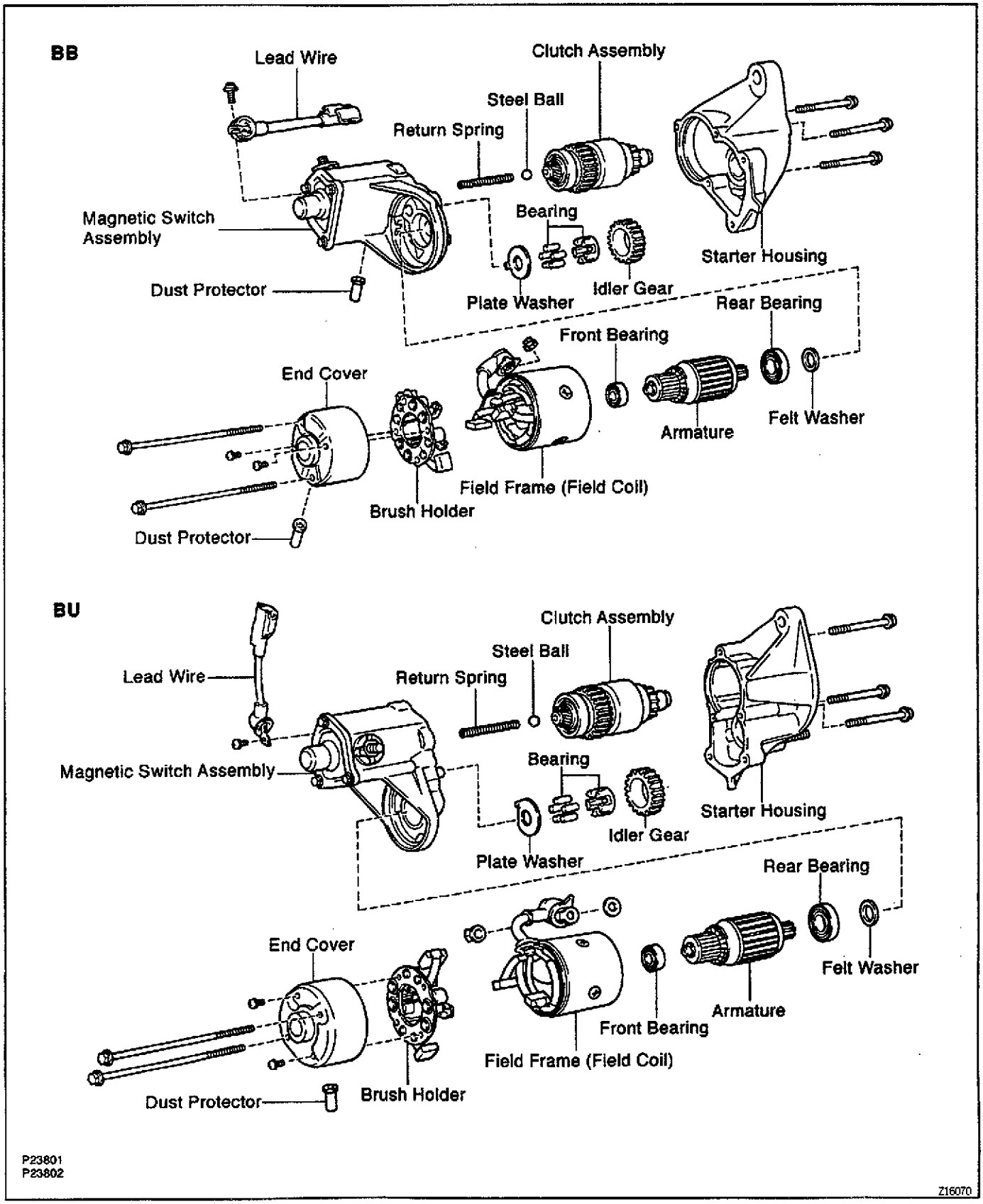
STARTER

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST00W-1A

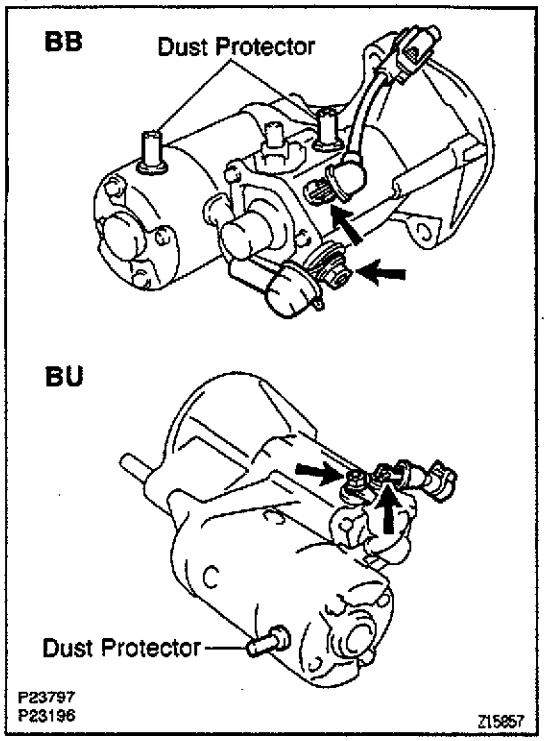


P23801
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Z16070

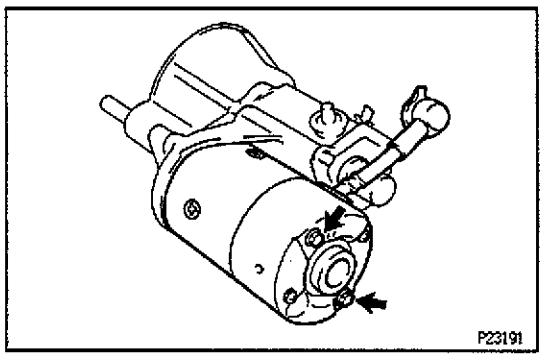
ST0BB-01

STARTER DISASSEMBLY

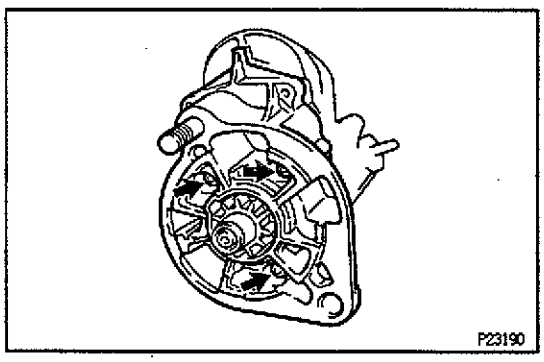


1. **REMOVE DUST PROTECTOR**
2. **REMOVE LEAD WIRE**
   Remove the screw and lead wire from terminal 50.
3. **REMOVE FIELD FRAME WITH ARMATURE FROM MAGNETIC SWITCH ASSEMBLY**

(a) Remove the nut, disconnect the lead wire from terminal C and remove the plate washer.

