# STARTING SYSTEM (2AZ–FE)

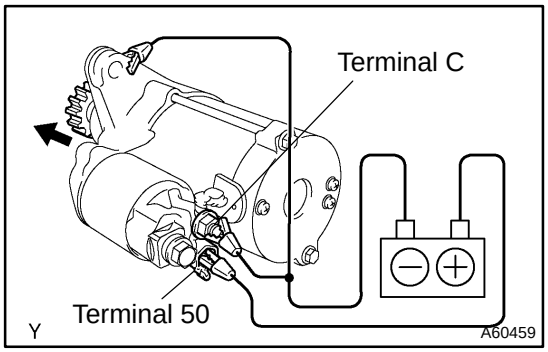
1902L–02

## INSPECTION

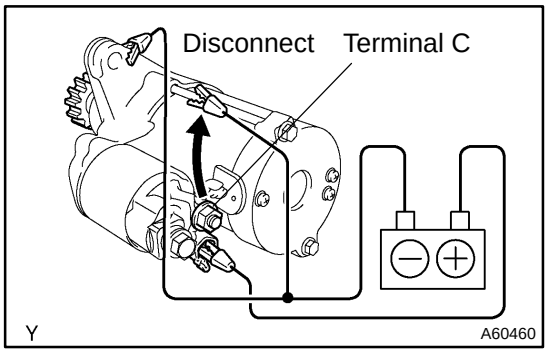
### 1. STARTER ASSY

**NOTICE:**
**These tests must be done within 3 to 5 seconds to avoid burning out the coil.**

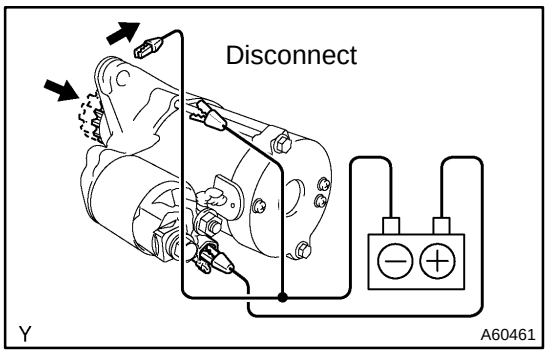
(a) Disconnect the field coil lead wire from terminal C.




(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

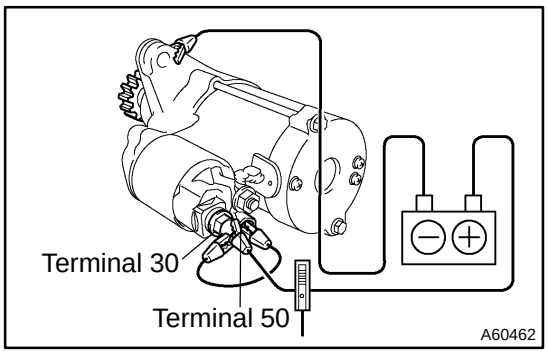



(c) With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.

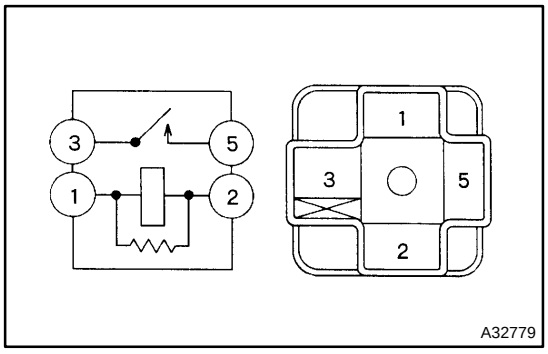



(d) Disconnect the negative (–) lead from the switch body. Check that the clutch pinion gear returns inward.

(e) Connect the lead wire to the terminal C with the nut.
**Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)**




(f) Connect the battery and ammeter to the starter as shown.
(g) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.
**Specified current: 90 A or less at 11.5 V**




## 2. STARTER RELAY ASSY

(a) Inspect the relay continuity.
(1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.

(b) Inspect the relay operation.
(1) Apply battery positive voltage across terminals 1 and 2.
(2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

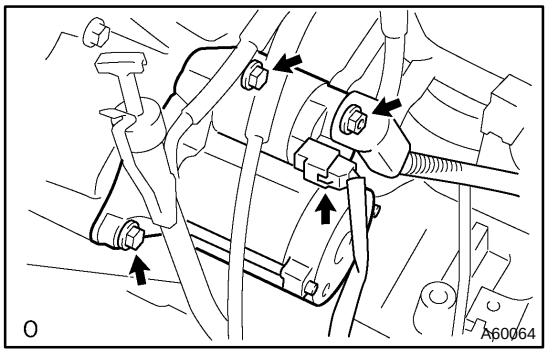
If there is no continuity, replace the relay.

# STARTER ASSY (2AZ–FE)

1902M–02

## REPLACEMENT

1. **REMOVE BATTERY**
2. **REMOVE AIR CLEANER ASSY**
3. **REMOVE AIR CLEANER BRACKET**
4. **REMOVE AIR CLEANER INLET ASSY**




5. **REMOVE STARTER ASSY**

(a) Disconnect the starter connector.
(b) Remove the nut and disconnect the terminal 30.
(c) Remove 2 bolts and starter.

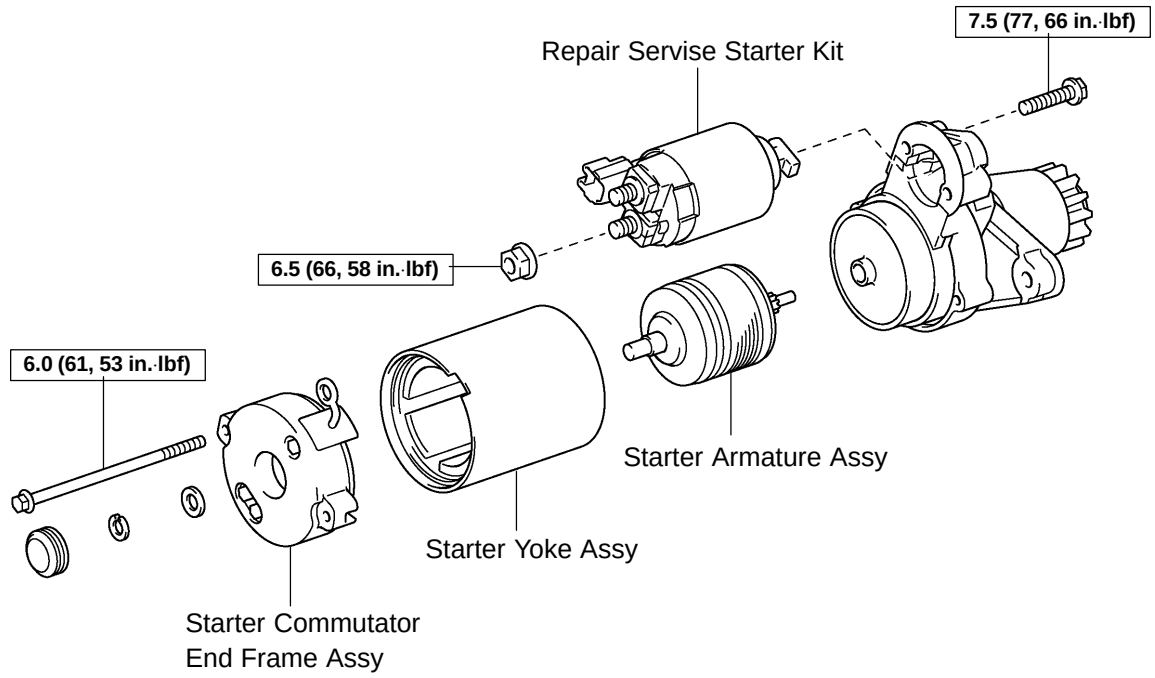
6. **INSTALL STARTER ASSY**

**Torque:**
**Bolt 39 N·m (398 kgf·cm, 29 ft·lbf)**
**Terminal 30 13 N·m (130 kgf·cm, 9 ft·lbf)**

7. **INSTALL AIR CLEANER INLET ASSY**
8. **INSTALL AIR CLEANER BRACKET**
9. **INSTALL AIR CLEANER ASSY**
10. **INSTALL BATTERY**

1908U–01

# COMPONENTS

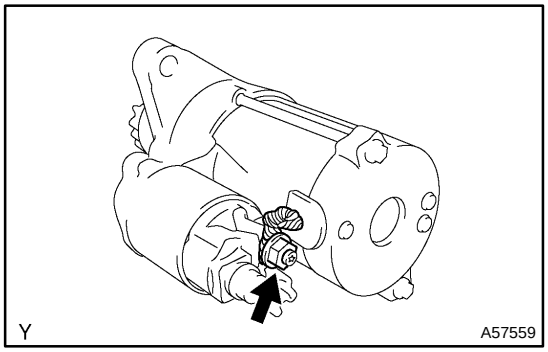



N·m (kgf·cm, ft·lbf): Specified torque

O

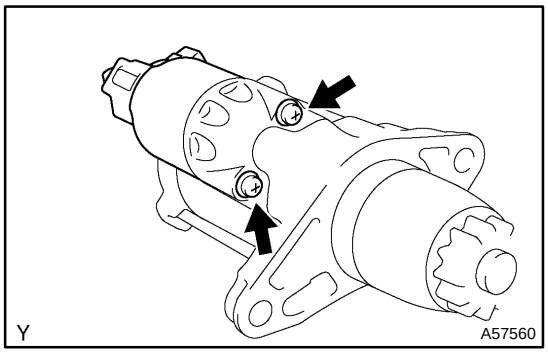
A59593

# OVERHAUL




**1. REMOVE REPAIR SERVICE STARTER KIT**

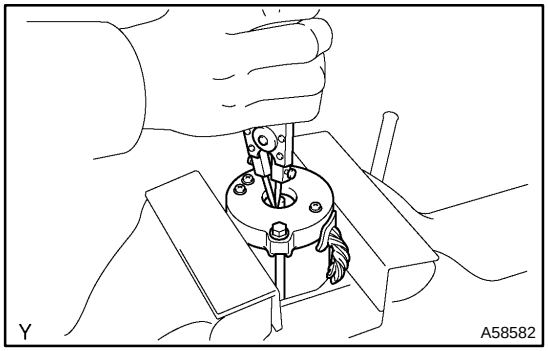
(a) Remove the nut, and disconnect the lead wire from the repair service starter kit.



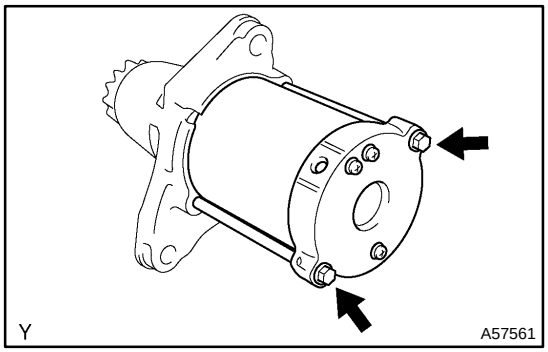

(b) Remove the 2 screws holding the repair service starter kit to the starter housing.
(c) Remove the repair service starter kit.
(d) Remove the return spring and plunger.

**2. REMOVE STARTER COMMUTATOR END FRAME ASSY**

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



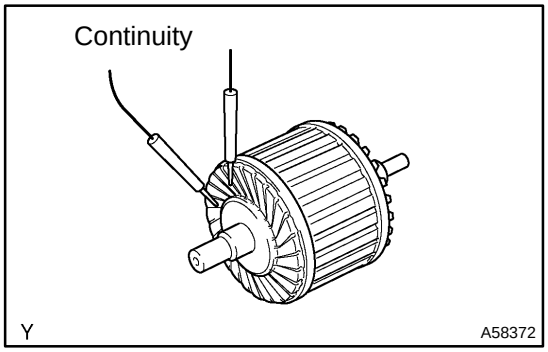

(b) Using snap ring pliers, remove the snap ring and plate washer.




(c) Remove the 2 through bolts, and pull out the starter yoke assy together with the commutator end frame assy.

## 3. REMOVE STARTER ARMATURE ASSY

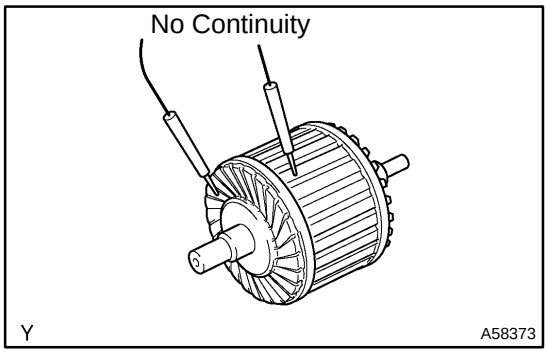
(a) Remove the starter armature assy from starter yoke assy.




