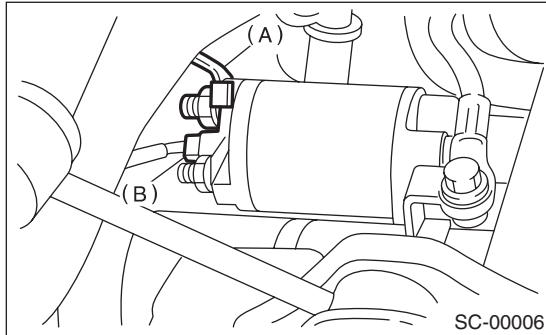


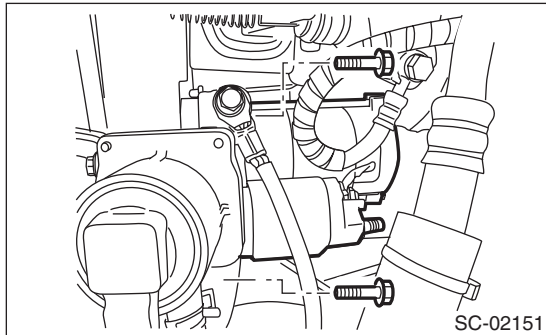
## 2. Starter

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the intercooler. <Ref. to IN(STI)-13, REMOVAL, Intercooler.>
- 3) Disconnect the connector (B) and terminal (A) from starter.



- 4) Remove the starter from transmission.

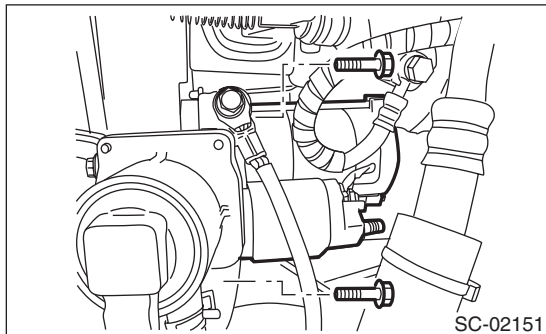


### B: INSTALLATION

Install in the reverse order of removal.

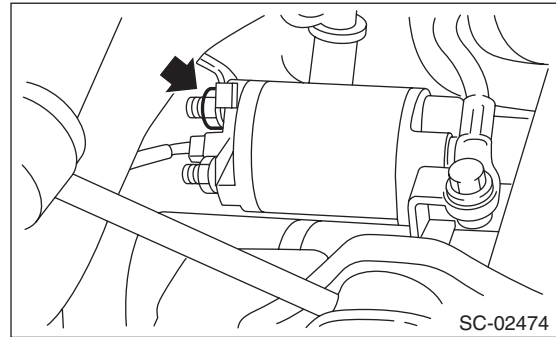
**Tightening torque:**

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**



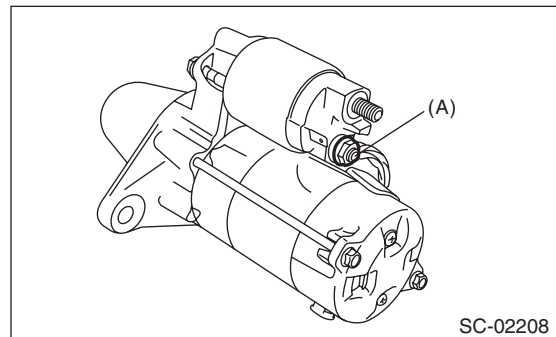
**Tightening torque:**

**10 N·m (1.0 kgf-m, 7.4 ft-lb)**

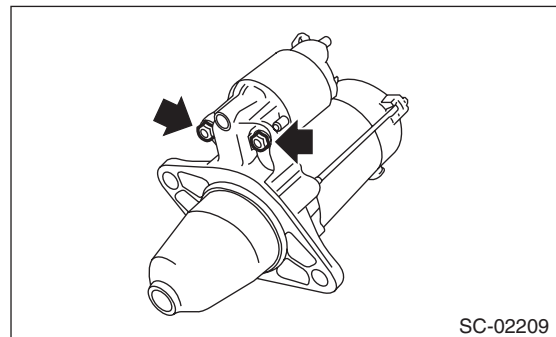


### C: DISASSEMBLY

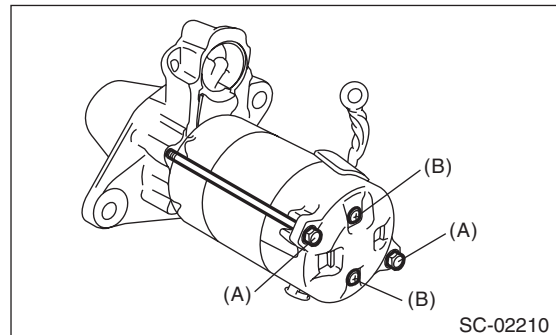
- 1) Disconnect cable from terminal M (A) of the magnet switch assembly.



