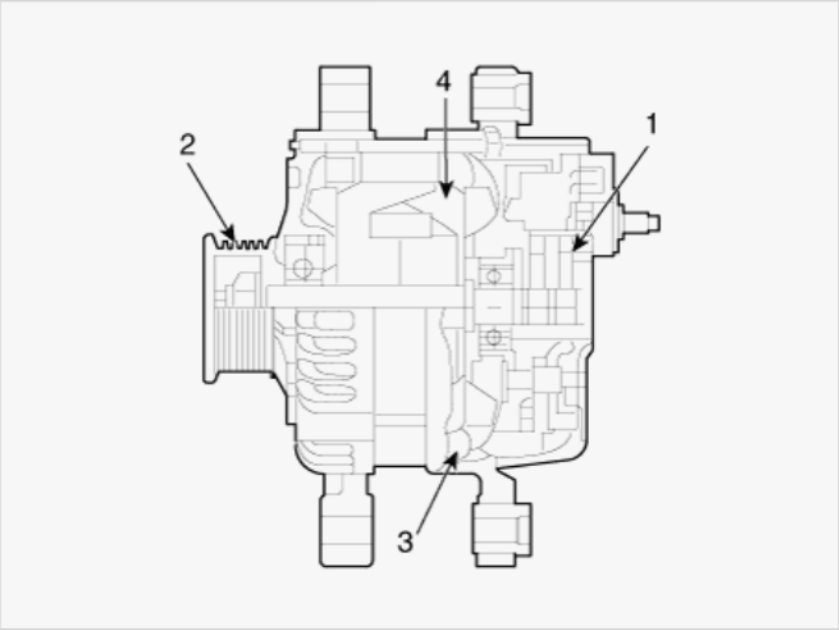
Description

The Alternator has eight built-in diodes, each rectifying AC current to DC current.
Therefore, DC current appears at alternator "B" terminal.
In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.
The alternator is regulated by the battery voltage detection system.
The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley.
The brush holder contains a built-in electronic voltage regulator.



1. Brush
2. Drive belt pully
3. Rotor
4. Stator

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Removal

1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Remove the turbo manifold module.
   (Refer to Engine Mechanical System - "Turbo Manifold Module")
3. Disconnect the alternator connector (A), and remove the cable (B) from alternator "B" terminal.



4. Remove the alternator bolts (A).



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Installation

1. Install in the reverse order of removal.

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Circuit Diagram

Click to see large image...

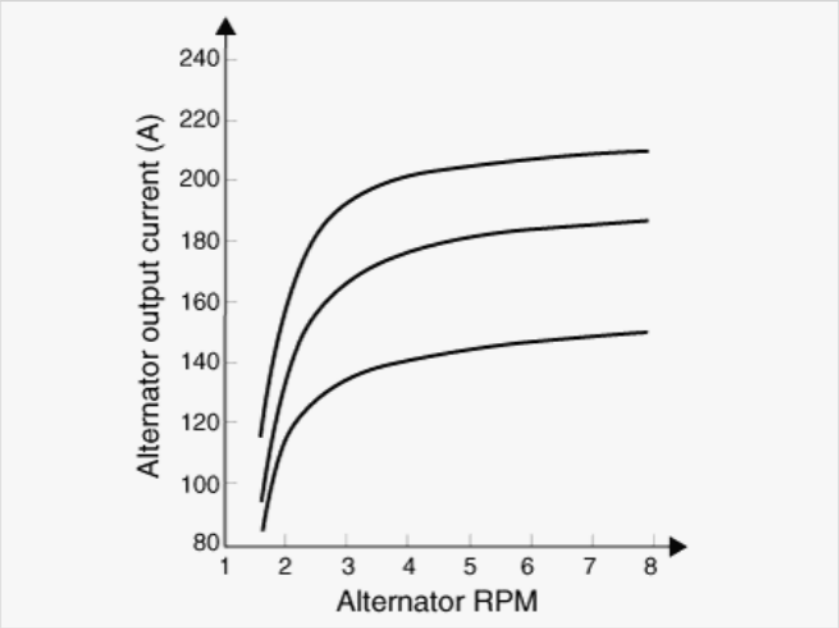
Information

- **COM signal**- LIN communication control
- **B+ Terminal**- The output voltage from the generator travels to the battery via the B+ terminal.

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Specification

Item	Specification	
Rated voltage	13.5V , 180A	
Speed in use	0 - 18,000rpm	
Voltage regulator	IC Regulator built in type	
Default regulated voltage (V)	Regulator (external mode)	10.6 - 16
	Regulator (internal mode)	14.2 - 14.8
Pin	1	



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Description

Vehicles have many control units that use more electricity. These units control their own system based on information from various sensors. It is important to provide a stable power supply as these sensors bring diverse information. Battery sensor is mounted on battery (-) terminal. It transmits battery voltage, current, temperature information to ECM. ECM controls generating voltage by duty cycle based on these signals.

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Removal

1. Turn the ignition switch OFF.
2. Remove the luggage covering (A).

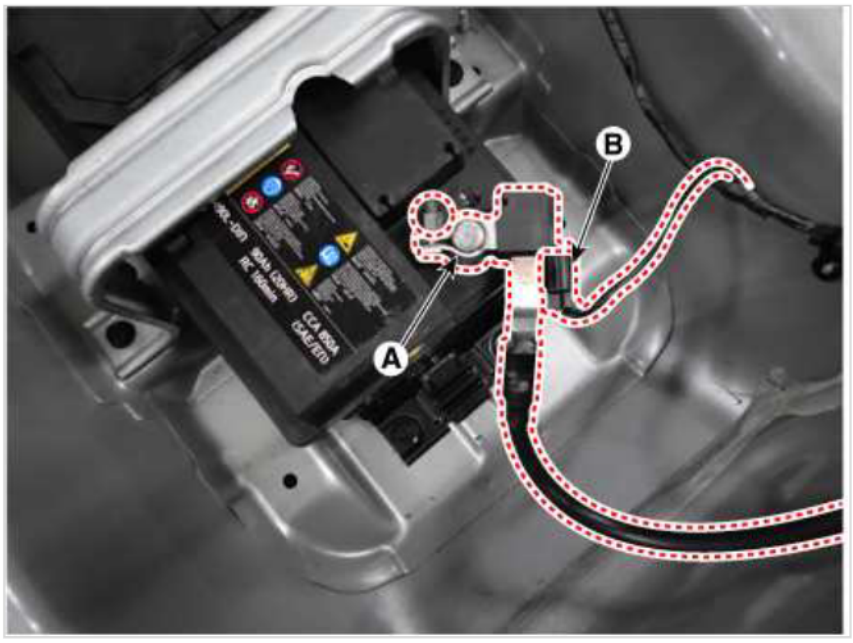


3. Remove the luggage center tray (A).



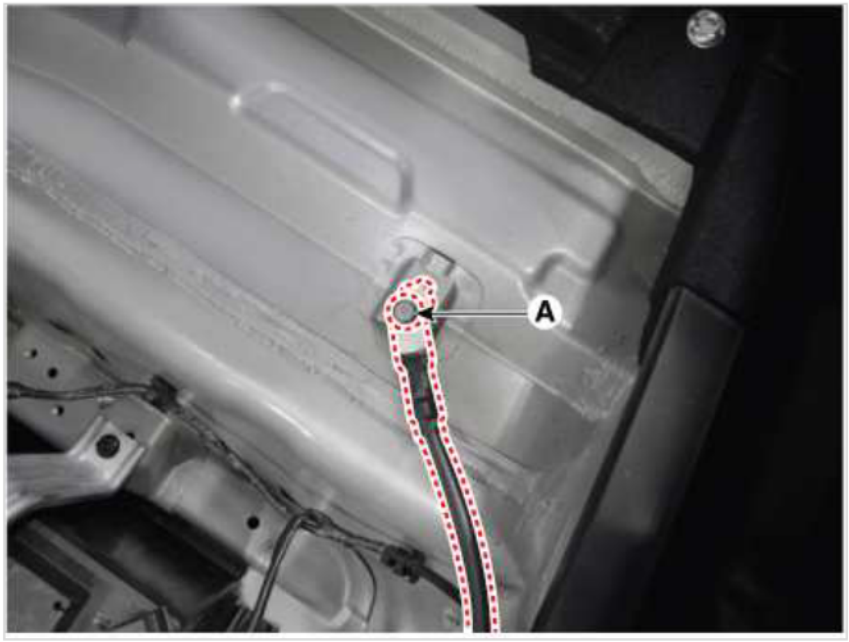
4. Disconnect the battery negative (-) terminal (A).
5. Disconnect the battery sensor connector (B).

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6. Remove the battery sensor by loosening the mounting bolts (A).

Battery Sensor Cable mounting bolt :
27.0 - 33.0 N·m (2.7 - 3.4 kgf·m, 19.9 - 24.3 lb·ft)



Installation

1. Install in the reverse order of removal.

NOTICE

- For the vehicle equipped with a battery sensor, be careful not to damage the battery sensor when the battery is replaced or recharged.

1) When replacing the battery, the new battery should be of the same type, capacity and brand with the previous one. If a battery of a different type is replaced, the battery sensor may recognize the battery to be abnormal.
2) When installing the ground cable on the negative post of battery, tighten the clamp to the specified torque. An excessive tightening can damage the PCB internal circuit and the battery terminal.
3) When recharging the battery, ground the negative terminal of the booster battery to the vehicle body.

Adjustment

Battery Sensor Recalibration Procedure

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After reconnecting the battery negative cable, AMS function does not operate until the system is stabilized, for about 4 hours. If disconnecting the negative (-) battery cable from the battery during repair work for the vehicle equipped with AMS function, Battery sensor recalibration procedure should be performed after finishing the repair work.

1. Turn the Iginition switch ON and OFF.
2. Park the vehicle for about 4 hours with the hood and all doors closed.

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Description

1. The CMF(Closed Maintenance Free) battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. The CMF(Closed Maintenance Free) battery does not require water replenishment for the repair.
3. The battery is completely sealed, except for small vent holes in the cover.

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Removal

1. Turn the ignition switch OFF.
2. Remove the luggage covering (A).



3. Remove the luggage center tray (A).



4. Turn the ignition switch OFF and disconnect the battery negative (-) terminal (A).

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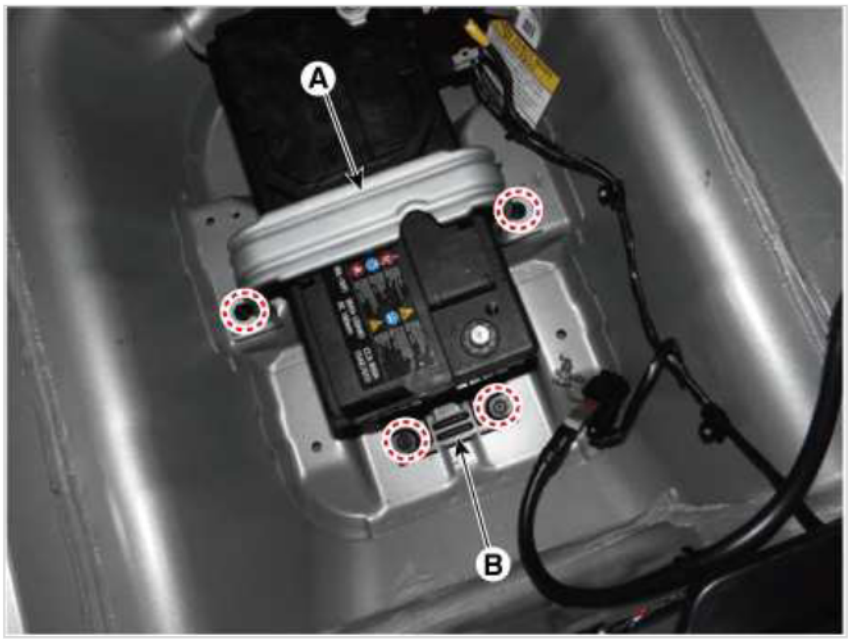


5. Disconnect the battery positive (+) terminal (A).
6. Disconnect the vent hose (B).



7. Remove the mounting band (A).
8. Remove the mounting bracket (B) and then remove the battery.

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9. Remove the battery.

Installation

1. Install in the reverse order of removal.

NOTICE

- When installing the battery, fix the mounting bracket on the tray correctly.

Information

- After disconnecting then reconnecting the battery negative cable, reset some parts that require the reset procedures. **(Refer to Body Electrical System – "General Information")**

Inspection

Battery Voltage and Status

Check the battery voltage and status using the battery tester.

Battery Terminal

1. Move back and forth to check if the battery terminals (A) are loose or corroded. If the terminals are corroded, clean them.

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If battery positive connection is loose, disconnect ground(GND) cable first before attempting to remove or tighten plus connection, to prevent personal injury.

2. If the battery clamp on battery positive (+) terminal is not seated securely:
   (1) Turn ignition switch OFF and disconnect the battery negative (-) terminal.
   (2) Tighten battery clamp (A) on battery positive (+) terminal

Battery positive (+) terminal:
7.8 - 9.8 N·m (0.8 - 1.0 kgf·m, 5.8 - 7.2 lb·ft)

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3. If the battery clamp on battery negative (-) terminal is not seated securely:
   (1) Tighten battery clamp (A) on battery negative (-) terminal.

Battery negative (-) terminal:
7.8 - 9.8 N·m (0.8 - 1.0 kgf·m, 5.8 - 7.2 lb·ft)



Battery Condition

Check the battery for damage or deformation. If severe damage, deformation or leakage is found, replace the battery.

Vehicle parasitic current inspection

[Using the Ammeter]

1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.
3. Wait for a few minutes until the vehicle's electrical systems go to sleep mode.

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NOTICE

- For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10 - 20 minutes.

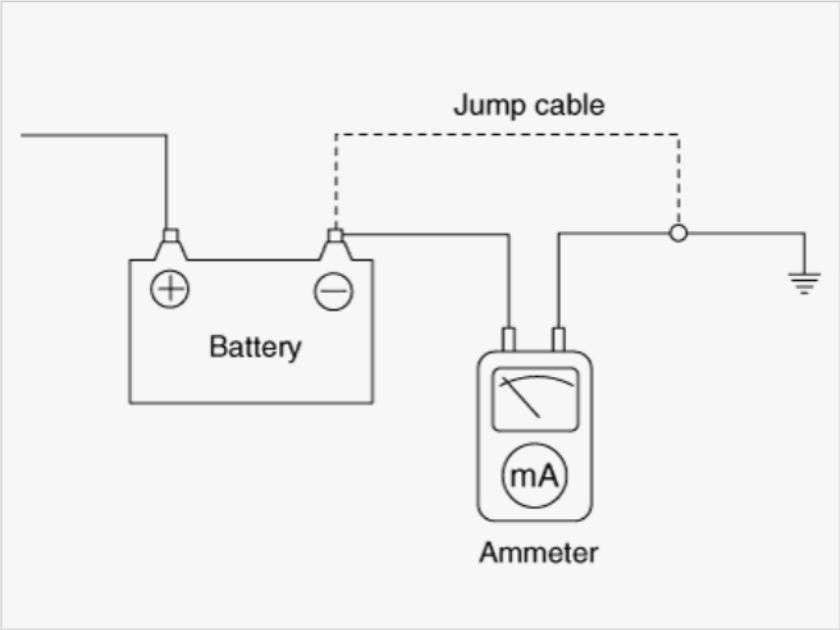
4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

NOTICE

- Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.

  To prevent the battery from being reset during the inspection,

1) Connect a jump cable between the battery (-) terminal and the ground cable.
2) Disconnect the ground cable from the battery (-) terminal.
3) Connect an ammeter between the battery (-) terminal and the ground cable.
4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   - If the parasitic current is over the limit value, search for abnormal circuit by removing the fuses one by one and checking for parasitic current.
   - Reconnect only the fuse suspected of parasitic current and search for the trouble unit by removing the components connected to the circuit one by one until the parasitic draw drops below limit value.

Limit value (after 10 - 20 min.) :Below 50mA

[Using the Clamp type Ammeter]

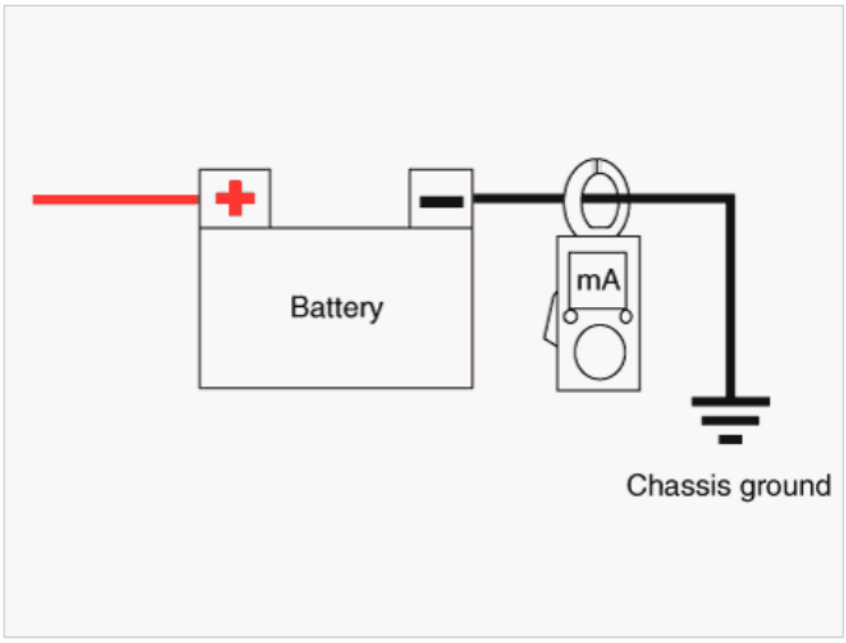
1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.
3. Wait for a few minutes until the vehicle's electrical systems go to sleep mode.

NOTICE

- For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10 - 20 minutes.

4. Install the clamp type ammerter on battery negative (-) terminal.

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5. Read the current value of the ammeter.
   - If the parasitic current is over the limit value, search for abnormal circuit by removing the fuses one by one and checking for parasitic current.
   - Reconnect only the fuse suspected of parasitic current and search for the trouble unit by removing the components connected to the circuit one by one until the parasitic draw drops below limit value.

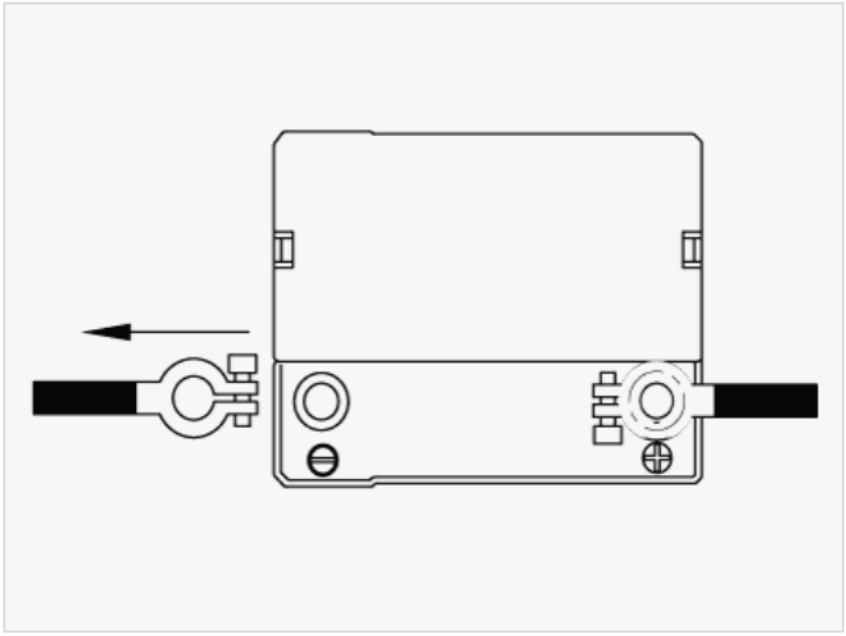
Limit value (after 10 - 20 min.) : Below 50mA

Cleaning

1. Make sure that the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

⚠ CAUTION

- Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be wore when removing the battery.



4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.

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7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts .
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

⚠ CAUTION

- When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.
  A spark will occur when the circuit is broken. Keep open flames away from battery.

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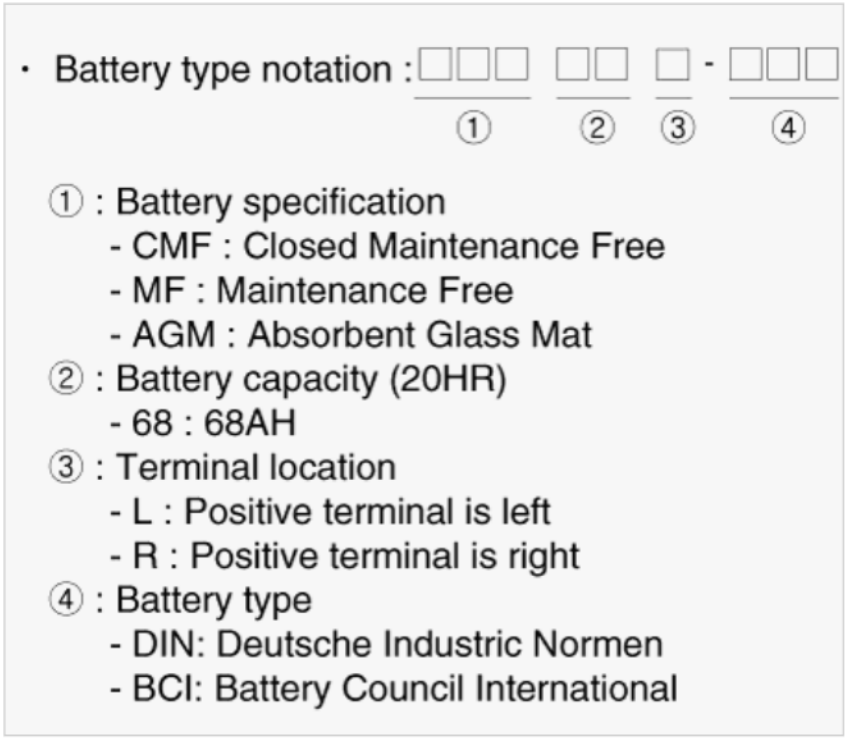
Specification

▷AGM90L-DIN

Item	Specification
Model type	AGM90L-DIN
Capacity [20HR/5HR] (AH)	90/72
Cold Cranking Amperage (A)	850 (SAE) / 850 (EN)
Reserve Capacity (Min)	160
Specific Gravity	1.28 - 1.34 [25°C (77°F)]

Information

• Model type description



• Cold Cranking Ampere (CCA): A rating used in the battery industry to define a battery"s ability to start an engine in cold temperatures.

– The rating is the number of amps a new, fully charged battery can deliver at -18 °C(-0.4 °F) for 30 seconds, while maintaining a voltage of at least 7.2 volts for a 12 volt battery.

– The higher the CCA rating, the greater the starting power of the battery.

• RESERVE CAPACITY (RC) : A battery industry rating, defining a battery"s ability to power a vehicle with an inoperative alternator or fan belt.

– The rating is the number of minutes a battery at 26.7 °C(80 °F) can be discharged at 25 amps and maintain a voltage of 10.5 volts for a 12 volt battery.

– The higher the reserve rating, the longer your vehicle can operate should your alternator or fan belt fail.

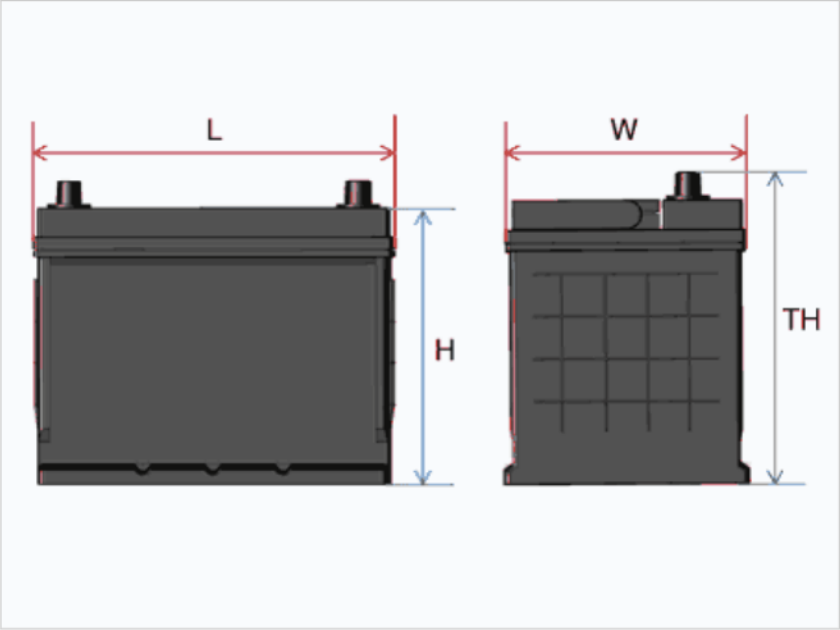
Information

BCI Type

Capacity (5HR/20HR)	Length	Width	Height	Total Height
	L (mm)	W (mm)	T (mm)	TH (mm)
28/35	188 - 192	126 - 130	198 - 202	218 - 222
32/40	194 - 198	133 - 137	199 - 203	223 - 227
36/45	203 - 207	173 - 177	200 - 204	221 - 225

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44/55	213 - 217	173 - 177	198 - 202	218 - 222
48/60	228 - 232	173 - 177	200 - 204	221 - 225
54/68	258 - 262	173 - 177	198 - 202	220 - 224
56/70	258 - 262	173 - 177	198 - 202	223 - 227
64/80	274 - 278	170 - 174	198 - 202	221 - 225
70/88	349 - 353	172 - 176	186 - 200	183 - 187
72/90	300 - 304	170 - 174	200 - 204	221 - 225
76/95	294 - 298	172 - 176	198 - 202	220 - 224
80/100	326 - 330	170 - 174	203 - 207	225 - 229



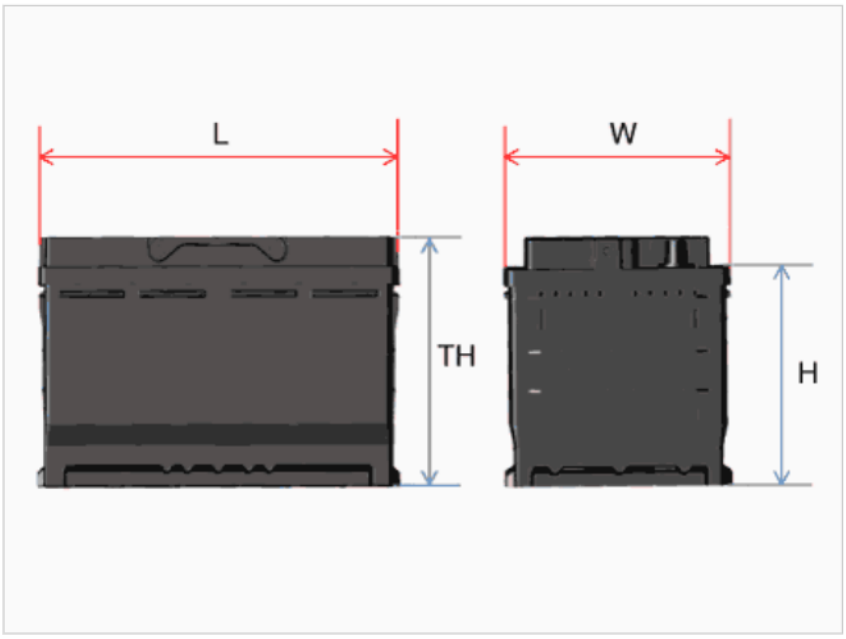
DIN Type

Capacity (5HR/20HR)	Length	Width	Height	Total Height
	L (mm)	W (mm)	T (mm)	TH (mm)
36/45	205 - 207	173 - 175	164 - 168	188 - 190
48/60	205 - 207	173 - 175	164 - 168	188 - 190
54/68	205 - 207	173 - 175	164 - 168	188 - 190
64/80	205 - 207	173 - 175	164 - 168	188 - 190
72/90	205 - 207	173 - 175	164 - 168	188 - 190
80/100	205 - 207	173 - 175	164 - 168	188 - 190
88/110	205 - 207	173 - 175	164 - 168	188 - 190

AGM DIN Type

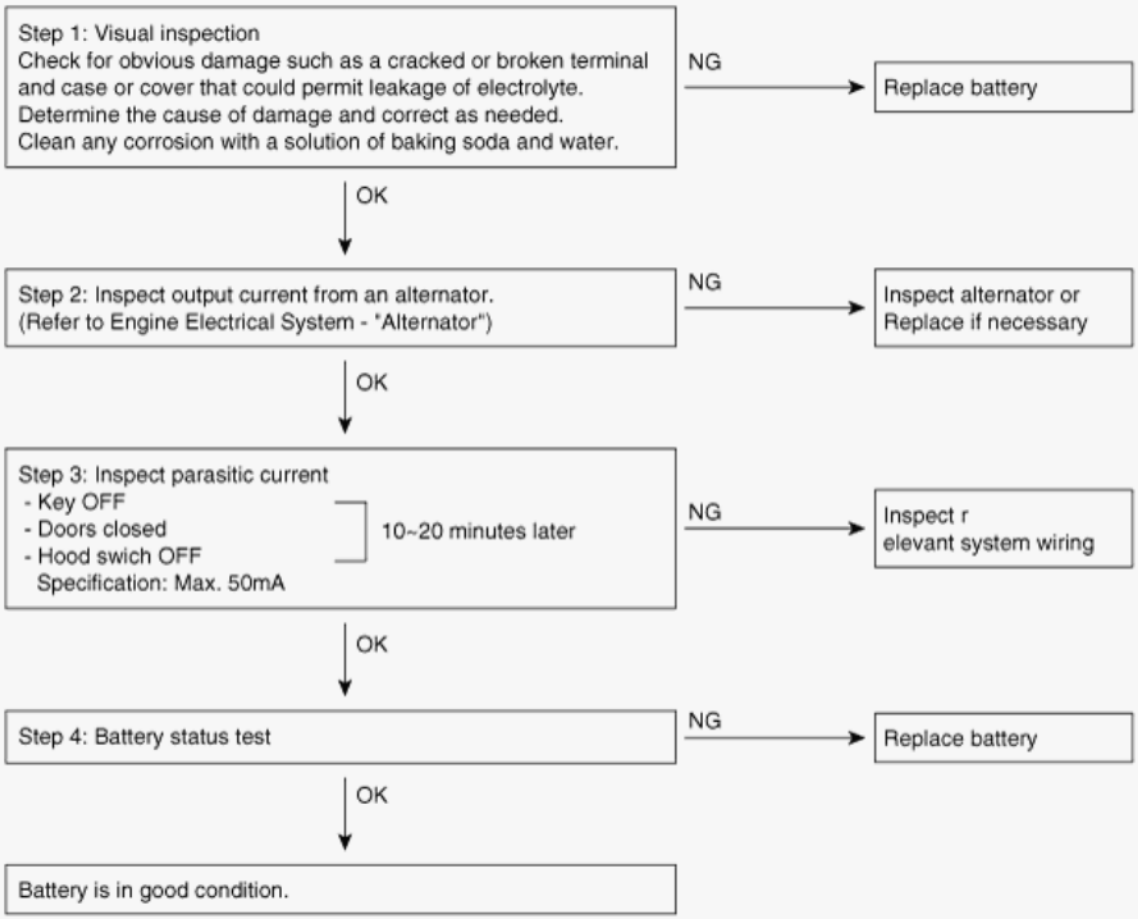
Capacity (5HR/20HR)	Length	Width	Height	Total Height
	L (mm)	W (mm)	T (mm)	TH (mm)
40/50	205 - 207	173 - 175	164 - 168	188 - 190
48/60	227 - 229	173 - 175	164 - 168	188 - 190
56/70	276 - 278	173 - 175	164 - 168	188 - 190
64/80	312 - 314	173 - 175	164 - 168	188 - 190
72/90	351 - 353	173 - 175	164 - 168	188 - 190
84/105	392 - 394	173 - 175	164 - 168	188 - 190

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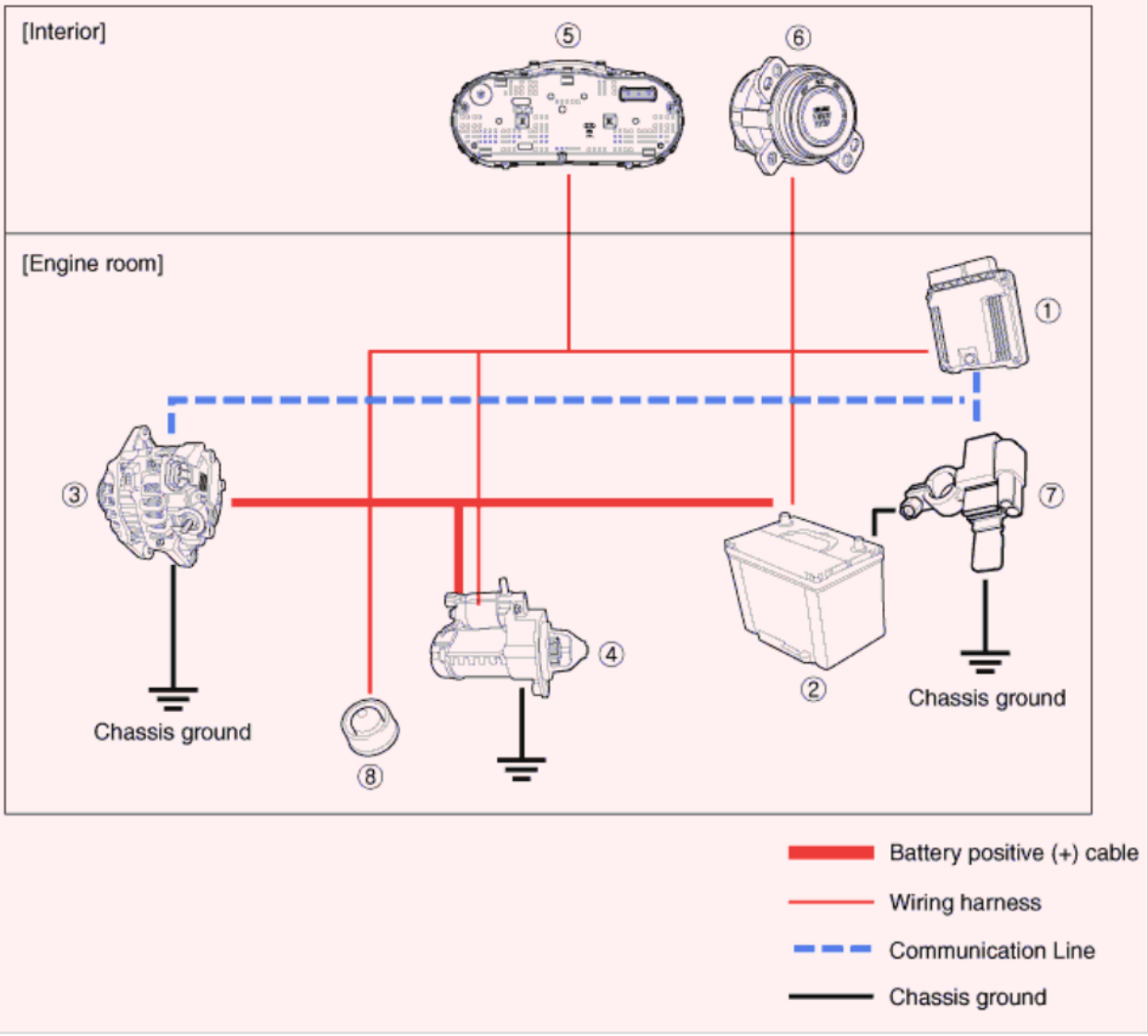
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Troubleshooting



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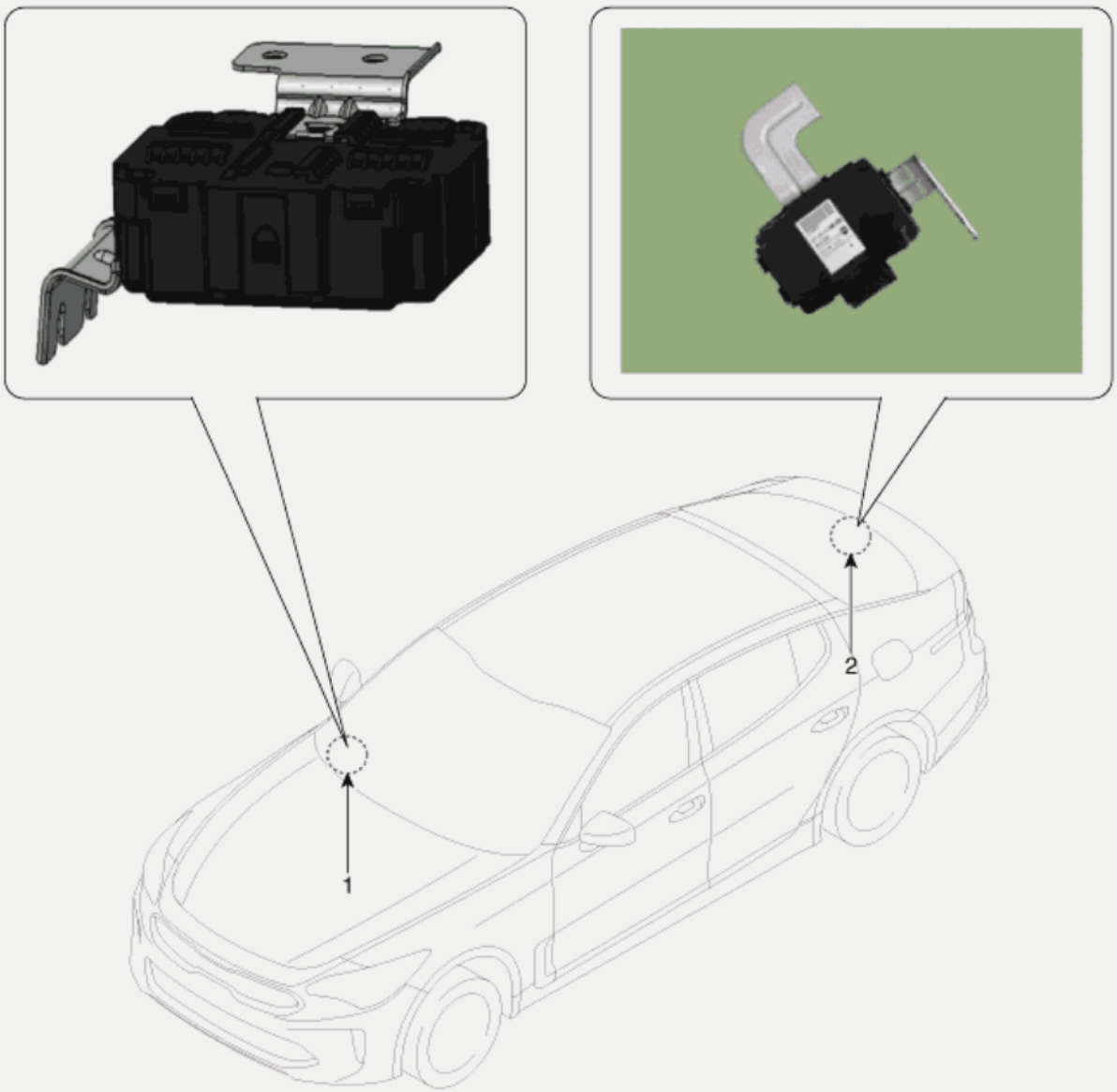
Components



① ECM
② Battery
③ Alternator
④ Starter
⑤ Instrument Cluster
⑥ Ignition switch or start/stop button
⑦ Battery sensor
⑧ Hood switch

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Components Location

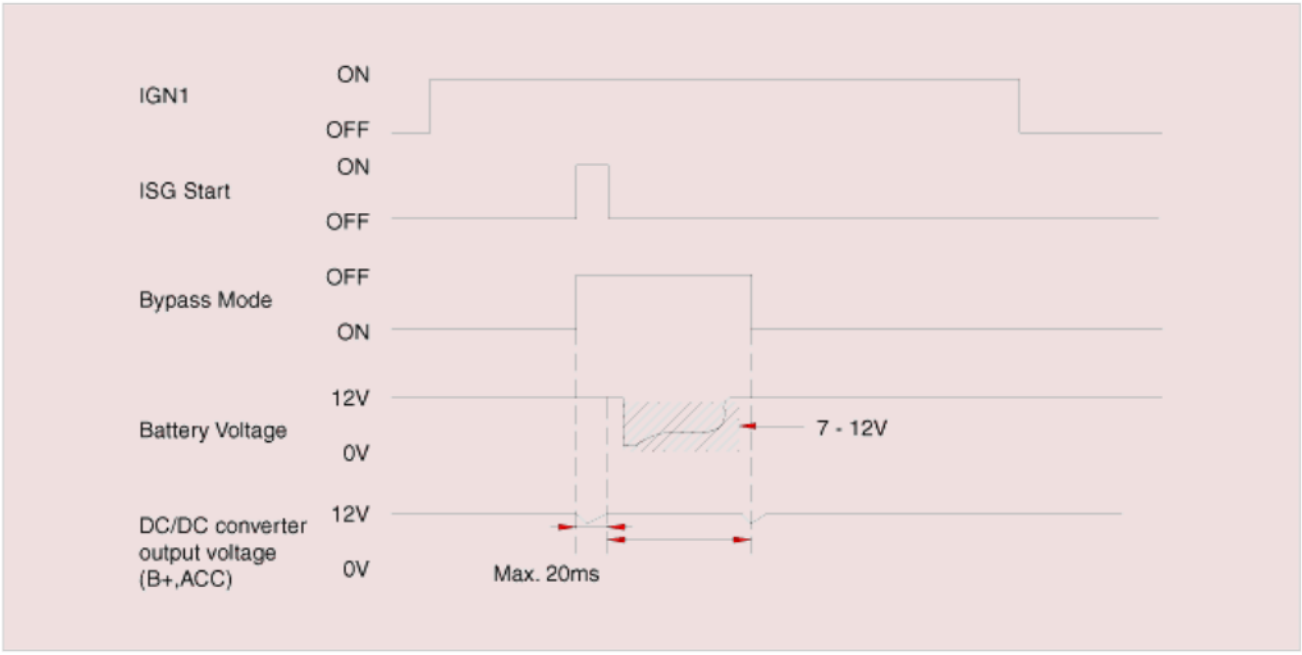


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Description

Due to the considerably more frequent occurrence of starting operations, the electrical load that occurs often leads to voltage dips in the vehicle network.In order to stabilize the power supply for certain voltage-sensitive electrical components, a DC/DC converter is used in conjunction with the ISG function.The DC DC converter supplies the relay with a voltage that also remains constant during the starting operation.

The DC/DC converter is fitted at the behind of the glove box.Via the test leads for input voltage and the start relay , the electronics decide whether the power is supplied to the output via the bypass or the DC/DC converter.In the bypass mode, the on-board supply voltage is not fed across the DC/DC converter, rather is transferred directly to the outputs. In the booster phase, the vehicle voltage is adapted.



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Removal

[200W]

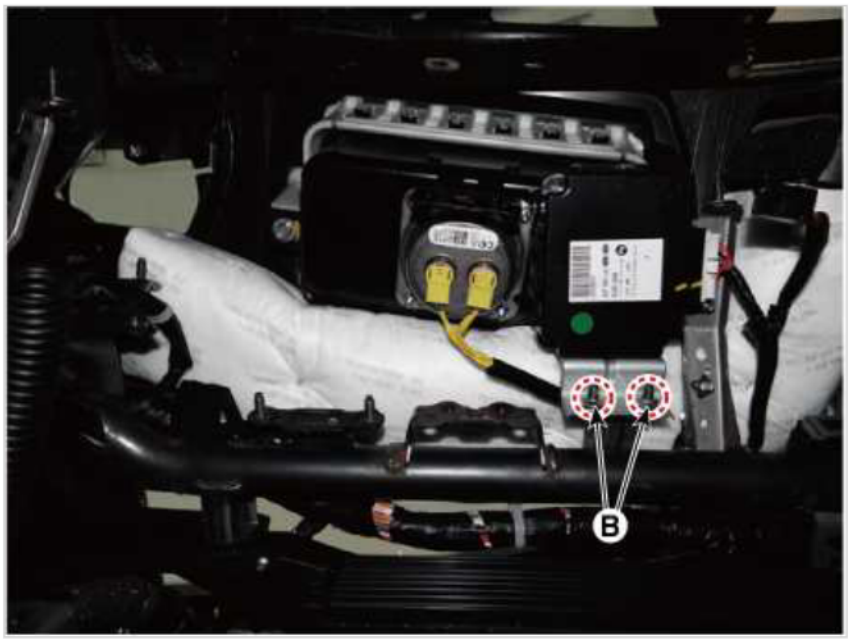
1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Remove the glove box housing.
   (Refer to Body (Interior and Exterior) - "Glove Box Housing")
3. Remove the [RH] side air bant duct (A) after loosening the mounting screw.



4. Remove the DC/DC converter after loosening the mounting bolt (A) and nut(B).



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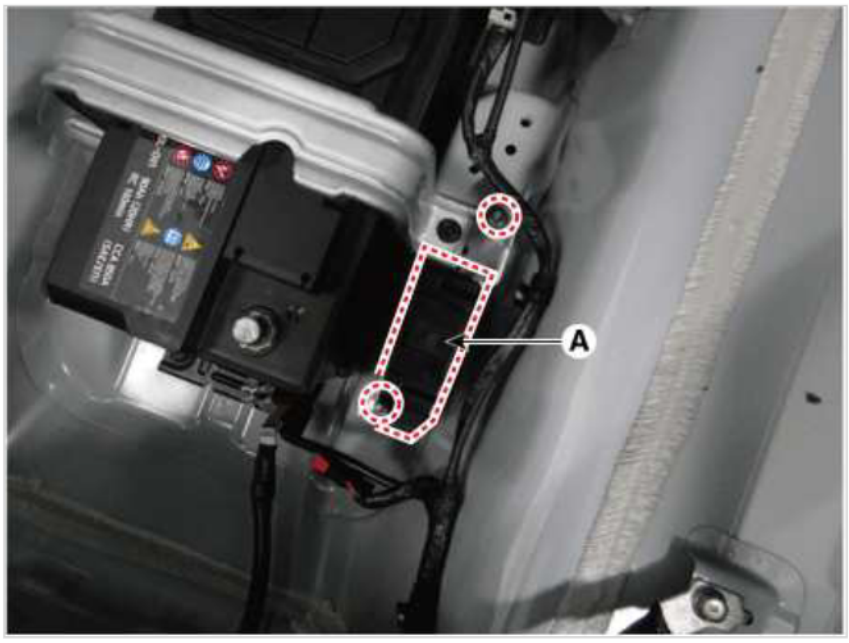
[400W]

1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Disconnect the DC/DC converter connector (A).



3. Remove the DC/DC converter (A) after loosening the mounting nuts.

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Installation

NOTICE

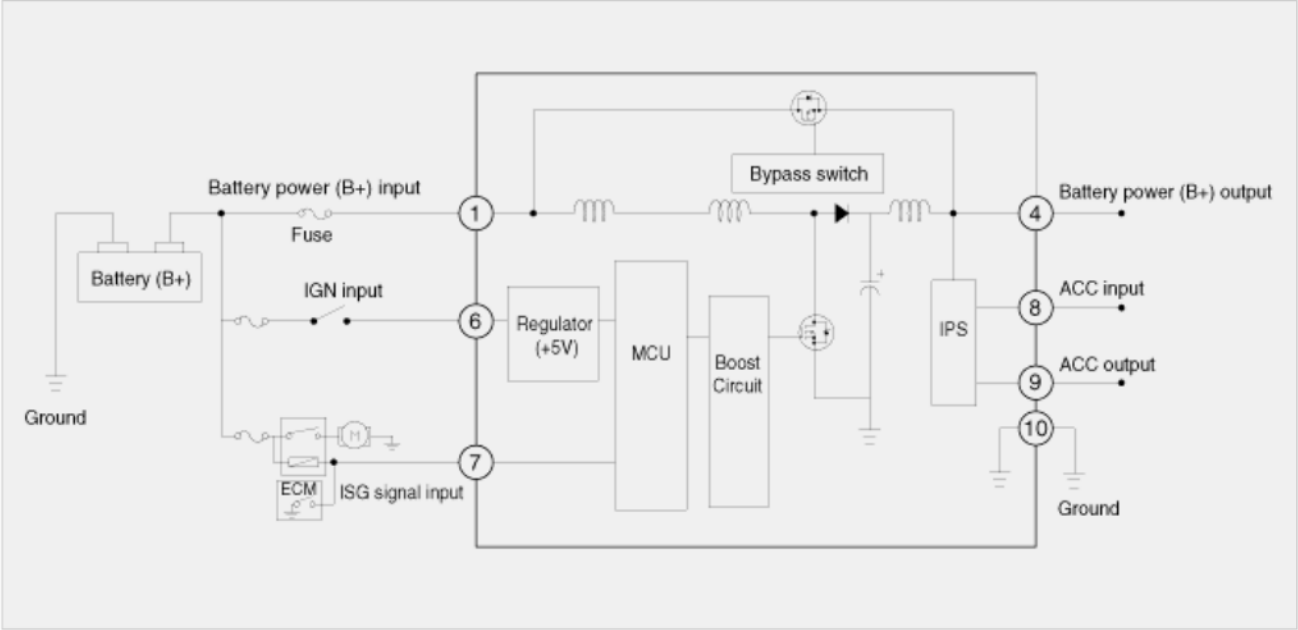
After reconnecting the battery negative cable, ISG function does not operates until the system is stabilized, about 4 hours. If disconnecting the negative (-) battery cable from the battery during repair work for the vehicle equipped with AMS function, Battery sensor recalibration procedure should be performed after finishing the repair work.

