

2002 STARTING & CHARGING SYSTEMS

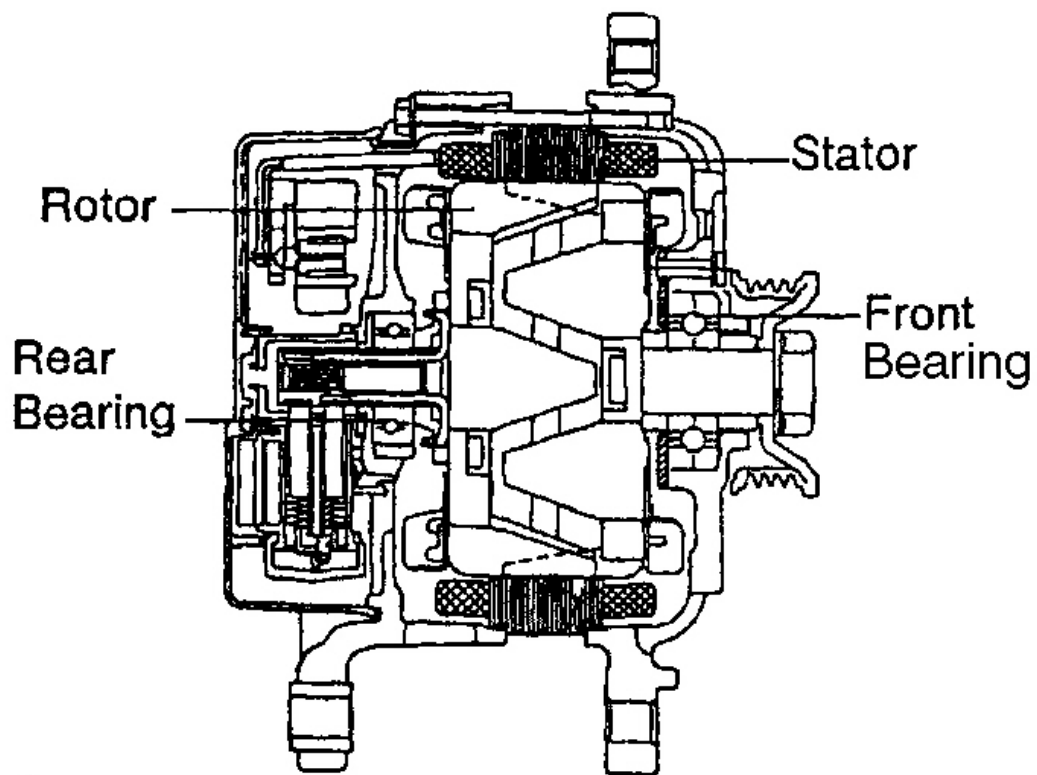
Generators & Regulators - Sedona

DESCRIPTION & OPERATION

Generator is a 70-amp, conventional 3-phase, self-rectifying type with an internal solid state voltage regulator. Components include a rotor, stator, rectifier, brushes and bearings. See **Fig. 1** . Battery, battery cables, charge indicator light, wiring and drive belt complete charging system.

Battery voltage is applied at all times to "B" terminal of generator. With ignition turned to ON position, battery voltage is applied to charge indicator light and to "L" terminal. See **Fig. 2** . With engine running, generator produces an alternating current that flows through a series of rectifying diodes, converting alternating current to direct current. Direct current is controlled by voltage regulator to keep battery charged. If voltage regulator senses generator is not producing sufficient output, it grounds "L" terminal, illuminating charge indicator light.

NOTE: **The terms generator and alternator are interchangeable. Either may be found within illustrations.**



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Fig. 1: Identifying Generator Components
Courtesy of KIA MOTORS AMERICA, INC.

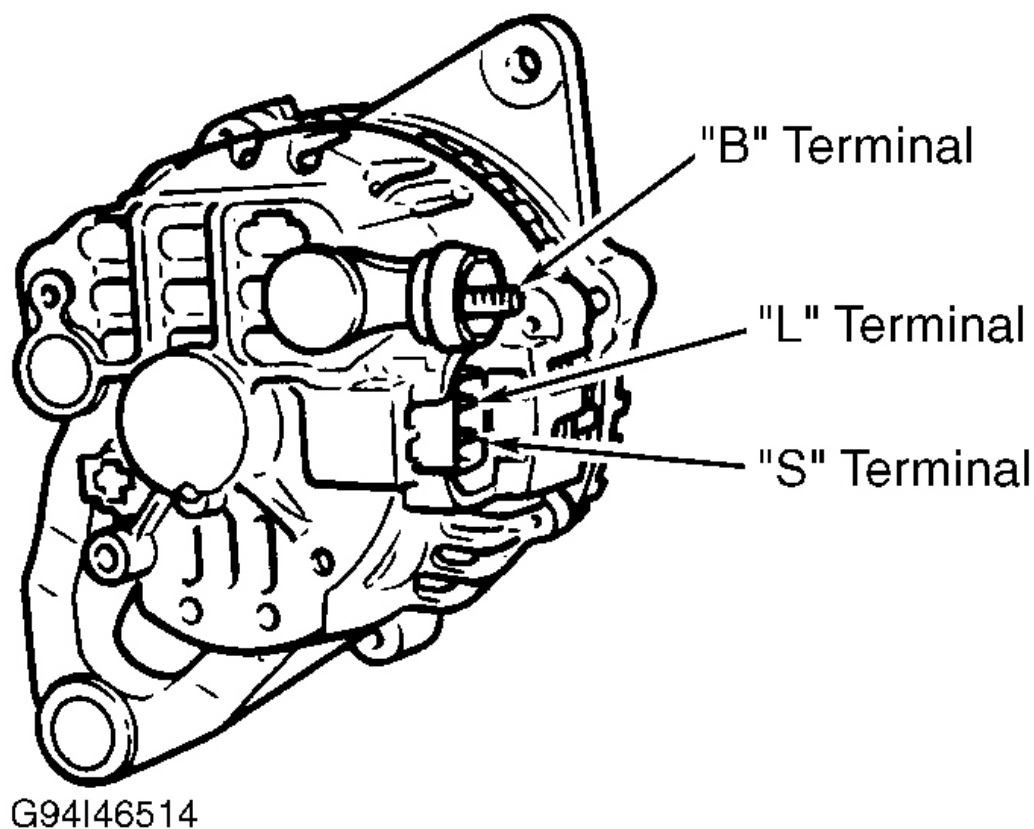


Fig. 2: Identifying Generator Terminals
Courtesy of KIA MOTORS AMERICA, INC.

COMPONENT LOCATIONS

COMPONENT LOCATIONS

| Component | Location |
|--------------------------------|---------------------------------|
| Engine Compartment Fuse Box | Left Side Of Engine Compartment |
| Passenger Compartment Fuse Box | Under Left Kick Panel |

ADJUSTMENTS

DRIVE BELT TENSION

For generator drive belt tension and deflection specifications, see **BELT ADJUSTMENT** table.

TROUBLE SHOOTING

NOTE: See **CHARGING SYSTEM - GENERAL TROUBLE SHOOTING** article in **GENERAL INFORMATION**.

ON-VEHICLE TESTING

NOTE: When battery is disconnected, vehicle computer may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See appropriate **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

BATTERY LOAD TEST

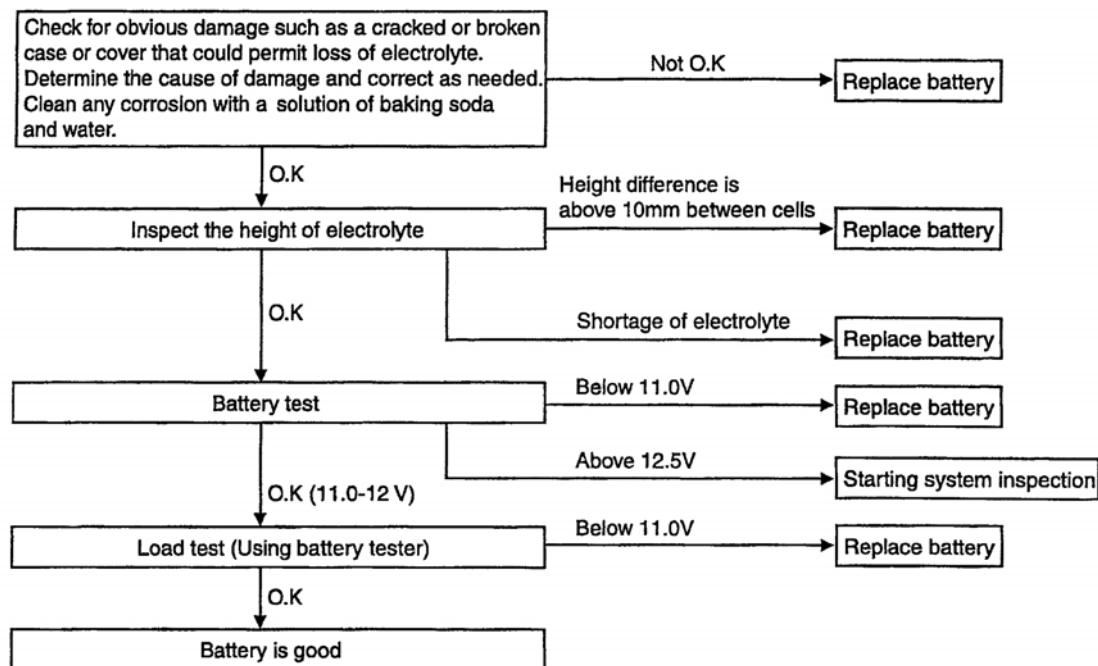
1. When discharging the battery during 15 seconds at half currency of Cold Cranking Ampere (CCA), the voltage of the battery should be as shown below.

REGULATING VOLTAGE

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

2. When the voltage is not within specification, repeat the load test again, and re-charge battery.
3. If the battery is left alone for 2 hours after re-charging and its output is over 12.5V, and the voltage after a load test is over the standard value, the battery can be used.

