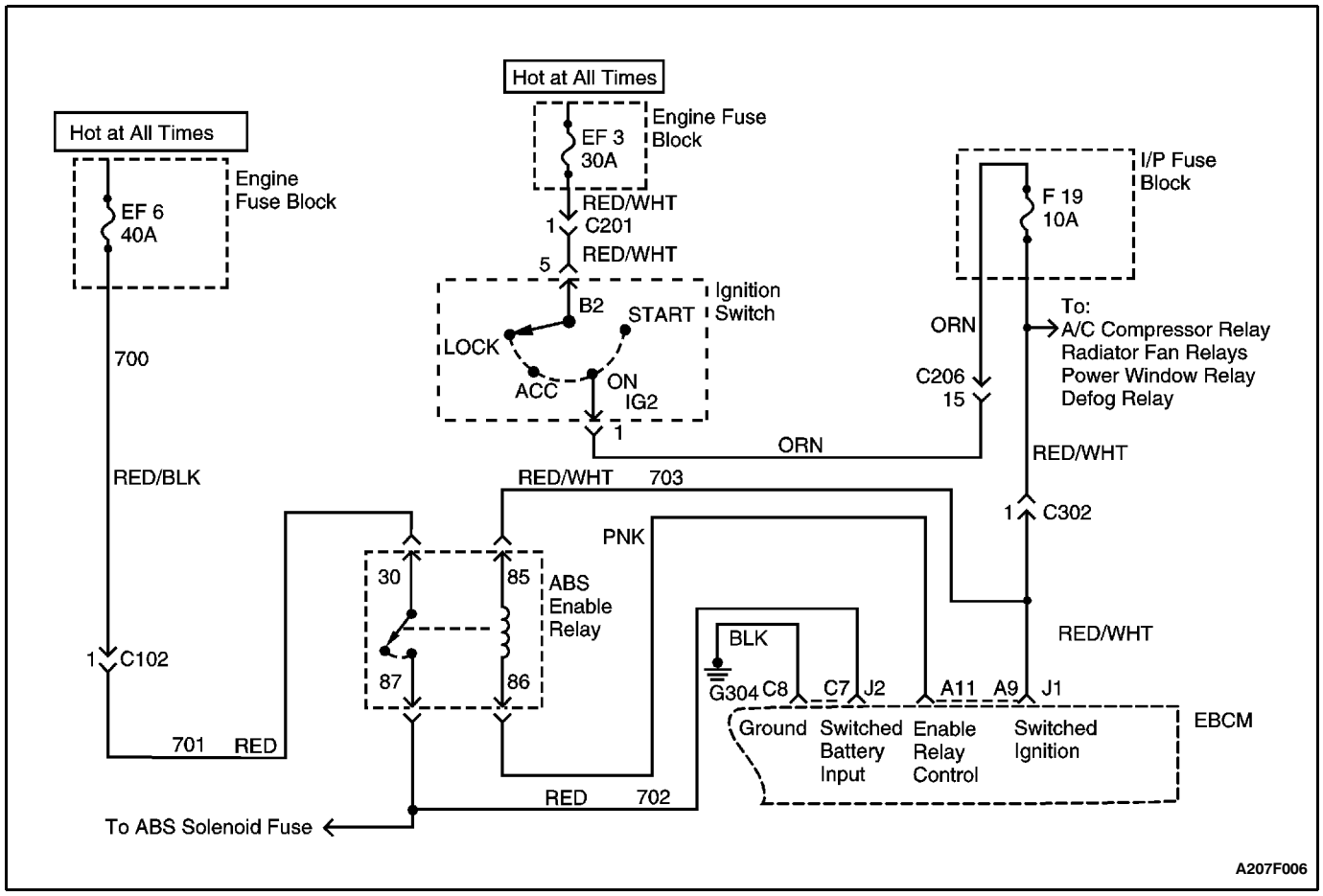
The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A017 - ABS Enable Relay Coil Circuit Shorted to Ground

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Use the relay test function of the scan tool scanner to command the ABS enable relay OFF. Does the scan tool indicate that the ABS enable relay is OFF and the battery voltage is less than the specified value?	5 v	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a digital voltmeter (DVM) between B+ and terminal A11 of the EBCM harness connector J1. Is the voltage less than the specified value?	2 v	Go to Step 4	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Unplug the ABS enable relay. 3. Connect a DVM between B+ and terminal 6 of the ABS enable relay harness connector. Is the voltage less than the specified value?	2 v	Go to Step 6	Go to Step 7
4	1. Turn the ignition switch to LOCK. 2. Inspect the EBCM connector J1 terminal A11 for a poor contact. 3. Reconnect all of the connectors. 4. Turn the ignition switch to ON. Does DTC reset?	-	Go to Step 5	Go to "Diagnostic Aids"
5	Replace the EBCM. Is the repair complete?	-	System OK	-
6	Replace the ABS enable relay. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit PNK. Is the repair complete?	-	System OK	-

This chart assumes that a current DTC is stored indicating that this malfunction is present.



DIAGNOSTIC TROUBLE CODE (DTC) A018
ABS ENABLE RELAY COIL CIRCUIT SHORTED TO BATTERY

Circuit Description

Ignition voltage is supplied through terminal 6 of the ABS enable relay socket. The EBCM then is able to energize the pull-in coil by completing the ground circuit at pin A11 of the EBCM. The magnetic field created closes the ABS enable relay contacts and supplies battery voltage and current to the EBCM, which supplies power to the motors.

Diagnosis

This test checks for a short to battery in the relay coil circuit. Such a short would cause the relay to remain off all the time. The relay coil is considered shorted to battery when the coil circuit voltage at the controller is greater than 3.4 volts.

Cause(s)

- The relay coil circuit is shorted to battery.
- The enable relay coil has low/no resistance.
- The EBCM driver circuit is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The brake warning lamp is turned on only if the rear piston is not at the top of the bore. This could cause degradation of the base brakes.

Test Description

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

1. This step indicates if the EBCM is capable of controlling the ABS enable relay as commanded.
2. With the ABS enable relay removed, voltage should not be available at terminal 4 of the relay socket. Any voltage at this point would indicate that circuit PNK was shorted to a voltage source.
3. This step checks for a shorted coil.
4. This ensures that a malfunction was not due to a poor connection.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

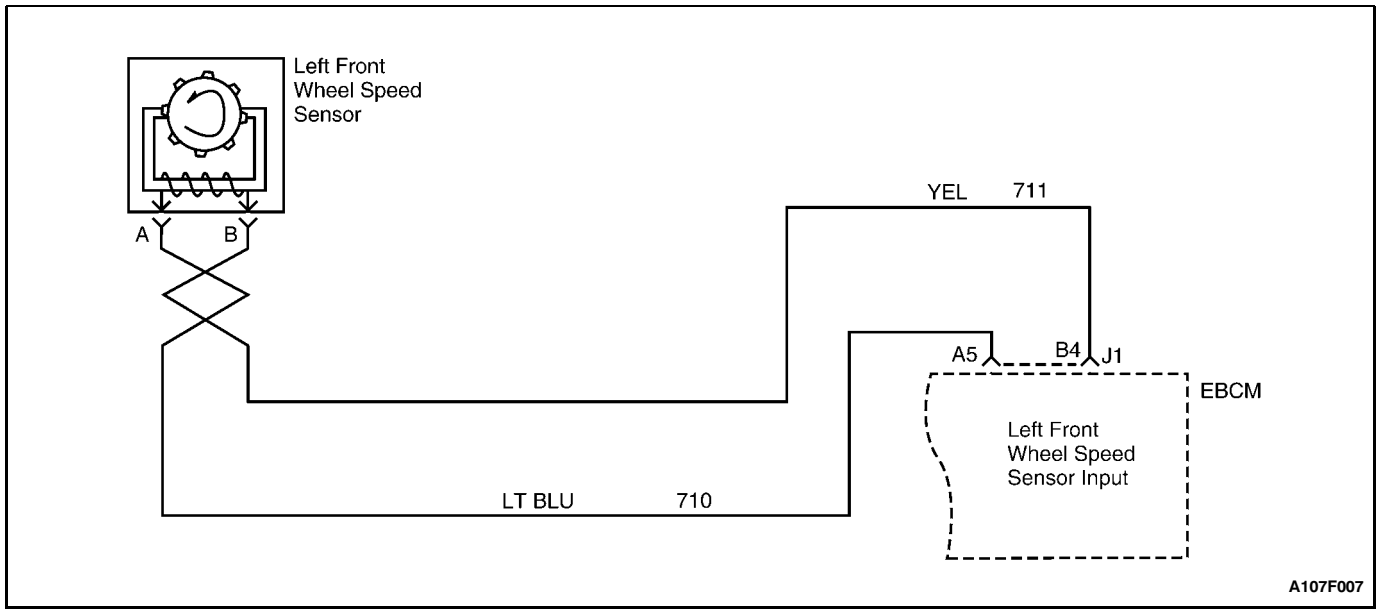
The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A018 - ABS Enable Relay Coil Circuit Shorted to Battery

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Use the relay test function of the scan tool scanner to command the ABS enable relay ON. Does the scan tool indicate that the ABS enable relay is ON and the battery voltage is greater than the specified value?	10 v	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Unplug the ABS enable relay. 3. Disconnect the EBCM connector J1. 4. Connect a digital voltmeter (DVM) between terminal 4 of the ABS enable relay harness connector and ground. 5. Turn the ignition switch to ON. Is the voltage less than the specified value?	2 v	Go to Step 3	Go to Step 6
3	1. Turn the ignition switch to LOCK. 2. Use a DVM to measure the resistance between ABS enable relay terminals 85 and 86. Is the resistance above the specified value?	40 W	Go to Step 4	Go to Step 7
4	1. Inspect terminal A11 of the EBCM connector J1 for a poor contact to the EBCM. 2. Reconnect all of the connectors. 3. Turn the ignition switch to ON. Does the DTC reset?	-	Go to Step 5	Go to "Diagnostic Aids"
5	Replace the EBCM. Is the repair complete?	-	System OK	-
6	Repair the short to voltage on circuit PNK. Is the repair complete?	-	System OK	-
7	Replace the ABS enable relay. Is the repair complete?	-	System OK	-

This chart assumes that a current DTC is stored indicating that this malfunction is present.



DIAGNOSTIC TROUBLE CODE (DTC) A021
LEFT FRONT WHEEL SPEED = 0

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring (often referred to as the air gap).

Diagnosis

This test checks for the left front wheel speed equal to 0 km/h (0 mph) for greater than 1.6 seconds while the other three wheel speeds are greater than 8 km/h (5 mph) and within 11 km/h (7 mph). This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- The sensor is physically damaged.
- The wheel speed input wires are shorted together.
- A sensor harness lead is shorted to voltage.
- A sensor harness lead is shorted to ground.
- There is an open or high resistance in a sensor harness lead.
- The speed ring is missing.
- The air gap exceeds the required specifications.
- The connector is damaged.
- The EBCM is faulty.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position. Two separate wheel speed = 0 codes are set if the following conditions are met:

- Two wheel speeds are 0 mph for greater than 20 seconds.
- The remaining wheel speeds are greater than 10 mph and within 7 mph.

Test Description

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

1. This test verifies whether the malfunction is currently present.
2. This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.
3. This test checks the wheel speed sensor for the proper resistance values.
6. This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.
7. This step ensures the wheel speed sensor is not shorted to ground.
8. This step checks for proper voltages at the speed sensor harness connector.
9. This test ensures that the wheel speed sensor circuitry is not internally shorted.
21. This checks for an open in circuit YEL.
23. This checks both wheel speed signal circuits for a short to ground.
25. This step ensures that DTC A021 was not set due to a poor connection between the EBCM and the EBCM harness connector J1.
31. This checks for an open in circuit LT BLU.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]). Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and the jumper harness as necessary.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A021 - Left Front Wheel Speed =0

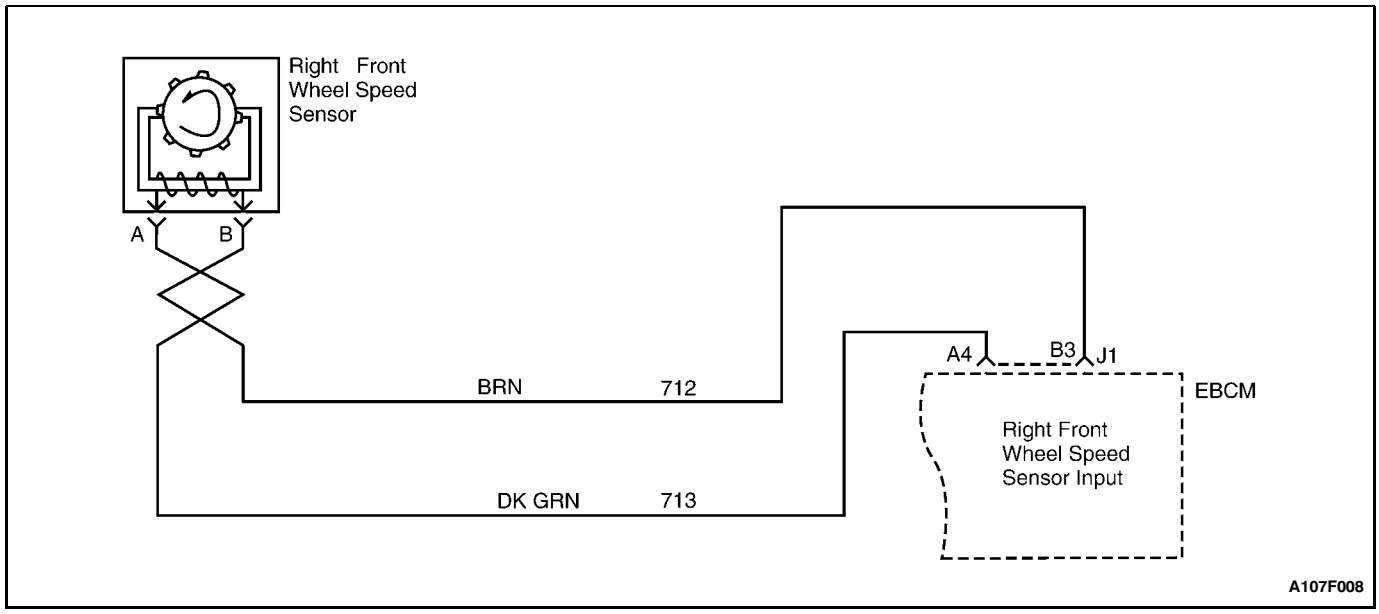
Step	Action	Value(s)	Yes	No
1	1. Test drive the vehicle. 2. Select "Data List" on the scan tool. 3. Monitor the wheel speed on the left front wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variation within the value specified?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor • Speed ring • Wiring • Connectors Pay particular attention to the speed ring. Any significant damage (other than nicks from stones, etc.) will affect the wheel speed input signal. Is any physical damage indicated?	-	Go to Step 5	Go to Step 3
3	1. Unplug the connector from left front wheel speed sensor. 2. Use a digital voltmeter (DVM) to measure the resistance between terminals A and B of the sensor. Is the resistance within the specified value when the sensor is approximately 20°C (68°F)?	969-1185 Ω	Go to Step 6	Go to Step 4
4	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
5	Correct any physical damage. Is the repair complete?	-	System OK	-

DTC A021 - Left Front Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Select the A/C voltage scale on the DVM. 2. Monitor the voltage while spinning the wheel by hand. Voltage will increase as the wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 7	Go to Step 4
7	Use the DVM to measure resistance between sensor terminal A and ground. Does the DVM display the specified value?	R	Go to Step 8	Go to Step 4
8	1. Turn the ignition switch to ON. 2. Connect the DVM to ground and measure the voltage at terminal A, then terminal B of the left front sensor harness connector. Is the voltage within the specified value at each terminal?	2.25-2.75 v	Go to Step 9	Go to Step 15
9	1. Turn the ignition switch to LOCK. 2. Unplug the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals B4 and A5 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 10	Go to Step 13
10	1. Inspect the EBCM connector J1 for poor connection. Is a poor connection found?	-	Go to Step 11	Go to Step 12
11	Repair the connector. Is the repair complete?	-	System OK	-
12	Replace the EBCM. Is the repair complete?	-	System OK	-
13	Check for an internal short between circuits YEL and LT BLU. Is there a short?	-	Go to Step 14	Go to Step 15
14	Repair the short between circuits YEL and LT BLU. Is the repair complete?	-	System OK	-
15	Replace the LF jumper harness. Is the repair complete?	-	System OK	-
16	Check the voltage at terminal B. Is the voltage outside of the value specified?	2.25-2.75 v	Go to Step 17	Go to Step 27
17	Check the voltage at terminal B. Is the voltage above the specified value?	2.75 v	Go to Step 18	Go to Step 21
18	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal B4 of EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 19	Go to Step 20
19	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
20	Repair the short to voltage in circuit YEL. Is the repair complete?	-	System OK	-

DTC A021 - Left Front Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
21	1. Turn the ignition switch to LOCK. 2. Disconnect EBCM connector J1. 3. Use a DVM to measure the resistance between terminal B on the left front wheel speed sensor harness connector and terminal B4 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 23	Go to Step 22
22	Repair the open or high resistance in circuit YEL. Is the repair complete?	-	System OK	-
23	Use a DVM to measure the resistance between ground and terminal B4, then terminal A5 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 25	Go to Step 24
24	Repair the short to ground in circuit LT BLU or YEL. Is the repair complete?	-	System OK	-
25	Inspect the EBCM connector J1 for a poor connection. Reconnect all of the connections and repeat the test of Step 1. Is the result normal, with no DTCs, and the wheel speed variation within the specified value?	8 km/h (5 mph)	System OK	Go to Step 26
26	Replace the EBCM. Is the repair complete?	-	System OK	-
27	Check the voltage at terminal A. Is the voltage above the specified value?	2.75 v	Go to Step 28	Go to Step 31
28	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal A5 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 29	Go to Step 30
29	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
30	Repair the short to voltage in circuit LT BLU. Is the repair complete?	-	System OK	-
31	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminal A, the wheel speed sensor harness connector, and terminal A5 of the EBCM harness connector J1. Does the DVM display less than the specified value?	2 W	Go to Step 23	Go to Step 32
32	Repair the open or high resistance in circuit LT BLU. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A022
RIGHT FRONT WHEEL SPEED = 0

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring (often referred to as the air gap).

Diagnosis

This test checks for the right front wheel speed equal to 0 km/h (0 mph) for greater than 1.6 seconds while the other three wheel speeds are greater than 8 km/h (5 mph) and within 11 km/h (7 mph). This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- The sensor is physically damaged.
- The wheel speed input wires are shorted together.
- A sensor harness lead is shorted to voltage.
- A sensor harness lead is shorted to ground.
- There is an open or high resistance in a sensor harness lead. The speed ring is missing.
- The air gap exceeds the required specifications.
- The connector is damaged.
- The EBCM is faulty.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position. Two separate wheel speed = 0 codes are set if the following conditions are met:

- Two wheel speeds are 0 mph for greater than 20 seconds.
- The remaining wheel speeds are greater than 10 mph and within 7 mph.

Test Description

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

1. This test verifies whether the malfunction is currently present.
2. This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.
3. This test checks the wheel speed sensor for the proper resistance values.
6. This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.
7. This step ensures the wheel speed sensor is not shorted to ground.
8. This step checks for proper voltages at the speed sensor harness connector.
9. This test ensures that the wheel speed sensor circuitry is not internally shorted.
21. This checks for an open in circuit BRN.
23. This checks for a short to ground in both wheel speed signal circuits.
25. This step ensures that DTC A022 was not set due to a poor connection between the EBCM and the EBCM harness connector J1.
31. This checks for an open in circuit DK GRN.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]). Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and the jumper harness as necessary.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A022 - Right Front Wheel Speed =0

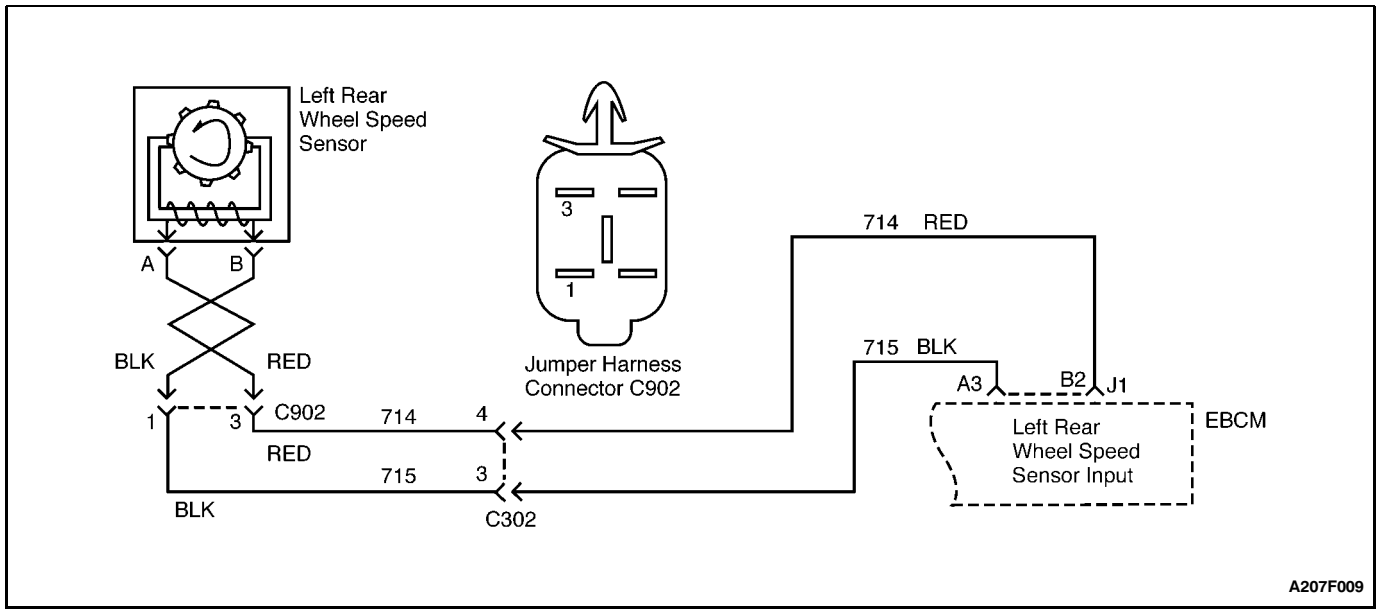
Step	Action	Value(s)	Yes	No
1	1. Test drive the vehicle. 2. Select "Data List" on the scan tool. 3. Monitor the wheel speed on the right front wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variation within the specified value?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor • Speed ring • Wiring • Connectors Pay particular attention to the speed ring. Any significant damage (other than nicks from stones, etc.) will affect the wheel speed input signal. Is any physical damage indicated?	-	Go to Step 5	Go to Step 3
3	1. Unplug the connector from the right front wheel speed sensor. 2. Use a digital voltmeter (DVM) to measure the resistance between terminals A and B of the sensor. Is the resistance within the specified value while the sensor is at a temperature of approximately 20°C (68°F)?	969-1185 W	Go to Step 6	Go to Step 4
4	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
5	Correct the physical damage. Is the repair complete?	-	System OK	-

DTC A022 - Right Front Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Select the A/C voltage scale on the DVM. 2. Monitor voltage while spinning the wheel by hand. Voltage will increase as the wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 7	Go to Step 4
7	Use the DVM to measure the resistance between sensor terminal A and ground. Does the DVM display the specified value?	R	Go to Step 8	Go to Step 4
8	1. Turn the ignition switch to ON. 2. Connect the DVM to ground and measure the voltage at terminal A, then terminal B of the right front sensor harness connector. Is the voltage within the specified value at each terminal?	2.25-2.75 v	Go to Step 9	Go to Step 16
9	1. Turn the ignition switch to LOCK. 2. Unplug the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals A4 and B3 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 10	Go to Step 13
10	1. Inspect the EBCM connector J1 for a poor connection. Is a poor connection found?	-	Go to Step 11	Go to Step 12
11	Repair the connection. Is the repair complete?	-	System OK	-
12	Replace the EBCM. Is the repair complete?	-	System OK	-
13	Check for an internal short between circuits BRN and DK GRN. Is there a short?	-	Go to Step 14	Go to Step 15
14	Repair the short between circuits BRN and DK GRN. Is the repair complete?	-	System OK	-
15	Replace the RF jumper harness. Is the repair complete?	-	System OK	-
16	Check the voltage at terminal B. Is the voltage outside of the specified value?	2.25-2.75 v	Go to Step 17	Go to Step 27
17	Check the voltage at terminal B. Is the voltage above the specified value?	2.75 v	Go to Step 18	Go to Step 21
18	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal B3 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 19	Go to Step 20
19	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK.	-
20	Repair the short to voltage in circuit BRN. Is the repair complete?	-	System OK	-

DTC A022 - Right Front Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
21	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal B on the right front wheel speed sensor harness connector and terminal B3 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 23	Go to Step 24
22	Repair the open or high resistance in circuit BRN. Is the repair complete?	-	System OK	-
23	Use a DVM to measure the resistance between ground and terminal A4, then terminal B3 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 25	Go to Step 24
24	Repair the short to ground in circuits DK GRN and BRN. Is the repair complete?	-	System OK	-
25	1. Inspect the EBCM connector J1 for a poor connection. 2. Reconnect all of the connections and repeat the test from Step 1. Is the result normal, with no DTCs, and the wheel speed variation within the value specified?	8 km/h (5 mph)	System OK	Go to Step 26
26	Replace the EBCM. Is the repair complete?	-	System OK	-
27	Check the voltage at terminal A. Is the voltage on terminal A above the minimum value specified?	2.75 v	Go to Step 28	Go to Step 31
28	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal A4 of the EBCM harness connector J1. Is the voltage below the maximum value specified?	1 v	Go to Step 29	Go to Step 30
29	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
30	Repair the short to voltage in circuit DK GRN. Is the repair complete?	-	System OK	-
31	1. Turn the ignition switch to LOCK. 2. Unplug EBCM connector J1. 3. Use the DVM to measure resistance between terminal A the wheel speed sensor harness connector and terminal A4 of EBCM harness connector J1. Does the DVM display the specified value?	t 2 W	Go to Step 23	Go to Step 32
32	Repair the open or high resistance in circuit DK GRN. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A023
LEFT REAR WHEEL SPEED = 0

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring (often referred to as the air gap).

Diagnosis

This test checks for the left rear wheel speed equal to 0 km/h (0 mph) for greater than 1.6 seconds while the other three wheel speeds are greater than 8 km/h (5 mph) and within 11 km/h (7 mph). This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- The sensor is physically damaged.
- The wheel speed input wires are shorted together.
- The speed ring is missing.
- A sensor harness lead is shorted to voltage.
- A sensor harness lead is shorted to ground.
- There is an open or high resistance in a sensor harness lead.
- The air gap exceeds the required specifications.
- The connector is damaged.
- The EBCM is faulty.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position. Two separate wheel speed = 0 codes are set if the following conditions are met:

- Two wheel speeds are 0 mph for greater than 20 seconds.
- The remaining wheel speeds are greater than 10 mph and within 7 mph.

Test Description

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

1. This test verifies whether the malfunction is currently present.
2. This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.
3. This test checks the wheel speed sensor for the proper resistance values.
8. This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.
9. This step ensures the wheel speed sensor is not shorted to ground.
10. This step checks for proper voltages at the speed sensor harness connector.
11. This test ensures that the wheel speed sensor circuitry is not internally shorted.
23. This checks for an open in circuit BLK.
25. This checks for a short to ground in both wheel speed signal circuits.
27. This step ensures that DTC A023 was not set due to a poor connection between the EBCM and the EBCM harness connector J1.
34. This checks for an open in circuit RED.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]). Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and jumper harness as necessary.

It is difficult to measure the resistance and the voltage at the terminals of the wheel speed sensor due to sensor mounting location and position. Terminals at the other end of the jumper harness are much more accessible. The rear wheel speed sensor jumper harnesses are connected to the system through connector C902, which is clipped to the vehicle near the right rear wheel. It connects to the floor harness, which passes through a grommet near that point. The clamp securing it to the vehicle is removed easily by pinching the tabs together and pushing up on the clamp. It is easier to handle the connector and take measurements if you free the connector from the axle first. Refer to "Rear Wheel Speed Sensor Jumper Harness" for illustrations.

After you unplug the jumper harness from the floor harness at C902, stand toward the rear of the car. Rotate the connector so you are looking at the open end, and you will see it as it appears in the sketch at the top of this procedure. It will then be easy to make the necessary measurements.

The jumper harnesses for both rear wheels are bound together at this connector and are replaced as a single assembly, not as separate right or left jumper harnesses.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A023 - Left Rear Wheel Speed =0

Step	Action	Value(s)	Yes	No
1	1. Test drive the vehicle. 2. Select "Data List" on the scan tool. 3. Monitor the wheel speed on the left rear wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variation within the specified value?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor jumper harness • Jumper harness connectors • Connector at the left wheel speed sensor Is any physical damage indicated?	-	Go to Step 7	Go to Step 3

DTC A023 - Left Rear Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Disconnect the rear jumper harness assembly from the floor harness at connector C902. See "Diagnostic Aids" for details on this connector. 2. Use a digital voltmeter (DVM) to measure the resistance between terminals 1 and 3 on the connector C902. Is the resistance within the specified value while the sensor is at a temperature of approximately 20°C (68°F)?	969-1185 W	Go to Step 8	Go to Step 4
4	Check the connection at the speed sensor. Is the connection in good condition?	-	Go to Step 6	Go to Step 5
5	Repair the speed sensor connection. Is the repair complete?	-	System OK	-
6	Replace the rear wheel hub assembly. Is the repair complete?	-	System OK	-
7	Correct any physical damage. Is the repair complete?	-	System OK	-
8	1. Select the A/C voltage scale on the DVM. 2. Monitor the voltage from the left wheel speed sensor while spinning the wheel by hand. Voltage will increase as the wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 9	Go to Step 6
9	Use the DVM to measure the resistance between terminal 1 of connector C902 and ground. Does the DVM display the specified value?	R	Go to Step 10	Go to Step 6
10	1. Reconnect connector C902. 2. Unplug the jumper harness connector from the left rear wheel speed sensor. 3. Turn the ignition switch to ON . 4. Connect the DVM to ground and measure the voltage at terminal B, then terminal A of the left rear speed sensor harness connector. Is the voltage within the specified value at each terminal?	2.25-2.75 v	Go to Step 11	Go to Step 18
11	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals B2 and A3 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 12	Go to Step 15
12	Inspect the EBCM connector J1 for a poor connection. Is a poor connection found?	-	Go to Step 13	Go to Step 14
13	Repair the connection. Is the repair complete?	-	System OK	-
14	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A023 - Left Rear Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
15	Check for an internal short between circuits BLK and RED. Is there a short?	-	Go to Step 16	Go to Step 17
16	Repair the short between circuits BLK and RED. Is the repair complete?	-	System OK	-
17	Replace the rear jumper harness. Is the repair complete?	-	System OK	-
18	Check the voltage at terminal A of the rear speed sensor harness connector. Is the voltage outside of the specified value?	2.25-2.75 v	Go to Step 19	Go to Step 31
19	Check the voltage at terminal A of the rear speed sensor harness connector. Is voltage above the specified value?	2.75 v	Go to Step 20	Go to Step 23
20	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal A3 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 20	Go to Step 21
21	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
22	Repair the short to voltage in circuit BLK. Is the repair complete?	-	System OK	-
23	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal A on the left rear wheel speed sensor harness connector and terminal A3 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 25	Go to Step 24
24	Check the jumper harness connector terminal B for a poor connection. Is the connection in good condition?	-	Go to Step 29	Go to Step 30
25	Use a DVM to measure resistance between ground and terminal B2, then terminal A3 of the EBCM harness connector J1. Does the resistance meet the specified value?	R	Go to Step 27	Go to Step 26
26	Repair the short to ground in circuits BLK and RED. Is the repair complete?	-	System OK	-
27	1. Inspect the EBCM connector J1 for a poor connection. 2. Reconnect all of the connections and repeat the test from Step 1. Is the result normal, with no DTCs, and the wheel speed variation within the specified value ?	8 km/h (5 mph)	System OK	Go to Step 28
28	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
29	Repair the open or high resistance in circuit BLK. Is the repair complete?	-	System OK	-

DTC A023 - Left Rear Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
30	Repair the poor connection in the jumper harness connector terminal B. Is the repair complete?	-	System OK	-
31	Check the voltage at terminal A. Is the voltage greater than the specified minimum value?	2.75 v	Go to Step 32	Go to Step 34
32	1. Turn ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal B2 of the EBCM harness connector J1. Is the voltage less than the specified value?	1 v	Go to Step 28	Go to Step 33
33	Repair the short to voltage in circuit RED. Is the repair complete?	-	System OK	-
34	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal B, the wheel speed sensor harness connector, and terminal B2 of the EBCM harness connector J1. Does the DVM display the specified value?	t 2 W	Go to Step 25	Go to Step 35
35	Check the jumper harness connector terminal A for a poor connection. Is the connection in good condition?	-	Go to Step 36	Go to Step 37
36	Repair the open or high resistance in circuit RED. Is the repair complete?	-	System OK	-
37	Repair the poor connection in the jumper harness connector terminal A. Is the repair complete?	-	System OK	-

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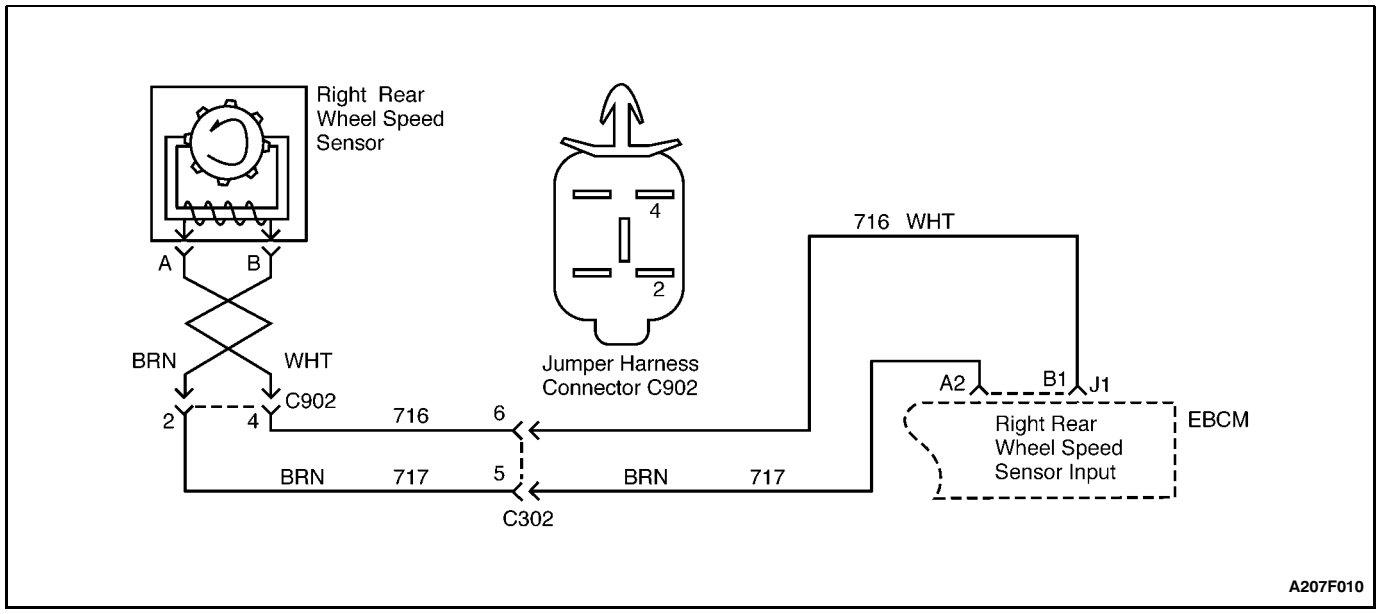

DIAGNOSTIC TROUBLE CODE (DTC) A024
RIGHT REAR WHEEL SPEED = 0

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring (often referred to as the air gap).

Diagnosis

This test checks for the right rear wheel speed equal to 0 km/h (0 mph) for greater than 1.6 seconds while the other three wheel speeds are greater than 8 km/h (5 mph) and within 11 km/h (7 mph). This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- The sensor is physically damaged.
- The wheel speed input wires are shorted together.
- A sensor harness lead is shorted to voltage.
- A sensor harness lead is shorted to ground.
- There is an open or high resistance in a sensor harness lead.
- The speed ring is missing.
- The air gap exceeds the required specifications.
- The connector is damaged.
- The EBCM is faulty.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position. Two separate wheel speed = 0 codes are set if the following conditions are met:

- Two wheel speeds are 0 mph for greater than 20 seconds.
- The remaining wheel speeds are greater than 10 mph and within 7 mph.

Test Description

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

1. This test verifies whether the malfunction is currently present.
2. This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.
3. This test checks the wheel speed sensor for the proper resistance values.
8. This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.
9. This step ensures the wheel speed sensor is not shorted to ground.
10. This step checks for proper voltages at the speed sensor harness connector.
11. This test ensures that the wheel speed sensor circuitry is not internally shorted.
24. This checks for an open in circuit WHT.
26. This checks for a short to ground in both wheel speed signal circuits.
28. This step ensures that DTC A024 was not set due to a poor connection between the EBCM and the EBCM harness connector J1.
35. This checks for an open in circuit BRN.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]). Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and jumper harness as necessary.

It is difficult to measure the resistance and the voltage at the terminals of the wheel speed sensor due to sensor mounting location and position. Terminals at the other end of the jumper harness are much more accessible. The rear wheel speed sensor jumper harnesses are connected to the system through connector C902, which is clipped to the vehicle near the right rear wheel. It connects to the floor harness, which passes through a grommet near that point.

It is easier to handle the connector and take measurements if you free the connector from the axle first. Remove the clamp securing it to the vehicle by pinching the tabs together and pushing up on the clamp.

After you unplug the jumper harness from the floor harness at C902, stand toward the rear of the car. Rotate the connector so you are looking at the open end, and you will see it as it appears in the sketch at the top of this procedure. It will then be easy to make the necessary measurements. Refer to "Rear Wheel Speed Sensor Jumper Harness" in this section for illustrations.

The jumper harnesses for both rear wheels are bound together at this connector and are replaced as a single assembly, not as separate right or left jumper harnesses.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A024 - Right Rear Wheel Speed =0

Step	Action	Value(s)	Yes	No
1	1. Test drive the vehicle. 2. Select "Data List" on the scan tool. 3. Monitor the wheel speed on the right rear wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variation within the specified value?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor jumper harness • Jumper harness connectors • Connector at right wheel speed sensor Is any physical damage indicated?	-	Go to Step 7	Go to Step 3

DTC A024 - Right Rear Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Disconnect the rear jumper harness assembly from the floor harness at connector C902. 2. Use a digital voltmeter (DVM) to measure the resistance between terminals 2 and 4 on connector C902. Is the resistance within the specified value while the sensor is at a temperature of approximately 20°C (68°F)?	969-1185 W	Go to Step 8	Go to Step 4
4	Check the connection at the speed sensor. Is the connection in good condition?	-	Go to Step 6	Go to Step 5
5	Repair the speed sensor connection. Is the repair complete?	-	System OK	-
6	Replace the rear wheel hub assembly. Is the repair complete?	-	System OK	-
7	Correct any physical damage. Is the repair complete?	-	System OK	-
8	1. Select the A/C voltage scale on the DVM. 2. Monitor the voltage while spinning the wheel by hand. Voltage will increase as the wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 9	Go to Step 6
9	Use the DVM to measure the resistance between terminal 4 of connector C902 and ground. Does the DVM display the specified value?	R	Go to Step 10	Go to Step 6
10	1. Reconnect connector C902. 2. Unplug the jumper harness connector from the right rear wheel speed sensor. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal B, then terminal A of the right rear speed sensor harness connector. Is the voltage within the specified value at each terminal?	2.25-2.75 v	Go to Step 11	Go to Step 18
11	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals B1 and A2 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 12	Go to Step 15
12	Inspect the EBCM connector J1 for a poor connection. Is a poor connection found?	-	Go to Step 13	Go to Step 14
13	1. Repair the connection. 2. Reconnect all of the connections. Is the repair complete?	-	Go to Step 1	-
14	Replace the EBCM. Is the repair complete?	-	System OK	-
15	Check for an internal short between circuits WHT and BRN. Is there a short?	-	Go to Step 16	Go to Step 17

DTC A024 - Right Rear Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
16	Repair the short between circuits WHT and BRN. Is the repair complete?	-	System OK	-
17	Replace the rear jumper harness. Is the repair complete?	-	System OK	-
18	Check the voltage at terminal A of the right rear speed sensor harness connector. Is voltage outside of the specified value ?	2.25-2.75 v	Go to Step 19	Go to Step 31
19	Check the voltage at terminal A of the right rear speed sensor harness connector. Is voltage above the specified value?	2.75 v	Go to Step 20	Go to Step 23
20	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal A2 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 21	Go to Step 22
21	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
22	Repair short to voltage in circuit WHT. Is the repair complete?	-	System OK	-
23	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal A on the right rear wheel speed sensor harness connector and terminal A2 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 25	Go to Step 24
24	Check the jumper harness connector terminal B for poor connection. Is the connection in good condition?	-	Go to Step 29	Go to Step 30
25	Use a DVM to measure the resistance between ground and terminal B1, then terminal A2 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 27	Go to Step 26
26	Repair the short to ground in circuits WHT and BRN. Is the repair complete?	-	System OK	-
27	1. Inspect the EBCM connector J1 for a poor connection. 2. Reconnect all of the connections and repeat the test from Step 1. Is the result normal, with no DTCs, and the wheel speed variation within the value specified?	8 km/h (5 mph)	System OK	Go to Step 28
28	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
29	Repair the open or high resistance in circuit WHT. Is the repair complete?	-	System OK	-

DTC A024 - Right Rear Wheel Speed =0 (Cont'd)

Step	Action	Value(s)	Yes	No
30	Repair the poor connection in jumper harness connector terminal B. Is the repair complete?	-	System OK	-
31	Check the voltage at terminal B. Is the voltage at terminal B greater than the specified value?	2.75 v	Go to Step 32	Go to Step 34
32	1. Turn ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal B1 of the EBCM harness connector J1. Is the voltage less than the specified value?	1 v	Go to Step 28	Go to Step 33
33	Repair the short to voltage in circuit BRN. Is the repair complete?	-	System OK	-
34	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminal B, the wheel speed sensor harness connector, and terminal B1 of the EBCM harness connector J1. Does the DVM display a resistance less than the specified value?	2 W	Go to Step 25	Go to Step 35
35	Check the jumper harness connector terminal A for a poor connection. Is the connection in good condition?	-	Go to Step 36	Go to Step 37
36	Repair the open or high resistance in circuit BRN. Is the repair complete?	-	System OK	-
37	Repair the poor connection in the jumper harness connector terminal A. Is the repair complete?	-	System OK	-

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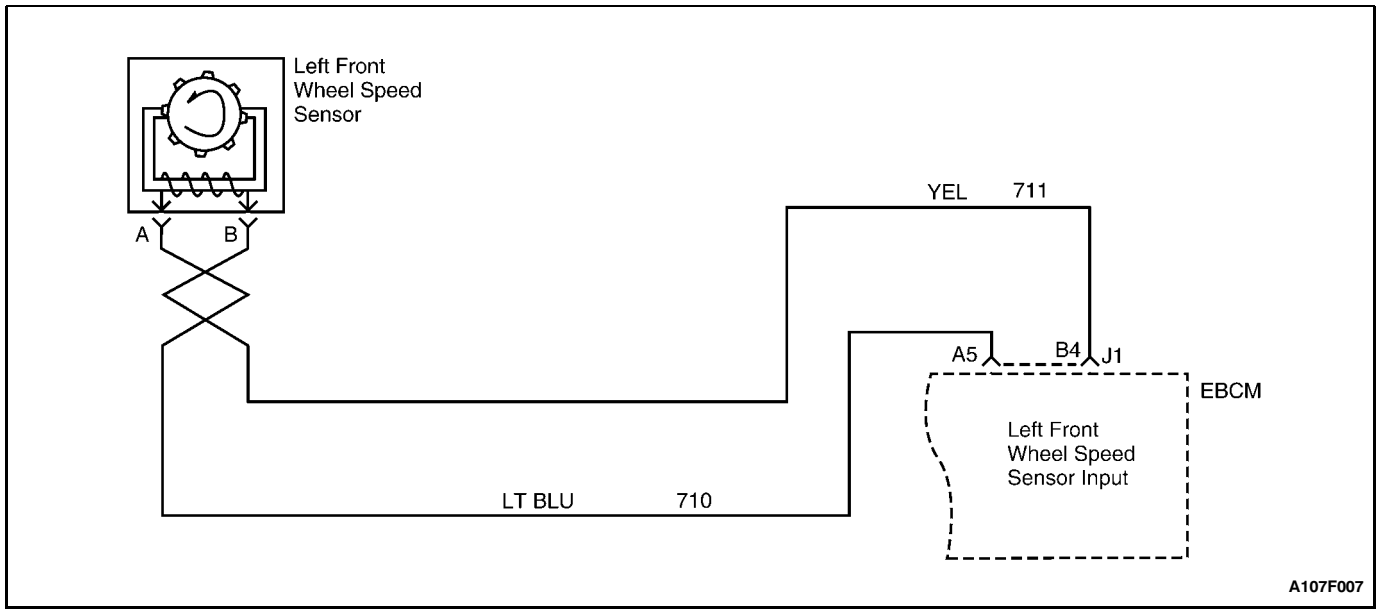


DIAGNOSTIC TROUBLE CODE (DTC) A025
LEFT FRONT EXCESSIVE WHEEL SPEED VARIATION

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring (often referred to as the air gap).

Diagnosis

This test detects a situation in which the left front wheel speed changes more than 19 km/h (12 mph) in 8 milliseconds. This change must occur five times with less than 0.2 second between occurrences. This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- A sensor is loose.
- There are worn suspension/drivetrain components.
- There is an intermittent short in the wheel speed input wires.
- The sensor is physically damaged.
- The wheel speed ring is damaged.
- A connector is damaged.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled, and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

1. This test verifies whether the malfunction is currently present.
2. This test checks to see if excessive wheel bearing end play caused the DTC.
4. This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.
5. This test checks the wheel speed sensor for the proper resistance values.
8. This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.
9. This step ensures the wheel speed sensor is not shorted to ground.
10. This step checks for proper voltages at the speed sensor harness connector.
11. This test ensures that the wheel speed sensor circuitry is not internally shorted.
23. This checks for an open in circuit YEL.
25. This checks for a short to ground in both wheel speed signal circuits.
27. This step ensures that DTC A025 was not set due to a poor connection between the EBCM and the EBCM harness connector J1.
33. This checks for an open in circuit LT BLU.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]). Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and jumper harness as necessary.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A025 - Left Front Excessive Wheel Speed Variation

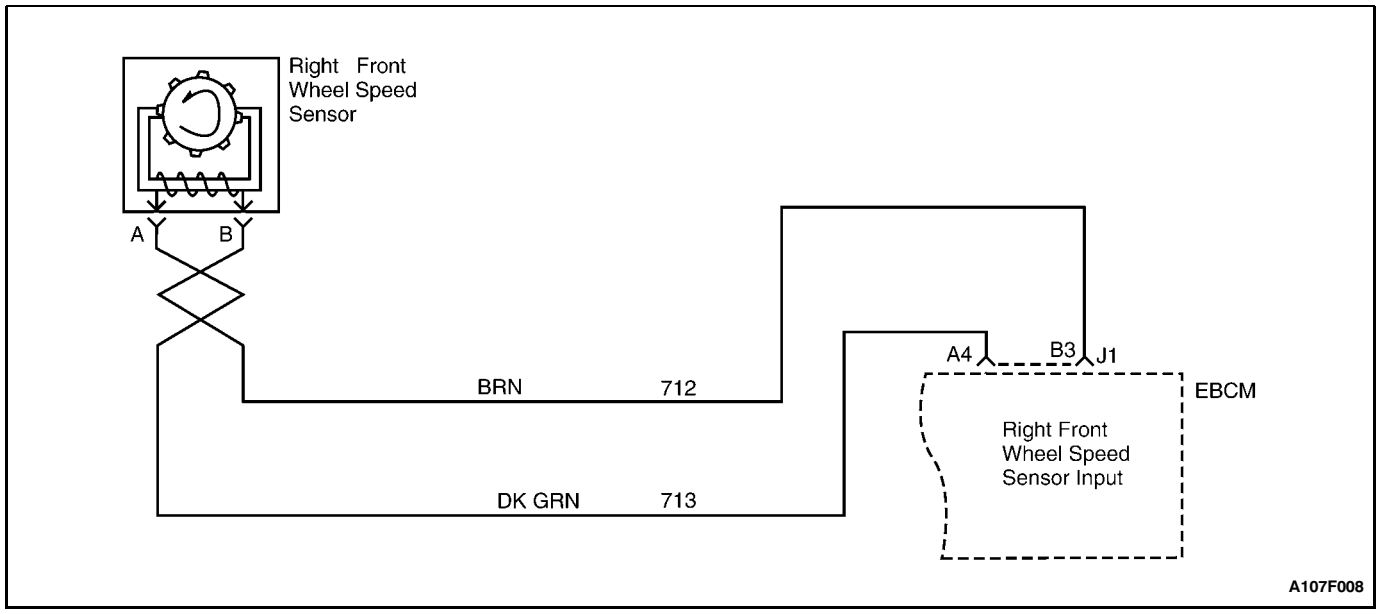
Step	Action	Value(s)	Yes	No
1	1. Test drive vehicle. 2. Select "Data List" on the scan tool. 3. Monitor the wheel speed on the left front wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variation within the specified value?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	Remove the left front tire and measure the bearing end play. Does the end play exceed the specified value?	0.5 mm (0.02 in.)	Go to Step 3	Go to Step 4
3	Replace the front wheel bearing assembly. Is the repair complete?	-	System OK	-
4	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor • Speed Ring • Wiring • Connectors Pay particular attention to the speed ring. Any significant damage (other than nicks from stones, etc.) will affect the wheel speed input signal. Is any physical damage indicated?	-	Go to Step 7	Go to Step 5
5	1. Disconnect the connector from the left front wheel speed sensor. 2. Use a digital voltmeter (DVM) to measure the resistance between terminals A and B of the sensor. Is resistance within specified value when the sensor is approximately 20°C (68°F)?	969-1185 Ω	Go to Step 8	Go to Step 6

DTC A025 - Left Front Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
6	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
7	1. Correct any physical damage. 2. Clear the DTCs. Is the repair complete?	-	Go to Step 1	-
8	1. Select the A/C voltage scale on the DVM. 2. Monitor the voltage while spinning the wheel by hand. Voltage will increase as wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 9	Go to Step 6
9	Use the DVM to measure the resistance between sensor terminal A and ground. Does the DVM display the specified value?	R	Go to Step 10	Go to Step 6
10	1. Turn the ignition switch to ON. 2. Connect the DVM to ground and measure the voltage at terminal A, then terminal B of the left front sensor harness connector. Is the voltage within the specified value at each terminal?	2.25-2.75 v	Go to Step 11	Go to Step 18
11	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals B4 and A5 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 12	Go to Step 15
12	Inspect the EBCM connector J1 for poor connection. Is a poor connection found?	-	Go to Step 13	Go to Step 14
13	Repair the connection. Is the repair complete?	-	System OK	-
14	Replace the EBCM. Is the repair complete?	-	System OK	-
15	Check for an internal short between circuits YEL and LT BLU. Is there a short?	-	Go to Step 16	Go to Step 17
16	Repair the short between circuits YEL and LT BLU. Is the repair complete?	-	System OK	-
17	Replace the left front jumper harness. Is the repair complete?	-	System OK	-
18	Check the voltage at terminal B. Is the voltage out of the specified value	2.25-2.75 v	Go to Step 19	Go to Step 29
19	Check the voltage at terminal B. Is the voltage above the specified value?	2.75 v	Go to Step 20	Go to Step 23
20	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal B4 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 21	Go to Step 22

DTC A025 - Left Front Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
22	Repair the short to voltage in circuit YEL. Is the repair complete?	-	System OK	-
23	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal B on the left front wheel speed sensor harness connector and terminal B4 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 25	Go to Step 24
24	Repair the open or high resistance in circuit YEL. Is the repair complete?	-	System OK	-
25	Use a DVM to measure the resistance between ground and terminal B4, then terminal A5 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 27	Go to Step 26
26	Repair the short to ground in circuits LT BLU and YEL. Is the repair complete?	-	System OK	-
27	1. Inspect the EBCM connector J1 for a poor connection. 2. Reconnect all of the connections and repeat the test from Step 1. Is the result normal, with no DTCs, and the wheel speed variation within the specified value?	8 km/h (5 mph)	System OK	Go to Step 28
28	Replace the EBCM. Is the repair complete?	-	System OK	-
29	Check the voltage at terminal A. Is the voltage at terminal A above the specified value?	2.75 v	Go to Step 30	Go to Step 33
30	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal A5 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 31	Go to Step 32
31	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
32	Repair the short to voltage in circuit LT BLU. Is the repair complete?	-	System OK	-
33	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminal A the wheel speed sensor harness connector and terminal A5 of the EBCM harness connector J1. Does the DVM display less than the specified value?	2 W	Go to Step 25	Go to Step 34
34	Repair the open or high resistance in circuit LT BLU. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A026
RIGHT FRONT EXCESSIVE WHEEL SPEED VARIATION

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring (often referred to as the air gap).

