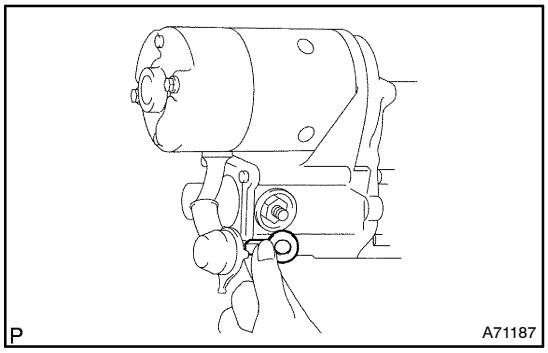
190LO–01

OVERHAUL

1. REMOVE DUST STARTER PROTECTOR

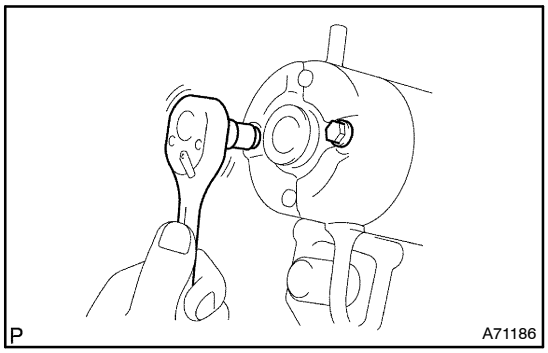
2. REMOVE STARTER LEAD WIRE

(a) Remove the screw and lead wire.



3. REMOVE STARTER YOKE ASSY

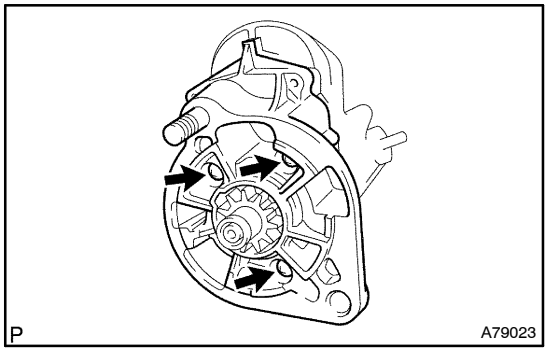
(a) Remove the nut and disconnect the lead wire from the magnetic switch terminal.



(b) Remove the 2 through bolts.

(c) Pull out the starter yoke together with the armature.

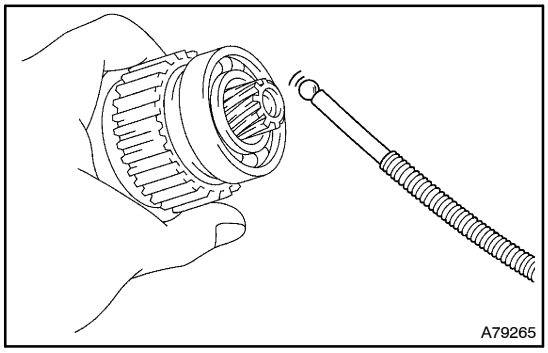
(d) Remove the felt seal and lock plate.



4. REMOVE STARTER CLUTCH SUB–ASSY

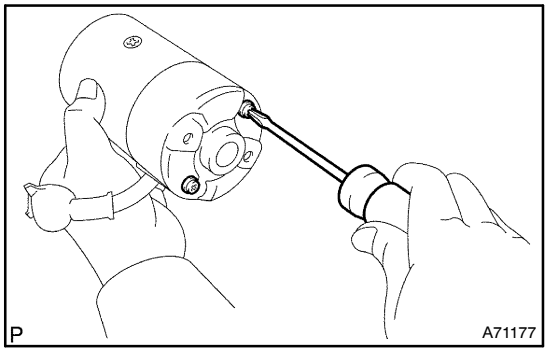
(a) Remove the 3 screws.

(b) Remove the starter housing, clutch sub–assy, return spring, idle gear, bearing and plate washer from the magnetic switch.



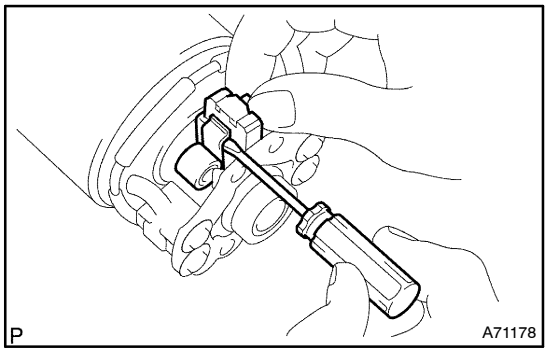
5. REMOVE STEEL BALL

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



6. REMOVE STARTER BRUSH HOLDER ASSY

(a) Remove the 2 screws and end cover from the starter yoke.