BATTERY VISUAL INSPECTION (1)



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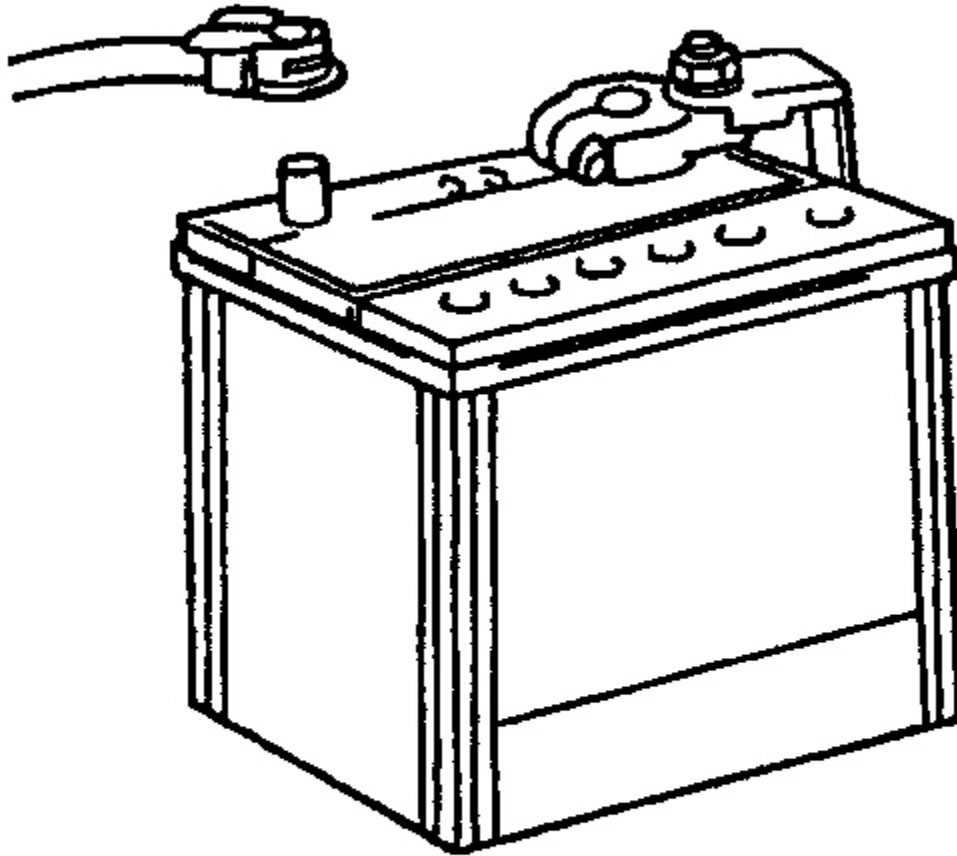
Fig. 3: Battery Visual Inspection
 Courtesy of KIA MOTORS AMERICA, INC.

BATTERY VISUAL INSPECTION (2)

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

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 batteries being charged. A spark will occur when the circuit is broken. Keep open flames away from the battery.

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first), see **Fig. 4**
3. Remove the battery from the vehicle.



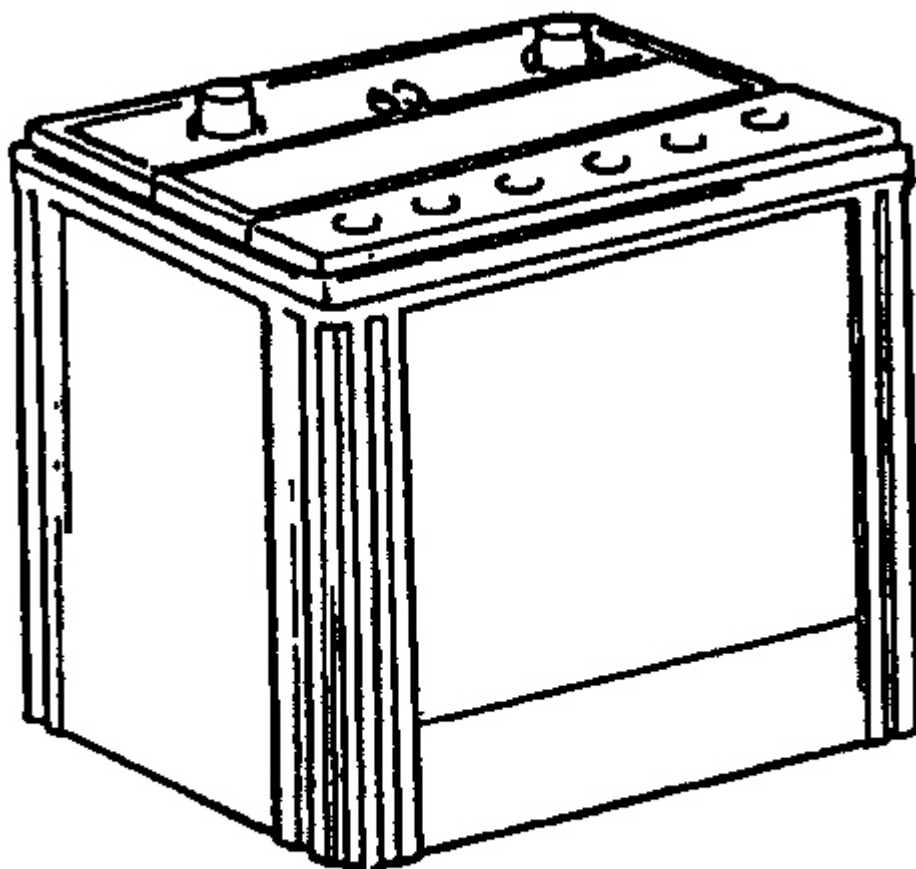
Disconnect Battery Cables (Negative First)

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Fig. 4: Disconnect Battery Cables (Negative First)
Courtesy of KIA MOTORS AMERICA, INC.

4. Inspect the battery carrier for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described in next step.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.

7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure the tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.



Inspection Of Battery

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GENERATOR OUTPUT LINE VOLTAGE DROP TEST

NOTE: **Ensure battery is fully charged and load tested before testing. Verify drive belt tension is correct, electrical wiring, connectors and generator installation connections are in good condition and battery terminals are clean and tight. Inspect all fuses in both the engine compartment fuse box and the passenger compartment fuse box.**

NOTE: **This test determines condition of wiring from generator "B" terminal to battery positive terminal, including fusible link.**

1. Ensure ignition is off. Disconnect negative battery cable. Disconnect generator output wire from generator "B" terminal. See **Fig. 2** . Connect positive lead of ammeter with a range of 0-100 amps, to the "B" terminal and negative lead to disconnected output wire.
2. Connect positive lead of DVOM to "B" terminal and negative lead to battery positive cable. Reconnect negative battery cable. Connect a tachometer or scan tool to vehicle. Leave hood open. Start engine. With engine running at about 2500 RPM, turn headlights on and off to adjust generator load on ammeter slightly above 30 amps.

NOTE: **When generator output is high and value displayed on ammeter does not decrease to 30 amps, set ammeter value to 40 amps, then read DVOM value. Maximum voltage should be 0.4 volt.**

3. Decrease engine speed gradually until the value displayed on ammeter is 30 amps. Record reading on DVOM. Maximum voltage should be 0.3 volt. If voltage reading on DVOM is greater than maximum voltage, a malfunction in the generator output wire may exist. Check wiring between generator "B" terminal and positive battery terminal, including fusible link. If a terminal is not sufficiently tight or if harness has become discolored due to overheating, repair wiring, then retest.
4. After test is complete, run engine at idle. Turn off all lights and turn ignition off. Disconnect tachometer or scan tool. Disconnect negative battery cable. Remove ammeter and DVOM. Connect generator output wire to generator "B" terminal. Connect negative battery cable.

OUTPUT CURRENT TEST

NOTE: **Ensure battery is fully charged and load tested before testing. Verify drive belt tension is correct, electrical wiring, connectors and generator installation connections are in good condition and battery terminals are clean and tight. Inspect all fuses in both the engine compartment fuse box and the passenger compartment fuse box.**

NOTE: **For the following test, battery should be slightly discharged. Load needed by a fully charged battery is insufficient for an accurate test. Ensure generator is**

cool prior to performing the following test.

1. Ensure ignition is off. Disconnect negative battery cable, see **Fig. 4** . Disconnect generator output wire from generator "B" terminal. Connect positive lead of ammeter with a range of 0-100 amps, to the "B" terminal and negative lead to disconnected output wire.

NOTE: If voltage reading in the following step is zero volt, cause is probably an open circuit in wire or fusible link between generator "B" terminal and positive battery terminal.

2. Connect positive lead of voltmeter with a range of 0-20 volts, to the "B" terminal and ground negative lead. Connect negative battery cable. Connect a tachometer or scan tool to vehicle. Leave hood open. Ensure reading on voltmeter is equal to battery voltage.

NOTE: Ensure engine is started and headlights are turned on as quickly as possible in order to obtain the maximum current output value. Battery current will soon drop after engine is started.

3. Start engine and turn headlights on quickly. Switch headlights to high beam, turn heater blower switch to high, increase engine speed to about 2500 RPM, and read maximum current output displayed on ammeter. Current limit should be 70 percent of nominal (rated) output. For rated output, see **SPECIFICATIONS** .
4. Reading on ammeter should be above limit value. If reading is below limit value, and generator output wire is okay, remove and inspect generator.
5. After test is complete, run engine at idle. Turn ignition off. Disconnect tachometer or scan tool. Disconnect negative battery cable. Remove ammeter and voltmeter. Connect generator output wire to generator "B" terminal. Connect negative battery cable.

REGULATED VOLTAGE TEST

NOTE: Ensure battery is fully charged and load tested before testing. Verify drive belt tension is correct, electrical wiring, connectors and generator installation connections are in good condition and battery terminals are clean and tight. Inspect all fuses in both the engine compartment fuse box and the passenger compartment fuse box.

1. Ensure ignition is off. Disconnect negative battery cable, see **Fig. 4** . Connect positive lead of voltmeter to the "S" terminal and ground negative lead. See **Fig. 2** . Disconnect generator output wire from generator "B" terminal.

NOTE: If voltage reading in the following step is zero volt, cause is probably an open circuit in wire or fusible link between generator "S" terminal and positive battery terminal.

2. Connect positive lead of ammeter with a range of 0-100 amps, to the "B" terminal and negative lead to

disconnected output wire. Reconnect negative battery cable. Connect a tachometer or scan tool to vehicle. Ensure reading on voltmeter is equal to battery voltage.