Diagnosis

This test detects a situation in which the right front wheel speed changes more than 19 km/h (12 mph) in 8 milliseconds. This change must occur five times with less than 0.2 second between occurrences. This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- **A sensor is loose.**
- **There are worn suspension/drivetrain components.**
- **There is an intermittent short in the wheel speed input wires.**
- **The sensor is physically damaged.**
- **The wheel speed ring is damaged.**
- **A connector is damaged.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

1. **This test verifies whether the malfunction is currently present.**
2. **This test checks to see if excessive wheel bearing end play caused the DTC.**
4. **This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.**
5. **This test checks the wheel speed sensor for the proper resistance values.**
8. **This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.**
9. **This step ensures the wheel speed sensor is not shorted to ground.**
10. **This step checks for proper voltages at the speed sensor harness connector.**
11. **This test ensures that the wheel speed sensor circuitry is not internally shorted.**
23. **This checks for an open in circuit BRN.**
25. **This checks for a short to ground in both wheel speed signal circuits.**
27. **This step ensures that DTC A026 was not set due to a poor connection between the EBCM and EBCM harness connector J1.**
33. **This checks for an open in circuit DK GRN.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]. Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and jumper harness as necessary.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A026 - Right Front Excessive Wheel Speed Variation

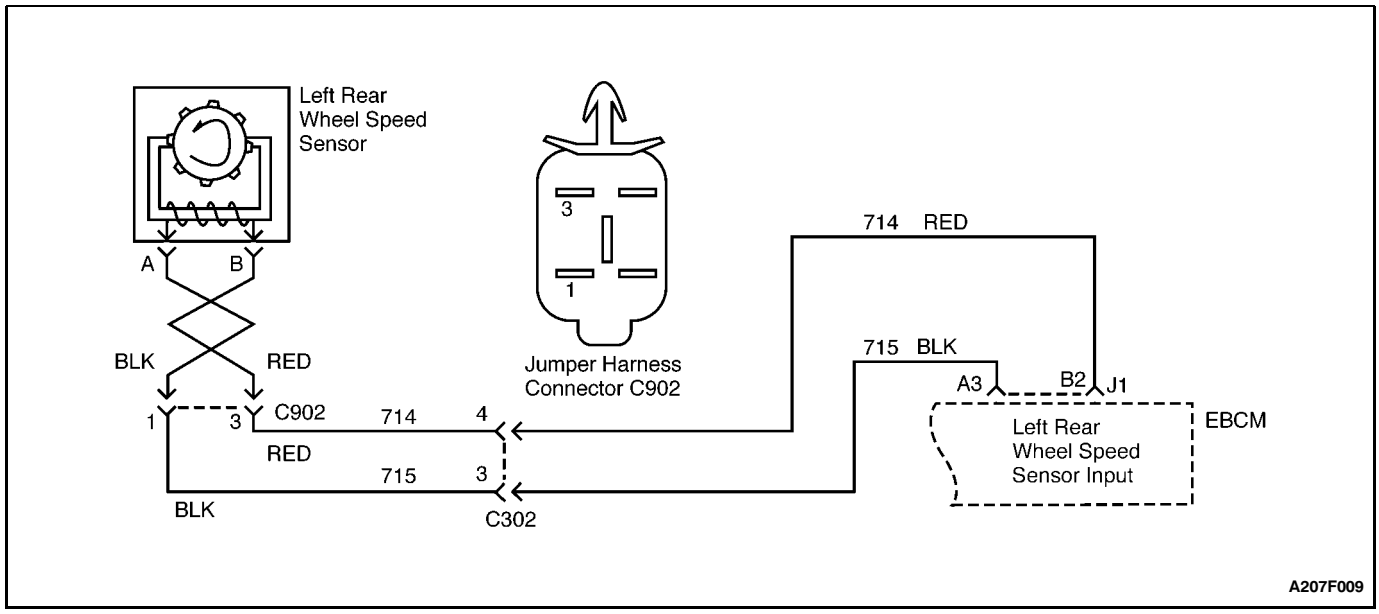
Step	Action	Value(s)	Yes	No
1	1. Test drive vehicle. 2. Select "Data List" on the scan tool. 3. Monitor wheel speed on the right front wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variation within the specified value?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	Remove the right front tire and measure the bearing end play. Does the end play exceed the specified value?	0.5 mm (0.02 in.)	Go to Step 3	Go to Step 4
3	Replace the front wheel bearing assembly. Is the repair complete?	-	System OK	-
4	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor • Speed Ring • Wiring • Connectors Pay particular attention to the speed ring. Any significant damage (other than nicks from stones, etc.) will affect the wheel speed input signal. Is any physical damage indicated?	-	Go to Step 7	Go to Step 5
5	1. Disconnect the connector from the right front wheel speed sensor. 2. Use a digital voltmeter (DVM) to measure the resistance between terminals A and B of the sensor. Is the resistance within the specified value when the sensor is approximately 20°C (68°F)?	969-1185 W	Go to Step 8	Go to Step 6

DTC A026 - Right Front Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
6	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
7	1. Correct any physical damage. 2. Clear the DTCs. Is the repair complete?	-	Go to Step 1	-
8	1. Select the A/C voltage scale on the DVM. 2. Monitor voltage while spinning wheel by hand. Voltage will increase as wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 9	Go to Step 6
9	Use the DVM to measure the resistance between sensor terminal A and ground. Does the DVM display the specified value?	R	Go to Step 10	Go to Step 6
10	1. Turn the ignition switch to ON. 2. Connect the DVM to ground and measure the voltage at terminal A, then terminal B of the right front sensor harness connector. Was voltage within the specified value at each terminal?	2.25-2.75v	Go to Step 11	Go to Step 18
11	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals A4 and B3 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 12	Go to Step 15
12	Inspect the EBCM connector J1 for a poor connection. Is a poor connection found?	-	Go to Step 13	Go to Step 14
13	Repair the connection. Is the repair complete?	-	System OK	-
14	Replace the EBCM. Is the repair complete?	-	System OK	-
15	Check for an internal short between circuits BRN and DK GRN. Is there a short?	-	Go to Step 16	Go to Step 17
16	Repair the short between circuits BRN and DK GRN. Is the repair complete?	-	System OK	-
17	Replace the RF jumper harness. Is the repair complete?	-	System OK	-
18	Check the voltage at terminal B. Is the voltage outside of the specified value?	2.25-2.75 v	Go to Step 19	Go to Step 29
19	Check the voltage at terminal B. Is the voltage above the specified value?	2.75 v	Go to Step 20	Go to Step 23
20	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal B3 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 21	Go to Step 22
21	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-

DTC A026 - Right Front Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
22	Repair the short to voltage in circuit BRN. Is the repair complete?	-	System OK	-
23	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal B on the right front wheel speed sensor harness connector and terminal B3 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 25	Go to Step 24
24	Repair the open or high resistance in circuit BRN. Is the repair complete?	-	System OK	-
25	Use a DVM to measure the resistance between ground and terminal A4, then terminal B3 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 27	Go to Step 26
26	Repair the short to ground in circuits DK GRN and BRN. Is the repair complete?	-	System OK	-
27	1. Inspect the EBCM connector J1 for a poor connection. 2. Repair any bad connections found. 3. Reconnect all connections and repeat the test from Step 1. Is the result normal, with no DTCs, and the wheel speed variation within the specified value?	8 km/h (5 mph)	System OK	Go to Step 28
28	Replace the EBCM. Is the repair complete?	-	System OK	-
29	Check the voltage at terminal A. Is the voltage above the specified value?	2.75 v	Go to Step 30	Go to Step 33
30	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal A4 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 31	Go to Step 32
31	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
32	Repair the short to voltage in circuit DK GRN. Is the repair complete?	-	System OK	-
33	1. Turn ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminal A, the wheel speed sensor harness connector, and terminal A4 of the EBCM harness connector J1. Does the DVM display less than the specified value?	2 W	Go to Step 25	Go to Step 34
34	Repair the open or high resistance in circuit DK GRN. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A027
LEFT REAR EXCESSIVE WHEEL SPEED VARIATION

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring(often referred to as the air gap).

Diagnosis

This test detects a situation in which the left rear wheel speed changes more than 19 km/h (12 mph) in 8 milliseconds. This change must occur five times with less than 0.2 second between occurrences. This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- **A sensor is loose.**
- **There are worn suspension/drivetrain components.**
- **There is an intermittent short in the wheel speed input wires.**
- **The sensor is physically damaged.**
- **The wheel speed ring is damaged.**
- **A connector is damaged.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

1. **This test verifies whether the malfunction is currently present.**
2. **This test checks to see if excessive wheel bearing end play caused the DTC.**
4. **This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.**
5. **This test checks the wheel speed sensor for the proper resistance values.**
7. **This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.**
8. **This step ensures the wheel speed sensor is not shorted to ground.**
9. **This step checks for proper voltages at the speed sensor harness connector.**
10. **This test ensures that the wheel speed sensor circuitry is not internally shorted.**
22. **This checks for an open in circuit BLK.**
24. **This checks for a short to ground in both wheel speed signal circuits.**
26. **This step ensures that DTC A027 was not set due to a poor connection between the EBCM and the EBCM harness connector J1.**
32. **This checks for an open in circuit RED.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]). Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and the harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and jumper harness as necessary.

It is difficult to measure the resistance and the voltage at the terminals of the wheel speed sensor due to sensor mounting location and position. Terminals at the other end of the jumper harness are much more accessible. The rear wheel speed sensor jumper harnesses are connected to the system through connector C902, which is clipped to the vehicle near the right rear wheel. It connects to the floor harness, which passes through a grommet near that point. The clamp securing it to the vehicle is removed easily by pinching the tabs together and pushing up on the clamp. It is easier to handle the connector and take measurements if you free the connector from the axle first. Refer to "Rear Wheel Speed Sensor Jumper Harness" in this section for illustrations.

After you unplug the jumper harness from the floor harness at C902, stand toward the rear of the car. Rotate the connector so you are looking at the open end, and you will see it as it appears in the sketch at the top of this procedure. It will then be easy to make the necessary measurements.

The jumper harnesses for both rear wheels are bound together at this connector and are replaced as a single assembly, not as separate right or left jumper harnesses.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A027 - Left Rear Excessive Wheel Speed Variation

Step	Action	Value(s)	Yes	No
1	1. Test drive the vehicle. 2. Select "Data List" on the scan tool. 3. Monitor the wheel speed on the left rear wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variance within the specified value?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	Remove the left rear tire and measure the bearing end play. Does the end play exceed the specified value?	0.5 mm (0.02 in.)	Go to Step 3	Go to Step 4
3	Replace the rear wheel hub assembly. Is the repair complete?	-	System OK	-
4	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor • Jumper harness • Wiring • Connectors Is any physical damage indicated?	-	Go to Step 6	Go to Step 5

DTC A027 - Left Rear Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the rear jumper harness assembly from the floor harness at connector C902. 2. Use a digital voltmeter (DVM) to measure the resistance between terminals 1 and 3 on connector C902. Is the resistance within the specified value when the sensor is approximately 20°C (68°F)?	989-1185 W	Go to Step 7	Go to Step 3
6	Correct any physical damage. Is the repair complete?	-	System OK	-
7	1. Select the A/C voltage scale on the DVM. 2. Monitor the voltage while spinning the wheel by hand. Voltage will increase as wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 8	Go to Step 3
8	Use the DVM to measure the resistance between terminal 1 of connector C902 and ground. Does the DVM display the specified value?	R	Go to Step 9	Go to Step 3
9	1. Reconnect the rear wheel speed sensor jumper harness to connector C902. 2. Unplug the jumper harness connector from the left rear wheel speed sensor. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal A, then terminal B of the left rear sensor harness connector. Is the voltage within the specified value at each terminal?	2.25-2.75 v	Go to Step 10	Go to Step 17
10	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals B2 and A3 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 11	Go to Step 14
11	Inspect the EBCM connector J1 for a poor connection. Is a poor connection found?	-	Go to Step 12	Go to Step 13
12	Repair the connection. Is the repair complete?	-	System OK	-
13	Replace the EBCM. Is the repair complete?	-	System OK	-
14	Check for an internal short between circuits BLK and RED. Is there a short?	-	Go to Step 15	Go to Step 16
15	Repair the short between circuits BLK and RED. Is the repair complete?	-	System OK	-
16	Replace the rear jumper harness. Is the repair complete?	-	System OK	-
17	Check the voltage at terminal A. Is the voltage outside of the specified value?	2.25-2.75 v	Go to Step 18	Go to Step 28

DTC A027 - Left Rear Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
18	Check the voltage at terminal A. Is the voltage above the specified value?	2.75 v	Go to Step 19	Go to Step 22
19	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal A3 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 20	Go to Step 21
20	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
21	Repair the short to voltage in circuit BLK. Is the repair complete?	-	System OK	-
22	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal A on the left rear wheel speed sensor harness connector and terminal A3 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 24	Go to Step 23
23	Check terminal 3 of the jumper harness connector C902 for a poor connection. Was a poor connection found?	-	Go to Step 35	Go to Step 36
24	Use a DVM to measure the resistance between ground and terminal B2, then terminal A3 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 26	Go to Step 25
25	Repair the short to ground in circuits BLK and RED. Is the repair complete?	-	System OK	-
26	1. Inspect the EBCM connector J1 for a poor connection. 2. Repair any faulty connection found. 3. Reconnect all of the connections and repeat the test from Step 1. Is the result normal, with no DTCs, and the wheel speed variance within the specified value?	8 km/h (5 mph)	System OK	Go to Step 27
27	Replace the EBCM. Is the repair complete?	-	System OK	-
28	Check the voltage at terminal B. Is the voltage above the specified value?	2.75 v	Go to Step 29	Go to Step 32
29	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal B2 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 30	Go to Step 31
30	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-

DTC A027 - Left Rear Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
31	Repair the short to voltage in circuit RED. Is the repair complete?	-	System OK	-
32	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminal B, the wheel speed sensor harness connector, and terminal B2 of the EBCM harness connector J1. Does the DVM display less than the specified value?	2 W	Go to Step 24	Go to Step 33
33	Check terminal 3 of the jumper harness connector C902 for a poor connection. Is a poor connection found?	-	Go to Step 34	Go to Step 37
34	Repair terminal 3 of the jumper harness connector C902. Is the repair complete?	-	System OK	-
35	Repair terminal 1 of the jumper harness connector C902. Is the repair complete?	-	System OK	-
36	Repair the open or high resistance in circuit BLK. Is the repair complete?	-	System OK	-
37	Repair the open or high resistance in circuit RED. Is the repair complete?	-	System OK	-

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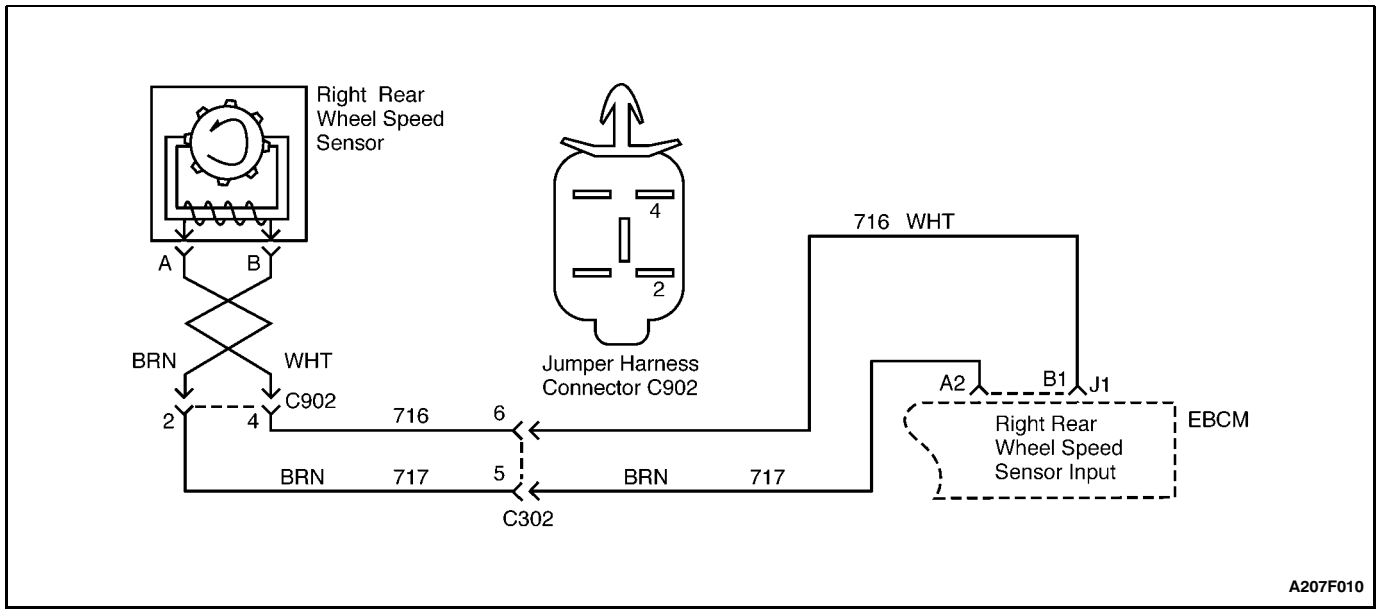

DIAGNOSTIC TROUBLE CODE (DTC) A028
RIGHT REAR EXCESSIVE WHEEL SPEED VARIATION

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring (often referred to as the air gap).

Diagnosis

This test detects a situation in which the right rear wheel speed changes more than 19 km/h (12 mph) in 8 milliseconds. This change must occur five times with less than 0.2 second between occurrences. This test will not fail if any wheel speed hardware faults (codes A032-A035) have already failed.

Cause(s)

- **A sensor is loose.**
- **There are worn suspension/drivetrain components.**
- **There is an intermittent short in the wheel speed input wires.**
- **The sensor is physically damaged.**
- **The wheel speed ring is damaged.**
- **A connector is damaged.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

1. **This test verifies whether the malfunction is currently present.**
2. **This test checks to see if excessive wheel bearing end play caused the DTC.**
4. **This step will identify a wheel speed sensor or circuitry that is damaged and visibly apparent.**
5. **This test checks the wheel speed sensor for the proper resistance values.**
7. **This test ensures the wheel speed sensor and the sensor ring generate the proper voltage.**
8. **This step ensures the wheel speed sensor is not shorted to ground.**
9. **This step checks for proper voltages at the speed sensor harness connector.**
10. **This test ensures that the wheel speed sensor circuitry is not internally shorted.**
22. **This checks for an open in circuit BRN.**
24. **This checks for a short to ground in both wheel speed signal circuits.**
26. **This step ensures that DTC A028 was not set due to a poor connection between the EBCM and the EBCM harness connector J1.**
32. **This checks for an open in circuit WHT.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS indicator is on only during moist environmental changes (rain, snow, vehicle wash, etc.), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. Use the following procedure:

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Start the vehicle and allow it to run for 10 seconds.
3. If the DTC returns immediately, replace the suspected harness.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

When measuring wheel speed sensor resistance, ensure that the vehicle is at room temperature (approximately 20°C [68°F]). Wheel speed sensor resistance will vary with temperature.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor and the jumper harness as necessary.

It is difficult to measure the resistance and the voltage at the terminals of the wheel speed sensor due to sensor mounting location and position. Terminals at the other end of the jumper harness are much more accessible. The rear wheel speed sensor jumper harnesses are connected to the system through connector C902, which is clipped to the vehicle near the right rear wheel. It connects to the floor harness, which passes through a grommet near that point. The clamp securing it to the vehicle is removed easily by pinching the tabs together and pushing up on the clamp. It is easier to handle the connector and take measurements if you free the connector from the axle first. Refer to "Rear Wheel Speed Sensor Jumper Harness" for illustrations.

After you unplug the jumper harness from the floor harness at C902, stand toward the rear of the car. Rotate the connector so you are looking at the open end, and you will see it as it appears in the sketch at the top of this procedure. It will then be easy to make the necessary measurements.

The jumper harnesses for both rear wheels are bound together at this connector and are replaced as a single assembly, not as separate right or left jumper harnesses.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections prior to an indicated step of this chart. This will insure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A028 - Right Rear Excessive Wheel Speed Variation

Step	Action	Value(s)	Yes	No
1	1. Test drive the vehicle. 2. Select "Data List" on the scan tool. 3. Monitor the wheel speed on the right rear wheel while decelerating slowly from 56 km/h (35 mph) to 0. Is the result normal, with no DTCs and the wheel speed variation within the specified value?	8 km/h (5 mph)	Go to "Diagnostic Aids"	Go to Step 2
2	Remove the right rear tire and measure the bearing end play. Does the end play exceed the specified value?	0.5 mm (0.02 in.)	Go to Step 3	Go to Step 4
3	Replace the rear wheel hub assembly. Is the repair complete?	-	System OK	-
4	1. Turn the ignition switch to LOCK. 2. Physically inspect the following components for damage: • Wheel speed sensor • Jumper harness • Wiring • Connectors Is any physical damage indicated?	-	Go to Step 6	Go to Step 5

DTC A028 - Right Rear Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the rear jumper harness assembly from the floor harness at connector C902. 2. Use a digital voltmeter (DVM) to measure resistance between terminals 2 and 4 on connector C902 of the sensor. Is resistance within the specified value when the sensor is approximately 20°C (68°F)?	989-1185 W	Go to Step 7	Go to Step 3
6	Correct any physical damage. Is the repair complete?	-	System OK	-
7	1. Select the A/C voltage scale on the DVM. 2. Monitor the voltage while spinning the wheel by hand. Voltage will increase as wheel speed increases. Is the voltage above the specified value?	100 mv	Go to Step 8	Go to Step 3
8	Use the DVM to measure the resistance between terminal 2 of connector C902 and ground. Does the DVM display the specified value?	R	Go to Step 9	Go to Step 3
9	1. Reconnect the rear wheel speed sensor jumper harness to connector C902. 2. Unplug the jumper harness connector from the right rear wheel speed sensor. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal A, then terminal B of the right rear sensor harness connector. Is the voltage within the specified value?	2.25-2.75 v	Go to Step 10	Go to Step 17
10	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminals B1 and A2 of the EBCM harness connector J1. Does the DVM display the specified value?	R	Go to Step 11	Go to Step 14
11	Inspect the EBCM connector J1 for a poor connection. Is a poor connection found?	-	Go to Step 12	Go to Step 13
12	Repair the connection. Is the repair complete?	-	System OK	-
13	Replace the EBCM. Is the repair complete?	-	System OK	-
14	Check for an internal short between circuits BRN and WHT. Is there a short?	-	Go to Step 15	Go to Step 16
15	Repair the short between circuits BRN and WHT. Is the repair complete?	-	System OK	-
16	Replace the rear jumper harness. Is the repair complete?	-	System OK	-
17	Check the voltage at terminal A. Is the voltage outside of the specified value?	2.25-2.75 v	Go to Step 18	Go to Step 28

DTC A028 - Right Rear Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
18	Check the voltage at terminal A. Is the voltage above the specified value?	2.75 v	Go to Step 19	Go to Step 22
19	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect a DVM to ground and measure the voltage at terminal A2 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 20	Go to Step 21
20	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
21	Repair the short to voltage in circuit BRN. Is the repair complete?	-	System OK	-
22	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use a DVM to measure the resistance between terminal A on the right rear wheel speed sensor harness connector and terminal A2 of the EBCM harness connector J1. Is the resistance below the specified value?	2 W	Go to Step 24	Go to Step 23
23	Check terminal 4 of the jumper harness connector C902 for a poor connection. Was a poor connection found?	-	Go to Step 35	Go to Step 36
24	Use a DVM to measure the resistance between ground and terminal B1, then terminal A2 of the EBCM harness connector J1. Does the DVM display the specified resistance?	R	Go to Step 26	Go to Step 25
25	Repair the short to ground in circuits BRN and WHT. Is the repair complete?	-	System OK	-
26	1. Inspect the EBCM connector J1 for a poor connection. 2. Repair any faulty connection found. 3. Reconnect all of the connections and repeat the test from Step 1. Is the result normal, with no DTCs, and the wheel speed variation within the specified value?	8 km/h (5 mph)	System OK	Go to Step 27
27	Replace the EBCM. Is the repair complete?	-	System OK	-
28	Check the voltage at terminal B. Is the voltage at terminal B above the maximum value specified?	2.75 v	Go to Step 29	Go to Step 32
29	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. 4. Connect the DVM to ground and measure the voltage at terminal B1 of the EBCM harness connector J1. Is the voltage below the specified value?	1 v	Go to Step 30	Go to Step 31
30	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-

DTC A028 - Right Rear Excessive Wheel Speed Variation (Cont'd)

Step	Action	Value(s)	Yes	No
31	Repair the short to voltage in circuit WHT. Is the repair complete?	-	System OK	-
32	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Use the DVM to measure the resistance between terminal B of the wheel speed sensor harness connector and terminal B1 of the EBCM harness connector J1. Does the DVM display less than the specified value?	2 W	Go to Step 24	Go to Step 33
33	Check the jumper harness connector terminal 4 for a poor connection. Is a poor connection found?	-	Go to Step 34	Go to Step 37
34	Repair the jumper harness connector terminal 4. Is the repair complete?	-	System OK	-
35	Repair the jumper harness connector terminal 2. Is the repair complete?	-	System OK	-
36	Repair the open or high resistance in circuit BRN. Is the repair complete?	-	System OK	-
37	Repair the open or high resistance in circuit WHT. Is the repair complete?	-	System OK	-

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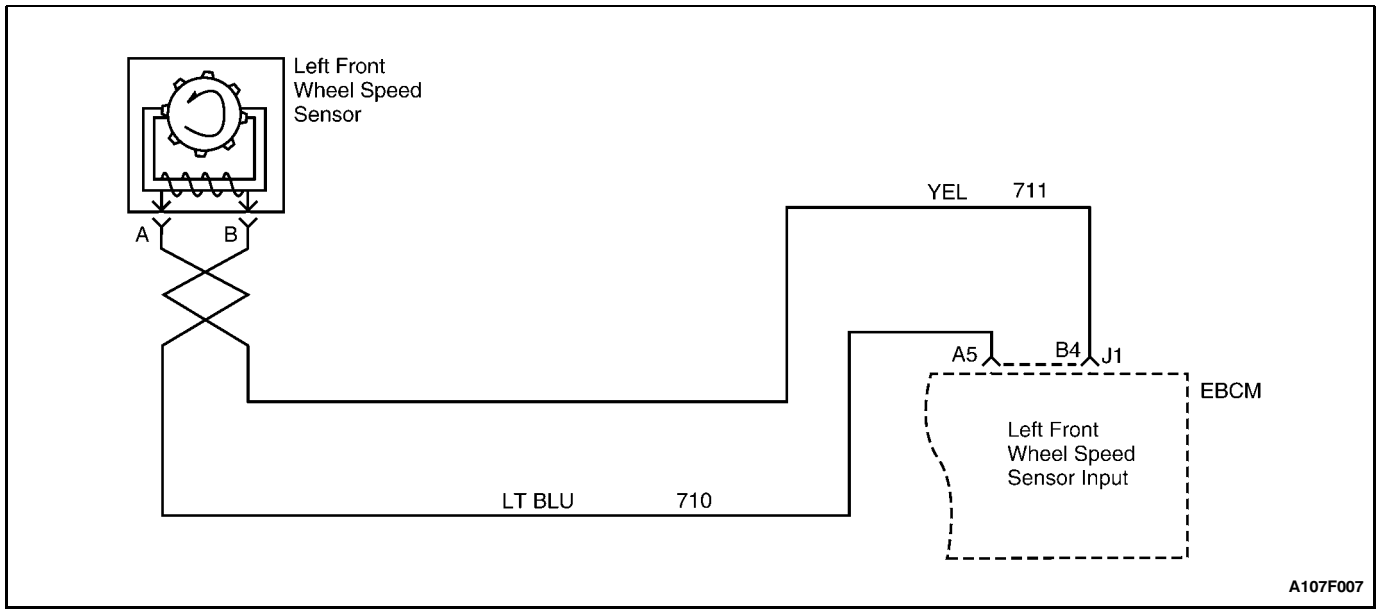


DIAGNOSTIC TROUBLE CODE (DTC) A032
LEFT FRONT SPEED SENSOR CIRCUIT OPEN OR SHORTED TO GROUND OR BATTERY

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the left front wheel speed sensor circuit.

Cause(s)

- **The wheel speed circuit is shorted to the battery or ground.**
- **There is a loose connection in the wheel speed circuit.**
- **The wheel speed sensor resistance is very high.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

1. **Checks for proper resistance of the wheel speed sensor coil.**
2. **Checks for a short to ground in the wheel speed sensor wiring.**
3. **Checks for a short to voltage in the wheel speed sensor wiring.**
4. **Ensures that the malfunction was not due to physical damage of the circuitry.**
8. **Checks for a short to voltage in circuit LT BLU.**
10. **Checks for a short to voltage in circuit YEL.**
13. **Checks for high resistance in circuit LT BLU.**
15. **Checks for high resistance in circuit YEL.**
17. **Verifies proper wheel speed sensor resistance.**
20. **Checks for a short to ground in circuit YEL.**
22. **Checks for a short to ground in circuit LT BLU.**
24. **Verifies that the wheel speed sensor is not internally shorted to ground.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool, as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS warning lamp is ON only during moist environmental changes (rain, snow, vehicle wash), inspect all wheel speed sensor circuitry thoroughly for signs or water intrusion. If the DTC is not current, clear the DTCs and simulate the effects of water intrusion. Use the following procedure.

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [2 teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Test drive the vehicle over various road surfaces (bumps, turns, etc.) above 24 km/h (15 mph) for at least 30 seconds.
3. If the DTC returns, replace the suspected harness.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wiring connections, or physical damage to the wiring harness.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to "Front Wheel Speed Sensor" in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A032 - Left Front Speed Sensor Circuit Open or Shorted

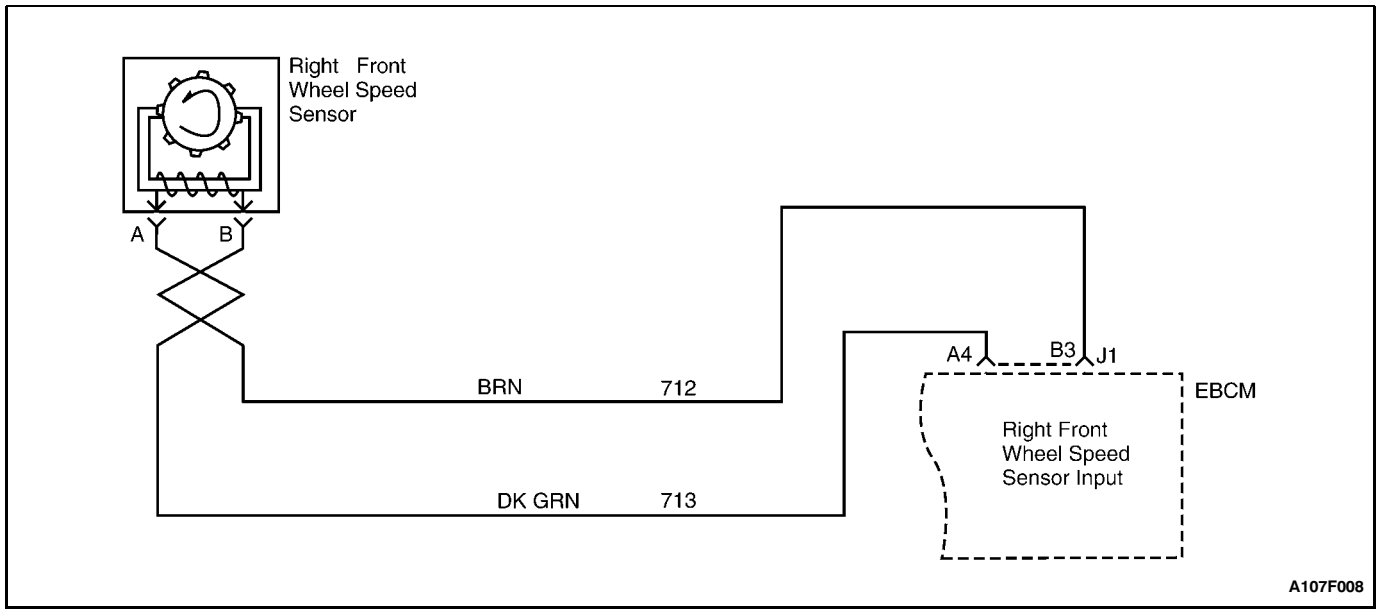
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition to LOCK. 2. Thoroughly spray the speed sensor harness at the left front wheel with a 5% salt water solution. 3. Disconnect the connector J1. 4. Use a digital voltmeter (DVM) to measure the resistance between terminals A5 and B4 of connector J1 on the EBCM harness. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	969-1185 W	Go to Step 2	Go to Step 13
2	Measure the resistance between ground and terminal B4 of the EBCM harness connector J1. Does the DVM show the specified resistance?	R	Go to Step 3	Go to Step 20
3	1. Turn the ignition ON. 2. Use a DVM to measure the voltage between ground and terminal A5 of EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 4	Go to Step 8
4	1. Turn the ignition to LOCK. 2. Inspect terminals A5 and B4 of the EBCM harness connector J1 for poor terminal contact and contamination. Also inspect circuits YEL and LT BLU for damage which may result in an open circuit, a short to ground, or a short to voltage. Did you find any damage?	-	Go to Step 5	Go to Step 6
5	1. Repair the damage as required. 2. Reconnect all of the connectors. 3. Turn the ignition ON. Does DTC A032 set as a current DTC?	-	Go to Step 7	System OK
6	1. Reconnect all of the connectors. 2. Turn the ignition ON. Does DTC A032 set as a current DTC?	-	Go to Step 7	Go to "Diagnostic Aids"
7	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A032 - Left Front Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition to LOCK. 2. Disconnect the harness from the left front wheel speed sensor. 3. Turn the ignition ON. 4. Use a DVM to measure the voltage between ground and terminal A5 of the EBCM harness connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 9	Go to Step 10
9	Repair the short to voltage in circuit LT BLU. Is the repair complete?	-	System OK	-
10	Use a DVM to measure the voltage between ground and terminal B4 of the EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 11	Go to Step 12
11	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
12	Repair the short to voltage in circuit YEL. Is the repair complete?	-	System OK	-
13	1. Disconnect the harness from the left front wheel speed sensor. 2. Use the DVM to measure the resistance between terminal A5 of the EBCM harness connector J1, and terminal A of the left front wheel speed sensor harness connector. Is the resistance within the specified value?	v 2 W	Go to Step 15	Go to Step 14
14	1. Repair the high resistance in circuit LT BLU. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
15	Use a DVM to measure the resistance between terminal B4 of the EBCM harness connector J1, and terminal B of the lest front wheel speed sensor harness connector. Is the resistance within the specified value?	v 2 W	Go to Step 17	Go to Step 16
16	1. Repair the high resistance in circuit YEL. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
17	Use a DVM to measure the resistance between terminal A and terminal B of the left front wheel speed sensor connector. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	969-1185 W	Go to Step 18	Go to Step 19

DTC A032 - Left Front Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
18	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. 4. Refer to "Diagnostic Aids" for more information. Is the repair complete?	-	System OK	-
19	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
20	1. Disconnect the EBCM harness from the left front wheel speed sensor. 2. Use a DVM to measure the resistance between ground and terminal B4 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 22	Go to Step 21
21	Repair the short to ground in circuit YEL. Is the repair complete?	-	System OK	-
22	Use a DVM to measure the resistance between ground and terminal A5 of the EBCM connector J1. Does the DVM show the specified value?	R	Go to Step 24	Go to Step 23
23	Repair the short to ground in circuit LT BLU. Is the repair complete?	-	System OK	-
24	Use a DVM to measure the resistance between ground and terminal A of the left front wheel speed sensor. Does the DVM show the specified value?	R	Go to Step 25	Go to Step 26
25	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
26	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A033 RIGHT FRONT SPEED SENSOR CIRCUIT OPEN OR SHORTED TO GROUND OR BATTERY

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the right front wheel speed sensor circuit.

Cause(s)

- The wheel speed circuit is shorted to the battery or ground.
- There is a loose connection in the wheel speed circuit.
- The wheel speed sensor resistance is very high.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The EBCM commands a rehome to ensure that the motors are in the home position.

Test Description

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

1. Checks for proper resistance of the wheel speed sensor coil.
2. Checks for a short to ground in the wheel speed sensor wiring.
3. Checks for a short to voltage in the wheel speed sensor wiring.
4. Ensures that the malfunction was not due to physical damage of the circuitry.
8. Checks for a short to voltage in circuit DK GRN.
10. Checks for a short to voltage in circuit BRN.
13. Checks for high resistance in circuit DK GRN.
15. Checks for high resistance in circuit BRN.
17. Verifies proper wheel speed sensor resistance.
20. Checks for a short to ground in circuit BRN.
22. Checks for a short to ground in circuit DK GRN.
24. Verifies that the wheel speed sensor is not internally shorted to ground.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool, as described in "Scan Tool Diagnostics" found in this section.

If the customer's comments reflect that the ABS warning lamp is ON only during moist environmental changes (rain, snow, vehicle wash), inspect all wheel speed sensor circuitry thoroughly for signs or water intrusion. If the DTC is not current, clear the DTCs and simulate the effects of water intrusion. Use the following procedure.

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [two teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Test drive the vehicle over various road surfaces (bumps, turns, etc.) above 24 km/h (15 mph) for at least 30 seconds.
3. If the DTC returns, replace the suspected harness.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wiring connections, or physical damage to the wiring harness.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to "Front Wheel Speed Sensor" in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A033 - Right Front Speed Sensor Circuit Open or Shorted to Ground or Battery

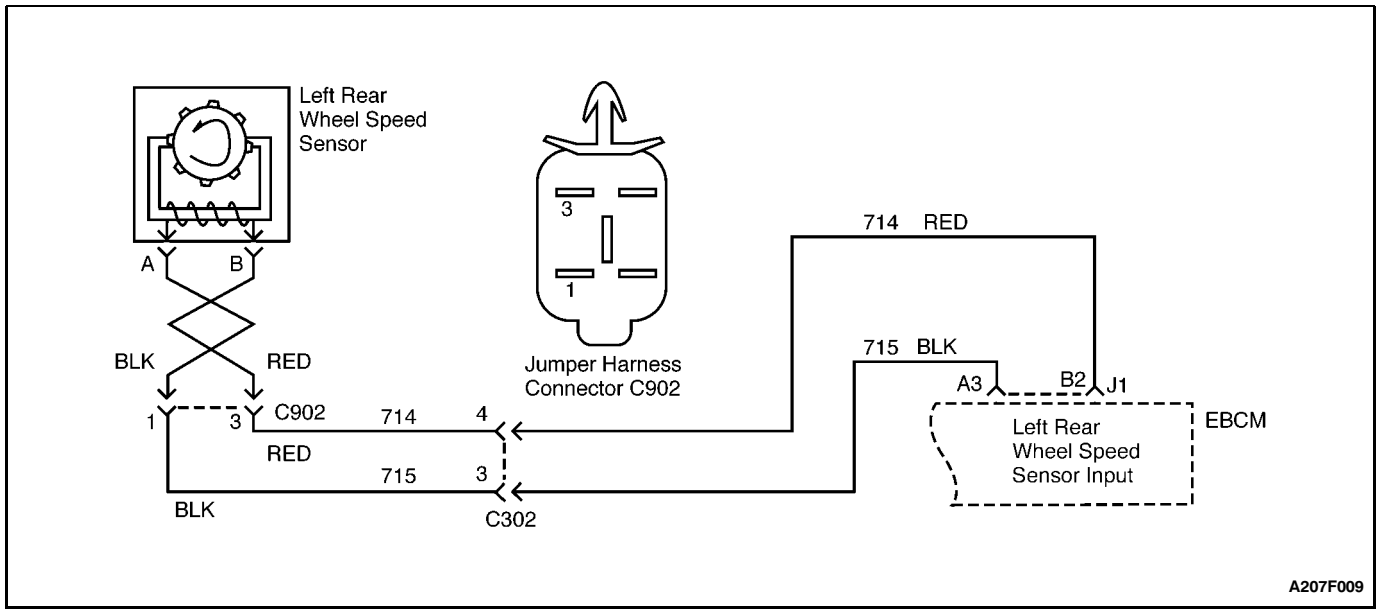
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition to LOCK. 2. Thoroughly spray the speed sensor harness at the right front wheel with a 5% salt water solution. 3. Disconnect connector J1. 4. Use a digital voltmeter (DVM) to measure the resistance between terminals A4 and B3 of connector J1 on the EBCM harness. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	969-1185 W	Go to Step 2	Go to Step 13
2	Measure the resistance between ground and terminal B3 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 3	Go to Step 20
3	1. Turn the ignition ON. 2. Use a DVM to measure the voltage between ground and terminal A4 of the EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 4	Go to Step 8
4	1. Turn the ignition to LOCK. 2. Inspect terminals A4 and B3 of the EBCM harness connector J1 for a poor terminal contact and contamination. Also inspect circuits DK GRN and BRN for damage which may result in an open circuit, short to ground, or short to voltage. Did you find any damage?	-	Go to Step 5	Go to Step 6
5	1. Repair the damage as required. 2. Reconnect all of the connectors. 3. Turn the ignition ON. Does DTC A032 set as a current DTC?	-	Go to Step 7	System OK
6	1. Reconnect all of the connectors. 2. Turn the ignition ON. Does DTC A033 set as a current DTC?	-	Go to Step 7	Go to "Diagnostic Aids"
7	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A033 - Right Front Speed Sensor Circuit Open or Shorted to Ground or Battery (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition to LOCK. 2. Disconnect the harness from the right front wheel speed sensor. 3. Turn the ignition ON. 4. Use a DVM to measure the voltage between ground and terminal A4 of the EBCM harness connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 9	Go to Step 10
9	Repair the short to voltage in circuit DK GRN. Is the repair complete?	-	System OK	-
10	Use a DVM to measure the voltage between ground and terminal B3 of the EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 11	Go to Step 12
11	1. This is an intermittent malfunction. 2. Inspect all connectors and harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
12	Repair the short to voltage in circuit BRN. Is the repair complete?	-	System OK	-
13	1. Disconnect the harness from the right front wheel speed sensor. 2. Use the DVM to measure the resistance between terminal A4 of the EBCM harness connector J1, and terminal A of the right front wheel speed sensor harness connector. Is the resistance within the specified value?	v 2 W	Go to Step 15	Go to Step 14
14	1. Repair the high resistance in circuit DK GRN. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
15	Use a DVM to measure the resistance between terminal B3 of the EBCM harness connector J1, and terminal B of the right front wheel speed sensor harness connector. Is the resistance within the specified value?	v 2 W	Go to Step 17	Go to Step 16
16	1. Repair the high resistance in circuit BRN. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
17	Use a DVM to measure the resistance between terminal A and terminal B of the right front wheel speed sensor connector. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	1502-2103 W	Go to Step 18	Go to Step 19
18	1. This is an intermittent malfunction. 2. Inspect all connectors and harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-

DTC A033 - Right Front Speed Sensor Circuit Open or Shorted to Ground or Battery (Cont'd)

Step	Action	Value(s)	Yes	No
19	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
20	1. Disconnect the EBCM harness from the right front wheel speed sensor. 2. Use a DVM to measure the resistance between ground and terminal B3 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 22	Go to Step 21
21	Repair the short to ground in circuit BRN. Is the repair complete?	-	System OK	-
22	Use a DVM to measure the resistance between ground and terminal A4 of the EBCM connector J1. Does the DVM show the specified resistance?	R	Go to Step 24	Go to Step 23
23	Repair the short to ground in circuit DK GRN. Is the repair complete?	-	System OK	-
24	Use the DVM to measure the resistance between ground and terminal A of the right front wheel speed sensor. Does the DVM show the specified value?	R	Go to Step 25	Go to Step 26
25	1. This is an intermittent malfunction. 2. Inspect all of the connectors and harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
26	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A034 LEFT REAR SPEED SENSOR CIRCUIT OPEN OR SHORTED TO GROUND OR BATTERY

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the left rear wheel speed sensor circuit.

Cause(s)

- **The wheel speed circuit is shorted to the battery or ground.**
- **There is a loose connection in the wheel speed circuit.**
- **The wheel speed sensor resistance is very high.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The EBCM commands a rehome to ensure that the motors are in the home position.

Test Description

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

1. **Checks for proper resistance of the wheel speed sensor coil.**
2. **Checks for a short to ground in the wheel speed sensor wiring.**
3. **Checks for a short to voltage in the wheel speed sensor wiring.**
4. **Ensures that the malfunction was not due to physical damage of the circuitry.**
8. **Checks for a short to voltage in circuit BLK.**
10. **Checks for a short to voltage in circuit RED.**
13. **Checks for high resistance in circuit BLK.**
15. **Checks for high resistance in circuit RED.**
17. **Verifies proper wheel speed sensor resistance.**
20. **Checks for a short to ground in circuit RED.**
22. **Checks for a short to ground in circuit BLK.**

Important: Do not allow water to enter any wheel speed sensor connector.

24. **Checks for a short to ground in the rear wheel speed sensor harness.**
26. **Verifies that the wheel speed sensor is not internally shorted to ground.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool, as described in "Scan Tool Diagnostics" found in this section.

If the customer's comments reflect that the ABS warning lamp is ON only during moist environmental changes (rain, snow, vehicle wash), inspect all wheel speed sensor circuitry thoroughly for signs or water intrusion. If the DTC is not current, clear the DTCs and simulate the effects of water intrusion. Use the following procedure.

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [two teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Test drive the vehicle over various road surfaces (bumps, turns, etc.) above 24 km/h (15 mph) for at least 30 seconds.
3. If the DTC returns, replace the suspected harness.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wiring connections, or physical damage to the wiring harness.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to "Rear Wheel Speed Sensor" in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A034 - Left Rear Speed Sensor Circuit Open or Shorted to Ground or Battery

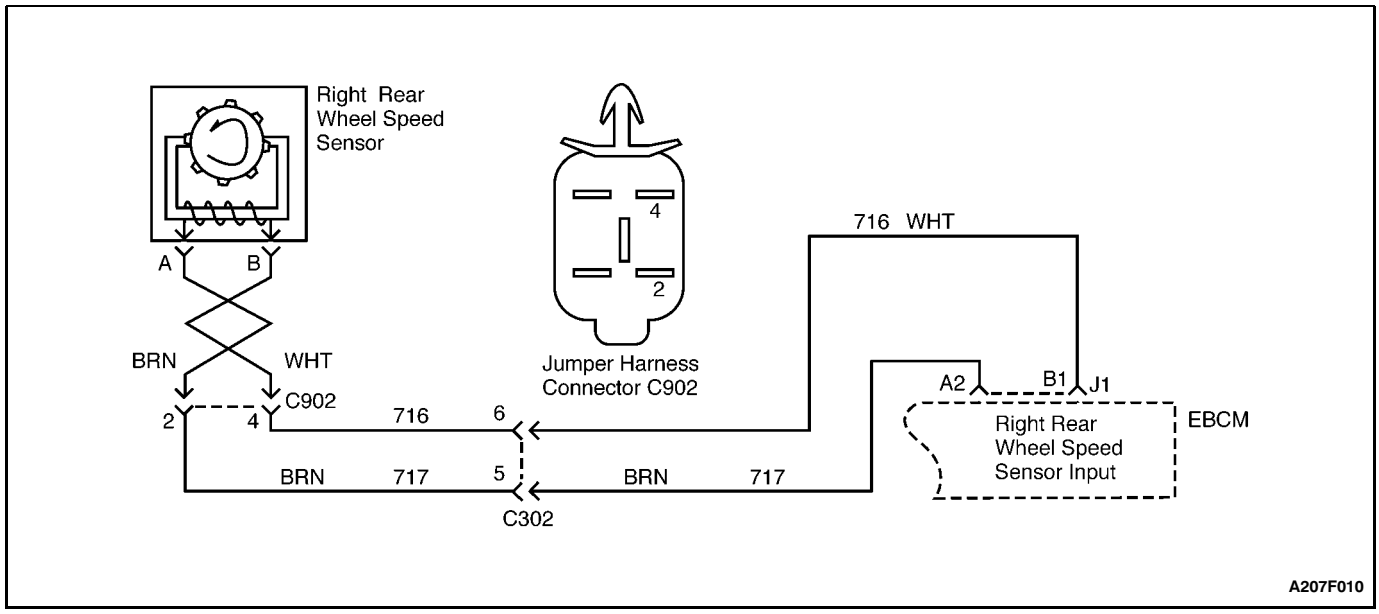
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition to LOCK. 2. Thoroughly spray the speed sensor harness at the left rear wheel with a 5% salt water solution. 3. Disconnect connector J1. 4. Use a digital voltmeter (DVM) to measure the resistance between terminals A3 and B2 of connector J1 on the EBCM harness. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	969-1185 W	Go to Step 2	Go to Step 13
2	Measure the resistance between ground and terminal B2 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 3	Go to Step 20
3	1. Turn the ignition ON. 2. Use a DVM to measure the voltage between ground and terminal A3 of the EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 4	Go to Step 8
4	1. Turn the ignition to LOCK. 2. Inspect terminals A3 and B2 of the EBCM harness connector J1 for poor terminal contact and contamination. Also inspect circuits BLK and RED for damage which may result in an open circuit, short to ground, or short to voltage. Did you find any damage?	-	Go to Step 5	Go to Step 6
5	1. Repair the damage as required. 2. Reconnect all of the connectors. 3. Turn the ignition ON. Does DTC A032 set as a current DTC?	-	Go to Step 7	System OK
6	1. Reconnect all of the connectors. 2. Turn the ignition ON. Does DTC A034 set as a current DTC?	-	Go to Step 7	Go to "Diagnostic Aids"
7	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A034 - Left Rear Speed Sensor Circuit Open or Shorted to Ground or Battery (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition to LOCK. 2. Disconnect the harness from the left rear wheel speed sensor. 3. Turn the ignition ON. 4. Use a DVM to measure the voltage between ground and terminal A3 of the EBCM harness connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 9	Go to Step 10
9	Repair the short to voltage in circuit BLK. Is the repair complete?	-	System OK	-
10	Use a DVM to measure the voltage between ground and terminal B2 of the EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 11	Go to Step 12
11	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
12	Repair the short to voltage in circuit RED. Is the repair complete?	-	System OK	-
13	1. Disconnect the harness from the left rear wheel speed sensor. 2. Use the DVM to measure the resistance between terminal A3 of the EBCM harness connector J1, and terminal A of the left rear wheel speed sensor harness connector. Does the DVM show the specified value?	v 2 W	Go to Step 15	Go to Step 14
14	1. Repair the high resistance in circuit BLK. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
15	Use a DVM to measure the resistance between terminal B2 of the EBCM harness connector J1, and terminal B of the left rear wheel speed sensor harness connector. Does the DVM show the specified value?	v 2 W	Go to Step 17	Go to Step 16
16	1. Repair the high resistance in circuit RED. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
17	Use a DVM to measure the resistance between terminal A and terminal B of the left rear wheel speed sensor connector. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	1930-2566 W	Go to Step 18	Go to Step 19
18	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-

DTC A034 - Left Rear Speed Sensor Circuit Open or Shorted to Ground or Battery (Cont'd)

Step	Action	Value(s)	Yes	No
19	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
20	1. Disconnect the rear wheel speed sensor harness from the floor wiring harness at connector C902. This is a four-pin connector located under the car, on the right side, above the rear axle. 2. Use a DVM to measure the resistance between ground and terminal B2 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 22	Go to Step 21
21	Repair the short to ground in circuit RED between the EBCM and connector C902. Is the repair complete?	-	System OK	-
22	Use a DVM to measure the resistance between ground and terminal A3 of the EBCM connector J1. Does the DVM show the specified value?	R	Go to Step 24	Go to Step 23
23	Repair the short to ground in circuit BLK. Is the repair complete?	-	System OK	-
24	1. Thoroughly respray the left rear wheel speed sensor harness with the salt water solution. 2. Disconnect the left rear wheel speed sensor harness from the sensor. 3. Use the DVM to measure the resistance between ground and terminal A, then terminal B of the left rear wheel speed sensor harness. Does the DVM show the specified value?	R	Go to Step 26	Go to Step 25
25	Replace the rear wheel speed sensor harness. This harness serves both rear wheels. Is the repair complete?	-	System OK	-
26	Use a DVM to measure the resistance between ground and terminal A of the left rear wheel speed sensor. Does the DVM show the specified value?	R	Go to Step 27	Go to Step 28
27	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
28	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A035 RIGHT REAR SPEED SENSOR CIRCUIT OPEN OR SHORTED TO GROUND OR BATTERY

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the right rear wheel speed sensor circuit.

