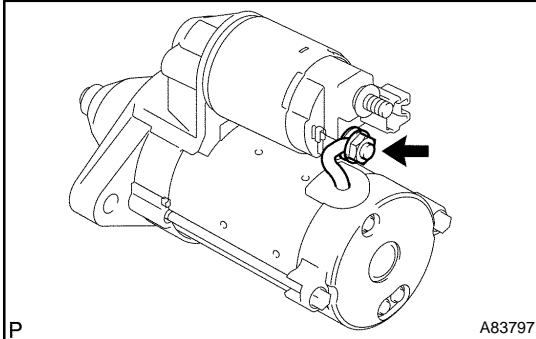


STARTING SYSTEM (1ZZ-FE) (April, 2003)

INSPECTION

1900O-02



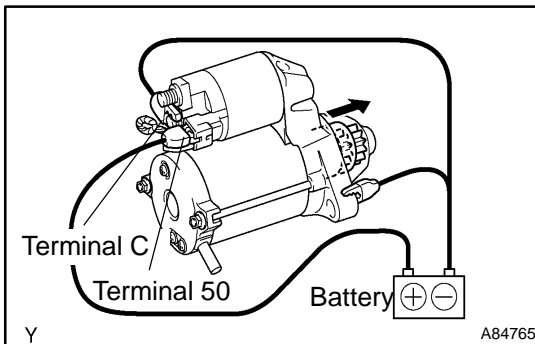
1. INSPECT STARTER ASSY

NOTICE:

These tests must be performed within 3 to 5 seconds to prevent burnout of the coil.

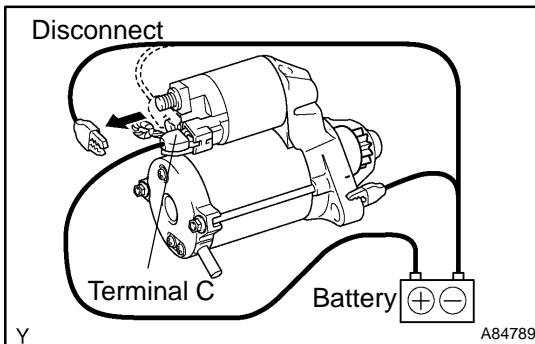
(a) Perform the pull-in test.

- (1) Remove the nut, then disconnect the lead wire from terminal C.



- (2) Connect the battery to the starter repair service kit as shown in the illustration. Check that the clutch pinion gear is extended.

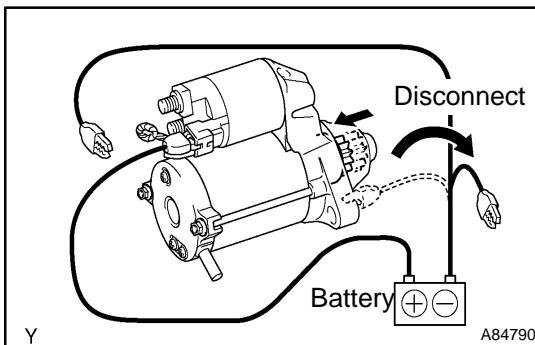
If the clutch pinion gear is not extended, replace the starter repair service kit.



(b) Perform the hold-in test.

- (1) Disconnect the negative (-) lead from terminal C with the lead wire disconnected from terminal C. Check that the clutch pinion gear remains extended.

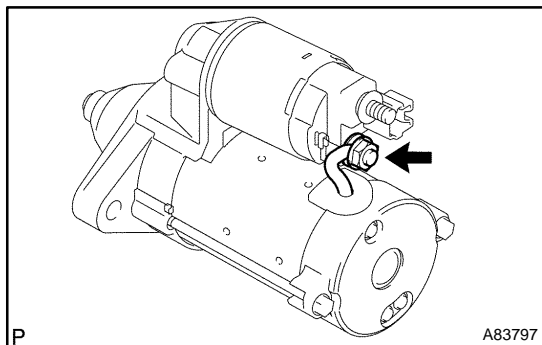
If the clutch pinion gear returns, replace the starter repair service kit.



(c) Check the clutch pinion gear returns.

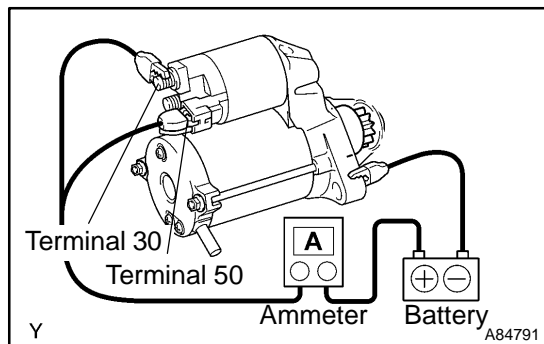
- (1) Disconnect the negative (-) lead from the starter body. Check that the clutch pinion gear returns.

If the clutch pinion gear does not return, replace the starter repair service kit.



- (d) Perform the no-load performance test.
- (1) Connect the lead wire to terminal C with the nut. Make sure that the lead is not grounded.

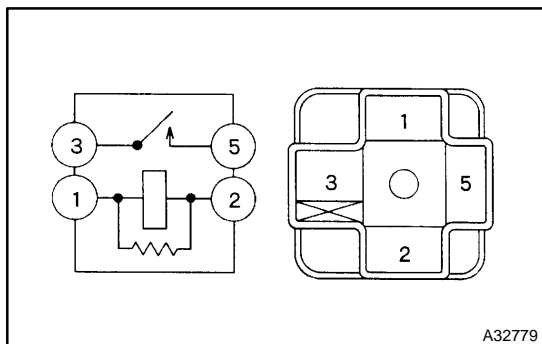
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)



- (2) Clamp the starter in a vise.
- (3) Connect the battery and an ammeter to the starter as shown in the illustration.
- (4) Check that the starter rotates smoothly and steadily with the clutch pinion gear extended. Check that the ammeter reads the specified current.

Specified current: 90 A or less at 11.5 V

If the current is not as specified, replace the starter repair service kit.



2. INSPECT STARTER RELAY ASSY

- (a) Check the continuity.
- (1) Using an ohmmeter, check for continuity between each terminal.

Specified condition:

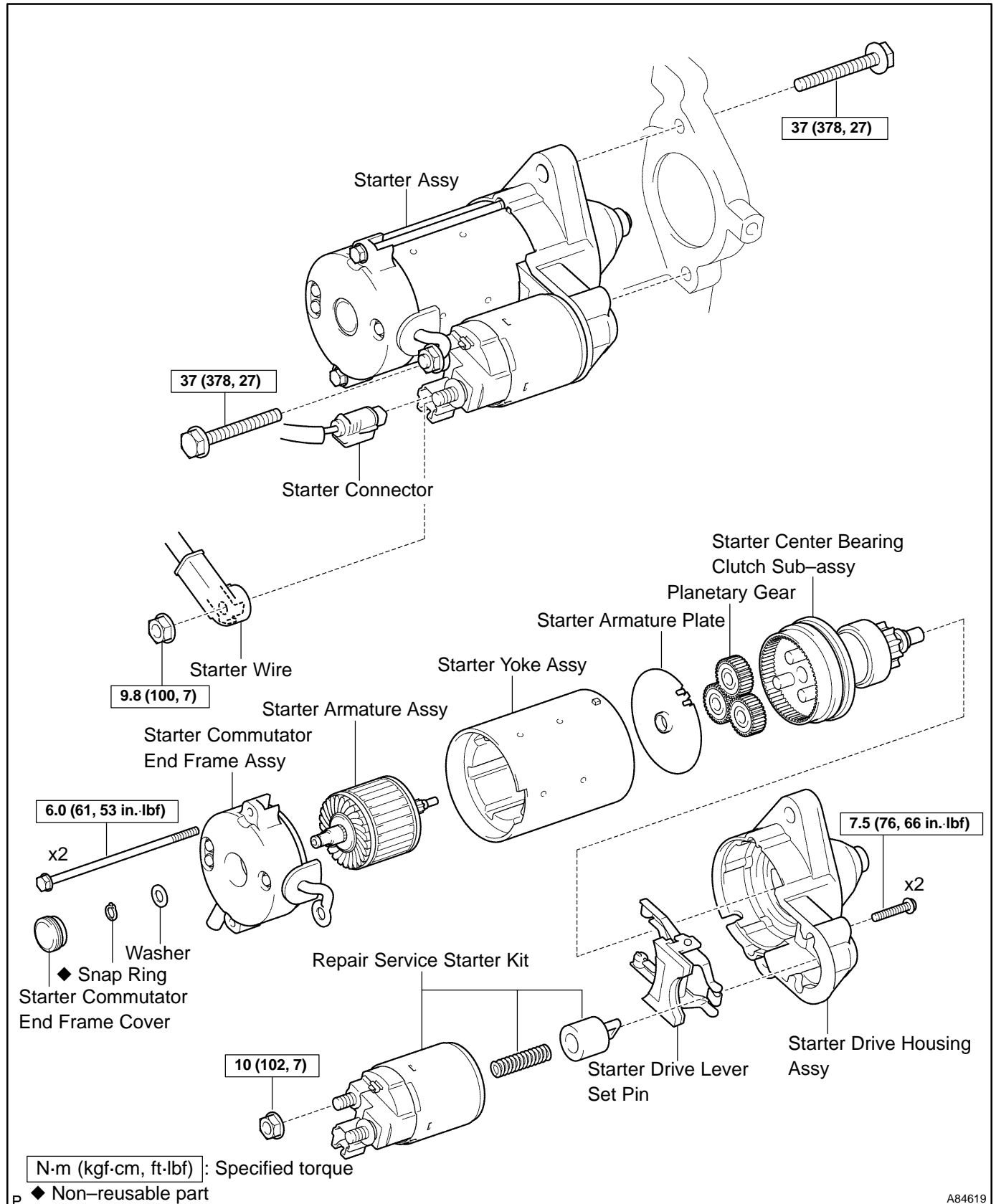
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No Continuity
3 – 5	Continuity (Apply battery voltage to terminals 1 and 2)