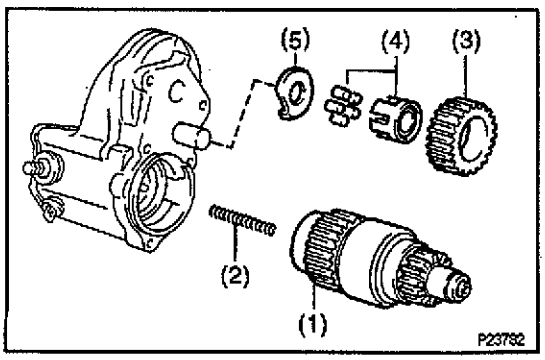


(c) Remove the 2 through bolts.
(d) Pull out the field frame together with the armature from the magnetic switch assembly.
(e) Remove the felt washer.

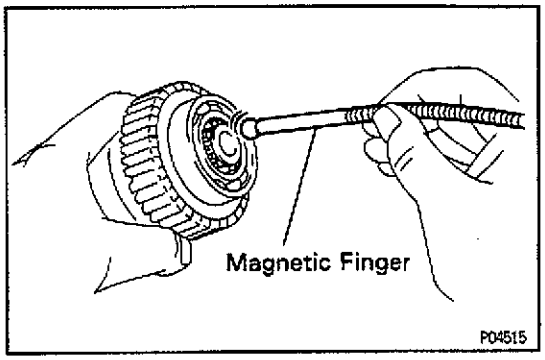


4. **REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS**

(a) Remove the 3 screws and starter housing.



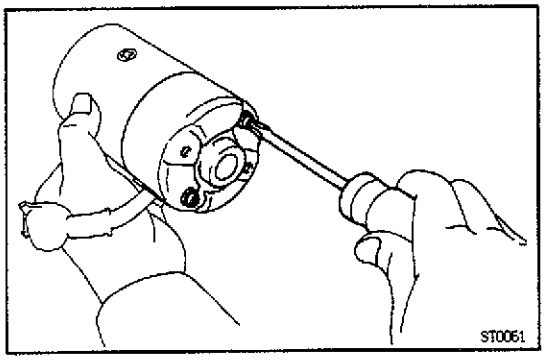
(b) Remove these parts from the magnetic switch assembly:
   (1) Clutch assembly
   (2) Return spring
   (3) Idler gear
   (4) Bearing
   (5) Plate washer



ST

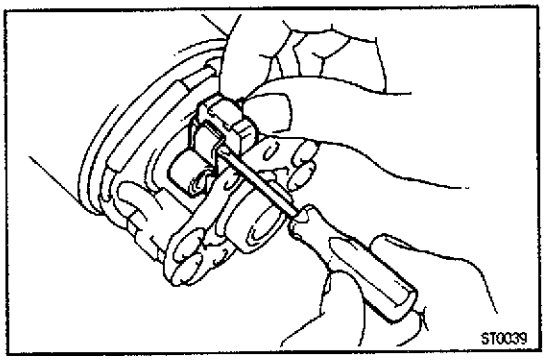
5. REMOVE STEEL BALL

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



6. 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.

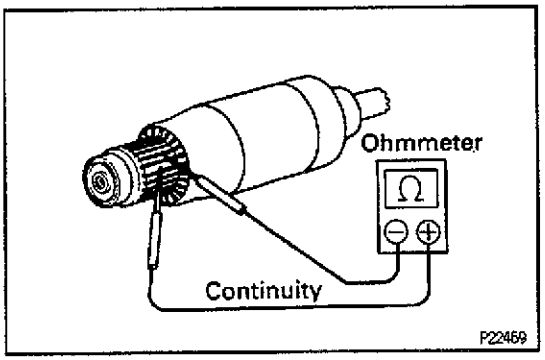
(c) Disconnect the 4 brushes and remove the brush holder.

7. REMOVE ARMATURE FROM FIELD FRAME

ST08C-01

STARTER INSPECTION AND REPAIR

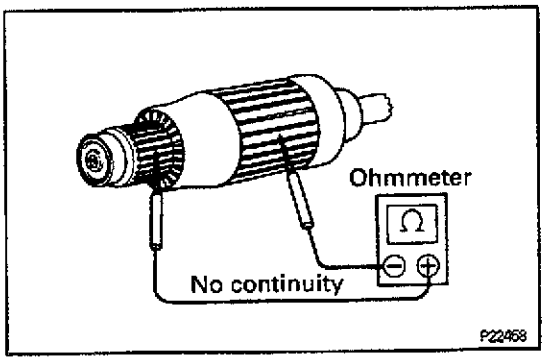
Armature Coil



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.



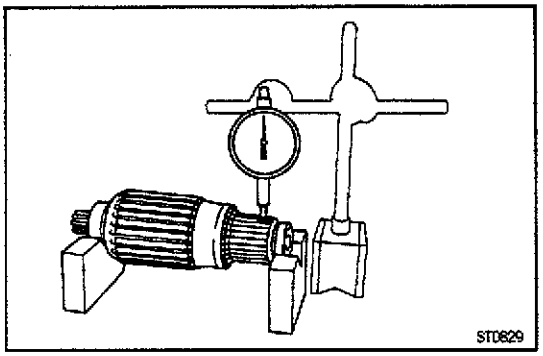
2. INSPECT COMMUTATOR FOR GROUND

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

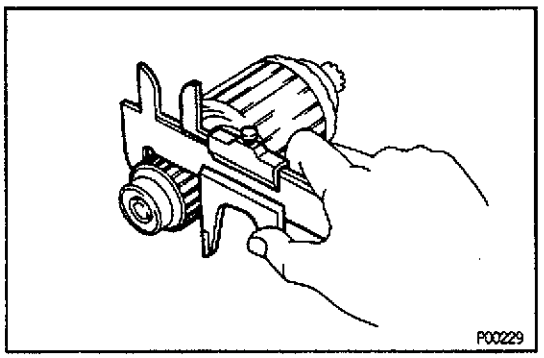
If there is continuity, replace the armature.

