OPTIMA(MS) > 2005 > G 2.7 DOHC > Engine Electrical System

Engine Electrical System > General Information > Specifications

Specification

Ignition Coil

Item	V6 Engines
Type	
Primary coil resistance	0.74 ± 10% (Ω)
secondary coil resistance	13.3 ± 15% (Ω)

Spark Plug

Item	V6 Engines
NGK	PFR5N-11
	PFR6N-11
Champion	RC10PYP4
Plug gap	1.0~1.1 mm (0.039~0.043 in)

Starter motor

Item	All Engines
Type Voltage Output	Reduction drive (with planetary gear) 12V 1.2kW
No-load characteristics Terminal voltage Amperage Speed	 11V 90 A 2,800 RPM MIN.
Number of pinion teeth	8
Pinion gap	0.5-2.0 mm (0.0197-0.079 in.)

Battery

Item	2.4 Liter Engines	V6 Engines
Type	MF68AH(20HR)	MF68AH(20HR)
Coldcranking [at 17.8°C (0°F)]	540 A or more	540 A or more
Reserve capacity	110 min	110 min
Specific gravity [at 25°C (77°F)]	1.280 ± 0.01	1.280 ± 0.01

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NOTE

COLDCRANKINGAMPERAGE is the amperagea batteey can deliver for 30 seconds andmaintain a terminal voltage of 7.2 or greater at a specified temperature.RESERVE CAPACITY RATING is the amount of time a battery can deliver 25A ANDmaintain a minimum terminal voltage of 10.5 at 26.7°C(80°F).

Generator

Item	All Engines
Type Rated output Voltage regulator type Regulator setting voltage Temperature compensation	Battery voltage sensing 13.5 V 110A Electronic built-in type 14.55 ± 0.2V -7 ± 3 mV/°C

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	204-306	15-21

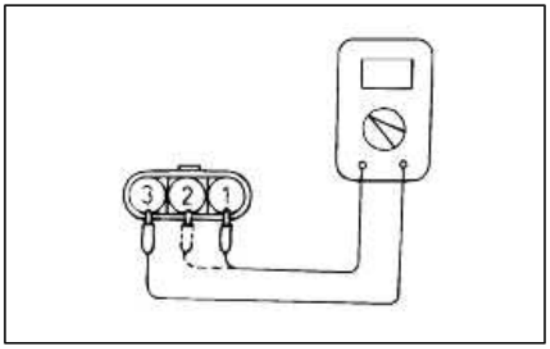
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Engine Electrical System > Ignition System > Ignition Coil > Repair procedures

INSPECTION

IGNITION COIL (2.4 Liter Engine : Power Transistor Bulilt-in)

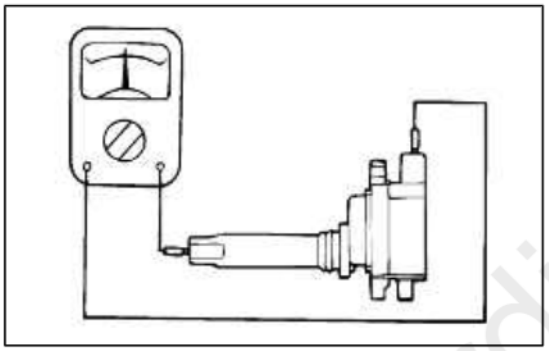
1. **Measurement of the primary coil resistance**
   Connect the negative (-) terminal of a 3V power supply to terminal 2 of the power transistor then check whether there is continuity between terminal3 and terminal 2 when terminal 1 and the positive (+) terminal are connected and disconnected.



Terminal 1 and (+) terminal	Terminal 3 and terminal 2
Connected	Continuity (Approx. 0.78Ω)
Disconnected	No continuity

Replace the power transistor if there is a malfunction.

1. **Measurement of the secondary coil resistance**
   Measure the resistance between the high-voltage terminals of the ignition coil.

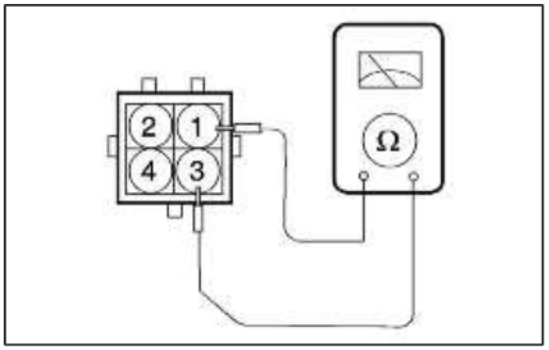


Standard value: Approximately 20 kΩ

IGNITION COIL (V6 ENGINE)

1. Measurement of the primary coil resistance
   Measure the resistance between connector terminals 4 and 3 (the coils at the No. 3 and No. 6 cylinder sides) of the ignition coil, and between terminals 4 and 1 (the coils at the No. 1 and No. 4 cylinder sides), and between terminals 4 and 2 (the coils at the No.2 and No.5 cylinder sides)

Standard value: 0.74 ± 10% (Ω)



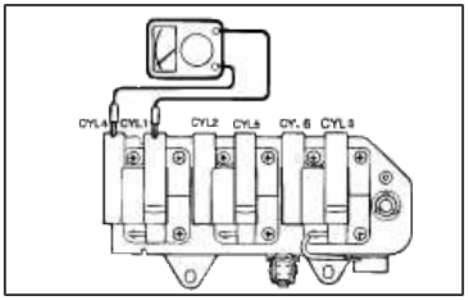
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2. Measurement of the secondary coil resistance
   Measure the resistance between the high-voltage terminal for the No. 3 and No. 6 cylinders, between the high-voltage terminals for the No. 1 and No. 4 cylinders and between the high-voltage terminals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

Standard value: 13.3 ± 15% (kΩ)

CAUTION

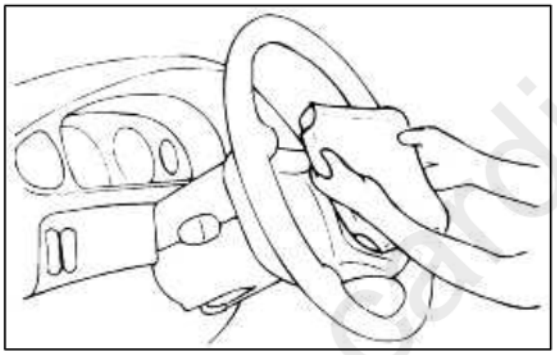
Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil



Engine Electrical System > Ignition System > Ignition Switch > Repair procedures

REMOVAL AND INSTALLATION

1. Disconnect the negative battery terminal.
2. Remove the air bag module.



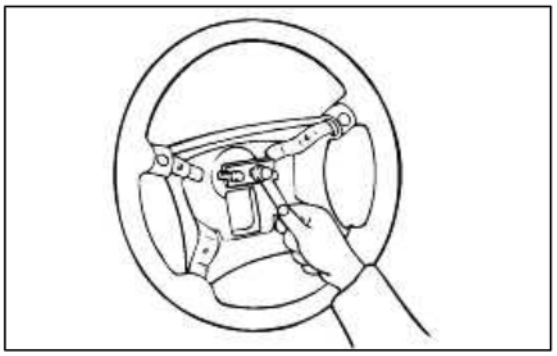
CAUTION

The SRS system is designed to retain enough power to deploy air bag for a short time even after the battery has been disconnected, so serious injury and/or death may result from unintended air bag deployment if service is done on the SRS system immediately after the negative (-) battery terminal is disconnected. Wait at least 30 seconds after disconnecting the negative (-) battery terminal before working on the SRS system.

3. Loosen the tapping screw and lift up horn pad and remove it.
4. Remove the lock nut and the washer.
5. Pulling the dynamic damper forward, lift it up and remove it.

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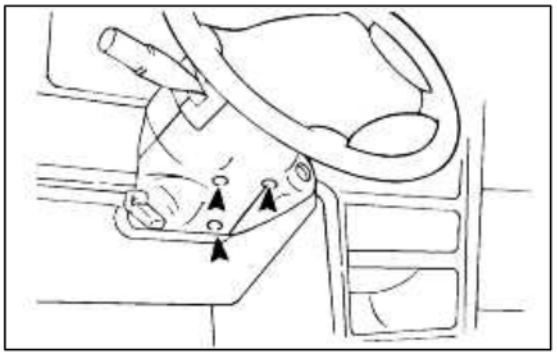
6. Install the special tool (09561-11001) and remove the steering wheel.



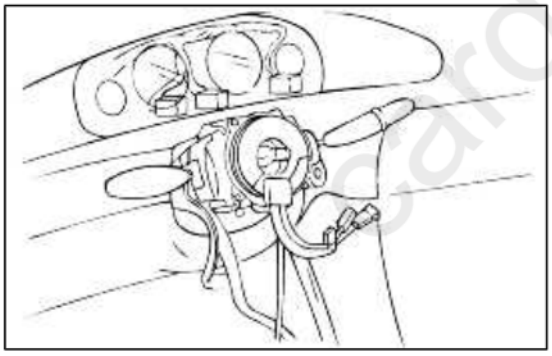
CAUTION

Do not hammer on the steering wheel to remove it, since that can damage the energy absorbing collapsible portion of the steering column, increasing the chance of personal injury or death in a frontal collision.

7. Remove the steering column lower and upper shrouds.
8. Remove the lower cover.



9. Disconnect the connectors and remove the multifunction switch. The ignition switch still cannot be removed. The entire lower portion of the dash has to be removed and the steering column has to be dropped otherwise it's impossible to remove the ignition switch.



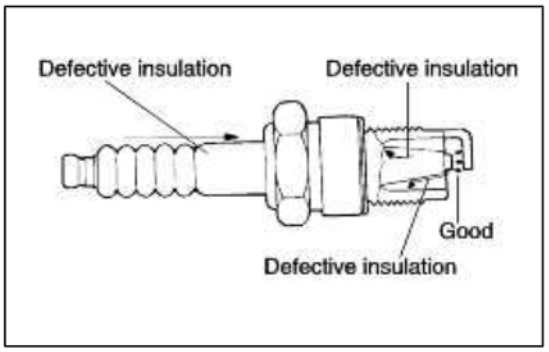
10. Remove the mounting bolts and separate ignition switch from steering column.

Engine Electrical System > Ignition System > Spark Plug > Repair procedures

INSPECTION

1. Remove the spark plug and connect to the spark plug cable.
2. Ground the spark plug outer electrode, and crank the engine.

3. Check to be sure that there is an electrical discharge between the electrodes at this time.



NOTE

When replacing the spark plug, should use the genuine parts having resistance.