## 4. INSPECT STARTER ARMATURE ASSY

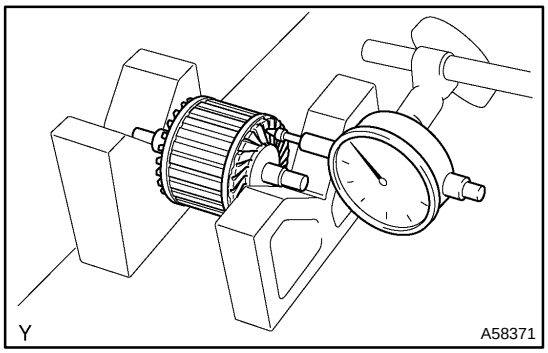
(a) Check the commutator for open circuit.
  (1) Using an ohmmeter, check that there is continuity between the segments of the commutator.

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




(b) Check the commutator for ground.
  (1) Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

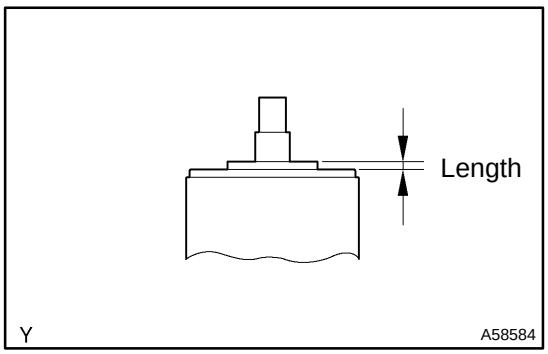



(c) Check the commutator for dirty and burn on surface.

If the surface is dirty or burnt, correct it with sandpaper (No.400) or a lathe.

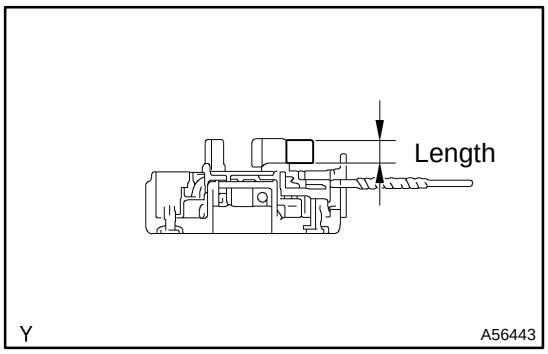
(d) Check for the commutator circuit runout.
  (1) Place the commutator on V–blocks.
  (2) Using a dial indicator, measure the circle runout.
  **Standard circle runout: 0.02 mm (0.0008 in.)**
  **Maximum circle runout: 0.05 mm (0.0020 in.)**

If the circle runout is greater than maximum, replace the armature.




(e) Using vernier calipers, measure the commutator length.
  **Standard length: 3.3 mm (0.130 in.)**
  **Maximum length: 4.0 mm (0.158 in.)**

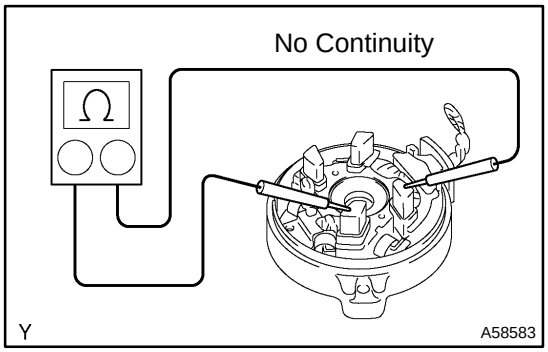
If the length is greater than maximum, replace the armature.




## 5. INSPECT STARTER COMMUTATOR END FRAME ASSY

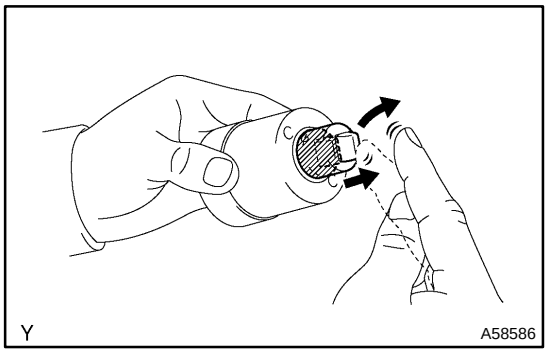
(a) Using vernier calipers, measure the brush holder length.
**Standard length: 9.0 mm (0.359 in.)**
**Maximum length: 4.0 mm (0.158 in.)**

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




(b) Check the brush holder.
(1) Using an ohmmeter, check that there is no continuity between the positive (+) and negative (–) brush holders.

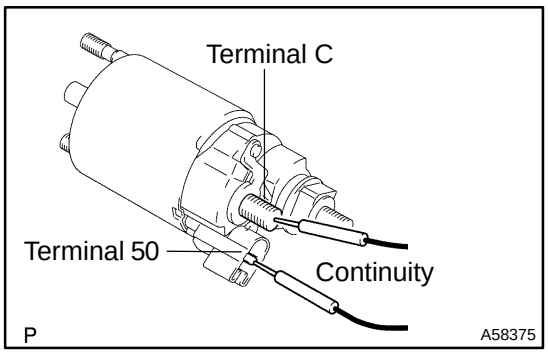
If the there is continuity repair or replace the starter commutator end frame assy.




## 6. INSPECT REPAIR SERVICE STARTER KIT

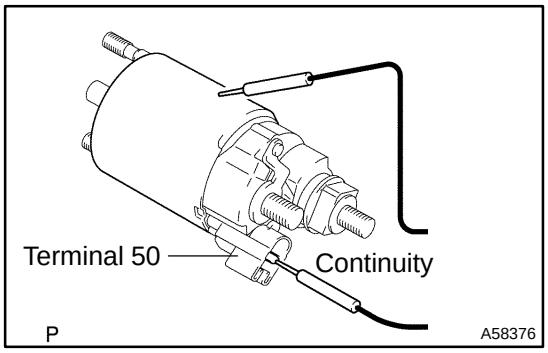
(a) Check the plunger.
(1) Push in the plunger and check that it returns quickly to its original position.

If necessary, replace the repair service starter kit.




(b) Check the pull–in coil for open circuit.
(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.

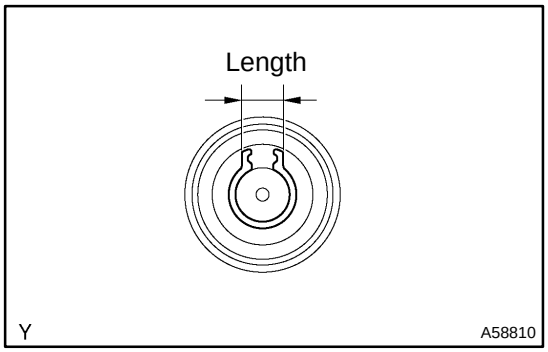



(c) Check whether the hold–in coil has an open circuit.
(1) Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

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

### 7. INSTALL STARTER ARMATURE ASSY

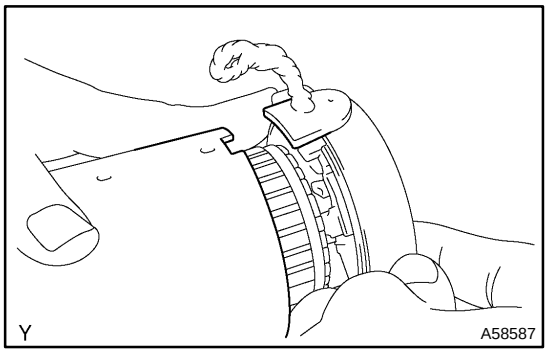
(a) Apply grease to the washer plate and armature shaft.
(b) Install the armature shaft to the starter commutator end frame assy.
(c) Using snap ring pliers, install the plate washer and new snap ring.



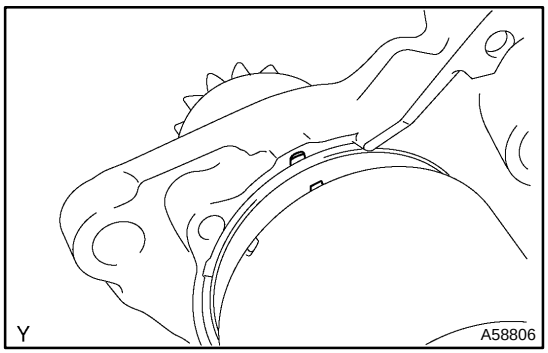

(d) Using vernier calipers, mesure the snap ring.
**Maximum length: 5.0 mm (0.197 in.)**

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

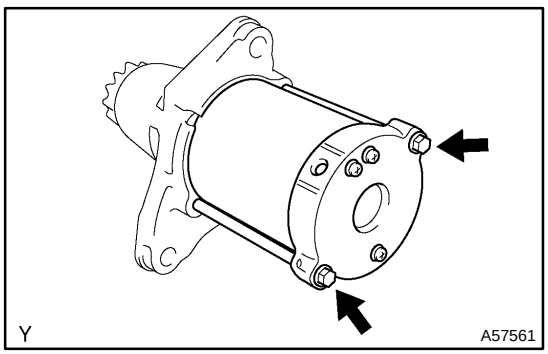
### 8. INSTALL STARTER COMMUTATOR END FRAME ASSY




(a) Align the starter commutator rubber end frame with the cutout of starter yoke.
(b) Install starter yoke assy to starter commutator end frame.




(c) Align the starer yoke assy with the cutout of motor terminal starter kit.

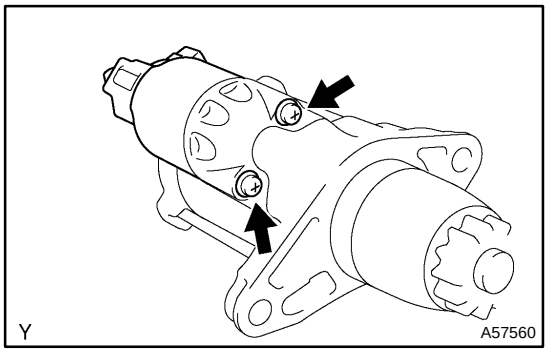



(d) Install the starter yoke assy with the 2 through bolts.
**Torque: 6.0 N·m (61 kgf·cm, 53 in.·lbf)**

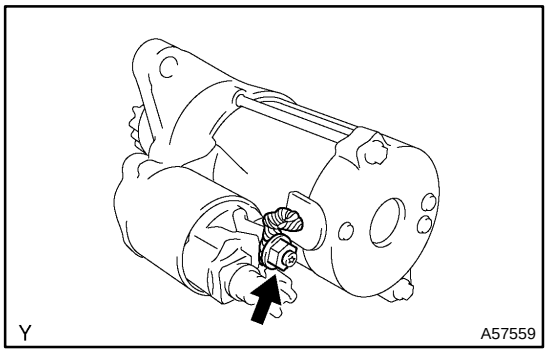
(e) Install the starter commutator end frame cover.

**9. 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 drive lever.
(c) Install the plunger and return spring.




(d) Install the repair service starter kit with the 2 screws.
**Torque: 7.5 N·m (77 kgf·cm, 66 in.·lbf)**




(e) Apply grease to the nut of the lead wire.
(f) Connect the lead wire to the terminal with the nut.
**Torque: 6.5 N·m (66 kgf·cm, 58 in.·lbf)**

# CHARGING SYSTEM (2AZ–FE)

1902O–02

## PRECAUTION

### 1. PRECAUTION

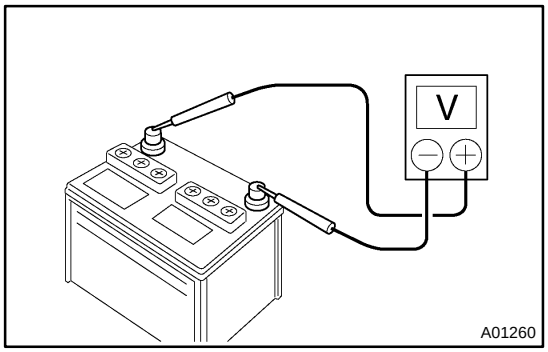
(a) Check that the battery cables are connected to the correct terminals.
(b) Disconnect the battery cables when the battery is given a quick charge.
(c) Do not perform tests with a high voltage insulation resistance tester.
(d) Never disconnect the battery while the engine is running.
(e) Check that the charging cable is tightened on terminal B of the alternator and the fuse box.
(f) Do not check whether the alternator generators or not with connecting terminal F to the other terminal.

