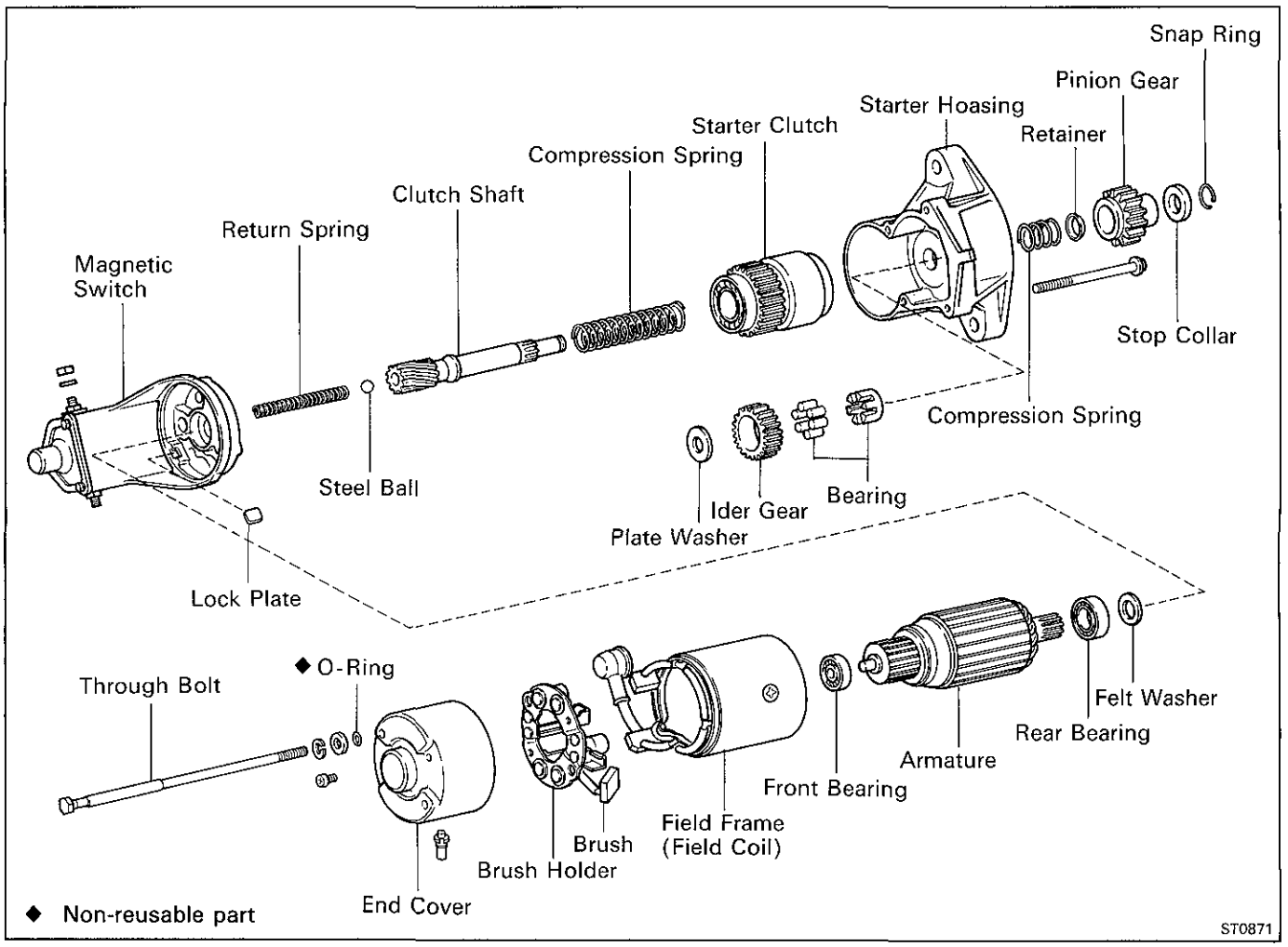
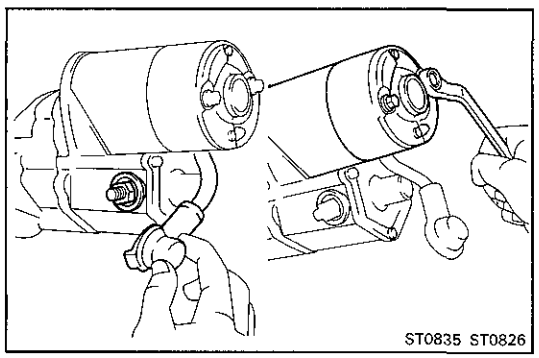
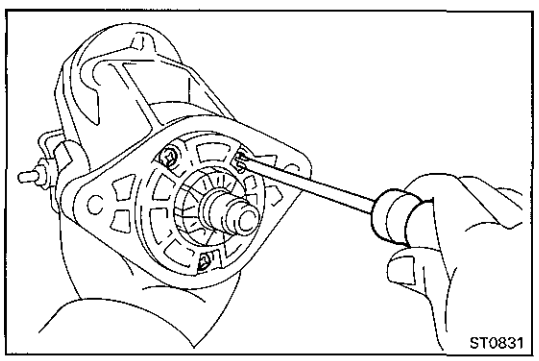
STARTER

