SPORTAGE(KM) > 2010 > G 2.0 DOHC > Engine Electrical System

Engine Electrical System > General Information > General Information

The Micro 570 Analyzer

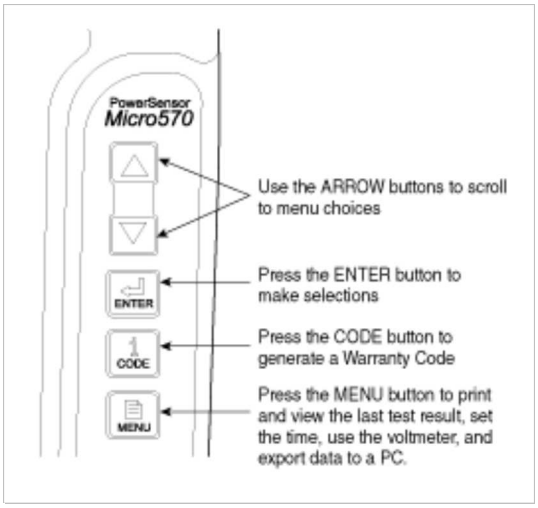
The Micro 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

CAUTION

Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.

Keypad

The Micro 570 button on the key pad provide the following functions :



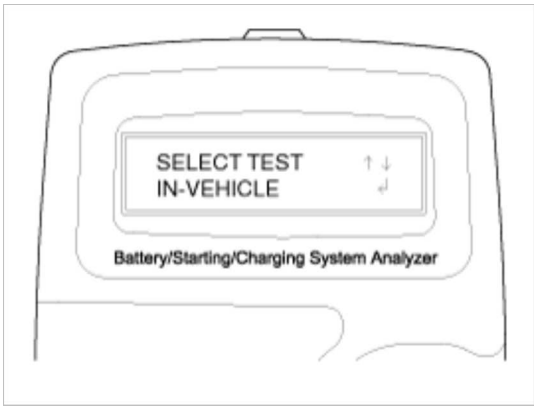
Battery Test Procedure

1. Connect the tester to the battery.
   A. Red clamp to battery positive (+) terminal.
   B. Black clamp to battery negative (-) terminal.

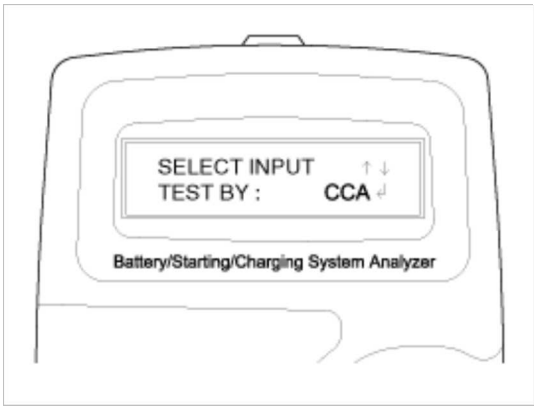
CAUTION

Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN-VEHICLE" or "OUT-OF-VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



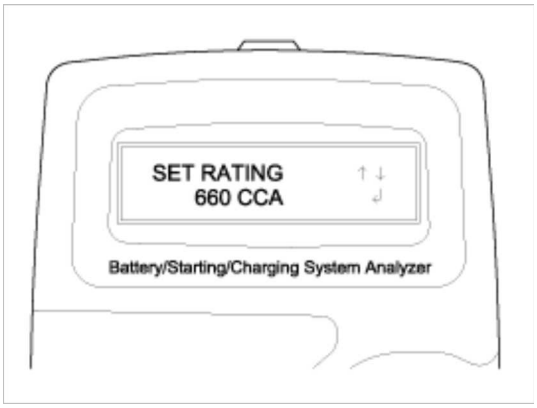
3. Select CCA and press the ENTER button.



NOTE

CCA : Cold cranking amps, is an SAE specification for cranking batteried at -0.4°F (-18°C).

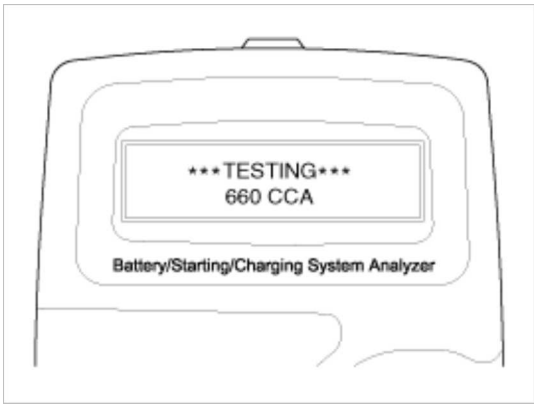
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



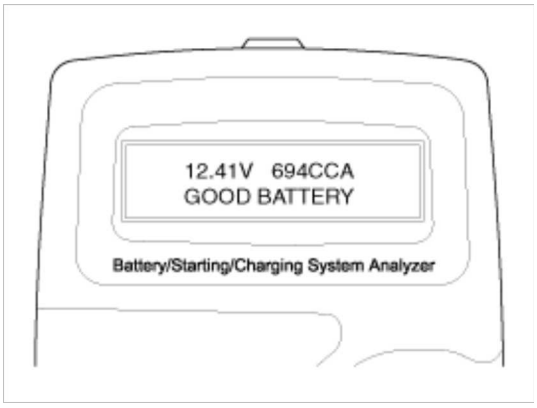
NOTE

The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester will conduct battery test.



6. The tester displays battery test results including voltage and battery ratings.
   Refer to the following table and take the appropriate action as recommended by the Micro 570.



Battery Test Results

Result On Printer	Remedy
GOOD BATTERY	No action is required
GOOD RECHARGE	Battery is in a good state Recharge the battery and use
CHARGE & RETEST	Battery is not charged properly - Charge and test the battery again. (Failure to charge the battery fully may read incorrect measurement value)

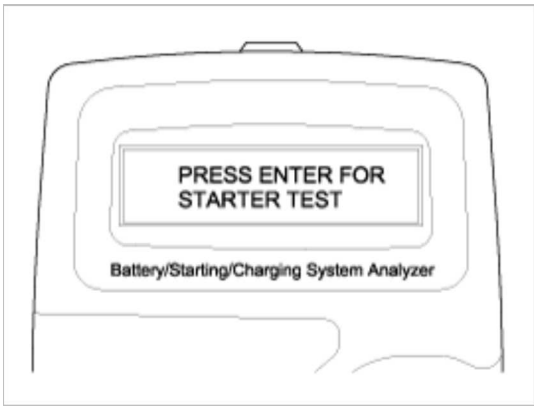
REPLACE BATTERY	Replace battery and recheck the charging system. - Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery.
BAD CELL-REPLACE	Charge and retest the battery. - If the Micro 570 recommends "REPLACE BATTERY", replace the battery and recheck the charging system.

WARNING

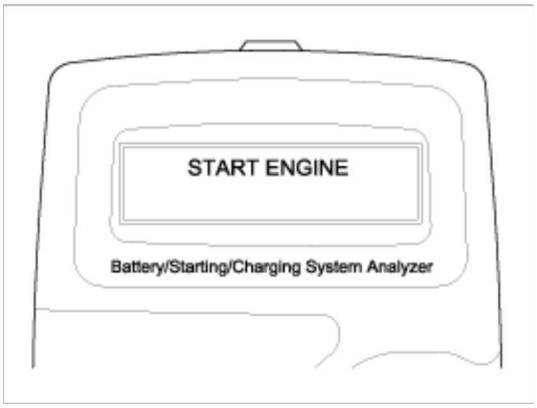
Whenever filing a claim for battery, the print out of the battery test results must be attached.

Starter Test Procedure

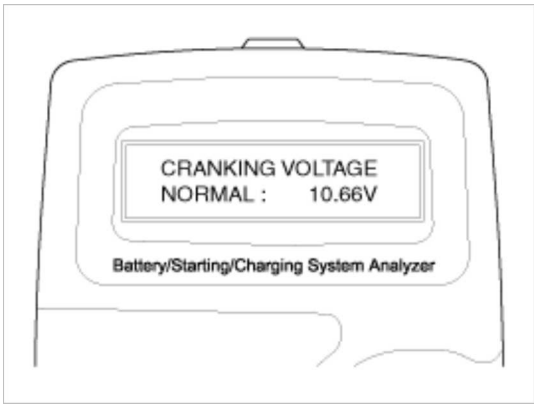
7. After the battery test, press ENTER immediately for the starter test.



8. Start the engine.



9. Cranking voltage and starter test results will be displayed on the screen.
   Refer to the following table and take the appropriate action as recommended by the Micro 570.



Starter Test Results

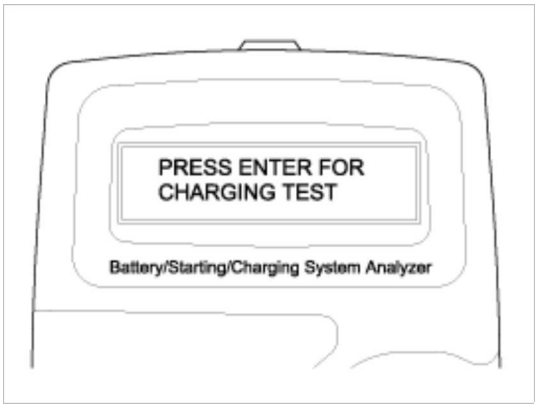
Result On Printer	Remedy
CRANKING VOLTAGE NORMAL	System shows a normal starter draw
CRANKING VOLTAGE LOW	Cranking voltage is lower than normal level - Check starter
CHARGE BATTERY	The state of battery charge is too low to test - Charge the battery and retest
REPLACE BATTERY	Replace battery - If the vehicle is not started though the battery condition of "GOOD BATTERY" is displayed, check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. - If the engine does crank, check fuel system.

NOTE

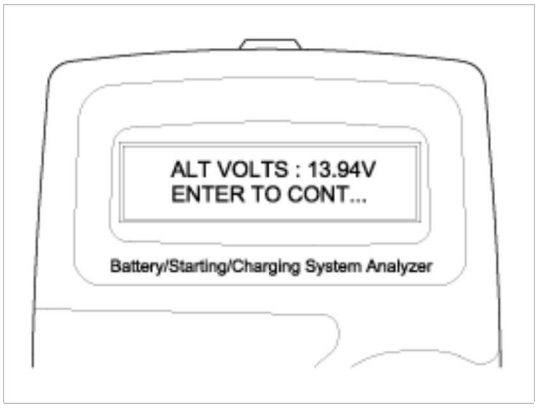
When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

Charging System Test Procedure

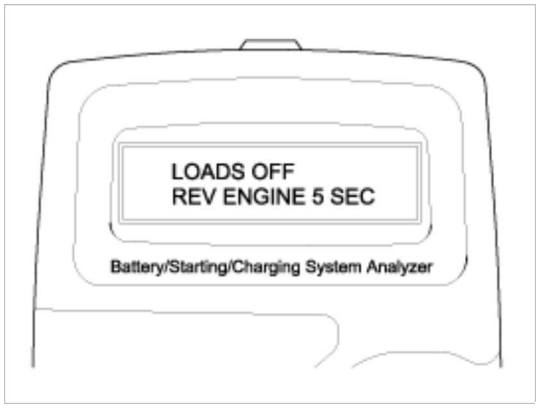
10. Press ENTER to begin charging system test.

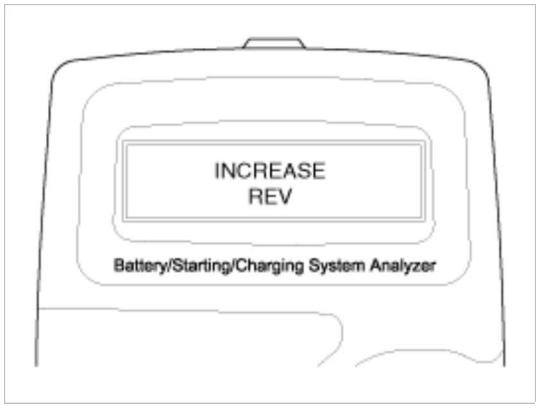


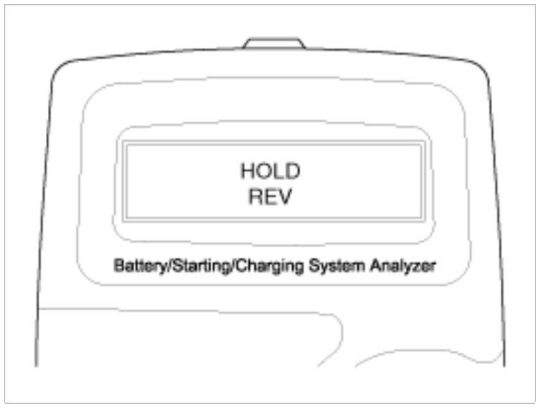
11. The tester displays the actual voltage of alternator.
    Press ENTER to continue.



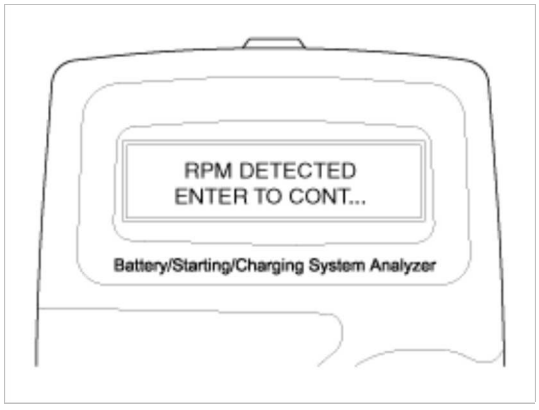
12. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)



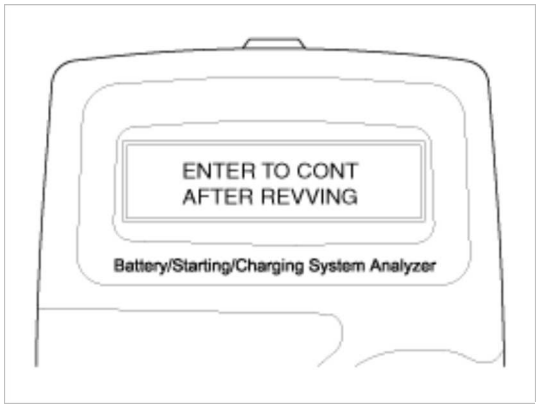




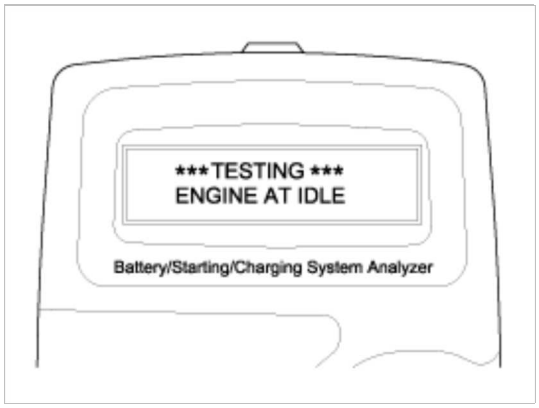
13. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.

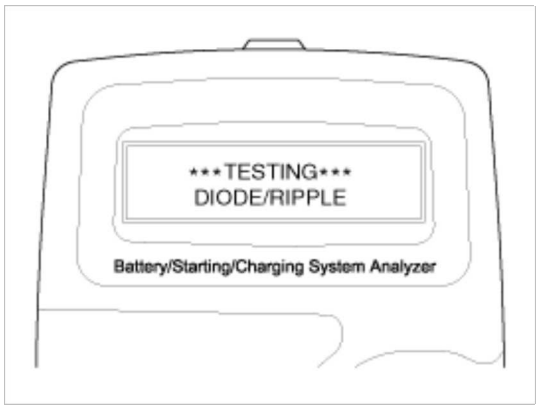


14. If the engine RPM is not detected, press ENTER after revving engine.

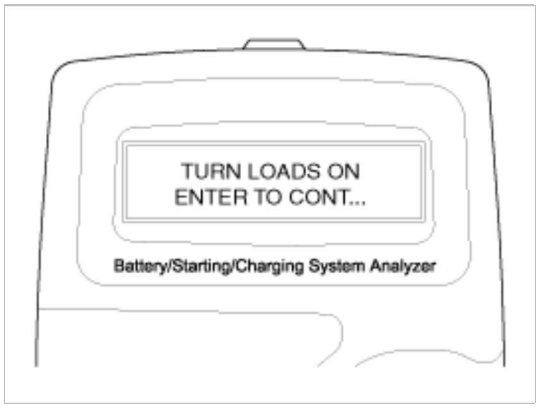


15. The tester will conduct charging system test during loads off.

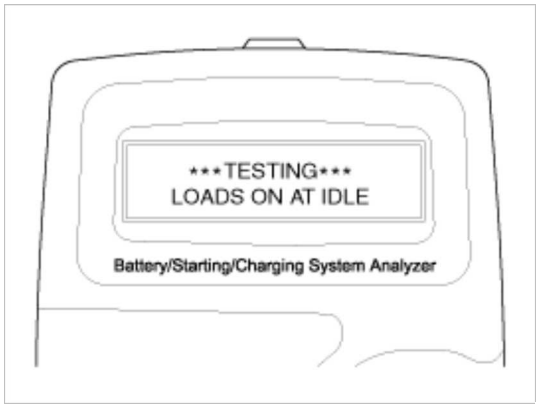




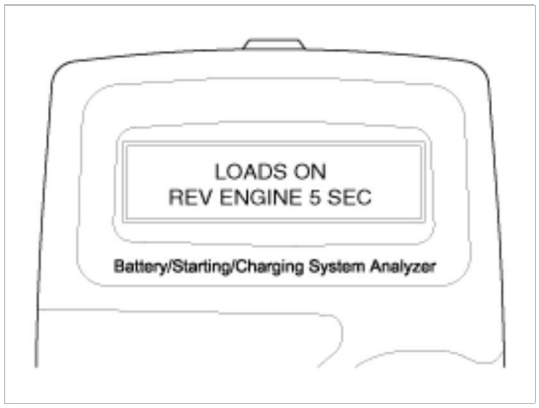
16. Turn on electrical loads (air conditioner, lamps, audio and etc). Press ENTER to continue.

