

<b>SERVICE MANUAL</b>	
Applies to: <a href="#">Hyundai Coupe/Tiburon 1998-2000</a>	
<b>GROUP</b>	
Engine Electrical System	General

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## SPECIFICATIONS

### IGNITION COIL

Type	Molded dual-coil
Primary coil resistance	0.5 ± 0.05 OHM
Secondary coil resistance	12.1 ± 1.8 KOHM

### SPARK PLUG

Type - Champion	RN9YC4, RC10YC4
Type - NGK	BKR5ES-11
Plug gap	1.0-1.1 (0.039-0.043 in.)

### STARTER MOTOR

Type	Reduction drive (with planetary gear)
Voltage	12V
Output	1.2kW
No-load characteristics	
Terminal voltage	11V
Amperage	90A
Speed	3,000 RPM
Number of pinion teeth	8

### GENERATOR

Type	Battery. voltage sensing
Rated output	13.5V 90A
Voltage regulator type	Electronic built-in type
Regulator setting voltage	14,4 ± 0,3V
Temperature compensation	-10 ± 3 mV/°C

### BATTERY

Type	MF 68Ah
Ampere house (5HR)	48Ah or more

Ampere house(20HR)	60Ah or more
Cold cranking [at -17,8°C (0°F)]	420A or more
Reserve capacity	92 min.
Specific gravity [at 25°C (77°F)]	1.280 ± 0.01

**NOTE**

**COLD CRANKING AMPERAGE** is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 or greater at a specified temperature. **RESERVE CAPACITY RATING** is the amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5 at 26.7°C (80°F).

**CRUISE CONTROL SYSTEM****Speed control module**

Operating voltage range	DC 10 - 16V
Operating temperature	-30 - +75°C (-22 - +167°F)
Voltage drop between unit and actuator	0.4V or less
Operating speed range	Low speed limit: 40 ± 3 km/h (25 ± 2 mph)
	High speed limit: 160 ± 5 km/h (90 ± 3 mph)

**Vacuum pump**

Type	Diaphragm type
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**Actuator**

Drive system	Vacuum type
Stroke mm (in.)	38-42 (1.5-1.7)

**Cruise main switch**

Rated voltage	DC 12V
Operating force	0.3 - 0.7 kg.cm
Voltage drop	0.2 V or less

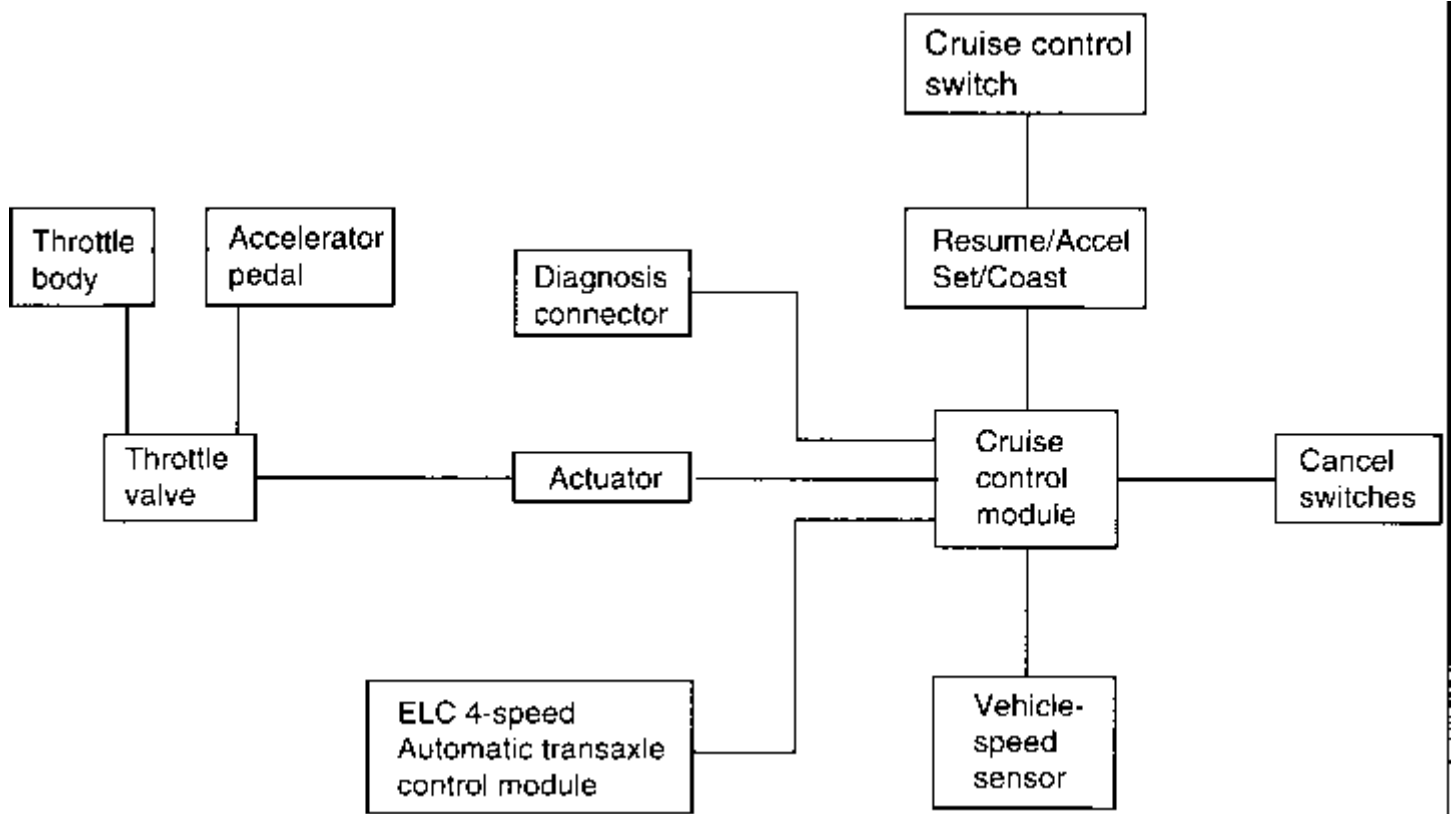
**Stop lamp switch**

Rated voltage	DC 12V
Rated load - Stop lamp	21 x 5W (lamp load)

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## SYSTEM BLOCK DIAGRAM



## COMPONENT PARTS AND FUNCTION OUTLINE

COMPONENT PART	FUNCTION
Vehicle-speed sensor	Converts vehicle speed to pulses.
Cruise control module (CCM)	Receives signals from sensor and control switch; CCM controls all automatic speed control function.
Actuator	Regulates the throttle valve to the set opening by signals from the CCM.
Control switch - CRUISE main switch	Switch for automatic speed control power supply.
Control switch - SET switch Control switch - RESUME switch	Controls automatic speed control functions by SET (COAST) and RESUME (ACCEL).
Control switch - 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 CCM.
Cancel switch - Transaxle range switch	

ELC 4-speed automatic transaxle control module	Controls the overdrive ON and OFF, based on signals from the CCM for the CC.
Data link connector	By connecting the voltmeter or scan tool, control module diagnostic codes can be read.

\*CCM: Cruise Control Module

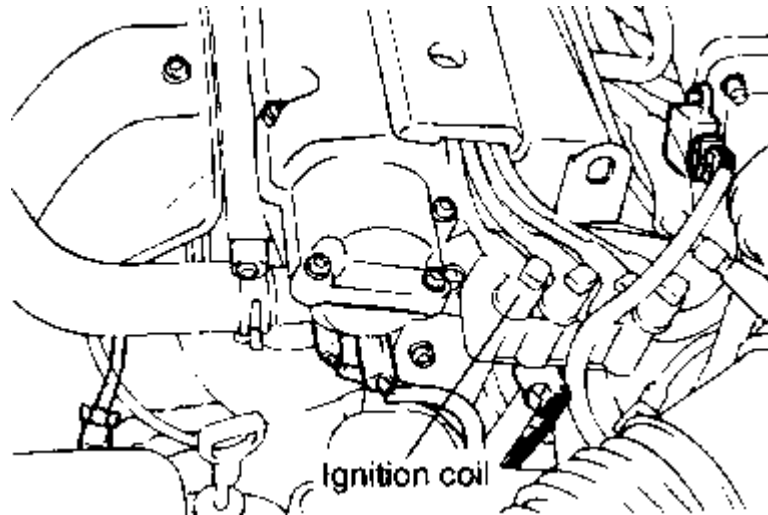
\*CC: Cruise Control

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Engine Electrical System	Ignition System

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## GENERAL INFORMATION

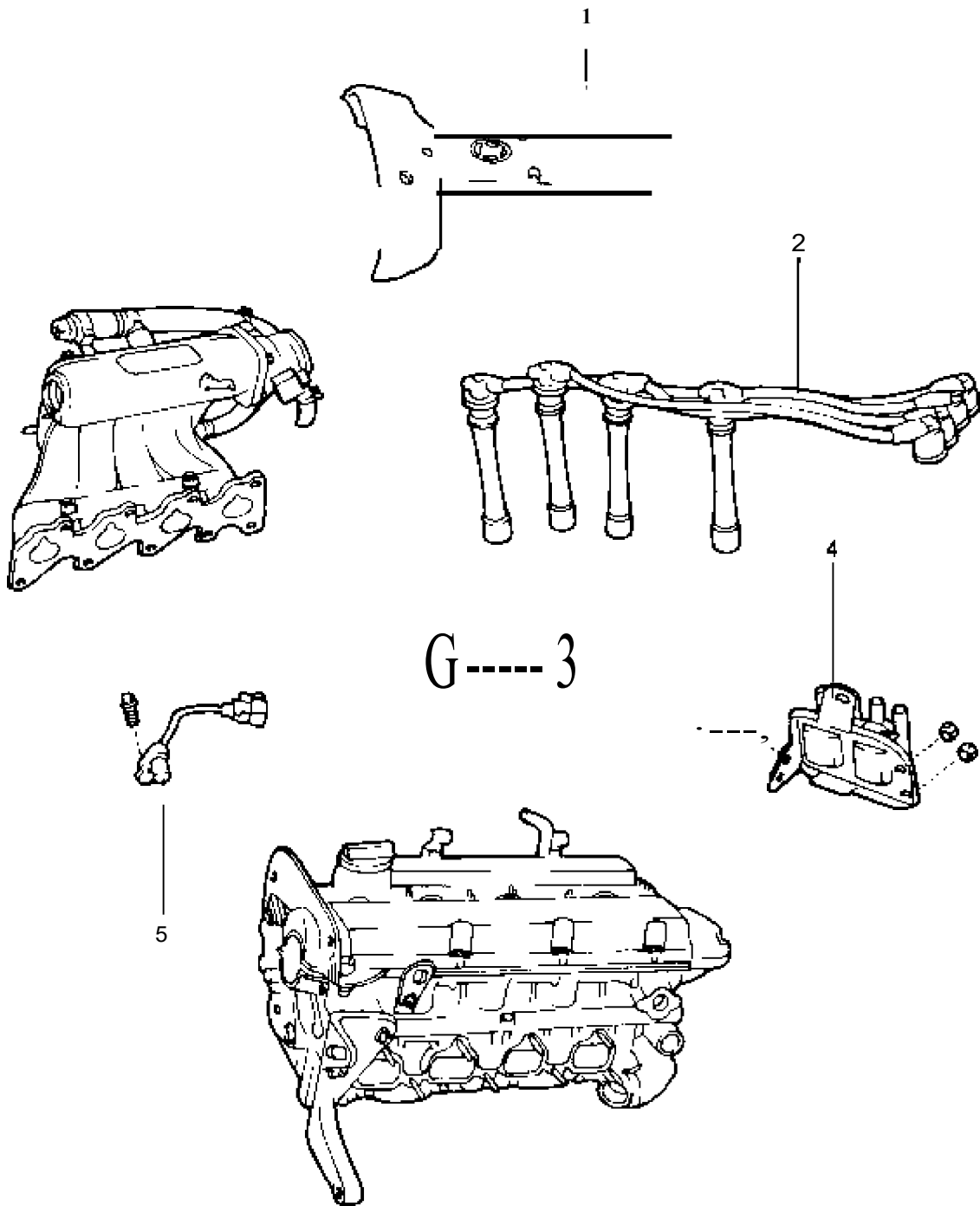
Ignition timing is controlled by the electronic control ignition. timing system. The ignition timing data for the engine operating conditions are programmed in the memory of the engine control module (ECM).



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 the primary current are sent to the engine control module. The ignition coil is activated, and timing is controlled at the optimum point.

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## REMOVAL AND INSTALLATION

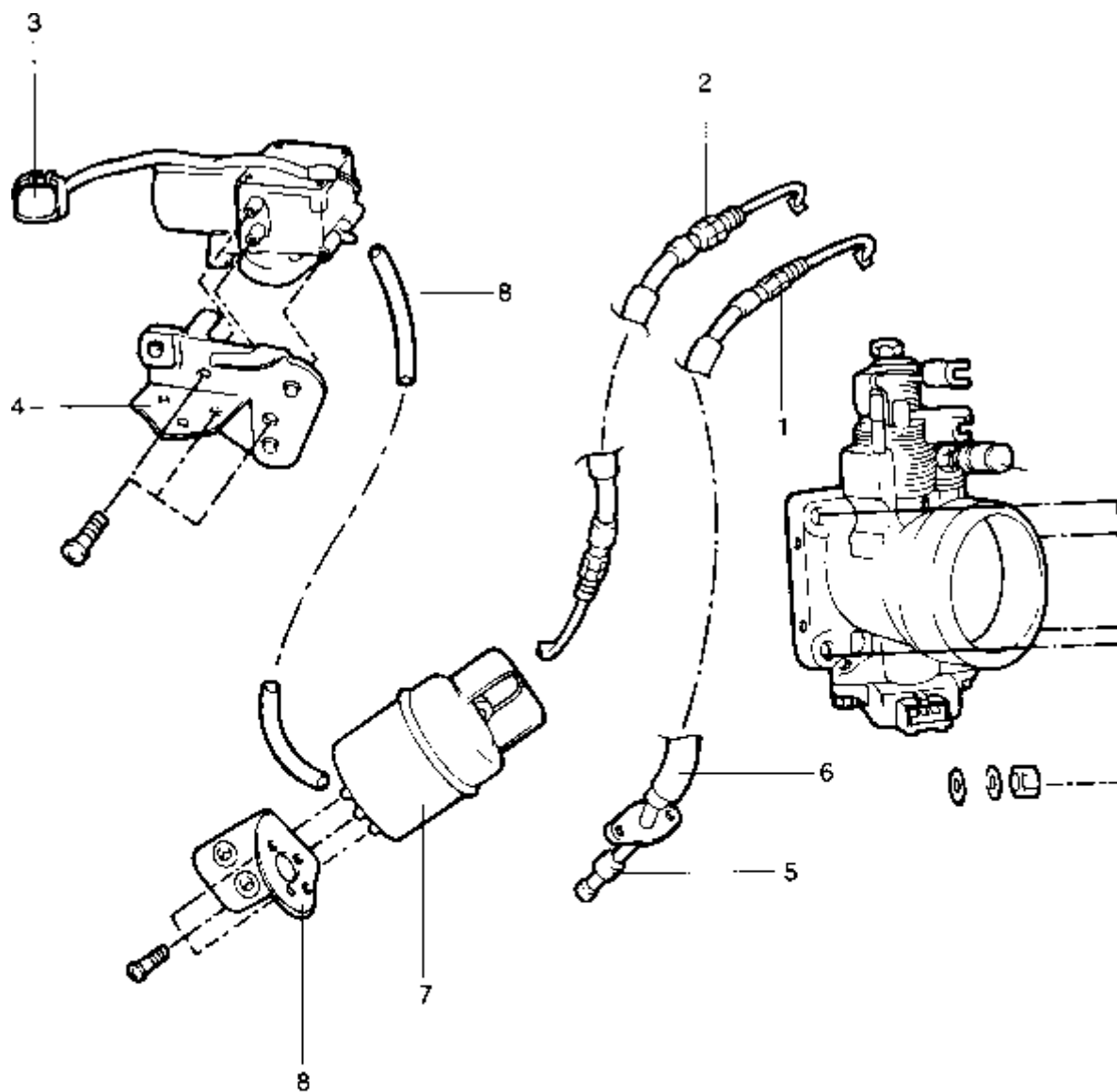


- 1, Center cover
- 2, Spark plug cable
- 3, Spark plug
- 4, Ignition coil
- 5, Camshaft position sensor

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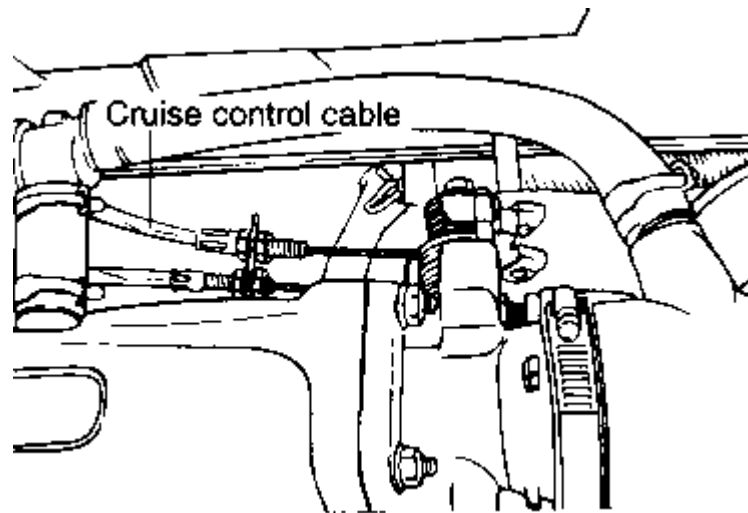
## SYSTEM COMPONENTS



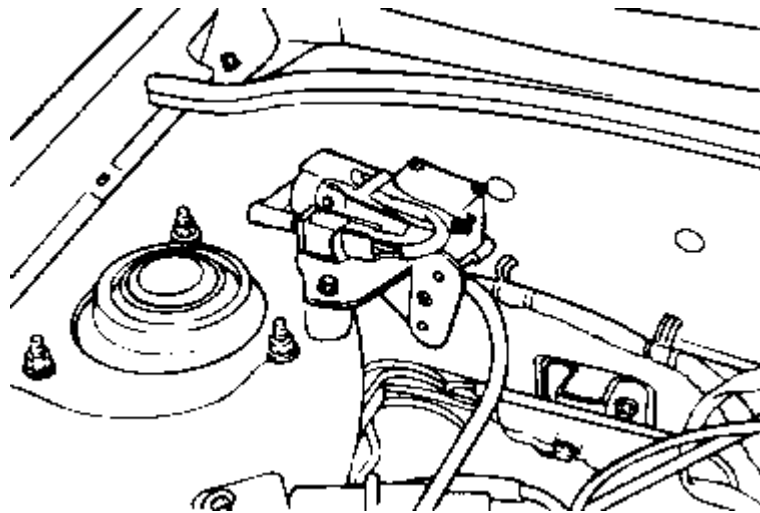
1. Accelerator cable and throttle lever connection
2. Cruise control cable and throttle lever connection
3. Vacuum pump connector
4. Pump bracket and pump assembly
5. Accelerator cable and pedal connection
6. Accelerator cable
7. Actuator
8. Actuator bracket
9. Vacuum hose

Remove the battery negative terminal.

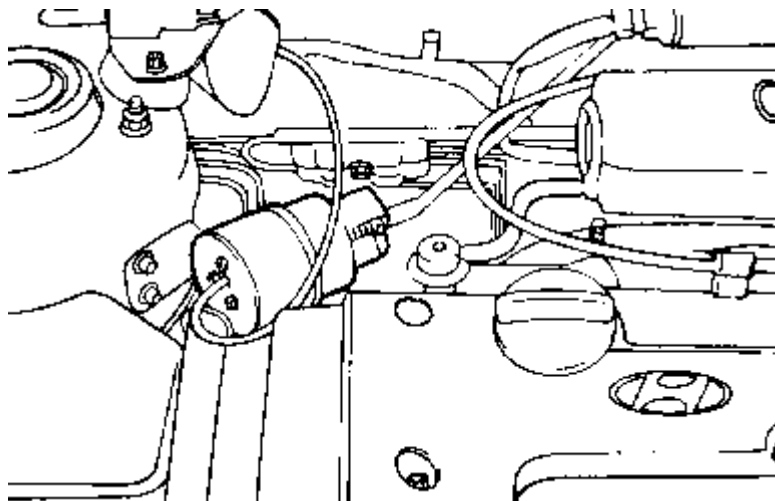
Disconnect the cruise control cable and throttle lever connection while turning throttle lever to the full open position.



Disconnect the vacuum pump connector and remove the vacuum pump assembly.



Remove the actuator bracket and disconnect the vacuum hose.



Installation is the reverse order of removal.



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## PARTS INSPECTION

### CRUISE CONTROL MAIN SWITCH

Operate the switch, and check for the continuity between the terminals.

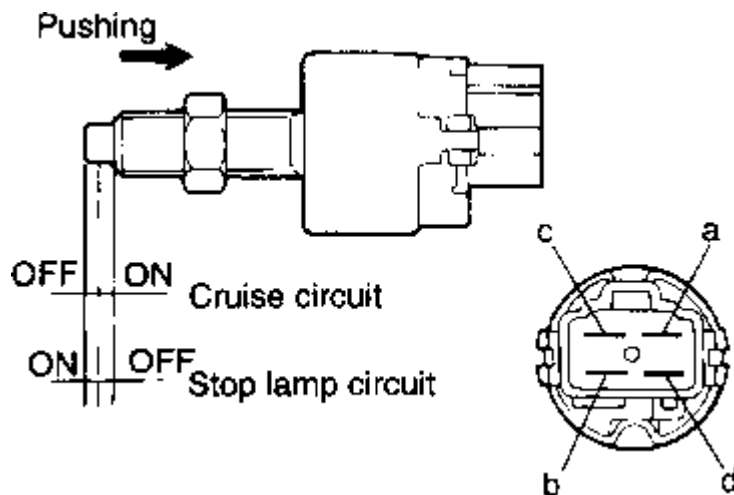
If continuity is not as specified, replace the switch.