Cause(s)

- **The wheel speed circuit is shorted to the battery or ground.**
- **There is a loose connection in the wheel speed circuit.**
- **The wheel speed sensor resistance is very high.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The EBCM commands a rehome to ensure that the motors are in the home position.

Test Description

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

1. **Checks for proper resistance of the wheel speed sensor coil.**
2. **Checks for a short to ground in the wheel speed sensor wiring.**
3. **Checks for a short to voltage in the wheel speed sensor wiring.**
4. **Ensures that the malfunction was not due to physical damage of the circuitry.**
8. **Checks for a short to voltage in circuit BRN.**
10. **Checks for a short to voltage in circuit WHT.**
13. **Checks for high resistance in circuit BRN.**
15. **Checks for high resistance in circuit WHT.**
17. **Verifies proper wheel speed sensor resistance.**
20. **Checks for a short to ground in circuit WHT.**
22. **Checks for a short to ground in circuit BRN.**

Important: Do not allow water to enter any wheel speed sensor connector.

24. **Checks for a short to ground in the rear wheel speed sensor harness.**
26. **Verifies that the wheel speed sensor is not internally shorted to ground.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool, as described in "Scan Tool Diagnostics."

If the customer's comments reflect that the ABS warning lamp is ON only during moist environmental changes (rain, snow, vehicle wash), inspect all wheel speed sensor circuitry thoroughly for signs or water intrusion. If the DTC is not current, clear the DTCs and simulate the effects of water intrusion. Use the following procedure.

1. Spray down the suspected area with a 5 percent salt water solution (10 ml [two teaspoons] of salt to 355 ml [12 fluid ounces] of water).
2. Test drive the vehicle over various road surfaces (bumps, turns, etc.) above 24 km/h (15 mph) for at least 30 seconds.
3. If the DTC returns, replace the suspected harness.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wiring connections, or physical damage to the wiring harness.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to "Rear Wheel Speed Sensor" in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC A035 - Right Rear Speed Sensor Circuit Open or Shorted to Ground or Battery

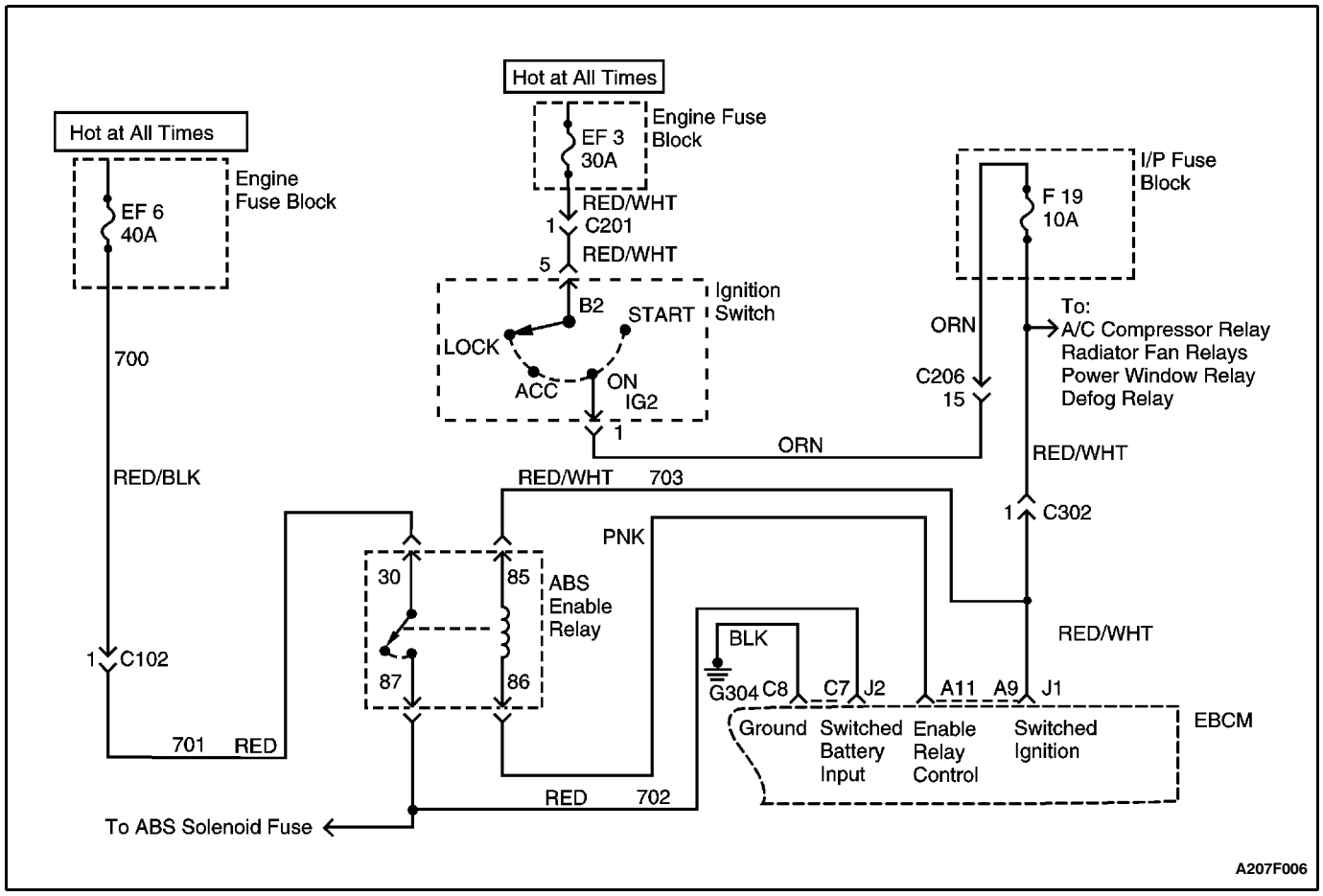
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition to LOCK. 2. Thoroughly spray the speed sensor harness at the right rear wheel with a 5% salt water solution. 3. Disconnect connector J1. 4. Use a digital voltmeter (DVM) to measure the resistance between terminals A2 and B1 of connector J1 on the EBCM harness. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	969-1185 W	Go to Step 2	Go to Step 13
2	Measure the resistance between ground and terminal B1 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 3	Go to Step 20
3	1. Turn the ignition ON. 2. Use a DVM to measure the voltage between ground and terminal A2 of the EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 4	Go to Step 8
4	1. Turn the ignition to LOCK. 2. Inspect terminals A2 and B1 of the EBCM harness connector J1 for poor terminal contact and contamination. Also inspect circuits BRN and WHT for damage which may result in an open circuit, short to ground, or short to voltage. Did you find any damage?	-	Go to Step 5	Go to Step 6
5	1. Repair the damage as required. 2. Reconnect all of the connectors. 3. Turn the ignition ON. Does DTC A032 set as a current DTC?	-	Go to Step 7	System OK
6	1. Reconnect all of the connectors. 2. Turn the ignition ON. Does DTC A034 set as a current DTC?	-	Go to Step 7	Go to "Diagnostic Aids"
7	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A035 - Right Rear Speed Sensor Circuit Open or Shorted to Ground or Battery (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition to LOCK. 2. Disconnect the harness from the right rear wheel speed sensor. 3. Turn the ignition ON. 4. Use a DVM to measure the voltage between ground and terminal A2 of the EBCM harness connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 9	Go to Step 10
9	Repair the short to voltage in circuit BRN. Is the repair complete?	-	System OK	-
10	Use a DVM to measure the voltage between ground and terminal B1 of the EBCM connector J1. Is the voltage within the specified value?	v 1 v	Go to Step 11	Go to Step 12
11	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
12	Repair the short to voltage in circuit WHT. Is the repair complete?	-	System OK	-
13	1. Disconnect the harness from the right rear wheel speed sensor. 2. Use the DVM to measure the resistance between terminal A2 of the EBCM harness connector J1, and terminal A of the right rear wheel speed sensor harness connector. Is the resistance within the specified value?	v 2 W	Go to Step 15	Go to Step 14
14	1. Repair the high resistance in circuit BRN. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
15	Use a DVM to measure the resistance between terminal B1 of the EBCM harness connector J1, and terminal B of the right rear wheel speed sensor harness connector. Is the resistance within the specified value?	v 2 W	Go to Step 17	Go to Step 16
16	1. Repair the high resistance in circuit WHT. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	-	System OK	-
17	Use a DVM to measure the resistance between terminal A and terminal B of the right rear wheel speed sensor connector. Is the resistance within the specified value when the sensor temperature is 5-43°C (41-110°F)?	1930-2566 W	Go to Step 18	Go to Step 19
18	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-

DTC A035 - Right Rear Speed Sensor Circuit Open or Shorted to Ground or Battery (Cont'd)

Step	Action	Value(s)	Yes	No
19	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
20	1. Disconnect the rear wheel speed sensor harness from the floor wiring harness at connector C902. This is a four-pin connector located under the car, on the right side, above the rear axle. 2. Use a DVM to measure the resistance between ground and terminal B1 of EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 22	Go to Step 21
21	Repair the short to ground in circuit WHT between the EBCM and connector C902. Is the repair complete?	-	System OK	-
22	Use a DVM to measure the resistance between ground and terminal A2 of the EBCM connector J1. Does the DVM show the specified value?	R	Go to Step 24	Go to Step 23
23	Repair the short to ground in circuit BRN. Is the repair complete?	-	System OK	-
24	1. Thoroughly respray the right rear wheel speed sensor harness with the salt water solution. 2. Disconnect the right rear wheel speed sensor harness from the sensor. 3. Use the DVM to measure the resistance between ground and terminal A, then terminal B of the right rear wheel speed sensor harness. Does the DVM show the specified value?	R	Go to Step 26	Go to Step 25
25	Replace the rear wheel speed sensor harness. This harness serves both rear wheels. Is the repair complete?	-	System OK	-
26	Use a DVM to measure the resistance between ground and terminal A of the right rear wheel speed sensor. Does the DVM show the specified value?	R	Go to Step 27	Go to Step 28
27	1. This is an intermittent malfunction. 2. Inspect all of the connectors and the harnesses for damage which may result in a short to voltage when all components are connected. 3. Repair all damage found. Is the repair complete?	-	System OK	-
28	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A036
LOW SYSTEM VOLTAGE

Circuit Description

This DTC is used to monitor the voltage level available to the EBCM. If the voltage drops below 11 volts, full performance of the ABS cannot be guaranteed. During ABS operation, there are several current requirements that will cause battery voltage to drop. Because of this, the voltage is monitored prior to ABS operation to indicate good charging system condition. The voltage is also monitored during ABS operation when voltage may drop significantly.

Diagnosis

The system checks the switched battery and the ignition voltage level for less than 10.6 volts when not in ABS or less than 8.3 volts while in ABS for more than 720 milliseconds. Voltage calibrations are based on wiring harness specifications.

Cause(s)

- **The vehicle charging system is not functioning well.**
- **There is high resistance in the ABS wiring harness.**
- **The vehicle battery is not performing well.**

Fail Action

Low voltage prevents ABS operation. The ABS system is disabled and the ABS warning lamp is turned on. The brake warning lamp is turned on only if the rear piston is not at the top of the bore. This could cause degradation of the base brakes.

Test Description

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

1. **This test checks to see what voltage is readily available at terminal C or EBCM harness connector J2. If the voltage is representative of good charging system condition, a malfunction is not present.**
2. **This step checks for a possible intermittent malfunction.**
3. **This step isolates the EBCM to check the condition of the circuitry and charging system.**
4. **This step checks for adequate voltage at the EBCM when a load is applied to the system.**

8. This step isolates the low voltage condition to high circuit resistance or improper charging system operation.
13. This step isolates which circuit is the source of the low voltage condition.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A036 - Low System Voltage

Step	Action	Value(s)	Yes	No
1	1. Start the engine. 2. Select "Data List" on the scan tool and monitor the system voltage with the engine running. Is the voltage above the specified value?	11.4 v	Go to Step 2	Go to Step 3
2	Use the scan tool to perform the voltage load test. Are the ignition and battery voltages above the specified value?	10 v	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connectors J1 and J2. 3. Jumper terminal A11 of the EBCM harness connector J1 to ground. 4. Start the engine. 5. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal C7 of the EBCM harness connector J2. Is the voltage greater than the specified value?	11.4 v	Go to Step 4	Go to Step 8
4	1. Turn the ignition switch to LOCK. 2. Reconnect the EBCM connectors. 3. Turn the ignition switch to ON. 4. Connect a test light between ground and terminal C7 of the EBCM harness connector J2. (Backprobe terminal C7, being careful not to damage the terminal.) 5. Observe the test light while using the scan tool to perform the voltage load test. Does the test light turn on?	-	Go to Step 5	Go to Step 8
5	Check for a poor connection at terminal C7 of the EBCM connector J2. Is the connection in good condition?	-	Go to Step 6	Go to Step 7
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair the connection at terminal C7 of the EBCM connector J2. Is the repair complete?	-	System OK	-
8	1. Turn the ignition switch to LOCK. 2. Reconnect both EBCM connectors. 3. Start the engine. 4. Use the scan tool to perform the voltage load test. 5. Monitor the battery and the ignition voltage. Are both the ignition and the battery voltages below the specified value?	10 v	Go to Step 9	Go to Step 12

DTC A036 - Low System Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
9	Inspect the following connections for corrosion or poor contact: • EBCM connector J1, terminal A11 • EBCM connector J2, terminal C7 Are the connectors in good condition?	-	Go to Step 10	Go to Step 11
10	Correct the low voltage condition. Is the repair complete?	-	System OK	-
11	Repair any poor connection found. Is the repair complete?	-	System OK	-
12	Check the battery voltage. Is the battery voltage less than the specified value?	10 v	Go to Step 13	Go to Step 18
13	Use the DVM to measure the voltage between ground and terminal 2 of the ABS enable relay socket. Is the voltage above the specified value?	10 v	Go to Step 14	Go to Step 15
14	Repair the high resistance or the open in circuit RED from terminal 8 of the ABS relay socket to terminal C7 of the EBCM harness connector J2. Is the repair complete?	-	System OK	-
15	Check the system fuse, EF6. Is the fuse open?	-	Go to Step 16	Go to Step 17
16	Replace the system fuse, EF6. Is the repair complete?	-	System OK	-
17	Repair high resistance or open in circuit RED/BLK from the system fuse EF6 to the front harness connector C102 (one terminal), or circuit RED from the ECM and ABS harness connector C102 to the ABS relay socket terminal 2. Is the repair complete?	-	System OK	-
18	Repair the open or high resistance in circuit RED/WHT. Is the repair complete?	-	System OK	-

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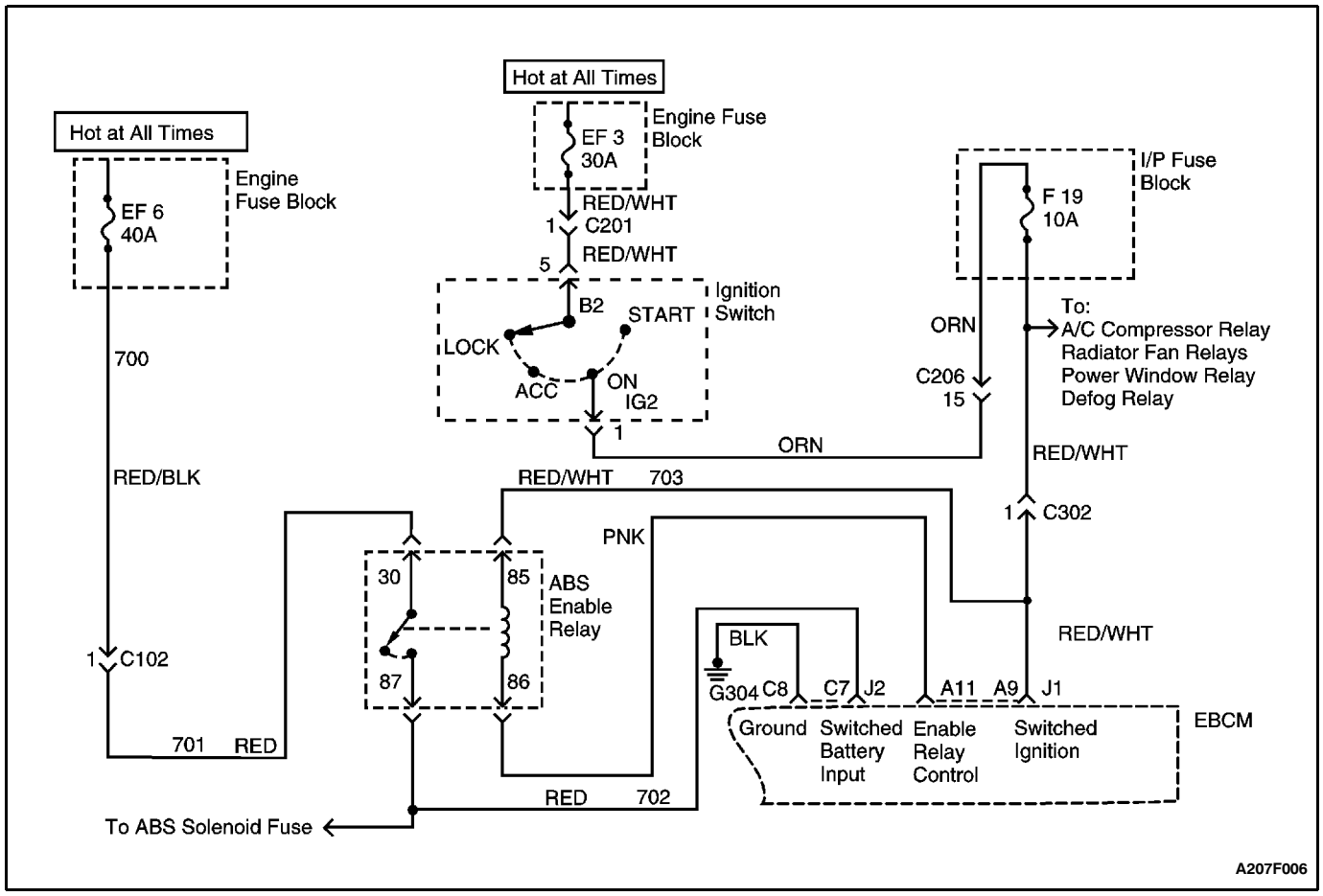


DIAGNOSTIC TROUBLE CODE (DTC) A037
HIGH SYSTEM VOLTAGE

Circuit Description

This DTC is designed to detect high vehicle voltage levels prior to any required motor movement (initialization or ABS operation). If excessive voltage exists, demagnetization of the motor magnets may occur, which would eventually affect or eliminate ABS performance.

Diagnosis

The system checks whether the switched battery voltage level is greater than 17 volts for 720 milliseconds.

Cause

- **The vehicle charging system is not functioning well.**

Fail Action

The ABS is deactivated to prevent damage to the EBCM motor circuit. The ABS warning lamp is turned on.

Test Description

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

1. **This step checks the voltage level being received by the EBCM.**
2. **This step indicates whether the high voltage condition is caused by a malfunctioning charging system or by the EBCM.**

Diagnostic Aids

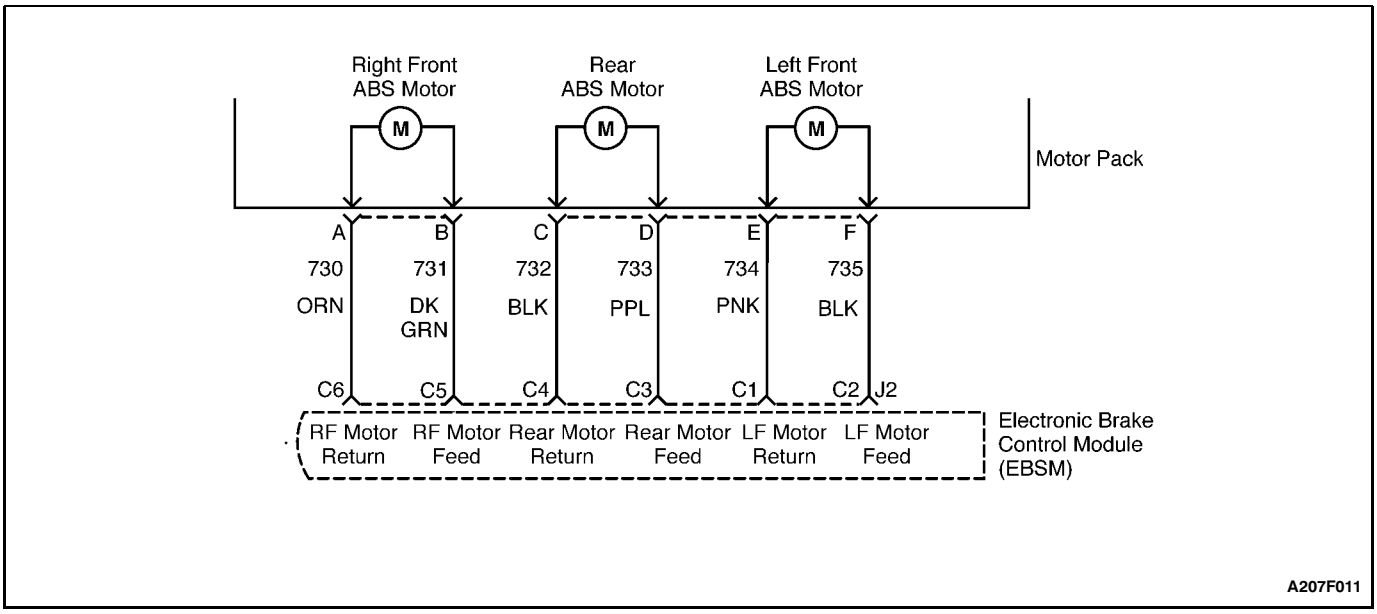
An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

The frequency of the malfunction can be checked by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

DTC A037 - High System Voltage

Step	Action	Value(s)	Yes	No
1	1. Start the engine. 2. Select "Data List" on the scan tool and monitor the system voltage. Is the system voltage less than the specified value?	16 v	Go to "Diagnostic Aids"	Go to Step 2
2	Connect a DVM between terminal 2 of the ABS enable relay harness connector and ground by back-probing. (This is a large red wire on the side of the connector housing with a ridge running along the side from the wire entry end to the relay. Is the voltage less than the specified value?	16 v	Go to Step 3	Go to Section 1E, Engine Electrical
3	Replace the EBCM and recheck. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A038
LEFT FRONT ESB WILL NOT HOLD MOTOR

Circuit Description

This DTC is designed to detect a slipping left front expansion spring brake (ESB). During initialization and braking, the left front motor is rehomed. If the ESB slips, the motor/piston will move. During the next ignition ON initialization, a rehome of the motor verifies that the motor/piston remained at the home position. If motor movement is detected, the ESB must be slipping.

Diagnosis

This test checks to see if the modulator is in the home position at ignition ON. If forward motor movement is detected and the modulator piston was expected to be at the home position, this fault is registered. This failure is detected if the motor sense current is less than the stall current (10.7 amps).

Cause(s)

- **There has been a mechanical failure of the ESB.**
- **There is high resistance in the motor.**
- **The motor pack assembly is malfunctioning.**
- **The piston is sticking and not returning to the home position.**

Fail Action

This is a critical operational fault as the driver might backdrive the motor when applying the brake, causing the brake pedal to drop. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

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

1. **This step checks the left front ESB. A broken or defective ESB would result in the left front piston's being backdriven by hydraulic pressure, and pedal movement would result.**
3. **This test checks for high resistance in the left front motor feed circuit.**
4. **This test checks for high resistance in the left front motor return circuit.**
5. **This test checks for high resistance in the left front motor.**
6. **This test determines if the fault is due to poor terminal contact or corrosion.**
8. **This test determines if the fault is due to a faulty EBCM.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks, binds, or slips.

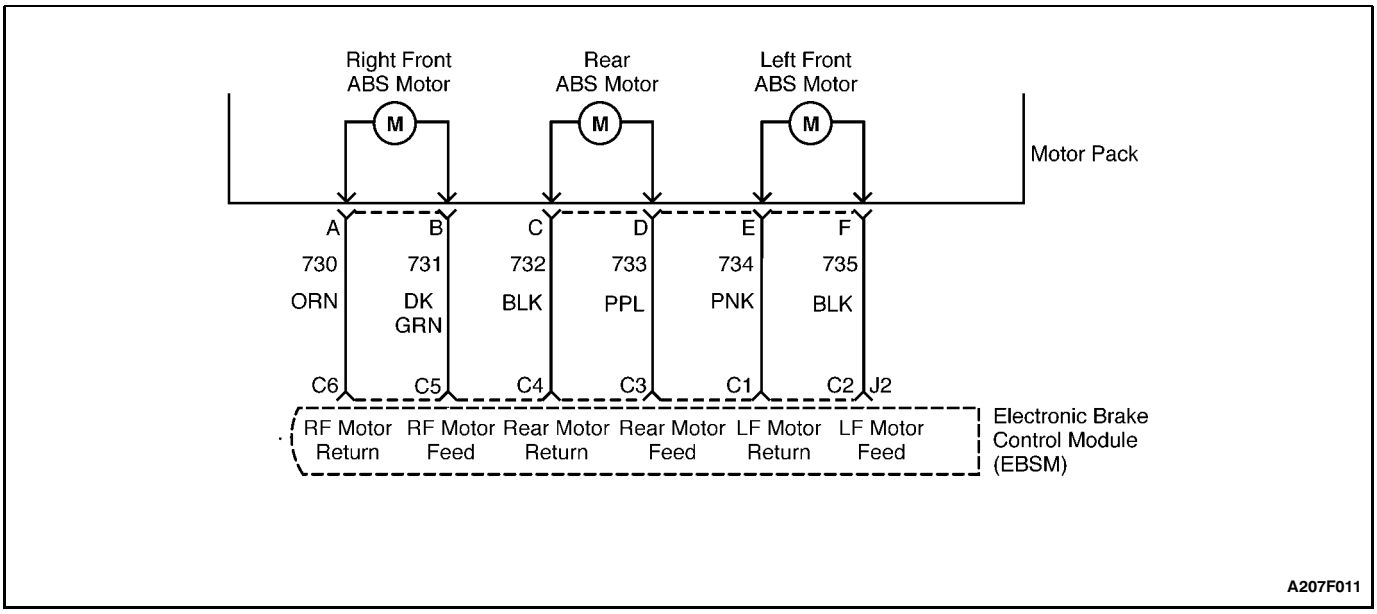
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Use the static modulator test function of the scan tool to locate an intermittent malfunction associated with the ESB.

DTC A038 - Left Front ESB Will Not Hold Motor

Step	Action	Value(s)	Yes	No
1	Inspect the motor pack harness connector and the EBCM connector J2 for proper wire color and terminal locations. Are all of the connections in good condition?	-	Go to Step 2	Go to Step 10
2	1. Turn the ignition switch to ON. 2. Deplete the vacuum reserve. 3. Select "ABS Tests" on the scan tool. 4. Use manual control to select "Left Front Motor Apply" and apply the motor. 5. Wait 5 seconds, then apply firm pressure on the brake pedal. Did the brake pedal fall?	-	Go to Step 11	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the motor pack connector and the EBCM connector J2. 3. Use a digital voltmeter (DVM) to measure the resistance between motor pack harness connector terminal F and the EBCM harness connector J2, terminal C2. Is the resistance less than the specified value?	1.5 W	Go to Step 4	Go to Step 12
4	Use a DVM to measure the resistance between the motor pack harness connector terminal E and the EBCM harness connector J2, terminal C1. Is the resistance less than the specified value?	1.5 W	Go to Step 5	Go to Step 13
5	Use a DVM to measure the resistance of the motor pack between terminal E and terminal F. Is the resistance less than the specified value?	1.5 W	Go to Step 6	Go to Step 11
6	Inspect the motor pack harness connector and the EBCM harness connector J2 for poor terminal contact or corrosion. Do any terminals exhibit poor contact or evidence of corrosion?	-	Go to Step 7	Go to Step 8
7	Replace the terminals that exhibit poor terminal contact or evidence of corrosion. Is the repair complete?	-	System OK	-
8	1. Reconnect all of the connectors. 2. Drive the vehicle for two drive cycles. Does DTC A038 reset?	-	Go to Step 9	Go to "Diagnostic Aids"
9	Replace the EBCM. Is the repair complete?	-	System OK	-
10	Repair any bad connections. Is the repair complete?	-	System OK	-
11	Replace the motor pack. Is the repair complete?	-	System OK	-
12	Repair the high resistance in circuit BLK. Is the repair complete?	-	System OK	-
13	Repair the high resistance in circuit PNK. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A041
RIGHT FRONT ESB WILL NOT HOLD MOTOR

Circuit Description

This DTC is designed to detect a slipping right front expansion spring brake (ESB). During initialization and braking, the right front motor is rehomed. If the ESB slips, the motor/piston will move. During the next ignition ON initialization, a rehome of the motor verifies that the motor/piston remained at the home position. If motor movement is detected, the ESB must be slipping.

Diagnosis

This test checks to see if the modulator is in the home position at ignition ON. If forward motor movement is detected and the modulator piston was expected to be at the home position, this fault is registered. This failure is detected if the motor sense current is less than the stall current (10.7 amps).

Cause(s)

- **There has been a mechanical failure in the ESB.**
- **There is high resistance in the motor.**
- **The motor pack assembly is malfunctioning.**
- **A piston is sticking and not returning to the home position.**

Action Taken

This is a critical operational fault as the driver might backdrive the motor when applying the brake, causing the brake pedal to drop. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

The numbers below refer to steps on the diagnostic table.

1. **This step checks the right front ESB. A broken or defective ESB would result in the right front piston's being backdriven by hydraulic pressure, and pedal movement would result.**
3. **This test checks for high resistance in the right front motor feed circuit.**
4. **This test checks for high resistance in the right front motor return circuit.**
5. **This test checks for high resistance in the right front motor.**
6. **This test determines if the fault is due to poor terminal contact or corrosion.**
8. **This test determines if the fault is due to a faulty EBCM.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks, binds, or slips.

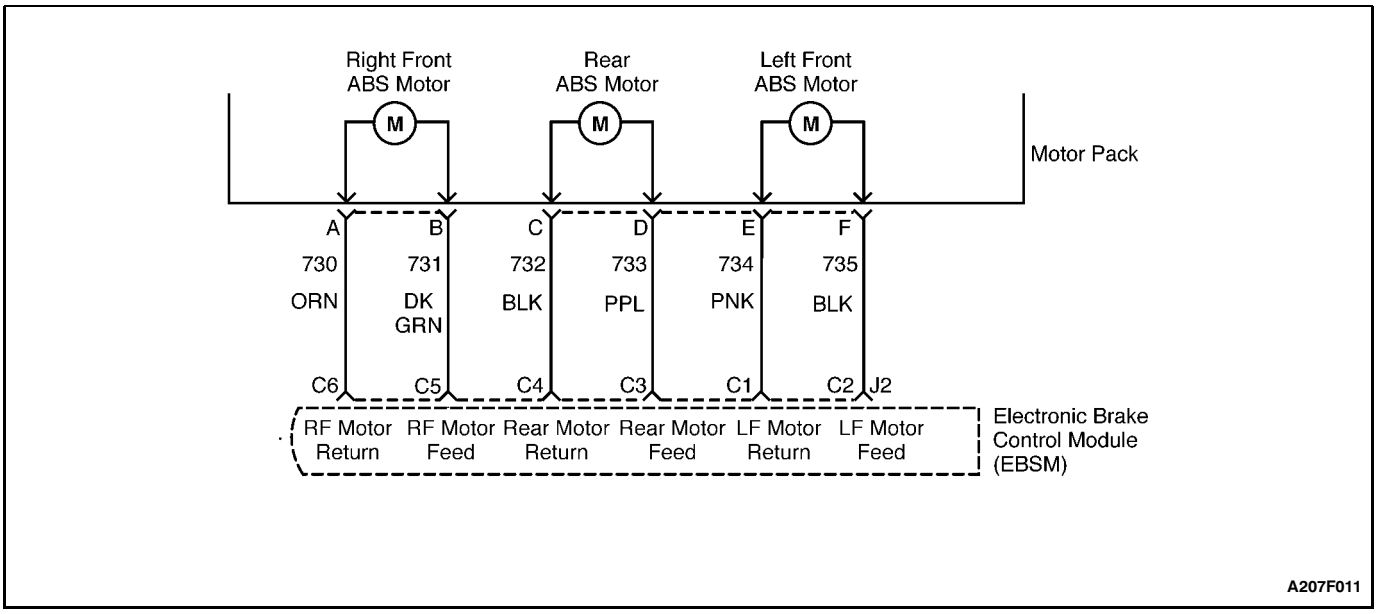
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Use the static modulator test function of the scan tool to locate an intermittent malfunction associated with the ESB.

DTC A041 - Right Front ESB Will Not Hold Motor

Step	Action	Value(s)	Yes	No
1	Inspect the motor pack harness connector and the EBCM connector J2 for proper wire color and terminal locations. Are all of the connections in good condition?	-	Go to Step 2	Go to Step 10
2	1. Turn the ignition switch to ON. 2. Deplete the vacuum reserve. 3. Select "ABS Tests" on the scan tool. 4. Use manual control to select "Right Front Motor Apply" and apply the motor. 5. Wait 5 seconds, then apply firm pressure on the brake pedal. Did the brake pedal fall?	-	Go to Step 11	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the motor pack connector and the EBCM connector J2. 3. Use a digital voltmeter (DVM) to measure the resistance between the motor pack harness connector terminal B and the EBCM harness connector J2, terminal C5. Is the resistance less than the specified value?	1.5 W	Go to Step 4	Go to Step 12
4	Use a DVM to measure the resistance between the motor pack harness connector terminal A and the EBCM harness connector J2, terminal C6. Is the resistance less than the specified value?	1.5 W	Go to Step 5	Go to Step 13
5	Use a DVM to measure the resistance of the motor pack between terminal A and terminal B. Is the resistance within the specified value?	0.2-1.5 W	Go to Step 6	Go to Step 11
6	Inspect the motor pack harness connector and the EBCM harness connector J2 for poor terminal contact or corrosion. Do any terminals exhibit poor contact or evidence of corrosion?	-	Go to Step 7	Go to Step 8
7	Replace the terminals that exhibit poor terminal contact or evidence of corrosion. Is the repair complete?	-	System OK	-
8	Reconnect all of the connectors. Drive the vehicle for two drive cycles. Does DTC A041 reset?	-	Go to Step 9	Go to "Diagnostic Aids"
9	Replace the EBCM. Is the repair complete?	-	System OK	-
10	Repair any bad connections. Is the repair complete?	-	System OK	-
11	Replace the motor pack. Is the repair complete?	-	System OK	-
12	Repair the high resistance in circuit DK GRN. Is the repair complete?	-	System OK	-
13	Repair the high resistance in circuit ORN. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A042
REAR AXLE ESB WILL NOT HOLD MOTOR

Circuit Description

This DTC is designed to detect a slipping rear expansion spring brake (ESB). During initialization and braking, the rear motor is rehomed. If the ESB slips, the motor/piston will move. During the next ignition ON initialization, a re-home of the motor verifies that the motor/piston remained at the home position. If motor movement is detected, the ESB must be slipping.

Diagnosis

This test checks to see if the modulator is in the home position at ignition ON. If forward motor movement is detected and the modulator piston was expected to be at the home position, this fault is registered. This failure is detected if the motor sense current is less than the stall current (10.7 amps).

Cause(s)

- **There has been a mechanical failure of the ESB.**
- **There is high resistance in the motor.**
- **The motor pack assembly is malfunctioning.**
- **The piston is sticking and not returning to the home position.**

Fail Action

This is a critical operational fault as the driver might backdrive the motor when applying the brake, causing the brake pedal to drop. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

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

1. **This step checks the rear ESB. A broken or defective ESB would result in the rear piston's being backdriven by hydraulic pressure, and pedal movement would result.**
3. **This test checks for high resistance in the rear motor feed circuit.**
4. **This test checks for high resistance in the rear motor return circuit.**
5. **This test checks for high resistance in the rear motor.**
6. **This test determines if the fault is due to poor terminal contact or corrosion.**
8. **This test determines if the fault is due to a faulty EBCM.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks, binds, or slips.

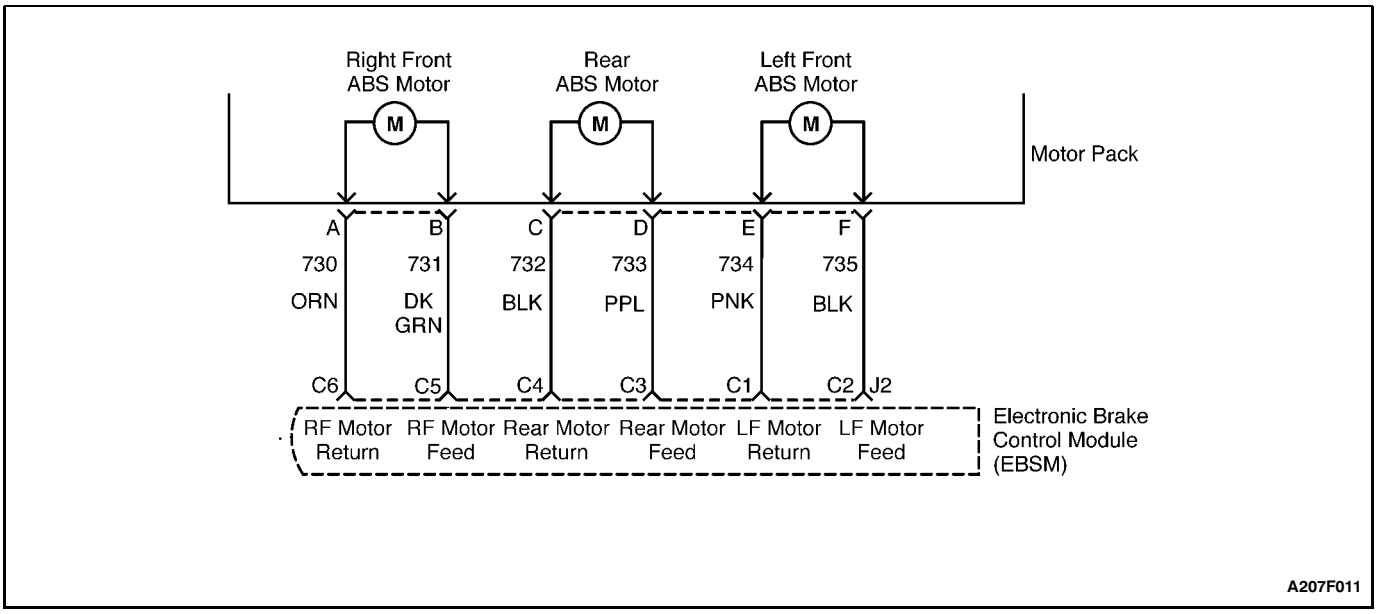
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Use the static modulator test function of the scan tool to locate an intermittent malfunction associated with the ESB.

DTC A042 - Rear Axle Will Not Hold Motor

Step	Action	Value(s)	Yes	No
1	Inspect the motor pack harness connector and the EBCM connector J2 for proper wire color and terminal locations. Are all of the connections in good condition?	-	Go to Step 2	Go to Step 10
2	1. Raise and support the vehicle so that the wheels are approximately 152 mm (6 in.) off the floor. 2. Turn the ignition switch to ON. 3. Deplete the vacuum reserve. 4. Apply firm pressure to the brake pedal and release. 5. Reapply firm pressure to the brake pedal and have an assistant try to spin the rear wheels by hand. Can the assistant spin the rear wheels?	-	Go to Step 11	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the motor pack connector and the EBCM connector J2. 3. Use a digital voltmeter (DVM) to measure the resistance between the motor pack harness connector terminal D and the EBCM harness connector J2, terminal C3. Is the resistance less than the specified value?	1.5 W	Go to Step 4	Go to Step 12
4	Use a DVM to measure the resistance between the motor pack harness connector terminal C and the EBCM harness connector J2, terminal C4. Is the resistance less than the specified value?	1.5 W	Go to Step 5	Go to Step 13
5	Use a DVM to measure the resistance of the motor pack between terminal C and terminal D. Is the resistance within the specified value?	0.2-1.5 W	Go to Step 6	Go to Step 11
6	Inspect the motor pack harness connector and the EBCM harness connector J2 for poor terminal contact or corrosion. Do any terminals exhibit poor contact or evidence of corrosion?	-	Go to Step 7	Go to Step 8
7	Replace the terminals that exhibit poor terminal contact or evidence of corrosion. Is the repair complete?	-	System OK	-
8	1. Reconnect all of the connectors. 2. Drive the vehicle for two drive cycles. Does DTC A042 reset?	-	Go to Step 9	Go to "Diagnostic Aids"
9	Replace the EBCM. Is the repair complete?	-	System OK	-
10	Repair any bad connections. Is the repair complete?	-	System OK	-
11	Replace the motor pack. Is the repair complete?	-	System OK	-
12	Repair the high resistance in circuit PPL. Is the repair complete?	-	System OK	-
13	Repair the high resistance in circuit BLK. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A044
LEFT FRONT CHANNEL WILL NOT MOVE

Circuit Description

This DTC is designed to detect a bound-up ESB, a stuck motor, or a seized hydraulic modulator. When the release is commanded during initialization, the ESB should release the motor, resulting in the sensed current being less than the commanded current (motor is spinning freely). If the motor is not moving, the sensed current will be equal to the stall current.

Diagnosis

The system commands the motors in the reverse and the forward directions. The left front channel fails to move if the motor sense current is always greater than 7 amps.

Cause(s)

- **The gears are frozen.**
- **A nut failed.**
- **The shaft is binding.**
- **There has been an ESB mechanical failure (the ESB does not release the motor).**
- **The motor pack assembly is malfunctioning.**
- **The piston is sticking or at the bottom of the bore.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

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

2. **This step checks for proper motor movement during apply and release commands from the scan tool.**
3. **This step verifies that the motor can actually apply when commanded.**
4. **This step compares the EBCM command current to the motor feedback current.**
5. **This test determines if the malfunction is caused by a defective EBCM or by a short circuit.**
6. **This step checks for proper hydraulic modulator gear and piston movement.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics" earlier in this section. DTC A044 may set after modulator disassembly if the modulator pistons are positioned at the bottom of their bore.

DTC A044 - Left Front Channel Will Not Move

Step	Action	Value(s)	Yes	No
1	Visually inspect the motor pack harness connector and the EBCM harness connector J2 for proper wire color/connector cavity combination. Are the proper wires located in the proper connector cavities?	-	Go to Step 2	Go to Step 7
2	1. Turn the ignition switch to ON. 2. Deplete the vacuum reserve. 3. Select "Manual Control" from the scan tool ABS tests. 4. Select "Left Front Motor Apply" and apply the motor. 5. Apply firm pressure to the brake pedal. 6. Select "Left Front Motor Release" and release the motor. Did the brake pedal fall?	-	Go to Step 3	Go to Step 4
3	1. Maintain firm pressure on the brake pedal. 2. Select "Left Front Motor Apply" and apply the motor. Did the brake pedal rise?	-	Go to "Diagnostic Aids"	Go to Step 4
4	1. Remove your foot from the brake pedal. 2. Select "Left Front Motor Apply" and apply the motor while carefully observing the commanded current and the feedback current on the scan tool. Is the feedback current higher than the commanded current?	-	Go to Step 5	Go to Step 6
5	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J2 and the motor pack connector. 3. Use a DVM to measure the resistance between terminal C1 and terminal C2 of the EBCM harness connector J2. Is the resistance value as specified?	R	Go to Step 8	Go to Step 9
6	1. Using the scan tool ABS tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly from the vehicle. 4. Separate the motor pack from the hydraulic modulator. 5. Grasp and attempt to move the left front hydraulic modulator gear. Can the gear be rotated at least eight full turns lock to lock?	-	Go to Step 10	Go to Step 11
7	Repair any bad connections. Is the repair complete?	-	System OK	-
8	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A044 - Left Front Channel Will Not Move (Cont'd)

Step	Action	Value(s)	Yes	No
9	Repair the short between circuit BLK and circuit PNK. Is the repair complete?	-	System OK	-
10	Replace the motor pack Is the repair complete?	-	System OK	-
11	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

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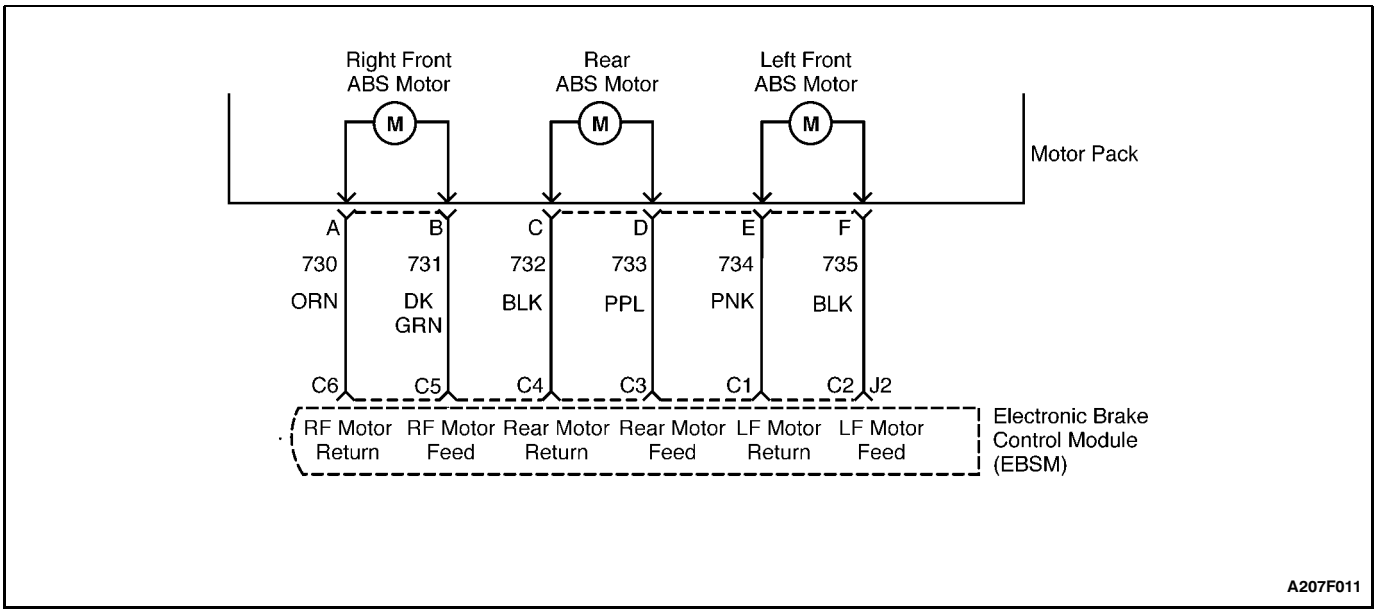

DIAGNOSTIC TROUBLE CODE (DTC) A045
RIGHT FRONT CHANNEL WILL NOT MOVE

Circuit Description

This DTC is designed to detect a bound-up ESB, a stuck motor, or a seized hydraulic modulator. When the release is commanded during initialization, the ESB should release the motor, resulting in the sensed current being less than the commanded current (motor is spinning freely). If the motor is not moving, the sensed current will be equal to the stall current.

Diagnosis

The system commands the motors in the reverse and the forward directions. The right front channel fails to move if the motor sense current is always greater than 7 amps.

Cause(s)

- **The gears are frozen.**
- **A nut failed.**
- **The shaft is binding.**
- **An ESB mechanical failure (the ESB does not release the motor).**
- **The motor pack assembly is bad.**
- **The piston is sticking or at the bottom of the bore.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

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

2. **This step checks for proper motor movement during apply and release commands from the scan tool.**
3. **This step verifies that the motor can actually apply when commanded.**
4. **This step compares the EBCM command current to the motor feedback current.**
5. **This test determines if the malfunction is caused by a defective EBCM or by a short circuit.**
6. **This step checks for proper hydraulic modulator gear and piston movement.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics." DTC A045 may set after modulator disassembly if the modulator pistons are positioned at the bottom of their bore.

DTC A045 - Right Front Channel Will Not Move

Step	Action	Value(s)	Yes	No
1	Visually inspect the motor pack harness connector and the EBCM harness connector J2 for proper wire color/connector cavity combination. Are the proper wires located in the proper connector cavities?	-	Go to Step 2	Go to Step 7
2	1. Turn the ignition switch to ON. 2. Deplete the vacuum reserve. 3. Select "Manual Control" from the scan tool ABS tests. 4. Select "Right Front Motor Apply" and apply the motor. 5. Apply firm pressure to the brake pedal. 6. Select "Right Front Motor Release" and release the motor. Did the brake pedal fall?	-	Go to Step 3	Go to Step 4
3	1. Maintain firm pressure on the brake pedal. 2. Select "Right Front Motor Apply" and apply the motor. Did the brake pedal rise?	-	Go to "Diagnostic Aids"	Go to Step 4
4	1. Remove your foot from the brake pedal. 2. Select "Right Front Motor Apply" and apply the motor while carefully observing the commanded current and the feedback current on the scan tool. Is the feedback current higher than the commanded current?	-	Go to Step 5	Go to Step 6
5	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J2 and the motor pack connector. 3. Use a digital voltmeter (DVM) to measure the resistance between terminal C5 and terminal C6 of the EBCM harness connector J2. Is the resistance value as specified?	R	Go to Step 8	Go to Step 9
6	1. Using the scan tool ABS tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly from the vehicle. 4. Separate the motor pack from the hydraulic modulator. 5. Grasp and attempt to move the right front hydraulic modulator gear. Can the gear be rotated at least 8 full turns lock to lock?	-	Go to Step 10	Go to Step 11
7	Repair any bad connections. Is the repair complete?	-	System OK	-
8	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A045 - Right Front Channel Will Not Move (Cont'd)

Step	Action	Value(s)	Yes	No
9	Repair the short between circuit DK GRN and circuit ORN. Is the repair complete?	-	System OK	-
10	Replace the motor pack Is the repair complete?	-	System OK	-
11	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

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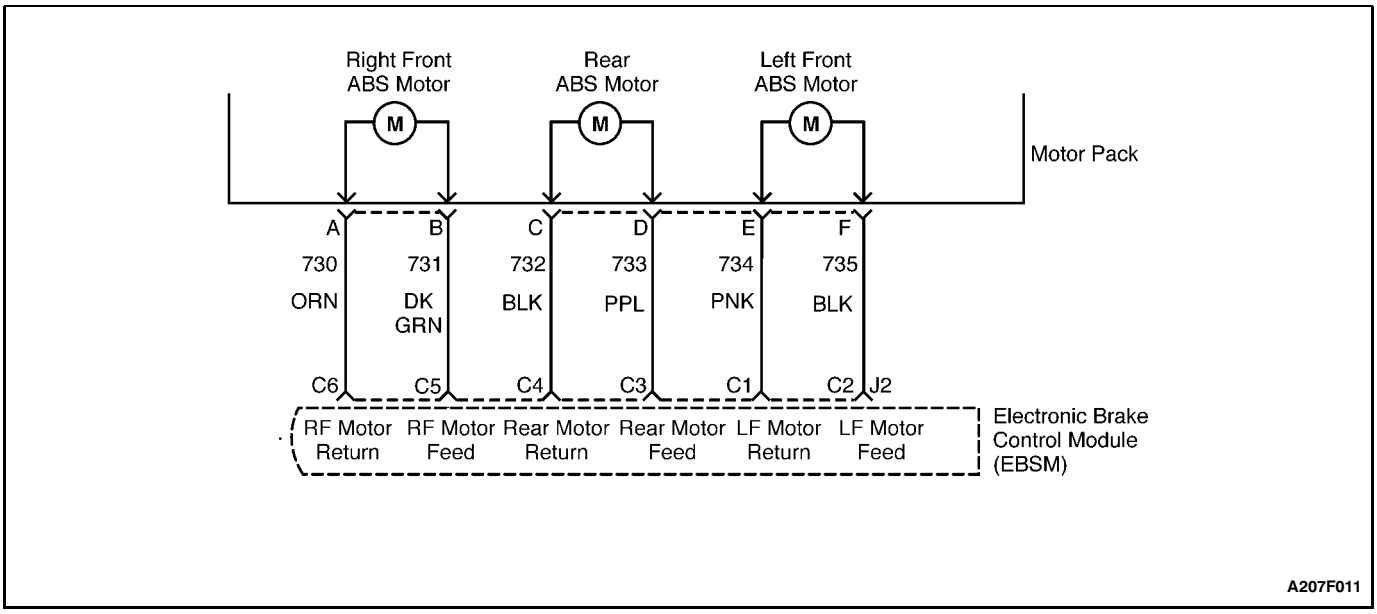

DIAGNOSTIC TROUBLE CODE (DTC) A046 REAR AXLE CHANNEL WILL NOT MOVE

Circuit Description

This DTC is designed to detect a bound-up ESB, a stuck motor, or a seized hydraulic modulator. When the release is commanded during initialization, the ESB should release the motor, resulting in the sensed current being less than the commanded current (motor is spinning freely). If the motor is not moving, the sensed current will be equal to the stall current.

