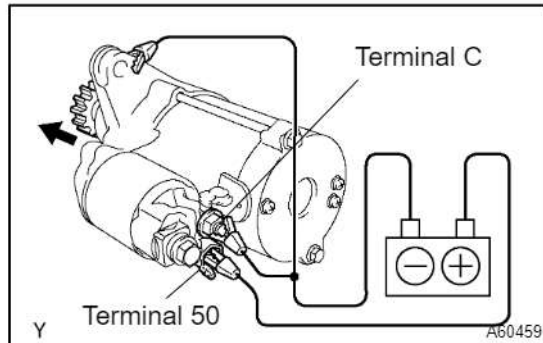


STARTING SYSTEM (2AZ-FE)(From July, 2003)

INSPECTION

190RS-03



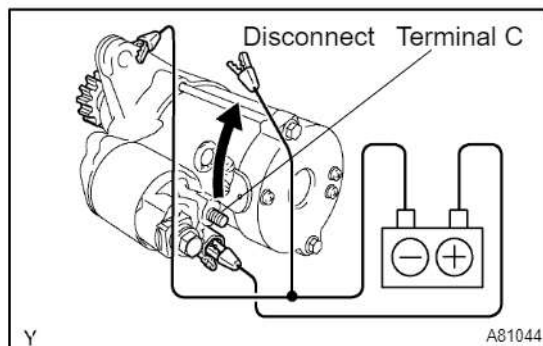
1. INSPECT STARTER ASSY

NOTICE:

These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

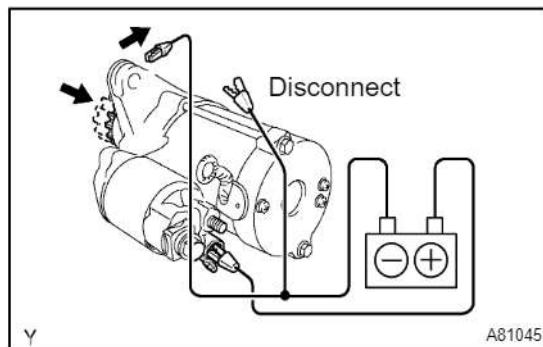
- (a) Do the pull-in test.
 - (1) Disconnect the lead wire from terminal C.
 - (2) Connect the battery to the magnetic switch as shown in the illustration on the left. Check that the clutch pinion gear extends.

If the clutch pinion gear does not move, replace the magnetic switch.



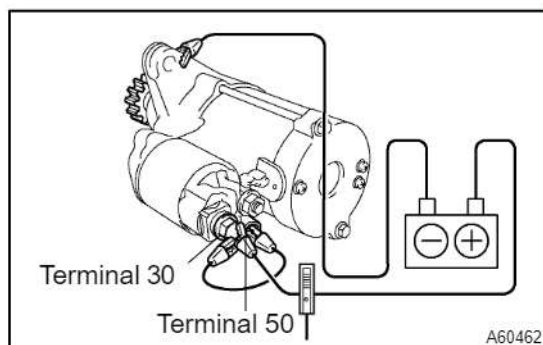
- (b) Do the hold-in test.
 - (1) Leave the battery connections in step (a), but disconnect the negative (-) lead from terminal C. Check that the pinion gear remains extended.

If the clutch pinion gear returns inward, replace the magnetic switch.



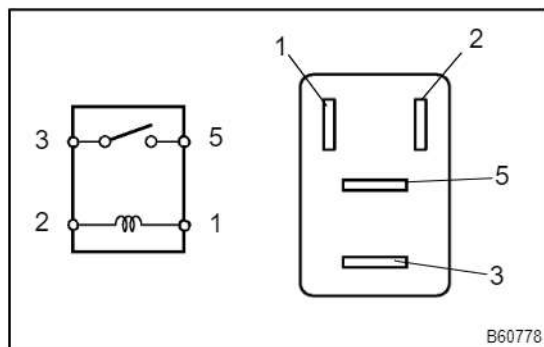
- (c) Check the clutch pinion gear return.
 - (1) Disconnect the negative (-) lead from the switch body. Check that the clutch pinion gear returns.

If the clutch pinion gear does not return, replace the magnetic switch.



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



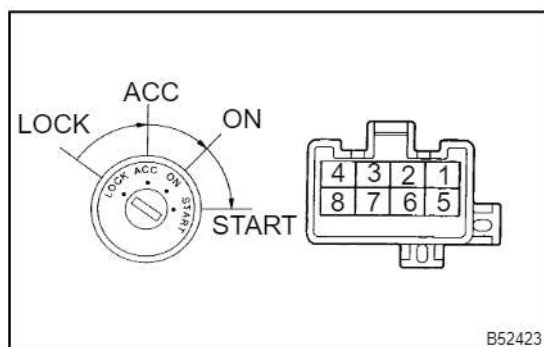
2. INSPECT STARTER RELAY ASSY

- (a) Check the resistance of the ST relay.

Standard:

Tester Connection	Specified Condition
3-5	10 kΩ or higher
3-5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

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



3. INSPECT IGNITION OR STARTER SWITCH ASSY

- (a) Inspect the switch resistance.

Standard:

Tester Connection	Switch Condition	Specified Condition
-	LOCK	10 kΩ or higher
2-3	ACC	Below 1 Ω
2-3 2-4 6-7	ON	Below 1 Ω
1-2 1-4 6-7 6-8	START	Below 1 Ω

If the result is not as specified, replace the switch assy.

CHARGING SYSTEM (2AZ-FE)(From July, 2003)

19020-05

PRECAUTION

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.
- Check that the charging cable is tightened on terminal **B** of the generator and the fuse box.

ON-VEHICLE INSPECTION

1. CHECK BATTERY CONDITION

- (a) Check the battery for damage and deformation. If severe damage, deformation or leakage is found, replace the battery.

- (b) Check the electrolyte quantity of each cell.

For batteries that are maintenance-free:

If the electrolyte quantity is below the recommended amount, replace the battery.

For batteries that are not maintenance-free:

If the electrolyte quantity is below the recommended amount, add distilled water.

CAUTION:

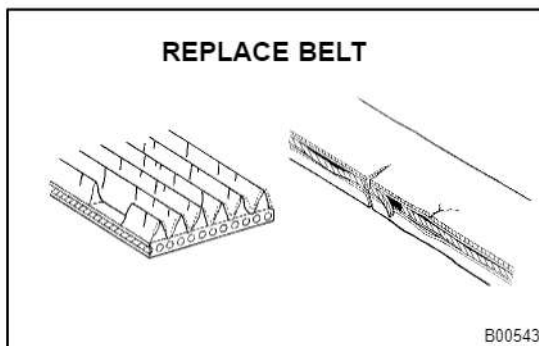
If the battery has gone flat or if the engine cannot be started easily, the engine may not be recovered properly. Recharge the battery and perform inspections again before returning the vehicle to the customer.

2. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

- (a) Check that the battery terminals are not loose or corroded.

If the terminals are corroded, clean the terminals.

- (b) Check the fusible link, high-current fuses and fuses for continuity.



3. INSPECT DRIVE BELT

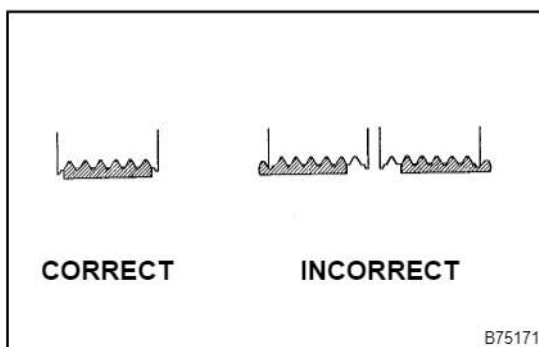
- (a) Check the belt for wear, cracks and other signs of damage.

If any defect is found, replace the drive belt.

HINT:

Replace the drive belt if the following defects are found:

- If the belt has worn out until the wire can be seen.
- If the cracks reach the wire more than one place.
- If the belt has chunks missing from the ribs.



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

HINT:

With your hand, confirm that the belt has not slipped out of the groove on the bottom of the pulley.

4. VISUALLY CHECK GENERATOR WIRING

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

5. LISTEN FOR ABNORMAL NOISES FROM GENERATOR

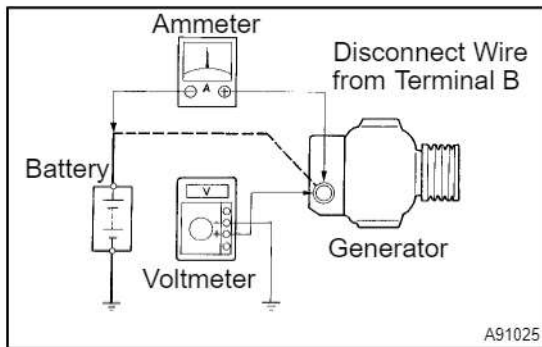
- (a) Check that there is no abnormal noise from the generator while the engine is running.

6. INSPECT CHARGE WARNING LAMP CIRCUIT

- (a) Turn the ignition switch ON. Check that the charge warning lamp turns on.

- (b) Start the engine and check that the lamp turns off.

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



7. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT:

If a battery/generator tester is available, connect the tester to the charging circuit according to the manufacturer's instructions.

- (a) If a tester is not available, connect a voltmeter to the charging circuit as follows.
 - (1) Disconnect the wire from terminal B of the generator and connect it to the negative (-) lead of the ammeter.
 - (2) Connect the positive (+) lead of the ammeter to terminal B of the generator.
 - (3) Connect the positive (+) lead of the voltmeter to terminal B of the generator.
 - (4) Ground the negative (-) lead of the voltmeter.
- (b) Check the charging circuit.
 - (1) Keep the engine speed at 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage: 10 A or less

Standard voltage: 13.2 to 14.8 V

8. INSPECT CHARGING CIRCUIT WITH LOAD

- (a) With the engine running at 2,000 rpm, turn on the high-beam headlamps and turn the heater blower switch to the HI position.
- (b) Check the reading on the ammeter.

Standard amperage: 30 A or more

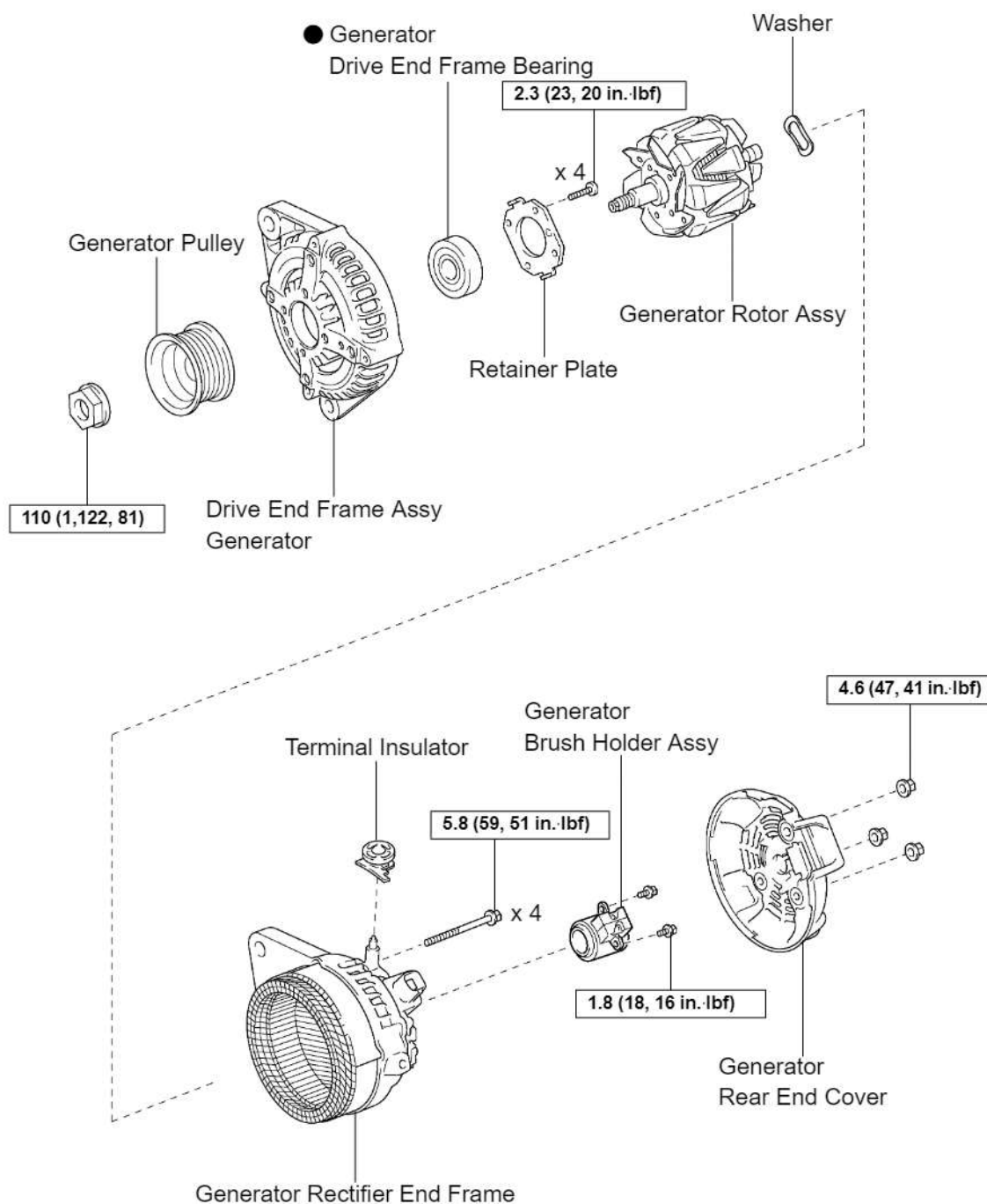
HINT:

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

GENERATOR ASSY (2AZ-FE)(From July, 2003)

COMPONENTS

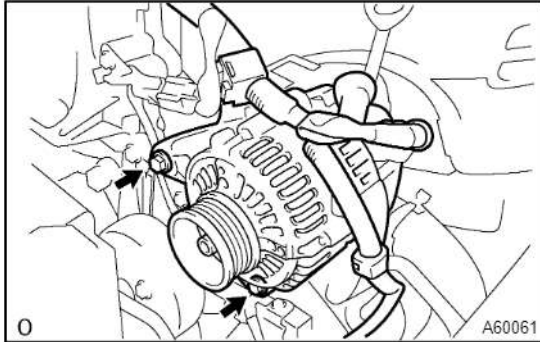
190SD-02



A90290

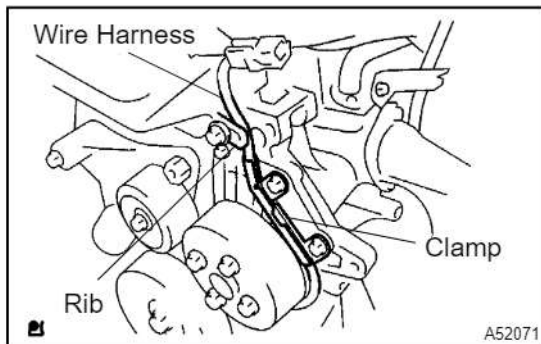
REPLACEMENT

1. REMOVE DRIVE BELT (See page 14-5)



2. REMOVE GENERATOR ASSY

- Disconnect the engine wire as shown in the illustration.
- Remove the 2 bolts and generator.



3. INSTALL GENERATOR ASSY

- Confirm that the wire harness of the crankshaft position sensor is placed as shown in the illustration.
- Install the generator.

Torque:

21 N·m (214 kgf·cm, 15 ft·lbf) for M8

52 N·m (530 kgf·cm, 38 ft·lbf) for M10

9 N·m (92 kgf·cm, 80 in·lbf) for wiring harness clamp

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

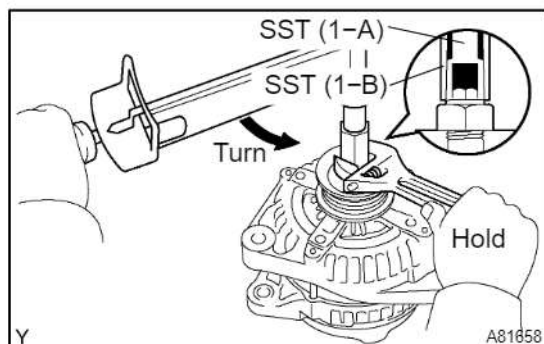
NOTICE:

Be careful not to put the wire harness in when install the generator.

4. INSTALL DRIVE BELT (See page 14-5)

5. INSPECT DRIVE BELT (See page 19-14)

OVERHAUL



1. REMOVE GENERATOR PULLEY

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

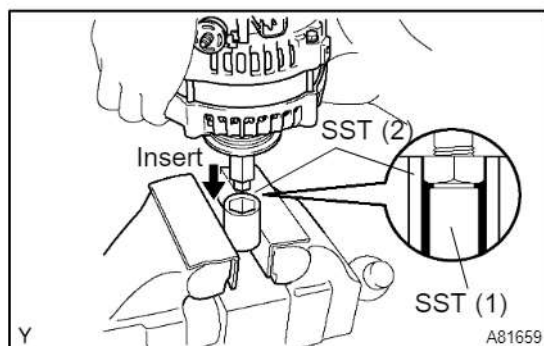
HINT:

SST (1-A, B)	09820-06010
SST (2)	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 (400 kgf·cm, 29 ft·lbf)**NOTICE:****Check that SST is secured to the rotor shaft.**

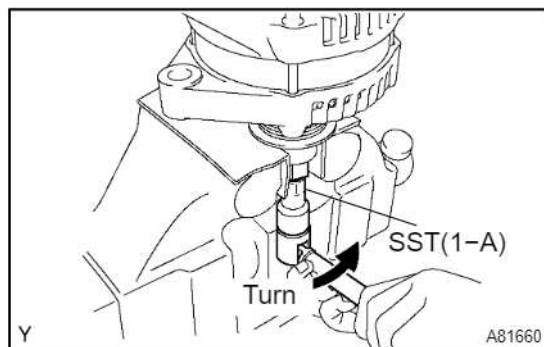
- (b) Clamp SST (2) in a vise.
 (c) Insert SST (1-A, B) into SST (2), and attach the pulley nut to SST (2).



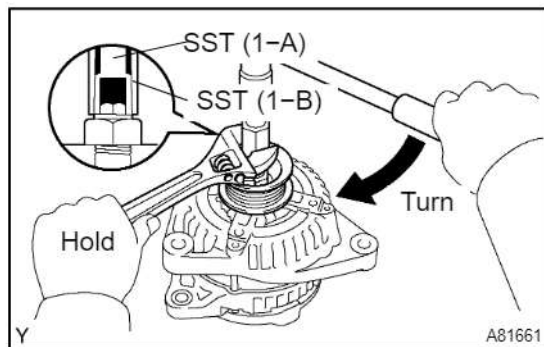
- (d) To loosen the pulley nut, turn SST (1-A) in the direction shown in the illustration.

