

# STARTING SYSTEM

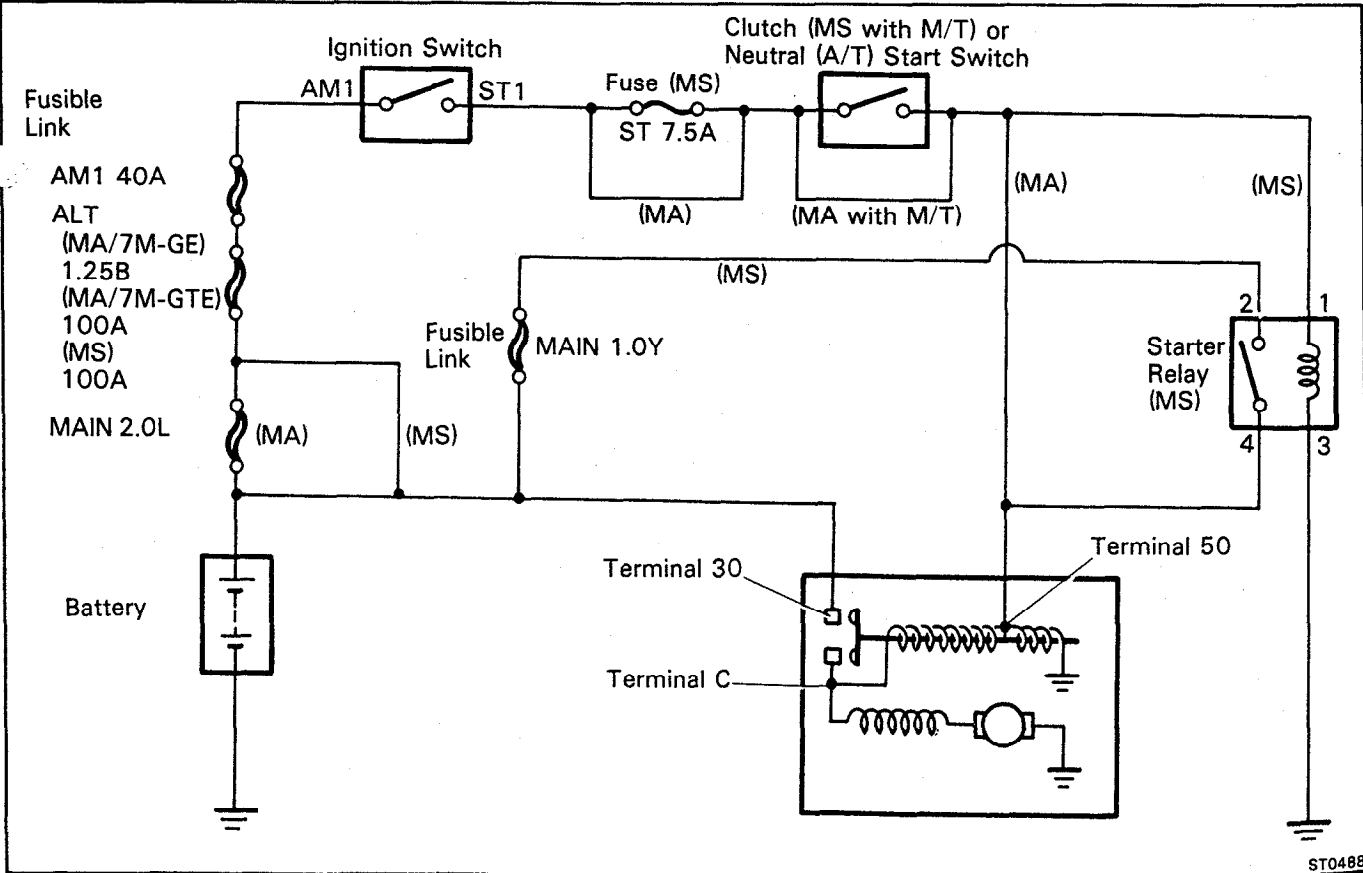
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STARTER RELAY (MS) .....	ST-13