COMPONENTS







DISASSEMBLY OF STARTER

1. REMOVE FIELD FRAME AND ARMATURE

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

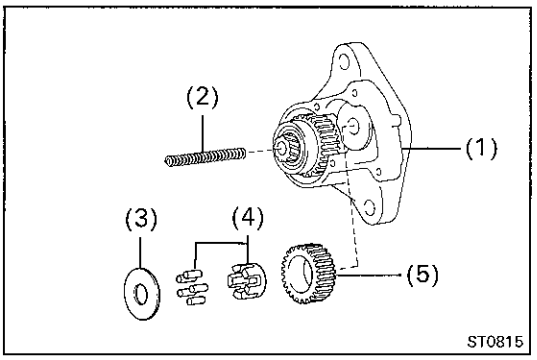
(b) Remove the two through bolts, spring washers, plate washers and O-rings.

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

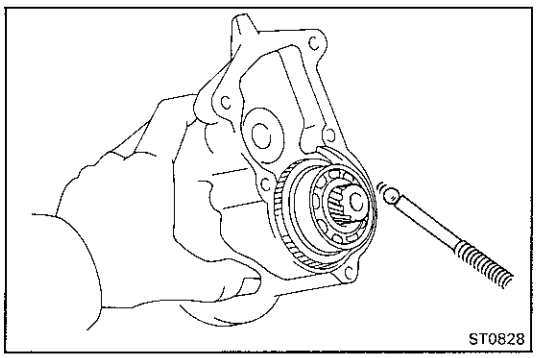
(d) Remove the felt washer and lock plate.

2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS

(a) Remove the three screws.

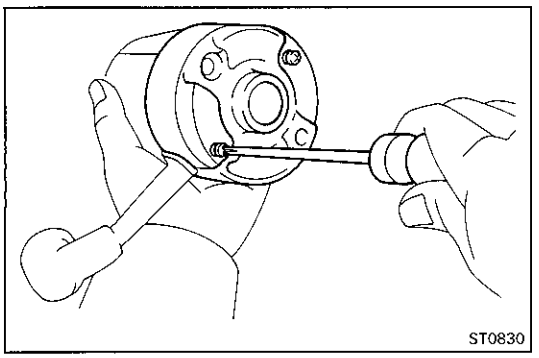


(b) Remove the following parts from the magnetic switch:
(1) Starter housing and clutch assembly
(2) Return spring
(3) Plate washer
(4) Idler gear
(5) Bearing



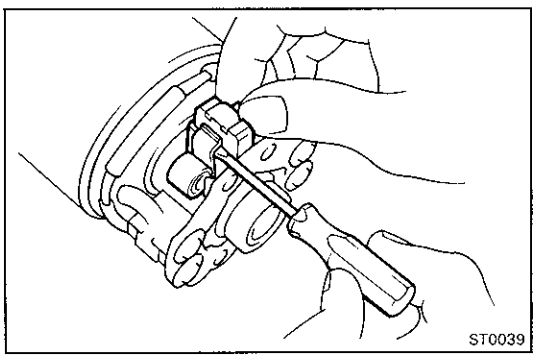
3. REMOVE STEEL BALL

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



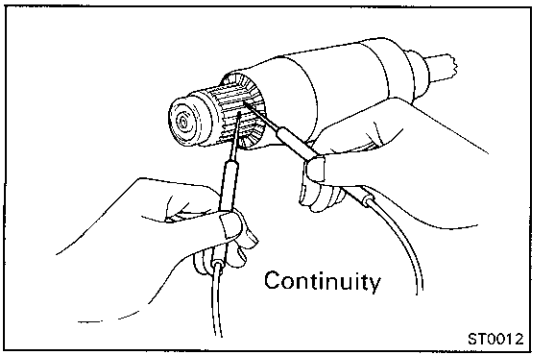
4. REMOVE BRUSH HOLDER

(a) Remove the two screws and end cover from the field frame.



(b) 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



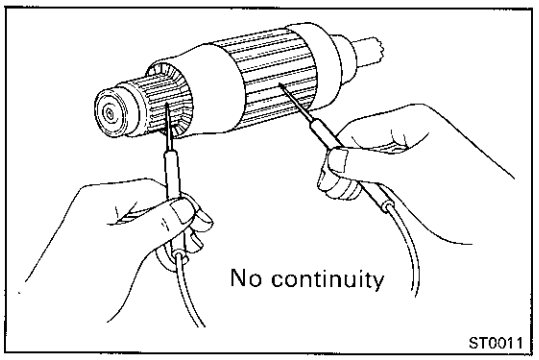
INSPECTION AND REPAIR OF STARTER

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, replace the armature.