1. Install in the reverse order of removal.

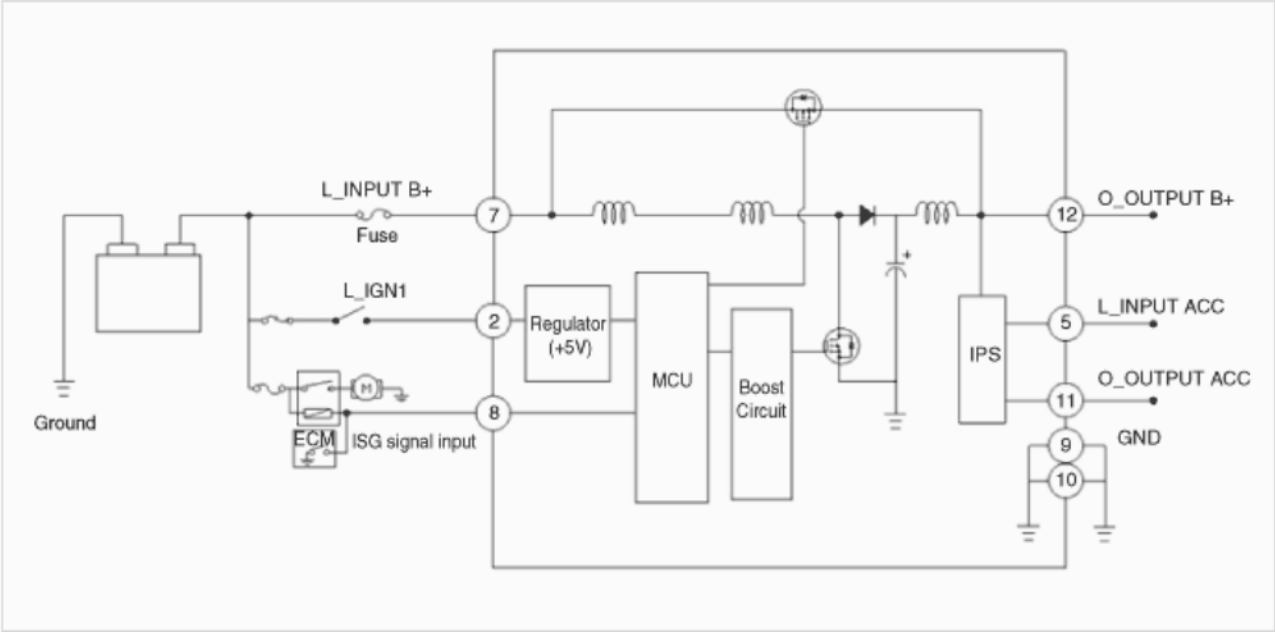
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Circuit Diagram

[200W]

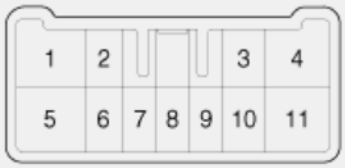


[400W]



Terminal Function

[200W]



PIn.	Description	PIn.	Description

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1	Battery power (B+) input	7	ISG signal input
2	-	8	ACC input
3	-	9	ACC output
4	Battery power (B+) output	10	Ground
5	-	11	-
6	IGN1 input		

[400W]



PIn.	Description	PIn.	Description
1	-	7	Battery power (B+) input
2	IGN1 input	8	ISG signal input
3	-	9	Ground
4	-	10	Ground
5	ACC input	11	ACC output
6	-	12	Battery power (B+) output

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Description

The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

The Alternator has eight built-in diodes, each rectifying AC current to DC current.

Therefore, DC current appears at alternator "B" terminal.

In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.

The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.

Alternator Management System

Alternator management system controls the charging voltage set point in order to improve fuel economy, manage alternator load under various operating conditions, keep the battery charged, and protect the battery from over-charging. ECM controls generating voltage by duty cycle (charging control, discharging control, normal control) based on the battery conditions and vehicle operating conditions.

The system conducts discharging control when accelerating a vehicle. Vehicle reduces an alternator load and consumes an electric power form a battery.

The system conducts charging control when decelerating a vehicle. Vehicle increases an alternator load and charges a battery.

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Inspection

Inspection Item

- Battery efficiency inspection
- Battery voltage inspection
- Charging voltage insptection
- General inspection
- Terminal tightening state inspection
- Engine/ transaxle ground state inspection
- Wiring harness ground state inspection
- Electrical Specified Value Inspection
- Vehicle parasitic current inspection
- Battery capacity inspection

Battery Efficiency Inspection

⚠ CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

NOTICE

- Inspect the battery test using the load tester and battery tester.

Battery Voltage Inspection

1. After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlamp, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
2. Turn the ignition switch OFF and turn off the electrical systems.
3. Measure the battery voltage between the negative (-) and positive (+) terminals of the battery.

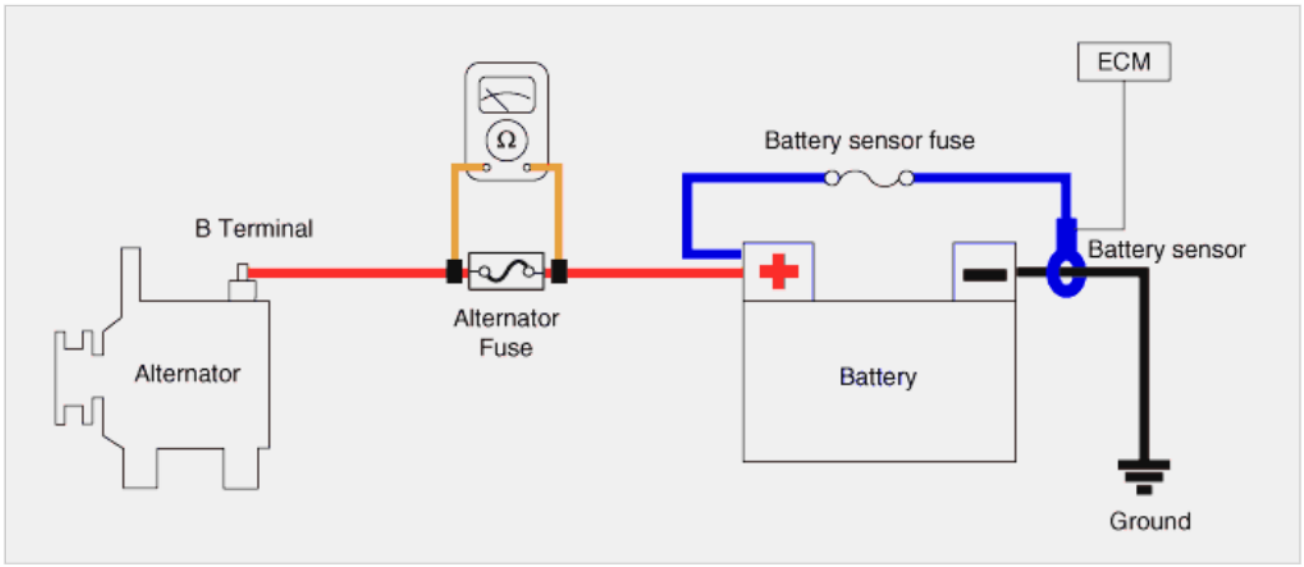
   Standard voltage : About 12.5 - 12.9V (20°C)

   If the voltage is less than specification, charge the battery.

General Inspection

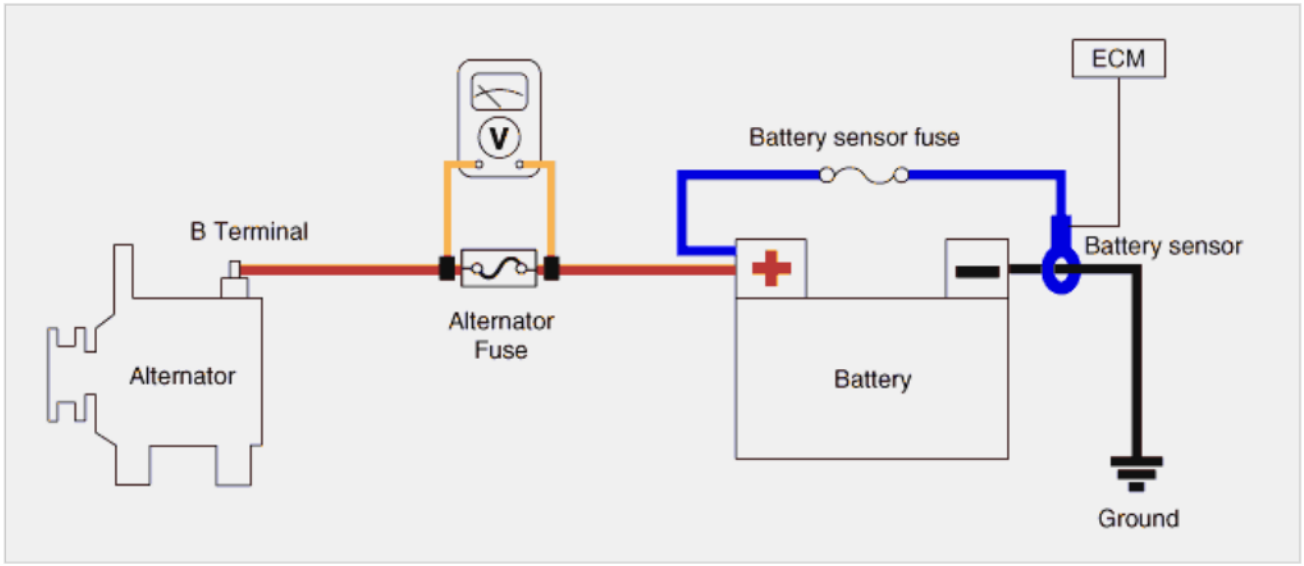
1. Check that the battery terminals are not loose or corroded.
   (Refer to Charging System - "Battery")
2. Check the fuses for continuity.
   Alternator Fuse
   (1) Check the alternator fuse for continuity.

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(2) Measure the voltage as shown in the image below.

Standard value :Approximately 0 V



(3) If the alternator fuse is blown, replace it as in the procedure below:

a. Turn ignition switch OFF and disconnect the battery negative (-) terminal.
b. Remove the battery positive (+) cable mounting nuts (A).
c. Remove the battery positive (+) cable (B).
d. Replace the norminal alternator fuse or battery cable.
e. Install in the reverse order of removal.

Battery Sensor Fuse

(1) Check the battery sensor fuse for continuity.

(2) If the alternator fuse is blown, replace the battery sensor fuse.

(3) Measure the voltage.

Standard value :Approximately 0 V

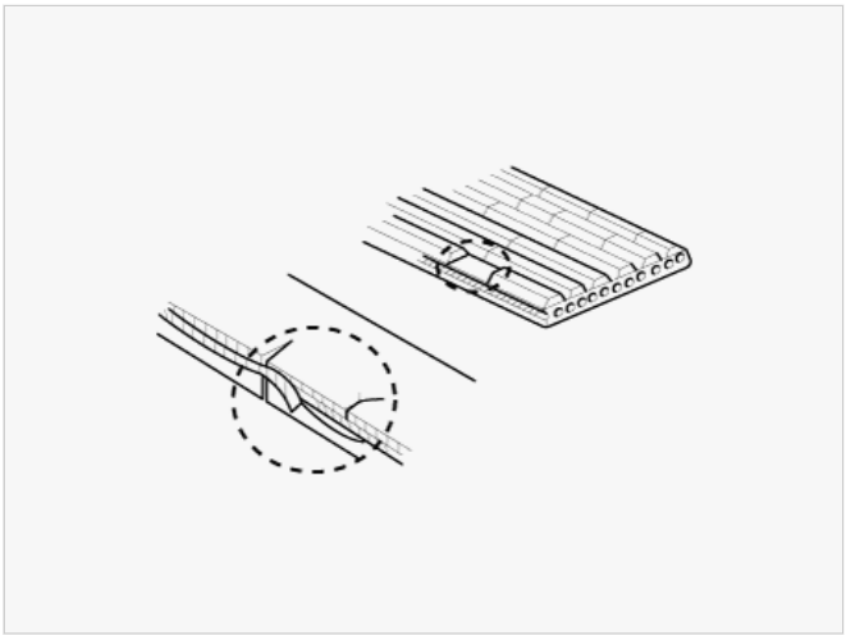
3. Inspect Drive Belt

(1) Visually check the belt for excessive wear, frayed cords etc.
If any defect has been found, replace the drive belt.

NOTICE

• Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

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4. Measure and adjust drive belt tension.
   (Refer to Engine Mechanical System - "Drive Belt")
5. Visually check alternator wiring and listen for abnormal noises.
   (1) Check that the wiring is in good condition.
   (2) Check that there is no abnormal noise from the alternator while the engine is running.
6. Check Discharge Warning Light Circuit
   (1) Warm up the engine and then turn it off.
   (2) Turn off all accessories.
   (3) Turn the ignition switch "ON". Check that the discharge warning light is lit.
   (4) Start the engine. Check that the light is lit.
   If the light does not go off as specified, troubleshoot the discharge light circuit.

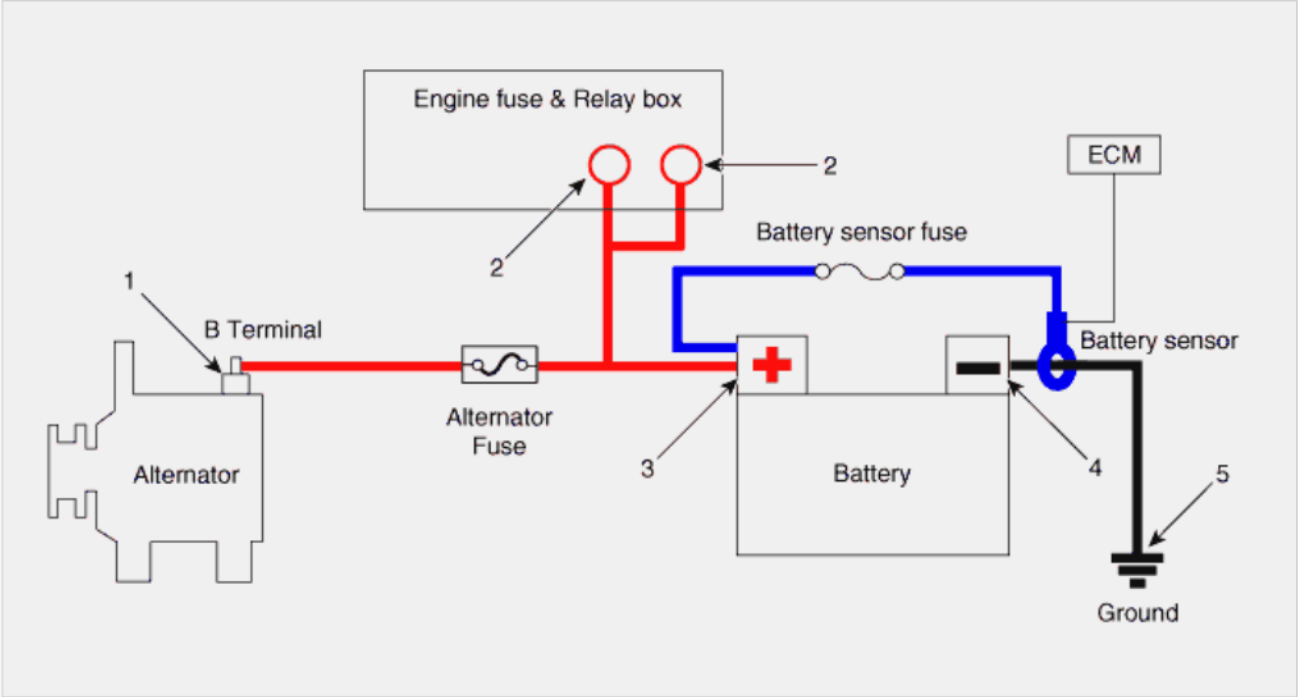
Terminal Tightening State Inspection

NOTICE

- Alternator B+ terminal state
- Alternator B+ termina tightening nut
- Battery positive (+) terminal state
- Battery positive (+) terminal tightening nut state
- Battery negative (-) terminal state
- Battery negative (-) terminal tightening nut state
- Battery negative (-) terminal mounting bolt tightening state (Chassis ground)
- Battery sensor negative (-) terminal state (With battery sensor)
- Battery sensor negative (-) terminal tightening nut state (With battery sensor)
- Battery sensor negative (-) terminal mounting bolt tightening state (Chassis ground) [With battery sensor]
- Engine room fuse & relay box positive (+) harness state
- Engine room fuse & relay box positive (+) harness tightening nut state
- Check the status of ground fault by chassis paint

Inspection Component Location

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1. Alternator B+ terminal
2. Engine room fuse & relay box positive (+) terminal
3. Battery negative (+) terminal
4. Battery negative (-) terminal
5. Chassis ground

Engine/ Transaxle Ground State Inspection

NOTICE

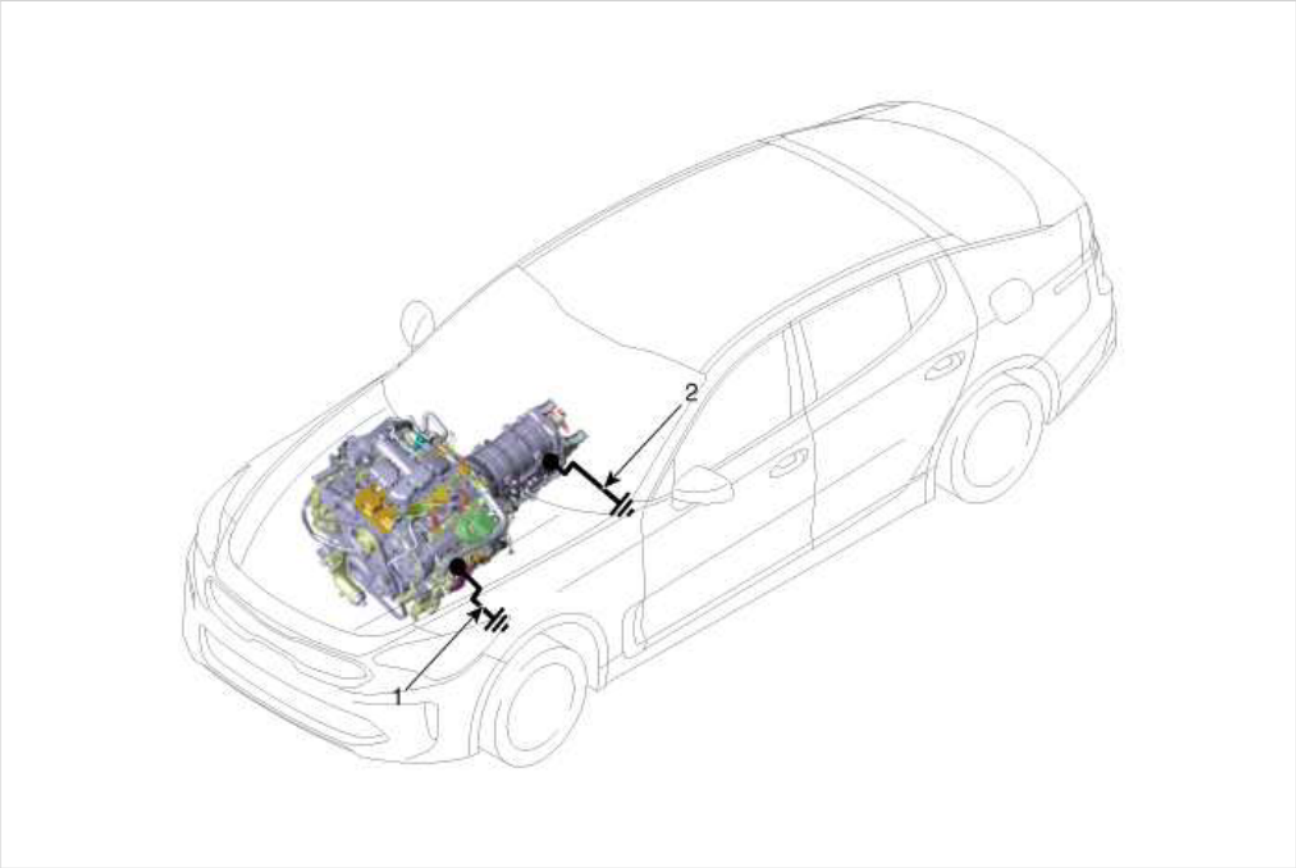
- Ground state
- Mounting bolt tightening state (Chassis)
- Mounting bolt tightening state (Engine)
- Check the status of ground fault by chassis paint

Wiring harness ground state inspection

NOTICE

- Ground state
- Mounting bolt tightening state (Chassis)
- Mounting bolt tightening state (Engine)
- Check the status of ground fault by chassis paint

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1. Engine ground (Engine ↔ Chassis)
2. Transaxle ground (Transaxle ↔ Chassis)

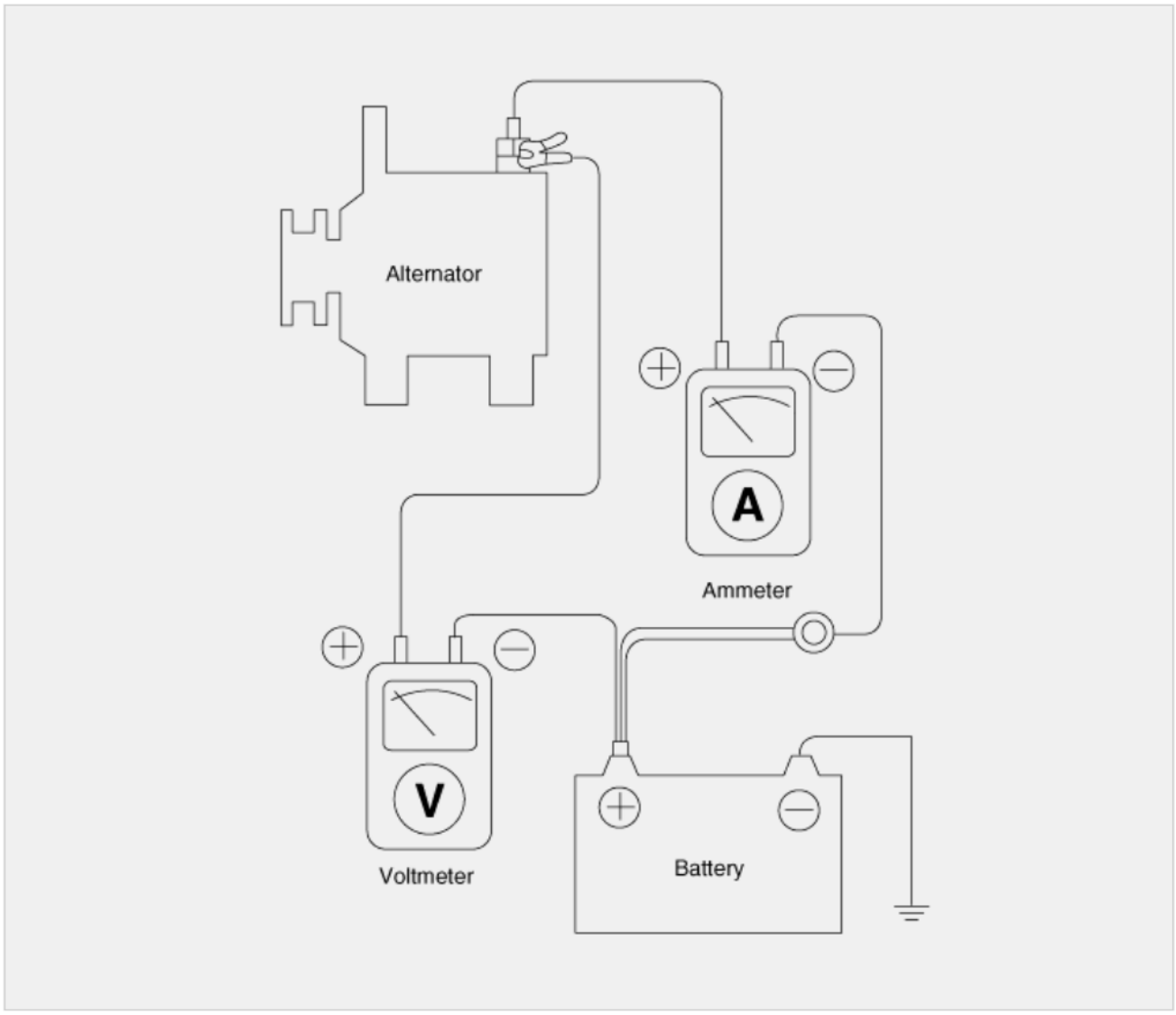
NOTICE

Check the ground point.
(Refer to ETM Harness Layout - "Ground Point")

Electrical Specified Value Inspection (Using the Voltmeter and Ammeter)

1. Voltage Drop Test of Alternator Output Wire
   This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.
   (1) Preparation
      a. Turn the ignition switch to "OFF".
      b. Disconnect the output wire from the alternator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of alternator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator and the (-) lead wire of voltmeter to the (+) terminal of battery.

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(2) Test

a. Start the engine.

b. Turn on the headlamps and blower motor, adjust the engine speed until the ammeter indicates 20A and read the voltmeter.

(3) Result

a. The voltmeter may indicate the standard value.

Standard value :0.2V max

b. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.

c. Upon completion of the test, set the engine speed at idle.Turn off the headlamps, blower motor and the ignition switch.

2. Output Current Test

This test determines whether or not the alternator gives an output current that is equivalent to the normal output.

(1) Preparation

a. Prior to the test, check the following items and correct as necessary.

Check the battery installed in the vehicle to ensure that it is in good condition. Refer to the "Battery" section for checking battery.

The battery used to test the output current should be partially discharged.

With a fully charged battery, the test may not be conducted correctly due to an insufficient load.

Check the tension of the alternator drive belt. Refer to the "Inspect drive belt" section for checking the belt tension.

b. Turn off the ignition switch.

c. Disconnect the battery ground cable.

d. Disconnect the alternator output wire from the alternator "B" terminal.

e. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

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NOTICE

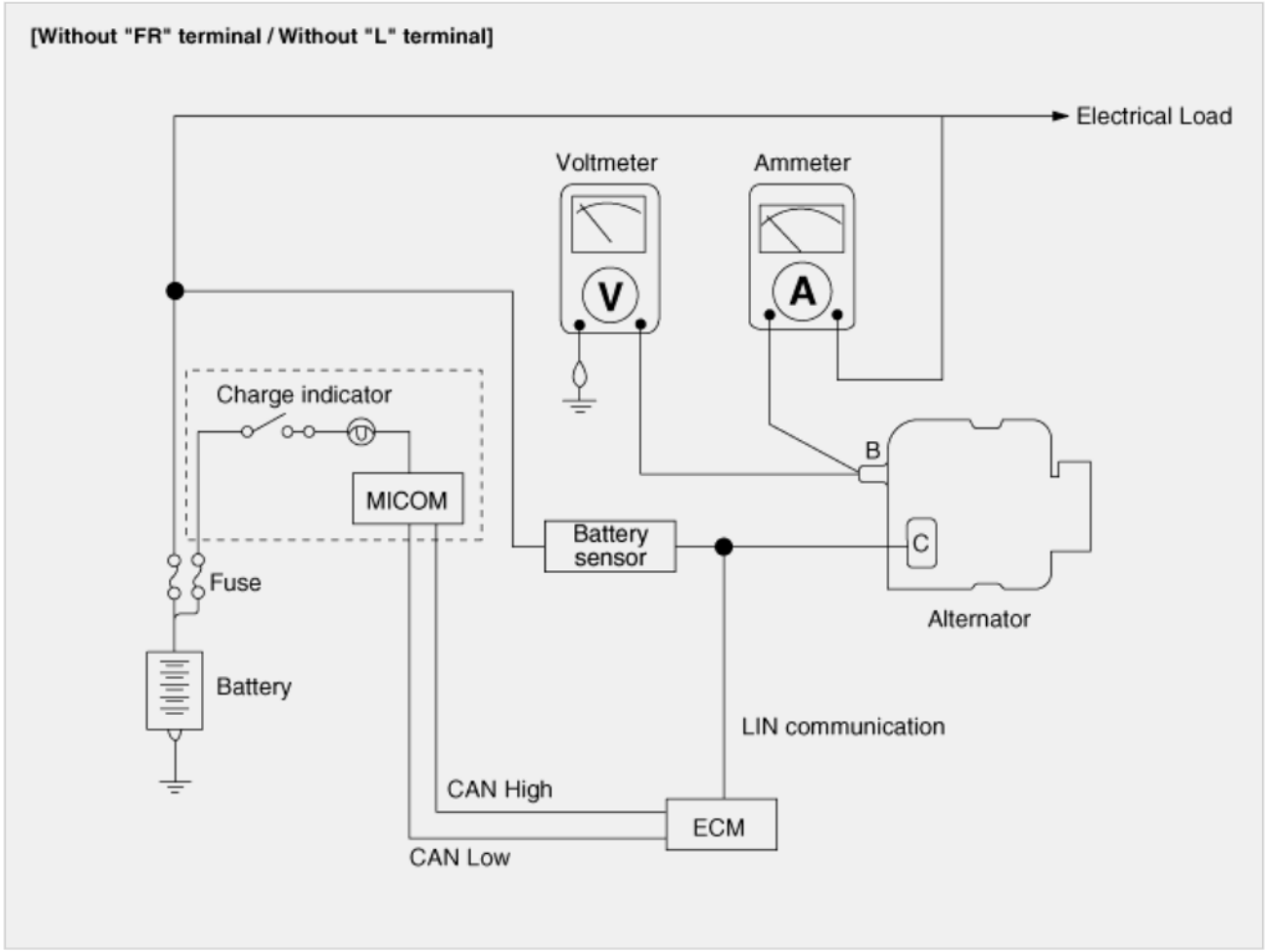
Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

f. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.

g. Connect the battery ground cable.

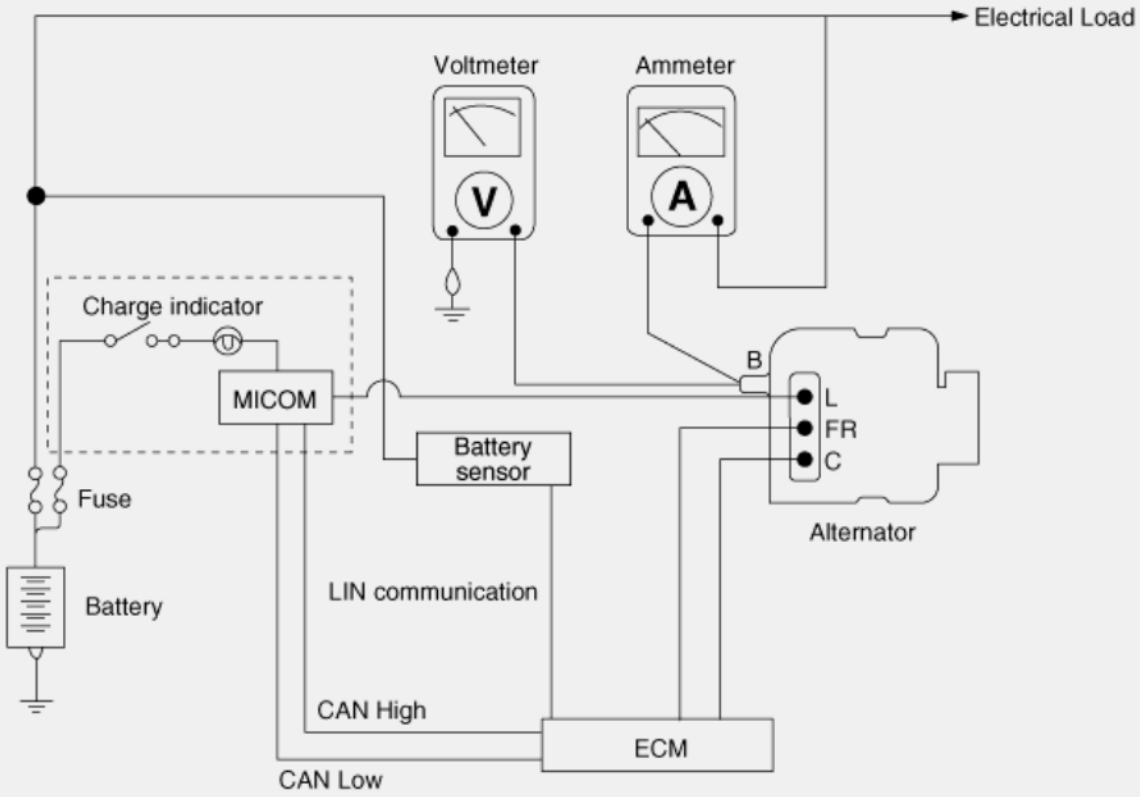
h. Leave the engine hood open.

[Without "FR" terminal / Without "L" terminal]



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[With "FR" terminal / With "L" terminal]



(2) Test

a. Check to see that the voltmeter reads the same value as the battery voltage. If the voltmeter reads 0V, open circuit in the wire between alternator "B" terminal and battery (+) terminal or poor grounding is suspected.

b. Start the engine and turn on the headlamps.

c. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

NOTICE

- After the engine start up, the charging current quickly drops. Therefore, the above operation must be done quickly to read the maximum current value correctly.

(3) Result

a. The ammeter reading must be higher than the limit value. If it is lower despite the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value :60% of the voltage rate

Information

- The nominal output current value is shown on the nameplate affixed to the alternator body.

NOTICE

- The output current value changes with the electrical load and the temperature of the alternator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on to discharge the battery or use lights of other vehicles to increase the electrical load.

  The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high. In such a case, reduce the temperature before testing again.

b. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.

c. Disconnect the battery negative (-) terminal.

d. Remove the ammeter and voltmeter and the engine tachometer.

e.

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Connect the alternator output wire to the alternator "B" terminal.

f. Connect the battery negative (-) terminal.

3. Regulated Voltage Test

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

(1) Preparation

a. Prior to the test, check the following items and correct if necessary.

Check that the battery installed on the vehicle is fully charged. Refer to the "Battery" section for checking the battery.

Check the alternator drive belt tension. Refer to the "Inspect drive belt" section for checking the belt tension.

b. Turn ignition switch to "OFF".

c. Disconnect the battery negative (-) terminal.

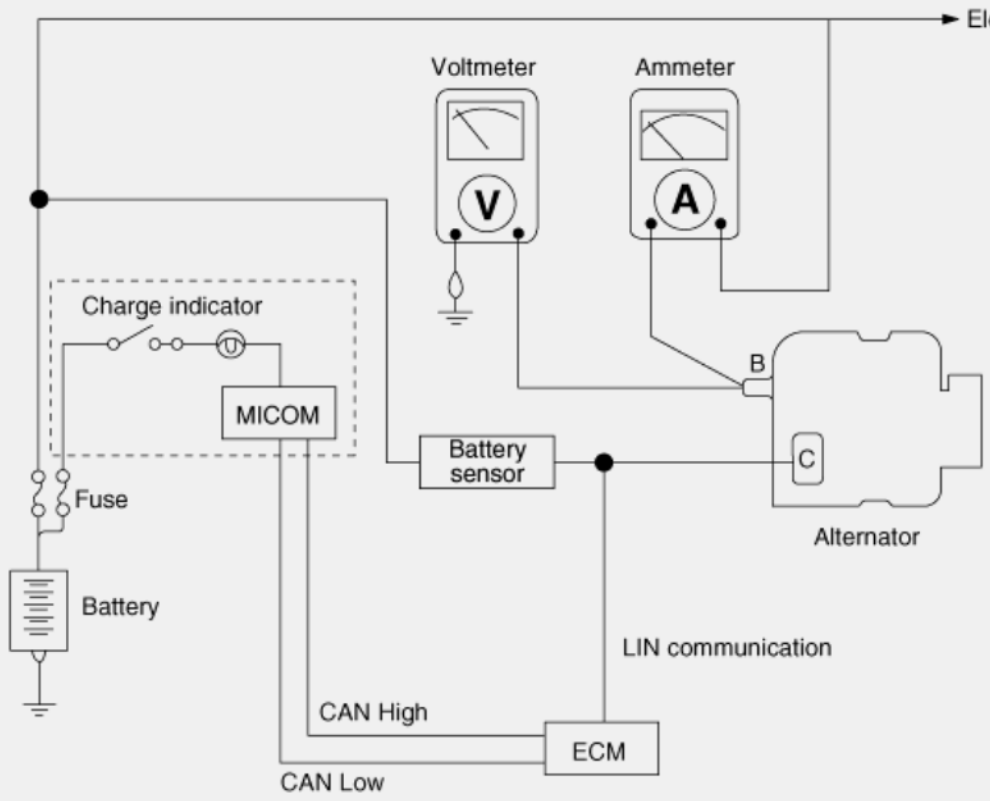
d. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.

e. Disconnect the alternator output wire from the alternator "B" terminal.

f. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) leadwire of the ammeter to the disconnected output wire.

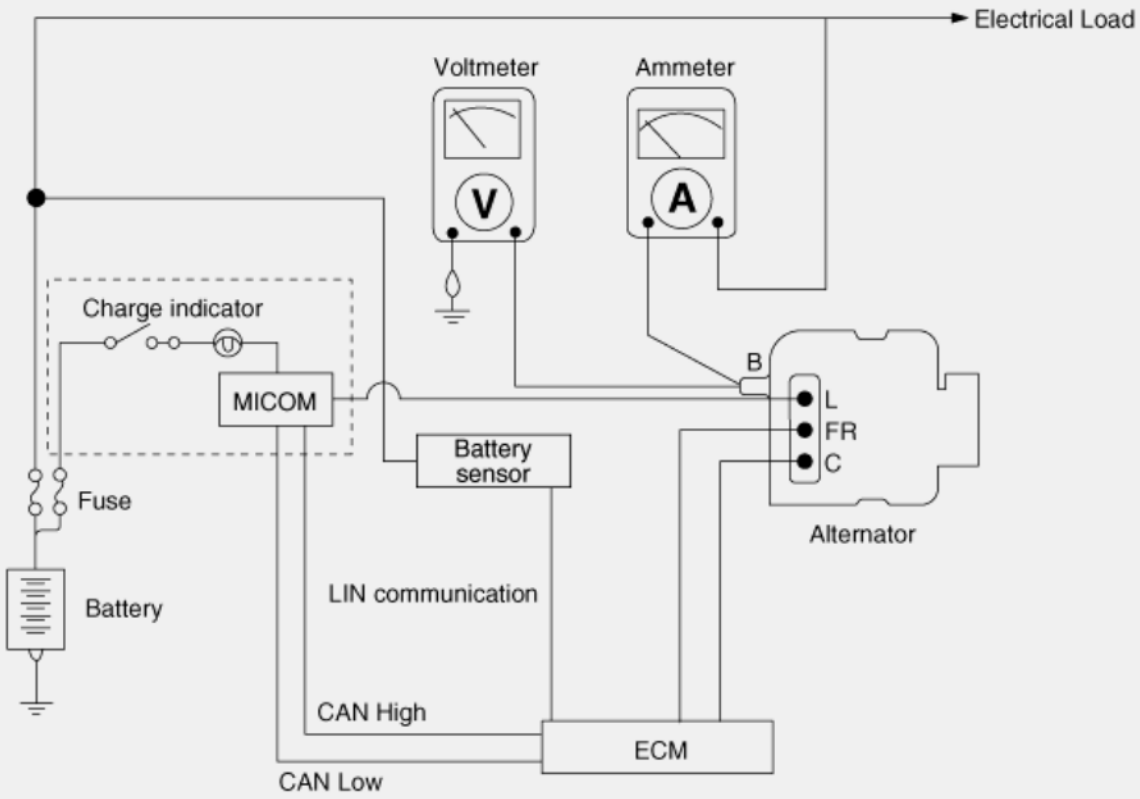
g. Connect the battery negative (-) terminal.

[Without "FR" terminal / Without "L" terminal]



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[With "FR" terminal / With "L" terminal]



(2) Test

a. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Voltage : Battery voltage

If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.

b. Start the engine. Keep all lights and accessories off.

c. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

(3) Result

a. If the voltmeter reading doesn"t agree with the standard value, the voltage regulator or the alternator is faulty.

Regulated Voltage :11.7 - 15.3V

b. If the voltmeter reading doesn"t agree with the standard value, the voltage regulator or the alternator is faulty.

c. Disconnect the battery negative (-) terminal.

d. Remove the voltmeter and ammeter.

e. Connect the alternator output wire to the alternator "B" terminal.

f. Connect the battery negative (-) terminal.

Electrical Specified Value Inspection (Using the Voltmeter and Clamp type Ammeter)

1. Voltage Drop Test of Alternator Output Wire

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

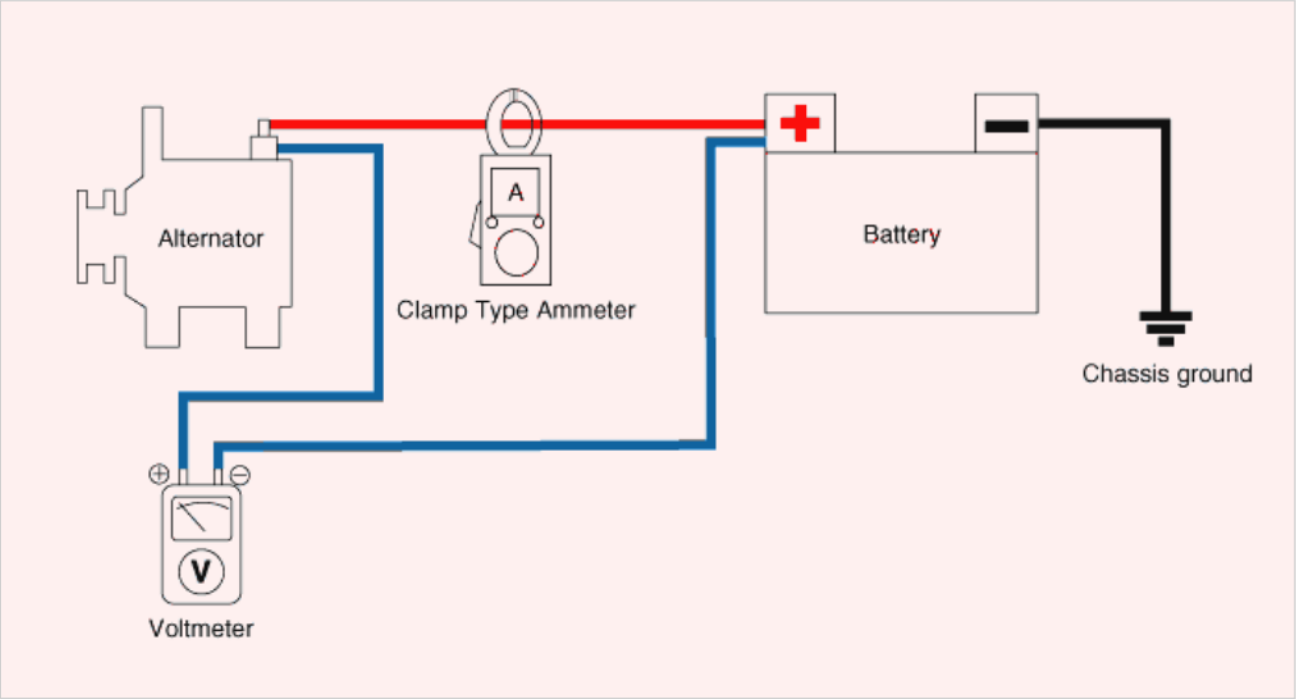
(1) Preparation

a. Turn the ignition switch to "OFF".

b. Install the clamp type ammeter between battery positive (+) and alternator "B" terminal.

c. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator and the (-) lead wire of voltmeter to the (+) terminal of battery.

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(2) Test

a. Start the engine.

b. Turn on the headlamps and blower motor, adjust the engine speed until the ammeter indicates 20A and read the voltmeter.

(3) Result

a. The voltmeter may indicate the standard value.

Standard value :0.2V max

b. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.

c. Upon completion of the test, set the engine speed at idle.Turn off the headlamps, blower motor and the ignition switch.

2. Output Current Test

This test determines whether or not the alternator gives an output current that is equivalent to the normal output.

(1) Preparation

a. Prior to the test, check the following items and correct as necessary.

Check the battery installed in the vehicle to ensure that it is good condition. Refer to the "Battery" section for checking the battery.

The battery used to test the output current should be partially discharged.

With a fully charged battery, the test may not be conducted correctly due to an insufficient load.

Check the tension of the alternator drive belt. Refer to the "Inspect drive belt" section for checking the belt tension.

b. Turn off the ignition switch.

c. Disconnect the battery negative (-) terminal.

d. Install the clamp type ammeter between battery positive (+) and alternator "B" terminal.

e. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

> ***NOTICE***
>
> Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

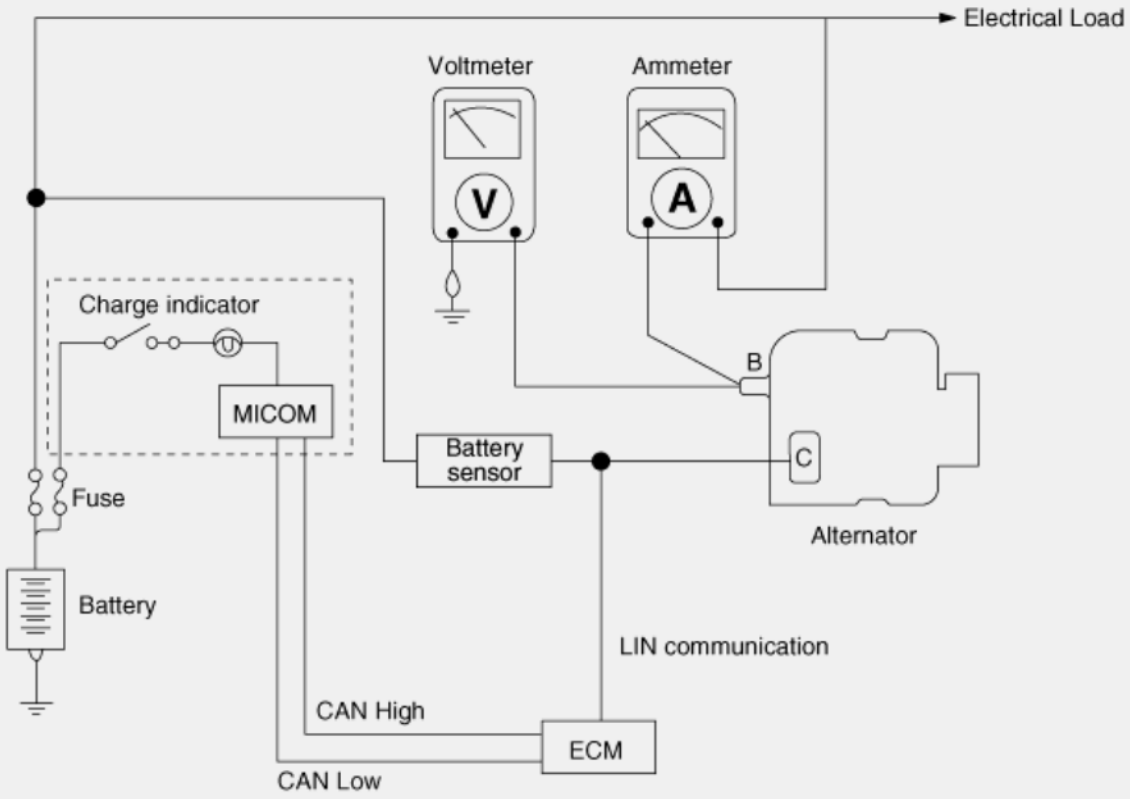
f. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.

g. Connect the battery negative (-) terminal.

h. Leave the engine hood open.

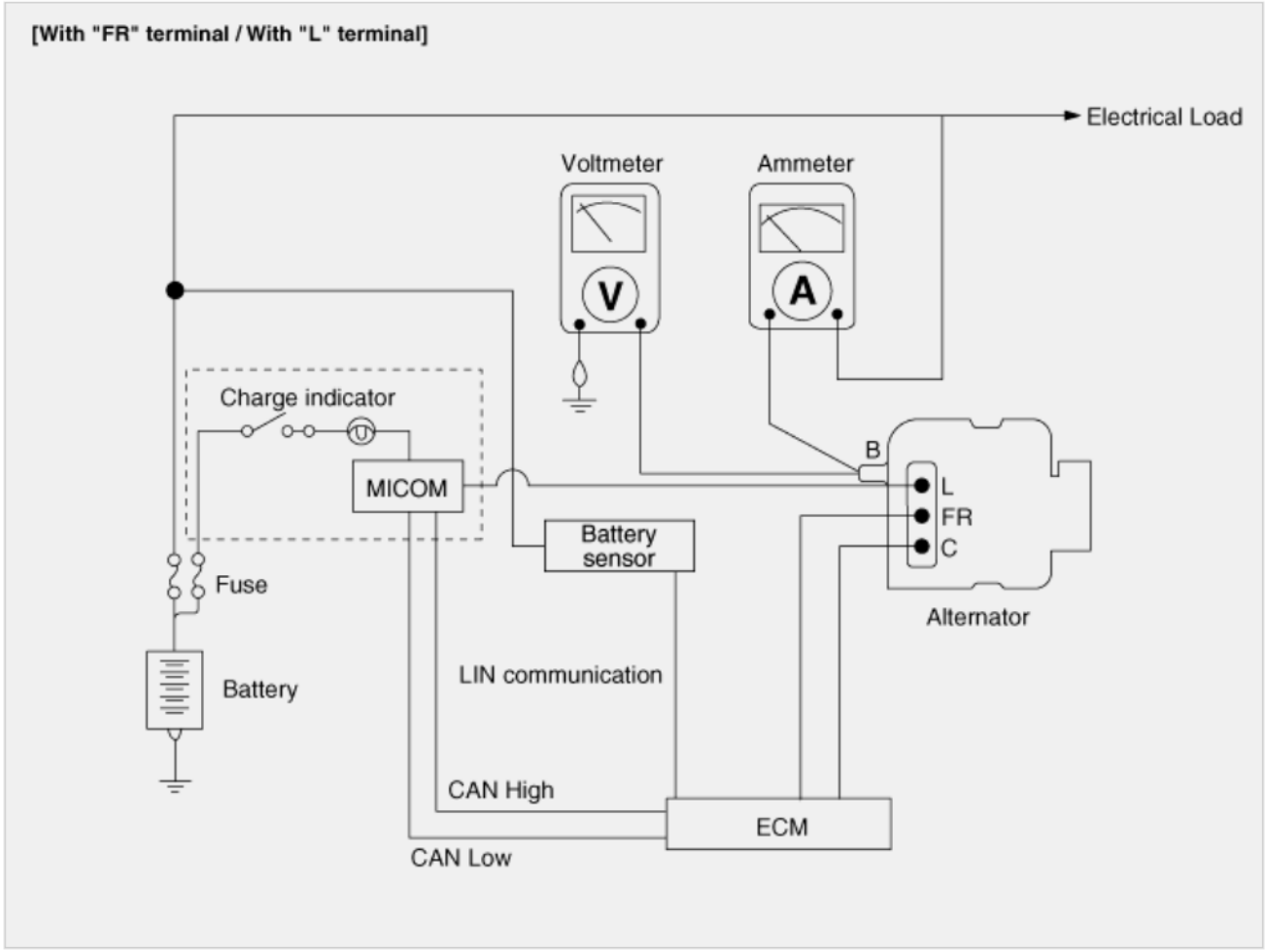
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[Without "FR" terminal / Without "L" terminal]



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[With "FR" terminal / With "L" terminal]



(2) Test

a. Check to see that the voltmeter reads the same value as the battery voltage. If the voltmeter reads 0V, open circuit in the wire between alternator "B" terminal and battery (+) terminal or poor grounding is suspected.

b. Start the engine and turn on the headlamps.

c. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

NOTICE

- After the engine start up, the charging current quickly drops. Therefore, the above operation must be done quickly to read the maximum current value correctly.

