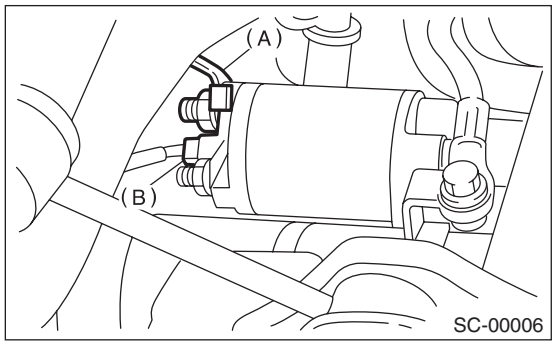
2. Starter

A: REMOVAL

1) Remove the collector cover.
2) Disconnect the ground cable from the battery.
3) Remove the air intake chamber. <Ref. to IN(H6DO)-6, REMOVAL, Air Intake Chamber.>
4) Disconnect the connector and terminal from starter.



(A) Terminals
(B) Connector

5) Remove the starter from transmission.

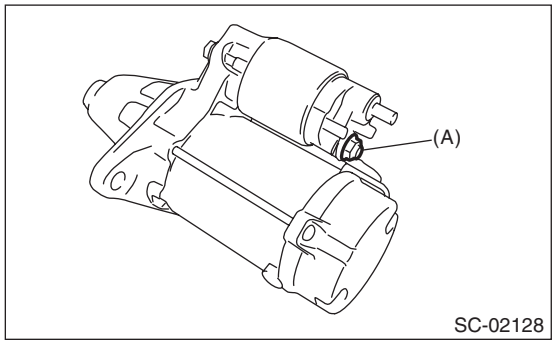
B: INSTALLATION

Install in the reverse order of removal.

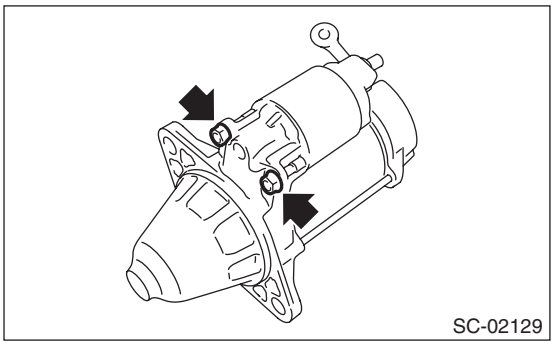
Tightening torque:
50 N·m (5.1 kgf-m, 37 ft-lb)

C: DISASSEMBLY

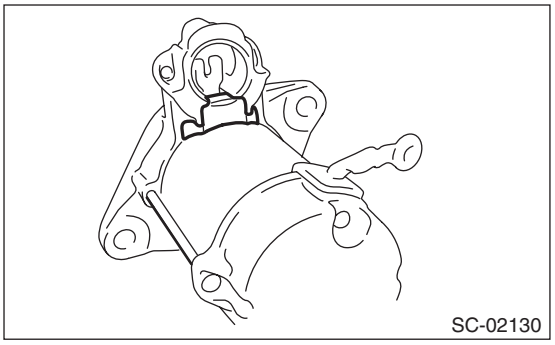
1) Loosen the nut which holds terminal M (A) of magnet switch assembly, and then disconnect the harness from terminal.



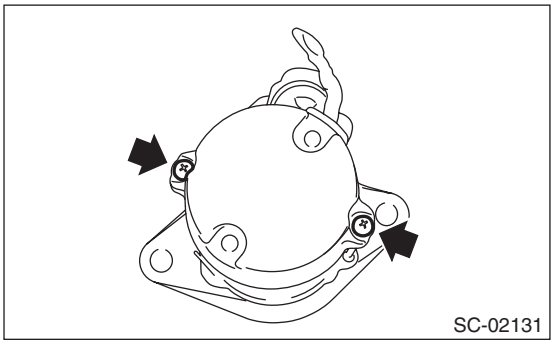
2) Remove the nuts which secure the magnet switch assembly and remove the magnet switch assembly.

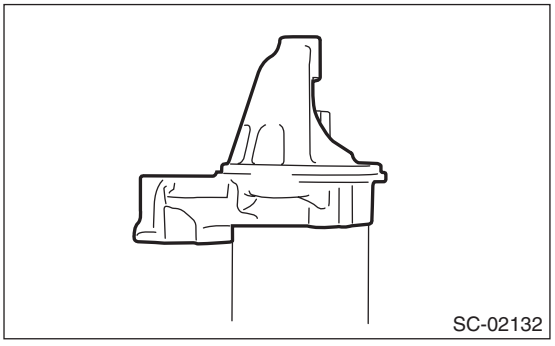


3) Remove the starter seal.

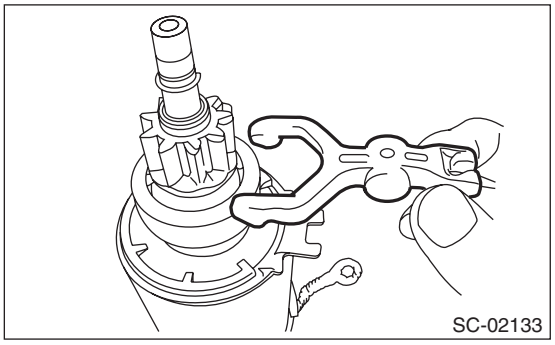


4) Remove the through bolts on both sides, and then remove the starter housing.

