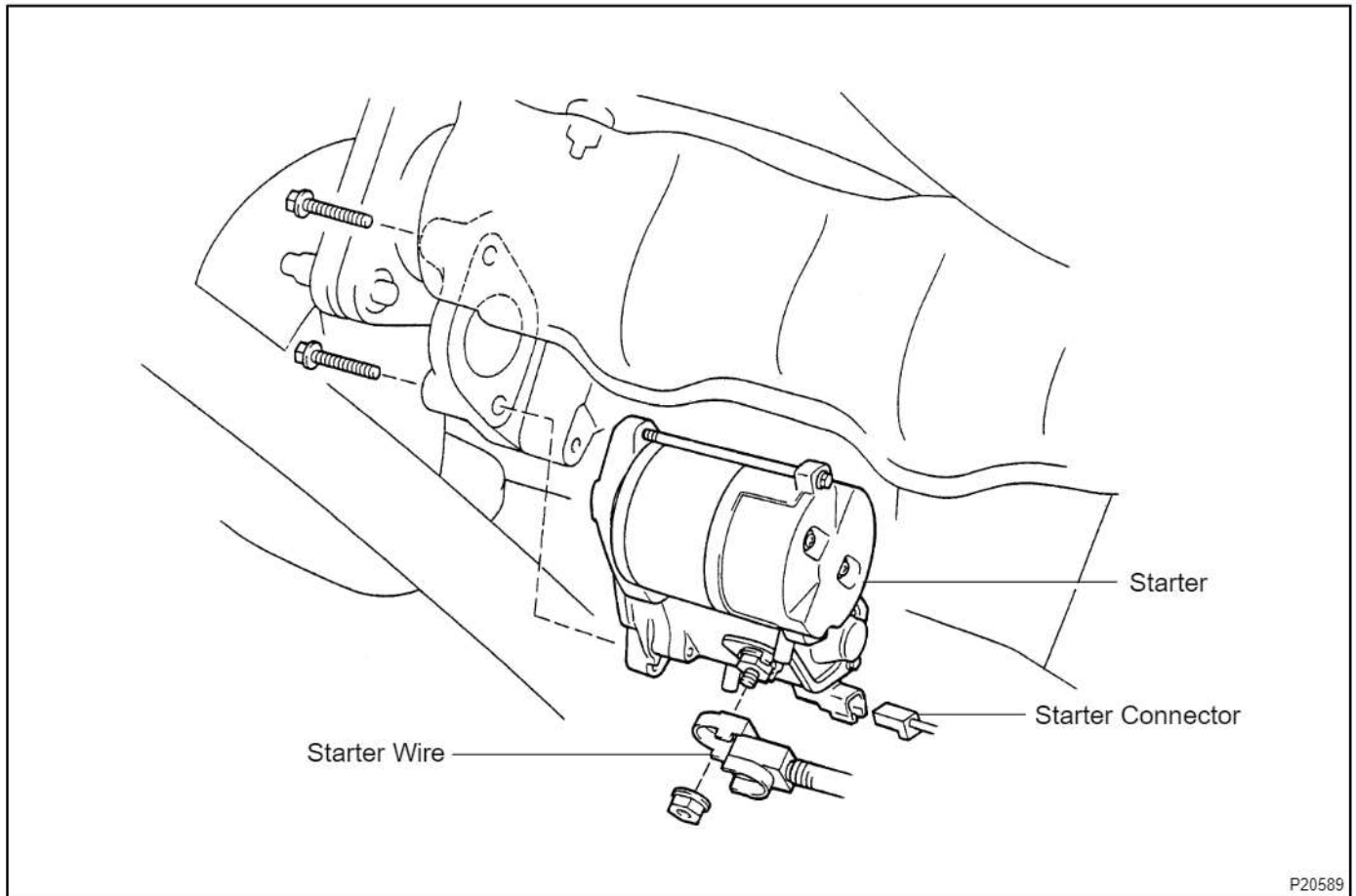
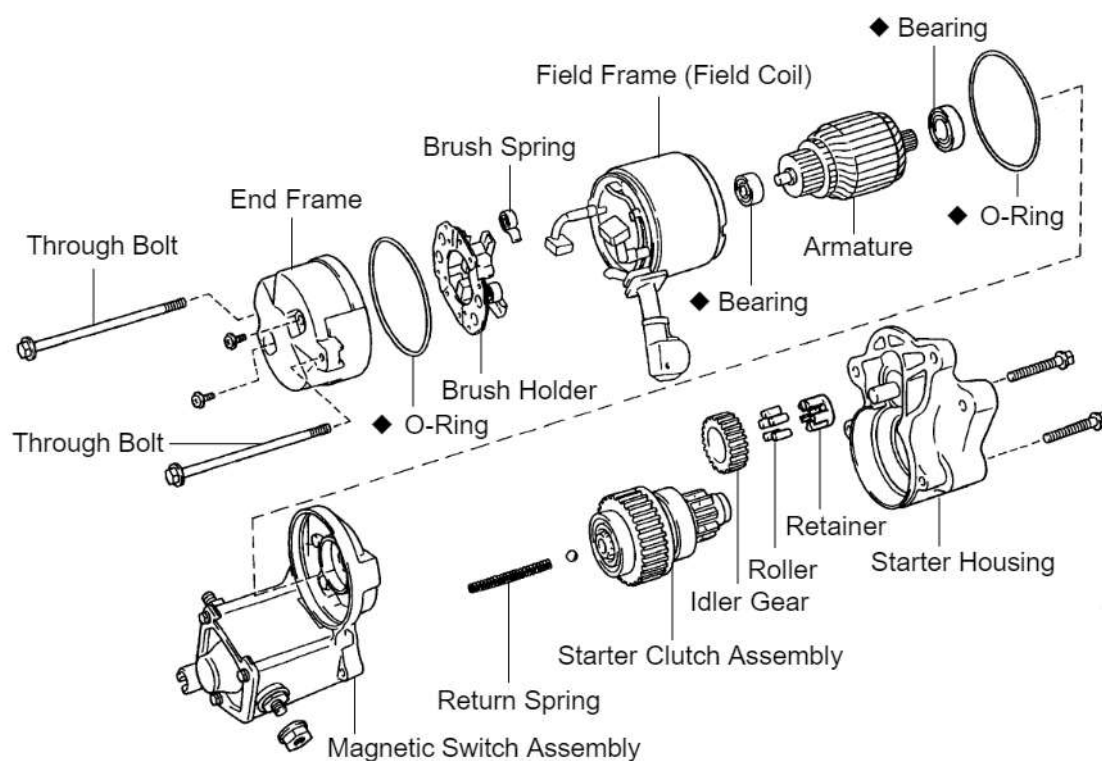


