



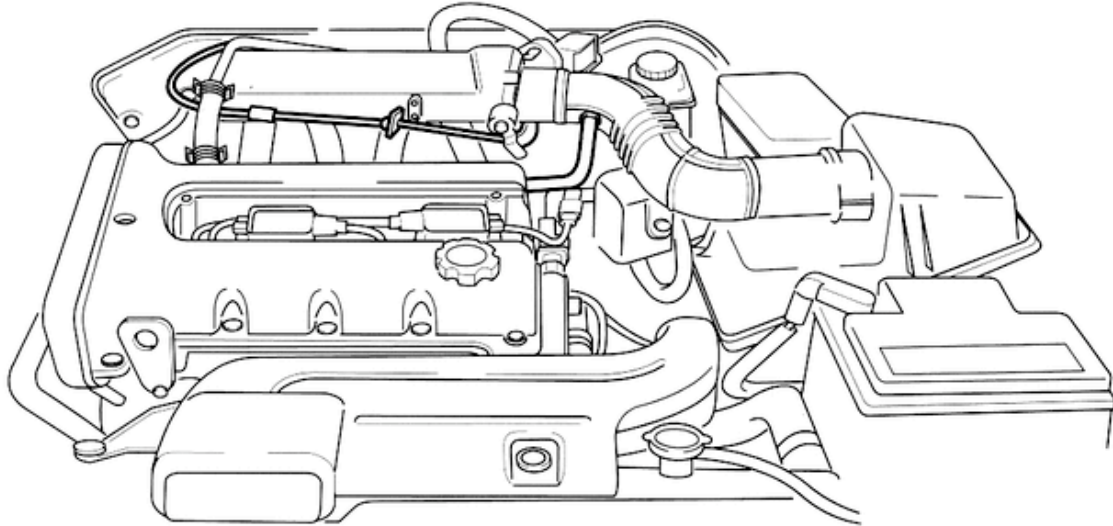
Engine Electrical System

General Information



GENERAL DESCRIPTION

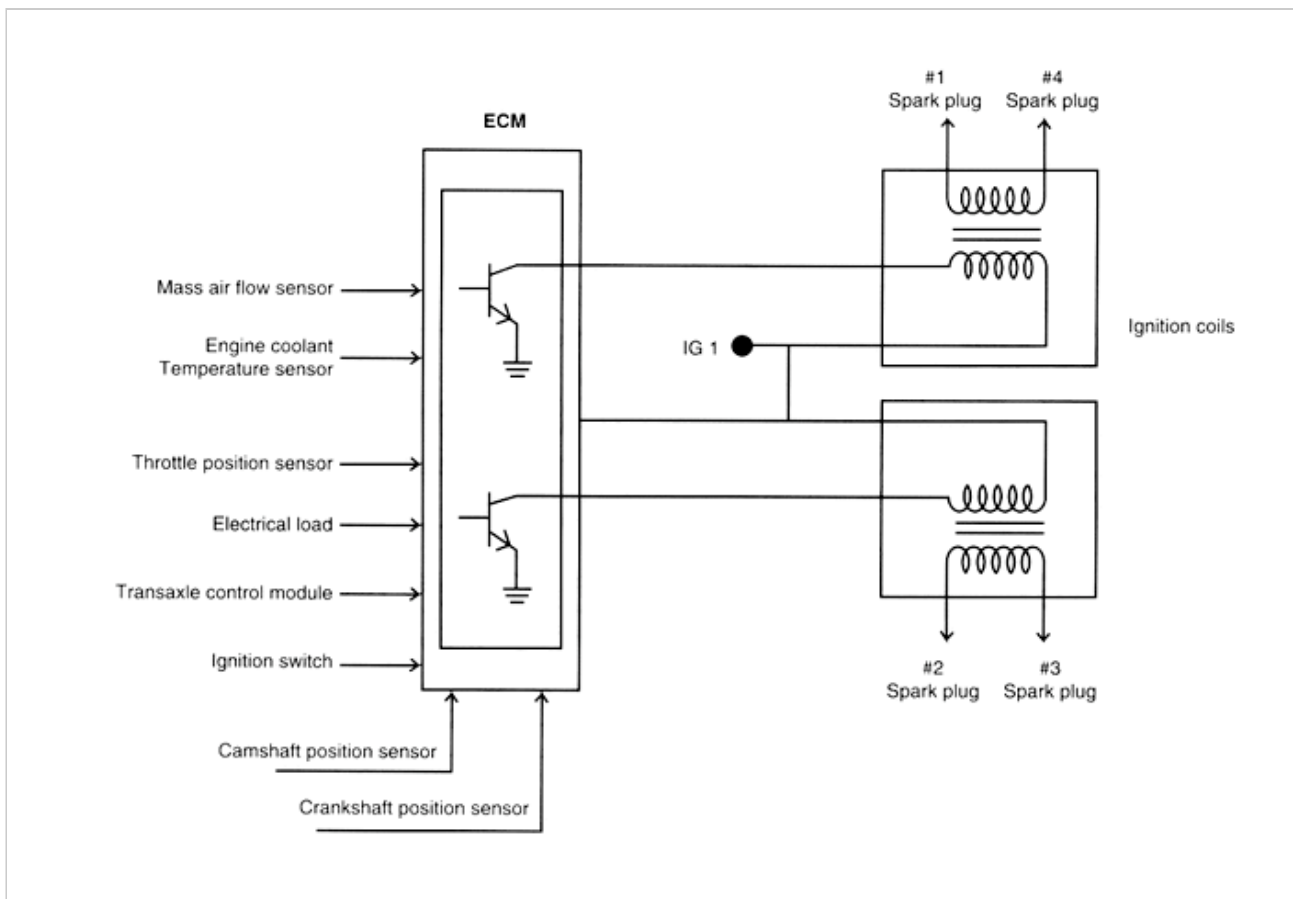
Ignition system overview



The Dual Overhead Cam(DOHC) Engine Ignition System is now a Distributorless Ignition System(DLI) type. This system is similar to the one currently used on Sephia/Shuma vehicles. The key components of this system are :

- 2 Separate Coil Packs
- A Crankshaft Position Sensor that provides engine RPM information to the ECM.
- An Ignition Control Module built into the ECM.
- A Canshaft Position Sensor that provides engine firing order information to the ECM
- Spark Plug Wires and Spark Plugs

Ignition system function



In a conventional ignition system, the ignition coil produces a high voltage current and the distributor then relays this current at the required time, to each spark plug. In the distributorless ignition system, two sensors the camshaft position sensor and the crankshaft position sensor, tell the Engine Control Module (ECM) which cylinder is ready to fire. The ECM then sends an ignition signal to an electronic ignition coil. This ignition coil then produces and sends a high voltage current to the proper spark plug.

Electronic spark advance system

Ignition Timing is determined and set within the ECM based on signals from various sensors and switches. Optimum performance is gained with this system. The ECM varies ignition timing according to engine speed, intake air amount, coolant temperature and other conditions.

NOTICE

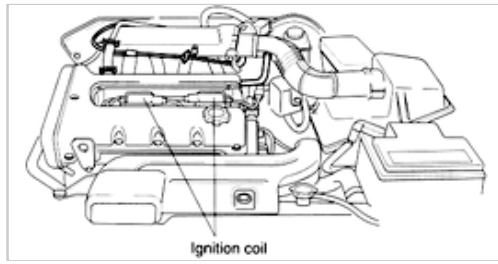
- Timing specification at idle is : $8 \pm 5^\circ$ BTDC
- Timing is not adjustable.

Ignition system components

The mechanical, rotating high-voltage distributor mechanism has been replaced by static electronically controlled components. These components are described below.

Ignition coil

1. Two ignition coils are used in this system. The engine locates them directly above the #2 and #4 spark plugs. The coil resistance is identical for these two coils and there is no maintenance required for them. If determined to be faulty, they must be replaced.



High-tension leads

The high-tension leads connect the two ignition coils to the spark plugs. Their function is basically the same as on the previous system. Because of their shorter length, the DLI high-tension leads enhance the ignition systems delivered voltage. In addition, they reduce the wave interference from one high tension wire to another.

Spark plugs

The spark plugs provide the air gap necessary to produce an arc from the electrical energy coming in from the ignition coil. This arc then ignites the fuel/air mixture in the cylinder, producing power.



DIAGNOSIS

Problem	Possible Cause	Action
Engine light is "ON"	Engine control module detects fault in system	Check engine module. Repair as required
Engine runs rough	Spark plug failure	Check, clean or replace plugs
	High-tension lead arcing to ground	Replace high-tension leads
	Ignition coil(s) faulty	Check/replace ignition coil
	CMP sensor faulty	Check/replace sensor
	CKP sensor faulty	Check/replace sensor
Engine fails to start, starter turning	Fuse failure	Check/replace IGN fuse
	Low battery current	Check charging system
	Ignition coil(s) failure	Check/replace coil(s)
	CMP sensor failure	Check/replace sensor
	CKP sensor failure	Check/replace sensor



SPECIFICATIONS

Fastener tightening specifications

Item	
Ignition coil bolt	5~7.2 lb-ft (7~10N·m, 0.7~10kg-m)
Spark plugs	18~22lb-ft (25-30N·m, 2.5~3.0kg-m)

SPECIFICATIONS

General specifications

Item		TBD
Engine idle speed		800 ± 50 rpm
Ignition coil	Type	Dual coil
	Primary coil resistance	0.45~0.55Ω at 68°F (20°C)
	Secondary coil resistance	13~15kΩ at 68°F (20°C)
High-tension lead		16kΩ per 3.28feet (1m)
Spark plug gap		0.027~0.031in (0.7~0.8mm)
Spark plug type		BKR6E

Starter

Engine/Trans			TBD	
Item			M/T	A/T
Starter	Type		Direct	Gear reduction
	Output		12V - 0.9kW	12V - 1.2kW
	Brush length	Standard	0.67in (17mm)	0.49in (12mm)
		Minimum	0.45in (11.5mm)	0.28in (7mm)



Engine Electrical System

Ignition System



Engine Electrical System

Ignition System - Ignition Coil



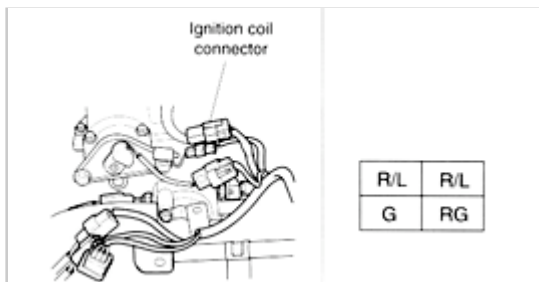
INSPECTION

Voltage check

1. Disconnect negative battery cable.
2. Disconnect ignition coil connector.
3. Turn ignition switch to "ON".
4. Measure voltage at red and blue wires at ignition coil connector.

Voltage : approximately 12volts

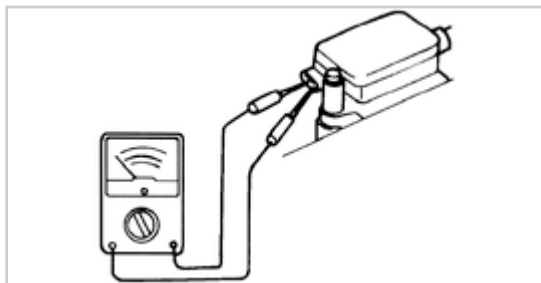
5. If not voltage check main fuse, ignition switch and wire harness.



Resistance check

1. Using an ohmmeter check resistance of primary coil. Connect one lead of ohmmeter to positive (+) terminal and other lead to each negative (-) terminal. If not within specification, replace coil. Remember that unit has two coil assemblies, so both must be checked.

