BRAKE CONTROL SYSTEM

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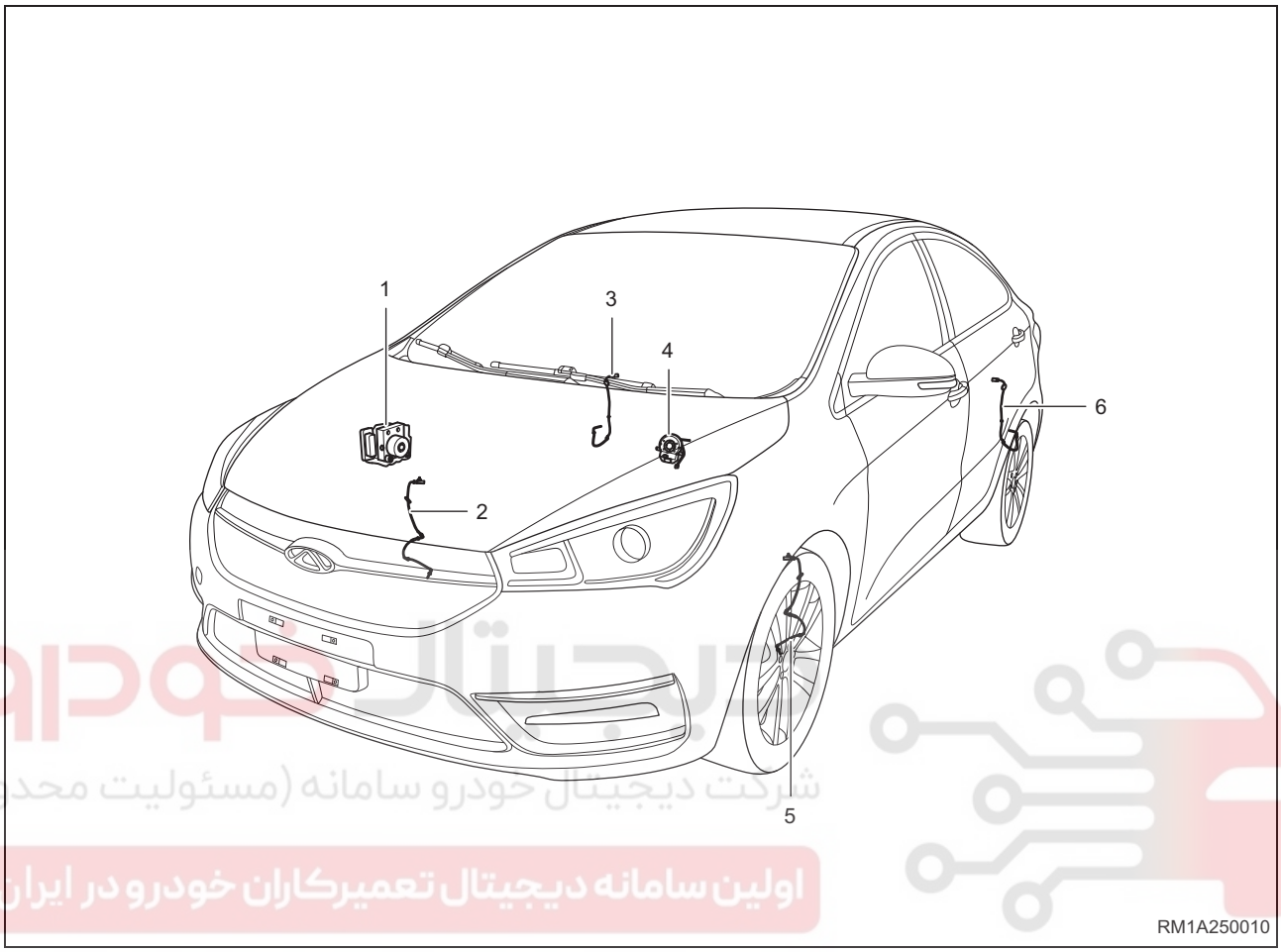
GENERAL INFORMATION

Description



1 - ABS/ESP Control Module Assembly	2 - Front Right Wheel Speed Sensor
3 - Rear Right Wheel Speed Sensor	4 - Steering Angle Sensor
5 - Front Left Wheel Speed Sensor	6 - Rear Left Wheel Speed Sensor

Brake control system equipped on this model is ABS (Anti-lock Brake System) + EBD (Electronic Brake Force Distribution) or ESP (Electronic Stability Program). It mainly consists of following components:

- ABS/ESP control module assembly (hydraulic control module and electronic control module)
- Wheel speed sensors (each wheel has one sensor)
- Steering angle sensor (if equipped with ESP)
- Yaw rate sensor (if equipped with ESP) (built in SRS control module assembly)

Primary purpose of ABS is to prevent wheels from being locked during sudden braking. It has following effects:

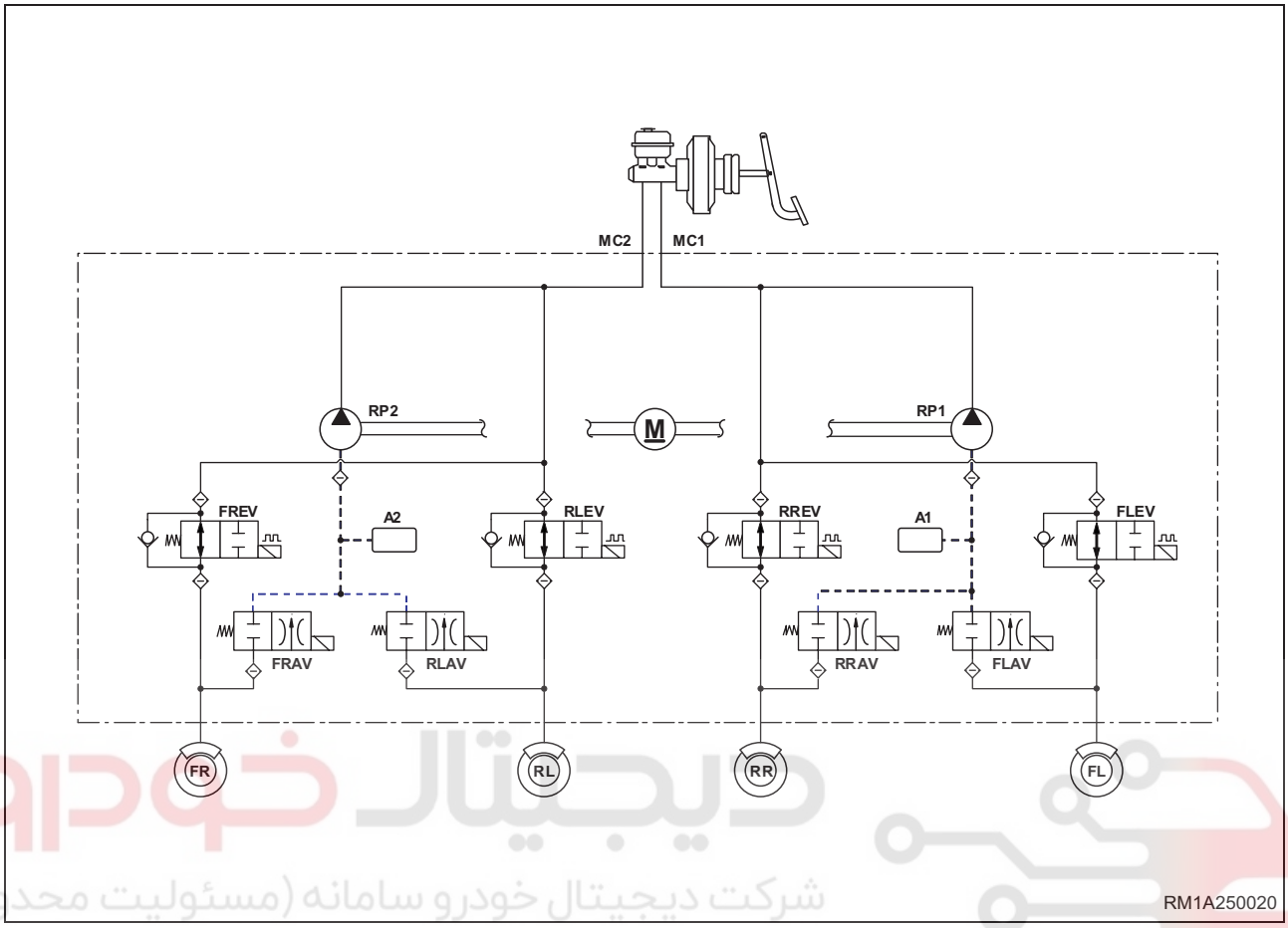
1. Improving vehicle driving stability.
2. Improving vehicle steering ability.
3. Maintaining optimal brake pressure.
4. Shortening brake distance efficiently.

Operation

ABS Braking

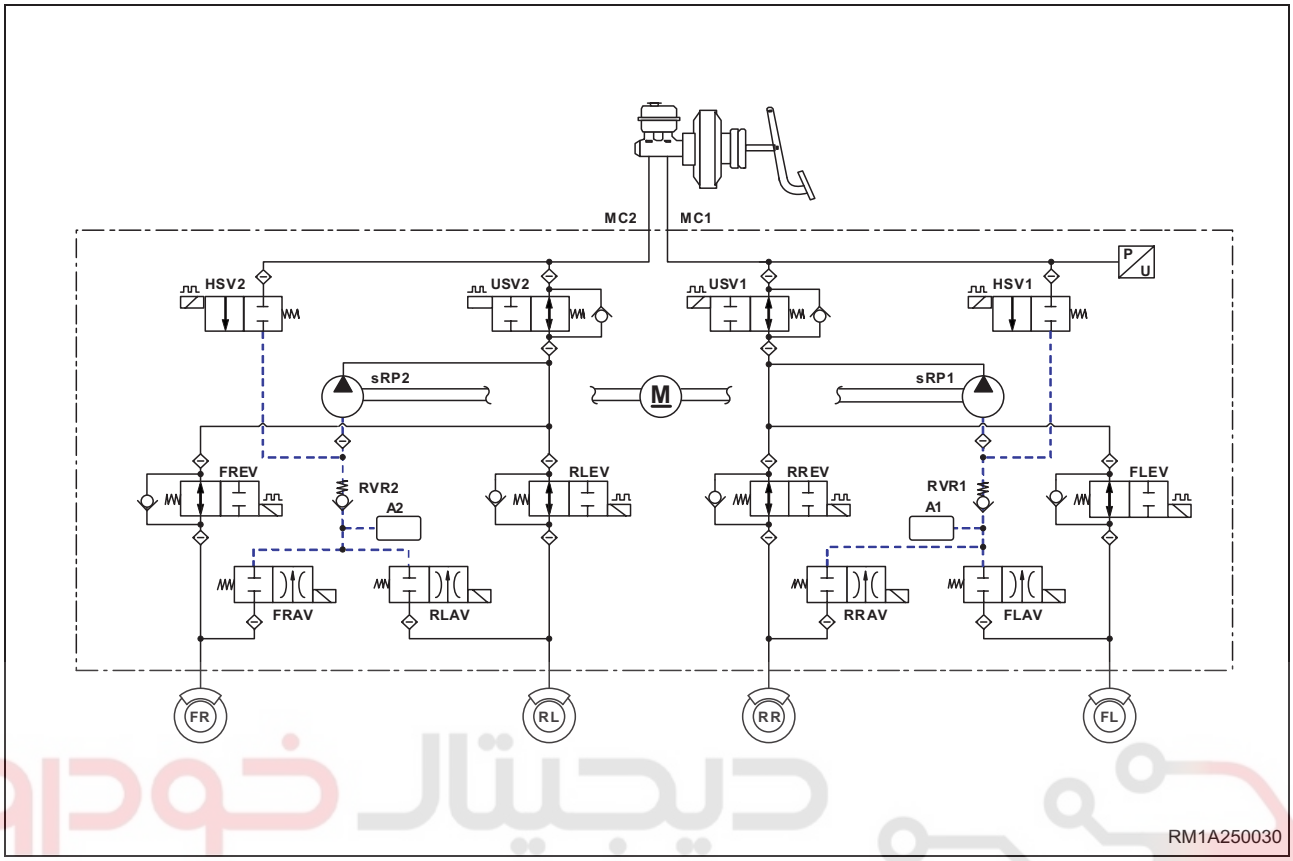
1. If ABS system detects that wheels may be locked when applying brake, brake system will enter ABS braking mode. During braking, ABS/ESP control module outputs signals from each wheel speed sensor to each solenoid valve after analysis and processing in order to adjust fluid pressure in each line, to prevent wheels from being locked.
2. There are some operating symptoms of ABS/ESP that seem to be abnormal at first, but in fact they are normal. Symptoms are as follows:
   a. If electronic control module is malfunctioning, fail-safe function will be activated, ABS/ESP system will not operate and ABS/ESP warning light will come on.
   b. After vehicle is powered on or engine is started, short "buzz" sound can be heard. This is normal sound from ABS/ESP self-check.
   c. Motor, solenoid valve, and return pump movement in hydraulic unit will make noise when ABS/ESP is operating normally, but this is normal.
   d. Brake pedal may vibrate slightly and mechanical noise can be heard during ABS/ESP operation, but this is normal.
   e. Bumping sound between suspension and vehicle body can be caused by sudden braking.

ABS Control Mode



Description	Definition	Description	Definition
MC1	Brake Master Cylinder Circuit 1	FR	Front Right Wheel
MC2	Brake Master Cylinder Circuit 2	FLEV	Front Left Wheel Inlet Valve
M	Motor	FLAV	Front Left Wheel Outlet Valve
RP1	Return Pump 1	FREV	Front Right Wheel Inlet Valve
RP2	Return Pump 2	FRAV	Front Right Wheel Outlet Valve
A1	Accumulator 1	RLEV	Rear Left Wheel Inlet Valve
A2	Accumulator 2	RLAV	Rear Left Wheel Outlet Valve
FL	Front Left Wheel	RREV	Rear Right Wheel Inlet Valve
RR	Rear Right Wheel	RRAV	Rear Right Wheel Outlet Valve
RL	Rear Left Wheel		

ESP Control Mode



Description	Definition	Description	Definition
MC1	Brake Master Cylinder Circuit 1	FLAV	Front Left Wheel Outlet Valve
MC2	Brake Master Cylinder Circuit 2	FREV	Front Right Wheel Inlet Valve
M	Motor	FRAV	Front Right Wheel Outlet Valve
RP1	Return Pump 1	RLEV	Rear Left Wheel Inlet Valve
RP2	Return Pump 2	RLAV	Rear Left Wheel Outlet Valve
A1	Accumulator 1	RREV	Rear Right Wheel Inlet Valve
A2	Accumulator 2	RRAV	Rear Right Wheel Outlet Valve
FL	Front Left Wheel	HSV1	High Pressure Valve 1
RR	Rear Right Wheel	HSV2	High Pressure Valve 2
RL	Rear Left Wheel	USV1	Guide Valve 1
FR	Front Right Wheel	USV2	Guide Valve 2
FLEV	Front Left Wheel Inlet Valve	P/U	Pressure Sensor

Normal Brake Operating Condition

For vehicles equipped with ABS, if brake pressure applied to wheels is not enough to lock wheels, fluid pressure generated by master cylinder will be transmitted to wheel cylinder through normal open valve, producing regular braking effect. When further braking is not necessary and driver reduces pressure acting on brake pedal, brake fluid of each wheel will return to master cylinder and brake pressure decreases.

Solenoid Valve	Powered Condition	Solenoid Valve Condition
Normal Open Valve	OFF	OPEN
Normal Close Valve	OFF	CLOSE

ABS Operating (Relief) Condition

For vehicles equipped with ABS, if brake pressure is applied excessively, friction coefficient between wheels and road will decrease, and wheels will decelerate earlier than vehicle would, which could cause wheels to lock first. In this case, ABS/ESP control module commands hydraulic control module to reduce wheel pressure. As a result, normal open valve shuts off its passage and the passage of normal close valve is opened, in order to reduce wheel cylinder pressure. At this time, brake fluid drained from wheel cylinder is temporarily stored in low pressure accumulator. Then, the brake fluid stored in low pressure accumulator returns to master cylinder with rotation of motor.

Solenoid Valve	Powered Condition	Solenoid Valve Condition
Normal Open Valve	ON	CLOSE
Normal Close Valve	ON	OPEN

ABS Operating (Holding) Condition

When appropriate pressure is applied to wheel cylinder, ABS system enters holding pressure state. As a result, normal open valve shuts off its passage and so does normal close valve, in order to maintain wheel cylinder pressure.

Solenoid Valve	Powered Condition	Solenoid Valve Condition
Normal Open Valve	ON	CLOSE
Normal Close Valve	OFF	CLOSE

ABS Operating (Boost) Condition

When ABS operates under relief pressure condition, if brake fluid is drained excessively or friction coefficient between wheels and road increases, it needs to increase each wheel pressure. In this case, ABS/ESP control module commands hydraulic control module to increase wheel pressure. As a result, normal open valve opens its passage and normal close valve shuts off passage, in order to increase wheel cylinder pressure. Brake fluid stored in low pressure accumulator is supplied to each wheel cylinder through master cylinder and normal open valve.

Solenoid Valve	Powered Condition	Solenoid Valve Condition
Normal Open Valve	OFF	OPEN
Normal Close Valve	OFF	CLOSE

ABS system operates circularly among relief, holding and boost pressure conditions until vehicle is completely stopped, ensuring vehicle's braking and steering performances.

ESP adjustment procedure is similar to ABS adjustment procedure. While traction control and stability control are realized, HSV valve opens and USV valve closes to supply brake fluid through pump to wheel cylinders that need to increase pressure.

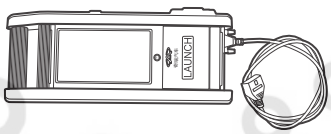
Specifications

Torque Specifications

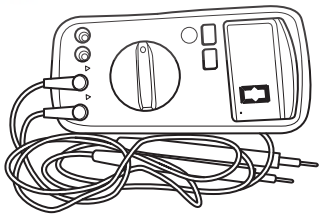
Description	Torque (N·m)
Brake Pipe Coupling Plug	18 ± 2
Coupling Nut Between ABS/ESP Control Module Assembly and Mounting Bracket	8 ± 2
Coupling Bolt Between ABS/ESP Control Module Assembly Mounting Bracket and Body	23 ± 3.5
Front Wheel Speed Sensor Fixing Bolt	9 ± 1.5
Rear Wheel Speed Sensor Fixing Bolt	9 ± 1.5

Tools

Special Tool

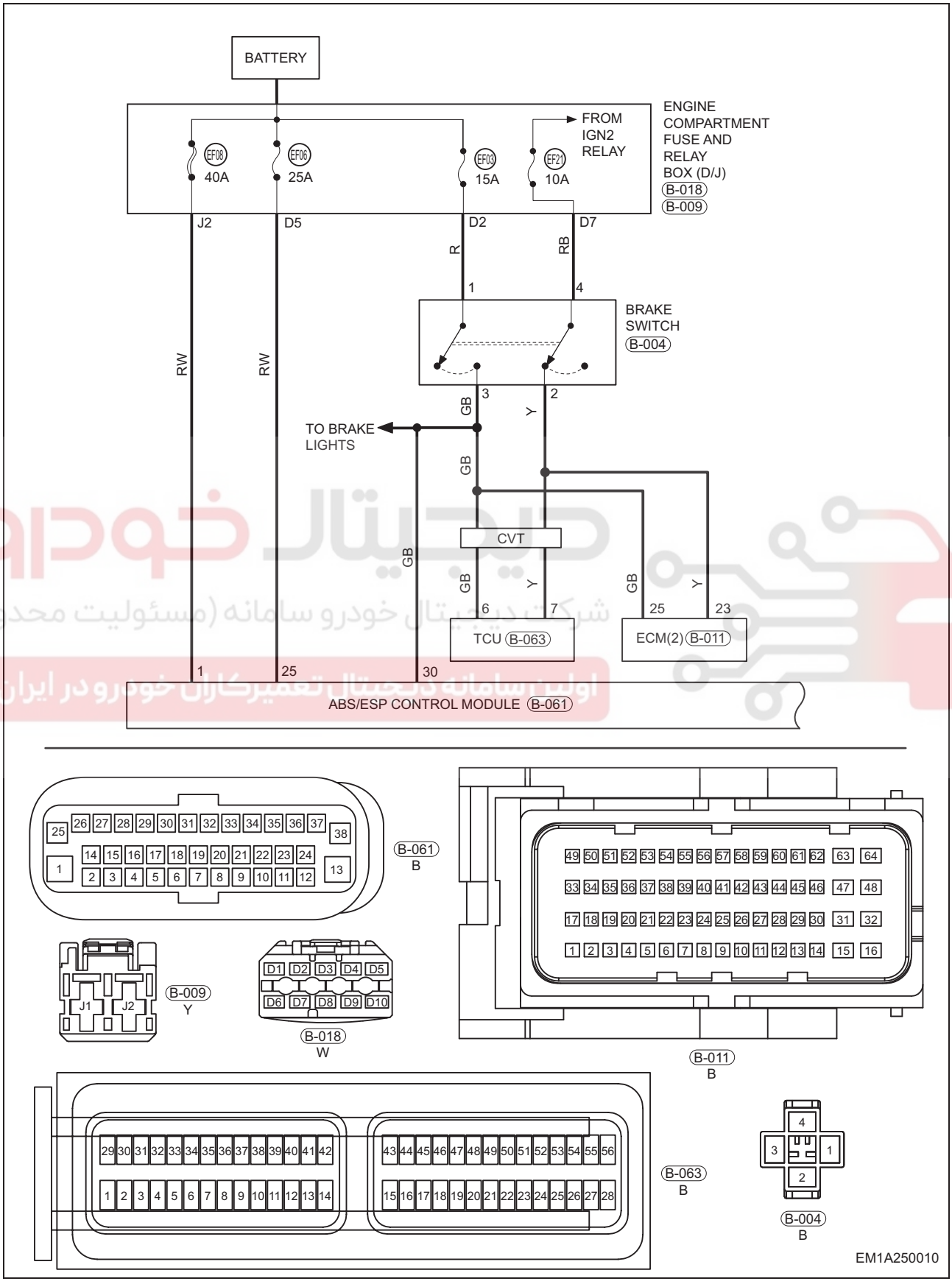
X-431 3G Diagnostic Tester	 RCH0000001

General Tool

Digital Multimeter	 RCH0000002

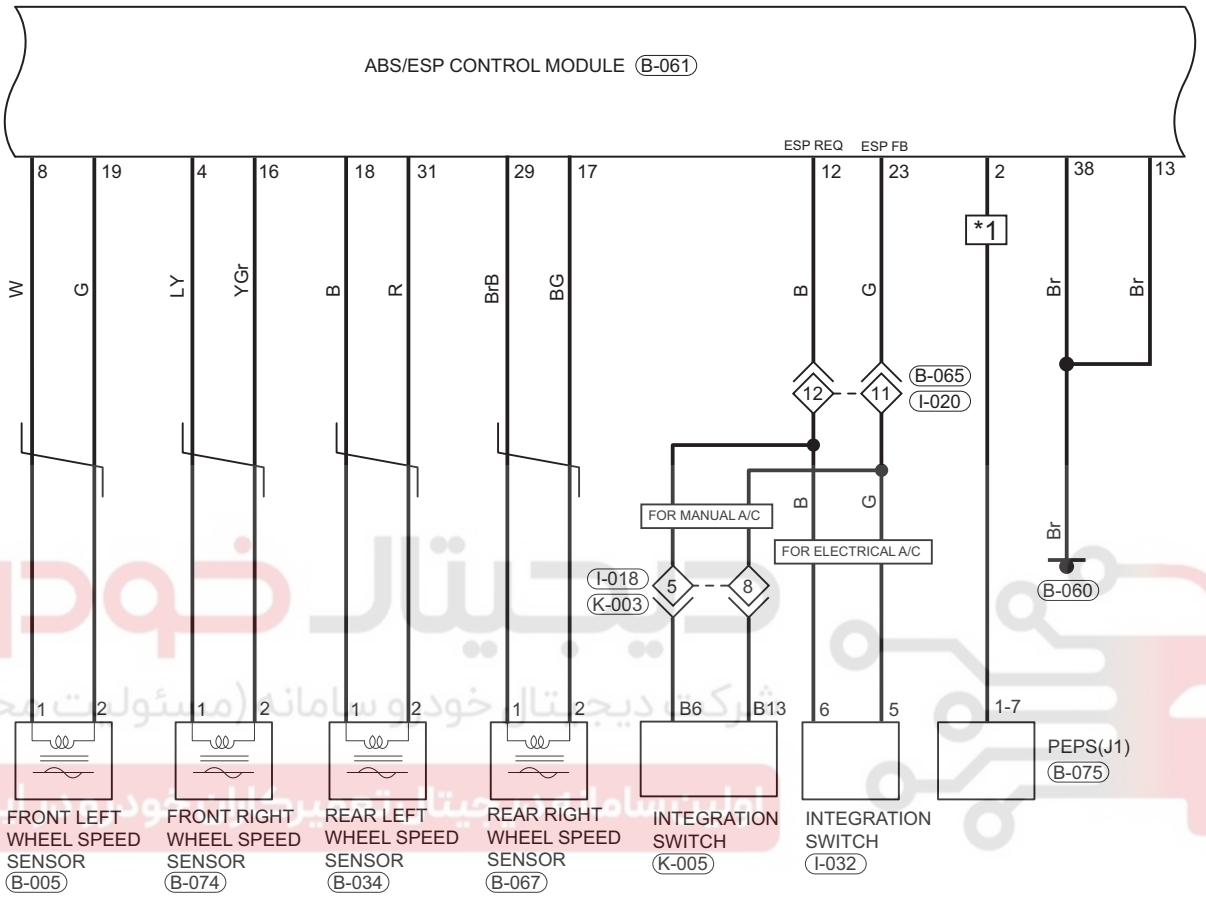
Circuit Diagram

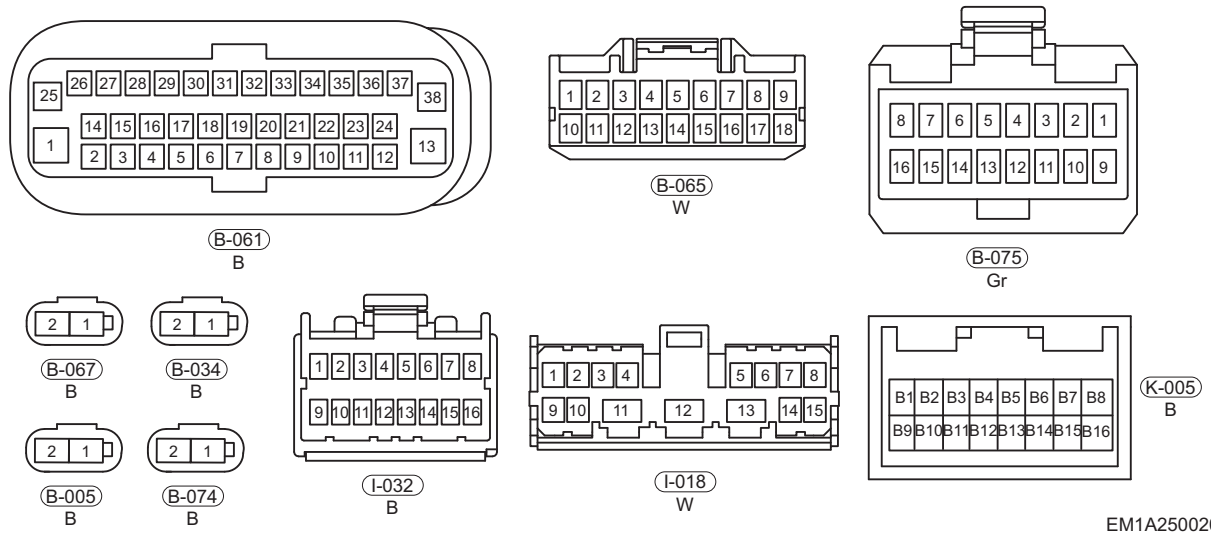
Brake Control System (Page 1 of 3)



Brake Control System (Page 2 of 3)

*1: W/ PEPS





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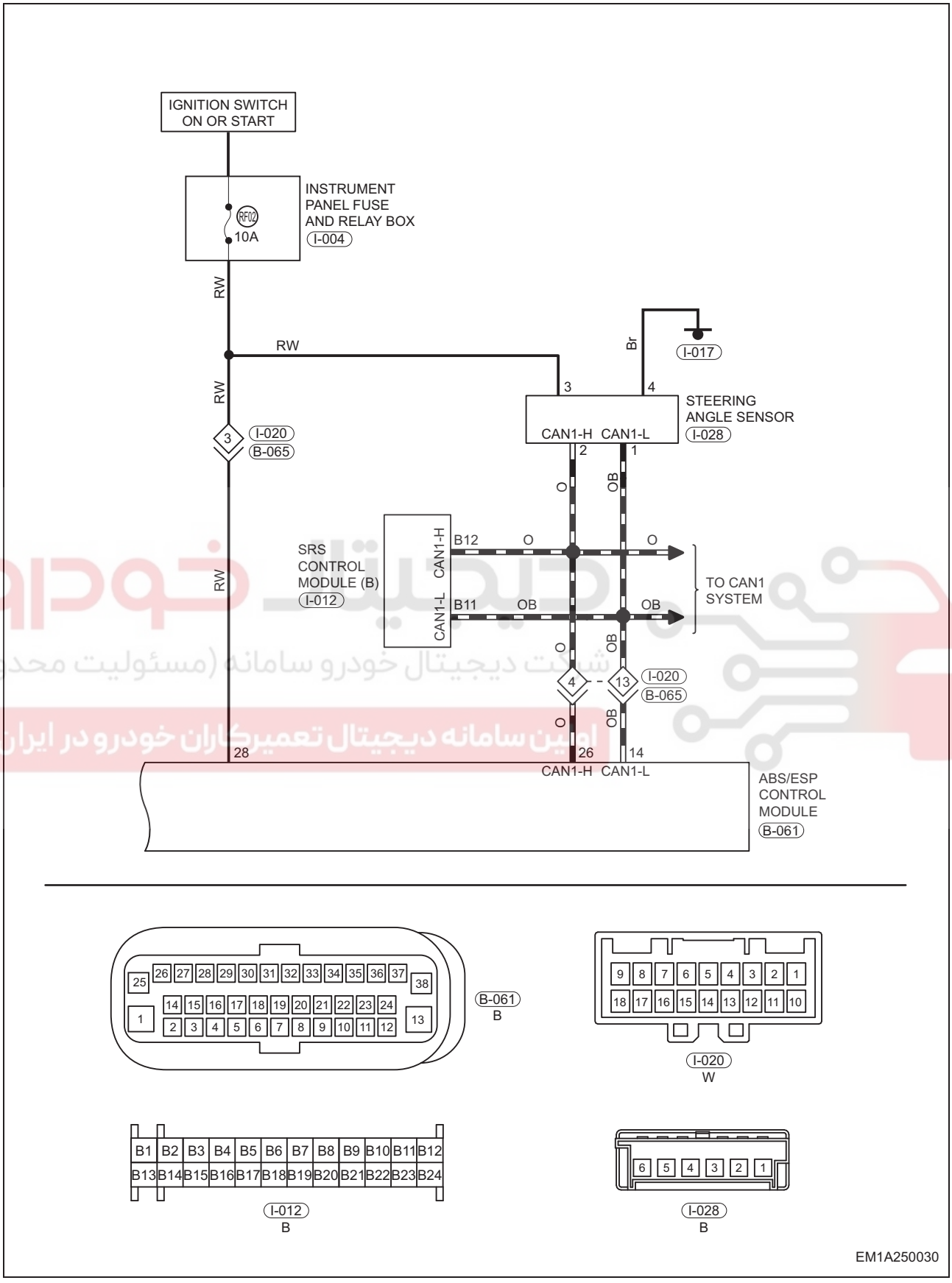
Brake Control System (Page 3 of 3)



DIAGNOSIS & TESTING

Problem Symptoms Table

HINT:
Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair or adjust faulty components, or replace as necessary.

Symptom	Suspected Area	See page
When turning ignition switch ON, ABS/ESP warning light does not come on	Fuse	54-32
	Wire harness or connector	-
	ABS/ESP control module assembly	25-80
	Instrument cluster	39-49
ABS/ESP warning light remains on	Fuse	54-32
	Wire harness or connector	-
	ABS/ESP control module assembly	25-80
	Instrument cluster	39-49
ESP OFF indicator does not come on or remains on	Center control integration panel assembly	30-28
	Wire harness or connector	-
	ABS/ESP control module assembly	25-80
	Instrument cluster	39-49
ABS/ESP operation is abnormal	Wheel speed sensor (damaged, improperly installed, foreign matter attached)	25-82
	Hub ring gear (damaged, improperly installed, foreign matter attached)	-
	Steering angle sensor (damaged, improperly installed, foreign matter attached)	-
	Brake line (blocked or leaked)	-
	Wire harness or connector	-
	ABS/ESP control module assembly	25-80
Communication with ABS/ESP control module cannot be performed	Fuse	54-32
	Wire harness or connector	-
	ABS/ESP control module assembly	25-80

Diagnosis Procedure

Use following procedures to troubleshoot the brake control system.

1	Vehicle brought to workshop

NEXT

2	Check battery voltage

Standard voltage: 11 to 14 V

If voltage is below 11 V, recharge or replace the battery before proceeding to next step.

NEXT

3	Customer problem analysis

NEXT

4	Check and clear DTCs

NEXT

5	Confirm and duplicate malfunction: accelerate vehicle to 15 km/h or above, simulate malfunction conditions and read DTCs again

DTC occurs	For current DTC, go to step 7
No DTC	For history DTC, go to step 8

6	Problem repair (no DTC), then go to step 9

NEXT

7	Troubleshoot according to Diagnostic Trouble Code (DTC) Chart, then go to step 9

NEXT

8	Troubleshoot according to Problem Symptoms Table, then go to step 9

NEXT

9	Conduct test and confirm malfunction has been repaired

NEXT

10	End

Problem Repair (No DTC)

If there is a problem in brake system, but no DTC is stored in ABS/ESP control module assembly, this problem is called a problem without DTC. A problem without DTC is caused by basic brake system malfunction. For example:

1. Brake fluid leakage (it may result in weak braking, brake pedal overtravel or even ineffective braking).
2. Use of inferior brake fluid (it can result in corrosion of brake line and ABS hydraulic regulating module internal elements, or even ineffective braking).
3. Air in brake line (it may result in weak braking or even ineffective braking).
4. Brake line blockage (it may result in hard braking or even ineffective braking).
5. Excessive wear of brake disc (it may result in weak braking or brake pedal overtravel).
6. Brake booster malfunction (it may result in weak or hard braking, brake pedal overtravel or even ineffective braking).
7. Wrong brake line connection (it may result in ABS/ESP braking performance decrease, drift, long braking distance etc.).

Note: ABS/ESP no power supply or power supply abnormality will cause ABS/ESP warning light always on without storing DTC.

Troubleshooting method: check components corresponding to the problem symptom, repair or replace as necessary.

DTC Confirmation Procedure

Confirm that battery voltage is normal before performing following procedures.

- Turn ignition switch to LOCK.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ABS/ESP control module assembly.
- Turn ignition switch to LOCK and wait for a few seconds.
- Start engine, drive vehicle at 20 km/h or more to perform a road test with X-431 3G diagnostic tester connected to Data Link Connector (DLC).
- Use X-431 3G diagnostic tester to read DTCs.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent. Please refer to Intermittent DTC Troubleshooting.

Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the followings:

- Check if connectors are loose.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Wiggle related wire harnesses and connectors and observe if signal is interrupted in the related circuit.
- If possible, try to duplicate the conditions under which DTC was set.
- Look for the changed data or the reset DTCs during wiggle test.
- Check for broken, bent, protruded or corroded terminals.
- Check wheel speed sensors and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
- Check and clean all wire harness connectors and ground points related to the current DTC.
- If multiple trouble codes were set, refer to circuit diagrams to look for any common ground circuit or power supply circuit applied to the DTC.
- Refer to any Technical Bulletin that may apply to the malfunction.

Ground Inspection

Ground points are very important to the proper operation of circuits. Ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) may increase load resistance. This may change the way in which a circuit works.

Circuits are very sensitive to ground that is normal or not. Loose or corroded ground can affect the control circuit. Check the ground points as follows:

1. Remove ground bolt or nut.
2. Check all contact surfaces for tarnish, dirt and rust, etc.
3. Clean as necessary to ensure that contacting is in good condition.
4. Reinstall ground bolt or nut securely.
5. Check if add-on accessories interfere with ground circuit.
6. If several wire harnesses are crimped into one ground terminal, check if they are installed correctly. Make sure all wire harnesses are clean and securely fastened while providing a good route to ground.

