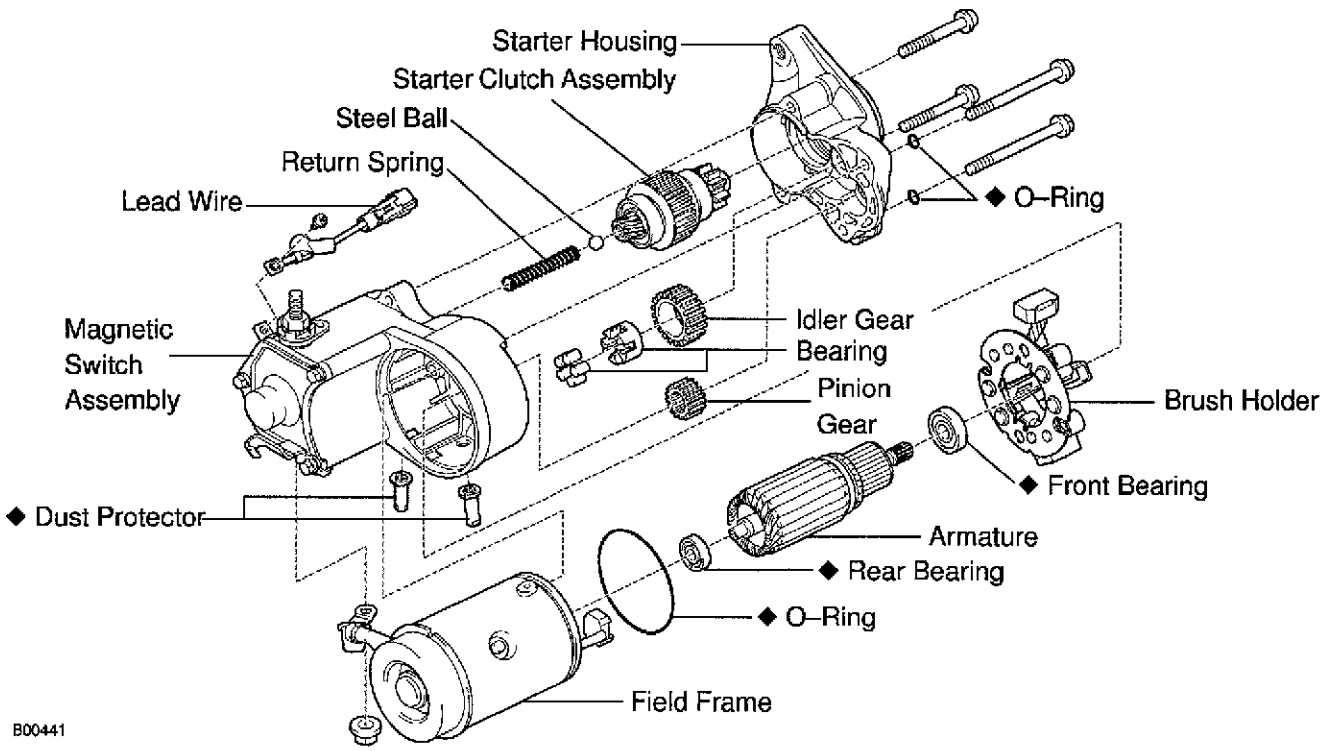
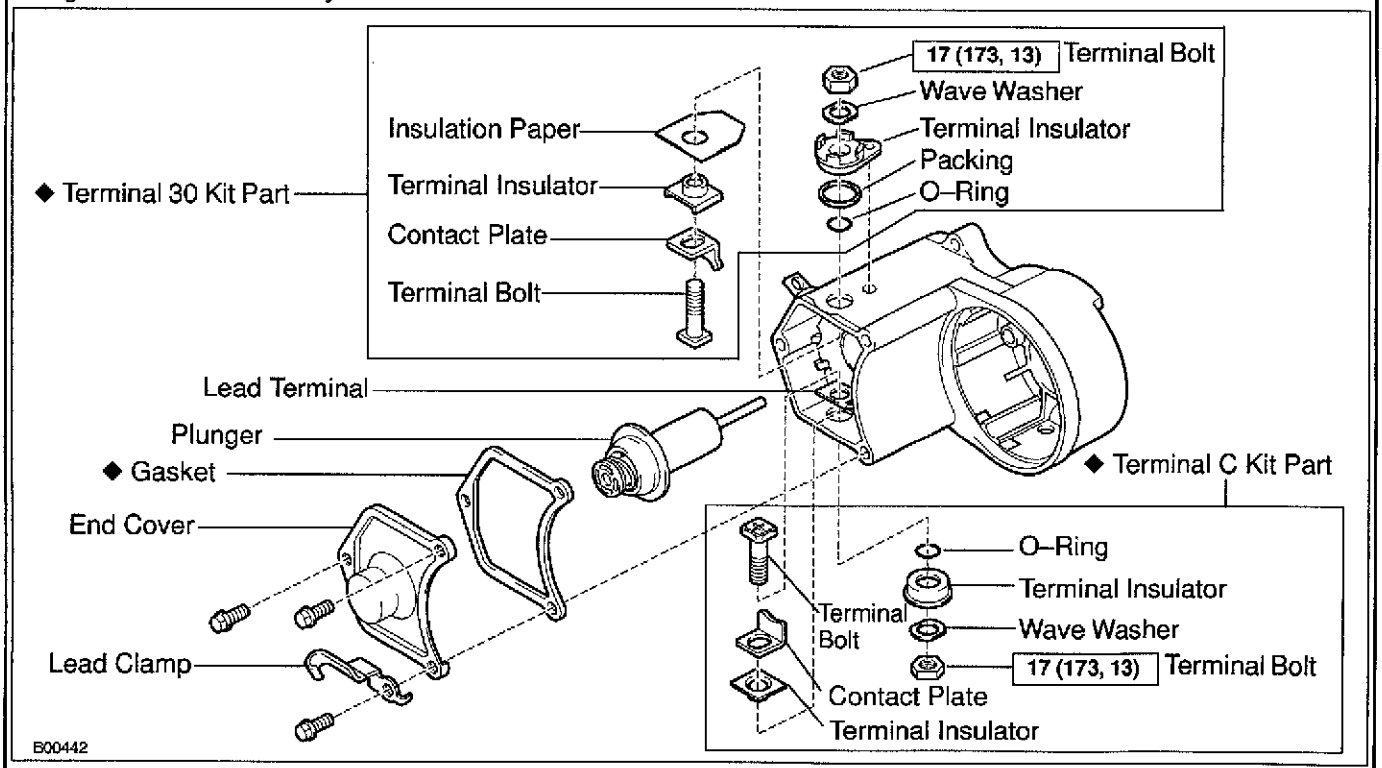
STARTER(2.2 kW)

