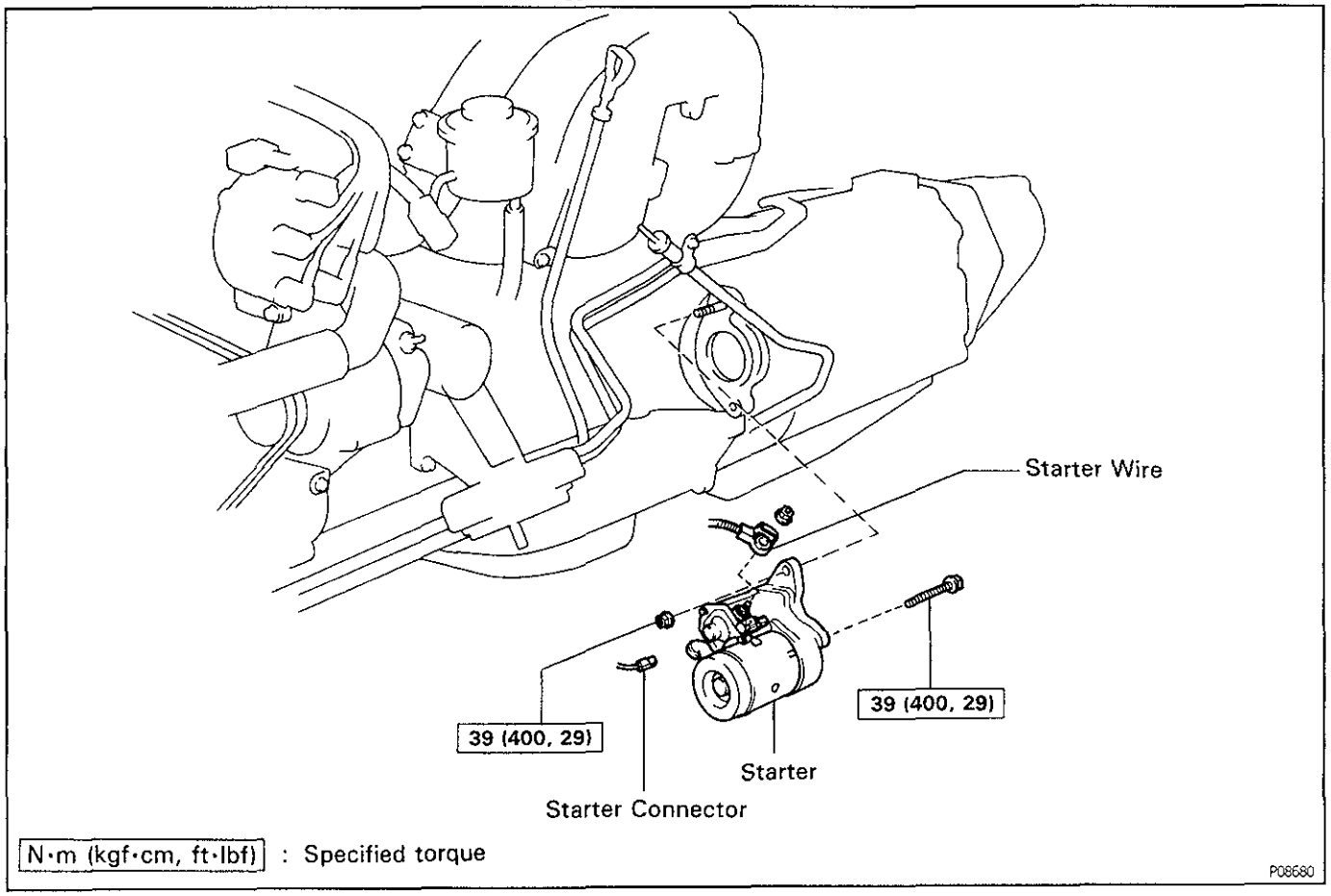
STARTER
(2.2 kW)