ABS/ESP Control Module Assembly Terminal List

Terminal No.	Terminal Definition	Terminal No.	Terminal Definition
1	Battery Power Supply (Pump Motor)	20	-
2	Wheel Speed Sensor Signal Output (Only for PEPS Model)	21	-
3	-	22	-
4	Front Right Wheel Speed Sensor Signal	23	ESP Switch Output
5	-	24	-
6	-	25	Battery Power Supply (Valve Relay)
7	-	26	CAN1-H
8	Front Left Wheel Speed Sensor Signal	27	-
9	-	28	Power Supply (Ignition Switch)
10	-	29	Rear Right Wheel Speed Sensor Signal
11	-	30	Brake Light Switch Signal
12	ESP Switch Input	31	Rear Left Wheel Speed Sensor Power Supply
13	Ground	32	-
14	CAN1-L	33	-
15	-	34	-
16	Front Right Wheel Speed Sensor Power Supply	35	-
17	Rear Right Wheel Speed Sensor Power Supply	36	-
18	Rear Left Wheel Speed Sensor Signal	37	-
19	Front Left Wheel Speed Sensor Power Supply	38	Ground

Diagnostic Trouble Code (DTC) Chart

Trouble Type Byte (Hex)	Description
00	No Data Information
01	Normal Circuit Failure
04	System Internal Failure
08	Bus Signal/Message Error
09	Component Failure
11	Circuit Short To Ground
12	Circuit Short To Power Supply
13	Circuit Open
16	Circuit Voltage Below Threshold
17	Circuit Voltage Above Threshold
28	Signal Deviation Out Of Range
29	Signal Invalid
31	No Signal
38	Signal Frequency Error
49	Internal Circuit Failure
52	Inactivated
53	Function Off
54	Missing Calibration
55	Not Configured
64	Signal Reliability Failure

DTC	DTC Definition
C0001-04	TCS Control Channel Changeover Valve1 (ESP Only)
C0002-04	TCS Control Channel Changeover Valve2 (ESP Only)
C0003-04	TCS Control Channel High Pressure Switch Valve1 (ESP Only)
C0004-04	TCS Control Channel High Pressure Switch Valve2 (ESP Only)
C0010-04	Left Front Inlet Control
C0011-04	Left Front Outlet Control
C0014-04	Right Front Inlet Control
C0015-04	Right Front Outlet Control
C0018-04	Left Rear Inlet Control
C0019-04	Left Rear Outlet Control
C001C-04	Right Rear Inlet Control
C001D-04	Right Rear Outlet Control
C0031-00	Left Front Wheel Speed Sensor

DTC	DTC Definition
C0031-09	Left Front Wheel Speed Sensor
C0031-11	Left Front Wheel Speed Sensor
C0031-12	Left Front Wheel Speed Sensor
C0031-13	Left Front Wheel Speed Sensor
C0031-29	Left Front Wheel Speed Sensor
C0034-00	Right Front Wheel Speed Sensor
C0034-09	Right Front Wheel Speed Sensor
C0034-11	Right Front Wheel Speed Sensor
C0034-12	Right Front Wheel Speed Sensor
C0034-13	Right Front Wheel Speed Sensor
C0034-29	Right Front Wheel Speed Sensor
C0037-00	Left Rear Wheel Speed Sensor
C0037-09	Left Rear Wheel Speed Sensor
C0037-11	Left Rear Wheel Speed Sensor
C0037-12	Left Rear Wheel Speed Sensor
C0037-13	Left Rear Wheel Speed Sensor
C0037-29	Left Rear Wheel Speed Sensor
C003A-00	Right Rear Wheel Speed Sensor
C003A-09	Right Rear Wheel Speed Sensor
C003A-11	Right Rear Wheel Speed Sensor
C003A-12	Right Rear Wheel Speed Sensor
C003A-13	Right Rear Wheel Speed Sensor
C003A-29	Right Rear Wheel Speed Sensor
C0040-64	Brake Pedal Switch (ESP Only)
C0044-01	Brake Pressure Sensor (ESP Only)
C0044-28	Brake Pressure Sensor (ESP Only)
C0051-29	Steering Wheel Position Sensor (ESP Only)
C0051-54	Steering Wheel Position Sensor (ESP Only)
C0051-64	Steering Wheel Position Sensor (ESP Only)
C0061-64	Lateral Acceleration Sensor (ESP Only)
C0062-64	Longitudinal Acceleration Sensor (ESP Only)
C0063-64	Yaw Rate Sensor (ESP Only)
C006B-00	Stability System Active Too Long
C0089-04	TCS Disable Switch (ESP Only)
C1000-16	ECU Voltage Supply
C1000-17	ECU Voltage Supply
C1001-04	ECU

DTC	DTC Definition
C1002-49	CAN Hardware
C1003-04	Valve Relay
C1004-00	General Valve
C1005-08	Hand Brake Switch (ESP Only)
C1006-29	Clutch Switch (ESP Only)
C1007-29	Reverse Gear Switch (ESP Only)
C1008-00	General WSS
C1009-00	ECU Hardware Related
U0005-00	High Speed CAN Communication Bus (+) High
U0007-00	High Speed CAN Communication Bus (-) Low
U0073-00	Control Module Communication Bus Off
U0100-00	Lost Communication With ECM (ESP Only)
U0101-00	Lost Communication With TCM (ESP Only)
U0126-00	Lost Communication With Steering Angle Sensor (ESP Only)
U0140-00	Lost Communication With BCM (ESP Only)
U0401-00	Invalid Data Received From ECM (ESP Only)
U0402-00	Invalid Data Received From TCM (ESP Only)
U0422-00	Invalid Data Received From Body Control Module (ESP Only)
U0428-00	Invalid Data Received From Steering Angle Sensor (ESP Only)
U1000-00	CAN Error Passive
U1300-55	Software Configuration Error

DTC	C0001-04	TCS Control Channel Changeover Valve1 (ESP Only)
DTC	C0002-04	TCS Control Channel Changeover Valve2 (ESP Only)
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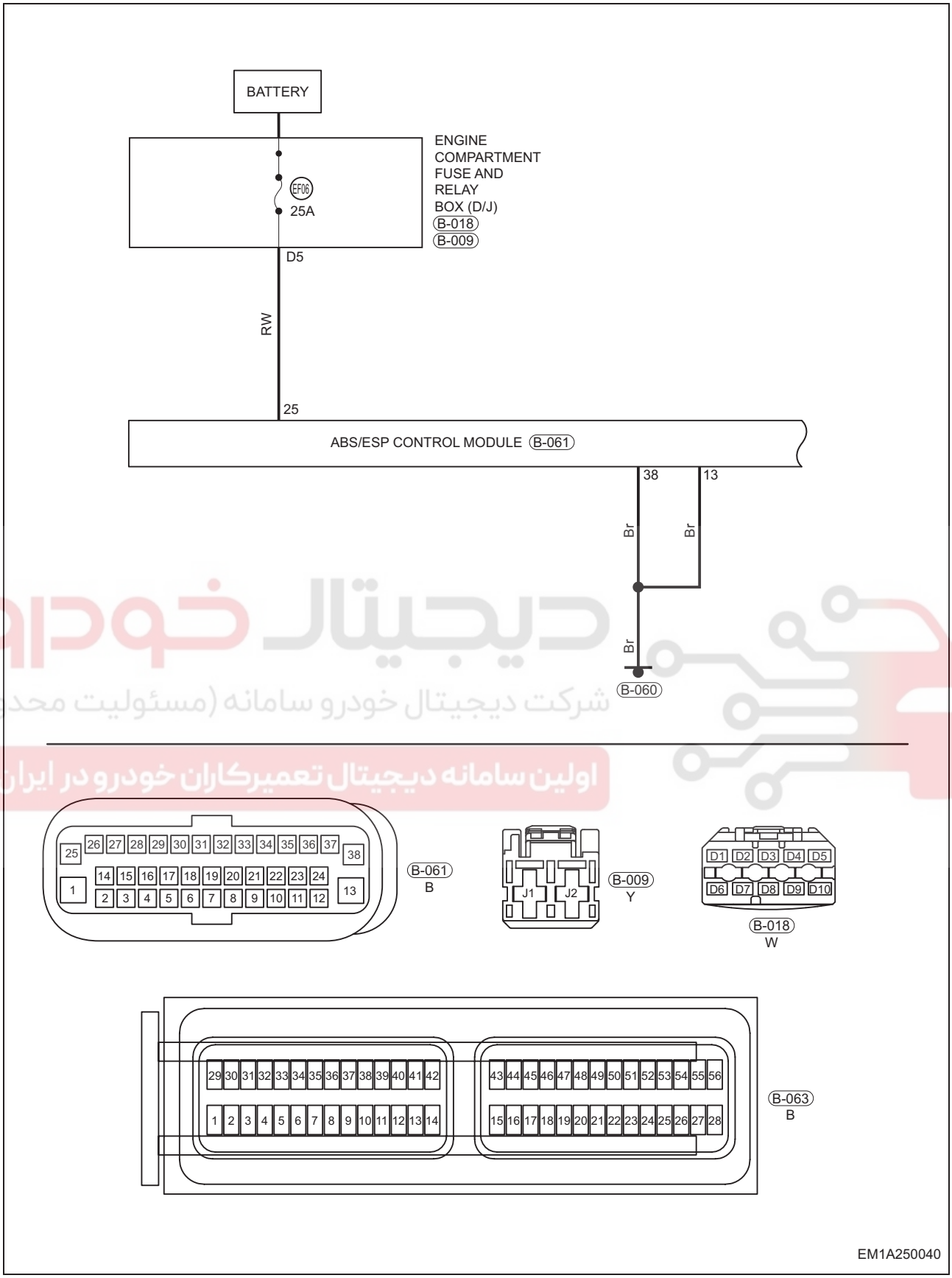
DTC	C0015-04	Right Front Outlet Control
DTC	C0018-04	Left Rear Inlet Control
DTC	C0019-04	Left Rear Outlet Control
DTC	C001C-04	Right Rear Inlet Control
DTC	C001D-04	Right Rear Outlet Control
DTC	C1003-04	Valve Relay
DTC	C1004-00	General Valve



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DTC	DTC Definition	DTC Detection Condition	Possible Cause
C0001-04	TCS Control Channel Changeover Valve1 (ESP Only)	These DTCs occur when any of following conditions is met: 1. Valve power supply malfunction (short to ground in power supply or ground circuit open). 2. Solenoid valve temperature too high (overheat protection). 3. Short circuit in more than 5 solenoid valves (fuses). 4. Corresponsive solenoid valve activated with no feedback. 5. Solenoid valve itself malfunction. 6. Valve set relay malfunction.	• Abnormal valve relay power supply • Poor connection of ABS/ESP control module assembly and ground • Fuse malfunction • Short to power supply or ground in solenoid valve, or open circuit • System overheat protection • ABS/ESP control module assembly damaged
C0002-04	TCS Control Channel Changeover Valve2 (ESP Only)		
C0003-04	TCS Control Channel High Pressure Switch Valve1 (ESP Only)		
C0004-04	TCS Control Channel High Pressure Switch Valve2 (ESP Only)		
C0010-04	Left Front Inlet Control		
C0011-04	Left Front Outlet Control		
C0014-04	Right Front Inlet Control		
C0015-04	Right Front Outlet Control		
C0018-04	Left Rear Inlet Control		
C0019-04	Left Rear Outlet Control		
C001C-04	Right Rear Inlet Control		
C001D-04	Right Rear Outlet Control		
C1003-04	Valve Relay		
C1004-00	General Valve		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check for DTCs

a. Leave vehicle for 5 minutes, clear and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.

b. Refer to DTC Confirmation Procedure.

c. Check if same DTC is output.

NO → **Problem indicated by DTC is intermittent (system overheat protection)**

YES ↓

2	Check fuse

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Remove fuse EF-06 (25 A) from engine compartment fuse and relay box.
d. Check if fuse is blown.

NG → **Replace fuse EF-06**

OK ↓

3	Check wire harness and connector

Use circuit diagram as a guide to perform following procedures:

- Turn ignition switch to LOCK.
- Disconnect the negative battery cable.
- Disconnect ABS/ESP control module assembly connector B-061 and engine compartment fuse and relay box connector B-021.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Check for broken, bent, protruded or corroded terminals.
- Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace body wire harness and connector**

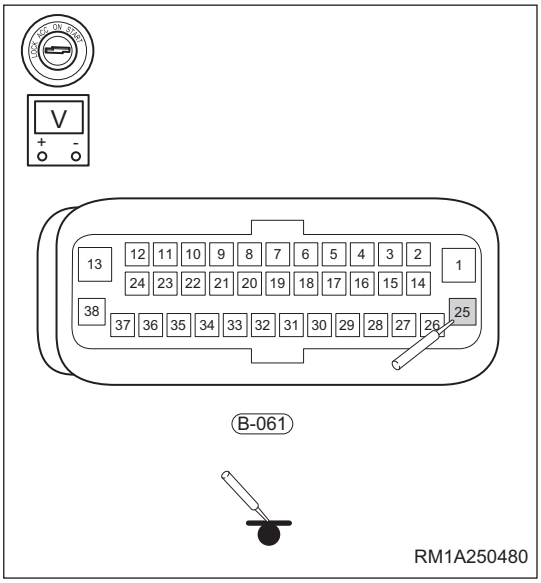
OK ↓

4	Check ABS/ESP control module power supply circuit (ABS/ESP control module assembly - battery)

a. Connect the negative battery cable.
b. Turn ignition switch to LOCK.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Using a digital multimeter, measure voltage between ABS/ESP control module assembly terminal 25 and body ground to check if system power supply circuit is normal according to table below.

Standard Voltage

Multimeter Connection	Condition	Specified Condition
B-061 (25) - Body ground	Always	9 to 16 V



NG → **Repair or replace body wire harness and connector**

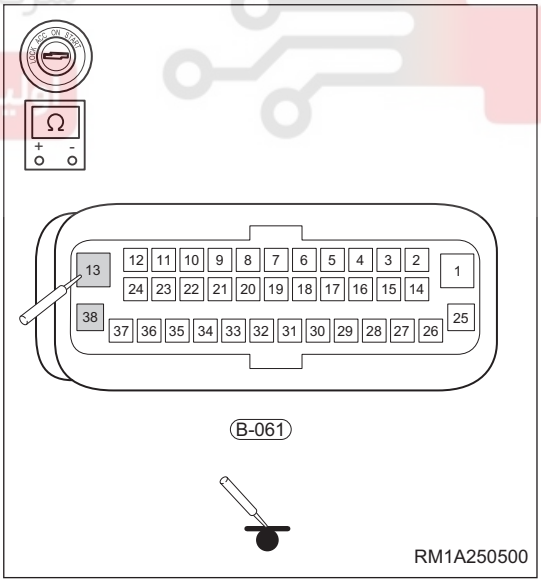
OK

5	Check ABS/ESP control module ground circuit (ABS/ESP control module assembly - body ground)

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Using a digital multimeter, check for continuity between ABS/ESP control module assembly terminals 13, 38 and body ground to check if system ground circuit is normal according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (13) - Body ground	Always	Continuity
B-061 (38) - Body ground	Always	Continuity



NG → **Repair or replace body wire harness and connector**

OK

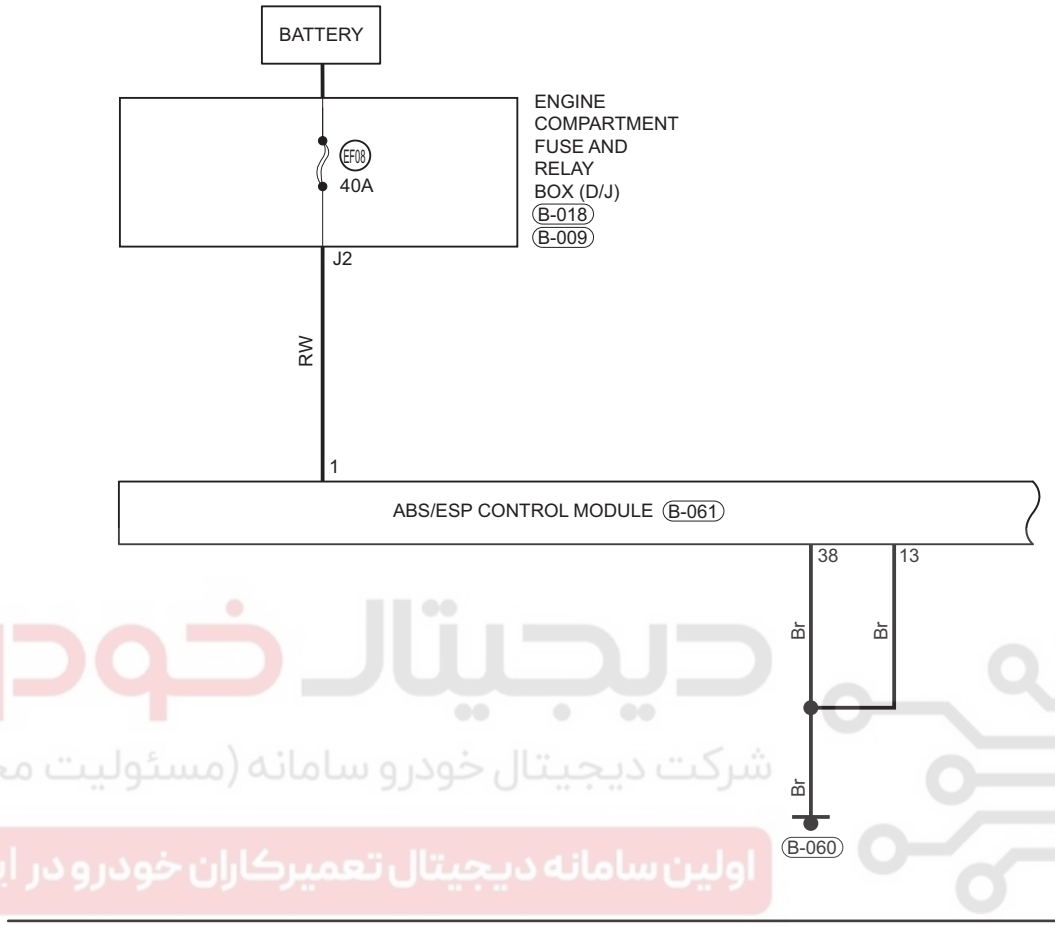
6	Reconfirm DTCs

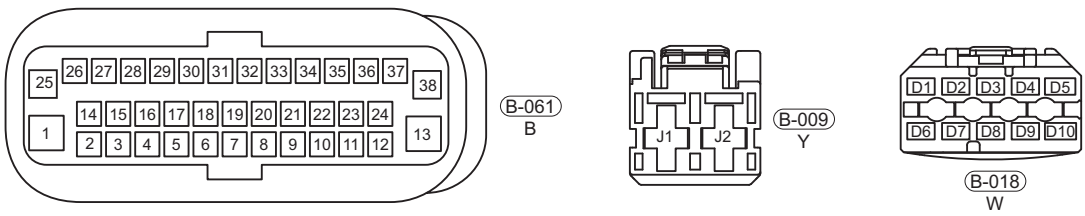
a. Use X-431 3G diagnostic tester to clear DTC.
b. Start the engine.
c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
d. Check if same DTC is output.

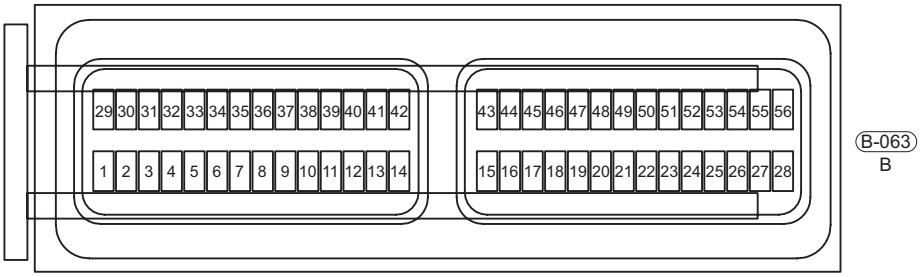
NO → System operates normally

YES → Replace ABS/ESP control module assembly

DTC	C0020-04	ABS Pump Motor Control







EM1A250050

DTC	DTC Definition	DTC Detection Condition	Possible Cause
C0020	ABS Pump Motor Control	This DTC occurs when any of following conditions is met: 1. Pump motor operates with overload, and temperature is too high (overheat protection). 2. Return pump monitor still cannot detect voltage signal after return pump motor relay operates for 60 ms. 3. Return pump monitor detects voltage for more than 2.5 s when return pump motor relay does not operate. 4. Return pump monitor detects that voltage does not drop when return pump motor relay stops operating.	• Fuse malfunction • Poor connection of pump motor and ground • System overheat protection • Abnormal pump motor power supply • Pump motor relay malfunction • Pump motor malfunction

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check for DTCs

a. Leave vehicle for 5 minutes, clear and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
b. Refer to DTC Confirmation Procedure.
c. Check if same DTC is output.

NO → **Problem indicated by DTC is intermittent (system overheat protection)**

YES

2	Check fuse

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Remove fuse EF-08 (40 A) from engine compartment fuse and relay box.
d. Check if fuse is blown.

NG → **Replace fuse EF-08**

OK

3	Check wire harness and connector

Use circuit diagram as a guide to perform following procedures:

- Turn ignition switch to LOCK.
- Disconnect the negative battery cable.
- Disconnect ABS/ESP control module assembly connector B-061 and engine compartment fuse and relay box connector B-009.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Check for broken, bent, protruded or corroded terminals.
- Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace body wire harness and connector**

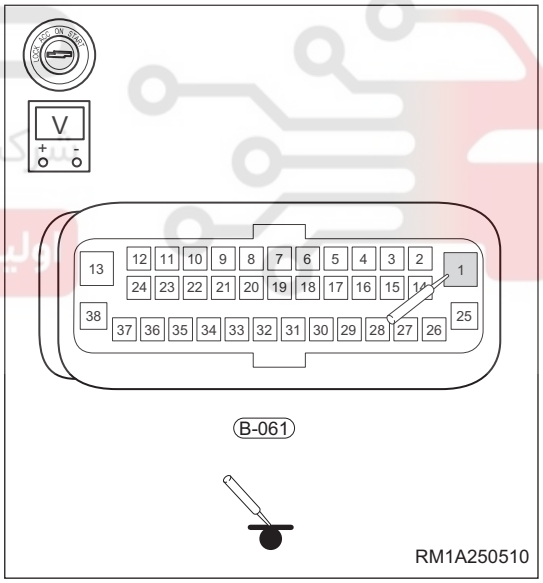
OK

4	Check wire harness and connector (ABS/ESP control module assembly - battery)

a. Connect the negative battery cable.
b. Turn ignition switch to LOCK.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Using a digital multimeter, measure voltage between ABS/ESP control module assembly terminal 1 and body ground to check if system power supply circuit is normal according to table below.

Standard Voltage

Multimeter Connection	Condition	Specified Condition
B-061 (1) - Body ground	Always	9 to 16 V



NG → **Repair or replace body wire harness and connector**

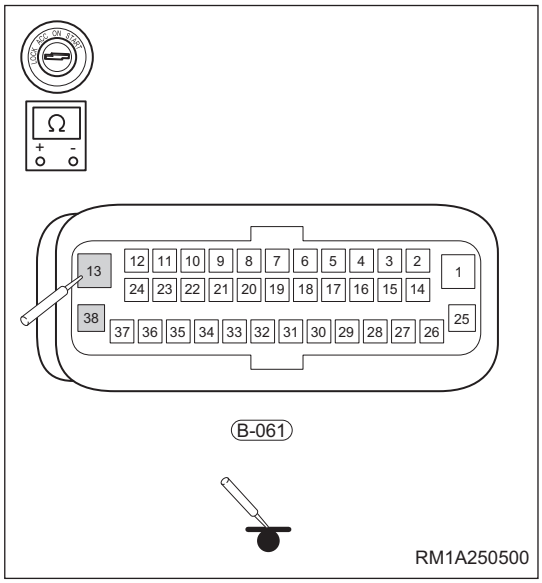
OK

5	Check wire harness and connector (ABS/ESP control module assembly - body ground)

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Using a digital multimeter, check for continuity between ABS/ESP control module assembly terminals 13, 38 and body ground to check if system ground circuit is normal according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (13) - Body ground	Always	Continuity
B-061 (38) - Body ground	Always	Continuity



NG → **Repair or replace body wire harness and connector**

OK

6	Reconfirm DTCs

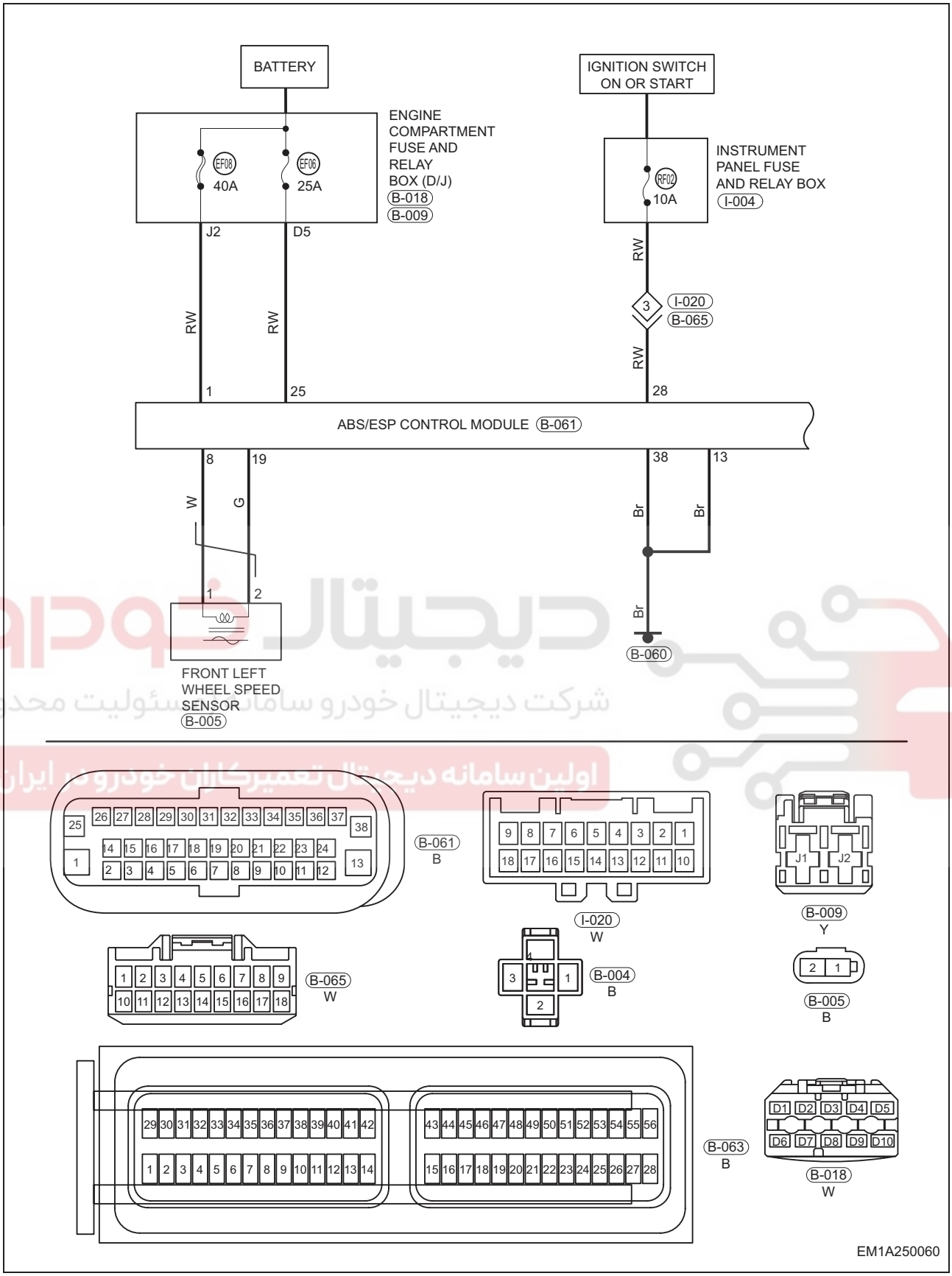
a. Use X-431 3G diagnostic tester to clear DTC.
b. Start the engine.
c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
d. Check if same DTC is output.

NO → **System operates normally**

YES

Replace ABS/ESP control module assembly

DTC	C0031-00	Left Front Wheel Speed Sensor
DTC	C0031-09	Left Front Wheel Speed Sensor
DTC	C0031-11	Left Front Wheel Speed Sensor
DTC	C0031-12	Left Front Wheel Speed Sensor
DTC	C0031-13	Left Front Wheel Speed Sensor
DTC	C0031-29	Left Front Wheel Speed Sensor



DTC	DTC Definition	DTC Detection Condition	Possible Cause
C0031-00	Left Front Wheel Speed Sensor	These DTCs occur when any of following conditions is met: 1. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to ground. 2. Wheel speed sensor wire is open. 3. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to power supply. 4. ABS/ESP control module assembly detects that wheel speed sensor power supply wire is short to ground. 5. Wheel speed sensor signal is invalid.	• Reverse connection of wheel speed sensor signal wire and power supply wire • Short to ground in wheel speed sensor signal wire • Wheel speed sensor wire disconnected, or connector loose or broken • Short to power supply in wheel speed sensor signal wire • Short to ground in wheel speed sensor power supply wire • Sensor head or connector pin damaged • Wheel speed sensor interfered by outside magnetic field (wheel or axle not demagnetized) • Wheel speed sensor body malfunction • Ring gear not installed, missing teeth, dirty, demagnetized, or off center • Excessive clearance between sensor and ring gear • Wrong number of ring gear teeth • Tire size not as specified • ABS/ESP control module assembly damaged
C0031-09	Left Front Wheel Speed Sensor		
C0031-11	Left Front Wheel Speed Sensor		
C0031-12	Left Front Wheel Speed Sensor		
C0031-13	Left Front Wheel Speed Sensor		
C0031-29	Left Front Wheel Speed Sensor		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check front left wheel speed sensor wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the front left wheel speed sensor connector B-005.
d. Check if wire harnesses are worn, pierced, pinched or partially broken.
e. Check for broken, bent, protruded or corroded terminals.
f. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace front left wheel speed sensor wire harness and connector**

OK

2	Check installation of front left wheel speed sensor

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check front left wheel speed sensor mounting bolt for looseness.
d. Check if excessive clearance exists between installation area of front left wheel speed sensor and front steering knuckle.
e. Check installation area of front left wheel speed sensor for dirt.

NG → **Tighten mounting bolt properly, clean or replace front left wheel speed sensor**

OK

3	Check front left wheel speed sensor

a. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
b. Drive vehicle straight ahead, and read datastream of front left wheel speed sensor with X-431 3G diagnostic tester.
c. Check if data change of front left wheel speed sensor matches that of other wheel speed sensors.

NG → **Replace left front wheel speed sensor**

OK

4	Check front left hub ring gear

a. Remove the front left hub assembly.
b. Check for foreign matter, missing teeth or damage on front left hub ring gear.
c. Check if front left hub assembly is securely installed.

NG → **Replace front left hub ring gear**

OK

5	Check wire harness and connector (front left wheel speed sensor - ABS/ESP control module assembly)

a. Turn ignition switch to LOCK.

b. Disconnect the negative battery cable.

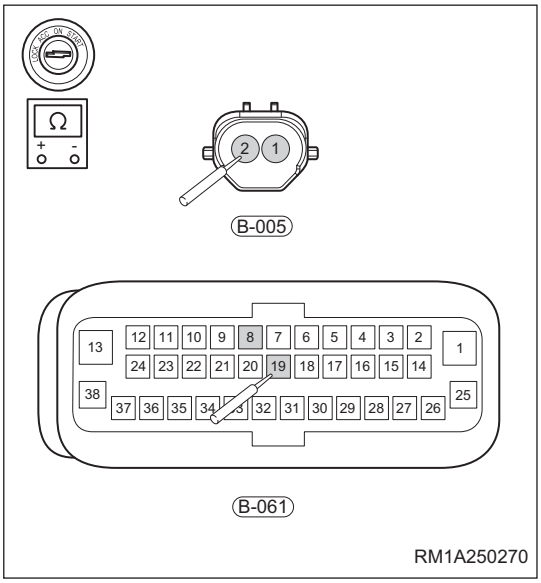
c. Disconnect the ABS/ESP control module assembly connector B-061.

d. Disconnect the front left wheel speed sensor connector B-005.

e. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector B-005 to check if there is an open in wire harness and connector according to table below.

Standard Condition

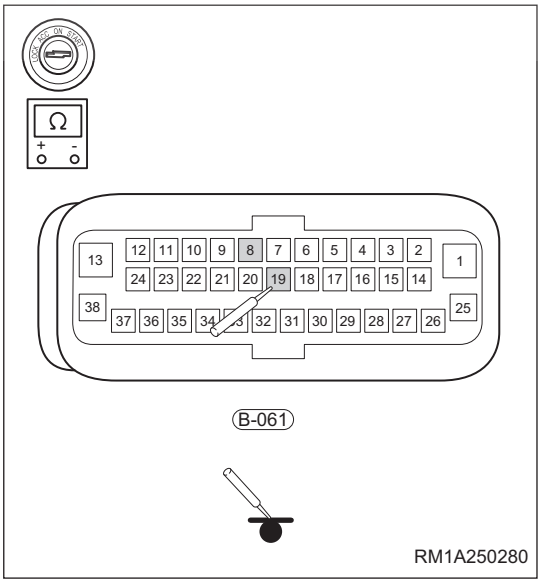
Multimeter Connection	Condition	Specified Condition
B-061 (8) - B-005 (1)	Always	Continuity
B-061 (19) - B-005 (2)	Always	Continuity
B-061 (8) - B-005 (2)	Always	No continuity
B-061 (19) - B-005 (1)	Always	No continuity
B-005 (1) - B-005 (2)	Always	No continuity
B-061 (8) - B-061 (19)	Always	No continuity



f. Using a digital multimeter, check for continuity between connector B-061 and body ground to check if front left wheel speed sensor is short to ground according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (8) - Body ground	Always	No continuity
B-061 (19) - Body ground	Always	No continuity



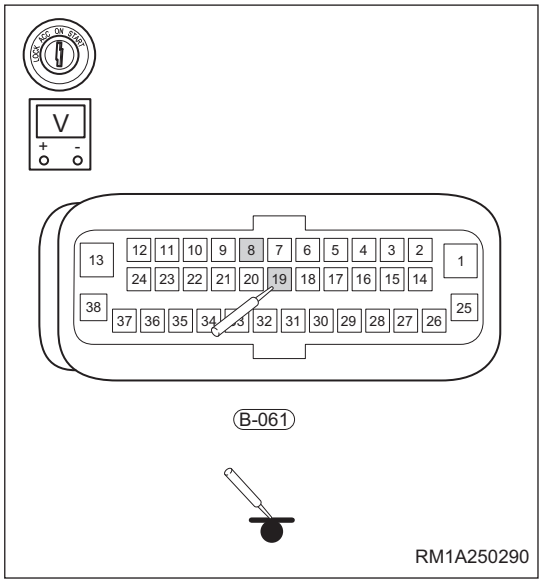
g. Connect the negative battery cable.

h. Turn ignition switch to ON.

i. Using a digital multimeter, measure voltage between connector B-061 and body ground to check if front left wheel speed sensor is short to power supply according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (8) - Body ground	Ignition switch ON	Approx. 0 V
B-061 (19) - Body ground	Ignition switch ON	Approx. 0 V



NG → **Repair or replace wire harness and connector between front left wheel speed sensor and ABS/ESP control module assembly**

OK ↓

6	Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.

b. Start the engine.

c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.

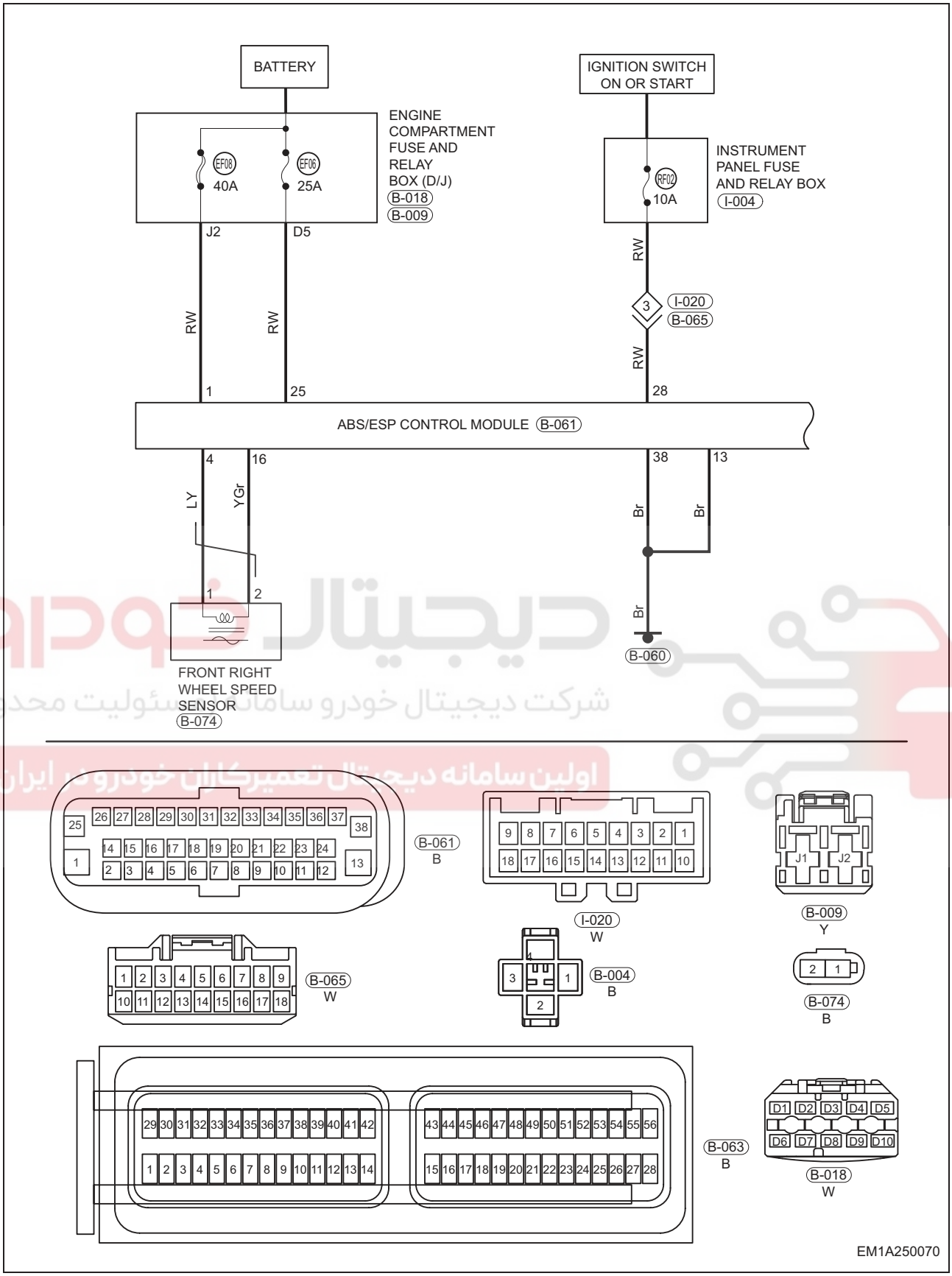
d. Check if same DTC is output.

NO → **System operates normally**

YES ↓

Replace ABS/ESP control module assembly

DTC	C0034-00	Right Front Wheel Speed Sensor
DTC	C0034-09	Right Front Wheel Speed Sensor
DTC	C0034-11	Right Front Wheel Speed Sensor
DTC	C0034-12	Right Front Wheel Speed Sensor
DTC	C0034-13	Right Front Wheel Speed Sensor
DTC	C0034-29	Right Front Wheel Speed Sensor



DTC	DTC Definition	DTC Detection Condition	Possible Cause
C0034-00	Right Front Wheel Speed Sensor	These DTCs occur when any of following conditions is met: 1. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to ground. 2. Wheel speed sensor wire is open. 3. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to power supply. 4. ABS/ESP control module assembly detects that wheel speed sensor power supply wire is short to ground. 5. Wheel speed sensor signal is invalid.	• Reverse connection of wheel speed sensor signal wire and power supply wire • Short to ground in wheel speed sensor signal wire • Wheel speed sensor wire disconnected, or connector loose or broken • Short to power supply in wheel speed sensor signal wire • Short to ground in wheel speed sensor power supply wire • Sensor head or connector pin damaged • Wheel speed sensor interfered by outside magnetic field (wheel or axle not demagnetized) • Wheel speed sensor body malfunction • Ring gear not installed, missing teeth, dirty, demagnetized, or off center • Excessive clearance between sensor and ring gear • Wrong number of ring gear teeth • Tire size not as specified • ABS/ESP control module assembly damaged
C0034-09	Right Front Wheel Speed Sensor		
C0034-11	Right Front Wheel Speed Sensor		
C0034-12	Right Front Wheel Speed Sensor		
C0034-13	Right Front Wheel Speed Sensor		
C0034-29	Right Front Wheel Speed Sensor		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check front right wheel speed sensor wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the front right wheel speed sensor connector B-074.
d. Check if wire harnesses are worn, pierced, pinched or partially broken.
e. Check for broken, bent, protruded or corroded terminals.
f. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace front right wheel speed sensor wire harness and connector**

OK

2	Check installation of front right wheel speed sensor

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check front right wheel speed sensor mounting bolt for looseness.
d. Check if excessive clearance exists between installation area of front right wheel speed sensor and front steering knuckle.
e. Check installation area of front right wheel speed sensor for dirt.

NG → **Tighten mounting bolt properly, clean or replace front right wheel speed sensor**

OK

3	Check front right wheel speed sensor

a. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
b. Drive vehicle straight ahead, and read datastream of front right wheel speed sensor with X-431 3G diagnostic tester.
c. Check if data change of front right wheel speed sensor matches that of other wheel speed sensors.

NG → **Replace front right wheel speed sensor**

OK

4	Check front right hub ring gear

a. Remove the front right hub assembly.
b. Check for foreign matter, missing teeth or damage on front right hub ring gear.
c. Check if front right hub assembly is securely installed.

NG → **Replace front right hub ring gear**

OK

5	Check wire harness and connector (front right wheel speed sensor - ABS/ESP control module assembly)

a. Turn ignition switch to LOCK.

b. Disconnect the negative battery cable.

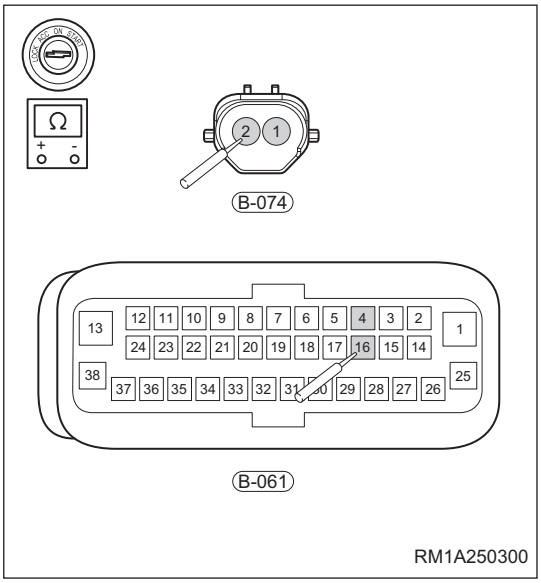
c. Disconnect the ABS/ESP control module assembly connector B-061.

d. Disconnect the front right wheel speed sensor connector B-074.

e. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector B-074 to check if there is an open in wire harness and connector according to table below.

