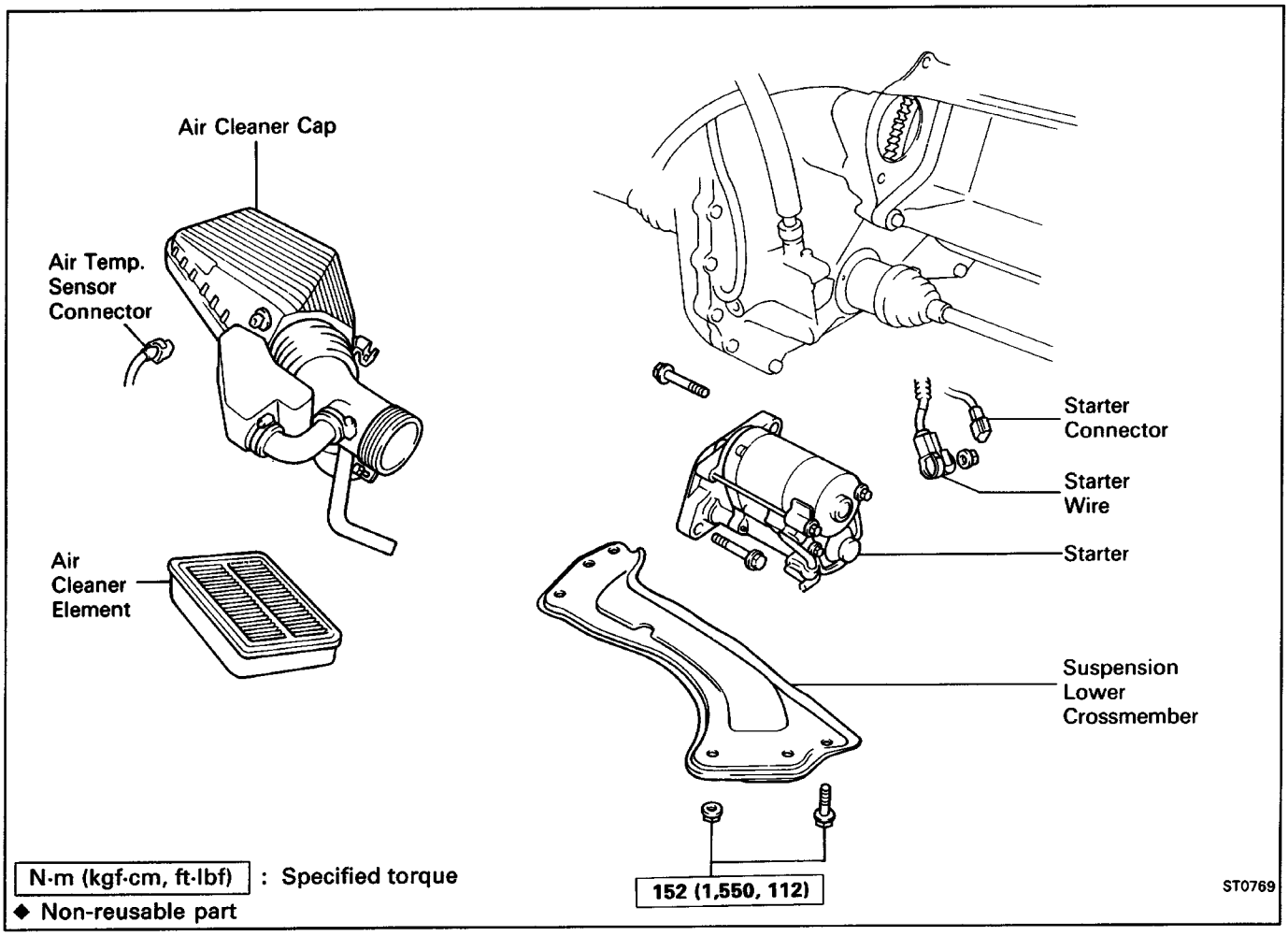
STARTER

REMOVAL OF STARTER (4A–FE)



1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

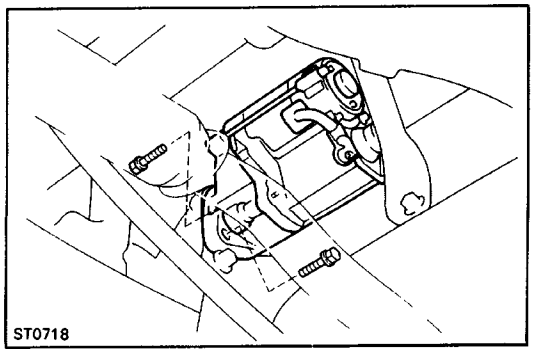
CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

2. REMOVE SUSPENSION LOWER CROSSMEMBER

(See step 24 on page EM–189)

3. REMOVE AIR CLEANER CAP

(See step 6 on page EM–185)



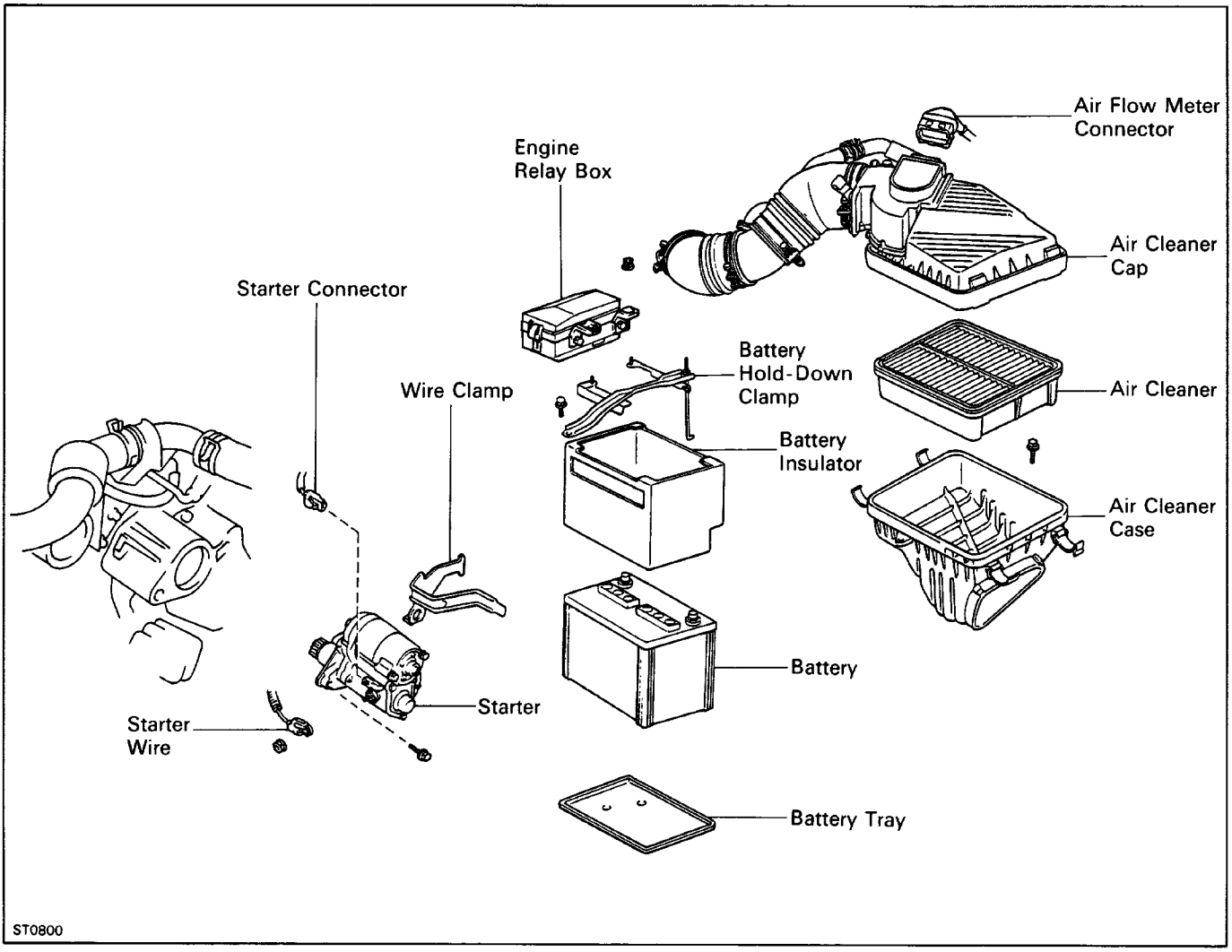
4. REMOVE STARTER

(a) Remove the two bolts holding the starter to the transaxle.

(b) Disconnect the starter connector.

(e) Remove the nut, and disconnect the starter wire. Remove the starter.

REMOVAL OF STARTER (3S–GTE)



1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) ter–minal cable is disconnected from the battery.