- 2) Remove the magnet switch assembly from the starter housing assembly.



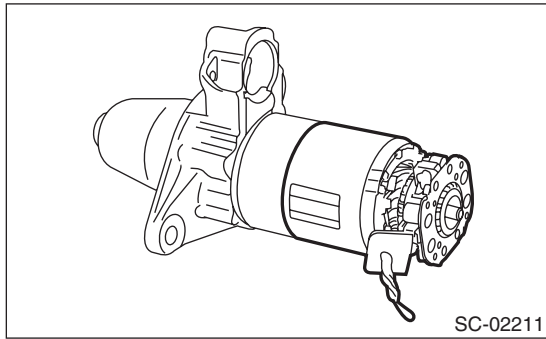
- 3) Remove through bolts (A) and screws (B) on both sides, and remove the starter cover assembly.



## Starter

### STARTING/CHARGING SYSTEMS

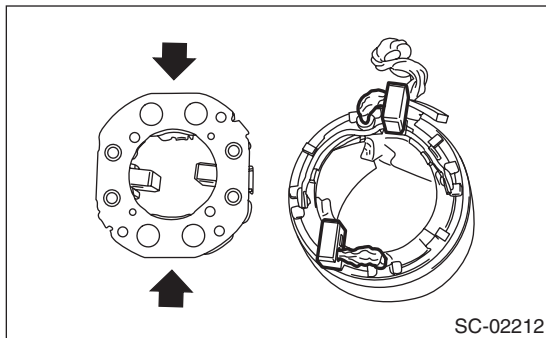
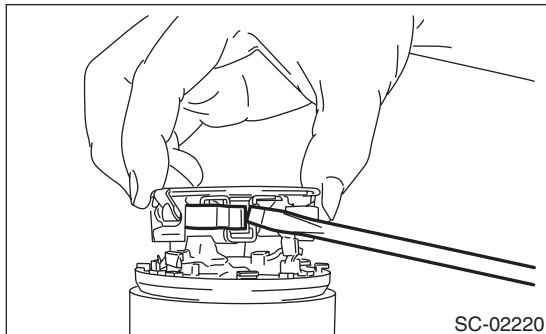
4) Remove the yoke assembly and brush holder assembly as a unit.



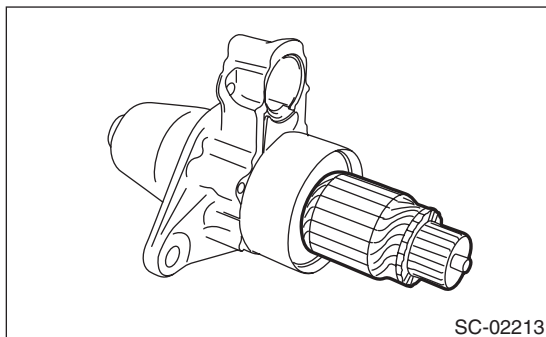
5) Remove the two brushes wired to the yoke assembly, and separate the yoke assembly and the brush holder assembly.

**NOTE:**

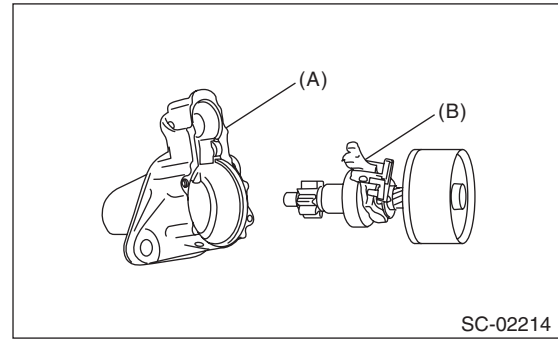
As shown in the figure, use a flat tip screwdriver, etc. to hold the brush spring and remove the brush.