Standard Condition

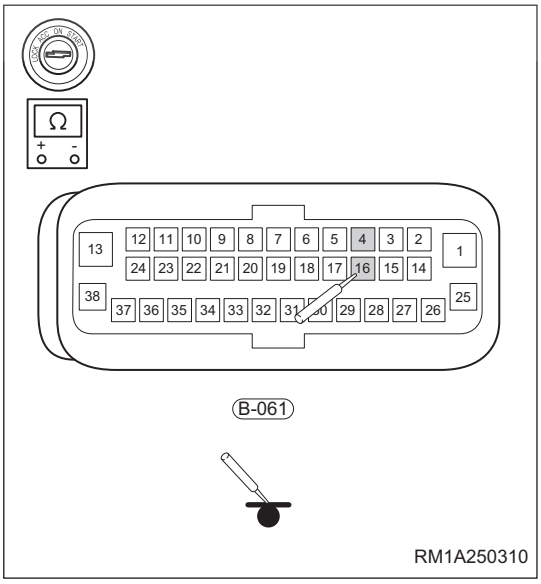
Multimeter Connection	Condition	Specified Condition
B-061 (4) - B-074 (1)	Always	Continuity
B-061 (16) - B-074 (2)	Always	Continuity
B-061 (4) - B-074 (2)	Always	No continuity
B-061 (16) - B-074 (1)	Always	No continuity
B-074 (1) - B-074 (2)	Always	No continuity
B-061 (4) - B-061 (16)	Always	No continuity



f. Using a digital multimeter, check for continuity between connector B-061 and body ground to check if front right wheel speed sensor is short to ground according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (4) - Body ground	Always	No continuity
B-061 (16) - Body ground	Always	No continuity



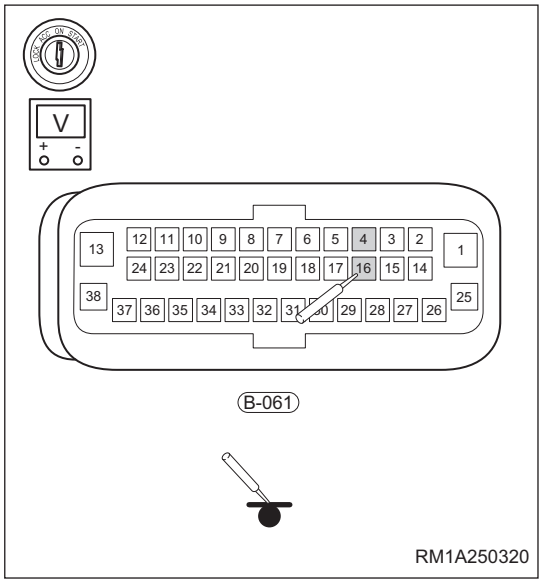
g. Connect the negative battery cable.

h. Turn ignition switch to ON.

i. Using a digital multimeter, measure voltage between connector B-061 and body ground to check if front right wheel speed sensor is short to power supply according to table below.

Standard Voltage

Multimeter Connection	Condition	Specified Condition
B-061 (4) - Body ground	Ignition switch ON	Approx. 0 V
B-061 (16) - Body ground	Ignition switch ON	Approx. 0 V



NG → **Repair or replace wire harness and connector between front right wheel speed sensor and ABS/ESP control module assembly**

OK

6	Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.

b. Start the engine.

c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.

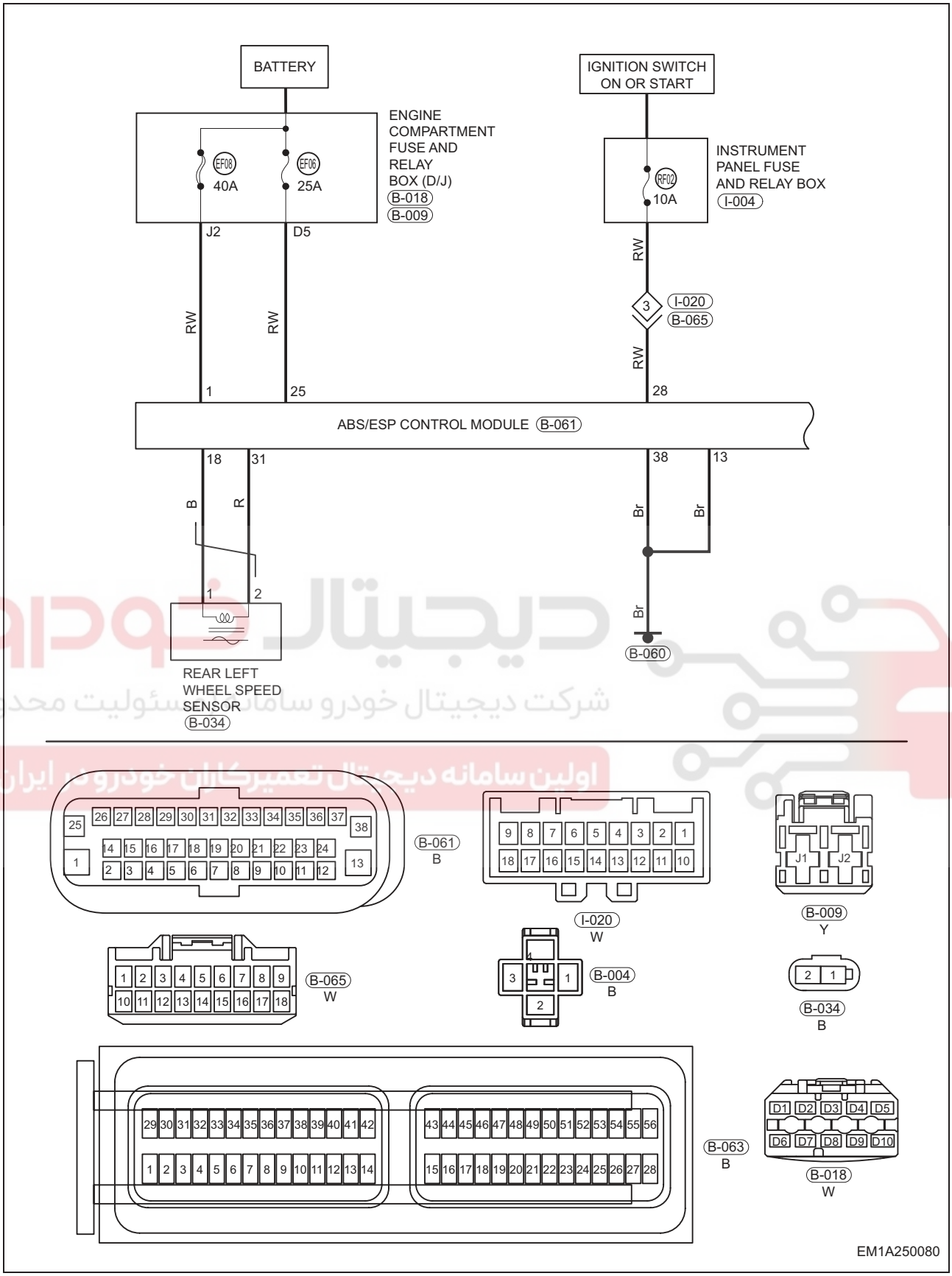
d. Check if same DTC is output.

NO → **System operates normally**

YES

Replace ABS/ESP control module assembly

DTC	C0037-00	Left Rear Wheel Speed Sensor
DTC	C0037-09	Left Rear Wheel Speed Sensor
DTC	C0037-11	Left Rear Wheel Speed Sensor
DTC	C0037-12	Left Rear Wheel Speed Sensor
DTC	C0037-13	Left Rear Wheel Speed Sensor
DTC	C0037-29	Left Rear Wheel Speed Sensor



EM1A250080

DTC	DTC Definition	DTC Detection Condition	Possible Cause
C0037-00	Left Rear Wheel Speed Sensor	These DTCs occur when any of following conditions is met: 1. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to ground. 2. Wheel speed sensor wire is open. 3. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to power supply. 4. ABS/ESP control module assembly detects that wheel speed sensor power supply wire is short to ground. 5. Wheel speed sensor signal is invalid.	• Reverse connection of wheel speed sensor signal wire and power supply wire • Short to ground in wheel speed sensor signal wire • Wheel speed sensor wire disconnected, or connector loose or broken • Short to power supply in wheel speed sensor signal wire • Short to ground in wheel speed sensor power supply wire • Sensor head or connector pin damaged • Wheel speed sensor interfered by outside magnetic field (wheel or axle not demagnetized) • Wheel speed sensor body malfunction • Ring gear not installed, missing teeth, dirty, demagnetized, or off center • Excessive clearance between sensor and ring gear • Wrong number of ring gear teeth • Tire size not as specified • ABS/ESP control module assembly damaged
C0037-09	Left Rear Wheel Speed Sensor		
C0037-11	Left Rear Wheel Speed Sensor		
C0037-12	Left Rear Wheel Speed Sensor		
C0037-13	Left Rear Wheel Speed Sensor		
C0037-29	Left Rear Wheel Speed Sensor		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check rear left wheel speed sensor wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the rear left wheel speed sensor connector B-034.
d. Check if wire harnesses are worn, pierced, pinched or partially broken.
e. Check for broken, bent, protruded or corroded terminals.
f. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace rear left wheel speed sensor wire harness and connector**

OK

2	Check installation of rear left wheel speed sensor

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check rear left wheel speed sensor mounting bolt for looseness.
d. Check if excessive clearance exists between installation area of rear left wheel speed sensor and rear axle hub ring gear.
e. Check installation area of rear left wheel speed sensor for dirt.

NG → **Tighten mounting bolt properly, clean or replace rear left wheel speed sensor**

OK

3	Check rear left wheel speed sensor

a. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
b. Drive vehicle straight ahead, and read datastream of rear left wheel speed sensor with X-431 3G diagnostic tester.
c. Check if data change of rear left wheel speed sensor matches that of other wheel speed sensors.

NG → **Replace rear left wheel speed sensor**

OK

4	Check rear left hub ring gear

a. Remove the rear left hub assembly.
b. Check for foreign matter, missing teeth or damage on rear left hub ring gear.
c. Check if rear left hub assembly is securely installed.

NG → **Replace rear left hub ring gear**

OK

5	Check wire harness and connector (rear left wheel speed sensor - ABS/ESP control module assembly)

a. Turn ignition switch to LOCK.

b. Disconnect the negative battery cable.

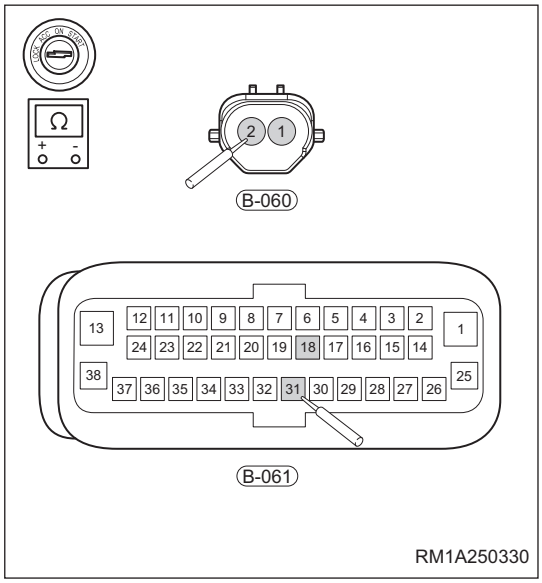
c. Disconnect the ABS/ESP control module assembly connector B-061.

d. Disconnect the rear left wheel speed sensor connector B-034.

e. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector B-034 to check if there is an open in wire harness and connector according to table below.

Standard Condition

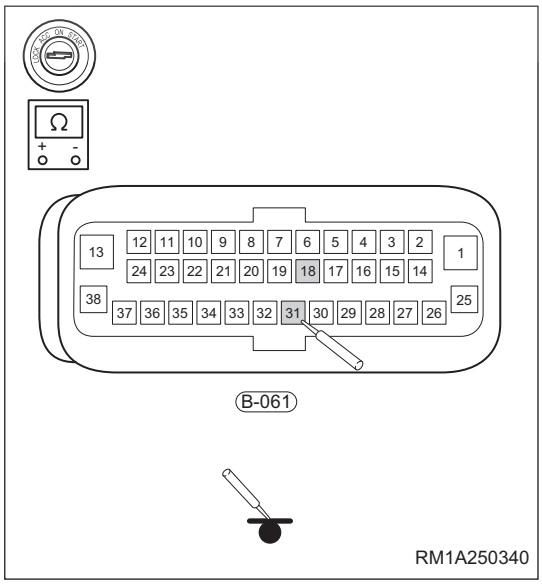
Multimeter Connection	Condition	Specified Condition
B-061 (18) - B-034 (1)	Always	Continuity
B-061 (31) - B-034 (2)	Always	Continuity
B-061 (31) - B-034 (1)	Always	No continuity
B-061 (18) - B-034 (2)	Always	No continuity
B-060 (1) - B-034 (2)	Always	No continuity
B-061 (18) - B-061 (31)	Always	No continuity



f. Using a digital multimeter, check for continuity between connector B-061 and body ground to check if rear left wheel speed sensor is short to ground according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (18) - Body ground	Always	No continuity
B-061 (31) - Body ground	Always	No continuity



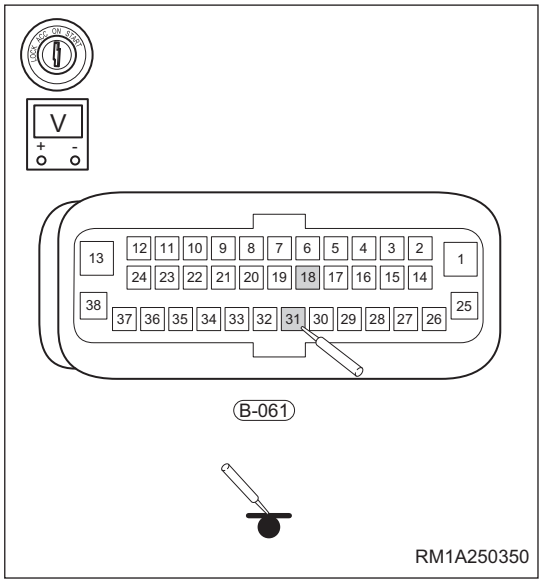
g. Connect the negative battery cable.

h. Turn ignition switch to ON.

i. Using a digital multimeter, measure voltage between connector B-061 and body ground to check if rear left wheel speed sensor is short to power supply according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (18) - Body ground	Ignition switch ON	Approx. 0 V
B-061 (31) - Body ground	Ignition switch ON	Approx. 0 V



NG → **Repair or replace wire harness and connector between rear left wheel speed sensor and ABS/ESP control module assembly**

OK

6	Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.

b. Start the engine.

c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.

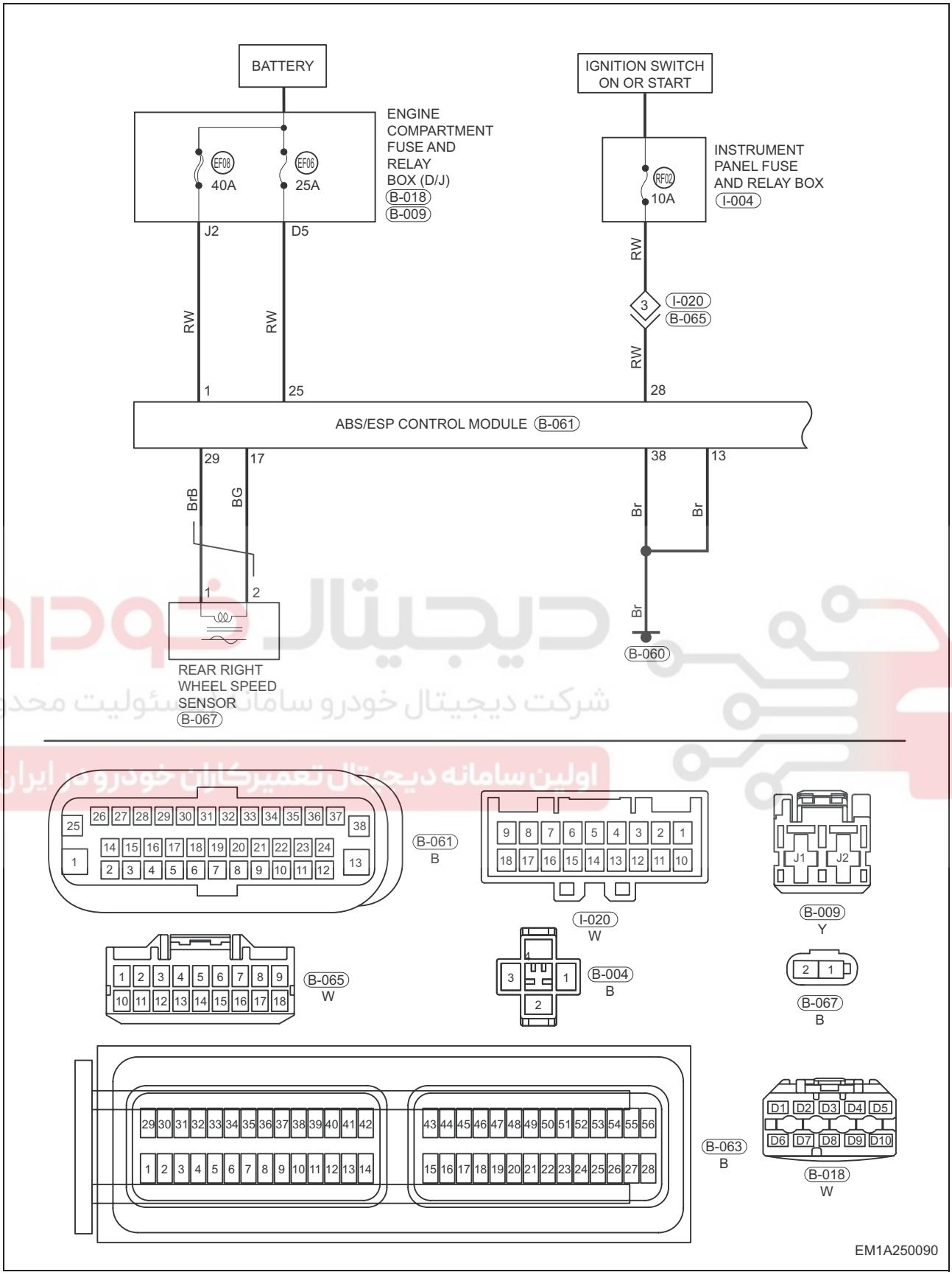
d. Check if same DTC is output.

NO → **System operates normally**

YES

Replace ABS/ESP control module assembly

DTC	C003A-00	Right Rear Wheel Speed Sensor
DTC	C003A-09	Right Rear Wheel Speed Sensor
DTC	C003A-11	Right Rear Wheel Speed Sensor
DTC	C003A-12	Right Rear Wheel Speed Sensor
DTC	C003A-13	Right Rear Wheel Speed Sensor
DTC	C003A-29	Right Rear Wheel Speed Sensor



DTC	DTC Definition	DTC Detection Condition	Possible Cause
C003A-00	Right Rear Wheel Speed Sensor	These DTCs occur when any of following conditions is met: 1. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to ground. 2. Wheel speed sensor wire is open. 3. ABS/ESP control module assembly detects that wheel speed sensor signal wire is short to power supply. 4. ABS/ESP control module assembly detects that wheel speed sensor power supply wire is short to ground. 5. Wheel speed sensor signal is invalid.	• Reverse connection of wheel speed sensor signal wire and power supply wire • Short to ground in wheel speed sensor signal wire • Wheel speed sensor wire disconnected, or connector loose or broken • Short to power supply in wheel speed sensor signal wire • Short to ground in wheel speed sensor power supply wire • Sensor head or connector pin damaged • Wheel speed sensor interfered by outside magnetic field (wheel or axle not demagnetized) • Wheel speed sensor body malfunction • Ring gear not installed, missing teeth, dirty, demagnetized, or off center • Excessive clearance between sensor and ring gear • Wrong number of ring gear teeth • Tire size not as specified • ABS/ESP control module assembly damaged
C003A-09	Right Rear Wheel Speed Sensor		
C003A-11	Right Rear Wheel Speed Sensor		
C003A-12	Right Rear Wheel Speed Sensor		
C003A-13	Right Rear Wheel Speed Sensor		
C003A-29	Right Rear Wheel Speed Sensor		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check rear right wheel speed sensor wire harness and connector

25

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the rear right wheel speed sensor connector B-067.
d. Check if wire harnesses are worn, pierced, pinched or partially broken.
e. Check for broken, bent, protruded or corroded terminals.

f. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace rear right wheel speed sensor wire harness and connector**

YES

2	Check installation of rear right wheel speed sensor

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check rear right wheel speed sensor mounting bolt for looseness.
d. Check if excessive clearance exists between installation area of rear right wheel speed sensor and rear axle hub ring gear.
e. Check installation area of rear right wheel speed sensor for dirt.

NG → **Tighten mounting bolt properly, clean or replace rear right wheel speed sensor**

OK

3	Check rear right wheel speed sensor

a. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
b. Drive vehicle straight ahead, and read datastream of rear right wheel speed sensor with X-431 3G diagnostic tester.
c. Check if data change of rear right wheel speed sensor matches that of other wheel speed sensors.

NG → **Replace rear right wheel speed sensor**

OK

4	Check rear right hub ring gear

a. Remove the rear right hub assembly.
b. Check for foreign matter, missing teeth or damage on rear right hub ring gear.
c. Check if rear right hub assembly is securely installed.

NG → **Replace rear right hub ring gear**

OK

5	Check wire harness and connector (rear right wheel speed sensor - ABS/ESP control module assembly)

a. Turn ignition switch to LOCK.

b. Disconnect the negative battery cable.

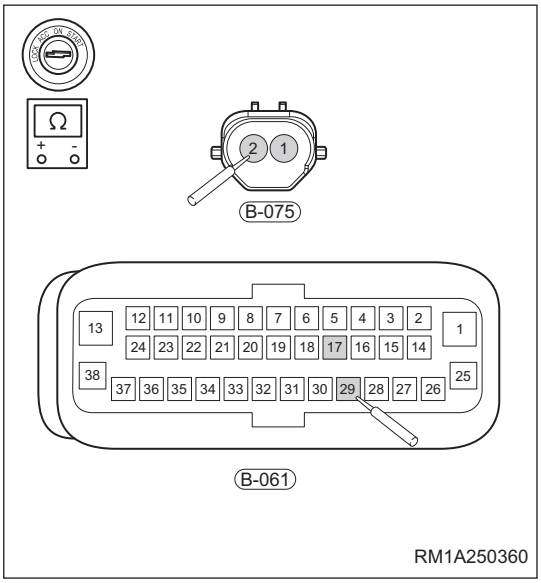
c. Disconnect the ABS/ESP control module assembly connector B-061.

d. Disconnect the rear right wheel speed sensor connector B-067.

e. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector B-067 to check if there is an open in wire harness and connector according to table below.

Standard Condition

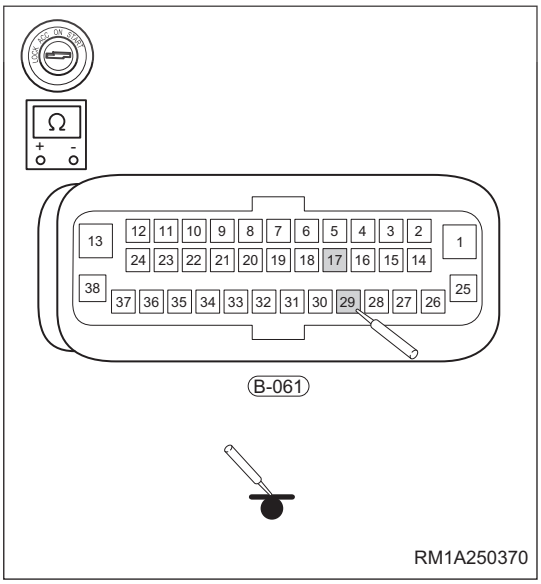
Multimeter Connection	Condition	Specified Condition
B-061 (29) - B-067 (1)	Always	Continuity
B-061 (17) - B-067 (2)	Always	Continuity
B-061 (17) - B-067 (1)	Always	No continuity
B-061 (29) - B-067 (2)	Always	No continuity
B-075 (1) - B-067(2)	Always	No continuity
B-061 (17) - B-061(29)	Always	No continuity



f. Using a digital multimeter, check for continuity between connector B-061 and body ground to check if rear right wheel speed sensor is short to ground according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (17) - Body ground	Always	No continuity
B-061 (29) - Body ground	Always	No continuity



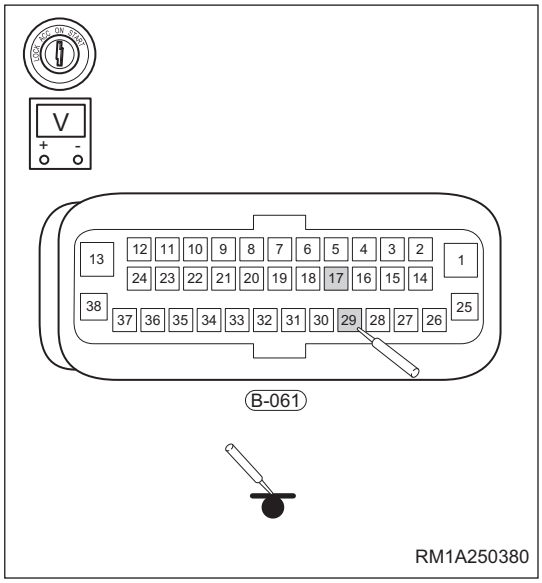
g. Connect the negative battery cable.

h. Turn ignition switch to ON.

i. Using a digital multimeter, measure voltage between connector B-061 and body ground to check if rear right wheel speed sensor is short to power supply according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (17) - Body ground	Ignition switch ON	Approx. 0 V
B-061 (29) - Body ground	Ignition switch ON	Approx. 0 V



NG → **Repair or replace wire harness and connector between rear right wheel speed sensor and ABS/ESP control module assembly**

OK

6 Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.

b. Start the engine.

c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.

d. Check if same DTC is output.

NO → **System operates normally**

YES

Replace ABS/ESP control module assembly

DTC	C0051-29	Steering Wheel Position Sensor (ESP Only)
DTC	C0051-54	Steering Wheel Position Sensor (ESP Only)
DTC	C0051-64	Steering Wheel Position Sensor (ESP Only)
DTC	C0061-64	Lateral Acceleration Sensor (ESP Only)
DTC	C0062-64	Longitudinal Acceleration Sensor (ESP Only)
DTC	C0063-64	Yaw Rate Sensor (ESP Only)

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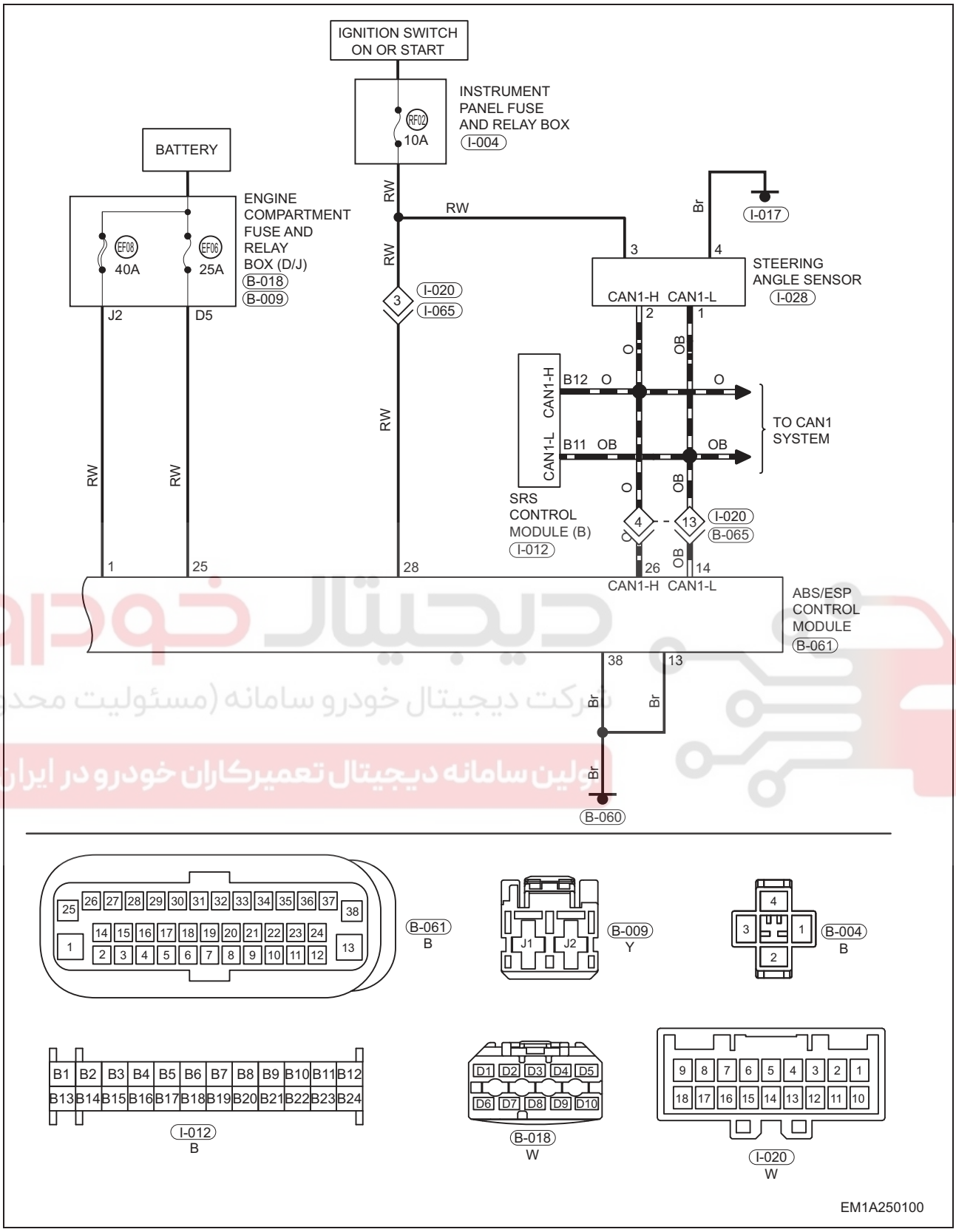


DTC	DTC Definition	DTC Detection Condition	Possible Cause
C0051-29	Steering Wheel Position Sensor (ESP Only)	These DTCs occur when any of following conditions is met: 1. Steering angle sensor is uncalibrated (central point is not found). 2. Steering angle sensor signal is abnormal. 3. Steering angle sensor signal is interrupted.	• Steering angle sensor uncalibrated • Short or open in steering angle sensor line • Steering angle sensor damaged
C0051-54	Steering Wheel Position Sensor (ESP Only)		
C0051-64	Steering Wheel Position Sensor (ESP Only)		
C0061-64	Lateral Acceleration Sensor (ESP Only)		
C0062-64	Longitudinal Acceleration Sensor (ESP Only)		
C0063-64	Yaw Rate Sensor (ESP Only)		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	**Check steering angle sensor calibration**

a. Turn ignition switch to ON.
b. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
c. Perform steering angle sensor calibration again according to instruction on diagnostic tester.
d. Use X-431 3G diagnostic tester to clear DTC.
e. Start the engine.
f. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
g. Check if same DTC is output.

NO → **Steering angle sensor is uncalibrated**

YES

2	Check wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect ABS/ESP control module assembly connector B-061 and steering angle sensor connector I-028.
d. Disconnect body wire harness connector B-065 and instrument panel wire harness connector I-020.
e. Check if wire harnesses are worn, pierced, pinched or partially broken.
f. Check for broken, bent, protruded or corroded terminals.
g. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace body/instrument panel wire harness and connector**

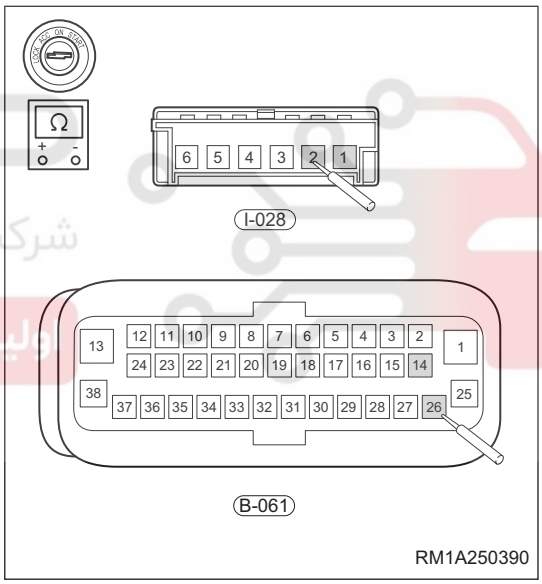
OK

3	Check CAN communication control circuit (ESP - steering angle sensor)

a. Turn ignition switch to LOCK, disconnect the negative battery cable and wait at least 90 seconds.
b. Disconnect the ABS/ESP control module assembly connector B-061.
c. Disconnect the steering angle sensor connector I-028.
d. Using a digital multimeter, check for continuity between the terminals of connector I-028 and connector B-061 to check if there is an open in CAN communication circuit according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
I-028 (1) - B-061 (14)	Always	Continuity
I-028 (2) - B-061 (26)	Always	Continuity

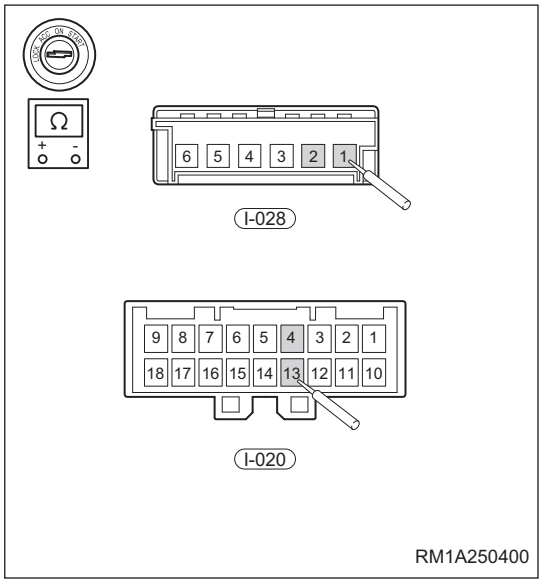


e. Disconnect body wire harness connector B-065 and instrument panel wire harness connector I-020.

f. Using a digital multimeter, check for continuity between the terminals of connector I-028 and connector I-020 to check if there is an open in CAN communication circuit according to table below.

Standard Condition

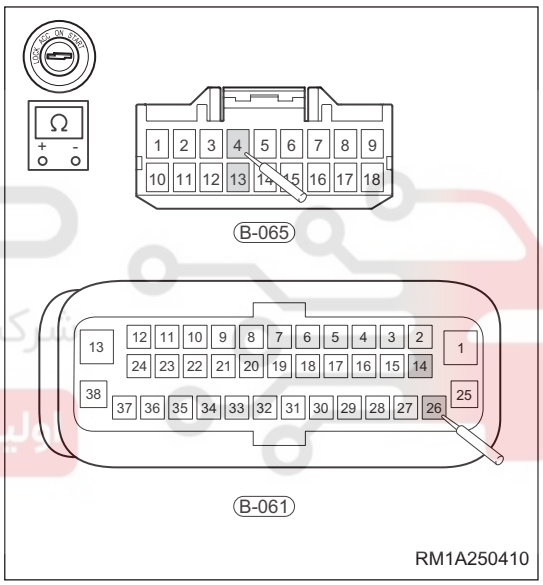
Multimeter Connection	Condition	Specified Condition
I-028 (2) - I-020 (4)	Always	Continuity
I-028 (1) - I-020 (13)	Always	Continuity



g. Using a digital multimeter, check for continuity between the terminals of connector B-065 and connector B-061 to check if there is an open in CAN communication circuit according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-065 (4) - B-061 (26)	Always	Continuity
B-065 (13) - B-061 (14)	Always	Continuity



NG → **Repair or replace instrument panel/body wire harness and connector**

OK

4	Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.
b. Start the engine.
c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
d. Check if same DTC is output.

NO → System operates normally

YES

Replace steering angle sensor and perform calibration again

DTC	C006B-00	Stability System Active Too Long (ESP Only)

DTC	DTC Definition	DTC Detection Condition	Possible Cause
C006B-00	Stability System Active Too Long (ESP Only)	This DTC occurs when following conditions are met: 1. ABS receives a continuous operation command (for more than 1 minute). 2. ESP receives a continuous operation command (for more than 10 seconds).	• Excessive wheel speed difference • Sensor signal error • ABS/ESP control module assembly damaged

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check sensor wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect all wheel speed sensor connectors and steering angle sensor connector.
d. Check if wire harnesses are worn, pierced, pinched or partially broken.
e. Check for broken, bent, protruded or corroded terminals.
f. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace related wire harness and connector**

OK

2	Check installation of wheel speed sensor

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check wheel speed sensor mounting bolt for looseness.
d. Check if excessive clearance exists between installation area of wheel speed sensor and hub ring gear.
e. Check installation area of wheel speed sensor for dirt.

NG → **Tighten mounting bolt properly, clean or replace wheel speed sensor**

OK

3	Check wheel speed sensor

a. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
b. Drive vehicle straight ahead, and read datastream of each wheel speed sensor with X-431 3G diagnostic tester.
c. Check if data change of each wheel speed sensor matches that of other wheel speed sensors.

NG → **Replace corresponding wheel speed sensor**

OK ↓

4	Check hub ring gear

a. Remove the hub assembly.
b. Check for foreign matter, missing teeth or damage on hub ring gear.
c. Check if hub assembly is securely installed.

NG → **Replace corresponding hub ring gear**

OK ↓

5	Check installation of steering angle sensor

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check if steering angle sensor connector is connected securely.
d. Check if steering angle sensor is installed in place.
e. Check installation area of steering angle sensor for dirt.

