

STARTING SYSTEM ON-VEHICLE INSPECTION

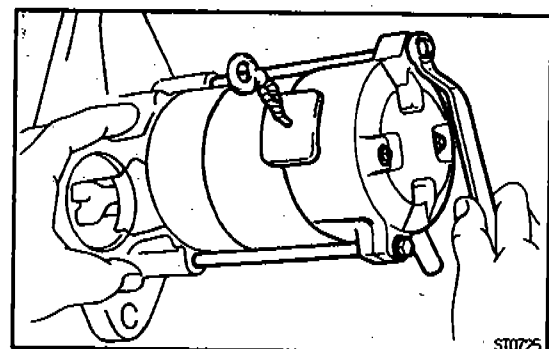
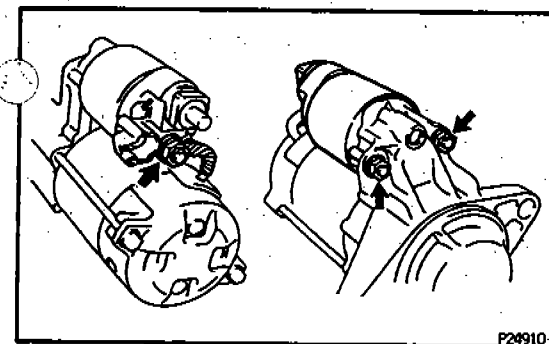
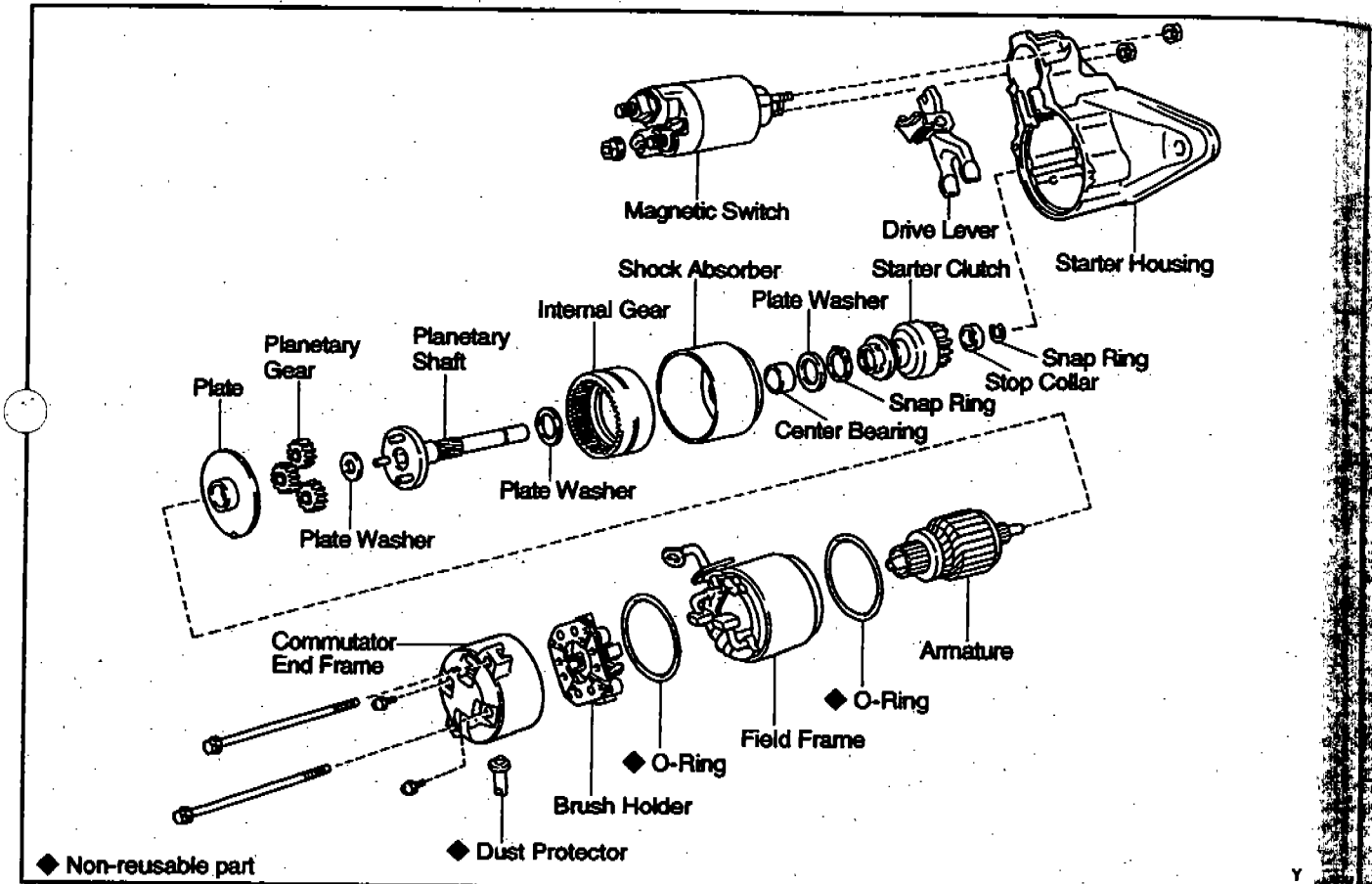
ST-1-25

NOTICE: Before changing the starter, check the following items again:

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

STARTER COMPONENTS

ST06-91



DISASSEMBLY

1. REMOVE MAGNETIC SWITCH

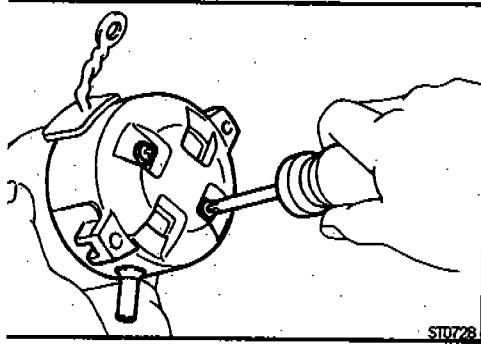
- Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
- Loosen the 2 nuts holding the magnetic switch to the starter housing.
- Pull the magnetic switch and while lifting the front part of the magnetic switch, release the plunger hook from the drive lever, then release the magnetic switch.