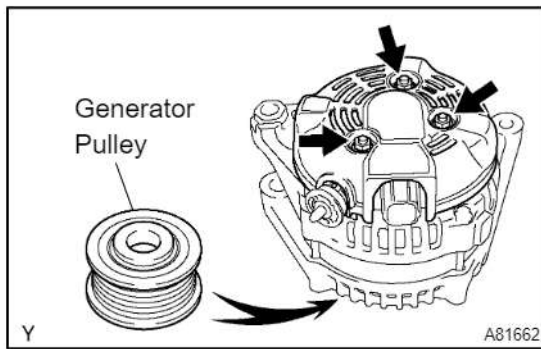
NOTICE:**To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half turn.**

- (e) Remove the generator from SST (2).



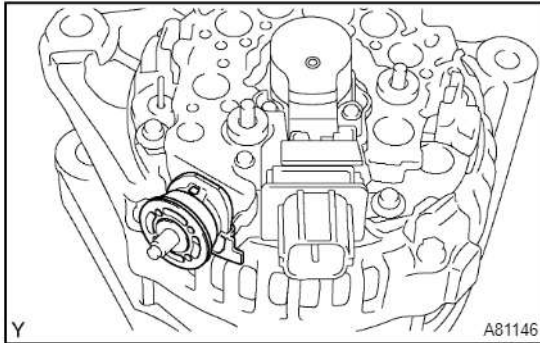
- (f) Turn SST (1-B) and remove SST (1-A, B).
 (g) Remove the pulley nut and generator pulley.





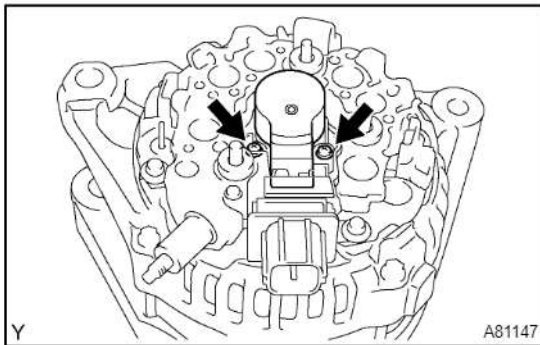
2. REMOVE GENERATOR REAR END COVER

- (a) Place the generator on the generator pulley.
- (b) Remove the 3 nuts and the generator rear end cover.



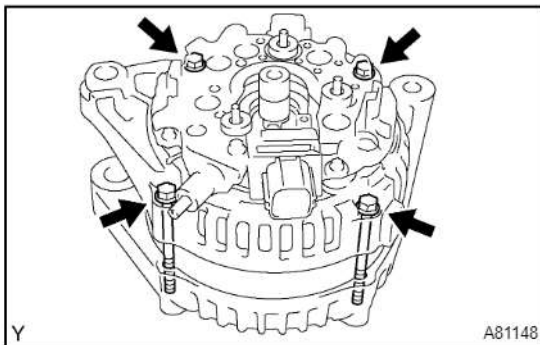
3. REMOVE TERMINAL INSULATOR

- (a) Remove the terminal insulator from the generator rectifier end frame.



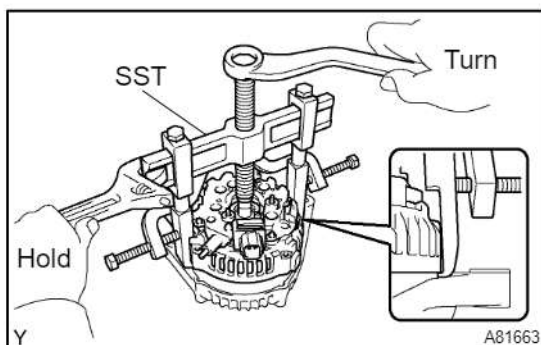
4. REMOVE GENERATOR BRUSH HOLDER ASSY

- (a) Remove the 2 screws and the generator brush holder.

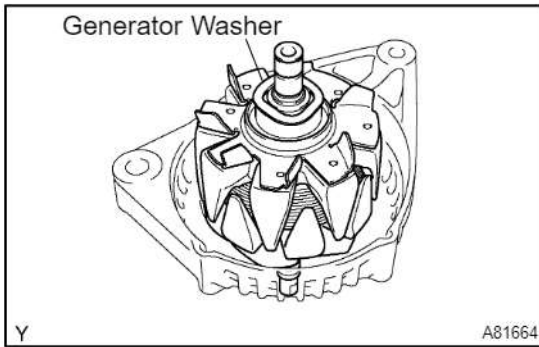


5. REMOVE GENERATOR COIL ASSY

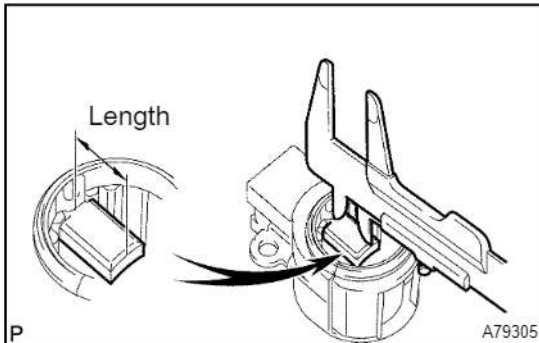
- (a) Remove the 4 bolts.



- (b) Using SST, remove the generator rectifier end frame.
 SST 09950-40011 (09951-04020, 09952-04010, 09953-04020, 09954-04010, 09955-04071, 09957-04010, 09958-04011)

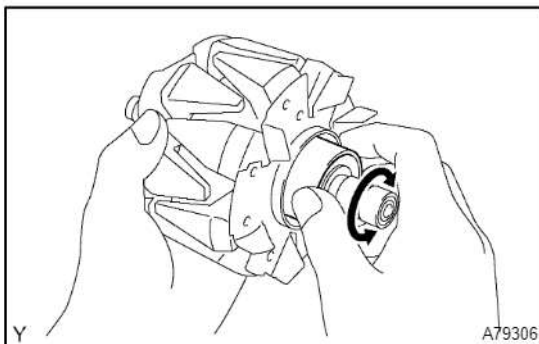
**6. REMOVE GENERATOR ROTOR ASSY**

- (a) Remove the generator washer and the generator rotor.

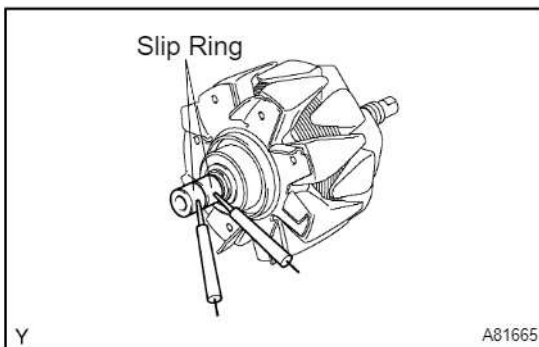
**7. INSPECT GENERATOR BRUSH HOLDER ASSY**

- (a) Check the brush length.
- (1) Using a vernier caliper, measure the exposed brush length.
- Specified brush length: 4.5 to 10.5 mm (0.177 to 0.413 in.)**

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

**8. INSPECT GENERATOR ROTOR ASSY**

- (a) Check the bearing is not rough or worn.
- If necessary, replace the generator rotor.

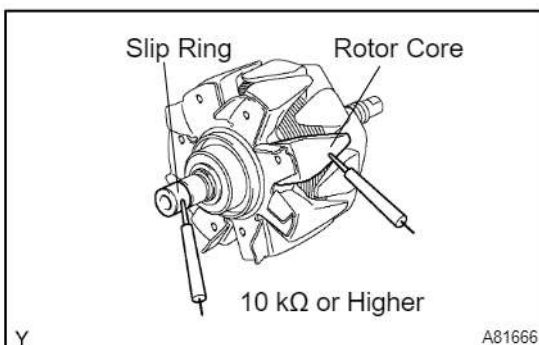


- (b) Check the rotor for open circuit.

- (1) Using an ohmmeter, measure the resistance between the slip ring.

Standard: 2.3 to 2.7 Ω at 20°C (68°F)

If the resistance is not as specified, replace the generator rotor.



- (c) Check the rotor for ground.

- (1) Using an ohmmeter, check the resistance between the slip ring and the rotor core.

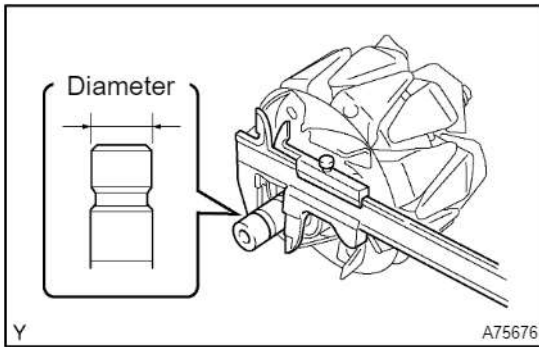
Standard: 10 k Ω or higher

If the resistance is not as specified, replace the generator rotor.

- (d) Inspect slip rings.

- (1) Check that the slip rings are not rough or scored.

If rough or scored, replace the generator rotor.

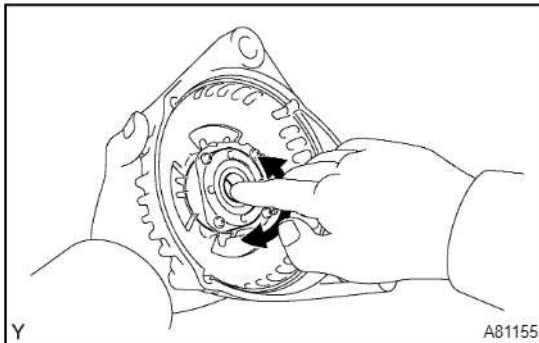


(e) Check the slip ring diameter.

(1) Using a vernier caliper, measure the slip ring diameter.

Specified diameter: 14.0 to 14.4 mm (0.551 to 0.567 in.)

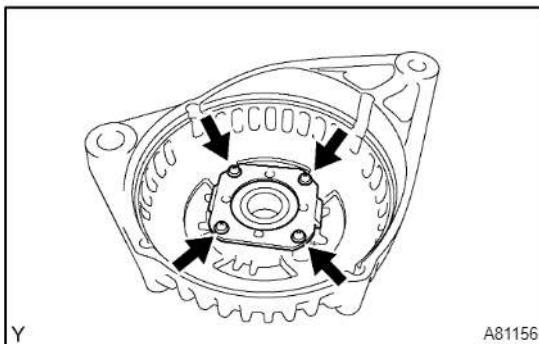
If the diameter is less than minimum, replace the generator rotor.



9. INSPECT GENERATOR DRIVE END FRAME BEARING

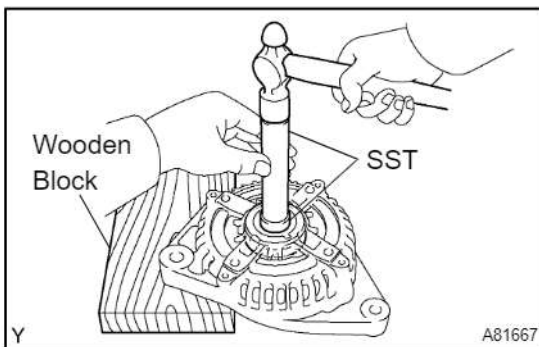
(a) Check the bearing is not rough or worn.

If necessary, replace the bearing.



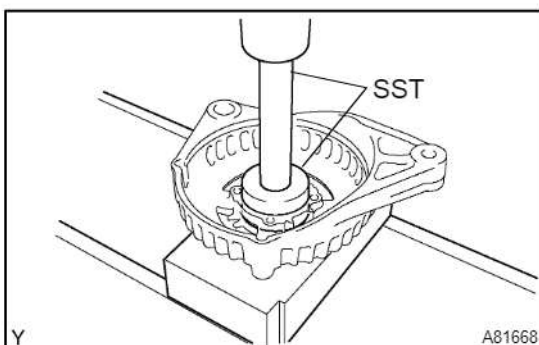
10. REMOVE GENERATOR DRIVE END FRAME BEARING

(a) Remove the 4 screws and the retainer plate.



(b) Using SST, tap out the bearing.

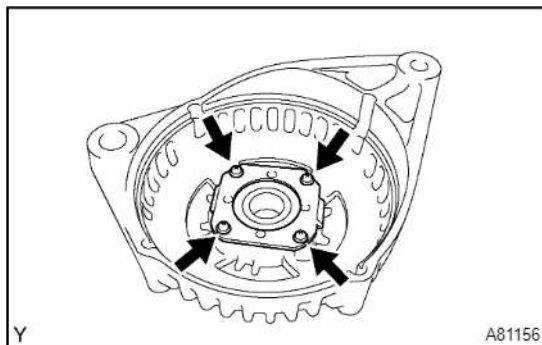
SST 09950-60010 (09951-00250), 09950-70010 (09951-07100)



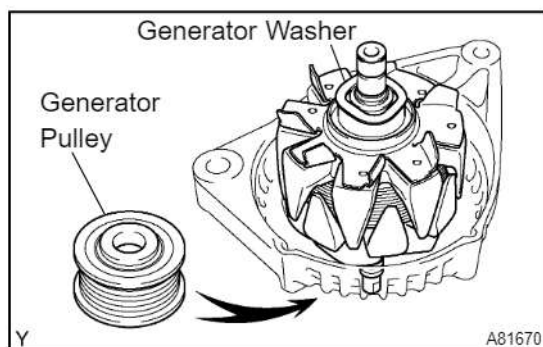
11. INSTALL GENERATOR DRIVE END FRAME BEARING

(a) Using SST and a press, press in a new bearing.

SST 09950-60010 (09951-00470), 09950-70010 (09951-07100)

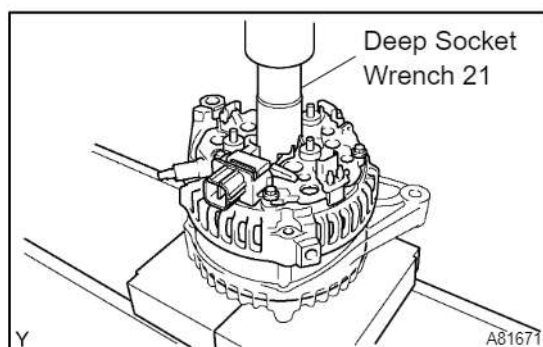


- (b) Install the retainer plate with the 4 screws.
Torque: 2.3 N·m (23 kgf·cm, 20 in·lbf)



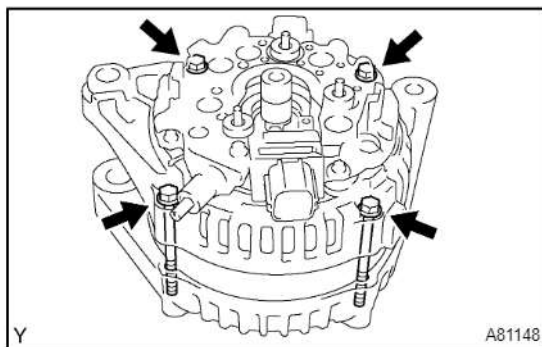
12. INSTALL GENERATOR ROTOR ASSY

- (a) Place the generator drive end frame on the generator pulley.
(b) Install the generator rotor and the generator washer.

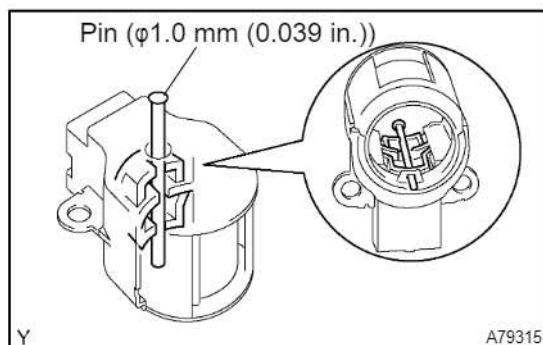


13. INSTALL GENERATOR COIL ASSY

- (a) Using a deep socket wrench 21 and a press, press in the generator rectifier end frame carefully.

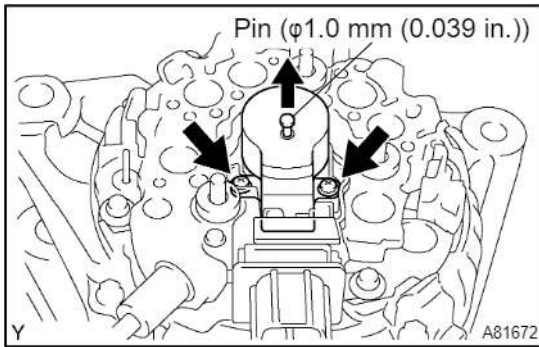


- (b) Tighten the 4 bolts.
Torque: 5.8 N·m (59 kgf·cm, 51 in·lbf)

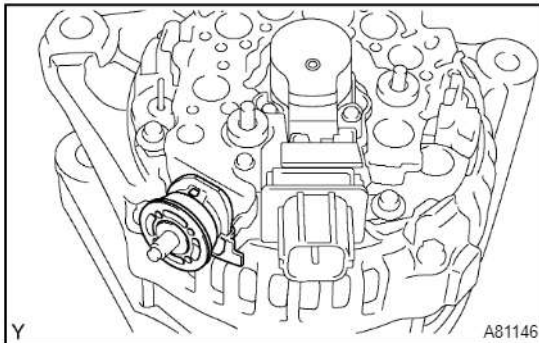


14. INSTALL GENERATOR BRUSH HOLDER ASSY

- (a) While pushing the 2 brushes to inside the brush holder, insert a pin (φ1.0 mm (0.039 in.)) into the brush holder hole.



- (b) Install the generator brush holder with the 2 screws.
Torque: 1.8 N·m (18 kgf·cm, 16 in.·lbf)
- (c) Pull out the pin (φ1.0 mm (0.039 in.)) from the generator brush holder.

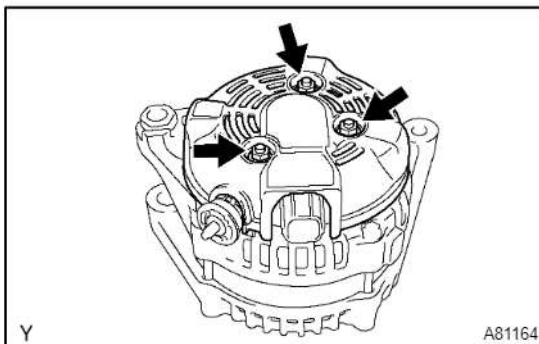


15. INSTALL TERMINAL INSULATOR

- (a) Install the terminal insulator to the generator rectifier end frame.