(3) Result

a. The ammeter reading must be higher than the limit value. If it is lower despite the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value :60% of the voltage rate

Information

- The nominal output current value is shown on the nameplate affixed to the alternator body.

NOTICE

- The output current value changes with the electrical load and the temperature of the alternator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on to discharge the battery or use lights of other vehicles to increase the electrical load.

  The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high. In such a case, reduce the temperature before testing again.

b. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch

c. Disconnect the battery negative (-) terminal.

d. Remove the ammeter and voltmeter and the engine tachometer.

e.

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Connect the alternator output wire to the alternator "B" terminal.

f. Connect the battery negative (-) terminal.

3. Regulated Voltage Test

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

(1) Preparation

a. Prior to the test, check the following items and correct if necessary.

Check that the battery installed on the vehicle is fully charged. Refer to the "Battery" section for checking the battery.

Check the alternator drive belt tension. Refer to the "Inspect drive belt" section for checking the belt tension.

b. Turn ignition switch to "OFF".

c. Disconnect the battery negative (-) terminal.

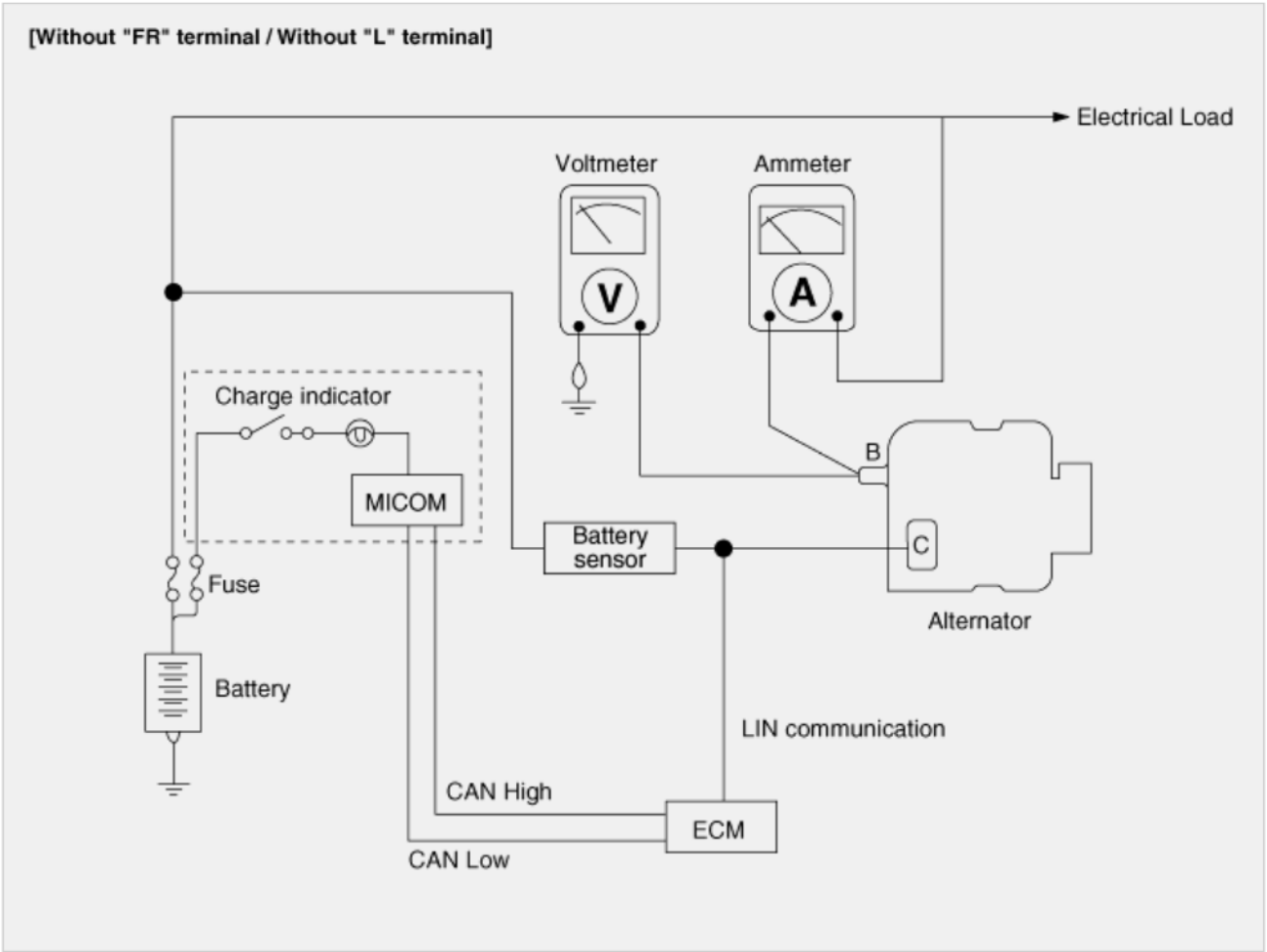
d. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.

e. Disconnect the alternator output wire from the alternator "B" terminal.

f. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire.Connect the (-) lead wire of the ammeter to the disconnected output wire.

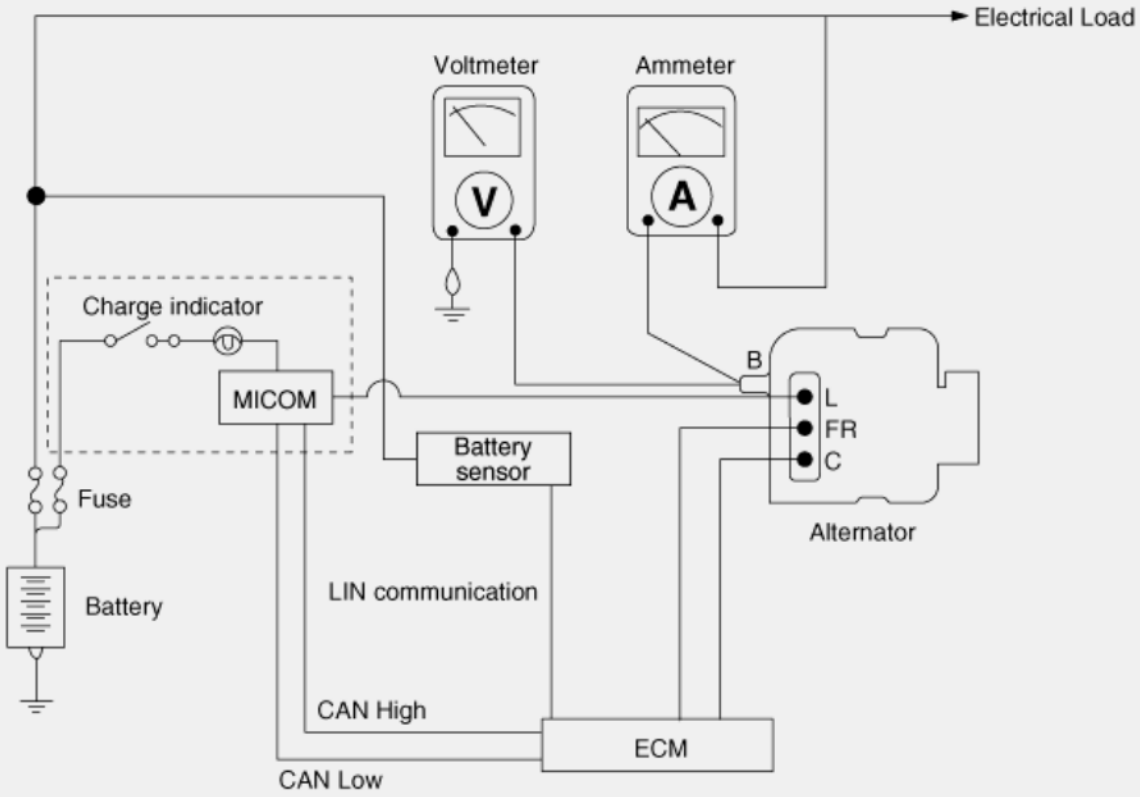
g. Connect the battery negative (-) terminal.

[Without "FR" terminal / Without "L" terminal]



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[With "FR" terminal / With "L" terminal]



(2) Test

a. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Voltage : Battery voltage

If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.

b. Start the engine. Keep all lights and accessories off.

c. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

(3) Result

a. If the voltmeter reading does not agree with the standard value, the voltage regulator or the alternator is faulty.

Regulated Voltage :11.7 - 15.3V

b. If the voltmeter reading does not agree with the standard value, the voltage regulator or the alternator is faulty.

c. Disconnect the battery negative (-) terminal.

d. Remove the voltmeter and ammeter.

e. Connect the alternator output wire to the alternator "B" terminal.

f. Connect the battery negative (-) terminal.

Vehicle parasitic current inspection

[Using the Ammeter]

1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.
3. Wait for a few minutes until the vehicle's electrical systems go to sleep mode.

NOTICE

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- For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10-20 minutes.

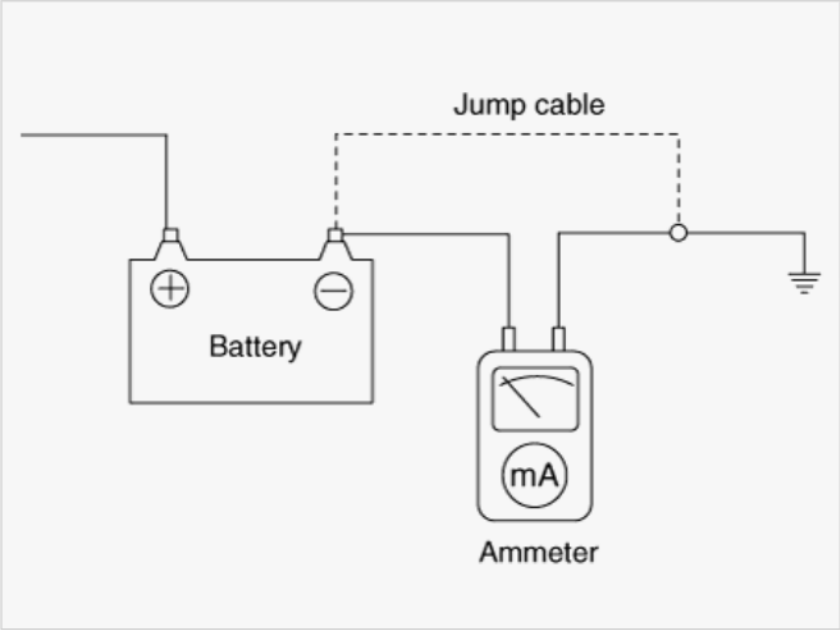
4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

NOTICE

- Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.

  To prevent the battery from being reset during the inspection:

1) Connect a jump cable between the battery (-) terminal and the ground cable.
2) Disconnect the ground cable from the battery (-) terminal.
3) Connect an ammeter between the battery (-) terminal and the ground cable.
4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   - If the parasitic current is over the limit value, search for abnormal circuit by removing the fuses one by one and checking for parasitic current.
   - Reconnect only the fuse suspected of parasitic current and search for the trouble unit by removing the components connected to the circuit one by one until the parasitic draw drops below limit value.

Limit value (after 10 - 20 min.) : Below 50mA

[Using the Clamp type Ammeter]

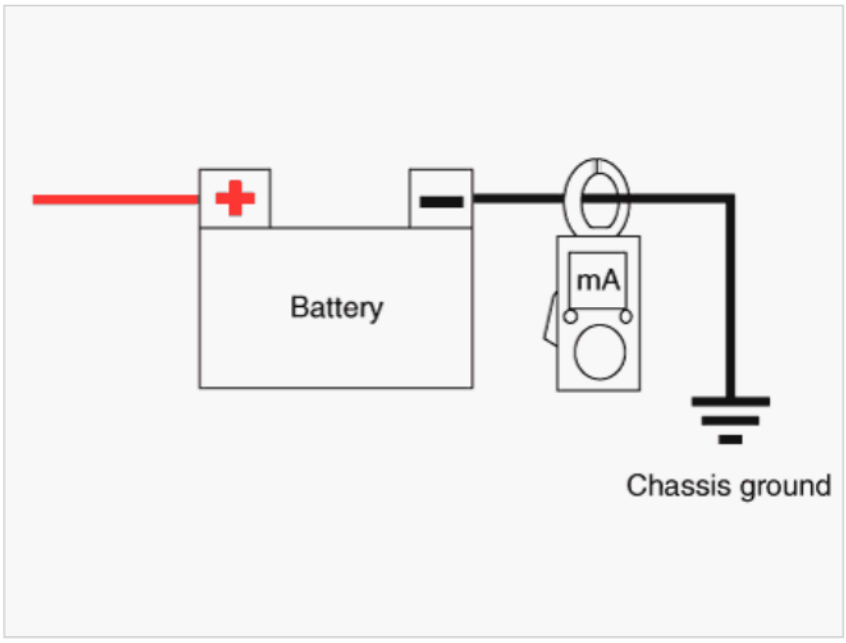
1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.
3. Wait for a few minutes until the vehicle's electrical systems go to sleep mode.

NOTICE

- For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10 - 20 minutes.

4. Install the clamp type ammerter on battery negative (-) terminal.

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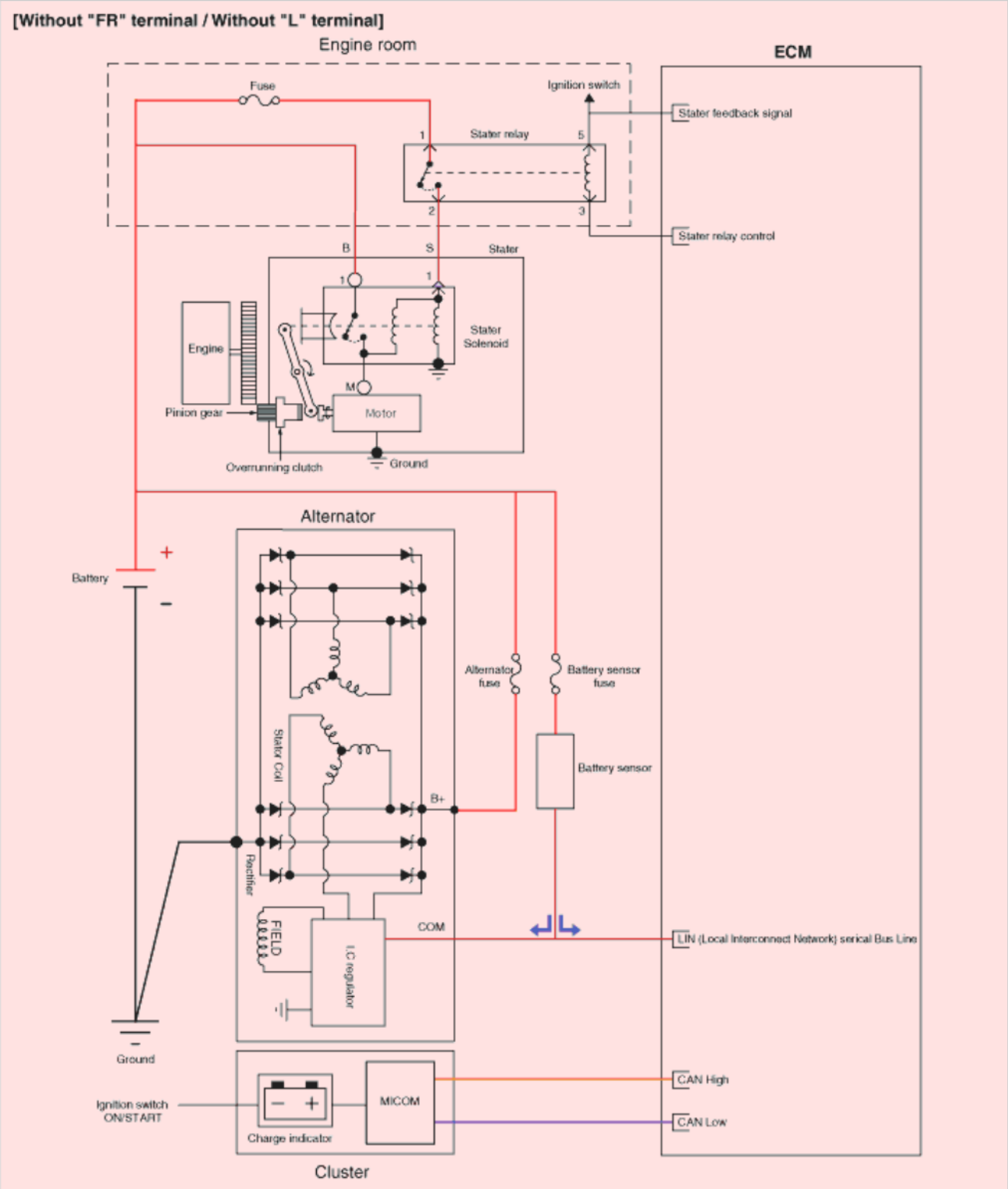


5. Read the current value of the ammeter.
   - If the parasitic current is over the limit value, search for abnormal circuit by removing the fuses one by one and checking for parasitic current.
   - Reconnect only the fuse suspected of parasitic current and search for the trouble unit by removing the components connected to the circuit one by one until the parasitic draw drops below limit value.

Limit value (after 10 - 20 min.) : Below 50mA

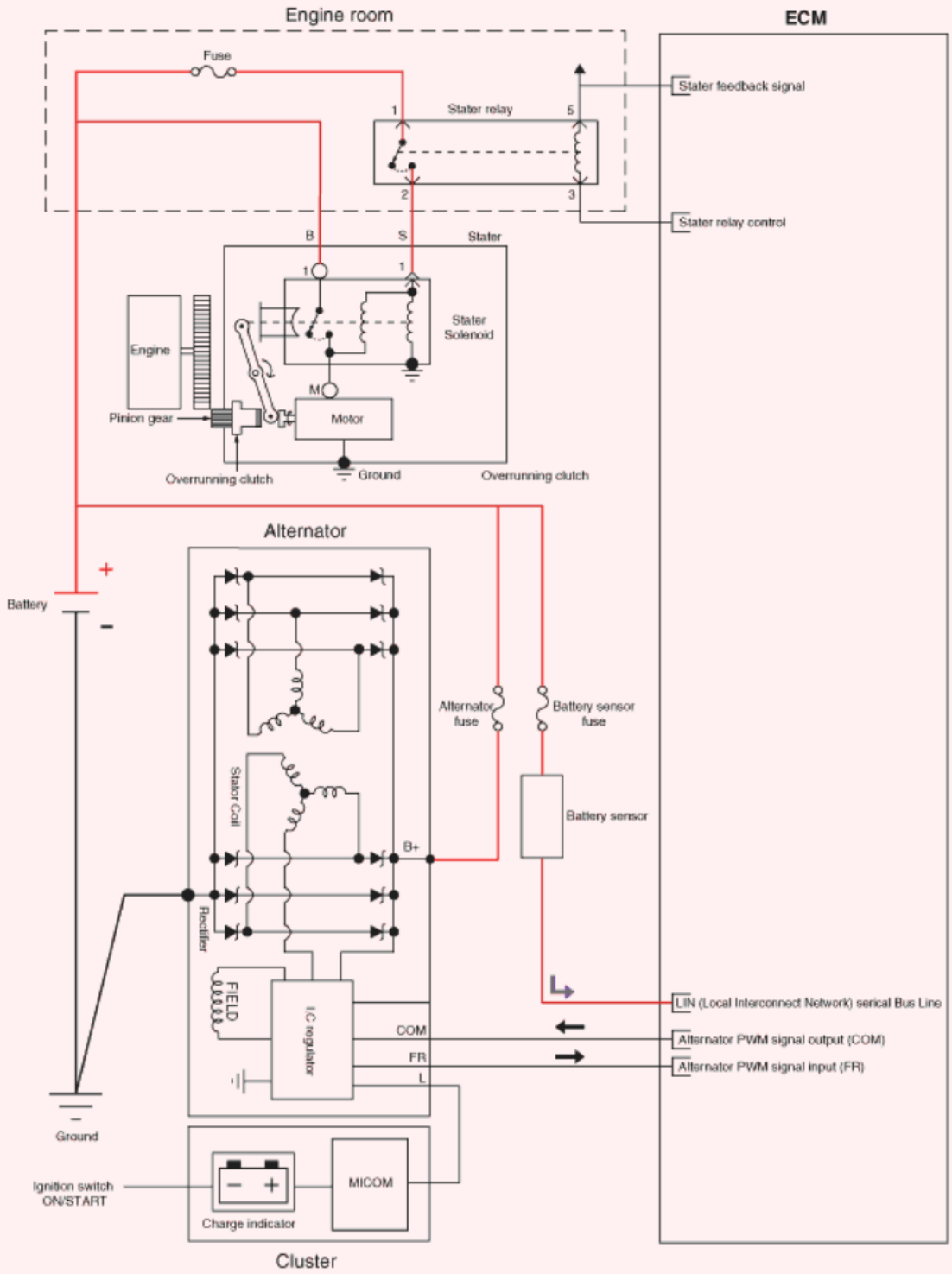
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Circuit Diagram



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[With "FR" terminal / With "L" terminal]



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Troubleshooting

NOTICE

- Be careful not to short-circuit the wiring by the body or other wirings.
- In case of discharging problem, measure dark current at all times.
  (Charging System - "Dark Current Inspection").
- When checking the alternator main fuse, perform continuity test and voltage test between terminals as well as visual check to confirm normal operation.
- When checking the ground, repair or replace after inspecting for defective ground cable, defective installation or defective contact due to foreign object.
- It is not recommended to use non-authentic parts as installing non-authentic parts may cause malfunction of charging system.
- Be careful as misassembly may cause short-circuit of wiring, which may result in battery discharge.
- As it will reset and appear as normal if the battery negative (-) terminal is disconnected while measuring dark current, measure by using a hook meter without disconnecting the negative (-) terminal.
- Note that there may be various phenomenons / possible causes / repair measures apart from above.
- For more effective repairs, refer to DTC guide and ETM.

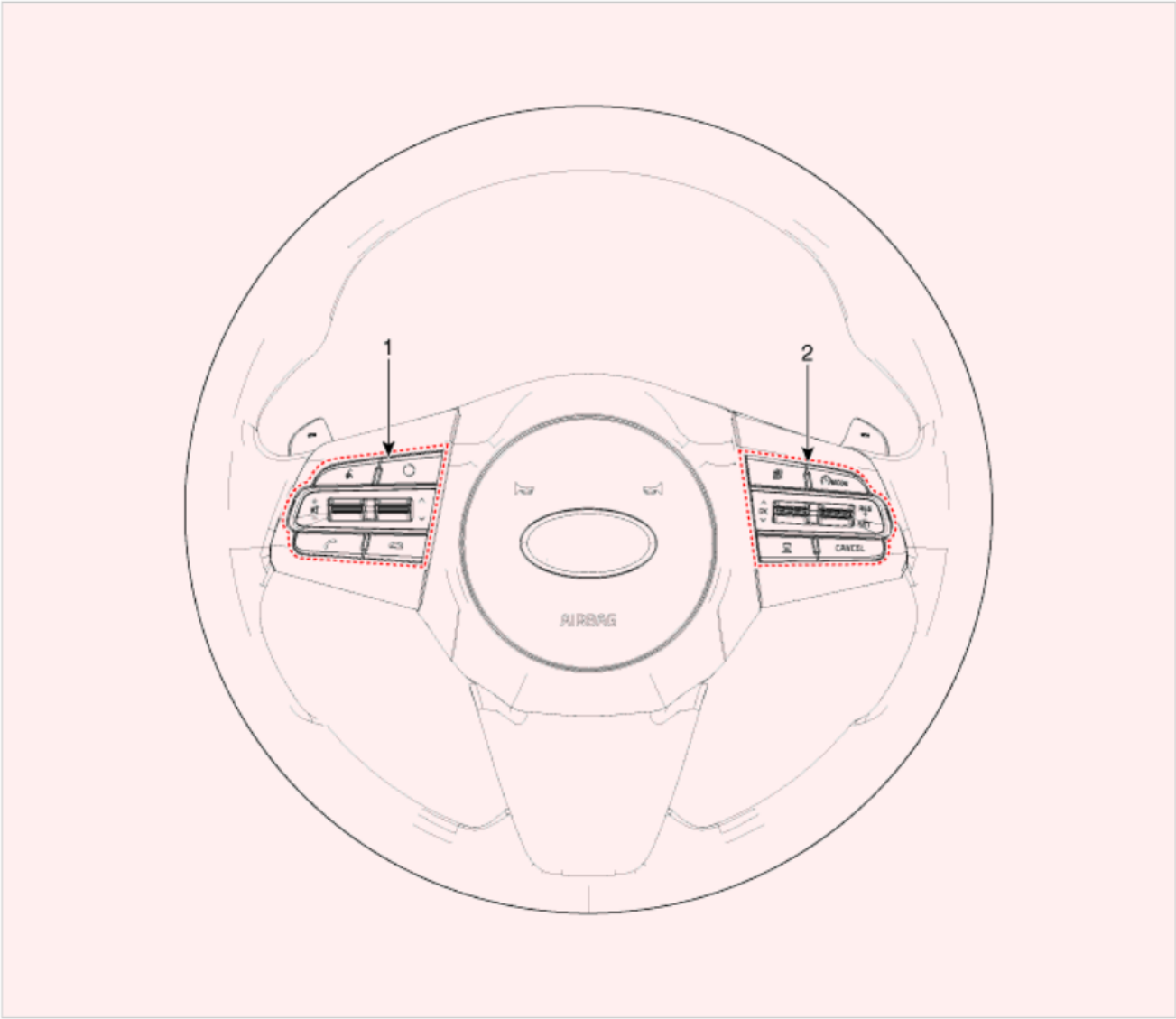
Symptom	Suspected Area	Remedy
Charging warning lamp does not turn on during IG ON.	Broken alternator main fuse	Inspect / Repair / Replace fuse.
	Broken instrument cluster fuse	Inspect / Repair / Replace fuse.
	Broken instrument cluster internal bulb	Inspect / Repair / Replace instrument cluster.
	Defective connection of wiring connector	Inspect / Repair / Replace wiring connection.
	Defective voltage regulator or alternator	Inspect / Repair / Replace voltage regulator or alternator.
	Defective connection of battery terminal	Inspect tightening of (+) and (-) battery terminals to specified torque.
	Communication error	Inspect wiring between regulator and ECM.
		Inspect transmission signal of ECM.
		Inspect / Repair / Replace alternator if the wiring and ECM are normal.
Charging warning lamp does not turn off during engine running.	Worn drive belt or lack of tension	Inspect / Repair / Replace drive belt.
	Defective connection, corroded or worn battery cable	Inspect connection of battery cable and Inspect / Repair / Replace cable.
	Broken alternator main fuse	Inspect / Replace alternator main fuse or battery cable.
	Defective voltage regulator or alternator	Inspect / Replace voltage regulator or alternator.
	Defective wiring	Inspect / Replace wiring.
	Defective instrument cluster	Inspect / Replace instrument cluster
	Slip in alternator pulley	Inspect / Replace alternator pulley.
		Adjust tension / Replace drive belt.
	Defective connection of battery terminal	Inspect tightening of (+) and (-) battery terminals to specified torque.
Charging warning lamp turns on.	Slip, worn or lack of tension in drive belt	Adjust tension / Replace drive belt.
		Inspect / Replace auto tensioner (only for auto tensioner type).
	Error in Alternator Management System (AMS) voltage	Inspect battery sensor connecting harness and connection with body.
	Error in battery sensor	Inspect / Repair / Replace battery sensor.
	Short between battery sensor wiring and body	Inspect / Repair / Replace battery sensor.
	Defective alternator L terminal output power	Inspect / Repair / Replace alternator or regulator.
	Degradation due to defective contact of battery (+) terminal	Check tightening to specified torque / Inspect / Repair / Replace battery wiring.
	Short in alternator connecting extension connector internal pin	Inspect / Repair / Replace wiring.
	Short circuit between body and mission ground	Inspect / Repair / Replace ground.

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	Communication error	Inspect / Repair / Replace wiring between regulator and ECM.
		Inspect transmission signal of ECM.
		Inspect / Repair / Replace alternator if wiring and ECM are normal.
	Short in the middle of connection to alternator L terminal (L terminal applied vehicle model)	Inspect / Repair / Replace wiring.
	Drive belt rotation stops due to slip in crankshaft damper pulley or defective pulley.	Inspect or replace crankshaft damper pulley / Inspect, repair or replace drive belt tensioner bearing.
	Slip, worn or lack of tension in drive belt	Adjust tension / Inspect / Repair / Replace drive belt.
	Defective voltage regulator	Inspect / Repair / Replace voltage regulator.
	Defective alternator	Inspect / Repair / Replace alternator.
	Broken alternator main fuse	Inspect / Repair / Replace alternator main fuse or battery wiring cable.
	Defective ground	Inspect / Repair / Replace ground.
	Discharged battery	Adjust tension / Inspect / Repair / Replace drive belt.
		Inspect / Repair / Replace wiring connection.
		Inspect / Repair / Replace alternator main fuse.
		Inspect / Repair / Replace alternator.
		Inspect / Repair / Replace voltage regulator.
		Inspect / Repair / Replace battery unit.
		Inspect for dark current / Repair / Replace.
		Learn / Inspect / Repair / Replace battery sensor.
		Inspect for short / Repair / Replace battery cable.
		Inspect / Repair / Replace ECM.
		Inspect / Repair / Replace body electrical related parts.
		Inspect / Repair / Replace installation status of alternator connector.
		Inspect / Repair / Replace tightening of (+) and (-) battery terminals to specified torque.
Swollen battery	Defective battery	Inspect / Replace battery.
	Defective voltage regulator or alternator	Inspect / Repair / Replace voltage regulator or alternator.
	Defective charging related parts or wiring	Inspect / Repair / Replace charging related parts and wiring.
After inspection, repair or replace related parts in case of malfunction.		

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Components



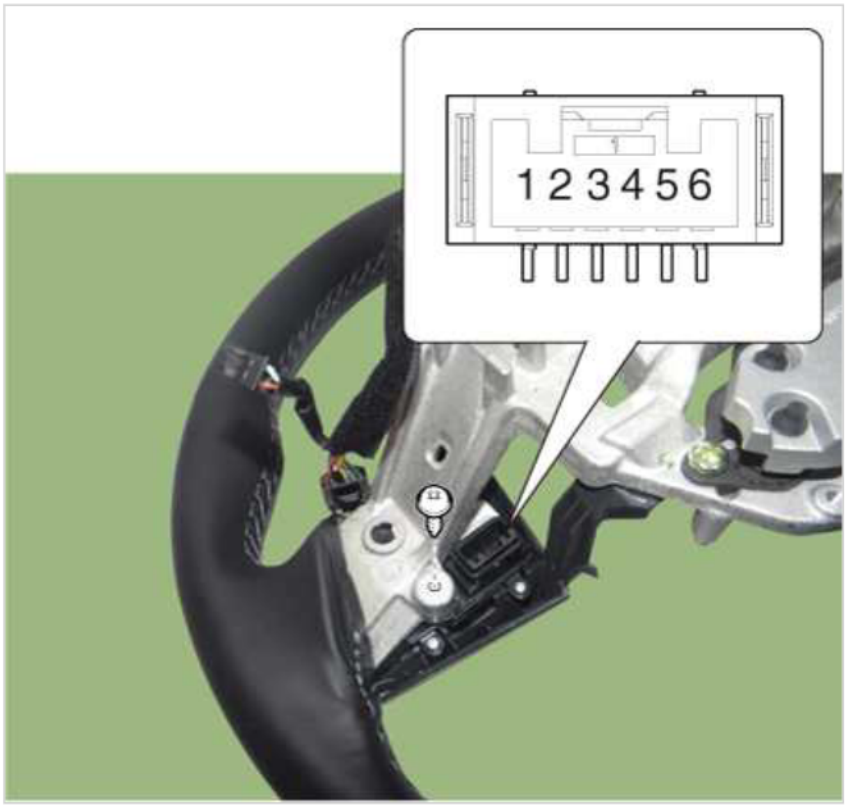
1. Left Remote Control Switch
(Audio + Bluetooth + Voice)

2. Right Remote Control Switch
(Trip Computer + ACC + SCC)

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Inspection

1. Check for resistance between terminals in each switch position (RH).



[RH : Trip + ACC + SCC]

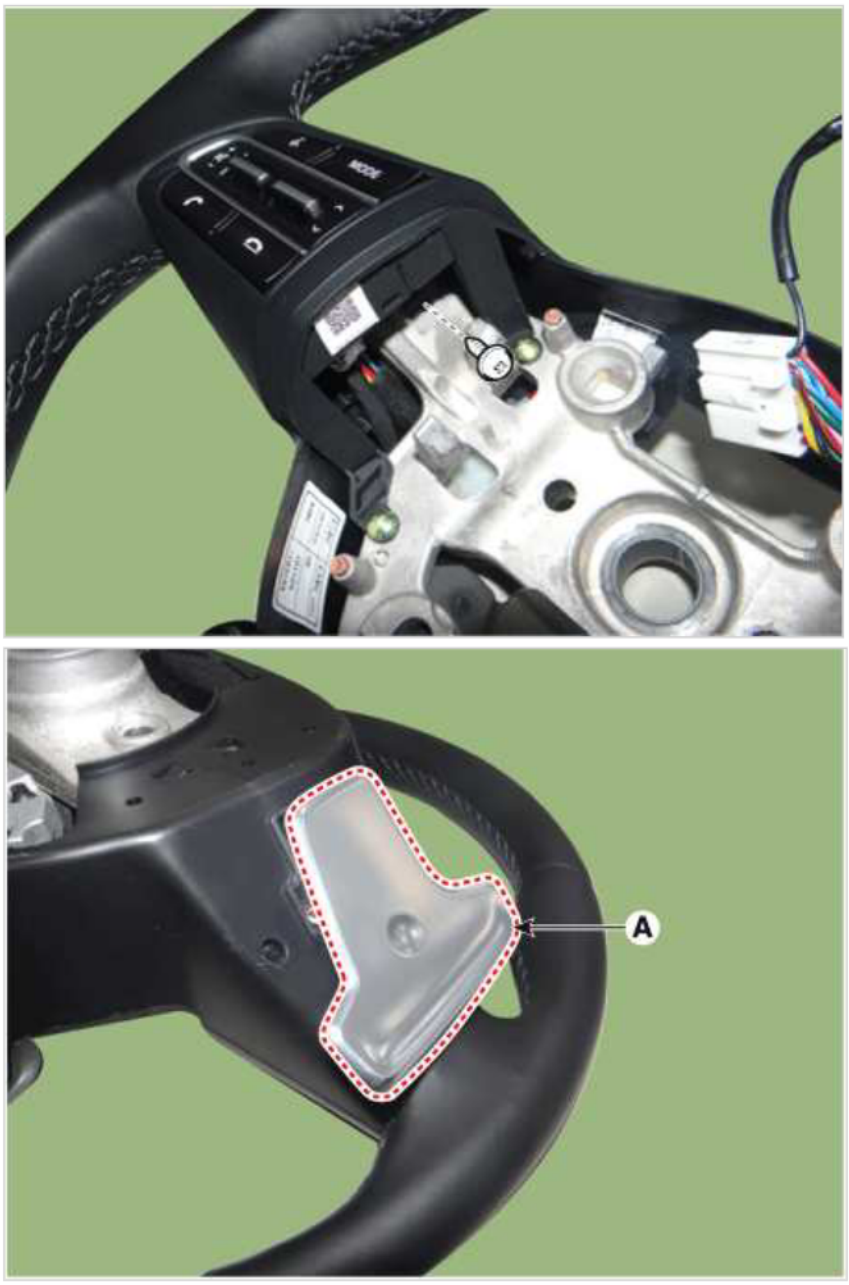
Switch	Connector terminal	Resistance (±3%)
Cancel	2-6	390 Ω
SET -		610 Ω
RES +		910 Ω
Cruise ON/OFF		1.38 kΩ
Cruise & Speed Limit ON/OFF		2.13 kΩ
SCC (Following distance control)		3.63 kΩ
Group	1-6	390 Ω
Trip Up		610 Ω
Trip Down		910 Ω
ENTER		1.38 kΩ

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel assembly.
   (Refer to Steering System - "Steering Wheel")
3. Remove the paddle shift switch (A) after loosening the mounting screws.

[LH]

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[RH]

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4. Disconnect the paddle shift switch connector (A).

[LH]

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[RH]



5. Remove the steering front cover (A) after loosening the mounting screws.

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6. Remove the steering rear cover (A) after loosening the mounting screws.



7. Remove the steering back cover (A) after loosening the mounting screws.

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8. Disconnect the steering wheel remote control connector (A).

[LH]



[RH]

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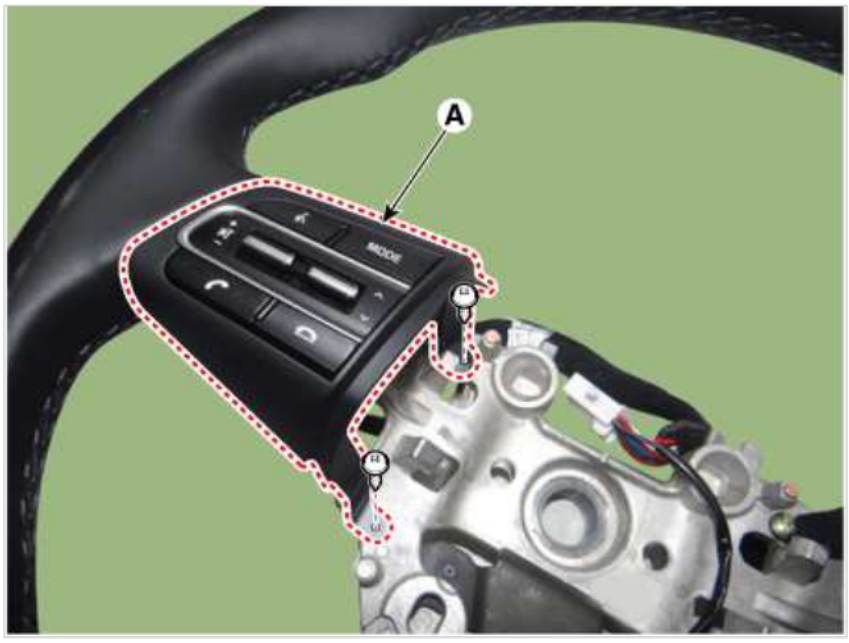


9. Remove the steering wheel remote control (A) after loosening the mounting screws.

[LH]



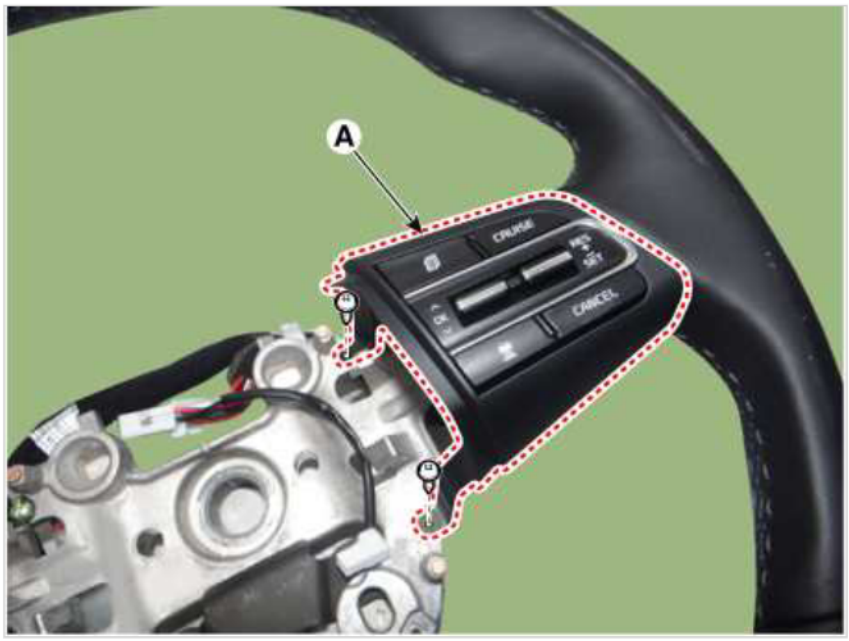
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[RH]



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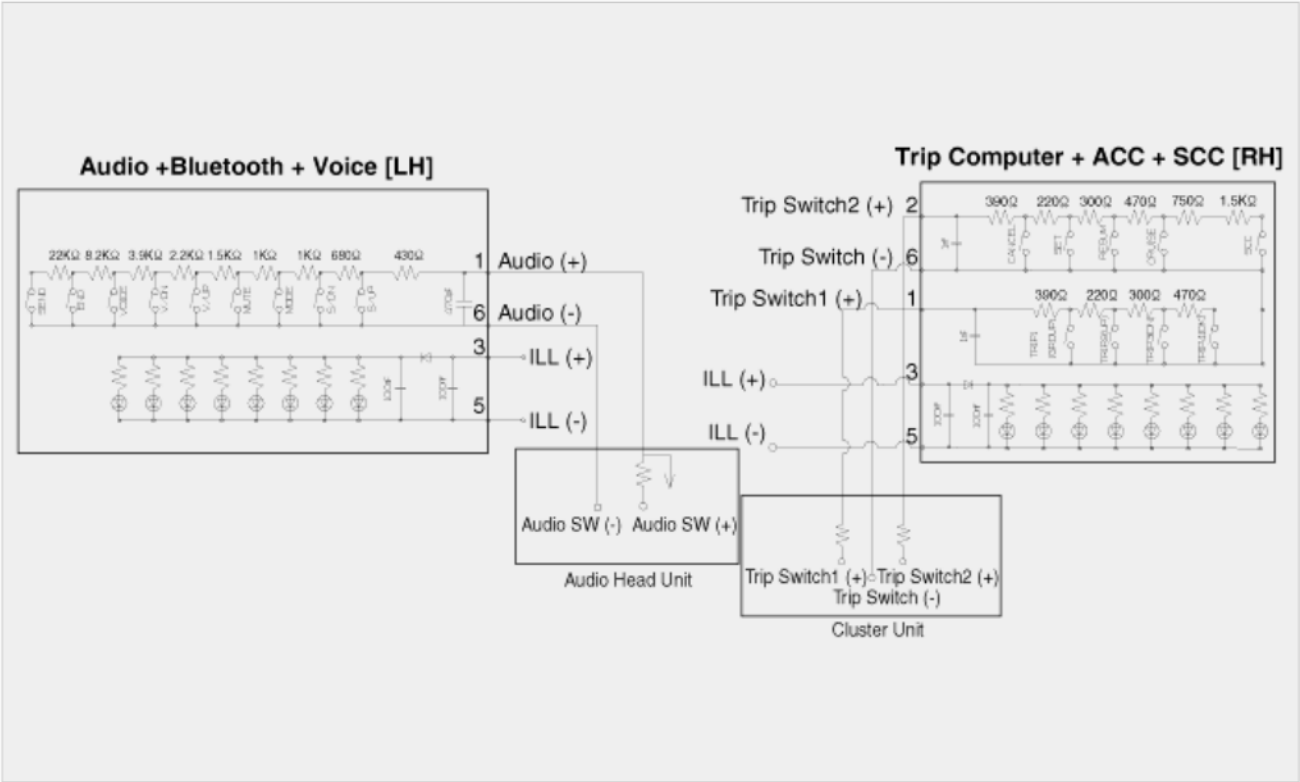


Installation

1. Install the steering wheel remote control.
2. Connect the steering remote control connector.
3. Install the steering back cover.
4. Install the steering rear cover.
5. Install the steering front cover.
6. Connect the paddle shift switch connector.
7. Install the paddle shift switch.
8. Install the steering wheel assembly.
9. Connect the negative (-) battery terminal.

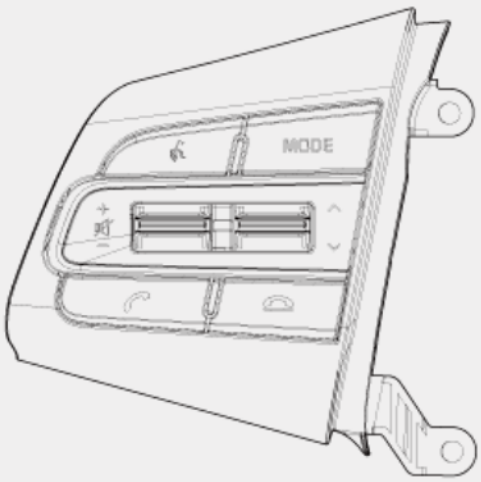
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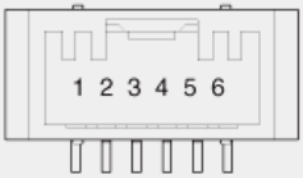
Circuit Diagram

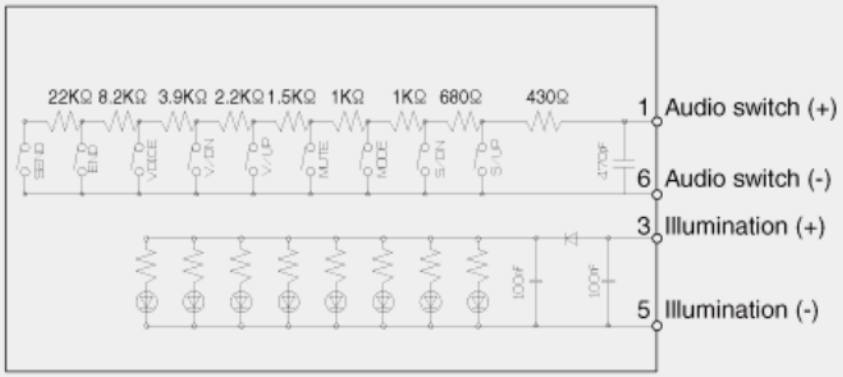


[Audio + Bluetooth + Voice]

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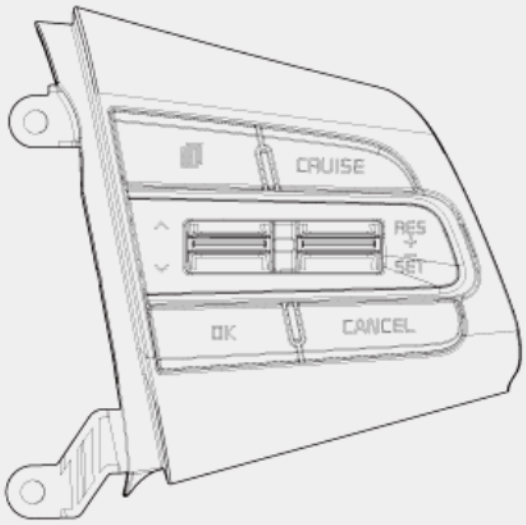


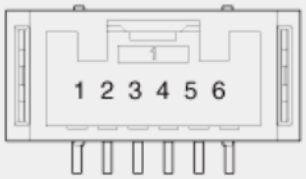
Connector	
	
No.	**Description**
1	Audio switch (+)
2	-
3	Illumination (+)
4	-
5	Illumination (-)
6	Audio switch (-)

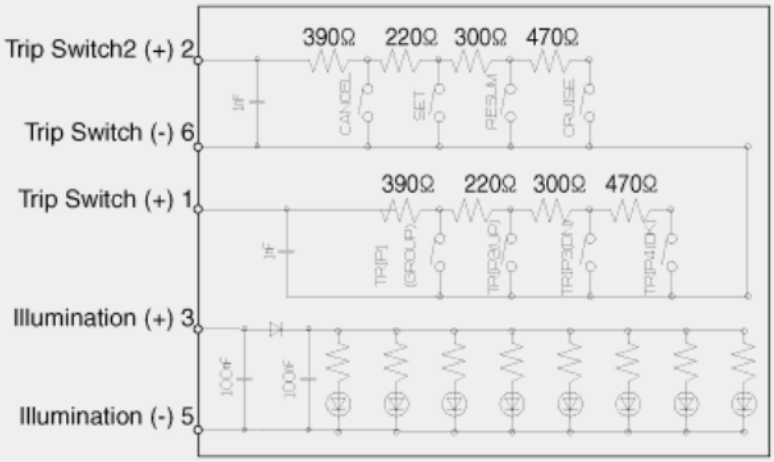


[Trip + ACC]

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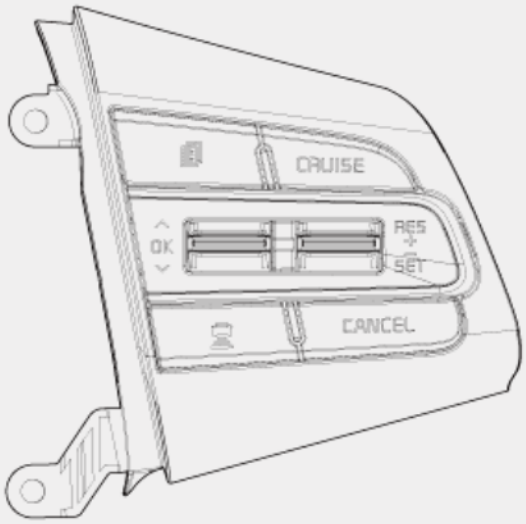


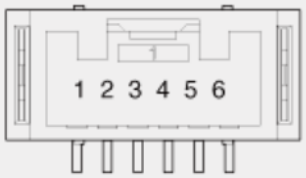
Connector	
	
No.	**Description**
1	Trip switch (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)

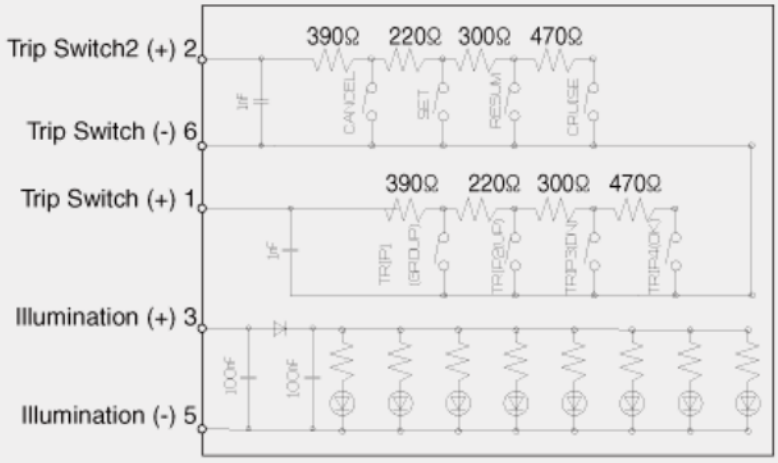


[Trip + ACC + SCC]

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Connector	
	
No.	**Description**
1	Trip switch (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)



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Cruise Control

The cruise control system is engaged by the cruise "ON/OFF" main switch located on the right-hand side of steering wheel column. The system has the capability to cruise, coast, accelerate and resume speed.