Diagnosis

The system commands the motors in the reverse and the forward directions. The rear axle channel fails to move if the motor sense current is always greater than 7 amps.

Cause(s)

- **The gears are frozen.**
- **A nut failed.**
- **The shaft is binding.**
- **An ESB mechanical failure (the ESB does not release the motor).**
- **The motor pack assembly is bad.**
- **The piston is sticking or at the bottom of the bore.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on since this failure could cause degradation of the base brakes.

Test Description

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

2. **This step checks for proper motor movement during apply and release commands from the scan tool.**
3. **This step verifies that the motor can actually release when commanded.**
4. **This step compares the EBCM command current to the motor feedback current.**
5. **This test determines if the malfunction is caused by a defective EBCM or by a short circuit.**
6. **This step checks for proper hydraulic modulator gear and piston movement.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics." DTC A046 may set after modulator disassembly if the modulator pistons are positioned at the bottom of their bore.

Depending on the frequency of the malfunction, a physical inspection of the mechanical parts suspected may be necessary.

DTC A046 - Rear Axle Channel Will Not Move

Step	Action	Value(s)	Yes	No
1	Visually inspect the motor pack harness connector and the EBCM harness connector J2 for proper wire color/connector cavity combination. Are the proper wires located in the proper connector cavities?	-	Go to Step 2	Go to Step 7
2	1. Raise and support the vehicle so that the rear wheels are approximately 152 mm (6 in.) off the floor. 2. Turn the ignition switch to ON. 3. Deplete the vacuum reserve. 4. Apply firm pressure to the brake pedal. 5. Select "Manual Control" from the scan tool ABS tests. 6. Select "Rear Motor Apply" and apply the motor. 7. Have an assistant try to spin the rear wheels by hand. Can the assistant spin the rear wheels?	-	Go to Step 4	Go to Step 3
3	1. Maintain firm pressure on the brake pedal. 2. Select "Rear Motor Release" and release the motor. 3. Have an assistant try to spin the rear wheels by hand. Can the assistant spin the rear wheels?	-	Go to "Diagnostic Aids"	Go to Step 4
4	1. Remove your foot from the brake pedal. 2. Select "Right Front Motor Apply" and apply the motor while carefully observing the commanded current and the feedback current on the scan tool. Is the feedback current higher than the commanded current?	-	Go to Step 5	Go to Step 6
5	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J2 and the motor pack connector. 3. Use a digital voltmeter (DVM) to measure the resistance between terminal C4 and terminal C3 of the EBCM harness connector J2. Is the resistance value as specified?	R	Go to Step 8	Go to Step 9
6	1. Using the scan tool ABS tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly from the vehicle. 4. Separate the motor pack from the hydraulic modulator. 5. Grasp and attempt to move the middle gear on the hydraulic modulator. Can the gear be rotated at least four full turns lock to lock?	-	Go to Step 10	Go to Step 11
7	Repair any bad connections. Is the repair complete?	-	System OK	-
8	Replace the EBCM. Is the repair complete?	-	System OK	-

DTC A046 - Rear Axle Channel Will Not Move (Cont'd)

Step	Action	Value(s)	Yes	No
9	Repair the short between circuit PPL and circuit BLK. Is the repair complete?	-	System OK	-
10	Replace the motor pack Is the repair complete?	-	System OK	-
11	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

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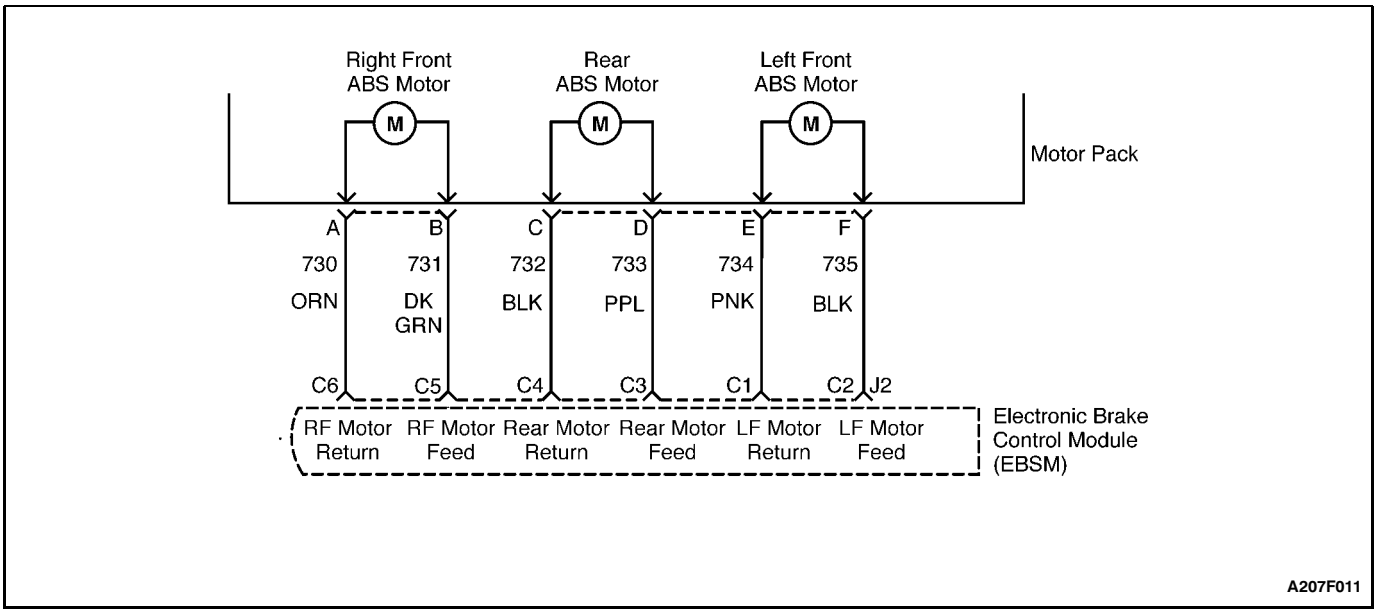


DIAGNOSTIC TROUBLE CODE (DTC) A047
LEFT FRONT MOTOR FREE SPINS

Circuit Description

This DTC is designed to detect a stripped nut or gear assembly during initialization. During the homing sequence, the piston should reach the top of the bore, resulting in a stalled motor. If this does not occur, the motor must be spinning with little or no resistance. This indicates a nut/screw or gear malfunction.

Diagnosis

The system monitors the time in which the left front motor is commanded in the forward direction. If this time duration exceeds the modulator total travel time, the motor is spinning freely. The motor is considered moving if the sense current is less than 10.7 amps.

Cause(s)

- **The gear, the nut, or the shaft is stripped.**
- **The gears or the shaft is dislocated.**
- **The motor pack assembly is faulty.**
- **There is a high resistance or an open circuit in the motor during ABS or initialization.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

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

1. **This step checks to see if the corresponding open ABS motor DTC is also set.**
2. **This step verifies that the ABS motor was actually applied as commanded by observing the feedback current.**
3. **This step verifies that the ABS motor can release.**
4. **This step verifies that the ABS motor can be applied by observing the pedal movement.**
5. **This test checks for high resistance in the left front ABS motor LOW circuit.**
7. **This test checks for high resistance in the left front ABS motor HIGH circuit.**
9. **This test checks for proper resistance of the left front ABS motor winding.**
12. **This step checks for a stripped gear on the hydraulic modulator.**

Notice: Be careful not to damage the gear set.

14. **This test verifies that the left front ABS motor can be applied.**
15. **This verifies that the hydraulic modulator is functioning properly.**
17. **This ensures that the malfunction was not due to a poor terminal contact.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks, binds, or slips.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

If the DTC fails only once and DTC A056 also fails, refer to the table for DTC A056. If intermittent and enhanced diagnostics show this DTC fails during ABS operation, refer to the table for DTC A056.

Depending on the frequency of the malfunction, it may be necessary to perform a physical inspection of the mechanical parts suspected.

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

DTC A047 - Left Front Motor Free Spins

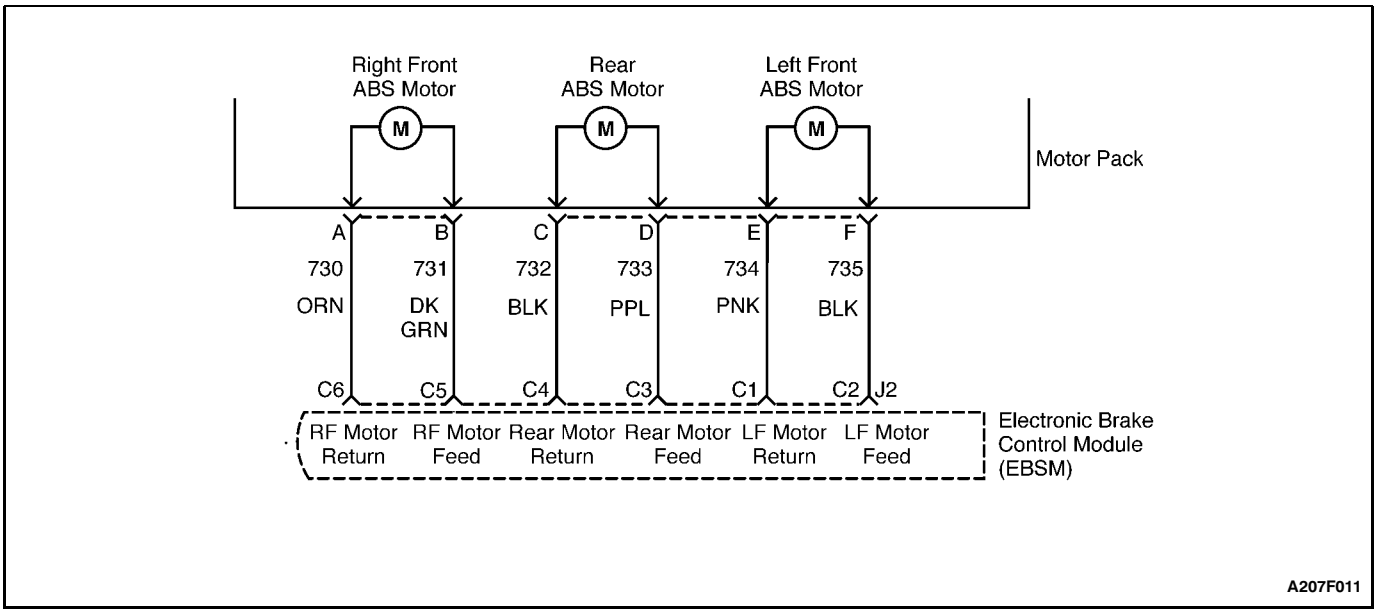
Step	Action	Value(s)	Yes	No
1	Check the scan tool for additional DTC codes. Is DTC A056 also currently set?	-	Go to DTC A056 Table	Go to Step 2
2	1. Turn the ignition switch to ON (engine OFF). 2. Pump the brake pedal until it is firm to deplete the vacuum reserve. 3. Select "Manual Control" from the scan tool ABS tests. 4. Select "Left Front ABS Motor Apply." 5. Apply the left front motor while carefully observing the command current and the feedback current on the scan tool. Are both the command and feedback current 10 amps?	-	Go to Step 3	Go to Step 5
3	1. Apply firm pressure to the brake pedal. 2. Select "Left Front ABS Motor Release" on the scan tool. 3. Release the left front motor. Does the brake pedal fall and are both the command and the feedback current 6 amps?	-	Go to Step 4	Go to Step 5
4	1. Maintain firm pressure on brake pedal. 2. Select "Left Front ABS Motor Apply" on the scan tool. 3. Apply the left front motor. This moves the piston to the top of its bore. Did the brake pedal rise?	-	Go to "Diagnostic Aids"	Go to Step 5
5	1. Using the scan tool misc. tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Disconnect the motor pack connector. 4. Use a digital voltmeter (DVM) to measure resistance between terminal E of the motor pack harness connector and terminal C1 of the EBCM harness connector J2. Is the resistance less than the specified value?	1.5 W	Go to Step 6	Go to Step 7
6	Repair the high resistance in circuit PNK. Is the repair complete?	-	System OK	-
7	Measure the resistance between the motor pack harness connector terminal F and the EBCM harness connector J2, terminal C2. Is the resistance less than the specified value?	1.5 W	Go to Step 8	Go to Step 9
8	Repair the high resistance in circuit BLK. Is the repair complete?	-	System OK	-
9	Measure the resistance of the motor pack between terminal E and terminal F. Is the resistance less than the specified value?	1.5 W	Go to Step 11	Go to Step 10

DTC A047 - Left Front Motor Free Spins (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ABS motor pack. Is the repair complete?	-	System OK	-
11	1. Remove the hydraulic modulator/motor pack assembly from the vehicle. 2. Remove the gear cover from the hydraulic modulator/motor pack assembly. 3. Check for a stripped gear on the ABS motor pack. The ABS motor pack is the unit with the three small gears. The left front gear is the gear nearest to the motor pack electrical connector. Is the ABS motor pack gear stripped?	-	Go to Step 10	Go to Step 12
12	Check for a stripped gear on the hydraulic modulator. The modulator is the unit with three large gears; the left front gear is the gear nearest to the motor pack electrical connector. Is the larger gear stripped?	-	Go to Step 13	Go to Step 14
13	Replace the hydraulic modulator gear. Is the repair complete?	-	System OK	-
14	1. Reconnect all of the electrical connectors. 2. Securely position the hydraulic modulator assembly onto the vehicle with its cover removed so that you can observe the gear set. 3. Do not allow the hydraulic modulator to move while testing. 4. Turn the ignition switch to ON. 5. Select "Manual Control" from the scan tool ABS tests. 6. Select "Left Front Motor Apply." 7. Apply the left front motor while observing the gear set nearest to the ABS motor electrical connector. 8. Select "Left Front Motor Release." 9. Release the left front motor while observing the gear set. 10. Again, select "Left Front Motor Apply" and apply the motor. Did the gear set move in both directions for at least one revolution?	-	Go to Step 15	Go to Step 10
15	1. Use the scan tool to perform the gear tension relief test. 2. Turn the ignition to OFF. 3. Separate the ABS motor pack from the hydraulic modulator. 4. Grasp the gear on the hydraulic modulator (the unit with the three large gears) and rotate the gear by hand. Can the gear be rotated more than eight full turns lock to lock?	-	Go to Step 17	Go to Step 16
16	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

DTC A047 - Left Front Motor Free Spins (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Inspect all of the connectors and the terminals for poor terminal contact and evidence of corrosion. 2. Replace all terminals that show signs of poor terminal contact or corrosion. 3. Reinstall the hydraulic modulator/motor pack assembly into the vehicle. 4. Reconnect all of the electrical connectors. 5. Start the engine with your foot off of the brake. 6. Allow the engine to run for at least 10 seconds. 7. Repeat the ignition cycle two more times. Did DTC A047 set in the last three ignition cycles?	-	Go to Step 18	Go to "Diagnostic Aids"
18	Replace the EBCM. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A048
RIGHT FRONT MOTOR FREE SPINS

Circuit Description

This DTC is designed to detect a stripped nut or gear assembly during initialization. During the homing sequence, the piston should reach the top of the bore, resulting in a stalled motor. If this does not occur, the motor must be spinning with little or no resistance. This indicates a nut/screw or gear malfunction.

Diagnosis

The system monitors the time in which the right front motor is commanded in the forward direction. If this time duration exceeds the modulator total travel time, the motor is spinning freely. The motor is considered moving if the sense current is less than 10.7 amps.

Cause(s)

- **The gear, the nut, or the shaft is stripped.**
- **The gears or the shaft is dislocated.**
- **The motor pack assembly is faulty.**
- **There is a high resistance or an open circuit in the motor during ABS or initialization.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

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

1. **This step checks to see if the corresponding open ABS motor DTC is also set.**
2. **This step verifies that the ABS motor was actually applied as commanded by observing the feedback current.**
3. **This step verifies that the ABS motor can release.**
4. **This step verifies that the ABS motor can be applied by observing the pedal movement.**
5. **This test checks for high resistance in the right front ABS motor HIGH circuit.**
7. **This test checks for high resistance in the right front ABS motor LOW circuit**
9. **This test checks for proper resistance of the right front ABS motor winding.**
12. **This step checks for a stripped gear on the hydraulic modulator.**

Notice: Be careful not to damage the gear set.

14. **This test verifies that the right front ABS motor can be applied.**
15. **This verifies that the hydraulic modulator is functioning properly.**
17. **This ensures that the malfunction was not due to a poor terminal contact.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks, binds, or slips.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

If the DTC fails only once and DTC A061 also fails, refer to the table for DTC A061. If intermittent and enhanced diagnostics show this DTC fails during ABS operation, refer to the table for DTC A061.

Depending on the frequency of the malfunction, it may be necessary to perform a physical inspection of the mechanical parts suspected.

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

DTC A048 - Right Front Motor Free Spins

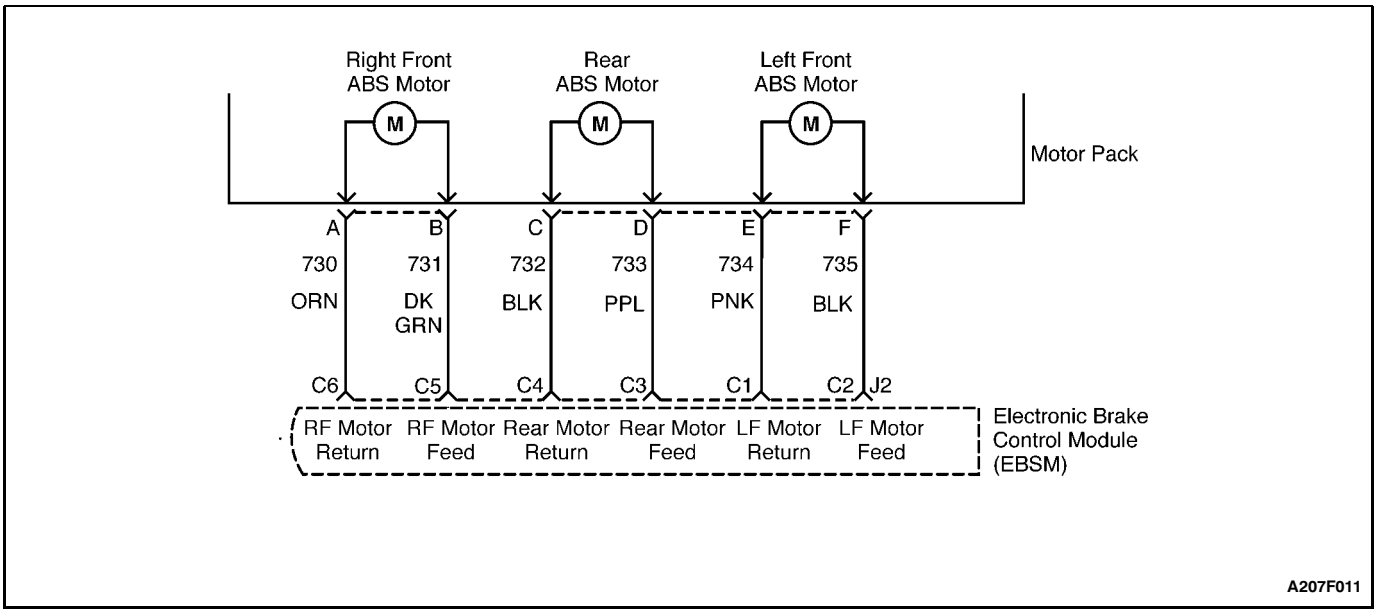
Step	Action	Value(s)	Yes	No
1	Check the scan tool for additional DTC codes. Is DTC A061 also currently set?	-	Go to DTC A061 Table	Go to Step 2
2	1. Turn the ignition switch to ON (engine OFF). 2. Pump the brake pedal until it is firm to deplete the vacuum reserve. 3. Select "Manual Control" from the scan tool ABS tests. 4. Select "Right Front ABS Motor Apply." 5. Apply the right front motor while carefully observing the command current and the feedback current on the scan tool. Are both the command and feedback current 10 amps?	-	Go to Step 3	Go to Step 5
3	1. Apply firm pressure to the brake pedal. 2. Select "Right Front ABS Motor Release" on the scan tool. 3. Release the right front motor. Does the brake pedal fall and are both the command and the feedback current 6 amps?	-	Go to Step 4	Go to Step 5
4	1. Maintain firm pressure on brake pedal. 2. Select "Right Front ABS Motor Apply" on the scan tool. 3. Apply the right front motor. This moves the piston to the top of its bore. Does the brake pedal rise?	-	Go To "Diagnostic Aids"	Go to Step 5
5	1. Using the scan tool misc. tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Disconnect the motor pack connector. 4. Use a digital voltmeter (DVM) to measure the resistance between terminal B of the motor pack harness connector and terminal C5 of the EBCM harness connector J2. Is the resistance less than the specified value?	1.5 W	Go to Step 6	Go to Step 7
6	Repair the high resistance in circuit DK GRN. Is the repair complete?	-	System OK	-
7	Measure the resistance between the motor pack harness connector terminal A and the EBCM harness connector J2, terminal C6. Is the resistance less than the specified value?	1.5 W	Go to Step 8	Go to Step 9
8	Repair the high resistance in circuit ORN. Is the repair complete?	-	System OK	-
9	Measure the resistance of the motor pack between terminal A and terminal B. Is the resistance less than the specified value?	1.5 W	Go to Step 11	Go to Step 10

DTC A048 - Right Front Motor Free Spins (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ABS motor pack. Is the repair complete?	-	System OK	-
11	1. Remove the hydraulic modulator/motor pack assembly from the vehicle. 2. Remove the gear cover from the hydraulic modulator/motor pack assembly. 3. Check for a stripped gear on the ABS motor pack. The ABS motor pack is the unit with the three small gears. The right front gear is the gear farthest from the motor pack electrical connector. Is the ABS motor pack gear stripped?	-	Go to Step 10	Go to Step 12
12	Check for a stripped gear on the hydraulic modulator. The modulator is the unit with three large gears; the right front gear is the gear farthest from the motor pack electrical connector. Is the larger gear stripped?	-	Go to Step 13	Go to Step 14
13	Replace the hydraulic modulator gear. Is the repair complete?	-	System OK	-
14	1. Reconnect all of the electrical connectors. 2. Securely position the hydraulic modulator assembly onto the vehicle with its cover removed so that you can observe the gear set. 3. Do not allow the hydraulic modulator to move while testing. 4. Turn the ignition switch to ON. 5. Select "Manual Control" from the scan tool ABS tests. 6. Select "Right Front Motor Apply." 7. Apply the right front motor while observing the gear set farthest from the ABS motor electrical connector. 8. Select "Right Front Motor Release." 9. Release the right front motor while observing the gear set. 10. Again, select "Right Front Motor Apply" and apply the motor. Did the gear set move in both directions for at least one revolution?	-	Go to Step 15	Go to Step 10
15	1. Use the scan tool to perform the gear tension relief test. 2. Turn the ignition to OFF. 3. Separate the ABS motor pack from the hydraulic modulator. 4. Grasp the gear on the hydraulic modulator (the unit with the three large gears) and rotate the gear by hand. Can the gear be rotated more than eight full turns lock to lock?	-	Go to Step 17	Go to Step 16
16	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

DTC A048 - Right Front Motor Free Spins (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Inspect all of the connectors and the terminals for poor terminal contact and evidence of corrosion. 2. Replace all terminals that show signs of poor terminal contact or corrosion. 3. Reinstall the hydraulic modulator/motor pack assembly into the vehicle. 4. Reconnect all of the connectors. 5. Start the engine with your foot off of the brake. 6. Allow the engine to run for at least 10 seconds. 7. Repeat the ignition cycle two more times. Did DTC A048 set in the last three ignition cycles?	-	Go to Step 18	Go to "Diagnostic Aids"
18	Replace the EBCM. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A051
REAR MOTOR FREE SPINS

Circuit Description

This DTC is designed to detect a stripped nut or gear assembly during initialization. During the homing sequence, the piston should reach the top of the bore, resulting in a stalled motor. If this does not occur, the motor must be spinning with little or no resistance. This indicates a nut/screw or gear malfunction.

Diagnosis

The system monitors the time in which the rear motor is commanded in the forward direction. If this time duration exceeds the modulator total travel time, the motor is spinning freely. The motor is considered moving if the sense current is less than 10.7 amps.

Cause(s)

- **The gear, a nut, or a shaft is stripped.**
- **The gears or the shaft is dislocated.**
- **The motor pack assembly is faulty.**
- **There is a high resistance or an open circuit in the motor during ABS or initialization.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The brake warning lamp is also turned on since this failure could cause degradation of the base brakes.

Test Description

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

1. **This step checks to see if the corresponding open ABS motor DTC is also set.**
2. **This step verifies that the ABS motor was actually applied as commanded by observing the feedback current.**
3. **This step verifies that the ABS motor can release.**
4. **This step verifies that the ABS motor can be applied by observing the pedal movement.**
5. **This test checks for high resistance in the rear ABS motor HIGH circuit.**
7. **This test checks for high resistance in the rear ABS motor LOW circuit**
9. **This test checks for proper resistance of the rear ABS motor winding.**
12. **This step checks for a stripped gear on the hydraulic modulator.**

Notice: Be careful not to damage the gear set.

14. **This test verifies that the rear ABS motor can be applied.**
15. **This verifies that the hydraulic modulator is functioning properly.**
17. **This ensures that the malfunction was not due to a poor terminal contact.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks, binds, or slips.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

If the DTC fails only once and DTC A064 also fails, refer to the table for DTC A064. If intermittent and enhanced diagnostics show this DTC fails during ABS operation, refer to the table for DTC A064.

Depending on the frequency of the malfunction, it may be necessary to perform a physical inspection of the mechanical parts suspected.

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

DTC A051 - Rear Motor Free Spins

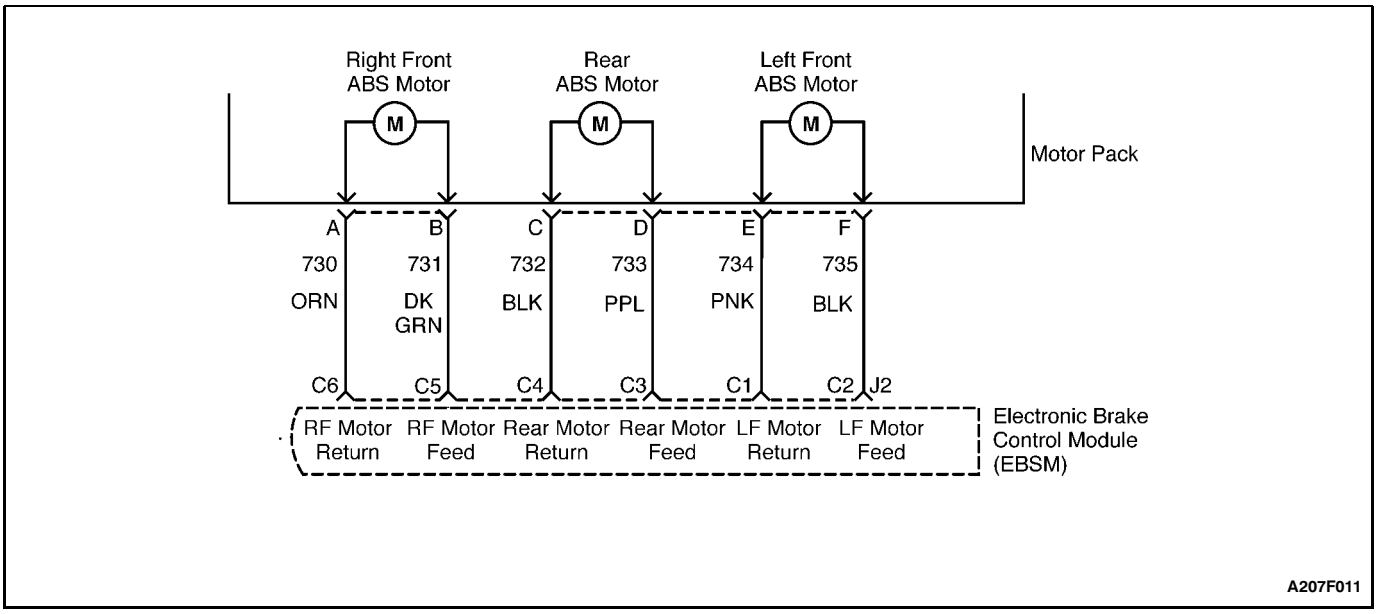
Step	Action	Value(s)	Yes	No
1	Check the scan tool for additional DTC codes. Is DTC A064 also currently set?	-	Go to DTC A064 Table	Go to Step 2
2	1. Turn the ignition switch to ON (engine OFF). 2. Pump the brake pedal until it is firm to deplete the vacuum reserve. 3. Select "Manual Control" from the scan tool ABS tests. 4. Select "Rear ABS Motor Apply." 5. Apply the rear motor while carefully observing the command current and the feedback current on the scan tool. Are both the command and feedback current 10 amps?	-	Go to Step 3	Go to Step 5
3	1. Apply firm pressure to the brake pedal. 2. Select "Rear ABS Motor Release" on the scan tool. 3. Release the rear motor. Does the brake pedal fall and are both the command and feedback current 6 amps?	-	Go to Step 4	Go to Step 5
4	1. Maintain firm pressure on the brake pedal. 2. Select "Rear ABS Motor Apply" on the scan tool. 3. Apply the rear motor. This moves the piston to the top of its bore. Does the brake pedal rise?	-	Go to "Diagnostic Aids"	Go to Step 5
5	1. Using the scan tool misc. tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Disconnect the motor pack connector. 4. Use a digital voltmeter (DVM) to measure the resistance between terminal D of the motor pack harness connector and terminal C3 of the EBCM harness connector J2. Is the resistance less than the specified value?	1.5 W	Go to Step 6	Go to Step 7
6	Repair the high resistance in circuit PPL. Is the repair complete?	-	System OK	-
7	Measure the resistance between the motor pack harness connector terminal C and the EBCM harness connector J2, terminal C4. Is the resistance less than the specified value?	1.5 W	Go to Step 8	Go to Step 9
8	Repair the high resistance in circuit BLK. Is the repair complete?	-	System OK	-

DTC A051 - Rear Motor Free Spins (Cont'd)

Step	Action	Value(s)	Yes	No
9	Measure the resistance of the motor pack between terminal C and terminal D. Is the resistance less than the specified value?	1.5 W	Go to Step 11	Go to Step 10
10	Replace the ABS motor pack. Is the repair complete?	-	System OK	-
11	1. Remove the hydraulic modulator/motor pack assembly from the vehicle. 2. Remove the gear cover from the hydraulic modulator/motor pack assembly. 3. Check for a stripped gear on the ABS motor pack. The ABS motor pack is the unit with the three small gears. The rear gear is the gear in the center of the gear set. Is the ABS motor pack gear stripped?	-	Go to Step 10	Go to Step 12
12	Check for a stripped gear on the hydraulic modulator. The modulator is the unit with three large gears; the rear gear is the gear in the center of the gear set. Is the larger gear stripped?	-	Go to Step 13	Go to Step 14
13	Replace the hydraulic modulator gear. Is the repair complete?	-	System OK	-
14	1. Reconnect all of the electrical connectors. 2. Securely position the hydraulic modulator assembly onto the vehicle with its cover removed so that you can observe the gear set. 3. Do not allow the hydraulic modulator to move while testing. 4. Turn the ignition switch to ON. 5. Select "Manual Control" from the scan tool ABS tests. 6. Select "Rear Motor Apply." 7. Apply the rear motor while observing the gear set in the center of the gear assembly. 8. Select "Rear Motor Release." 9. Release the rear motor while observing the gear set. 10. Again select "Rear Motor Apply" and apply the motor. Did the gear set move in both directions for at least one revolution?	-	Go to Step 15	Go to Step 10
15	1. Use the scan tool to perform the gear tension relief test. 2. Turn the ignition to OFF. 3. Separate the ABS motor pack from the hydraulic modulator. 4. Grasp the gear on the hydraulic modulator (the unit with the three large gears) and rotate the gear by hand. Can the gear be rotated more than four full turns lock to lock?	-	Go to Step 17	Go to Step 16
16	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

DTC A051 - Rear Motor Free Spins (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Inspect all of the connectors and the terminals for poor terminal contact and evidence of corrosion. 2. Replace all terminals that show signs of poor terminal contact or corrosion. 3. Reinstall the hydraulic modulator/motor pack assembly into the vehicle. 4. Reconnect all connectors. 5. Start the engine with your foot off of the brake. 6. Allow the engine to run for at least 10 seconds. 7. Repeat the ignition cycle two more times. Did DTC A051 set in the last three ignition cycles?	-	Go to Step 18	Go to "Diagnostic Aids"
18	Replace the EBCM. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A052 LEFT FRONT CHANNEL IN RELEASE TOO LONG

Circuit Description

This DTC will diagnose a motor that is energized longer than expected. This could occur if a wheel speed sensor is malfunctioning, the motor does not turn, the left front solenoid mechanically fails open, or the motor wires are crossed.

Diagnosis

The system monitors the total time in which release is commanded. If the left front channel is in release for more than 3 seconds, the system will store a failure code.

Cause(s)

- **The left front wheel speed sensor or the wiring shorted together during ABS operation.**
- **The solenoid had a mechanical failure.**
- **The motor pack assembly is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

2. **This step identifies a problem in a wheel speed sensor that may cause the system to be in release too long.**
3. **This step identifies a motor as being failed or wired incorrectly.**
4. **This step checks for a solenoid that may have mechanically failed open.**
6. **If Step 4 has failed, this serves to trace the cause of the hydraulic problem to either the solenoid or the hydraulic modulator.**
11. **This step determines whether a malfunctioning motor pack or hydraulic modulator is the reason for DTC A052 being set.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks or binds.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

DTC A052 may fail if the vehicle is on ice and the steering wheel is turned to lock during braking. Use the scan tool to perform the hydraulic test to ensure that the total brake system is functional.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A052 - Left Front Channel in Release Too Long

Step	Action	Value(s)	Yes	No
1	Check the scan tool for current DTC codes. Are any wheel speed DTCs or DTC A056 currently set?	-	Go to the appropriate DTC table	Go to Step 2
2	Test the vehicle during a steady decelerating condition from 56 km/h (35 mph) to 0 while monitoring all wheel speeds on the scan tool data list. Do any of the wheel speeds indicate erratic or intermittent operation?	-	Go to the "Wheel Speed = 0" table for the affected wheel	Go to Step 3
3	1. Stop the engine and return the ignition switch to ON. 2. Select "Left Front Motor Apply" with the manual control function of the scan tool. 3. Apply the left front motor. 4. Apply firm pressure to the brake pedal. 5. Select "Left Front Motor Release" on the scan tool and release the motor. Does the brake pedal fall?	-	Go to Step 4	Go to Step 9
4	1. Release the brake pedal. 2. Select "Left Front Solenoid Apply" on the scan tool. 3. Energize the left front solenoid. 4. Apply firm pressure to the brake pedal. Does the brake pedal fall?	-	Go to Step 6	Go to Step 5
5	1. Maintain firm pressure on the brake pedal. 2. Use the scan tool to turn off the left front solenoid. Does the brake pedal fall?	-	Go to "Diagnostic Aids"	Go to Step 6
6	Replace the left front solenoid with the right front solenoid and repeat the tests of steps 4 and 5. Does the brake pedal fall in either test?	-	Go to Step 7	Go to Step 8
7	1. Using the scan tool ABS tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly from the vehicle. 4. Separate the motor pack from the hydraulic modulator. 5. Replace the hydraulic modulator. Is the repair complete?	-	System OK	-
8	Replace the solenoid that failed step 4 of this test. Is the repair complete?	-	System OK	-
9	Does the brake pedal rise?	-	Go to Step 10	Go to Step 11
10	Repair the crossed wires to the left front ABS motor circuit. Is the repair complete?	-	System OK	-

DTC A052 - Left Front Channel in Release Too Long (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using the scan tool ABS tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly from the vehicle. 4. Separate the motor pack from the hydraulic modulator. 5. Grasp and attempt to move the left front gear on the hydraulic modulator. Can the gear be moved in either direction by hand?	-	Go to Step 12	Go to Step 13
12	Replace the motor pack. Is the repair complete?	-	System OK	-
13	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

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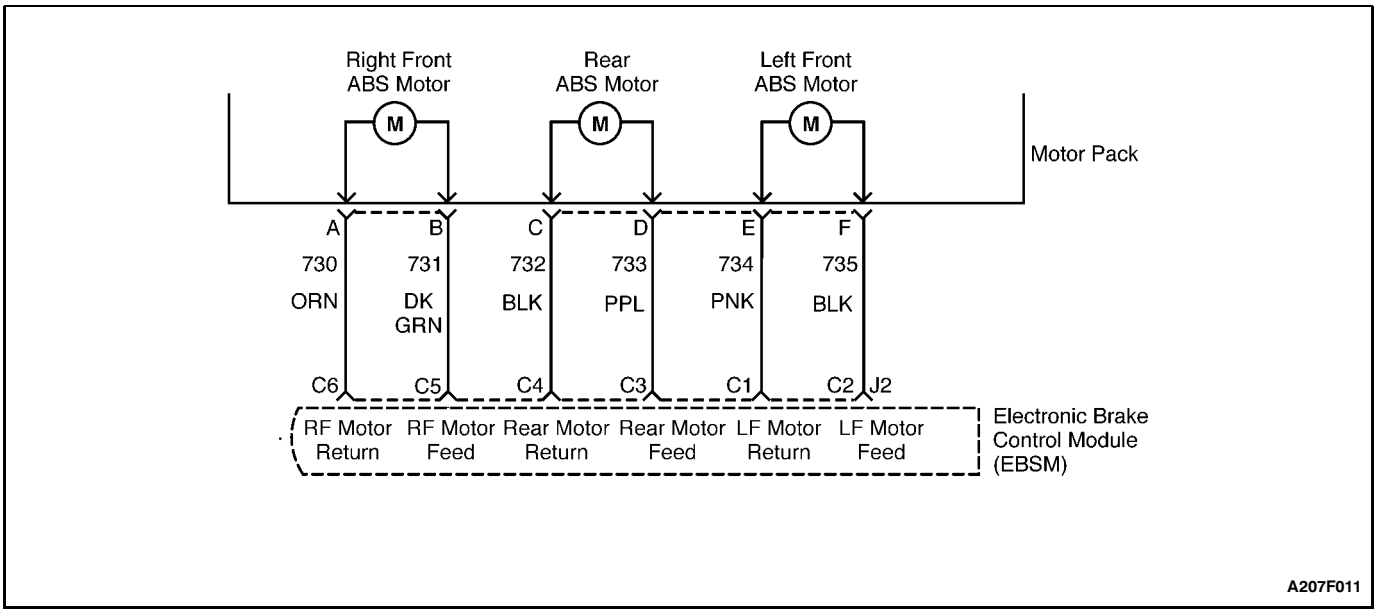

DIAGNOSTIC TROUBLE CODE (DTC) A053 RIGHT FRONT CHANNEL IN RELEASE TOO LONG

Circuit Description

This DTC will diagnose a motor that is energized longer than expected. This could occur if a wheel speed sensor is malfunctioning, the motor does not turn, the right front solenoid mechanically fails open, or the motor wires are crossed.

Diagnosis

The system monitors the total time in which release is commanded. If the right front channel is in release fro more than 3 seconds, the system will store a failure code.

Cause(s)

- **The right front wheel speed sensor or the wiring shorted together during ABS operation.**
- **The solenoid had a mechanical failure.**
- **The motor pack assembly is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

2. **This step identifies a problem in a wheel speed sensor that may cause the system to be in release too long.**
3. **This step identifies a motor as being failed or wired incorrectly.**
4. **This step checks for a solenoid that may have mechanically failed open.**
6. **If Step 4 has failed, this serves to trace the cause of the hydraulic problem to either the solenoid or the hydraulic modulator.**
11. **This step determines whether a malfunctioning motor pack or hydraulic modulator is the reason for DTC A053 being set.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks or binds.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

DTC A053 may fail if the vehicle is on ice and the steering wheel is turned to lock during braking. Use the scan tool to perform the hydraulic test to ensure that the total brake system is functional.

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

Important: Excessive drag or high resistance in the base brake or suspension system must be inspected and corrected before proceeding with DTC analysis.

DTC A053 - Right Front Channel in Release Too Long

Step	Action	Value(s)	Yes	No
1	Check the scan tool for current DTC codes. Are any wheel speed DTCs or DTC A061 currently set?	-	Go to the appropriate DTC table	Go to Step 2
2	Test the vehicle during a steady decelerating condition from 56 km/h (35 mph) to 0 while monitoring all wheel speeds on the scan tool data list. Do any of the wheel speeds indicate erratic or intermittent operation?	-	Go to the "Wheel Speed = 0" table for the affected wheel	Go to Step 3
3	1. Stop the engine and return the ignition switch to ON. 2. Select "Right Front Motor Apply" with the manual control function of the scan tool. 3. Apply the right front motor. 4. Apply firm pressure to the brake pedal. 5. Select "Right Front Motor Release" on the scan tool and release the motor. Does the brake pedal fall?	-	Go to Step 4	Go to Step 9
4	1. Release the brake pedal. 2. Select "Right Front Solenoid Apply" on the scan tool. 3. Energize the right front solenoid. 4. Apply firm pressure to the brake pedal. Does the brake pedal fall?	-	Go to Step 6	Go to Step 5
5	1. Maintain firm pressure on the brake pedal. 2. Use the scan tool to turn off the right front solenoid. Does the brake pedal fall?	-	Go to "Diagnostic Aids"	Go to Step 6
6	Replace the right front solenoid with the right front solenoid and repeat the tests of steps 4 and 5. Does the pedal fall?	-	Go to Step 7	Go to Step 8
7	1. Using the scan tool ABS tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly from the vehicle. 4. Separate the motor pack from the hydraulic modulator. 5. Replace the hydraulic modulator. Is the repair complete?	-	System OK	-
8	Replace the solenoid that failed step 4 of this test. Is the repair complete?	-	System OK	-
9	Does the brake pedal rise?	-	Go to Step 10	Go to Step 11
10	Repair the crossed wires to the right front ABS motor circuit. Is the repair complete?	-	System OK	-

DTC A053 - Right Front Channel in Release Too Long (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using the scan tool ABS tests, perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly from the vehicle. 4. Separate the motor pack from the hydraulic modulator. 5. Grasp and attempt to move the right front gear on the hydraulic modulator. Can the gear moved in either direction by hand?	-	Go to Step 12	Go to Step 13
12	Replace the motor pack. Is the repair complete?	-	System OK	-
13	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.

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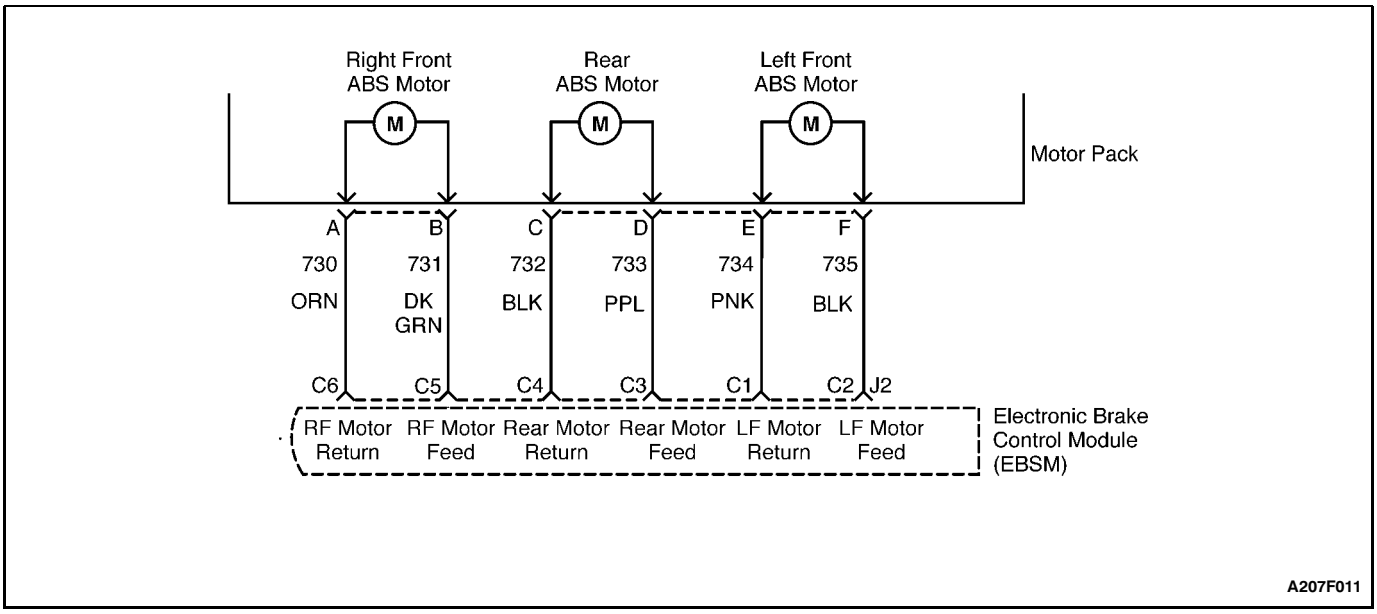


DIAGNOSTIC TROUBLE CODE (DTC) A054 REAR CHANNEL IN RELEASE TOO LONG

Circuit Description

This DTC will diagnose a motor that is energized longer than expected. This could occur if a wheel speed sensor is malfunctioning, the motor does not turn, or the motor wires are crossed.

Diagnosis

The system monitors the total time in which the rear axle release mode is commanded. This test fails under the following conditions:

- **The difference between the reference speed and the maximum rear speed exceeds 11 km/h (7 mph) while the rear channel is in release for more than 3 seconds.**
- **The difference between the reference speed and the maximum rear speed is less than 11 km/h (7 mph) while the rear channel is in release for more than 4 seconds.**

Cause(s)

- **The rear axle wheel speed sensor or the wiring shorted together during ABS operation.**
- **The motor pack assembly is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded to ensure that the motors are in the home position.

Test Description

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

2. **This step identifies a problem in a wheel speed sensor that may cause the system to be in release too long.**
3. **This checks for a wheel that may stick or bind because of a mechanical fault.**
4. **This checks to see if the motor is capable of moving and applying the hydraulic piston for the rear wheels.**
5. **This step ensures that the motor wiring is not crossed.**
6. **This isolates the fault of a "no-apply" situation to either the motor pack or the hydraulic modulator.**

Diagnostic Aids

An "intermittent" malfunction in this DTC may result from a mechanical part of the system that sticks or binds.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics." Use the scan tool to perform the hydraulic test to ensure that the total brake system is functional.

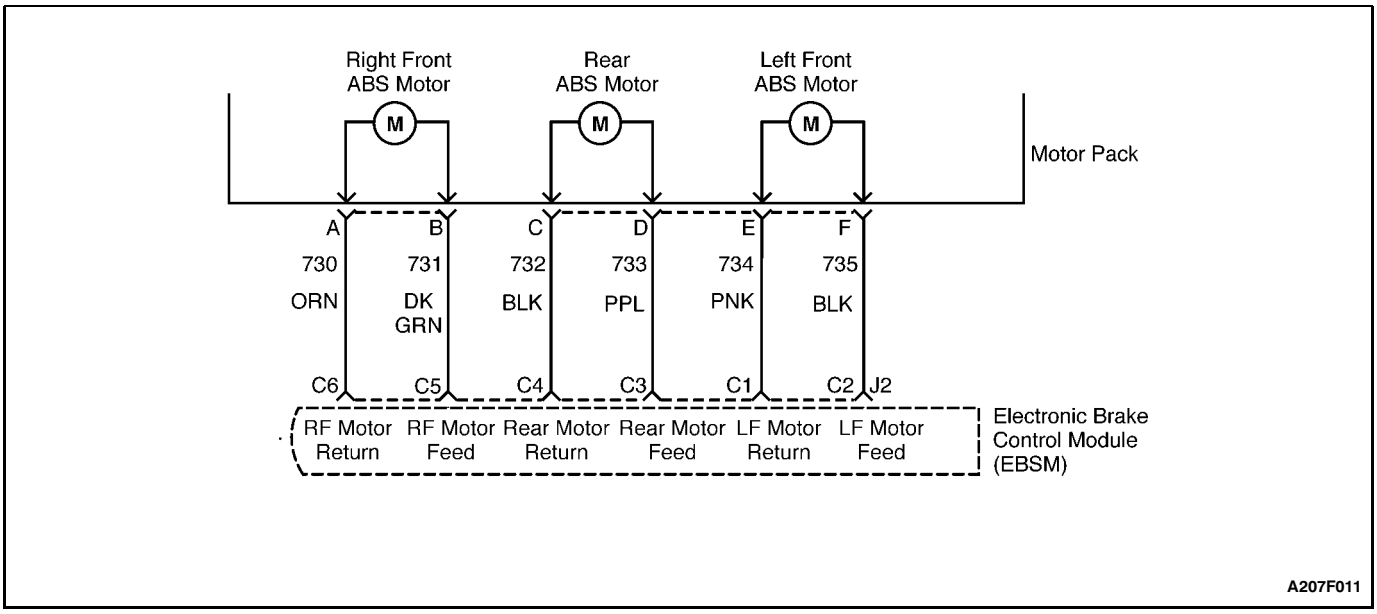
Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

Important: Excessive drag or high resistance in the base brake or suspension system must be inspected and corrected before proceeding with DTC analysis.

DTC A054 - Rear Channel in Release Too Long

Step	Action	Value(s)	Yes	No
1	Check the scan tool for current DTC codes. Are any wheel speed DTCs or DTC A064 currently set?	-	Go to the appropriate DTC table	Go to Step 2
2	Test the vehicle during a steady decelerating condition from 56 km/h (35 mph) to 0 while monitoring all wheel speeds on the scan tool data list. Do any of the wheel speeds indicate erratic or intermittent operation?	-	Go to the "Wheel Speed = 0" table for the affected wheel	Go to Step 3
3	1. Turn ignition switch to LOCK. 2. Raise and support vehicle such that the rear wheels are approximately 152 mm (6 in.) off the floor. 3. Spin both rear wheels and confirm physical condition of base brake system. Can both rear wheels be spun freely by hand?	-	Go to Step 4	Go to Step 9
4	1. Turn ignition switch to ON. 2. Select "Rear Motor Apply" with the manual control function of the scan tool. 3. Apply firm pressure to the brake pedal. 4. Apply the rear motor with the scan tool. 5. Have an assistant try to spin the rear wheels by hand. Can the rear wheels be spun by hand?	-	Go to Step 5	Go to "Diagnostic Aids"
5	1. Maintain firm pressure on the brake pedal. 2. Use the scan tool to release the rear motor. Can the wheels be moved?	-	Go to Step 6	Go to Step 10
6	1. Use the scan tool to perform the gear tension relief test. 2. Turn the ignition switch to LOCK. 3. Remove the hydraulic modulator/motor pack assembly. 4. Separate the motor pack from the hydraulic modulator. 5. Connect the motor pack wiring. 6. Turn the ignition switch to ON. 7. Perform the motor test with the scan tool. Do all three motor pack gears (small gears) spin freely?	-	Go to Step 7	Go to Step 8
7	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-
8	Replace the motor pack. Is the repair complete?	-	System OK	-
9	Replace the source of the resistance in the base brake system. Is the repair complete?	-	System OK	-
10	Repair the crossed wires at the rear motor circuit. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A055
EBCM MALFUNCTION

Circuit Description

This DTC identifies a malfunction detected by the MDI custom IC. It also insures that the cause of the malfunction is not a result of a problem with the enable relay under a DTC A055 malfunction.

Diagnosis

This test checks for a failure of the EBCM internal circuitry. It also performs fail-safe diagnostics.

Cause(s)

- **The EBCM is faulty.**

Fail Action

The EBCM will not operate properly and ABS is unpredictable. ABS is therefore disabled and the ABS warning lamp is turned on. The brake warning lamp is turned on if the rear piston is not at the top of the bore, since this could cause degradation of the base brakes.