**ST**

TROUBLESHOOTING

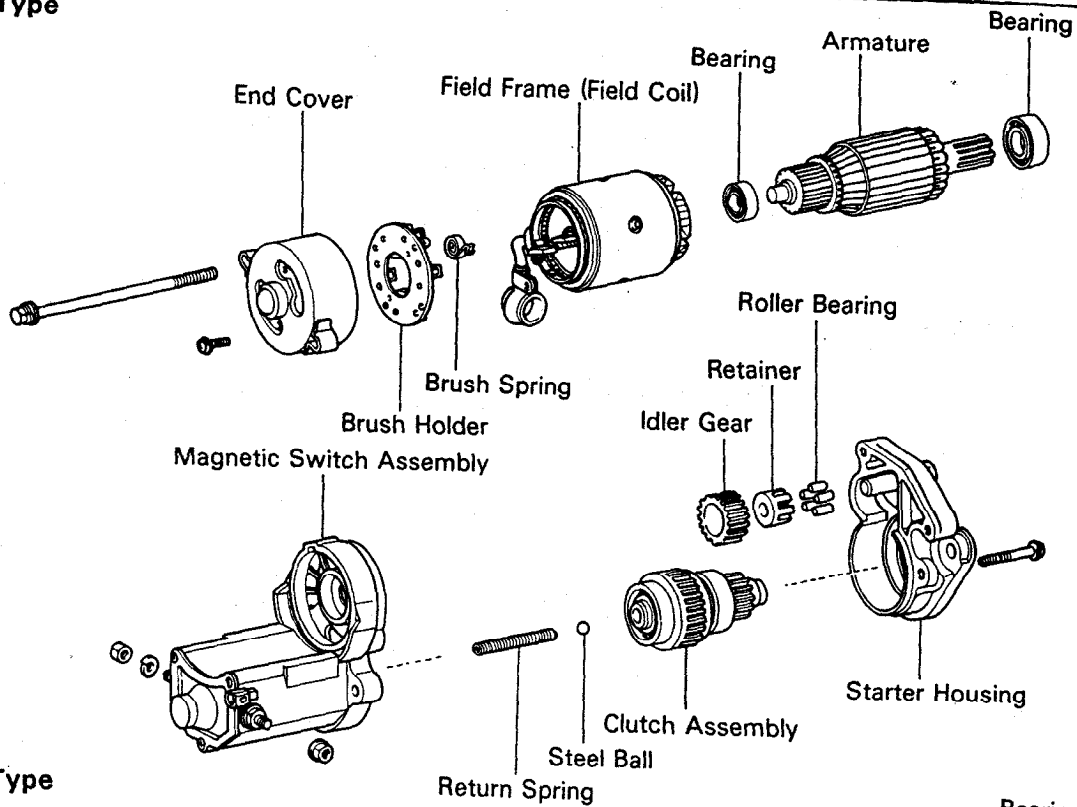
Problem	Possible cause	Remedy	Page
Engine will not crank	Battery charge low	Check battery specific gravity Charge or replace battery	CH-3
	Battery cables loose, corroded or worn Neutral start switch faulty (A/T only) Fusible link blown Starter relay faulty (MS only) Starter faulty Ignition switch faulty	Repair or replace cables Replace switch Replace fusible link Replace starter relay Repair starter Replace ignition switch	ST-3
Engine cranks slowly	Battery charge low	Check battery specific gravity Charge or replace battery	CH-3
	Battery cables loose, corroded or worn Starter faulty	Repair or replace cables Repair starter	ST-3
Starter keeps running	Starter faulty Ignition switch faulty Short in wiring	Repair starter Replace ignition switch Repair wiring	ST-3
Starter spins – engine will not crank	Pinion gear teeth broken or faulty starter Flywheel teeth broken	Repair starter Replace flywheel	ST-3