It also has a safety interrupt, engaged upon depressing brake or shifting select lever.

The ECM is the control module for this system. The main components of cruise control system are mode control switches, transmission range switch, brake switch, vehicle speed sensor, ECM and ETS motor that connect throttle body.

The ECM has a low speed limit that prevents system engagement below a minimum speed of 40km/h (25mph).

The operation of the controller is controlled by mode control switches located on steering wheel.

Transmission range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transmission. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

Cruise main switch (ON/OFF)

The cruise control system is engaged by pressing the cruise "ON/OFF" main switch. Pressing the cruise "ON/OFF" main switch again releases throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

Set/Coast switch (SET/–)

The "SET/–" switch located on right-hand side of steering wheel column, has two functions.

The set function - Push the "SET/–" switch and release it at the desired speed. The SET indicator light in the instrument cluster will illuminate. Release the accelerator pedal. The desired speed will automatically be maintained.

The coast function - Push the "SET/–" switch and hold it when the cruise control is on. The vehicle will gradually slow down. Release the switch at the desired speed. The desired speed will be maintained.

Push the "SET/–" switch and release it quickly. The cruising speed will decrease by 2.0km/h (1.2mph).

Resume/Accel switch (RES/+)

The "RES/+" switch located on right-hand side of steering wheel column, has two functions.

The resume function - If any method other than the cruise “ON/OFF” main switch was used to cancel cruising speed temporarily and the system is still activated, the most recent set speed will automatically resume when the "RES/+" switch is pushed. It will not resume, however, if the vehicle speed has dropped below approximately 40km/h (25mph).

The accel function - Push the "RES/+" switch and hold it when the cruise control is on. The vehicle will gradually accelerate. Release the switch at the desired speed. The desired speed will be maintained.

Push the "RES/+" switch and release it quickly. The cruising speed will increase by 2.0km/h (1.2mph).

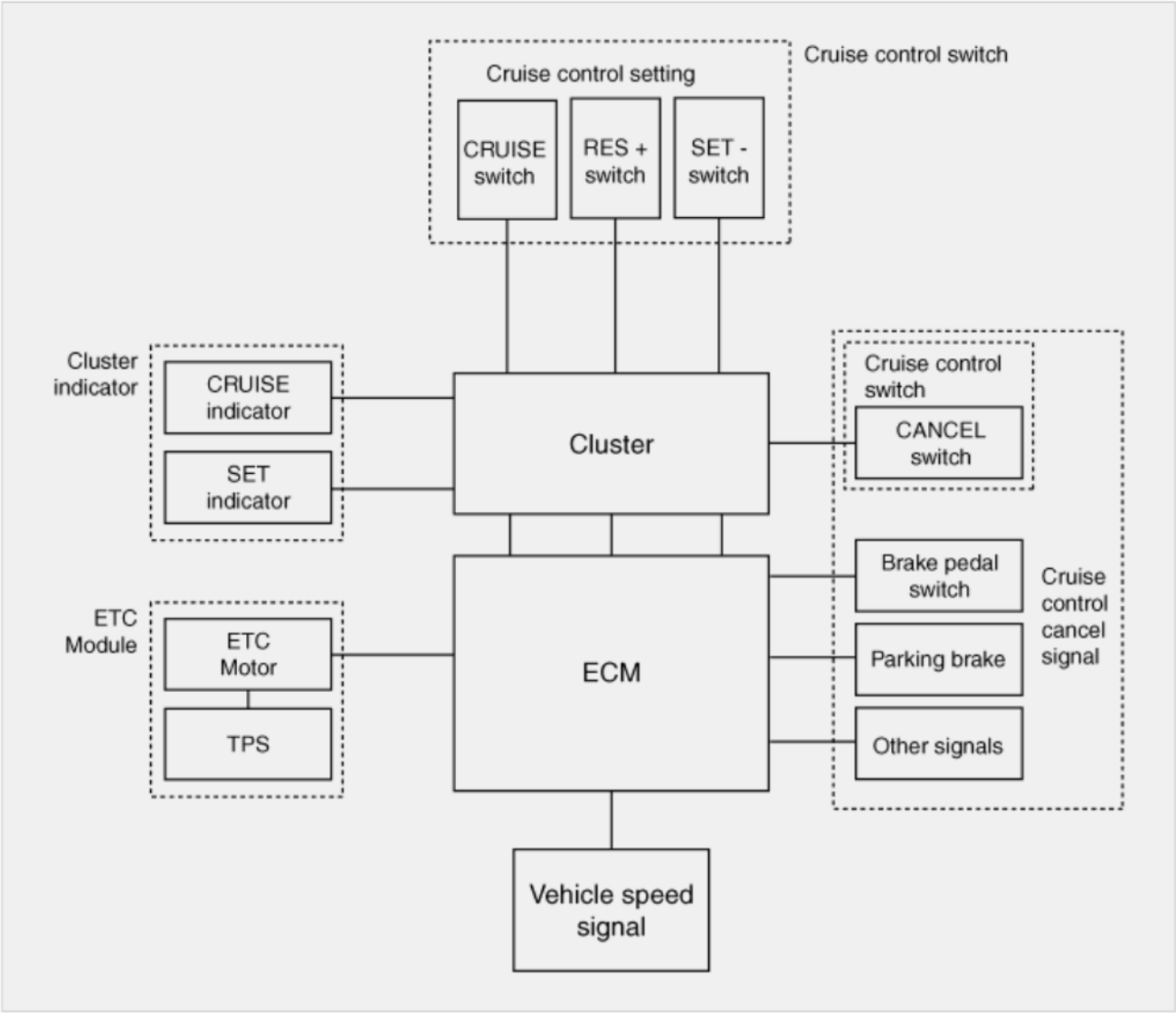
Cancel switch (CANCEL)

The cruise control system is temporarily disengaged by pushing the "CANCEL" switch.

Cruise speed canceled by this switch can be recovered by pushing the "RES/+" switch.

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System Block Diagram



Component Parts And Function Outline

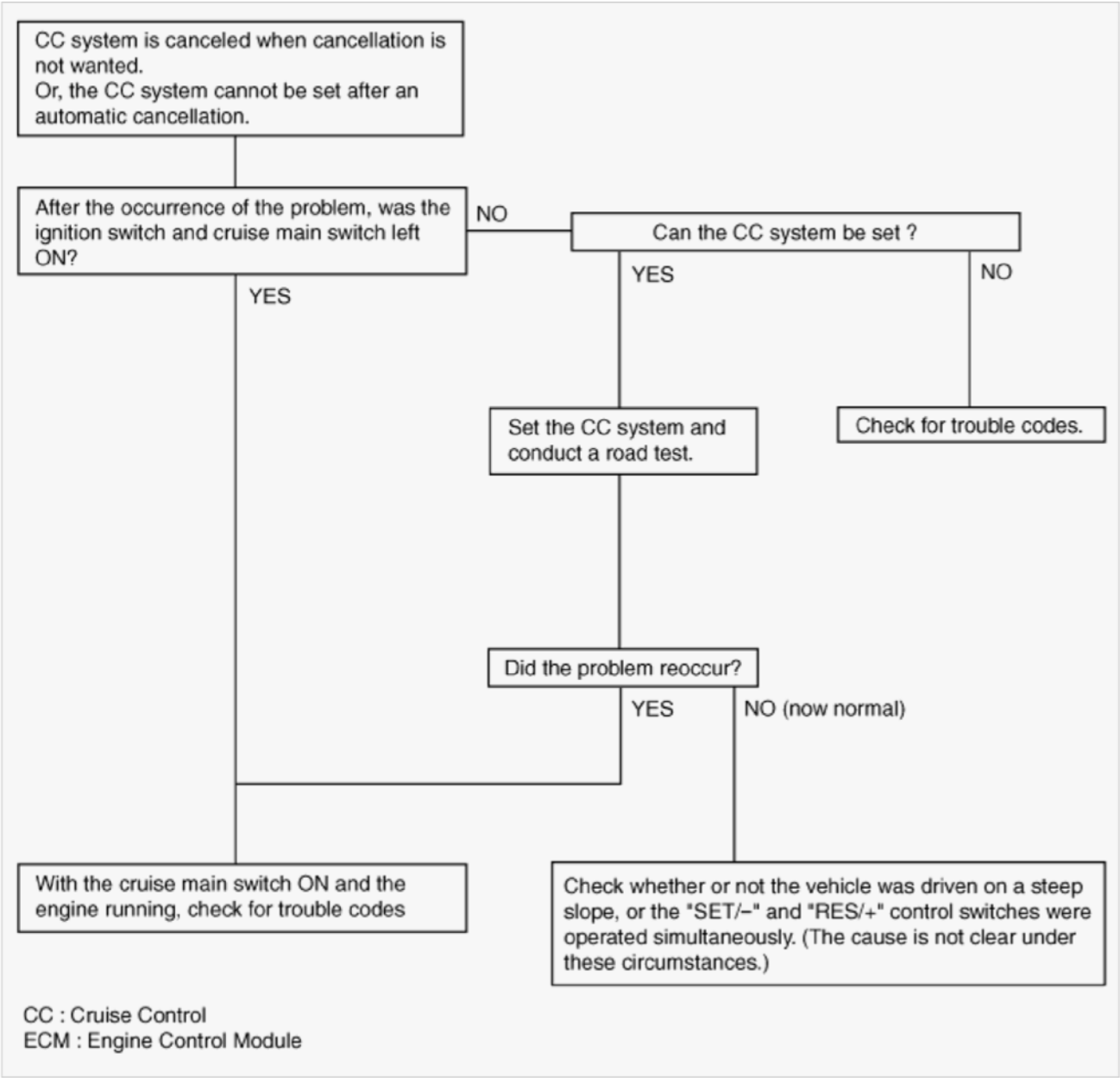
Component part		Function
Vehicle-speed sensor, ESP/ABS Control Module		Converts vehicle speed to pulse.
ECM		Receives signals from sensor and control switches.
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	CRUISE switch	Switch for automatic speed control power supply.
	RES+ switch	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	SET- switch	
Cancel switches	Cancel switch	Sends cancel signals to ECM.
	Brake-pedal switch	
	Transaxle range switch (A/T)	
ETC motor		Regulates the throttle valve to the set opening by ECM.

* ETC Motor : Electronic Throttle Control Motor

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Trouble Symptom Charts

Trouble Symptom 1



Trouble Symptom 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of ECM	Check input and output signals at ECM

Trouble Symptom 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the brake pedal switch	Repair the harness or replace the brake pedal switch
	Malfunction of the ECM signals	Check input and output signals at ECM

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Trouble Symptom 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed)	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace the inhibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the ECM signals	Check input and output signals at ECM

Trouble Symptom 5

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the "SET/–" switch	Temporary damaged or disconnected wiring of "SET/–" switch input circuit	Repair the harness or replace the "SET/–" switch
	Malfunction of the ECM signals	Check input and output signals at ECM

Trouble Symptom 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the "RES/+" switch	Damaged or disconnected wiring, or short circuit, or "RES/+" switch input circuit	Repair the harness or replace the "RES/+" switch
	Malfunction of the ECM signals	Check input and output signals at ECM

Trouble Symptom 7

Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM signals	Check input and output signals at ECM

Trouble Symptom 8

Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (although CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

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Description

Ignition timing is controlled by the electronic control ignition timing system.

The standard reference ignition timing data for the engine operating conditions are pre-programmed in the memory of the ECM (Engine Control Module).

The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM.

The ignition coil is activated, and timing is controlled.

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Description

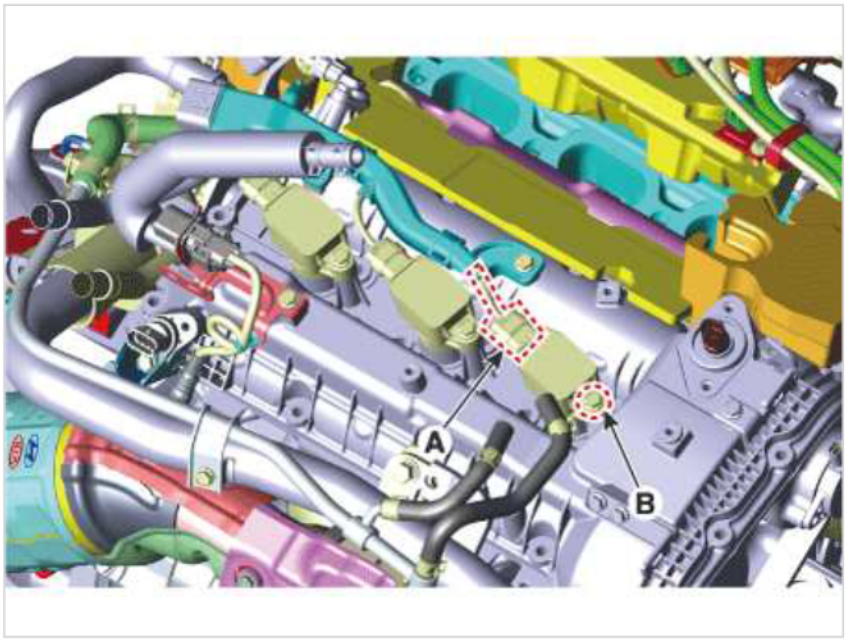
An ignition coil is an induction coil in an engine"s ignition system which transforms the battery"s low voltage to the high voltage needed to create an electric spark in the spark plugs to ignite the fuel. Coils have an internal resistor while others rely on a resistor wire or an external resistor to limit the current flowing into the coil from the battery 12 V supply.

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Removal

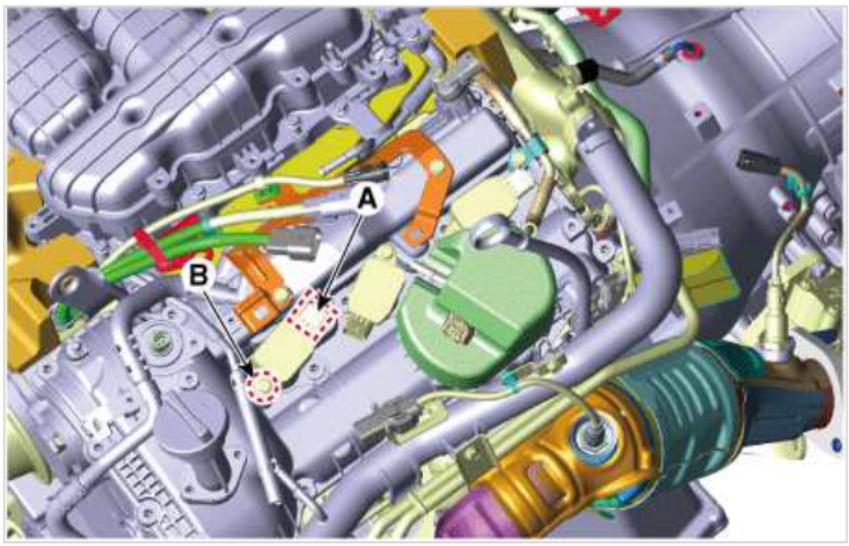
Ignition coil (Cylinder #1)

1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Remove the ETC moduel.
   (Refer to Engine Control / Fuel System - "ETC (Electronic Throttle Control) System")
3. Disconnect the ignition coil connector (A).
4. Remove the ignition coil after loosening the mounting bolt (B).



Ignition coil (Cylinder #2)

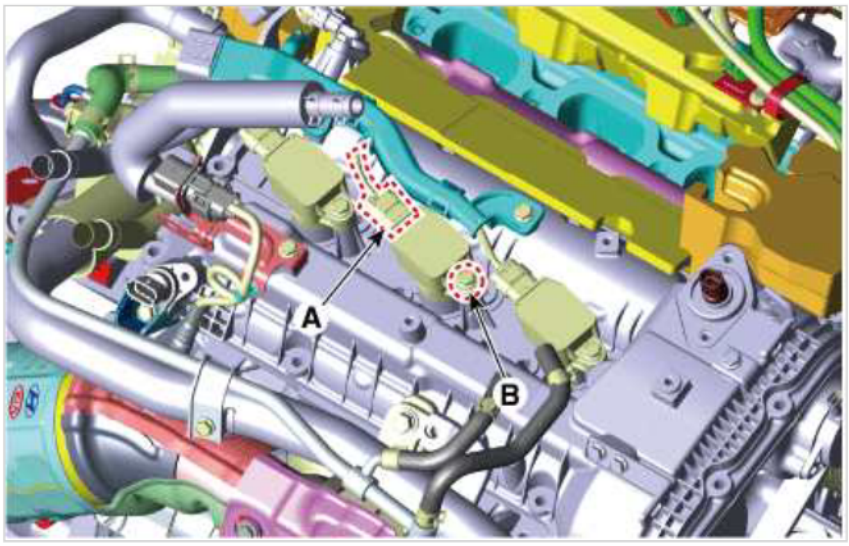
1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Disconnect the ignition coil connector (A).
3. Remove the ignition coil after loosening the mounting bolt (B).



Ignition coil (Cylinder #3)

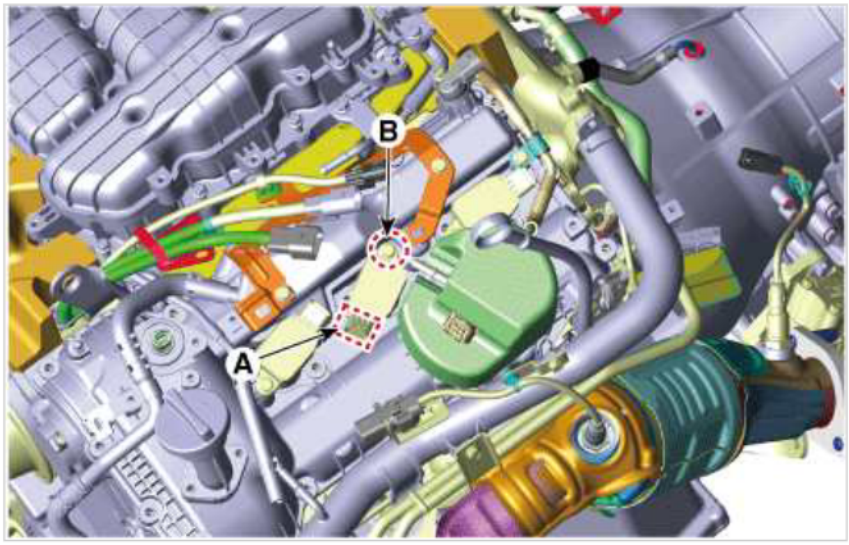
1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Remove the surge tank.
   (Refer to Engine Mechanical System - "Surge Tank")
3. Disconnect the ignition coil connector (A).
4. Remove the ignition coil after loosening the mounting bolt (B).

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Ignition coil (Cylinder #4)

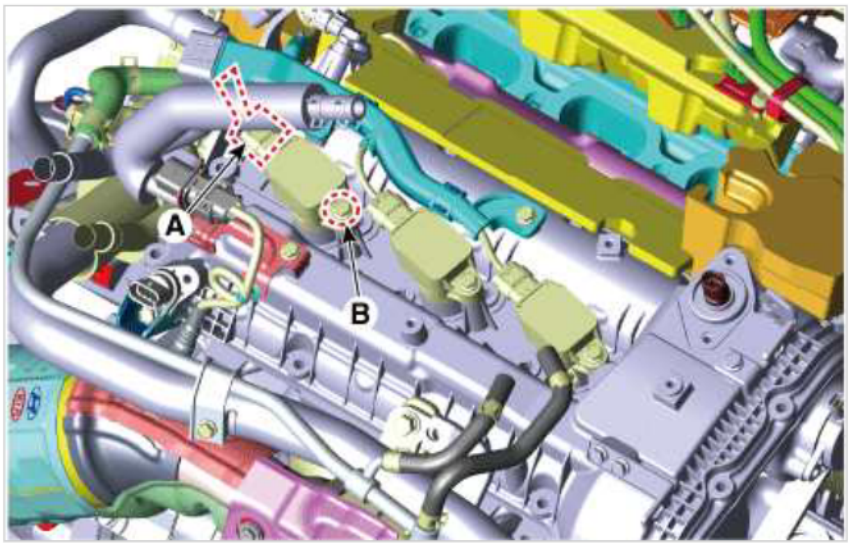
1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Disconnect the ignition coil connector (A).
3. Remove the ignition coil after loosening the mounting bolt (B).



Ignition coil (Cylinder #5)

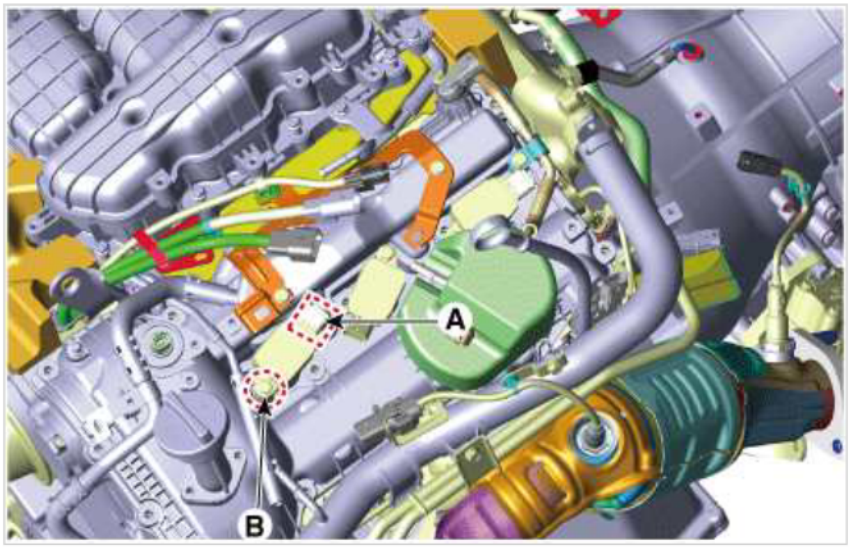
1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Remove the surge tank.
   (Refer to Engine Mechanical System - "Surge Tank")
3. Disconnect the ignition coil connector (A).
4. Remove the ignition coil after loosening the mounting bolt (B).

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Ignition coil (Cylinder #6)

1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Disconnect the ignition coil connector (A).
3. Remove the ignition coil after loosening the mounting bolt (B).



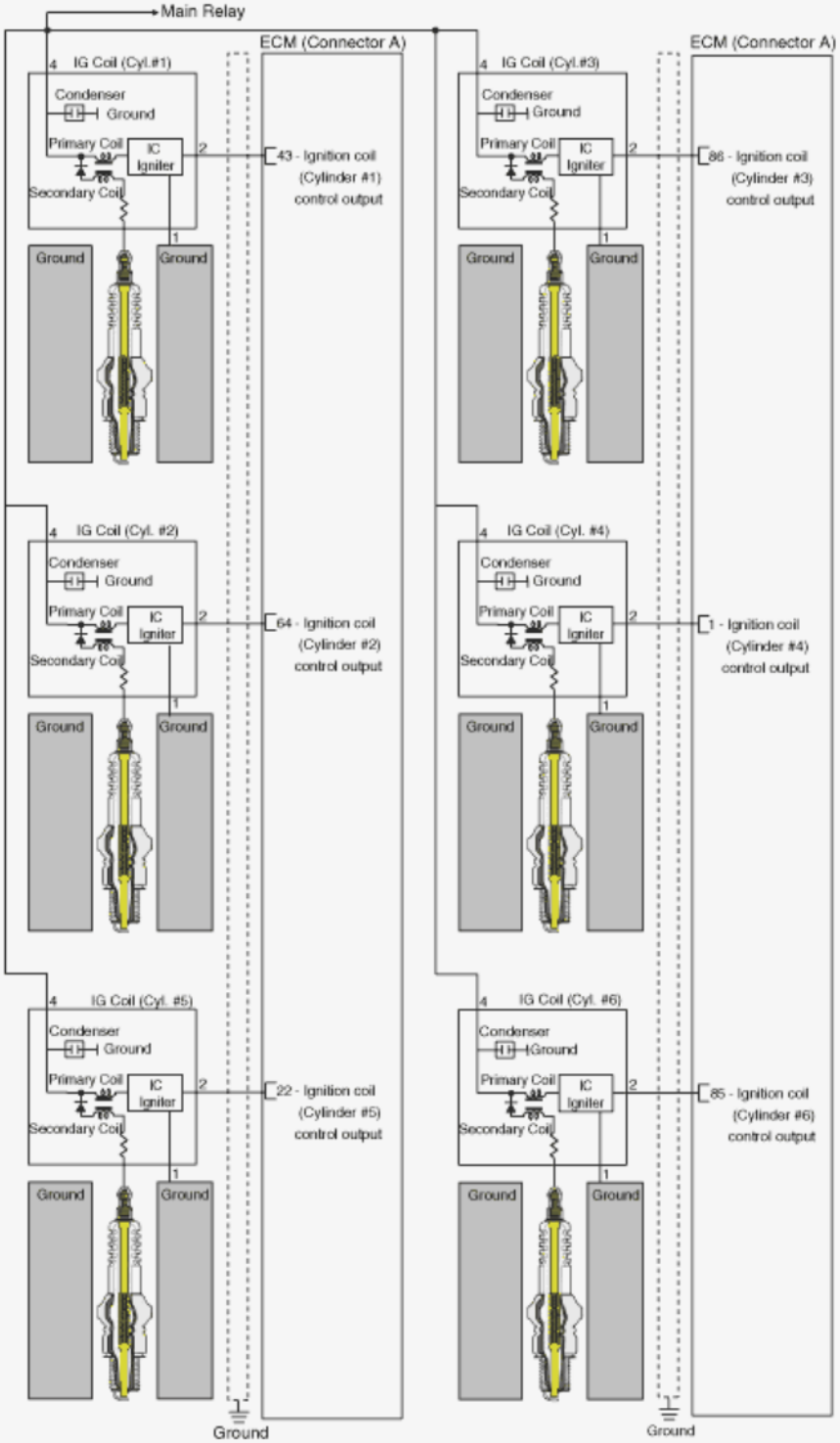
Installation

1. Install in the reverse order of removal.

Ignition coil mounting bolt:
9.8 - 11.8 N·m (1.0 - 1.2 kgf·m, 7.2 - 8.7 lb·ft)

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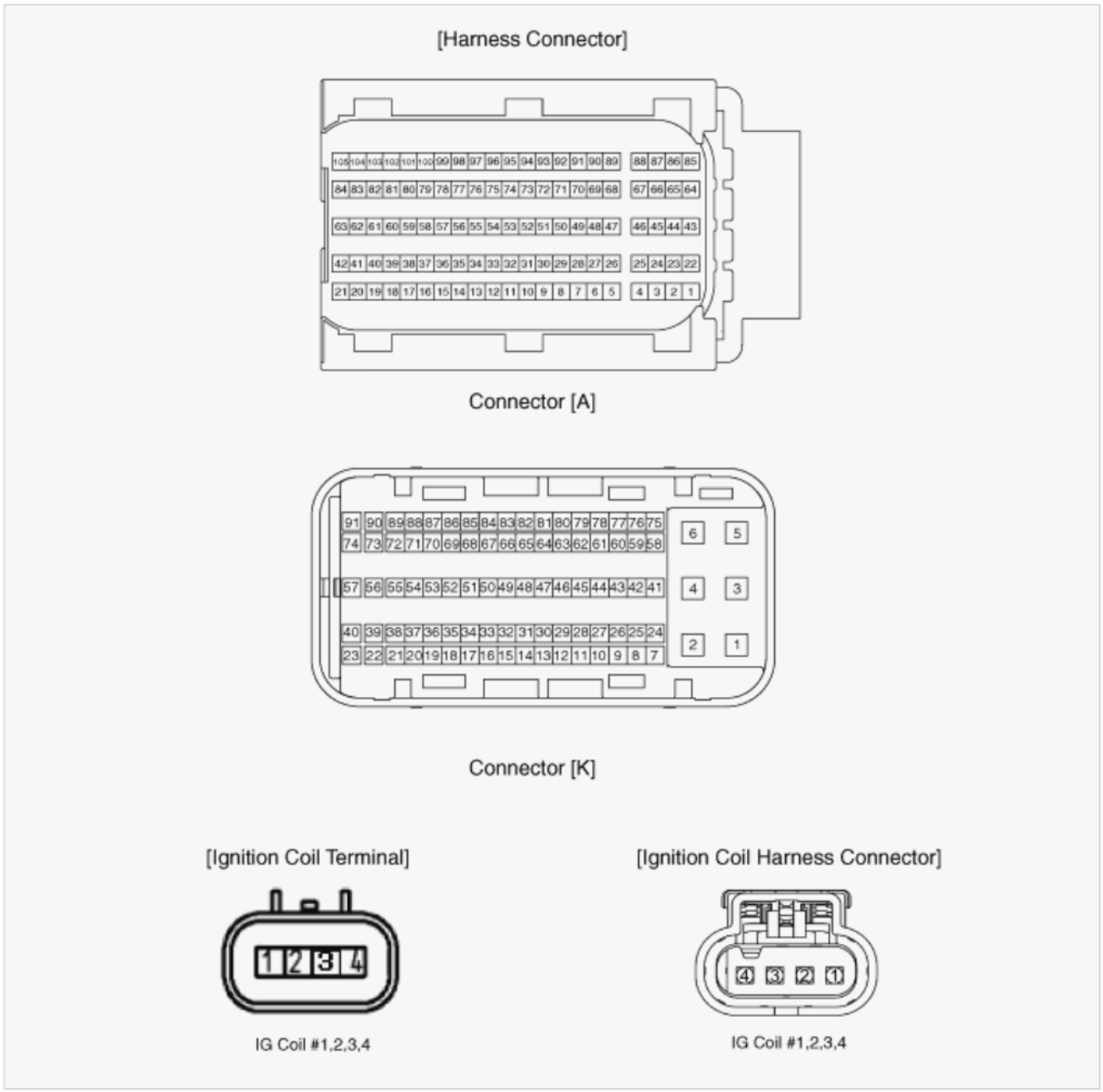
Circuit Diagram



Ignition Coil Connector Terminal Function

Connector View

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Ignition Coil Terminal Function

Ignition Coil #1 (Cylinder #1)

Pin No.	Description	Connected to
1	Chassis	Chassis
2	Ignition Coil #1 Control	ECM Connector [A] (43)
3	-	
4	Battery Power (B+)	Main Relay

Ignition Coil #2 (Cylinder #2)

Pin No.	Description	Connected to
1	Chassis	Chassis
2	Ignition Coil #2 Control	ECM Connector [A] (64)
3	-	
4	Battery Power (B+)	Main Relay

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Ignition Coil #3 (Cylinder #3)

Pin No.	Description	Connected to
1	Chassis	Chassis
2	Ignition Coil #3 Control	ECM Connector[A] (86)
3	-	
4	Battery Power (B+)	Main Relay

Ignition Coil #4 (Cylinder #4)

Pin No.	Description	Connected to
1	Chassis	Chassis
2	Ignition Coil #4 Control	ECM Connector [A] (1)
3	-	
4	Battery Power (B+)	Main Relay

Ignition Coil #5 (Cylinder #5)

Pin No.	Description	Connected to
1	Chassis	Chassis
2	Ignition Coil #5 Control	ECM Connector [A] (22)
3	-	
4	Battery Power (B+)	Main Relay

Ignition Coil #6 (Cylinder #6)

Pin No.	Description	Connected to
1	Chassis	Chassis
2	Ignition Coil #6 Control	ECM Connector [A] (85)
3	-	
4	Battery Power (B+)	Main Relay

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Specification

Item	Specification
Rated Voltage (V)	14
Operating Voltage (V)	4 - 16

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On-vehicle Inspection

Inspect ignition coil assembly and Perform spark test

1. Check for DTCs.

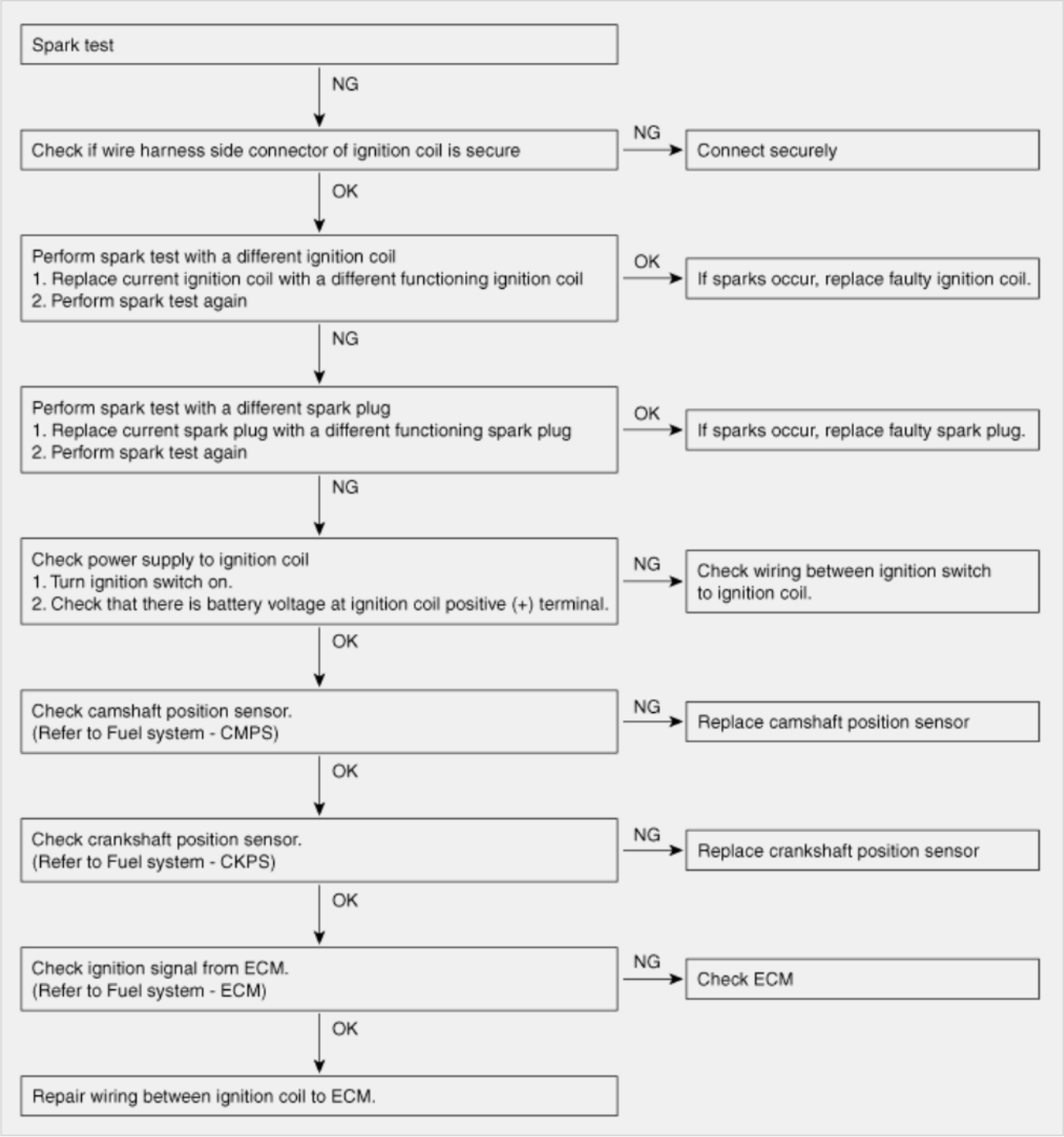
> **NOTICE**
> - If a DTC is present, perform troubleshooting in accordance with the procedure for that DTC. (Refer to DTC guide)

2. Check if sparks occur.
   (1) Remove the engine cover.
   (2) Remove the ignition coils.
   (Refer to Engine Electrical System - "Ignition Coil")
   (3) Using a spark plug wrench, remove the spark plugs.
   (4) Disconnect the 6 injector extention connectors.
   (5) Ground the spark plug to the engine.
   (6) Check if sparks occur at each spark plug while engine is being cranked.

> **NOTICE**
> - Do not crank the engine for more then 5 seconds.

3. If sparks do not occur, perform the following test.

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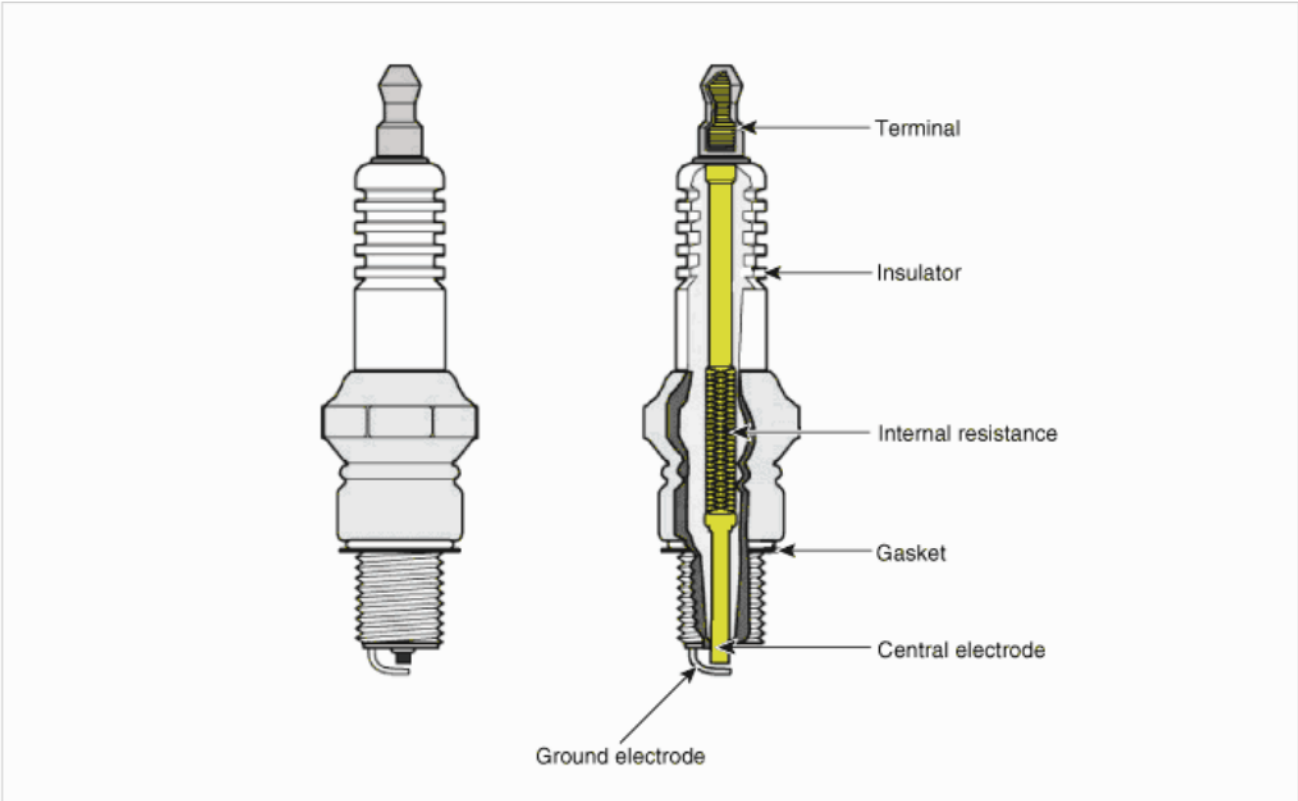
4. Using a spark plug wrench, install spark plugs.
5. Install the ignition coils.
6. Install the engine cover.

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Description

A spark plug is a device for delivering electric current from an ignition system to the combustion chamber of a spark-ignition engine to ignite the compressed fuel/air mixture therein by means of an electric spark, while containing combustion pressure within the engine. A spark plug has a metal threaded shell, electrically isolated from a central electrode by a porcelain insulator.





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Inspection

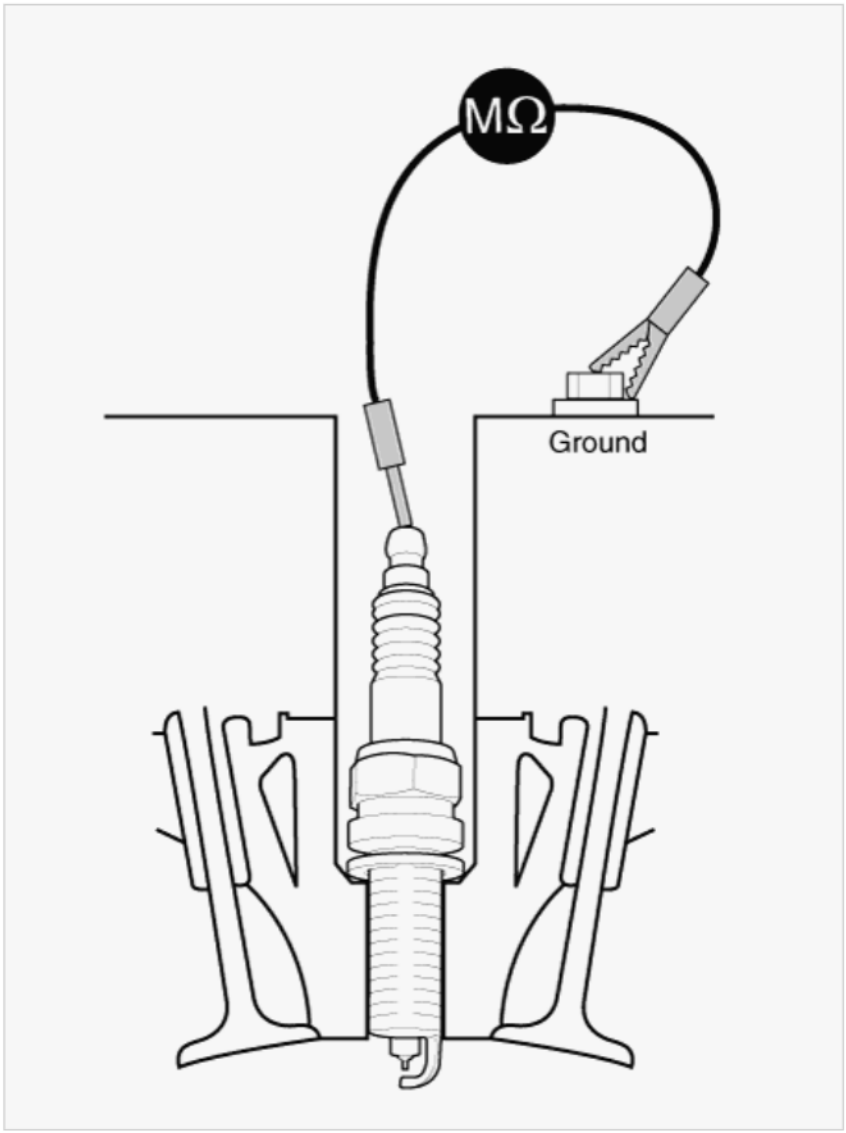
[On vehicle inspection]

1. Accelerate the engine to about 3,000 rpm 3 times or more.
2. Remove the spark plug.
3. Check the spark plug visually.
   If the electrode is dry, the spark plug is normal.
   If the electrode is wet, check for damage and inspect the electrode gap as follows.

[Component Inspection]

1. Check the spark plug for any damage on its thread and insulator.
   If there is damage, replace the spark plug.
2. Check the electrode. Measure the insulation resistance with an ohmmeter.
   If the resistance is less than the specified value, adjust the electrode gap.

Specification: 10 MΩ or more



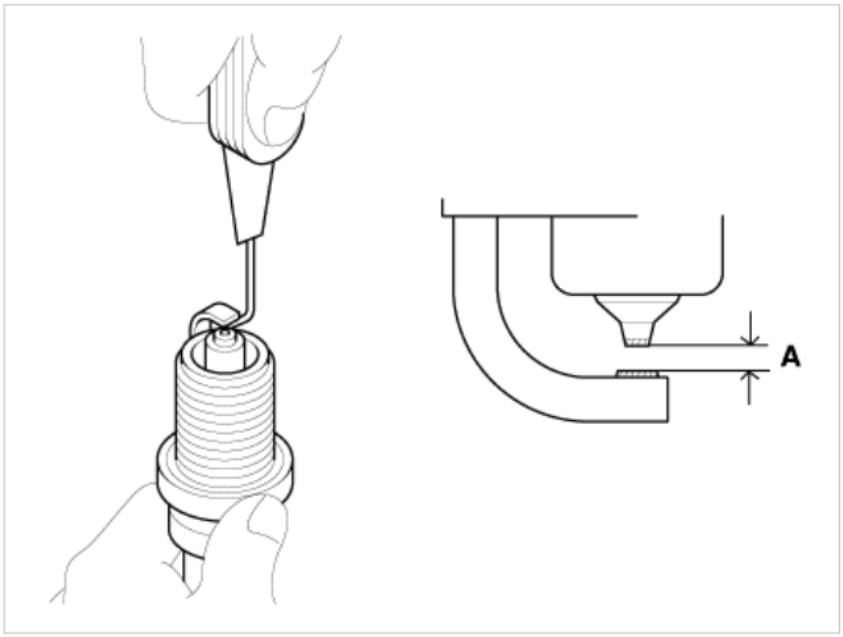
3. Check the spark plug electrode gap.
   If the gap is greater than the maximum, replace the spark plug.

Specification: 0.8 - 0.9 mm (0.0314 - 0.0354 in.)

NOTICE

- When adjusting the gap of a new spark plug, bend only the base of the ground electrode. Do not touch the tip.
  Never attempt to adjust the gap on a used plug.

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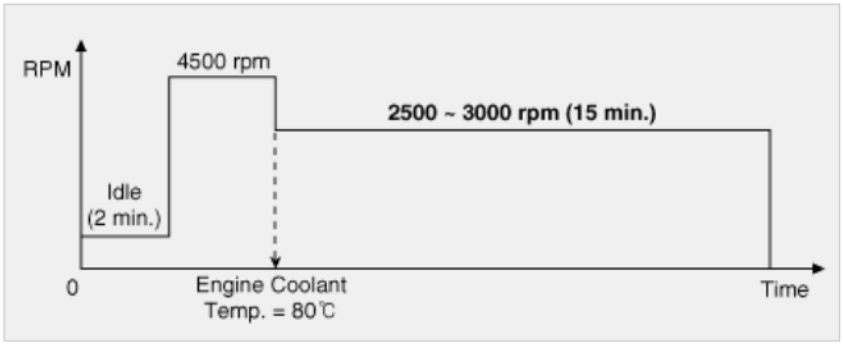


Cleaning

The combustion temporarily becomes unstable, due to the aged fuel and the carbon deposits accumulated on the spark plug(s) after long-term storage.

[1st Method]

1. Start the engine and keep the engine running at idle for 2 minutes.
2. Step on the accelerator pedal and hold it steady at 4500 rpm with the shift lever in N position to warm up the engine until the temperature of the engine coolant reaches 80°C.
3. Keep the engine running at 2500 - 3000 rpm in the N position for 15 minutes.



[2nd Method]

NOTICE

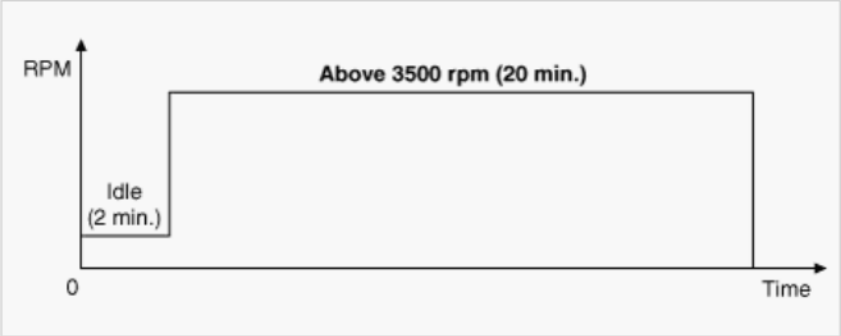
- The 2nd method should be performed only if the 1st method fails (the misfire-related codes recur).

1. Start the engine and keep the engine running at idle for 2 minutes.
2. Drive the vehicle for over 20 minutes, keeping the engine speed above 3500 rpm.

NOTICE

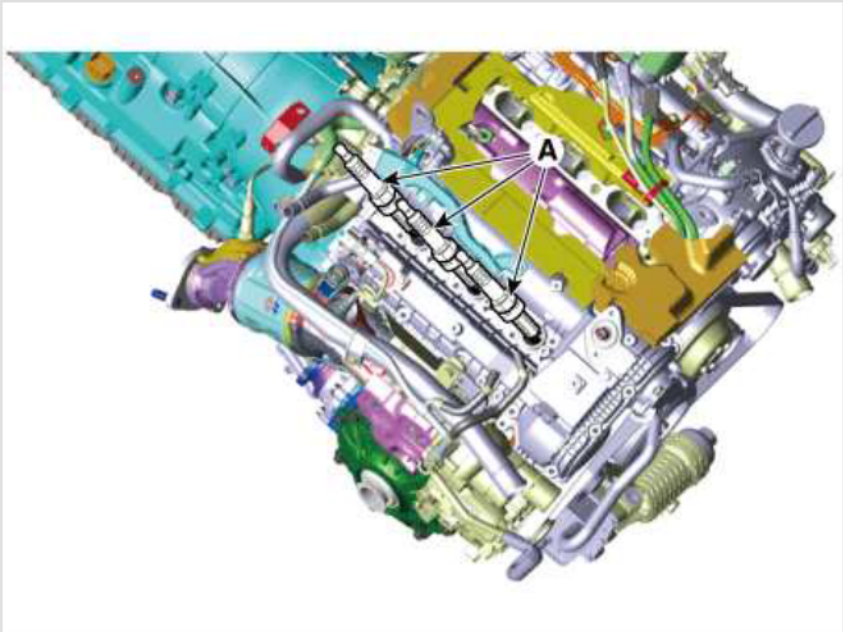
- If equipped with manual transaxle, shift the gear properly for keeping the engine speed above 3500 rpm.