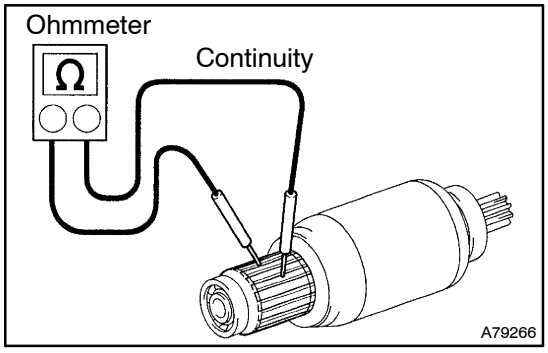
(b) Using a screwdriver, hold the spring back and disconnect the brushes from the brush holder.

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

7. REMOVE STARTER ARMATURE ASSY

8. INSPECT STARTER ARMATURE ASSY (ARMATURE COIL)

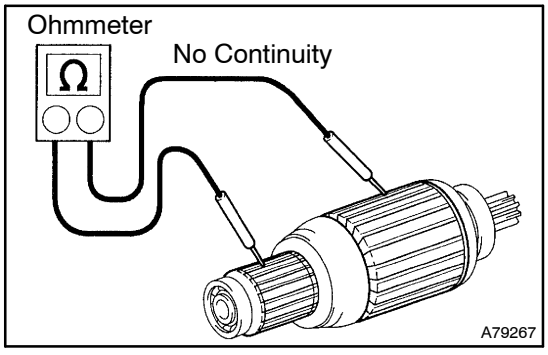
If the surface of the commutator is dirty or burned, polish the part with sandpaper (#400).



(a) Check the commutator open circuit.

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

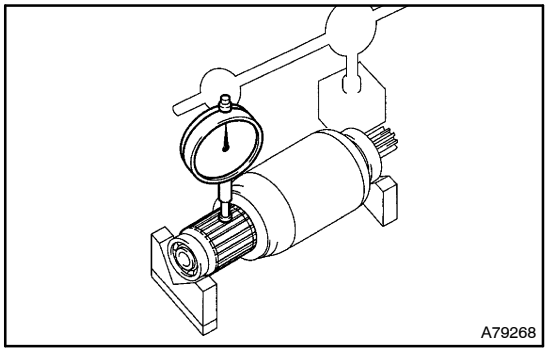
If there is no continuity between any segments, replace the armature assy.



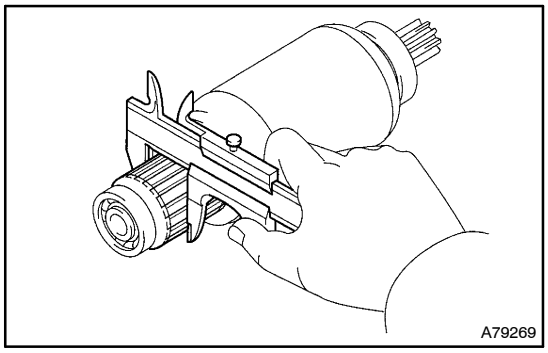
(b) Check the commutator ground.

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

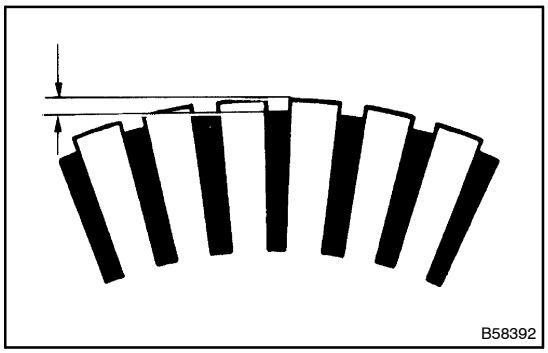
If there is continuity, replace the armature assy.



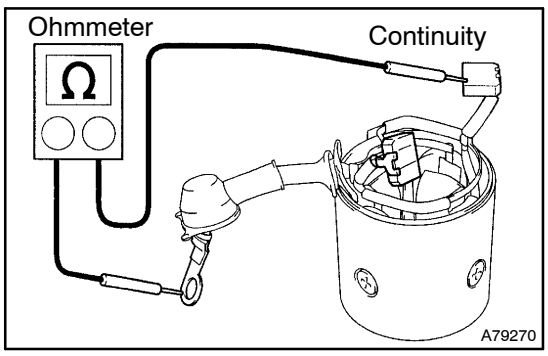
(c) Check the commutator circle runout.
Maximum circle runout: 0.05 mm (0.0020 in.)
If the circle runout is greater than the maximum, correct it using a lathe.