6) Remove the armature from the internal gear assembly.

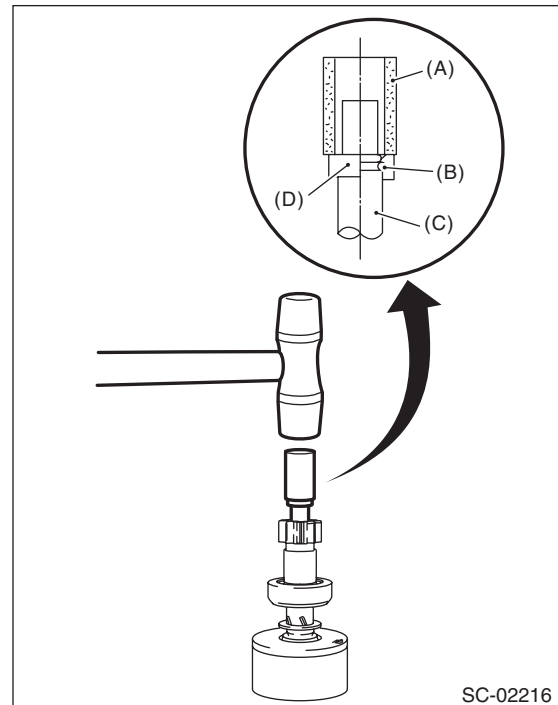


7) Remove the starter housing assembly (A) then remove the shift lever (B).



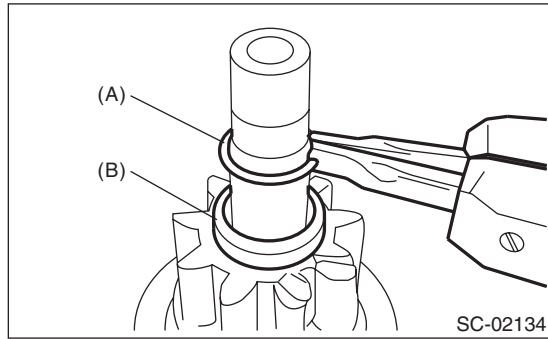
8) Use the following procedures to remove the overrunning clutch from the shaft.

(1) Use an appropriate tool (such as a fit socket wrench), and remove the stopper from snap ring by lightly tapping the stopper with a plastic hammer.

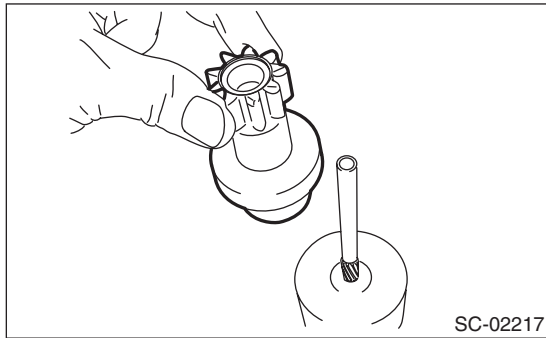


- (A) Appropriate tool
- (B) Snap ring
- (C) Shaft
- (D) Stopper

- (2) Remove snap ring (A) from the shaft, and remove stopper (B).

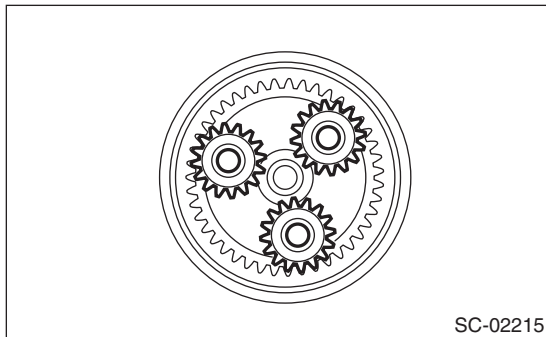


- (3) Remove the overrunning clutch from the shaft.

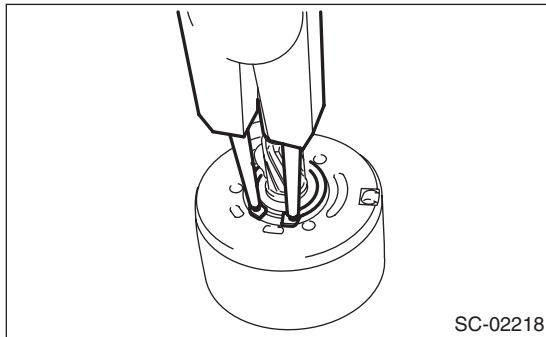


- 9) Use the following procedures to remove the shaft.

