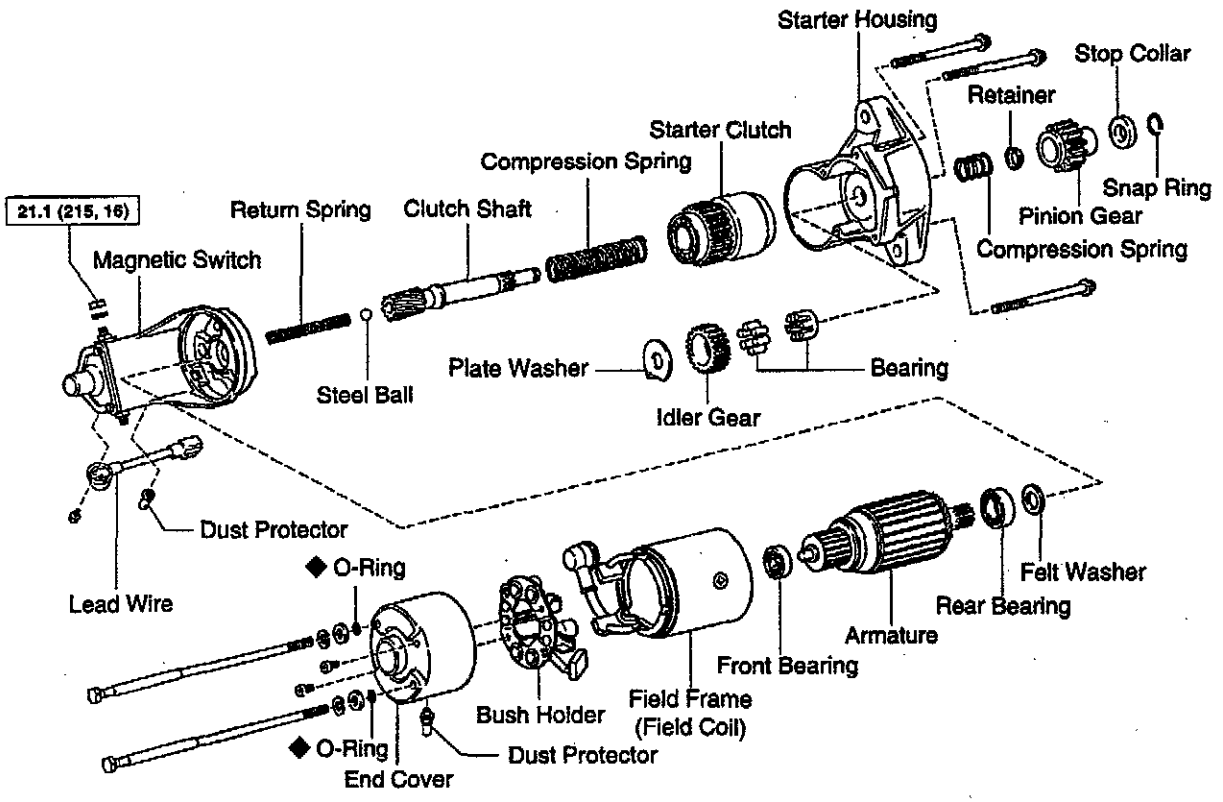
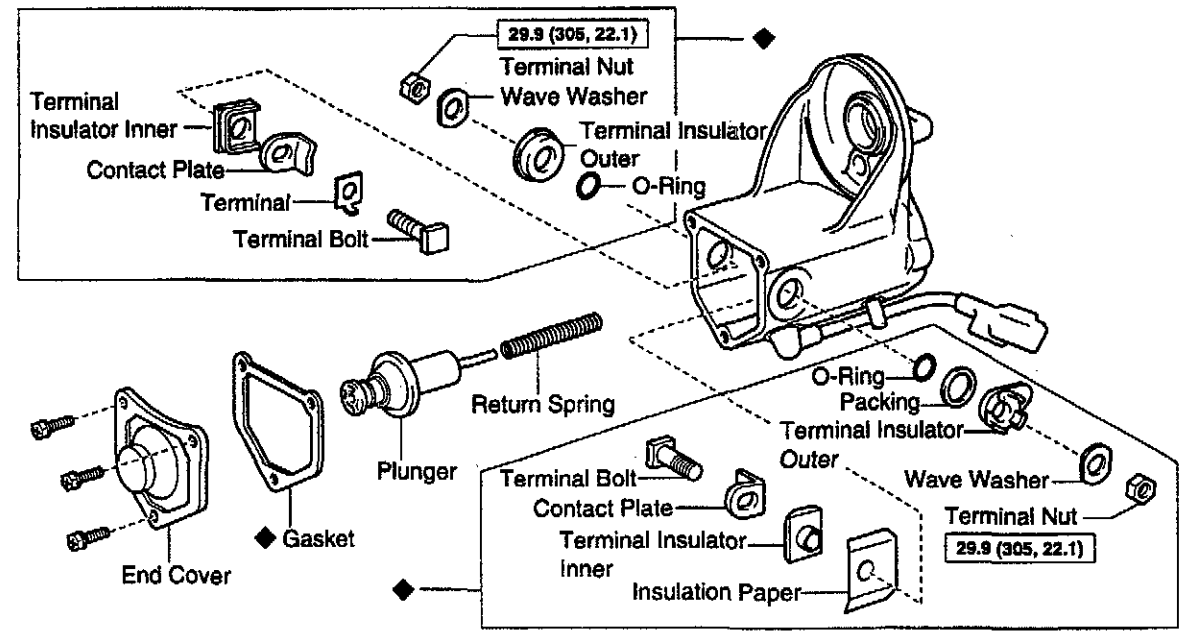
STARTER