2. INSPECT COMMUTATOR FOR GROUND

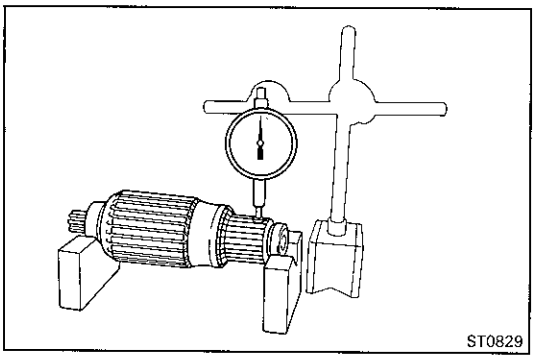
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACE

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



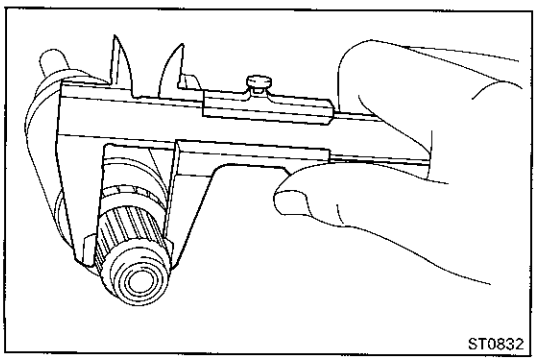
2. INSPECT COMMUTATOR FOR RUNOUT

(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.



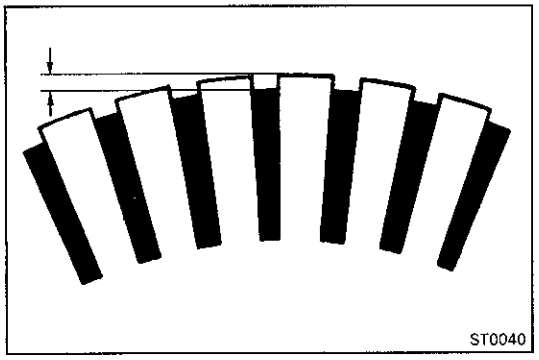
3. INSPECT COMMUTATOR DIAMETER

Using calipers, measure the diameter.

Standard diameter: 36.0 mm (1.417 in.)

Minimum diameter: 35.0 mm (1.378 in.)

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



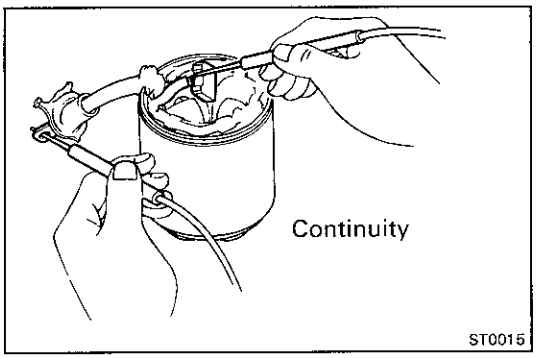
4. **INSPECT UNDERCUT DEPTH**

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

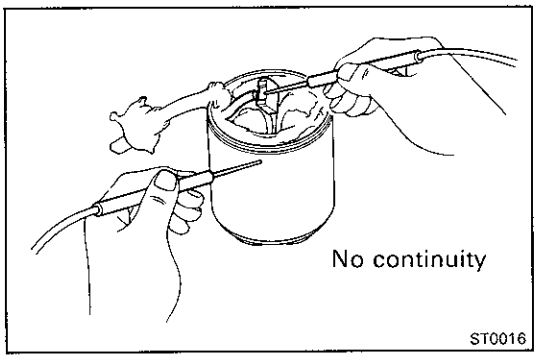


Field Coil (Field Frame)

1. **INSPECT FIELD COIL FOR OPEN CIRCUIT**

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

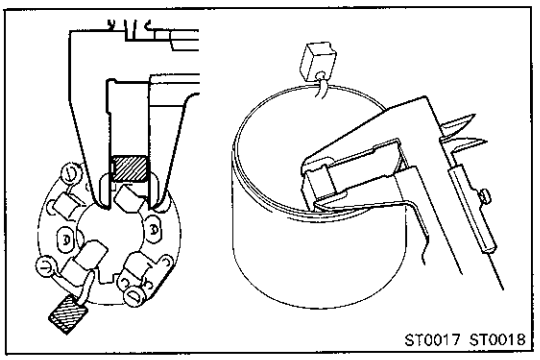
If there is no continuity, replace the field frame.



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, replace the field frame.