STARTING SYSTEM CIRCUIT

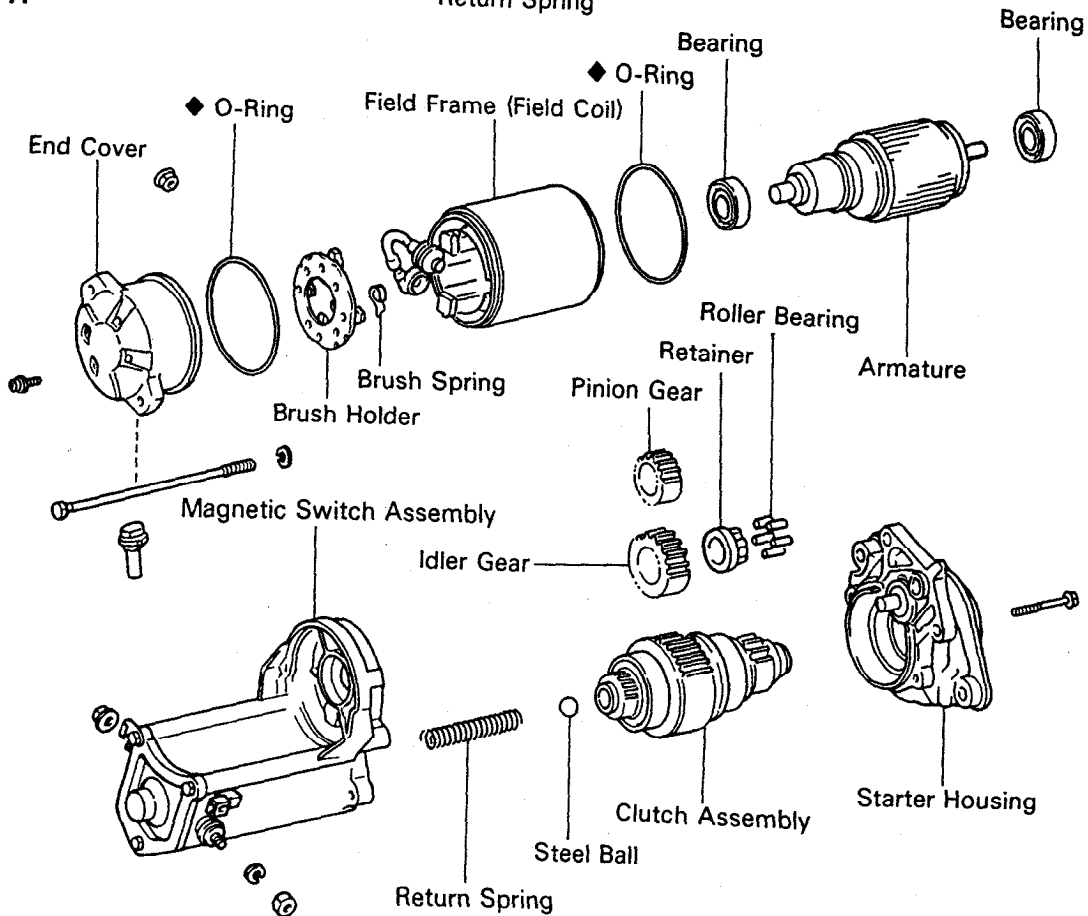


# STARTER COMPONENTS

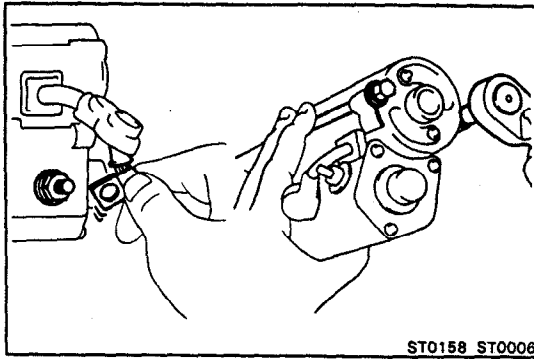
## 1.0 kW Type



## 1.4 kW Type



◆ Non-reusable part

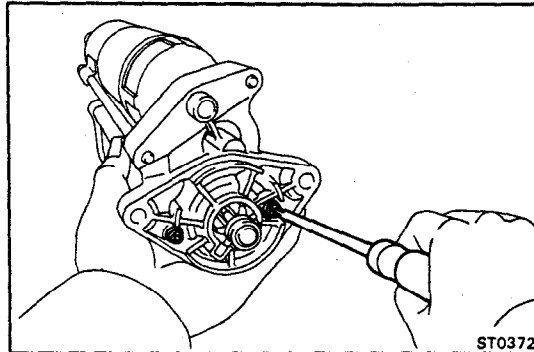


## DISASSEMBLY OF STARTER

(See page ST-3)

### 1. REMOVE FIELD FRAME WITH ARMATURE FROM MAGNETIC SWITCH ASSEMBLY

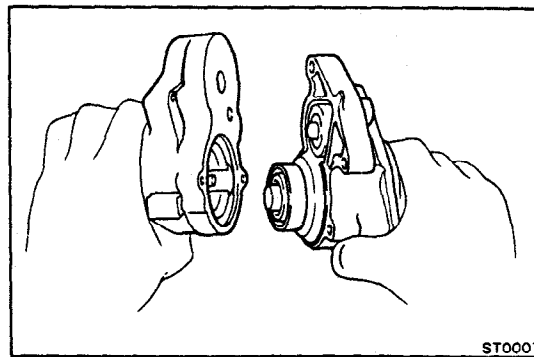
- (a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
- (b) Remove the two through bolts. Pull out the field frame with the armature from the magnetic switch assembly.
- (c) Remove the O-ring. (1.4 kW type only)



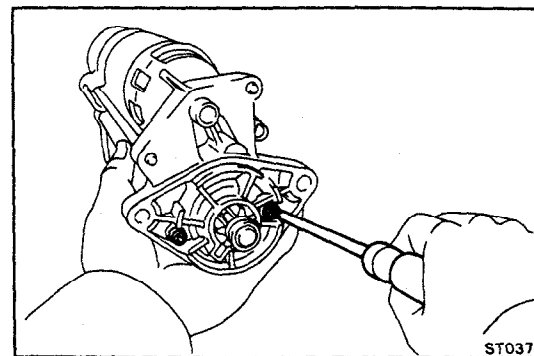
### 2. REMOVE STARTER HOUSING FROM MAGNETIC SWITCH ASSEMBLY

(1.0 kW type)

- (a) Remove the two screws

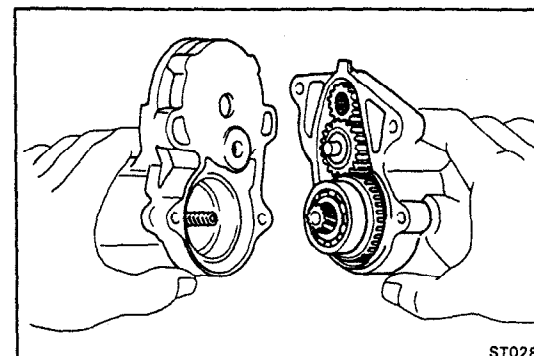


- (b) Remove the starter housing with the idler gear, bearing and clutch assembly.