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST00W-1D



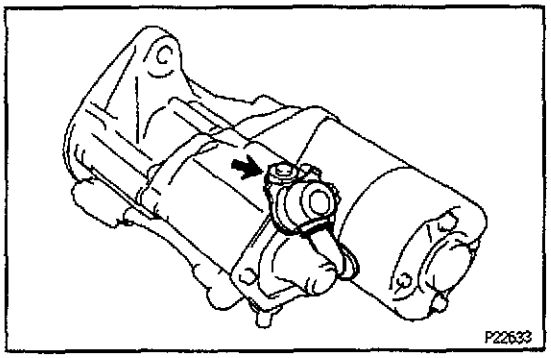
Magnetic Switch Assembly



N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part

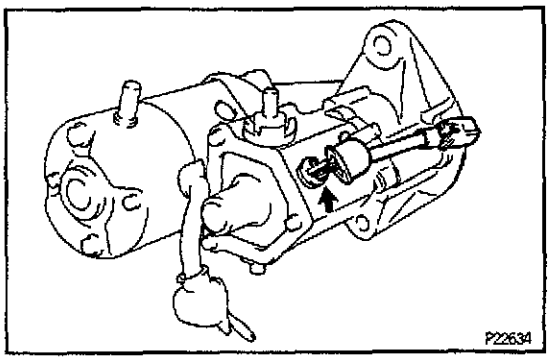
P25611

STARTER DISASSEMBLY

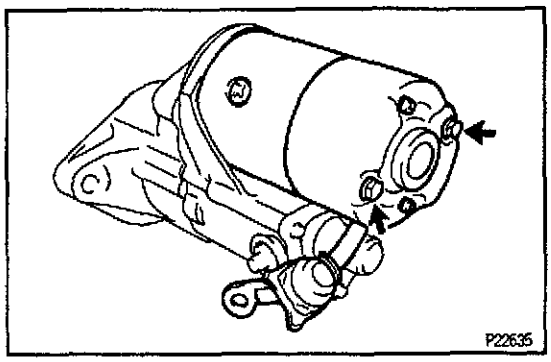


1. **REMOVE FIELD FRAME WITH ARMATURE AND LEAD WIRE FROM MAGNETIC SWITCH**

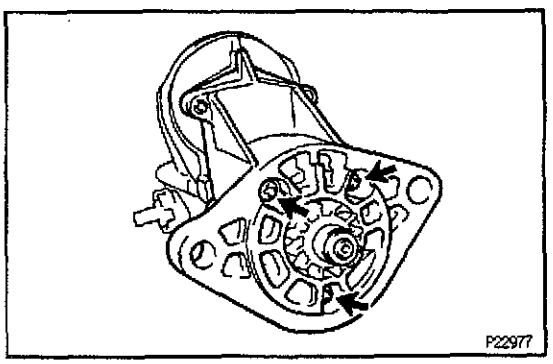
(a) Remove the nut, and disconnect lead wire from the magnetic switch terminal.



(b) Remove the screw, washer and the lead wire from the terminal 30.

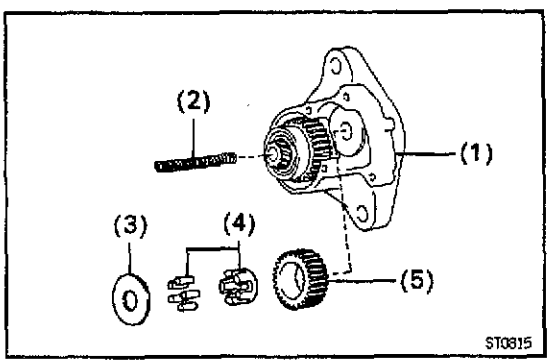


(c) Remove the 2 through bolts and spring washers.
(d) Pull out the field frame with the armature from the magnetic switch assembly.
(e) Remove the felt washer from the rear bearing.

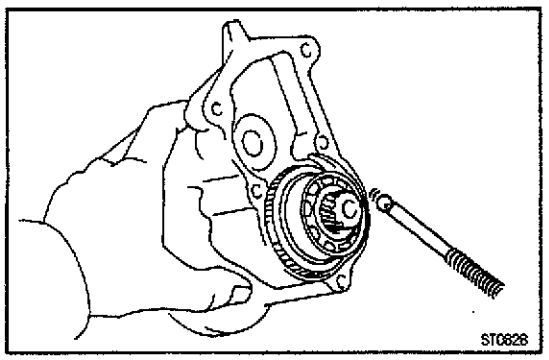


2. **REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS**

(a) Remove the 3 screws.

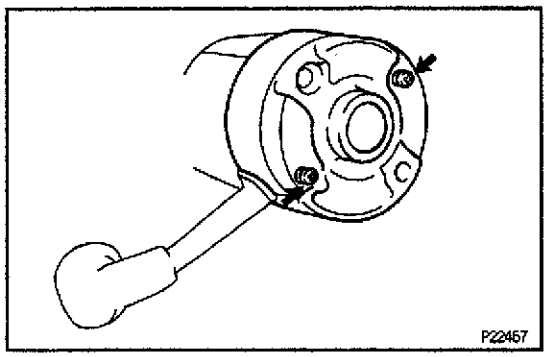


(b) Remove these parts from the magnetic switch assembly:
(1) Starter housing and clutch assembly
(2) Return spring
(3) Plate washer
(4) Idler gear
(5) Bearing



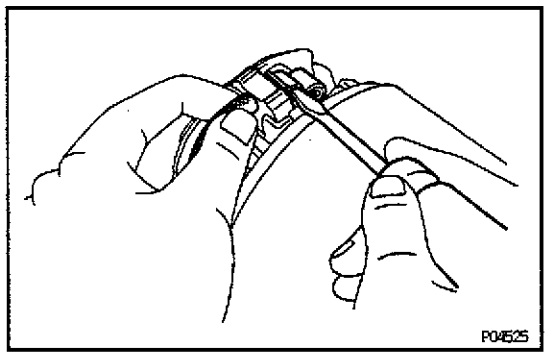
3. REMOVE STEEL BALL

Using a magnetic finger, remove the steel ball from the clutch shaft hole.



4. REMOVE BRUSH HOLDER

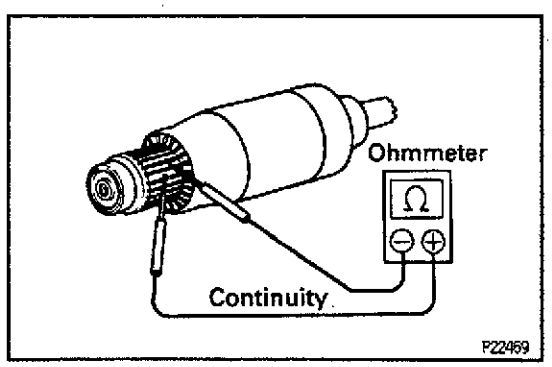
(a) Remove the 2 screws and end cover from the field frame.



(b) Using a screwdriver, hold the spring tank back and disconnect the brush from the brush holder.

(c) Disconnect the 4 brushes and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME



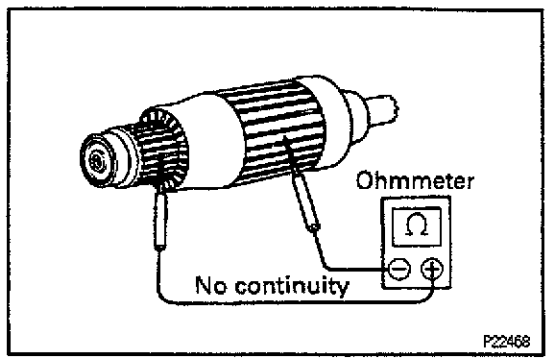
STARTER INSPECTION AND REPAIR

Armature Coil

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.