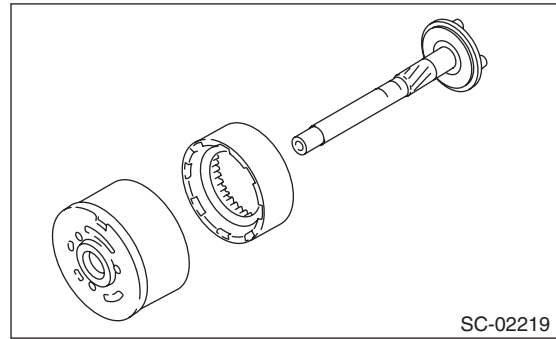
- (1) Remove the starter plate, and remove the pinion gear.



- (2) Remove the snap ring from the shaft.



- (3) Remove the shaft from the internal gear assembly.



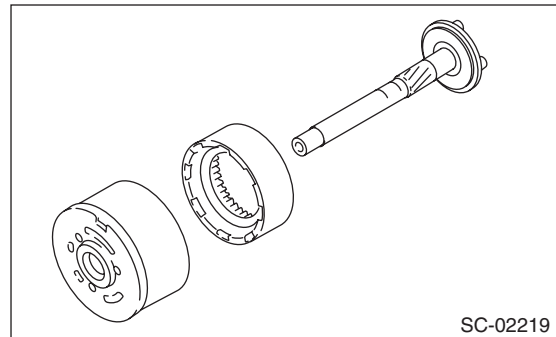
### D: ASSEMBLY

- 1) Use the following procedures to install the shaft.  
(1) Apply grease to the shaft sliding surfaces of the internal gear assembly.

#### Grease:

**DENSO HL50**

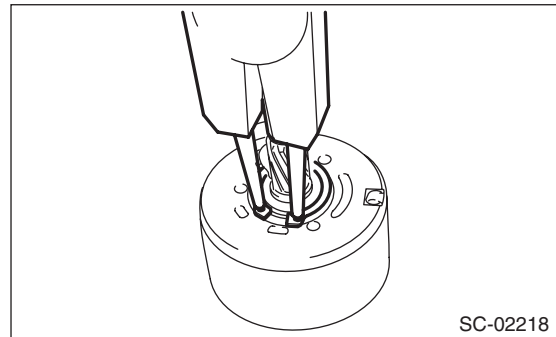
- (2) Assemble the shaft to the internal gear assembly.



- (3) Install the snap ring to shaft.

#### NOTE:

Use new snap rings.



- (4) Apply grease to the pinion gear attachment area.

#### Grease:

**DENSO HL50**

- (5) Attach the pinion gear to the pin.

# Starter

## STARTING/CHARGING SYSTEMS

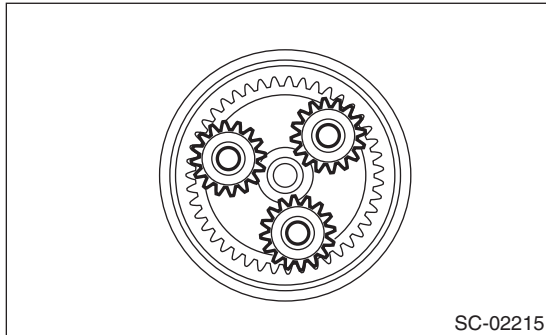
- (6) Apply grease to the pinion gear, internal gear assembly, and on top of the shaft pin.

**NOTE:**

- Apply grease so that it contacts each gear.
- Be careful not to allow dirt to get in.

**Grease:**

**DENSO HL50**



- (7) Install the starter plate.

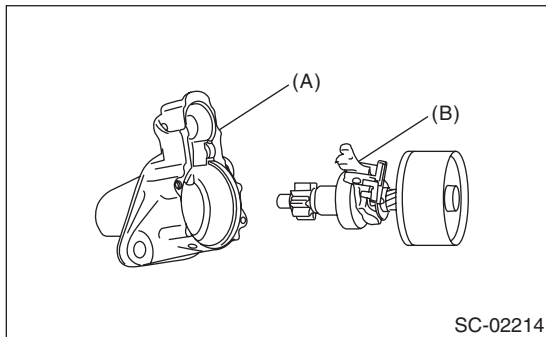
- 2) Assemble the overrunning clutch and shift lever (B) to the starter housing (A) as a unit.

