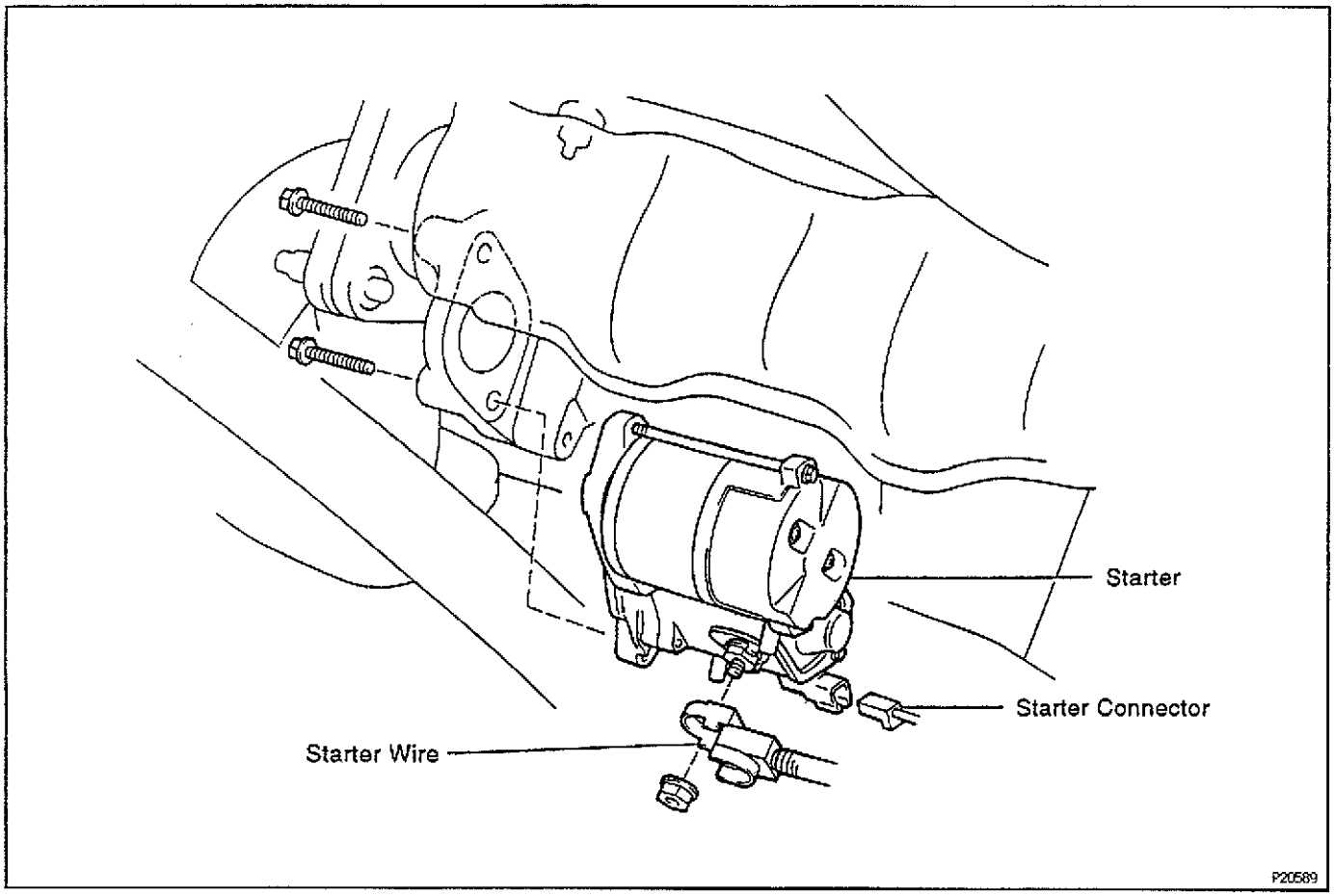
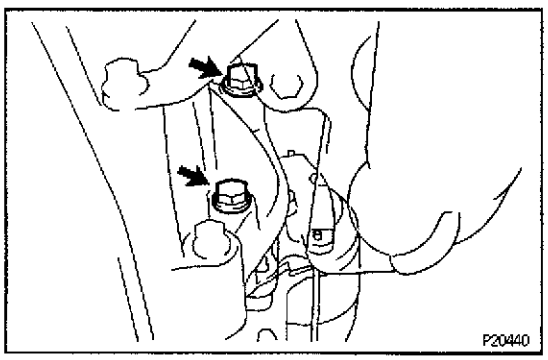
STARTER