Terminal Position	1	2	3	4	5	6
ON	○	○	⊗	○	○	○
OFF	○	⊗	○	○		

### STOP LAMP SWITCH

After operating the stop lamp switch, check for continuity between the terminals.

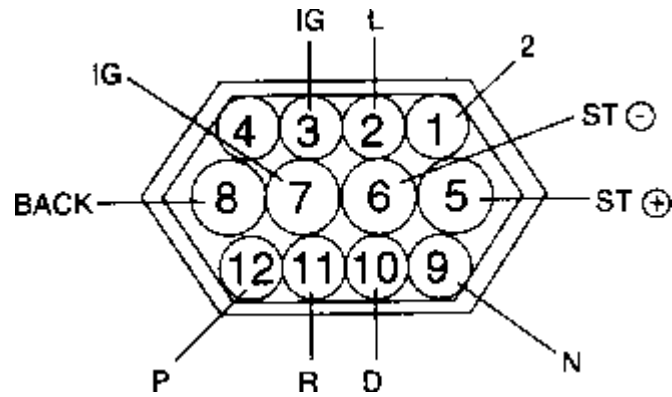
Terminal Position	a	b	c	d
Pushing			○	○
Not pushing	○	○		



## P/N POSITION SWITCH

Disconnect the connector.

Check that there is continuity between connector terminals 10 and 11 when the shift lever is moved to the "N" range.

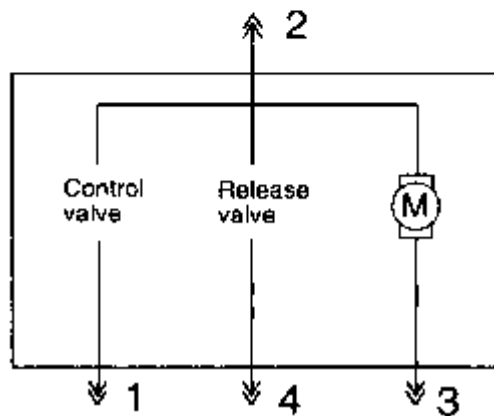
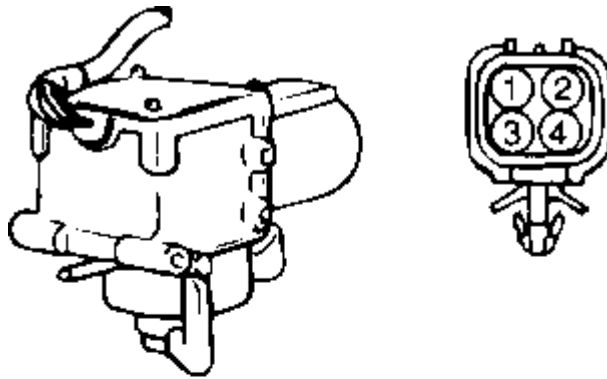


## CRUISE VACUUM PUMP

### SOLENOID VALVE (CONTROL VALVE, RELEASE VALVE)

Remove the auto-cruise vacuum pump connector.

Measure the resistance value between connector terminal 1 and 2, and connector terminals 2 and 4.



### RESISTANCE SPECIFICATION

resistance value between
--------------------------

connector terminal 1, 2 and 4	50-60 O
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Check that the solenoid valve makes an operating noise when battery voltage is impressed between terminals 2 and 1, and connector terminals 2 and 4.

If there is a malfunction of the solenoid valve. Replace the cruise vacuum pump assembly.

## MOTOR

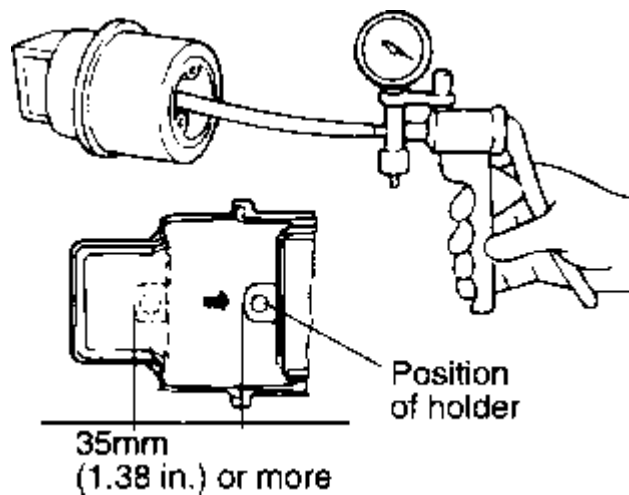
Remove the cruise vacuum pump connector.

Check that the motor revolves when battery voltage applied between connector terminals 2 and 3.

## ACTUATOR

Remove the actuator.

Apply negative pressure to the actuator with the vacuum pump and check that the holder moves more than 35mm (1.38 in.). In addition, check that there is no change in the position of the holder when negative pressure is maintained in then inspect and adjust the cruise control cable.

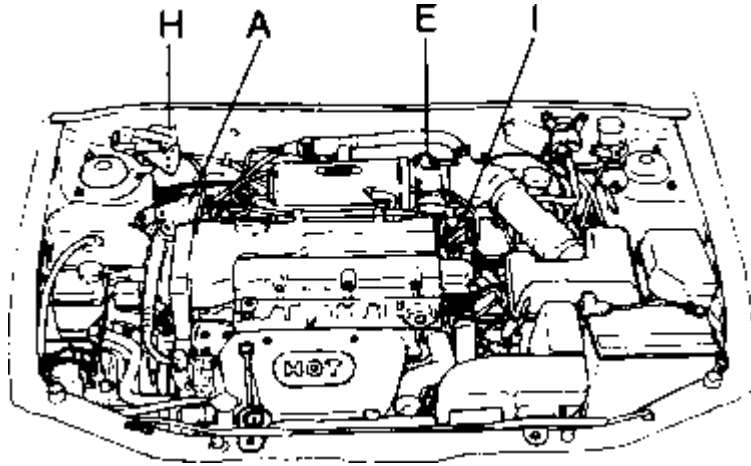


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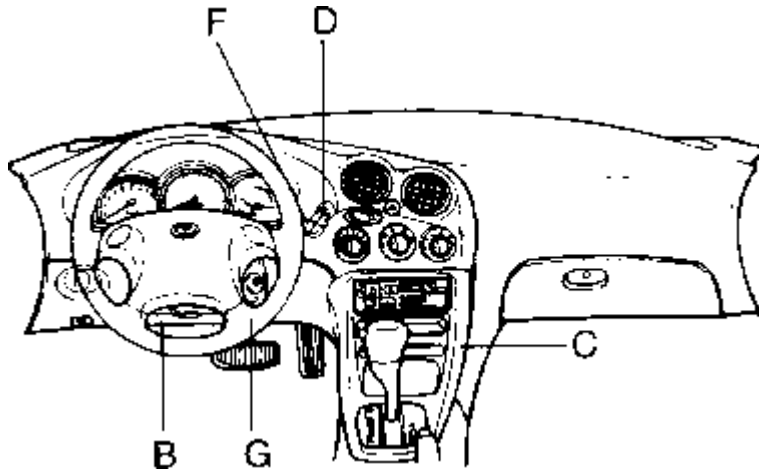
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## COMPONENTS LOCATION

### ENGINE COMPARTMENT

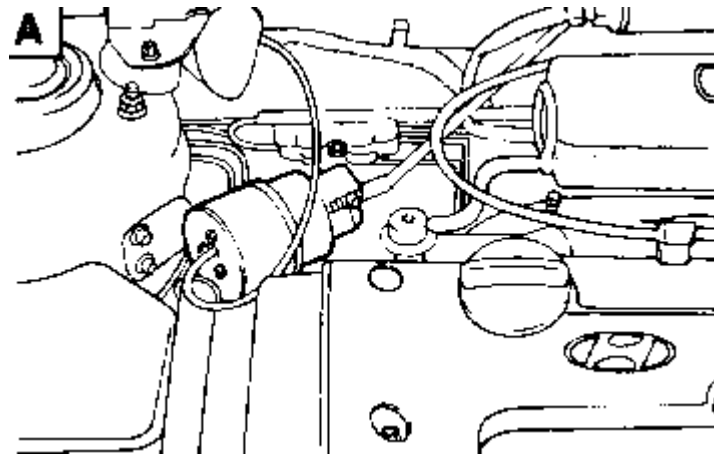


### INTERIOR

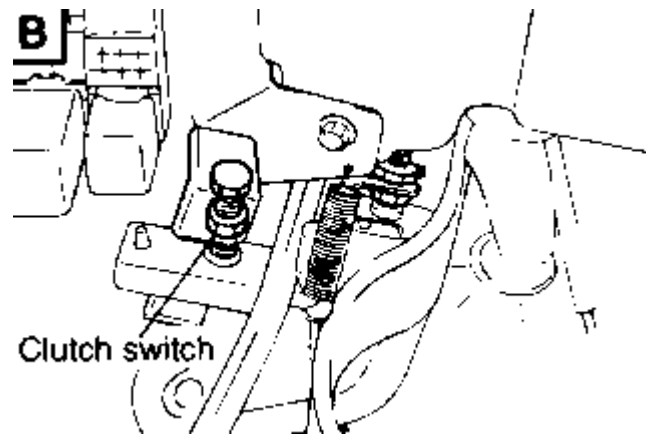


NAME	SYMBOL	NAME	SYMBOL
Actuator	A	Speed control switch (in multi function switch)	F
Clutch switch	B	Stop lamp switch	G
Cruise control module	C	Vacuum motor	H
Cruise main switch	D	Vehicle speed sensor	I
Pulley assembly	E		

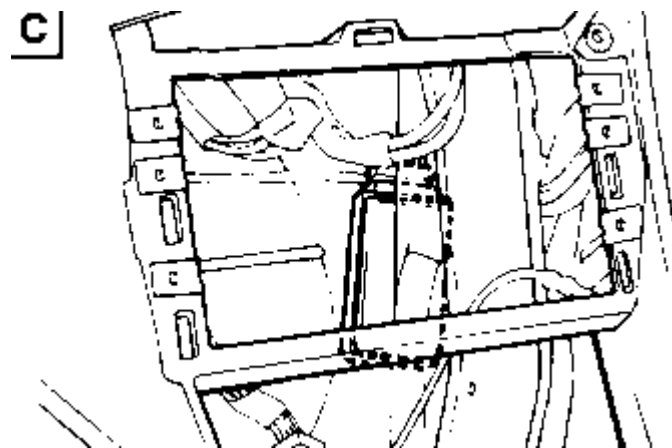
**A - Actuator**



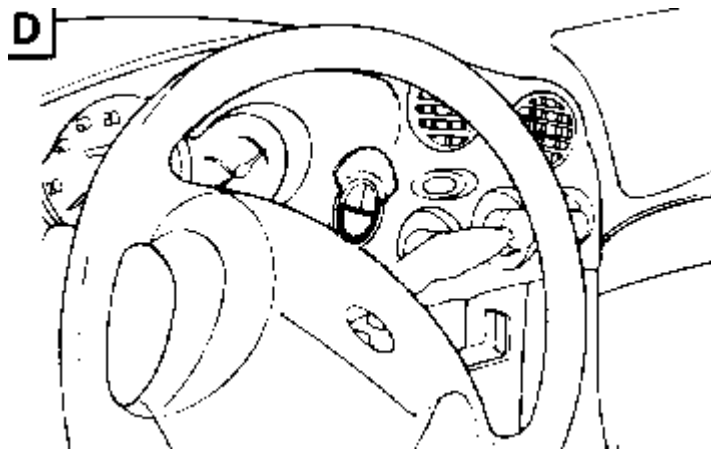
**B - Clutch switch**



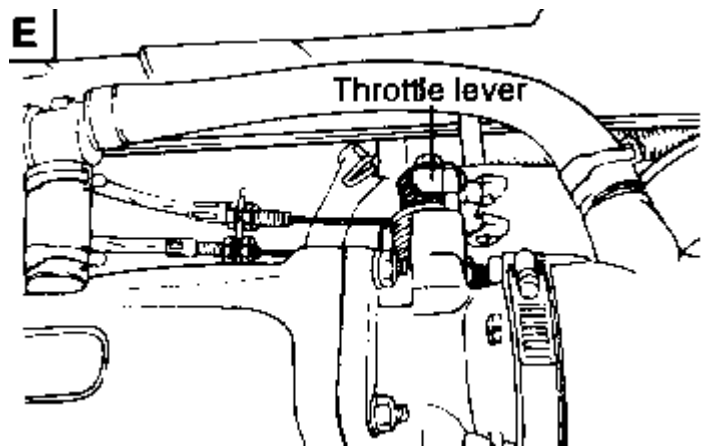
**C - Cruise control module**



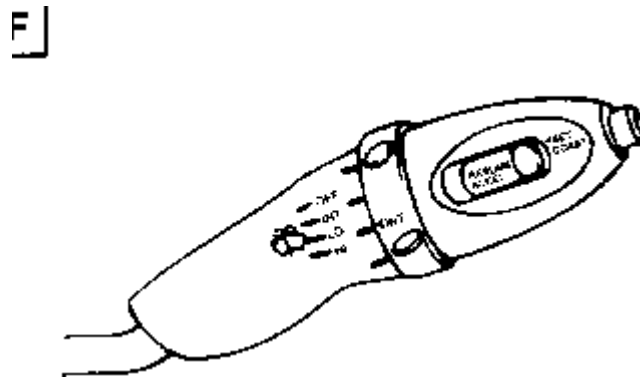
**D - Cruise main switch**



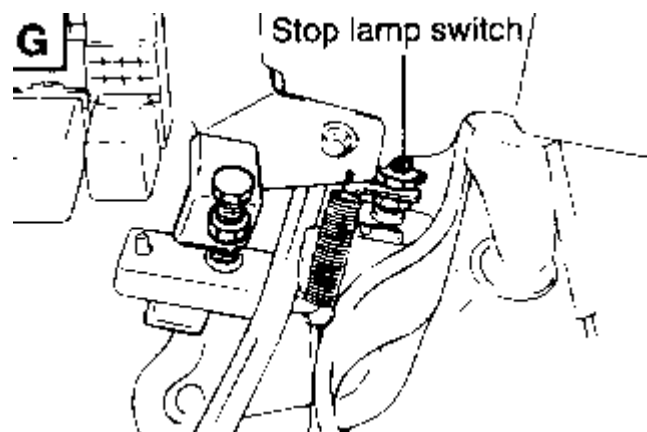
**E - Pulley assembly**



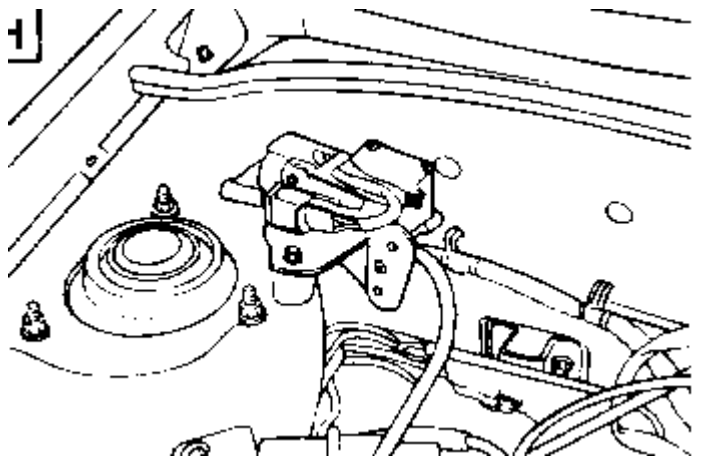
**F - Speed control switch (in multi-function switch)**



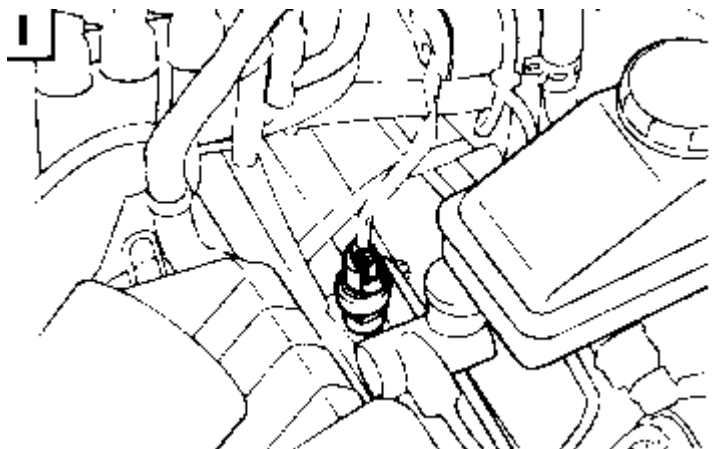
**G - Stop lamp switch**



**H - Vacuum motor**



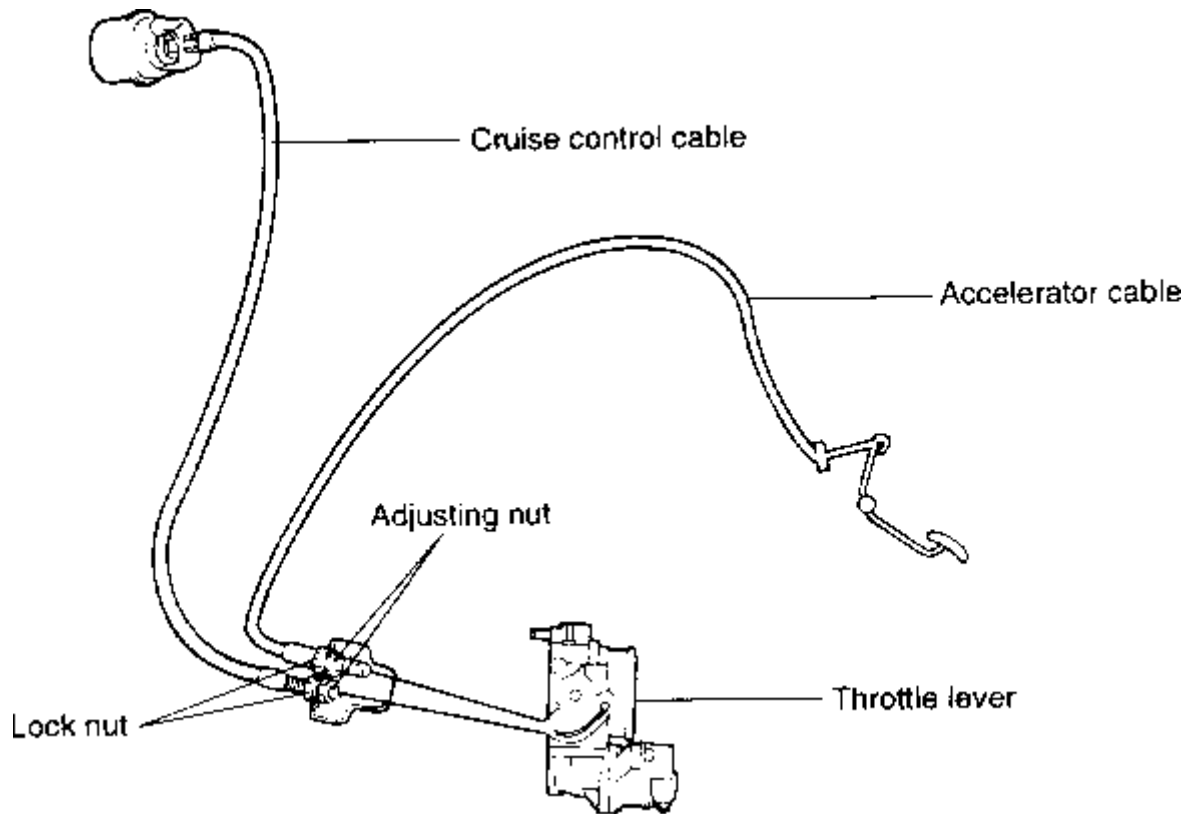
**I - Vehicle speed sensor**



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## CRUISE CONTROL CABLES: INSPECTION AND ADJUSTMENT



### ADJUSTMENT CONDITIONS

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.

### INSPECTION

Confirm there are no sharp bends in cables.

Depress the accelerator pedal and check to see the throttle lever moves smoothly from fully closed to fully open.

Check inner cables for correct slack.

If there is too much slack or no slack, adjust play by the following procedures.

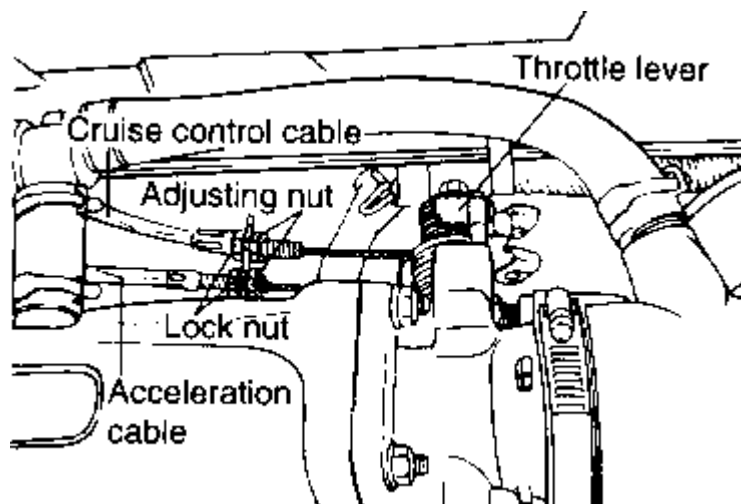
### HINT

If the cable is very loose, the loss of speed going uphill will be large.

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



## ADJUSTMENT



Loosen the adjusting nuts and lock nuts of the accelerator cable and the cruise control cable, so that the throttle lever can move freely.

Turn the ignition switch to the ON position (without starting the engine).

Tighten the adjusting nut of the cruise control cable in the direction to lessen its play. At the position where the cruise control lever touches the stopper, unscrew the adjusting nut the specified number of turns.

