

2002 ELECTRICAL

Charging - RAV4

CHARGING SYSTEM

ON-VEHICLE INSPECTION

CAUTION:

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Do not perform tests with a high voltage insulation resistance tester.
- Never disconnect the battery while the engine is running.

1. CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

Maintenance-Free Battery:

If under the lower level, replace the battery (or add distilled water if possible) and check the charging system.

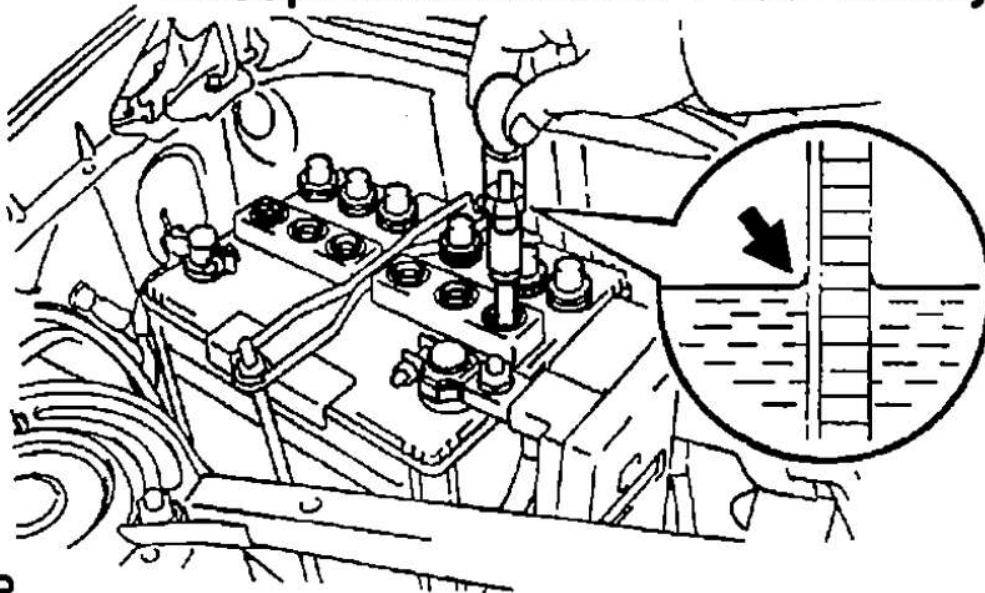
Except Maintenance-Free Battery:

If under the lower level, add distilled water.

2. Except Maintenance-Free Battery:

CHECK BATTERY SPECIFIC GRAVITY

Except Maintenance-Free Battery

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Fig. 1: Checking Battery Specific Gravity
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard specific gravity: 1.25 - 1.29 at 20°C (68°F)

If the specific gravity is less than specification, charge the battery.

3. Maintenance-Free Battery:

CHECK BATTERY VOLTAGE

- a. After having driven the vehicle, if 20 minutes have not passed after having stopped the engine, turn the ignition switch on and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

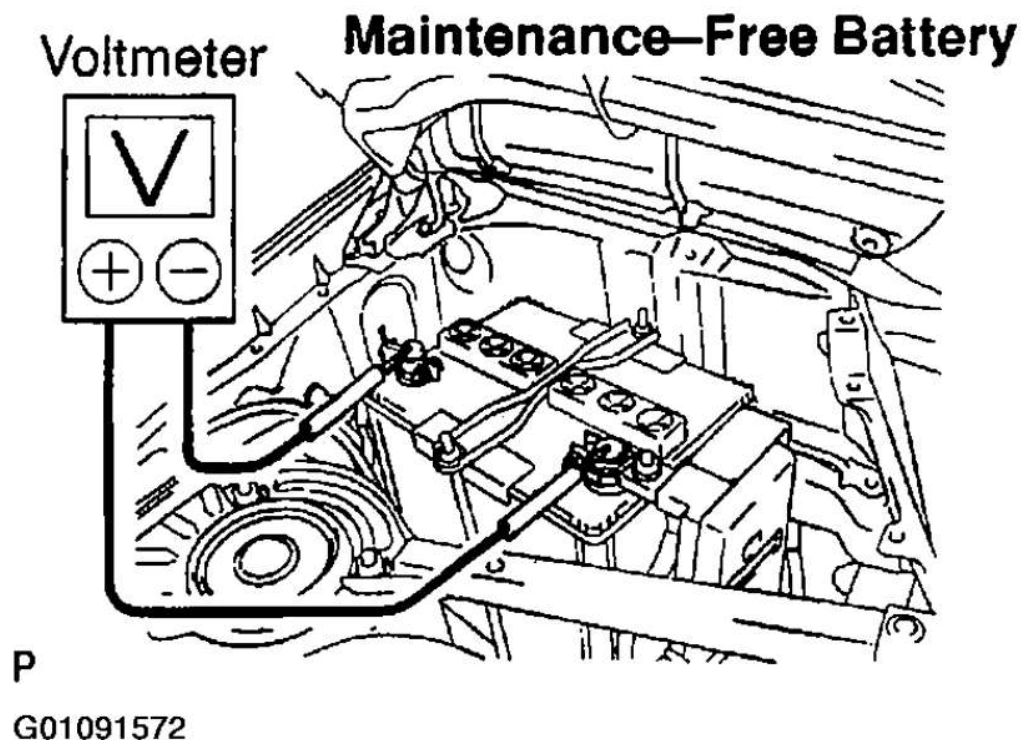


Fig. 2: Checking Battery Voltage

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Turn the ignition switch off and turn off the electrical systems.
- c. Measure the battery voltage between the negative (-) and positive (+) terminals of the battery.

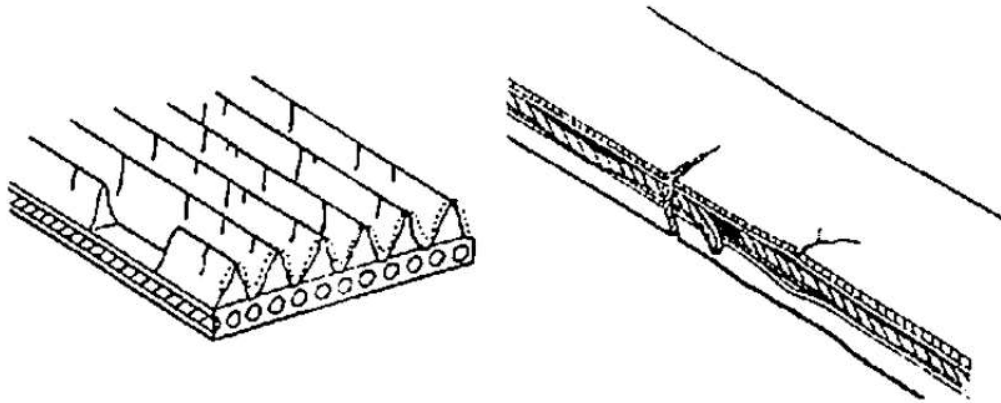
Standard voltage: 12.5 - 12.9 V at 20°C (68°F)

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

4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

- a. Check that the battery terminals are not loose or corroded.
- b. Check the H-fuses, M-fuses and fuses for continuity.

5. INSPECT DRIVE BELT



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Fig. 3: Inspecting Drive Belt

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Visually check the belt for excessive wear, frayed cords etc.

If any defect has been found, replace the drive belt.

NOTE:

- Cracks on the rib side of a belt are considered acceptable.

If the belt has chunks missing from the ribs, it should be replaced.

- Hook SST on the hexagonal portion of the drive belt tensioner bracket, compress the drive belt tension by turning the drive belt tensioner bracket clockwise and, take 3 seconds or more for 1 stroke.

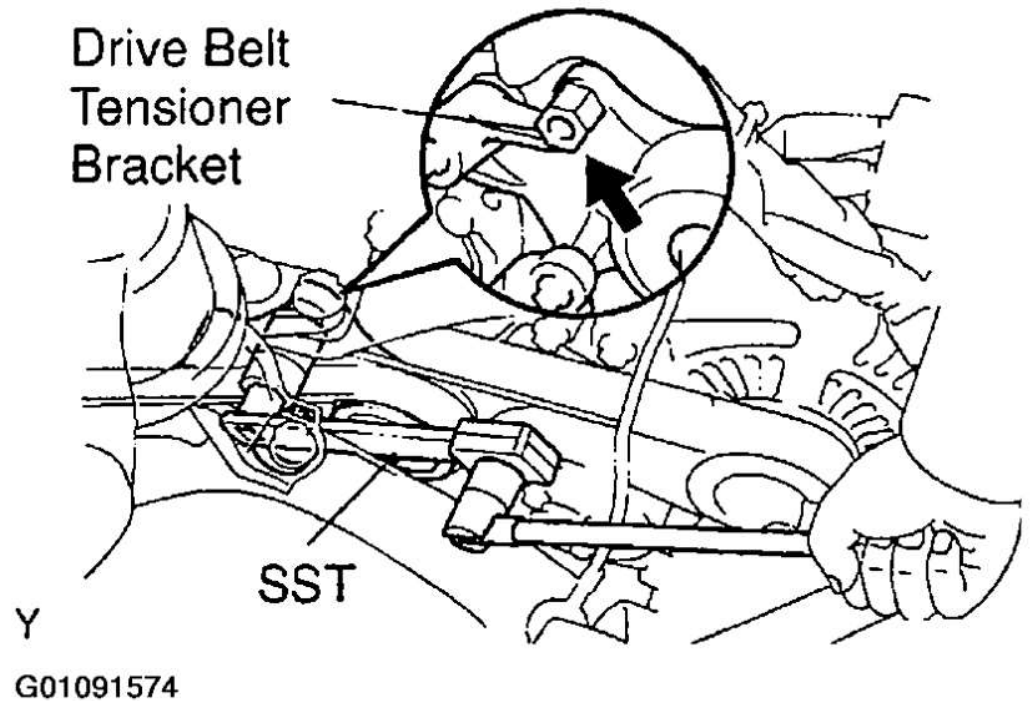
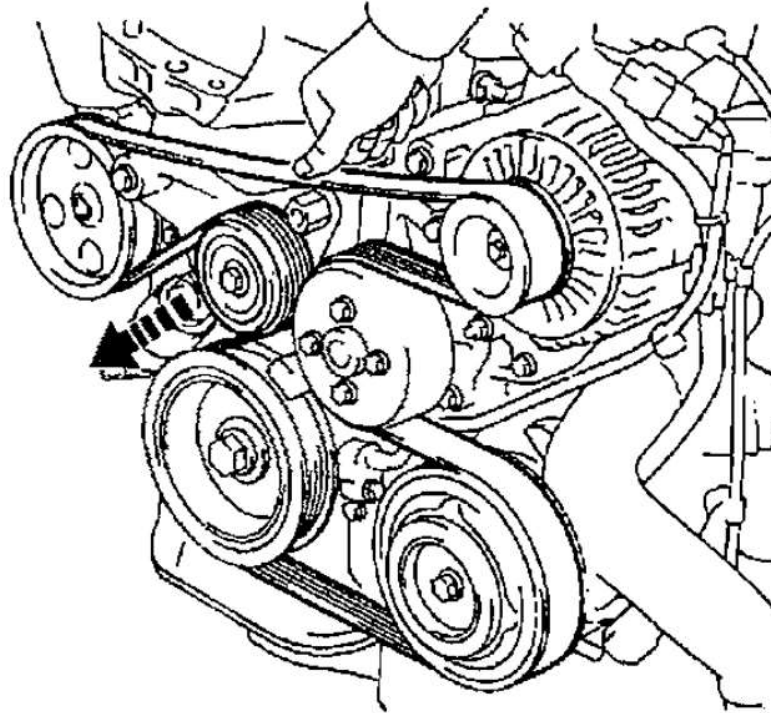


Fig. 4: Identifying Drive Belt Tensioner Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- The drive belt tension can be released by turning the belt tensioner.

SST 09249-63010

- b. Check the belt tensioner operation.



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Fig. 5: Checking Belt Tensioner Operation

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Check that belt tensioner moves downward when the drive belt is pressed down at the points indicated in the illustration with approx. 98 N (10kgf, 22.0 lbf) of force.
- Check the alignment of the belt tensioner pulley to make sure the drive belt will not slip off the pulley.

If necessary, replace the belt tensioner.

NOTE:

- After installing a belt, check that it fits properly in the ribbed groove
- Check with your hand to confirm that the belt has not slipped out groove on the bottom of the pulley.

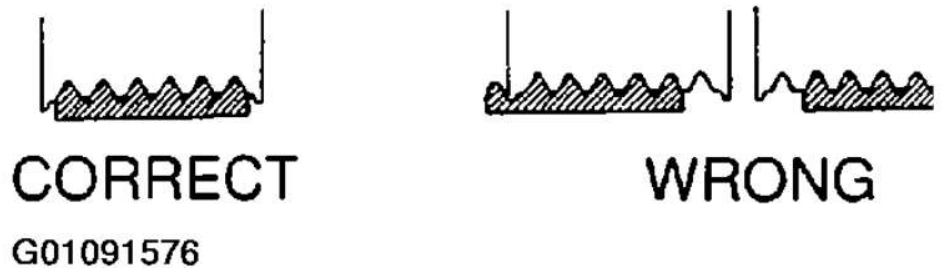


Fig. 6: Checking Drive Belt For Proper Fit
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- After installing a new belt, run the engine for about 5 minutes and the belt tension existing.

6. VISUALLY CHECK GENERATOR WIRING AND LISTEN FOR ABNORMAL NOISES

- Check that the wiring is in good condition.
- Check that there is no abnormal noise from the generator while the engine is running.

7. INSPECT CHARGE WARNING LIGHT CIRCUIT

- Turn the ignition switch on. Check that the charge warning light comes on.
- Start the engine. Check that the light goes off.

If the light does not operate as specified, troubleshoot the charge warning light circuit.

8. INSPECT CHARGING CIRCUIT WITHOUT LOAD

NOTE: If a battery/generator tester is available, connect the tester to the charging circuit as per manufacturer's instructions.

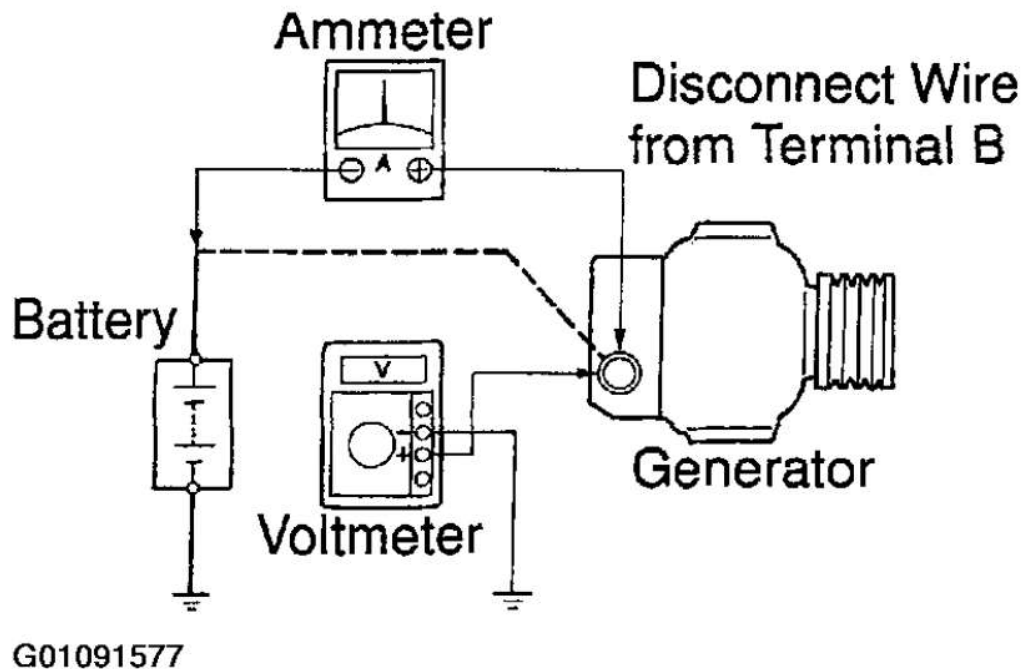


Fig. 7: Inspecting Charging Circuit

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. If a tester is not available, connect a voltmeter to the charging circuit as follows:
 1. Connect to the wire from terminal B of the alternator and connect it to the negative (-) lead of the ammeter.
 2. Connect the positive (+) lead of the ammeter to terminal B of the alternator.
 3. Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
 4. Ground the negative (-) lead of the voltmeter.
- b. Check the charging circuit as follows:

With the engine running from idle to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage: 10 A or less

Standard voltage: 13.2 - 14.8 V

If the voltmeter reading is more than standard voltage, replace the voltage regulator.

9. INSPECT CHARGING CIRCUIT WITH LOAD

- a. With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at HI.

- b. Check the reading on the ammeter.

Standard amperage: 30 A or more

If the ammeter reading is less than standard amperage, repair the generator.