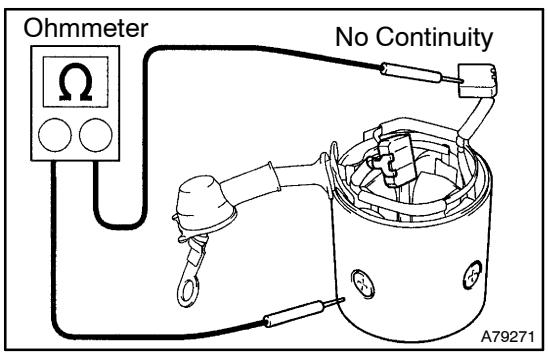
(d) Check the commutator diameter.
(1) Using vernier calipers, measure the commutator diameter.
Standard diameter: 36.0 mm (1.42 in.)
Minimum diameter: 35.0 mm (1.38 in.)
If the diameter is less than the minimum, replace the armature assy.



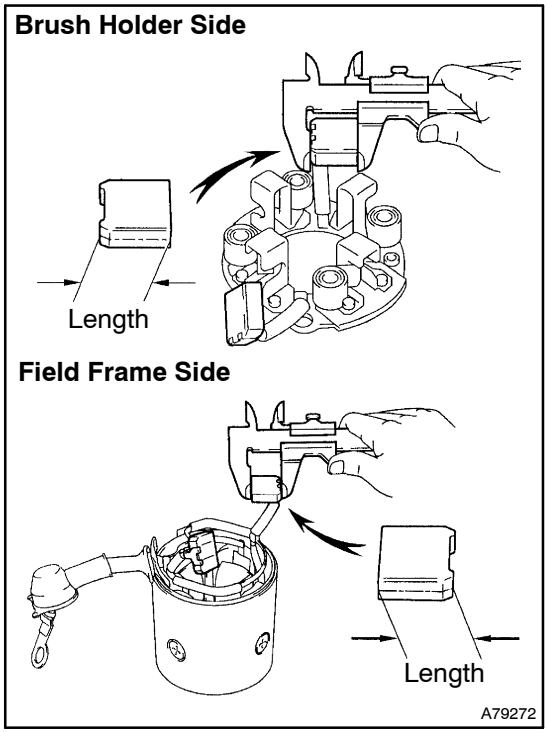
(e) Measure the undercut depth of the commutator.
Standard undercut depth: 0.7 mm (0.028 in.)
Minimum undercut depth: 0.2 mm (0.008 in.)
If the undercut depth is less than the minimum, correct it with a hacksaw blade.



9. INSPECT STARTER YOKE ASSY (FIELD COIL)
(a) Inspect for open circuit.
(1) Using an ohmmeter, check that there is continuity between the lead wire and brush.
If there is no continuity, replace the starter yoke assy.



(b) Inspect for ground.
(1) Using an ohmmeter, check that there is no continuity between the brush and starter yoke body.
If there is continuity, repair or replace the starter yoke assy.



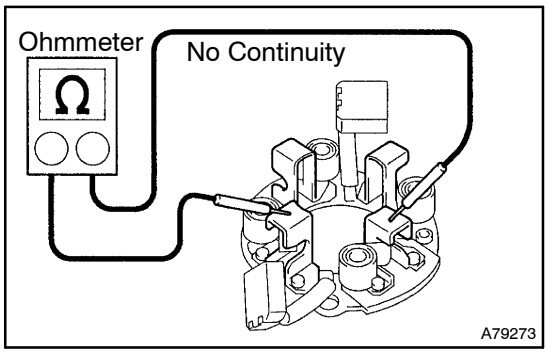
10. INSPECT BRUSH

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

Standard length: 20.5 mm (0.807 in.)

Minimum length: 11.0 mm (0.433 in.)

If the length is less than the minimum, replace the brush holder assy and starter yoke assy.

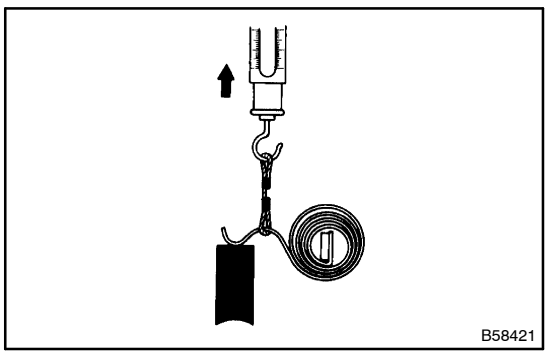


11. INSPECT STARTER BRUSH HOLDER ASSY

(a) Inspect the brush holder insulation.

(1) 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.



(b) Inspect the brush spring load.

(1) Take the pull scale reading the instant the brush spring separates from the brush.