Amount to unscrew the adjusting nut: Approx. 1 turn [inner cable play 1-2 mm 0.04-0.08 in ]

Lock the cruise cable with the lock nut.

While keeping the throttle lever touching the cruise control lever, tighten the adjusting nut of the acceleration cable in the direction to lessen its play. Then unscrew the adjusting nut the specified number of turns just before the throttle lever begins to move.

Lock the accelerator cable with the lock nut.

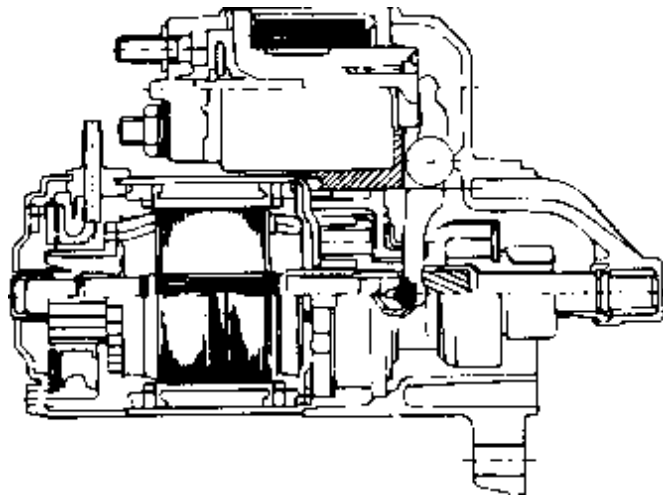
After adjusting, check to see if the end of the fixed idle switch is touching the stopper of the throttle lever.

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## GENERAL INFORMATION

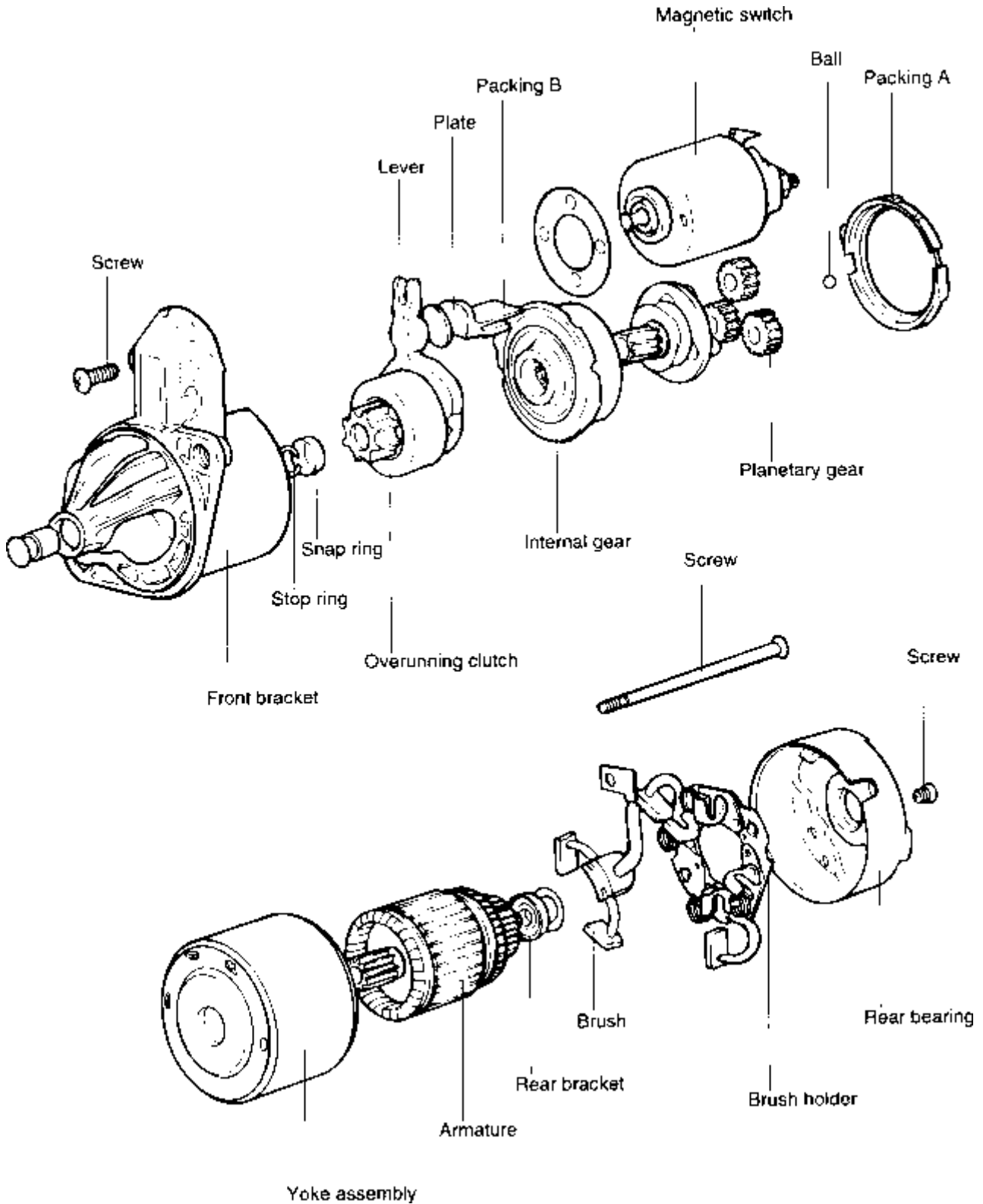
The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch (A/T only), connection wires and the battery cables. When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil. The solenoid plunger and 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.



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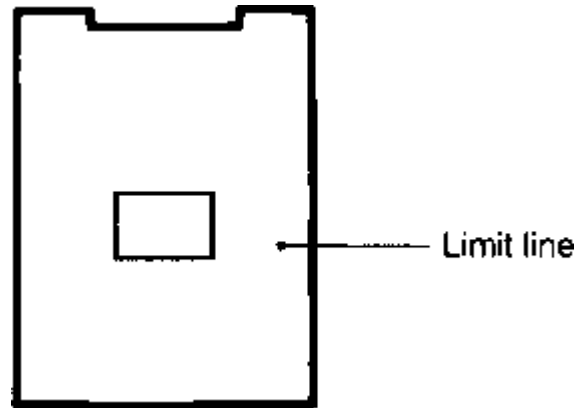
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## COMPONENTS



## REPLACEMENT OF BRUSHES AND SPRINGS

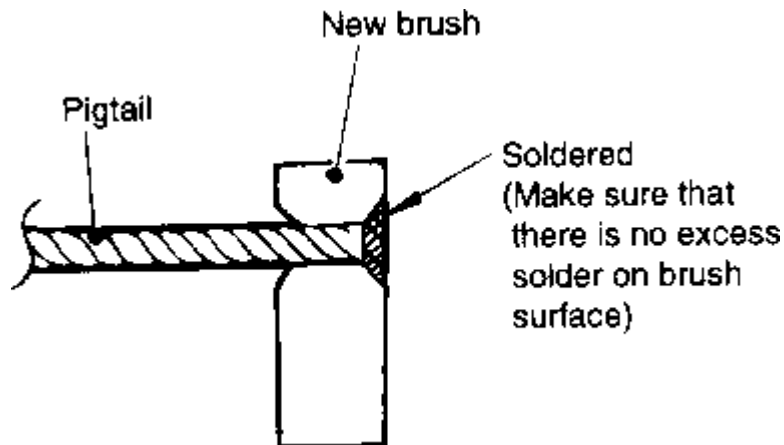
Brushes that are worn beyond wear limit line, or oil-soaked, should be replaced.



When replacing field coil brushes, crush worn brush with pliers, taking care not to damage pigtail.

Sand pigtail end with sandpaper to ensure good soldering.

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.

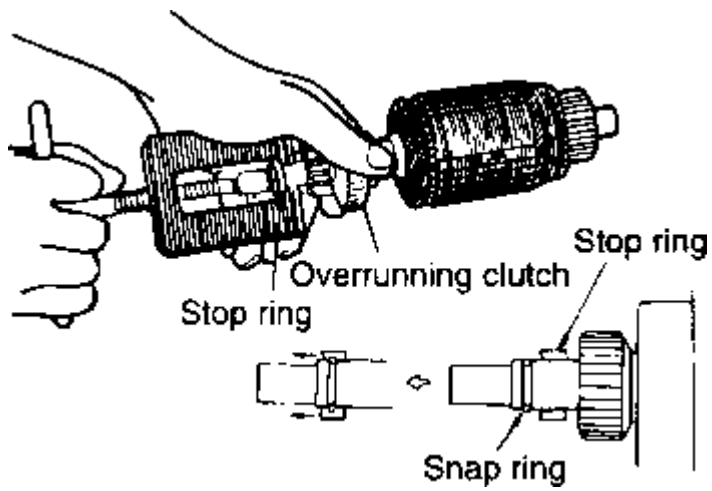


When replacing ground brush, slide the brush from brush holder by prying retaining spring back

## SERVICE POINTS OF ASSEMBLY

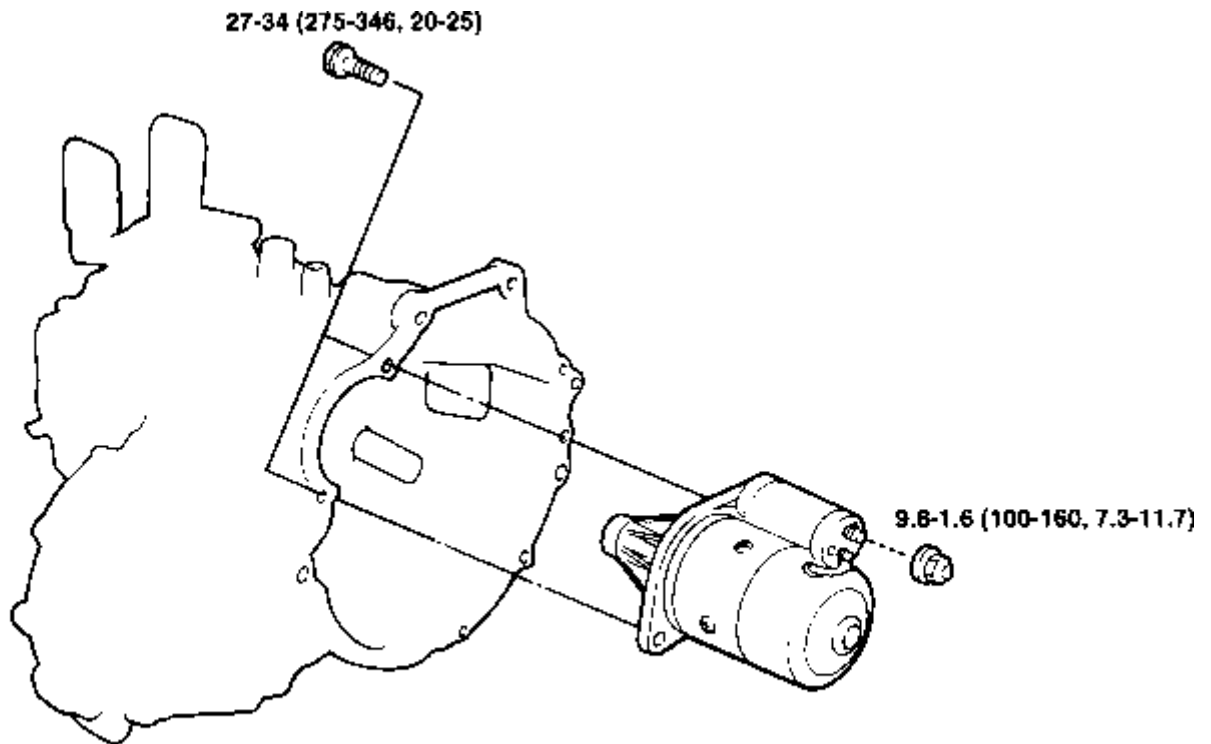
### INSTALLATION OF THE STOP RING AND SNAP RING

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



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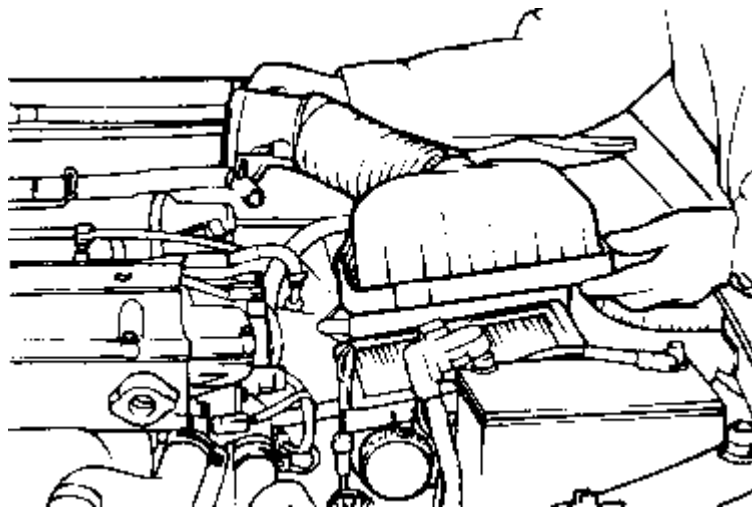
## REMOVAL AND INSTALLATION



### TORQUE : Nm (kg.cm, lb.ft)

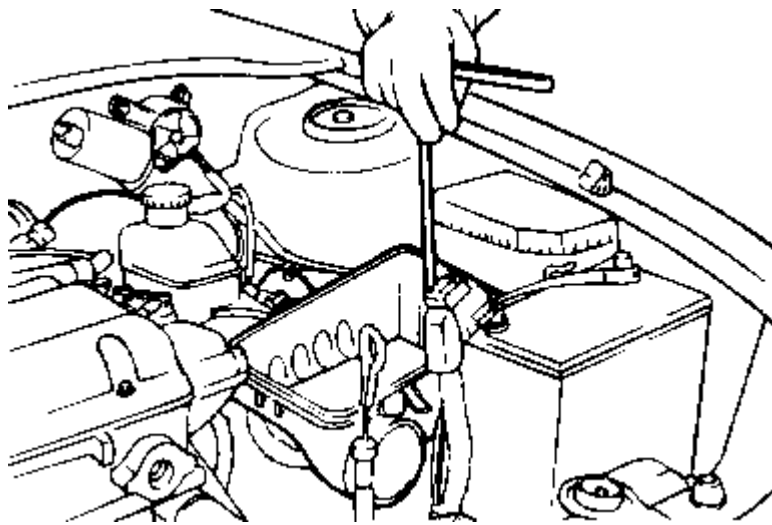
Remove the battery negative terminal.

Remove the air duct and air cleaner cover.



Remove the air cleaner assembly, and speedo meter cable.

Remove the starter motor.



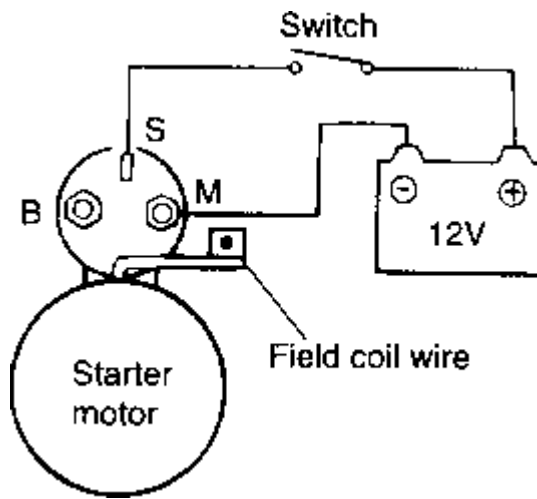
Installation is the reverse order of removal.

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## CHECKING FOR OPERATION

### SERVICE, ADJUSTMENT PROCEDURES FOR PINION GAP ADJUSTMENT

Disconnect the field coil wire from the M-terminal of the solenoid.



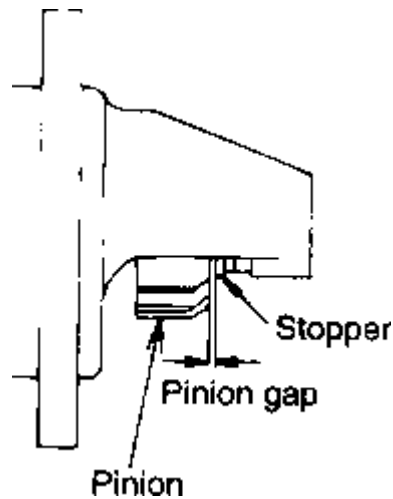
Connect a 12V battery the S-terminal and the M-terminal.

The pinion will move out.

**CAUTION**

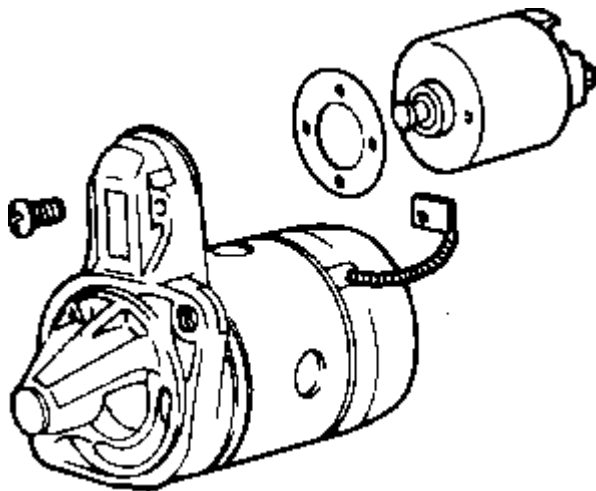
**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**

Check the pinion to stopper clearance (pinion gap) with a feeler gauge.



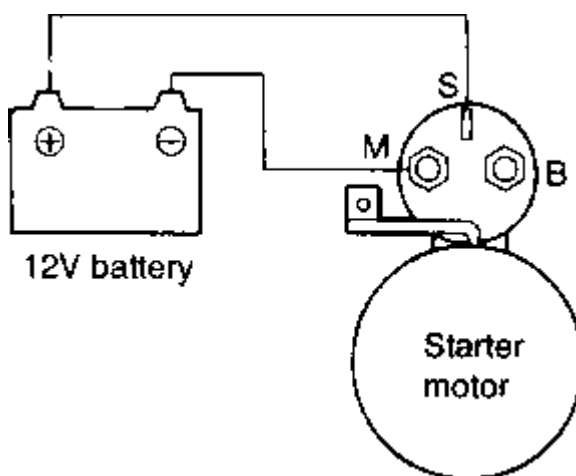
MEASUREMENT SPECIFICATION	
Pinion gap:	0.5-2.0 mm ( 0.02-0.079 in )

If the pinion gap is out of specification, adjust by adding or removing gaskets between the solenoid and the front bracket.



## MAGNETIC SWITCH PULL-IN TEST

Disconnect the field coil wire from the M-terminal of the magnetic switch.



Connect a 12V battery between the S-terminal and the M-terminal.

### **CAUTION**

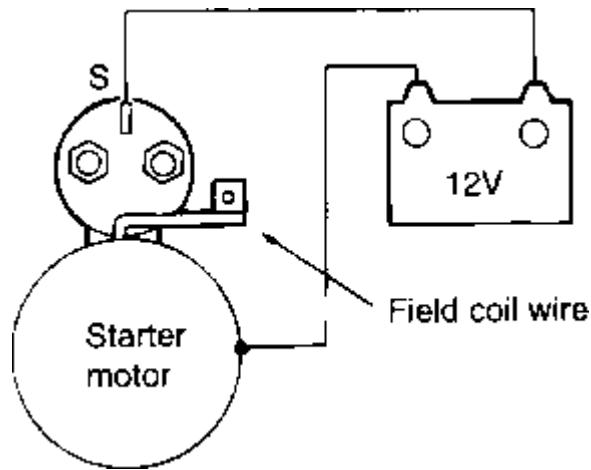
**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**

If the pinion moves out, then the pull-in coil is good. If it doesn't move out, replace the magnetic switch.

## MAGNETIC SWITCH HOLD-IN TEST

Disconnect the field coil wire from the M-terminal of the magnetic switch.





Connect a 12V battery between the S-terminal and the body.

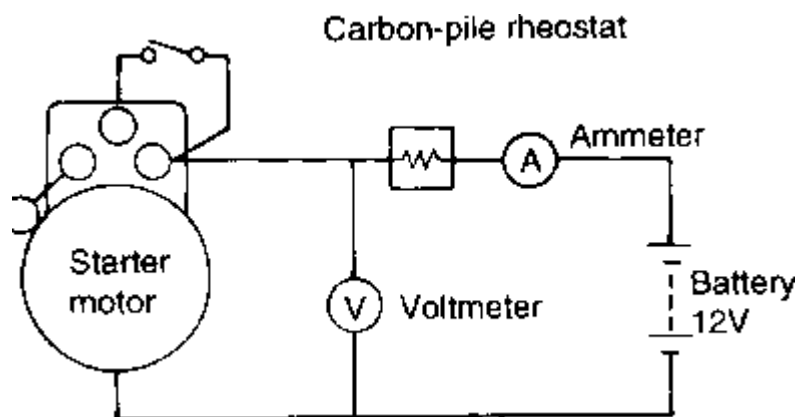
### CAUTION

**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**

If the pinion moves out, everything is in order. If the pinion moves back and forth repeatedly the hold-in circuit is open. Then replace the magnetic switch.

### FREE RUNNING TEST

Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows:



Connect a test ammeter (100-ampere scale) and carbon pile rheostat as shown in the illustration.

Connect a voltmeter (15-volt scale) across starter motor.

Rotate carbon pile to the off position.

Connect battery cable from battery negative post to starter motor body.

Adjust until battery voltage shown on the voltmeter reads 11 volts.