NOTE: **If the battery is fully charged, the indication will sometimes be less than standard amperage.**

GENERATOR

COMPONENTS

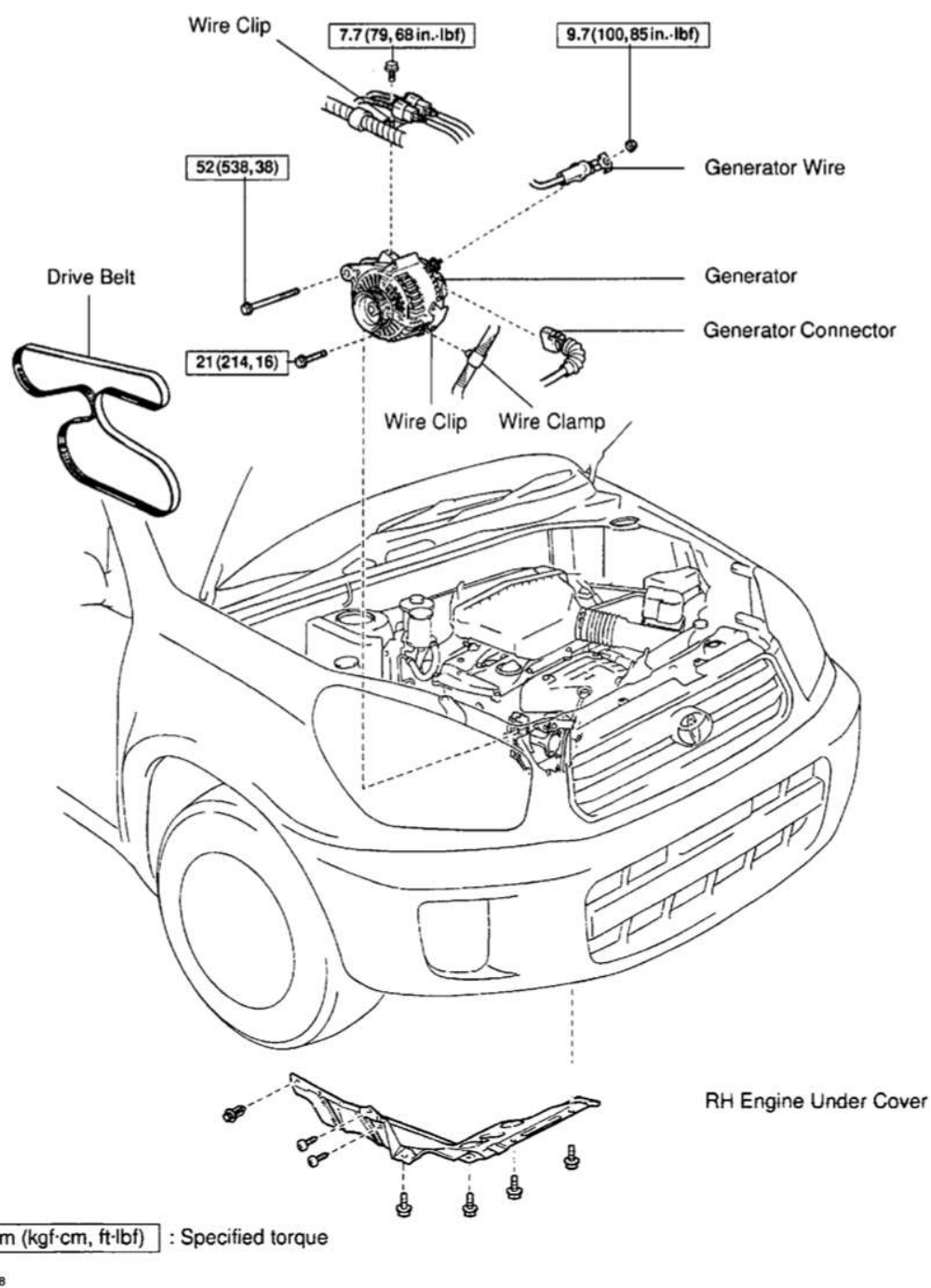
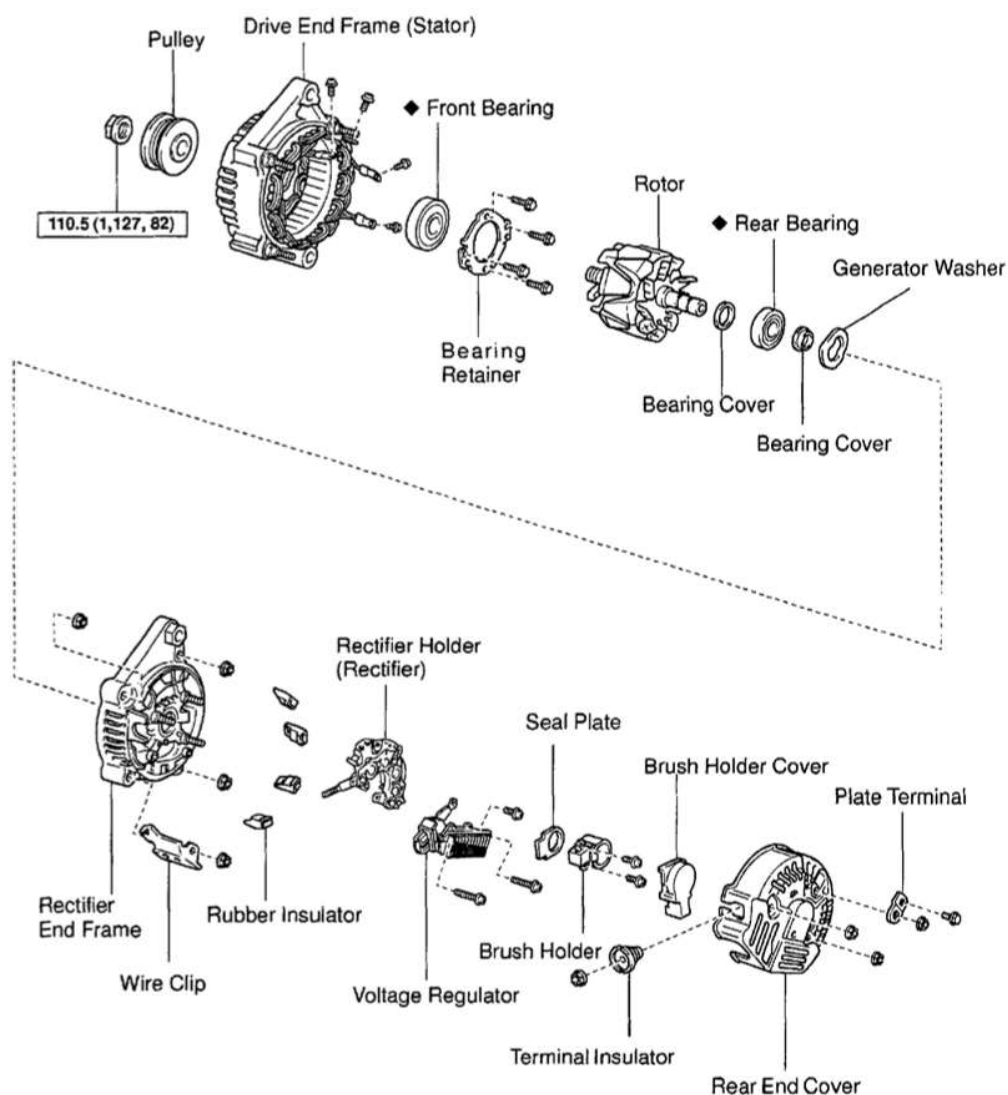


Fig. 8: Identifying Generator Components (1 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



$\boxed{\text{N} \cdot \text{m} (\text{kgf} \cdot \text{cm}, \text{ft} \cdot \text{lbf})}$: Specified torque
 ◆ Non-reusable part

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Fig. 9: Identifying Generator Components (2 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE DRIVE BELT

Hook SST on the hexagonal portion of the drive belt tensioner bracket, compress the drive belt tension by turning the drive belt tensioner bracket clockwise, and remove the drive belt.

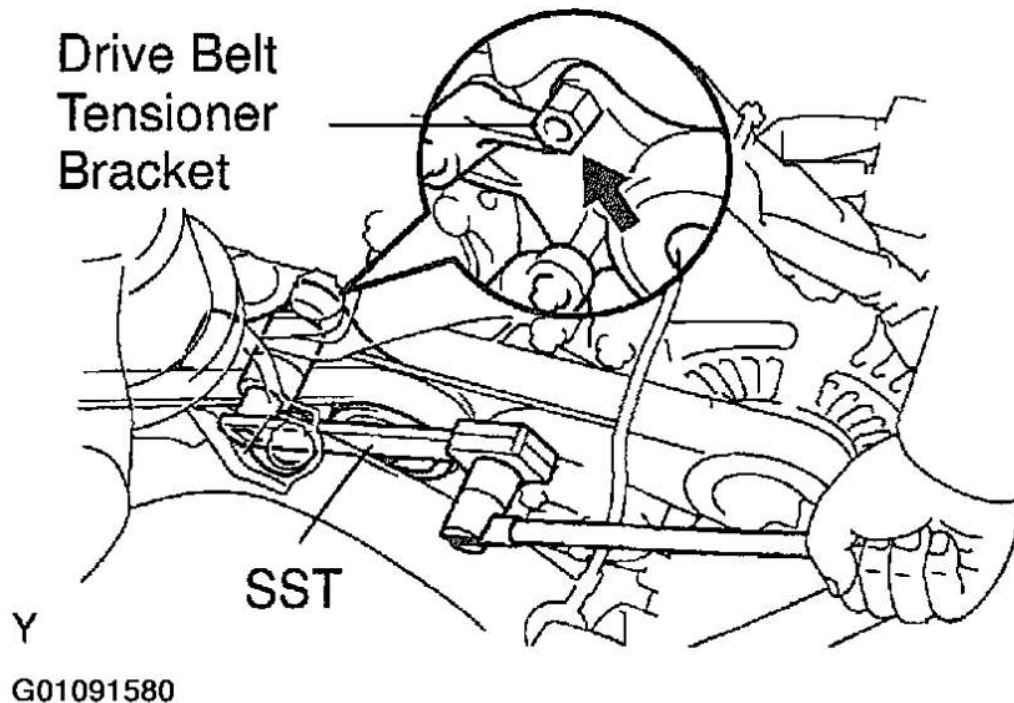


Fig. 10: Identifying Drive Belt Tensioner Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09249-63010

NOTE: Compress the drive belt tensioner by taking 3 seconds or more and remove the drive belt.

2. REMOVE GENERATOR

- Remove the bolt, and disconnect the wire clip on the wire connectors from the generator.
- Disconnect the wire clamp from the wire clip.
- Remove the cap and nut, and disconnect the generator wire.
- Disconnect the generator connector.

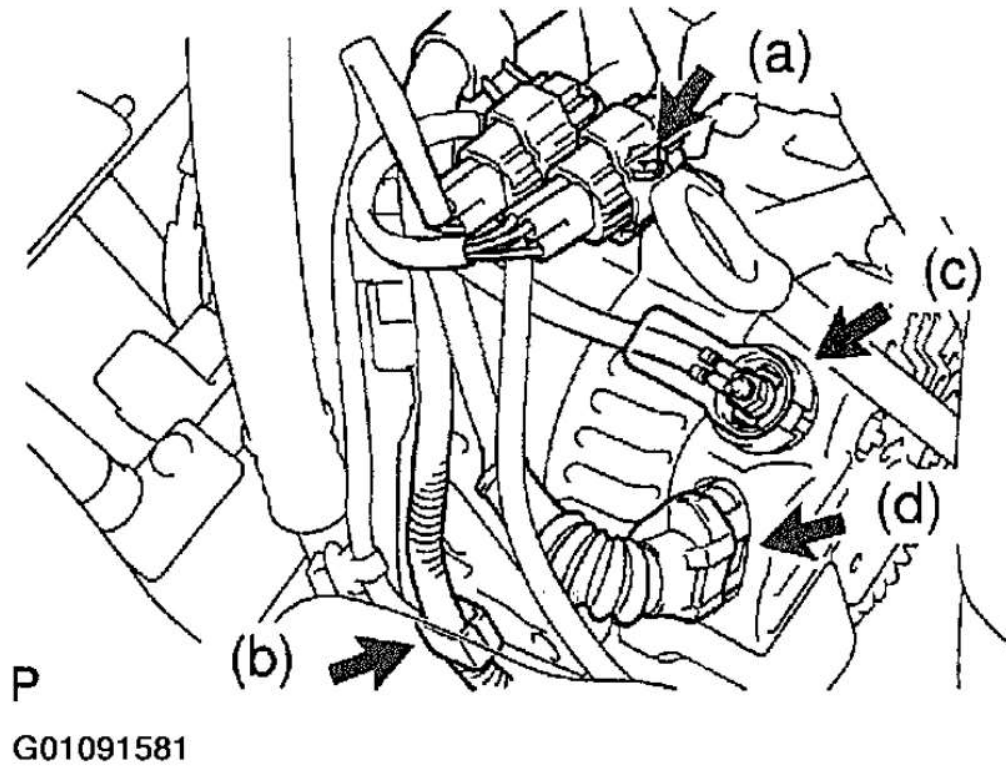


Fig. 11: Disconnecting Generator

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the 2 bolts and generator.

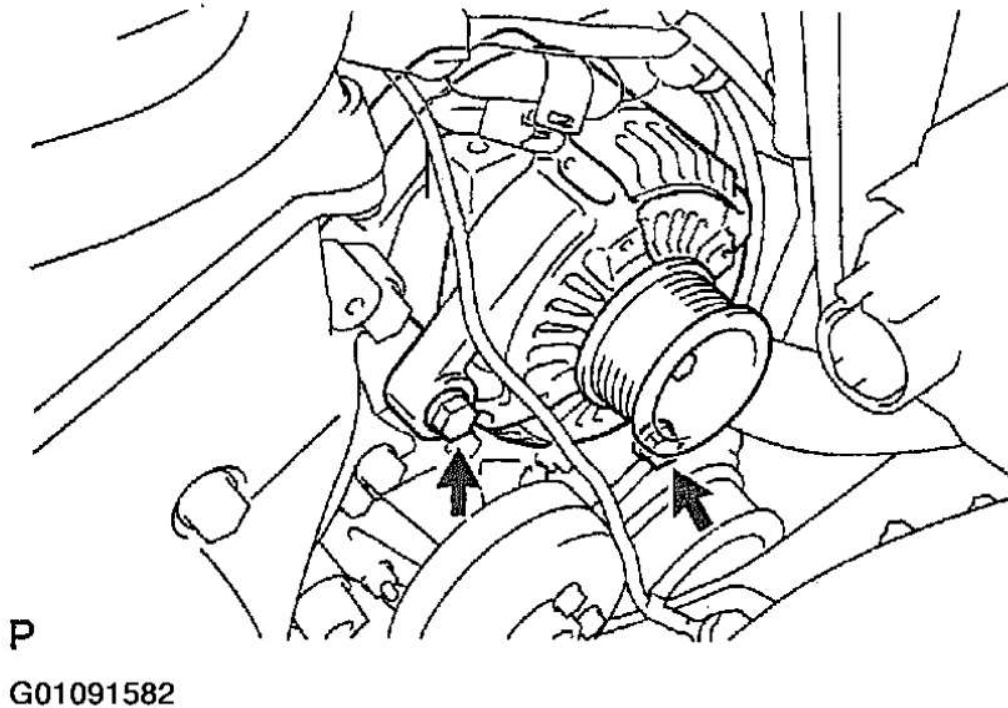
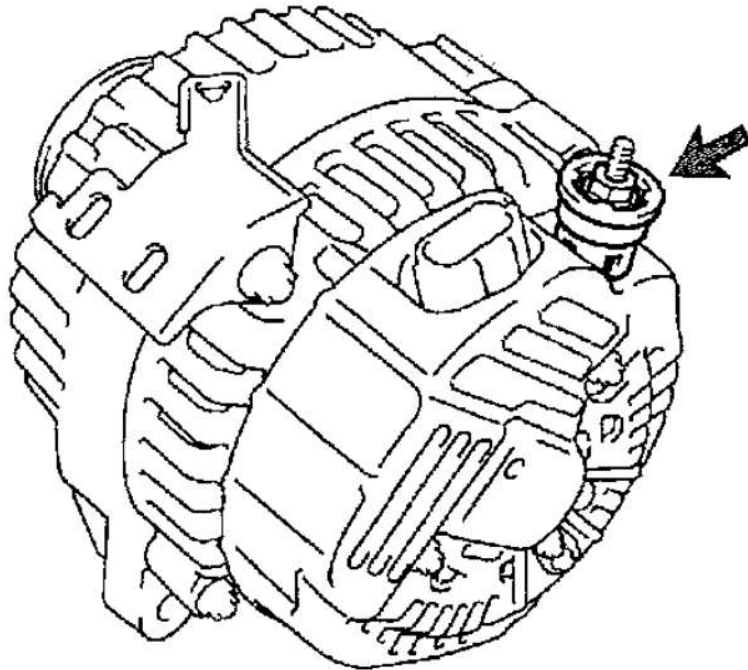


Fig. 12: Unbolting Generator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. REMOVE REAR END COVER

- a. Remove the nut and terminal insulator.



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Fig. 13: Removing Rear End Cover (1 Of 2)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt, 3 nuts, plate terminal, end cover and brush holder cover.

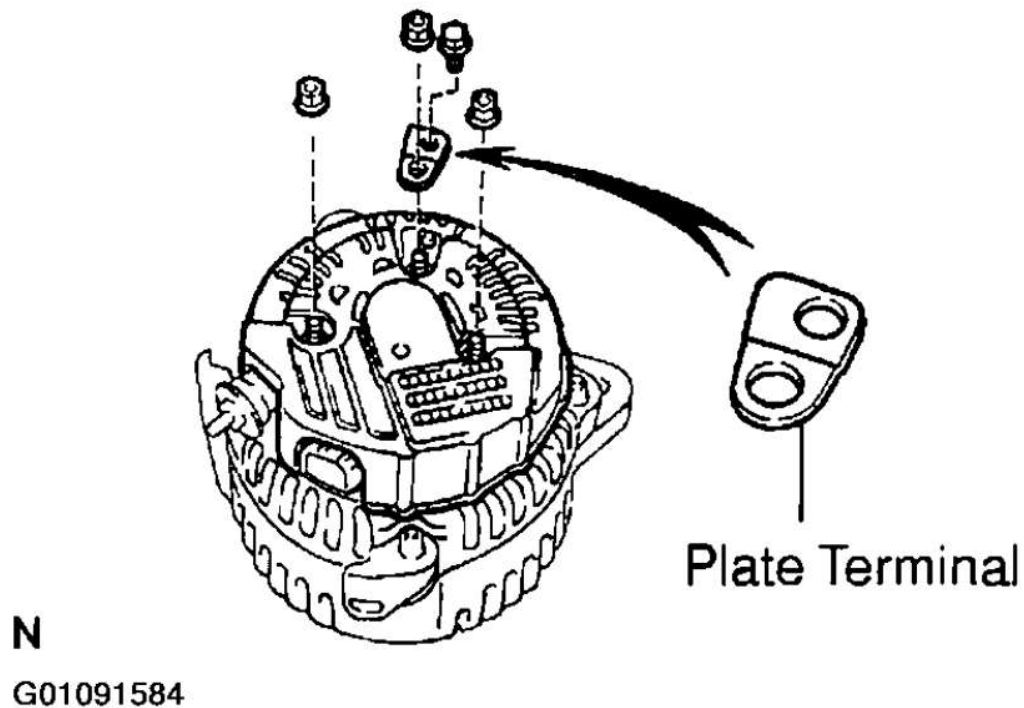
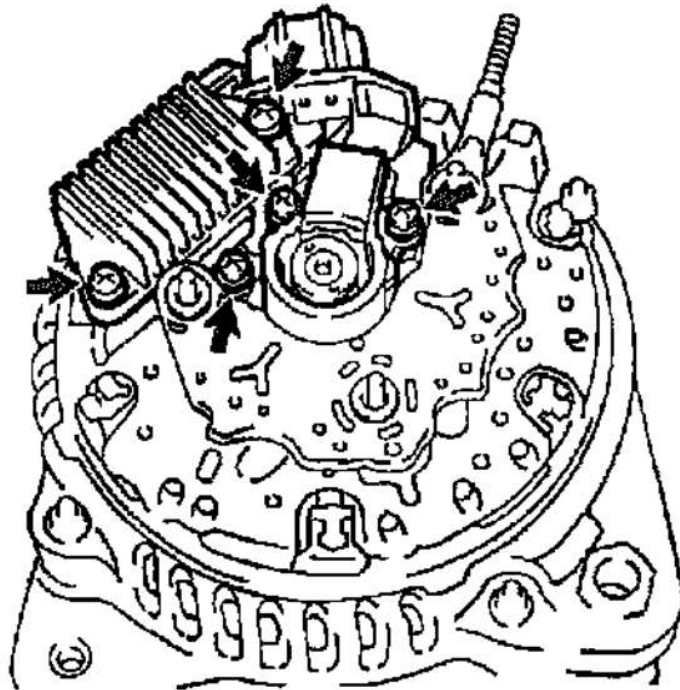


Fig. 14: Removing Rear End Cover (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE BRUSH HOLDER AND VOLTAGE REGULATOR

- a. Remove the 5 screws, brush holder and voltage regulator.
- b. Remove the seal plate from the rectifier end frame.