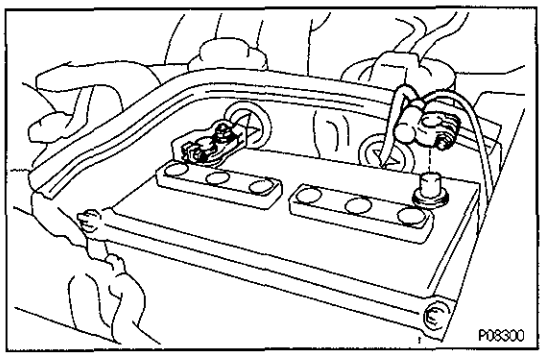
ST044-01

COMPONENTS FOR REMOVAL AND INSTALLATION

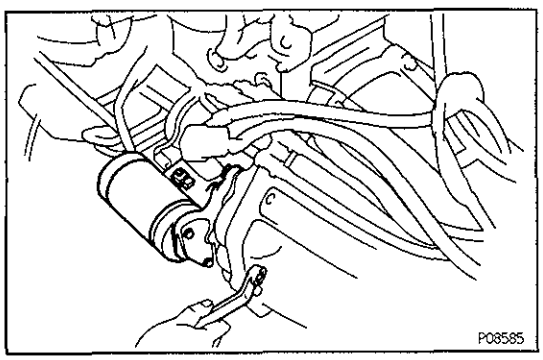


ST02N-02

STARTER REMOVAL



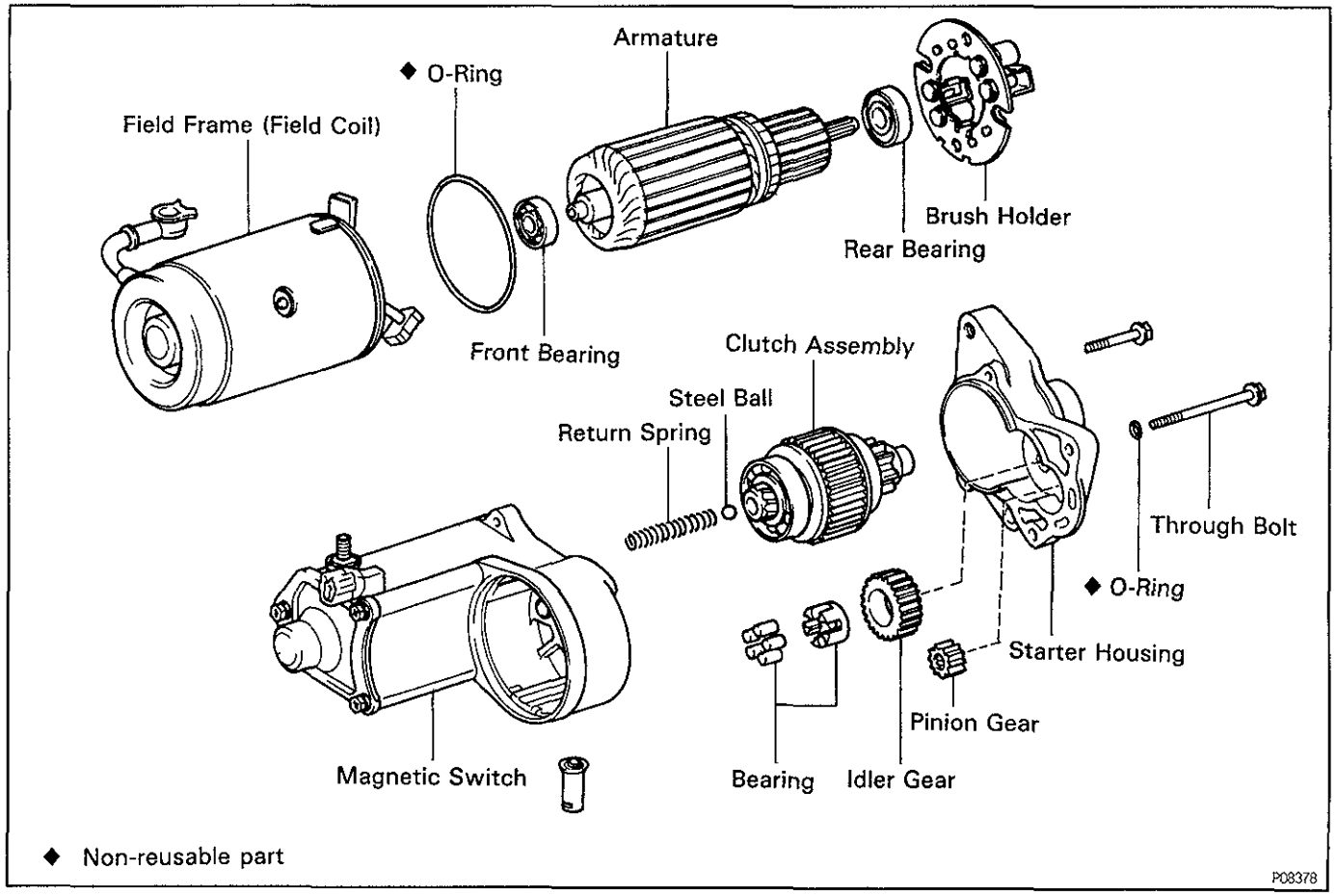
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**



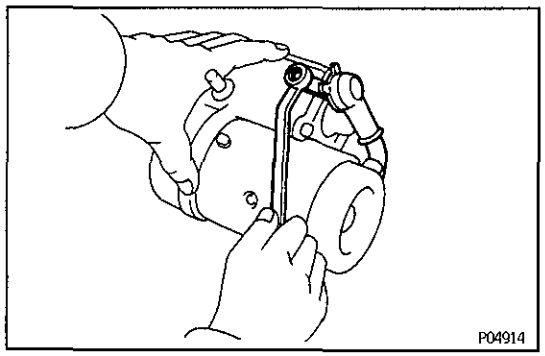
2. **REMOVE STARTER**
(a) Disconnect the starter connector.
(b) Remove the nut, and disconnect the starter wire.
(c) Remove the bolt, nut and starter.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST00W-08



