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## SECTION 4F

# ANTILOCK BRAKE SYSTEM

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

**CAUTION:** Don't diagnosis the Antilock Brake System (ABS) under the vehicle moving status. Because the ABS function will be stopped.

## TABLE OF CONTENTS

<b>Description and Operation</b> .....	<b>4F-3</b>	DTC 0456 Left Rear Wheel Speed Sensor Circuit Intermittent Shorted .....	4F-38
ABS System Components .....	4F-3	DTC 0504 Right Rear Wheel Speed Sensor Circuit Open or Shorted .....	4F-42
Hydraulic Unit .....	4F-3	DTC 0505 Right Rear Wheel Speed Sensor Poor Air Gap or Missing Tooth Ring .....	4F-46
EBCM (Electronic Brake Control Module) .....	4F-4	DTC 0506 Right Rear Wheel Speed Sensor Circuit Intermittent Shorted .....	4F-48
Wheel Speed Sensors and Rings .....	4F-5	DTC 0601 Left Front Dump Shorted or Driver Open .....	4F-52
Electronic Brake Distribution .....	4F-5	DTC 0602 Left Front Dump Open or Driver Shorted .....	4F-54
Indicator .....	4F-5	DTC 0651 Left Front Isolation Shorted or Driver Open .....	4F-56
EBCM Connector .....	4F-6	DTC 0652 Left Front Isolation Open or Driver Shorted .....	4F-58
Hydraulic Fluid Flow Diagrams .....	4F-7	DTC 0701 Right Front Dump Shorted or Driver Open .....	4F-60
Normal Braking Mode .....	4F-7	DTC 0702 Right Front Dump Open or Driver Shorted .....	4F-62
Isolation Mode (Pressure Maintain) .....	4F-8	DTC 0751 Right Front Isolation Shorted or Driver Open .....	4F-64
Dump Mode (Pressure Decrease) .....	4F-9	DTC 0752 Right Front Isolation Open or Driver Shorted .....	4F-66
Reapply Mode (Pressure Increase) .....	4F-10	DTC 0801 Left Rear Dump Shorted or Driver Open .....	4F-68
Proportioning Function .....	4F-11	DTC 0802 Left Rear Dump Open or Driver Shorted .....	4F-70
<b>Visual Identification</b> .....	<b>4F-12</b>	DTC 0851 Left Rear Isolation Shorted or Driver Open .....	4F-72
EBCM Connector Face View .....	4F-12	DTC 0852 Left Rear Isolation Open or Driver Shorted .....	4F-74
<b>Component Locator</b> .....	<b>4F-13</b>	DTC 0901 Right Rear Dump Shorted or Driver Open .....	4F-76
ABS .....	4F-13	DTC 0902 Right Rear Dump Open or Driver Shorted .....	4F-78
<b>Diagnostic Information and Procedures</b> ....	<b>4F-16</b>		
DTC 0354 Left Front Wheel Speed Sensor Circuit Open or Shorted .....	4F-16		
DTC 0355 Left Front Wheel Speed Sensor Poor Air Gap or Missing Tooth Ring .....	4F-20		
DTC 0356 Left Front Wheel Speed Sensor Circuit Intermittent Shorted .....	4F-22		
DTC 0404 Right Front Wheel Speed Sensor Circuit Open or Shorted .....	4F-24		
DTC 0405 Right Front Wheel Speed Sensor Poor Air Gap or Missing Tooth Ring .....	4F-28		
DTC 0406 Right Front Wheel Speed Sensor Circuit Intermittent Shorted .....	4F-30		
DTC 0454 Left Rear Wheel Speed Sensor Circuit Open or Shorted .....	4F-32		
DTC 0455 Left Rear Wheel Speed Sensor Poor Air Gap or Missing Tooth Ring .....	4F-36		

## 4F-2 ANTILOCK BRAKE SYSTEM

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DTC 0951 Right Rear Isolation Shorted or Driver Open . . . . .	4F-80	DTC 5640 RAM Error 16 Bit . . . . .	4F-120
DTC 0952 Right Rear Isolation Open or Driver Shorted . . . . .	4F-82	DTC 8001 Battery High Voltage Fault (More Than 16V) . . . . .	4F-122
DTC 1102 Return Pump Motor Circuit Open . .	4F-84	DTC 8002 Battery Low Voltage Fault (Less Than 9V) . . . . .	4F-124
DTC 1103 Return Pump Motor Relay Fault . . .	4F-86	DTC 8003 Battery Low Voltage Fault (Less Than 9.5V) . . . . .	4F-126
DTC 1104 Return Pump Motor Circuit Shorted . . . . .	4F-88	<b>Repair Instructions . . . . .</b>	<b>4F-128</b>
DTC 1211 EBCM Main Relay Shorted . . . . .	4F-90	On-Vehicle Service . . . . .	4F-128
DTC 1212 EBCM Main Relay Open . . . . .	4F-92	Service Precautions . . . . .	4F-128
DTC 1213 EBCM Main Relay Fault . . . . .	4F-94	Bleeding System . . . . .	4F-128
DTC 1610 Stoplamp Switch Circuit Open . . . .	4F-96	Front Wheel Speed Sensor . . . . .	4F-129
DTC 2321 ABS (Amber) Indicator Shorted to Battery . . . . .	4F-100	Rear Wheel Speed Sensor . . . . .	4F-130
DTC 2322 ABS (Amber) Indicator Shorted to Ground . . . . .	4F-104	Front Wheel Speed Ring . . . . .	4F-131
DTC 2458 Wheel Speed Sensor Intermittent Error . . . . .	4F-107	Rear Wheel Speed Ring . . . . .	4F-131
DTC 2459 Wheel Speed Sensor Excessive Wheel Speed Variation . . . . .	4F-108	Hydraulic Modulator and Upper/Lower Mounting Bracket . . . . .	4F-132
DTC 2520 EBCM Internal Fault . . . . .	4F-110	EBCM (Electronic Brake Control Module) . . .	4F-134
DTC 5501 Vehicle Inhibit Code . . . . .	4F-112	<b>Specifications . . . . .</b>	<b>4F-136</b>
DTC 5502 Isolation Valve Time-Out . . . . .	4F-114	General Specifications . . . . .	4F-136
DTC 5503 CPU Loop Time Error . . . . .	4F-115	Fastener Tightening Specifications . . . . .	4F-136
DTC 5504 Excessive Dump Valve Time . . . . .	4F-116	<b>Special Tools and Equipment . . . . .</b>	<b>4F-136</b>
DTC 5560 Inoperative External Watch-Dog . .	4F-117	Special Tools Table . . . . .	4F-136
DTC 5610 RAM/ROM Error 8 Bit . . . . .	4F-118	<b>Schematic and Routing Diagrams . . . . .</b>	<b>4F-137</b>
DTC 5630 ROM Error 16 Bit . . . . .	4F-119	ABS Circuit . . . . .	4F-137
		ABS Block Diagram . . . . .	4F-140

## DESCRIPTION AND OPERATION

### ABS SYSTEM COMPONENTS

The 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 drum brakes, interconnecting hydraulic brake pipes and hoses, brake fluid level sensor and the BRAKE indicator.

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

### HYDRAULIC UNIT

The hydraulic unit with the attached EBCM is located between the surge tank and the fire wall on the right side of the vehicle. The basic hydraulic unit configuration consists of return pump motor, return pump, four isolation valves, four dump valves, two Low Pressure Accumulators (LPA), two High Pressure Attenuators (HPA). The hydraulic unit controls hydraulic pressure to the front calipers and rear wheel cylinders by modulating hydraulic pressure to prevent wheel lockup.

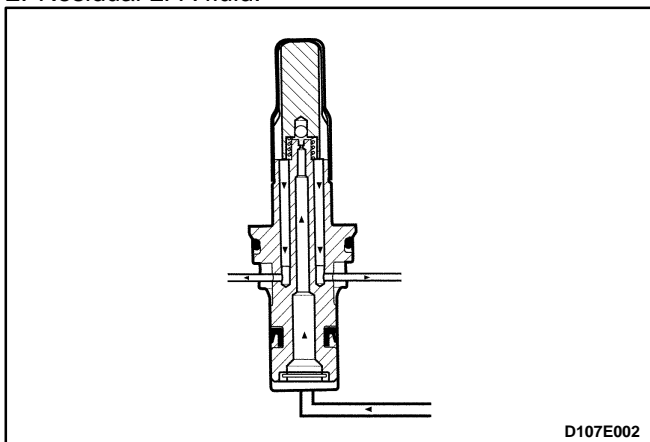
#### Isolation valve

The isolation valve is placed in the brake fluid path from the master cylinder to the relevant brake caliper and allows free flow as commanded by the driver during normal braking and reapply phases.

In the isolation phase the coil moves the armature down, which closes the normally open isolation orifice and prevents any further increase of pressure in the brake. The valve also remains closed during the dump phase.

The lip seal provides a one way return path for brake fluid to flow through in:

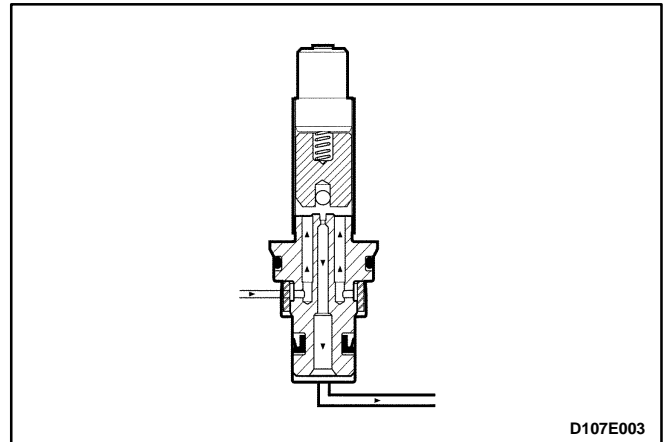
1. Foot off pedal during isolation.
2. Residual LPA fluid.



#### Dump Valve

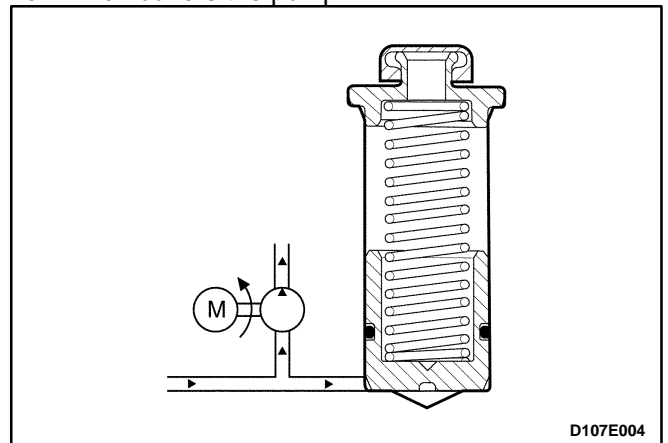
The dump valve creates a flow path from the isolation cartridge (brake side) to the low pressure accumulator (LPA). The valve keeps this path permanently closed except during the dump phase in the ABS mode. On activation (dump phase), the coil moves up the armature which opens the normally closed dump orifice and allow to drain the pressure in the brake line with the brake fluid flowing into the LPA.

The lip seal provides a return path for residual brake fluid in the LPA.



#### Low Pressure Accumulator (LPA)

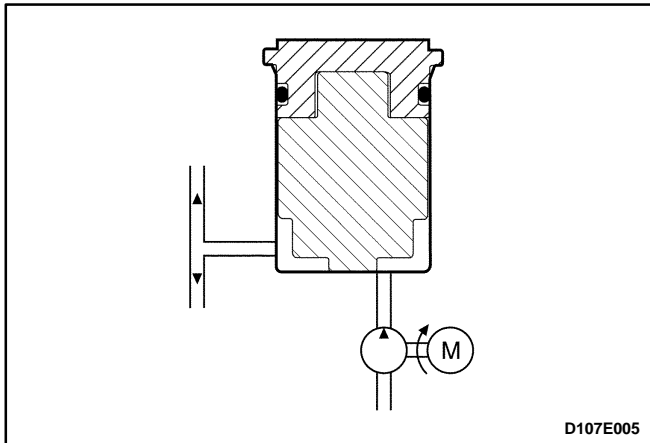
LPA provides a variable chamber for brake fluid to be quickly pushed in through the dump valve at the beginning of a departure. This chamber then acts as a reservoir which buffers the pump.



#### High Pressure Attenuator (HPA)

The HPA is in between the pump and the ISO valve (master cylinder side) and uses the bulk mode of the contained plastic damper and orifice size to dump out the pressure oscillations from the pump to reduce the

feed back to the master cylinder and brake pedal.



### Return Pump Motor

The motor drives two pump elements through the eccentric wheel on its shaft.

### Return Pump

**Description:** Each pump element consists of a fixed displacement piston driven by an eccentric on the end of the eccentric motor. It has two check valves (inlet and outlet) and is fed with fluid by the low pressure accumulator.

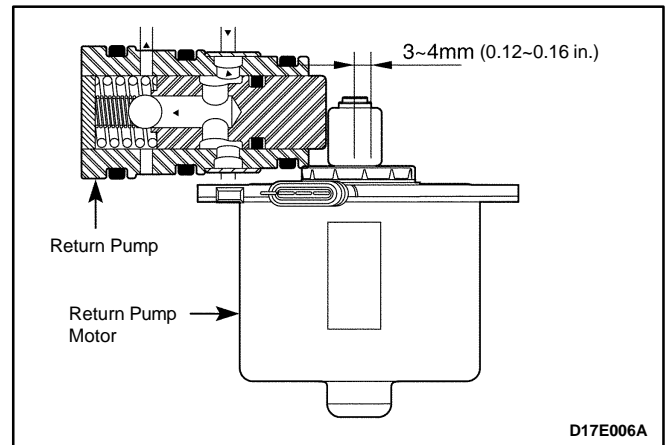
### Operation:

**Compression stroke:** the pump is filled via the inlet ball seat, then the motor eccentric rotates moving the piston to displace the fluid. After the pressure build-up closes the inlet valve the piston displacement increases the pressure until the outlet ball opens. The outlet pressure will continue to increase for the rest of the piston stroke.

**Return Stroke:** The piston retracts, forced by its spring, as the motor eccentric returns to its low end position. The pressure at the inlet side of the outlet ball then decreases due to the displaced volume and the pressure difference across this ball holds it closed.

The pressure at the outlet side of the inlet ball seat, which is set to open at a certain pressure level also decreases until this valve opens. With the outlet ball closed, the pump is filled with additional fluid from the low pressure accumulator.

The pressure will continue until a stall point is reached and compression of the piston cannot generate enough differential pressure anymore to open the outlet ball seat.



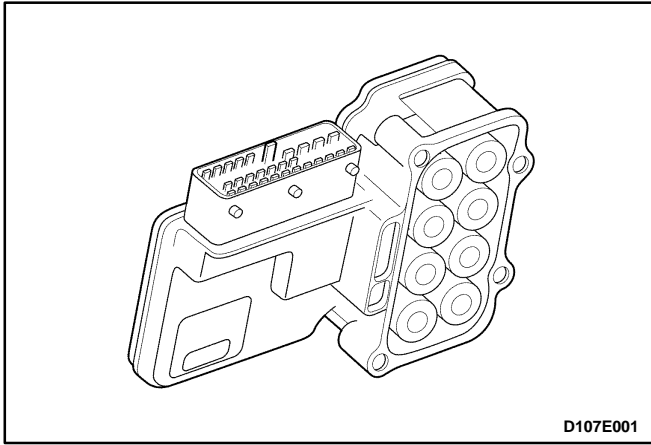
## EBCM (ELECTRONIC BRAKE CONTROL MODULE)

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

The EBCM is attached to the hydraulic unit in the engine compartment. The controlling element of ABS is a microprocessor-based EBCM. Inputs to the system include the four wheel speed sensors, the stoplamp switch, the ignition switch, and the unswitched battery voltage. There is an output to a bi-directional serial data link, located in pin M of the assembly line diagnostic link (ALDL), for service diagnostic tools and assembly plate 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 dump valve 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. The 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).