Standard installed load:

34.3 – 42.1 N (3.5 – 4.3 kgf, 7.9 – 9.6 lbf)

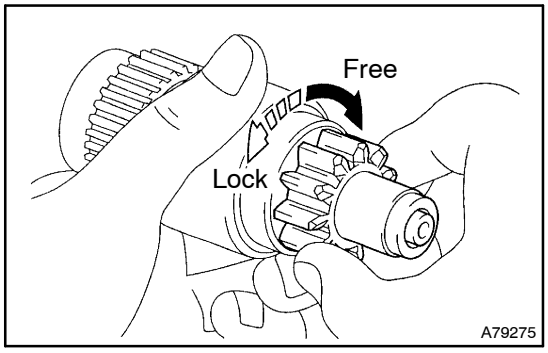
Minimum installed load: 18.6 N (1.9 kgf, 4.2 lbf)

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

12. INSPECT GEAR

(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 sub–assy and also check the flywheel ring gear for wear or damage.

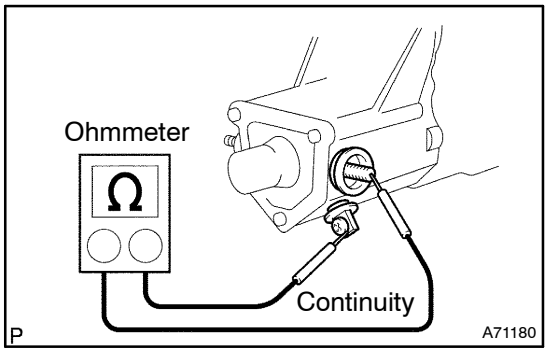


13. INSPECT STARTER CLUTCH SUB–ASSY

(a) With the clutch fixed, turn only the inner sleeve right and left.

(b) Check that the inner sleeve lightly turns in the arrow mark direction but does not turn in the opposite direction.

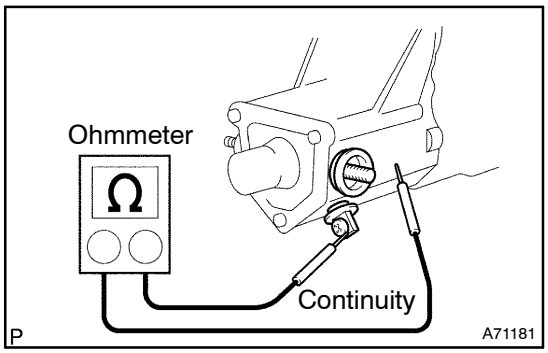
If the starter clutch does not operate, replace a new one.



14. INSPECT MAGNET STARTER SWITCH ASSY

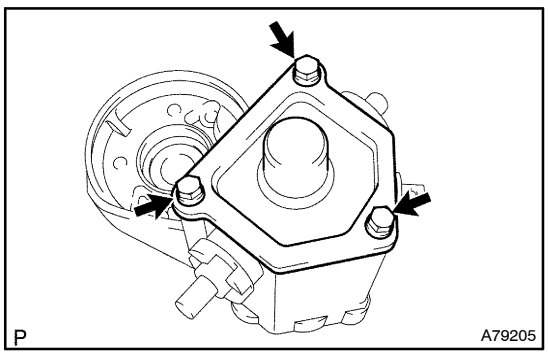
(a) Check the pull–in coil open circuit.

(1) Using an ohmmeter, check that there is continuity between terminals M and C.



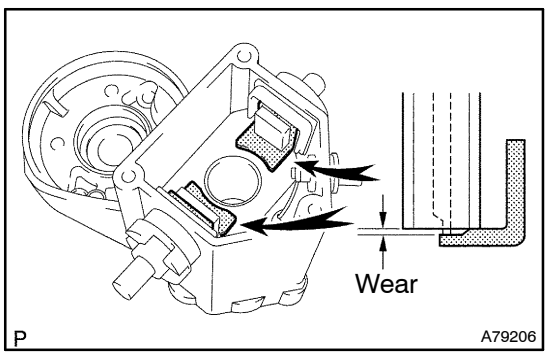
(b) Check the hold–in coil open circuit.

(1) Using an ohmmeter, check that there is continuity between terminal M and the switch body.



15. REPLACE STARTER TERMINAL KIT

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

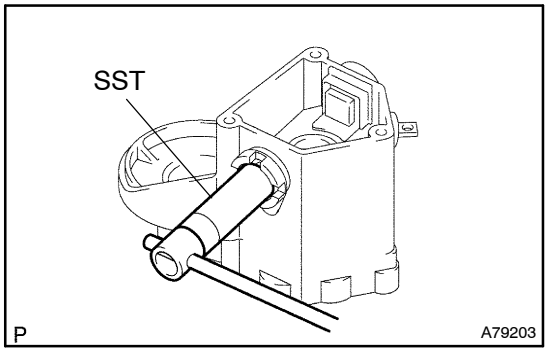


(b) Inspect the contact plate for wear.