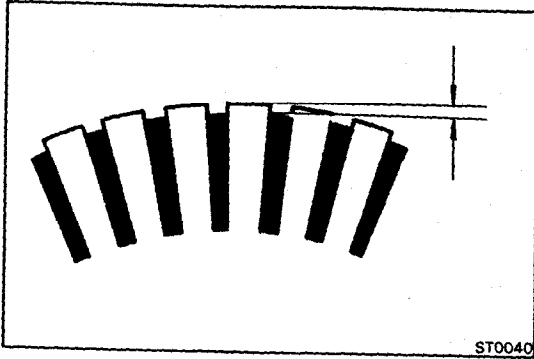


(1.4 kW type)

- (a) Remove the two screws



- (b) Remove the starter housing with the pinion gear, idler gear, bearing and clutch assembly.



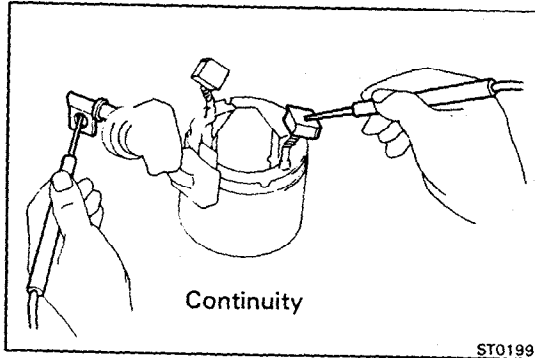
#### 4. INSPECT UNDERCUT DEPTH OF SEGMENT

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.

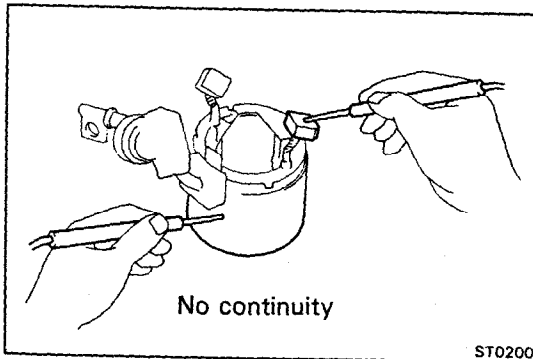


### Field Frame (Field Coil)

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

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

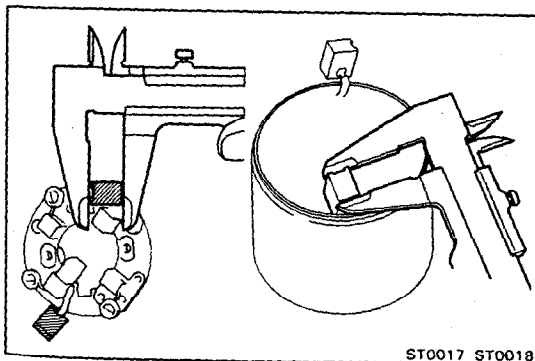
If there is no continuity, replace the field frame.



#### 2. INSPECT 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.



### Brushes

#### INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

**Standard length:**

1.0 kW type 13.5 mm (0.531 in.)

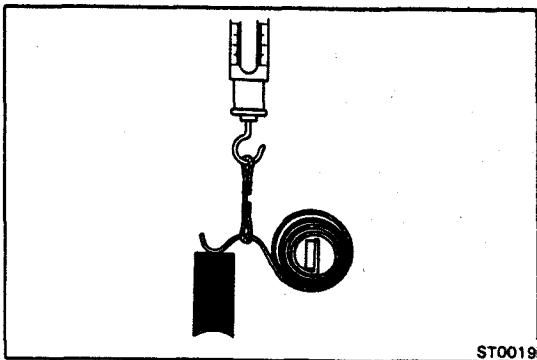
1.4 kW type 15.5 mm (0.610 in.)

**Minimum length:**

1.0 kW type 8.5 mm (0.335 in.)

1.4 kW type 10.0 mm (0.394 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.