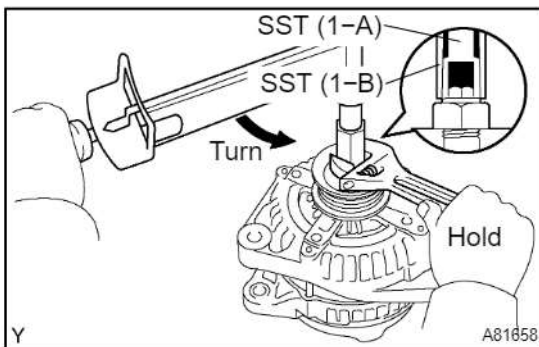
NOTICE:

Pay attention the mounting orientation of the terminal insulator.



16. INSTALL GENERATOR REAR END COVER

- (a) Install the generator rear end cover with the 3 nuts.
Torque: 4.6 N·m (47 kgf·cm, 41 in.·lbf)



17. INSTALL GENERATOR PULLEY

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

HINT:

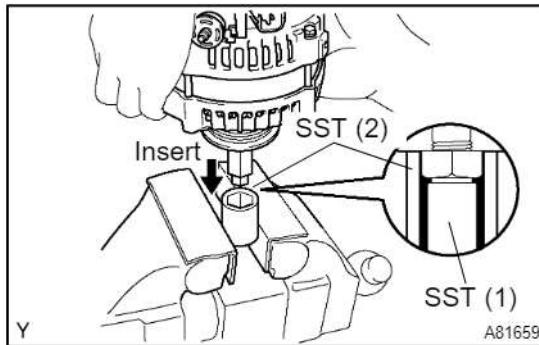
SST (1-A, B)	09820-06010
SST (2)	09820-06020

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

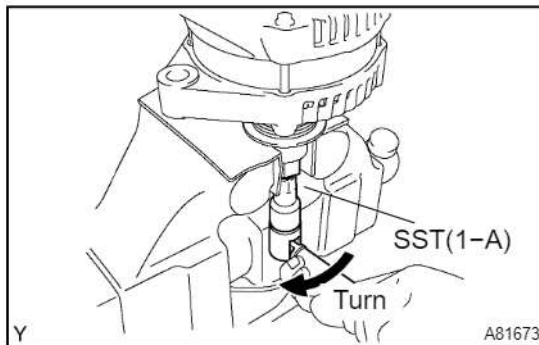
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

NOTICE:

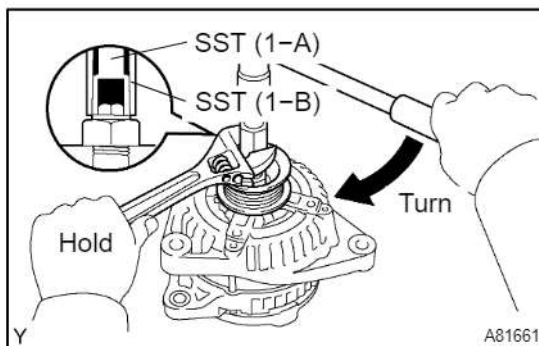
Check that SST is secured to the rotor shaft.



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



- (e) Tighten the pulley nut by turning SST (1-A) in the direction shown in the illustration.
Torque: 111 N·m (1,125 kgf·cm, 81 ft·lbf)
- (f) Remove the generator from SST (2).

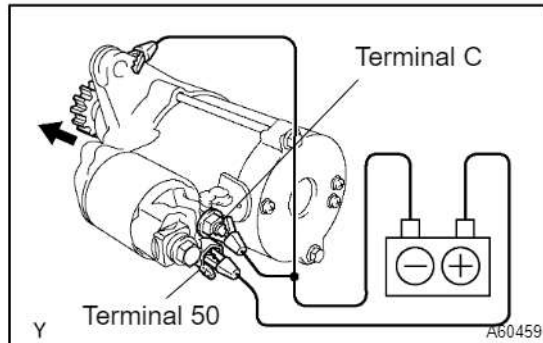


- (g) Turn SST (1-B), and remove SST (1-A, B).
- (h) Turn the generator pulley and check that the generator pulley moves smoothly.

STARTING SYSTEM (1MZ-FE/3MZ-FE)

INSPECTION

190SS-02



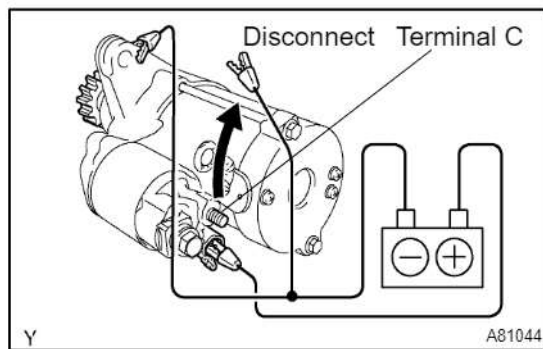
1. INSPECT STARTER ASSY

NOTICE:

These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

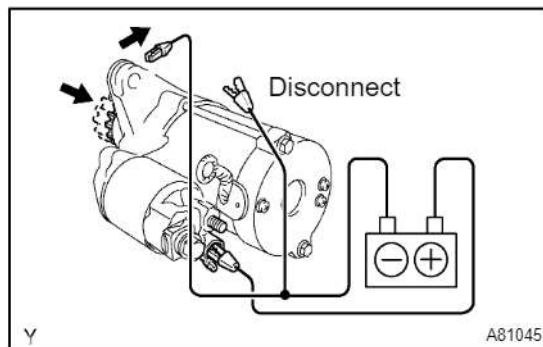
- (a) Do the pull-in test.
 - (1) Disconnect the lead wire from terminal C.
 - (2) Connect the battery to the magnetic switch as shown in the illustration on the left. Check that the clutch pinion gear extends.

If the clutch pinion gear does not move, replace the magnetic switch.



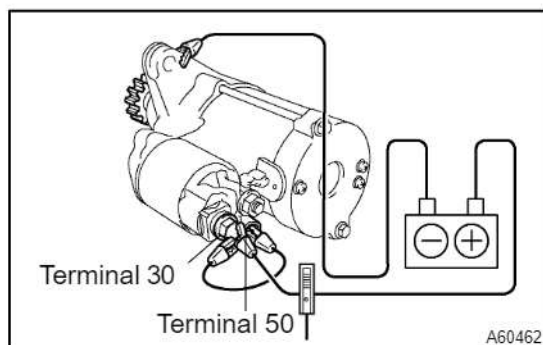
- (b) Do the hold-in test.
 - (1) Maintain the battery connections in step (a), but disconnect the negative (-) lead from terminal C. Check that the pinion gear remains extended.

If the clutch pinion gear returns inward, replace the magnetic switch.



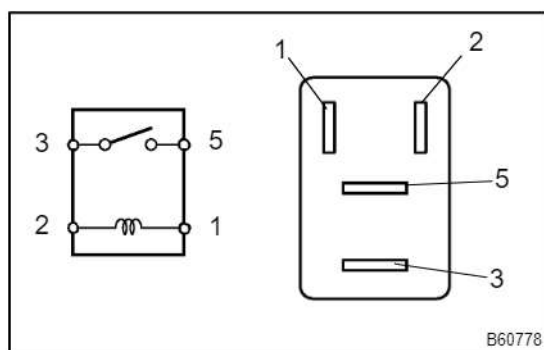
- (c) Check the clutch pinion gear return.
 - (1) Disconnect the negative (-) lead from the switch body. Check that the clutch pinion gear returns.

If the clutch pinion gear does not return, replace the magnetic switch.



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



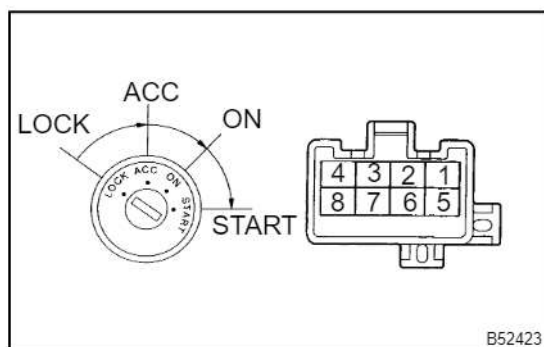
2. INSPECT STARTER RELAY ASSY

- (a) Check the resistance of the ST relay.

Standard:

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

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



3. INSPECT IGNITION OR STARTER SWITCH ASSY

- (a) Inspect the switch resistance.

Standard:

Tester Connection	Switch Condition	Specified Condition
-	LOCK	10 kΩ or higher
2 - 3	ACC	Below 1 Ω
2 - 3 2 - 4 6 - 7	ON	Below 1 Ω
1 - 2 1 - 4 6 - 7 6 - 8	START	Below 1 Ω

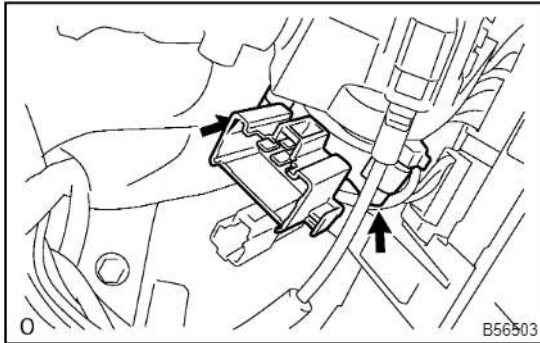
If the result is not as specified, replace the switch assy.

IGNITION OR STARTER SWITCH ASSY (1MZ-FE/3MZ-FE) REPLACEMENT

190SQ-03

The installation procedures are the removal procedures in reverse order.

1. REMOVE DISCONNECT BATTERY NEGATIVE TERMINAL
2. REMOVE INSTRUMENT PANEL SUB-ASSY UPPER (See page 71-16)

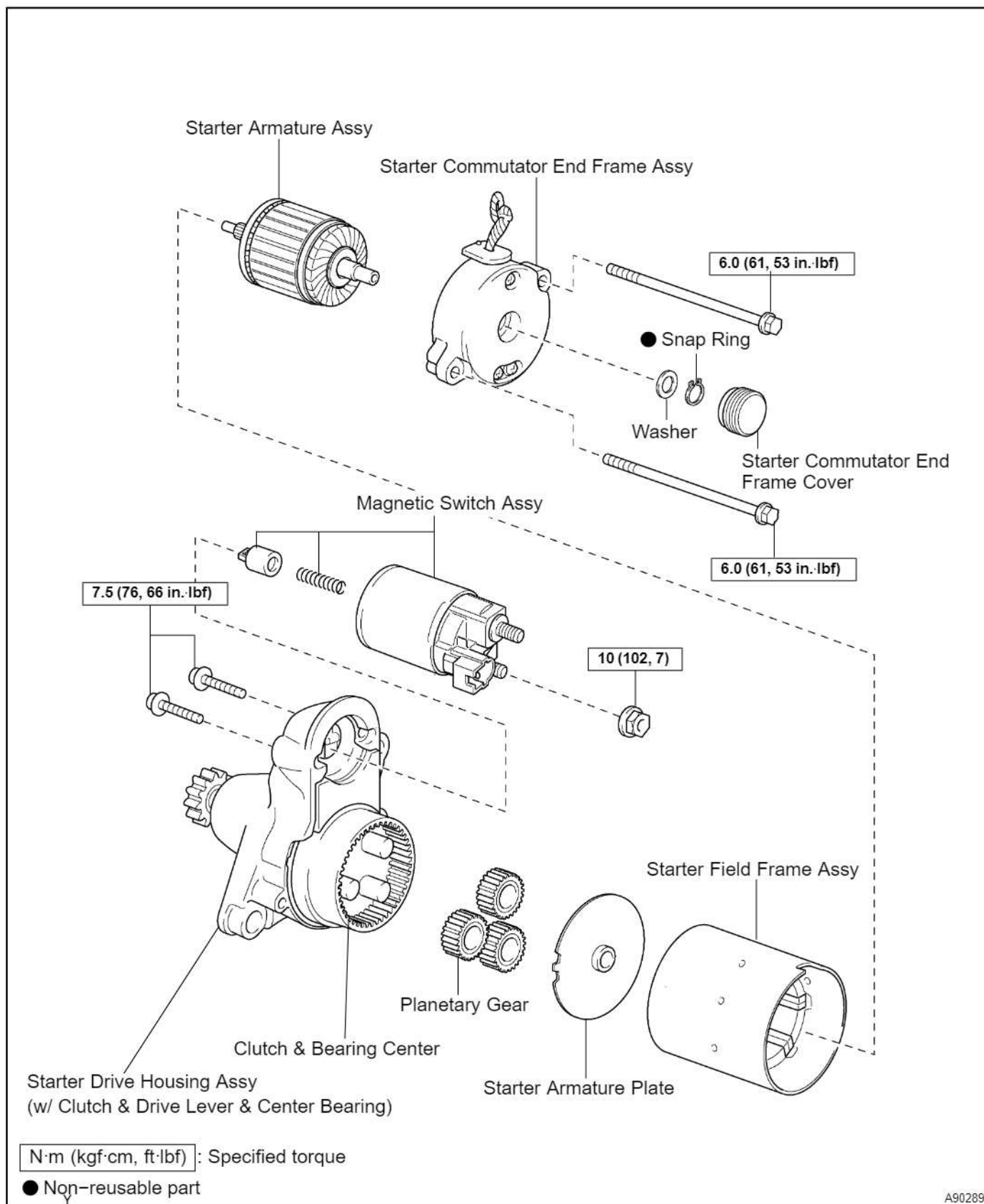


3. REMOVE IGNITION OR STARTER SWITCH ASSY
 - (a) Disconnect the ignition switch connector and unlock warning switch connector.
 - (b) Remove the clamp.
 - (c) Remove the 2 screws and ignition switch.

STARTER ASSY (1MZ-FE/3MZ-FE)

COMPONENTS

190ST-02



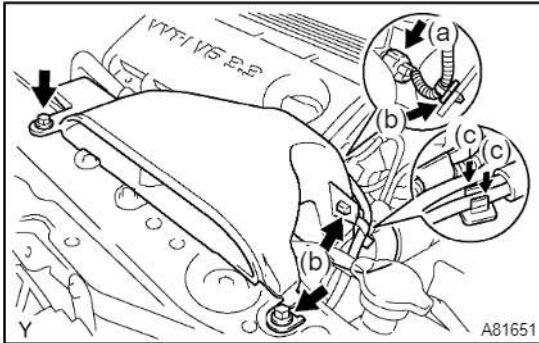
A90289

REPLACEMENT

NOTICE:

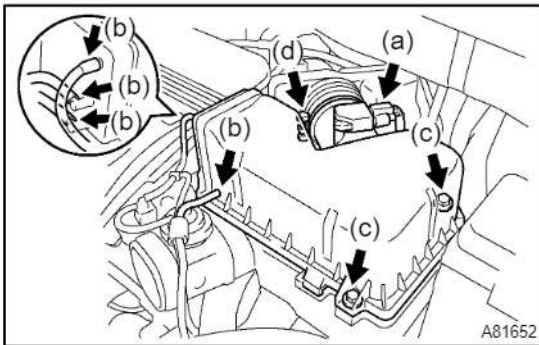
Before changing the starter, check these items again:

- Connector connection
 - Accessory installation
1. REMOVE BATTERY
 2. REMOVE BATTERY TRAY



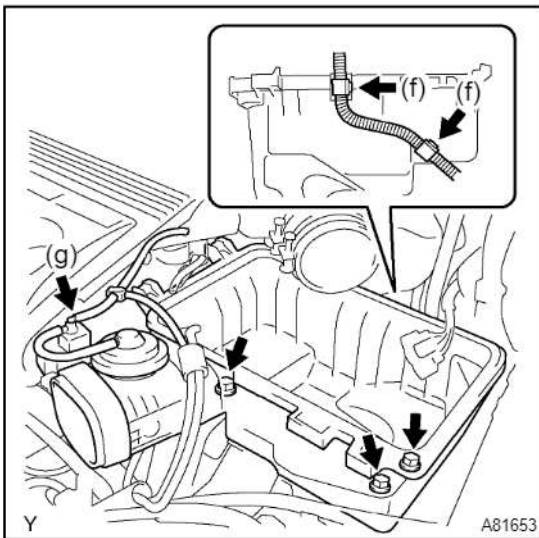
3. REMOVE AIR CLEANER INLET ASSY

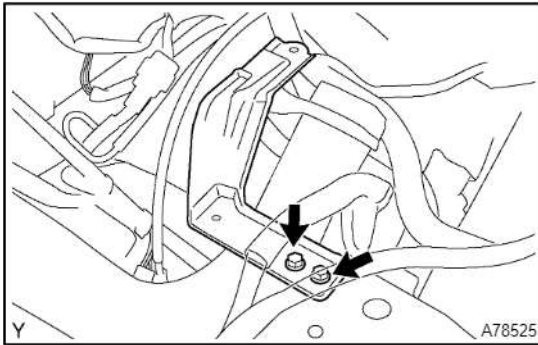
- (a) Disconnect the VSV connector.
- (b) Remove the 2 wire harness clamps.
- (c) Remove the vacuum hoses from the hose clamp.
- (d) Remove the 2 bolts and air cleaner inlet.



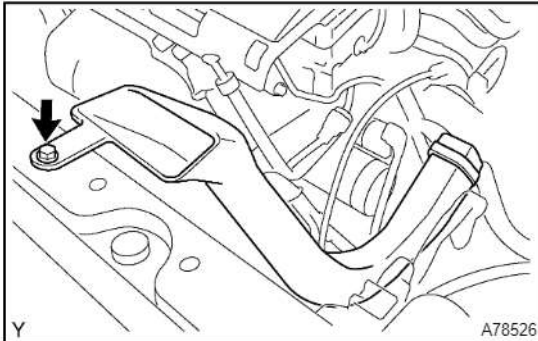
4. REMOVE AIR CLEANER ASSY

- (a) Disconnect the MAF meter connector.
- (b) Disconnect the 4 vacuum hoses.
- (c) Loosen the 2 air cleaner cap bolts.
- (d) Loosen the air cleaner hose clamp bolt and remove the air cleaner cap.
- (e) Remove the air cleaner filter element.
- (f) Remove the wire harness from the 2 wire harness clamps.
- (g) Disconnect the vacuum hose.
- (h) Remove the 3 bolts and air cleaner case.

