Service Data

Ignition System

Ignition Coil

Item	Specification
Rated Voltage (V)	14
Operation Voltage (V)	5 - 16

Item	Specification					
Engine Speed (RPM)	1000	2000	3000	4000	5000	6000
Dwell Time (ms)	1.9	1.9	1.9	1.9	1.9	1.9
Secondary Coil Voltage (kV)	29 ↑	29 ↑	29 ↑	29 ↑	29 ↑	29 ↑

Spark plug

Item	Specification
Type	SILZKR6B10E
Gap	1.0 - 1.1 mm
	(0.0394 - 0.0433in.)

Item	Specification
Type	ELR9IQP10
Gap	0.9 - 1.0 mm
	(0.0354 - 0.0394in.)

Condenser

Item	Specification
Capacitance (uF)	0.47 [1KHz]
Insulation resistance (MΩ)	1,000 [DC 500 V/1 Min]

Charging System

Alternator

Item		Specification
Rated voltage		13.5V, 130A
Speed in use		1,000 - 18,000 rpm
Voltage regulator		IC Regulator built-in type
Regulator Setting Voltage	External mode	Refer to below graph
	Internal mode	14.55 ± 0.3V
Temperature Gradient	External mode	0 ± 3 mV / °C
	Internal mode	-3.5 ± 2mV / °C
Type		OAP

Battery

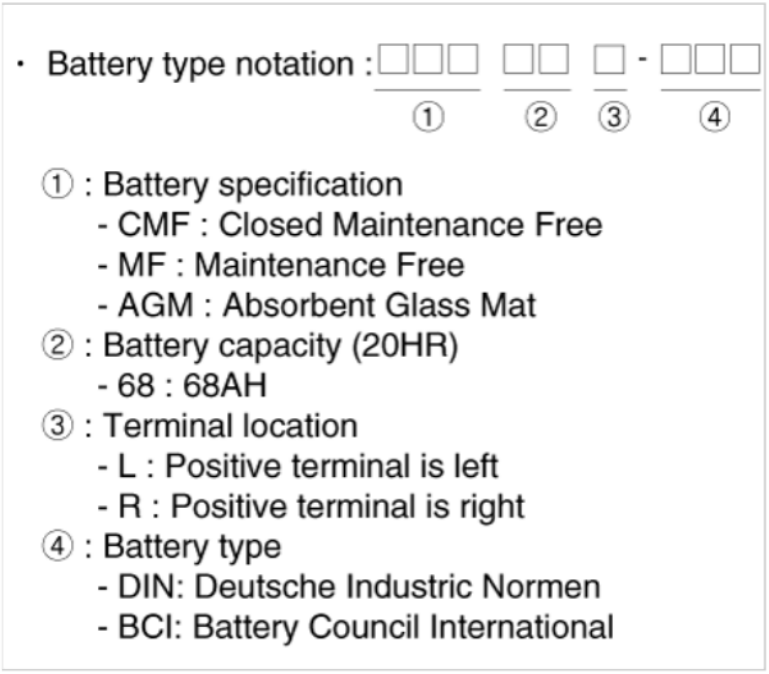
▹ AGM60L-DIN

Item	Specification
Capacity [20HR/5HR] (AH)	60 / 48
Cold Cranking Amperage (A)	640 (SAE) / 640 (EN)
Reserve Capacity (Min)	100

Information

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• Model type description



• Cold Cranking Ampere (CCA): Cold Cranking Amps is 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) : Reserve Capacity is 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.

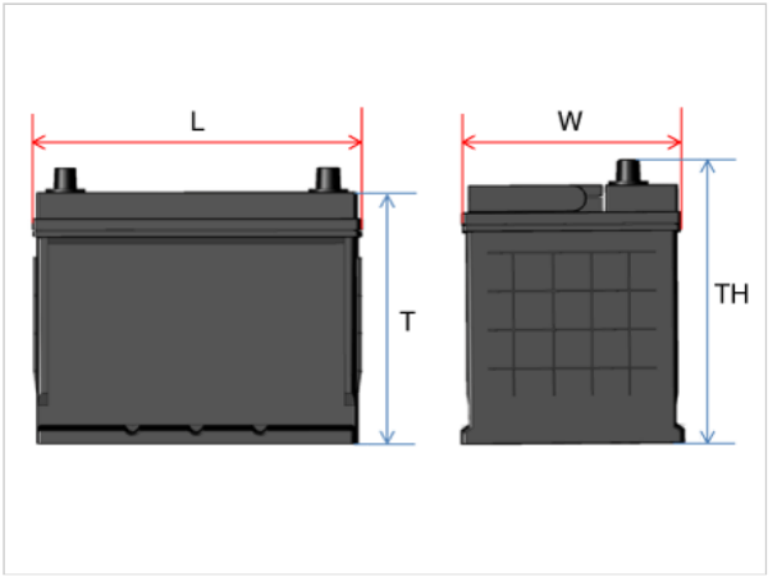
– The higher the reserve rating, the longer your vehicle can operate should your alternator or fan belt fail.

Information

BCI Type

Capacity (5HR/20HR)	Length L (mm)	Width W (mm)	Height T (mm)	Total Height 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

Starting System

Starter

Item		Specification
Rated voltage		12 V, 0.9 kW
The number of pinion teeth		11
Performance [No-load, 11.5 V]	Ampere	Max. 85A
	Speed	Min. 3,300 rpm

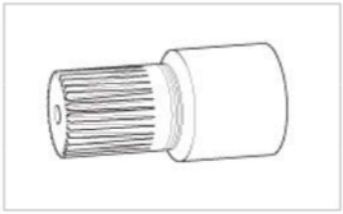
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Tightening Torques

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	14.7 - 24.5	1.5 - 2.5	10.9 - 18.1
Condenser & Hanger bracket mounting bolt	18.6 - 23.5	1.9 - 2.4	13.7 - 17.4
Alternator mounting upper bolt	23.5 - 26.5	2.4 - 2.7	17.4 - 19.5
Alternator mounting lower bolt	29.4 - 41.2	3.0 - 4.2	21.7 - 30.4
Alternator brace mounting bolt	19.6 - 26.4	2.0 - 2.7	14.5 - 19.5
Battery (+) terminal tightening nut	8.0 - 10.0	0.8 - 1.0	5.9 - 7.4
Battery (-) terminal tightening nut	8.0 - 10.0	0.8 - 1.0	5.9 - 7.4
Battery mounting bracket bolt	9.0 - 14.0	1.0 - 1.5	6.6 - 10.3
Battery tray mounting bolt	9.0 - 14.0	0.9 - 1.4	6.6 - 10.3
Battery sensor cable mounting bolt	27.0 - 33.0	2.8 - 3.4	19.9 - 24.3
Starter mounting bolt	49.0 - 63.7	5.0 - 6.5	36.2 - 47.0

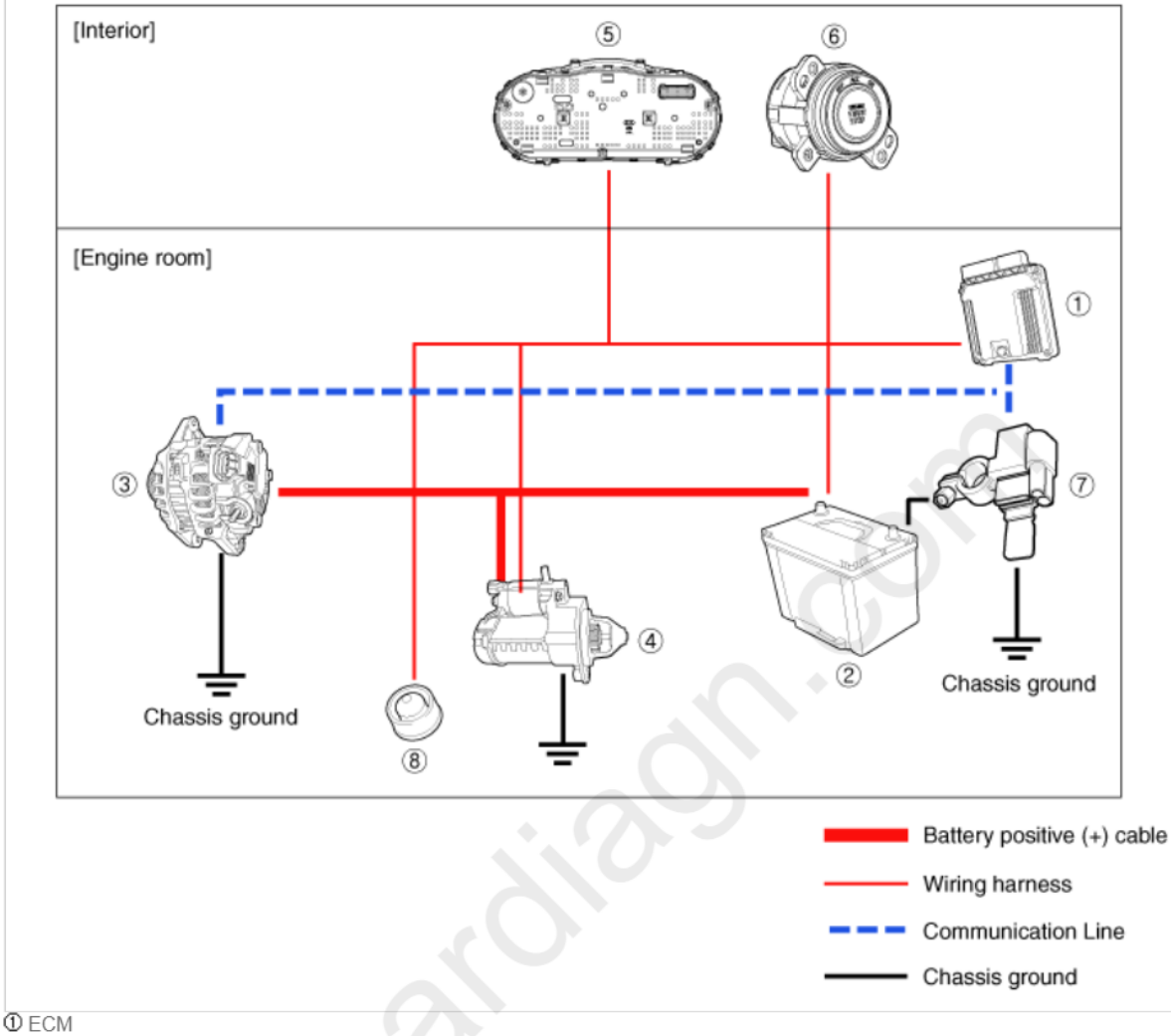
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Special Service Tools

Tool Name / Number	Illustration	Description
Alternator pulley remover wrench 09373-27000		Used for removing / installing alternator pulley

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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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Description

The charging system included 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 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.

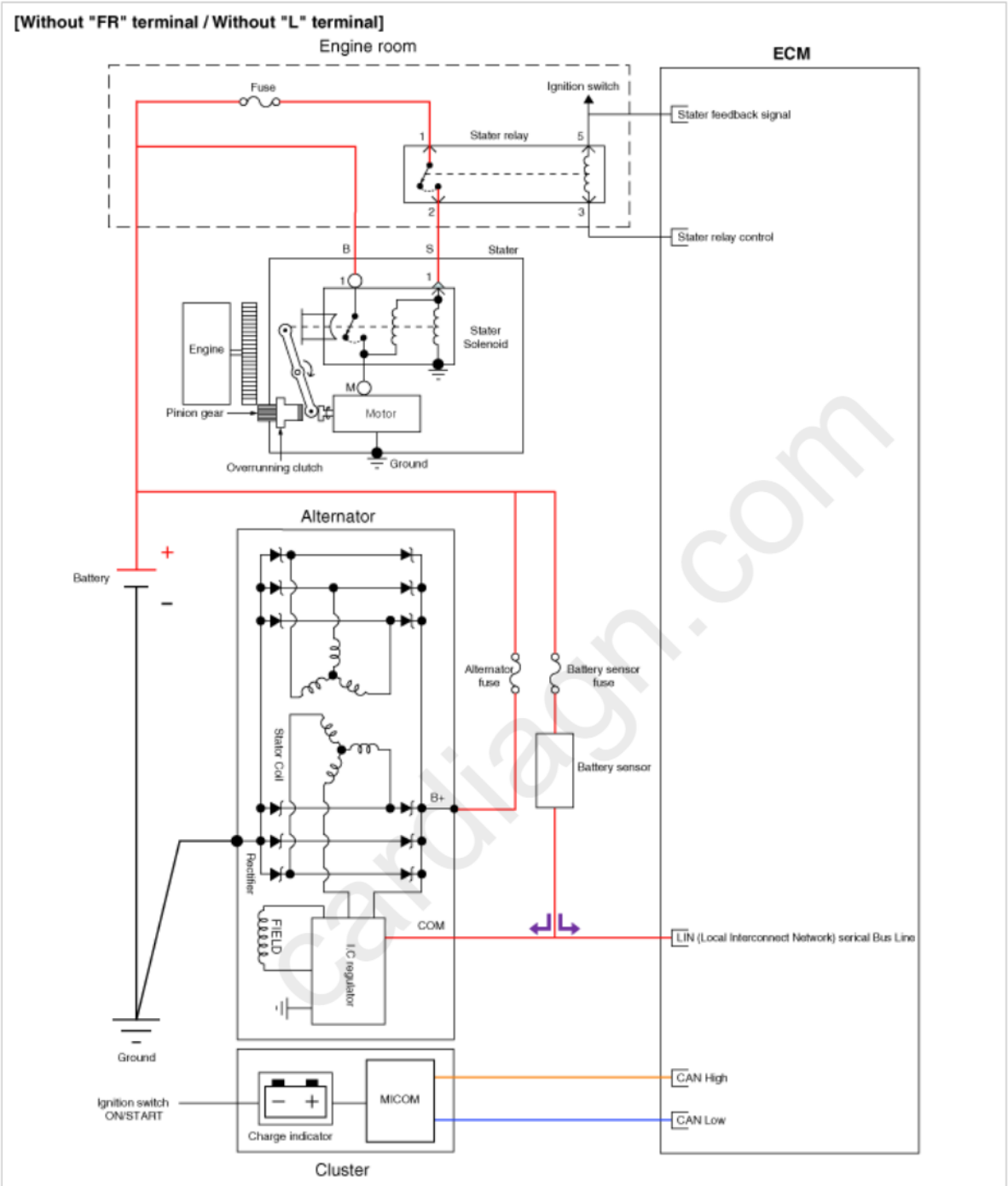
The system conducts discharging control when accelerating a vehicle. Vehicle reduces an alternator load and consumes an electric power form a battery.

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

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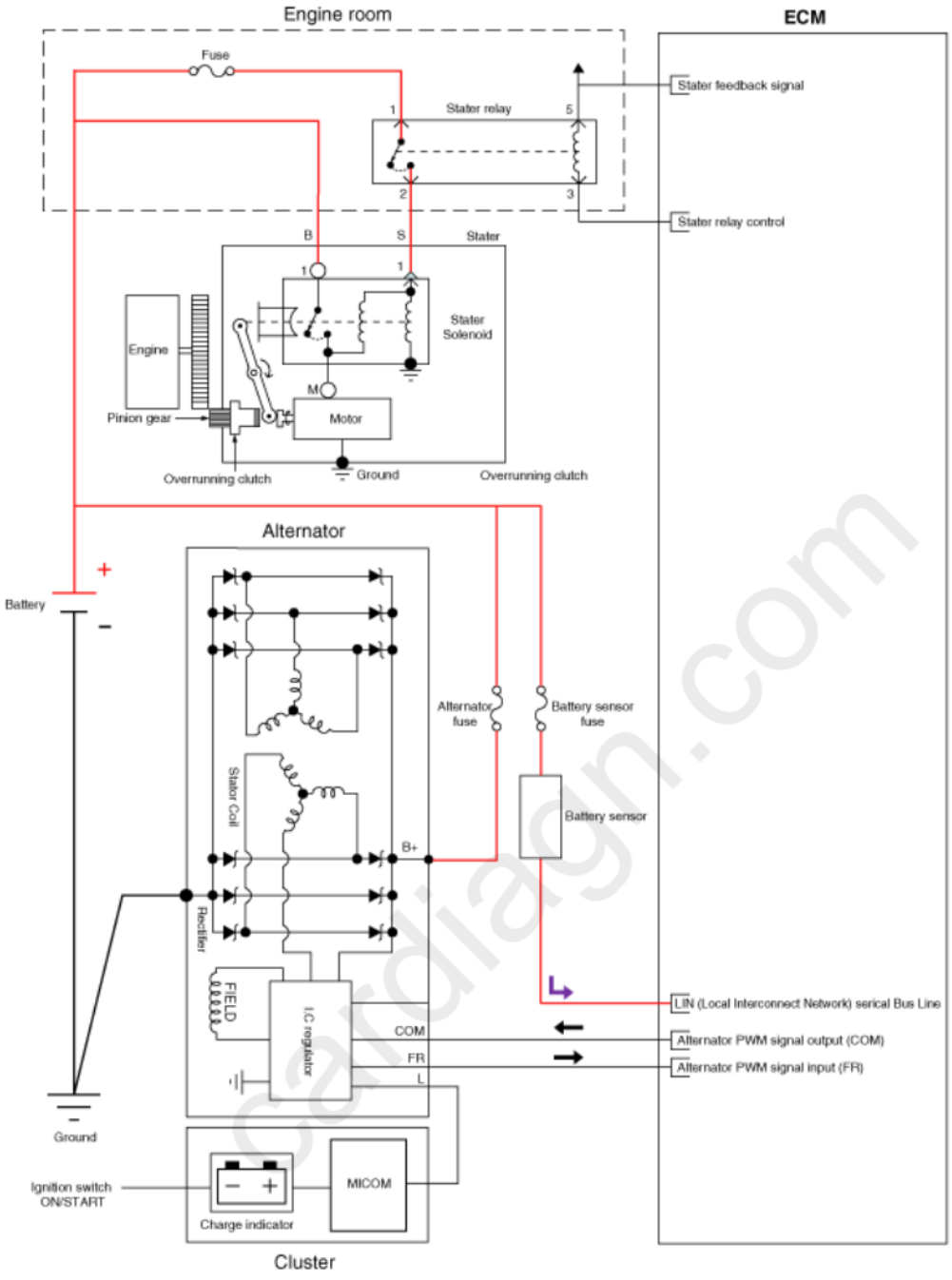
Circuit Diagram

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



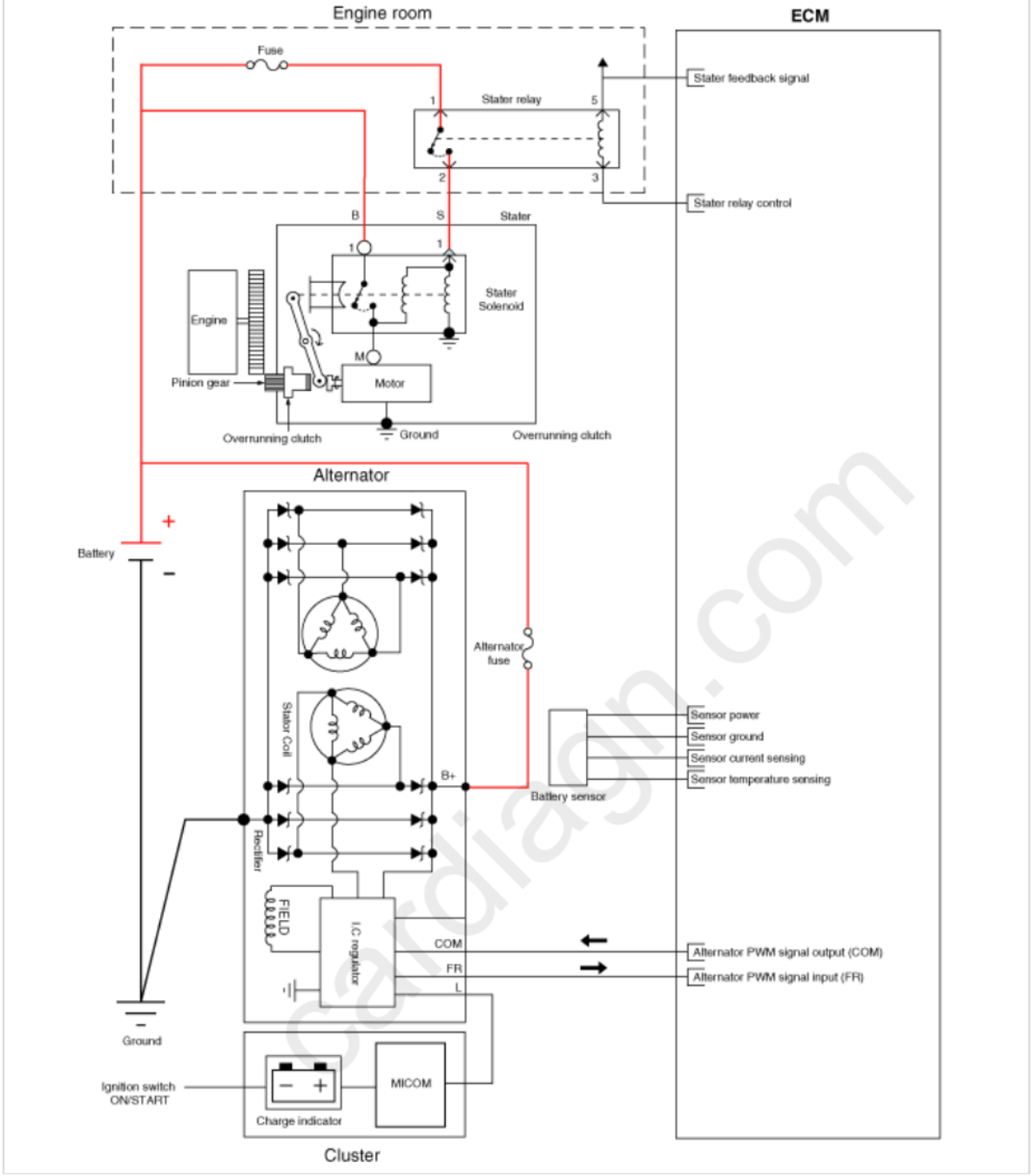
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[With "FR" terminal / With "L" terminal]



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[With "FR" terminal / With "L" terminal / With battery sensor 4pin type]



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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 :

   Approximately 12.5-12.9V [20°C (68°F)]

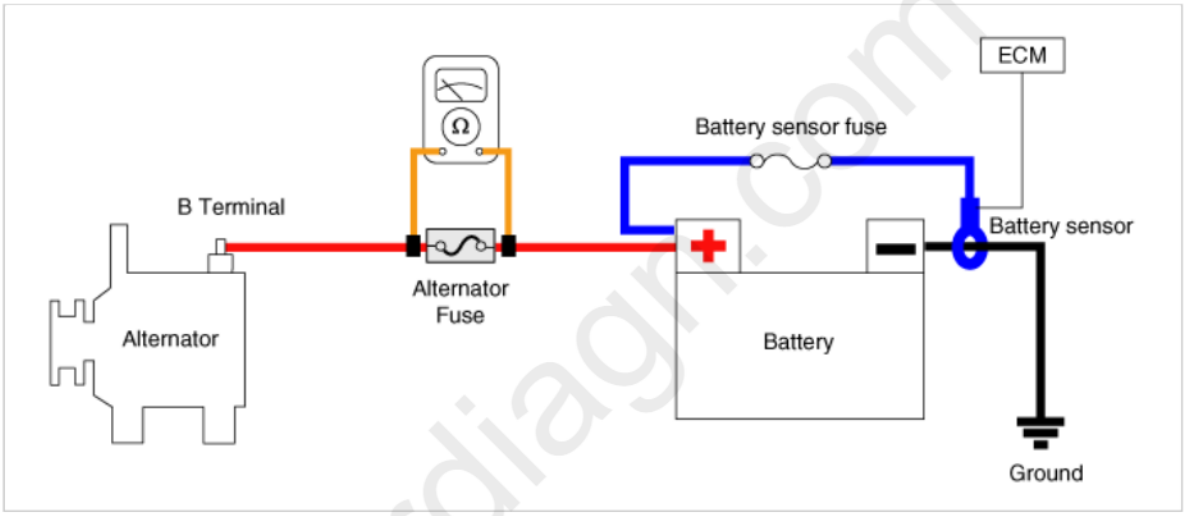
   If the voltage is less than specification, charge the battery.

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 (A) for continuity.

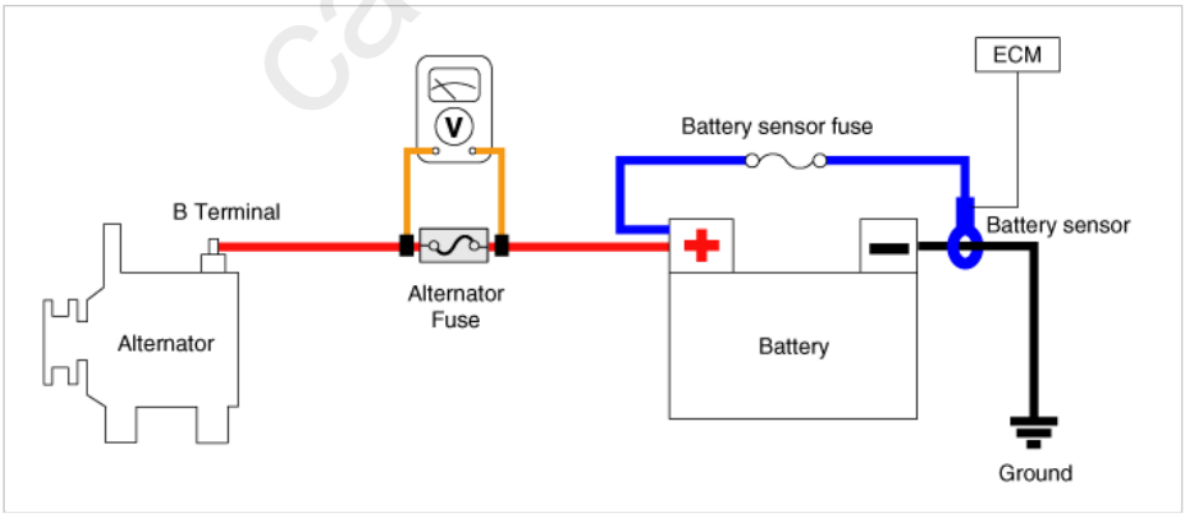
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(2) Measure the voltage as shown in the image below.

Standard value :Approximately 0 V



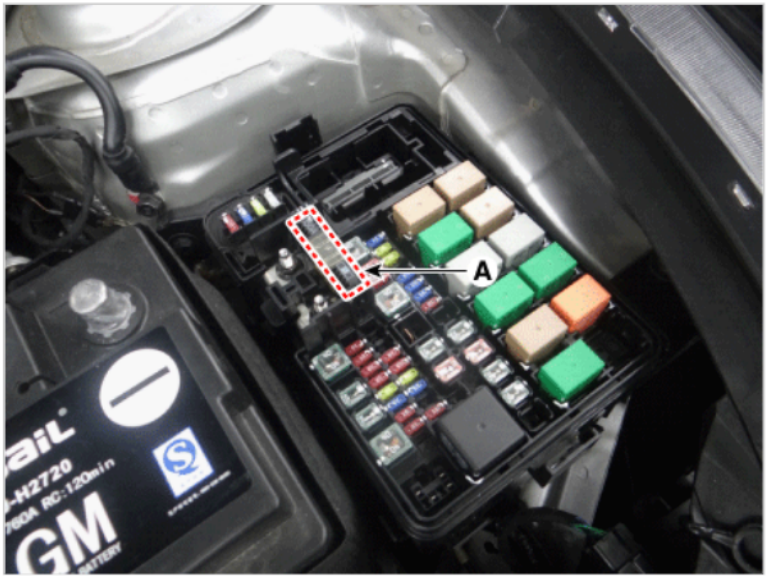
(3) If the alternator fuse is blown, replace it as in the procedure below:

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

b. Remove the battery positive (+) cable mounting nuts (A).

c. Replace the norminal alternator fuse or battery cable.

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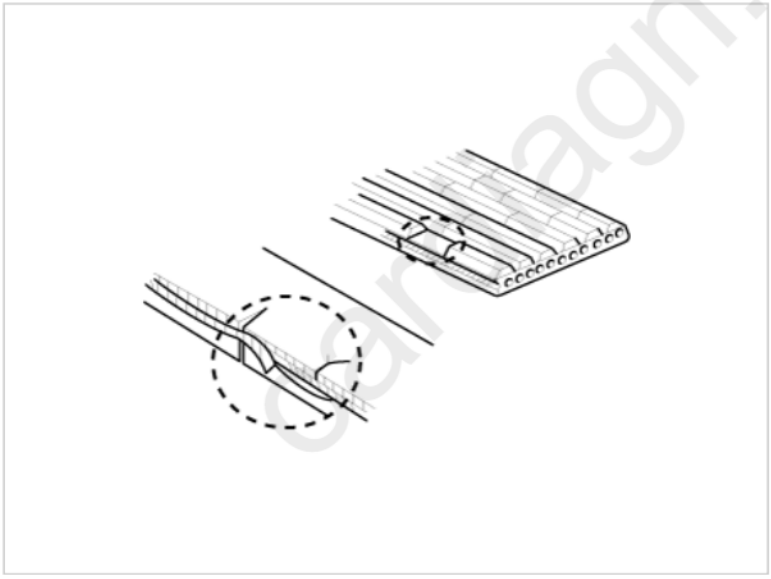


d. Install in the reverse order of removal.

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.



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.