ST

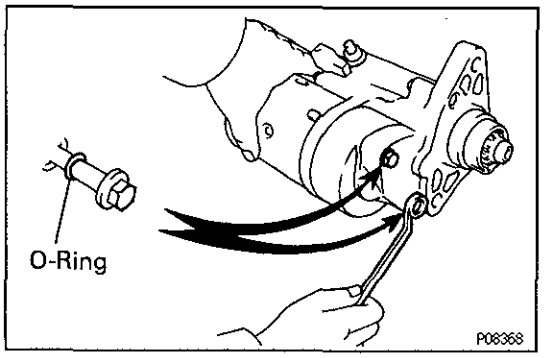


STARTER DISASSEMBLY

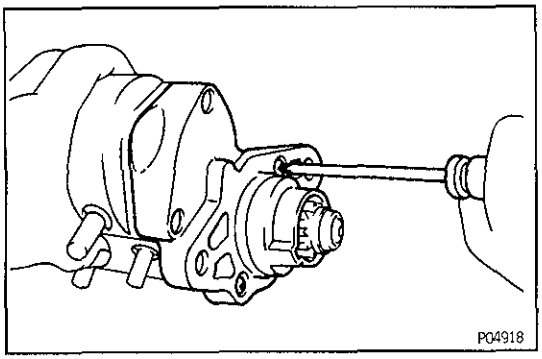
ST00X-05

1. REMOVE FIELD FRAME AND ARMATURE

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



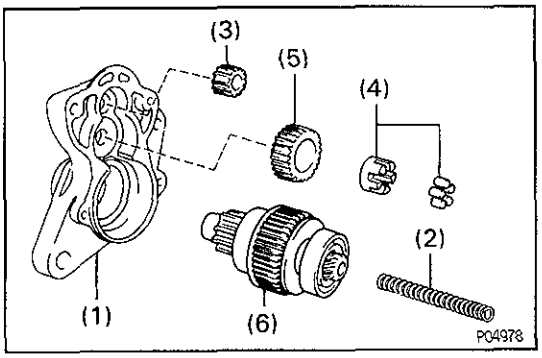
(b) Remove the two through bolts and O–rings.
(c) Pull out the field frame with the armature from the magnetic switch assembly.
(d) Remove the O–ring from the field frame.



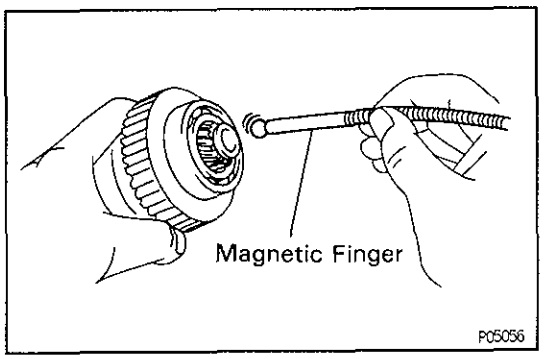
2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS

(a) Remove the two screws.

ST

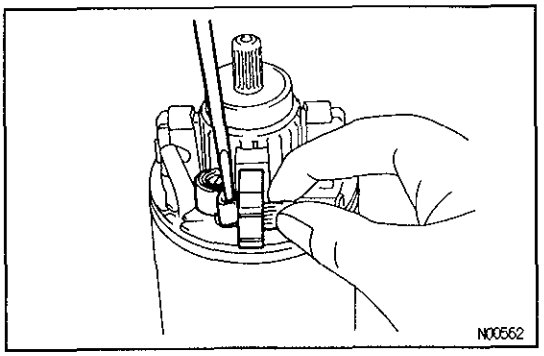


(b) Remove the following parts from the magnetic switch assembly:
(1) Starter housing
(2) Return spring
(3) Pinion gear
(4) Bearing
(5) Idler gear
(6) Clutch assembly



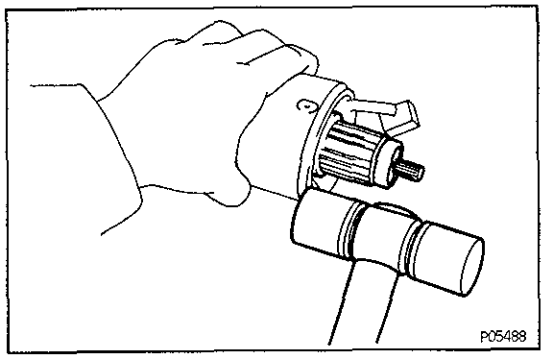
3. REMOVE STEEL BALL

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



4. REMOVE BRUSH HOLDER

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



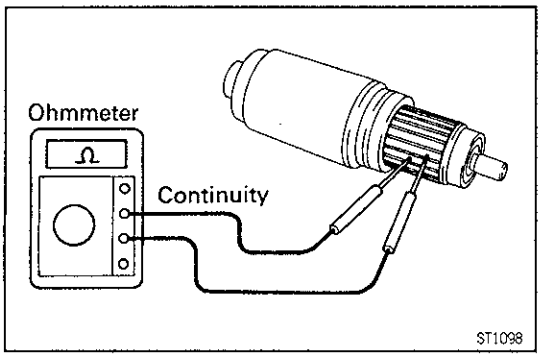
5. REMOVE ARMATURE FROM FIELD FRAME

Using a plastic hammer, tap the frame end to remove the armature from the field frame.

ST02P–02

STARTER INSPECTION AND REPAIR

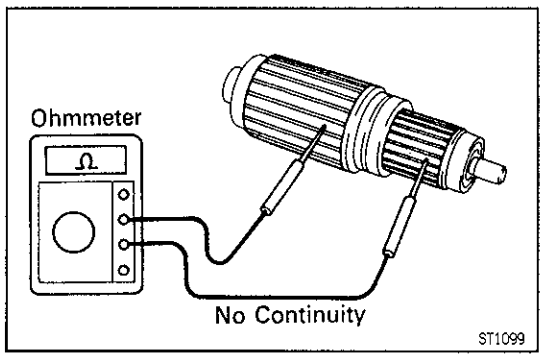
Armature Coil



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.