Brushes

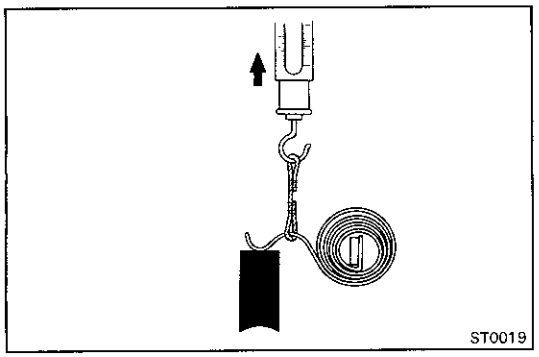
INSPECT BRUSH LENGTH

Using calipers, measure the brush length.

Standard length: 20.5 – 21.0 mm (0.807 – 0.827 in.)

Minimum length: 13.0 mm (0.512 in.)

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



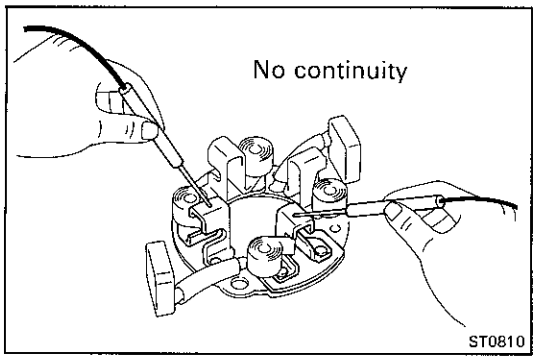
Brush Springs

INSPECT BRUSH SPRING LOAD

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

Standard installed load: 3.2 – 4.0 kg (7.1 – 8.8 lb, 31 – 39 N)

If the installed load is not as specified, 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.

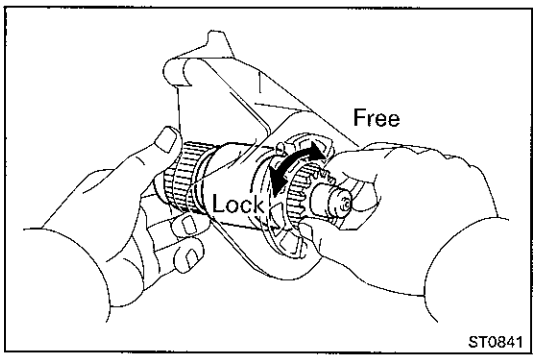
Clutch and Gears

1. INSPECT GEAR TEETH

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

If damaged, replace the gear or clutch assembly.

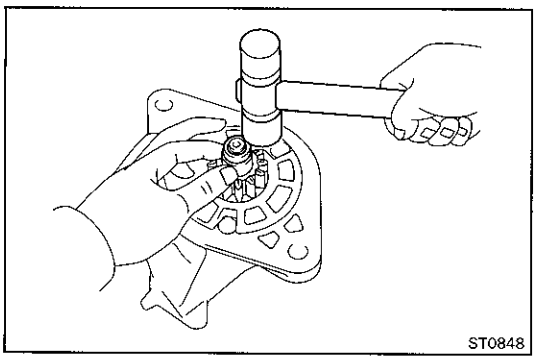
If damaged, also check the flywheel ring gear for wear or damage.



2. INSPECT CLUTCH PINION GEAR

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.

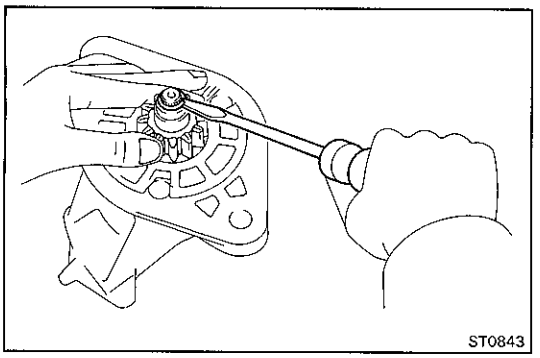


3. IF NECESSARY, REPLACE CLUTCH ASSEMBLY

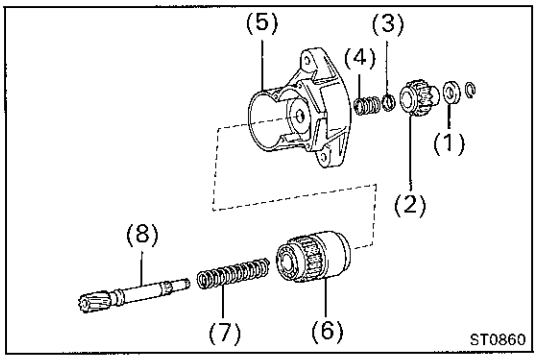
A. Disassembly starter housing and clutch assembly

(a) Push down the pinion gear and starter housing.