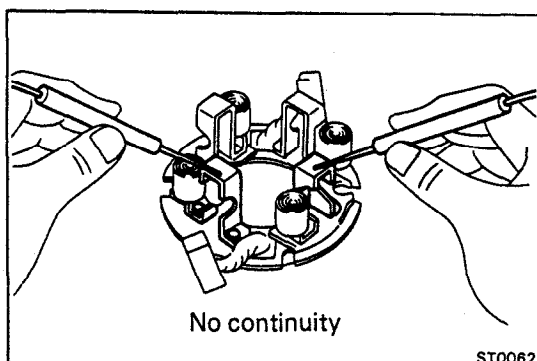
**Standard installed load:**

1.785 – 2.415 kg (3.9 – 5.3 lb, 18 – 24 N)

**Minimum installed load:**

1.2 kg (2.6 lb, 12 N)

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



## Brush Holder

### 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.

## Clutch and Gears

### 1. INSPECT GEAR TEETH

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

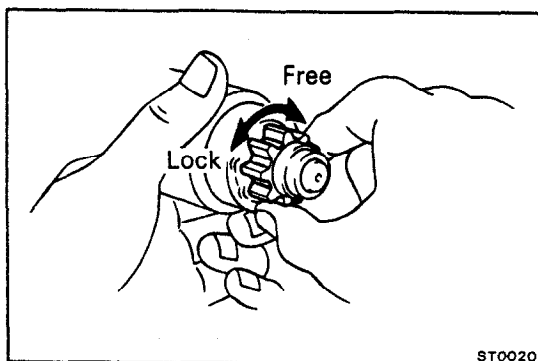
If damaged, replace the gear or clutch assembly.

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

### 2. INSPECT CLUTCH

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

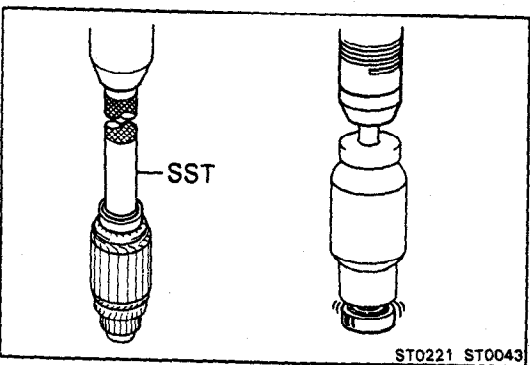
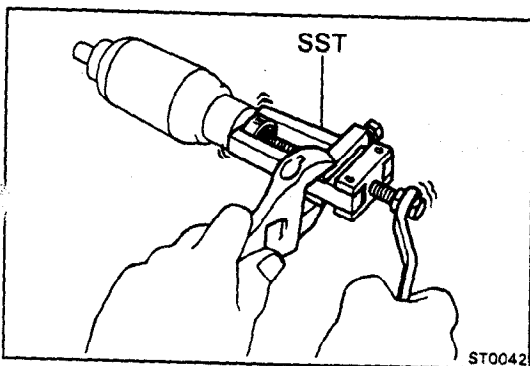
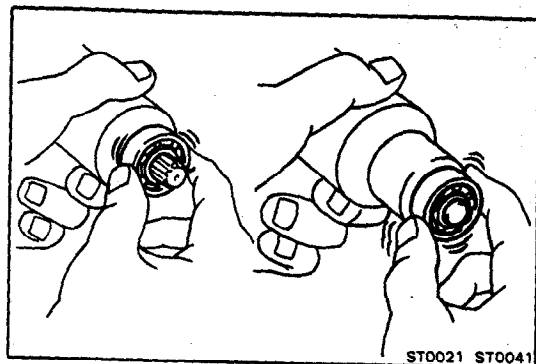
If necessary, replace the clutch assembly.



## 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) Using SST, remove the bearing.

SST 09286-46011

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

SST 1.0 kw type 09285-76010

1.4 kw type 09201-41020

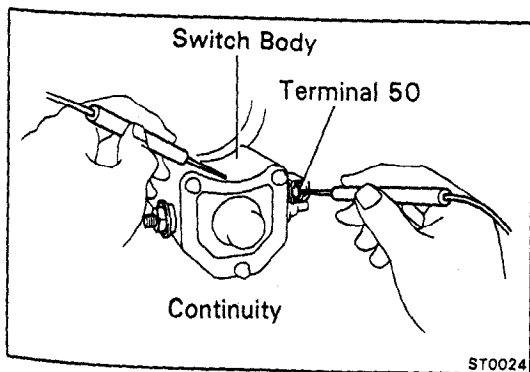
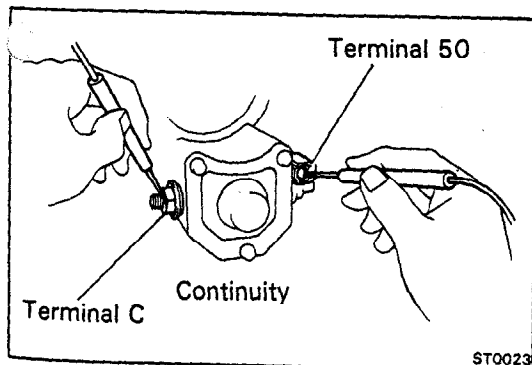
(c) Using a press, press in a new rear bearing.

