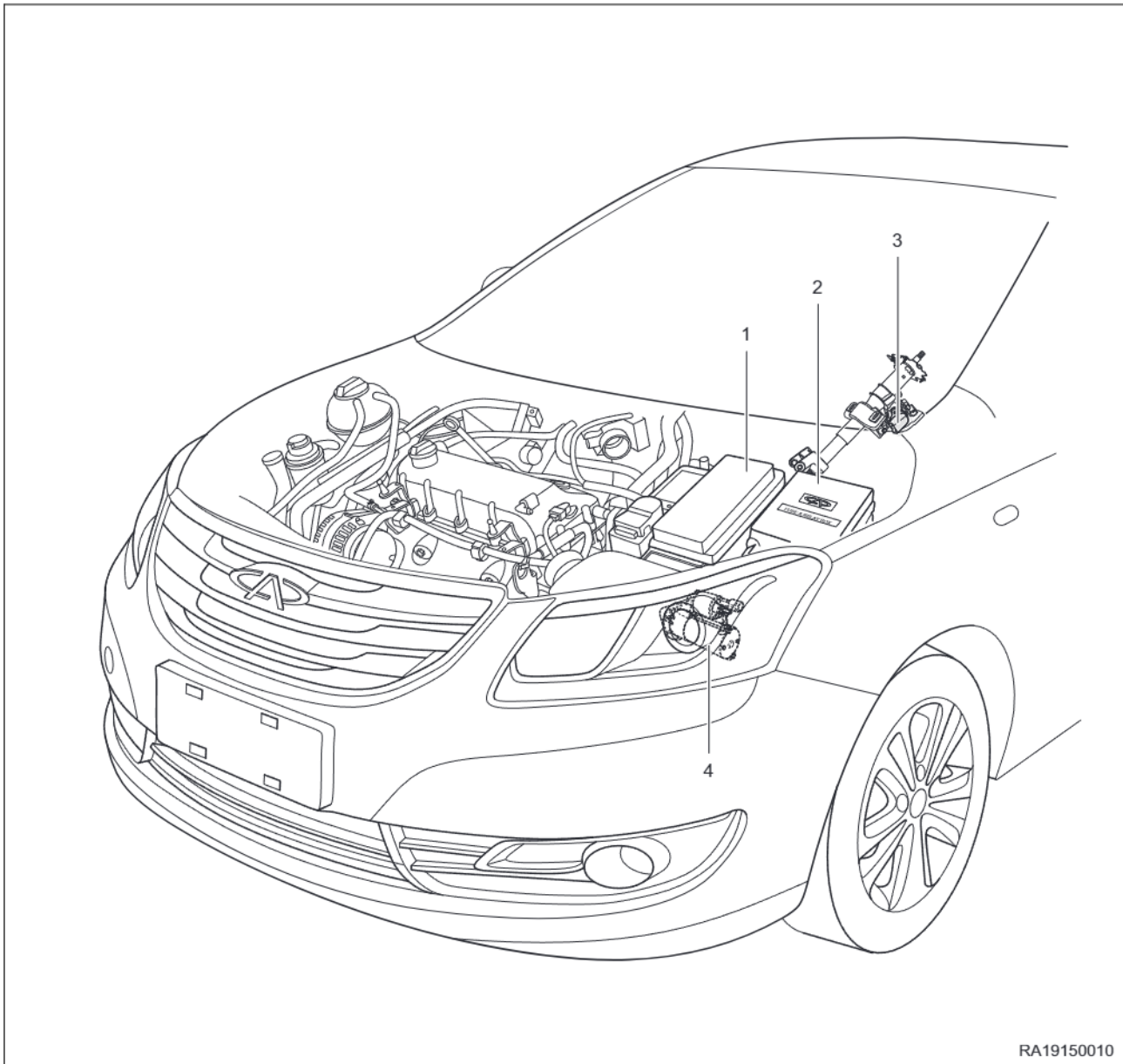

SQR477F STARTING SYSTEM

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GENERAL INFORMATION

Description



RA19150010

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1 - Battery	2 - Fuse and Relay Box
3 - Ignition Starting Switch	4 - Starter

The starting system consists of battery, ignition switch, starter, etc. The function of starting system is to convert electrical energy from the battery into mechanical energy by starter so as to crank the engine initially, and disconnect the power transmission between starter and engine when the engine runs normally.

Operation

The starter consists of three parts: control mechanism, drive train mechanism and DC motor.