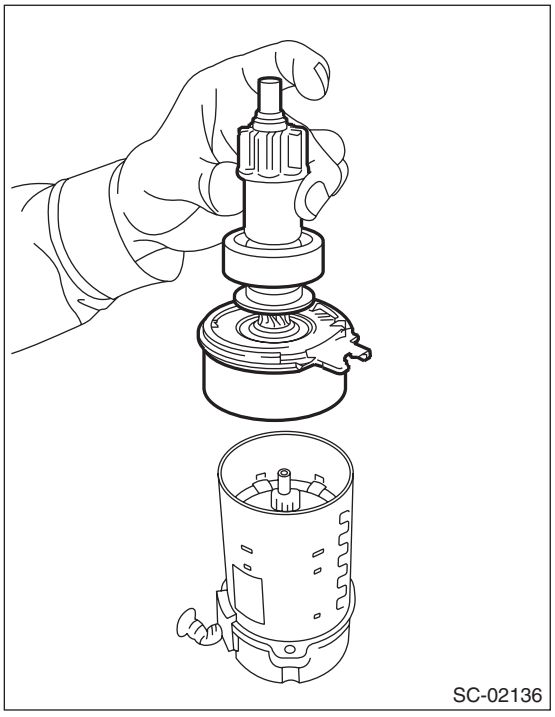




5) Remove the shift lever.

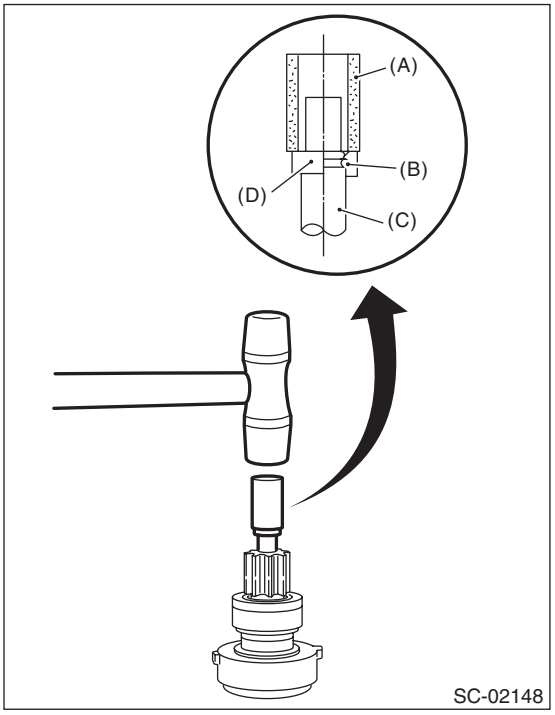


6) Remove the overrunning clutch, shock absorber bearing and shaft from the yoke as an assembly.



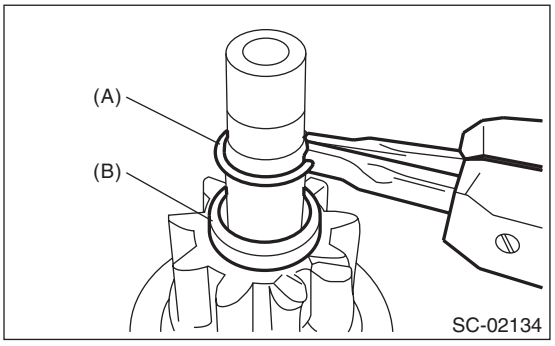
7) Remove the overrunning clutch from shaft assembly as follows:

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

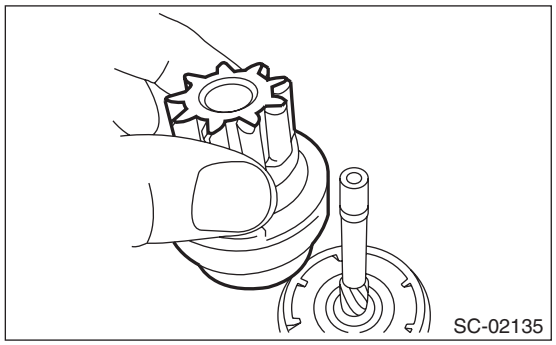


(A) Appropriate tool
(B) Snap ring
(C) Shaft
(D) Stopper

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

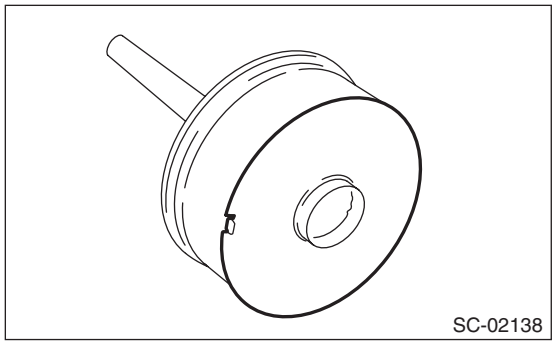


(3) Remove the overrunning clutch from the shaft.

