SECTION 4E

ABS SYSTEM AND TRACTION CONTROL SYSTEM

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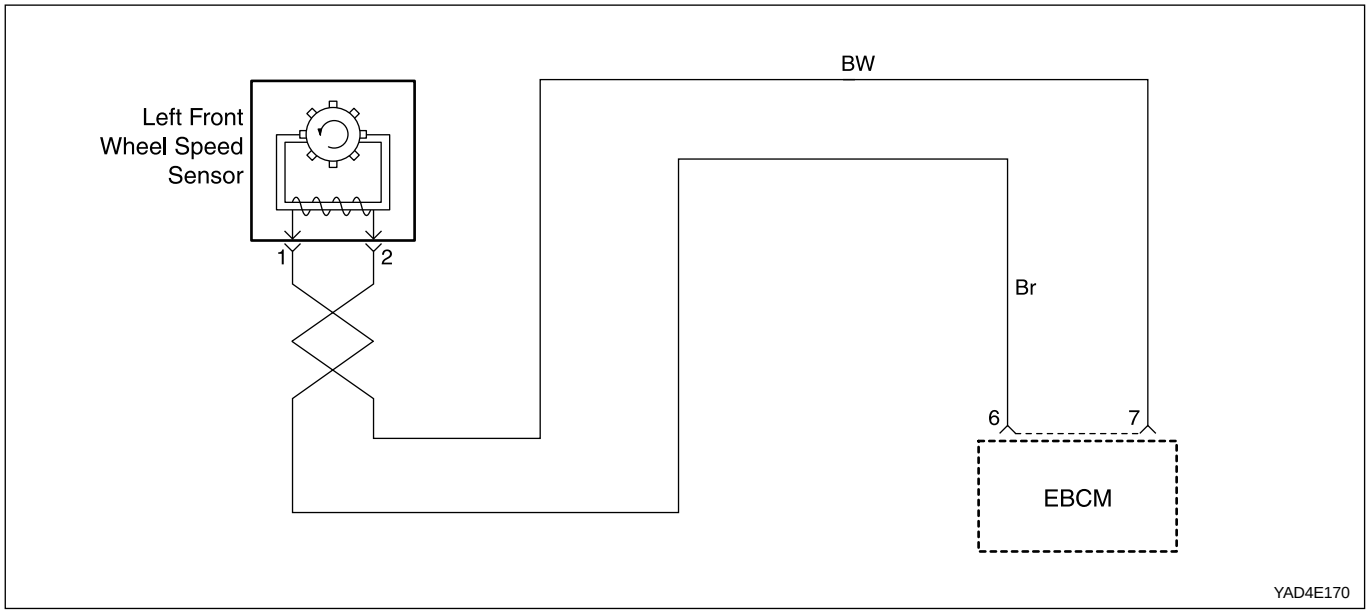


DIAGNOSTIC TROUBLE CODE (DTC) 035 LEFT FRONT WHEEL SPEED SENSOR FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

Diagnostic Aids

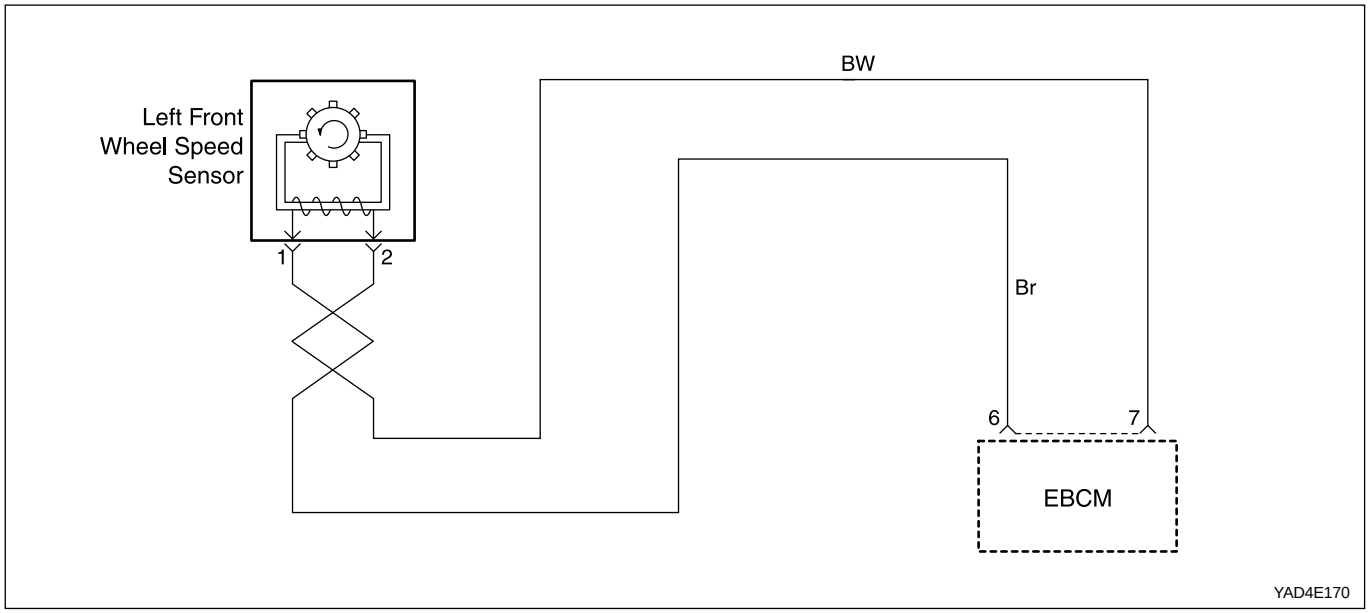
Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

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

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

DTC 035 - Left Front Wheel Speed Sensor Fault

Step	Action	Value	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Disconnect the left front wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure resistance between the sensor terminals. Is the resistance within the specified value at approximately 25 °C (77 °F)?	1280 - 1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the AC mV. 2. Measure the voltage output between the wheel speed sensor terminals while rotating the wheel about 1 revolution per second. Is the output within the specified value?	≈ 70 mV	Go to Step 10	Go to Step 9
5	Replace the speed sensor or the toothed wheel, as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to LOCK. 2. Measure the resistance to ground from terminal 6 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 7 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 7 at the harness EBCM connector and the harness wheel speed sensor connector. 2. Measure the resistance between terminal 6 at the harness EBCM connector and the harness wheel speed sensor connector. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or the high resistance in the affected circuit, as required. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 07 - LEFT FRONT WHEEL SPEED SENSOR CONTINUITY FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

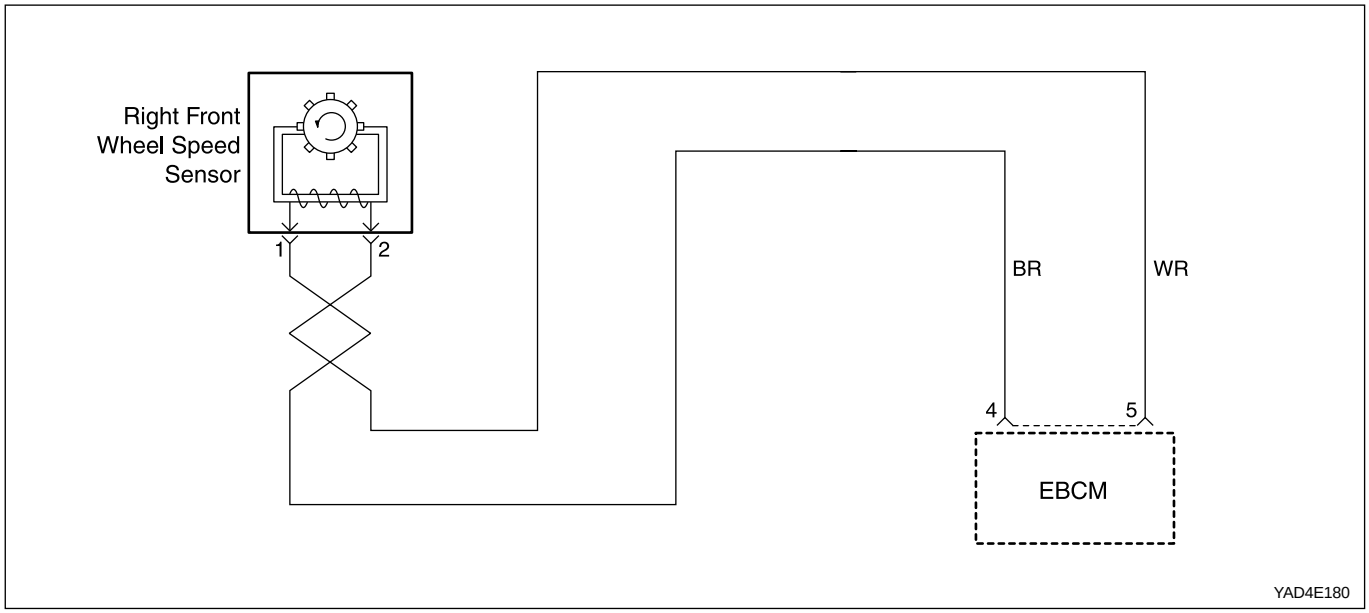
Diagnostic Aids

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

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

DTC 07 - Left Front Wheel Speed Sensor Continuity Fault

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



DIAGNOSTIC TROUBLE CODE (DTC) 040 - RIGHT FRONT WHEEL SPEED SENSOR FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

Diagnostic Aids

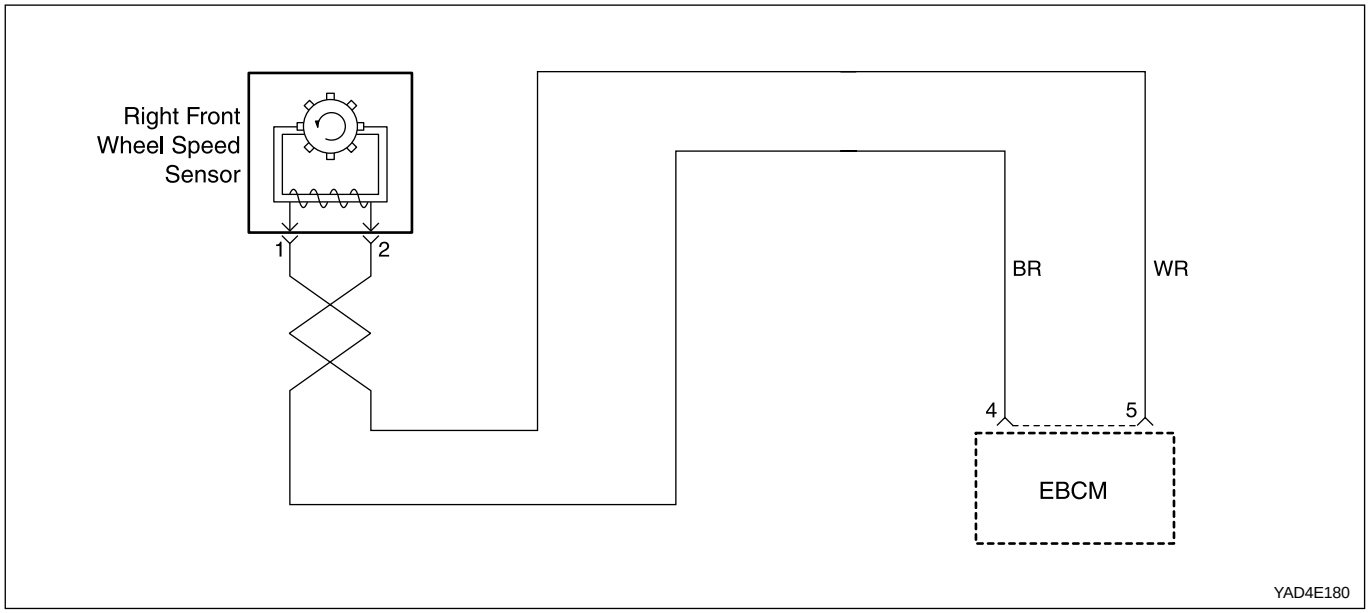
Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

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

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

DTC 040 - Right Front Wheel Speed Sensor Fault

Step	Action	Value	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Disconnect the right front wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25 °C (77 °F)?	1280 - 1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the AC mV. 2. Measure the voltage output between the wheel speed sensor terminals while rotating the wheel about 1 revolution per second. Is the output within the specified value?	≈ 70 mV	Go to Step 6	Go to Step 5
5	Replace the speed sensor or the toothed wheel, as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to LOCK. 2. Measure the resistance to ground from terminal 4 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 5 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	Go to Step 9	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 4 at the harness EBCM connector and the harness wheel speed sensor connector. 2. Measure the resistance between terminal 5 at the harness EBCM connector and the harness wheel speed sensor connector. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or high resistance in the affected circuit, as required. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 08 - RIGHT FRONT WHEEL SPEED SENSOR CONTINUITY FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

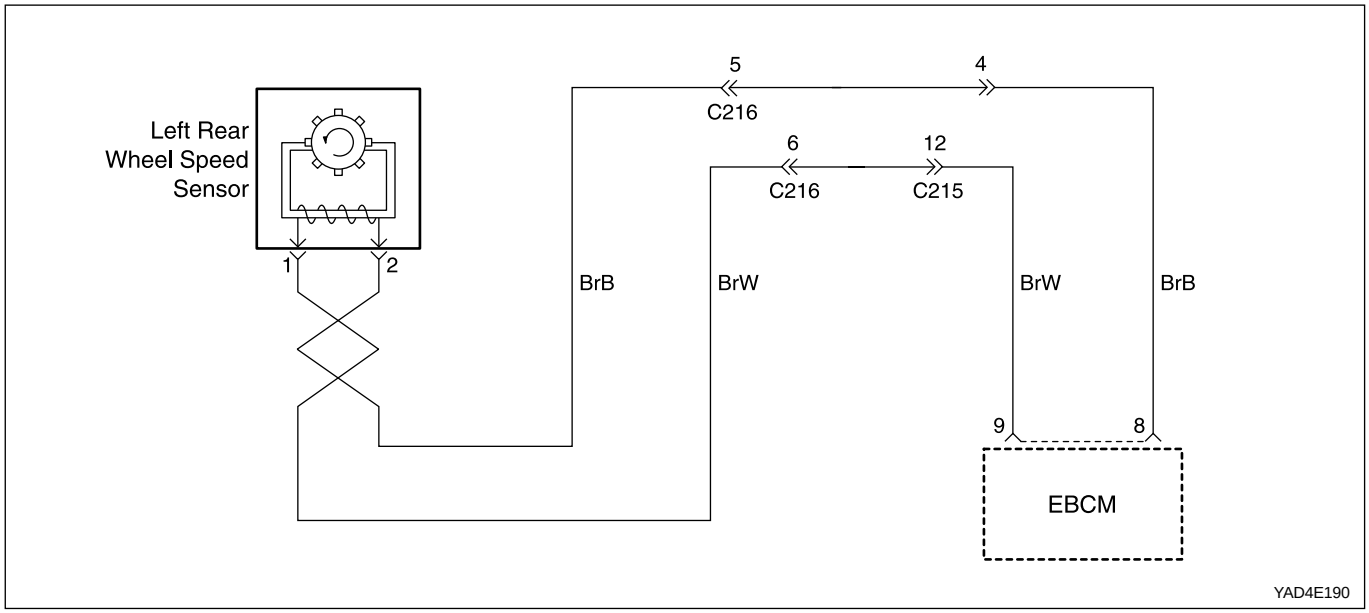
Diagnostic Aids

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

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

DTC 08 - Right Front Wheel Speed Sensor Continuity Fault

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



DIAGNOSTIC TROUBLE CODE (DTC) 045 - LEFT REAR WHEEL SPEED SENSOR FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

Diagnostic Aids

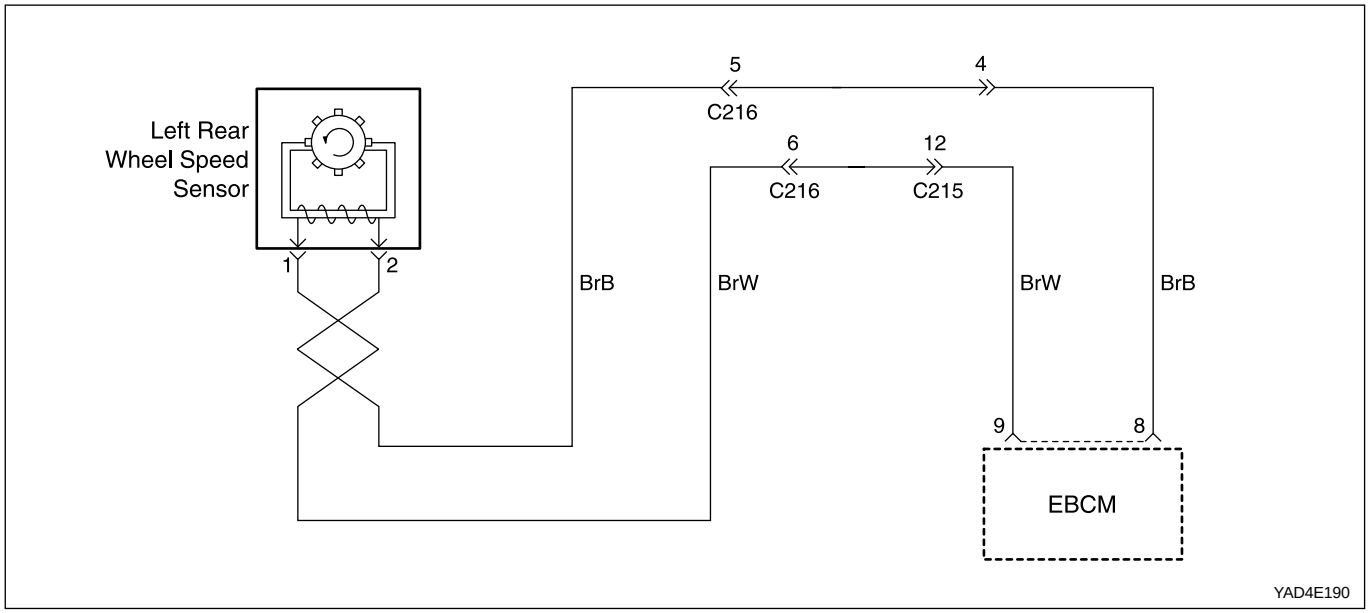
Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

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

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

DTC 045 - Left Rear Wheel Speed Sensor Fault

Step	Action	Value	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Disconnect the left rear wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25 °C (77 °F)?	1280 - 1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the AC mV. 2. Measure the voltage output between the wheel speed sensor terminals while rotating the wheel about 1 revolution per second. Is the output within the specified value?	≈ 70 mV	Go to Step 6	Go to Step 5
5	Replace the speed sensor or the toothed wheel, as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to LOCK. 2. Measure the resistance to ground from terminal 8 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 9 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 8 at the harness EBCM connector and the harness wheel speed sensor connector. 2. Measure the resistance between terminal 9 at the harness EBCM connector and the harness wheel speed sensor connector. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or high resistance in the affected circuit, as required. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



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

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

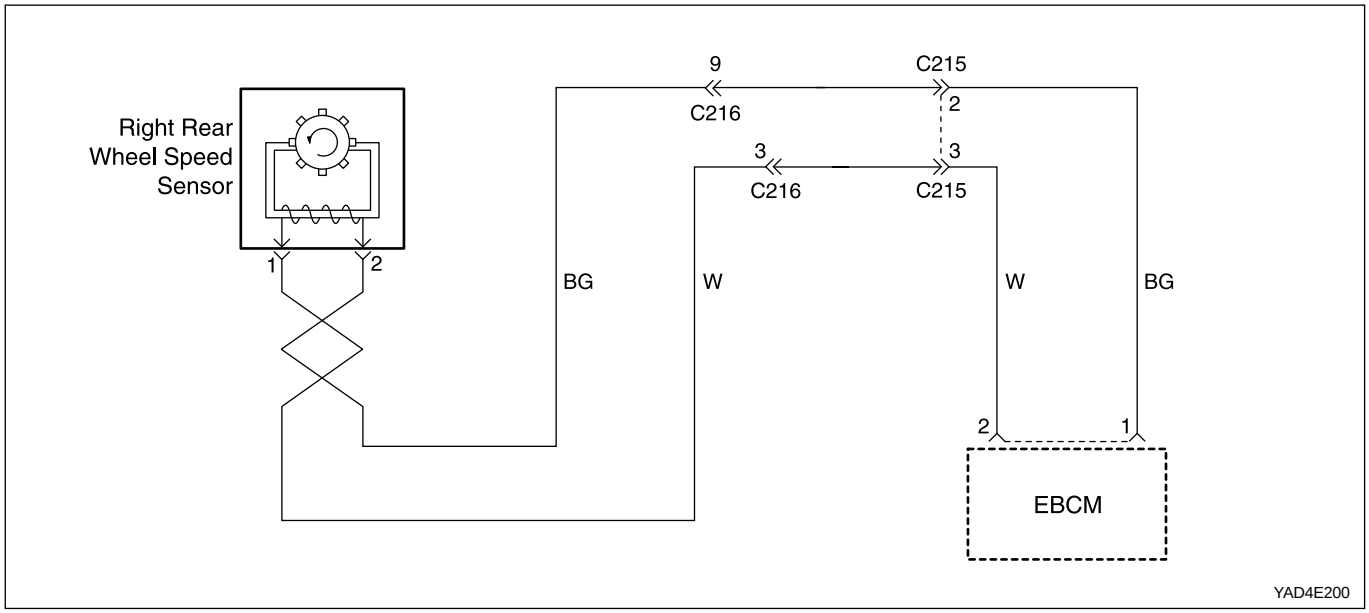
Diagnostic Aids

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

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

DTC Right Front Wheel Speed Sensor Continuity Fault

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



DIAGNOSTIC TROUBLE CODE (DTC) 050 - RIGHT REAR WHEEL SPEED SENSOR FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

Diagnostic Aids

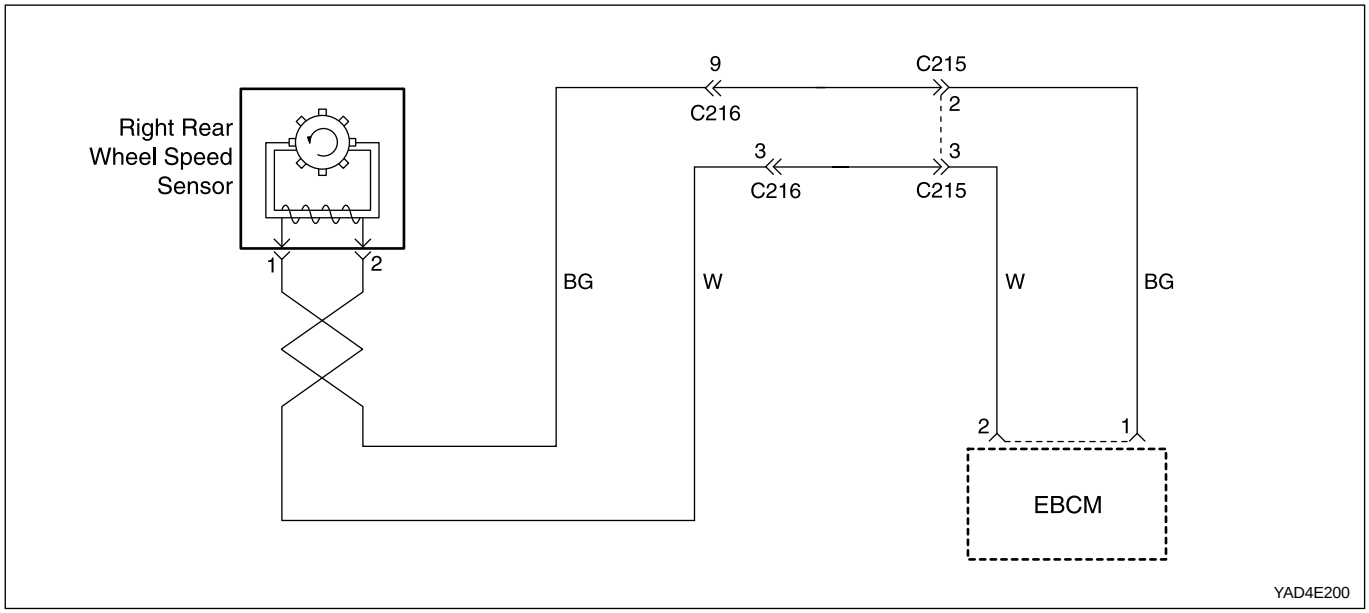
Be sure that the speed sensor wiring is properly routed and retained. This will help to prevent false signals due to the pickup of electrical noise.