# ON–VEHICLE INSPECTION

## 1. CHECK BATTERY ELECTROLYTE LEVEL

(a) Check the electrolyte quantity of each cell

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




## 2. CHECK BATTERY VOLTAGE

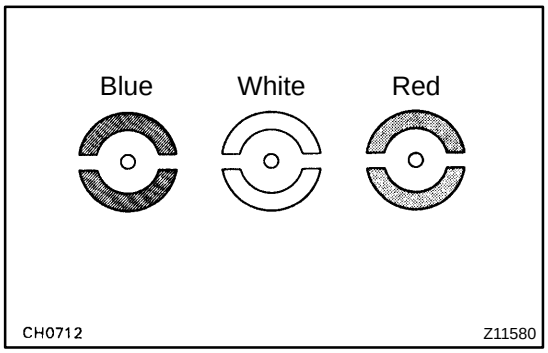
(a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

(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)**

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




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

HINT:

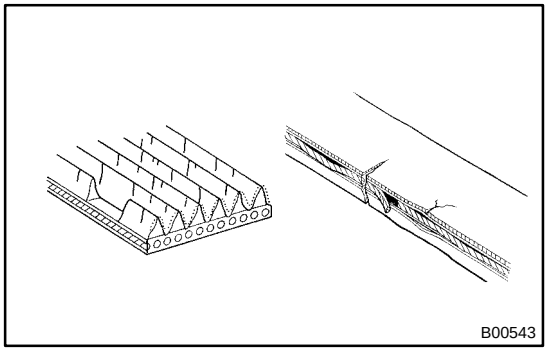
- Blue: OK
- White: Charging Necessary
- Red: Insufficient Water

## 3. 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, H–fuses and fuses for continuity.



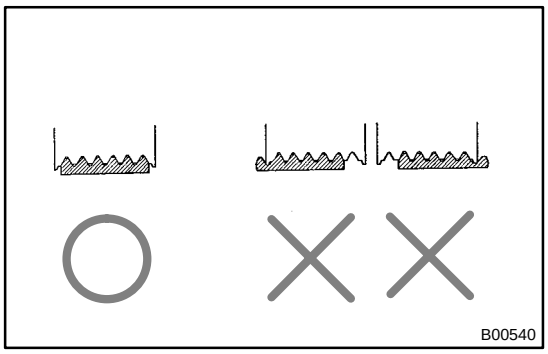

## 4. INSPECT DRIVE BELT

(a) Check the belt for wear and cracks etc.

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

HINT:

- Replace the drive belt if the belt has worn out until the wire has been seen.
- Replace the drive belt if the cracks reached to the wire more than one place.
- Replace the drive belt if the belt has chunks missing from the ribs.




(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.

**5. VISUALLY CHECK ALTERNATOR WIRING**

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

**6. LISTEN FOR ABNORMAL NOISES FROM ALTERNATOR**

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

**7. CHECK DISCHARGE WARNING LIGHT CIRCUIT**

(a) Warm up engine and then turn it off.

(b) Switch off all accessories.

(c) Turn the ignition switch ON. Check that the discharge warning light is lit.

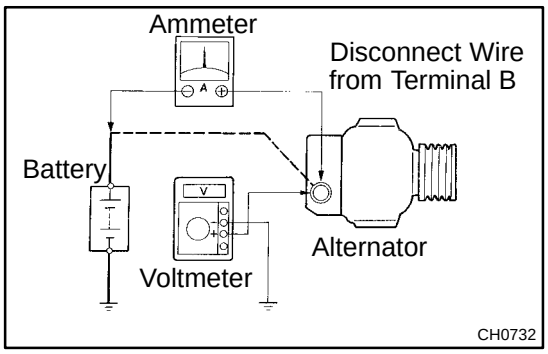
(d) Start the engine. Check that the light goes off.

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

**8. INSPECT CHARGING CIRCUIT WITHOUT LOAD**

HINT:

If a battery/alternator tester is available, connect the tester to the charging circuit as per 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 alternator, and connect it to the negative (–) tester probe of the ammeter.

(2) Connect the positive (+) tester probe of the ammeter to terminal B of the alternator.

(3) Connect the positive (+) tester probe of the voltmeter to terminal B of the alternator.

(4) Ground the negative (–) tester probe of the voltmeter.

(b) Check the charging circuit as follows.

(1) With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

**Standard amperage: 10 A or less**

**Standard voltage: 13.2 – 14.8 V**

**9. INSPECT CHARGING CIRCUIT WITH LOAD**

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

(b) Check the reading on the ammeter.

**Standard amperage: 30 A or more**

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

HINT:

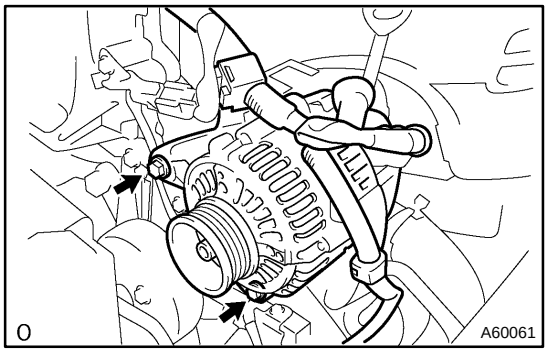
If the battery is fully charged, the indication will sometimes be less than standard amperage.

# GENERATOR ASSY (2AZ–FE)

1902Q–02

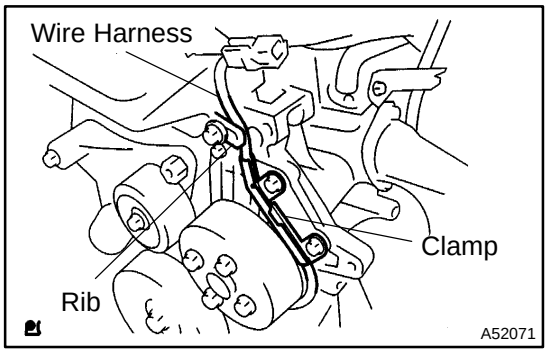
## REPLACEMENT

**1. REMOVE FAN AND GENERATOR V BELT**
**(See page 14–1)**
SST 09249–63010




**2. REMOVE GENERATOR ASSY**

(a) Disconnect the engine wire as shown in the illustration.
(b) Remove 2 bolts and alternator assembly.




**3. INSTALL GENERATOR ASSY**

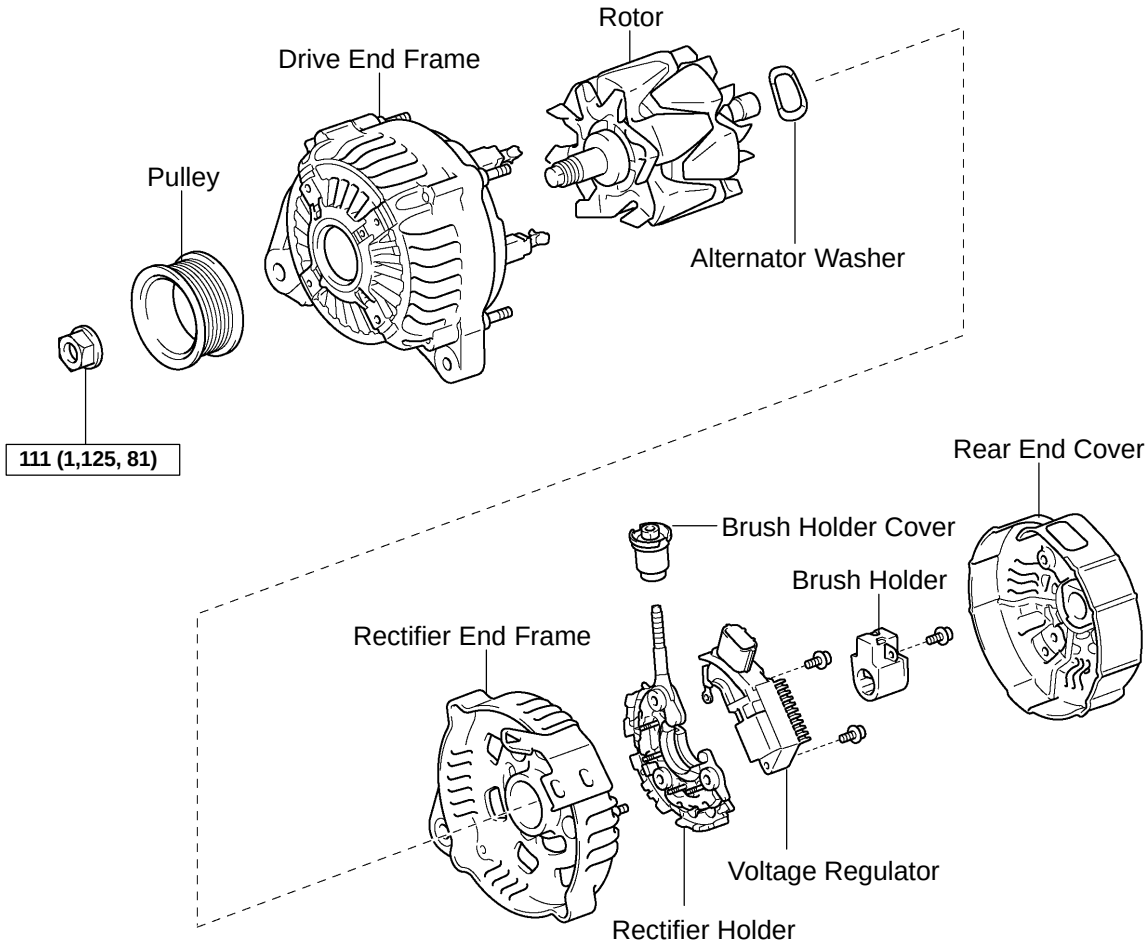
(a) Confirm the wire harness of the crank position sensor is placed as shown in the illustration.
(b) Install the alternator assembly.
**Torque:**
**M8 21 N·m (214 kgf·cm, 15 ft·lbf)**
**M10 52 N·m (530 kgf·cm, 38 ft·lbf)**
**Wiring harness clamp 8.4 N·m ( 85 kgf·cm, 74 in.·lbf)**
**Alternator wire 9.8 N·m (100 kgf·cm, 7 ft·lbf)**

**NOTICE:**
**Be careful not to put the wire harness in when install the alternator.**

**4. INSTALL FAN AND GENERATOR V BELT**
**(See page 14–1)**
SST 09249–63010

1908W–01

# COMPONENTS




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

Y

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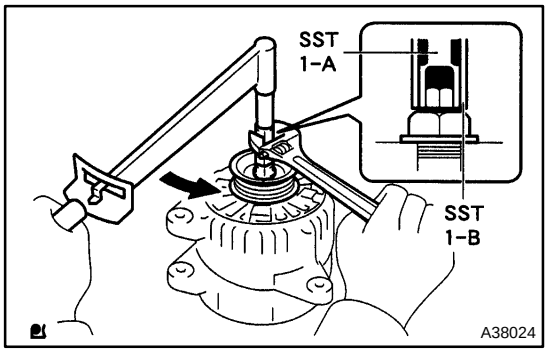
# OVERHAUL

## 1. REMOVE GENERATOR PULLEY

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

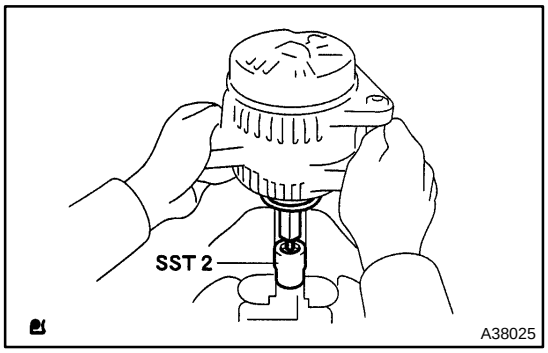
HINT:

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

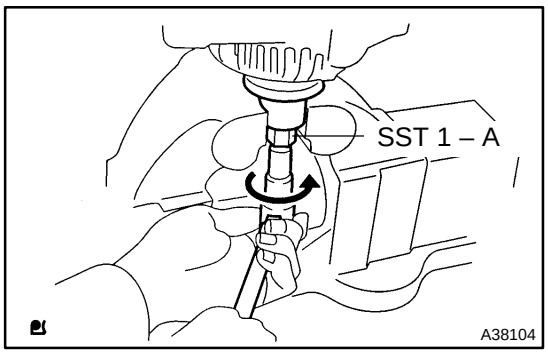



(a) Hold SST 1 – A with a torque wrench, and tighten SST 1 – B clockwise to the specified torque.
**Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**

**NOTICE:**
**Check that SST is secured to the rotor shaft.**



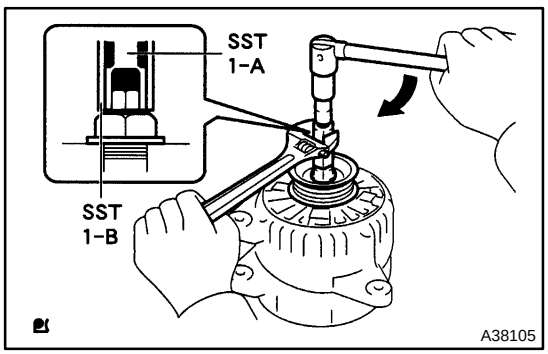

(b) Mount SST 2 in a vise.
(c) Insert SST 1 – A, B into SST 2, and attach the pulley nut to SST 2.




(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 form 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 bolt, 3 nuts, plate terminal and end cover.
(c) Remove the brush cover.
(d) Remove the 2 screws and brush holder.

**3. REMOVE GENERATOR REGULATOR ASSY**

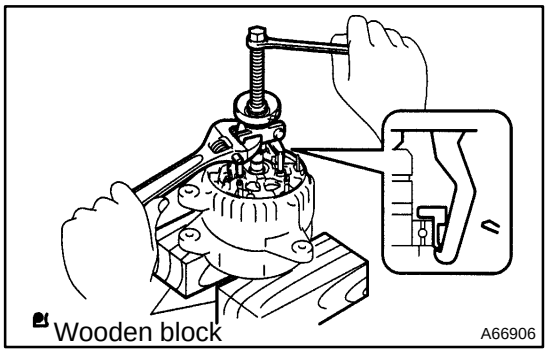
(a) Remove the 3 screws and voltage regulator.