If the result is not as specified, replace the starter relay.

STARTER ASSY (1ZZ-FE) (April, 2003)

COMPONENTS

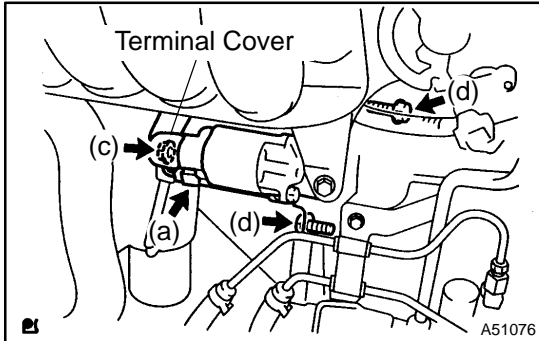
190QP-02



A84619

REPLACEMENT

1. DISCONNECT BATTERY NEGATIVE TERMINAL
2. REMOVE ENGINE UNDER COVER RH



3. REMOVE STARTER ASSY
 - (a) Disconnect the starter connector.
 - (b) Open the terminal cover.
 - (c) Remove the nut, then disconnect the starter wire.
 - (d) Remove the 2 bolts, then remove the starter.

4. INSTALL STARTER ASSY

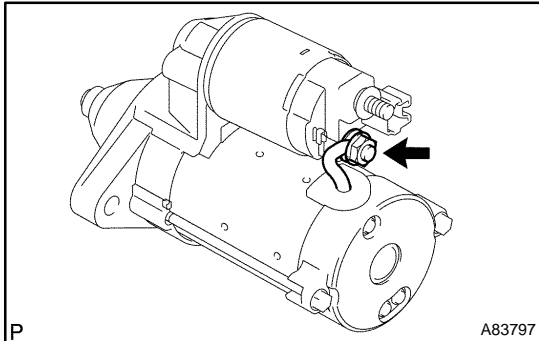
Torque:

37 N·m (378 kgf·cm, 27 ft·lbf) for bolt

9.8 N·m (100 kgf·cm, 7 ft·lbf) for nut

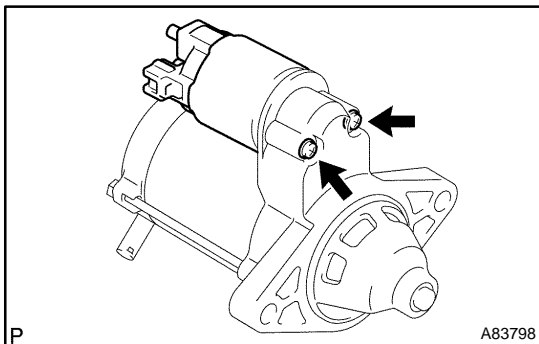
5. INSTALL ENGINE UNDER COVER RH
 6. CONNECT BATTERY NEGATIVE TERMINAL
- Torque: 5.4 N·m (55 kgf·cm, 48 in·lbf)

OVERHAUL

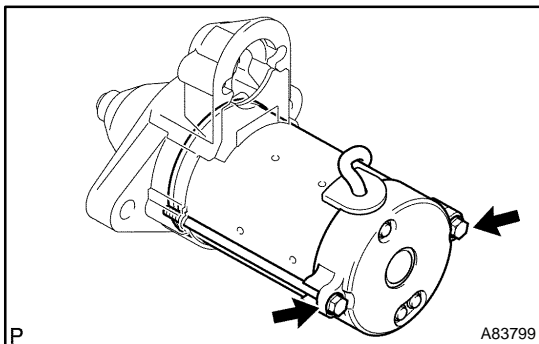


1. REMOVE REPAIR SERVICE STARTER KIT

- (a) Remove the nut, then disconnect the lead wire from terminal C.

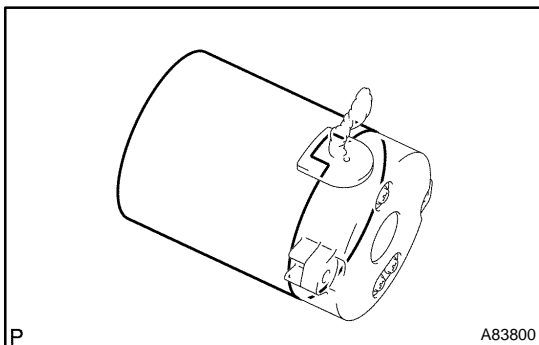


- (b) Remove the 2 screws which are used to secure the repair service starter kit to the starter drive housing.
(c) Remove the repair service starter kit.
(d) Remove the return spring and plunger from the starter drive housing.

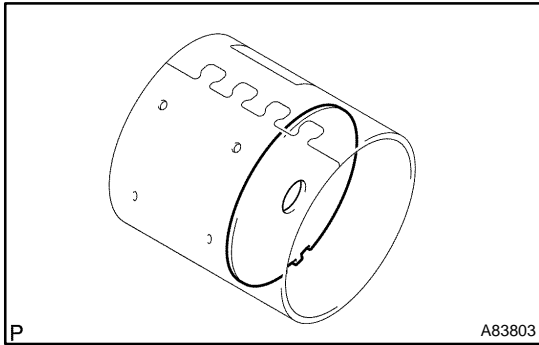


2. REMOVE STARTER YOKE ASSY

- (a) Remove the 2 through bolts, then pull out the starter yoke together with the starter commutator end frame.

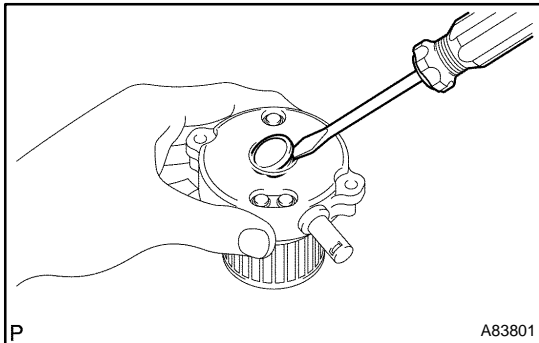


- (b) Remove the starter yoke from the starter commutator end frame.



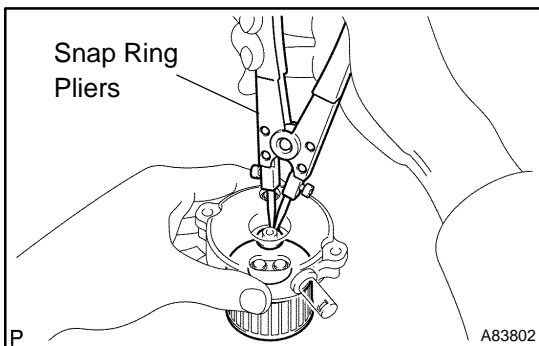
3. REMOVE STARTER ARMATURE PLATE

- (a) Remove the starter armature plate from the starter yoke.



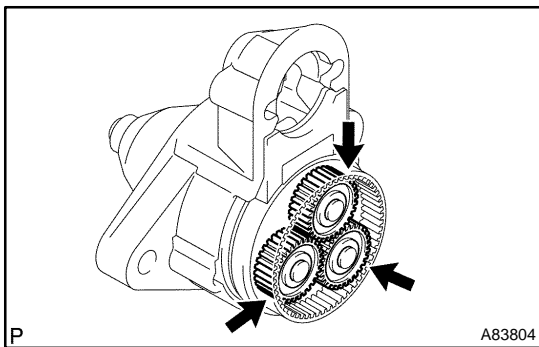
4. REMOVE STARTER COMMUTATOR END FRAME COVER

- (a) Using a screwdriver, remove the starter commutator end frame cover.