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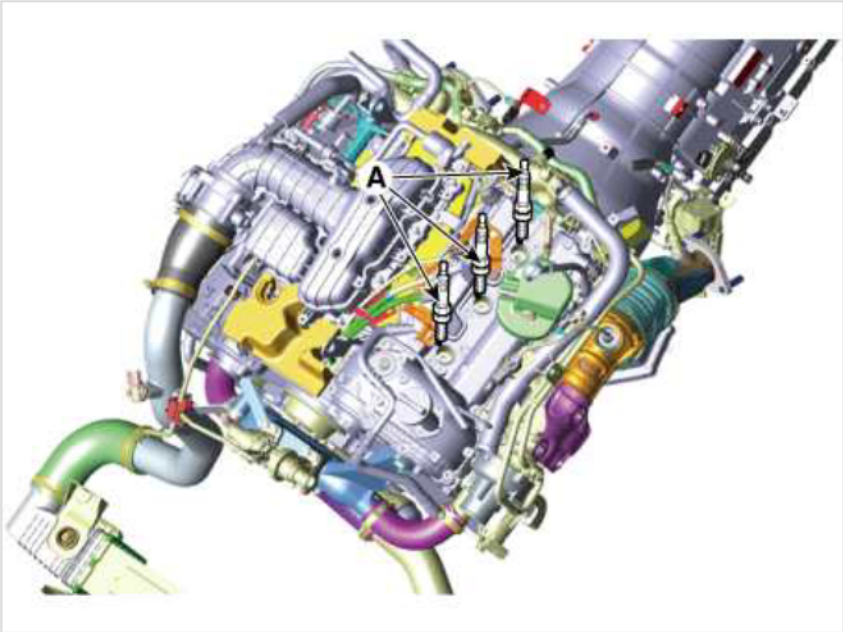


Removal

1. Remove the ignition coil.
   (Refer to Engine Electrical System - "Ignition Coil")
2. Using a spark plug wrench, remove the spark plug (A).
   [Bank 1]



[Bank 2]



Installation

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1. Install in the reverse order of removal.

Spark Plug:
19.6 - 29.4 N·m (2.0 - 3.0 kgf·m, 14.5 - 21.7 lb·ft)

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Specification

Item	Specification
Type	SILZKR7A9G
Gap	0.8 - 0.9 mm (0.0314 - 0.0354 in.)
Insulation resistance (MΩ)	10 or more

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Troubleshooting

Trouble symptom	Probable cause	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch	Inspect ignition lock switch, or replace as required
	Ignition coil	Inspect ignition coil, or replace as required
	Spark plugs	Inspect spark plugs, or replace as required
	Ignition wiring disconnected or broken	Repair wiring, or replace as required
Rough idle or stalls	Ignition wiring	Repair wiring, or replace as required
	Ignition coil	Inspect ignition coil, or replace as required
Engine hesitates/poor acceleration	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required
	Ignition wiring	Repair wiring, or replace as required
Poor mileage	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required

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Service Data

Ignition System

Ignition Coil

Item	Specification
Rated Voltage (V)	14
Operating Voltage (V)	4 - 16

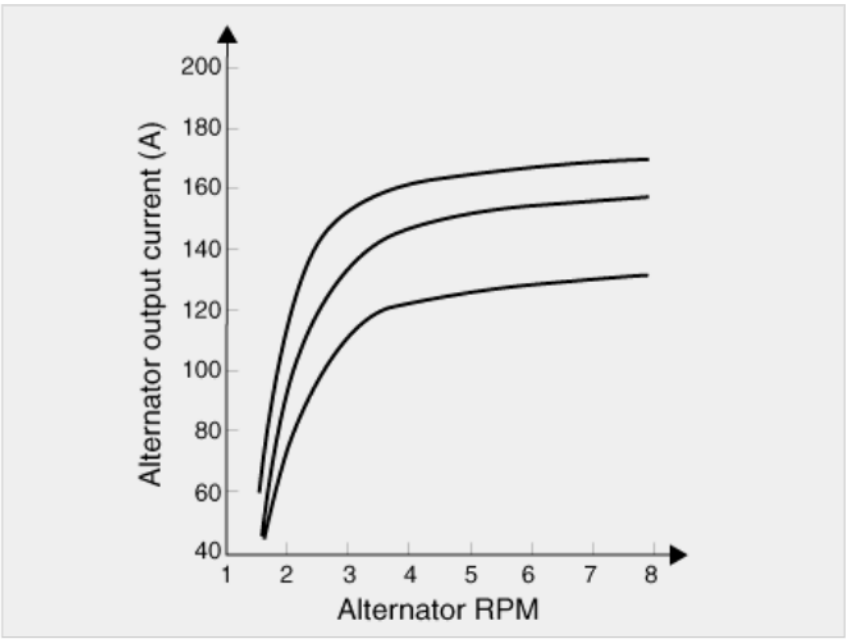
Spark plug

Item	Specification
Type	SILZKR7A9G
Gap	0.8 - 0.9 mm (0.0314 - 0.0354 in.)
Insulation resistance (MΩ)	10 or more

Charging System

Alternator

Item	Specification	
Rated voltage	13.5V , 180A	
Speed in use	0 - 18,000rpm	
Voltage regulator	IC Regulator built in type	
Default regulated voltage (V)	Regulator (external mode)	10.6 - 16
	Regulator (internal mode)	14.2 - 14.8
Pin	1	



Battery

▷AGM90L-DIN

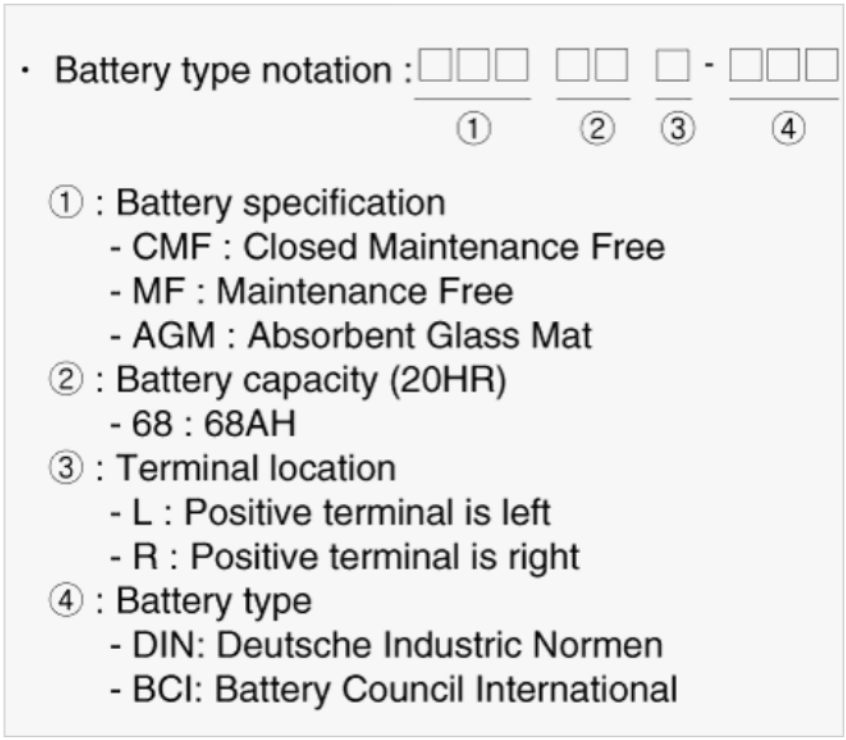
Item	Specification
Model type	AGM90L-DIN
Capacity [20HR/5HR] (AH)	90/72
Cold Cranking Amperage (A)	850 (SAE) / 850 (EN)
Reserve Capacity (Min)	160

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Specific Gravity	1.28 - 1.34 [25°C (77°F)]

Information

• Model type description



• Cold Cranking Ampere (CCA): A rating used in the battery industry to define a battery"s ability to start an engine in cold temperatures.

– The maximum current that a fully charged battery can deliver at -18 °C (-0.4 °F) for 30 seconds while maintaining a voltage of at least 7.2 volts for a 12-volt battery.

– The higher the CCA rating, the greater the starting power of the battery.

• RESERVE CAPACITY (RC): A battery industry rating that defines the battery"s ability to power a vehicle with an inoperative alternator or fan belt.

– The rating is the number of minutes a battery at 26.7 °C(80 °F) can be discharged at 25 amps and maintain a voltage of 10.5 volts for a 12 volt battery.

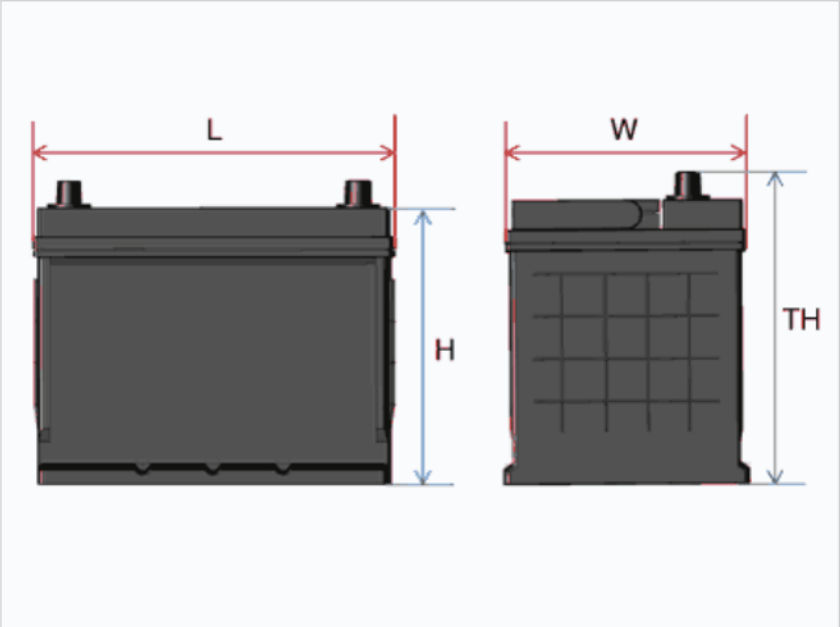
– The higher the reserve rating, the longer your vehicle can operate should your alternator or fan belt fail.

Information

BCI Type

Capacity (5HR/20HR)	Length	Width	Height	Total Height
	L (mm)	W (mm)	T (mm)	TH (mm)
28/35	188 - 192	126 - 130	198 - 202	218 - 222
32/40	194 - 198	133 - 137	199 - 203	223 - 227
36/45	203 - 207	173 - 177	200 - 204	221 - 225
44/55	213 - 217	173 - 177	198 - 202	218 - 222
48/60	228 - 232	173 - 177	200 - 204	221 - 225
54/68	258 - 262	173 - 177	198 - 202	220 - 224
56/70	258 - 262	173 - 177	198 - 202	223 - 227
64/80	274 - 278	170 - 174	198 - 202	221 - 225
70/88	349 - 353	172 - 176	186 - 200	183 - 187
72/90	300 - 304	170 - 174	200 - 204	221 - 225
76/95	294 - 298	172 - 176	198 - 202	220 - 224
80/100	326 - 330	170 - 174	203 - 207	225 - 229

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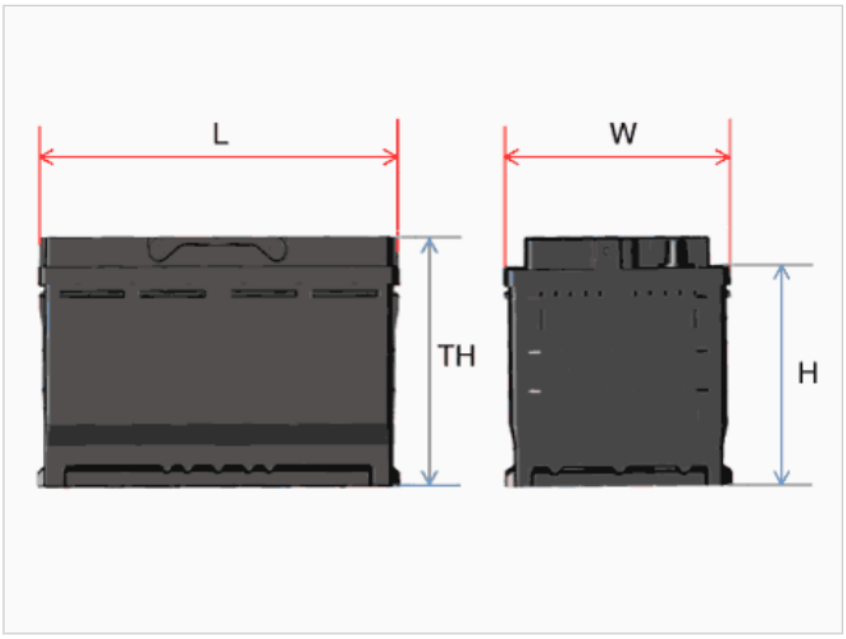
DIN Type

Capacity (5HR/20HR)	Length	Width	Height	Total Height
	L (mm)	W (mm)	T (mm)	TH (mm)
36/45	205 - 207	173 - 175	164 - 168	188 - 190
48/60	205 - 207	173 - 175	164 - 168	188 - 190
54/68	205 - 207	173 - 175	164 - 168	188 - 190
64/80	205 - 207	173 - 175	164 - 168	188 - 190
72/90	205 - 207	173 - 175	164 - 168	188 - 190
80/100	205 - 207	173 - 175	164 - 168	188 - 190
88/110	205 - 207	173 - 175	164 - 168	188 - 190

AGM DIN Type

Capacity (5HR/20HR)	Length	Width	Height	Total Height
	L (mm)	W (mm)	T (mm)	TH (mm)
40/50	205 - 207	173 - 175	164 - 168	188 - 190
48/60	227 - 229	173 - 175	164 - 168	188 - 190
56/70	276 - 278	173 - 175	164 - 168	188 - 190
64/80	312 - 314	173 - 175	164 - 168	188 - 190
72/90	351 - 353	173 - 175	164 - 168	188 - 190
84/105	392 - 394	173 - 175	164 - 168	188 - 190

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Starting System

Starter

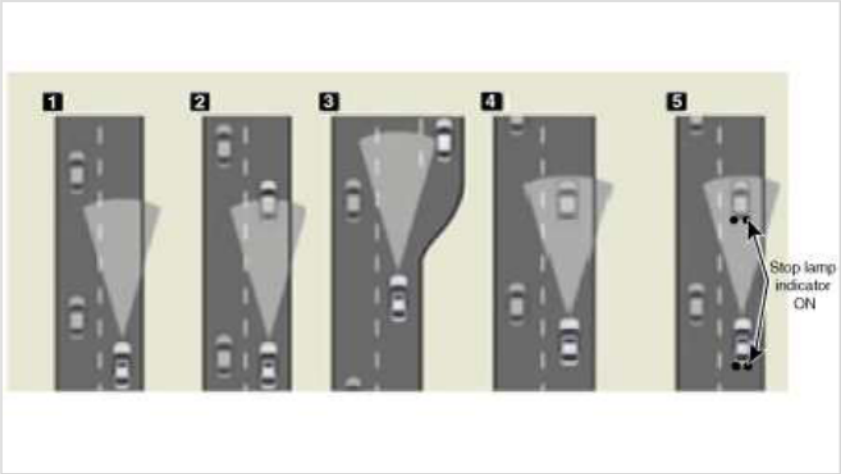
Item		Specification
Rated voltage		12 V, 2.0 kW
The number of pinion teeth		12
Performance [No-load, 11 V]	Ampere	Max. 135 A
	Speed	Min. 3,200 rpm

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Description

The smart cruise control system allows a driver to program the vehicle to control the speed and following distance by detecting the vehicle ahead without depressing the brake pedal or the accelerator pedal.

1. Cruise speed control: The vehicle maintains the selected speed if there are no vehicles ahead.
2. Retardation control: The vehicle decelerates if a vehicle ahead is detected.
3. Following distance control: The vehicle maintains the selected following distance.
4. Acceleration control: The vehicle accelerates to the selected speed if a vehicle ahead is not detected.
5. Congested area control : In traffic, your vehicle will stop if the vehicle ahead of you stops. Also, if the vehicle ahead of you starts moving, your vehicle will start as well. However, if the vehicle stops for more than 3 seconds, you must depress the accelerator pedal or push the RES+ switch to start driving.

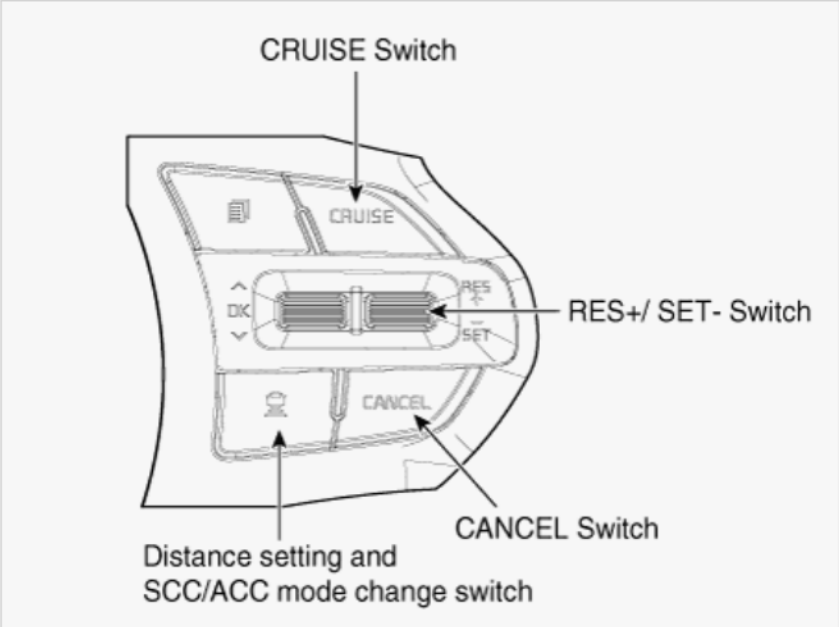


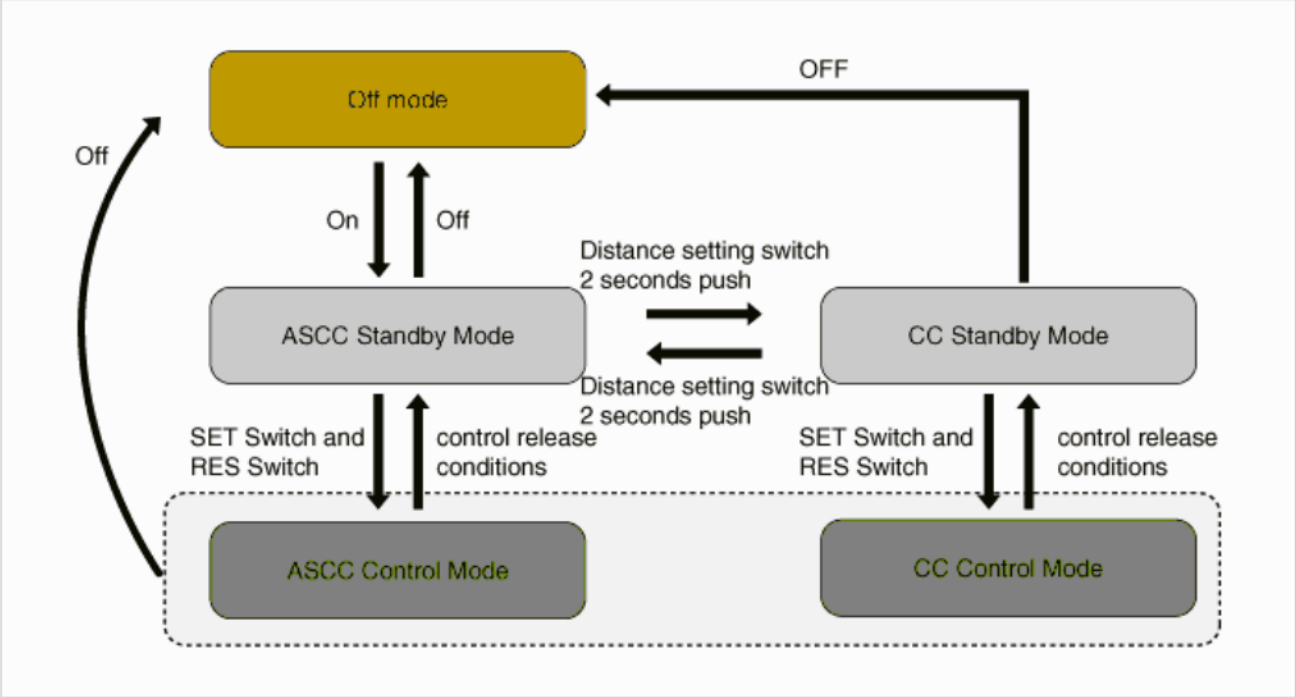
6. Control on curves
   (1) The sensor may not detect a vehicle ahead or may detect a vehicle on other lanes because the detection range of the sensor is limited.
   (2) On curves, if the vehicle equipped with the SCC is driving at high speed, the vehicle can slip outside. Therefore reduce the speed on curves even if there is no vehicle ahead.
   (3) If a vehicle ahead enters on curve while following a vehicle on a straight road, the vehicle equipped with the SCC may accelerate to keep the following distance.
   (4) At curve road, ikf a front vehicle dissapears, the vehicle does not accelerate to the designated speed. It maintains previos speed to prevent repetitive acceleration/deceleration. (If driver changes the lane or pushes the accelerator pedal, then the vehicle acceleartes)
7. Warning alarm
   If the vehicle equipped the SCC decelerates because a vehicle ahead decelerates or moves into your lane, the warning will operate.
   (1) In case that the vehicle equipped with SCC is able to decelerate properly by the system – No warning
   (2) In case that the vehicle equipped with SCC is not able to decelerate properly by the system
      – LCD Display in the cluster will blink and the warning buzzer will sound. (The warning and deceleration by the system will go on until the brake pedal is applied.)
   (3) If the vehicle ahead (vehicle speed: less than 30km/h) disappears to the next lane while controlling following distance, the warning chime will sound and a message will appear. Adjust your vehicle speed for vehicles or objects that can suddenly appear in front of you.
8. Accelerating by driver
   Even when the vehicle is being decelerated by the SCC system, the vehicle can be accelerated by applying the accelerator pedal. When the SCC system is on and driver depresses the accelerator pedal, the LCD display in the cluster will blink.

NOTICE

• Smart cruise control operating conditions

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– Vehicle speed at approximately 30 - 200km/h (18.6mph - 124.2mph) : When there is no vehicle in front
Vehicle speed at approximately 0 - 200km/h (0mph - 124.2mph) : When there is a vehicle in front
– Transmission in D or Sports mode
– "ESP OFF" switch OFF
– "CRUISE" switch ON

Under the above conditions, activate the cruise system using the "SET/–" or "RES/+" switch.

• Smart cruise control disabling conditions
– "CRUISE" switch OFF
– "CANCEL" switch ON
– Brake pedal applied
– Driver's door opened
– Vehicle speed at more than approximately 200km/h (124.2mph)
– Transmission in N or P or R
– ESP/ TCS / ABS operating
– An accelerator pedal applied for more than 300 sec
– ESP OFF" switch ON (ESP OFF indicator ON)
– Parking brake applied
–

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System failure (The warning indicator ON)

– Crack, damage or wrong installation of smart cruise control unit cover (The warning indicator ON)

– Yaw rate sensor offset compensation incomplete

9. Function of cruise control

The driver may choose to only use the cruise control mode (speed control function) by doing as follows:

When the Smart Cruise Control system is on (SCC Standby mode), push the distance to distance switch for more than 2 seconds. "Smart cruise control (SCC) mode" and "Cruise control (CC) mode" can be selected. The speed control of the cruise control mode is the same as that of the smart cruise control mode.

When using the cruise control mode, the driver must manually access the distance to other vehicles as the system will not automatically brake to slow down for other vehicles.

Cruise main switch (CRUISE)

The smart cruise control system is engaged by pressing the cruise "ON/OFF" main switch.

Set/Coast switch (SET/–)

The "SET/–" switch located on the right-hand side of steering wheel column has two functions.

The set function - Push the "SET/–" switch and release it at the desired speed. Release the accelerator pedal. The desired speed will automatically be maintained.

At low speed of 10 - 180km/h (6mph - 111.8mph), there should be a vehicle in front of driver’s vehicle. The target speed is set to 30km/h (20mph).

The coast function - Push the "SET/–" switch and hold it when the smart cruise control is on. The vehicle will gradually slow down. Release the switch at the desired speed.

The desired speed will be maintained. Push the "SET/–" switch and release it quickly.

When pushing and releasing the "SET/-" switch quickly, the cruising speed will decrease by 1.0 mph. Also, when pushing and holding the "SET/-" switch, the cruise speed will decrease by 5.0 mph.

NOTICE

If the vehicle speed is above the set speed by applying the accelerator pedal, the vehicle speed will be the set speed.

Resume/Accel switch (RES/+)

The "RES/+" switch located on the right-hand side of steering wheel column has two functions.

The resume function - If any method other than the cruise “ON/OFF” main switch was used to cancel cruising speed temporarily and the system is still activated, the most recent set speed will automatically resume when the "RES/+" switch is pushed.

The accel function - Push the "RES/+" switch and hold it when the smart cruise control is on. The vehicle will gradually accelerate. Release the switch at the desired speed. The desired speed will be maintained.

When pushing and releasing the "SET/+" switch quickly, the cruising speed will increase by 1.0 mph. Also, when pushing and holding the "RES/+" switch, the cruising speed will increase by 5.0 mph.

Cancel switch (CANCEL)

The cruise control system is temporarily disengaged by pushing the "CANCEL" switch.

Following distance control switch

This system assists you to set the distance from the vehicle ahead and maintain the selected following distance even when you do not push the accelerator or the brake pedal.

Select the appropriate following distance according to road conditions and vehicle speed.

Each time the button is pressed, the following distance changes as follows:

e.g., Distance 4 → Distance 3 → Distance 2 → Distance 1 → Distance 4

If you drive at 90 km/h (55.9 mph), the following distance maintains as follows:

Distance 4 - approximately 52.5m (172.2ft)

Distance 3 - approximately 40m (131.2ft)

Distance 2 - approximately 30m (98.4ft)

Distance 1 - approximately 25m (82.0ft)

The following distance of each stage is changed according to the speed of the vehicle ahead.

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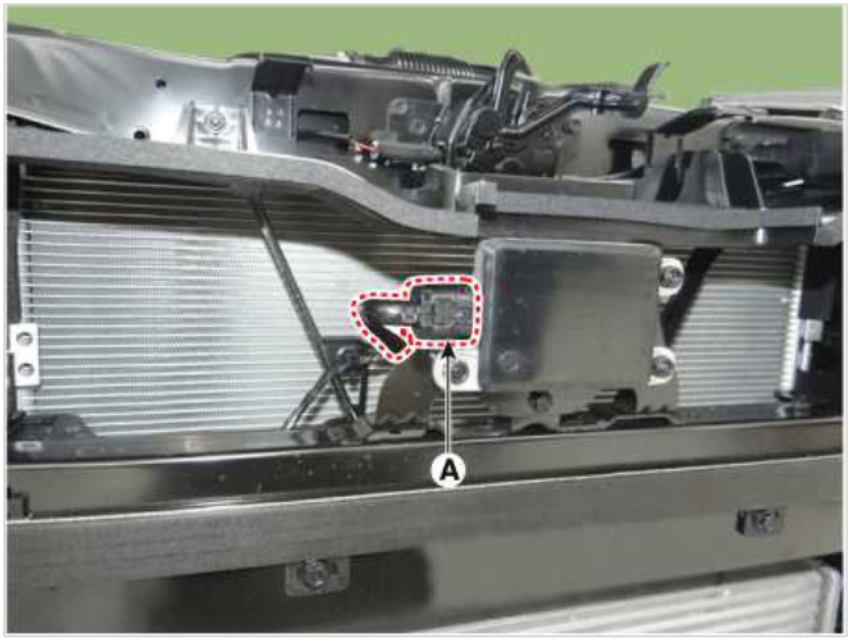
Description

The smart cruise control unit is installed on the front right-hand side of the chassis. A radar sensor is embedded in the front section of the unit. This sensor detects vehicles and objects in front of the vehicle. The radar sensor can detect up to 64 objects ahead of the vehicle. The alarm goes off when the vehicle deviates from the horizontal and vertical alignment reference points during operation. This sensor communicates with the dashboard, warning buzzer, smart cruise control switch, Electronic Stability Program (ESP), ECM, and TCM via CAN communication. The sensor controls vehicle speed through CAN communication between the Electronic Stability Program (ESP) system and the ECM and TCM.

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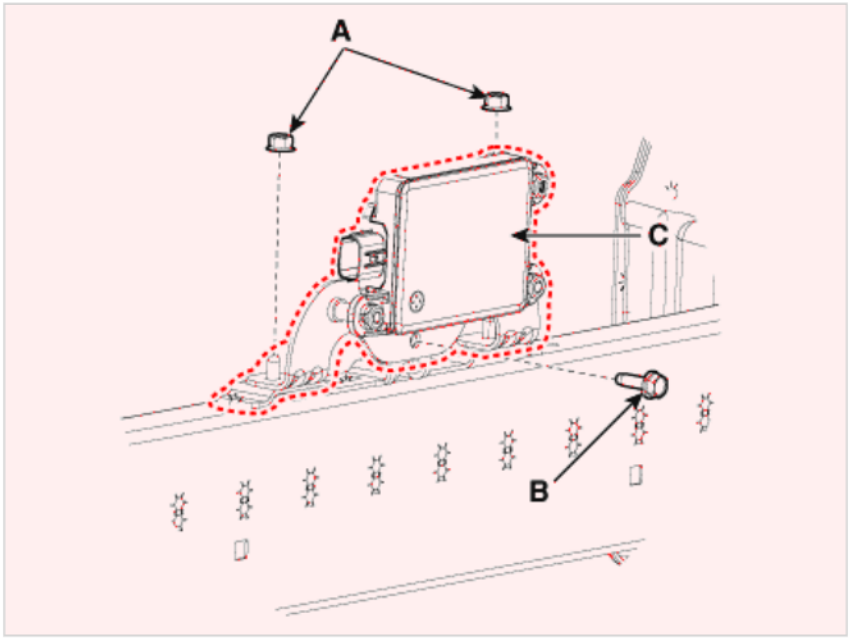
Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remover the front bumbper assembly.
   (Refer to Body - "Front bumper assembly")
3. Disconnect the SCC ECU & radar connector (A).



4. Loosen the SCC ECU & radar nuts (A) and bolt (B) and then remove the SCC ECU & radar (C).

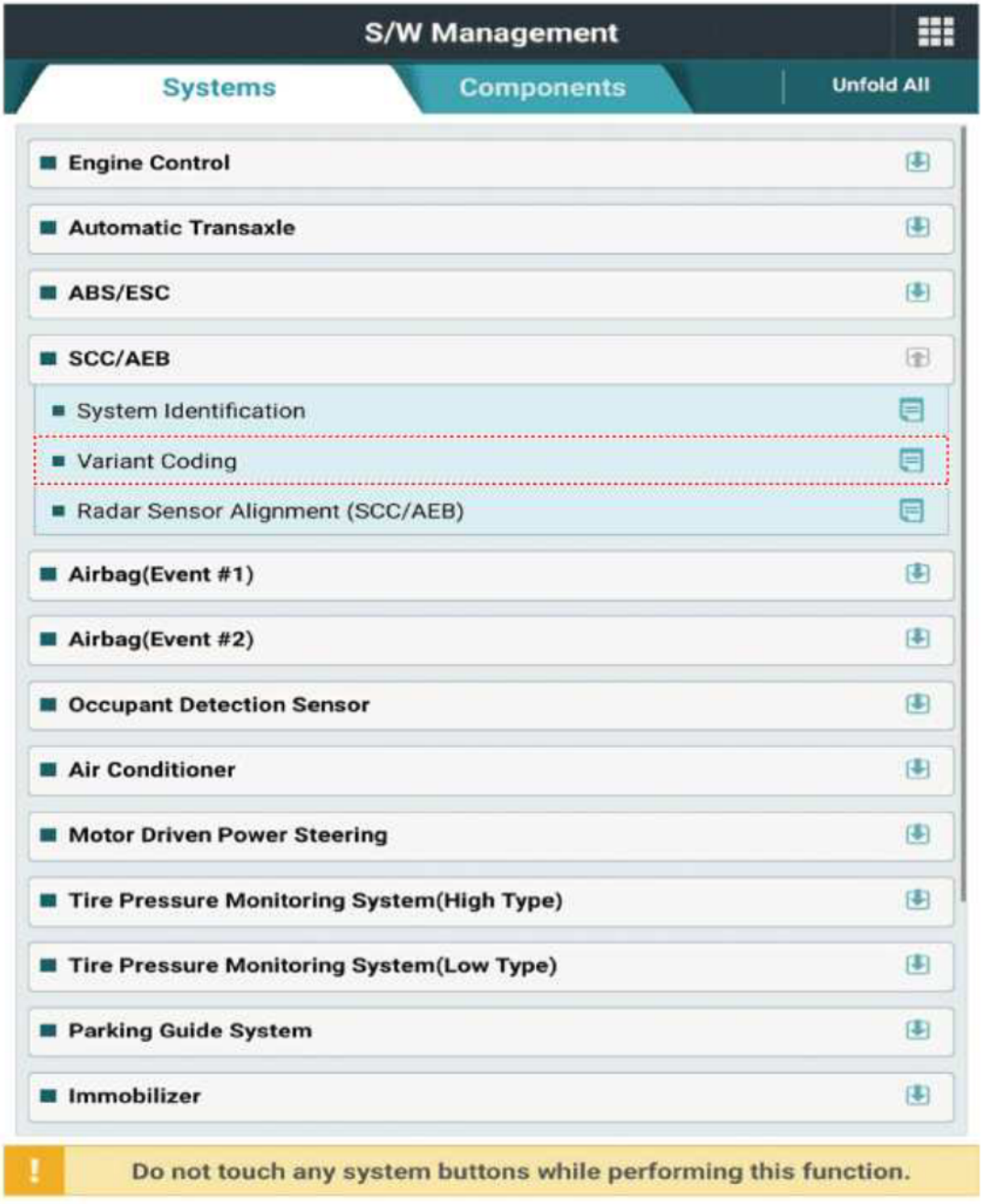
Tightening torque:
(A,B) : 9.8 - 11.8 N·m (1.0 - 1.2 kgf·m, 7.2 - 8.7 lb·ft)



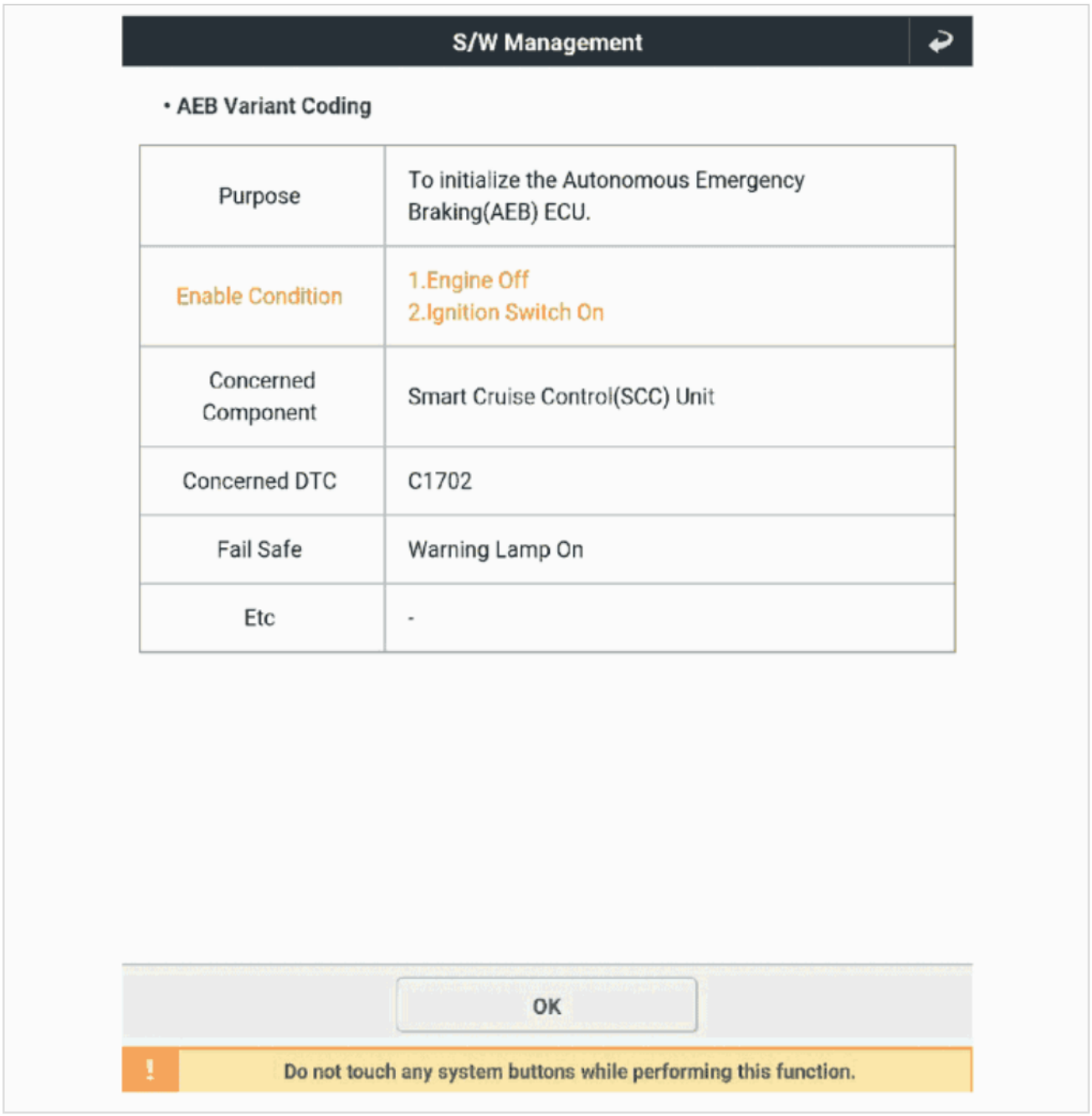
Installation

1. Install in the reverse order of removal.
2. Perform SCC variant coding.

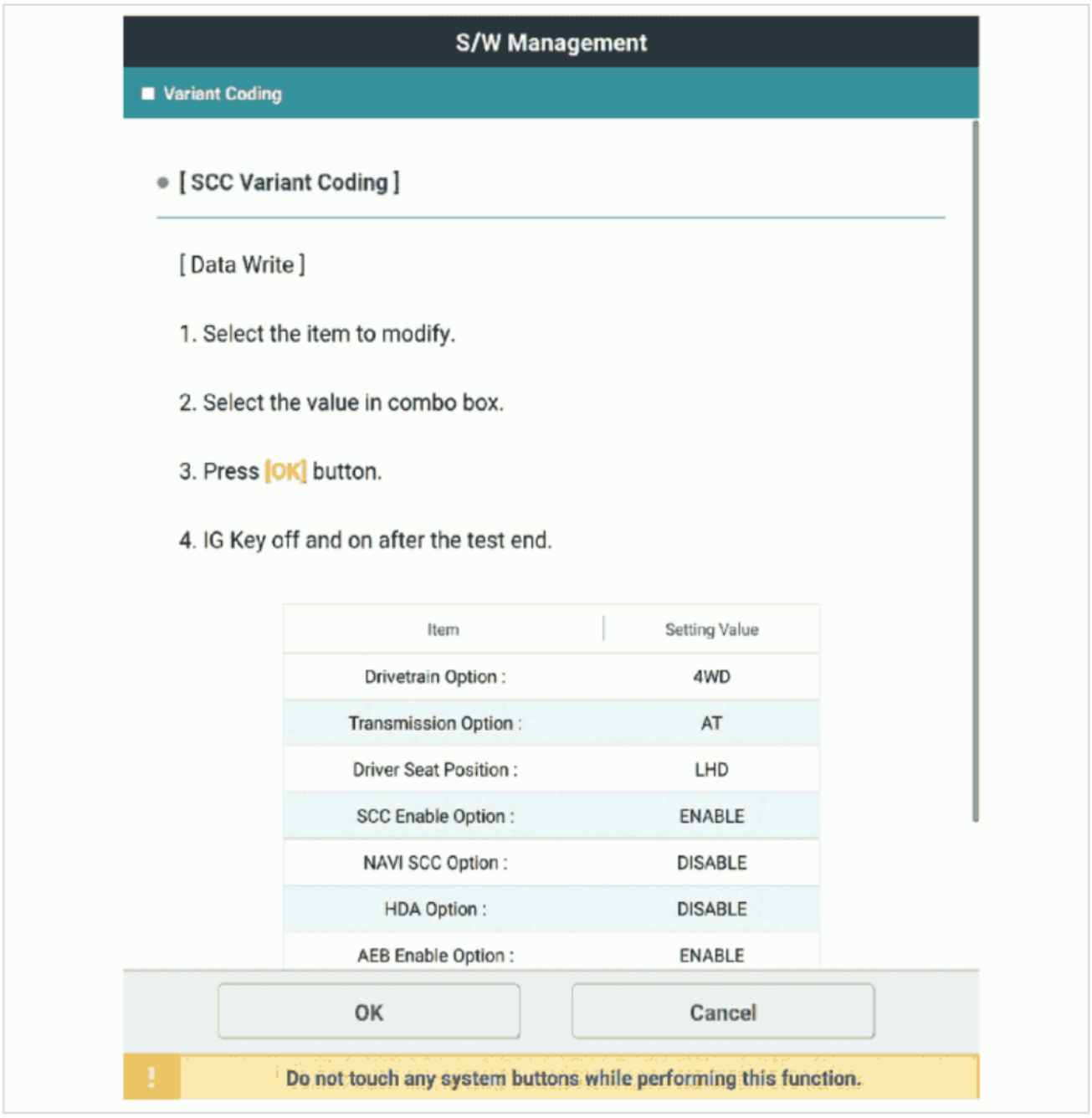
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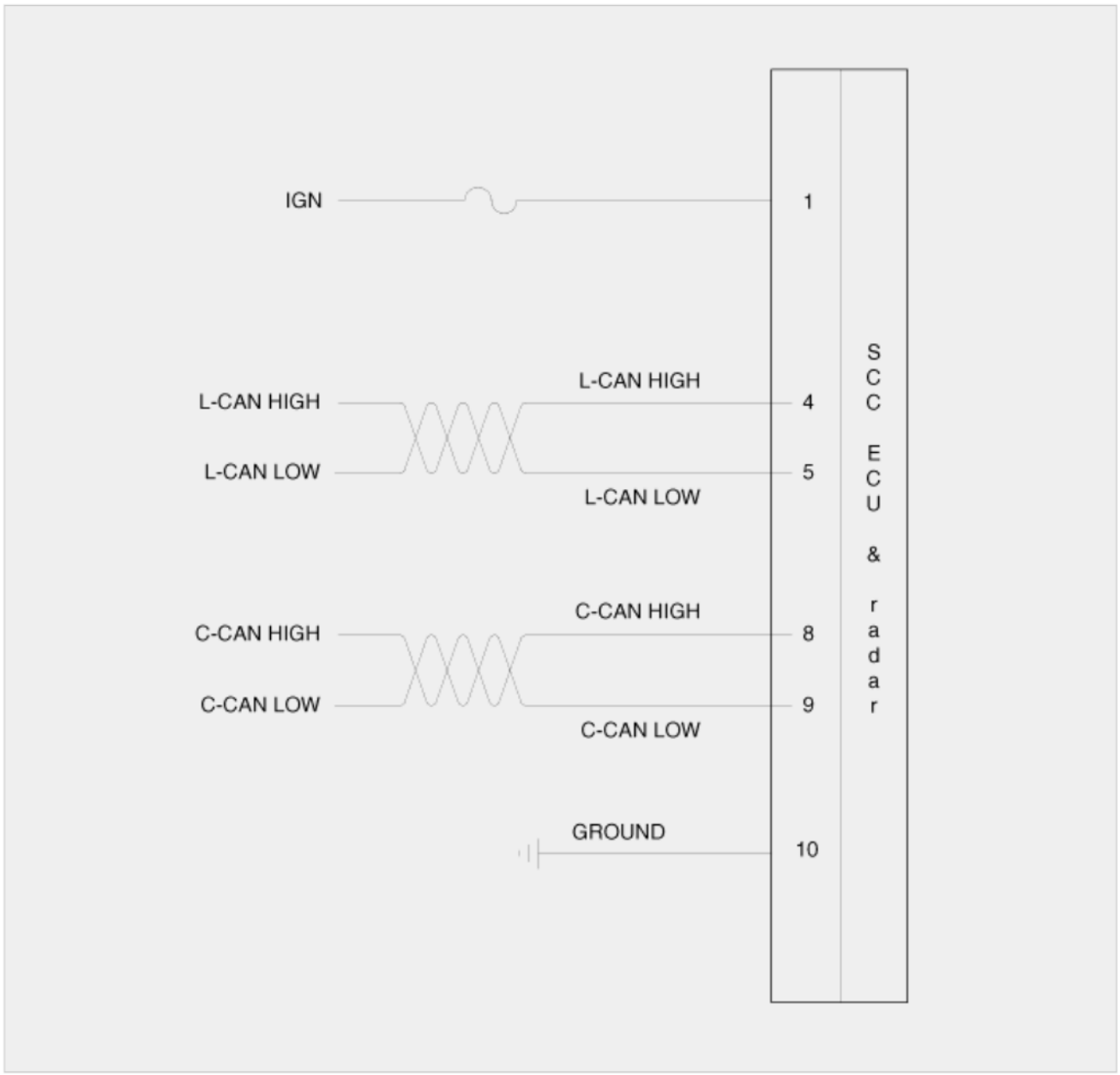
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3. Perform the smart cuise control system (Stop & Go) unit radar alignment.
(Refer to Engine Electrical System - "Smart cruise control (Stop & Go) unit-radar")

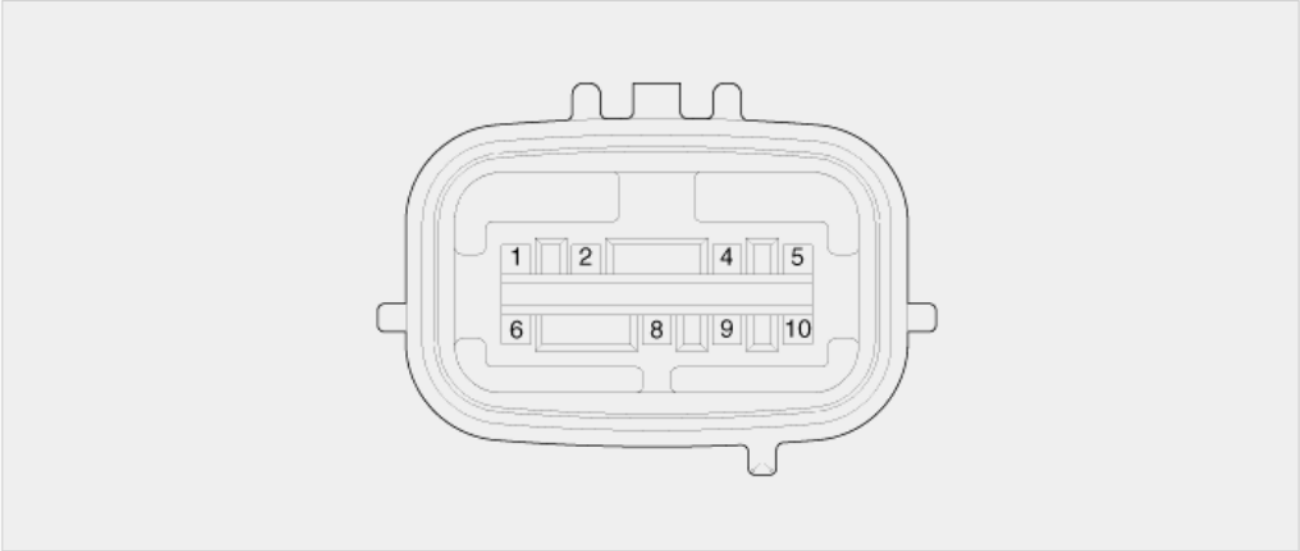
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Schematic Diagrams



Terminal function

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Pin No	Terminal function
1	IGN
2	-
3	-
4	L-CAN HIGH
5	L-CAN LOW
6	-
7	-
8	C-CAN HIGH
9	C-CAN LOW
10	GROUND

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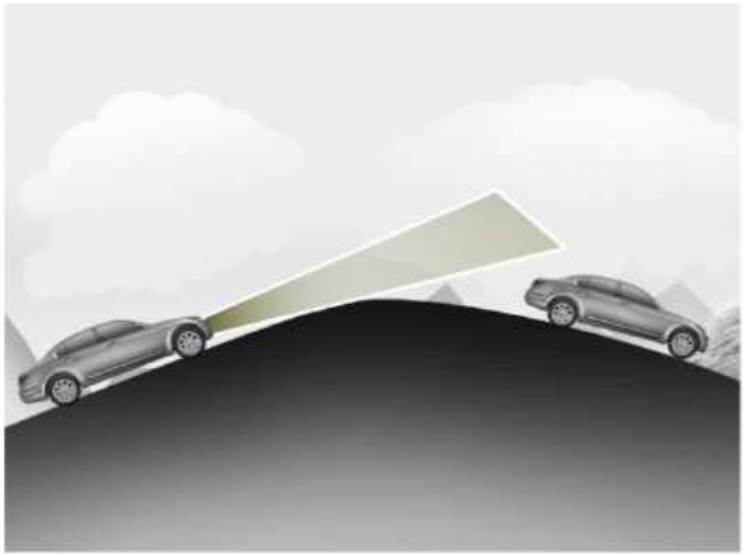
General Safety Information and Caution

Be careful when driving the vehicle using the smart cruise control system as follows.

⚠ CAUTION

- The smart cruise control system may be restricted to detect distance to the vehicle ahead due to road and traffic conditions.
- On curves or inclines/declines

– On curves or inclines/declines, the smart cruise control system may not detect a moving vehicle in your lane, and then your vehicle may accelerate to the set speed directly. Also, the vehicle speed may slow down abruptly when the vehicle ahead is recognized. Select the appropriate set speed on curves or inclines/declines and control the vehicle speed by applying the brake pedal if necessary.



– Your vehicle speed can be reduced due to a vehicle in the adjacent lane. Apply the accelerator pedal and select the appropriate set speed. Check to be sure that the road conditions permit.

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• Lane changing

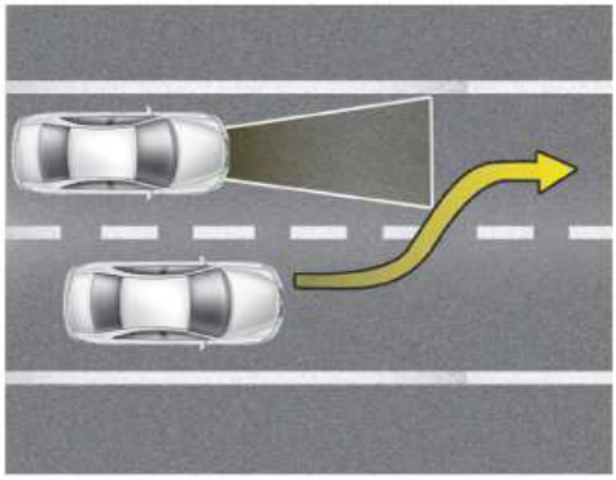
– A vehicle which moves into your lane from an adjacent lane cannot be recognized by the sensor until it is in the sensor"s detection range.

– Be always cautious as detecting a vehicle that suddenly moves into your lane may be delayed by the sensor.

– If the vehicle which moves into your lane is slower than your vehicle, the speed may decrease to maintain the distance to the vehicle ahead.