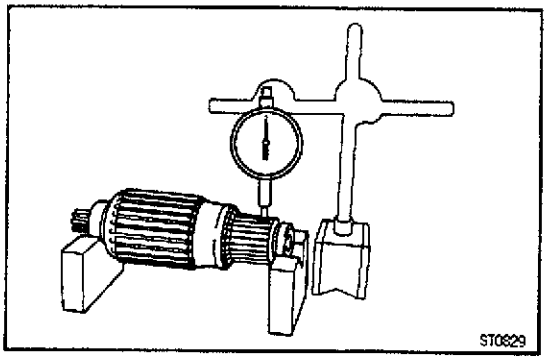
If there is no continuity between any segment, replace the armature.



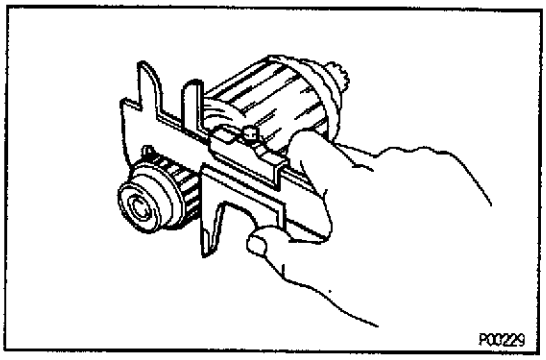
2. INSPECT COMMUTATOR FOR GROUND

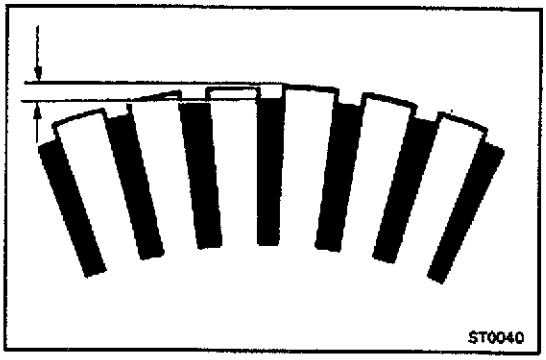
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

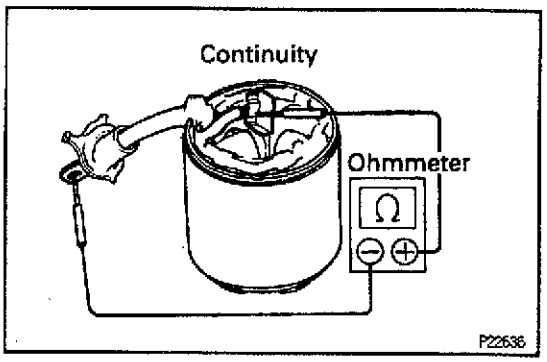
If there is continuity, replace the armature.

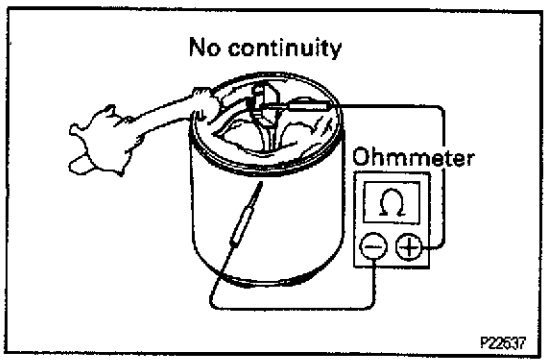


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Commutator

1. **INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES**

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

2. **INSPECT COMMUTATOR CIRCLE RUNOUT**

(a) Place the commutator on V–blocks.

(b) Using a dial gauge, measure the circle runout.

Maximum circle runout:

0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.

3. **INSPECT COMMUTATOR DIAMETER**

Using vernier calipers, measure the commutator diameter.

Standard diameter:

36.0 mm (1.417 in.)

Minimum diameter:

35.0 mm (1.378 in.)

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

4. **INSPECT UNDERCUT DEPTH**

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth:

0.7 – 0.9 mm (0.028 – 0.035 in.)

Minimum undercut depth:

0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

Field Frame (Field Coil)

1. **INSPECT FIELD COIL FOR OPEN CIRCUIT**

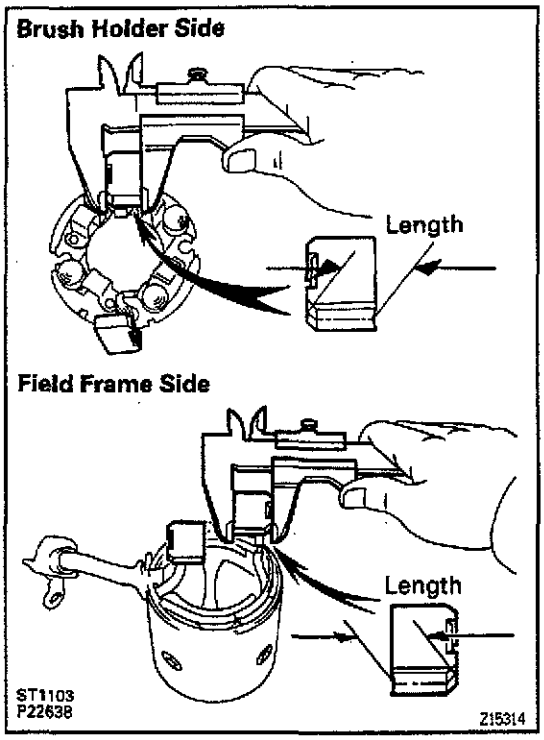
Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

If there is no continuity, replace the field frame.

2. **INSPECT FIELD COIL FOR GROUND**

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

If there is continuity, repair or replace the field frame.



Brushes

INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

Standard length:

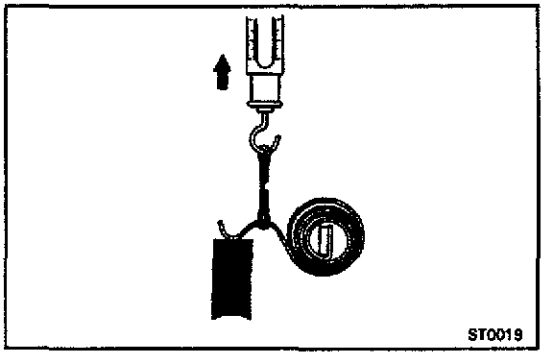
20.5 – 21.0 mm (0.807 – 0.827 in.)