- 3. Ensure all lights and accessories are off. Start engine and increase engine speed to about 2500 RPM. Read voltmeter when current output by the generator becomes 10 amps or less. If voltage reading conforms to value in **VOLTAGE REGULATION** table, voltage regulator is operating normal. If voltage reading does not confirm within standard value, a malfunction of the voltage regulator or generator exists. Repair or replace as necessary.

VOLTAGE REGULATION

| Voltage Regulator Ambient Temperature °F (°C) | Regulating Voltage (VE) |
|---|-------------------------|
| -4 (-20) | 14.2-15.4 |
| 68 (20) | 13.9-14.9 |
| 140 (60) | 13.4-14.6 |
| 176 (80) | 13.1-14.5 |

- 4. Reduce engine speed to idle, then turn ignition off. Disconnect negative battery cable. Remove tachometer, scan tool, DVOM and ammeter. Connect generator output wire to generator "B" terminal. Connect negative battery cable.

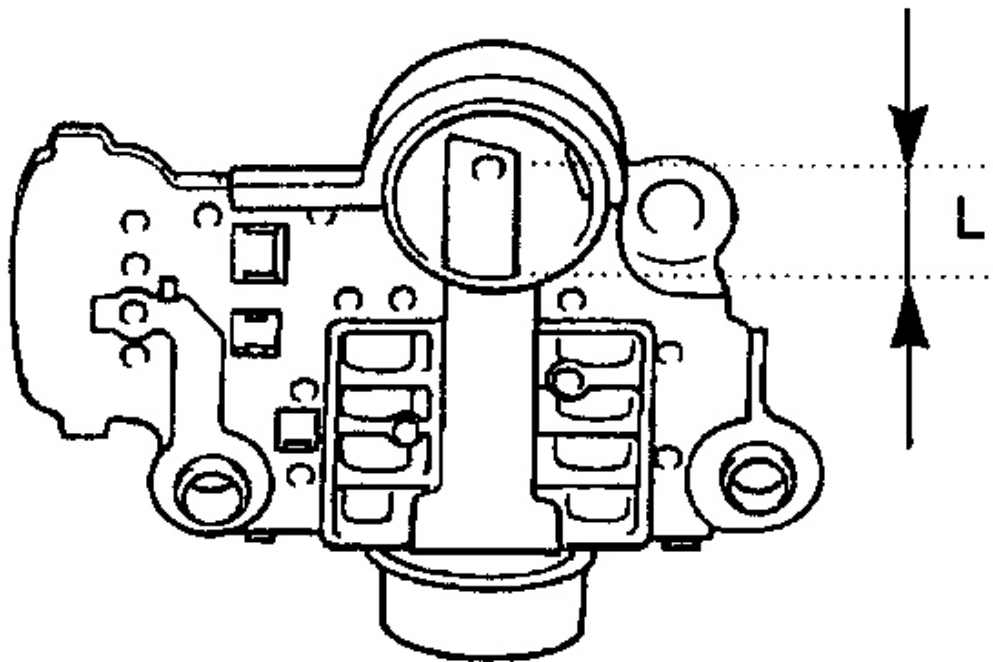
BENCH TESTING

BEARING

Check for abnormal noise, looseness and insufficient lubrication. Replace bearing(s) if necessary.

BRUSH

New brush length is .846" (21.5 mm). Minimum brush length is 0.079" (2 mm). If brushes are worn beyond limit, replace them. See **Fig. 6** .

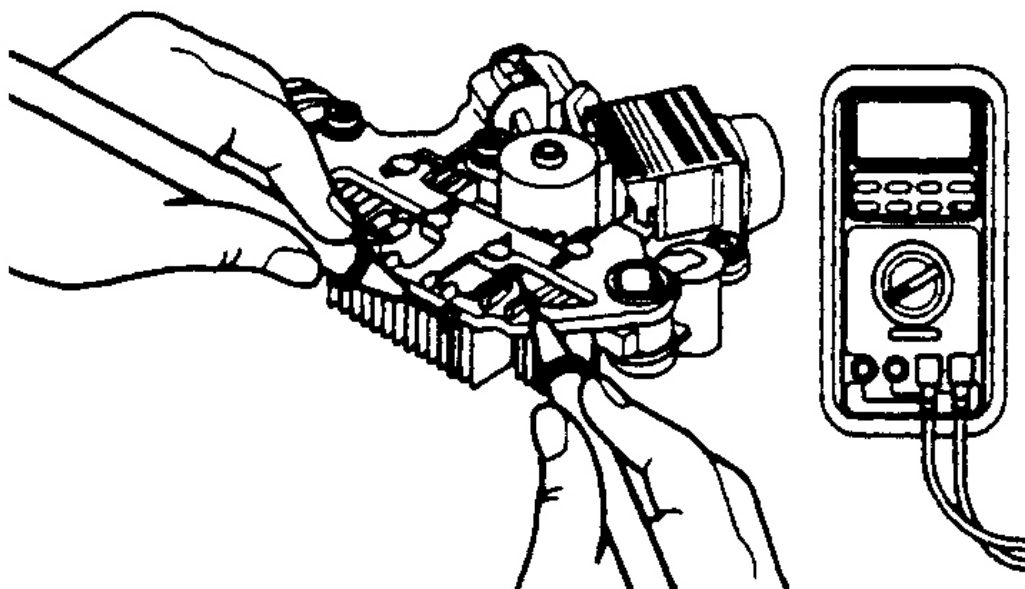


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Fig. 6: Measuring For Brush Replacement
Courtesy of KIA MOTORS AMERICA, INC.

DIODE TEST

Check the 3 diodes for continuity by connecting an ohmmeter to both ends of each diode. See **Fig. 7** . Each diode should have continuity in one direction only. If continuity is not as specified, replace complete assembly.

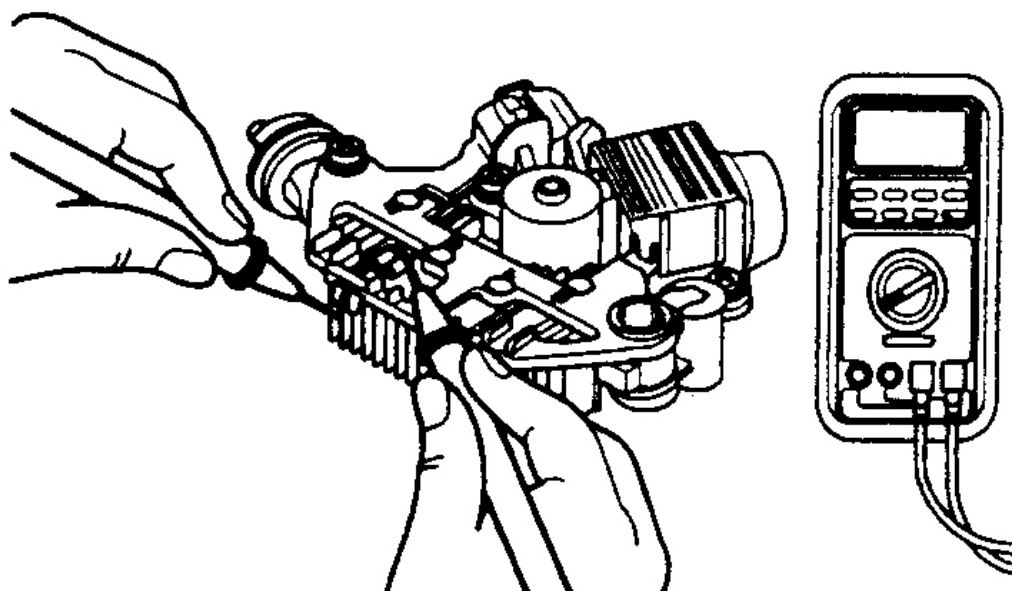


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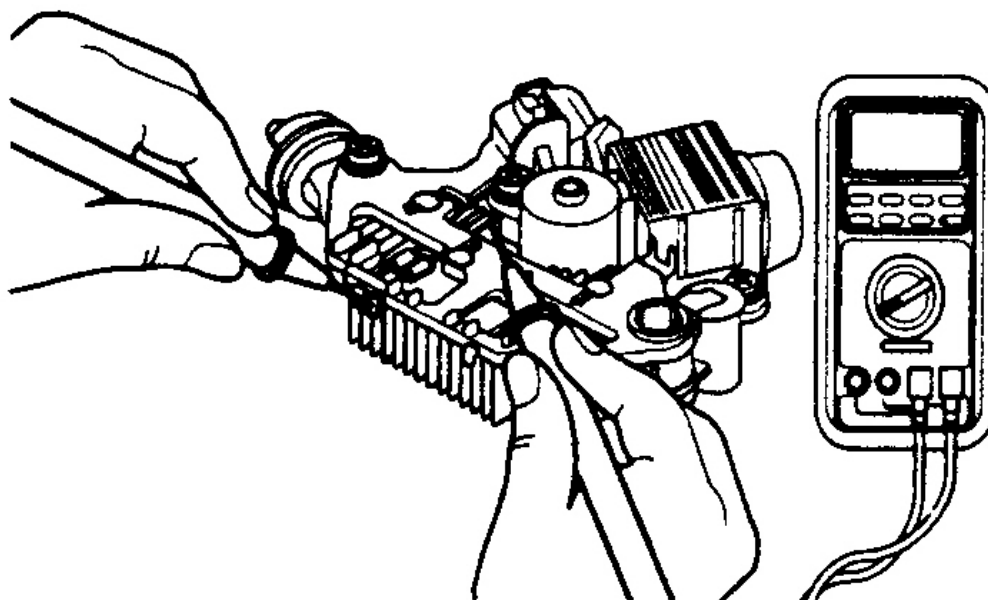
Fig. 7: Performing Diode Test
Courtesy of KIA MOTORS AMERICA, INC.

RECTIFIER

Using ohmmeter, check for continuity between positive rectifier and stator coil lead connection terminal. Continuity should exist in one direction only. Check for continuity between negative rectifier and stator coil lead connection terminal. See **Fig. 8** . Continuity should exist in one direction only. If continuity exists in both directions, a diode is shorted. Replace rectifier.



Positive



Negative

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Fig. 8: Testing Rectifier
Courtesy of KIA MOTORS AMERICA, INC.

ROTOR

Using ohmmeter, measure resistance between slip rings. If resistance is not 3.1 ohms, replace rotor. Check for continuity between slip ring and core. If continuity exists, replace rotor. If slip ring surface is rough, smooth with a lathe or fine sandpaper.