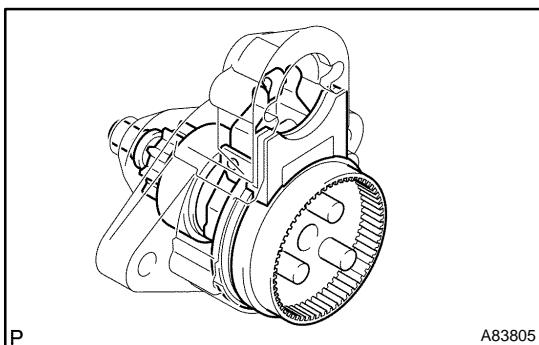
5. REMOVE STARTER ARMATURE ASSY

- (a) Using snap ring pliers, remove the snap ring.
(b) Remove the washer and starter armature from the starter commutator end frame.



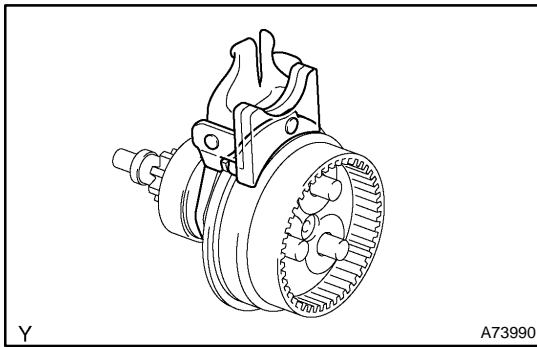
6. REMOVE PLANETARY GEAR

- (a) Remove the 3 planetary gears from the starter center bearing clutch.



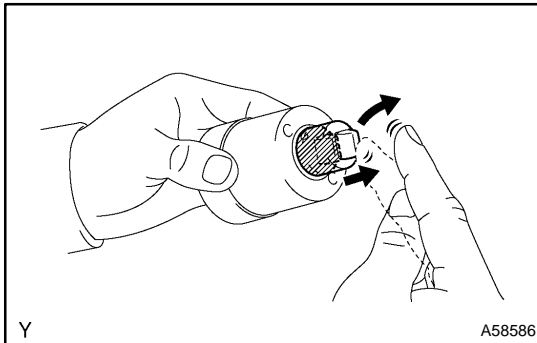
7. REMOVE STARTER CENTER BEARING CLUTCH SUB-ASSY

- (a) Remove the starter center bearing clutch together with the starter drive lever set pin from the starter drive housing.



8. REMOVE STARTER DRIVE LEVER SET PIN

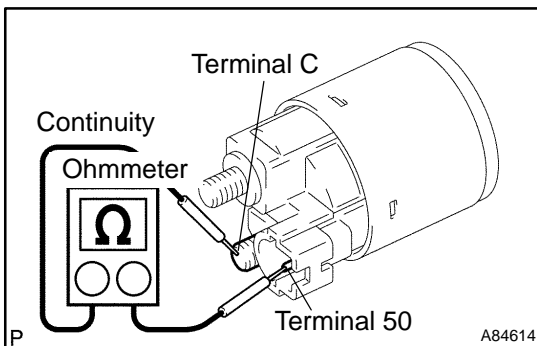
- (a) Remove the starter drive lever set pin from the starter center bearing clutch.



9. INSPECT REPAIR SERVICE STARTER KIT

- (a) Check the operation.
 (1) Push in the plunger, then check that it returns quickly to its original position.

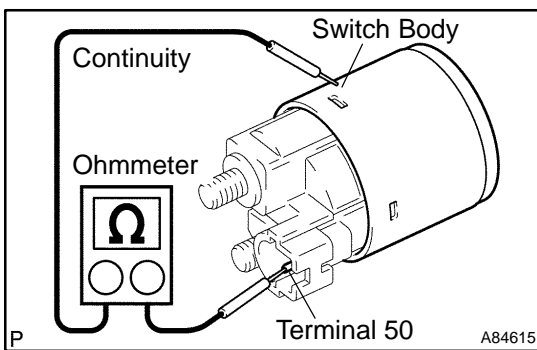
If necessary, replace the repair service starter kit.



- (b) Check the continuity.

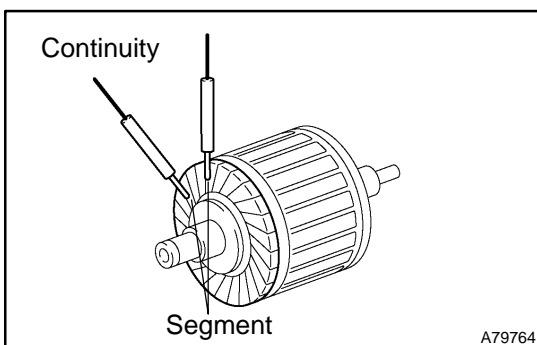
- (1) Using an ohmmeter, check that there is continuity between terminals 50 and C.

If there is no continuity, replace the repair service starter kit.



- (2) Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the repair service starter kit.

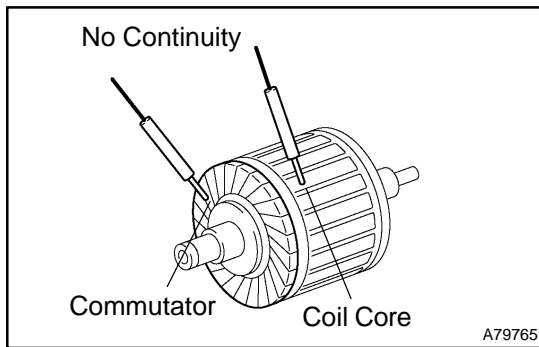


10. INSPECT STARTER ARMATURE ASSY

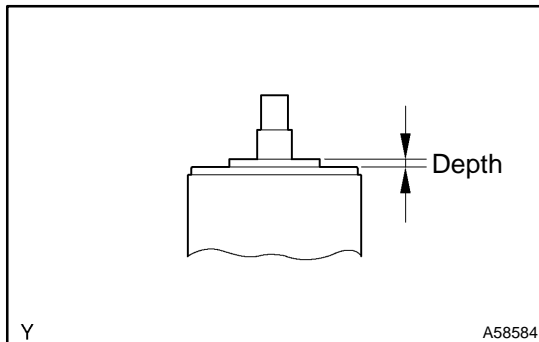
- (a) Check the continuity.

- (1) Using an ohmmeter, check that there is continuity between the segments of the commutator.

If there is no continuity between any segments, replace the starter armature.



- (2) Using an ohmmeter, check that there is no continuity between the commutator and armature coil core. If there is continuity, replace the starter armature.
- (b) Check the commutator surface for dirt or burn. If the surface is dirty or burnt, smooth the surface with 400-grit sandpaper or lathe.

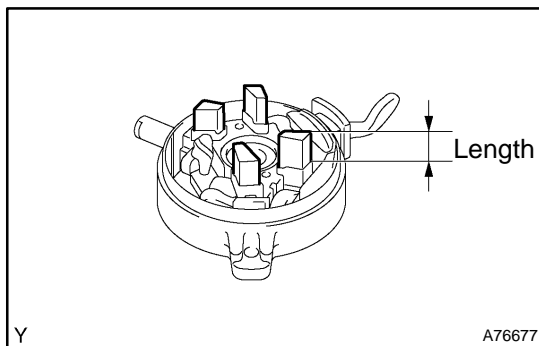


- (c) Check the commutator depth.
- (1) Using vernier calipers, measure the commutator depth.

Standard depth: 3.1 mm (0.122 in.)

Maximum depth: 3.8 mm (0.150 in.)

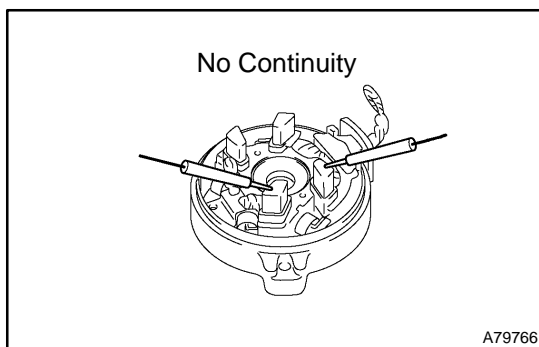
If the depth is greater than maximum, replace the starter armature.