COMPONENTS

ST029–01



Magnetic Switch Assembly



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

B00902

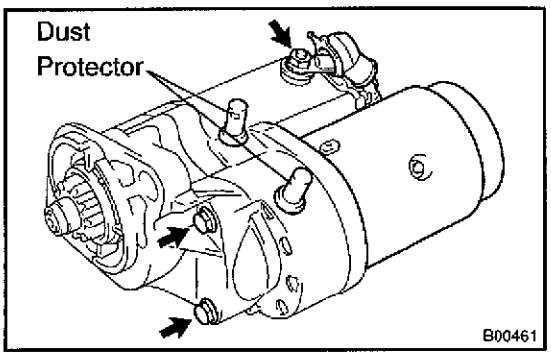
ST

ST02A–01

DISASSEMBLY

1. REMOVE LEAD WIRE

Remove the screw and lead wire.



2. REMOVE DUST PROTECTORS

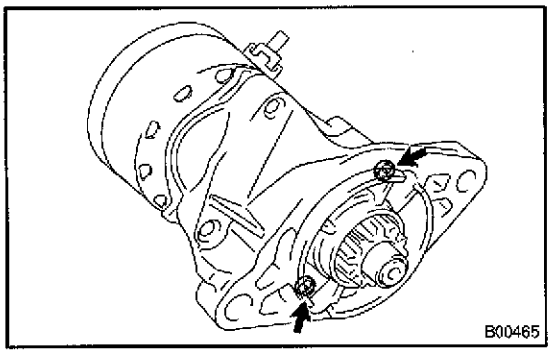
3. REMOVE FIELD FRAME AND ARMATURE

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

(b) Remove the 2 through bolts and 2 O–rings.

(c) Pull out the field frame together with the armature from the magnetic switch.

(d) Remove the O–ring from the filed frame.



4. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS

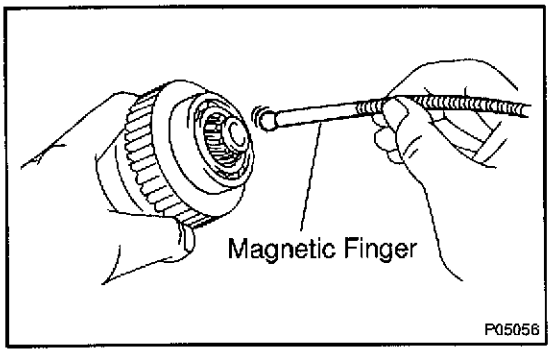
(a) Remove the 2 screws.

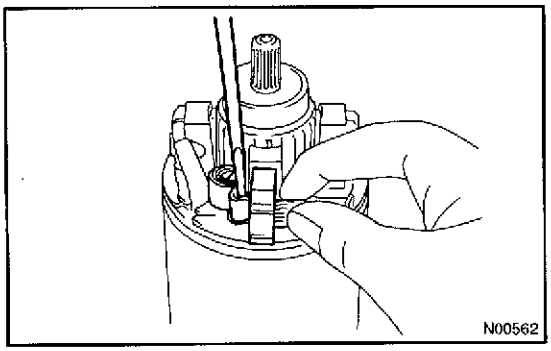
(b) Remove these parts from the magnetic switch:

- Starter housing
- Return spring
- Pinion gear
- Bearing
- Idler gear
- Starter clutch assembly

5. REMOVE STEEL BALL

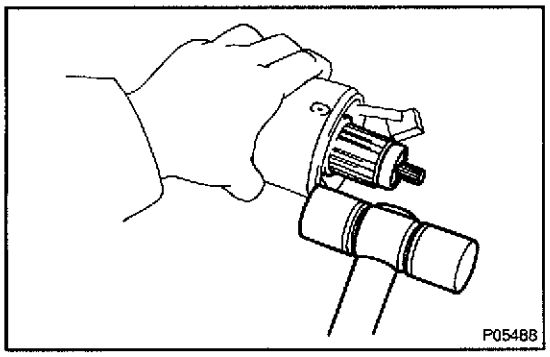
Using a magnetic finger, remove the steel ball from the clutch shaft hole.