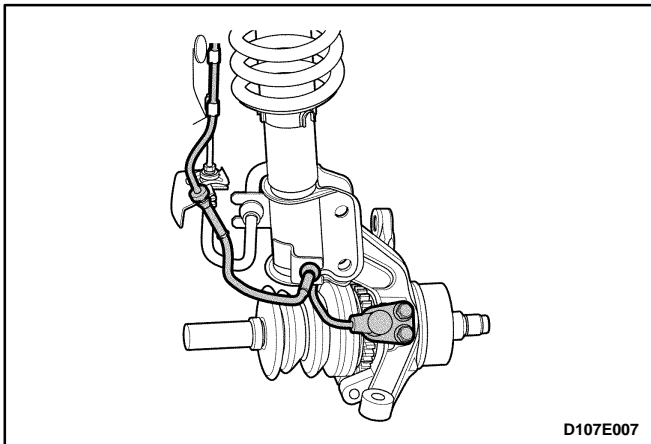


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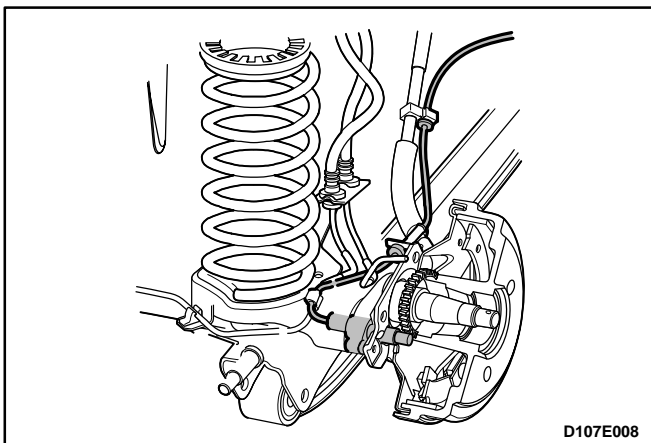
## WHEEL SPEED SENSORS AND RINGS

Front wheel speed sensors are installed to the front knuckle and rear wheel speed sensors are installed to the backing plate.

Wheel speed sensors are not serviceable. And the air cap is not adjusted. Front wheel speed sensor ring is pressed onto the drive axle shaft. Each ring contains 40 equally spaced teeth. Exercise care during service procedures to avoid prying or contacting this ring. Excessive contact may cause damage to one or more teeth. Rear wheel speed sensor rings are incorporated into the hub drum.



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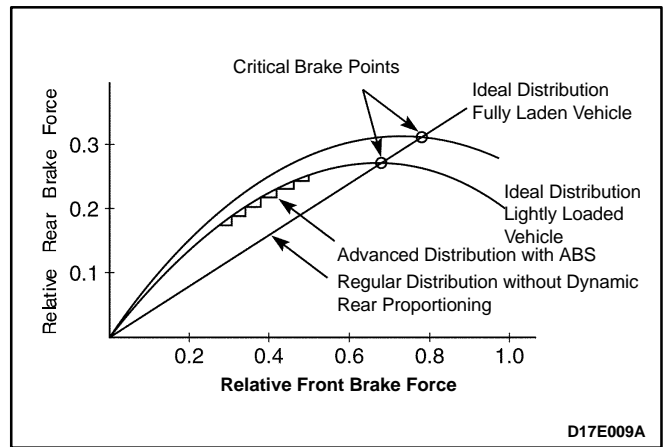


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## ELECTRONIC BRAKE DISTRIBUTION

ABS features an enhanced algorithm which includes control of the brake force distribution between the front and rear axles. This is called Electronic Brake Distribution or Dynamic Rear Proportioning valve. In an unladen car condition the brake efficiency is comparable to the conventional system but for a fully laden vehicle the efficiency of the Dynamic Rear Proportioning System is higher due to the better use of rear axle braking capability.

No indication is given to the driver when Dynamic Rear Proportioning is activated. Also, DRP remains active even in such cases where the anti-lock function of the ABS is disabled.

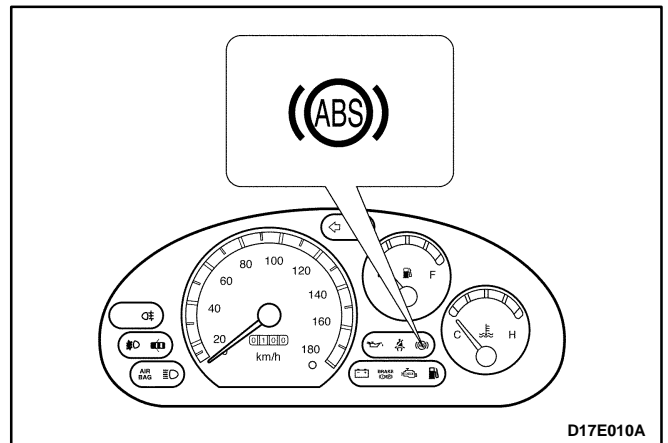


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## INDICATOR

It illuminates for four seconds immediately after the ignition has been turned on to show that the anti-lock system self-test is being carried out. If the light does not go off after this time it means that there may be a problem and ABS operation is not available.

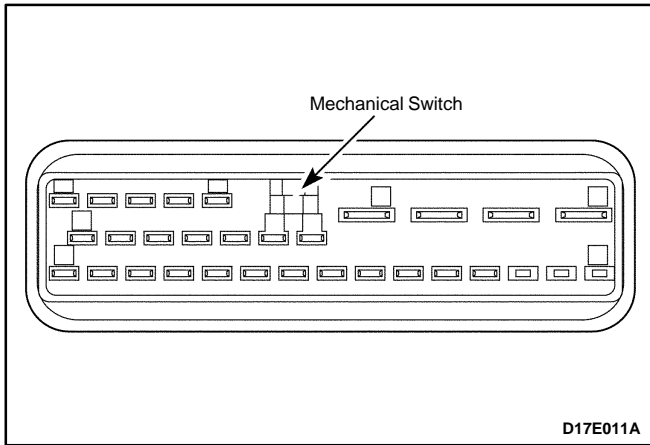
If any malfunction or error, including an unplugged EBCM connector, is detected during vehicle operation, the light will come on, warning the driver that the ABS is not operative and brake operation is in conventional, non-ABS mode.



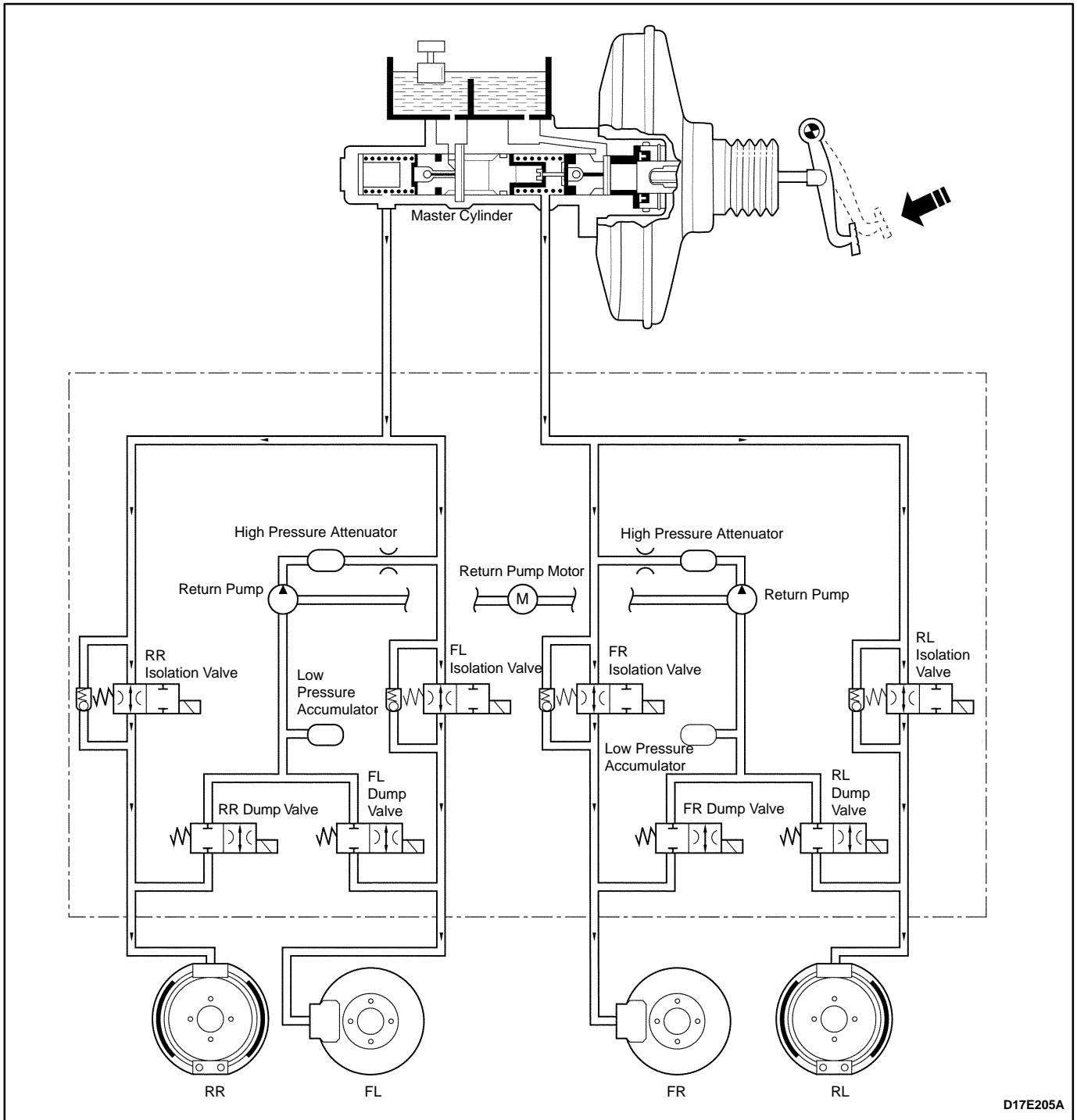
D17E010A

## EBCM CONNECTOR

A Connector has 31 pins which are shown below figure. And a connector includes a warning switch which grounds and lights the ABS warning lamp if there is No EBCM unit plugged in, so that an indication is given that ABS is not available.



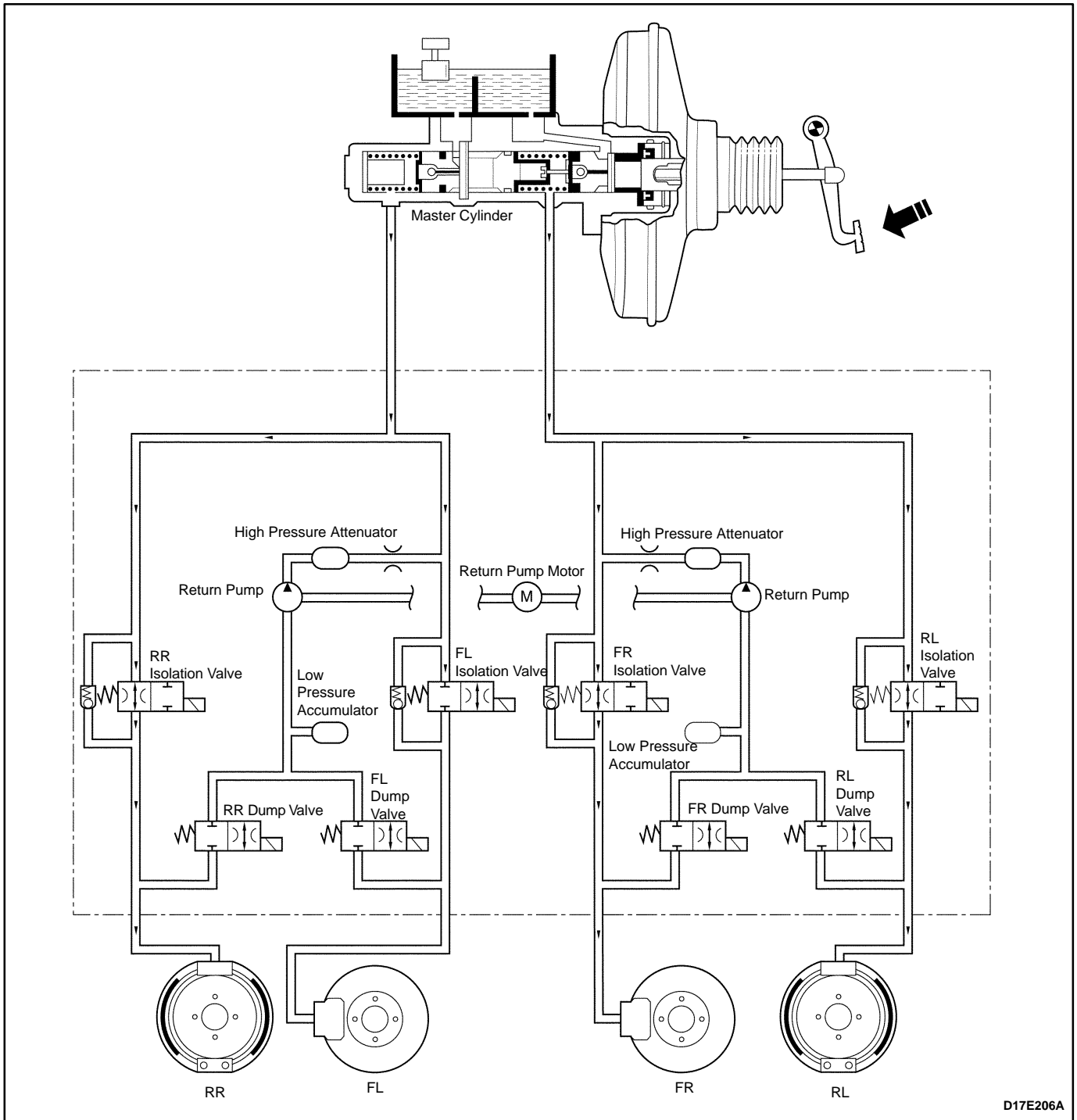
## HYDRAULIC FLUID FLOW DIAGRAMS



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### NORMAL BRAKE MODE

During non-antilock braking, pressure is applied through the brake pedal and fluid comes from the master cylinder into the hydraulic unit. The normally open isolation cartridge and normally closed dump cartridge would remain in these positions to allow fluid pressure to the calipers and the wheel cylinders. And each wheel begins locking.