STATOR

Using ohmmeter, check continuity between stator coil leads. If continuity does not exist, replace stator. Check continuity between stator coil leads and core. If continuity exists, replace stator.

REMOVAL & INSTALLATION

GENERATOR

Removal

NOTE: When battery is disconnected, vehicle computer may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See appropriate COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

1. Disconnect negative battery cable. See **Fig. 9** .
2. Remove the 10 rosebud clips that attach the cover assembly upper shroud to the upper radiator support. See **Fig. 10** .
3. Loosen the clamp securing the air cleaner assembly to the fresh air duct assembly.
4. Remove the fresh air duct assembly. See **Fig. 11** .
5. Detach wire harness retainers from upper radiator support.
6. Detach hood release cable retainer from upper radiator support. See **Fig. 12** .
7. Disconnect connectors from both horns.
8. Remove hood latch to upper radiator support bolts.
9. Remove bolts from each end of the upper radiator support and remove support. See **Fig. 13** .
10. Disconnect electrical connectors from both engine cooling fans.
11. Remove cooling fan bolts and remove both cooling fans from radiator beginning with the driver side fan.
12. Insert a piece of cardboard behind the radiator to protect radiator fins when removing the generator. See **Fig. 14** .
13. Loosen lock nut on drive belt tensioner pulley. See **Fig. 15** .
14. From under vehicle, loosen belt tension using adjustment bolt "B". See **Fig. 16** .

NOTE: One generator connector is a male/female connector and the other is a 12 mm nut/bolt connector.

15. Disconnect electrical connections at back of generator. See **Fig. 17** .
16. Remove generator brace bolts and remove generator brace.
17. Loosen lower mounting bolt from generator. See **Fig. 18** .

NOTE: **Lower mounting bolt can interfere with body before clearing generator. Bolt will be removed along with generator.**

18. Loosen but do not remove upper mounting bolt.
19. Remove bolts securing upper generator bracket to engine. See **Fig. 19** .
20. Slide generator straight up until it clears the lower mounting bolt hole, then remove the lower mounting bolt. See **Fig. 20** .

NOTE: **Due to tight fit, removal may require shifting the engine to the right so the mounting bolt will clear the body. Loosen the passenger side motor mount if needed. Retighten motor mount after removal.**

21. Carefully remove generator by sliding unit to right and lifting from vehicle.

Installation

1. Verify that the cardboard used to protect the radiator is still in place next to the radiator. See **Fig. 14** .

NOTE: **Verify that upper mounting bracket is attached and set snug against the body of the generator. Insert, but DO NOT start lower mounting bolt prior to installing generator onto lower mounting bracket. See Fig. 21 . Manufacturer does not provide bolt torque specifications.**

2. Install and tighten upper generator bracket bolts. See **Fig. 19** .
3. Install generator brace and brace bolts. Tighten all generator mounting bolts. See **TORQUE SPECIFICATIONS** .
4. Remove protective cardboard.
5. Install the drive belt. See **Fig. 22** .
6. Turn adjustment bolt "B" to set belt tension to specified deflection. See **Fig. 16** . See **BELT ADJUSTMENT** table.
7. Tighten pulley lock nut "A" to specification. See **Fig. 16** . See **TORQUE SPECIFICATIONS** .
8. Connect generator electrical connectors. See **Fig. 17** .
9. Install both cooling fans, beginning with passenger side fan. Reconnect electrical connectors.

NOTE: **Hoses and cables should be arranged below radiator support prior to installation of support.**

10. Install upper radiator support, using caution not to pinch hood release cable in left radiator mount. See

Fig. 13 .

- 11. Attach wiring harness retaining clips and hood release cable retainer to upper radiator support.
- 12. Install bolts securing hood latch to upper radiator support.
- 13. Connect horn electrical connectors.
- 14. Install fresh air duct. See **Fig. 11** .
- 15. Tighten the clamp securing the air cleaner assembly to the fresh air duct assembly.
- 16. Attach the upper cover assembly shroud to the upper radiator support using the 10 rosebud clips. See **Fig. 10** .
- 17. Connect negative battery cable.

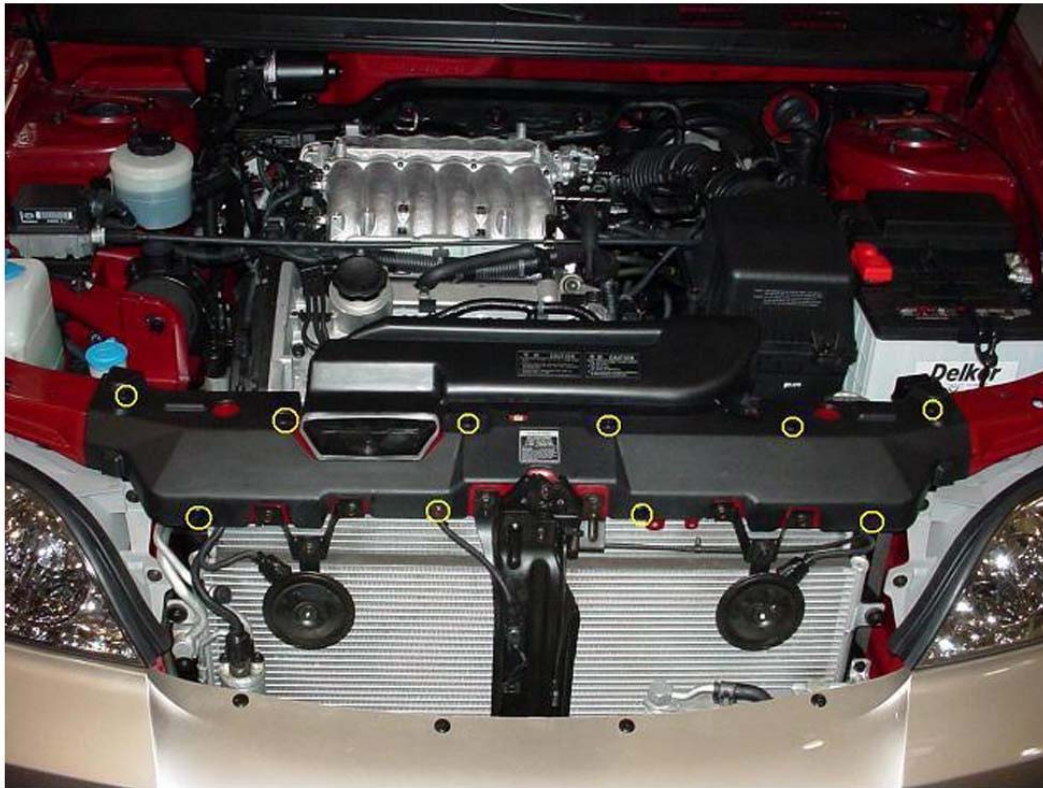
BELT ADJUSTMENT

| Application | (1) Deflection - In. (mm) |
|---|---------------------------|
| Generator & Air Conditioning Compressor | |
| New Belt Deflection | .31-.35 (8-9) |
| Used Belt Deflection | .35-.39 (9-10) |
| (1) Deflection is measured at the contact point with 22 lbs. (10 kg) of deflection force. | |



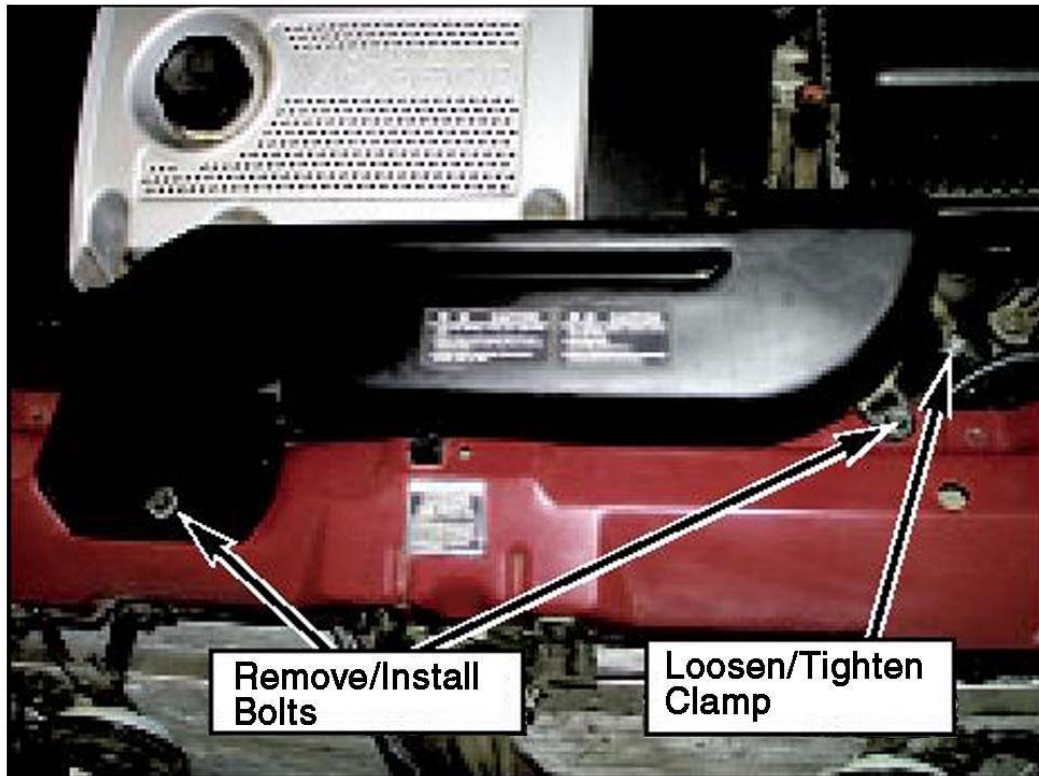
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Fig. 9: Disconnecting Negative Battery Terminal
Courtesy of KIA MOTORS AMERICA, INC.