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Fig. 15: Removing Brush Holder & Voltage Regulator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. REMOVE RECTIFIER HOLDER

- a. Remove the 4 screws and rectifier holder.
- b. Remove the 4 rubber insulators.

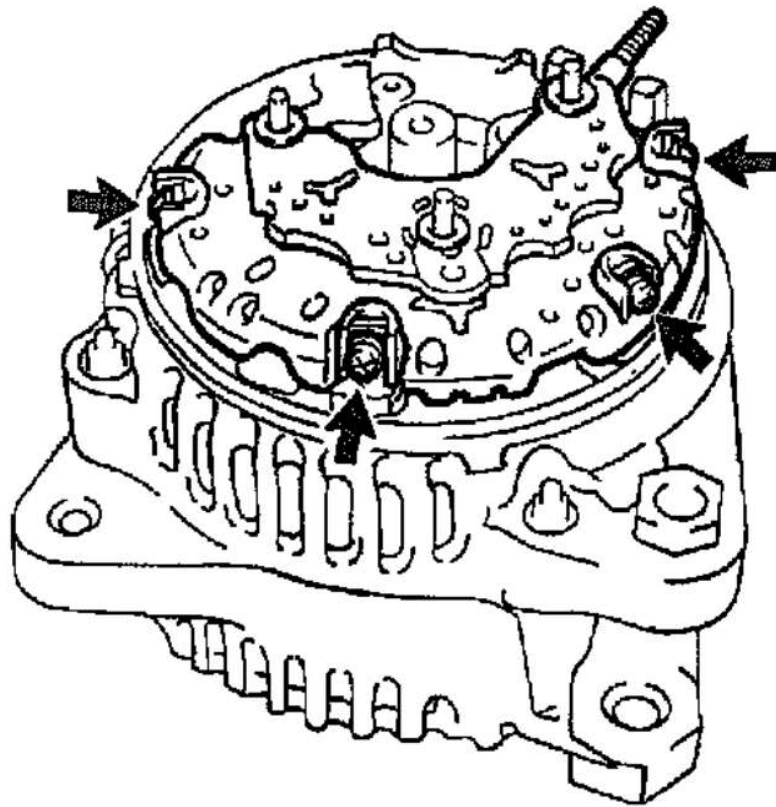
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Fig. 16: Removing Rectifier Holder

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE PULLEY

- a. Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820-63011
Torque: 39 N.m (400 kgf.cm, 29 ft.lbf)
- b. Check that SST (A) is secured to the rotor shaft.

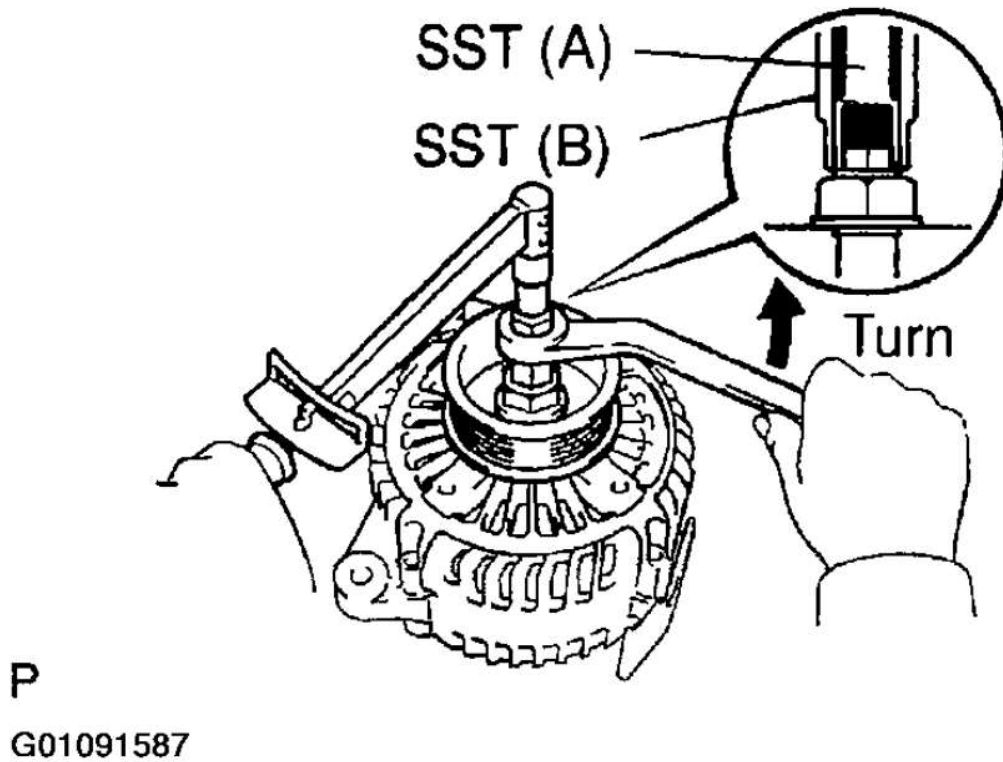
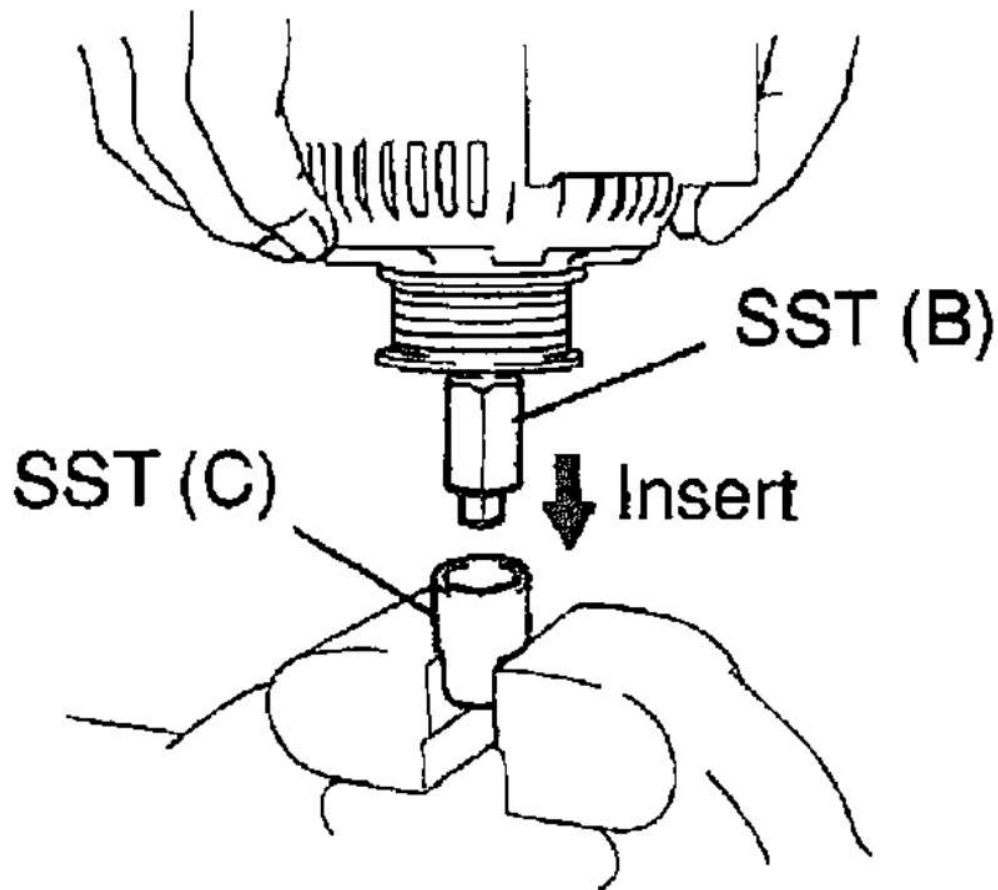


Fig. 17: Using SSTs To Remove Generator Pulley (1 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mount SST (C) in a vise.
- d. Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



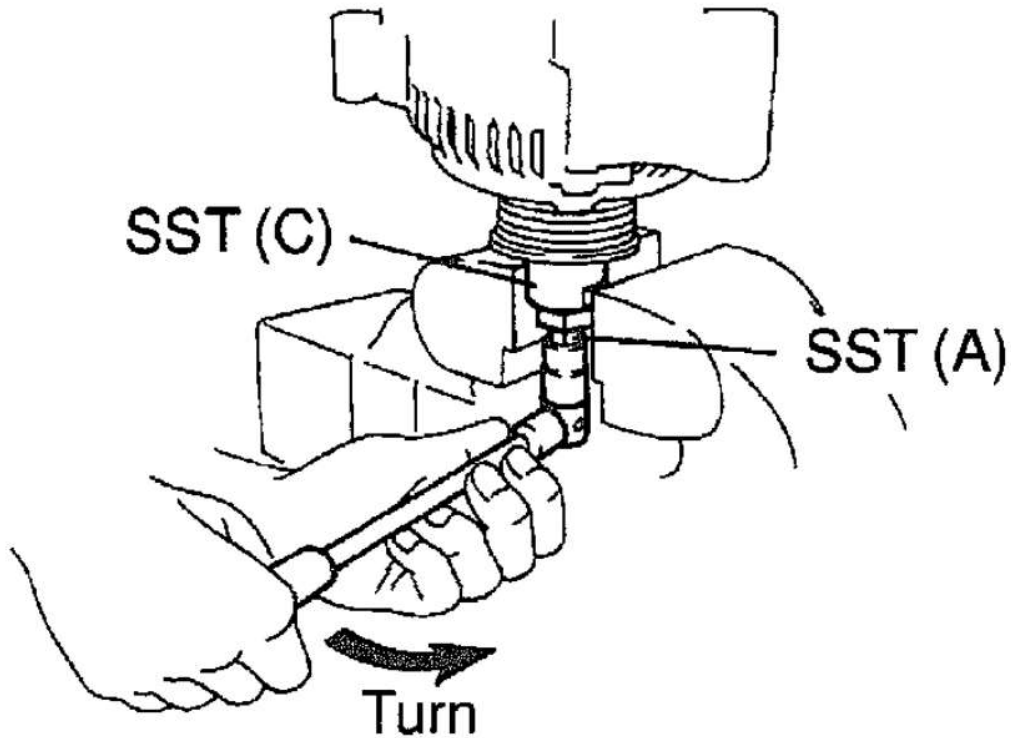
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Fig. 18: Using SSTs To Remove Generator Pulley (2 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

NOTE: To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.

- f. Remove the generator from SST (C).



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Fig. 19: Using SSTs To Remove Generator Pulley (3 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Turn SST (B), and remove SST (A and B).
- h. Remove the pulley nut and pulley.

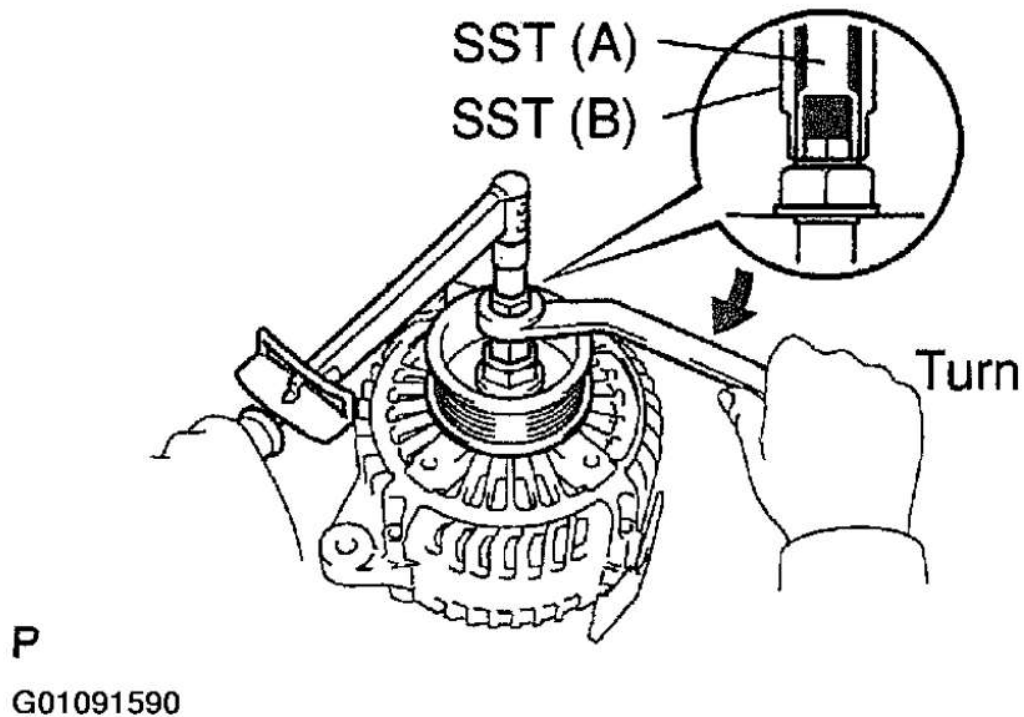


Fig. 20: Using SSTs To Remove Generator Pulley (4 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE RECTIFIER END FRAME

- a. Remove the 4 nuts and wire clip.

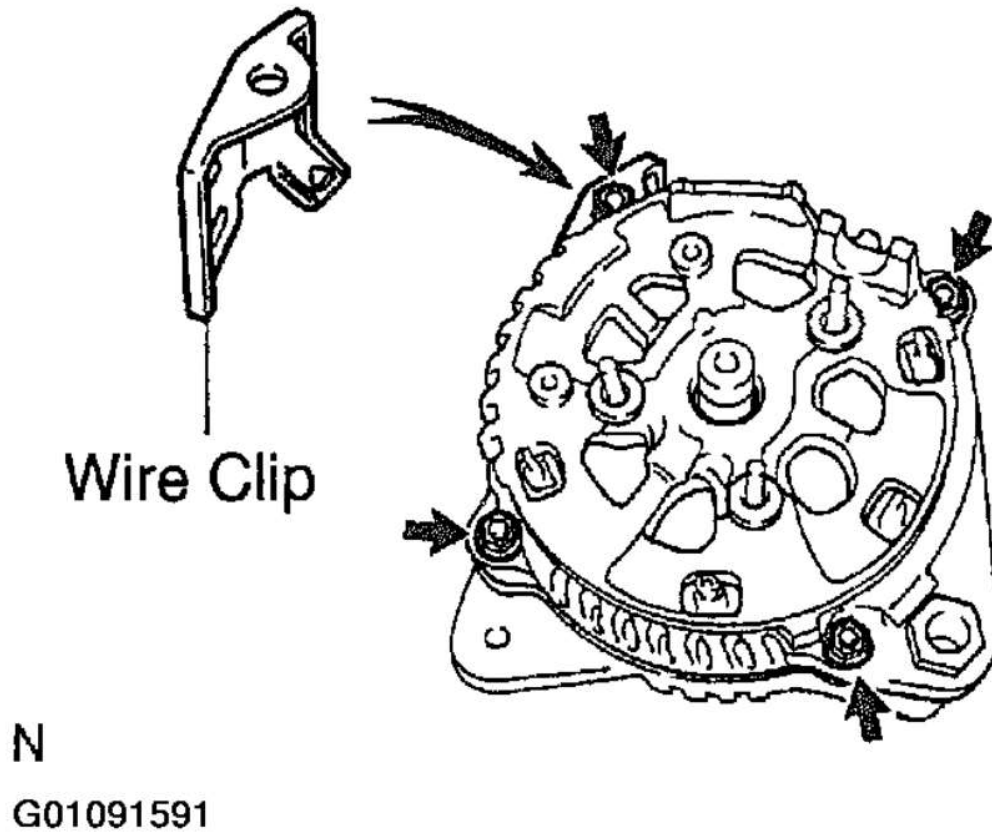


Fig. 21: Removing Rectifier End Frame
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, remove the rectifier end frame.