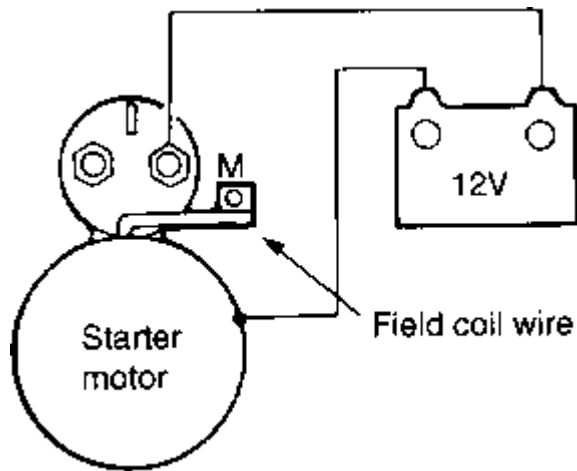
Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely:

**Current: Max. 90 Amps**

**Speed: Min. 3,000 rpm**

### MAGNETIC SWITCH RETURN TEST

Disconnect field coil wire from the M-terminal of the magnetic switch.



Connect a 12V battery between M-terminal and the body.

### **NOTE**

**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**

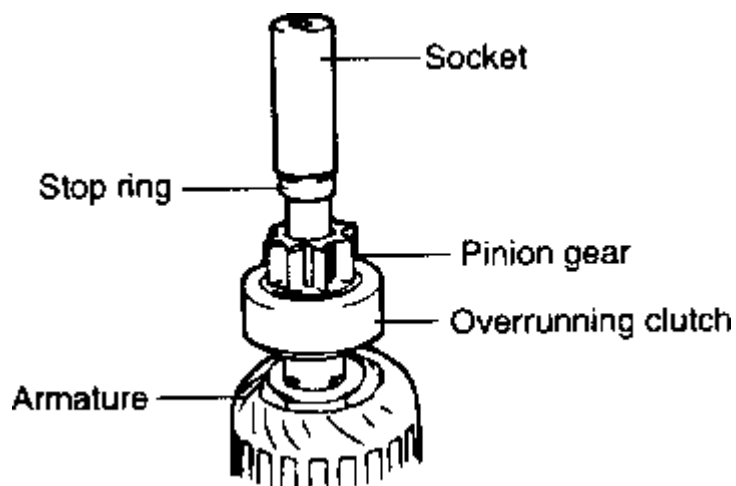
Pull pinion out and release. If pinion returns quickly to its original position, everything is in order. If it doesn't, replace the magnetic switch.

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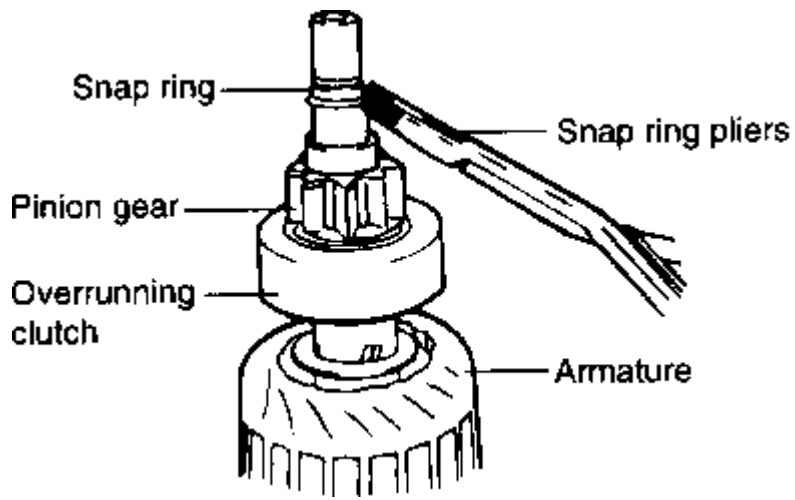
## **DISASSEMBLY**

### **REMOVAL OF SNAP RING AND STOP RING**

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



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



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## CLEANING STARTER MOTOR PARTS

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.

Do not immerse drive unit in cleaning solvent. The overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.

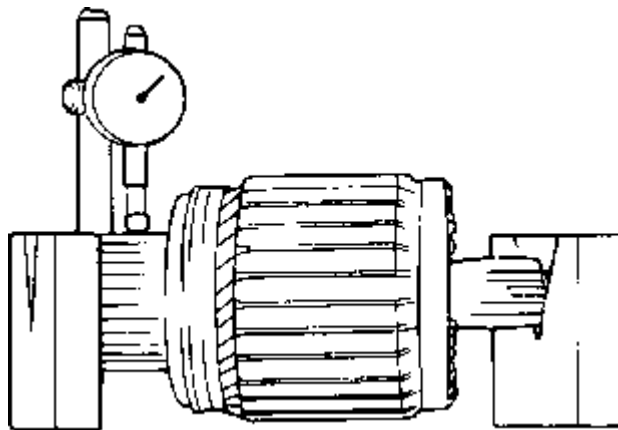
The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

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## INSPECTION

### CHECKING THE COMMUTATOR

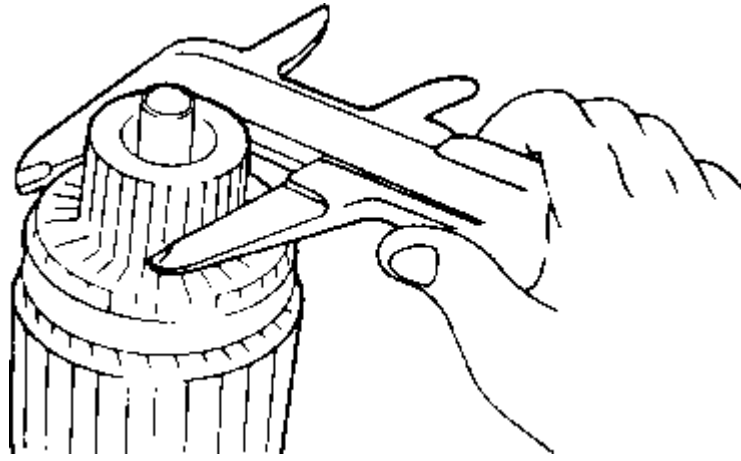
Place the armature on a pair of V-blocks, and check the run-out by using a dial gauge.



MEASUREMENT SPECIFICATION	
Armature run-out	0.05 mm ( 0.002 in )

MEASUREMENT SPECIFICATION	
Armature run-out	0.1 mm ( 0.0039 in )

Check the outer diameter of the commutator.

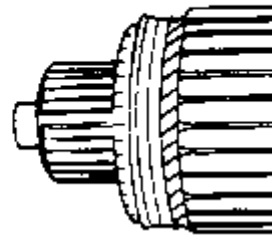
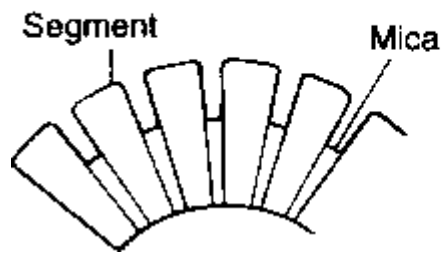


MEASUREMENT SPECIFICATION	
Outer diameter of the commutator	29.4 mm ( 1.157 in )

MEASUREMENT SPECIFICATION	
Outer diameter of the commutator	28.4 mm ( 1.118 in )

Check the depth of the undercut between segments.

### Undercut

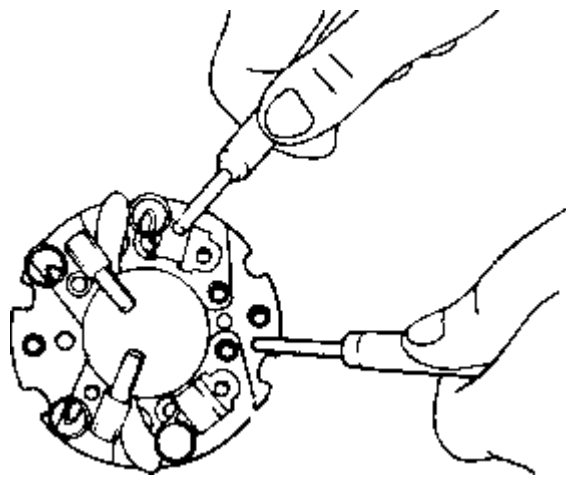


MEASUREMENT SPECIFICATION	
Depth of the undercut between segments	0.5 mm ( 0.020 in )

MEASUREMENT SPECIFICATION	
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.

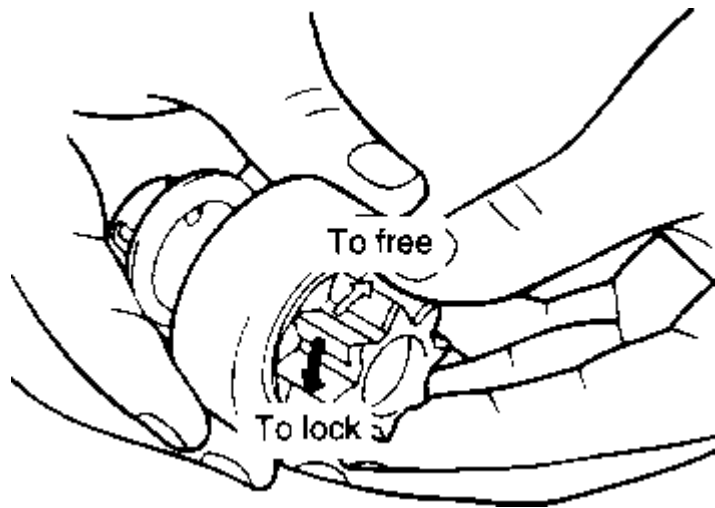


The normal condition is no continuity.

## OVERRUNNING CLUTCH

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.

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.

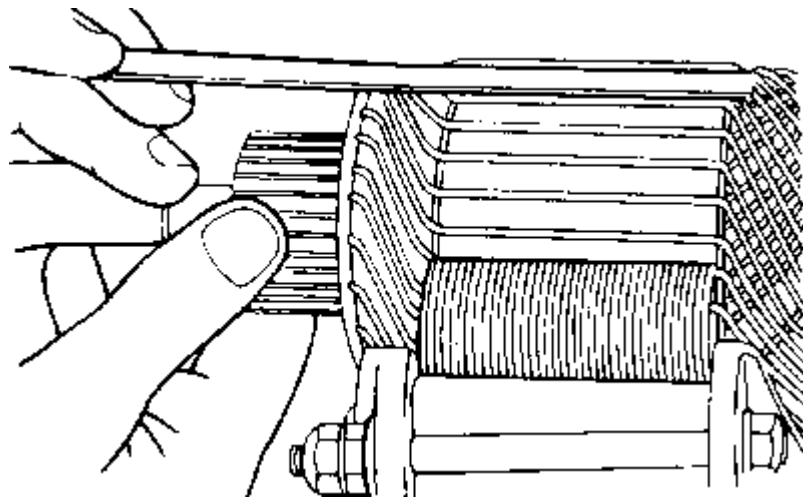
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## TESTING ARMATURE

### TESTING ARMATURE FOR SHORT-CIRCUIT

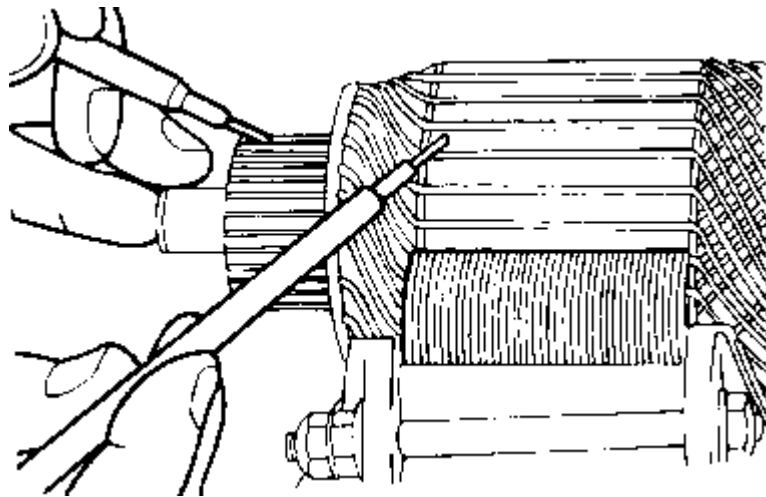
Place armature in a growler.

Hold a thin steel blade parallel and just above while rotating armature slowly in growler. A shorted armature will cause blade to vibrate and be attracted to the core. Replace shorted armature.



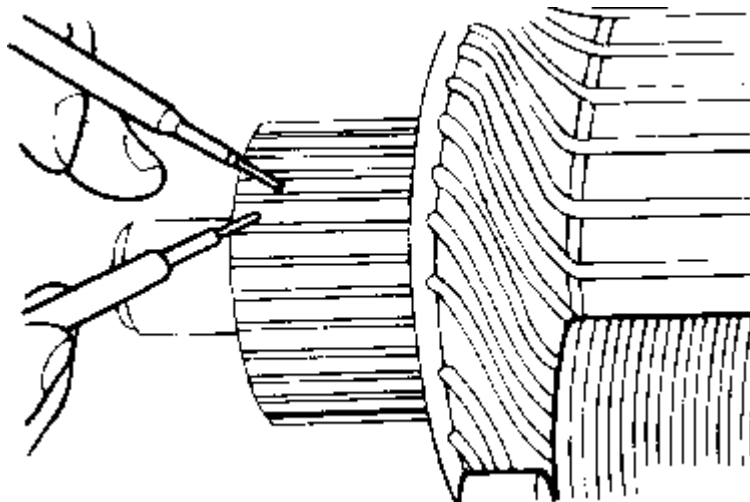
## **TESTING ARMATURE FOR GROUNDING**

Check the insulation between the armature coil cores and the commutator segments. They are normal if there is no continuity.



## **CHECKING FOR ARMATURE COIL WIRING DAMAGE/DISCONNECTION**

Check for continuity between segments. The condition is normal if there is continuity.



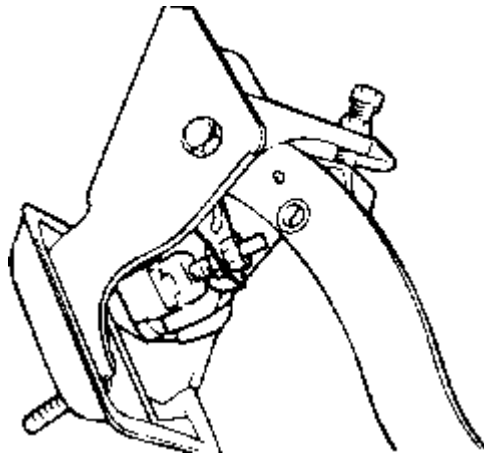
<b>SERVICE MANUAL</b>	
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<b>GROUP</b>	
Engine Electrical System	Starting System

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## INSPECTION OF CLUTCH START SYSTEM (IGNITION LOCK SYSTEM)

### CHECK CLUTCH PEDAL

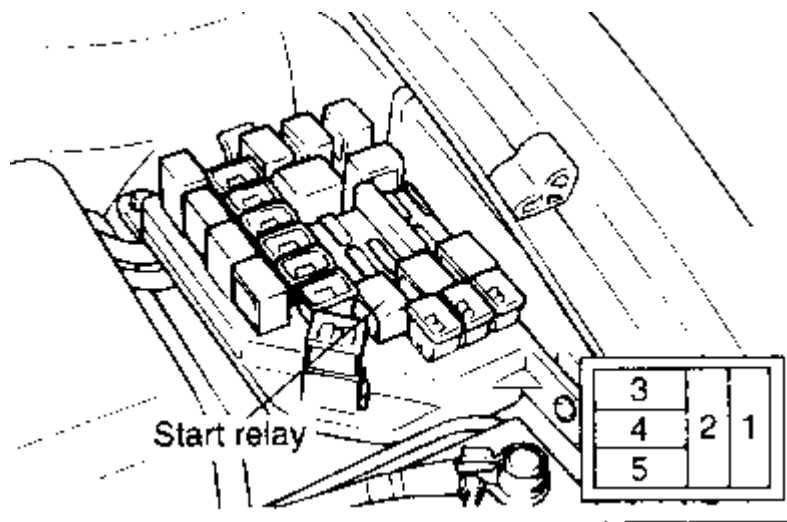
Check that pedal height, pedal freeplay and clutch pedal clevis pin play are correct. (Refer to clutch section)



### CHECK STARTER RELAY

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

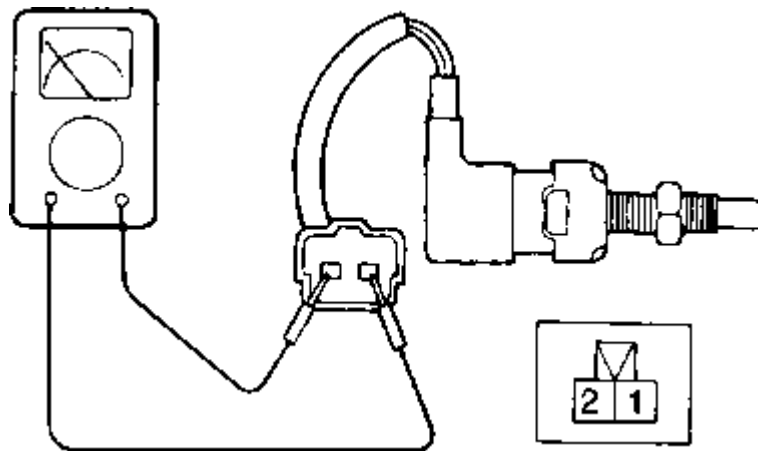
Terminal	S1 <sup>(3)</sup>	S2 <sup>(5)</sup>	L <sup>(1)</sup>	B <sup>(2)</sup>
When de-energized	○ — ○			
When energized	○ — ○		○ — ○	



## CHECK IGNITION LOCK SWITCH

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

Condition \ Terminal	1	2
Pushed	○—————○	
Free		





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## INSPECTION

### VOLTAGE DROP TEST OF GENERATOR OUTPUT WIRE

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

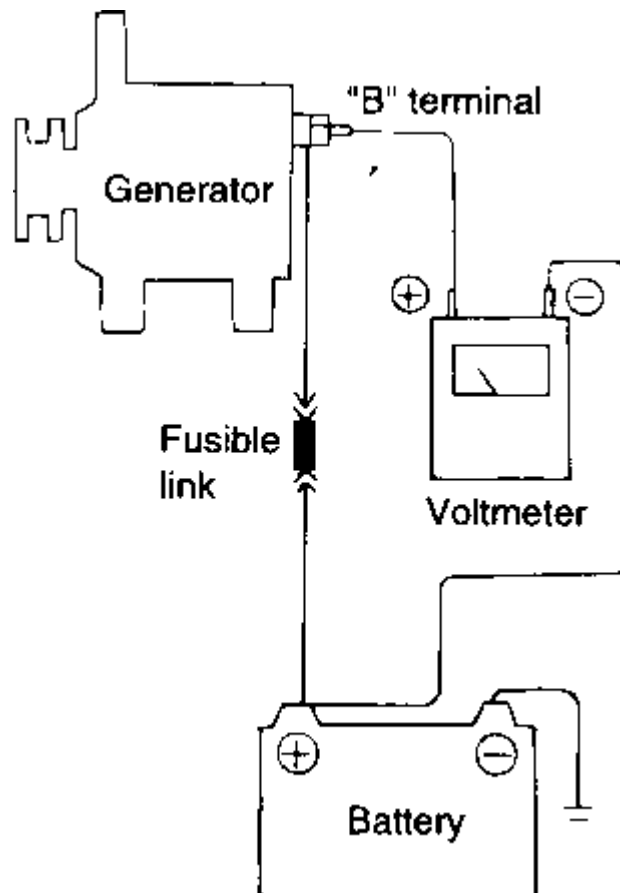
#### PREPARATION

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 connections during the test.**

Connect a digital voltmeter between the generator "B" terminal. and 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

Start the engine.

Turn on the headlamps, blower motor and so on. And then, read the voltmeter under this condition.

## RESULT

It is okay if the voltmeter indicates the standard value.

Standard value: 0.2V max.

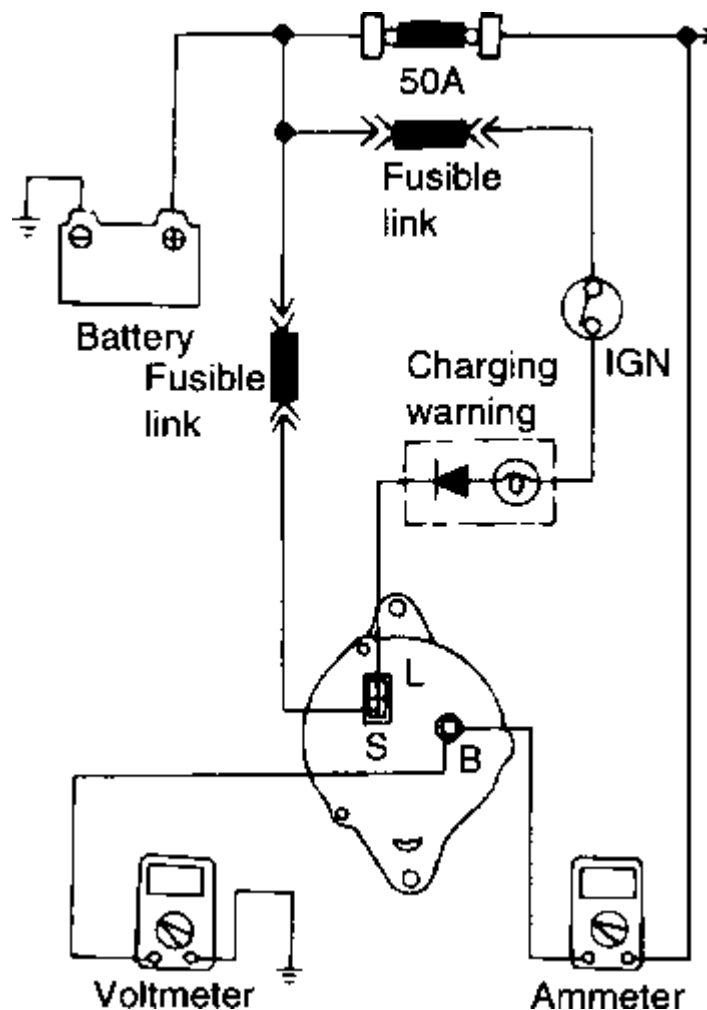
If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the generator "B" terminal to the fusible link to the battery (+) terminal. Check for loose connections, color change due to an overheated harness, etc. Correct them before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

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

## OUTPUT CURRENT TEST

This test judges whether or not the generator gives an output current that is equivalent to the nominal output.