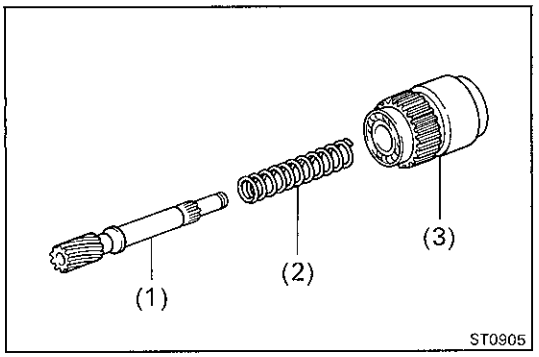
(b) Using a plastic-faced hammer, tap in the stop collar.



(c) Using a screwdriver, pry out the snap ring.

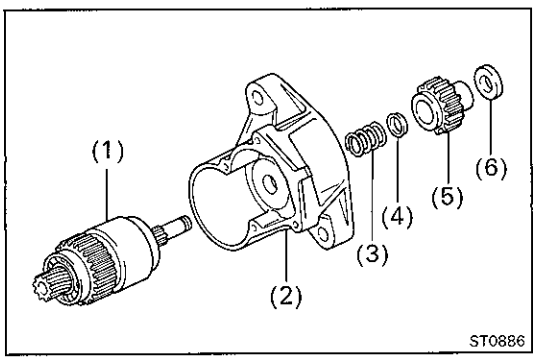


(d) Disassembly the following parts:
(1) Stop collar
(2) Pinion gear
(3) Retainer
(4) Compression spring
(5) Starter housing
(6) Starter clutch
(7) Compression spring
(8) Clutch shaft

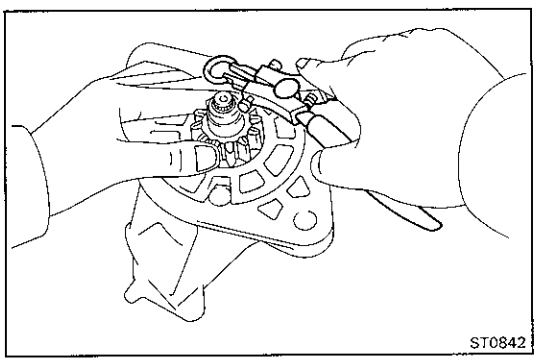


B. Assemble starter housing and clutch assembly

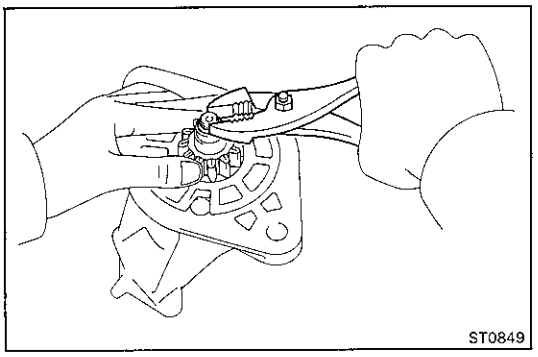
(a) 1st, assemble the following parts:
(1) Clutch shaft
(2) Compression spring
(3) Starter clutch



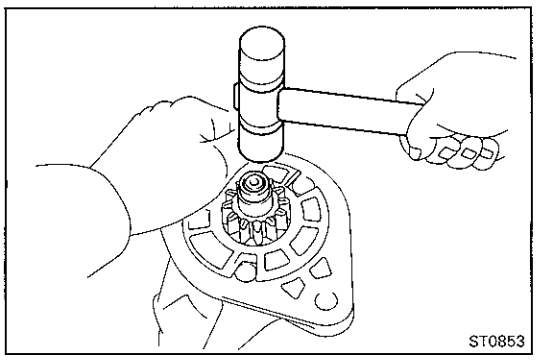
(b) 2nd, assemble the following parts:
(1) Clutch shaft and starter shaft assembly
(2) Starter housing
(3) Compression spring
(4) Retainer
(5) Pinion gear
(6) Stop collar



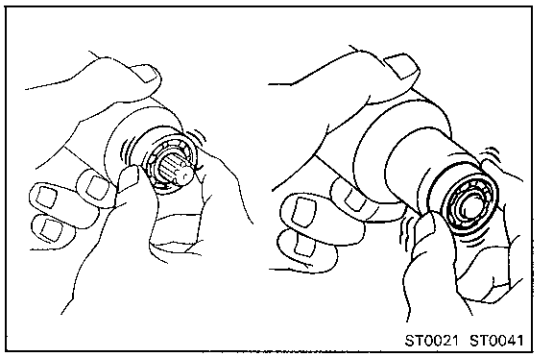
(c) Push down the pinion gear and starter housing.
(d) Using snap ring pliers, install the snap ring.



(e) Using pliers, compress the snap ring.
(f) Check that the snap ring fits correctly.