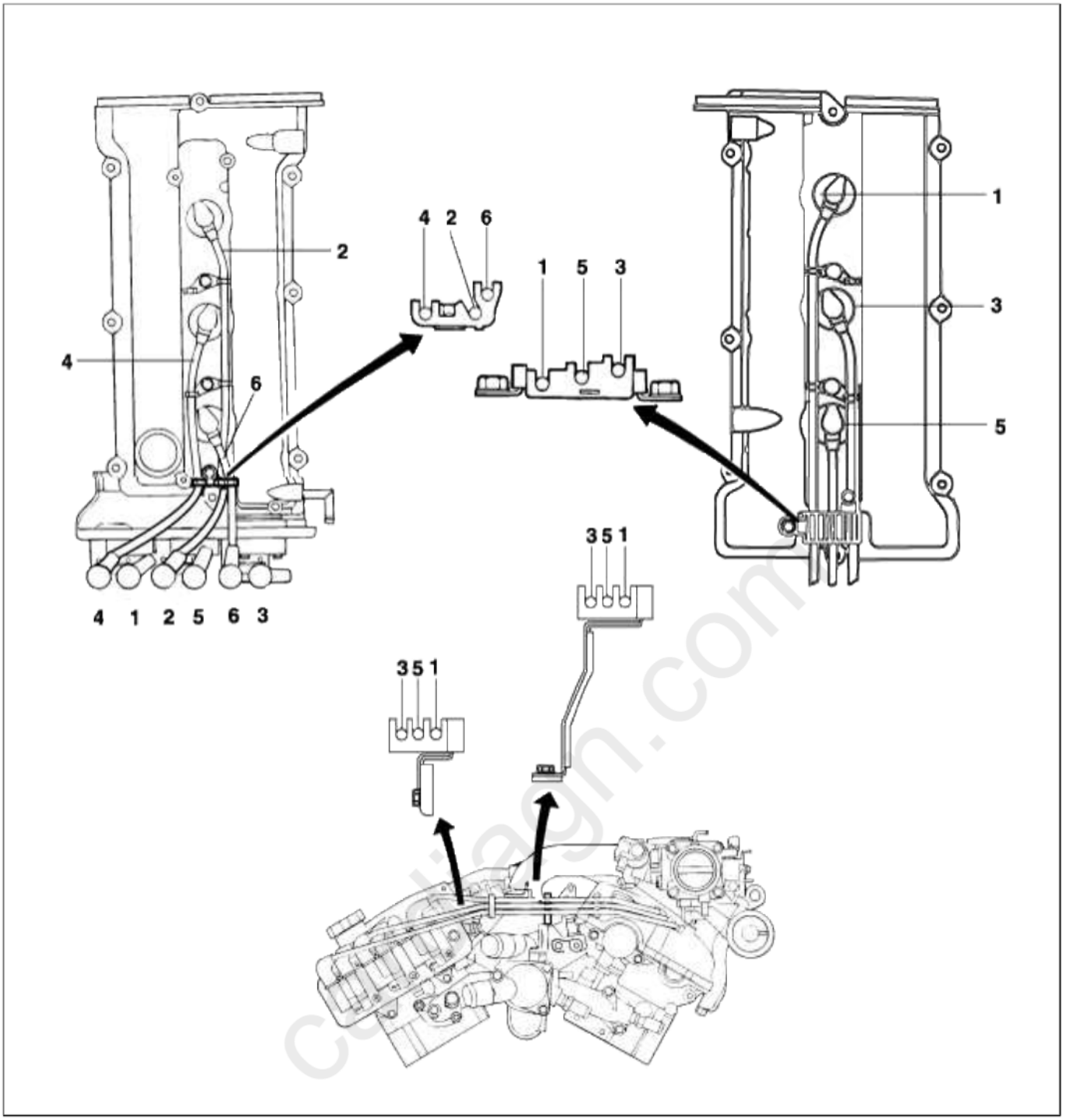
Engine Electrical System > Ignition System > Spark Plug Cable > Repair procedures

INSTALLATION (V6 Engine)

Improper arrangement of spark plug cables will induce voltage between the cables, causing misfiring and surging at acceleration in high-speed operation.

Therefore, be careful to arrange the spark plug cables properly as shown in the illustration.

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Engine Electrical System > Ignition System > Description and Operation

GENERAL INFORMATION

Ignition timing is controlled by the electric control ignition timing system. The ignition timing data for the engine operating conditions are programmed in the memory of the engine control module (ECM).

The engine conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based upon these sensor signals and the ignition timing data, signals to interrupt he primary current are sent to the power transistor. The ignition coil is activated, and timing is controlled at the optimum point.

Engine Electrical System > Ignition System > Troubleshooting

TROUBLESHOOTING GUIDE

Trouble condition	Probable cause	Remedy
Engine will not start or is hard to start. (Cranks OK)	Ignition lock switch faulty	Replace ignition lock switch
	Ignition coil faulty	Inspect ignition coil
	Power transistor faulty	Inspect power transistor
	Spark plugs faulty	Replace plugs
	Ignition wiring disconnected or broken	Inspect wiring
	Spark plugs faulty	Replace plugs
Rough idle or stalls	Ignition wiring faulty	Inspect wiring
	Ignition coil faulty	Inspect ignition coil
	Spark plug cable faulty	Inspect spark plug cable
Engine hesitates/poor acceleration	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Inspect ignition coil
Poor mileage	Spark plugs faulty	Replace plugs

Engine Electrical System > Ignition System > Repair procedures

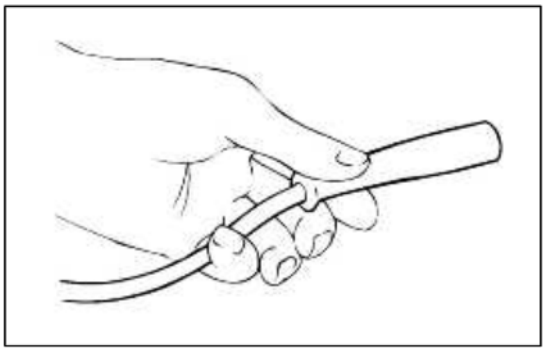
Inspection and Cleaning

1. Disconnect the spark plug cable from the spark plug.

> NOTE
>
> Pull on the spark plug cable boot when removing the spark plug cable, not the cable, as it may be damaged.

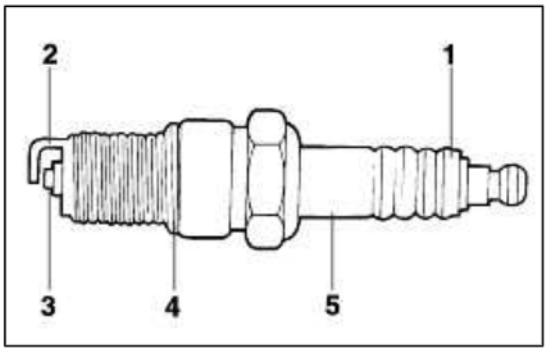
2. Using spark plug wrench, remove all of the spark plugs from the cylinder head.

> CAUTION
>
> Take care not to allow contaminants to enter through the spark plug holes because severe engine damage could occur.



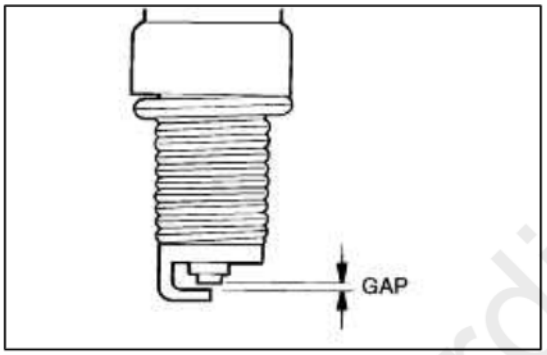
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3. Check spark plugs for the following:
   (1) Broken insulator
   (2) Worn electrode
   (3) Carbon deposits
   (4) Damaged or broken gasket
   (5) Condition of the porcelain insulator at the tip of the spark plug.



4. Check the spark plug gap using a wire gap gauge, and adjust if necessary.

Standard value :
Spark plug gap : 1.0-1.1 mm (0.039-0.043 in.)



5. Install the spark plug and tighten to the specified torque.

CAUTION

If the spark plug is over-tightened, damage to the threaded portion of the cylinder head may result.

Tightening torque
Spark plug : 20-30 Nm (204-306 kg.cm, 15-21 lb.ft)

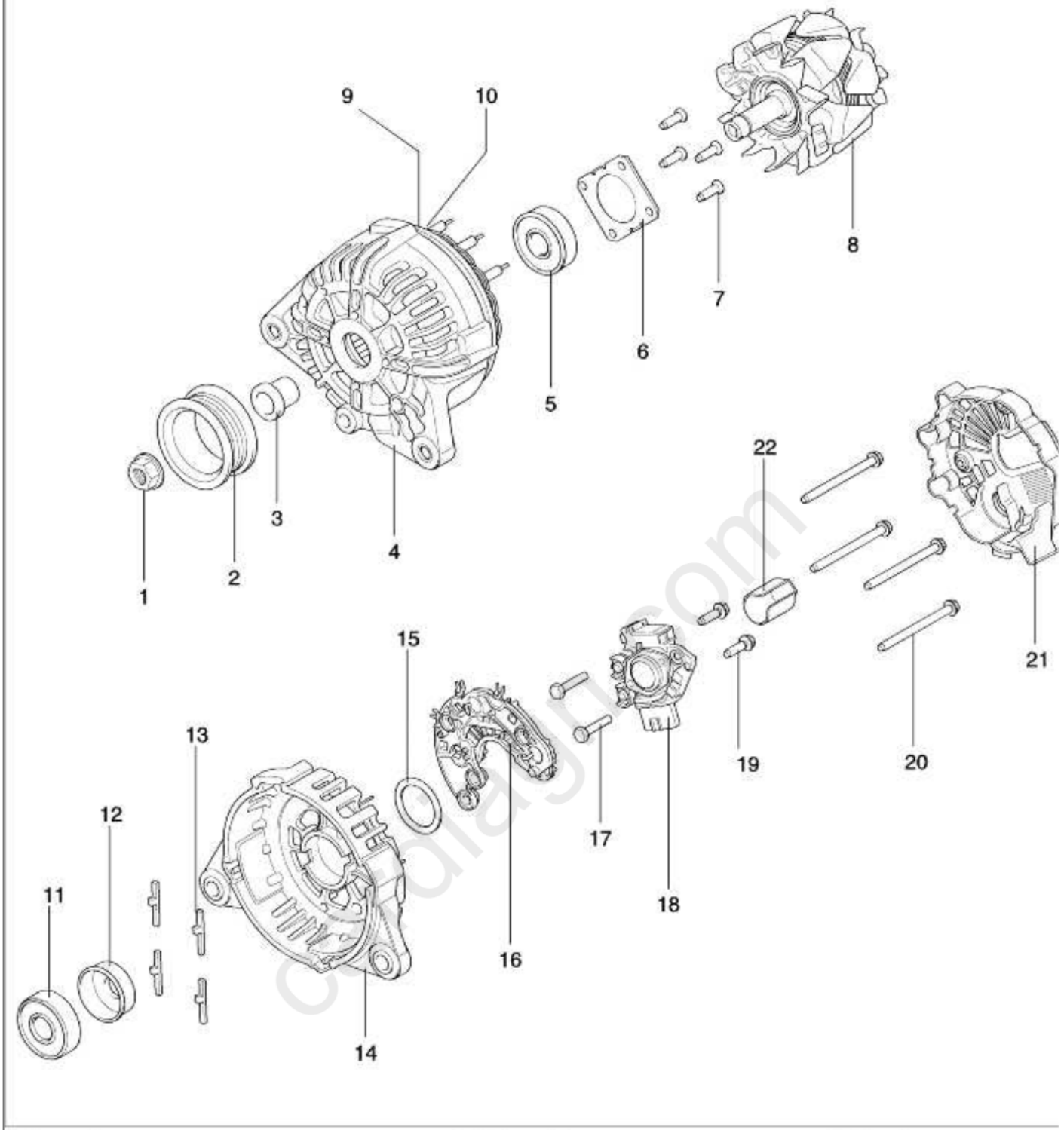
NOTE

When replacing the spark plug, should use the genuine parts having resistance.

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

COMPONENTS (CONTINUED)

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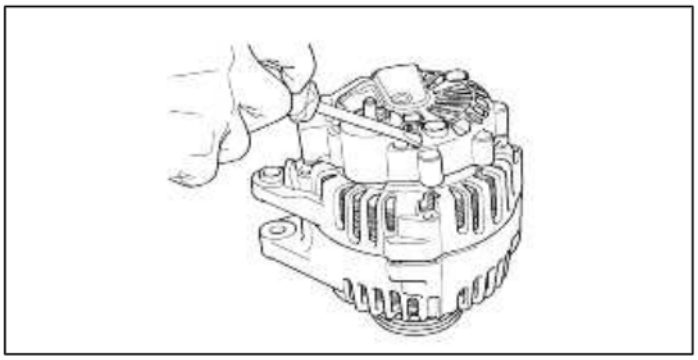


1. Hex nut	8.Rotor coil	15.Seal
2. Pulley	9.Silicon injection	16.Rectifier
3. Bushing	10.Stator coil	17.Bolts
4. Front cover assembly	11.Rear bearing	18.Brush holder assemb
5. Front bearing	12.Bearing cover	19.Brush holder bolt
6. Bearing cover	13.Damper	20.Bolts
7. Bearing bolt	14.Rear cover	21.Cover
		22.Guard

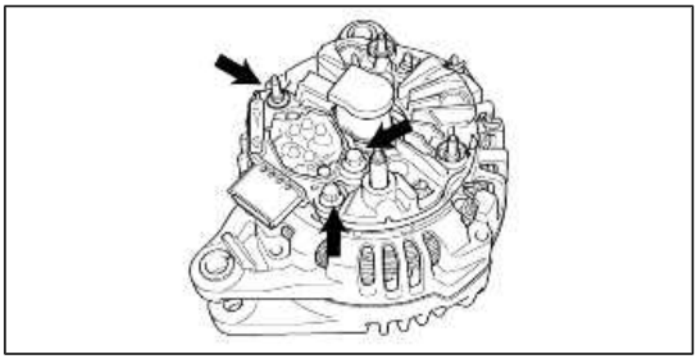
Engine Electrical System > Charging System > Alternator > Repair procedures

Disassembly

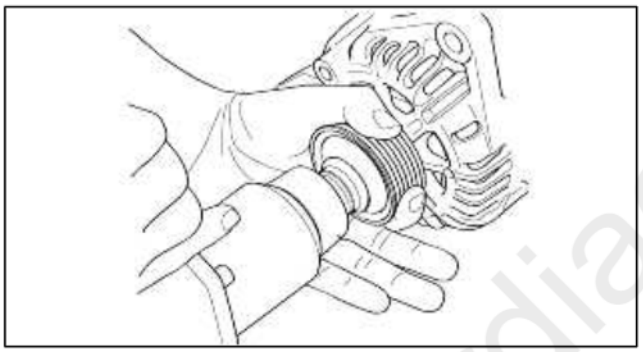
1. Remove the generator cover using a screwdriver or equivalent.