STARTER COMPONENTS

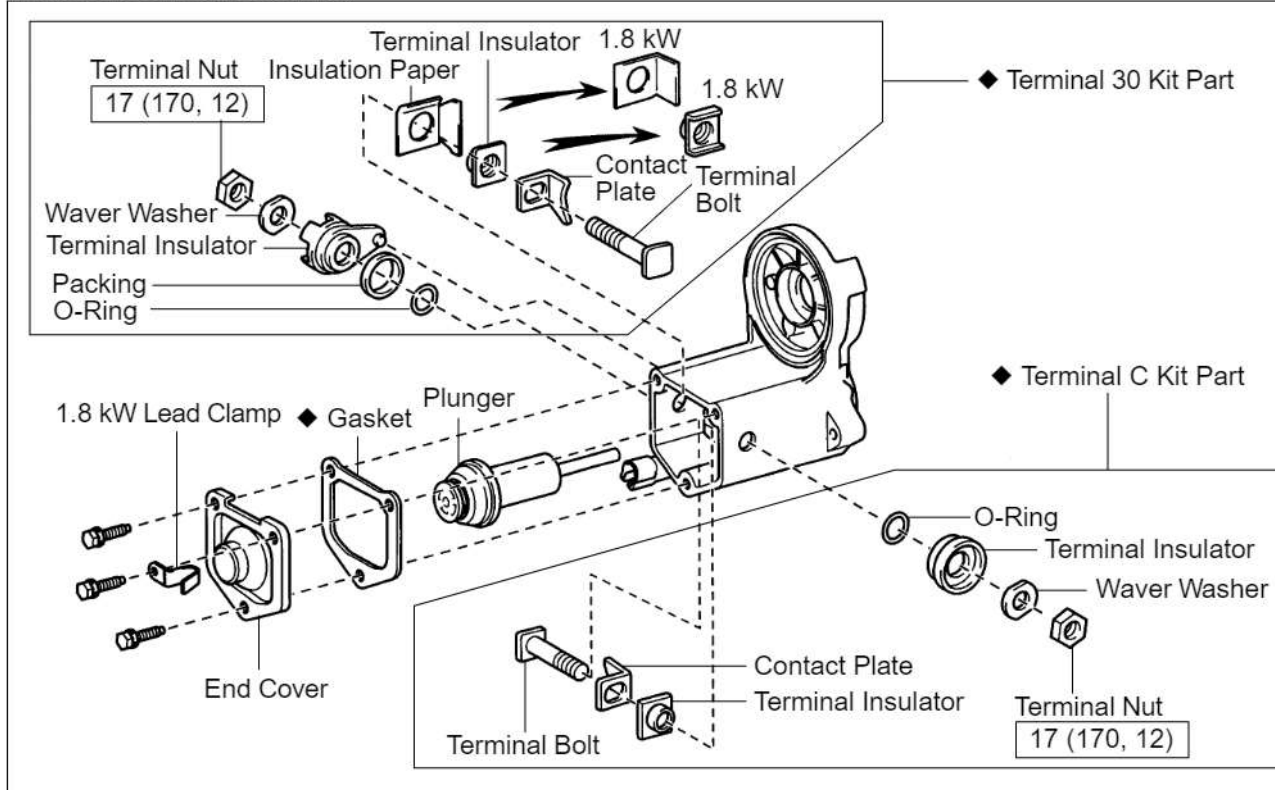
ST00F-02



P20589

**Magnetic Switch Assembly**

S05731

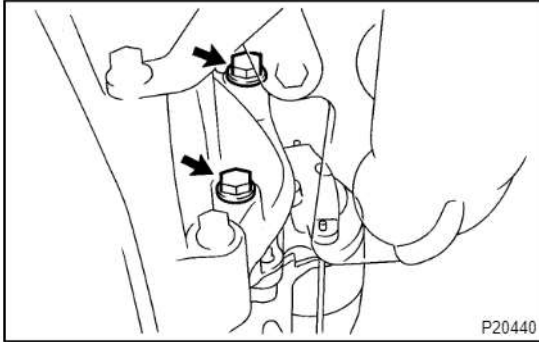


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

S02425

Z19063



REMOVAL

NOTICE:

Before changing the starter, check the following items again:

- Connector connection
- Accessory installation, e.g.: theft deterrent system

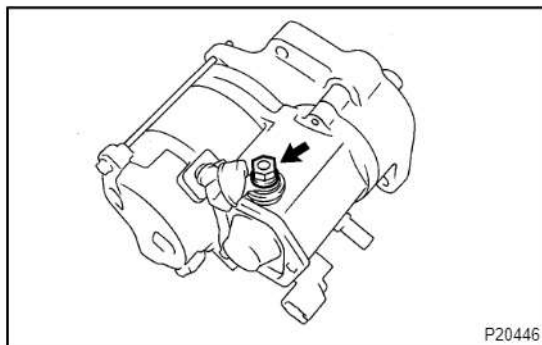
REMOVE STARTER

- (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)



DISASSEMBLY

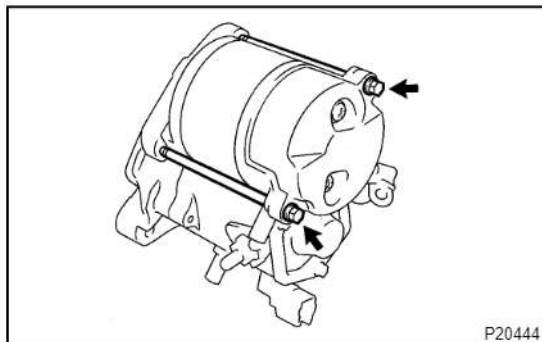
HINT:

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)

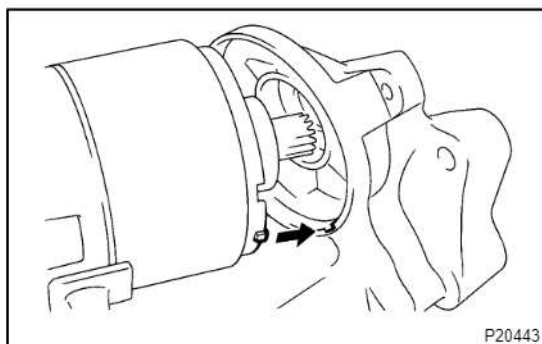


- (b) Remove the 2 through bolts.

Torque:

1.4 kW type: 5.9 N·m (60 kgf·cm, 52 in.·lbf)

1.8 kW type: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



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

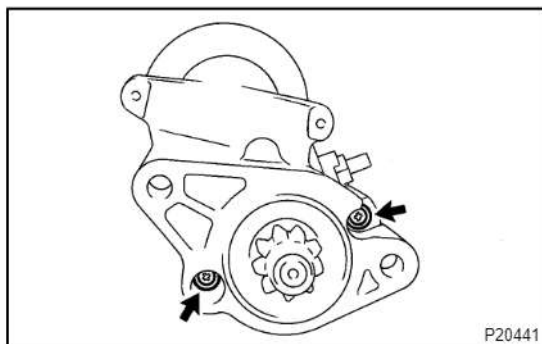
NOTICE:

Align the protrusion of the field frame with cutout of the magnetic switch.

- (d) Remove the O-ring.

HINT:

Use a new O-ring.



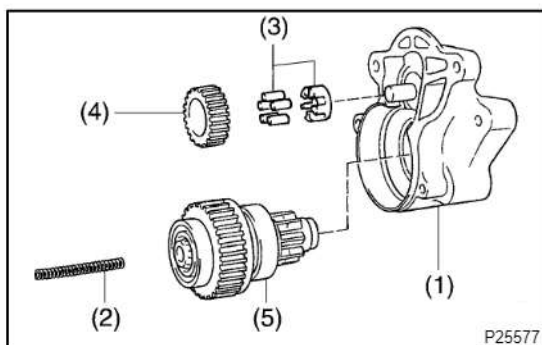
2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

- (a) Remove the 2 screws.

Torque:

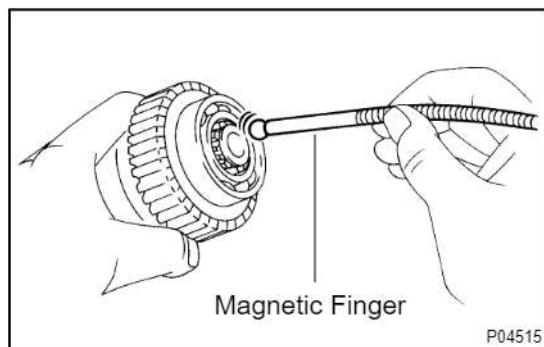
1.4 kW type: 5.9 N·m (60 kgf·cm, 52 in.·lbf)

1.8 kW type: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



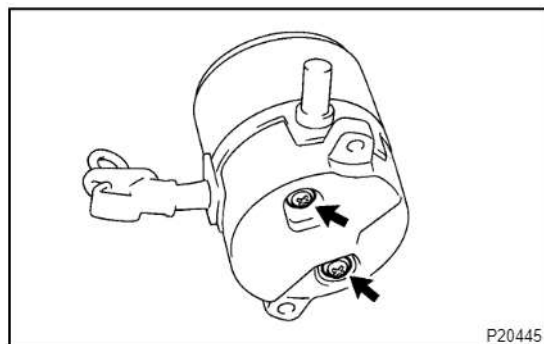
- (b) Remove these parts from the magnetic switch assembly:

- (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.



4. REMOVE BRUSH HOLDER

- (a) Remove the 2 screws and 2 O-rings, and pull the end frame from the field frame.

Torque:

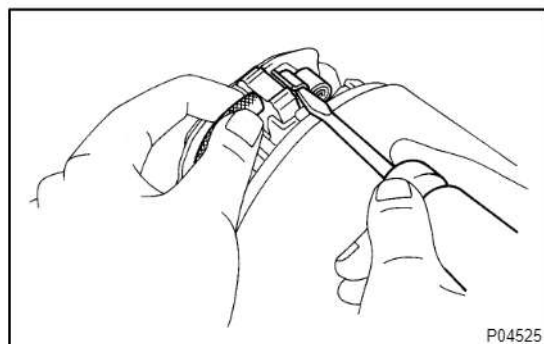
1.4 kW type: 1.5 N·m (15 kgf·cm, 13 in.·lbf)

1.8 kW type: 3.8 N·m (39 kgf·cm, 34 in.·lbf)

- (b) Remove the O-ring from the field frame.