**4. REMOVE GENERATOR HOLDER W/RECTIFIER**

(a) Remove the 4 screws and rectifier holder.

**5. REMOVE ALTERNATOR RECTIFIRE END FRAME**

(a) Remove the rubber insulator.
(b) Remove the seal plate.
(c) Remove the 4 nuts.

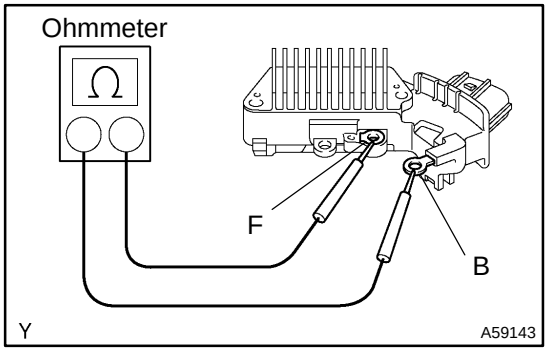



(d) Using bearing puller set, remove the rectifier end frame.

**6. REMOVE GENERATOR ROTOR ASSY**

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

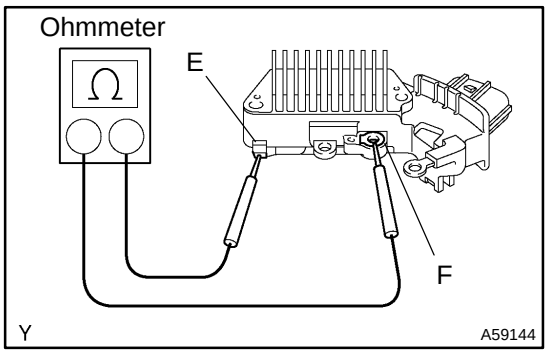
**NOTICE:**
**Do not drop the rotor.**




**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.**

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

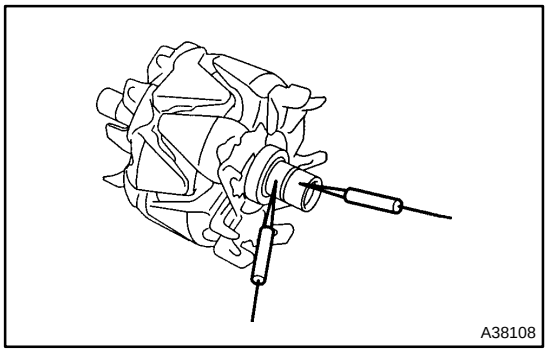



(b) Using an ohmmeter, check the continuity between terminals F and E.

**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.**

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



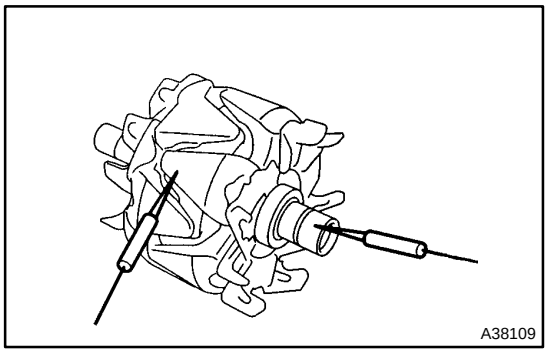

## 8. INSPECT GENERATOR ROTOR ASSY

(a) Inspect rotor for open circuit.

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

**Standard resistance: 2.7 – 3.1 Ω at 20°C (68°F)**

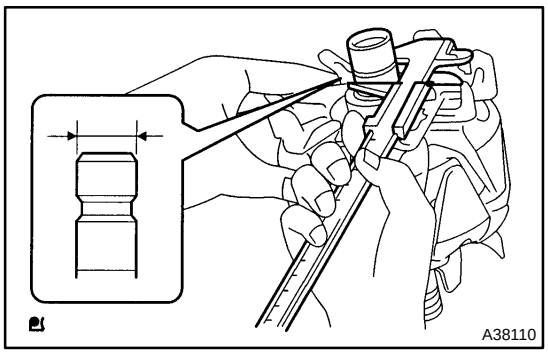
If there is no continuity, replace the rotor.




(b) Inspect rotor for ground.

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

If there is continuity, replace the rotor.



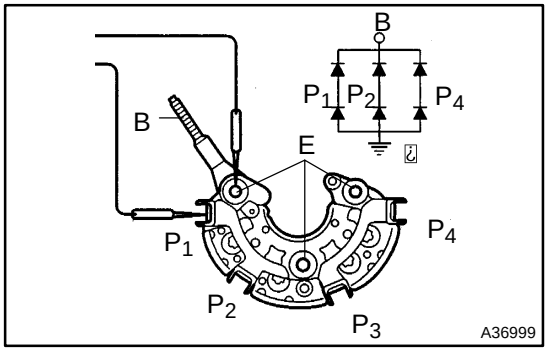

(c) Inspect slip rings.

(1) Using 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.)**

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

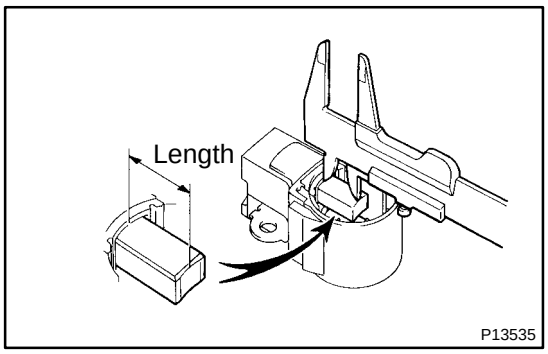



## 9. INSPECT GENERATOR HOLDER W/RECTIFIER

(a) Using an ohmmeter, connect one tester probe to the B or E terminal and the other to each rectifier terminal.

(b) Reverse the polarity of the tester probes and repeat step (a).

(c) Check that one shows continuity and the other shows no continuity.




**10. INSPECT BRUSH**

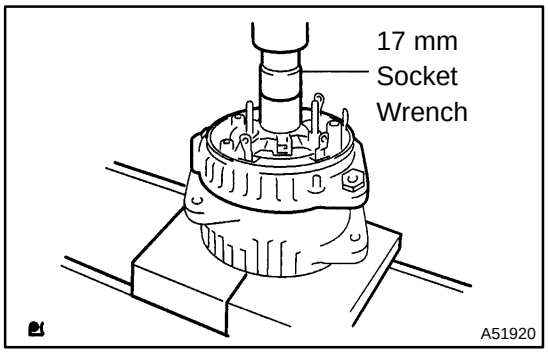
(a) Using vernier calipers, measure the exposed brush length.

**Standard exposed length:**
**9.5 – 11.5 mm (0.374 – 0.453 in.)**
**Minimum exposed length: 1.5 mm (0.059 in.)**

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

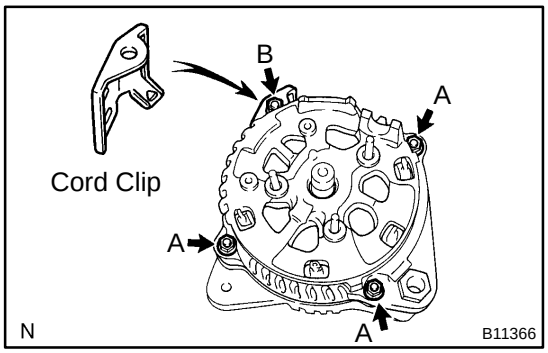
**11. INSTALL GENERATOR ROTOR ASSY**

(a) Install the generator rotor.
(b) Install the alternator washer to the rotor.




**12. INSTALL ALTERNATOR RECTIFIRE END FRAME**

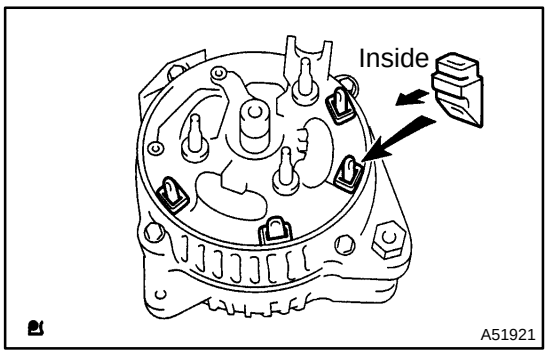
(a) Using a 17 mm socket wrench and press, slowly press in the rectifier end frame.




(b) Install the cord clip and 4 nuts.

**Torque:**
**Nut A 4.5 N·m (46 kgf·cm, 39 in.·lbf)**
**Nut B 5.4 N·m (55 kgf·cm, 47 in.·lbf)**

(c) Install the seal plate on the rectifier end frame.




(d) Install the 4 rubber insulators on the lead wires.

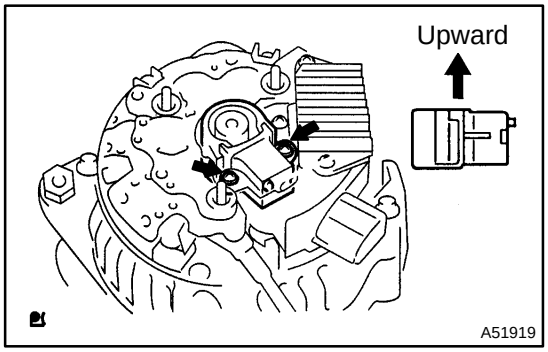
**NOTICE:**
**Be careful of the rubber insulators installation direction.**

**13. INSTALL GENERATOR HOLDER W/RECTIFIER**

(a) Install the rectifier holder while pushing it with the 4 screws.
**Torque: 2.9 N·m (30 kgf·cm, 26 in.·lbf)**

## 14. INSTALL GENERATOR REGULATOR ASSY

(a) Install the 3 screws and voltage regulator.
**Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)**




## 15. INSTALL GENERATOR BRUSH HOLDER ASSY

(a) Install the 2 screws and brush holder.
**Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)**

**NOTICE:**
**Be careful of the holder installation direction.**

(b) Install the brush cover.
(c) Install the end cover and plate terminal with the bolt and 3 nuts.
**Torque:**
**Nut 4.4 N·m (45 kgf·cm, 39 in.·lbf)**
**Bolt 3.9 N·m (39 kgf·cm, 35 in.·lbf)**
(d) Install the terminal insulator with the nut.
**Torque: 4.1 N·m (42 kgf·cm, 36 in.·lbf)**

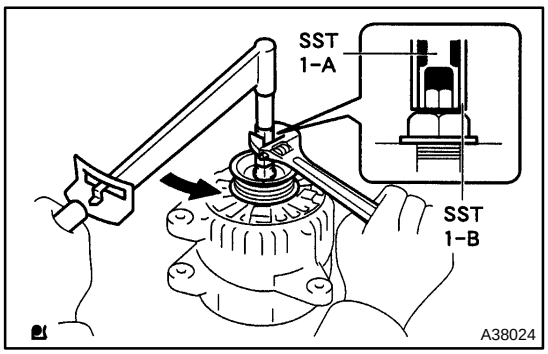
## 16. INSTALL GENERATOR PULLEY

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

HINT:

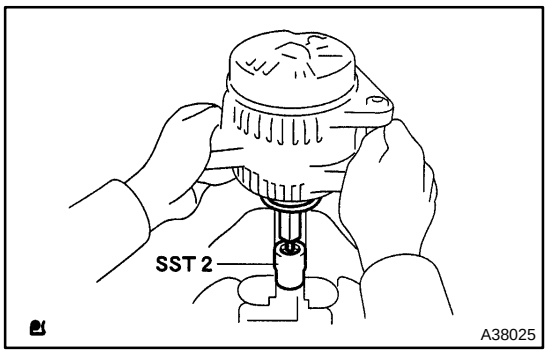
| | |
|---|---|
| SST1 – A, B | 09820–06010 |
| SST2 | 09820–06020 |

(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

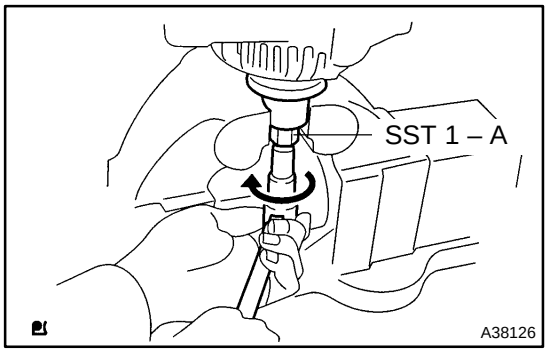



(b) Hold SST 1 – A with a torque wrench, and tighten SST 1 – B clockwise to the specified to torque.
**Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**

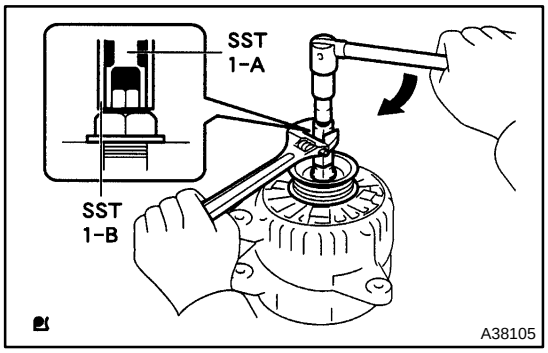
**NOTICE:**
**Check that SST is secured to the pulley shaft.**




(c) Mount 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, turn SST 1 – A in the direction shown in the illustration.
**Torque: 111 N·m (1,125 kgf·cm, 81 ft·lbf)**
(f) Remove the alternator form SST 2.