2. After loosening the 3 mounting bolts, detach the brush holder assembly.



3. Remove the nut, pulley, and spacer.

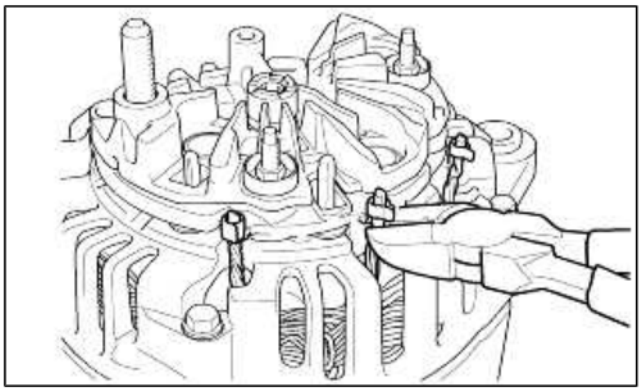


NOTE

Put on gloves to protect hands during working.

CAUTION

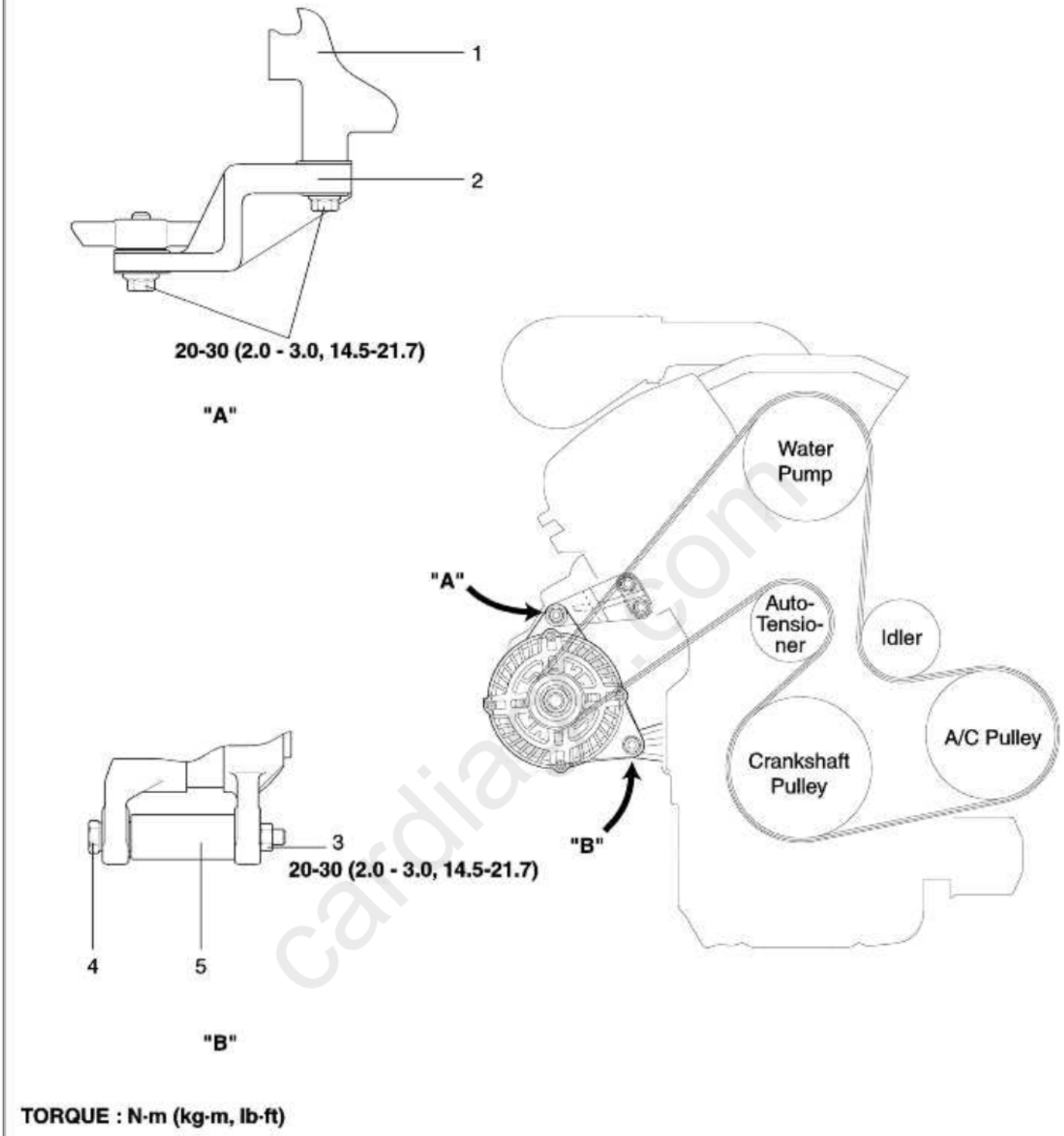
Cutting the stator coil lead line connecting to the rectifier may damage the generator beause the rectifier and the stator coil lead line are soldered together. So, do not disassembles further



4. Reassembly is the reverse of disassembly.

REMOVAL

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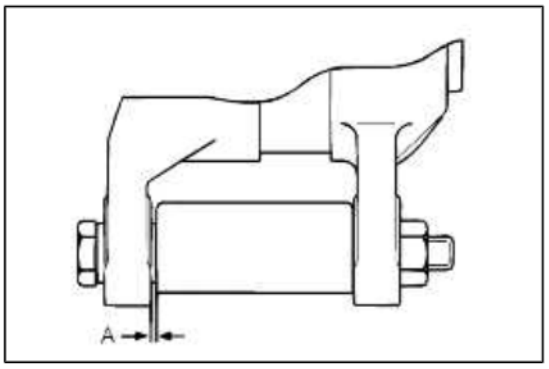


1. Cylinder head
2. Mounting Bracket
3. Plange nut
4. Bolt
5. Front case

Installation

1. Place the alternator and insert a support bolt (Do not insert a nut this time).
2. After pushing the alternator forward, count that how many spacers (a spacer thickness : 0.198 mm) should be inserted between the alternator front leg and front case as shown in "A".

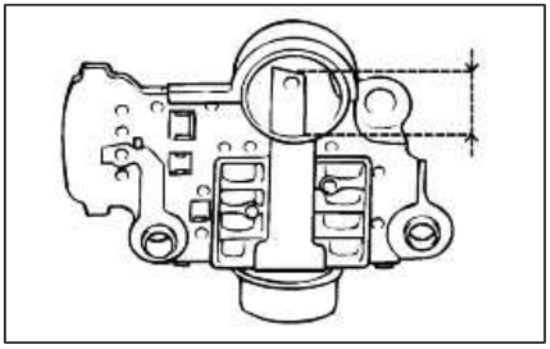
3. After inserting spacers, insert and tighten a nut securely.



BRUSH REPLACEMENT

1. Measure the length of the brush protrusion shown in the illustration, and replace the brush if the measured value is below the limit value.

Limit : 2mm (0.079 in.) or less

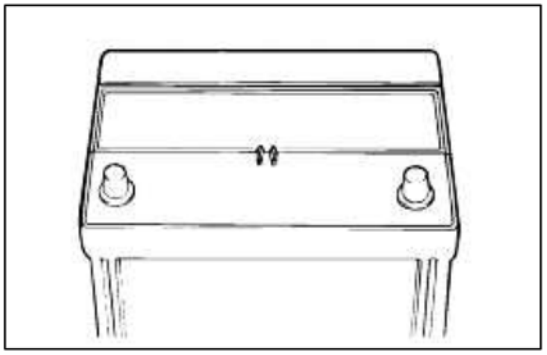


2. The brush can be removed if the solder of the brush lead wire is removed.
3. When installing a new brush, insert the brush into the holder, and then solder the lead wire.

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.

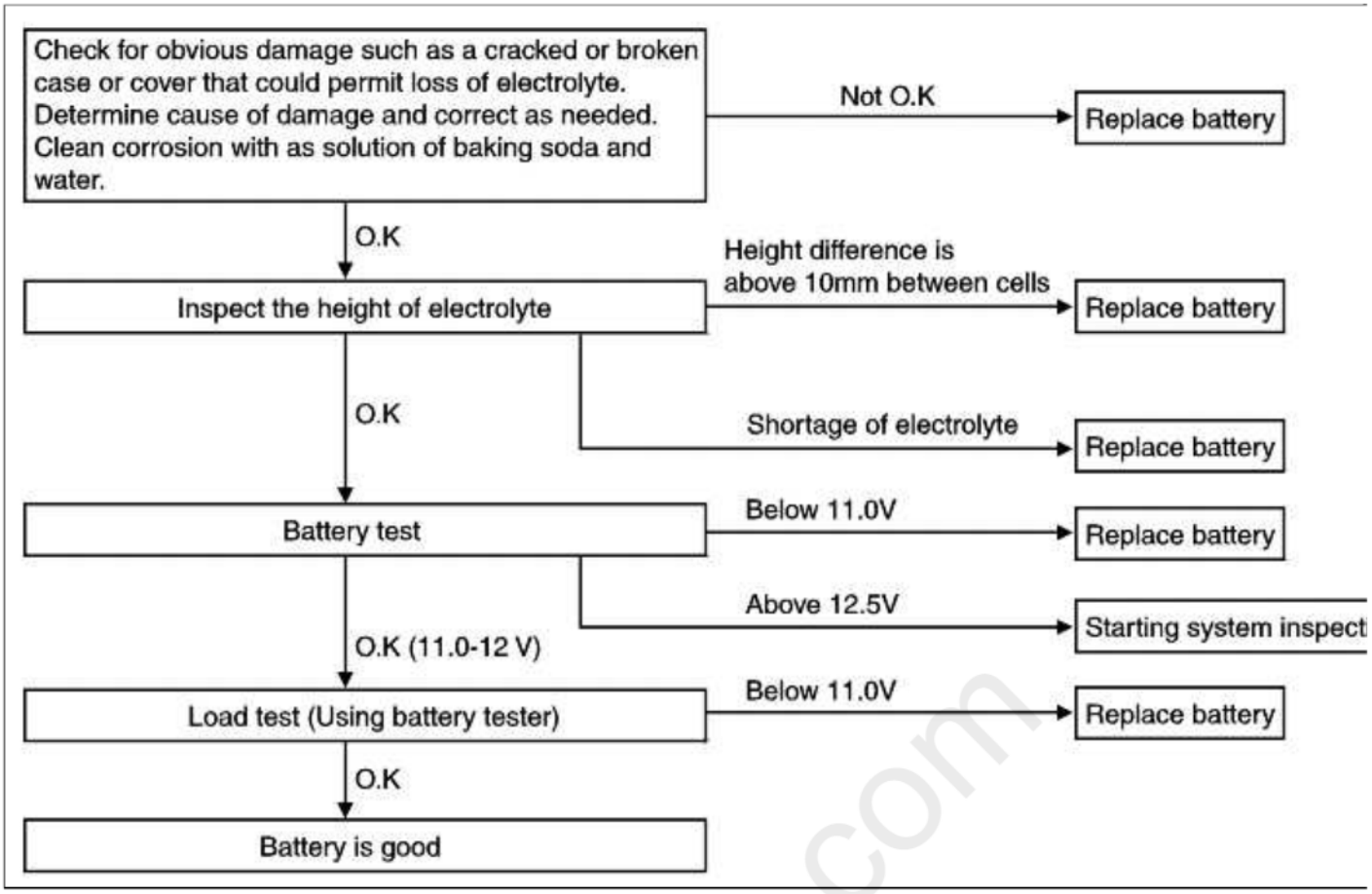


Engine Electrical System > Charging System > Battery > Troubleshooting

BATTERY INSPECTION (1)