COMPONENTS FOR REMOVAL AND INSTALLATION

ST09A-06





STARTER REMOVAL

ST0C9-01

REMOVE STARTER

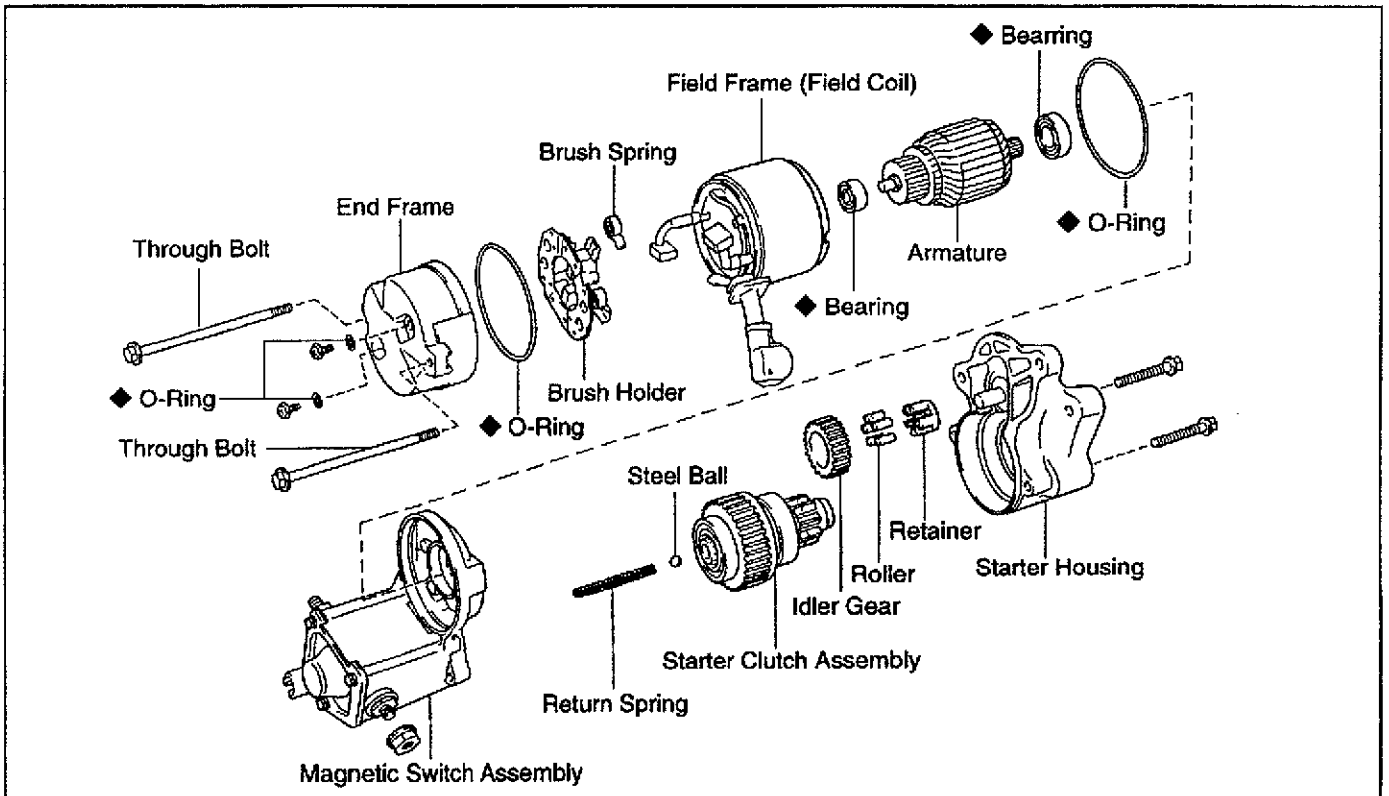
(a) Disconnect the starter connector.

(b) Remove the nut, and disconnect the starter wire.
Torque: 8.8 N·m (90 kgf·cm, 70 in.·lbf)

(c) Remove the 2 bolts and starter.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

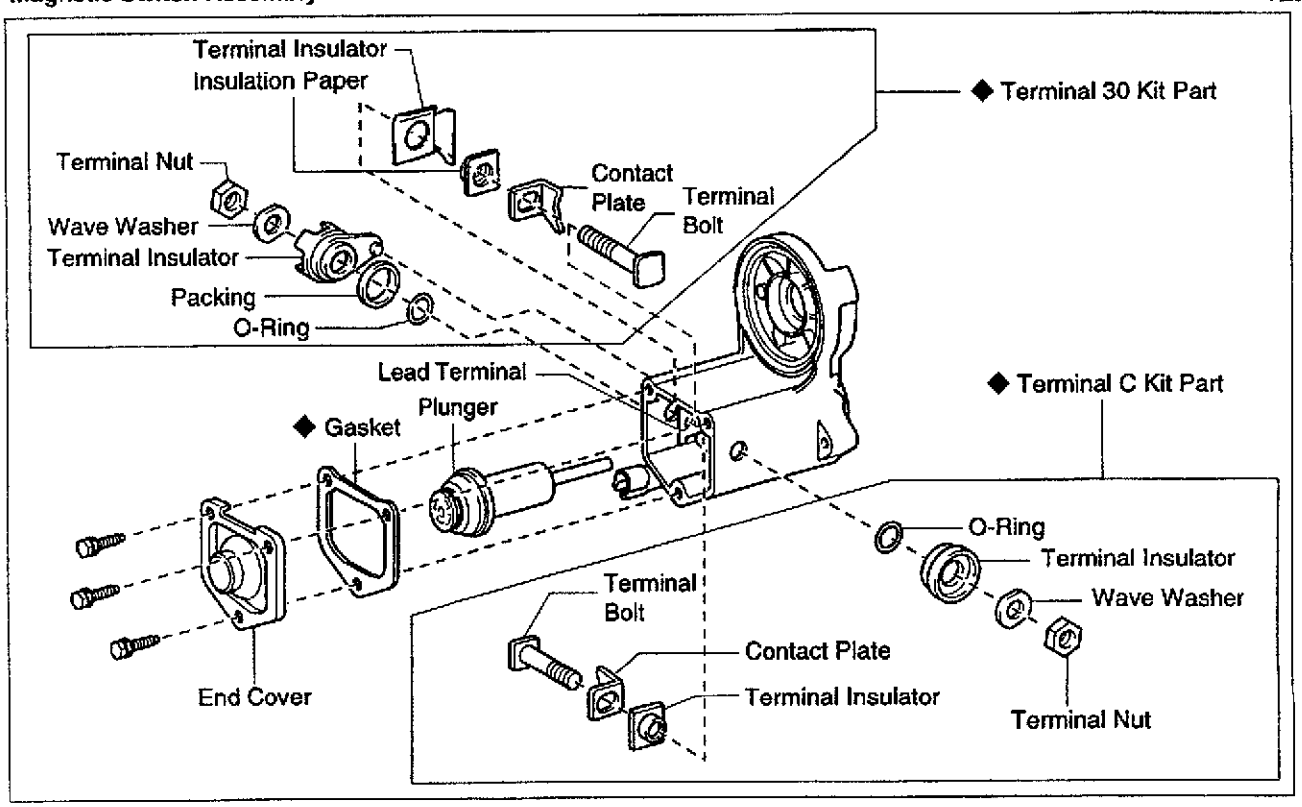
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST0CA-02