– If the vehicle that moves into your lane is faster than your vehicle, your vehicle will maintain the selected speed even when the other vehicle is in the sensor"s detection range.

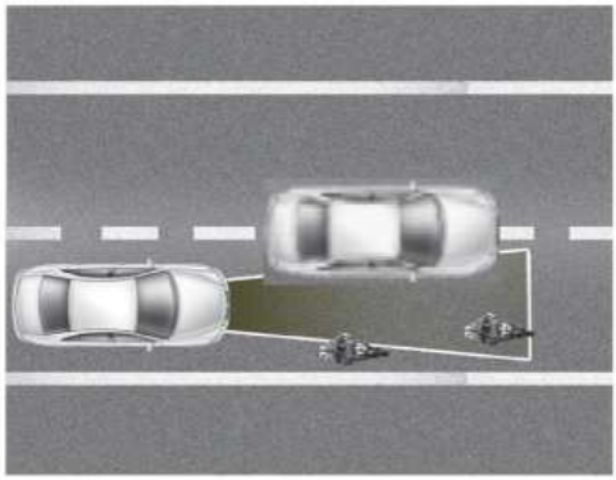
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• Vehicle recognition

– Even though a vehicle is in the same lane, a vehicle which is out of the sensor's detection range cannot be recognized by the sensor.

1) Small vehicle such as motorcycle, bicycle and cultivator
2) A vehicle offset to one side
3) A slow-moving vehicle or sudden-decelerating vehicle
4) A stopped vehicle
5) A vehicle with small rear profile such as trailer with no loads



– In the following situation, the front vehicle cannot be recognized correctly, so control the vehicle speed by applying the brake pedal or accerator pedal as necessary.

1) When the vehicle is leaning to the back due to overloading in the trunk.
2) While making turns by steering
3) When driving to one side of the lane
4) When driving on narrow lanes or on curves

• If the smart cruise control is left on (CRUISE indicator light ON), the smart cruise control can be switched on accidentally. Keep the smart cruise control system off (CRUISE indicator light OFF) when the smart cruise control is not in use, to avoid inadvertently setting a speed.

• Observe the speed regulation on road when setting the cruise speed.

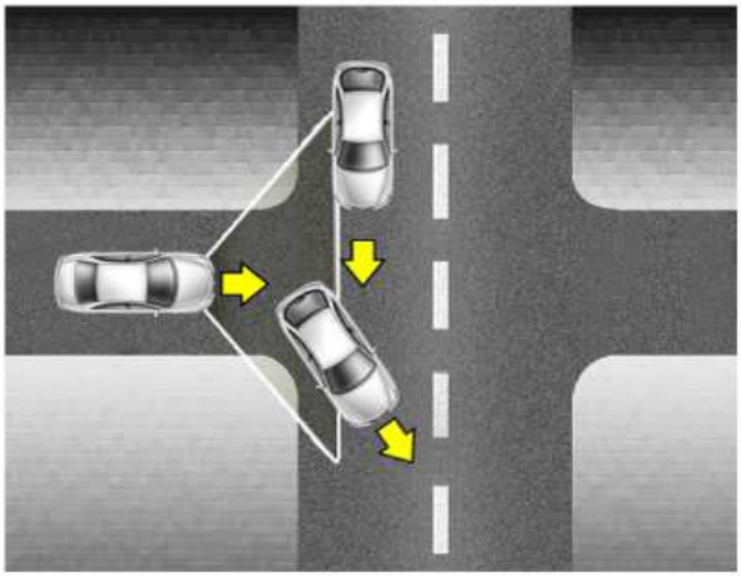
• Use the smart cruise control system only when traveling on open highways in good weather. Do not use the smart cruise control when it may not be safe to keep the car at a constant speed, for instance, driving in heavy or varying traffic, or on slippery (rainy, icy or snow-covered) or winding roads or steep up-hill or down-hill roads.

• Pay particular attention to the driving conditions whenever using the smart cruise control system.

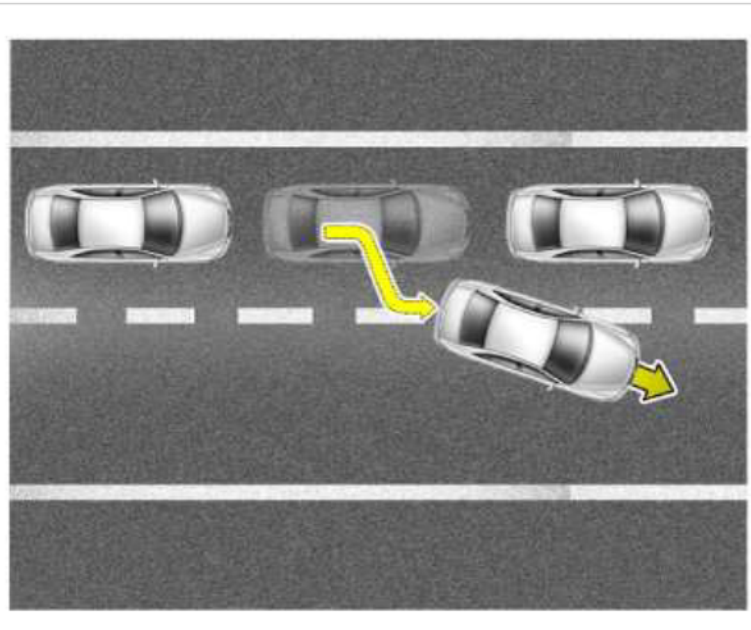
• The vehicle cannot be stopped by using the smart cruise control system. Apply the brake if emergency stop is needed.

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- Keep the safe distance according to road conditions and vehicle speed. If the following distance is too close when driving at a high speed, it is dangerous.
- The smart cruise control system can not recognize a stopped vehicle, pedestrians or an oncoming vehicle. Always look ahead cautiously to prevent unexpected and sudden situations from occurring.
- The smart cruise control system is not a substitute for safe driving practices but a supplementary function only. It is the responsibility of the driver to always check the speed and the distance to the vehicle ahead.
- Vehicles that make a frequent lane changes ahead of your vehicle may cause delay in the system"s reaction or may cause the system to react to a vehicle in adjacent lane. Always look ahead cautiously to prevent unexpected and sudden situations from occurring.
- Your vehicle may accelerate when a vehicle ahead of you disappears. When you are warned that the vehicle ahead of you is not detected, drive with caution.

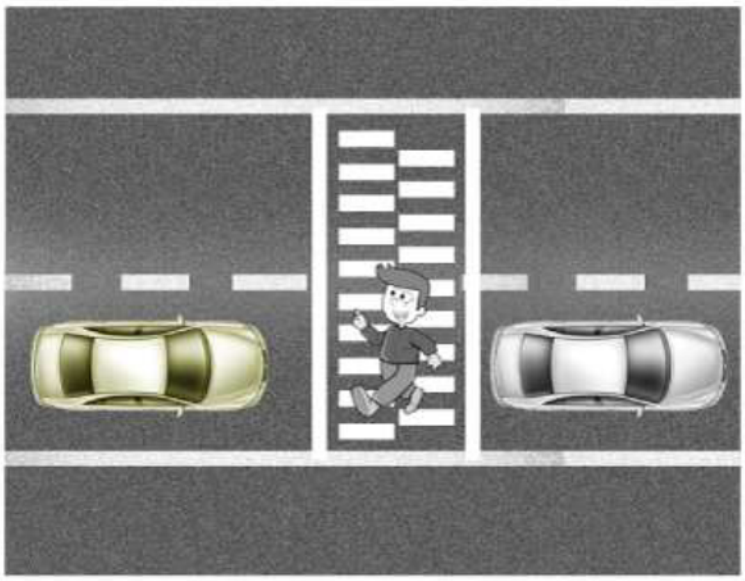


- When vehicles are at a standstill and the vehicle in front of you changes to the next lane, be careful when your vehicle starts to move because it may not recognize the stopped vehicle in front of you.

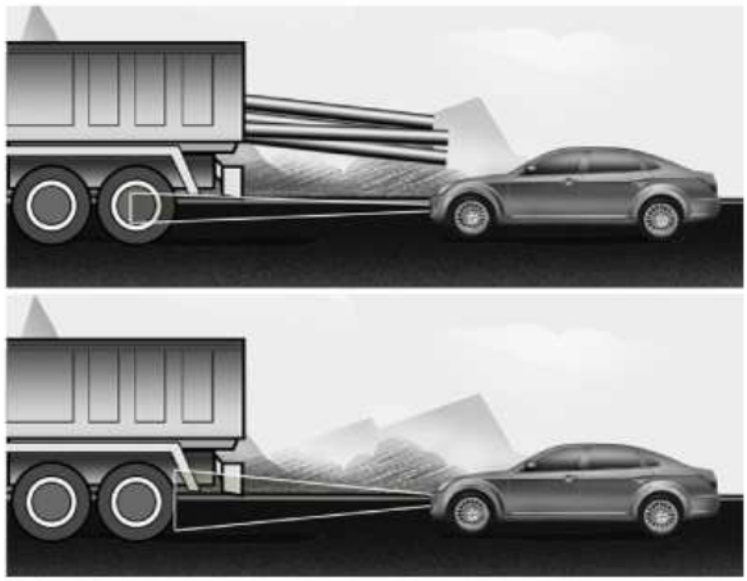


- Always look out for pedestrians when your vehicle is maintaining a distance with the vehicle ahead.

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- Always be cautious for vehicles with higher height or vehicles carrying loads that stick out to the back of the vehicle.



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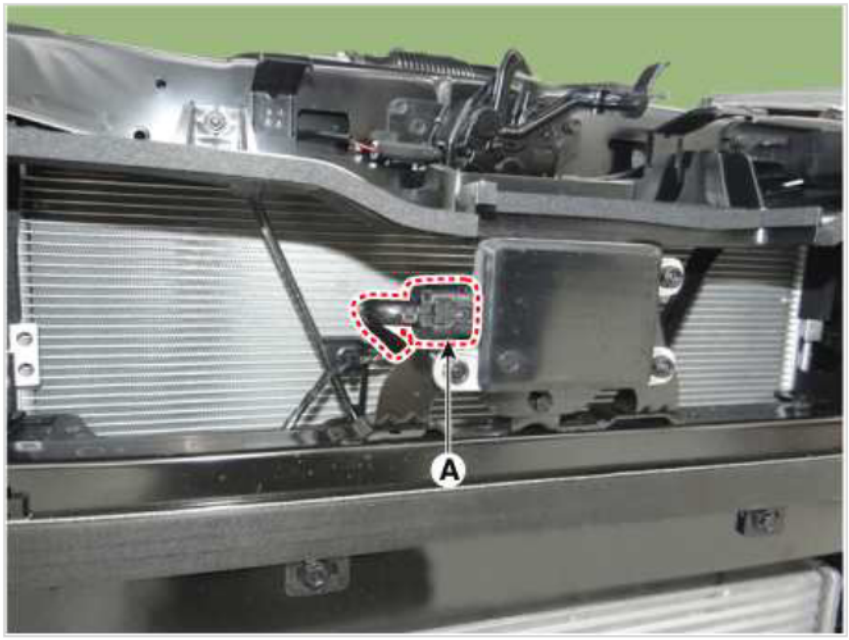
Description

The smart cruise control unit is installed on the front right-hand side of the chassis. A radar sensor is embedded in the front section of the unit. This sensor detects vehicles and objects in front of the vehicle. The radar sensor can detect up to 32 objects ahead of the vehicle. The alarm goes off when the vehicle deviates from the horizontal and vertical alignment reference points during operation. This sensor communicates with the dashboard, warning buzzer, smart cruise control switch, Electronic Stability Program (ESP), ECM, and TCM via CAN communication. The sensor controls vehicle speed through CAN communication between the Electronic Stability Program (ESP) system and the ECM and TCM.

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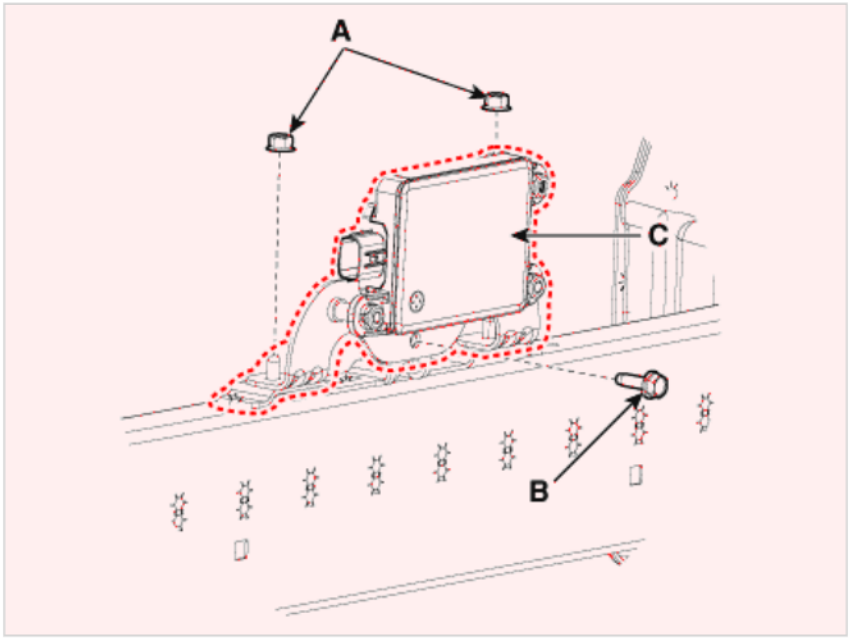
Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remover the front bumbper assembly.
   (Refer to Body - "Front bumper assembly")
3. Disconnect the SCC ECU & radar connector (A).



4. Loosen the SCC ECU & radar nuts (A) and bolt (B) and then remove the SCC ECU & radar (C).

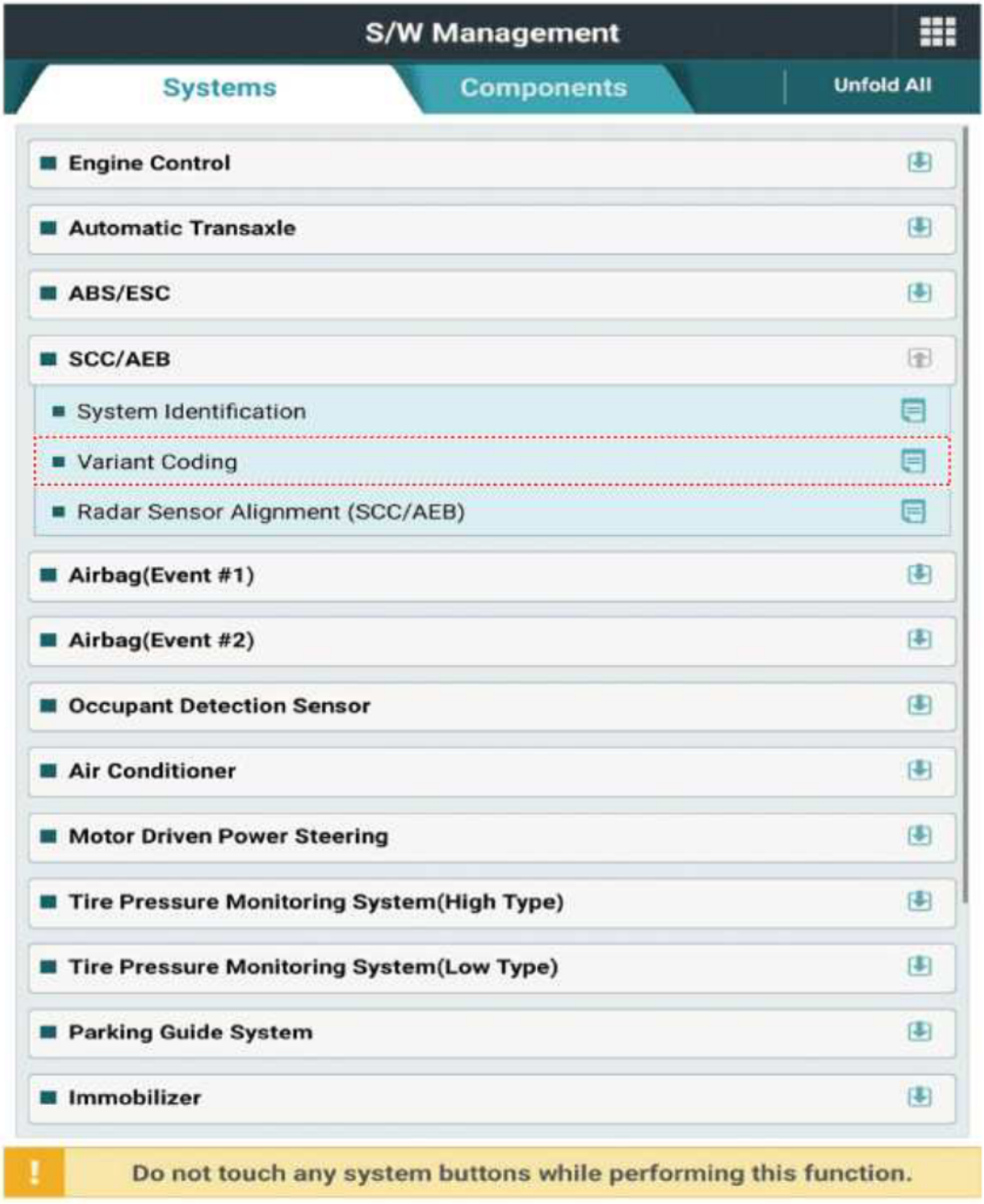
Tightening torque:
(A,B) : 9.8 - 11.8 N·m (1.0 - 1.2 kgf·m, 7.2 - 8.7 lb·ft)



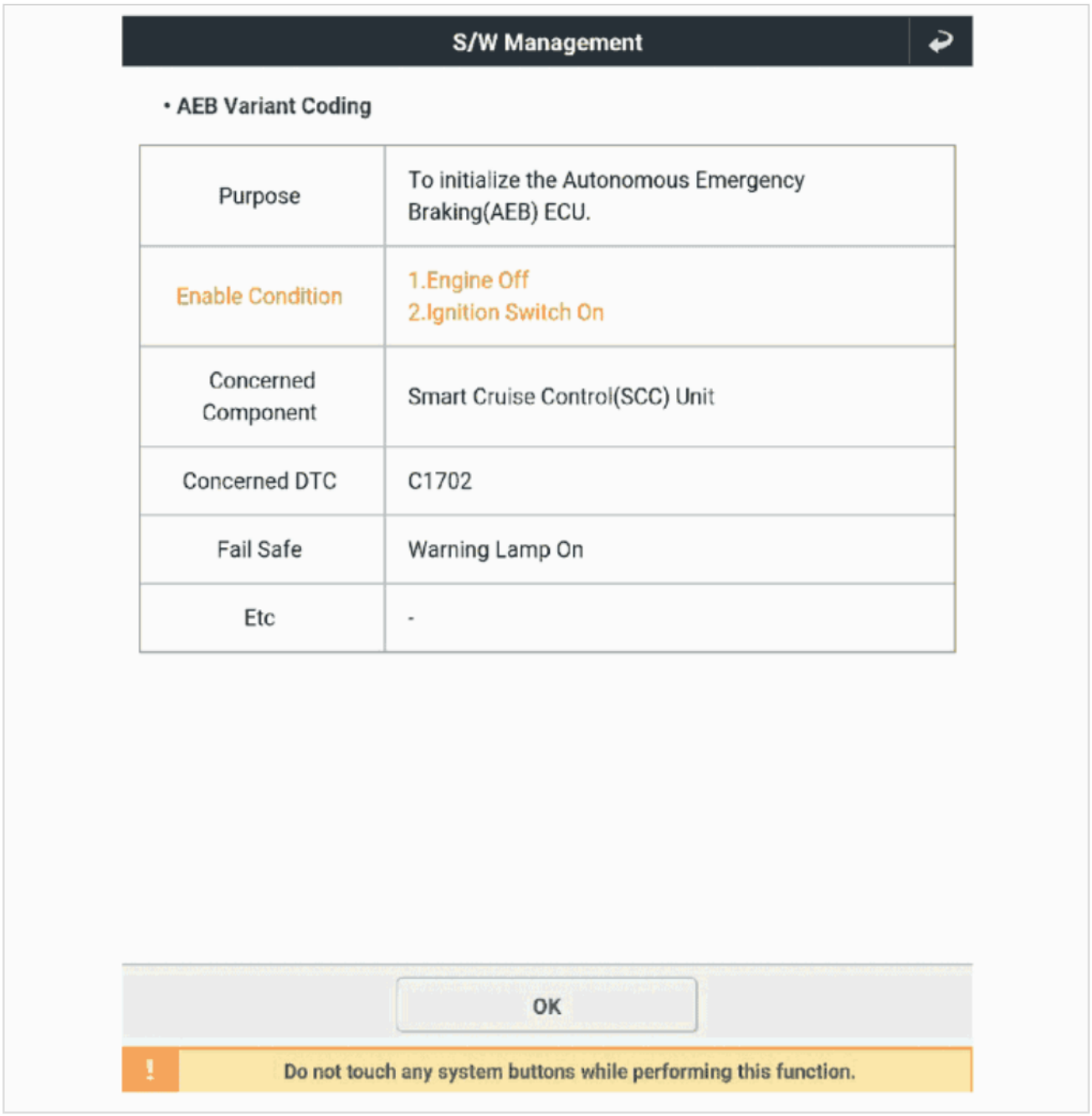
Installation

1. Install in the reverse order of removal.
2. Perform SCC variant coding.

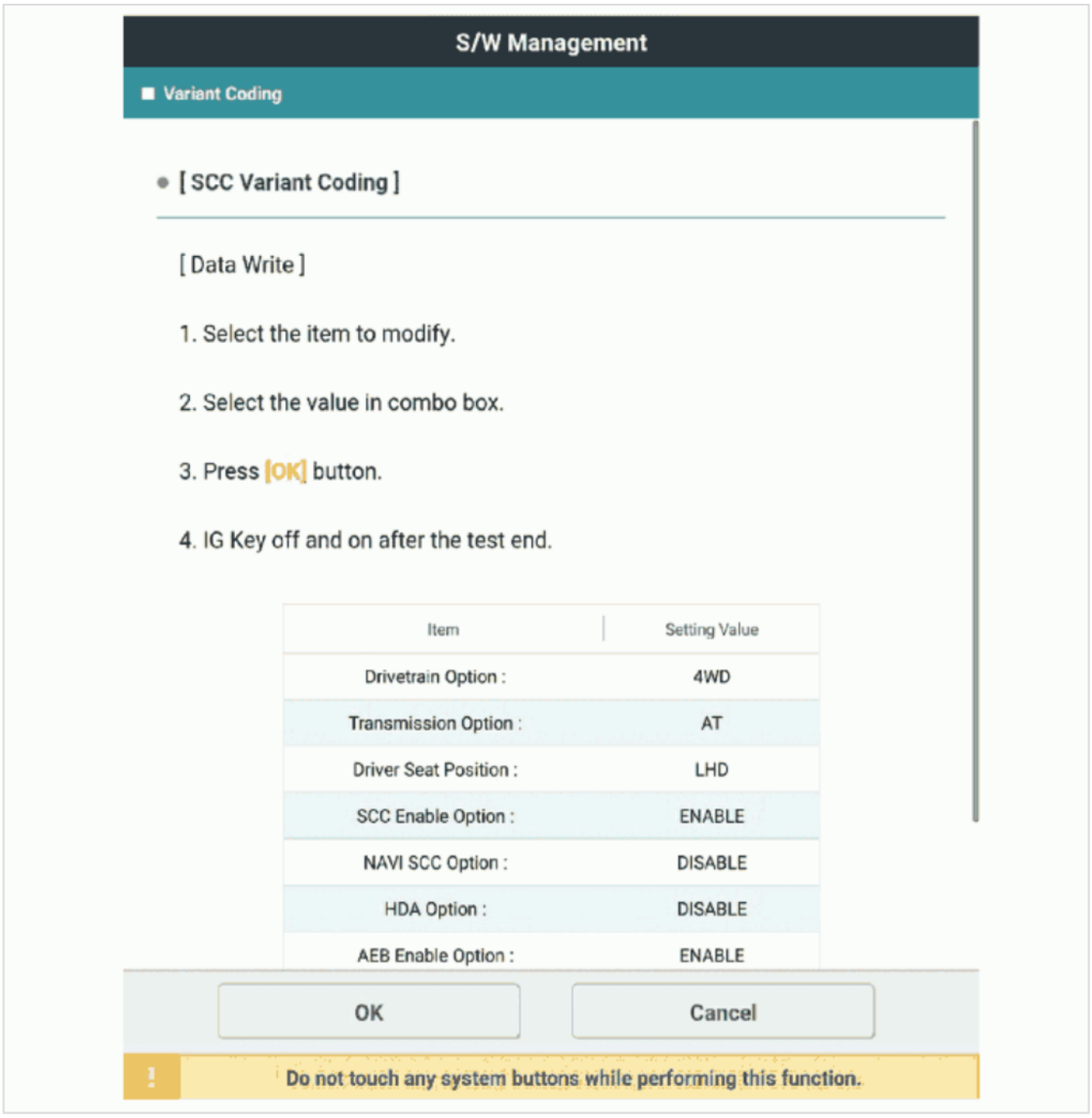
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3. Perform the smart cuise control system (Stop & Go) unit radar alignment.
(Refer to Engine Electrical System - "Smart cruise control (Stop & Go) unit-radar")

Smart Cruise Control (SCC) Radar Sensor Alignment

Smart Cruise Control (SCC) unit detects a forward vehicle and then recognizes the distance to the forward vehicle and the relative speed using the built-in radar sensor. In order for the radar sensor to operate correctly, it must be properly aligned parallel to the driving direction of the vehicle. So, the radar sensor alignment procedure must be carried out after the sensor is reinstalled or replaced with new one. If not performing the sensor alignment in the conditions mentioned above, the smart cruise control system may not operate correctly.

Information

The SCC radar sensor alignment is required when:

- The SCC unit is reinstalled or replaced with a new one.
- The radar sensor or the surrounding parts are impacted by a collision.
- The sensor does not recognize a forward vehicle.
- The Steering Angle Sensor (SAS) is replaced or adjusted.

NOTICE

Preparation before the SCC radar sensor alignment:

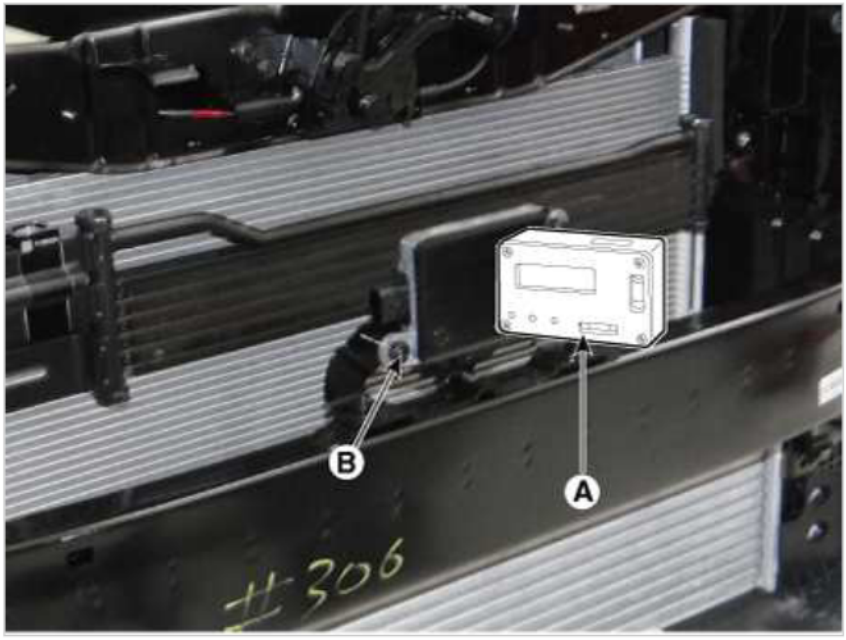
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- Put the vehicle on the level ground.
- Take out heavy luggage from the vehicles' seats or trunk.
- Set all tires according to the specified pressure.
- Check wheel alignment.
- Check that the front surface of the SCC unit is clean.

Radar sensor should be aligned in both vertical and lateral direction. Vertical alignment can performed by using the SST (0K964-3T000) and lateral alignment can be performed automatically by driving on a road.

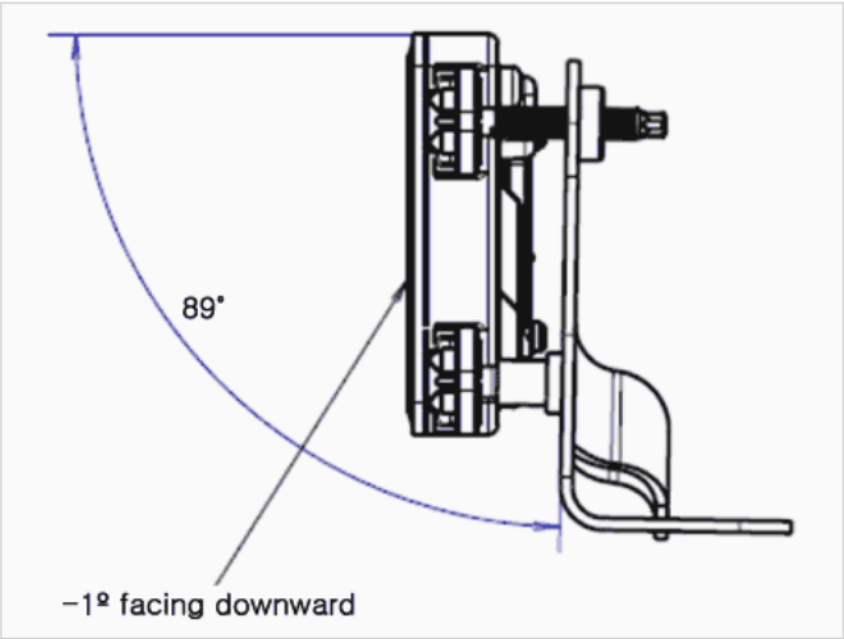
1. Park the vehicle on a level ground.
2. Remove the front bumper assembly.
   (Refer to Body - "Front Bumper Assembly")
3. Check the vertical alignment of the radar sensor using the digital level/tilt meter (A).
   If the vertical alignment is out of the the tolerance, turn the adjustment screw (B) until the alignment is within the tolerance.

   Tolerance: ±1.5º or less



NOTICE

The vertical mounted degree should be -1º downward.



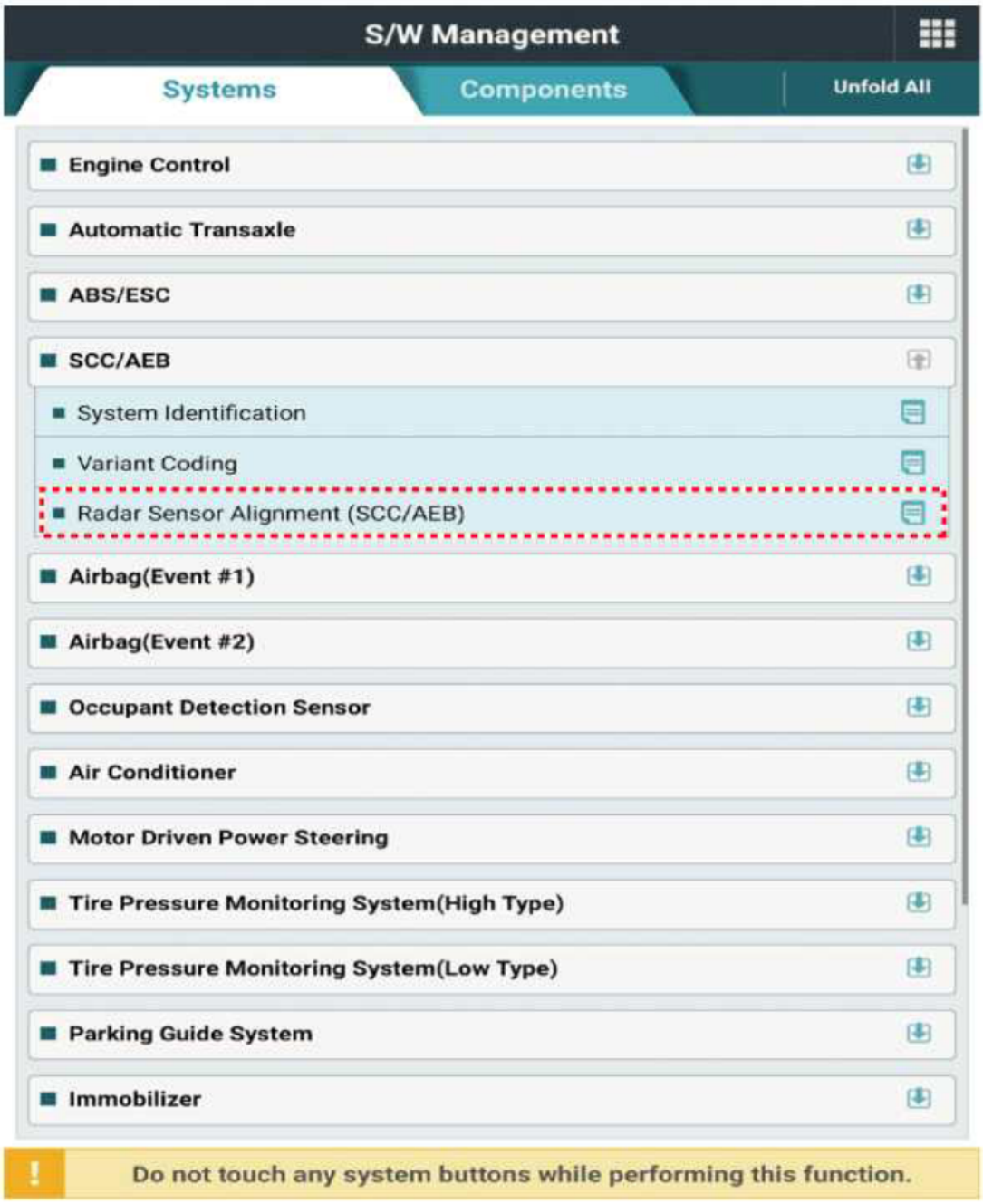
4. Install the front bumper.
   (Refer to Body - "Front Bumper Assembly")

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5. To perform the lateral alignment, connect the KDS with the engine started and select the “SCC Alignment”.

Information

Be sure to erase DTC before performing the lateral alignment.



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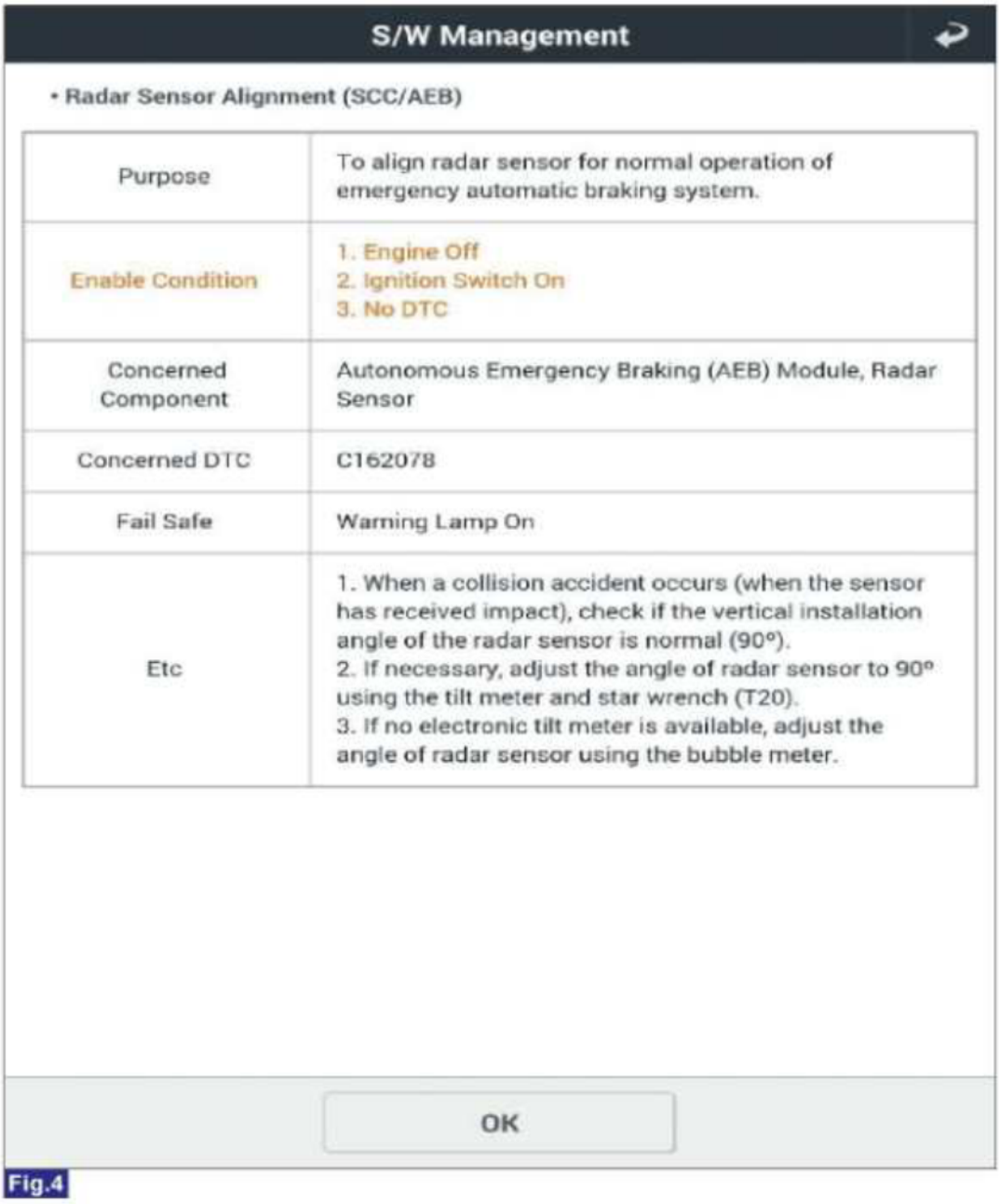


Fig.4

6. Select “Driving Mode” to start sensor alignment.

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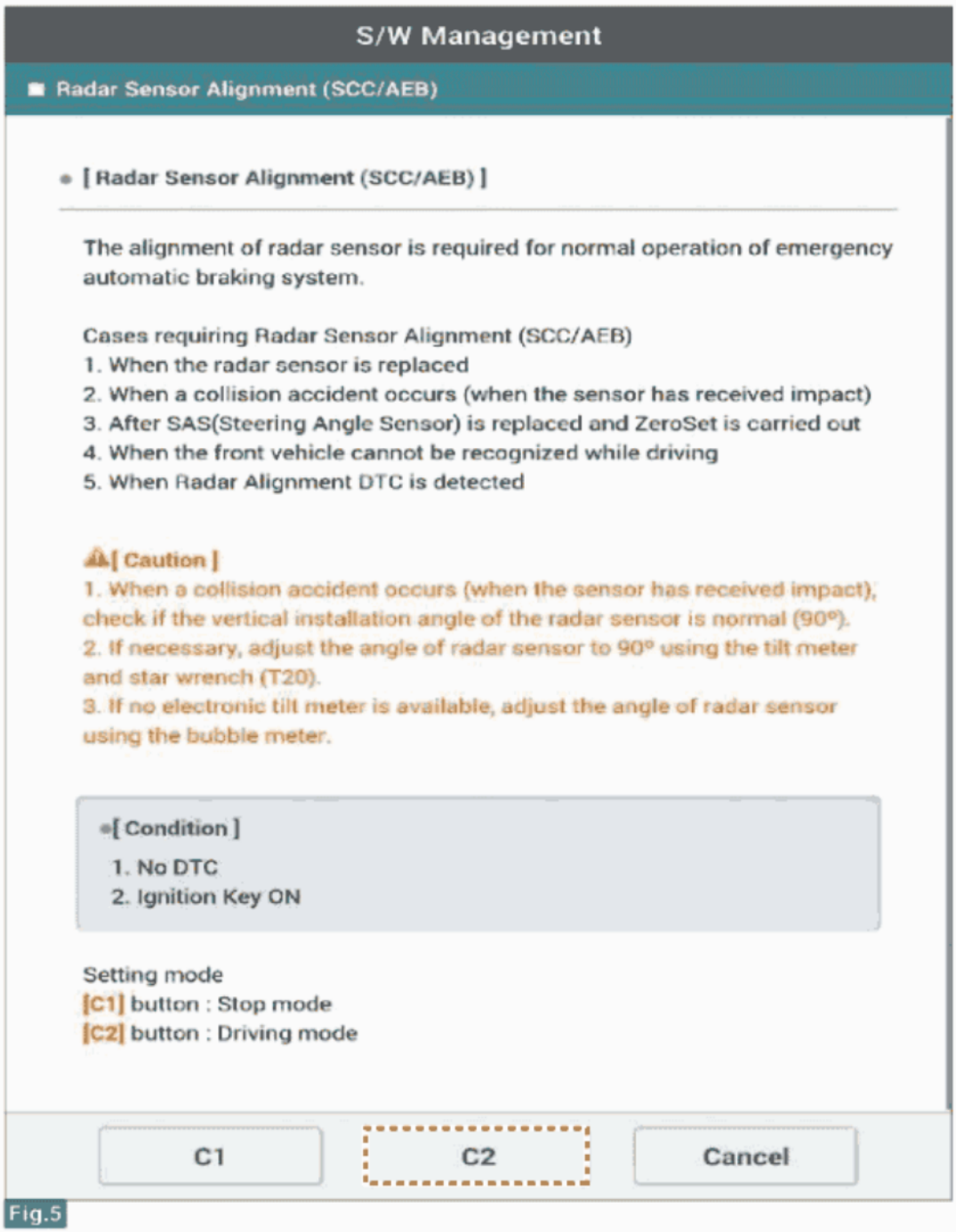


Fig.5

7. Drive the vehicle and check that the yellow warning light on the cluster is turned ON and then OFF.

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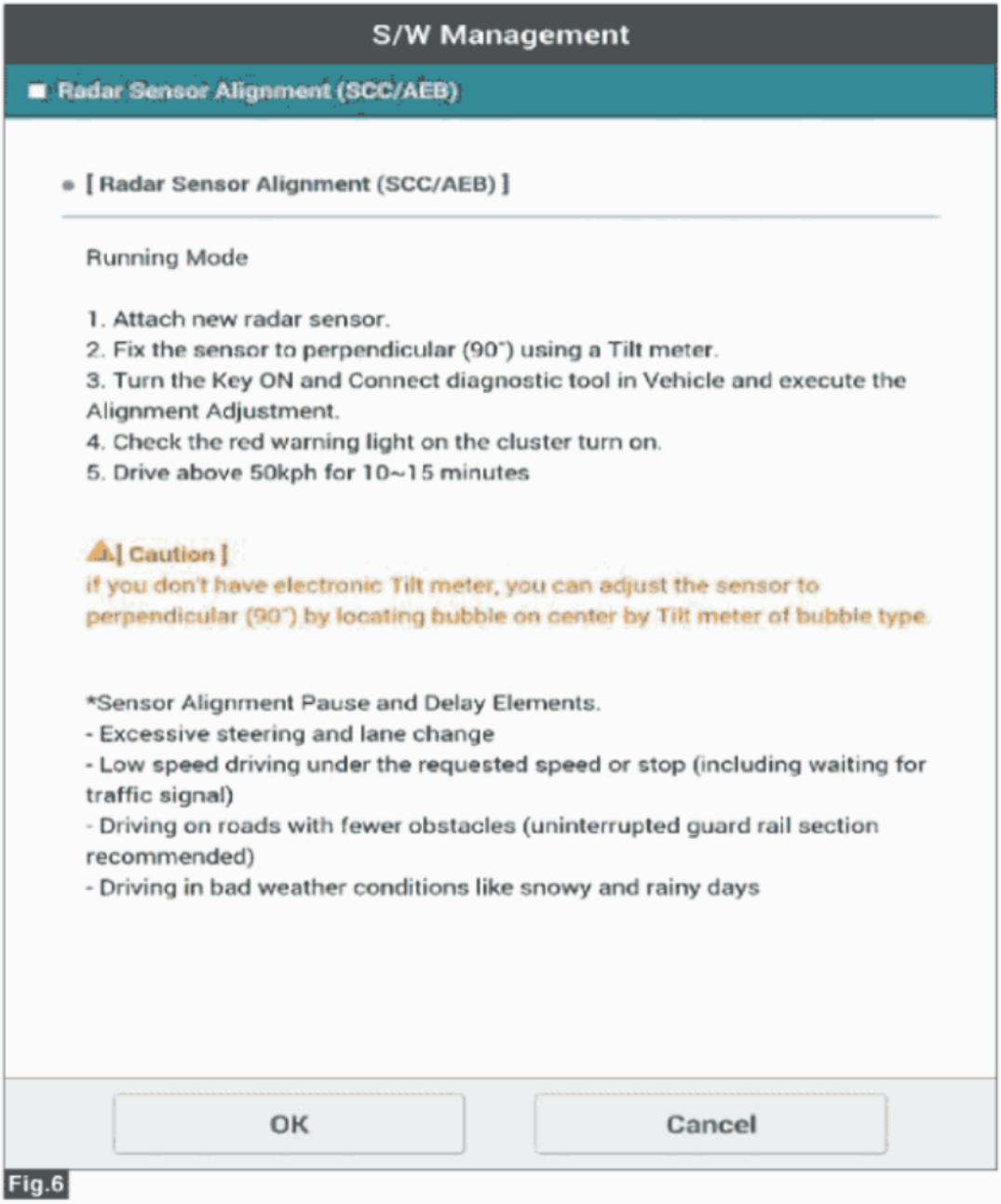


Fig.6

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Fig.7

NOTICE

The lateral alignment takes about 5 to 15 minutes generally but it can be shorten or extended depending on the road condition or driving condition.

- Road or driving conditions for shortening the alignment :
  - Driving at more than 65 km/h (40.4 mph)
  - Driving on a road without curve and slope
  - Driving on a thick and wide paved road
  - Driving on a road where there are repetitive and fixed targets (metal materials such as street lights or guard rails)
  - Driving on a dry road without rain or snow
- Road or driving conditions that can interrupt the alignment process
  - Driving a road with the sharp curve where the radius is within 100m (328.0ft)
  - Driving at a lower speed than suggested above or during a stop due to a red light
  - Driving in a tunnel or under an overpass
  - Turning the steering wheel excessively to the left or right or changing the lane suddenly

⚠ CAUTION

Be sure to follow the below safety guidelines while driving the vehicle for the lateral alignment :

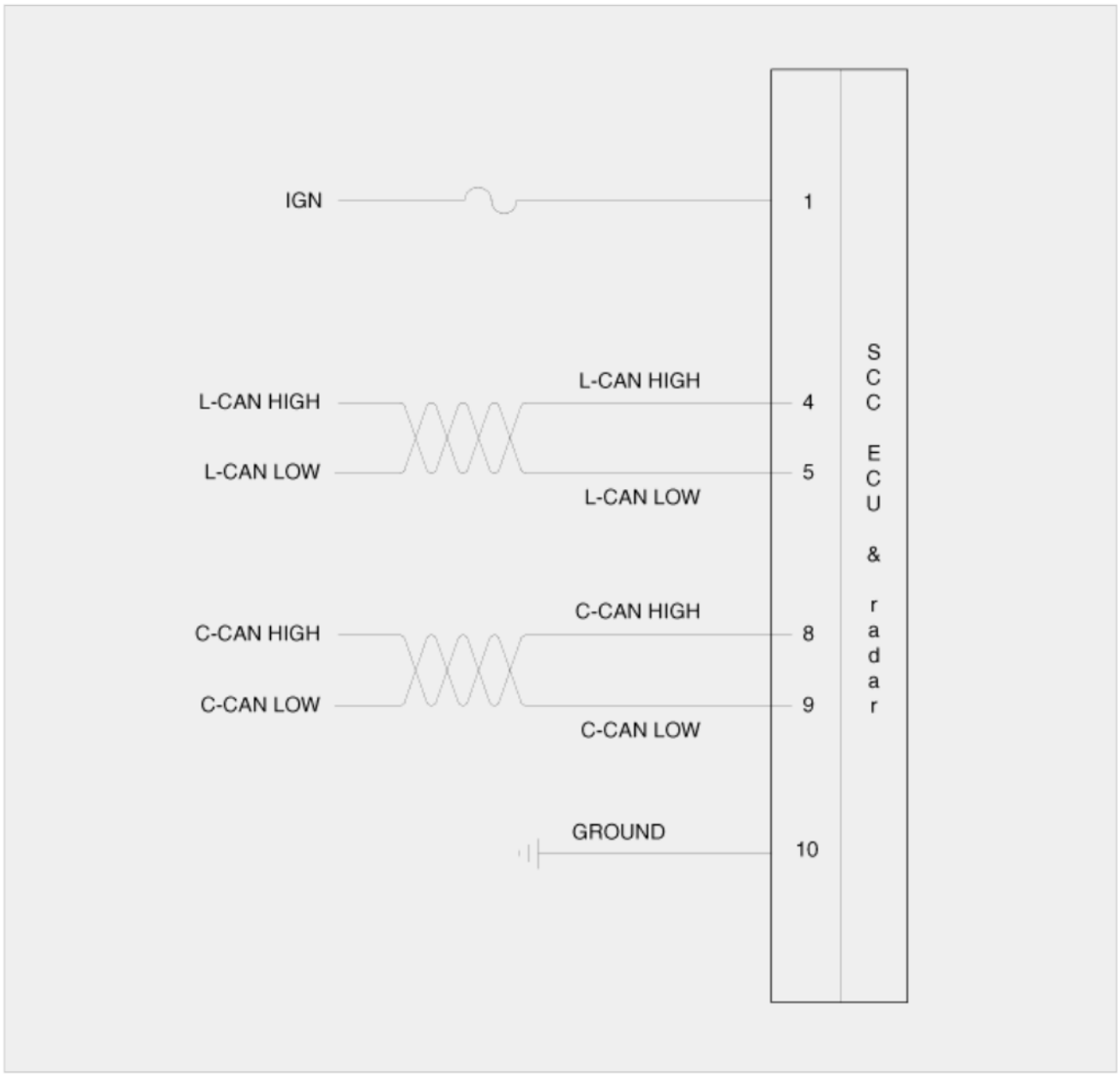
- Observe a regulation speed
- Do not drive too fast for shortening the sensor alignment. Drive safely considering the road condition and traffic situation.
- Do not stare the KDS screen or operate the KDS while driving. Only while stopping, the KDS should be operated.

NOTICE

If the lateral alignment is not completed successfully, check the alignment using the KDS. If the value is out of ±3º, check that the back beam or bracket where the SCC unit is mounted are in a good condition and then if there is no problems, replace the SCC unit with new one. After replacing the SCC unit, repeat the alignment procedure described above.