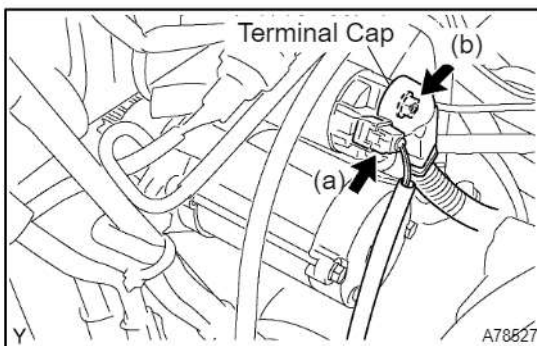


**5. REMOVE AIR CLEANER BRACKET**

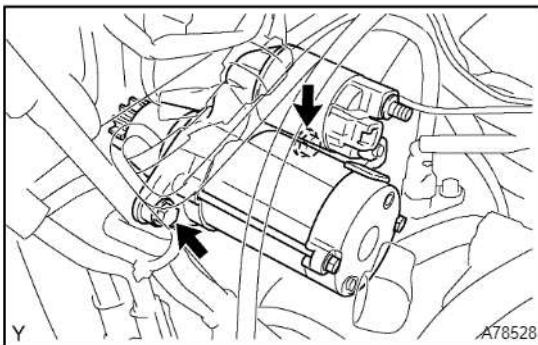
- (a) Remove the 2 bolts and air cleaner bracket.

**6. REMOVE AIR CLEANER INLET NO.1**

- (a) Remove the bolt and cleaner inlet.

**7. REMOVE STARTER ASSY**

- (a) Disconnect the starter connector.
 (b) Open the terminal cap, and remove the nut and disconnect the starter wire.



- (c) Remove the 2 bolts and starter.

8. INSTALL STARTER ASSY

- (a) Install the starter with the 2 bolts.
Torque: 37 N·m (380 kgf·cm, 26 ft·lbf) for bolt
 (b) Connect the starter wire.
 (c) Install the terminal nut and cover the nut with the cap.
Torque: 9.8 N·m (100 kgf·cm, 7 ft·lbf) for nut

9. INSTALL AIR CLEANER INLET NO.1

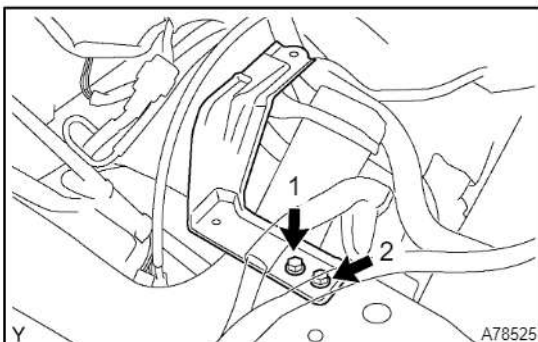
- (a) Install the cleaner inlet with the bolt.
Torque: 7.0 N·m (71 kgf·cm, 62 in·lbf)

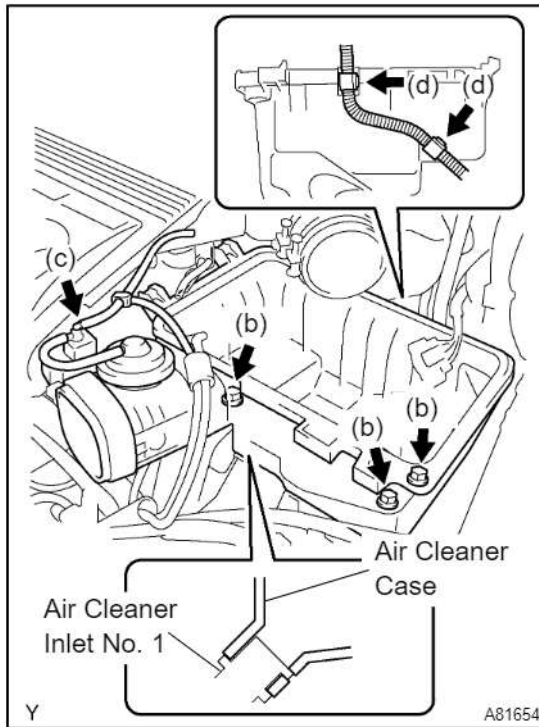
10. INSTALL AIR CLEANER BRACKET

- (a) Install the air cleaner bracket with the 2 bolts. Tighten the 2 bolts little by little in the numerical order shown in the illustration.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)

NOTICE:

Fully tightening each bolt one by one may damage the air cleaner bracket and bolts.



**11. INSTALL AIR CLEANER ASSY**

- (a) Install the air cleaner case to the air cleaner inlet No. 1, as shown in the illustration.
- (b) Tighten the 3 bolts little by little in the numerical order shown in the illustration.

Torque: 5.0 N·m (51 kgf·cm, 44 in·lbf)

NOTICE:

Fully tightening each bolt one by one may damage the air cleaner case and bolts.

- (c) Connect the vacuum hose.
 - (d) Install the 2 wire harness clamps.
 - (e) Install the air cleaner filter element.
 - (f) Connect the air cleaner hose No. 1 and tighten the air cleaner hose clamp bolt.
 - (g) Tighten the 2 air cleaner cap bolts.
- Torque: 5.0 N·m (51 kgf·cm, 44 in·lbf)**
- (h) Connect the 4 vacuum hoses.
 - (i) Connect the MAF meter connector.

12. INSTALL AIR CLEANER INLET ASSY

Torque: 7.0 N·m (71 kgf·cm, 62 in·lbf)

13. CHECK CONNECTION OF VACUUM HOSE**14. INSTALL BATTERY TRAY****15. INSTALL BATTERY**

- (a) Install the battery clamp with the bolt and nut.

Torque: 5.5 N·m (56 kgf·cm, 49 in·lbf)

- (b) Connect the wires to the battery terminals.

Torque: 3.5 N·m (36 kgf·cm, 31 in·lbf)

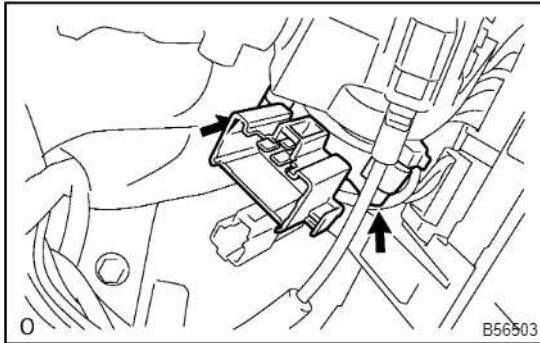
IGNITION OR STARTER SWITCH ASSY (2AZ-FE)(From July, 2003)

190SP-03

REPLACEMENT

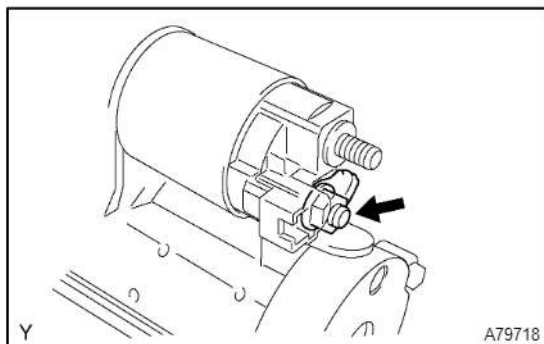
The installation procedures are the removal procedures in reverse order.

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **REMOVE INSTRUMENT PANEL SUB-ASSY UPPER (See page 71-16)**



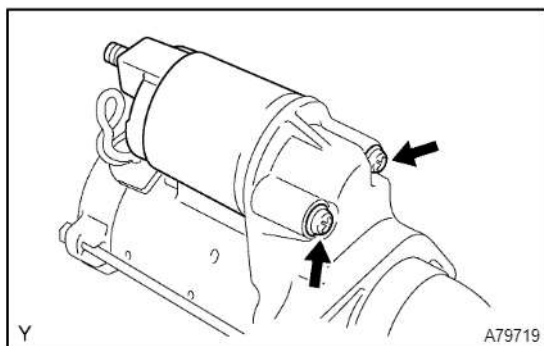
3. **REMOVE IGNITION OR STARTER SWITCH ASSY**
 - (a) Disconnect the ignition switch connector and unlock warning switch connector.
 - (b) Remove the clamp.
 - (c) Remove the 2 screws and ignition switch.

OVERHAUL

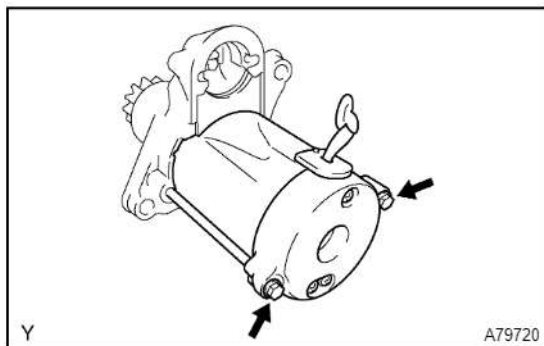


1. REMOVE MAGNETIC SWITCH ASSY

- (a) Remove the nut and disconnect the lead wire from the magnetic switch.

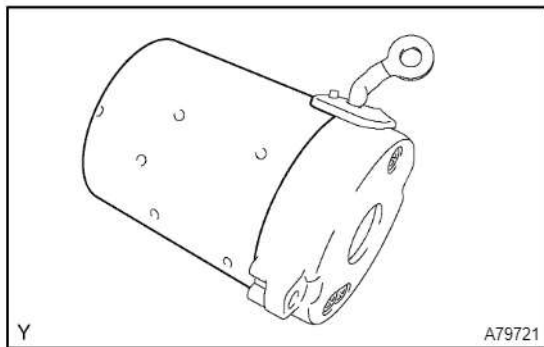


- (b) Remove the 2 screws holding the magnetic switch to the starter drive housing.
(c) Remove the magnetic switch.
(d) Remove the return spring and plunger from starter drive housing.

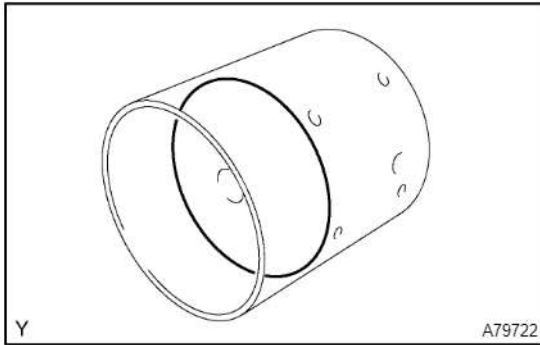


2. REMOVE STARTER FIELD FRAME ASSY

- (a) Remove the 2 through-bolts, and pull out the field frame together with the commutator end frame assy.

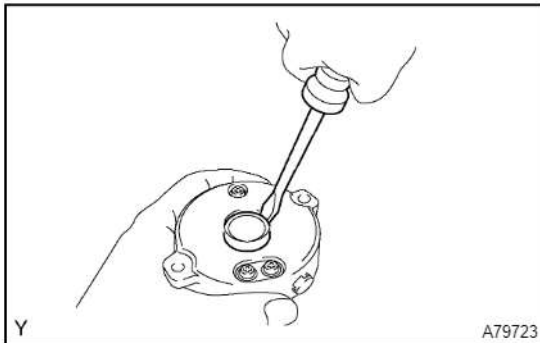


- (b) Remove the field frame from the commutator end frame.



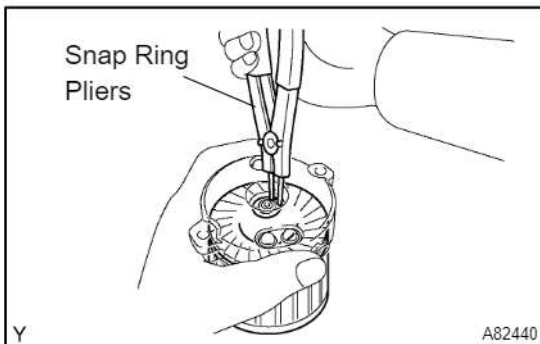
3. REMOVE STARTER ARMATURE PLATE

- (a) Remove the armature plate from the field frame.



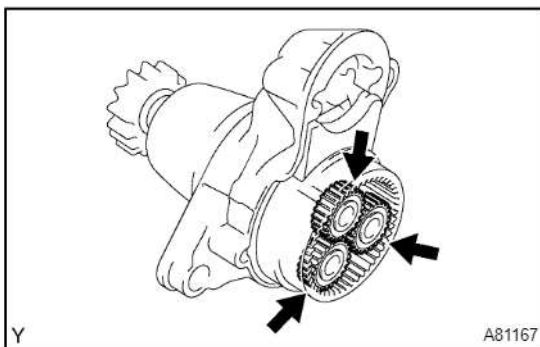
4. REMOVE STARTER COMMUTATOR END FRAME COVER

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



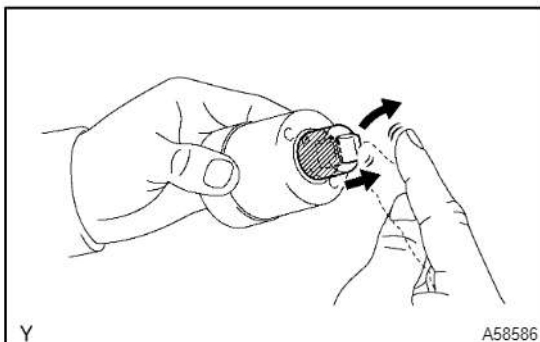
5. REMOVE STARTER ARMATURE ASSY

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



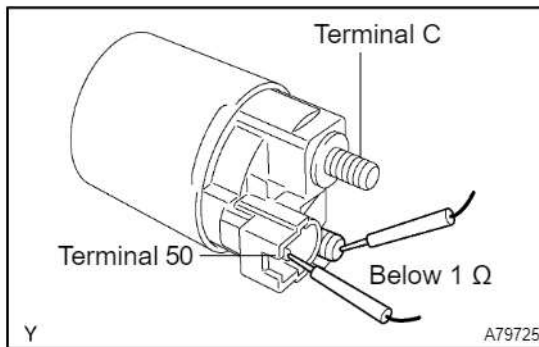
6. REMOVE PLANET GEAR

- (a) Remove the 3 planetary gears from the starter drive housing assy.

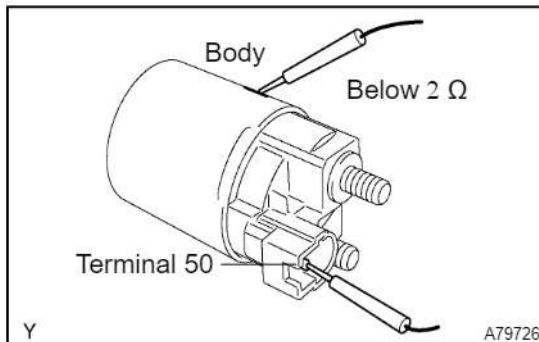


7. INSPECT MAGNETIC SWITCH ASSY

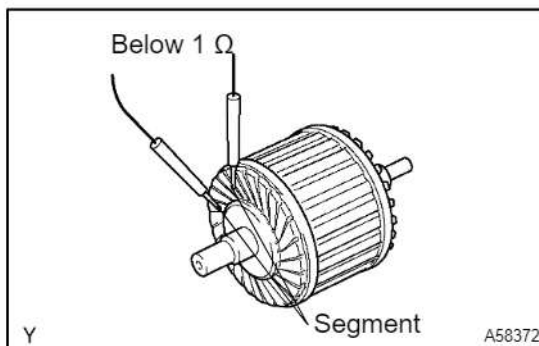
- (a) Check the plunger.
(1) Push in the plunger and check that it returns quickly to its original position.
If necessary, replace the magnetic switch.



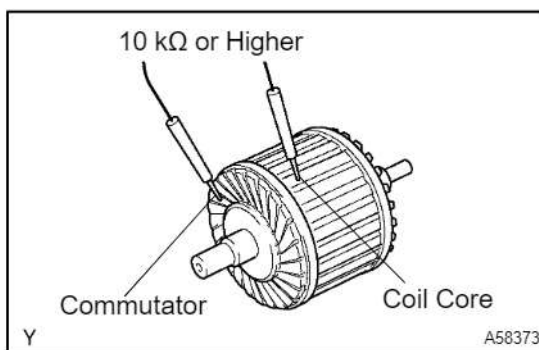
- (b) Check if the pull-in coil has an open circuit.
 (1) Check the resistance between terminals 50 and C.
Standard: Below 1 Ω
 If the the result is not as specified, replace the magnetic switch.



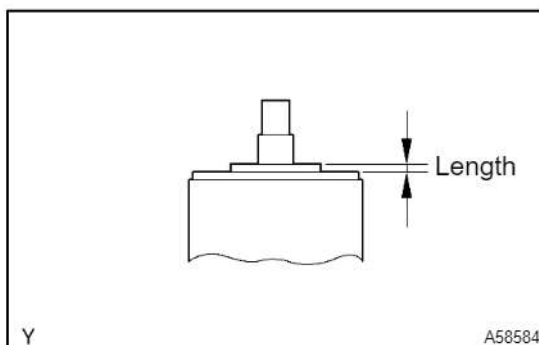
- (c) Check if the hold-in coil has an open circuit.
 (1) Check the resistance between terminal 50 and the switch body.
Standard: Below 2 Ω
 If the the result is not as specified, replace the magnetic switch.



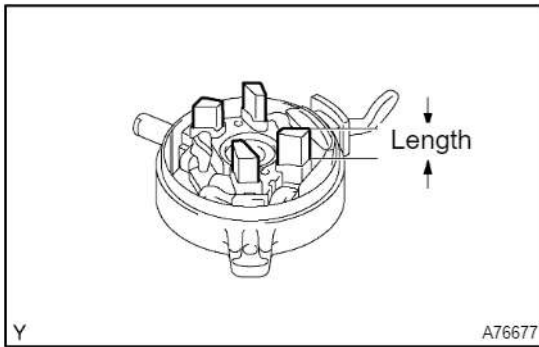
- 8. INSPECT STARTER ARMATURE ASSY**
 (a) Check if the commutator has an open circuit.
 (1) Check the resistance between the segments of the commutator.
Standard: Below 1 Ω
 If the result is not as specified, replace the armature assy.



- (b) Check if the commutator is grounded.
 (1) Check the resistance between the commutator and armature coil core.
Standard: 10 k Ω or higher
 If the result is not as specified, replace the armature assy.
 (c) Check the commutator for contamination and burns on its surface.
 If the surface is dirty or burnt, correct it with sandpaper (No.400) or a lathe.



- (d) Using a vernier caliper, measure the commutator's length.
Specified length: 3.1 to 3.8 mm (0.122 to 0.150 in.)
 If the length is greater than the maximum, replace the starter armature.

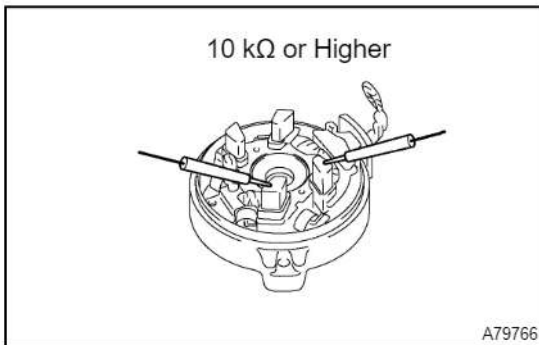


9. INSPECT STARTER COMMUTATOR END FRAME COVER

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

Specified length: 4.0 to 9.0 mm (0.158 to 0.359 in.)