Minimum length:

13.0 mm (0.512 in.)

If the length is less than minimum, replace the brush holder and field frame.

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Brush Springs

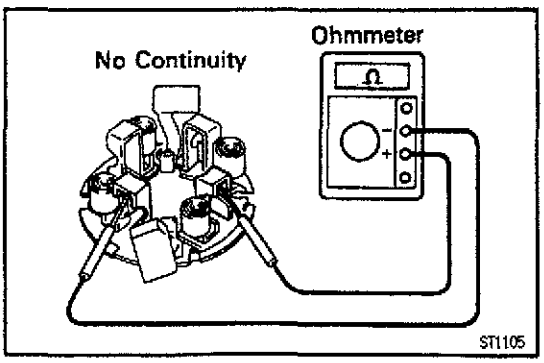
INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:

18.6 – 35.3 N (1.9 – 3.6 kgf, 4.2 – 7.9 lbf)

If the installed load is not within specification, replace the brush springs.



Brush Holder

INSPECT BRUSH HOLDER INSULATION

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

If there is continuity, repair or replace the brush holder.

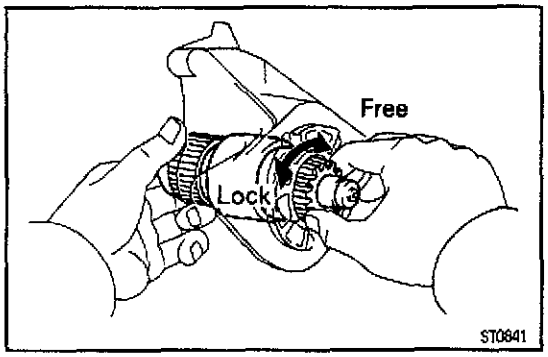
Clutch and Gears

1. **INSPECT GEAR TEETH**

Check the gear teeth on the pinion gear, idle gear and clutch assembly for wear or damage.

If damaged, replace the gear or clutch assembly.

If damaged, also check the drive plate ring gear for wear or damage.

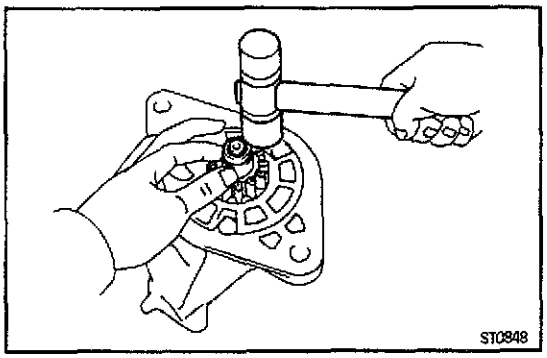


2. INSPECT CLUTCH PINION GEAR

Hold the starter clutch and rotate the pinion gear clockwise, and check that it turns freely. Try to rotate the pinion gear counterclockwise and check that it locks.

If necessary, replace the clutch assembly.

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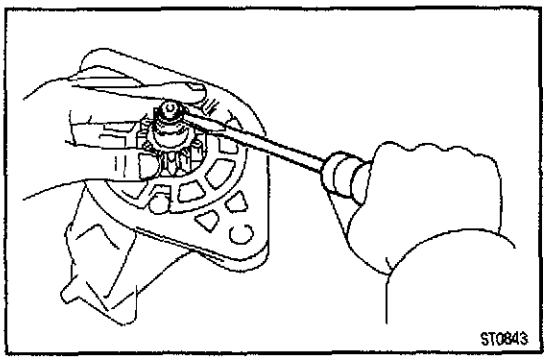


3. IF NECESSARY, REPLACE CLUTCH ASSEMBLY

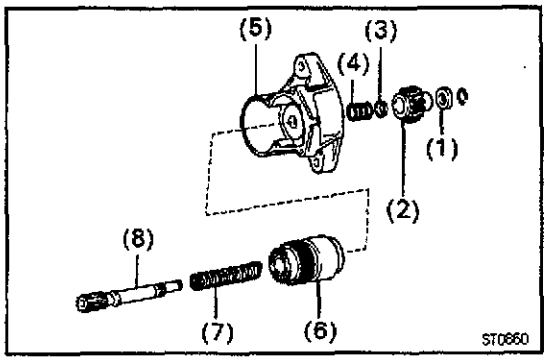
A. Disassemble starter housing and clutch assembly

(a) Push down the pinion gear and starter housing.

(b) Using a plastic–faced hammer, tap down the stop collar.

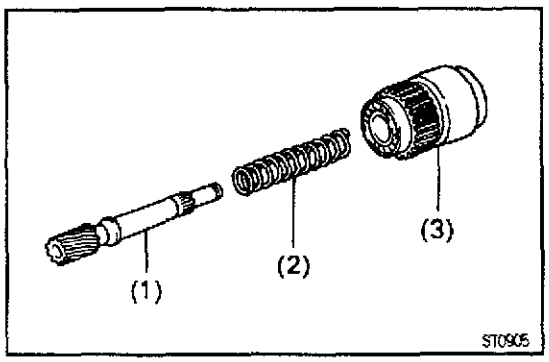


(c) Using a screwdriver, pry out the snap ring.



(d) Disassemble these parts:

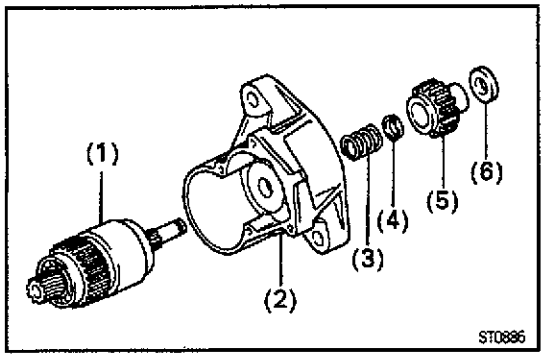
(1) Stop collar
(2) Pinion gear
(3) Retainer
(4) Compression spring
(5) Starter housing
(6) Starter clutch
(7) Compression spring
(8) Clutch shaft



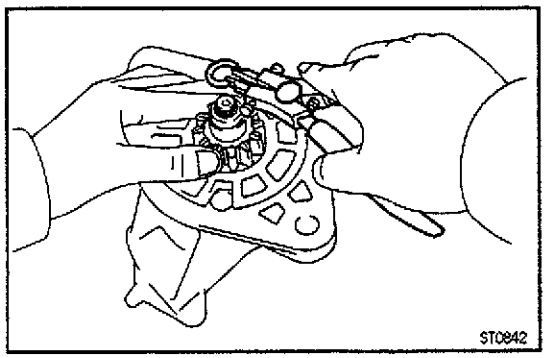
B. Assemble starter housing and clutch assembly