Commutator

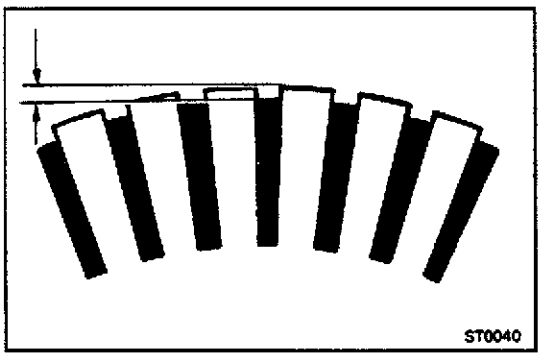
1. **INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES**
If the surface is dirty or burnt, correct it with sandpaper (No. 400) or on a lathe.



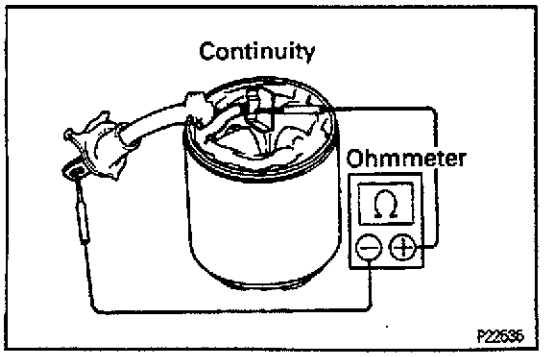
2. **INSPECT COMMUTATOR CIRCLE RUNOUT**
(a) Place the commutator on V–blocks.
(b) Using a dial gauge, measure the circle runout.
Maximum circle runout:
0.05 mm (0.0020 in.)
If the circle runout is greater than maximum, correct it on a lathe.



3. **INSPECT COMMUTATOR DIAMETER**
Using a vernier calipers, measure the commutator diameter.
Standard diameter:
36 mm (1.42 in.)
Minimum diameter:
35 mm (1.38 in.)
If the diameter is less than minimum, replace the armature.

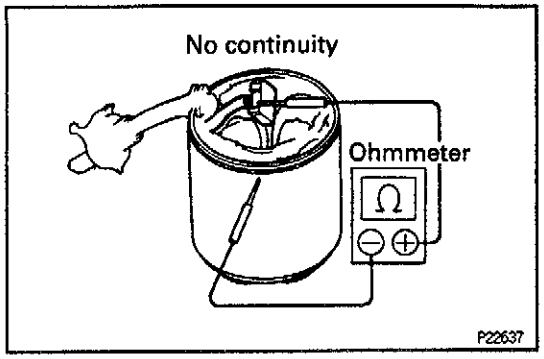


4. **INSPECT UNDERCUT DEPTH**
Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.
Standard undercut depth:
0.7 – 0.9 mm (0.028 – 0.035 in.)
Minimum undercut depth:
0.2 mm (0.008 in.)
If the undercut depth is less than minimum, correct it with a hacksaw blade.



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.

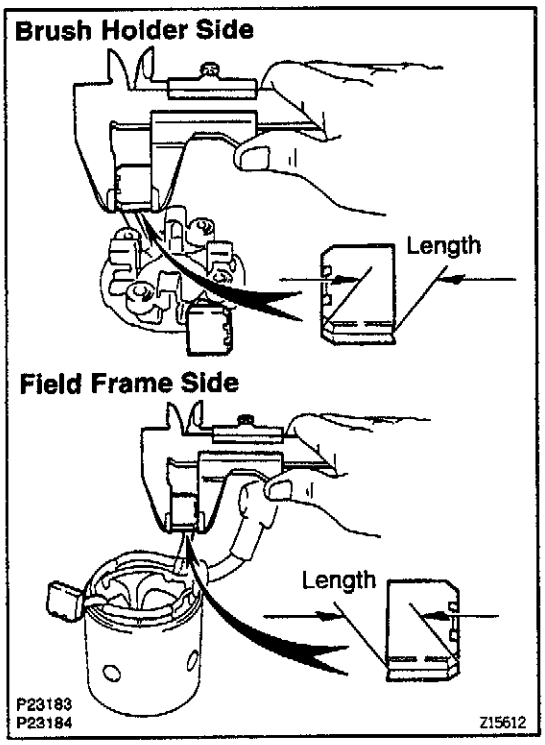


ST

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 a vernier calipers, measure the brush length.

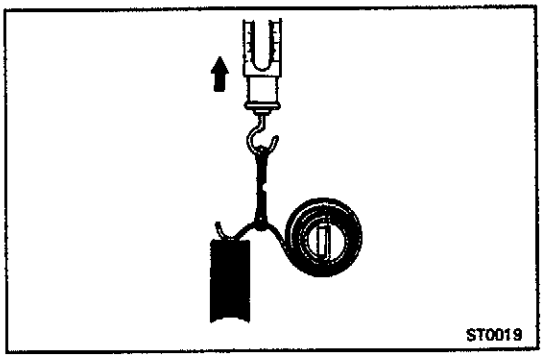
Standard length:

20.5 — 21.0 mm (0.807 — 0.827 in.)

Minimum length:

13.5 mm (0.531 in.)

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



Brush Springs

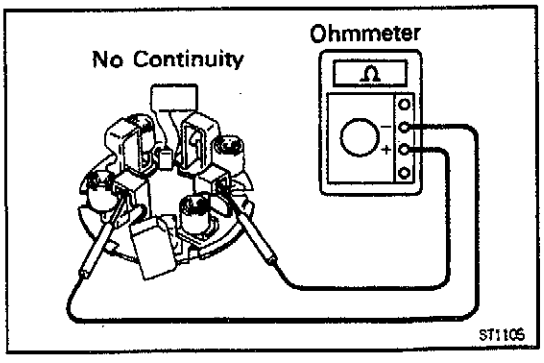
INSPECT BRUSH SPRING LOAD

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

Spring installed load:

32 — 38 N (3.3 — 3.9 kgf, 7.3 — 8.5 lbf)

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



Brush Holder

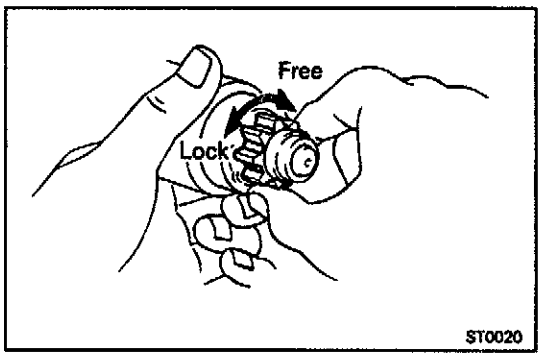
INSPECT BRUSH HOLDER INSULATION

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.