(g) Using a plastic-faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.

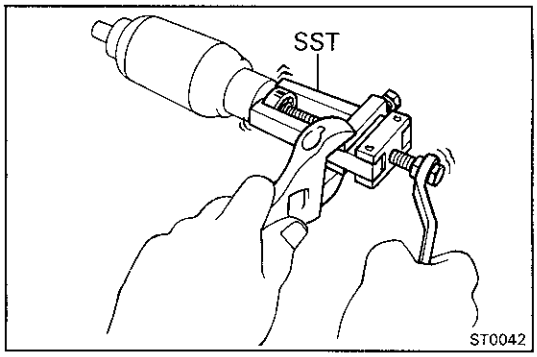


Bearings

1. INSPECT BEARINGS

Turn each bearing by hand while applying inward force.

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

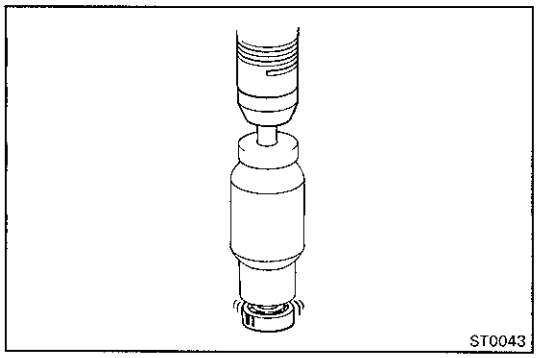


2. IF NECESSARY, REPLACE BEARINGS

A. Remove bearings

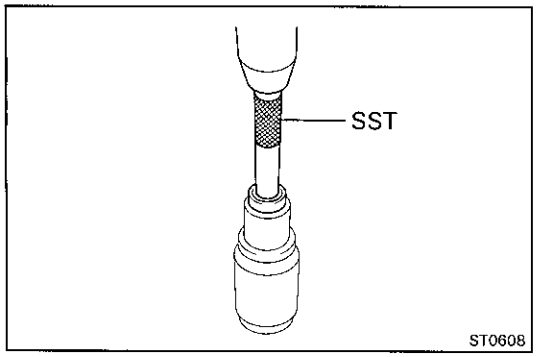
Using SST, remove the bearing.

SST 09286-46011



B. Install bearings
(Front)

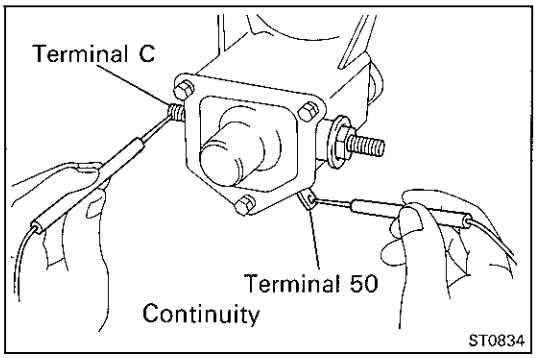
Using a press, press in a new bearing.



(Rear)

Using SST and a press, press in a new bearing.

SST 09285-76010

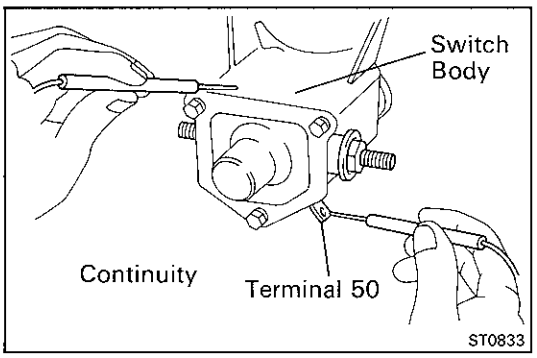


Magnetic Switch

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, replace the magnetic switch.



2. PERFORM HOLD-IN COIL OPEN CIRCUIT TEST

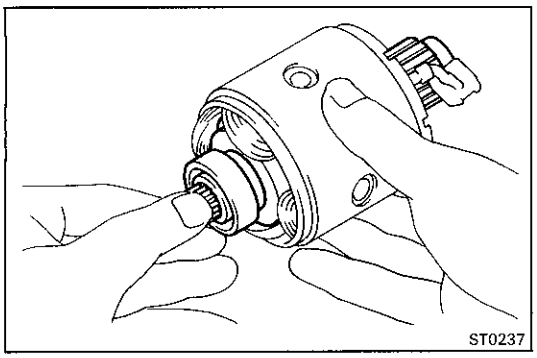
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.