1. Checking flow

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2. Checking Sheet

Item	Trouble	Cause	Remedy	Decision of and battery	
				User	Manufacture
1. Visual Inspection	• Battery terminal damage	• Dealing carelessness • Bad tightening condition between battery cable and terminal	Replace	O	
	Cover Breakage	• Dealing carelessness	Replace	O	
	• Electrolyte leakage				
	- Cover breakage	• Dealing carelessness	Replace	O	
	- Cover sealing part leakage	• Bad cover sealing	Replace		O
2. Electrolyte height	• Electrolyte height	• Cell short	Replace		O

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height inspection	height between cells is over 10mm	• Vaporization caused by outer temperature	Replace	O	
	• Shortage of electrolyte	• Electrolyte loss caused by over-charge	Replace	O	
3. Voltage inspection	1. Battery voltage < 13.2V 2. 12.5V < Battery voltage < 12.9V	1. Over charge 2. Normal	• Replace • Check the electric system	O	
	3. 12.0V < Battery voltage < 12.4V (Simple discharge)	1. Insufficient charge 2. Internal failure	• Battery Load Test (Refer to Load Test sheet)	O	
	4. 11.0 < Batter voltage <12.0 (Over discharge)			O	
	5. Battery voltage : 11.0V	1. Charge condition failure	Replace	O	
		2. Let the battery alone on discharge conditionfor long period		O	
		3. Internal circuit open			O

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3. Load Test

1. When discharging the battery for 15 seconds at half the rated current, the battery voltage should be more than the voltage shown in the following table.

Ambient Temperature	Voltage
above 20°C	9.6V
~ 18°C	9.5V
~ 10°C	9.4V
~ 4°C	9.3V
~ -1°C	9.1V
~ -7°C	8.9V
~ 12°C	8.7V

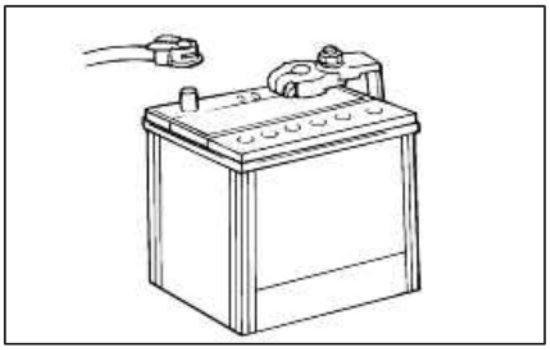
2. When the voltage is not within specification, test 2nd load test again, and if not, do the re-charge.

3. If the battery voltage (left alone within 2 hours after re-charging) is over 12.5V and the voltage after load test is over the standard value, this battery can be used.

Engine Electrical System > Charging System > Battery > Repair procedures

BATTERY INSPECTION (2)

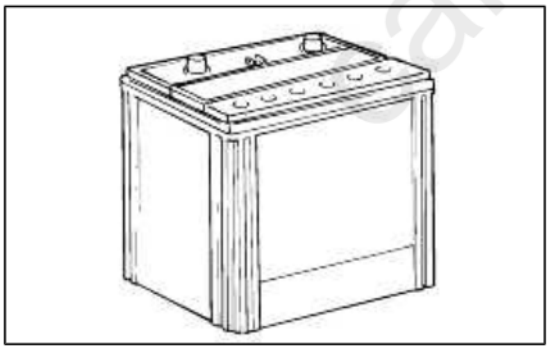
1. Make sure ignition switch is in the Off position and all accessories are Off.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.



WARNING

Care should be taken because of the risk that the battery case is cracked or leaking to protect your skin from the battery electrolyte. A suitable pair of industrial rubber gloves should be worn when removing the battery. Do not use household cleaning gloves when handling the battery.

4. Inspect the battery carrier for damage caused by the loss of acid from the battery. If acid damage is present, it will be necessary to clean the areawith 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 in Step(4).
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 cleaner.
8. Clean the inside surface of the terminal clamps with a suitable battery terminal 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 the top of the terminal are flush with the top of the post.
11. Tighten the terminal nut securely.

12. Coat all connections with light mineral grease after tightening.

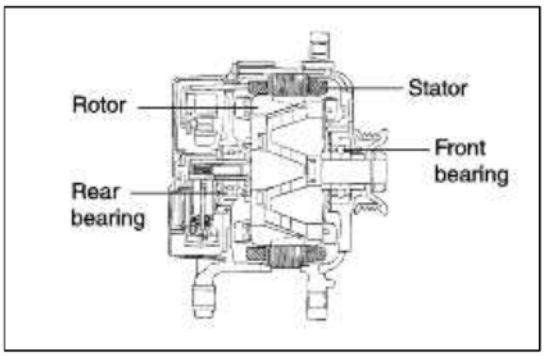
> WARNING
>
> When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not use open flames or smoke near batteries being charged or which have recently been charged. Do not break live circuits at the terminals of the batteries being charged. A spark will occur where the circuit is broken, which could ignite the fumes and cause an explosion.

Engine Electrical System > Charging System > Description and Operation

GENERAL INFORMATION

The charging system includes a battery, a generator with integrated voltage regulator and a charging system indicator light and related circuitry. Thegenerator has six built-in diodes (three positive and three negative), each rectifying AC current to DC current. Therefore, DC current appears at generator "B" terminal.

Additionally, the generator charging voltage 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 > Troubleshooting

TROUBLESHOOTING GUIDE

Trouble condition	Probable cause	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connections
	Electronic voltage regulator faulty	Replace voltage regulator
Charging warning indicator does not go out with engine running (Battery requires frequent recharging)	Drive belt loose or worn	Adjust tension or replace drive belt
	Battery cables loose, corroded or worn	Repair or replace cables
	Fuse blown	Check fuses
	Fusible link blown	Replace fusible link
	Electronic voltage regulator or generator faulty	Test generator
	Wiring faulty	Repair wiring

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Engine hesitates/poor acceleration Overcharge	Drive belt loose or worn	Adjust tension or replace drive belt
	Wiring connection loose or open circuit	Tighten loose connection or repair wiring
	Fusible link blown	Replace fusible link
	Poor grounding	Repair
	Electronic voltage regulator or generator faulty	Test generator
	Worn battery	Replace battery
	Electronic voltage regulator faulty	Replace voltage regulator
	Voltage sensing wire faulty	Repair wire

Engine Electrical System > Charging System > Repair procedures

INSPECTION (FOR V6 ENGINE)

VOLTAGE DROP TEST OF GENERATOR OUTPUT WIRE[2.7L V6]

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

PREPARTION

CONDITIONS FOR THE TEST

RESULT

REGULATED VOLTAGE TEST[2.7L V6]

Preparation

Test

RESULT

OUTPUT CURRENT TEST[2.7L V6]