1. Control mechanism (solenoid switch): it controls the engagement and disengagement between starter drive gear and engine flywheel gear and switches on/off the DC motor circuit; the solenoid switch can also short out the ignition coil additional resistance when starting.
2. Drive train mechanism: it makes the starter drive gear get engaged with the flywheel gear ring when the engine starts and transmits the torque of starter to the engine crankshaft; after the engine starts, the drive gear and flywheel gear disengage automatically, so that the engine cannot drive the starter to run at a high speed in reverse by flywheel, avoiding damage to the starter.
3. DC motor: it converts electrical energy from the battery into electromagnetic moment.

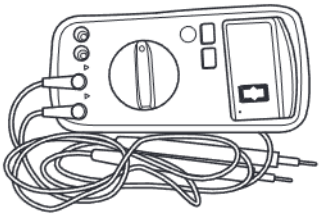
Specifications

Torque Specifications

Description	Torque (N·m)
Starter Power Cable Nut	18 ± 2
Starter Fixing Bolt	40 ± 5
Ignition Starting Switch Fixing Screw	13 ± 2

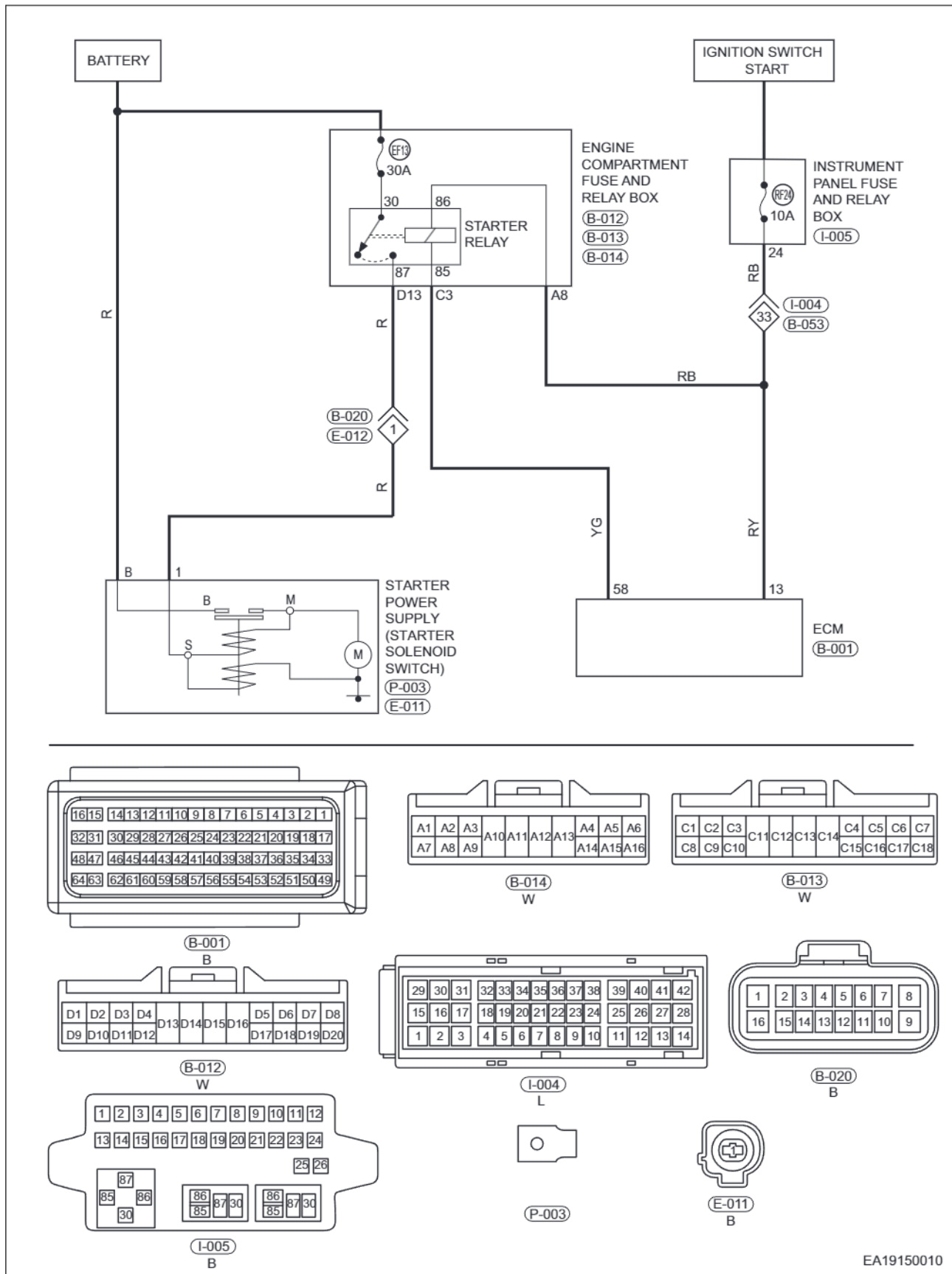
Tool

General Tool

15	Digital Multimeter	 RCH0000002
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Circuit Diagram

Starting System



DIAGNOSIS & TESTING

Problem Symptoms Table

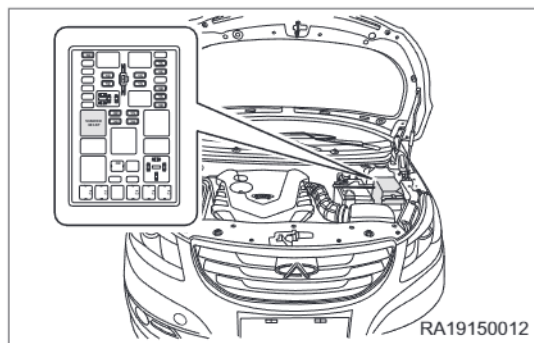
HINT:

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

Symptom	Suspected Area	See page
When ignition switch is turned to START, solenoid switch makes a "clanking" sound and engine cannot start	Battery (weak battery, poor contact of battery cable)	-
Starter does not run	Battery (depleted)	-
	Starter	15-8
	Ignition starting switch	15-11
	Starting system wire harness	-
Starter runs weakly	Battery (weak battery, internal fault)	16-7