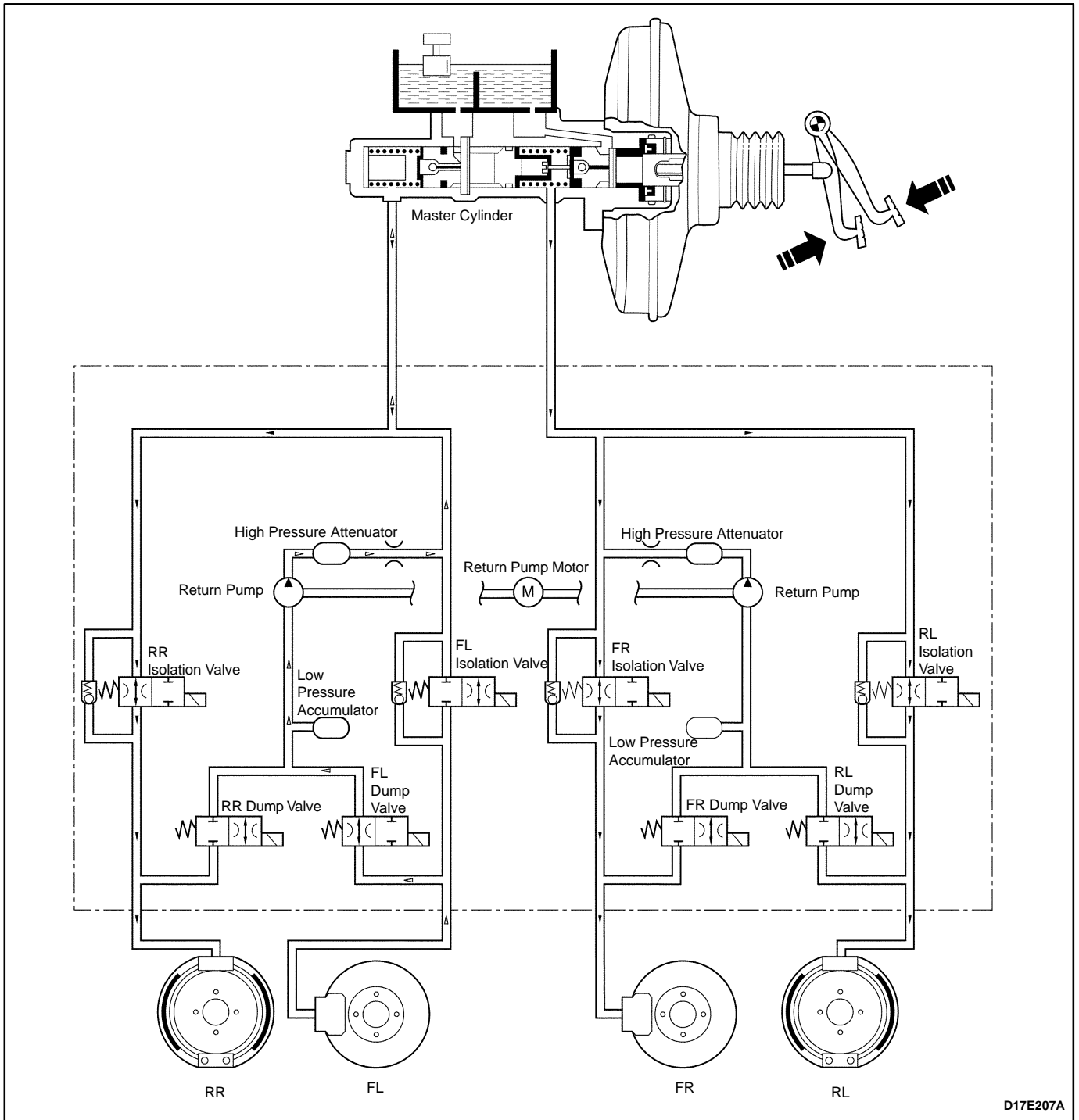


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### ISOLATION MODE (PRESSURE MAINTAIN)

If the information from the wheel speed sensors indicate excessive wheel deceleration (imminent lockup), the first step in the antilock sequence is to isolate the brake pressure being applied by the driver. The EBCM sends a voltage to the coil to energize and close the isolation valves by pulling down on the armature. This prevents any additional fluid pressure applied by the driver from reaching the wheel. Though each channel of the 4-channel system can operate independently, once any front channel (brake) sees excessive deceleration, both front isolation valves are energized and close thus, with the isolation valves closed, further unnecessary increases in the brake pressure will be prohibited.



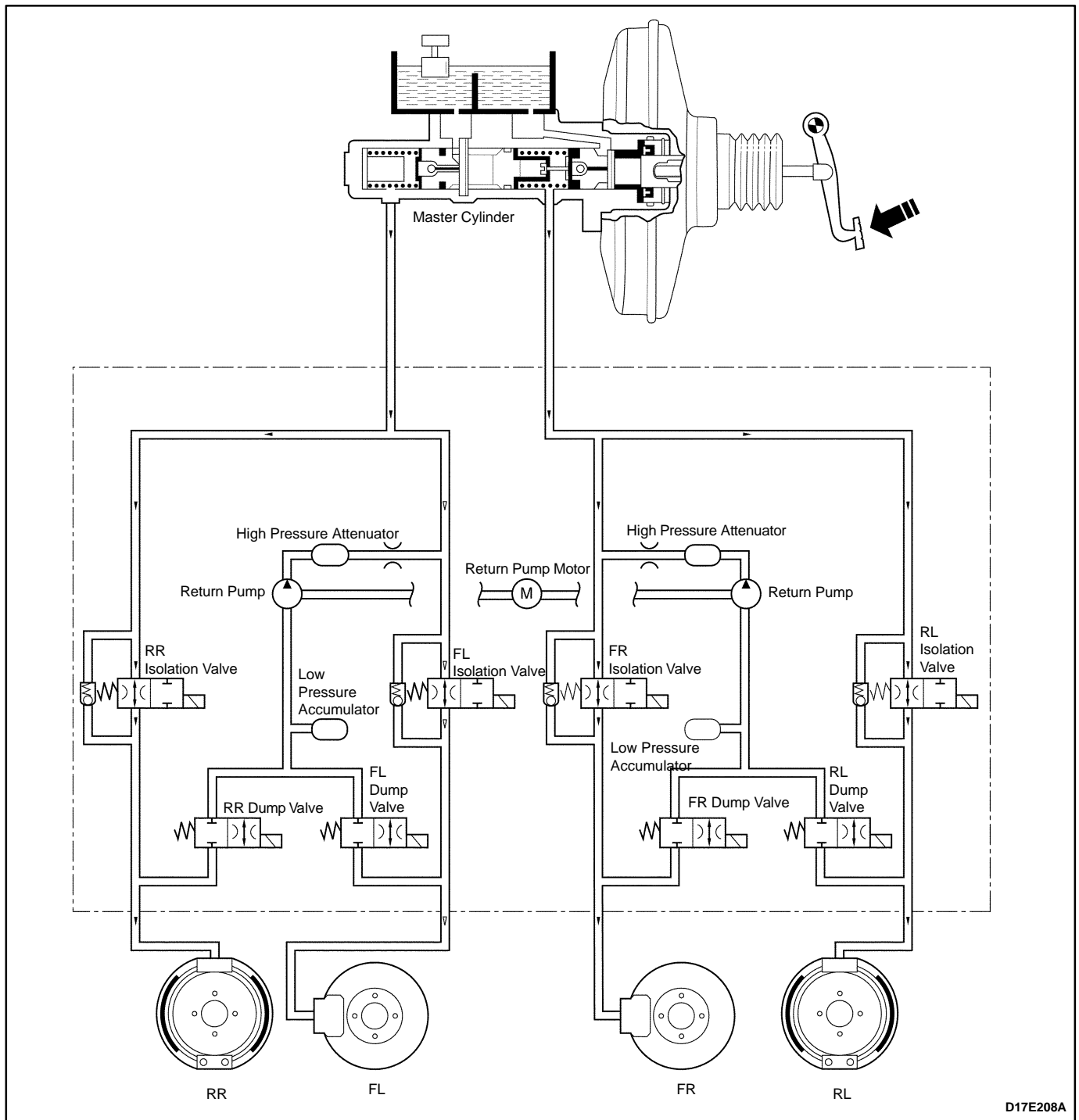


### DUMP MODE (PRESSURE DECREASE)

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

The EBCM energizes the dump cartridge coil(s) to open the dump cartridge, allowing fluid from the wheels to be dumped into the LPA. This done with very short activation pulses opening and closing the dump cartridge passageway. Brake pressure is lowered at the wheel and allows the wheel to begin spinning again.

The fluid taken from the wheels forces the spring back and is stored in the LPA. A portion of the fluid also primes the pump. The dump cartridges are operated independently to control the deceleration of the wheel.



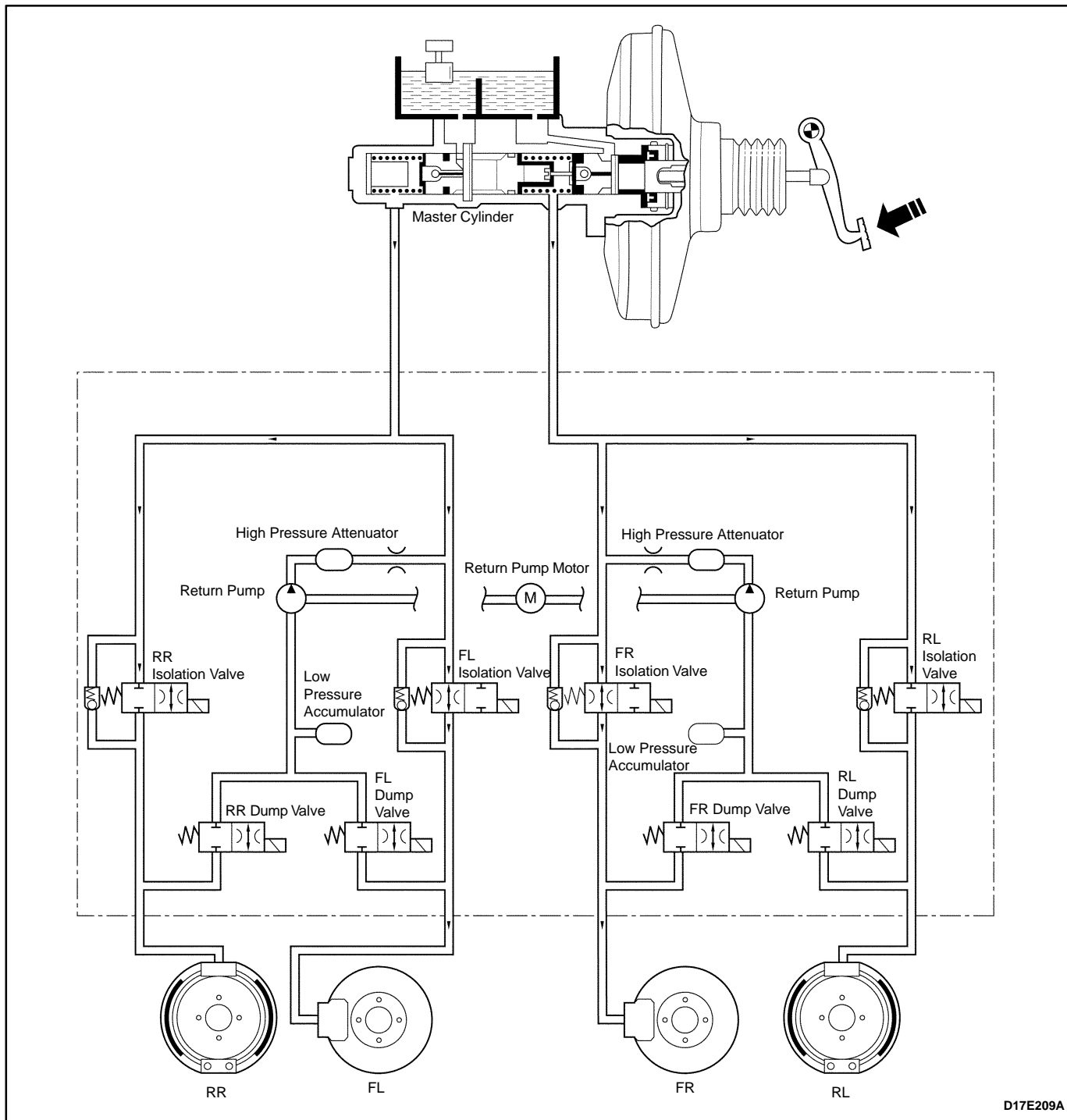
### REAPPLY MODE (PRESSURE INCREASE)

This reapply sequence is initiated to obtain optimum braking. The isolation valve is momentarily pumped open to allow master cylinder and pump pressure to reach the brakes. This controlled pressure rise continues until the wheel is at optimum brake output or until the brake pressure is brought up to the master cylinder output pressure.

If more pressure is required, more fluid is drawn from the master cylinder and applied to the brakes. The driver may feel slight pedal pulsations, or pedal drop, this is normal and expected.

As fluid is reapplied to the wheel, they begin to slow down. If they approach imminent lockup again, the EBCM will isolate, dump and reapply again. The control cycle (isolation, dump, reapply) occurs in milli-second intervals, allowing several cycles to occur each second.

It is a much faster and more controlled way of "pumping the pedal".



D17E209A

### PROPORTIONING FUNCTION

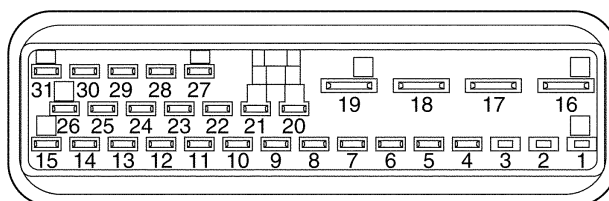
If the rear wheels lock formerly during braking, the vehicle may lose the stability. Therefore to prevent this, the ECM processes the speed sensor signal and brake signal to determine when the rear wheels are tending to lock up. The EBCM then actuates the rear wheel isolation valves to reduce the rear brake pressure and keep the wheels rolling.

# VISUAL IDENTIFICATION

## EBCM CONNECTOR FACE VIEW

Terminal 9 is identified as they appear from the wire entry end of the harness connector.

### EBCM Connector

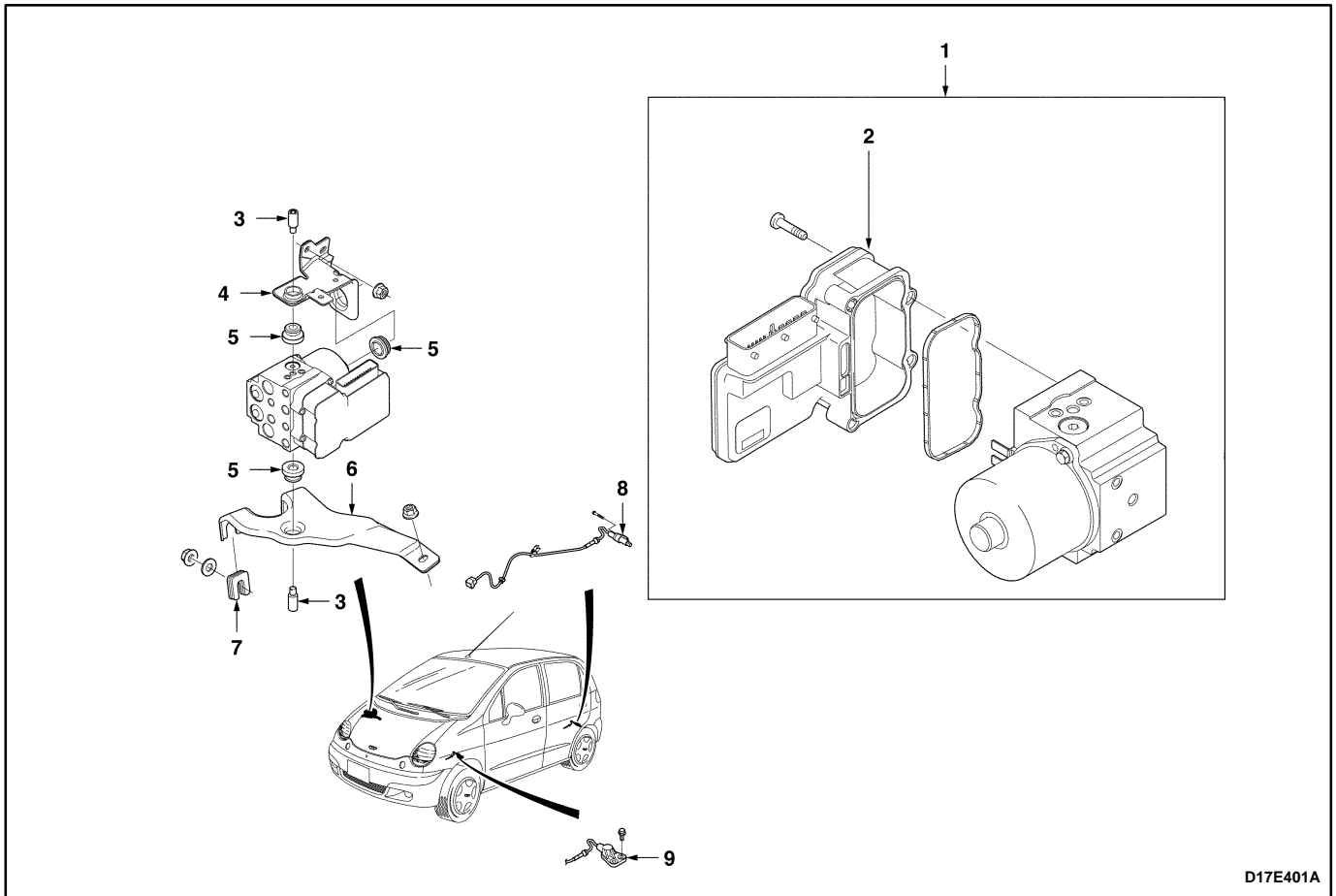


D107E204

Pin	Signal Name	Color	Circuit
2	ROUGH ROAD	GRY/YEL	Buffered Wheel Speed Signal : to ECM-55 (Sirius D3)
9	RRWSHI	BRN	Right Rear Wheel Speed High
10	RRWSLO	WHT	Right Rear Wheel Speed Low
11	SDLUART	BRN/DK GRN	Serial Data Link
12	RFWSHI	DK GRN/BLK	Right Front Wheel Speed High
13	RFWSLO	BRN/DK GRN	Right Front Wheel Speed Low
14	LFWSHI	DK BLU	Left Front Wheel Speed High
15	IGN	RED/YEL	Switched Ignition
16	GND	BLK	Negative Battery Terminal
17	BATT	RED	Battery
18	BATT	RED	Battery
19	GND	BLK	Negative Battery Terminal
20	ABSWARN	DK GRN/GRY	ABS Warning Indicator
22	LRWSHI	BLK	Left Rear Wheel Speed High
23	LRWSLO	RED	Left Rear Wheel Speed Low
24	BRAKESW	YEL	Brake Switch
25	LFWSLO	YEL	Left Front Wheel Speed Low