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

# STARTING SYSTEM (1MZ–FE)

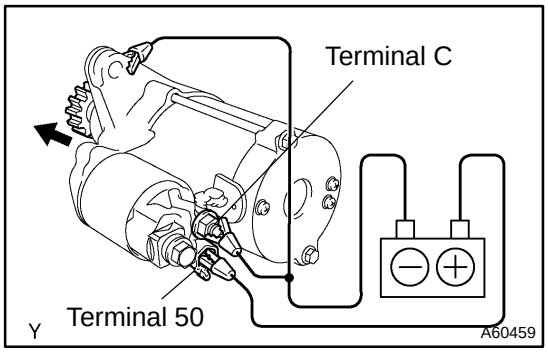
1902T–02

## INSPECTION

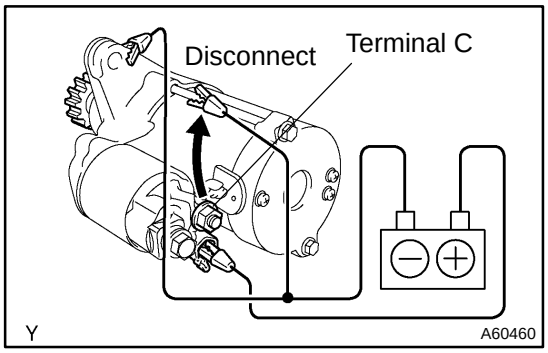
### 1. STARTER ASSY

**NOTICE:**
**These tests must be done within 3 to 5 seconds to avoid burning out the coil.**

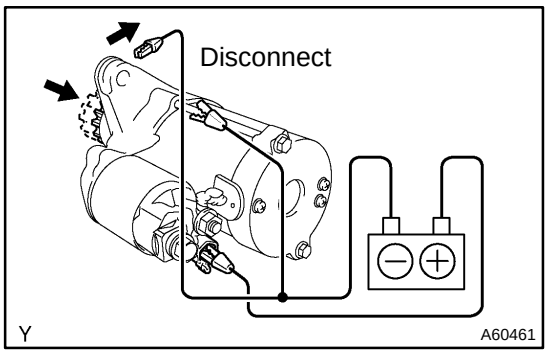
(a) Disconnect the field coil lead wire from terminal C.




(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

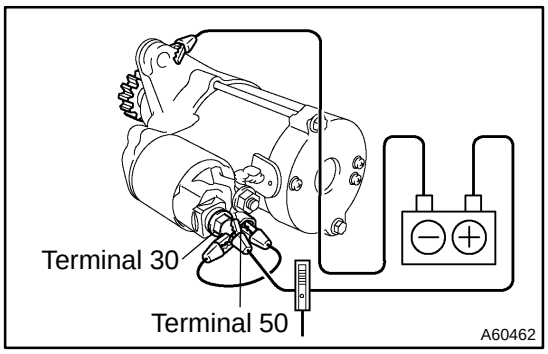



(c) With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.

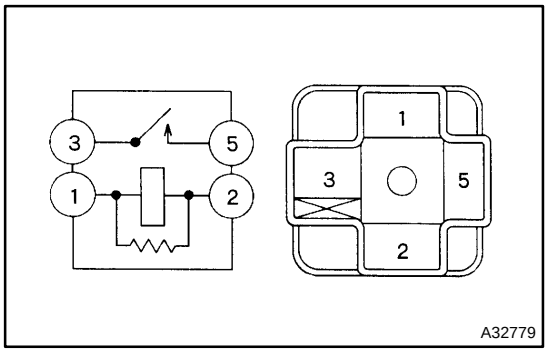



(d) Disconnect the negative (–) lead from the switch body. Check that the clutch pinion gear returns inward.

(e) Connect the lead wire to the terminal C with the nut.
**Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)**




(f) Connect the battery and ammeter to the starter as shown.
(g) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.
**Specified current: 90 A or less at 11.5 V**




## 2. STARTER RELAY ASSY

(a) Inspect the relay continuity.
(1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.

(b) Inspect the relay operation.
(1) Apply battery positive voltage across terminals 1 and 2.
(2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

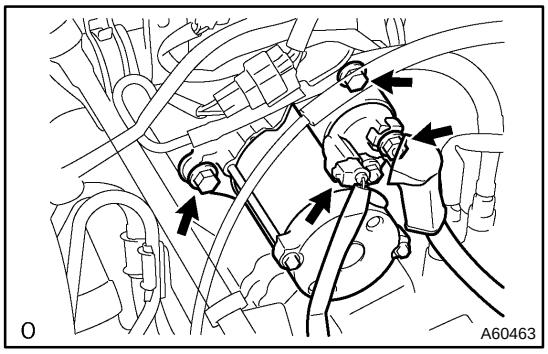
If there is no continuity, replace the relay.

# STARTER ASSY (1MZ–FE)

1902U–02

## REPLACEMENT

1. REMOVE BATTERY
2. REMOVE AIR CLEANER INLET ASSY
3. REMOVE AIR CLEANER ASSEMBLY WITH HOSE
4. REMOVE AIR CLEANER BRACKET
5. REMOVE AIR CLEANER INLET NO.1




6. REMOVE STARTER ASSY

(a) Disconnect the starter connector.
(b) Remove the nut, and disconnect the lead wire from terminal 30.
(c) Remove the 2 bolts and starter.

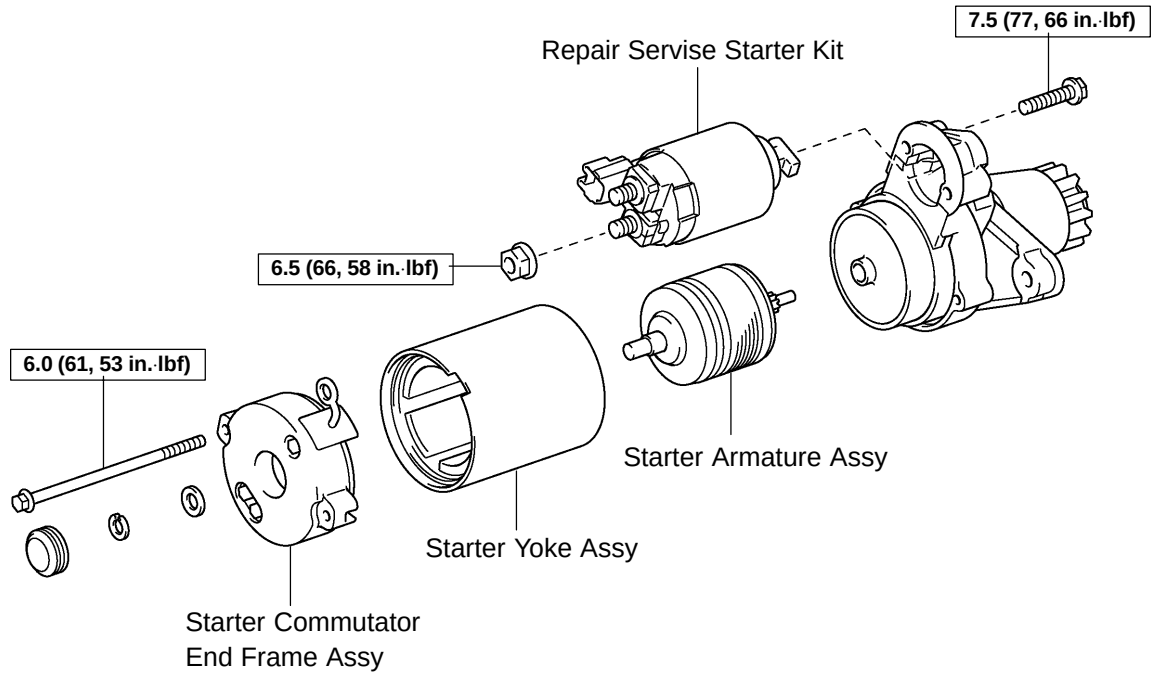
7. INSTALL STARTER ASSY

**Torque:**
**Bolt 42 N·m (429 kgf·cm, 31 ft·lbf)**
**Nut 9.8 N·m (100 kgf·cm, 7 ft·lbf)**

8. INSTALL AIR CLEANER ASSEMBLY WITH HOSE

1908L–01

# COMPONENTS

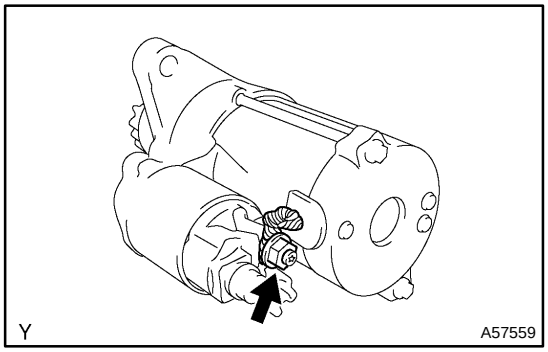



N·m (kgf·cm, ft·lbf): Specified torque

O

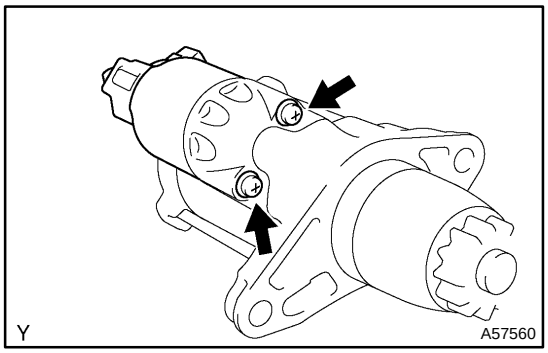
A59593

# OVERHAUL




**1. REMOVE REPAIR SERVICE STARTER KIT**

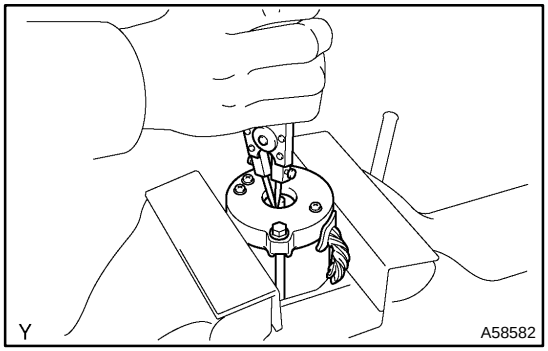
(a) Remove the nut, and disconnect the lead wire from the repair service starter kit.



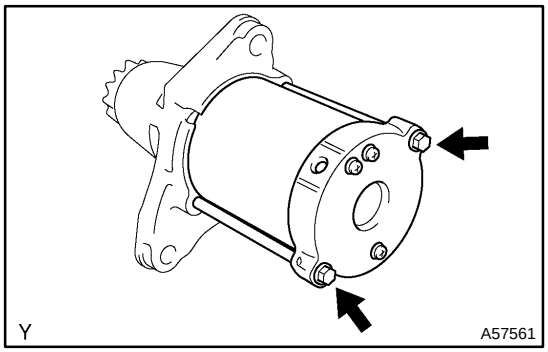

(b) Remove the 2 screws holding the repair service starter kit to the starter housing.
(c) Remove the repair service starter kit.
(d) Remove the return spring and plunger.

**2. REMOVE STARTER COMMUTATOR END FRAME ASSY**

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



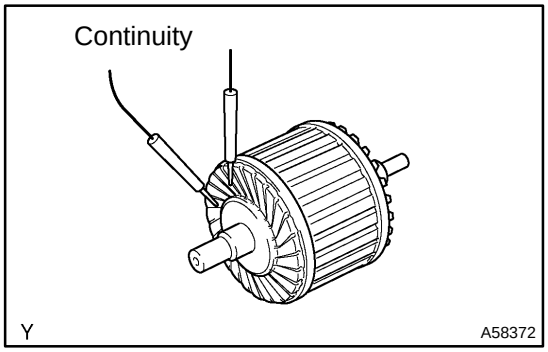

(b) Using snap ring pliers, remove the snap ring and plate washer.




(c) Remove the 2 through bolts, and pull out the starter yoke assy together with the commutator end frame assy.

## 3. REMOVE STARTER ARMATURE ASSY

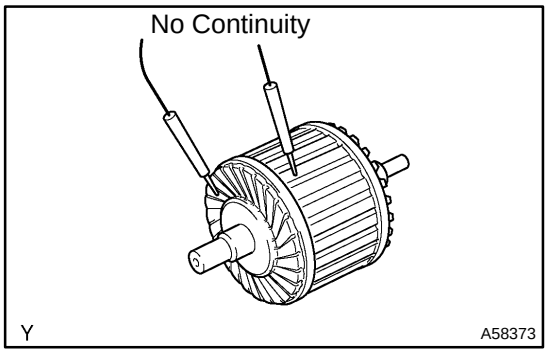
(a) Remove the starter armature assy from starter yoke assy.