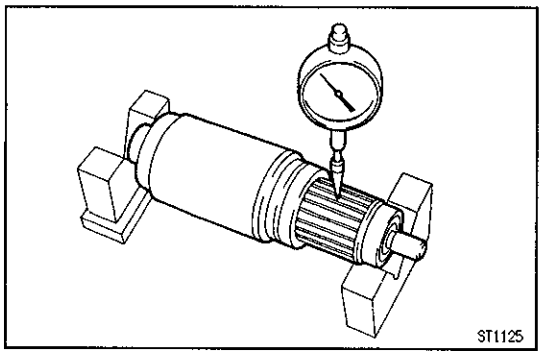
If there is continuity, replace the armature.

ST

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

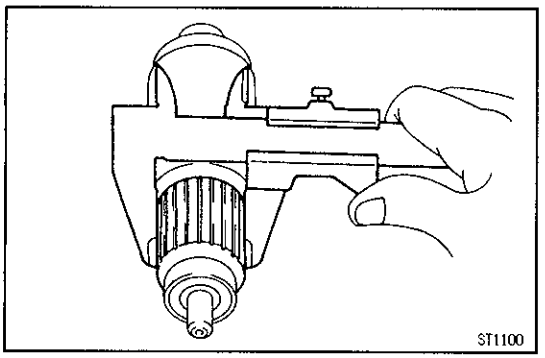
(a) Place the commutator on V—blocks.

(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 caliper, measure the commutator diameter.

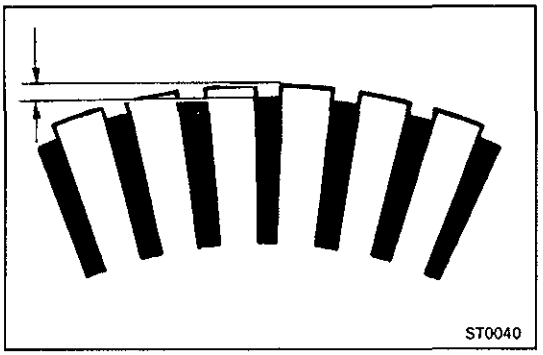
Standard diameter:

35 mm (1.38 in.)

Minimum diameter:

34 mm (1.34 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:

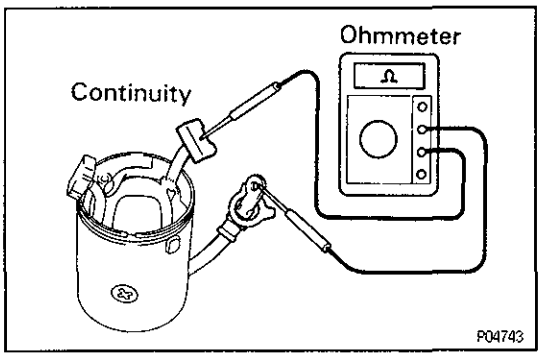
0.7 – 0.9 mm (0.028 – 0.035 in.)

Minimum undercut depth:

0.2 mm (0.008 in.)

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

ST

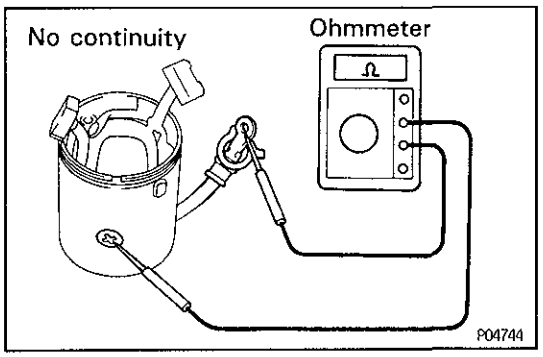


Field Frame (Field Coil)

1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

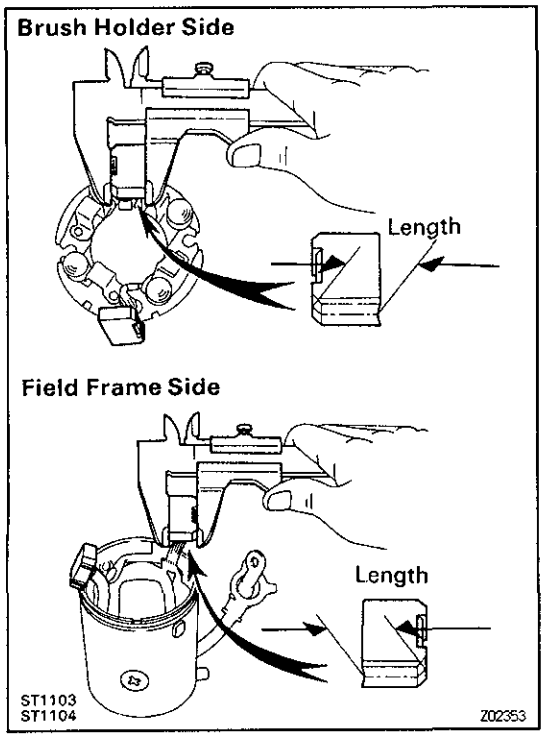
If there is no continuity, replace the field frame.



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.



Brushes

INSPECT BRUSH LENGTH

Using a vernier caliper, measure the brush length.