2. REMOVE FIELD FRAME AND ARMATURE

Remove the 2 through bolts, and pull out the field frame together with the armature.

R021

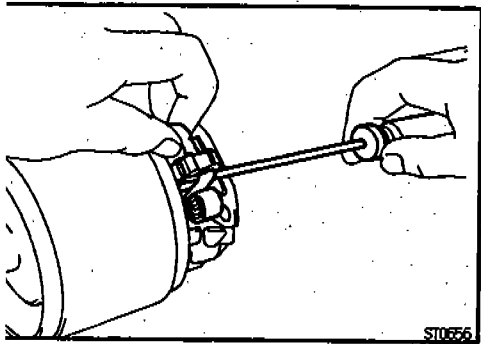
ST06E



3. REMOVE COMMUTATOR END FRAME

Remove the 2 screws and commutator end frame, and hold down the lead wire while releasing the commutator end frame.

NOTICE: To avoid interference between the brush holder and the dust protector pull the commutator end frame away at an angle.



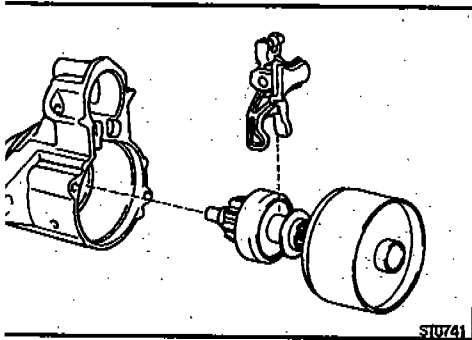
4. REMOVE BRUSH HOLDER

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

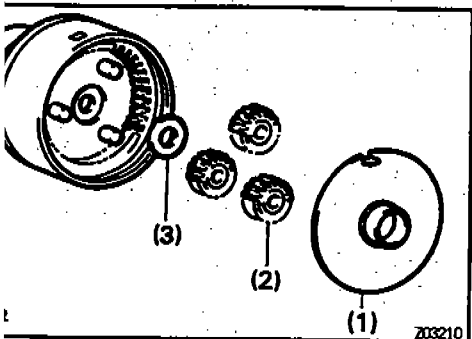
(b) Disconnect the 4 brushes, and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME

6. REMOVE 2 O-RINGS FROM FIELD FRAME



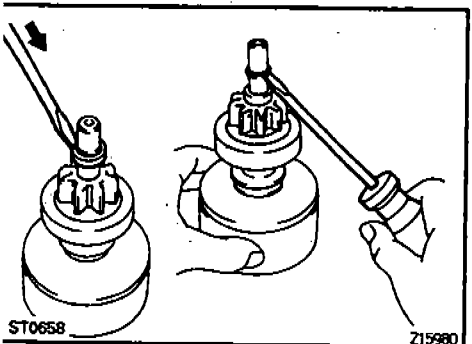
7. REMOVE DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER FROM STARTER HOUSING



8. REMOVE PLANETARY GEARS

Remove these parts from the shock absorber.

- (1) Plate
- (2) 3 planetary gears
- (3) Plate washer

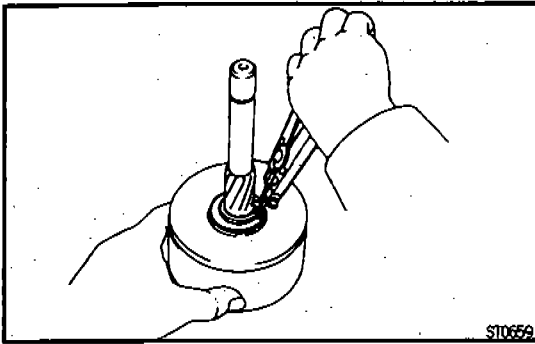


9. REMOVE STARTER CLUTCH

(a) Using a screwdriver, tap in the stop collar towards the starter clutch.

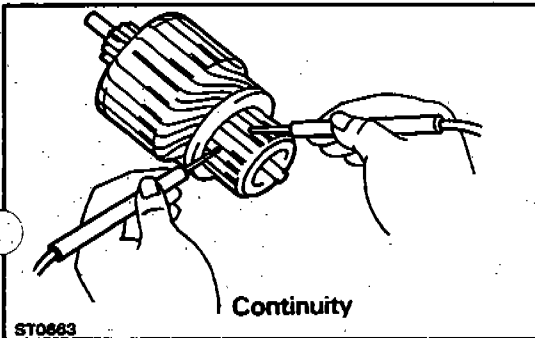
(b) Using a screwdriver, pry off the snap ring.

(c) Remove the stop collar and starter clutch from the planetary shaft.



10. REMOVE PLANETARY SHAFT AND INTERNAL GEAR

- (a) Using snap ring pliers, remove the snap ring and plate washer.
- (b) Remove the planetary shaft and plate washer.