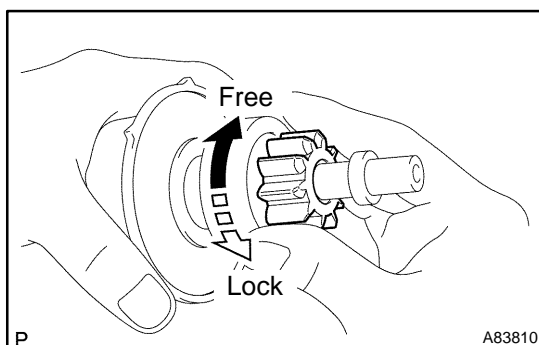
11. INSPECT STARTER COMMUTATOR END FRAME ASSY

- (a) Check the brush length.
- (1) Using vernier calipers, measure the brush length.
- Standard length: 9.0 mm (0.354 in.)**
- Minimum length: 4.0 mm (0.158 in.)**

If the length is less than minimum, replace the starter commutator end frame.



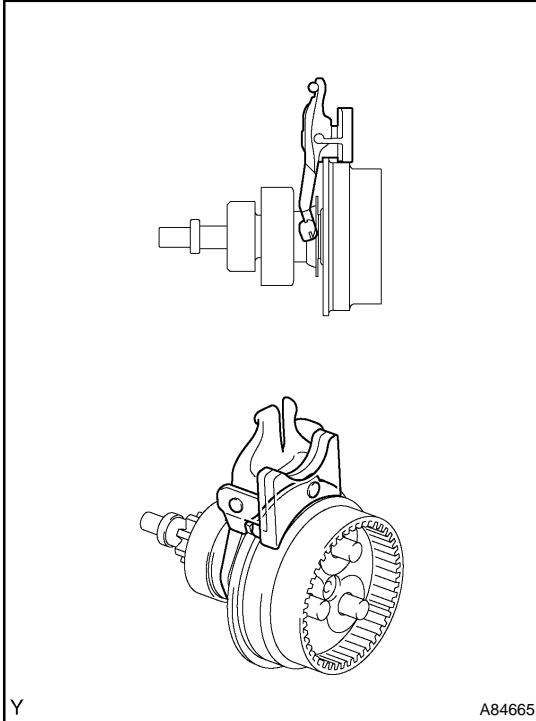
- (b) Check the continuity.
- (1) Using an ohmmeter, check that there is no continuity between the positive (+) and negative (-) brush. If there is continuity, repair or replace the starter commutator end frame.



12. INSPECT STARTER CENTER BEARING CLUTCH SUB-ASSY

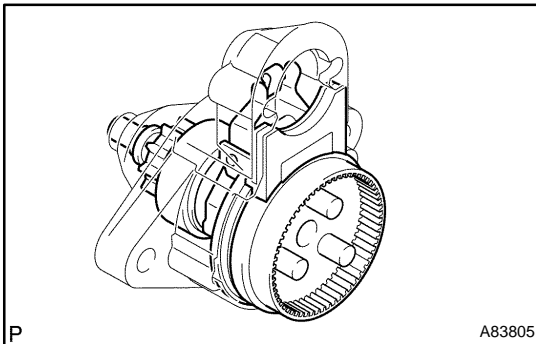
- (a) Check the starter clutch.
- (1) Rotate the clutch pinion gear clockwise, then check that it turns freely. Try to rotate the clutch pinion gear counterclockwise, then check that it locks.
- If necessary, replace the starter center bearing clutch.

- (b) Check the wear or damage.
 - (1) Inspect the gear teeth on the planetary gear, internal gear and starter clutch for wear or damage.
- If damaged, replace the starter center bearing clutch.



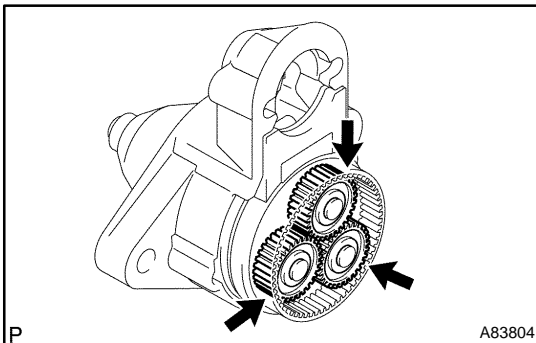
13. INSTALL STARTER DRIVE LEVER SET PIN

- (a) Install the starter drive lever set pin to the starter center bearing clutch as shown in the illustration.



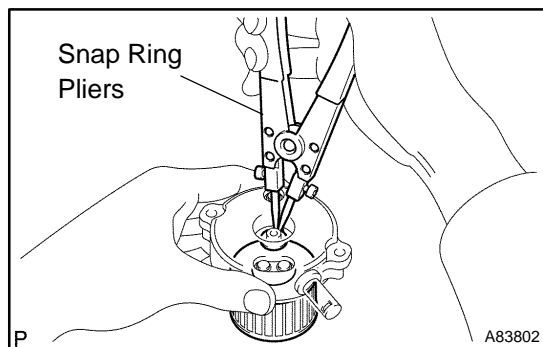
14. INSTALL STARTER CENTER BEARING CLUTCH SUB-ASSY

- (a) Install the starter center bearing clutch together with the starter drive lever set pin to the starter drive housing.

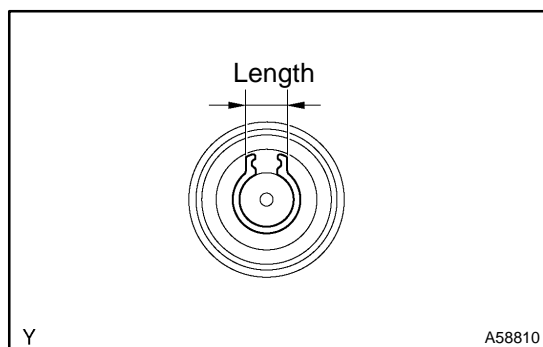


15. INSTALL PLANETARY GEAR

- (a) Apply grease to the planetary gears and pin parts of the planetary shaft.
- (b) Install the 3 planetary gears to the starter center bearing clutch.

**16. INSTALL STARTER ARMATURE ASSY**

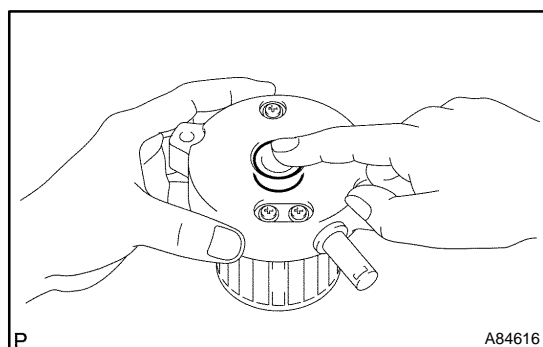
- (a) Apply grease to the washer and the armature shaft.
- (b) Install the starter armature and the washer to the starter commutator end frame.
- (c) Using snap ring pliers, install a new snap ring.



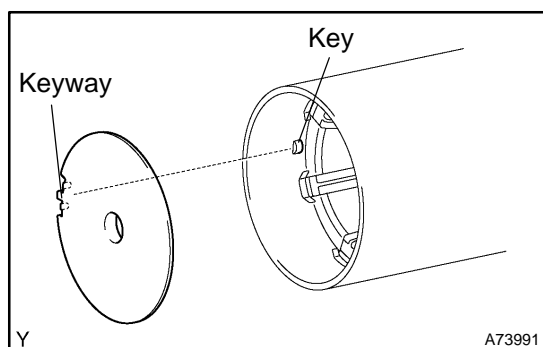
- (d) Check the snap ring length.
 - (1) Using vernier calipers, measure the snap ring length.

Maximum length: 5.0 mm (0.197 in.)

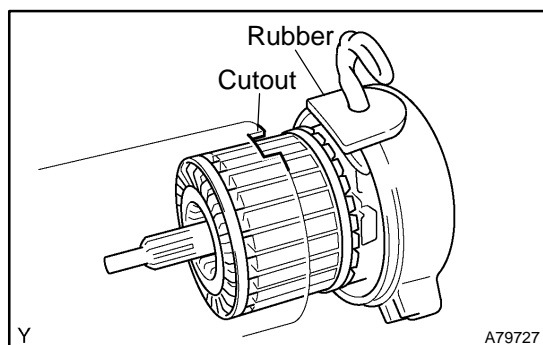
If the length is greater than maximum, replace it with a new snap ring.