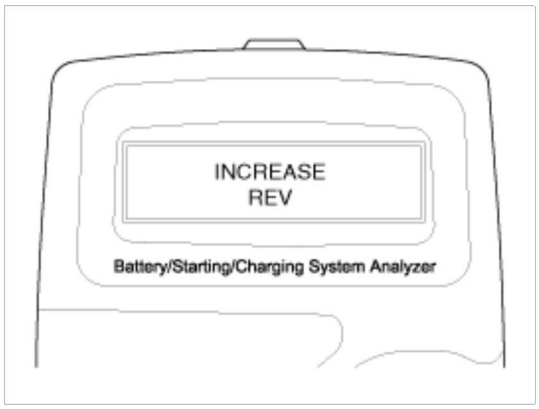


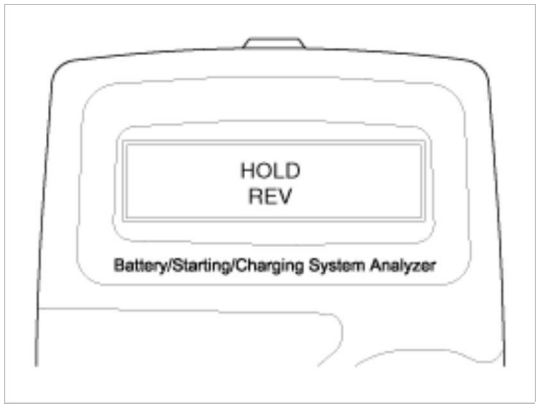
17. The tester will conduct charging system test during loads on.



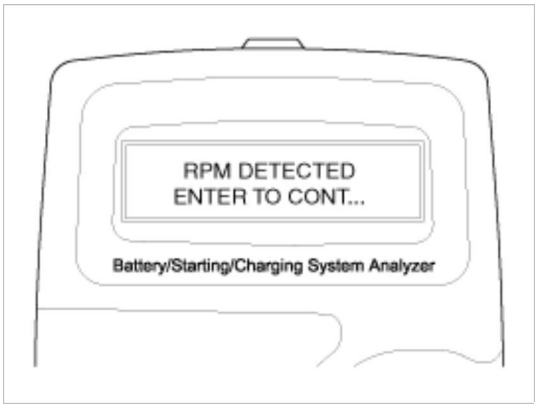
18. Rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)



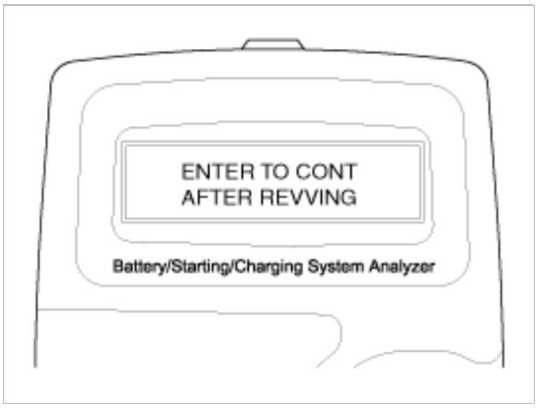




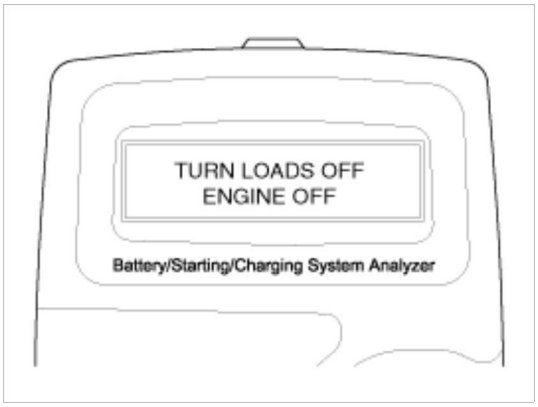
19. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.



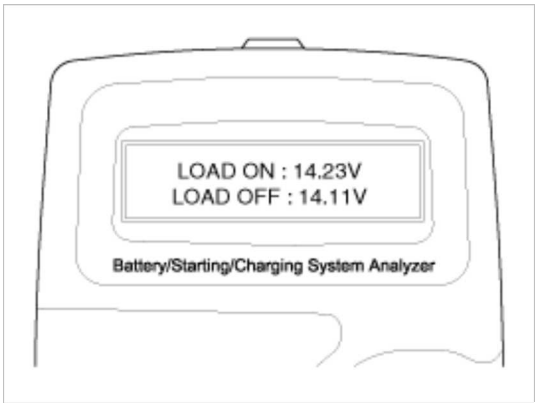
20. If the engine RPM is not detected, press ENTER after revving engine.

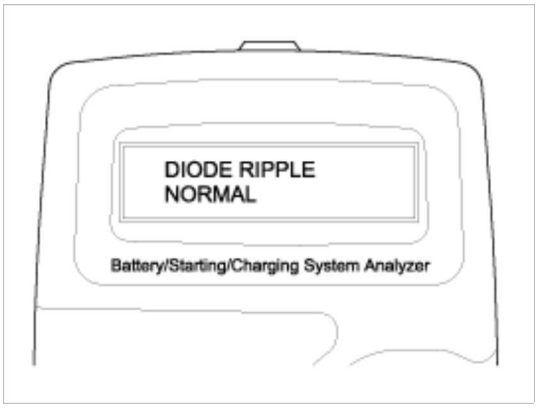


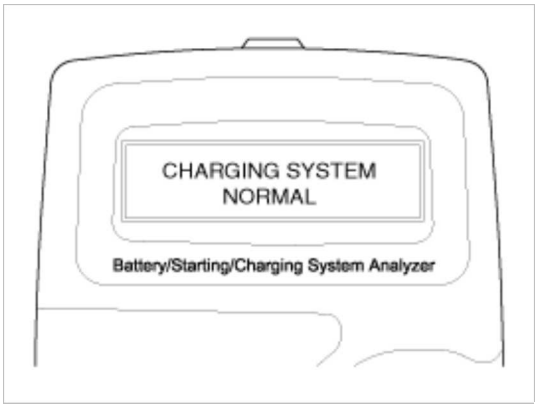
21. Turn off electrical loads (air conditioner, lamps, audio and etc). Turn the engine off.



22. Charging voltage and charging system test results will be displayed on the screen.
    Shut off engine end disconnect the tester clamps from the battery. Refer to the following table and take the appropriate action as recommended by the Micro 570.







Charging System Test Results

Result On Printer	Remedy
CHARGING SYSTEM NORMAL / DIODE RIPPLE NORMAL	Charging system is normal
NO CHARGING VOLTAGE	Alternator does not supply charging current to battery - Check belts, connection between alternator and battery and replace belts or cable or alternator as necessary
LOW CHARGING VOLTAGE	Alternator does not supply charging current to battery and electrical load to system fully - Check belts and alternator and replace as necessary
HIGH CHARGING VOLTAGE	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check connection and ground and replace regulator as necessary - Check electrolyte level in the battery
EXCESS RIPPLE DETECTED	One or more diodes in the alternator is not functioning properly - Check alternator mounting and belts and replace as necessary

Engine Electrical System > General Information > Troubleshooting

TROUBLESHOOTING

IGNITION SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch Ignition coil Spark plugs	Inspect See page EE-19 See page EE-17

	Ignition wiring disconnected or broken Spark plug cable	Inspect See page EE-17
Rough idle or stalls	Ignition wiring Ignition coil Spark plug cable	Inspect See page EE-19 See page EE-17
Engine hesitates/poor acceleration	Spark plugs and spark plug cable Ignition wiring	See page EE-17 Inspect
Poor mileage	Spark plugs and spark plugs cable	See page EE-17

CHARGING SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connections See page EE-27
Charging warning indicator does not go out with engine running (Battery requires frequent recharging)	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown Electronic voltage regulator or generator Wiring	See page EE-23, 36 See page EE-39 Check fuses Replace fusible link See page EE-27 Repair wiring
Engine hesitates/poor acceleration Overcharge	Drive belt loose or worn Wiring connection loose or open circuit Fusible link blown Poor grounding Electronic voltage regulator or generator Worn battery Electronic voltage regulator Voltage sensing wire	See page EE-23, 36 Tighten loose connection or repair wiring Replace fusible link Repair See page EE-27 Replace battery See page EE-27 Repair wire

STARTING SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fusible link blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables See page TR group-automatic transaxle Replace fusible link See page EE-44 Inspect
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor	Charge or replace battery Repair or replace cables See page EE-44
Starter keeps running	Starter motor Ignition switch	See page EE-44 Inspect
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring See page EE-44 See page EM group-fly wheel

CRUISE CONTROL SYSTEM

NOTE

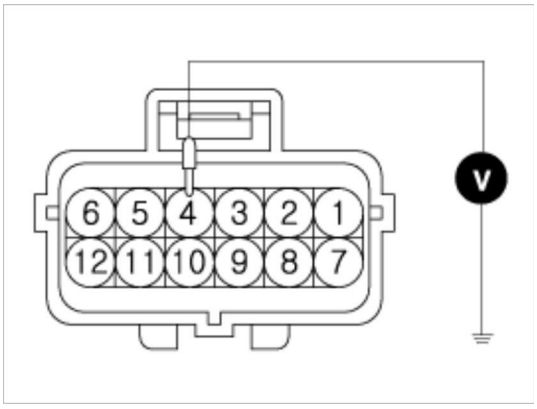
Before troubleshooting :
- Check the ECM(10A), Horn(10A), ECU #3(10A) and ECU B+(15A) fuse in the under - hood fuse/relay box.
- Check that the horn sounds.
- Check the tachometer to see if it works properly.

Symptom	Suspect Area	See Page
Cruise control cannot be set	Remocon switch Brake switch A/T gear position switch Cruise control unit	See page EE-57 See page EE-58 See page TR group-automatic transaxle See page EE-8
Cruise control cannot be set but indicator light does not go on	Dimming circuit in gauge Cruise control unit	See page EE-8 See page EE-8
Cruise speed is noticeably higher or lower than what was set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic transaxle See page EE-58 See page EE-8
Excessive overshooting or undershooting when trying to set speed	Cruise control unit and actuator cable deflection Vehicle speed sensor Cruise control unit	See page EE-58 See page TR group-automatic transaxle See page EE-8
Speed fluctuation on a flat road with cruise control set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic tranxaxle See page EE-58 See page EE-8
Vehicle does not decelerate or accelerate accordingly when SET/RESUME/CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-57 See page EE-8
Cruise control does not cancel when shift lever is moved to N position (A/T)	A/T gear position switch Cruise control unit	See page TR group-automatic tranxaxle See page EE-8
Set speed is not cancelled when brake pedal is pushed	Brake switch Cruise control unit	See page EE-58 See page EE-8
Cruise control will not cancel when main switch is pushed OFF	Remocon switch Cruise control unit	See page EE-57 See page EE-8
Cruise control will not cancel when CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-57 See page EE-8
Set speed will not resume when RESUME button (with main switch on, when set speed is temporarily cancelled)	Remocon switch Cruise control unit	See page EE-57 See page EE-8
The transmission shifts down slower than normal when going up a hill with the cruise control on (A/T)	Troubleshooting the cruise control communication circuit	See page EE-8

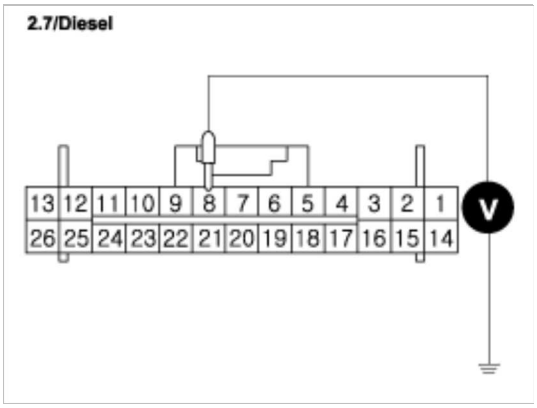
CRUISE CONTROL COMMUNICATION CIRCUIT TROUBLESHOOTING (A/T)

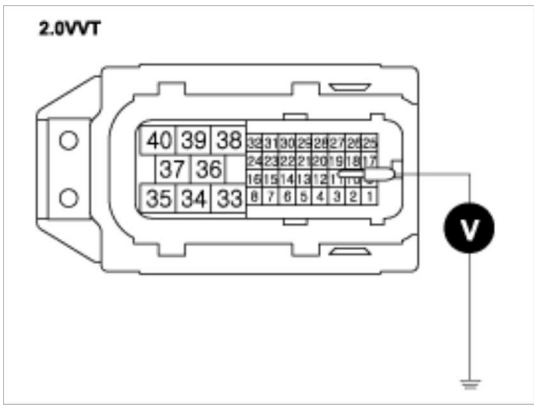
1. Start the engine.

2. Turn on the cruise control main switch, then drive the vehicle to speeds over 25 mph (40km/h) with the cruise control.
   Does the cruise control operate ?
   - Go to step 3.
   - Check the cruise control unit or cruise control actuator.
3. Measure the voltage between the O/D control terminal of the cruise control unit connector and ground.
   Is there approx. 1V?
   - Go to step 4.
   - Replace the cruise control unit.



4. Measure the voltage between the cruise control terminal of the TCM(or PCM) connector and ground.





   Is there approx. 1V?
   - Check for loosen connectors. If necessary replace the TCM and recheck. (See Page TR group-automatic transaxle)
   - Repair short or open in the wire between the TCM (or PCM) terminal and cruise control unit.

Engine Electrical System > General Information > Specifications

SPECIFICATION

IGNITION SYSTEM

Item	Specifications

			2.7	2.0
Ignition coil	Type		Mold coil type	Mold coil type
	Primary resistance		0.96 ± 10%(Ω)	0.58 ± 10%(Ω)
	Secondary resistance		12.5 ± 15%(kΩ)	8.8 ± 15%(kΩ)
Spark plugs	Unleaded	NGK	IFR5G-11	PFR5N-11
		CHAMPION	-	RC10PYPB4
	Gap		1.0 mm ~ 1.1 mm	

STARTING SYSTEM

Item			Specifications	
			2.7	2.0
Starter	Type		Reduction drive (with planetary gear)	
	Rated voltage		12V, 1.2KW	12V, 1.2KW
	No. of pinion teeth		8	8
	No-load charasteristics	Voltage	11V	11V
		Amperage	90A, MAX	90A, MAX
		Speed	2,800rpm, MIN	3,000rpm, MIN
	Commutator diameter	Standard	29.4 mm (1.157 in.)	
		Limit	28.4 mm (1.118 in.)	
	Undercut depth	Standard	0.5 mm (0.02 in.)	
		Limit	0.2 mm (0.008 in.)	

CHARGING SYSTEM

Item		Specifications	
		2.7	2.0
Alternator	Type	Battery voltage sensing	
	Rated voltage	12V, 120A	13.5V, 90A
	Speed	1,000 ~ 18,000 rpm	
	Voltage regulator	Electronic built-in type	
	Regulator setting voltage	14.55 ± 0.2V	14.4 ± 0.3V
	Temperrature compensation	-3.5 ± 1mV/°C	-10 ± 3mV/°C
Battery	Type	MF 68 AH	MF 60 AH
	Cold cranking amperage at-18°C (0°F)	600A	550A
	Reserve capacity	113min	92min
	Specific gravity at 20°C (77°F)	1.280 ± 0.01	1.280 ± 0.01

NOTE

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- REVERSE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal

voltage of 10.5V at 26.7°C(80°F)

AUTO CRUISE CONTROL SYSTEM

Items	Specification
Setting error	Within ± 1.5Km/h on level road
Vehicle speed memory variation	No variation
Setting time	0.1sec max.
Resuming time	0.1sec max.
Minimum operating speed	40 ± 2Km/h
Cancel speed range	15 ± 2Km/h
Maximum memorized speed	160 ± 2Km/h
Pulling force	127N(13Kgf)
Main switch serial resistance value	3.9kΩ ± 1%
Command switch serial resistance value	SET switch : 220Ω ± 1%
	RESUME switch : 910Ω ± 1%

TIGHTENING TORQUE

Items	Nm	kg·cm	lb-ft
Generator terminal (B+)	5 ~ 7	50 ~ 70	3.6 ~ 5.1
Starter motor terminal (B+)	10 ~ 12	100 ~ 120	7.3 ~ 8.8
Battery terminal	4 ~ 6	40 ~ 60	2.9 ~ 4.3
Spark plug	20 ~ 30	200 ~ 300	15 ~ 22

Engine Electrical System > Ignition System > Description and Operation

DESCRIPTION

Ignition timing is controlled by the electronic control ignitiontiming system. The standard reference ignition timing data for the engineoperating conditions are pre-programmed in the memory of the ECM (engine controlmodule).
The engine operating conditions (speed, load, warm-up condition,etc.) are detected by the various sensors. Based on these sensor signals andthe ignition timing data, signals to interrupt the primary current are sentto the ECM. The ignition coil is activated, and timing is controlled.