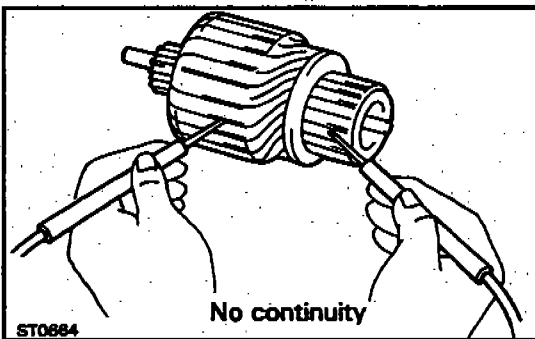


INSPECTION

Armature Coil

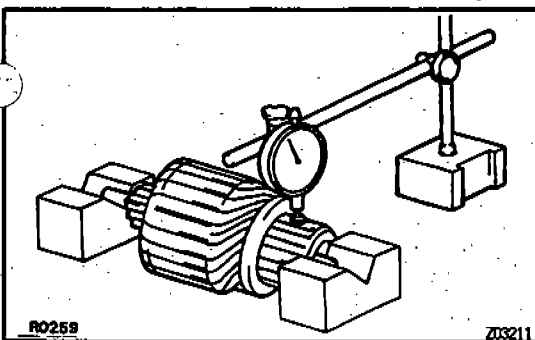
1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

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.



Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNED SURFACES

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

2. INSPECT COMMUTATOR CIRCLE RUNOUT

- (a) Place the armature 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

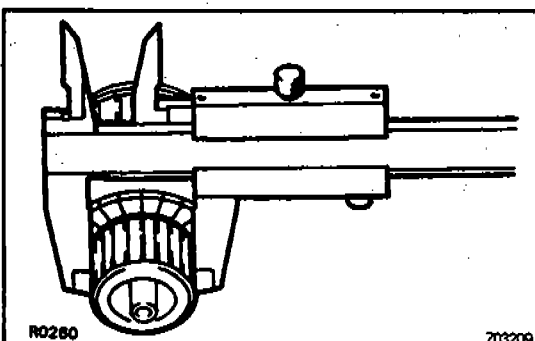
Using vernier calipers, measure the commutator diameter.

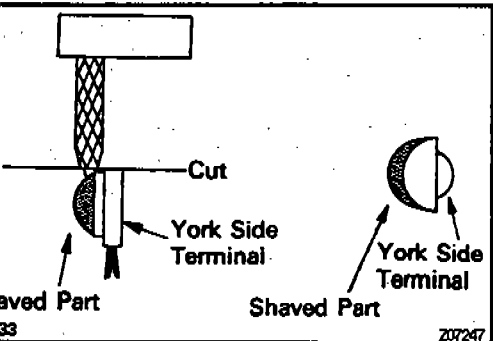
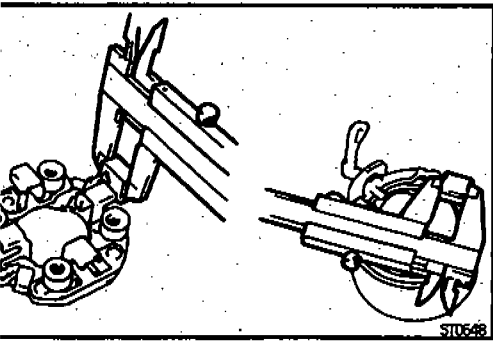
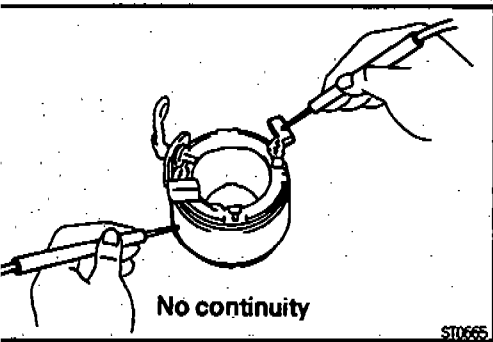
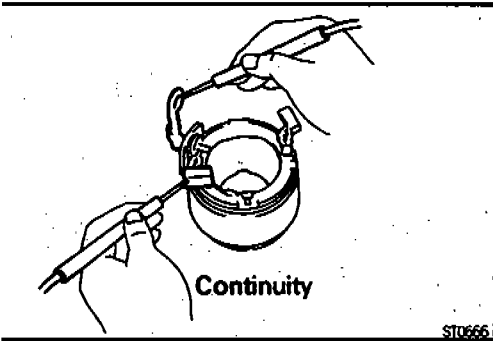
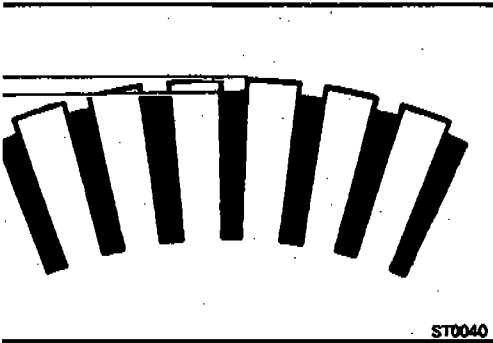
Standard diameter:

28.0 mm (1.10 in.)

Minimum diameter:

27.0 mm (1.06 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:

0.6 mm (0.024 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 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 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

1. INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

Standard length:

14.0 mm (0.551 in.)

Minimum length:

9.0 mm (0.354 in.)

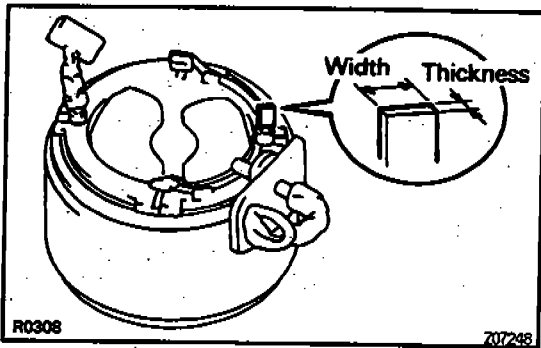
If the length is less than minimum, replace the brush (field frame side) or brush holder, and dress with an emery cloth.