6. REMOVE BRUSH HOLDER

Using a screwdriver, hold the spring back and disconnect the brush from the brush holder. Disconnect the 4 brushes, and remove the brush holder.



7. REMOVE ARMATURE FROM FIELD FRAME

Using a plastic–faced hammer, tap the field frame end and remove the armature.

5T02B-01

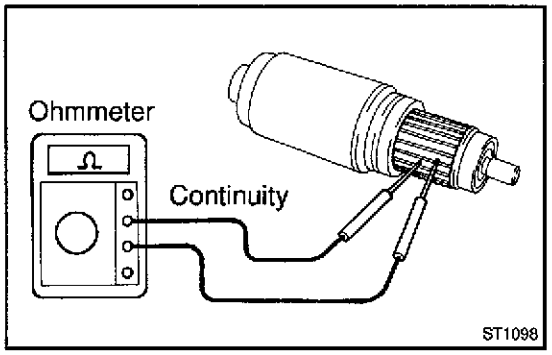
INSPECTION

1. INSPECT ARMATURE COIL

(a) Check the commutator for open circuit.

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

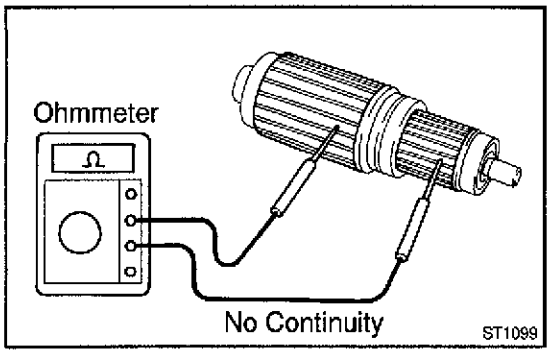
If there is no continuity between any segment, replace the armature.



(b) Check the 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.



2. INSPECT COMMUTATOR

(a) Check the commutator for the dirty and burnt surfaces.

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

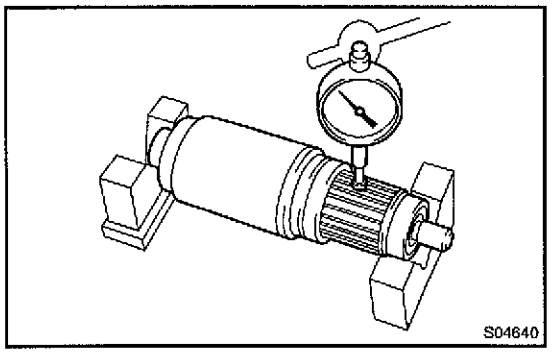
(b) Check the commutator circle runout.

(1) Place the commutator on V–blocks.

(2) 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.

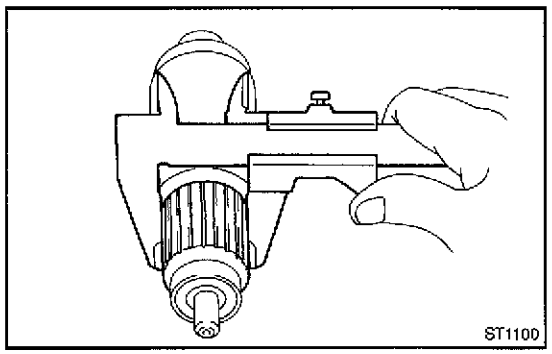


(c) Using vernier calipers, measure the commutator diameter.

Standard diameter: 35.0 mm (1.378 in.)

Minimum diameter: 34.0 mm (1.339 in.)

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

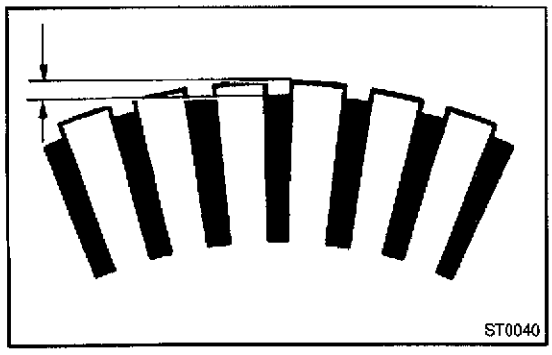


(d) Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

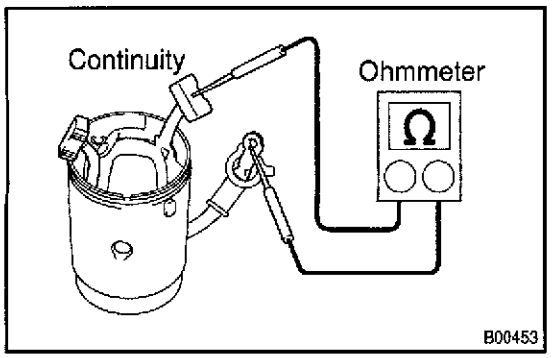
Standard undercut depth: 0.7 mm (0.028 in.)

Minimum undercut depth: 0.2 mm (0.008 in.)