SST 09286-46011

- c. Remove the generator washer from the rotor

6. REMOVE ROTOR FROM DRIVE END FRAME

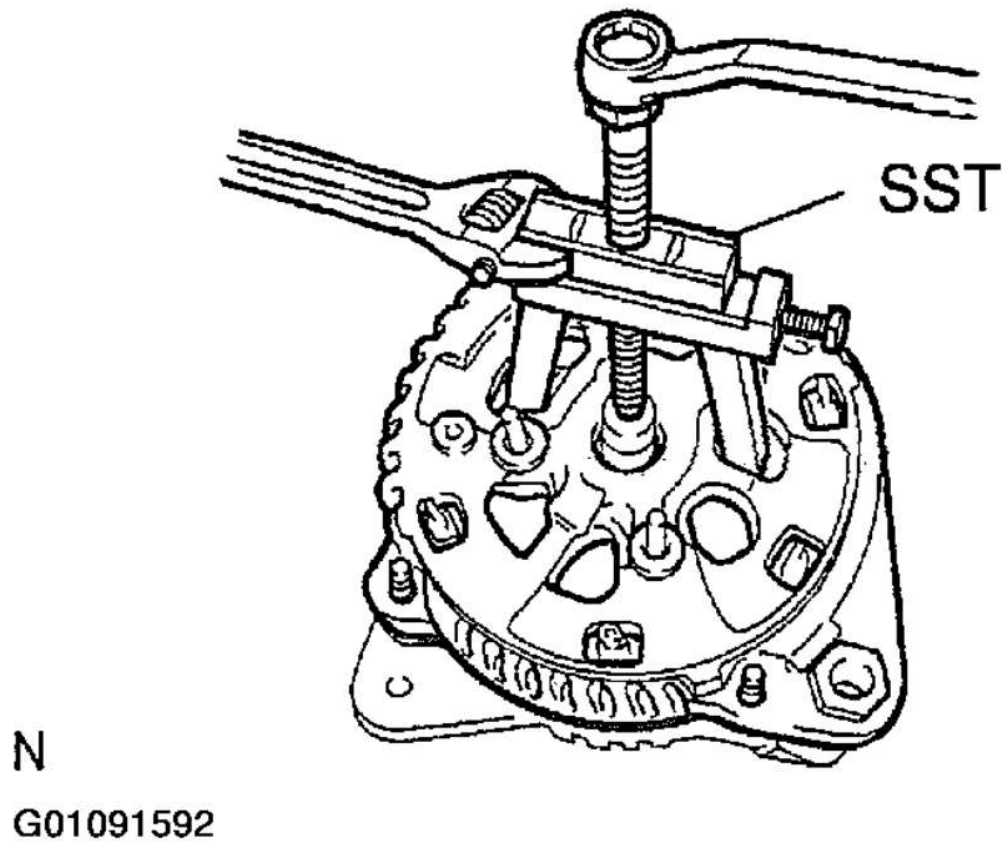


Fig. 22: Removing Rotor From Drive End Frame
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT VOLTAGE REGULATOR

- Using an ohmmeter, check the continuity between terminals F and B.

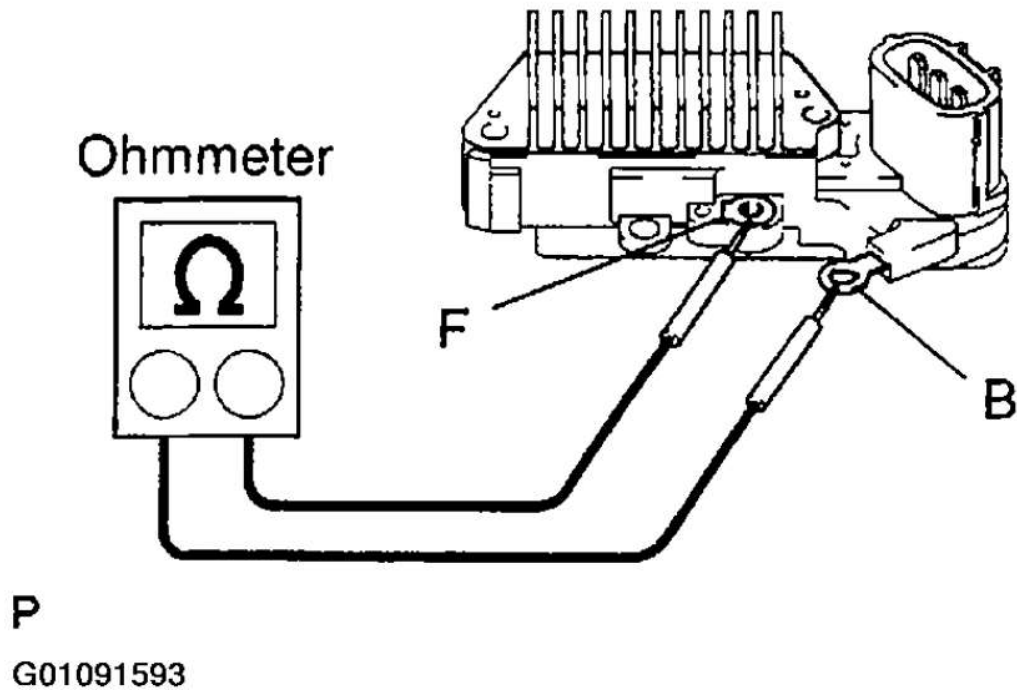


Fig. 23: Using Ohmmeter To Inspect Voltage Regulator (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard: When the positive and negative poles between terminals F and B are exchanged, there is continuity in one direction, but not the other.

If the continuity is not as specified, replace the voltage regulator.

- b. Using an ohmmeter, check the continuity between terminals F and E.

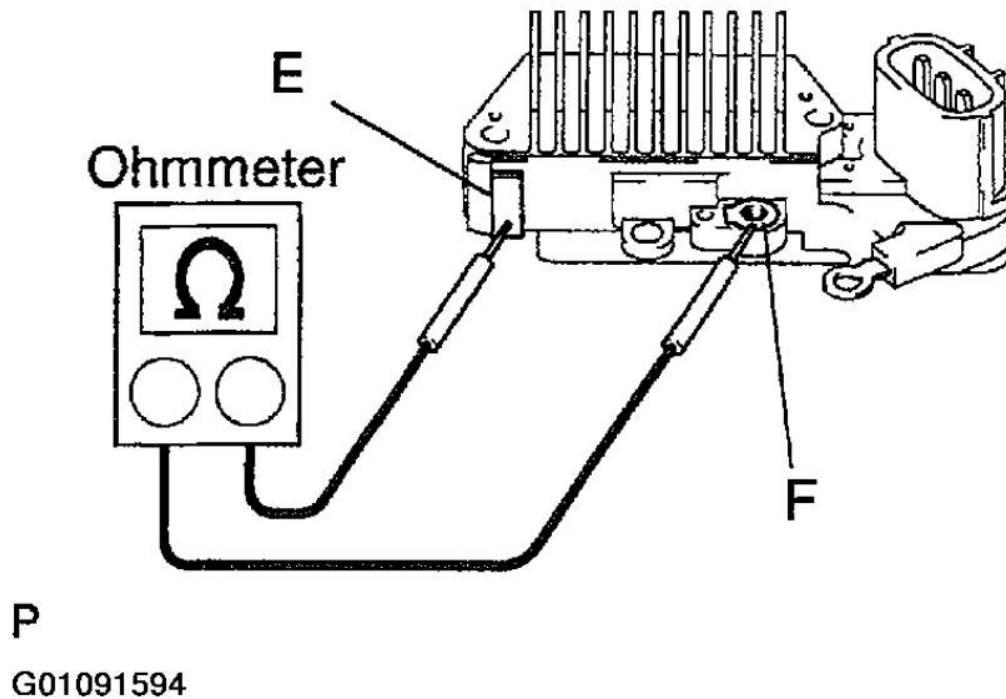


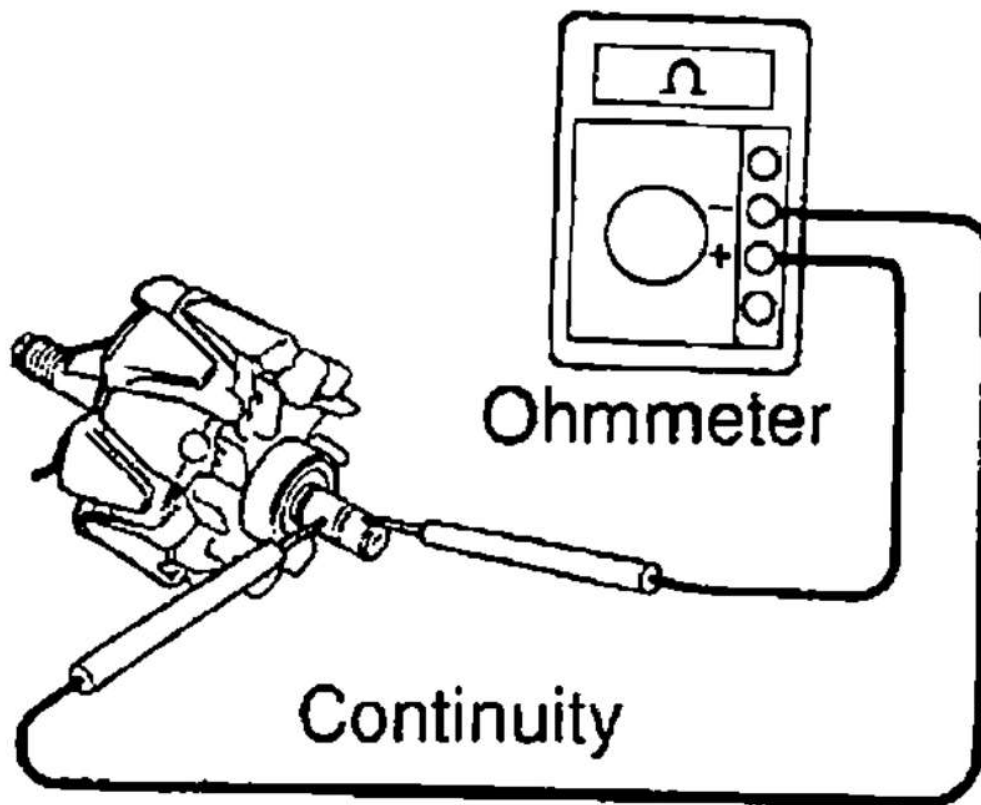
Fig. 24: Using Ohmmeter To Inspect Voltage Regulator (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard: When the positive and negative poles between terminals F and E are exchanged, there is continuity in one direction, but not the other.

If the continuity is not as specified, replace the voltage regulator.

2. INSPECT ROTOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the slip rings.



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Fig. 25: Using Ohmmeter To Inspect Rotor (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard resistance: 2.1 - 2.5 Ohms at 20°C (68°F)

If there is no continuity, replace the rotor.

3. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and rotor.

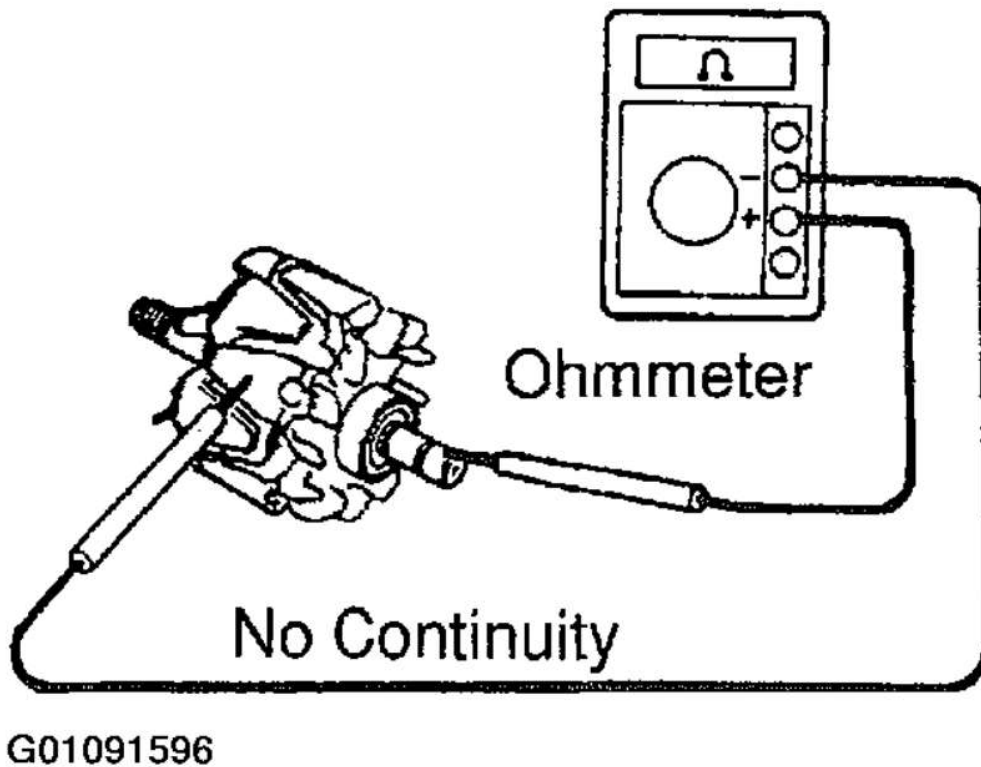


Fig. 26: Using Ohmmeter To Inspect Rotor (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

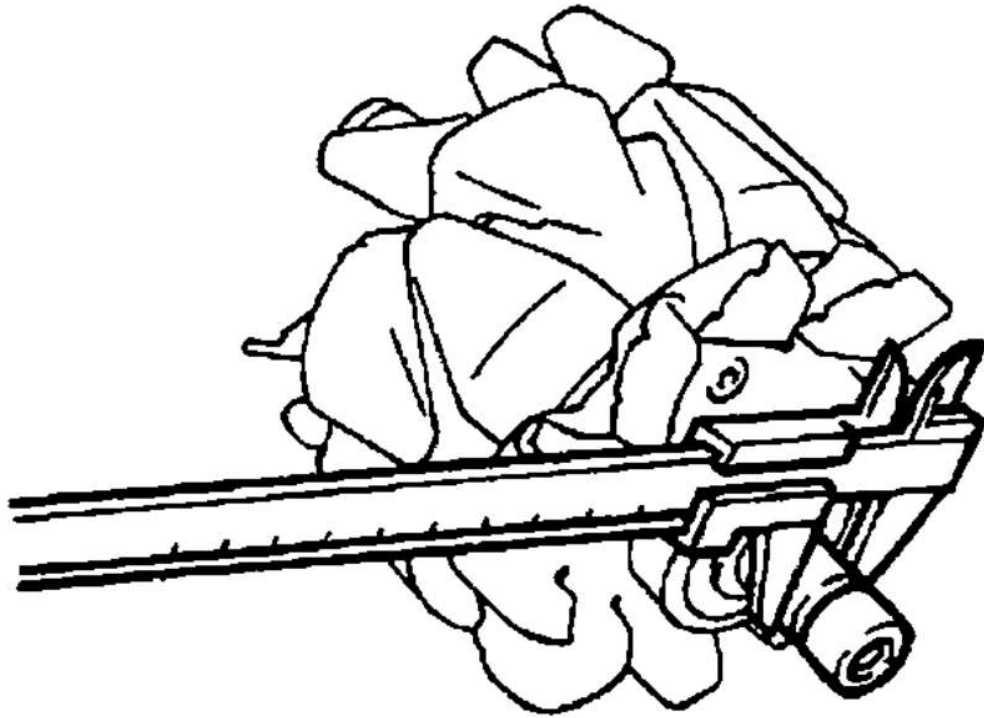
If there is continuity, replace the rotor.

4. INSPECT SLIP RINGS

- a. Check that the slip rings are not rough or scored.

If rough or scored, replace the rotor.

- b. Using vernier calipers, measure the slip ring diameter.



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Fig. 27: Measuring Slip Ring Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard diameter: 14.2 - 14.4 mm (0.559 - 0.567 in.)

Minimum diameter: 12.8 mm (0.504 in.)

If the diameter is less than minimum, replace the rotor.

5. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.

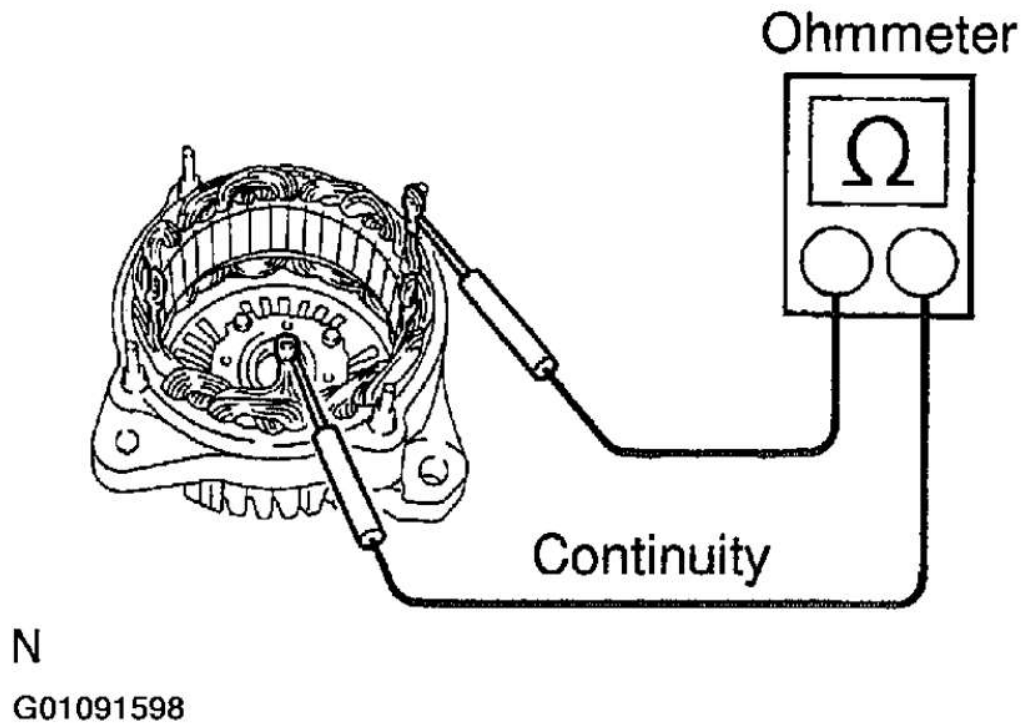


Fig. 28: Using Ohmmeter To Inspect Stator (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If there is no continuity, replace the drive end frame assembly

6. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil lead and drive end frame.