2. IF NECESSARY, REPLACE BRUSHES

HINT: Only the 2 brushes of the positive (+) side (yoke side) are exchangeable, negative (-) side brush must be changed in the body with the brush holder.

(a) Cut the brush lead wire at the terminal side.

(b) Shave welded mark of the brush lead wire with sandpaper etc., and correct the terminal to the specified.



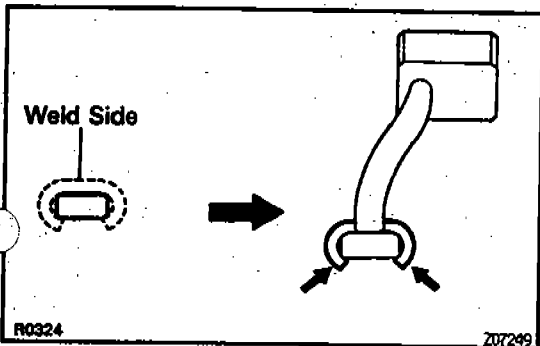
NOTICE: Part to be shaved is so narrow that you should take care not to harm the field coil.

Specified width:

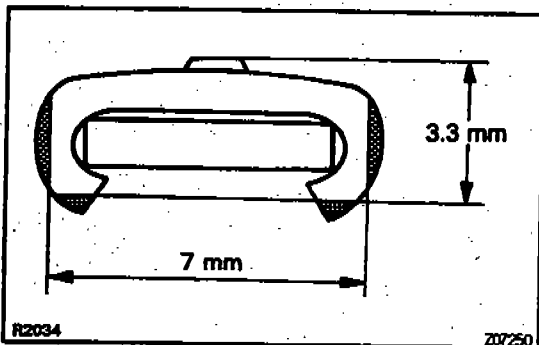
5.0 mm (0.197 in.)

Specified thickness:

1.5 - 1.7 mm (0.059 - 0.067 in.)



(c) Press the plate of the supply brush on the welded side of the terminal lead wire.



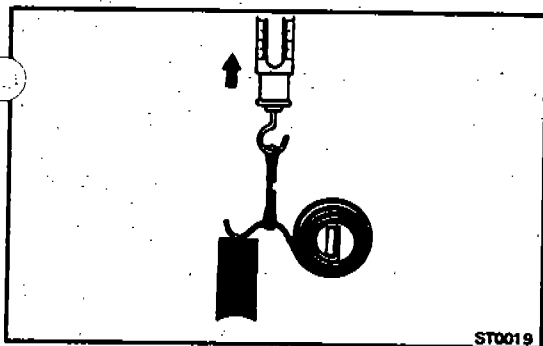
(d) Solder the pressed part, and shave to the specified dimensions with the sandpaper etc.

Specified width: 7.0 mm (0.276 in.)

Specified thickness: 3.3 mm (0.130 in.)

HINT:

- Heat the soldered part well, and flow the solder on the side the plate, take care not to flow it into the terminal lead wire.
- Take care not to flow the solder into the field.



Brush Springs

INSPECT BRUSH SPRING LOAD

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

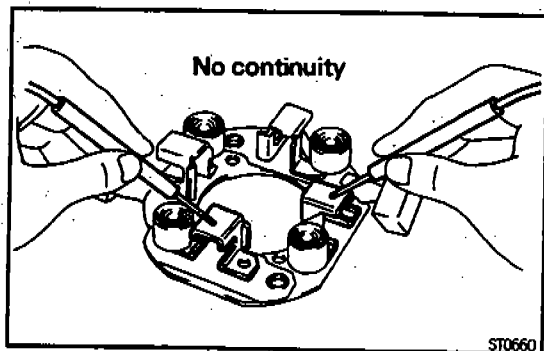
Spring installed load:

13.7 - 17.6 N (1.4 - 1.8 kgf, 3.1 - 4.0 lbf)

Minimum spring installed load:

8.8 N (0.9 kgf, 2.0 lbf)

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 planetary gear, internal gear and starter clutch for wear or damage.

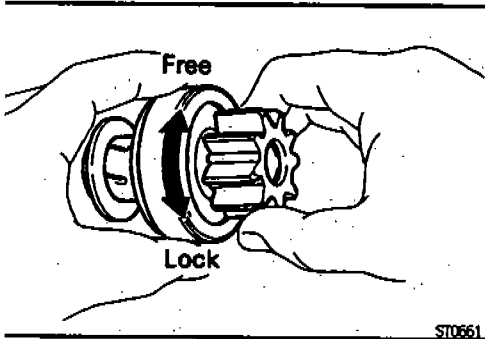
If the gear is damaged, replace it.

If the starter clutch teeth are damaged, replace the starter clutch and also inspect the flywheel ring gear for wear or damage.

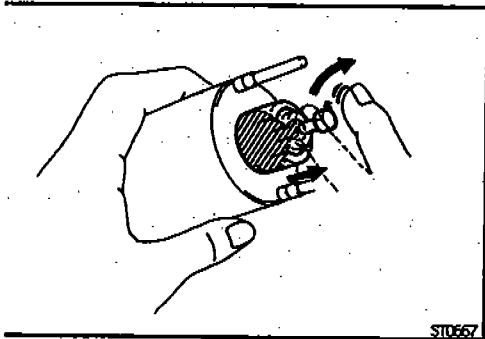
2. INSPECT STARTER CLUTCH

Rotate the clutch pinion gear clockwise and check that it turns freely. Try to rotate the clutch pinion gear counter-clockwise and check that it locks.

If necessary, replace the starter clutch.



ST0661



ST0667

Magnetic Switch**1. INSPECT PLUNGER**

Push in the plunger and replace it.