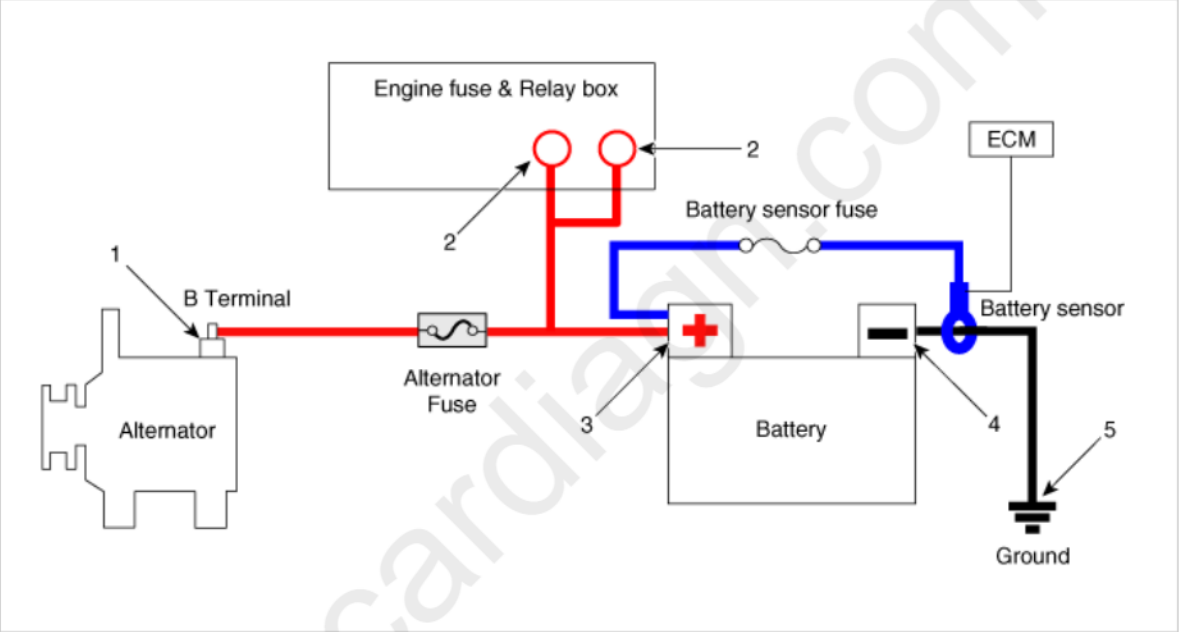
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Terminal Tightening State Inspection

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



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

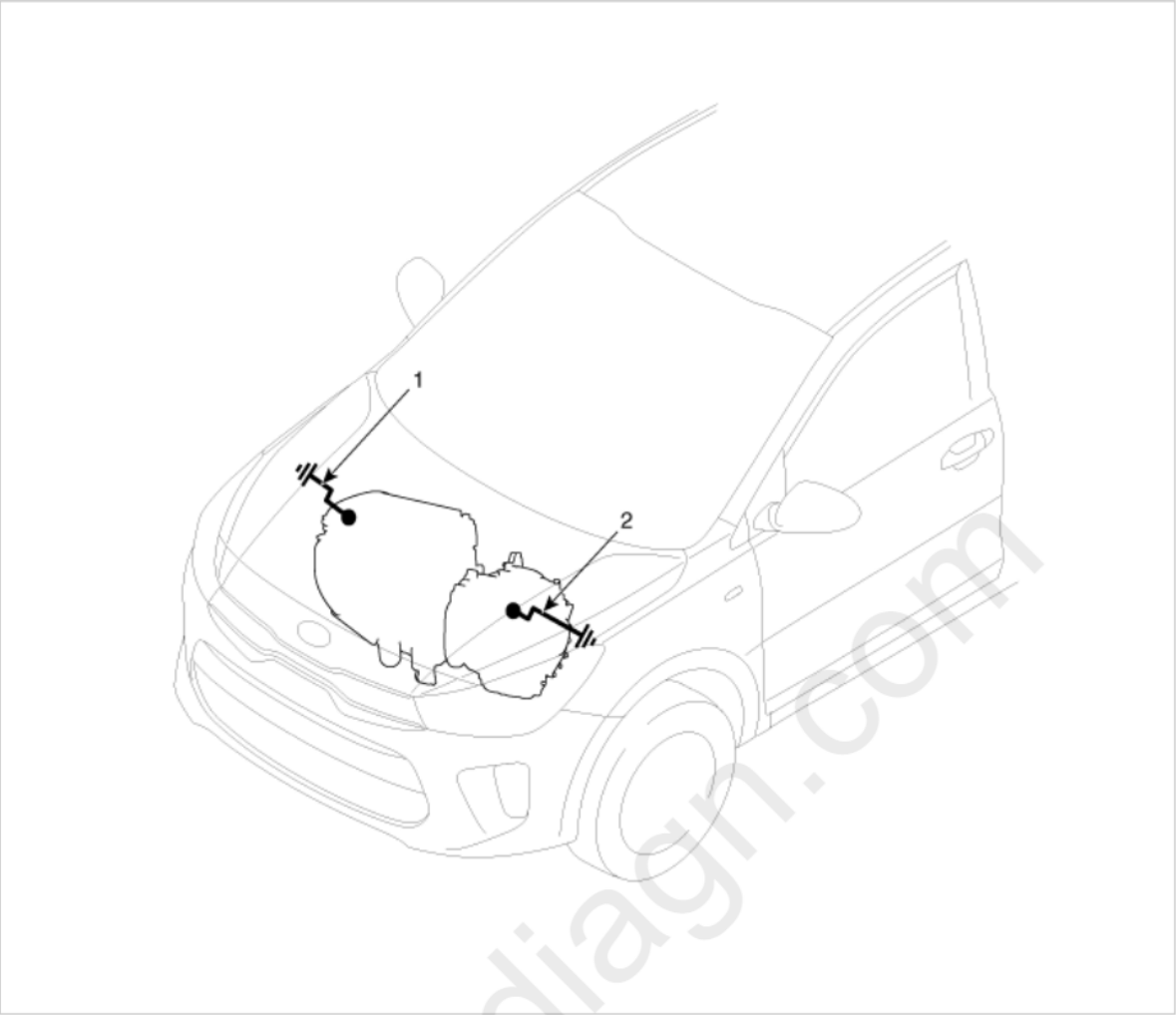
Wiring harness ground state inspection

NOTICE

- Ground state
- Mounting bolt tightening state (Chassis)
- Mounting bolt tightening state (Engine)

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• Check the status of ground fault by chassis paint



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

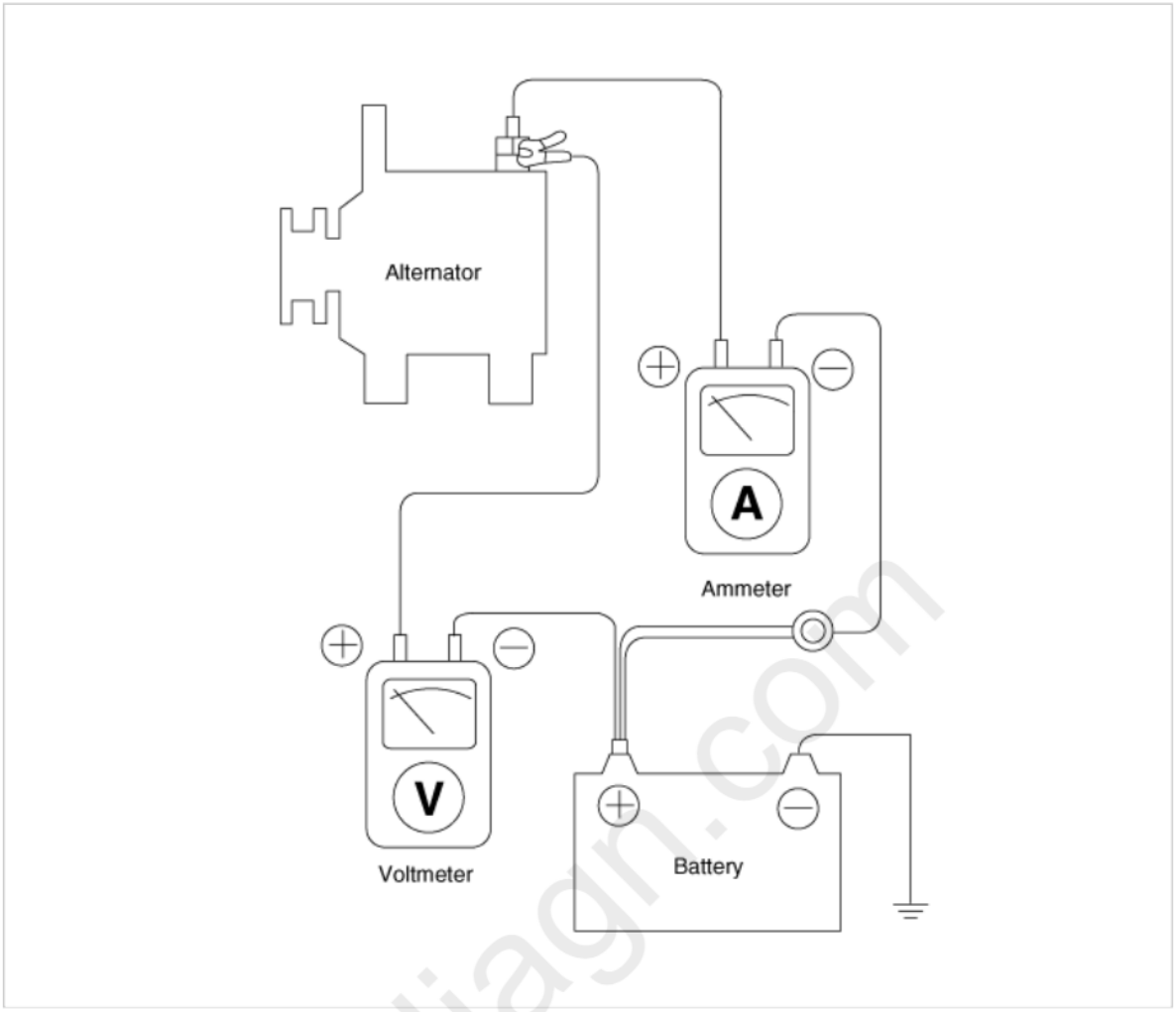
NOTICE

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.

NOTICE

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

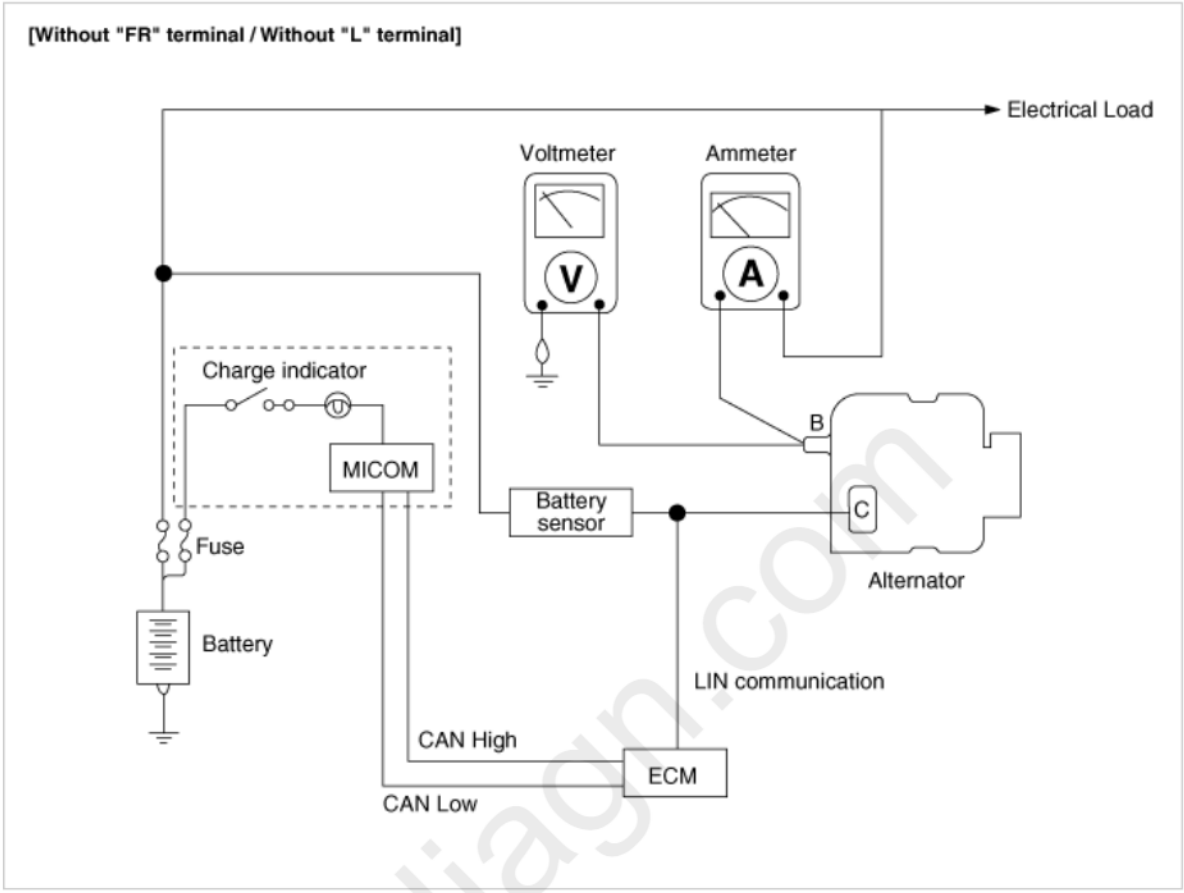
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f. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.

g. Connect the battery ground cable.

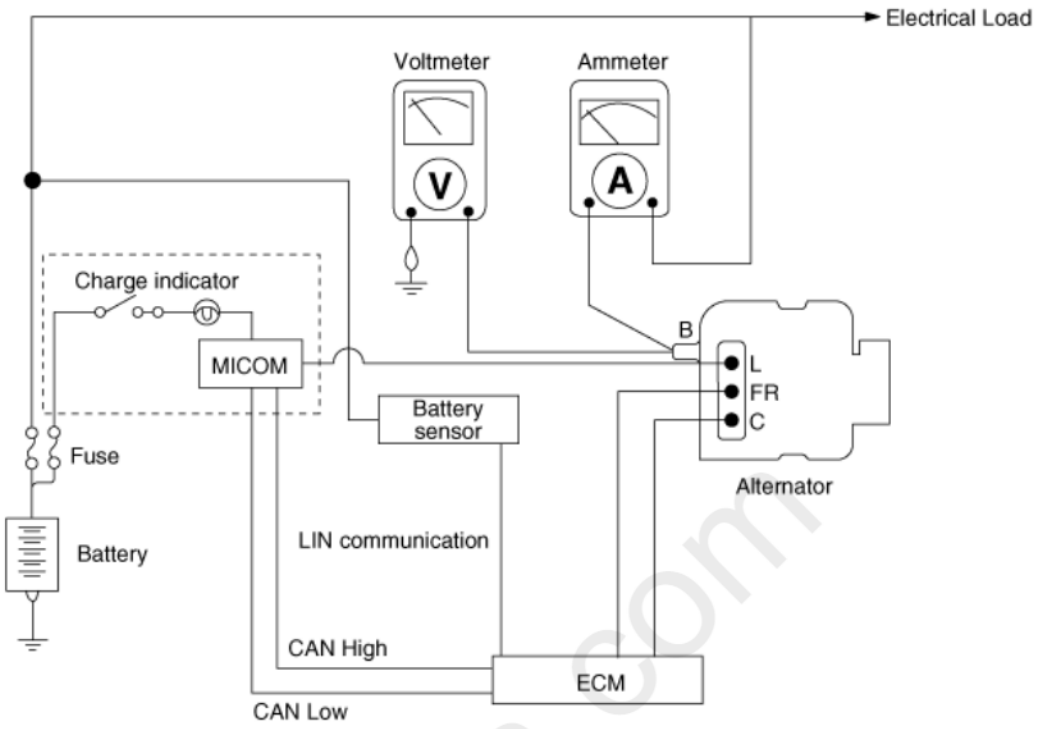
h. Leave the engine hood open.

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

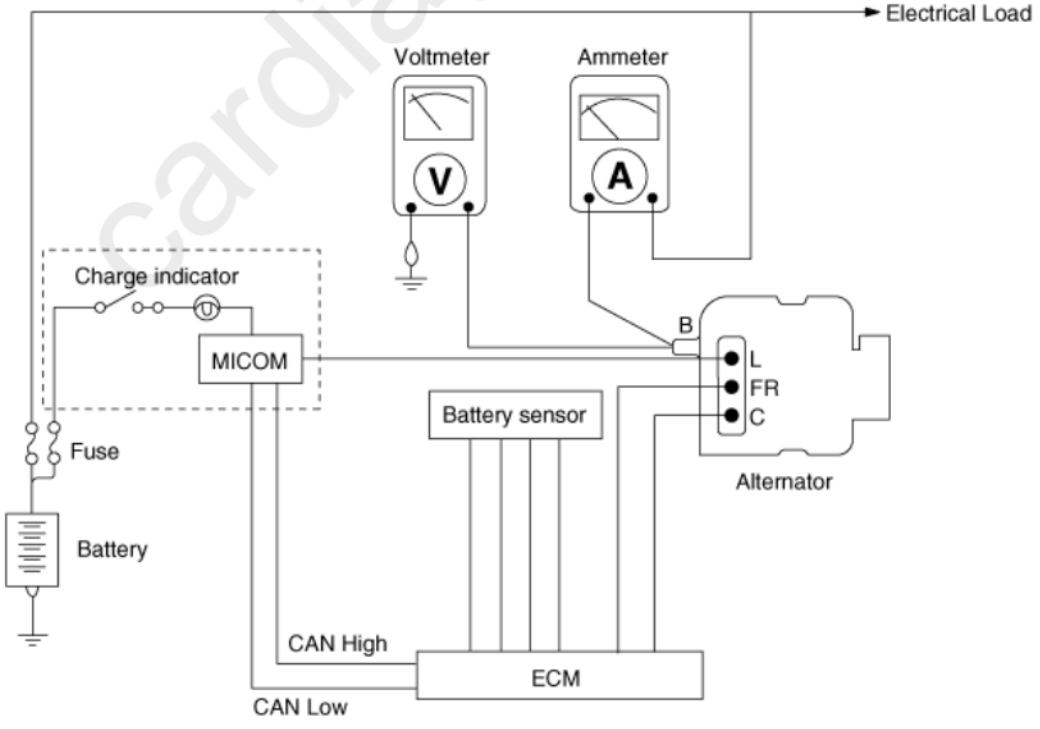


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[With "FR" terminal / With "L" terminal]



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



(2) Test

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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. 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.

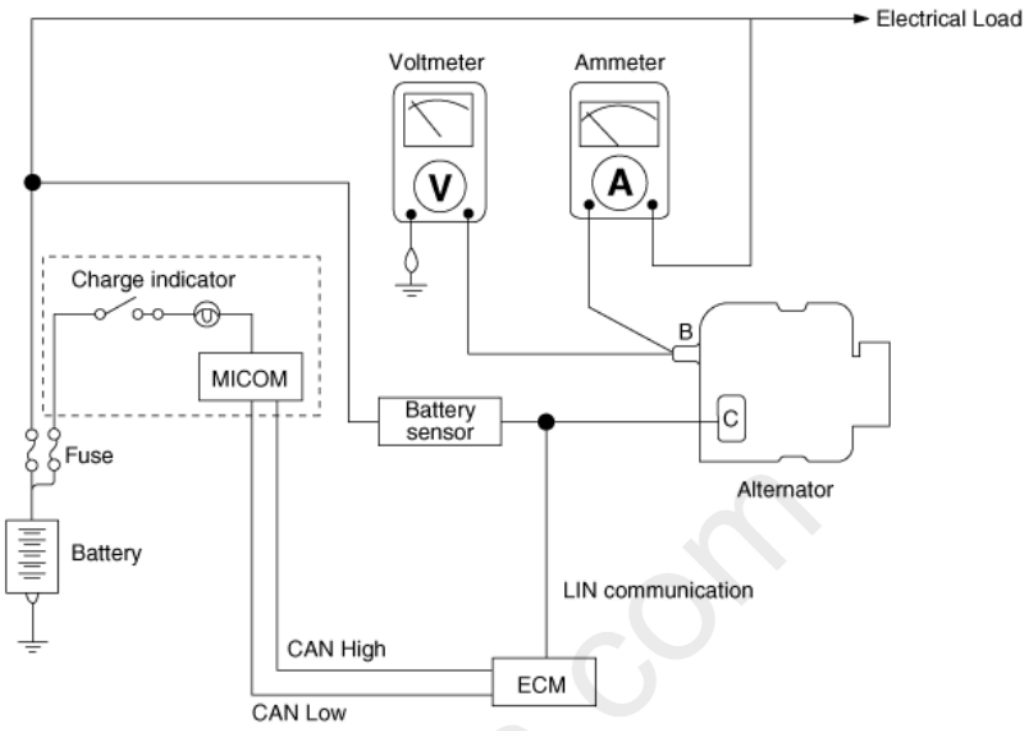
e. Disconnect the alternator output wire from the alternator "B" terminal.

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.

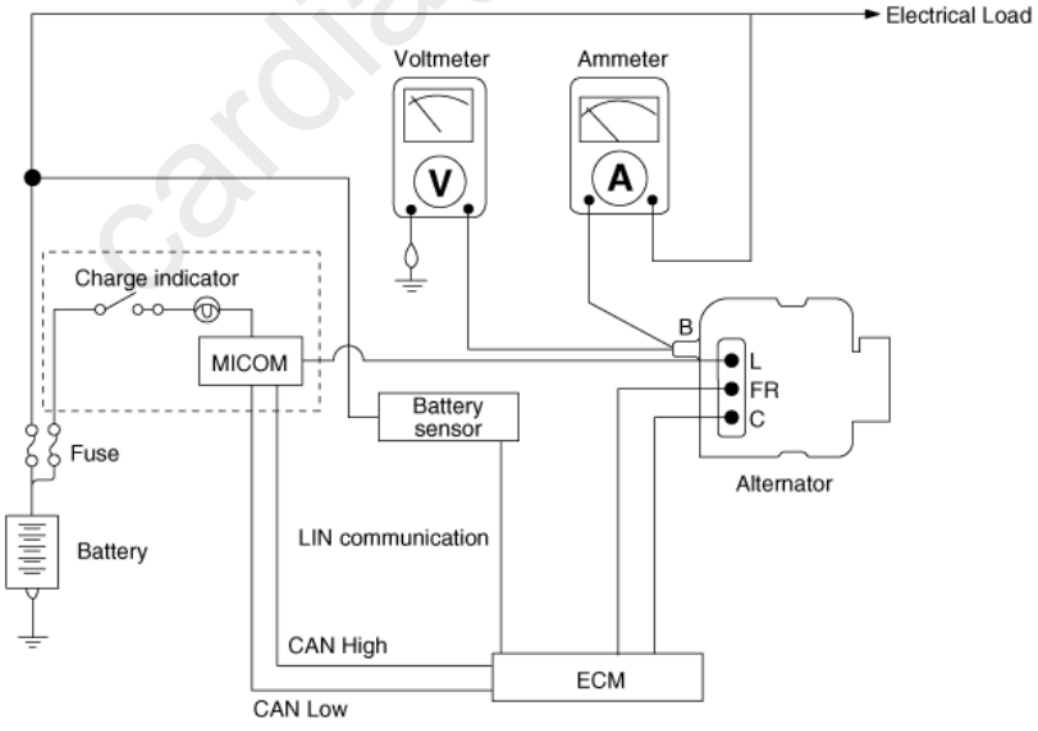
g. Connect the battery negative (-) terminal.

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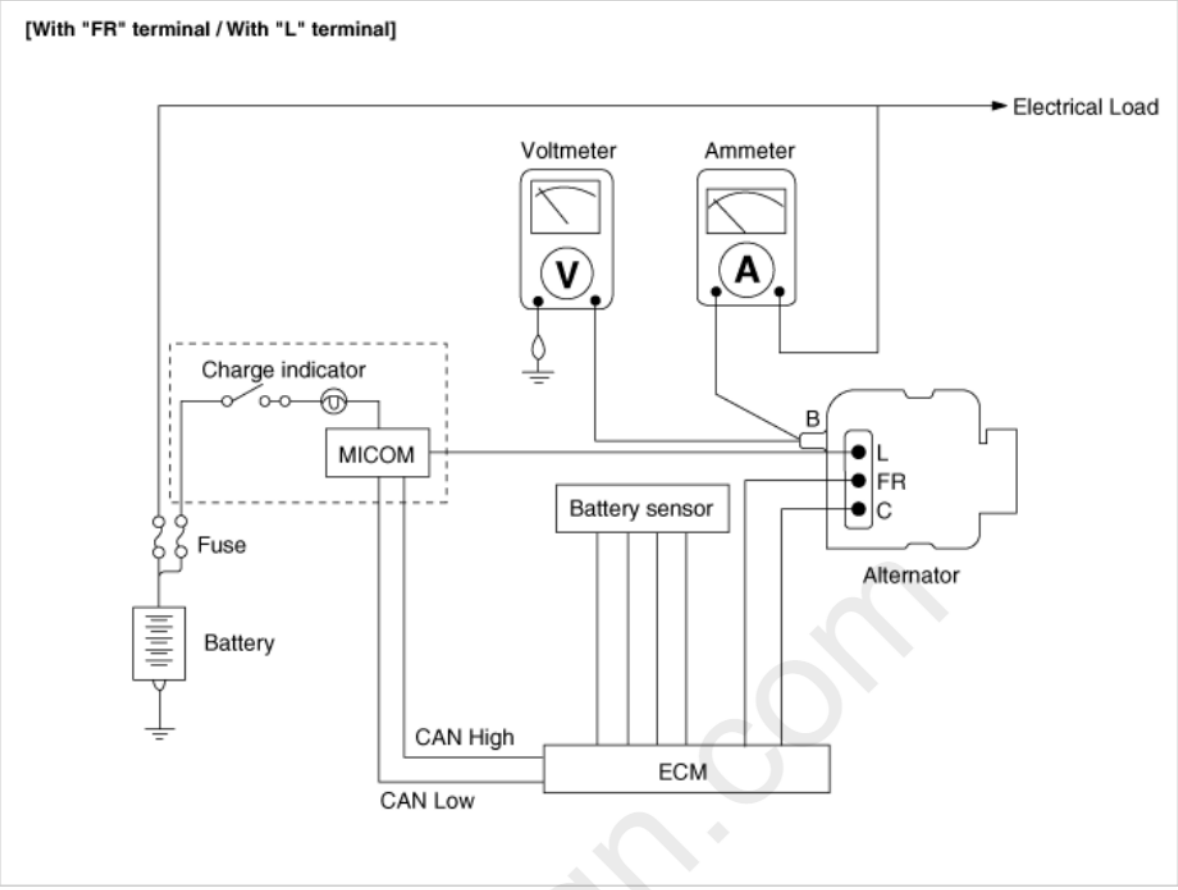
[Without "FR" terminal / Without "L" terminal]



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



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(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.

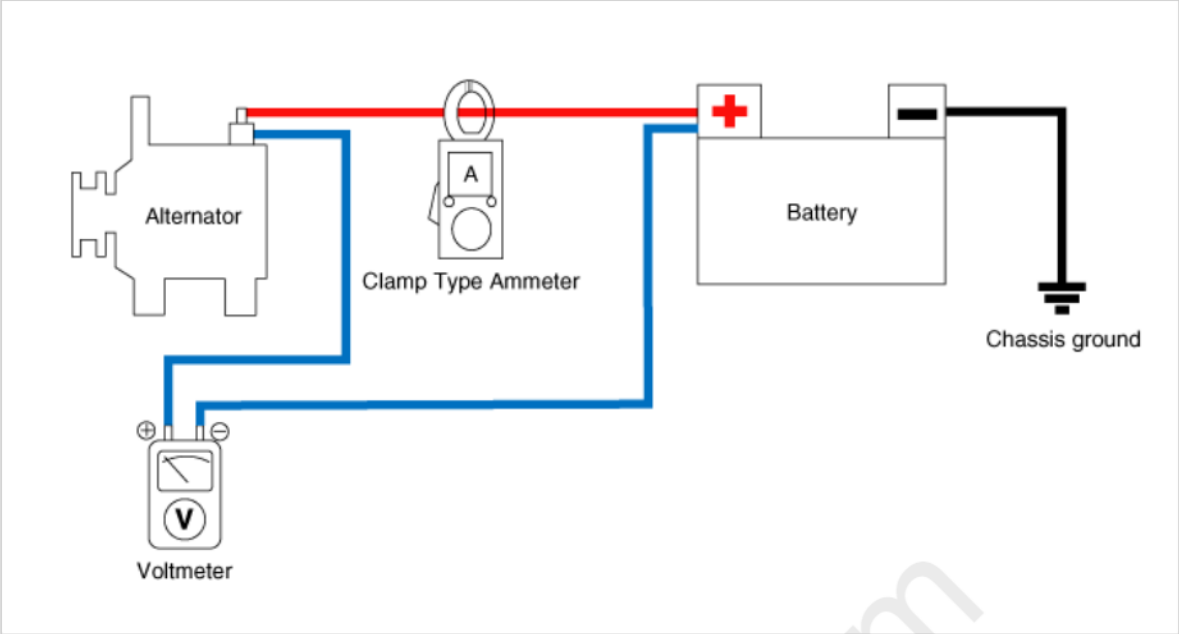
(1) Preparation

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.

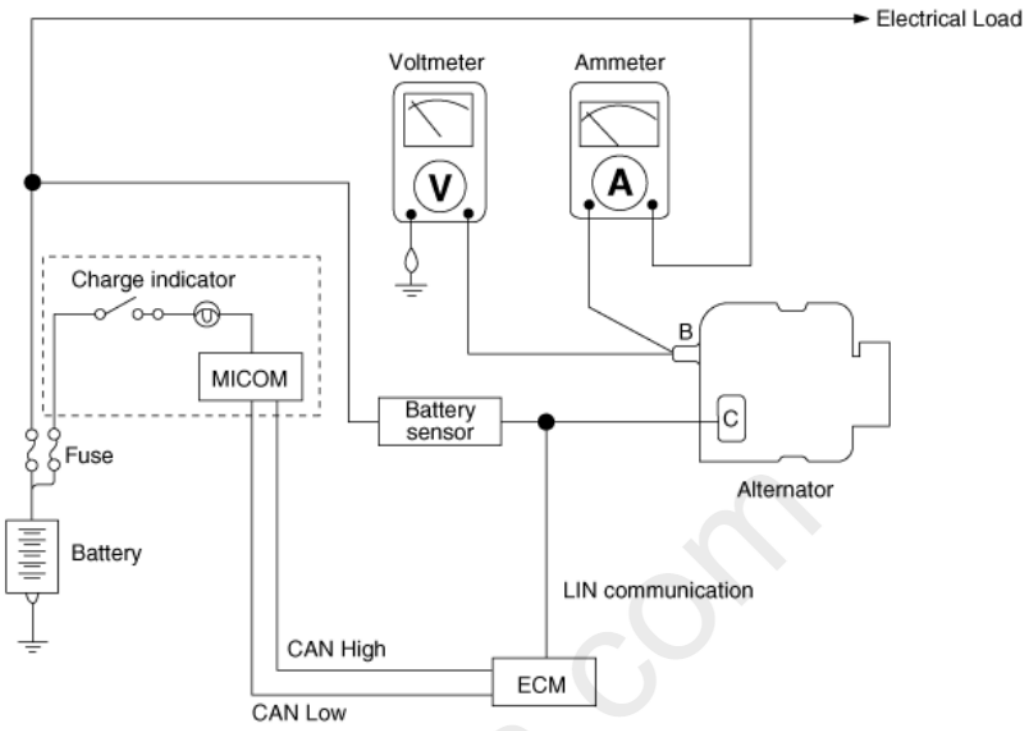
f. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.

g. Connect the battery negative (-) terminal.