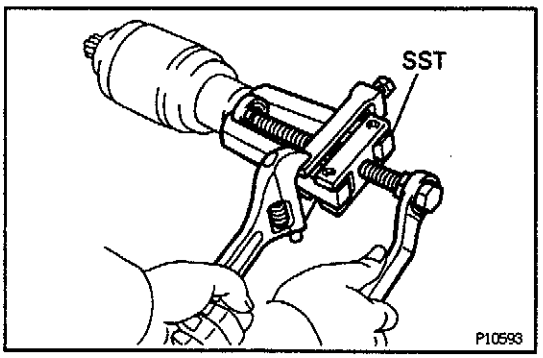
Clutch and Gears

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 flywheel ring gear for wear or damage.

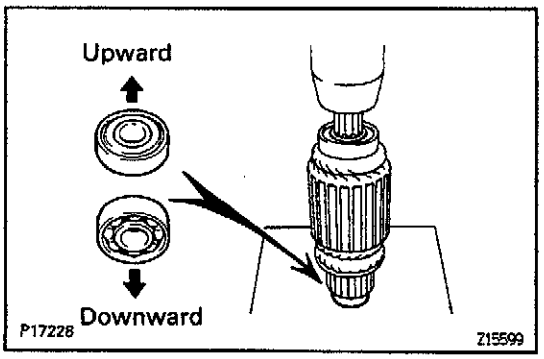


2. **INSPECT CLUTCH PINION GEAR**
Hold the starter clutch and rotate the pinion gear clockwise, and check that it turns freely. Try to rotate the pinion gear counterclockwise and check that it locks.
If necessary, replace the clutch assembly.

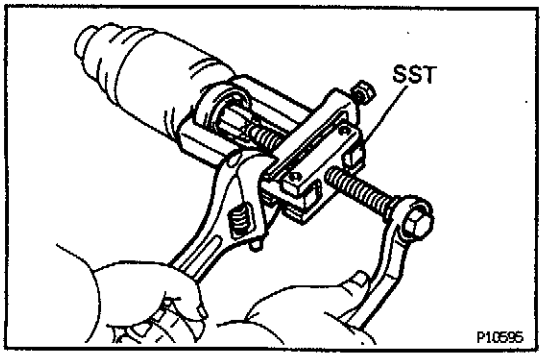
Bearings



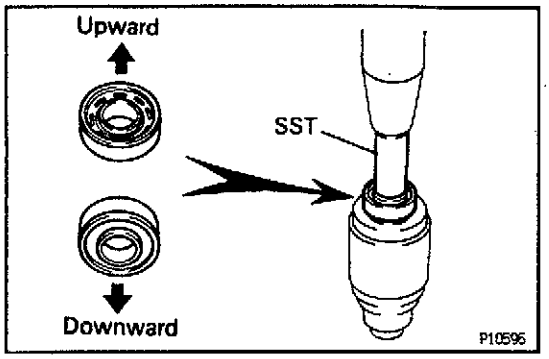
1. **INSPECT BEARINGS**
Turn the bearing by hand while applying inward force.
If resistance is felt or the bearing sticks, replace the bearing.
2. **IF NECESSARY, REPLACE FRONT BEARING**
(a) Using SST, remove the bearing.
SST 09286–46011



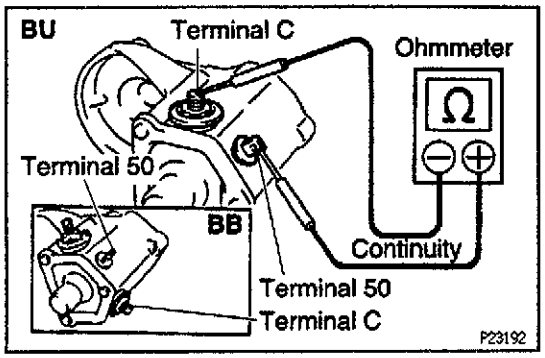
(b) Using a press, press in a new bearing.
NOTICE: Be careful of the bearing installation direction.



3. **IF NECESSARY, REPLACE REAR BEARING**
(a) Using SST, remove the bearing.
SST 09286–46011

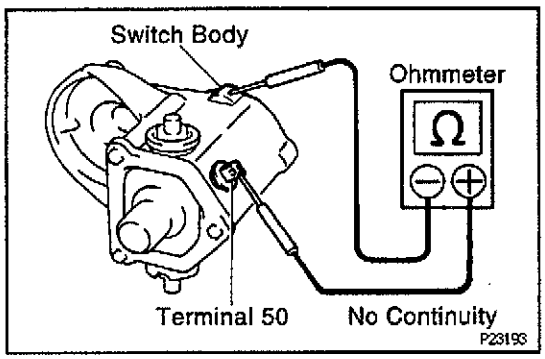


(b) Using SST and a press, press in a new bearing.
SST 09285–76010
NOTICE: Be careful of the bearing installation direction.



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, check and replace the magnetic switch.

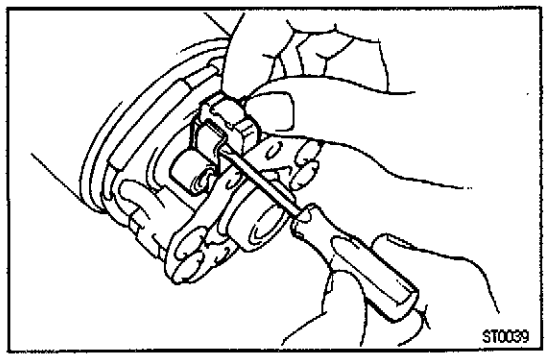


2. **PERFORM HOLD–IN COIL OPEN CIRCUIT TEST**
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.

STARTER ASSEMBLY

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

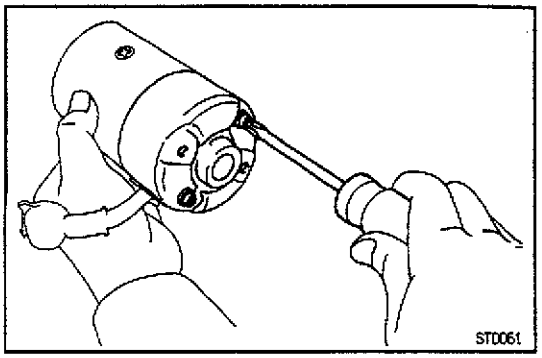
1. **PLACE ARMATURE INTO FIELD FRAME**
Apply grease to the armature bearings, and insert the armature into the field frame.