**NOTE:**

Apply grease to the contact portion of the shift lever.

**Grease:**

**DENSO HL50**



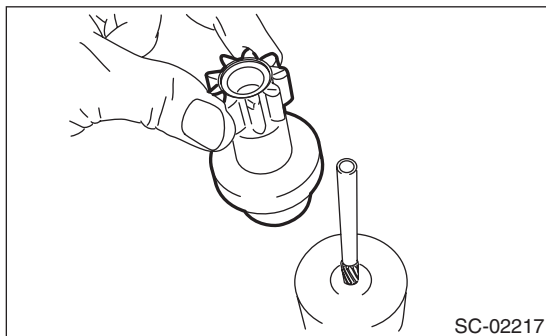
- 3) Assemble the overrunning clutch as follows:

- (1) Apply grease to the spline portion of the shaft.

**Grease:**

**DENSO HL50**

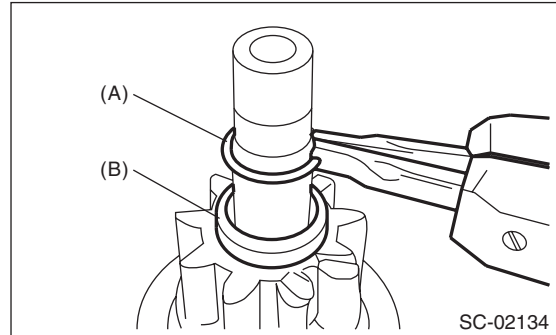
- (2) Install the overrunning clutch to shaft.



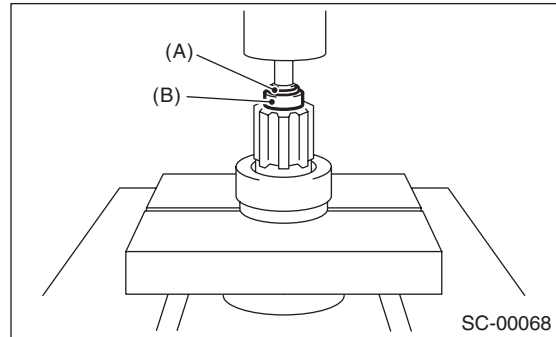
- (3) Pass stopper (B) through the shaft, and attach snap ring (A).

**NOTE:**

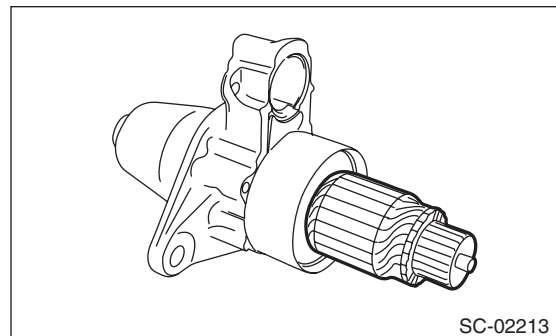
Use new snap rings.



- (4) Using a press, pressure fit stopper (B) into snap ring (A).



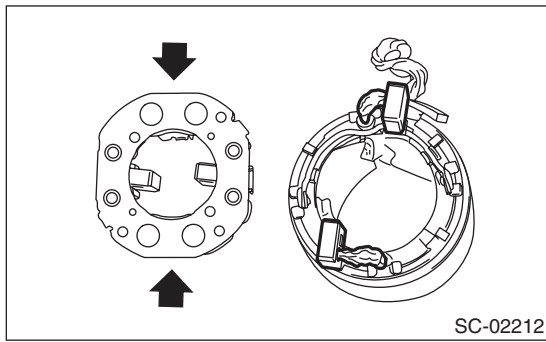
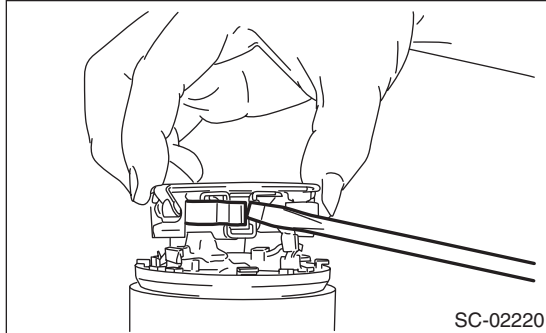
- 4) Install the armature to the internal gear assembly.