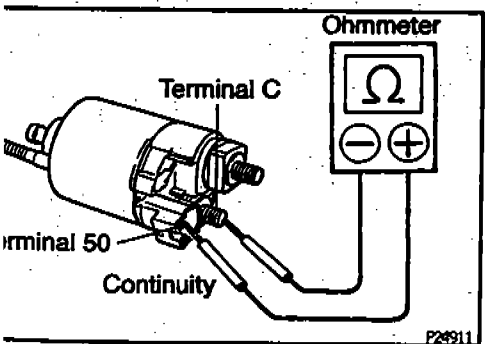
Check that it returns quickly to its original position.

If necessary, replace the magnetic switch.

2. 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, replace the magnetic switch.

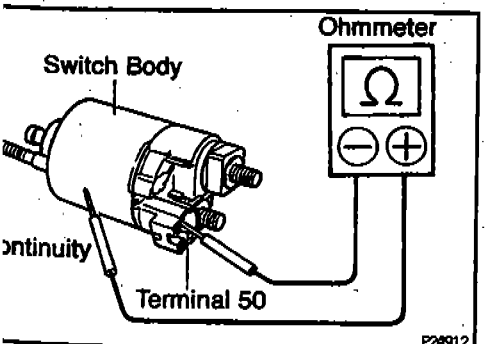


P28911

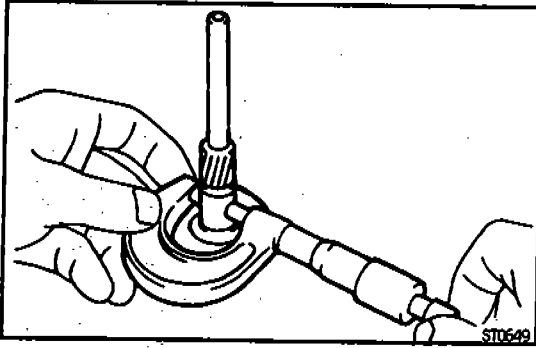
3. DO HOLD-IN COIL OPEN CIRCUIT TEST

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

If there is no continuity, replace the magnetic switch.



P28912



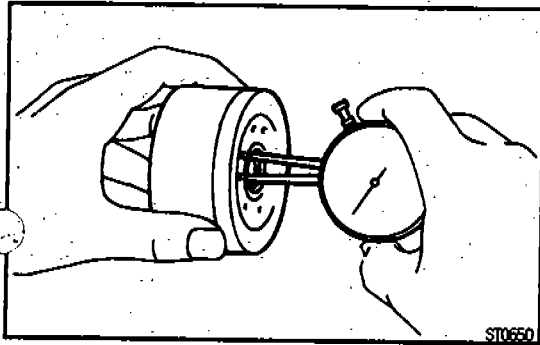
Planetary Shaft and Center Bearing

1. INSPECT PLANET CARRIER SHAFT AND CENTER BEARING

- (a) Using a micrometer, measure the outer diameter of the surface in contact with the center bearing of the planetary shaft.

Standard shaft diameter:

14.982 – 15.000 mm (0.5898 – 0.5906 in.)



- (b) Using a caliper gauge, measure the inside diameter of the center bearing.

Center bearing inside diameter:

15.008 – 15.050 mm (0.5909 – 0.5925 in.)

- (c) Subtract the planetary shaft diameter from the bearing inside diameter measurement.

Standard center bearing oil clearance:

0.01 – 0.06 mm (0.0004 – 0.0024 in.)

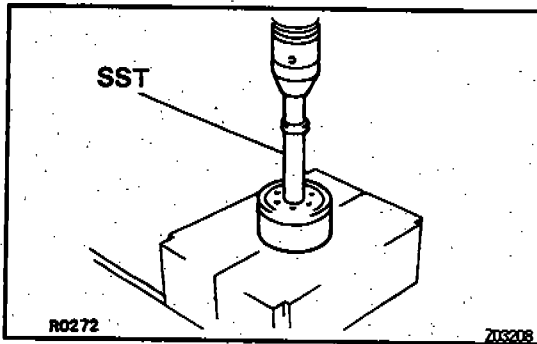
Maximum center bearing oil clearance:

0.2 mm (0.008 in.)

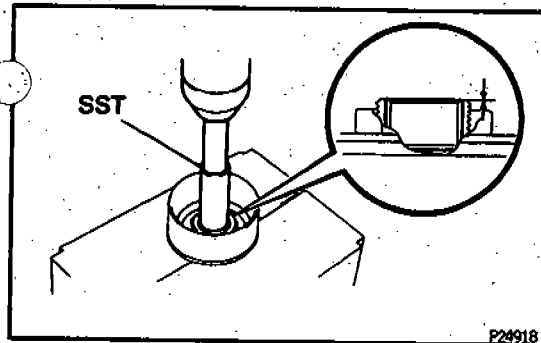
If the clearance is greater than maximum, replace the planetary shaft and center bearing.

2. IF NECESSARY, REPLACE CENTER BEARING

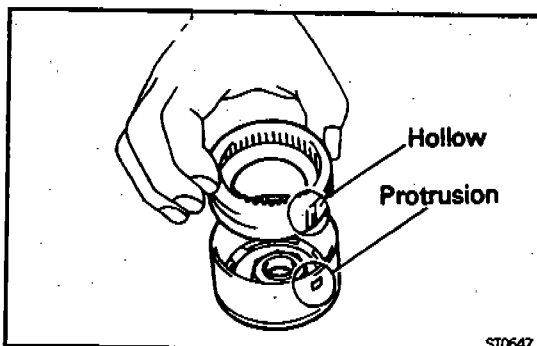
- (a) Using SST and press, press out the center bearing.
SST 09221-25026 (09221-00090)



- (b) Using SST and a press in a new center bearing to the position shown in the illustration.
SST 09221-25026 (09221-00071)



- (c) Align the hollow of the internal gear with the protrusion on the side the shock absorber, and remove the internal gear.