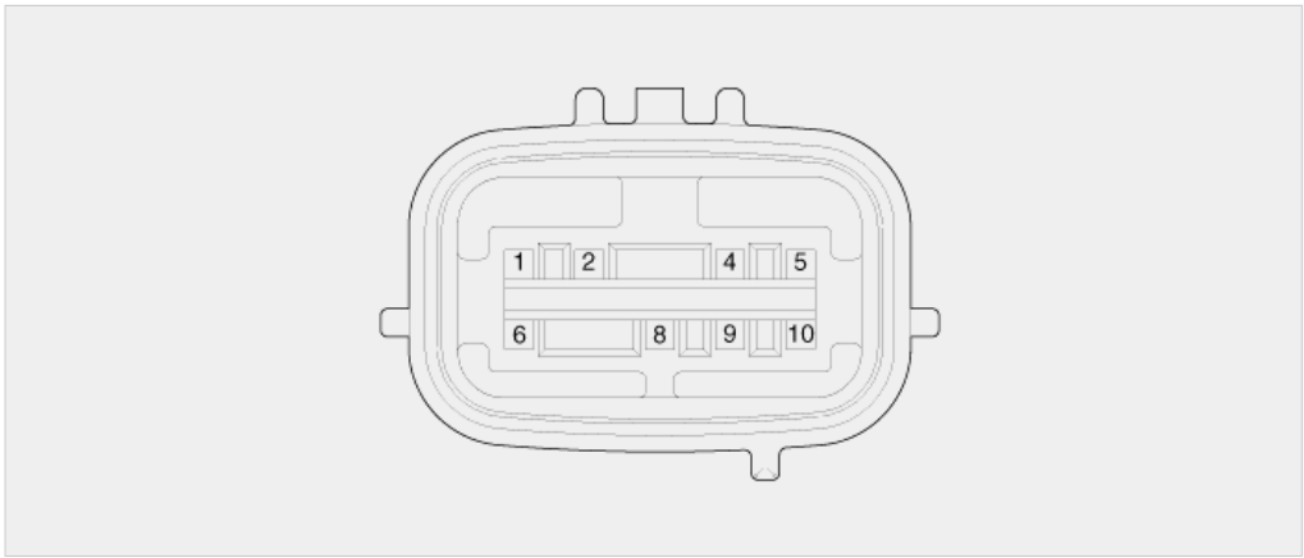
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Schematic Diagrams



Terminal function

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Pin No	Terminal function
1	IGN
2	-
3	-
4	L-CAN HIGH
5	L-CAN LOW
6	-
7	-
8	C-CAN HIGH
9	C-CAN LOW
10	GROUND

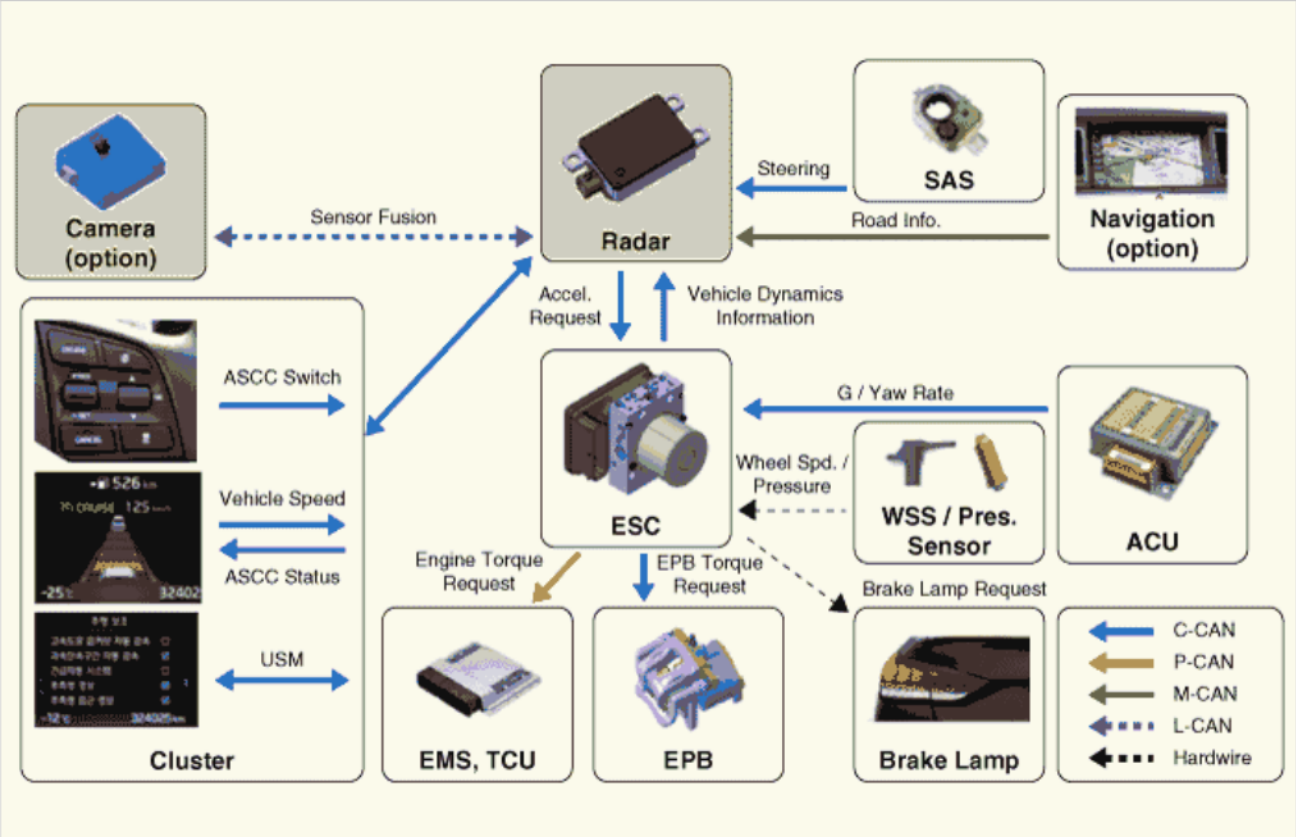
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Specification

Item	Specification
Power supply(V)	12
Operation voltage (V)	9 - 16

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Trouble Symptom Charts

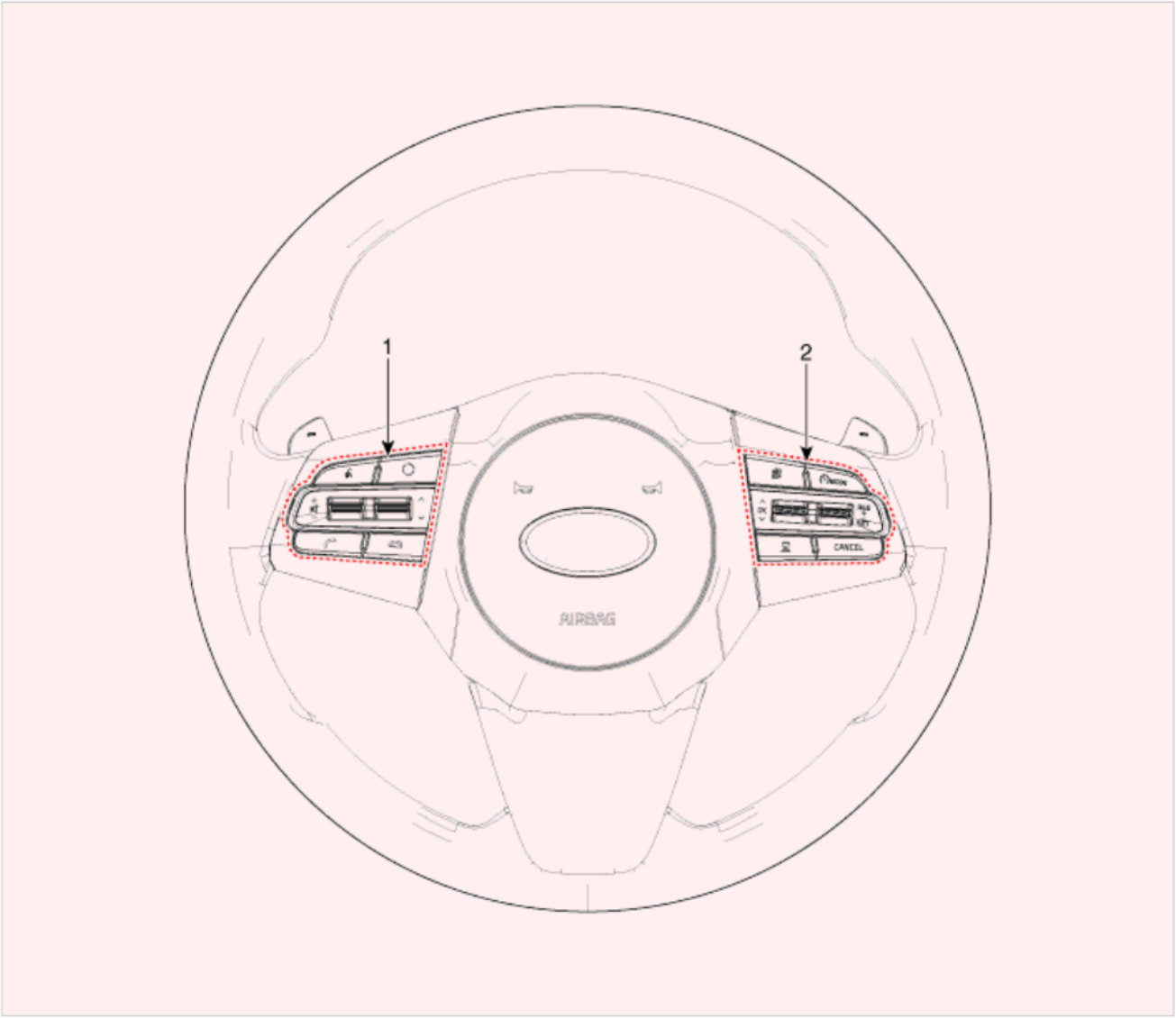


Component Parts And Function Outline

Component part	Function
Cruise Control Switch	Input the set speed and distance to the SCC ECU.
Instrument Cluster	Display various information inputted from SCC.
Smart Cruise Control Unit	Recognize and track the vehicle ahead. Calculate the target speed and distance Request the acceleration and retardation to ESP
VDC (HECU)	Automatic braking and request the engine torque control to the engine (ECM) Request the EPB torque control on the Electronic Parking Brake (EPB) Request the stop lamp indicator ON
Engine (ECM)	Control the engine torque
Electronic Parking Brake (EPB)	Control the EPB torque
Stop lamp	Stop lamp indicator ON

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Components



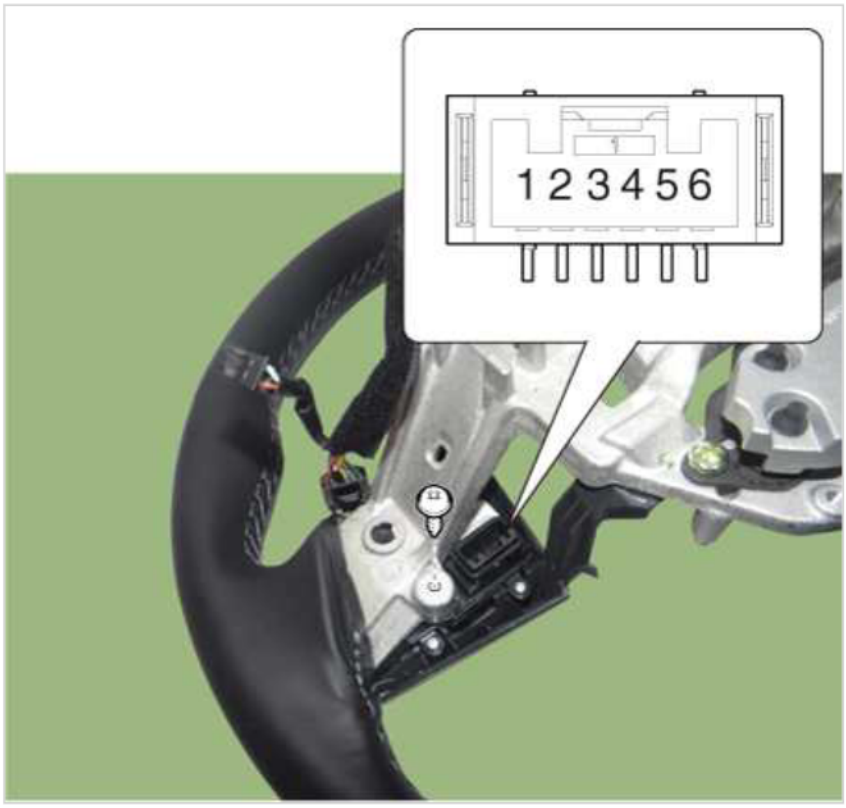
1. Left Remote Control Switch
(Audio + Bluetooth + Voice)

2. Right Remote Control Switch
(Trip Computer + ACC + SCC)

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Inspection

1. Check for resistance between terminals in each switch position (RH).



[RH : Trip + ACC + SCC]

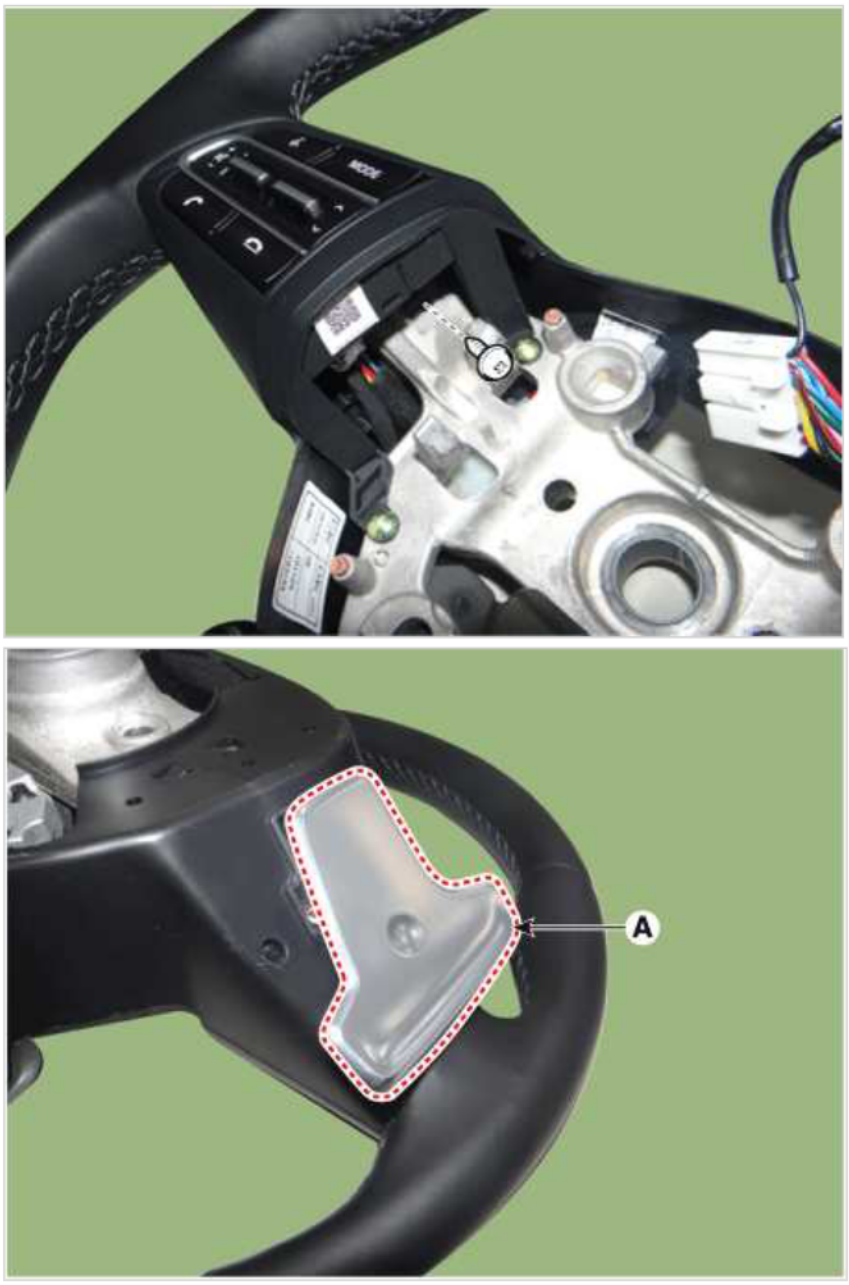
Switch	Connector terminal	Resistance (±3%)
Cancel	2-6	390 Ω
SET -		610 Ω
RES +		910 Ω
Cruise ON/OFF		1.38 kΩ
Cruise & Speed Limit ON/OFF		2.13 kΩ
SCC (Following distance control)		3.63 kΩ
Group	1-6	390 Ω
Trip Up		610 Ω
Trip Down		910 Ω
ENTER		1.38 kΩ

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel assembly.
   (Refer to Steering System - "Steering Wheel")
3. Remove the paddle shift switch (A) after loosening the mounting screws.

[LH]

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[RH]

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4. Disconnect the paddle shift switch connector (A).

[LH]

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[RH]



5. Remove the steering front cover (A) after loosening the mounting screws.

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6. Remove the steering rear cover (A) after loosening the mounting screws.



7. Remove the steering back cover (A) after loosening the mounting screws.

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8. Disconnect the steering wheel remote control connector (A).

[LH]



[RH]

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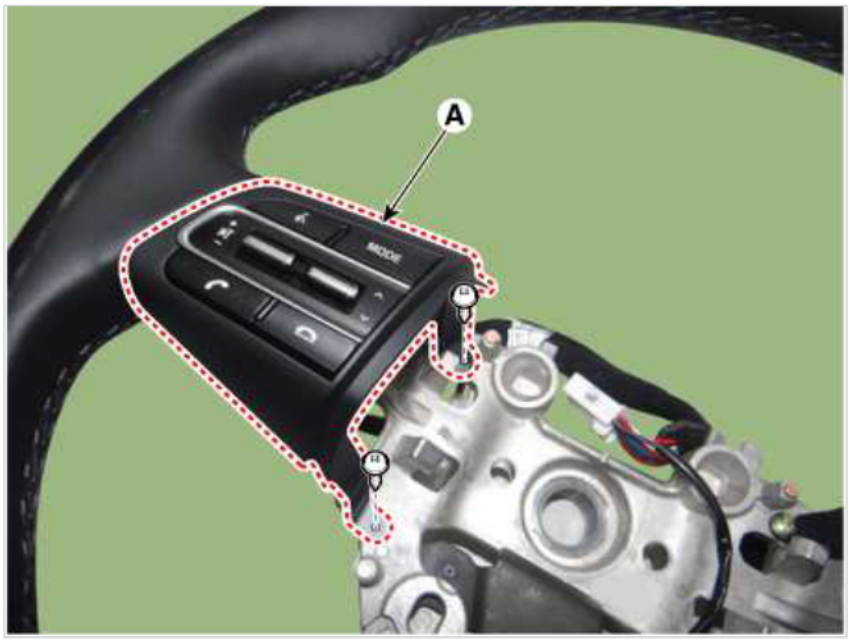


9. Remove the steering wheel remote control (A) after loosening the mounting screws.

[LH]



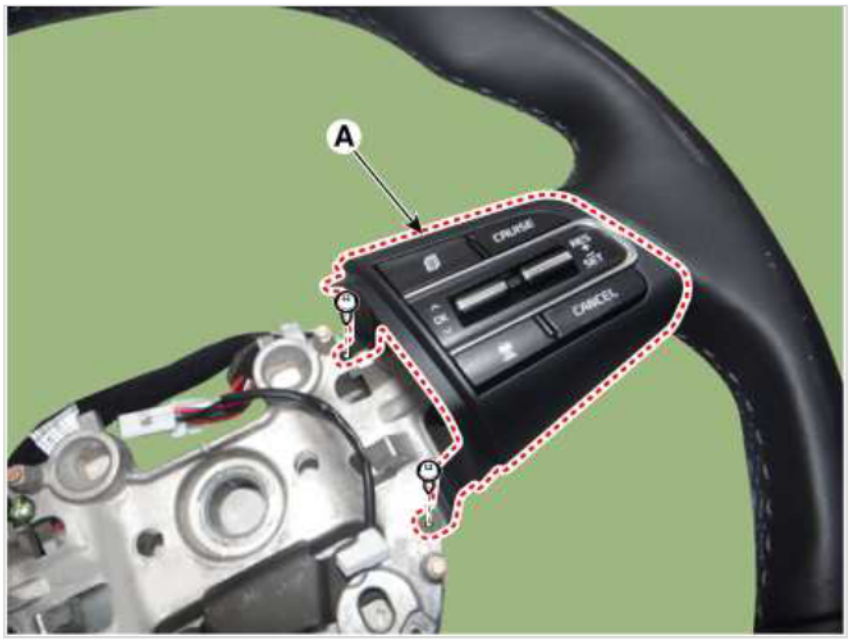
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[RH]



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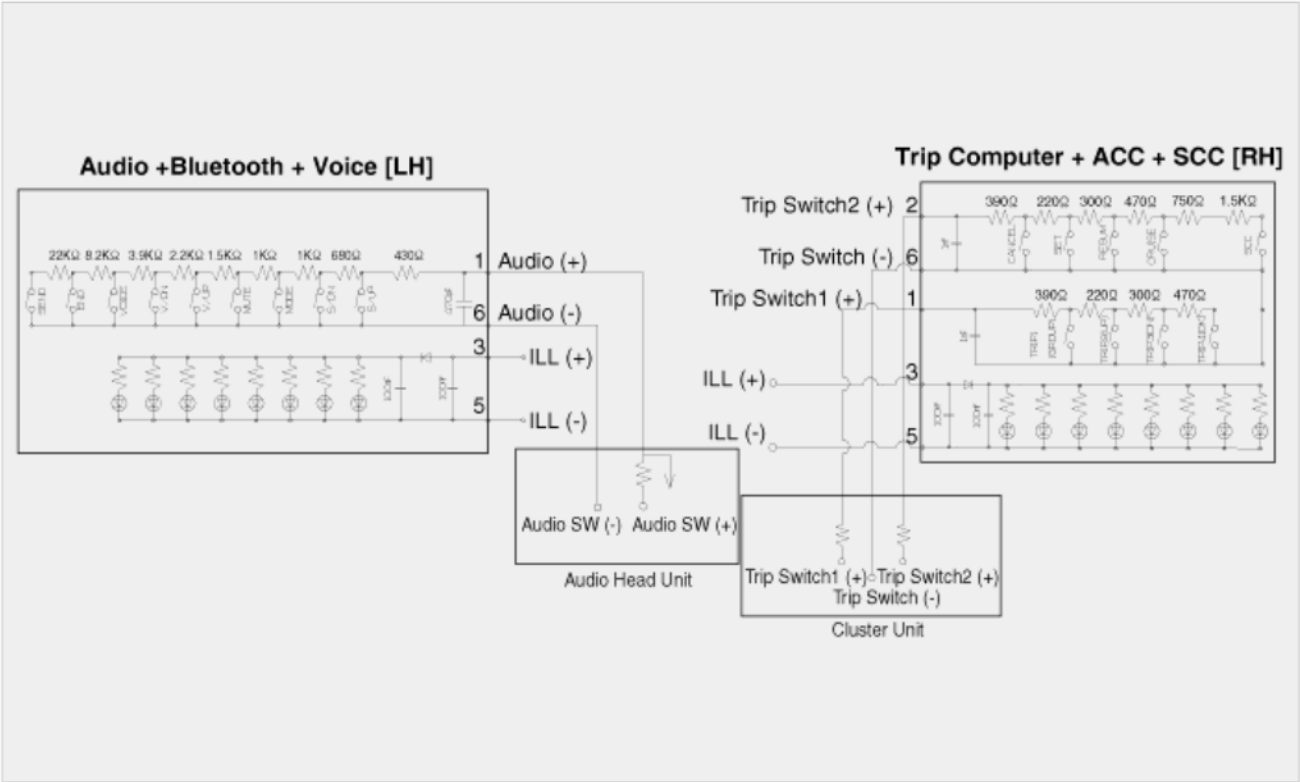


Installation

1. Install the steering wheel remote control.
2. Connect the steering remote control connector.
3. Install the steering back cover.
4. Install the steering rear cover.
5. Install the steering front cover.
6. Connect the paddle shift switch connector.
7. Install the paddle shift switch.
8. Install the steering wheel assembly.
9. Connect the negative (-) battery terminal.

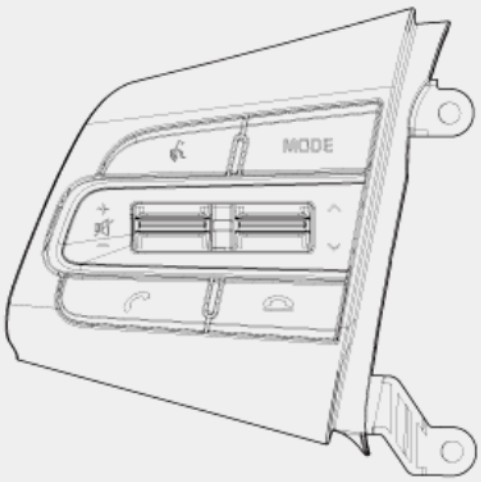
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Circuit Diagram

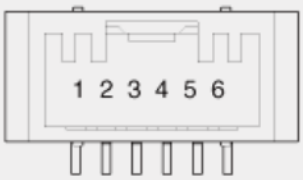


[Audio + Bluetooth + Voice]

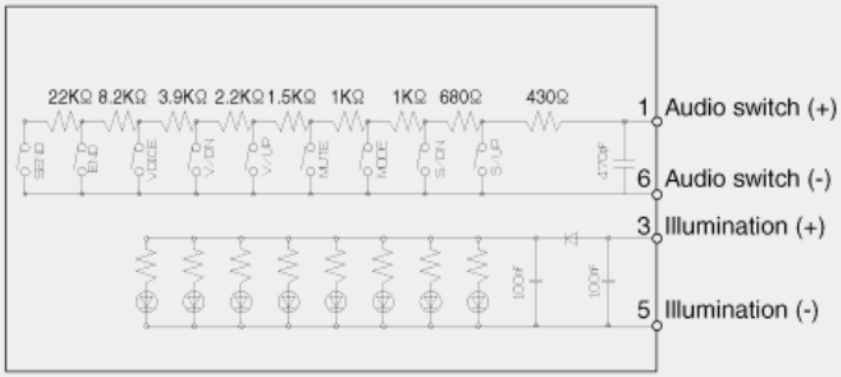
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Connector

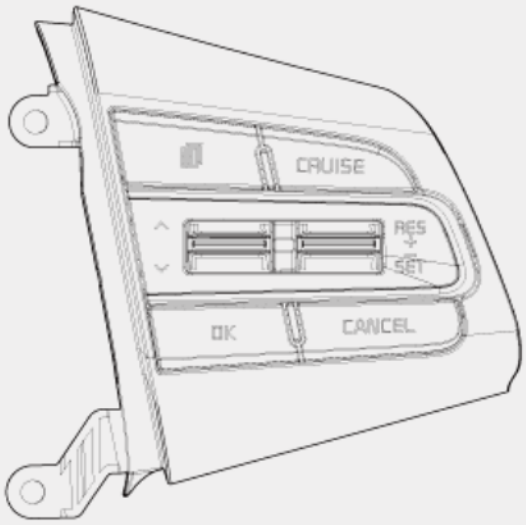


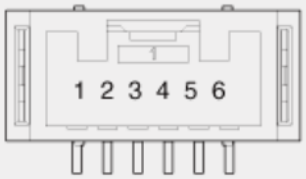
No.	Description
1	Audio switch (+)
2	-
3	Illumination (+)
4	-
5	Illumination (-)
6	Audio switch (-)

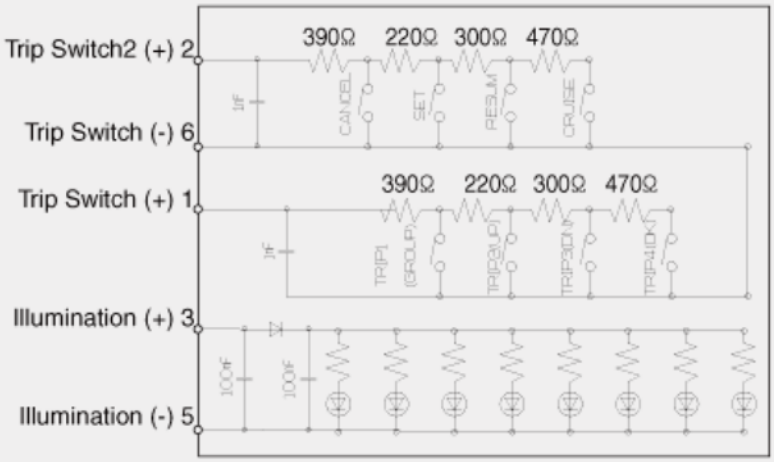


[Trip + ACC]

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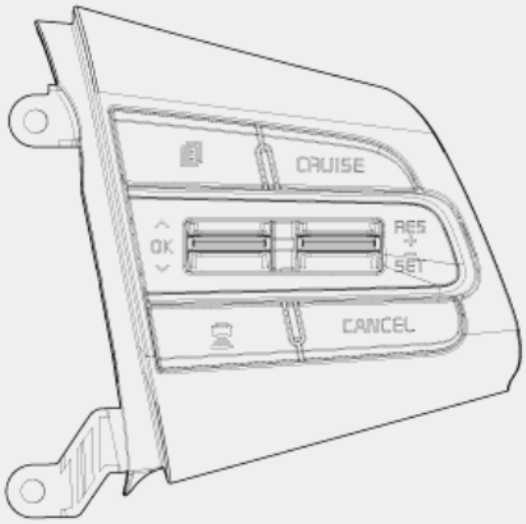


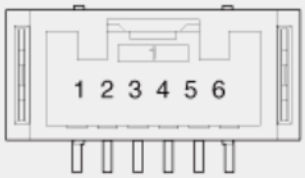
Connector	
	
No.	**Description**
1	Trip switch (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)

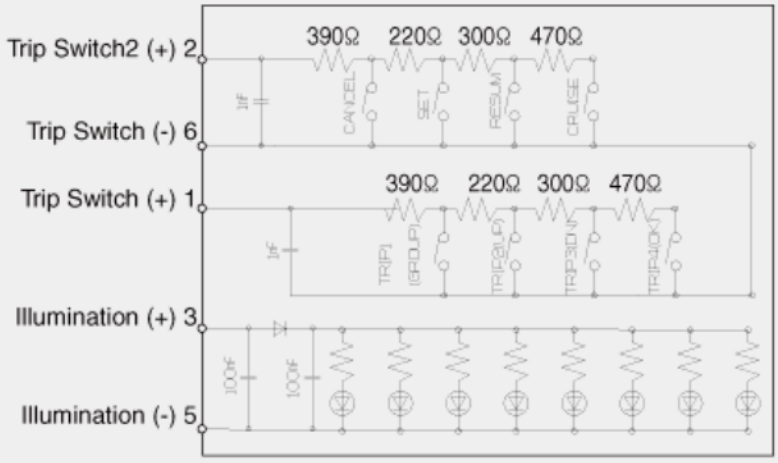


[Trip + ACC + SCC]

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Connector	
	
No.	**Description**
1	Trip switch (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)



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Description

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), clutch pedal switch (M/T), ignition lock switch, connection wires and the battery cable.

When the ignition key is turned to the start position, current flows and energizes the starter motor''s solenoid coil.

The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks.

In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.

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Inspection

1. Turn ignition switch OFF and disconnect the battery negative (-) terminal.
2. Remove the fuse box cover (A).



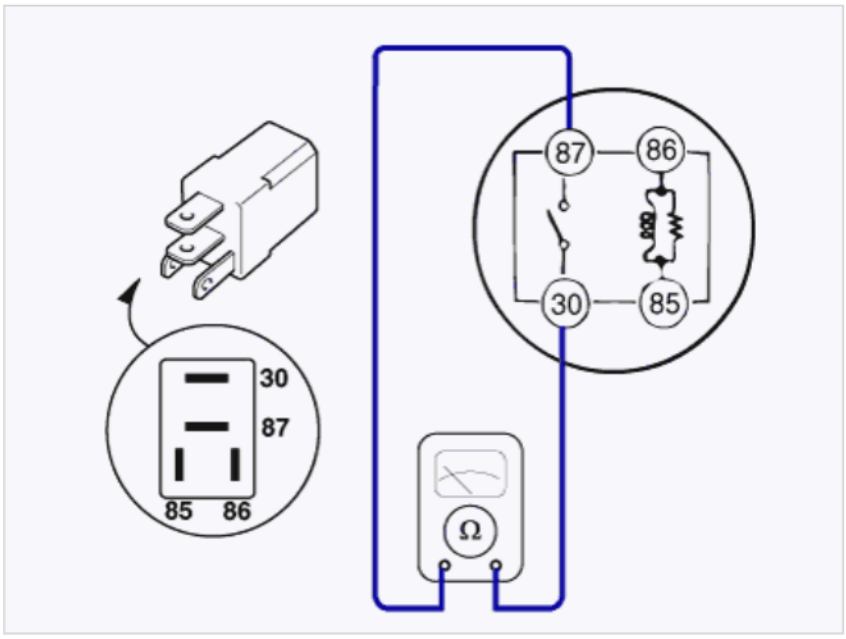
3. Remove the starter relay (A).



4. Check for continuity between the terminals (30 and 87) using an ohmmeter.

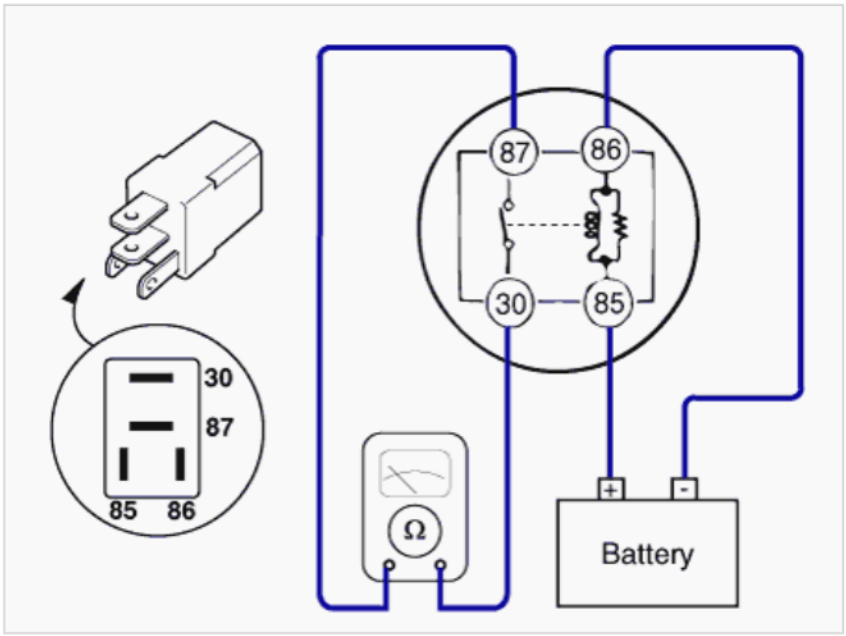
Terminal	Resistance	Measure
30 - 87	1MΩ or higher	If there is continuity between the terminals, replace the relay.

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5. Apply 12V to the terminal 85 and ground to the terminal 86 and then check for continuity between the terminals (30 and 87).

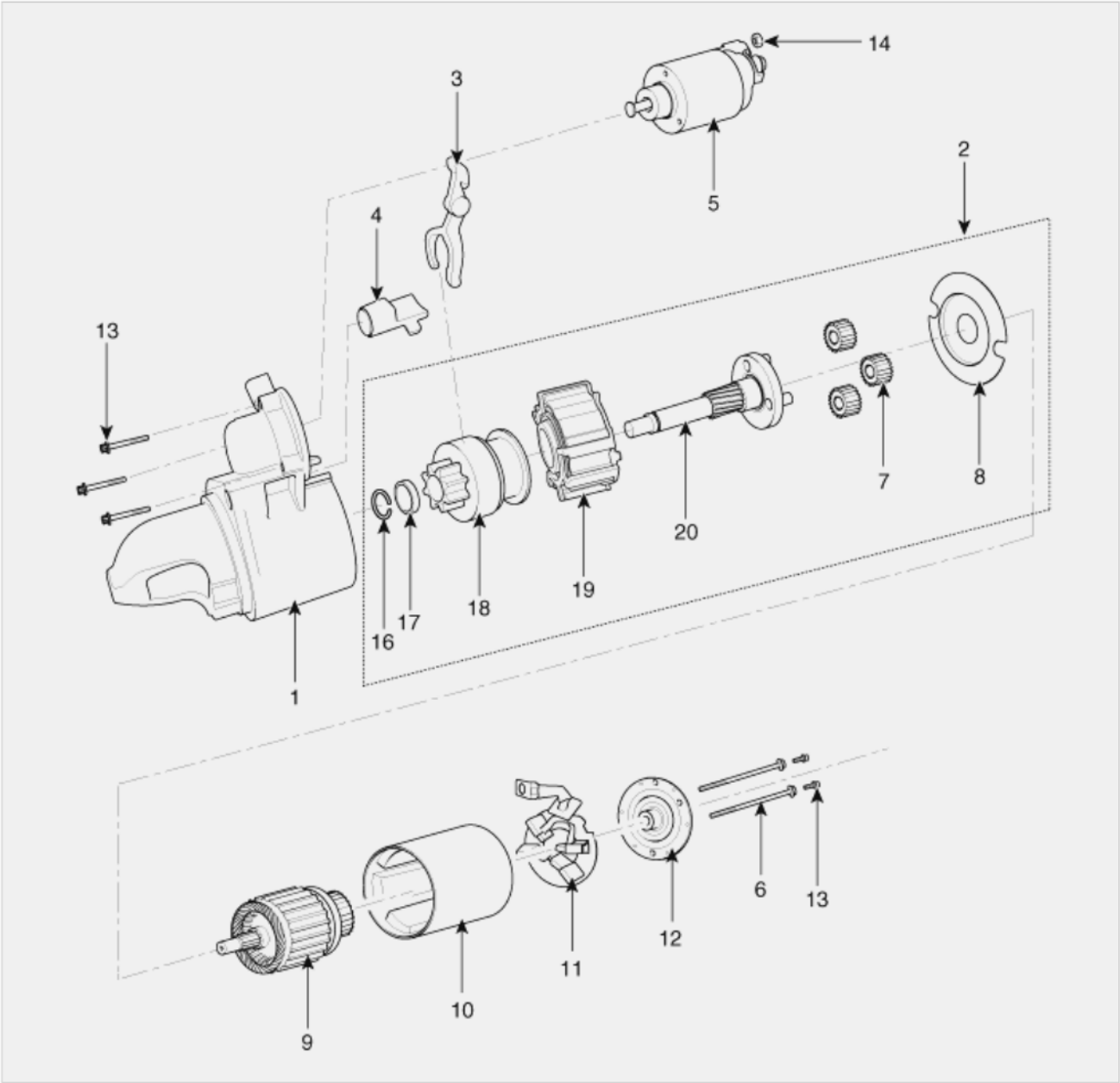
Terminal	Resistance	Measure
30 - 87	1Ω or less	If there is no continuity between the terminals, replace the relay.



6. Install the starter relay.
7. Install the fuse box coveCalibration beam

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Components



1. Front bracket assembly
2. Clutch set assembly
3. Lever
4. Lever packing
5. Magnetic switch assembly
6. Through bolt
7. Planet gear
8. Shield
9. Armature assembly
10. Yoke assembly
11. Brush holder assembly
12. Rear bracket assembly
13. Screw
14. Nut
15. Name plate
16. Stop ring
17. Snap ring
18. Overrunning clutch (ORC) assembly
19. Internal gear assembly
20. Planet shift assembly

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Description

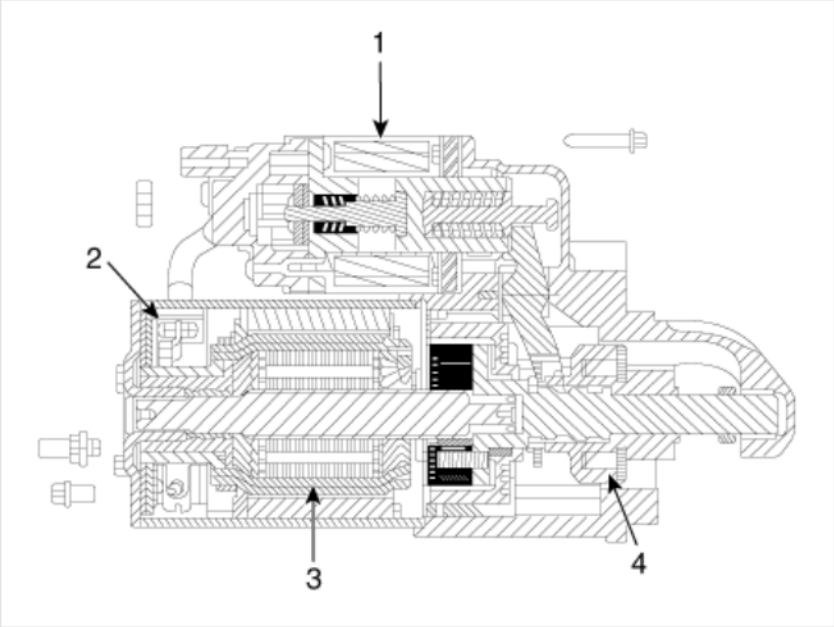
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When the ignition key is turned to the start position, current flows and energizes the starter motor"s solenoid coil.

The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks.

In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.

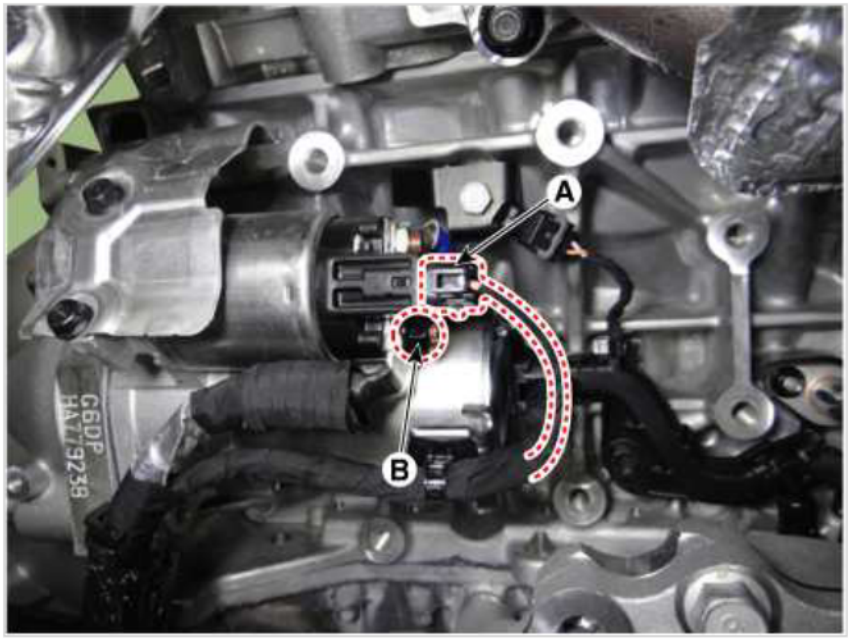


1. Solenoid
2. Brush assembly
3. Armature
4. Overrun clutch

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Removal

1. Switch "OFF" the ignition and disconnect the negative (-) battery terminal.
2. Remove the RH engine mounting support bracket.
   (Refer to Engine Mechanical System - "Engine Mounting")
3. Remove the stater solenoid "B" terminal mounting nut (B), and then disconnect the stater cable and ST connector (A).



4. Remove the starter mounting bolts.

Starter mounting bolt :
49.0 - 63.7 N·m (5.0 - 6.5 kgf·m, 36.2 - 47.0 lb·ft)



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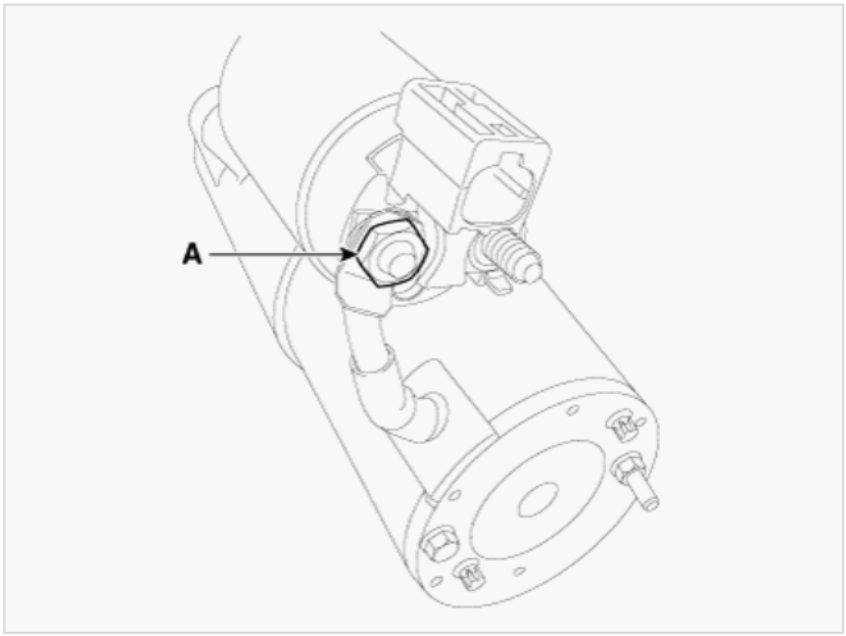


Installation

1. Install in the reverse order of removal.

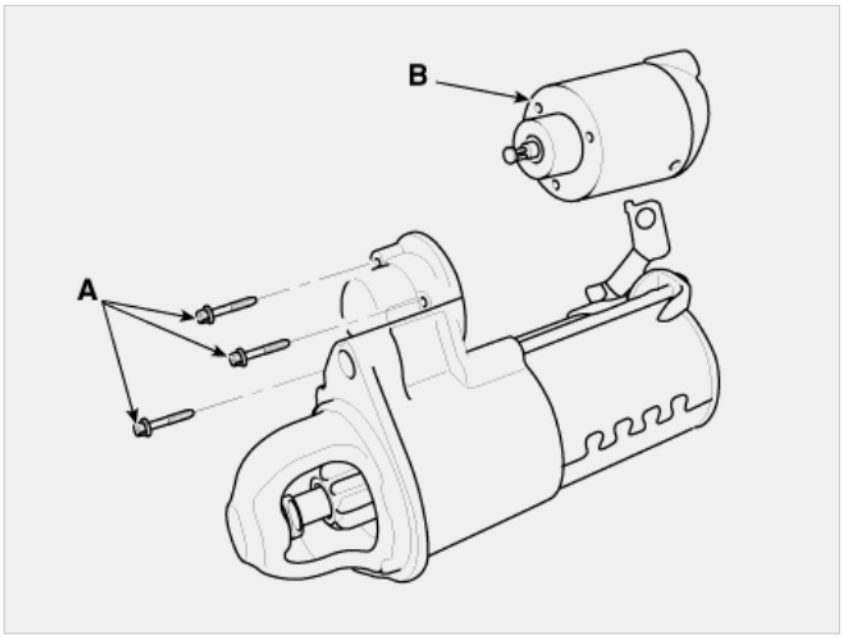
Disassembly

1. Disconnect the M-terminal (A) on the starter solenoid assembly.

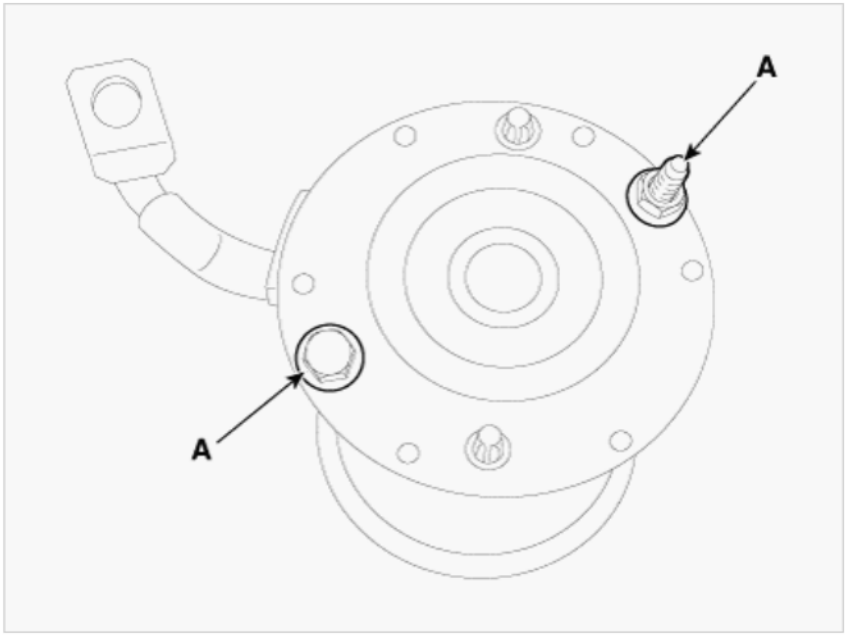


2. After loosening the screws (A), detach the starter solenoid assembly (B).

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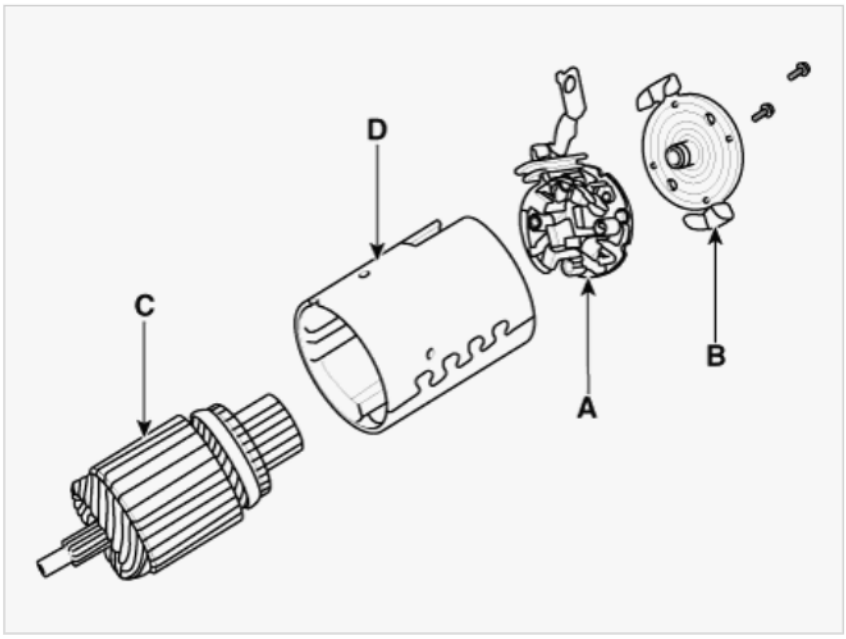


3. Loosen the through bolts (A).

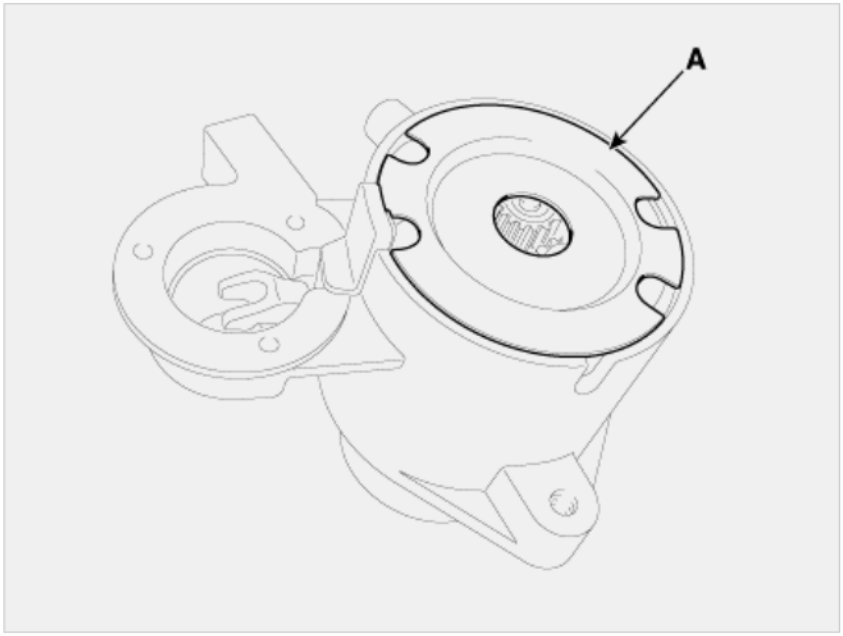


4. Remove the brush holder assembly (A), rear bracket assembly (B) after loosening the mounting screws.
5. Remove the armature assembly (C) and york assembly (D).