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

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

DTC 050 - Right Rear Wheel Speed Sensor Fault

Step	Action	Value	Yes	No
1	Examine the wheel speed sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Disconnect the right rear wheel speed sensor connector. 3. Use a digital voltmeter (DVM) to measure the resistance between the sensor terminals. Is the resistance within the specified value at approximately 25 °C (77 °F)?	1280 - 1920 Ω	Go to Step 4	Go to Step 3
3	Replace the wheel speed sensor. Is the repair complete?	-	System OK	-
4	1. Switch the DVM to the AC mV. 2. Measure the voltage output between the wheel speed sensor terminals while rotating the wheel about 1 revolution per second. Is the output within the specified value?	≈ 70 mV	Go to Step 6	Go to Step 5
5	Replace the speed sensor or the toothed wheel, as required. Is the repair complete?	-	System OK	-
6	1. Disconnect the harness from the EBCM. 2. Connect a DVM between ground and one terminal of the wheel speed connector. 3. Turn the ignition to ON. 4. Repeat the above test for the other terminal of the wheel speed connector. Is the voltage for either of these terminals within the specified value?	> 1 V	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the affected circuit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to LOCK. 2. Measure the resistance to ground from terminal 1 at the harness EBCM connector. 3. Measure the resistance to ground from terminal 2 at the harness EBCM connector. Is the resistance at either circuit less than the specified value?	∞	Go to Step 9	Go to Step 10
9	Repair the short to ground in the affected circuit. Is the repair complete?	-	System OK	-
10	1. Measure the resistance between terminal 1 at the harness EBCM connector and the harness wheel speed sensor connector. 2. Measure the resistance between terminal 2 at the harness EBCM connector and the harness wheel speed sensor connector. Is the resistance on either circuit within the specified value?	> 5 Ω	Go to Step 11	Go to Step 12
11	Repair the open or high resistance in the affected circuit, as required. Is the repair complete?	-	System OK	-
12	Replace the ABS unit. Is the repair complete?	-	System OK	-



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

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

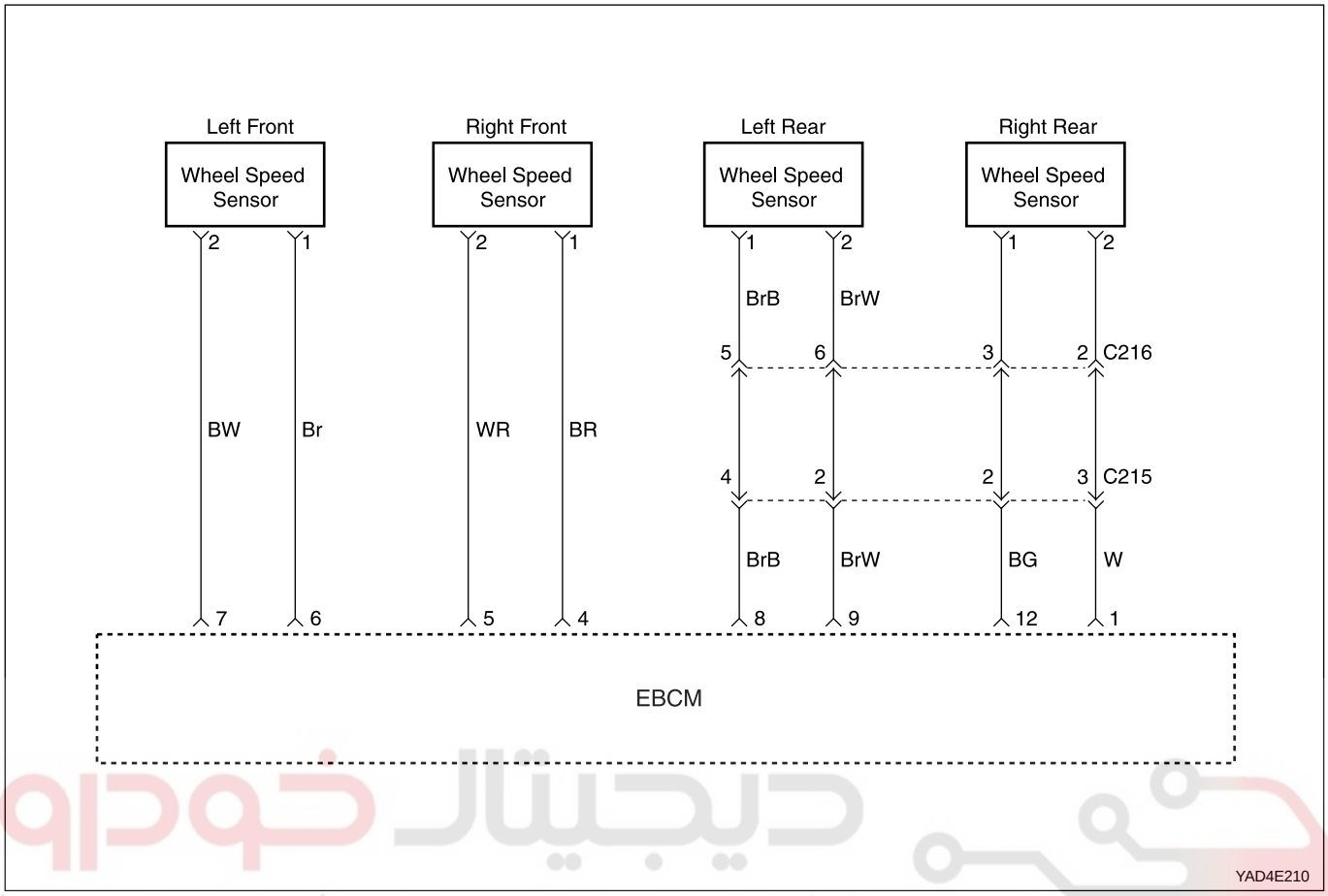
Diagnostic Aids

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

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

Right Rear Wheel Speed Sensor Continuity Fault

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



DIAGNOSTIC TROUBLE COED (DTC) 245 - WHEEL SPEED SENSOR FREQUENCY ERROR

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

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

Diagnostic Aids

DTC 11 may be set by running the scan tool auto test if the throttle angle readings are not updating while in the date list mode. If this is the case, clear the DTCs, disconnect the scan tool, and road test the vehicle to at least 25 km/h (15 mph) to see if the DTC resets.

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

A badly worn hub/bearing assembly may cause this malfunction. The wheel speed sensor-to-toothed wheel air gap may change excessively due to bearing play.

If an improper rear hub assembly or front outer constant velocity joint is installed, one with a toothed wheel containing the incorrect number of teeth, this DTC can set. Be sure that all the toothed wheels have 52 teeth.

DTC 245 - Wheel Speed Sensro Frequency Error

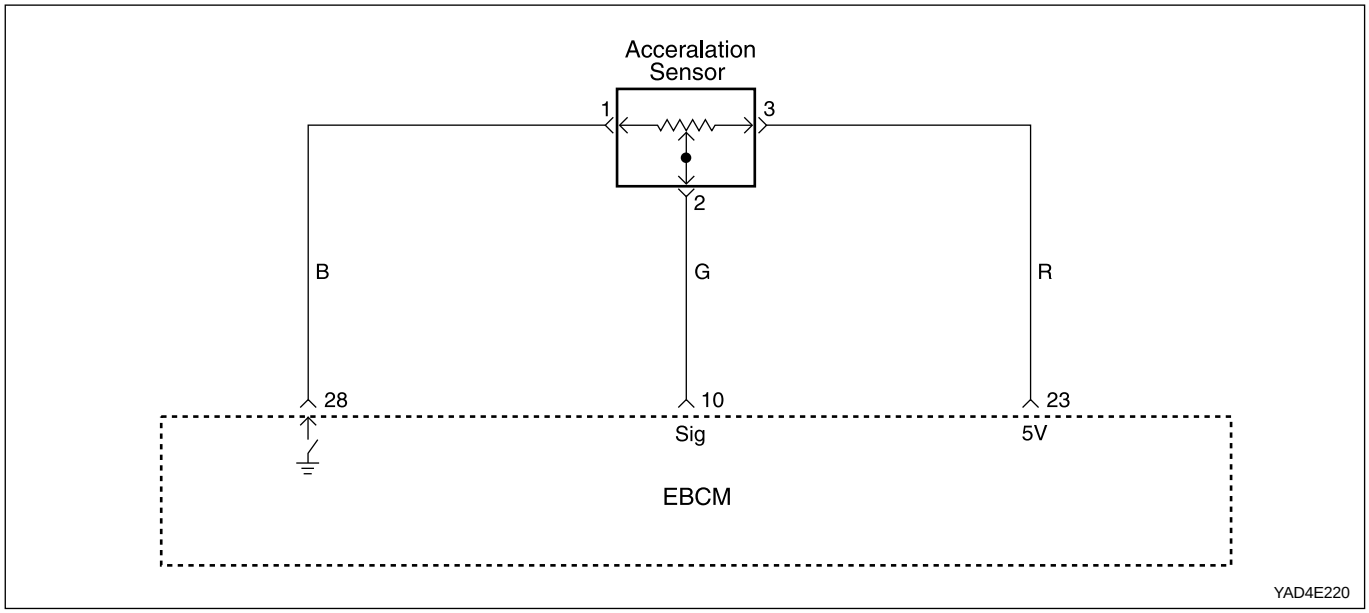
Step	Action	Value	Yes	No
1	Visually inspect the wiring for the front wheel speed sensors. Is there any damage?	-	Go to Step 2	Go to Step 3
2	Repair or replace components, as required. Is the repair complete?	-	System OK	-
3	Check that the correct outer constant velocity (CV) joints are installed on the vehicle, They should have speed rings with 52 teeth. Is one of these incorrect?	-	Go to Step 4	Go to Step 5
4	Replace the incorrect outer CV joint with the proper unit. Is the repair complete?	-	System OK	-
5	1. Disconnect the wheel speed sensor harnesses from the wheel speed sensor connectors. 2. Measure the wheel speed sensor resistance at the wheel speed sensor connector terminals. Does the resistance fall within the specified values for both wheel speed sensors?	1280 - 1920 Ω	Go to Step 7	Go to Step 6
6	Replace the faulty wheel speed sensor. Is the repair complete?	-	System OK	-
7	1. Disconnect the ABS control module connector. 2. Check each wheel speed sensor harness for a short circuit between its wires with a digital ohmmeter attached to the two terminals at the harness side of the wheel speed sensor connector. 3. Also check each wheel speed sensor harness wire for a short to ground from the connector terminals. Is there any short circuit in either wheel speed sensor harness?	-	Go to Step 8	Go to Step 9
8	Repair the short circuit tin the wiring or from a wiring harness to ground. Is the repair complete?	-	System OK	-
9	Check the continuity of the wiring in both front wheel speed sensor circuits between the EBCM connector and the wheel speed sensor connector an each side of the vehicle. • The left side uses terminals 7 and 6 at the EBCM connector. • The right side uses terminals 4 and 5 at the EBCM connector. Is continuity good for both harnesses?	-	Go to Step 11	Go to Step 10

DTC 245 - Wheel Speed Sensro Frequency Error (Cont'd)

Step	Action	Value	Yes	No
10	Repair the discontinuity found in the front wheel speed sensor harness or connector C110. Is the repair complete?	-	System OK	-
11	1. Visually inspect the wiring for the rear wheel speed sensors. 2. Check that the wheel speed sensors are properly mounted and that the retaining belts are properly tightened. Is there any damage?	-	System OK	Go to Step 12
12	Remove each wheel speed sensor from the rear axle and inspect the toothed ring through the wheel speed sensor mounting holes. • Make sure that the toothed ring has 52 teeth. • Check for any damaged or missing teeth. • Check that the ring is properly positioned under the wheel speed sensor. Is there any damage or other fault with either speed ring?	-	Go to Step 13	Go to Step 14
13	Replace the rear wheel hub with the proper unit. Is the repair complete?	-	System OK	-
14	1. Disconnect the rear wheel speed sensor harnesses from the wheel speed sensor connectors. 2. Measure the wheel speed sensor resistance at the wheel speed sensor connector terminals. Does the resistance fall within the specified values for both wheel speed sensors?	1280 - 1920 Ω	Go to Step 16	Go to Step 15
15	Replace the faulty wheel speed sensor. Is the repair complete?	-	System OK	-
16	1. The ABS control module connector should still be disconnected. Disconnect it now if it is not. 2. Check each wheel speed sensor harness for a short circuit between its wires with a digital ohmmeter attached to the two terminals at the harness side of the wheel speed sensor connector. 3. Also, check each wheel speed sensor harness wire for a short to ground from the connector terminals. Is there any short circuit in either wheel speed sensor harness?	-	Go to Step 17	Go to Step 18
17	Repair the short circuit in the wiring or from a wire to ground. Is the repair complete?	-	System OK	Go to Step 19
18	Check the continuity of the wiring in both rear wheel speed sensor circuits between the EBCM connector and the wheel speed sensor connector on each side of the vehicle. • The left side uses terminals 8 and 9 at the EBCM connector. • The right side uses terminals 2 and 1 at the EBCM connector. Is continuity good for both harnesses?	-	Go to Step 20	-

DTC 245 - Wheel Speed Sensro Frequency Error (Cont'd)

Step	Action	Value	Yes	No
19	Repair the discontinuity found in the rear wheel speed sensor harness. Is the repair complete?	-	System OK	-
20	Replace the ABS unit. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 930 - ACCELERATION SENSOR FAULT

Circuit Description

The acceleration sensor provides a voltage signal that changes in relation to the acceleration of vehicle. The signal voltage will vary from about 1.95 to 3.45 volt. The electronic brake control module (EBCM) monitor a signal voltage of deceleration in the vehicle.

Diagnosis

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

Cause

- The vertical acceleration sensor is defective or disconnected.
- There is a problem in the wiring.
- There is a problem with a connector
- Wrong installed vertical acceleration sensor

Fail Action

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

Test Description

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

2. This step checks for the voltage reference from the EBCM.
5. This step checks for the voltage signal from the acceleration sensor.

Diagnostic Aids

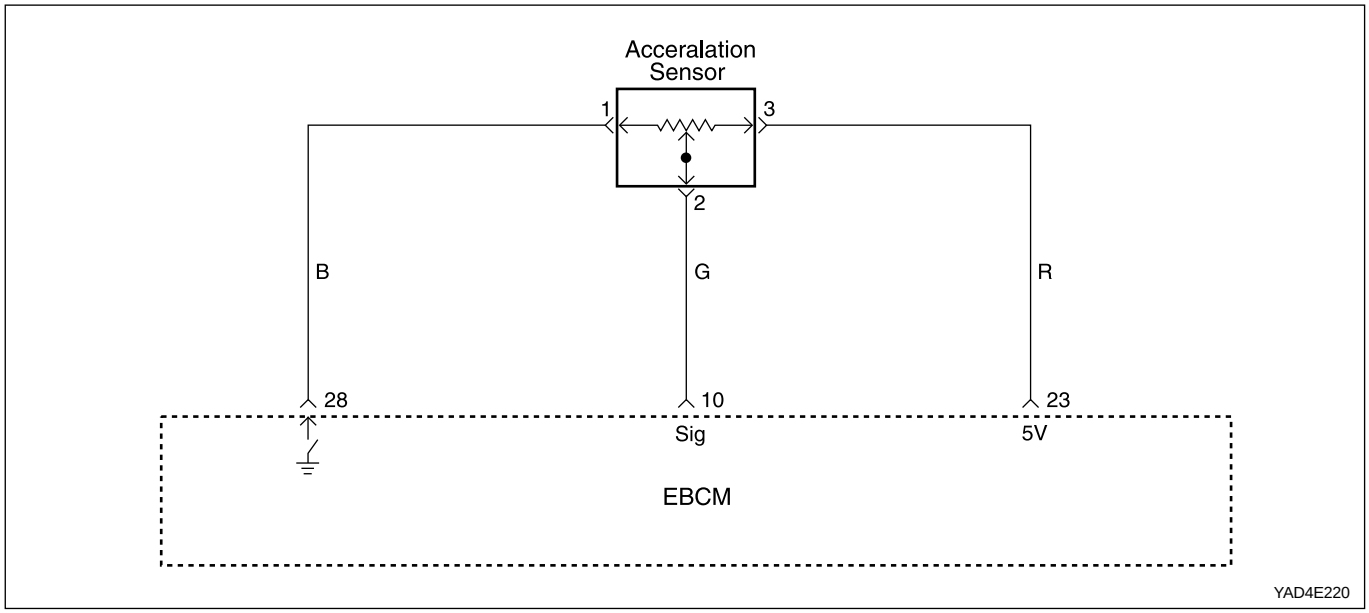
Be sure that the acceleration sensor wiring is properly routed and retained.

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

You can use the scan tool to monitor acceleration sensor during a road test. Watch the acceleration sensor being display on the scan tool to see if any of the reading is unusual.

DTC 930 - Acceleration Sensor Fault

Step	Action	Value	Yes	No
1	Examine the acceleration sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition switch to ON. 2. Use a digital voltmeter (DVM) to measure the voltage between terminal 28 and 23 of EBCM. Is the voltage within the specified value?	4.75 - 5.25 V	Go to Step 5	Go to Step 4
3	Replace the acceleration sensor. Is the repair complete?	-	System OK	-
4	Repair the open in the affected circuit or replace the acceleration sensor, if necessary. Is the repair complete?	-	System OK	-
5	1. Place the acceleration sensor horizontally and let the acceleration sensor. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between terminal 28 and 10 of EBCM. Is the voltage within the specified value?	1.95 - 3.45 V	Go to Step 7	Go to Step 6
6	Repair the open in the affected circuit or replace the acceleration sensor, if necessary. Is the repair complete?	-	System OK	-
7	Replace the ABS unit. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) - ACCELERATION SENSOR CONTINUITY FAULT

Circuit Description

The acceleration sensor provides a voltage signal that changes in relation to the acceleration of vehicle. The signal voltage will vary from about 1.95 to 3.45 volt. The electronic brake control module (EBCM) monitor a signal voltage of deceleration in the vehicle.

Diagnosis

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

Cause

- The vertical acceleration sensor is defective or disconnected.
- There is a problem in the wiring.
- There is a problem with a connector
- Wrong installed vertical acceleration sensor

Action Taken When the DTC Sets

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

Test Description

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

2. This step checks for the voltage reference from the EBCM.
5. This step checks for the voltage signal from the acceleration sensor.

Diagnostic Aids

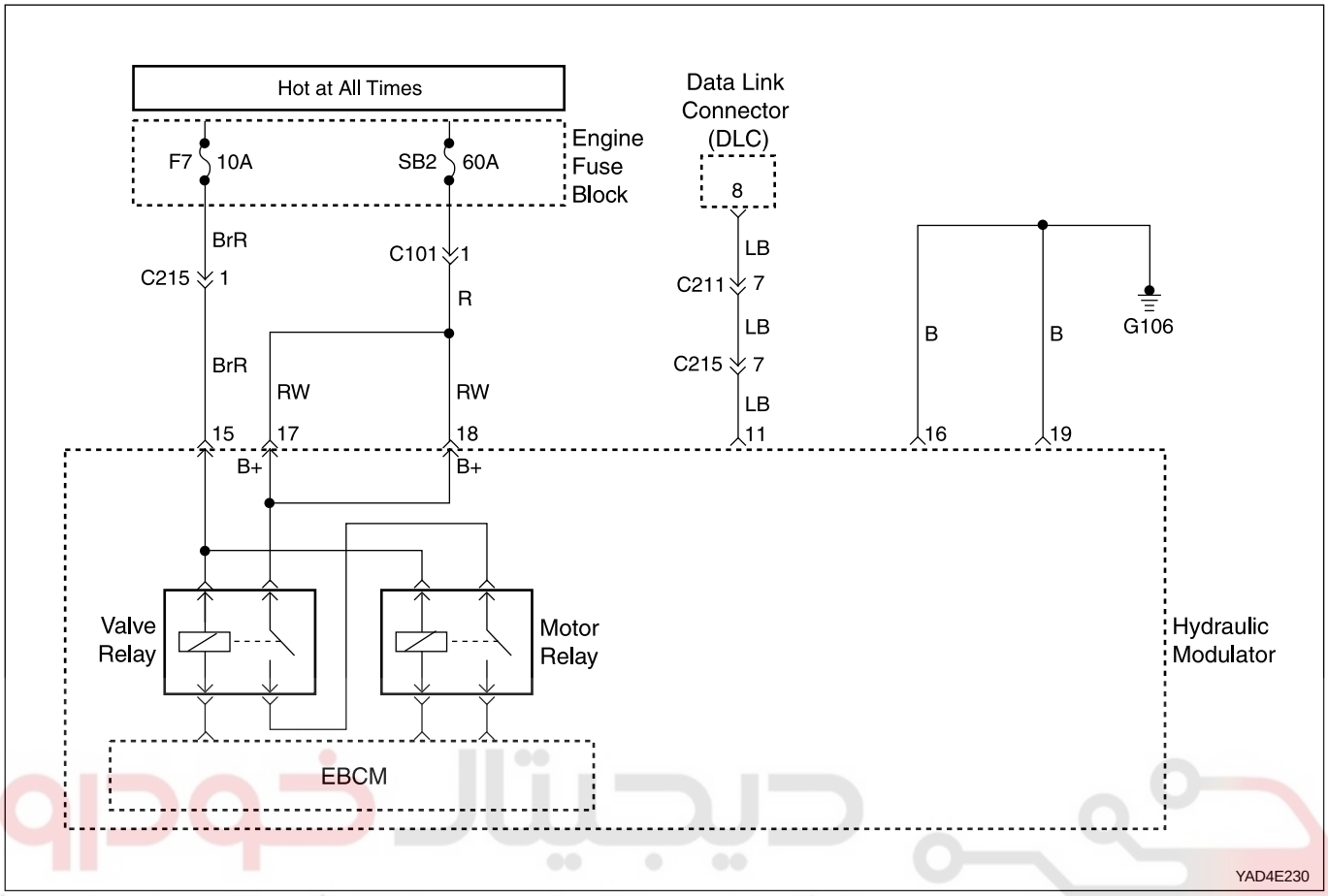
Be sure that the acceleration sensor wiring is properly routed and retained.

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

You can use the scan tool to monitor acceleration sensor during a road test. Watch the acceleration sensor being display on the scan tool to see if any of the reading is unusual.

DTC - Acceleration Sensor Continuity Fault

Step	Action	Value	Yes	No
1	Examine the acceleration sensor. Are there any signs of physical damage?	-	Go to Step 3	Go to Step 2
2	1. Turn the ignition switch to ON. 2. Use a digital voltmeter (DVM) to measure the voltage between terminal 28 and 23 of EBCM. Is the voltage within the specified value?	4.75 - 5.25 V	Go to Step 5	Go to Step 4
3	Replace the acceleration sensor. Is the repair complete?	-	System OK	-
4	Repair the open in the affected circuit or replace the acceleration sensor, if necessary. Is the repair complete?	-	System OK	-
5	1. Place the acceleration sensor horizontally and let the acceleration sensor. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between terminal 28 and 10 of EBCM. Is the voltage within the specified value?	1.95 - 3.45 V	Go to Step 7	Go to Step 6
6	Repair the open in the affected circuit or replace the acceleration sensor, if necessary. Is the repair complete?	-	System OK	-
7	Replace the ABS unit. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE COED (DTC) 060/065 - LEFT FRONT INLET AND OUTLET VALVE SOLENOID FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

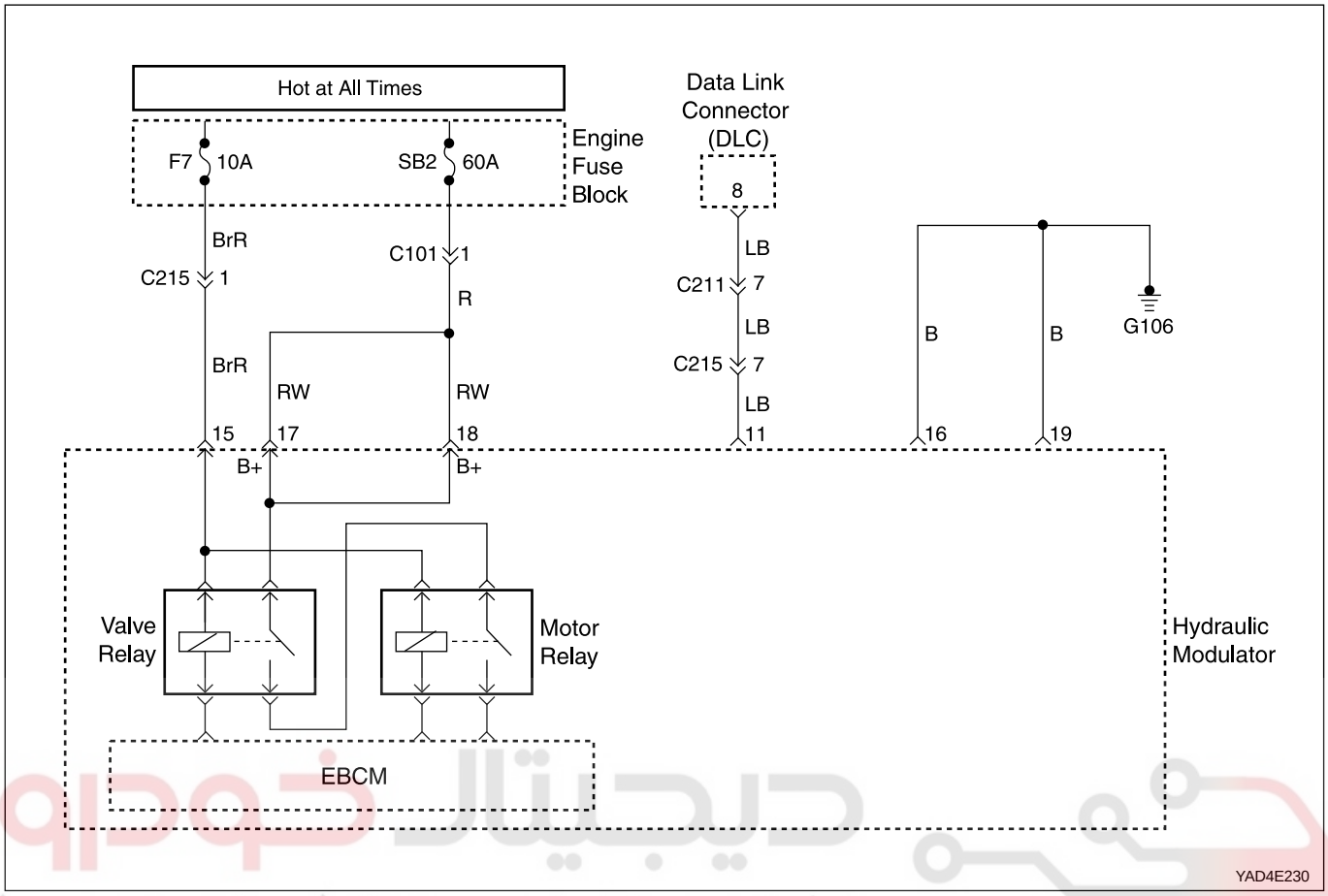
Test Description

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

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

DTC 060/065 - Left Front Inlet and Outlet Valve Solenoid Fault

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



DIAGNOSTIC TROUBLE COED (DTC) 070/075 - RIGHT FRONT INLET AND OUTLET VALVE SOLENOID FAULT

Circuit Description

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

Diagnosis

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

Cause

- A solenoid coil is open or shorted.