Primary coil resistance : 0.45~0.55Ω @ 68°F (20°C)



2. Using an ohmmeter, check resistance of the secondary coil. If not within specification, replace coil. Remember that you must check resistance of both top and bottom secondary coil. If one is out of specification replace the whole unit.

Secondary coil resistance : 13~15Ω @ 68°F (20°C)



REMOVAL

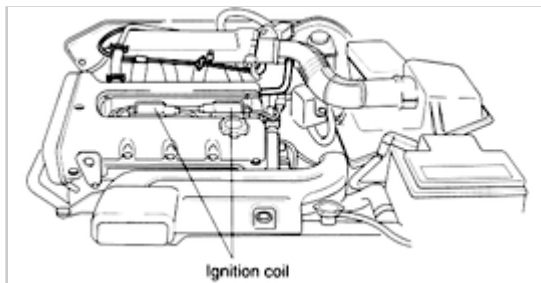
1. Disconnect battery cable.
2. Disconnect high-tension leads.
3. Disconnect ignition coil connector.
4. Remove four ignition coil mounting bolts.
5. Remove ignition coils.

INSTALLATION

1. Position two coils above No. 2 and No. 4 spark plugs, and firmly push down to connect.
2. Insert and tighten four ignition coil mounting bolts.

Tightening torque : 14~19lb-ft (19~25N·m, 1.9~2.6kg-m)

3. Reconnect ignition coil connectors.
4. Reattach high tension leads. Lead are marked for correct connection.
5. Reconnect battery cable.





Engine Electrical System

Ignition System - Spark Plug

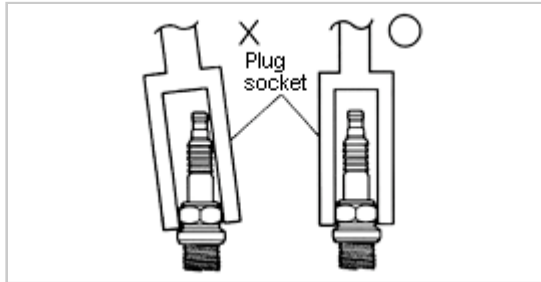


REMOVAL

CAUTION

Do not attempt any maintenance on spark plugs if engine is hot.

1. Disconnect negative battery terminal.
2. Carefully remove high-tension leads.
3. Use compressed air to blow any dirt or debris from around spark plug hole.
4. Check that spark plug fits squarely in spark plug socket and remove spark plug.



INSTALLATION

1. Install spark plug into cylinder head.

Tightening torque : 18~22lb-ft (25~30N·m, 2.5~3.0kg-m)

2. Reconnect high-tension leads.
3. Reconnect negative battery cable.

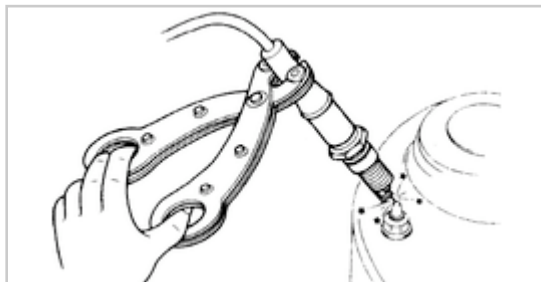
INSPECTION

1. Reconnect negative battery cable.
2. Connect spark plug to high-tension lead.
3. Hold spark plug with insulated pliers 0.2 to 0.39 inch (5~10mm) from a ground.

WARNING

DO NOT TOUCH VEHICLE BODY DURING FOLLOWING INSTRUCTIONS.

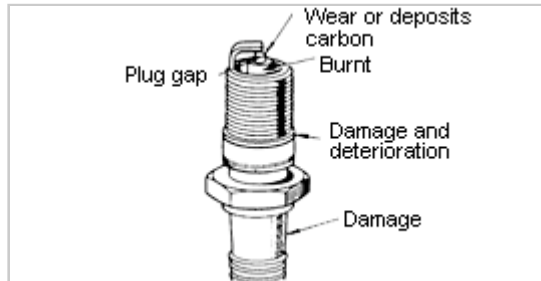
4. While holding spark plug, have a second person crank engine. Verify that a strong blue spark jumps from spark plug to ground.



5. If there is no spark or the spark is weak, check for, and implement correction :
 - A. Carbon deposits. Clean out or replace plug.
 - B. Oil fouling. Correct oil problem, replace plug.

- C. Worn or burnt electrode. If present, replace plug.
- D. Broken or burned ceramic insulator. If present replace plug.
- E. Damaged spark plug ring. If so, replace ring.
- F. Improper spark plug gap. Regap if possible, otherwise replace plug.

Gap : 0.027~0.031in (07~0.8mm)





Engine Electrical System

Ignition System - Spark Plug Cable



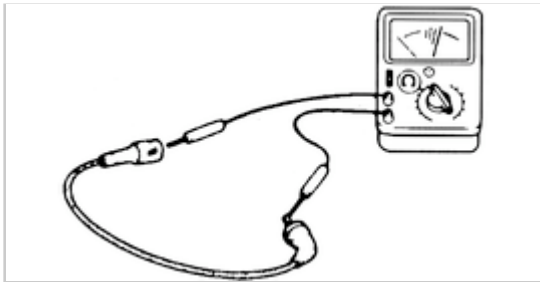
INSPECTION

High-tension leads

1. Disconnect from coil spark plugs.
2. Check for breaks in insulation.
3. Check inside high-tension lead connectors for corrosion or carbon deposits.
4. Connect high-tension lead to an ohmmeter and check resistance.

Resistance : 16k Ω per 3.28 feet (1m)

5. Replace if defective.





INSPECTION

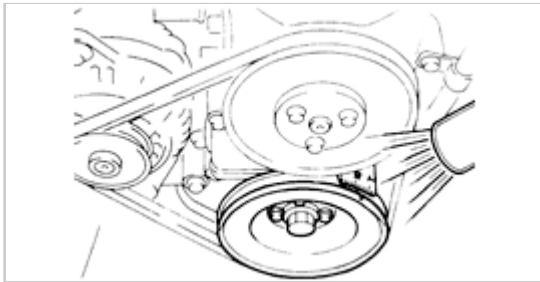
Ignition timing

Ignition timing can be thrown off for two reasons :

A problem with a sensor, which will be detected by ECM or a misalignment of camshaft to crankshaft. This last problem indicates a problem with timing belt, which is covered in Group Engine. There is no need to adjust engine timing after replacement of a coil.

Check procedure

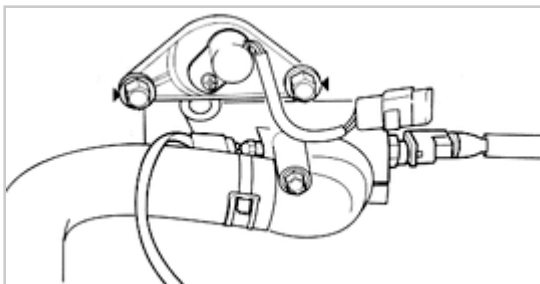
1. Warm engine and let idle.
2. Turn all other electrical system OFF.
3. Connect timing light to high-tension lead number one.
4. Check that ignition timing mark on crankshaft pulley aligns with timing mark on engine block.



REMOVAL

Camshaft position sensor

1. Disconnect negative battery cable.
2. Disconnect two wire harness.
3. Remove mounting bolts.
4. Remove sensor from the cylinder head.



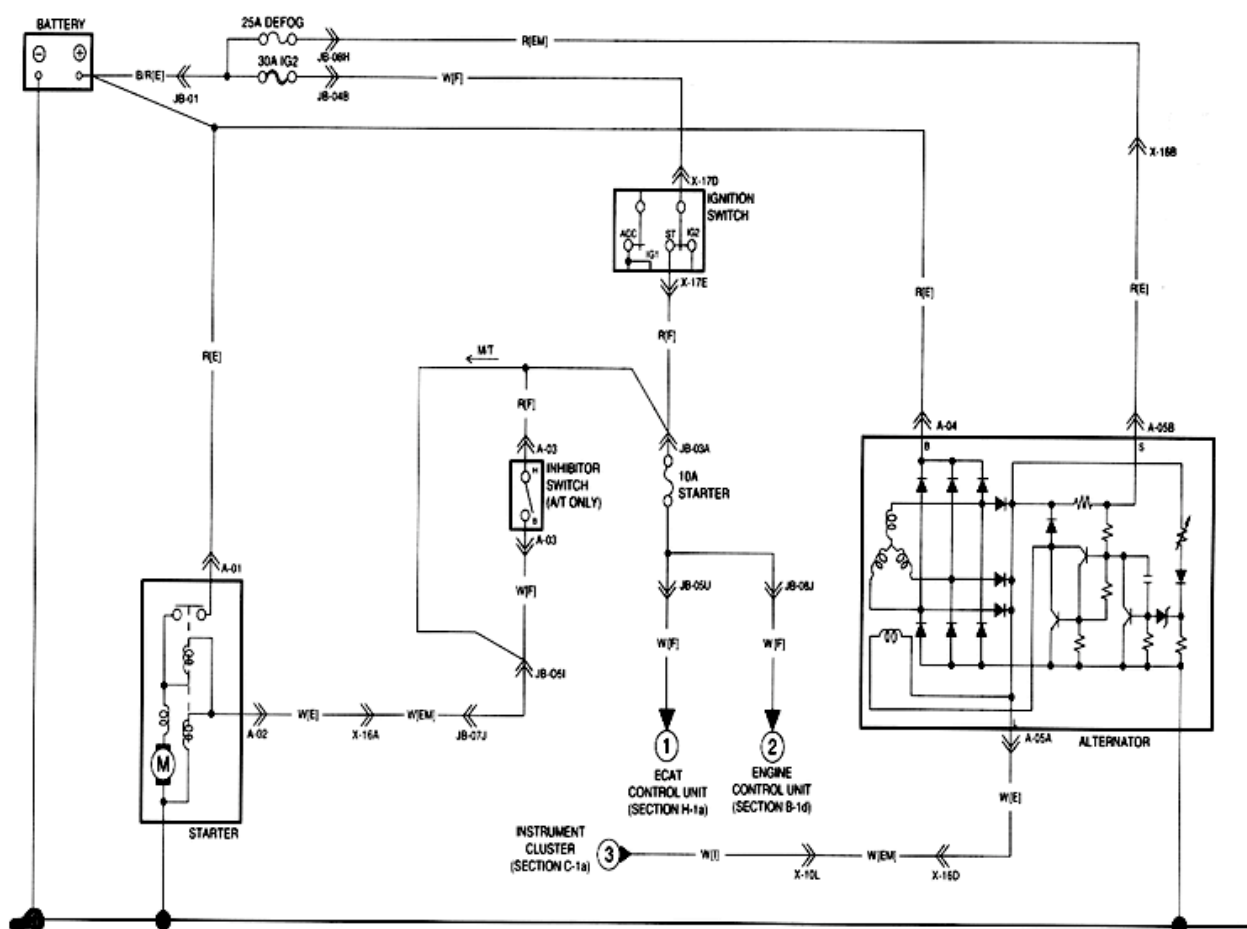


Engine Electrical System

Charging System



CIRCUIT DIAGRAM



The generator has a self-diagnostic function that illuminates the generator warning light when there is low or no voltage output generated by the charging system.