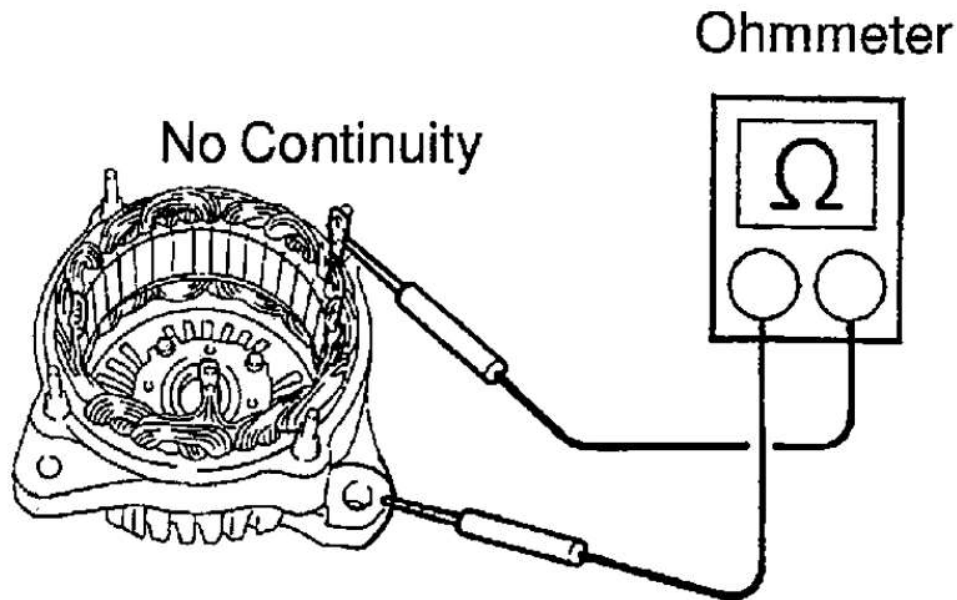
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Fig. 29: Using Ohmmeter To Inspect Stator (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If there is continuity, replace the drive end frame assembly

7. INSPECT EXPOSED BRUSH LENGTH

Using vernier calipers, measure the exposed brush length.

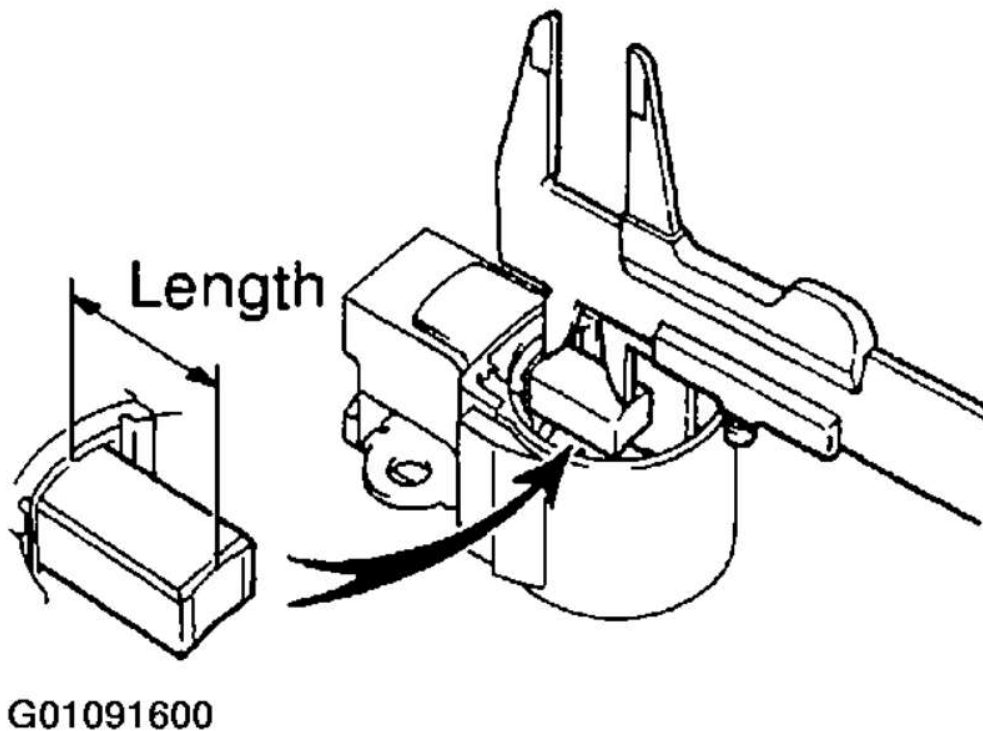


Fig. 30: Measuring Exposed Brush Length
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard exposed length: 9.5 - 11.5 mm (0.374 - 0.453 in.)

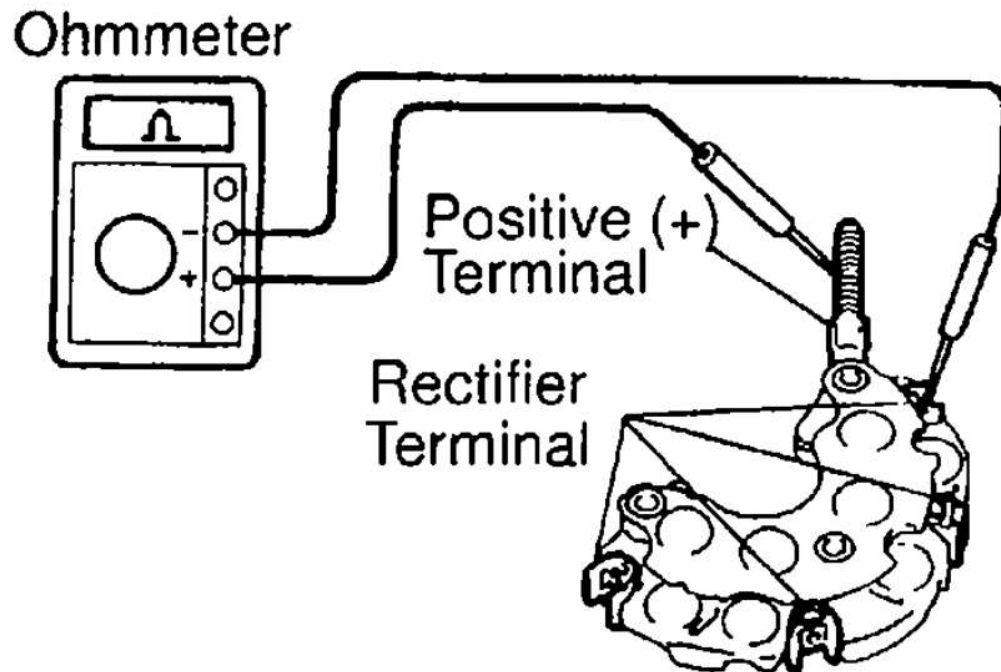
Minimum exposed length: 1.5 mm (0.059 in.)

If the exposed length is less than minimum, replace the brush holder assembly.

8. INSPECT RECTIFIERS (RECTIFIER HOLDER)

a. Check the positive (+) rectifier.

1. Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.



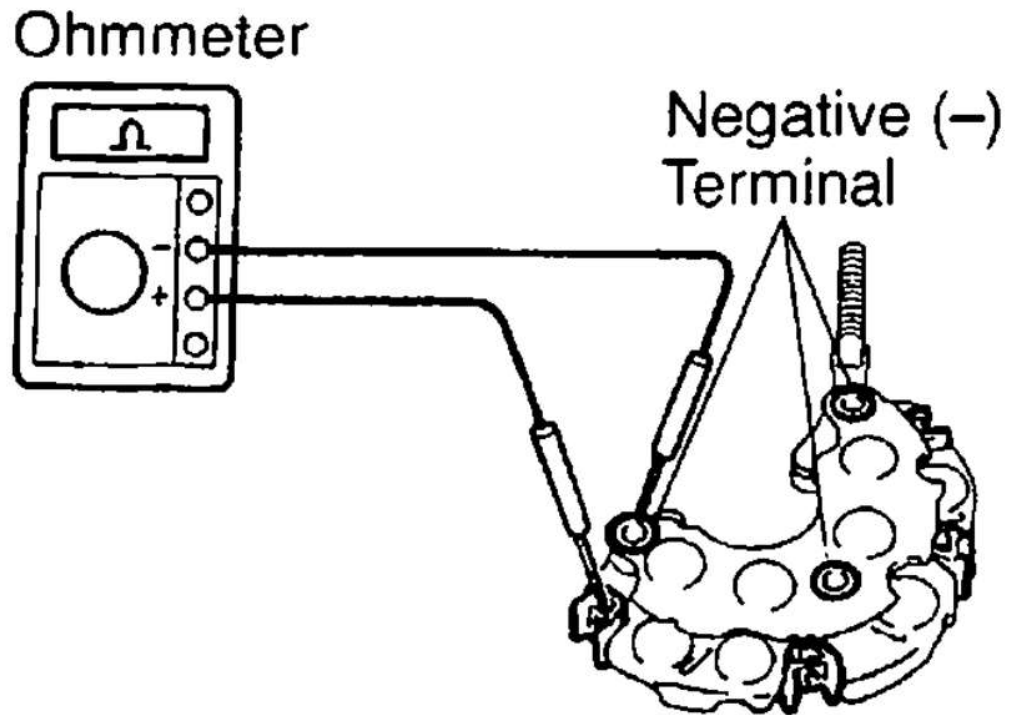
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Fig. 31: Using Ohmmeter To Inspect Rectifiers (1 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Reverse the polarity of the tester probes and repeat step (a).
3. Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.

- b. Check the negative (-) rectifier.
 1. Using an ohmmeter, connect one tester probe to each negative (-) terminal and the other to each rectifier terminal.



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Fig. 32: Using Ohmmeter To Inspect Rectifiers (2 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Reverse the polarity of the tester probes and repeat step (a).
3. Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.

9. INSPECT BEARINGS

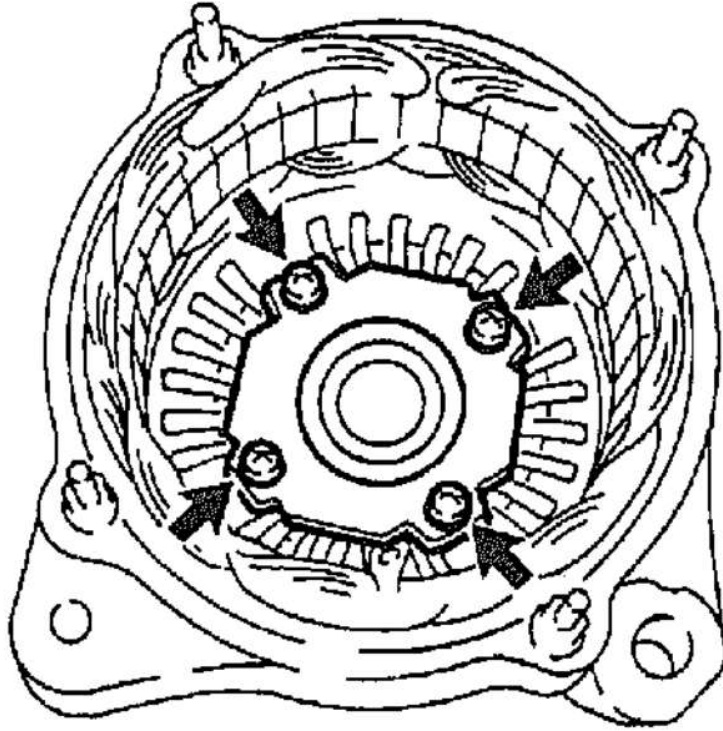
Check that the bearing is not rough or worn.

If necessary, replace the bearing (See **REPLACEMENT**).

REPLACEMENT

1. REPLACE FRONT BEARING

- a. Remove the 4 screws and bearing retainer.



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Fig. 33: Replacing Front Bearing

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a press, press out the bearing.

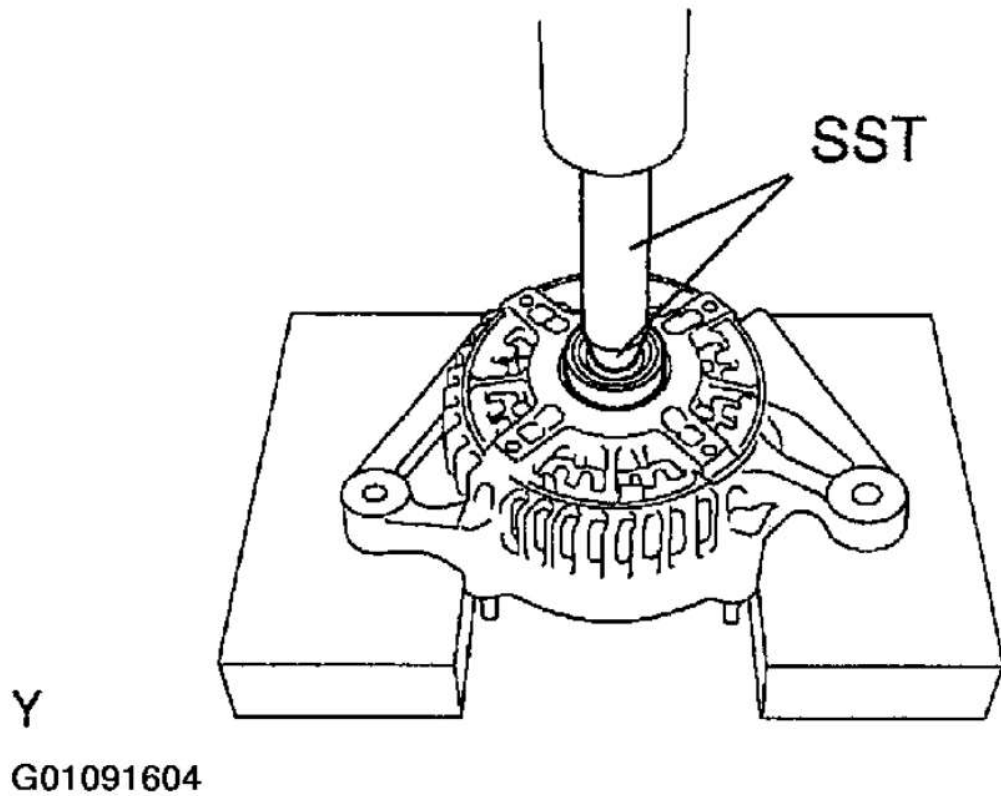


Fig. 34: Using SST To Remove Front Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09950-60010 (09951-00350), 09950-70010 (09951-07100)

- c. Using SST and a press, press in a new bearing.

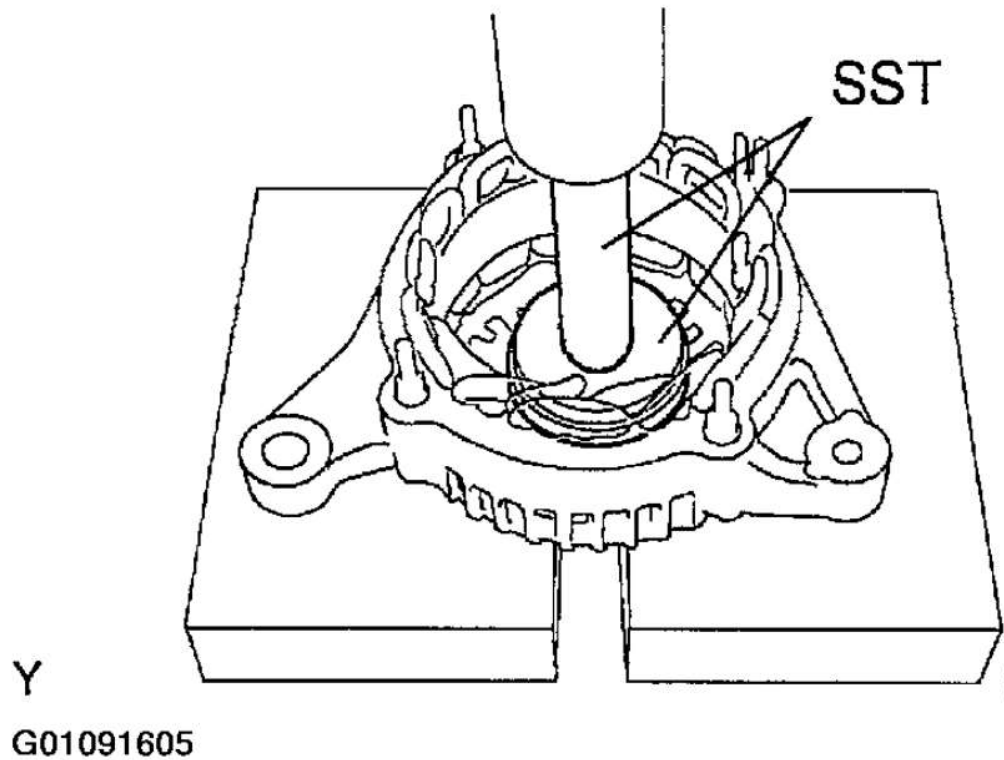


Fig. 35: Using SST To Install Front Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

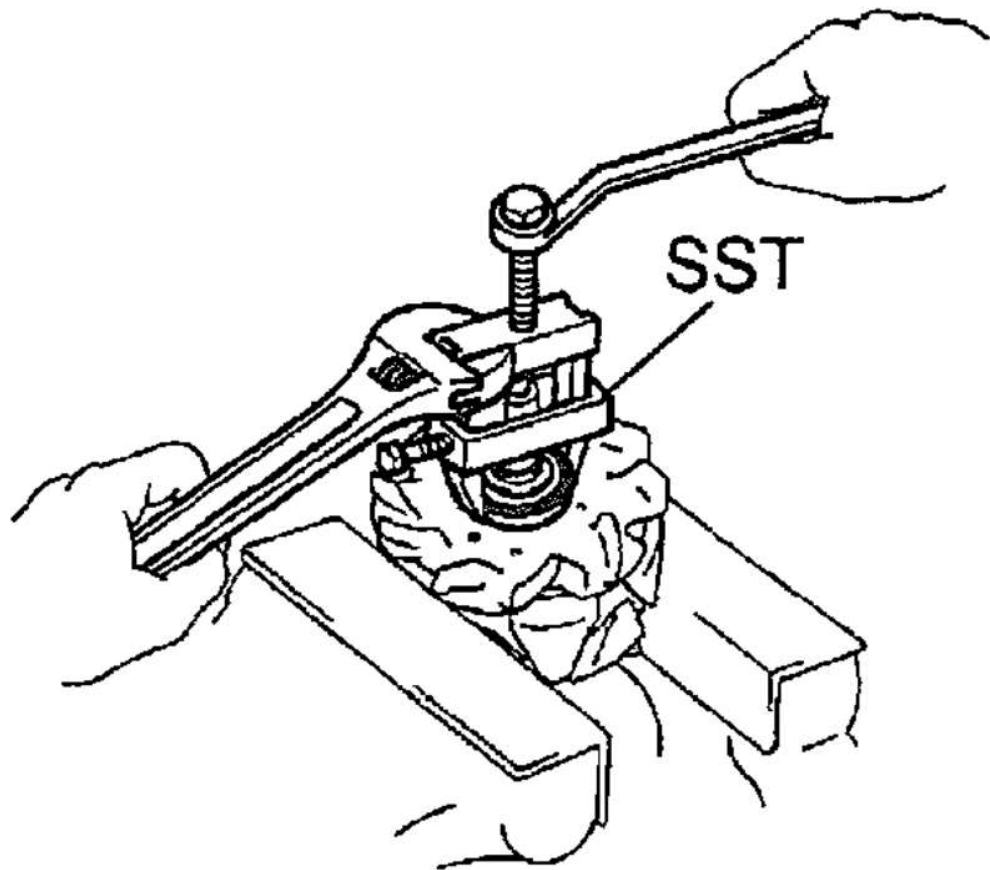
SST 09950-60010 (09951-00530), 09950-70010 (09951-07100)

- d. Install the bearing retainer with the 4 screws.