Action Taken When the DTC Sets

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

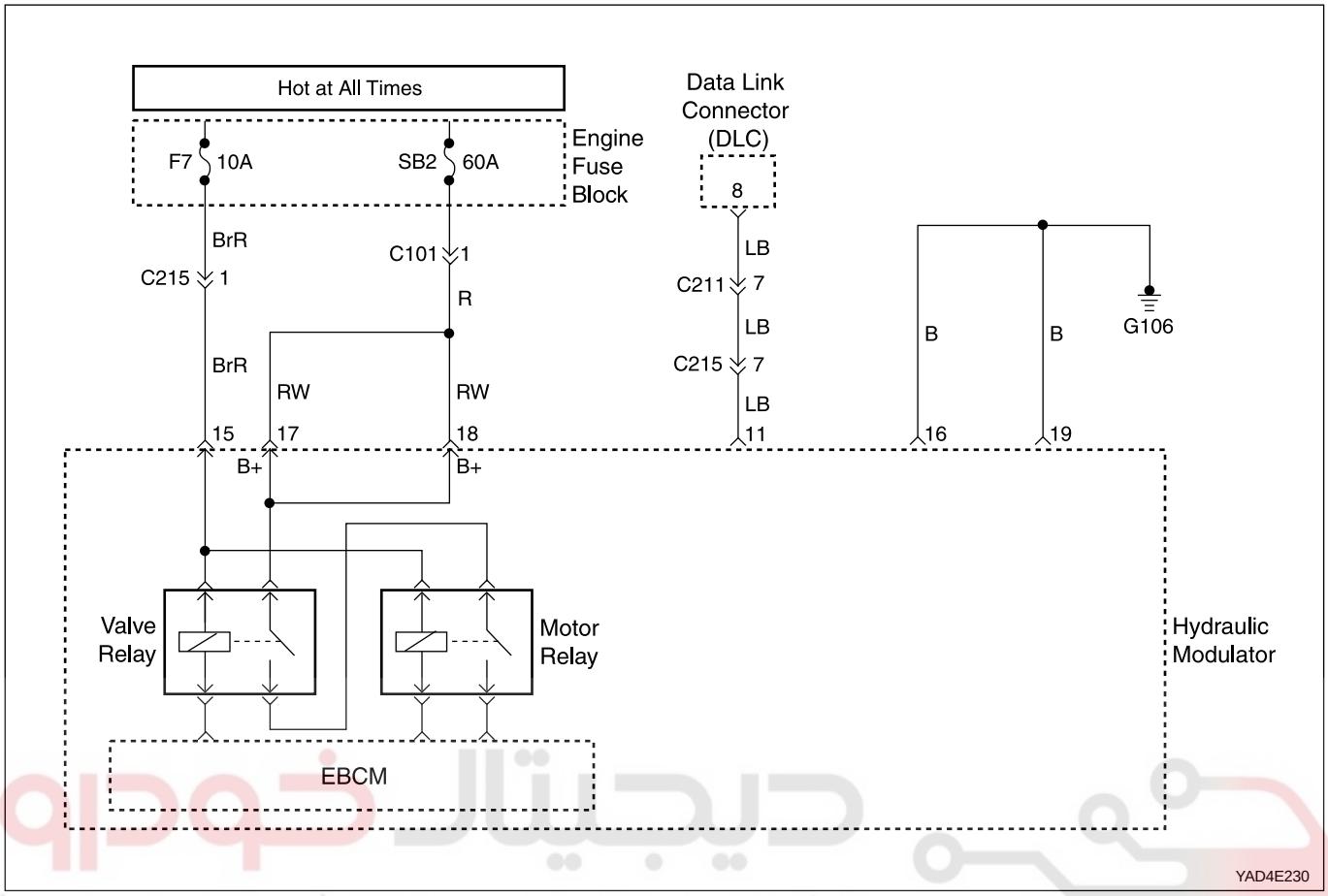
Test Description

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

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

DTC 070/075 - Right Front Inlet and Outlet Valve Solenoid Fault

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



DIAGNOSTIC TROUBLE COED (DTC) 080/085 - LEFT REAR INLET AND OUTLET VALVE SOLENOID FAULT

Circuit Description

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

Diagnosis

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

Cause(s)

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

Action Taken When the DTC Sets

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

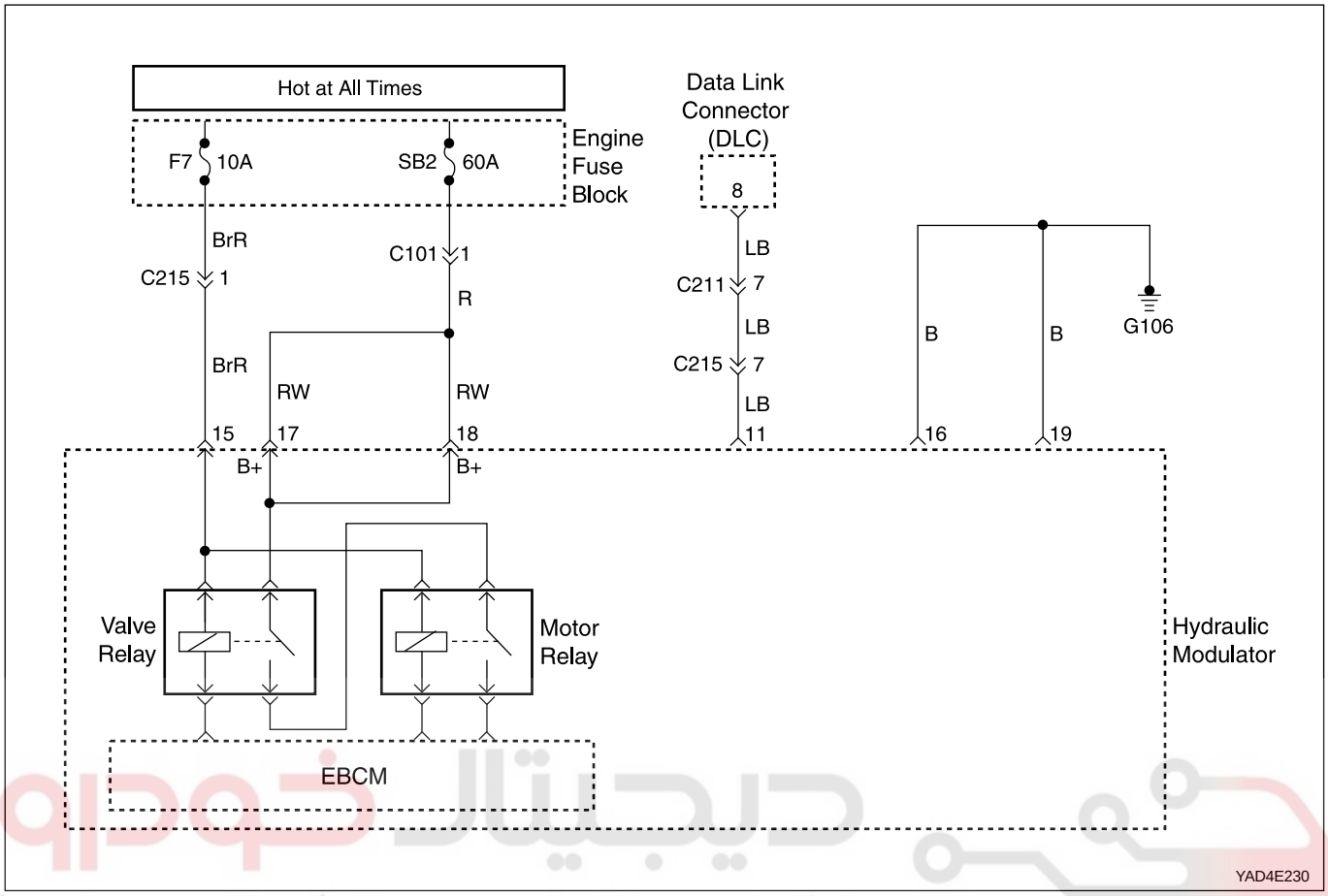
Test Description

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

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

DTC 080/085 - Left Rear Inlet and Outlet Valve Solenoid Fault

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



DIAGNOSTIC TROUBLE COED (DTC) 090/095 - RIGHT REAR INLET AND OUTLET VALVE SOLENOID FAULT

Circuit Description

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

Diagnosis

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

Cause(s)

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

Action Taken When the DTC Sets

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

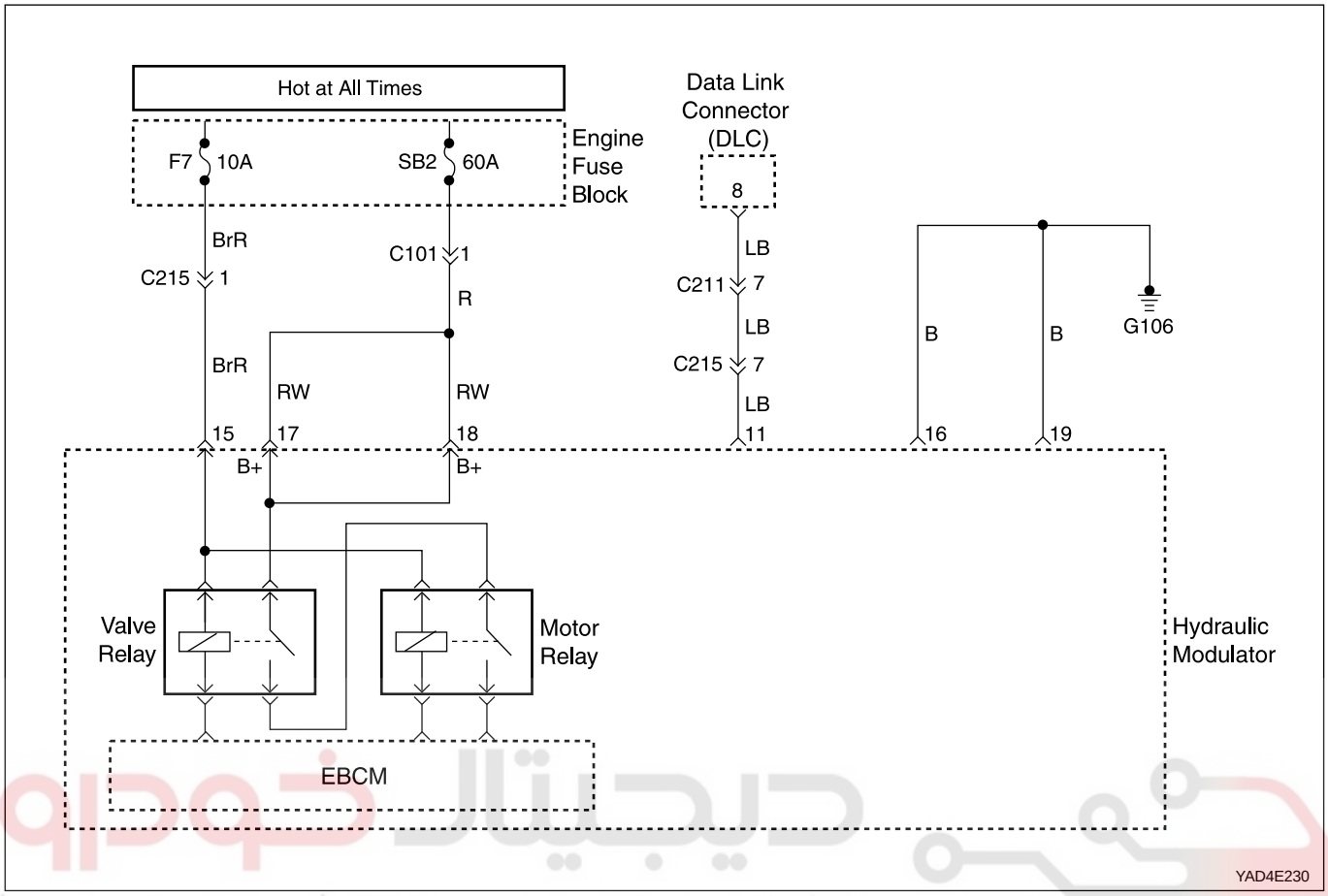
Test Description

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

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

DTC 090/095 – Right Rear Inlet and Outlet Valve Solenoid Fault

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



DIAGNOSTIC TROUBLE COED (DTC) 141/146 - LEFT REAR PRIME LINE AND TRACTION CONTROL SYSTEM (TCS) PILOT VALVE FAULT

Circuit Description

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

Diagnosis

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

Cause(s)

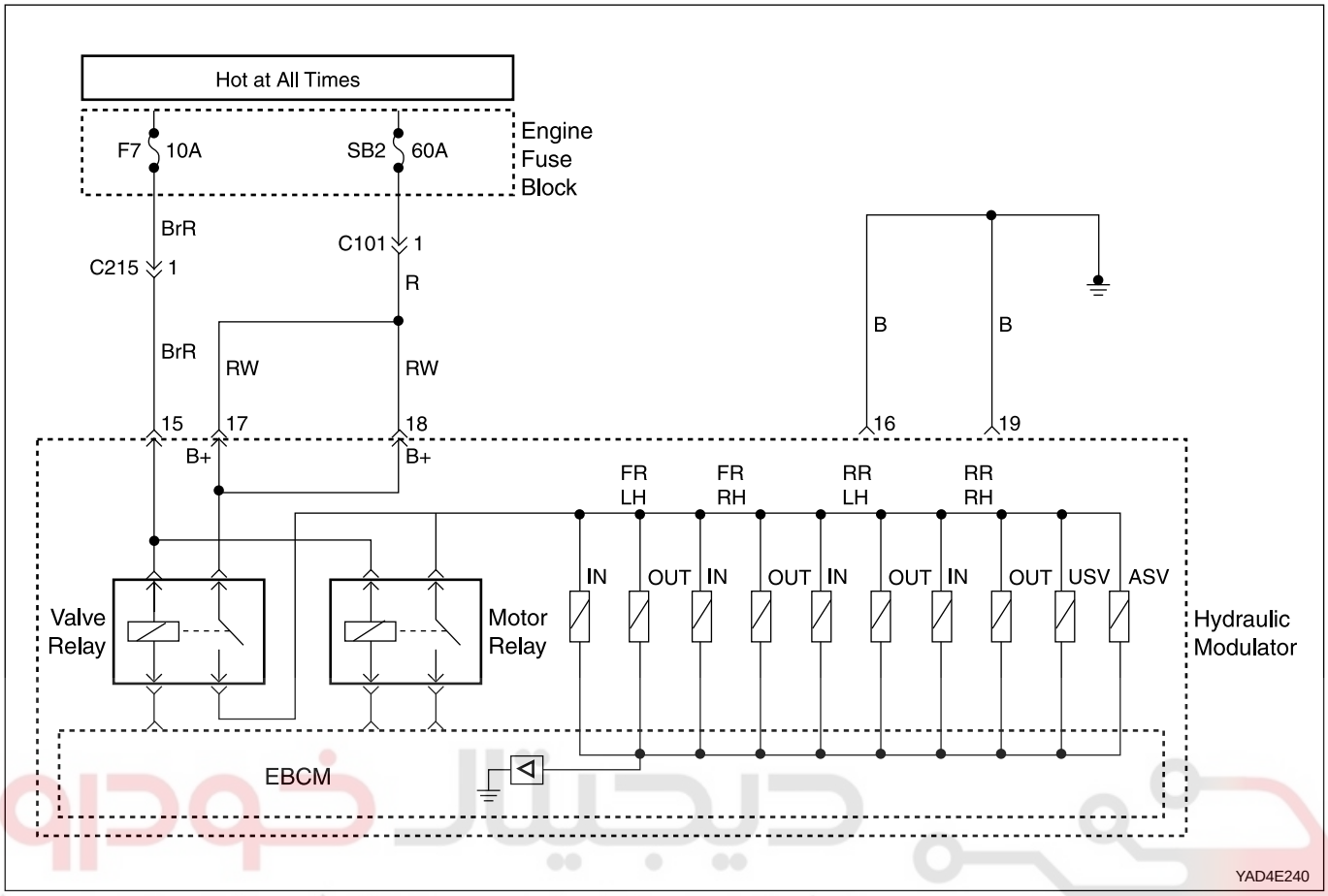
- A solenoid coil is open or shorted.

Action Taken When the DTC Sets

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

DTC 141/146 - Left Rear Prime Line and TCS Pilot Valve Fault

Step	Action	Value	Yes	No
1	1. Raise and suitably support the vehicle at the corner being tested. 2. Turn the ignition to ON. **Important:** Do not step on the brake pedal at any time during this test. 3. Install the scan tool to the data link connector (DLC). 4. Select the TCS function and “Wheel rear left” to begin the solenoid tests at that wheel. This will test both the prime and pilot valves. 5. When the scan tool indicates a pressure increase, attempt to rotate the wheel. Can the wheel be rotated?	-	Go to Step 6	Go to Step 2
2	When the scan tool indicates that the prime valve was turned OFF, attempt to rotate the wheel again. Can the wheel be rotated now?	-	Go to Step 6	Go to Step 3
3	When the scan tool indicates that the pilot valve and the pump motor were switched OFF, attempt to rotate the wheel again. Can the wheel be rotated?	-	Go to Step 4	Go to Step 6
4	1. Clear all DTCs. 2. Road test the vehicle. Does the DTC set again?	-	Go to Step 6	Go to Step 5
5	1. Check the wiring harness and connector terminals for an intermittent problem. 2. Repair any problem found. Is the repair complete?	-	System OK	-
6	Replace the ABS unit. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 121 - VALVE RELAY CIRCUIT FAULT

Circuit Description

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

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

Diagnosis

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

Cause(s)

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

Action Taken When the DTC Sets

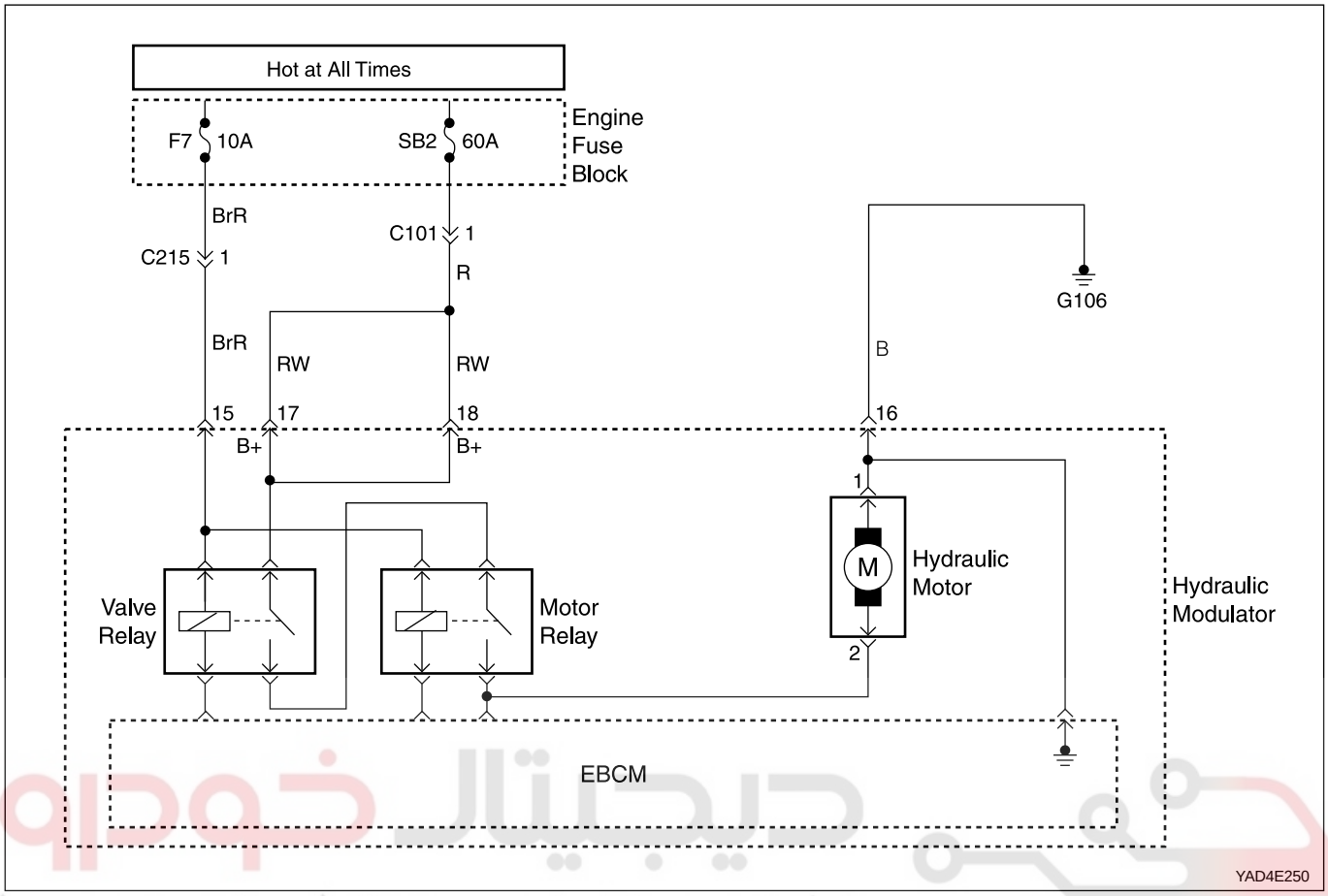
ABS/TCS is disabled, and the ABS warning lamp is turned ON for the remainder of the ignition cycle. If the failure is intermittent, the control module will enable the system at the next ignition cycle and set a history DTC 12.

Diagnostic Aids

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

DTC 121 - Valve Relay Circuit Fault

Step	Action	Value	Yes	No
1	1. Use a scan tool to clear all DTCs. 2. Road test the vehicle. Does DTC 121 set again?	-	Go to Step 3	Go to Step 2
2	1. Check all system wiring harness connectors and terminals, especially the electronic brake control module (EBCM), for any problem that could cause an intermittent condition. 2. Repair any intermittent problem found. Is the repair complete?	-	System OK	-
3	Check fuse SB2. Is fuse SB2 blown?	-	Go to Step 4	Go to Step 5
4	1. Check for a short circuit and repair it, if necessary. 2. Replace fuse SB2. Is the repair complete?	-	System OK	-
5	1. Disconnect the valve relay. 2. Check the voltage between the valve relay connector terminal 15 and ground of EBCM. Is the voltage equal to the specified valve?	11 - 14 V	Go to Step 7	Go to Step 6
6	Repair the open circuit between the valve relay connector terminal 15 and terminal SB2 of EBCM. Is the repair complete?	-	System OK	-
7	Replace the hydraulic modulator. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 110 - RETURN PUMP MOTOR CIRCUIT FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

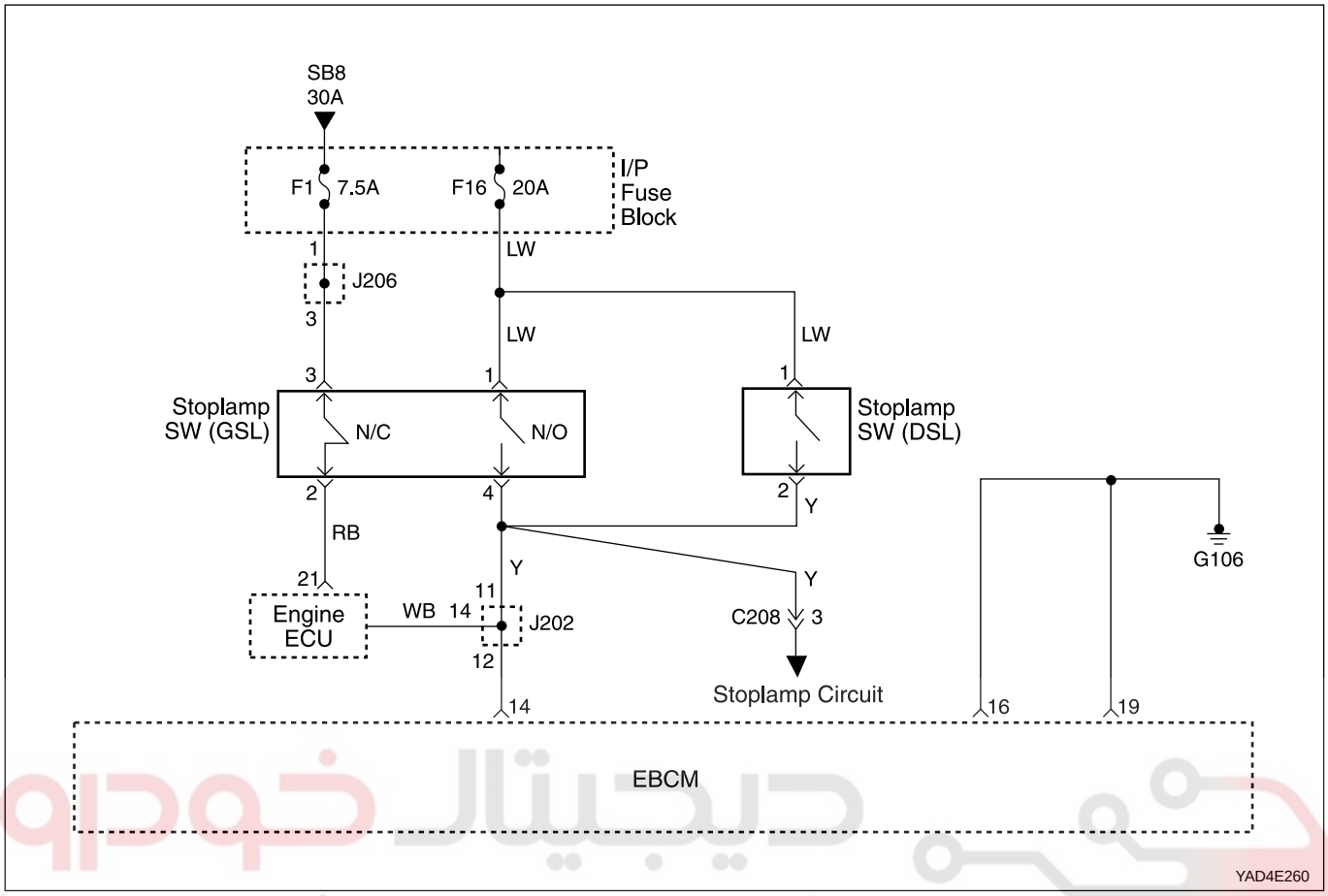
2. This step checks for poor connection.
5. This step checks for the motor relay.
13. This step checks for the hydraulic modulator.

Diagnostic Aids

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

DTC 110 - Pump Motor or Pump Motor Relay Fault

Step	Action	Value	Yes	No
1	1. Use a scan tool to clear all DTCs. 2. Road test the vehicle. Does DTC 110 set again?	-	Go to Step 3	Go to Step 2
2	1. Check all system wiring harness connectors and terminals, especially the electronic brake control module (EBCM), for any problem that could cause an intermittent condition. 2 Repair any intermittent problem found. Is the repair complete?	-	System OK	-
3	Check fuse SB2. Is fuse SB2 blown?	-	Go to Step 4	Go to Step 5
4	1. Check for a short circuit and repair it, if necessary. 2. Replace fuse SB2. Is the repair complete?	-	System OK	-
5	1. Disconnect the motor relay. 2. Check the resistance between the motor relay connector terminal 17 and terminal 18 of EBCM. Is the resistance equal to the specified value?	11 - 14 V	Go to Step 7	Go to Step 6
6	Repair the open circuit between the motor relay connector terminal 17 and fuse SB2 of EBCM. Is the repair complete?	-	System OK	-
7	1. Turn the ignition to ON. 2. Check the voltage between the motor relay connector terminal 15 and ground of EBCM. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 9	Go to Step 8
8	1. Repair the open circuit between the motor relay connector terminal 87 and terminal 14 of hydraulic modulator. 2. Road test the vehicle Does DTC 110 clear?	-	System OK	Go to Step 9
9	1. Replace the hydraulic modulator/EBCM. 2. Road test the vehicle Does DTC 110 clear?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 161 - STOPLAMP SWITCH FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

The system records a DTC 161. ABS operation is not disabled.