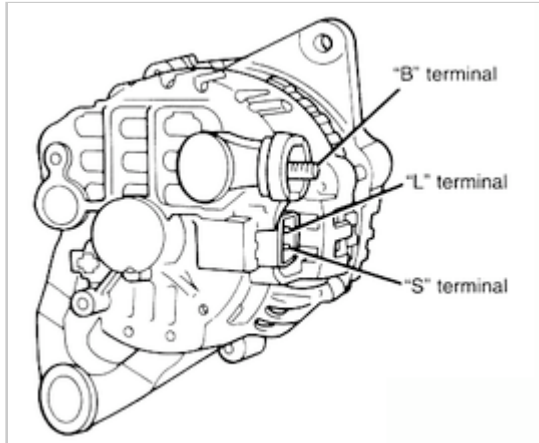
Engine Electrical System

Charging System - Alternator

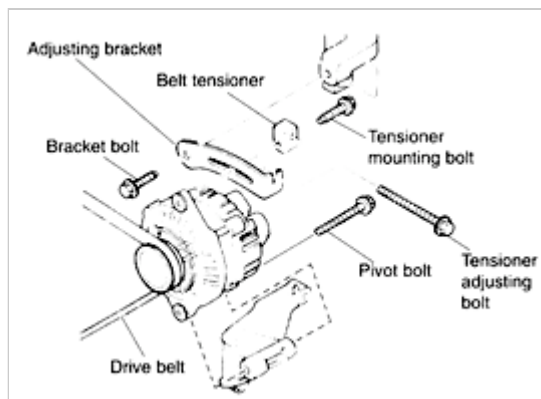


REMOVAL

1. Removal negative battery cable.
2. Open B terminal cover cap.
3. Remove B terminal nut.
4. Remove B terminal lead.
5. Disconnect generator L and S terminal connectors.



6. Loosen pivot bolt and tensioner mounting bolt. Do not remove.
7. Relieve tension on drive belt by rotating adjustment bolt.
8. Remove drive belt from generator pulley.
9. Remove tensioner mounting bolt and belt tensioner.
10. Remove generator pivot bolt.
11. Loosen bolt at base of adjusting bracket and rotate the bracket up.
12. Lift generator from engine compartment.



INSTALLATION

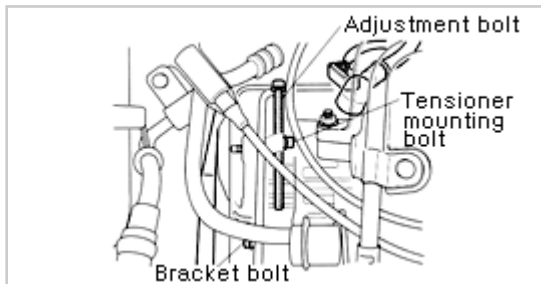
1. Position generator on engine.
2. Install pivot bolt (leave loose).
3. Rotate bracket into position on adjustment bracket.
4. Place belt tensioner into position on top of generator.
5. Install tensioner mounting bolt (leave loose).
6. Place drive belt on generator pulley.

7. Adjust belt tension by rotating adjustment bolt.

Allowable deflection :

New belt : 0.23~0.31in (6~8mm)

Old belt : 0.28~0.35in (7~9mm)



8. Tighten tensioner bolt.

Tighten tensioner bolt to : 14~19lb-ft (19~26N·m)

9. Tighten pivot bolt and bracket bolt.

Tighten pivot and bracket bolt to : 28~38lb-ft (38~51N·m)

10. Connect generator L and S terminal connectors.

11. Connect B terminal lead.

12. Install and tighten B terminal nut.

13. Close B terminal nut cover.

14. Install air intake inlet pipe and tighten end clamp.

15. Connect top hose to air intake inlet pipe.

16. Install front air intake inlet pipe bolts.

17. Connect negative battery cable.

CAUTION

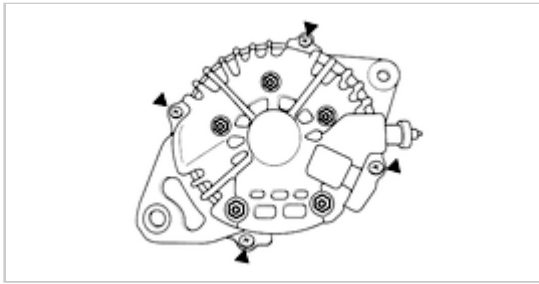
- 1) Be sure battery connections are not reversed. This will damage rectifier.
- 2) Do not use highvoltage testers, such as a megger. They will damage the rectifier.
- 3) Remember that battery voltage is always applied to alternator B terminal.
- 4) Do not ground L terminal while engine is running.
- 5) Do not start engine while L and S terminals are disconnected from generator.

DISASSEMBLY

NOTICE

Insert protective material in the jaws of the vise.

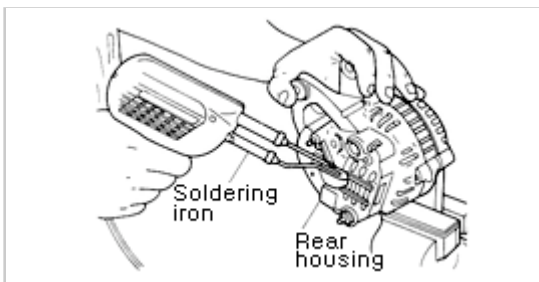
1. Remove four cap screws from rear housing.



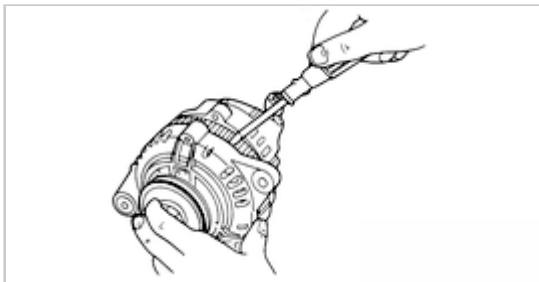
2. Use a 200-watt soldering iron to heat the rear of bearing box to allow the bearing to be removed from rear housing.

NOTICE

If bearing box is not heated, bearing cannot be pulled out of rear housing. The rear bearing and rear housing fit together very tightly.

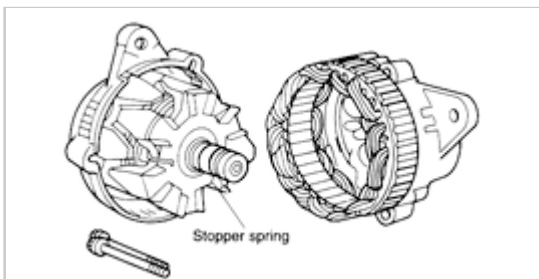


3. Use a flat-blade screwdriver to separate front housing from stator.

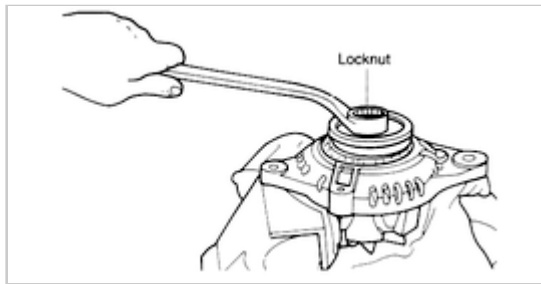


NOTICE

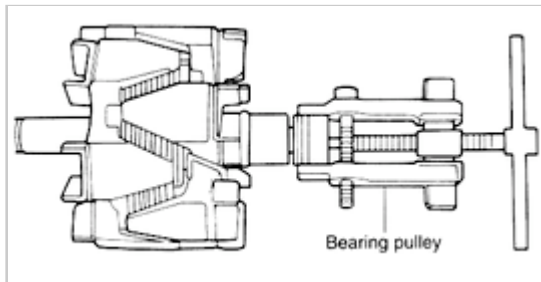
- Be careful not to lose the stopper spring that fits around the rear bearing.
- Insert protective material in the jaw of the vise.



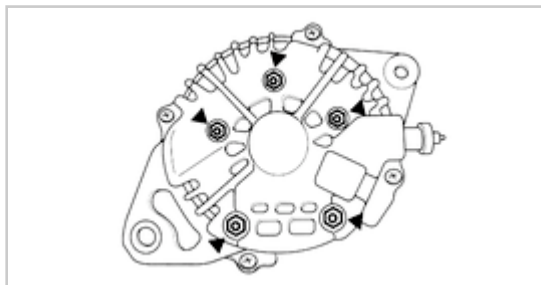
4. Place rotor in a vise and loosen locknut, then disassemble pulley, rotor and front housing.



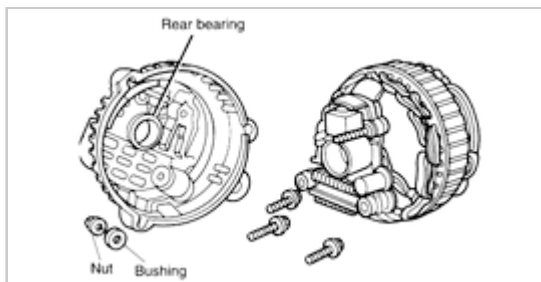
5. If necessary, remove front bearing using a socket and a hand press or vise.
6. Remove rear bearing with a bearing puller.



7. Remove B terminal nut and insulating bushing.
8. Remove five screws holding the rectifier and brush holder.



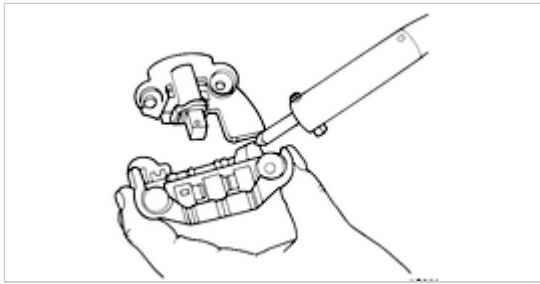
9. Separate rear bracket and stator.



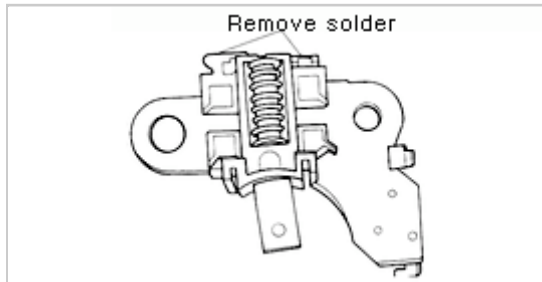
10. Use a soldering iron to remove solder from rectifier and stator leads and then remove IC regulator.

NOTICE

Disconnect quickly. If soldering iron is used for more than 5 seconds, rectifier may be damaged by heat.



11. Replace brushes. Remove solder from pigtail and then remove brush.

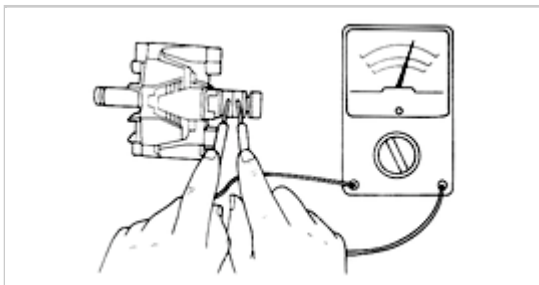


INSPECTION

1. Rotor

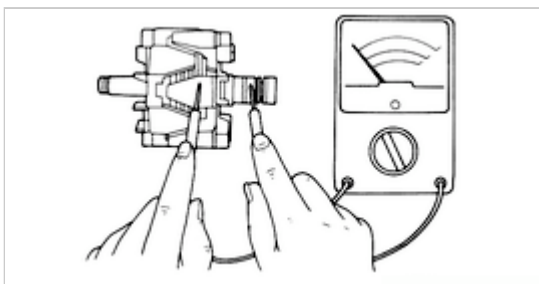
(1) Measure resistance between slip rings with a ohmmeter. If it is not within standard resistance, replace rotor.