# COMPONENT LOCATOR

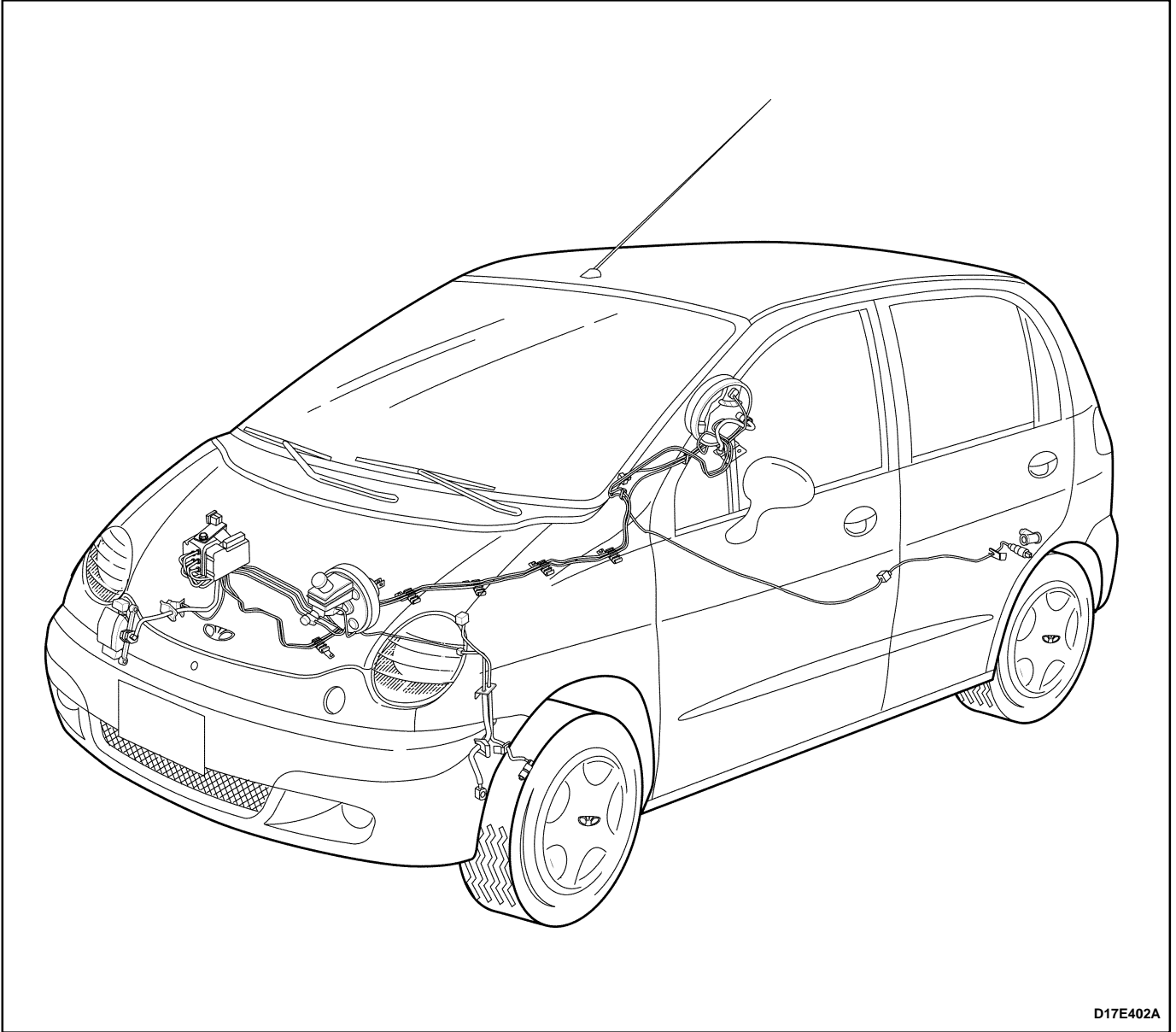
## ABS



- 1. Hydraulic Modulator Unit
- 2. Electronic Brake Control Module (EBCM)
- 3. Bolt
- 4. Upper Mounting Bracket
- 5. Grommet

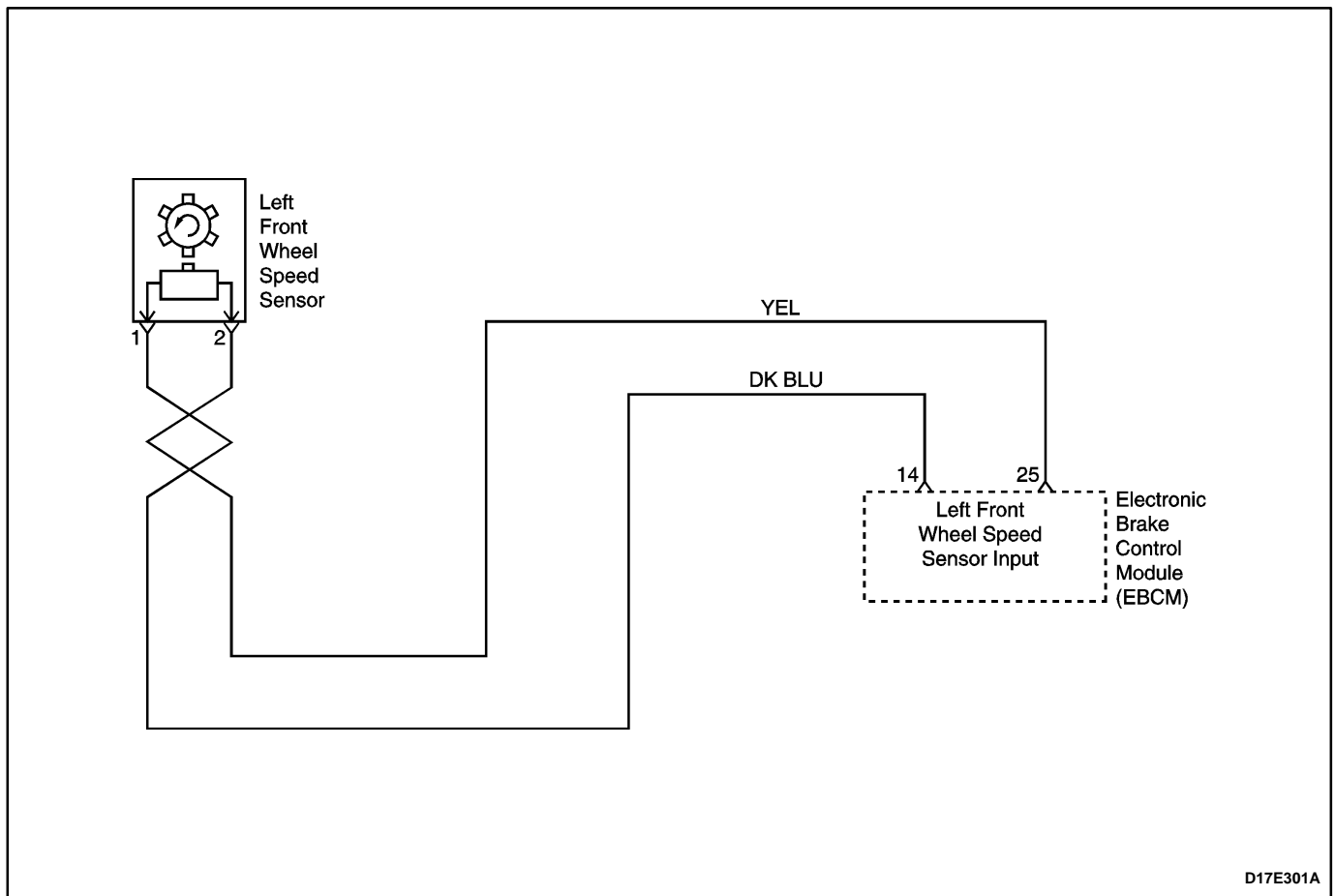
- 6. Lower Mounting Bracket
- 7. Bracket Grommet
- 8. Rear Wheel Speed Sensor
- 9. Front Wheel Speed Sensor

ABS (Cont'd)



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## DIAGNOSTIC INFORMATION AND PROCEDURES



### DIAGNOSTIC TROUBLE CODE (DTC) 0354 LEFT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

#### 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 open or 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 proportioning is operation.

#### 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.

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.

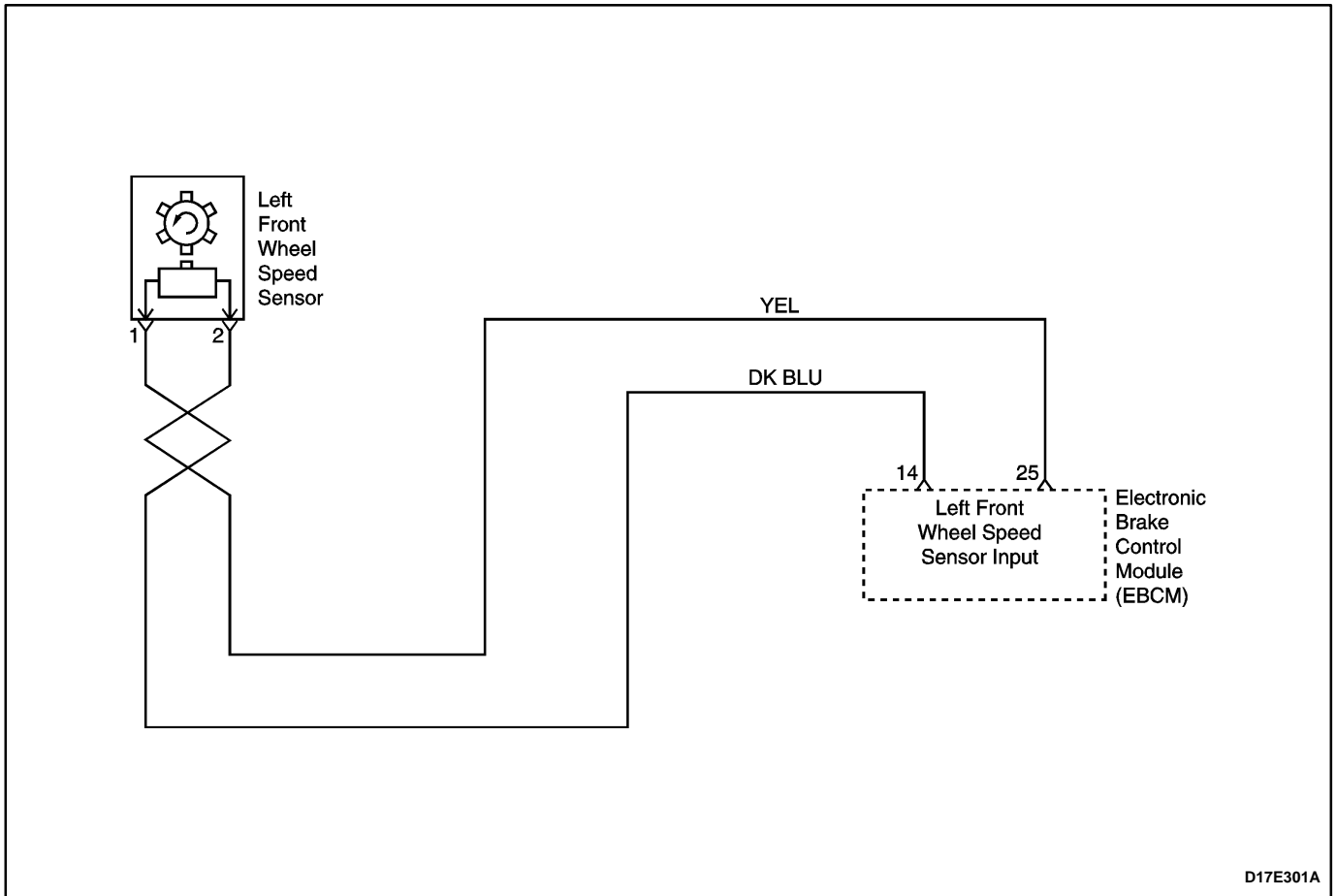
**DTC 0354 – Left Front Wheel Speed Sensor Circuit Open or Shorted**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 14 and 25 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 2
2	1. Disconnect the harness from the left front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left front wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between terminal 14 of the EBCM harness connector, and terminal 1 of the left front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1Ω	Go to Step 6	Go to Step 5
5	1. Repair the high resistance in circuit DK BLU. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 25 of the EBCM harness connector, and terminal 2 of the left front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1Ω	Go to Step 8	Go to Step 7
7	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	–
8	Use a DVM to measure the resistance between ground and terminal 14 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 10	Go to Step 9
9	Repair the short to ground in circuit DK BLU. Is the repair complete?	–	System OK	–

**DTC 0354 – Left Front Wheel Speed Sensor Circuit Open or Shorted (Cont'd)**

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between ground and terminal 25 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 12	Go to Step 11
11	Repair the short to ground in circuit YEL. Is the repair complete?	–	System OK	–
12	1. Reconnect all of the connectors. 2. Turn the ignition to ON. 3. Use a DVM to measure the voltage between ground and terminal 14 of EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 14	Go to Step 13
13	Repair the short to voltage in circuit DK BLU. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the voltage between ground and terminal 25 of EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 16	Go to Step 15
15	Repair the short to voltage in circuit YEL. Is the repair complete?	–	System OK	–
16	Replace the EBCM. Is the repair complete?	–	System OK	–

**BLANK**



D17E301A

## DIAGNOSTIC TROUBLE CODE (DTC) 0355 LEFT FRONT WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

### 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 checks for the left front wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

### Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

### Fail Action

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

### 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.

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

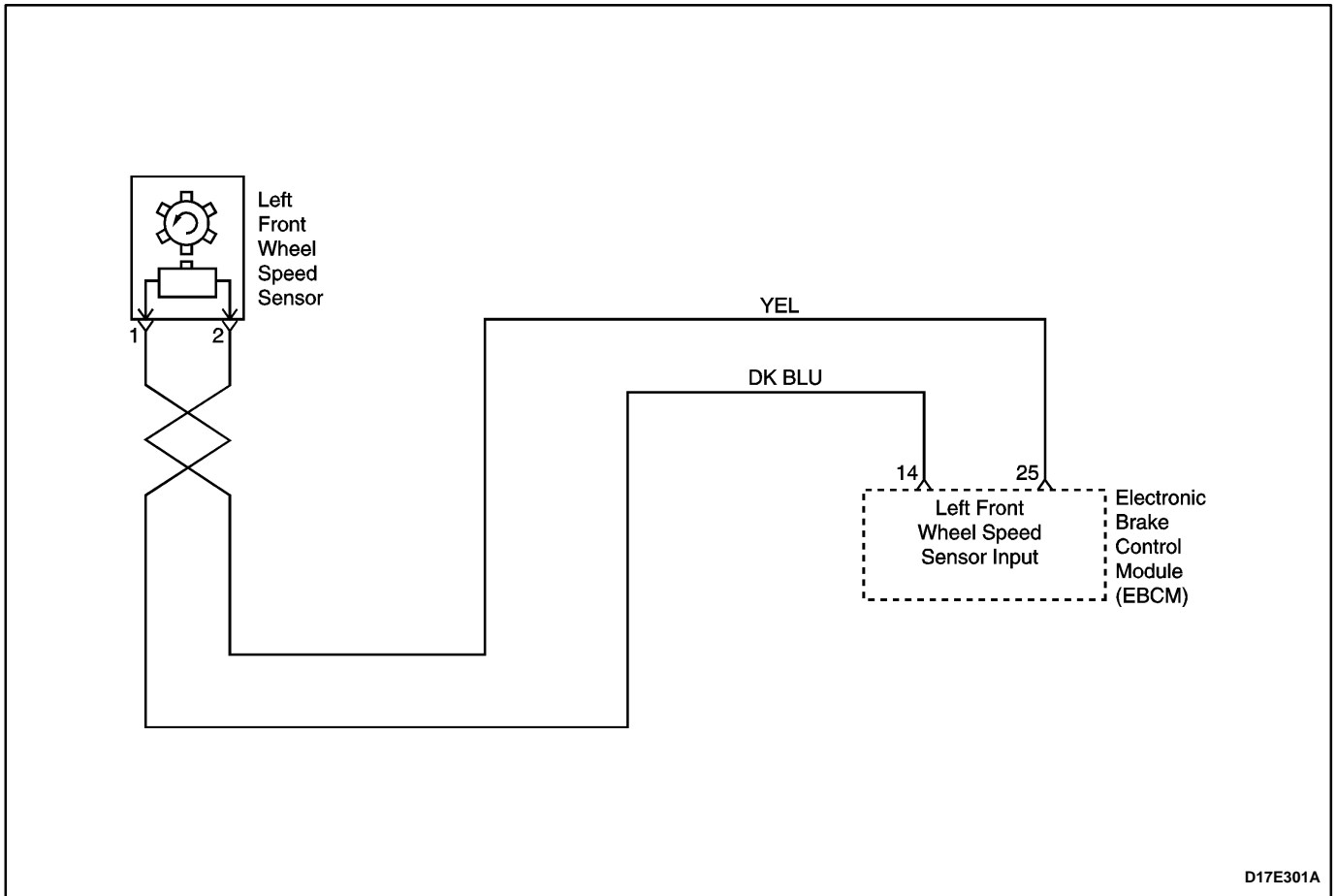
sensor. Refer to “Front Wheel Speed Sensor” in this section.