(a) 1st, assemble these parts:

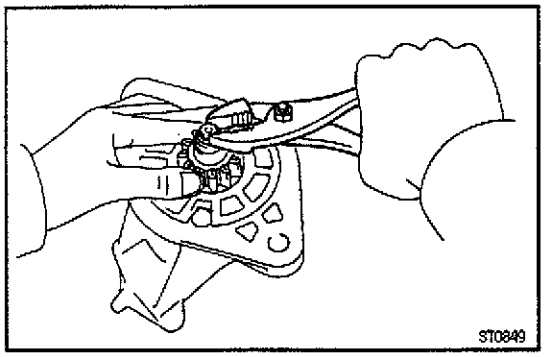
(1) Clutch shaft
(2) Compression spring
(3) Starter clutch



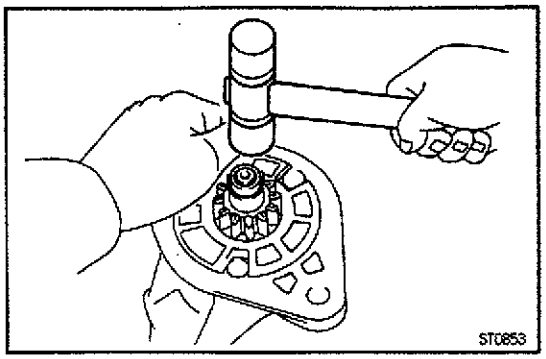
(b) 2nd, assemble these parts:
(1) Clutch shaft and starter shaft assembly
(2) Starter housing
(3) Compression spring
(4) Retainer
(5) Pinion gear
(6) Stop collar



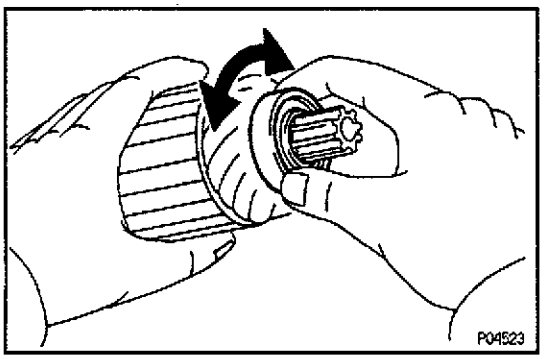
(c) Push down the pinion gear and starter housing.
(d) Using snap ring pliers, install a new snap ring.



(e) Using pliers, compress the snap ring.
(f) Check that the snap ring fits correctly.

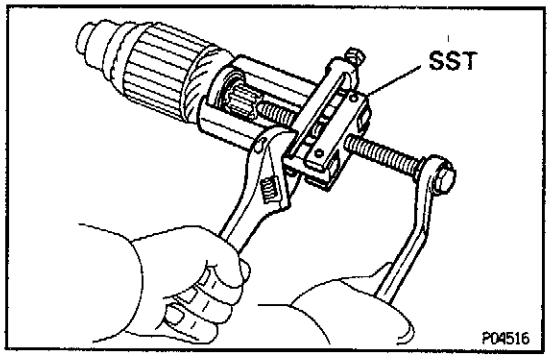


(g) Using a plastic–faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.



Bearings

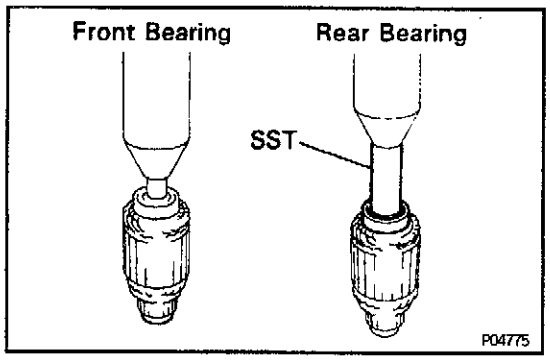
1. **INSPECT BEARINGS**
Turn the bearing by hand while applying inward force. If resistance is felt or the bearing sticks, replace the bearing.



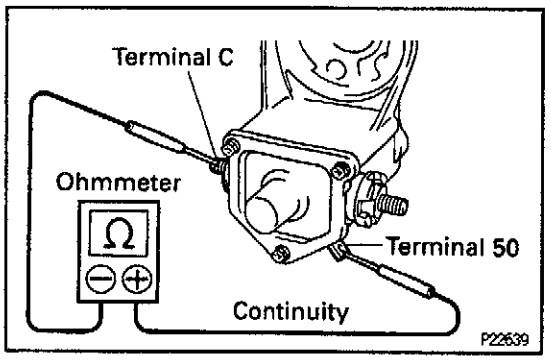
ST

2. IF NECESSARY, REPLACE BEARINGS

(a) Using SST, remove the bearing.
SST 09286–46011



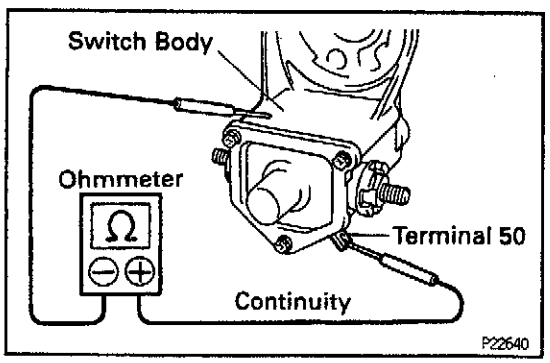
(b) Using a press, press in a new front bearing.
(c) Using SST and a press, press in a new rear bearing.
SST 09820–00030



Magnetic Switch

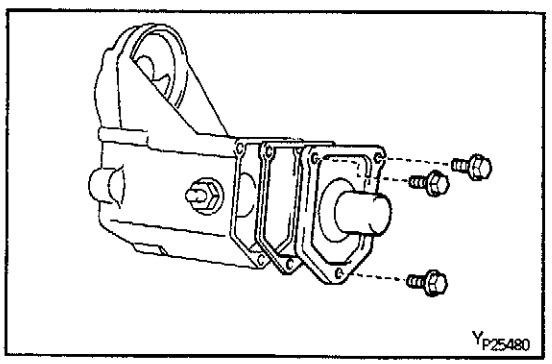
1. PERFORM PULL–IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.