HINT:

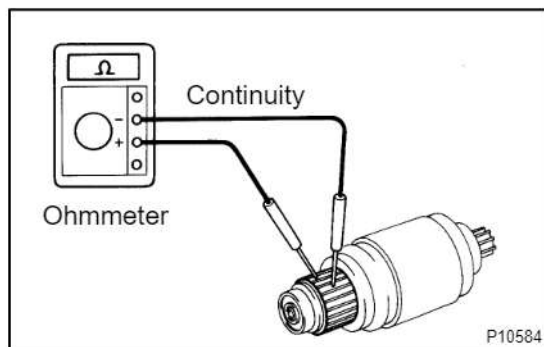
Use a new O-ring.



- (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.

5. REMOVE ARMATURE FROM FIELD FRAME

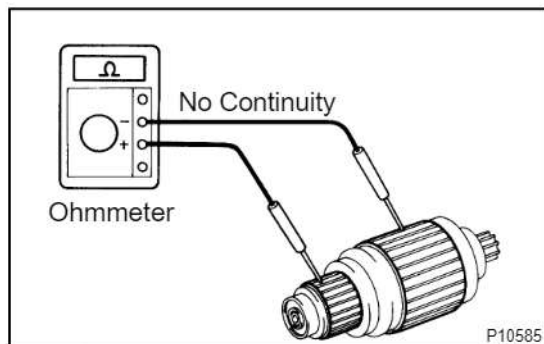


INSPECTION

1. INSPECT ARMATURE COIL 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.



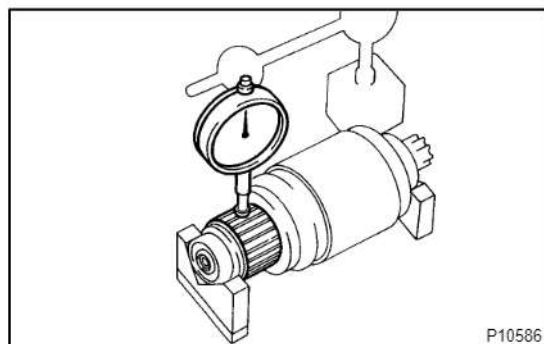
2. INSPECT ARMATURE COIL FOR GROUNDED

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

If there is continuity, replace the armature.

3. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

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



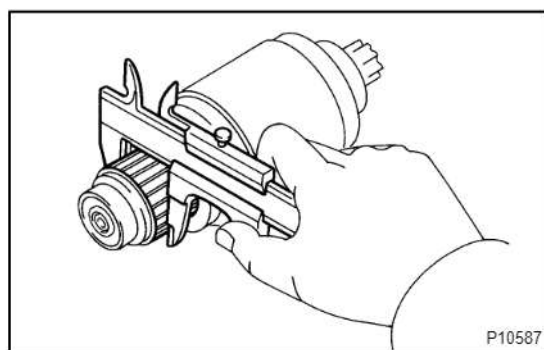
4. INSPECT COMMUTATOR CIRCLE RUNOUT

(a) Place the commutator on V-blocks.

(b) Using a dial indicator, 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.



5. INSPECT COMMUTATOR DIAMETER

Using vernier calipers, measure the commutator diameter.

Standard diameter:

1.4 kW type: 30 mm (1.180 in.)

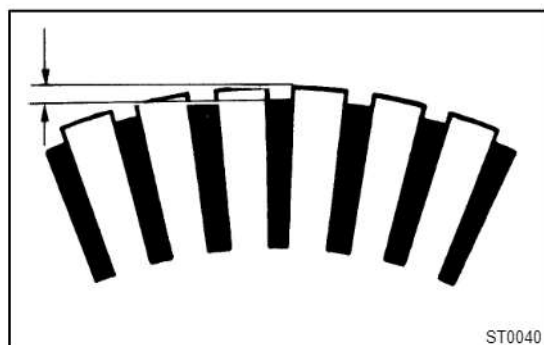
1.8 kW type: 35 mm (1.378 in.)

Minimum diameter:

1.4 kW type: 29 mm (1.140 in.)

1.8 KW type: 34 mm (1.339 in.)

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



6. INSPECT UNDERCUT DEPTH OF SEGMENT

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

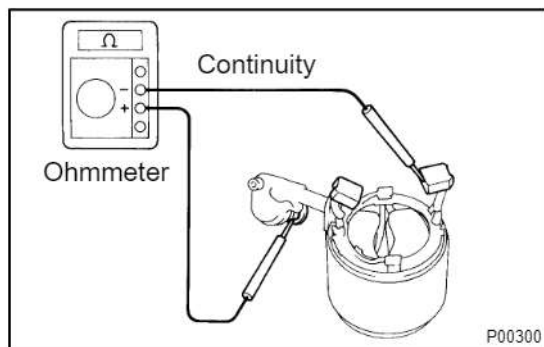
Standard undercut depth:

1.4 kW type: 0.6 mm (0.024 in.)

1.8 kW type: 0.7 mm (0.028 in.)

Minimum undercut depth: 0.2 mm (0.008 in.)