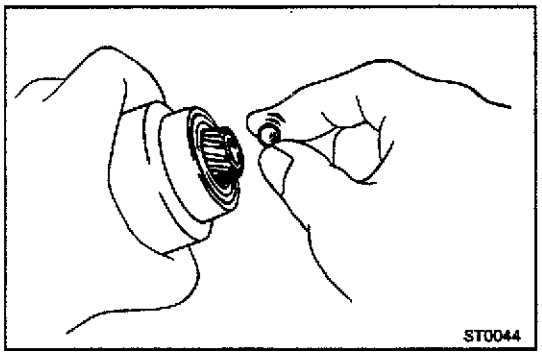
2. **INSTALL BRUSH HOLDER**

(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 4 brushes.
NOTICE: Check that the positive (+) lead wires are not grounded.



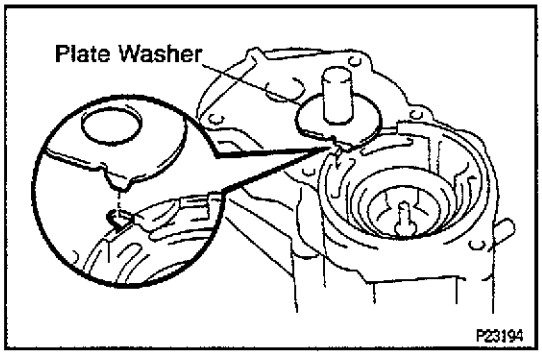
(c) Install the end cover to the field frame with the 2 screws.



3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

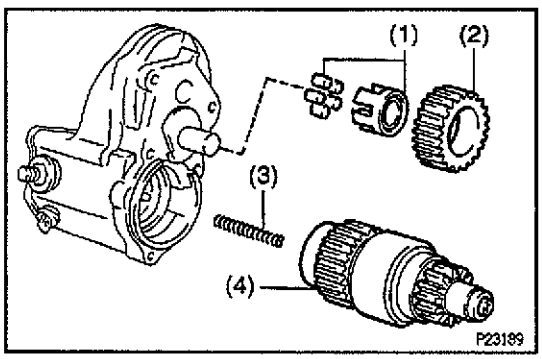
(a) Apply grease to the steel ball.

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



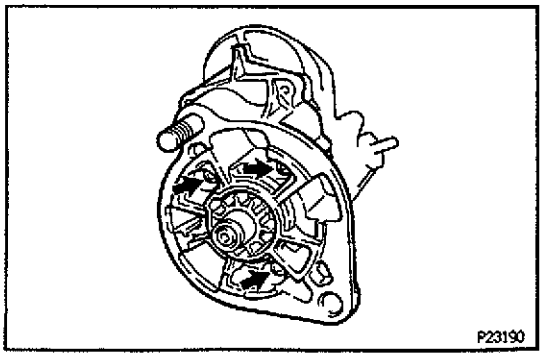
4. INSTALL STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

(a) Place the plate washer in position on the magnetic switch assembly as shown in the illustration.

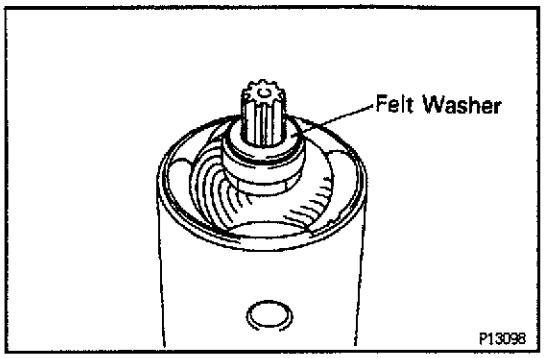


(b) Place these parts in position on the magnetic switch assembly:

(1) Bearing
(2) Idler gear
(3) Return spring
(4) Clutch assembly

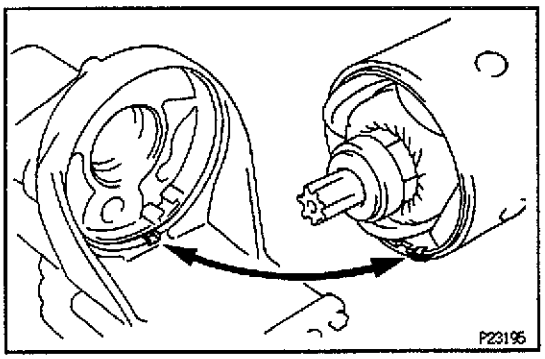


(d) Assemble the starter housing and magnetic switch assembly and install the 3 screws.

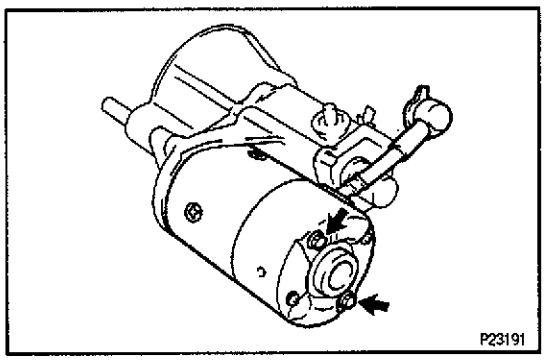


5. INSTALL FIELD FRAME WITH ARMATURE TO MAGNETIC SWITCH ASSEMBLY

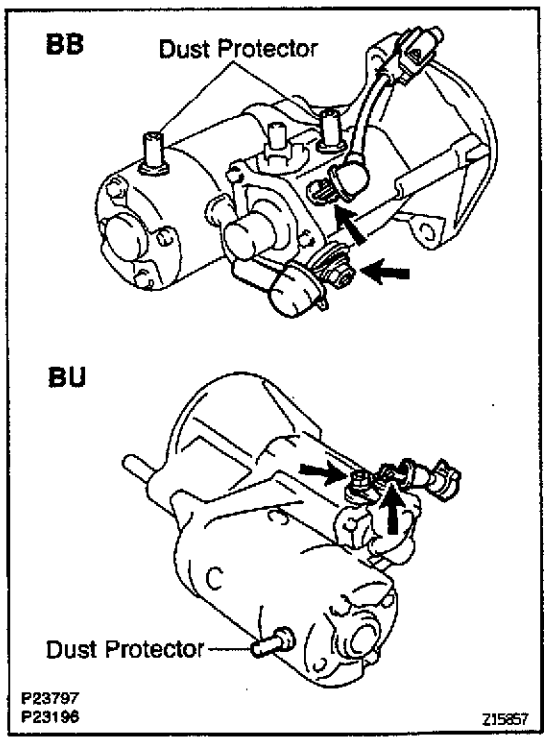
(a) Place the felt washer in position on the armature shaft.