Standard resistance : $3.5\sim 4.5\Omega$



(2) Check for continuity between slip ring and core with a circuil tester. Replace rotor if there is continuity.

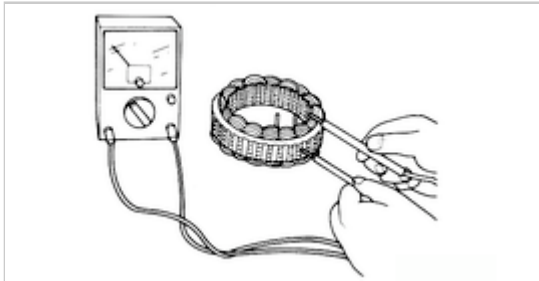
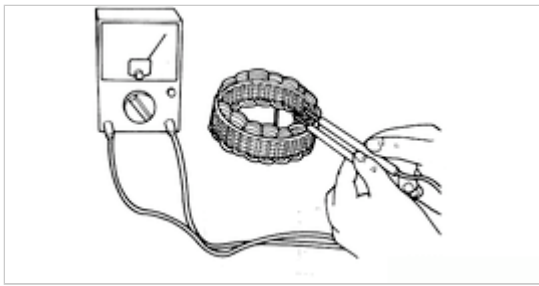
(3) If slip ring surface is rough, smooth with a lathe or fine sandpaper.



2. Stator

(1) Check for continuity between stator coil leads with a circuit tester.

(2) Replace stator if there is no continuity.



(3) Check for continuity between stator coil leads and core with a circuit tester.

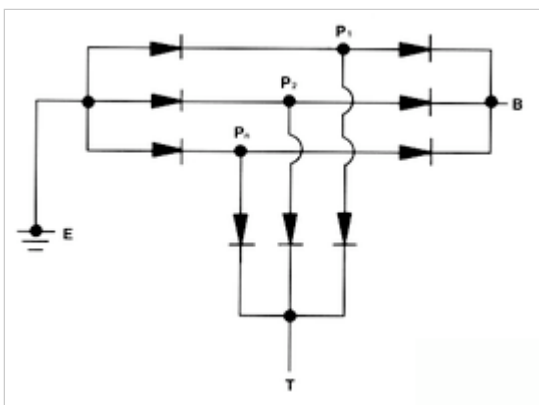
(4) Replace stator if there is continuity.

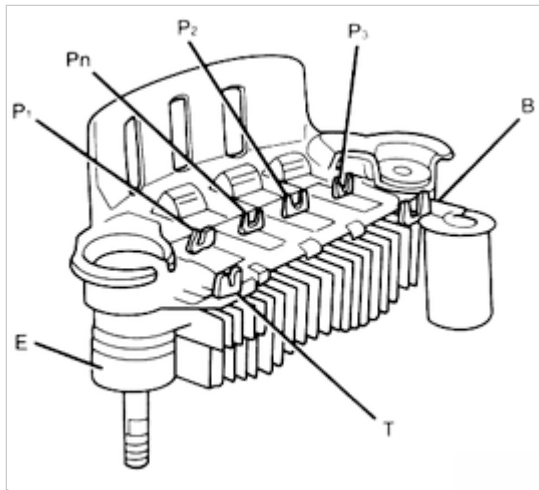
3. Rectifier

(1) Check for continuity between each diode with an ohmmeter.

Negative (Black)	Positive (Red)	Continuity
E	Pn, P ₁ , P ₂ , P ₃	○
B	Pn, P ₁ , P ₂ , P ₃	×
T	Pn, P ₁ , P ₂ , P ₃	×
Pn, P ₁ , P ₂ , P ₃	E	×
	B	○
Pn, P ₁ , P ₂ , P ₃	T	○
	T	×

(2) Replace if necessary.



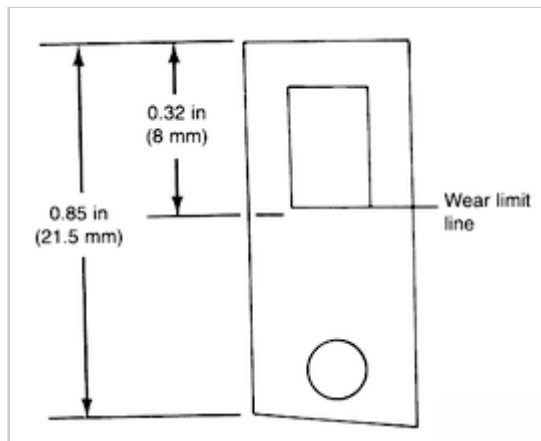


4. Brush

If brushes are worn to or beyond, limit. replace them.

Standard : 0.85in (21.5mm)

Minimum : 0.32in (8.0mm)



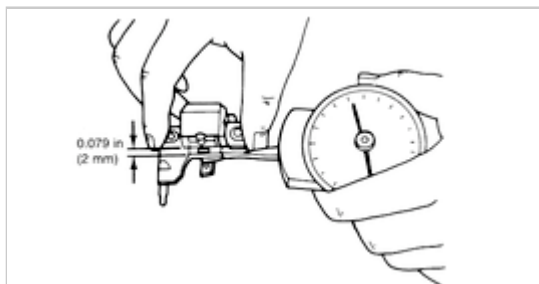
5. Brush spring

- (1) Measure force of brush spring with a spring pressure gauge.
- (2) Replace the spring if necessary.

Standard force : 0.71~0.93lb-ft (3.1~4.1N·m, 0.32~0.42kg-m)

Minimum : 0.36~0.52lb-ft (1.60~2.4N·m, 0.16~0.24kg-m)

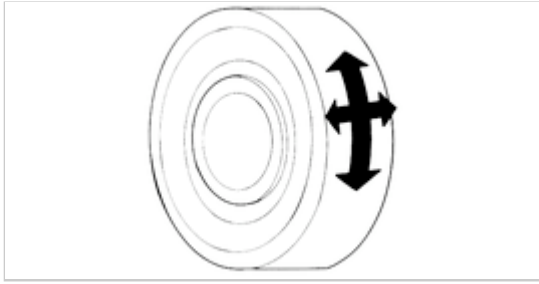
Read spring pressure with brush tip projecting 0.08in (2mm).



6. Bearing

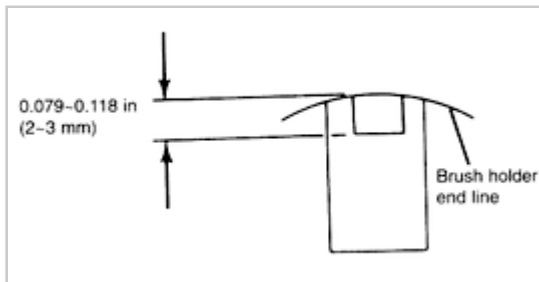
- (1) Check for abnormal noise, looseness insufficient lubrication, etc.

- (2) Replace bearing(s) if there is any abnormality.



RESSEMBLY

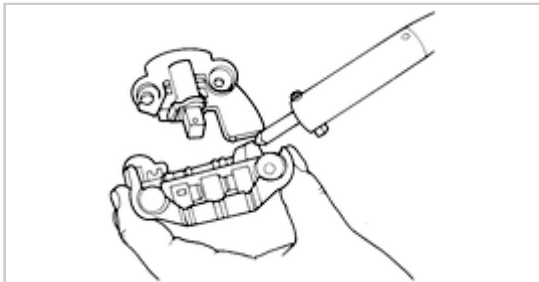
1. Assemble brush and solder pigtail so that wear limit line of brush projects 0.079~0.118 in (2~3 mm) out of brush holder.



2. Assemble regulator and solder with rectifier and stator leads.

NOTICE

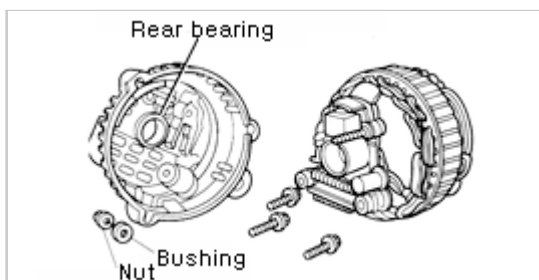
Disconnect quickly. If soldering iron is used for more than 5 seconds rectifier may be damaged by heat.



3. Assemble rear bracket and stator.
4. Tighten screws holding rectifier and brush holder.

Tightening torque : 1.5~4.0lb-ft (2.0~5.4N·m, 0.2~0.55kg-m)

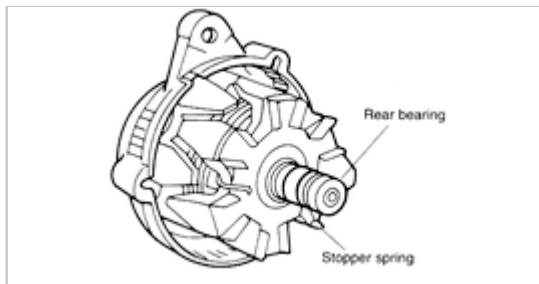
5. Tighten B terminal nut and insulating brushing.



6. Assemble rear bearing and stopper spring.

NOTICE

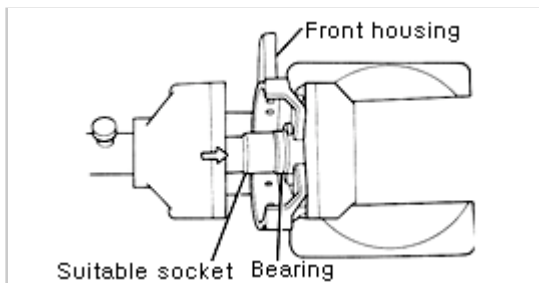
Make sure groove on bearing rim is facing slip ring side.



7. Assemble front bearing. Using a socket which exactly fits outer race of bearing, carefully push in front bearing. Use a hand press or vise.

NOTICE

Insert protective material in the jaws of the vise.





Engine Electrical System

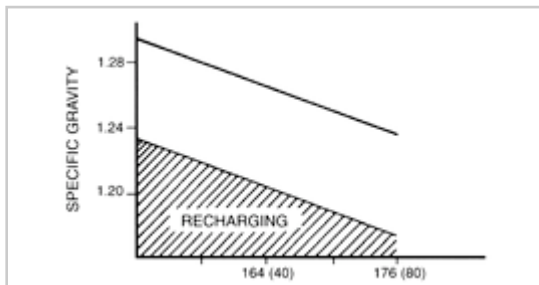
Charging System - Battery



RECHARGING

1. Slow charging

It is not necessary to remove vent caps to perform a slow charge.



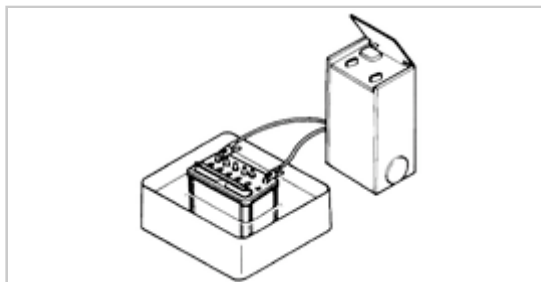
Battery	Slow charge (A)	Quick charge (A)
PT48 - 24GL MF	Under 5	Maximum 20

2. Quick charging

Remove battery from vehicle and remove vent caps to perform a quick charge.

WARNING

- BEFORE PERFORMING MAINTENANCE OR RECHARGING BATTERY, TURN OFF ALL ACCESSORIES AND STOP ENGINE.
- NEGATIVE CABLE MUST BE REMOVED FIRST AND INSTALLED LAST.
- SET BATTERY IN WATER WHEN QUICK CHARGING TO PREVENT OVERHEATING BATTERY.