NG → **Correctly and securely install, clean or replace steering angle sensor**

OK ↓

6	Reconfirm DTCs

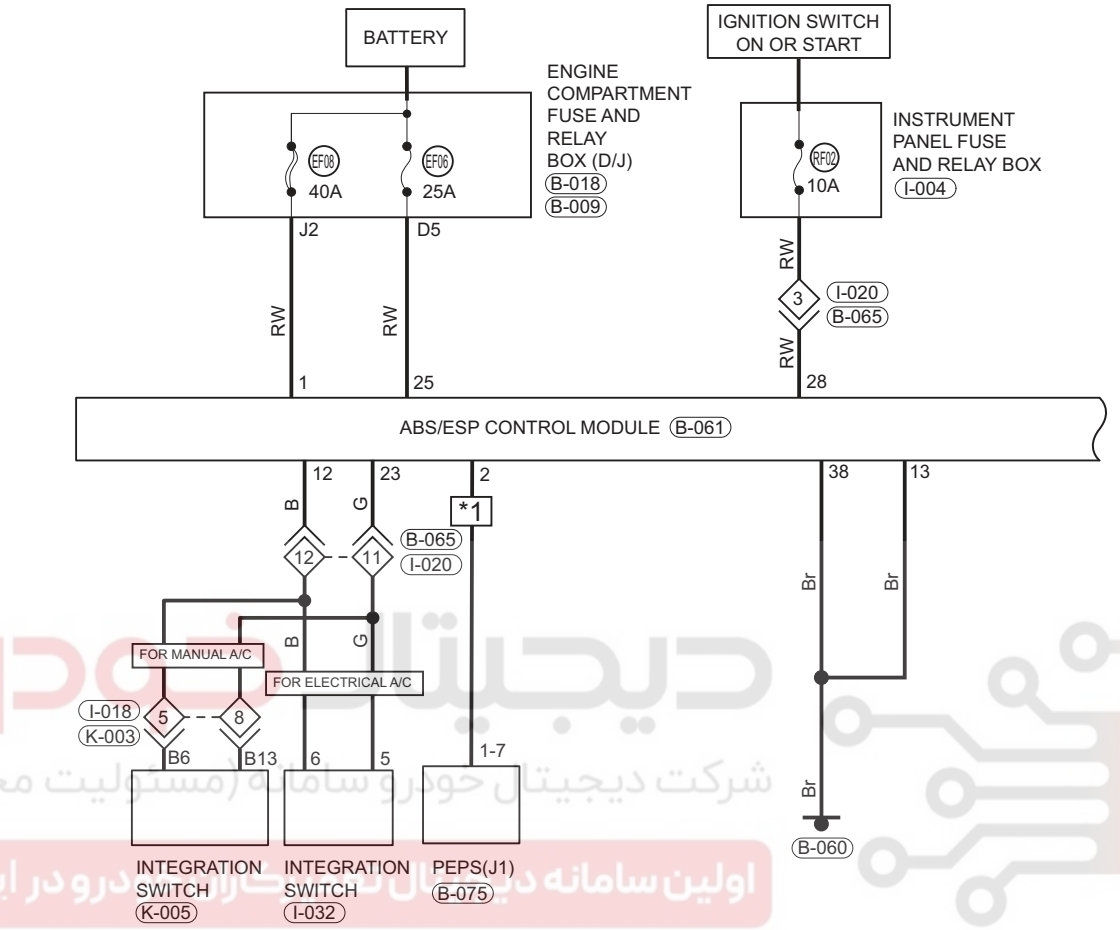
a. Use X-431 3G diagnostic tester to clear DTC.
b. Start the engine.
c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
d. Check if same DTC is output.

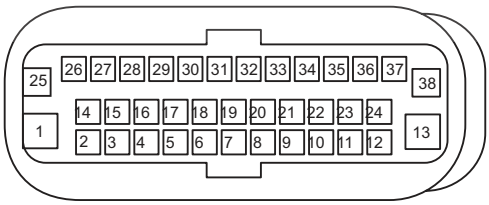
NO → **System operates normally**

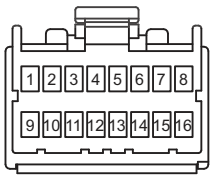
YES ↓

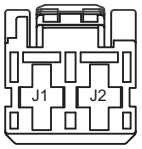
Replace ABS/ESP control module assembly

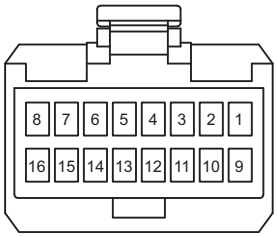
DTC	C0089-04	TCS Disable Switch (ESP Only)

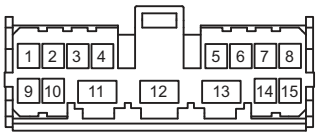


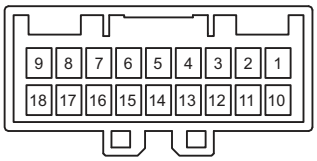


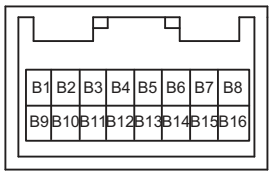


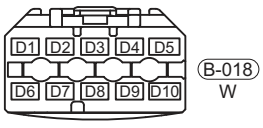












EM1A250110

DTC	DTC Definition	DTC Detection Condition	Possible Cause
C0089-04	TCS Disable Switch (ESP Only)	This DTC occurs when any of following conditions is met: 1. ESP OFF switch is pressed and held for more than 10 seconds. 2. During ignition, ESP OFF switch active signal is detected for more than 2 seconds.	• ESP OFF switch pressed by object • ESP OFF switch damaged

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check ESP OFF switch

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check if ESP OFF switch is stuck or pressed by other objects.

NG → **Release ESP OFF switch or move away other objects**

OK

2	Check wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Check if wire harnesses are worn, pierced, pinched or partially broken.
d. Check for broken, bent, protruded or corroded terminals.
e. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace body/instrument panel wire harness and connector**

OK

3	Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.
b. Start the engine.
c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
d. Check if same DTC is output.

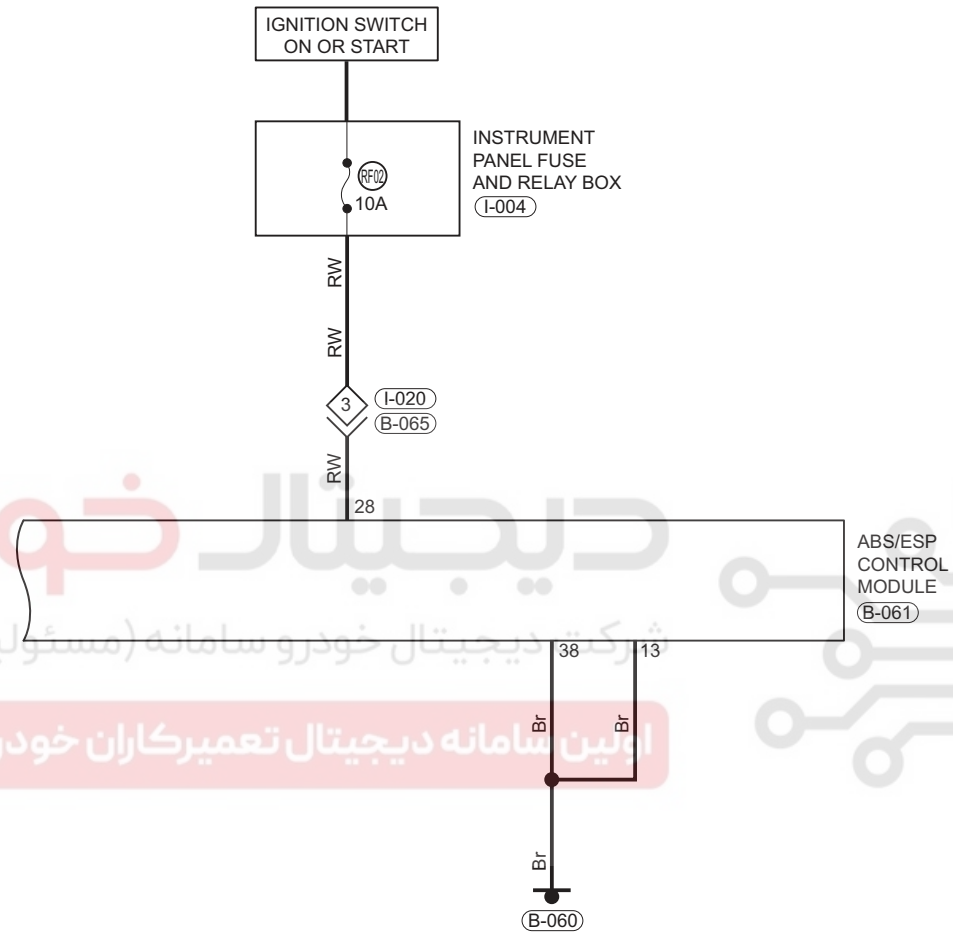
NO → **System operates normally**

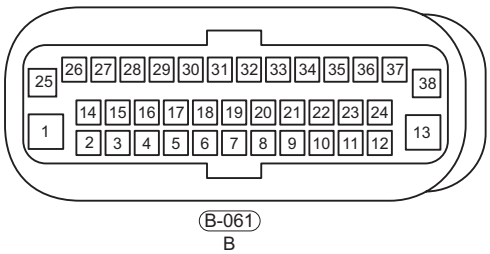
YES ↓

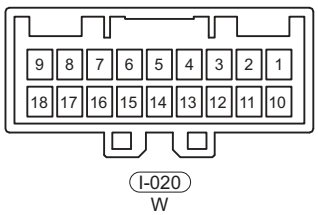
Replace center control integration panel assembly

DTC	C1000-16	ECU Voltage Supply

DTC	C1000-17	ECU Voltage Supply







EM1A250120

DTC	DTC Definition	DTC Detection Condition	Possible Cause
C1000-16	ECU Voltage Supply	These DTC occur when ECU supply voltage meets any of following conditions: 1. Voltage is below 4.5 V just after vehicle is powered on. 2. Voltage is below 7.7 V or above 16.8 V with ignition switch ON. 3. Voltage is 7.7 to 9.2 V when vehicle speed is above 6 km/h.	• Fuse malfunction • High or low battery voltage • Charging system malfunction • Wire harness or connector damaged • ABS/ESP control module assembly malfunction
C1000-17	ECU Voltage Supply		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check fuse

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Remove fuse RF02 (10 A) from instrument panel fuse box.
d. Check if fuse is blown.

NG → Replace fuse RF02

OK

2	Check battery voltage

a. Using a digital multimeter, measure voltage between positive battery terminal and negative battery terminal.
b. Battery voltage should be between 9 and 16 V.

NG → Check charging system (See page 16-6)

OK

3	Check ABS/ESP control module assembly wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Check if wire harnesses are worn, pierced, pinched or partially broken.
e. Check for broken, bent, protruded or corroded terminals.
f. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace ABS/ESP control module assembly wire harness and connector**

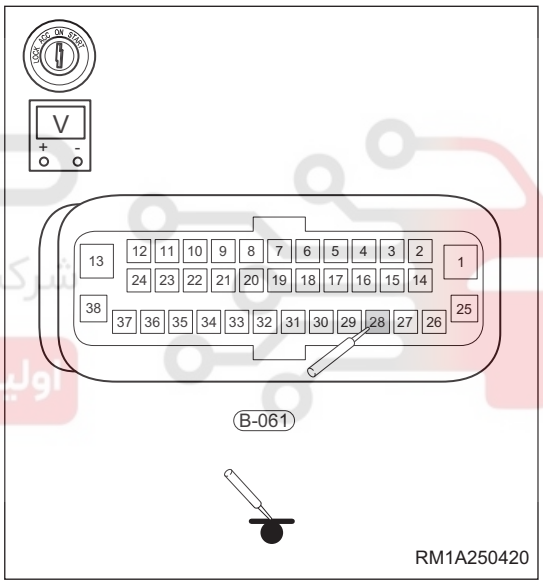
OK

4	Check wire harness and connector (ABS/ESP control module assembly - battery)

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Connect the negative battery cable.
e. Turn ignition switch to ON.
f. Using a digital multimeter, measure supply voltage between ABS/ESP control module assembly connector B-061 and body ground to check if system power supply circuit is normal according to table below.

Standard Voltage

Multimeter Connection	Condition	Specified Condition
B-061 (28) - Body ground	Ignition switch ON	9 to 16 V



NG → **Repair or replace related wire harness and connector**

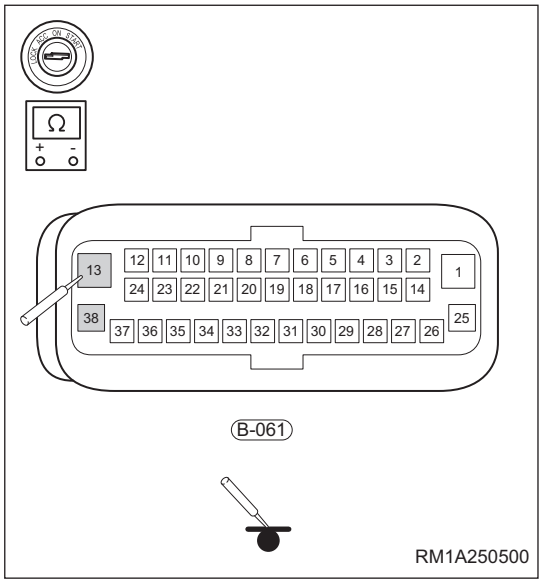
OK

5	Check wire harness and connector (ABS/ESP control module assembly - body ground)

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Using a digital multimeter, check for continuity between ABS/ESP control module assembly connector B-061 and body ground to check if system ground circuit is normal according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (13) - Body ground	Always	Continuity
B-061 (38) - Body ground	Always	Continuity



NG → **Repair or replace ABS/ESP control module assembly wire harness and connector**

OK ↓

6	Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.
b. Start the engine.
c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
d. Check if same DTC is output.

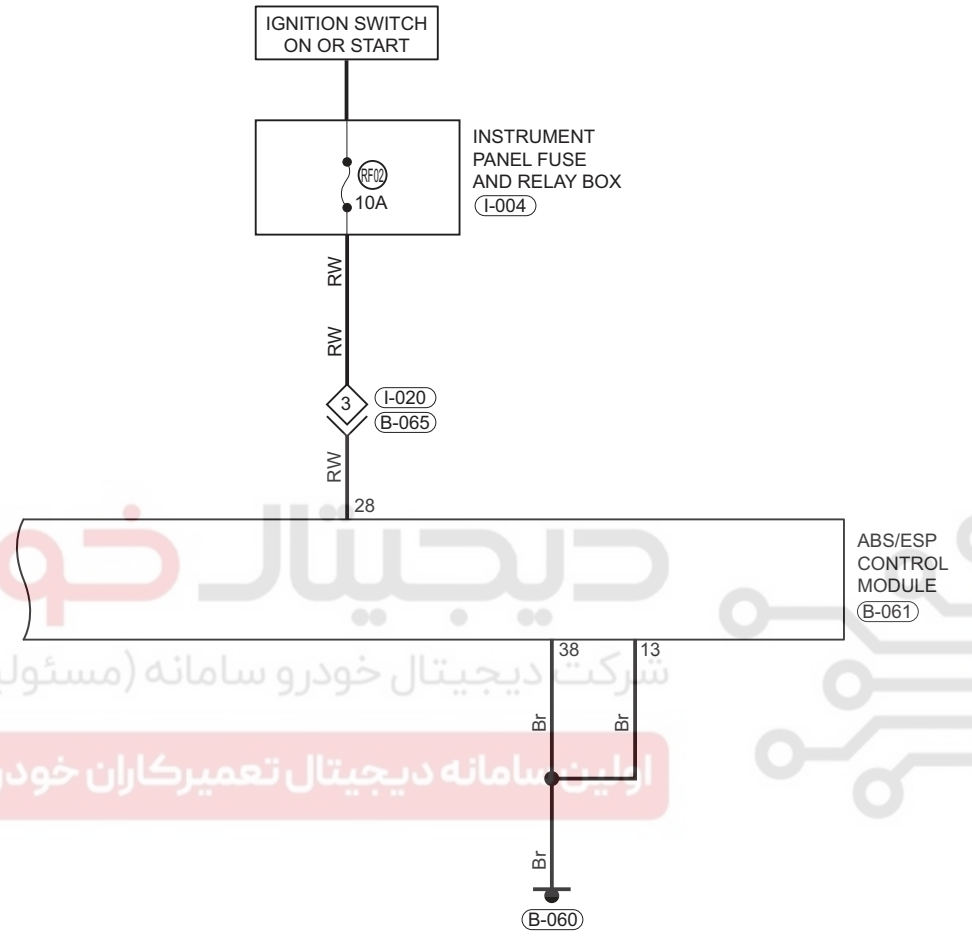
NO → **System operates normally**

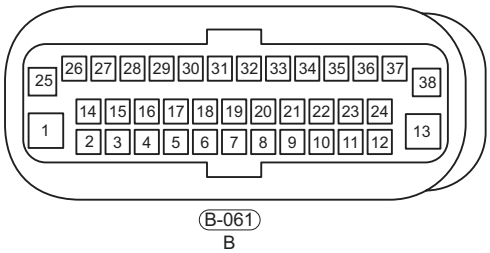
YES ↓

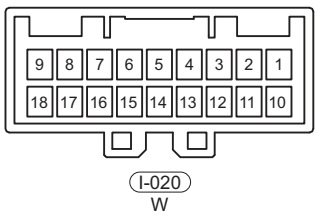
Replace ABS/ESP control module assembly

DTC	C1001-04	ECU

DTC	C1009-00	ECU Hardware Related







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DTC	DTC Definition	DTC Detection Condition	Possible Cause
C1001-04	ECU	These DTC occur when any of following conditions is met: 1. ECU power supply is malfunctioning. 2. ECU is damaged.	• Fuse malfunction • Wire harness or connector damaged • ABS/ESP control module assembly malfunction
C1009-00	ECU Hardware Related		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check fuse

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Remove fuse RF02 (10 A) from instrument panel fuse box.
d. Check if fuse is blown.

NG → **Replace fuse RF02**

OK

2	Check ABS/ESP control module assembly wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Check if wire harnesses are worn, pierced, pinched or partially broken.
e. Check for broken, bent, protruded or corroded terminals.
f. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace ABS/ESP control module assembly wire harness and connector**

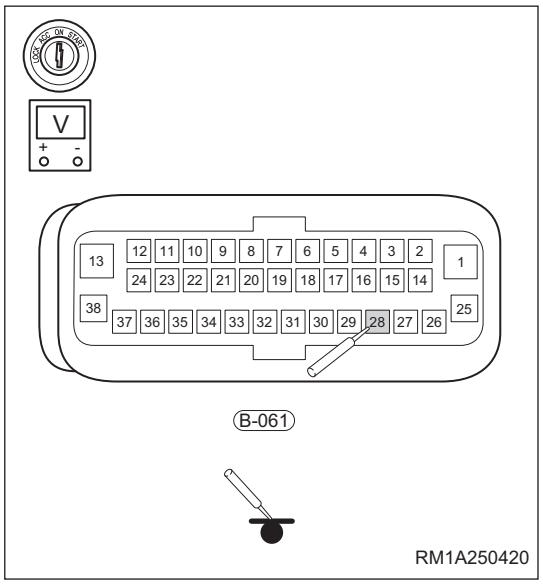
OK

3	Check wire harness and connector (ABS/ESP control module assembly - battery)

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Connect the negative battery cable.
e. Turn ignition switch to ON.
f. Using a digital multimeter, measure supply voltage between ABS/ESP control module assembly connector B-061 and body ground to check if system power supply circuit is normal according to table below.

Standard Voltage

Multimeter Connection	Condition	Specified Condition
B-061 (28) - Body ground	Ignition switch ON	9 to 16 V



NG → **Repair or replace engine compartment wire harness and connector**

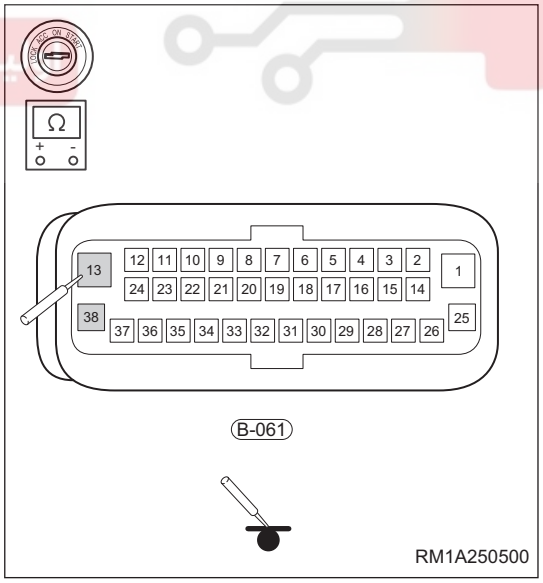
OK

4	Check wire harness and connector (ABS/ESP control module assembly - body ground)

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Using a digital multimeter, check for continuity between ABS/ESP control module assembly connector B-061 and body ground to check if system ground circuit is normal according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (13) - Body ground	Always	Continuity
B-061 (38) - Body ground	Always	Continuity



NG → **Repair or replace ABS/ESP control module assembly wire harness and connector**

OK

5	Reconfirm DTCs

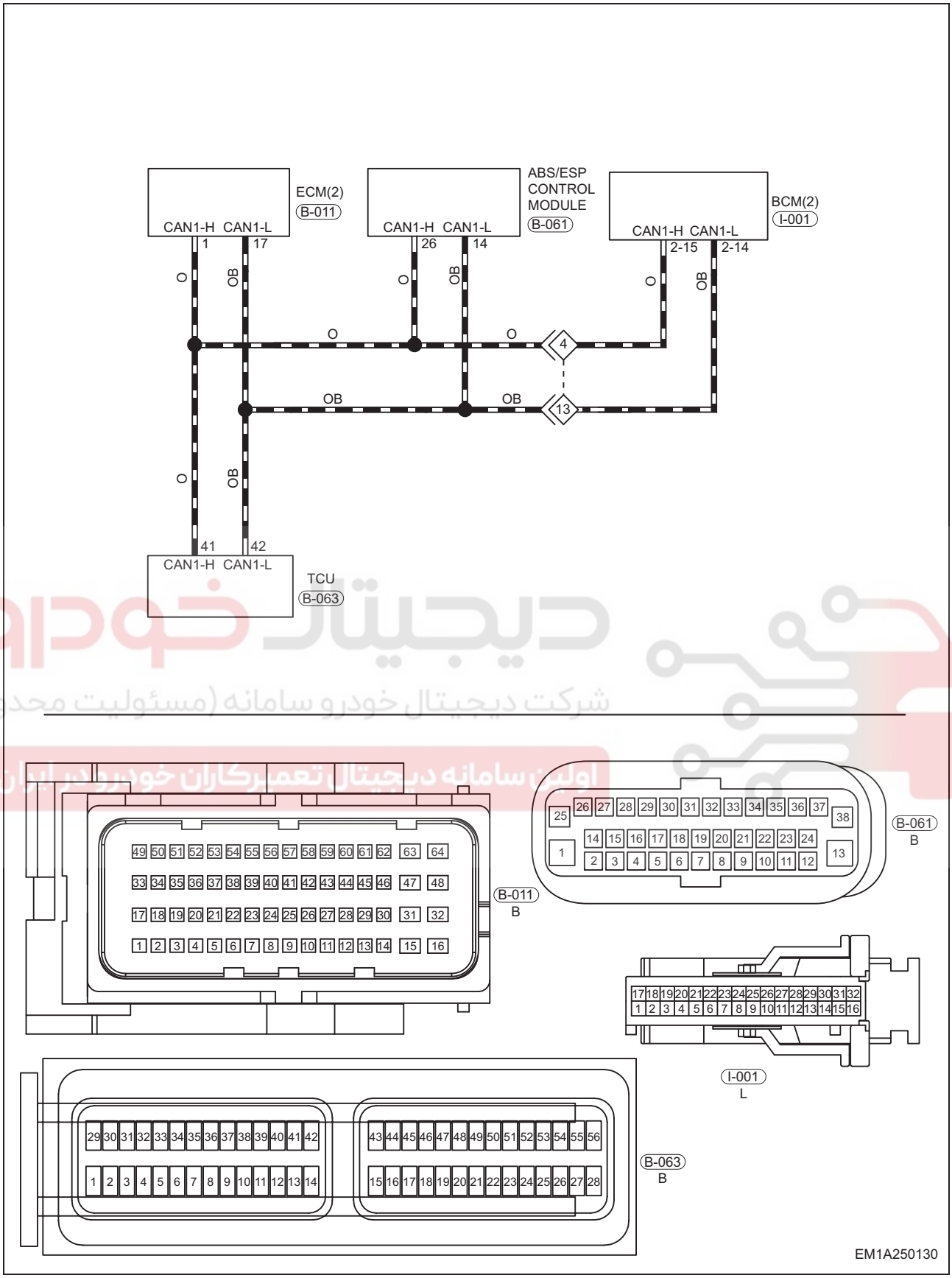
a. Use X-431 3G diagnostic tester to clear DTC.
b. Start the engine.
c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.
d. Check if same DTC is output.

NO → System operates normally

YES

Replace ABS/ESP control module assembly

DTC	C1005-08	Hand Brake Switch (ESP Only)
DTC	C1006-29	Clutch Switch (ESP Only)
DTC	C1007-29	Reverse Gear Switch (ESP Only)
DTC	U0005-00	High Speed CAN Communication Bus (+) High
DTC	U0007-00	High Speed CAN Communication Bus (-) Low
DTC	U0073-00	Control Module Communication Bus Off
DTC	U0100-00	Lost Communication with ECM (ESP Only)
DTC	U0101-00	Lost Communication With TCM (ESP Only)
DTC	U0140-00	Lost Communication with BCM (ESP Only)
DTC	U0401-00	Invalid Data Received from ECM (ESP Only)
DTC	U0402-00	Invalid Data Received from TCM (ESP Only)
DTC	U0422-00	Invalid Data Received from Body Control Module (ESP Only)
DTC	U1000-00	CAN Error Passive
DTC	U0126-00	Lost Communication With Steering Angle Sensor (ESP Only)
DTC	U0428-00	Invalid Data Received From Steering Angle Sensor (ESP Only)



DTC	DTC Definition	DTC Detection Condition	Possible Cause
C1005-08	Hand Brake Switch (ESP Only)	These DTCs occur when any of following conditions is met: 1. Malfunction in CAN bus communication, configuration information or line. 2. ECM message timeout. 3. ECM message error. 4. TCU message timeout. 5. TCU message error.	• CAN controller malfunction • CAN configuration information unmatched • CAN communication off • CAN bus line malfunction • ECM software version unmatched • ECM damaged • TCU software version unmatched • TCU damaged • BCM damaged • ESP (ABS) damaged
C1006-29	Clutch Switch (ESP Only)		
C1007-29	Reverse Gear Switch (ESP Only)		
U0005-00	High Speed CAN Communication Bus (+) High		
U0007-00	High Speed CAN Communication Bus (-) Low		
U0073-00	Control Module Communication Bus Off		
U0100-00	Lost Communication with ECM (ESP Only)		
U0101-00	Lost Communication with TCM (ESP Only)		
U0140-00	Lost Communication with BCM (ESP Only)		
U0401-00	Invalid Data Received from ECM (ESP Only)		
U0402-00	Invalid Data Received from TCM (ESP Only)		
U0422-00	Invalid Data Received from Body Control Module (ESP Only)		
U1000-00	CAN Error Passive		
U0126-00	Lost Communication With Steering Angle Sensor (ESP Only)		
U0428-00	Invalid Data Received From Steering Angle Sensor (ESP Only)		

CAUTION

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Diagnosis Procedure

1	Check wire harness and connector

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Disconnect the Engine Control Module (ECM) connector B-011.
e. Disconnect the Transmission Control Module (TCM) connector B-063.
f. Disconnect the Body Control Module (BCM) connector I-001.
g. Check if wire harnesses are worn, pierced, pinched or partially broken.
h. Check for broken, bent, protruded or corroded terminals.
i. Check if related connector terminal contact pins are in good condition.

NG → **Repair or replace body wire harness and connector**

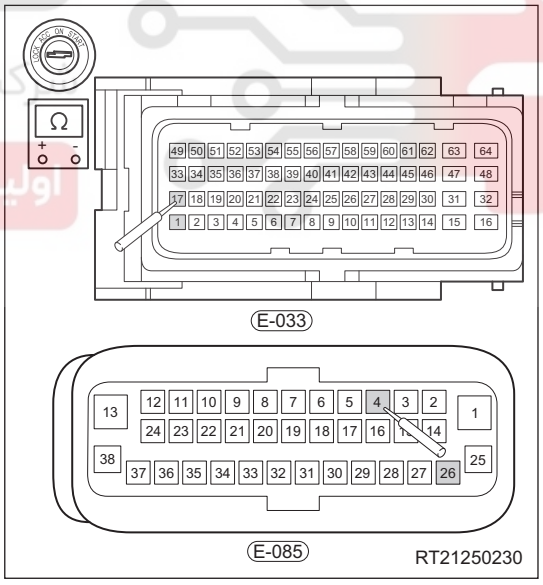
OK

2	Check CAN communication control circuit (ABS/ESP control module assembly - Engine Control Module (ECM))

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Disconnect the Engine Control Module (ECM) connector B-011.
e. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector B-011 to check if there is an open in CAN communication circuit according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (26) - B-011 (1)	Always	Continuity
B-061 (4) - B-011 (17)	Always	Continuity



NG → **Repair or replace body wire harness and connector**

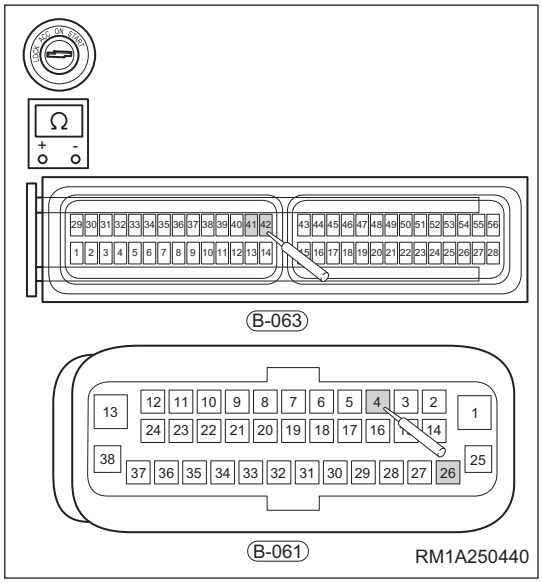
OK

3	Check CAN communication control circuit (ABS/ESP control module assembly - Transmission Control Module (TCM))

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Disconnect the Transmission Control Module (TCM) connector B-063.
e. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector B-063 to check if there is an open in CAN communication circuit according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (26) - B-063 (41)	Always	Continuity
B-061 (4) - B-063 (42)	Always	Continuity



NG → Repair or replace body wire harness and connector

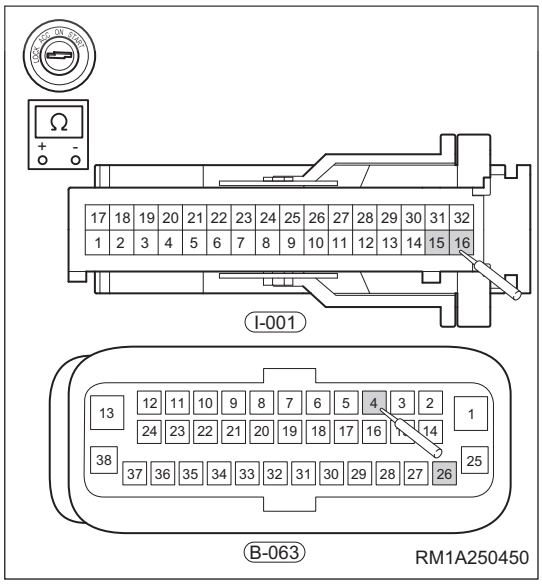
OK

4	Check CAN communication control circuit (ABS/ESP control module assembly - Body Control Module (BCM))

a. Turn ignition switch to LOCK.
b. Disconnect the negative battery cable.
c. Disconnect the ABS/ESP control module assembly connector B-061.
d. Disconnect the Body Control Module (BCM) connector I-001.
e. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector I-001 to check if there is an open in CAN communication circuit according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (26) - I-001 (15)	Always	Continuity
B-061 (4) - I-001 (16)	Always	Continuity

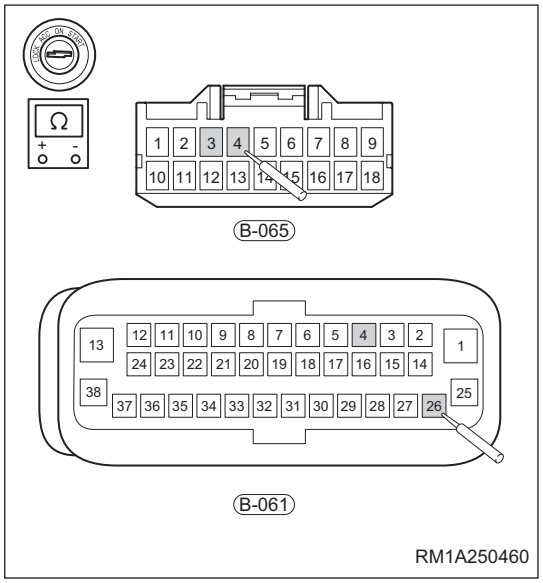


f. Disconnect the body wire harness connector B-065.

g. Using a digital multimeter, check for continuity between the terminals of connector B-061 and connector B-065 to check if there is an open in CAN communication circuit according to table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
B-061 (26) - B-065 (4)	Always	Continuity
B-061 (4) - B-065 (3)	Always	Continuity



NG → **Repair or replace body/instrument panel wire harness and connector**

OK

5	Check module software version information

a. Connect the negative battery cable.

b. Turn ignition switch to ON.

c. Use X-431 3G diagnostic tester to read ECM/TCM software version information.

d. Check if there is any abnormality.

NG → **ECM/TCM software version is unmatched**

OK

6	Reconfirm DTCs

a. Use X-431 3G diagnostic tester to clear DTC.

b. Start the engine.

c. Drive vehicle at 15 km/h or above, and read DTC for ABS/ESP control module assembly again with X-431 3G diagnostic tester.

d. Check if same DTC is output.

NO → **System operates normally**

YES

Replace ABS/ESP control module assembly

ON-VEHICLE SERVICE

ABS Bleeding

⚠ WARNING

- When bleeding brake system, wear safety glasses. If brake fluid gets on your eyes or skin, wash off with water immediately.
- DO NOT drop brake fluid on body paint, as brake fluid is corrosive.

CAUTION

- Type of brake fluid as Chery specified (DOT 4) should be used. DO NOT mix brake fluid with other types of brake fluid.
- As brake fluid has strong water absorbability, be sure to place it in the original sealed container.
- To prevent dust and other foreign matter from entering reservoir, wipe it off before removing reservoir cap.

Bleeding procedures for brake system with X-431 3G diagnostic tester are as follows:

1. Make sure all brake lines are installed and tightened properly.
2. Check that battery voltage is normal.
3. Turn ignition switch to LOCK.
4. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
5. Turn ignition switch to ON.
6. Using X-431 3G diagnostic tester, read and clear DTCs stored in ABS/ESP control module assembly.
7. Using X-431 3G diagnostic tester, enter brake control system, select manual bleeding, and then perform operation according to information and procedures displayed on diagnostic tester.

HINT:

- If bleeder plug is open, never depress brake pedal repeatedly. Doing so will increase the amount of air in system.
- Do not drain brake fluid from brake fluid reservoir while bleeding the system. Otherwise, low fluid level in brake fluid reservoir will cause additional air to enter brake system.
- Always check brake fluid level at all times to ensure that brake fluid level in brake fluid reservoir is always close to MAX level.

8. For X type brake circuit, bleeding order is: rear left wheel, front left wheel, front right wheel, rear right wheel.
9. After bleeding is completed, fill brake fluid reservoir with brake fluid to MAX level.
10. Drive vehicle to perform a road test, and confirm that ABS/ESP system operates normally and brake pedal feels well.

ABS/ESP Control Module Assembly

Removal

WARNING

- When repairing ABS/ESP system, first release the high brake fluid pressure in accumulator, to prevent high pressure brake fluid from spraying out and causing injury.
- Operation procedures: turn ignition switch to LOCK first, and then depress and release brake pedal repeatedly until brake pedal becomes hard.
- In addition, never turn ignition switch on before ABS/ESP system is installed completely, to prevent hydraulic pump from being energized to run.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Drain the brake fluid (See page 26-15).

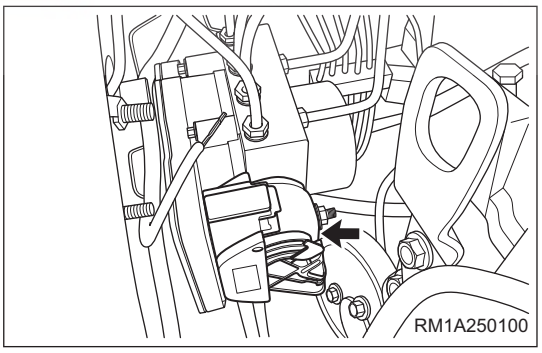
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

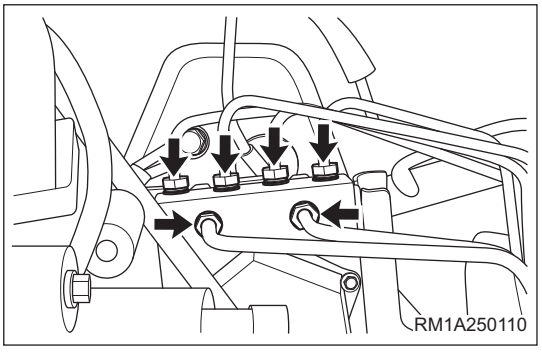
ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

4. Remove the engine trim cover assembly.
5. Remove the ABS/ESP control module assembly.
   a. Press lock portion of ABS/ESP control module assembly connector, pull connector lock bracket upward and disconnect ABS/ESP control module assembly connector (arrow).



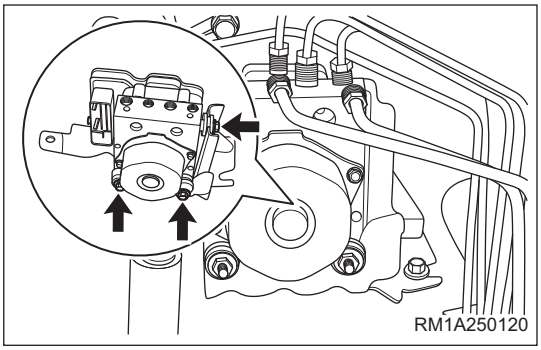
   b. Using a fixing wrench, carefully disconnect 6 brake pipe coupling plugs (arrow).
   (Tightening torque: 18 ± 2 N·m)



CAUTION

- When removing brake line, prevent foreign matter form entering ABS/ESP control module assembly threaded holes.
- After disconnecting brake line, sealing measure should be taken to prevent foreign matter form entering.

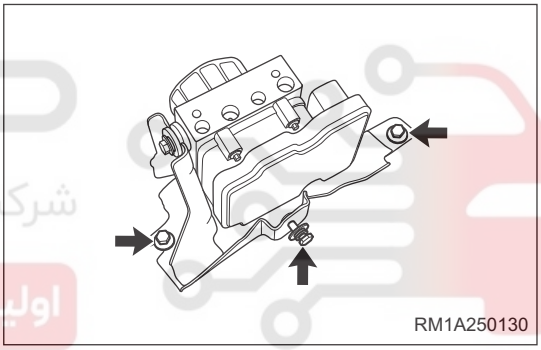
c. Remove 3 coupling nuts (arrow) between ABS/ESP control module assembly and mounting bracket. (Tightening torque: 8 ± 2 N·m)



d. Disengage insulator from mounting bracket and remove ABS/ESP control module assembly.

6. Remove the ABS/ESP control module assembly mounting bracket.

a. Remove 3 coupling bolts (arrow) between ABS/ESP control module assembly mounting bracket and body. (Tightening torque: 23 ± 3.5 N·m)



b. Remove the ABS/ESP control module assembly mounting bracket.

Installation

Installation is in the reverse order of removal.

CAUTION

- ABS/ESP control module assembly contains hydraulic control module and electronic control module. As a unit, both cannot be repaired or replaced individually.
- Check insulator for aging or damage. Replace if necessary.
- When installing fixing bolts and nuts, be sure to tighten to specified torques.
- Perform ABS bleeding procedures for brake system after installation (See page 25-79).
- Using X-431 3G diagnostic tester, enter brake control system, record and clear trouble code, then drive vehicle to perform a road test, confirm that ABS/ESP system operates normally and brake pedal feels well.

Front Wheel Speed Sensor

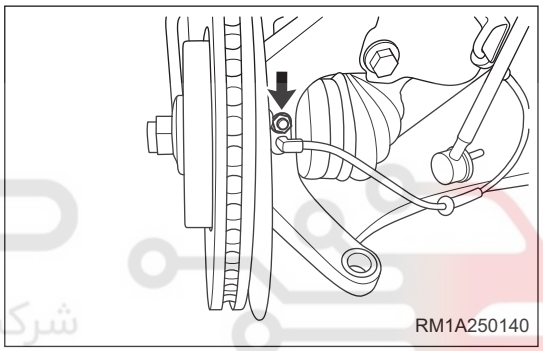
Removal

CAUTION

- Keep wheel speed sensor away from oil or other foreign matters. Otherwise speed signal generated by wheel speed sensor may be inaccurate, or even system may fail to operate normally.