Engine Electrical System > Ignition System > Repair procedures

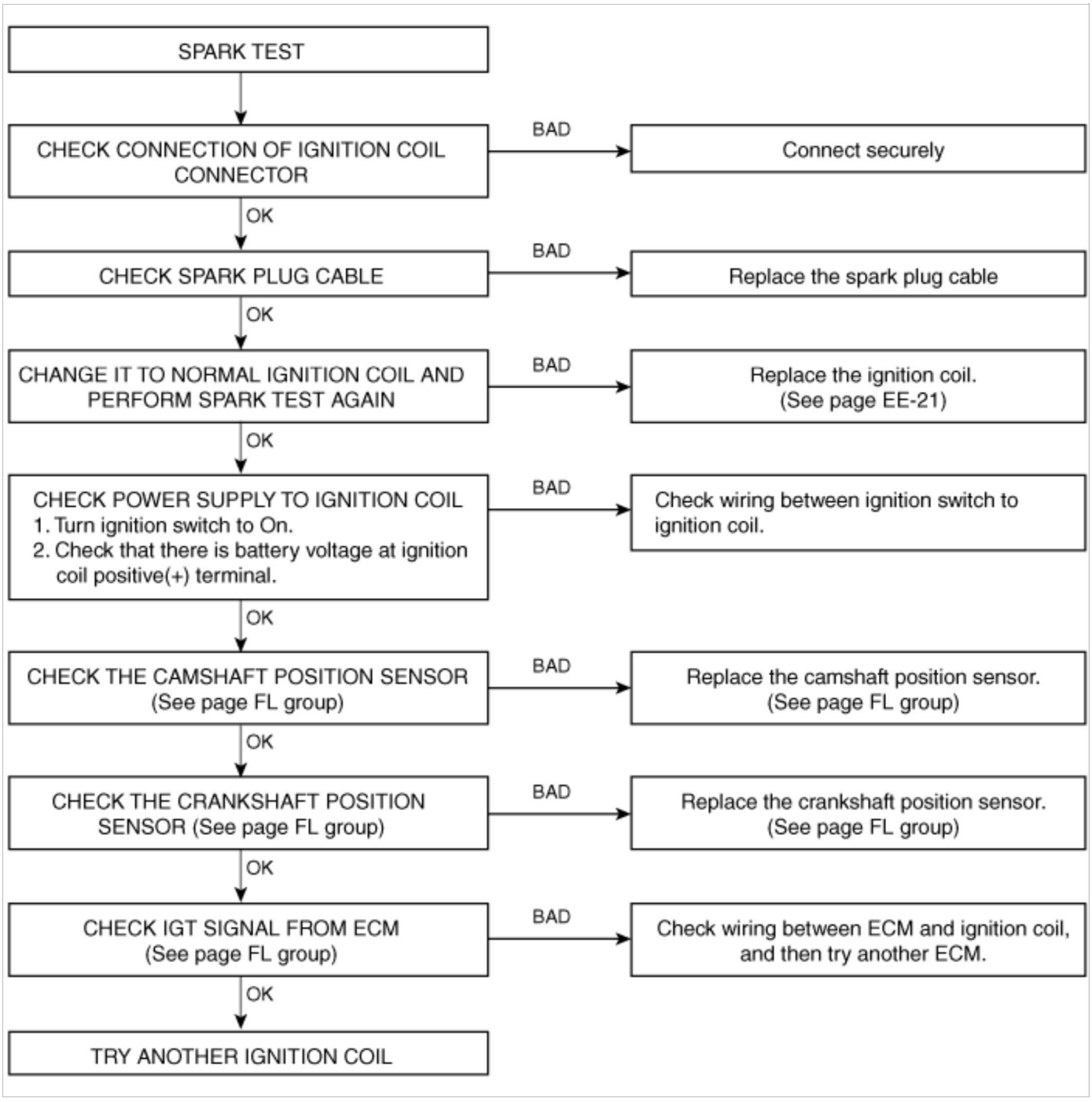
ON-VEHICLE INSPECTION

INSPECT SPARK TEST

1. Remove the spark plug cable.
2. Using a spark plug socket, remove the spark plug.
3. Remove the ignition coil.
4. Install the spark plugs to each spark plug cable.
5. Ground the spark plugs.
6. Check is spark occurs while engine is being cranked.

NOTE

To prevent gasoline from being injected from injectors during this test, crank the engine for no more then 5~10 seconds at time.



7. Using a spark plug socket, install the spark plugs.
8. Install the spark plug cable and ignition coil.

INSPECT SPARK PLUG AND SPARK PLUG CABLE

2.0

1. Remove the spark plug cable(A).

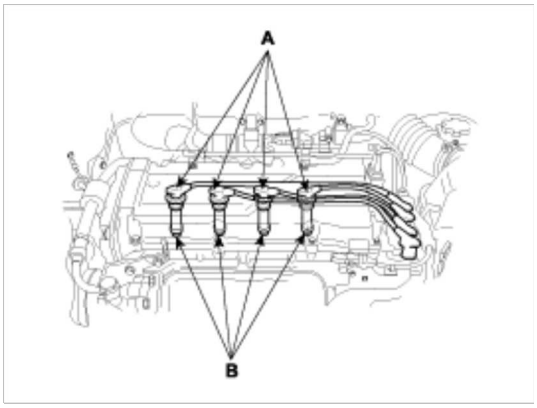
NOTE

When removing the spark plug cable, pull on the spark plug cable boot (not the cable), as it may be damaged.

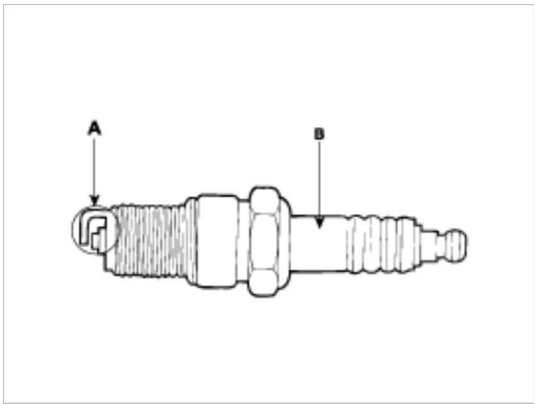
2. Using a spark plug socket, remove the spark plug(B).

CAUTION

Be careful that no contaminats enter through the spark plug holes.

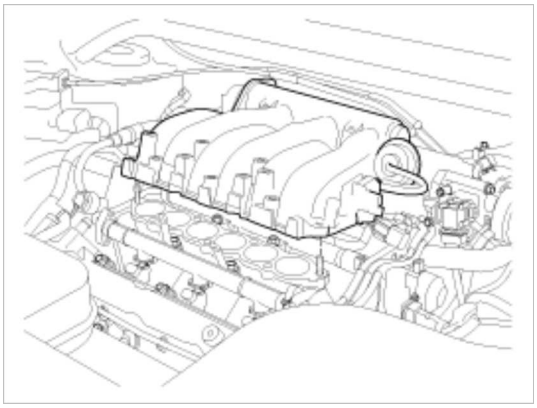


3. Inspect the electrodes(A) and ceramic insulator(B).



2.7

1. Remove the engine cover.
2. Disconnect the VIS actuator connectors and injector connectors.
3. Remove the accelerator cable.
4. Remvoe surge tank sub assembly.



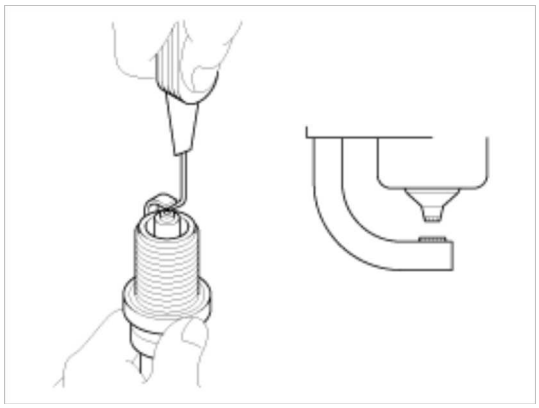
5. Remove the spark plug cable.
6. Remvoe the spark plug.
7. Inspect the electrodes and ceramic insulator.

1. **INSPECTION OF ELECTRODES**

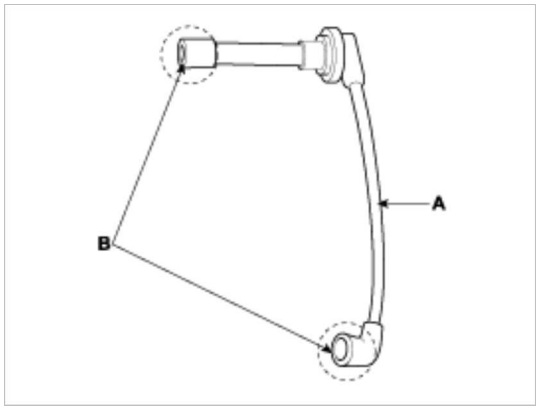
CONDITION	DARK DEPOSITS	WITHE DEPOSITS
DESCRIPTION	- Fuel mixture too rich - Low air intake	- Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening

A. Check the electrode gap(A).

Standard (New)
1.0~1.1 mm (0.039~0.043 in.)

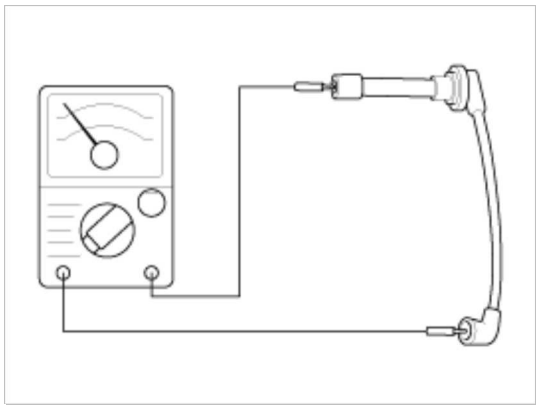


B. Carefully remove the spark plug cable by pulling on the rubber boots(A).
Check the condition of the spark plug cable terminals(B), if any terminal is corroded, clean it, and if it broken or distorted, replace the spark plug cable.



C. Connect the ohmmeter probes and measure resistance.

RESISTANCE : 5.6KΩ/m ± 20%

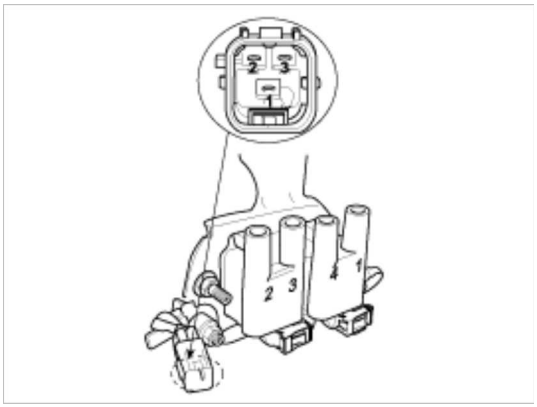


D. Resistance should not be higher than 10KΩ per meter of cable.

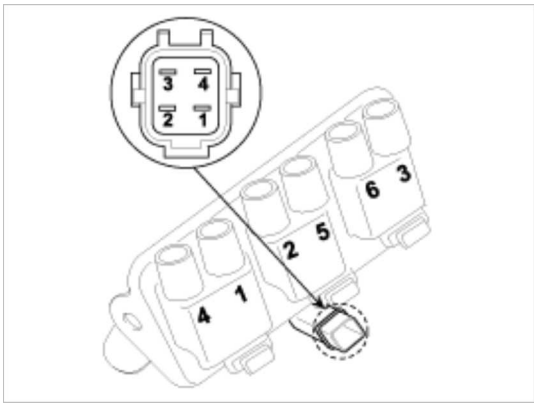
If resistance is higher, replace the cable.

INSPECT IGNITION COIL

1. Measure the primary coil resistance between terminals 1-2 and 1-3.



Measure the primary coil resistance between terminals 1-4, 2-4 and 3-4.



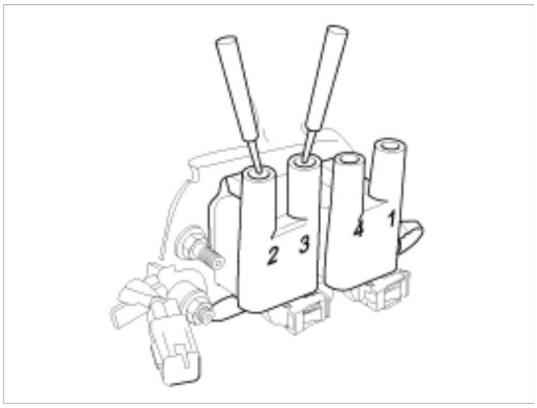
Standard value :
0.58Ω ± 10% (2.0)
0.96Ω ± 10% (2.7)

2. Measure the secondary coil resistance between the high-voltage terminal for the No.1 and No.4 cylinders, and between the high-voltage terminals for the No.2 and No.3 cylinders.

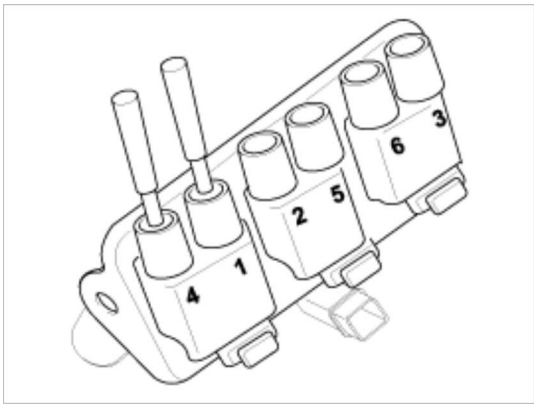
Standard value :
8.8kΩ ± 15% (2.0)
12.5kΩ ± 15% (2.7)

CAUTION

Be sure, when measuring the resistnace of the secondary coil, to disconnect the connector of the ignition coil.



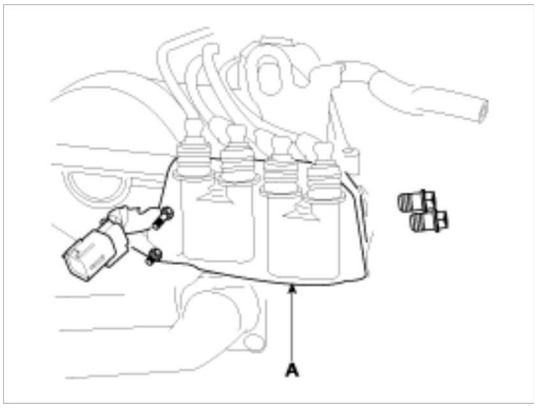
Measure the secondary coil resistance between the high-voltage terminals for the No.1 and No.4 cylinders, No.2 and No.5 cylinders and No.3 and No.6 cylinders.

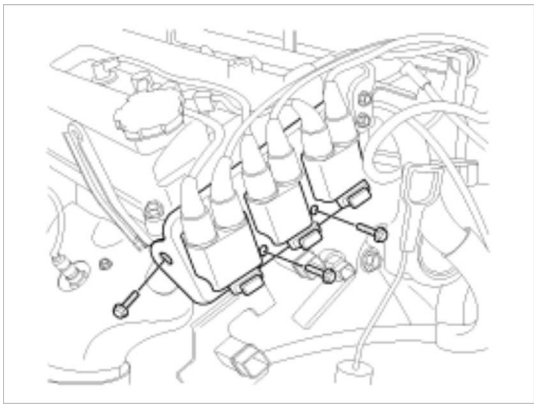


REPLACEMENT

IGNITION COIL

1. Remove the engine cover.
2. Disconnect the spark plug cable and connector.
3. Remove the ignition coil(A).
4. Installation is the reverse of removal.





CRANKSHAFT POSITION SENSOR

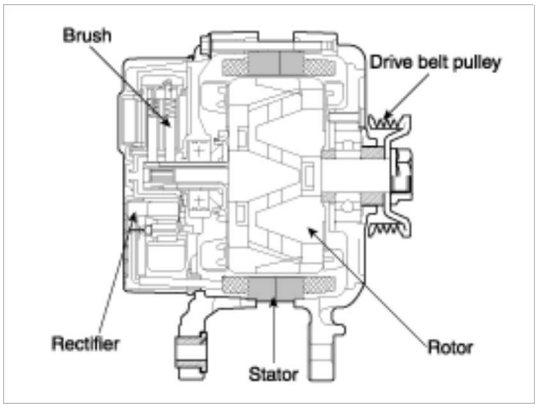
1. Disconnect the crankshaft position sensor connector.
2. Remove the crankshaft position sensor(A).

Engine Electrical System > Charging System > Description and Operation

DESCRIPTION

GASOLINE

The charging system included a battery, an generator with a built-in regulator, and the charging indicator light and wire.
The generator has eight built-in diodes (four positive and four negtive), each rectifying AC current to DC current.
Therefore, DC curent appears at generator "B" terminal.
In addition, the charging voltage of this generator is regulated by the battery voltage detection system.
The generator is regulated by the battery voltage detection system. The main components of the generator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.



Engine Electrical System > Charging System > Repair procedures

ON-VEHICLE 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.
- Do not perform tests with a high voltage insulation resistance tester.
- Never disconnect the battery while the engine is running.

CHECK BATTERY VOLTAGE

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 : 12.5~12.9V at 20°C (68°C)

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

CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

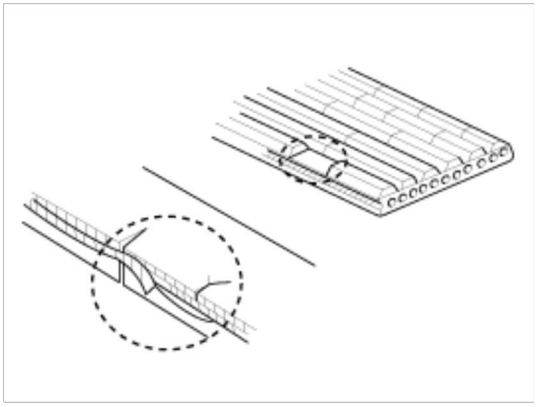
1. Check that the battery terminals are not loose or corroded.
2. Check the fusible link and fuses for continuity.

INSPECT DRIVE BELT

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

   NOTE

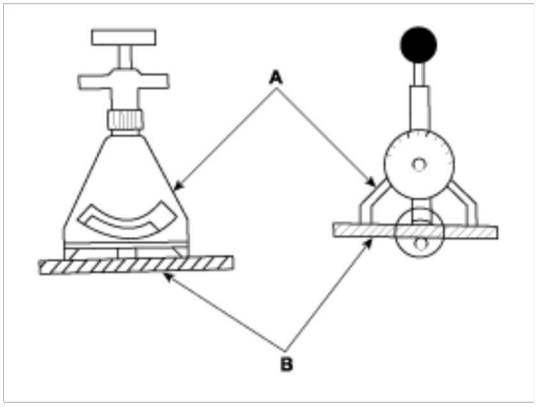
   Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

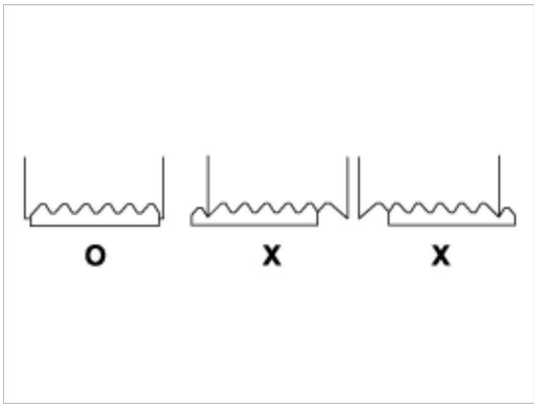


2. Using a belt tension gauge(A), measure the drive belt(B) tension.
   DRIVE BELT TENSION

New belt	540~640 N (121~143 lb)
Used belt	340~490 N (77~110 lb)

   If the belt tension is not as specified, adjust it.