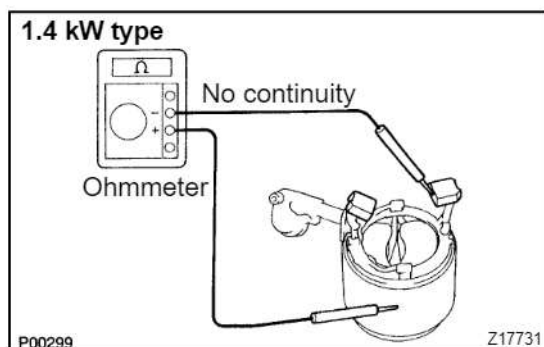
If the undercut depth is less than minimum, correct it with a hacksaw blade.



7. 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.

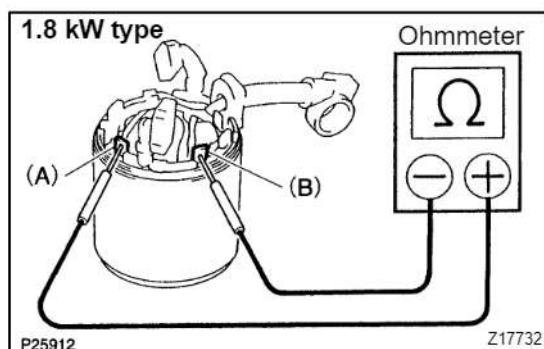


8. (1.4 kW type)

INSPECT THAT FIELD COIL IS NOT GROUNDED

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.



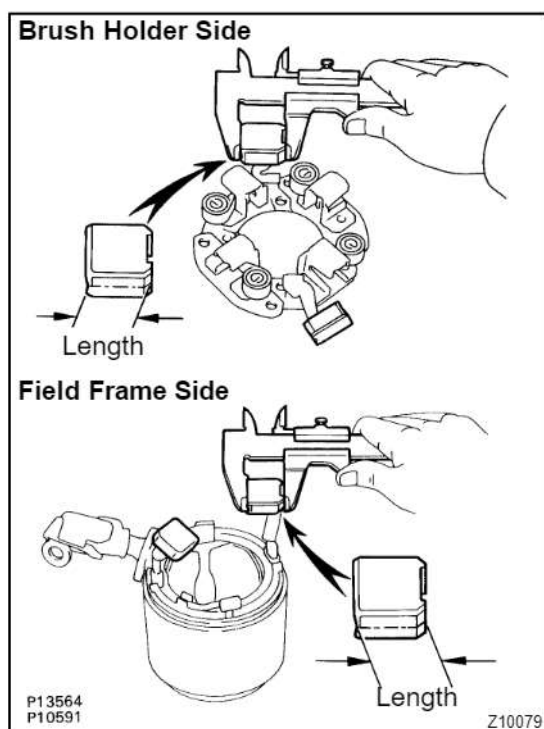
9. (1.8 kW type)

INSPECT SHUNT COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between terminal (A) and (B).

Standard resistance: At 20°C (68°F): 1.4 - 1.9 Ω

If the resistance is not as specified, repair or replace the field frame.



10. INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

Standard length:

1.4 kW type: 15.5 mm (0.610 in.)

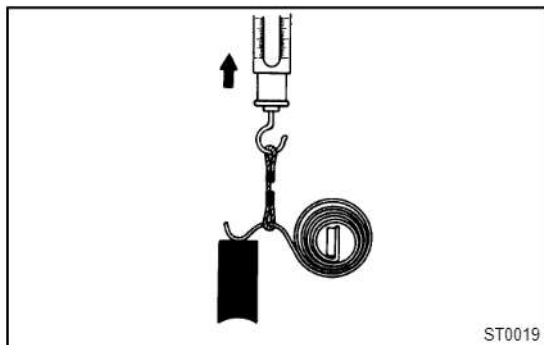
1.8 kW type: 15.0 mm (0.591 in.)

Minimum length:

1.4 kW type: 10.0 mm (0.394 in.)

1.8 kW type: 9.0 mm (0.354 in.)

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



ST0019

11. INSPECT BRUSH SPRING LOAD

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

Standard installed load:

1.4 kW type: 17.6 - 23.5 N (1.80 - 2.40 kgf, 4.0 - 5.3 lbf)

1.8 kW type: 21.5 - 27.5 N (2.20 - 2.80 kgf, 4.9 - 6.2 lbf)

Minimum installed load:

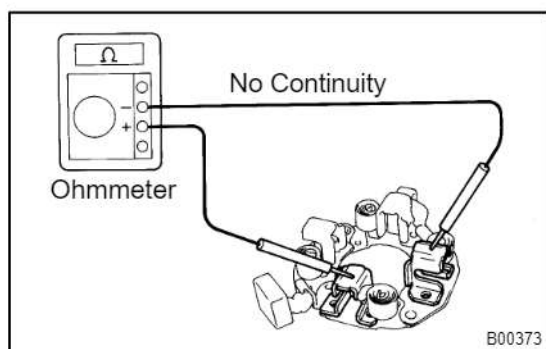
1.4 kW type: 11.8 N (1.20 kgf, 2.6 lbf)

1.8 kW type: 12.7 N (1.30 kgf, 2.7 lbf)

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

HINT:

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

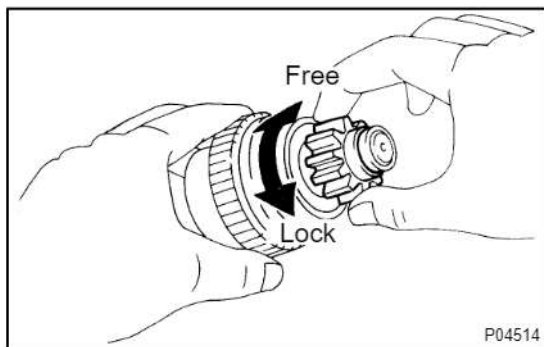


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12. INSPECT INSULATION OF BRUSH HOLDER

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.