HINT:
- Use same procedures for right and left sides.
- Procedures listed below are for left side.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the front left wheel (See page 24-9).
4. Remove the front left wheel speed sensor.
   a. Remove coupling bolt (arrow) between front left wheel speed sensor and front left steering knuckle assembly, and carefully disengage front left wheel speed sensor.
   (Tightening torque: 9 ± 1.5 N·m)

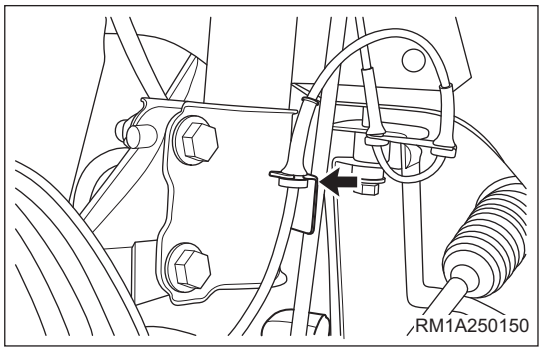

RM1A250140

CAUTION

- Keep the head and installation hole of sensor free of foreign matter.

   b. Disengage attachment part (arrow) of front left wheel speed sensor wire harness from front left shock absorber assembly.

   HINT:
   Observe winding direction of sensor wire harness to prevent incorrect installation.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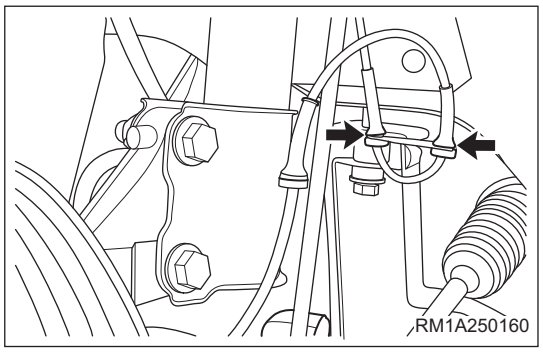
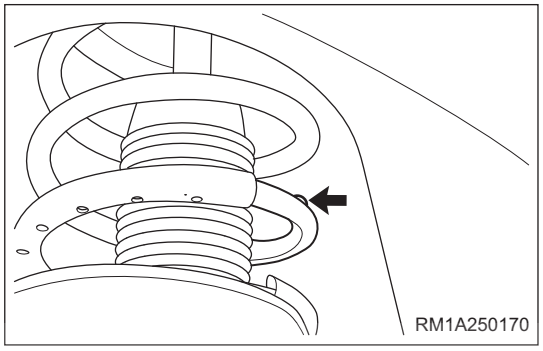
c. Disengage attachment parts (arrow) of front left wheel speed sensor wire harness from front sub frame welding assembly.

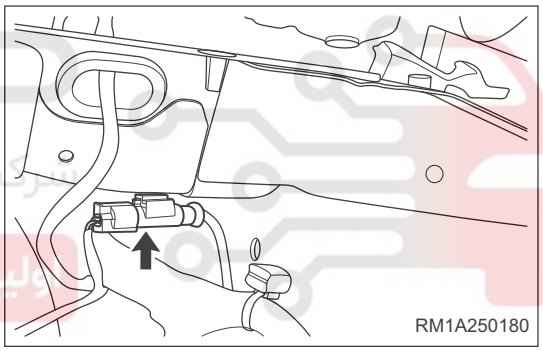
HINT:
Observe winding direction of sensor wire harness to prevent incorrect installation.



d. Detach front left wheel speed sensor wire harness cover (arrow) and fixing clip (1) from body.



e. Disconnect the front left wheel speed sensor wire harness connector (arrow).



f. Detach wire harness connector fixing clip and remove front left wheel speed sensor.

Inspection

1. Check the front wheel speed sensor.
   a. Check front wheel speed sensor surface for breakage, dent or notch.
   b. Check front wheel speed sensor connector or wire harness for scratches, breakage or damage.
   c. If any of above conditions occurs, replace front wheel speed sensor with a new one.

Installation

Installation is in the reverse order of removal.

CAUTION

- When installing coupling bolt, be sure to tighten to specified torque.

Rear Wheel Speed Sensor

Removal

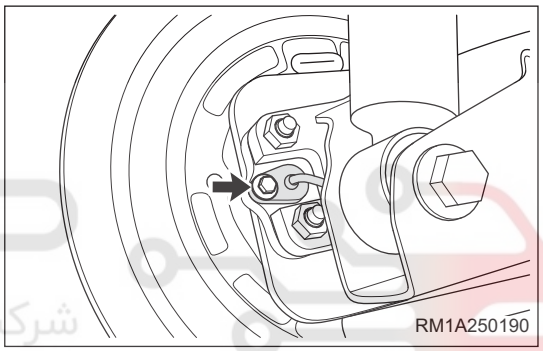
CAUTION

- Keep wheel speed sensor away from oil or other foreign matters. Otherwise speed signal generated by wheel speed sensor may be inaccurate, or even system may fail to operate normally.

HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

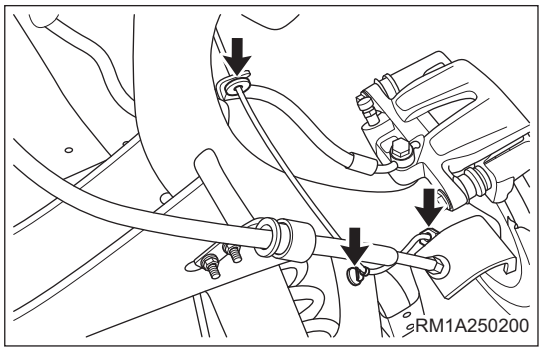
1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the rear left wheel (See page 24-9).
4. Remove the rear left wheel speed sensor.
   a. Remove coupling bolt (arrow) between rear left wheel speed sensor and rear left steering knuckle assembly, and carefully disengage rear left wheel speed sensor. (Tightening torque: 9 ± 1.5 N·m)



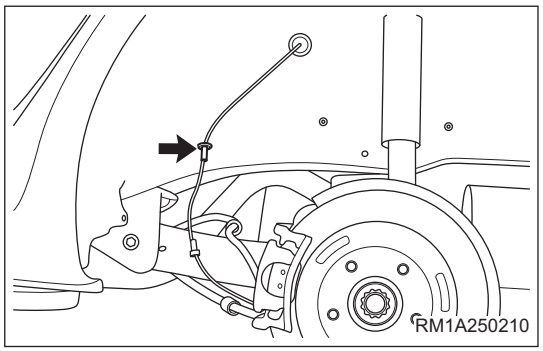
CAUTION

- Keep the head and installation hole of sensor free of foreign matter.

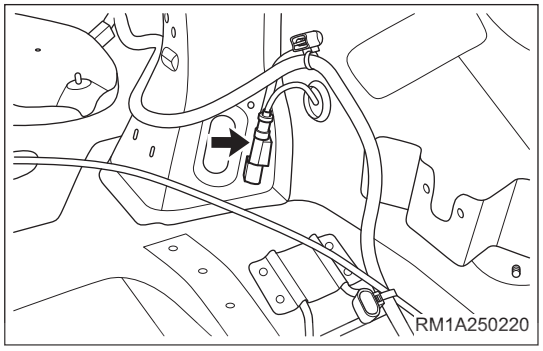
   b. Disengage rear wheel speed sensor wire harness from fixing brackets (arrow) of rear trailing arm assembly and rear brake line.



c. Disengage rear left wheel speed sensor wire harness from body fixing clamp (arrow).



d. Disconnect the rear left wheel speed sensor wire harness connector (arrow).



e. Remove the rear left wheel speed sensor.

Inspection

1. Check the rear wheel speed sensor.
   a. Check rear wheel speed sensor surface for breakage, dent or notch.
   b. Check rear wheel speed sensor connector or wire harness for scratches, breakage or damage.
   c. If any of above conditions occurs, replace rear wheel speed sensor with a new one.

Installation

Installation is in the reverse order of removal.

CAUTION

- When installing coupling bolt, be sure to tighten to specified torque.

Steering Angle Sensor

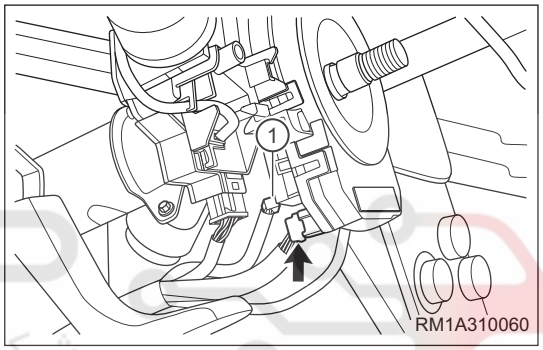
Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.

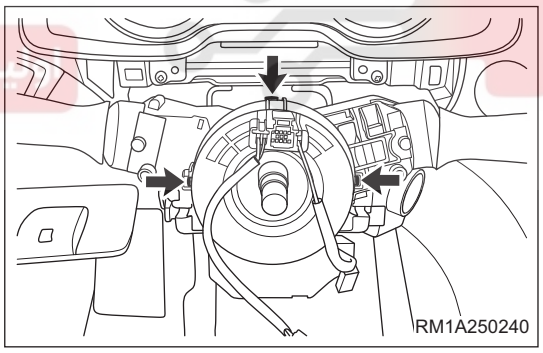
⚠ WARNING

- Wait at least 90 seconds after disconnecting the negative battery cable to disable supplemental restraint system.

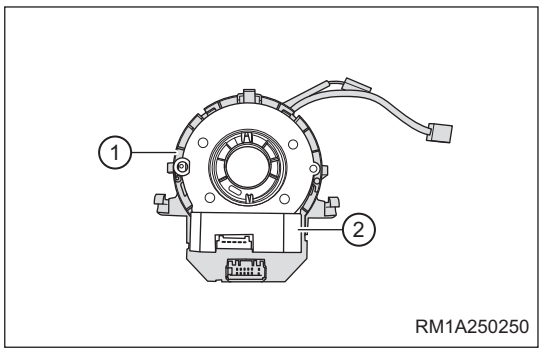
3. Set front wheels to straight-ahead position.
4. Remove the steering wheel assembly (See page 28-10).
5. Remove the combination switch cover assembly (See page 28-13).
6. Remove the steering angle sensor.
   a. Disconnect spiral cable wire harness connector (arrow) and angle sensor connector (1).



   b. Disengage fixing claws (arrow) between spiral cable and steering column, and remove spiral cable.



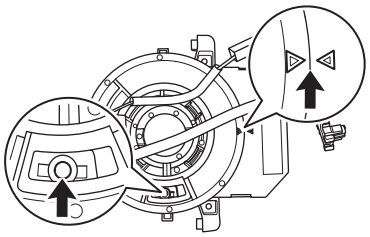
   c. Disengage fixing claws of angle sensor, and disengage spiral cable (1) and angle sensor (2).



Installation

Installation is in the reverse order of removal.

HINT:
Always install spiral cable correctly according to matchmarks on spiral cable and steering column (slowly and fully turn spiral cable clockwise, then turn it counterclockwise until yellow ball appears in transparent neutral window and arrow marks align with each other), otherwise the spiral cable may be damaged.



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CAUTION

- Always install spiral cable correctly according to specified operating instructions.
- DO NOT rotate spiral cable over specified turns to prevent it from breaking.
- Be sure to install fixing claws in place when installing spiral cable.
- Check that horn operates normally after installation.
- Check SRS warning light after installation, and make sure that supplemental restraint system operates normally.

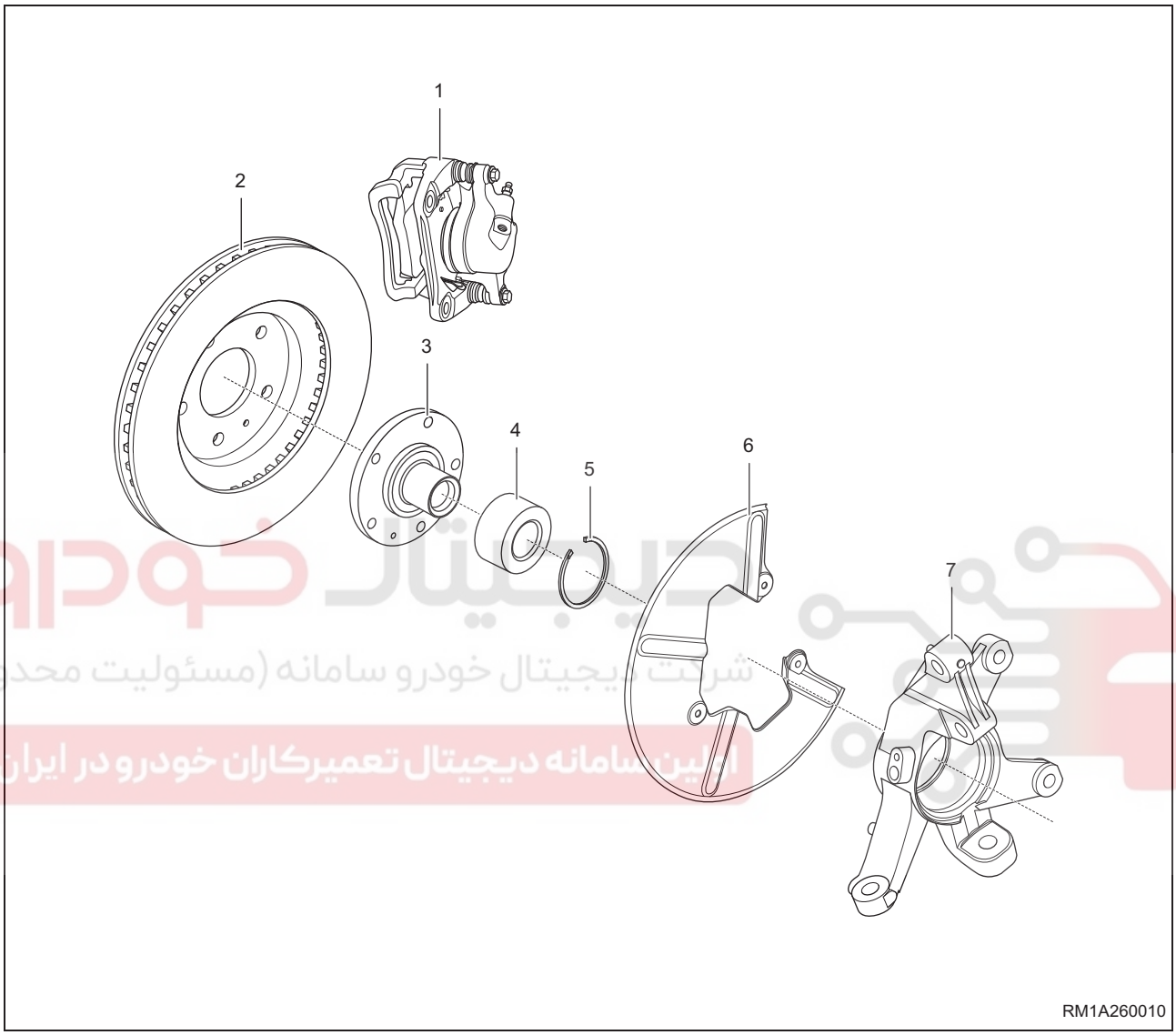
- MEMO -

BRAKE

GENERAL INFORMATION

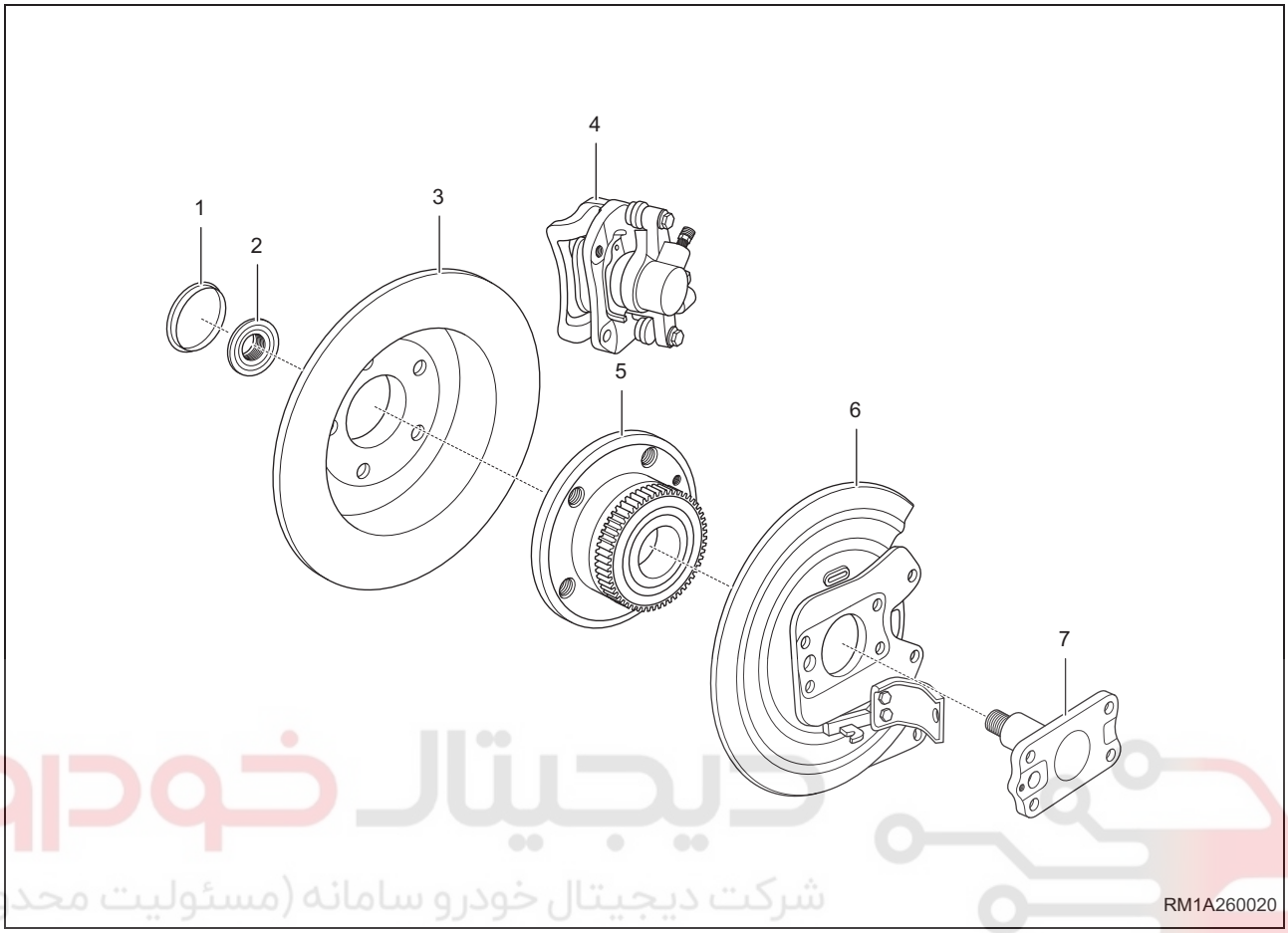
Description

Front Disc Brake Assembly



1 - Front Brake Caliper Assembly	2 - Front Brake Disc
3 - Front Hub	4 - Front Hub Bearing
5 - Bearing Retainer	6 - Front Dust Guard
7 - Front Steering Knuckle	

Rear DIH (Drum-in-hat) Assembly



1 - Bearing End Cap	2 - Locking Nut
3 - Rear Brake Disc	4 - Rear Brake Caliper Assembly
5 - Rear Hub Bearing Assembly	6 - Parking Brake Assembly
7 - Rear Hub Shaft	

Brake system uses the following configuration: a disc brake is used for each front wheel, and DIH (Drum-in-hat) (disc brake is used as service brake, and drum brake is used as parking brake) is used for each rear wheel.

Using lever principle, brake pedal pushes the pushrod into vacuum booster, which boosts the force of pushrod by using vacuum and then transmits the force to brake master cylinder assembly. Hydraulic pressure, produced in brake master cylinder assembly, is transmitted to ABS Hydraulic Control Unit (HCU) through brake line, and then distributed to individual brake calipers. Brake calipers apply pressure to brake linings using hydraulic pressure. Depending on the amount of brake pressure applied to brake linings, wheels will slow down or stop.

Specifications

Torque Specifications

Description	Torque (N·m)
Wheel Mounting Bolt	110 ± 10
Coupling Plug Between Brake Master Cylinder Assembly and Brake Pipe	18 ± 2
Coupling Nut Between Vacuum Booster Assembly and Brake Pedal Assembly	23 ± 3.5
Coupling Nut Between Brake Pedal Assembly and Body	23 ± 3.5
Coupling Plug Between Front Brake Caliper Assembly and Front Brake Hose Assembly	18 ± 2
Coupling Bolt Between Front Brake Caliper Assembly and Front Steering Knuckle Assembly	100 ± 10
Front Brake Disc Locating Screw	4.5 ± 0.5
Front Brake Caliper Bleeder Plug	9 - 11
Coupling Plug Between Front Brake Hose Assembly and Front Brake Pipe	18 ± 2
Coupling Bolt Between Rear Brake Caliper Assembly and Rear Brake Hose Assembly	27 ± 2
Coupling Bolt Between Rear Brake Caliper Assembly and Brake Caliper Mounting Board Assembly	100 ± 10
Rear Brake Disc Locating Screw	4.5 ± 0.5
Rear Brake Caliper Bleeder Plug	9 - 11
Coupling Plug Between Rear Brake Hose Assembly and Brake Pipe	18 ± 2

Front Disc Brake

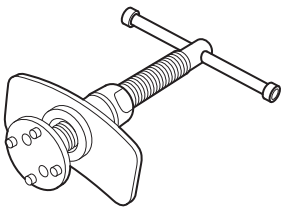
Description	Standard Thickness (mm)	Minimum Thickness (mm)	Maximum Runout (mm)
Front Brake Disc	25	23	0.025
Front Brake Lining	11.2	2.0	-

Rear DIH (Drum-in-hat)

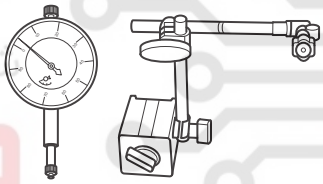
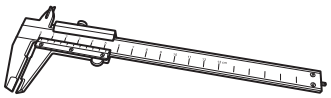
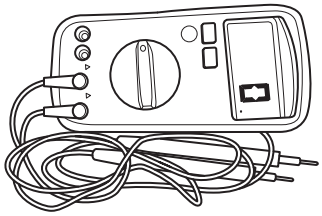
Description	Standard Thickness (mm)	Minimum Thickness (mm)	Maximum Runout (mm)
Rear Brake Disc	10	9	0.025
Rear Brake Lining	11.2	2.0	-

Tools

Special Tool

Brake Caliper Piston Pressing Tool	 RCH0000053

General Tools

Dial Indicator and Magnetic Holder	 RCH0000023
Vernier Caliper	 RCH0000019
Digital Multimeter	 RCH0000002

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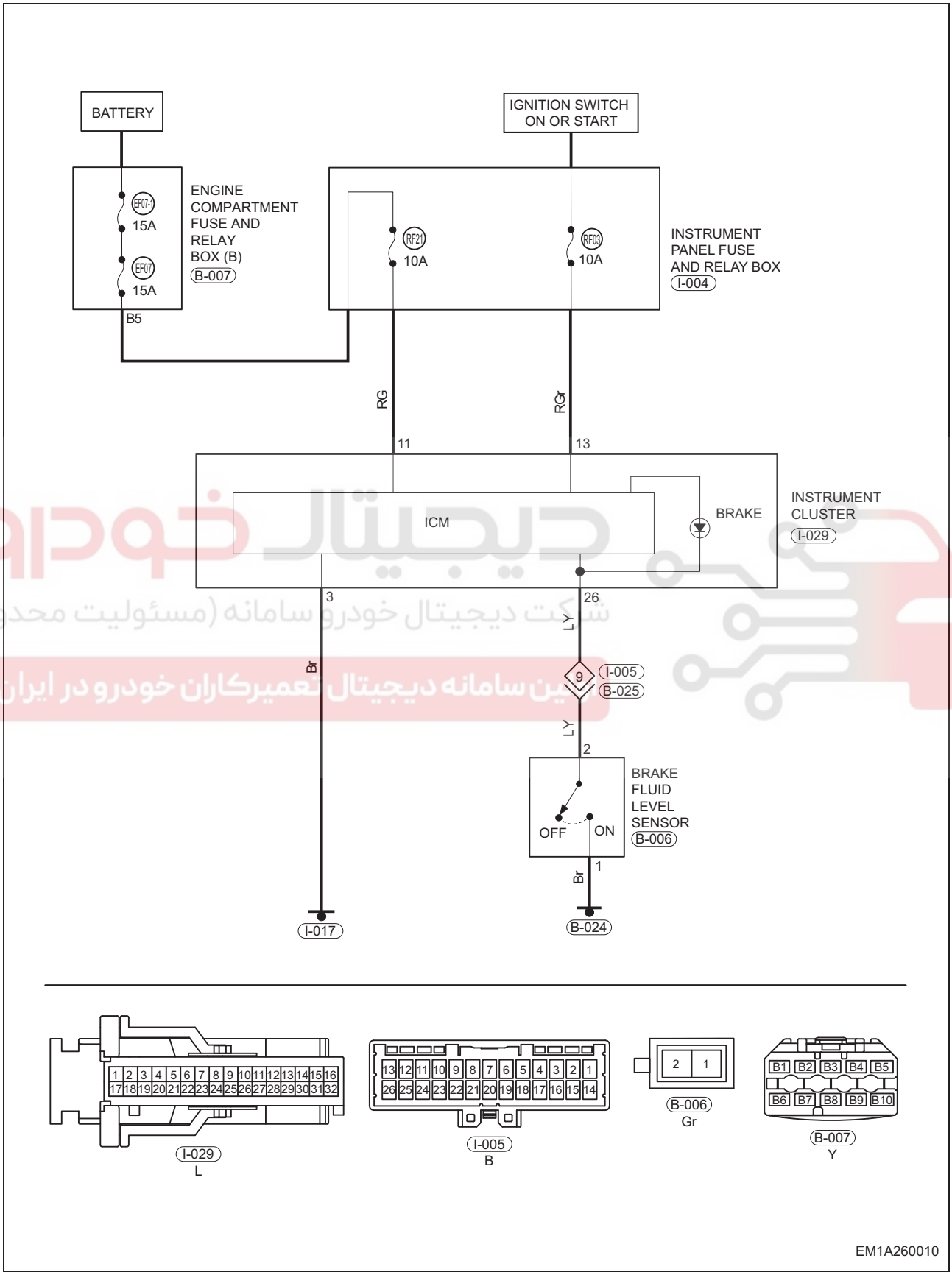
Circuit Diagram

Brake System (Page 1 of 1)



DIAGNOSIS & TESTING

Problem Symptoms Table

HINT:
Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair or adjust faulty components, or replace as necessary.

Symptom	Suspected Area	See page
Noise in brake	Front brake lining (cracked, deformed, dirty or burnished)	26-28
	Rear brake lining (cracked, deformed, dirty or burnished)	26-39
	Front disc brake guide bolt guide pin (worn)	26-28
	Rear disc brake guide bolt guide pin (worn)	26-39
	Front brake caliper assembly fixing bolt (loose)	26-28
	Rear brake caliper assembly fixing bolt (loose)	26-39
	Front brake disc (scored)	26-27
	Rear brake disc (scored)	26-38
	Brake disc runout (excessive)	26-27
	Brake shoe stopper spring (damaged)	27-18
	Brake shoe return tension spring (damaged or insufficient in elasticity)	27-18
	Front brake disc (foreign matter)	-
	Rear brake disc (foreign matter)	-
Hard pedal but braking inefficient	Front brake lining (worn, cracked, deformed, oily or burnished)	26-28
	Rear brake lining (worn, cracked, deformed, oily or burnished)	26-39
	Front brake disc (unevenly worn)	26-27
	Rear brake disc (unevenly worn)	26-38
	Vacuum booster pushrod position (incorrect)	26-20
	Booster system (vacuum leaks)	26-22
Hard pedal (firm-depress unable to lock-up wheels)	Vacuum booster (bounce)	26-20
Pedal overtravel (vehicle stops normally)	Brake system (air ingress)	26-11
	Brake system (leaked)	-
Pedal pulsates/bounces during braking	Brake disc (unevenly worn)	26-27

Symptom	Suspected Area	See page
Low or spongy pedal	Brake system (air ingress)	26-11
	Brake system (leaked)	-
	Front brake piston seal (worn or damaged)	26-28
	Rear brake piston seal (worn or damaged)	26-39
	Brake master cylinder assembly (malfunction)	26-18
	Vacuum booster pushrod position (incorrect)	26-20
Vehicle pulls during braking	Front brake piston (seized or frozen)	26-28
	Rear brake piston (seized or frozen)	26-39
	Front brake lining (dirty, cracked or deformed)	26-28
	Rear brake lining (dirty, cracked or deformed)	26-39
	Front brake disc (unevenly worn)	26-27
	Rear brake disc (unevenly worn)	26-38
Brake catching	Brake pedal free play (minimum)	26-23
	Parking brake control mechanism stroke (in need of adjustment)	27-7
	Parking brake cable (catching)	27-13
	Parking brake shoe clearance (in need of adjustment)	27-7
	Front brake lining (cracked or deformed)	26-28
	Rear brake lining (cracked or deformed)	26-39
	Front brake piston (seized or frozen)	26-28
	Rear brake piston (seized or frozen)	26-39
	Brake shoe return tension spring (loose or damaged)	27-18
	Vacuum booster pushrod position (incorrect)	26-20
	Booster system (vacuum leaks)	26-22
	Brake master cylinder assembly (malfunction)	26-18

Inspection

CAUTION

- Use well-sealed brake fluid DOT4 or equivalent. DO NOT use oily solution, otherwise brake system seal may be damaged.
- Brake fluid may damage paint surface. If brake fluid spills on paint surface, wash it off immediately with water.
- DO NOT use gasoline, kerosene, alcohol, engine oil, transmission oil or any other fluid that contains mineral oil to clean the system components. These kinds of fluid will damage the rubber cover and seal.
- During servicing, be sure to clean the grease or other foreign matter on outer surfaces of brake caliper assembly, brake lining, brake disc and wheel hub.
- When operating brake disc and brake caliper, be careful not to damage brake disc and brake caliper and scratch or cut brake shoe linings.

1. Check conditions of tires and wheels. Damaged or worn wheels and tires can cause a pull, shudder, vibration and a condition similar to sudden braking.
2. If noise occurs while braking, check suspension components. Bounce the vehicle up and down several times and check suspension or steering components for any looseness, wear or damage.
3. Check brake fluid level and condition.
   a. If brake fluid level is too low, check ABS/ESP control unit assembly, brake wheel cylinder, brake caliper, brake line, brake master cylinder assembly and brake fluid reservoir, etc. for leakage.
   b. If brake fluid is contaminated, drain a certain amount of fluid for inspection. Replace with new fluid as necessary.

   HINT:
   It is normal that brake fluid will become dark after being used for a period of time. Do not mistake this for contamination.

ON-VEHICLE SERVICE

Brake Bleeding

Be sure to perform brake bleeding and clutch bleeding after replacing hydraulic parts related to brake and clutch. For details about clutch bleeding, See page 19-15. There are 2 methods for brake bleeding, and specific operation procedures are as follows:

Method 1: manual bleeding brake

⚠ WARNING

- When bleeding brake system, wear safety glasses.
- Be careful when bleeding air, as brake fluid at high pressure may spray out from bleeder plug.

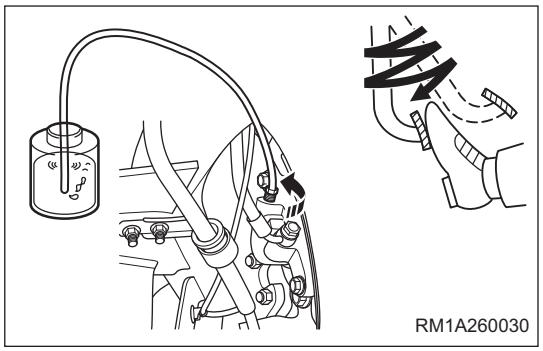
CAUTION

- Before removing brake fluid reservoir, wipe off any dust and other foreign matters on brake fluid reservoir to prevent them from entering.
- Use fresh, clear and well-sealed brake fluid with specified type or equivalent.
- DO NOT allow the brake fluid to adhere to any paint surface, such as vehicle body. If brake fluid leaks onto any paint surface, immediately wash it off.
- During bleeding, do not depress brake pedal repeatedly whenever bleeder plug is opened. Otherwise, air amount in the system will increase to make an extra bleeding.
- DO NOT drain the brake fluid in brake fluid reservoir while bleeding brake system.

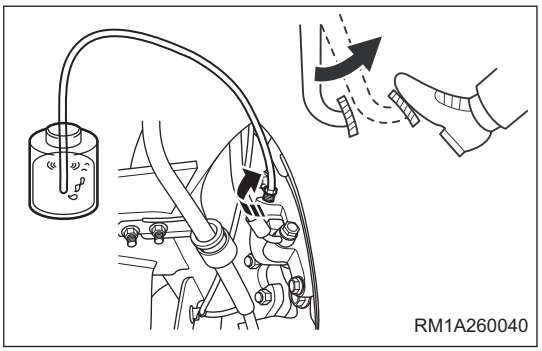
HINT:

An assistant will be required to assist when bleeding brake system.

1. Fill brake fluid reservoir with brake fluid to a proper level.
2. Loosen bleeder plug cap and connect a clear plastic hose to bleeder plug. Submerge the end of hose into clear container filled with fresh brake fluid.
3. Have an assistant depress brake pedal 3 to 4 times repeatedly; and then depress and hold it at a lower position. Then loosen bleeder plug at least one turn.



4. Tighten bleeder plug every time brake pedal goes down quickly. Then release the brake pedal.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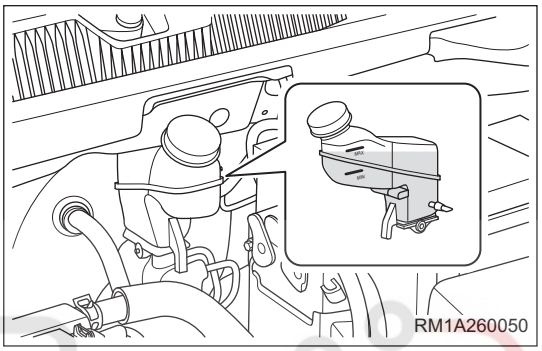
5. Repeat above steps, and use the same procedures to bleed brake line of each wheel in order of rear left wheel, front left wheel, front right wheel and rear right wheel, until no air exists in brake system.
   Empty sign: a stream of fresh brake fluid flows into clear container without bubbles.

   HINT:
   During bleeding brake system, make sure brake fluid level in brake fluid reservoir is always near "MAX" mark. Check brake fluid level at all times during bleeding. Add brake fluid as necessary.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6. Check and adjust brake fluid level to "MAX" mark.
7. Check the brake pedal effect. If braking effect is poor or pedal is spongy, air may still exist in system. Perform bleeding procedures for brake system again as necessary.
8. Test vehicle to confirm that brakes operate properly with good depressing feel.

Method 2: bleeding brake using diagnostic tester

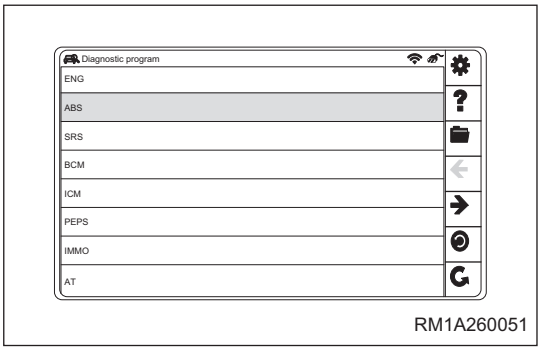
CAUTION

- Check that battery voltage should not be lower than 10 V.
- Bleeding order must be rear left / front left / front right / rear right. If it is necessary to repeat part or whole bleeding procedure, be sure to wait for 5 minutes to cool solenoid valve down, otherwise solenoid valve may be damaged due to overheat.

In order to reach sufficient pressure in hydraulic regulator, depress brake pedal repeatedly during whole process.

1. Fill brake fluid reservoir with brake fluid to a proper level.
2. Depress brake pedal 20 times or more with engine stopped.
3. Turn ignition switch to ON, and enter M1A "ABS" system using X-431 3G diagnostic tester (latest software).

- Please select [ABS] on Diagnostic program screen.



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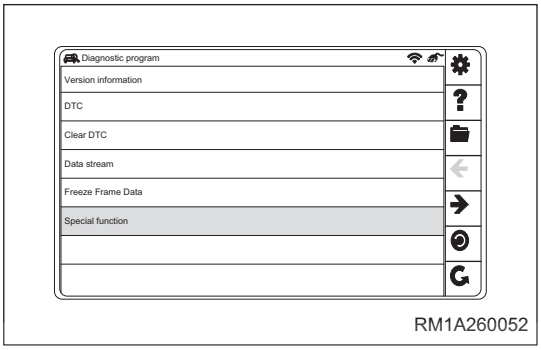
- Please select [Special function] on Diagnostic program screen.



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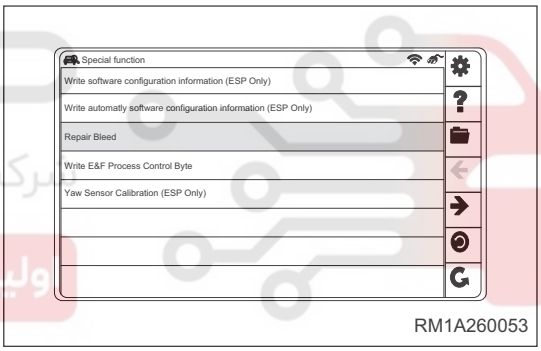
- Please select [Repair Bleed] on Special function screen.



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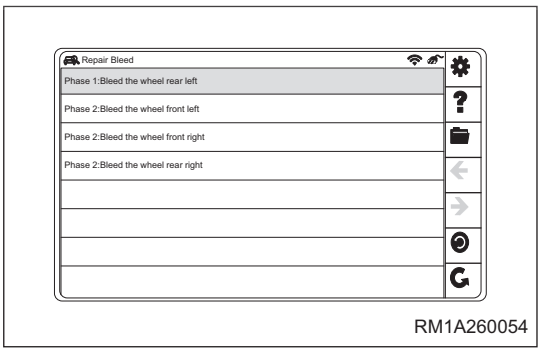
- Please select [phase 1: Bleed the wheel rear left] on Repair Bleed screen, then perform bleeding operation for rear left wheel.



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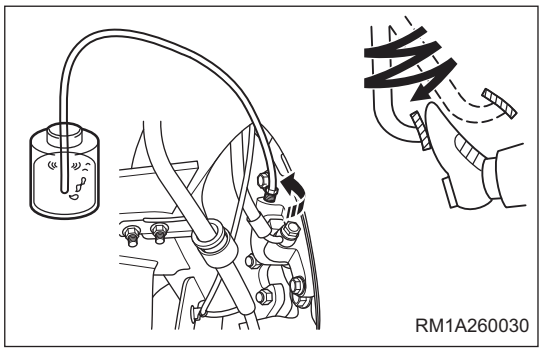
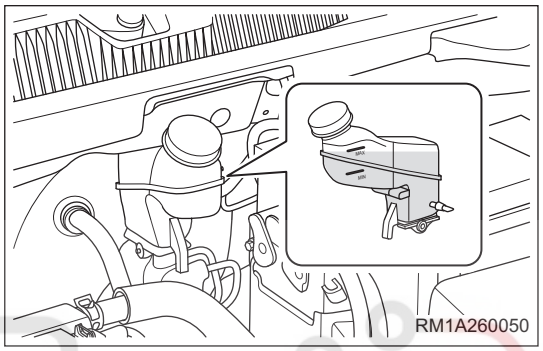
4. Loosen bleeder plug cap of rear left wheel and connect a clear plastic hose to bleeder plug. Submerge the end of hose into clear container filled with fresh brake fluid.