## PREPARATION



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".

## **IMPORTANT**

**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 generator drive belt. The belt tension check method is described in the section "COOLING".

Turn off the ignition switch.

Disconnect the battery ground cable.

Disconnect the generator output wire from the generator "B" terminal.

Connect a DC ammeter (0 to 100A) 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.**

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

Attach an engine tachometer and connect the battery ground cable.

Leave the engine hood open.

## **TEST**

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

Start the engine and turn on the headlights.

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**

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

Limit value: 63A min 90A generator

## **NOTE**

- **The nominal output current value is shown on the nameplate affixed to the generator body.**
- **The output current value changes with the electrical load and the temperature of the generator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlights on to 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 generator itself or ambient temperature is too high. In such a case, reduce the temperature before testing again.**

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

Disconnect the battery ground cable.

Remove the ammeter and voltmeter and the engine tachometer.

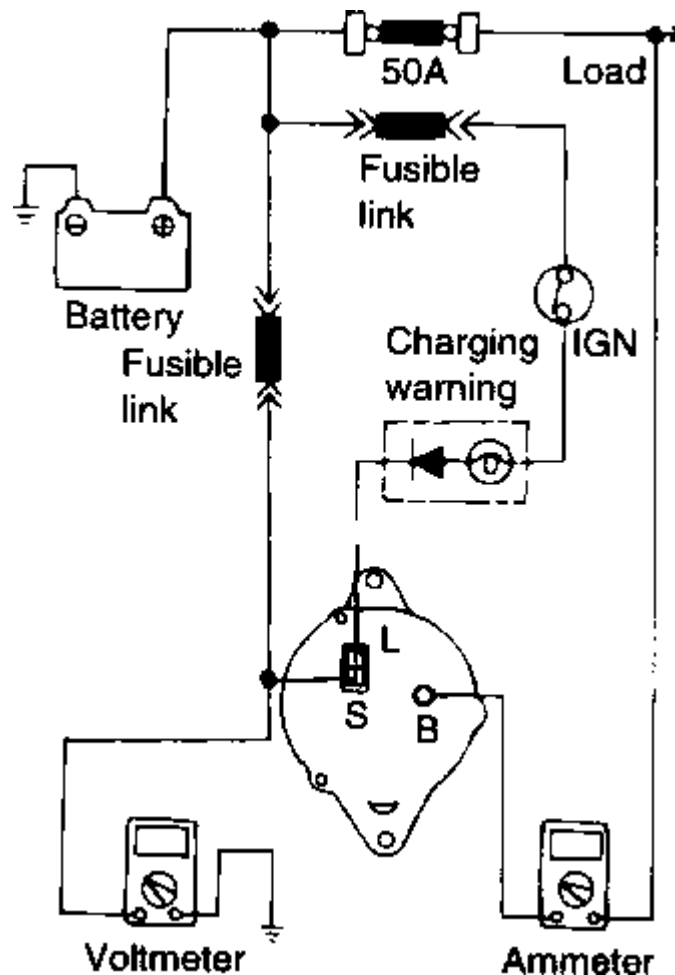
Connect the generator output wire to the generator "B" terminal.

Connect the battery ground cable.

## REGULATED VOLTAGE TEST

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

## PREPARATION



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 generator drive belt tension. For belt tension check, see section, "COOLING."

Turn ignition switch to "OFF."

Disconnect the battery ground cable.

Connect a digital voltmeter between the "S(L)" terminal of the generator and ground. Connect the (+) lead of the voltmeter to the "S(L)" terminal of the generator. Connect the (-) lead to good ground or the battery (-) terminal.

Disconnect the generator output wire from the generator "B" terminal.

Connect a DC ammeter (0 to 100A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.

Attach the engine tachometer and connect the battery ground cable.

## TEST

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

Voltage: Battery voltage

If it reads 0V, there is an open circuit in the wire between the generator "S(L)" terminal and the battery and the battery (+), or the fusible link is blown.

Start the engine. Keep all lights and accessories off.

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

## RESULT

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 generator is faulty.

### Regulating Voltage Table

Voltage regulator ambient temperature °C(°F)	Regulating voltage V
-20 (-4)	14.2-15.4
20 (68)	13.9-14.9
60 (140)	13.4-14.6
80 (176)	13.1-14.5

Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.

Disconnect the battery ground cable.

Remove the voltmeter and ammeter and the engine tachometer.

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

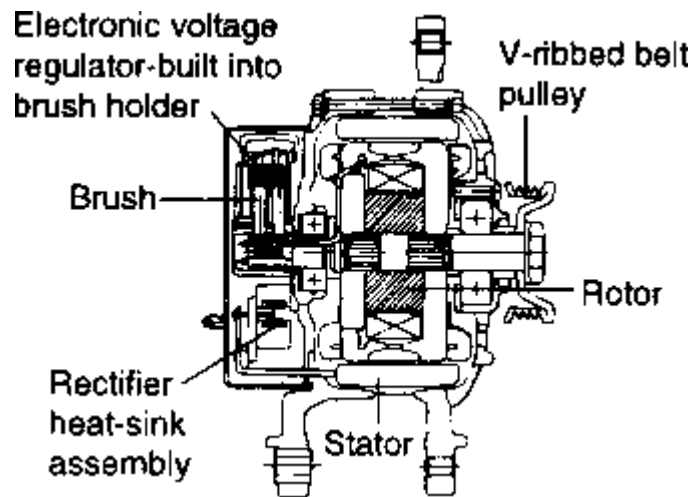
Connect the battery ground cable.

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## GENERAL INFORMATION

The charging system includes a battery, a generator with a built-in regulator, and the charging indicator light and wire. The generator has eight built-in diodes, each rectifying AC current to DC current. Therefore, DC current appears at generator "B" terminal.

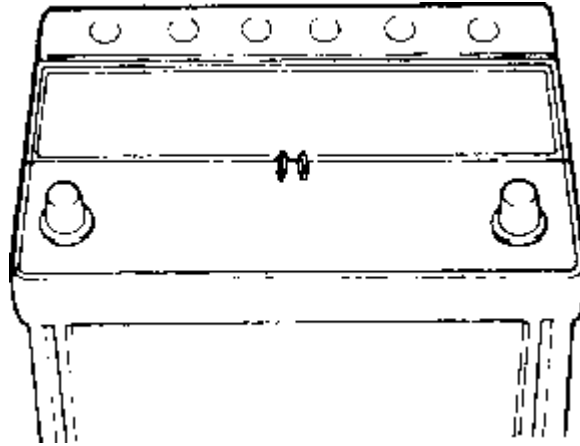


In addition, the charging voltage of this generator is regulated by the battery voltage detection system. The main components of the generator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.

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## DESCRIPTION



The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.

Water never needs to be added to the maintenance-free battery.

The battery is completely sealed, except for small vent holes in the cover.

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## BATTERY VISUAL INSPECTION (1)

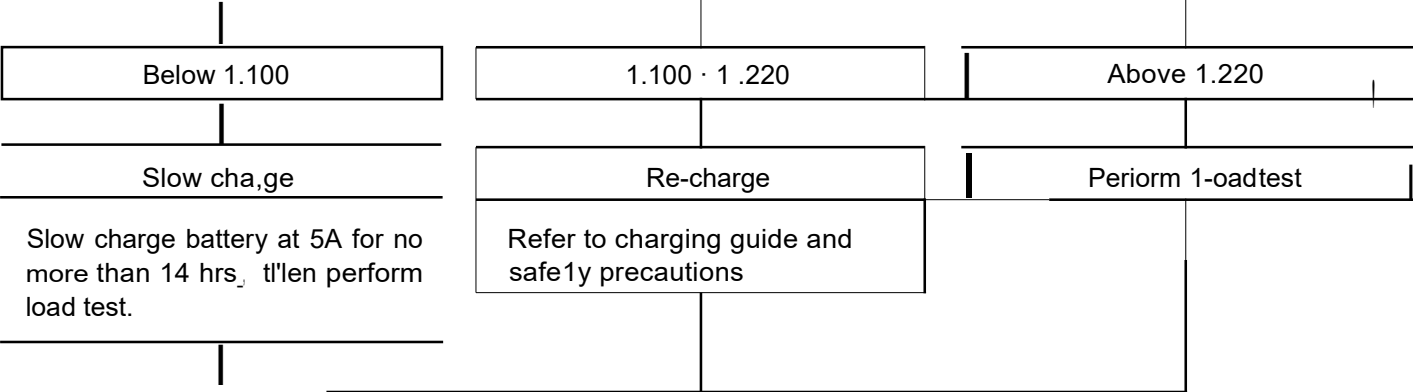
Check to, obvious damage such as a cracked or broken case or cover that could permit loss of electrolyte. Determine cause of damage and correct as needed. Clean corrosion with solution of baking soda and water.

Not O.K.

Replace battery

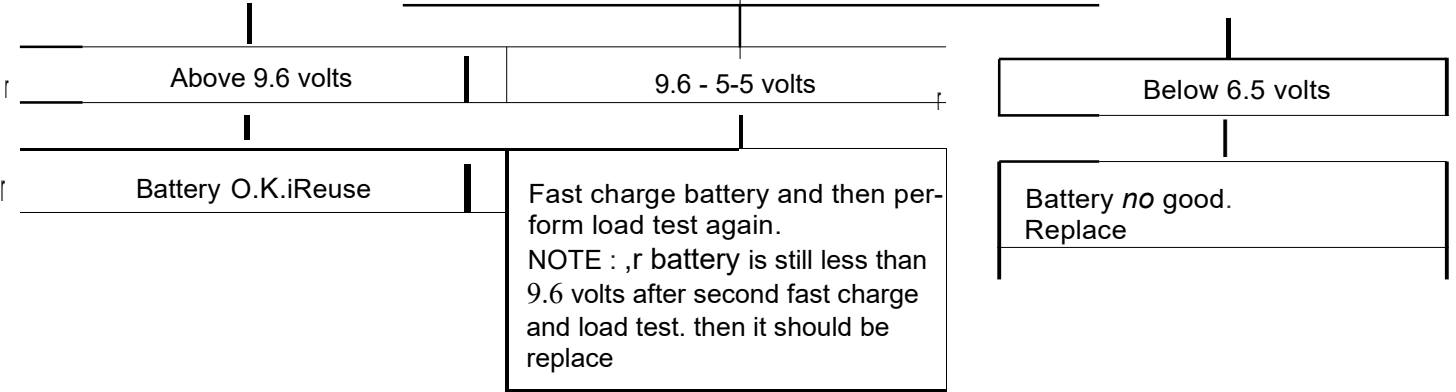
O.K.

Check specific gravity. Refer to "Specific gravity check chart" for electrolyte temperature compensation. and then select proper reading below.

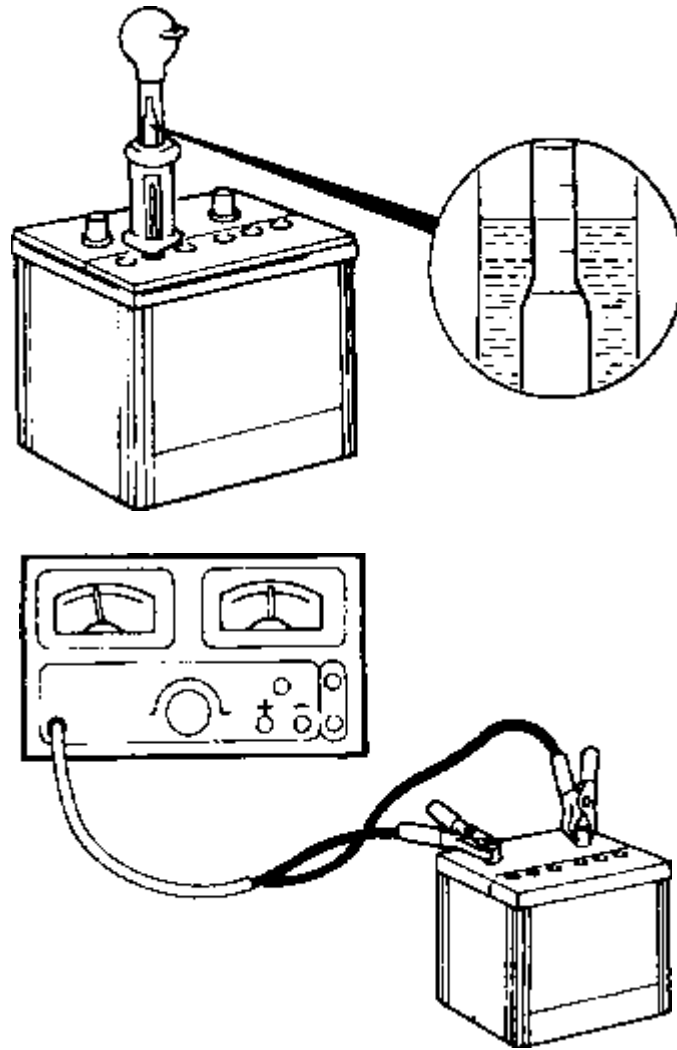


Continue

Load test battery  
Apply 200A load for 15 sec., then check battery voltage and compare below







## SPECIFIC GRAVITY CHECK CHART

The specific gravity of battery electrolyte changes with temperature. Heat thins the solution and lowers the specific gravity. Cold thickens the solution and raises the specific gravity.

A fully charged battery should have a specific gravity between 1.260 and 1.280, with the electrolyte temperature at 80°F. The specific gravity reading must be corrected by adding 4 points (.004) for each 10°F above 80°F or subtracting 4 points for every 10°F below 80°F.

For example: The hydrometer reading is 1.280, and the electrolyte temperature reading is 10°F. According to the chart below, the specific gravity must be lowered by 0.028 points. The true corrected reading is 1.252.

$$280 - 0.028 = 1.252$$

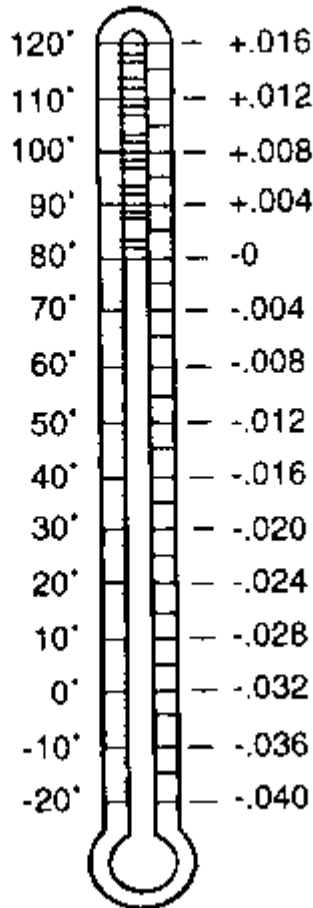
You should never take a hydrometer reading immediately after water has been added. The water and electrolyte must be mixed by either charging for a few minutes at a low rate or by allowing the battery to sit for an hour.

### **CAUTION**

**A difference of 50 points (0.050) or more between one or more cells indicates a defective battery. It should be replaced.**

**ELECTROLYTE  
TEMPERATURE**

**SPECIFIC GRAVITY  
CORRECTION**



**BATTERY CHARGE RATE**

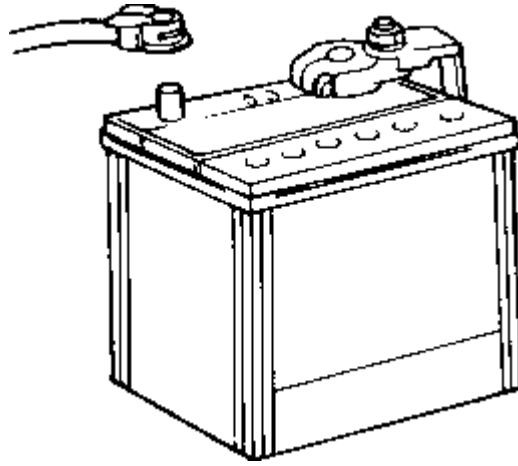
**Charge method**

Specific gravity	Slow charge (5A)	Fast charge (20A)
Below 1.100	14 hours	4 hours
100 - 1.130	12 hours	3 hours
130 - 1.160	10 hours	2.5 hours
160 - 1.190	8 hours	2.0 hours
190 - 1.220	6 hours	1.5 hours
Above 1.220	4 hours	1.0 hours

**BATTERY VISUAL INSPECTION (2)**

Make sure ignition switch is in the Off position and all accessories are Off.

Disconnect the battery cables (negative first).

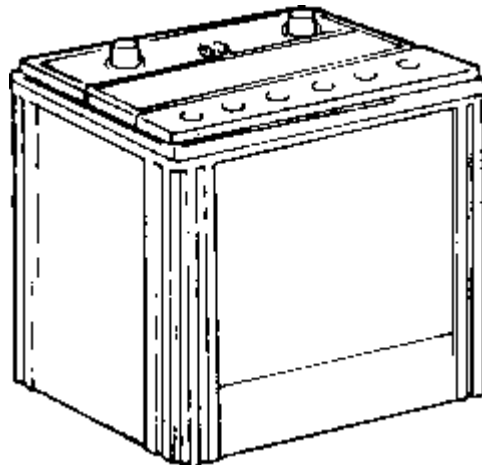


Remove the battery from the vehicle.

**CAUTION**

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

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 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.



Clean the top of the battery with the same solution as described in Step (4).

Inspect the battery case, and cover, for cracks. If cracks are present, the battery must be replaced.

Clean the battery posts with a suitable battery post cleaner.

Clean the inside surface of the terminal clamps with a suitable battery terminal cleaning tool. Replace damaged or frayed cables and broken terminal clamps.

Install the battery in the vehicle.

Connect the cable terminals to the battery post, making sure the top of the terminal are flush with the top of the post.

Tighten the terminal nut securely.

Coat all connections with light mineral grease after tightening.

**CAUTION**

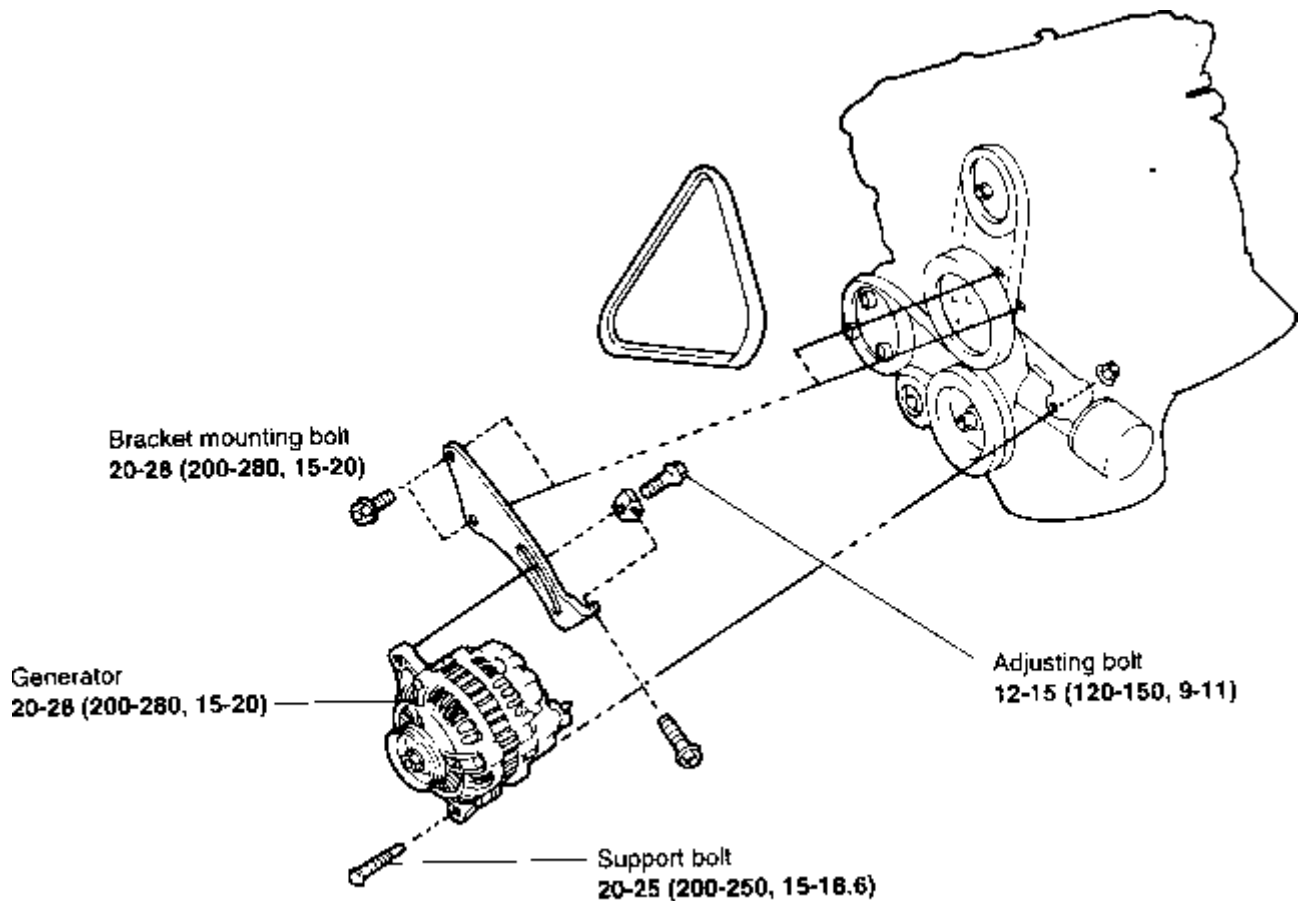
When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not

**smoke near batteries being charged or which have recently been charged. Do not break live circuits at the terminals of the batteries being charged. A spark will occur where the circuit is broken. Keep all open flames away from the battery.**

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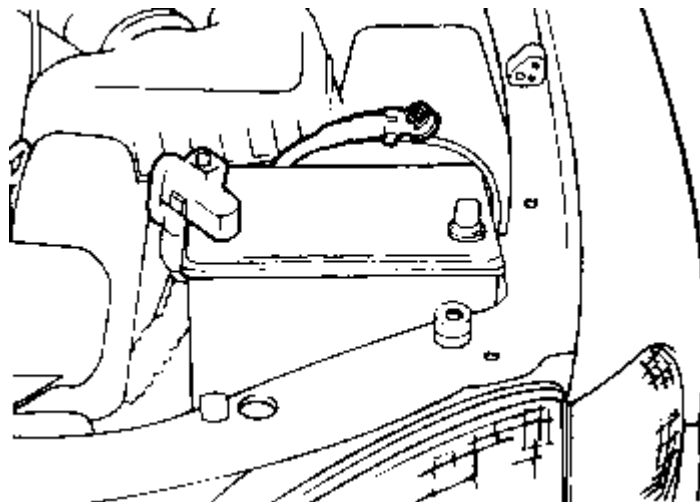
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## REMOVAL AND INSTALLATION

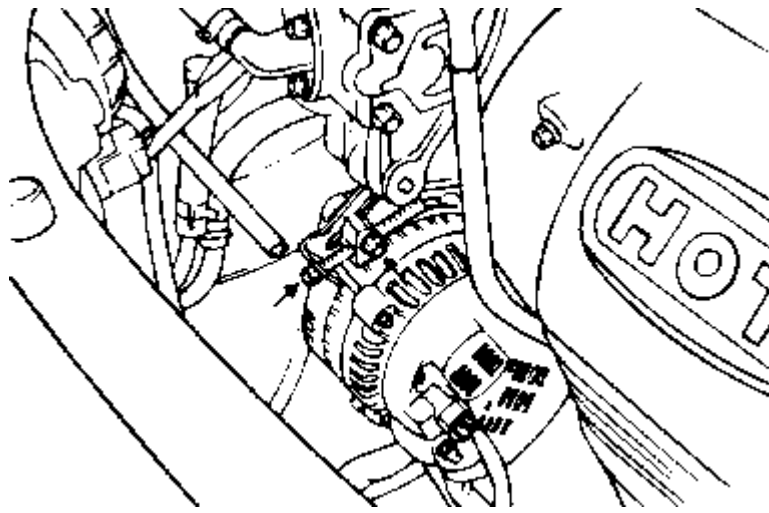


### TORQUE : Nm (kg.cm, lb.ft)

Disconnect the negative terminal from the battery.