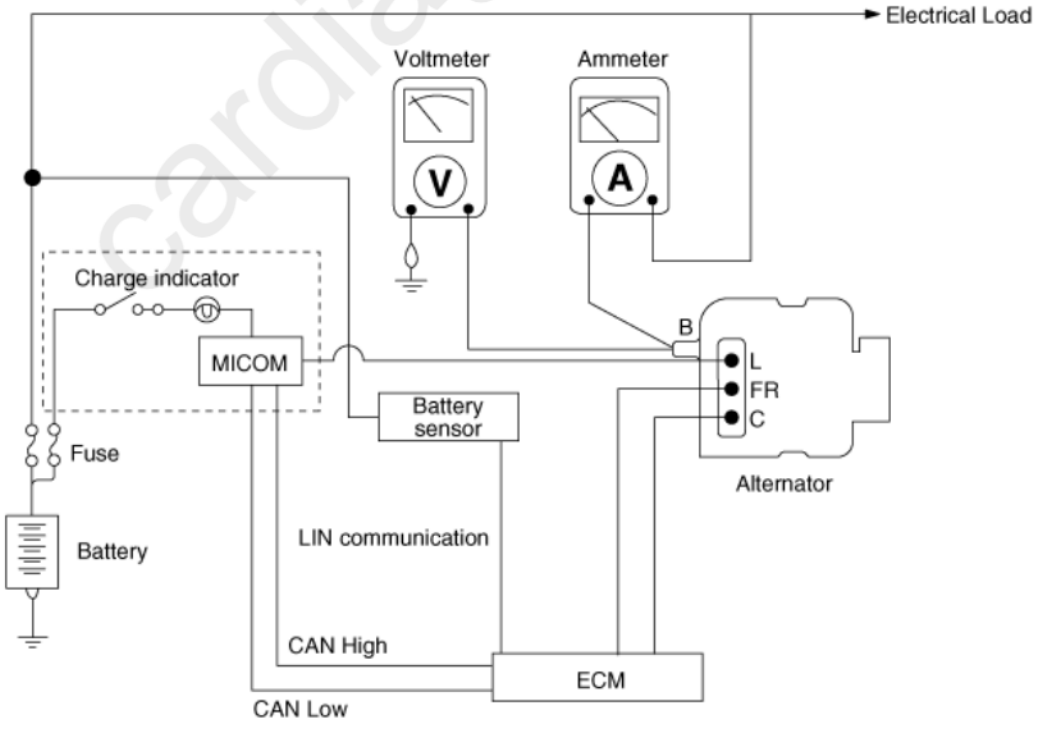
h. Leave the engine hood open.

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

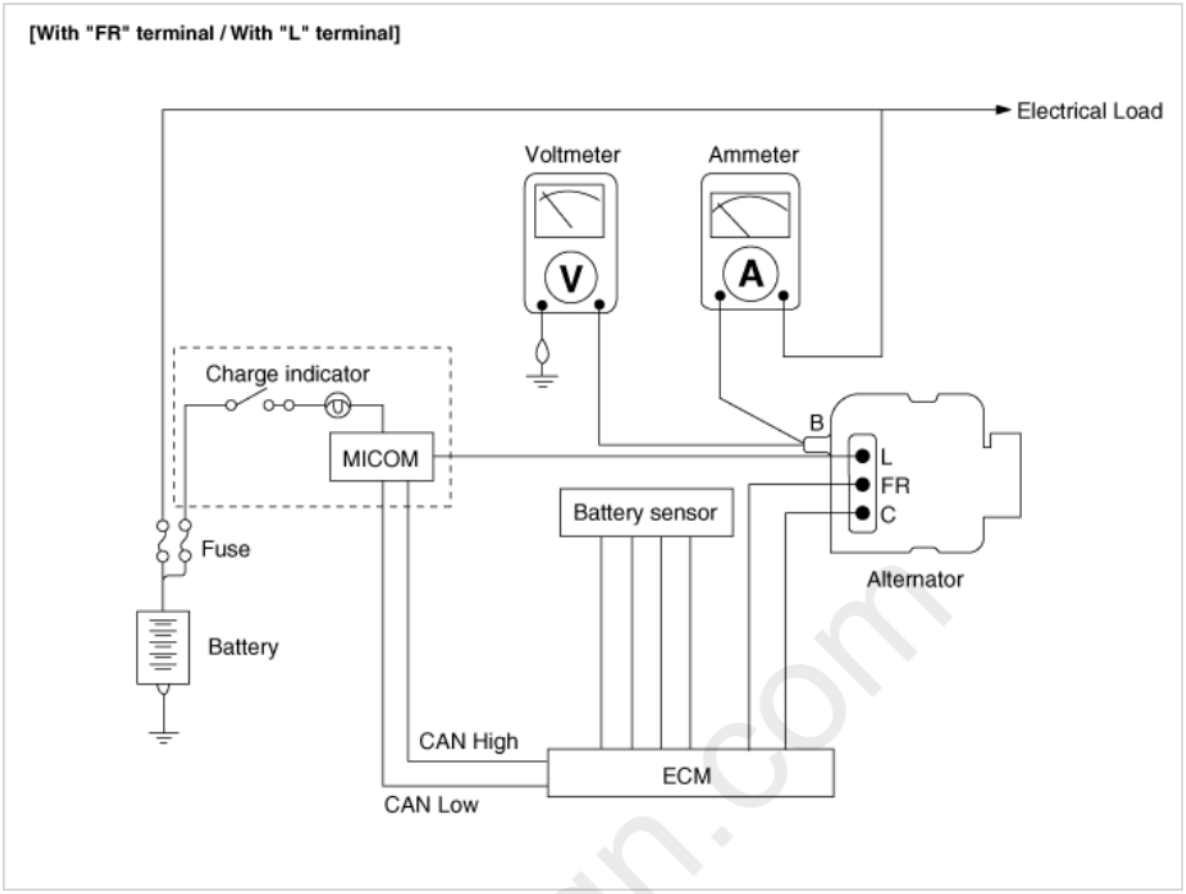


[With "FR" terminal / With "L" terminal]



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

f. Connect the battery negative (-) terminal.

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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.

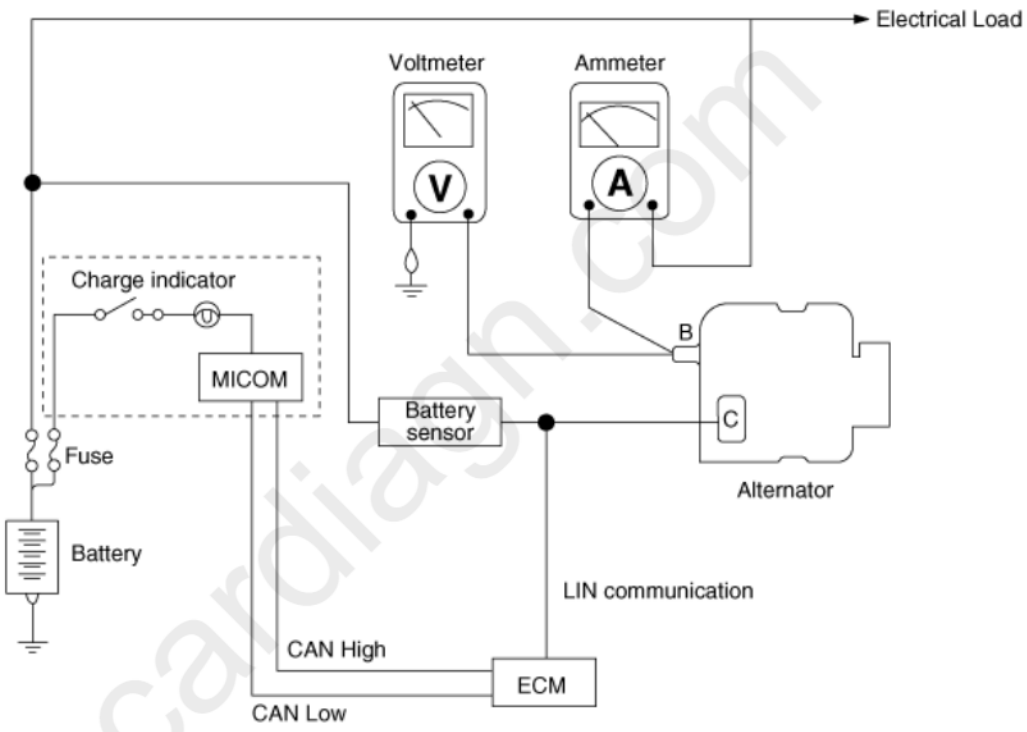
d. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.

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.

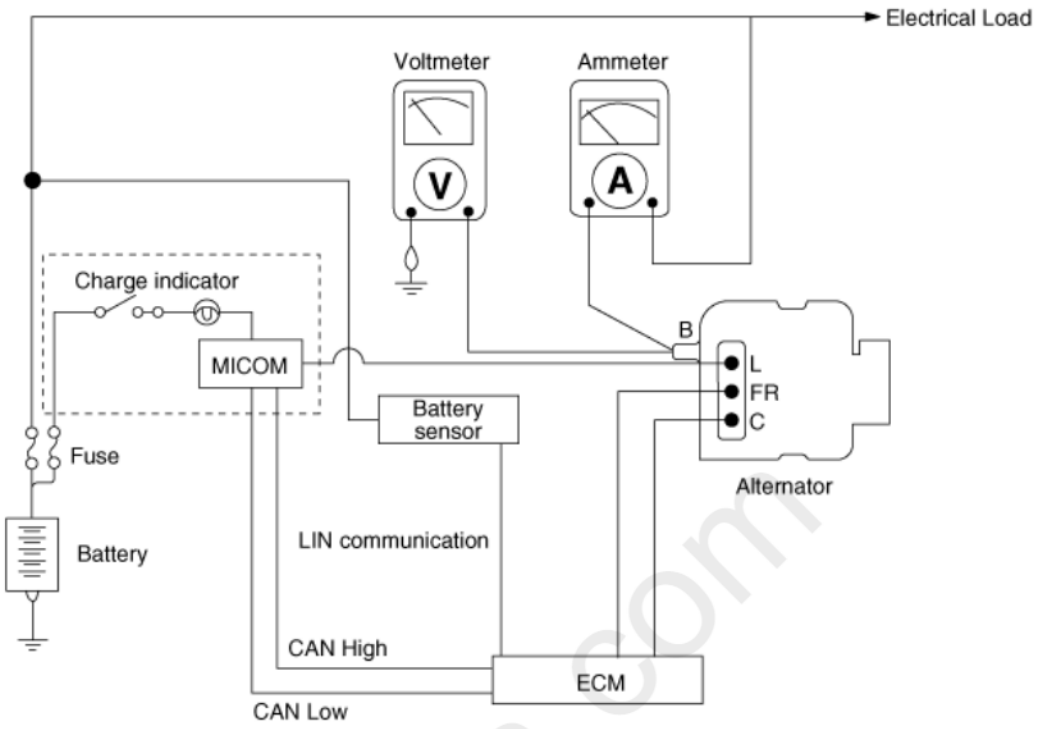
g. Connect the battery negative (-) terminal.

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

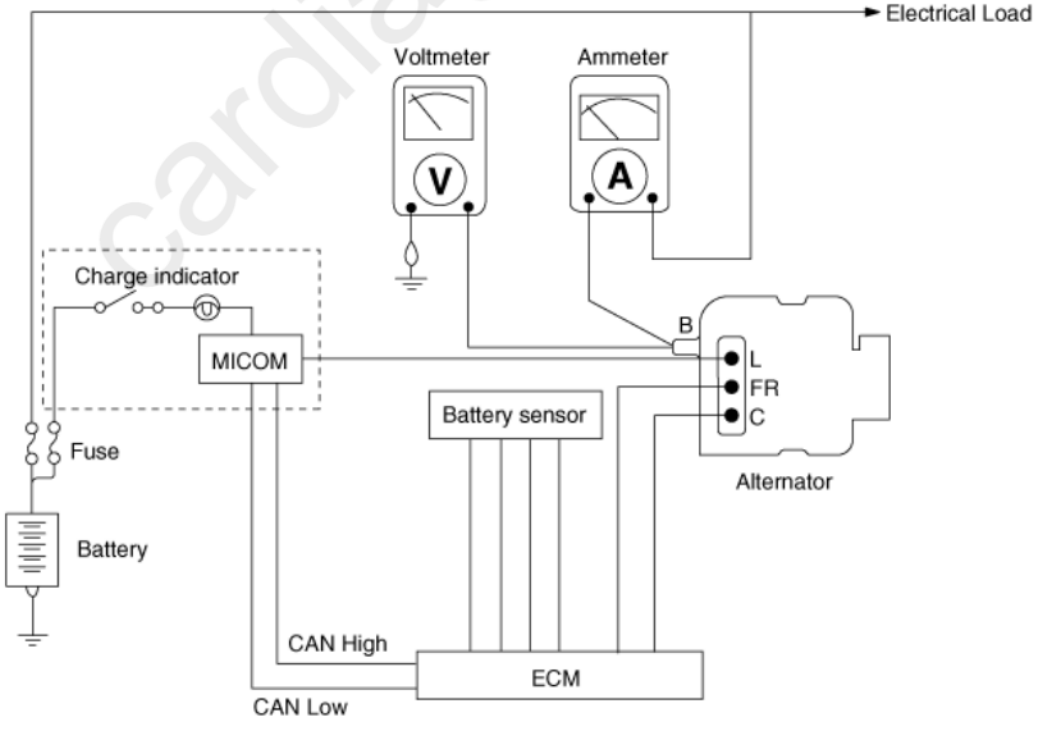


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[With "FR" terminal / With "L" terminal]



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



(2) Test

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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]

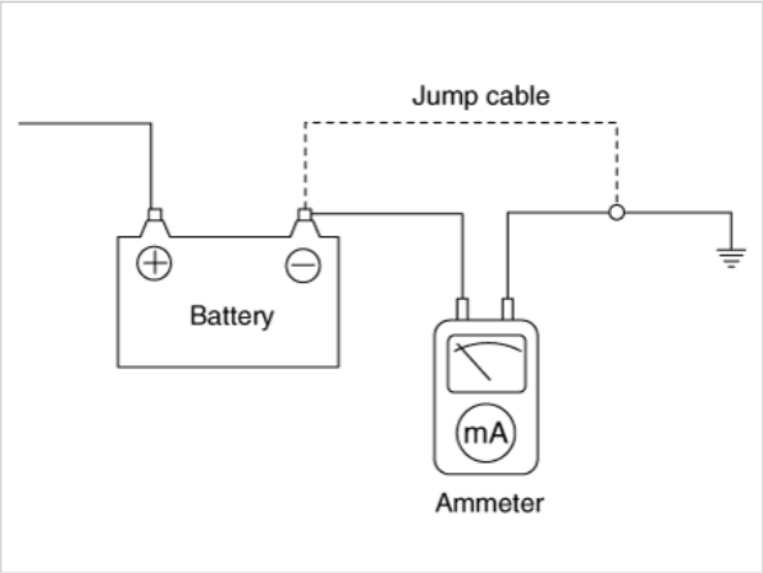
1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.
3. Wait for a few minutes until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

> **NOTICE**
> • 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.

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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.

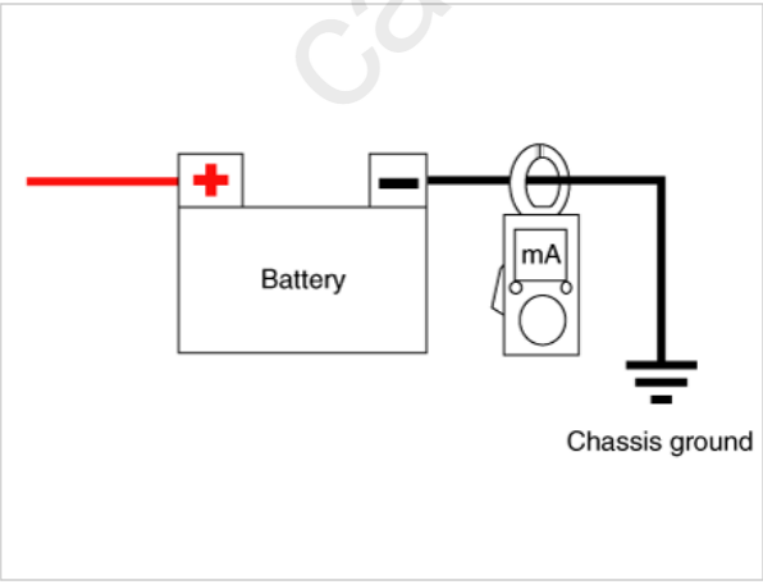
Limit value (after 10-20 min.) : Below 50mA

[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.



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.

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- 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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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.
	Communication error	

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		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.
	Defective battery	Inspect / Replace battery.
Swollen 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.		

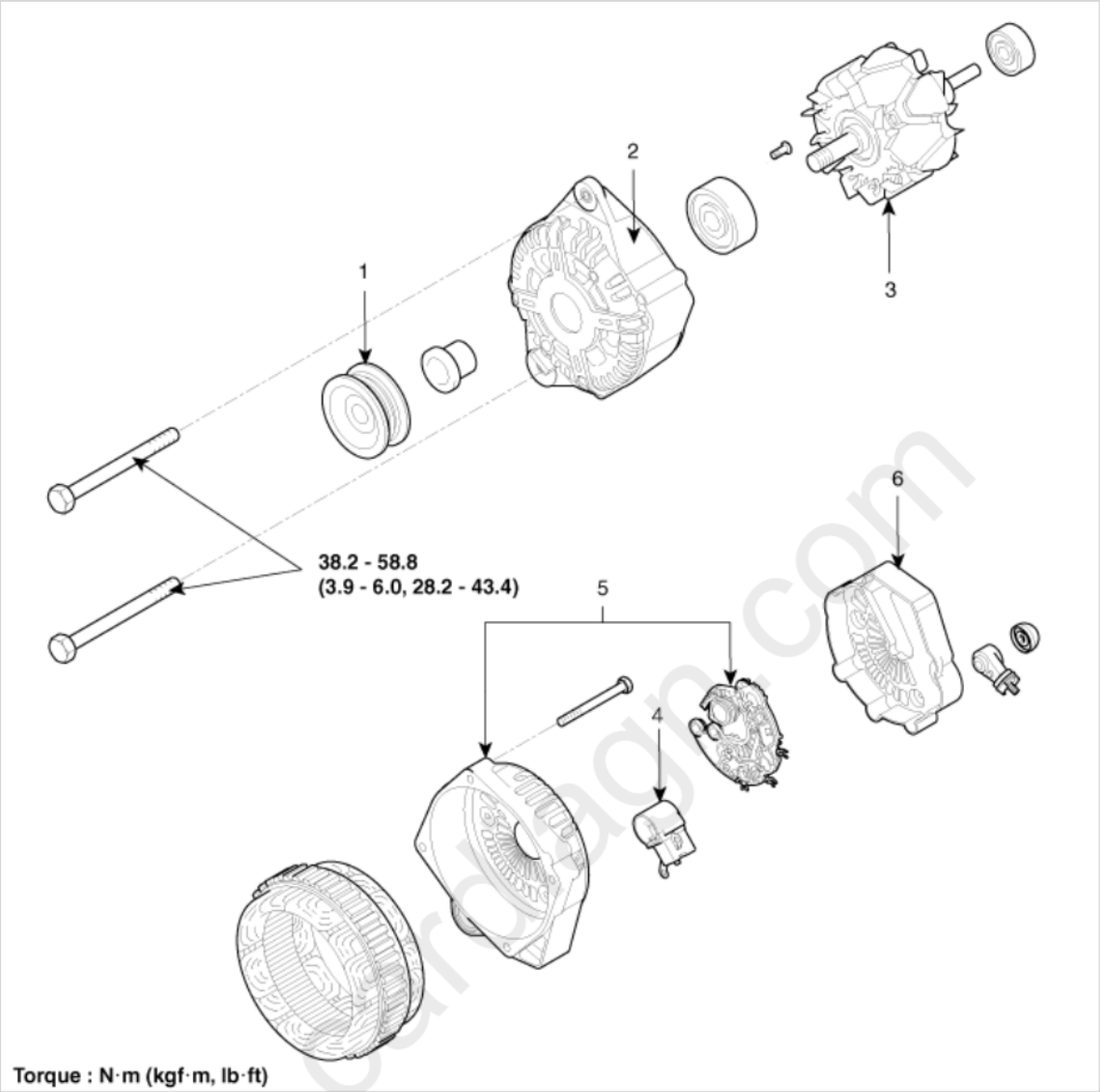
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Specification

Item		Specification
Rated voltage		13.5V, 130A
Speed in use		1,000 - 18,000 rpm
Voltage regulator		IC Regulator built-in type
Regulator Setting Voltage	External mode	Refer to below graph
	Internal mode	14.55 ± 0.3V
Temperature Gradient	External mode	0 ± 3 mV / °C
	Internal mode	-3.5 ± 2mV / °C
Type		OAP

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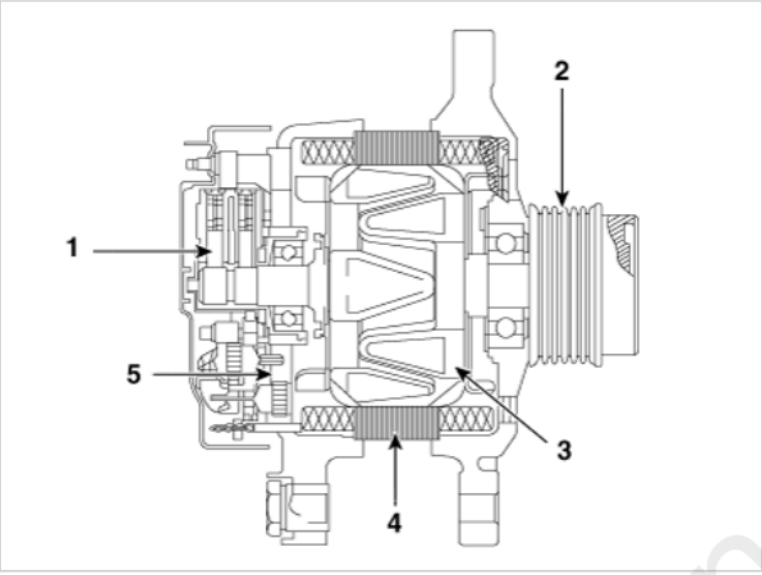
Components



1. Pulley
2. Front housing complete
3. Rotor assembly
4. Regulator
5. Rectifier assembly
6. Cover

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.

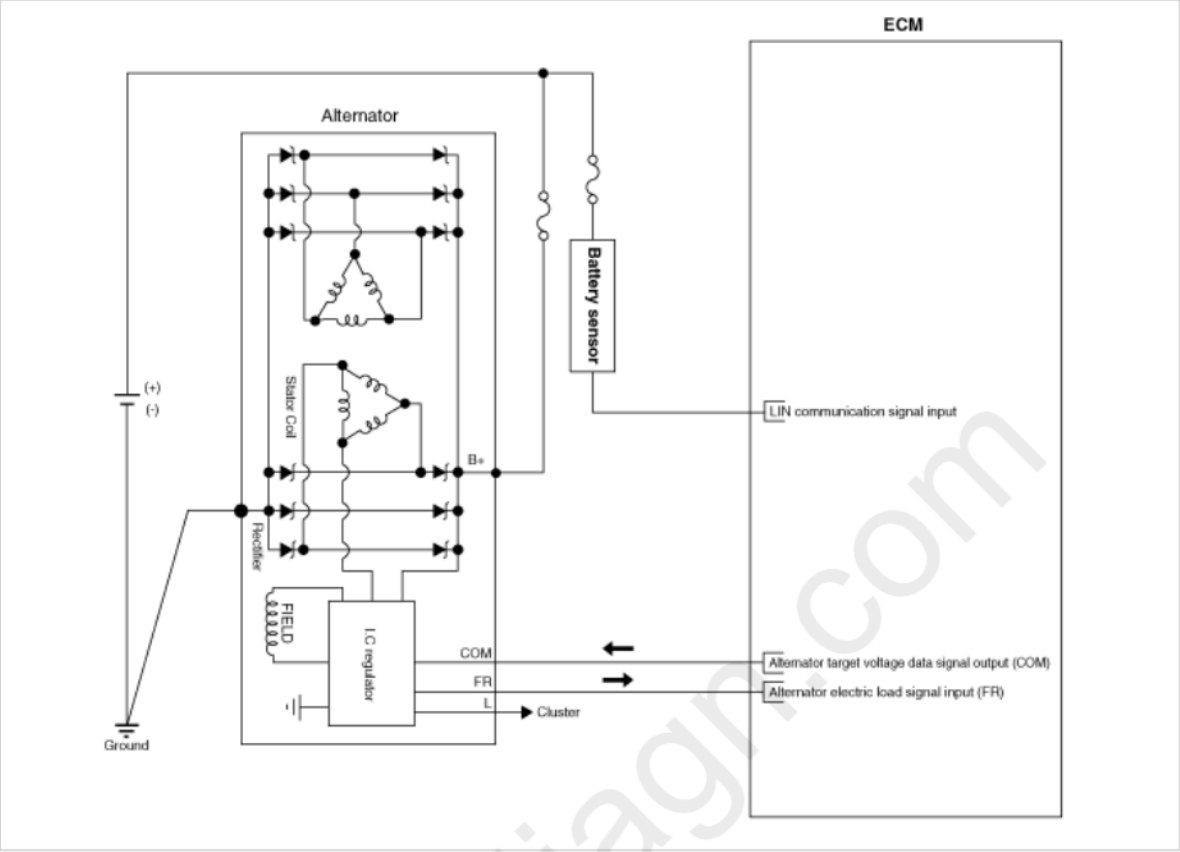


1. Brush
2. Pulley
3. Rotor
4. Stator
5. Rectifier

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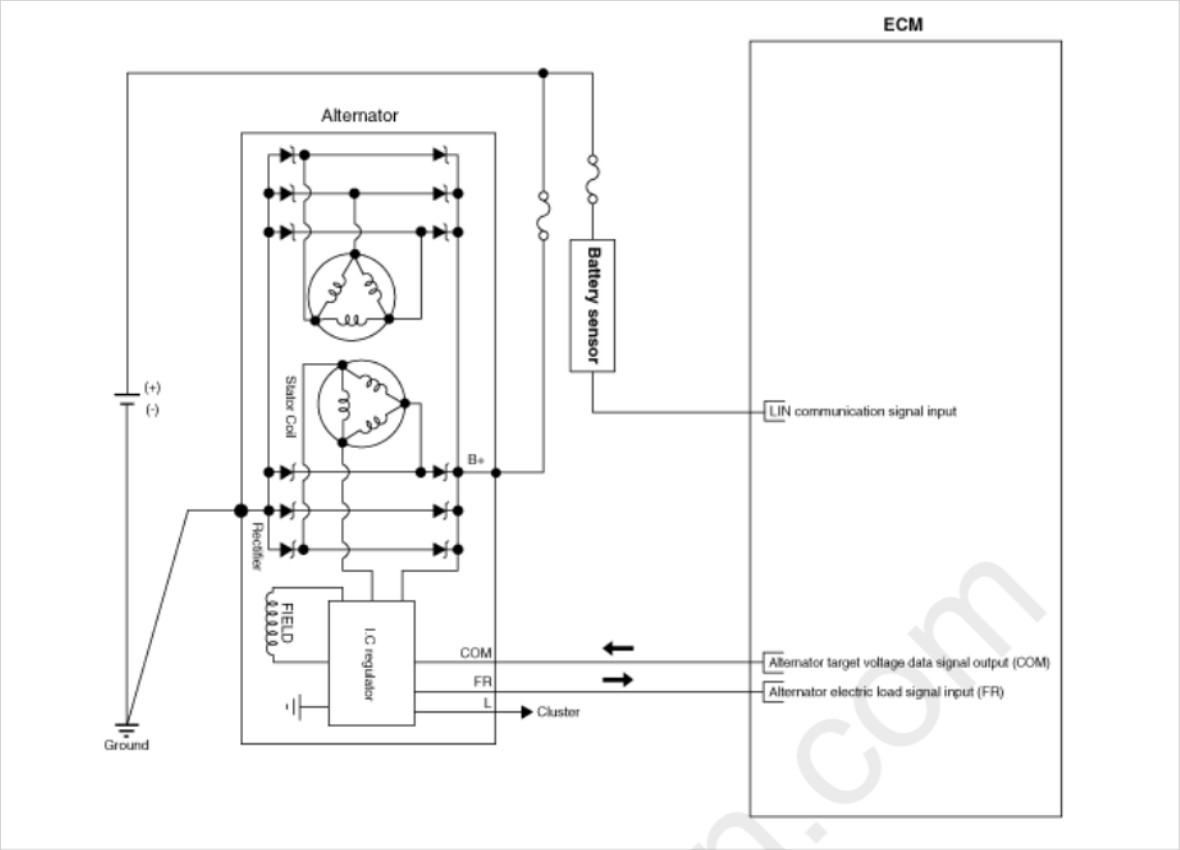
Circuit Diagram

[ISG only]



[NON-ISG]

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Information

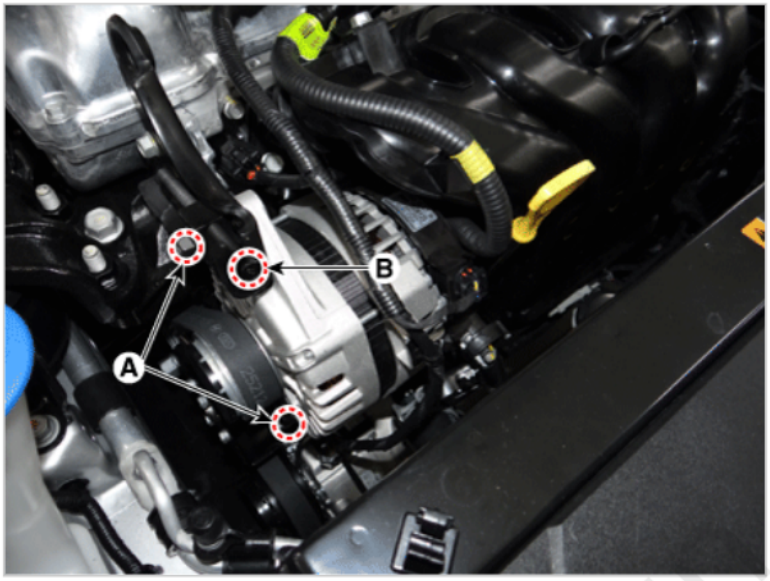
- **COM signal**- When controlling the voltage generated, the ECM sends the target voltage data to the alternator via a PWM signal.
- **FR signal -**
  The transistor activation signal inside thealternator monitors the voltage generated by thealternator to control the field current before itsends the FR signal to the ECM. (At certain RPM/electric loads, the FR duty can remain static. However, more often, the RPM, electric load, target voltage, etc. are always changing in the vehicle, so the FR must also change constantly)
- **L signal -**
  Turns on the battery warning lamp on the dashboard when the battery charging system malfunctions. (Conditions for turning on the lamp - overcharge, over discharge, a field coil blown inside the alternator)
- **B+ terminal -**The output voltage from the generator travels to the battery via the B+ terminal.