## 4. INSPECT STARTER ARMATURE ASSY

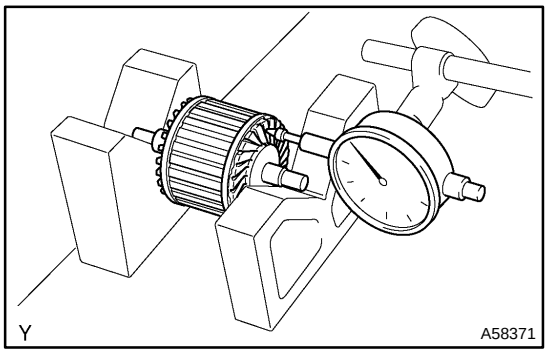
(a) Check the commutator for open circuit.
  (1) Using an ohmmeter, check that there is continuity between the segments of the commutator.

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




(b) Check the commutator for ground.
  (1) Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

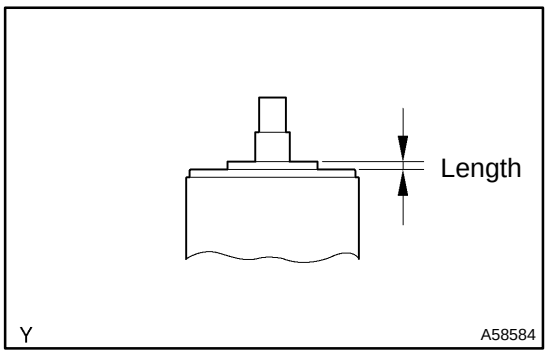



(c) Check the commutator for dirty and burn on surface.

If the surface is dirty or burnt, correct it with sandpaper (No.400) or a lathe.

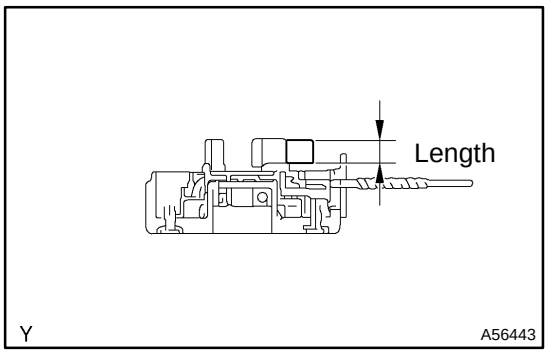
(d) Check for the commutator circuit runout.
  (1) Place the commutator on V–blocks.
  (2) Using a dial indicator, measure the circle runout.
  **Standard circle runout: 0.02 mm (0.0008 in.)**
  **Maximum circle runout: 0.05 mm (0.0020 in.)**

If the circle runout is greater than maximum, replace the armature.




(e) Using vernier calipers, measure the commutator length.
  **Standard length: 3.3 mm (0.130 in.)**
  **Maximum length: 4.0 mm (0.158 in.)**

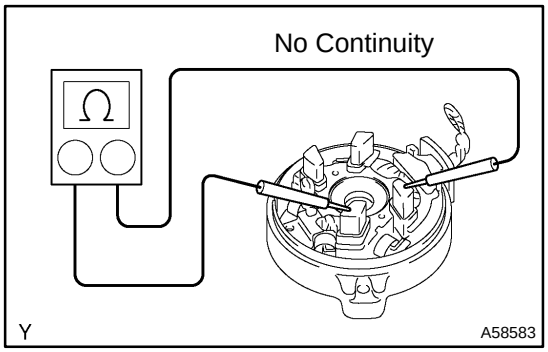
If the length is greater than maximum, replace the armature.




## 5. INSPECT STARTER COMMUTATOR END FRAME ASSY

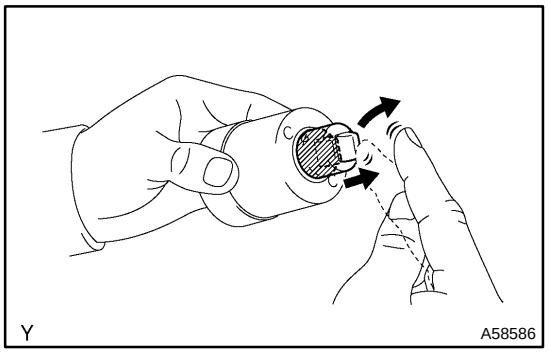
(a) Using vernier calipers, measure the brush holder length.
**Standard length: 9.0 mm (0.354 in.)**
**Maximum length: 4.0 mm (0.158 in.)**

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




(b) Check the brush holder.
(1) Using an ohmmeter, check that there is no continuity between the positive (+) and negative (–) brush holders.

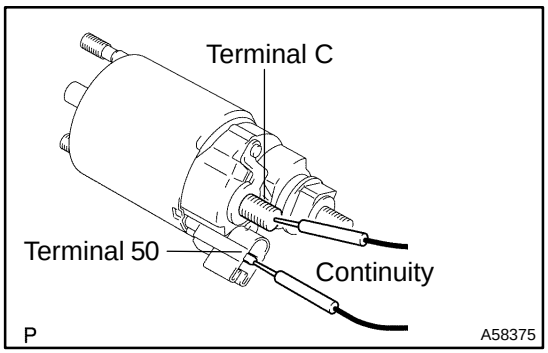
If the there is continuity repair or replace the starter commutator end frame assy.




## 6. INSPECT REPAIR SERVICE STARTER KIT

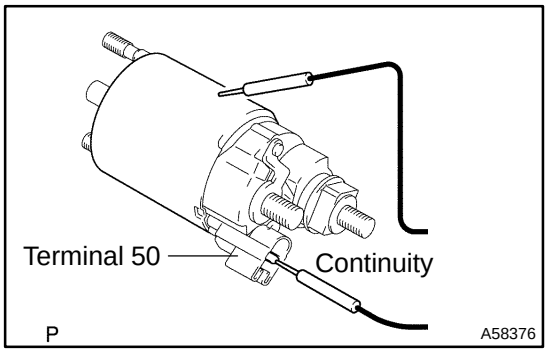
(a) Check the plunger.
(1) Push in the plunger and check that it returns quickly to its original position.

If necessary, replace the repair service starter kit.




(b) Check the pull–in coil for open circuit.
(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.

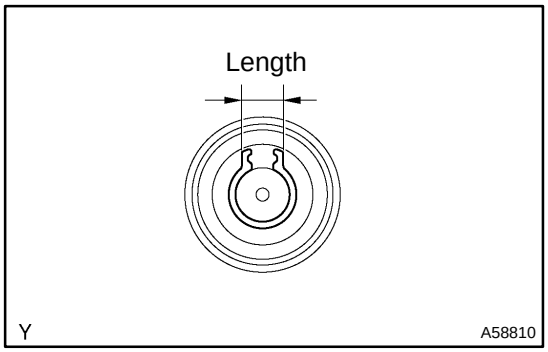



(c) Check whether the hold–in coil has an open circuit.
(1) Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

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

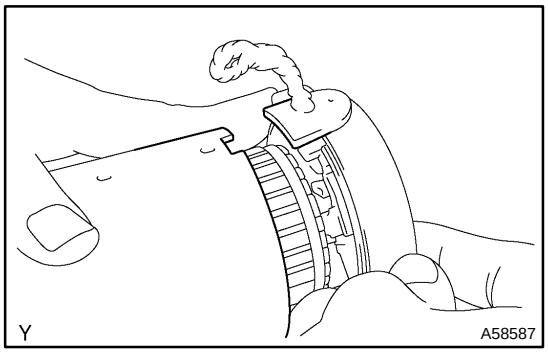
### 7. INSTALL STARTER ARMATURE ASSY

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



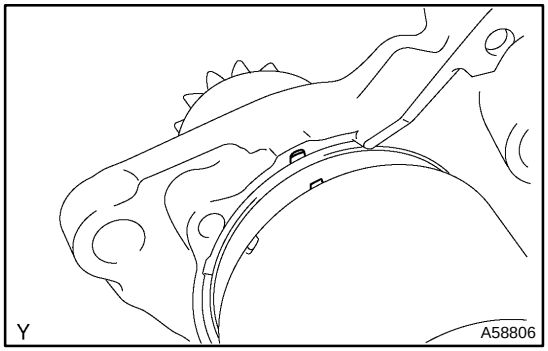

(d) Using vernier calipers, mesure the snap ring.
**Maximum length: 5.0 mm (0.197 in.)**

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

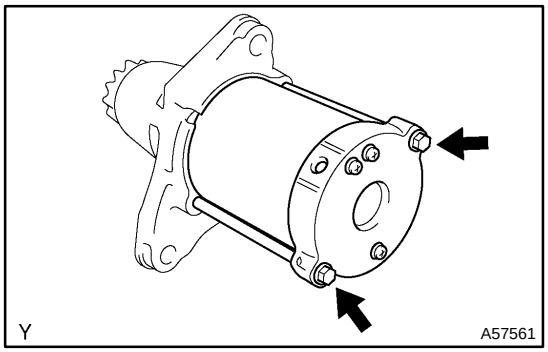



### 8. INSTALL STARTER COMMUTATOR END FRAME ASSY

(a) Align the starter commutator rubber end frame with the cutout of starter yoke.
(b) Install starter yoke assy to starter commutator end frame.



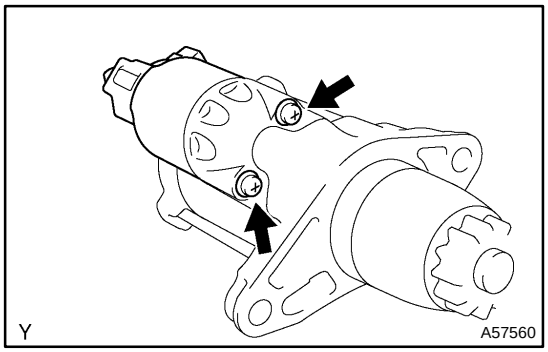

(c) Align the starer yoke assy with the cutout of motor terminal starter kit.



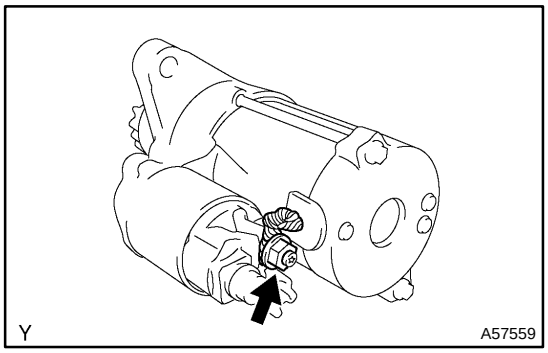

(d) Install the starter yoke assy with the 2 through bolts.
**Torque: 6.0 N·m (61 kgf·cm, 53 in.·lbf)**
(e) Install the starter commutator end frame cover.

### 9. 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 drive lever.
(c) Install the plunger and return spring.




(d) Install the repair service starter kit with the 2 screws.
**Torque: 7.5 N·m (77 kgf·cm, 66 in.·lbf)**




(e) Apply grease to the nut of the lead wire.
(f) Connect the lead wire to the terminal with the nut.
**Torque: 6.5 N·m (66 kgf·cm, 58 in.·lbf)**

# CHARGING SYSTEM (1MZ–FE)

1902W–02

## PRECAUTION

### 1. PRECAUTION

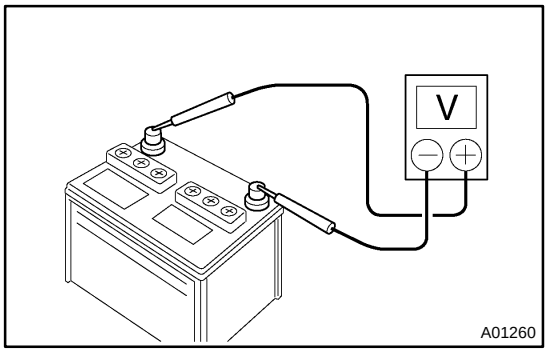
(a) Check that the battery cables are connected to the correct terminals.
(b) Disconnect the battery cables when the battery is given a quick charge.
(c) Do not perform tests with a high voltage insulation resistance tester.
(d) Never disconnect the battery while the engine is running.
(e) Check that the charging cable is tightened on terminal B of the alternator and the fuse box.
(f) Do not check whether the alternator generates or not with conncting terminal F to the other terminal.