**17. INSTALL STARTER COMMUTATOR END FRAME COVER**

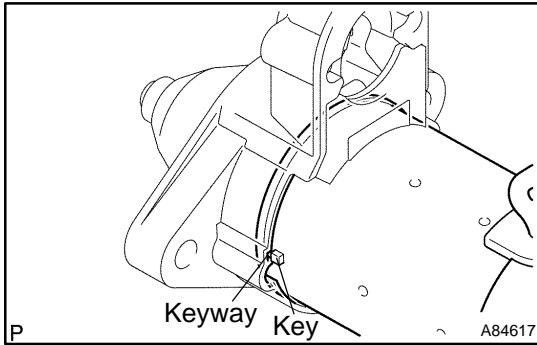
- (a) Install the starter commutator end frame cover to the starter commutator end frame.

**18. INSTALL STARTER ARMATURE PLATE**

- (a) Align the keyway of the starter armature plate with the key inside the starter yoke, then install the armature plate to the starter yoke.

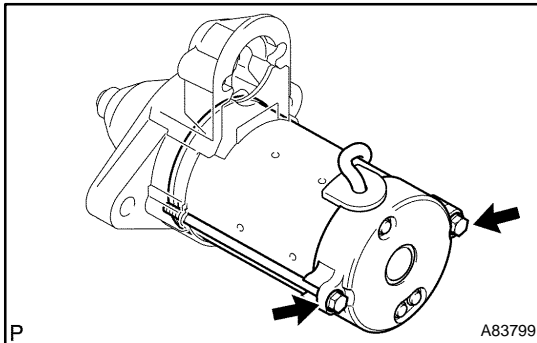
**19. INSTALL STARTER COMMUTATOR END FRAME ASSY**

- (a) Align the rubber with the cutout of the starter yoke, then install the starter commutator end frame to the starter yoke.

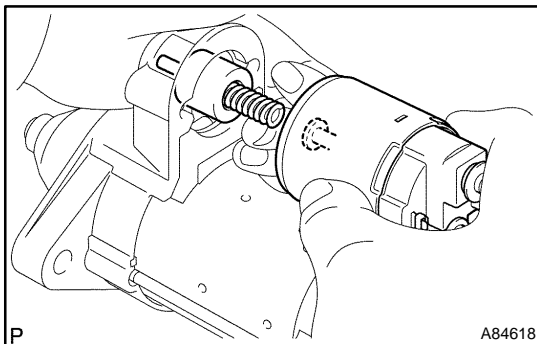


20. INSTALL STARTER YOKE ASSY

- (a) Align the key of the starter yoke with the keyway of the starter drive housing, then install the starter yoke to the starter drive housing.

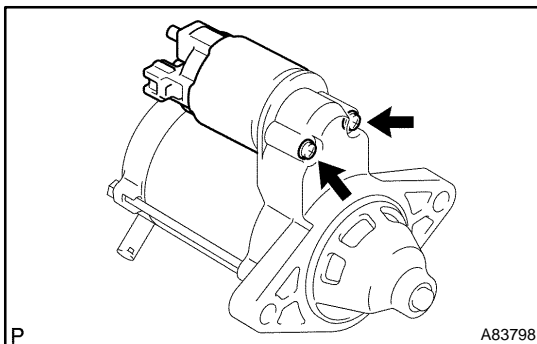


- (b) Tighten the 2 through bolts.
Torque: 6.0 N·m (61 kgf·cm, 53 in·lbf)

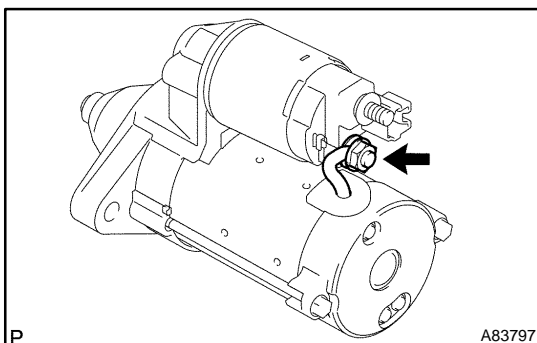


21. INSTALL REPAIR SERVICE STARTER KIT

- (a) Apply grease to the plunger and hook.
(b) Hang the plunger hook of the repair service starter kit to the starter drive lever set pin.
(c) Install the plunger and return spring.



- (d) Install the repair service starter kit with the 2 screws.
Torque: 7.5 N·m (76 kgf·cm, 66 in·lbf)



- (e) Connect the lead wire to terminal C with the nut.
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)

CHARGING SYSTEM

190C8-01

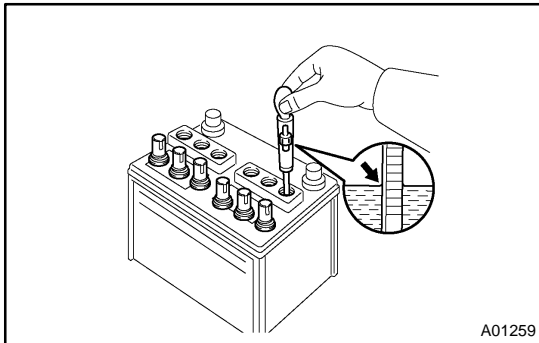
PRECAUTION

1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.
5. Check that the charging cable is tightened on terminal B of the alternator and the fuse box.
6. Do not check whether the alternator generates or not with connecting terminal F to other terminal.

ON-VEHICLE INSPECTION

1. CHECK BATTERY ELECTROLYTE LEVEL

- (a) Check the electrolyte quantity of each cell (Maintenance-Free Battery).
 - (1) If under the lower level, replace the battery (or add distilled water if possible) and check the charging system.
- (b) Check the electrolyte quantity of each cell (Except Maintenance-Free Battery).
 - (1) If under the lower level, add distilled water.

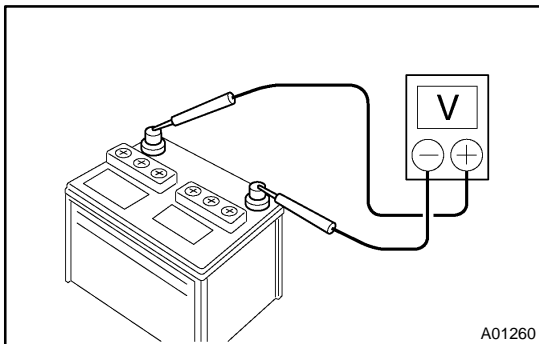


2. CHECK BATTERY SPECIFIC GRAVITY (Except Maintenance-Free Battery)

- (a) Check the specific gravity of each cell.
Standard specific gravity: 1.25 – 1.29 at 20°C (68°F)

HINT:

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



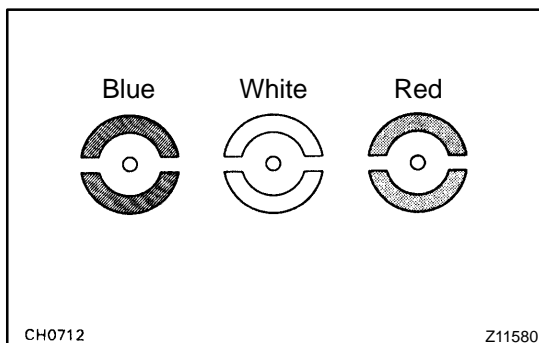
3. CHECK BATTERY VOLTAGE

- (a) After having driven the vehicle and in the case that 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.
- (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)

HINT:

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



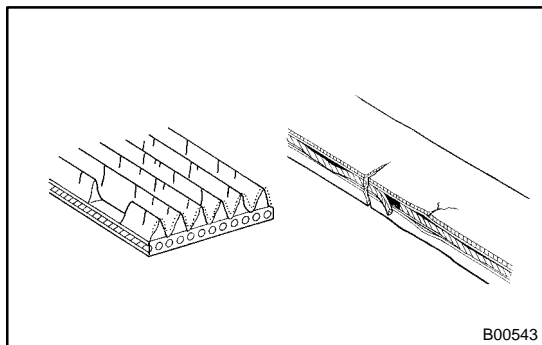
- (d) Check the indicator as shown in the illustration.

HINT:

- Blue: OK
- White: Charging Necessary
- Red: Insufficient Water

4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

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

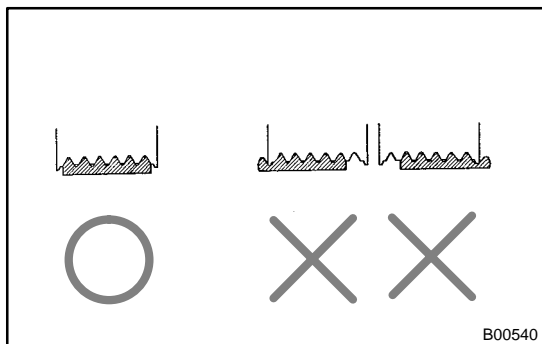


5. INSPECT DRIVE BELT

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

HINT:

- If any defect has been found, replace the drive belt.
- Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



- (b) Check that it fits properly in the ribbed grooves.