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Removal

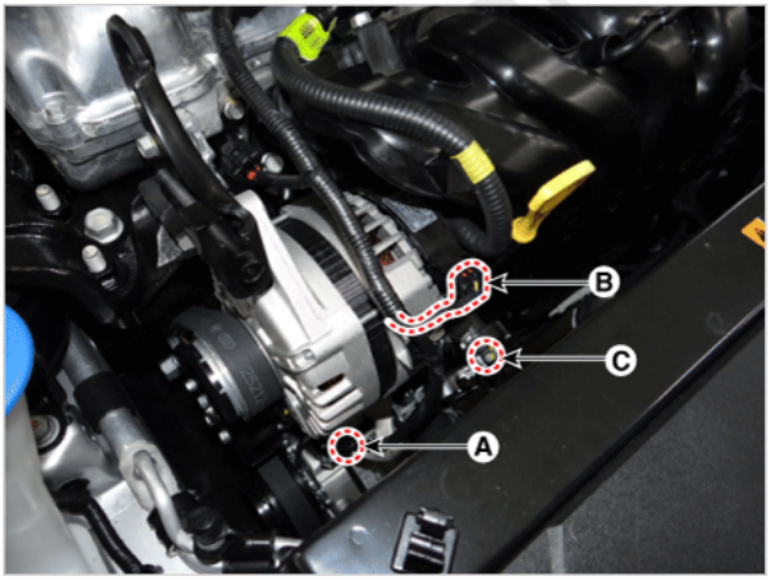
1. Turn ignition switch OFF and disconnect the battery negative (-) terminal.
2. Loosen the mounting bolts (A) and then, turn the adjusting bolt (B) clockwise to loosen tension.

Alternator upper bolt :
23.5 - 26.5 N·m (2.4 - 2.7 kgf·m, 17.4 - 19.5 lb·ft)
Alternator lower bolt :
29.4 - 41.2 N·m (3.0 - 4.2 kgf·m, 21.7 - 30.4 lb·ft)



3. Remove the drive belt.
(Refer to Engine Mechanical System - "Drive Belt")
4. Disconnect the air compressor connector (A) and the alternator connector (B), and remove the cable (C) from alternator "B" terminal.

Alternator B-terminal cable mounting nut :
9.8 - 14.7 N·m (1.0 - 1.5 kgf·m, 7.2 - 10.8 lb·ft)



5. Remove the alternator (A).





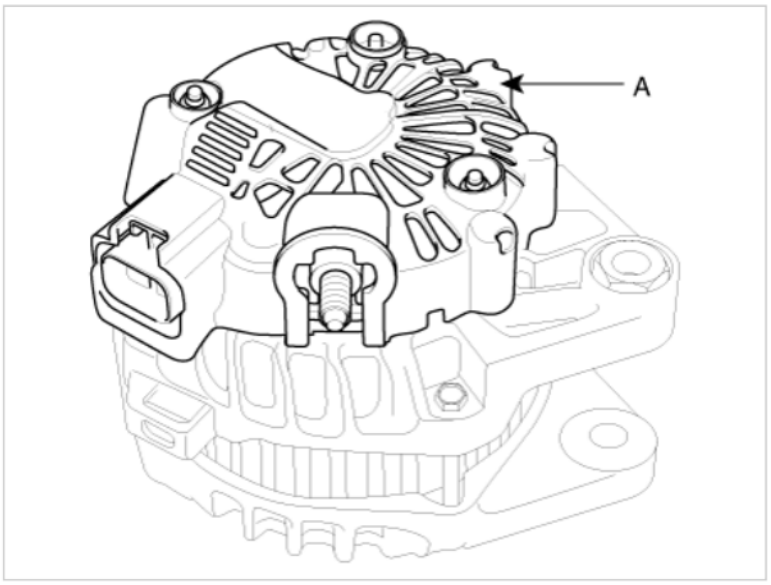
Installation

1. Install in the reverse order of removal.
2. Adjust the alternator belt tension after installation.
   (Refer to Engine Mechanical System - "Drive Belt")

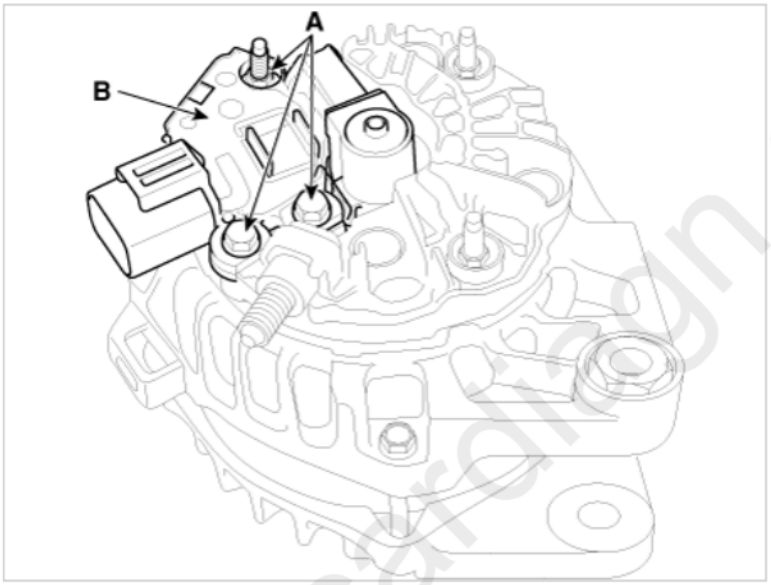
Disassembly

1. Remove the rear cover (A) after removing nuts.

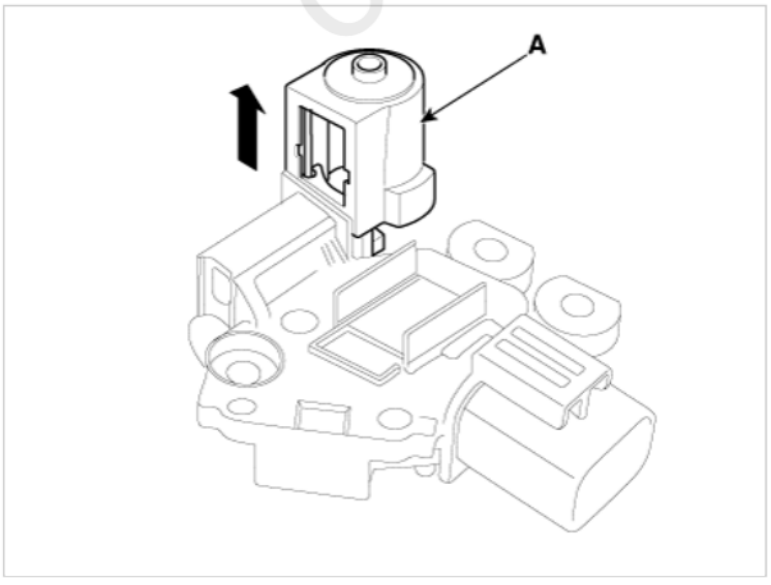
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2. Remove the mounting bolts (A) and the brush holder assembly (B).



3. Remove the slip ring guide (A) after pulling it.



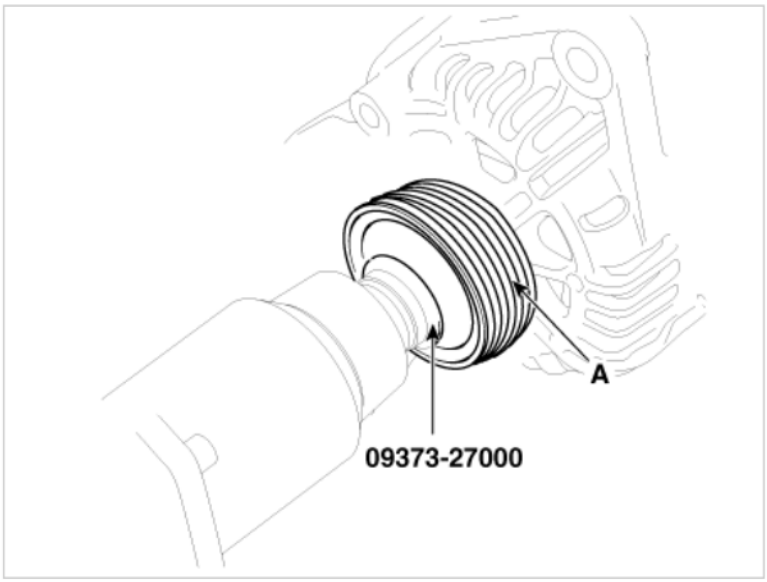
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4. Remove the OAP cap.

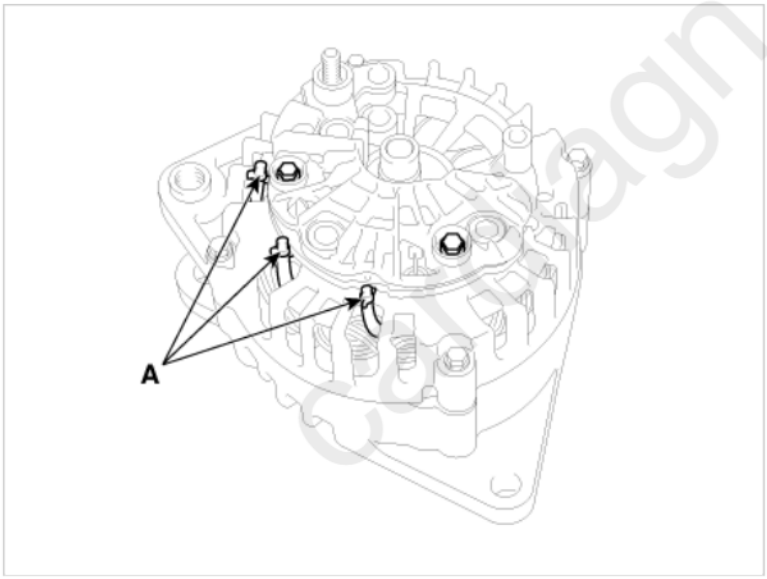
NOTICE

- When installing, replace with new OAP cap.

5. Remove the OAP pulley (A) using the special tool.

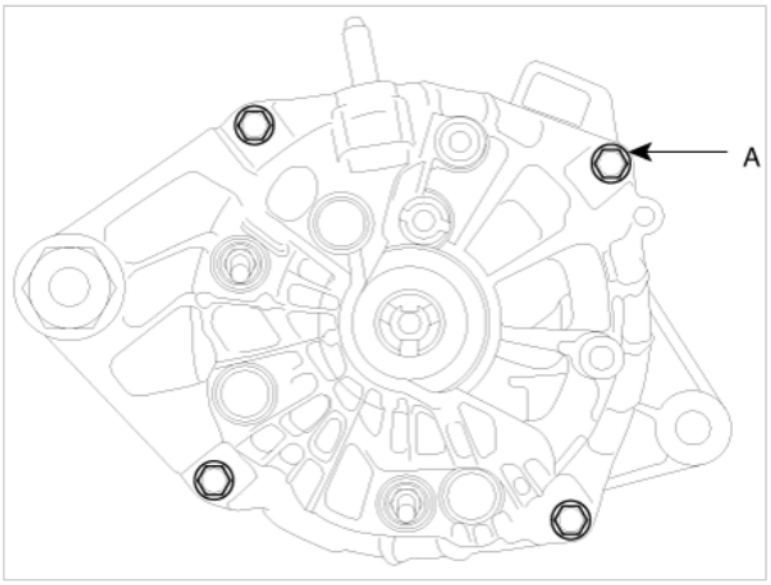


6. Unsolder the 3 stator leads (A).

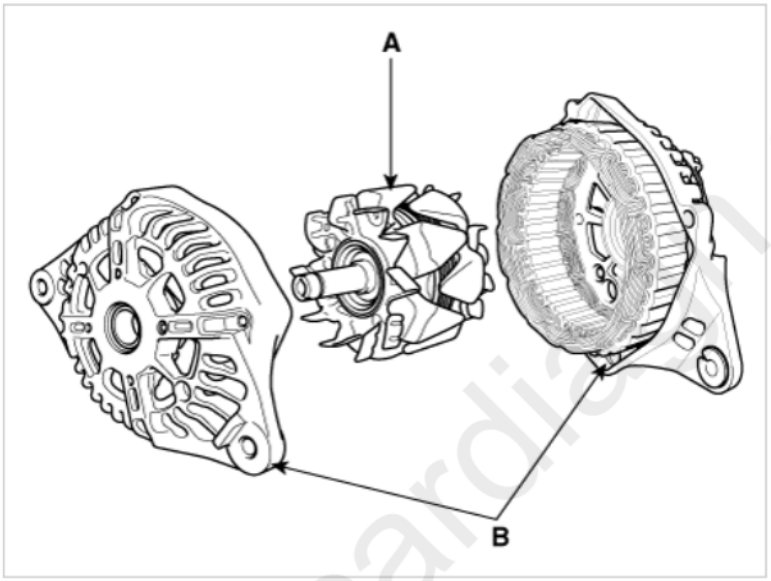


7. Remove the 4 through bolts (A).

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8. Disconnect the rotor (A) and bracket (B).



Reassembly

1. Reassemble in the reverse order of disassembly.

NOTICE

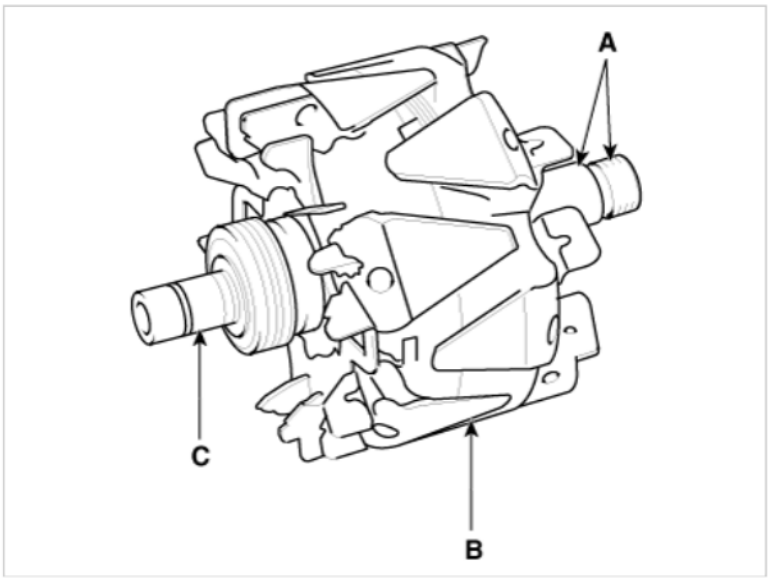
When reassembling OAP pulley, replace with new OAP cap.

Inspection

[Rotor]

1. Check that there is continuity between the slip rings (C).
2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (A).

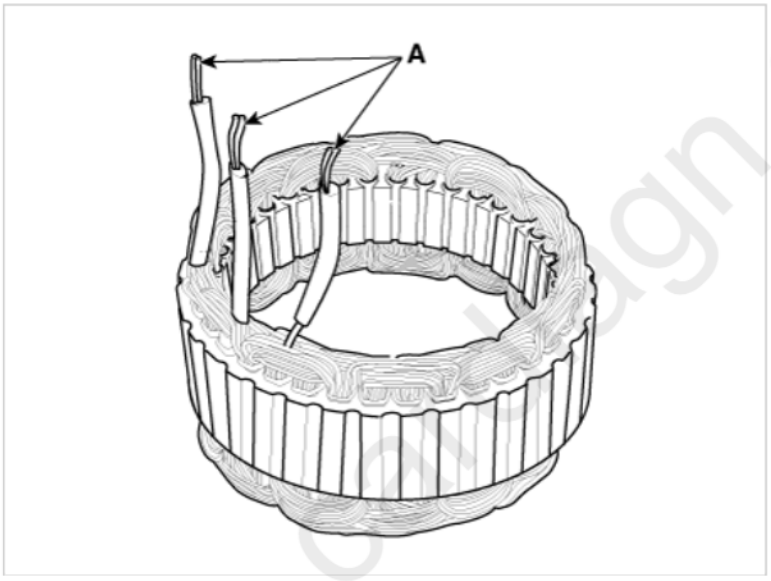
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3. If the rotor fails either continuity check, replace the alternator.

[Stator]

1. Check that there is continuity between each pair of leads (A).



2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the alternator.

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Specification

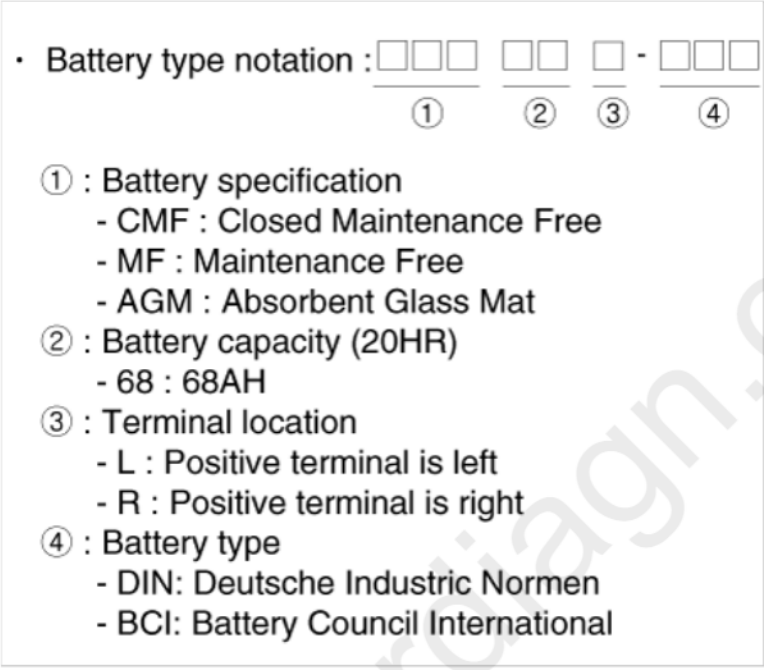
Battery

▹ AGM60L-DIN

Item	Specification
Capacity [20HR/5HR] (AH)	60 / 48
Cold Cranking Amperage (A)	640 (SAE) / 640 (EN)
Reserve Capacity (Min)	100

Information

• Model type description



• Cold Cranking Ampere (CCA): Cold Cranking Amps is 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) : Reserve Capacity is 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.

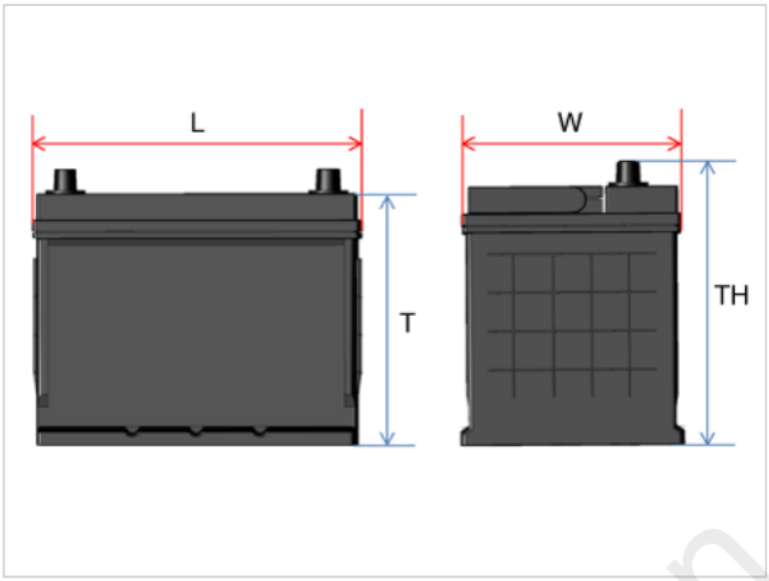
Information

BCI Type

Capacity (5HR/20HR)	Length L (mm)	Width W (mm)	Height T (mm)	Total Height 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

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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



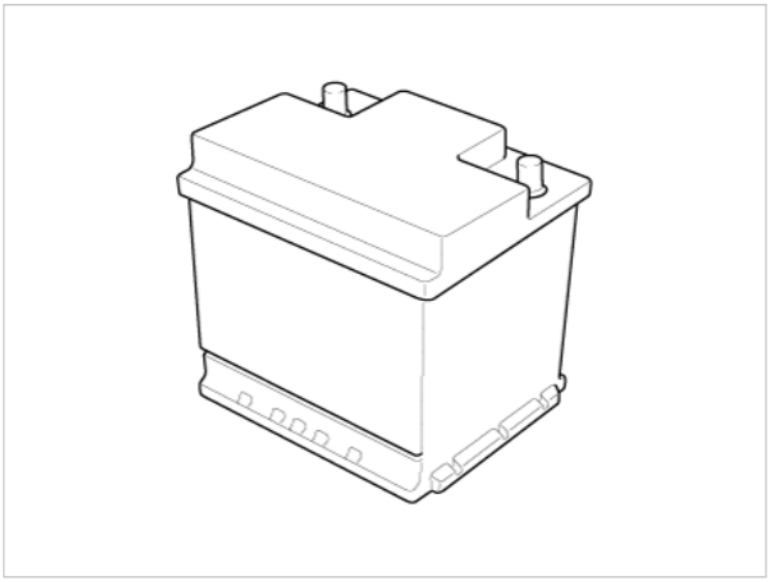
DIN Type

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

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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.



Information

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

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Removal

Information

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

Battery

1. Turn the ignition switch OFF.
2. Disconnect the battery negative (-) terminal (A).

Battery negative (-) terminal tightening nut :
8.0 - 10.0 N·m (0.8 - 1.0 kgf·m, 5.9 - 7.4 lb·ft)



3. Disconnect the battery positive (+) terminal (A).

Battery positive (+) terminal tightening nut :
8.0 - 10.0 N·m (0.8 - 1.0 kgf·m, 5.9 - 7.4 lb·ft)



4. Remove the battery mounting bracket after loosening the mounting bolt (A).



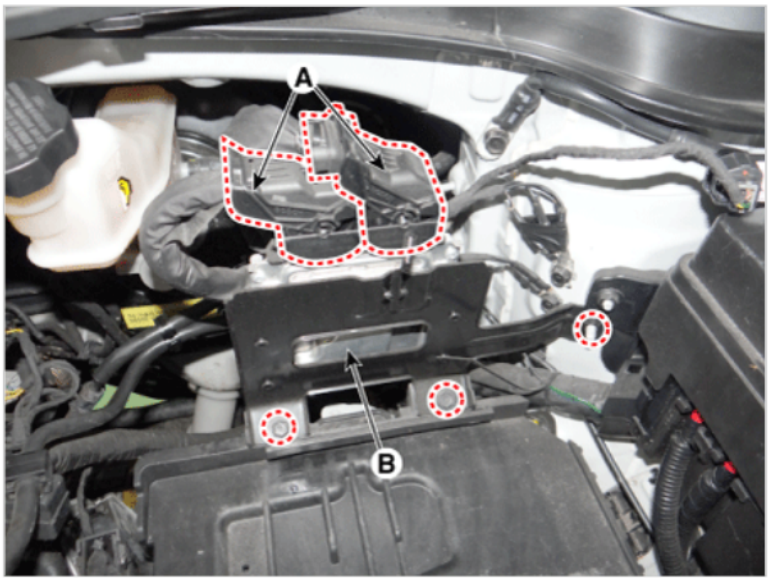
5. Remove the battery (A).

Battery mounting bracket mounting bolt :
9.0 - 14.0 N·m (0.9 - 1.4 kgf·m, 6.6 - 10.3 lb·ft)



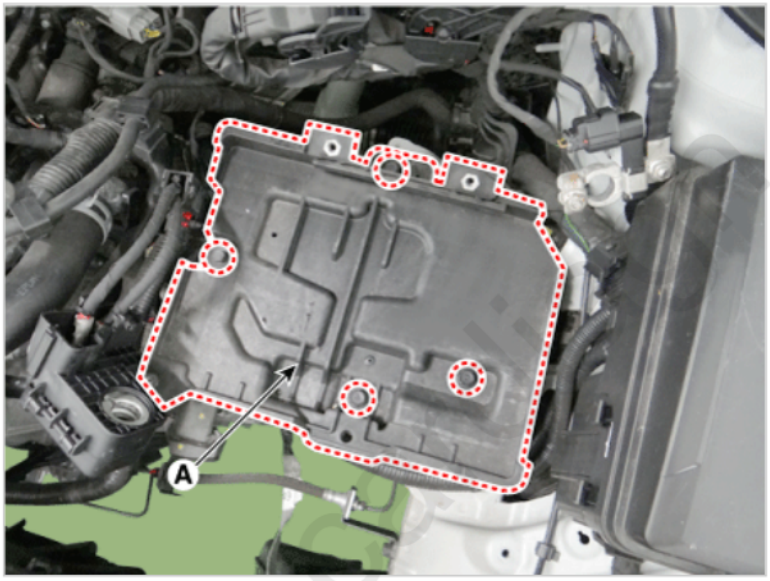
Battery Tray

1. Remove the battery.
   (Refer to Charging System - "Battery")
2. Remove the air cleaner.
   (Refer to Engine Mechanical System - "Air Cleaner")
3. Disconnect the ECM Connector (A).
4. Remove the mounting bolts and nut, and then remove the ECM bracket assembly (B).



5. Remove the battery tray (A) after loosening the mounting bolts

Battery tray mounting bolt:
9.0 - 14.0 N·m (0.9 - 1.4 kgf·m, 6.6 - 10.3 lb·ft)



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")**

Adjustment

Battery charging

In general, vehicle battery charging system has three forms.

1. Constant current charge: The battery voltage gradually rises by charging with setting a constant current. If charging current and time are not managed correctly, the battery is over-charged, therefore charging should be stopped after confirming the completion of charging.

–

General charge: Charging the battery for a long time with low current

– Quick charge: Charging the battery for a short time with high current

2. Constant voltage charge: The battery charge current is gradually reduced by charging with setting a constant voltage.

⚠ CAUTION

If the battery is charged directly at the battery terminals on vehicles with battery sensor, misinterpretations of battery condition and under certain circumstances also unwanted Check Control messages or fault memory entire can occur.

After recharging finished, let the battery stand for over 10 hours with normal temperature for battery stabilization.

Inspection

Battery Voltage and Status

Check the battery voltage and status using the battery tester.

Battery Terminal

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





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:
8.0 - 10.0 N·m (0.8 - 1.0 kgf·m, 5.9 - 7.4 lb·ft)



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:
8.0 - 10.0 N·m (0.8 - 1.0 kgf·m, 5.9 - 7.4 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 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.

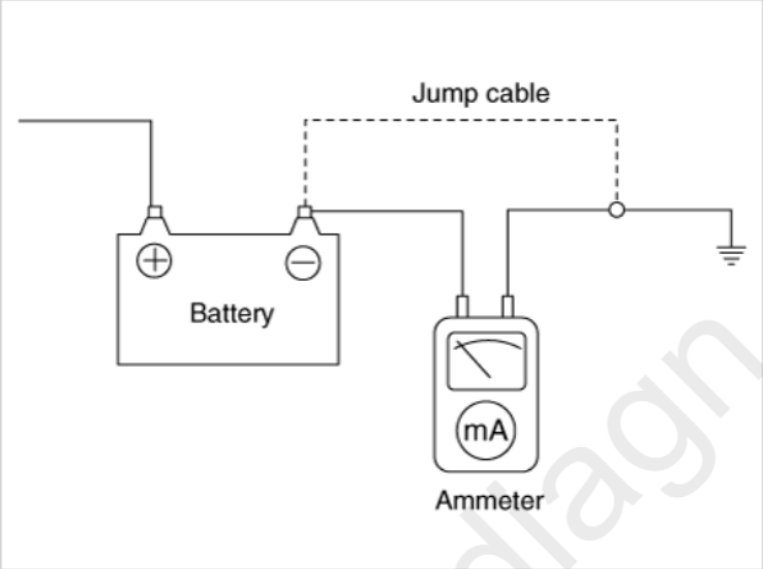
4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

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 a fuse one by one and checking the parasitic current.
   - Reconnect the suspected parasitic currentdraw circuit fuse only and search for suspectedunit by removing the component connected with thecircuit one by one until the parasitic draw dropsbelow limit value.

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

[Using the Clamp type Ammeter]

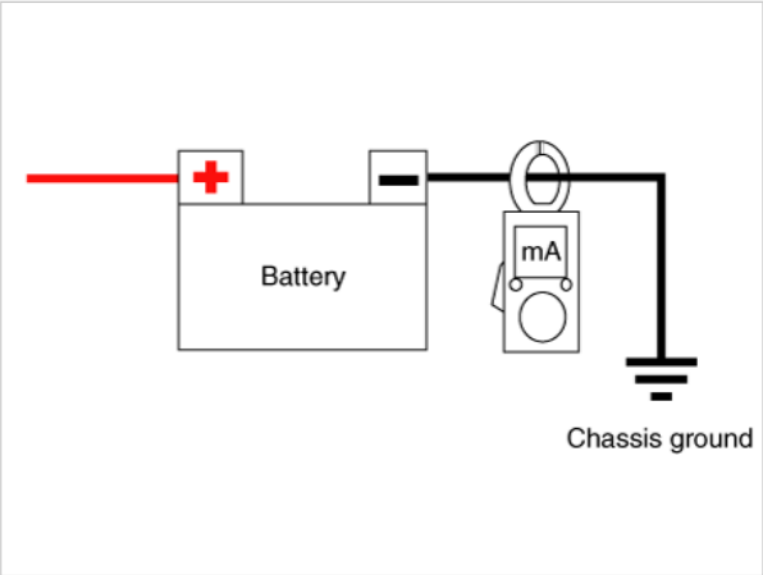
1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.
3. Wait a few minutes until the 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 a fuse one by one and checking the parasitic current.
   - Reconnect the suspected parasitic currentdraw circuit fuse only and search for suspectedunit by removing the component connected with thecircuit one by one until the parasitic draw dropsbelow limit value.