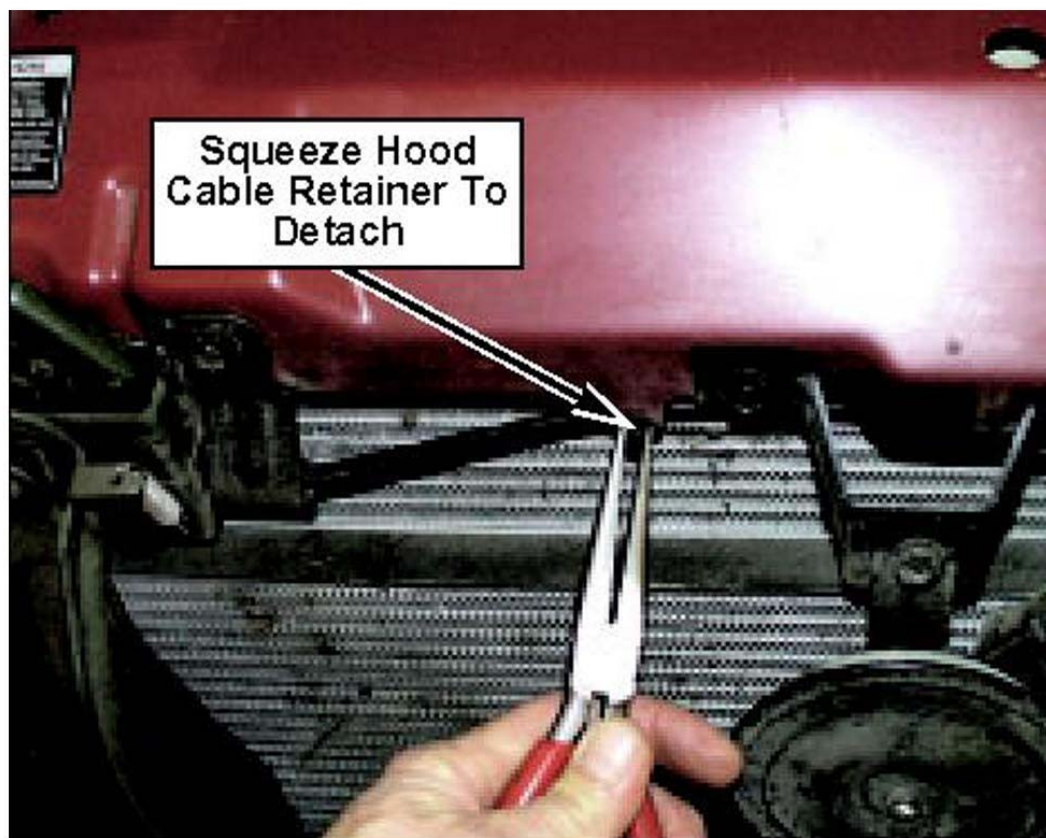
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Fig. 10: Removing & Installing Rosebud Clips
Courtesy of KIA MOTORS AMERICA, INC.



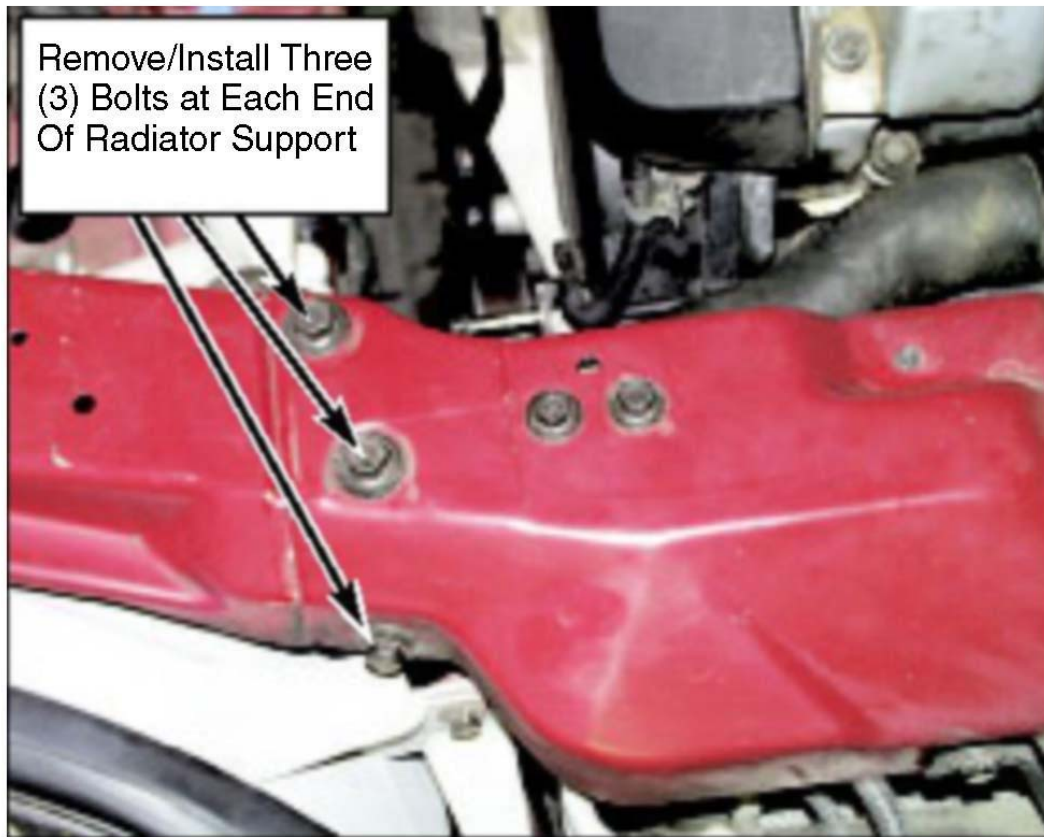
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Fig. 11: Removing & Installing Fresh Air Duct
Courtesy of KIA MOTORS AMERICA, INC.



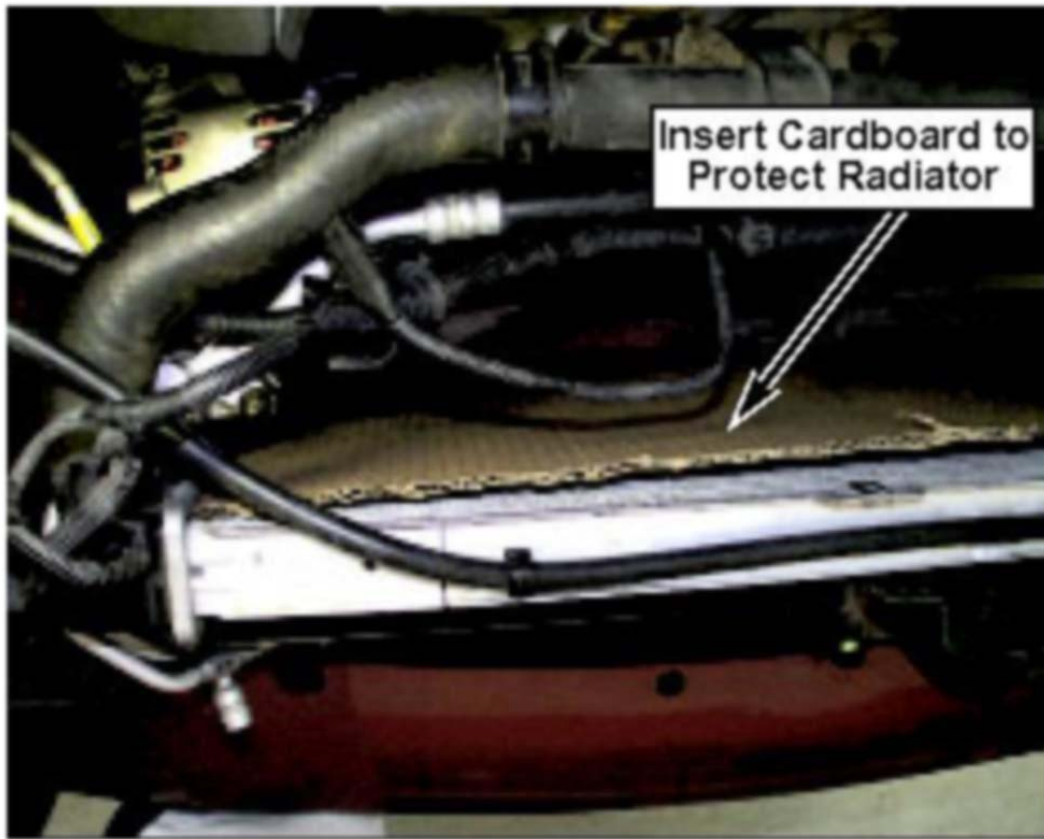
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Fig. 12: Detaching Hood Release Cable Retainer
Courtesy of KIA MOTORS AMERICA, INC.



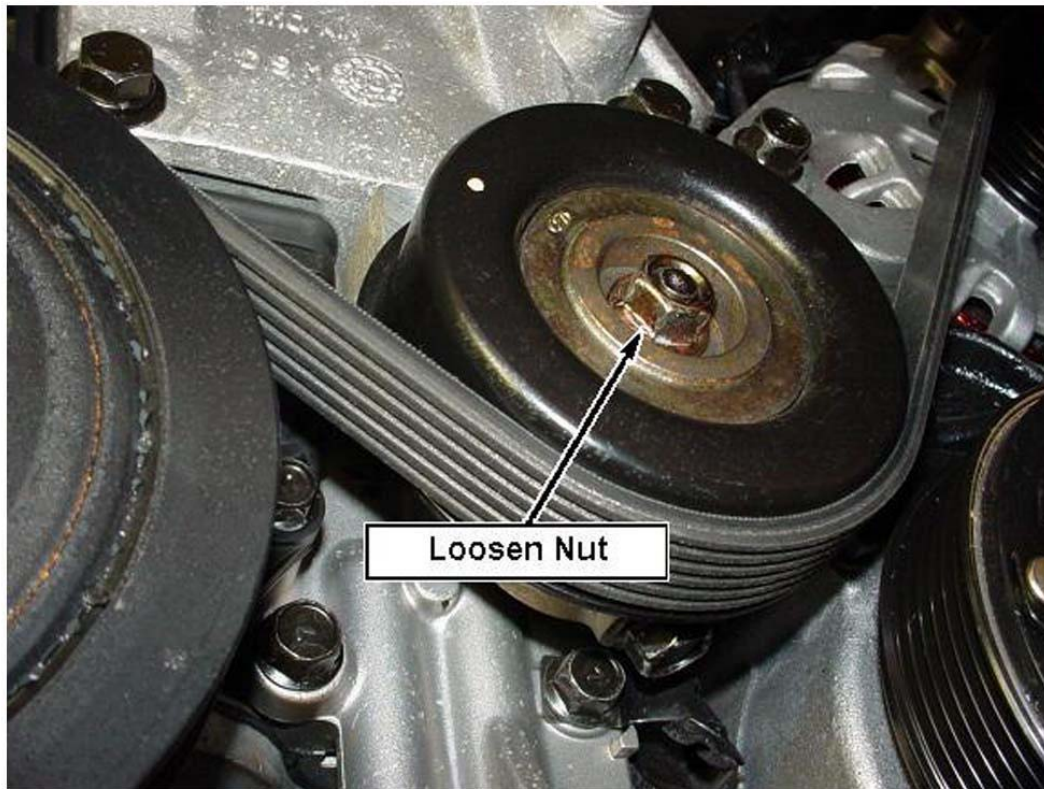
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Fig. 13: Removing & Installing Upper Radiator Support Bolts
Courtesy of KIA MOTORS AMERICA, INC.