2. REMOVE AIR CLEANER

(See step 7 on page EM–224)

3. REMOVE ENGINE RELAY BOX

(See step 9 on page EM–224)

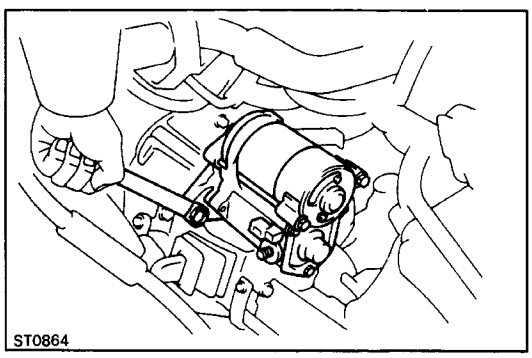
4. REMOVE BATTERY

5. REMOVE STARTER

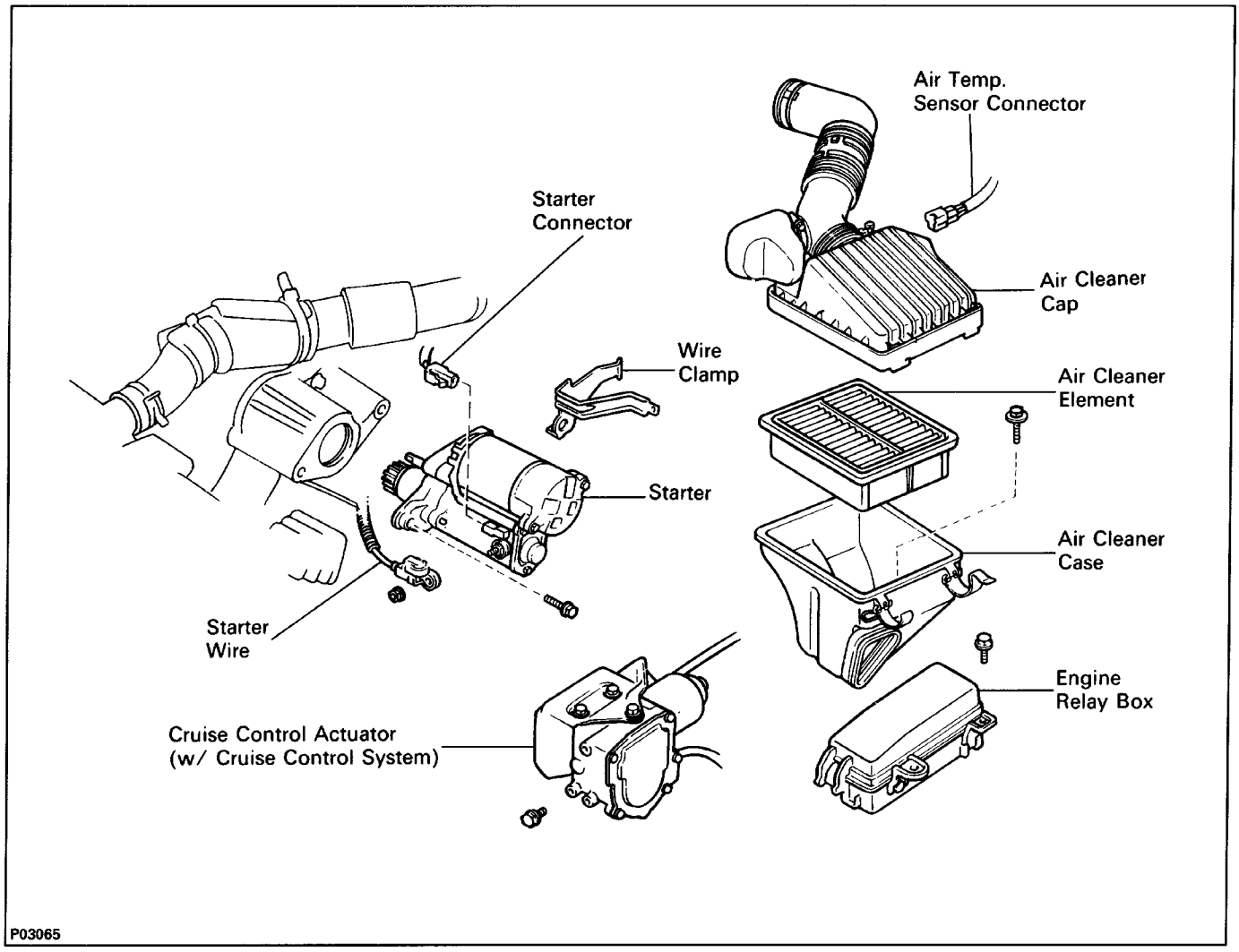
(a) Disconnect the starter connector.

(b) Remove the nut, and disconnect the starter wire.

(c) Remove the two bolts, wire clamp and starter.



REMOVAL OF STARTER (5S–FE)



1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

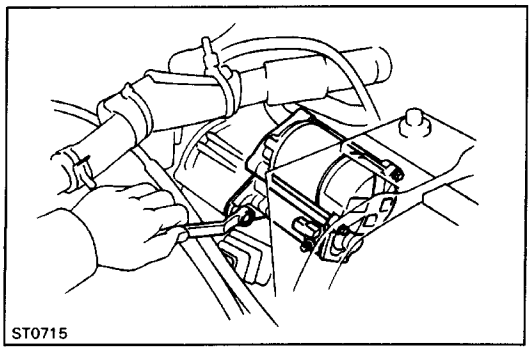
CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

2. REMOVE AIR CLEANER

(See step 6 on page EM–269)

3. REMOVE ENGINE RELAY BOX

(See step 8 on page EM–269)



4. (w/ CRUISE CONTROL SYSTEM (w/ ABS))

REMOVE CRUISE CONTROL ACTUATOR

(See step 10 on page EM–270)

5. REMOVE STARTER

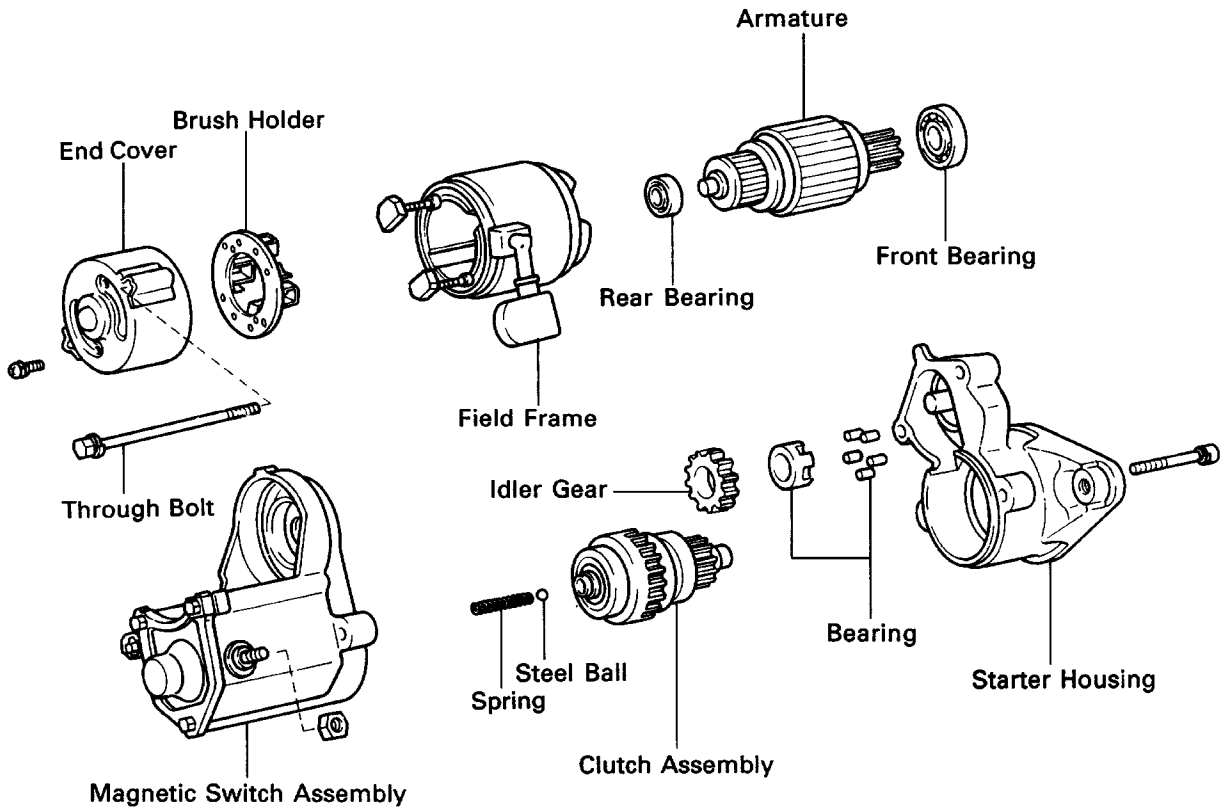
(a) Disconnect the starter connector.

(b) Remove the nut, and disconnect the starter wire.

(c) Remove the two bolts, wire clamp and starter.

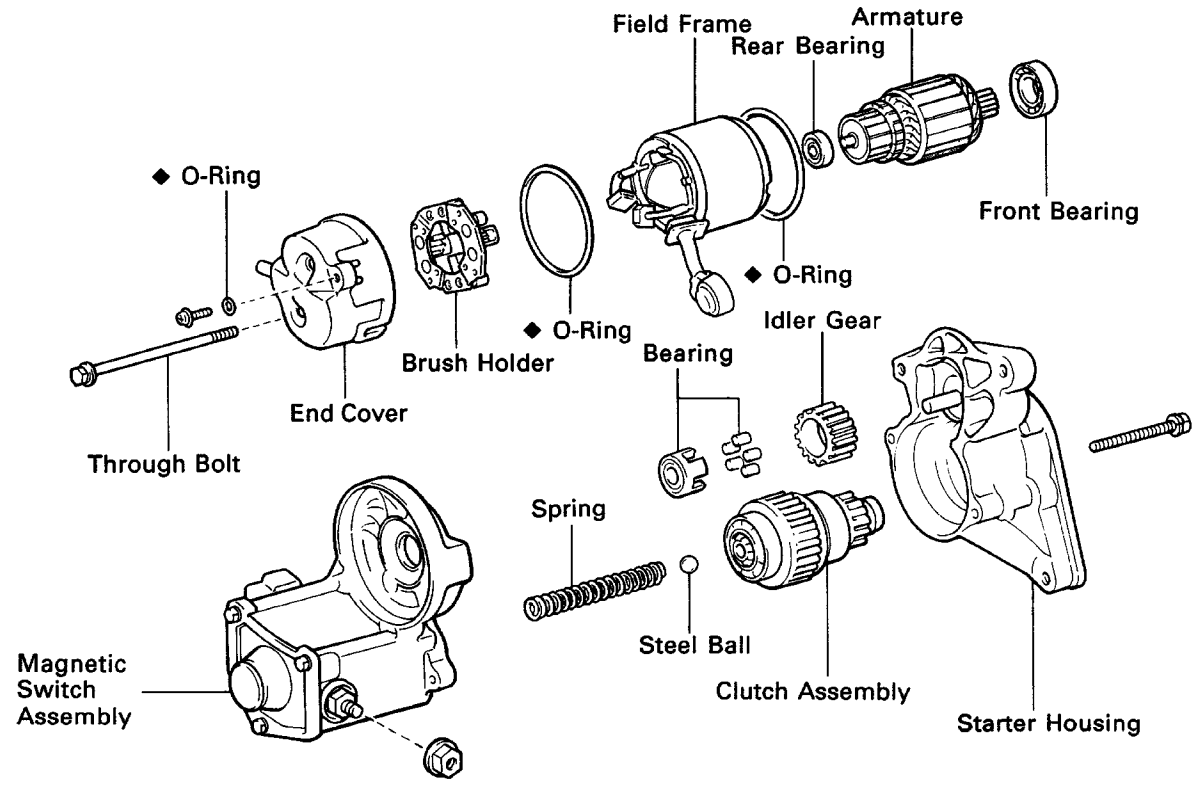
COMPONENTS

4A-FE (1.0 kW Type)