(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) Place the plate washer on terminal C, connect the lead wire to it and install the nut.
Torque: 21 N·m (215 kgf·cm, 16 ft·lbf)

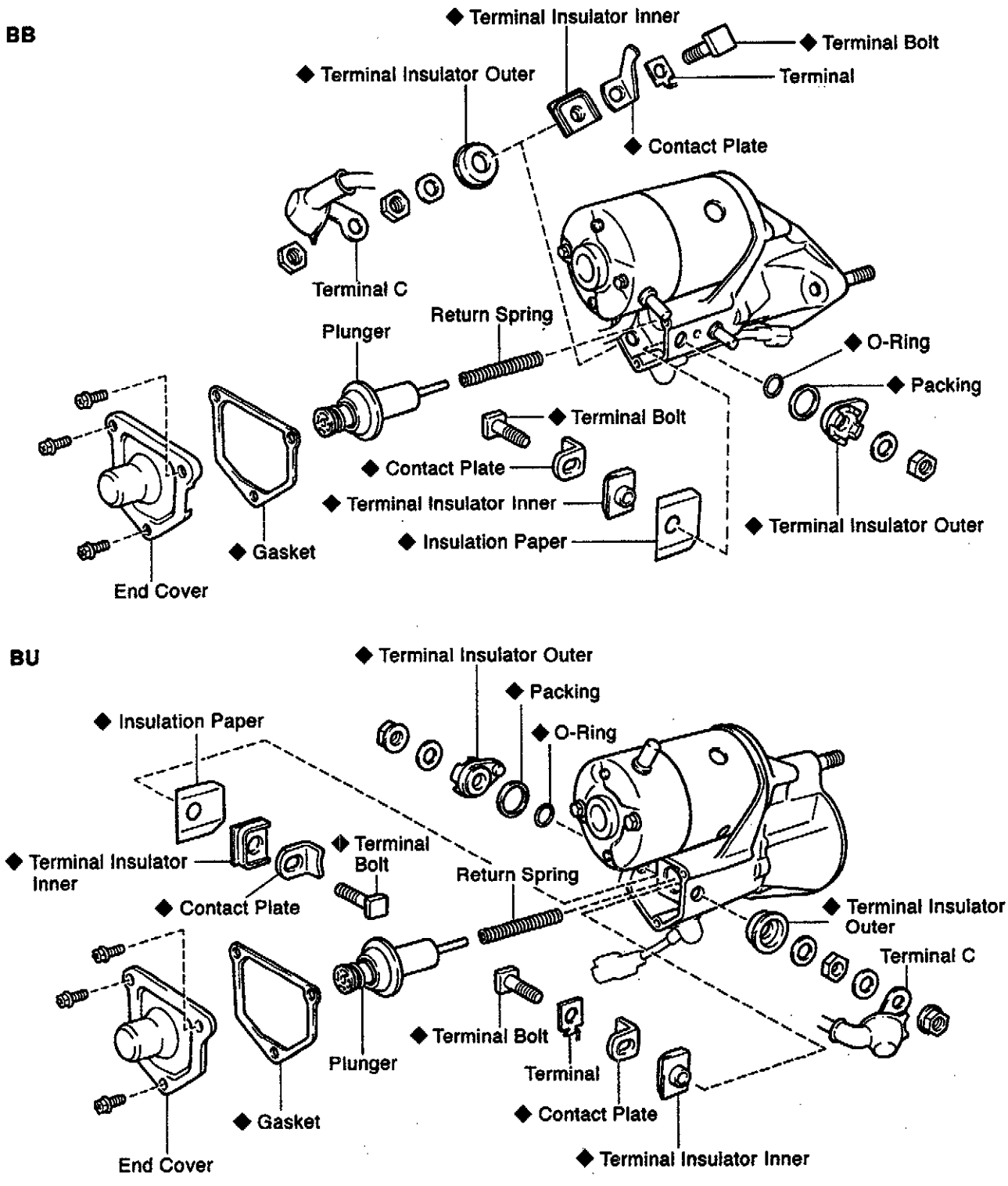
6. INSTALL LEAD WIRE

Install the lead wire to terminal 50 with the screw.
Torque: 3.6 N·m (41 kgf·cm, 32 in.·lbf)

7. INSTALL DUST PROTECTOR

COMPONENTS FOR MAGNETIC SWITCH TERMINAL KIT PARTS REPLACEMENT

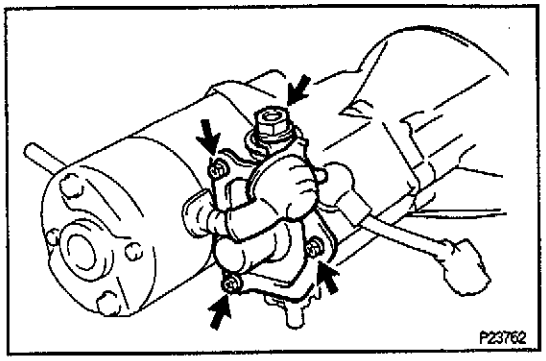
ST



P24230
P24231

◆ Non-reusable part

Z16056

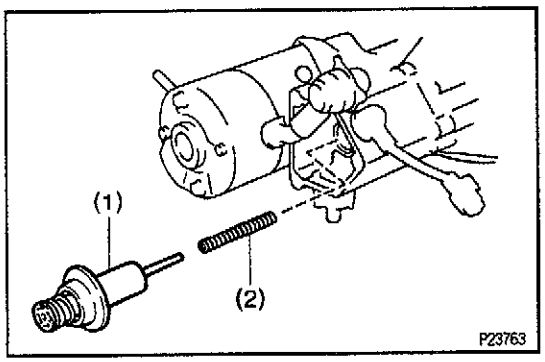


MAGNETIC SWITCH TERMINAL KIT PARTS REPLACEMENT

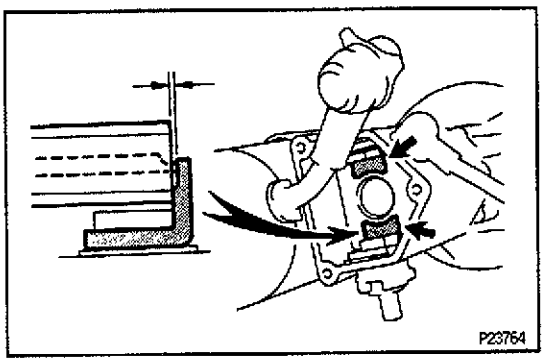
1. REMOVE MAGNETIC SWITCH END COVER

(a) Remove the nut, disconnect the lead wire from terminal C and remove the plate washer.