NOTE

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.

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.

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 it.
4. Start the engine. Check that the light goes off.

INSPECT CHARGING SYSTEM

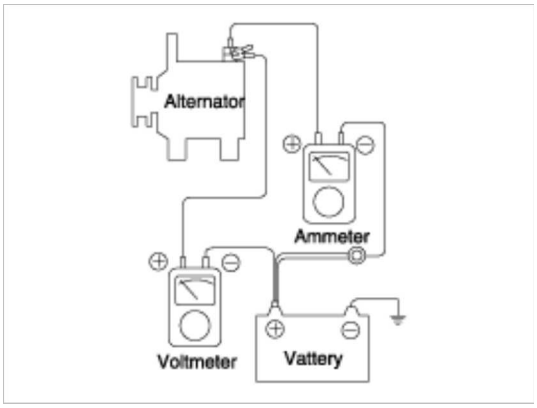
PREPARATION

1. Turn the ignition switch to "OFF".

NOTE

To find abnormal conditions of the connection, actions should not be taken on the two terminals and each connection during the test.

2. Connect a digital voltmeter between the alternator "B" terminal and battery (+) lead wire to the battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.



CONDITIONS FOR THE TEST

1. Start the engine.
2. Switch on the headlamps, blower motor and so on. And then, read the voltmeter under this condition.

RESULT

1. The voltmeter may indicate the standard value.

   0.2V max.

2. 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 fusible link to the battery (+) terminal. Check for loose connections, color change due to an overheated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle. Turn off the head lamps, blower motor and the ignition switch.

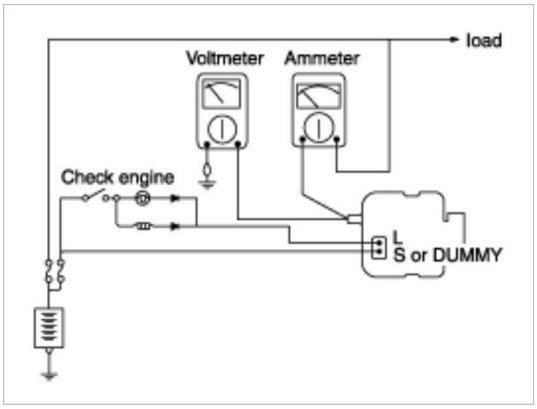
PREPARATION

1. 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. The battery checking method is described in "BATTERY".
   The battery that is used to test the output current should be one that has been 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.
2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. 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.

   NOTE

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

6. 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.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between the alternator "B" terminal and battery (+) terminal, a blown fusible link or poor grounding is suspected.
2. Start the engine and turn on the headlights.
3. Set the headlights 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.

   NOTE

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

RESULT

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

63A min.

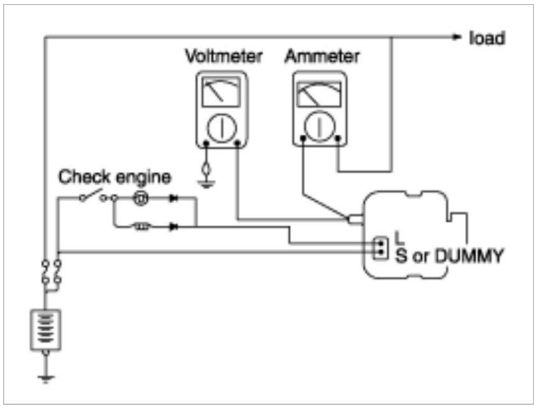
NOTE

- The nominal output current value is shown on the nameplate affixed to the alternator body.
- 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 headlights on the cause discharge of the battery, or use the lights of another vehicle 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.

2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

PREPARATION

1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. For battery checking method, see "BATTERY".
   Check the alternator drive belt tension.
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. 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.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. 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.
7. Attach the engine tachometer and connect the battery ground cable.



TEST

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

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 (-), or the fusible link is blown.

2. Start the engine. Keep all lights and accessories off.
3. 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.

RESULT

1. If the voltmeter reading agrees with the value listed in the Regulating Voltage Table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.
   REGULATING VOLTAGE TABLE
   GASOLINE

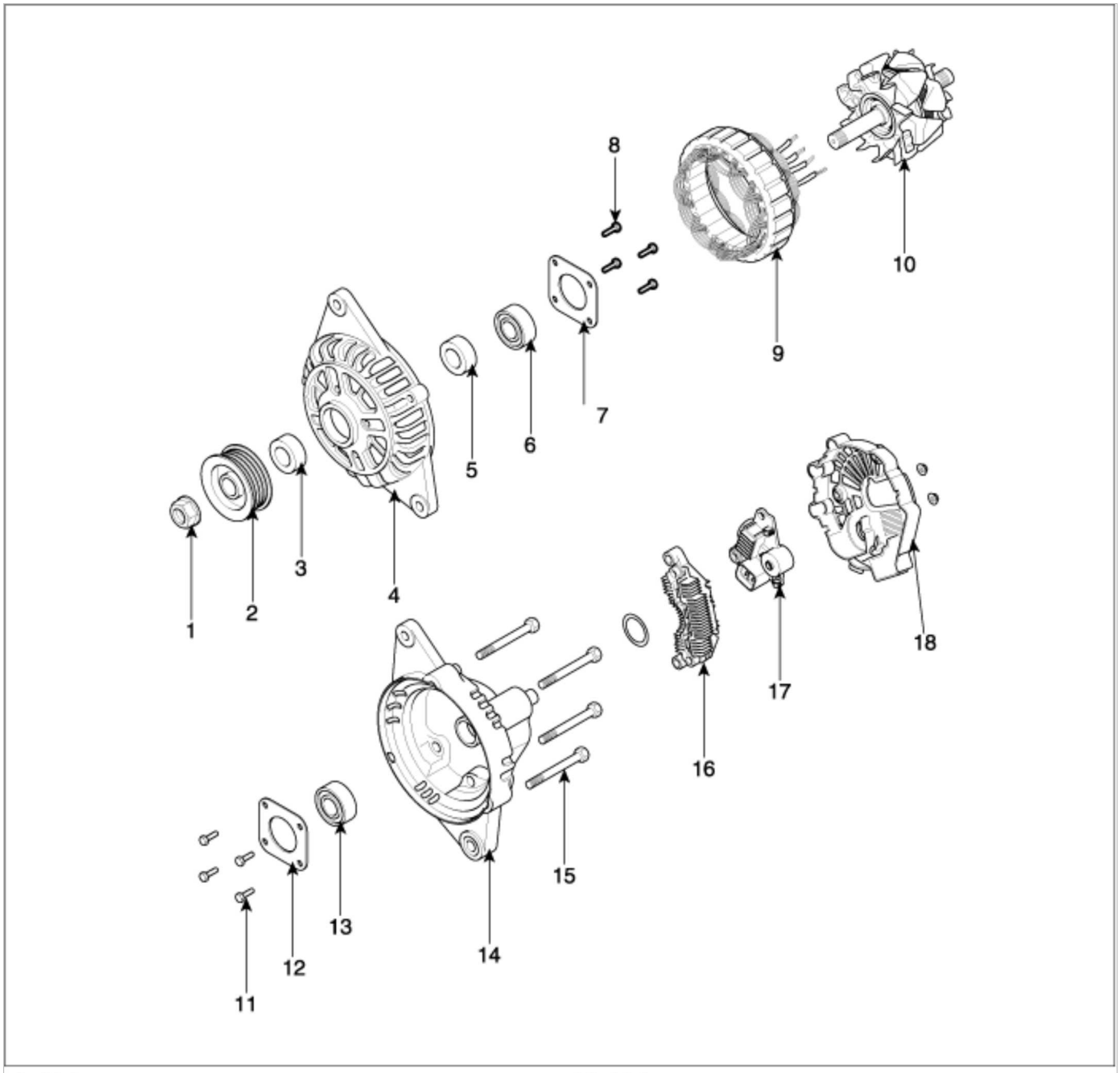
Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-20 (-4)	14.2 ~ 15.4
20 (68)	14.0 ~ 15.0
60 (140)	13.7 ~ 14.9
80 (176)	13.5 ~ 14.7

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Engine Electrical System > Charging System > Alternator > Components and Components Location

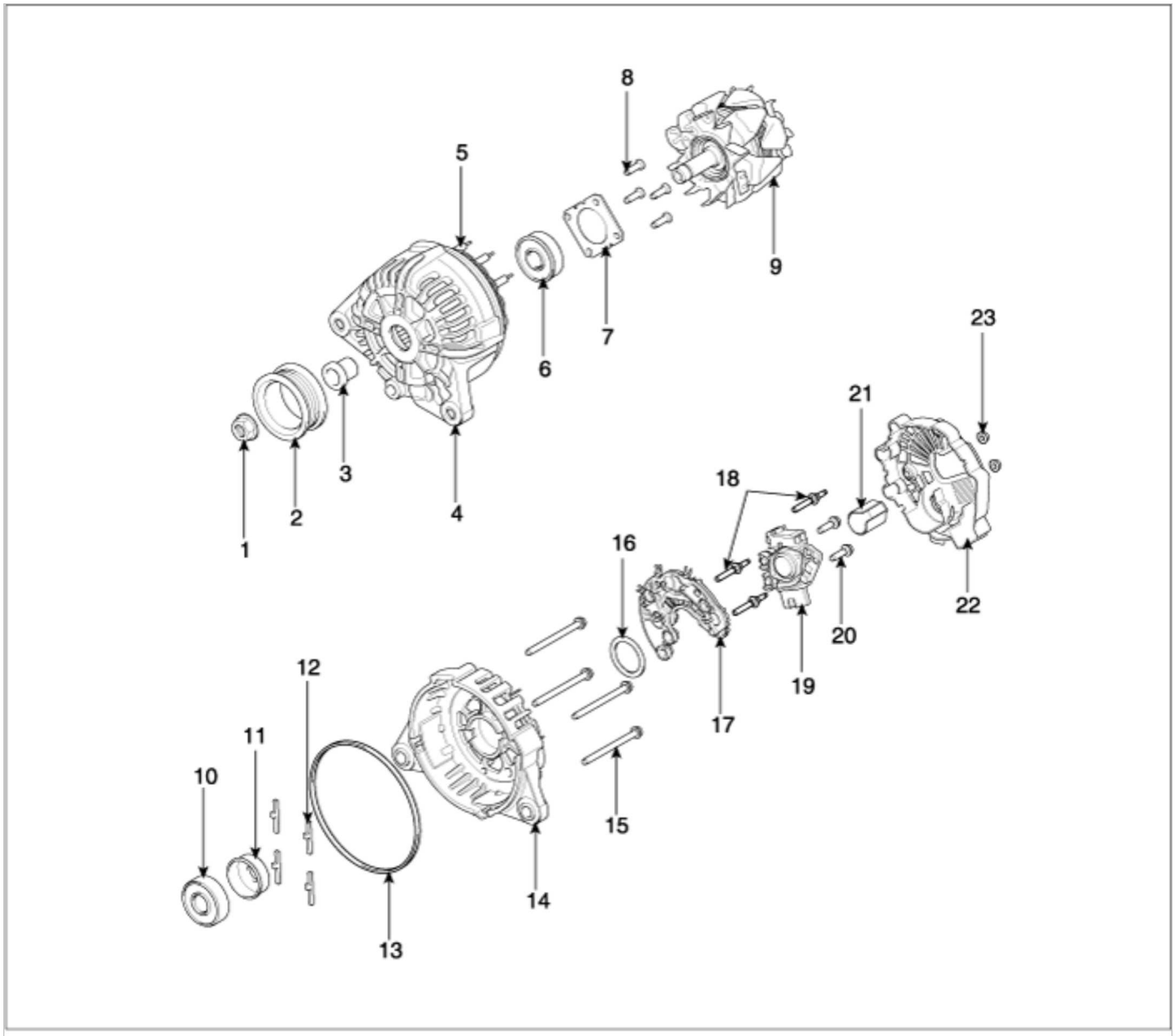
COMPONENTS

GASOLINE (2.0)



1. Nut
2. Pulley
3. Spacer
4. Front bracket
5. Spacer
6. Bearing
7. Bearing cover
8. Bolts
9. Stator
10. Rotor
11. Bolts
12. Bearing cover
13. Bearing
14. Rear bracket
15. Through bolts
16. Rectifier
17. Brush holder
18. Rear cover

GASOLINE (2.7)

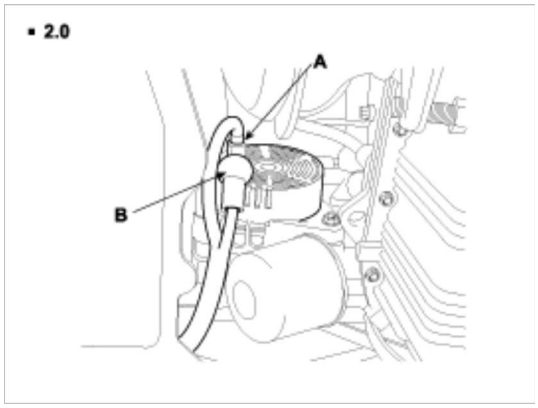


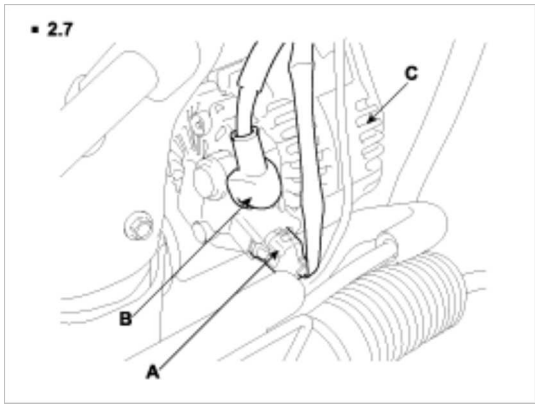
1. Nut
2. Pulley
3. Bushing
4. Front cover assembly
5. Stator coil
6. Front bearing
7. Front bearing cover
8. Front bearing cover bolt
9. Rotor coil
10. Rear bearing
11. Rear bearing cover
12. Damper
13. Packing
14. Rear cover
15. Through bolt
16. Seal
17. Rectifier assembly
18. Stud bolt
19. Brush holder assembly
20. Brush holder bolt
21. Guard
22. Cover
23. Cover nut

Engine Electrical System > Charging System > Alternator > Repair procedures

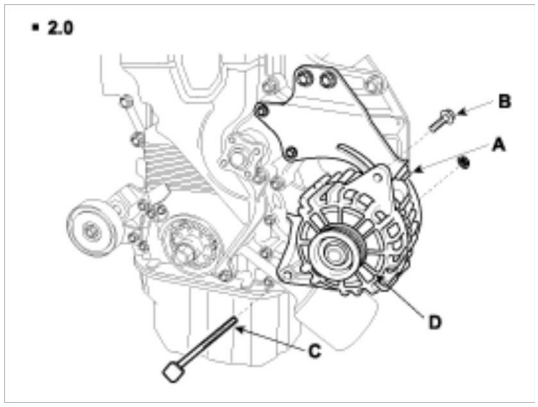
REPLACEMENT

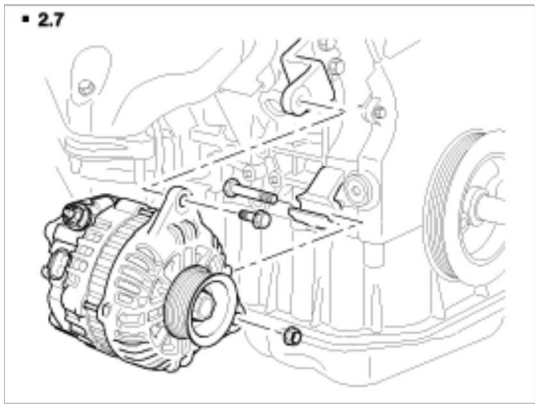
1. Disconnect the battery negative terminal first, then the positive terminal.
2. Deisconnect the alternator connector(A) and "B" terminal cable(B) from the alternator(C).





3. Remove the adjusting bolt(A) and mounting bolt(B), then remove the alternator belt.
4. Pull out the through bolt(C), then remove the alternator(D).