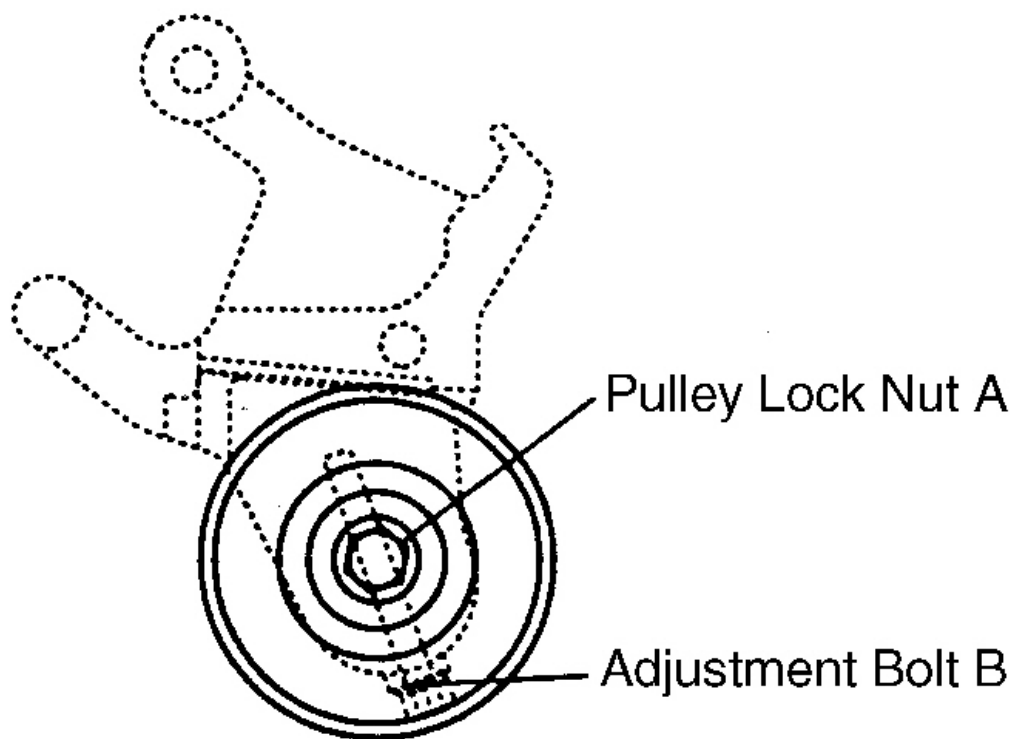
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Fig. 14: Inserting Protective Cardboard
Courtesy of KIA MOTORS AMERICA, INC.



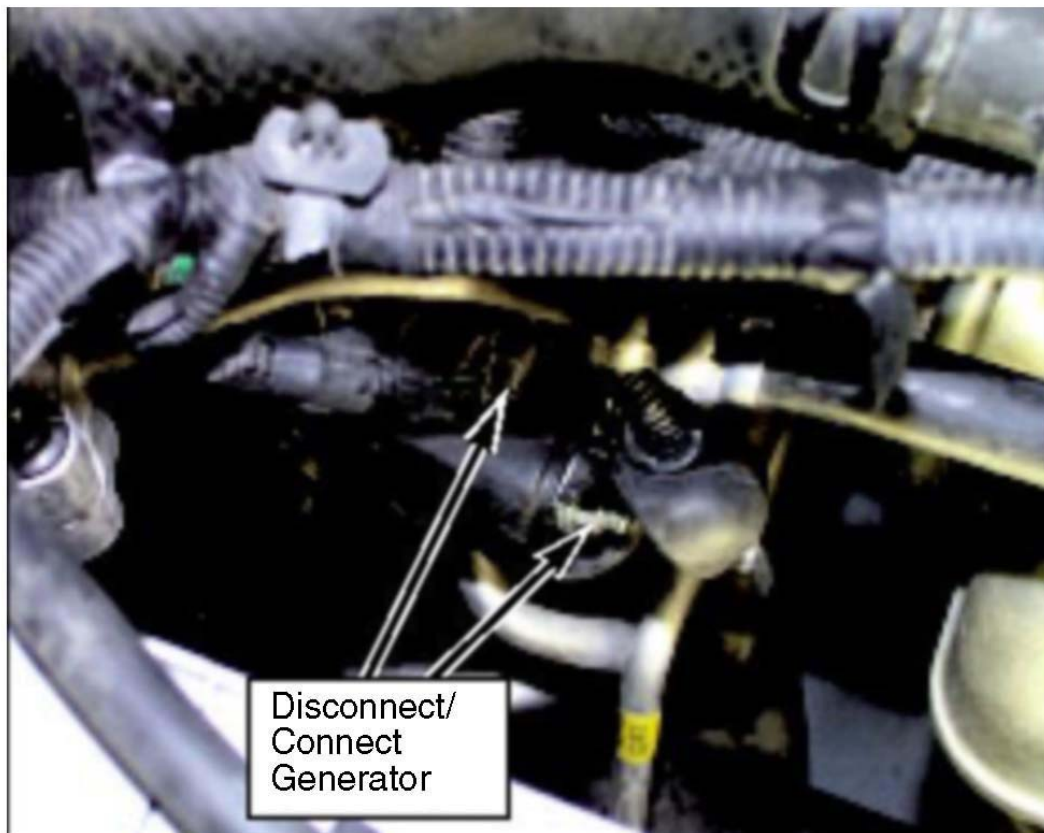
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Fig. 15: Loosening & Tightening Drive Belt Tensioner Lock Nut
Courtesy of KIA MOTORS AMERICA, INC.



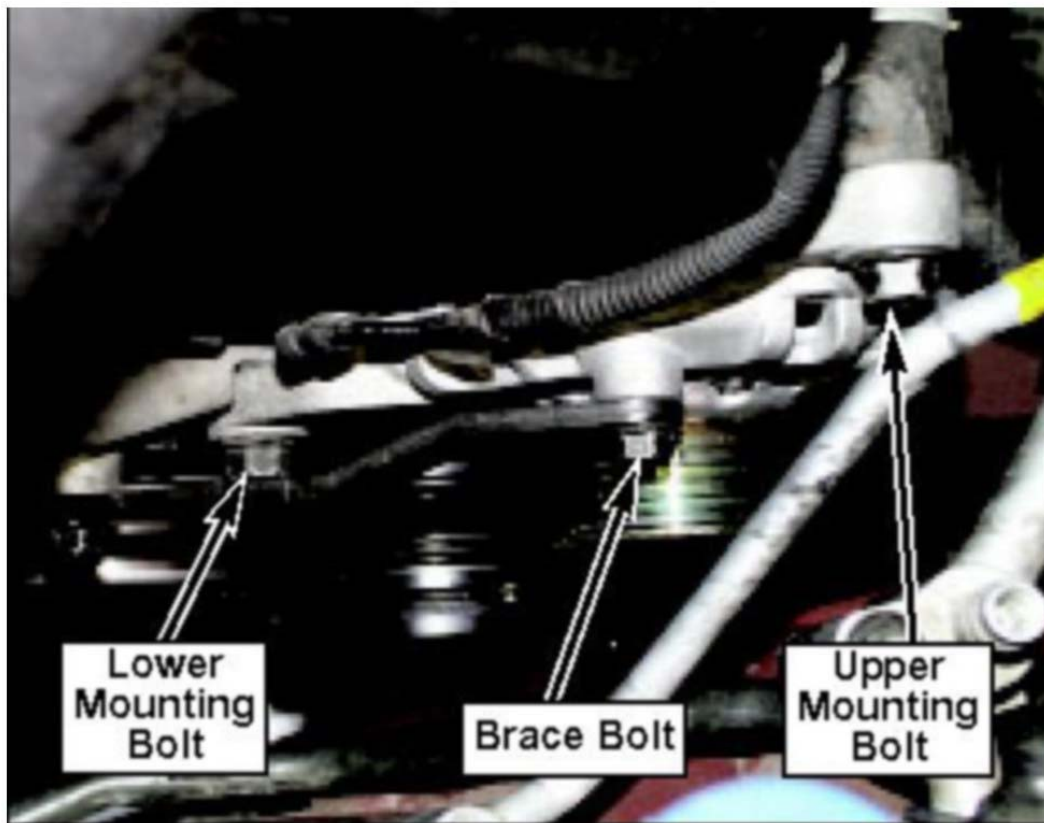
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Fig. 16: Loosening & Tightening Generator Belt Tensioner
Courtesy of KIA MOTORS AMERICA, INC.