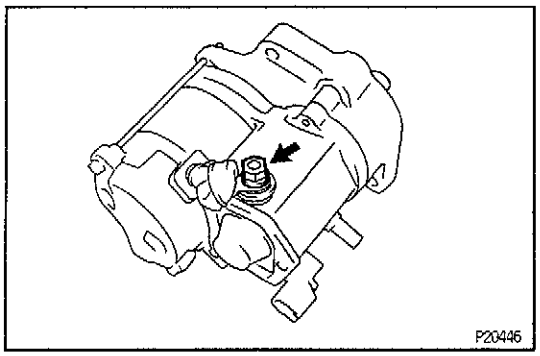
Magnetic Switch Assembly

P25573



◆ Non-reusable part

S05107
Y 218965

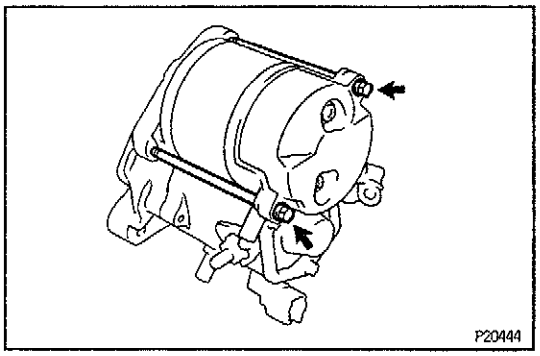


STARTER DISASSEMBLY

ASSEMBLY HINT: Use high—temperature grease to lubricate the bearings, gears, return spring and steel ball when assembling the starter.

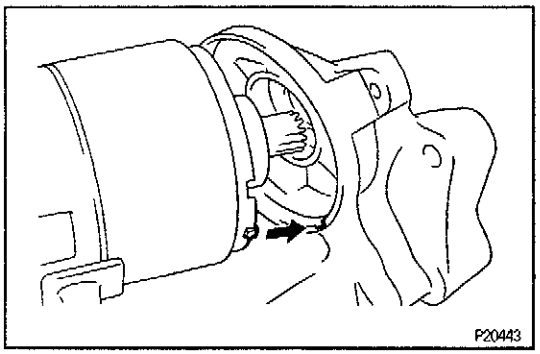
1. **REMOVE FIELD FRAME AND ARMATURE**

(a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



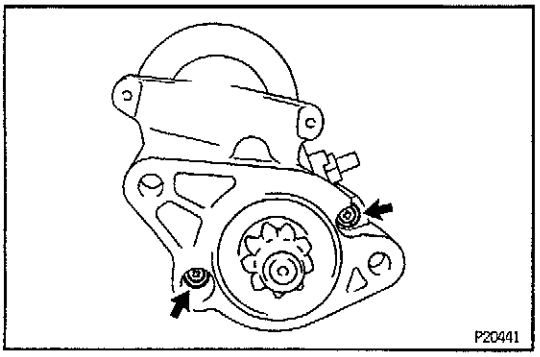
(b) Remove the 2 through bolts.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)

ST



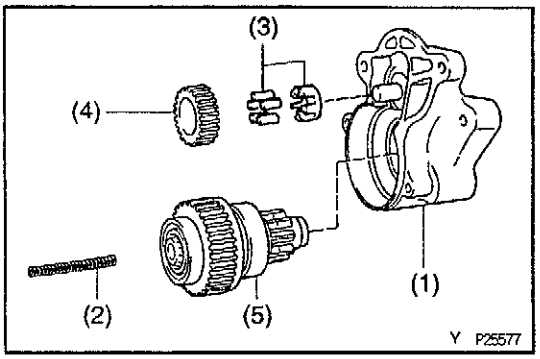
(c) Pull out the field frame with the armature from the magnetic switch assembly.
ASSEMBLY NOTICE: Align the protrusion of the field frame with groove of the magnetic switch.

(d) Remove the O—ring.
ASSEMBLY HINT: Use a new O—ring.