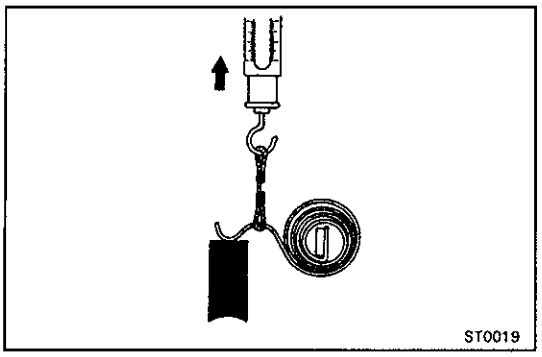
Standard length:

15.0 – 15.5 mm (0.591 – 0.610 in.)

Minimum length:

9.5 mm (0.374 in.)

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



Brush Springs

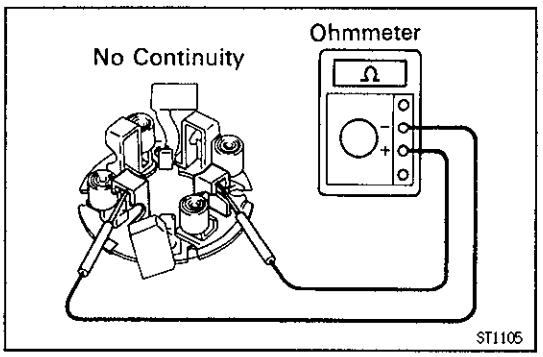
INSPECT BRUSH SPRING LOAD

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

Spring installed load:

26 – 32 N (2.7 – 3.3 kgf, 6.0 – 7.3 lbf)

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



Brush Holder

ST

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.

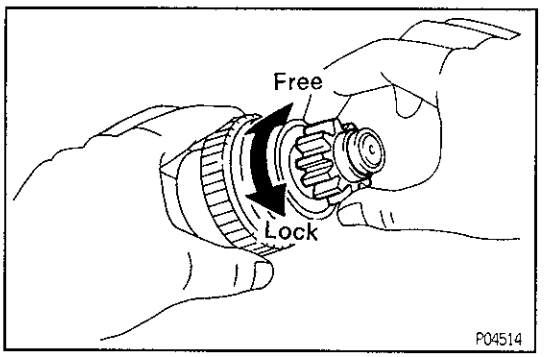
Clutch and Gears

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.

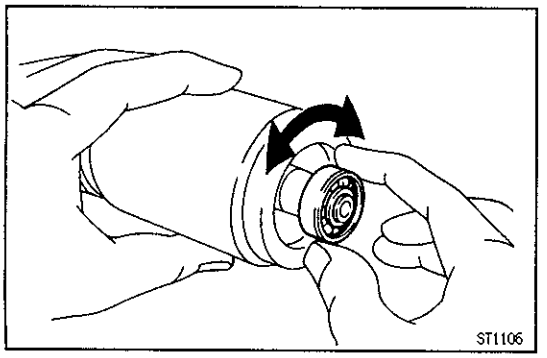
If damaged, also check the drive plate ring gear for wear or damage.



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.

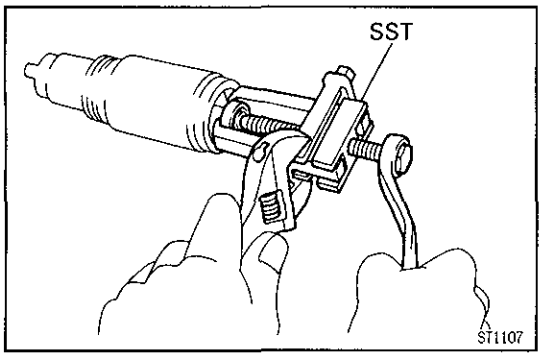


Bearings

1. **INSPECT FRONT BEARING**

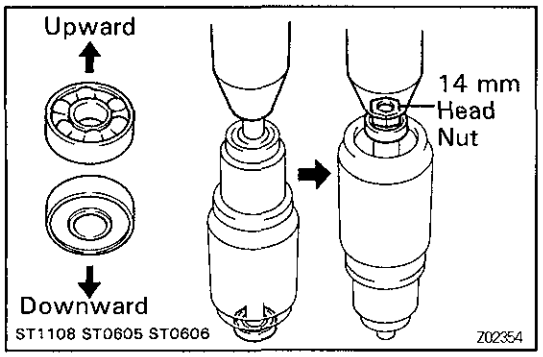
Turn the bearing by hand while applying inward force.

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

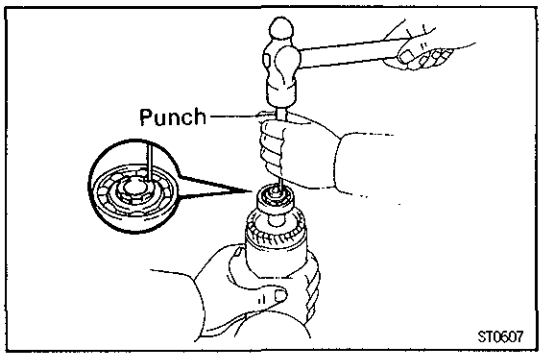


2. IF NECESSARY, REPLACE FRONT BEARING

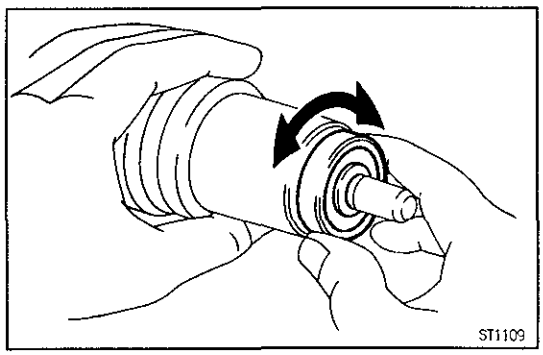
(a) Using SST, remove the bearing.
SST 09286–46011



(b) Using a 14 mm head nut and press, press in a new bearing.
NOTICE: Be careful of the bearing installation direction.