INSPECTION

Terminal and cable

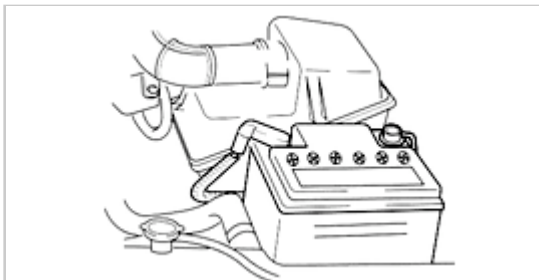
1. Check that battery terminal connections are tight to ensure good electrical connections.
2. Check for corroded or frayed battery cables.
3. Check rubber protector on positive terminal for proper coverage.
4. Clean terminals, if necessary and lightly coat them with grease.



INSPECTION

Terminal and cable

1. Check that battery terminal connections are tight to ensure good electrical connections.
2. Check for corroded or frayed battery cables.
3. Check rubber protector on positive terminal for proper coverage.
4. Clean terminals, if necessary and lightly coat them with grease.





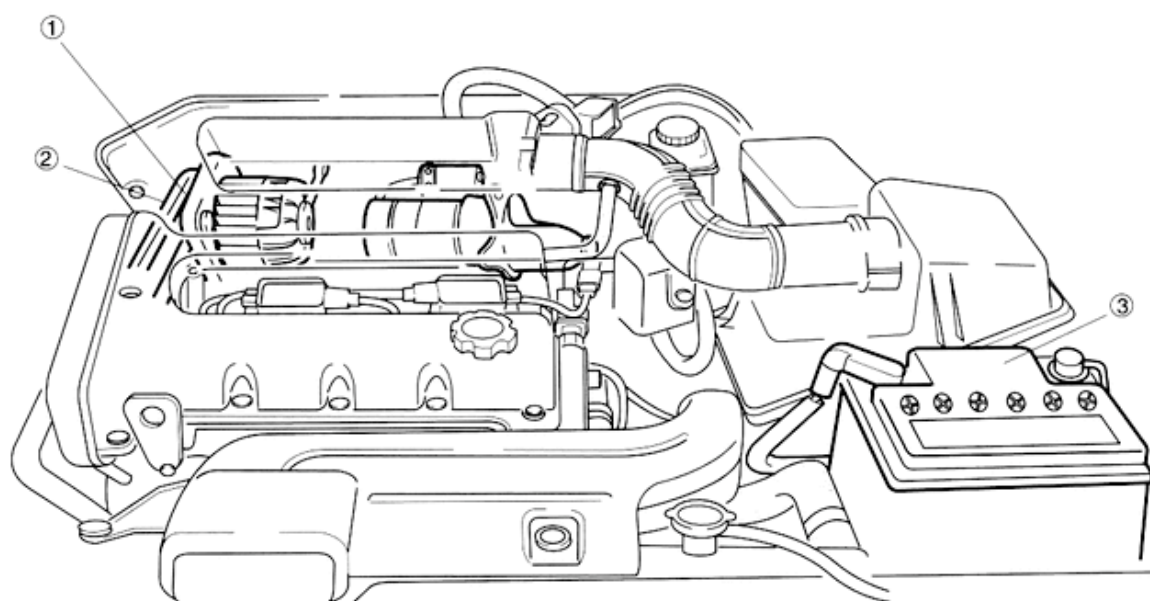
Circuit operation

When the ignition switch is turned to ON or START, battery voltage is applied to the charge indicator and terminals B and S of the alternator. After the engine has started and is running, the generator produces alternating current. The direct current and voltage keeps the battery fully charged and provides power to operate the vehicle's electrical system. The amount of direct current and voltage of the alternator outputs is controlled by the voltage regulator.

If the voltage regulator senses that the output of the alternator is not sufficient for charging the battery, it will ground terminal L of the alternator and the charge indicator will illuminate.



COMPONENTS

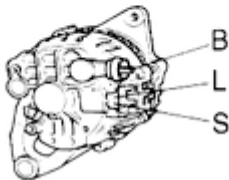
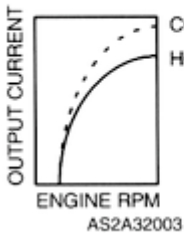
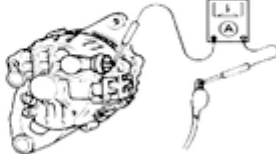


(1) Generator
(2) Drive belt

(3) Battery



DIAGNOSTIC CHART

Step	Inspection	Action													
1	Check battery voltage Specification : Above 12.4V	Yes	Go to next step.												
		No	Check battery												
2	Start engine and check if generator warning light goes out	Yes	Go to step 4.												
		No	Go to next step.												
3	Check if voltage at generator terminals are correct Specification <table><tr><th>Terminal</th><th>Ign: On (V)</th><th>Idle (V)</th></tr><tr><td>B</td><td>Approx. 12</td><td>14.1~14.7</td></tr><tr><td>L</td><td>Approx. 1</td><td>14.1~14.7</td></tr><tr><td>S</td><td>Approx. 12</td><td>14.1~14.7</td></tr></table> 	Terminal	Ign: On (V)	Idle (V)	B	Approx. 12	14.1~14.7	L	Approx. 1	14.1~14.7	S	Approx. 12	14.1~14.7	Yes	Check wiring harness between battery and terminal B.
		Terminal	Ign: On (V)	Idle (V)											
B	Approx. 12	14.1~14.7													
L	Approx. 1	14.1~14.7													
S	Approx. 12	14.1~14.7													
No	<ul style="list-style-type: none">• Check wiring harness.• Replace generator.														
4	1.Connect an ammeter (80A minimum) between terminal B and terminal B harness connector. 2.Start engine. 3.Turn all electrical loads ON and depress brake pedal. 4.Check if output current is 65A or more at 2,500~3,000 rpm. Caution Do not ground terminal B.  	Yes	Charging system normal.												
		No	Go to next step.												
5	Check drive belt tension OK?	Yes	Replace generator.												
		No	Adjust drive belt tension.												

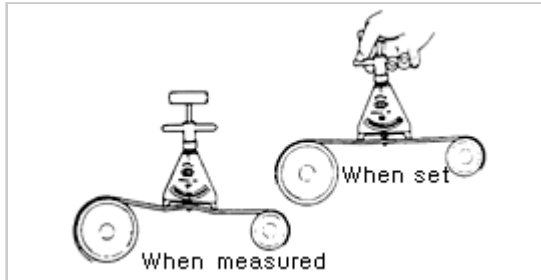


INSPECTION

1. Check drive belt and pulley for wear, cracks, and fraying. Replace if necessary.
2. Measure drive tension with a tension gauge.

Tension

Drive belt	New	Used
Generator	85.8~103.4 (383~461N)	68.2~85.8lb (304~383N)
A/C and P/S	110~132lb (491~589N)	95~110lb (422~491N)



3. Measure deflection by applying moderate pressure (22lb [98N]) midway between pulleys. Adjust if necessary.

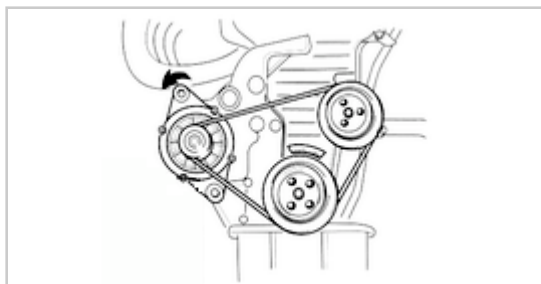
Deflection

Drive belt	New	Used
Generator	0.31~0.35in (8~9mm)	0.35~0.39in (9~10mm)
A/C and P/S	0.31~0.35in (8~9mm)	0.35~0.39in (9~10mm)

ADJUSTMENT

Drive belt

1. Loosen generator mounting bolt and adjusting bolt.
2. Adjust generator to achieve specified belt deflection.
3. Tighten all bolts recheck tension.



INSTALLATION

Drive belt

1. Remove A/C and P/S drive belt, if equipped.
2. Loosen generator mounting bolt and adjusting bolt.
3. Remove generator belt.
4. Install new generator belt and adjust to specification.

5. Tighten all bolts to specification torque.

Tightening torque

Mounting bolt : 27~38lb-ft (37~52N·m, 3.8~5.3kg-m)

Adjusting bolt : 14-18lb-ft (19~26N·m, 1.9~2.6kg-m)

6. Install A/C and P/S drive belt, if equipped, and adjust to specification.





SPECIFICATION

Generator

Engine			TBD
Item			
Battery	Voltage		12V
	Type		PT48-24FL
	Capacity (20-hour rate)		60A-h
Current draw*			Maximum 20-0
Generator	Type		A/C
	Output		12V-80A
	Regulator type		Transistorized (Built-in IC regulator)
	Regulator voltage		14.1 - 14.7
	Brush length	Standard	0.846in (21.5mm)
		Minimum	0.315in (8.0mm)

* Current draw is the residual flow of current that occurs when the ignition switch is OFF.
(Powertrain control module [PCM], radio, etc.)



Engine Electrical System

Starting System

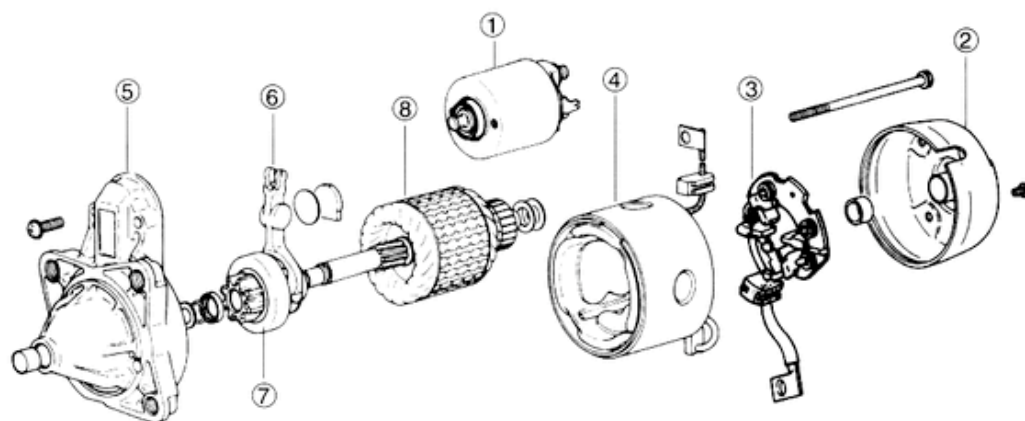


Engine Electrical System

Starting System - Starter



COMPONENT



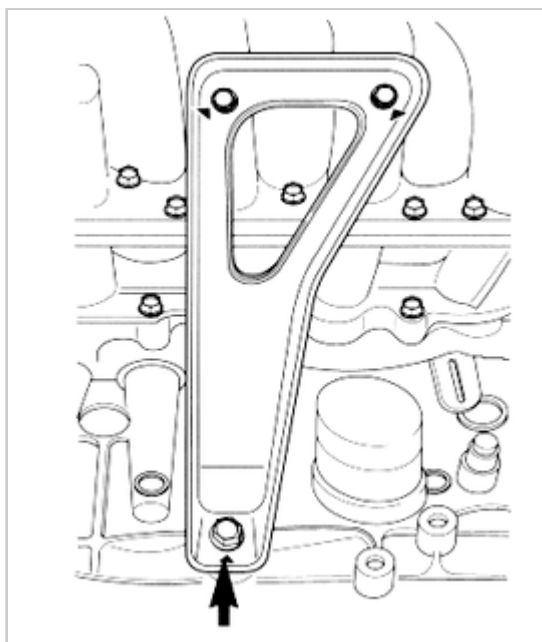
- (1) Solenoid
- (2) Rear cover
- (3) Brush holder assembly
- (4) Field coil