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



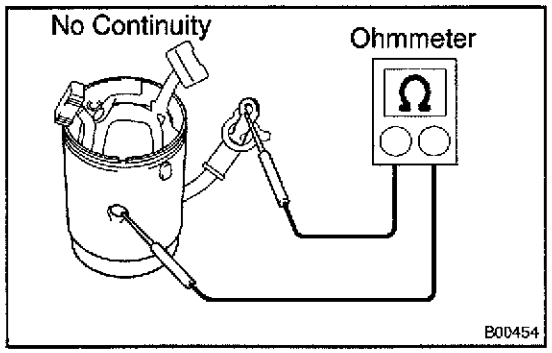
ST



3. INSPECT FIELD COIL (FIELD FRAME)

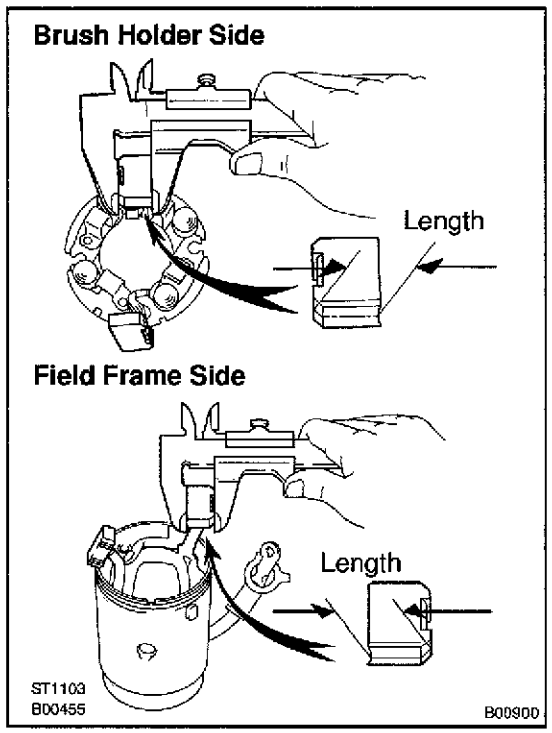
(a) Check the field coil for open circuit.
Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

If there is no continuity, replace the filed frame.



(b) Check the field coil for ground.
Using an ohmmeter, check that there is no continuity between the coil end and filed frame.

If there is continuity, replace the field frame.

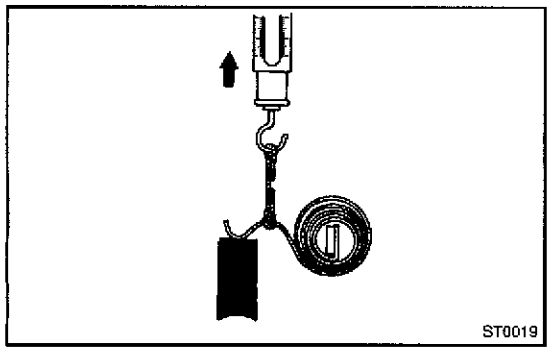


4. INSPECT BRUSHES

Using vernier calipers, measure the brush length.

Standard length: 16.5 mm (0.650 in.)
Minimum length: 9.0 mm (0.354 in.)

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



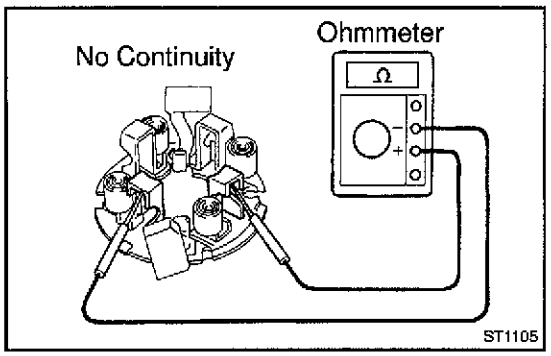
5. INSPECT BRUSH SPRINGS

Check the brush spring load.

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

Standard spring installed load:
26.5 – 32.3 N (2.7 – 3.3 kgf, 6.0 – 7.3 lbf)
Minimum spring installed load:
17.6 N (1.8 kgf, 4.0 lbf)

If the installed load is less than minimum, replace the brush springs.



6. INSPECT BRUSH HOLDER

Check the 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.

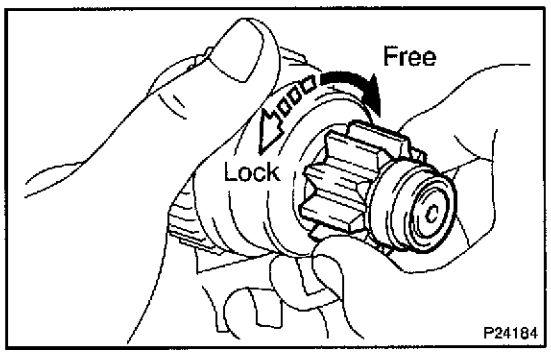
7. INSPECT CLUTCH AND GEARS

(a) 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 ring gear of the flywheel for wear or damage.

ST



(b) Check the 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.

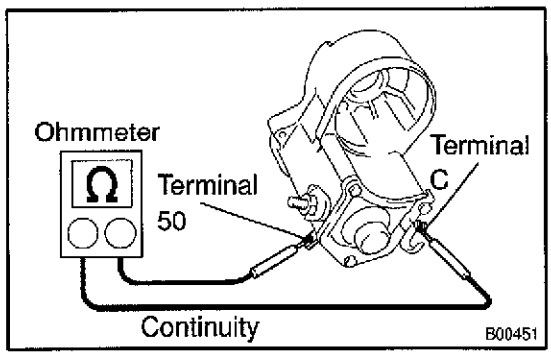
If necessary, replace the clutch assembly.