P04514

13. INSPECT GEAR TEETH

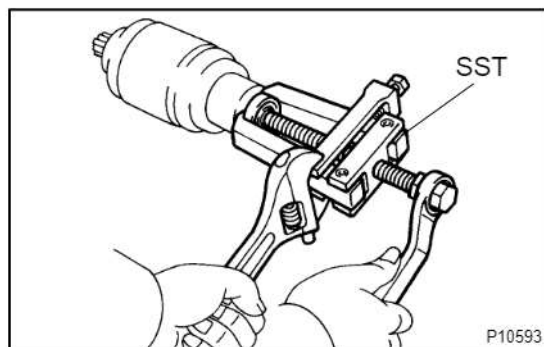
Check the gear teeth on the pinion gear, idler gear and clutch assembly for wear or damage.

If damaged, replace the gear or clutch assembly.

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

14. INSPECT CLUTCH

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.

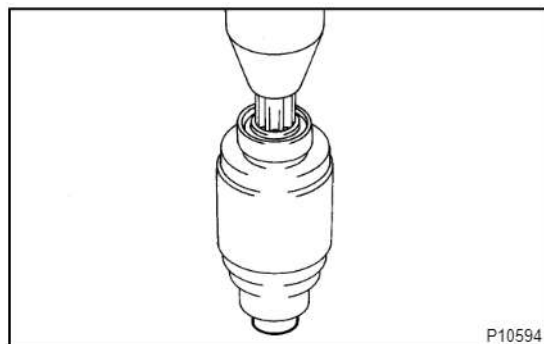
**15. INSPECT FRONT BEARING**

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

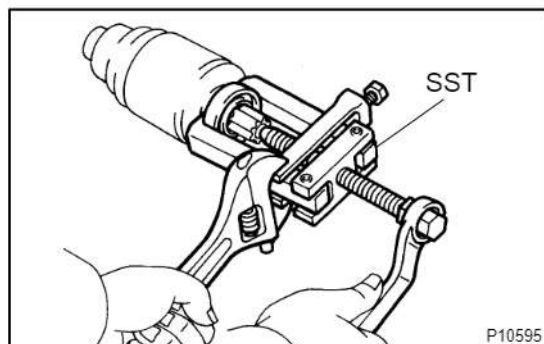
16. IF NECESSARY, REPLACE FRONT BEARING

- (a) Using SST, remove the bearing.

SST 09286-4601 1



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

**17. INSPECT REAR BEARING**

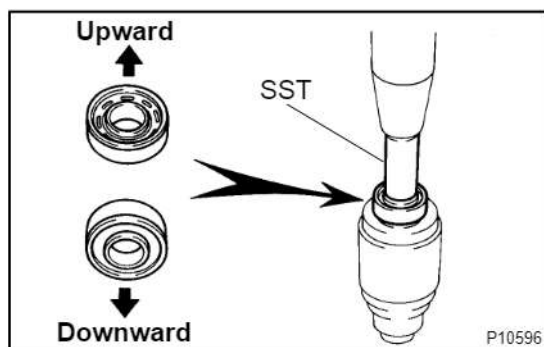
Turn the bearing by hand while applying inward force.

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

18. IF NECESSARY, REPLACE REAR BEARING

- (a) Using SST, remove the bearing.

SST 09286-4601 1

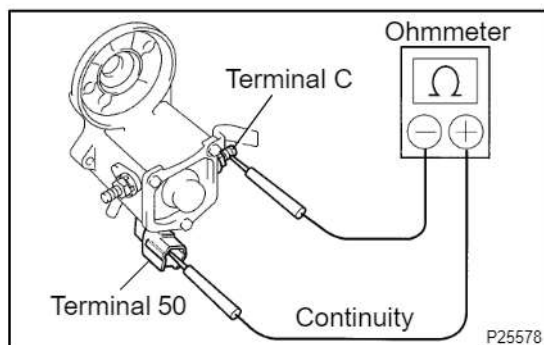


- (b) Using SST and a press, press in a new rear bearing.

NOTICE:

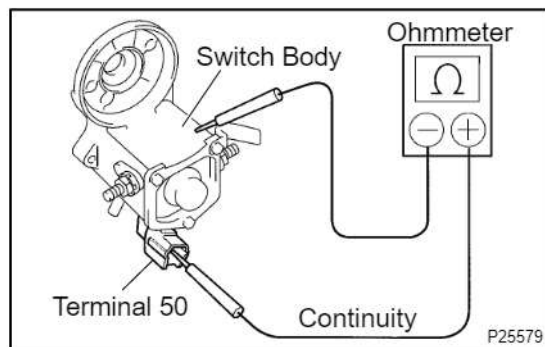
Be careful of the bearing installation direction.

SST 09201-41020

**19. DO PULL-IN COIL OPEN CIRCUIT TEST**

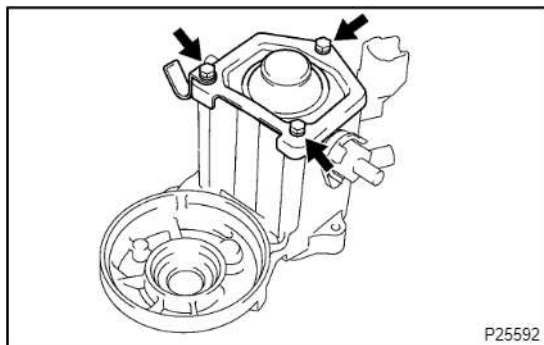
Using an ohmmeter, check that there is continuity between terminals 50 and C.