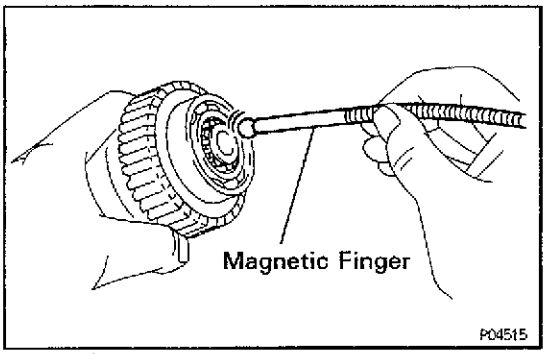


2. **REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR**

(a) Remove the 2 screws.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



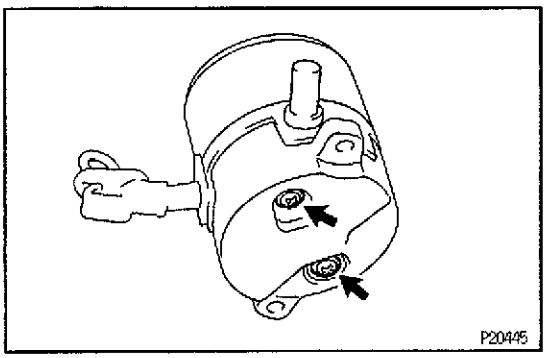
(b) Remove these parts from the magnetic switch
(1) Starter housing
(2) Return spring
(3) Bearing
(4) Idler Gear
(5) Clutch assembly



3. REMOVE STEEL BALL

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

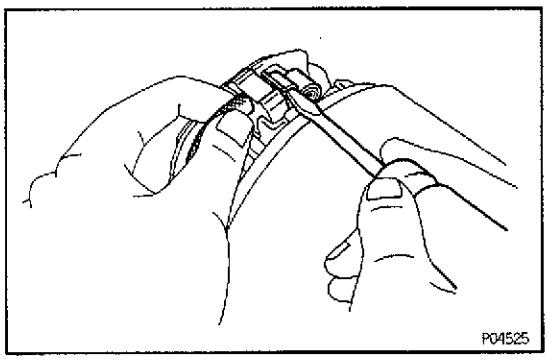
ST



4. REMOVE BRUSH HOLDER

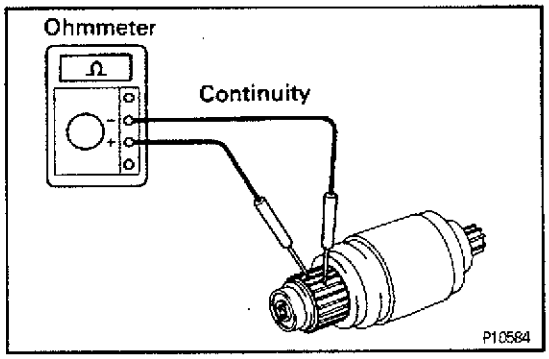
(a) Remove the 2 screws and 2 O–rings, and pull the end cover from the field frame.
Torque: 1.5 N·m (15 kgf·cm, 13 in.·lbf)

(b) Remove the O–ring from the field frame.
ASSEMBLY HINT: Use a new O–ring.



(c) Using a screwdriver hold the spring back and disconnect the brush from the brush holder.
Disconnect the 4 brushes, and remove the brush holder.
ASSEMBLY NOTICE: Check that the positive (+) lead wires are not grounded.

5. REMOVE ARMATURE FROM FIELD FRAME



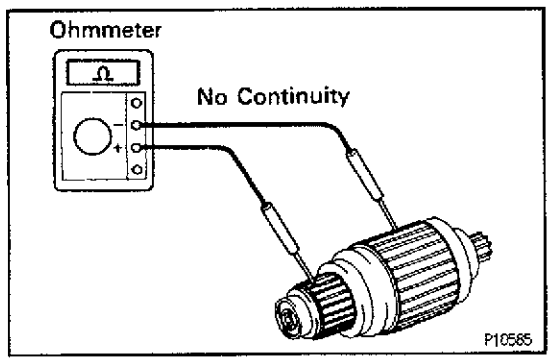
STARTER INSPECTION AND REPAIR

ST0AF–05

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.

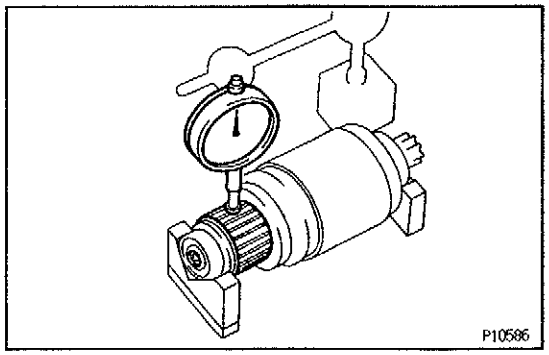


2. INSPECT COMMUTATOR FOR GROUND

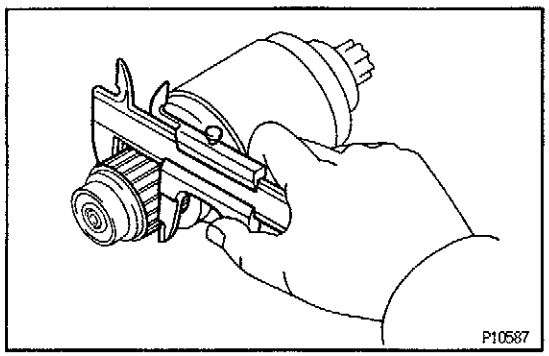
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.
If there is continuity, replace the armature.

Commutator

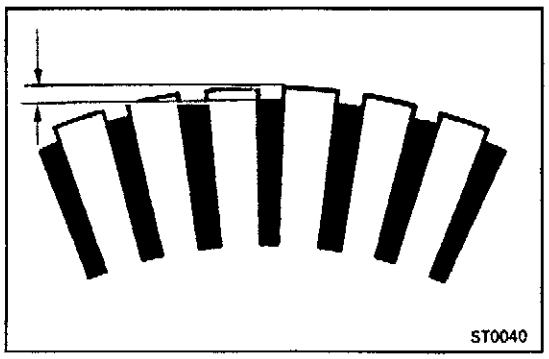
1. **INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES**
   If the surface is dirty or burnt, correct it with sandpaper (No.400) or on a lathe.