Preparation

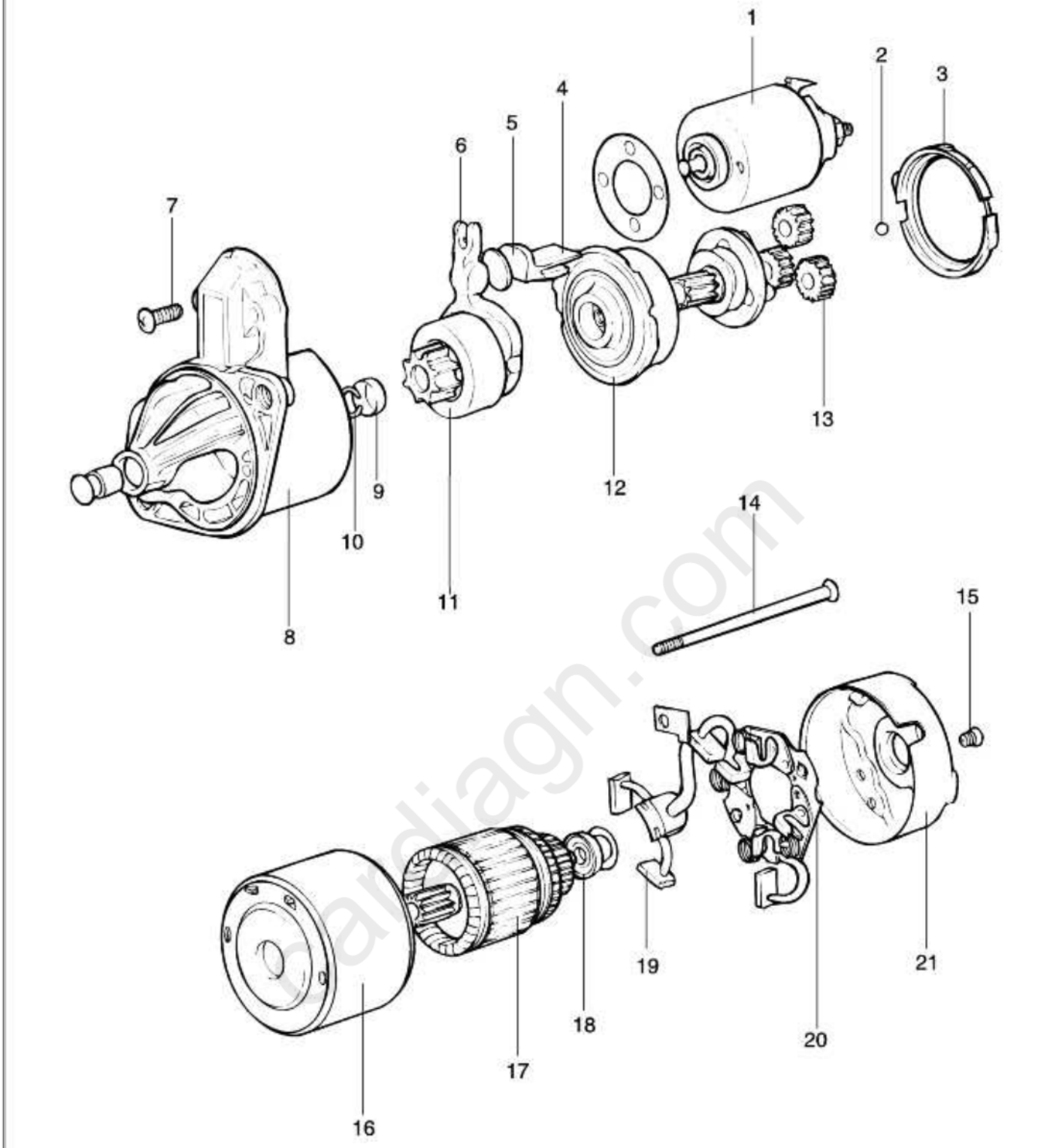
Test

Result

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

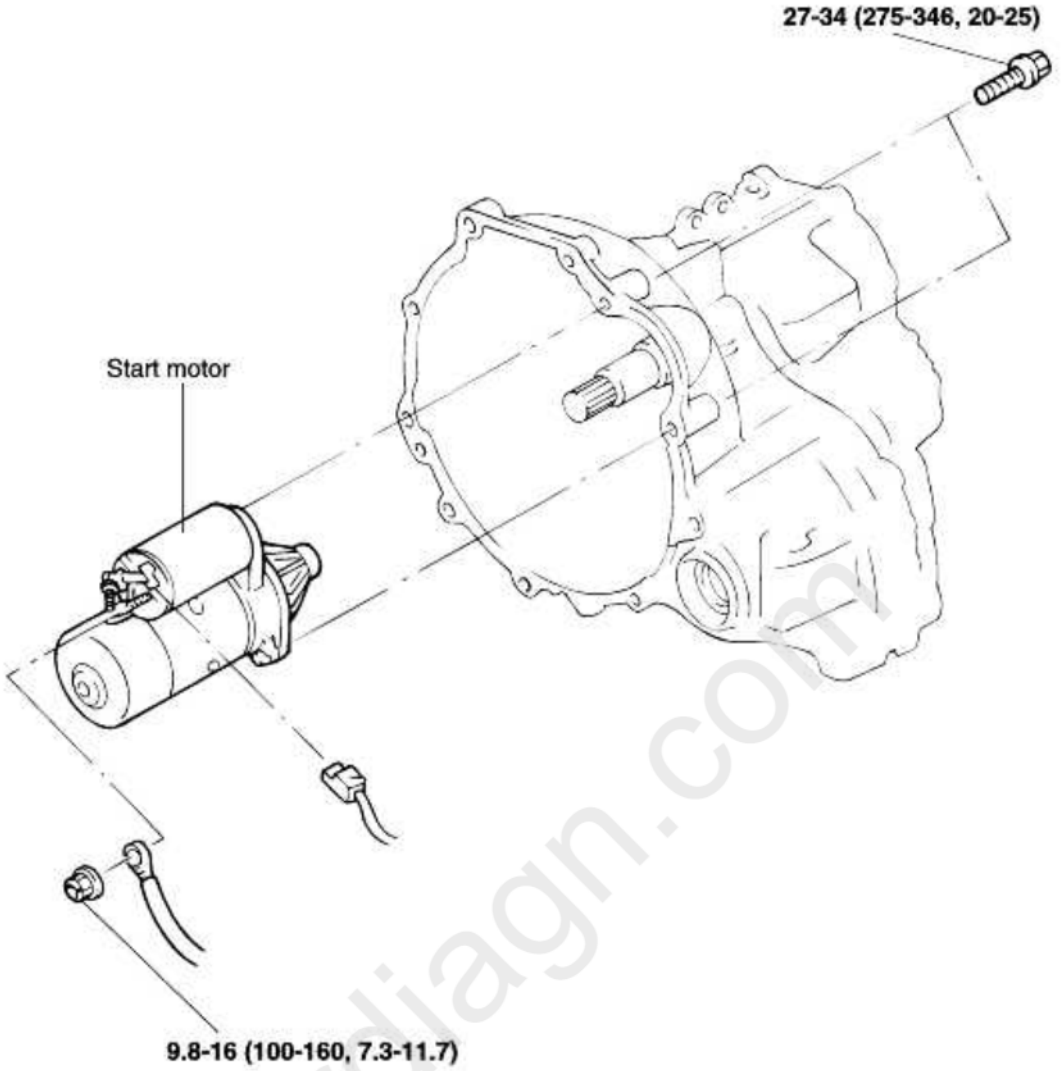
COMPONENTS

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1. Magnetic switch	8. Front bracket	15.Screw
2. Bal	9. Snap ring	16Yoke assembly
3. Packing A	10.Stop ring	17.Armature
4. Packing B	11.Overunning clutch	18.Rear bracket
5. Plate	12.Internal gear	19.Brush
6. Lever	13.Planetary gear	20.Brush holder
7. Screw	14.Screw	21.Rear bearing

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

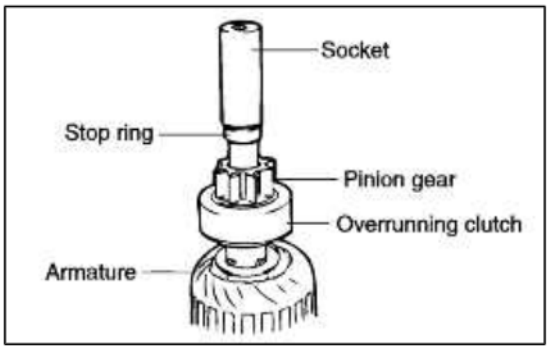
1. Discconnect the battery ground cable.
2. Remove the speed meter cable and the shift cable.
3. Disconnect the starter motor connector and terminal.
4. Remove the starter motor assembly.
5. Installation is the reverse order of removal.

Engine Electrical System > Starting System > Starter > Repair procedures

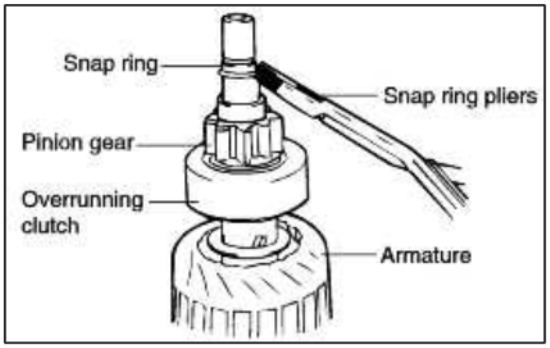
REMOVAL (SNAP RING AND STOP RING)

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1. Press the stop ring to the snap ring side using a socket wrench, to the snap ring side.

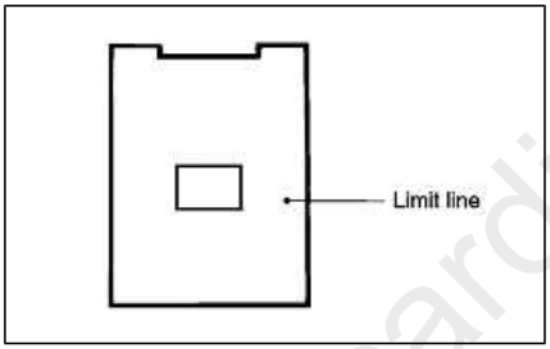


2. After removing the snap ring (using snap-ring pliers), remove the stop ring and the overrunning clutch.

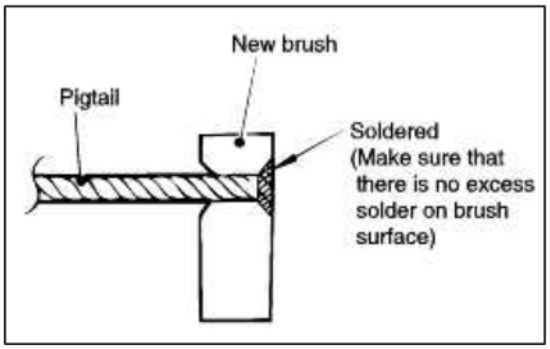


REPLACEMENT (BRUSHES AND SPRINGS)

1. Brushes that are worn beyond wear limit line, or oil-soaked, should be replaced.
2. When replacing field coil brushes, crush worn brush with pliers, taking care not to damage pigtail.



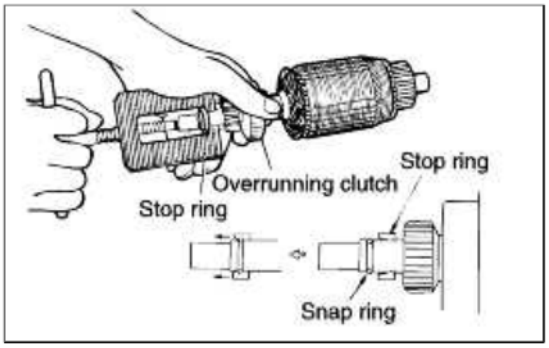
3. Sand pigtail end with sandpaper to ensure good soldering.
4. Insert pigtail into hole provided in new brush and solder it. Make sure that pigtail and excess solder do not come out onto brush surface.
5. When replacing ground brush, slide the brush from brush holder by prying retaining spring back.



INSTALLATION OF THE STOP RING AND SNAP RING

Using a suitable pulling tool, pull overrunning clutch stop ring over snap ring

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CLEANING

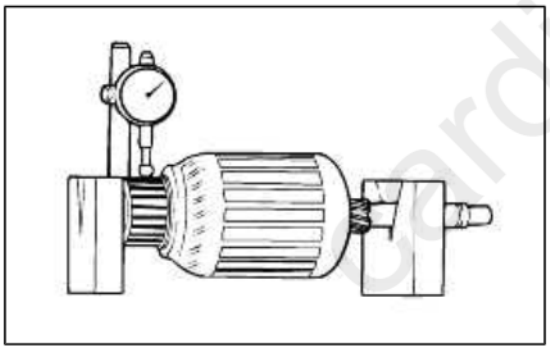
1. Do not immerse parts in cleaning solvent. Immersing the yoke and field coil assembly and/or armature will damage insulation. Wipe these parts with a cloth only.
2. Do not immerse drive unit in cleaning solvent. Overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from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

INSPECTION

CHECKING THE COMMUTATOR

1. Place the armature on a pair of V-blocks, and check the deflection by using a dial gauge.

Standard value:
Armature deflection : 0.05 mm (0.002 in.)
Limit:
Armature deflection : 0.1 mm (0.0039 in.)



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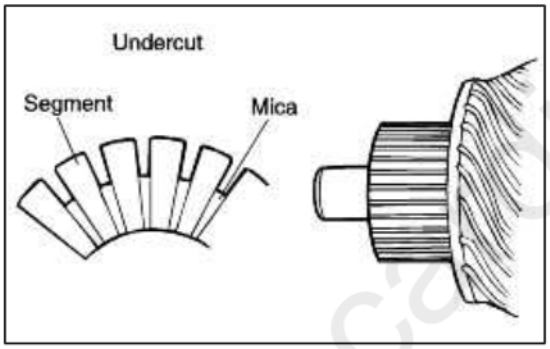
2. Check the outr diameter of the commutator.

Standard value:
Outer diameter of the commutator : 29.4 mm (1.157 in.)
Limit:
Outer diameter of the commutator : 28.4 mm (1.118 in.)



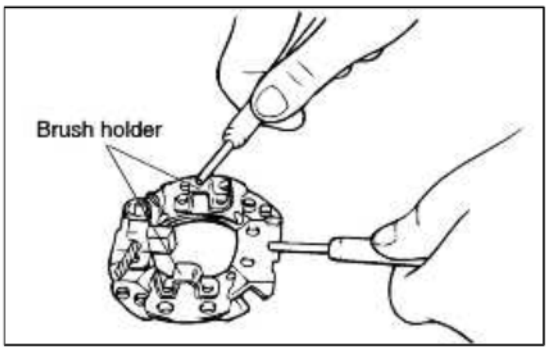
3. Check the depth of the undercut between segments.

Standard value:
Depth of the undercut between segments
: 0.5 mm (0.020 in.)
Limit:
Depth of the undercut between segments
: 0.2 mm (0.0079 in.)



BRUSH HOLDER

Check for continuity between the brush holder plate and the brush holder. The normal condition is no continuity.



OVERRUNNING CLUTCH

1. While holding clutch housing, rotate the pinion. Drive pinion should rotate smoothly in one direction, but should not rotate in opposite direction. If clutch does not function properly, replace overrunning clutch assembly.

2. Inspect pinion for wear or burrs. If pinion is worn or burred, replace overrunning clutch assembly. If pinion is damaged, also inspect ring gear for wear or burrs.



FRONT AND REAR BRACKET BUSHING

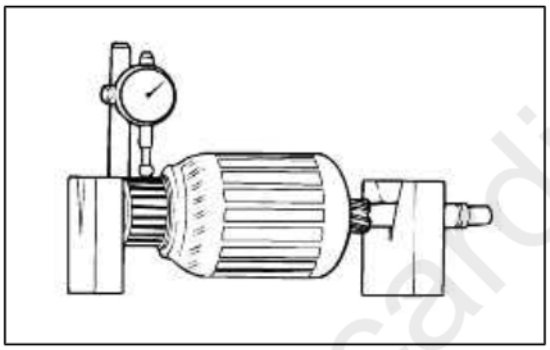
Inspect bushing for wear or burrs. If bushing is worn or burred, replace front bracket assembly or rear bracket assembly.

INSPECTION

CHECKING THE COMMUTATOR

1. Place the armature on a pair of V-blocks, and check the deflection by using a dial gauge.

Standard value:
Armature deflection : 0.05 mm (0.002 in.)
Limit:
Armature deflection : 0.1 mm (0.0039 in.)