Torque: 3.0 N.m (31 kgf.cm, 27 in..lbf)

2. REPLACE REAR BEARING

- a. Using SST, remove the bearing cover (outside) and bearing.



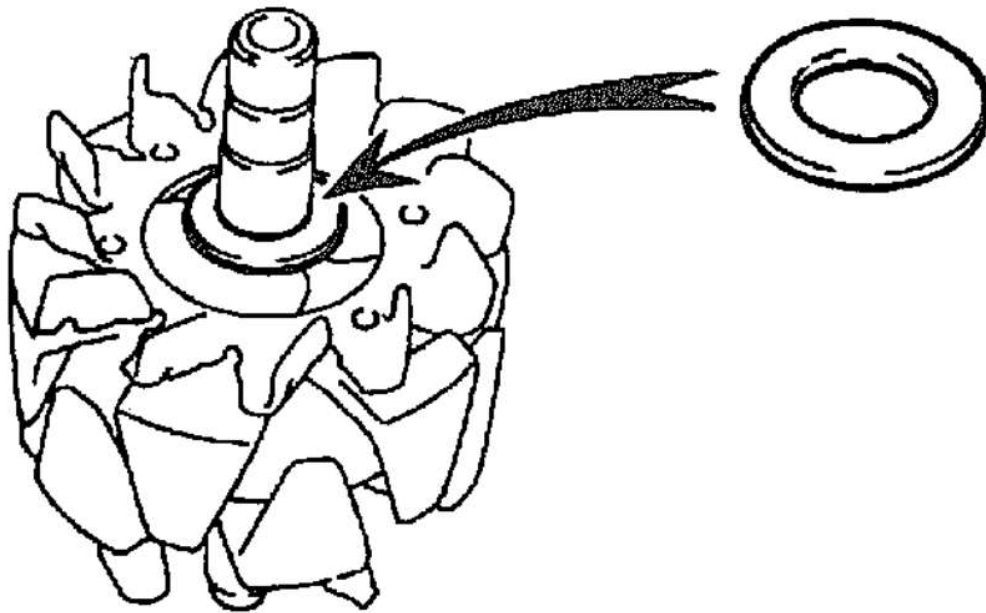
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Fig. 36: Using SST To Remove Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09821-00021

NOTE: Be careful not to damage the fan.

- b. Remove the bearing cover (inside).



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Fig. 37: Removing Inside Bearing Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the bearing cover (inside) on the rotor.
- d. Using SST and a press, press in a new bearing.

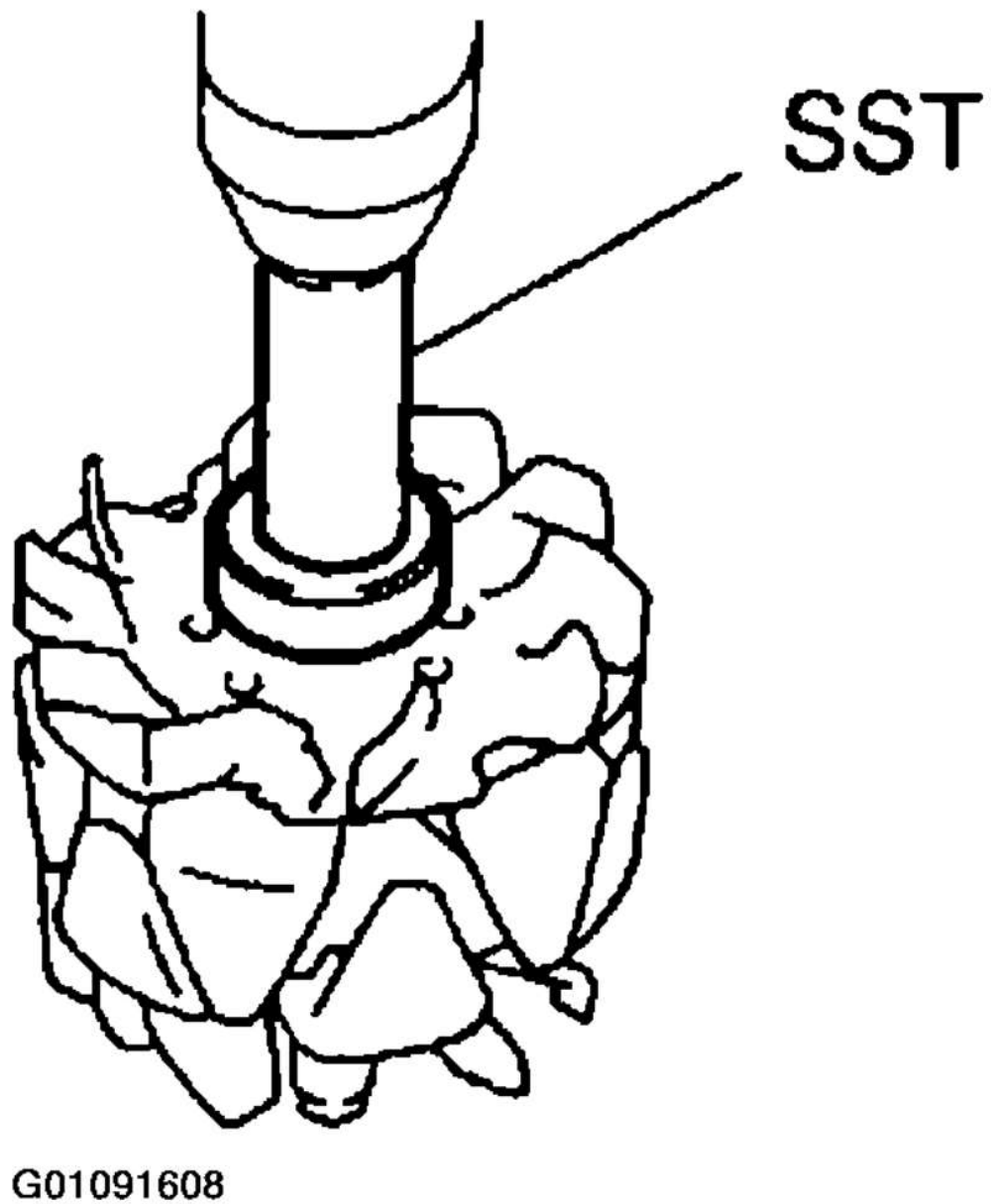


Fig. 38: Using SST To Install Rear Bearing (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09820-00031

- e. Using SST, push in the bearing cover (outside).

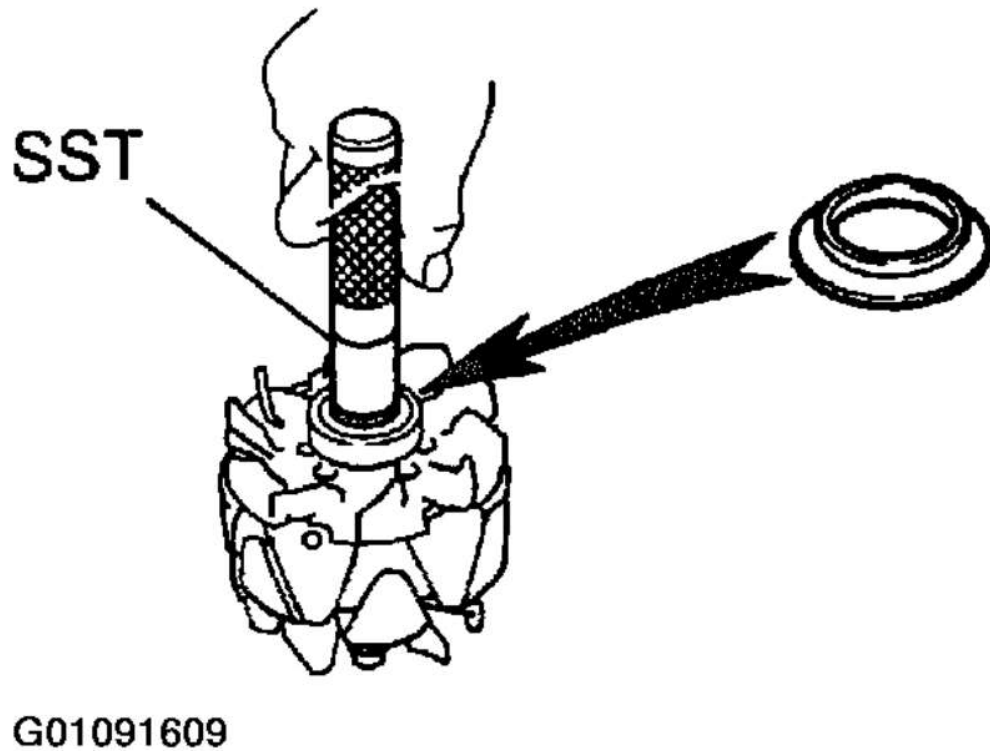


Fig. 39: Using SST To Install Rear Bearing (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09825-76010

REASSEMBLY

1. INSTALL ROTOR TO DRIVE END FRAME

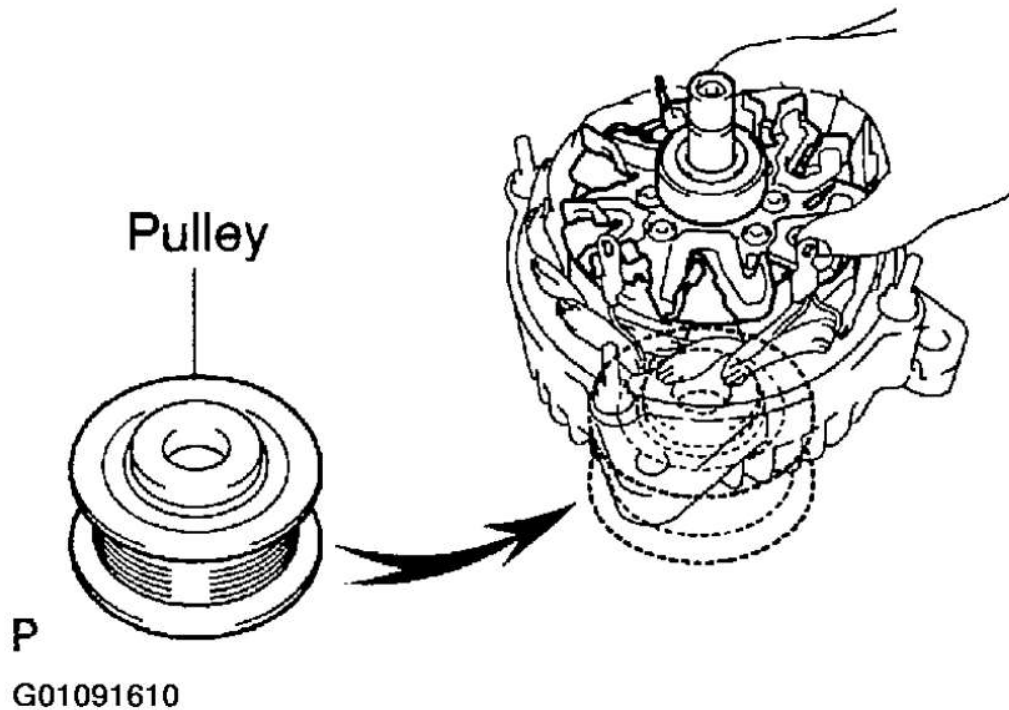
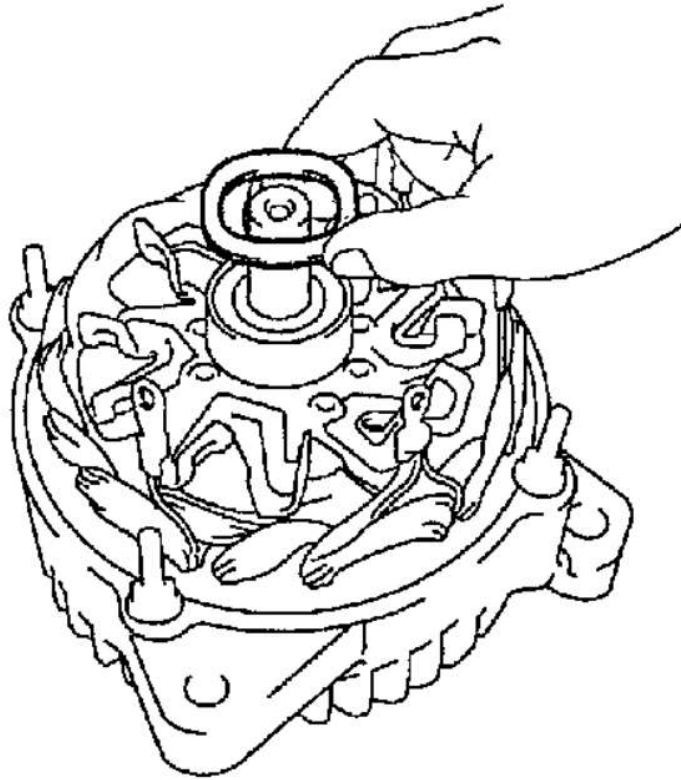


Fig. 40: Installing Rotor To Drive End Frame
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Place the drive end frame on the pulley.
- b. Install the rotor to the drive end frame.

2. INSTALL RECTIFIER END FRAME

- a. Place the generator washer on the rotor.



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Fig. 41: Installing Rectifier End Frame (1 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.

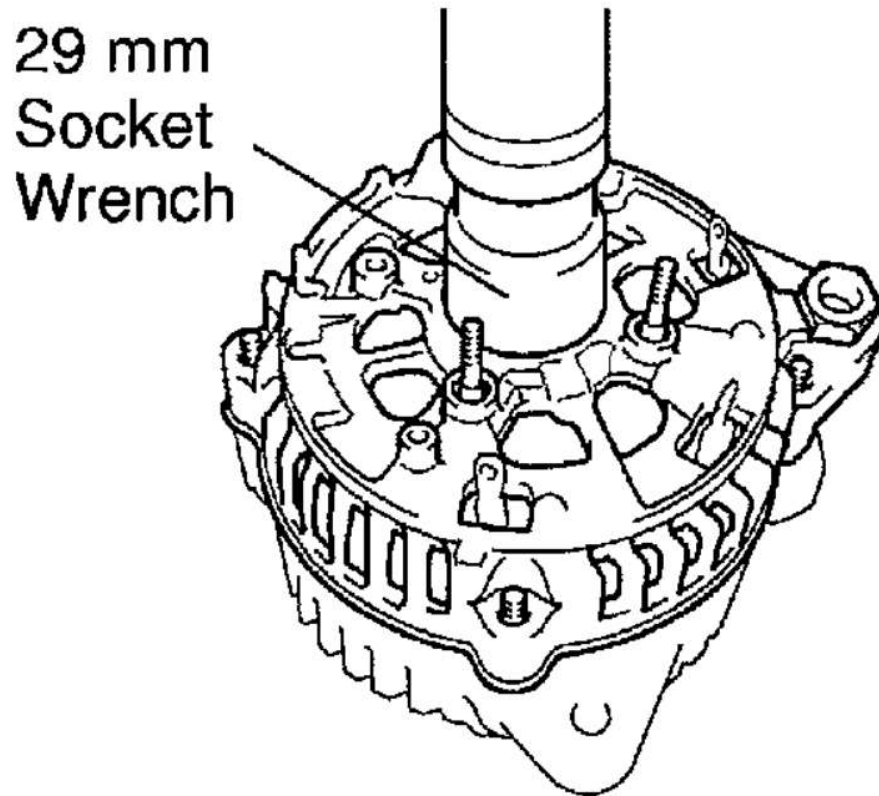
**P****G01091612**

Fig. 42: Installing Rectifier End Frame (2 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the wire clip and 4 nuts.