**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 0355 – Left Front Wheel Speed Sensor poor air Gap or Missing Tooth Ring**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. <ul style="list-style-type: none"> <li>● Wheel speed sensor is loose.</li> <li>● The air gap exceeds the required specifications.</li> <li>● The speed ring is missing or damaged.</li> </ul> 3. Repair or replace the damaged. Is the repair complete?	–	System OK	Go to <i>Step 2</i>
2	Replace the EBCM. Is the repair complete?	–	System OK	–



D17E301A

## DIAGNOSTIC TROUBLE CODE (DTC) 0356 LEFT FRONT WHEEL SPEED SENSOR CIRCUIT INTERMITTENT SHORTED

### 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 intermittent the left front wheel speed sensor circuit.

### Cause(s)

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

### Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

### 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.

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.

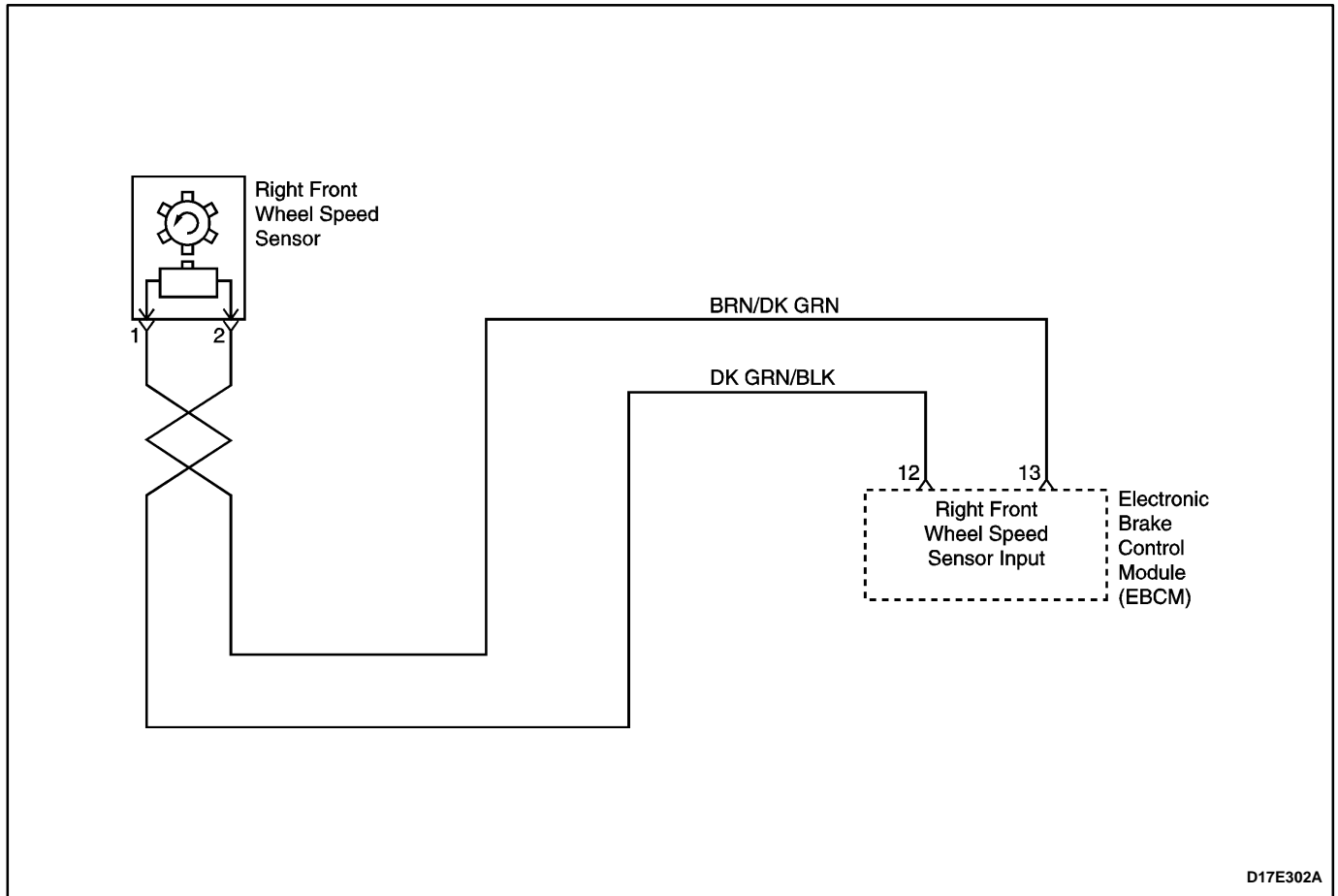
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

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 0356 – Left Front Wheel Speed Sensor Circuit Intermittent Shorted**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 14 and 25 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 2
2	1. Disconnect the harness from the left front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left front wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 14 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 6	Go to Step 5
5	Repair the short to ground in circuit DK BLU. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 25 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 8	Go to Step 7
7	Repair the short to ground in circuit YEL. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 14 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 10	Go to Step 9
9	Repair the short to voltage in circuit DK BLU. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 25 of the EBCM connector. Does the voltage within the specified value?	0 v	Go to Step 12	Go to Step 11
11	Repair the short to voltage in circuit YEL. Is the repair complete?	–	System OK	–
12	Replace the EBCM. Is the repair complete?	–	System OK	–



## DIAGNOSTIC TROUBLE CODE (DTC) 0404 RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

### 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 open or 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 proportioning is operation.

### 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.

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.

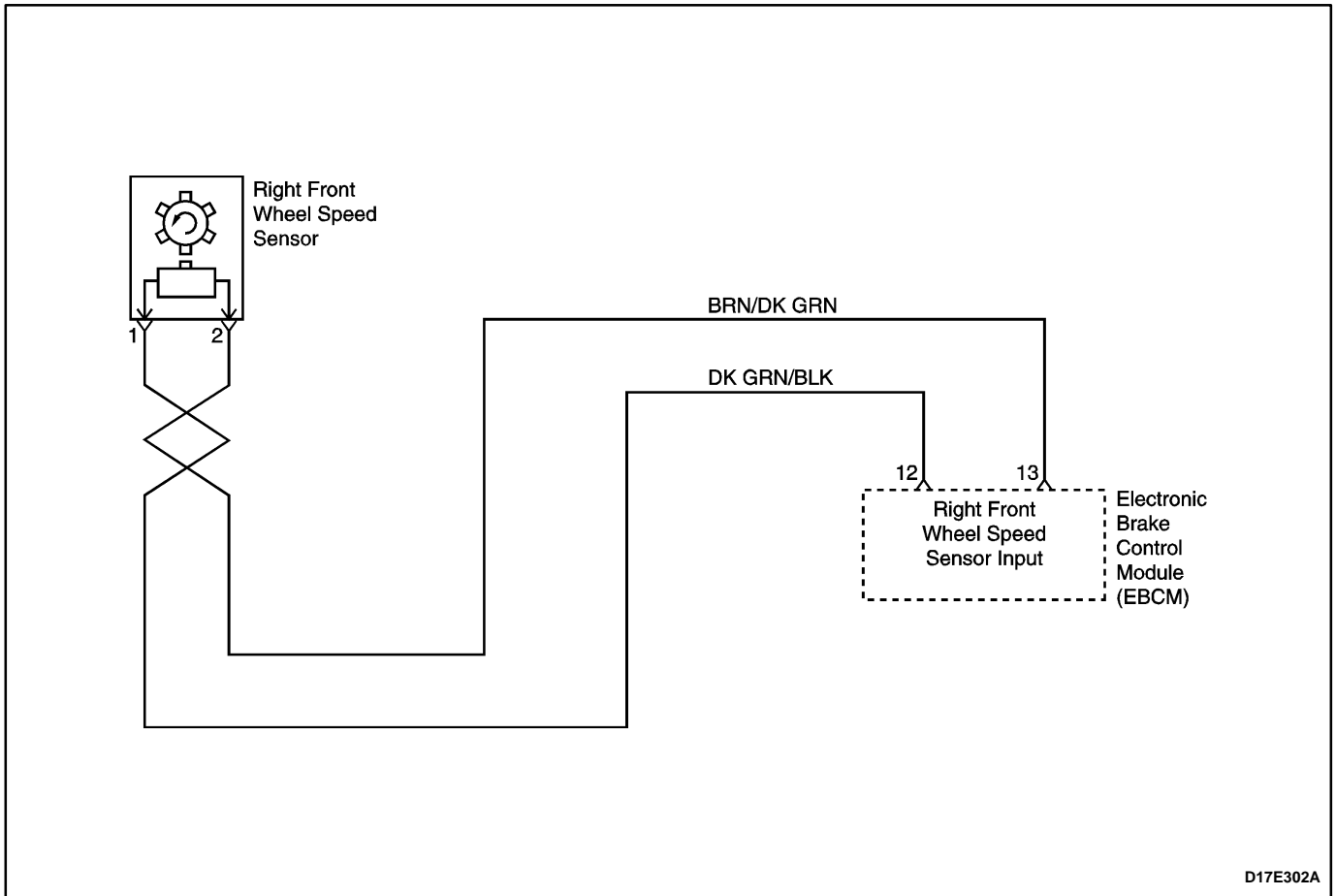
**DTC 0404 – Right Front Wheel Speed Sensor Circuit Open or Shorted**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 12 and 13 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 2
2	1. Disconnect the harness from the right front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right front wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between terminal 12 of the EBCM harness connector, and terminal 1 of the right front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 Ω	Go to Step 6	Go to Step 5
5	1. Repair the high resistance in circuit DK GRN/BLK. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 13 of the EBCM harness connector, and terminal 2 of the right front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 Ω	Go to Step 8	Go to Step 7
7	1. Repair the high resistance in circuit BRN/DK GRN. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between ground and terminal 12 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 10	Go to Step 9
9	Repair the short to ground in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–

**DTC 0404 – Right Front Wheel Speed Sensor Circuit Open or Shorted (Cont'd)**

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between ground and terminal 13 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 12	Go to Step 11
11	Repair the short to ground in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
12	1. Reconnect all of the connectors. 2. Turn the ignition to ON. 3. Use a DVM to measure the voltage between ground and terminal 12 of EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 14	Go to Step 13
13	Repair the short to voltage in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the voltage between ground and terminal 13 of EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 16	Go to Step 15
15	Repair the short to voltage in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
16	Replace the EBCM. Is the repair complete?	–	System OK	–

**BLANK**



D17E302A

## DIAGNOSTIC TROUBLE CODE (DTC) 0405 RIGHT FRONT WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

### 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 checks for the right front wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

### Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

### Fail Action

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

### 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.

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

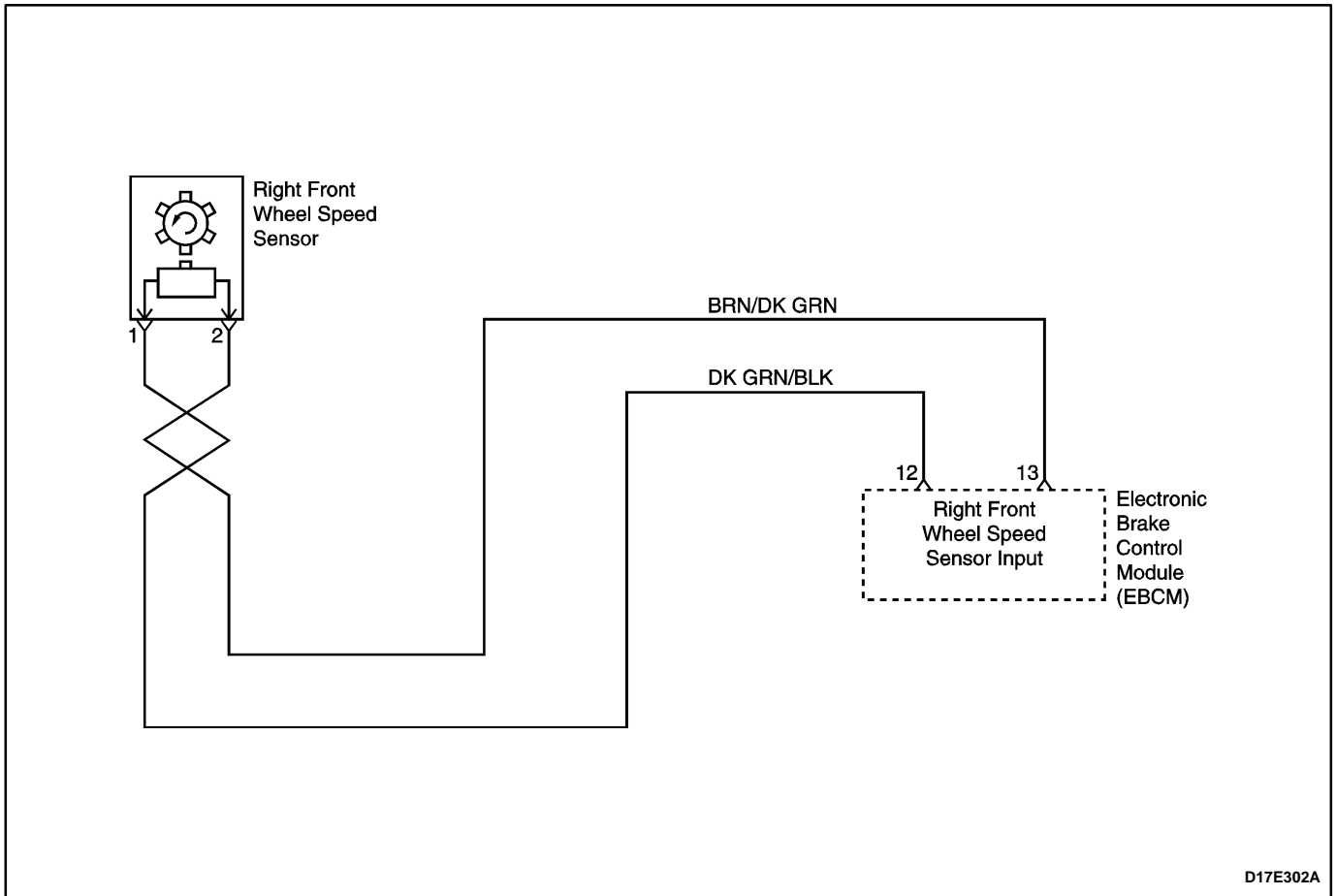
sensor. Refer to “Front Wheel Speed Sensor” in this section.