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.



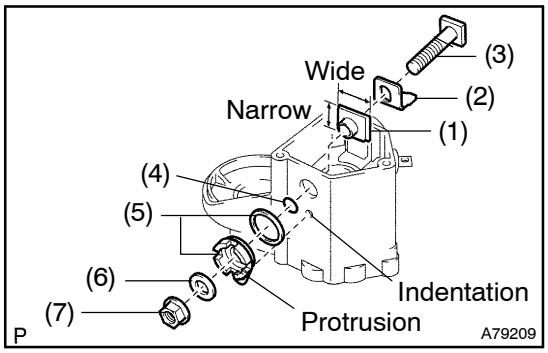
(c) Using SST, loosen the terminal nuts.
SST 09810–38170

(d) Remove the terminal C kit.
(1) Remove the terminal nut, wave washer, terminal insulator (outside), terminal bolt, contact plate and terminal insulator (inside).

(e) Remove the terminal 30 kit.
(1) Remove the terminal nut, plate washer, terminal insulator (outside), packing, O–ring, terminal bolt, contact plate and terminal insulator (inside).

(f) Remove the insulation washer.

(g) Install the insulation washer.



(h) Temporarily install new a terminal 30 kit.
(1) Install a new terminal insulator (inside).

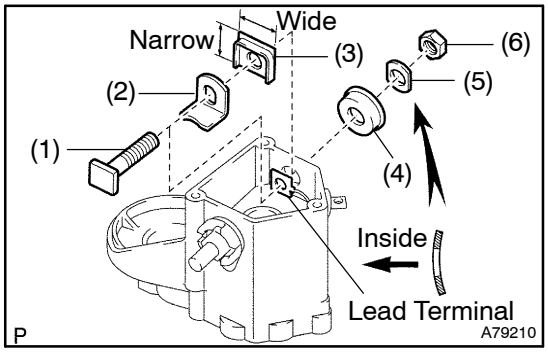
NOTICE:

Be sure to install the terminal insulator in the correct direction.

(2) Install a new contact plate.
(3) Install a new terminal bolt.
(4) Install a new O–ring.
(5) Install a new 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.

(6) Install a new plate washer.
(7) Install a new terminal nut.



(i) Temporarily install new a terminal C kit.
(1) Install a new terminal insulator (inside).

NOTICE:

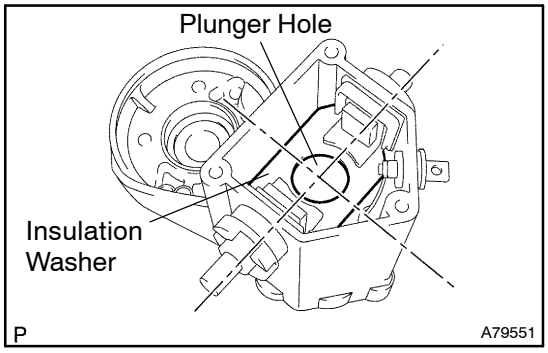
Be sure to install the terminal insulator (inside) in the correct direction.

(2) Install a new contact plate.
(3) Install a new terminal bolt.
(4) Install a new terminal insulator (outside).
(5) Install a new wave washer.

NOTICE:

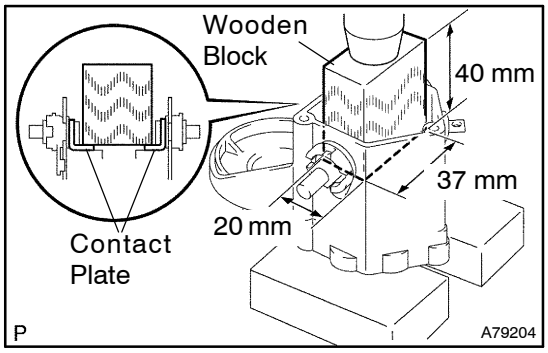
Be sure to install the wave washer in the correct direction.

(6) Install a new terminal nut.



(j) Align the plunger holes of the insulation washer and magnetic switch housing.

(k) Temporarily tighten the terminal nuts.



(l) Tighten the terminal nut.