	Starter	-
Starter is racing	Starter (incorrect installation, internal fault)	15-8
	Flywheel ring gear (gear teeth broken)	07-55

Starter Relay Inspection

1. Recognize and remove the starter relay from the engine compartment fuse and relay box.

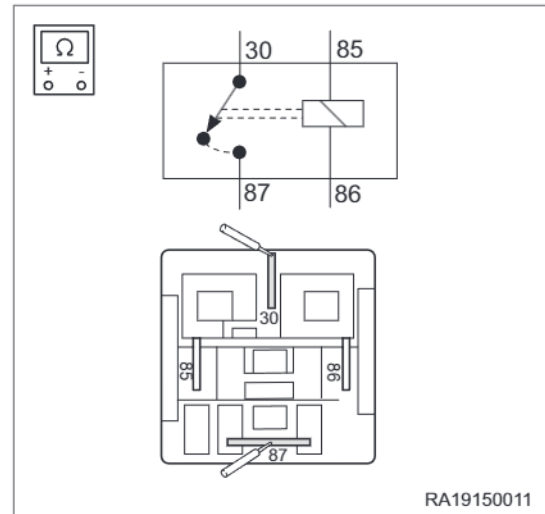


2. Check the starter relay.
 - a. Using a digital multimeter, measure the resistance according to the value below.

Standard Resistance

Multimeter Connection	Specified Condition
30 - 87	10 k Ω or more
30 - 87	Below 1 Ω (when battery voltage is applied to terminals 85 and 86)

If the result is not as specified, replace the starter relay.



Precautions for Starting System

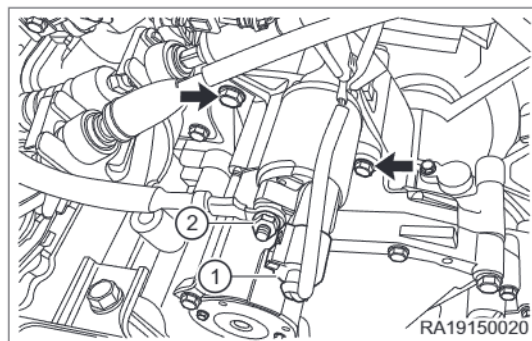
1. Shift the transmission to neutral and apply parking brake before starting, and depress the clutch pedal while starting.
2. Make sure that the battery is fully charged to reduce the repeat operating time of starter.
3. Do not start the engine for more than 5 seconds each time, the repeated starting time should not be less than 10 - 15 seconds, and the consecutive starting is not allowed more than 3 times.
4. If the starter cannot stop, turn off the ignition switch immediately, or remove the negative battery cable to find the problem.
5. Check the starter circuit frequently to make sure that each wire for starting system is connected securely and in good insulation.
6. Generally, perform maintainable service for the starter when servicing the vehicle. Also, the maintenance interval can be shortened or extended properly depending on actual conditions.
7. Remove the negative battery cable before removing the starter.