P02900

4A-FE (1.4 kW Type)

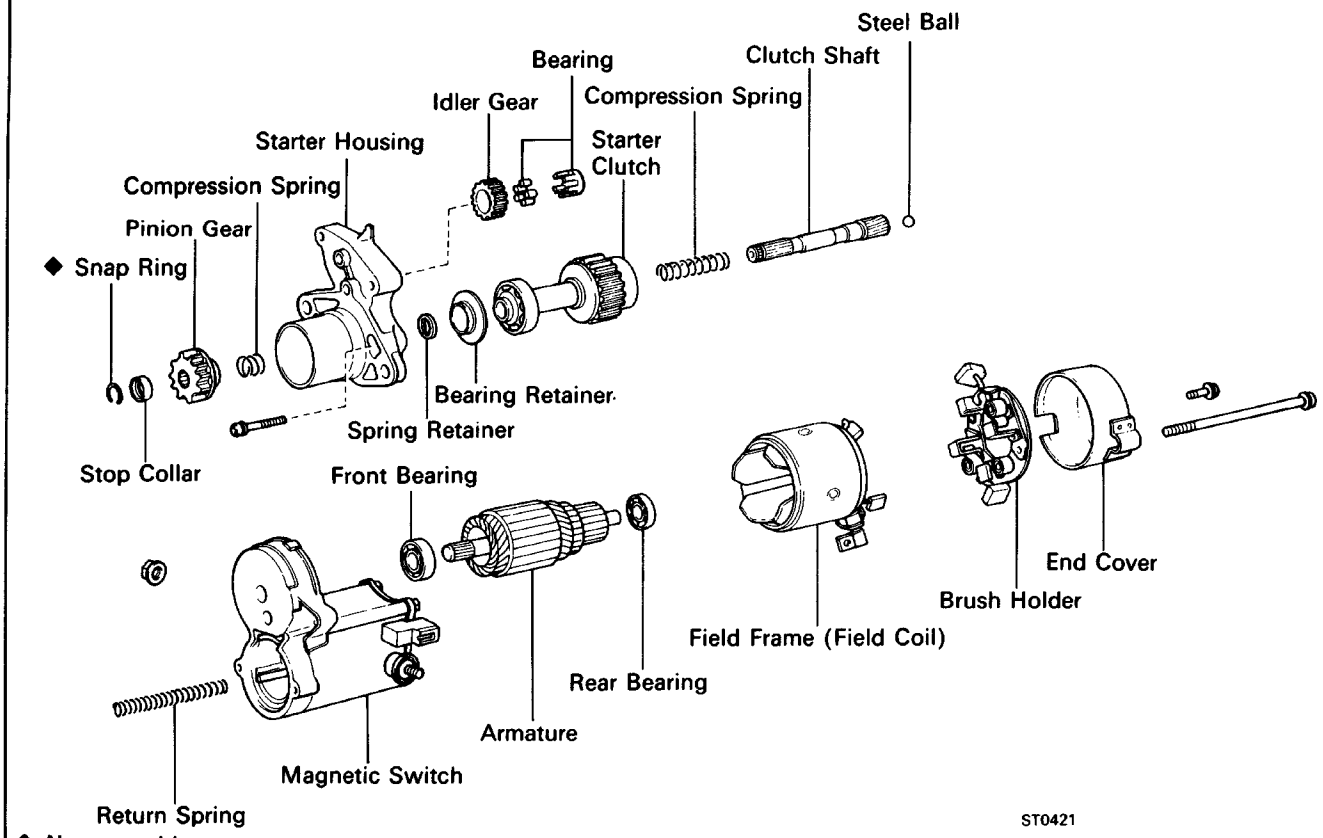


P02899

◆ Non-reusable part

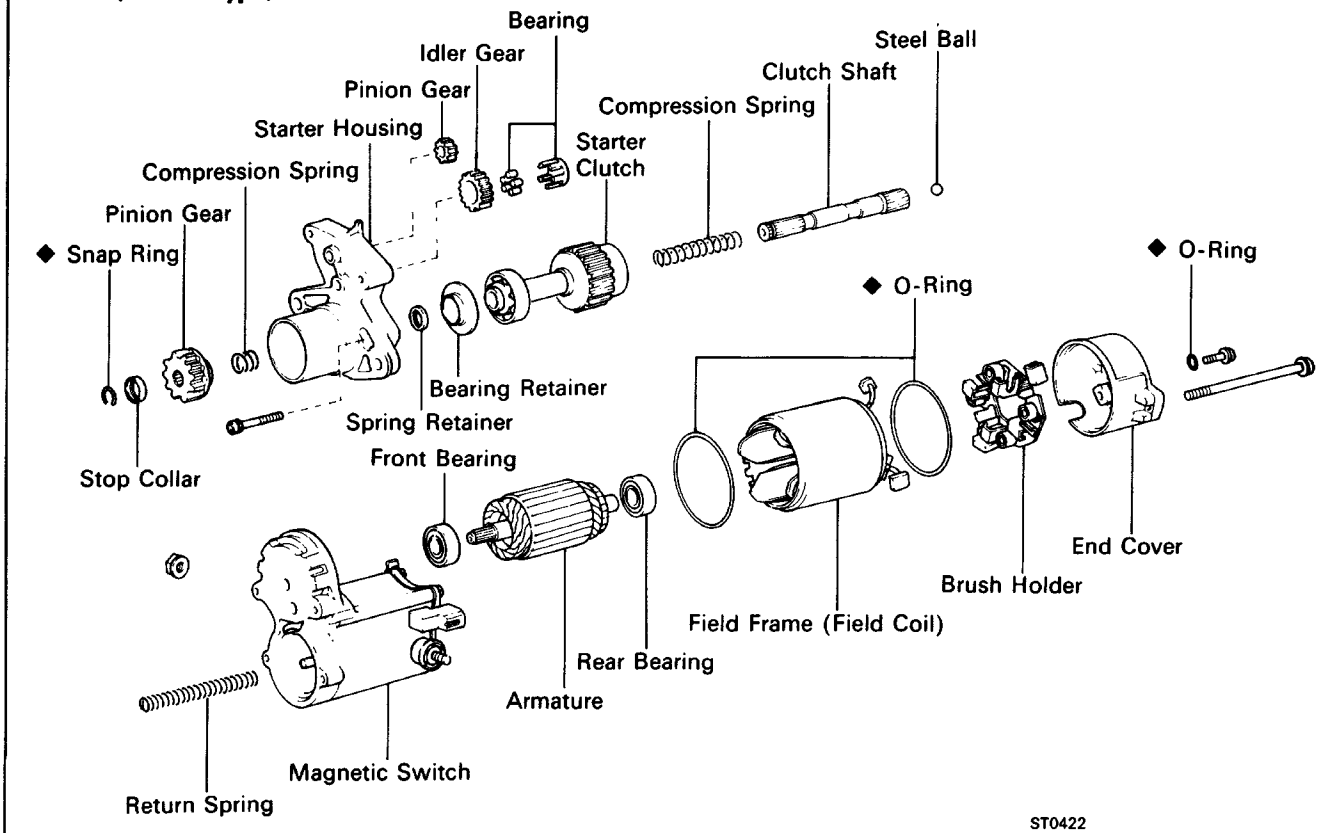
COMPONENTS (Cont'd)

3S-GTE (1.0 kW Type)

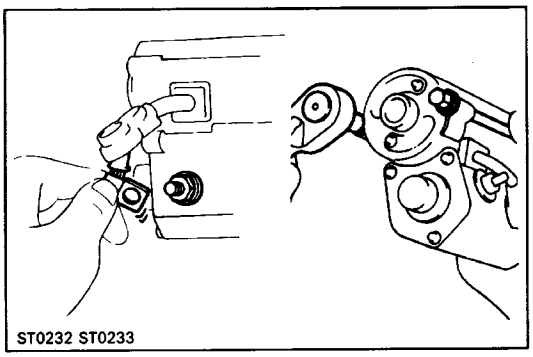


◆ Non-reusable part

3S-GTE (1.6 kW Type) and 5S-FE



◆ Non-reusable part



DISASSEMBLY OF STARTER

4A–FE (See page ST–6)

3S–GTE and 5S–FE (See page ST–7)

1. REMOVE FIELD FRAME AND ARMATURE

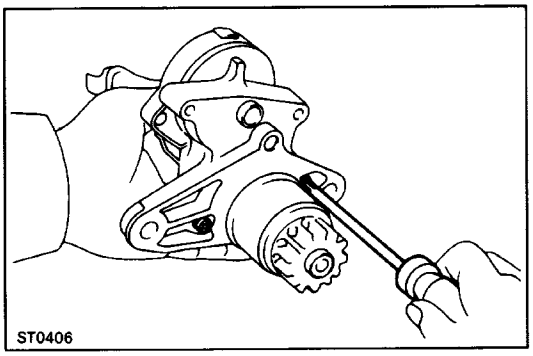
(a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.