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

**20. DO HOLD-IN COIL CIRCUIT TEST**

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

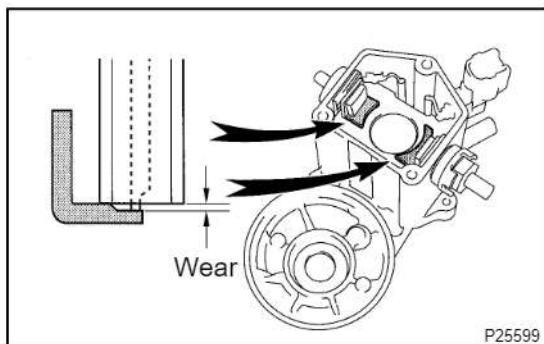
If there is no continuity, check and replace the magnetic switch.



REPLACEMENT

1. REMOVE MAGNETIC SWITCH END COVER

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

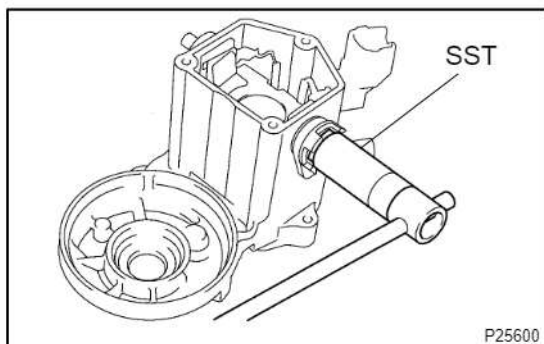


2. INSPECT CONTACT PLATE FOR WEAR

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

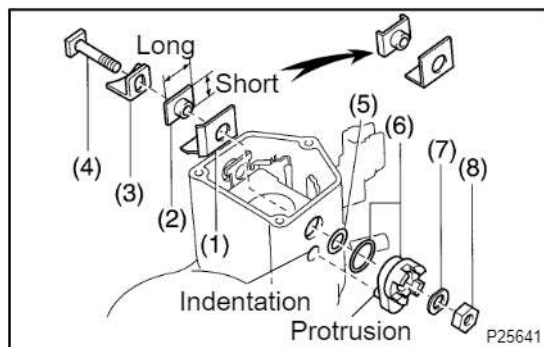
Maximum wear: 0.9 mm (0.035 in.)

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) Terminal 30:

Install these new parts:

- (1) Insulation paper
- (2) Terminal insulator (inside)

NOTICE:

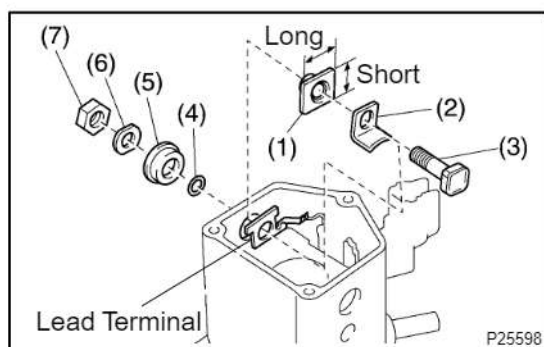
Be careful to install the terminal insulator in the correct direction.

- (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



(b) Terminal C:

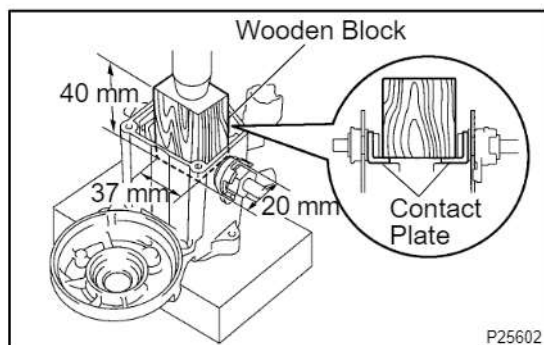
Install these new parts:

- (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) in the correct direction.

- (c) 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.

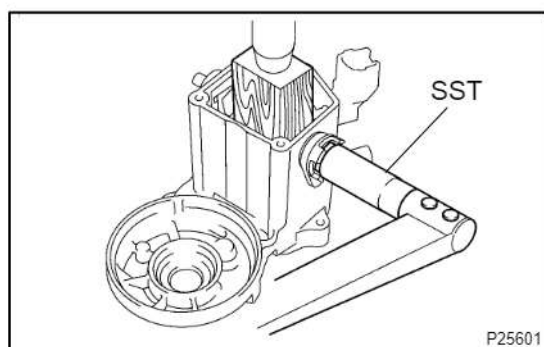
Gauge pressure:

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

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

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

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



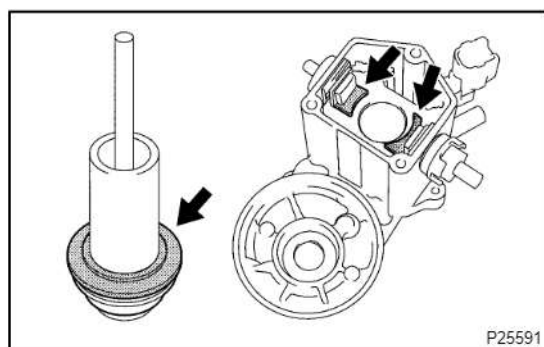
(b) Using SST, tighten the nuts to the specified torque.

SST 09810-38140

Torque: 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.