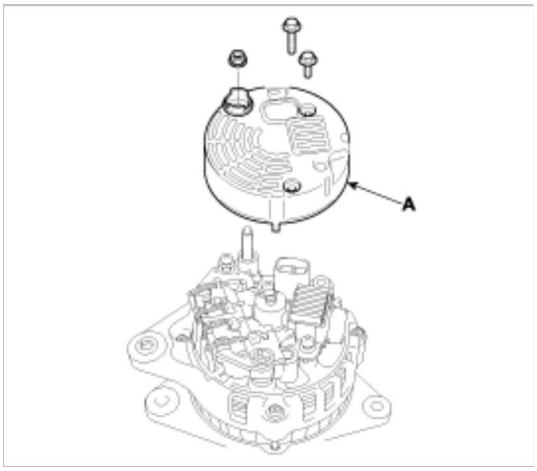


5. Installation is the reverse of removal.
6. Adjust the alternator belt tension after installation (See page EE-36).

DISASSEMBLY

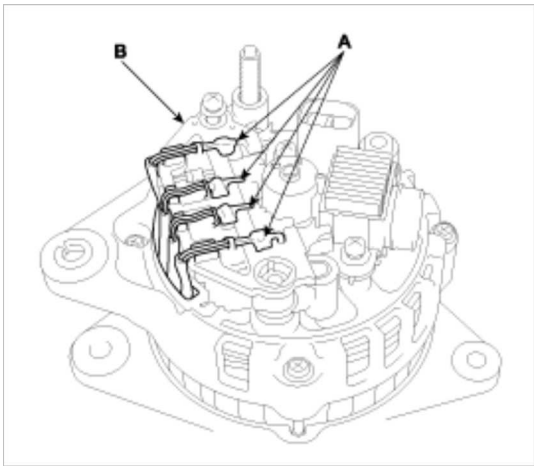
GASOLINE (2.0)

1. Remove the rear cover(A).

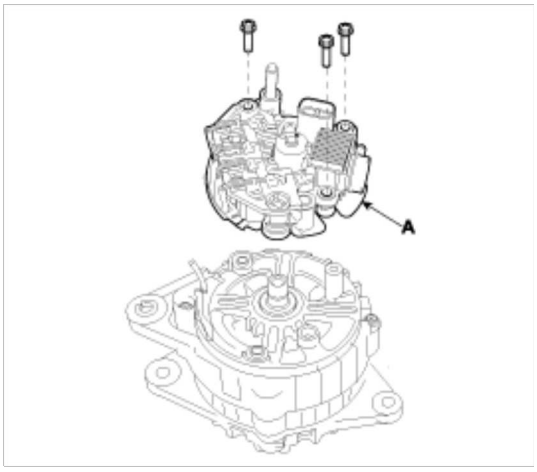


2. Unsolder the 4 stator leads(A) to the main diodes on the rectifier(B).

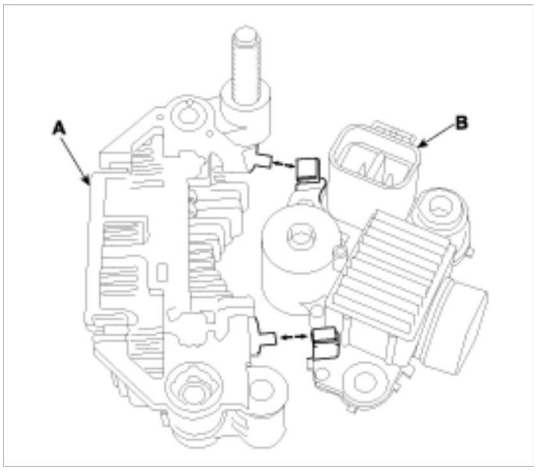
> CAUTION
>
> - When soldering or unsoldering, be careful not to heat the diodes for too long.
> - Be careful that excesive force is not exerted on the leads of the diodes.



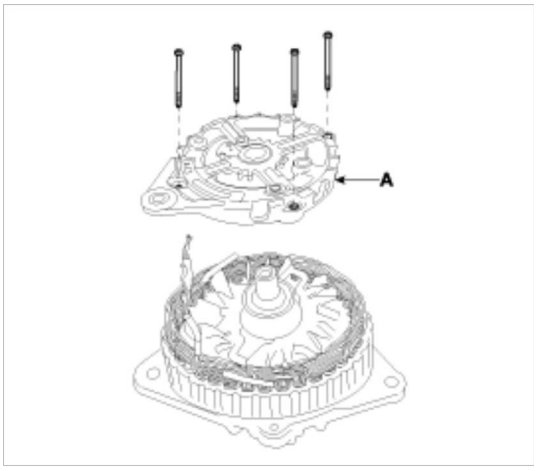
3. Remove the rectifier assembly(A).



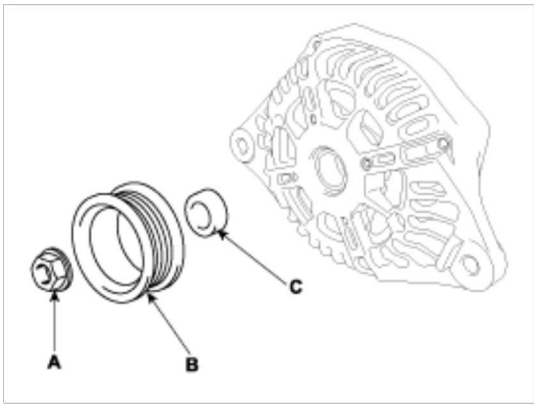
4. Unsolder between rectifier(A) and brush holder(B).



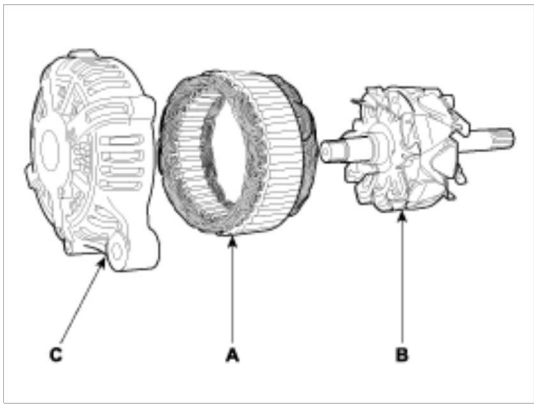
5. Remove the rear bracket(A).



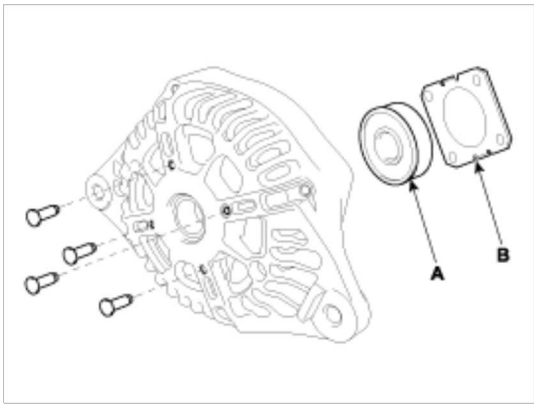
6. Remove the nut(A), pulley(B) and spacer(C).



7. Disconnect the stator(A), rotor(B) and front bracket(C).



8. Remove the rear bearing(A) and cover(B).

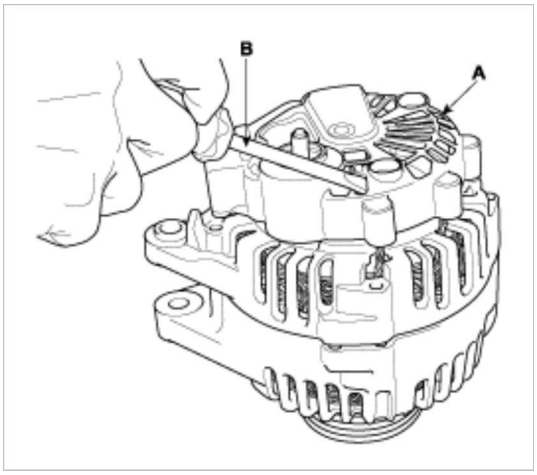


9. Reassembly is the reverse or disassembly.

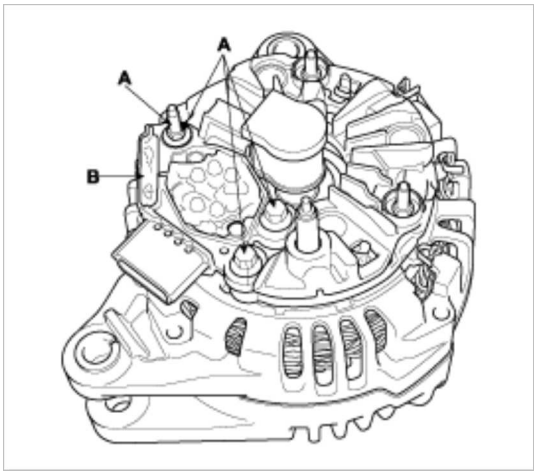
> NOTE
>
> Before the rotor is attached to the rear bracket, insert a wire through the small hole in the rear bracket to lock the brush. After the rotor has been installed, the wire can be removed.

GASOLINE (2.7)

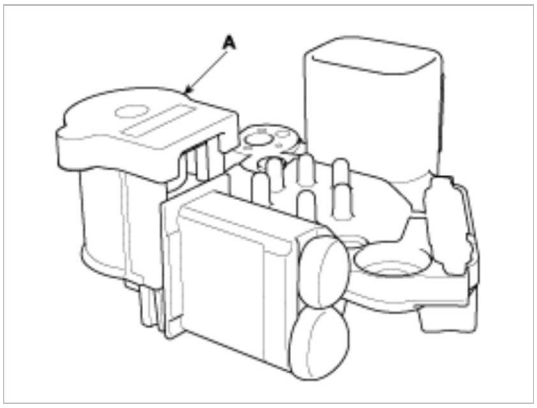
1. Remove the alternator cover(A) using a screw driver(B).



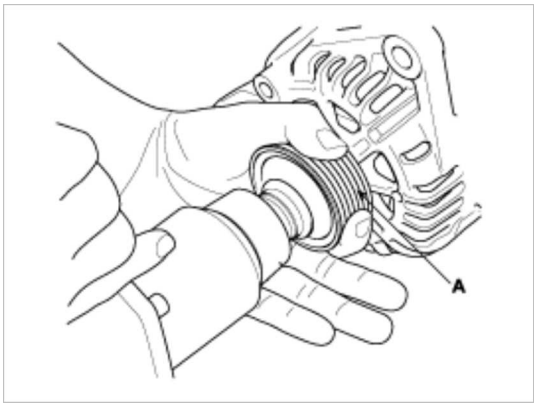
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



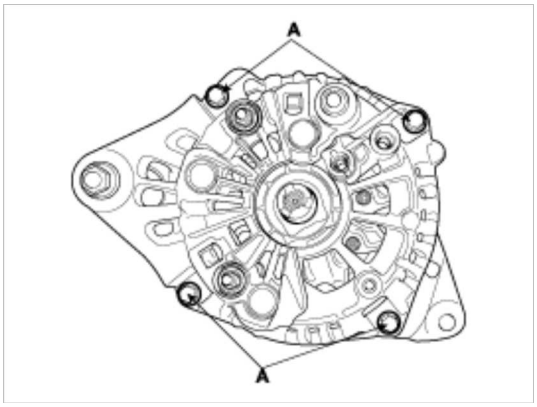
3. Remove the slip ring guide(A).



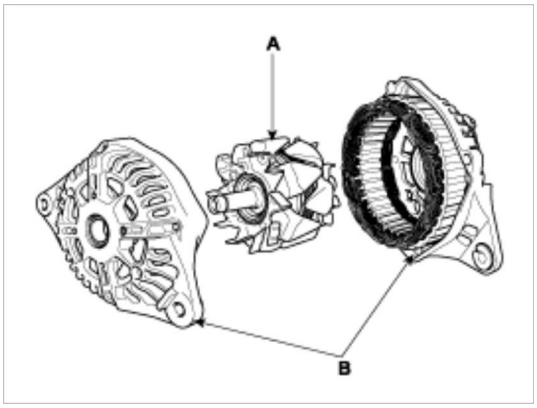
4. Remvoe the nut, pully(A) and spacer.



5. Loosen the 4 through bolts(A).



6. Disconnect the rotor(A) and cover(B).

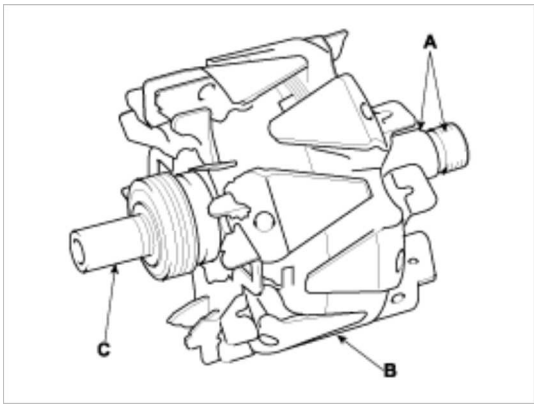


7. Reassembly is the reverse of disassembly.

INSPECTION

INSPECT ROTOR

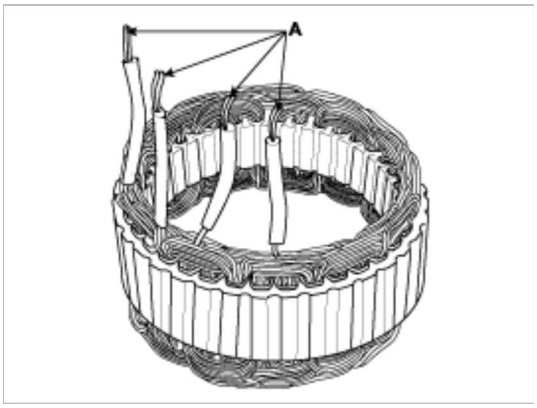
1. Check that there is continuity between the slip rings(A).



2. Check that there is no continuity between the slip rings and the rotor(B) or rotor shaft(C).
3. If the rotor fails either continuity check, replace the alternator.

INSPECT 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 generator.

ALTERNATOR BELT INSPECTION AND ADJUSTMENT (GASOLINE 2.0)

NOTE

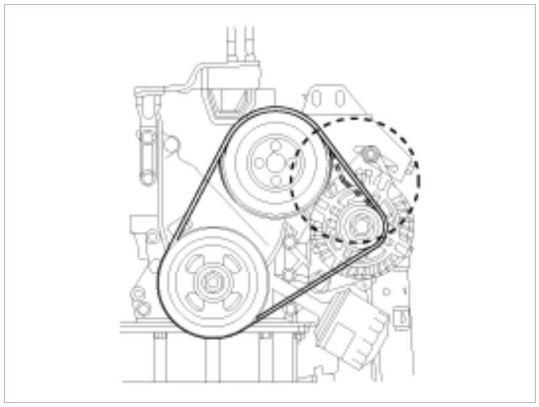
When using a new belt, first adjust the deflection or tension to the values for the new belt, then readjust the deflection or tension to the values for the used belt after running engine for five minutes.

Deflection method :
Apply a force of 98N (10 kgf, 22 lbf), and measure the deflection between the alternator and crankshaft pulley.

Deflection
Used Belt : 5.0 ~ 6.0 mm (0.20 ~ 0.23 in)
New Belt : 4.0 ~ 5.0 mm (0.16 ~ 0.20 in)

NOTE

If the belt is worn or damaged, replace it.



Belt tension gauge method :

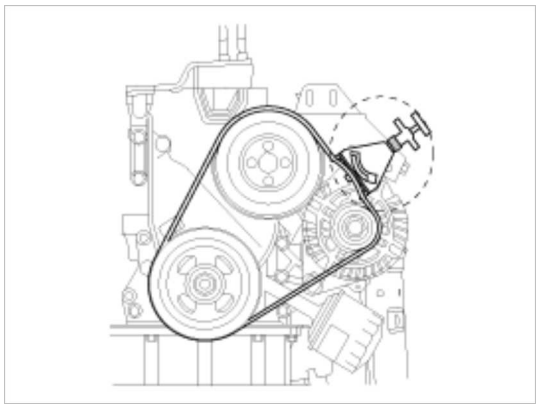
Attach the belt tension gauge to the belt and measure the tension. Follow the gauge manufacturer's instructions.

Tension

Used Belt : 340~490 N (35~50 kgf, 77~110 lbf)
New Belt : 540~640 N (55~65 kgf, 121~143 lbf)

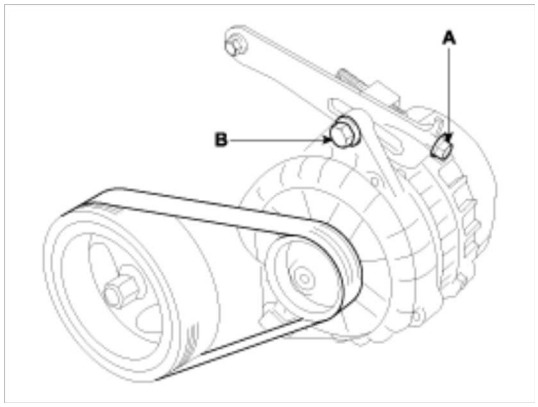
NOTE

If the belt is worn or damaged, replace it.



If adjustment is necessary :

1. Loosen the adjusting bolt(A) and the lock bolt(B).
2. Move the alternator to obtain the proper belt tension, then retighten the nuts.