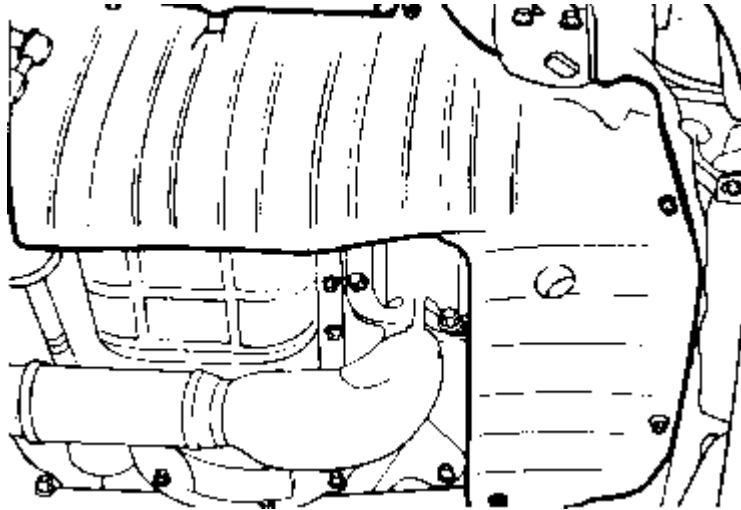
Loosen the belt tension.



Raise the vehicle.

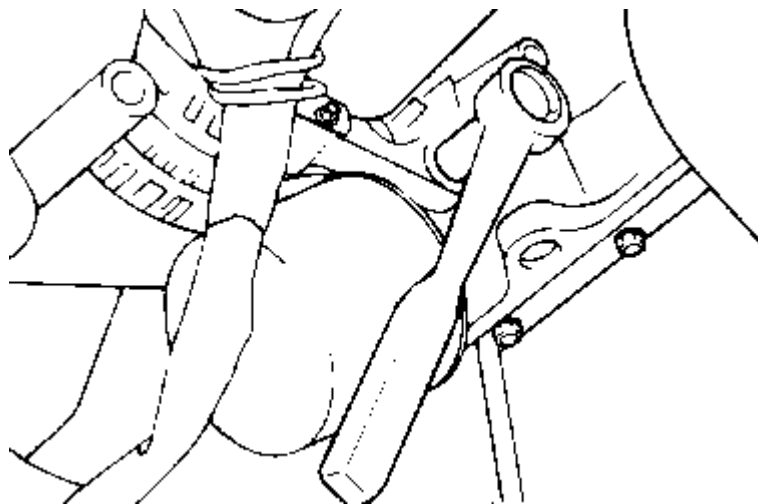
Remove the mud guard - RH

Disconnect the generator B+ terminal wire and connector.



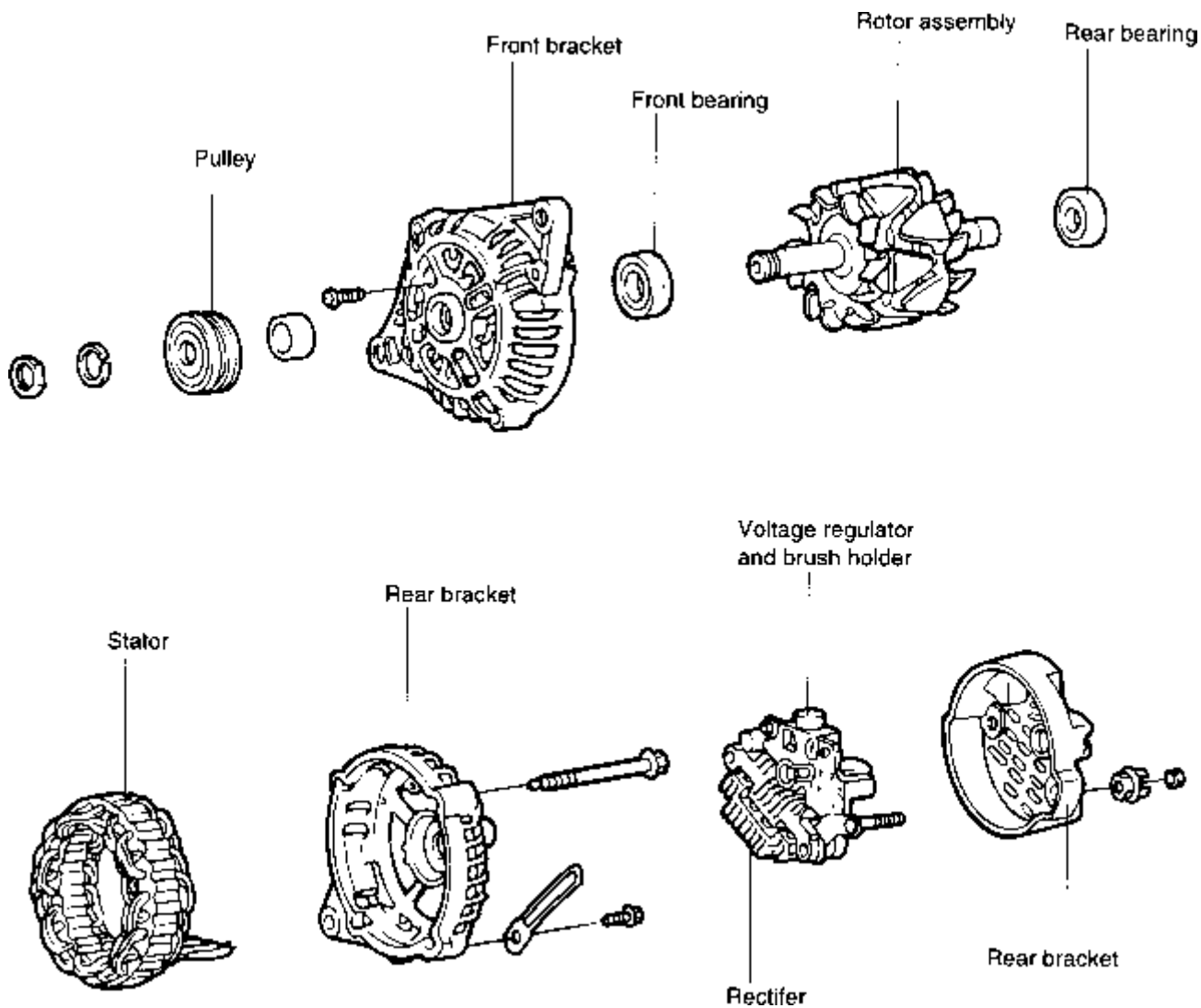
Remove the belt and generator mounting bolt (2EA).

Remove the generator assembly.



Installation is the reverse order of removal.

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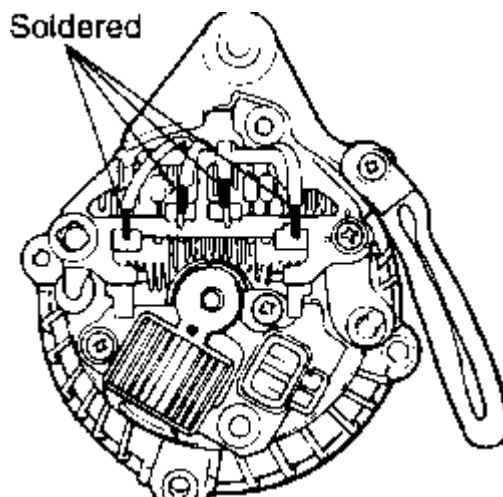


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## DISASSEMBLY

Remove the nut from the "B" terminal, and rear cover.

When the stator is to be removed, unsolder the four stator leads to the main diodes on the rectifier.



**CAUTION**

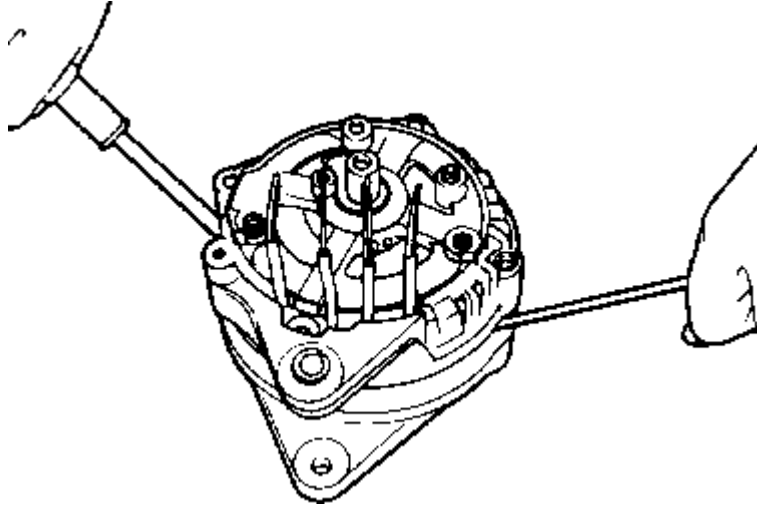
1. When soldering or unsoldering, use care to make sure that heat of the soldering iron is not transmitted to the diodes for a long period.
2. Use care that excessive force is not exerted on the leads of the diodes.

Remove the stator assembly from the rear bracket.

Remove the brush holder and the rectifier.

Remove the four through bolts

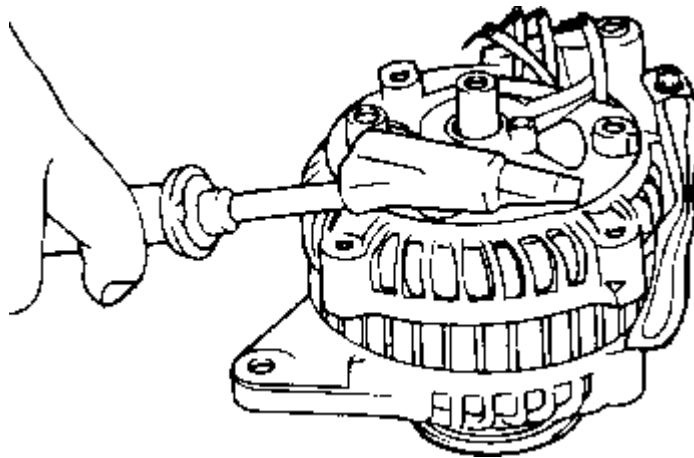
Insert a flat screwdriver between the front bracket and stator core, and pry downward.



### CAUTION

1. Do not insert the screwdriver too deeply, as there is a danger of damaging the stator coil.
2. The rear cover may be hard to remove because a ring is used to lock the outer race of the rear bearing. To facilitate removal of rear cover, heat just the bearing box' section with a 200-watt soldering iron. Do not use a heat gun, as it may damage the diode assembly.

Secure the rotor in a vise with the pulley side up.

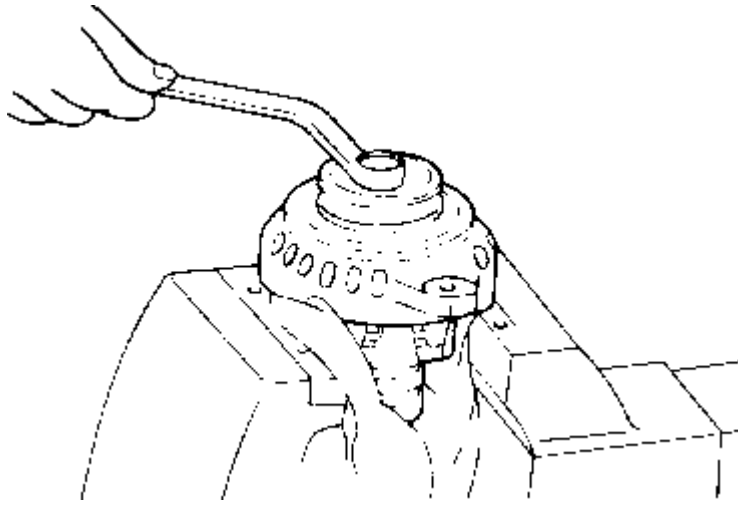


### CAUTION

Be careful that the vise jaws do not damage the rotor.

Remove the pulley nut, then remove the spring washer, then the pulley, and then the spacer.

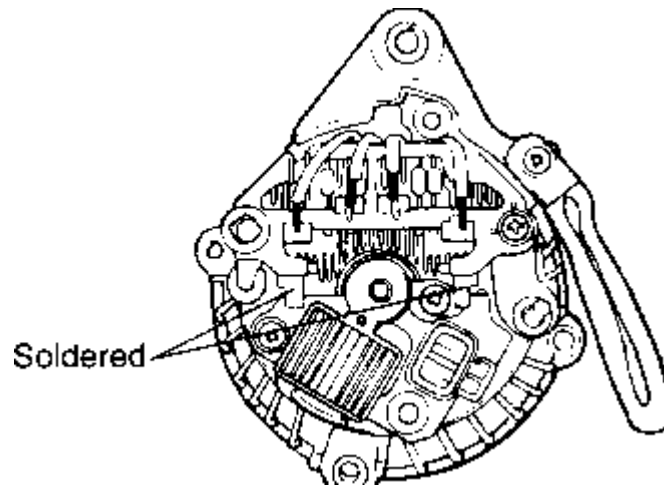




Remove the front bracket and seals.

Remove the rotor from the vise.

When separating the rectifier from the brush holder, unsolder the two plates soldered to the rectifier.

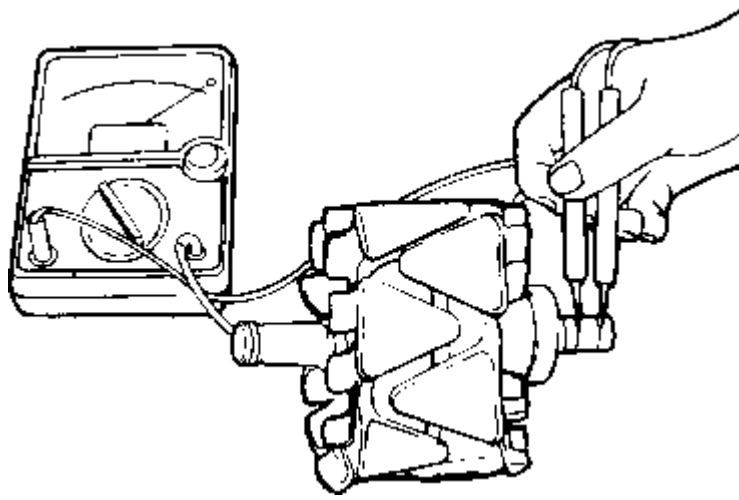


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## INSPECTION

### ROTOR

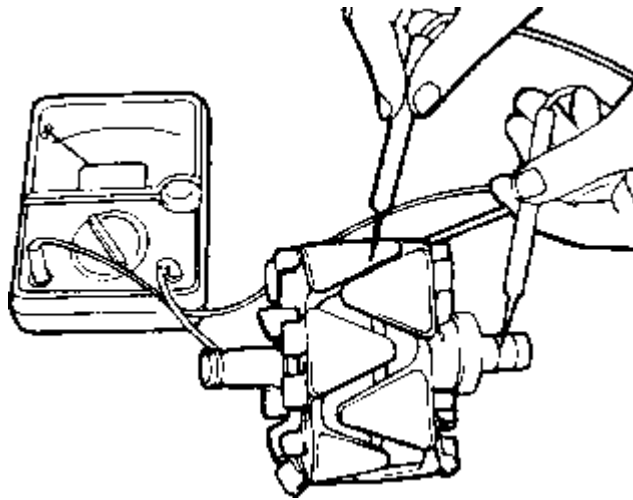
Check the rotor coil for continuity. Check to make sure that there is continuity between the slip rings. If resistance is extremely low, it means that there is a short. If there is no continuity or if there is a short circuit, replace the rotor assembly.



### RESISTANCE SPECIFICATION

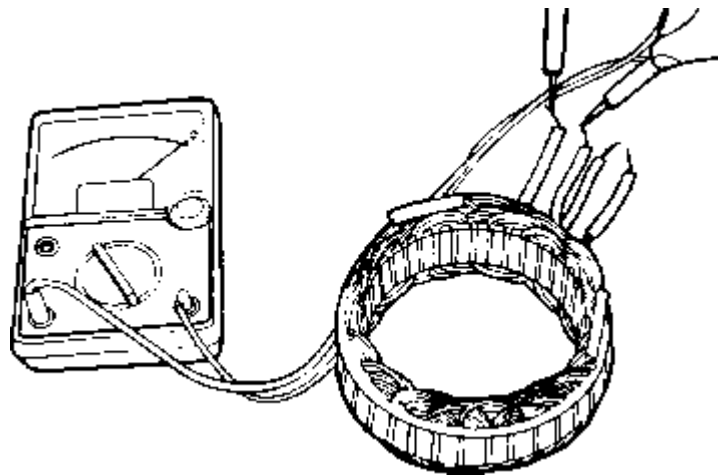
Resistance value:	Approx. 2.7 $\Omega$
-------------------	----------------------

Check the rotor coil for ground. Check to make sure that there is no continuity between the slip ring and the core. If there is continuity, replace rotor assembly.

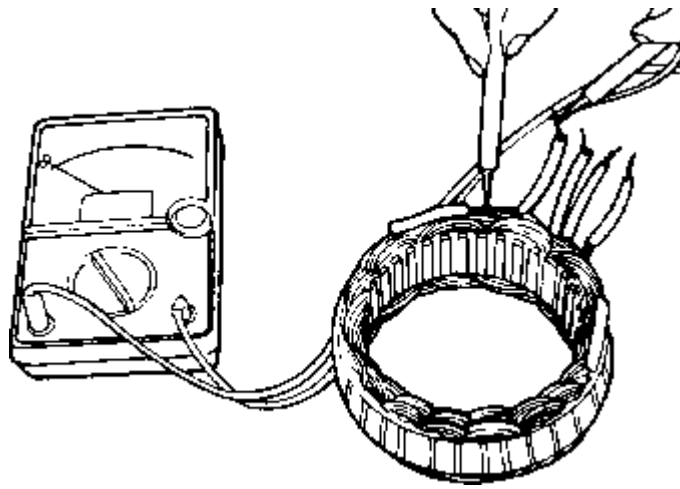


### STATOR

Make a continuity check on the stator coil. Check to make sure that there is continuity between the coil leads. If there is no continuity, replace stator assembly.



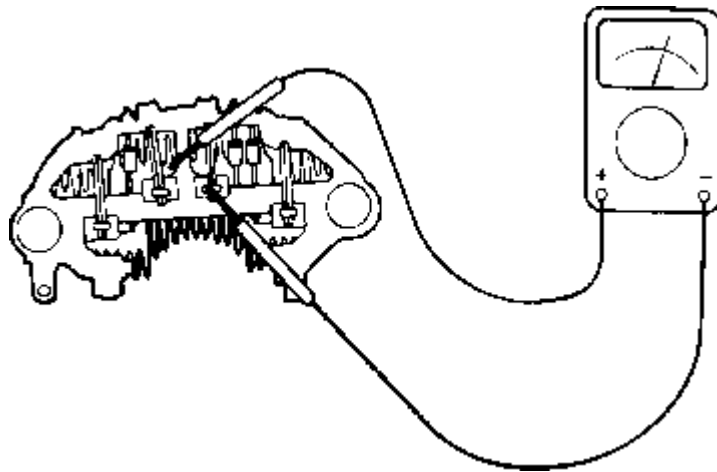
Check the coil for grounding. Check to make sure that there is no continuity between the coil and the core. If there is continuity, replace the stator assembly.