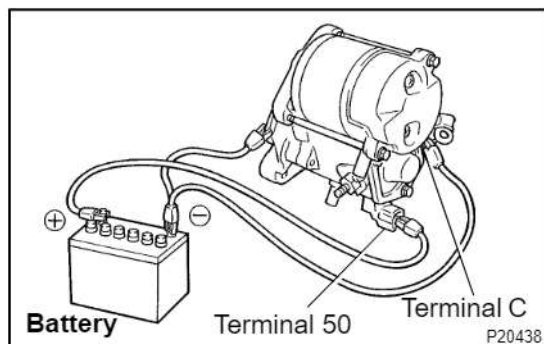
Torque:

1.4 kW type: 2.5 N·m (25 kgf·cm, 22 in·lbf)

1.8 kW type: 3.6 N·m (37 kgf·cm, 32 in·lbf)

REASSEMBLY

Reassembly is in the reverse order of disassembly (See page [ST-4](#)).



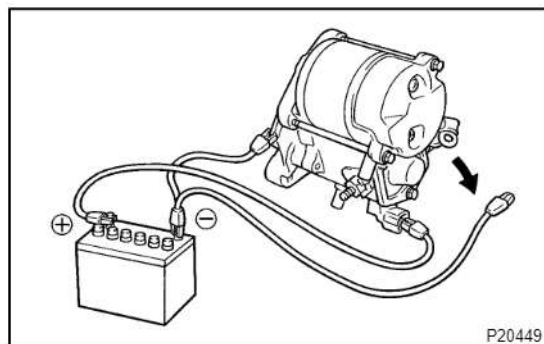
TEST

NOTICE:

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

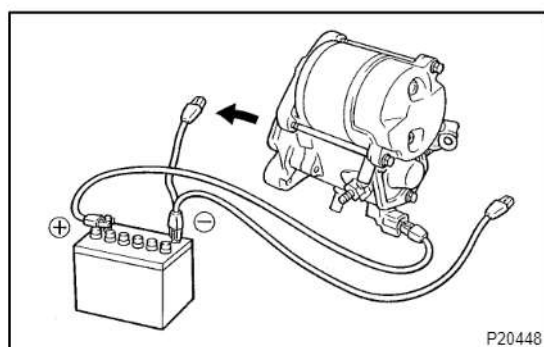
1. DO PULL-IN TEST

- Disconnect the field coil lead wire from terminal C.
- Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.



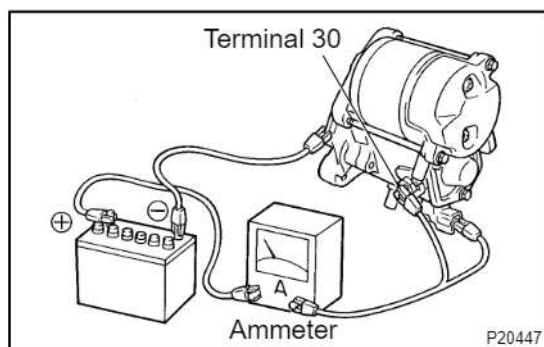
2. DO HOLD-IN TEST

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

- Connect the battery and ammeter to the starter as shown.
- Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter reads the specified current.

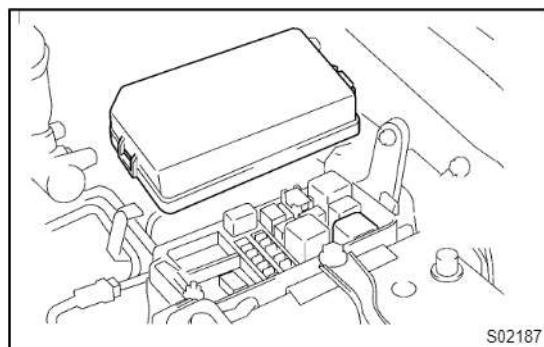
Specified current:

1.4 kW type: At 11.5 V: 90 A or less

1.8 kW type: At 11.5 V: 100 A or less

INSTALLATION

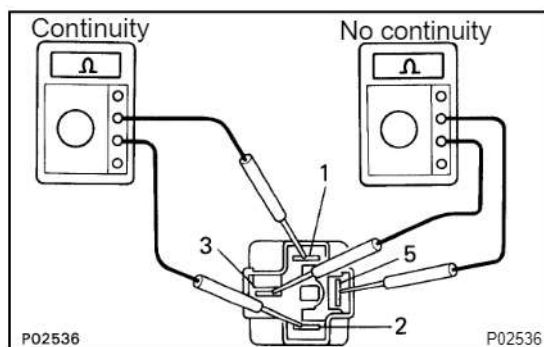
Installation is in the reverse order of removal (See page [ST-3](#)).



STARTER RELAY INSPECTION

ST00N-02

1. REMOVE STARTER RELAY



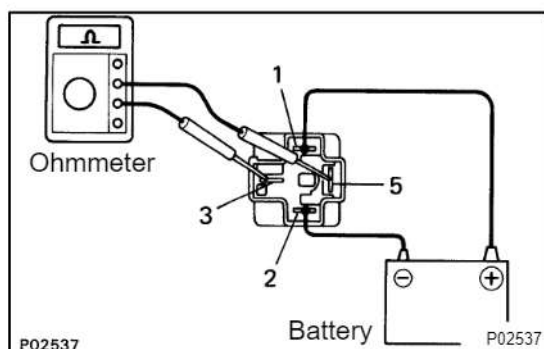
2. INSPECT STARTER RELAY CONTINUITY

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there no continuity, replace the relay.

- (b) Check that there is no continuity between terminals 3 and 5.

If there continuity, replace the relay.



3. INSPECT STARTER RELAY OPERATION

- (a) Apply battery voltage across terminals 1 and 2.

- (b) Check that there is continuity between terminals 3 and 5. If operation is not as described, replace the relay.

4. REINSTALL STARTER RELAY