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

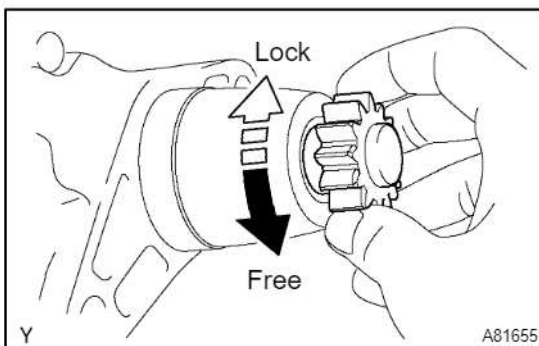


- (b) Check the brush insulation.

- (1) Check the resistance between the positive (+) and negative (-) brush.

Standard: 10 kΩ or higher

If the result is not as specified, repair or replace the end frame assy.

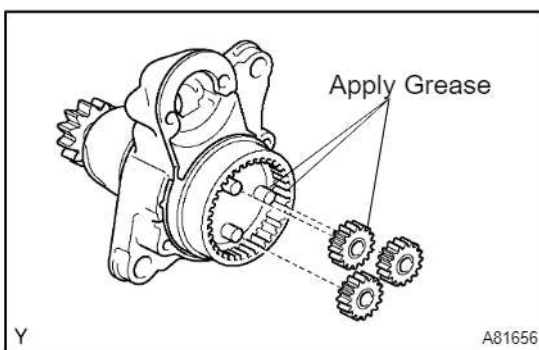


10. INSPECT CLUTCH&BEARING CENTER

- (a) Check the starter clutch.

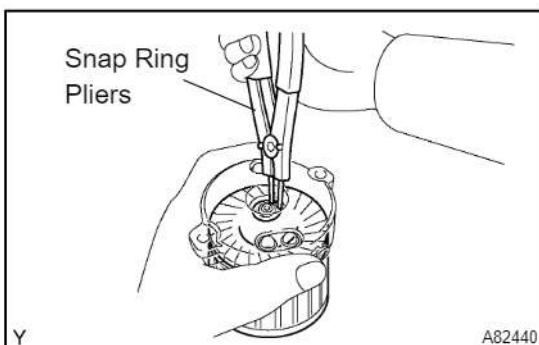
- (1) Rotate the clutch pinion gear counterclockwise and check that it turns freely. Try to rotate the clutch pinion gear clockwise and check that it locks.

If necessary, replace the clutch & bearing center.



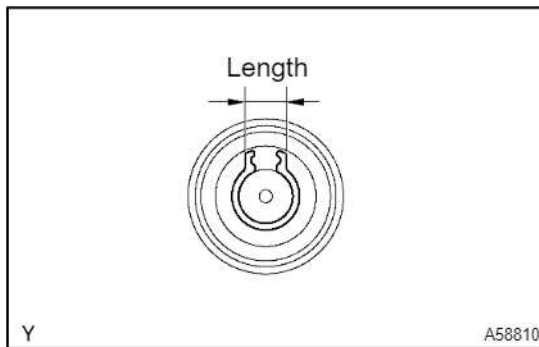
11. INSTALL PLANETARY GEAR

- (a) Apply grease to the planet gears and pin parts of the planetary shaft.
(b) Install the 3 planetary gears.

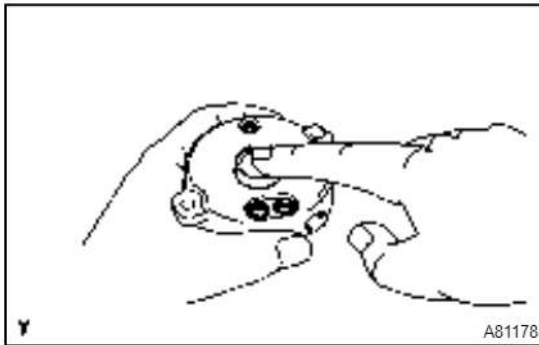


12. INSTALL STARTER ARMATURE ASSY

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

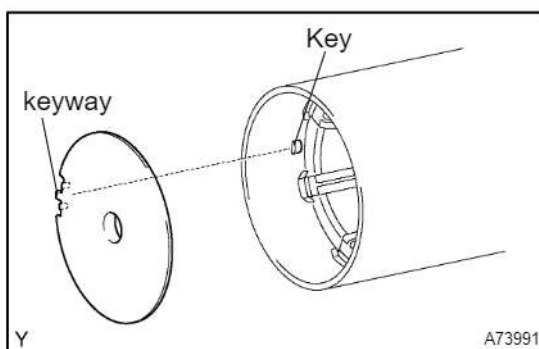


- (d) Using a vernier caliper, measure length of the snap ring.
Maximum length: 5.0 mm (0.197 in.)
 If the length is greater than the maximum, replace it with a new snap ring.



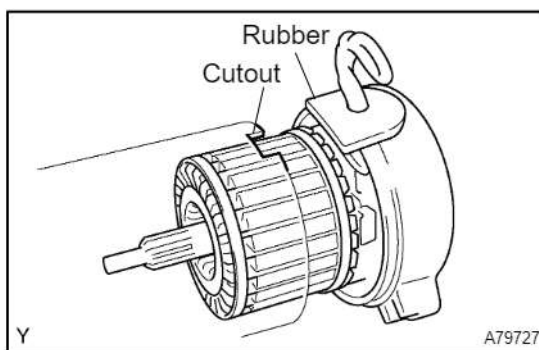
13. INSTALL STARTER COMMUTATOR END FRAME COVER

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



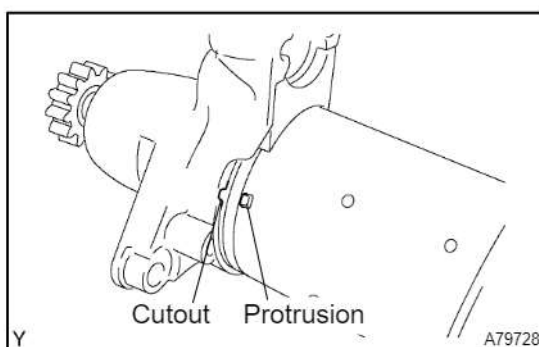
14. INSTALL STARTER ARMATURE PLATE

- (a) Insert the armature plate to the starter field frame.
 (b) Align the keyway of the starter plate with the key inside the starter field frame, and install the starter plate.



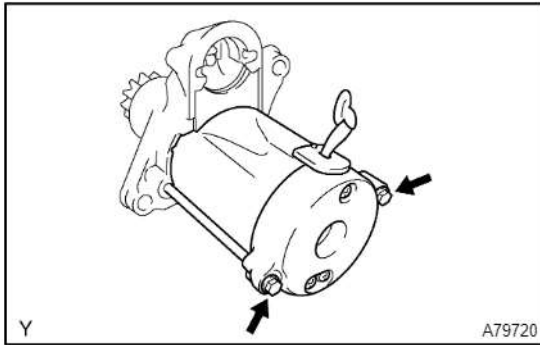
15. INSTALL STARTER COMMUTATOR END FRAME ASSY

- (a) Align the rubber of the end frame with the cutout of the field frame.
 (b) Install the end frame to the field frame.

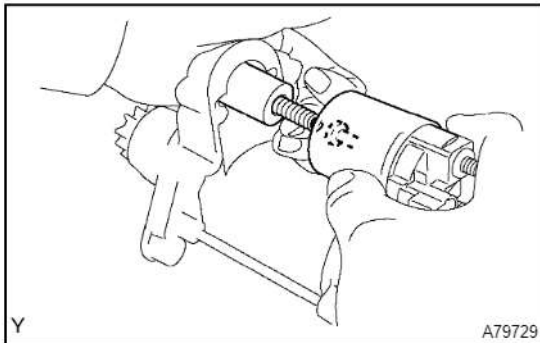


16. INSTALL STARTER FIELD FRAME ASSY

- (a) Align the protrusion of the starter field frame with the cut out of the starter drive housing.

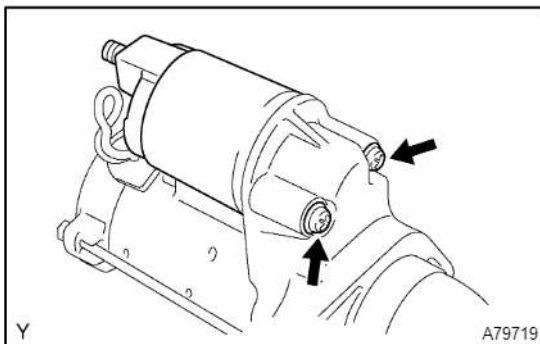


- (b) Install the field frame with the 2 through bolts.
Torque: 6.0 N·m (61 kgf·cm, 53 in·lbf)

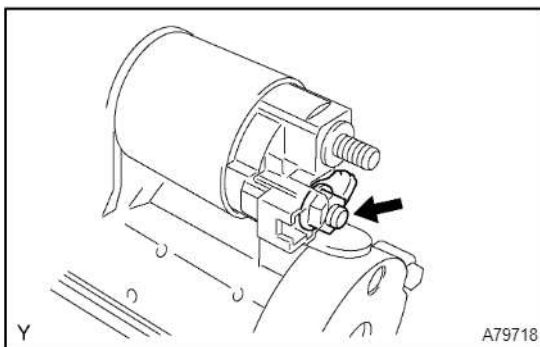


17. INSTALL MAGNETIC SWITCH ASSY

- (a) Apply grease to the plunger and the hook.
(b) Hang the plunger hook of the magnetic switch to the drive lever.
(c) Install the plunger and the return spring.



- (d) Install the magnetic switch with the 2 screws.
Torque: 7.5 N·m (76 kgf·cm, 66 in·lbf)



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

CHARGING SYSTEM (1MZ-FE/3MZ-FE)

190NY-03

PRECAUTION

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.
- Check that the charging cable is tightened on terminal **B** of the generator and the fuse box.

ON-VEHICLE INSPECTION

1. CHECK BATTERY CONDITION

- (a) Check the battery for damage and deformation. If severe damage, deformation or leakage is found, replace the battery.

- (b) Check the electrolyte quantity of each cell.

For batteries that are maintenance-free:

If the electrolyte quantity is below the recommended amount, replace the battery.

For batteries that are not maintenance-free:

If the electrolyte quantity is below the recommended amount, add distilled water.

CAUTION:

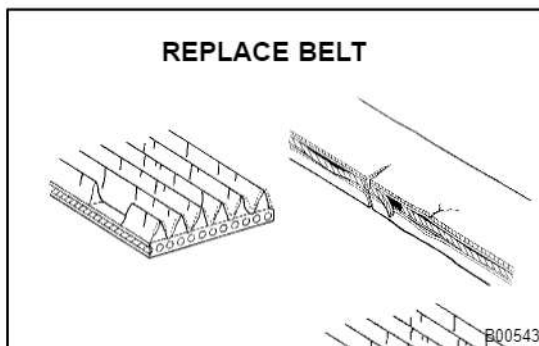
If the battery has gone flat or if the engine cannot be started easily, the engine may not be recovered properly. Recharge the battery and perform inspections again before returning the vehicle to the customer.

2. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

- (a) Check that the battery terminals are not loose or corroded.

If the terminals are corroded, clean the terminals.

- (b) Check the fusible link, high-current fuses and fuses for continuity.



3. INSPECT DRIVE BELT

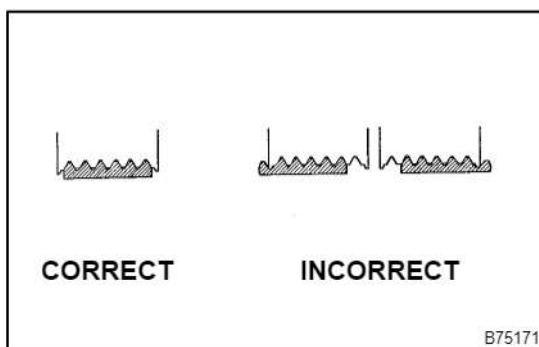
- (a) Check the belt for wear, cracks and other signs of damage.

If any defect is found, replace the drive belt.

HINT:

Replace the drive belt if the following defects are found:

- If the belt has worn out until the wire can be seen.
- If the cracks reach the wire more than one place.
- If the belt has chunks missing from the ribs.



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

HINT:

With your hand, confirm that the belt has not slipped out of the groove on the bottom of the pulley.

4. VISUALLY CHECK GENERATOR WIRING

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

5. LISTEN FOR ABNORMAL NOISES FROM GENERATOR

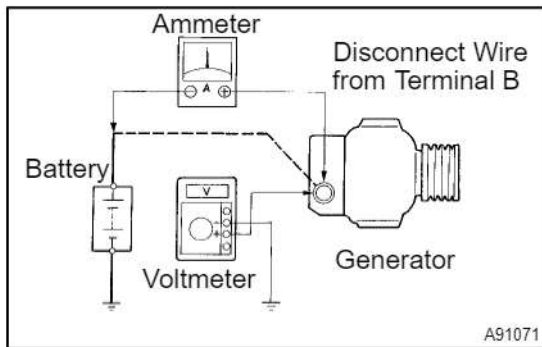
- (a) Check that there is no abnormal noise from the generator while the engine is running.

6. INSPECT CHARGE WARNING LAMP CIRCUIT

- (a) Turn the ignition switch ON. Check that the charge warning lamp turns on.

- (b) Start the engine and check that the lamp turns off.

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



7. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT:

If a battery/generator tester is available, connect the tester to the charging circuit according to the manufacturer's instructions.

- (a) If a tester is not available, connect a voltmeter to the charging circuit as follows.
 - (1) Disconnect the wire from terminal B of the generator and connect it to the negative (-) lead of the ammeter.
 - (2) Connect the positive (+) lead of the ammeter to terminal B of the generator.
 - (3) Connect the positive (+) lead of the voltmeter to terminal B of the generator.
 - (4) Ground the negative (-) lead of the voltmeter.
- (b) Check the charging circuit.
 - (1) Keep the engine speed at 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage: 10 A or less

Standard voltage: 13.2 to 14.8 V

8. INSPECT CHARGING CIRCUIT WITH LOAD

- (a) With the engine running at 2,000 rpm, turn on the high-beam headlamps and turn the heater blower switch to the HI position.
- (b) Check the reading on the ammeter.

Standard amperage: 30 A or more

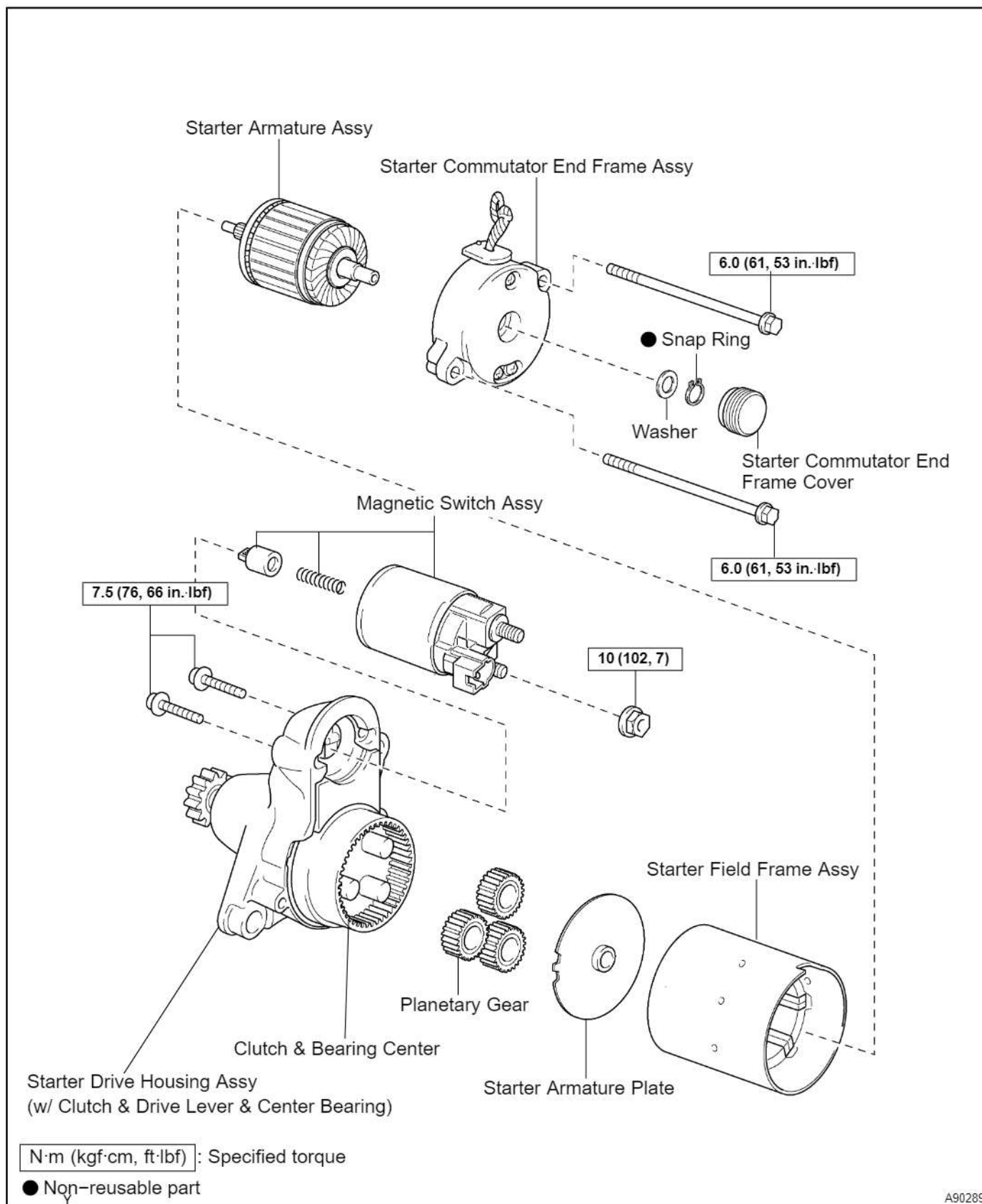
HINT:

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

STARTER ASSY (2AZ-FE)(From July, 2003)