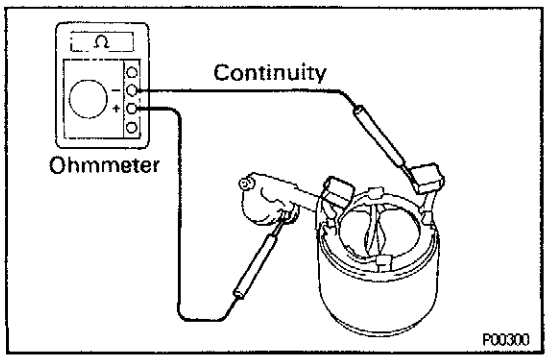
2. **INSPECT COMMUTATOR CIRCLE RUNOUT**
(a) Place the commutator on V–blocks.
(b) Using a dial gauge, measure the circle runout.
Maximum circle runout:
0.05 mm (0.0020 in.)
If the circle runout is greater than maximum, correct it on a lathe.



3. **INSPECT COMMUTATOR DIAMETER**
Using vernier caliper, measure the commutator diameter.
Standard diameter:
30.0 mm (1.181 in.)
Minimum diameter:
29.0 mm (1.142 in.)
If the diameter is less than minimum, replace the armature.

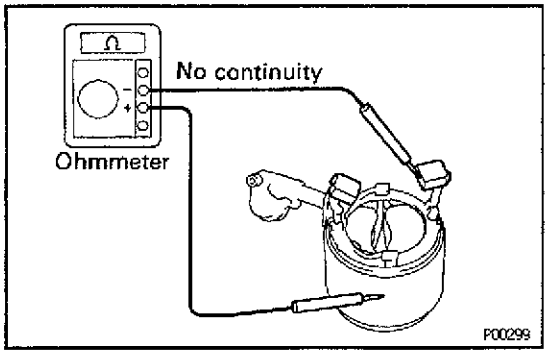


4. **INSPECT UNDERCUT DEPTH OF SEGMENT**
Check that the undercut depth is clean and free of foreign material. Smooth out the edge.
Standard undercut depth:
0.6 mm (0.024 in.)
Minimum undercut depth:
0.2 mm (0.008 in.)
If the undercut depth is less than minimum, correct it with a hacksaw blade.



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.

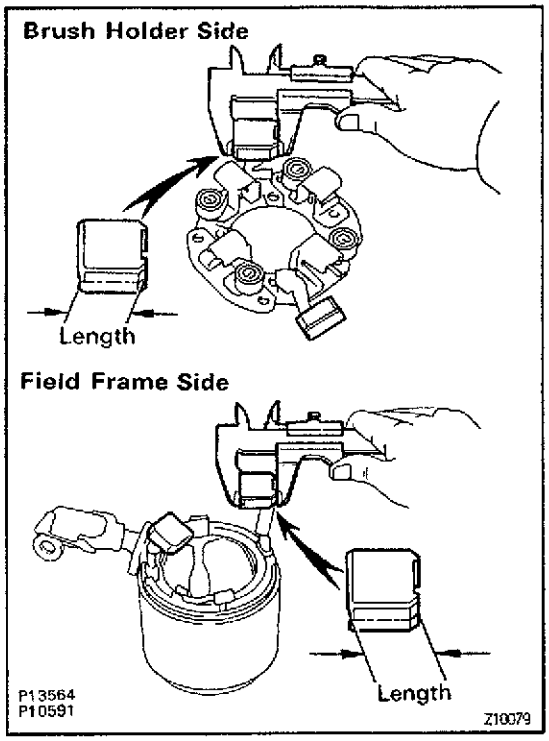


2. INSPECT FIELD COIL FOR GROUND

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.

ST



Brushes

INSPECT BRUSH LENGTH

Using a vernier caliper, measure the brush length.

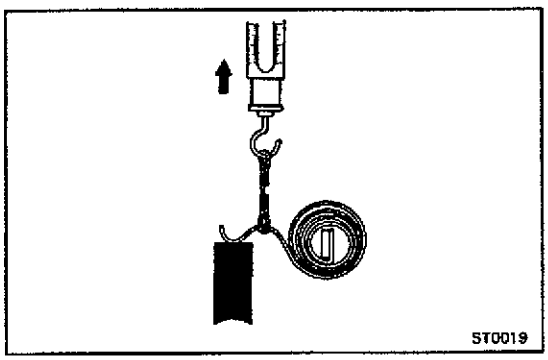
Standard length:

15.5 mm (0.610 in.)

Minimum length:

10.0 mm (0.394 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.

Standard spring installed load:

1.2 kW type

13.7 – 19.6 N (1.40 – 2.00 kgf, 3.1 – 4.4 lbf)

1.4 kW type

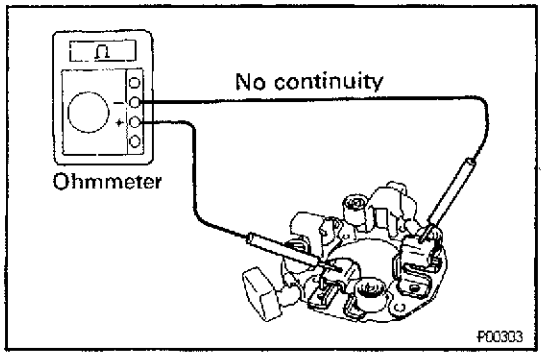
17.6 – 23.5 N (1.80 – 2.40 kgf, 4.0 – 5.3 lbf)

Minimum spring installed load:

1.2 kw type: 9.8 N (1.00 kgf, 2.2 lbf)

1.4 kw type: 11.8 N (1.20 kgf, 2.6 lbf)

If the installed load is less than minimum, 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

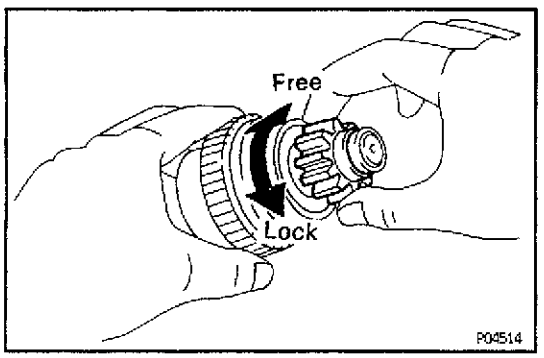
ST

1. **INSPECT GEAR TEETH**

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

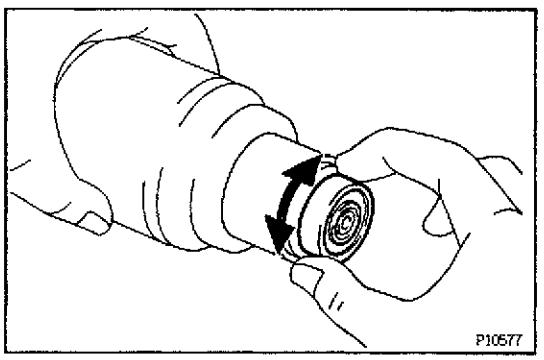
If damaged, replace the gear or clutch assembly.

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



2. **INSPECT CLUTCH PINION GEAR**

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

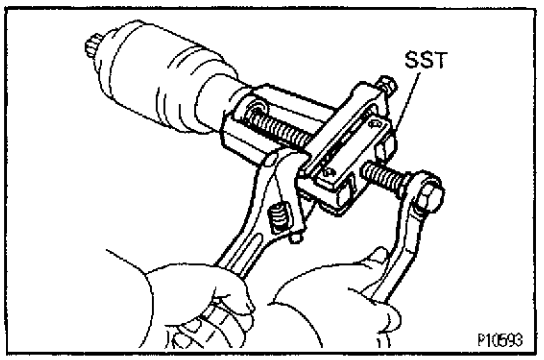


Bearings

1. **INSPECT REAR BEARING**

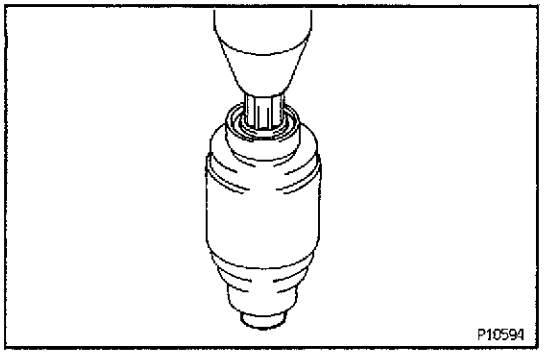
Turn each bearing by hand while applying inward force.

If the resistance is felt or if the bearing sticks, replace the bearing.



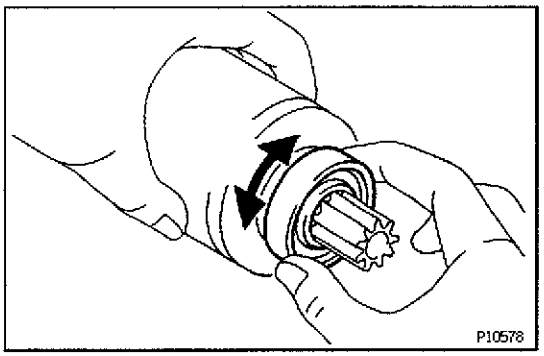
2. **IF NECESSARY, REPLACE REAR BEARING**

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



(b) Using a press, press in a new rear bearing.

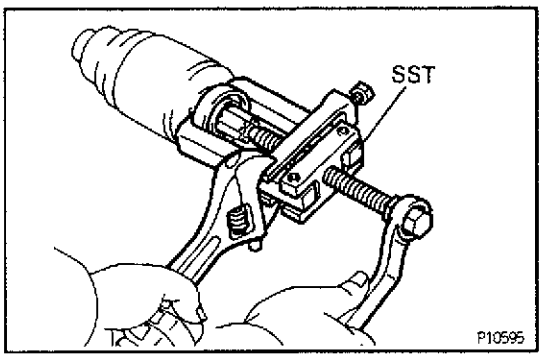
ST



3. INSPECT FRONT BEARING

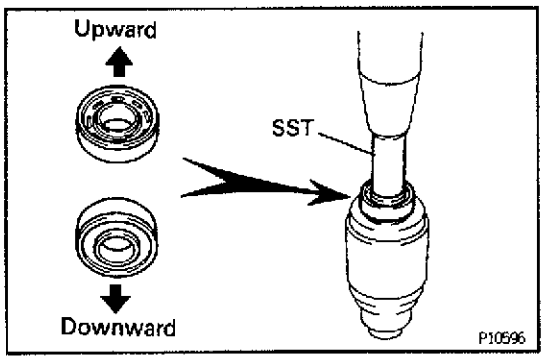
Turn each bearing by hand while applying inward force.

If the resistance is felt or if the bearing sticks, replace the bearing.