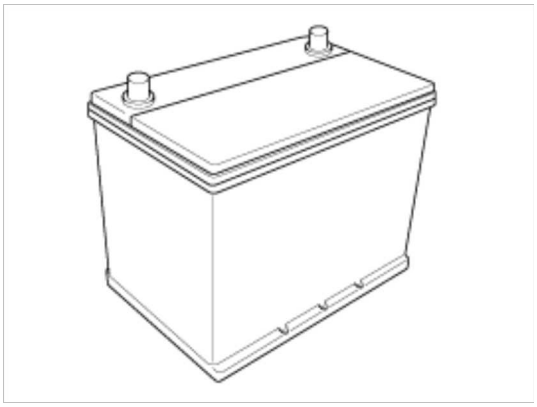


3. Recheck the deflection or tension of the belt.

Engine Electrical System > Charging System > Battery > Description and Operation

DESCRIPTION

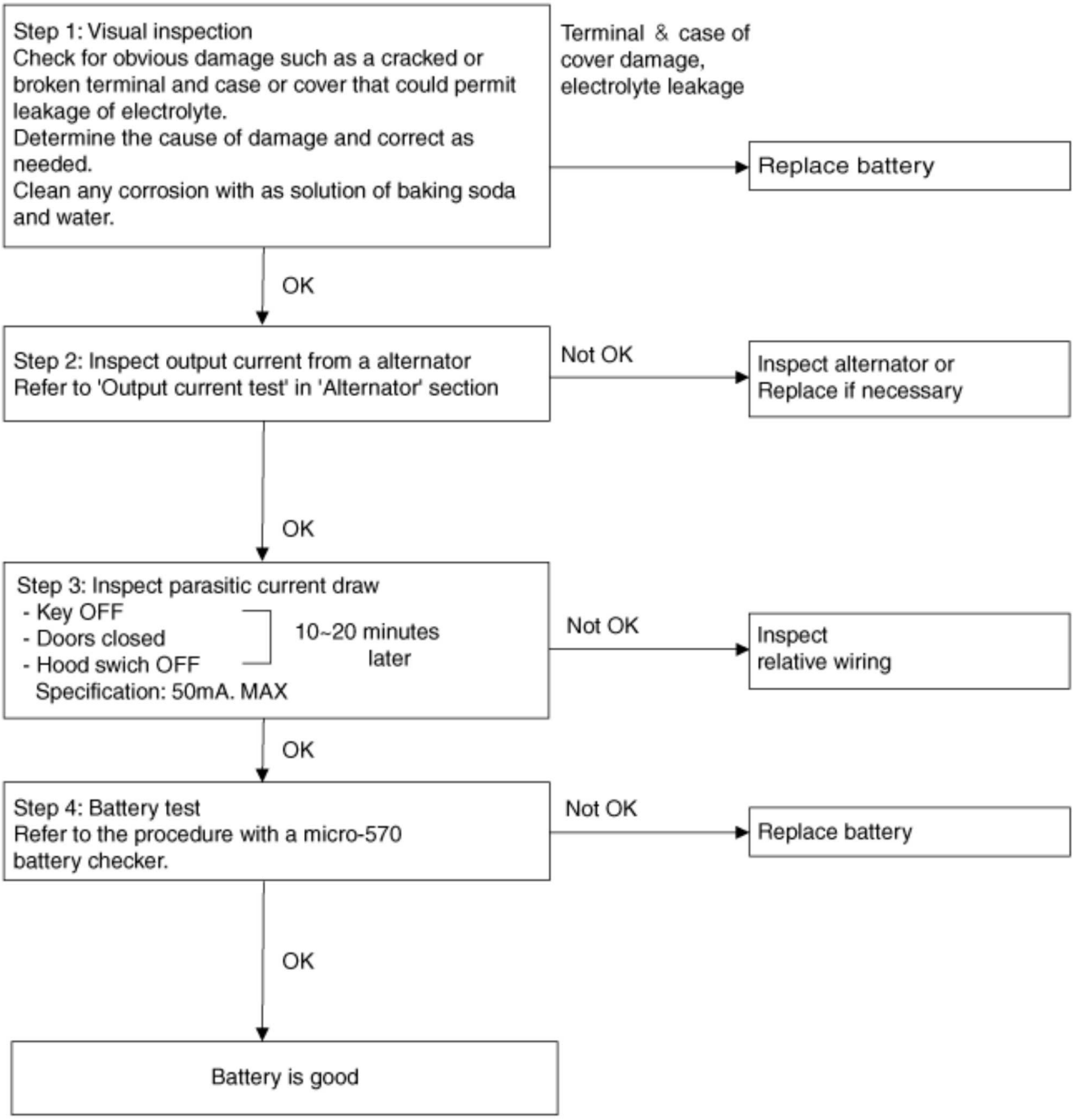
1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.



Engine Electrical System > Charging System > Battery > Repair procedures

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

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.

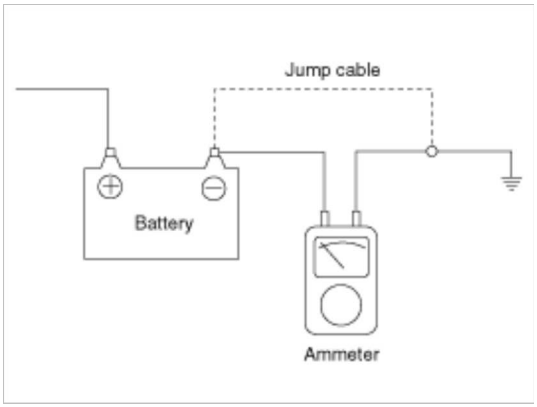
NOTE

For an accurate measurement of a vehicle parasitic current, all electriacl 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.

CAUTION

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.
   A. 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.
   B. Check the parasitic current again, and search for suspected unit by removing a unit connected with the abnormal circuit one by one.

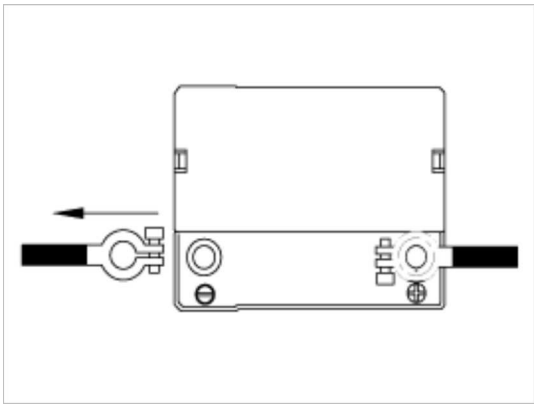
Limit value (after 10~20 min.) : Below 50mA

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

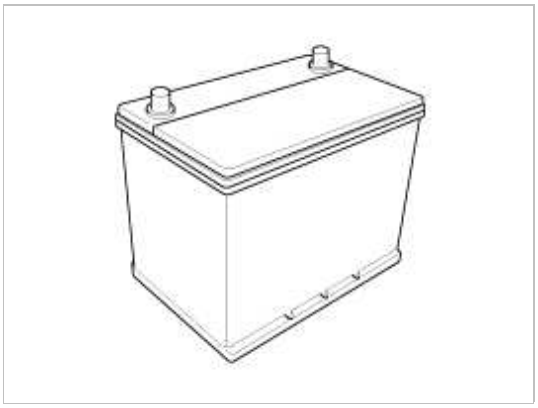
Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be wore when removing the battery.



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.
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.

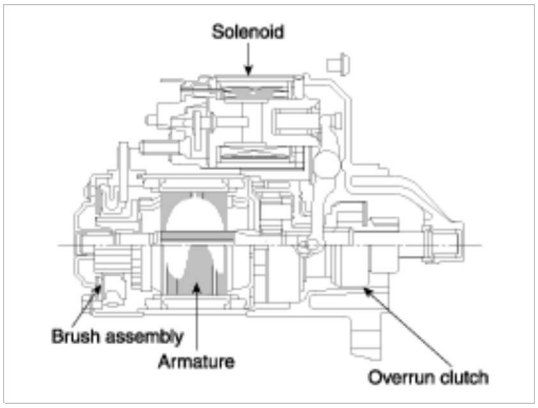


Engine Electrical System > Starting System > Description and Operation

DESCRIPTION

The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch(A/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.



Engine Electrical System > Starting System > Repair procedures

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.

INSPECTION

START TEST

NOTE

The air temperature must be between 59 and 100°F (15 and 38°C) before testing.

Recommended procedure :

- Use a starter system tester.
- Connect and operate the equipment in accordance with the manufacturer's instructions.
- Test and troubleshoot as described.

Alternate Procedure :

- Use the following equipment :
  - Ammeter, 0~400A
  - Voltmeter, 0~20V (accurate within 0.1 volt)
  - Tachometer, 0~1,200 rpm
- Hook up a voltmeter and ammeter as shown.

NOTE

After this test, or any subsequent repair, reset the ECM/PCM to clear any codes.

Check the Starter Engagement :

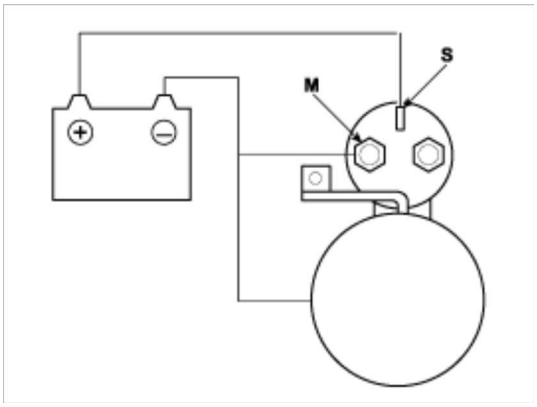
1. Remove the ECM(B+) fuse from the fuse/relay box.
2. Turn the ignition switch to START (III) with the shift lever in N or P position (A/T) or with the clutch pedal depressed (M/T). The starter should crank the engine.
   A. If the starter does not crank the engine, go to step 3.
   B. If it cranks the engine erratically or too slowly, go to "Check for Wear and Damage" on the next page.
3. Check the battery, battery positive cable, ground, starter cut relay, and the wire connections for looseness and corrosion. Test again.

If the starter still does not crank the engine, go to step 4.

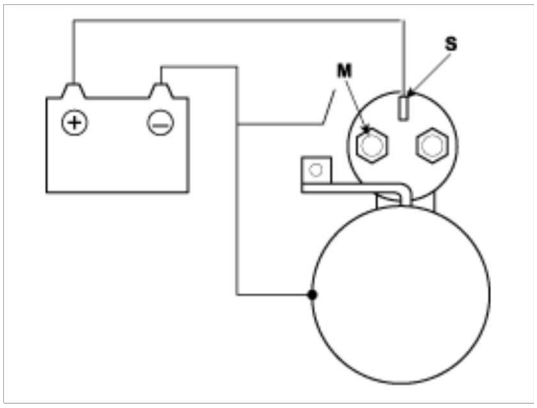
4. Unplug the connector from the starter.
5. Connect a jumper wire from the battery positive (+) terminal to the solenoid terminal.
   The starter should crank the engine.
   A. If the starter still does not crank the engine, remove it, and diagnose its internal problem.
   B. If the starter cranks the engine, go to step 6.
6. Check the ignition switch.
7. Check the starter relay (see page EE-54).
8. Check the A/T gear position switch (A/T) or the clutch interlock switch (M/T).
9. Check for an open in the wire between the ignition switch and starter.

STARTER SOLENOID TEST

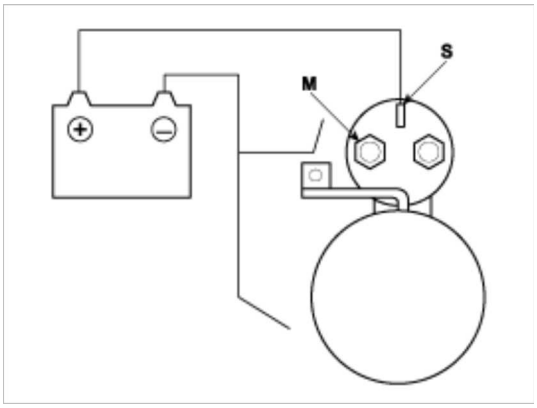
1. Disconnect the wires from the Sterminal and the M terminal.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly.
   To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



FREE RUNNING TEST

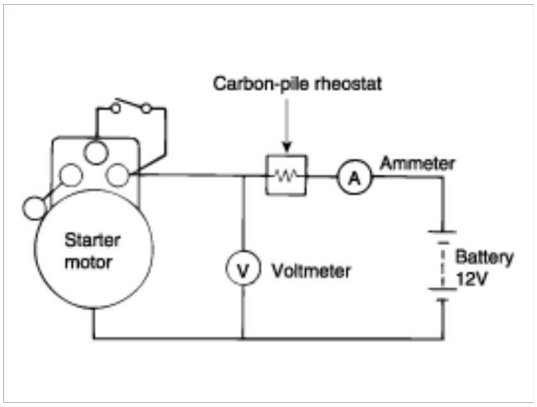
1. Place the starter motor in a vise equipped with soft jaws and connecta fully-charged 12-volt battery to starter motor as follows :
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostatas shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11 volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely :

2.7

Current : Max. 90 Amps
Speed : Min. 2,800 rpm

2.0

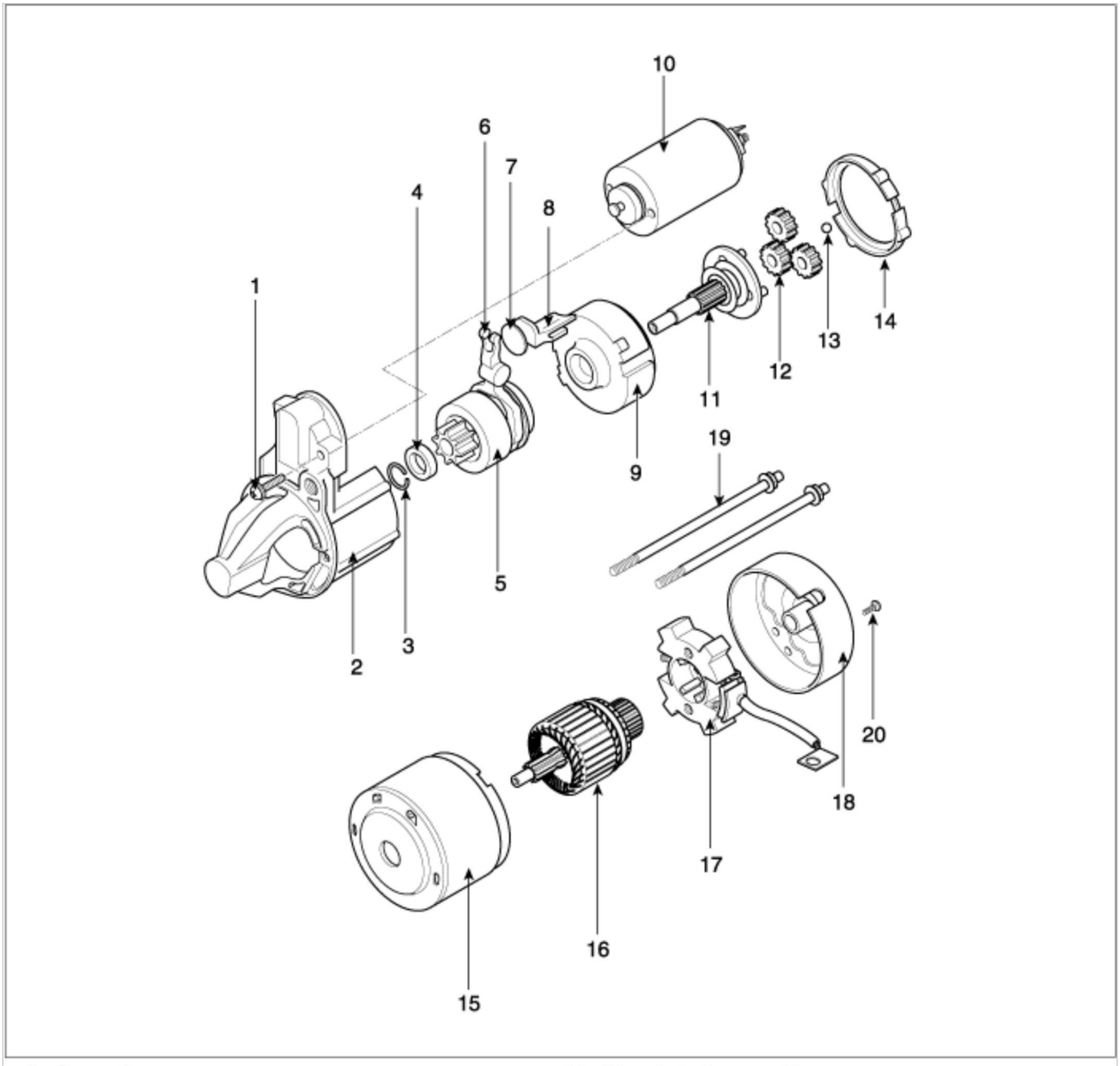
Current: Max. 90 Amps
Speed: Min. 3,000 rpm



Engine Electrical System > Starting System > Starter > Components and Components Location

COMPONENTS

GASOLINE



1. Screw flange
2. Front bracket assembly
3. Stop ring
4. Stopper
5. Overrun clutch assembly
6. Lever
7. Plate
8. Lever packing
9. Internal gear assembly
10. Magnet switch assembly
11. Planet shaft assembly
12. Planetary gear assembly
13. Steel ball
14. Packing
15. Yoke assembly
16. Armature assembly
17. Brush holder assembly
18. Rear bracket
19. Through bolt
20. Screw flange

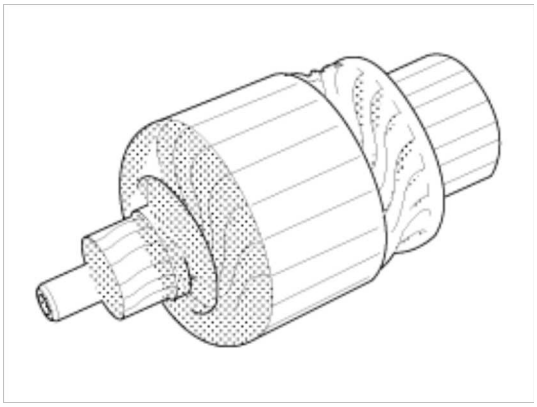
Engine Electrical System > Starting System > Starter > Repair procedures

INSPECTION

ARMATURE INSPECTION AND TEST

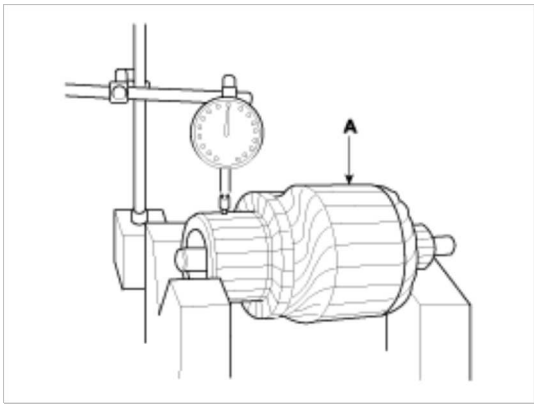
1. Remove the starter (see page EE-47).

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.

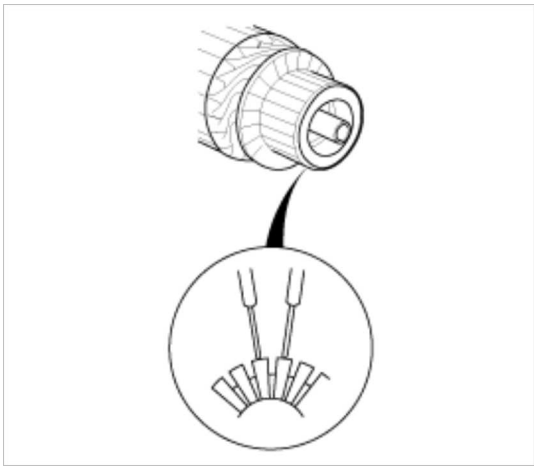


4. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator runout is not within the service limit, replace the armature.