Test description

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

12. This step begins the process of troubleshooting stoplamps that are always on.

Diagnostic Aids

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

DTC 161 - Stoplamp Switch Fault

Step	Action	Value	Yes	No
1	Observe the stoplamps when the brakes are applied. Do the stoplamps turn on?	-	Go to Step 12	Go to Step 2
2	Check fuse SB8. Is fuse SB8 blown?	-	Go to Step 3	Go to Step 4
3	1. Check for a short circuit and repair it, if necessary. 2. Replace fuse SB8. Is the repair complete?	-	System OK	-
4	Check the voltage at fuse SB8. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 6	Go to Step 5
5	Repair the power supply circuit for fuse SB8. Is the repair complete?	-	System OK	-
6	Check the voltage at fuse F16. Is fuse F16 blown?	-	Go to Step 7	Go to Step 8
7	1. Check for a short circuit between terminal SB8 and fuse F16 in the I/P fuse block and repair it, if necessary. 2. Replace fuse F16. Is the repair complete?	-	System OK	-
8	Check the voltage at terminal 1 of the stoplamps switch. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 10	Go to Step 9
9	Repair the open circuit between fuse F16 and terminal 1 of the stoplamp switch. Is the repair complete?	-	System OK	-
10	With the brakes applied, check the voltage at terminal 2 or 4 of the stoplamp switch. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 12	Go to Step 11
11	Replace the stoplamp switch. Is the repair complete?	-	System OK	-
12	1. Disconnect the electronic brake control module (EBCM) connector. 2. Visually inspect the EBCM and its connector for damaged pins or terminals. Are there any damaged pins or terminals?	-	Go to Step 13	Go to Step 14
13	Repair the damaged pins or terminals. Is the repair complete?	-	System OK	-
14	1. With the EBCM connector disconnected, applied the brake. 2. Check the voltage at terminal 14 of the EBCM. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 16	Go to Step 15
15	Repair the open circuit between 1 of the stoplamp switch and terminal 14 of the EBCM connector. Is the repair complete?	-	System OK	-
16	With the EBCM disconnected, use an ohmmeter to measure the resistance between ground and terminal 16 of the EBCM connector. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 18	Go to Step 17

DTC 161 - Stoplamp Switch Fault (Cont'd)

Step	Action	Value	Yes	No
17	Repair the open circuit between ground and terminal 14 of the EBCM. Is the repair complete?	-	System OK	-
18	Replace the ABS unit. Is the repair complete?	-	System OK	-

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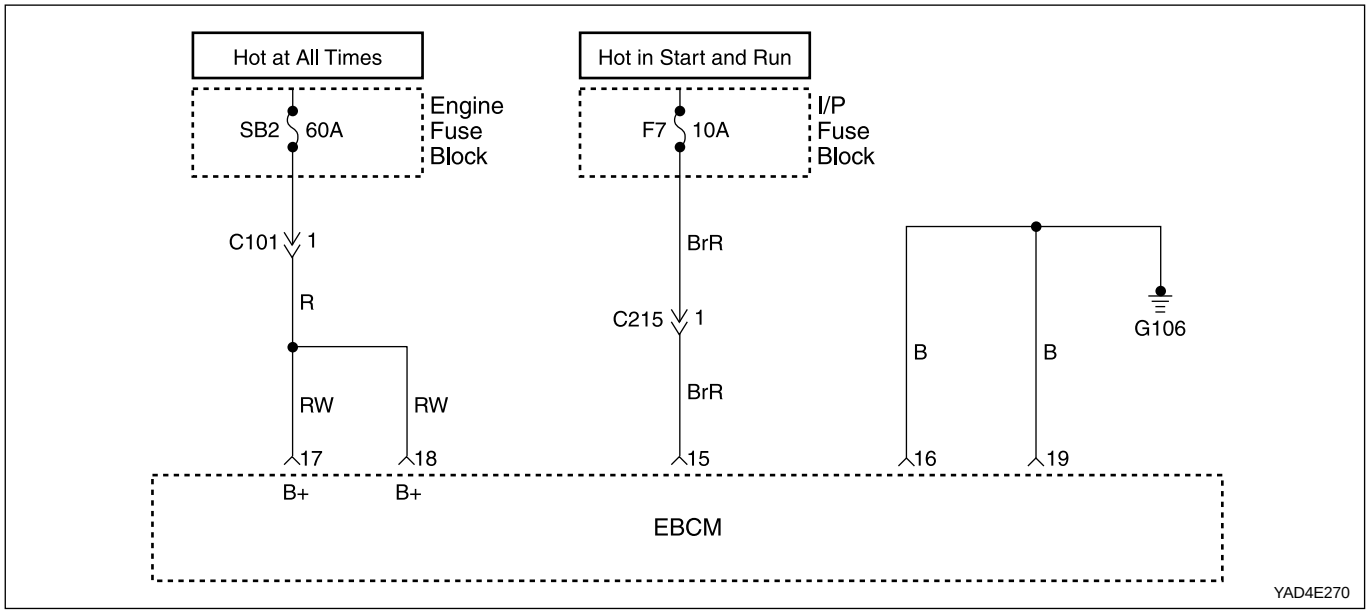

DIAGNOSTIC TROUBLE CODE (DTC) 800 - LOW VOLTAGE FAULT

Circuit Description

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

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

ABS action is disabled during the period of low voltage, and the ABS warning lamp is ON for the remainder of the ignition cycle. If the failure is intermittent, the EBCM will enable the system at the next ignition cycle and set a history DTC 800.

Test Description

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

1. This step determines whether there is voltage at the battery and at the high current source.

7. This step checks for voltage at the ignition 1 source.

15. This step begins the check for voltage at the EBCM end of the ABS harness.

Diagnostic Aids

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

DTC 800 - Low Voltage Fault

Step	Action	Value	Yes	No
1	Check the voltage at the battery. Is the voltage within the specified value?	11 - 14 V	Go to Step 3	Go to Step 2
2	Charge or replace the battery, as required. Is the repair complete?	-	System OK	-
3	Check fuse SB2 in the engine fuse block. Is the fuse blown?	-	Go to Step 4	Go to Step 7
4	1. Replace fuse SB2. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to Step 5	Go to Step 6
5	1. Turn the ignition to OFF. 2. Trace the wires in the ABS wiring harness from terminal SB2 at the engine fuse block to the terminal 17, 18 in EBCM. 3. Repair any short circuit found along this path. Is the repair complete?	-	System OK	-
6	1. Turn the ignition to OFF. 2. Install the scan tool. 3. Clear all DTCs. 4. Road test the vehicle. Does DTC 800 reset?	-	System OK	-
7	Check terminal 1 in the C101 connector. Is the connection good?	-	Go to Step 8	Go to Step 10
8	Repair the terminal. Is the repair complete?	-	System OK	Go to Step 9
9	1. Turn the ignition to OFF. 2. Install the scan tool. 3. Clear all DTCs. 4. Rood test the vehicle. Does DTC 800 reset?	-	System OK	-
10	Check fuse F7 in the I/P fuse block. Is fuse F7 blown?	-	Go to Step 11	Go to Step 14
11	1. Replace fuse F7. 2. Turn the ignition to ON. Does fuse F7 blow again?	-	Go to Step 12	Go to Step 13
12	1. Turn the ignition to OFF. 2. Trace the WHT/RED wires in the ABS wiring harness from fuse F7 to terminal 15 of the EBCM connector. 3. Repair any short circuit found along this path. Is the repair complete?	-	System OK	-
13	1. Turn the ignition to OFF 2. Install the scan tool. 3. Clear all DTCs. 4. Rood test the vehicle. Does DTC 800 reset?	-	System OK	-

DTC 800 - Low Voltage Fault (Cont'd)

Step	Action	Value	Yes	No
14	1. Disconnect the connector from the EBCM. 2. Turn the ignition to ON. 3. Check the voltage between ground and terminal 17, and between ground and terminal 18. Is the voltage within the specified value?	11 - 14 V	Go to Step 16	-
15	1. Turn the ignition to OFF. 2. Trace the WHT/RED wires between terminals 17 and 18 of the EBCM connector to fuse F7 and SB2 in the I/P fuse block. 3. Repair the open in this circuit. Is the repair complete?	-	System OK	-
16	1. Turn the ignition ON. 2. Check the voltage at fuse SB2. Is the voltage within the specified value?	11 - 14 V	Go to Step 18	-
17	Repair the power supply circuit for fuse SB2. Is the repair complete?	-	System OK	Go to Step 17
18	1. Turn the ignition to OFF. 2. Check the resistance between ground and terminals 16 and 19 of the ABS harness EBCM connector. Is the resistance equal to the specified value?	0 Ω	Go to Step 19	-
19	Examine terminals 15, 16, 17, 18 and 19 of the EBCM connector. Is there a defective terminal?	-	Go to Step 20	Go to Step 21
20	Repair the defective terminal or replace the connector or wiring harness, as required. Is the repair complete?	-	System OK	Go to Step 22
21	Repair the defective ground connection. Is the repair complete?	-	System OK	-
22	1. Install the scan tool. 2. Clear all DTCs. 3. Road test the vehicle. Does DTC 800 set again?	-	Go to Step 23	Go to Step 24
23	Replace the ABS unit. Is the repair complete?	-	System OK	-
24	1. Examine the wiring harness and connectors for causes of intermittent problems. 2. Repair any intermittent problem found. Is the repair complete?	-	System OK	-

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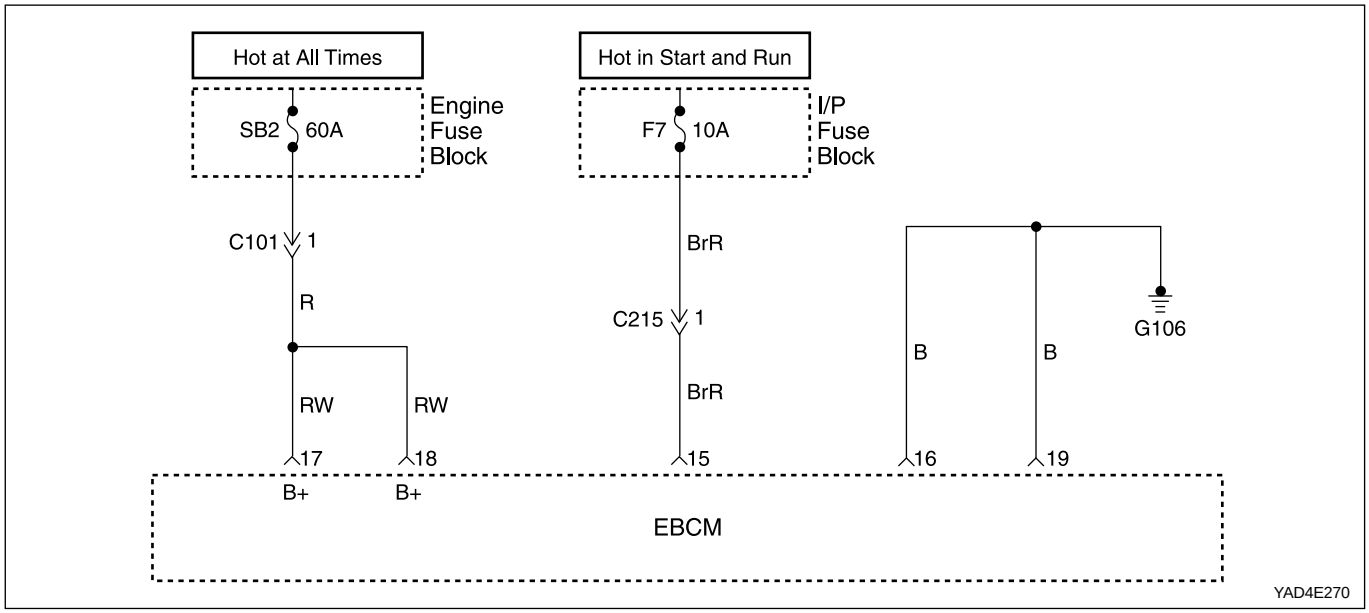


DIAGNOSTIC TROUBLE CODE (DTC) 550 - EBCM INTERNAL FAULT

Circuit Description

The ABS control module performs various diagnostic checks on itself. If it finds a problem, it sets DTC 550.

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

ABS is disabled, and the ABS warning lamp is turned ON. If the failure is intermittent, the control module will enable the system at the next ignition cycle and will store a history DTC 550.

Test Description

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

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

Diagnostic Aids

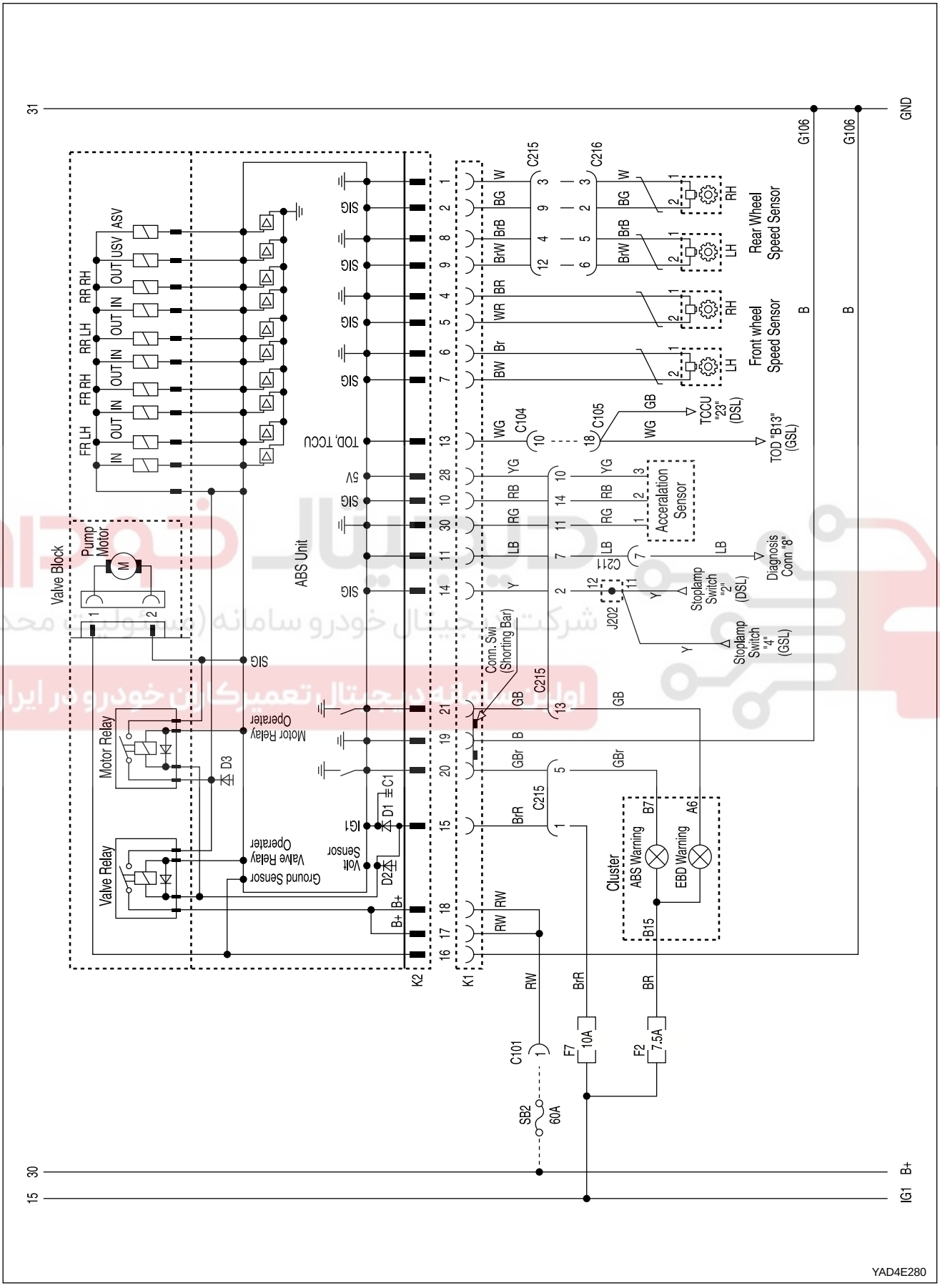
It is very important to perform a thorough inspection of the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and completely may result in misdiagnosis, causing part replacement with the reappearance of the malfunction.

DTC 550 - EBCM Internal Fault

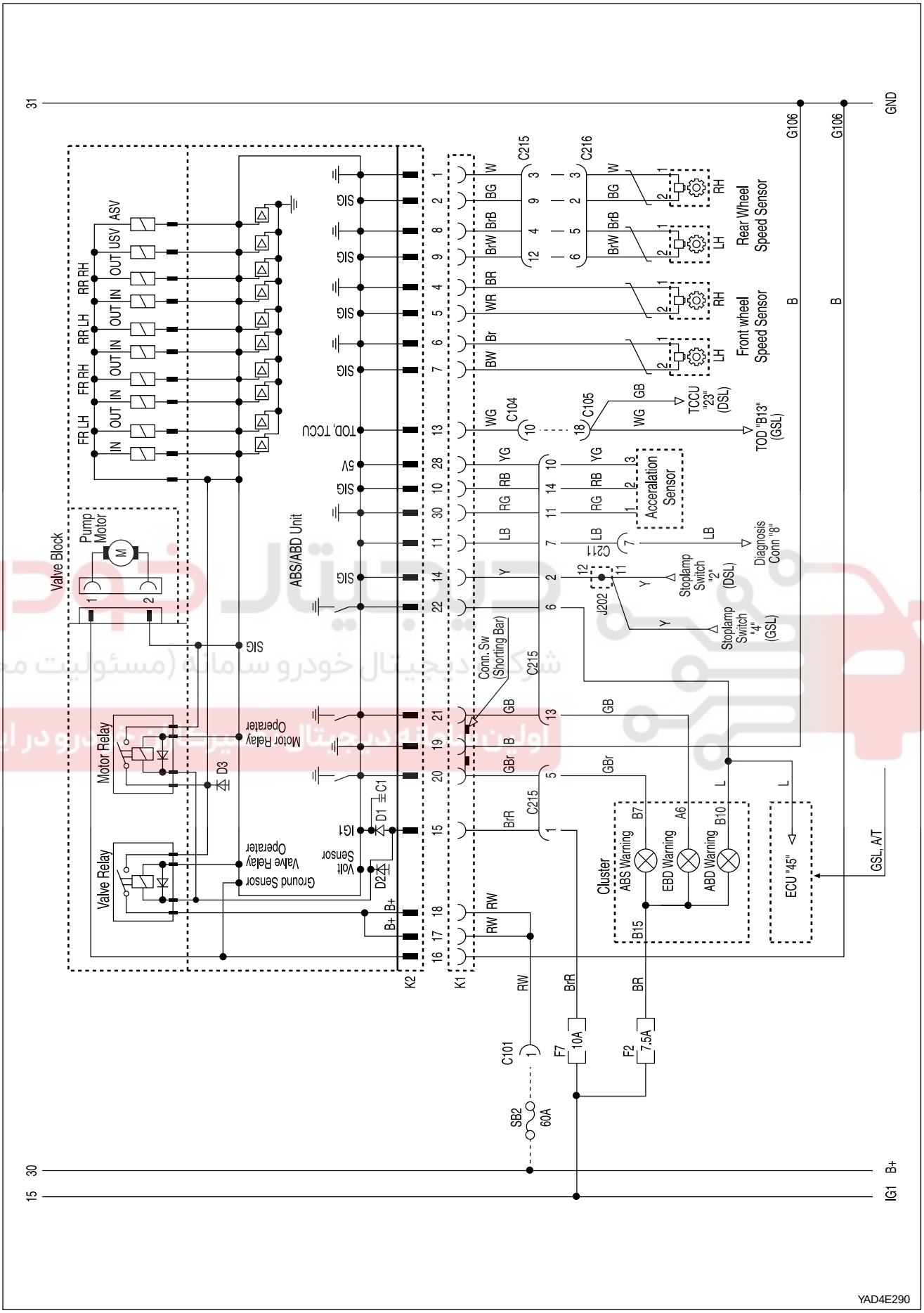
Step	Action	Value	Yes	No
1	Use the scan tool to determine if any other DTCs are set. Are other DTCs set?	-	Go to the applicable Diagnostic Table	Go to Step 2
2	Clear all DTCs and road test the vehicle. Does DTC 550 set again?	-	Go to Step 4	Go to Step 3
3	1. Check all wiring harness connectors and terminals, especially those at the EBCM, for any condition that could cause an intermittent. 2. Repair any problems found. Is the repair complete?	-	System OK	-
4	1. Turn the ignition to OFF. 2. Disconnect the EBCM connector. 3. Turn the ignition to ON. 4. Measure the voltage between ground and terminals 15, 17 and 18 of the EBCM harness connector. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 6	Go to Step 5
5	1. Check the voltage supply and the ground connections to the EBCM. 2. Repair any open or high resistance found. Is the repair complete?	-	System OK	-
6	Check the EBCM connector for any damaged terminals. Are there any problems?	-	Go to Step 7	Go to Step 8
7	Repair any connector problem found. Is the repair complete?	-	System OK	-
8	Clear all DTCs and road test the vehicle. Does DTC 550 set again?	-	Go to Step 9	System OK
9	Replace the EBCM. Is the repair complete?	-	System OK	-

SCHEMATIC AND ROUTING DIAGRAMS

ABS 5.3 CIRCUIT

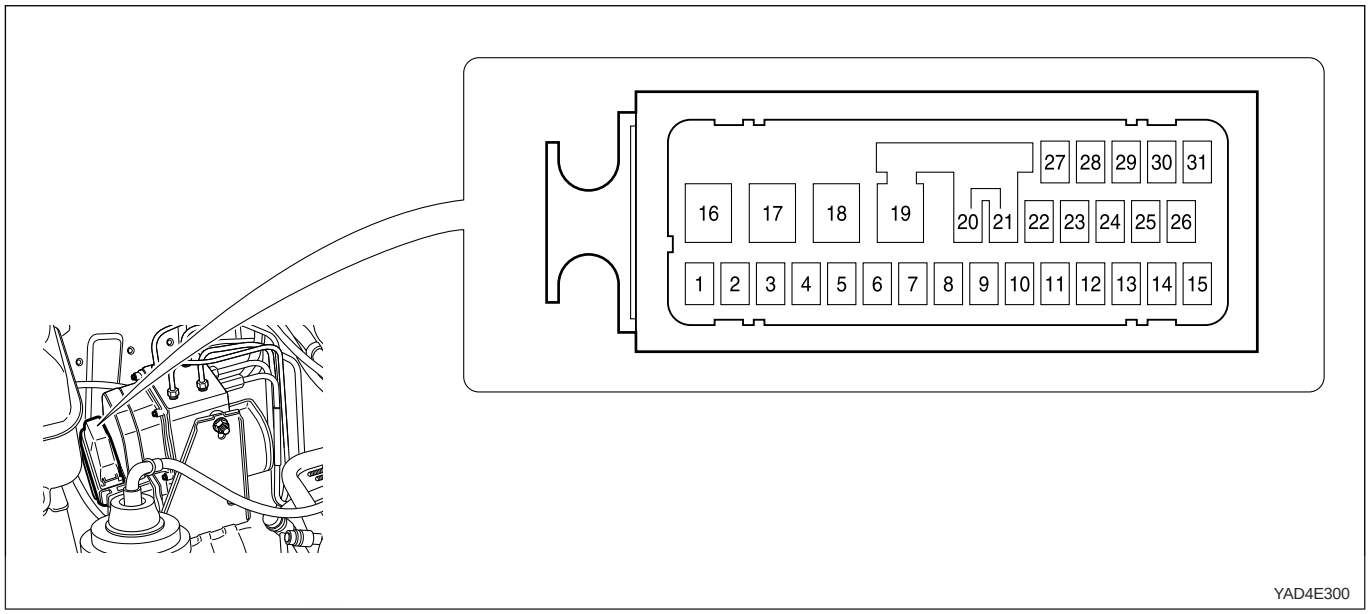


ABD 5.3 CIRCUIT



CONNECTOR END VIEWS

EBCM (HYDRAULIC MODULATOR/UNIT INTEGRATED)



Pin	Wire Color	Circuit
1	WHT	Right Rear Speed Sensor Ground
2	BLK/GRN	Right Rear Speed Sensor
3	-	Not Used
4	BLK/RED	Right Front Speed Sensor Ground
5	WHT/RED	Right Front Speed Sensor
6	BRN	Left Front Speed Sensor Ground
7	BLK/WHT	Left Front Speed Sensor
8	BRN/BLK	Left Rear Speed Sensor Ground
9	BRN/WHT	Left Rear Speed Sensor
10	RED/BLK	Acceleration Sensor Signal
11	BLU/BLK	Data Link Connector
12	-	Not Used
13	WHT/GRN	TOD
14	YEL	Stoplamp SW
15	BRN/RED	Ignition
16	BLK	Ground

Pin	Wire Color	Circuit
17	RED/WHT	Battery
18	RED/WHT	Battery
19	BLK	Ground
20	GRN/BRN	ABS Warning Lamp
21	GRN/BLK	EBD Warning Lamp
22	BLU	TCS Warning Lamp
23	YEL/GRN	Acceleration Sensor Supply Voltage (5V)
24	-	Not Used
25	-	Not Used
26	-	Not Used
27	-	Not Used
28	RED/GRN	Acceleration Sensor Ground
29	-	Not Used
30	-	Not Used
31	-	Not Used

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE

SERVICE PRECAUTIONS

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

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

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

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

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

Notice : Avoid spilling brake fluid on any 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.

Electronic System Service Precautions

Take care to avoid electronic brake control module (EBCM) circuit overloading. In testing for opens or shorts, do not ground or apply voltage to any circuit unless instructed to do so by the diagnostic procedure.

Test circuits only with a high-impedance multi-meter. Never remove or apply power to any control module with the ignition switch in the ON position. Always turn the ignition to the OFF position before removing or connecting battery cables, fuses or connectors.

General Service Precautions

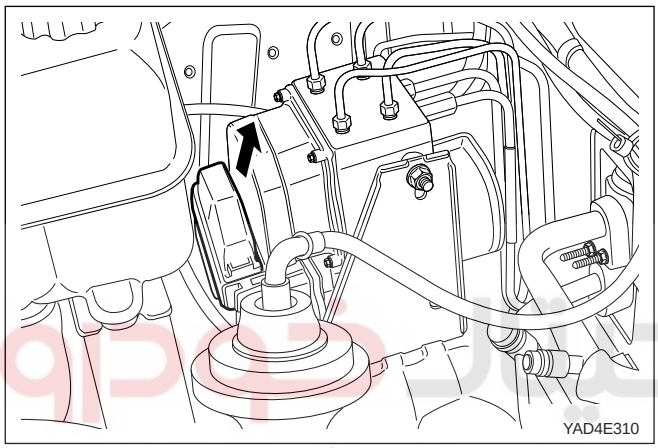
Disconnect the EBCM connector before performing any vehicle welding work using an electric arc welder.