2. PERFORM HOLD–IN COIL OPEN CIRCUIT TEST

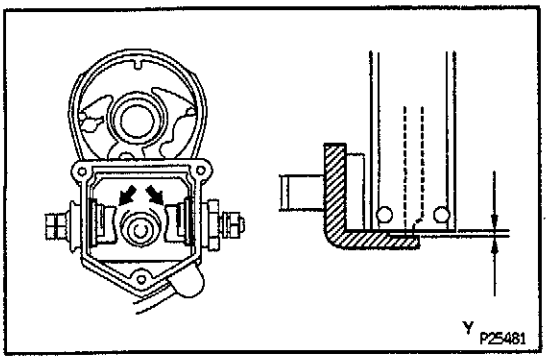
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.



MAGNETIC SWITCH TERMINAL KIT PARTS REPLACEMENT

1. REMOVE MAGNETIC SWITCH END COVER

Remove the 3 bolts, lead clamp, end cover, gasket and plunger.



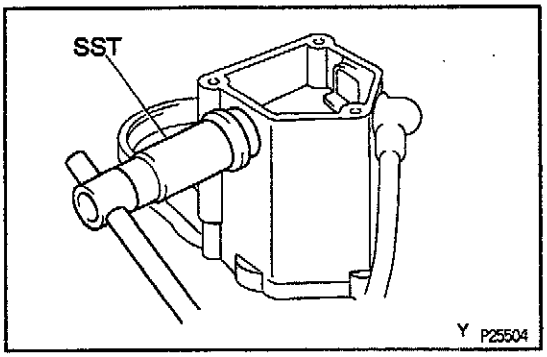
2. INSPECT CONTACT PLATE FOR WEAR

Using vernier calipers, measure the contact plate for depth of wear.

Maximum wear:

0.9 mm (0.035 in.)

If the depth of wear is greater than the maximum, replace the contact plate.

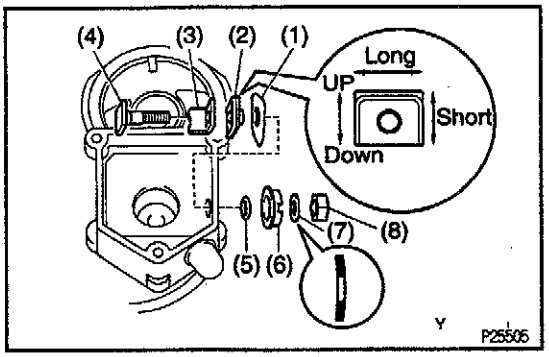


3. REMOVE TERMINAL KIT PARTS

(a) Using SST, loosen the terminal nuts.
SST 09810–38140

(b) Terminal C:
Remove the terminal nut, wave washer, terminal insulator (outside), O–ring, terminal bolt, contact plate and terminal insulator (inside).

(c) Terminal 30:
Remove the terminal nut, wave washer, terminal insulator (outside), packing, O–ring, terminal bolt, contact plate, terminal insulator (inside) and insulation paper.



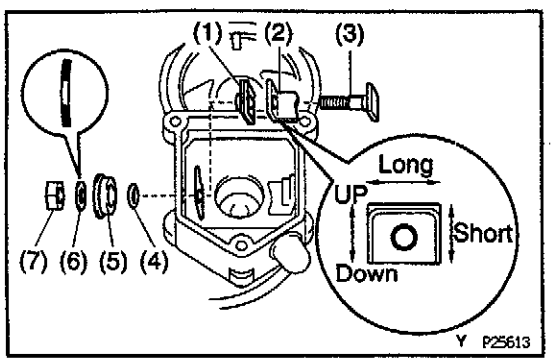
4. REINSTALL TERMINAL KIT PARTS

(a) Install these new parts:
Terminal 30:
(1) Insulation paper
(2) Terminal insulator (inside)
(3) Contact plate
(4) Terminal bolt
(5) O–ring
(6) Packing and terminal insulator (outside)
Install the packing to the terminal insulator, and install them.

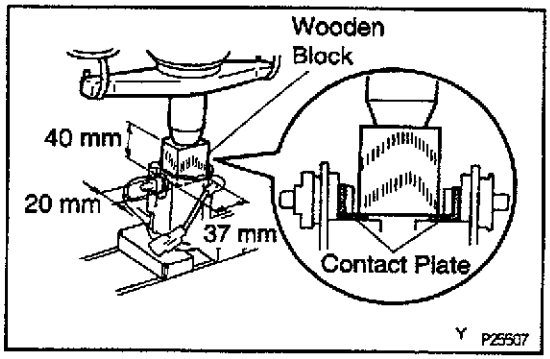
HINT: Match the protrusion of the insulator with the indentation of the housing.

(7) Wave washer
(8) Terminal nut

NOTICE: Be careful to install the terminal insulators (inside) and wave washers in the correct direction.



Terminal C:
(1) Terminal insulator (inside)
(2) Contact plate
(3) Terminal bolt
(4) O–ring
(5) Terminal insulator (outside)
(6) Wave washer
(7) Terminal nut



ST

NOTICE: Be careful to install the terminal insulators (inside) and wave washers in the correct direction.

(b) Temporarily tighten the terminal nuts.

5. TIGHTEN TERMINAL NUT

(a) Put a wooden block on the contact plate and press it down with a hand press.

Dimensions of wooden block:

20 x 37 x 40 mm (0.79 x 1.46 x 1.57 in.)

Press force:

981 N (100 kgf, 221 lbf)

NOTICE:

- **Check the diameter of the hand press ram. Then calculate the gauge pressure of the press when 981 N (100 kgf, 221 lbf) of force is applied.**

Gauge pressure:

$$(\text{kgf/cm}^2) = \frac{100\ \text{kgf}}{\left(\frac{\text{Ram diameter (cm)}}{2}\right)^2 \times 3.14\ (\pi)}$$

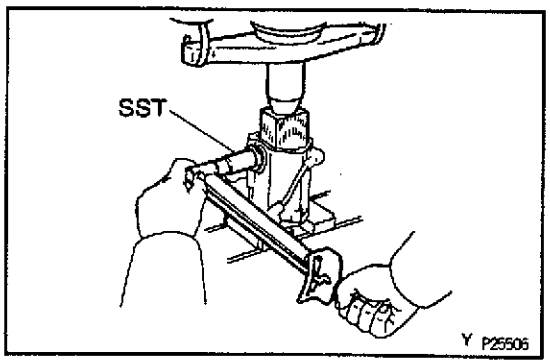
$$(\text{psi}) = \frac{221\ \text{lbf}}{\left(\frac{\text{Ram diameter (in.)}}{2}\right)^2 \times 3.14\ (\pi)}$$

(kPa) = (kgf/cm²) x 98.1

(kPa) = (psi) x 6.9

V06796

- **If the contact plate is not pressed down with the specified pressure, the contact plate may tilt due to coil deformation or the tightening of the nut.**



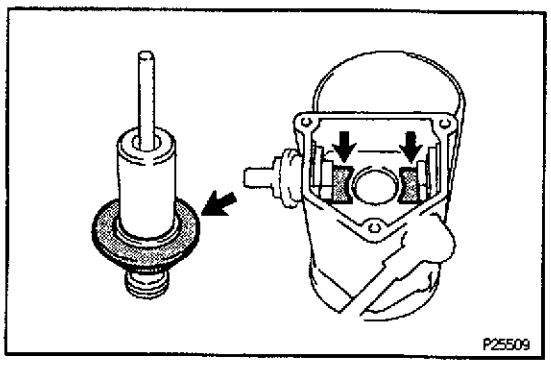
(b) Using SST, tighten the nuts to the specified torque.
SST 09810–38170

Torque:

Terminal C and Terminal 30

29.9 N·m (305 kgf·cm, 22.1 ft·lbf)

NOTICE: If the nut is over tightened, it may cause cracks on the inside of the insulator.