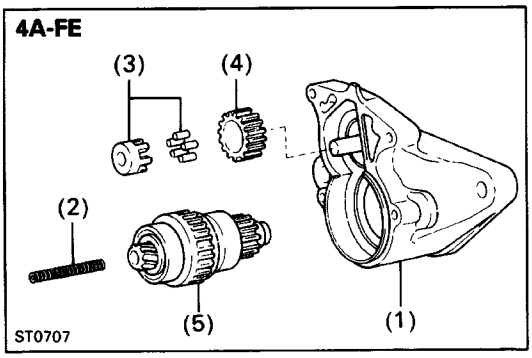
(b) Remove the two through bolts, and pull out the field frame together with the armature.

(c) (1.4 kW and 1.6 kW Types)
Remove the O–ring from the field frame.

2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS

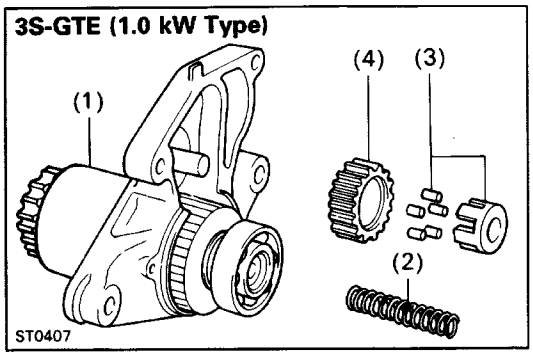
(a) Remove the two screws.



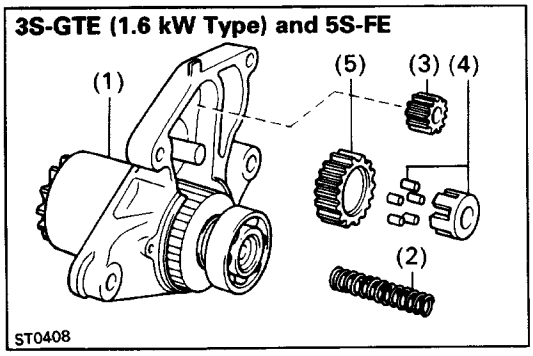


(b) Remove the following parts from the magnetic switch:

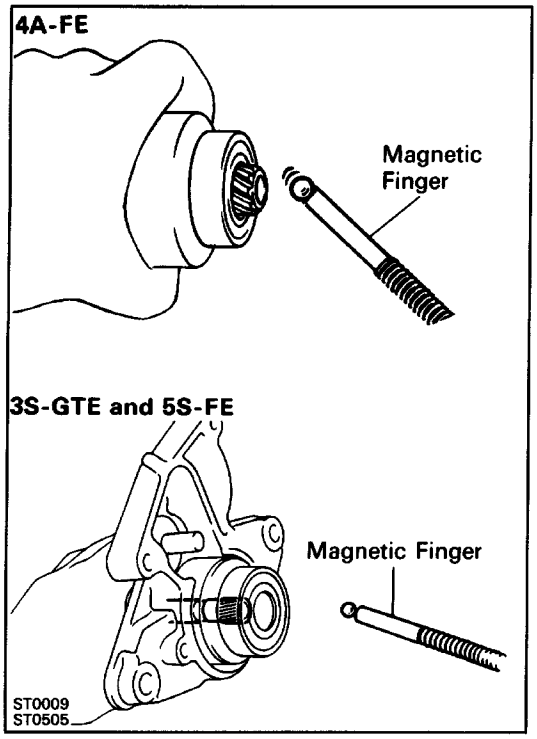
(4A–FE)
(1) Starter housing
(2) Return spring
(3) Bearing
(4) Idler gear
(5) Clutch assembly



(3S–GTE (1.0 kW Type))
(1) Starter housing and clutch assembly
(2) Return spring
(3) Bearing
(4) Idler gear

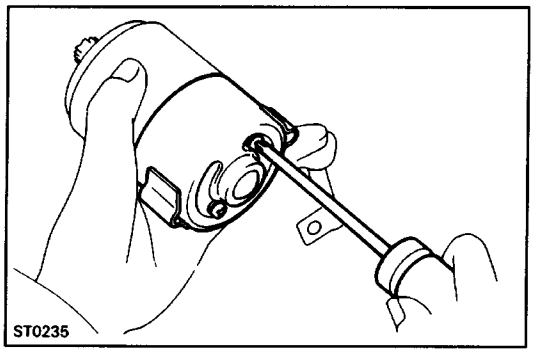


(3S–GTE (1.6 kW Type) and 5S–FE)
(1) Starter housing and clutch assembly
(2) Return spring
(3) Pinion gear
(4) Bearing
(5) Idler gear



3. REMOVE STEEL BALL

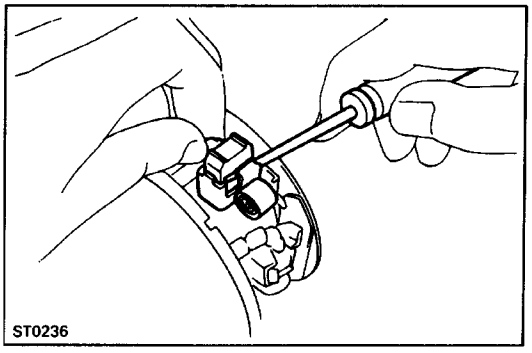
Using a magnetic finger, remove the steel ball from the clutch shaft hole.



4. REMOVE BRUSH HOLDER

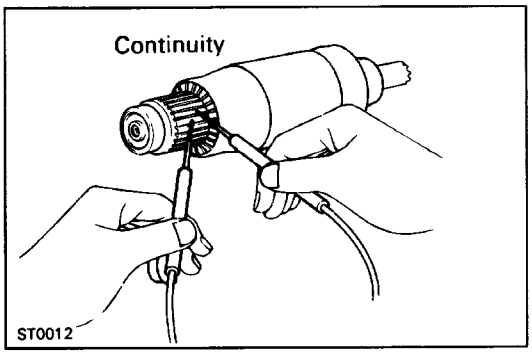
(a) Remove the two screws, two O–rings (1.4 kW and 1.6 kW types) and end cover from the field frame.

(b) (1.4 kW and 1.6 kW Types)
Remove the O–ring from the field frame.



(c) Using a screwdriver, hold the spring back and dis–connect the brush from the brush holder. Discon–nect the four brushes, and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME

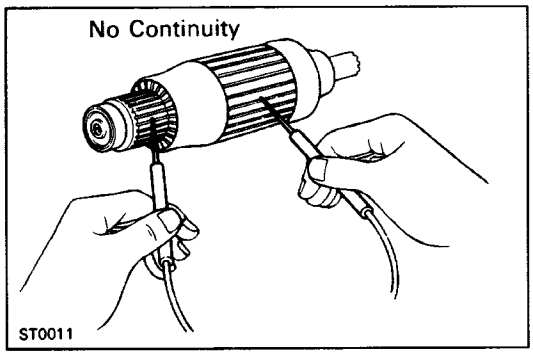


INSPECTION AND REPAIR OF STARTER

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.



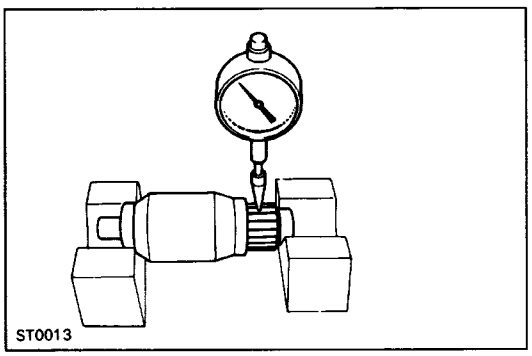
2. INSPECT COMMUTATOR FOR GROUND

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

Commutator

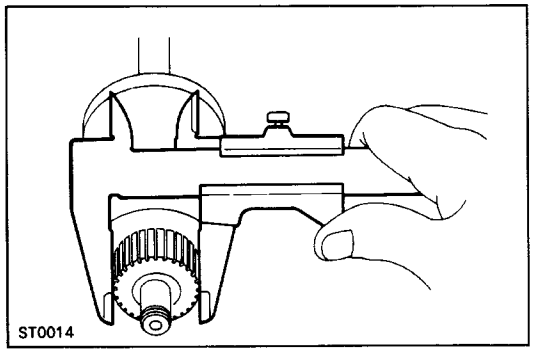
1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACE

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



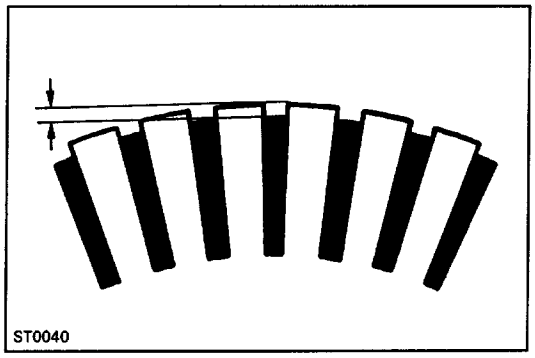
2. INSPECT COMMUTATOR FOR RUNOUT

(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 a vernier caliper, measure the diameter.
Standard diameter: 30.0 mm (1.181 in.)
Minimum diameter: 29.0 mm (1.142 in.)
If the diameter is less than minimum, replace the armature.



4. INSPECT UNDERCUT DEPTH

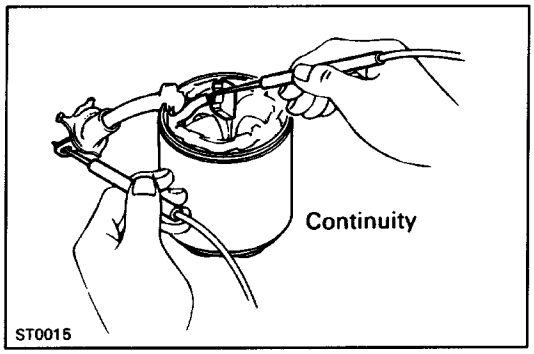
Check that the undercut depth is clean and free of foreign material. Smooth out the edge.

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.