## RECTIFIERS

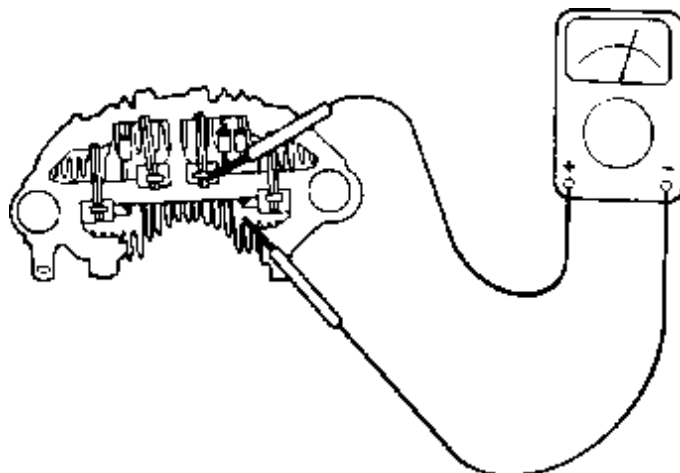
### POSITIVE RECTIFIER TEST

Check for continuity between the positive rectifier and stator coil lead connection terminal with an ohmmeter. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted. Replace the rectifier assembly.



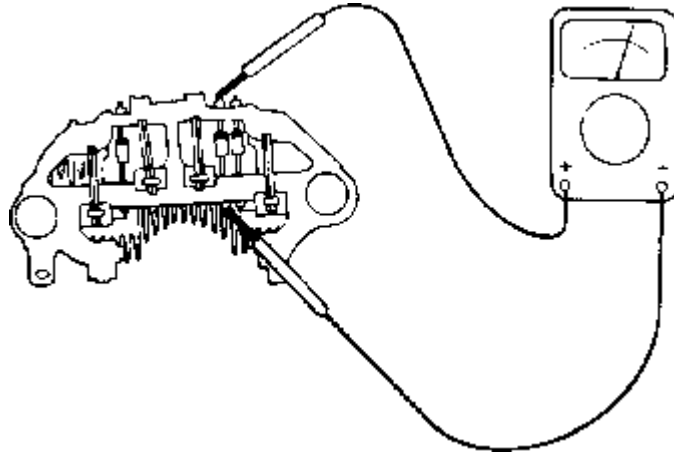
### NEGATIVE RECTIFIER TEST

Check for continuity between the negative rectifier and the stator coil lead connection terminal. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted, and the rectifier assembly must be replaced.



## DIODE TRIO TEST

Check the three diodes for continuity by connecting an ohmmeter to both ends of each diode. Each diode should have continuity in only one direction. If continuity is present in both directions, a diode is defective and the heatsink assembly must be replaced.

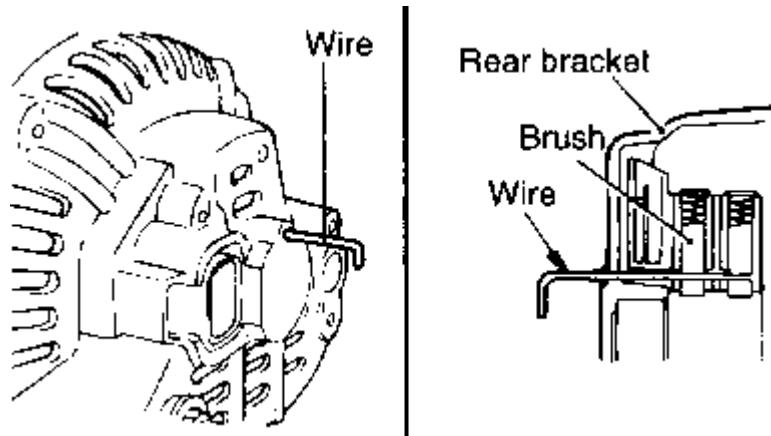


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## REASSEMBLY

Perform reassembly in the reverse procedure of disassembly. Pay attention to the following:

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

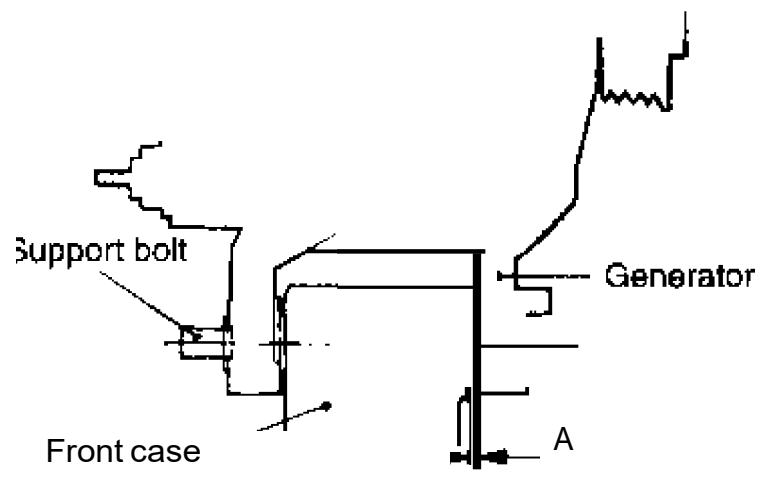


## INSTALLATION

Position the generator and insert the support bolt. (Do not attach the nut.)

Push the generator forward and determine how many spacers (thickness: 0.198mm) should be inserted between the front leg of the generator and the front case (space A in the illustration). (There should be enough spacers so that they do not fall out when you let go of them.)

Insert the spacers (space A in the illustration), attach the nut, and complete the installation.



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## TROUBLESHOOTING

### IGNITION SYSTEM

Trouble condition	Probable cause	Remedy
Engine will not start or is hard to start. (Crank OK)	Ignition coil faulty	Inspect ignition coil
	Camshaft position sensor faulty	Replace camshaft position sensor
	Spark plug cable faulty	Inspect spark plug cable
	Spark plugs faulty	Replace plugs
	Ignition wiring disconnected or broken	Inspect wiring
Rough idle or stalls	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Inspect wiring
	Ignition coil faulty	Inspect ignition coil
Engine hesitates/poor acceleration	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Inspect wiring
Poor mileage	Spark plugs faulty	Replace plugs

### CHARGING SYSTEM

Trouble condition	Probable cause	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown	Check fuses
	Bulb burned out	Replace bulb
	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
Discharge battery	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
Overcharge	Electronic voltage regulator faulty	Replace voltage regulator
	Voltage sensing wire faulty	Repair wire

## **CRUISE CONTROL SYSTEM BEFORE TROUBLESHOOTING**

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

Check if the installation and connection routes of the cables and vacuum hoses of the cruise vacuum pump assembly, actuator and pulley assembly are all normal.

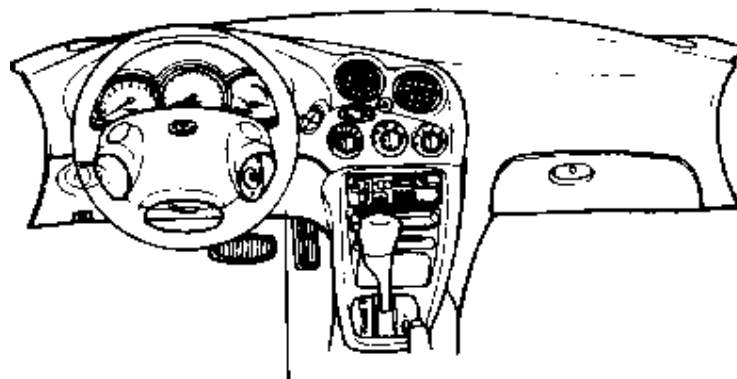
Check if the pulley assembly and the movement of all cables are all working smoothly.

Check if there is no excessive play or tension in each cable.

## **SELF-DIAGNOSIS CHECKING**

Self-diagnosis checking is performed when there has been an automatic cancellation, without cancel switch operation.

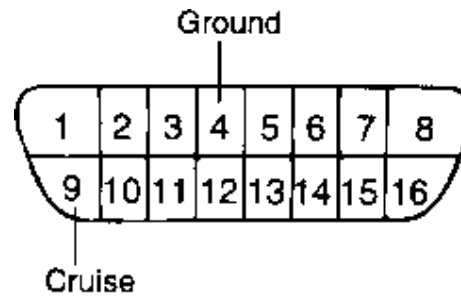
The following methods can be used for checking the diagnosis. Note that the data link connector is located in the fuse box.



DATA LINK CONNECTOR


If an indicator lamp is used, connect directly between the ground terminal and the terminal for CC of the data link connector. It is possible to discover which circuit is the cause of the cancellation by verifying the indication shown by the indicator lamp with the display patterns shown on the next page. All diagnostic trouble codes are stored so that it is possible to check if a problem occurred in the past or not until disconnecting the battery terminals, even when the ignition key is turned to OFF.

CC: Cruise control









DATA LINK CONNECTOR

### Diagnosis display patterns and codes

CODE NO.	DISPLAY PATTERNS (Use with scan tool)	PROBABLE CAUSE	CHECK ITEMS
01 (Vacuum pump)		Abnormal condition of auto cruise vacuum pump drive system	<ol style="list-style-type: none"> <li>1. Vacuum pump assembly</li> <li>2. CCM</li> <li>3. Relevant wiring</li> </ol>
			<ol style="list-style-type: none"> <li>1. Vehicle speed</li> </ol>



02 (Speed sensor)		Abnormal condition of vehicle speed signal system	sensor 2. Relevant wiring
03 (Low speed limit)		Vehicle speed less than 40km/h	
04 (Redundant brake)		Vehicle speed less than memory speed by 15km/h	
05 (Control switch)		SET and RESUME switches on simultaneously	
06 (Control module)		Abnormal condition of CCM	1. CCM 2. Relevant wiring
07 (Cancel signal)		Cancel switch ON	1. Brake switch 2. P/N position switch 3. Clutch switch 4. Relevant wiring

## TROUBLESHOOTING PROCEDURES

First, select the applicable malfunction symptom from the Trouble Symptom Charts. Conduct the self-diagnostic test following the directions on the charts. Determine the condition of all function circuits.

### CAUTION

**Because the computer (self-diagnosis) memory data will be erased when the system is unintentionally cancelled during fixed-speed driving, the ignition switch and/or the cruise main switch of the CC system should not be switched OFF, and the battery should not be disconnected.**

Make the following preliminary inspections.

- Check that the installation of the actuator, accelerator cable are correct, and that the cables and links are securely connected.
- Check that the accelerator pedal moves smoothly.

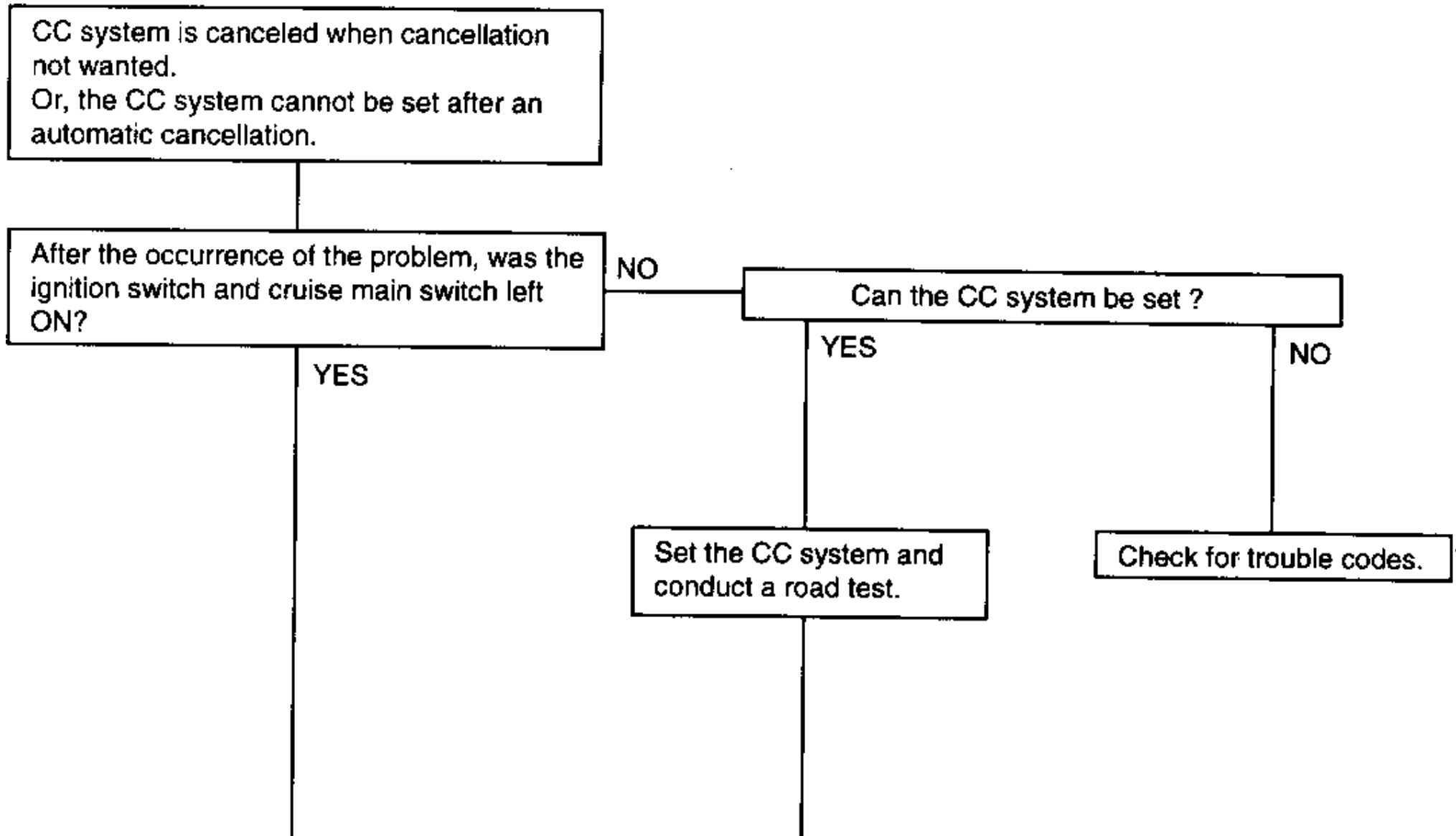
- Adjust the cable so there is not excessive tension or excessive play on the accelerator cable.
- Check that the CCM, actuator, cruise main and control switch and the connector of each cancel switch are connected securely.

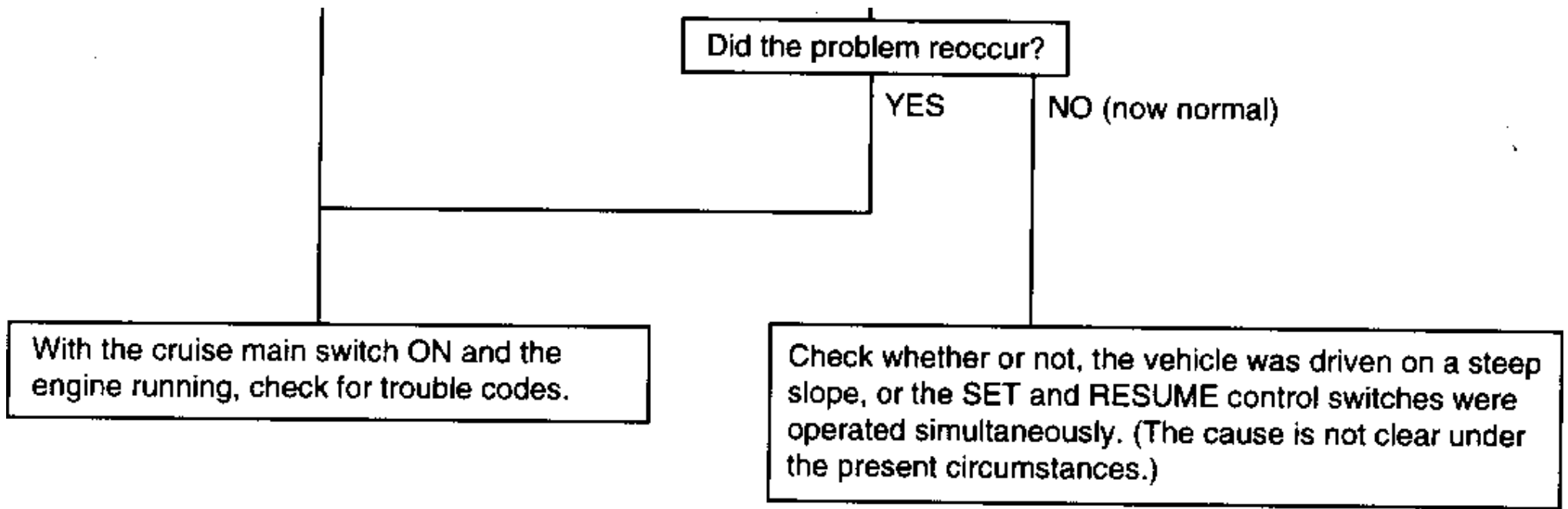
Check in the sequence indicated in the Trouble Symptom Chart.

If these checks indicate a normal condition, replace the cruise control module.

## TROUBLE SYMPTOM CHARTS

### TROUBLE SYMPTOM 1





### Trouble Symptom 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the speedometer cable or speedometer drive gear	
	Cruise vacuum pump circuit poor contact	Repair the actuator system, or replace the part
	Malfunction of the CCM	Replace the CCM

### Trouble Symptom 3

Trouble symptom	Probable cause	Remedy
The CC system is not cancelled 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 CCM	Replace the CCM

### Trouble Symptom 4

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

### 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 CCM	Replace the CCM

### 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 CCM	Replace the CCM

### Trouble Symptom 7

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

### Trouble Symptom 8

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

### 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 CCM	

### Trouble Symptom 10

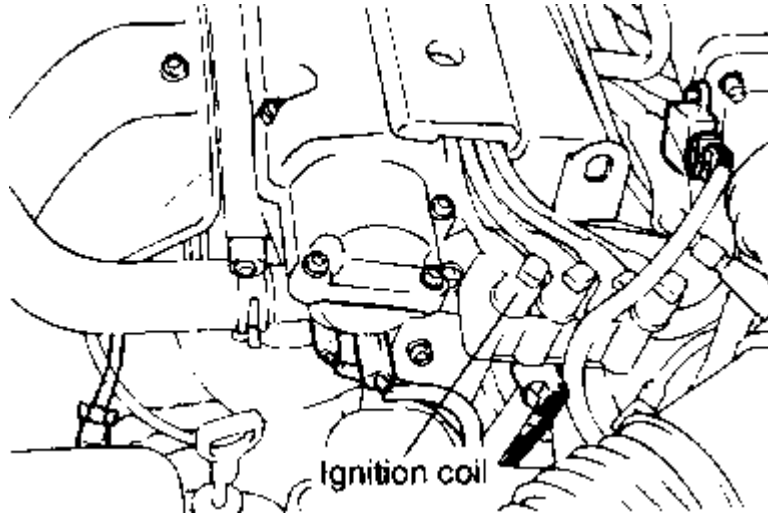
Trouble symptom	Probable cause	Remedy
Overdrive is not cancelled during fixed speed driving	Malfunction of circuit related to over-drive cancellation, or malfunction of CCM	Repair the harness or replace the part
No shift to overdrive during manual driving		

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## GENERAL INFORMATION

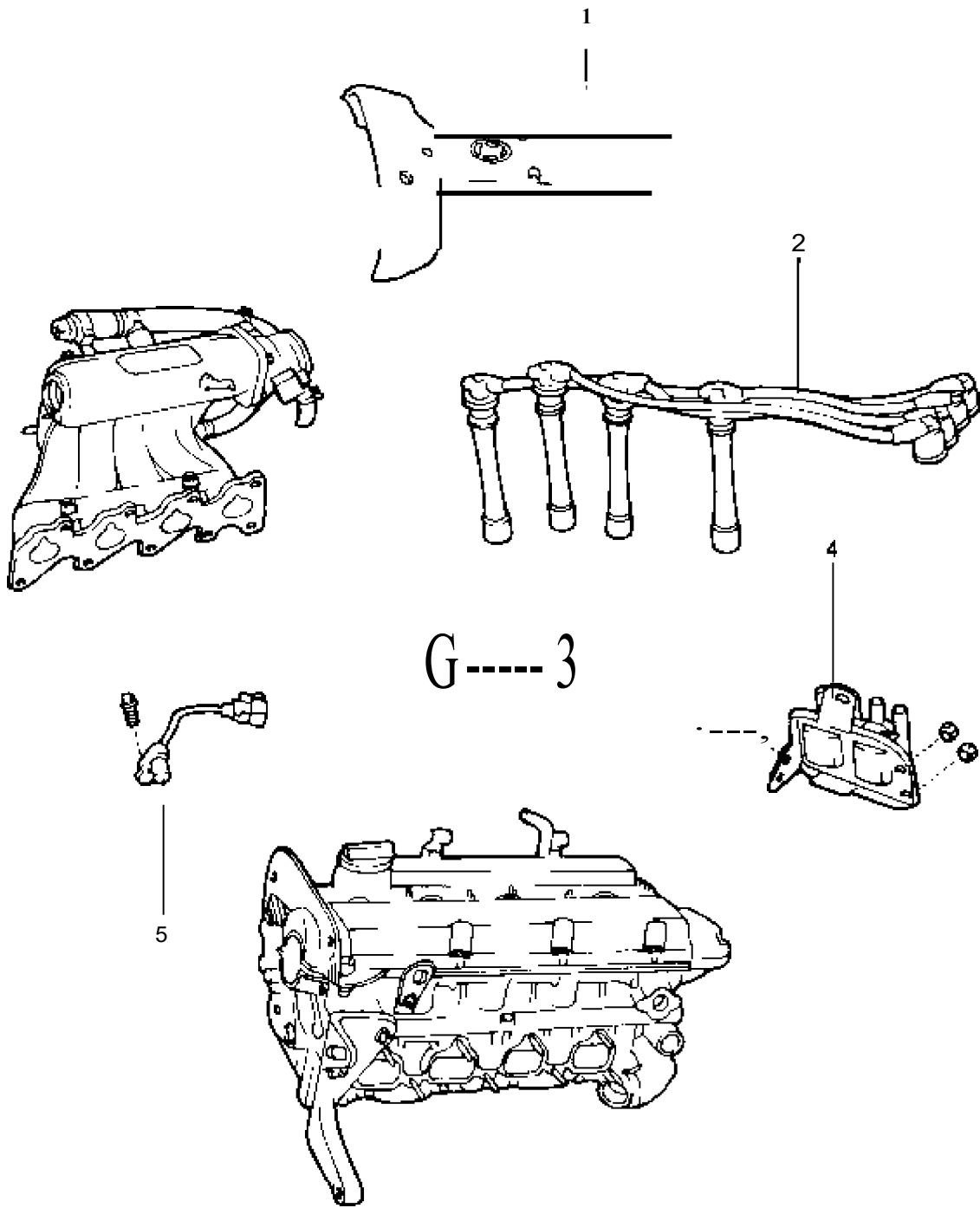
Ignition timing is controlled by the electronic control ignition. timing system. The ignition timing data for the engine operating conditions are programmed in the memory of the engine control module (ECM).