6. CLEAN CONTACT SURFACES OF CONTACT PLATE AND PLUNGER

Clean the contact surfaces of the remaining contact plate and plunger with a dry shop rag.

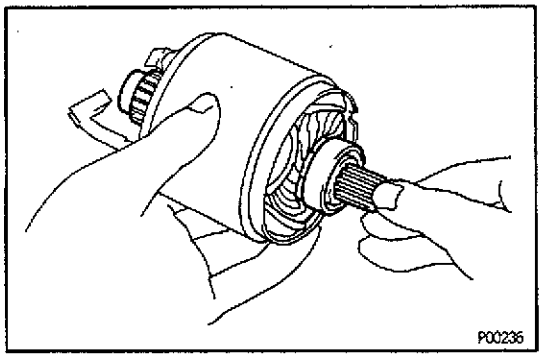
7. REINSTALL MAGNETIC SWITCH END COVER

Install the plunger, new gasket, end cover and lead clamp with the 3 bolts.

Torque: 2.55 N·m (26 kgf·cm, 23 in.·lbf)

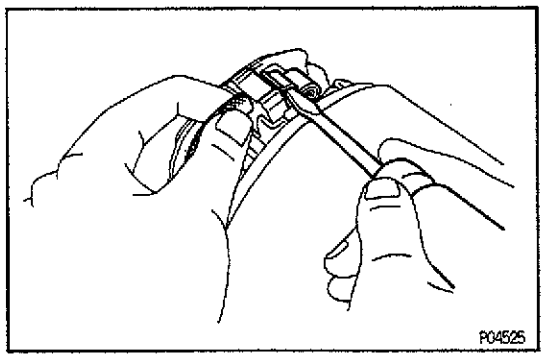
ST0A1–02

STARTER ASSEMBLY



HINT: Use high–temperature grease to lubricate the bearings and gears when assembling the starter.

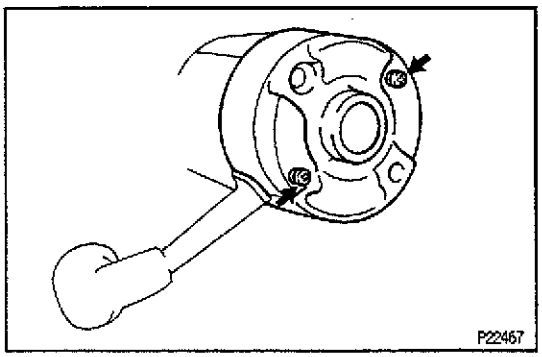
1. **PLACE ARMATURE INTO FIELD FRAME**
Apply grease to the armature bearings, and insert the armature into the field frame.



2. **INSTALL BRUSH HOLDER**

(a) Place the brush holder on the armature.

(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the four brushes.
NOTICE: Check that the positive (+) lead wires are not grounded.

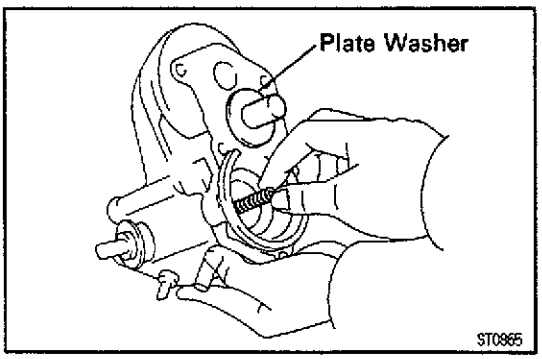


(c) Install the end cover to the field frame with the 2 screws.

3. **INSERT STEEL BALL INTO CLUTCH SHAFT HOLE**

(a) Apply grease to the steel ball.

(b) Insert the steel ball into the clutch shaft hole.

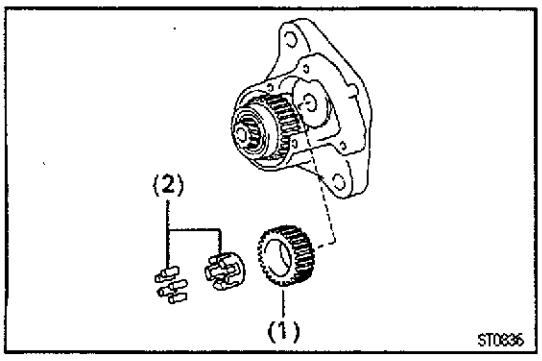


4. **INSTALL STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR**

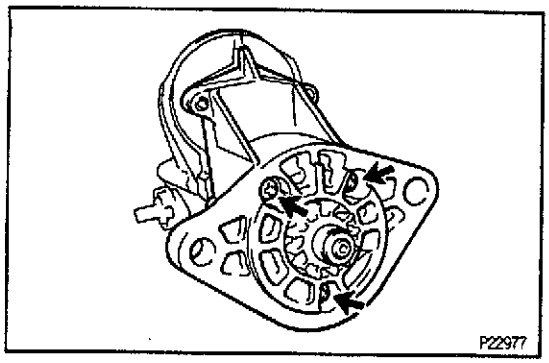
(a) Apply grease to the return spring.

(b) Insert the return spring into the magnetic switch hole.

(c) Install the plate washer to the magnetic switch.