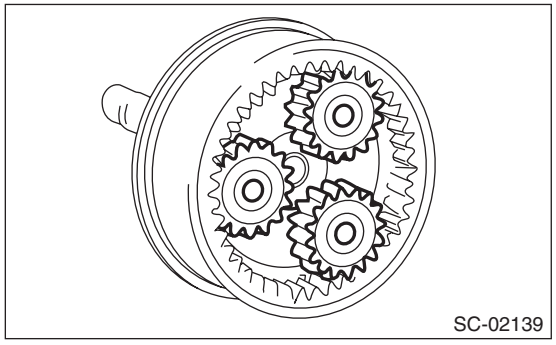

SC-02135

8) Remove the shock absorber as follows:

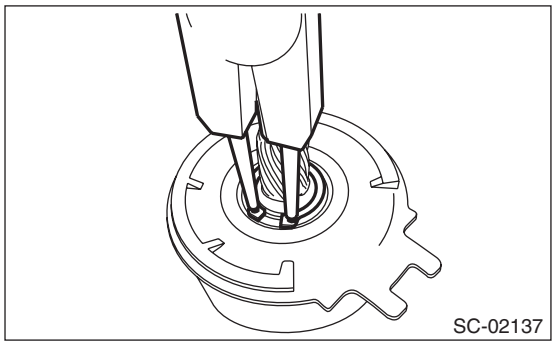
(1) Remove the starter plate.

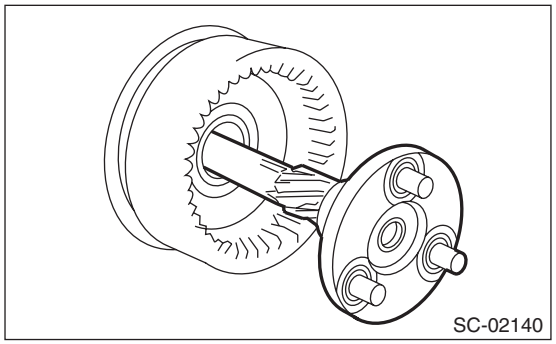

SC-02138

(2) Remove the planetary gear.

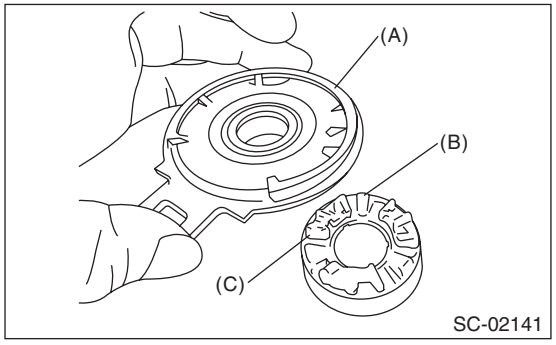

SC-02139

(3) Remove the snap ring, and then remove the shaft.


SC-02137


SC-02140

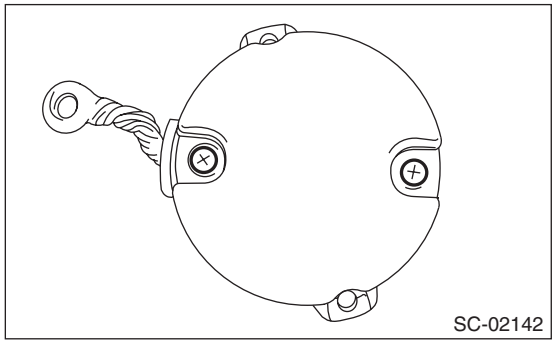
(4) Separate the shock absorber bearing (A) from the internal gear (B), and then remove the shock absorber (C).

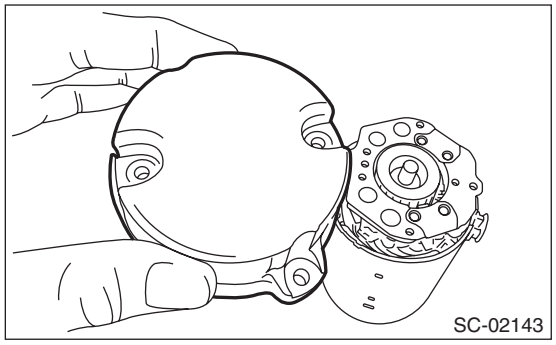


SC-02141

9) Remove the screws to remove the starter cover from the brush holder assembly.

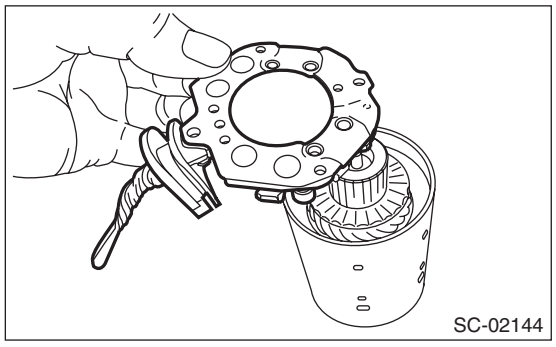
NOTE:
Hold the screws down and separate the starter cover so that the brush holder assembly remains on the armature side.