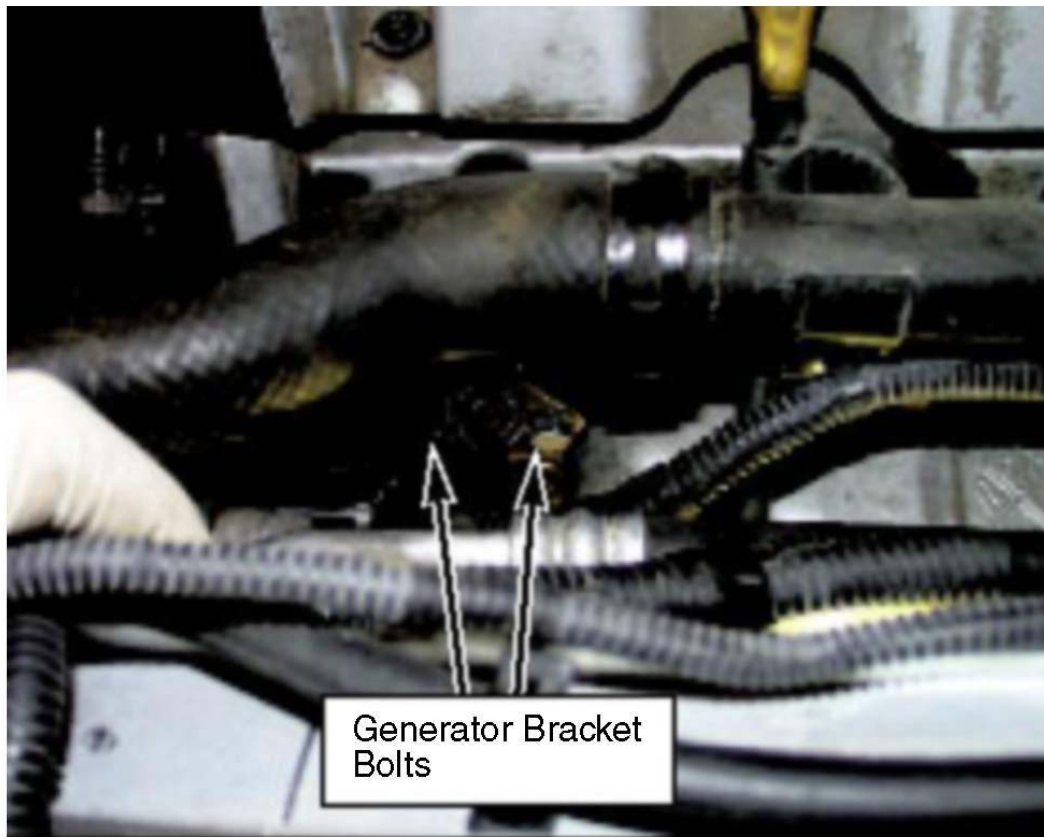
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Fig. 17: Disconnecting & Connecting Generator Connectors
Courtesy of KIA MOTORS AMERICA, INC.



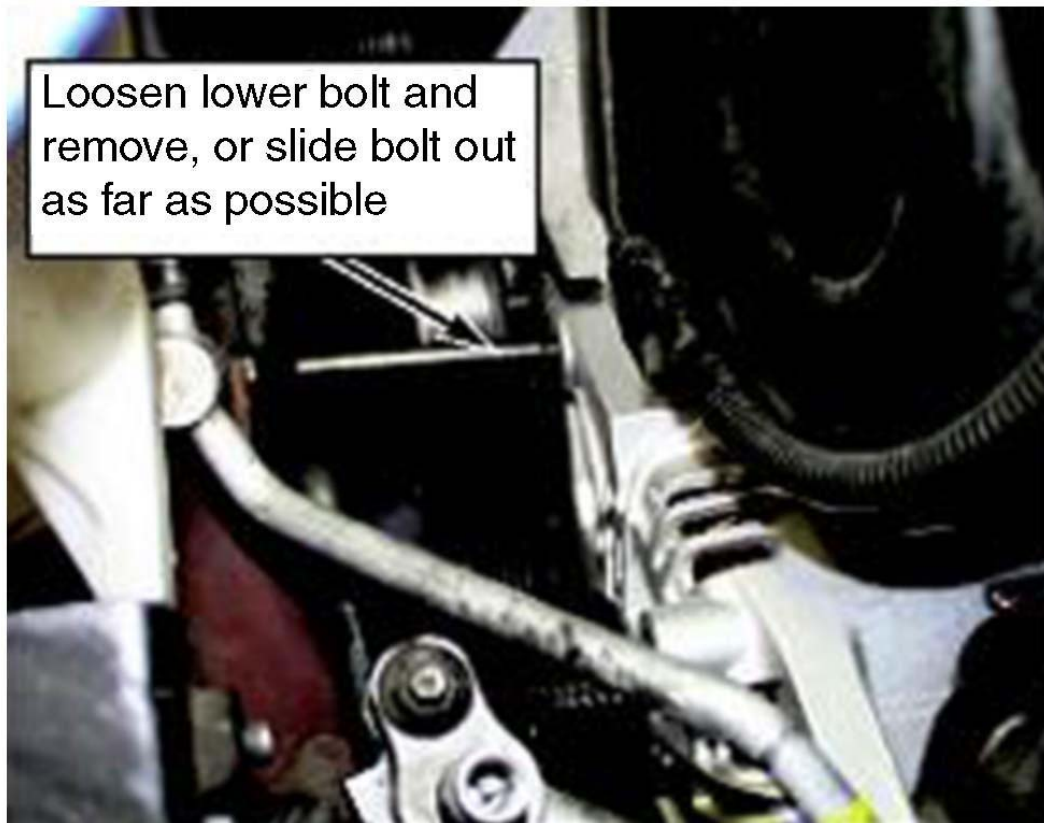
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Fig. 18: Loosening & Tightening Generator Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.



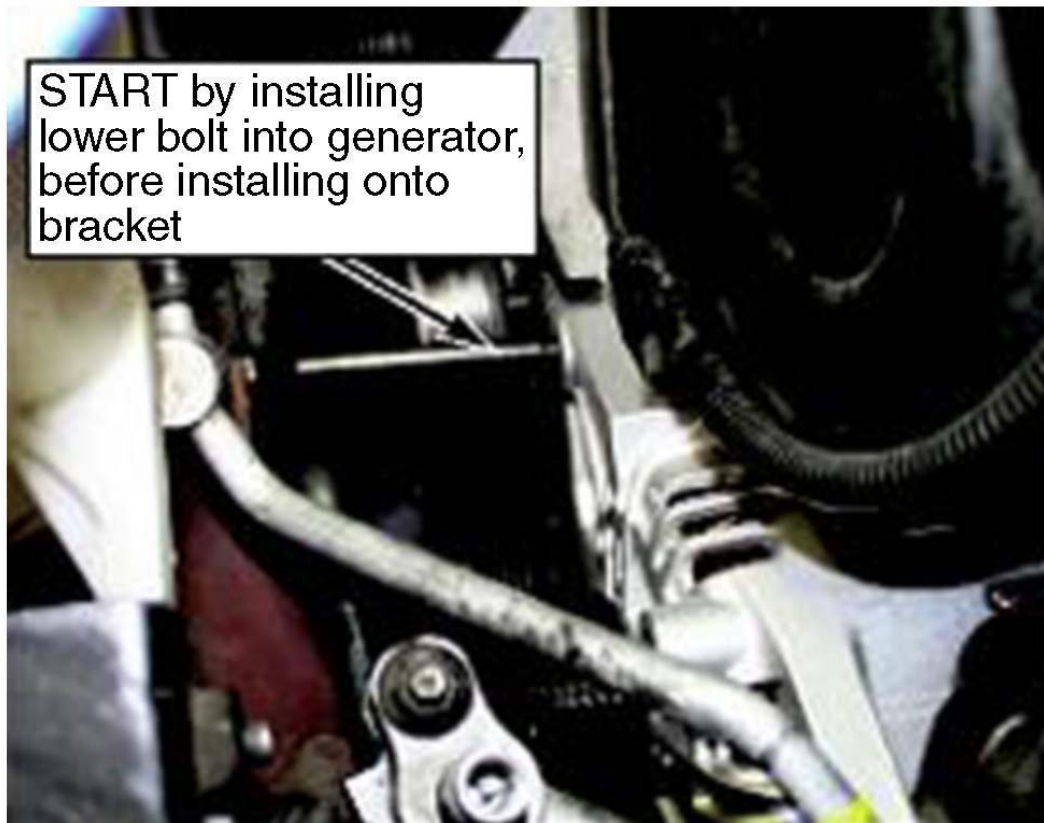
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Fig. 19: Removing & Installing Bracket Bolts
Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 20: Removing Lower Mounting Bolt
Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 21: Installing Lower Mounting Bolt
Courtesy of KIA MOTORS AMERICA, INC.

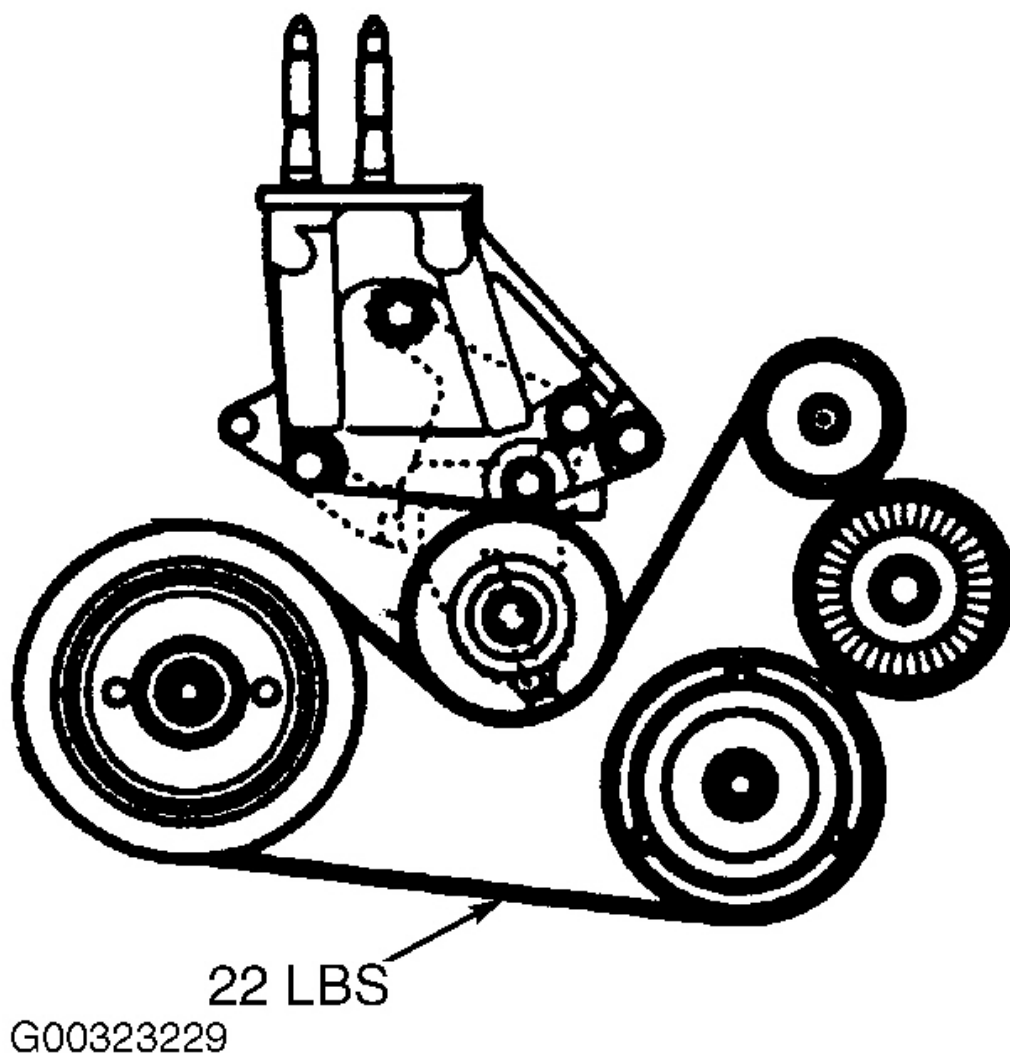


Fig. 22: Identifying Belt Routing & Measuring Drive Belt Deflection
Courtesy of KIA MOTORS AMERICA, INC.