(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:

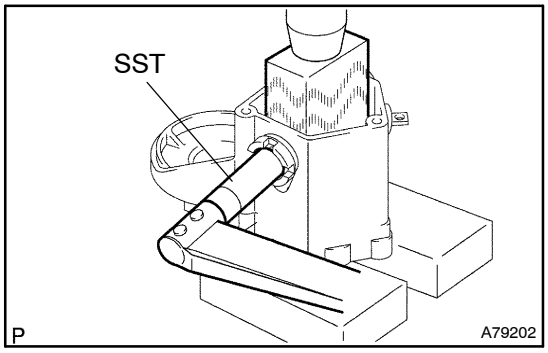
$$(\text{kgf/cm}^2) = \frac{100\ \text{kgf}}{\left(\frac{\text{Ram diameter (cm)}}{2}\right)^2 \times 3.14\ (\pi)}$$

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

$$(\text{kPa}) = (\text{kgf/cm}^2) \times 98.1$$

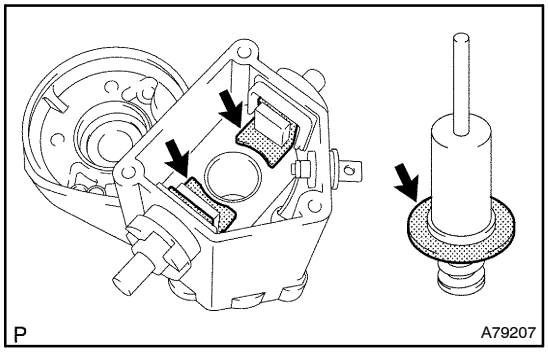
$$(\text{kPa}) = (\text{psi}) \times 6.9$$

- **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.**

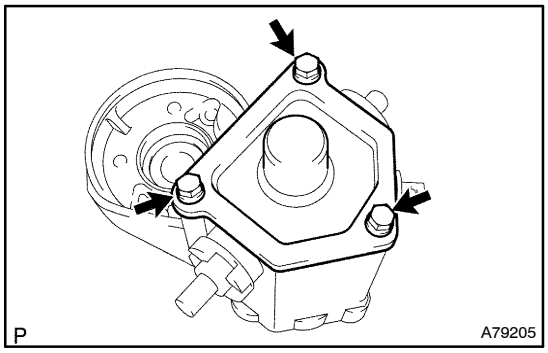


(2) Using SST, tighten the nuts to the specified torque.
SST 09810–38170
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

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



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

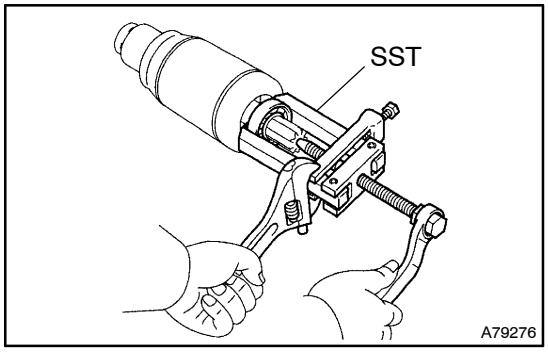


(n) Install the plunger, a new gasket and the end cover with the 3 bolts.
Torque: 3.6 N·m (37 kgf·cm, 32 in.·lbf)

16. INSPECT STARTER ARMATURE BEARING

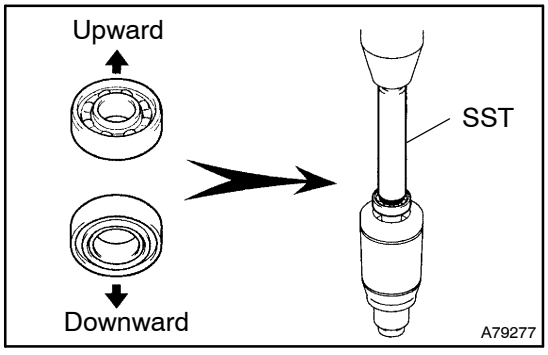
(a) Check the starter armature bearings smoothly rotate.

If the bearings are rough or worn, replace the bearings (No. 1: See step 17) (No. 2: See step 18).



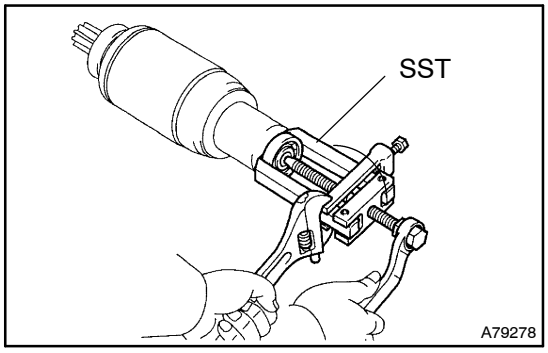
17. REPLACE STARTER ARMATURE BEARING NO. 1

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



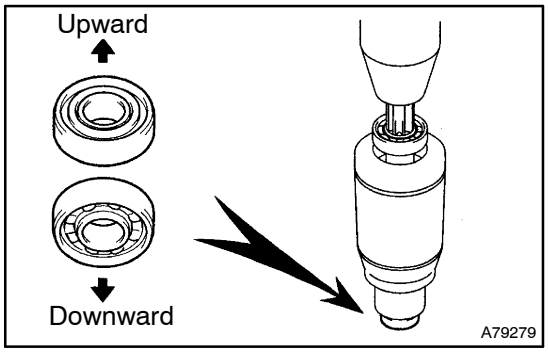
(b) Using SST and a press, press in a new bearing.
SST 09285–76010

NOTICE:
Be careful of the bearing installation direction.