SC-02142

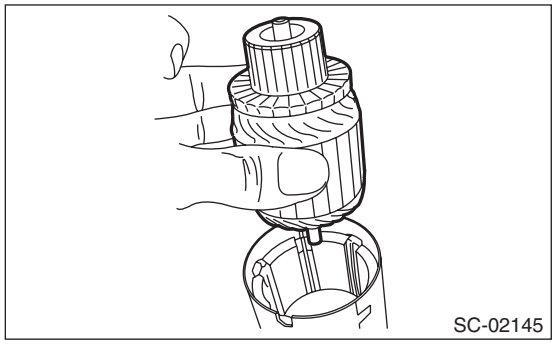

SC-02143

10) Remove the brush holder assembly from the armature by hand.

NOTE:
Push the brushes against the springs by hand to avoid the damage to the brushes.

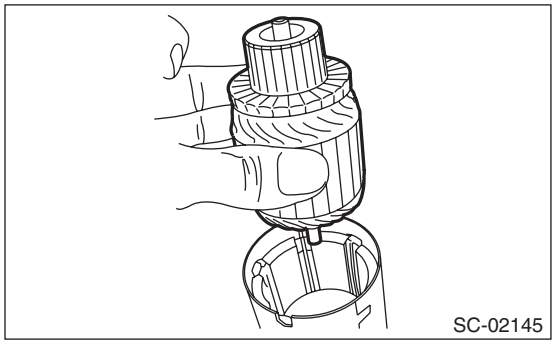

SC-02144

11) Remove the armature from yoke.


SC-02145

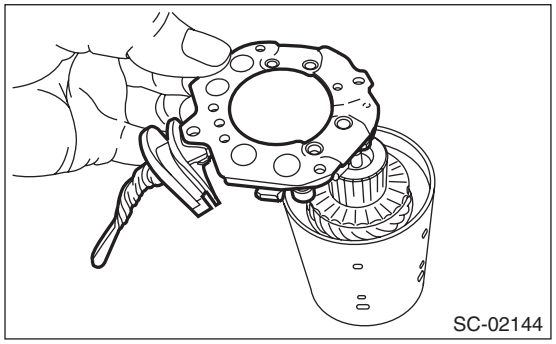
D: ASSEMBLY

1) Install the armature to yoke.

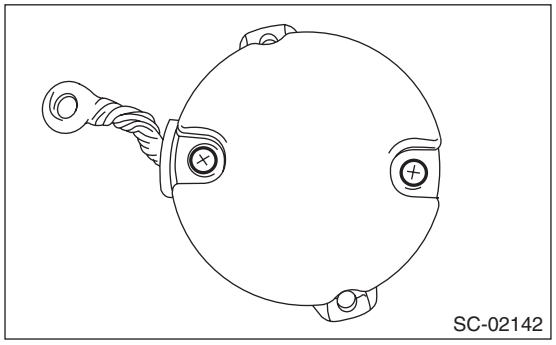

SC-02145

2) Install the brush holder assembly to the armature.

NOTE:
Push the brushes against the springs by hand to avoid the damage to the brushes.


SC-02144

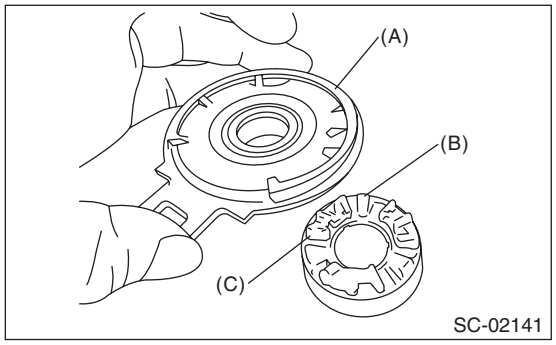
3) Install the starter cover, and then secure it to the brush holder assembly with the screws.


SC-02142

4) Assemble the shock absorber as follows:
(1) Apply grease to the shock absorber (C), and install the internal gear (B) to the shock absorber bearing (A).

NOTE:
Align with the claw position of internal gear to install shock absorber bearing.

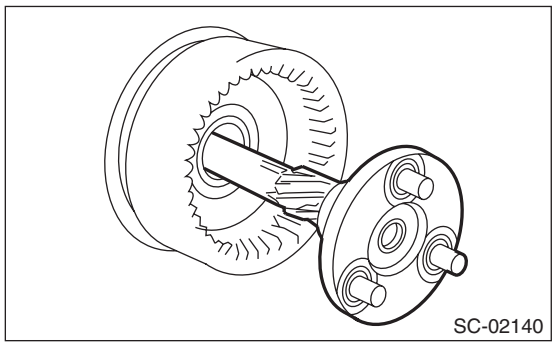
Grease:
DENSO HL50



(2) Install the shaft to the internal gear.