## Magnetic Switch

### 1. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

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

If there is no continuity, replace the magnetic switch assembly.



### 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.

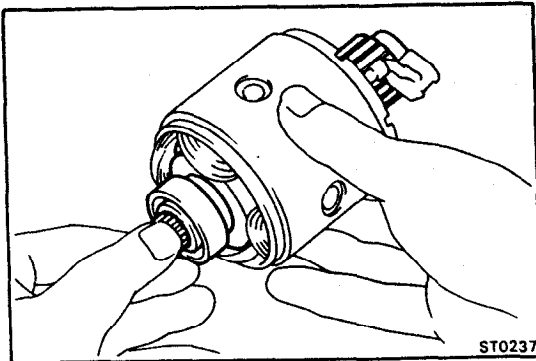
## ASSEMBLY OF STARTER

(See page ST-3)

**NOTE:** 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.

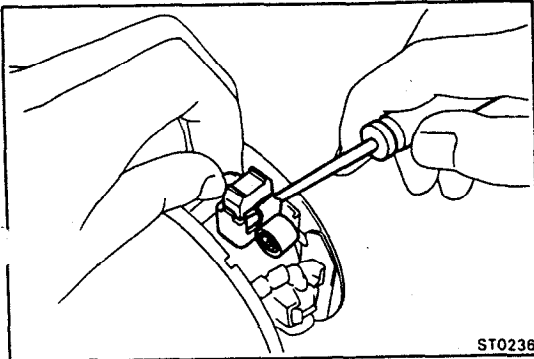


### 2. INSTALL BRUSH HOLDER

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

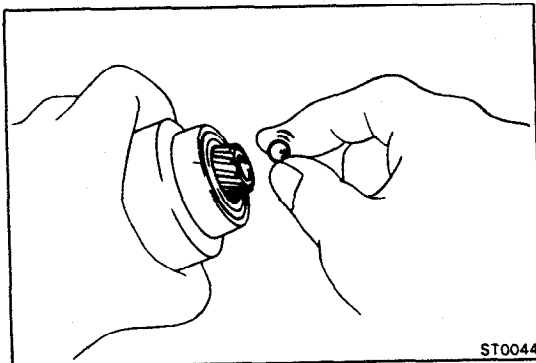
**NOTE:** Check that the positive (+) lead wires are not grounded.

- (b) Place a new O-ring on the field frame.(1.4 kW type only)
- (c) Install the end cover to the field frame.



### 3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

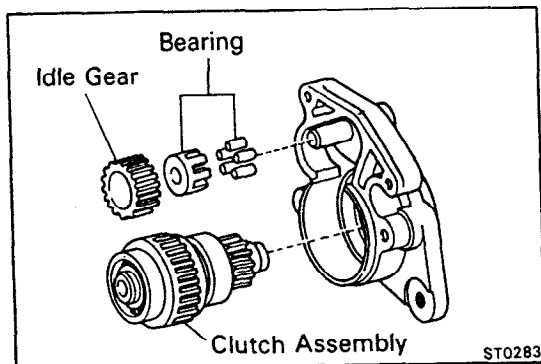
- (a) Apply grease to the steel ball.
- (b) Insert the steel ball into the clutch shaft hole.



### 4. INSTALL GEARS AND CLUTCH ASSEMBLY

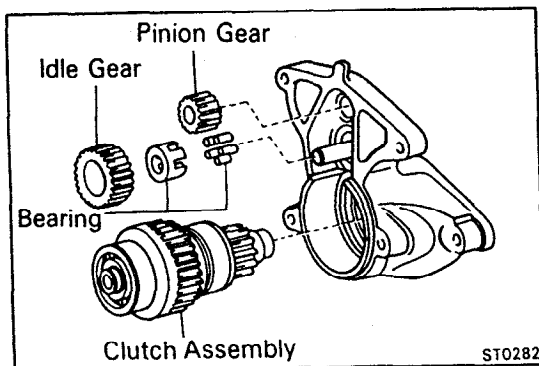
(1.0 kW type)

- (a) Apply grease to the gear and clutch assembly.
- (b) Place the clutch assembly, idler gear and bearing in the starter housing.