ON-VEHICLE SERVICE

Starter

Removal

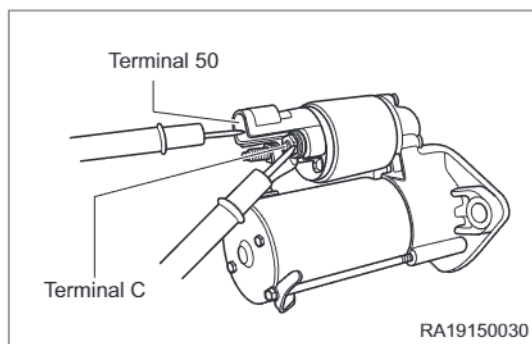
1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Remove the battery (See page 16-7).
4. Remove the battery tray (See page 16-8).
5. Remove the starter.
 - a. Disconnect the starter connector (1).
 - b. Move away the terminal cap, remove the starter power cable nut (2) and disconnect the starter power cable.
(Tightening torque: $18 \pm 2 \text{ N}\cdot\text{m}$)
 - c. Remove 2 starter fixing bolts (arrow).
(Tightening torque: $40 \pm 5 \text{ N}\cdot\text{m}$)



- d. Remove the starter.

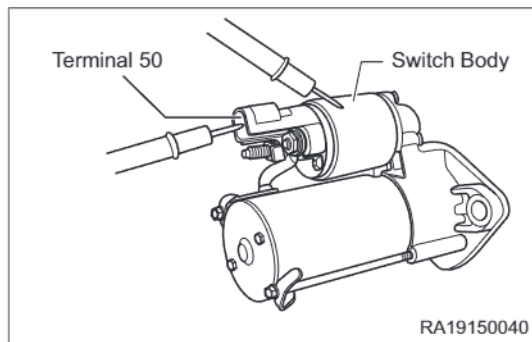
Inspection

1. Check the starter solenoid switch.
 - a. Check the pull-in coil.
 - Measure the resistance between the terminal 50 and the terminal C.



- The standard resistance should be below 2Ω .
If the result is not as specified, replace the starter.

- b. Check the hold-in coil.
 - Measure the resistance between terminal 50 and starter solenoid switch body.



- The standard resistance should be below 2Ω .

If the result is not as specified, replace the starter.

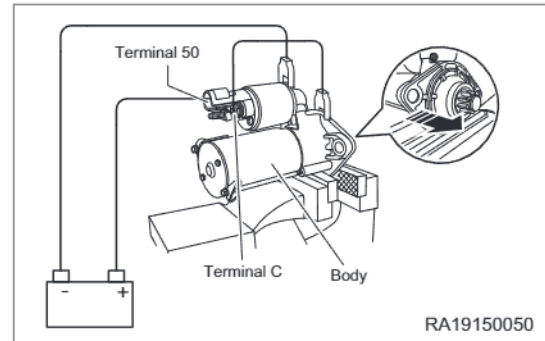
2. Check the starter assembly.

CAUTION

- These measurements must be performed within 3 to 5 seconds to avoid coil burnout.
- Place the starter assembly onto a vise. The jaws of vise should be covered by aluminum sheet or brass plate; otherwise, the starter assembly will be easily damaged when clamping it.

a. Perform pull-in test.

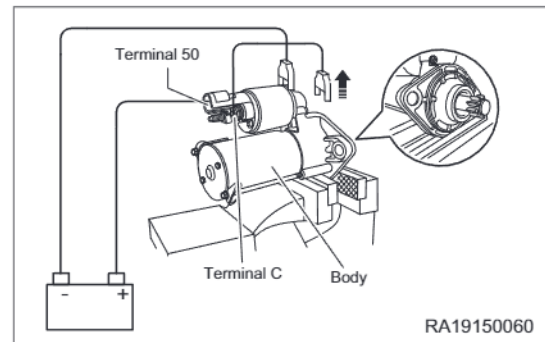
- Remove the nut and disconnect the field coil lead from terminal C.
- As shown in the illustration, connect the battery to the solenoid switch, and check that the starter clutch pinion sticks out.



If the starter clutch pinion does not move, replace the starter assembly.