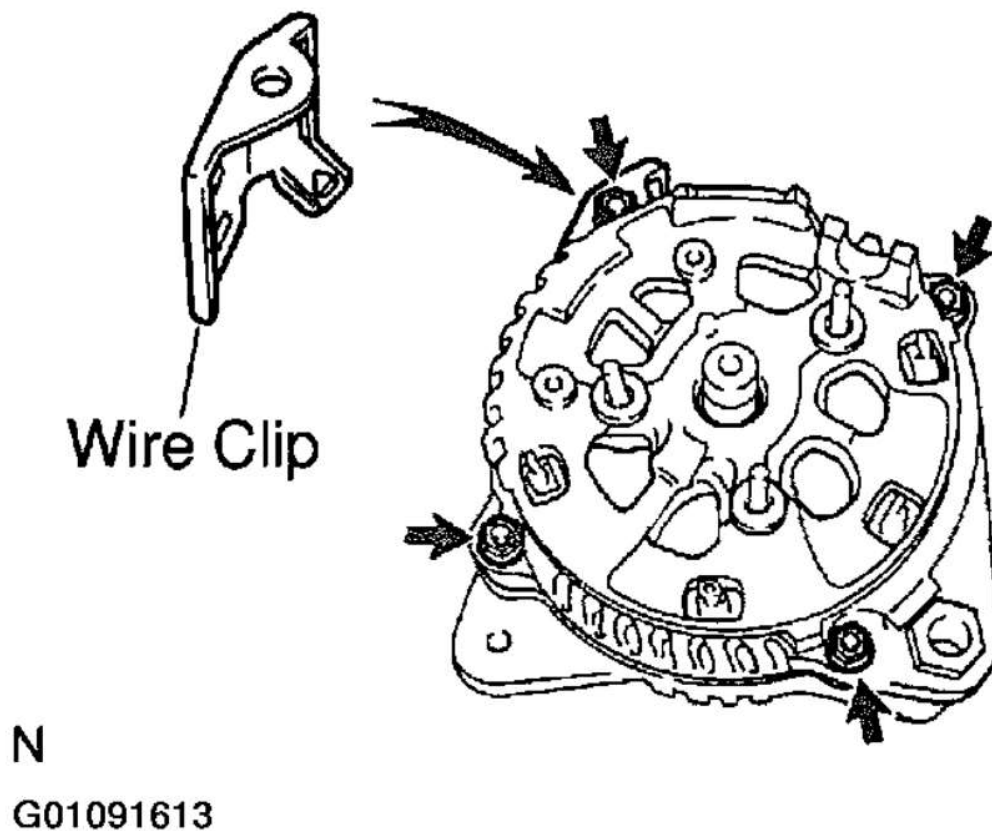


Fig. 43: Installing Rectifier End Frame (3 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque:

4.5 N.m (46 kgf.cm, 40 in..lbf) for without wire clip

5.4 N.m (55 kgf.cm, 48 in..lbf) for with wire clip

3. INSTALL PULLEY

- Install the pulley to the rotor shaft by tightening the pulley nut by hand.
- Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.

SST 09820-63011

Torque: 39 N.m (400 kgf.cm, 29 ft.lbf)

- Check that SST (A) is secured to the pulley shaft.

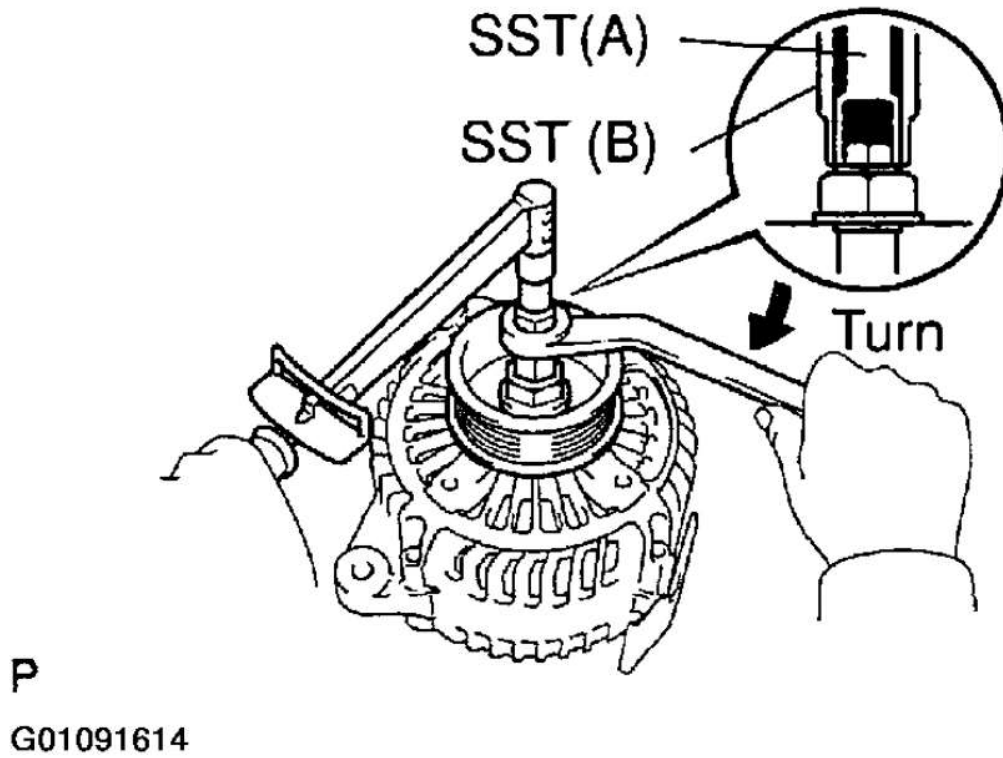
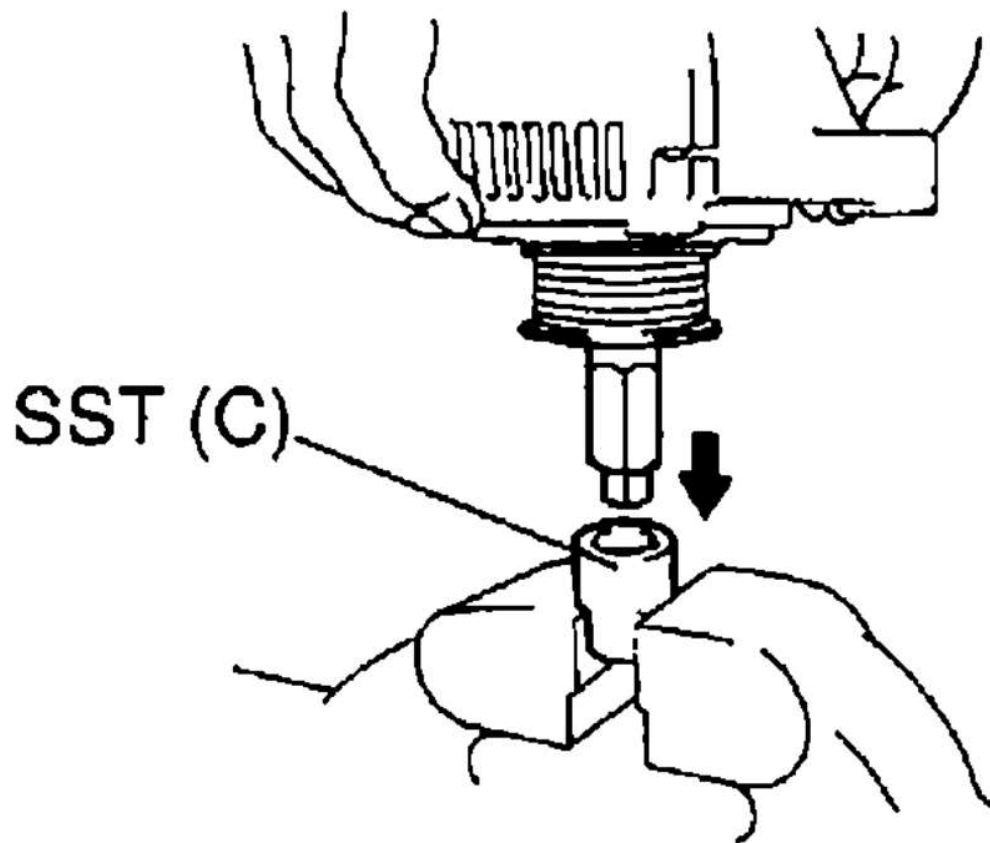


Fig. 44: Using SSTs To Install Generator Pulley (1 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

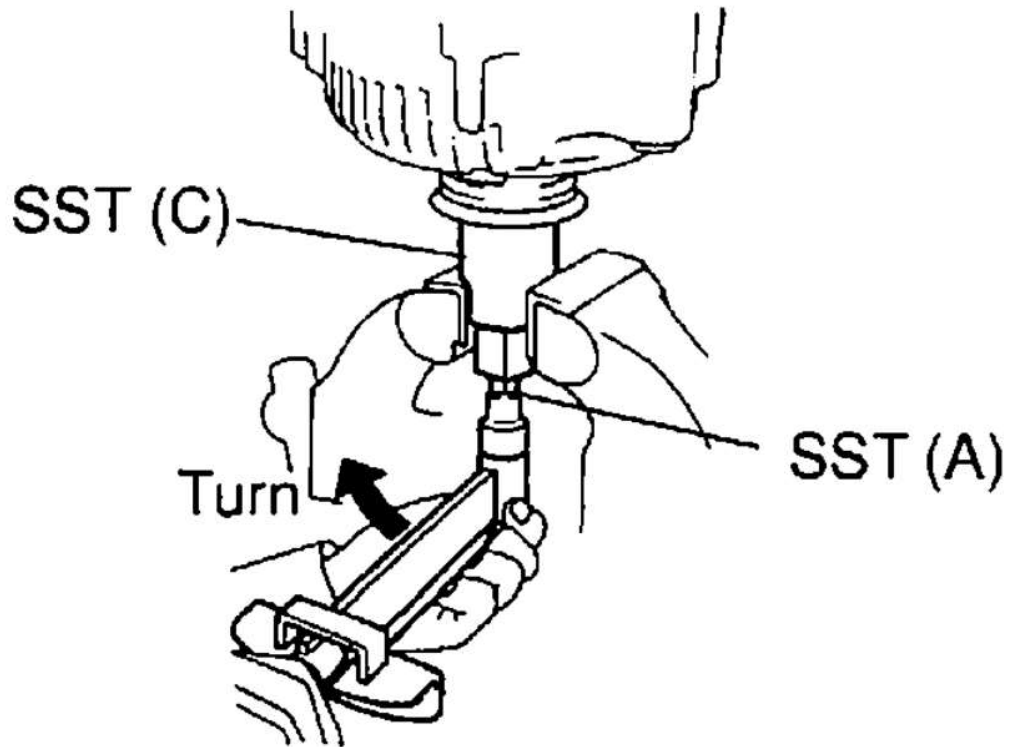
- d. Mount SST (C) in a vise.



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Fig. 45: Using SSTs To Install Generator Pulley (2 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Insert SST (B) into SST (C), and attach the pulley nut to SST (C).
- f. To torque the pulley nut, turn SST (A) in the direction shown.
Torque: 111 N.m (1,125 kgf.cm, 81 ft.lbf)
- g. Remove the generator from SST (C).



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Fig. 46: Using SSTs To Install Generator Pulley (3 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Turn SST (B), and remove SST (A and B).

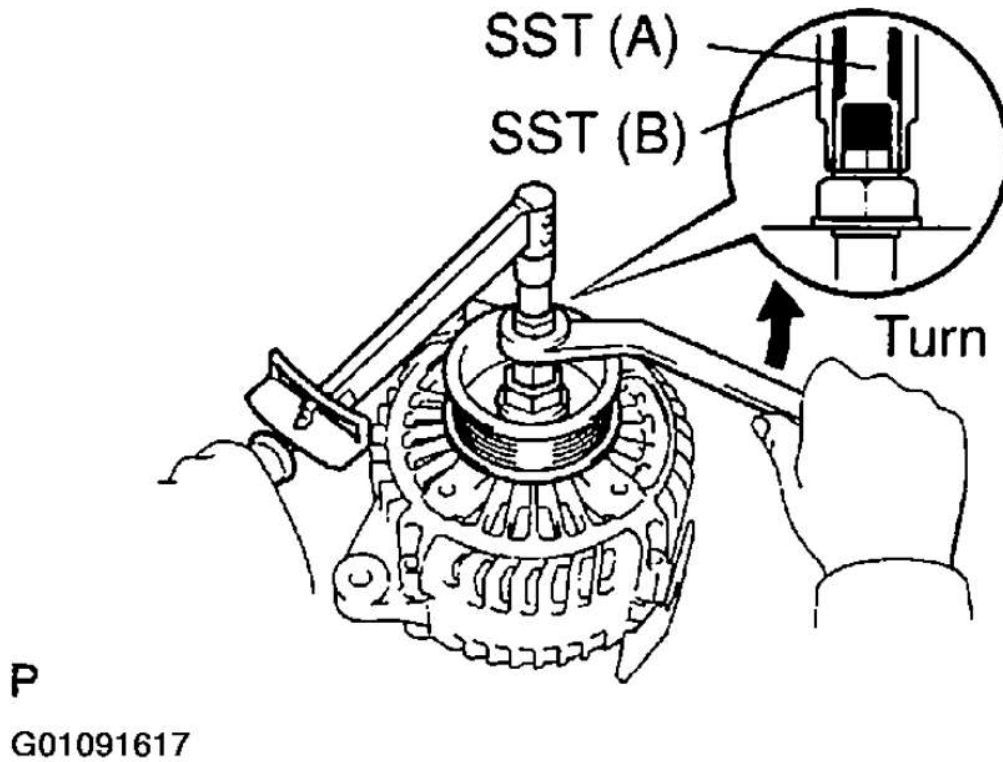


Fig. 47: Using SSTs To Install Generator Pulley (4 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL RECTIFIER HOLDER

- a. Install the 4 rubber insulators on the lead wires.

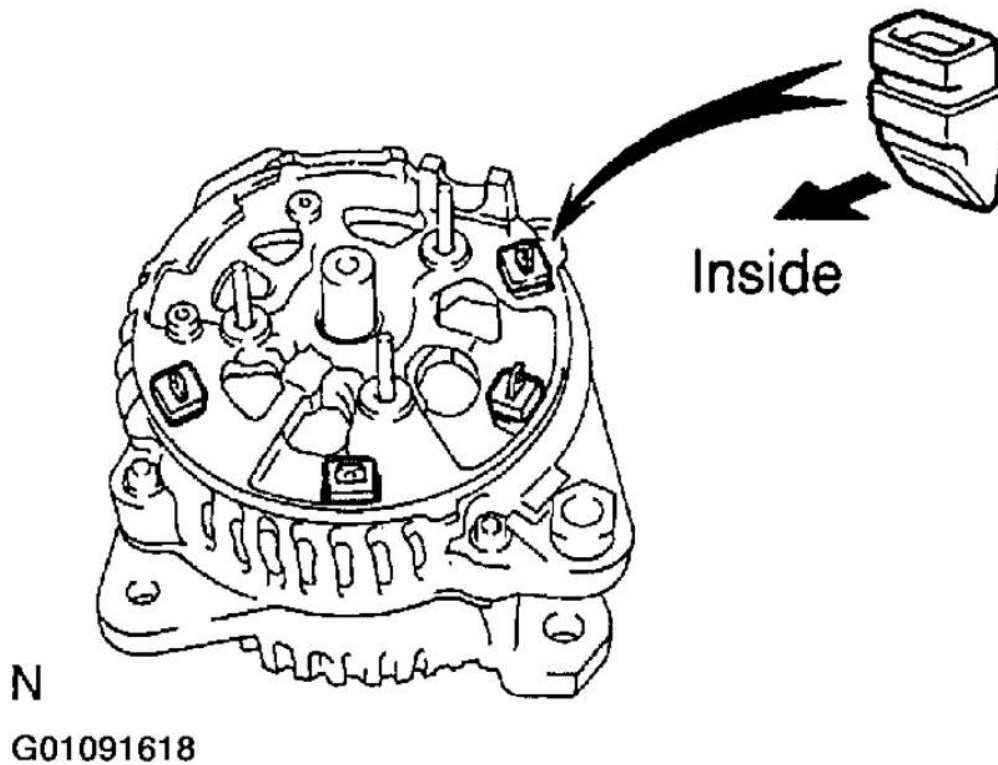


Fig. 48: Installing Rubber Insulators

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful of the rubber insulators installation direction.

- b. Install the rectifier holder while pushing it with the 4 screws

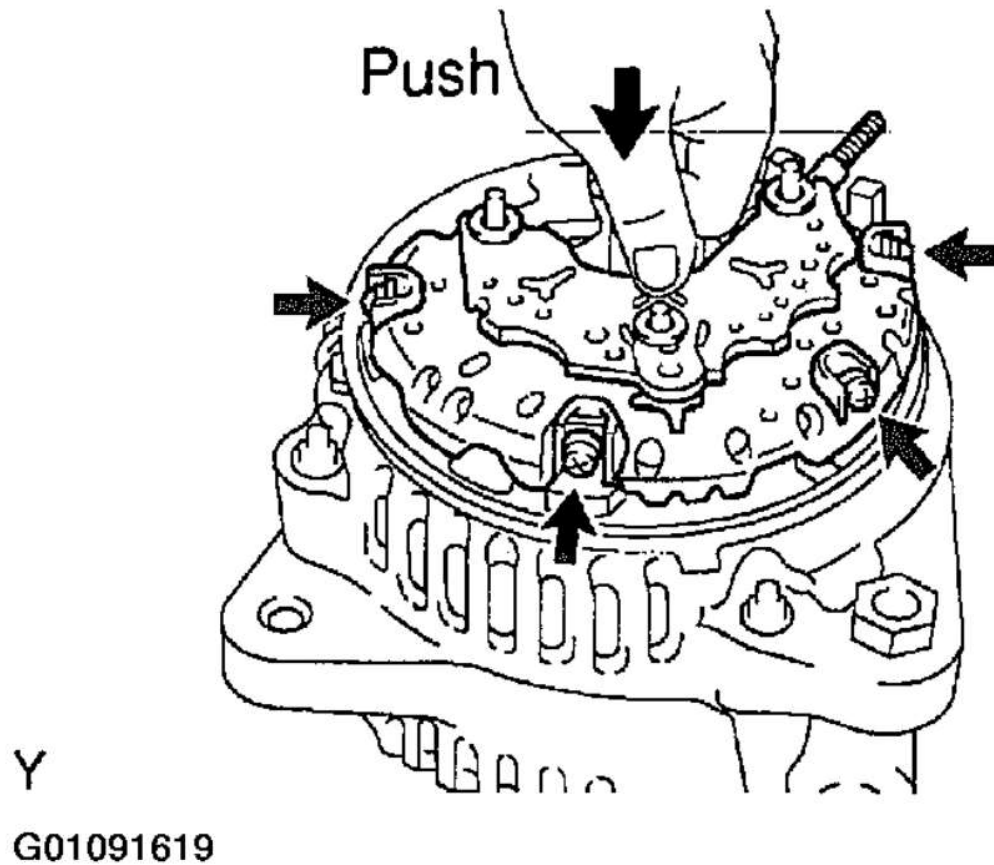


Fig. 49: Installing Rectifier Holder

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 2.9 N.m (30 kgf.cm, 26 in..lbf)

5. INSTALL VOLTAGE REGULATOR AND BRUSH HOLDER

- a. Place the seal plate on the rectifier end frame.