Do not attempt to disassemble any component designated as nonserviceable. The hydraulic modulator and the EBCM can be separated from each other and replaced separately but cannot be serviced. They have no replaceable parts, and there is no replaceable parts, and there is no access to the components they contain.

Bleeding System

Replacement modulators are shipped already filled and bled. In normal procedures requiring removal of the modulator, such as to replace the EBCM, air will not enter the modulator, and normal bleeding will be all that is needed.

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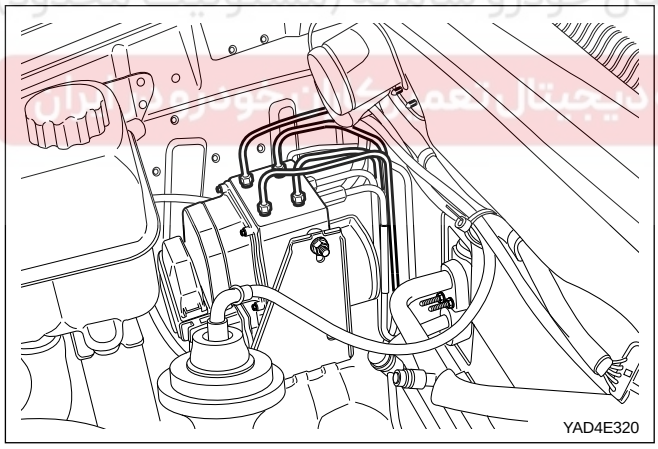
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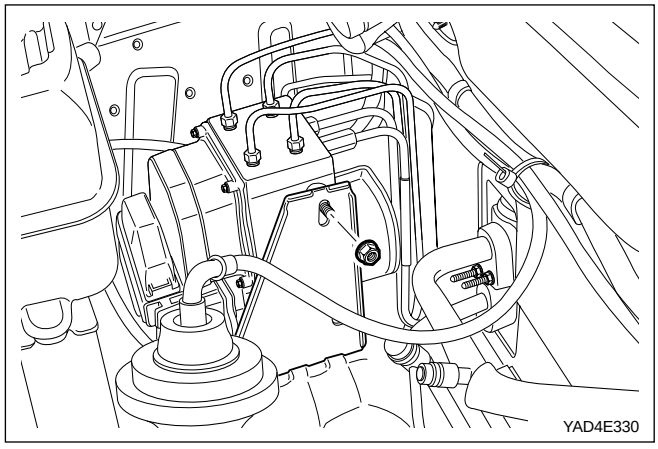

YAD4E330

HYDRAULIC MODULATOR/EBCM ASSEMBLY

Removal & Installation Procedure

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

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

4. Remove the brake pipes from the hydraulic modulator.

Installation Notice

Tightening Torque	14 N•m (124 lb-in)

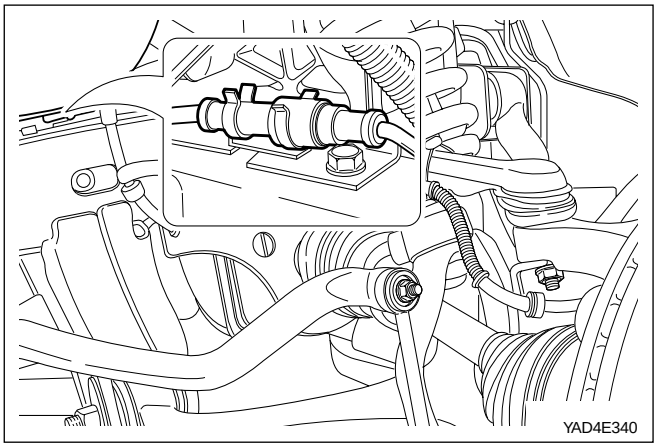
5. Loosen the mounting nuts on the hydraulic unit.
6. Move the brake pipes aside far enough to allow for lifting the ABS 5.3 unit out of the mounting bracket.
7. Cap the brake pipes.

Installation Notice

Tightening Torque	6 N•m (53 lb-in)

- Bleed the hydraulic system.

8. Installation should follow the removal procedure in the reverse order.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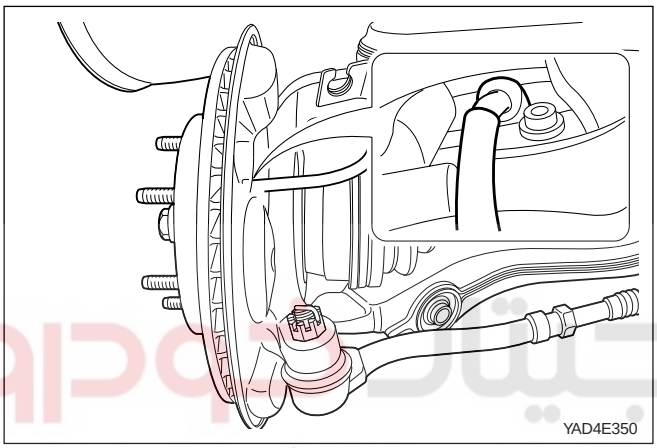
FRONT WHEEL SPEED SENSOR

Removal & Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the front wheel speed sensor electrical connector.

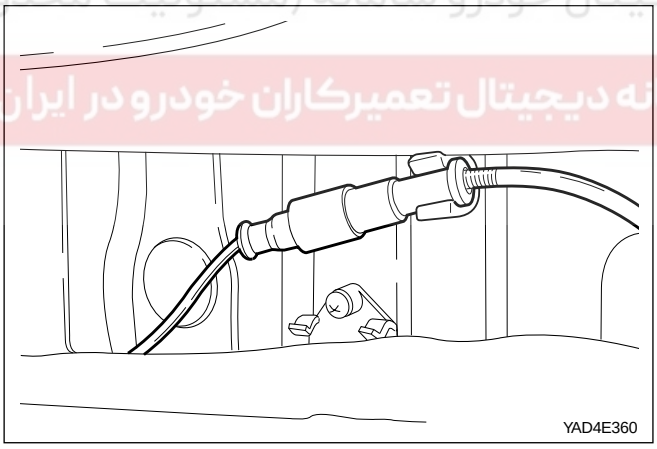

YAD4E350

3. Raise and suitably support the vehicle.
4. Turn the steering wheel to expose the front wheel speed sensor. It is located at the rear of the steering knuckle near tie rod end.
5. Remove the bolt and the front wheel speed sensor from the steering knuckle.

Installation Notice

Tightening Torque	7 N•m (62 lb-in)

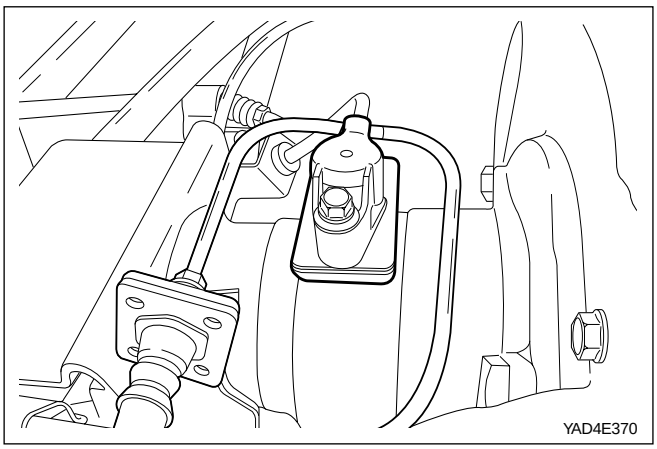
6. Installation should follow the removal procedure in the reverse order.


YAD4E360

REAR WHEEL SPEED SENSOR

Removal & Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the rear wheel speed sensor electrical connector.


YAD4E370

3. Raise and suitably support the vehicle.
4. Remove the rear wheel speed sensor.

Installation Notice

Tightening Torque	7 N•m (62 lb-in)

5. Installation should follow the removal procedure in the reverse order.

ACCELERATION SENSOR

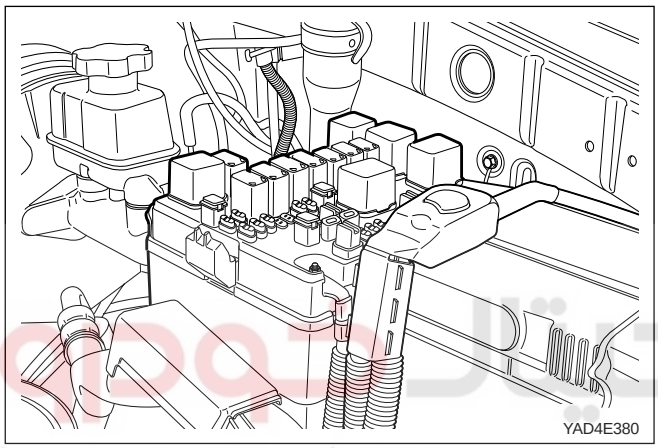
Removal & Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the acceleration sensor connector.
3. Remove the acceleration sensor mounting bolts.

Installation Notice

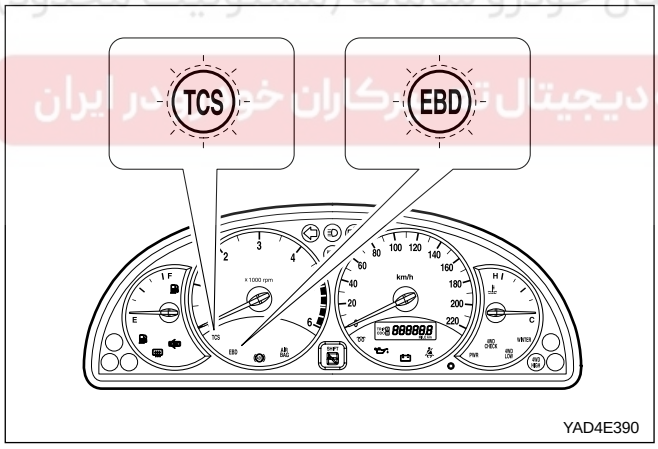
Tightening Torque	7 N•m (62 lb-in)

4. Installation should follow the removal procedure in the reverse order.


YAD4E380

SYSTEM FUSE

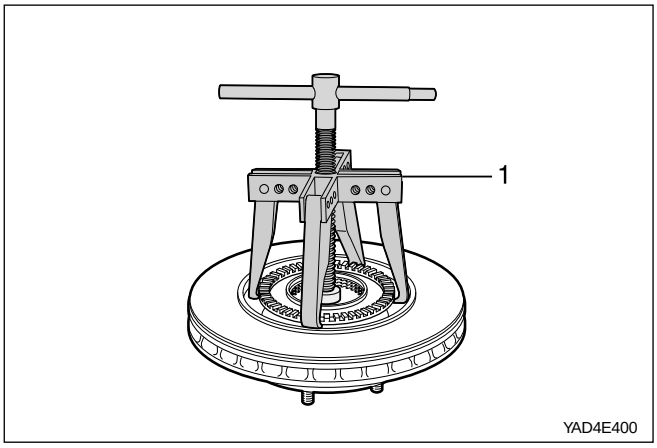
The ABS/TCS system fuse, SB2, is located in the engine fuse blcok. Counting from the battery toward the surge tank, it is the first system fuse in the row.

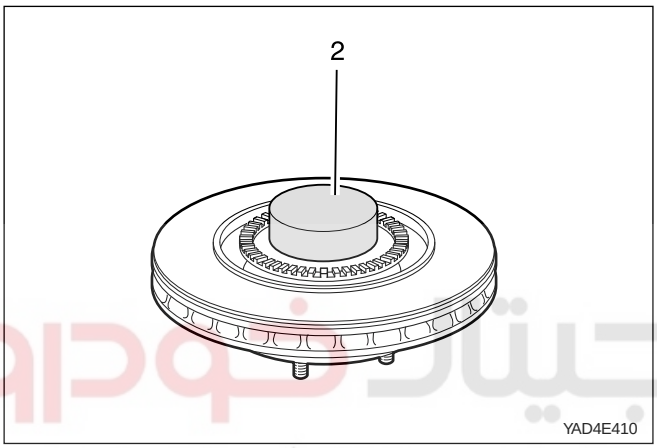


YAD4E390

INDICATORS

The indicator lamps ABS and TCS are part of the instrument cluster.





UNIT REPAIR

ABS FRONT TOOTH WHEEL

Tool Requires

661 589 16 33 00 ABS Tooth Wheel Puller

Removal Procedure

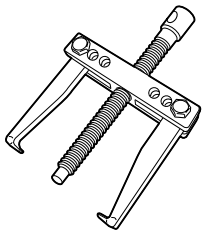
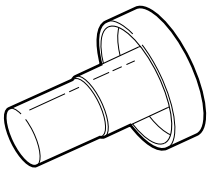
1. Remove the disc brake rotor. Refer to Front Disc Brakes Section.
2. Remove the ABS front toothed wheel using the ABS tooth wheel puller 661 589 16 33 00.

Installation Procedure

1. Install the ABS front toothed wheel using the ABS tooth wheel installer 661 589 17 33 00.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 YAD4E420	**661 589 16 33 00** **ABS Tooth Wheel Puller**
 YAD4E430	**661 589 17 33 00** **ABS Tooth Wheel Installer**

DESCRIPTION AND OPERATION

ABS(ANTI-LOCK BRAKE SYSTEM)

When wheel slip is noted during a brake application, the ABS enters antilock mode. During antilock braking, hydraulic pressure in the individual wheel circuits is controlled in order to prevent any wheel from slipping. A separate hydraulic line and specific solenoid valves are provided for each wheel. The ABS can decrease, hold or increase hydraulic pressure to each wheel brake. However, the ABS cannot increase hydraulic pressure above the amount which is transmitted by the master cylinder during braking.

During antilock braking, a series of rapid pulsations will be felt in the brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as they respond to their desired wheel speed. This pedal pulsation is present during antilock braking and stops when normal braking is resumed or when the vehicle comes to a stop. A ticking or popping noise may also be heard as the solenoid valves rapidly cycle. During antilock braking on dry pavement, the tires may make intermittent chirping noises as they approach slipping. These noises and pedal pulsations should be considered normal during antilock operation.

The vehicle may be stopped by applying normal force to the brake pedal. Brake pedal operation during normal braking should be no different than previous systems. Maintaining a constant force on the pedal will provide the shortest stopping distance while maintaining vehicle stability.

Basic Knowledge Required

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

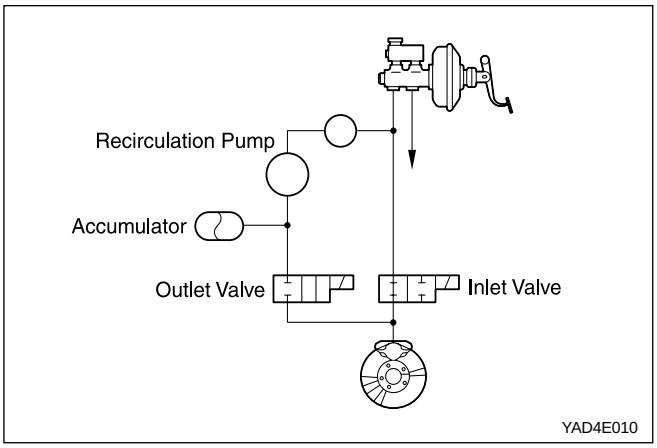
Basic Electrical Circuits - You should understand the basic theory of electricity and know the meaning of voltage, current (amps) And resistance (ohms). You should understand what happens in a circuit with an open or shorted wire. You should be able to read and understand a wiring diagram.

Use of Circuit Testing Tools - You should know how to use a test light and how to bypass components to test circuits using fused jumper wires. You should be familiar with a digital multimeter. You should be able to measure voltage, resistance, and current, and be familiar with the controls and how to use them correctly.

Basic Hydraulic System

Each solenoid valve consists of one inlet valve and one outlet valve in order to become the channel.

The inlet valve and the outlet valve close/open by the electrical signal and control the hydraulic pressure as increase, decrease and hold.



ABS System Components

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

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

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

Units equipped with TCS add two more valves for each drive wheel for the purpose of applying the brake to a wheel that is slipping. This is done with pressure from the hydraulic pump in the unit. There is also a TCS indicator lamp on the instrument panel to alert the driver to the fact that the TCS system is active. The components identified in the drawing are those added to the basic ABS 5.3 system to provide traction control.

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

TRACTION CONTROL SYSTEM (TCS) DESCRIPTION

General Information

The traction control system (TCS) is a traction system by means of brake intervention only, available in a low speed range (< 60 kph).

It works on µ-split roads with sidewise different friction coefficients.

The spinning driven wheel is braked and the drive torque can be transferred to the wheel on the high-µ side. During TCS active, the TCS information lamp is blinking.

The temperature of the brakes is calculated by a mathematical model and TCS is switched passive if the calculated temperature is greater than a threshold value (500 °C). TCS is permitted again, when the calculated temperature is less than 350 °C.

Lamp Concepts

The system is equipped with an TCS information lamp, which is blinking during TCS operation.

The activation of the EBD, TCS warning lamp and the TCS info lamp is summarized in the following table:

	Ignition ON	ABS Operation	TCS Operation	System Failure (EBD, ABS or TCS are Not Distinguished)	TCS Passive Due to Temperature Model
ABS Warning Lamp	2 second on for lamp check	OFF	OFF	ON	OFF
TCS Info Lamp	2 second on for lamp check	OFF	Blinking (FLASHING)	OFF	ON
EBD Warning Lamp	2 second on for lamp check	EBD operation/OFF	OFF	ON	OFF

Automatic Brake Differential (ABD)

ABD (Automatic Brake Differential) system is a type of the TCS (ASR) system and substitutes the function of the mechanical LSD (Limited Slip Differential) system.

ABD system operates by controlling the braking forces only under 60km/h.

TCS System Function

Traction control does not have any effect on the operation of the vehicle until the control module detects one or both of the front wheels rotating faster than the rear wheels. At this time, the electronic brake control module (EBCM) requests the powertrain control module to reduce the amount of torque applied to the drive wheels. The powertrain control module does this by retarding timing and selectively turning off fuel injectors. The EBCM applies the front brakes, thus reducing torque to the front wheels. Once the front wheel begins to rotate at the same speed as the rear wheels, the system returns full control to the driver. During traction control mode, if the brake is applied to only one front wheel, most of the torque from the engine is directed to the other front wheel which improves the traction of the vehicle.

Pressure Modulation

Depending on the control deviation and the wheel acceleration of the spinning wheel, pressure increase, hold and decrease are made.

The pressure modulation is done with the conventional control with the valves. Prime valve, inlet valve and outlet valve according to the following table:

	Increase	Hold	Decrease
Prime Valve	Open	Open	Open
Pilot Valve	Closed	Closed	Closed
Inlet Valve	Open	Closed	Closed
Outlet Valve	Closed	Closed	Open

Speed Range

TCS is available in the speed range ≤ 60 kph.

Above 60 kph vehicle speed, TCS is passive.

It is possible to initiate TCS operation up to a vehicle speed of 55 kph.

Control Algorithm

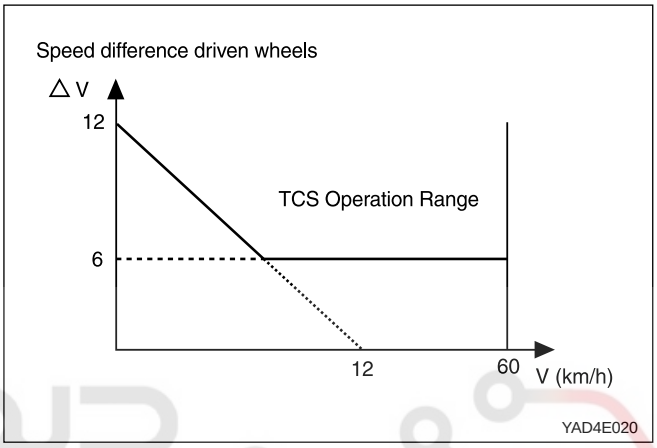
The input signals for the control algorithm are the filtered wheel speed signals from the ABS speed processing.

With the speed difference of the driven wheels, the control deviation is calculated.

If the control deviation exceeds a certain threshold value, the wheel with the greater slip is braked actively.

The threshold value depends on the vehicle speed:

It is reduced with increasing vehicle speed down to a constant value.



△V = Faster rear wheel speed - Slower rear wheel speed

V = Vehicle speed

* TCS is switched passive if the calculated temperature is greater than a threshold value (500 °C).

- TCS (ABD) Indicator turns on but TCS is permitted again, when the calculated temperature is less than 350 °C.

Temperature Model

TCS operation is a high thermal load for the brakes.

To avoid any damages at the brakes, the disk temperature is calculated with a mathematical model for each driven wheel separately, After ignition on, the calculation starts with 30 °C and then three different phases are evaluated separately and added:

TCS operation, braking and cooling phase.

If the temperature is higher than 500 °C, TCS is disabled for this wheel.

It is permitted again, if the model has calculated down the 350 °C.

EBD (ELECTRONIC BRAKE FORCE DISTRIBUTION) SYSTEM

System Description

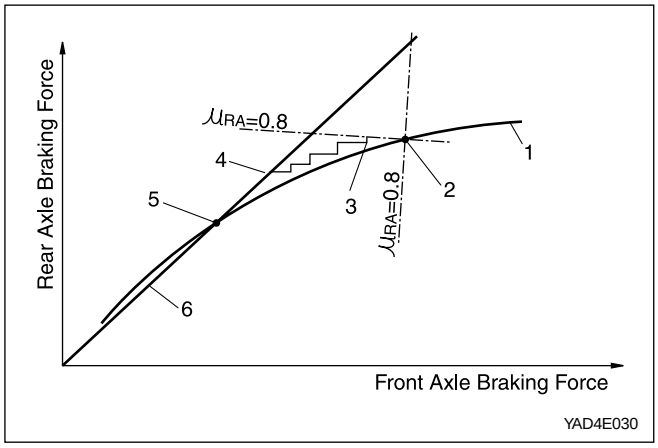
As an add-on logic to the ABS base algorithm, EBD works in a range in which the intervention thresholds for ABS control are not reached yet.

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

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. In an unloading car condition the brake efficiency is comparable to the conventional system but for a fully loaden vehicle the efficiency of the EBD system is higher due to the better use of rear axle braking capability.

The Benefits of EBD

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

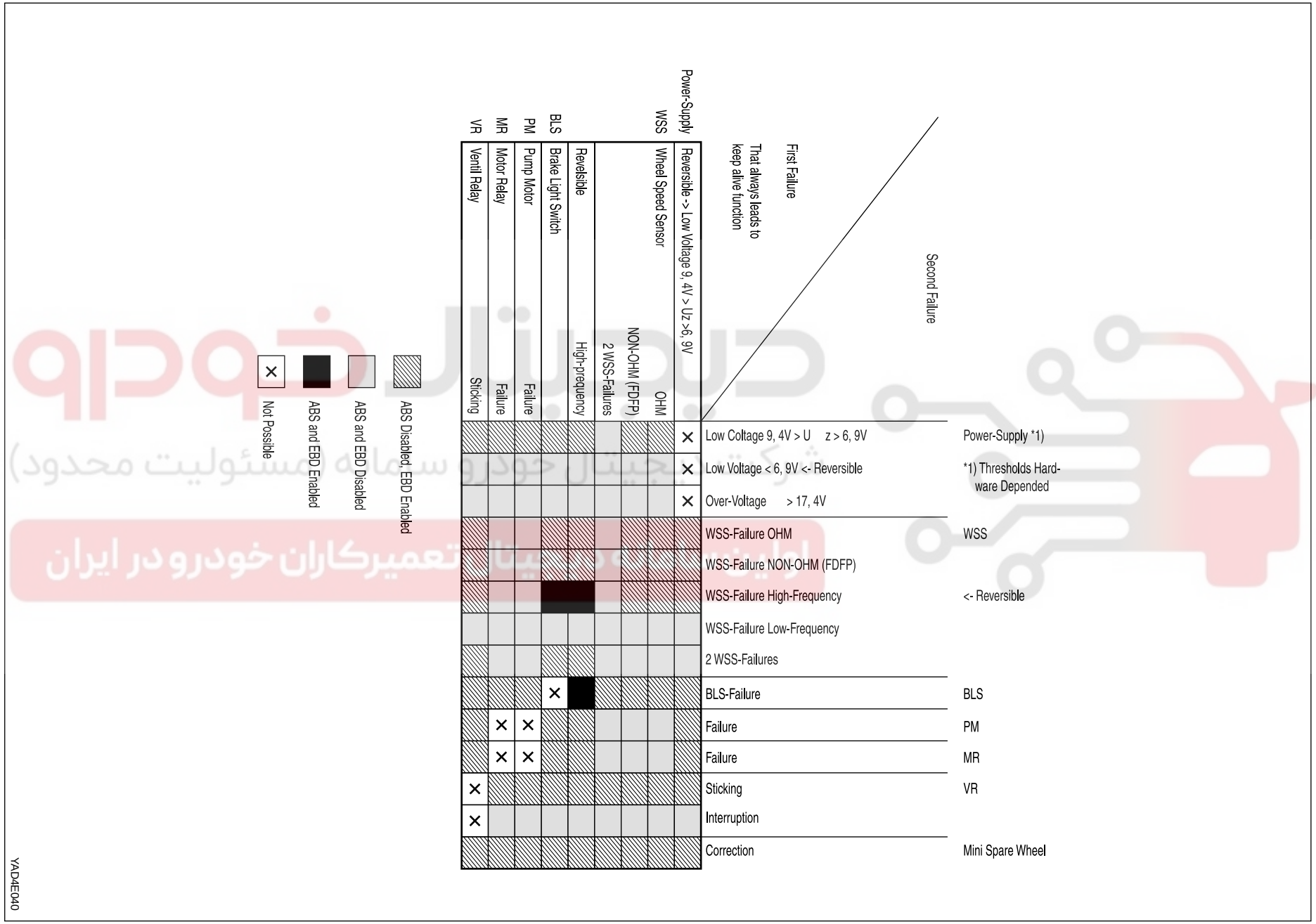


Service Precautions

Observe the following general precautions during any ABS/TCS service. Failure to adhere to these precautions may result in ABS/TCS system damage.