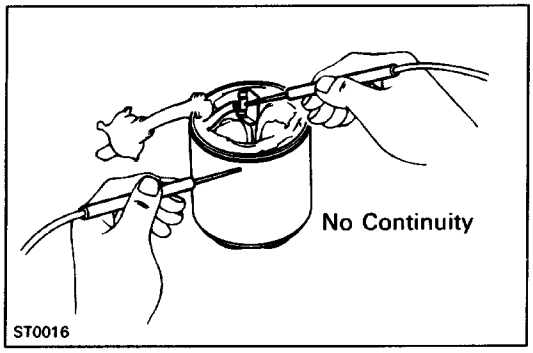
Field Coil (Field Frame)



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.

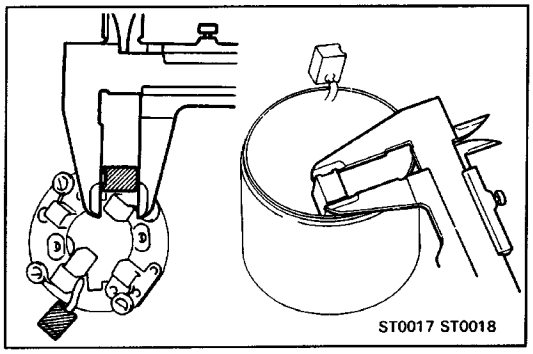


2. INSPECT FIELD COIL FOR GROUND

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 a vernier caliper, measure the brush length.

Standard length:

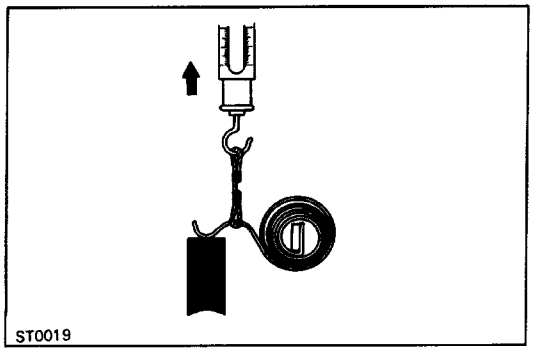
1.0 kW type	**13.5 mm (0.531 in.)**
1.4 kW and 1.6 kW types	**15.5 mm (0.610 in.)**

Minimum length:

1.0 kW type	**8.5 mm (0.335 in.)**
1.4 kW and 1.6 kW types	**10.0 mm (0.394 in.)**

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

Brush Springs



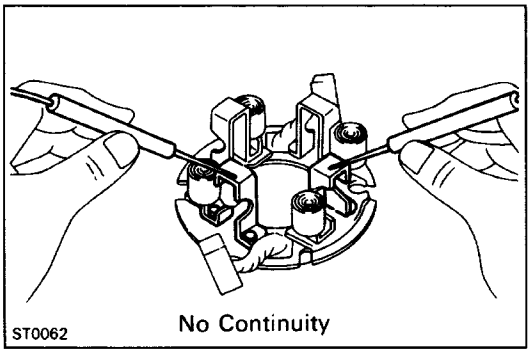
INSPECT BRUSH SPRING LOAD

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

Standard installed load:

18–24 N (1.79–2.41 kgf, 3.9–5.3 lbf)

If the installed load is not as specified, replace the brush springs.



Brush Holder

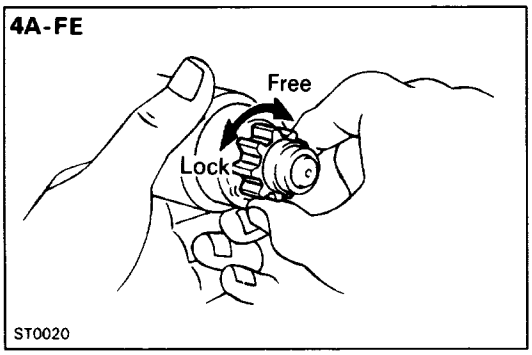
INSPECT BRUSH HOLDER INSULATION

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

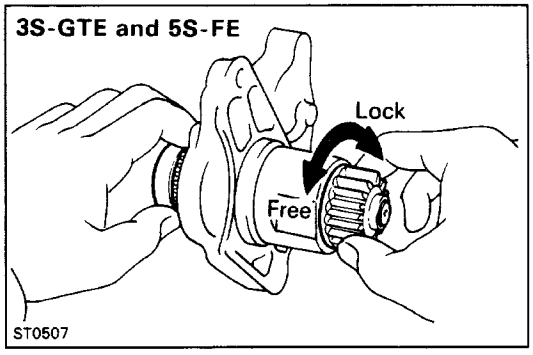
1. INSPECT GEAR TEETH

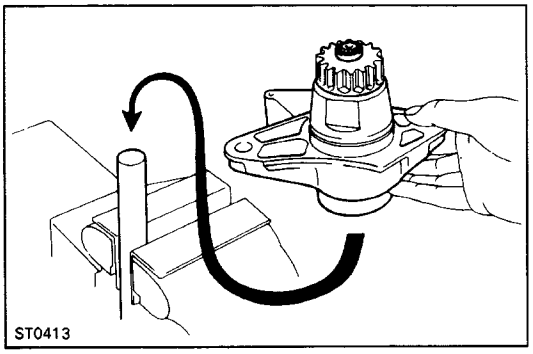
Check the gear teeth on the pinion gear, idler gear and the clutch assembly for wear or damage.
If damaged, replace the gear or clutch assembly.
If damaged, also check the flywheel ring gear for wear or damage.



2. INSPECT CLUTCH PINION GEAR

Rotate the pinion gear clockwise (4A–FE) or counter–clockwise (3S–GTE and 5S–FE) and check that it turns freely. Try to rotate the pinion gear counterclockwise (4A–FE) or clockwise (3S–GTE and 5S–FE) and check that it locks.
If necessary, replace the clutch assembly.

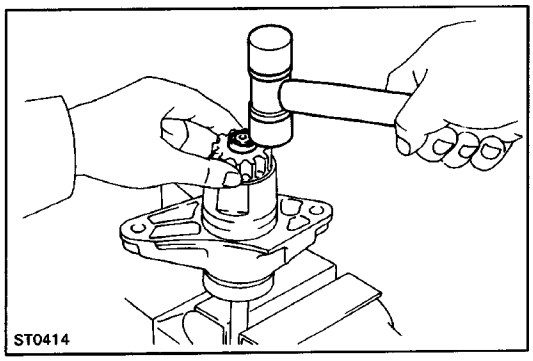




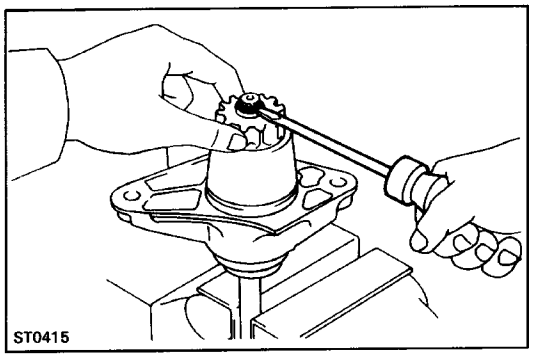
3. (3S–GTE AND 5S–FE)
IF NECESSARY, REPLACE CLUTCH ASSEMBLY

A. Disassemble starter housing and clutch assembly

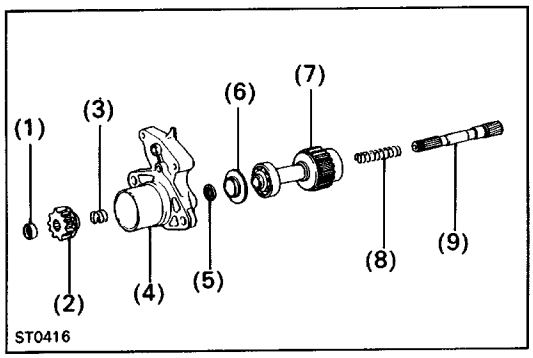
(a) Mount a brass bar in a vise, and install the starter housing and clutch assembly to the brass bar.



(b) Push down the pinion gear.
(c) Using a plastic–faced hammer, tap down the stop collar.

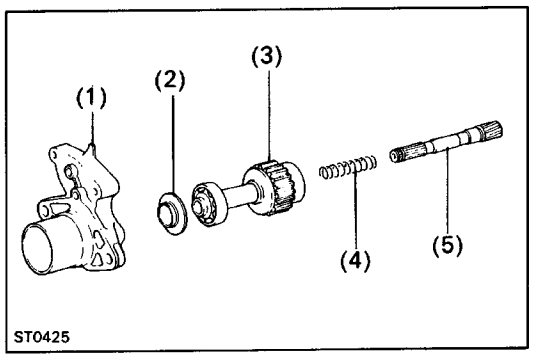


(d) Using a screwdriver, pry out the snap ring.