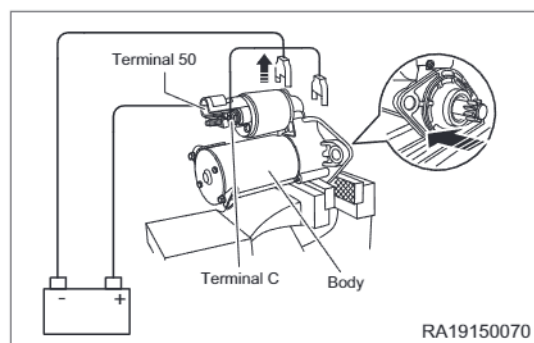
b. Perform hold-in test.

- Keep the starter clutch pinion sticking out and the connection condition of battery mentioned above, and disconnect the negative battery cable from terminal C.
- Check that the starter clutch pinion keeps sticking out.



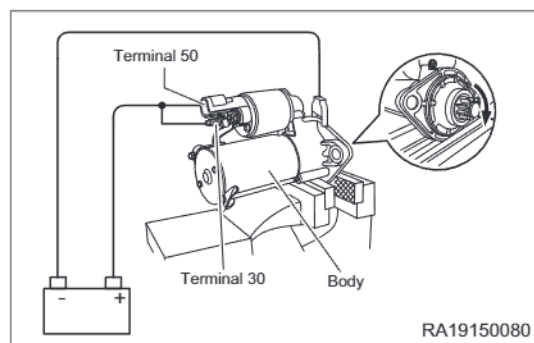
If the starter clutch pinion moves inward, replace the starter assembly.

- c. Check if the starter clutch pinion returns back.
- Disconnect the negative battery cable from the starter body. Check that the starter clutch pinion returns back.



If the starter clutch pinion does not return back, replace the starter assembly.

- d. Check if the starter rotates smoothly.
- Connect the field coil lead to terminal C, and tighten it with a nut.
 - As shown in the illustration, connect the battery to the starter. Check that the starter rotates smoothly when the starter clutch pinion moves outward.



If the result is not as specified, replace the starter.

CAUTION

- The lead to be connected should avoid the pinion side to prevent the lead stuck as the pinion rotates.

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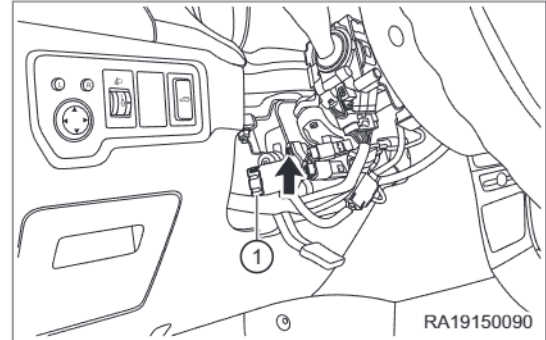
Installation

Installation is in the reverse order of removal.

Ignition Starting Switch

Removal

1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Remove the steering column cover assembly (See page 27-12).
4. Remove the ignition starting switch.
 - a. Disconnect the ignition starting switch assembly connecting wire harness joint (1).
 - b. Remove the ignition starting switch fixing screw (arrow).
(Tightening torque: $13 \pm 2 \text{ N}\cdot\text{m}$)

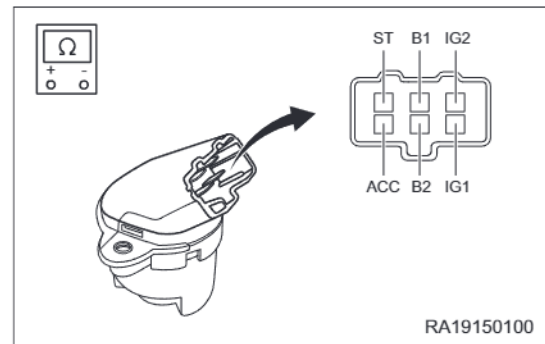


- c. Remove the ignition starting switch.

Inspection

1. Check for continuity of the ignition starting switch.

Multimeter Connection	Switch Condition	Specified Condition
All terminals	LOCK	No continuity
Terminal B1 - Terminal ACC	ACC	Continuity
Terminal B1 - Terminal IG1 Terminal B1 - Terminal ACC Terminal IG2 - Terminal B2 Terminal IG1 - Terminal ACC	ON	Continuity
Terminal ST - Terminal B2 Terminal IG1 - Terminal B1	START	Continuity



If the result is not as specified, replace the ignition starting switch.

Installation

Installation is in the reverse order of removal.