HINT:

Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.

6. VISUALLY CHECK ALTERNATOR WIRING

- (a) Check that the wiring is in good condition.

7. LISTEN FOR ABNORMAL NOISES FROM ALTERNATOR

- (a) Check that there is no abnormal noise from the alternator while the engine is running.

8. INSPECT CHARGE WARNING LIGHT CIRCUIT

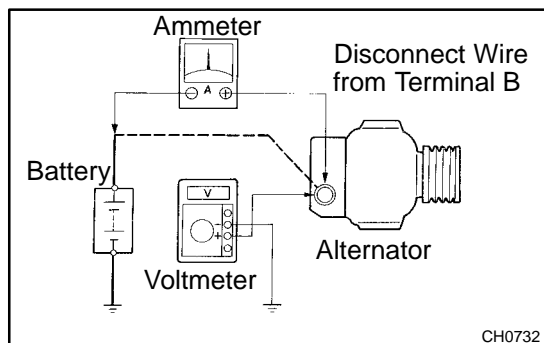
- (a) Turn the ignition switch ON. Check that the charge warning light comes on.
 (b) Start the engine. Check that the light goes off.

HINT:

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

9. INSPECT CHARGING CIRCUIT WITHOUT LOAD

- (a) If a battery/alternator tester is available, connect the tester to the charging circuit as per manufacturer's instructions.



- (b) If a tester is not available, connect a voltmeter to the charging circuit as follows.

- (1) Disconnect 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.

- (c) Check the charging circuit (DENSO made).
 - (1) 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: 12.9 – 14.9 V

10. 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.

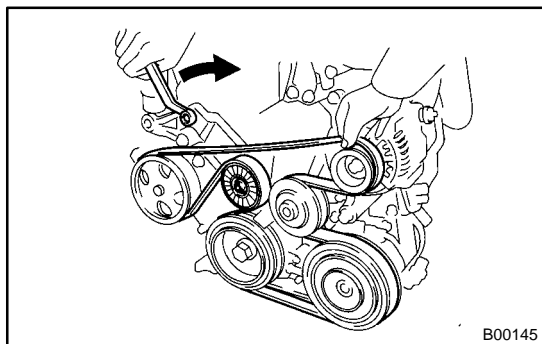
Standard amperage: 30 A or more

HINT:

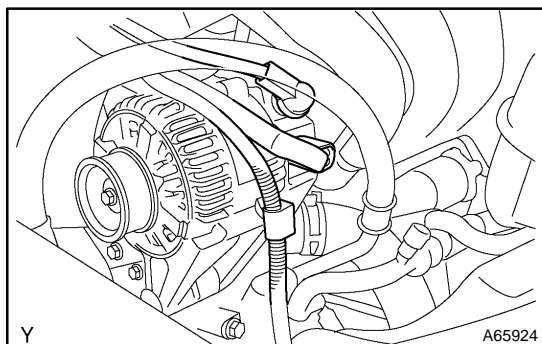
- If the ammeter reading is less than standard amperage, repair the alternator.
- If the battery is fully charged, the indication will sometimes be less than standard amperage.

GENERATOR ASSY REPLACEMENT

1. REMOVE ENGINE UNDER COVER RH

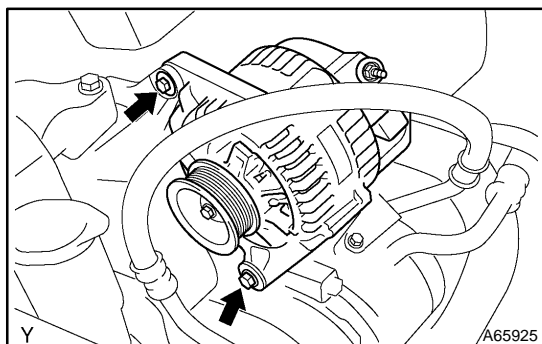


2. REMOVE FAN AND GENERATOR V BELT (See page 14-4)

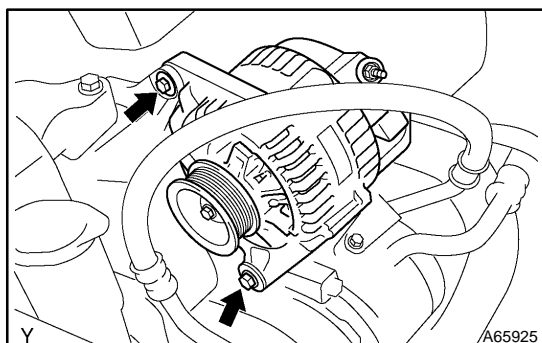


3. REMOVE GENERATOR ASSY

- Disconnect the wire clamp from the wire clip on the recti-fire end frame.
- Remove the rubber cap and nut, and disconnect the alternator wire.
- Disconnect the alternator connector.



- Remove the 2 bolts and alternator.



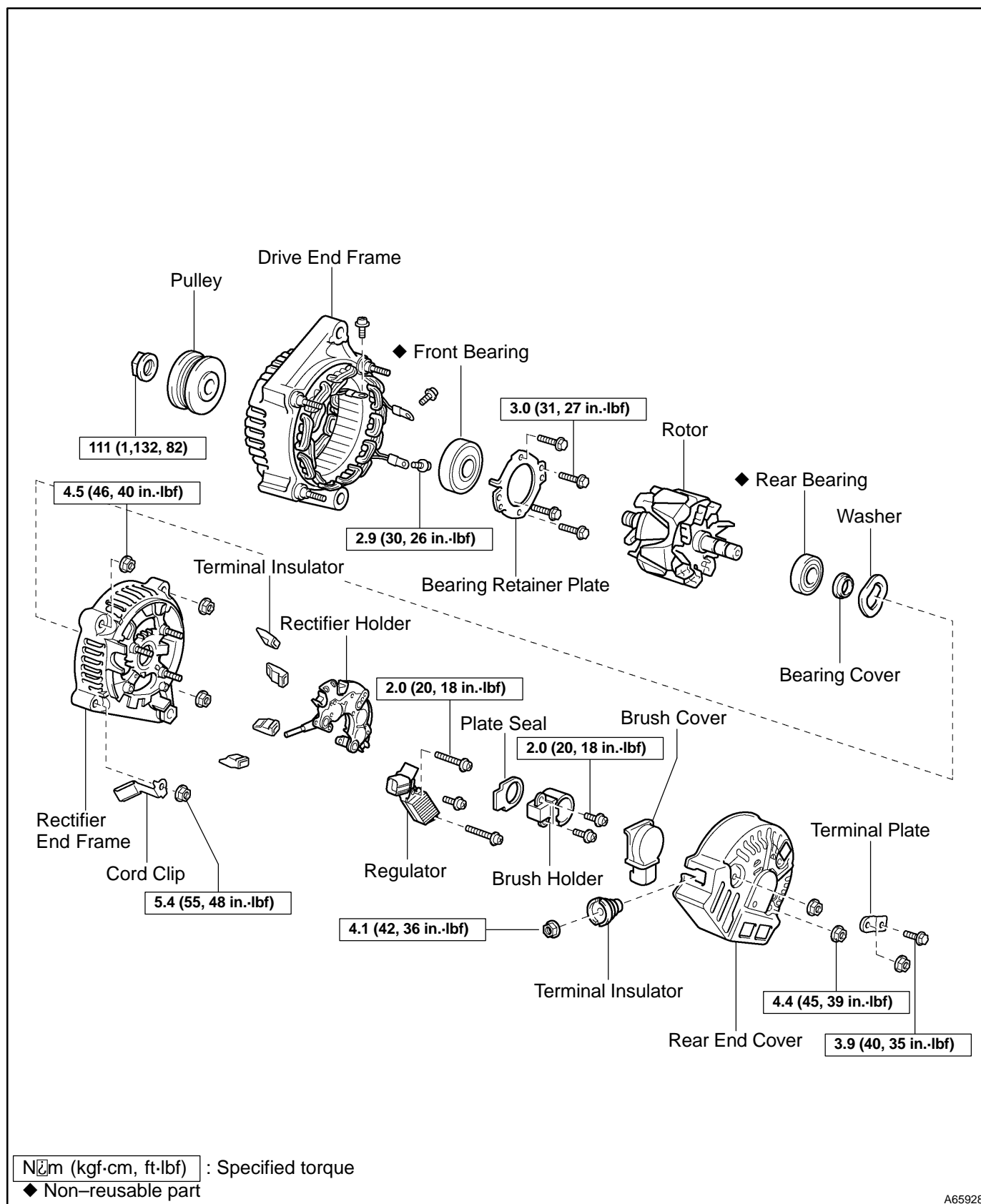
4. INSTALL GENERATOR ASSY

Torque:

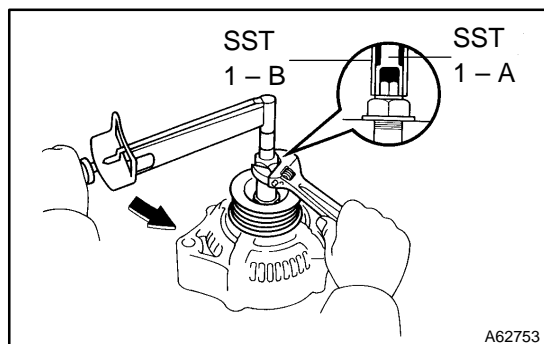
12 mm head 25 N·m (250 kgf·cm, 18 ft·lbf)

14 mm head 54 N·m (550 kgf·cm, 39 ft·lbf)

COMPONENTS



OVERHAUL



1. REMOVE GENERATOR PULLEY

SST 09820-63010 (09820-06010, 09820-06020)

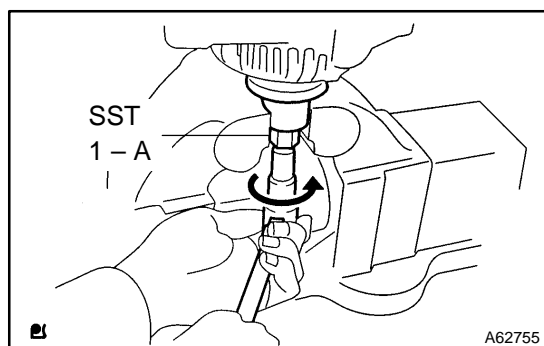
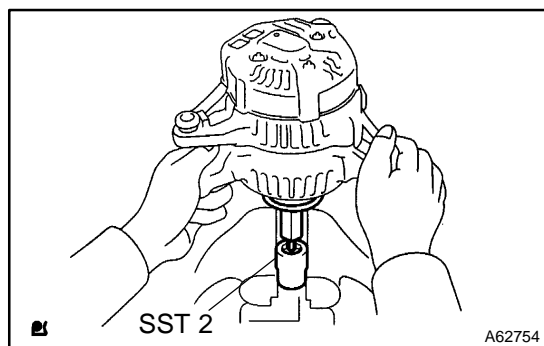
HINT:

SST1 - A, B	09820-06010
SST2	09820-06020

- (a) Hold SST 1 - A with a torque wrench, and tighten SST 1 - B clockwise to the specified torque.

Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)**NOTICE:****Check that SST is secured to the rotor shaft.**

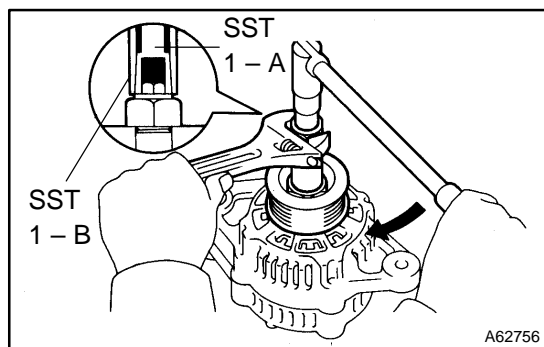
- (b) Mount SST 2 in a vise.
 (c) Insert SST 1 - A, B into SST 2, and attach the pulley nut to SST 2.



- (d) To loosen the pulley nut, turn SST 1 - A in the direction shown in the illustration.

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

- (e) Remove the alternator from SST 2.



- (f) Turn SST 1 - B, and remove SST 1 - A, B.
 (g) Remove the pulley nut and pulley.

2. REMOVE GENERATOR BRUSH HOLDER ASSY

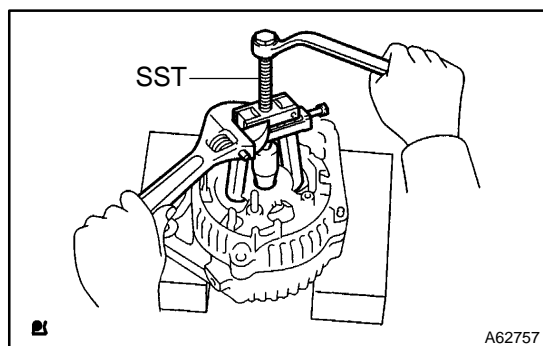
- (a) Remove the nut and terminal insulator.
- (b) Remove the screw, nut and terminal plate.
- (c) Remove the 2 nuts and rear end cover.
- (d) Remove the brush cover from the brush holder.
- (e) Remove the 2 screw and brush holder.
- (f) Remove the plate seal.

3. REMOVE GENERATOR REGULATOR ASSY

- (a) Remove the 3 screws and regulator.

4. REMOVE GENERATOR HOLDER W/RECTIFIER

- (a) Remove the 4 screws and holder w/ rectifier.

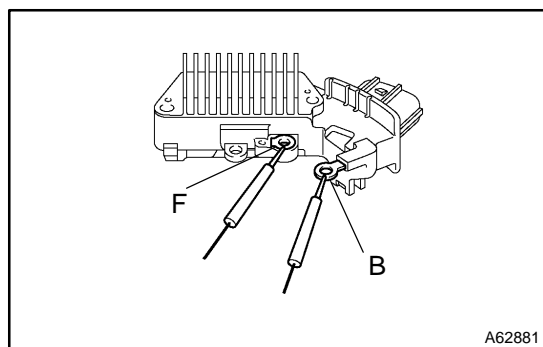
**5. REMOVE GENERATOR RECTIFIER END FRAME**

- (a) Remove the plate seal from the rectifier end frame.
- (b) Remove the 4 terminal insulator, 4 nuts and cord clip.
- (c) Using SST, remove the rectifier end frame.

SST 09286-46011

6. REMOVE GENERATOR ROTOR ASSY

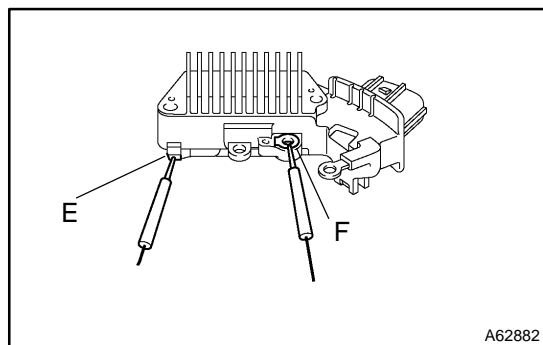
- (a) Remove the washer from the rotor.
- (b) Remove the rotor from drive end frame.

**7. INSPECT GENERATOR REGULATOR ASSY**

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

Standard:

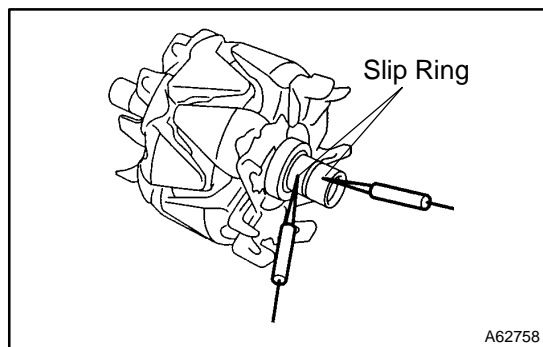
When the positive and negative poles between terminals F and B are exchanged, there is continuity in one way but no continuity in another way.



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

Standard:

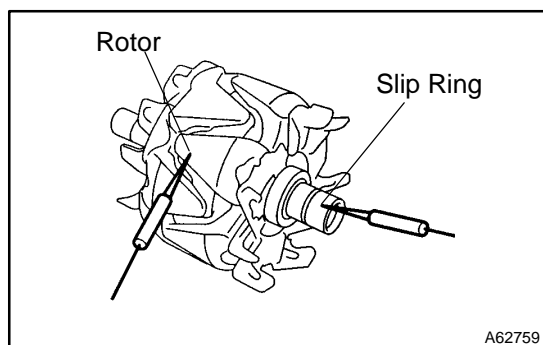
When the positive and negative poles between terminals F and E are exchanged, there is continuity in one way but no continuity in another way.