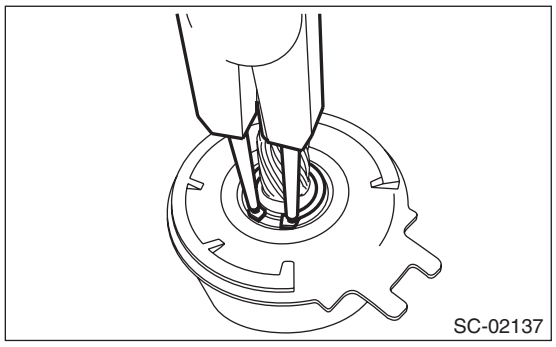
NOTE:
Apply grease to the sliding part for the shaft inside the internal gear.

Grease:
DENSO HL50



(3) Install the snap ring to shaft.

NOTE:
Use new snap rings.



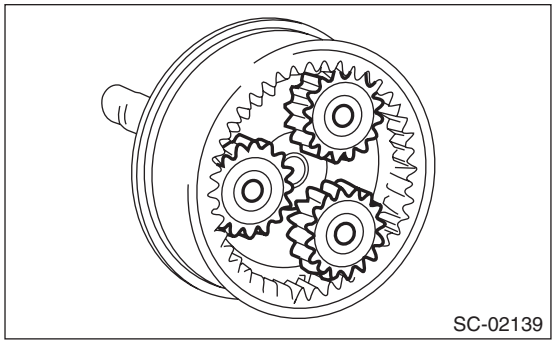
5) Install the planetary gear to the internal gear.
(1) Apply grease to the installation part of the planetary gear.

Grease:
DENSO HL50

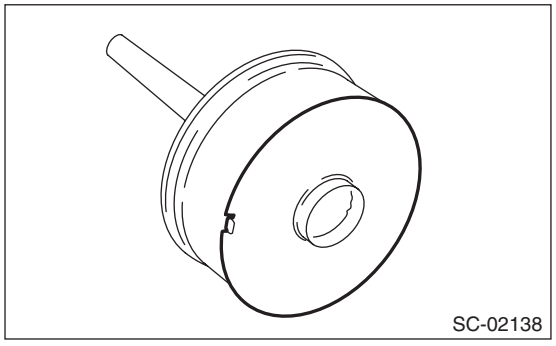
(2) Install the planetary gear to pin.
(3) Apply grease to the planetary gear, internal gear and upper part of the pin.

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

Grease:
DENSO HL50



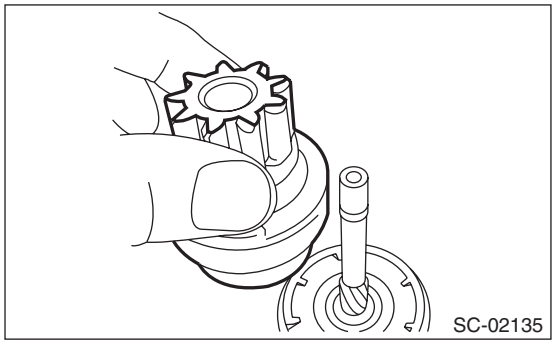
(4) Install the starter plate.



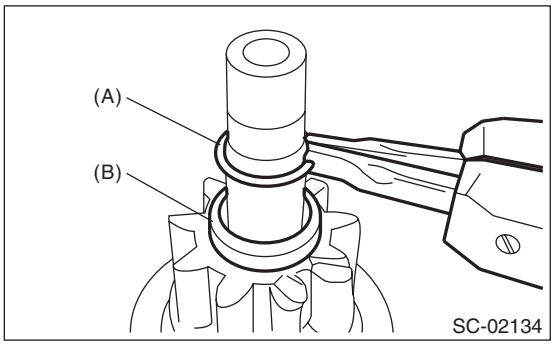
6) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

Grease:
DENSO HL50

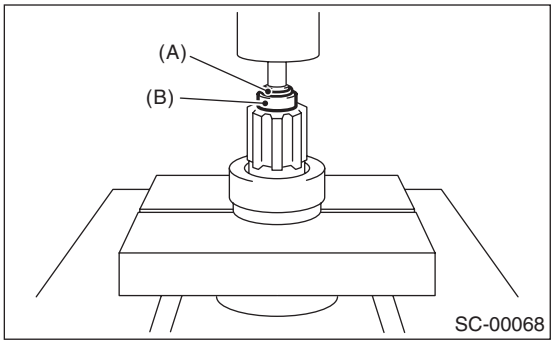
(2) Install the overrunning clutch to shaft.



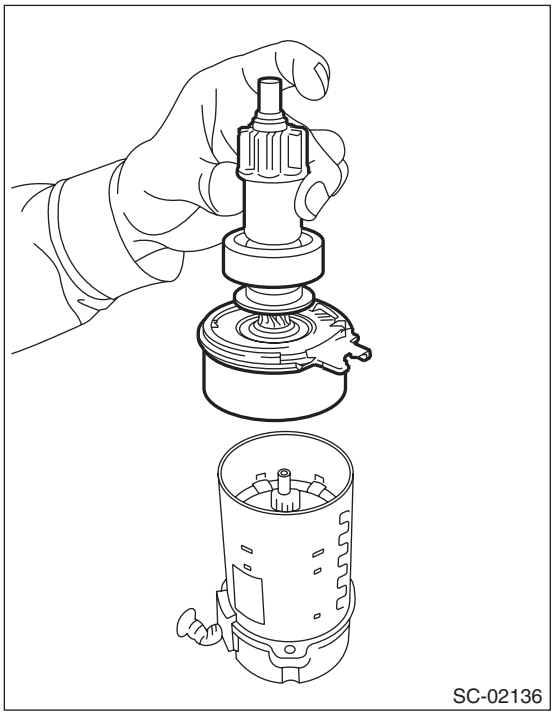
(3) Install the stopper (B) to the shaft, and install the snap ring (A).