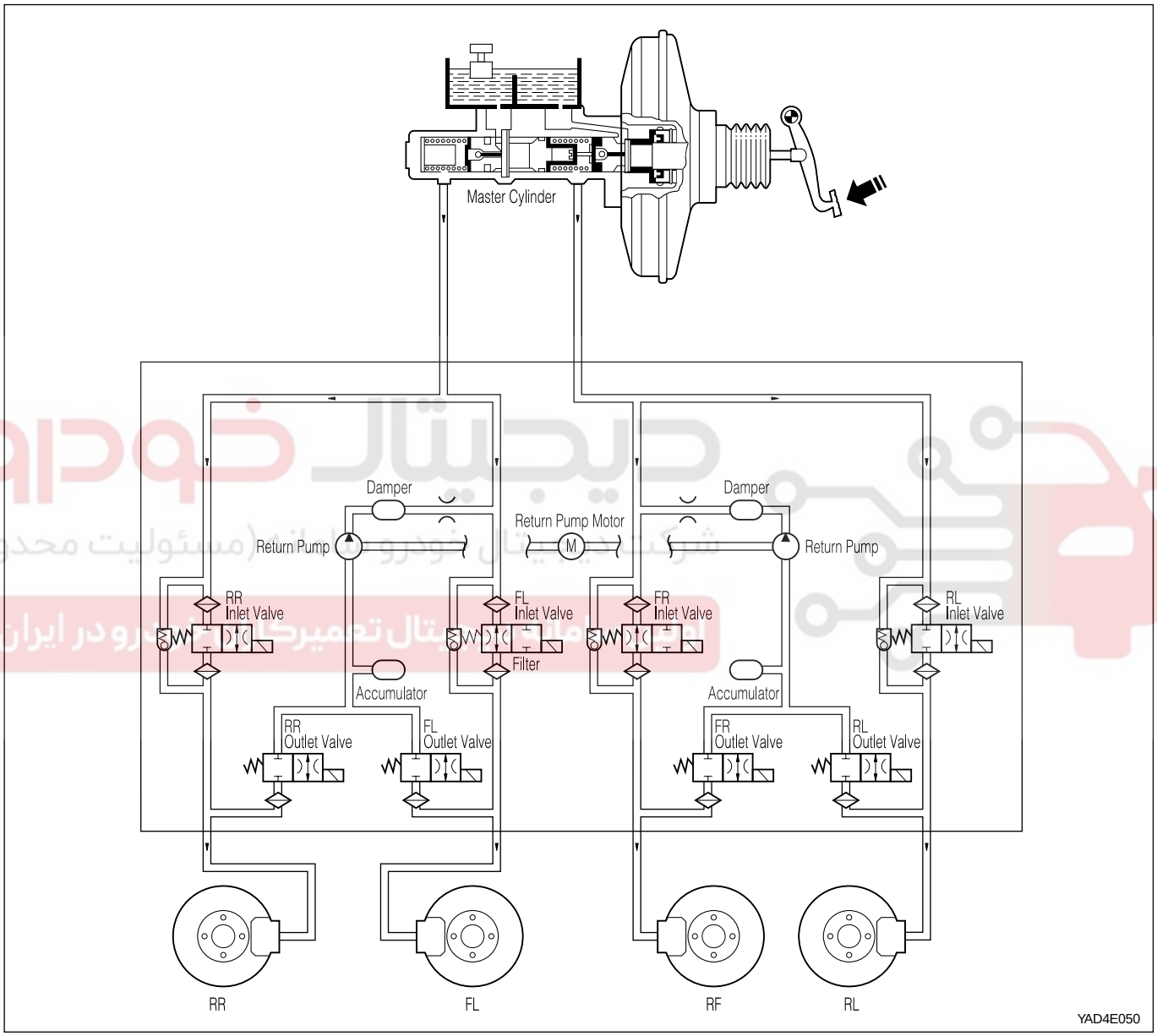
1. Disconnect the EBCM harness connector before performing the electric welding procedures.
2. Carefully note the routing of the ABS/TCS wiring and wring components during removal. The ABS/TCS components are extremely sensitive to EMI (eletromagnetic interference). Proper mounting is critical during component service.
3. Disconnect the EBCM connector with the ignition OFF.
4. Do not hang the suspension components from the wheel speed sensor cables. The cables may be damaged.
5. Do not use petroleum based fluids in the master cylinder. Do not use any containers previously used for petroleum based fluids. Petroleum causes swelling and distortion of the rubber components in the hydraulic brake system, resulting in water entering the system and lowering the fluid boiling point.

Electronic Brake-Force Distribution (EBD) Failure Matrix

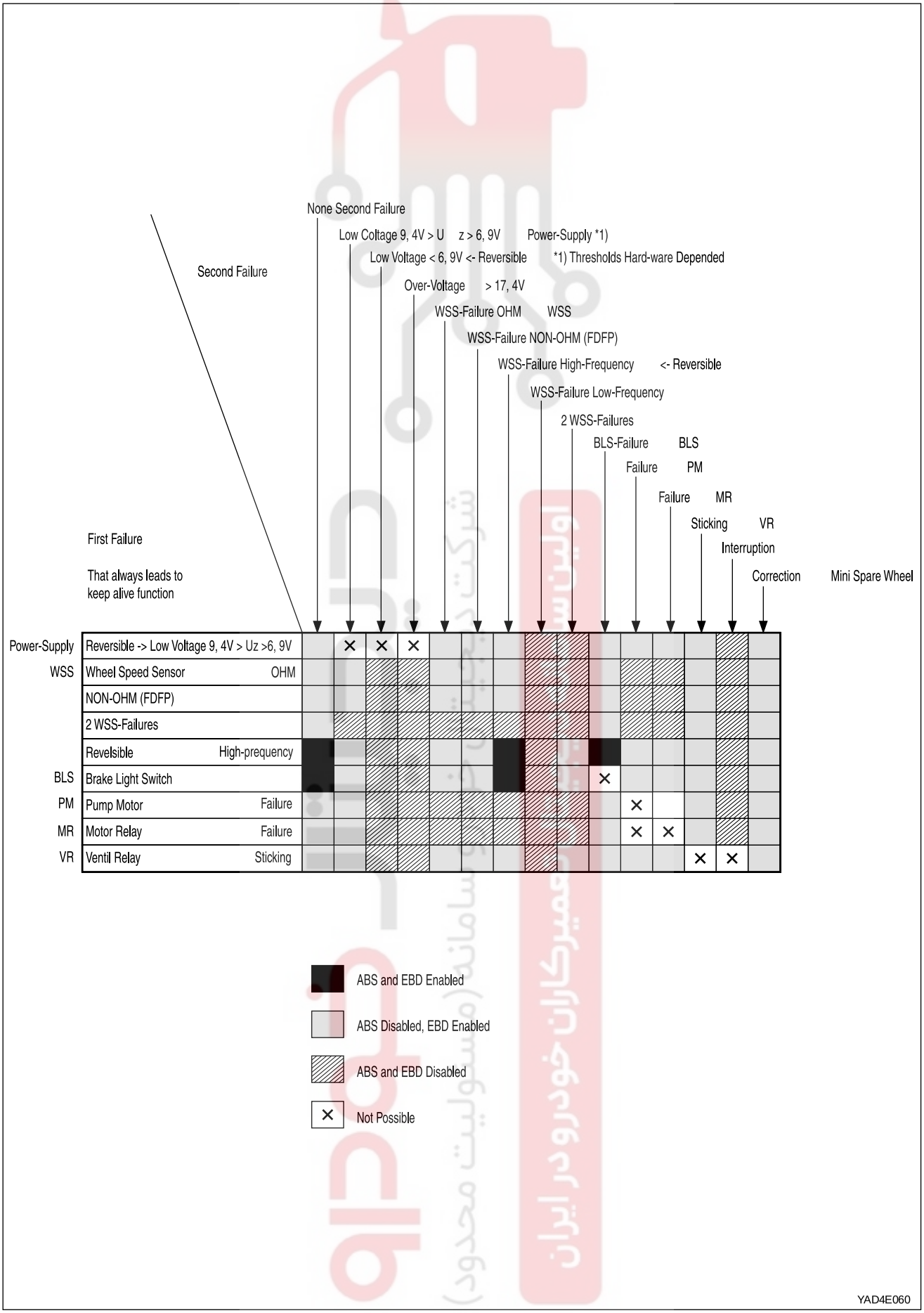


Hydraulic Fluid Flow Diagrams

For 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.



Electronic Brake-Force Distribution (EBD) Failure Matrix For Malfunction



TIRES AND ABS/TCS

Replacement Tires

Tire size is important for proper performance of the ABS system. Replacement tires should be the same size, load range, and construction as the original tires. Replace tires in axle sets and only with tires of the same tire performance criteria (TPC) specification number.

The use of any other size or type of tire may seriously affect the ABS operation.

Electronic Brake Control Module (EBCM)

Notice: There is on serviceable or removable EEPROM. The EBCM must be replaced as an assembly (Only ABS). ABS/TCS is separated hydraulic modulator and EBCM.

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

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

Additionally, the EBCM monitors itself, each input (except the serial data link), and each output for proper operation. If it detects any system malfunction, the EBCM will store a DTC in nonvolatile memory (EERPOM) (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. 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 52 equally spaced teeth. Exercise care during service procedures to avoid prying or contacting this ring. Excessive contact may cause damage to one or more teeth. If the ring is damaged, the 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 sensor. They incorporate a length of flexible harness with the connector attached to the end of the harness. The rear wheel speed rings are incorporated into the hub assemblies and cannot be replaced separately, require replacement of the rear hub/bearing assembly.

Valve Realy And Pump Motor Relay

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

Wiring Harness

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

Indicators

The electronic brake control module (EBCM) continuously monitors itself and the other ABS components If the EBCM detects a problem with the system, the amber ABS indicator will light continuously to alert the driver to the problem. An illuminated ABS indicator indicates that the ABS system has detected a problem that affects the operation of ABS. On antilock braking will be available. Normal, non-antilock brake performance will remain. In order to regain ABS braking ability, the ABS must be serviced.

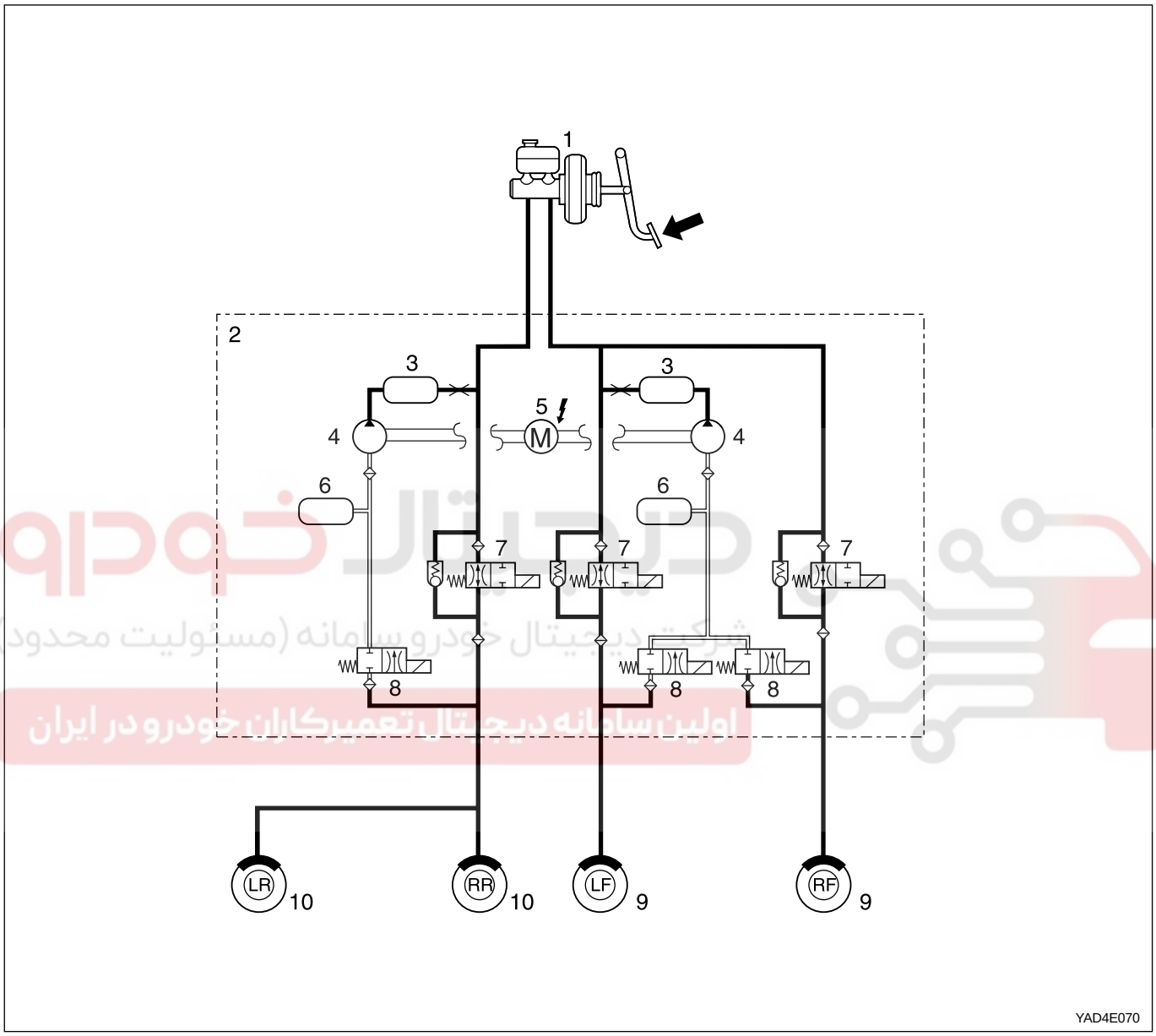
The red BRAKE indicator will be illuminated when the system detects a low brake fluid level in the master cylinder or when the parking brake switch is closed (the parking brake is engaged).

The EBD indicator will light continuously to alert the driver to the problem in the basic brake system. The EBD system must be serviced.

HYDRAULIC CIRCUIT

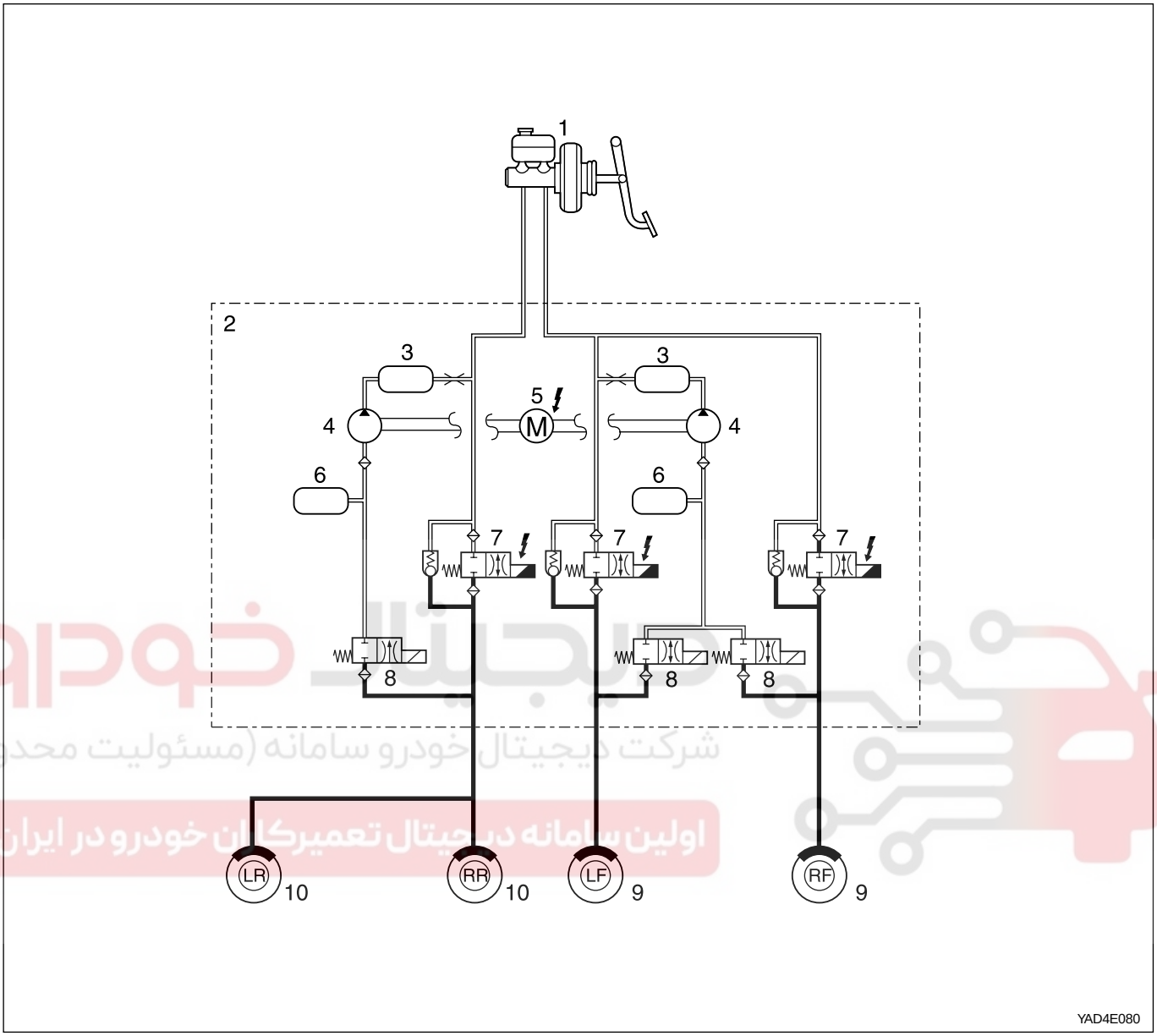
ABS 5.3

Pressure Increase



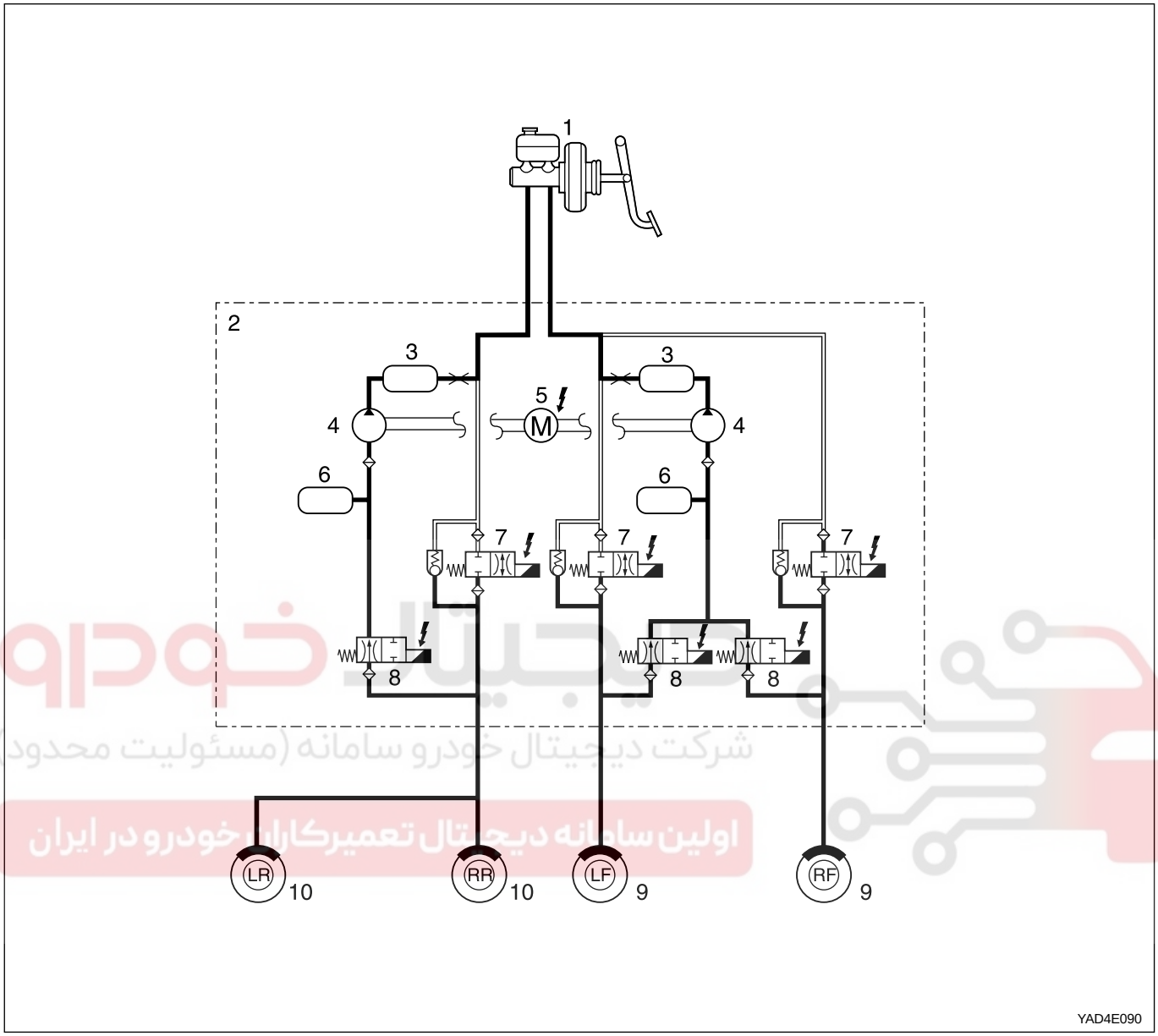
1 Master Cylinder
2 Hydraulic Modulator
3 Damper
4 Pump
5 Pump Motor
6 Accumulator
7 Inlet Valve for each wheel
8 Outlet Valve for each wheel
9 Front Wheel
10 Rear Wheel

Pressure Hold



1 Master Cylinder
2 Hydraulic Modulator
3 Damper
4 Pump
5 Pump Motor
6 Accumulator
7 Inlet Valve for each wheel
8 Outlet Valve for each wheel
9 Front Wheel
10 Rear Wheel

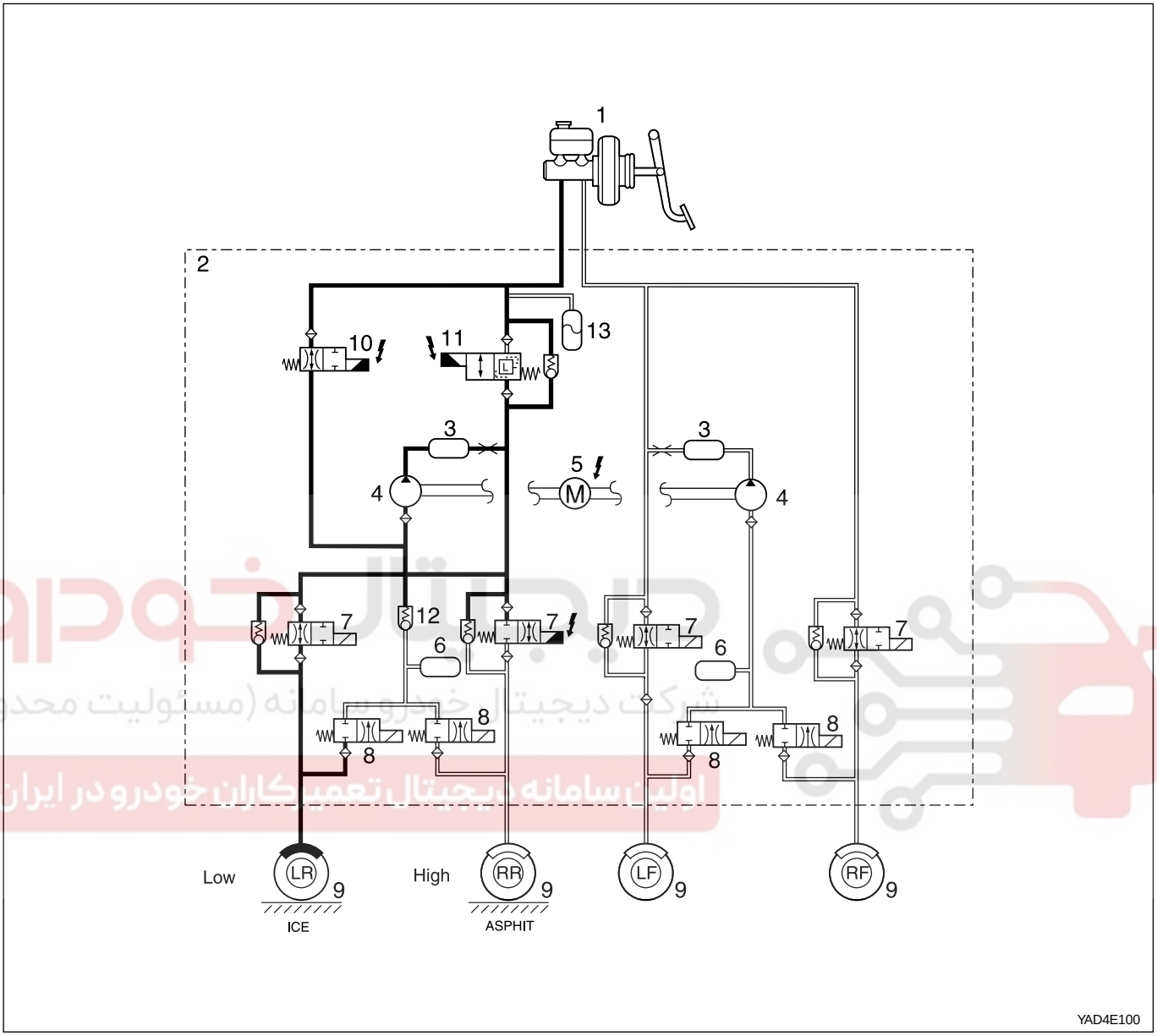
Pressure Decrease



1 Master Cylinder
2 Hydraulic Modulator
3 Damper
4 Pump
5 Pump Motor
6 Accumulator
7 Inlet Valve for each wheel
8 Outlet Valve for each wheel
9 Front Wheel
10 Rear Wheel