- (5) Drive end housing
- (6) Lever
- (7) Drive pinion
- (8) Armature

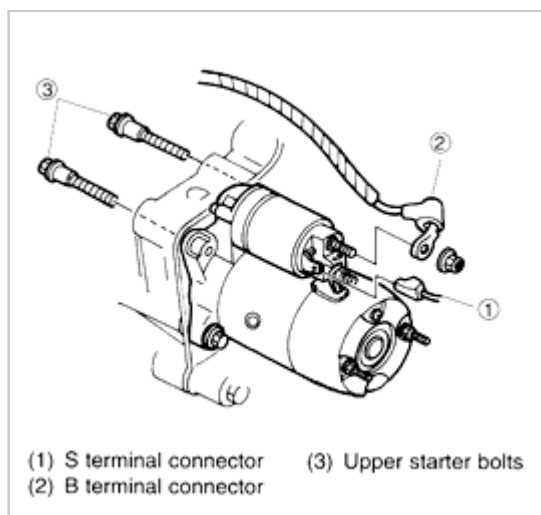


REMOVAL

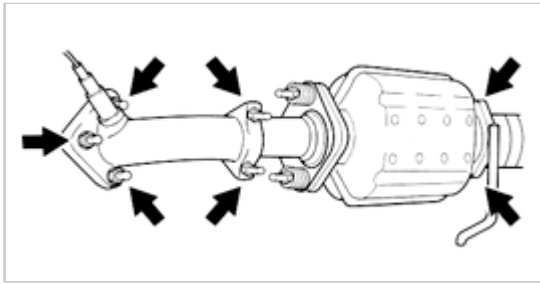
1. Disconnect negative battery terminal.
2. Remove two upper intake manifold support bracket bolts.



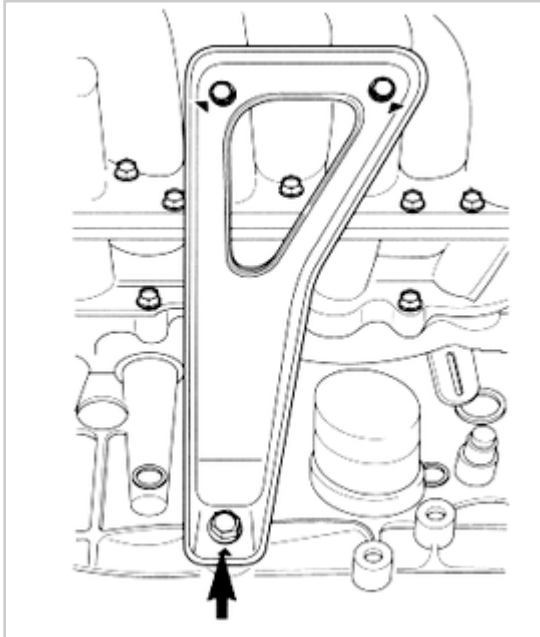
3. Disconnect S terminal connector.
4. Disconnect B terminal connector.
5. Remove two upper starter bolts.



6. Raise vehicle support with safety stands.
7. Remove exhaust pipe.

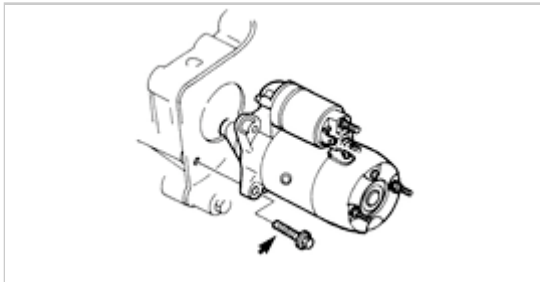


8. Remove lower intake manifold support bracket bolt.



9. Remove intake manifold support bracket.

10. Remove lower starter bolt.

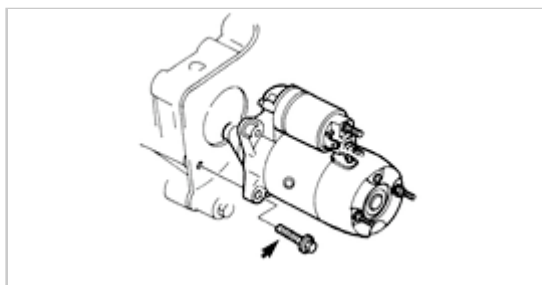


11. Remove starter.

INSTALLATION

1. Place starter in engine.
2. Insert lower starter bolt and tighten.

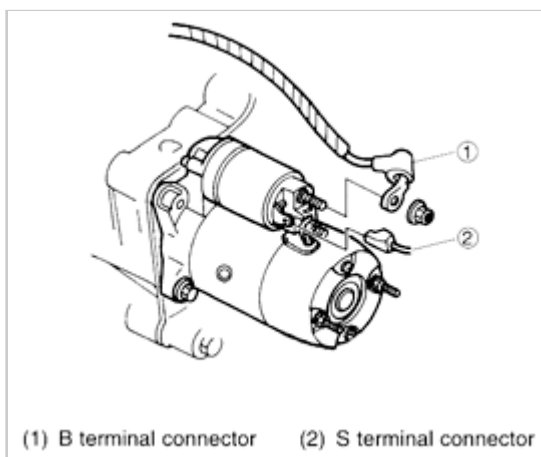
Tightening torque : 27~38lb-ft (37~52N·m, 3.7~5.3kg-m)



3. Connect B terminal connector and tighten.

Tightening torque : 7.2~8.9N·m, 1~1.2kg-m)

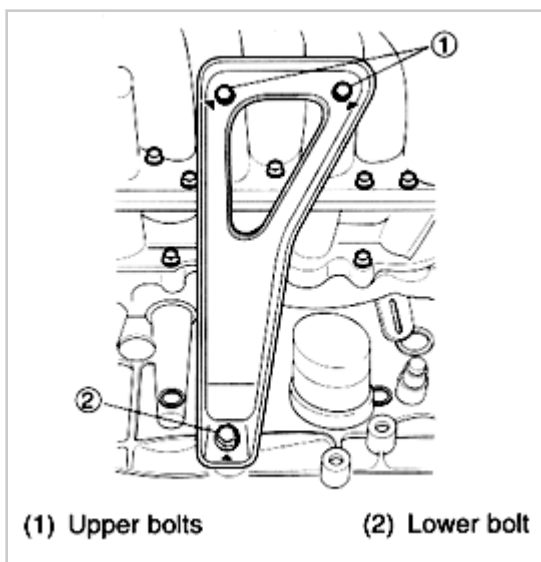
4. Connect S terminal connector.



5. Place intake manifold support bracket.

6. Insert three intake manifold support bracket bolts. and tighten lower intake manifold support brake bolts.

Tightening torque : 27~38lb-ft (37~52N·m, 1~1.2kg-m)

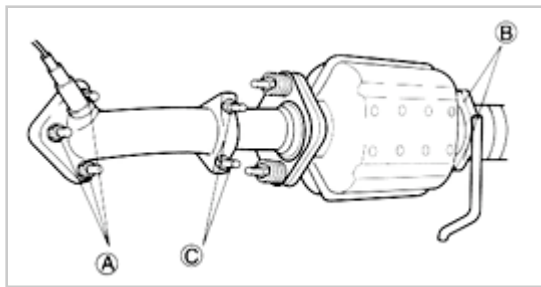


7. Position exhaust pipe and tighten bolts.

Tightening torque :

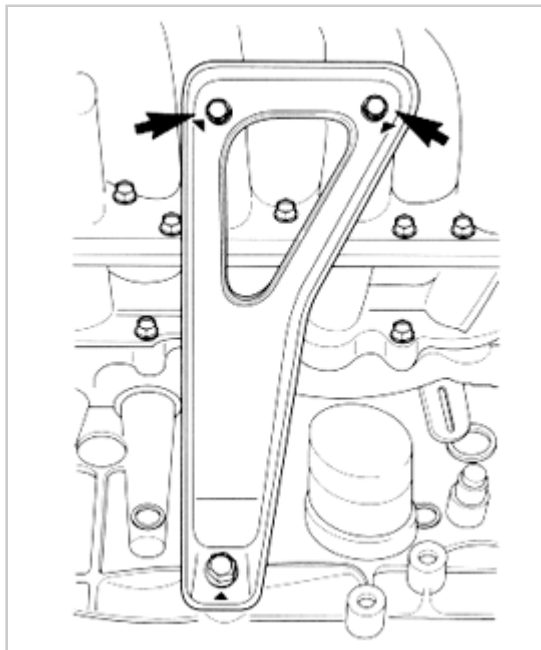
A : 29.7~40.5lb-ft (40.2~54.9N·m, 4.1~5.1kg-m)

B : 51~69lb-ft (69~94N·m, 6.9~9.4kg-m)
C : 15.2~20.2lb-ft (20.6~27.4N·m, 2.8kg-m)



8. Lower vehicle.
 9. Tighten two upper intake manifold support bracket bolts.
-

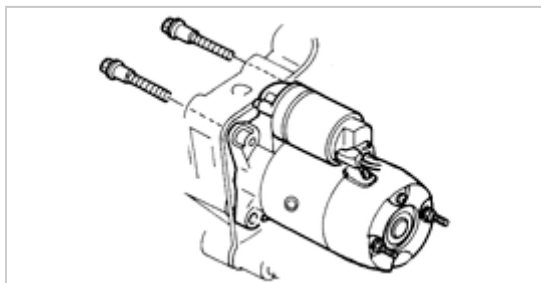
Tightening torque : 27~38lb-ft (37~52N·m, 1~1.2kg-m)



10. Place two starter bolts and tighten.
-

Tightening torque : 27~38lb-ft (37~52N·m, 1~1.2kg-m)

11. Connect negative battery terminal.

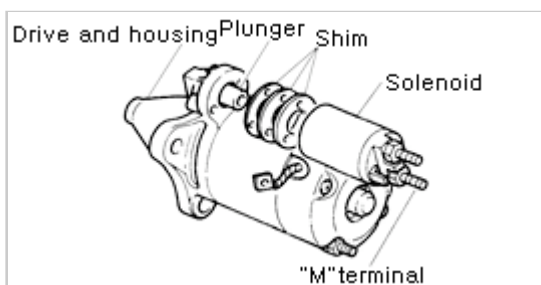


DISASSEMBLY

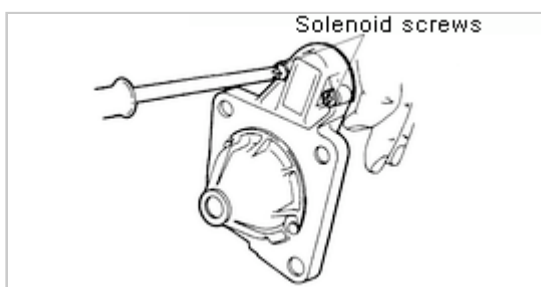
1. Remove nut from M terminal.
2. Remove field wire from M terminal.

NOTICE

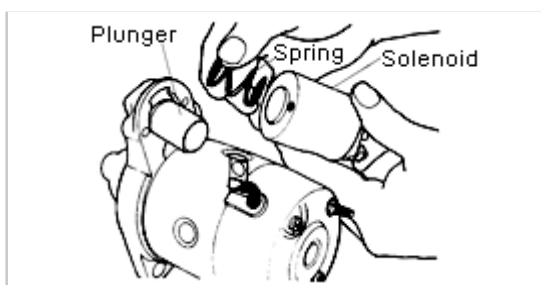
If pinion depth shims are found between solenoid and drive end housing, remove them and set aside.