8. INSPECT BEARINGS

Turn the bearing by hand while applying inward force.

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

(See page ST–11)

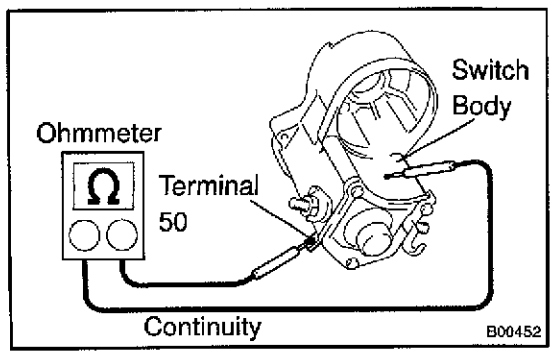


9. INSPECT MAGNETIC SWITCH

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

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

If there is no continuity, replace the magnetic switch.



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

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

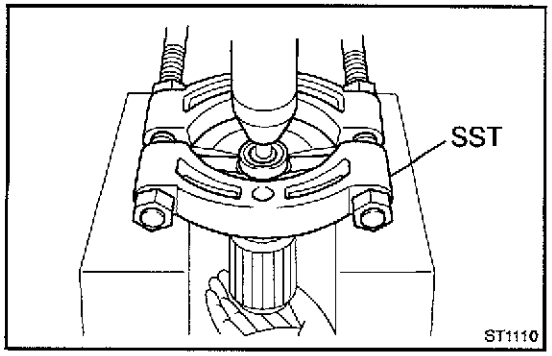
If there is no continuity, replace the magnetic switch.

ST02C-01

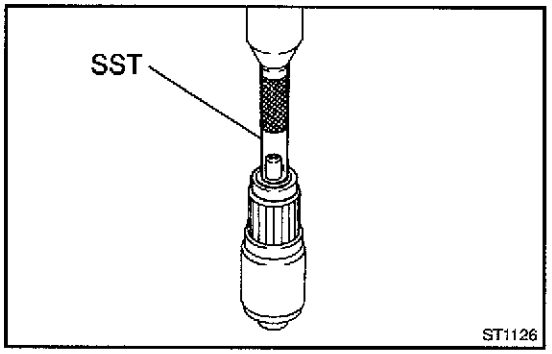
REPLACEMENT

1. REPLACE FRONT BEARING

(a) Using SST and a press, press out the bearing.
SST 09950–00020

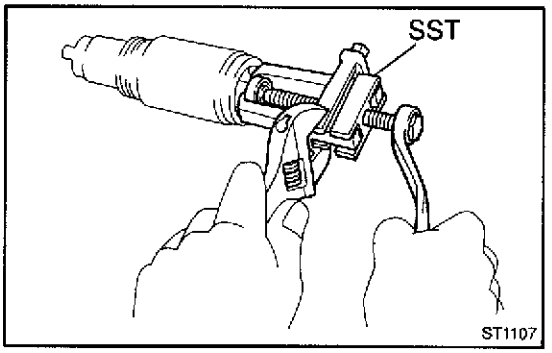


(b) Using SST and a press, press in a new bearing.
SST 09201–41020



2. REPLACE REAR BEARING

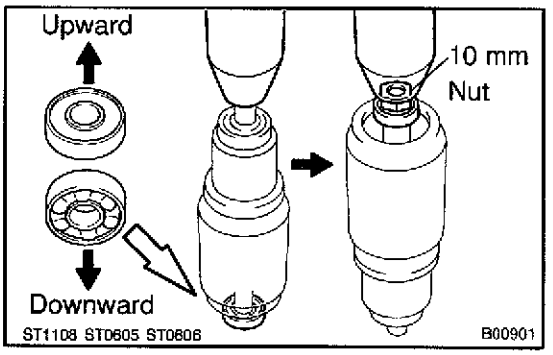
(a) Using SST, remove the bearing.
SST 09286–46011



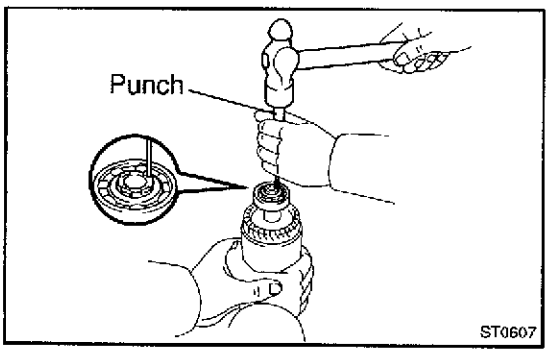
(b) Using a 10 mm (for thread diameter) nut and press, press in a new bearing.

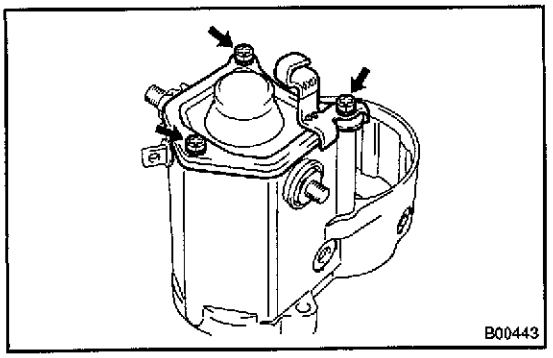
NOTICE:

Be careful of the installation direction.