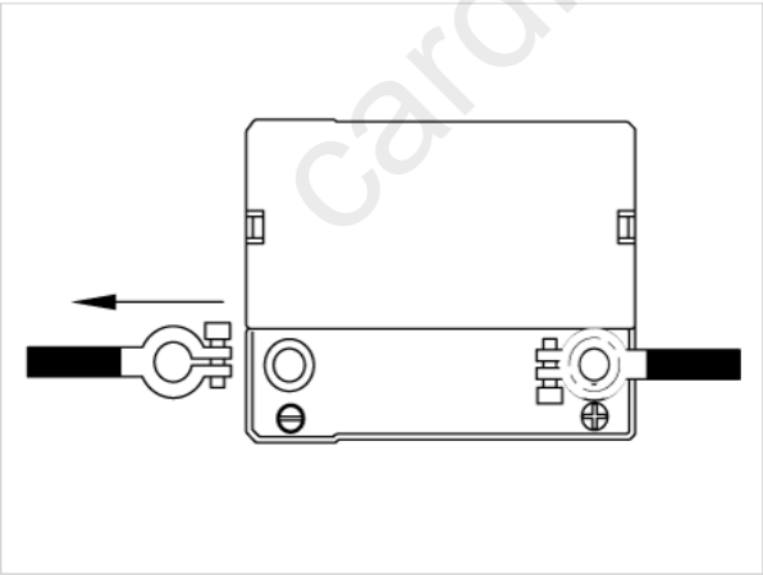
Limit value (after 10-20 min.) : Below 50mA

Cleaning

1. Make sure 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.
7. Clean the battery posts with a suitable battery post tool.

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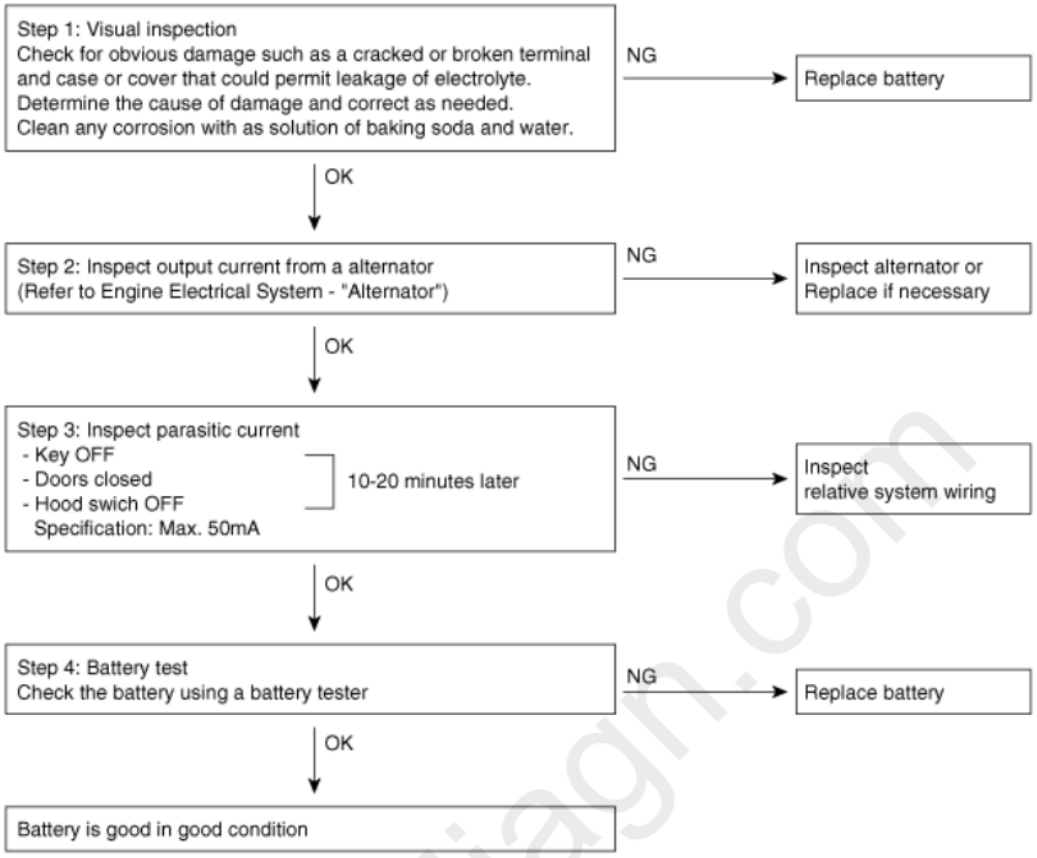
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops 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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Troubleshooting



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Description

Vehicles have many control units that use more electricity. These units control their own system based on information from diverse sensors. It is important to have a stable power supply as there diverse sensors giving a variety of information. Battery sensor (A) 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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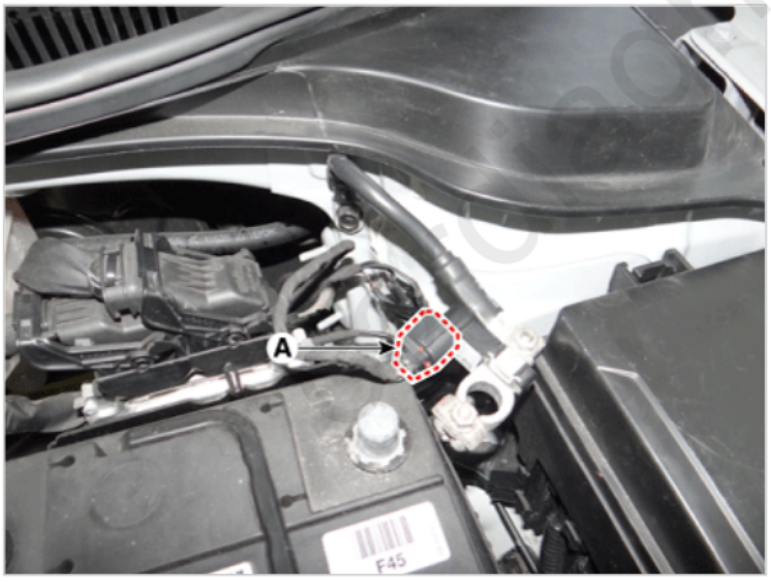
Removal

1. Turn the ignition switch OFF.
2. Disconnect the battery negative (-) terminal (A).

Battery negative (-) terminal tightening nut :
8.0 - 10.0 N·m (0.8 - 10.0 kgf·m, 5.9 - 7.4 lb·ft)

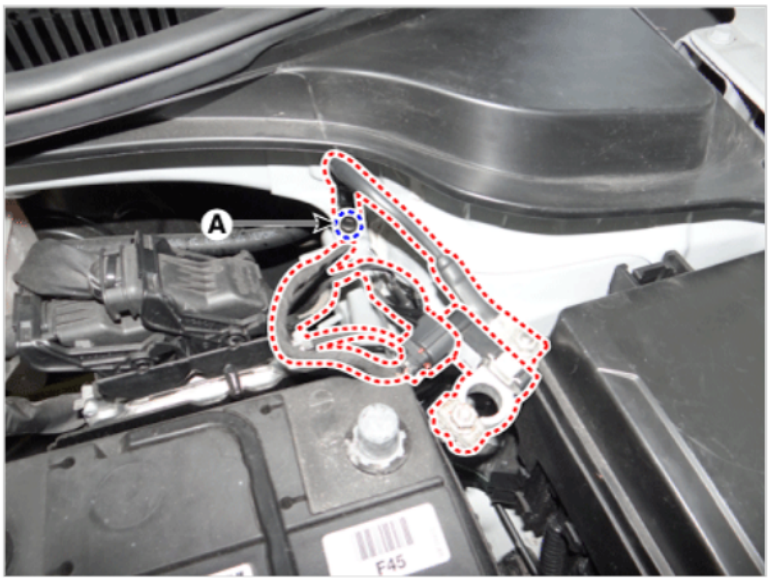


3. Disconnect the battery sensor connector (A).



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

Battery sensor cable mounting bolt(Chassis ground) :
27.0 - 33.0 N·m (2.8 - 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, it should be same one (type, capacity and brand) that is originally installed on your vehicle. 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 with specified torque. An excessive tightening torque 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.

Battery Sensor Recalibration Procedure

After reconnecting the battery negative cable, AMS 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. 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

The cruise control system is engaged by the cruise "ON/OFF" main switch located on right 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 contains a low speed limit which will prevent 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 (CRUISE)

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 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 2km/h or 1mph.

Resume/Accel switch (RES/+)

The "RES/+" switch located on right 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 2km/h or 1mph.

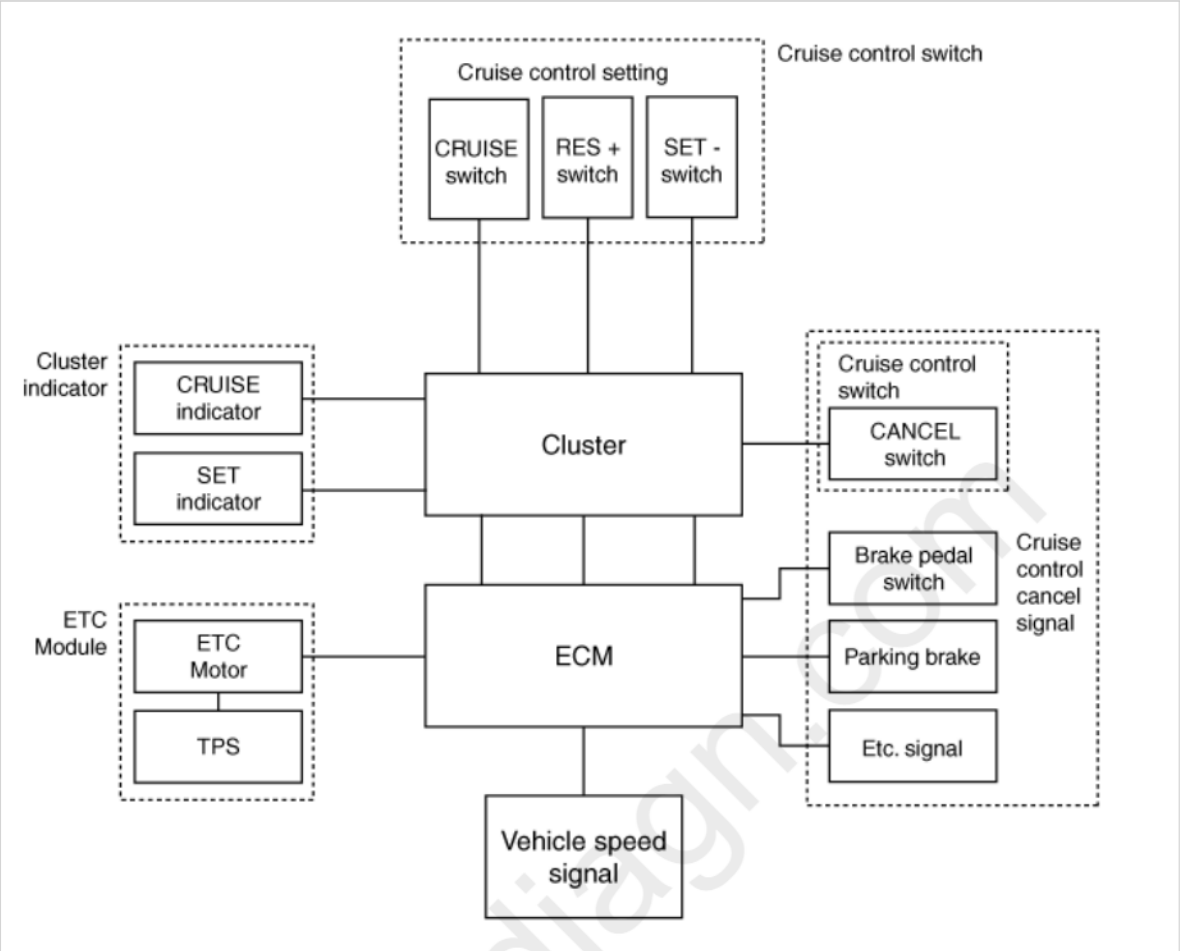
Cancel switch (CANCEL)

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

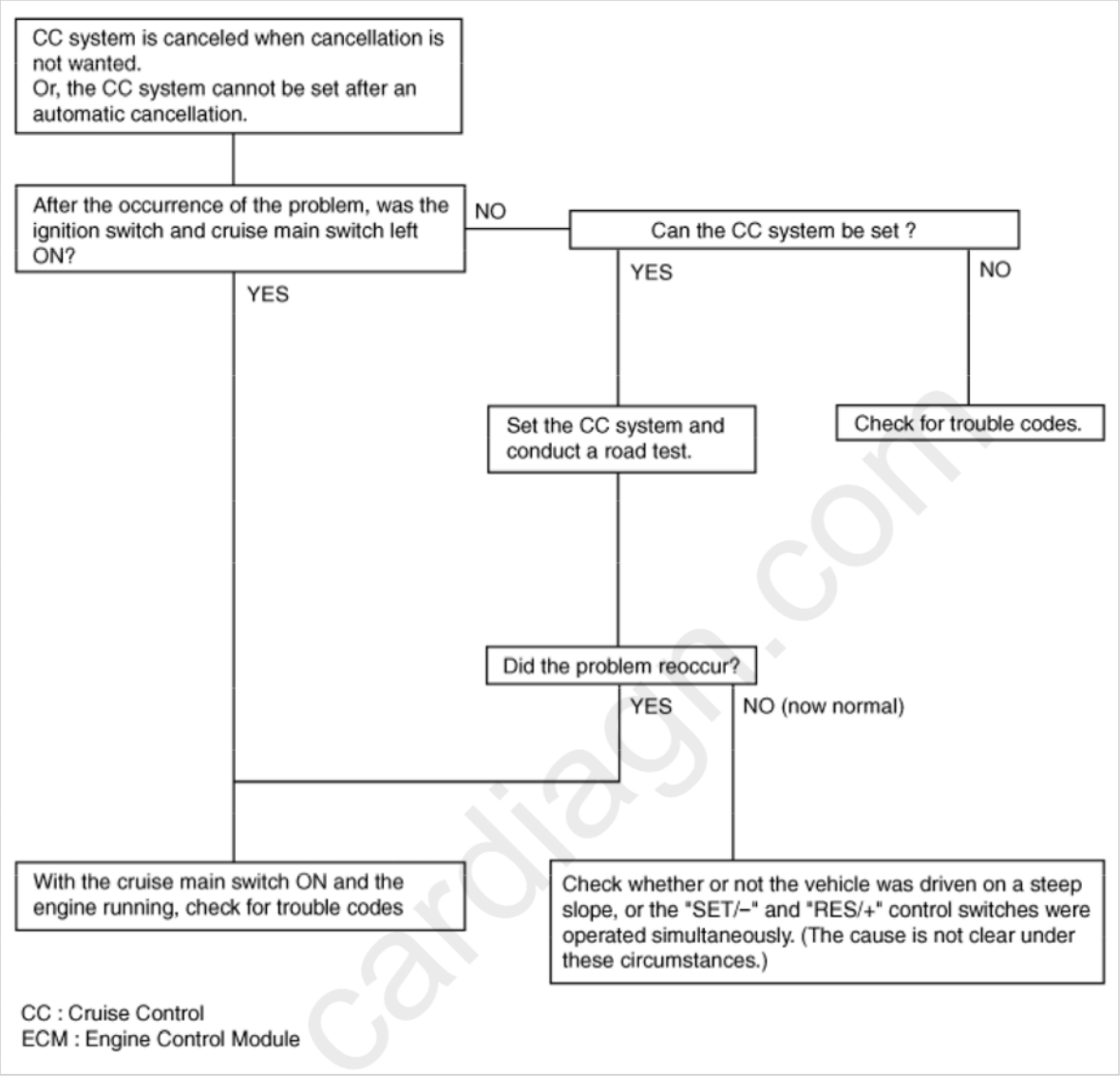
Component part		Function
Vehicle-speed sensor, ESP/ABS Control Module		Converts vehicle speed to pulse.
ECM		Receives signals from sensor and control switches.
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	CRUISE switch	Switch for automatic speed control power supply.
	Resume/Accel switch (RES +)	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	Set/Coast switch (RES -)	
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

Trouble Symptom 4

Trouble symptom	Probable cause	Remedy

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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

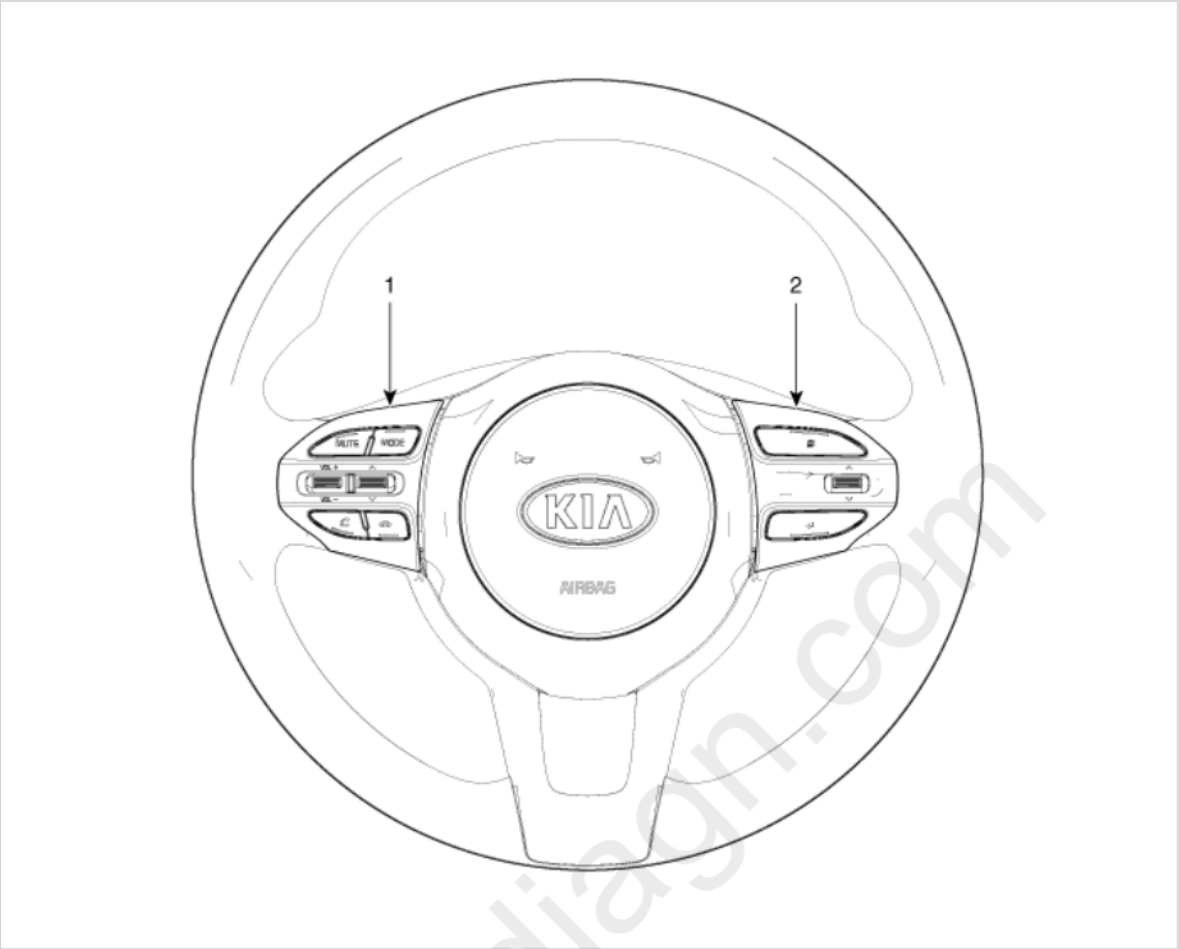
Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the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

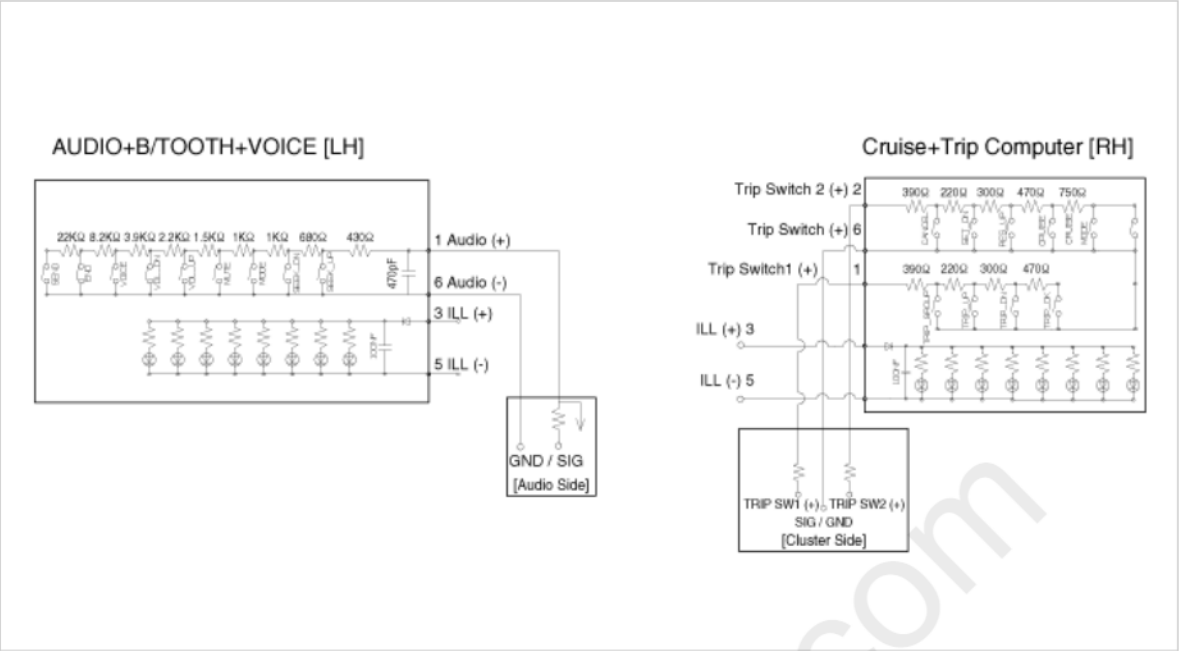


1. Left Remote Control Switch
(Audio + Hands free + Voice)

2. Right Remote Control Switch
(Cruise+Trip Computer)

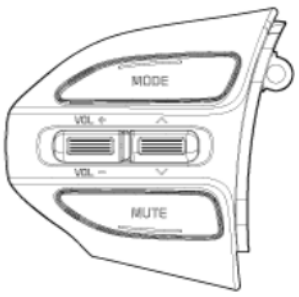
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Circuit Diagram



[Audio]

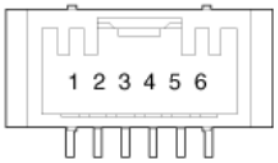
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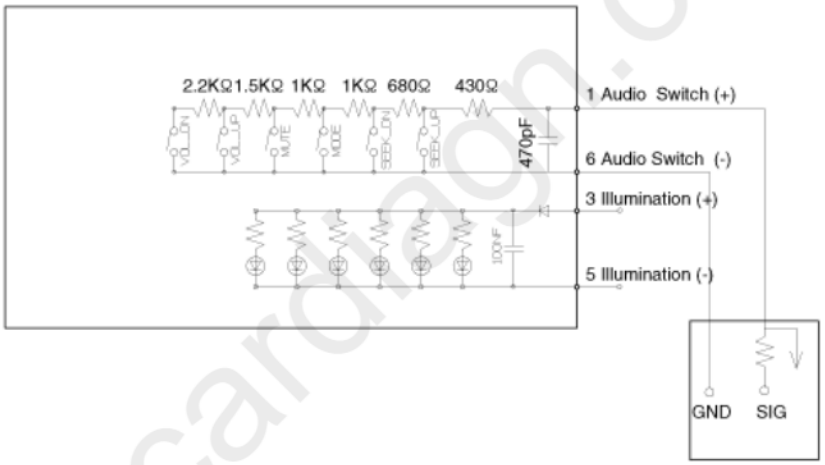


[General]



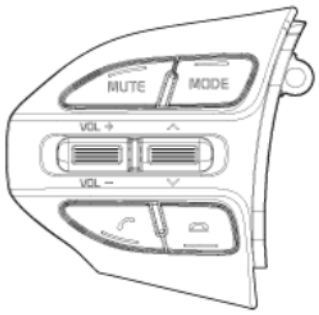
[Europe]

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

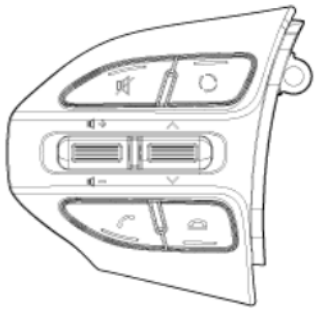


[Audio + Bluetooth]

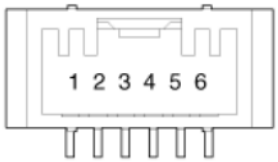
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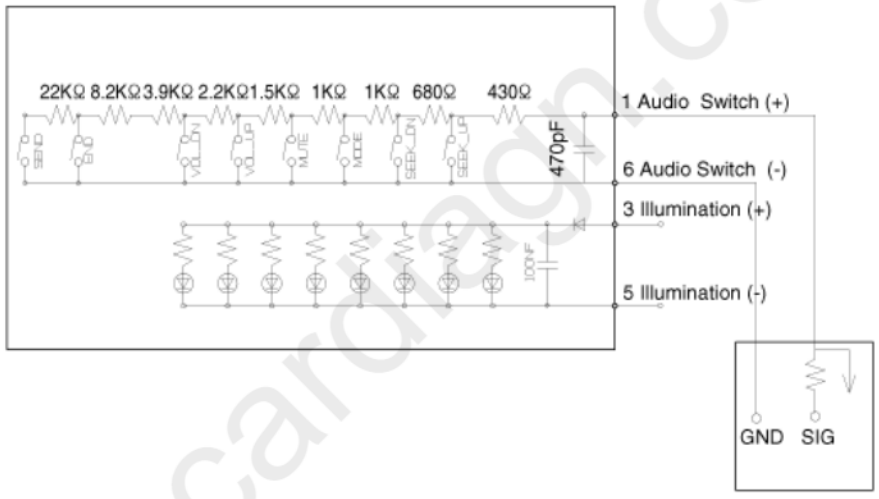


[General]



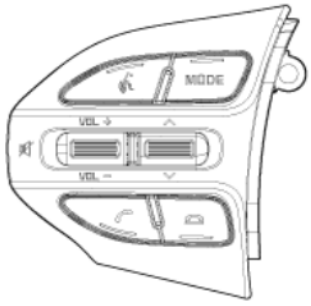
[Europe]

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

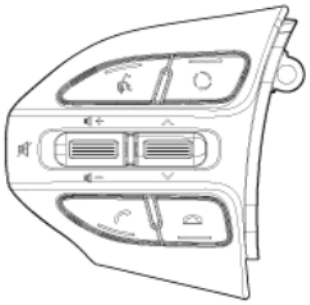


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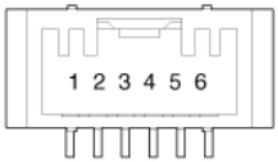
[Audio + Bluetooth + Voice]

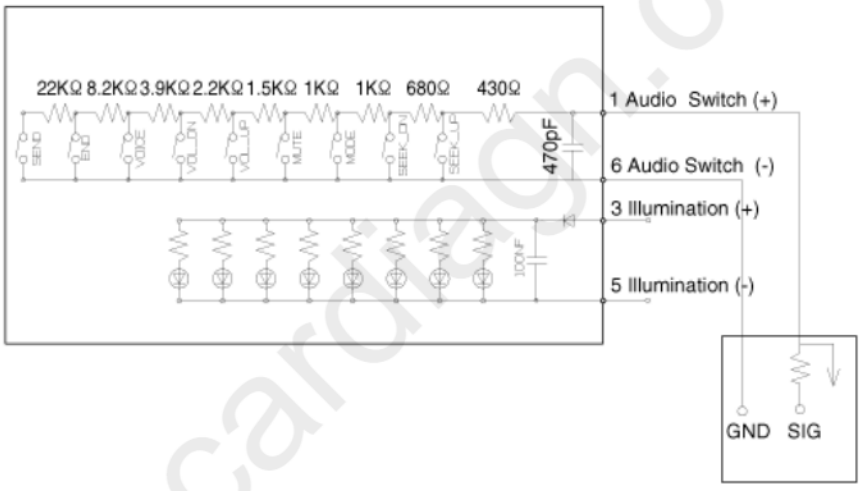


[General]



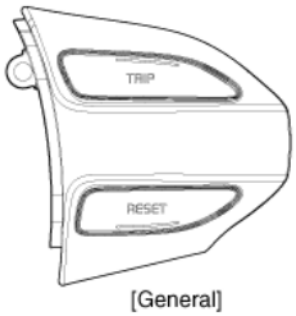
[Europe]

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

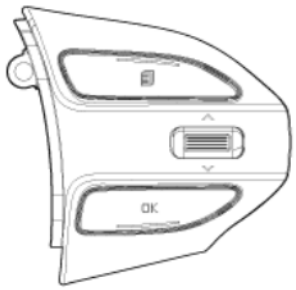


[Trip]

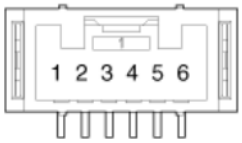
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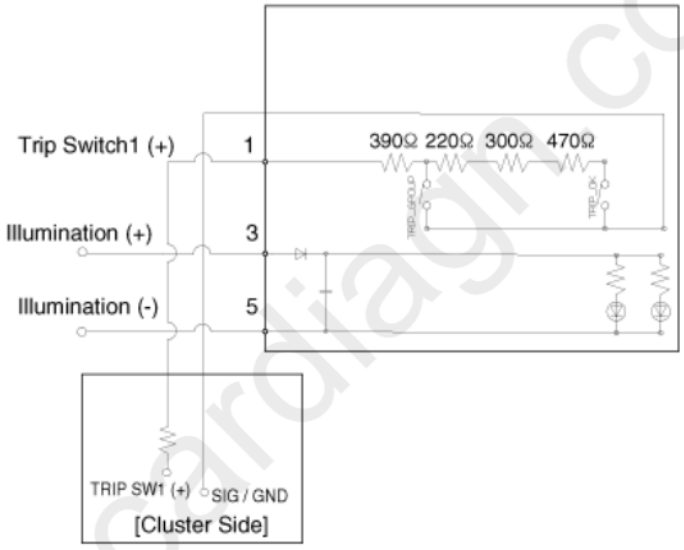


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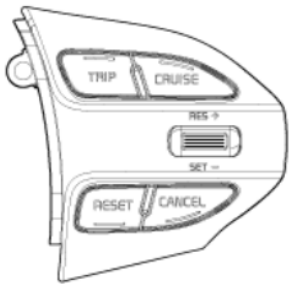
[Europe]

Connector	
	
No.	**Description**
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)

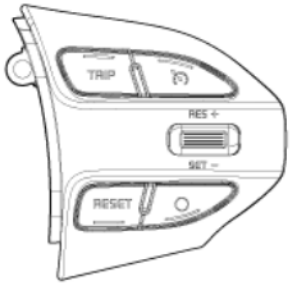


[Trip + ACC (2 Button)]