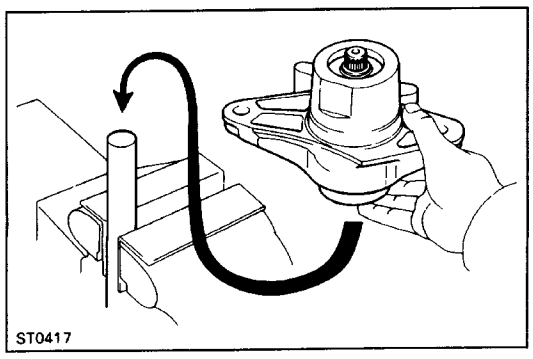


(e) Disassemble the following parts:
(1) Stop collar
(2) Pinion gear
(3) Compression spring
(4) Starter housing
(5) Spring retainer
(6) Bearing retainer
(7) Starter clutch
(8) Compression spring
(9) Clutch shaft

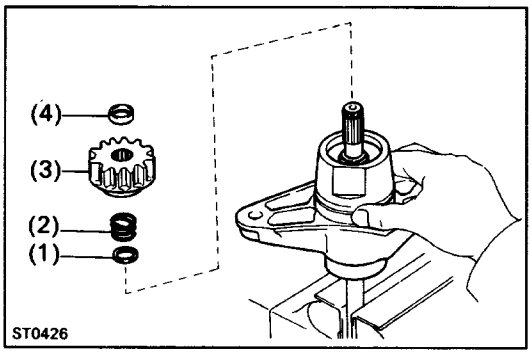
B. Assemble starter housing and clutch assembly



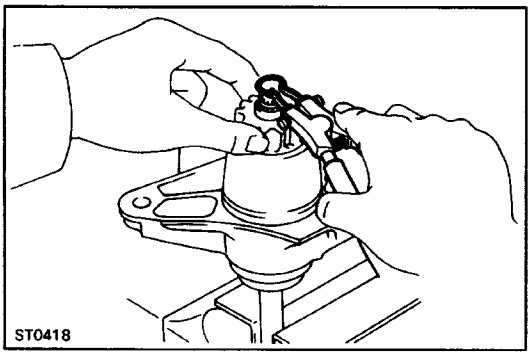
(a) Assemble the following parts:
(1) Starter housing
(2) Bearing retainer
(3) Starter clutch
(4) Compression spring
(5) Clutch shaft



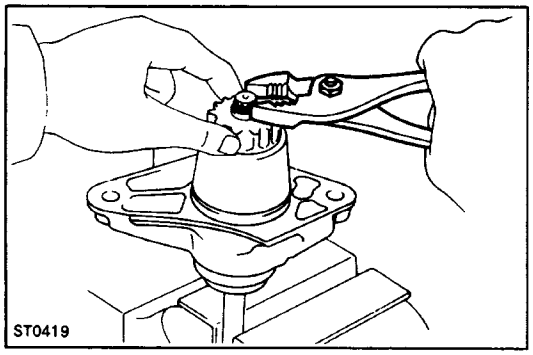
(b) Mount a brass bar in a vise, and install the starter housing and clutch assembly to the brass bar.



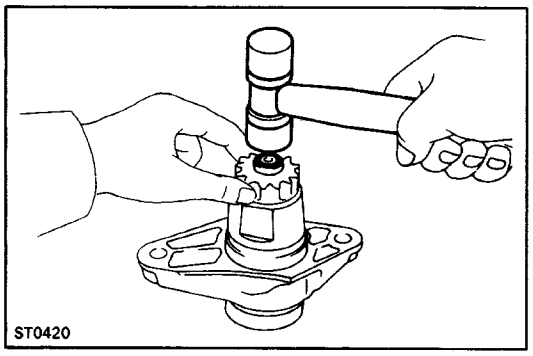
(c) Push down the starter housing, and install the fol–lowing parts:
(1) Spring retainer
(2) Compression spring
(3) Pinion gear
(4) Stop collar



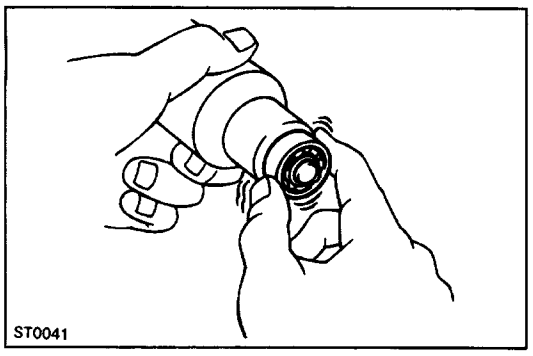
(d) Push down the pinion gear.
(e) Using snap ring pliers, install a new snap ring.



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



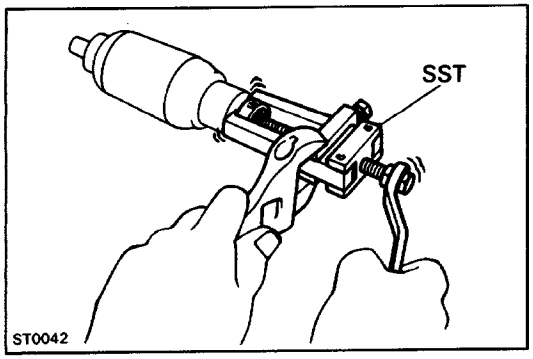
(h) Remove the starter housing and clutch assembly from the brass bar.
(i) Using a plastic–faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.



Bearings

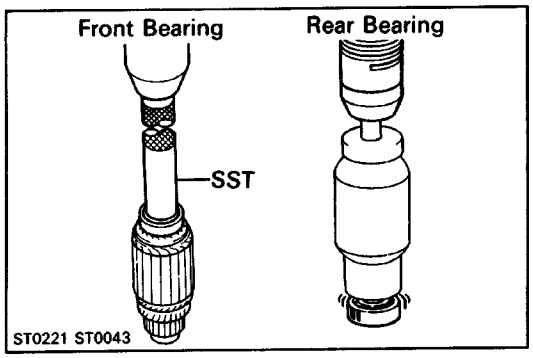
1. INSPECT BEARINGS

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



2. IF NECESSARY, REPLACE BEARINGS

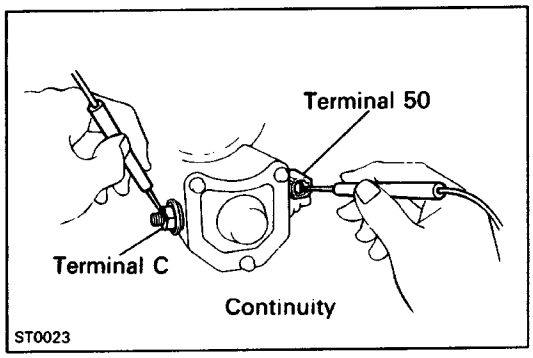
(a) Using SST, remove the bearing.
SST 09286–46011



(b) Using SST and a press, press in a new front bearing.
SST 09285–76010 for 1.0 kW type
09820–00030 for 1.4 kW type
09201–41020 for 1.6 kW type

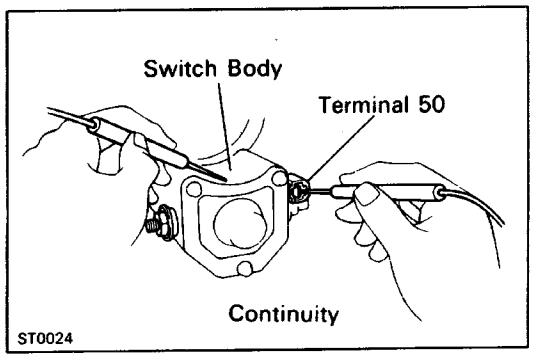
(c) Using a press, press in a new rear bearing.

Magnetic Switch (4A–FE)



1. PERFORM PULL–IN COIL OPEN CIRCUIT TEST

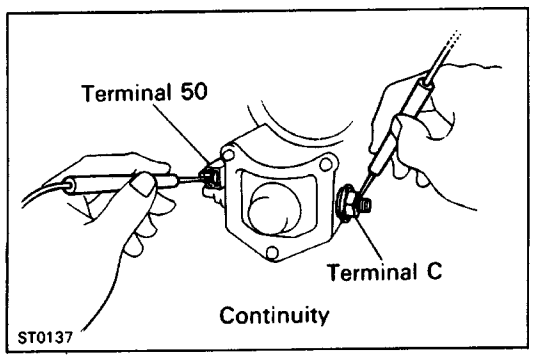
Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.



2. PERFORM HOLD–IN COIL OPEN CIRCUIT TEST

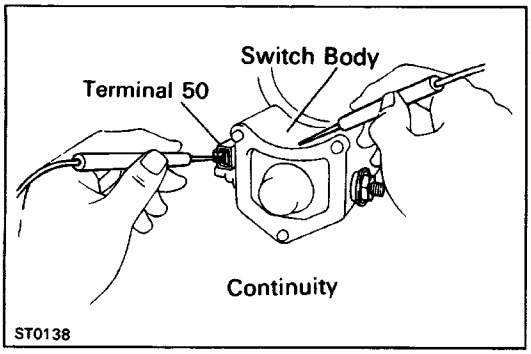
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.

Magnetic Switch (3S–GTE and 5S–FE)



1. PERFORM PULL–IN COIL OPEN CIRCUIT TEST

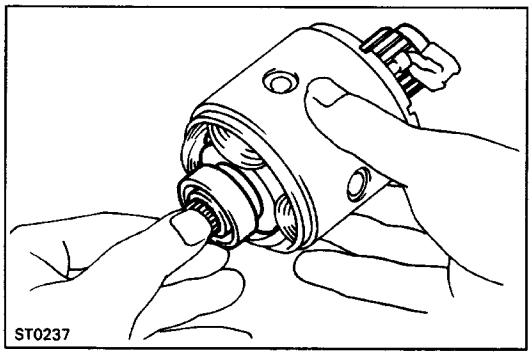
Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.



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

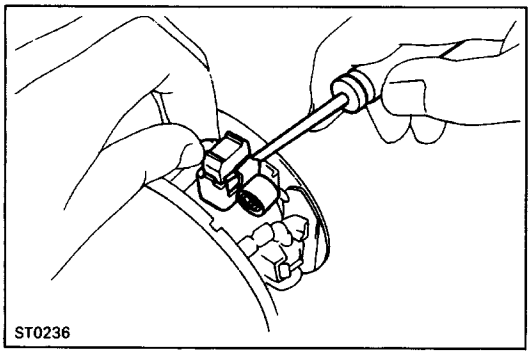
4A–FE (See page ST–6)

3S–GTE and 5S–FE (See page ST–7)

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.

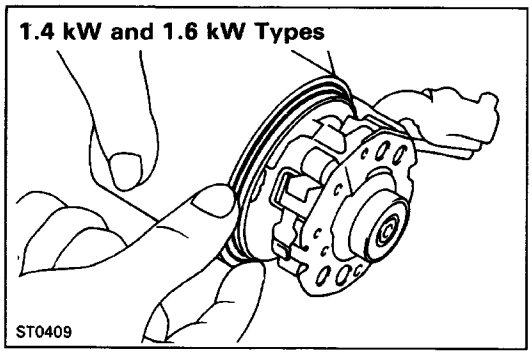


2. INSTALL BRUSH HOLDER

(a) Place the brush holder in position on the armature.