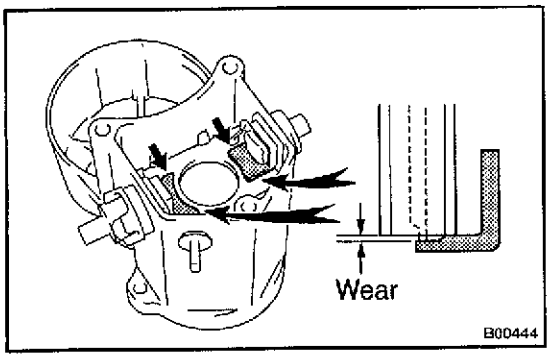
(c) Using a punch, stake the armature shaft.





3. REPLACE MAGNETIC SWITCH TERMINAL KIT PARTS

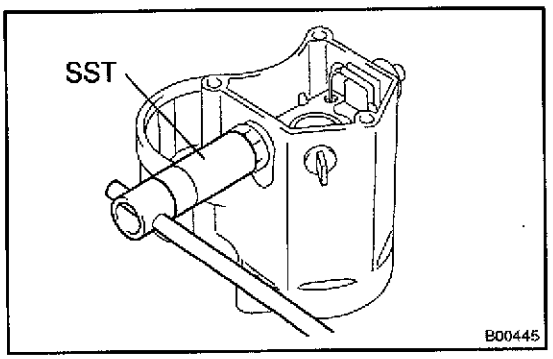
(a) Remove the 3 bolts, lead clamp, end cover, gasket and plunger.



(b) 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.



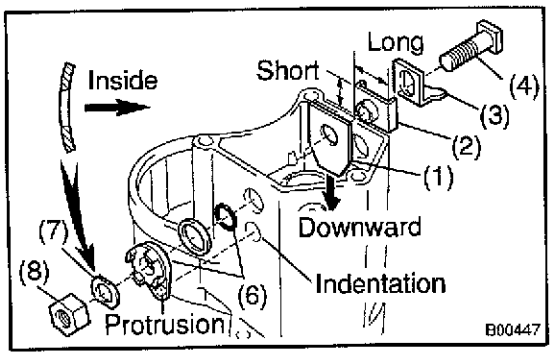
(c) Remove the terminal kit parts.

(1) Using SST, loosen the terminal nuts.

SST 09810–38140

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

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



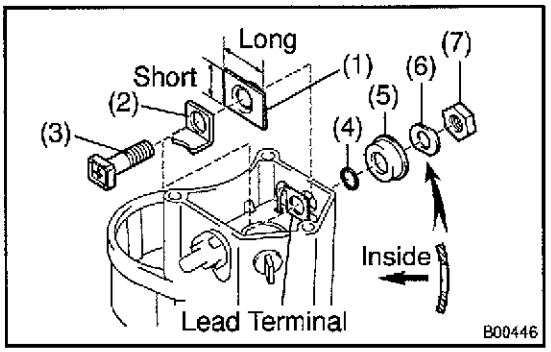
(d) Temporarily install these new terminal 30 kit parts:

(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 nit

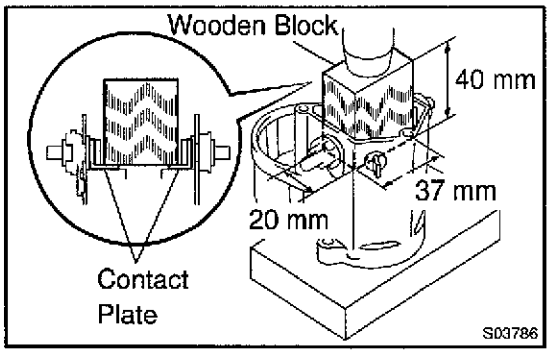
NOTICE:
Be careful to install the insulation paper, terminal insulator (inside) and wave washer in the correct direction.



(e) Temporarily install these new terminal C kit parts:
(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) and wave washer in the correct direction.

(f) Temporarily tighten the terminal nuts.



(g) Tighten terminal nuts.
(1) 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.**

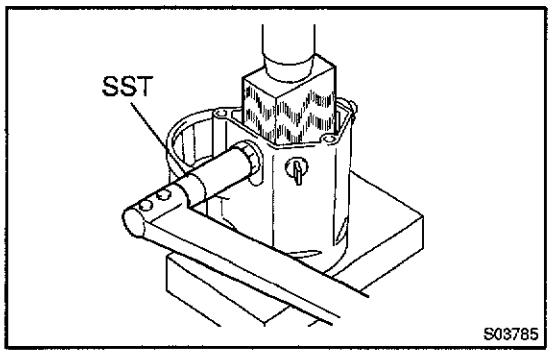
Gauge pressure:

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

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

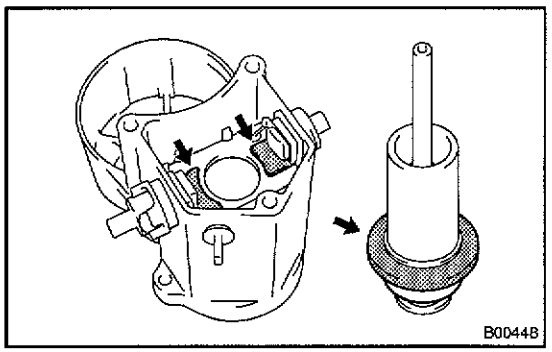
(kPa) = (kgf/cm^2) x 98.1
(kPa) = (psi) x 6.9

- **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.**



(2) Using SST, tighten the nuts to the specified torque.
SST 09810–38140
Torque: 17 N·m (173 kgf·cm, 13 ft·lbf)

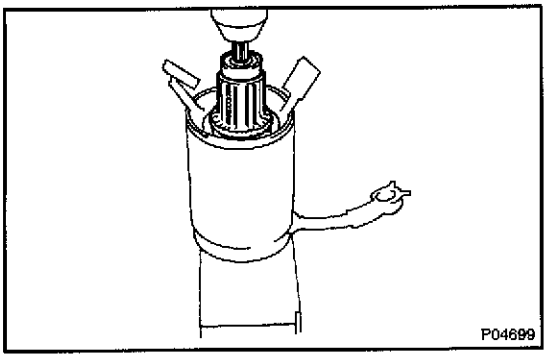
NOTICE:
If the nut is over tightened, it may cause cracks on the inside of the insulator.



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

(i) Reinstall the plunger, a new gasket, the end cover and lead clamp with the 3 bolts.
Torque: 3.6 N·m (37 kgf·cm, 32 in.·lbf)

ST02D-01



REASSEMBLY

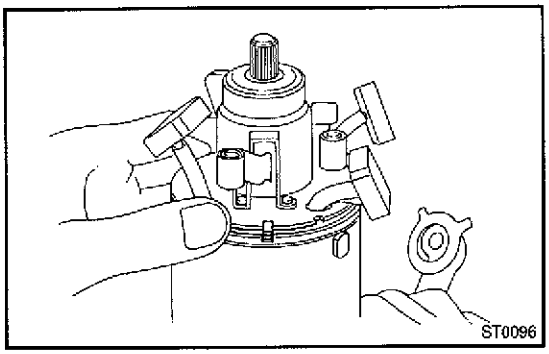
HINT:

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

1. PLACE ARMATURE INTO FIELD FRAME

(a) Apply grease to the armature bearings.

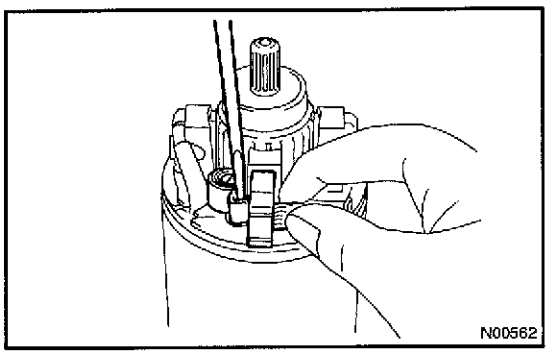
(b) Using a press, press in armature.



2. INSTALL BRUSH HOLDER

(a) Align the claw of the brush holder with the claw groove of the field frame.

(b) Place the brush holder on the field frame.

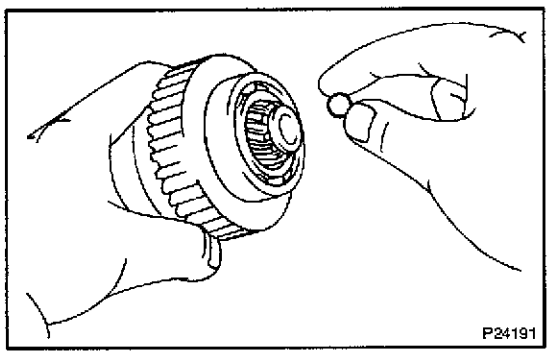


(c) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the 4 brushes.

NOTICE:

Check that the positive (+) lead wires are not grounded.

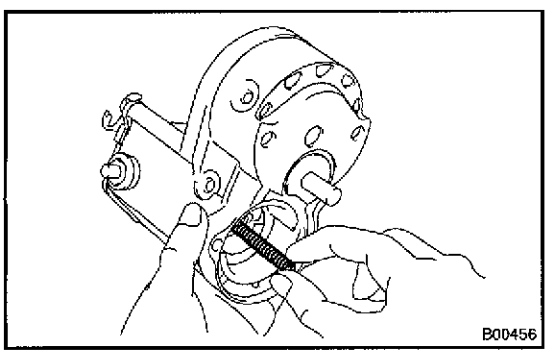
(d) Install a new O–ring to the groove of the field frame.



3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

(a) Apply grease to the steel ball.

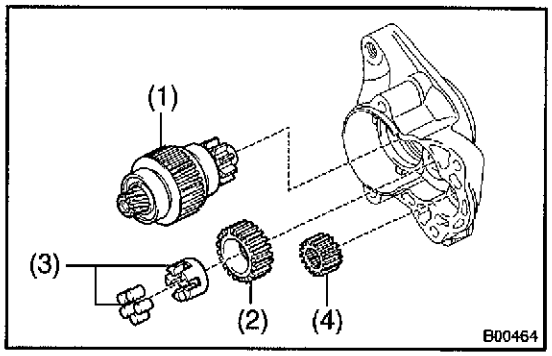
(b) Insert the steel ball into the clutch shaft hole.