2. Check the outr diameter of the commutator.

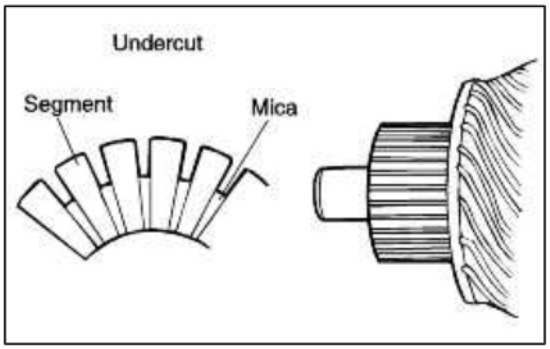
Standard value:
Outer diameter of the commutator : 29.4 mm (1.157 in.)
Limit:
Outer diameter of the commutator : 28.4 mm (1.118 in.)



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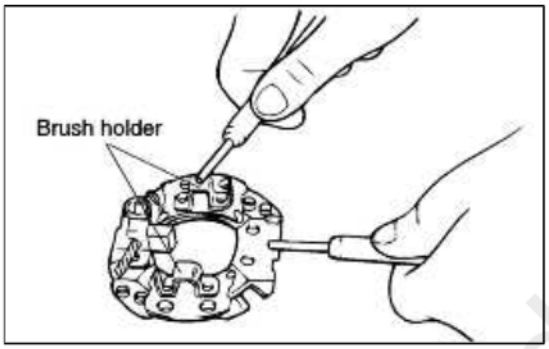
3. Check the depth of the undercut between segments.

Standard value:
Depth of the undercut between segments
: 0.5 mm (0.020 in.)
Limit:
Depth of the undercut between segments
: 0.2 mm (0.0079 in.)



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Check for continuity between the brush holder plate and the brush holder. The normal condition is no continuity.



OVERRUNNING CLUTCH

1. While holding clutch housing, rotate the pinion. Drive pinion should rotate smoothly in one direction, but should not rotate in opposite direction. If clutch does not function properly, replace overrunning clutch assembly.
2. Inspect pinion for wear or burrs. If pinion is worn or burred, replace overrunning clutch assembly. If pinion is damaged, also inspect ring gear for wear or burrs.



FRONT AND REAR BRACKET BUSHING

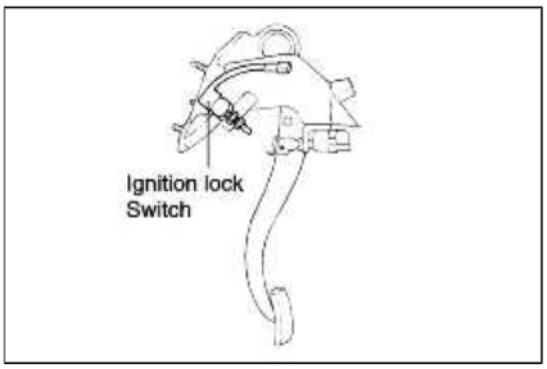
Inspect bushing for wear or burrs. If bushing is worn or burred, replace front bracket assembly or rear bracket assembly.

Engine Electrical System > Starting System > Ignition Lock Switch > Repair procedures

CHECK INSPECTION

CLUTCH PEDAL

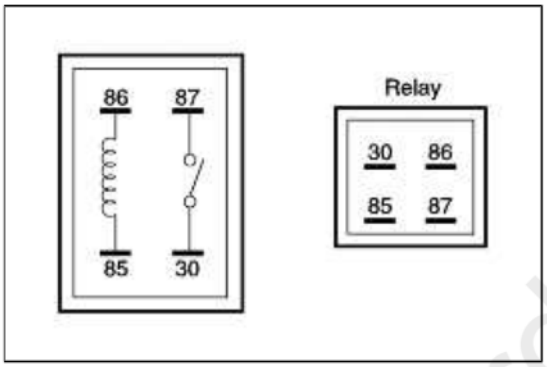
Check that pedal height, pedal freeplay and clutch pedal clevis pin play are correct. (Refer to clutch group)



STARTER RELAY

Remove the starter relay and check continuity between the terminals. If the continuity is not as specified, replace the relay.

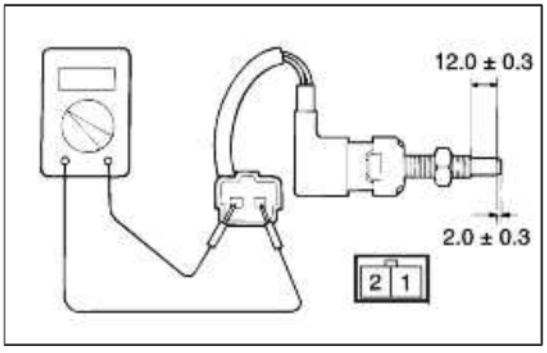
Terminal No. / Condition	85	86	87	30
When de-energized	○	○		
When energized	○	○	○	○



IGNITION LOCK SWITCH

Remove the ignition lock switch and check continuity between the terminals. If the continuity is not as specified, replace the switch.

Terminal / Condition	1	2
Pushed	○	○
Free		



Engine Electrical System > Starting System > Description and Operation

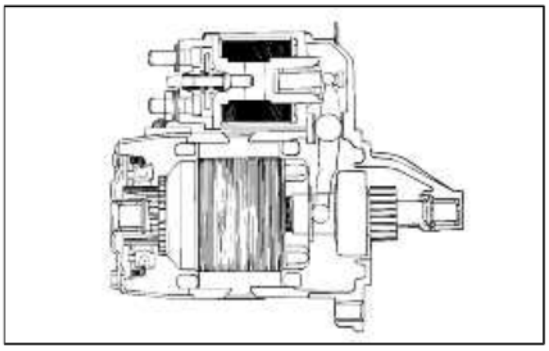
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GENERAL INFORMATION

The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch (A/T only), connection wires and the battery cables.

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 > Troubleshooting

TROUBLESHOOTING GUIDE

Trouble condition	Probable cause	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Transaxle range switch faulty (Vehicle with automatic transaxle only)	Adjust or replace switch
	Fusible link blown	Replace fusible link
	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Replace ignition switch
	Ignition lock switch faulty	Replace ignition lock switch
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Starter motor faulty	Repair starter motor
Starter keeps running	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Replace ignition switch
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor faulty	Repair starter motor
	Ring gear teeth broken	Replace flywheel ring gear or torque converter

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Engine Electrical System > Cruise Control System > General Information

PRE-TROUBLESHOOTING

Before commencing troubleshooting, inspect each of the following sections, and if there is an abnormality, carry out a repair.

1. Check if the installation and connection routes of the cables and vacuum hoses of the cruise vacuum pump assembly, actrator and pulley assembly are all normal.
2. Check if the pulley assembly and the movement of all cables are all working smoothly.
3. Check if there is no excessive play or tension in each cable.

TROUBLESHOOTING PROCEDURES

First, select the applicable malfunction symptom from the Trouble Symptom charts. Determine the condition of all function circuits.

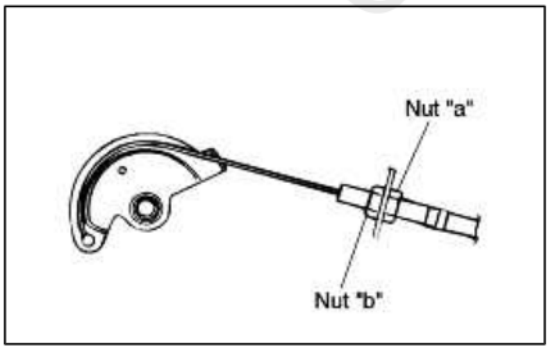
1. Make the following preliminary inspections.
   A. Check that the installation of the actuator, accelerator cable are correct, and that the cables and links are securely connected.
   B. Check that the accelerator pedal moves smoothly.
   C. Adjust the cable so there is not excessive tension or excessive play on the accelerator cable.
   D. Check that the actuator & unit assembly, cruise main and control switch and the connector of each cancel switch are connected securely.
2. Check in the sequence indicated in the Trouble Symptom chart.
3. If these checks indicate a normal condition, replace the cruise control module.

Engine Electrical System > Cruise Control System > Cruise Control Cable > Repair procedures

ADJUSTMENT

Prior to proceeding with the final cable adjustment, make sure that the lever attached to throttle valve is in the normal idle position.

1. Assemble the cable to actuator & unit assembly.
2. Tightn nut "b" after pulled cable tightly.
3. Back nut "b" off one turn.
4. Tighten nut "a".
5. Cable should have approximately 1mm off slack with actuator & unit against stop.



Engine Electrical System > Cruise Control System > Description and Operation

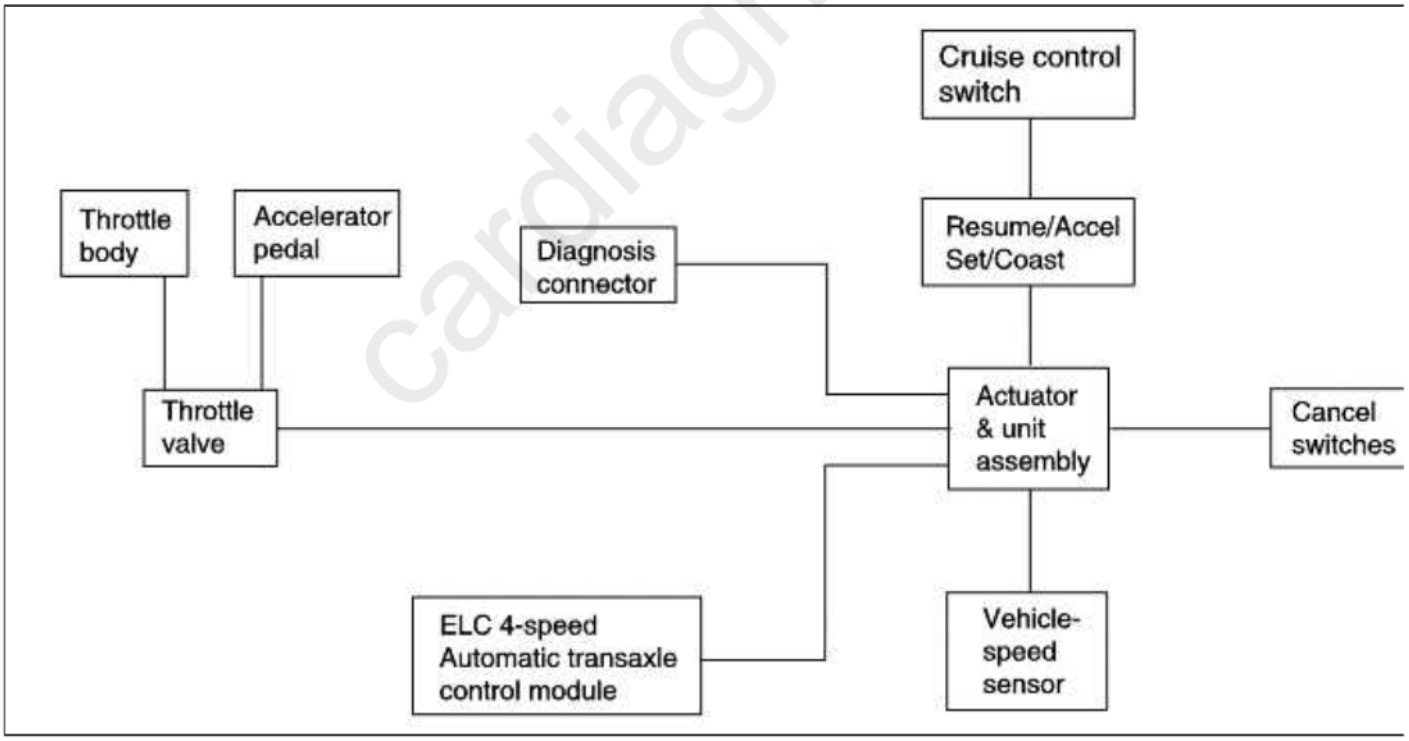
COMPONENT PARTS AND FUNCTION OUTLINE

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Components part		Function
Vehicle-speed sensor		Converts vehicle speed to pulse.
Actuator & unit assembly.		Receives signals from sensor and control switches; CCM controls all automatic speed control functions. And regulates the throttle valve to the set opening by signals from the actuator unit assembly.
Control switch	CRUISE main switch	Switch for automatic speed control power supply.
	SET switch RESUME switch	Controls automatic speed control functions by SET (COAST) and RESUME (ACCEL).
	CRUISE main switch indicator	Illuminates when CRUISE main switch is ON (Built into cluster).
Cancel switch	Stop lamp switch/Clutch switch (M/T)	Sends cancel signals to the actuator unit assembly.
	Transaxle range switch	
ELC 4-speed automatic transaxle control module		Controls the overdrive ON and OFF, based on signals from the actuator unitassembly for the CC.