18. REPLACE STARTER ARMATURE BEARING NO.2

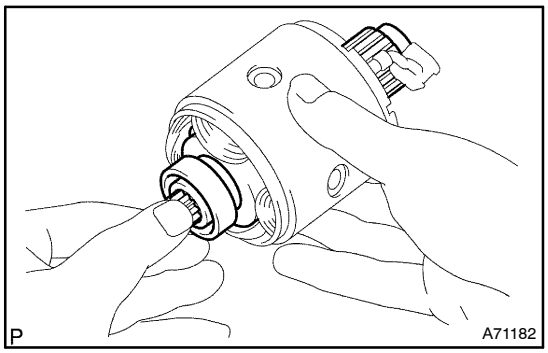
(a) Using SST, remove the bearing.
SST 09286–46011



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

NOTICE:

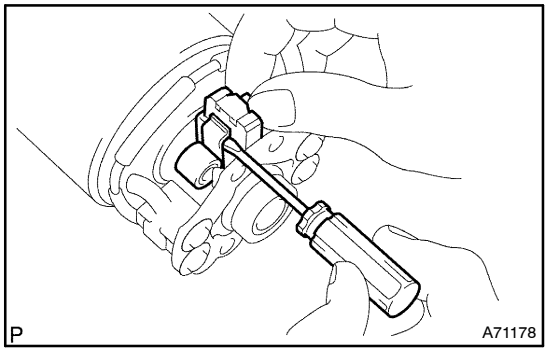
Be careful of the bearing installation direction.



19. INSTALL STARTER ARMATURE ASSY

(a) Apply grease to the armature bearings.

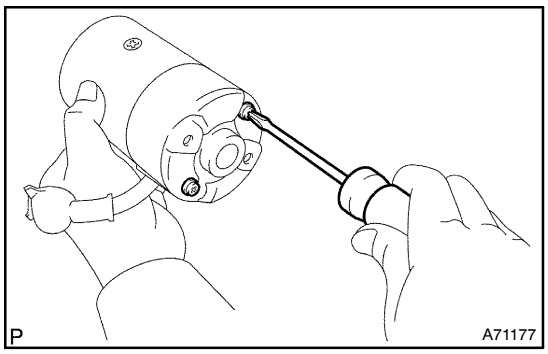
(b) Install the armature to the starter yoke.



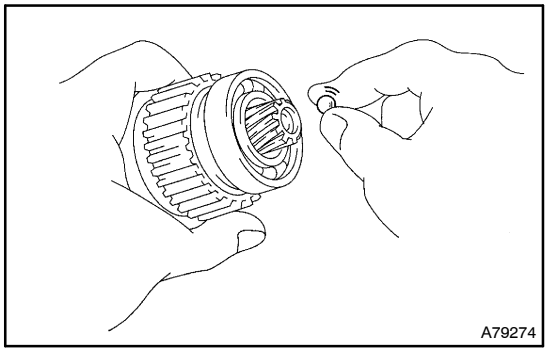
20. INSTALL STARTER BRUSH HOLDER ASSY

(a) Place the brush holder in position on the armature.

(b) Using a screwdriver, hold the brush spring back. Then, install the brush to the brush holder and install the 4 brushes.



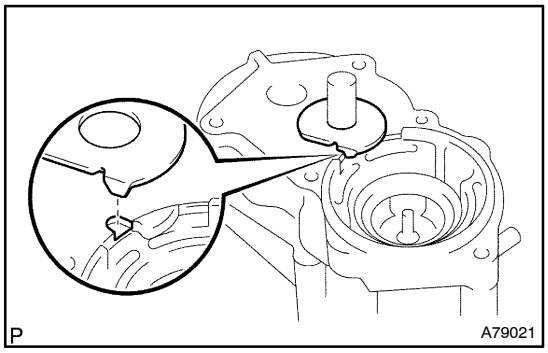
(c) Install the end cover with the 2 screws.
Torque: 3.6 N·m (37 kgf·cm, 32 in.·lbf)



21. INSTALL STEEL BALL

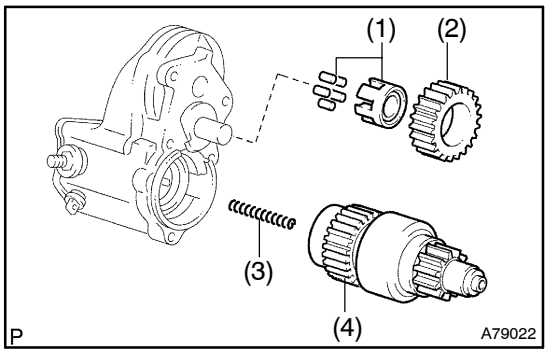
(a) Apply grease to the steel ball.