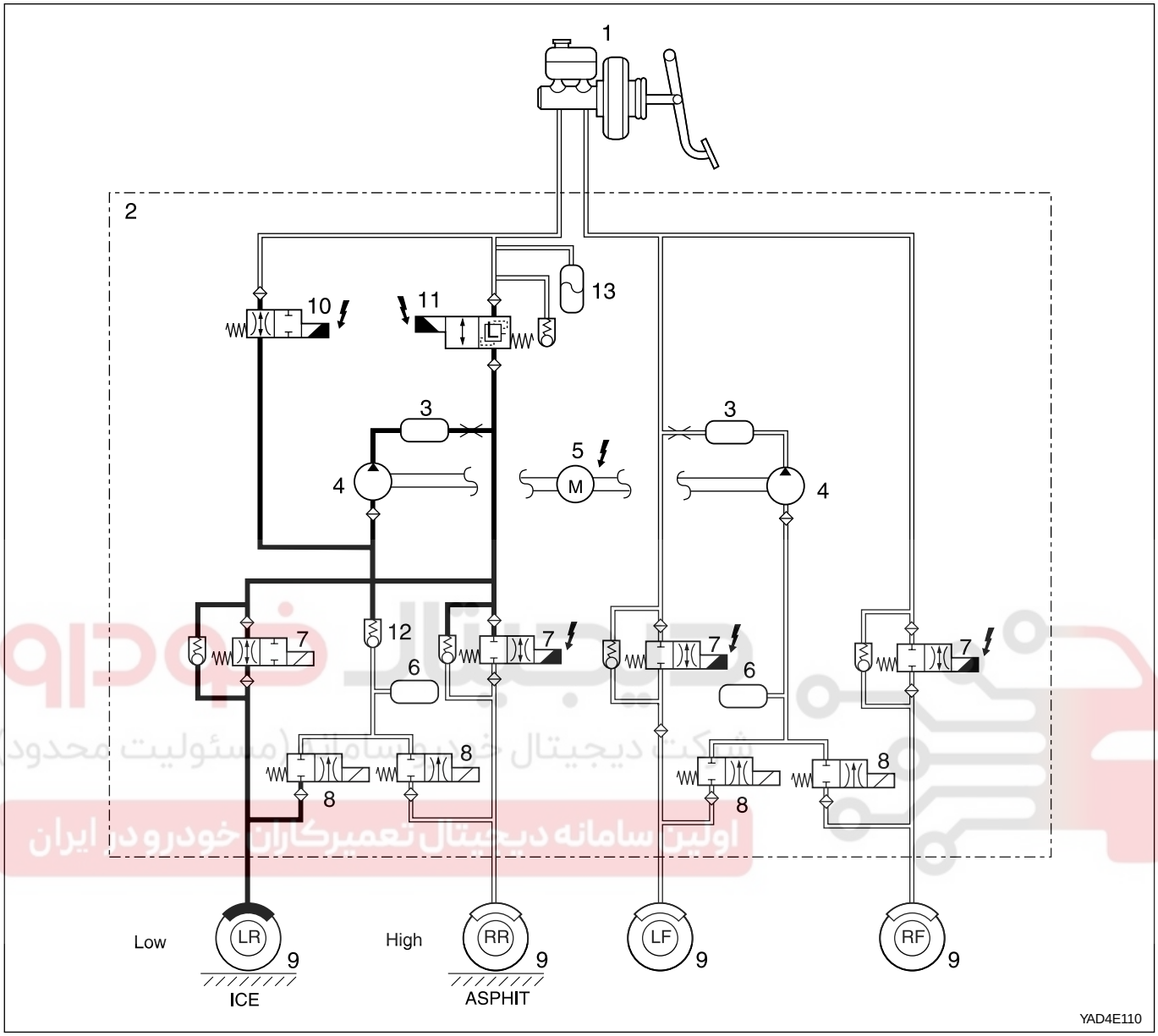
ABS/TCS 5.3

Pressure Increase



1 Master Cylinder
2 Hydraulic Modulator
3 Damper
4 Pump
5 Pump Motor
6 Accumulator
7 Inlet Valve for each wheel
8 Outlet Valve for each wheel
9 Wheel
10 Prime Valve
11 Pilot Valve
12 Check Valve
13 ISD (Integrated Suction Damper)

Pressure Hold



1 Master Cylinder
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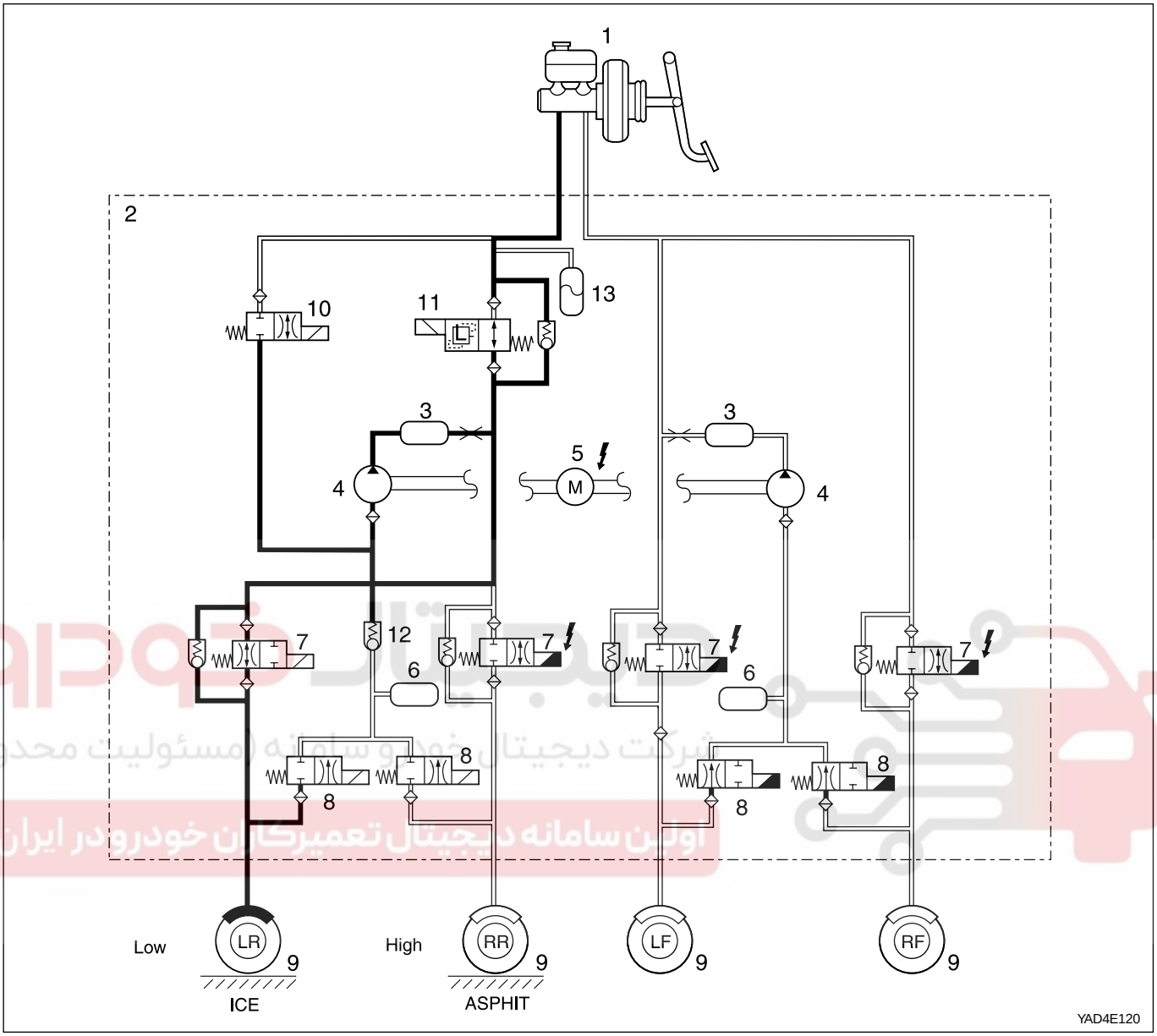
13 ISD (Integrated Suction Damper)

Pressure Decrease



1 Master Cylinder
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6 Accumulator
7 Inlet Valve for each wheel
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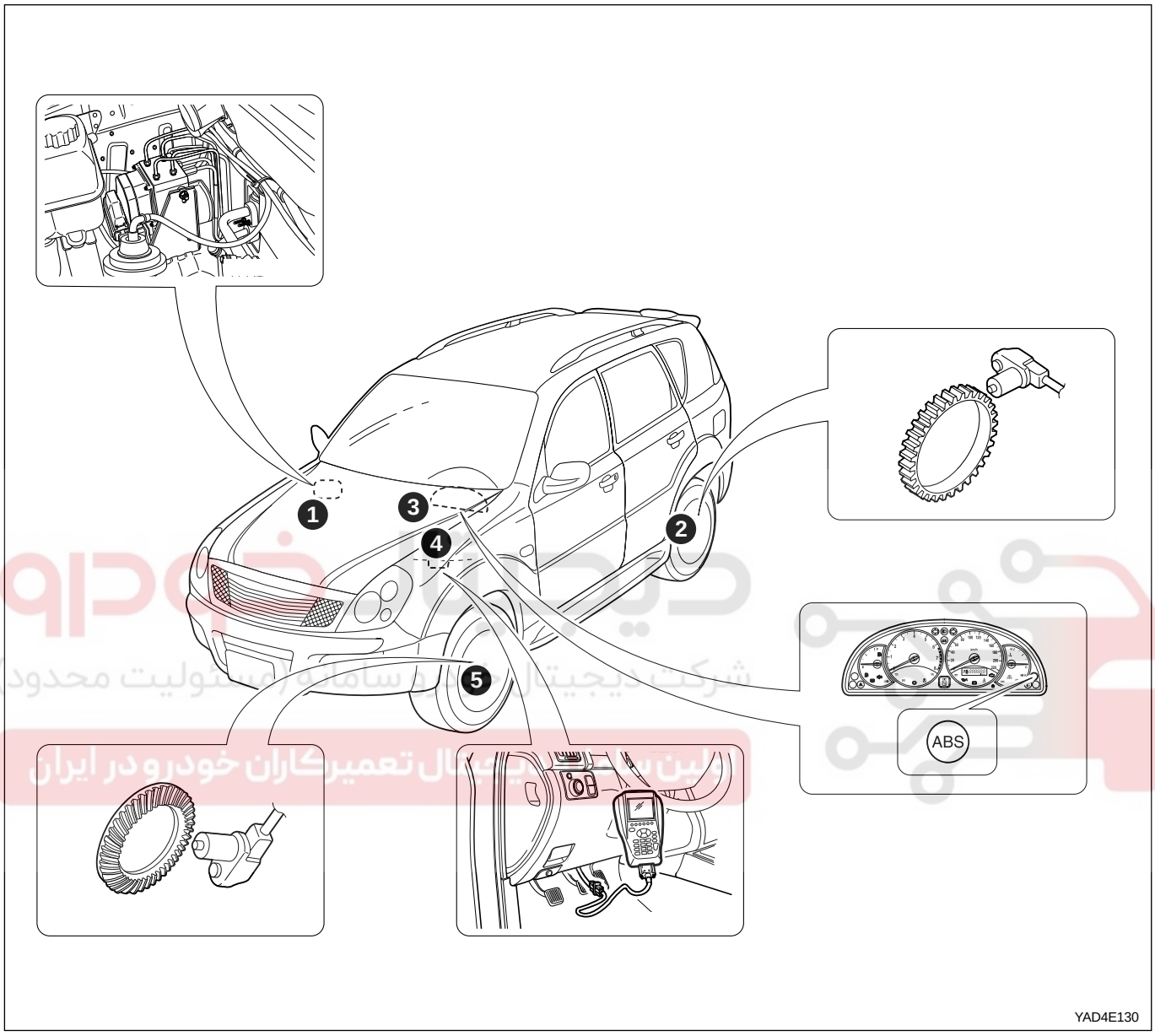
9 Wheel
10 Prime Valve
11 Pilot Valve
12 Check Valve
13 ISD (Integrated Suction Damper)

COMPONENT LOCATOR

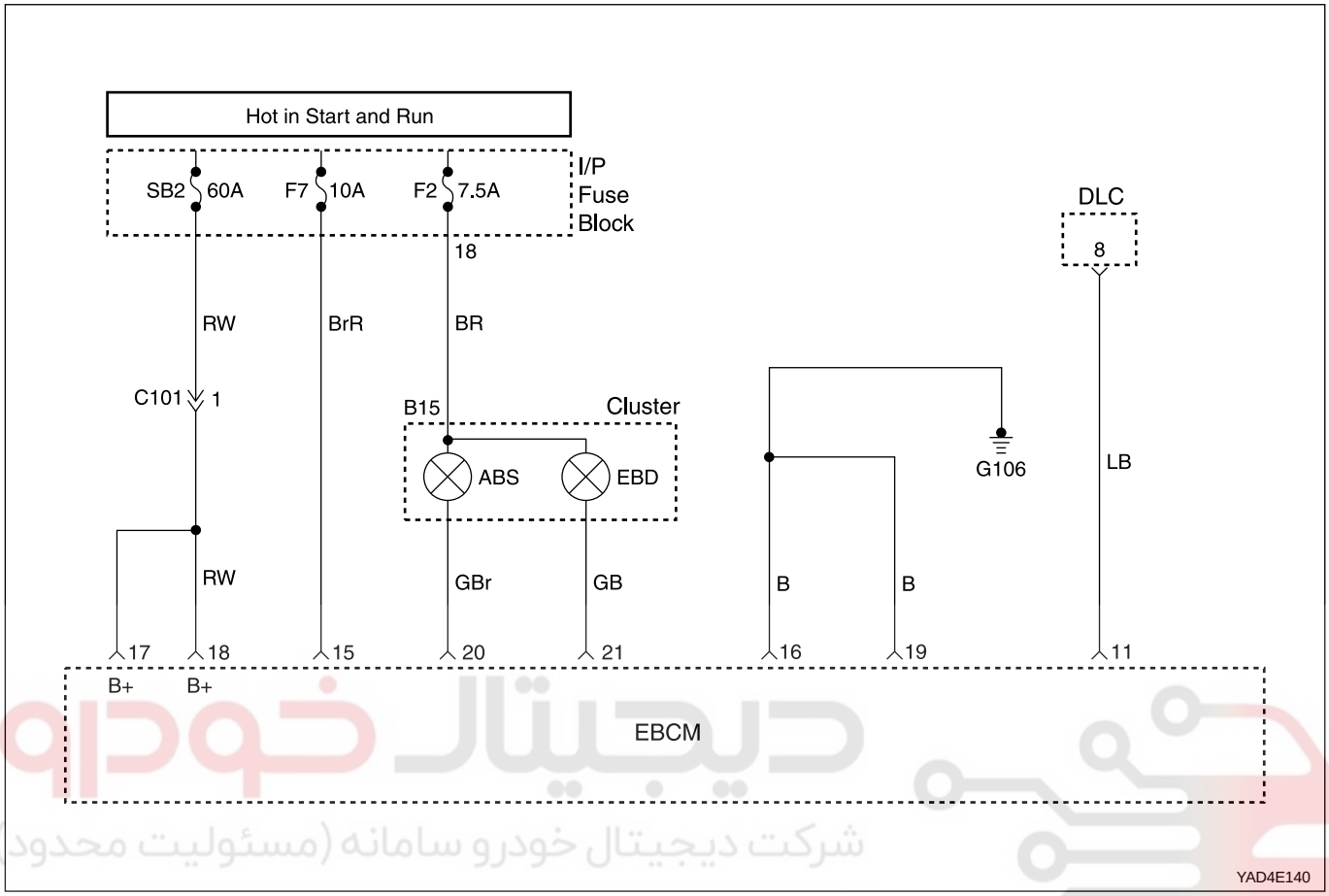
ABS, ABS/TCS 5.3



1 ABS/TCS Hydraulic Unit and Control Unit
2 Rear Wheel Speed Sensor
3 ABS Warning Indicator
4 Diagnosis connector
5 Front Wheel Speed Sensor

BLANK

DIAGNOSTIC INFORMATION AND PROCEDURES



DIAGNOSTIC CIRCUIT CHECK

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

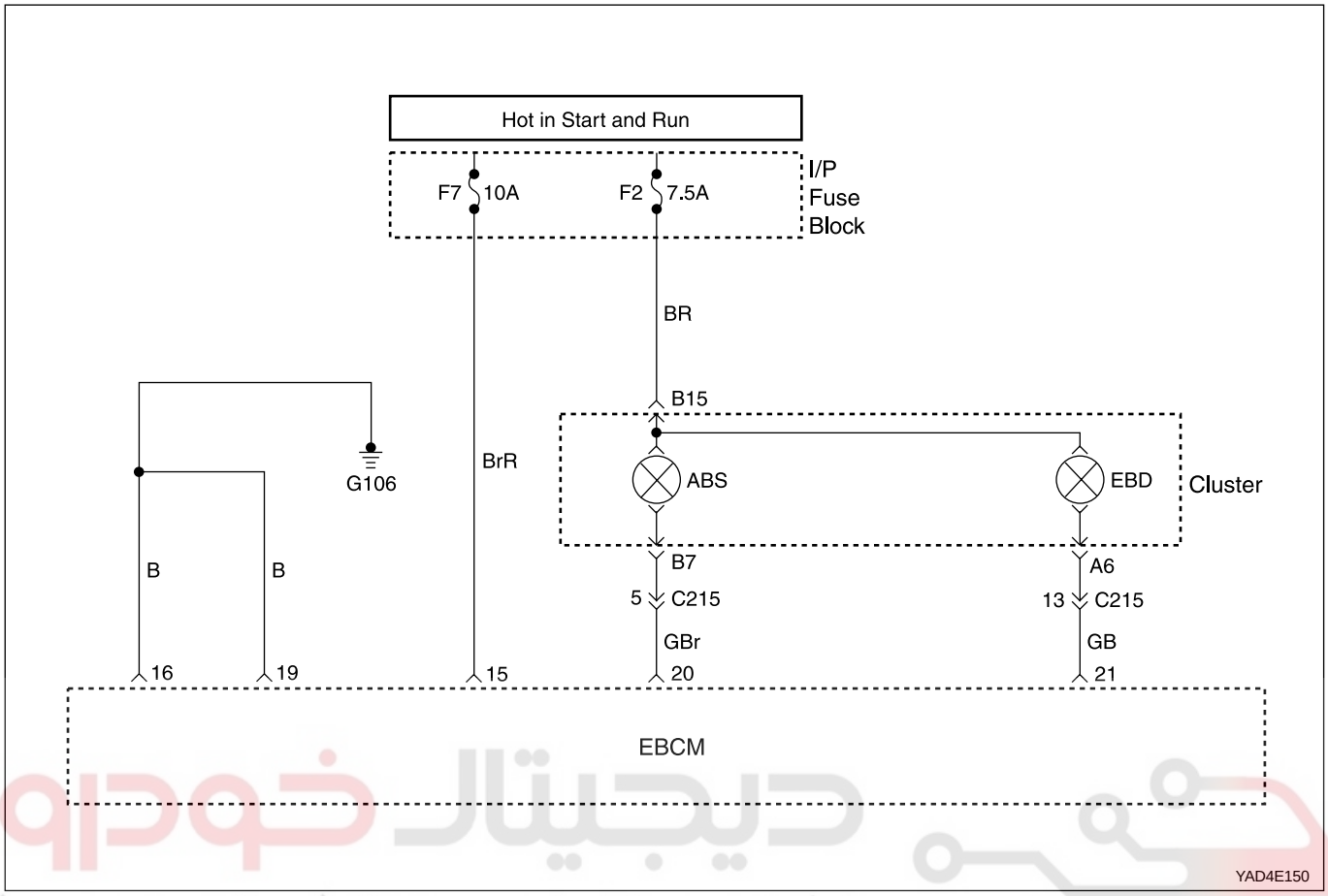
Diagnostic Process

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

1. Perform the tests of the table below.
2. Perform a road test if directed by the table.
   - Test drive the vehicle while using the snapshot feature of the scan tool.
   - Perform normal acceleration, stopping, and turning maneuvers.
   - If this does not reproduce the malfunction, perform an ABS stop or TCS maneuver on a low friction surface such as gravel.
3. Clear the diagnostic trouble codes (DTCs) after all system malfunctions have been corrected.

Diagnostic Circuit Check

Step	Action	Value	Yes	No
1	1. Install the scan tool. 2. Turn ignition switch to ON. 3. Select the Data List mode. Is the scan tool receiving data from the electronic brake control module (EBCM)?	-	Go to Step 2	Go to Step 7
2	Check the display. Are there any current DTCs displayed?	-	Refer to the applicable DTC table	Go to Step 3
3	1. Turn the ignition to LOCK for 10 seconds. 2. Turn the ignition to On and observe the ABS indicator. Does the indicator light for 2 seconds and then go off?	-	Go to Step 5	Go to Step 4
4	Check the ABS indicator. Did the ABS indicator turn on and stay on?	-	Go to “ABS Indicator Lamp Illuminated Constantly”	Go to “ABS Indicator Lamp Inoperative”
5	Check whether the vehicle is equipped with traction control. Is the vehicle equipped with traction control?	-	Go to Step 6	Go to Step 13
6	1. Turn the ignition to LOCK for 10 seconds. 2. Turn the ignition to ON and observe the TCS indicator. Does the indicator light for 2 seconds and then go off?	-	Go to Step 13	Go to “TCS Indicator Lamp Inoperative”
7	1. Turn the ignition to LOCK. 2. Disconnect the EBCM harness connector. 3. Turn the ignition to ON. 4. Use a digital voltmeter (DVM) to measure the voltage from ground to terminal 15 of the EBCM harness connector. Is the voltage equal to the specified valve?	11 - 14 V	Go to Step 8	Go to “Power Supply to Control Module, No DTCs Stored”
8	1. Turn the ignition to LOCK. 2. Use a DVM to measure the resistance from the EBCM harness connector, terminals 16 and 19 to ground. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 10	Go to Step 9
9	Repair the open in the circuit that failed. Is the repair complete?	-	System OK	-
10	Use a DVM to measure the resistance between terminal 11 of the EBCM harness connector and terminal 8 of the data link connector (DLC). Is the resistance below the specified valve?	2 Ω	Go to Step 11	Go to Step 12
11	Replace the ABS unit. Is the repair complete?	-	System OK	-
12	Repair the open or high resistance in circuit between terminal 11 of the EBCM harness connector and terminal 8 of the DLC. Is the repair complete?	-	Go to Step 1	-
13	Perform the road test described above. Are any DTC set?	-	Go to the DTC table	System OK



ABS INDICATOR LAMP INOPERATIVE

Circuit Description

Battery voltage is supplied to the ABS lamp with the ignition switch in the ON or START positions. The warning lamp can be activated only by the ABS control module internally supplying ground to terminal 20 or by the shorting bar in the ABS module connector if the connector in disconnected from the module.

Diagnosis

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

Cause

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

Test Description

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

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

19. This begins a series of tests of the voltage supply circuits that power the indicator lamp.

ABS Indicator Lamp Inoperative

Step	Action	Value	Yes	No
1	Install the scan tool and check for any DTCs. Is any DTC set?	-	Go to the DTC table	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Disconnect the scan tool. 3. Turn the ignition to ON. 4. Observe the ABS indicator lamp. Does the lamp illuminate for about 2 seconds, then turn off?	-	Go to “Intermittent and Poor Connections”	Go to Step 3
3	With the ignition still ON, observe the oil pressure lamp. Is the oil pressure lamp illuminated?	-	Go to Step 4	Go to Step 19
4	1. Turn the ignition to LOCK. 2. Disconnect the connector from the electronic brake control module (EBCM). 3. Turn the ignition switch to ON. Does the ABS indicator illuminate?	-	Go to Step 5	Go to Step 8
5	1. Turn the ignition to LOCK. 2. Examine terminals 16 and 20 at the EBCM connector on both the ABS wiring harness and on the EBCM. Is there a poor connection at any of these terminals?	-	Go to Step 6	Go to Step 7
6	Repair the faulty terminals or replace the ABS unit, as required. Is the repair complete?	-	System OK	-
7	Replace the ABS unit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to LOCK. 2. Disconnect the wire from the negative battery terminal. 3. Measure the resistance between the negative battery wire, which is attached to ground, and the shorting bar in the EBCM connector. Is the resistance equal to the specified valve?	≈ 0 Ω	Go to Step 10	Go to Step 9
9	Repair the open or high resistance in the circuit from EBCM connector, terminal 16 to ground G106. Is the repair complete?	-	System OK	-
10	1. Remove the I/P cluster. 2. Remove and check the ABS indicator bulb. Is the bulb burned out?	-	Go to Step 11	Go to Step 12
11	1. Replace the ABS indicator bulb. 2. Install the I/P cluster. Is the repair complete?	-	System OK	-
12	Check the continuity at the I/P cluster connector terminal B7. Is the continuity equal to the specified value?	≈ 0 Ω	Go to Step 14	Go to Step 13
13	Repair the contact at the I/P cluster connector terminal B7. Is the repair complete?	-	System OK	-

ABS Indicator Lamp Inoperative (Cont'd)

Step	Action	Value	Yes	No
14	Check the wiring harnesses and the connectors in circuit from the I/P cluster terminal B7 to terminal 20 of the EBCM connector. Is the voltage equal to the specified value?	∞	Go to Step 15	Go to Step 16
15	Repair the open or the resistance found. Is the repair complete?	-	System OK	-
16	Check for continuity between terminal 16 of the EBCM connector and ground G106. Is the continuity equal to the specified value?	≈ 0 Ω	Go to Step 10	Go to Step 9
17	Replace the ABS unit. Is the repair complete?	-	System OK	-
18	Repair the continuity problem between terminal 16 of the EBCM connector and ground G106. Is the repair complete?	-	System OK	-
19	1. Turn the ignition to LOCK. 2. Check fuse F2 in the I/P fuse block. Is fuse F2 blown?	-	Go to Step 20	Go to Step 21
20	Replace fuse F2. Is the repair complete?	-	System OK	-
21	1. Turn the ignition on. 2. Check the voltage at Fuse 2. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 22	Go to Step 21
22	Repair the power supply to Fuse 2. Is the repair complete?	-	System OK	-
23	1. Remove the instrument cluster. 2. Check the circuit from fuse F2 to terminal B15 of the I/P cluster connector. 3. Repair any open or high resistance found in a wiring harness, splice pack, or connector. Is the repair complete?	-	System OK	-

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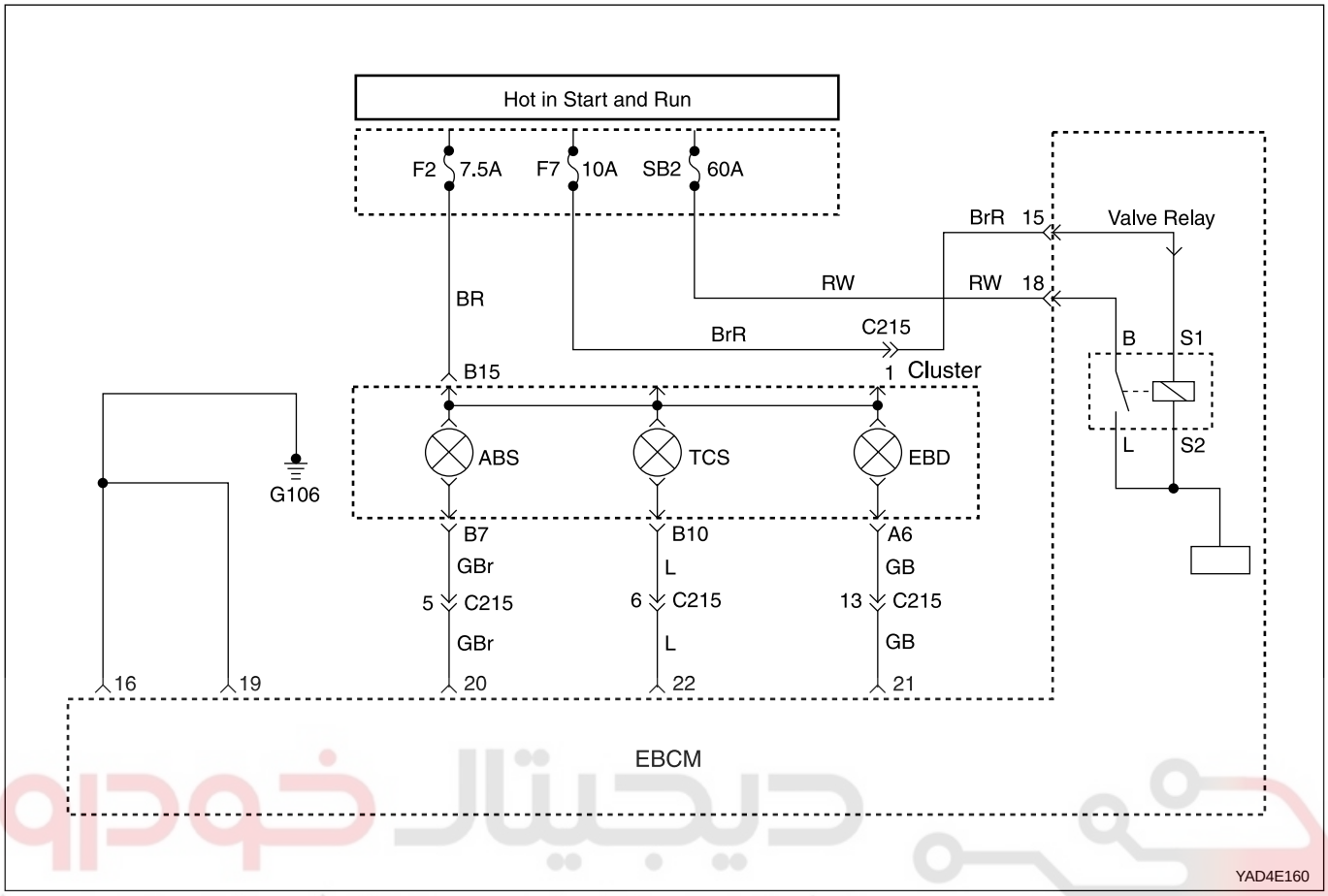

TRACTION CONTROL SYSTEM (TCS) INDICATOR LAMP INOPERATIVE

Circuit Description

Battery voltage is supplied to the TCS warning lamp with the ignition in ON or START. The warning lamp can be activated only by the ABS control module internally supplying ground to terminal 22.