(4) Press-fit the stopper (B) to snap ring (A) using a press.



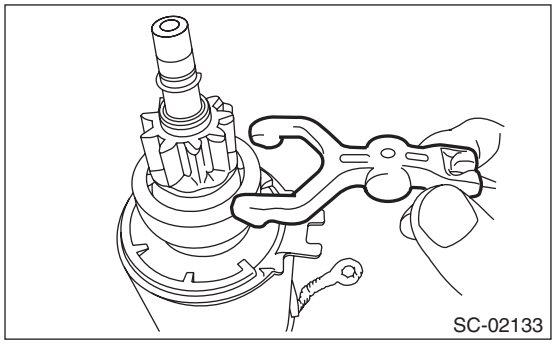
7) Assemble the overrunning clutch, shock absorber and shaft to the yoke as one unit.



8) Install the shift lever.

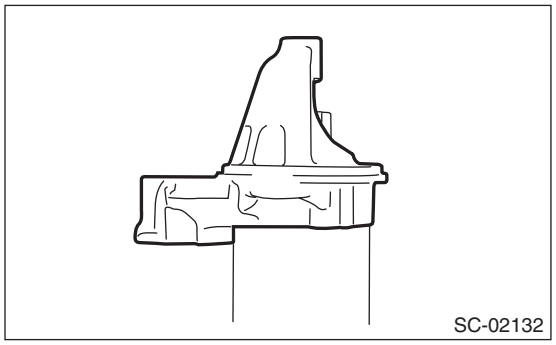
NOTE:
Apply grease to the contact portion of the shift lever.

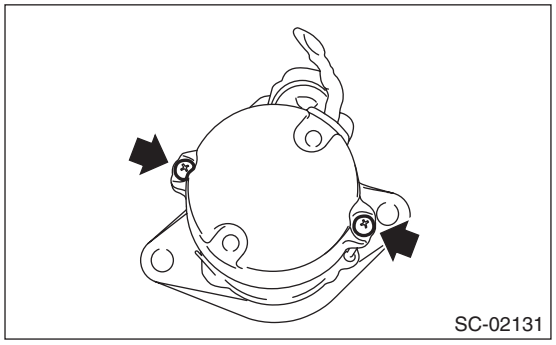
Grease:
DENSO HL50



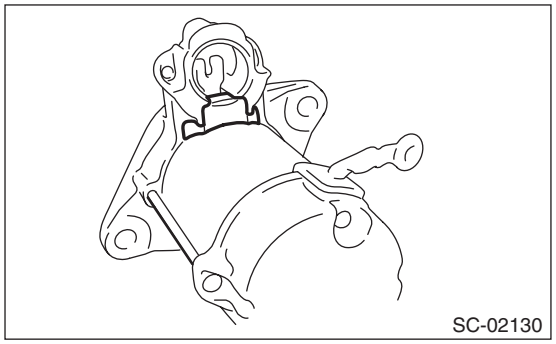
9) Install the starter housing, and tighten the through bolts on both sides.

Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)





10) Install the starter seal.

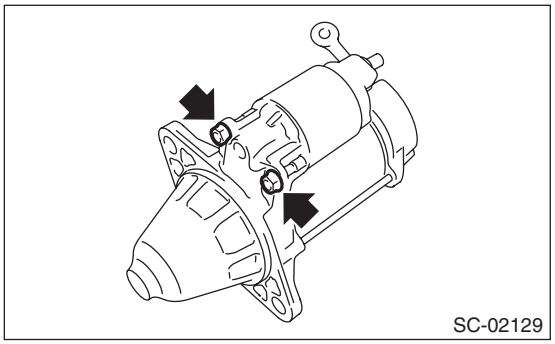


11) Install the magnet switch assembly to the starter housing, and tighten the nuts.

NOTE:
Apply grease to the installation part of the shift lever.

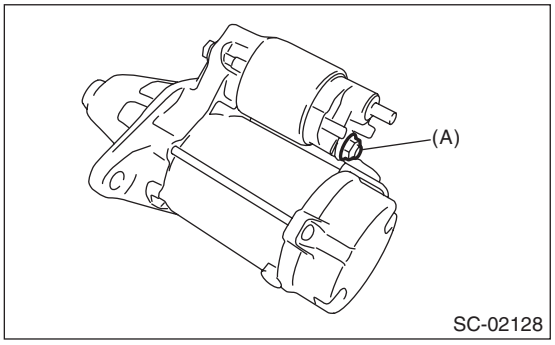
Grease:
DENSO HL50

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



12) Install the harness to the terminal M (A) of the magnet switch assembly, and tighten the nut.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