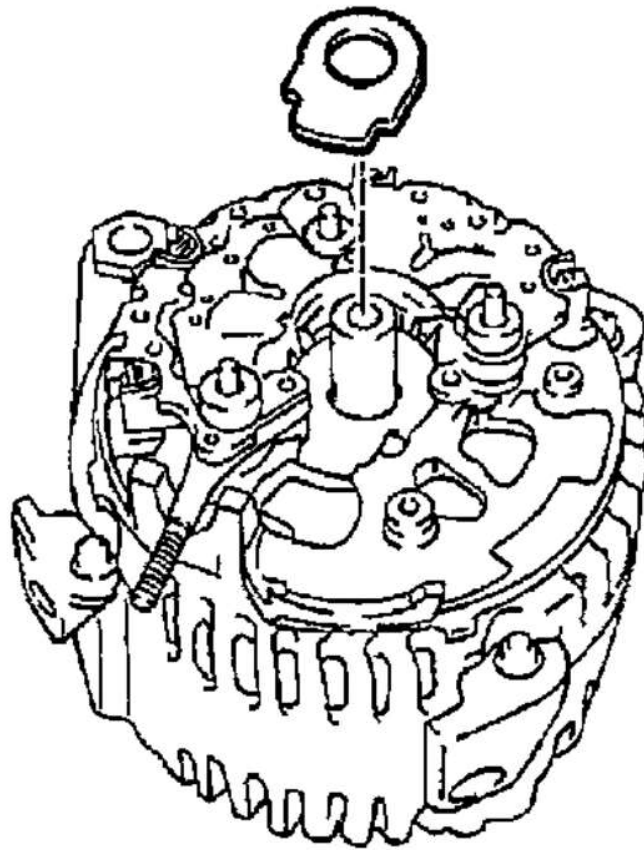
**N****G01091620**

Fig. 50: Installing Voltage Regulator & Brush Holder (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Place the voltage regulator and brush holder on the rectifier end frame.

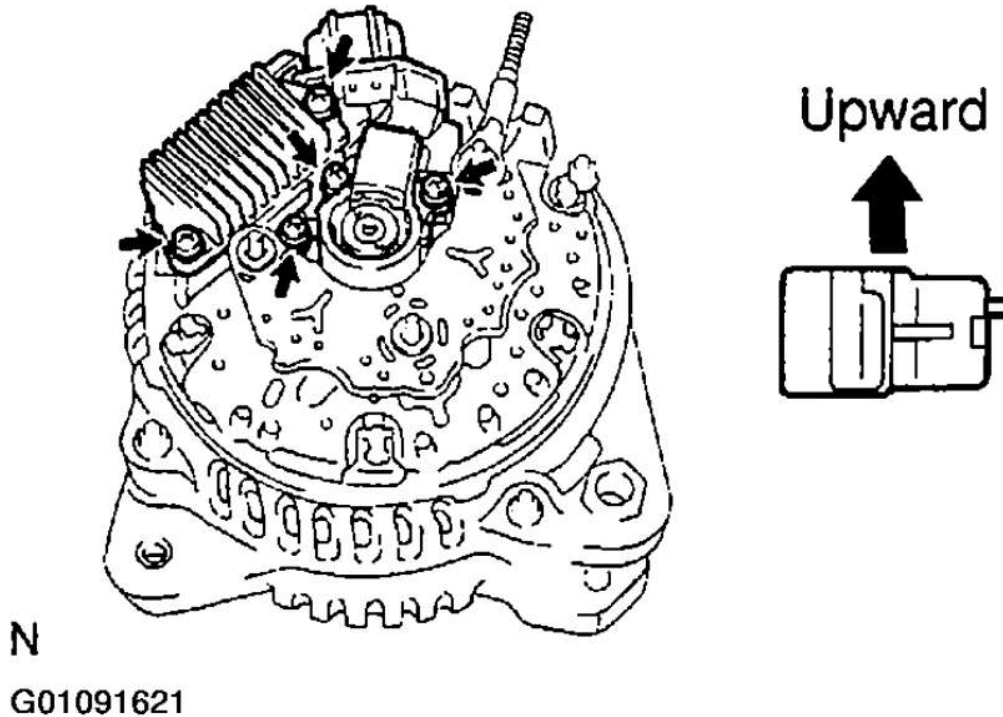


Fig. 51: Installing Voltage Regulator & Brush Holder (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful of the holder installation direction.

- c. Install the 5 screws.

Torque: 2.0 N.m (20 kgf.cm, 18 in..lbf)

6. INSTALL REAR END COVER

- a. Place the brush holder cover on the brush holder.

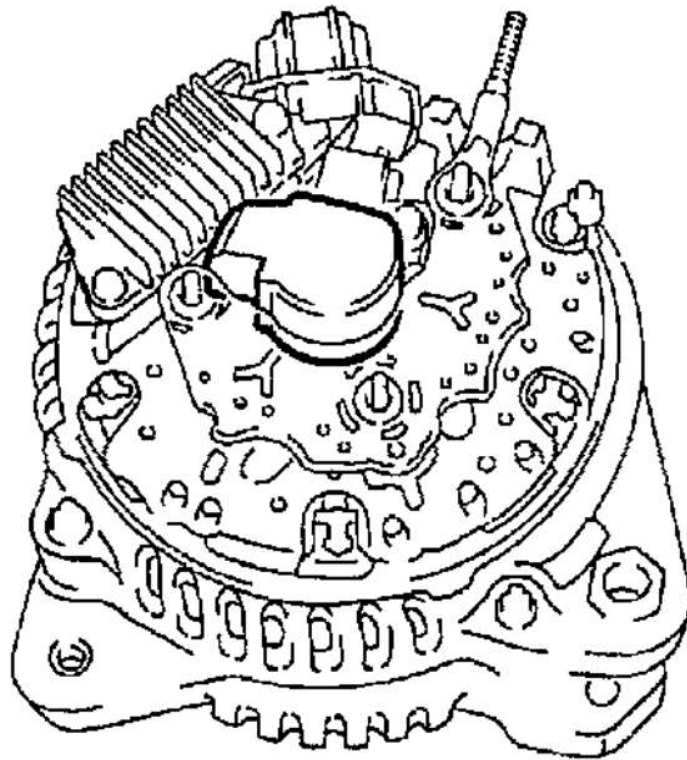
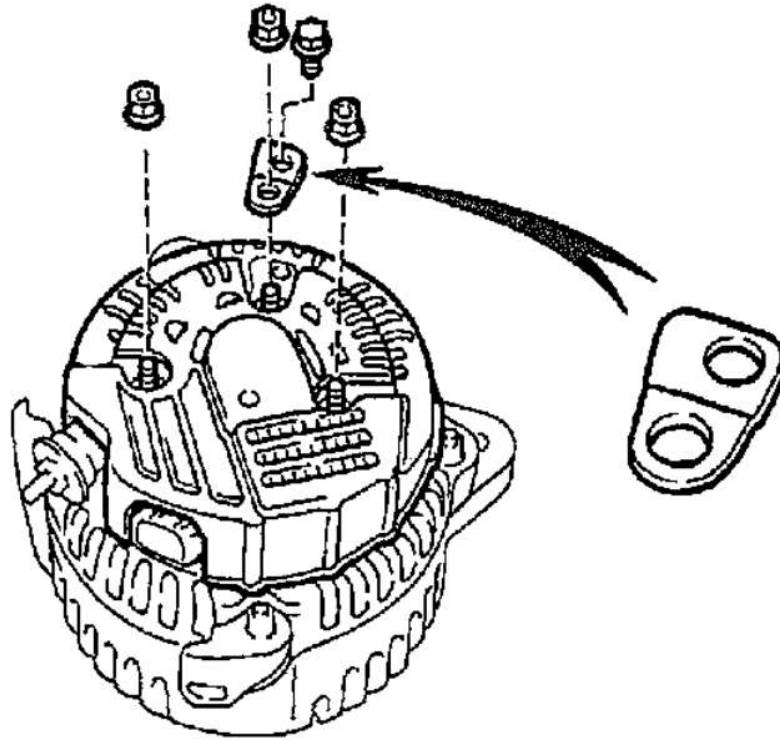
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Fig. 52: Installing Rear End Cover (1 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the end cover and plate terminal with the bolt and 3 nuts.



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Fig. 53: Installing Rear End Cover (2 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque:

4.4 N.m (45 kgf.cm, 39 in..lbf) for nut

3.9 N.m (39 kgf.cm, 35 in..lbf) for bolt

- c. Install the terminal insulator with the nut.

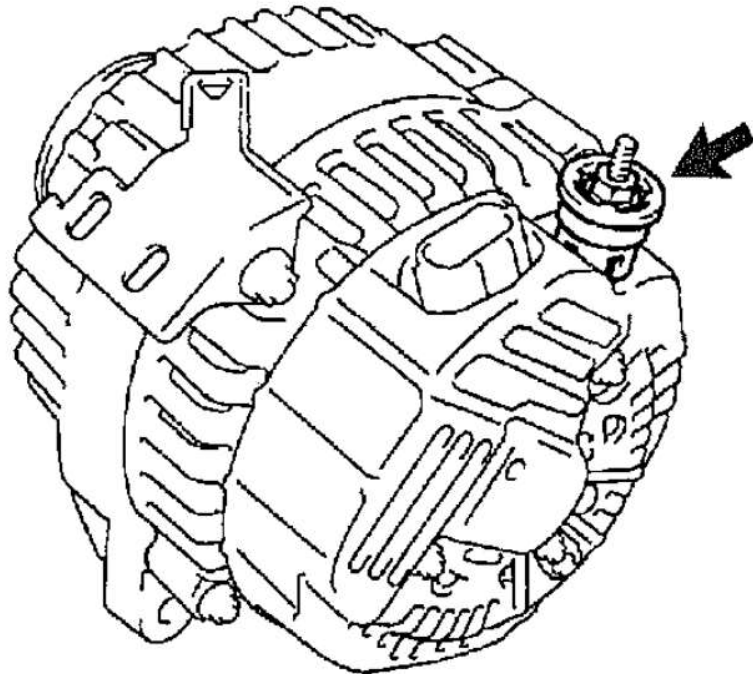
**P****G01091624**

Fig. 54: Installing Rear End Cover (3 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 4.1 N.m (42 kgf.cm, 36 in..lbf)

7. CHECK THAT ROTOR ROTATES SMOOTHLY

INSTALLATION

1. INSTALL GENERATOR

- a. Install the generator with the 2 bolts.

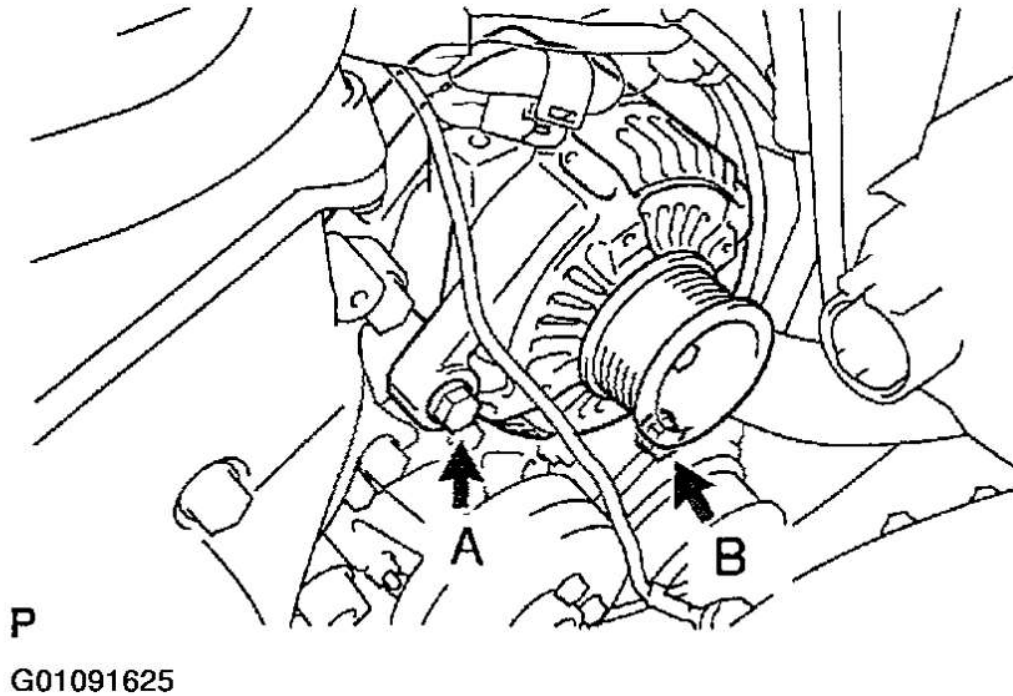


Fig. 55: Installing Generator & Components (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque:

52 N.m (530 kgf.cm, 38 ft.lbf) for bolt A

21 N.m (215 kgf.cm, 16 ft.lbf) for bolt B

- b. Connect the generator connector.

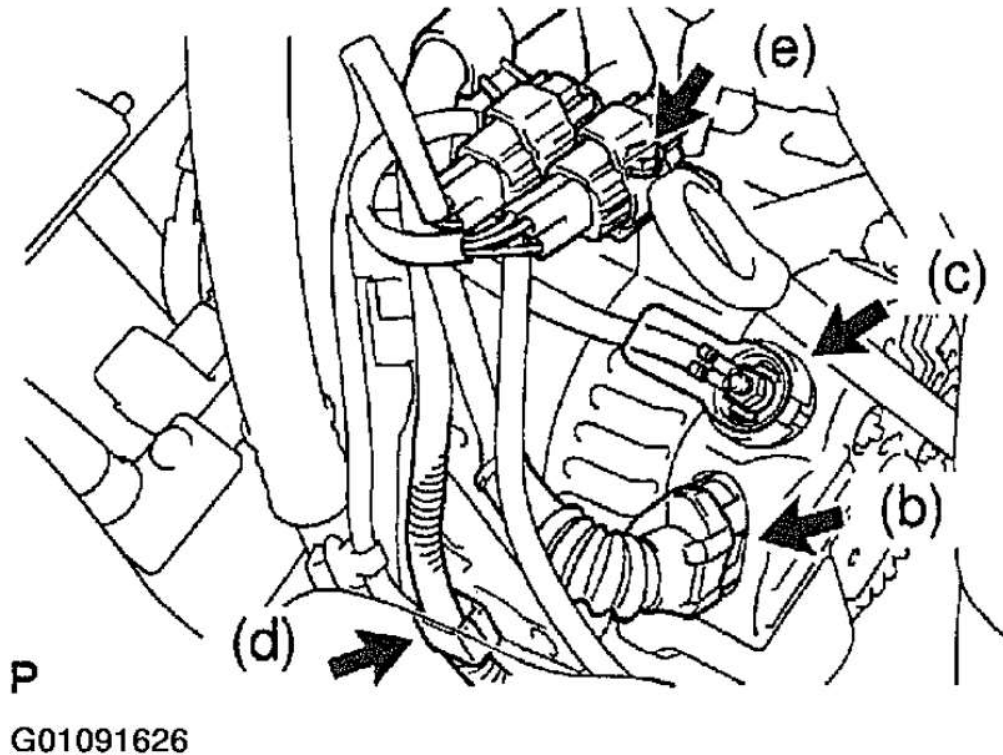


Fig. 56: Installing Generator & Components (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the generator wire with the nut, and install the cap.
Torque: 9.7 N.m (100 kgf.cm, 85 in..lbf)
- d. Install the wire clamp to the wire clip.
- e. Install the wire clip on the wire connectors to the generator.

2. INSTALL DRIVE BELT

Hook SST on the hexagonal portion of the drive belt tensioner bracket, compress the drive belt tension by turning the drive belt tensioner bracket clockwise, and install the drive belt.

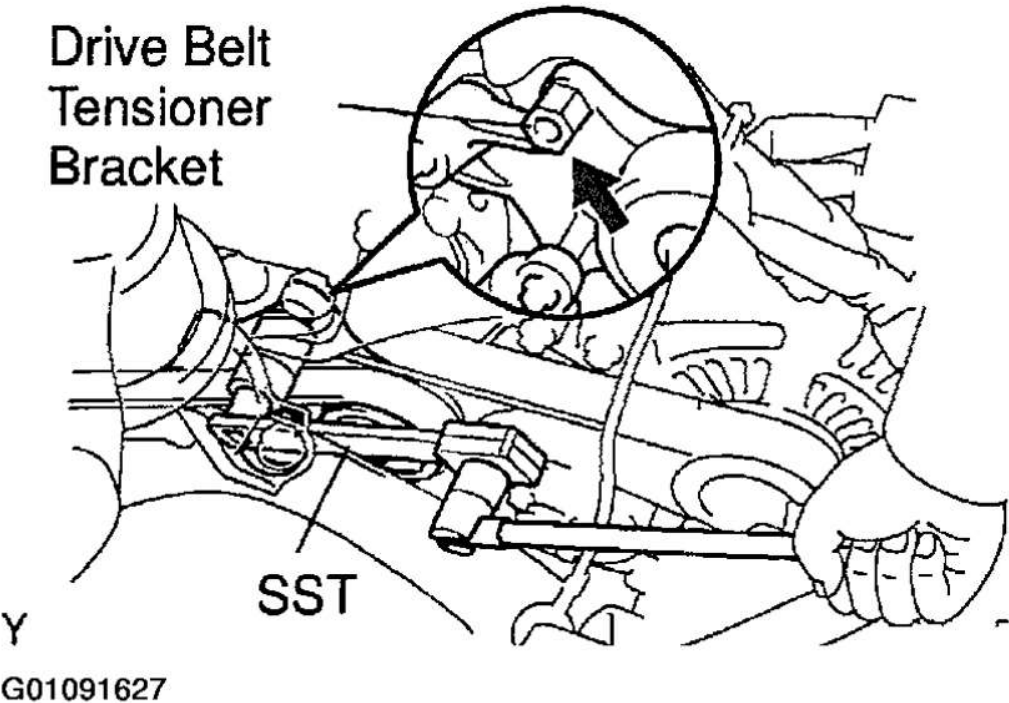


Fig. 57: Adjusting Drive Belt Tensioner Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09249-63010

NOTE: Compress the drive belt tensioner by taking 3 seconds or more and installed the drive belt.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Generator Mounting Bolt	
Lower (Short Bolt) Mounting Bolt	16 (22)
Upper (Long Bolt) Mounting Bolt	38 (52)
Generator Pulley Nut	81 (110)