**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 0405 – Right Front Wheel Speed Sensor poor air Gap or Missing Tooth Ring**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. <ul style="list-style-type: none"> <li>● Wheel speed sensor is loose.</li> <li>● The air gap exceeds the required specifications.</li> <li>● The speed ring is missing or damaged.</li> </ul> 3. Repair or replace the damaged. Is the repair complete?	–	System OK	Go to <i>Step 2</i>
2	Replace the EBCM. Is the repair complete?	–	System OK	–



D17E302A

## DIAGNOSTIC TROUBLE CODE (DTC) 0406 RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT INTERMITTENT SHORTED

### 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 intermittent the right front wheel speed sensor circuit.

### Cause(s)

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

### Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

### 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.

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.

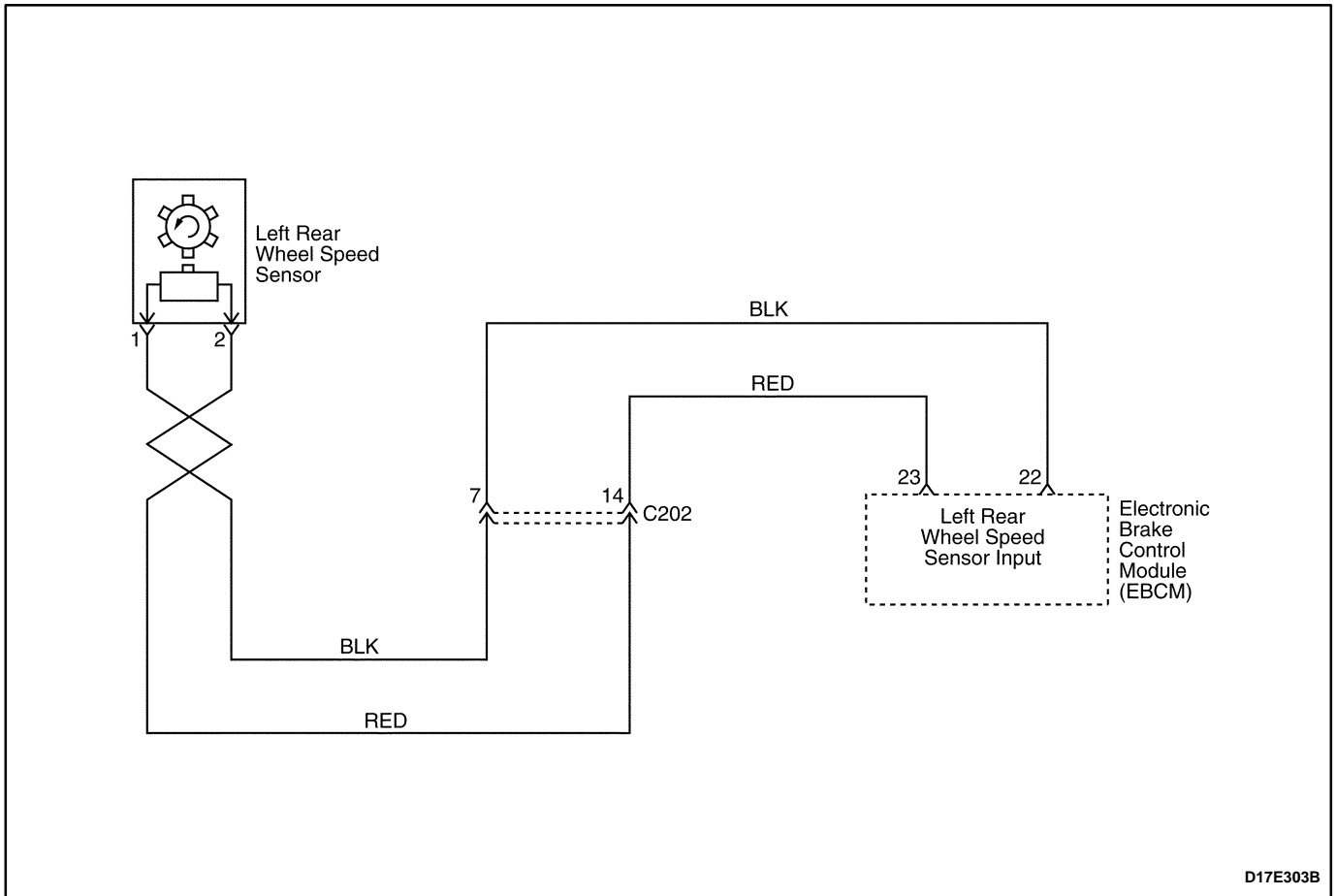
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

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 0406 – Right Front Wheel Speed Sensor Circuit Intermittent Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 12 and 13 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 k $\Omega$ to 1.5 k $\Omega$	Go to Step 4	Go to Step 2
2	1. Disconnect the harness from the right front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right front wheel speed sensor connector. Is the resistance within the specified value?	1.0 k $\Omega$ to 1.5 k $\Omega$	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 12 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 6	Go to Step 5
5	Repair the short to ground in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 13 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 8	Go to Step 7
7	Repair the short to ground in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 12 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 10	Go to Step 9
9	Repair the short to voltage in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 13 of the EBCM connector. Does the voltage within the specified value?	0 v	Go to Step 12	Go to Step 11
11	Repair the short to voltage in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
12	Replace the EBCM. Is the repair complete?	–	System OK	–



D17E303B

## DIAGNOSTIC TROUBLE CODE (DTC) 0454 LEFT REAR WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

### 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 open or 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 proportioning is operation.

### 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.

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 0454 – Left Rear Wheel Speed Sensor Circuit Open or Shorted**

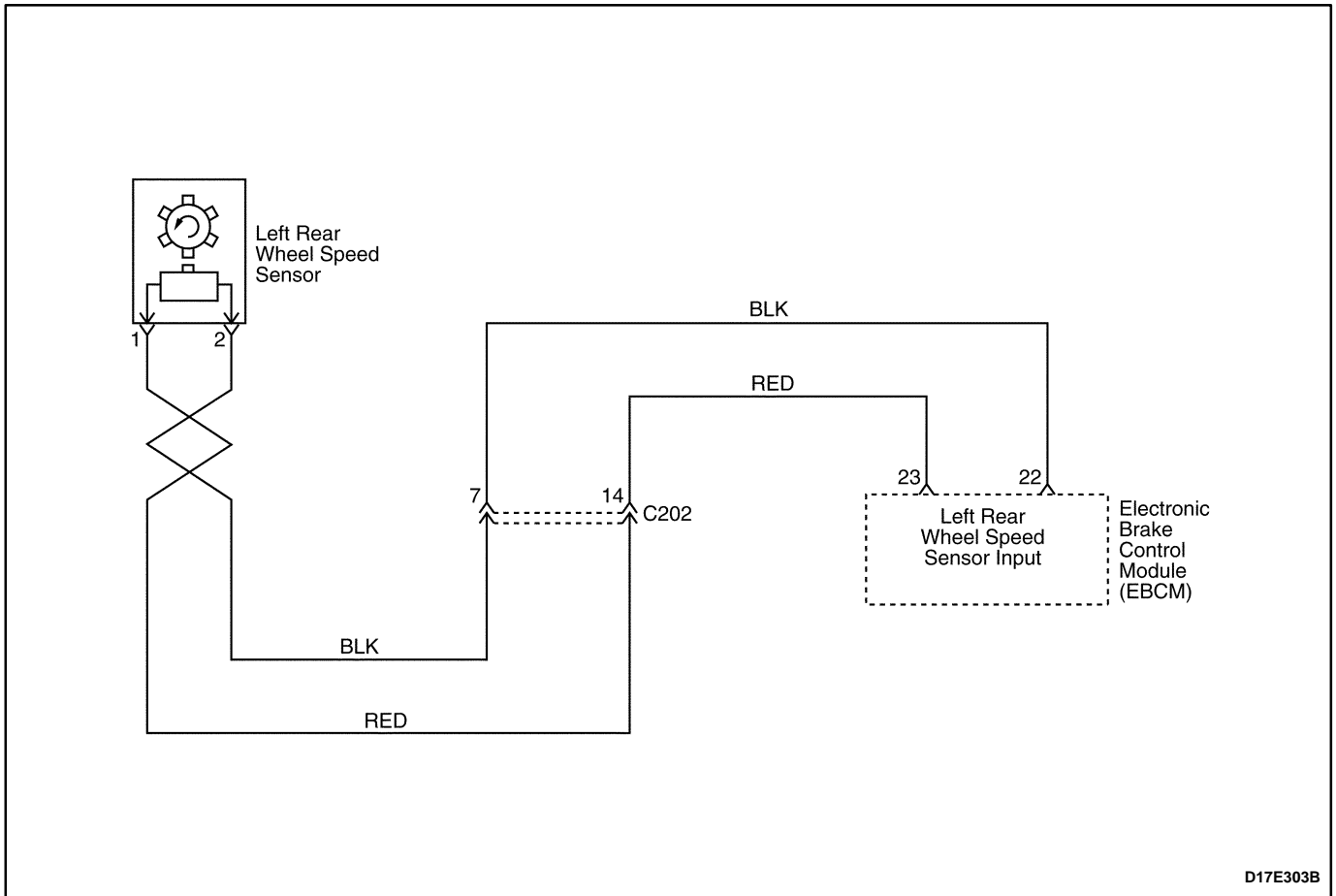
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 22 and 23 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 2
2	1. Disconnect the harness from the left rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	1. Disconnect the connector C202. 2. Use a DVM to measure the resistance between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Does the DVM show the specified value?	less than 1 Ω	Go to Step 6	Go to Step 5
5	Repair the high resistance between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 Ω	Go to Step 8	Go to Step 7
7	Repair the high resistance between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Does the DVM show the specified value?	less than 1 Ω	Go to Step 10	Go to Step 9
9	Repair the high resistance between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–

**DTC 0454 – Left Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)**

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the resistance within specified value?	less than 1 $\Omega$	Go to Step 12	Go to Step 11
11	Repair the high resistance between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	Use a DVM to measure the resistance between ground and terminal 22 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 14	Go to Step 13
13	Repair the short to ground between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the resistance between ground and terminal 7 of the connector C202. Does the DVM show the specified value?	$\infty$	Go to Step 16	Go to Step 15
15	Repair the short to ground between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	Use a DVM to measure the resistance between ground and terminal 23 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 18	Go to Step 17
17	Repair the short to ground between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
18	Use a DVM to measure the resistance between ground and terminal 14 of the connector C202. Does the DVM show the specified value?	$\infty$	Go to Step 20	Go to Step 19
19	Repair the short to ground between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 22 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 22	Go to Step 21
21	Repair the short to voltage between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
22	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 7 of the connector C202. Is the voltage within the specified value?	0 v	Go to Step 24	Go to Step 23

**DTC 0454 – Left Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)**

Step	Action	Value(s)	Yes	No
23	Repair the short to voltage between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
24	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 26	Go to Step 25
25	Repair the short to voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
26	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 14 of the connector C202. Is the voltage within the specified value?	0 v	Go to Step 28	Go to Step 27
27	Repair the short to voltage between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
28	Replace the EBCM. Is the repair complete?	–	System OK	–



D17E303B

## DIAGNOSTIC TROUBLE CODE (DTC) 0455 LEFT REAR WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

### 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 checks for the left rear wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

### Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

### Fail Action

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

### 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.

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

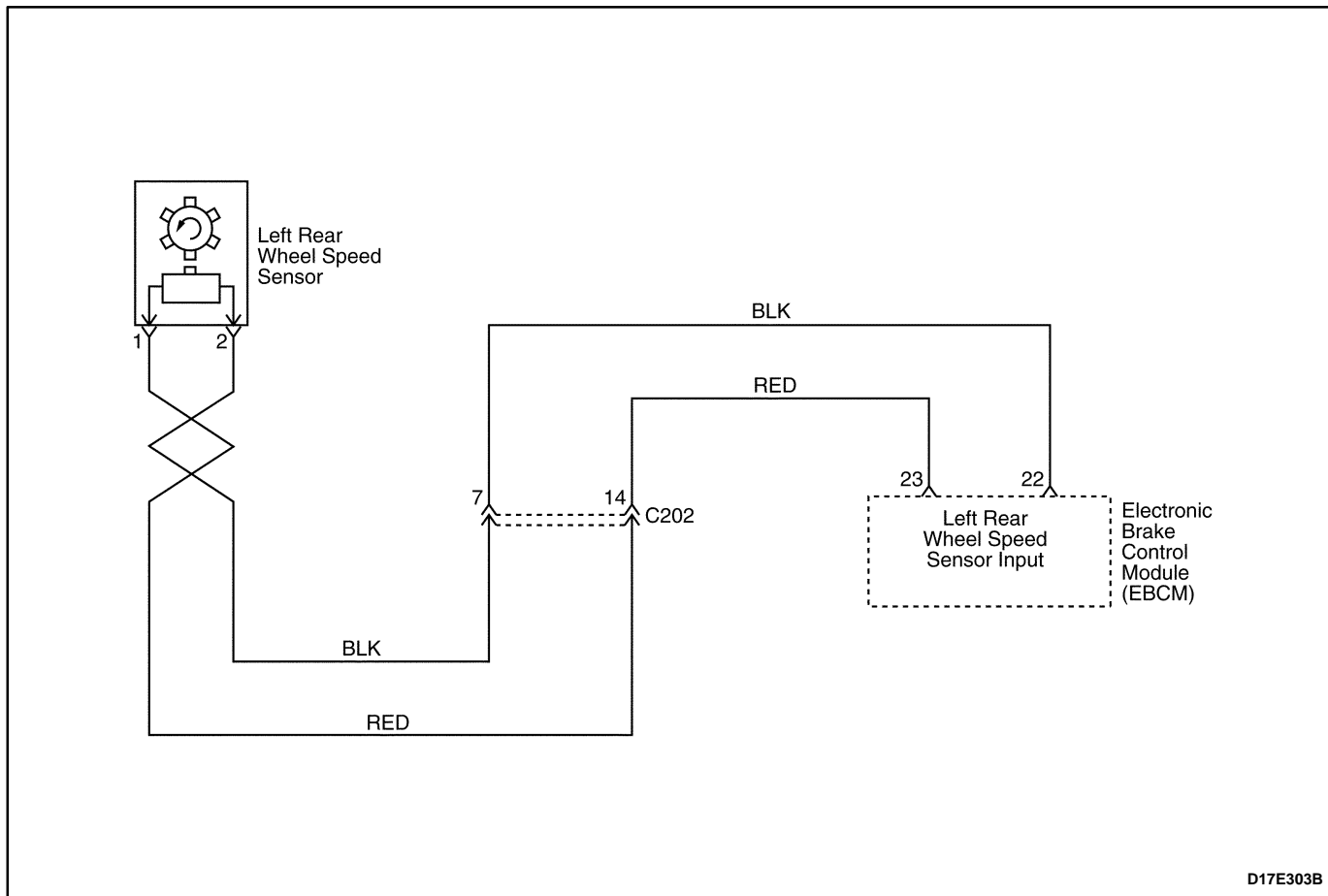
sensor. Refer to "Rear Wheel Speed Sensor" in this section.