- 5) Attach the two brushes wired to the yoke assembly to the brush holder assembly to the brush holder assembly.

**NOTE:**

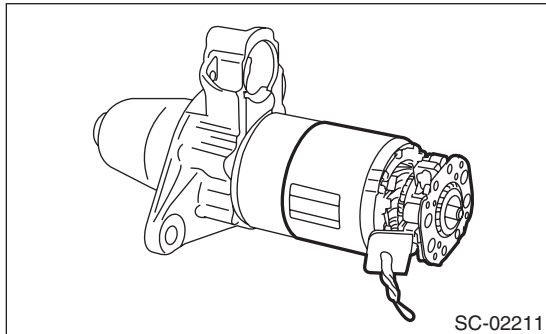
As shown in the figure, use a flat tip screwdriver, etc. to hold the brush spring and insert the brush while being careful not to damage the brush.



- 6) Install the yoke assembly and brush holder assembly as a single unit to the armature.

**NOTE:**

Spread the brush with your fingers, being careful not to damage the brush.



- 7) Install starter cover assembly to the brush holder assembly with screws (B).

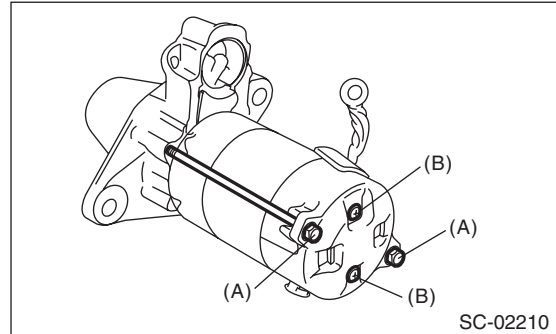
**Tightening torque:**

**1.4 N·m (0.1 kgf-m, 1.0 ft-lb)**

- 8) Tighten the through bolts (A) on both sides.

**Tightening torque:**

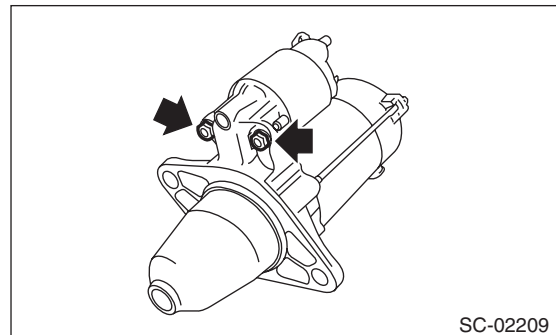
**6 N·m (0.6 kgf-m, 4.4 ft-lb)**



- 9) Attach the magnet switch assembly to the starter housing assembly.

**Tightening torque:**

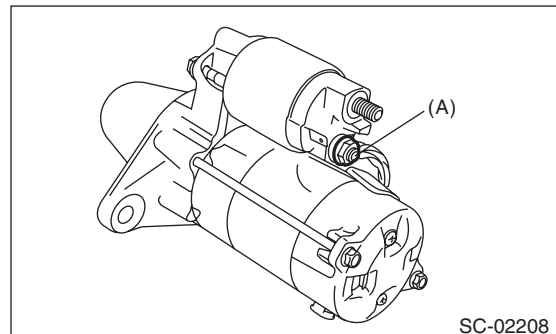
**7.5 N·m (0.8 kgf-m, 5.5 ft-lb)**



- 10) Connect terminal M (A) to magnet switch assembly.

**Tightening torque:**

**10 N·m (1.0 kgf-m, 7.4 ft-lb)**



### E: INSPECTION

#### 1. ARMATURE

- 1) Check the commutator for signs of seizure or stepped wear caused by roughness of the surface. If there is light wear, use sandpaper to repair.
- 2) Check for runout on the commutator. If excessive, replace the armature.