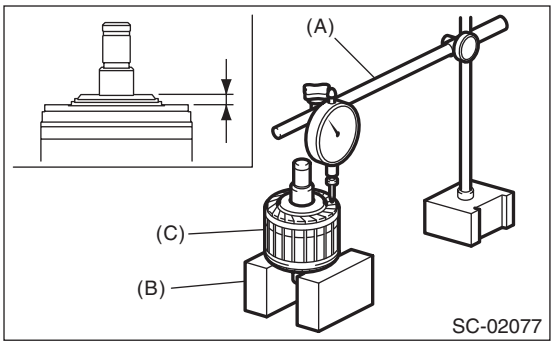


E: INSPECTION

1. ARMATURE

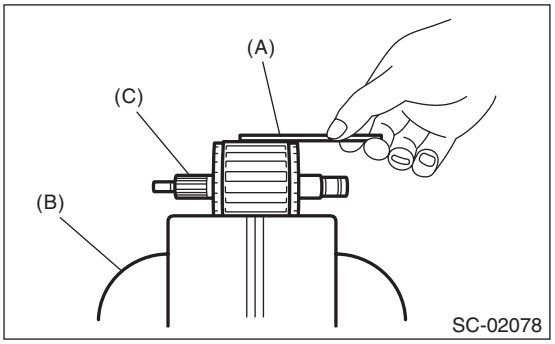
1) Check the commutator for any sign of burns of rough surfaces or stepped wear. If it has minor wear, correct it by using sand paper (#300).
2) Run-out test
Check the commutator for run-out, and then replace if it exceeds the limit.

Commutator run-out:
Standard
3.1 mm (0.1220 in)
Service limit
3.8 mm (0.1496 in) or less



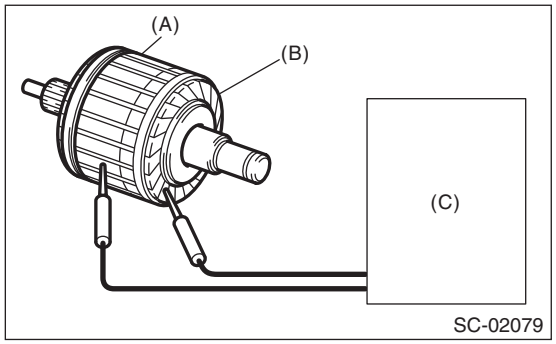
(A) Dial gauge
(B) Block
(C) Armature

3) Armature short-circuit test
Check the armature for short circuit by placing it on growler tester. Hold an iron sheet (thickness gauge, etc.) against the armature core while slowly rotating the armature. A short-circuited armature will cause the iron sheet to vibrate and to be attracted to core. If the iron sheet is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.



(A) Iron sheet (thickness gauge etc.)
(B) Growler tester
(C) Armature

4) Armature discontinuity test
Using a circuit tester, touch one probe to the Armature and the other to commutator. No continuity is normal. If there is continuity, the armature is grounded. Replace the armature if it is grounded.



(A) Armature core
(B) Commutator
(C) Circuit tester

2. OVERRUNNING CLUTCH

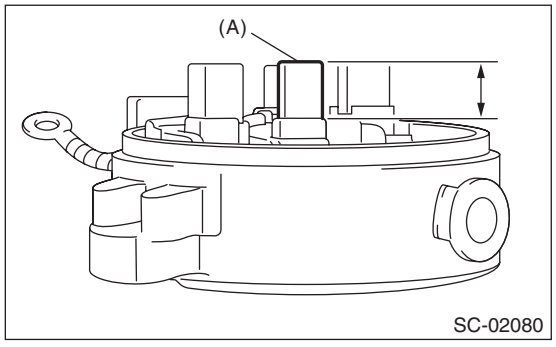
Inspect the teeth of pinion for wear and damage. Replace if it is damaged. Rotate the pinion in the right direction of rotation (counterclockwise). It should rotate smoothly. But in the opposite direction, it should be locked.

CAUTION:
Do not clean the overrunning clutch with oil to prevent grease from flowing out.

3. BRUSH AND BRUSH HOLDER

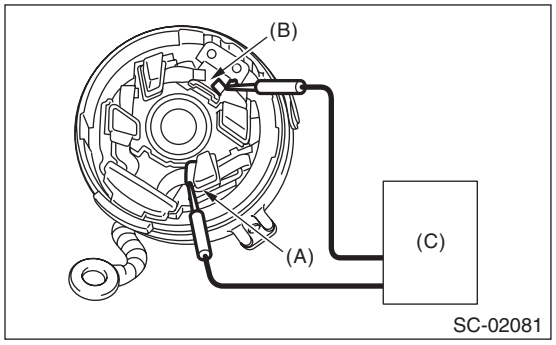
1) Brush length
Measure the brush length, and then replace if it exceeds the service limit or abnormal wear or cracks are noticed

Brush length:
Standard
9.0 mm (0.354 in)
Service limit
6.0 mm (0.236 in)



(A) Brush

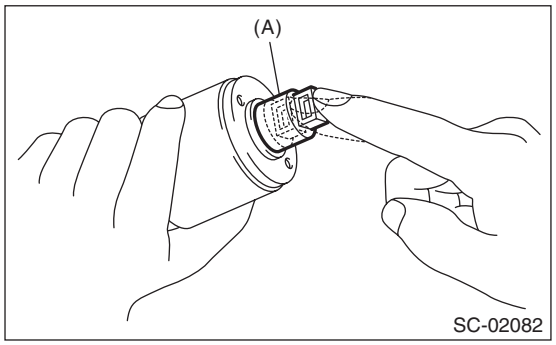
2) Brush movement
Be sure the brush moves smoothly inside brush holder.
3) Brush holder discontinuity test
Using a circuit tester, bring one probe into contact with positive side brush holder and the other with negative side brush holder. No continuity is normal.