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 the primary current are sent to the engine control module. The ignition coil is activated, and timing is controlled at the optimum point.

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## REMOVAL AND INSTALLATION



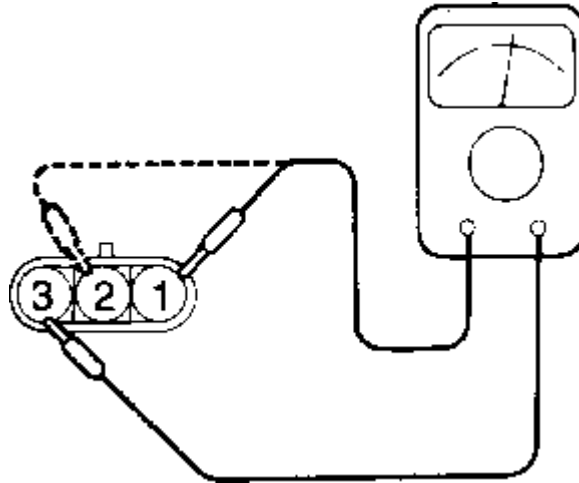
- 1, Center cover
- 2, Spark plug cable
- 3, Spark plug
- 4, Ignition coil
- 5, Camshaft position sensor

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## MEASUREMENT OF THE PRIMARY COIL RESISTANCE

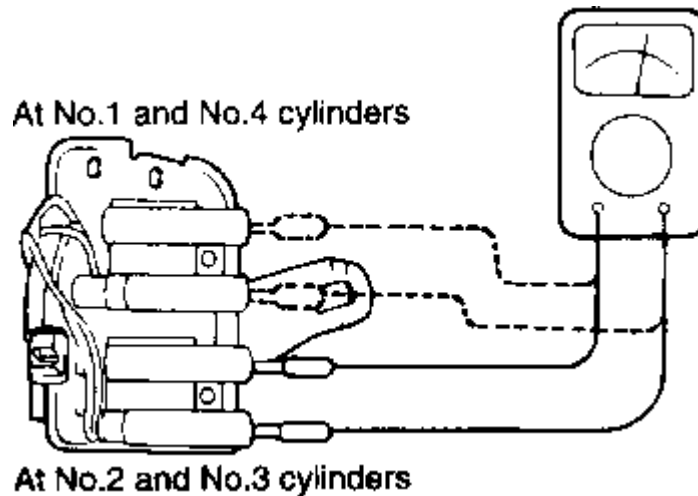
Measure the resistance between connector terminals 3 and 2 (the coils at the No.1 and No.4 cylinder sides) of the ignition coil, and between terminals 3 and 1 (the coils at the No.2 and No.3 cylinder sides).



<b>RESISTANCE SPECIFICATION</b>	
Standard value:	0.45 - 0.55 Ω

## MEASUREMENT OF THE SECONDARY COIL RESISTANCE

Measure the 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.



<b>RESISTANCE SPECIFICATION</b>	
Standard value:	10.3 - 13.9 K Ω

**CAUTION**



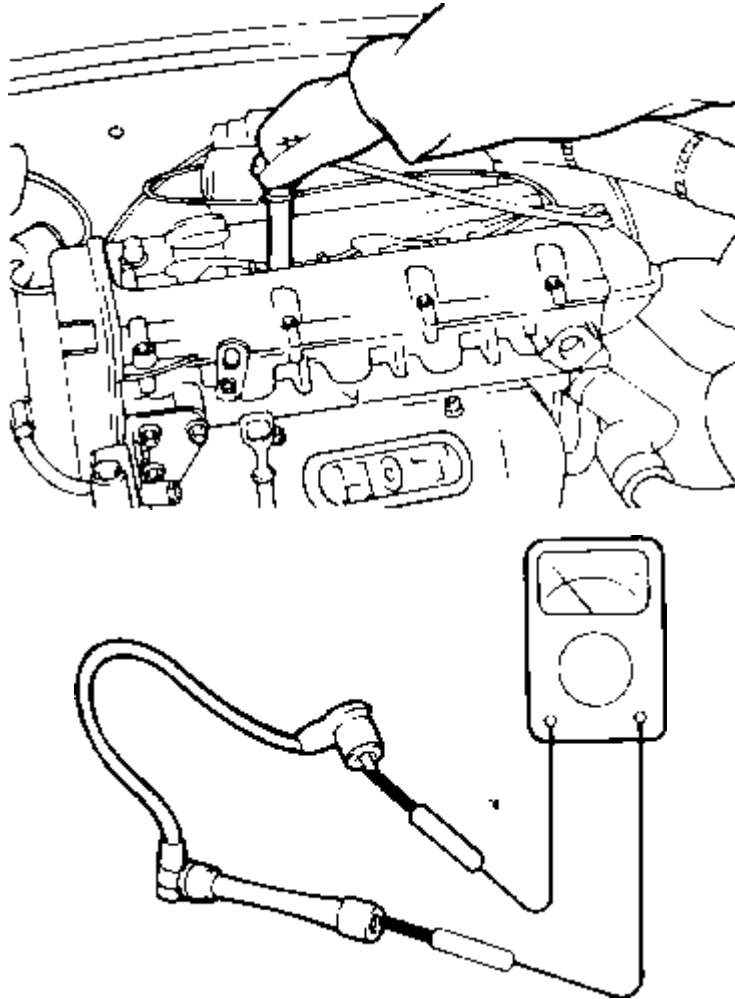
**Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.**

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## SPARK PLUG CABLES TEST

Disconnect, one at a time each of the spark plug cables while the engine is idling to check whether the engine's running performance changes or not.



### **CAUTION**

**Wear rubber gloves while doing so.**

If the engine performance does not change, check the resistance of the spark plug, and check the spark plug itself.

Check the cap and outer shell for cracks.

Measure the resistance.

### **Spark plug cable**

No. 1	No. 2	No. 3	No. 4

15.3kOHM | 12.4kOHM | 10.7kOHM | 8.8kOHM

**NOTE**

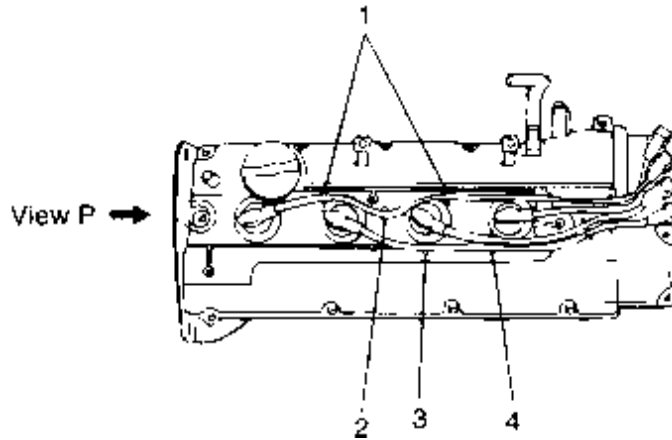
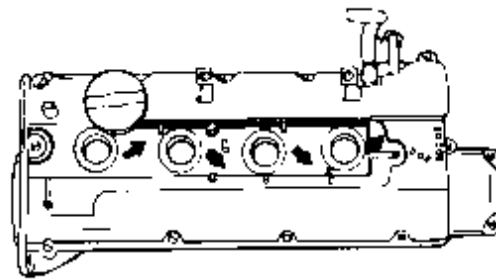
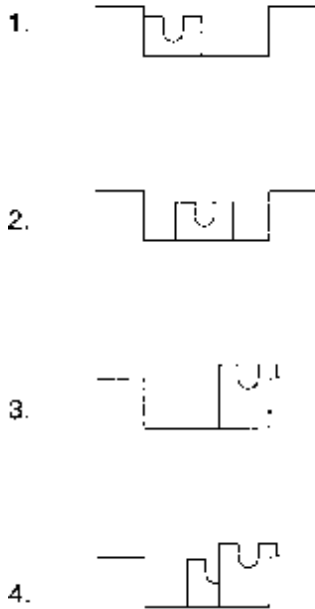
Resistance should not be higher than 10,000OHM-per foot of cable. If resistance is higher, replace the cable.

**INSTALLATION OF SPARK PLUG CABLE**

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

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

Place each spark plug cable on the rocker cover as the arrows indicate.



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## INSPECTION

Disconnect the battery negative terminal.

Remove the connector located under the steering column.

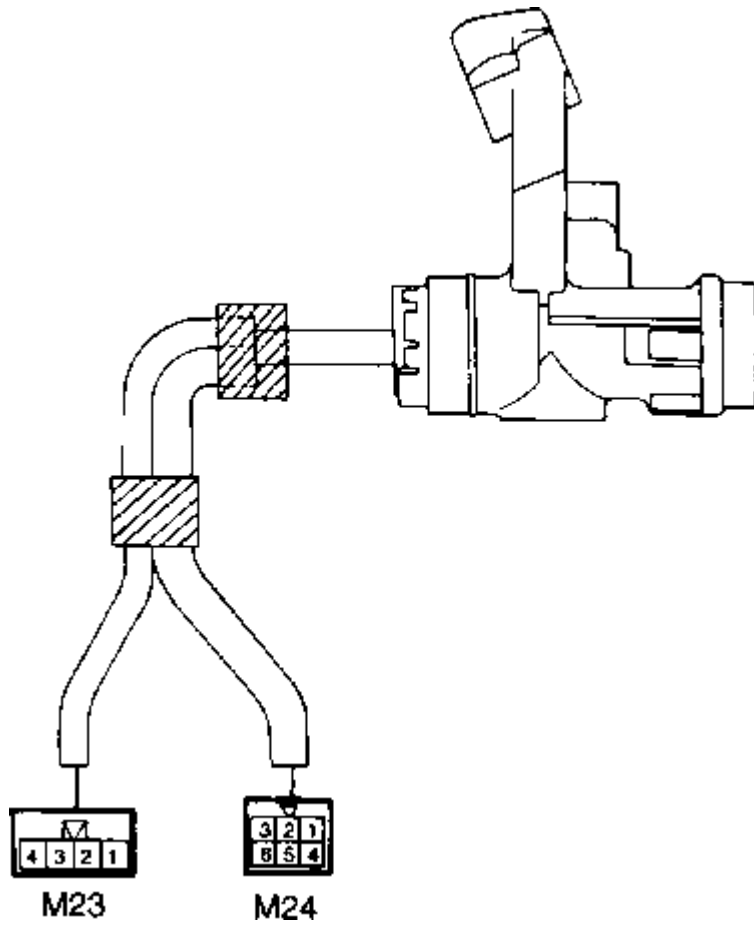
Check for continuity between terminals.

Terminal Position \ Key		Ignition switch (M24)					Door warning switch (M23)		Steering
		1	2	4	5	6	1	2	
LOCK	Removed								LOCK
	Inserted								Lock or Free
ACC		○—○					○—○		FREE
ON		○—○—○—○							FREE
START				○—○—○					FREE

### NOTE:

○—○ : indicates that there is a continuity between terminals.

**Lock or Free** : indicates that the steering wheel is locked when the key is inserted at first, and that the steering wheel is free when the key is returned from other position once.



## HINTS

If engine won't crank condition determine whether the condition exists with the transaxle range switch in the "PARK" or in the "NEUTRAL" position.

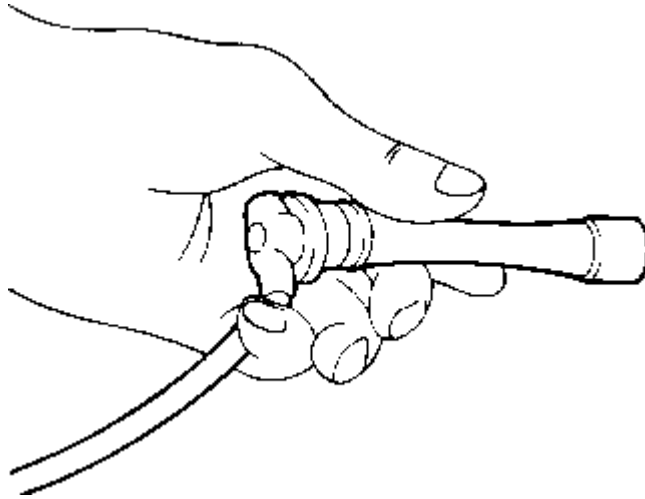
If the "NO-CRANK" condition occurs in one shift lever position but not the other, a more probable cause is the transaxle range switch.

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## CHECKING SPARK PLUG

Disconnect the spark plug cable from the spark plug.



### CAUTION

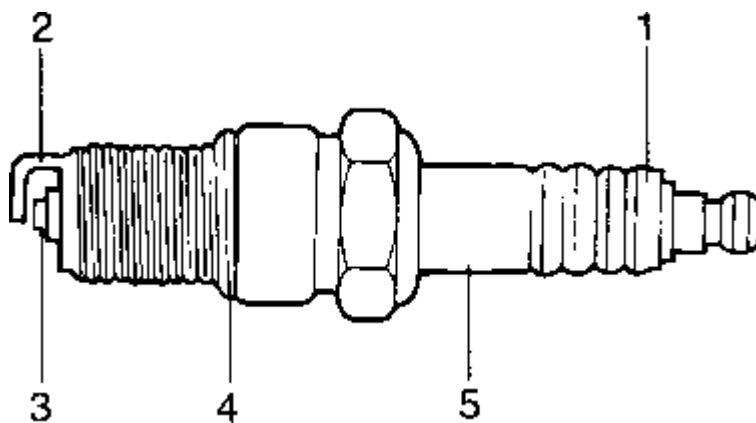
**Pull on the spark plug cable boot when removing the spark plug cable, not the cable, as it may be damaged.**

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.**

Check spark plugs for the following:

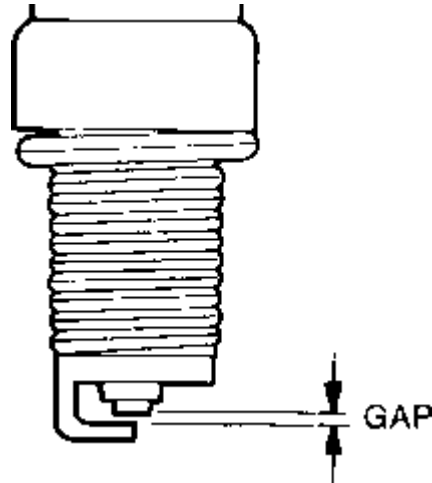


Broken insulator  
Worn electrode  
Carbon deposits

Damaged or broken gasket

Condition of the porcelain insulator at the tip of the spark plug

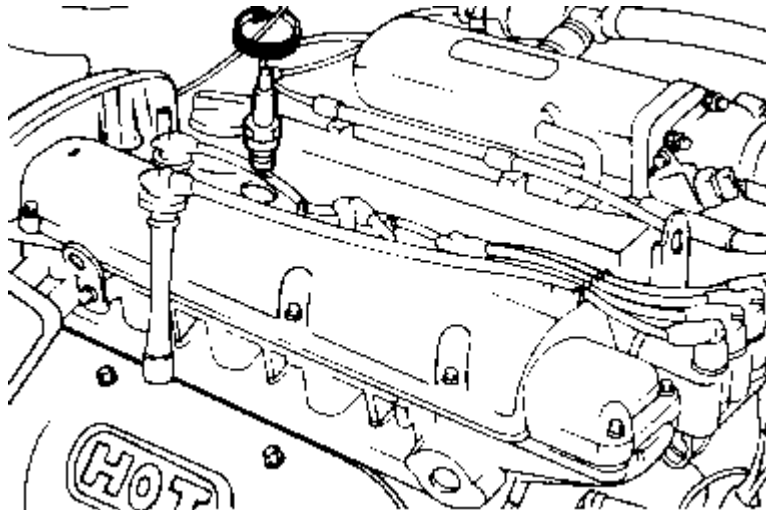
Check the spark plug gap using a wire gap gauge, and adjust if necessary.



#### MEASUREMENT SPECIFICATION

Spark plug gap	1.0-1.1 mm ( 0.039-0.043 in )
----------------	-------------------------------

Re-insert the spark plug and tighten to the specified torque. If it is over torqued, damage to the threaded portion of cylinder head may result.



#### TORQUE SPECIFICATION

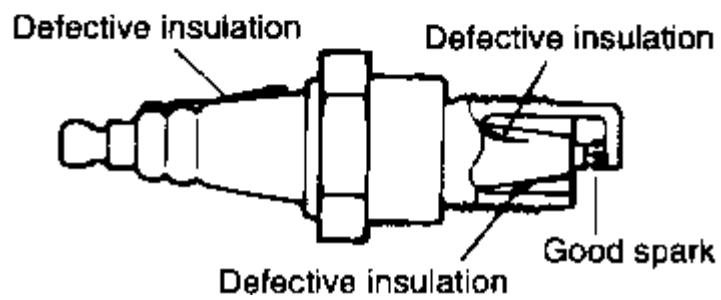
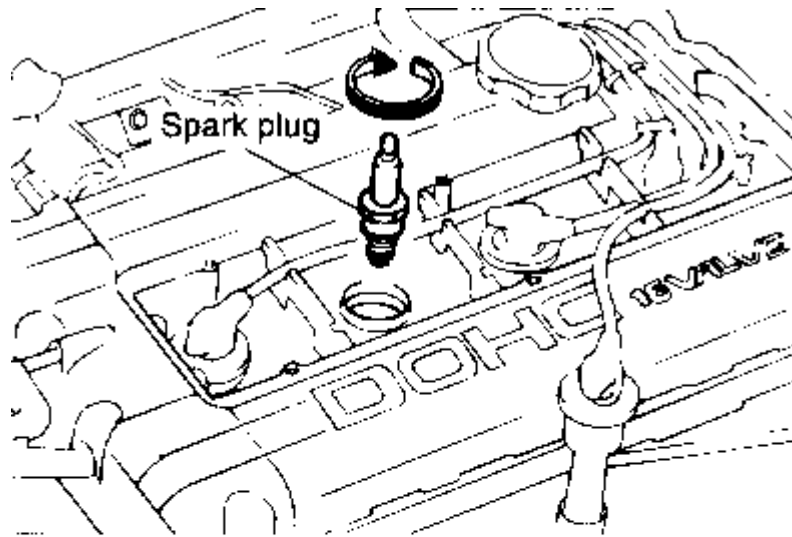
Spark plug	20-30 Nm ( 204-306 kg·cm, 15-21 lb·ft )
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### ANALYZING SPARK PLUG

Engine conditions can be analyzed by the tip deposits near the electrode.

Condition	Dark deposit	White deposits
Description	<ul style="list-style-type: none"><li>• Too rich a fuel mixture</li><li>• Too Low air intake</li></ul>	<ul style="list-style-type: none"><li>• Too lean a fuel mixture</li><li>• Advanced ignition timing</li><li>• Insufficient plug tightening</li></ul>

### SPARK PLUG TEST



Remove the spark plug and connect to the spark plug cable.

Ground the spark plug outer electrode, and crank the engine.

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



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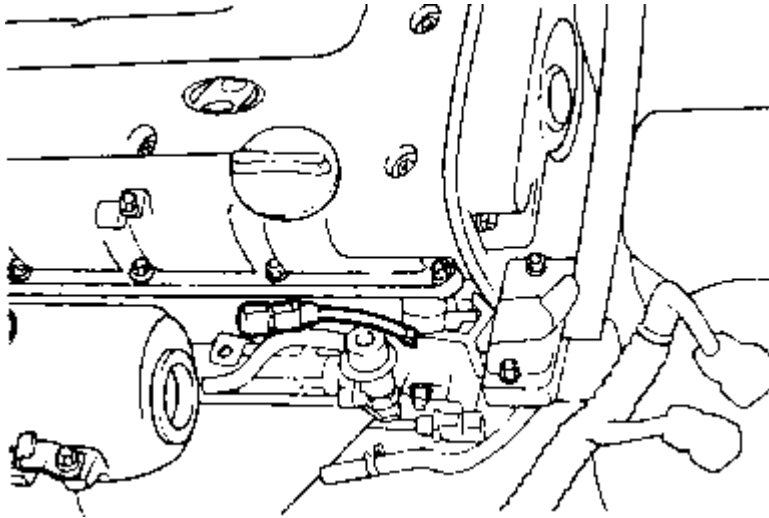
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## REMOVAL AND INSPECTION

Remove the battery ground cable.

Remove the camshaft position sensor mounting bolt.

Pull out the camshaft position sensor from cylinder head.



Check the camshaft position sensor. Refer to FL-CMP sensor.



After check, securely install the CMP sensor.

<b>TORQUE SPECIFICATION</b>	
CMP sensor	8 Nm ( 80 kg·cm, 6 lb·ft )