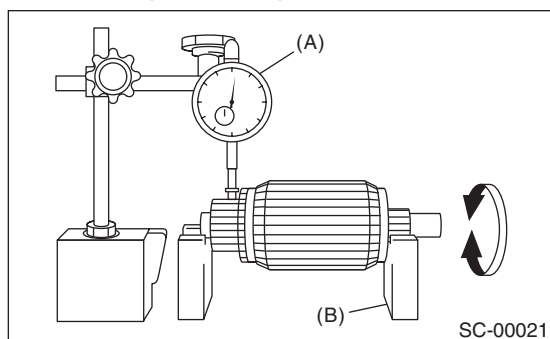
##### **Commutator runout:**

###### **Standard**

**0.05 mm (0.0020 in)**

###### **Limit**

**0.10 mm (0.0039 in)**



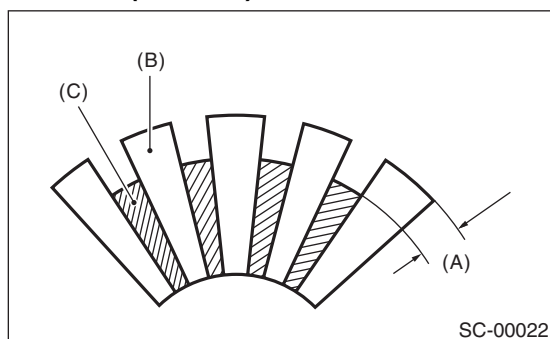
- (A) Dial gauge  
(B) V-block

- 3) Check the depth of the segment mold. If it is not within the standard, replace the armature.

##### **Depth of segment mold:**

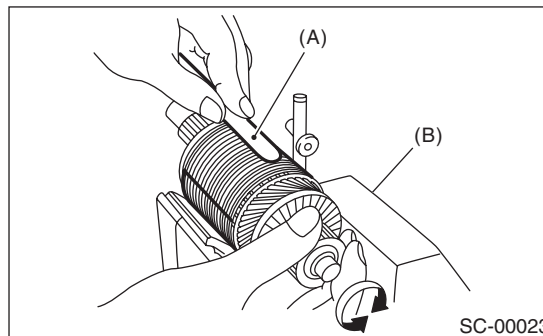
###### **Standard**

**0.5 mm (0.020 in)**



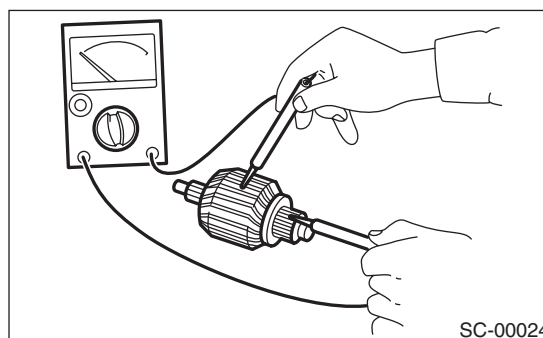
- (A) Depth of mold  
(B) Segment  
(C) Mold

- 4) Place the armature on the growler tester to check for short circuits. While slowly turning the armature, support the steel sheet for the armature core. If the circuit of the armature is shorted, the steel sheet will vibrate, causing it to move towards the core. When the steel sheet has moved or vibrated, replace the armature.



- (A) Steel sheet  
(B) Growler tester

- 5) Use a circuit tester to touch the probe of one side to the commutator segment, and the other probe to the shaft. If there is continuity, replace the armature.



#### 2. YOKE

Make sure that the pole is set at the predetermined position.

#### 3. OVERRUNNING CLUTCH

Check that there is no wear or damage to the piston teeth. Replace the overrunning clutch if it is damaged.

Check that it rotates smoothly when rotated in the correct direction (counterclockwise) and does not return to the other direction. Replace the overrunning clutch if any fault is found.

##### **CAUTION:**

**To prevent spilling of grease, do not clean the overrunning clutch with oil.**

### 4. BRUSH AND BRUSH HOLDER

1) Measure the length of the brush. Replace if it exceeds service limits or there is abnormal wear or cracks.

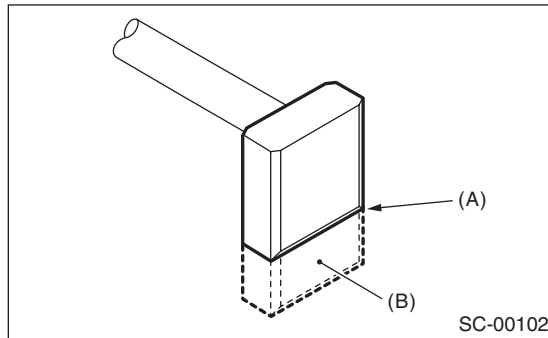
#### **Brush length:**

##### **Standard**

**12.3 mm (0.484 in)**

##### **Limit**

**7.0 mm (0.276 in)**



(A) Service limit line

(B) Brush

2) Check that the brush moves smoothly in the brush holder.