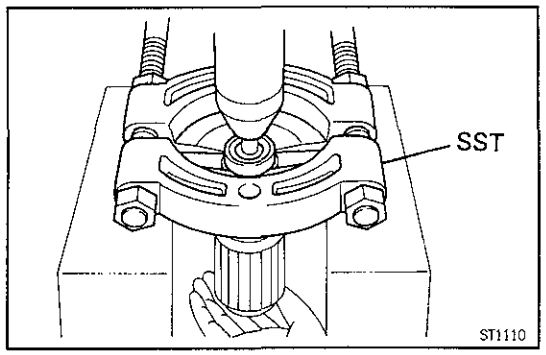


(c) Using a punch, stake the armature shaft.



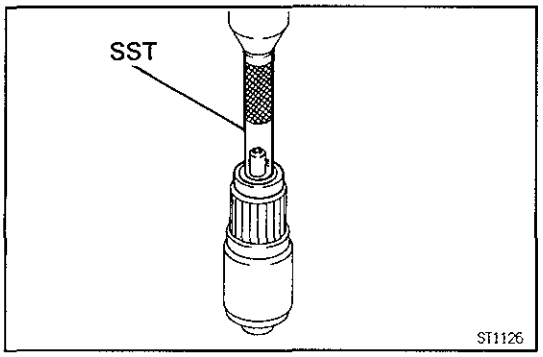
3. INSPECT REAR BEARING

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

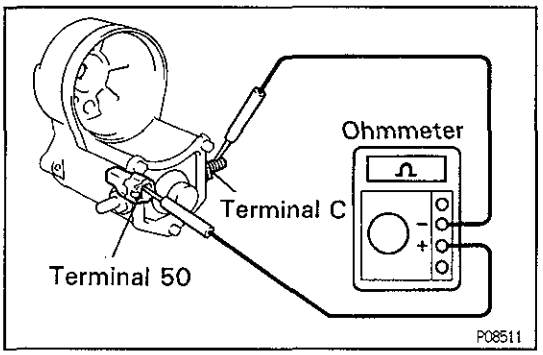


4. IF NECESSARY, REPLACE REAR EARING

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



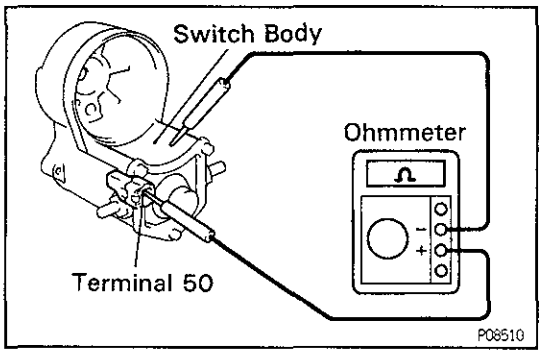
(b) Using SST and a press, press in a new bearing.
SST 09201–41020



Magnetic Switch

ST

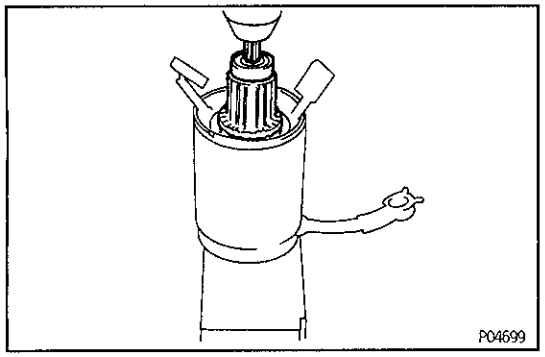
1. **PERFORM PULL–IN COIL OPEN CIRCUIT TEST**
Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.



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.

ST02Q-02

STARTER ASSEMBLY



(See Components for Disassembly and Assembly)

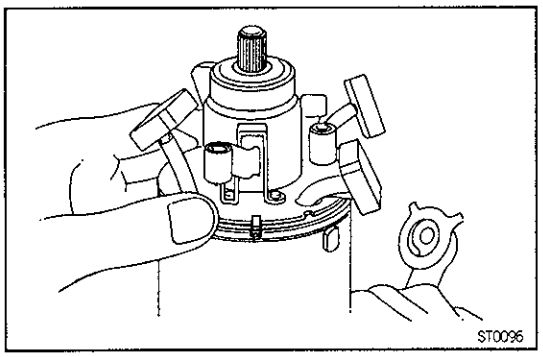
HINT: Use high–temperature grease to lubricate the bearings and gears when assembling the starter.

1. PLACE ARMATURE INTO FIELD FRAME

(a) Apply grease to the armature bearings.

(b) Using a press, press the armature into the field frame.