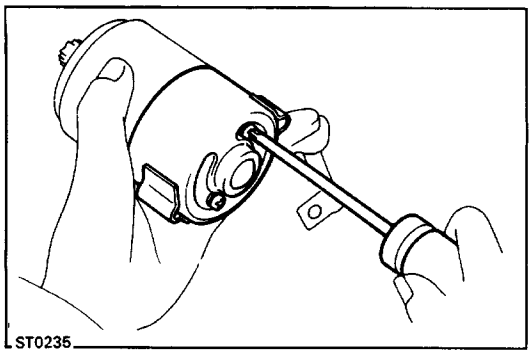
(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the four brushes.

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

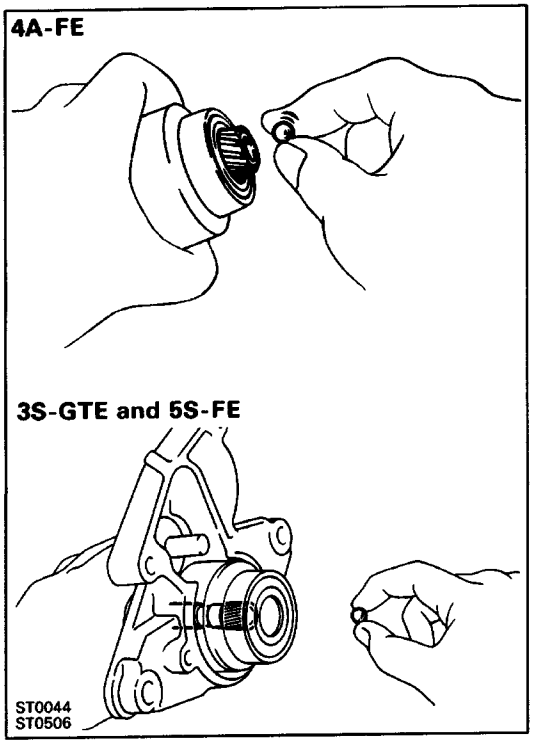


(c) (1.4 kW and 1.6 kW Types)

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



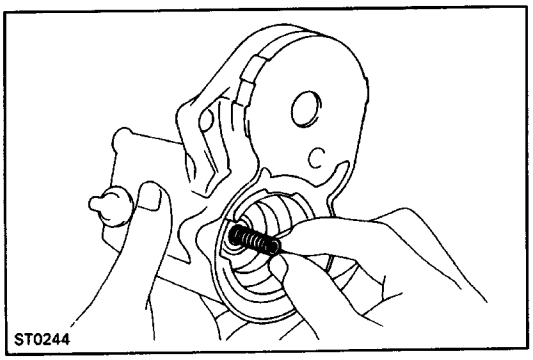
(d) Install the end cover with two new O–rings (1.4 kW and 1.6 kW types) and the two screws.



3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

(a) Apply grease to the steel ball.

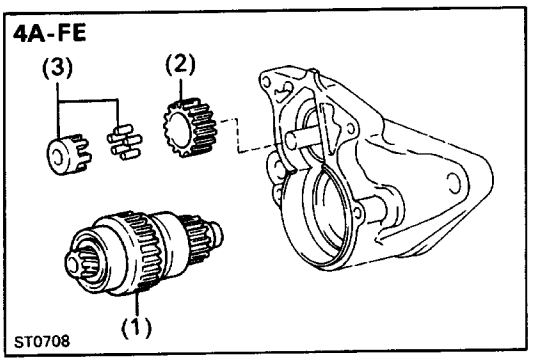
(b) insert the steel ball into the clutch shaft hole.



4. INSTALL CLUTCH ASSEMBLY (4A–FE) AND GEARS

(a) Apply grease to the return– spring.

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



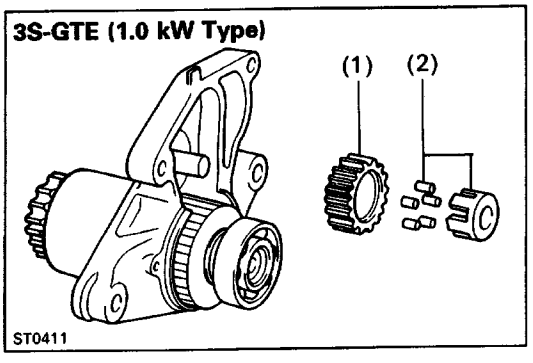
(c) Place the following parts in position on the starter housing:

(4A–FE)

(1) Clutch assembly

(2) Idler gear

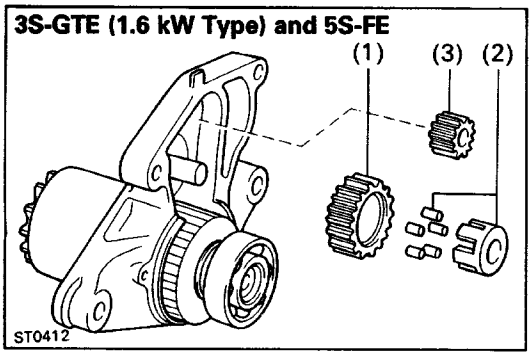
(3) Bearing



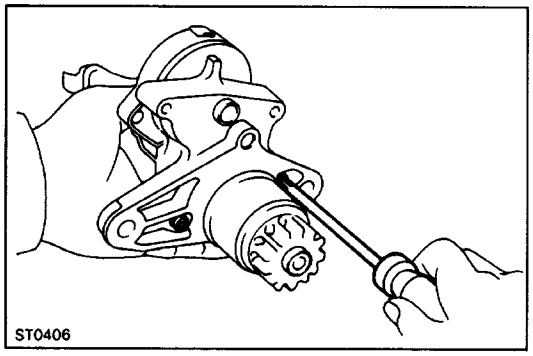
(3S–GTE (1.0 kW Type))

(1) Idler gear

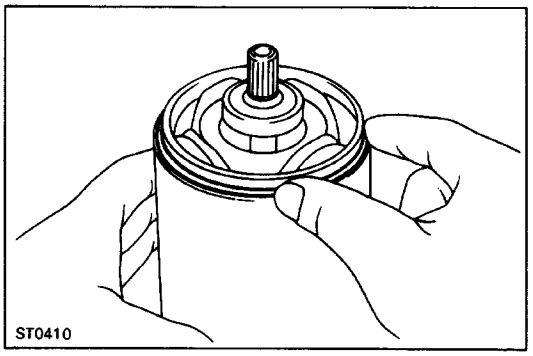
(2) Bearing



(3S–GTE (1.6 kW Type) and 5S–FE)
(1) Idler gear
(2) Bearing
(3) Pinion gear

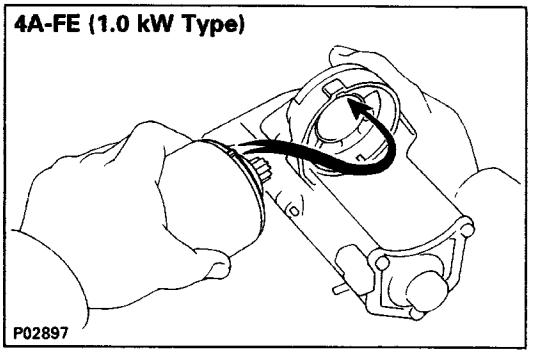


(d) Assemble the starter housing and magnetic switch with the two screws.

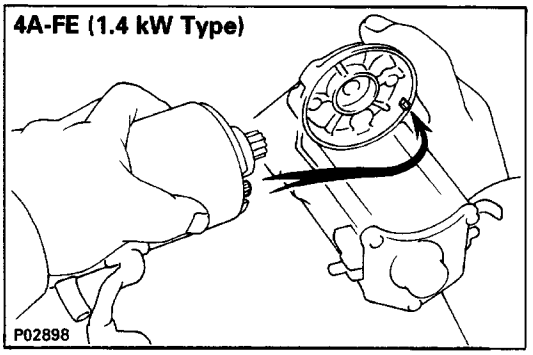


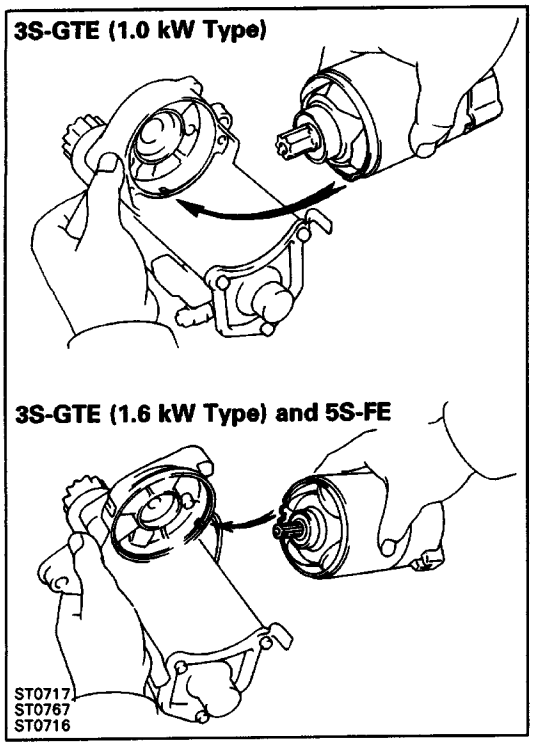
5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

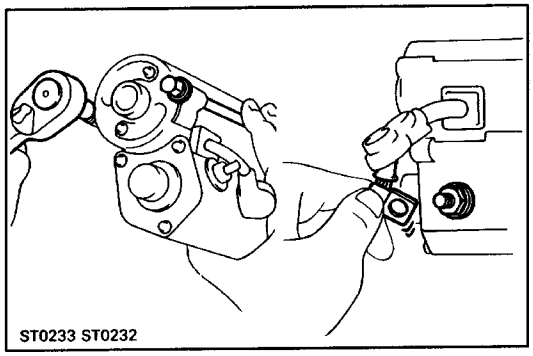
(a) (1.4 kW and 1.6 kW Types)
Place a new O–ring in position on the field frame.