REASSEMBLY

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

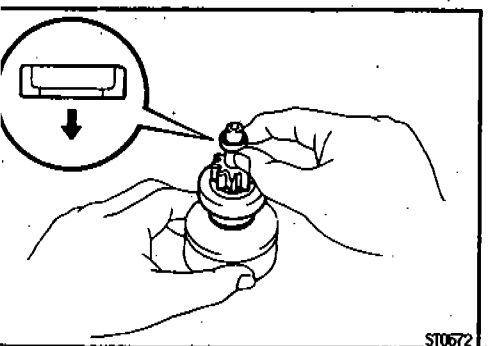
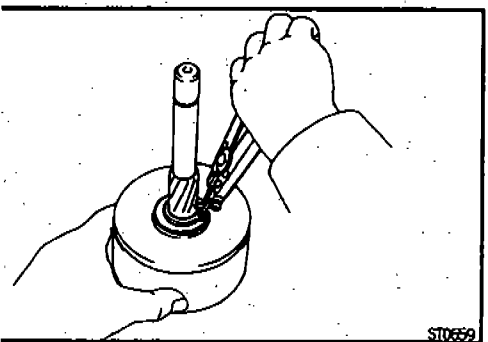
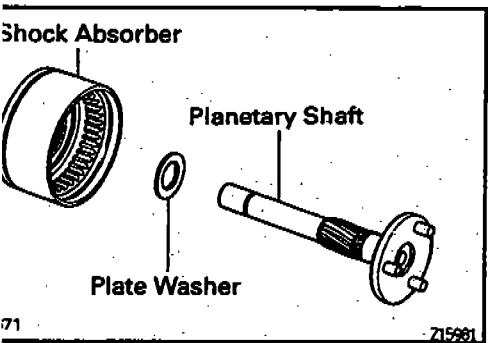
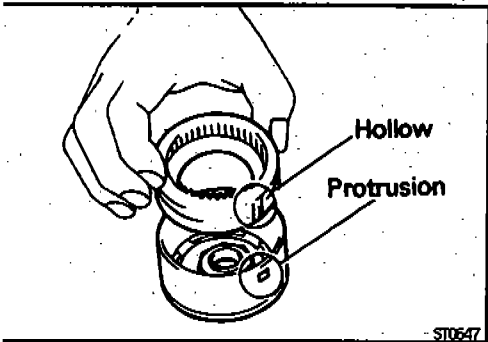
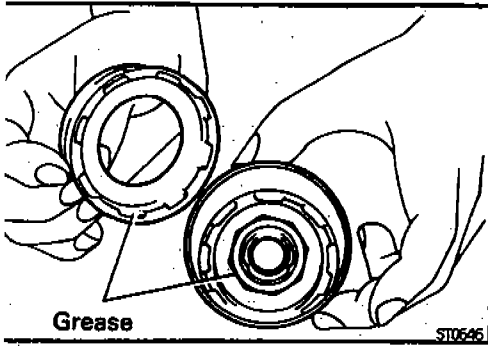
1. INSTALL INTERNAL GEAR AND PLANETARY SHAFT

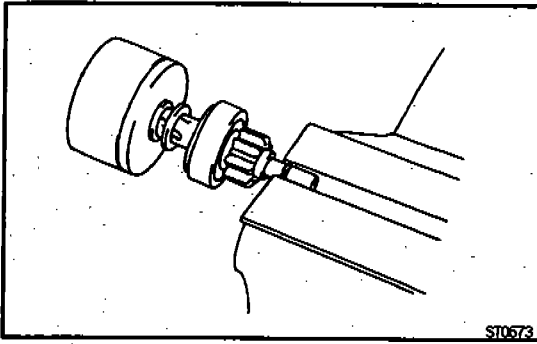
- (a) Apply grease to the internal gear touching the sock absorber and planetary gears.
- (b) Align the hollow of the internal gear with the protrusion inside the shock absorber.
- (c) Insert and turn the internal gear so that it interlocks with the shock absorber.
- (d) Apply turbine oil with additives to the center bearing.
- (e) Apply grease to the plate washer, and install it to the planetary shaft.
- (f) Install the planetary shaft to the shock absorber.

- (g) Using snap ring pliers, install the plate washer and snap ring.

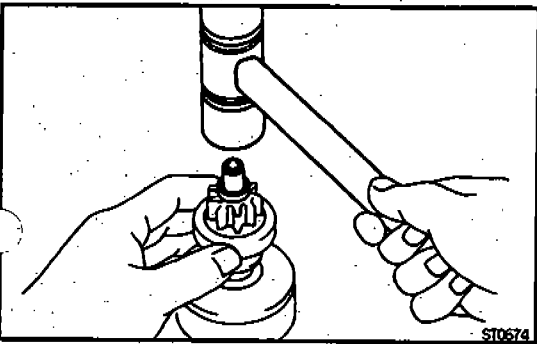
2. INSTALL STARTER CLUTCH

- (a) Apply grease to the bushing and spline of the starter clutch and stop collar.
- (b) Place the starter clutch and stop collar on the planetary shaft.

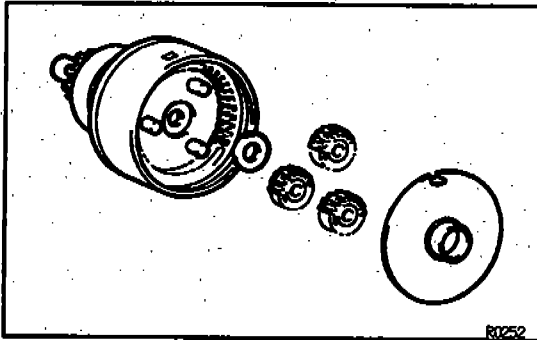




- (c) Apply grease to the snap ring, and install it to the planetary shaft groove.
- (d) Using a vise, compress the snap ring.