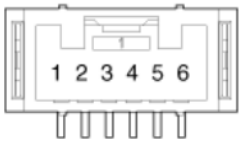
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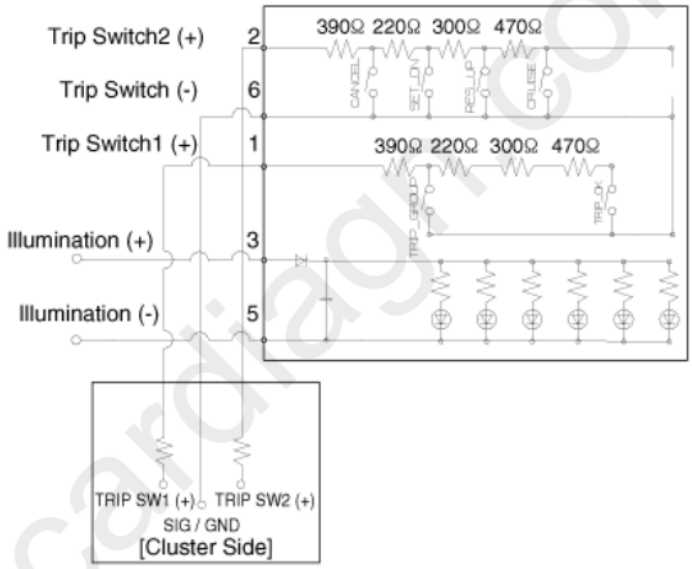


[General]



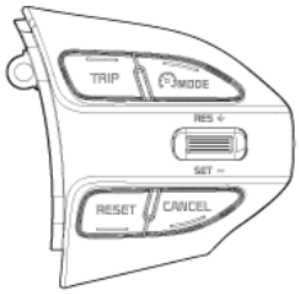
[Europe]

Connector	
	
No.	**Description**
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)

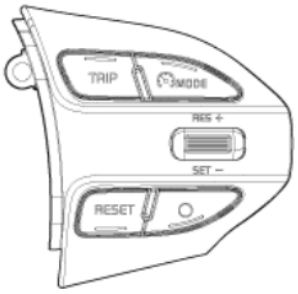


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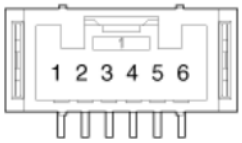
[Trip + ACC + SLD (2 Button)]

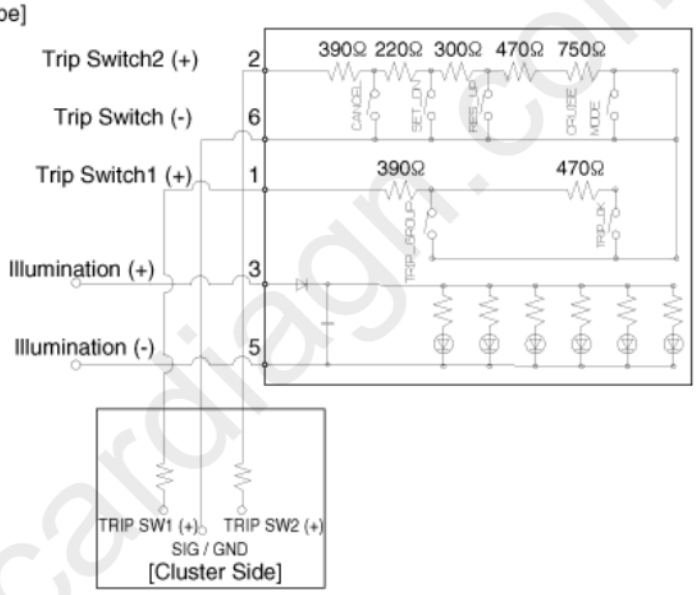


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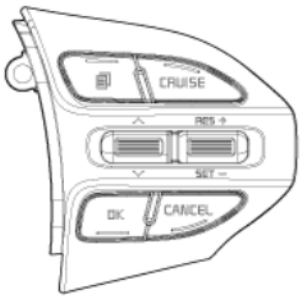
[Europe]

Connector	
	
No.	**Description**
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)

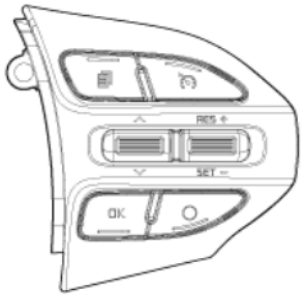


[Trip + ACC (4 Button)]

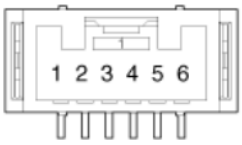
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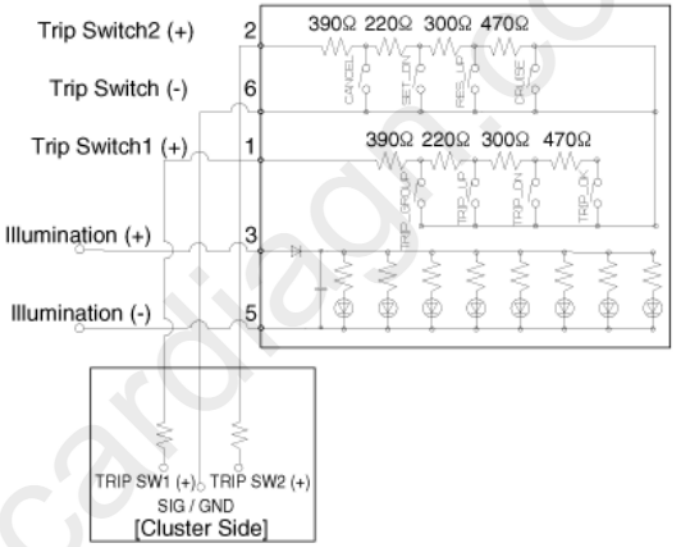


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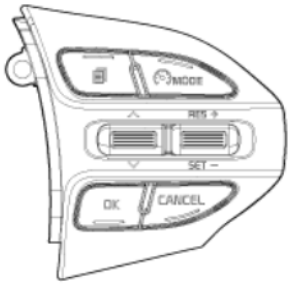
[Europe]

Connector	
	
No.	**Description**
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)

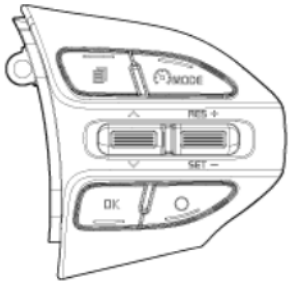


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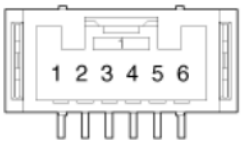
[Trip + ACC + SLD (4 Button)]

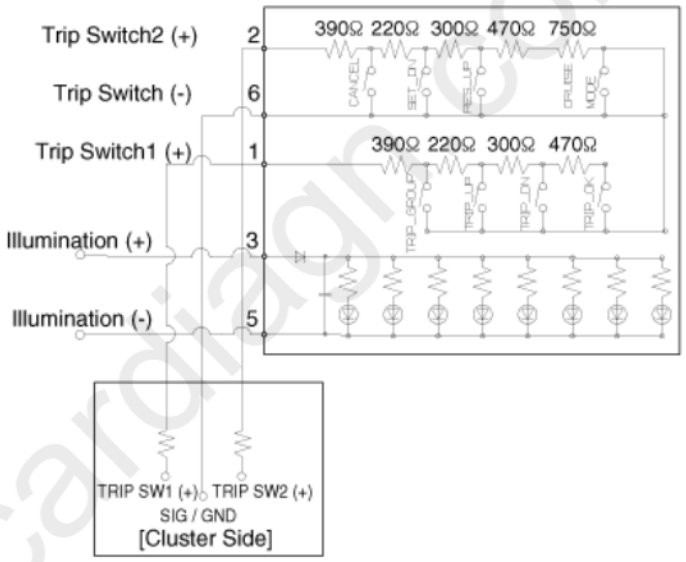


[General]



[Europe]

Connector	
	
No.	**Description**
1	Trip switch1 (+)
2	Trip switch2 (+)
3	Illumination (+)
4	-
5	Illumination (-)
6	Trip switch (-)



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Removal

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

[LH]





[RH]



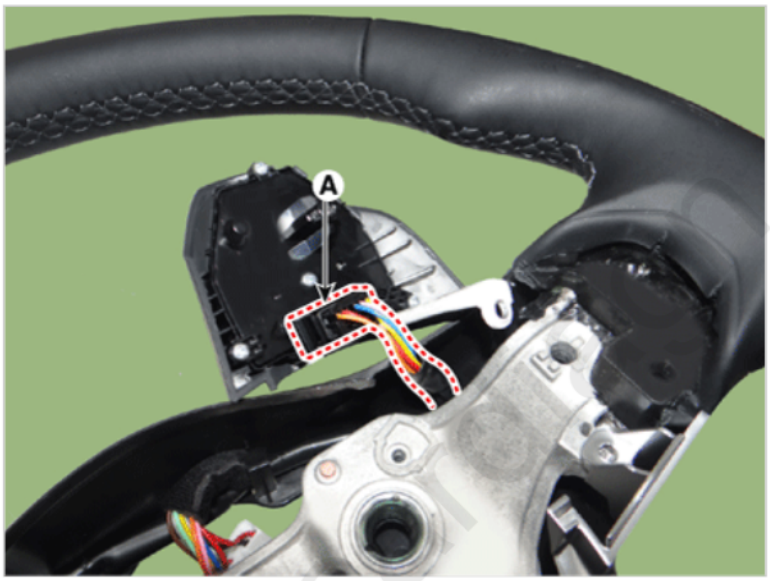
4. Disconnect the steering wheel remote control connector (A).

[LH]

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[RH]

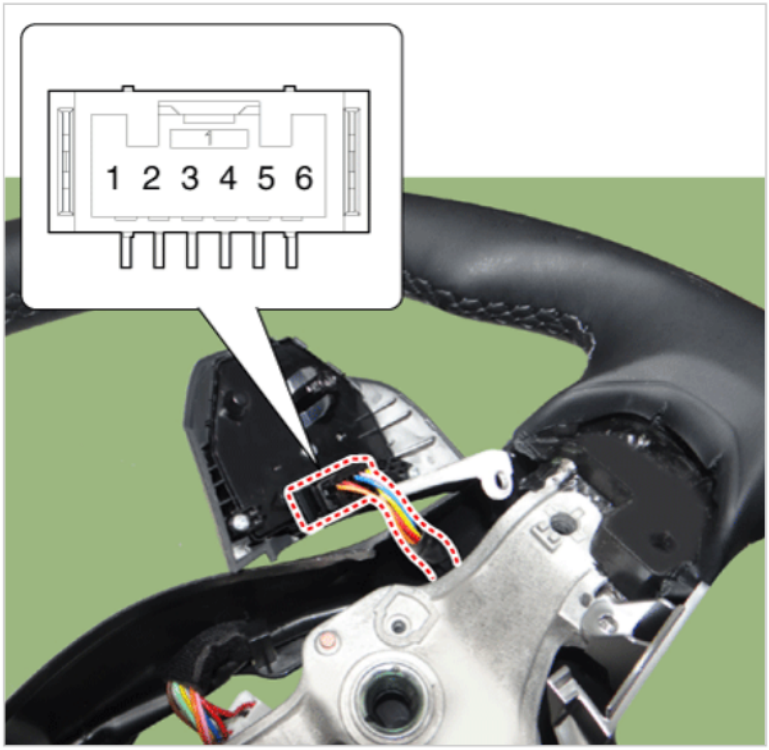


Installation

1. Connect the steering wheel remote control connector.
2. Install the steering wheel remote control.
3. Install the steering wheel and driver airbag module.
4. Connect the negative (-) battery terminal.

Inspection

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



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 Cruise Mode		2.13 kΩ

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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-pro grammed 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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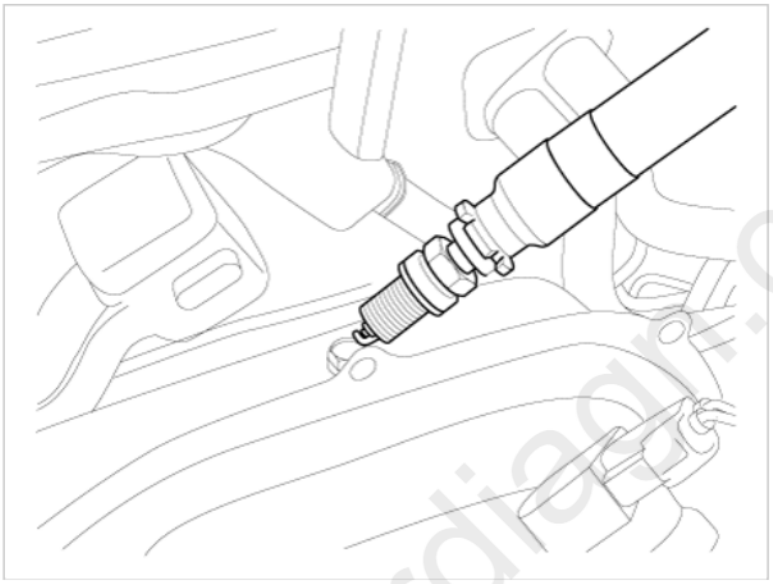
On-vehicle Inspection

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.
   (3) Using a spark plug wrench, remove the spark plugs.
   (4) Disconnect the 4 injector connectors.
   (5) Ground the spark plug to the engine.

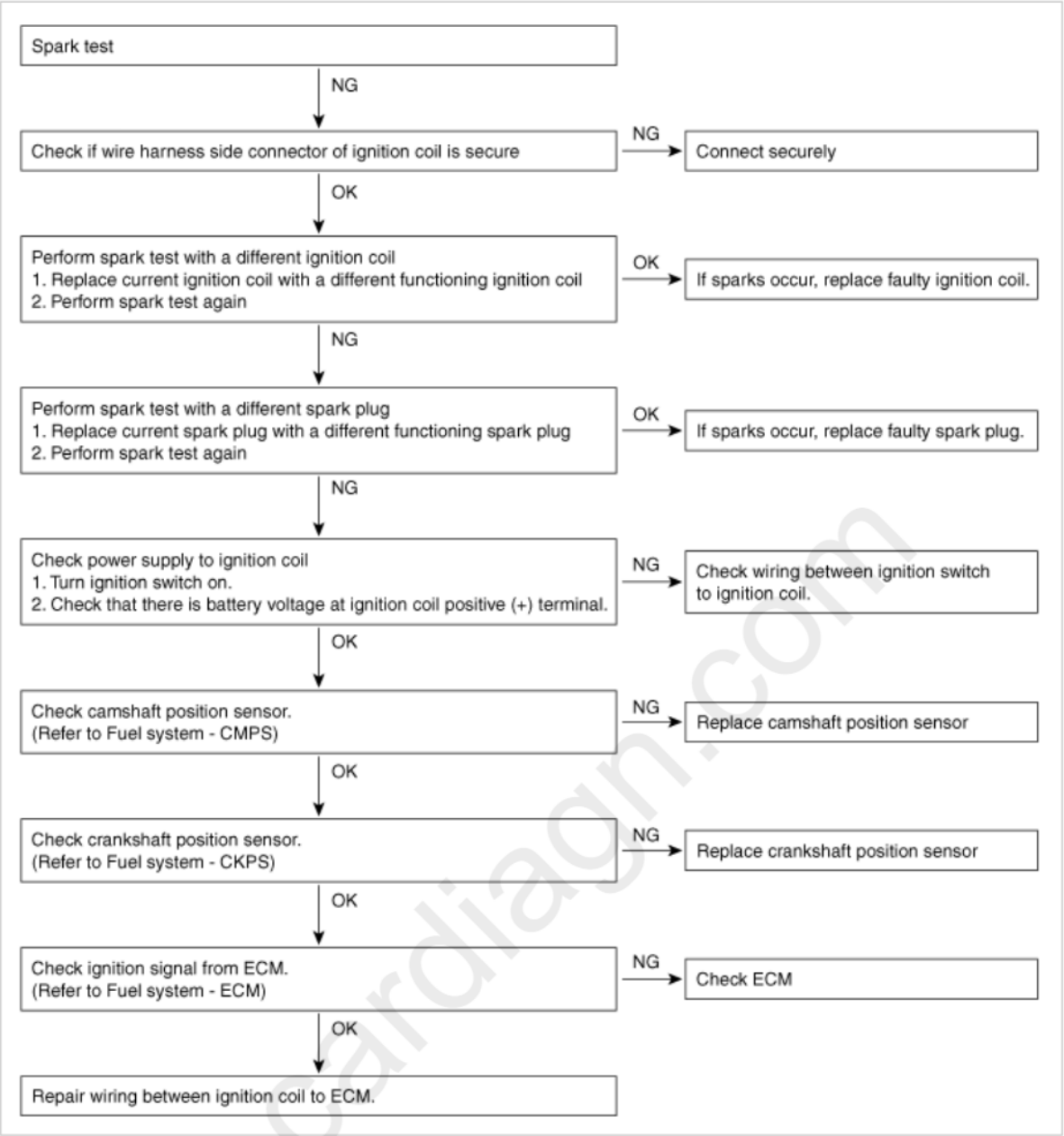


   (6) Check if sparks occur at each spark plug while engine is being cranked.

> **NOTICE**
> • Do not crank the engine for more then 5 seonds.

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.

Troubleshooting

Symptom	Suspect Area	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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Specification

Item	Specification
Rated Voltage (V)	14
Operation Voltage (V)	5 - 16

Item	Specification					
Engine Speed (RPM)	1000	2000	3000	4000	5000	6000
Dwell Time (ms)	1.9	1.9	1.9	1.9	1.9	1.9
Secondary Coil Voltage (kV)	29 ↑	29 ↑	29 ↑	29 ↑	29 ↑	29 ↑

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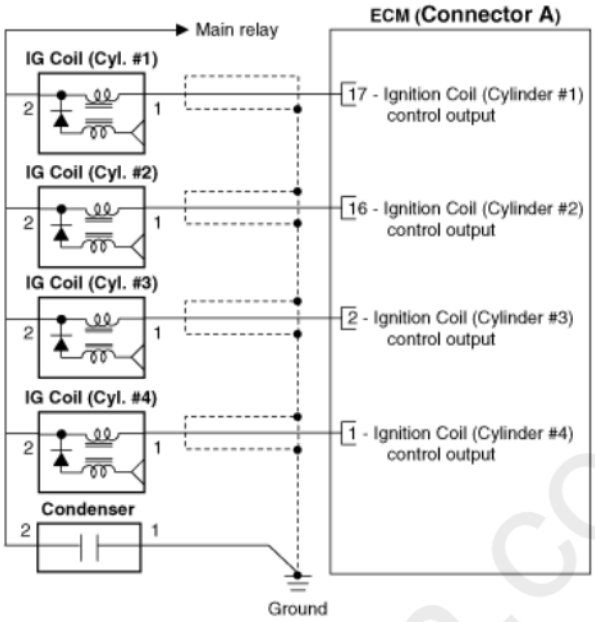
Description

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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Circuit Diagram

[M/T]



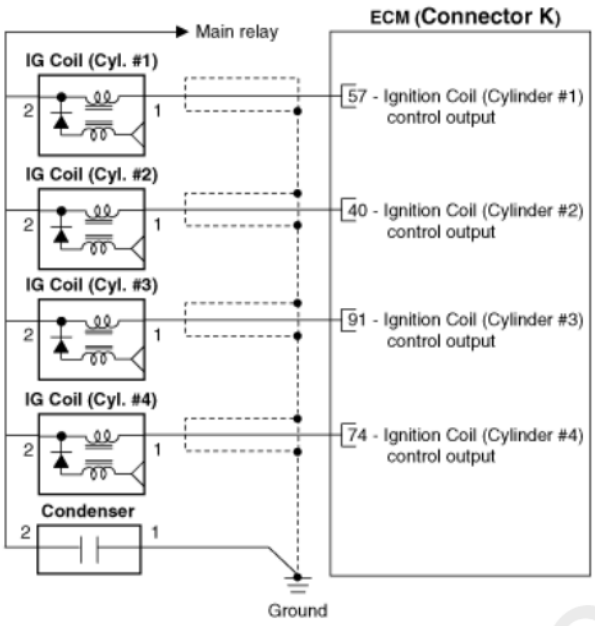
[Harness Connector]



Ignition Coil #1,2,3,4

[A/T]

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[Harness Connector]



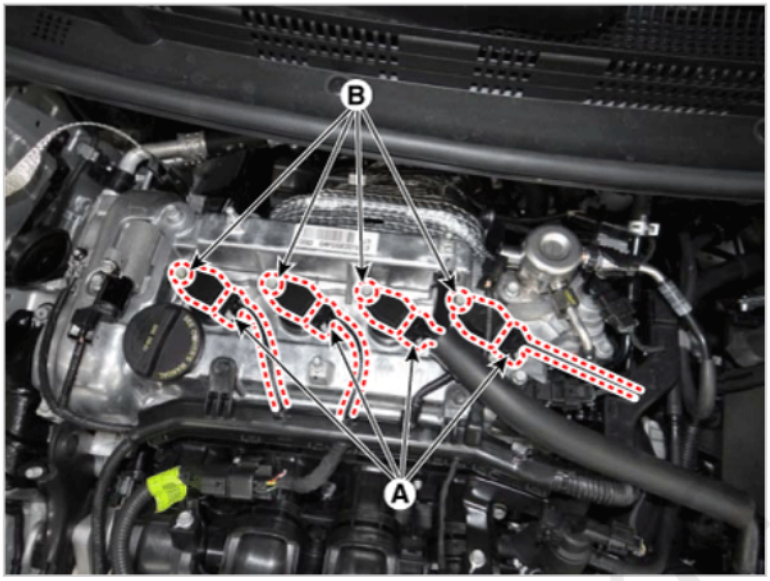
Ignition Coil #1,2,3,4

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Removal

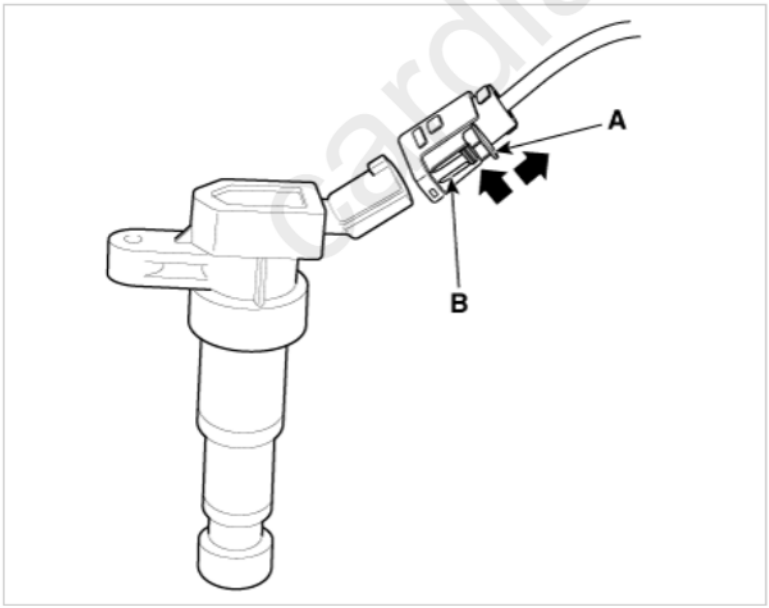
1. Turn ignition switch OFF and disconnect the battery negative (-) terminal.
2. Remove the engine cover.
   (Refer to Engine Mechanical System - "Engine Cover")
3. Disconnect the ignition coil connector (A).
4. Remove the ignition coil after loosening the mounting bolt (B).

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



NOTICE

- When removing the ignition coil connector, pull the lock pin (A) and push the clip (B).



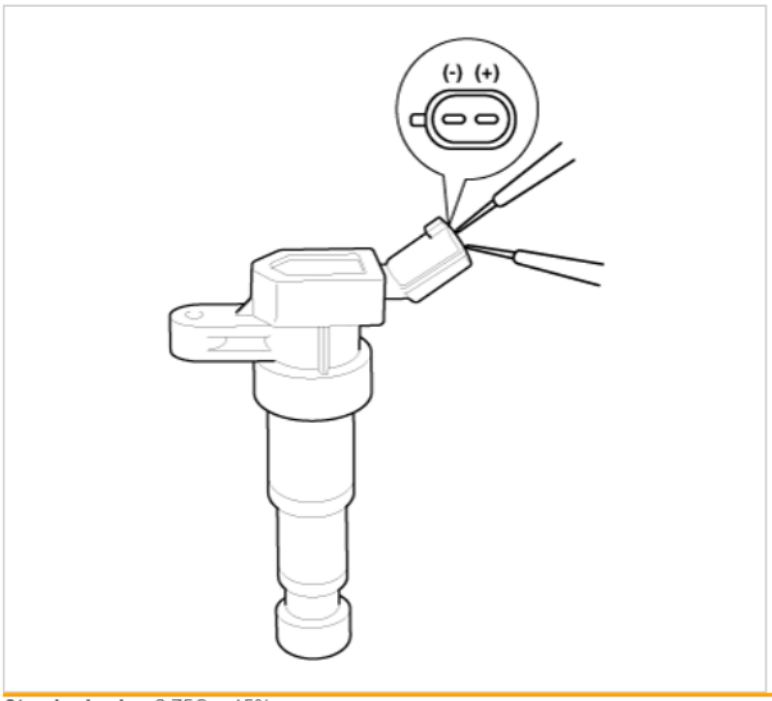
Installation

1. Install in the reverse order of removal.

Inspection

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1. Measure the primary coil resistance between terminals (+) and (-).



Standard value:0.75Ω ± 15%

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Specification

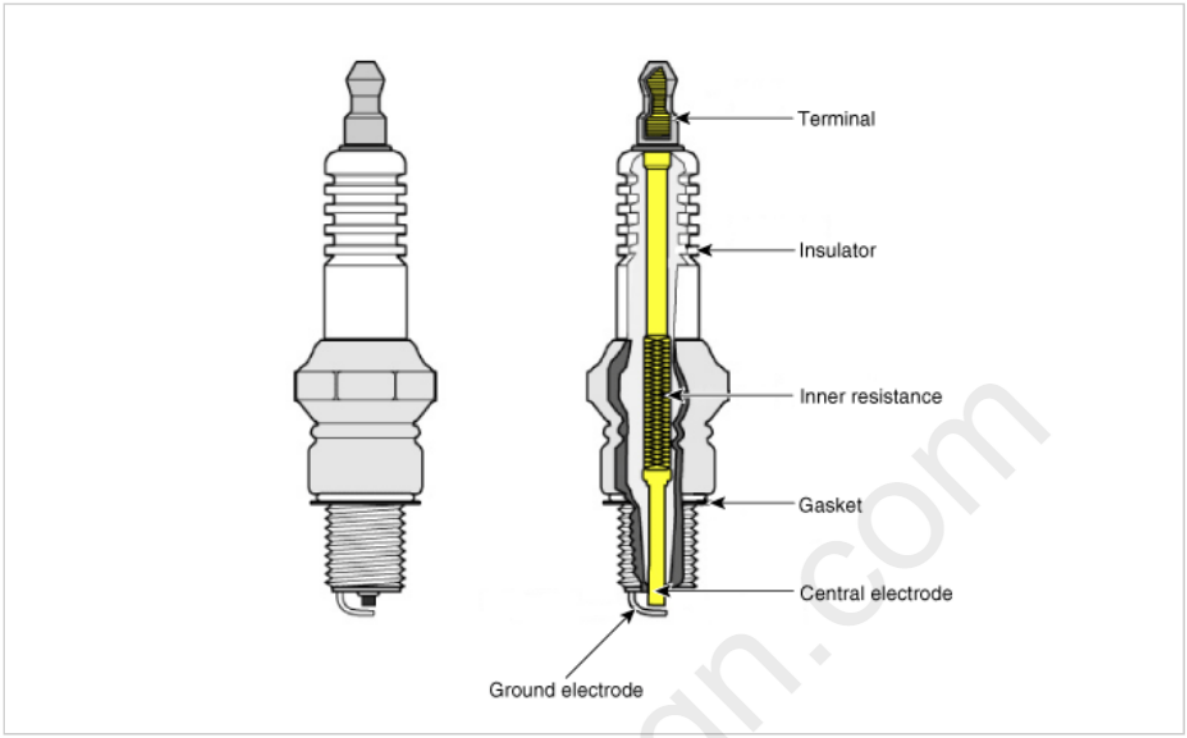
Item	Specification
Type	SILZKR6B10E
Gap	1.0 - 1.1 mm
	(0.0394 - 0.0433in.)

Item	Specification
Type	ELR9IQP10
Gap	0.9 - 1.0 mm
	(0.0354 - 0.0394in.)

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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

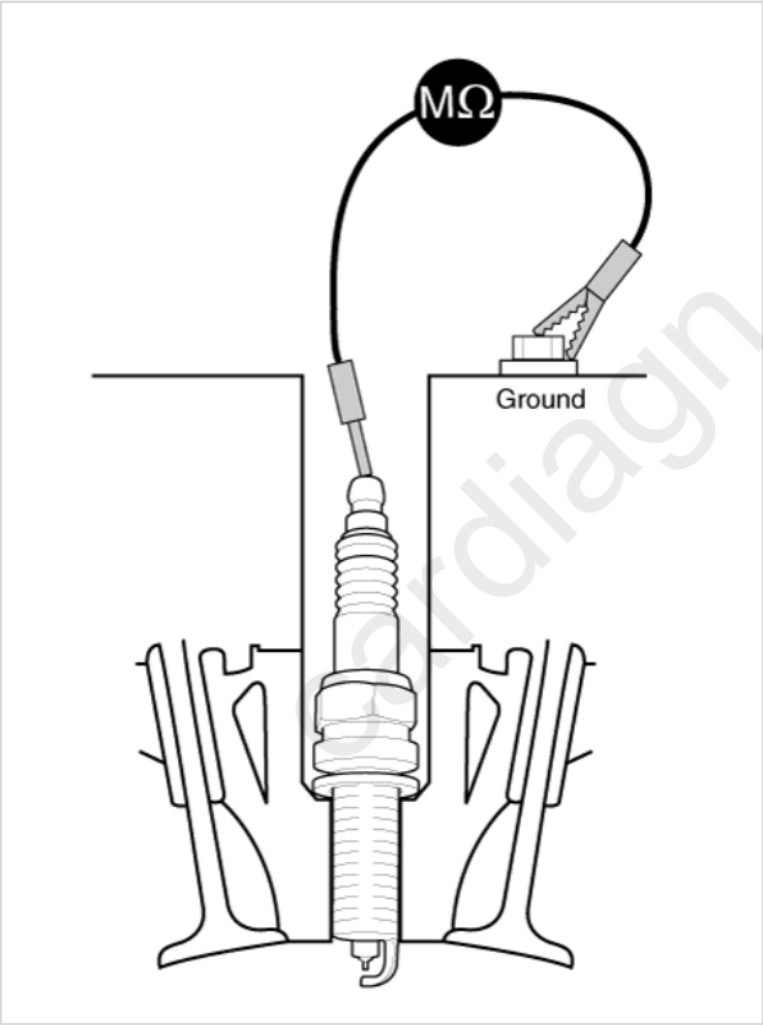
[On vehicle inspection]

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 the damage and electrode gap as below.