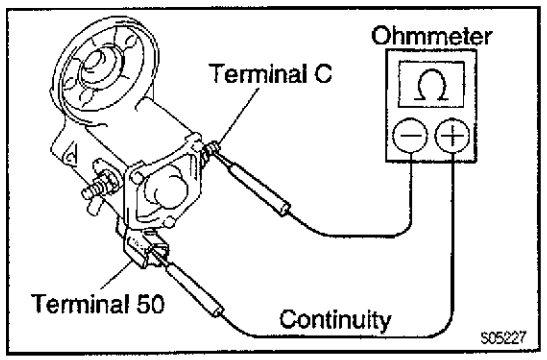
4. IF NECESSARY, REPLACE FRONT BEARING

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



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

NOTICE: Be careful of the bearing installation direction.

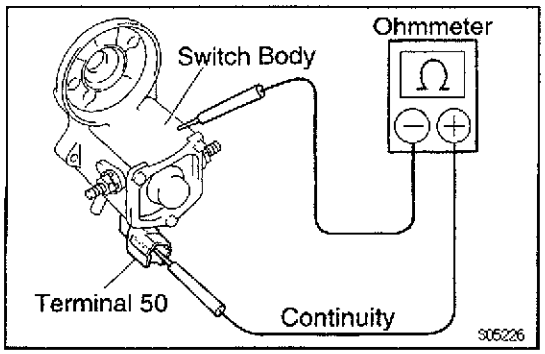


Magnetic Switch

1. PERFORM PULL–IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminals 50 and C.

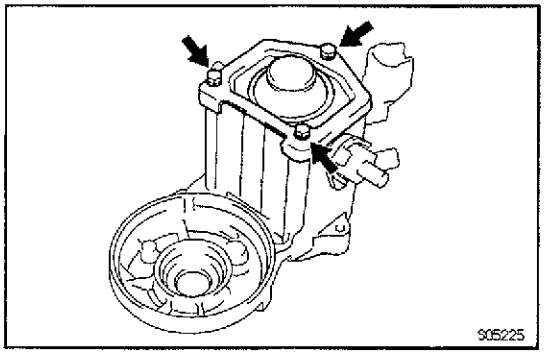
If there is no continuity, check and replace the magnetic switch.



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 assembly.



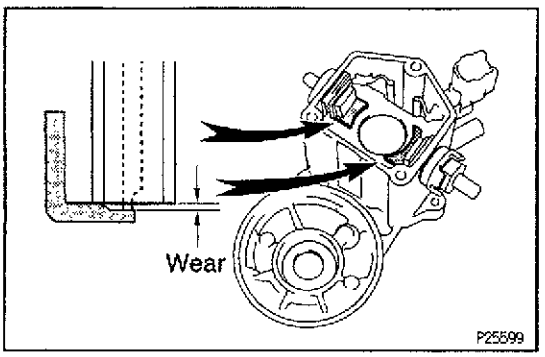
MAGNETIC SWITCH TERMINAL KIT PARTS REPLACEMENT

STOFM—01

ST

1. REMOVE MAGNETIC SWITCH END COVER

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



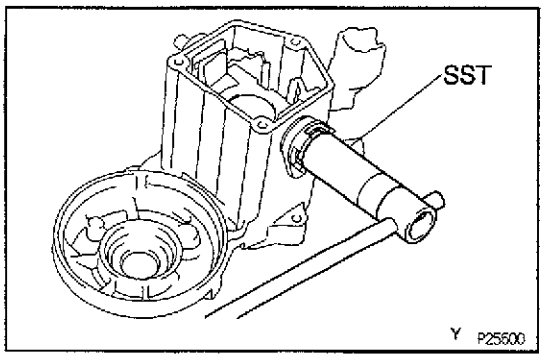
2. INSPECT CONTACT PLATE FOR WEAR

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.

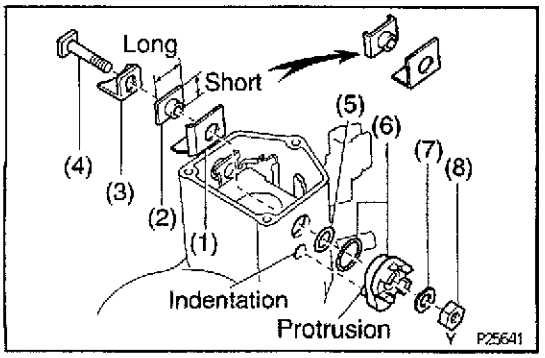


3. REMOVE TERMINAL KIT PARTS

(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.



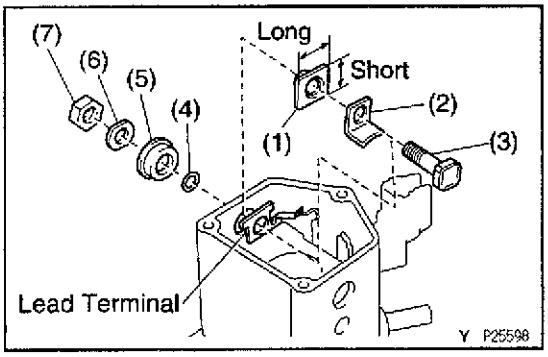
4. REINSTALL TERMINAL KIT PARTS

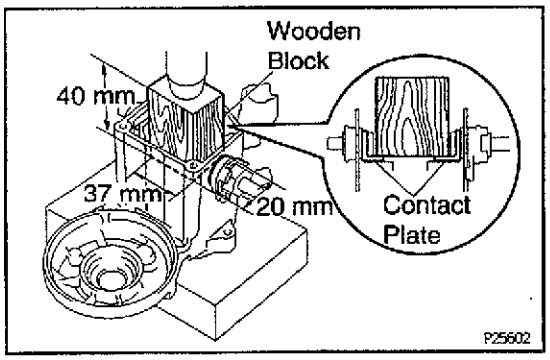
(a) Install these new parts:
Terminal 30:
(1) Insulation paper
(2) Terminal insulator (inside)

NOTICE: Be careful to install the terminal insulator in the correct direction.