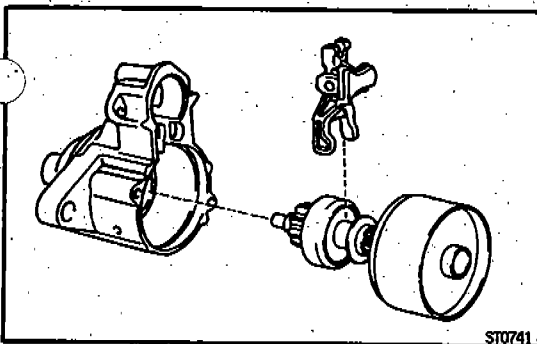


- (e) Hold the starter clutch, tap the planetary shaft and install the stop collar onto the snap ring with a plastic-faced hammer.



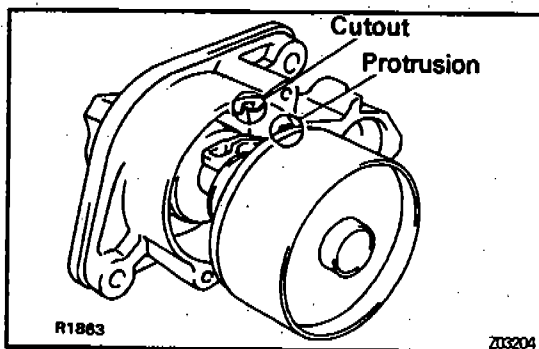
3. INSTALL PLANETARY GEARS

- (a) Apply grease to the planetary gears and flange pin parts of the planetary shaft.
- (b) Install the plate washer and 3 planetary gears.
- (c) Align the cutout of the plate with the protrusion inside the shock absorber, and install the plate.

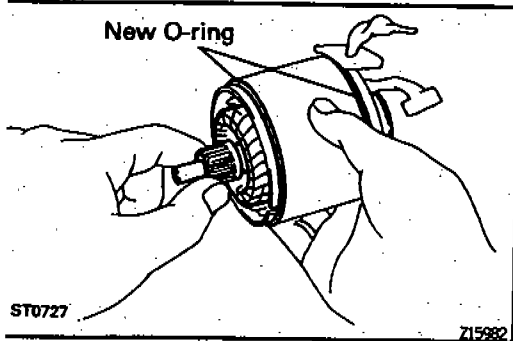


4. INSTALL DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER

- (a) Apply turbine oil with additives to the bearing of the starter housing.
- (b) Apply grease to the drive lever touching the starter pivot part of the drive lever.
- (c) Install the drive lever to the starter clutch.



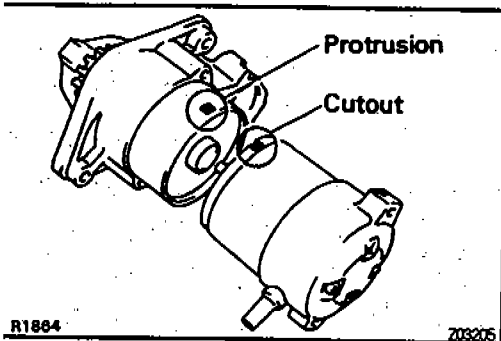
- (d) Align the protrusion of the shock absorber with the cutout of the starter housing and install them.



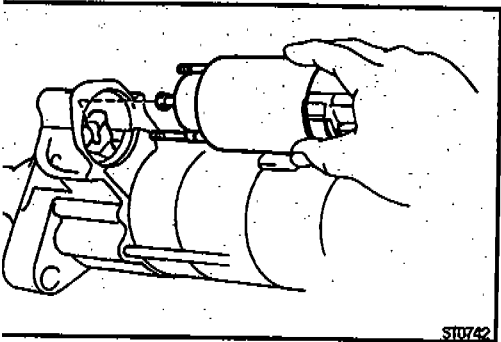
5. **INSTALL 2 NEW O-RINGS TO FIELD FRAME**
6. **PLACE ARMATURE INTO FIELD FRAME**
7. **INSTALL BRUSH HOLDER**
 - (a) Place the brush holder in position on the armature.
 - (b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the 4 brushes.

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

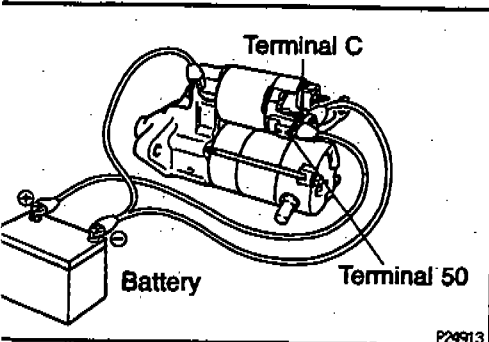
8. **INSTALL COMMUTATOR END FRAME**
 - (a) Apply turbine oil with additives to the bearing of the end frame.
 - (b) Install the end frame with the 2 screws.
Torque: 1.5 N·m (15 kgf·cm, 13 in.-lbf)
- NOTICE: To avoid interference between the brush holder and the dust protector pull the commutator end frame away at an angle.