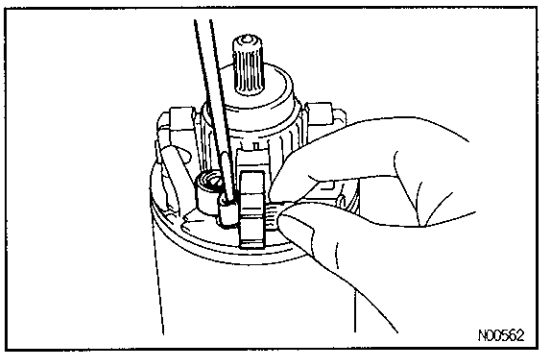
ST



2. INSTALL BRUSH HOLDER

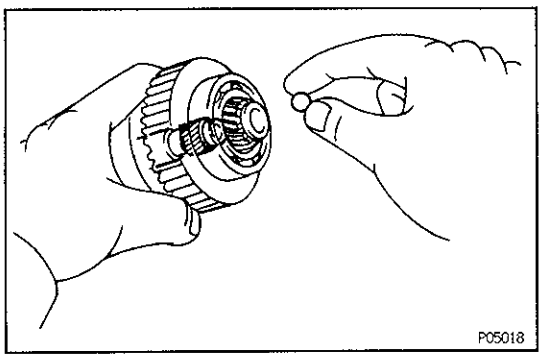
(a) Align the claw of the brush holder with the claw groove of the field frame.

(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 four brushes.

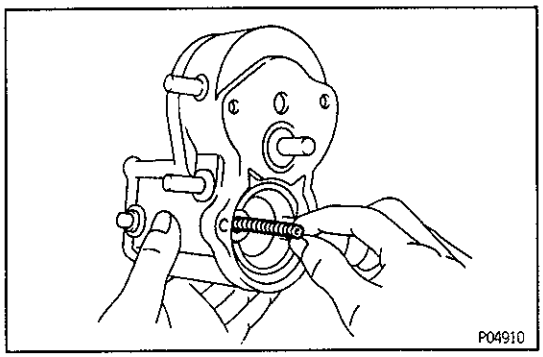
NOTICE: Check that the positive (+) lead wires are not grounded.



3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

(a) Apply grease to the steel ball.

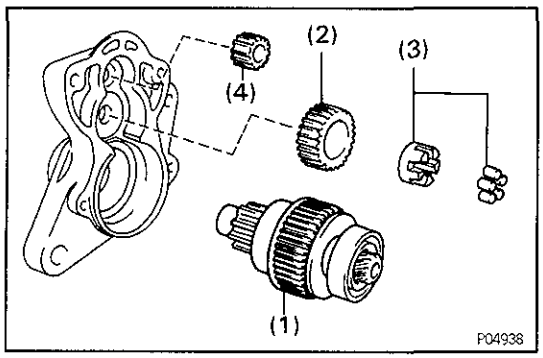
(b) Insert the steel ball into the clutch shaft hole.



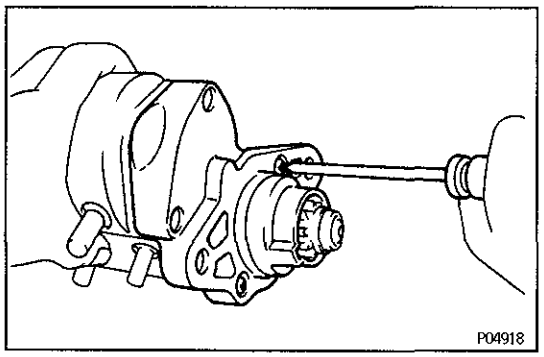
4. INSTALL STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS

(a) Apply grease to the return spring.

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

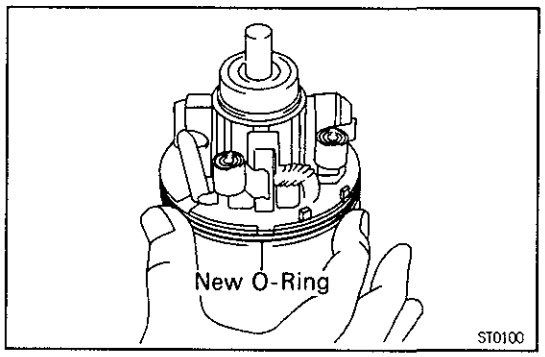


(c) Place the following parts in position on the starter housing:
(1) Clutch assembly
(2) Idler gear
(3) Bearing
(4) Pinion gear



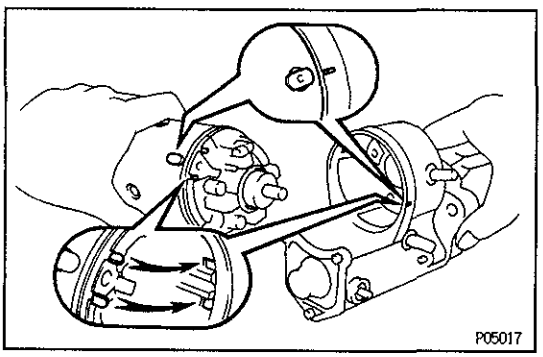
(d) Assemble the starter housing and magnetic switch assembly and install the two screws.