3) Measure the brush spring force with a spring scale. Replace the brush holder if below the service limit.

#### **Brush spring force:**

##### **Standard**

**15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf) (When new)**

##### **Limit**

**2.5 N (0.25 kgf, 0.56 lbf)**

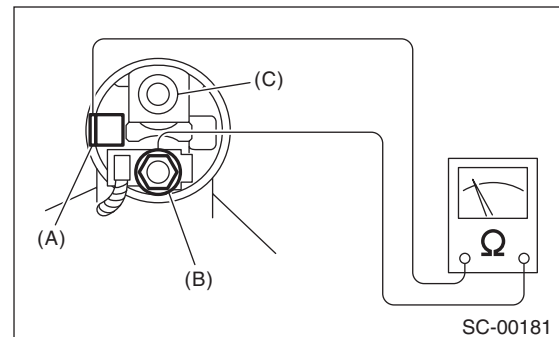
### 5. SWITCH ASSEMBLY

Using a circuit tester (set to “ohm”), check that there is continuity between terminals S and M, and between terminal S and ground.

Also check to be sure there is no continuity between M terminal and B.

#### **Resistance between switch assembly terminals:**

Terminals	Standard
S — M	1 $\Omega$ or less
S — Ground	1 $\Omega$ or less
M — B	1 M $\Omega$ or more



(A) S terminal

(B) M terminal

(C) B terminal



### 6. SWITCH ASSEMBLY OPERATION

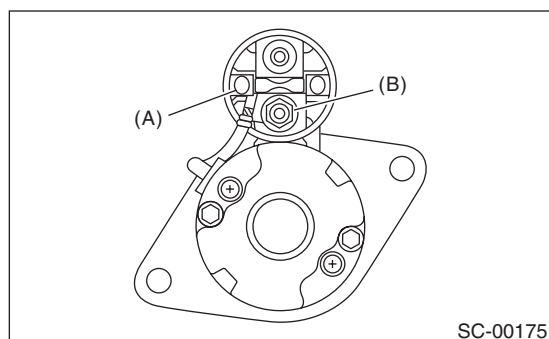
1) Using a lead wire, connect the terminal S of switch assembly to positive terminal of battery, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

#### NOTE:

With the pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.

2) Disconnect the connector from terminal M. Then using a lead wire, connect the positive terminal of battery and terminal M, and ground terminal to starter body.

In this test set up, the pinion should return to its original position even when it is pulled out with a screwdriver.



(A) Terminal S

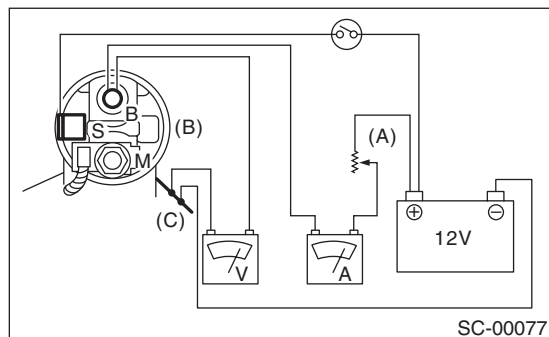
(B) Terminal M

### 7. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.

Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.

For these performance tests, use the circuit shown in figure.



(A) Variable resistance

(B) Magnet switch

(C) Starter body

1) Adjust the variable resistance with the switch on until the voltage is 11 V, and read the value displayed by the ammeter to measure starter speed. Compare these values with the standard.

#### No-load test (standard):

##### Voltage/Current

**Max. 11 V/90 A or less**

##### Rotating speed

**2,860 rpm or more**

2) Apply the specified braking torque to starter. The condition is normal if the current draw and starter speed are within standard.

#### Load test (standard):

##### Voltage/Load

**8 V/9.3 N·m (0.9 kgf-m, 6.9 ft-lb) or more**

##### Current/Speed

**280 A/860 rpm or more**

3) With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to standard voltage.

#### Lock test (standard):

##### Voltage/Current

**4 V/515 A or less**

##### Torque

**16 N·m (1.6 kgf-m, 11.8 ft-lb) or more**

### 8. OTHER INSPECTIONS

Check that the starter does not have deformation, cracks and any other damage.