COMPONENTS

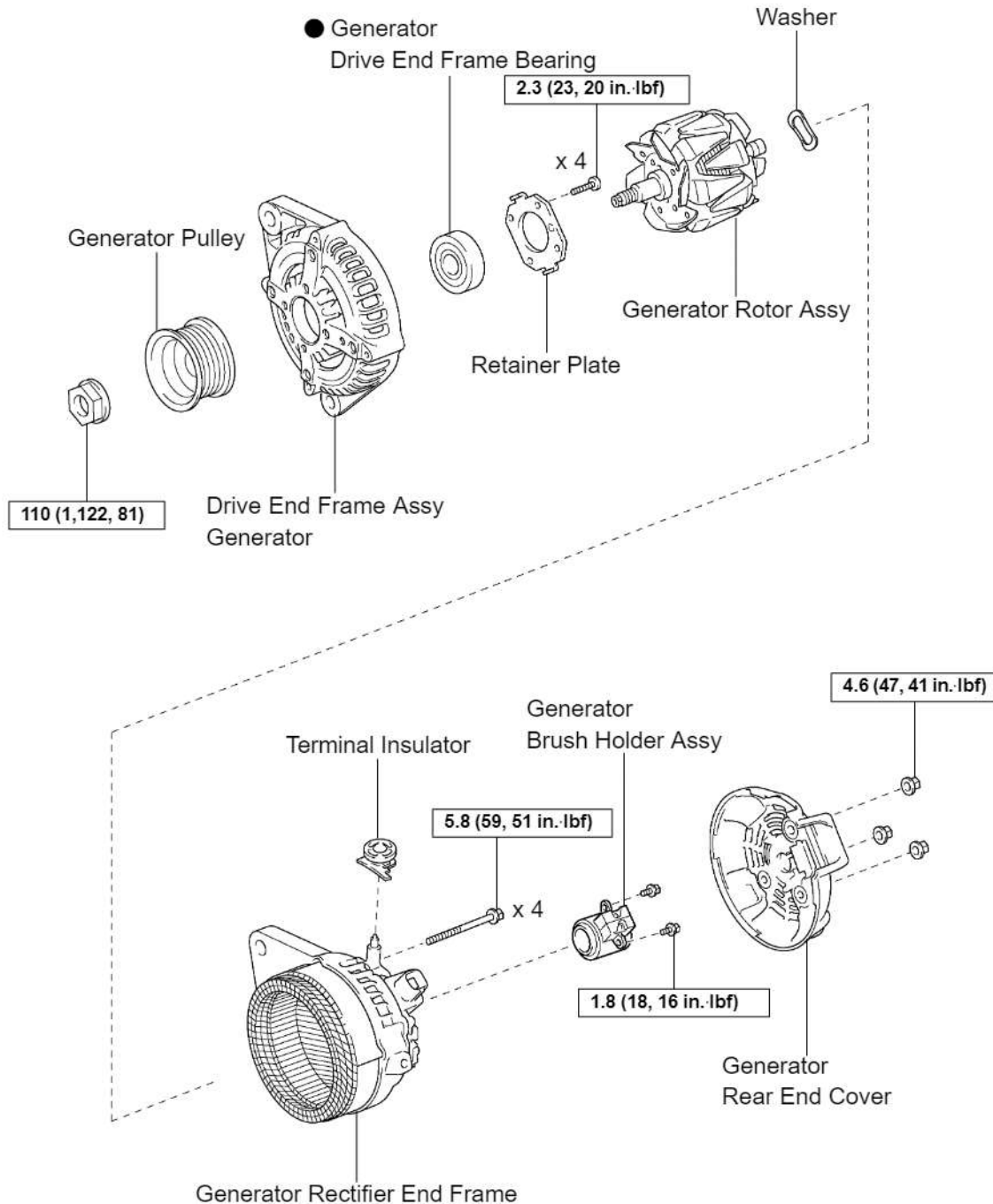
190RU-02



A90289

GENERATOR ASSY (1MZ-FE/3MZ-FE) COMPONENTS

190SB-02

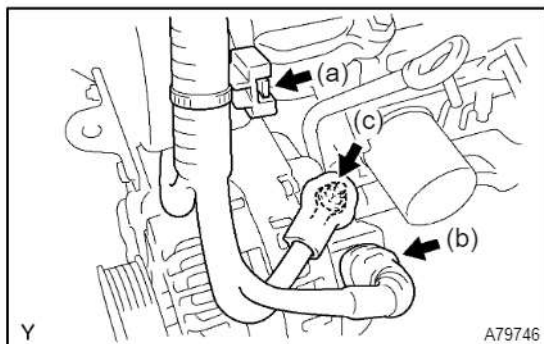


N·m (kgf·cm, ft·lbf) : Specified torque

● Not-reusable part

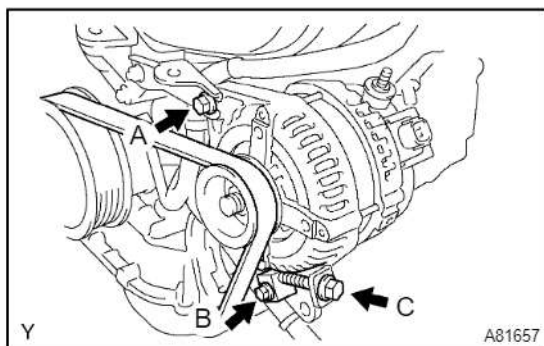
A90290

REPLACEMENT

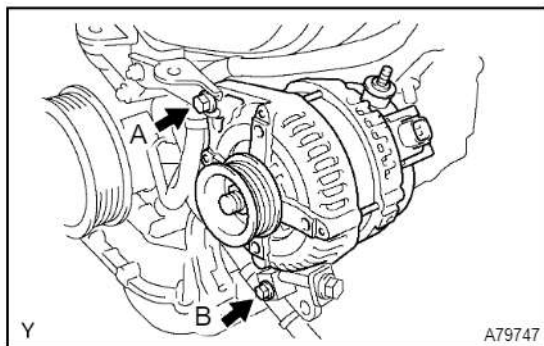


1. REMOVE GENERATOR ASSY

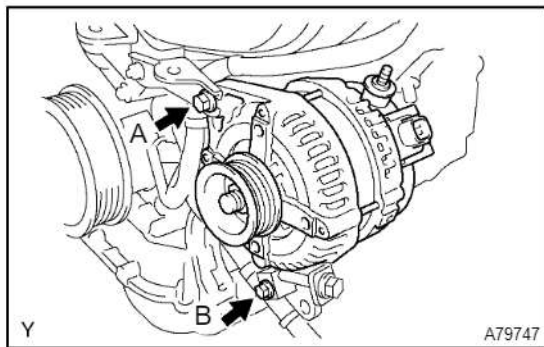
- (a) Remove the wire harness clamp.
- (b) Disconnect the generator connector.
- (c) Open the terminal cap, remove the nut and disconnect the generator wire.



- (d) Loosen bolts A and B.
- (e) Loosen bolt C to lessen the tension of the V belt.

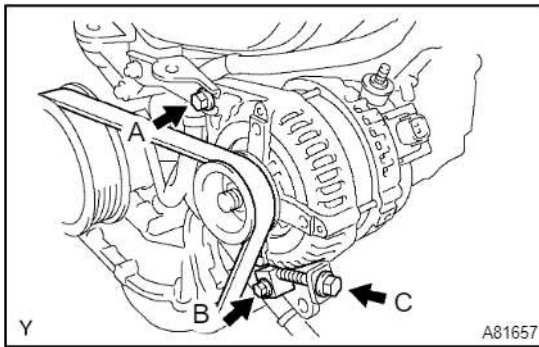


- (f) Remove bolts A and B, and the generator.



2. INSTALL GENERATOR ASSY

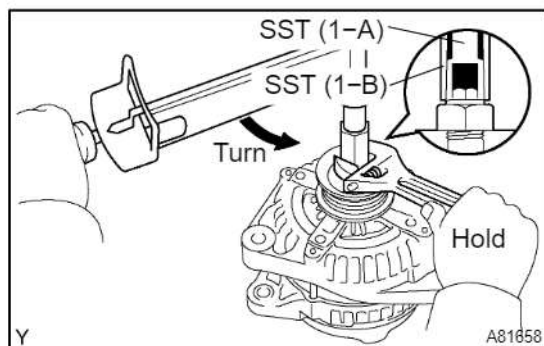
- (a) Temporarily install the generator with bolts A and B.



- (b) Adjust the V belt tension by tightening bolt C (see page [14-140](#)).
- (c) Tighten bolts A and B.
Torque:
58 N·m (592 kgf·cm, 43 ft·lbf) for bolt A
18 N·m (184 kgf·cm, 13 ft·lbf) for bolt B
- (d) Install the generator wire with the nut.
Torque: 9.8 N·m (100 kgf·cm, 7 ft·lbf)
- (e) Connect the generator connector.
- (f) Install the wire harness clamp.

3. **INSPECT DRIVE BELT** (See page [19-39](#))

OVERHAUL



1. REMOVE GENERATOR PULLEY

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

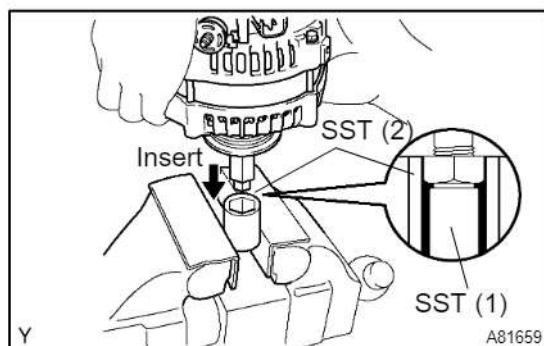
HINT:

SST (1-A, B)	09820-06010
SST (2)	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 (400 kgf·cm, 29 ft·lbf)**NOTICE:****Check that SST is secured to the rotor shaft.**

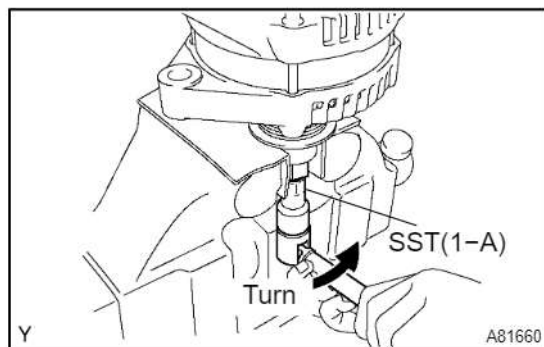
- (b) Clamp SST (2) in a vise.
 (c) Insert SST (1-A, B) into SST (2), and attach the pulley nut to SST (2).



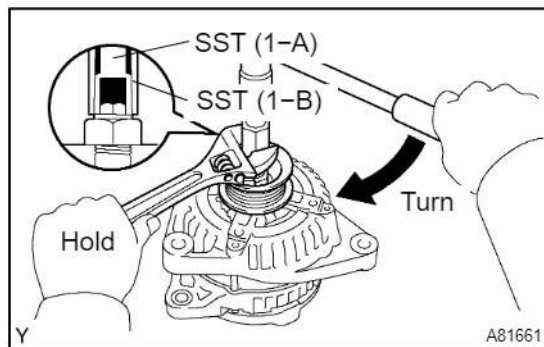
- (d) To loosen the pulley nut, turn SST (1-A) in the direction shown in the illustration.

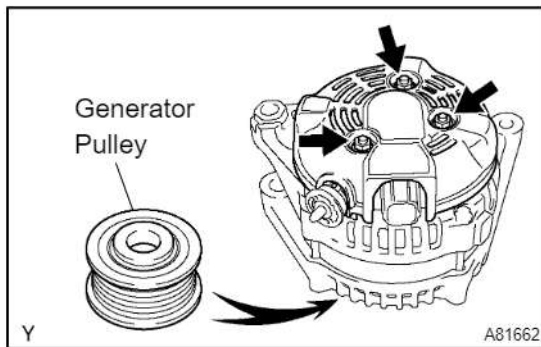
NOTICE:**To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half turn.**

- (e) Remove the generator from SST (2).



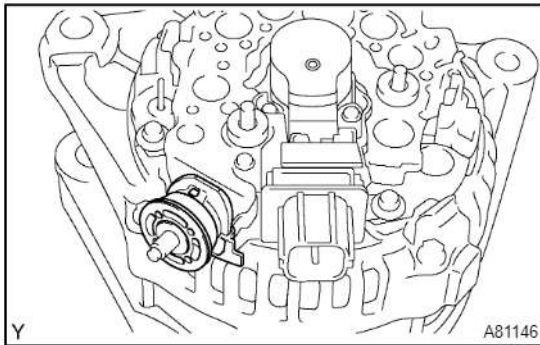
- (f) Turn SST (1-B) and remove SST (1-A, B).
 (g) Remove the pulley nut and generator pulley.





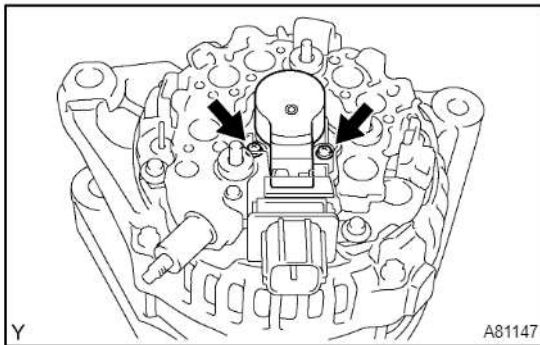
2. REMOVE GENERATOR REAR END COVER

- (a) Place the generator on the generator pulley.
- (b) Remove the 3 nuts and the generator rear end cover.



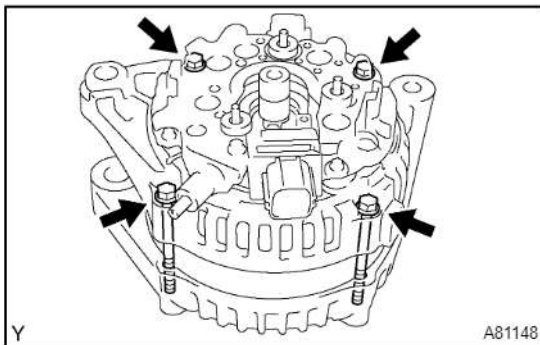
3. REMOVE TERMINAL INSULATOR

- (a) Remove the terminal insulator from the generator rectifier end frame.



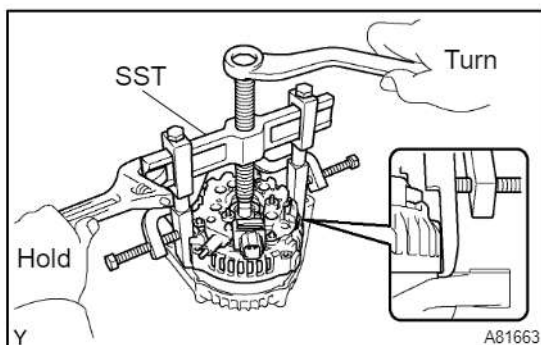
4. REMOVE GENERATOR BRUSH HOLDER ASSY

- (a) Remove the 2 screws and the generator brush holder.

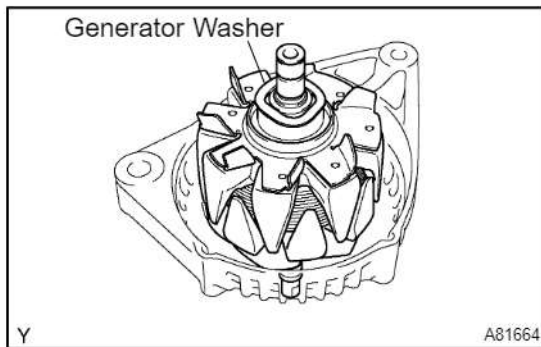


5. REMOVE GENERATOR COIL ASSY

- (a) Remove the 4 bolts.

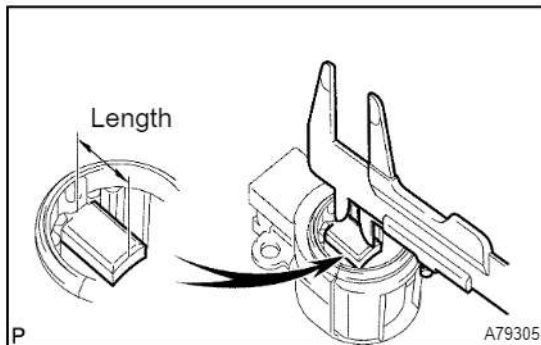


- (b) Using SST, remove the generator rectifier end frame.
SST 09950-40011 (09951-04020, 09952-04010, 09953-04020, 09954-04010, 09955-04071, 09957-04010, 09958-04011)



6. REMOVE GENERATOR ROTOR ASSY

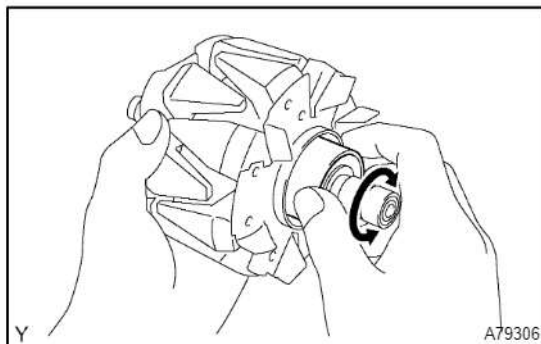
- (a) Remove the generator washer and the generator rotor.



7. INSPECT GENERATOR BRUSH HOLDER ASSY

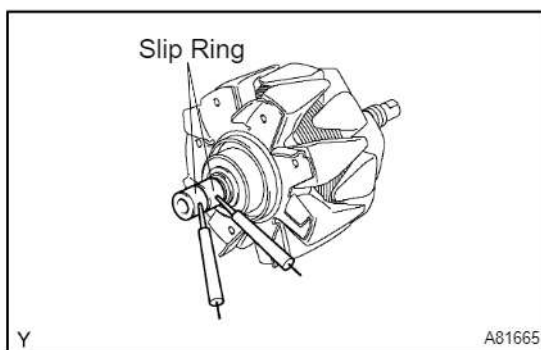
- (a) Check the brush length.
- (1) Using a vernier caliper, measure the exposed brush length.
- Specified brush length: 4.5 to 10.5 mm (0.177 to 0.413 in.)**

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



8. INSPECT GENERATOR ROTOR ASSY

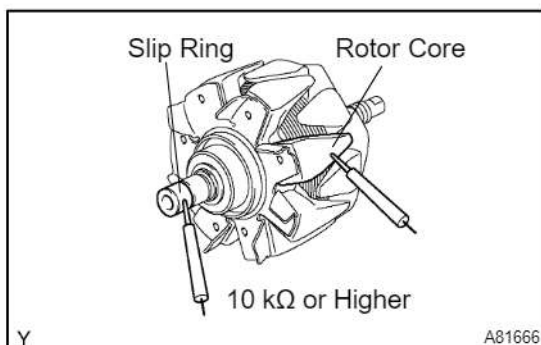
- (a) Check the bearing is not rough or worn.
- If necessary, replace the generator rotor.



- (b) Check the rotor for open circuit.
- (1) Using an ohmmeter, measure the resistance between the slip ring.