# ON–VEHICLE INSPECTION

## 1. CHECK BATTERY ELECTROLYTE LEVEL

(a) Check the electrolyte quantity of each cell

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




## 2. CHECK BATTERY VOLTAGE

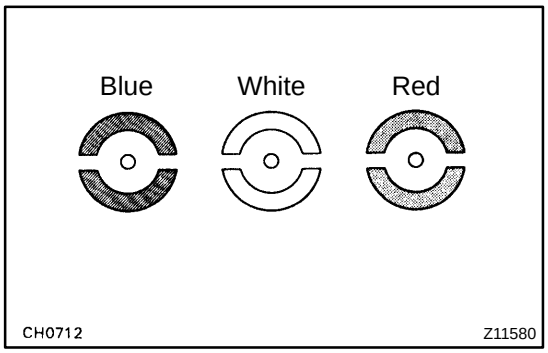
(a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

(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)**

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




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

HINT:

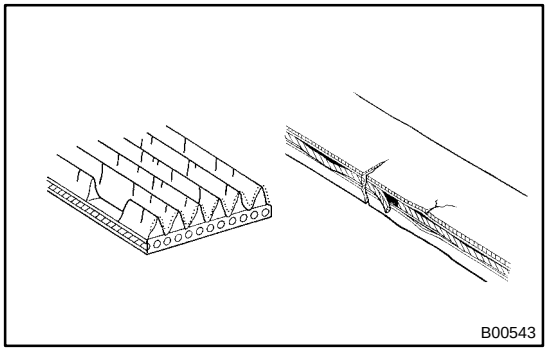
- Blue: OK
- White: Charging Necessary
- Red: Insufficient Water

## 3. 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, H–fuses and fuses for continuity.




## 4. INSPECT DRIVE BELT

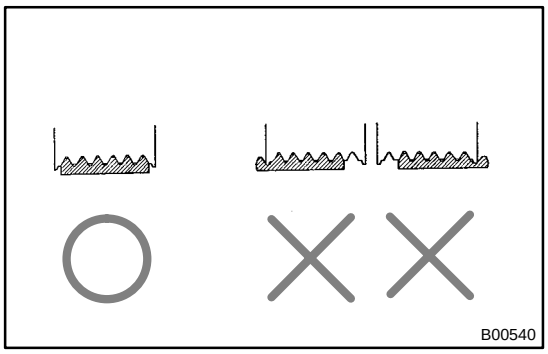
(a) Visually check the belt for excessive wear, frayed cords etc.

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

HINT:

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.

**5. VISUALLY CHECK ALTERNATOR WIRING**

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

**6. LISTEN FOR ABNORMAL NOISES FROM ALTERNATOR**

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

**7. CHECK DISCHARGE WARNING LIGHT CIRCUIT**

(a) Warm up engine and then turn it off.

(b) Switch off all accessories.

(c) Turn the ignition switch ON. Check that the discharge warning light is lit.

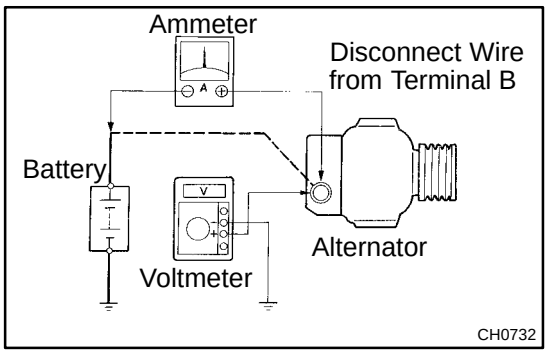
(d) Start the engine. Check that the light goes off.

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

**8. INSPECT CHARGING CIRCUIT WITHOUT LOAD**

HINT:

If a battery/alternator tester is available, connect the tester to the charging circuit as per 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 alternator, and connect it to the negative (–) tester probe of the ammeter.

(2) Connect the positive (+) tester probe of the ammeter to terminal B of the alternator.

(3) Connect the positive (+) tester probe of the voltmeter to terminal B of the alternator.

(4) Ground the negative (–) tester probe of the voltmeter.

(b) Check the charging circuit as follows.

(1) With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

**Standard amperage: 10 A or less**

**Standard voltage: 13.2 – 14.8 V**

**9. INSPECT CHARGING CIRCUIT WITH LOAD**

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

(b) Check the reading on the ammeter.

**Standard amperage: 30 A or more**

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

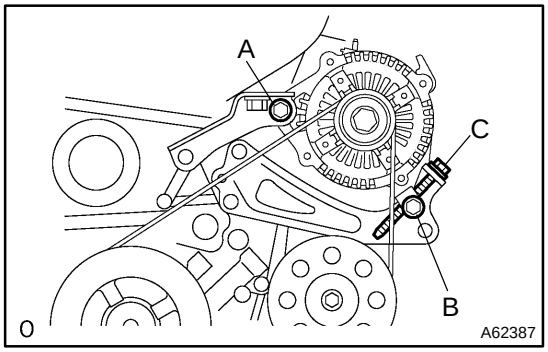
HINT:

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

# GENERATOR ASSY (1MZ–FE)

1902Y–02

## REPLACEMENT




### 1. REMOVE GENERATOR ASSY

(a) Disconnect the generator connector.
(b) Remove the nut, and disconnect the lead wire from terminal B.
(c) Loosen the bolt A and B.
(d) Loosen the bolt C to lessen the tension of the drive belt.
(e) Remove the bolt A, B and the generator.

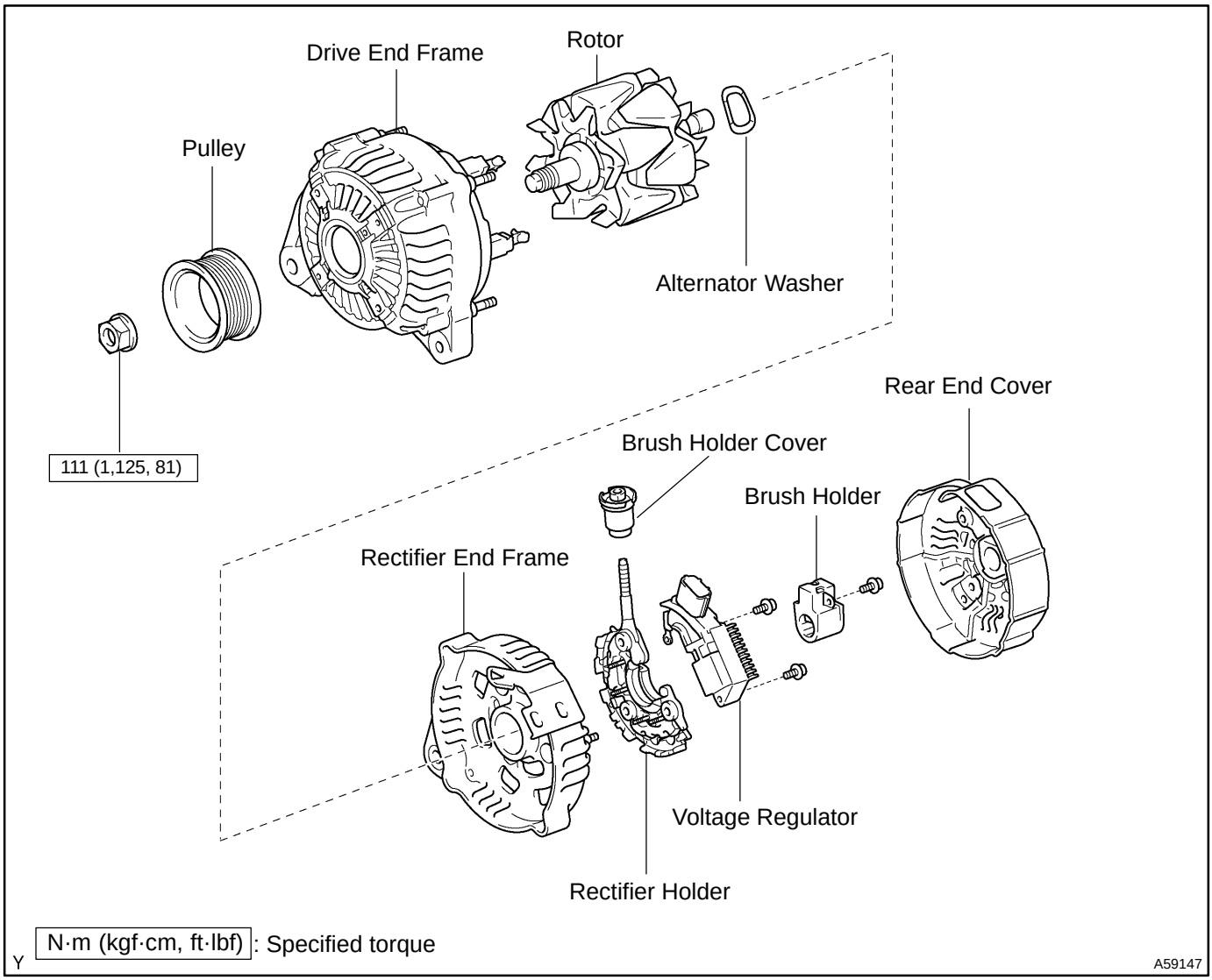
### 2. INSTALL GENERATOR ASSY

(a) Temporarily install the bolt A and B.
(b) Adjust the V–ribbed belt tension by tightening the adjusting bolt C. (See page 14–136)
(c) Tighten the bolt A and B.
**Torque:**
**Bolt A 58 N·m (592 kgf·cm, 43 ft·lbf)**
**Bolt B 18 N·m (184 kgf·cm, 13 ft·lbf)**
(d) Install the lead wire from terminal B.
**Torque: 9.8 N·m (100 kgf·cm, 7 ft·lbf)**

### 3. INSPECT DRIVE BELT DEFLECTION AND TENSION(REFERENCE) (Seee page 14–136)

1908N–01

# COMPONENTS



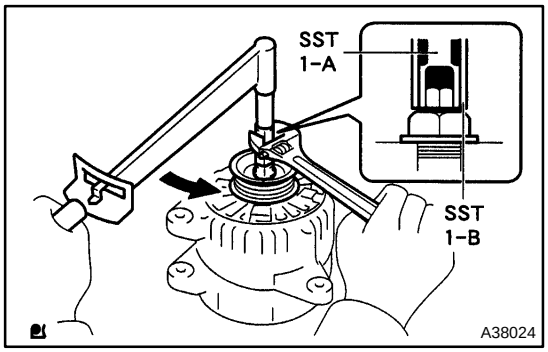
# OVERHAUL

## 1. REMOVE GENERATOR PULLEY

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

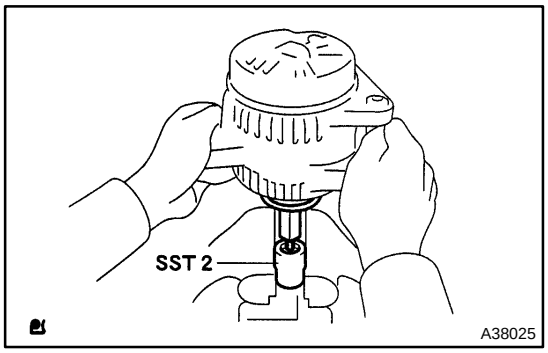
HINT:

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

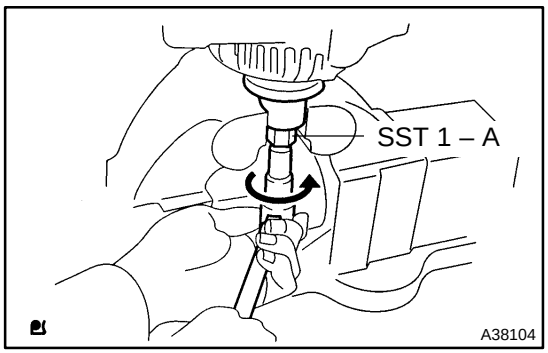



(a) Hold SST 1 – A with a torque wrench, and tighten SST 1 – B clockwise to the specified torque.
**Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**

**NOTICE:**
**Check that SST is secured to the rotor shaft.**



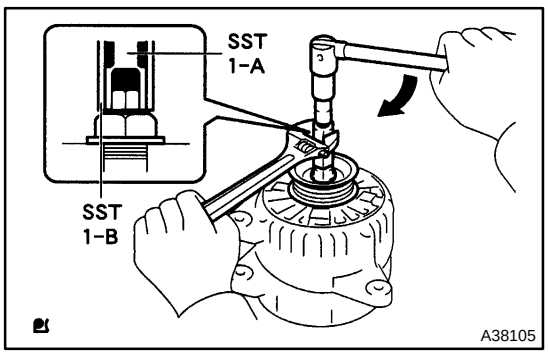

(b) Mount SST 2 in a vise.
(c) Insert SST 1 – A, B into SST 2, and attach the pulley nut to SST 2.




(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 form 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 bolt, 3 nuts, plate terminal and end cover.
(c) Remove the brush cover.
(d) Remove the 2 screws and brush holder.

**3. REMOVE GENERATOR REGULATOR ASSY**

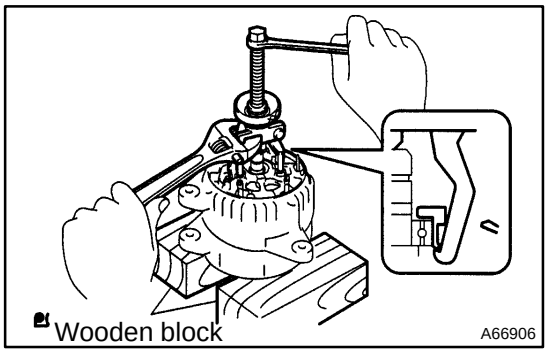
(a) Remove the 3 screws and voltage regulator.