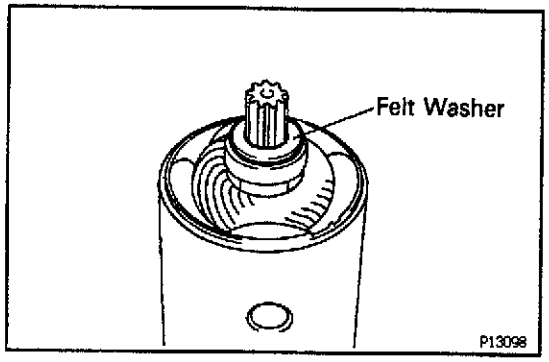


(d) Place these parts to the starter housing:
(1) Idler gear
(2) Bearing



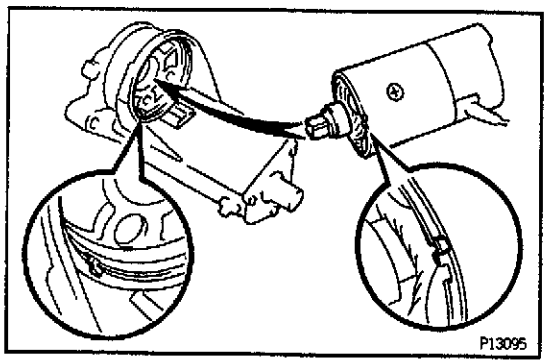
(e) Assemble the starter housing and magnetic switch assembly and install the 3 screws.

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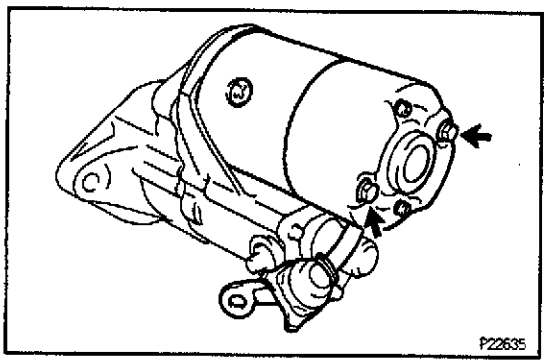


5. INSTALL FIELD FRAME WITH ARMATURE AND LEAD WIRE TO MAGNETIC SWITCH

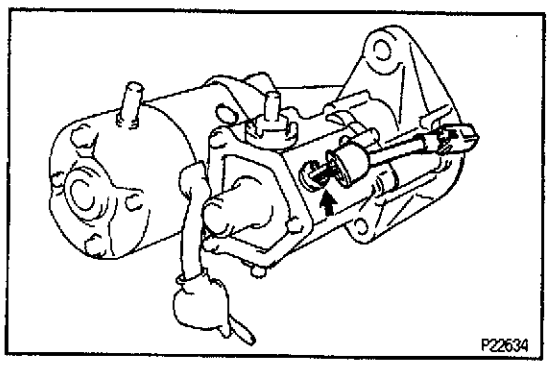
(a) Install a new felt washer to the armature.



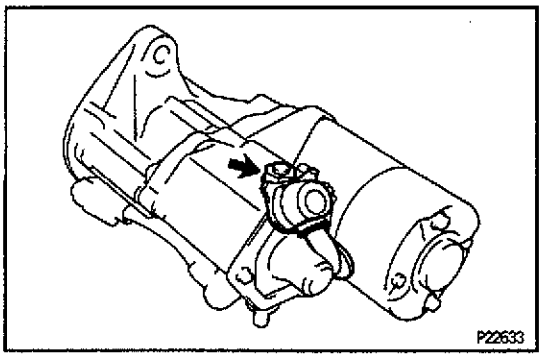
(b) Align the protrusion of the field frame with the cutout of the magnetic switch.



(c) Install the field frame and armature assembly with the 2 through bolts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



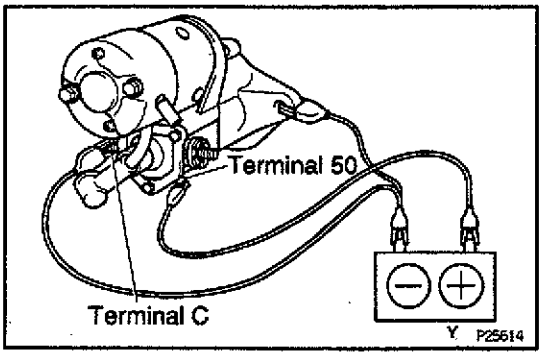
(d) Install the lead wire to terminal 30 with the screw and washer.
Torque: 3.6 N·m (41 kgf·cm, 32 in.·lbf)



(e) Connect the lead wire to terminal C, and install the nut.
Torque: 21.1 N·m (215 kgf·cm, 16 ft·lbf)

STARTER PERFORMANCE TEST

ST010-18



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

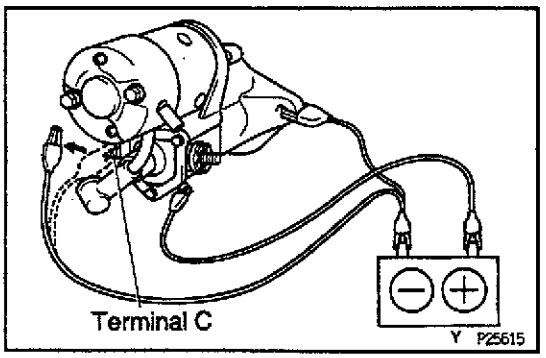
1. DO PULL–IN TEST

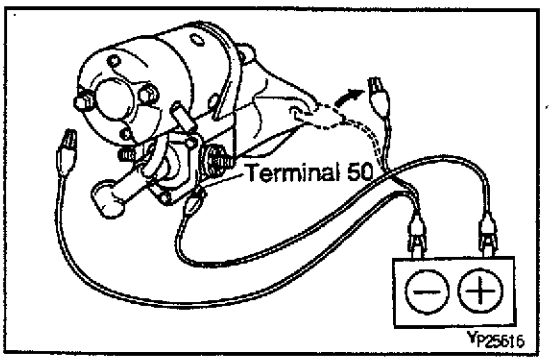
(a) Disconnect the field coil lead wire from terminal C.

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

2. DO HOLD–IN TEST

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.

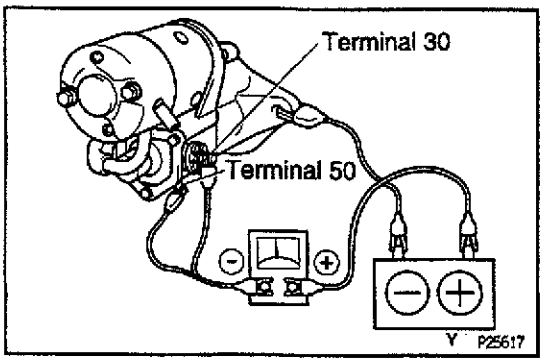




3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.

Check that the clutch pinion gear returns inward.



4. DO NO–LOAD PERFORMANCE TEST

(a) Connect the battery and ammeter to the starter as shown.

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.

Specified current:

12 V type:

At 11.0 V: 180 A or less

24 V type:

At 23.0 V: 90 A or less