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

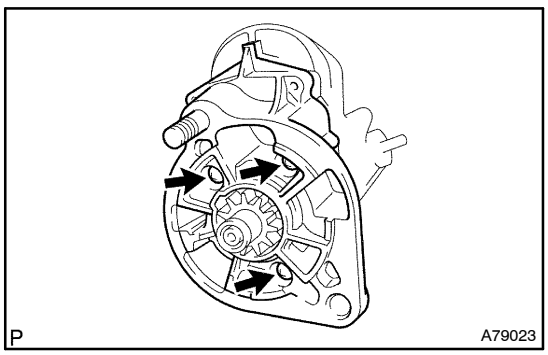


22. INSTALL STARTER CLUTCH SUB–ASSY

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

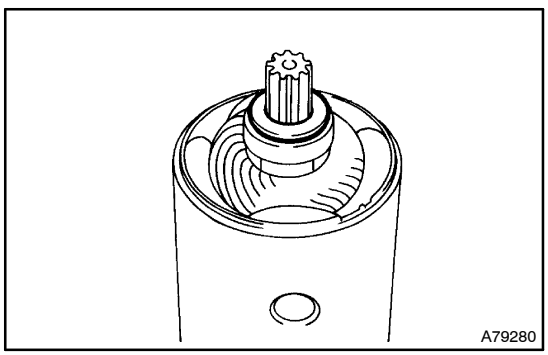


(b) Place the bearing (1), idle gear (2), return spring (3) and clutch sub–assy (4) in position on the starter magnet switch.



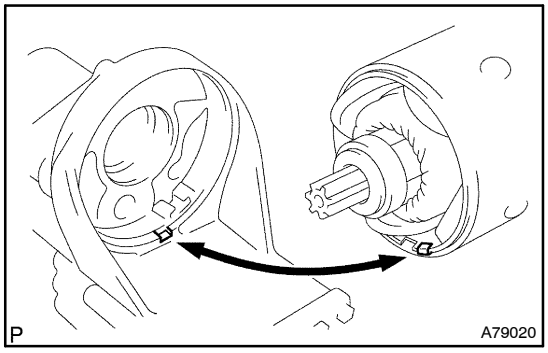
(c) Assemble the starter housing and magnet switch with the 3 screws.

Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)

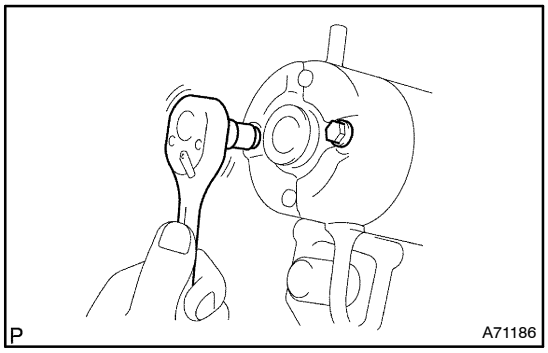


23. INSTALL STARTER YOKE ASSY

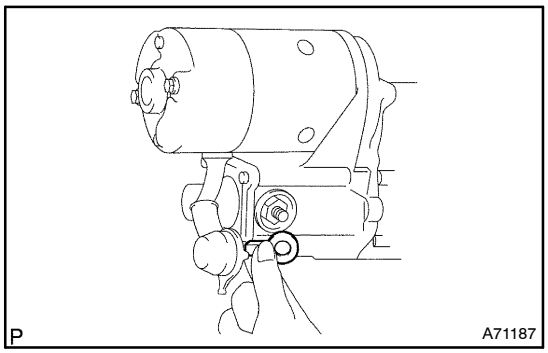
(a) Place the felt seal on the armature shaft.



(b) Align the cutout of the magnet starter switch with the protrusion of the starter yoke.



(c) Install the starter yoke and armature with the 2 throught bolts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



(d) Connect the lead wire to the magnet switch terminal with the nut.
Torque: 24 N·m (245 kgf·cm, 18 ft·lbf)

24. INSTALL STARTER LEAD WIRE

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

25. INSTALL DUST STARTER PROTECTOR