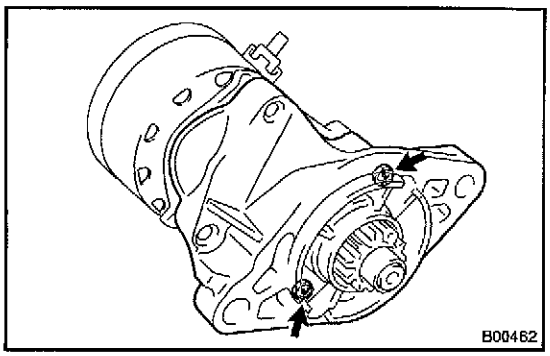
4. INSTALL STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS

(a) Apply grease to the return spring.

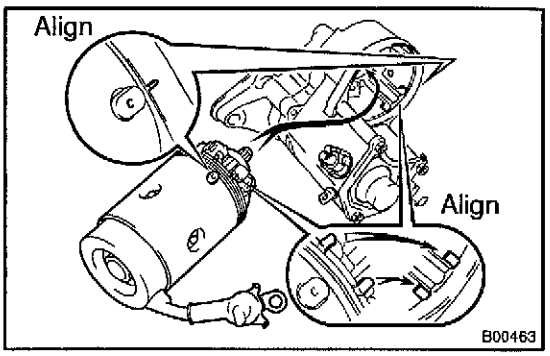
(b) Insert the return spring into the magnetic switch hole.



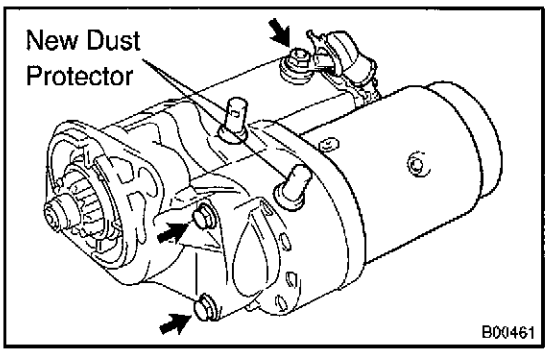
(c) Place these parts on the starter housing:
(1) Starter clutch assembly
(2) Idler gear
(3) Bearing
(4) Pinion gear



(d) Install the starter housing to the magnetic switch with the 2 screws.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY
(a) Install a new O–ring to the groove of the filed frame.
(b) Align the claws of the brush holder with the grooves of the magnetic switch, and install the field frame and armature shaft assembly.
(c) Align the punch mark of the field frame with the line of the magnet switch.



(d) Install a new O–ring to the through bolt.
(e) Install the field frame and armature assembly with the 2 through bolts.
Torque: 12.7 N·m (130 kgf·cm, 9 ft·lbf)
(f) Connect the lead wire to terminal C, and install the nut.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)

6. INSTALL DUST PROTECTORS
Install 2 new dust protectors.

7. INSTALL LEAD WIRE
Install the lead wire with the screw.
Torque: 3.6 N·m (37 kgf·cm, 32 in.·lbf)

ST02E-01

TEST

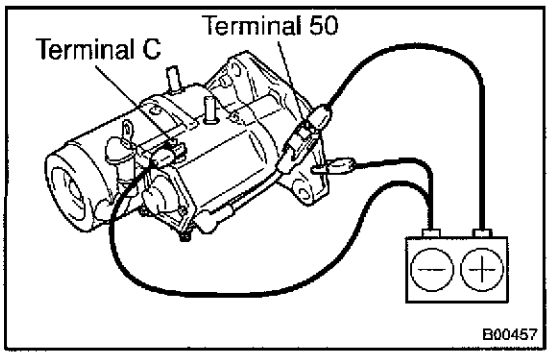
NOTICE:

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

1. PERFORM PULL–IN TEST

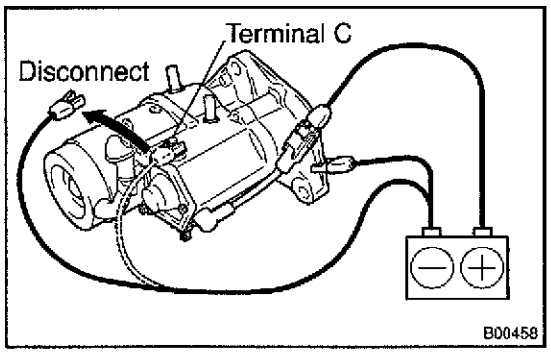
(a) Disconnect the field coil lead wire from terminal C.

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



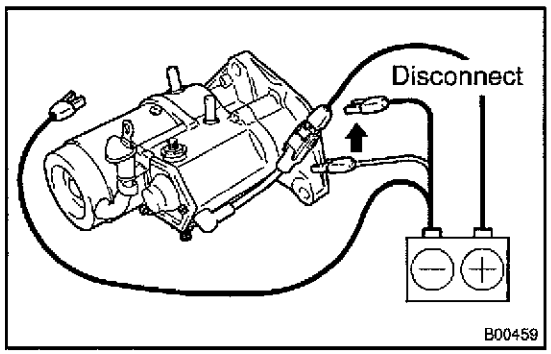
2. PERFORM HOLD–IN TEST

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: 120 A or less at 11.5 V