**4. REMOVE GENERATOR HOLDER W/RECTIFIER**

(a) Remove the 4 screws and rectifier holder.

**5. REMOVE ALTERNATOR RECTIFIRE END FRAME**

(a) Remove the rubber insulator.
(b) Remove the seal plate.
(c) Remove the 4 nuts.

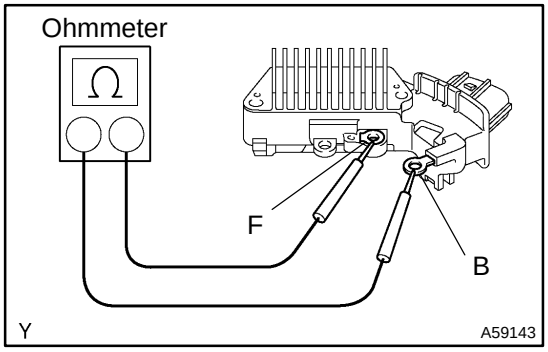



(d) Using bearing puller set, remove the rectifier end frame.

**6. REMOVE GENERATOR ROTOR ASSY**

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

**NOTICE:**
**Do not drop the rotor.**

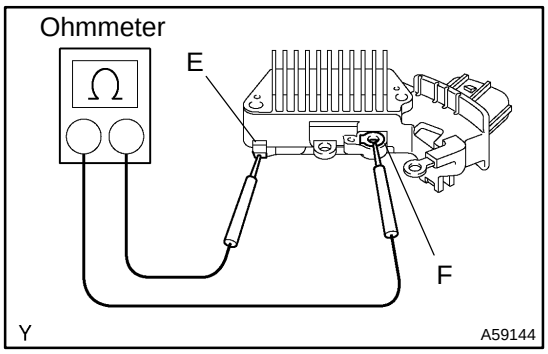



**7. INSPECT GENERATOR REGULATOR ASSY**

(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.**

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

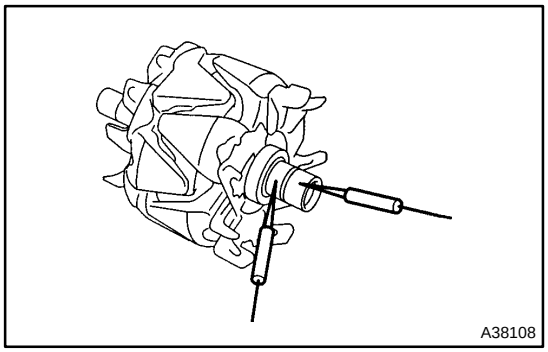



(b) Using an ohmmeter, check the continuity between terminals F and E.

**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.**

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



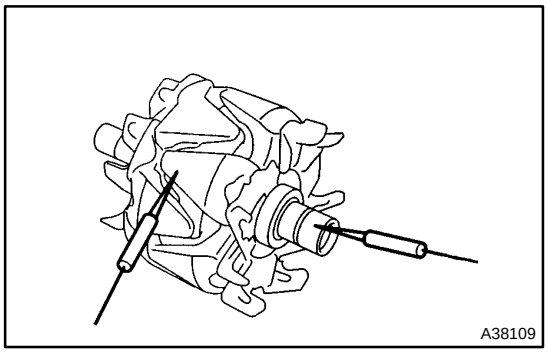

## 8. INSPECT GENERATOR ROTOR ASSY

(a) Inspect rotor for open circuit.

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

**Standard resistance: 2.7 – 3.1 Ω at 20°C (68°F)**

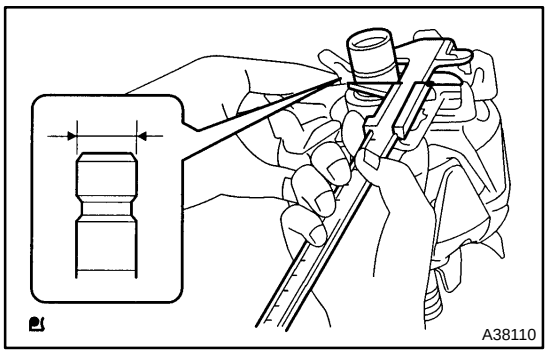
If there is no continuity, replace the rotor.




(b) Inspect rotor for ground.

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

If there is continuity, replace the rotor.



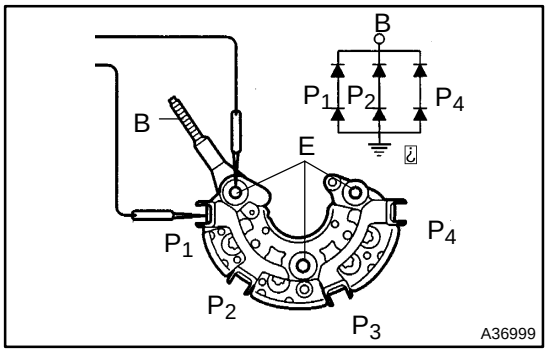

(c) Inspect slip rings.

(1) Using 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.)**

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

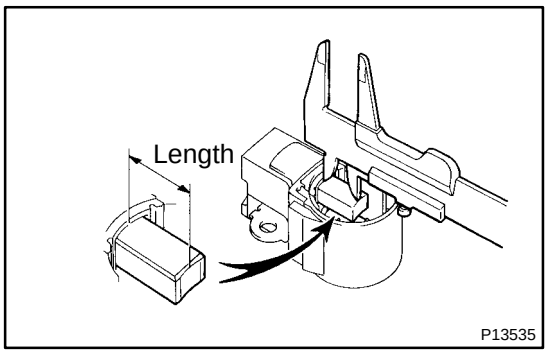



## 9. INSPECT GENERATOR HOLDER W/RECTIFIER

(a) Using an ohmmeter, connect one tester probe to the B or E terminal and the other to each rectifier terminal.

(b) Reverse the polarity of the tester probes and repeat step (a).

(c) Check that one shows continuity and the other shows no continuity.




**10. INSPECT BRUSH**

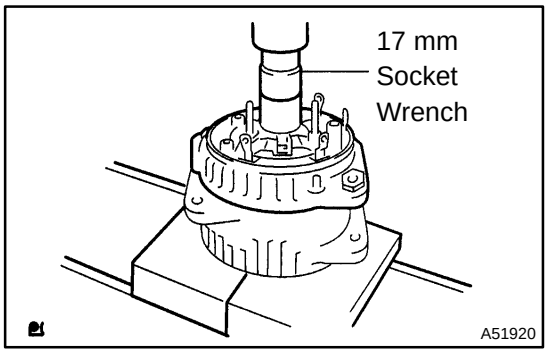
(a) Using vernier calipers, measure the exposed brush length.

**Standard exposed length:**
**9.5 – 11.5 mm (0.374 – 0.453 in.)**
**Minimum exposed length: 1.5 mm (0.059 in.)**

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

**11. INSTALL GENERATOR ROTOR ASSY**

(a) Install the generator rotor.
(b) Install the alternator washer to the rotor.




**12. INSTALL ALTERNATOR RECTIFIRE END FRAME**

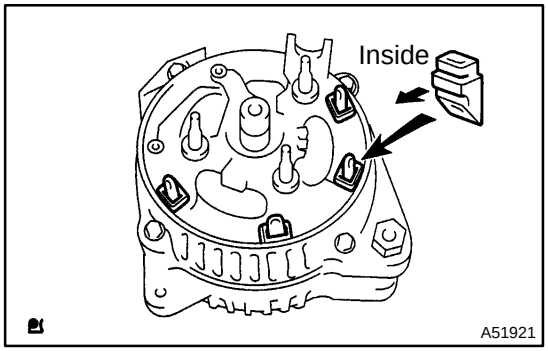
(a) Using a 17 mm socket wrench and press, slowly press in the rectifier end frame.

(b) Install the cord clip and the 4 nuts.
**Torque: 4.5 N·m (46 kgf·cm, 39 in.·lbf) for without cord clip**
**Torque: 5.4 N·m (55 kgf·cm, 47 in.·lbf) for with cord clip**

(c) Install the seal plate on the rectifier end frame.

(d) Install the 4 rubber insulators on the lead wires.

**NOTICE:**
**Be careful of the rubber insulators installation direction.**

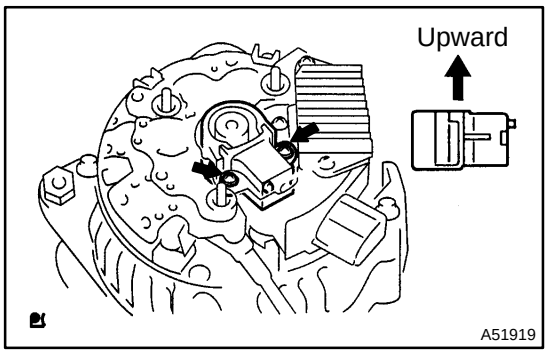



**13. INSTALL GENERATOR HOLDER W/RECTIFIER**

(a) Install the rectifier holder while pushing it with the 4 screws.
**Torque: 2.9 N·m (30 kgf·cm, 26 in.·lbf)**

**14. INSTALL GENERATOR REGULATOR ASSY**

(a) Install the 3 screws and voltage regulator.
**Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)**




**15. INSTALL GENERATOR BRUSH HOLDER ASSY**

(a) Install the 2 screws and brush holder.
**Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)**

**NOTICE:**
**Be careful of the holder installation direction.**

(b) Install the brush cover.
(c) Install the end cover and plate terminal with the bolt and 3 nuts.
**Torque:**
**Nut 4.4 N·m (45 kgf·cm, 39 in.·lbf)**
**Bolt 3.9 N·m (39 kgf·cm, 35 in.·lbf)**
(d) Install the terminal insulator with the nut.
**Torque: 4.1 N·m (42 kgf·cm, 36 in.·lbf)**

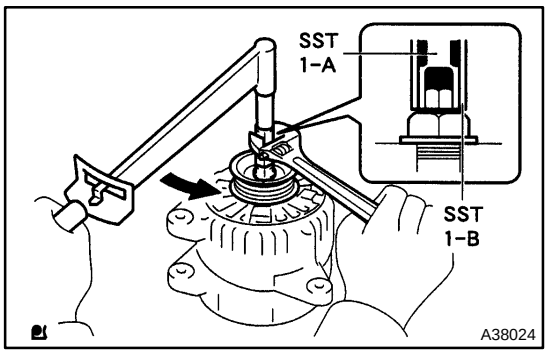
**16. INSTALL GENERATOR PULLEY**

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

HINT:

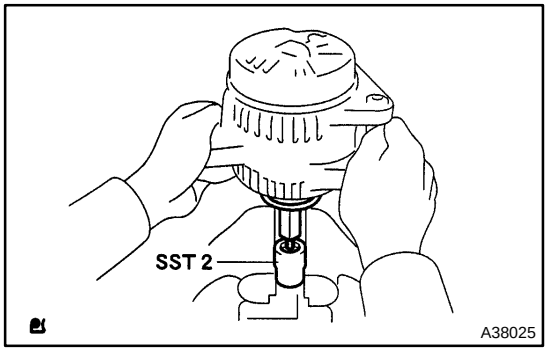
| | |
|---|---|
| SST1 – A, B | 09820–06010 |
| SST2 | 09820–06020 |

(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

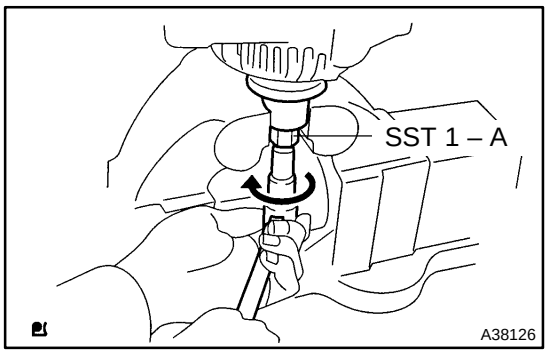



(b) Hold SST 1 – A with a torque wrench, and tighten SST 1 – B clockwise to the specified to torque.
**Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**

**NOTICE:**
**Check that SST is secured to the pulley shaft.**

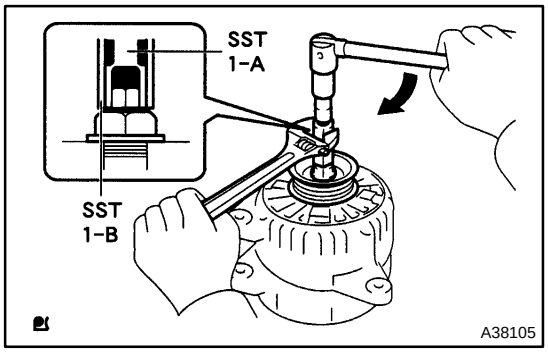



(c) Mount SST 2 in a vise.
(d) Insert SST 1 – A, B into SST 2, and attach the pulley nut to SST 2.




(e) Tighten the pulley nut, turn SST 1 – A in the direction shown in the illustration.
**Torque: 111 N·m (1,125 kgf·cm, 81 ft·lbf)**

(f) Remove the alternator form SST 2.




(g) Turn SST 1 – B, and remove SST 1 – A, B.

(h) Turn the pulley, and check that the pulley moves smoothly.