**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 0455 – Left Rear Wheel Speed Sensor poor air Gap or Missing Tooth Ring**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. <ul style="list-style-type: none"> <li>● Wheel speed sensor is loose.</li> <li>● The air gap exceeds the required specifications.</li> <li>● The speed ring is missing or damaged.</li> </ul> 3. Repair or replace the damaged. Is the repair complete?	-	System OK	Go to <i>Step 2</i>
2	Replace the EBCM. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 0456 LEFT REAR WHEEL SPEED SENSOR CIRCUIT INTERMITTENT SHORTED

### 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 intermittent the left rear wheel speed sensor circuit.

### Cause(s)

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

### Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

### 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.

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 0456 – Left Rear Wheel Speed Sensor Circuit Intermittent Shorted**

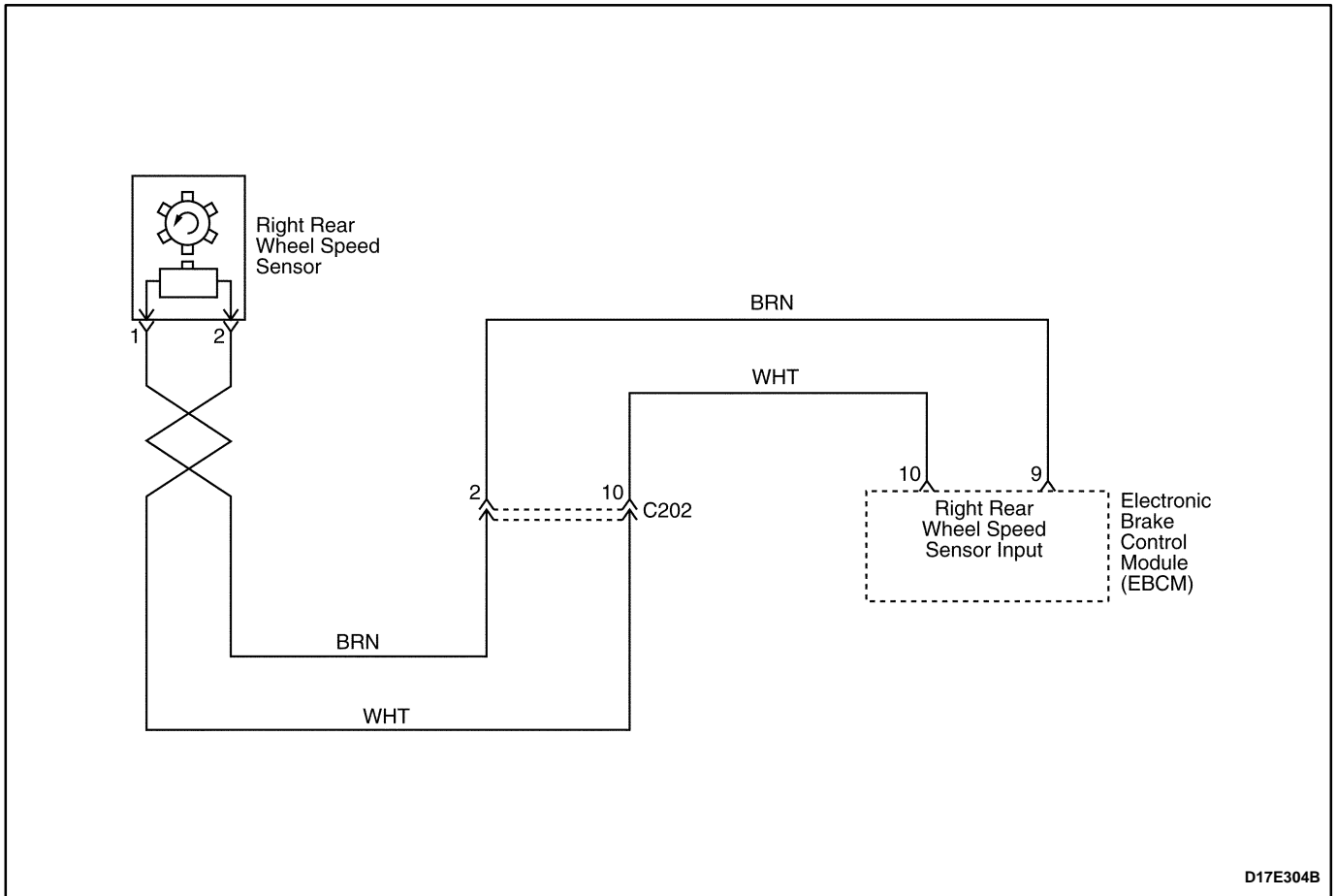
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 22 and 23 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 2
2	1. Disconnect the harness from the left rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 22 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 6	Go to Step 5
5	Repair the short to ground between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 7 of the connector C202. Does the DVM show the specified value?	∞	Go to Step 8	Go to Step 7
7	Repair the short to ground between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between ground and terminal 23 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 10	Go to Step 9
9	Repair the short to ground between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 14 of the connector C202. Does the DVM show the specified value?	∞	Go to Step 12	Go to Step 11

**DTC 0456 – Left Rear Wheel Speed Sensor Circuit Intermittent Shorted (Cont'd)**

Step	Action	Value(s)	Yes	No
11	Repair the short to ground between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 22 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 14	Go to Step 13
13	Repair the short to voltage between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
14	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 7 of the connector C202. Is the voltage within the specified value?	0 v	Go to Step 16	Go to Step 15
15	Repair the short to voltage between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 18	Go to Step 17
17	Repair the short to voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
18	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 14 of the connector C202. Is the voltage within the specified value?	0 v	Go to Step 20	Go to Step 19
19	Repair the short to voltage between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	Replace the EBCM. Is the repair complete?	–	System OK	–



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## DIAGNOSTIC TROUBLE CODE (DTC) 0504 RIGHT REAR WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

### 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 open or 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 proportioning is operation.

### 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.

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 0504 – Right Rear Wheel Speed Sensor Circuit Open or Shorted

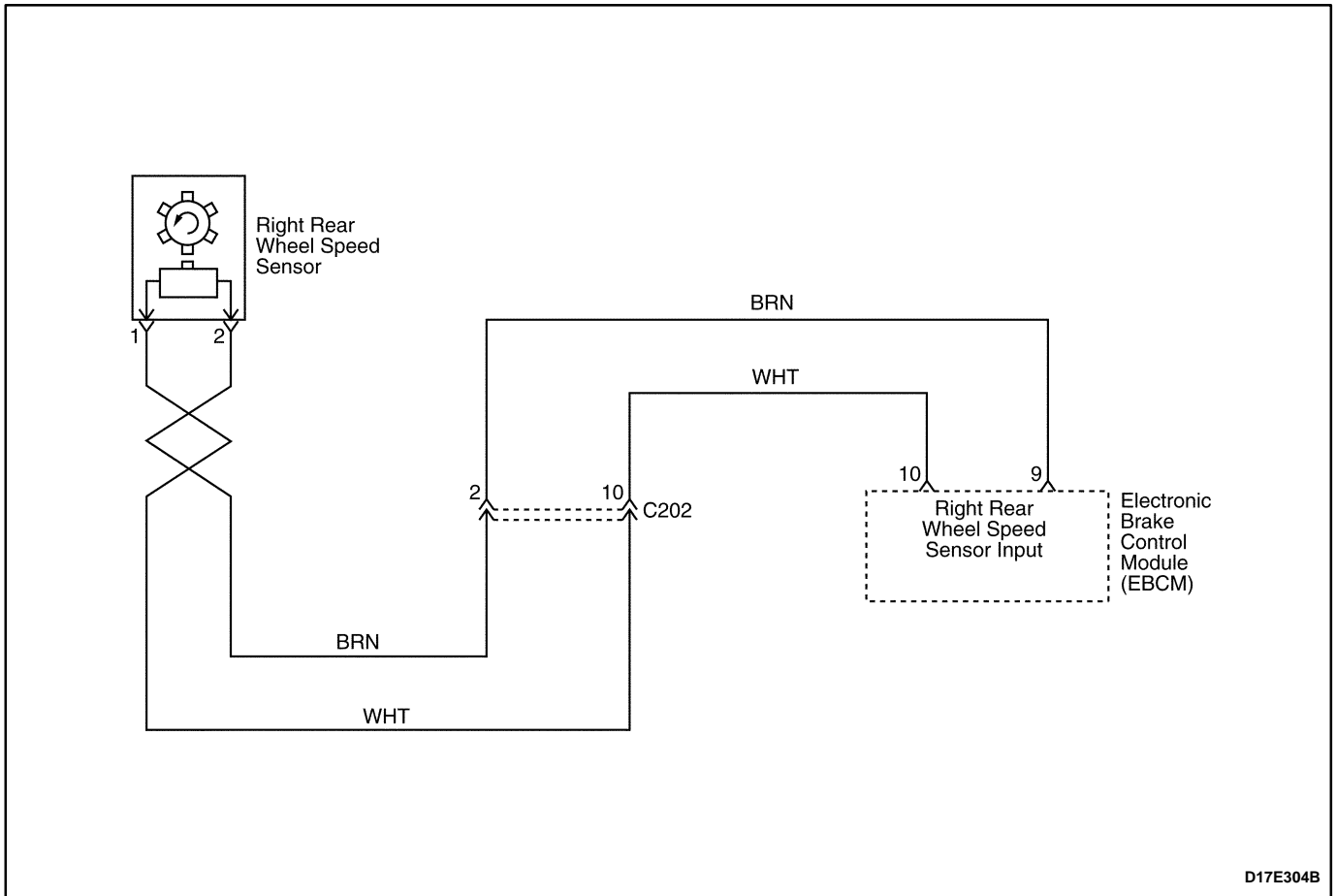
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 9 and 10 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 k $\Omega$ to 1.5 k $\Omega$	Go to <i>Step 4</i>	Go to <i>Step 2</i>
2	1. Disconnect the harness from the right rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 k $\Omega$ to 1.5 k $\Omega$	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	1. Disconnect the connector C202. 2. Use a DVM to measure the resistance between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Does the DVM show the specified value?	less than 1 $\Omega$	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	Repair the high resistance between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 $\Omega$	Go to <i>Step 8</i>	Go to <i>Step 7</i>
7	Repair the high resistance between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Does the DVM show the specified value?	less than 1 $\Omega$	Go to <i>Step 10</i>	Go to <i>Step 9</i>
9	Repair the high resistance between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–

**DTC 0504 – Right Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)**

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the resistance within specified value?	less than 1 $\Omega$	Go to Step 12	Go to Step 11
11	Repair the high resistance between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	Use a DVM to measure the resistance between ground and terminal 9 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 14	Go to Step 13
13	Repair the short to ground between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the resistance between ground and terminal 2 of the connector C202. Does the DVM show the specified value?	$\infty$	Go to Step 16	Go to Step 15
15	Repair the short to ground between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	Use a DVM to measure the resistance between ground and terminal 10 of the EBCM connector. Does the DVM show the specified value?	$\infty$	Go to Step 18	Go to Step 17
17	Repair the short to ground between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–
18	Use a DVM to measure the resistance between ground and terminal 10 of the connector C202. Does the DVM show the specified value?	$\infty$	Go to Step 20	Go to Step 19
19	Repair the short to ground between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 9 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 22	Go to Step 21
21	Repair the short to voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
22	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 2 of the connector C202. Is the voltage within the specified value?	0 v	Go to Step 24	Go to Step 23

**DTC 0504 – Right Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
23	Repair the short to voltage between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
24	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to <i>Step 26</i>	Go to <i>Step 25</i>
25	Repair the short to voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
26	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 10 of the connector C202. Is the voltage within the specified value?	0 v	Go to <i>Step 28</i>	Go to <i>Step 27</i>
27	Repair the short to voltage between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
28	Replace the EBCM. Is the repair complete?	–	System OK	–



D17E304B

## DIAGNOSTIC TROUBLE CODE (DTC) 0505 RIGHT REAR WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

### 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 checks for the right rear wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

### Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

### Fail Action

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

### 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.

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

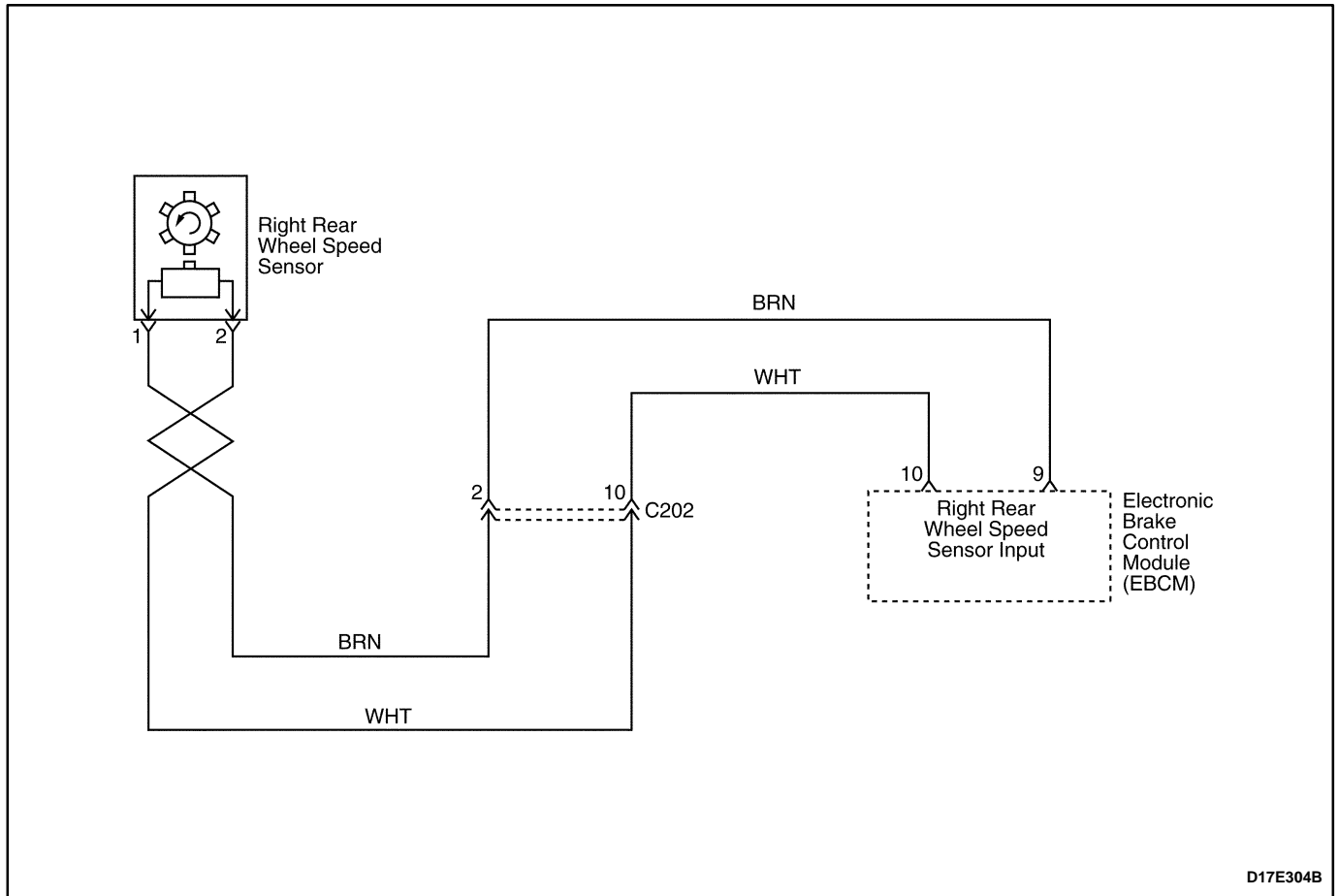
sensor. Refer to "Rear Wheel Speed Sensor" in this section.

**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 0505 – Right Rear Wheel Speed Sensor poor air Gap or Missing Tooth Ring**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. <ul style="list-style-type: none"> <li>● Wheel speed sensor is loose.</li> <li>● The air gap exceeds the required specifications.</li> <li>● The speed ring is missing or damaged.</li> </ul> 3. Repair or replace the damaged. Is the repair complete?	-	System OK	Go to <i>Step 2</i>
2	Replace the EBCM. Is the repair complete?	-	System OK	-



## DIAGNOSTIC TROUBLE CODE (DTC) 0506 RIGHT REAR WHEEL SPEED SENSOR CIRCUIT INTERMITTENT SHORTED

### 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 intermittent the right rear wheel speed sensor circuit.

### Cause(s)

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

### Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

### 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.

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.