5. Use same bleeding procedures as rear left wheel to bleed air for brake lines of front left wheel, front right wheel and rear right wheel, until no air exists in brake system.
   Empty sign: a stream of fresh brake fluid flows into clear container without bubbles.

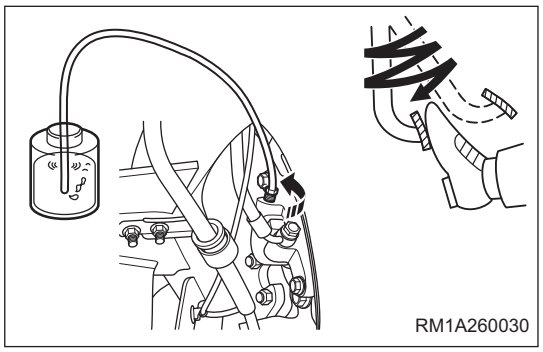
   HINT:
   During bleeding brake system, make sure brake fluid level in brake fluid reservoir is always near "MAX" mark. Check brake fluid level at all times during bleeding. Add brake fluid as necessary.



6. Check and adjust brake fluid level to "MAX" mark.
7. Check the brake pedal effect. If braking effect is poor or pedal is spongy, air may still exist in system. Perform bleeding procedures for brake system again as necessary.
8. Test vehicle to confirm that brakes operate properly with good depressing feel.

Brake Fluid Replacement

1. Drain the brake fluid.
   a. Start engine and run it at idle.
   b. Unscrew filler cap of brake fluid reservoir assembly.
   Loosen bleeder plug cap and connect a clear plastic hose to bleeder plug. Submerge the end of hose into clear container filled with new brake fluid.
   c. Loosen bleeder plug, and depress brake pedal continuously until no brake fluid comes out.

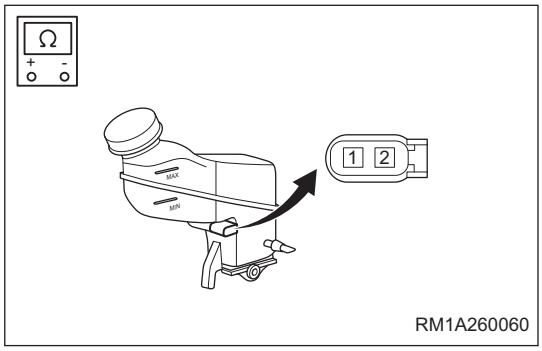


2. Add the brake fluid.
   a. Tighten bleeder plug after confirming that brake fluid has been drained. Fill brake fluid reservoir with new brake fluid to a proper level.
3. Perform the bleeding procedures.
   a. After replacing with new brake fluid, be sure to bleed brake system for normal operation. For details about brake system bleeding, See page 26-11.

Brake Fluid Reservoir Assembly

On-vehicle Inspection

1. Check the brake fluid level warning switch.
   a. Remove the brake fluid reservoir filler cap.
   b. Disconnect the brake fluid level warning switch wire harness connector.
   c. Using ohm band of digital multimeter, check for continuity between brake fluid level warning switch terminals according to conditions shown in table below.



Standard Condition

Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 2	Float upward (switch ON)	No continuity
Terminal 1 - Terminal 2	Float downward (switch OFF)	Continuity

HINT:

There is a float in fluid reservoir. Position of float changes as brake fluid level rises or drops.

If result is not as specified, replace brake fluid reservoir assembly.

   d. Add brake fluid to "MAX" mark.

Removal

1. Drain the brake fluid (See page 26-15).

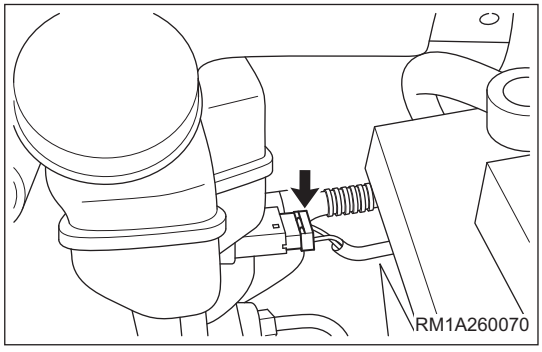
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

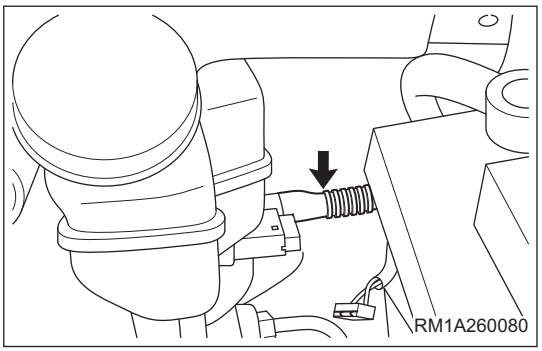
ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

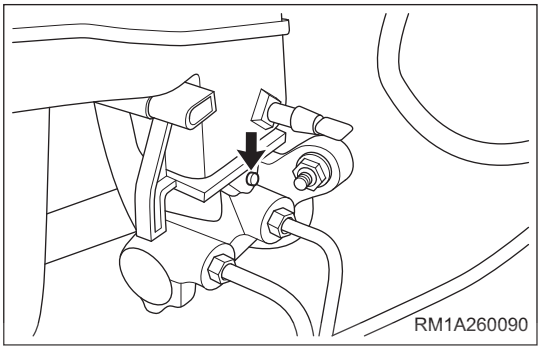
2. Remove the brake fluid reservoir assembly.
   a. Disconnect the brake fluid level warning switch connector (arrow).



b. Disconnect clutch hose (arrow) from brake fluid reservoir assembly (for MT model).



c. Remove dowel pin (arrow) between brake fluid reservoir assembly and brake master cylinder assembly.



d. Remove brake fluid reservoir assembly from brake master cylinder assembly.

Installation

Installation is in the reverse order of removal.

HINT:

Perform bleeding procedures for brake system and add brake fluid to a proper level after completing installation.

Brake Master Cylinder Assembly

Removal

CAUTION

- Release vacuum in vacuum booster before removing brake master cylinder assembly to avoid damaging the brake master cylinder assembly and prevent booster from sucking in any pollutant.
- When engine is not running, release vacuum by pumping brake pedal until brake pedal can be depressed firmly.
- When removing brake line, sealing measures should be taken to prevent foreign matter from entering.

1. Drain the brake fluid (See page 26-15).

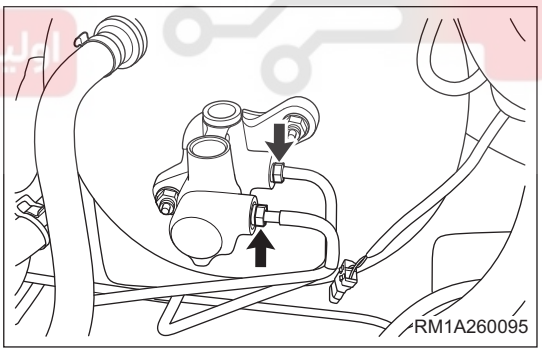
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

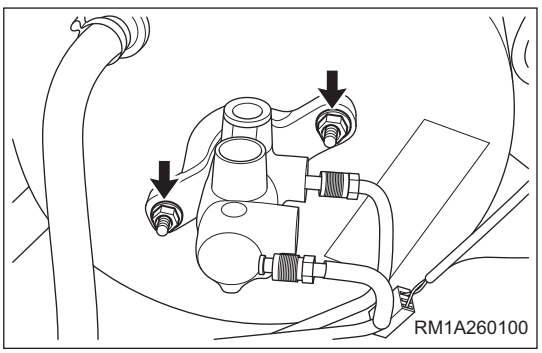
ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

2. Remove the brake fluid reservoir assembly (See page 26-16).
3. Remove the brake master cylinder assembly.
   a. Loosen 2 coupling plugs (arrow) between brake master cylinder assembly and brake pipes. (Tightening torque: 18 ± 2 N·m)



   b. Loosen 2 coupling nuts and washers (arrow) between brake master cylinder assembly and vacuum booster.



   c. Slide brake master cylinder assembly straight out of vacuum booster carefully.

CAUTION

- The design of brake master cylinder assembly and piston could make piston easy to fall out. To prevent this, make sure that master cylinder is horizontal or end surface faces down (piston surface faces upward) when handling brake master cylinder assembly.
- Make sure that no foreign matter adheres to brake master cylinder assembly piston. If foreign matter adheres, clean it off with a piece of clean cloth. Then, apply grease to entire periphery of contact surface of master cylinder piston.
- Master cylinder should be handled carefully. Avoid any impact to master cylinder, such as dropping. It cannot be reused if dropped.
- DO NOT tap or pinch master cylinder piston, and avoid damaging master cylinder piston in any other ways.

Installation

Installation is in the reverse order of removal.

CAUTION

- Make sure to tighten coupling plugs and nuts to specified torque during installation.
- Perform bleeding procedures for brake system and add brake fluid to a proper level after completing installation.

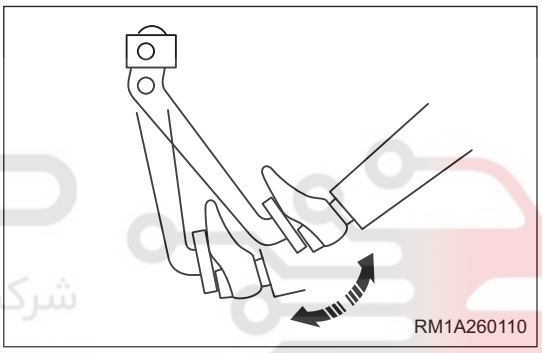
Vacuum Booster with Brake Master Cylinder Assembly

On-vehicle Inspection

1. Check the vacuum booster assembly.
   a. Check the air tightness.
      i. Start engine and stop it after 1 or 2 minutes. Slowly depress the brake pedal several times.
      ii. Make sure that booster is airtight. Check that the amount every time pedal can be depressed decreases gradually in comparison with previous depression amount.

      If pedal operation is not as specified, check the check valve. If check valve is normal, replace vacuum booster assembly.
      iii. Start the engine. Depress and hold the pedal, and then stop engine.
      iv. Make sure that booster is airtight. Depress and hold pedal for 30 seconds, and check that pedal reserve distance does not change.

      If pedal operation is not as specified, check the check valve. If check valve is normal, replace vacuum booster assembly.
   b. Check the operation.
      i. Stop the engine.
      ii. Depress the pedal several times, and check that pedal reserve distance does not change.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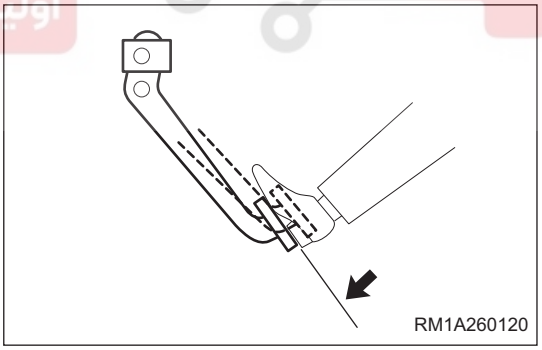
      iii. Depress and hold pedal, and then start engine. Check that pedal can only be depressed slightly.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      If pedal operation is not as specified, check the check valve. If check valve is normal, replace vacuum booster assembly.

Removal

1. Drain the brake fluid (See page 26-15).

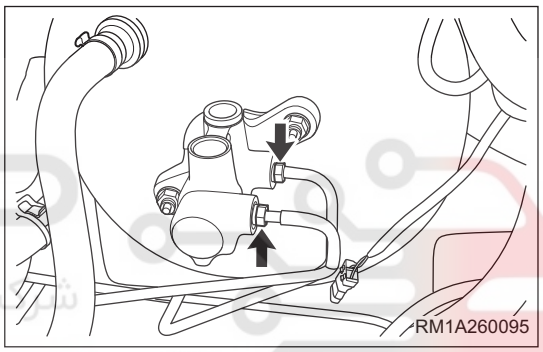
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

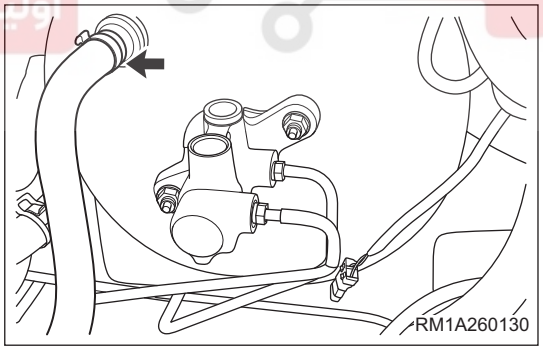
ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

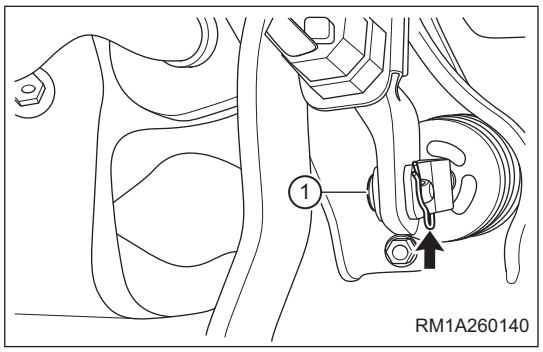
2. Remove the battery (See page 16-7).
3. Remove the battery tray (See page 16-9).
4. Remove the brake fluid reservoir assembly (See page 26-16).
5. Remove the vacuum booster with brake master cylinder assembly.
   a. Loosen 2 coupling plugs (arrow) between brake master cylinder assembly and brake pipes.
   (Tightening torque: 18 ± 2 N·m)



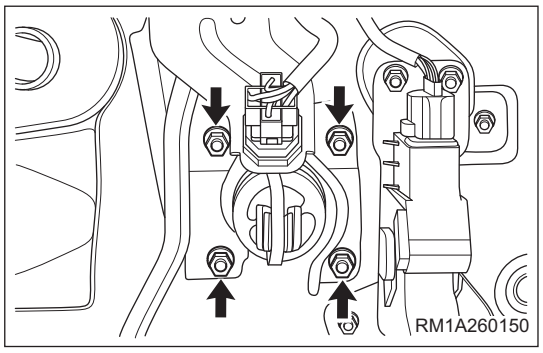
   b. Detach vacuum hose assembly with check valve (arrow) from vacuum booster assembly.



   c. Using needle-nose pliers, remove locking pin (arrow) and pushrod pin (1) from vacuum booster pushrod and detach brake pedal assembly.



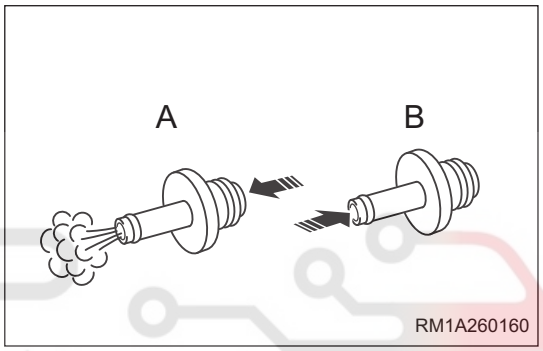
d. Remove 4 coupling nuts (arrow) between vacuum booster assembly and brake pedal assembly. (Tightening torque: 23 ± 3.5 N·m)



e. Remove vacuum booster with brake master cylinder assembly from engine compartment.

Inspection

1. Check the check valve.
   a. Remove check valve from vacuum hose assembly.
   b. Check that there is airflow (A) from vacuum booster to engine, and no airflow (B) from engine to vacuum booster.



If result is not as specified, replace vacuum hose assembly.

Installation

Installation is in the reverse order of removal.

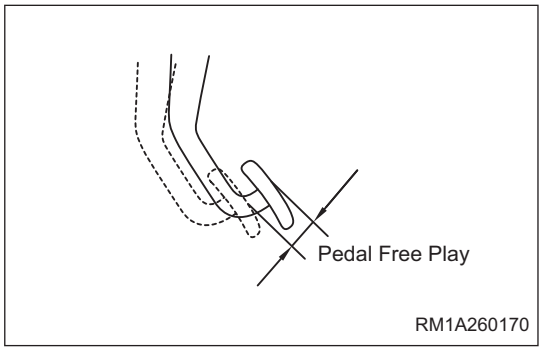
CAUTION

- Make sure to tighten coupling plugs and nuts to specified torques during installation.
- Perform bleeding procedures for brake system and add brake fluid to a proper level after completing installation.

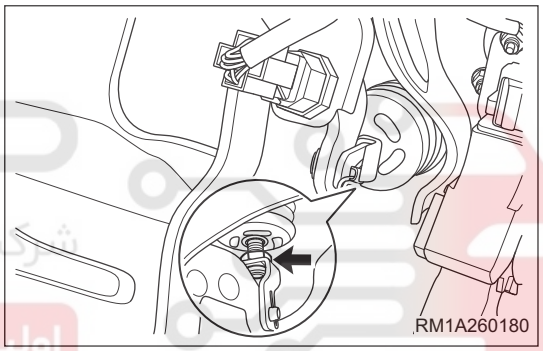
Brake Pedal Assembly

On-vehicle Inspection

1. Check the brake pedal free play.
   a. Stop engine. Depress brake pedal several times until no vacuum is left in vacuum booster, then release brake pedal.
   b. Depress brake pedal until resistance is felt.
   c. As shown in illustration, check brake pedal free play by measuring distance between pedal position in previous step and pedal position after released.
   Standard brake pedal free play: 1 - 9 mm

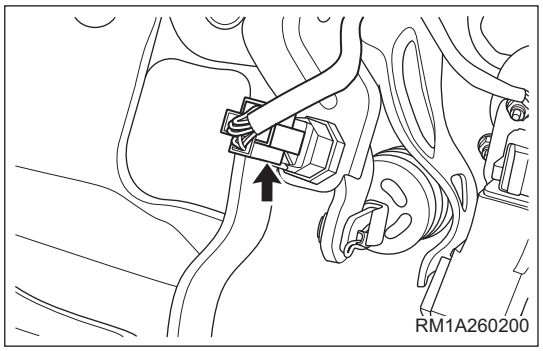


2. Adjust the brake pedal free play.
   a. As shown in illustration, loosen vacuum booster pushrod locking nut (arrow) and rotate vacuum booster pushrod counterclockwise or clockwise to adjust brake pedal free play to specified value.

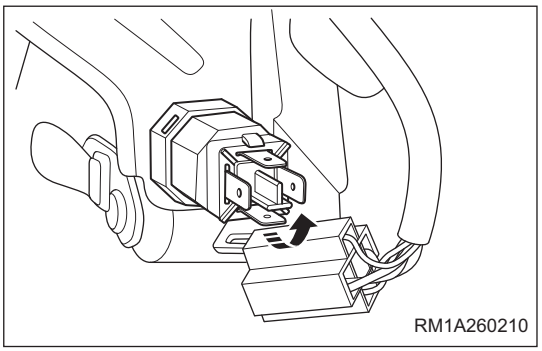


Removal

1. Remove the brake light switch assembly.
   a. Disconnect the brake light switch assembly wire harness connector (arrow).

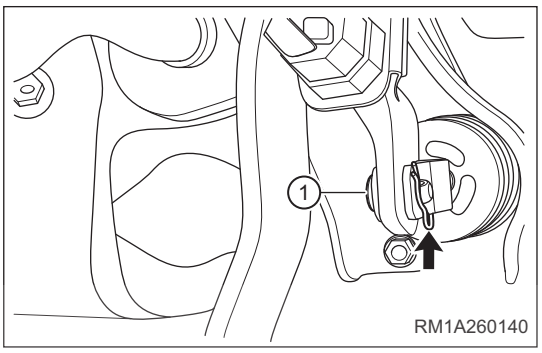


b. Remove brake light switch assembly by rotating it 90° clockwise or counterclockwise.

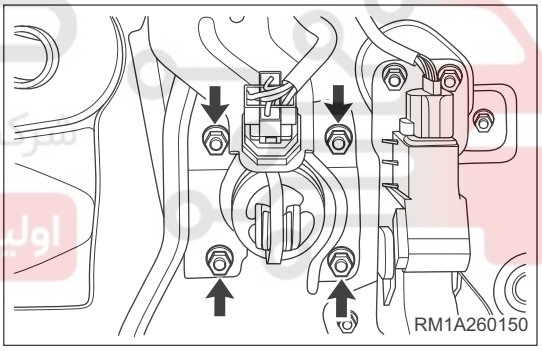


2. Remove the brake pedal assembly.

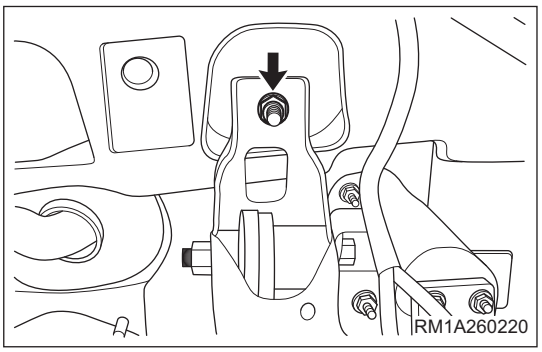
a. Using needle-nose pliers, remove locking pin (arrow) and pushrod pin (1) from vacuum booster pushrod and detach brake pedal assembly.



b. Remove 4 coupling nuts (arrow) between vacuum booster assembly and brake pedal assembly.
(Tightening torque: 23 ± 3.5 N·m)



c. Remove coupling nut (arrow) between brake pedal assembly and body.
(Tightening torque: 23 ± 3.5 N·m)



d. Remove brake pedal assembly from inside of vehicle.

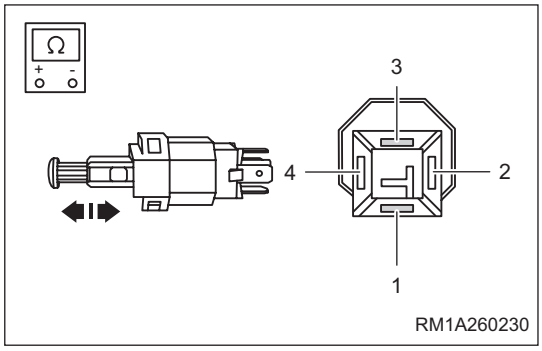
Inspection

1. Check the brake light switch assembly.

   Using ohm band of digital multimeter, check for continuity between brake light switch assembly terminals according to table below.

   Standard Condition

Multimeter Connection	Switch Condition	Specified Condition
Terminal 1 - Terminal 3	Brake pedal depressed (switch pin released)	Continuity
Terminal 2 - Terminal 4	Brake pedal depressed (switch pin released)	No continuity
Terminal 1 - Terminal 3	Brake pedal released (switch pin pushed)	No continuity
Terminal 2 - Terminal 4	Brake pedal released (switch pin pushed)	Continuity



   If result is not as specified, replace brake light switch assembly.

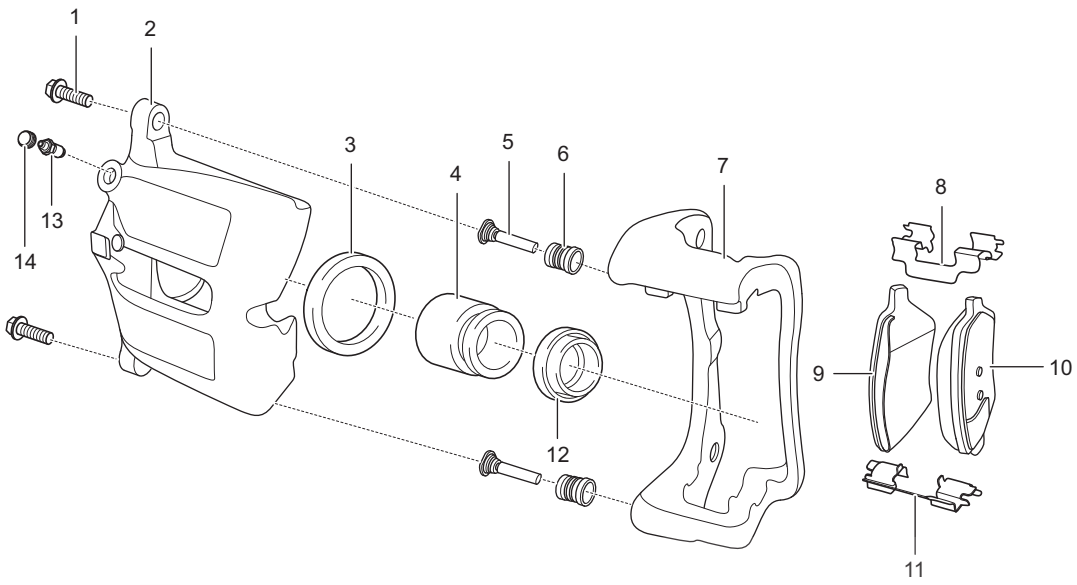
Installation

Installation is in the reverse order of removal.

CAUTION

- Make sure to tighten coupling nuts to specified torque during installation.
- Check that brake light operates properly after installation.

Front Disc Brake Assembly



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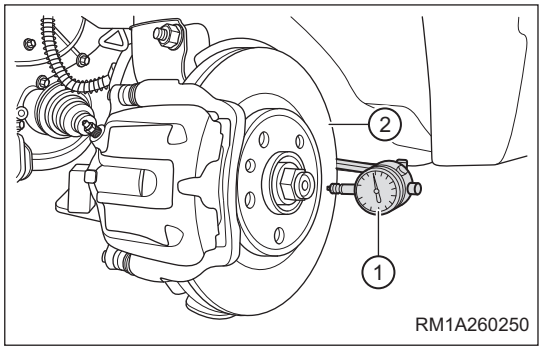
1 - Brake Caliper Guide Bolt	2 - Front Disc Brake Cylinder
3 - Front Disc Brake Piston Seal Ring	4 - Front Disc Brake Piston
5 - Brake Caliper Guide Bolt Guide Pin	6 - Brake Caliper Guide Pin Rubber Dust Boot
7 - Front Disc Brake Caliper Fixing Bracket	8 - Upper Support Shim
9 - Inner Brake Lining	10 - Outer Brake Lining
11 - Lower Support Shim	12 - Front Disc Brake Piston Dust Boot
13 - Bleeder Plug	14 - Bleeder Plug Cap

On-vehicle Inspection

1. Check the brake disc runout.
   a. Remove the front wheel (See page 24-9).
   b. Secure a dial indicator (1) to a proper position. Then position dial indicator pointer approximately 10 mm from outer edge of brake disc.
   c. Slowly rotate brake disc (2) and check its runout. Mark the lowest and highest points and record these measured values.



   d. Check runout on opposite side of brake disc in the same way. Mark the lowest and highest points and record these measured values.
   e. Compare recorded runout value with limit value.
   Maximum runout for front brake disc: 0.025 mm
   f. If runout exceeds the maximum value, replace brake disc.

Removal

HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

1. Drain the brake fluid (See page 26-15).

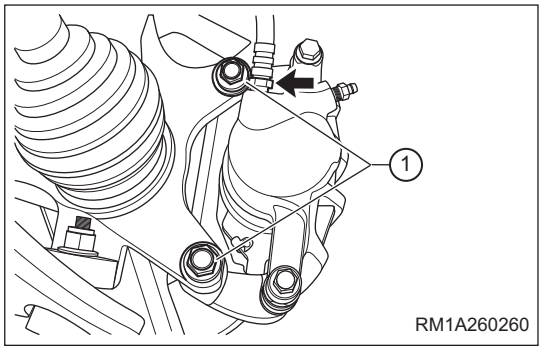
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

2. Remove the front left wheel (See page 24-9).
3. Remove the front left brake caliper assembly.
   a. Remove coupling plug (arrow) between front left brake caliper assembly and front left brake hose assembly (tightening torque: 18 ± 2 N·m).
   Remove 2 coupling bolts (1) between front left brake caliper assembly and front left steering knuckle (tightening torque: 100 ± 10 N·m).



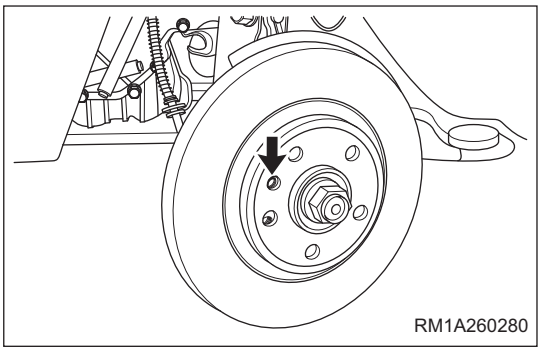
CAUTION

- DO NOT allow brake fluid to be sprayed on your clothes or skin when removing brake hose, as brake fluid is corrosive.

b. Remove the front left brake caliper assembly.

4. Remove the front left brake disc.

a. Remove locating screw (arrow) from front left brake disc and remove front left brake disc.
(Tightening torque: 4.5 ± 0.5 N·m)


RM1A260280

Disassembly

HINT:

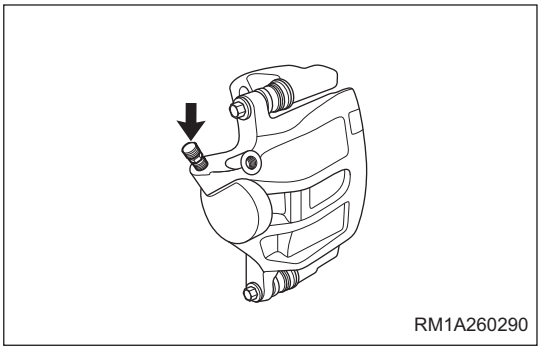
- Use same procedures for right and left sides.
- Procedures listed below are for left side.

WARNING

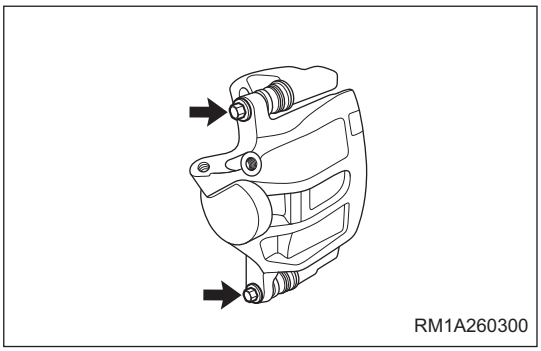
- Never use high pressure when removing piston from the bore of brake caliper. Otherwise, this may cause personal injuries.
- If it is needed to remove the piston with compressed air, do not allow the piston to face yourself or place your hands around the brake caliper and piston.

1. Remove the bleeder plug (w/ bleeder plug cap).

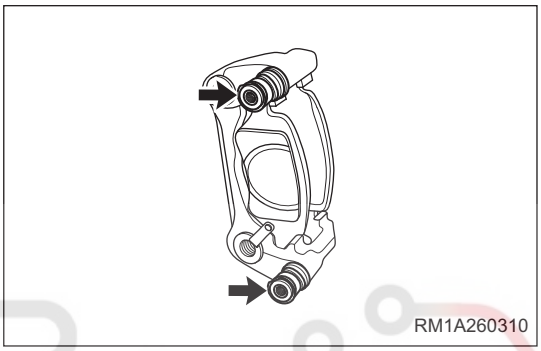
a. Remove bleeder plug (w/ bleeder plug cap) (arrow) from brake caliper assembly.


RM1A260290

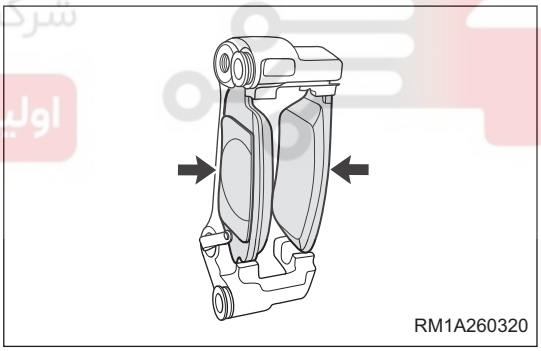
2. Remove the brake cylinder assembly.
   a. Remove 2 guide bolts (arrow) between brake caliper fixing bracket and brake cylinder assembly.


RM1A260300

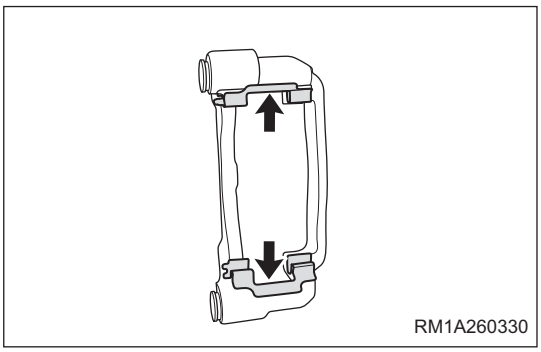
   b. Separate brake cylinder assembly and brake caliper fixing bracket.
3. Remove the front brake caliper guide bolt guide pin (w/ dust boot).
   a. Remove 2 brake caliper guide bolt guide pins (w/ dust boot) (arrow) from brake caliper fixing bracket.


RM1A260310

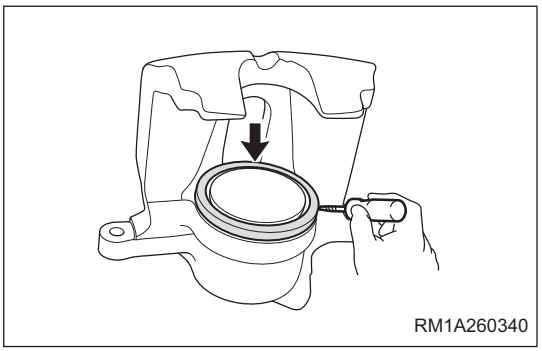
4. Remove the front brake lining.
   a. Remove inner brake lining and outer brake lining (arrow) from brake caliper fixing bracket.


RM1A260320

5. Remove the brake lining support shim.
   a. Remove 2 brake lining support shims (arrow) from brake caliper fixing bracket.


RM1A260330

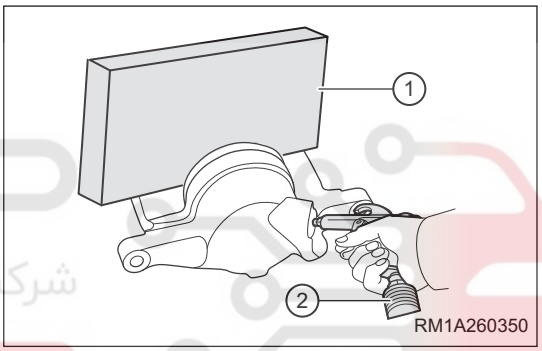
6. Remove the brake cylinder dust boot.
   a. Using a flat tip screwdriver wrapped with protective tape, pry out dust boot (arrow) carefully.


RM1A260340

CAUTION

- Be careful not to damage the brake piston and brake cylinder.

7. Remove the front disc brake piston.
   a. Place a wooden board (1) between front disc brake piston and front disc brake cylinder.
   b. Use compressed air (2) to carefully press out piston from front disc brake cylinder through attachment hole.



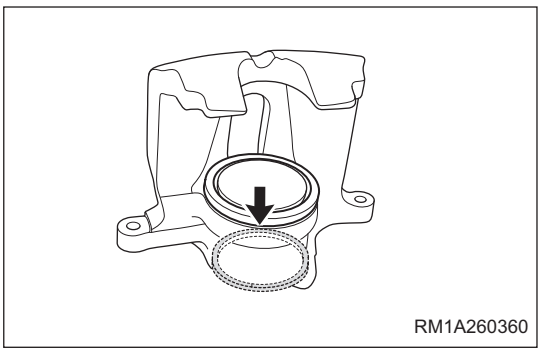
RM1A260350

CAUTION

- Be careful not to splash brake fluid.
- DO NOT hold piston by hands to prevent injury.
- DO NOT remove or install the brake piston by yourself, and always perform these operations by a professional.

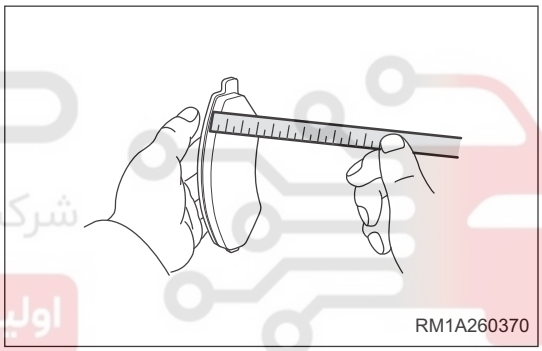
   c. Clean piston bore with alcohol or proper solution, and then wipe it with a piece of lint.

8. Remove the front disc brake piston seal ring.
   a. Using a flat tip screwdriver wrapped with protective tape, carefully pry out front disc brake piston seal ring (arrow) from brake cylinder rear ring groove.


RM1A260360

Inspection

1. Check brake cylinder and piston.
   a. Check piston and bore for scratches or corrosion. If there are scratches or corrosion, remove them with fine sand cloth.
   b. Remove dirt on piston with a soft brass wire brush and coarse cloth. Do not clean piston with polishing cloth or sand cloth, as this may damage its surface. If surface of piston is damaged, replace it. If piston is stuck or bore is worn or corroded, replace entire brake caliper assembly. Using polishing cloth, remove the small pitting inside bore.
2. Check brake caliper fixing bracket and brake caliper guide pin set.
   a. Clean contact surfaces of brake caliper fixing bracket and brake lining support shims with brake cleaner. Check for deformation, cracks, rust and foreign matter which is difficult to remove.
   b. Check brake caliper guide pin rubber dust boot for deformation, cracks, wear and foreign matter which is difficult to remove.
   c. Install brake caliper guide pin and its rubber dust boot to brake caliper fixing bracket. Brake caliper guide pin set should move smoothly without sticking when pushing it by hand; otherwise replace it.
   d. After installing brake lining, check if it is easy to fall out (due to weak elasticity of support shim). Replace it as necessary.
3. Check the brake lining.
   a. Visually check brake lining for flatness, and also check for excessive wear. If condition of lining cannot be confirmed accurately only by visual inspection, perform physical inspection as necessary.
   b. Measure the minimum brake lining thickness. When minimum thickness of brake lining is 2.0 mm or less, replace brake linings.

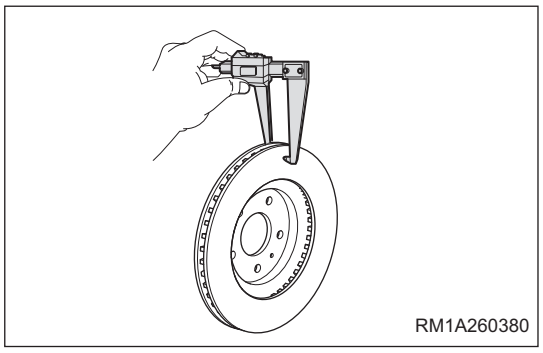

RM1A260370

   c. When replacing the over worn brake linings (inner and outer), it is also necessary to replace the linings on opposite side of vehicle as well as unchecked linings to maintain proper braking performance. If it is unnecessary to replace brake linings, be sure to reinstall them to original positions.
4. Check the brake disc.
   a. Minor scratch or wear on brake disc surface is acceptable. If severe scratch or deformation exists, brake disc must be replaced.
   b. Excessive wear of brake disc may cause poor contact between brake lining and surface of brake disc. If protrusion on brake disc is not removed before installing new brake lining, it will cause abnormal wear of brake disc.
   c. It is normal that surface of brake disc is worn when replacing brake lining. If cracks or burned spots exist, brake disc must be replaced.
5. Check the brake disc thickness.

a. Using a vernier caliper, measure brake disc thickness at center of brake lining contact surface as shown in illustration.

Standard thickness: 25 mm

Minimum thickness: 23 mm



b. If it is less than minimum thickness due to wear of brake disc, replace brake disc.

CAUTION

- DO NOT machine brake disc, because it may make brake disc thickness less than the minimum.