Test Description

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

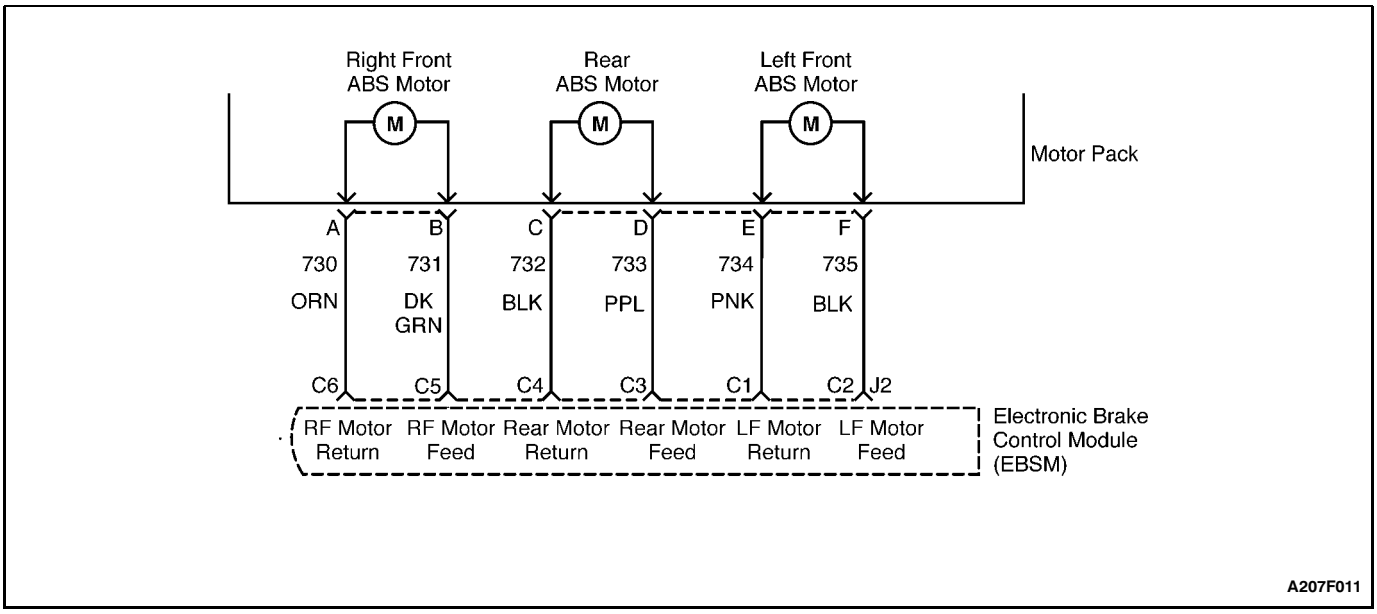
1. **This checks to see if the malfunction is still present.**
2. **This step checks to see if the malfunction is intermittent.**

Diagnostic Aids

Check the frequency of the malfunction by using the enhanced diagnostic function of the scan tool as described in "Scan Tool Diagnostics."

DTC A055 - EBCM Malfunction

Step	Action	Value(s)	Yes	No
1	Turn the ignition switch to ON. Read any DTCs on the scan tool. Is DTC A055 currently set?	-	Go to Step 2	Go to "Diagnostic Aids"
2	Clear the DTCs with the scan tool. Test drive the vehicle for three drive cycles. A drive cycle consists of turning the ignition ON, driving the vehicle over 16 km/h (10 mph), then turning the ignition OFF. Does DTC A055 reset?	-	Go to Step 3	Go to "Diagnostic Aids"
3	Replace the EBCM. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A056
LEFT FRONT MOTOR CIRCUIT OPEN

Circuit Description

This DTC identifies a motor that cannot be energized due to an open in its circuitry.

Diagnosis

This test will detect an open in the left front motor circuit any time the motor is off and the system is enabled.

Cause(s)

- **An open exists in the wiring from the EBCM to the motor.**
- **The motor armature winding is open or has high resistance.**
- **There is a poor contact at the EBCM or at the motor pack connector.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position.

Test Description

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

2. This step checks for proper resistance of the motor.

3. This step checks for an open in the motor feed circuitry.

4. This step checks for an open in the motor return circuitry.

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

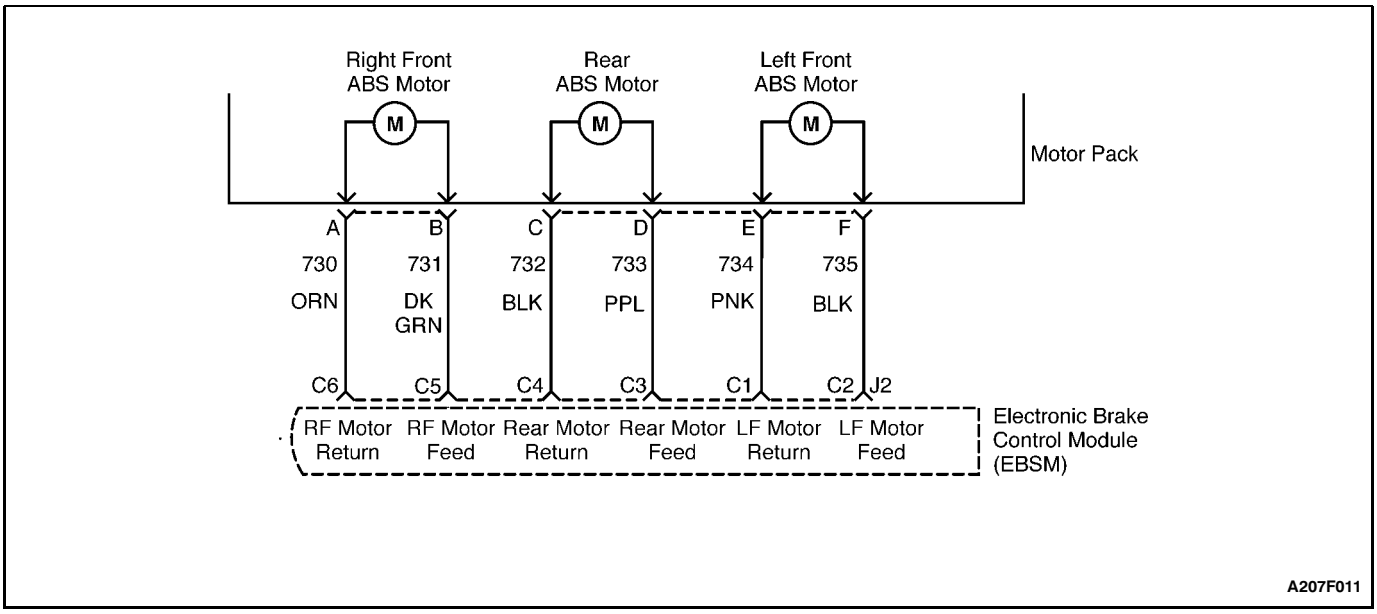
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A056 - Left Front Motor Circuit Open

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC A056. Does DTC A056 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack. 3. Use a digital voltmeter (DVM) to measure the resistance across motor pack terminals E and F. Is the resistance below the specified value?	2000 W	Go to Step 3	Go to Step 9
3	1. Disconnect the EBCM connector J2. 2. Use a DVM to measure the resistance between terminal C2 of EBCM harness connector J2 and terminal F of the motor pack. Is the resistance below the specified value?	2 W	Go to Step 4	Go to Step 10
4	Use a DVM to measure the resistance between terminal C1 of the EBCM harness connector J2 and terminal E of the motor pack harness connector. Is the resistance below the specified value?	2 W	Go to Step 5	Go to Step 8
5	Check for a poor contact or corrosion at the EBCM connector J2 and at the motor pack connector. Are all contacts in good condition?	-	Go to Step 6	Go to Step 7
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair or replace the connectors showing contact problems. Is the repair complete?	-	System OK	-
8	Repair the open or high resistance in circuit PNK. Is the repair complete?	-	System OK	-
9	Replace the motor pack. Is the repair complete?	-	System OK	-
10	Repair the open or high resistance in circuit BLK. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A057
LEFT FRONT MOTOR CIRCUIT SHORTED TO GROUND

Circuit Description

This DTC identifies a motor circuit that is shorted to ground. This malfunction will prevent the motor from being controlled at the commanded current rate or will cause the driver circuit to allow current directly to ground.

Diagnosis

This test will identify a situation in which a short to ground exists in the left front motor circuit.

Cause(s)

- **There is a short to ground in the wiring from the EBCM to the motor.**
- **The motor armature winding is grounded (low resistance to ground).**
- **There is a short to ground at the motor pack connector.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position.

Test Description

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

2. **This step checks for a short to ground in the motor feed circuit.**
3. **This step checks for a short to ground in the motor return circuit.**
4. **This step checks for a motor that is internally shorted to ground.**

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

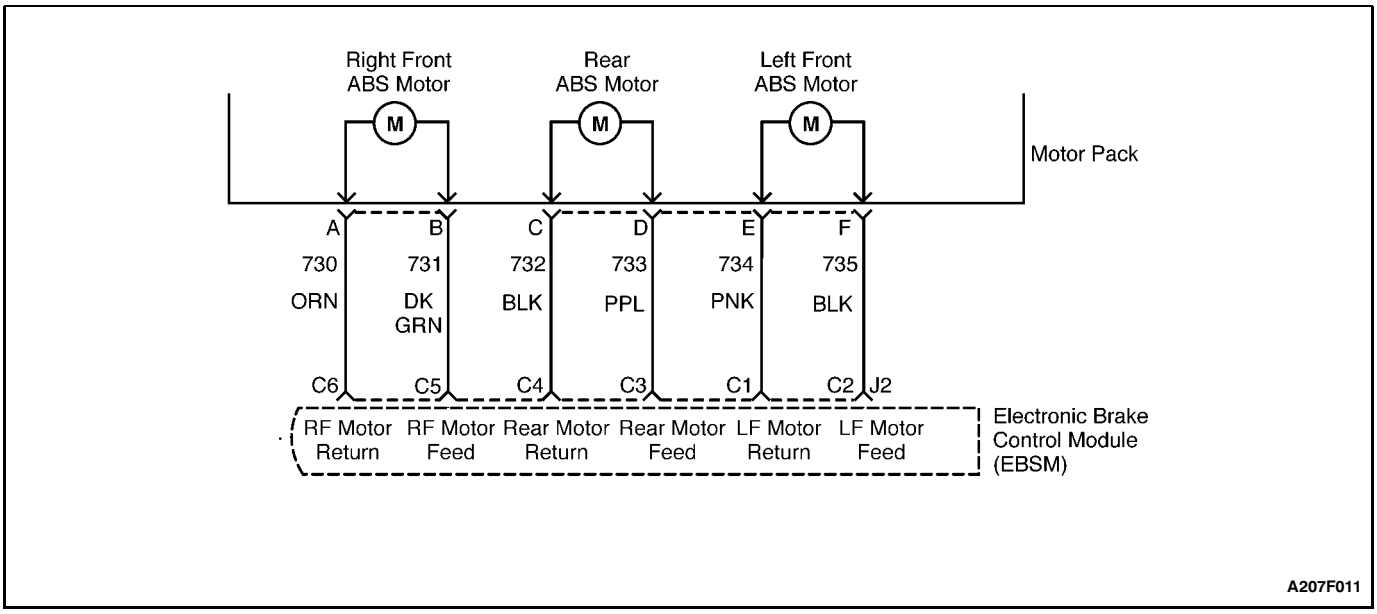
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A057 - Left Front Motor Circuit Shorted to Ground

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A057. Does DTC A057 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack and the EBCM connector J2. 3. Use a digital voltmeter (DVM) to measure the resistance between ground and terminal F of the motor pack harness connector. Does the DVM show the specified value?	R	Go to Step 3	Go to Step 7
3	Measure the resistance between ground and terminal E of the motor pack harness connector. Does the DVM show the specified value?	R	Go to Step 4	Go to Step 8
4	Measure the resistance between ground and terminal F of the motor pack. Does the DVM show the specified value?	R	Go to Step 5	Go to Step 6
5	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
6	Replace the motor pack. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit BLK. Is the repair complete?	-	System OK	-
8	Repair the short to ground in circuit PNK. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A058
LEFT FRONT MOTOR CIRCUIT SHORTED TO BATTERY OR MOTOR SHORTED

Circuit Description

This DTC identifies a motor circuit that is shorted to the battery or a motor that has low or no resistance. This malfunction will prevent the motor from being controlled at the commanded current rate or will cause the motor to turn in the opposite direction or not at all.

Diagnosis

This test will detect a short to the battery in the left front motor circuitry.

Cause(s)

- **There is a short to battery in the wiring from the EBCM to the motor.**
- **The motor armature winding has low/no resistance.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position.

Test Description

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

3. **This step checks for a short to voltage in the motor feed circuitry.**
4. **This step checks for a short to voltage in the motor return circuitry.**
5. **This step checks for a motor that is internally shorted.**

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

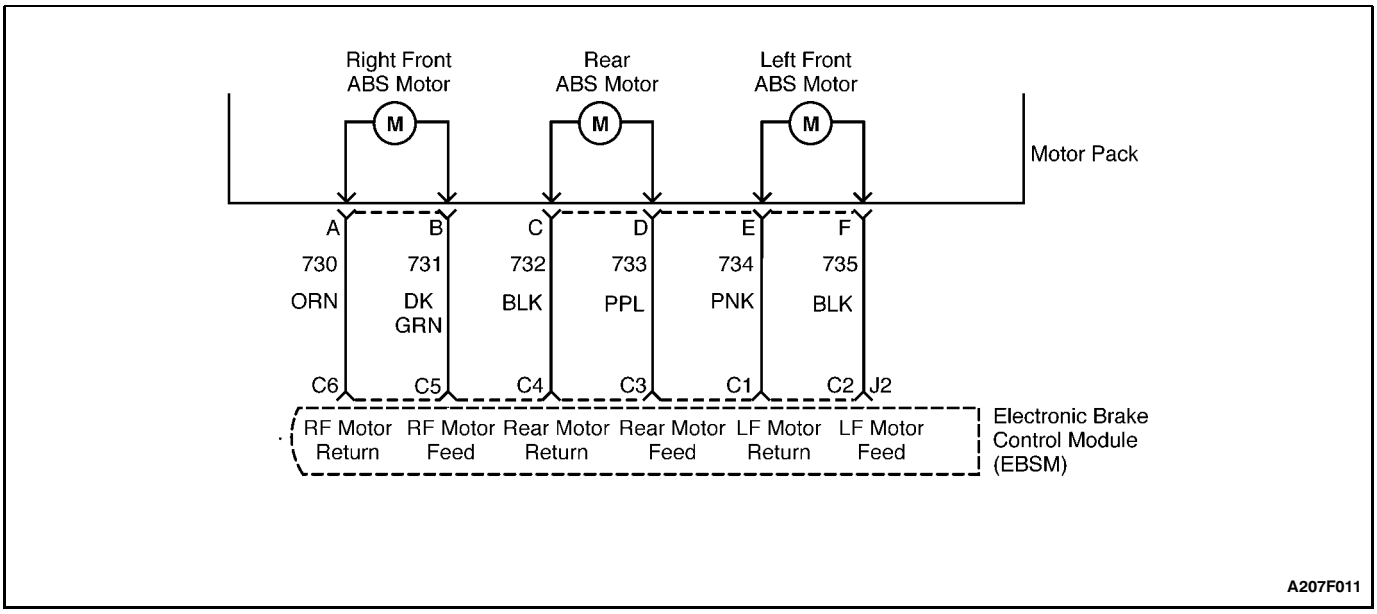
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

DTC A058 - Left Front Motor Circuit Shorted to Battery or Motor Shorted

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A058. Does DTC A058 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	Check the scan tool for DTC code A036. Is DTC A036 also set?	-	Go to DTC A036 chart	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack and the EBCM connector J2. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal F of the motor pack harness connector. Is the voltage below the specified value?	1 v	Go to Step 4	Go to Step 8
4	Measure the voltage between ground and terminal E of the motor pack harness connector. Is the voltage below the specified value?	1 v	Go to Step 5	Go to Step 9
5	1. Turn the ignition switch to LOCK. 2. Use a DVM to measure the resistance between terminal E and terminal F of the motor pack. Is this resistance greater than the specified value?	0.4 W	Go to Step 6	Go to Step 7
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Replace the motor pack. Is the repair complete?	-	System OK	-
8	Repair the short to voltage in circuit BLK. Is the repair complete?	-	System OK	-
9	Repair the short to voltage in circuit PNK. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A061
RIGHT FRONT MOTOR CIRCUIT OPEN

Circuit Description

This DTC identifies a motor that cannot be energized due to an open in its circuitry.

Diagnosis

This test will detect an open in the right front motor circuit any time the motor is off and the system is enabled.

Cause(s)

- **An open exists in the wiring from the EBCM to the motor.**
- **The motor armature winding is open or has high resistance.**
- **There is a poor contact at the EBCM or at the motor pack connector.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position.

Test Description

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

2. This step checks for proper resistance of the motor.

3. This step checks for an open in the motor feed circuitry.

4. This step checks for an open in the motor return circuitry.

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

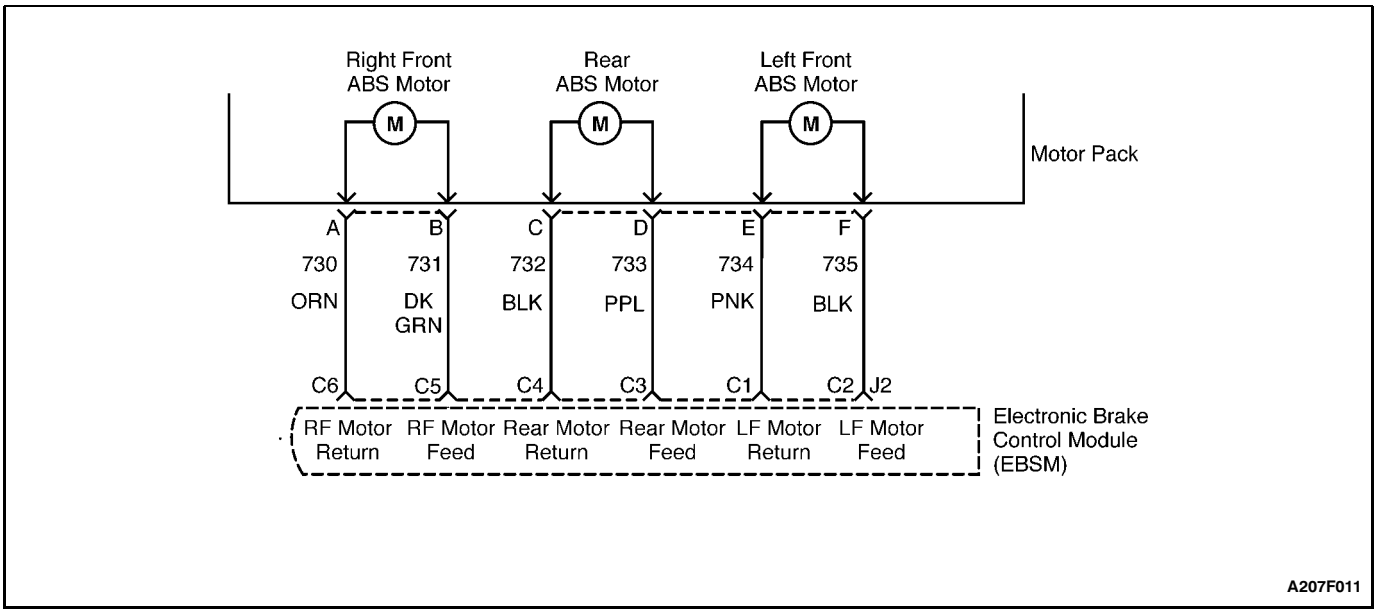
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

DTC A061 - Right Front Motor Circuit Open

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A061. Does DTC A061 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack. 3. Use a digital voltmeter (DVM) to measure the resistance across motor pack terminals A and B. Is the resistance below the specified value?	2000 W	Go to Step 3	Go to Step 9
3	1. Disconnect the EBCM connector J2. 2. Use a DVM to measure the resistance between terminal C5 of the EBCM harness connector J2 and terminal B of the motor pack. Is the resistance below the specified value?	2 W	Go to Step 4	Go to Step 10
4	Use a DVM to measure the resistance between terminal C6 of the EBCM harness connector J2 and terminal A of the motor pack harness connector. Is the resistance below the specified value?	2 W	Go to Step 5	Go to Step 8
5	Check for a poor contact or corrosion at the EBCM connector J2 and at the motor pack connector. Are all contacts in good condition?	-	Go to Step 6	Go to Step 7
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair or replace any connectors showing contact problems. Is the repair complete?	-	System OK	-
8	Repair the open or high resistance in circuit ORN. Is the repair complete?	-	System OK	-
9	Replace the motor pack. Is the repair complete?	-	System OK	-
10	Repair the open or high resistance in circuit DK GRN. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A062 RIGHT FRONT MOTOR CIRCUIT SHORTED TO GROUND

Circuit Description

This DTC identifies a motor circuit that is shorted to ground. This malfunction will prevent the motor from being controlled at the commanded current rate or will cause the driver circuit to allow current directly to ground.

Diagnosis

This test will identify a situation in which a short to ground exists in the right front motor circuit.

Cause(s)

- **There is a short to ground in the wiring from the EBCM to the motor.**
- **The motor armature winding is grounded (low resistance to ground).**
- **There is a short to ground at the motor pack connector.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position.

Test Description

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

2. **This step checks for a short to ground in the motor feed circuit.**
3. **This step checks for a short to ground in the motor return circuit.**
4. **This step checks for a motor that is internally shorted to ground.**

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

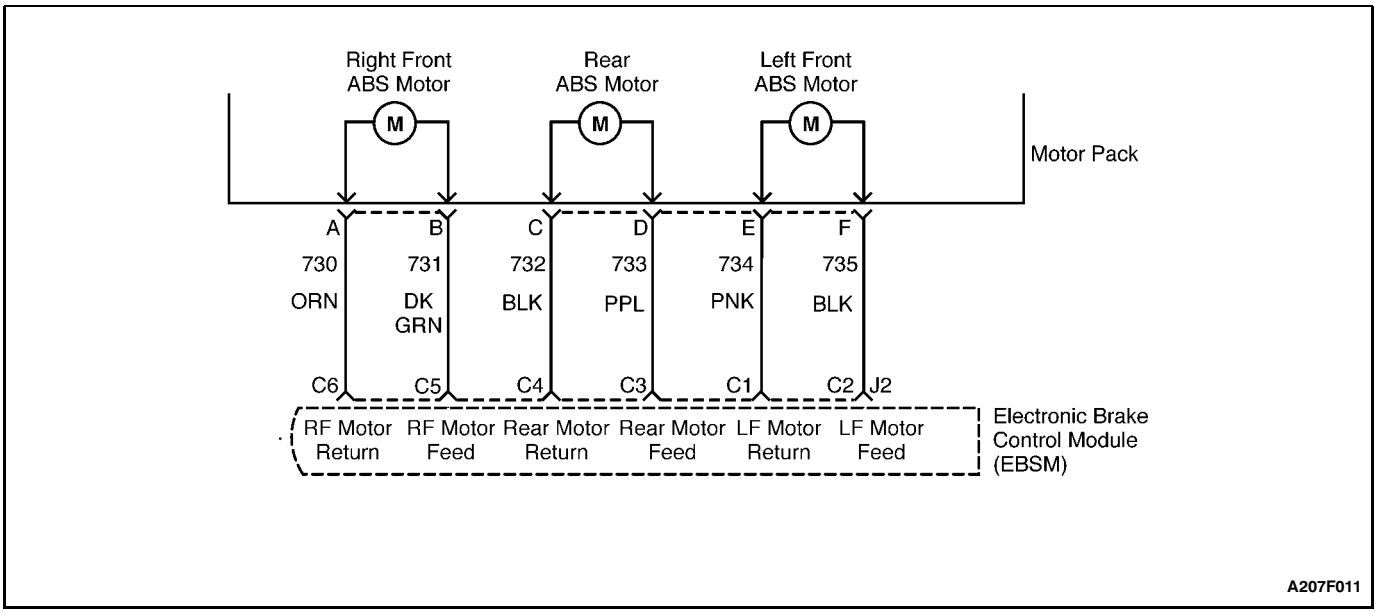
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A062 - Right Front Motor Circuit Shorted to Ground

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A062. Does DTC A062 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack and the EBCM connector J2. 3. Use a digital voltmeter (DVM) to measure the resistance between ground and terminal B of the motor pack harness connector. Does the DVM show the specified value?	R	Go to Step 3	Go to Step 7
3	Measure the resistance between ground and terminal A of the motor pack harness connector. Does the DVM show the specified value?	R	Go to Step 4	Go to Step 8
4	Measure the resistance between ground and terminal B of the motor pack. Does the DVM show the specified value?	R	Go to Step 5	Go to Step 6
5	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
6	Replace the motor pack. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit DK GRN. Is the repair complete?	-	System OK	-
8	Repair the short to ground in circuit ORN. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A063 RIGHT FRONT MOTOR CIRCUIT SHORTED TO BATTERY OR MOTOR SHORTED

Circuit Description

This DTC identifies a motor circuit that is shorted to the battery or a motor that has low or no resistance. This malfunction will prevent the motor from being controlled at the commanded current rate or will cause the motor to turn in the opposite direction or not at all.

Diagnosis

This test will detect a short to the battery in the right front motor circuitry.

Cause(s)

- **There is a short to battery in the wiring from the EBCM to the motor.**
- **The motor armature winding has low/no resistance.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position.

Test Description

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

3. **This step checks for a short to voltage in the motor feed circuitry.**
4. **This step checks for a short to voltage in the motor return circuitry.**
5. **This step checks for a motor that is internally shorted.**

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

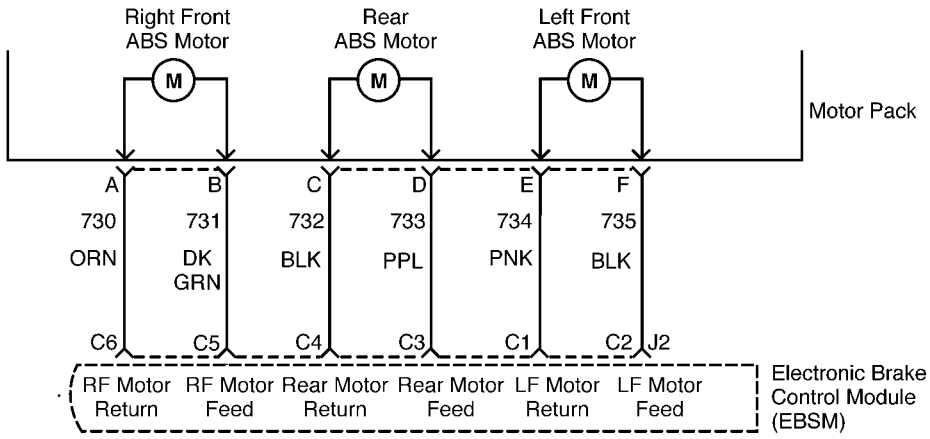
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A063 - Right Front Motor Circuit Shorted to Battery or Motor Shorted

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A063. Does DTC A063 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	Check the scan tool for DTC A036. Is DTC A036 also set?	-	Go to DTC A036 chart	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack and the EBCM connector J2. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal B of the motor pack harness connector. Is the voltage below the specified value?	1 v	Go to Step 4	Go to Step 8
4	Measure the voltage between ground and terminal A of the motor pack harness connector. Is the voltage below the specified value?	1 v	Go to Step 5	Go to Step 9
5	1. Turn the ignition switch to LOCK. 2. Use a DVM to measure the resistance between terminal A and terminal B of the motor pack. Is this resistance greater than the specified value?	0.4 W	Go to Step 6	Go to Step 7
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Replace the motor pack. Is the repair complete?	-	System OK	-
8	Repair the short to voltage in circuit DK GRN. Is the repair complete?	-	System OK	-
9	Repair the short to voltage in circuit ORN. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



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DIAGNOSTIC TROUBLE CODE (DTC) A064
REAR AXLE MOTOR CIRCUIT OPEN

Circuit Description

This DTC identifies a motor that cannot be energized due to an open in its circuitry.

Diagnosis

This test will detect an open in the rear axle motor circuit any time the motor is off and the system is enabled.

Cause(s)

- **An open exists in the wiring from the EBCM to the motor.**
- **The motor armature winding is open or has high resistance.**
- **There is a poor contact at the EBCM or at the motor pack connector.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position.

Test Description

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

2. This step checks for proper resistance of the motor.

3. This step checks for an open in the motor feed circuitry.

4. This step checks for an open in the motor return circuitry.

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

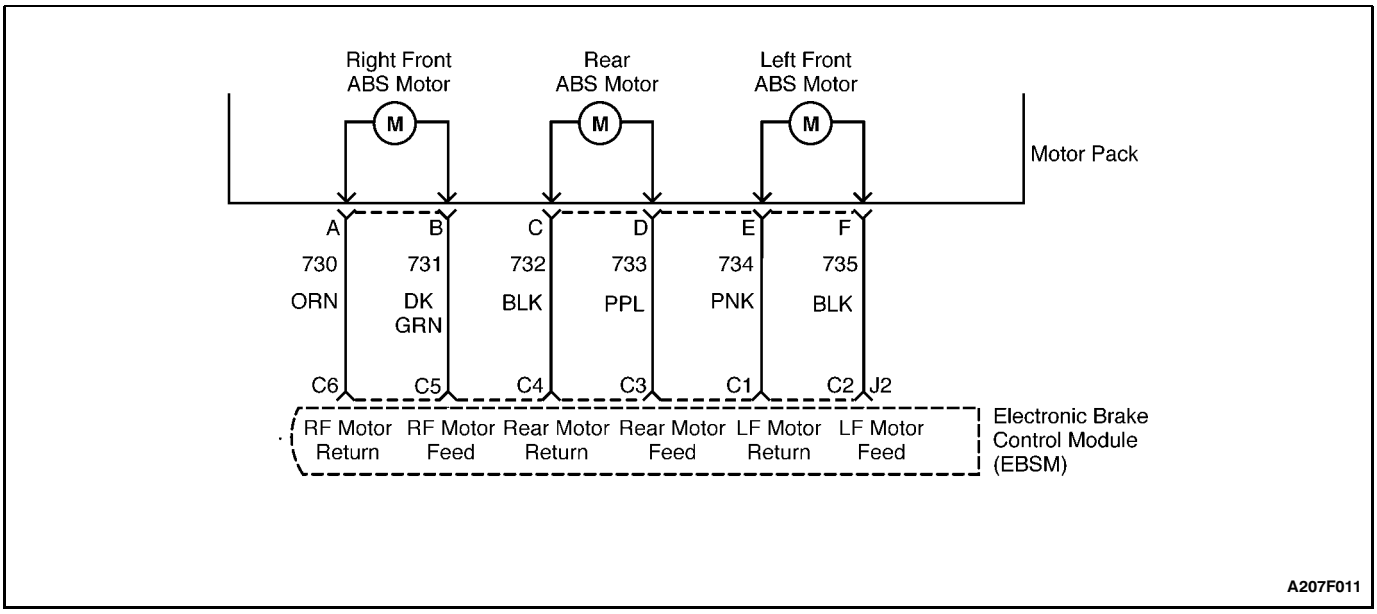
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A064 - Rear Axle Motor Circuit Open

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A064. Does DTC A064 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack. 3. Use a digital voltmeter (DVM) to measure the resistance across motor pack terminals C and D. Is the resistance below the specified value?	2000 W	Go to Step 3	Go to Step 9
3	1. Disconnect the EBCM connector J2. 2. Use a DVM to measure the resistance between terminal C3 of the EBCM harness connector J2 and terminal D of the motor pack. Is the resistance below the specified value?	2 W	Go to Step 4	Go to Step 10
4	Use a DVM to measure the resistance between terminal C4 of the EBCM harness connector J2 and terminal C of the motor pack harness connector. Is the resistance below the specified value?	2 W	Go to Step 5	Go to Step 8
5	Check for a poor contact or corrosion at the EBCM connector J2 and at the motor pack connector. Are all contacts in good condition?	-	Go to Step 6	Go to Step 7
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair or replace any connectors showing contact problems. Is the repair complete?	-	System OK	-
8	Repair the open or high resistance in circuit BLK. Is the repair complete?	-	System OK	-
9	Replace the motor pack. Is the repair complete?	-	System OK	-
10	Repair the open or high resistance in circuit PPL. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A065
REAR AXLE MOTOR CIRCUIT SHORTED TO GROUND

Circuit Description

This DTC identifies a motor circuit that is shorted to ground. This malfunction will prevent the motor from being controlled at the commanded current rate or will cause the driver circuit to allow current directly to ground.

Diagnosis

This test will identify a situation in which a short to ground exists in the rear axle motor circuit.

Cause(s)

- **There is a short to ground in the wiring from the EBCM to the motor.**
- **The motor armature winding is grounded (low resistance to ground).**
- **There is a short to ground at the motor pack connector.**
- **The EBCM is faulty.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position. The brake warning lamp is also turned on if the rear axle piston is not in the home position.

Test Description

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

2. **This step checks for a short to ground in the motor feed circuit.**
3. **This step checks for a short to ground in the motor return circuit.**
4. **This step checks for a motor that is internally shorted to ground.**

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

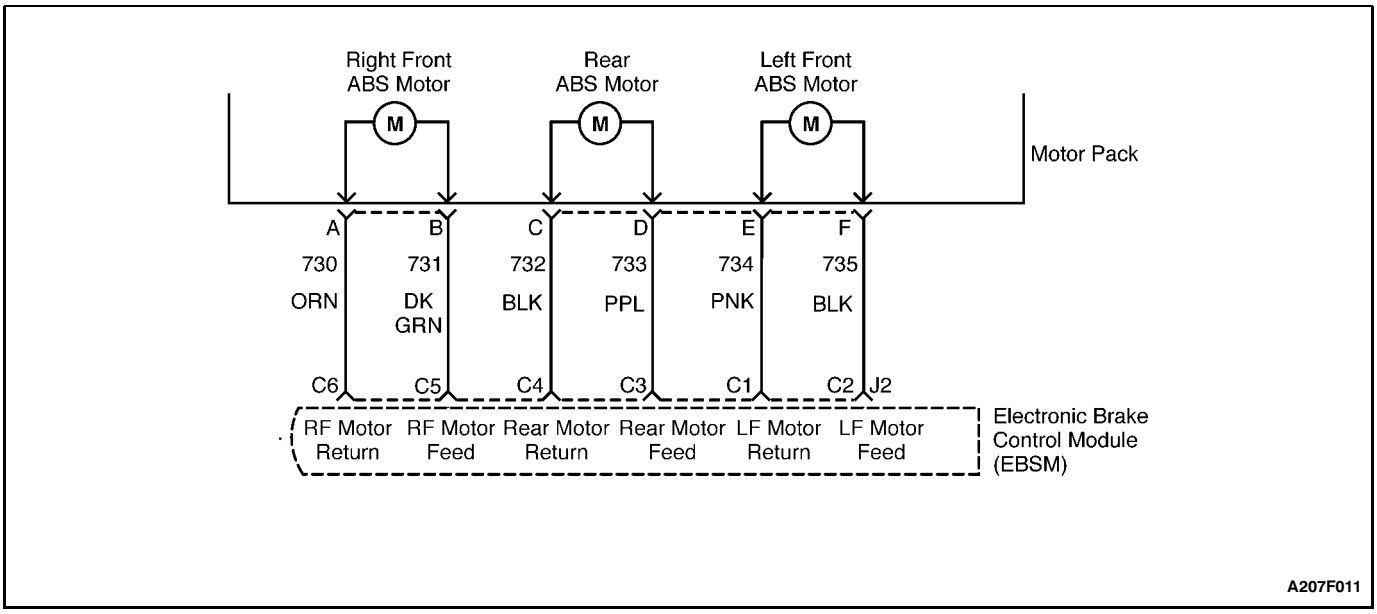
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A065 - Rear Axle Motor Circuit Shorted to Ground

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A065. Does DTC A065 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack and the EBCM connector J2. 3. Use a digital voltmeter (DVM) to measure the resistance between ground and terminal D of the motor pack harness connector. Does the DVM show the specified value?	R	Go to Step 3	Go to Step 7
3	Measure the resistance between ground and terminal C of the motor pack harness connector. Does the DVM show the specified value?	R	Go to Step 4	Go to Step 8
4	Measure the resistance between ground and terminal D of the motor pack. Does the DVM show the specified value?	R	Go to Step 5	Go to Step 6
5	Replace the EBCM and recheck the ABS system. Is the repair complete?	-	System OK	-
6	Replace the motor pack. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit PPL. Is the repair complete?	-	System OK	-
8	Repair the short to ground in circuit BLK. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A066
REAR AXLE MOTOR CIRCUIT SHORTED TO BATTERY OR MOTOR SHORTED

Circuit Description

This DTC identifies a motor circuit that is shorted to the battery or a motor that has low or no resistance. This malfunction will prevent the motor from being controlled at the commanded current rate or will cause the motor to turn in the opposite direction or not at all.

Diagnosis

This test will detect a short to the battery in the rear axle motor circuitry.

Cause(s)

- **There is a short to battery in the wiring from the EBCM to the motor.**
- **The motor armature winding has low/no resistance.**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. A rehome is commanded on the other two channels to ensure that they are in the home position. The brake warning lamp is also turned on if the rear axle piston is not in the home position.

Test Description

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

3. **This step checks for a short to voltage in the motor feed circuitry.**
4. **This step checks for a short to voltage in the motor return circuitry.**
5. **This step checks for a motor that is internally shorted.**

Diagnostic Aids

Select the manual control function of the scan tool to exercise motor movement of the affected channel in both directions while applying light pressure on the brake pedal. If erratic or "jumpy" brake pedal movement is detected while performing an APPLY or a RELEASE function on the motor, an intermittent malfunction may be indicated.

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

If the malfunction is not current, wiggle the wires of the affected channel and check if the DTC resets. This will help to pinpoint an intermittent malfunction in the motor circuitry or the connections.

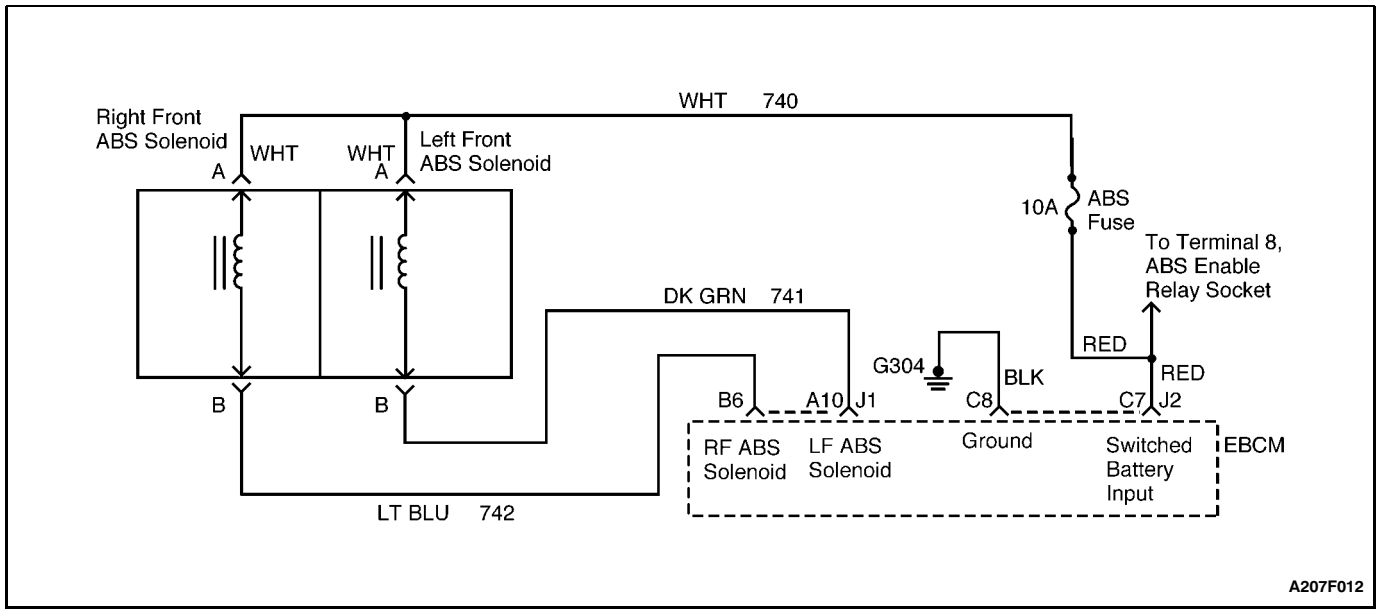
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A066 - Rear Axle Motor Circuit Shorted to Battery or Motor Shorted

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A066. Does DTC A066 occur intermittently?	-	Go to "Diagnostic Aids"	Go to Step 2
2	Check the scan tool for DTC code A036. Is DTC A036 also set?	-	Go to DTC A036 chart	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Disconnect the connector from the motor pack and the EBCM connector J2. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal D of the motor pack harness connector. Is the voltage below the specified value?	1 v	Go to Step 4	Go to Step 8
4	Measure the voltage between ground and terminal C of the motor pack harness connector. Is the voltage below the specified value?	1 v	Go to Step 5	Go to Step 9
5	1. Turn the ignition switch to LOCK. 2. Use a DVM to measure the resistance between terminal C and terminal D of the motor pack. Is this resistance greater than the specified value?	0.4 W	Go to Step 6	Go to Step 7
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Replace the motor pack. Is the repair complete?	-	System OK	-
8	Repair the short to voltage in circuit PPL. Is the repair complete?	-	System OK	-
9	Repair the short to voltage in circuit BLK. Is the repair complete?	-	System OK	-

After all diagnosis is complete, clear the DTCs and test drive the vehicle for three drive cycles to verify that the DTC does not reset. A drive cycle consists of starting the vehicle, driving over 16 km/h (10 mph), and then turning off the ignition.



DIAGNOSTIC TROUBLE CODE (DTC) A076
LEFT FRONT SOLENOID CIRCUIT OPEN OR SHORTED TO GROUND

Circuit Description

This DTC identifies a solenoid that cannot be energized due to an open in its circuitry, or a solenoid that is always energized due to a short to ground in its circuitry between the driver and the solenoid. An open will prevent proper ABS operation, but the short to ground simply turns the solenoid ON. A path for base brakes is still allowed once the motor rehomes and the check ball is lifted off its seat during ignition ON initialization.

Diagnosis

This test detects a short to ground or open in the left front solenoid circuitry. The open will prevent proper ABS operation, but the short to ground simply turns on the solenoid. The system can not differentiate between the two faults.

Cause(s)

- **The solenoid connector is open.**
- **There is a short to ground in the solenoid control circuitry.**
- **There is an open in the solenoid control circuitry.**
- **There is an open in the solenoid or battery circuit.**
- **The solenoid is defective (high/infinite coil resistance).**
- **The EBCM is faulty.**

Fault Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The system commands a rehome to ensure that all motors are in the home position.

Test Description

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

1. **This checks for a short to ground in the control circuitry of the solenoid.**
2. **This checks for an open in the control circuit of the solenoid.**
3. **This step checks the solenoid coil for proper resistance.**
4. **This step checks for an open in the solenoid voltage supply.**
5. **This step checks for a possible intermittent malfunction in the solenoid circuitry due to a poor terminal contact.**

Diagnostic Aids

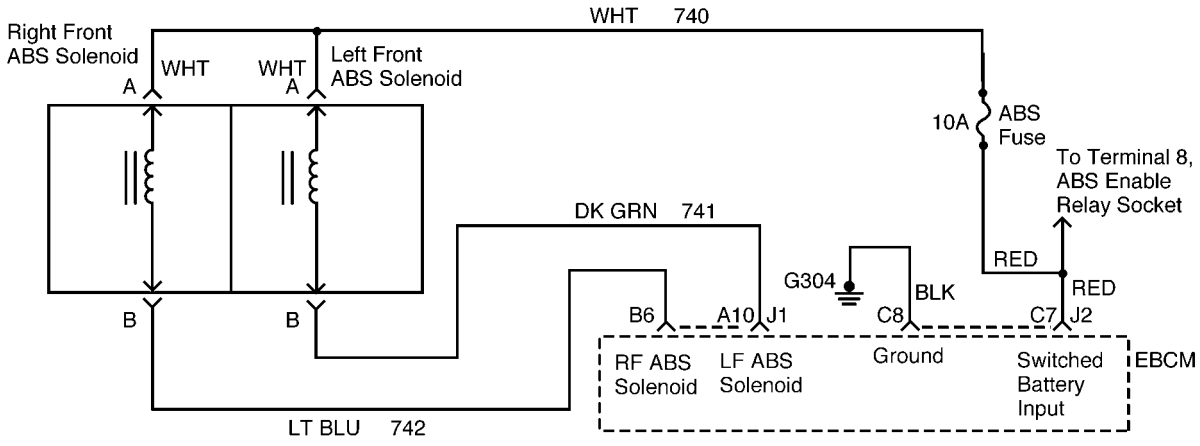
An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A076 - Left Front Solenoid Circuit Open or Shorted to Ground

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. Do not start the engine. 4. Use a digital voltmeter (DVM) to measure the resistance between ground and terminal A10 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 2	Go to Step 7
2	1. Turn the ignition switch to LOCK. 2. Disconnect the left front solenoid connector. 3. Use a DVM to measure the resistance between terminal A10 of the EBCM harness connector J1 and the terminal of the left front solenoid harness connector fed by the DK GRN wire. Is the resistance no more than the specified value?	2 W	Go to Step 3	Go to Step 8
3	Use a DVM to measure the resistance between the two terminals of the left front solenoid. Is this resistance within the specified value?	2.5-5 W	Go to Step 4	Go to Step 9
4	Use a DVM to measure the resistance between the ABS relay connector terminal 8 and the terminal of the left front solenoid harness connector fed by the WHT wire. Is the resistance no more than the specified value?	2 W	Go to Step 5	Go to Step 10
5	1. Inspect the left front solenoid and the EBCM harness connector J1 terminals for poor terminal contact and evidence of corrosion. 2. Replace any terminals that show signs of poor terminal contact or corrosion. 3. Inspect circuit DK GRN for any damage which may result in a short to ground with all connectors connected. 4. Repair any damage found. 5. Reconnect the solenoid connector and the EBCM connector J1. 6. Turn the ignition switch to ON. 7. Use the scan tool to clear the DTCs. 8. Test drive the vehicle for one drive cycle. Does DTC A076 reset?	-	Go to Step 6	Go to "Diagnostic Aids"
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit DK GRN. Is the repair complete?	-	System OK	-
8	Repair the open or high resistance in circuit DK GRN. Is the repair complete?	-	System OK	-
9	Replace the left front solenoid. Is the repair complete?	-	System OK	-
10	Locate and repair the open or high resistance in circuit WHT-Fuse-RED-ABS relay socket terminal 8. • The 10 amp ABS solenoid fuse is located in the ABS wiring harness between the blower housing and the firewall. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A077
LEFT FRONT SOLENOID CIRCUIT SHORTED TO BATTERY

Circuit Description

This DTC identifies a solenoid that cannot be energized due to a short to voltage in its driver circuitry. These malfunctions can affect ABS operation since the flow of brake fluid to the caliper cannot be stopped, making ABS operation for that channel impossible.

Diagnosis

This test identifies a situation in which a short to battery in the driving circuitry for the left front solenoid prevents energizing the solenoid.

Cause(s)

- **The solenoid circuitry is shorted to the battery.**
- **The solenoid is shorted to the battery internally.**
- **The solenoid is defective (low coil resistance).**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The system commands a rehome to ensure that all motors are in the home position.

Test Description

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

1. **This checks for a solenoid that is internally shorted to voltage.**
2. **This checks for a solenoid that is not within proper resistance values.**
3. **This step indicates if a short to voltage exists in the solenoid control circuitry.**
4. **This step checks for a possible intermittent malfunction in the solenoid control circuitry due to connector damage.**

Diagnostic Aids

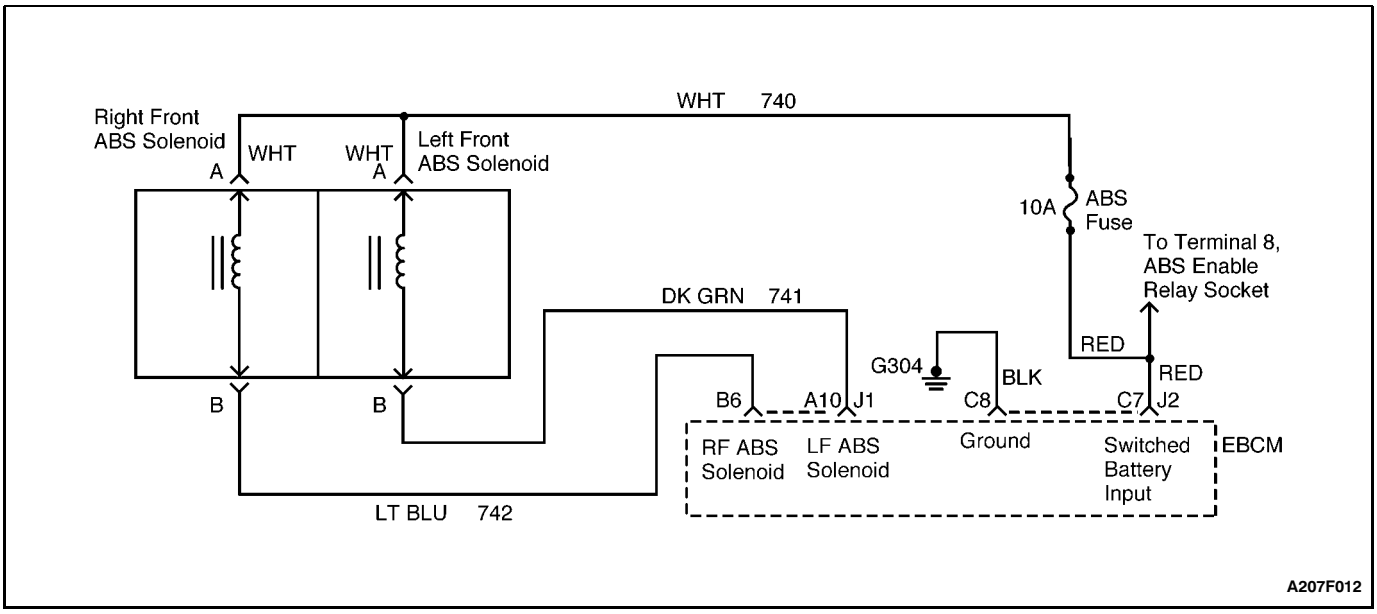
An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A077 - Left Front Solenoid Circuit Shorted to Battery

Step	Action	Value(s)	Yes	No
1	Turn the ignition switch to LOCK. Disconnect the left front solenoid connector. Use a DVM to measure the voltage between ground and the terminal of the left front solenoid connector that is fed by the DK GRN wire. Is the less than the specified limit?	1 v	Go to Step 2	Go to Step 6
2	Use a digital voltmeter (DVM) to measure the resistance between the two terminals of the left front solenoid. Is the resistance within the specified value?	2.5-5 W	Go to Step 3	Go to Step 6
3	Disconnect the EBCM connector J1. Use a DVM to measure the voltage between ground and terminal A10 of the EBCM harness connector J1. Is the resistance less than the specified value?	1 v	Go to Step 4	Go to Step 7
4	1. Inspect circuit DK GRN, the left front solenoid, and connector J1 for damage which may result in a short to voltage with all of the connectors connected. 2. Repair any damage found. 3. Reconnect the solenoid connector and the EBCM connector J1. 4. Turn the ignition switch to ON. 5. Use the scan tool to clear the DTCs. 6. Start the engine with your foot off the brake. 7. Allow the engine to run for at least 10 seconds. Does DTC A077 reset?	-	Go to Step 5	Go to "Diagnostic Aids"
5	Replace the EBCM. Is the repair complete?	-	System OK	-
6	Replace the left front solenoid. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit DK GRN. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A078
RIGHT FRONT SOLENOID CIRCUIT OPEN OR SHORTED TO GROUND

Circuit Description

This DTC identifies a solenoid that cannot be energized due to an open in its circuitry, or a solenoid that is always energized due to a short to ground in its circuitry between the driver and the solenoid. An open will prevent proper ABS operation, but the short to ground simply turns the solenoid on. A path for base brakes is still allowed once the motor rehomes and the check ball is lifted off its seat during initialization.

Diagnosis

This test detects a short to ground or open in the right front solenoid circuitry. The open will prevent proper ABS operation, but the short to ground simply turns on the solenoid. The system can not differentiate between the two faults.

Cause(s)

- **The solenoid connector is open.**
- **There is a short to ground in the solenoid control circuitry.**
- **There is an open in the solenoid control circuitry.**
- **There is an open in the solenoid or battery circuit.**
- **The solenoid is defective (high/infinite coil resistance).**
- **The EBCM is faulty.**

Fault Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The system commands a rehome to ensure that all motors are in the home position.