[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



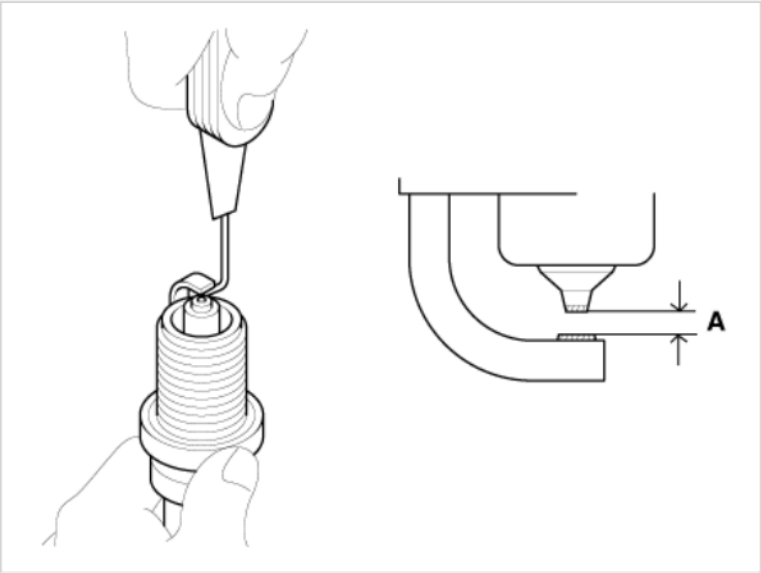
3. Check the spark plug electrode gap.
   If the gap is greater than the maximum, replace the spark plug.

Specification :1.0 - 1.1 mm (0.0394 - 0.0433 in.)

NOTICE

- If 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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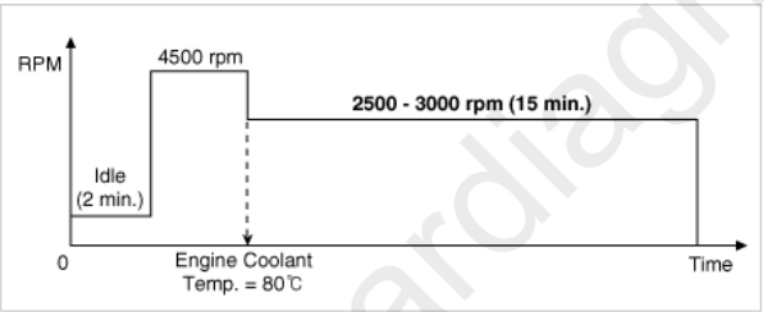


Cleaning

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

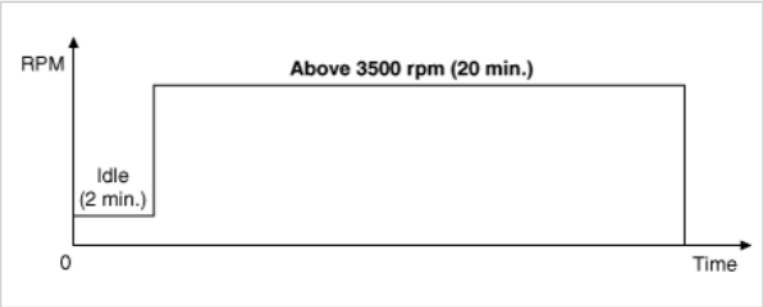
- The 2nd method should be performed only if the 1st method fails (the misfire-related codes recur).

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 Ignition System - "Ignition Coil")
2. Using a spark plug wrench, remove the spark plug (A).

NOTICE

- Be careful that no contaminates enter into spark plug holes.



Installation

1. Install in the reverse order of removal.

Tightening torque :
14.7 - 24.5 N·m (1.5 - 2.5 kgf·m, 10.8 - 18.0 lb·ft)

Description

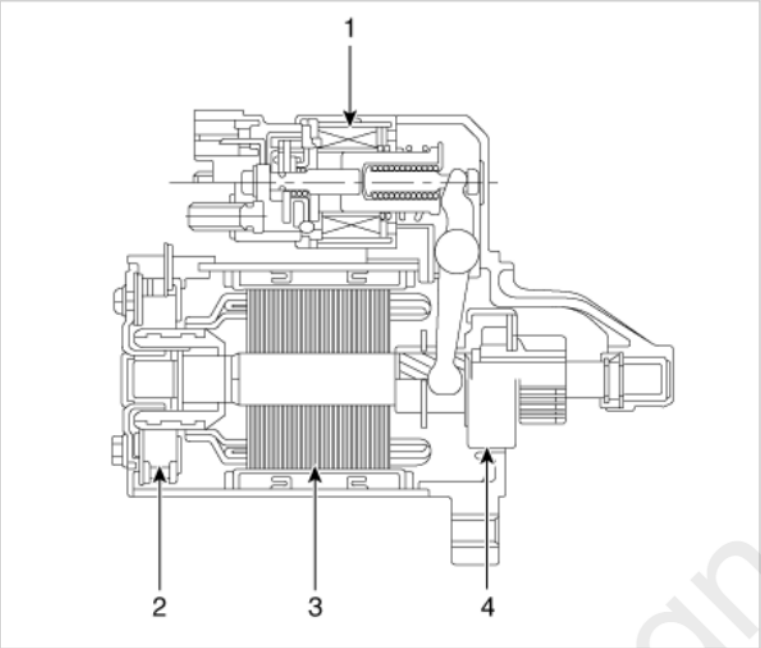
The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), clutch pedal switch (M/T), ignition lock switch, connection wires and the battery cable.

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.



1. Magnet switch assembly
2. Brush holder assembly
3. Armature assembly
4. Over runing clutch assembly

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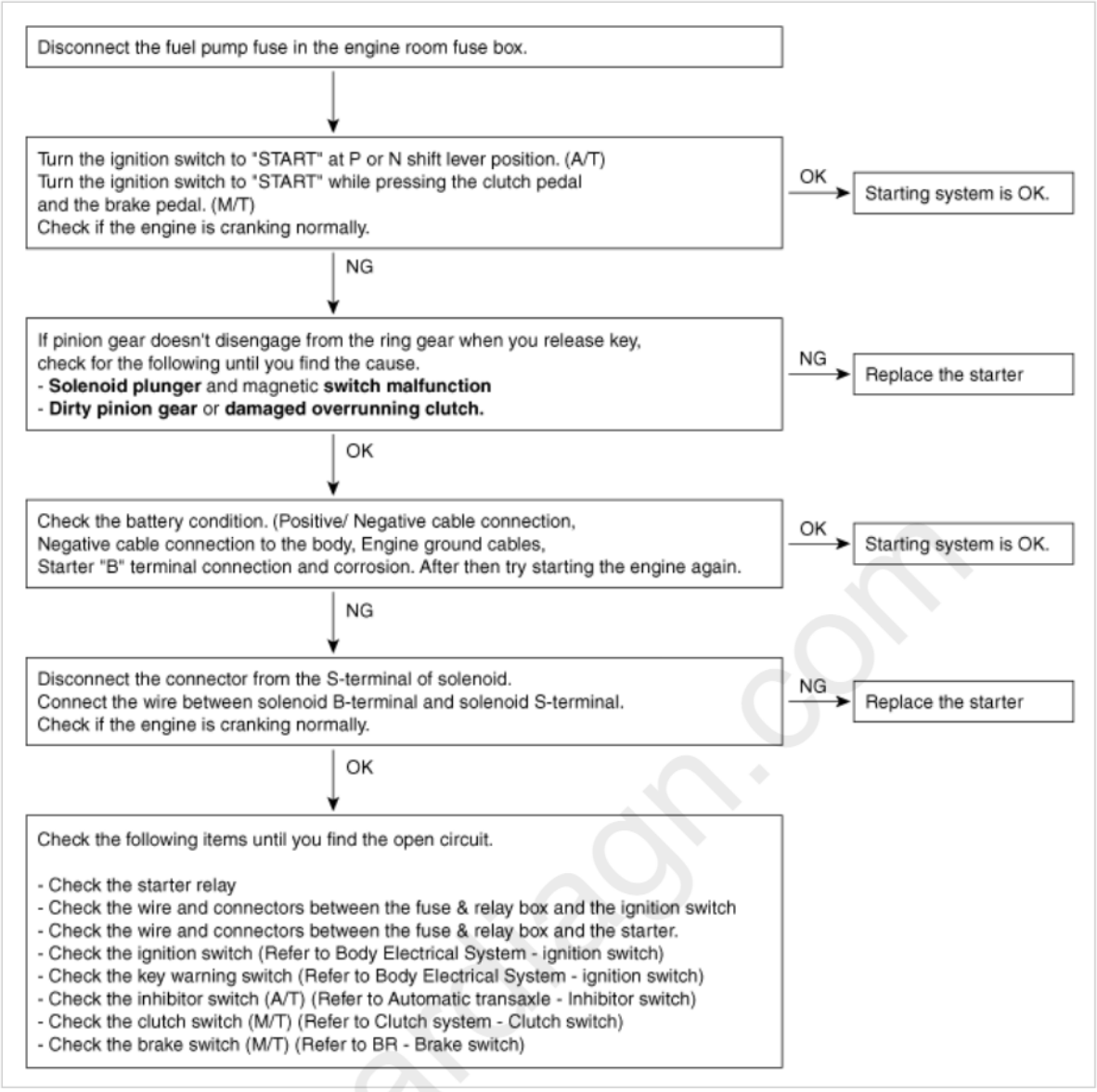
Troubleshooting

Symptom	Suspected Area	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Inhibitor switch [AT Type only]	**Refer to Automatic Transaxle System - "Inhibitor switch"**
	Inhibitor switch [DCT Type only]	Refer to Daul Clutch Transmission System - "Inhibitor switch"
	Clutch Switch [MT Type only]	Refer to Clutch System - "Clutch Switch"
	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
	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

NOTICE

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

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Disconnect the fuel pump fuse in the engine room fuse box.
Turn the ignition switch to "START" at P or N shift lever position. (A/T)
Turn the ignition switch to "START" while pressing the clutch pedal and the brake pedal. (M/T)
Check if the engine is cranking normally.
OK
Starting system is OK.
NG
If pinion gear doesn't disengage from the ring gear when you release key, check for the following until you find the cause.
- Solenoid plunger and magnetic switch malfunction
- Dirty pinion gear or damaged overrunning clutch.
NG
Replace the starter
OK
Check the battery condition. (Positive/ Negative cable connection, Negative cable connection to the body, Engine ground cables, Starter "B" terminal connection and corrosion. After then try starting the engine again.
OK
Starting system is OK.
NG
Disconnect the connector from the S-terminal of solenoid.
Connect the wire between solenoid B-terminal and solenoid S-terminal.
Check if the engine is cranking normally.
NG
Replace the starter
OK
Check the following items until you find the open circuit.
- Check the starter relay
- Check the wire and connectors between the fuse & relay box and the ignition switch
- Check the wire and connectors between the fuse & relay box and the starter.
- Check the ignition switch (Refer to Body Electrical System - ignition switch)
- Check the key warning switch (Refer to Body Electrical System - ignition switch)
- Check the inhibitor switch (A/T) (Refer to Automatic transaxle - Inhibitor switch)
- Check the clutch switch (M/T) (Refer to Clutch system - Clutch switch)
- Check the brake switch (M/T) (Refer to BR - Brake switch)

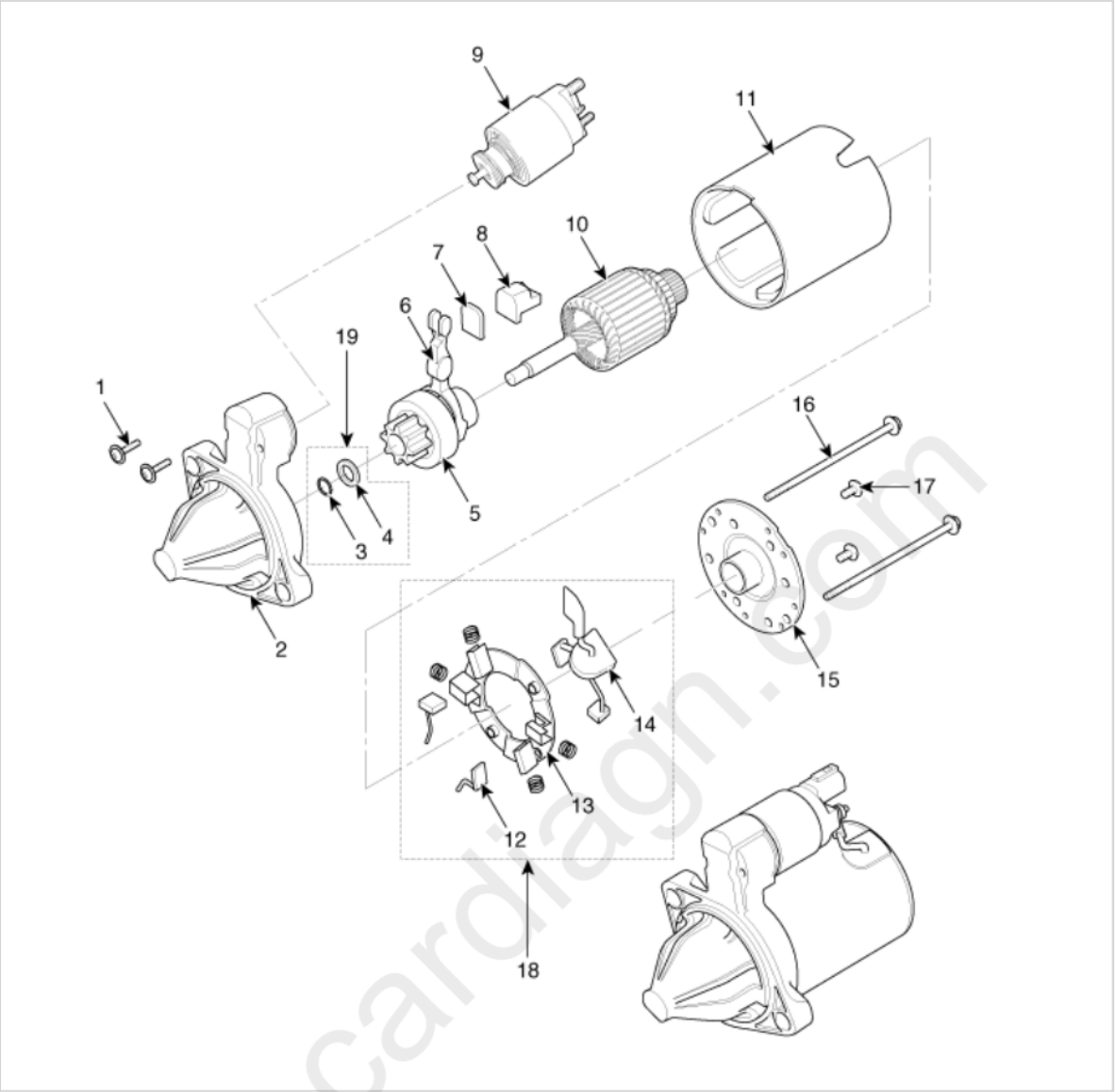
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Specification

Item		Specification
Rated voltage		12 V, 0.9 kW
The number of pinion teeth		11
Performance [No-load, 11.5 V]	Ampere	Max. 85A
	Speed	Min. 3,300 rpm

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Components



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1. Screw
2. Front bracket assembly
3. Stop ring
4. Stopper
5. Overrunning clutch
6. Lever
7. Lever plate
8. Lever packing
9. Magnet switch assembly
10. Armature assembly
11. Yoke assembly
12. Brush (-)
13. Brush holder
14. Brush (+)
15. Rear bracket assembly
16. Through bolt
17. Screw
18. Brush holder assembly
19. Stopper set

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.

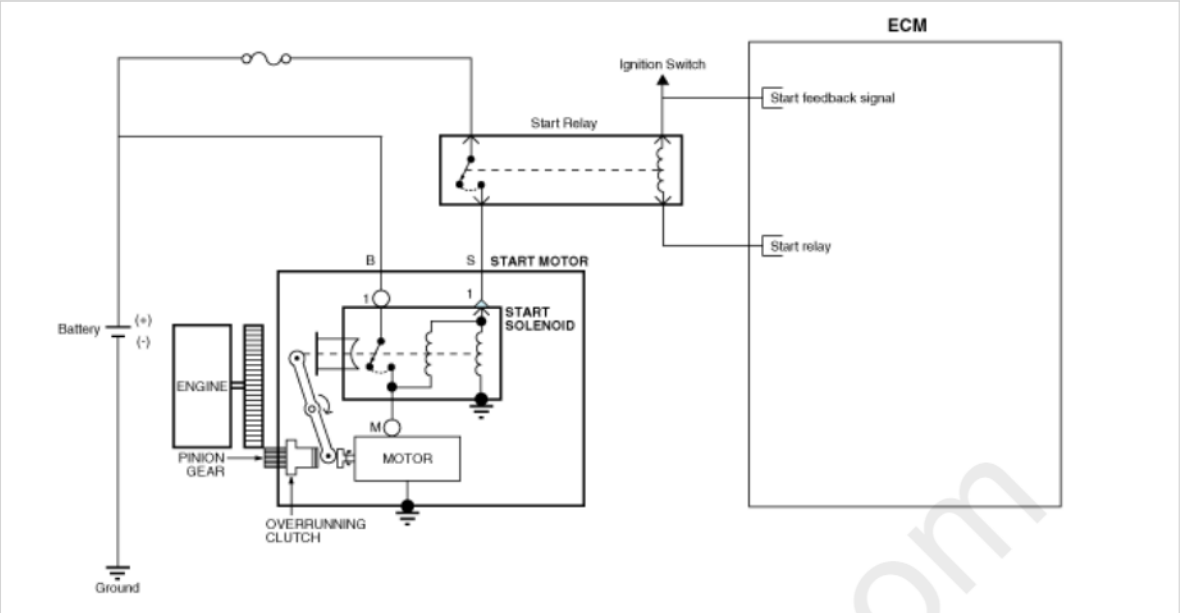
The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.The contacts close and the starter motor cranks.

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

In conjunction with the ISG function, the starter motor must do a great deal more work. Therefore, the starter motor is configured for a significantly higher number of start cycles. The components of the starter motor have been adapted to the higher requirements.

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Circuit Diagram



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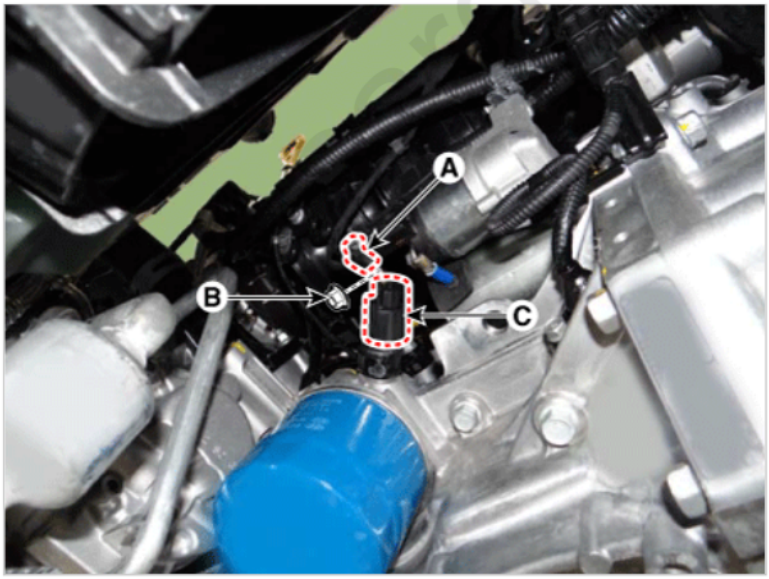
Removal

1. Turn ignition switch OFF and disconnect the battery negative (-) terminal.
2. Remove the air cleaner.
   (Refer to Engine Mechanical System - "Air Cleaner")
3. Remove the starter upper bolt (A).



4. Lift the vehicle.
5. Remove the engine room under cover.
   (Refer to Engine Mechanical System - "Engine Room Under Cover")
6. Remove the stater solenoid "B" terminal mounting nut (B), and then disconnect the stater cable and ST connector (A).
7. Disconnect the oil pressure switch connector (C).

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



8. Remove the starter after loosening the mounting lower bolt (A).



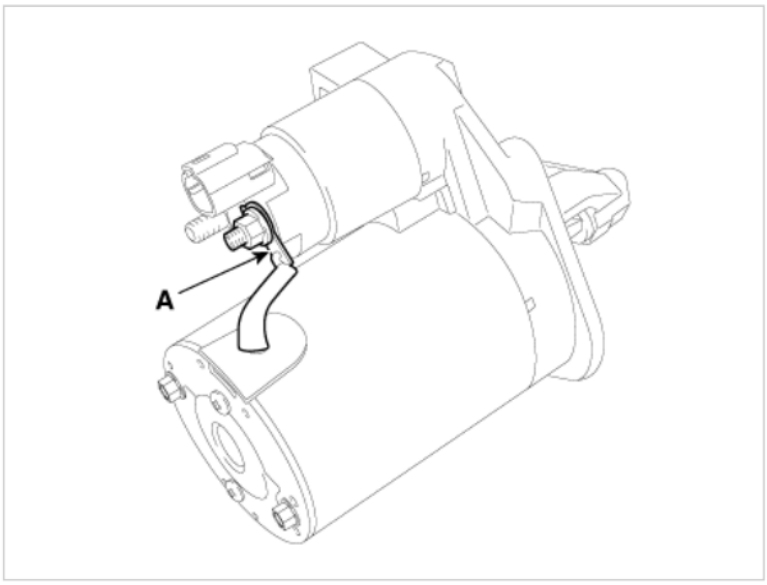


Installation

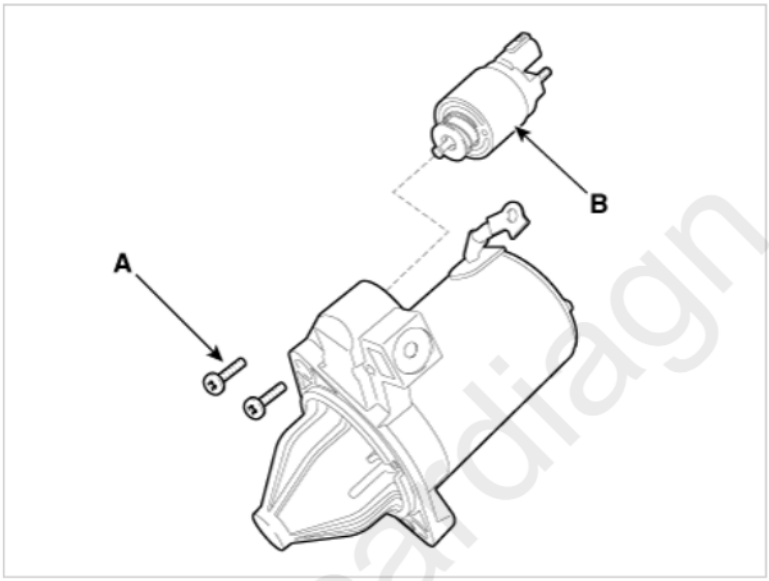
1. Install in the reverse order of removal.

Disassembly

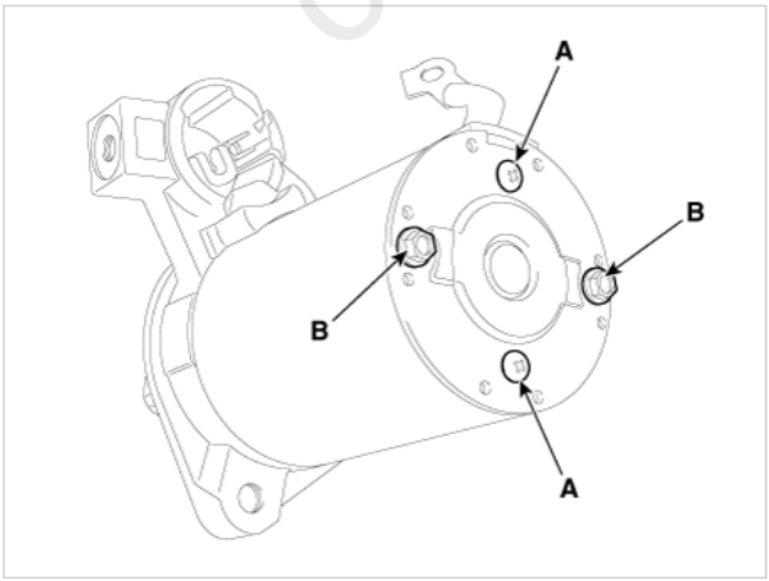
1. Disconnect the M-terminal (A) on the magnet switch assembly.



2. After loosening the screws (A), detach the magnet switch ssembly (B).

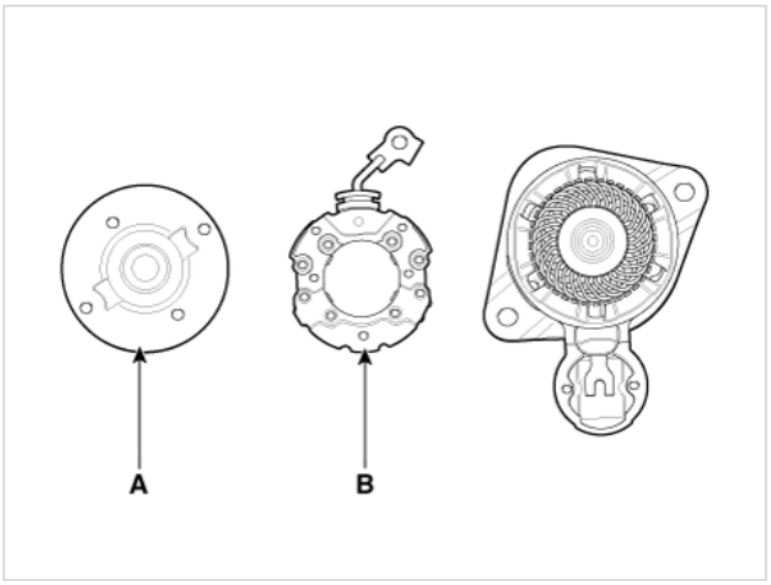


3. Loosen the brush holder mounting screws (A) and the trough bolts (B).

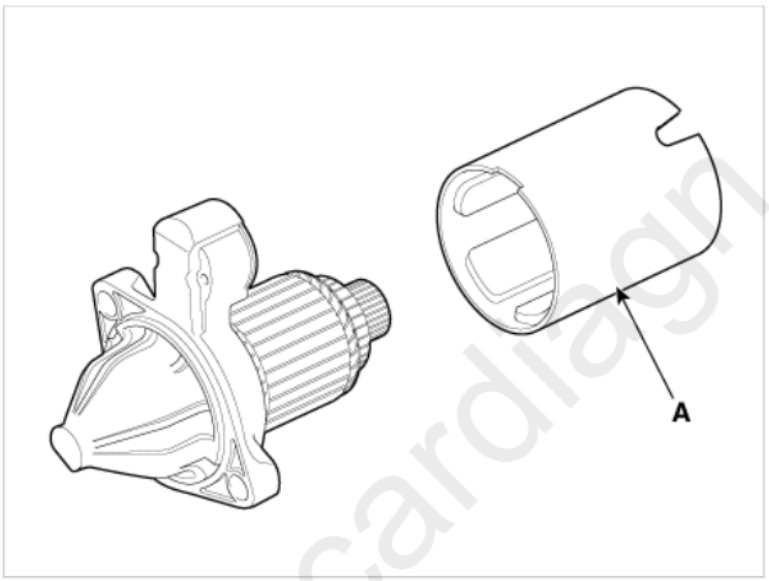


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4. Remove the rear bracket assembly (A) and brush holder assembly (B).

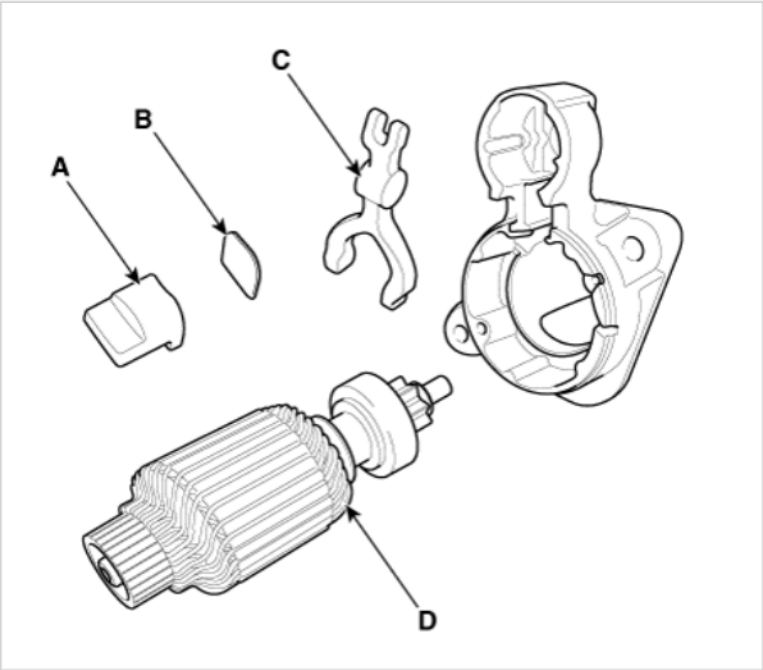


5. Remove the yoke assembly (A).



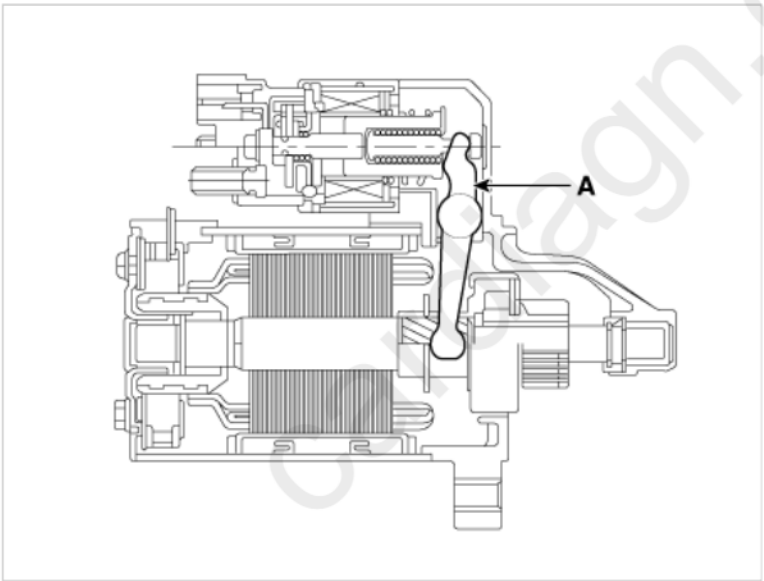
6. Remove the packing (A), lever plate (B), lever (C), armature assembly (D).