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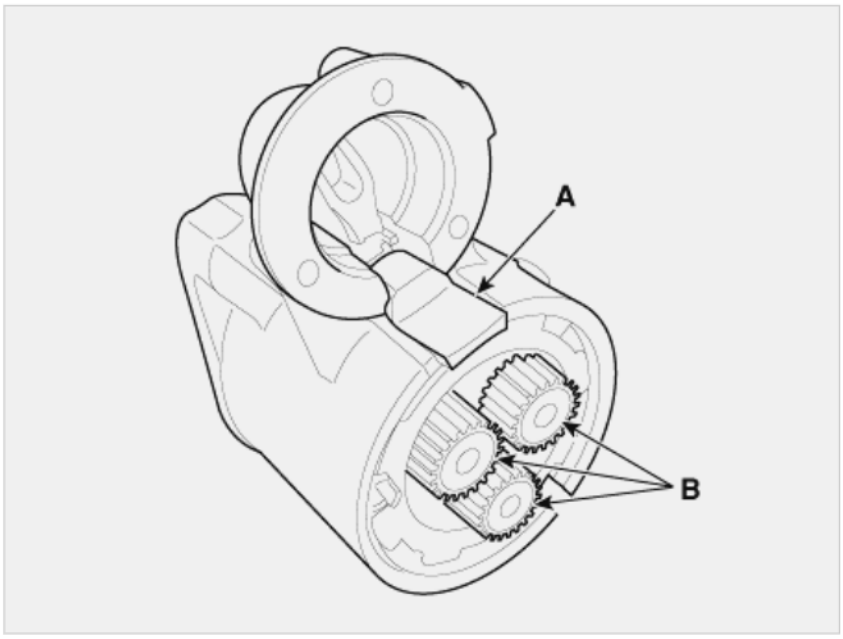


6. Remove the shield (A).

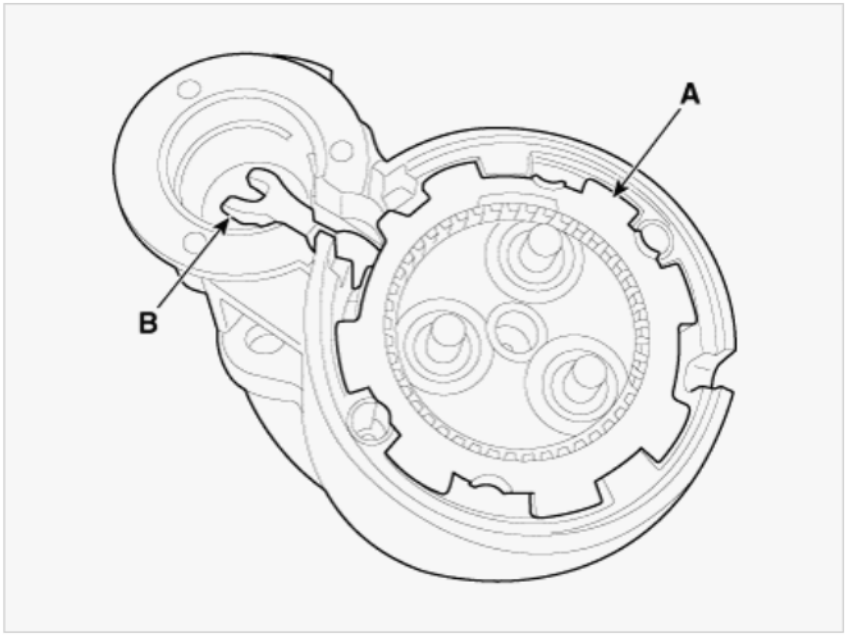


7. Remove the lever packing (A) and the planet gear (B).

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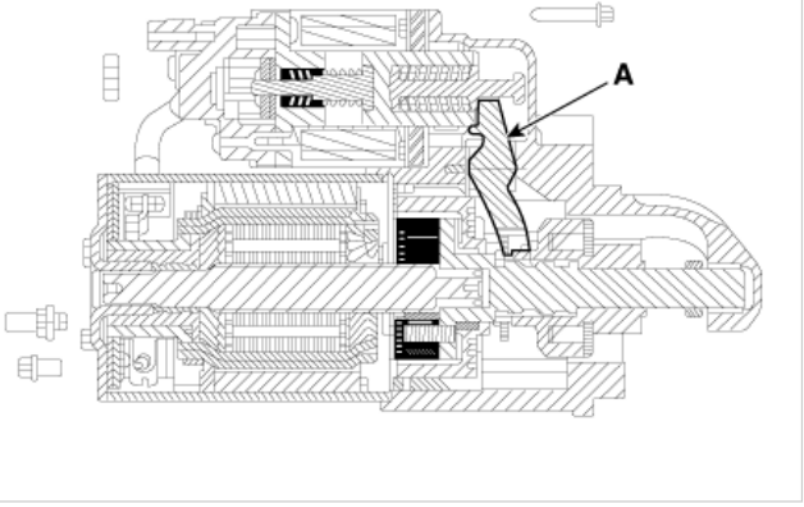
8. Remove the clutch set assembly (A) and lever (B).



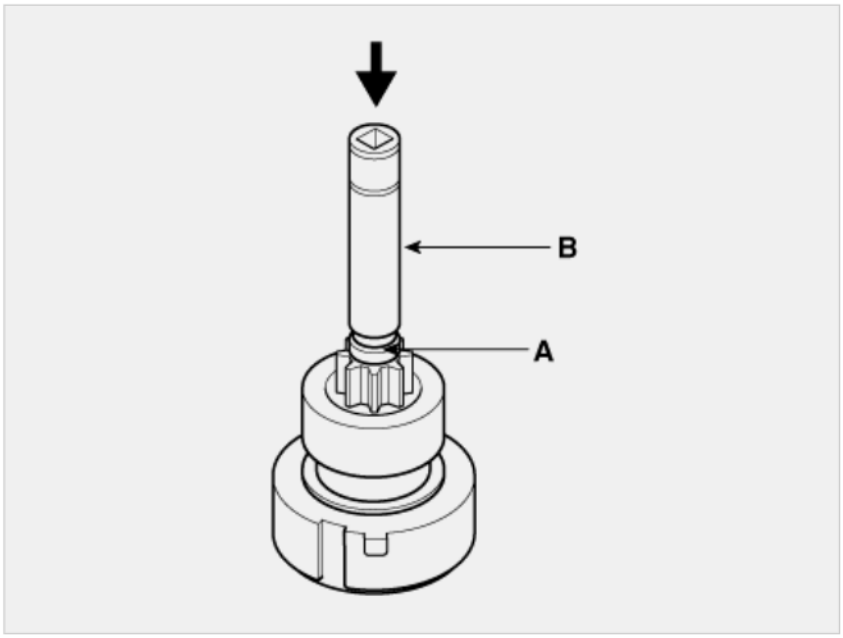
NOTICE

Beware of the direction of the lever (A).

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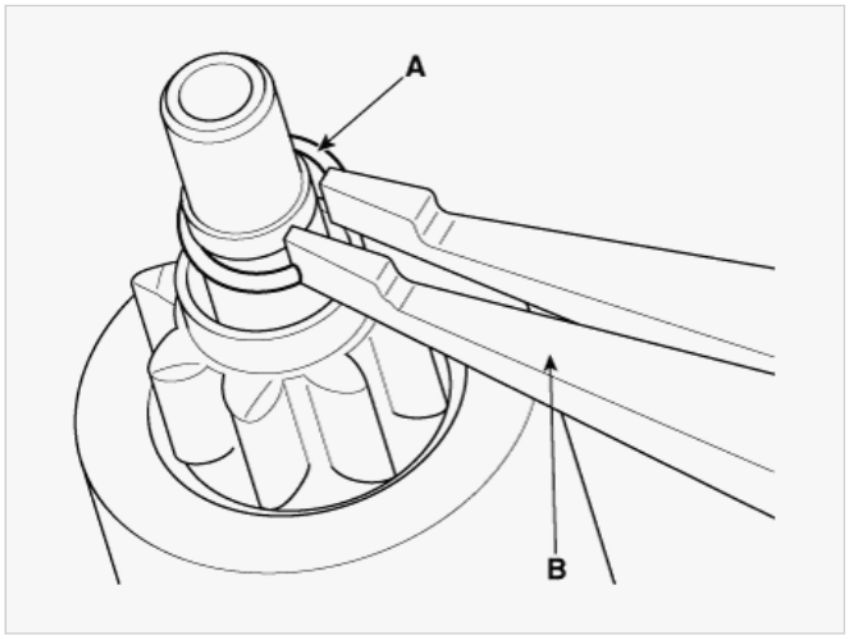


9. Press the stopper (A) using a socket (B).

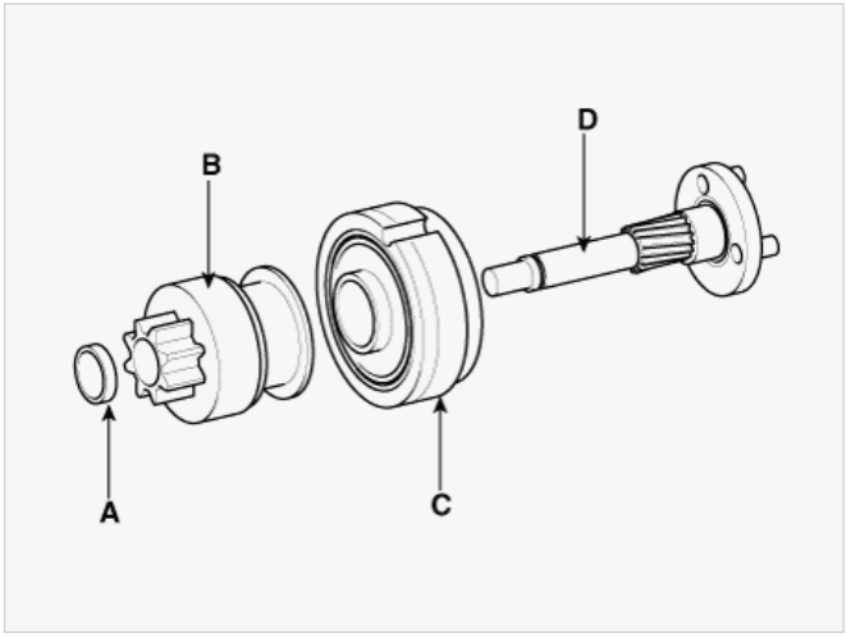


10. Remove the stop ring (A) using the stop ring pliers (B).

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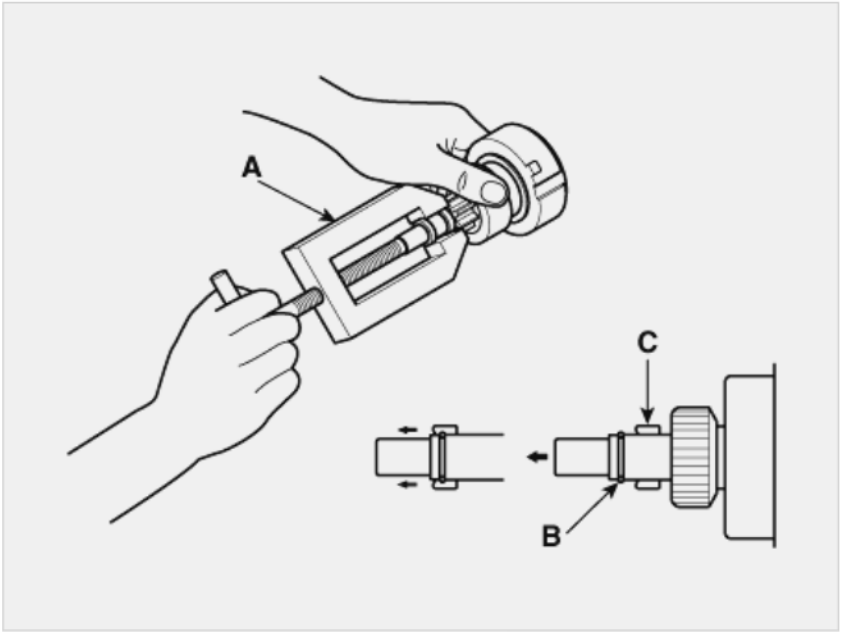
11. Remove the stopper (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



NOTICE

Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).

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Reassembly

1. Reassemble in the reverse order of disassembly.

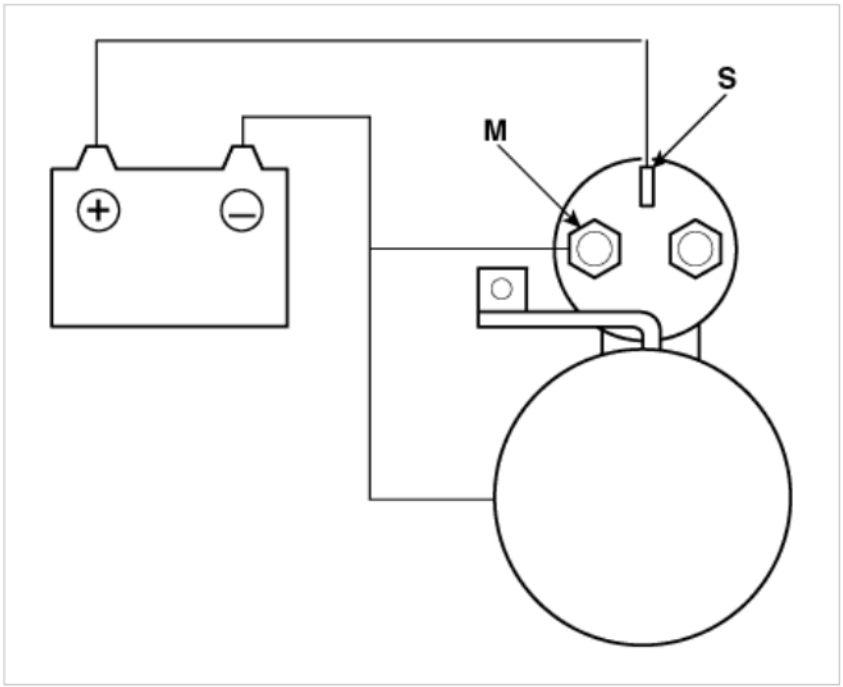
Inspection

Starter Solenoid Inspection

1. Disconnect the lead wire from the M-terminal of solenoid switch.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly.

NOTICE

- To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

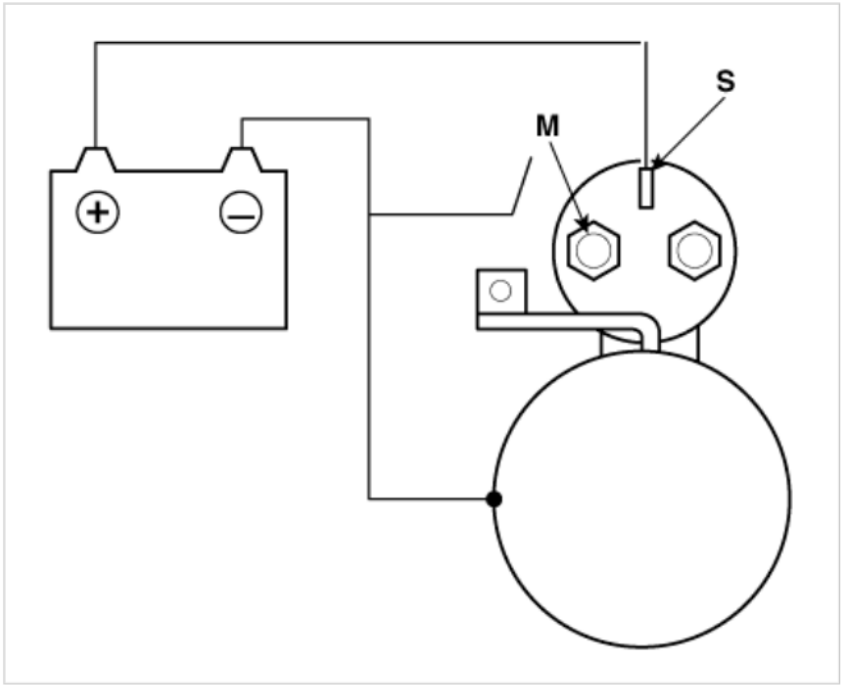


3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly.

NOTICE

- To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

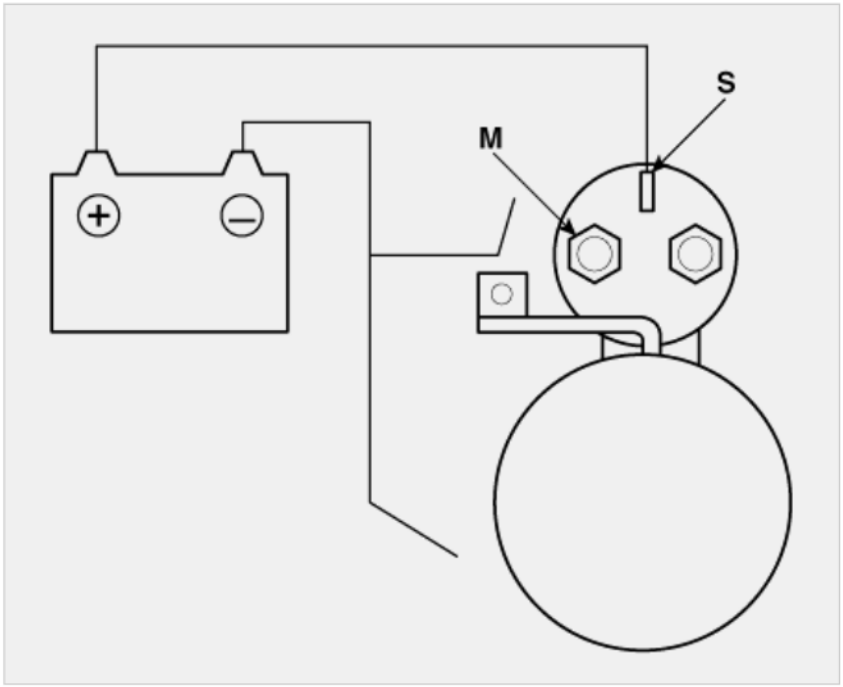
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4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly.

NOTICE

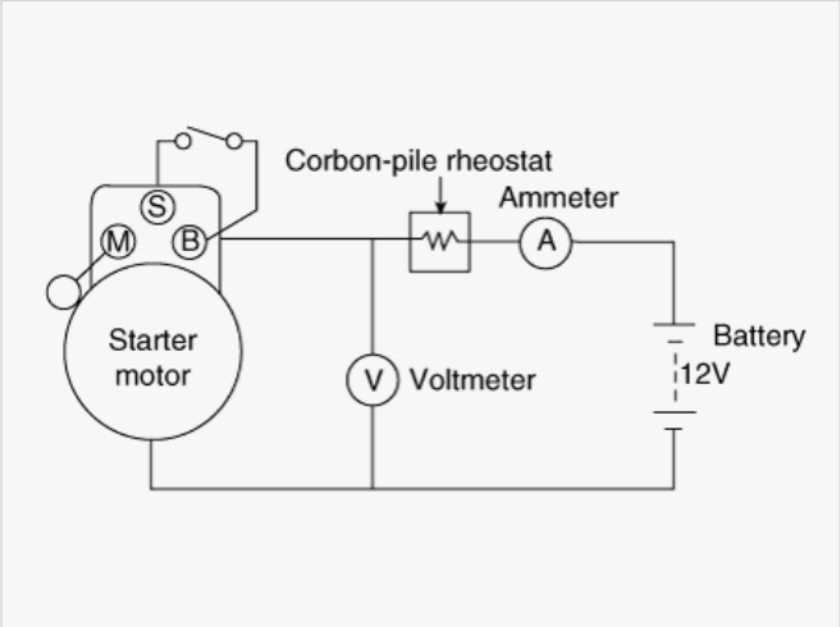
- To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



Free Running Inspection

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (150-ampere scale) and carbon pile rheostats shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.

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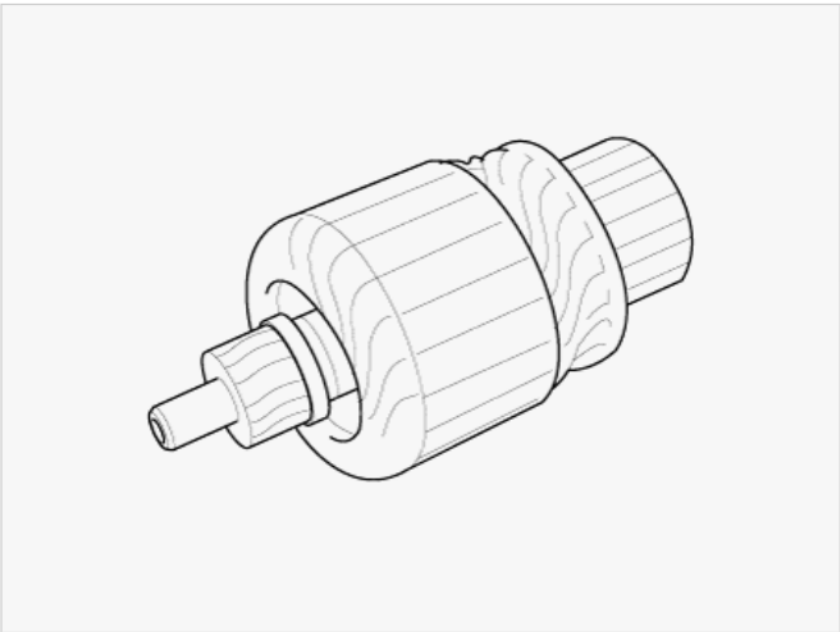


4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery''s negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11 volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Items	Specification
Current (Max.)	135
Speed (Min.)	3,200

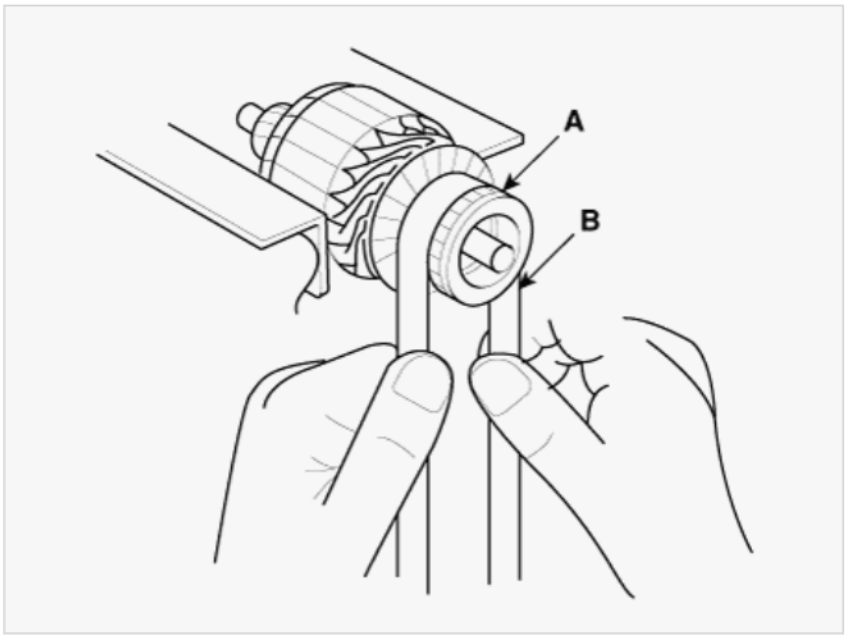
Armature Inspection And Test

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.



4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).

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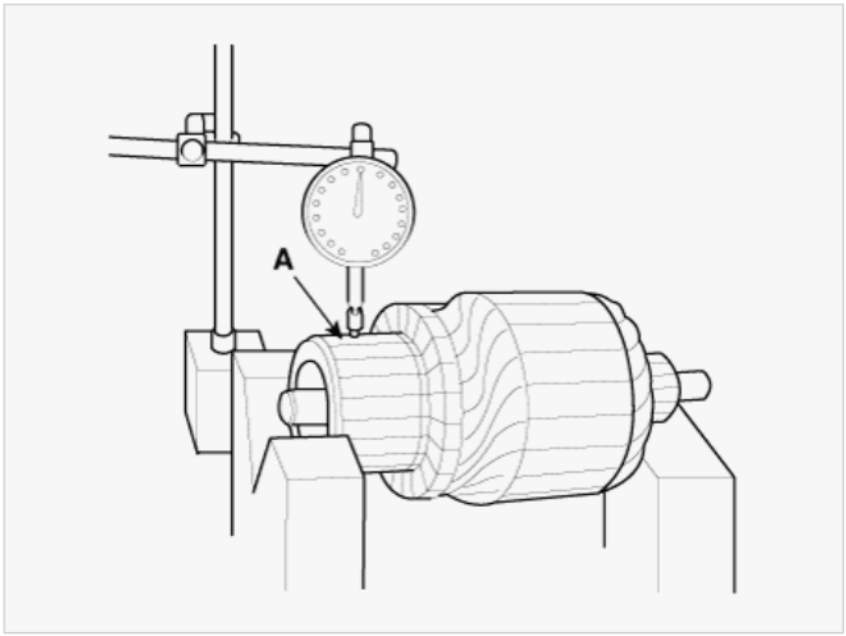


5. Measure the commutator (A) runout.
   - If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   - If the commutator run out is not within the service limit, replace the armature.

Commutator runout

Standard (New): 0.05mm (0.0019in.) max

Service limit: 0.08mm (0.0031in.)



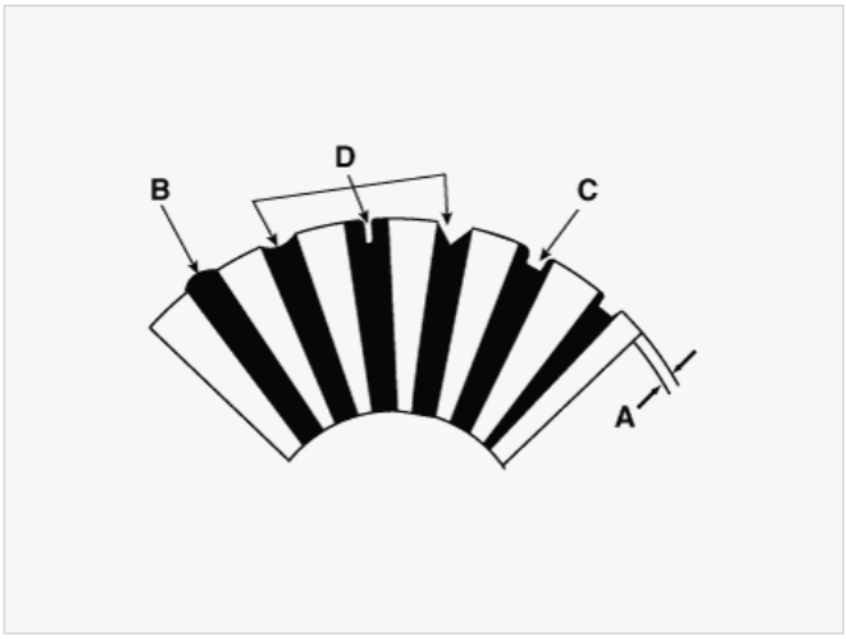
6. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

Commutator mica depth

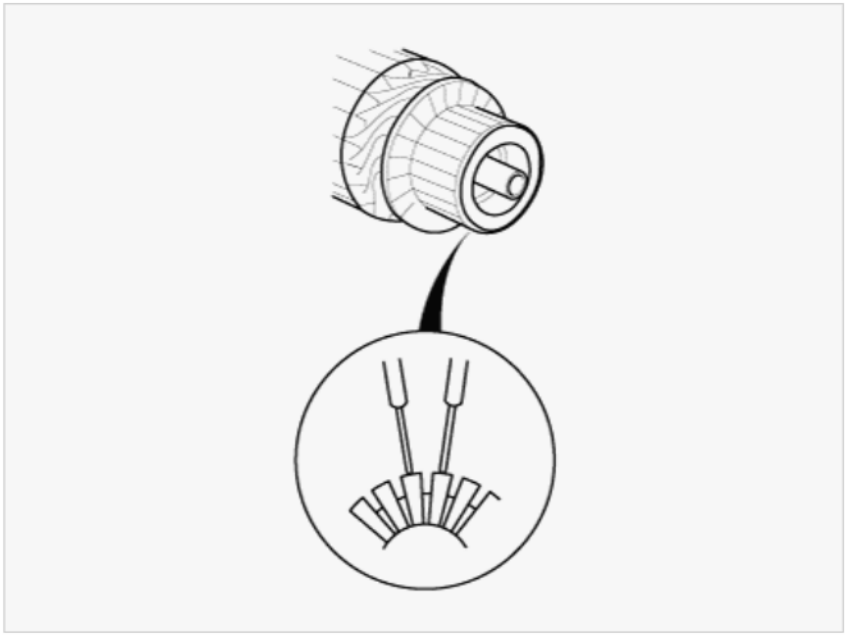
Standard (New) : 0.8 mm (0.314 in.)

Limit : 0.2mm (0.0079 in.)

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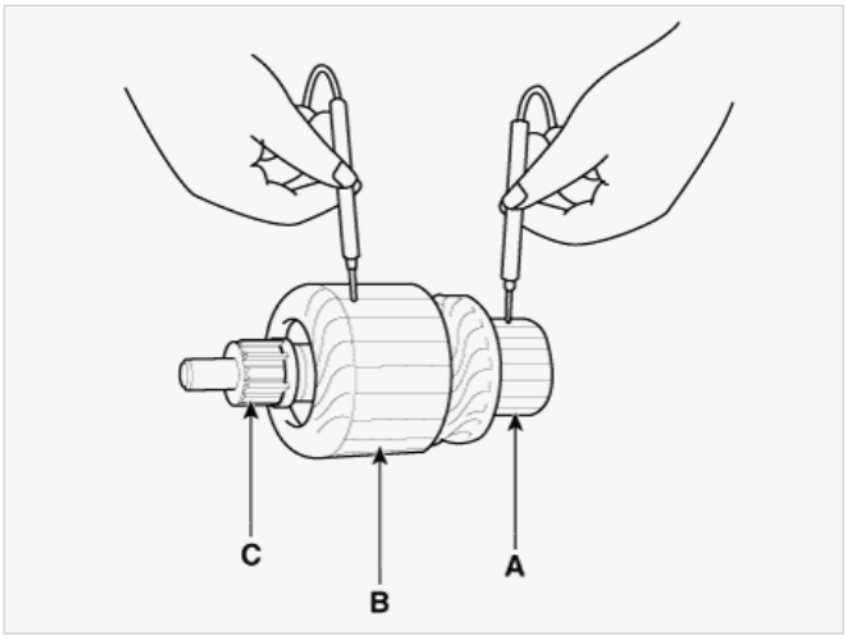


7. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



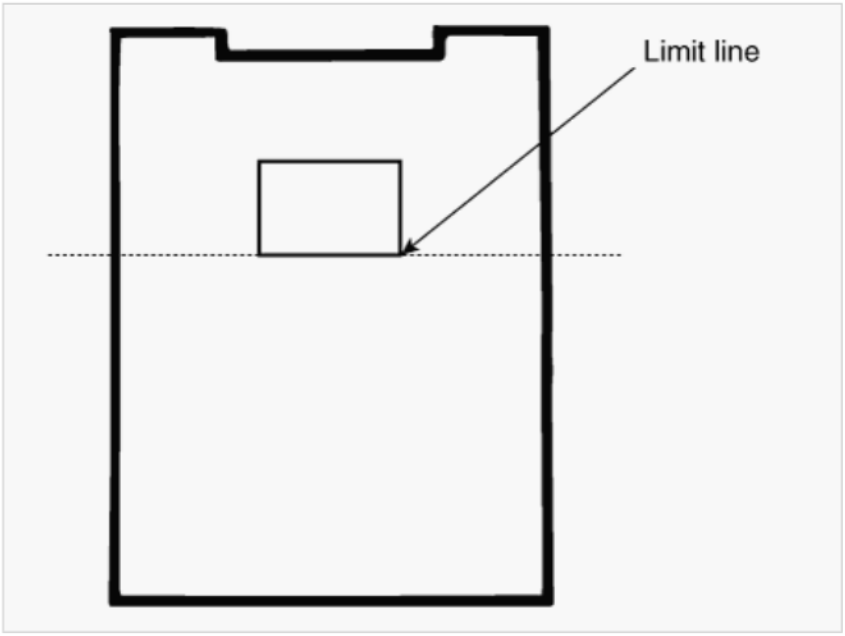
8. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.

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Inspect Starter Brush

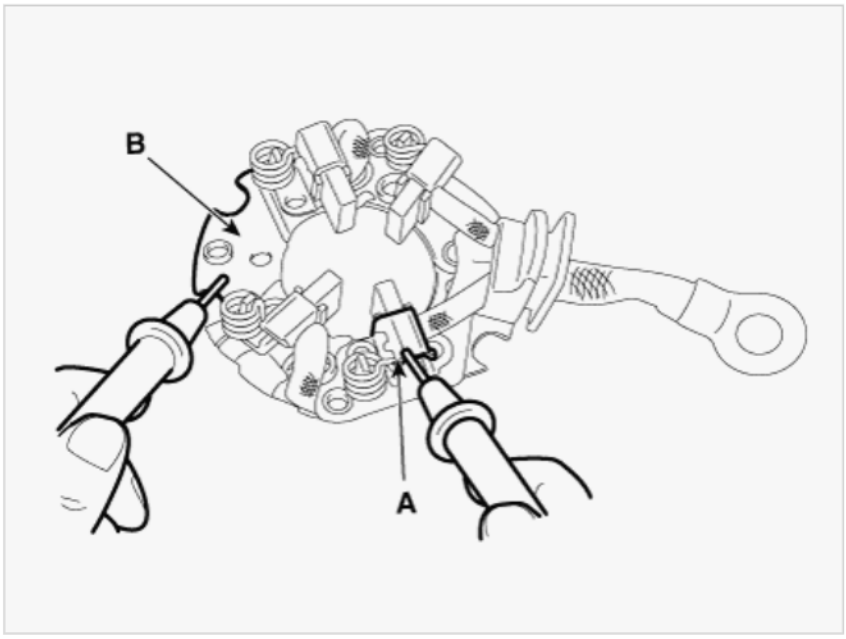
Any worn out or oil-soaked brushes should be replaced.



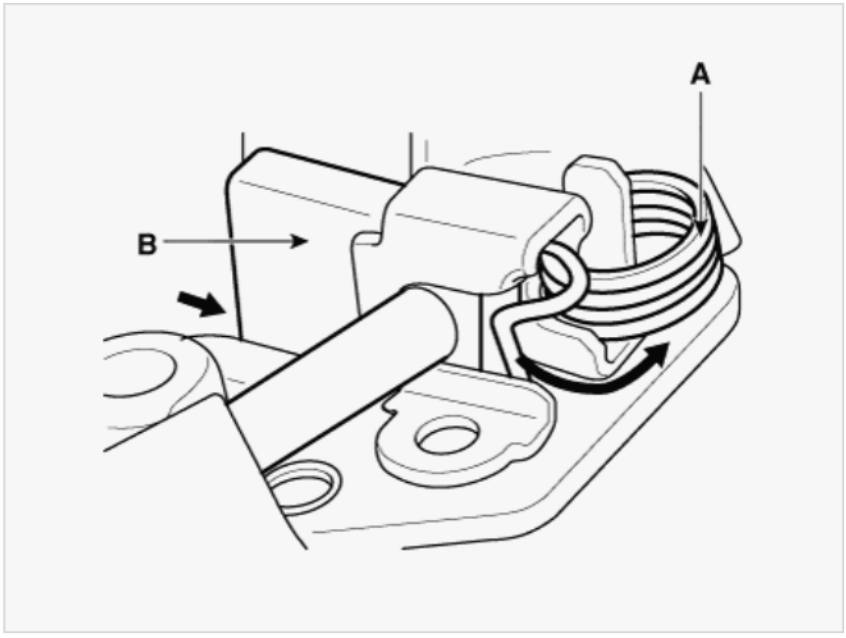
Starter Brush Holder Test

1. Check that there is no continuity between the (+) brush holder (A) and (-) plate (B). If there is continuity, replace the brush holder assembly.

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2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.

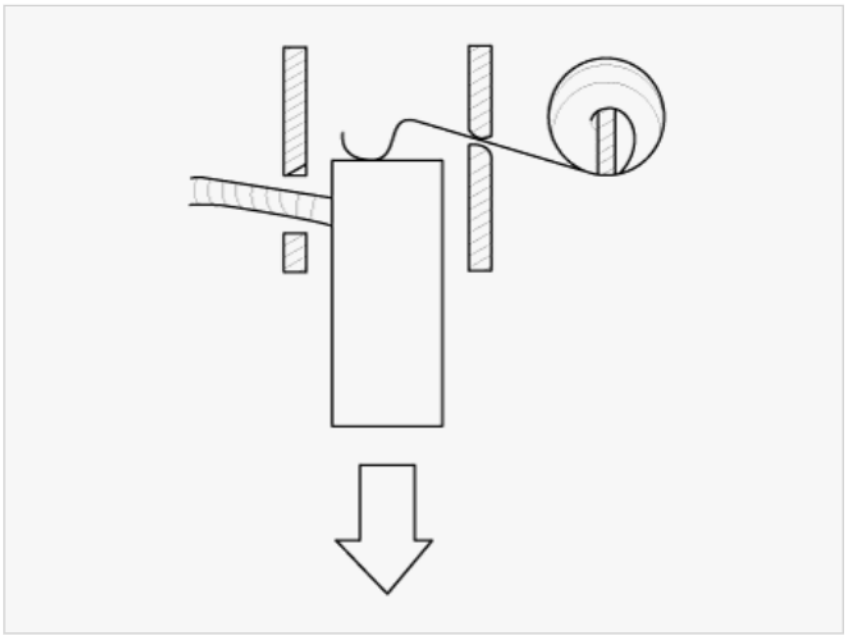


3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

NOTICE

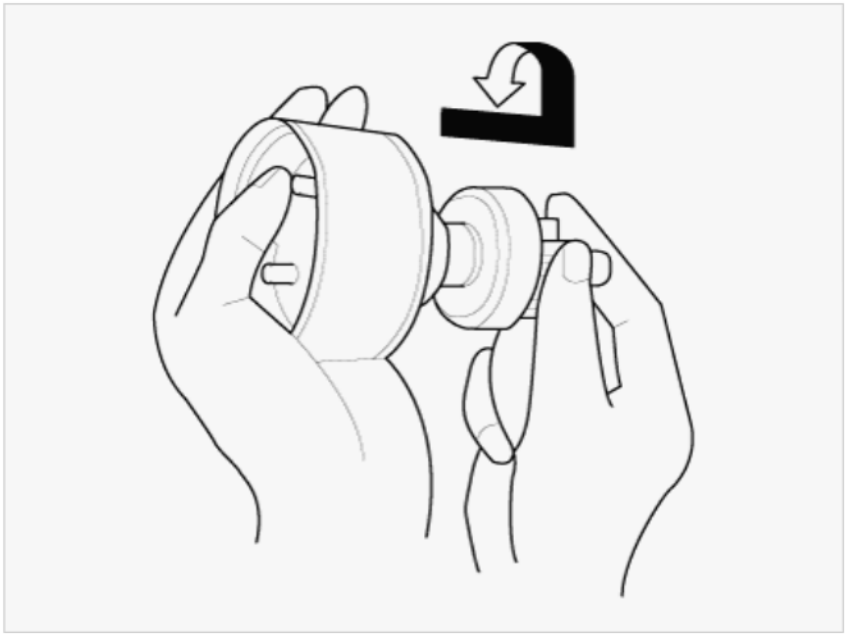
To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.

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Inspect Overrunning Clutch

1. Slide the overrunning clutch along the shaft.
   Replace if it does not slide smoothly.
2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or locks in both directions, replace it.



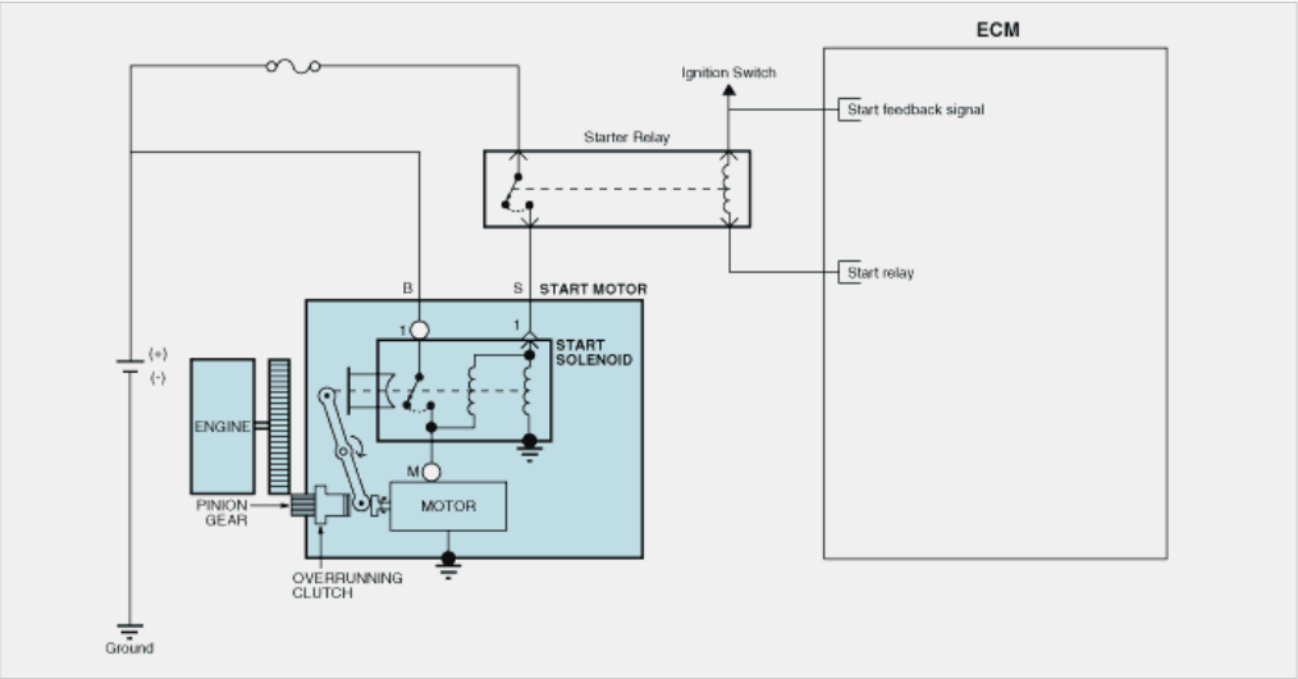
3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (The gear is not available separately.)
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

Cleaning

1. Do not immerse parts in cleaning solvent.
   Immersing the yoke assembly and/or armature will damage the insulation wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent.
   The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

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Circuit Diagram



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Specification

Starter

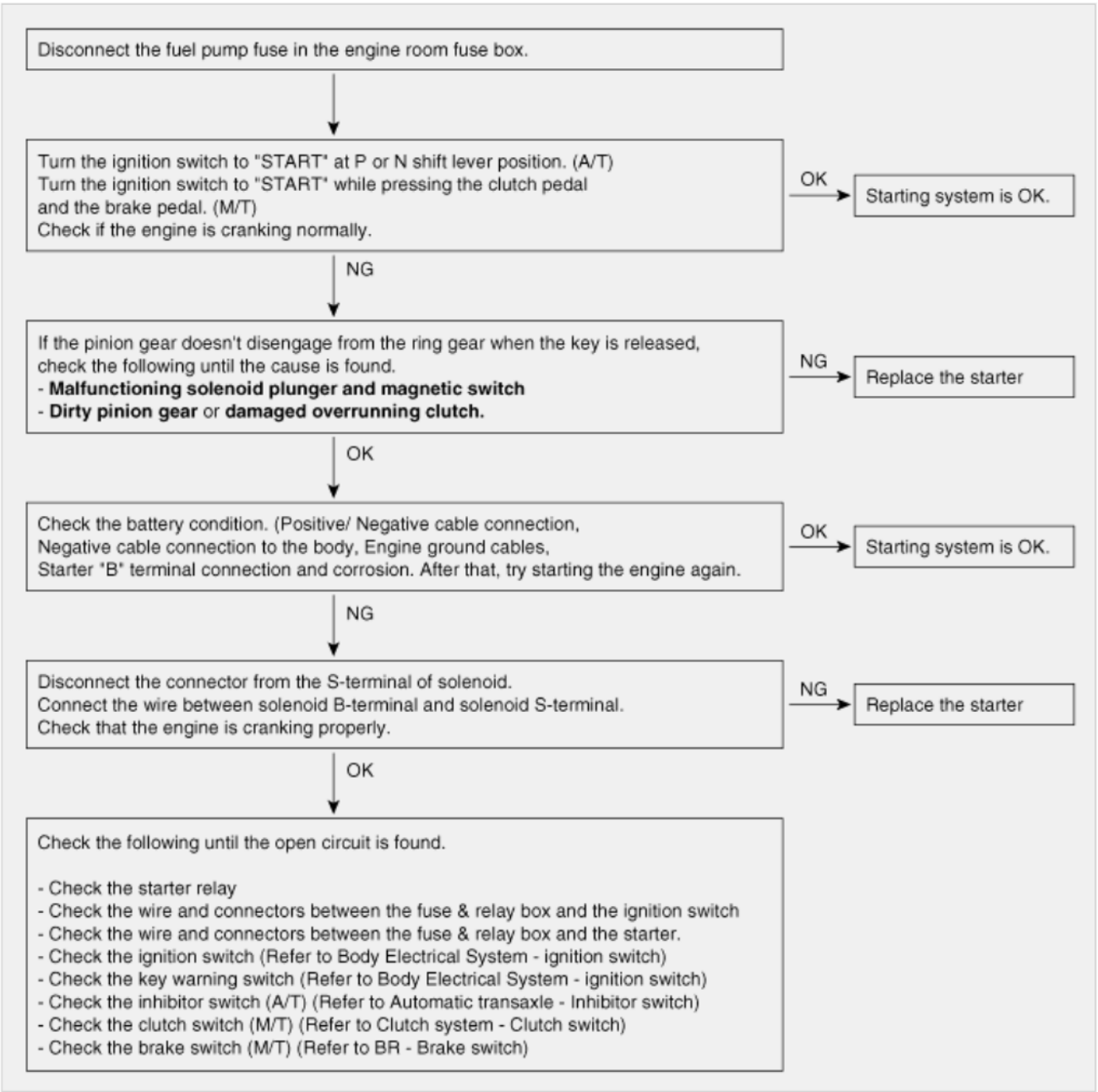
Item		Specification
Rated voltage		12 V, 2.0 kW
The number of pinion teeth		12
Performance [No-load, 11 V]	Ampere	Max. 135 A
	Speed	Min. 3,200 rpm

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Troubleshooting

NOTICE

- The battery must be in good condition and fully charged for this troubleshooting.



Trouble symptom	Probable cause	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Transaxle range switch (Vehicle with automatic transaxle only)	Refer to AT group-automatic transaxle
	Fuse blown	Replace fuse
	Starter motor faulty	Replace
	Ignition switch faulty	Replace
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables

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	Starter motor faulty	Replace
Starter keeps running	Starter motor faulty	Replace
	Ignition switch	Replace
Starter spins but engine will not crank	Short in wiring	Repair or replace wiring
	Pinion gear teeth broken or starter motor	Replace
	Ring gear teeth broken	Replace fly wheel or torque converter

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Tightening Torques

Item	N.m	kgf.m	lb-ft
Ignition coil mounting bolt	9.8 - 11.8	1.0 - 1.2	7.2 - 8.7
Spark plug	19.6 - 29.4	2.0 - 3.0	14.5 - 21.7
Alternator mounting bolt	49.0 - 63.7	5.0 - 6.5	36.2 - 47.0
Battery (+) terminal tightening nut	7.8 - 9.8	0.8 - 1.0	5.2 - 8.7
Battery (-) terminal tightening nut	7.8 - 9.8	0.8 - 1.0	5.2 - 8.7
Battery bracket mounting bolt	8.8 - 29.4	0.9 - 3.0	6.5 - 21.7
Battery tray mounting bolt	8.8 - 29.4	0.9 -3.0	6.5 - 21.7
Battery sensor cable mounting bolt (Chassis ground)	27.0 - 33.0	2.7 - 3.4	19.9 - 24.3
Starter mounting bolt	49.0 - 63.7	5.0 - 6.5	36.2 - 47.0
Starter cover mounting bolt	8.8 - 13.7	0.9 - 1.4	6.5 - 10.1

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