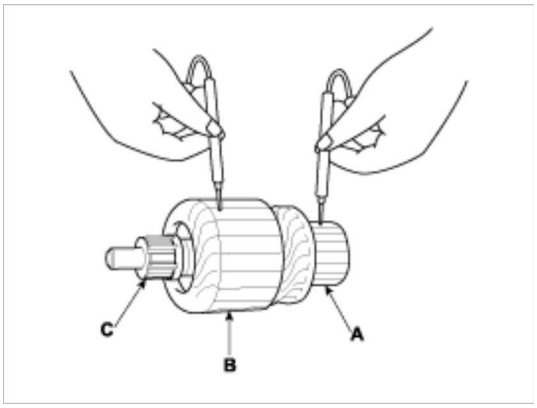
Commutator Runout
Standard (New) : 0.02mm (0.001 in.) max.
Service limit : 0.05mm (0.002 in.)



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

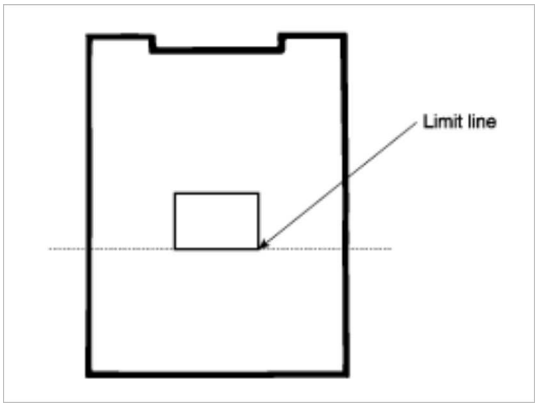


6. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



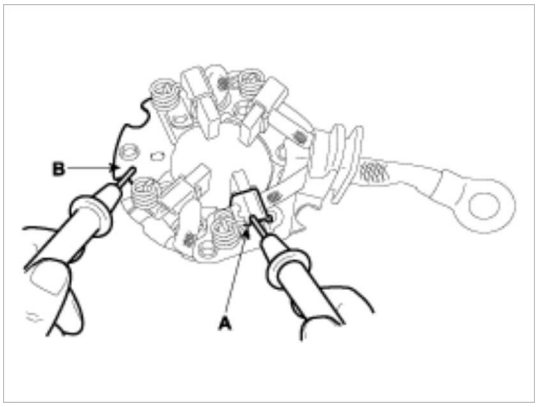
INSPECT STARTER BRUSH

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



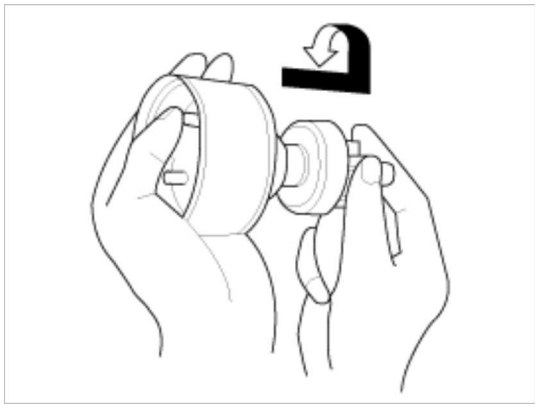
STARTER BRUSH HOLDER TEST

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



INSPECT OVERRUNNING CLUTCH

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.
2. Rotate the overrunning clutch (A) 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.

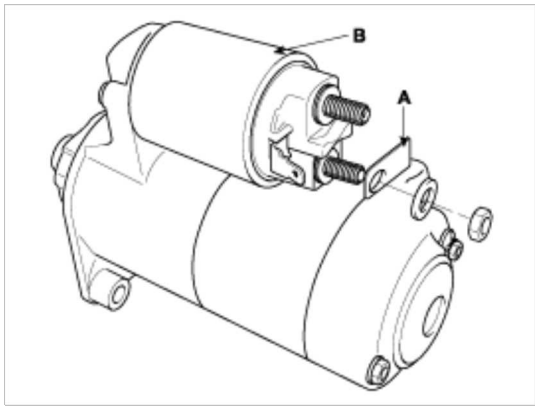


3. If the starter driver gear (B) is worn or damaged, replace the overrunning clutch assembly: the gear is not available separately.
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

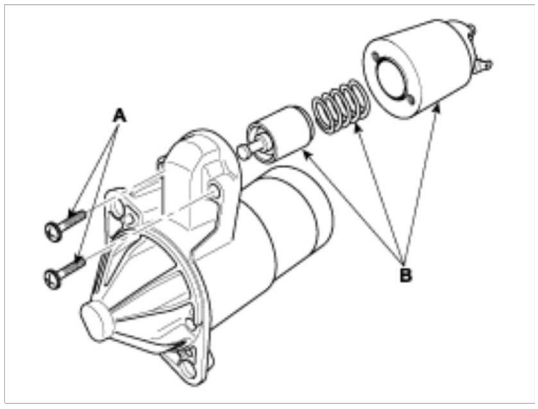
DISASSEMBLY

GASOLINE

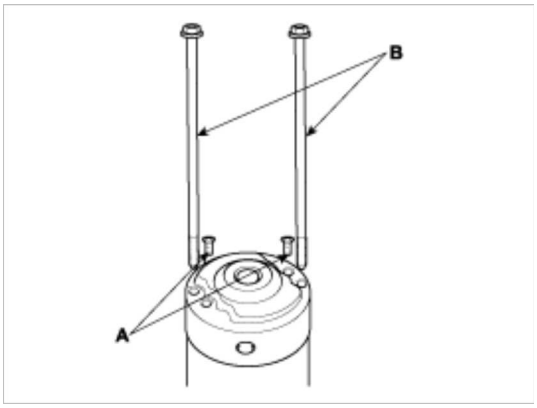
1. Disconnect the M-terminal(A) on the magnet switch assembly(B).



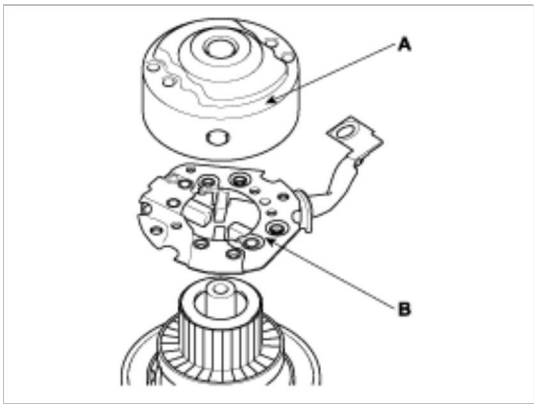
2. After loosening the 2 screws(A), detach the magnet switch assembly(B).



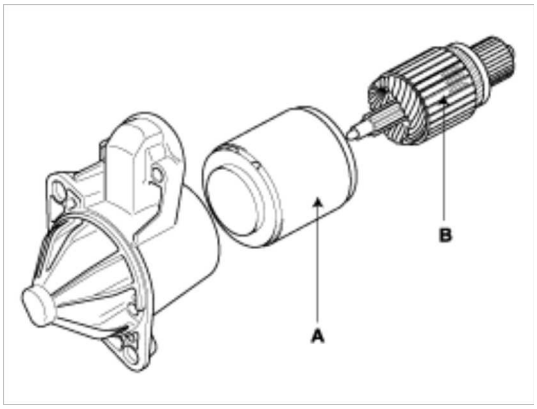
3. Loosen the brush holder mounting screws(A) and through bolts(B).



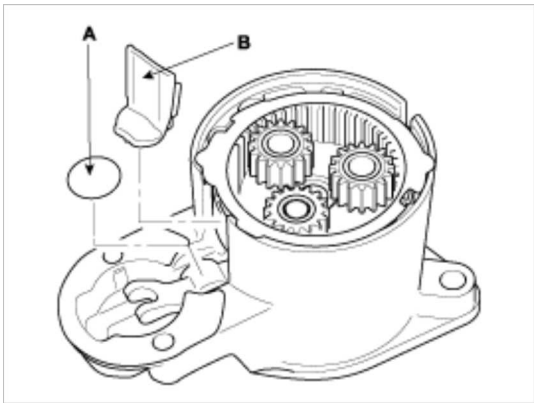
4. Remove the rear bracket(A) and brush holder assembly(B).



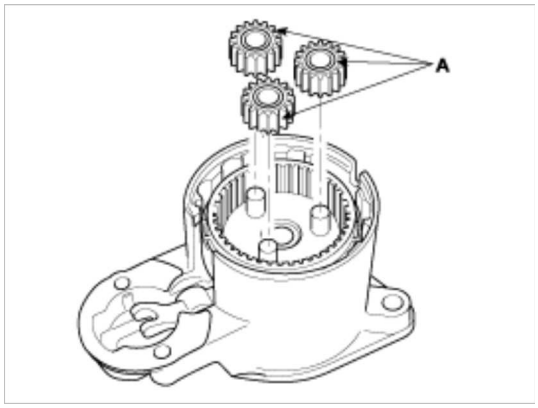
5. Remove the yoke(A) and armature(B).



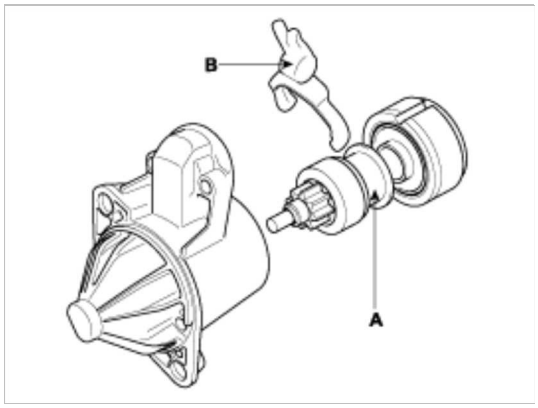
6. Remove the, lever plate(A) and planet shaft packing(B).



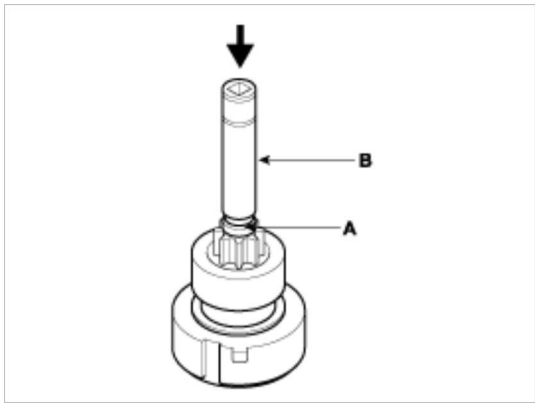
7. Disconnect the planet gear(A).



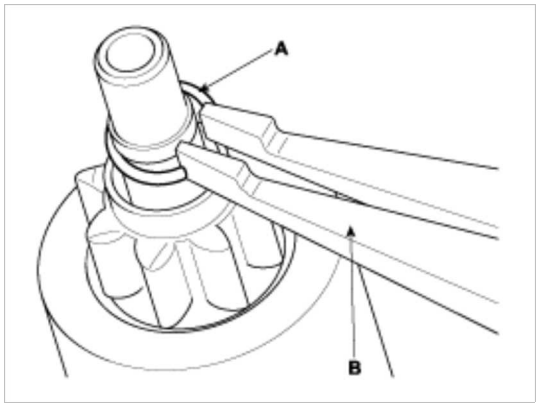
8. Disconnect the planet shaft assembly(A) and lever(B).



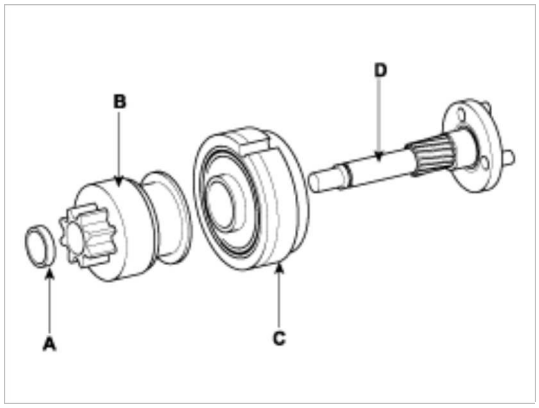
9. Press the stop ring(A) using a socket(B).



10. After removing the stopper(A) using stopper pliers(B).



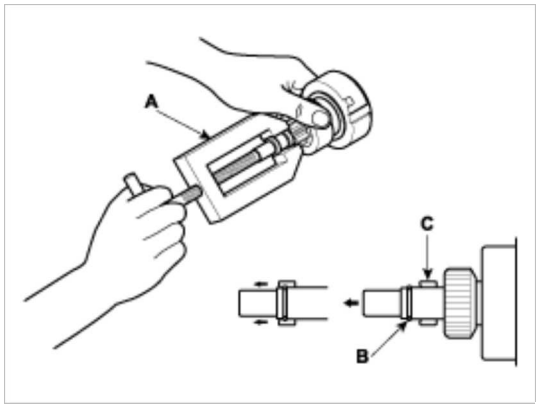
11. Disconnect the stop ring(A), overrunning clutch(B), internal gear(C) andplanet shaft(D).



12. Reassembly is the reverse of disassembly.

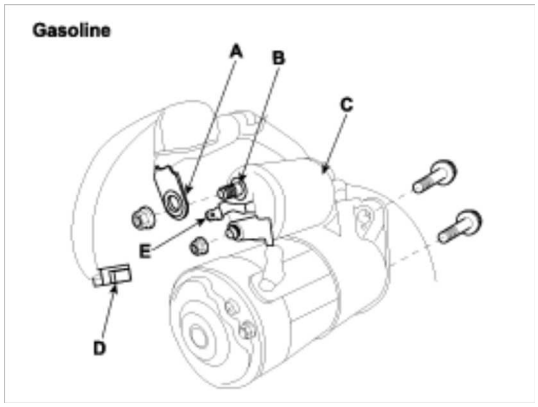
NOTE

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



REPLACEMENT

1. Disconnect the battery negative cable.
2. Disconnect the starter cable(A) from the B terminal(B) on the solenoid(C), then disconnect the connector(D) from the S terminal(E).

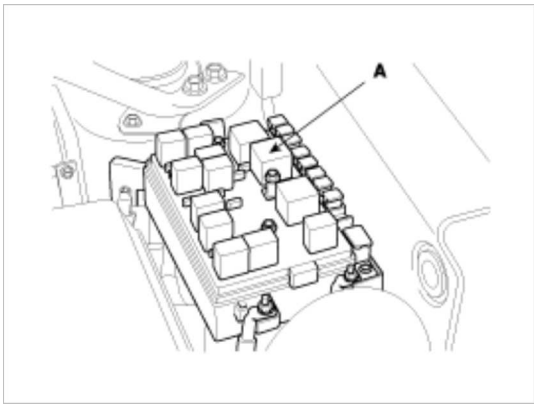


3. Remove the 2 bolts holding the starter, then remove the starter.
4. Installation is the reverse of removal.
5. Connect the battery positive cable and negative cable to the battery.

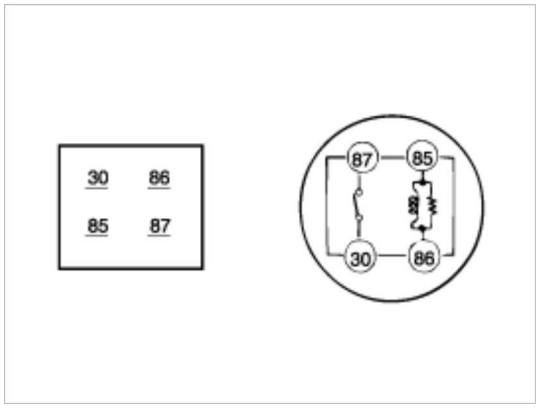
Engine Electrical System > Starting System > Starter Relay > Repair procedures

INSPECTION

1. Remove the fuse box cover.
2. Remove the starter relay(A).



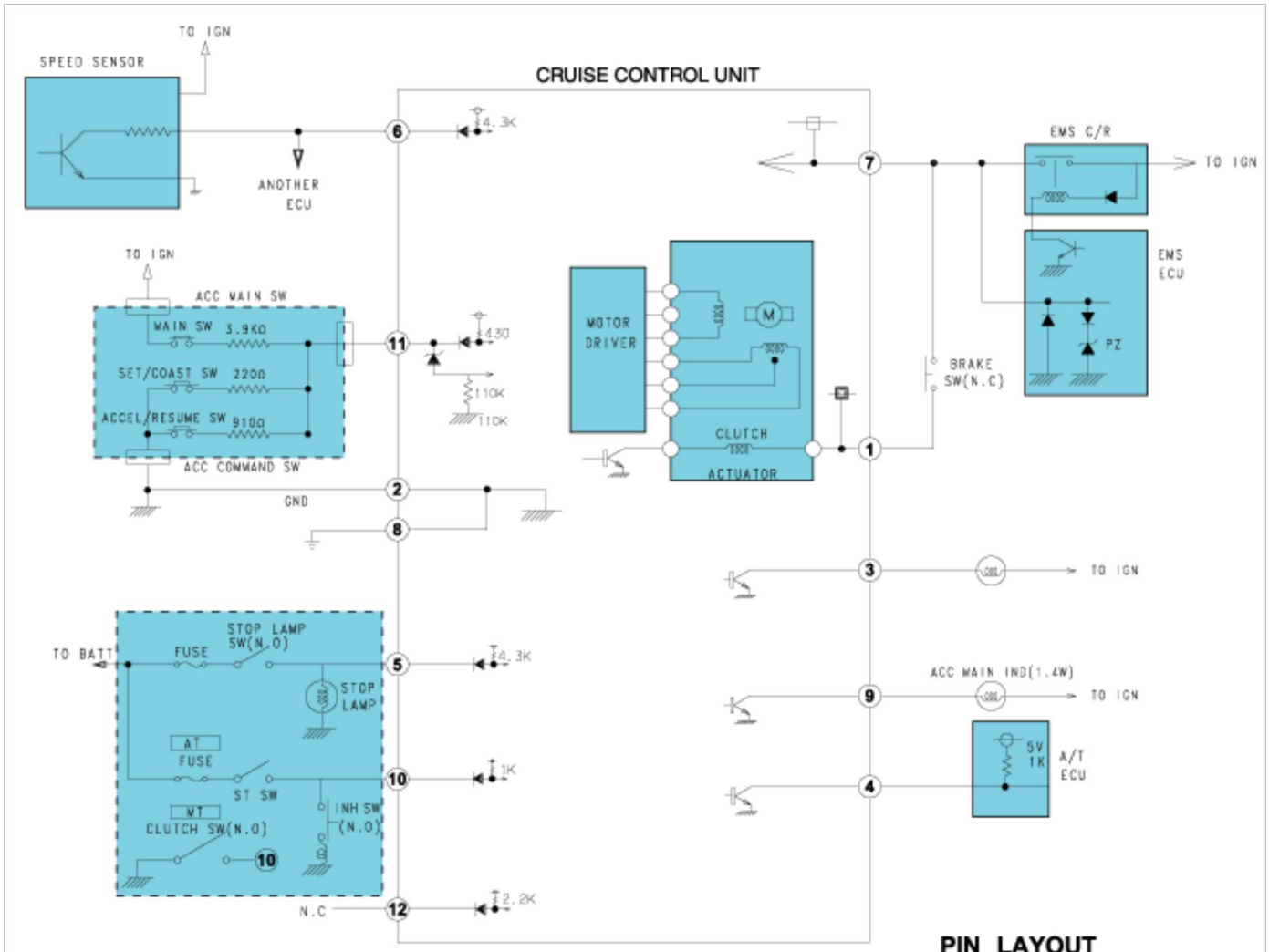
3. Inspect the relay continuity.
   A. Using an ohmmeter, check that there is continuity between terminals 85 and 86.
      If there is no continuity, replace the relay.
   B. Check that there is no continuity between terminals 30 and 87.
      If there is continuity, replace the relay.
4. Inspect the relay operation.
   A. Apply battery positive voltage across terminals 85 and 86.
   B. Using an ohmmeter, check that there is continuity between terminals 30 and 87.
      If there is no continuity, replace the relay.