Diagnosis

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

Cause

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

Test description

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

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

19. This begins a series of tests of the voltage supply circuits that power the indicator lamp.

Traction Control System (TCS) Indicator Lamp Inoperative

Step	Action	Value	Yes	No
1	Install the scan tool and check for any DTCs. Is any DTC set?	-	Go to the DTC table	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Disconnect the scan tool. 3. Turn the ignition to ON. 4. Observe the TCS indicator lamp. Does the lamp illuminate for about 2 seconds, then turn off?	-	Go to “Intermittent and Poor Connections”	Go to Step 3
3	With the ignition still ON, observe the oil pressure lamp. Is the oil pressure lamp illuminated?	-	Go to Step 4	Go to Step 19
4	1. Turn the ignition to LOCK. 2. Disconnect the connector from the EBCM. 3. Connect a jumper form terminal 22 to the grounding bar in the connector. 4. Turn the ignition to ON. Does the TCS indicator illuminate?	-	Go to Step 5	Go to Step 8
5	1. Turn the ignition to LOCK. 2. Examine terminals 16, 19 at the EBCM connector on both the ABS wiring harness and on the EBCM. Is there a poor connection at any of these terminals?	-	Go to Step 6	Go to Step 7
6	Repair the faulty terminals or replace the ABS unit, as required. Is the repair complete?	-	System OK	-
7	Replace the ABS unit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to LOCK. 2. Disconnect the wire from the negative battery terminal. 3. Measure the resistance between the negative battery wire, which is attached to ground, and the shorting bar in the EBCM connector. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 10	Go to Step 9
9	Repair the open or high resistance in the circuit from EBCM connector, terminal 16, 19 to ground G106. Is the repair complete?	-	System OK	-
10	1. Remove the I/P cluster. 2. Remove and check the TCS indicator bulb. Is the bulb burned out?	-	Go to Step 11	Go to Step 12
11	1. Replace the TCS indicator bulb. 2. Replace the I/P cluster. Is the repair complete?	-	System OK	-
12	Check continuity at the I/P cluster connector terminal B10. Is the continuity equal to the specified value?	≈ 0 Ω	Go to Step 14	Go to Step 13
13	Repair the contact at the I/P cluster connector terminal B10. Is the repair complete?	-	System OK	-

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

Step	Action	Value	Yes	No
14	Check the wiring harnesses and connectors in circuit from the I/P cluster terminal B10 to terminal 22 of the EBCM connector. Is the voltage equal to the specified value?	0 Ω	Go to Step 15	Go to Step 16
15	Repair the open or high resistance. Is the repair complete?	-	System OK	-
16	Check for continuity between terminal 16, 19 of the ABS connector and ground G106. Is the continuity equal to the specified value?	0 Ω	Go to Step 17	Go to Step 18
17	Replace the ABS unit. Is the repair complete?	-	System OK	-
18	Repair the continuity between terminal 16, 19 of the EBCM connector and ground G106. Is the repair complete?	-	System OK	-
19	1. Turn the ignition to LOCK. 2. Check fuse F2 in the I/P fuse block. Is fuse F2 blown?	-	Go to Step 20	Go to Step 21
20	Replace fuse F2. Is the repair complete?	-	System OK	-
21	1. Turn the ignition ON. 2. Check the voltage at fuse F2. Is the voltage equal to the specifies value?	11 - 14 V	Go to Step 22	Go to Step 23
22	Repair the power supply to fuse F2. Is the repair complete?	-	System OK	-
23	1. Remove the I/P cluster. 2. Check circuit from fuse F2 to terminal 15 of the I/P cluster connector. 3. Repair any open or high resistance found in a wiring harness, a splice pack, or a connector. Is the repair complete?	-	System OK	-

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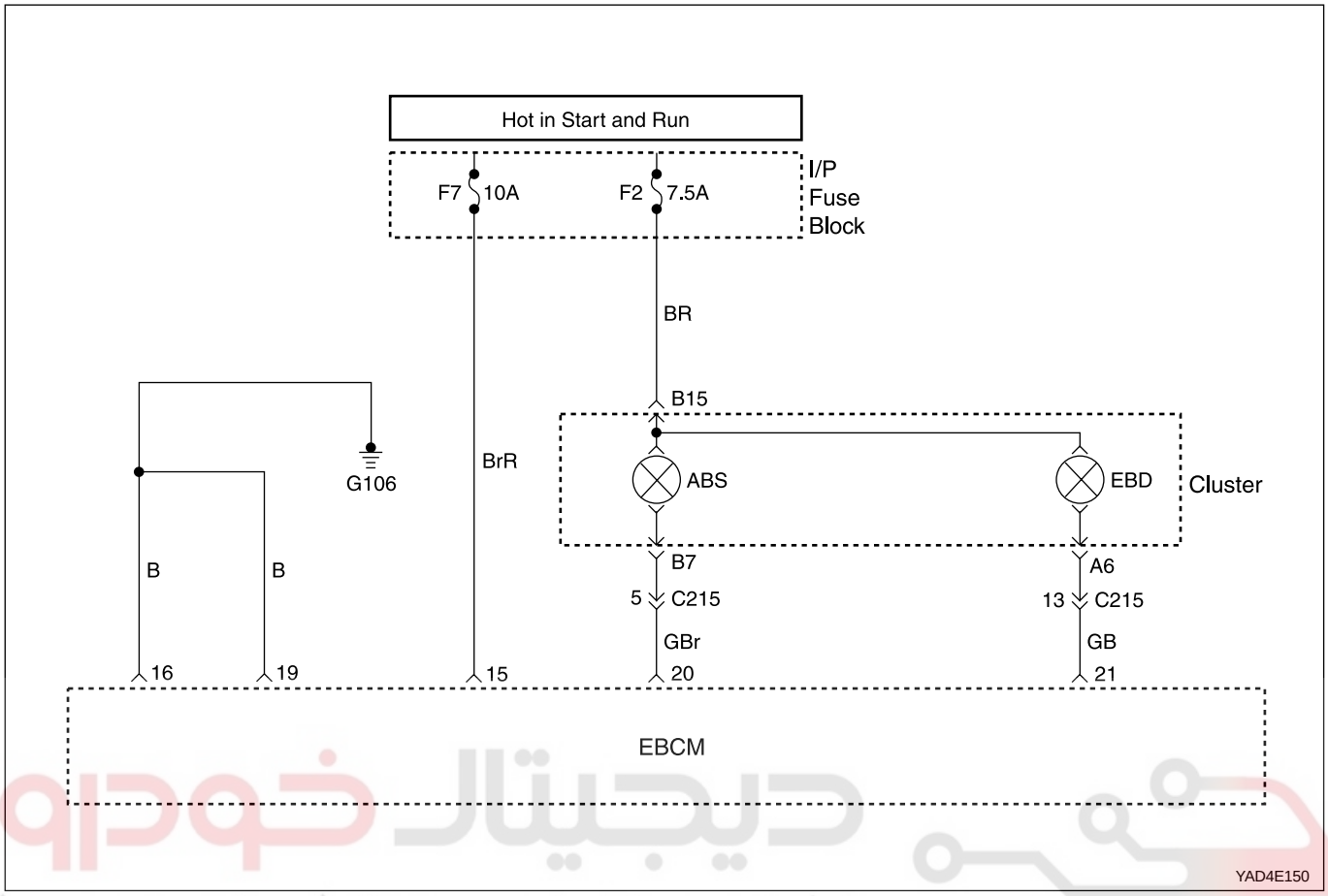

ELECTRONIC BRAKE-FORCE DISTRIBUTION SYSTEM (EBD) INDICATOR LAMP INOPERATIVE

Circuit Description

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

Diagnosis

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

Cause

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

Test Description

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

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

19. This begins a series of tests of the voltage supply circuits that power the indicator lamp.

Electronic Brake-Force Distribution System (EBD) Indicator Lamp Inoperative

Step	Action	Value	Yes	No
1	Install the scan tool and check for any DTCs. Is any DTC set?	-	Go to the DTC table	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Disconnect the scan tool. 3. Turn the ignition to ON. 4. Observe the EBD indicator lamp Does the lamp illuminate for about 2 seconds, then turn off?	-	Go to “Intermittent and Poor Connections”	Go to Step 3
3	With the ignition still ON, observe the oil pressure lamp. Is the oil pressure lamp illuminated?	-	Go to Step 4	Go to Step 19
4	1. Turn the ignition to LOCK. 2. Disconnect the connector from the EBCM. 3. Connect a jumper form terminal 16, 19 to the grounding bar in the connector. 4. Turn the ignition to ON. Does the EBD indicator illuminate?	-	Go to Step 5	Go to Step 8
5	1. Turn the ignition to LOCK. 2. Examine terminals 16, 19 and 28, 29 at the EBCM connector on both the ABS wiring harness and on the EBCM. Is there a poor connection at any of these terminals?	-	Go to Step 6	Go to Step 7
6	Repair the faulty terminals or replace the ABS unit, as required. Is the repair complete?	-	System OK	-
7	Replace the ABS unit. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to LOCK. 2. Disconnect the wire from the negative battery terminal. 3. Measure the resistance between the negative battery wire, which is attached to ground, and the shorting bar in the EBCM connector. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 10	Go to Step 9
9	Repair the open or high resistance in the circuit from EBCM connector, terminal 16, 19 to ground G106. Is the repair complete?	-	System OK	-
10	1. Remove the I/P cluster. 2. Remove and check the EBD indicator bulb. Is the bulb burned out?	-	Go to Step 11	Go to Step 12
11	1. Replace the EBD indicator bulb. 2. Replace the I/P cluster. Is the repair complete?	-	System OK	-
12	Check continuity at the I/P cluster connector terminal A6. Is the continuity equal to the specified value?	≈ 0 Ω	Go to Step 14	Go to Step 13
13	Repair the contact at the I/P cluster connector terminal A6. Is the repair complete?	-	System OK	-

Electronic Brake-Force Distribution System (EBD) Indicator Lamp Inoperative (Cont'd)

Step	Action	Value	Yes	No
14	Check the wiring harnesses and connectors in circuit from the I/P cluster terminal A6 to terminal 21 of the EBCM connector. Is the voltage equal to the specified value?	∞	Go to Step 15	Go to Step 16
15	Repair the open or high resistance. Is the repair complete?	-	System OK	-
16	Check for continuity between terminal 16, 19 of the ABS connector and ground G106. Is the continuity equal to the specified value?	≈ 0 Ω	Go to Step 17	Go to Step 18
17	Replace the ABS unit. Is the repair complete?	-	System OK	-
18	Repair the continuity between terminal 16, 19 of the EBCM connector and ground G106. Is the repair complete?	-	System OK	-
19	1. Turn the ignition to LOCK. 2. Check fuse F2 in the I/P fuse block. Is fuse F2 blown?	-	Go to Step 20	Go to Step 21
20	Replace fuse F2. Is the repair complete?	-	System OK	-
21	1. Turn the ignition ON. 2. Check the voltage at fuse F2. Is the voltage equal to the specifies value?	11 - 14 V	Go to Step 22	Go to Step 23
22	Repair the power supply to fuse F2. Is the repair complete?	-	System OK	-
23	1. Remove the I/P cluster. 2. Check circuit from fuse F2 to terminal 15 of the I/P cluster connector. 3. Repair any open or high resistance found in a wiring harness, a splice pack, or a connector. Is the repair complete?	-	System OK	-

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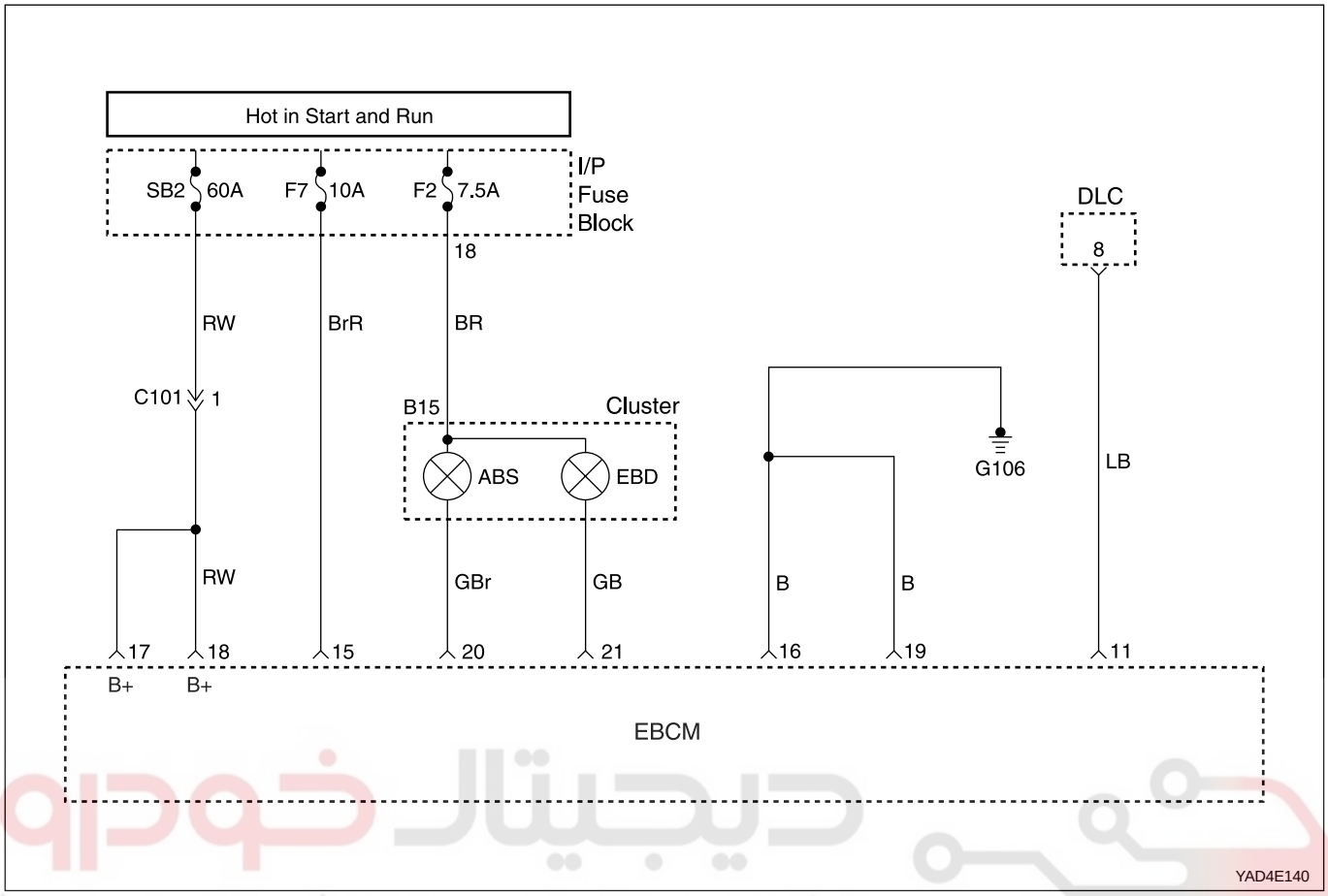

POWER SUPPLY TO CONTROL MODULE, NO DTCS STORED

Circuit Description

Battery voltage is supplied to the electronic brake control module (EBCM) through fuse F3 and F2 in the I/P fuse block, to terminal 15 and 20 of the EBCM connector. The voltage is present when the ignition switch is in ON or START.

Diagnosis

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

Cause

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

Action Taken When the DTC Sets

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

Test Description

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

1. This step determines whether there is voltage at the battery and the high current source.
7. This step checks for voltage at the ignition 1 source.

Diagnostic Aids

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

Power Supply to Control Module, No DTCs Stored

Step	Action	Value	Yes	No
1	Check the voltage at the battery. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 3	Go to Step 2
2	Charge or replace the battery, as required. Is the repair complete?	-	System OK	-
3	Check fuse F7 in the I/P fuse block. Is the fuse blown?	-	Go to Step 4	Go to Step 8
4	1. Replace fuse F7. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to Step 6	Go to Step 5
5	Check the ABS function. Is the repair complete?	-	System OK	-
6	1. Turn the ignition to OFF. 2. Remove fuse F7. 3. Disconnect the ABS connector from the EBCM. 4. Measure the resistance to ground at terminals 15. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to Step 7	Go to Step 26
7	Repair the short to ground in circuit between F7 and the ABS harness EBCM connector. Is the repair complete?	-	System OK	-
8	1. Turn the ignition to ON. 2. Check the voltage at fuse F2. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 10	Go to Step 9
9	Repair the power supply to fuse 2. Is the repair complete?	-	System OK	-
10	Check fuse F2 in the I/P fuse block. Is the fuse F2 blown?	-	Go to Step 14	Go to Step 18
11	1. Replace fuse F2. 2. Turn the ignition to ON. Does the fuse blow again?	-	Go to Step 13	Go to Step 12
12	Check the ABS function. Is the repair complete?	-	System OK	-
13	1. Turn the ignition to OFF. 2. Remove fuse F2. 3. Disconnect the ABS connector from the EBCM. 4. Measure the resistance between ground and terminal 20. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 14	Go to Step 13
14	Repair the short to ground in circuit fuse F2 of the I/P fuse block and terminal 20 of the ABS harness EBCM connector. Is the repair complete?	-	System OK	-
15	1. Disconnect the EBCM connector from the EBCM. 2. Turn the ignition to ON. 3. Check for the presence of battery voltage between ground and terminal 17, 18. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 10	Go to Step 9

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

Step	Action	Value	Yes	No
16	1. Turn the ignition switch to OFF. 2. Trace the RW wires between terminal 15 of the EBCM connector to fuse F7 of the I/P fuse block. 3. Repair the open in this circuit. Is the repair complete?	-	System OK	-
17	Check the voltage between ground and terminal 20 of the EBCM connector. Is the voltage equal to the specified value?	11 - 14 V	Go to Step 19	Go to Step 18
18	1. Turn the ignition switch to OFF. 2. Check the resistance between ground and terminals 16 of the EBCM connector. Is the resistance equal to the specified value?	-	System OK	-
19	1. Turn the ignition to OFF 2. Check the resistance between ground and terminals 16 of the EBCM connector. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 20	Go to Step 23
20	Examine terminals 15, 20, 16 of the EBCM connector. Is there a defective terminal?	-	Go to Step 21	Go to Step 22
21	Repair the defective terminal or replace the connector or wiring harness, as required. Is the repair complete?	-	System OK	-
22	Replace the ABS unit. Is the repair complete?	-	System OK	-
23	Repair the defective ground connection. Is the repair complete?	-	System OK	-

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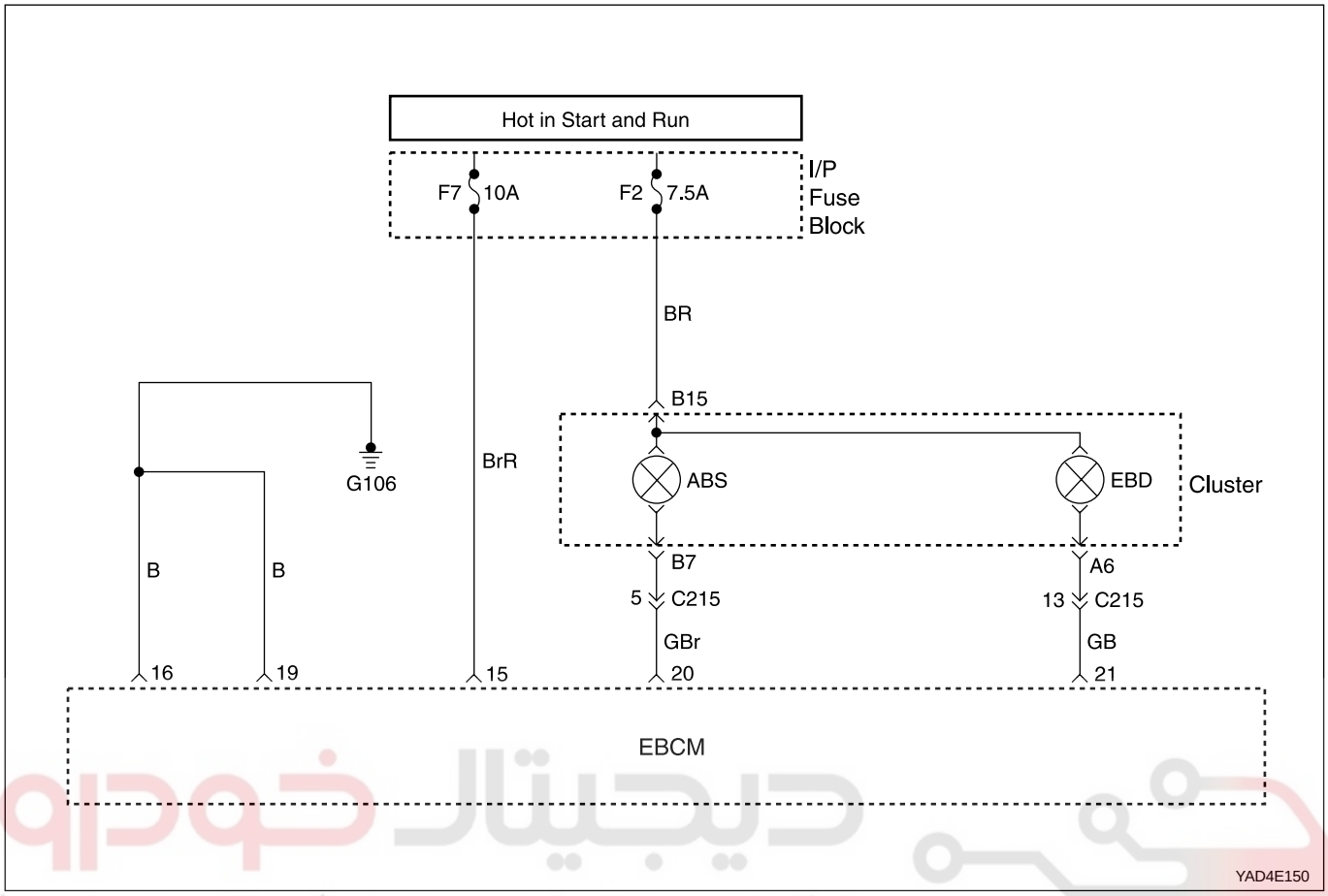

ABS INDICATOR LAMP ILLUMINATED CONTINUOUSLY, NO DTCS STORED

Circuit Description

Battery voltage is supplied to the ABS warning lamp with the ignition in ON or START. The warning lamp should be activated only by the ABS control module internally supplying ground to terminal 20.

Diagnosis

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

Cause

- There is a short to ground in the circuit between the cluster terminal D7 and the EBCM terminal 31.
- The EBCM is faulty.

ABS Indicator Lamp Illuminated Continuously, No DTCs Stored

Step	Action	Value	Yes	No
1	Check the EBCM connector. Is it connected properly?	-	Go to Step 3	Go to Step 2
2	Connect the EBCM connector. Is the repair complete?	-	System OK	-
3	1. Disconnect the EBCM connector. 2. Turn the ignition to ON. 3. Use an insulated tool to push the shorting bar in the connector away from terminal 20. Does the ABS indicator lamp go out?	-	Go to Step 4	Go to Step 5
4	Replace the ABS unit Is the repair complete?	-	System OK	-
5	Repair the short to ground in circuit Lg between I/P cluster connector B7 and terminal 20 EBCM. Is the repair complete?	-	System OK	-

SELF-DIAGNOSTICS

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

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

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

DISPLAYING DTCs

Tools Required

Scan Tool

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

CLEARING DTCs

Tool Required

Scan Tool

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

- Use the scan tool “Clear DTCs” selection.
- After 249 DTC-free ignition cycles.

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

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

Scan Tool Method

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

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

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

Ignition Cycle Default

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

INTERMITTENT AND POOR CONNECTIONS

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

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

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

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