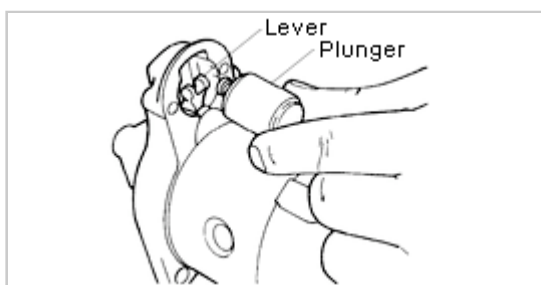
3. Remove solenoid screws and magnetic switch.



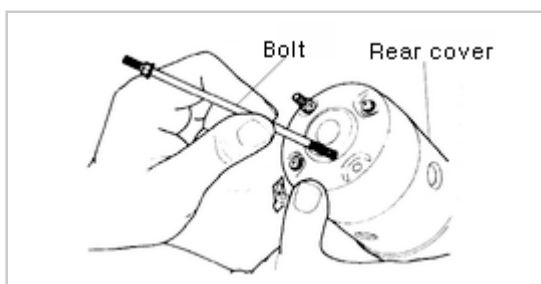
4. Remove solenoid plunger spring.



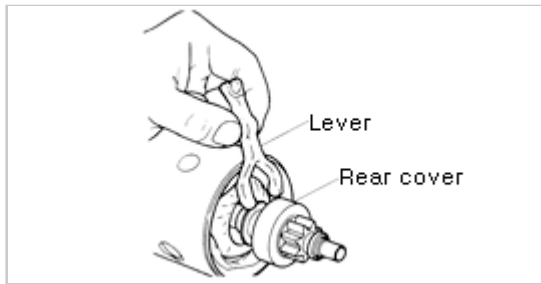
5. Disengage plunger from lever and remove plunger.



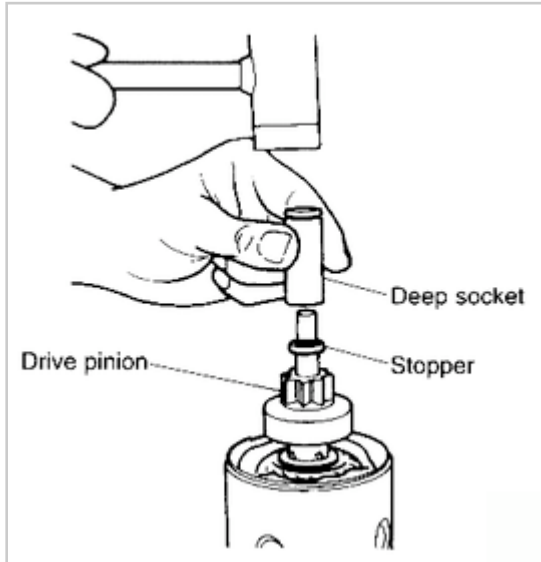
6. Remove bolts from rear cover. Separate motor assembly from drive end housing. Also separate motor assembly from planetary gear set, if present.



7. Remove lever from drive pinion.

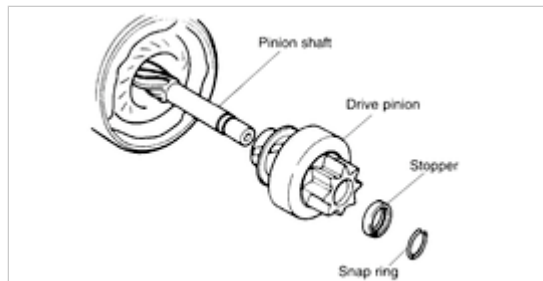


8. Drive stopper from snap ring using a deep well socket or similar tool.



9. Remove snap ring from its groove in pinion shaft.

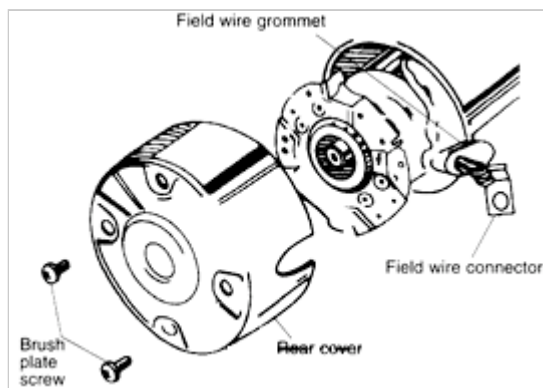
10. Remove stopper and drive pinion from pinion shaft.



11. Remove two brush plate screws and rear cover.

12. Remove armature from field coil housing.

13. Remove armature washers from the end of the armature.



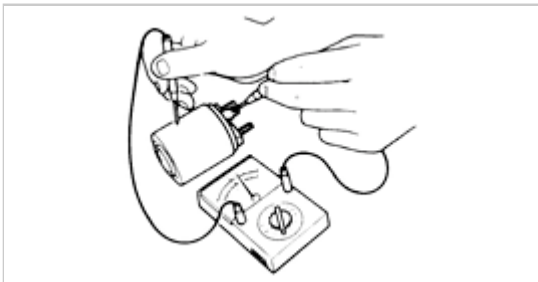
INSPECTION

1. Solenoid

- (1) Check for continuity between S and M terminals with ohmmeter. Replace solenoid if there is no continuity.



- (2) Check for continuity between S terminal and solenoid body with ohmmeter. Replace solenoid if there is no continuity.



- (3) Check continuity between M and B terminal with ohmmeter. Replace solenoid if there is continuity.



2. Brush and brush holder

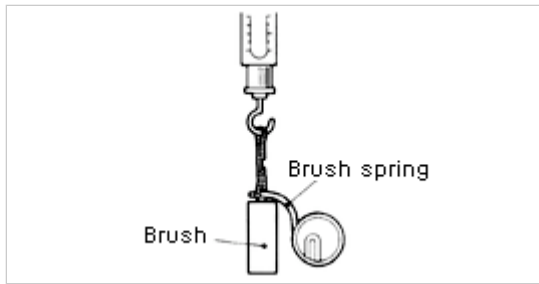
- (1) Check continuity between each insulated brush and plate with ohmmeter. Replace brush holder if there is continuity.



- (2) Measure the force of brush spring with spring balance.

Brush spring force : 2.0lb (8.8N)

- (3) Replace spring if force is insufficient.

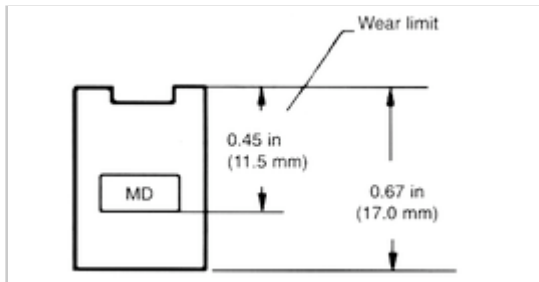


3. Brush

If brush is worn to the wear limit, replace all brushes.

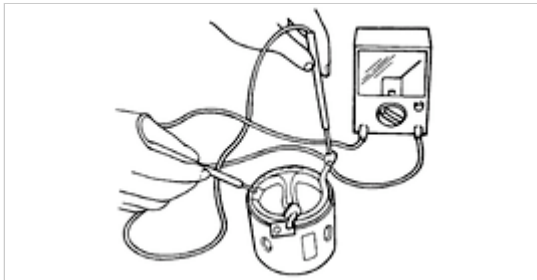
Standard : 0.67in (17mm)

Wear limit : 0.45in (11.5mm)



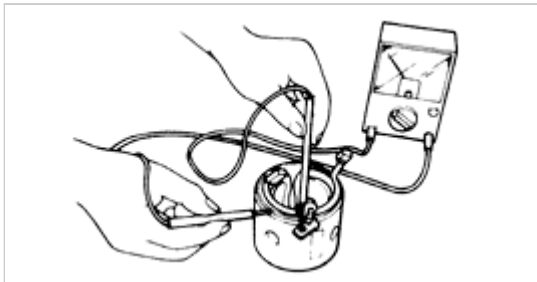
4. Field coil

- (1) Check for continuity between M terminal wire and brushes with ohmmeter. Replace yoke assembly if there is no continuity.



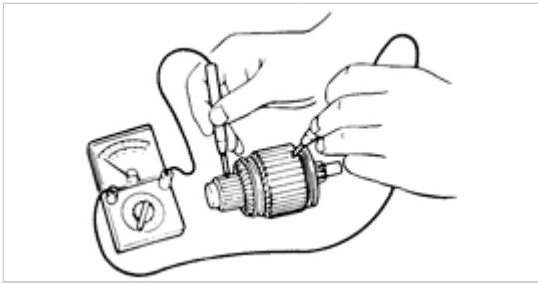
- (2) Check continuity between M terminal wire and yoke with ohmmeter. Replace yoke assembly if there is continuity.

- (3) Check if field coil is loose. Replace yoke assembly if necessary.

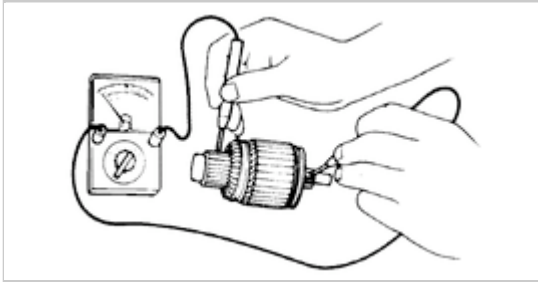


5. Armature

- (1) Check continuity between commutator and core with ohmmeter. Replace armature if there is continuity.

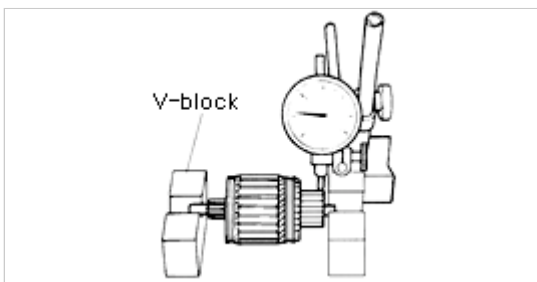


- (2) Check continuity between commutator and shaft with ohmmeter. Replace armature if there is continuity.



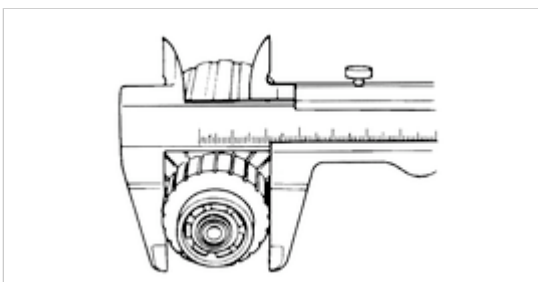
- (3) Place armature on V-blocks, and measure runout with a dial indicator.
if runout is not within specification, repair armature with a lathe or replace armature.

Runout : 0.002in (0.05mm)
Maximum : 0.016in (0.4mm)



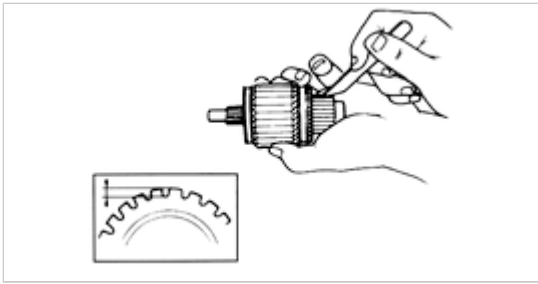
- (4) Replace armature if diameter or commutator diameter is at, or less than, grind limit.
(5) If commutator surface is dirty, wipe it with a cloth ; if it is rough, repair it with a lathe or fine sandpaper.