Test Description

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

1. **This checks for a short to ground in the control circuitry of the solenoid.**
2. **This checks for an open in the control circuit of the solenoid.**
3. **This step checks the solenoid coil for proper resistance.**
4. **This step checks for an open in the solenoid voltage supply circuit.**
5. **This step checks for a possible intermittent malfunction in the solenoid circuitry due to a poor terminal contact.**

Diagnostic Aids

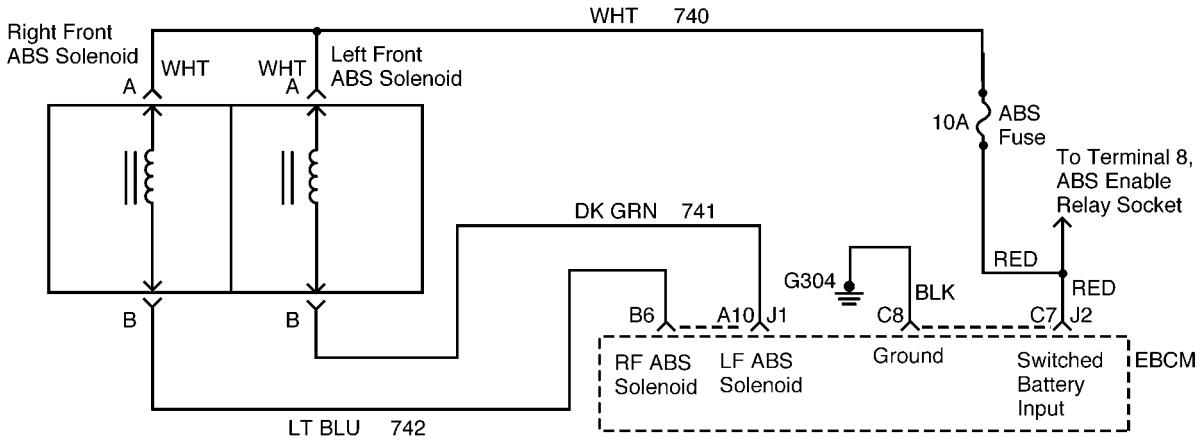
An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A078 - Right Front Solenoid Circuit Open or Shorted to Ground

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM connector J1. 3. Turn the ignition switch to ON. Do not start the engine. 4. Use a digital voltmeter (DVM) to measure the resistance between ground and terminal B6 of the EBCM harness connector J1. Does the DVM show the specified value?	R	Go to Step 2	Go to Step 7
2	1. Turn the ignition switch to LOCK. 2. Disconnect the right front solenoid connector. 3. Use a DVM to measure the resistance between terminal B6 of the EBCM harness connector J1 and the terminal of the right front solenoid harness connector fed by the LT BLU wire. Is the resistance less than the specified value?	2 W	Go to Step 3	Go to Step 8
3	Use a DVM to measure the resistance between the two terminals of the right front solenoid. Is this resistance within the specified value?	2.5-5 W	Go to Step 4	Go to Step 9
4	Use a DVM to measure the resistance between ABS relay connector terminal 8 and the terminal of the right front solenoid harness connector fed by the WHT wire. Is the resistance less than the specified value?	2 W	Go to Step 5	Go to Step 10
5	1. Inspect the right front solenoid and the EBCM connectors J1 for poor terminal contact and evidence of corrosion. 2. Replace any terminals that exhibit signs of poor terminal contact or corrosion. 3. Inspect circuit LT BLU for any damage which may result in a short to ground when all of the connectors are connected. 4. Repair any damage found. 5. Reconnect the solenoid connector and the EBCM connector J1. 6. Turn the ignition switch to ON. 7. Use the scan tool to clear the DTCs. 8. Test drive the vehicle for one drive cycle. Does DTC A078 reset?	-	Go to Step 6	Go to "Diagnostic Aids"
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair the short to voltage in circuit LT BLU. Is the repair complete?	-	System OK	-
8	Repair the open or high resistance in circuit LT BLU. Is the repair complete?	-	System OK	-
9	Replace the right front solenoid. Is the repair complete?	-	System OK	-
10	Locate and repair the open or high resistance in circuit WHT-fuse-RED-ABS enable relay socket terminal 8. • The ABS solenoid fuse is located in the ABS wiring harness between the blower housing and the firewall. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A081
RIGHT FRONT SOLENOID CIRCUIT SHORTED TO BATTERY

Circuit Description

This DTC identifies a solenoid that cannot be energized due to a short to voltage in its driver circuitry. This malfunction can affect ABS operation since the flow of brake fluid to the caliper cannot be stopped, making ABS operation for that channel impossible.

Diagnosis

This test identifies a situation in which a short to battery in the driving circuitry for the right front solenoid prevents energizing the solenoid.

Cause(s)

- **The solenoid circuitry is shorted to the battery.**
- **The solenoid is shorted to the battery internally.**
- **The solenoid is defective (low coil resistance).**
- **The EBCM is malfunctioning.**

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The system commands a rehome to ensure that all motors are in the home position.

Test Description

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

1. **This checks for a solenoid that is internally shorted to voltage.**
2. **This checks for a solenoid that is not within proper resistance values.**
3. **This step indicates if a short to voltage exists in the solenoid circuitry.**
4. **This step checks for a possible intermittent malfunction in the solenoid control circuitry due to a damaged connector.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A081 - Right Front Solenoid Circuit Shorted to Battery

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to LOCK. 2. Disconnect the right front solenoid connector. 3. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal A of the right front solenoid. Is the voltage less than the specified value?	1 v	Go to Step 2	Go to Step 6
2	Use a DVM to measure the resistance between the two terminals of the right front solenoid. Is the resistance within the specified value?	2.5-5 W	Go to Step 3	Go to Step 6
3	1. Disconnect the EBCM connector J1. 2. Use a DVM to measure the voltage between ground and terminal B6 of the EBCM harness connector J1. Is the voltage less than the specified value?	1 v	Go to Step 4	Go to Step 7
4	1. Reconnect the solenoid connector and the EBCM connector J1. 2. Turn the ignition switch to ON. 3. Use the scan tool to clear the DTCs. 4. Test drive the vehicle for one drive cycle. Does DTC A081 reset?	-	Go to Step 5	Go to "Diagnostic Aids"
5	Replace the EBCM. Is the repair complete?	-	System OK	-
6	Replace the right front solenoid. Is the repair complete?	-	System OK	-
7	Repair the short to ground in circuit LT BLU. Is the repair complete?	-	System OK	-

DIAGNOSTIC TROUBLE CODE (DTC) A082 CALIBRATION MALFUNCTION

Circuit Description

This DTC allows the EBCM to check for a calibration malfunction by comparing the calibration value to a known value stored in the EEPROM. This DTC is also used as a security measure to prevent improper use of calibrations or changes to these calibrations that may alter the designed function of the ABS.

Diagnosis

This test will identify a situation in which the calibration checksum is not equal to the resident checksum.

Cause(s)

- The calibration is incorrect.
- The calibrations are not programmed.
- The EBCM is faulty.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on.

Test Description

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

1. This step checks to see if the malfunction is present during diagnosis. If present, the EBCM is not functioning correctly and must be replaced.

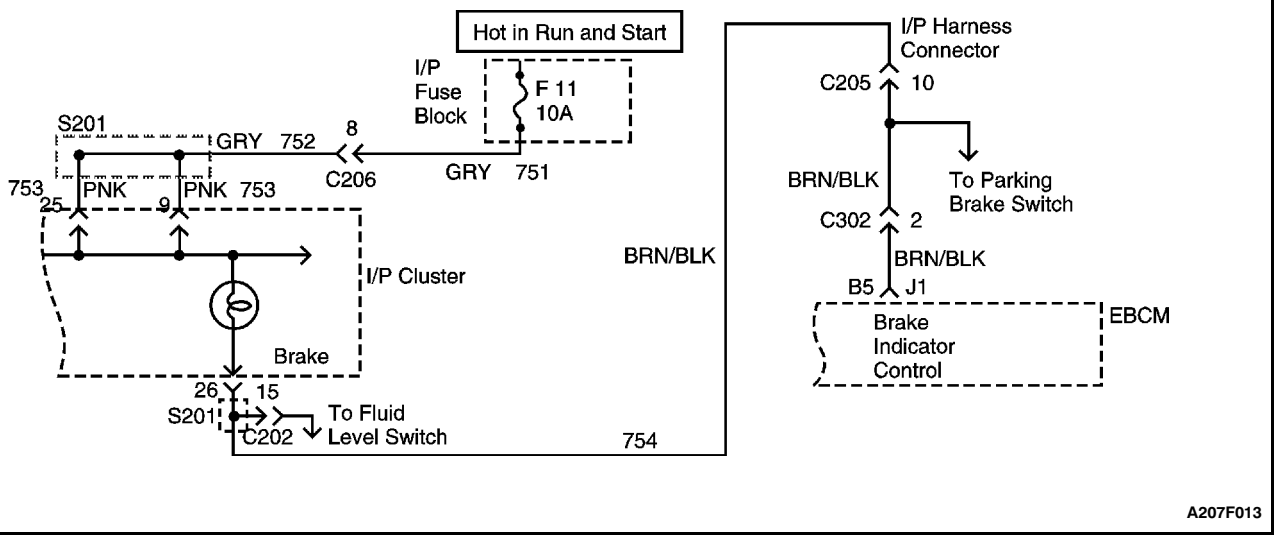
Diagnostic Aids

An "intermittent" DTC A082 may be caused by a bad cell in the EEPROM that is sensitive to temperature changes. If DTC A082 failed more than once, but is intermittent, replace the EBCM.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

DTC A082 - Calibration Malfunction

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Use the scan tool to clear the DTCs. Does DTC 082 reset?	-	Go to Step 2	Go to "Diagnostic Aids"
2	1. Replace the EBCM. 2. Verify the ABS operation. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A086
EBCM TURNED ON THE RED BRAKE WARNING LAMP

Diagnosis

This is an information-only test and reflects the status of the command issued by the ABS EBCM to illuminate the brake warning light.

Fail Action

This test is for service only. It is to distinguish if the brake warning lamp was enabled due to an ABS failure. If another diagnostic test issues a command to illuminate the BRAKE indicator, DTC A086 will be stored in EEPROM as a history DTC at the conclusion of the ignition cycle.

Test Description

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

1. This step serves to identify if a DTC other than DTC A086 commanded the BRAKE indicator on.

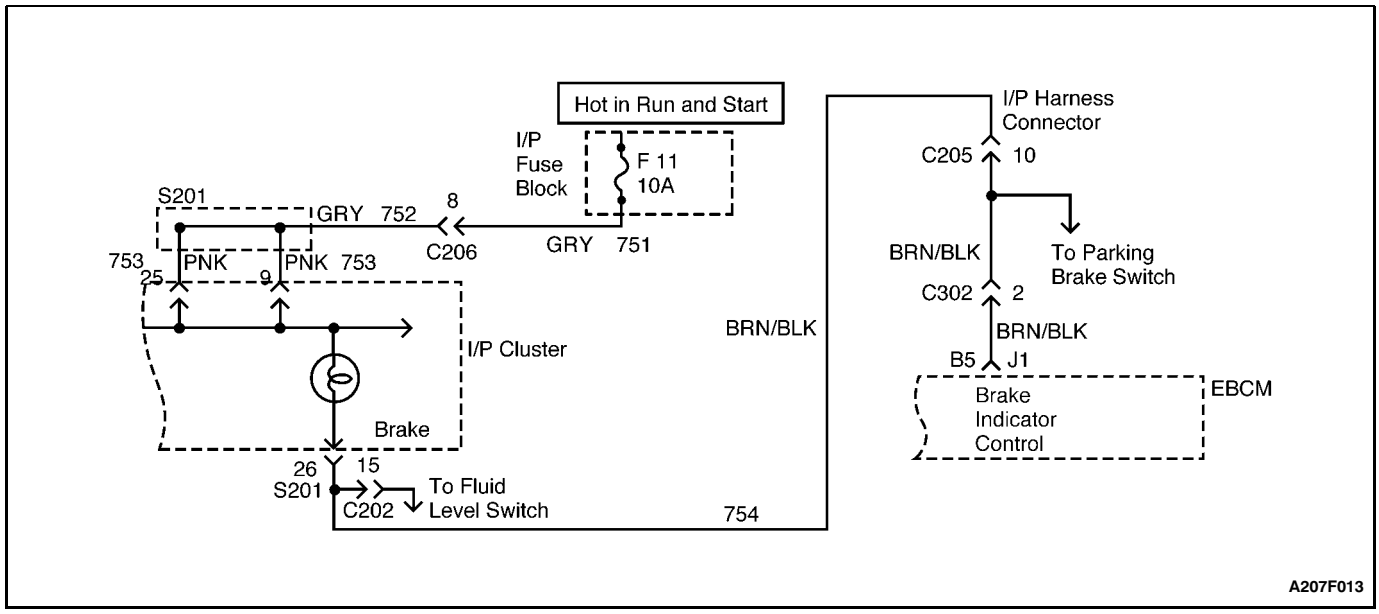
Diagnostic Aids

Any ABS mechanical DTC that issues a command to illuminate the BRAKE indicator will also result in DTC A086 being stored in EEPROM during shut down. These DTCs are A042, A046, and A051. If the motors are not in their home position, certain electrical DTCs will also command the BRAKE indicator on. These DTCs are A014, A016, A018, A036, A055, A064, A065, and A066.

Any other DTCs indicated along with DTC A086 must be corrected prior to addressing a DTC A086 malfunction.

DTC A086 - EBCM Turned on the Red Brake Warning Lamp

Step	Action	Value(s)	Yes	No
1	Check the scan tool for current DTCs. Are there any other DTCs currently set with DTC A086?	-	Go to Step 2	Go to "Diagnostic Aids"
2	Use the scan tool to clear the DTC. Is the DTC cleared?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A087
RED BRAKE WARNING LAMP CIRCUIT OPEN OR SHORT TO BATTERY

Circuit Description

This DTC identifies an open or short to voltage between the EBCM and the red BRAKE warning lamp, or an open driver that prevents the EBCM from turning ON the BRAKE warning lamp. This will occur only if the system detects an ABS malfunction that may degrade base brake operation. Because the ABS is not the only device controlling the BRAKE warning lamp (the parking brake switch or the brake fluid level switch may also turn it ON), the system cannot detect a short to ground in this circuit.

Diagnosis

This test will detect an open or short to battery between the EBCM and the BRAKE warning lamp. A short to battery exists if for 2 seconds the output for the BRAKE warning lamp circuit is greater than 3.43 volts when the lamp is commanded ON. An open is detected when the BRAKE warning lamp voltage is between 3.35 volts and 5.23 volts for more than 2 seconds. This failure prevents the EBCM from illuminating the BRAKE warning lamp.

Cause(s)

- **There is a short to battery in the brake warning lamp circuitry.**
- **The brake warning lamp bulb or fuse is blown.**
- **The brake warning lamp circuit is open.**
- **There is high resistance in the parking brake switch.**
- **There are poor contacts in the EBCM connector J1.**
- **The EBCM driving circuit is malfunctioning.**

Fail Action

Only a history code is stored for this fault. If the ABS is disabled and the brake warning lamp is commanded on to indicate the possibility of base brake degradation, the ABS warning lamp will flash.

Test Description

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

1. **This step tests whether the BRAKE warning lamp circuitry is open or shorted to voltage.**
2. **This step checks the complete BRAKE warning lamp circuitry by attempting to turn the BRAKE warning lamp ON manually.**
3. **This step checks the integrity of the BRAKE warning lamp.**
5. **This step checks for high resistance in the BRAKE warning lamp control circuitry.**
7. **This tests for high resistance in the parking brake circuitry.**
8. **This test checks for a malfunctioning EBCM.**
10. **This test ensures that the malfunction is not due to a poor terminal contact at the at the brake fluid level switch.**
11. **This identifies if a malfunction is currently present.**
12. **This checks for the presence of DTC A086.**
14. **This test uses a scan tool to attempt to turn on the BRAKE warning lamp.**

15. This tests for a short to voltage in the I/P circuitry associated with the BRAKE warning lamp.
17. This ensures that the malfunction was not due to physical damage of the circuitry.

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A087 - Red Brake Warning Lamp Circuit Open or Short to Battery

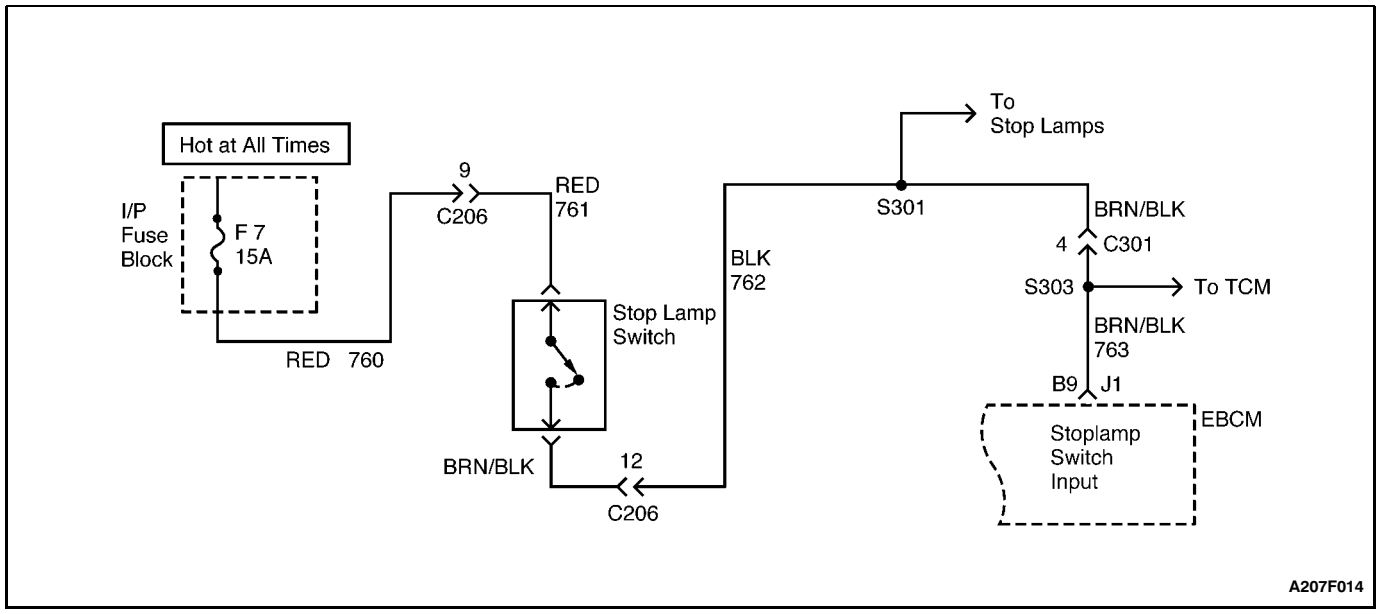
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition to LOCK. 2. Disconnect the EBCM harness connector J1 (24-pin) from the EBCM. 3. Disconnect the 10-pin instrument cluster harness connector from the instrument cluster. 4. Turn the ignition ON. 5. Use a digital voltmeter (DVM) to measure the voltage from ground to terminal B5 of the EBCM harness connector J1. Does the voltage exceed the specified value?	1 v	Go to Step 11	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Reconnect the 10-pin instrument cluster harness connector to the instrument cluster. 3. Use a fused jumper with a 3-amp fuse to connect terminal B5 of the EBCM harness connector J1 to ground. Is the red BRAKE warning lamp ON ?	-	Go to Step 7	Go to Step 3
3	1. Turn the ignition switch to LOCK. 2. Remove the instrument cluster. 3. Remove and inspect the red BRAKE warning lamp. Is the bulb open?	-	Go to Step 4	Go to Step 5
4	Replace the BRAKE warning lamp. Is the repair complete?	-	System OK	-
5	Use a DVM to measure resistance between terminal 25 of the 10-pin instrument cluster harness connector and terminal B5 of the EBCM harness connector J1. Is the resistance less than the specified value?	2 W	Go to Section 9E, Instrumentation/Driver Information	Go to Step 6
6	Repair the open or high resistance in the circuit from terminal B5 of the EBCM connector J1 to terminal 25 of the 10-pin instrument cluster harness connector.	-	System OK	-
7	1. Check whether the brake fluid is at the proper level in the master cylinder reservoir. Add fluid as needed. 2. Remove the jumper used in Step 2. 3. Apply the parking brake. 4. Turn the ignition ON. 5. Use a DVM to measure the voltage between ground and terminal B5 of the EBCM harness connector J1. Is the voltage less than the specified value?	2 v	Go to Step 8	Go to Section 9E, Instrumentation/Driver Information

DTC A087 - Red Brake Warning Lamp Circuit Open or Short to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Release the parking brake. 2. Turn the ignition to LOCK. 3. Disconnect the brake fluid level indicator sensor at the cap on the master cylinder reservoir. 4. Inspect terminal B5 of the EBCM harness connector J1 for poor terminal contact or corrosion. Repair as needed. 5. Reconnect the EBCM harness connector J1 to the EBCM. 6. Start the engine. 7. Wait 10 seconds. Does the scan tool indicate that DTC A087 is set as a current DTC?	-	Go to Step 9	Go to Step 10
9	Replace the EBCM. Is the repair complete?	-	System OK	-
10	1. Turn the ignition to LOCK. 2. Inspect the harness connector terminals of the brake fluid level sensor for evidence of corrosion or poor terminal contact. Replace any terminals that exhibit signs of poor terminal contact or corrosion. 3. Reconnect connector to the brake level fluid level sensor. 4. Start the engine. 5. Wait 10 seconds. Does DTC A087 set as a current DTC?	-	Go to Section 9E, Instrumentation/Driver Information	Go to "Diagnostic Aids"
11	1. Turn the ignition to LOCK. 2. Reconnect the 10-pin instrument cluster harness connector to the instrument cluster. 3. Turn the ignition ON. Is the red BRAKE warning lamp OFF?	-	Go to Step 14	Go to Step 12
12	Check the scan tool for DTC code A086. Is DTC A086 also set?	-	Go to DTC A086 table	Go to Step 13
13	Check for low brake fluid level or parking brake switch closed and correct as necessary. Is the repair complete?	-	System OK	-
14	Using the scan tool misc. tests, select "Lamp Test Function," and command the BRAKE lamp ON. Is the lamp on?	-	Go to "Diagnostic Aids"	Go to Step 15
15	1. Turn the ignition to LOCK. 2. Remove the 10 amp fuse F11 in the I/P fuse block. 3. Disconnect the EBCM connector J1. 4. Turn the ignition ON. 5. Use the DVM to measure the voltage between ground and terminal B5 of the EBCM harness connector J1. Is the voltage less than the specified value?	1 v	Go to Step 17	Go to Step 16

DTC A087 - Red Brake Warning Lamp Circuit Open or Short to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
16	Repair the short to voltage in BRAKE lamp circuit between terminal B5 of the EBCM connector J1 and I/P Fuse 11 output. Is the repair complete?	-	System OK	-
17	1. Turn the ignition switch to LOCK. 2. Inspect the circuit from terminal B5 of the EBCM harness connector J1 to terminal 25 of the 10-pin instrument cluster for any damage which may result in a short to voltage with all connectors connected. 3. Repair any damage found. 4. Reconnect all of the connectors. 5. Turn the ignition ON. Does DTC A087 set as a current DTC?	-	Go to Step 18	Go to "Diagnostic Aids"
18	Replace the EBCM. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A091
OPEN STOPLAMP SWITCH DURING DECELERATION

Circuit Description

This DTC is used to detect an open stoplamp switch in the non-ABS mode. The EBCM looks for deceleration rates that would indicate braking action and verifies this assumption by requiring several repeats of this detection method. In each case, ABS will not be available since no stoplamp switch input is seen.

Diagnosis

This test monitors and calculates the deceleration for each wheel on a continuous basis. A fault is stored if a deceleration of 6.4 km/h/second (4 mph/second) is seen on 3 separate occasions while the stoplamp switch is off. The deceleration must begin above 24 km/h (15 mph) and end below 16 km/h (10 mph).

Cause(s)

- **The stoplamp switch is malfunctioning (contacts open all the time).**
- **The stoplamp switch fuse is blown.**
- **The power feed circuit for the stoplamp switch is open.**
- **The EBCM is faulty.**

Fail Action

The ABS is not available since the stoplamp switch is not available. The ABS is disabled and the ABS warning lamp is turned on. The system commands a rehome to ensure that all motors are in the home position.

Test Description

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

2. **This indicates if the EBCM has received the stoplamp switch signal.**
3. **This step indicates the existence of an open circuit in the stoplamp switch or the rear combination light circuitry.**
4. **This step traces the open circuit to either the stoplamp switch input circuitry or the EBCM.**
11. **This step verifies that voltage is available at the stoplamp switch.**
15. **This step verifies that the stoplamp switch is functioning properly.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A091 - Open Stoplamp Switch During Deceleration

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A095. Is DTC A095 currently set?	-	Go to DTC A095 table	Go to Step 2
2	1. Turn the ignition switch to ON. 2. Select "ABS Data List" on the scan tool. 3. Apply light pressure to the brake pedal while monitoring the brake switch on the scan tool. Does the scan tool indicate stoplamp ON within 25 mm (1 in.) of pedal travel?	-	Go to "Diagnostic Aids"	Go to Step 3
3	Maintain pressure on the brake pedal and observe the stoplamps. Are they lit?	-	Go to Step 4	Go to Step 11
4	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM harness connector J1. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal B9 of the EBCM harness connector J1 while applying firm pressure to the brake pedal. Is the voltage above the specified value?	10 v	Go to Step 5	Go to Step 8
5	Check for a poor contact at the EBCM harness connector J1, terminal B9. Is the contact bad?	-	Go to Step 6	Go to Step 7
6	Repair the contact at terminal B9 on the EBCM harness connector J1. Is the repair complete?	-	System OK	-
7	Replace the EBCM. Is the repair complete?	-	System OK	-
8	Check BRN/BLK wire terminal of the stoplamp switch connector for a poor connection. Is the connection bad?	-	Go to Step 9	Go to Step 10
9	Repair the connection at BRN/BLK wire terminal of the stoplamp switch connector. Is the repair complete?	-	System OK	-
10	Repair the open or short to ground in the circuit between BRN/BLK wire terminal of the stoplamp switch connector and terminal B9 of the EBCM connector J1. Is the repair complete?	-	System OK	-
11	Use a DVM to measure the voltage between ground and RED wire terminal of the stoplamp switch. Is the voltage greater than the specified value?	10 v	Go to Step 15	Go to Step 12
12	Check for an open in fuse F7. Is the fuse open?	-	Go to Step 13	Go to Step 14
13	Replace fuse F7. Is the repair complete?	-	System OK	-
14	Repair the open or short to ground in the wire between fuse F7 and RED wire terminal of the brake light switch connector. Is the repair complete?	-	System OK	-

DTC A091 - Open Stoplamp Switch During Deceleration (Cont'd)

Step	Action	Value(s)	Yes	No
15	Use a DVM to measure the voltage between ground and BRN/BLK wire terminal of the stoplamp switch while applying firm pressure to the brake pedal. Is the voltage greater than the specified value?	10 v	Go to Step 17	Go to Step 16
16	1. The problem is a misadjusted or faulty stoplamp switch. 2. Adjust or replace the brake light switch as required. Is the repair complete?	-	System OK	-
17	Check BRN/BLK wire terminal of the stoplamp switch connector for a poor connection. Is the connection bad?	-	Go to Step 18	Go to Step 10
18	Correct the poor connection at BRN/BLK wire terminal of the stoplamp switch connector. Is the repair complete?	-	System OK	-

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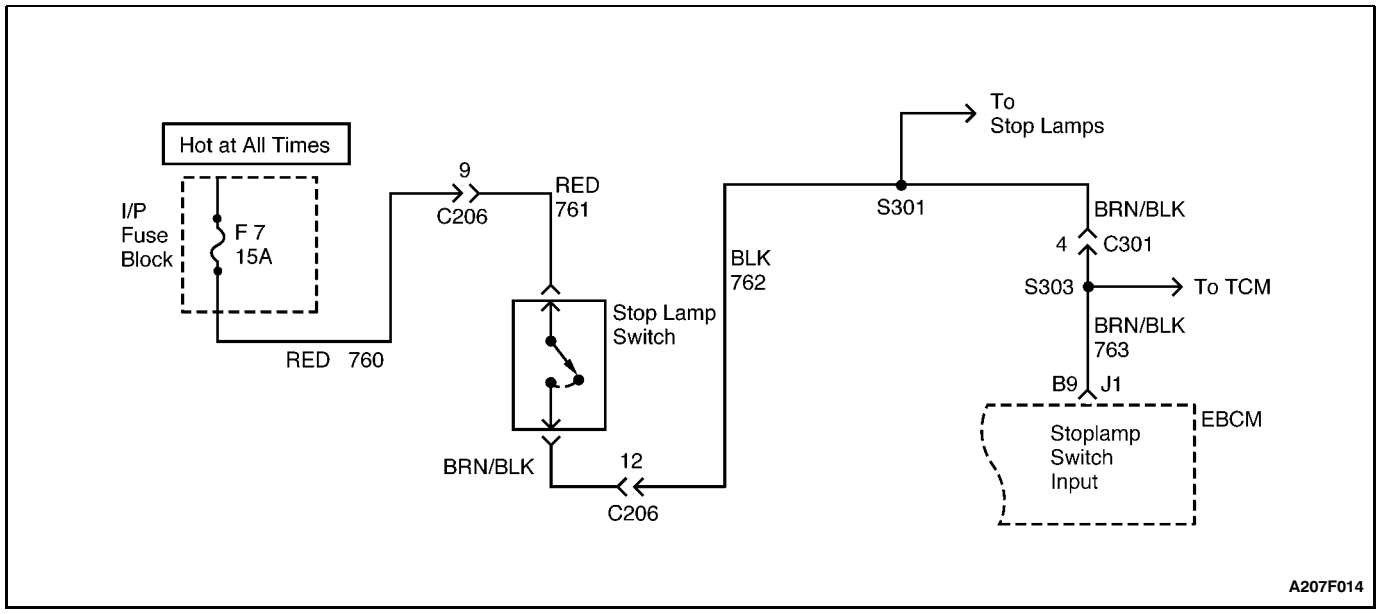

DIAGNOSTIC TROUBLE CODE (DTC) A092
OPEN STOPLAMP SWITCH WHEN ABS WAS REQUIRED

Circuit Description

This DTC is run to determine the proper operation of the stoplamp switch. This is important because ABS is activated when the stoplamp switch is closed. If the stoplamp switch is open, the ABS will never be activated. Since this malfunction is difficult to detect under normal braking conditions, this malfunction is detected only when ABS if required.

Cause(s)

- **The stoplamp switch is malfunctioning.**
- **The stoplamp switch fuse is blown.**
- **The stoplamp switch fuse power feed circuit is open.**
- **Two wheel speed sensors have been lost at the same time.**
- **The EBCM is malfunctioning.**

Fail Action

DTC A092 can be set if the vehicle's speed is greater than 8 km/h (5 mph). If the stoplamp switch was not closed and a release was required on two channels for 0.5 seconds, a malfunction exists.

Action Taken

A DTC A092 is stored, ABS is disabled and the ABS indicator is turned on.

Test Description

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

2. **This indicates if the EBCM has received the stoplamp switch signal.**
3. **This step indicates the existence of an open circuit in the stoplamp switch or the rear combination light circuitry.**
4. **This step isolates the open circuit to either the stoplamp switch input circuitry or the EBCM.**
11. **This step verifies that voltage is available at the stoplamp switch.**
15. **This step verifies that the stoplamp switch is functioning properly.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A092 - Open Stoplamp Switch When ABS Was Required

Step	Action	Value(s)	Yes	No
1	Check the scan tool for DTC code A095. Is DTC A095 currently set?	-	Go to DTC A095 table	Go to Step 2
2	1. Turn the ignition switch to ON. 2. Select "ABS Data List" on the scan tool. 3. Apply light pressure to the brake pedal while monitoring the stoplamp switch on the scan tool. Does the scan tool indicate stoplamp switch ON within 25 mm (1 in.) of pedal travel?	-	Go to "Diagnostic Aids"	Go to Step 3
3	Maintain pressure on the brake pedal and observe the stoplamps. Are they lit?	-	Go to Step 4	Go to Step 11
4	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM harness connector J1. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal B9 of the EBCM harness connector J1 while applying firm pressure to the brake pedal. Is the voltage above the specified value?	10 v	Go to Step 5	Go to Step 8
5	Check for a poor contact at the EBCM harness connector J1, terminal B9. Is the contact bad?	-	Go to Step 6	Go to Step 7
6	Repair the contact at terminal B9 on the EBCM harness connector J1. Is the repair complete?	-	System OK	-
7	Replace the EBCM. Is the repair complete?	-	System OK	-
8	Check BRN/BLK wire terminal of the stoplamp switch connector for a poor connection. Is the connection bad?	-	Go to Step 9	Go to Step 10
9	Repair the connection at the BRN/BLK wire terminal of the stoplamp switch connector. Is the repair complete?	-	System OK	-
10	Repair the open or short to ground between stoplamp switch connector BRN/BLK wire terminal and the EBCM connector J1, terminal B9. Is the repair complete?	-	System OK	-
11	Use a DVM to measure the voltage between ground and RED terminal wire or the stoplamp switch. Is the voltage greater than the specified value?	10 v	Go to Step 15	Go to Step 12
12	Check for an open in fuse F7. Is the fuse open?	-	Go to Step 13	Go to Step 14
13	Replace fuse F7. Is the repair complete?	-	System OK	-
14	Repair the open or short to ground in the wire between fuse F7 and the stoplamp switch. Is the repair complete?	-	System OK	-

DTC A092 - Open Stoplamp Switch When ABS Was Required (Cont'd)

Step	Action	Value(s)	Yes	No
15	Use a DVM to measure the voltage between ground and BRN/BLK wire terminal of the stoplamp switch while applying firm pressure on the brake pedal. Is the voltage greater than the specified value?	10 v	Go to Step 17	Go to Step 16
16	1. The problem is a misadjusted or faulty stoplamp switch. 2. Adjust or replace the stoplamp switch as required. Is the repair complete?	-	System OK	-
17	Check the I/P harness connector BRN/BLK wire terminal for a poor connection? Is the connection bad?	-	Go to Step 18	Go to Step 10
18	Correct the poor connection at the BRN/BLK wire terminal of the I/P harness. Is the repair complete?	-	System OK	-

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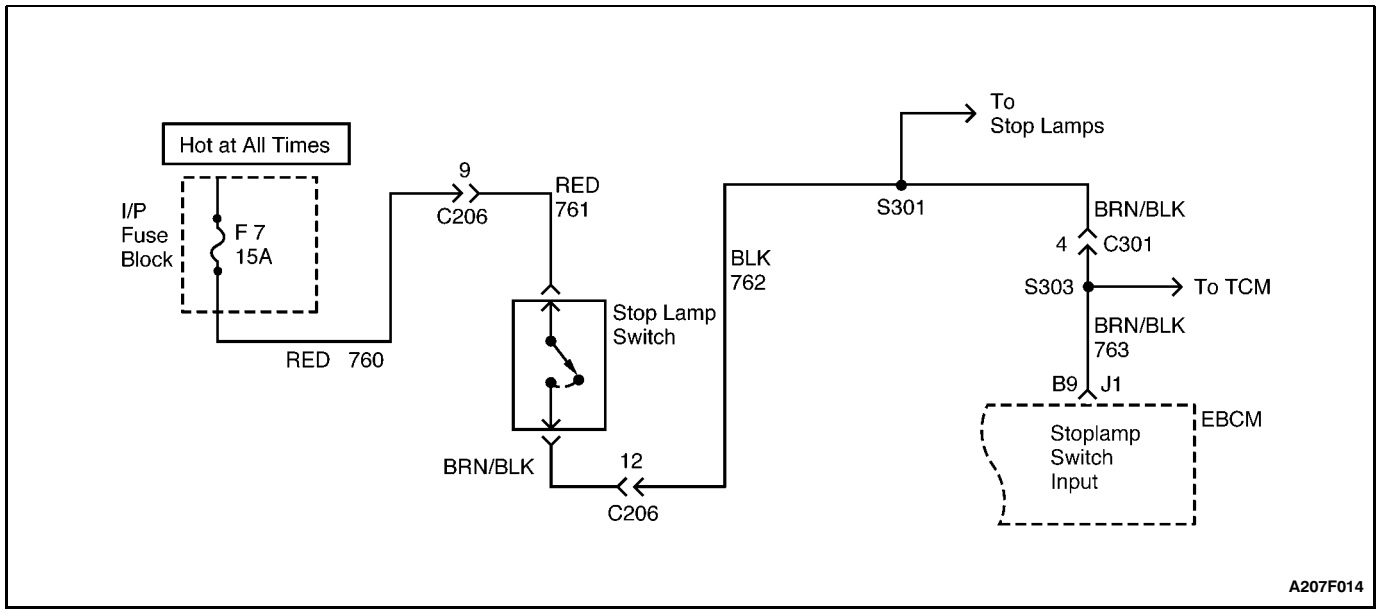


DIAGNOSTIC TROUBLE CODE (DTC) A093
CODE A091 OR A092 SET IN CURRENT OR PREVIOUS IGNITION CYCLE

Diagnosis

The system monitors tests A091 and A092 during the last or current ignition cycle and sees no transition of the brake switch from OFF to ON.

Fail Action

This DTC is the second portion of DTCs A091 and A092. If DTCs A091 or A092 failed during the last ignition cycle, DTC A093 becomes a current failure during the next ignition cycle, keeping the ABS disabled and the ABS warning lamp ON until a brake light switch transition is seen from OFF to ON. When a brake ON is seen during an ignition cycle in which DTC A093 is a current malfunction, the system will enable the ABS at the start of the next ignition cycle. If no transition is seen, DTC A093 will remain a current failure during all following ignition cycles until a transition from OFF to ON is seen.

Test Description

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

1. **This step indicates which DTC (either A091 or A092) caused DTC A093 to set.**
2. **This insures that the DTC that set is repaired so that DTC A093 can be cleared.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

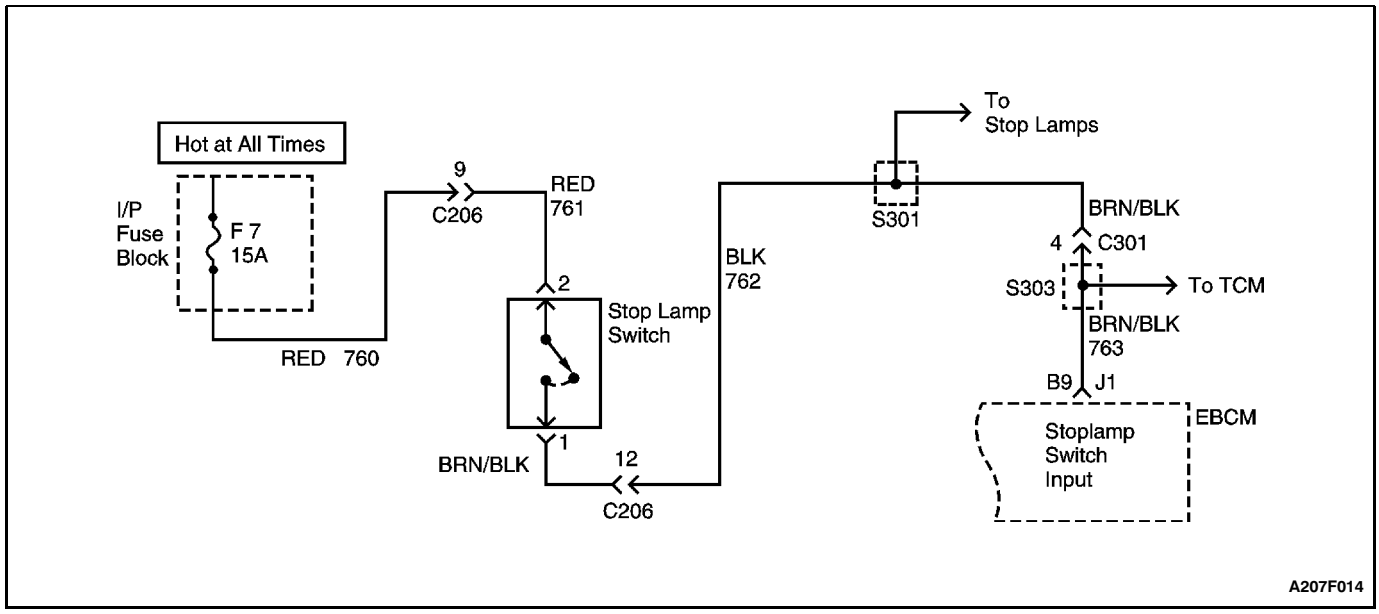
Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

Verify proper brake light switch operation with the Data List of the scan tool. As the brake is applied, the data list should display the brake switch ON within 25 mm (1 in.) of travel.

DTC A093 - Code A091 or A092 Set in Current or Previous Ignition Cycle

Step	Action	Value(s)	Yes	No
1	1. Turn ignition switch to ON. 2. Read the DTCs on the scan tool. Is DTC A091 or A092 set as history or current DTCs?	-	Go to Step 2	Go to Step 3
2	Proceed to the table for the DTC that set and repair the problem as necessary. Is the repair complete?	-	System OK	-
3	1. Use the enhanced diagnostic function of the scan tool to verify that the malfunction frequency was low. 2. Use the scan tool to clear the DTCs. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A094
STOPLAMP SWITCH CONTACTS ALWAYS CLOSED

Circuit Description

This DTC is run to determine the proper operation of the stoplamp switch. This is important because ABS is activated when the stoplamp switch is closed and deactivated when the switch is open. If the stoplamp switch is always closed, ABS operation will always be requested, resulting in potential hydraulic modulator cycling on rough roads. Additionally, this malfunction will most likely result in a discharged battery (due to the stoplamps remaining on) if the driver is not informed of the problem.

Diagnosis

This test checks if the stoplamp switch input is seen at ignition ON and remains on for the rest of the drive cycle until the vehicle reaches 40 km/h (25 mph) for two consecutive drive cycles.

Cause(s)

- **The stoplamp switch contacts are misadjusted or shorted.**
- **There is a short to voltage in the stoplamp switch circuitry.**
- **The EBCM is faulty.**

Fail Action

Set history code.

Test Description

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

1. **This checks if the malfunction is currently present.**
2. **This step checks for unwanted voltage on the stoplamp switch input circuit.**
3. **This step checks for a possible intermittent malfunction.**
8. **This step traces the cause of the malfunction to either a malfunctioning or misadjusted stoplamp switch or a short to voltage in the stoplamp switch circuitry.**

Diagnostic Aids

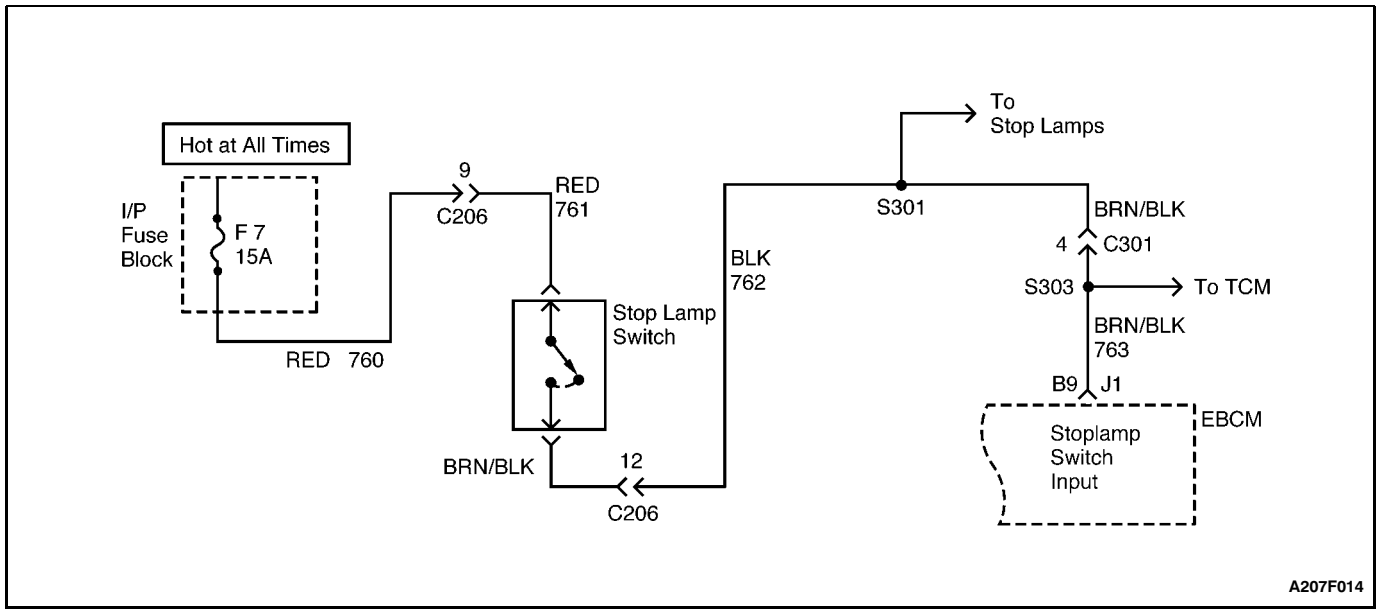
An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or physical damage to the wiring harness.

DTC A094 - Stoplamp Switch Contacts Always Closed

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to LOCK. 2. Observe the stoplamps. Are the stoplamps OFF?	-	Go to Step 2	Go to Step 8
2	1. Disconnect the EBCM harness connector J1. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between terminal B9 of the EBCM connector J1 and ground. Is the voltage less than the specified value?	2 v	Go to Step 3	Go to Step 7
3	1. Turn the ignition switch to LOCK. 2. Inspect the EBCM harness connector J1, terminal B9 for a poor contact. Is there poor contact?	-	Go to Step 4	Go to Step 5
4	Repair the poor contact found at terminal B9 of the EBCM harness connector J1. Is the repair complete?	-	Go to Step 5	-
5	1. Reconnect all of the connectors. 2. Test drive the vehicle for two consecutive drive cycles above 40 km/h (25 mph). Does DTC A094 reset?	-	Go to Step 6	Go to "Diagnostic Aids"
6	Replace the EBCM. Is the repair complete?	-	System OK	-
7	Repair the short to voltage between BRN/BLK wire terminal of the stoplamp switch connector and terminal B9 of the EBCM connector J1. Is the repair complete?	-	System OK	-
8	Disconnect the stoplamp switch connector. Are the stoplamps on?	-	Go to Step 7	Go to Step 9
9	1. The problem is a misadjusted or malfunctioning stoplamp switch. 2. Adjust or replace the switch as required. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) A095 STOPLAMP SWITCH CIRCUIT OPEN

Diagnosis

This test checks for an open in the stoplamp circuit that prevents the stoplamp input to the EBCM from changing states when the bake is applied. A fault exists if the voltage reading for the stoplamp switch is between 5.23 volts and 3.35 volts for 1 second.

Cause(s)

- **There is an open in the stoplamp switch circuit.**
- **All the stoplamps are open.**
- **The ground path for all the stoplamps is open.**
- **There is a poor contact in the EBCM connector J1.**
- **The EBCM is faulty.**

Fail Action

This DTC is used in conjunction with DTCs A091, and A092 to determine the cause of an open stoplamp switch fault. A "not open" circuit condition with no brake input may indicate a stoplamp contact, a fuse, or a mounting/adjustment problem and is associated with DTC A091 and A092 failures. This fault identifies the cause as the monitor line, the lights (all bulbs open), the controller connection, or the controller interface circuit. The ABS is disabled and the ABS warning lamp is turned ON. A rehome is commanded to ensure that all motors are in the home position.

Test Description

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

1. **This step is used to confirm the existence of an open in the stoplamp switch circuitry.**
2. **This step indicates if the EBCM has received the stoplamp switch signal.**
3. **This step indicates the existence of an open circuit in the stoplamp switch or the stoplamp circuitry.**
4. **This step isolates the open circuit to either the stoplamp switch input circuitry or the EBCM.**

Diagnostic Aids

An "intermittent" malfunction may be caused by a poor connection, wire insulation that has been rubbed through, or a wire that is broken inside the insulation.

Check the frequency of the malfunction by using the enhanced diagnostic feature of the scan tool as described in "Scan Tool Diagnostics."

Any circuitry that is suspected of causing the intermittent complaint should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

DTC A095 - Stoplamp Switch Circuit Open

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Monitor the stoplamp switch status from "ABS Data List" on the scan tool. Does the scan tool indicate that the stoplamp switch is open?	-	Go to Step 2	Go to "Diagnostic Aids"
2	Apply light pressure to the brake pedal while monitoring the stoplamp switch status on the scan tool. Does the scan tool indicate stoplamp switch ON within 25 mm (1 in.) of pedal travel?	-	Go to Step 11	Go to Step 3
3	Apply firm pressure to the brake pedal and observe the stoplamps. Are the stoplamps on?	-	Go to Step 4	Go to Step 11
4	1. Turn the ignition switch to LOCK. 2. Disconnect the EBCM harness connector J1. 3. Turn the ignition switch to ON. 4. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal B9 of the EBCM harness connector J1 while applying firm pressure to the brake pedal. Is the voltage greater than the specified value?	10 v	Go to Step 8	Go to Step 5
5	Check BRN/BLK terminal wire of the stoplamp switch connector for a poor connection. Is the connection bad?	-	Go to Step 6	Go to Step 7
6	Repair the connection at the BRN/BLK terminal wire of the stoplamp switch connector. Is the repair complete?	-	System OK	-
7	Repair the open between the BRN/BLK terminal wire of the stoplamp switch connector and terminal B9 of the EBCM harness connector J1. Is the repair complete?	-	System OK	-
8	Check for a poor contact at terminal B9 of the EBCM harness connector J1. Is the contact bad?	-	Go to Step 9	Go to Step 10
9	Repair the poor connection at terminal B9 of the EBCM harness connector J1. Is the repair complete?	-	System OK	-
10	Replace the EBCM . Is the repair complete?	-	System OK	-
11	Repair the open in the stoplamp circuit. Is the repair complete?	-	System OK	-

AUTOMATED MODULATOR TEST

Tools Required

Scan Tool

If a mechanical modulator malfunction is suspected, rough ABS performance is reported, or if any modulator service has been performed, the automated modulator test must be performed to verify the repair has corrected the identified problem and the displacement cylinder pistons are returned to their top-most (home) position. The scan tool will prompt you for replies to changes in the brake pedal position. These brake pedal position changes are a result of modulator component control in a specific order that allows component malfunctions to be determined. It is very important, especially when testing the rear channel, that each reply to the scan tool questions be carefully considered. During rear channel testing, pedal movement will be felt as a bump, which is much different from the movement felt in the front channels. The pedal movement for the front brakes should be smoothly downward toward the floor on "release" or smoothly upward toward the top of the pedal travel on "apply."

AUTOMATED MOTOR PACK DIAGNOSIS TEST

Tools Required

Scan Tool

Using the scan tool, perform the motor pack diagnosis test to identify a potential problem in the motor pack. If a problem exists, the results of the motor pack test will be indicated on the scan tool.

If the motor is indicated to be malfunctioning, the motor pack is not serviceable and must be replaced as an assembly. Refer to "Motor Pack" in this section.

NO GEAR MOVEMENT

If all three motors release at this point, the motor pack appears to function properly. Remove the hydraulic pack from the hydraulic modulator. Refer to "Motor Pack" in this section. Rotate each gear on the hydraulic modulator by hand. The front gears should be free to rotate approximately 8.5 turns lock to lock. If the gears do not turn freely or if at least eight turns are not possible, replace the hydraulic modulator. Refer to "Hydraulic Modulator/Motor Pack Assembly" in this section.

The rear gear should rotate approximately four turns. If the gear does not turn freely or if at least 3.5 turns are not possible, replace the hydraulic modulator. Refer to "Hydraulic Modulator/Motor Pack Assembly" in this section.

HYDRAULIC FUNCTIONAL CONTROL

Tools Required

Scan Tool

This test is used to verify base brake apply and ABS release, hold and apply functions. During testing, the scan tool will provide information on any problem that may be encountered.

1. Turn the ignition switch to LOCK.
2. Raise and suitably support the vehicle so that all four wheels are off the ground.
3. Install the brake cartridge into the scan tool and connect it to the ALDL. Power the scan tool using the battery adapter.
4. Turn the ignition switch to ON.
5. Select a channel to test - left front, right front, or rear. When testing the rear brakes, both rear wheels should rotate and not rotate together at the various points in the test. This is true because both rear brake pressures are controlled together.
6. Firmly depress the brake pedal. The pedal should remain high and firm.
7. Have an assistant attempt to rotate the wheel being tested. If the wheel does not rotate, base brake apply is functioning properly.
8. With the brake pedal still depressed, press the â (up arrow) key on the scan tool to begin the test. The brake pedal should remain high and firm. If the brake pedal drops toward the floor, verify the solenoid electrical connectors are connected to the correct solenoids.
9. With the brake pedal still depressed, have the assistant attempt to rotate the wheel. The wheel should rotate with little or no resistance for the full 18 seconds of this test.
10. After 18 seconds, brake pressure will be applied, and a slight bump may be felt in the brake pedal. This is normal. The assistant should not be able to rotate the wheel at this point.

MOTOR TESTING

Tools Required

Scan Tool

Each motor can be turned on manually for up to 5 seconds at a current of 10 amps forward or 6 amps backward. The test below describes how the front motors will operate. The rear motor can be tested in a similar manner, except there will be only a slight pedal drop and rise (bump) during the test.

1. Turn the ignition switch to LOCK.
2. Install the brake cartridge into the scan tool and connect it to the ALDL. Power the scan tool using the battery adapter.
3. Turn the ignition switch to ON, with the engine stopped.
4. Pump the brake pedal several times to deplete the vacuum reserve.

5. Depress and hold the brake pedal.
6. Using the scan tool, release one of the motors. The brake pedal should move smoothly toward the floor. As the pedal drops, the feedback current should momentarily drop to only a few amps (indicated motor movement) and then become equal to the command current (6 amps). This indicates the motor is no longer moving since the piston has bottomed out.
   - Rough or "jumpy" pedal movement indicates an intermittent electrical connection within the motor.
7. With the brake pedal still depressed and at the floor, apply the same motor. The brake pedal should now rise smoothly back to the top of its travel. The feedback current should drop momentarily to a few amps, then quickly increase to the command current (10 amps). This indicates that the motor is no longer moving since the piston has reached the top of its travel.