9. **INSTALL FIELD FRAME AND ARMATURE ASSEMBLY**
 - (a) Align the cutout of the field frame with the protrusion of the shock absorber.
 - (b) Install the field frame and armature assembly with the 2 through bolts.
Torque: 5.9 N·m (60 kgf·cm, 52 in.-lbf)



10. **INSTALL MAGNETICS SWITCH**
 - (a) Install the plunger cover to the magnetic switch.
 - (b) Hang the plunger of the magnetic switch to the drive lever from the upper side.
 - (c) Install the magnetic switch with the 2 nuts.
Torque: 8.3 N·m (85 kgf·cm, 73 in.-lbf)
 - (d) Connect the lead wire to the terminal, and install the nut.
Torque: 9.8 N·m (100 kgf·cm, 87 in.-lbf)

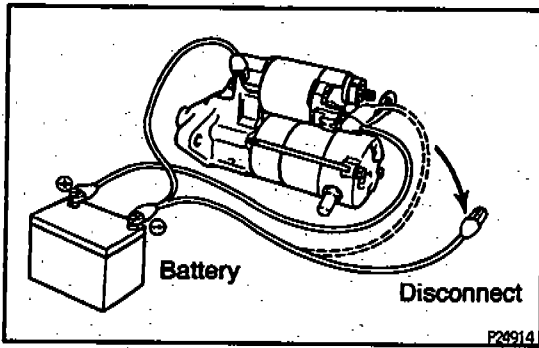


TEST

ST06C-0P

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

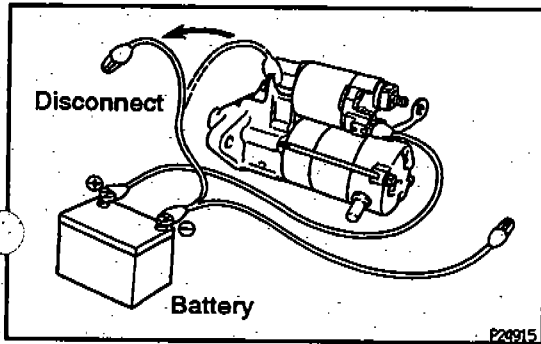
1. **DO PULL-IN TEST**
 - (a) Disconnect the field coil lead from terminal C.
 - (b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward. If the clutch pinion gear does not move, replace the magnetic switch.



2. DO HOLD-IN TEST

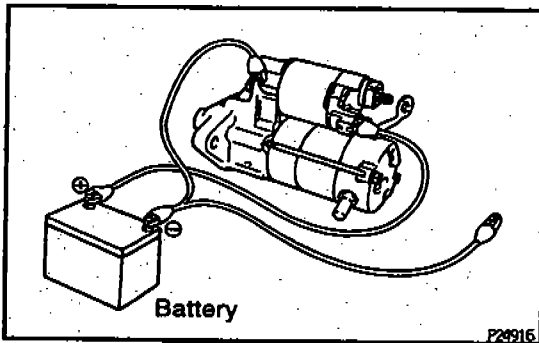
With the battery connected as above and with the clutch pinion gear out disconnect the negative (-) lead from terminal C.

Check that the clutch pinion gear remains out. If the clutch pinion gear returns inward, replace the magnetic switch.



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.



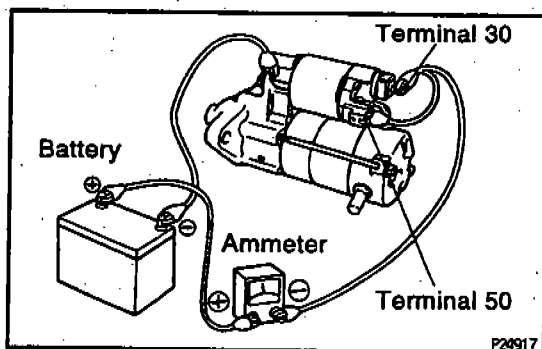
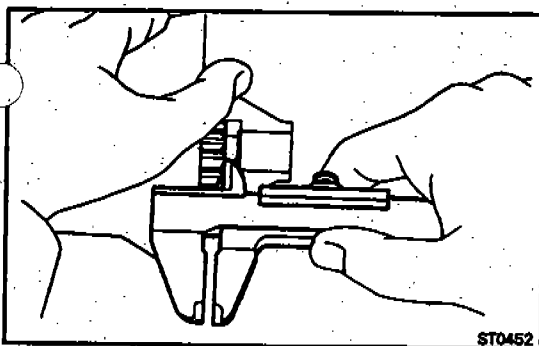
4. INSPECT CLUTCH PINION GEAR CLEARANCE

(a) Connect the battery to the magnetic switch as shown.

(b) Move the pinion gear toward the armature to remove slack and measure the clearance between the pinion gear end and stop collar.

Standard clearance:

1-5 mm (0.04-0.20 in.)



5. DO NO-LOAD PERFORMANCE TEST

(a) Connect the field coil lead to terminal C. Make sure the lead is not grounded.

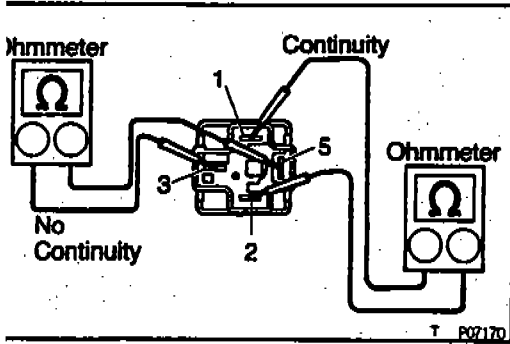
(b) Connect the battery and ammeter to the starter as shown.

(c) Check that the starter rotates smoothly and steadily with the clutch pinion gear moving out.

Check that the ammeter reads the specified current.

Specified current:

At 11.5 V: Less than 90 A



STARTER RELAY

ST-13-01

1. REMOVE STARTER RELAY (Marking: "ST")

2. INSPECT RELAY CONTINUITY

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

If there is no continuity, replace the relay.

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

If there is continuity, replace the relay.

3. INSPECT RELAY OPERATION

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

- (b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

4. REINSTALL STARTER RELAY