*CC : Cruise Control

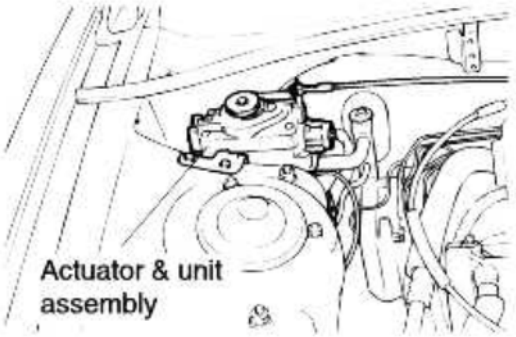
SYSTEM BLOCK DIAGRAM

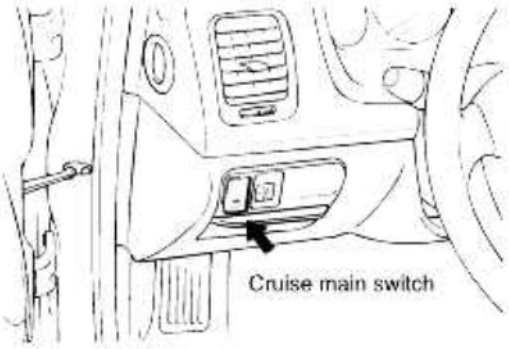


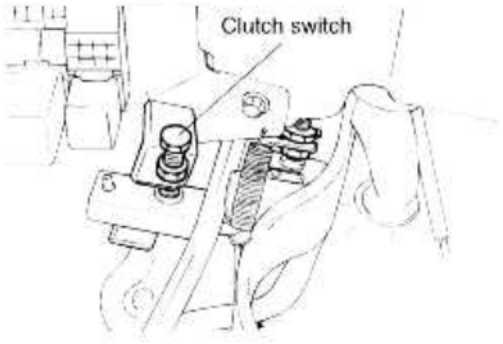
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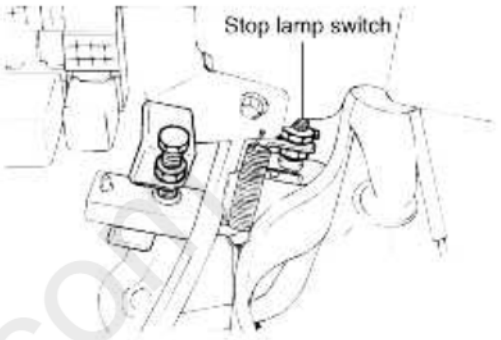
Engine Electrical System > Cruise Control System > Components and Components Location

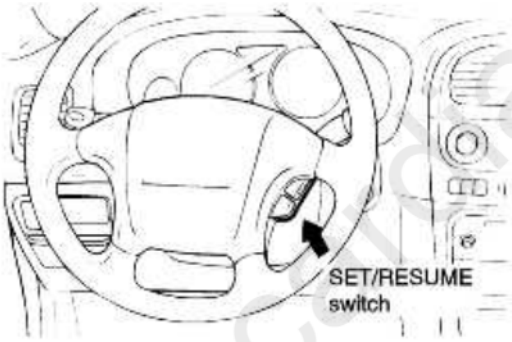
COMPONENTS LOCATION

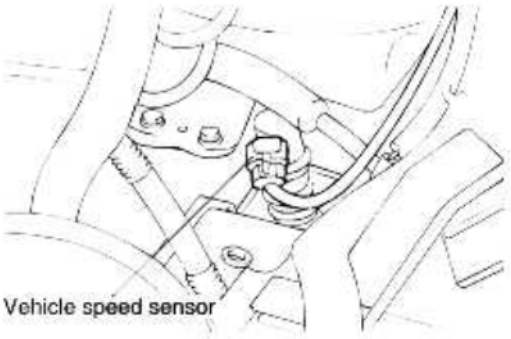








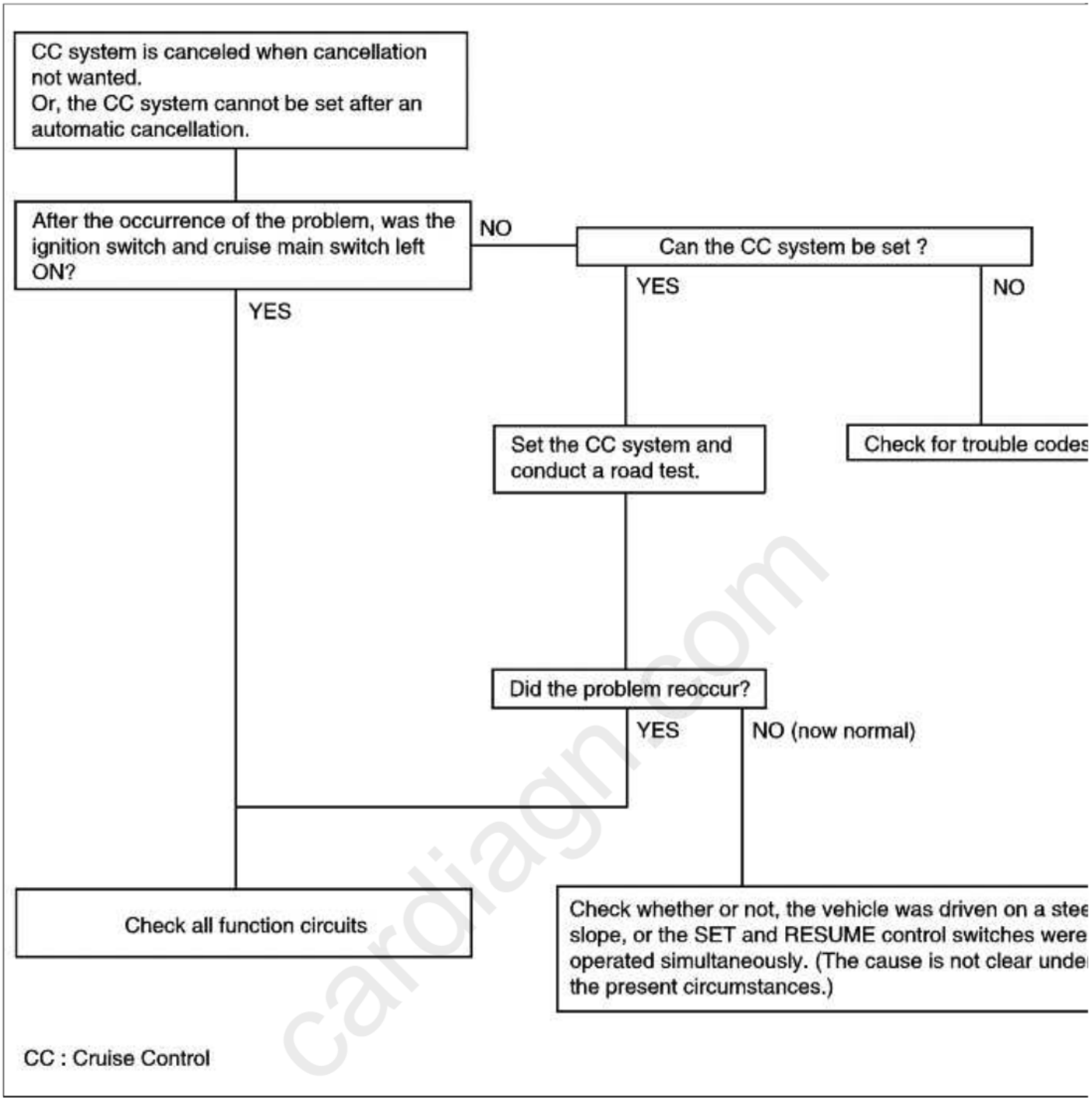




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Engine Electrical System > Cruise Control System > Troubleshooting

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 the speedometer carble or speedometer drive gear	
	Cruise vacuum pump circuit poor contact	Repair the actuator system, or replace the part
	Malfunction of the actuator & unit	Replace the actuator & unit

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 stop lamp switch	Repair the harness or replace the stop lamp switch
	Cruise vacuum pump drive circuit short-circuit	Repair the harness or replace the vacuum pump
	Malfunction of the actuator & unit	Replace actuator & unit

Trouble Symptom 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the shift lever is moved to the "N" position(It is canceled, however, when the brake pedal is depressed)	Damaged or disconncted wiring of inhibitor switch input circuit	Repair the harness or repair or replace the inhibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the actuator & unit	Replace the actuator & unit

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
	Actuator circuit poor contact	Repair the harness or replace the actuator
	Malfunction of the actuator	
	Malfunction of the actuator & unit	Replace the actuator & unit

Trouble Symptom 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or replace the RESUME switch
	Actuator circuit poor contact	Repair the harness or replace the actuator
	Malfunction of the actuator	
	Malfunction of the actuator & unit	Replace the actuator & unit

Trouble Symptom 7

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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 speedometer cable of the speedometer drive gear	
	Malfunction of the actuator & unit	Replace the actuator & unit

Trouble Symptom 8

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

Trouble Symptom 9

Trouble symptom	Probable cause	Remedy
Malfunction of control function by ON/OFF switching of idle switch	Malfunction of circuit related to idle switch function	Repair the harness or replace the part
	Malfunction of the actuator & unit	

Trouble Symptom 10

Trouble symptom	Probable cause	Remedy
Overdrive is not canceled during fixed speed driving	Malfunction of circuit related to overdrive cancelation, or malfunction ofactuator & unit	Repair the harness or replace the part
No shift to overdrive during manual driving		

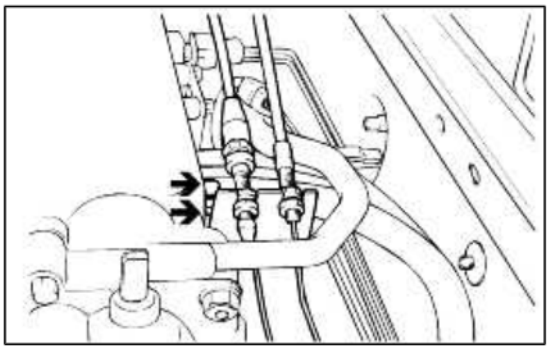
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Engine Electrical System > Cruise Control System > Repair procedures

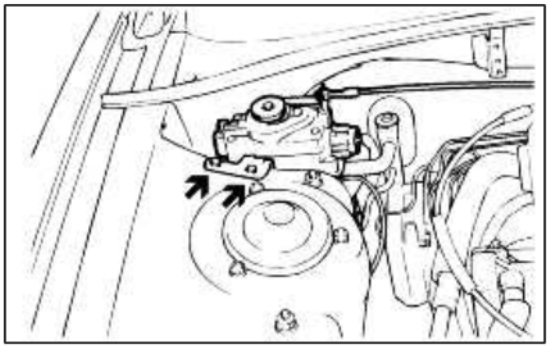
REMOVAL

1. Remove the battery negative terminal.
2. Disconnect the accelerator cable and cruise control cable from throttle assembly by turning the throttle lever to the full open position.
3. Disconnect the accelerator cable from accelerator pedal connection.

4. Remove the accelerator cable mounting bolts.



5. Remove the actuator & unit assembly mounting bolt.



6. Installation is the reverse order of removal.

INSPECTION

Condition

- Turn A/C and all lights OFF. Inspect and adjust at no load.
- Warm engine until stabilized at idle. Confirm idle speed is at specified RPM.
- Then, ignition switch OFF.

1. Confirm there are no sharp bends in cables.
2. Depress the accelerator pedal and check if the throttle lever moves smoothly from fully closed to fully open.
3. Check inner cables for correct slack.
4. If there is too much slack or no slack, adjust play by the following procedures.

Serivce Hint

1. If the cable is very loose, the loss of speed going uphill will be large.
2. If the cable is too tight, the idle RPM will become high.

INSPECTION

Condition

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2. If the cable is too tight, the idle RPM will become high.