Assembly

HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

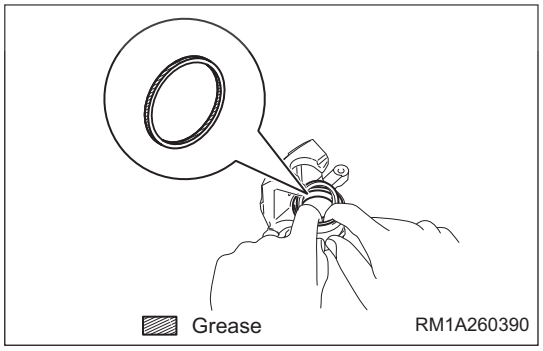
CAUTION

- When assembling brake caliper assembly, always keep your hands clean.
- When assembling brake caliper assembly, always use new clean brake fluid.
- Never use old front disc brake piston seal ring.

1. Install the front disc brake piston seal ring.

a. Apply a light coat of grease to entire inner and outer circumferences of new front disc brake piston seal ring.

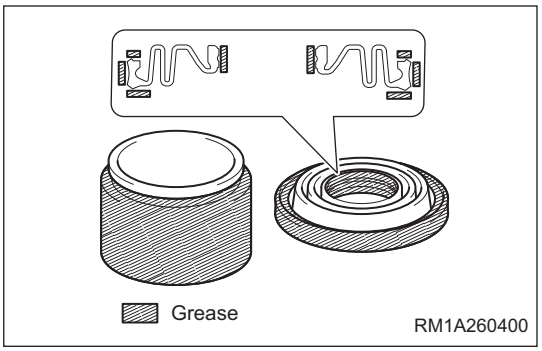
b. Install front disc brake piston seal ring to brake cylinder.



CAUTION

- Securely install front disc brake piston seal ring into rear ring groove of brake cylinder.

2. Install the front disc brake piston.
   a. Apply a light coat of grease to inner and outer circumferences, and entire periphery of outer flange top/bottom surface of new brake cylinder dust boot as shown in illustration.
   b. Apply a light coat of grease to entire outer circumference (part contacting with brake cylinder dust boot and front disc brake cylinder) of front disc brake piston.

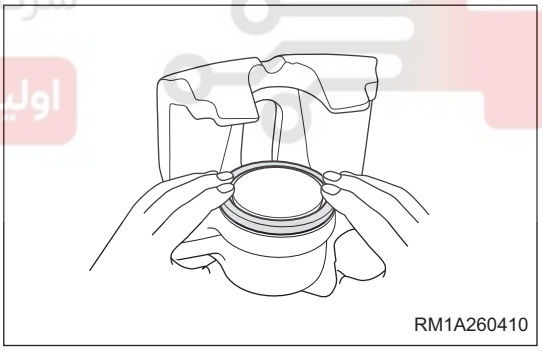


   c. Install brake cylinder dust boot to front disc brake piston.
3. Install the brake cylinder dust boot.
   a. Install front disc brake piston to front disc brake cylinder.

CAUTION

- DO NOT install piston forcibly to brake cylinder.

   b. Install brake cylinder dust boot to brake cylinder.



CAUTION

- Securely install brake cylinder dust boot into front ring groove of disc brake cylinder.
- DO NOT damage the brake cylinder dust boot.

Installation

Installation is in the reverse order of removal.

CAUTION

- Make sure contact surface of lining and brake disc is free of oil and grease.
- Make sure to tighten fixing bolt and nut to specified torque during installation.
- Before installing brake linings, completely retract the brake caliper piston back into bore of brake caliper.
- Depress brake pedal several times to secure brake linings to brake disc in order to ensure safety, after installing brake linings and before moving vehicle.
- Replace the brake linings in pairs. DO NOT replace one alone.
- DO NOT install inner brake lining and outer brake lining reversely.
- Be sure to check brake system for leakage after installation. Repair or replace malfunctioning parts as necessary.
- Be sure to perform bleeding procedures for brake system after installation.
- Be sure to add brake fluid to a proper level after installation.

Front Brake Hose Assembly

Removal

CAUTION

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

HINT:
- Use same procedures for right and left sides.
- Procedures listed below are for left side.

1. Remove the front left wheel (See page 24-9).
2. Drain the brake fluid (See page 26-15).

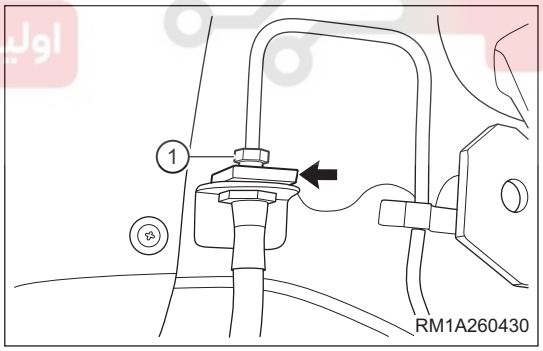
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

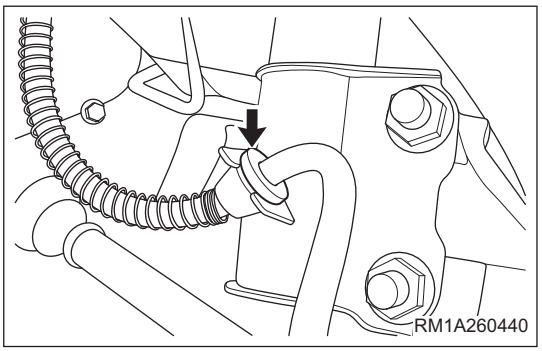
3. Remove the front left brake hose assembly.
   a. Detach fixing clip (arrow) and loosen coupling plug (1) between front left brake hose assembly and front left brake pipe.
   (Tightening torque: 18 ± 2 N·m)



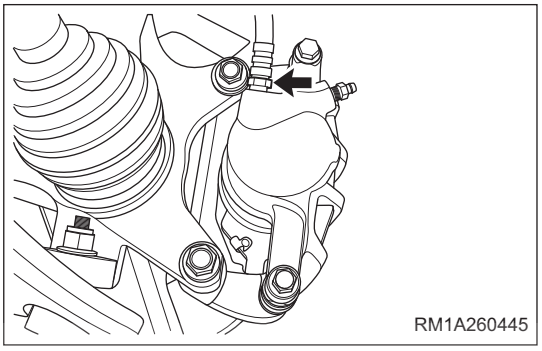
CAUTION

- DO NOT bend or damage brake tube.
- DO NOT allow any foreign matter such as dirt and dust to enter the brake tube from joint parts.
- After removing brake line, perform sealing treatment to prevent foreign matter from entering.

b. Detach fixing part (arrow) of front left brake hose assembly from front left shock absorber assembly.



c. Remove coupling plug (arrow) between front left brake caliper assembly and front left brake hose assembly.
(Tightening torque: 18 ± 2 N·m)



CAUTION

- DO NOT allow brake fluid to be sprayed on your clothes or skin when removing brake hose, as brake fluid is corrosive.

d. Remove the front left brake hose assembly.

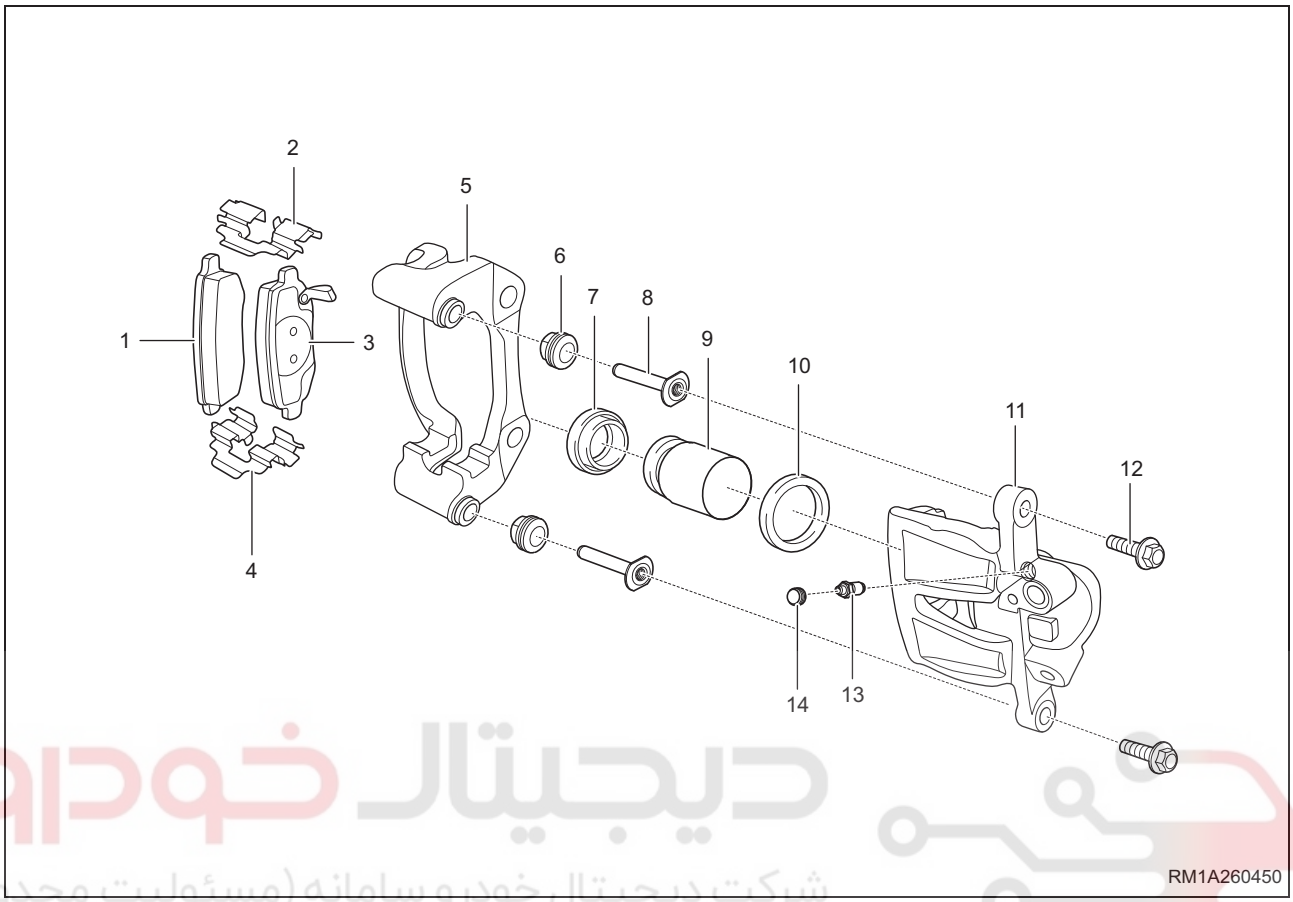
Installation

Installation is in the reverse order of removal.

CAUTION

- Make sure to tighten coupling plug to specified torque during installation.
- Be sure to check brake system for leakage after installation. Repair or replace malfunctioning parts as necessary.
- Be sure to perform bleeding procedures for brake system after installation.
- Be sure to add brake fluid to a proper level after installation.

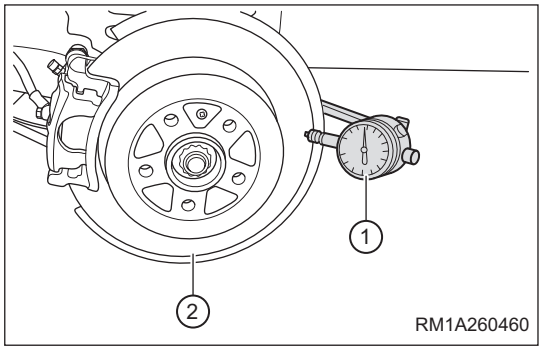
Rear Disc Brake Assembly



1 - Outer Brake Lining	2 - Upper Support Shim
3 - Inner Brake Lining	4 - Lower Support Shim
5 - Rear Disc Brake Caliper Fixing Bracket	6 - Brake Caliper Guide Pin Rubber Dust Boot
7 - Rear Disc Brake Piston Dust Boot	8 - Brake Caliper Guide Bolt Guide Pin
9 - Rear Disc Brake Piston	10 - Rear Disc Brake Piston Seal Ring
11 - Rear Disc Brake Cylinder	12 - Brake Caliper Guide Bolt
13 - Bleeder Plug	14 - Bleeder Plug Cap

On-vehicle Inspection

1. Check the brake disc runout.
   a. Remove the rear wheel (See page 24-9).
   b. Secure a dial indicator (1) to a proper position. Then position dial indicator pointer approximately 10 mm from outer edge of rear brake disc.



   c. Slowly rotate brake disc (2) and check its runout. Mark the lowest and highest points and record these measured values.
   d. Check runout on opposite side of brake disc in the same way. Mark the lowest and highest points and record these measured values.
   e. Compare recorded runout value with limit value.
   Maximum runout for rear brake disc: 0.025 mm
   f. If runout exceeds the maximum value, replace brake disc.

Removal

HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

1. Drain the brake fluid (See page 26-15).

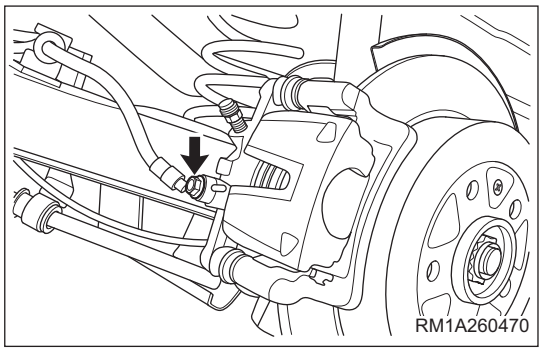
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

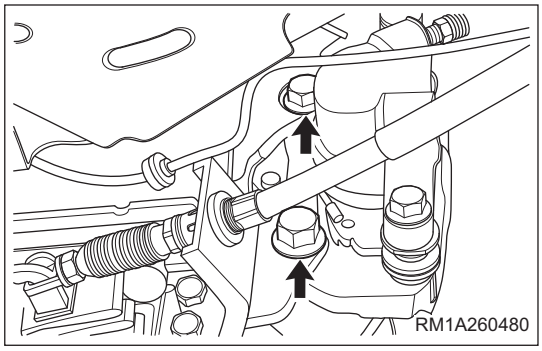
2. Remove the rear left wheel (See page 24-9).
3. Remove the rear left brake caliper assembly.
   a. Remove coupling bolt and washer (arrow) between rear left brake caliper assembly and rear left brake hose assembly.
   (Tightening torque: 18 ± 2 N·m)



CAUTION

- DO NOT allow brake fluid to be sprayed on your clothes or skin when removing brake hose, as brake fluid is corrosive.

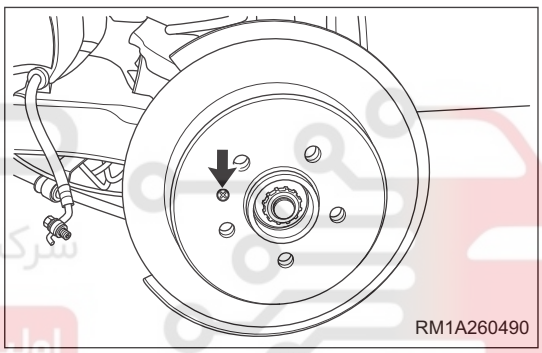
b. Remove coupling bolts (arrow) between rear left brake caliper assembly and left brake caliper mounting board assembly.
(Tightening torque: 100 ± 10 N·m)



c. Remove the rear left brake caliper assembly.

4. Remove the rear left brake disc.

a. Remove locating screw (arrow) from rear left brake disc and remove rear left brake disc.
(Tightening torque: 4.5 ± 0.5 N·m)



Disassembly

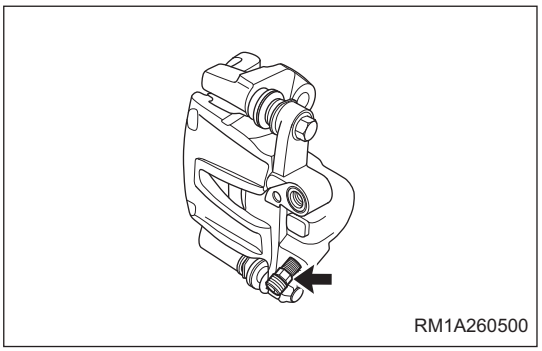
HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

WARNING

- Never use high pressure when removing piston from the bore of brake caliper. Otherwise, this may cause personal injuries.
- If it is needed to remove the piston with compressed air, do not allow the piston to face yourself or place your hands around the brake caliper and piston.

1. Remove the bleeder plug (w/ bleeder plug cap).
   a. Remove bleeder plug (w/ bleeder plug cap) (arrow) from brake caliper assembly.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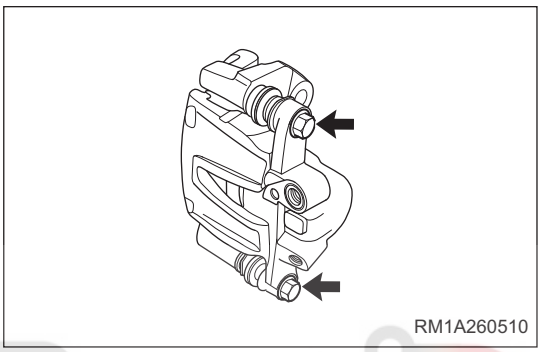
2. Remove the brake cylinder assembly.
   a. Remove 2 guide bolts (arrow) between brake caliper fixing bracket and brake cylinder assembly.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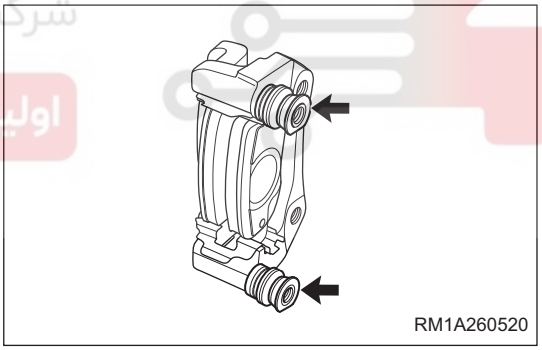
   b. Separate brake cylinder assembly and brake caliper fixing bracket.
3. Remove the rear brake caliper guide bolt guide pin (w/ dust boot).
   a. Remove 2 brake caliper guide bolt guide pins (w/ dust boot) (arrow) from brake caliper fixing bracket.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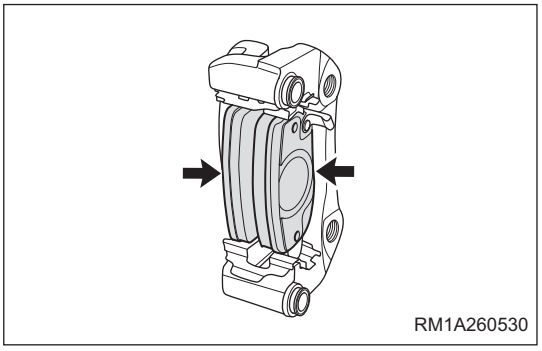
4. Remove the rear brake lining.
   a. Remove inner brake lining and outer brake lining (arrow) from brake caliper fixing bracket.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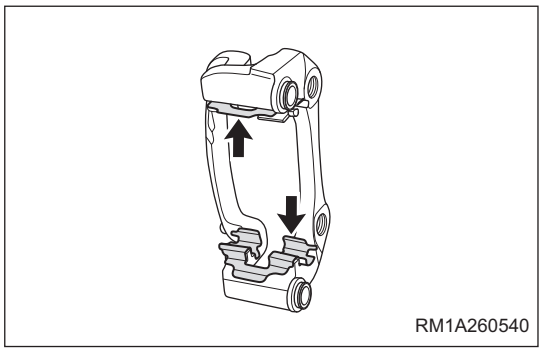
5. Remove the brake lining support shim.
   a. Remove 2 brake lining support shims (arrow) from brake caliper fixing bracket.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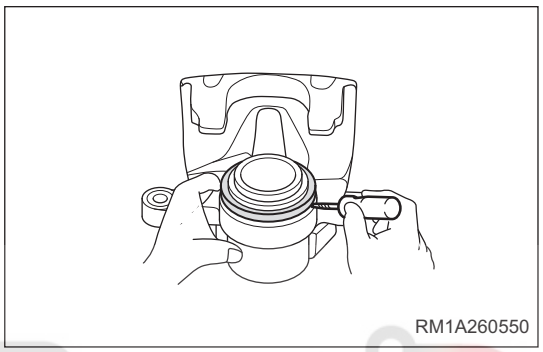
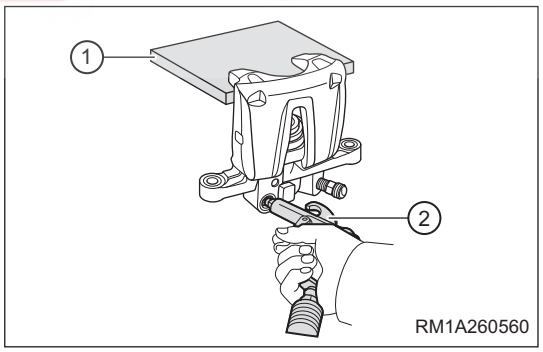
6. Remove the brake cylinder dust boot.
   a. Using a flat tip screwdriver wrapped with protective tape, pry out dust boot carefully.


RM1A260550

CAUTION

- Be careful not to damage brake piston and brake cylinder.

7. Remove the rear disc brake piston.
   a. Place a wooden board (1) between rear disc brake piston and rear disc brake cylinder.
   b. Use compressed air (2) to carefully press out piston from rear disc brake cylinder through attachment hole.



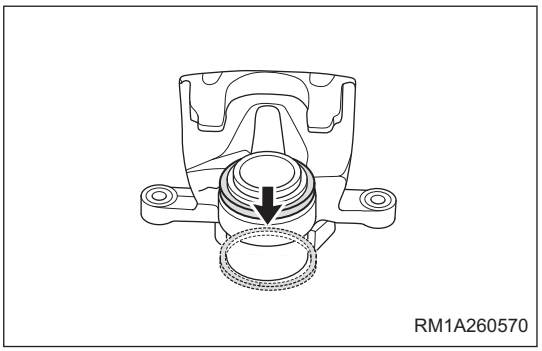
RM1A260560

CAUTION

- Be careful not to splash brake fluid.
- DO NOT hold piston by hands to prevent injury.
- DO NOT remove or install the brake piston by yourself, and always perform these operations by a professional.

   c. Clean piston bore with alcohol or proper solution. Then wipe it with a piece of lint.

8. Remove the rear disc brake piston seal ring.
   a. Using a flat tip screwdriver wrapped with protective tape, carefully pry out rear disc brake piston seal ring (arrow) from rear ring groove of brake cylinder.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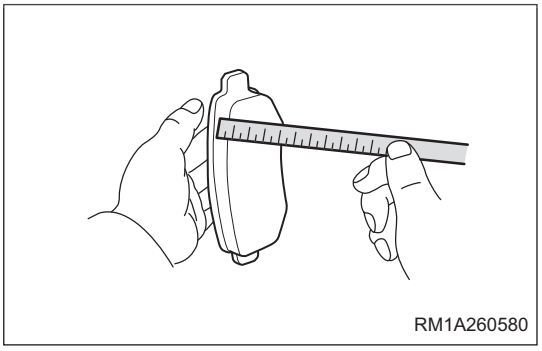
Inspection

1. Check brake cylinder and piston.
   a. Check piston and bore for scratches or corrosion. If there are scratches or corrosion, remove them with fine sand cloth.
   b. Remove dirt on piston with a soft brass wire brush and coarse cloth. Do not clean piston with polishing cloth or sand cloth, as this may damage its surface. If surface of piston is damaged, replace it. If piston is stuck or bore is worn or corroded, replace entire brake caliper assembly. Using polishing cloth, remove the small pitting inside bore.
2. Check brake caliper fixing bracket and brake caliper guide pin set.
   a. Clean contact surfaces of brake caliper fixing bracket and brake lining support shims with brake cleaner. Check for deformation, cracks, rust and foreign matter which is difficult to remove.
   b. Check brake caliper guide pin rubber dust boot for deformation, cracks, wear and foreign matter which is difficult to remove.
   c. Install brake caliper guide pin and its rubber dust boot to brake caliper fixing bracket. Brake caliper guide pin set should move smoothly without sticking when pushing it by hand; otherwise replace it.
   d. After installing brake lining, check if it is easy to fall out (due to weak elasticity of support shim). Replace it as necessary.
3. Check the brake lining.
   a. Visually check brake lining for flatness, and also check for excessive wear. If condition of lining cannot be confirmed accurately only by visual inspection, perform physical inspection as necessary.
   b. Measure the minimum brake lining thickness. When minimum thickness of brake lining is 2.0 mm or less, replace brake linings.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   c. When replacing the over worn brake linings (inner and outer), it is also necessary to replace the linings on opposite side of vehicle as well as unchecked linings to maintain proper braking performance. If it is unnecessary to replace brake linings, be sure to reinstall them to original positions.
4. Check the brake disc.
   a. Minor scratch or wear on brake disc surface is acceptable. If severe scratch or deformation exists, brake disc must be replaced.

b. Excessive wear of brake disc may cause poor contact between brake lining and surface of brake disc. If protrusion on disc is not removed before installing new brake lining, it will cause abnormal wear of brake disc.

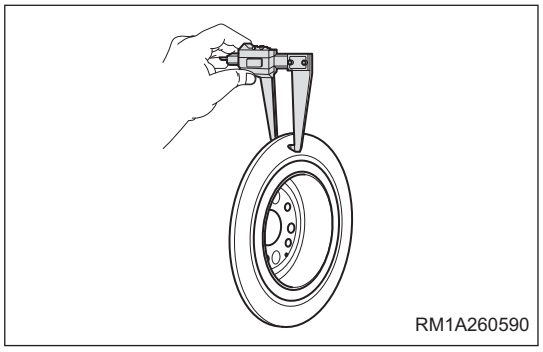
c. It is normal that surface of brake disc is worn when replacing brake lining. If cracks or burned spots exist, brake disc must be replaced.

5. Check the brake disc thickness.

a. Using a vernier caliper, measure brake disc thickness at center of brake lining contact surface as shown in illustration.

Standard thickness: 10 mm

Minimum thickness: 9 mm


RM1A260590

b. If it is less than minimum thickness due to wear of brake disc, replace brake disc.

CAUTION

- DO NOT machine brake disc, because it may make brake disc thickness less than the minimum.

Assembly

HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

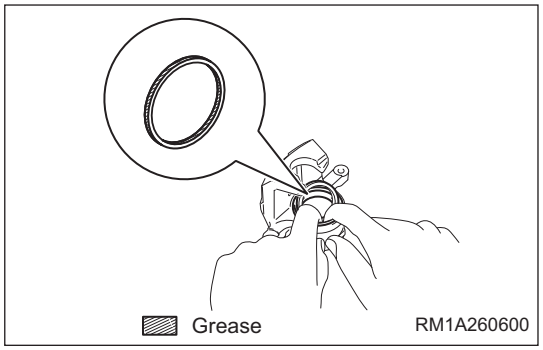
CAUTION

- When assembling brake caliper assembly, always keep your hands clean.
- When assembling brake caliper assembly, always use new clean brake fluid.
- Never use old front disc brake piston seal ring.

1. Install the rear disc brake piston seal ring.

a. Apply a light coat of grease to entire inner and outer circumferences of new rear disc brake piston seal ring.

b. Install rear disc brake piston seal ring to brake cylinder.



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CAUTION

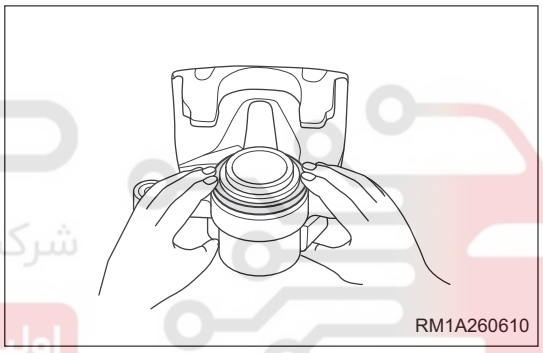
- Securely install the rear disc brake piston seal ring into rear ring groove of brake cylinder.

2. Install the rear disc brake piston.
   a. Apply a light coat of grease to inner and outer circumferences, and entire periphery of outer flange top/bottom surface of new brake cylinder dust boot as shown in illustration.
   b. Apply a light coat of grease to entire outer circumference (part contacting with the brake cylinder dust boot and rear disc brake cylinder) of rear disc brake piston.
   c. Install brake cylinder dust boot to rear disc brake piston.
3. Install the brake cylinder dust boot.
   a. Install rear disc brake piston to rear disc brake cylinder.

CAUTION

- DO NOT install piston forcibly to brake cylinder.

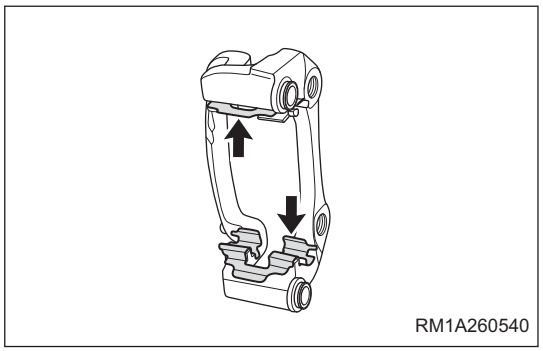
   b. Install brake cylinder dust boot to brake cylinder.



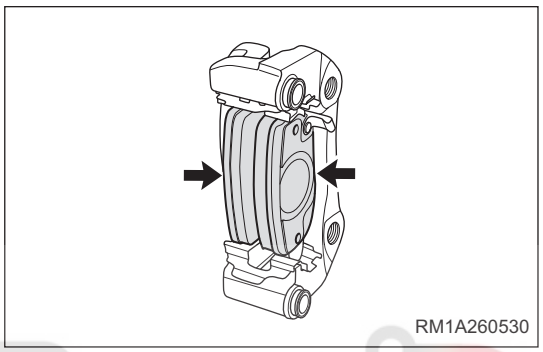
CAUTION

- Securely install brake cylinder dust boot into front ring groove of disc brake cylinder.
- DO NOT damage the brake cylinder dust boot.

4. Install the brake lining support shim.
   a. Securely install upper and lower support shims (arrow) to brake caliper fixing bracket.


RM1A260540

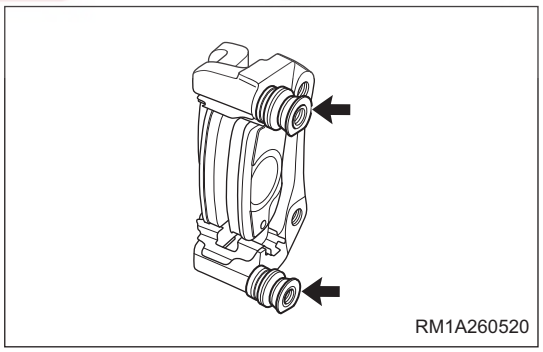
5. Install the rear brake lining.
   a. Securely install inner brake lining and outer brake lining (arrow) to brake caliper fixing bracket. Make sure they are clamped in place.


RM1A260530

CAUTION

- Make sure contact surface of lining and brake disc is free of oil and grease.

6. Install the rear brake caliper guide bolt guide pin (w/ dust boot).
   a. Apply a small amount of grease to contact surface between guide bolt guide pin and guide pin rubber dust boot (arrow), and securely install them to brake caliper fixing bracket.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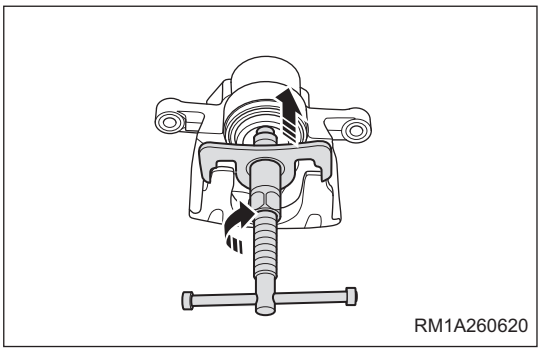
7. Install the brake cylinder assembly.
   a. Using brake cylinder piston pressing tool, slightly retract brake cylinder piston.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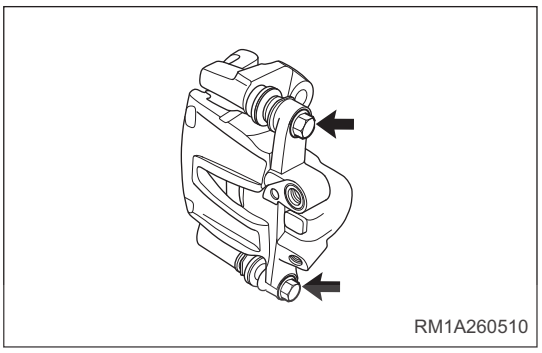
   b. Align brake caliper guide bolts (arrow) with guide pin holes and securely install brake cylinder assembly.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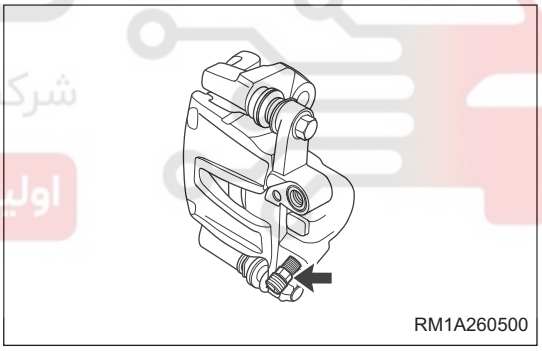
8. Install the bleeder plug (w/ bleeder plug cap).
   a. Securely install bleeder plug (w/ bleeder plug cap) (arrow) to rear brake caliper assembly.
   (Tightening torque: 9 - 11 N·m)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Installation

Installation is in the reverse order of removal.

CAUTION

- Make sure to tighten fixing bolt and nut to specified torque during installation.
- Before installing brake linings, completely retract the brake caliper piston back into bore of brake caliper.
- Depress brake pedal several times to secure brake linings to brake disc in order to ensure safety, after installing brake linings and before moving vehicle.
- Replace the brake linings in pairs. DO NOT replace one alone.
- DO NOT install inner brake lining and outer brake lining reversely.
- Be sure to check brake system for leakage after installation. Repair or replace malfunctioning parts as necessary.
- Be sure to perform bleeding procedures for brake system after installation.
- Be sure to add brake fluid to a proper level after installation.

Rear Brake Hose Assembly

Removal

CAUTION

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

HINT:
- Use same procedures for right and left sides.
- Procedures listed below are for left side.

1. Drain the brake fluid (See page 26-15).

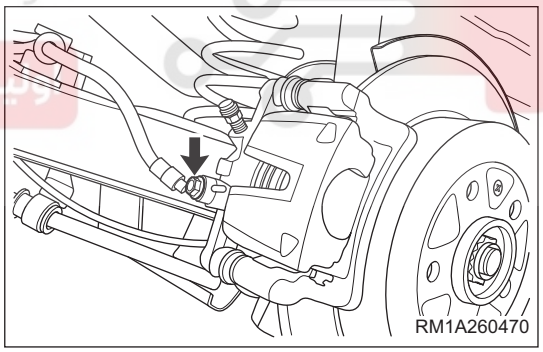
CAUTION

- Wash off brake fluid immediately if it comes in contact with any paint surface.

ENVIRONMENTAL PROTECTION

- Drained brake fluid should be well kept in a container. Never discard it at will.

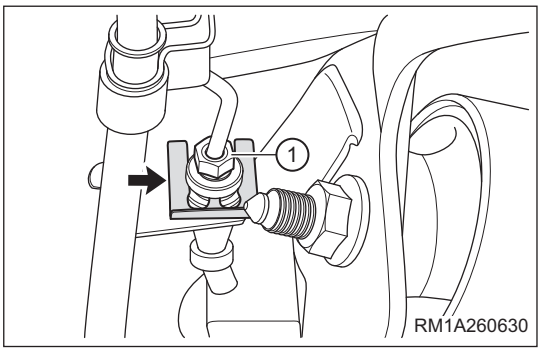
2. Remove the rear left brake hose assembly.
   a. Remove coupling bolt and washer (arrow) between rear left brake caliper assembly and rear left brake hose assembly.
   (Tightening torque: 18 ± 2 N·m)



CAUTION

- DO NOT allow brake fluid to be sprayed on your clothes or skin when removing brake hose, as brake fluid is corrosive.

b. Detach fixing clip (arrow) and loosen coupling plug (1) between rear left brake hose assembly and rear brake pipe.
(Tightening torque: 18 ± 2 N·m)



CAUTION

- DO NOT bend or damage brake tube.
- DO NOT allow any foreign matter such as dirt and dust to enter the brake tube from joint parts.
- After removing brake line, perform sealing treatment to prevent foreign matter from entering.

c. Remove the rear left brake hose assembly.

Installation

Installation is in the reverse order of removal.

CAUTION

- Be sure to tighten bolt and plug in place.
- Be sure to check brake system for leakage after installation. Repair or replace malfunctioning parts as necessary.
- Be sure to perform bleeding procedures for brake system after installation.
- Be sure to add brake fluid to a proper level after installation.

PARKING BRAKE

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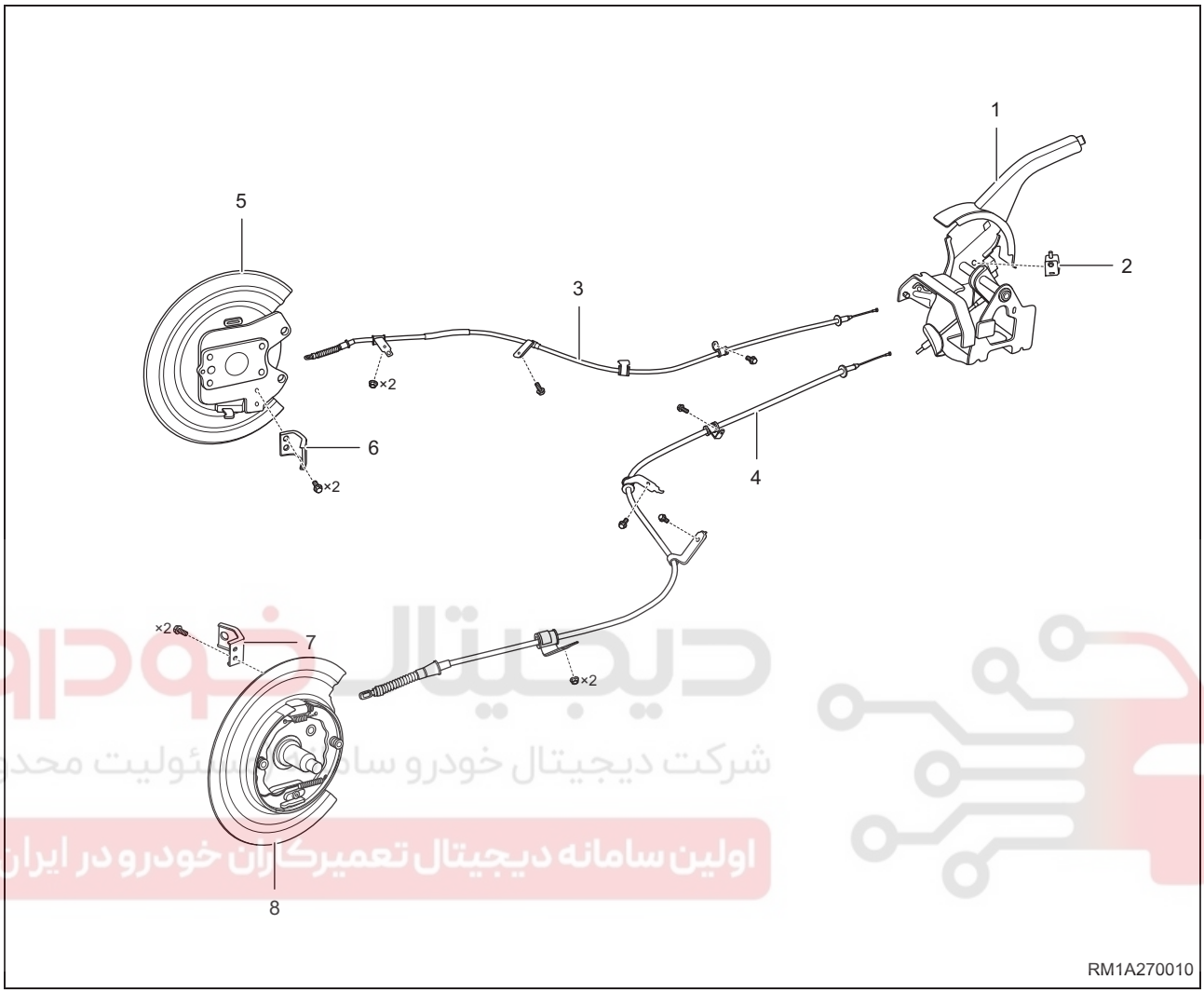
GENERAL INFORMATION

Parking Brake Assembly



1 - Parking Brake Control Mechanism Assembly	2 - Parking Brake Switch Assembly
3 - Rear Left Parking Brake Cable Assembly	4 - Rear Right Parking Brake Cable Assembly
5 - Rear Left Parking Brake Assembly	6 - Rear Left Cable Bracket
7 - Rear Right Cable Bracket	8 - Rear Right Parking Brake Assembly

Description

M1A vehicles are equipped with a manual-operated parking brake control mechanism assembly, which is mounted between front seats. Each rear wheel has an individual rear parking brake cable assembly, which is respectively connected with parking brake control mechanism assembly and parking brake assembly. The parking brake cable is made of flexible wire.