ST

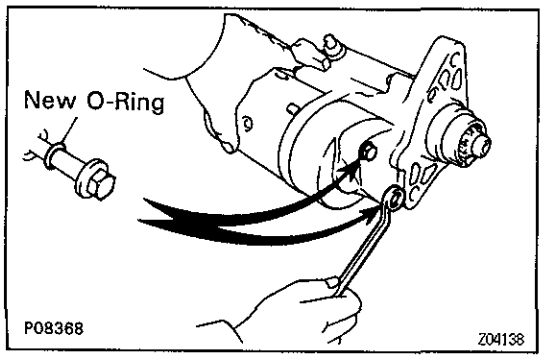


5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

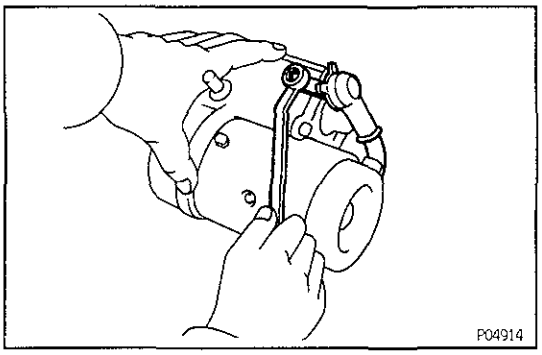
(a) Place a new O–ring in position on the field frame.



(b) Align the claws of the brush holder with the grooves of the magnetic switch, and install the field frame and amature shaft assembly.
(c) Align the punch mark of the field frame with the line of the magnet switch.

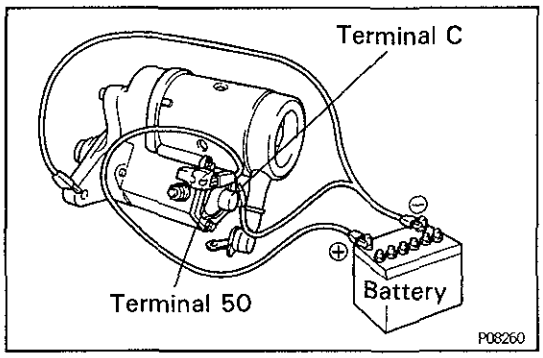


(d) Install new O–rings to the through bolts.
(e) Install the field frame and armature assembly with the two through bolts.



(f) Connect the lead wire to terminal C, and install the nut.

ST



STARTER PERFORMANCE TEST

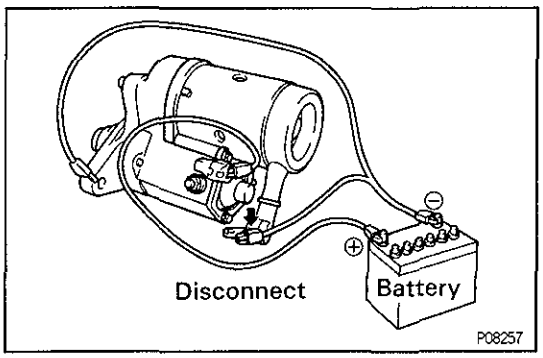
ST010–07

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

1. PERFORM PULL–IN TEST

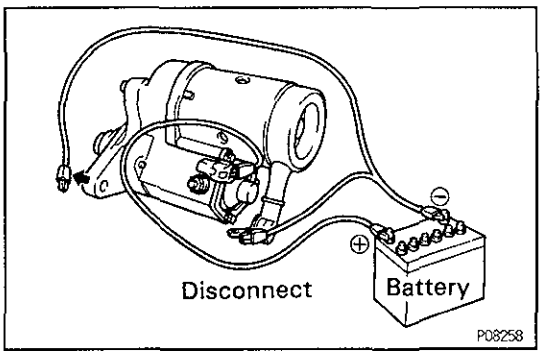
(a) Disconnect the field coil lead wire from terminal C.

(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.
If the clutch pinion gear does not move, replace the magnetic switch assembly.



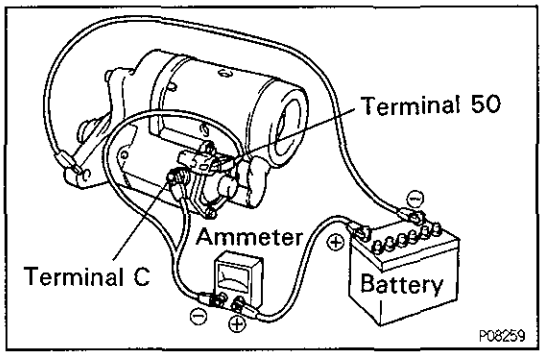
2. PERFORM HOLD–IN TEST

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.
If the clutch pinion gear returns inward, replace the magnetic switch assembly.



3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.
Check that the clutch pinion gear returns inward.
If the clutch pinion gear does not return, replace the magnetic switch assembly.



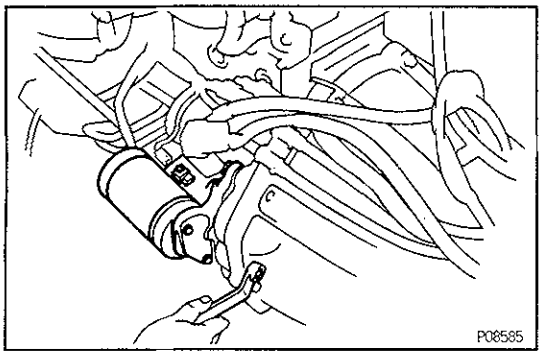
4. PERFORM NO–LOAD PERFORMANCE TEST

(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



ST02R-02

STARTER INSTALLATION

(See Components for Removal and Installation)

1. INSTALL STARTER

(a) Install the starter with the bolt and nut.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

(b) Connect the starter wire with the nut.
Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)

(c) Connect the starter connector.

2. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

3. CHECK THAT ENGINE STARTS