Grind limit : 1.22in (31mm)



- (6) If depth of mold between segments is at, or less than minimum, replace armature.

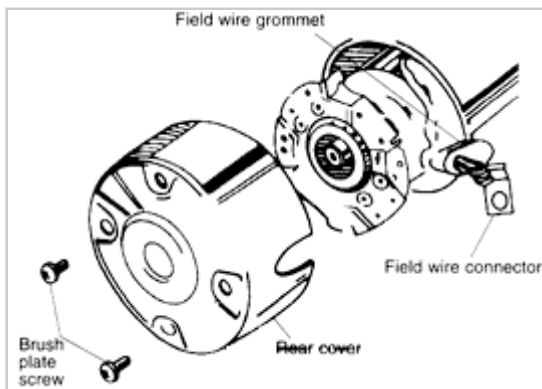
Depth : 0.02~0.03in (0.5~0.8mm)
Minimum : 0.008in (0.2mm)



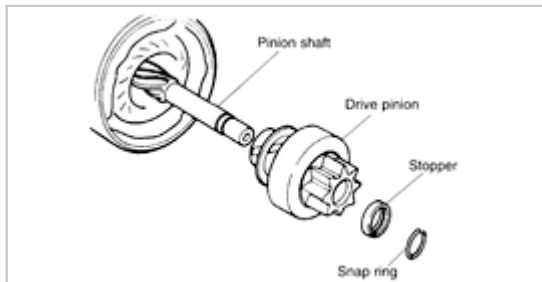
REASSEMBLY

1. Reassembly armature washers to the end of armature.
2. Reassembly armature in field coil housing.
3. Reassembly rear cover and tighten two brush two brush plate screws.

Tightening torque : 1.7~3.2lb-ft (2.4~4.4N·m)



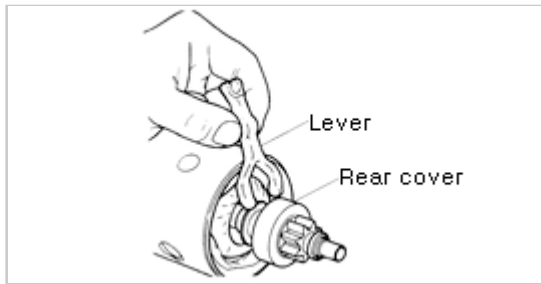
4. Reassembly drive pinion and stopper on pinion shaft.
5. Place snap ring on its groove in pinion shaft.



6. Reassemble stopper.

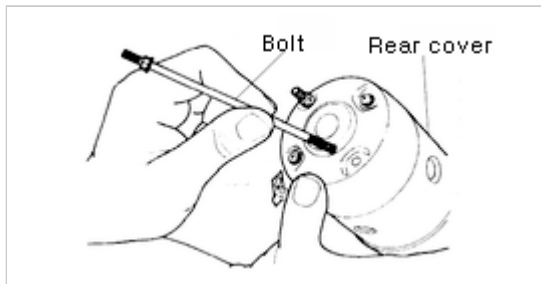


7. Reassemble lever on drive pinion.

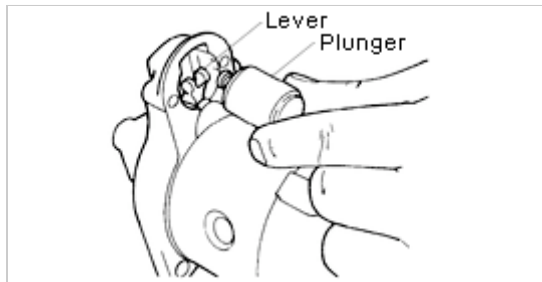


8. If present, reassembly planetary gear set to motor assembly.
9. Reassembly motor assembly in drive end housing.
10. Place bolts in rear cover and tighten.

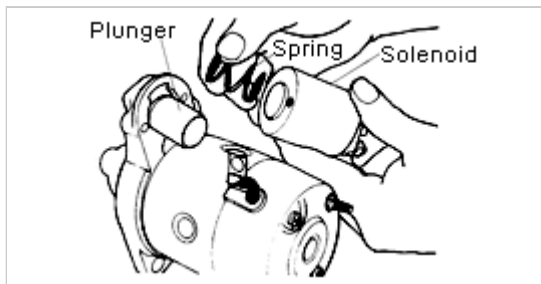
Tightening torque : 2.8~5.2lb-ft (3.8~7.1N·m, 0.39~0.72kg-m)



11. Engage plunger in lever.



12. Insert solenoid plunger spring.



13. Reassemble magnetic switch and tighten solenoid screws.

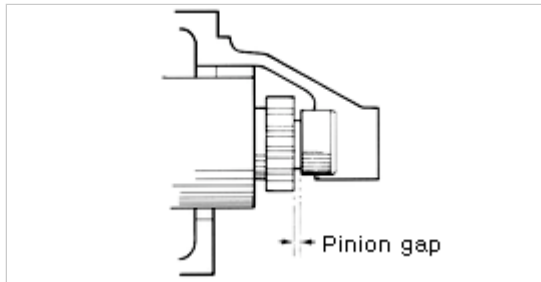
Tightening torque : 3.0~5.6lb-ft (4.1~7.6N·m, 0.42~0.77kg-m)

14. Apply battery power to the S terminal and ground starter motor body. Pinion will eject outward and then stop.
15. Measure clearance (pinion gap) between pinion and stopper.

Pinion gap : 0.020~0.079in (0.5~2.0mm)

NOTICE

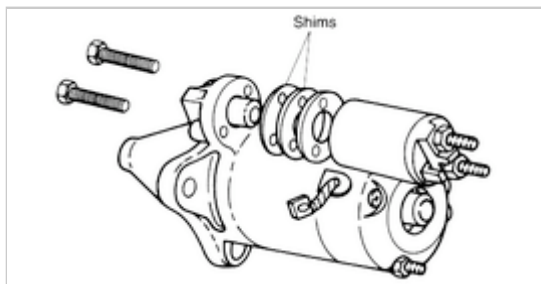
Be careful not to let electricity flow continuously for more than 10 seconds.



16. If pinion gap is not within specified range, adjust it by increasing or decreasing the number of washers used between ordecreasing the number of washers used between solenoid and drive housing. The gap will become smaller if the number of washers increased.

NOTICE

Do not use washers than plates.



17. Connect field wire to M terminal.



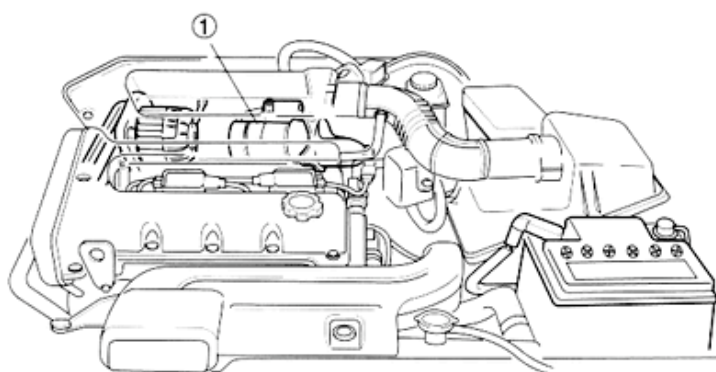
Circuit operation

Battery voltage is at all times applied from the positive battery terminal to the ignition switch and the normally open starter solenoid contacts. When the ignition switch is turned to START and the transaxle is in park or neutral (automatic transaxle), battery voltage is applied to the starter solenoid coils.

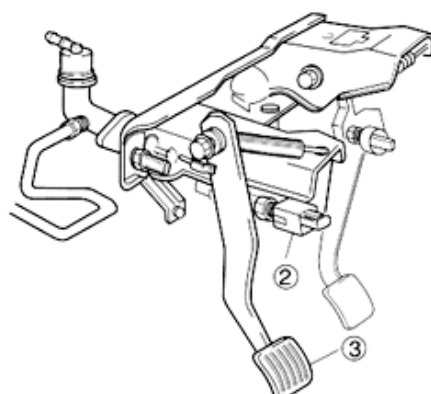
The starter solenoid coils energize, the starter solenoid contacts close, and battery voltage is applied to the starter motor. The starter motor engaged to start the engine.



COMPONENTS



- (1) Starter
(2) Starter clutch pedal position switch



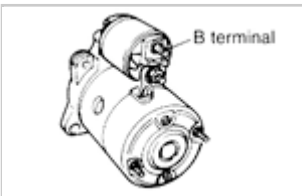
- (3) Clutch

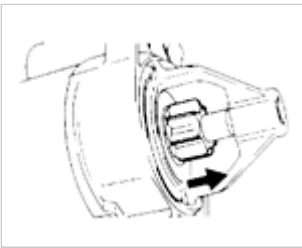


SYMPTOM GUIDE

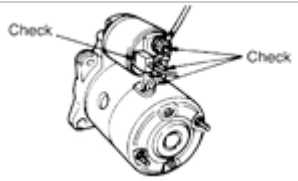
No.	
1	Will not crank-starter motor does not operate
2	Will not crank-starter motor spins
3	Cranks slowly
4	Generator warning lights illuminates with engine running
5	Discharged battery
6	Misfire

Symptom troubleshooting

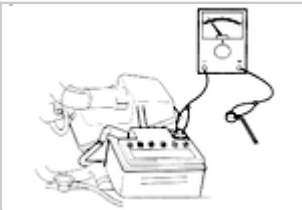
1	Will not crank-starter motor does not operate		
Step	Inspection		Action
1	Check if engine cranks with fully charged battery.	Yes	Check charging system
		No	Go to next step.
2	Check battery voltage is supplied at B terminal. 	Yes	Go to next step.
		No	Check wiring harness
3	Check battery voltage is supplied at S terminal with clutch pedal depressed (M/T), car in park (A/T), and ignition switch in START position	Yes	Replace starter unit
		No	<ul style="list-style-type: none"> • Check starter clutch pedal position switch (M/T) • Check transmission range switch (A/T) • Check ignition switch • Check wiring harness

2	Will not crank-starter motor spins		
Step	Inspection		Action
1	Check if drive is pulled out while cranking. (Click heard when pulled out.) 	Yes	Remove starter and check flywheel ring gear teeth and starter drive pinion teeth.
		No	Replace starter unit

3	Cranks slowly
---	---------------

Step	Inspection		Action
1	Check if engine cranks normally when fully charged.	Yes	Check charging system.
		No	Go to next step.
2	Check starter cable connection for looseness and corrosion. 	Yes	Repair or replace connection.
		No	Check for seized motor armature. Repair or replace as necessary.

4	Generator warning lamp illuminates with engine running		
Step	Inspection		Action
1	Check for correct battery voltage at idle. Specification : 14.1~14.7V	Yes	Check wiring harness between generator L terminal and generator warning lamp.
		No	Check charging system.

5	Discharged battery		
Step	Inspection		Action
1	Check charging system	Yes	Turn ignition switch ON and check dark current as shown.  Dark current : Below 20mA
		No	Repair or replace parts as necessary.

6	Misfire		
Step	Inspection		Action
1	Disconnect spark plug wire from each spark plug and check for strong blue while cranking	Yes	Check spark plug. If OK, engine electrical system is normal. If not OK. clean or replace spark plug.
		No	Check ignition system.

**INSPECTION**

1. Disconnect starter clutch pedal position switch connector.
2. Connector an ohmmeter to switch connector.
3. Check continuity.

Clutch pedal position	Continuity
Depressed	Yes
Released	No

4. Replace switch if continuity is not as specified.