If the brake pedal does not move both up and down as indicated and there are no DTCs set, monitor the feedback current closely while performing the test again. If the feedback current is only a few amps, the motor is free-spinning. The motor pack must be separated from the hydraulic modulator to identify an expansion spring brake (ESB), a motor, a gear, or a ball screw problem. Refer to "Motor Pack" in this section.

MOTOR PACK FUNCTIONAL TEST

Once the motor pack has been separated from the hydraulic modulator, this test will help to determine if the motor pack is operating properly.

The scan tool will rotate the motors in one direction, then the other.

- If any motor does not turn in both directions, the motor pack is malfunctioning and must be replaced. Refer to "Motor Pack" in this section.
- If all three motors rotate, try to rotate each gear on the hydraulic modulator. Refer to "No Gear Movement" in this section.

SOLENOID TEST

Tools Required

Scan Tool

1. Turn the ignition switch to LOCK.
2. Install the brake cartridge into the scan tool and connect it to the ALDL. Power the scan tool using the battery adapter.
3. Turn the ignition switch to ON, with the engine stopped.
4. Pump the brake pedal to deplete the vacuum from the power booster.
5. Select manual control.
6. Select left front or right front motor release.
7. Release the motor for the channel being tested. Check the motor command and feedback currents to be sure that the motor released properly. Refer to "Motor Testing" in this section.
8. Select the solenoid for the same channel.
9. With no brake pressure applied, turn the solenoid on.
10. Depress the brake pedal. It should be very high and firm.
    - If the pedal goes nearly to the floor, the solenoid is leaking or not closing and/or the checkball is leaking. Go to step 12.
11. With brake pressure still applied, turn the solenoid off. If the brake pedal drops immediately toward the floor, operation is normal. End the test.
12. If the brake pedal does not drop and the motor is moving, the solenoid is stuck on.
13. Physically switch the two solenoids.
14. Repeat the test for the channel in question.
    - If the pedal sinks slowly to the floor, the check valve is leaking, and the hydraulic modulator must be replaced. Refer to "Hydraulic Modulator/ Motor Pack Assembly" in this section.
    - If the test now works properly, test the opposite channel. If the pedal sinks or rises, that solenoid must be replaced. Refer to "ABS Solenoid" in this section.

ABS ENABLE RELAY TEST

Tools Required

Scan Tool

This test allows monitoring of the voltage at the EBCM while turning the ABS enable relay ON and OFF.

When the relay is commanded ON, the voltage should be equal to the battery voltage. When the relay is OFF, the voltage should drop below 5 volts.

Important: Voltage will not drop to zero when the relay contacts are open due to capacitors in the EBCM. If the voltage drops below 5 volts, the relay is operating properly.

VOLTAGE LOAD TEST

Tools Required

Scan Tool

The ABS VI system can draw significant amounts of current while operating. This test turns on many of the system components to load test the vehicle's electrical system.

If low voltage malfunctions or intermittent EBCM operation are occurring, this test will allow you to monitor two separate power circuits for ABS: ignition and battery. If only one of these two inputs drops below 10 volts during testing, a high resistance may be present in that power feed circuit.

GEAR TENSION RELIEF SEQUENCE

Tools Required

Scan Tool

When the displacement cylinder pistons are in the topmost (home) position, each motor has prevailing torque due to the force necessary to ensure each piston is held firmly at the top of its travel. This torque results in gear tension, or force on each gear that makes motor pack separation difficult. To avoid injury or damage to the gears, the gear tension relief sequence briefly reverses each motor to eliminate the prevailing torque.

Always perform the gear tension relief sequence prior to removing the hydraulic modulator from the vehicle. Each hydraulic modulator gear (the large gears) should be free to turn in one direction and then in the other direction when the motor pack is removed. If any gear will not move, replace the hydraulic modulator. Refer to "Hydraulic Modulator/Motor Pack Assembly" in this section.

ABS AND BRAKE INDICATOR CONTROL

Tools Required

Scan Tool

This allows a functional test of the ABS indicator circuit and lamp driver module by flashing the indicator or illuminating it. The BRAKE indicator can be cycled ON and OFF using this test.

MOTOR REHOME FUNCTION

Tools Required

Scan Tool

The motor rehome function is initiated by pressing the "F%" key from the scan tool main ABS VI screen. The motor rehome function should always be used prior to bleeding the brake system to eliminate any trapped air within the hydraulic modulator cylinders. It accomplishes this by returning the hydraulic modulator pistons to their home positions and forcing any trapped air toward the bleeder valves where it can easily be bled out.

Important: The motor rehome function cannot be performed if any current DTCs are present. If current DTCs are present, the vehicle must be repaired and the DTCs cleared before performing the motor rehome function.

MAINTENANCE AND REPAIR
ON-VEHICLE SERVICE

SERVICE PRECAUTIONS

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

- [illegible]
- **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 or 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.

BLEEDING SYSTEM

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

Tools Required

Scan Tool

Notice: Prior to bleeding the brakes, the front and rear displacement cylinder pistons must be returned to the top-most (home) position. Using a scan tool, select the motor rehome function. You cannot perform the motor rehome function if current DTCs are present. If DTCs are present, you must repair the vehicle and clear the DTCs.

If you do not have a scan tool available to command a motor rehome, follow the procedure below:

1. **Raise and suitably support the front end of the vehicle so that the drive wheels are off the ground.**
2. **Start the engine, engage the transaxle, and run the vehicle above 5 km/h (3 mph) for at least 10 seconds.**

3. Observe the ABS indicator. Make sure that the indicator goes out after approximately 3 seconds.
   - If the ABS indicator remains illuminated, use a scan tool to diagnose the malfunction.
   - If the ABS indicator goes out and stays off, stop the engine and repeat steps 2 and 3 one more time.

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

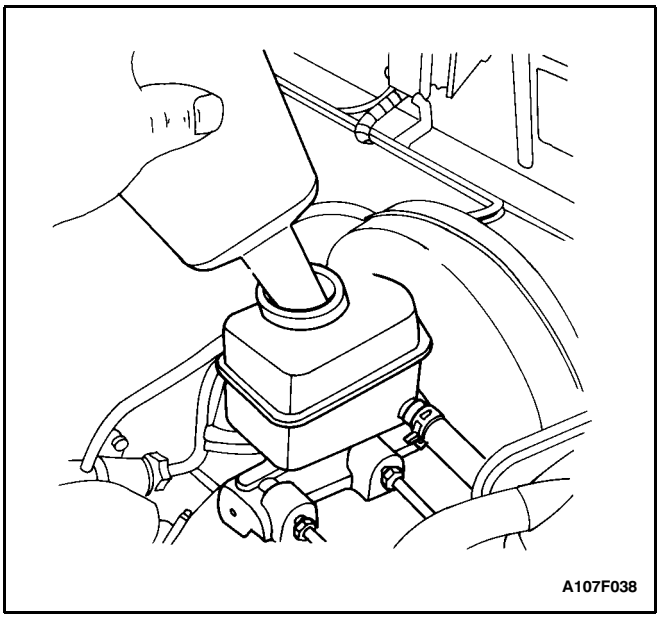
- Eye contact - rinse thoroughly with water.
- Skin contact - wash with soap and water.
- Ingestion - consult a physician immediately.

Important: In the following procedure, use a suitable container and/or shop cloths to catch brake fluid and prevent it from contacting any painted surfaces, wiring, cables, or electrical connectors.

4. Clean the master cylinder reservoir and the surrounding area.
5. Remove the master cylinder reservoir cap.

Notice: Do not use fluid from an open container that may be contaminated with water.

6. Inspect the brake fluid level. Add clean DOT 3 or equivalent hydraulic brake fluid if needed.
7. Install the master cylinder reservoir cap.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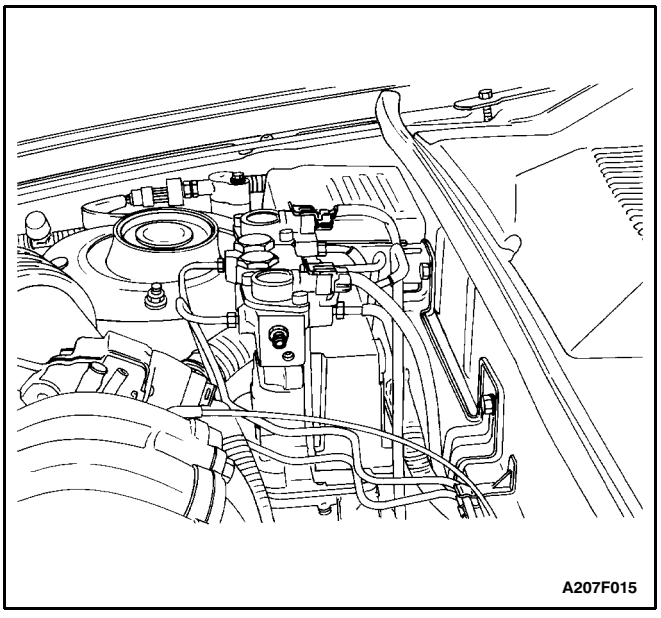
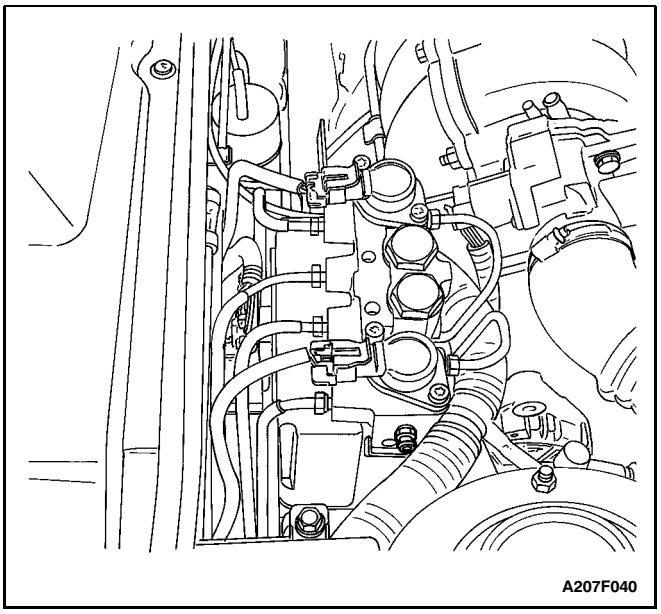

A207F015

8. Bleed the hydraulic modulator:
   - 8.1. Attach a clear plastic bleeder hose to the left-side bleeder valve on the hydraulic modulator. Submerge the other end of the bleeder hose in a clean container partially filled with brake fluid.
   - 8.2. Slowly open the left-side bleeder valve 1/2 to 3/4 turn.
   - 8.3. Have an assistant press the brake pedal and hold it down until the brake fluid begins to flow.
   - 8.4. Close the bleeder valve and release the brake pedal. Repeat steps 5.2 and 5.3 until no air bubbles are present.

Tighten

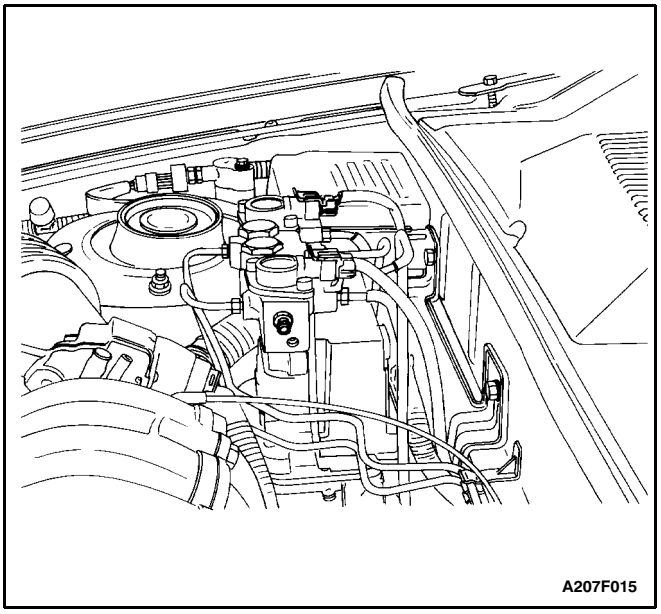
Tighten the bleeder valve to 9 N•m (80 lb-in).


A207F040

8.5. Repeat the procedure for the right-side bleeder valve.

Important: Once fluid flows from both hydraulic modulator bleeder valves, the hydraulic modulator is sufficiently full of brake fluid. However, it may not be completely purged of air. At this point, move to the wheel cylinders and the calipers and bleed them. This ensures that the lowest points in the system are completely free of air. Then the hydraulic modulator can be purged of any remaining air.

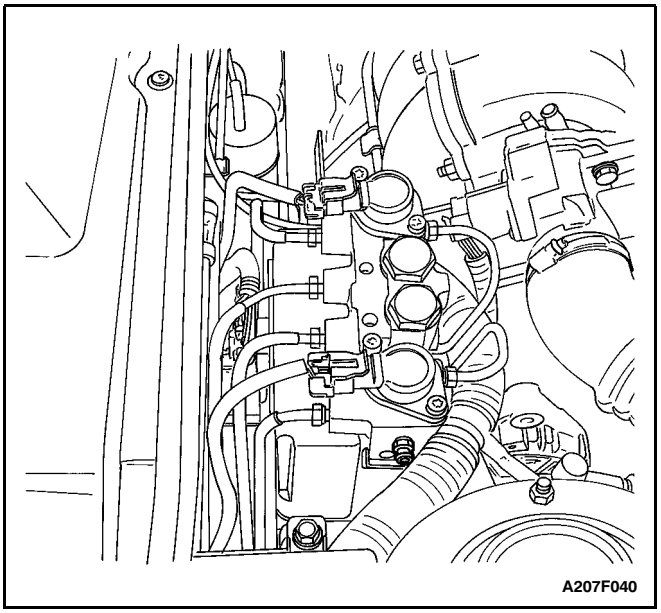
9. Bleed the system according to one of the bleeding procedures. Refer to Section 4A, Hydraulic Brakes.


A207F015

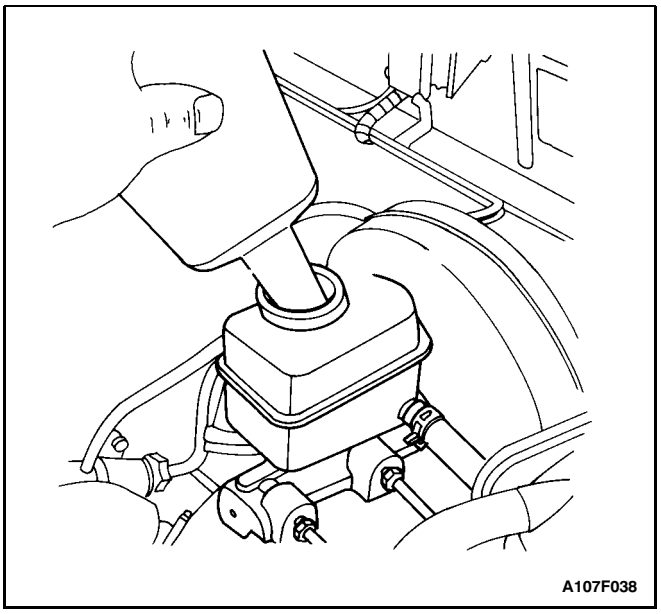
10. Bleed the hydraulic modulator.
    10.1. Attach a clear plastic bleeder hose to the left-side bleeder valve on the hydraulic modulator. Submerge the other end of the bleeder hose in a clean container partially filled with brake fluid.
    10.2. Slowly open the left-side bleeder valve 1/2 to 3/4 turn.
    10.3. Have an assistant press the brake pedal and hold it down until the brake fluid begins to flow.
    10.4. Close the bleeder valve and have the assistant release the brake pedal. Repeat Steps 15.2 and 15.3 until no air bubbles are present.

Tighten

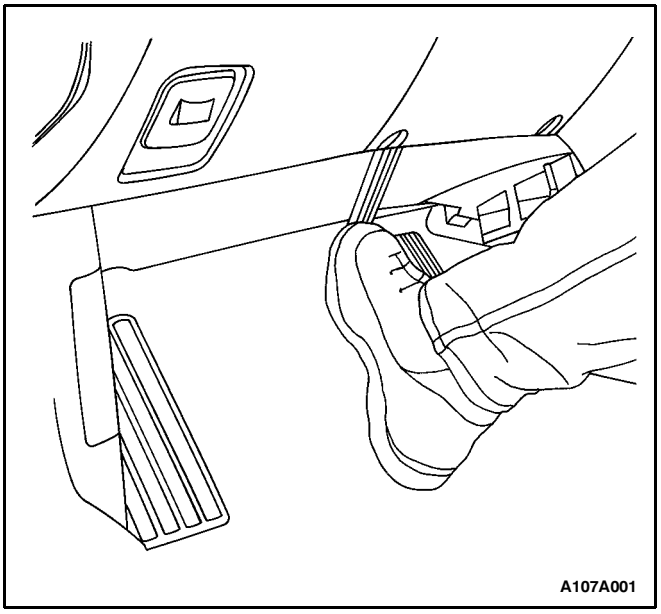
Tighten the bleeder valve to 9 N•m (80 lb-in).


A207F040

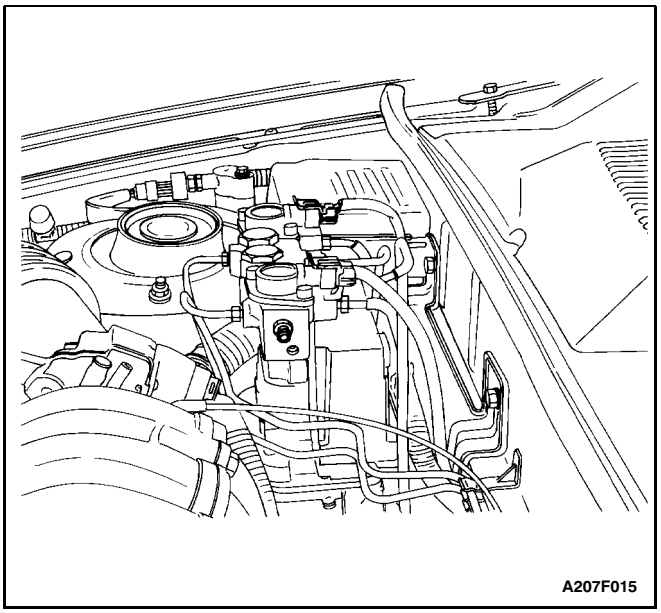
10.5. Repeat the procedure for the right-side bleeder valve.


A107F038

11. Remove the master cylinder reservoir cap.
12. Inspect the brake fluid level; add clean DOT 3 or equivalent hydraulic brake fluid if needed.
13. Install the master cylinder reservoir cap.


A107A001

14. Inspect the brakes.
    - With the ignition switch ON, press the brake pedal with moderate force and hold it in position. Note pedal travel and feel.
    - If the pedal feels firm and constant and pedal travel is not excessive, start the engine. With the engine running, re-check the pedal travel. If it is still firm and pedal travel is not excessive, proceed with step 15.
    - If the pedal feels soft or has excessive travel whether initially or after the engine starts, using the scan tool, release then apply the motors 3 times and cycle the solenoids 10 times. Be sure to apply the motors to ensure that the pistons are in the home position. Repeat the bleeding procedure.
15. Road test the vehicle. Make several normal (non-ABS) stops from a moderate speed to ensure proper brake system function.

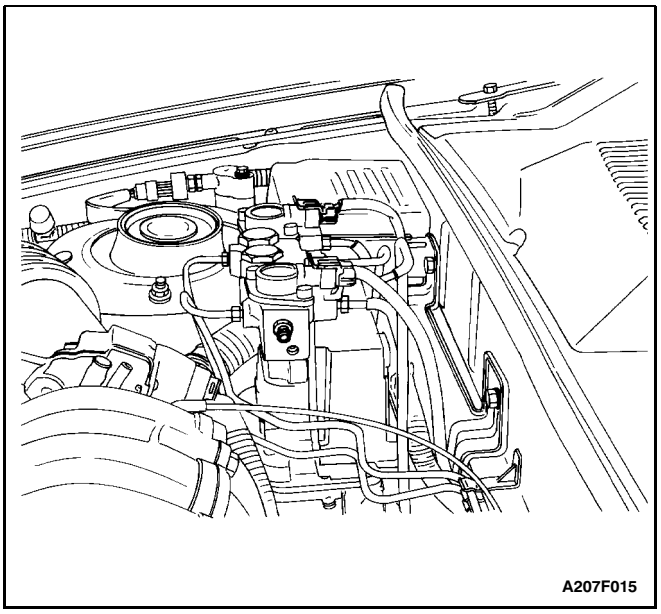

A207F015

HYDRAULIC MODULATOR BLEEDER VALVE

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

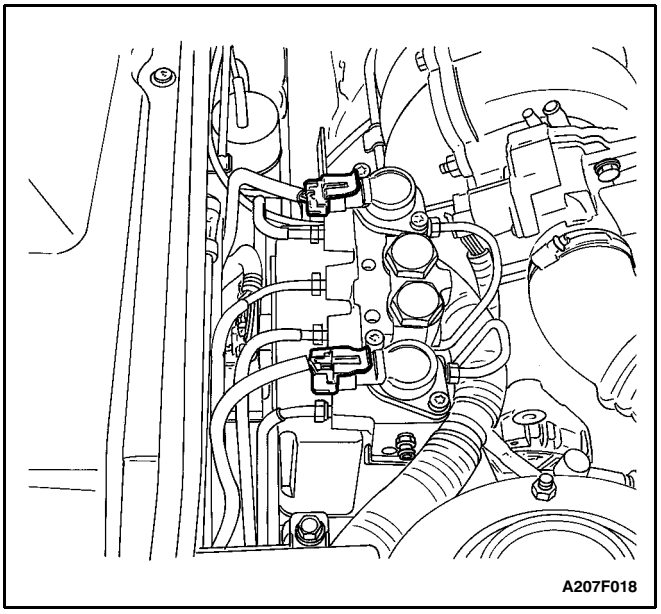
Removal Procedure

1. Place a shop cloth or suitable container below the bleeder valve to catch escaping brake fluid.
2. Unscrew and remove the bleeder valve from the hydraulic modulator. This illustration shows the left-side bleeder valve. There is another bleeder valve on the right side.


A207F015

Installation Procedure

1. Install the bleeder valve into the hydraulic modulator. Do not tighten fully.
2. Bleed the brake system. Refer to "Bleeding System" in this section.

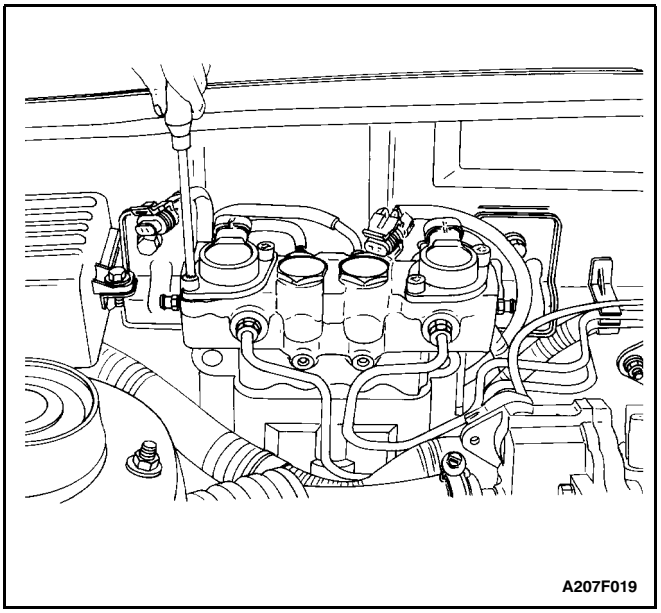

A207F018

ABS SOLENOID

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

Removal Procedure

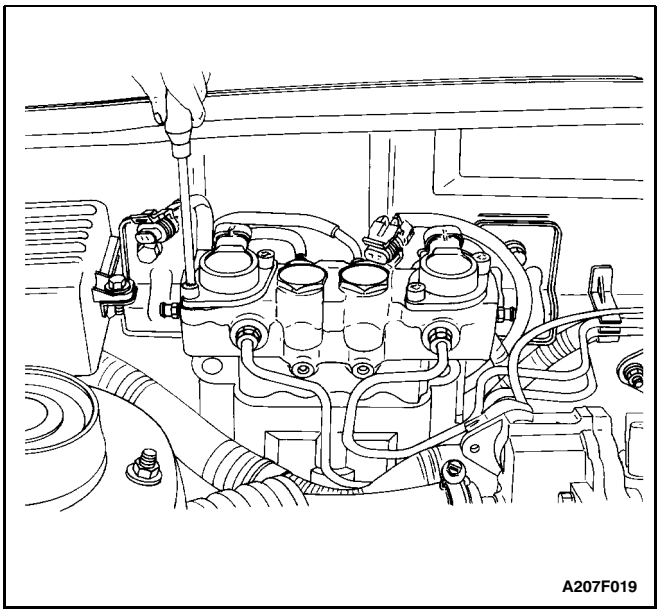
1. Disconnect the negative battery cable.
2. Unplug the ABS solenoid electrical connector.


A207F019

3. Remove the Torx® head bolts and the solenoid from the hydraulic modulator.

Important:

- Be sure that the O-ring seal is still attached to the solenoid shaft when it is removed. If not, check the solenoid bore in the hydraulic modulator.
- Do not attempt to disassemble the solenoid; it is serviceable only as an assembly.


A207F019

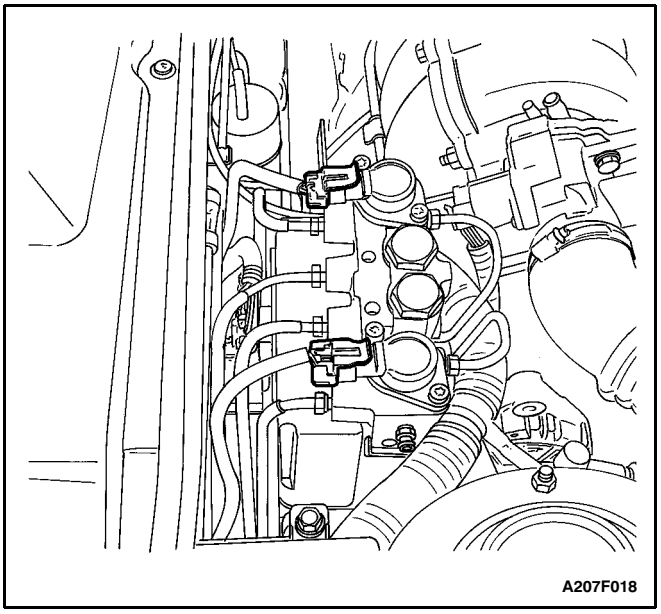
Installation Procedure

Important: Verify that the solenoid O-ring seal is properly positioned before installing the solenoid into the hydraulic modulator.

1. **Lubricate the seal on the solenoid with clean brake fluid.**
2. **Install the solenoid to the hydraulic modulator.**
3. **Install the Torx® head bolts securing the solenoid.**

Tighten

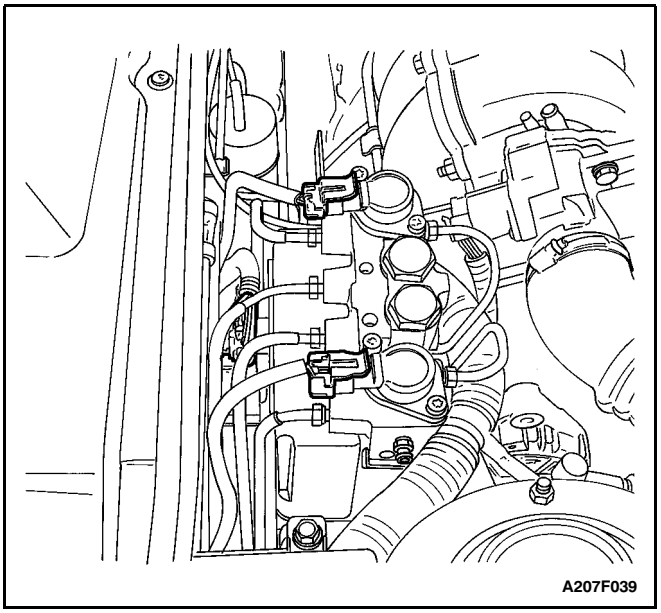
Tighten the ABS solenoid Torx® head bolts to 4.5 N•m (40 lb-in).


A207F018

4. **Connect the solenoid electrical connector.**

Important: Make sure that the solenoid electrical connectors are correctly installed.

5. **Connect the negative battery cable.**
6. **Bleed the brake system. Refer to "Bleeding System" in this section.**


A207F039

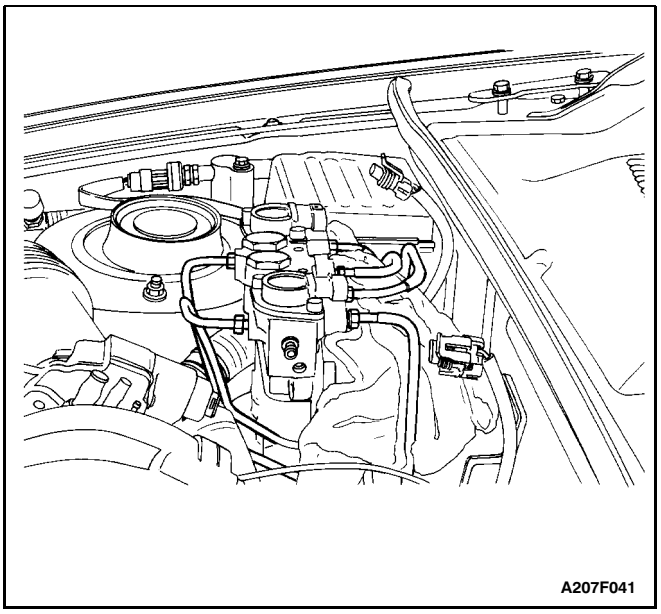
HYDRAULIC MODULATOR/MOTOR PACK ASSEMBLY

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

Caution: To help avoid personal injury due to the reĆ tained load on the hydraulic modulator/motor pack assembly, perform the gear tension relief function of the scan tool before removing the hydraulic modĆ ulator/motor pack assembly.

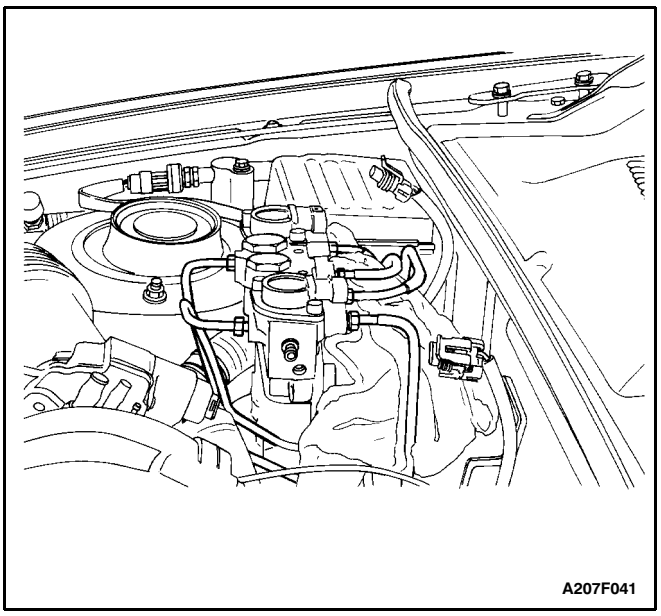
Removal Procedure

1. **Using the scan tool, perform the gear tension relief sequence. Refer to "Gear Tension Relief Sequence" in this section.**
2. **Disconnect the negative battery cable.**
3. **Disconnect the ABS solenoid and the motor pack electrical connectors.**


A207F041

Notice: Place a shop cloth beneath the hydraulic modulator brake pipes to prevent brake fluid from contaminating the motor pack or the electrical connectors. Plug the brake pipes to prevent loss or contamination of brake fluid.

4. **Disconnect the brake pipes from the hydraulic modulator.**
5. **Remove the nuts securing the hydraulic modulator/ motor pack assembly to its mount.**
6. **Remove the hydraulic modulator/motor pack assembly from the vehicle.**


A207F041

Installation Procedure

1. **Install the hydraulic modulator/motor pack assembly to the vehicle. Install the nuts.**

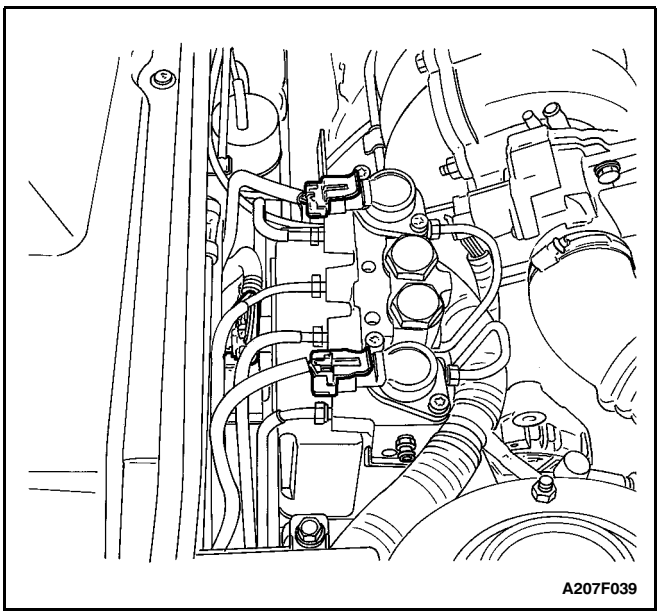
Tighten

Tighten the hydraulic modulator/motor pack assembly nuts to 5 N•m (44 lb-in).

2. **Remove the plugs from the brake pipes and connect them to the hydraulic modulator. Secure each pipe with a pipe nut.**

Tighten

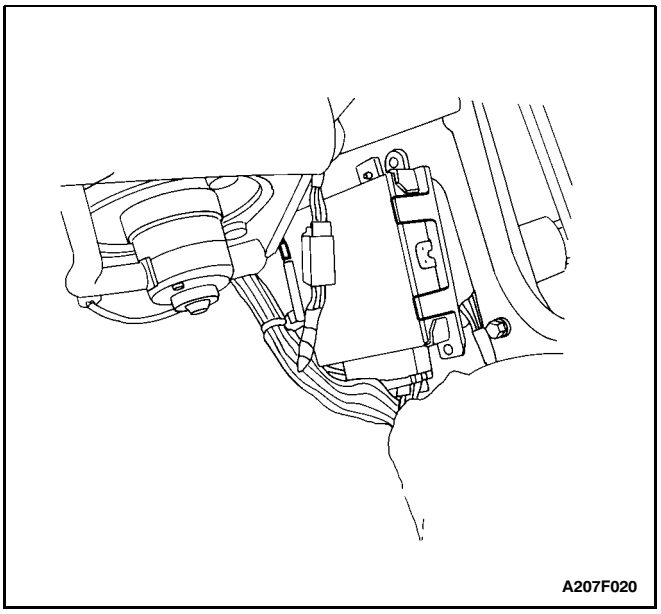
Tighten the brake pipe nuts to 16 N•m (12 lb-ft).


A207F039

3. **Install the motor pack and solenoid electrical connectors.**

Important: Make sure that the solenoid electrical connectors are correctly installed.

4. **Reconnect the negative battery cable.**
5. **Bleed the brake system. Refer to "Bleeding System" in this section.**

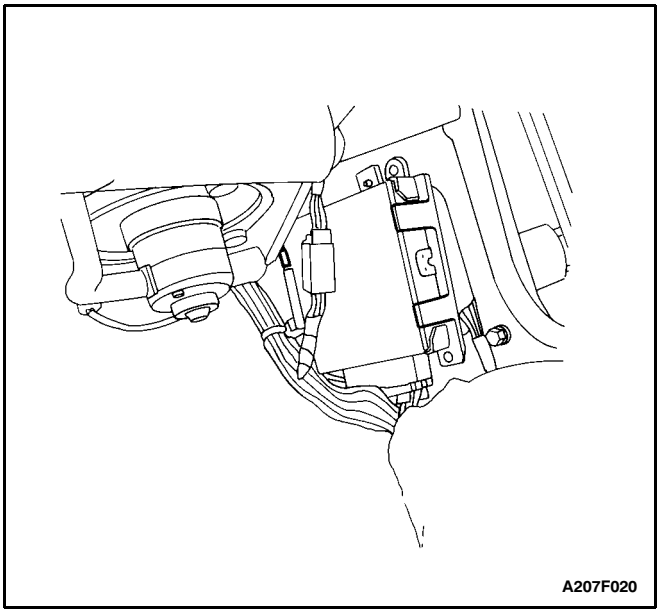

A207F020

ELECTRONIC BRAKE CONTROL MODULE (EBCM)

The EBCM is located behind the kick panel, on the right side of the car.

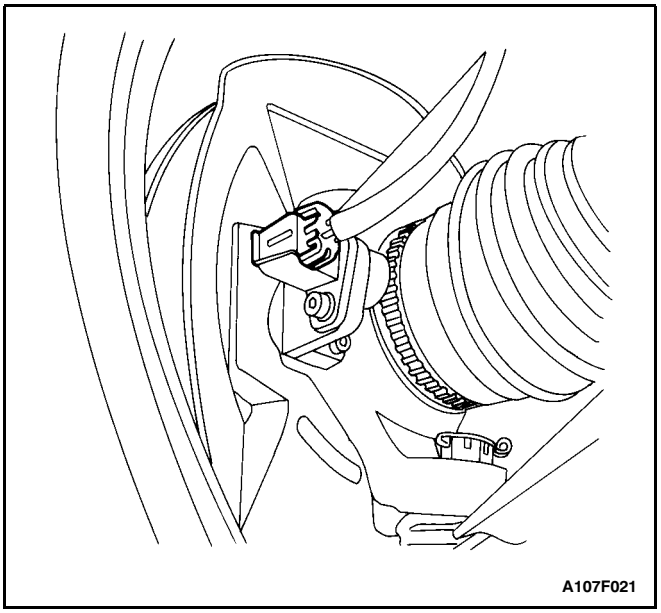
Removal Procedure

1. **Disconnect the negative battery cable.**
2. **Remove the right-side kick panel. Refer to Section 9G, Interior Trim.**
3. **Pull back the retaining clamps and remove the EBCM from its holding fixture.**
4. **Disconnect the EBCM electrical connectors and remove the EBCM from the vehicle.**


A207F020

Installation Procedure

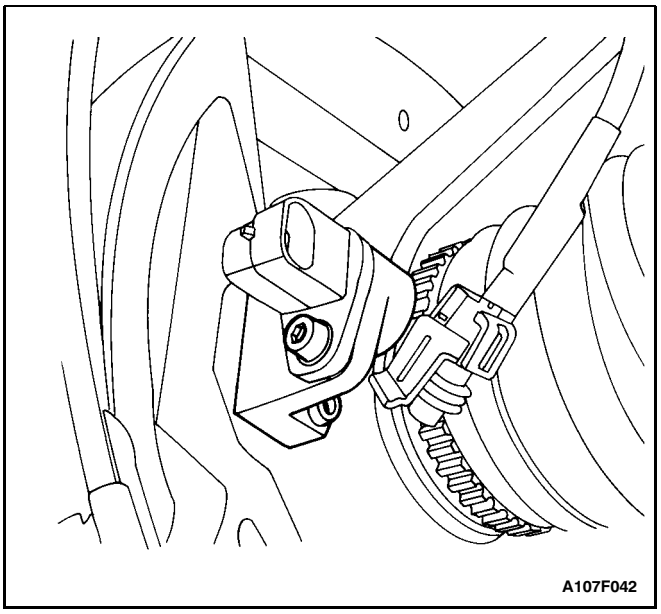
1. **Connect the EBCM to the vehicle by connecting the electrical connectors.**
2. **Install the EBCM to the vehicle. Secure the EBCM under the clamps.**
3. **Install the right-side kick panel. Refer to Section 9G, Interior Trim.**
4. **Connect the negative battery cable.**


A107F021

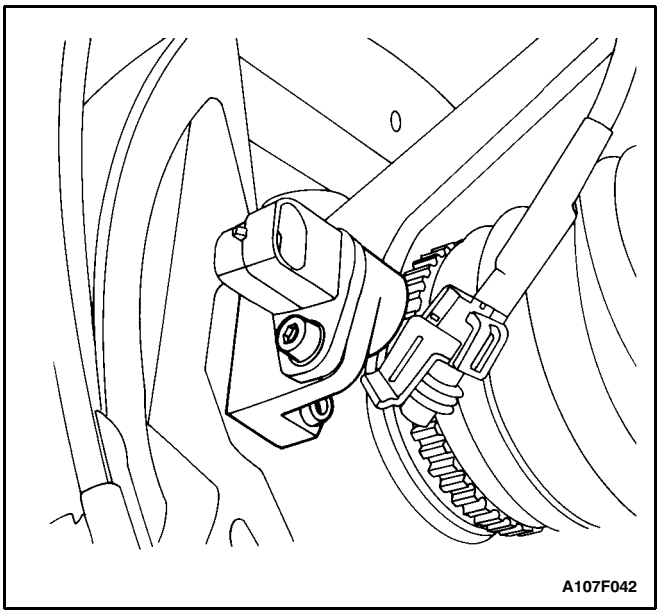
FRONT WHEEL SPEED SENSOR

Removal Procedure

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



4. Remove the bolt and the front wheel speed sensor from the steering knuckle.

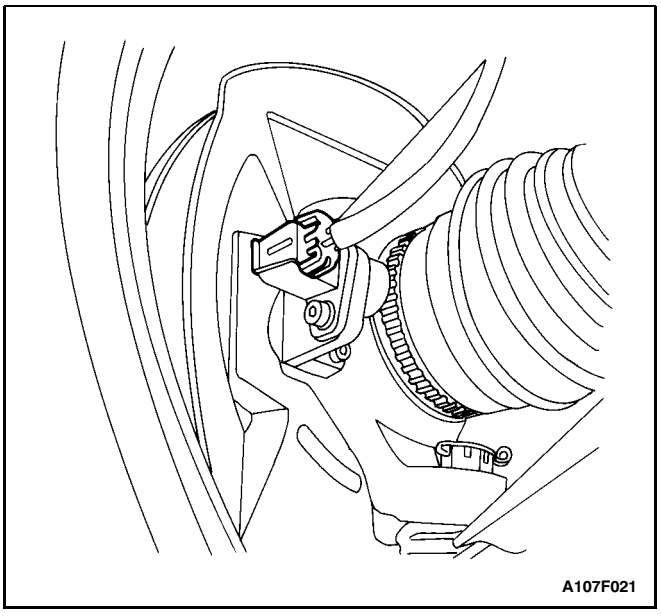


Installation Procedure

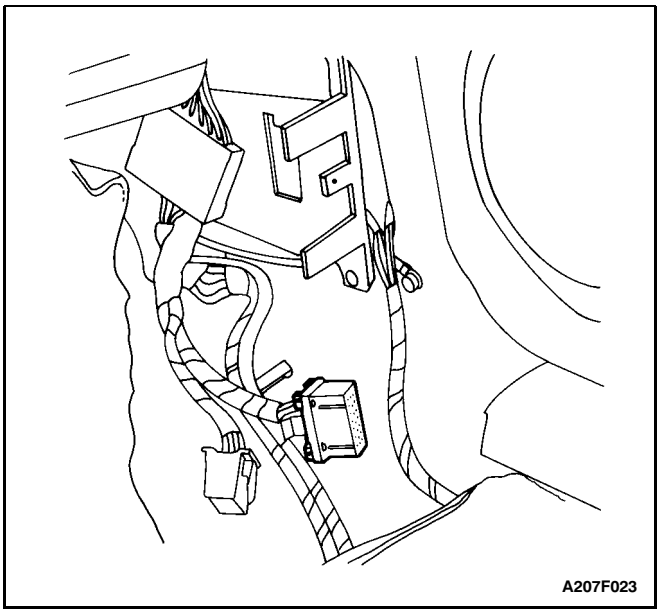
1. Install the front wheel speed sensor to the steering knuckle. Secure it with the bolt.

Tighten

Tighten the front wheel speed sensor bolt to 7.8 N•m (69 lb-in).



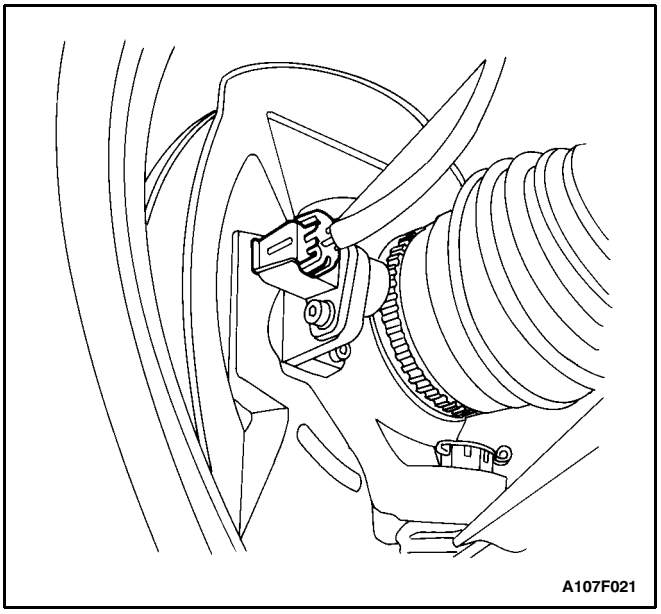
2. Connect the front wheel speed sensor electrical connector.
3. Lower the vehicle.
4. Connect the negative battery cable.


A207F023

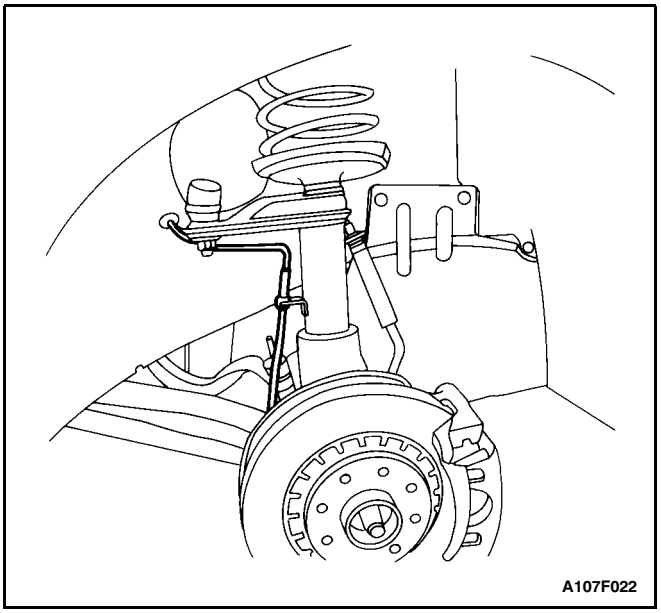
FRONT WHEEL SPEED SENSOR JUMPER HARNESS

Removal Procedure

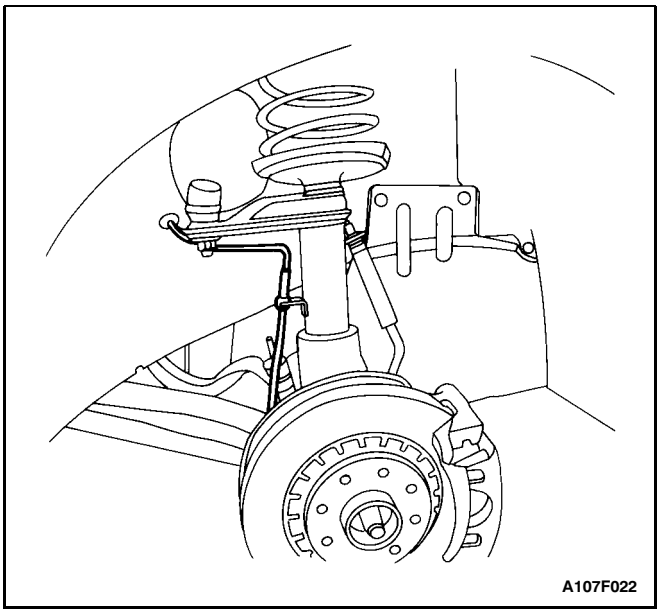
1. Disconnect the negative battery cable.
2. Remove the EBCM from its retaining clamp. Refer to "Electronic Brake Control Module (EBCM)" in this section.
3. Disconnect connector J1 (24-pin connector) from the EBCM which is located behind the right-side kick panel.
4. Remove the appropriate terminals from connector J1:
   - Right side: terminals B3 (BRN) and A4 (DK GRN).
   - Left side: terminals B4 (YEL) and A5 (LT BLU).


A107F021

5. Open the wiring harness along the path of the harness to be replaced. They both pass through the firewall. The right-side speed sensor harness breaks out just inside the engine compartment. The left-side speed sensor harness follows a branch of the wiring harness along the top of the firewall to the left side of the vehicle where it breaks out behind the surge tank.
6. Remove the speed sensor harness from the wiring harness.
7. Raise and suitably support the vehicle.
8. Disconnect the front wheel speed sensor electrical connector.

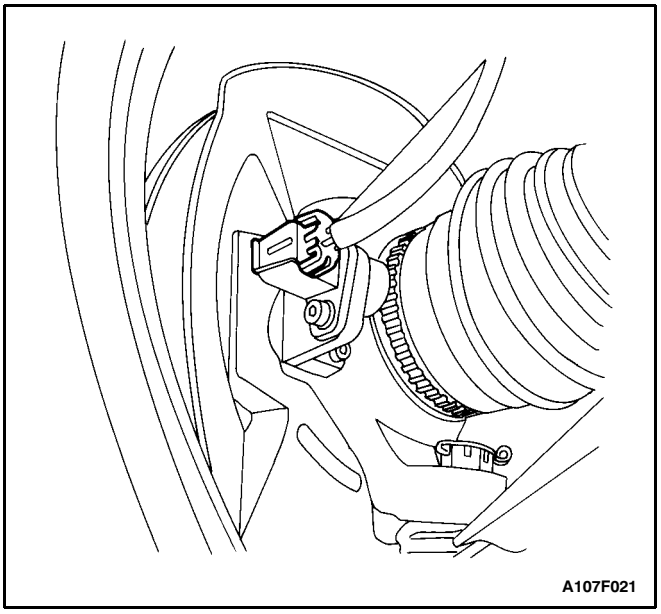

A107F022

9. Remove the jumper harness grommet and pull the jumper harness through the body.

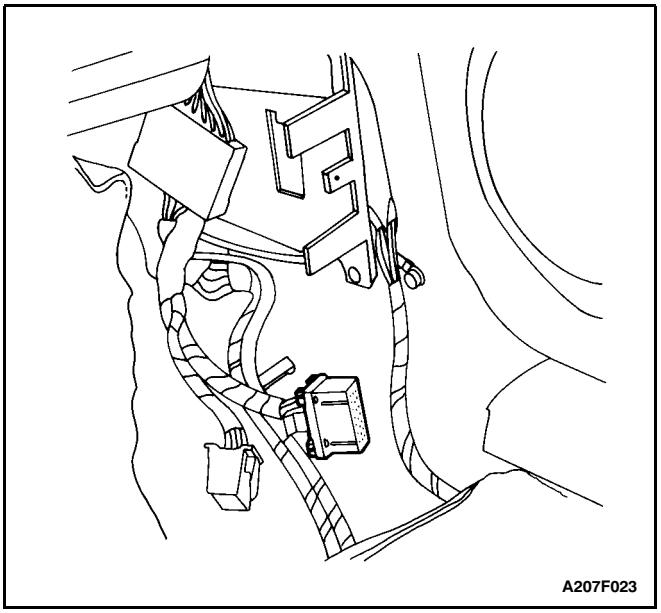

A107F022

Installation Procedure

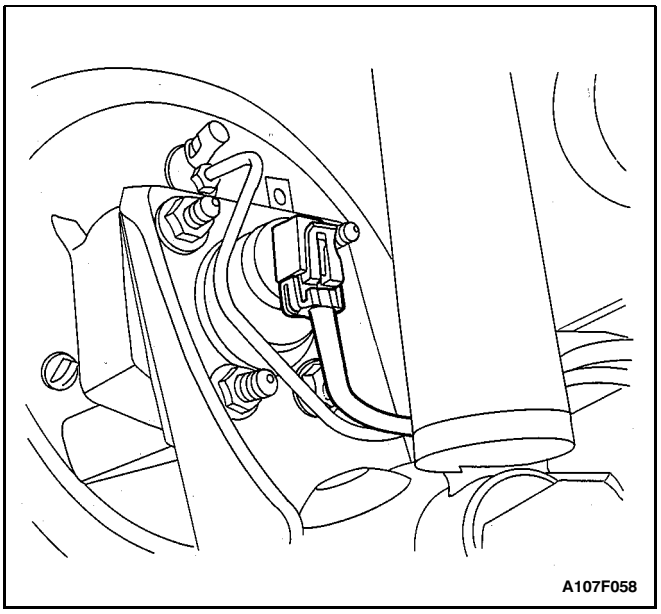
1. Install the front wheel speed sensor jumper harness. Route the harness through the body and secure the grommet.