OVERHAUL

GENERATOR

NOTE: When removing solder from rectifier leads, DO NOT use soldering iron for more than 5 seconds. Rectifier may be damaged by excessive heat.

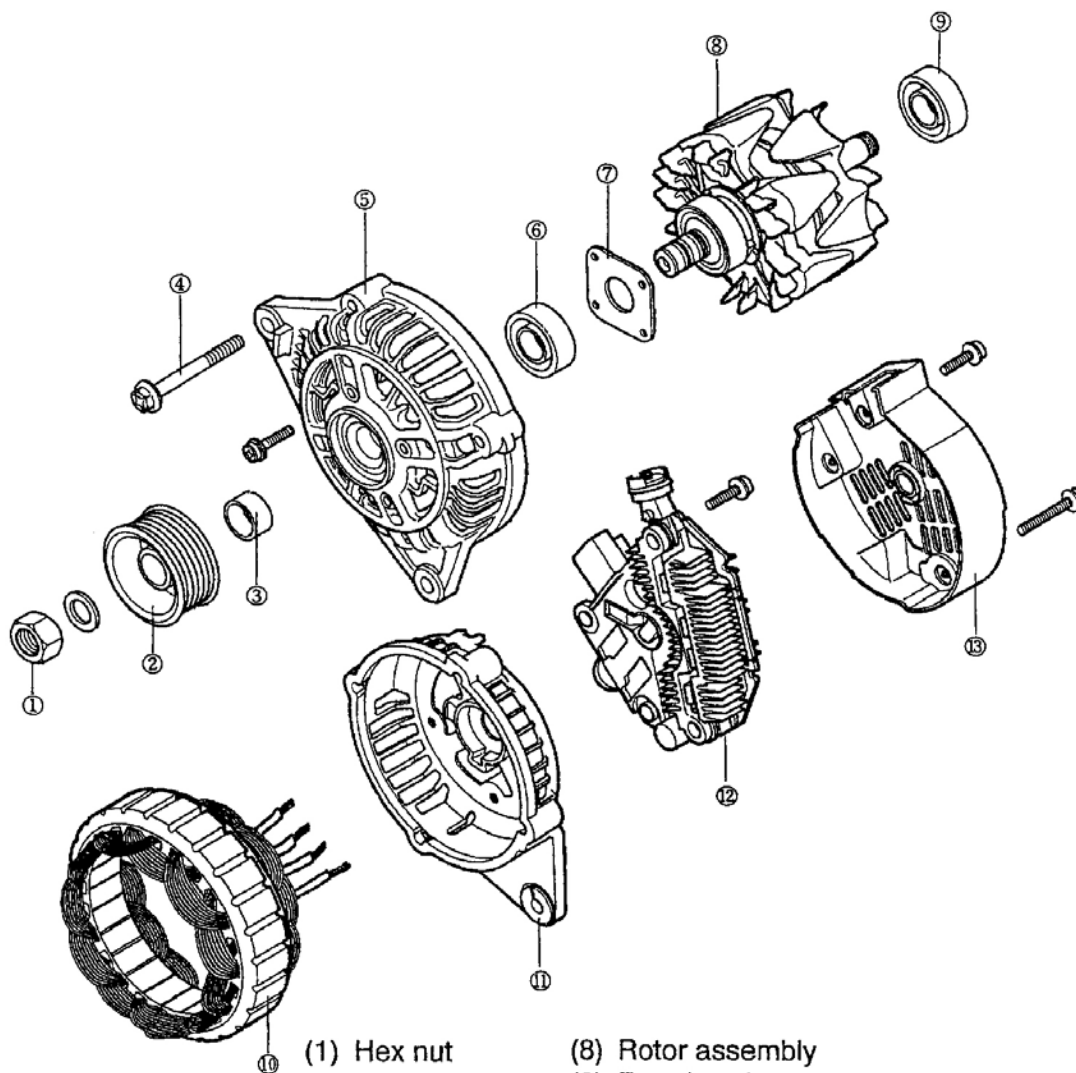
Disassembly

CAUTION: Do not insert screwdriver too far, as damage to stator coil may occur. Rear cover may be hard to remove due to a ring which is used to lock outer race of rear bearing. To assist in removal of rear cover, heat just the bearing box section with a 200-watt soldering iron. Do not use a heat gun, as damage may occur to diode assembly.

1. Remove the 4 through bolts. See **Fig. 23** . Insert a flat screwdriver between the front bracket and stator core, and pry downward. Remove rear cover.
2. Place rotor into a vise with pulley side up and loosen lock nut. Disassemble pulley nut spring washer, pulley and spacer. Remove front bracket and 2 seals. Remove rotor from vise.
3. Remove screws holding rectifier, brush holder and the nut from the "B" terminal. Separate rear bracket and stator.
4. Detach slinger from the brush holder. Before the stator is removed, unsolder the 3 stator leads to the main diodes on the rectifier.
5. When separating the rectifier from the brush holder, unsolder the 2 plates soldered to the rectifier.

Assembly

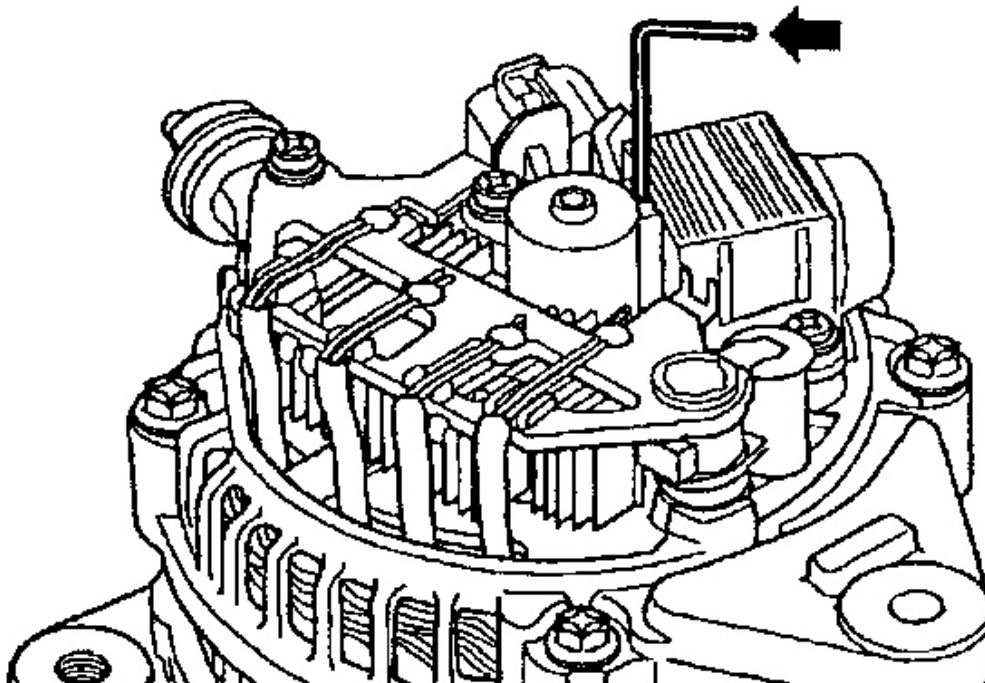
1. When connecting brush, solder pigtail so that wear limit line of brush projects .079-.118" (2-3 mm) out of brush holder. Before assembly, hold brushes in brush holder. Pass a .079" (2 mm) wire 1.6-2.0" (40-50 mm) through hole located in rear bracket to secure brushes in position. Remove wire after assembly is completed. See **Fig. 24** .
2. Using a socket same size as bearing and a hand press or vise, carefully push in front bearing. When installing rear bearing, ensure groove on bearing rim is on slip ring side. To complete assembly, reverse disassembly procedure. Tighten all bolts and nuts to specification. See **TORQUE SPECIFICATIONS** .



- | | |
|-------------------|----------------------|
| (1) Hex nut | (8) Rotor assembly |
| (2) Pulley | (9) Rear bearing |
| (3) Spacer | (10) Stator assembly |
| (4) Screw (4EA) | (11) Rear bracket |
| (5) Front bracket | (12) Rectifier |
| (6) Front bearing | (13) Cover |
| (7) Retainer | |

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Fig. 23: Exploded View Of Generator
Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 24: Identifying Wire Insertion
 Courtesy of KIA MOTORS AMERICA, INC.

SPECIFICATIONS

GENERATOR SPECIFICATIONS

| Application | Specification |
|--------------------------|---------------------|
| Type | A/C, Rectifying |
| Rated Output | 13.5 Volts/120 Amps |
| Voltage Regulator | Electronic Built-In |
| Regulator Setting Volts | 14.1-14.7 |
| Temperature Compensation | 7-13 mV/ °C |

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

| | |
|--|--|
| | |
|--|--|

| Applications | Ft. Lbs. (N.m) |
|-----------------------|-----------------|
| Pivot Bolt | 28-38 (38-51) |
| Pulley Lock Nut | 44-72 (59-98) |
| Tensioner Bolt | 14-19 (19-26) |
| INCH Lbs. (N.m) | |
| Generator Body Screws | 26-57 (2.9-6.4) |
| Generator Terminal | 89-106 (10-12) |
| Rectifier Screws | 18-48 (2.0-5.4) |

WIRING DIAGRAMS

For wiring diagram, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in ELECTRICAL.