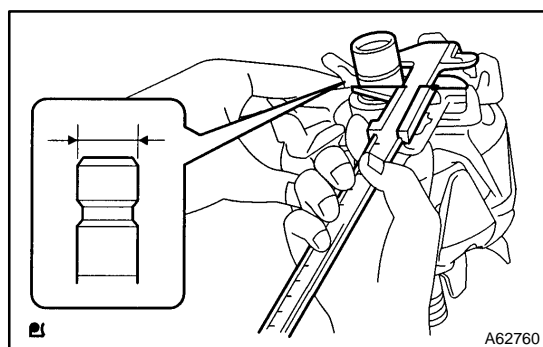
8. INSPECT GENERATOR REGULATOR ASSY

- (a) Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance: 2.1 – 2.5 Ω at 20°C (68°F)



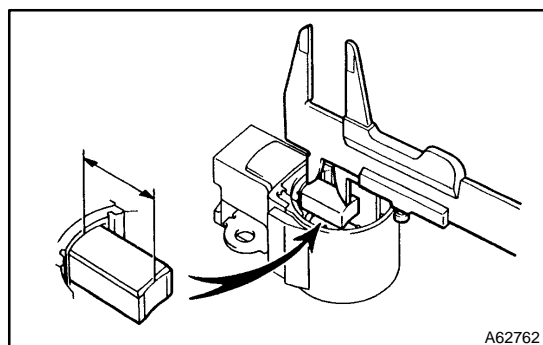
- (b) Using an ohmmeter, check that there is no continuity between the slip ring and rotor.



- (c) Using a vernier calipers, measure the slip ring diameter.

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

Minimum diameter: 12.8 mm (0.504 in.)



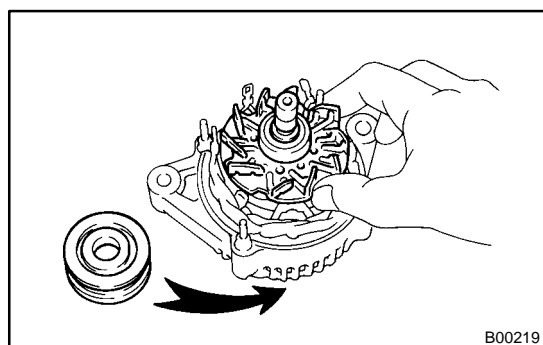
9. INSPECT BRUSH

- (a) Using a vernier calipers, measure the exposed brush length.

Standard exposed length:

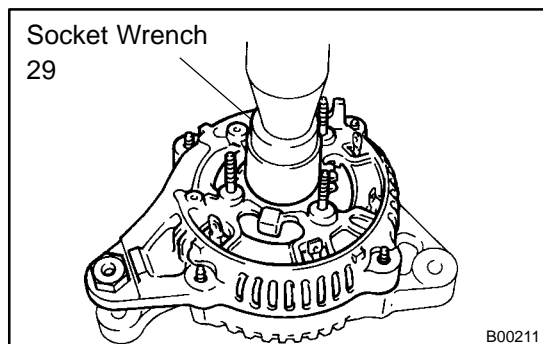
9.5 – 11.5 mm (0.374 – 0.453 in.)

Minimum exposed length: 1.5 mm (0.059 in.)

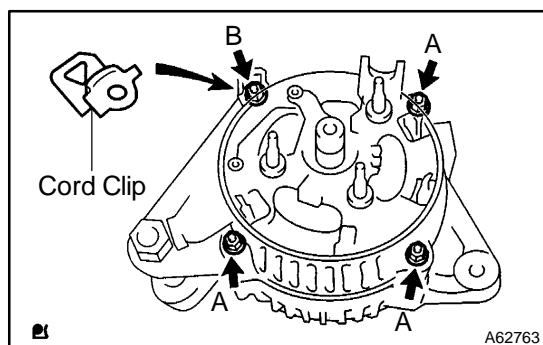


10. INSTALL GENERATOR ROTOR ASSY

- (a) Install the rotor to the drive end frame.
(b) Install the washer on the rotor.



- (c) Using a socket wrench 29 and press, slowly press in the rectifier end frame.



- (d) Install the cord clip and 4 nuts.

Torque:

Nut A 4.5 N·m (46 kgf·cm, 40 in.·lbf)

Nut B 5.4 N·m (55 kgf·cm, 48 in.·lbf)

11. INSTALL GENERATOR HOLDER W/RECTIFIER

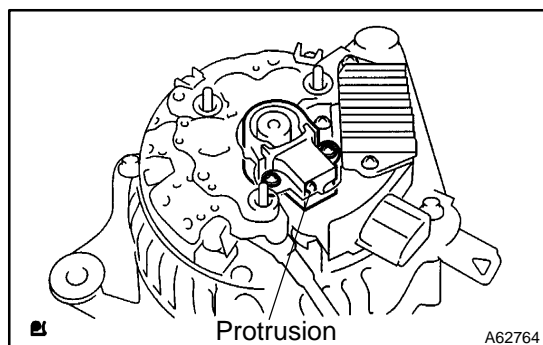
- (a) Install the holder w/ rectifier with 4 screws.

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

12. INSTALL GENERATOR REGULATOR ASSY

- (a) Install the regulator with the 3 screw.

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



13. INSTALL GENERATOR BRUSH HOLDER ASSY

- (a) Place the plate seal on the brush holder.
(b) Install the brush holder with the 2 screws.

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

NOTICE:

Pay attention to the holder installation direction.

- (c) Place the brush cover on the brush holder.
(d) Install the rear end cover with the 2 nuts.
(e) Install the terminal plate with the screw and nut.

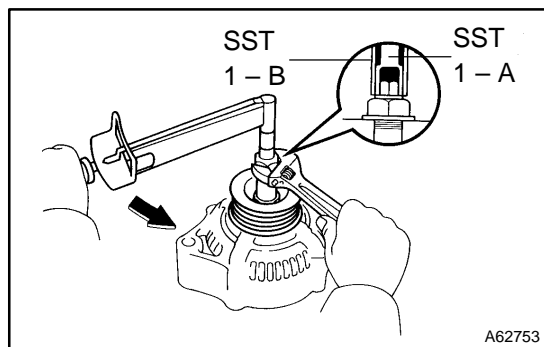
Torque:

Bolt 3.9 N·m (40 kgf·cm, 35 in.·lbf)

Nut 4.4 N·m (45 kgf·cm, 39 in.·lbf)

- (f) Install the terminal insulator with the nut.

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



14. INSTALL GENERATOR PULLEY

SST 09820-63010 (09820-06010, 09820-06020)

HINT:

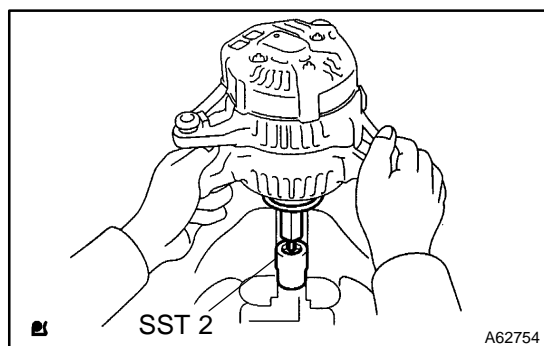
SST1 – A, B	09820-06010
SST2	09820-06020

- Install the pulley to the rotor shaft by tightening the pulley nut by hand.
- Hold SST 1 – A with a torque wrench, and tighten SST 1 – B clockwise to the specified torque.

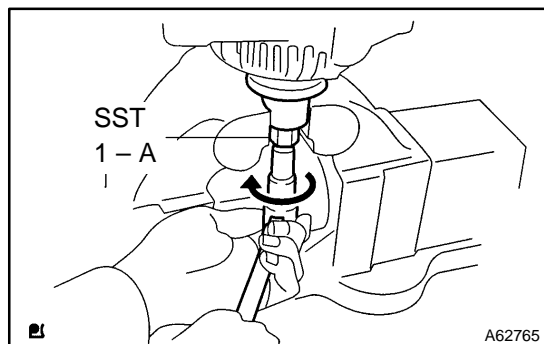
Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)

NOTICE:

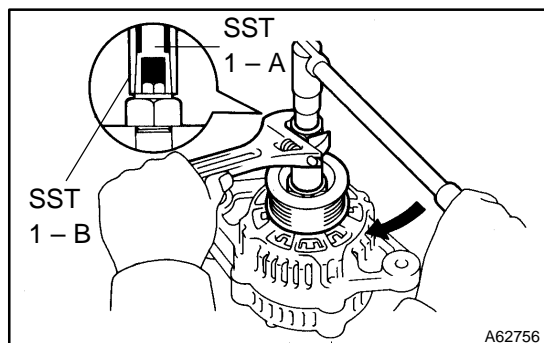
Check that SST is secured to the pulley shaft.



- Mount SST 2 in a vise.
- Insert SST 1 – A, B into SST 2, and attach the pulley nut to SST 2.



- Tighten the pulley nut, turn SST 1 – A in the direction shown in the illustration.
- Torque: 111 N·m (1,132 kgf·cm, 82 ft·lbf)**
- Remove the alternator from SST 2.



- Turn SST 1 – B, and remove SST 1 – A, B.
- Turn the pulley, and check that the pulley moves smoothly.