A107F021

2. Connect the front wheel speed sensor electrical connector.


A207F023

3. Lower the vehicle.
4. Replace the jumper harness into the wiring harness and route it through the firewall into the vehicle interior at the EBCM.
5. Insert the terminals into connector J1 as they had been removed:
   - Right side: terminals B3 (BRN) and A4 (DK GRN).
   - Left side: terminals B4 (YEL) and A5 (LT BLU).
6. Connect the EBCM connector J1.
7. Replace the EBCM into its mounting. Refer to "Electronic Brake Control Module (EBCM)" in this section.
8. Connect the negative battery cable.


A107F058

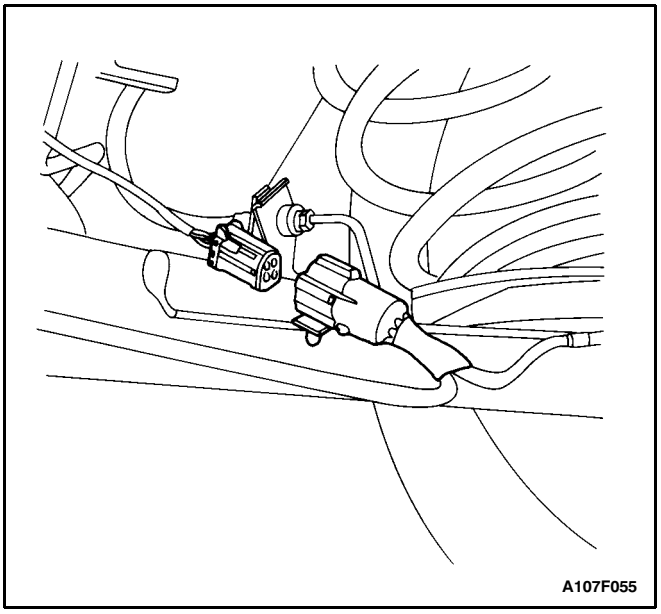
REAR WHEEL SPEED SENSOR

The rear wheel speed sensor is an integral component of the rear wheel hub assembly. If the rear wheel speed sensor is defective, you must replace the wheel hub assembly. Refer to Section 2D, Rear Suspension.

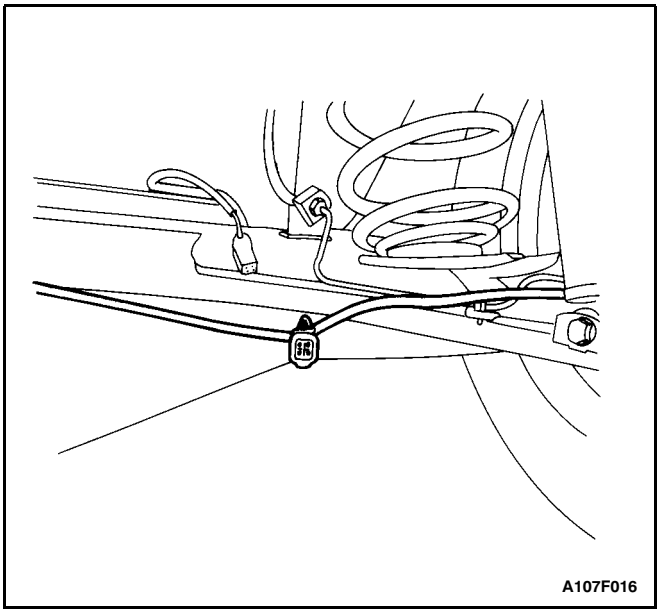
REAR WHEEL SPEED SENSOR JUMPER HARNESS

Removal Procedure

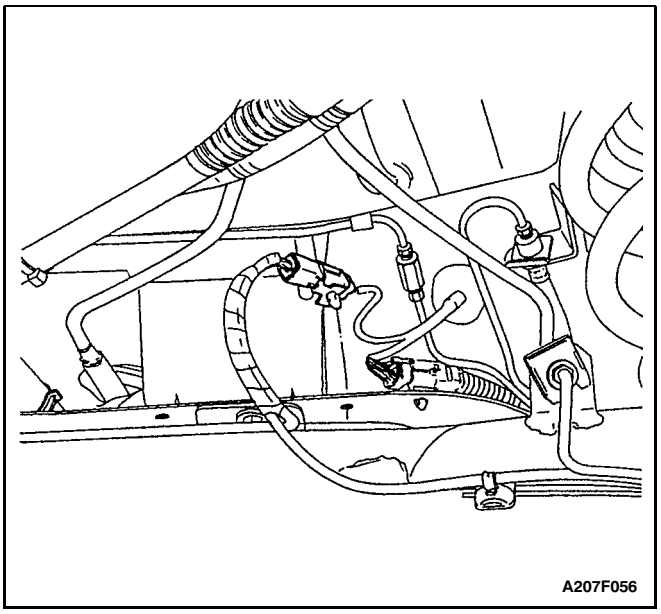
1. **Remove the negative battery cable.**
2. **Raise and suitably support the vehicle.**
3. **Disconnect the rear wheel speed sensor electrical connectors at both wheels.**


A107F055

4. **Remove connector C902 from its mounting by pinching the retainer clips and pushing the retainer up and out of its mounting hole in the axle.**
5. **Unplug the rear jumper harness from connector C902.**

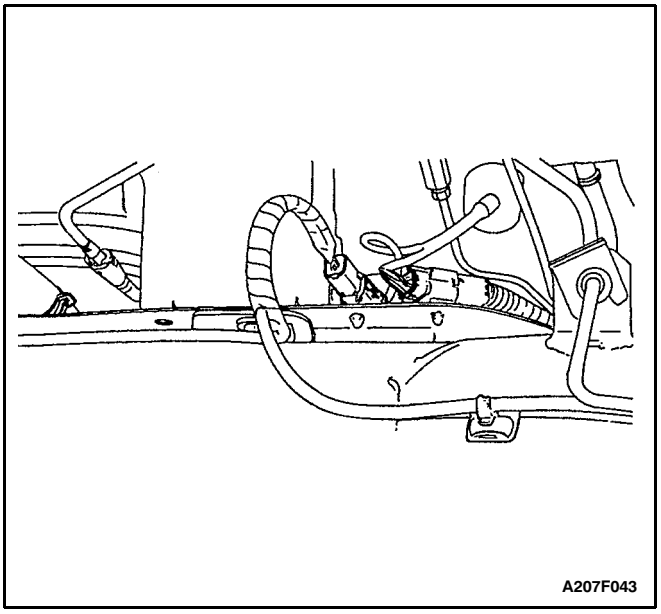

A107F016

6. **Release both branches of the harness from the retainers and remove it from the vehicle.**

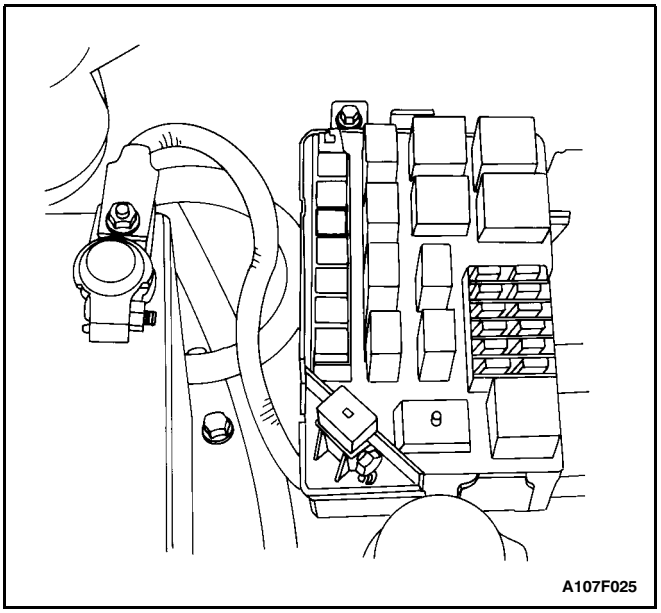

A207F056

Installation Procedure

1. Connect the new wheel speed sensor harness to both wheel speed sensors.
2. Plug the harness connector into C902.


A207F043

3. Secure the harness into its retainers.
4. Push the retainer clamp of C902 into its mounting hole.
5. Lower the vehicle.
6. Connect the negative battery cable.

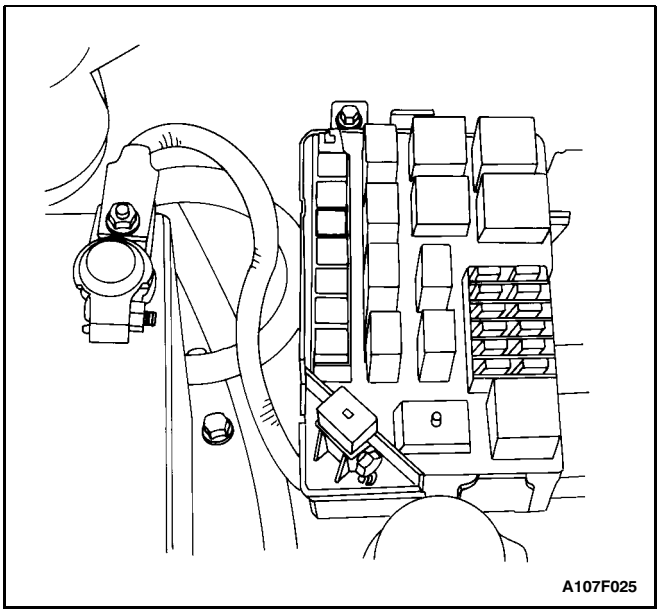

A107F025

SYSTEM FUSE

Removal Procedure

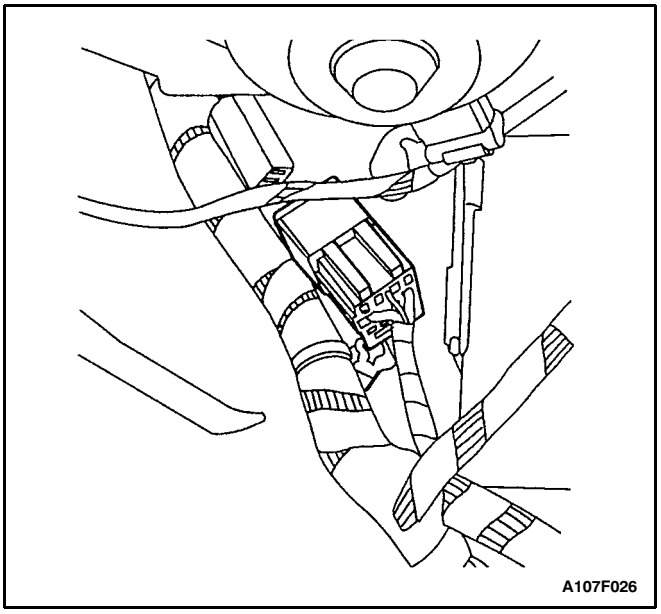
The ABS system fuse, EF6, is located in the engine fuse block, the fifth system fuse in the row behind the main fuse, EF1, which is mounted diagonally at the front of the fuse block, toward the battery.

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



Installation Procedure

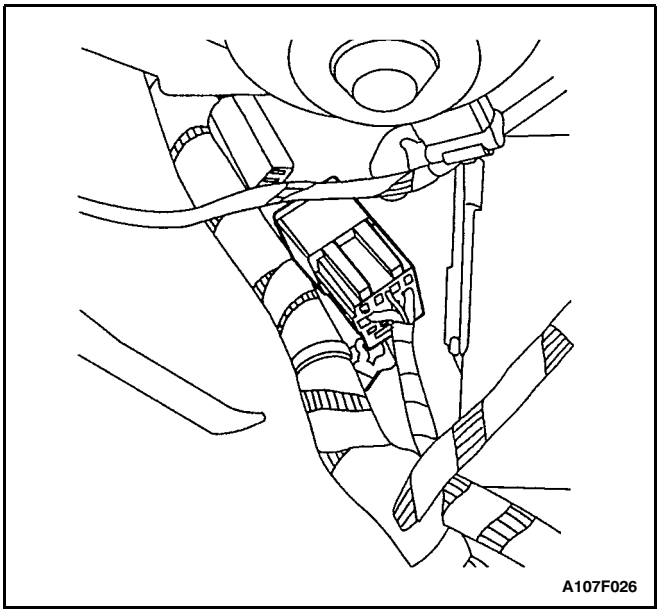
1. Install a new 40-amp system fuse into the fuse holder.
2. Connect the negative battery cable.



ABS ENABLE RELAY

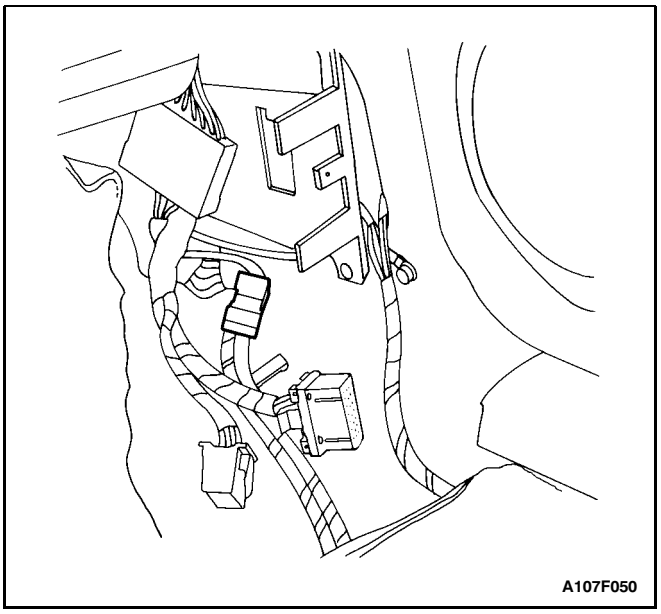
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the right-side kick panel. Refer to Section 9G, Interior Trim.
3. Remove the ABS enable relay from the connector in the wiring harness.



Installation Procedure

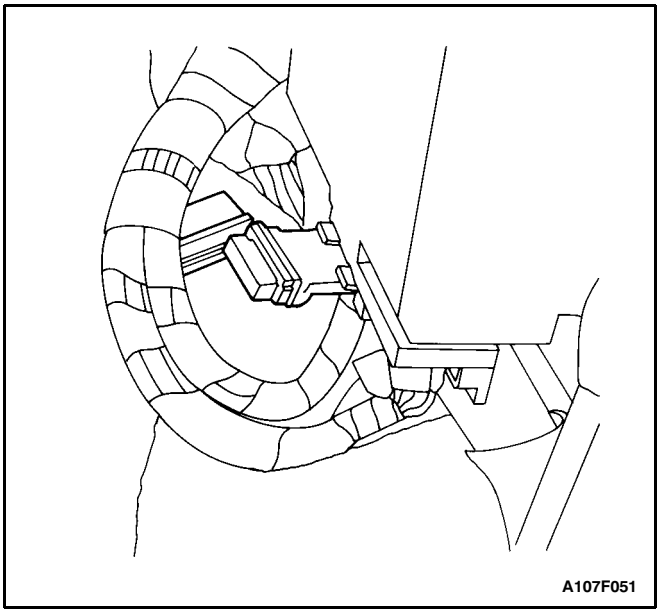
1. Install the ABS enable relay to the electrical connector.
2. Install the right-side kick panel. Refer to Section 9G, Interior Trim.
3. Connect the negative battery cable.


A107F050

ABS SOLENOID FUSE

Removal Procedure

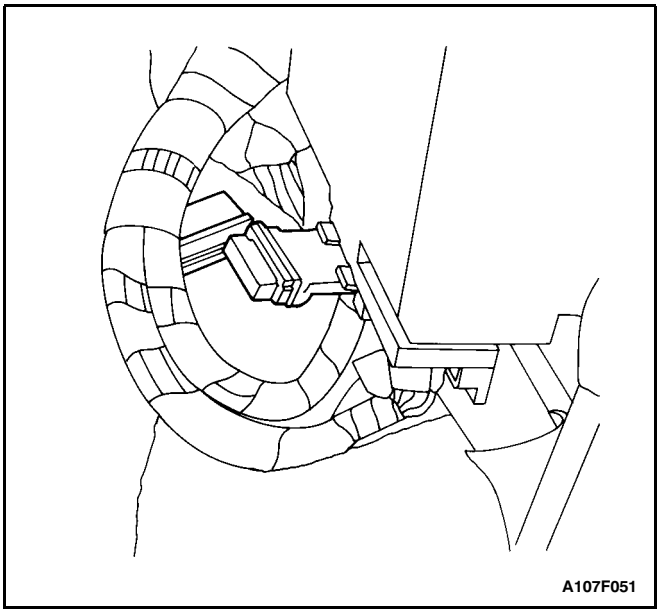
1. Disconnect the negative battery cable.
2. Locate the ABS solenoid fuse holder taped to the ABS wiring harness between the heater/air distributor case and the firewall.


A107F051

3. Unlatch the cover and open the fuse holder.
4. Remove the fuse.

Installation Procedure

1. Install the new 10-amp solenoid fuse into the connector.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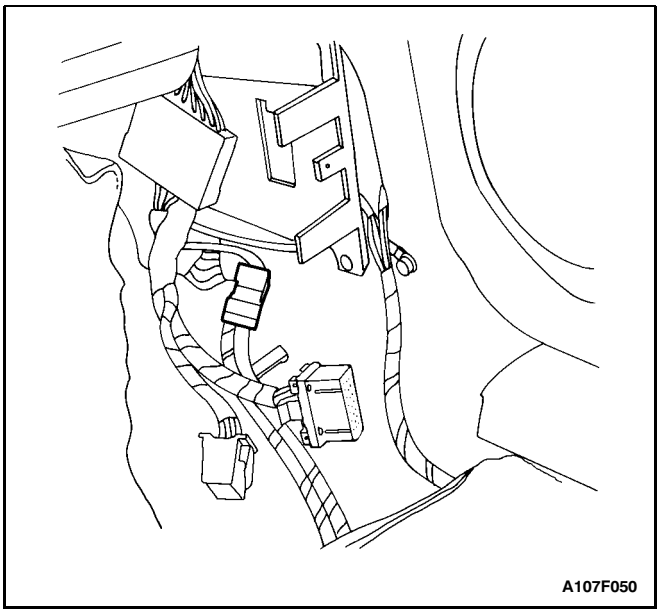
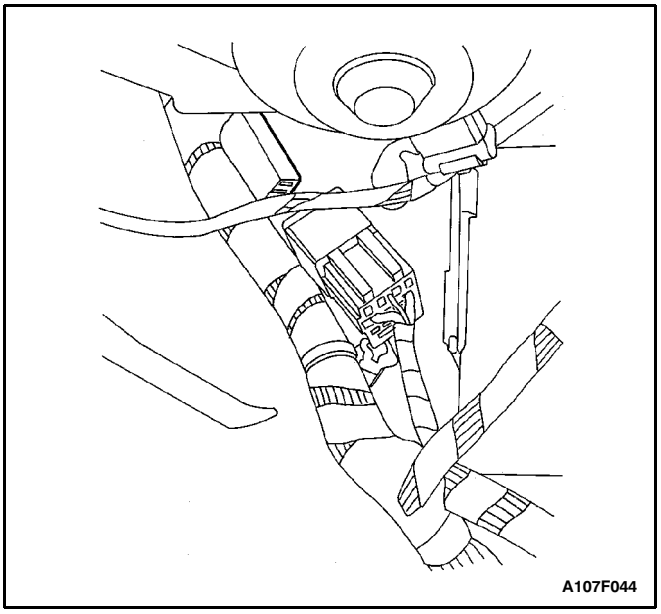

A107F050

2. Close and latch the cover.
3. Install the right-side kick panel. Refer to Section 9G, Interior Trim.
4. Connect the negative battery cable.


A107F044

INDICATORS

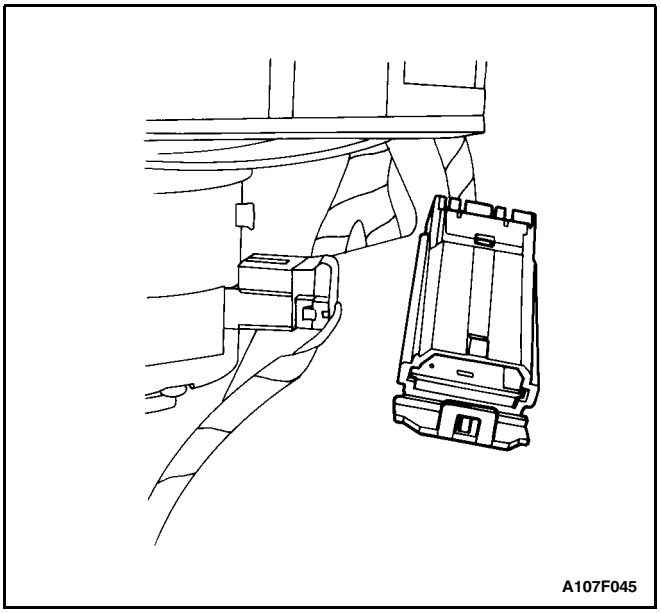
The indicator lamps associated with ABS operation are part of the instrument cluster. Refer to Section 9E, Instrumentation/Driver Information for removal and replacement details.

LAMP DRIVER MODULE

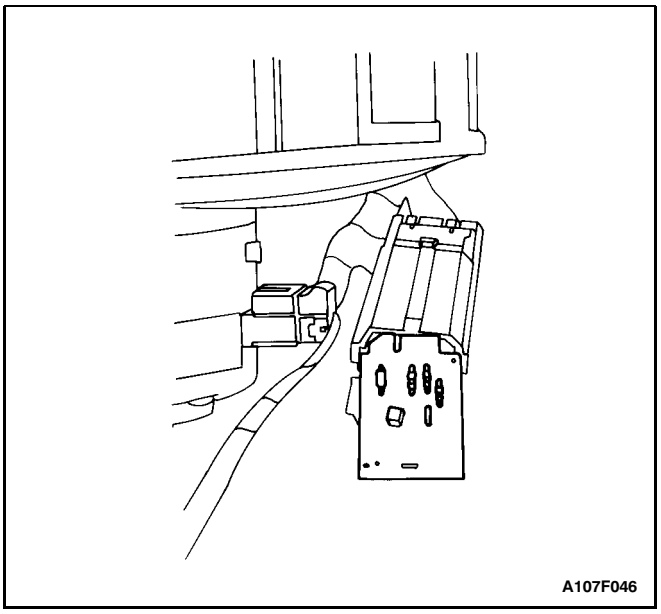
The lamp driver module is taped to the ABS wiring harness between the heater/air distributor case and the firewall.

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the right-side kick panel. Refer to Section 9G, Interior Trim.
3. Untape the lamp driver module from the ABS wiring harness.

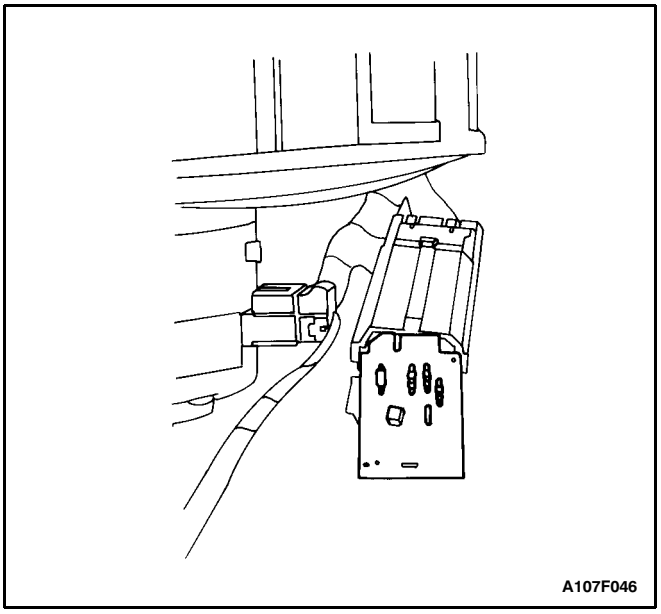

A107F045

4. Open the lamp driver module cover.



A107F046

5. Remove the module from the housing. You may need to insert the blade of a screwdriver into the slot near the end of the card and use the screwdriver as a lever to free the card from its connector inside the housing.

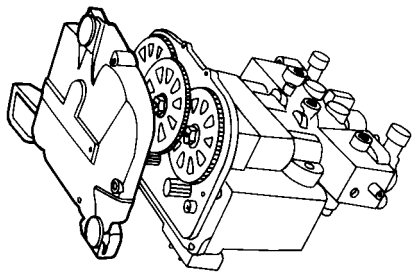


A107F046

Installation Procedure

1. Install the lamp driver module into the housing. Press the card into the connector inside the module, and close the cover. Be sure to orient the card the same as the card you removed. There is a slot that serves as a keyway to allow entry one way only. Look into the housing to see where the slot has to be.
2. Secure the lamp driver module to the ABS harness with electrical tape.
3. Install the right-side kick panel. Refer to Section 9G, Interior Trim.
4. Connect the negative battery cable.

UNIT REPAIR

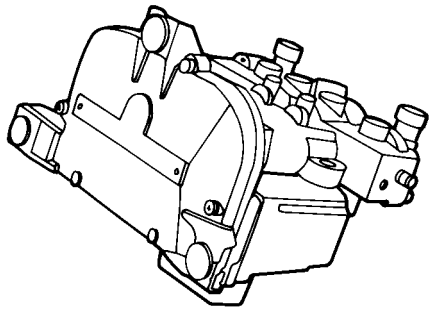


A107F027

GEAR COVER

Disassembly Procedure

1. Remove the hydraulic modulator/motor pack assembly from the vehicle. Refer to "Hydraulic Modulator/ Motor Pack Assembly" in this section.
2. Remove the Torx® head screws.
3. Lift the gear cover from the hydraulic modulator/motor pack assembly.



A107F054

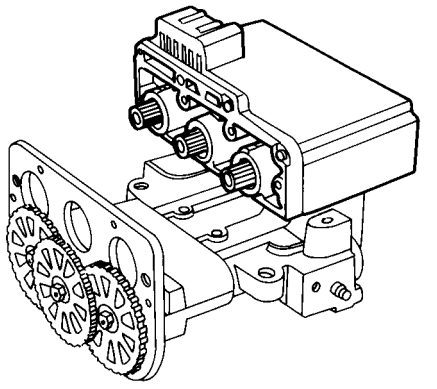
Assembly Procedure

1. Install the gear cover to the hydraulic modulator/motor pack assembly.
2. Secure it with Torx® head screws.

Tighten

Tighten the gear cover Torx® head screws to 4 N•m (35 lb-in).

3. Install the hydraulic modulator/motor pack assembly into the vehicle. Refer to "Hydraulic Modulator/Motor Pack Assembly" in this section.



A107F052

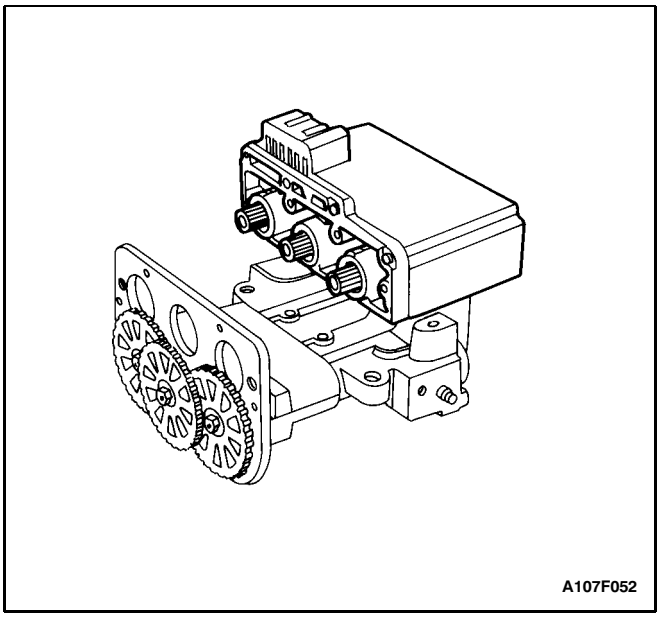
MOTOR PACK

Disassembly Procedure

1. Remove the hydraulic modulator/motor pack assembly from the vehicle. Refer to "Hydraulic Modulator/ Motor Pack Assembly" in this section.
2. Remove the gear cover. Refer to "Gear Cover" in this section.

Caution: The modulator drive gears are under spring load and will turn during disassembly. After removing the gear cover, exercise extreme care not to place fingers into the gear set, since fingers can be pinched by the rotating gears.

3. Remove the Torx® head screws that hold the motor pack to the hydraulic modulator.
4. Remove the motor pack from the hydraulic modulator.


A107F052

Assembly Procedure

1. Position the hydraulic modulator upside down with the gears facing you.
2. Rotate each hydraulic modulator gear counterclockwise until the movement stops. This will position the pistons very close to the top of the modulator bore, simplifying the brake bleeding procedure.

Important:

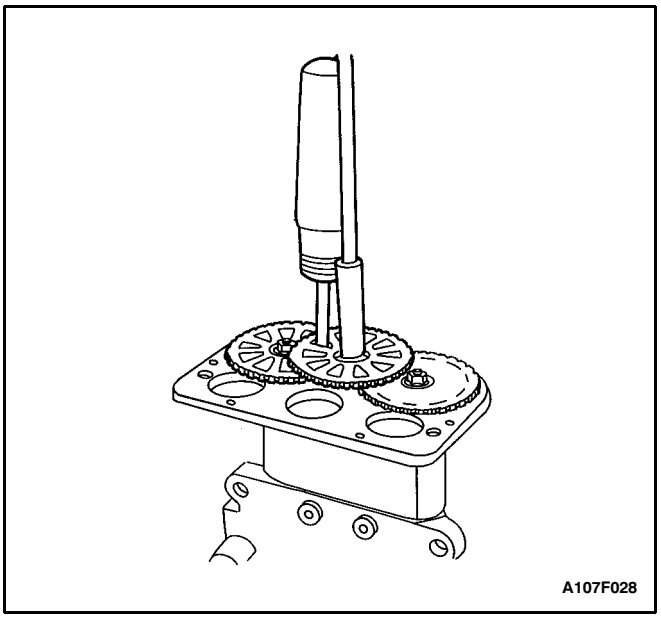
- Take care in handling the motor pack. If it is dropped or damaged during handling, the motor pack must be replaced.
- Align each of the three motor pack pinions with the hydraulic modulator gears.

3. Install the motor pack to the hydraulic modulator.
4. Install the Torx® head screws securing the motor pack.

Tighten

Tighten the motor pack Torx® head screws to 4.5 N•m (40 lb-in).

5. Install the gear cover to the hydraulic modulator/motor pack assembly. Refer to "Gear Cover" in this section.
6. Install the hydraulic modulator/motor pack assembly into the vehicle. Refer to "Hydraulic Modulator/Motor Pack Assembly" in this section.


A107F028

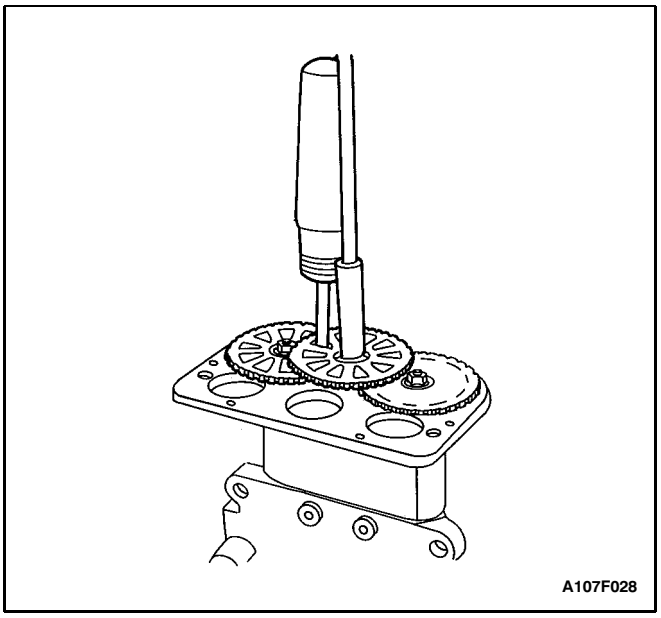
GEAR REPLACEMENT

Disassembly Procedure

1. Remove the motor pack from the hydraulic modulator/motor pack assembly. Refer to "Motor Pack" in this section.

Notice: Do not allow the gear to turn while removing the retaining nut, since the modulator piston can hit the top of the modulator bore, damaging the piston. Turn the modulator gear to position the piston in the center of its travel. Place a screwdriver through the holes in the gears (not between the gears) into the recessed hole in the modulator base. This will prevent the gear from turning, aiding in gear removal.

2. Remove the retaining nut holding the gear(s) you are replacing.
3. Remove the gear(s).


A107F028

Assembly Procedure

Notice:

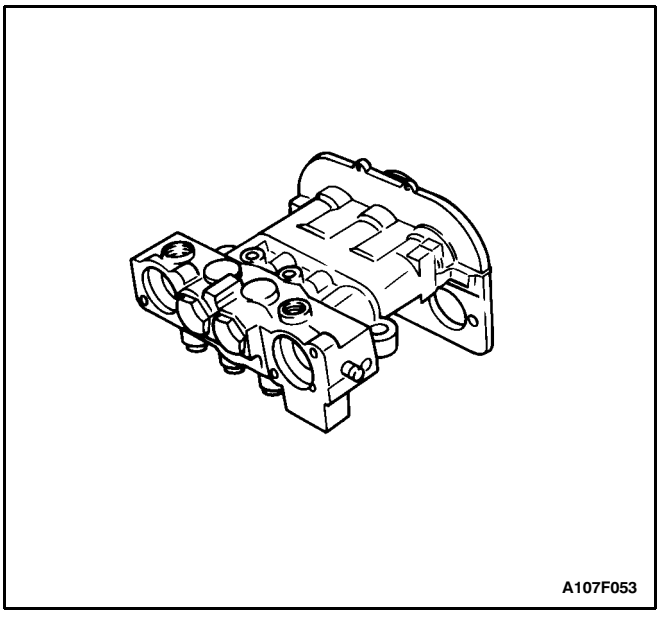
- **Do not allow the gear to turn while installing the retaining nut. Turn the modulator gear to position the piston in the center of its travel. Place a screwdriver through the holes in the gears (not between the gears) into the recessed hole in the modulator base. This will prevent the gear from turning, aiding in gear removal.**
- **Install the gears in the same locations they had before removal.**

Important: Do not lubricate or oil the gears on the motor pack.

1. **Install the gear(s) onto the hydraulic modulator. Secure each gear with one nut.**

   Tighten

   Tighten gear nuts to 8.5 N•m (76 lb-in).
2. **Install the motor pack to the hydraulic modulator. Refer to "Motor Pack" in this section.**

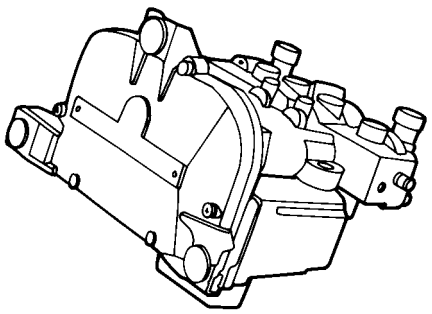

A107F053

HYDRAULIC MODULATOR

Disassembly Procedure

1. **Remove the hydraulic modulator/motor pack assembly from the vehicle. Refer to "Hydraulic Modulator/ Motor Pack Assembly" in this section.**
2. **Remove the two solenoids from the hydraulic modulator/motor pack assembly. Refer to "ABS Solenoid" in this section.**
3. **Remove the gear cover from the hydraulic modulator/ motor pack assembly. Refer to "Gear Cover" in this section.**
4. **Remove the motor pack from the hydraulic modulator. Refer to "Motor Pack" in this section.**

Important: No repair of the hydraulic modulator is authorized. Replace the modulator as an assembly.



A107F054

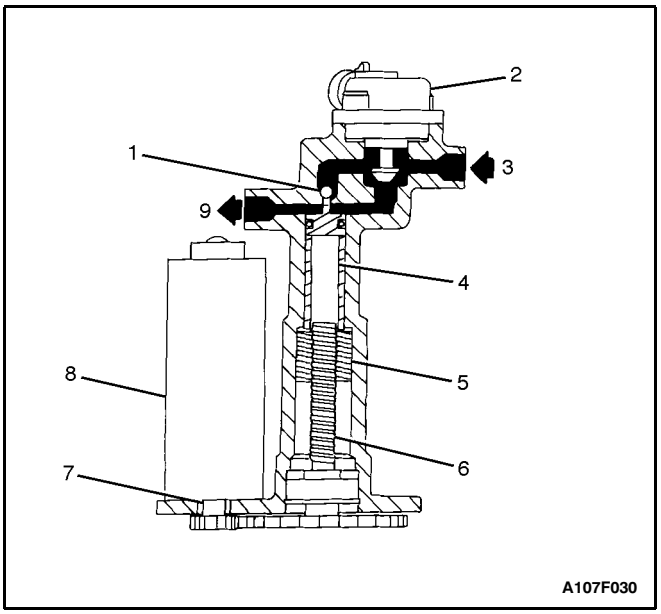
Assembly Procedure

1. Install the motor pack onto the hydraulic modulator aligning the motor pack gears with the modulator gears. Refer to "Motor Pack" in this section.
2. Install the gear cover to the hydraulic modulator/motor pack assembly. Refer to "Gear Cover" in this section.
3. Install the solenoids onto the hydraulic modulator/motor pack assembly. Refer to "ABS Solenoid" in this section.
4. Install the hydraulic modulator/motor pack assembly into the vehicle. Refer to "Hydraulic Modulator/Motor Pack Assembly" in this section.

GENERAL DESCRIPTION AND SYSTEM OPERATION

BASE BRAKING MODE

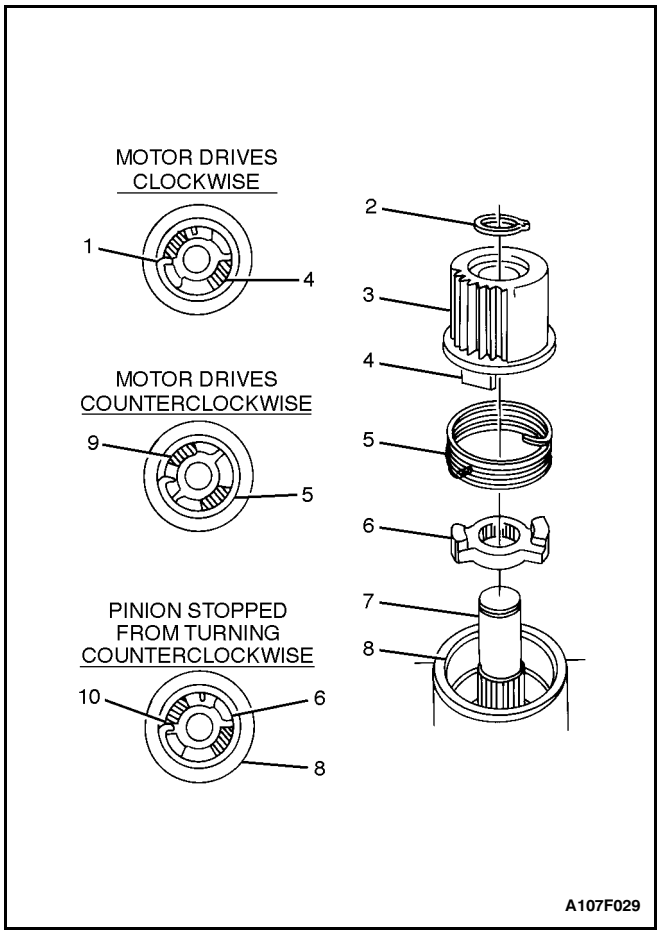
Under normal operating conditions, the brake system will operate using conventional braking by means of brake pedal force, the vacuum booster, and the master cylinder. Each front channel consists of a motor, a solenoid, an expansion spring brake (ESB), a ball screw, a piston, and a check valve. As illustrated, under normal operating conditions (base braking), the piston is held in the upmost or "home" position. This is accomplished by the screw via the motor turning the ball screw and driving the nut upwards.



1 Check Valve Open
2 Solenoid Valve Open
3 Brake Pressure from Proportional Valve
4 Piston
5 Ball Screw Nut
6 Ball Screw Spindle
7 Expansion Spring Brake (ESB)
8 ABS Motor Pack
9 Brake Pressure to Front Brake

Once the piston is at the upmost position, it is held by an ESB. An ESB is a spring that is retained in a housing at a close tolerance. One end of the spring is in contact with the motor drive dog, and the other end is in contact with the pinion drive dog. In normal braking, brake pressure is present on the top of the piston, applying a downward force. This force applies a counterclockwise torque to the motor pinion, which tries to rotate the spring counterclockwise. This torque expands the spring outward within the housing and prevents the gear from rotating.

While the piston is at the upmost position, it unseats the check valve and opens a path for the brake fluid.



1 Motor Drive Dog Releases Spring Brake and Drive Pinion
2 Circlip
3 Motor Pinion
4 Pinion Drive Dog
5 Expansion Spring Brake (ESB)
6 Motor Drive Dog
7 Motor Shaft
8 Steel Sleeve
9 Motor Drive Dog Releases Spring Brake (spring leg beneath pinion dog)
10 Pinion Dog Expands Spring and Locks Against Sleeve

Two paths are available to transfer brake fluid to the calipers: (1) through the modulator, around the open check valve, and out to the caliper; and (2) through the modulator, through the normally open solenoid and out to the caliper. The solenoid in the front circuits provides an alternate brake fluid pressure path to the caliper. With this arrangement, if the ABS were to lose power or malfunction with the piston out of the "home" position, an equivalent brake fluid path would always be available.

The rear channels operate in a similar manner except: (1) both rear channels are controlled together and (2) no solenoid exists. Both rear channels are controlled by one motor to simplify the design. Since ABS operates on a select low principle (if either rear wheel begins to lock, brake pressure to both rear wheels is reduced to maximize vehicle stability), both rear brakes are controlled together.

There is no rear solenoid due to the nature of the braking system. The vast majority of the braking is accomplished with the front brakes. An ABS failure that affected the operation of the rear base brakes would cause a DTC to be stored and the EBCM would illuminate both the amber ABS indicator and the red BRAKE indicator.

ANTILOCK BRAKING MODE

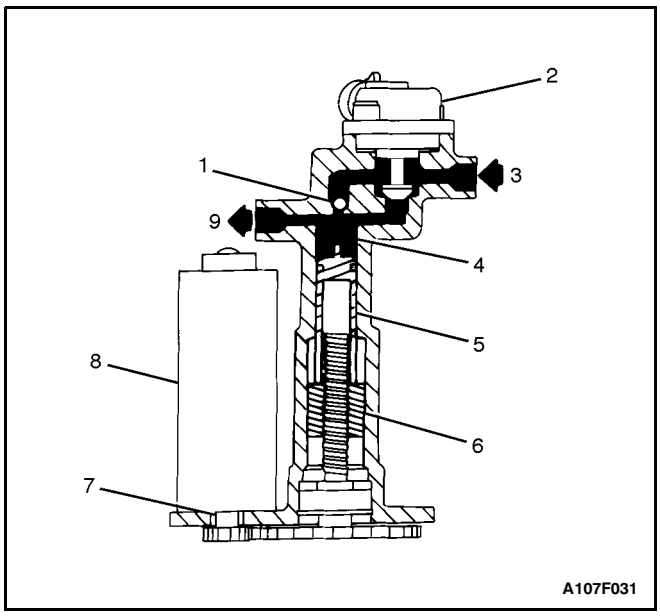
ABS VI has been designed to improve the controllability and steerability of a vehicle during braking. ABS VI accomplishes this by controlling the hydraulic brake pressure applied to each front caliper and the rear wheel cylinders. Antilock braking occurs only when the stoplamp switch is closed and a microprocessor, located in the EBCM, determines that at least one wheel is about to lose traction during braking. The EBCM will then allow the hydraulic modulator to change the brake pressures several times each second to keep the wheel(s) from locking and provide the driver with maximum vehicle controllability. ABS VI cannot increase the brake pressure above the master cylinder pressure applied by the driver and cannot apply the brakes by itself.

The result is greatly improved braking, enabling the driver to maintain steerability more easily and to bring the vehicle to a controlled stop. ABS VI provides effective braking and directional control over a wide range of read surfaces and driving conditions.

If any wheel begins to approach lockup, the EBCM will control the three motors and two solenoids, appropriately, to control brake pressure to the affected wheel(s). During front wheel ABS operation, the solenoids are turned on to isolate that brake pressure path to the caliper.

The EBCM then provides controlled current to the motors to regulate the speed and amount of movement. When the motor is activated and tries to drive the ball screw nut, the end of the ESB in contact with the motor drive dog rotates inward, causing the spring to contract in its housing and allowing the motor to rotate the modulator gear.

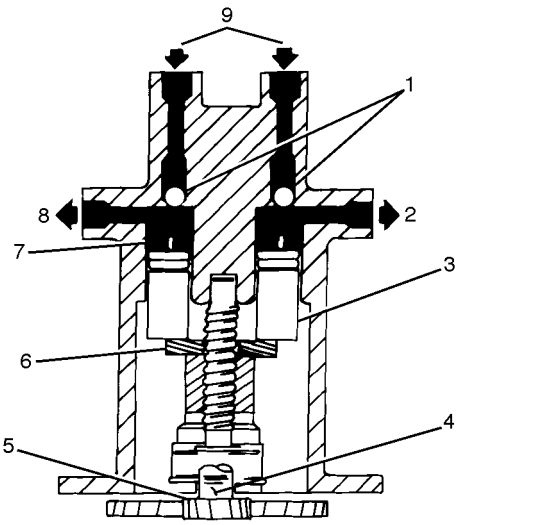
The most common application of this principle is in window crank mechanisms, where the weight of the window or the force of the window will not allow the window to move downward, but a small amount of force on the regulator handle allows the window to be lowered or raised. For the ESB, brake pressure on the top of the pistons corresponds to the weight of the window and the motor corresponds to the window regulator handle. As the motor moves backwards, the piston follows the nut downward, allowing the check valve to seat. The brake pressure to the caliper is now a function of the controlled volume within the piston chamber. To reduce brake pressure, the motor drives the nut further downward. To reapply or increase brake pressure, the motor drives the nut and piston upward. If ABS were entered during low brake pressure, such as in ice, and dry pavement is then encountered during reapply, the piston is driven all the way to the top. This results in the unseating of the check valve and a return to base braking until sufficient brake pressure exists to cause the wheel to approach lockup again. At this point, the ABS cycle would start again. Total brake pressure during ABS is limited to the brake pressure present when ABS was entered. Also, any time wheel brake pressure exceeds the brake pressure at the master cylinder (caused by reduced force on the brake pedal), the check valve unseats and a small volume of brake fluid is returned to the master cylinder to equalize pressure. In this manner, ABS VI cannot increase the brake pressure above the master cylinder pressure applied by the driver and cannot apply the brakes by itself. When ABS is no longer required, the pistons are returned to their upmost position, and the solenoids on the front channels are opened to provide an optional base braking path again.



1 Check Valve Closed
2 Solenoid Valve Closed
3 Brake Pressure from Master Cylinder
4 Modulation Chamber
5 Piston in "Modulation" Position
6 Ball Screw Nut in "Modulation" Position
7 Expansion Spring Brake (ESB)
8 ABS Motor Pack
9 Modulated to Front Brake

The rear channel operates in a similar manner except that no solenoid is used.

Both rear brakes' pressures are controlled by the same motor, and both rear brakes' pressures are maintained at nearly equal levels.



1 Check Valves Closed
2 Modulated Pressure to Left Rear Brake
3 Piston Lowered
4 Expansion Spring Brake (ESB) Location
5 Motor Pinion
6 Yoke on Ball Screw Drives Both Rear Circuit Pistons
7 Modulation Chamber
8 Modulated Pressure to Right Rear Brake
9 Brake Pressure from Master Cylinder

Initialization

The "ABS" indicator will be illuminated for about 3 seconds when the ignition switch is first turned to ON. System initialization will occur when the vehicle speed reaches approximately 8 km/h (5 mph). A slight mechanical noise may be heard during system initialization. This is a normal occurrence, the result of the hydraulic modulator pistons returning to their upmost (or home) position. A driver who is applying the brake during system initialization may feel a slight pedal bump. When this occurs, system initialization is interrupted.

Indicator Operation

The standard brake system uses a single red BRAKE indicator located in the instrument cluster. The antilock brake system uses two lamps, the red BRAKE indicator, and an amber ABS indicator.

1. When the ignition switch is turned to the ON position, before starting the engine, the amber ABS indicator should illuminate for approximately 3 seconds. The red BRAKE indicator will quickly flash on also.
2. As the engine is cranked, the red BRAKE indicator and the amber ABS indicator should illuminate steadily.
3. In 3 to 4 seconds after the engine is started, the ABS indicator should be off. The red BRAKE indicator will go off immediately.

For further information regarding indicator operation, refer to "Indicators" in this section.

TIRES AND ABS

Replacement Tires

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

ABS SYSTEM COMPONENTS

The ABS VI 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, a brake fluid level sensor and the BRAKE indicator.

The ABS components include a hydraulic modulator/motor pack assembly, an EBCM, a system enable relay, two system fuses, four wheel speed sensors (one at each wheel), interconnecting wiring, a lamp driver module, and the ABS indicator. See "ABS Component Locator" in this section for the general layout of this system.

The hydraulic modulator/motor pack assembly is located at the firewall on the right side of the vehicle.

The basic hydraulic modulator configuration consists of drive gear subassemblies, ball screws, nuts, pistons, and hydraulic check valves. The hydraulic modulator/motor pack assembly controls hydraulic pressure to the front calipers and the rear wheel cylinders by modulating hydraulic pressure to prevent wheel lockup. For more information, refer to "Base Braking Mode" and "Antilock Braking Mode" in this section.

ELECTRONIC BRAKE CONTROL MODULE (EBCM)

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

The EBCM is located behind the right-side kick panel.

The controlling element of ABS VI is a microprocessor-based EBCM. Inputs to the system include four wheel speed sensors, the stoplamp switch, the ignition switch and the unswitched battery voltage. Outputs include three bi-directional motor controls, two solenoid controls, and the system enable relay. A bi-directional serial data link, located in pin M of the ALDL, is provided 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 motors and solenoids to reduce brake pressure to the wheel approaching lockup. Once the wheel regains traction, brake pressure is increased until the wheel again begins to approach lockup. This cycle repeats until either the vehicle comes to a stop, the brake pedal is released, or no wheels approach lockup.

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

FRONT WHEEL SPEED SENSORS

The front wheel speed sensors are of a variable reluctance type. Each sensor is attached to the steering knuckle close to a toothed ring. The result, as teeth pass by the sensor, is an AC voltage with a frequency proportional to the speed of the wheel. The magnitude of the voltage and frequency increase with increasing speed. The sensor is not repairable, nor is the air gap adjustable.

FRONT WHEEL SPEED SENSOR RINGS

The toothed ring mentioned above is pressed onto the 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. Excessive contact may cause damage to one or of the more teeth. If the ring is damaged, the wheel-side constant velocity joint must be replaced.

REAR WHEEL SPEED SENSORS AND RINGS

The rear wheel speed sensors operate in the same manner as the front wheel speed sensors. The rear wheel speed sensors and the speed sensor rings are integrated into the rear wheel hub assembly and are not serviced separately. If a rear wheel speed sensor or a speed sensor ring is malfunctioning, you must replace the rear wheel hub assembly.

ABS ENABLE RELAY

The ABS enable relay is located near the EBCM behind the right-side kick panel.

The ABS enable relay is a normally-open contact type and has special contact material to handle the high currents required for ABS VI operation. The relay supplies the battery voltage and the current to the solenoids and to the EBCM, which supplies power to the motors and operates the solenoids by switching ground for them.

BRAKE FLUID LEVEL SWITCH

The brake fluid level switch is contained within the master cylinder reservoir cap.

WIRING HARNESS

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

INDICATORS

The EBCM continuously monitors itself and the other ABS components. If the EBCM detects a problem with the system, the amber ABS indicator will either flash or light continuously to alert the driver to the problem. The ABS indicator will flash if the problem does not immediately hamper ABS operation. However, a flashing ABS indicator signals the driver that repairs must be made to the system as soon as possible.

A solid ABS indicator indicates that the ABS system has detected a problem that affects the operation of the 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, the parking brake switch is closed (parking brake engaged), or the ignition switch is ON and the engine is not running or under control of the EBCM. The EBCM will illuminate the BRAKE indicator when an ABS fault could interfere with base brake operation. When this type of fault is detected, the EBCM will store the appropriate DTC, store a DTC A086 (indicating that the EBCM has turned the BRAKE indicator on), and disable the ABS.