(3) Contact plate

ST





(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

NOTICE: Be careful to install the terminal insulator (inside) 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:

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

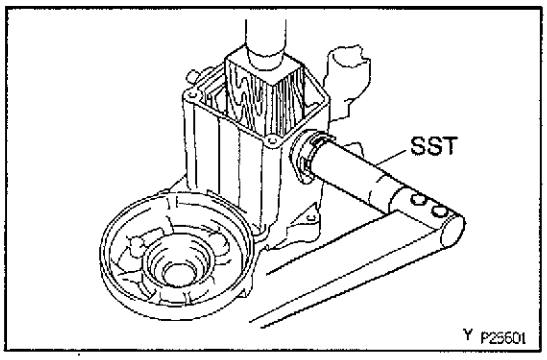
$$(\text{psi}) = \frac{221\ \text{lbf}}{\left(\frac{\text{Ram diameter (in.)}}{2}\right)^2 \times 3.14\ (\pi)}$$

(kPa) = (kgf/cm²) x 98.1

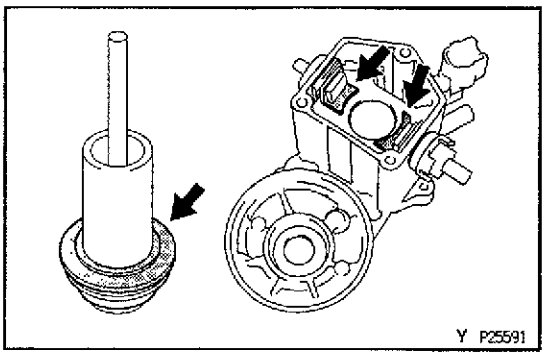
(kPa) = (psi) x 6.9

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 09810–38140
Torque:
Terminal 30 and Terminal C
17 N·m (170 kgf·cm, 12 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.

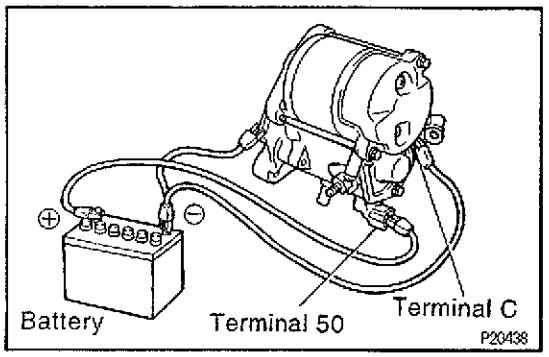
7. REINSTALL MAGNETIC SWITCH END COVER
Install the plunger, new gasket, end cover and lead clamp with the 3 bolts.
Torque: 2.5 N·m (25 kgf·cm, 22 in.·lbf)

ST

STARTER ASSEMBLY

ST0AG–02

Assembly is in the reverse order of disassembly.



STARTER PERFORMANCE TEST

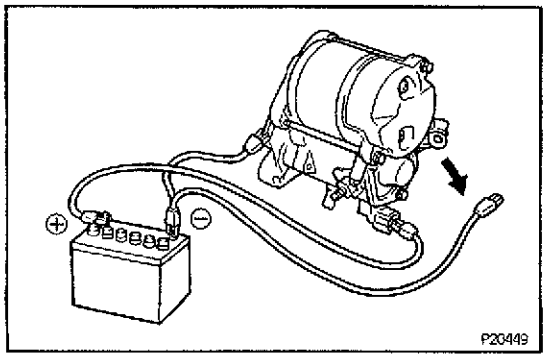
ST0BX–0F

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

1. PERFORM PULL–IN TEST

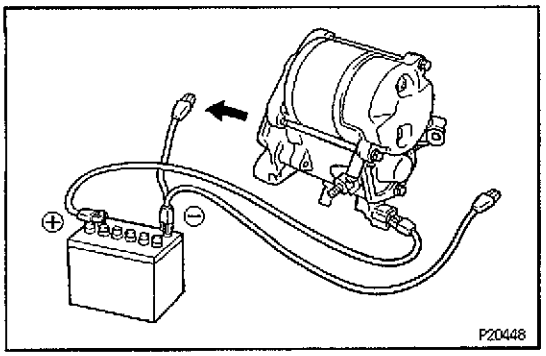
(a) Disconnect the field coil lead wire from terminal C.

(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.

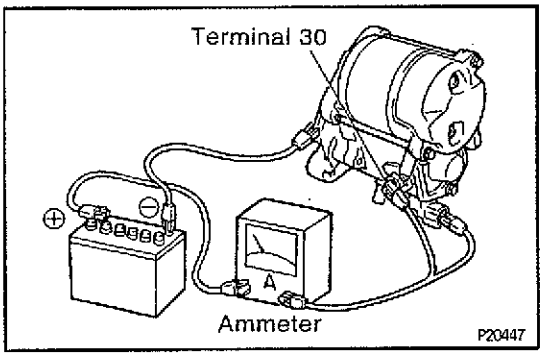


3. INSPECT CLUTCH PINION GEAR RETURN

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

Check that the clutch pinion gear returns inward.

ST



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 reads the specified current.

Specified current:

At 11.5 V: 90 A or less

STARTER INSTALLATION

Installation is in the reverse order of removal.