(b) Remove the 3 bolts and end cover from the magnetic switch assembly.



(c) Remove these parts from the magnetic switch assembly:
(1) Plunger
(2) Return spring



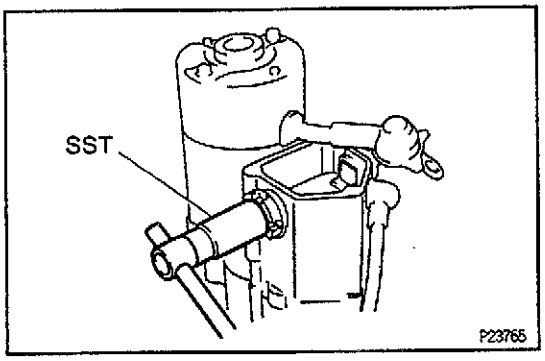
2. INSPECT CONTACT PLATE FOR WEAR

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

Maximum wear:

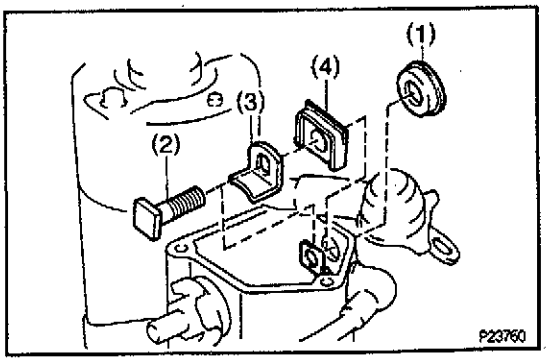
1.6 mm (0.063 in.)

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



3. REMOVE TERMINAL KIT PARTS

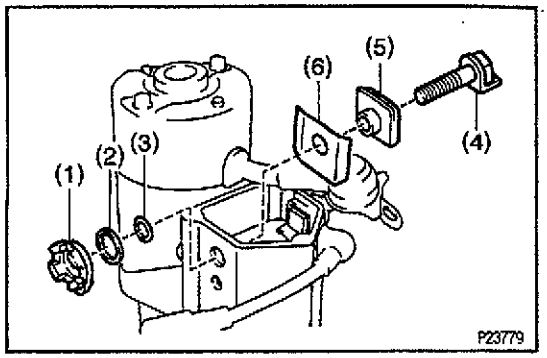
(a) Using SST, remove the nut and washer.
SST 09810–38170



(b) Remove these parts from the magnetic switch assembly:

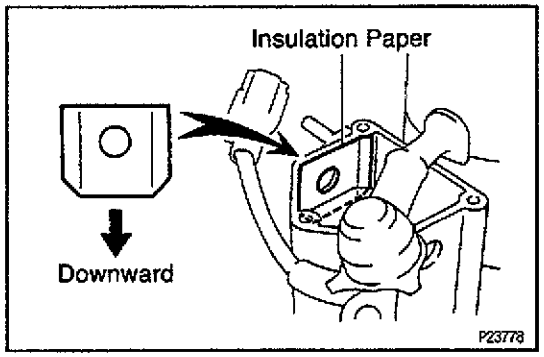
Terminal C:

(1) Terminal insulator outer
(2) Terminal bolt
(3) Contact plate
(4) Terminal insulator inner



Terminal 30:
(1) Terminal insulator outer
(2) Packing
(3) O–ring
(4) Contact plate and terminal bolt
(5) Terminal insulator inner
(6) Insulation paper

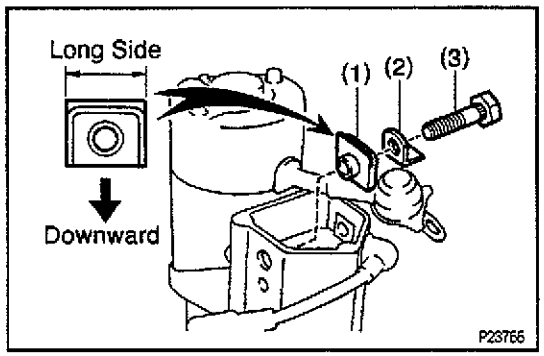
ST



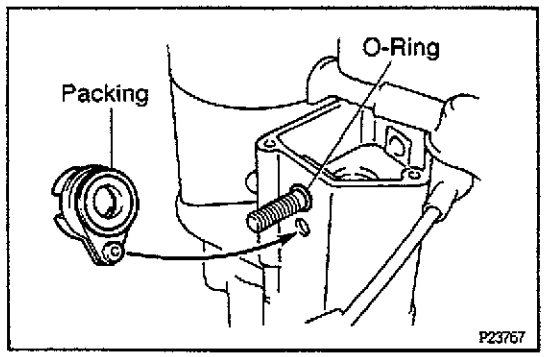
4. REINSTALL TERMINAL KIT PARTS

Terminal 30:

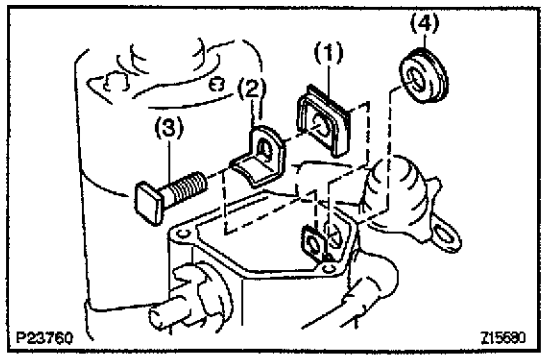
(a) Insert the insulation paper between the coil and housing.
HINT: Install the insulation paper facing the correct direction as shown in the illustration.



(b) Install these parts to the magnetic switch assembly:
(1) Terminal insulator inner
(2) Contact plate
(3) Terminal bolt
HINT: Install the terminal insulator inner in the direction as shown in the illustration.

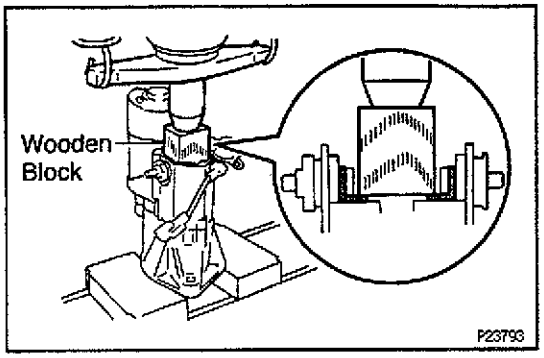


(c) Install the O–ring on the terminal bolt.
(d) Place the packing to the terminal insulator outer, and install it to the terminal.
HINT: Match the protrusion of the insulator with the indentation of the housing.
(e) Install the washer and nut, temporarily tighten the nut.