Standard: 2.3 to 2.7 Ω at 20°C (68°F)

If the resistance is not as specified, replace the generator rotor.

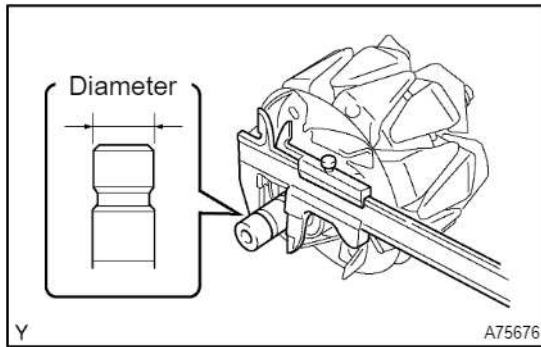


- (c) Check the rotor for ground.
- (1) Using an ohmmeter, check the resistance between the slip ring and the rotor core.

Standard: 10 k Ω or higher

If the resistance is not as specified, replace the generator rotor.

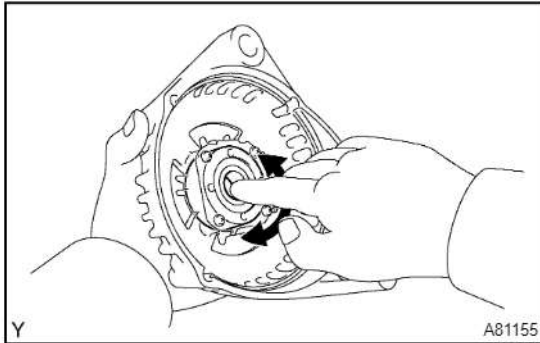
- (d) Inspect slip rings.
- (1) Check that the slip rings are not rough or scored.
- If rough or scored, replace the generator rotor.



- (e) Check the slip ring diameter.
 (1) Using a vernier caliper, measure the slip ring diameter.

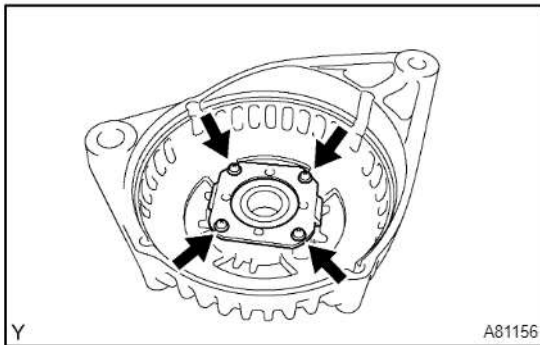
Specified diameter: 14.0 to 14.4 mm (0.551 to 0.567 in.)

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



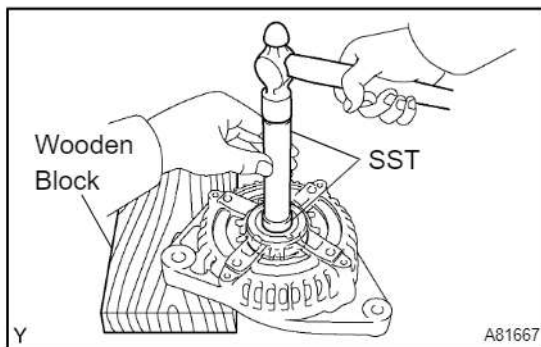
9. INSPECT GENERATOR DRIVE END FRAME BEARING

- (a) Check the bearing is not rough or worn.
 If necessary, replace the bearing.

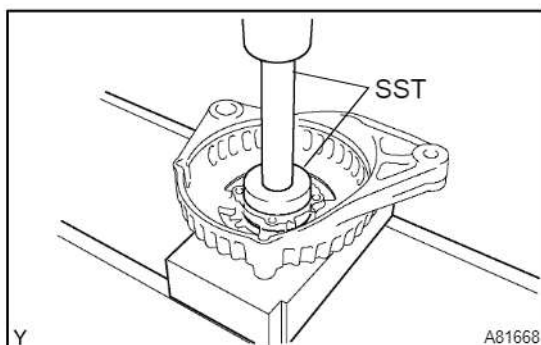


10. REMOVE GENERATOR DRIVE END FRAME BEARING

- (a) Remove the 4 screws and the retainer plate.

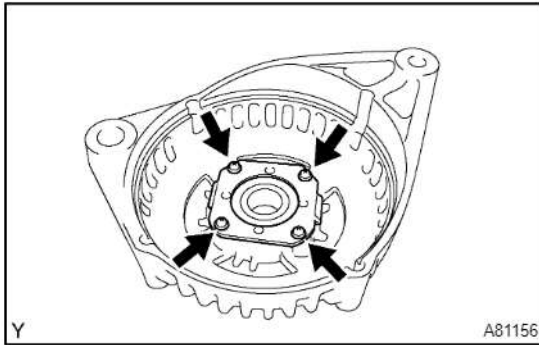


- (b) Using SST, tap out the bearing.
 SST 09950-60010 (09951-00250), 09950-70010 (09951-07100)

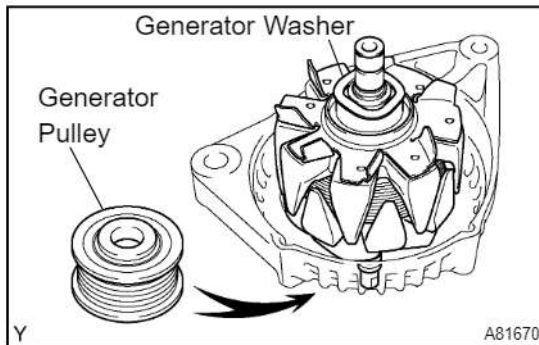


11. INSTALL GENERATOR DRIVE END FRAME BEARING

- (a) Using SST and a press, press in a new bearing.
 SST 09950-60010 (09951-00470), 09950-70010 (09951-07100)

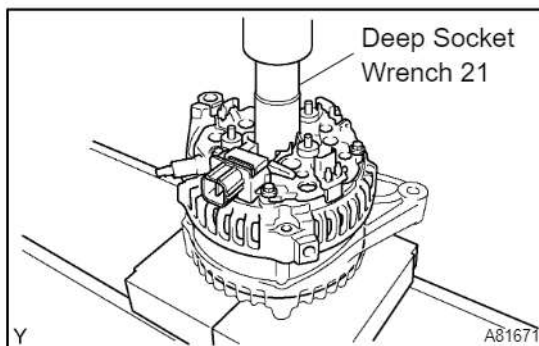


- (b) Install the retainer plate with the 4 screws.
Torque: 2.3 N·m (23 kgf·cm, 20 in·lbf)



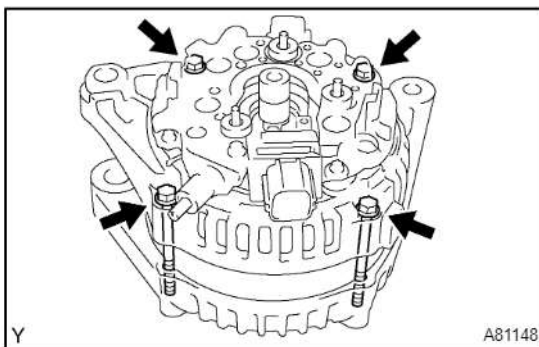
12. INSTALL GENERATOR ROTOR ASSY

- (a) Place the generator drive end frame on the generator pulley.
 (b) Install the generator rotor and the generator washer.

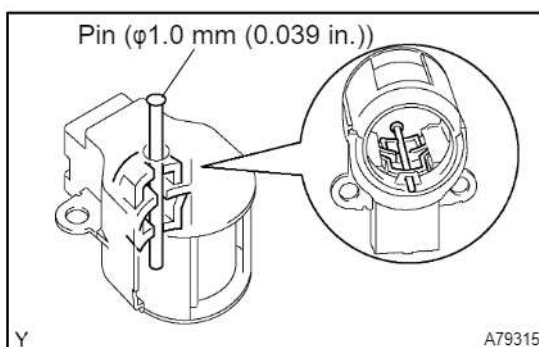


13. INSTALL GENERATOR COIL ASSY

- (a) Using a deep socket wrench 21 and a press, press in the generator rectifier end frame carefully.

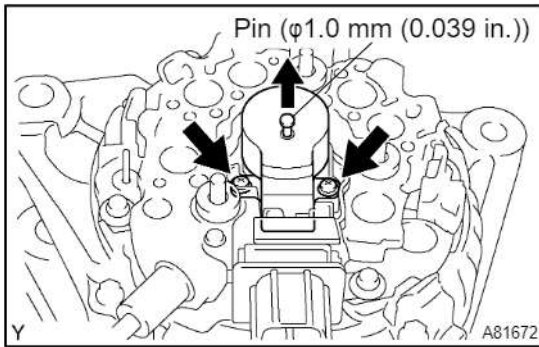


- (b) Tighten the 4 bolts.
Torque: 5.8 N·m (59 kgf·cm, 51 in·lbf)

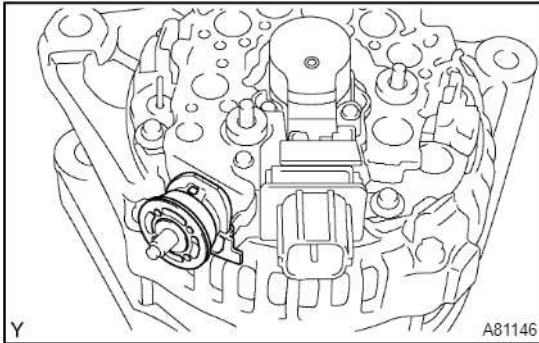


14. INSTALL GENERATOR BRUSH HOLDER ASSY

- (a) While pushing the 2 brushes to inside the brush holder, insert a pin (φ1.0 mm (0.039 in.)) into the brush holder hole.



- (b) Install the generator brush holder with the 2 screws.
Torque: 1.8 N·m (18 kgf·cm, 16 in.·lbf)
- (c) Pull out the pin (φ1.0 mm (0.039 in.)) from the generator brush holder.

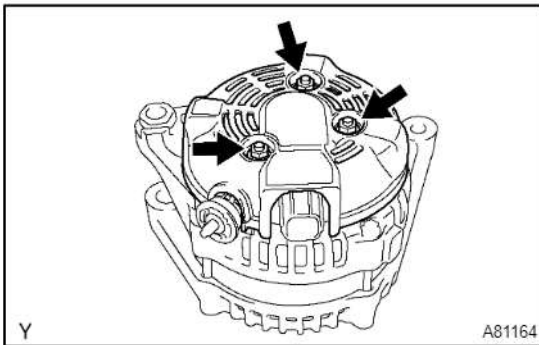


15. INSTALL TERMINAL INSULATOR

- (a) Place the generator drive end frame on the generator pulley.
- (b) Install the generator rotor and the generator washer.

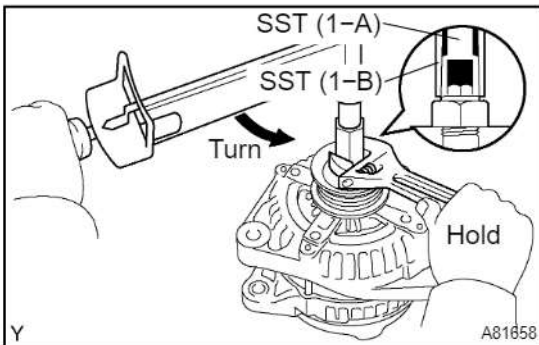
NOTICE:

Pay attention the mounting orientation of the terminal insulator.



16. INSTALL GENERATOR REAR END COVER

- (a) Install the generator rear end cover with the 3 nuts.
Torque: 4.6 N·m (47 kgf·cm, 41 in.·lbf)



17. INSTALL GENERATOR PULLEY

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

HINT:

SST (1-A, B)	09820-06010
SST (2)	09820-06020

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

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

NOTICE:

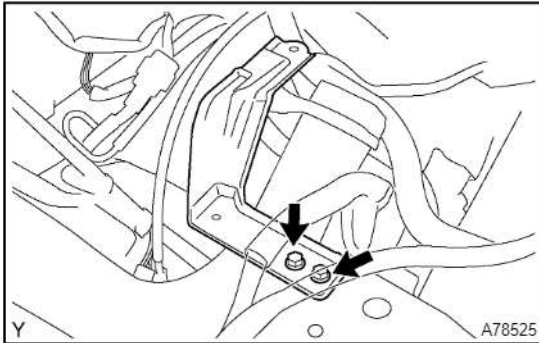
Check that SST is secured to the rotor shaft.

REPLACEMENT

NOTICE:

Before changing the starter, check these items again:

- Connector connection
 - Accessory installation
1. REMOVE BATTERY
 2. REMOVE BATTERY TRAY
 3. REMOVE AIR CLEANER ASSY

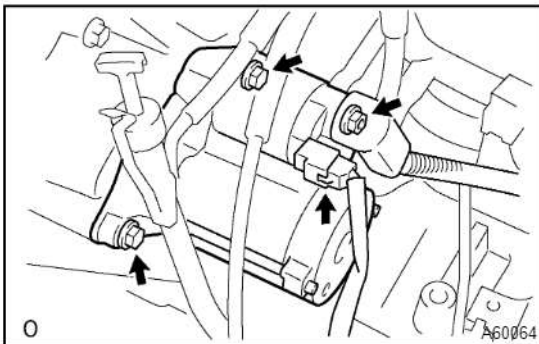


4. REMOVE AIR CLEANER BRACKET

- (a) Remove the 2 bolts and air cleaner bracket.

5. REMOVE AIR CLEANER INLET ASSY

- (a) Remove the 2 bolts and air cleaner inlet.



6. REMOVE STARTER ASSY

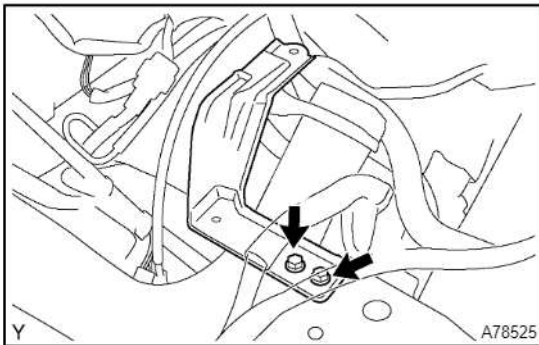
- (a) Disconnect the starter connector.
- (b) Remove the nut and disconnect the starter wire.
- (c) Remove the 2 bolts and starter.

7. INSTALL STARTER ASSY

- (a) Install the and starter with the 2 bolts.
Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)
- (b) Install the starter wire and the nut.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)
- (c) Connect the starter connector.

8. INSTALL AIR CLEANER BRACKET

- (a) Install the air cleaner bracket with the 2 bolts.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)



9. INSTALL AIR CLEANER ASSY

Torque: 5.0 N·m (51 kgf·cm, 44 in·lbf)

10. INSTALL AIR CLEANER INLET ASSY

- (a) Install the air cleaner inlet with the 2 bolts.
Torque: 7.0 N·m (71 kgf·cm, 62 in·lbf)

11. CHECK CONNECTION OF VACUUM HOSE**12. INSTALL BATTERY TRAY****13. INSTALL BATTERY**

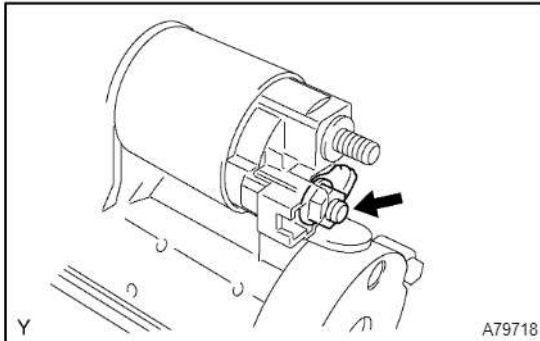
- (a) Install the battery clamp with the bolt and nut.

Torque: 5.5 N·m (56 kgf·cm, 49 in·lbf)

- (b) Connect the wires to the battery terminals.

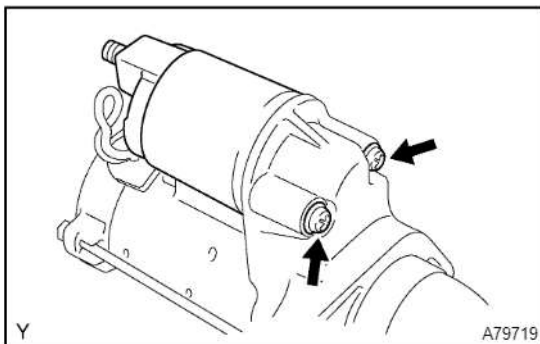
Torque: 3.5 N·m (36 kgf·cm, 31 in·lbf)

OVERHAUL

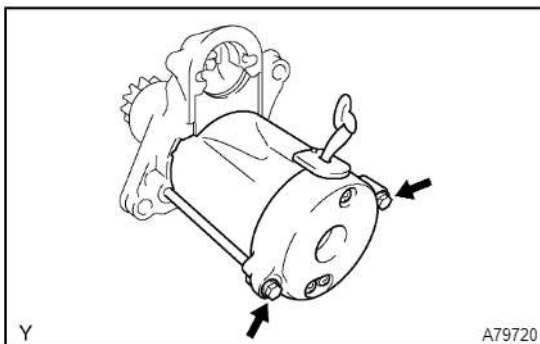


1. REMOVE MAGNETIC SWITCH ASSY

- (a) Remove the nut and disconnect the lead wire from the magnetic switch.

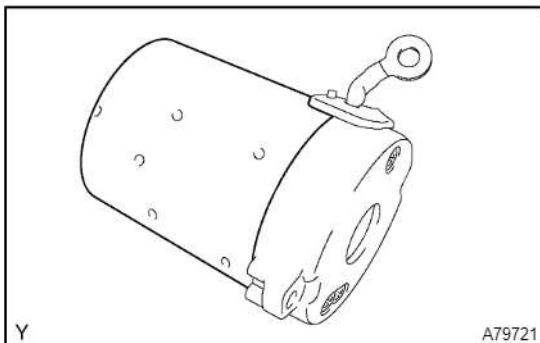


- (b) Remove the 2 screws holding the magnetic switch to the starter drive housing.
(c) Remove the magnetic switch.
(d) Remove the return spring and plunger from starter drive housing.

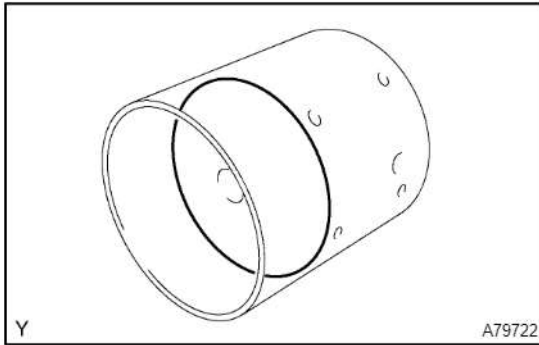


2. REMOVE STARTER FIELD FRAME ASSY

- (a) Remove the 2 through-bolts, and pull out the field frame together with the commutator end frame assy.