ASSEMBLY OF STARTER

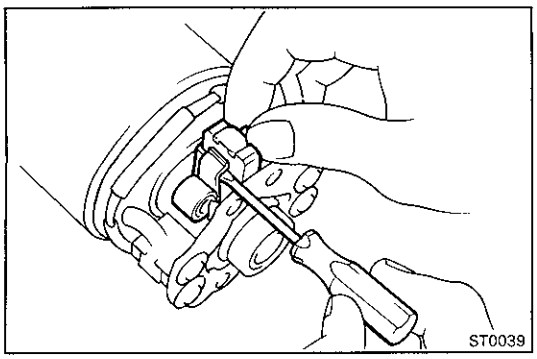
(See page ST-15)

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



1. PLACE ARMATURE INTO FIELD FRAME

Apply grease to the armature bearings, and insert the armature into the field frame.

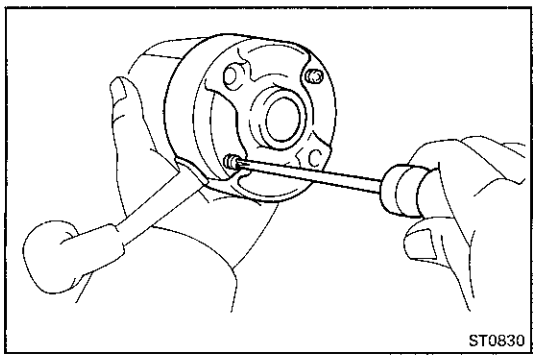


2. INSTALL BRUSH HOLDER

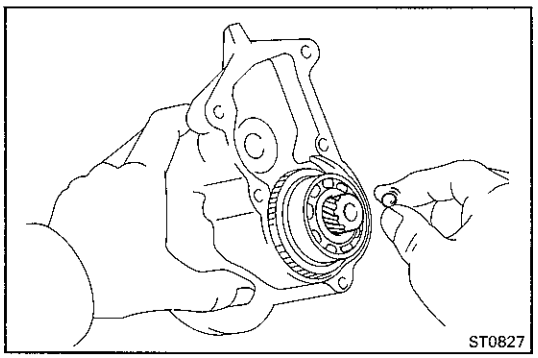
(a) Place the brush holder on the armature.

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

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



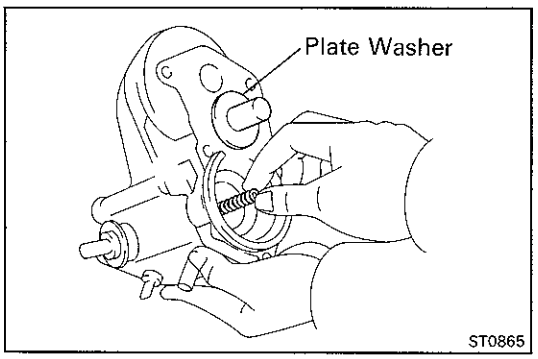
(c) Install the end cover with the two screws.



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.

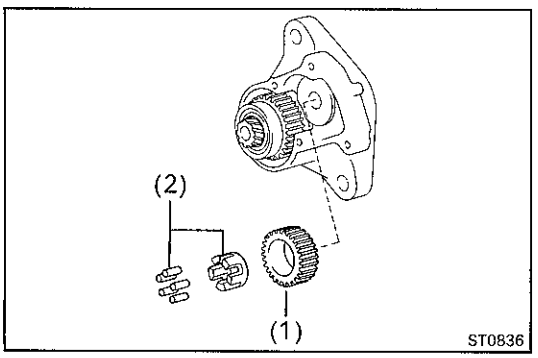


4. INSTALL GEAR, CLUTCH ASSEMBLY AND STARTER HOUSING

(a) Apply grease to the return spring.

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

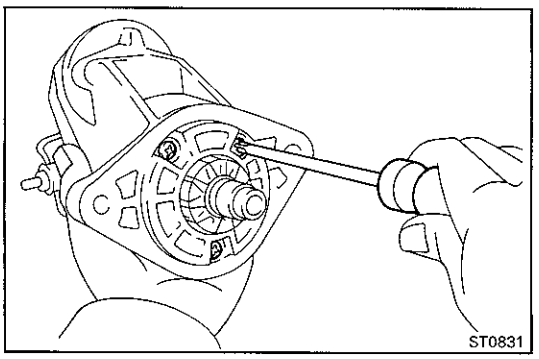
(c) Install the plate washer to the magnetic switch.