Terminal C:

(a) Install these parts to the magnetic switch assembly:
(1) Terminal insulator inner
(2) Contact plate
(3) Terminal bolt
(4) Terminal insulator outer
HINT: Install the terminal insulator inner in the same direction as terminal 30.
(b) Install the washer and nut, temporarily tighten the nut.



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5. TIGHTEN TERMINAL NUT

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

Dimensions of wood 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

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

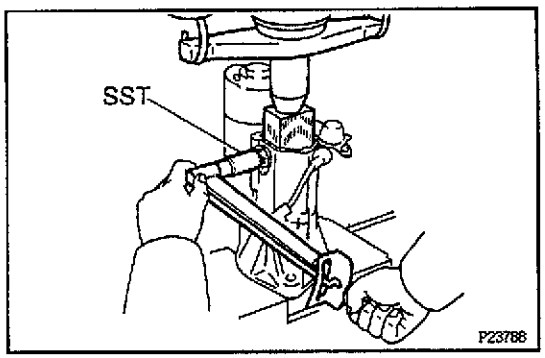
$$(psi) = \frac{221\ lbf}{\left(\frac{\text{Ram diameter (in.)}}{2}\right)^2 \times 3.14\ (\pi)}$$

(kPa) = (kgf/cm²) x 98.1

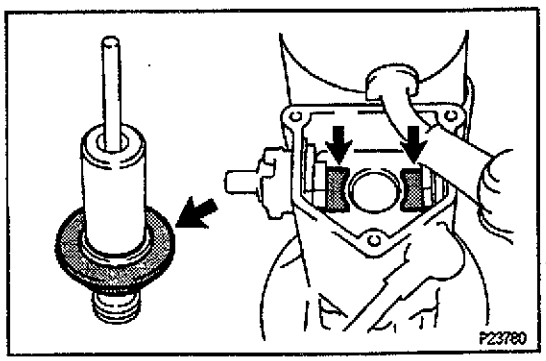
(kPa) = (psi) x 6.9

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- **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.**

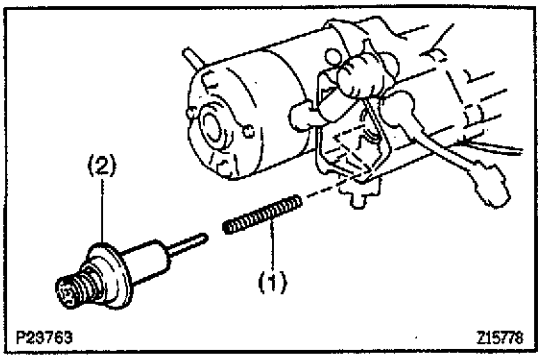


(b) Using SST, tighten the nut to the specified torque.
SST 09810–38170
Torque: 30 N·m (305 kgf·cm, 22 ft·lbf)
NOTICE: If the nut is over tightened, it may cause cracks on the inside of the insulator.



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

(a) Install these parts to the magnetic switch assembly:
(1) Return spring
(2) Plunger

(b) Install the gasket and magnetic switch end cover with the 3 bolts.
Torque: 3.6 N·m (37 kgf·cm, 32 in.·lbf)

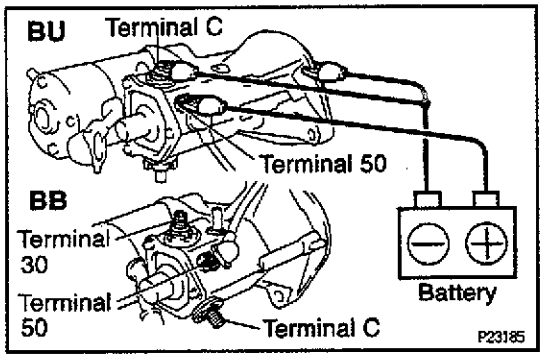
(c) Place the plate washer on terminal C, connect the lead wire to it and install the nut.
Torque: 21 N·m (215 kgf·cm, 16 ft·lbf)

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STARTER PERFORMANCE TEST

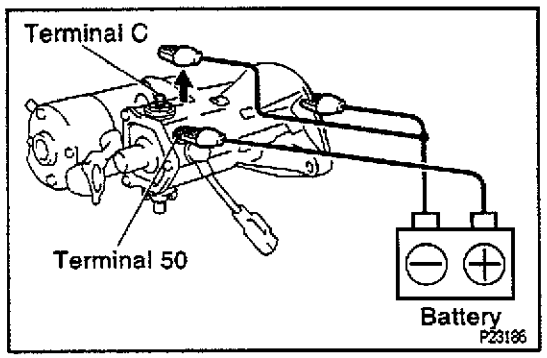
NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.



1. PERFORM PULL–IN TEST

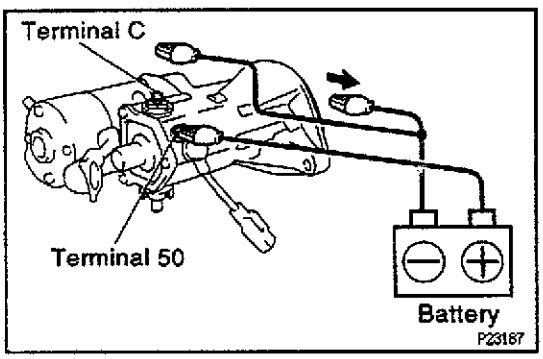
(a) Disconnect the field coil lead wire from terminal C.

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



2. PERFORM HOLD–IN TEST

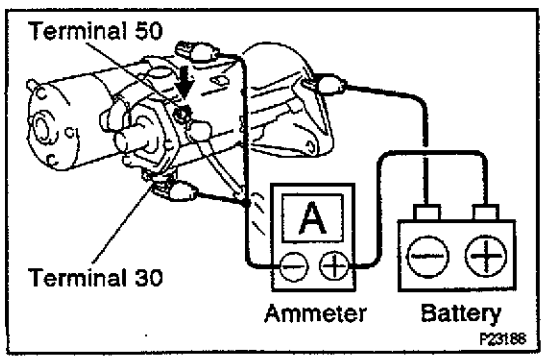
With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.



3. INSPECT CLUTCH PINION GEAR RETURN

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

Check that the clutch pinion gear returns inward.



4. PERFORM 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:
2.5 kW: 180 A or less at 11.0 V
4.5 kW: 90 A or less at 23.0 V