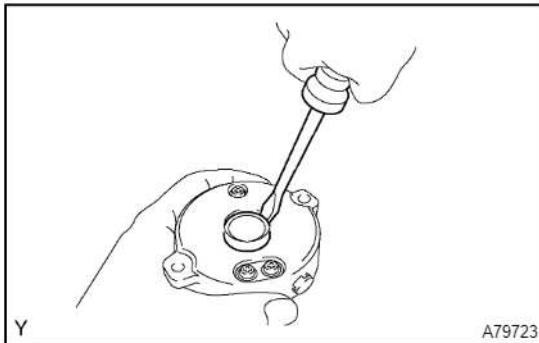


- (b) Remove the field frame from the commutator end frame.



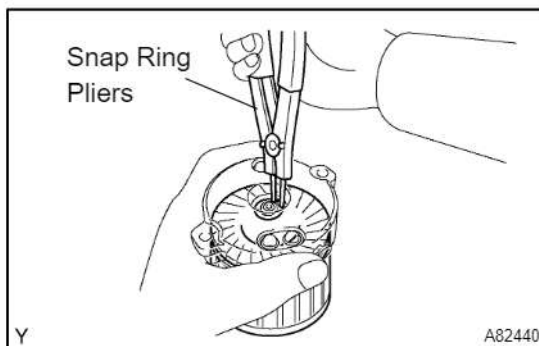
3. REMOVE STARTER ARMATURE PLATE

- (a) Remove the armature plate from the field frame.



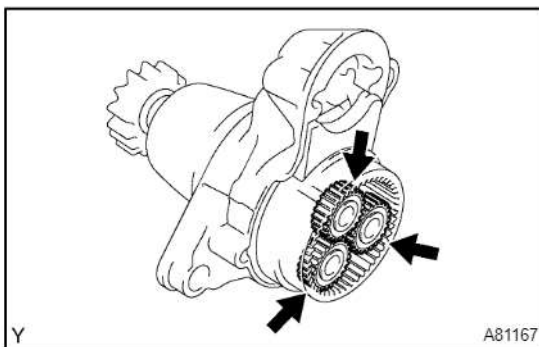
4. REMOVE STARTER COMMUTATOR END FRAME COVER

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



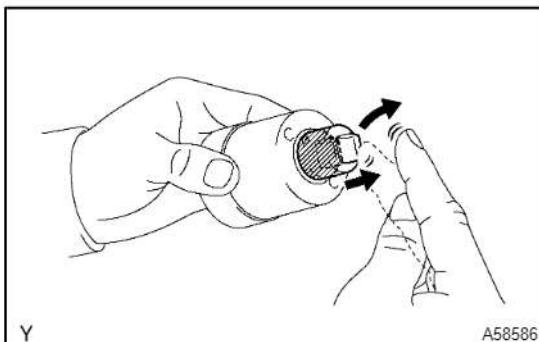
5. REMOVE STARTER ARMATURE ASSY

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



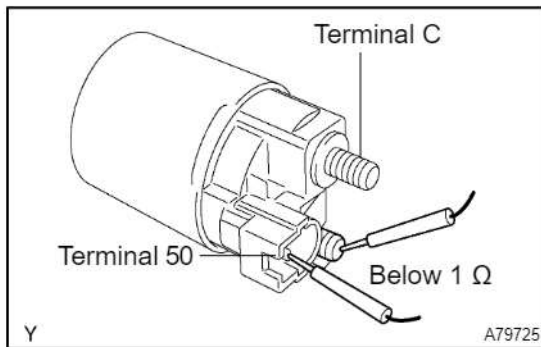
6. REMOVE PLANETARY GEAR

- (a) Remove the 3 planetary gears from the starter drive housing assy.

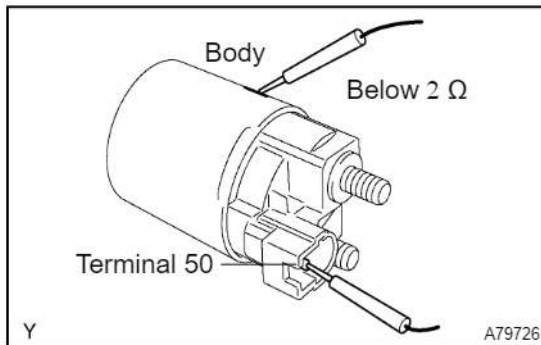


7. INSPECT MAGNETIC SWITCH ASSY

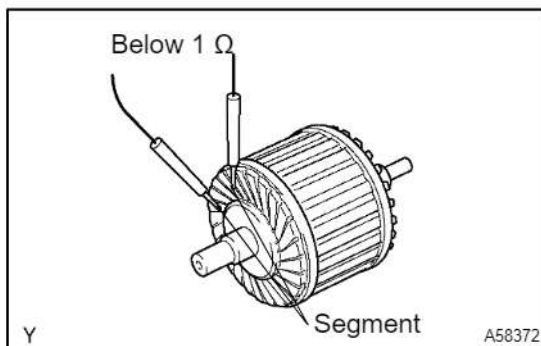
- (a) Check the plunger.
(1) Push in the plunger and check that it returns quickly to its original position.
If necessary, replace the magnetic switch.



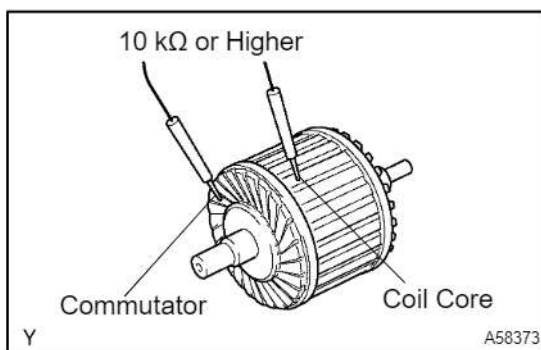
- (b) Check if the pull-in coil has an open circuit.
 (1) Check the resistance between terminals 50 and C.
Standard: Below 1 Ω
 If the the result is not as specified, replace the magnetic switch.



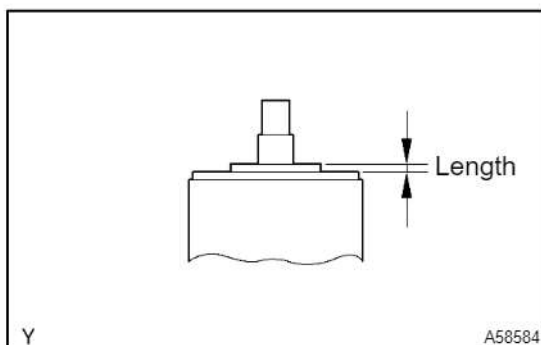
- (c) Check if the hold-in coil has an open circuit.
 (1) Check the resistance between terminal 50 and the switch body.
Standard: Below 2 Ω
 If the the result is not as specified, replace the magnetic switch.



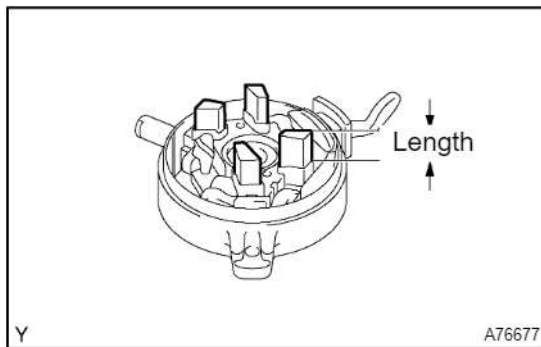
- 8. INSPECT STARTER ARMATURE ASSY**
 (a) Check if the commutator has an open circuit.
 (1) Check the resistance between the segments of the commutator.
Standard: Below 1 Ω
 If the result is not as specified, replace the armature assy.



- (b) Check if the commutator is grounded.
 (1) Check the resistance between the commutator and armature coil core.
Standard: 10 k Ω or higher
 If the result is not as specified, replace the armature assy.
 (c) Check the commutator for contamination and burns on its surface.
 If the surface is dirty or burnt, correct it with sandpaper (No.400) or a lathe.



- (d) Using a vernier caliper, measure the commutator's length.
Specified length: 3.1 to 3.8 mm (0.122 to 0.150 in.)
 If the length is greater than the maximum, replace the starter armature.

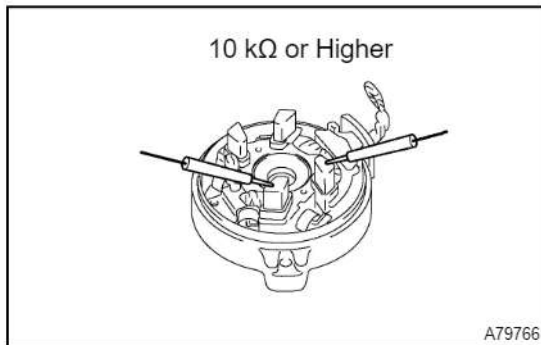


9. INSPECT STARTER COMMUTATOR END FRAME COVER

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

Specified length: 4.0 to 9.0 mm (0.158 to 0.359 in.)

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

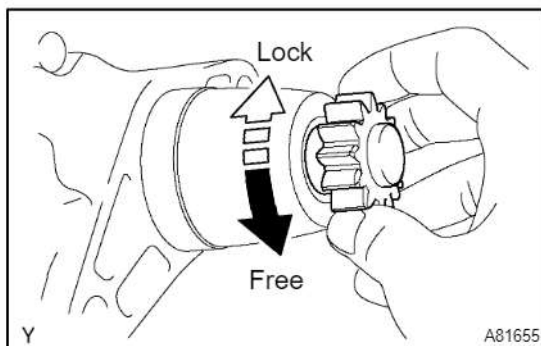


- (b) Check the brush insulation.

- (1) Check the resistance between the positive (+) and negative (-) brush.

Standard: 10 kΩ or higher

If the result is not as specified, repair or replace the end frame assy.

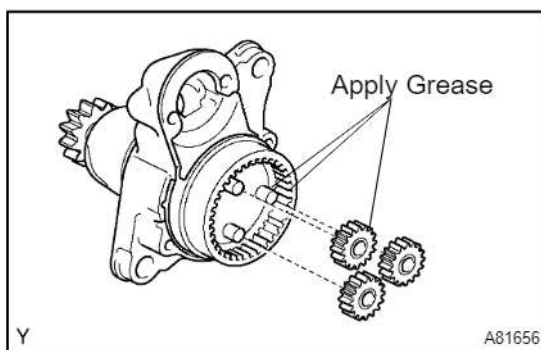


10. INSPECT AND ADJUST CLUTCH & BEARING CENTER

- (a) Check the starter clutch.

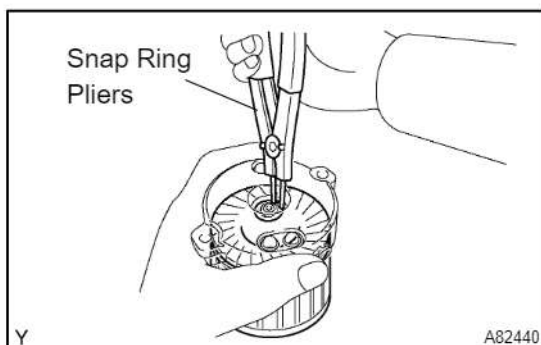
- (1) Rotate the clutch pinion gear counterclockwise and check that it turns freely. Try to rotate the clutch pinion gear clockwise and check that it locks.

If necessary, replace the clutch & bearing center.



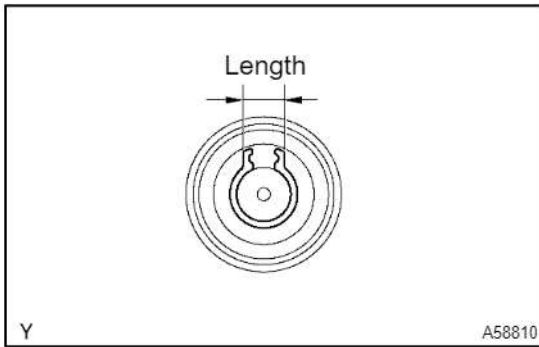
11. INSTALL PLANETARY GEAR

- (a) Apply grease to the planet gears and pin parts of the planetary shaft.
(b) Install the 3 planetary gears.

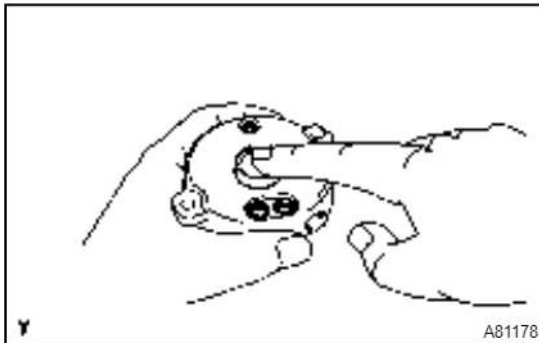


12. INSTALL STARTER ARMATURE ASSY

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

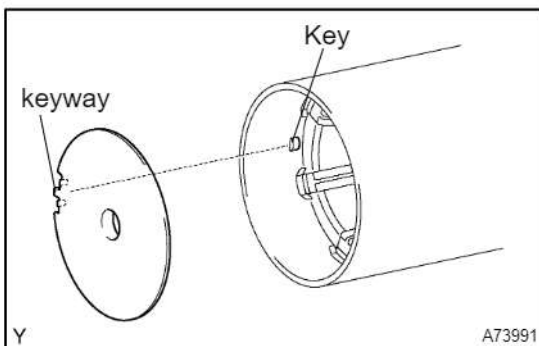


- (d) Using a vernier caliper, measure length of the snap ring.
Maximum length: 5.0 mm (0.197 in.)
 If the length is greater than the maximum, replace it with a new snap ring.



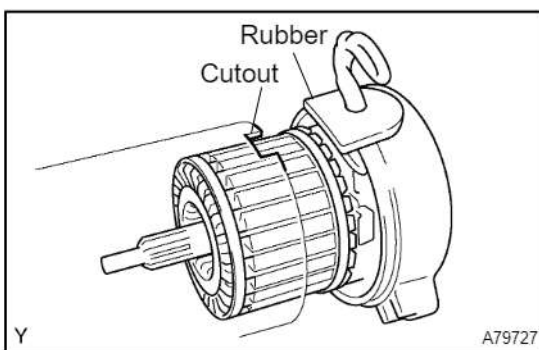
13. INSTALL STARTER COMMUTATOR END FRAME COVER

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



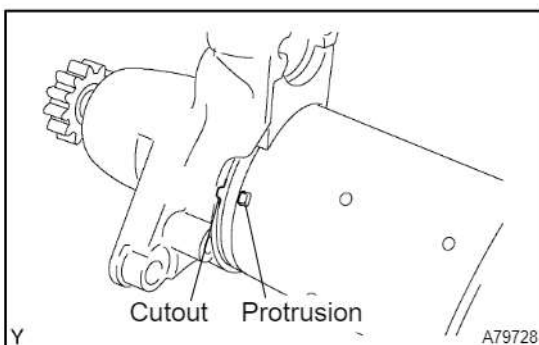
14. INSTALL STARTER ARMATURE PLATE

- (a) Insert the armature plate to the starter field frame.
 (b) Align the keyway of the starter plate with the key inside the starter field frame, and install the starter plate.



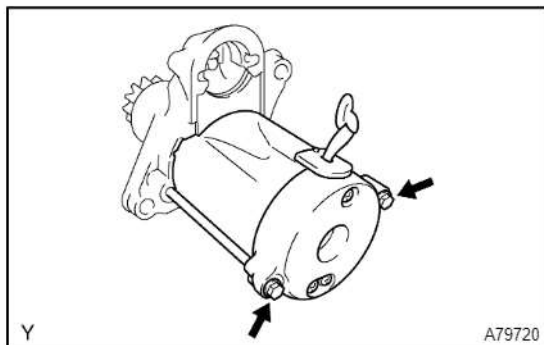
15. INSTALL STARTER COMMUTATOR END FRAME ASSY

- (a) Align the rubber of the end frame with the cutout of the field frame.
 (b) Install the end frame to the field frame.

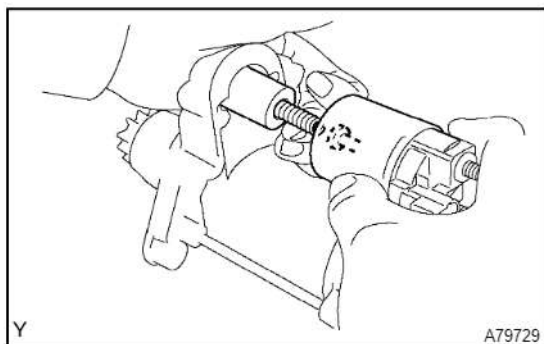


16. INSTALL STARTER FIELD FRAME ASSY

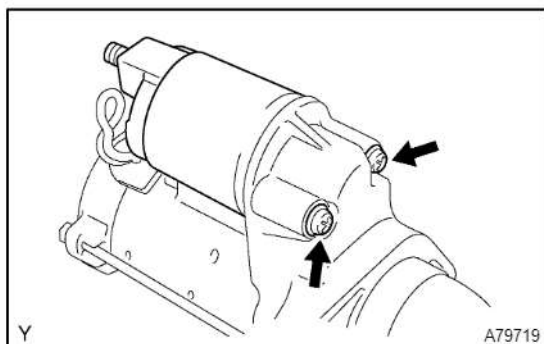
- (a) Align the protrusion of the starter field frame with the cut out of the starter drive housing.



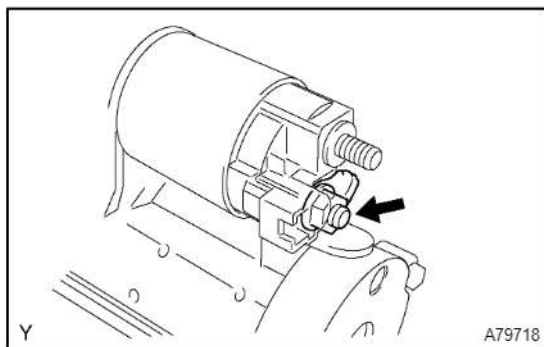
- (b) Install the field frame with the 2 through bolts.
Torque: 6.0 N·m (61 kgf·cm, 53 in·lbf)



- 17. INSTALL MAGNETIC SWITCH ASSY**
(a) Apply grease to the plunger and the hook.
(b) Hang the plunger hook of the magnetic switch to the drive lever.
(c) Install the plunger and the return spring.



- (d) Install the magnetic switch with the 2 screws.
Torque: 7.5 N·m (76 kgf·cm, 66 in·lbf)



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