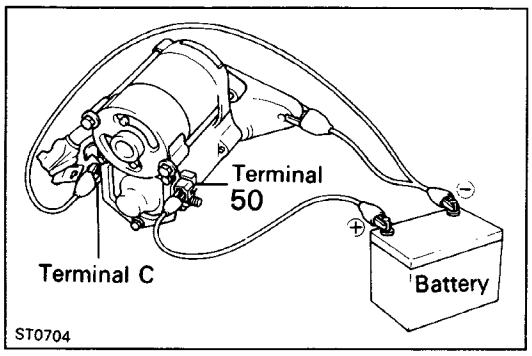
(b) Align the protrusion of the field frame with the cutout of the magnetic switch.







(c) Install the field frame and armature assembly with the two through bolts.
(d) Connect the lead wire to terminal C, and install the nut.



PERFORMANCE TEST OF STARTER (4A–FE)

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

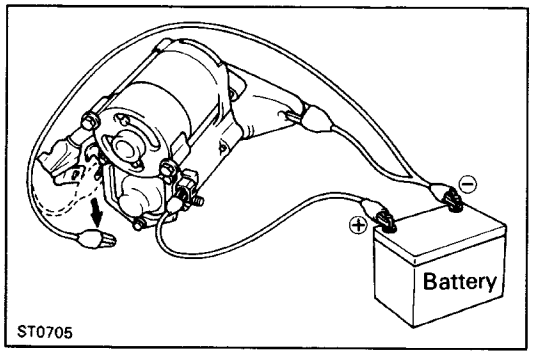
1. PERFORM PULL–IN TEST

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

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

Check that the pinion gear moves outward.

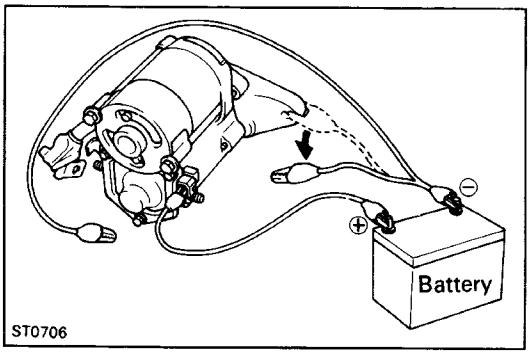
If the pinion gear does not move, replace the magnetic switch.



2. PERFORM HOLD–IN TEST

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

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

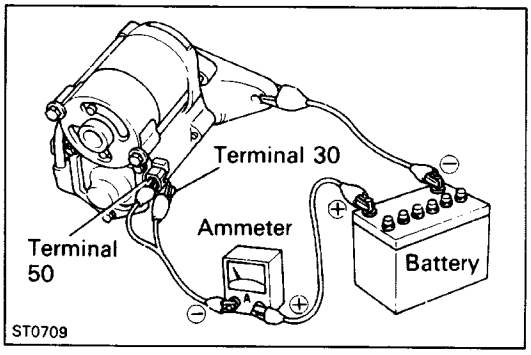


3. INSPECT PLUNGER RETURN

Disconnect the negative (+) lead from the switch body.

Check that the pinion gear returns inward.

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

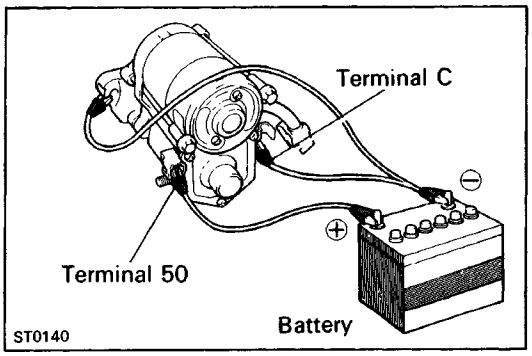


4. PERFORM NO–LOAD PERFORMANCE TEST

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

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check the reading on the ammeter.

Standard amperage: 90 A or less at 11.5 V



PERFORMANCE TEST OF STARTER (3S–GTE and 5S–FE)

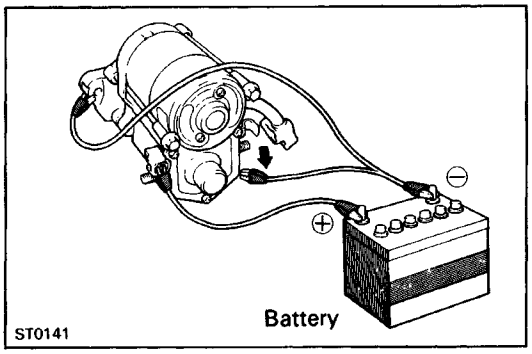
NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

1. PERFORM PULL–IN TEST

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

(b) Connect battery to the magnetic switch as shown. Check that the pinion gear moves outward.

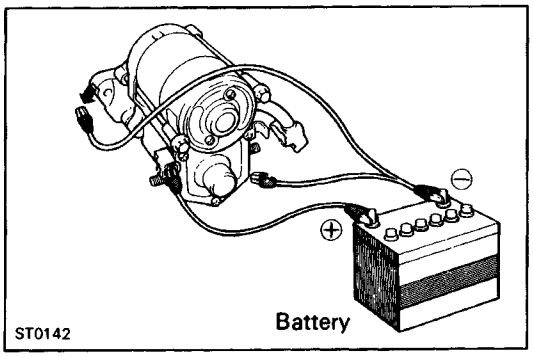
If the pinion gear does not move, replace the magnetic switch.



2. PERFORM HOLD–IN TEST

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

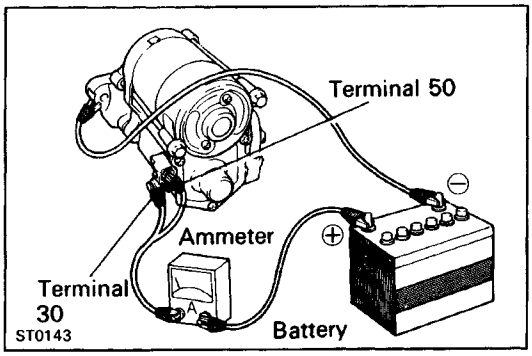
If the pinion gear returns inward, replace the magnetic switch.



3. INSPECT PLUNGER RETURN

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

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

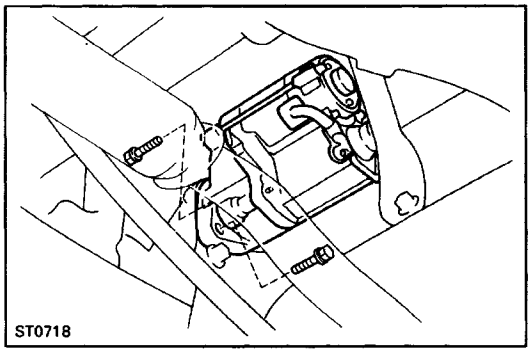


4. PERFORM NO–LOAD PERFORMANCE TEST

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

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check the reading on the ammeter.

Standard amperage: 90 A or less at 11.5 V



INSTALLATION OF STARTER (4A–FE)

(See page ST–3)

1. INSTALL STARTER

(a) Connect the starter wire with the nut.

(b) Connect the starter connector.

(c) Install the starter with the two bolts.

Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)

2. INSTALL AIR CLEANER CAP

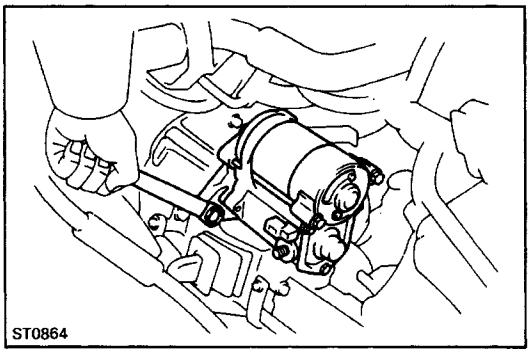
(See step 36 on page EM–221)

3. INSTALL SUSPENSION LOWER CROSSMEMBER

(See step 18 on page EM–218)

4. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

5. CHECK THAT ENGINE STARTS



INSTALLATION OF STARTER (3S–GTE)

(See page ST–4)

1. INSTALL STARTER

(a) Install the starter with the two bolts.

Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)

(b) Connect the starter wire with the nut.

(c) Connect the starter connector.

2. INSTALL CRUISE CONTROL ACTUATOR

3. INSTALL ENGINE RELAY BOX

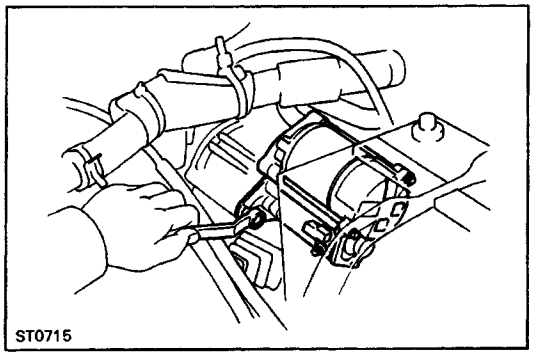
(See step 44 on page EM–266)

4. INSTALL AIR CLEANER

(See step 45 on page EM–266)

5. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

6. CHECK THAT ENGINE STARTS



INSTALLATION OF STARTER (5S–FE)

(See page ST–5)

1. INSTALL STARTER

(a) Install the starter with the two bolts.

Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)

(b) Connect the starter wire with the nut.

(c) Connect the starter connector.

2. (w/ CRUISE CONTROL SYSTEM (w/ ABS))
INSTALL CRUISE CONTROL ACTUATOR
(See step 35 on page EM–309)

3. INSTALL ENGINE RELAY BOX
(See step 37 on page EM–310)

4. INSTALL AIR CLEANER
(See step 39 on page EM–310)

5. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

6. CHECK THAT ENGINE STARTS