(1.4 kW type)

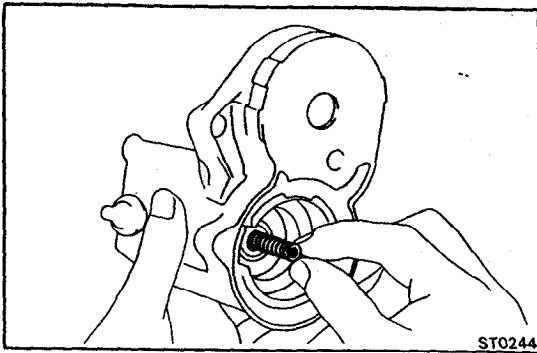
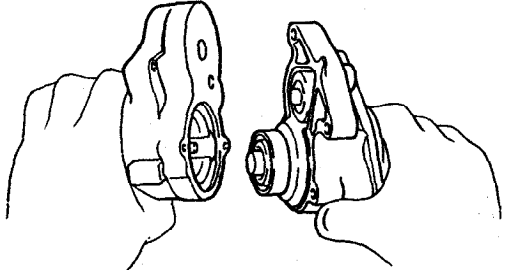
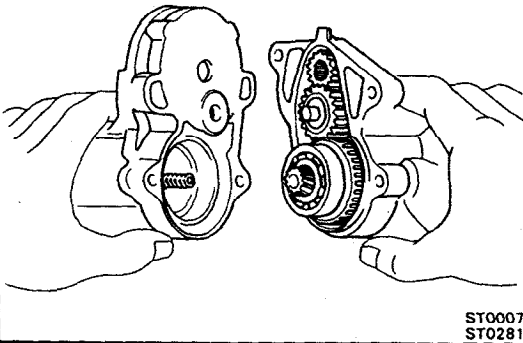
- (a) Apply grease to the gears and clutch assembly.
- (b) Place the clutch assembly, idler gear, bearing and pinion gear in the starter housing.





**5. INSTALL STARTER HOUSING**

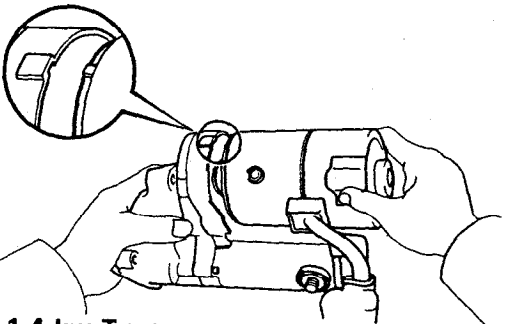
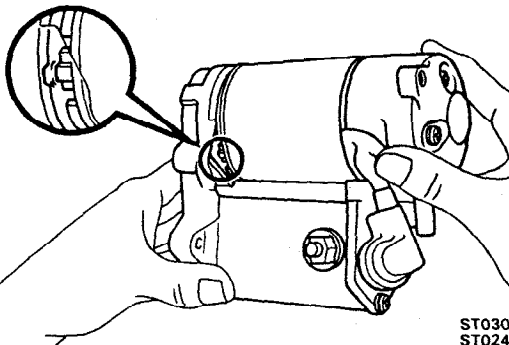
- (a) Apply grease to the return spring.
- (b) Insert the return spring into the magnetic switch hole.

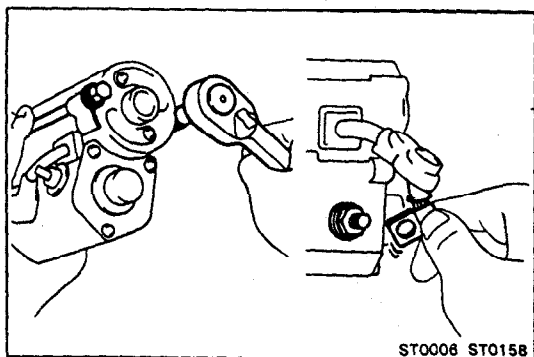
**1.0 kw Type****1.4 kw Type**

- (c) Place the starter housing on the magnetic switch and insert the two screws.

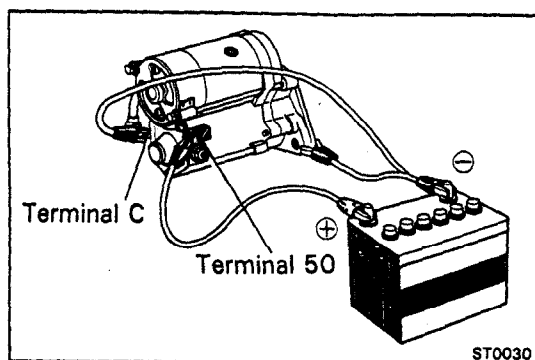
**6. INSTALL FIELD FRAME WITH ARMATURE TO MAGNETIC SWITCH ASSEMBLY**

- (a) Place a new O-ring on the field frame. (1.4 kW type only)
- (b) Align the protrusion of the field frame with the cutout of the magnetic switch.

**1.0 kw Type****1.4 kw Type**



- (c) Install the two through bolts.
- (d) Connect the lead wire to the magnetic switch terminal C, and install the nut.