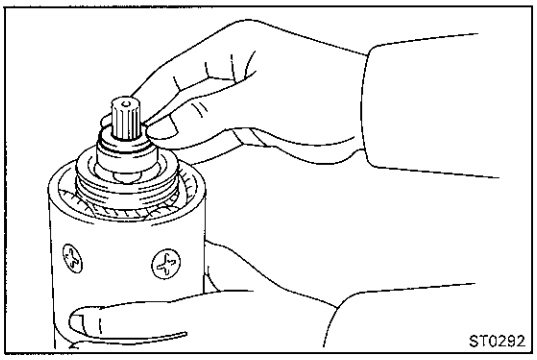
(d) Install the following parts to the starter housing:

(1) Idler gear

(2) Bearing

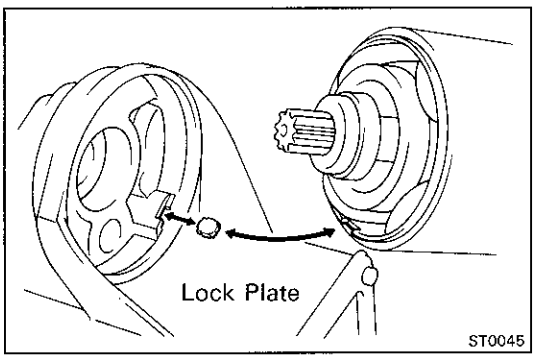


(e) Assemble the starter housing and magnetic switch with the three screws.



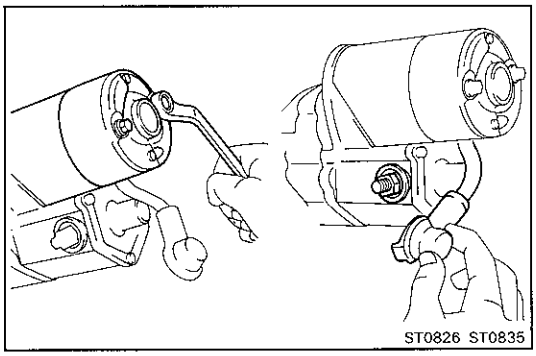
5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

(a) Install a new felt washer to the armature.



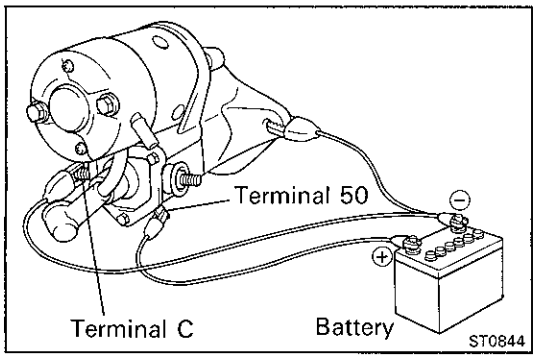
(b) Install the lock plate to the cutout portion of the magnetic switch.

(c) Align the lock plate with the cutout portion of the field frame.



(d) Install the field frame and armature assembly with two new O-rings, the two plate washers, spring washers and two through bolts.

(e) Connect the lead wire to terminal C, and install the spring washer and nut.



PERFORMANCE TEST OF STARTER

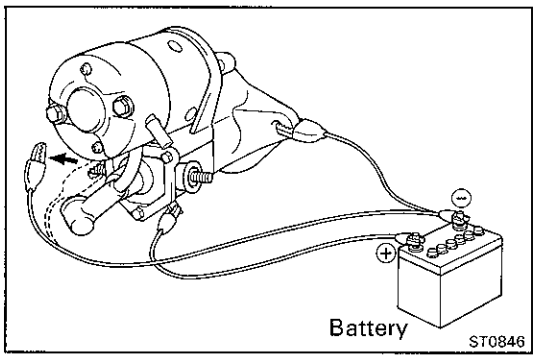
NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

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.

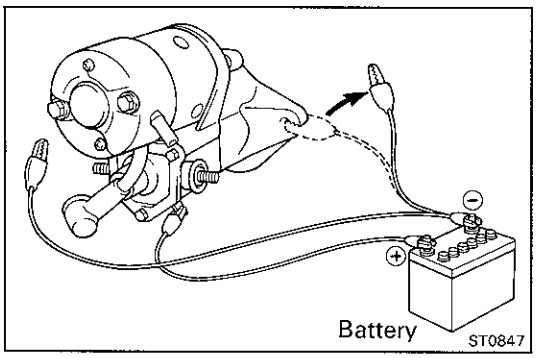
If the clutch pinion gear does not move, replace the magnetic switch assembly.



2. PERFORM HOLD-IN TEST

While connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.

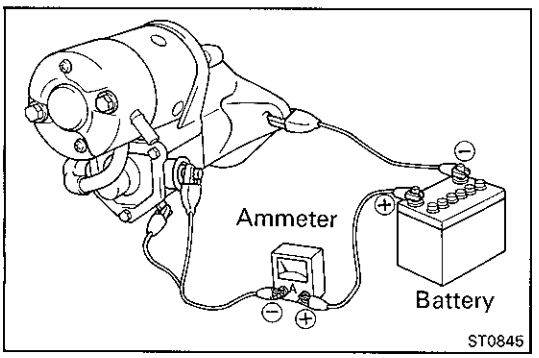
If the clutch pinion gear returns inward, replace the magnetic switch assembly.



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:

12 V type 180 A or less at 11 V
24 V type 90 A or less at 23 V