Engine Electrical System > Cruise Control System > Specifications

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CRUISE CONTROL SYSTEM

Speed control module Operating voltage range Operating temperature Voltage drop between unit and actuator Operating speed range	 DC 10 - 16V -30 + 75°C (-22 + 167°F) 0.4V Low speed limit : 40 ± 3 km/h (25 ± 2 mph) High speed limit : 145 ± 5 km/h (90 ± 3 mph)
Actuator Rated voltage Operating temperature Operating consumption Insulating resistance	 DC 12V -30 + 90°C (-22 + 194°F) 3A or less (at 12V 20°C) 1MΩ or less (at 500V megger)
Cruise main switch Rated voltage Operating force Voltage drop	 DC 12V 0.3 - 1.0 kg 0.15 V or less
Stop lamp switch Rated voltage Rated load Stop lamp Cruise control Insulating resistance	 DC 12V 27 x 5W (lamp load) 0.1 - 0.5A (relay load) Min 3 MΩ (by 500V megger)

Engine Electrical System > Troubleshooting > C1103

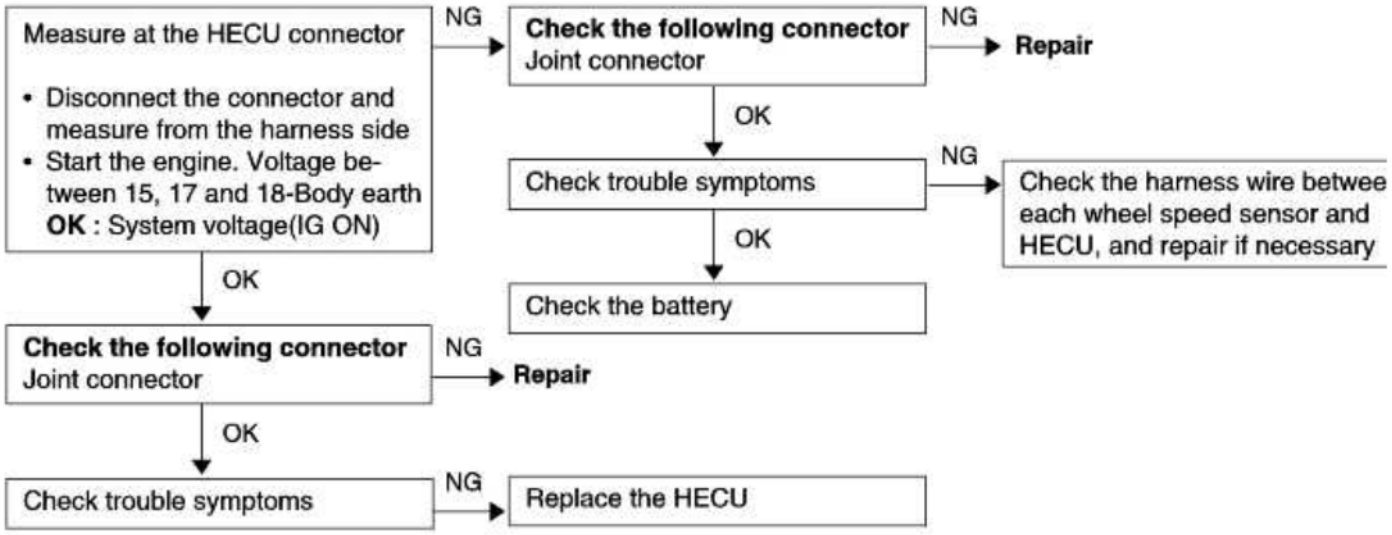
Under and over voltage

DTC No. C1103 Voltage out of range (Under and over voltage)	**Probable cause**
[Comment] The voltage of the HECU power supply drops lower or rises higher than specified value. If the voltage returns to the specified value, this code is no longer output.	• Malfunction of wiring harness or connector • Malfunction of HECU

CAUTION

- If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output.
- Before carrying out the following inspection, check the battery level, and refill it if necessary.

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Engine Electrical System > Troubleshooting > P0300

TROUBLESHOOTING PROCEDURE FOR DTC

Diagnostic trouble code No. P0300	**Random Misfire Detected**
Diagnostic trouble code No. P0301	**Cylinder 1 Misfire Detected**
Diagnostic trouble code No. P0302	**Cylinder 2 Misfire Detected**
Diagnostic trouble code No. P0303	**Cylinder 3 Misfire Detected**
Diagnostic trouble code No. P0304	**Cylinder 4 Misfire Detected**
Diagnostic trouble code No. P0305	**Cylinder 5 Misfire Detected**
Diagnostic trouble code No. P0306	**Cylinder 6 Misfire Detected**
[Related items]	• Vacuum leak in air intake system • CKP circuit malfunction • Ignition circuit malfunction • Faulty ignition coil or plug wire • Spark plug malfunction • Low compression due to blown head gasket, leaking valve or piston ring • Low/high fuel pressure due to faulty pressure regulator, restricted fuel lines, plugged fuel filter or faulty fuel pump • Fuel injector circuit malfunction • Faulty fuel injector

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NOTE

If any injectors, HO2S, WTS, and MAF codes are present, do all repairs associated with those codes before proceeding this troubleshooting guide.

step	Inspection		Action
1	Connect SCAN TOOL to data link connector or OBD-II check connector. Turn ignition to ON and monitor DTCs. Are any other codes set?	Yes	Do all repairs associated with those codes before proceeding this procedure.
		No	Go to step 2.
2	Check for any split, disconnected or perforated vacuum hoses. Also, check PCV valve for proper operation. Are vacuum hoses and PCV okay?	Yes	Go to step 3.
		No	Replace faulty vacuum hoses or PCV.
3	Turn ignition to OFF and disconnect ignition coil connector. Turn ignition to ON and measure voltage of ignition coil battery voltage between ignition coil harness connector and chassis ground. • **Specification: approximately B+** Is battery voltage within specifications?	Yes	Go to step 4.
		No	Open circuit or short circuit to chassis ground between ignition coil harness connector and main relay. Repair as necessary.
4	Turn ignition to OFF and check ignition coils and plug wires for cracks or carbon tracing. Check resistance of primary coils (0.666~0.814 Ω at 20°C) and secondary coils (11.305~15.295 KΩ at 20°C). Check for resistance of plug wires (16 KΩ per 1m). Are ignition coils and plug wires OK?	Yes	Go to step 5.
		No	Repair or replace as necessary.
5	Disconnect CKP connector and measure resistance between CKP terminal 2 and terminal 3 (800~900Ω at 20°C). Remove CKP and calculate air gap between sensor and flywheel/torque converter (0.3~1.7 mm [0.012~0.067 in]) {measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A" = air gap}. Are air gap and resistance measurements within specifications?	Yes	Thoroughly check for loose, bent or corroded terminals between CKP and ECU. Measure resistance between CKP terminal 3 and chassis ground ([1Ω). Repair as necessary.
		No	Repair as necessary.
6	Release fuel pressure and attach fuel pressure gauge to service port on fuel rail. Start an engine and warm up to operating temperature. Check for fuel pressure at idle. • **Fuel pressure at idle: 46~49 psi (320~340kPa, 3.26~3.47kg/cm2)** Is fuel pressure within specification?	Yes	Go to step 7.
		No	Check fuel delivery system.
7	and plug condition. Are spark plugs gapped properly and in good condition?	Yes	Go to step 9.
		No	Repair as necessary.
8	(no more than 10% between highest and lowest cylinder)].	Yes	Go to step 10.

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	Is compression OK?	No	Perform leak down test to determine source of low compression and repair as necessary.
9	Return vehicle to original condition. Clear all diagnostic trouble codes. Verify by driving vehicle with SCAN TOOL connected and monitor for pending codes.		

Engine Electrical System > Troubleshooting > P0350

TROUBLESHOOTING PROCEDURE FOR DTC

Diagnostic trouble code No. P0350	**Ignition Coil Primary/Secondary Circuit Malfunction**
Diagnostic trouble code No. P0351	**Ignition Coil 'A' Primary/Secondary Circuit Malfunction**
Diagnostic trouble code No. P0352	**Ignition Coil 'B' Primary/Secondary Circuit Malfunction**
Diagnostic trouble code No. P0353	**Ignition Coil 'C' Primary/Secondary Circuit Malfunction**
Diagnostic trouble code No. P0354	**Ignition Coil 'D' Primary/Secondary Circuit Malfunction**
Diagnostic trouble code No. P0355	**Ignition Coil 'E' Primary/Secondary Circuit Malfunction**
Diagnostic trouble code No. P0356	**Ignition Coil 'F' Primary/Secondary Circuit Malfunction**
[Related items]	• Open or short between ignition coil and ECU • Open or short between ignition coil and spark plug • Short between ignition coil wires • Faulty ignition coil • Poor connection at ignition coil • Faulty ignition system

step	Inspecion		Action
1	Using SCAN TOOL and monitor any DTCs. Is DTC P0300, P0301, P0302, P0303, P0304, P0305, P0306, or P0320 set?	Yes	Do all repairs associated with those codes before proceeding this procedure.
		No	Go to step 2.
2	Connect SCAN TOOL to data link connector or OBD-II check connector.	Yes	Problem is intermittent or was repaired and engine control module memory was not

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	Start engine and monitor spark plug signal pattern. Is signal pattern normal?		cleared. Check terminal connections at ECU and ignition coils.
		No	Go to step 3.
3	Thoroughly check all coils and spark plug wires for loose, bent, corroded, contaminated, deteriorated or damaged connectors. Is any problem present?	Yes	Repair as necessary.
		No	Go to step 4.
4	Start engine. Using SCAN TOOL monitor spark plug signal pattern. Are all signal patterns normal?	Yes	Go to step 5
		No	Verify what ignition coil is problem and go to step 5.
5	Turn ignition to OFF and disconnect ignition coil connector. Turn ignition to ON and measure voltage of ignition coil power circuit between ignition coil harness connector and chassis ground. • **Specification: approximately B+** Is voltage within specification?	Yes	Go to step 6.
		No	Open circuit or short circuit to chassis ground between ignition coil harness connector and ignition failure sensor connector. Repair as necessary.
6	Turn ignition to OFF and disconnect ECU connector. Measure resistance of ignition coil signal circuit between ignition coil harness connector and ECU harness connector. Measure resistance of ignition coil ground circuit between ignition coil harness connector and chassis ground. • **Specifications: below 1Ω** Does each resistance indicate continuity circuit?	Yes	Go to step 7.
		No	Open circuit between ignition coil harness connector and ECU harness connector and/or chassis ground. Repair as necessary.
7	Turn ignition to ON. Measure voltage of ignition coil signal circuit between ignition coil harness connector and chassis ground. • **Specifications: below 0.5V** Is voltage within specifications?	Yes	Go to step 8.
		No	Short circuit to power between ignition coil harness connector and ECU harness connector. Repair as necessary.
8	Tun ignition to OFF. Measures resistance between ignition coil harness connector and chassis ground at ignition coil signal circuit. • **Specifications: infinite** Does resistance indicate open circuit?	Yes	Temporarily install a known good ignition coil and check for proper operation. If problem is corrected, replace ignition coil.
		No	Short circuit to chassis ground between ignition coil harness connector and chassis ground. Repair as necessary.
9	Return vehicle to original condition. Clear all diagnostic trouble codes. Verify by driving vehicle with SCAN TOOL connected and monitor for pending codes.		

Engine Electrical System > Troubleshooting > P0560

TROUBLESHOOTING PROCEDURE FOR DTC

Diagnostic trouble code No. P0560	**Battery backup Line Malfunction**
Diagnostic trouble code No. P0562	**Battery backup Line Low Input**
Diagnostic trouble code No. P0563	**Battery backup Line High Input**
[Related items]	• Open or short between ECU and battery • ECU internal faulty

step	Inspection		Action
1	Turn ignition to OFF and disconnect ECU connector. Measure voltage of backup circuit between battery and chassis ground. • **Specification: approximately B+** Is voltage within specification?	Yes	Thoroughly check for poor connection, misplaced, corroded terminals at ECU connector. Repair as necessary.
		No	Open circuit or short circuit to chassis ground between ECU harness connector and battery. Repair as necessary.
2	• Temporarily install a known good ECU and check for proper operation. If problem is corrected replace ECU. • Return vehicle to original condition. Clear all diagnostic trouble codes. Verify by driving vehicle with SCAN TOOL connected and monitor for pending codes.		

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