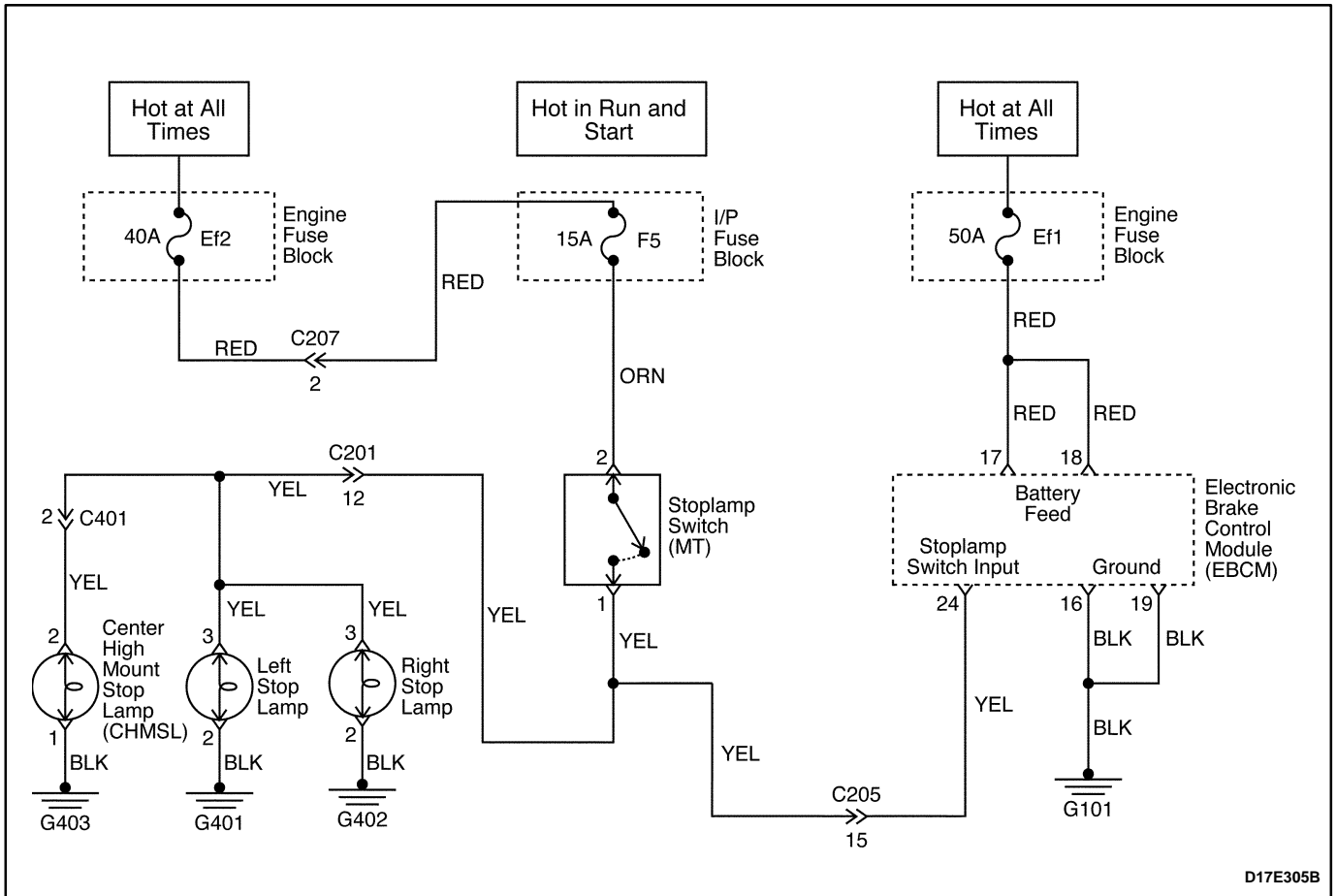
**DTC 0506 – Right Rear Wheel Speed Sensor Circuit Intermittent Shorted**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 9 and 10 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 2
2	1. Disconnect the harness from the right rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 9 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 6	Go to Step 5
5	Repair the short to ground between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 2 of the connector C202. Does the DVM show the specified value?	∞	Go to Step 8	Go to Step 7
7	Repair the short to ground between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between ground and terminal 10 of the EBCM connector. Does the DVM show the specified value?	∞	Go to Step 10	Go to Step 9
9	Repair the short to ground between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 10 of the connector C202. Does the DVM show the specified value?	∞	Go to Step 12	Go to Step 11

**DTC 0506 – Right Rear Wheel Speed Sensor Circuit Intermittent Shorted (Cont'd)**

Step	Action	Value(s)	Yes	No
11	Repair the short to ground between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 9 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 14	Go to Step 13
13	Repair the short to voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
14	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 2 of the connector C202. Is the voltage within the specified value?	0 v	Go to Step 16	Go to Step 15
15	Repair the short to voltage between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to Step 18	Go to Step 17
17	Repair the short to voltage between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–
18	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 10 of the connector C202. Is the voltage within the specified value?	0 v	Go to Step 20	Go to Step 19
19	Repair the short to voltage between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	Replace the EBCM. Is the repair complete?	–	System OK	–

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D17E305B

## DIAGNOSTIC TROUBLE CODE (DTC) 0601 LEFT FRONT DUMP SHORTED OR DRIVER OPEN

### Circuit Description

EBCM proceeds the self-test about the dump valve or the motor driver, if the EBCM senses the brake signal.

### Diagnosis

If the EBCM proceeds the self-test about the dump valve or the motor driver and senses the fault, the EBCM may make the fault code.

### Cause(s)

- EBCM internal fault (Left front dump voltage shorted or ground open).

### Warning Lamp Operation

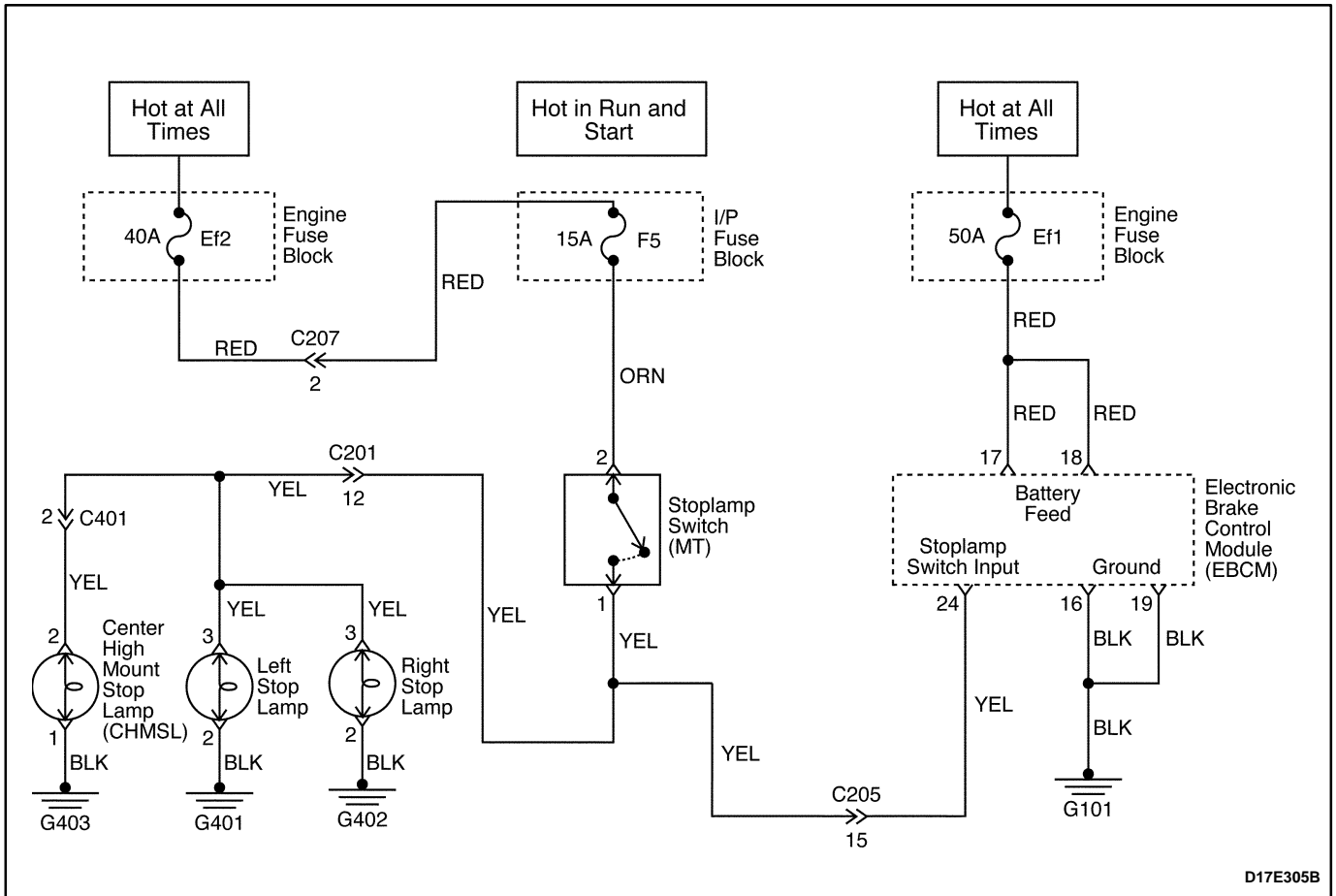
- ABS warning lamp ON.
- ABS warning lamp OFF if the ignition switch ON/OFF.

### Fail Action

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

**DTC 0601 – Left Front Dump Shorted or Drive Open**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	1. Turn the ignition switch to OFF. 2. Remove the fuse Ef1 in the engine fuse block. 3. Check for an open in fuse Ef1. Is the fuse open?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
2	Replace the fuse Ef1. Is the repair complete?	–	System OK	–
3	1. Disconnect the EBCM harness connector. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal 18 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	Repair the short to voltage between terminal 18 of the EBCM connector and engine fuse block Ef1 output. Is the repair complete?	–	System OK	–
5	Use a DVM to measure the voltage between terminal 18 and terminal 19 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	Repair the open between terminal 19 of the EBCM connector and ground G101. Is the repair complete?	–	System OK	–
7	Replace the EBCM. Is the repair complete?	–	System OK	–



D17E305B

## DIAGNOSTIC TROUBLE CODE (DTC) 0602 LEFT FRONT DUMP OPEN OR DRIVER SHORTED

### Circuit Description

EBCM proceeds the self-test about the dump valve or the motor driver, if the EBCM senses the brake signal.

### Diagnosis

If the EBCM proceeds the self-test about the dump valve or the motor driver and senses the fault, the EBCM may make the fault code.

### Cause(s)

- EBCM internal fault (Left front dump voltage open or ground shorted).

### Warning Lamp Operation

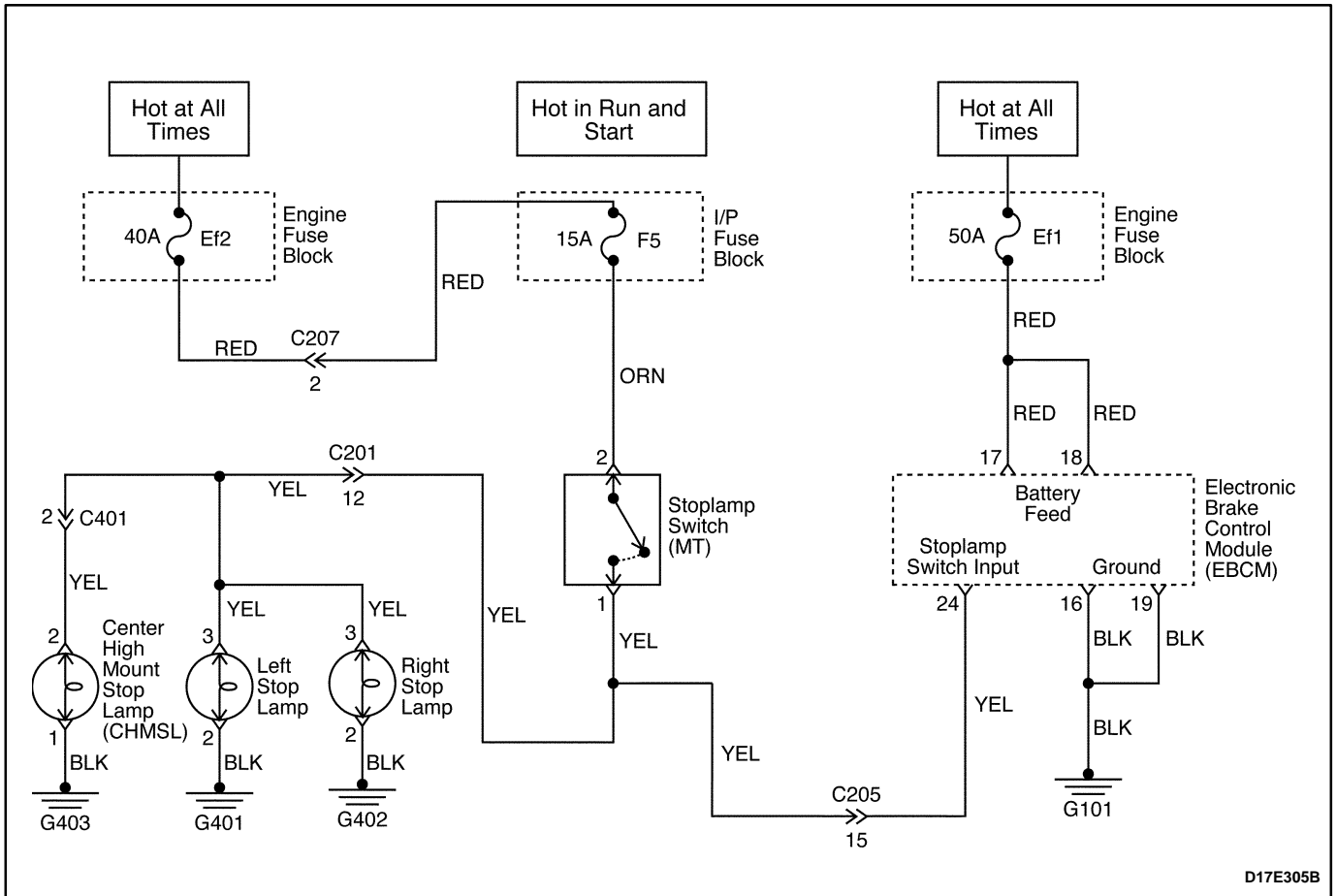
- ABS warning lamp ON.
- ABS warning lamp OFF if the ignition switch ON/OFF.

### Fail Action

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

**DTC 0602 – Left Front Dump Open or Driver Shorted**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Remove the fuse Ef1 in the engine fuse block. 3. Check for an open in fuse Ef1. Is the fuse open?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
2	Replace the fuse Ef1. Is the repair complete?	–	System OK	–
3	1. Disconnect the EBCM harness connector. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal 18 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	Repair the short to voltage between terminal 18 of the EBCM connector and engine fuse block Ef1 output. Is the repair complete?	–	System OK	–
5	Use a DVM to measure the voltage between terminal 18 and terminal 19 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	Repair the open between terminal 19 of the EBCM connector and ground G101. Is the repair complete?	–	System OK	–
7	Replace the EBCM. Is the repair complete?	–	System OK	–



D17E305B

## DIAGNOSTIC TROUBLE CODE (DTC) 0651 LEFT FRONT ISOLATION SHORTED OR DRIVER OPEN

### Circuit Description

EBCM proceeds the self-test about the dump valve or the motor driver, if the EBCM senses the brake signal.

### Diagnosis

If the EBCM proceeds the self-test about the dump valve or the motor driver and senses the fault, the EBCM may make the fault code.

### Cause(s)

- EBCM internal fault (Left front isolation voltage shorted or ground open).

### Warning Lamp Operation

- ABS warning lamp ON.
- ABS warning lamp OFF if the ignition switch ON/OFF.

### Fail Action

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



**DTC 0651 – Left Front Isolation Shorted or Driver Open**

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Remove the fuse Ef1 in the engine fuse block. 3. Check for an open in fuse Ef1. Is the fuse open?	–	Go to <i>Step 3</i>	Go to <i>Step 2</i>
2	Replace the fuse Ef1. Is the repair complete?	–	System OK	–
3	1. Disconnect the EBCM harness connector. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal 18 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	Repair the short to voltage between terminal 18 of the EBCM connector and engine fuse block Ef1 output. Is the repair complete?	–	System OK	–
5	Use a DVM to measure the voltage between terminal 18 and terminal 19 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	Repair the open between terminal 19 of the EBCM connector and ground G101. Is the repair complete?	–	System OK	–
7	Replace the EBCM. Is the repair complete?	–	System OK	–