## PERFORMANCE TEST OF STARTER

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

### 1. PERFORM PULL-IN TEST

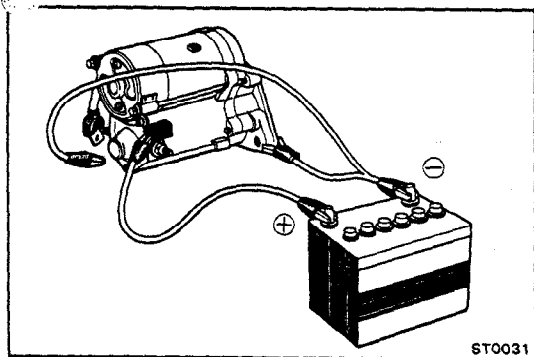
- (a) Disconnect the field coil lead wire from terminal C.
- (b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

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.

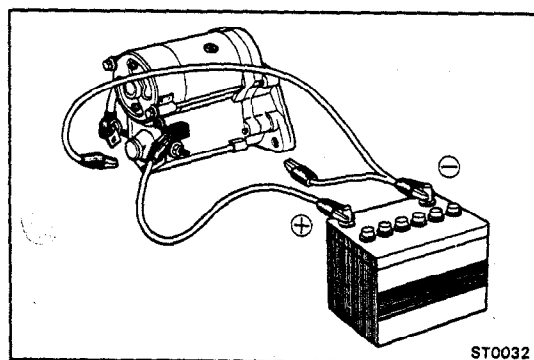
If the clutch pinion gear returns inward, replace the magnetic switch assembly.



### 3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body. Check that the clutch pinion gear returns inward.

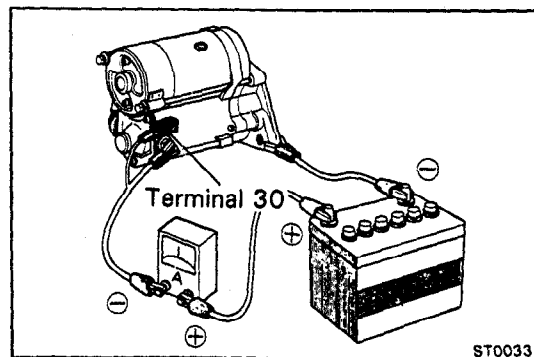
If the clutch pinion gear does not return, replace the magnetic switch assembly.



### 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 reads the specified current.

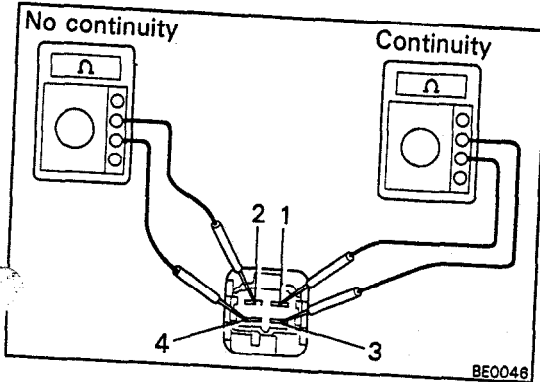
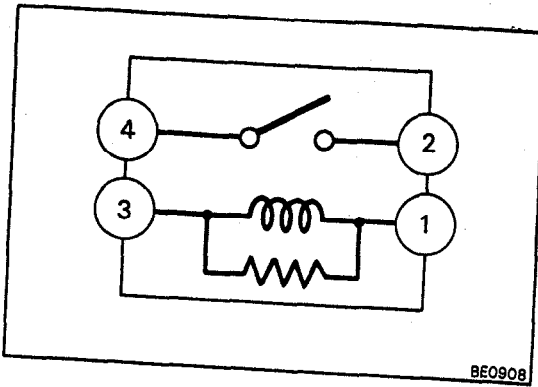
**Specified current: 90A or less at 11.5 V**



## STARTER RELAY (MS)

### INSPECTION OF STARTER RELAY

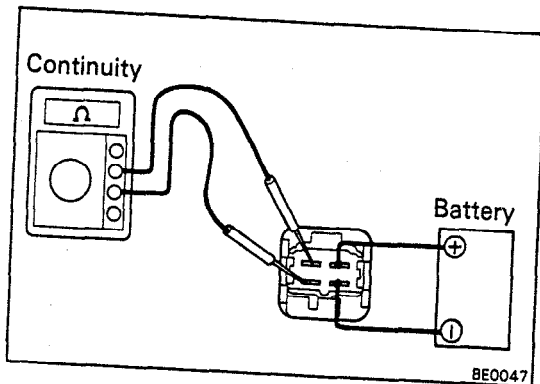
LOCATION: In the No. 2 relay block of the engine compartment.



#### 1. INSPECT RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- Check that there is no continuity between terminals 2 and 4.

If continuity is not as specified, replace the relay.



#### 2. INSPECT RELAY OPERATION

- Apply battery voltage across terminals 1 and 3.
- Using an ohmmeter, check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.