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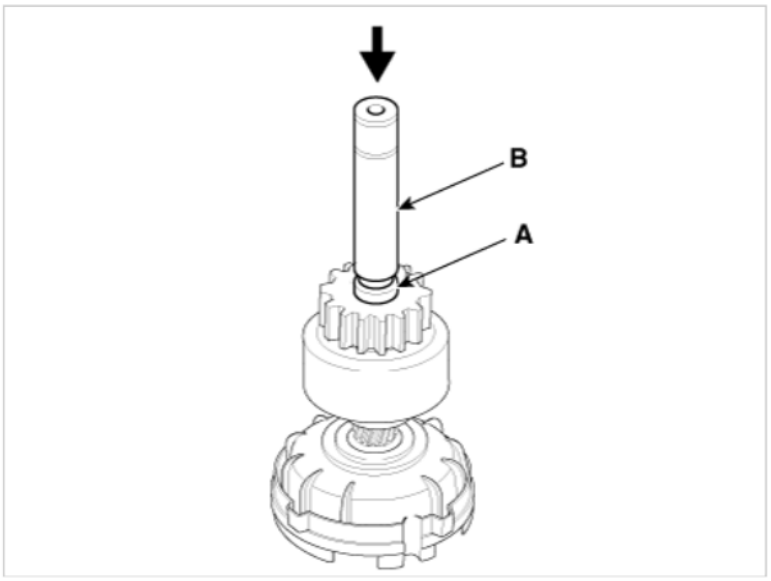


NOTICE

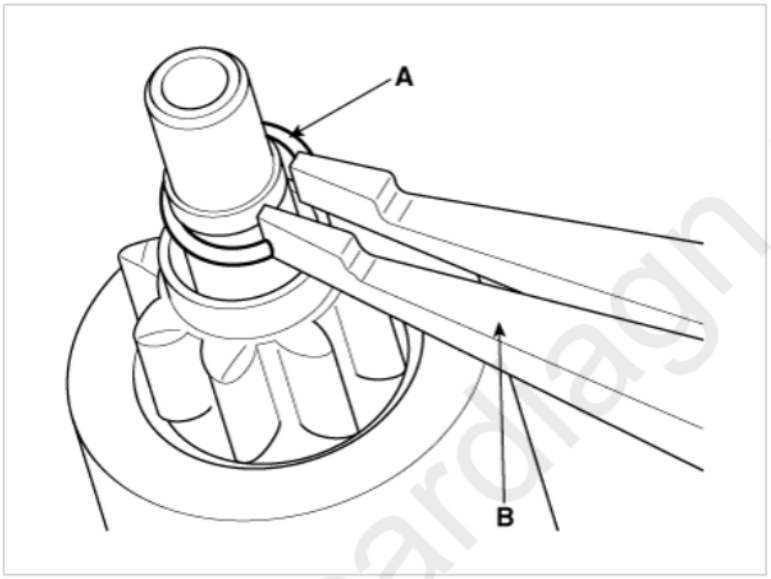
Beware the direction of lever (A).



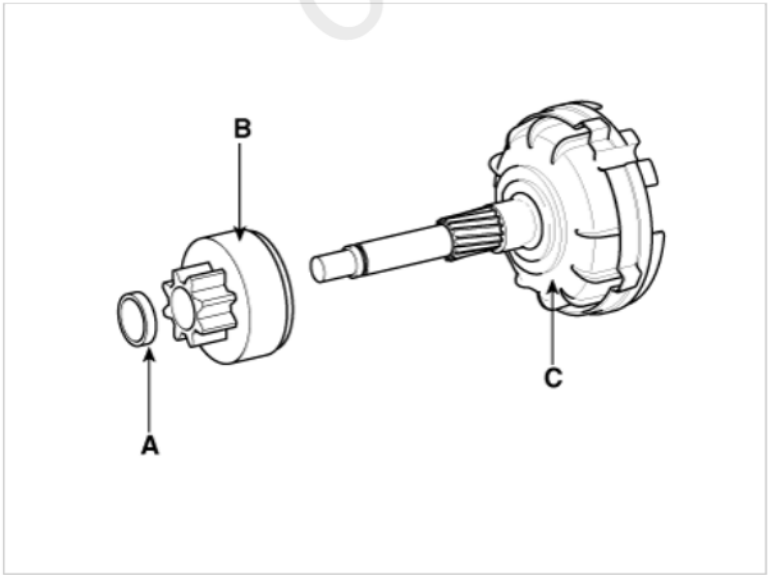
7. Press the stopper (A) using a socket (B).



8. After removing the stop ring (A) using stop ring pliers (B).



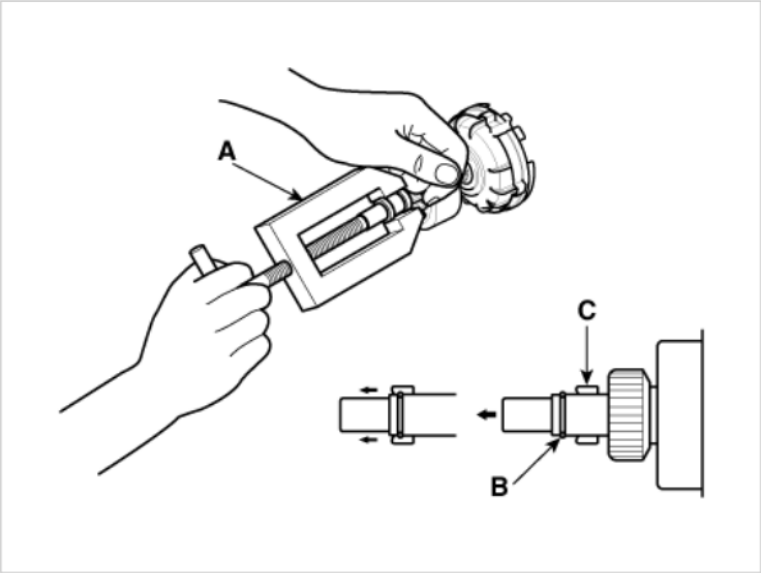
9. Disconnect the stopper (A), overrunning clutch (B) and internal gear (C).



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NOTICE

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



10. Reassembly is the reverse of disassembly.

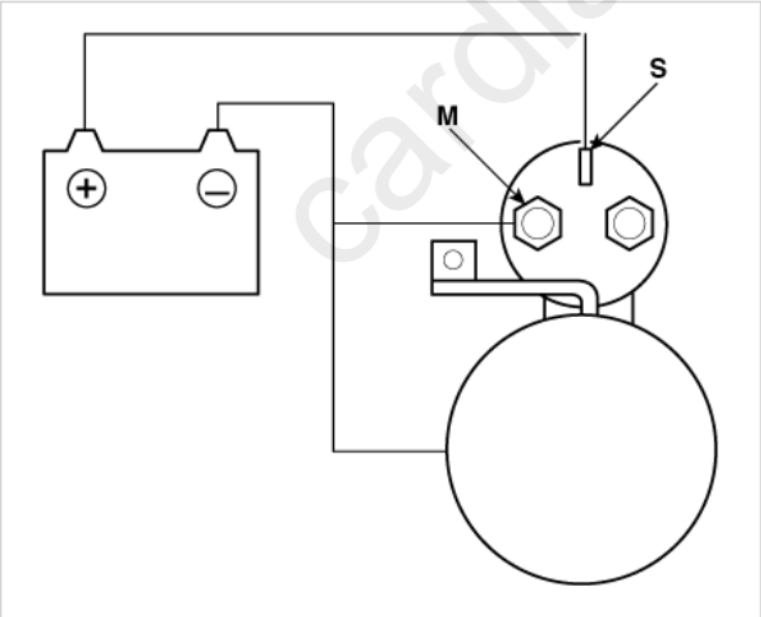
Inspection

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.

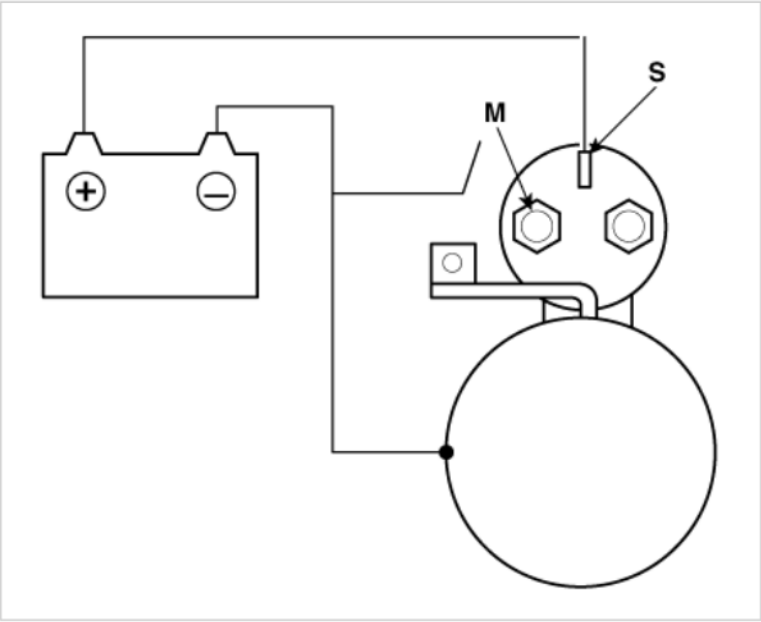


3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly.

NOTICE

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

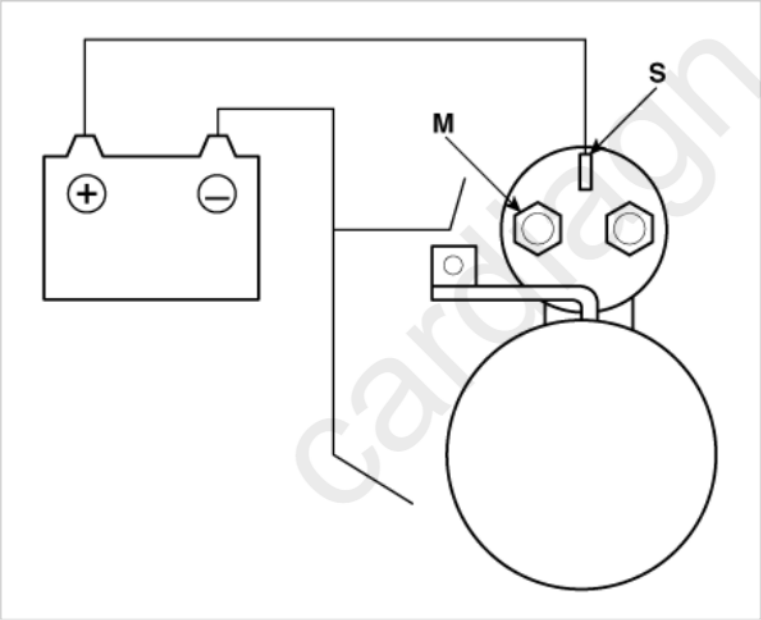
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4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly.

NOTICE

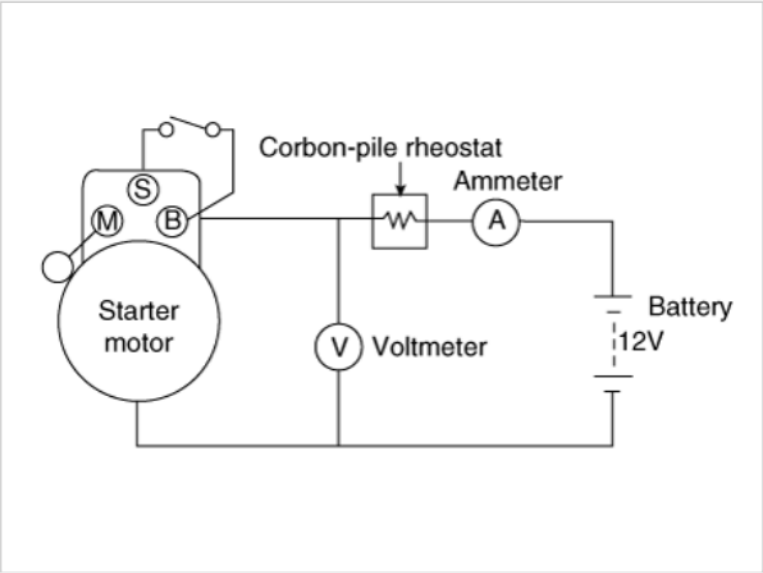
- To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



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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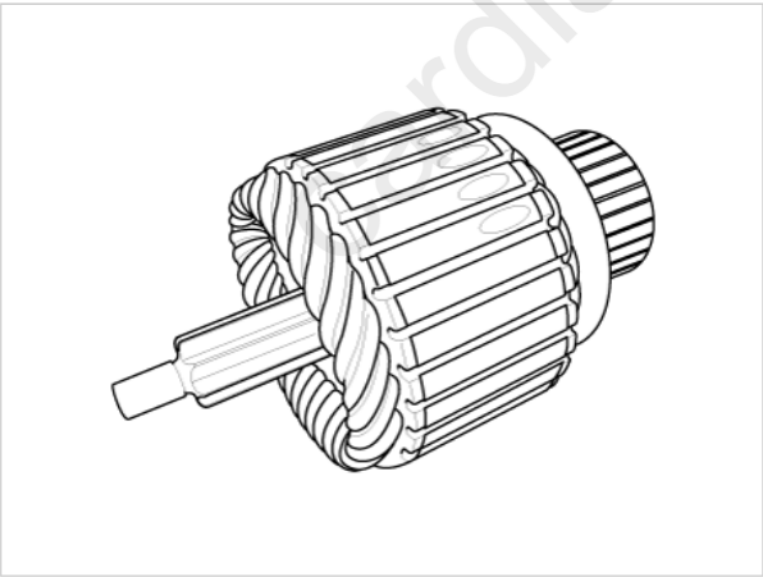


4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery"s negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11.5 volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Current (Max.)	Speed (Min.)
85A	3,300 rpm

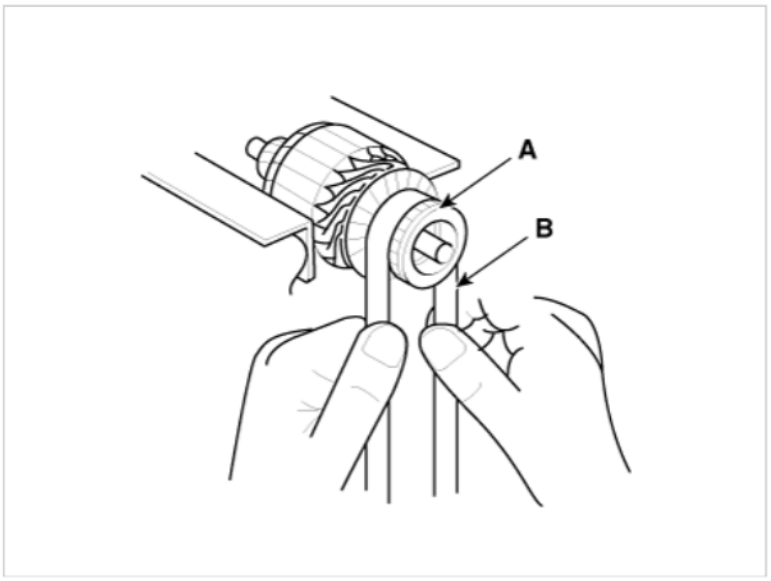
Armature Inspection And Test

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.



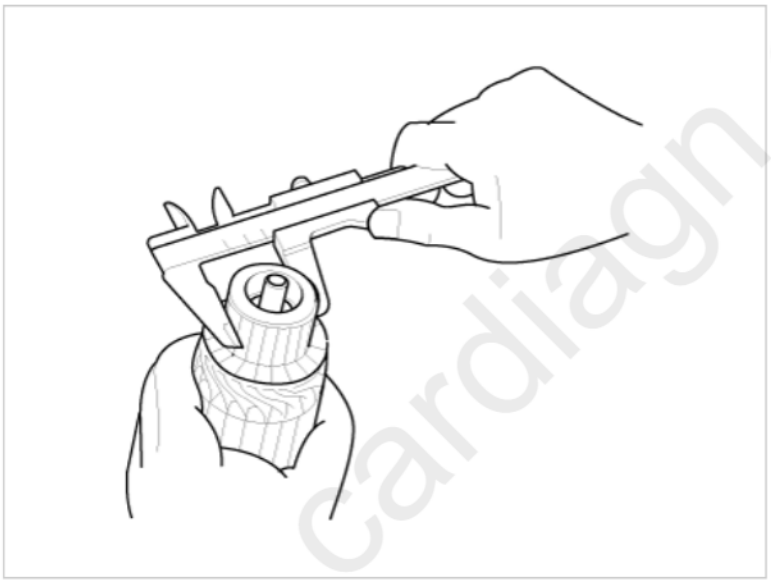
4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).

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5. Check the commutator diameter. If the diameter is below the service limit, replace the armature.

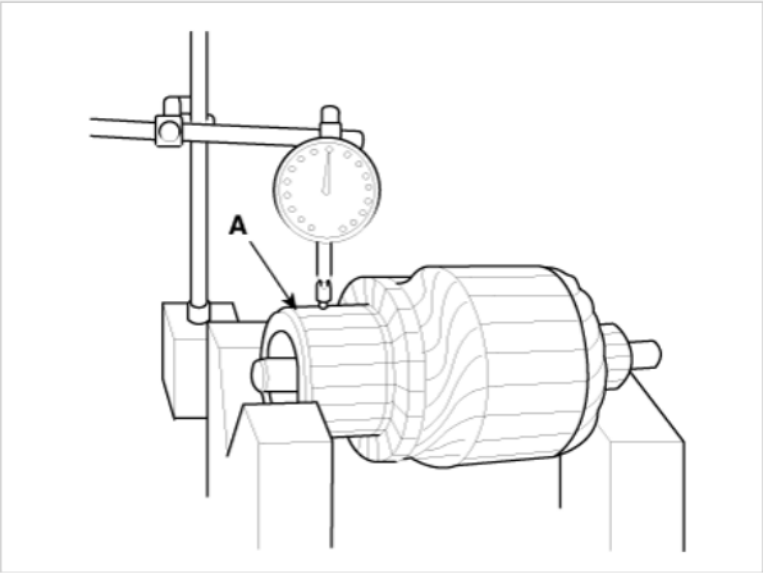
Commutator diameter
Standard (New): 27.0 mm (1.06 in.)
Service limit: 26.0 mm (1.02 in.)



6. 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): 0.05 mm (0.0019 in.) max
Service limit: 0.08 mm (0.0031 in.)

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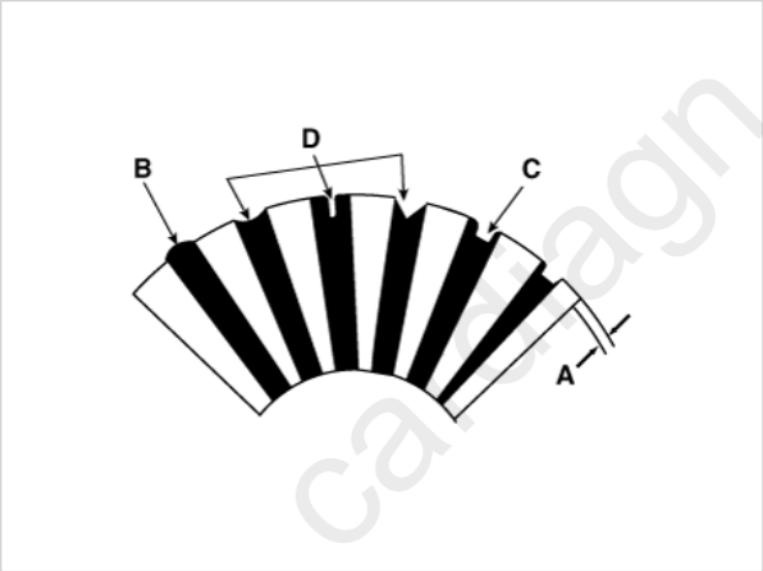


7. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

Commutator mica depth

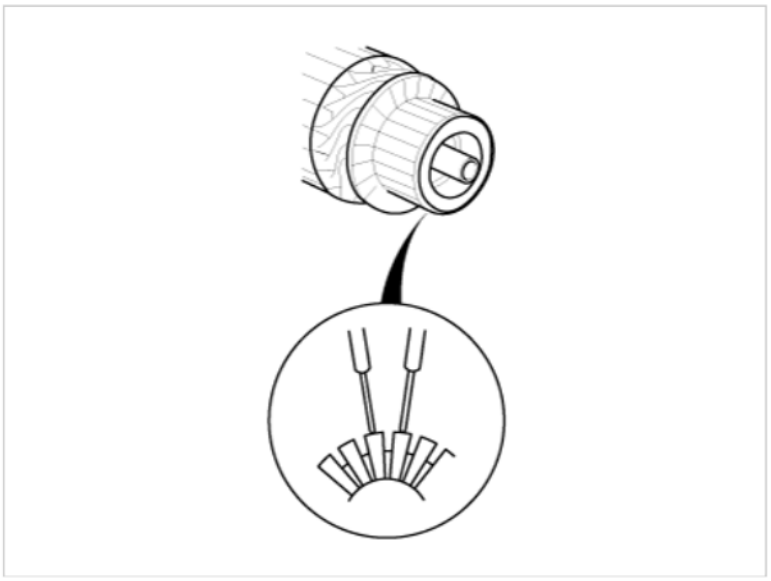
Standard (New): 0.8 mm (0.0314 in.)

Limit: 0.2 mm (0.0079 in.)

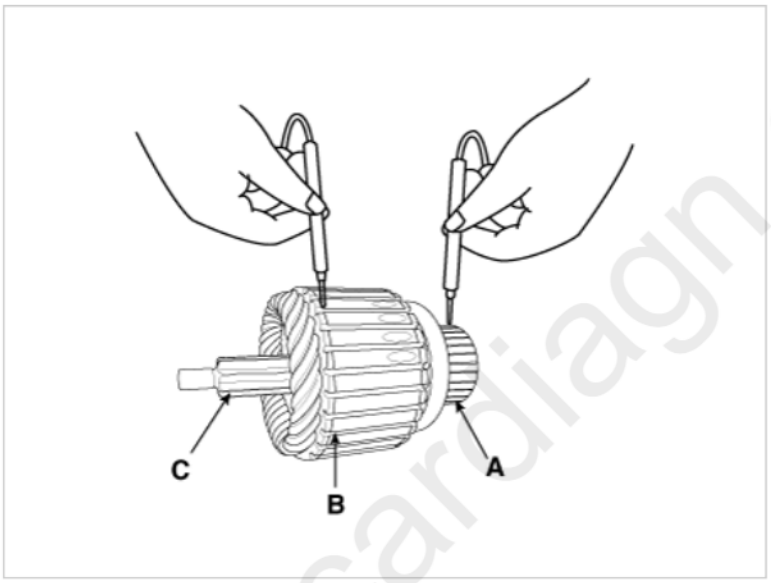


8. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.

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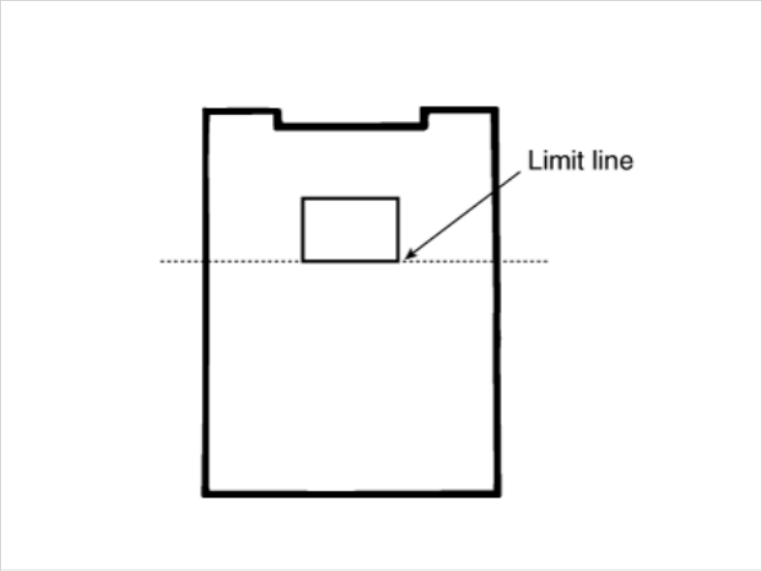
9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



Inspect Starter Brush

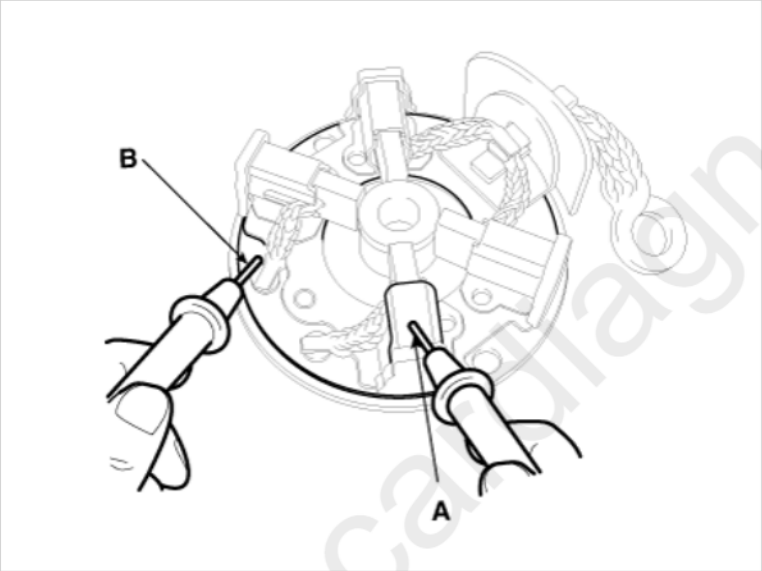
Brushes that are worm out, or oil-soaked, should be replaced.

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Starter Brush Holder Test

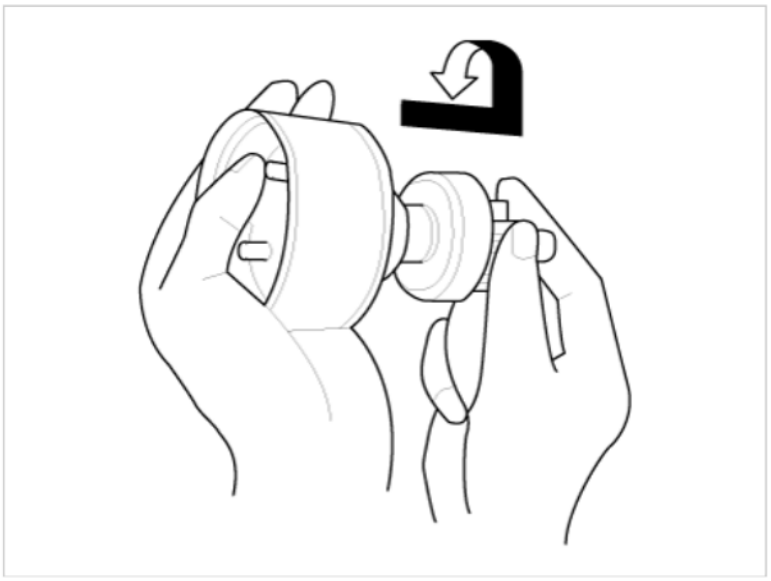
Make sure there is no continuity between the (+) brush holder (A) and (-) plate (B). If there is continuity, replace the brush holder assembly.



Overrunning Clutch

1. Slide the overrunning clutch along the shaft.
   Replace it if 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 it locks in both directions, replace it.

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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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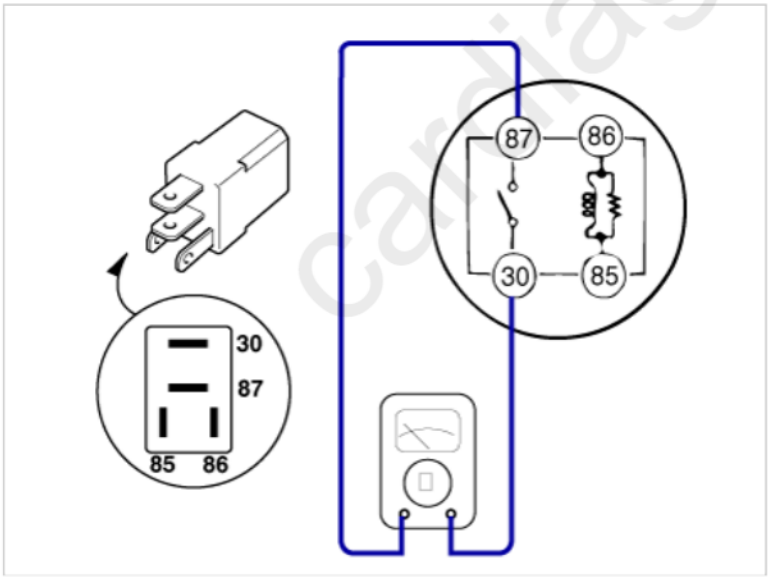
Inspection

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



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

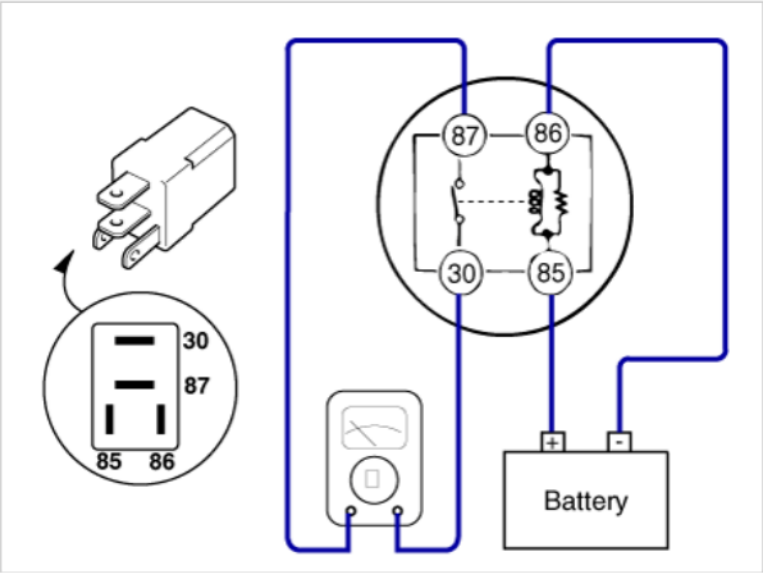
Terminal	Resistance	Measure
30-87	1MΩ or higher	If there is continuity between the terminals, replace the relay.



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.

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6. Install the starter relay.
7. Install the fuse box cover.

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