Specifications

Torque Specifications

Description	Torque (N·m)
Wheel Mounting Bolt	110 ± 10
Parking Brake Control Mechanism Adjusting Nut	4 ± 1
Coupling Nut Between Parking Brake Control Mechanism Assembly and Body	25 ± 4
Coupling Nut Between Rear Parking Brake Cable Assembly Fixing Bracket and Rear Shaft Assembly	10 ± 1.5
Coupling Bolt Between Speed Sensor and Parking Brake Assembly	9 ± 1.5

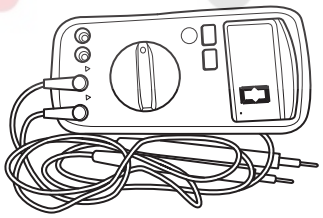
Rear DIH (Drum-in-hat)

Description	Standard Thickness (mm)	Minimum Thickness (mm)
Rear Brake Shoe Lining	2.8	1

Description	Standard Inner Diameter (mm)	Maximum Inner Diameter (mm)
Rear Brake Disc	186	186.2

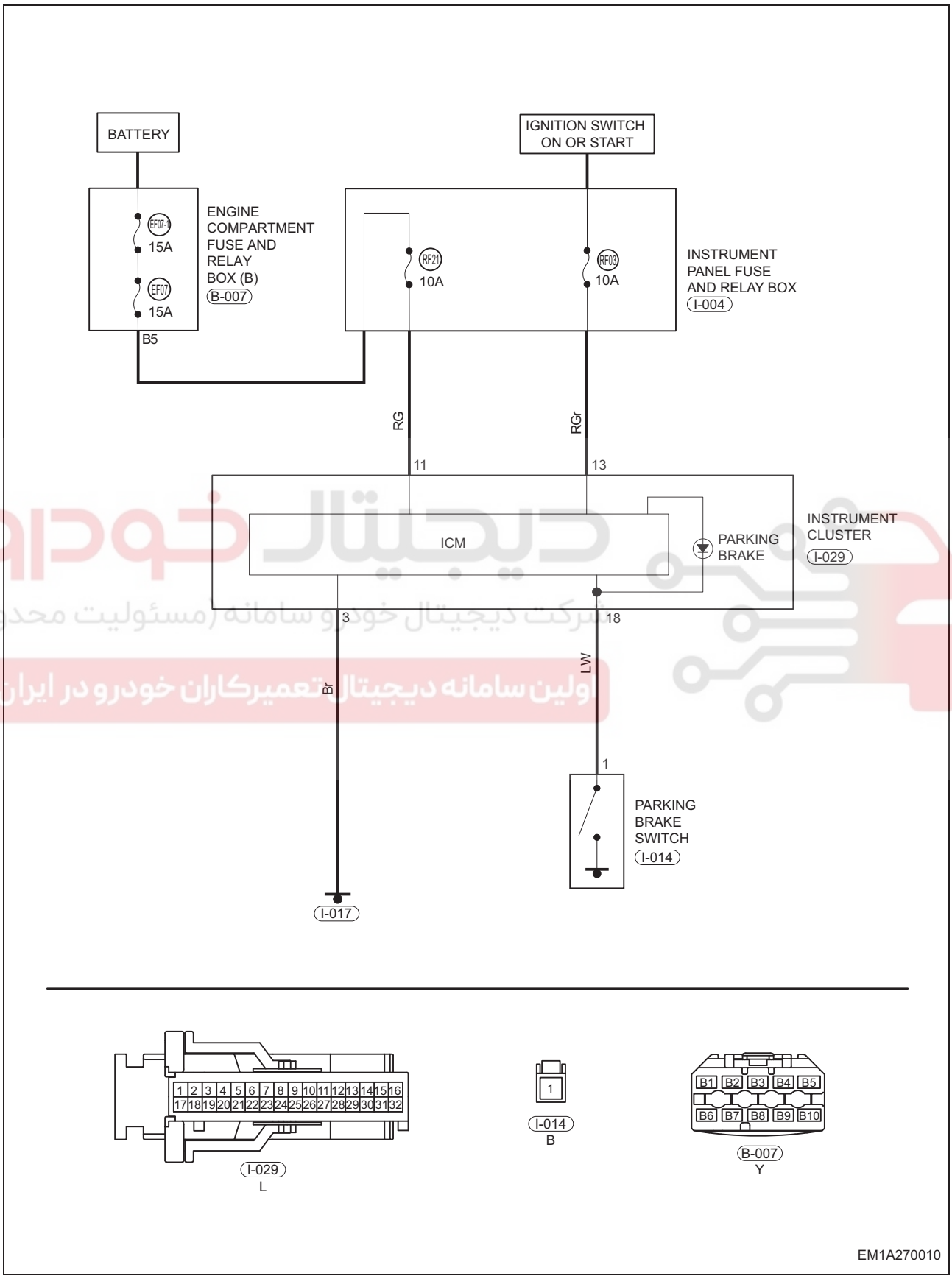
Tools

General Tools

Digital Multimeter	 RCH0000002
Vernier Caliper	 RCH0000019

Circuit Diagram

Parking Brake System



DIAGNOSIS & TESTING

Problem Symptoms Table

HINT:
Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair or adjust faulty components, or replace as necessary.

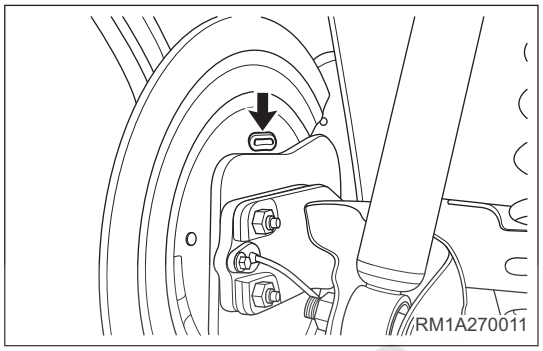
Symptom	Suspected Area	See page
Parking brake drag	Parking brake control mechanism stroke (incorrect)	27-7
	Parking brake shoe clearance (incorrect)	27-7
	Parking brake shoe return tension spring (damaged)	27-18
Abnormal parking brake operation	Parking brake shoe (worn)	27-18
	Rear brake disc (excessively worn)	26-38
	Parking brake control mechanism assembly (improperly fixed)	27-11
	Parking brake control mechanism assembly (catching)	27-11
	Parking brake cable assembly (improperly fixed)	27-13
Brake warning light does not come on when parking brake is applied	Warning light circuit (faulty)	27-9

ON-VEHICLE SERVICE

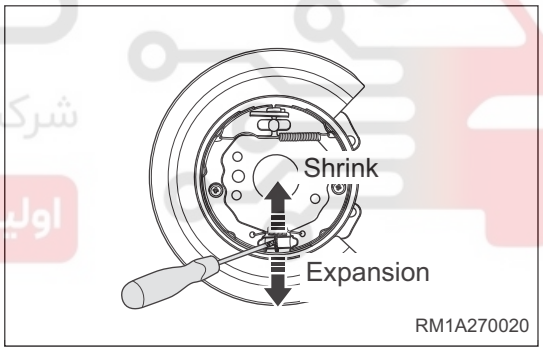
Adjustment

Abnormal parking brake operation may be caused by worn brake shoe lining, incorrect brake shoe clearance adjustment, incorrect parking brake control mechanism stroke or incorrect parking brake component installation. Perform following procedures to adjust parking brake shoe clearance and parking brake control mechanism stroke:

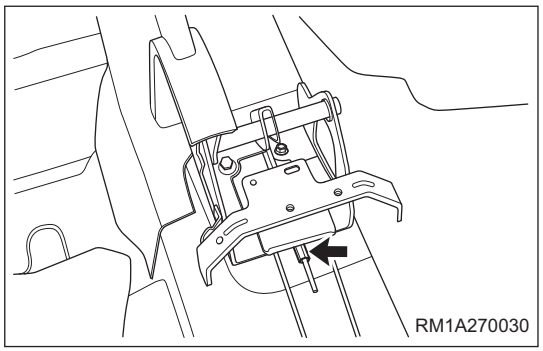
1. Support and raise vehicle to a proper height.
2. Remove the rear wheel (See page 24-9).
3. Adjust the parking brake shoe clearance:
   a. Fully release the parking brake control mechanism.
   b. Using a flat tip screwdriver, pry off brake shoe adjusting hole plug (arrow).



   c. Rotate brake shoe clearance adjustment mechanism assembly clockwise or counterclockwise to adjust parking brake shoe clearance.



   d. Try to rotate rear brake disc by hand to confirm that brake disc rotates freely. Check that there is no brake drag for brake shoe.
4. Adjust the parking brake control mechanism stroke:
   a. Fully release the parking brake control mechanism.
   b. Rotate parking brake control mechanism adjusting nut (arrow), until parking brake control mechanism stroke is correct.



c. Correct judgment method: After adjustment, completely release parking brake control mechanism and rotate rear wheel by hand.

OK: Rear wheel can rotate freely without dragging.

Pull up parking brake control mechanism until one click sound is heard and resistance is felt when rotating rear wheel by hand. Pull up parking brake control mechanism until 2 or 3 click sounds are heard and rear wheel cannot rotate.

d. When operating parking brake control mechanism, check that brake warning light illuminates at the first click.

OK: Parking brake warning light always illuminates at the first click.

e. Followings should be met after adjusting parking brake control mechanism stroke:

Parking brake force should be less than 250 N when vehicle is parking on a ramp with a slope of 20%.

Parking brake stroke is 3 to 6 teeth when vehicle is driving on general road.

f. If result is not as specified, repeat above procedures until parking brake control mechanism stroke is proper.

5. Install the rear wheel (See page 24-9).

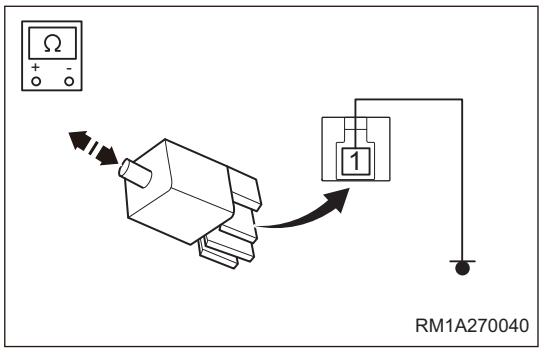
Parking Brake Switch Assembly

On-vehicle Inspection

1. Disconnect parking brake switch assembly connector, and check continuity of parking brake switch assembly with ohm band of digital multimeter as shown in table below.

Standard Condition

Multimeter Connection	Condition	Specified Condition
Terminal 1 - Body ground	Parking brake applied (switch pin released)	Continuity
	Parking brake released (switch pin pushed)	No continuity



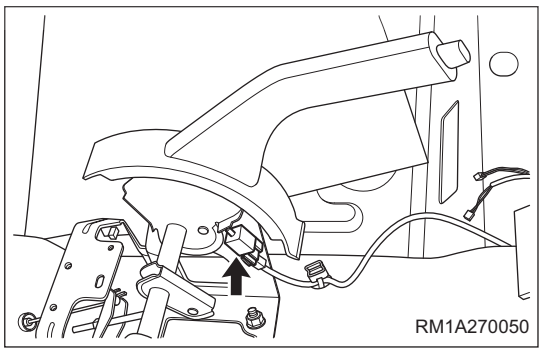
If result is not as specified, replace parking brake switch assembly.

Removal

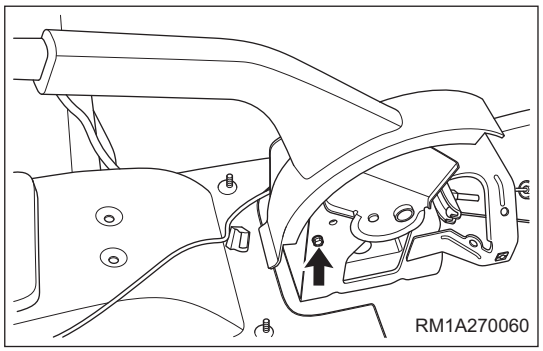
CAUTION

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Fix the wheel assembly.
2. Remove the auxiliary fascia console assembly (See page 46-8).
3. Remove the parking brake switch assembly.
   a. Disconnect parking brake switch assembly wire harness connector (arrow) as shown in illustration.



b. Loosen fixing screw (arrow) from parking brake switch assembly.



c. Remove the parking brake switch assembly.

Inspection

1. Check the parking brake switch assembly.
   a. Check parking brake switch assembly for wear or breakage. Replace parking brake switch assembly as necessary.
   b. Check parking brake switch assembly compression spring for damage or weak in elasticity. Replace parking brake switch assembly as necessary.

Installation

Installation is in the reverse order of removal.

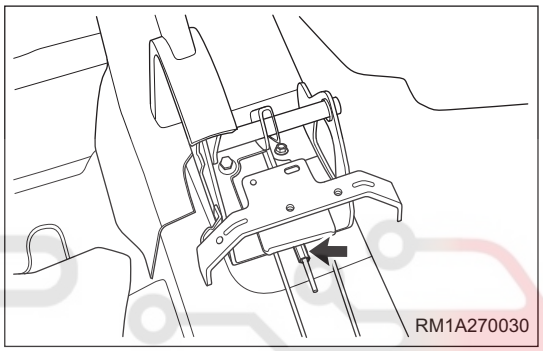
Parking Brake Control Mechanism Assembly

Removal

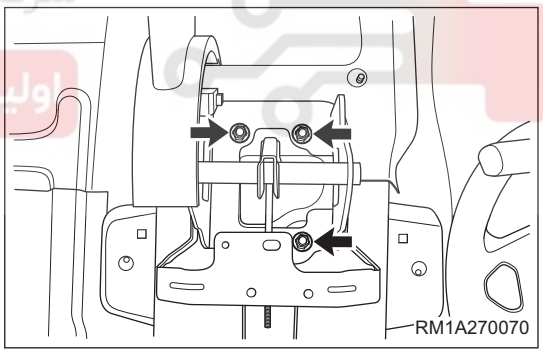
CAUTION

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

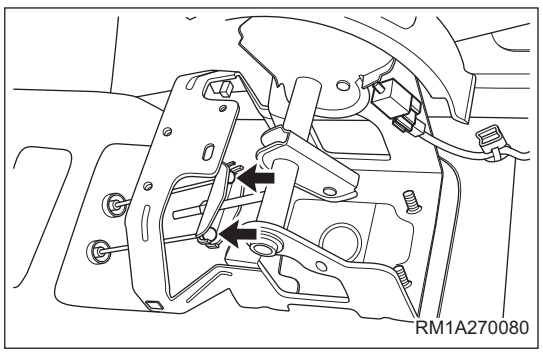
1. Fix the wheel assembly.
2. Remove the auxiliary fascia console assembly (See page 46-8).
3. Remove the parking brake switch assembly (See page 27-9).
4. Remove the parking brake control mechanism assembly.
   a. Fully release the parking brake control mechanism.
   b. Loosen locking nut (arrow) from parking brake control mechanism assembly to release tension of parking brake cable assembly.
   (Tightening torque: 4 ± 1 N·m)



   c. Remove 3 coupling nuts (arrow) between parking brake control mechanism assembly and body.
   (Tightening torque: 25 ± 4 N·m)



   d. Disengage rear parking brake cable assemblies from grooves (arrow) on both rear sides of parking brake control mechanism assembly.



   e. Remove the parking brake control mechanism assembly.

Installation

Installation is in the reverse order of removal.

CAUTION

- Be sure to tighten coupling nuts to specified torques.

HINT:
Be sure to check parking brake control mechanism stroke, after installing parking brake control mechanism assembly. Adjust parking brake control mechanism stroke to proper position by adjusting parking brake control mechanism locking nut if necessary.

Rear Parking Brake Cable Assembly

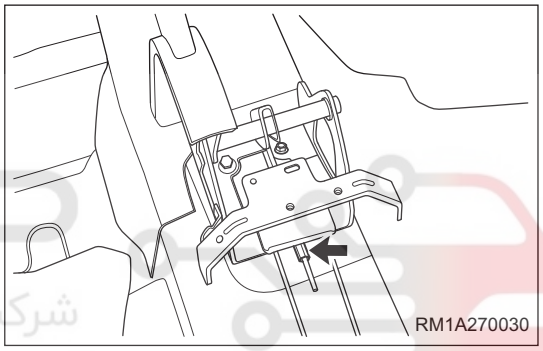
Removal

CAUTION

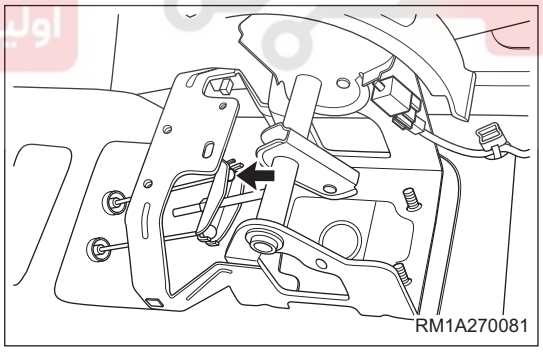
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

HINT:
- Use same procedures for right and left sides.
- Procedures listed below are for left side.

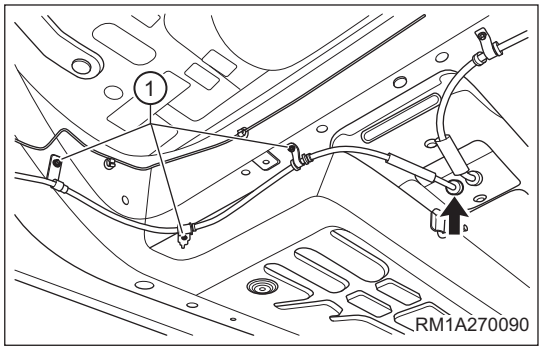
1. Remove the rear left wheel (See page 24-9).
2. Remove the auxiliary fascia console assembly (See page 46-8).
3. Remove the rear parking brake cable assembly.
   a. Fully release the parking brake control mechanism.
   b. Loosen locking nut (arrow) from parking brake control mechanism assembly to release tension of parking brake cable assembly.
   (Tightening torque: 4 ± 1 N·m)



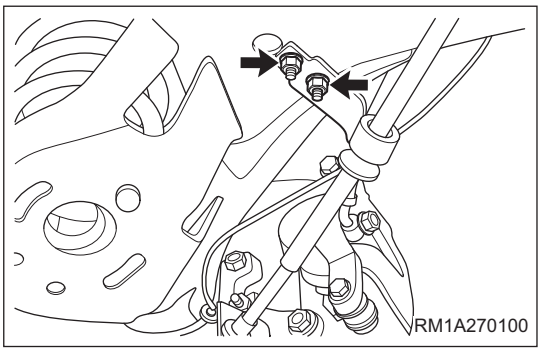
   c. Disengage rear parking brake cable assembly from groove (arrow) on rear side of parking brake control mechanism assembly.



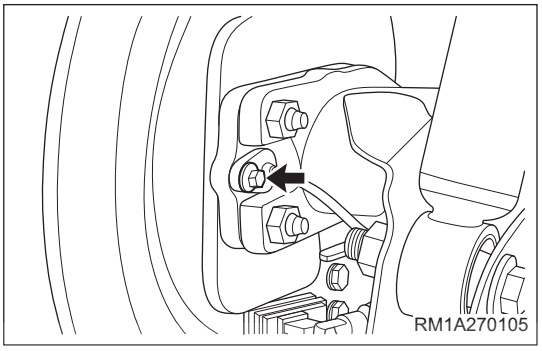
   d. Disengage rear parking brake cable assembly from body lower positioning hole (arrow), and remove 3 coupling bolts (1) between rear parking brake cable assembly fixing bracket and body.
   (Tightening torque: 10 ± 1.5 N·m)



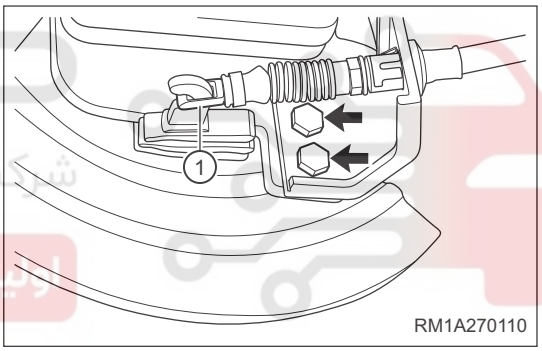
e. Remove 2 coupling nuts (arrow) between rear parking brake cable assembly fixing bracket and rear shaft assembly.
(Tightening torque: 10 ± 1.5 N·m)



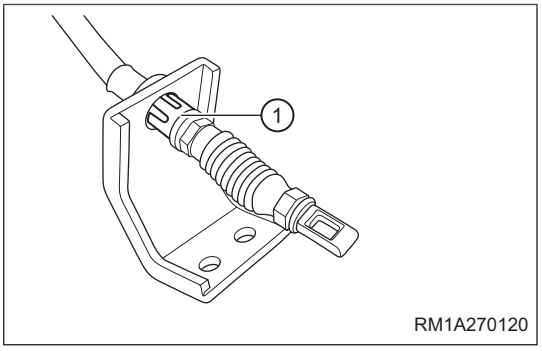
f. Remove the rear left wheel speed sensor assembly fixing bolt (arrow).
(Tightening torque: 9 ± 1.5 N·m)



g. Remove fixing bolts (arrow) between rear parking brake cable bracket and rear brake assembly, and disengage rear parking brake cable assembly end (1) from pulling arm.



h. Disengage clip (1) and remove rear parking brake cable assembly.



Installation

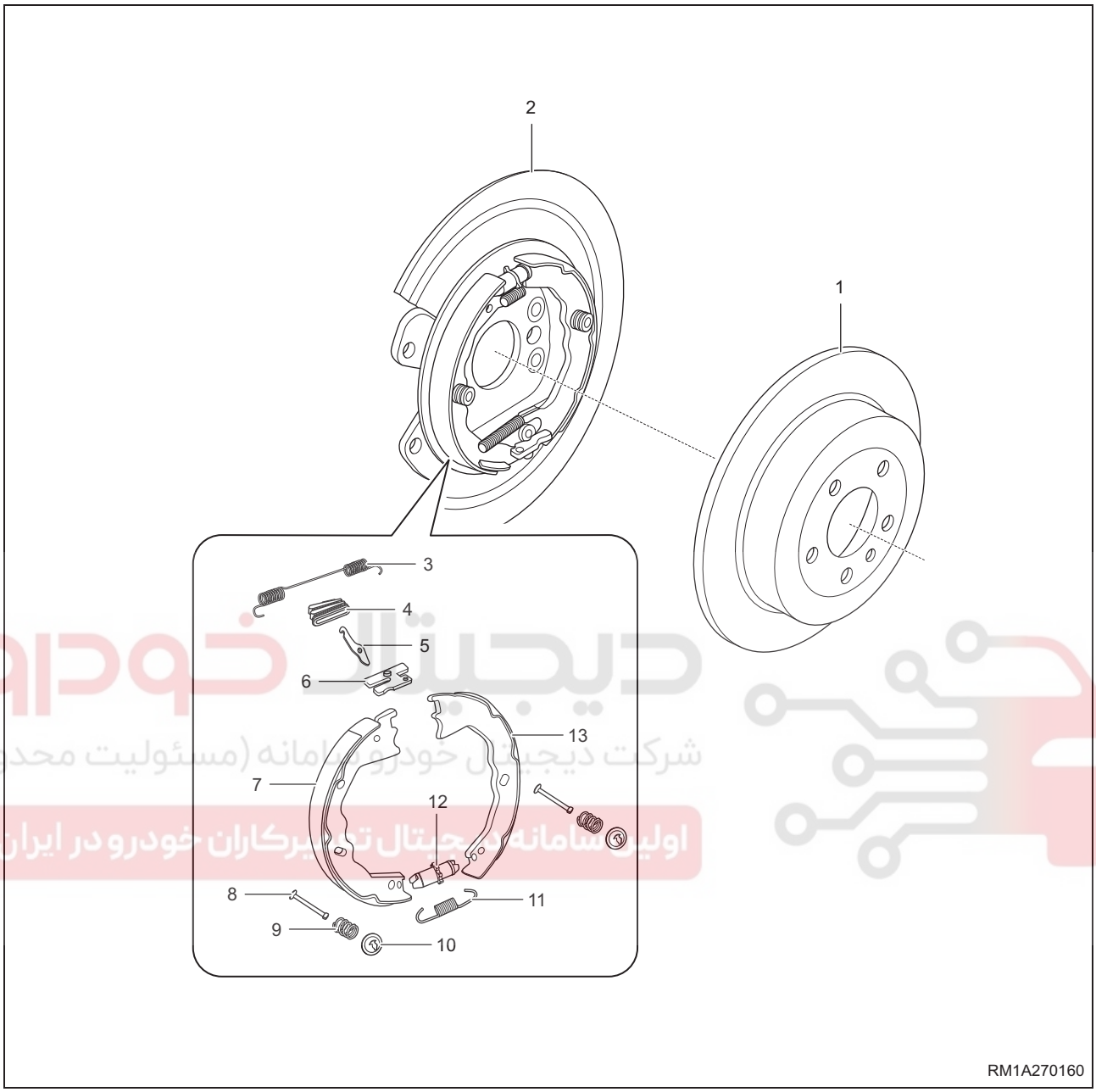
Installation is in the reverse order of removal.

CAUTION

- Be sure to tighten coupling bolts and nuts to specified torques.

HINT:
Parking brake should be adjusted after replacing parking brake shoe or parking brake cable assembly. Check if parking brake functions properly after adjustment. Check the parking brake control mechanism stroke. Release parking brake control mechanism and check if rear wheels rotate freely. If wheels are difficult to rotate freely, repeat adjustment procedure. After driving for a period of time, parking brake control mechanism stroke should be readjusted due to wear of rear brake shoe linings.

Parking Brake Assembly



1 - Rear Brake Disc	2 - Parking Brake Assembly
3 - Brake Shoe Return Tension Spring (Upper)	4 - Pulling Arm Dust Boot
5 - Pulling Arm	6 - Parking Push Rod
7 - Left Parking Brake Shoe Lining	8 - Compression Spring Pin
9 - Brake Shoe Compression Spring	10 - Compression Spring Seat
11 - Brake Shoe Return Tension Spring (Lower)	12 - Brake Shoe Clearance Adjustment Mechanism Assembly
13 - Right Parking Brake Shoe Lining	

Removal

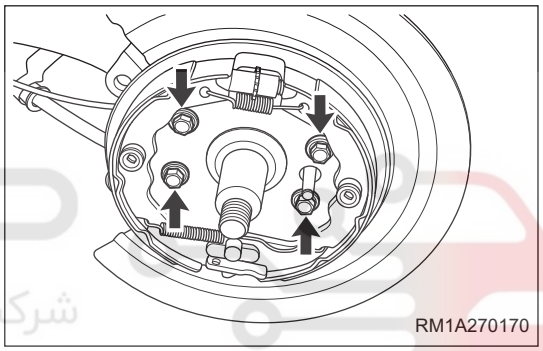
CAUTION

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

1. Remove the rear left wheel (See page 24-9).
2. Remove the rear left brake caliper assembly (See page 26-38).
3. Remove the rear left brake disc (See page 26-38).
4. Remove the rear left hub bearing assembly (See page 22-20).
5. Remove the left parking brake assembly.
   a. Fully release the parking brake control mechanism.
   b. Remove 4 coupling bolts (arrow) between left parking brake assembly and rear shaft assembly.
   (Tightening torque: 55 - 60 N·m)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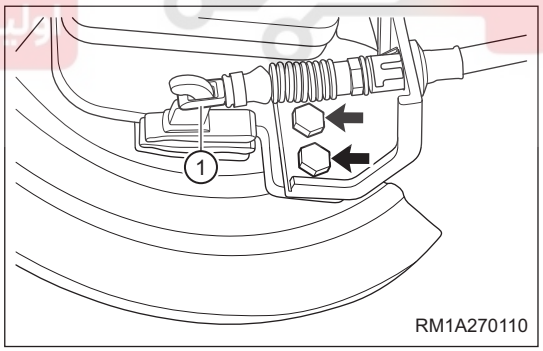
   c. Remove fixing bolts (arrow) between rear parking brake cable bracket and rear brake assembly, and disengage rear parking brake cable assembly end (1) from pulling arm.



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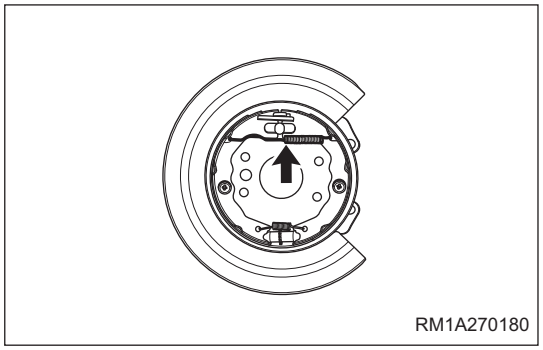
   d. Remove the left parking brake assembly.

Disassembly

1. Using needle-nose pliers, carefully remove brake shoe return tension spring (upward arrow).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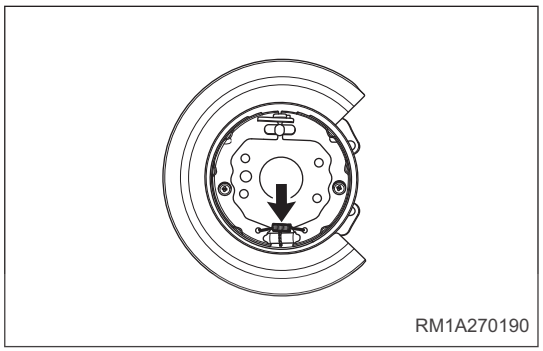
2. Using needle-nose pliers, carefully remove brake shoe return tension spring (downward arrow).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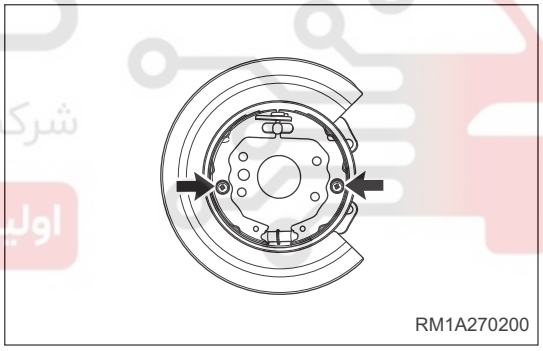
3. Using needle-nose pliers, press brake shoe compression spring and rotate compression spring pin to remove stopper spring sets (arrow) on both sides.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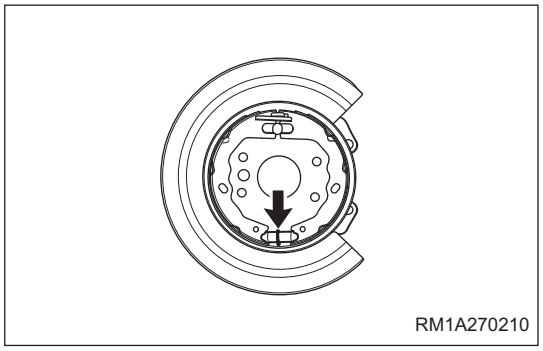
4. Remove the brake shoe clearance adjustment mechanism assembly.
   a. Disengage brake shoe linings on both sides and remove brake shoe clearance adjustment mechanism assembly (arrow) as shown in illustration.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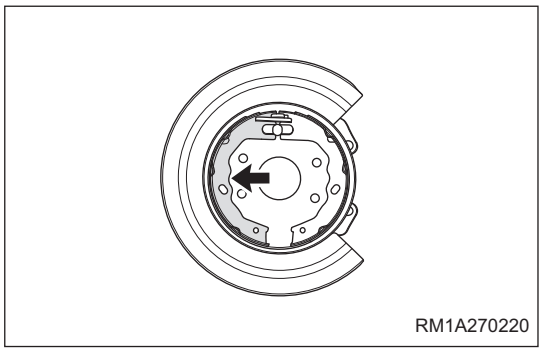
5. Remove the left brake shoe lining.
   a. Disengage left brake shoe lining (arrow) from parking push rod as shown in illustration.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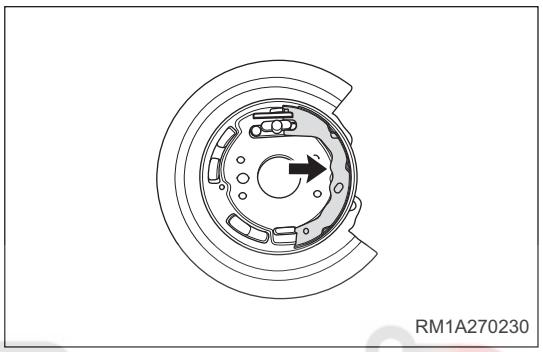
6. Remove the right brake shoe lining.
   a. Disengage right brake shoe lining (arrow) from parking push rod as shown in illustration.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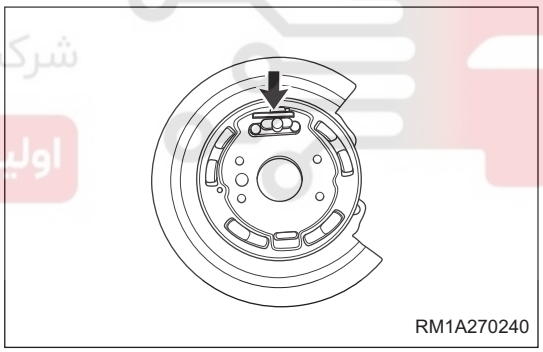
7. Remove the parking push rod.
   a. Disengage parking push rod (arrow) from pulling arm as shown in illustration.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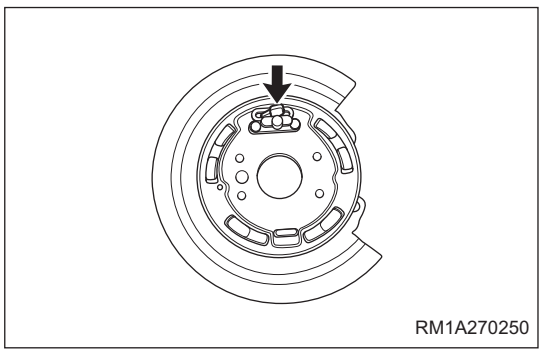
8. Remove the pulling arm.
   a. Remove pulling arm (arrow) from pulling arm dust boot as shown in illustration.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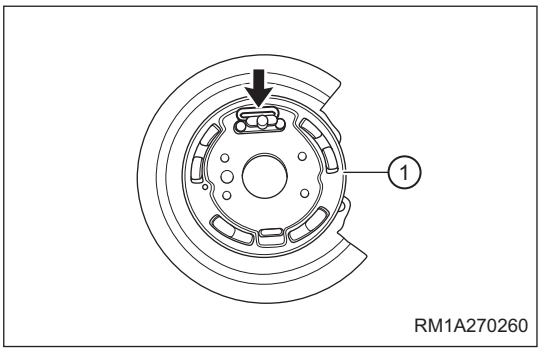
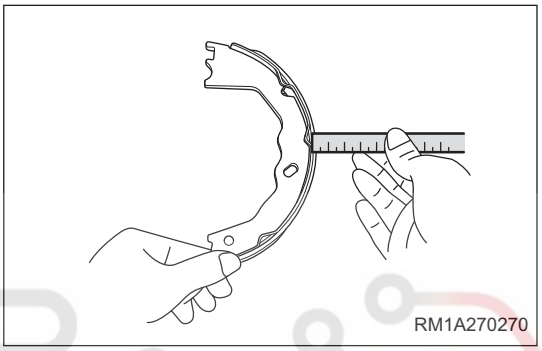
9. Remove the pulling arm dust boot.
   a. Disengage pulling arm dust boot (arrow) from brake caliper mounting board assembly (1) as shown in illustration.



Inspection

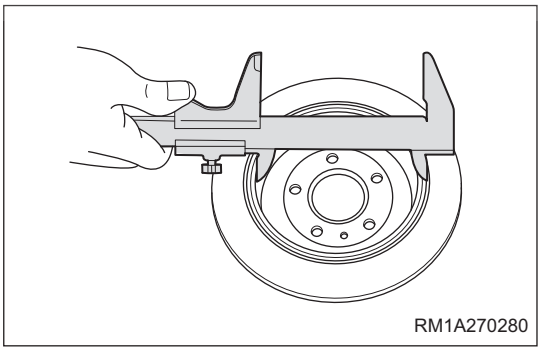
1. Check thickness of brake shoe lining.
   a. Using a straightedge, measure thickness of brake shoe lining as shown in illustration.
      Standard thickness: 2.8 mm
      Minimum thickness: 1 mm
   b. If thickness of brake shoe lining is not more than minimum value, replace brake shoe linings.



CAUTION

- Replace brake shoe linings in pairs, never replace it alone.

2. Check the rear brake disc inner diameter.
   a. Using a vernier caliper or equivalent, measure rear brake disc inner diameter.
      Standard inner diameter: 186 mm
      Maximum inner diameter: 186.2 mm



   b. If rear brake disc inner diameter is more than maximum value, replace rear brake disc.
3. Check other components.
   a. Check if brake shoe return tension spring (upper) is broken, bent, damaged or weak in elasticity. Replace as necessary.
   b. Check if brake shoe return tension spring (lower) is broken, bent, damaged or weak in elasticity. Replace as necessary.
   c. Check if parking push rod and pulling arm are broken, bent or damaged. Replace as necessary.
   d. Check if pulling arm dust boot is worn, cracked or dirty. Replace as necessary.

e. Check if brake shoe stopper spring sets are broken, bent, damaged or weak in elasticity. Replace as necessary.

f. Check if brake shoe clearance adjustment mechanism assembly is struck, damaged or slides off. Replace as necessary.

Assembly

Assembly is in the reverse order of disassembly.

CAUTION

- Adjust brake shoe clearance to the proper position by brake shoe clearance adjustment mechanism assembly after installation is completed.

Installation

Installation is in the reverse order of removal.

CAUTION

- Make sure to tighten fixing bolts to specified torques during installation.
- Make sure to install fixing clamp in place.

HINT:
Parking brake should be adjusted after replacing parking brake shoe. Check if parking brake functions properly after adjustment. Check the parking brake control mechanism stroke. Release parking brake control mechanism and check if rear wheels rotate freely. If wheels are difficult to rotate freely, repeat adjustment procedure. After driving for a period of time, parking brake control mechanism stroke should be readjusted due to wear of rear brake shoe linings.

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