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

Engine Electrical System > Cruise Control System > Schematic Diagrams

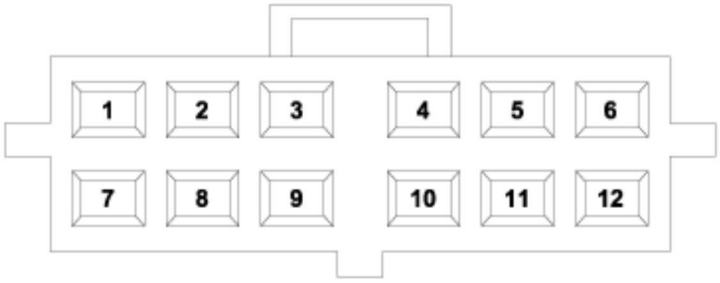
CIRCUIT DIAGRAM FOR CRUISE CONTROL SYSTEM



PIN LAYOUT

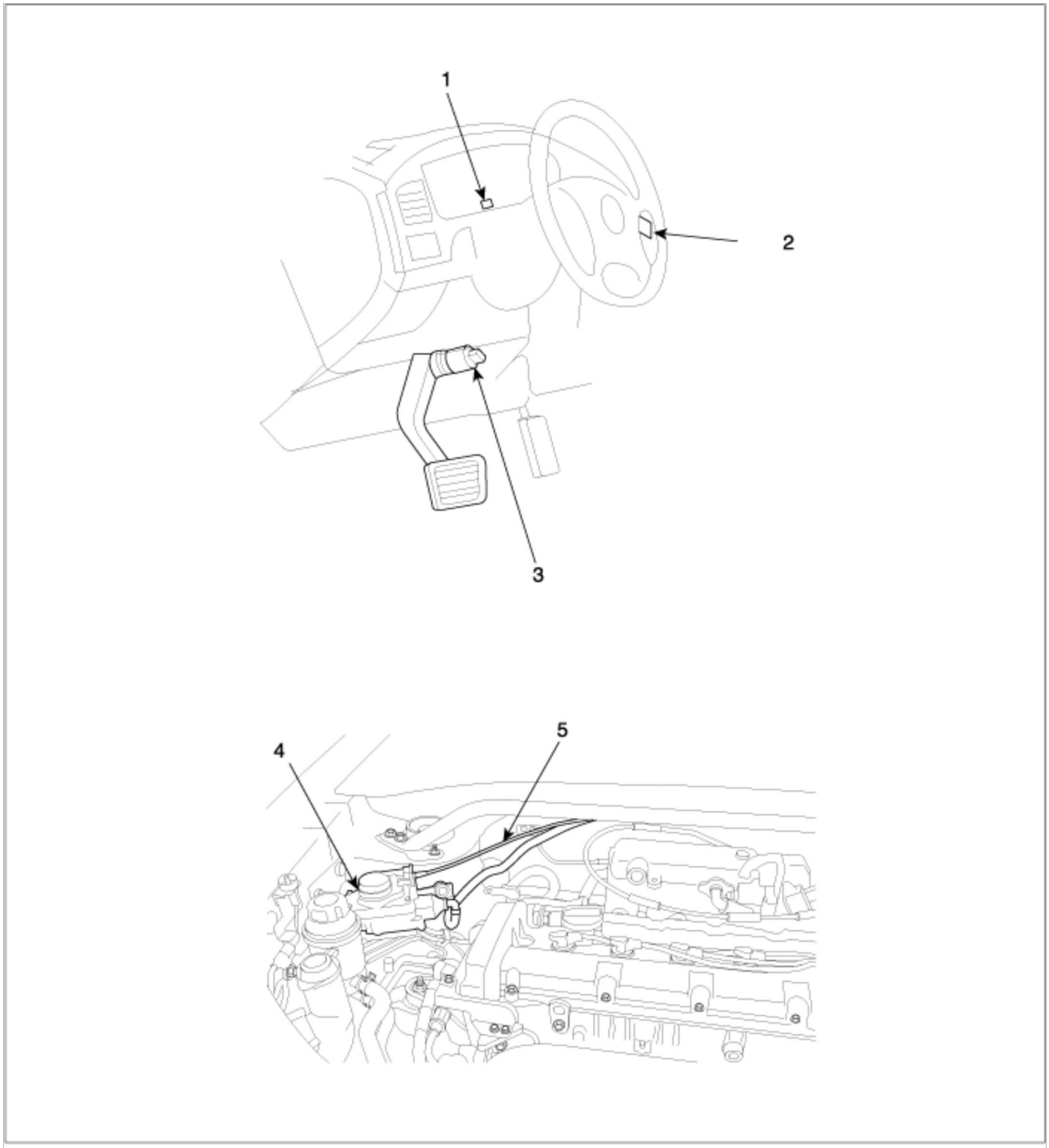
No	Name	Note
1	BRK	AUTUATOR CLUTCH
2	GND	GND
3	NC	NO CONNECTION
4	AT	OD CONTROL
5	STOP	STOP LAMP SW
6	SPD	SPEED SENSOR
7	IGN1	POWER SOURCE
8	GND	GND
9	MAIN	MAIN INDICATOR
10	CLU	INH./CLUTCH SW
11	COM	MAIN/COMMAND SW
12	NC	NO CONNECTION

CONNECTOR NO.



Engine Electrical System > Cruise Control System > Components and Components Location

COMPONENTS LOCATION



1. Cruise control indicator
2. Main switch
3. Brake switch
4. Actuator & unit assembly
5. Actuator cable

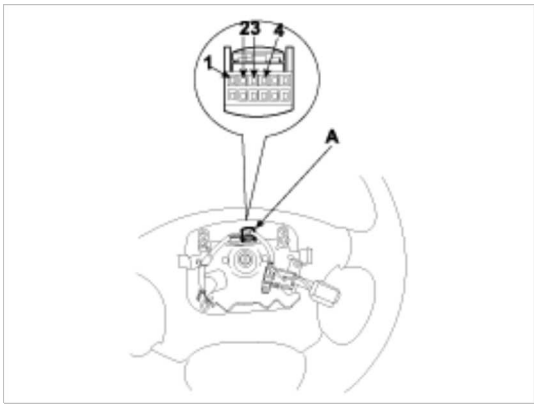
Engine Electrical System > Cruise Control System > Repair procedures

INSPECTION

CRUISE REMOCON SWITCH TEST

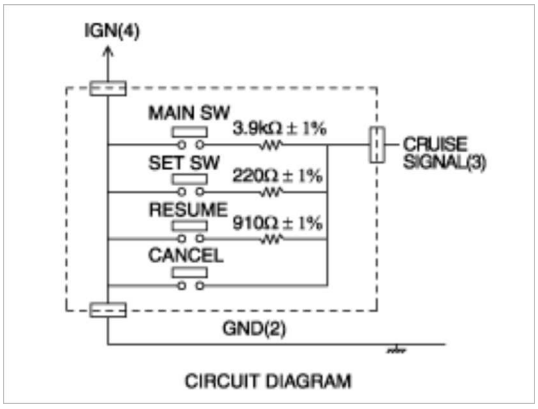
1. Disconnect the battery negative cable, then disconnect the positive cable, and wait at least three minutes.
2. Remove the driver's airbag (See page RT group-air bag module).

3. Disconnect the remocon switch connector(A).



4. Check the continuity between the terminals of the connector in each switch position according to the table.
   A. If there is continuity, and it matches the table, the switch is O.K.
   B. If there is no continuity, replace the remocon switch.

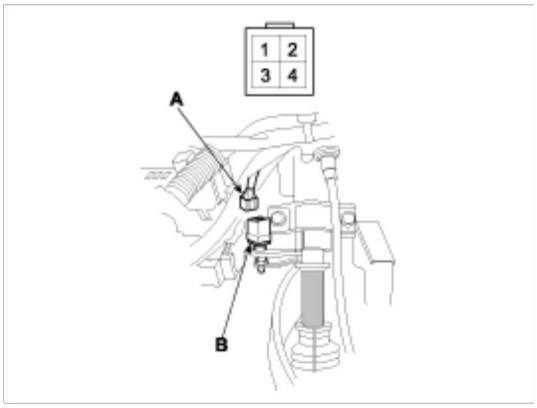
Position \ Terminal	1	2	3	4
MAIN (ON)			○—○	
SET (ON)		○—○		
RESUME (ON)		○—○		
CANCEL (ON)		○—○		



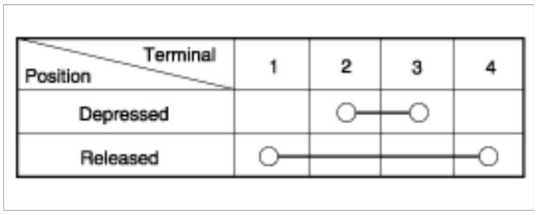
CIRCUIT DIAGRAM

BRAKE SWITCH TEST

1. Disconnect the connector(A) from the brake switch.
2. Remove the brake switch(B).



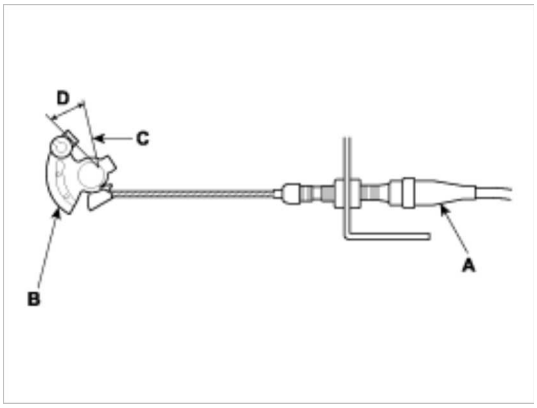
3. Check for continuity between the terminals according to the table.



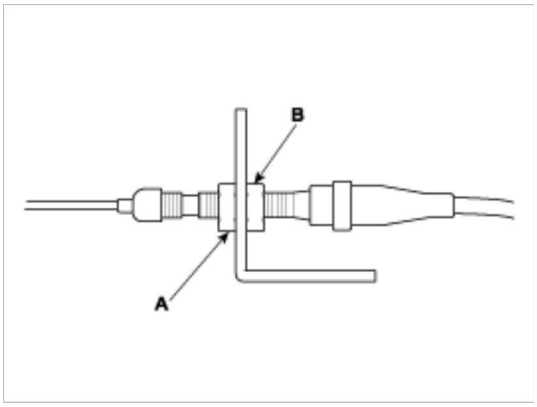
4. If necessary, replace the switch or adjust the pedal height.

ACTUATOR CABLE ADJUSTMENT

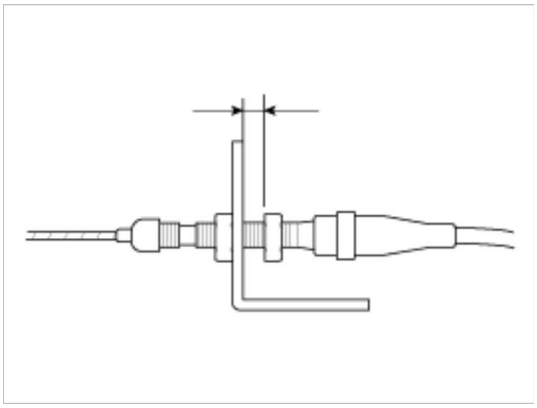
1. Check that the actuator cable (A) moves smoothly with no binding or sticking.



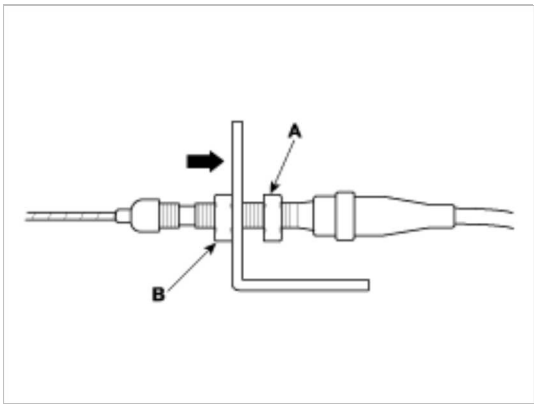
2. position, M/T in neutral) until the radiator fan comes on, then let it idle.
3. Measure the amount of movement of the output linkage (B) until the engine speed starts to increase.
   At first, the output linkage should be located at the fully closed position (C). The free play (D) should be 3.75±0.5 mm (0.15±0.02 in.)
4. If the free play is not within specs, move the cable to the point where the engine speed starts to increase, and tighten the locknut (A) and adjusting nut (B).



5. Turn the adjusting nut (A) until it is 3.75±0.5 mm (0.15±0.02 in.) away from the bracket (B).



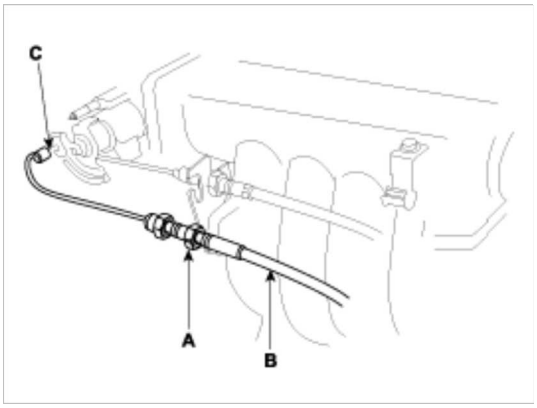
6. Pull the cable so that the adjusting nut (A) touches the bracket, and tighten the locknut (B).



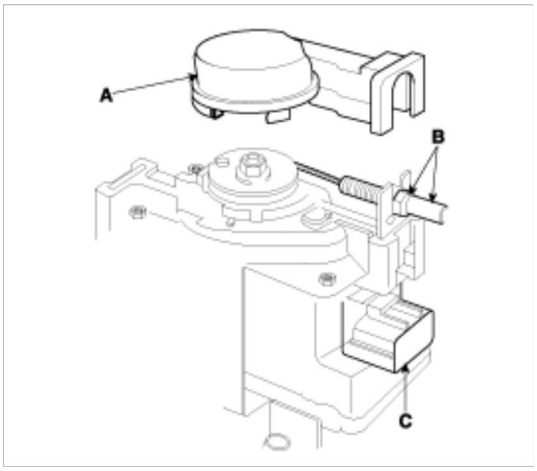
REPLACEMENT

CRUISE CONTROL UNIT AND CABLE

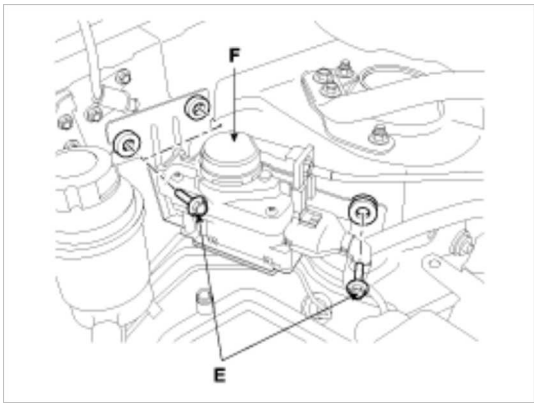
1. Loosen the locknuts(A) and disconnect the actuator cable (B) from the throttle linkage(C).



2. Disconnect the cover, actuator cable and connector.



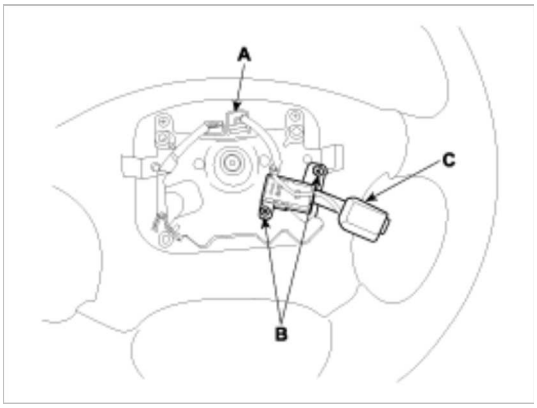
3. Loosen the three mounting bolts(E), and remove the actuator(F) with the bracket.



4. Installation is the reverse of removal.

CRUISE REMOCON SWITCH REPLACEMENT

1. Disconnect the battery negative cable, them disconnect the positive cable, and wait at least three minutes.
2. Remove the driver's airbg (See page RT group-air bag module).
3. Disconnect the remocon switch connector(A).
4. Loosen the two mounting screws(B), and remove the cruise remocon switch(C).



5. Installation is the reverse of removal.
6. Connect the battery positive cable and negative cable to the battery.