(A) Positive side
(B) Negative side
(C) Circuit tester

4. SWITCH ASSEMBLY

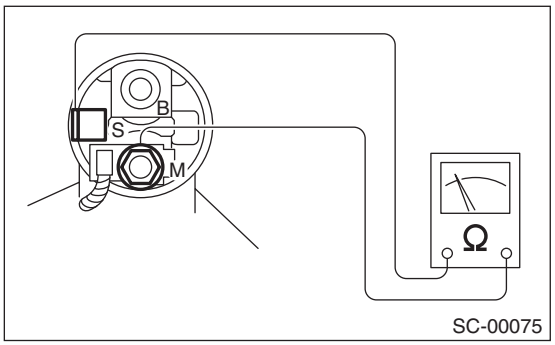
1) Return spring check
Make sure the plunger returns to its original position immediately after pressed-in then released.



(A) Plunger

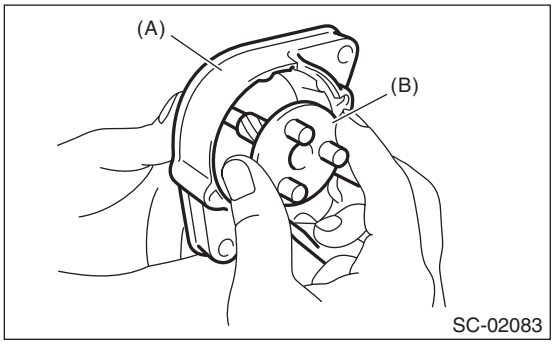
2) Magnet switch continuity test
Be sure there is continuity between the terminals S and M, and between terminal S and ground. Use a circuit tester. Also check to be sure there is no continuity between terminal M and B.

Terminal/Resistance:
S — M/1 Ω or less
S — Ground/1 Ω or less
M — B/1 MΩ or more



5. FRONT BEARING

Check the front bearing to make sure there are no damage or rust. Also, insert the shaft into front bearing to make sure the front bearing rotates smoothly when the shaft is rotated. Replace the front bearing if faulty.



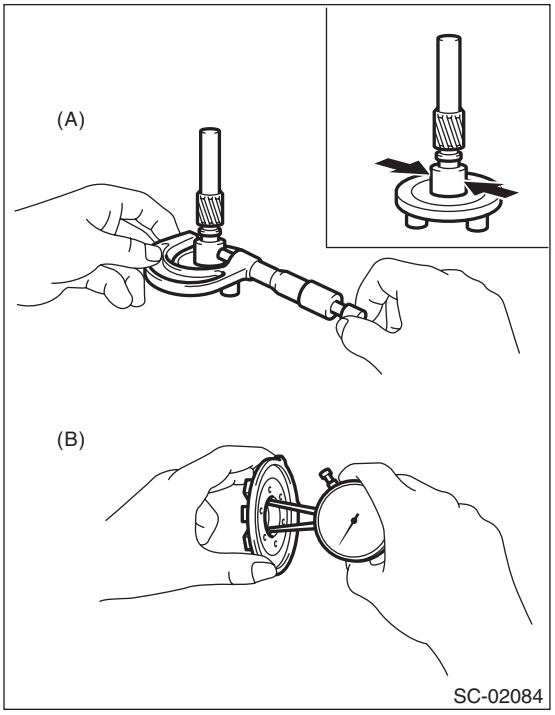
(A) Front bracket
(B) Shaft

6. SHOCK ABSORBER BEARING CLEARANCE

Measure the outside (A) diameter of sliding part for shaft shock absorber bearing. Then, measure the inside (B) diameter of shock absorber bearing, and calculate the clearance. If it exceeds the service limit, replace the oilless bearing or shaft.

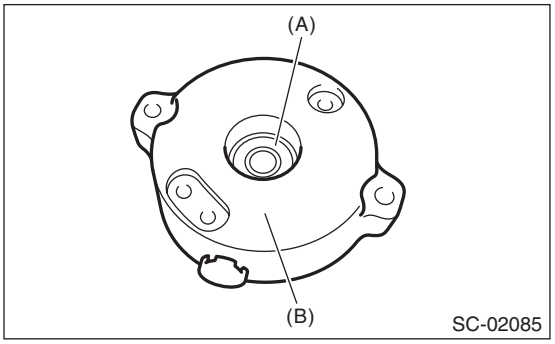
Shock absorber bearing sliding part:
Standard
18 mm (0.709 in)

Clearance:
Standard
0.03 — 0.061 mm (0.001 — 0.0024 in)
Service limit
0.1 mm (0.003 in)



7. REAR BEARING

Check the rear bearing, and replace the rear bearing if there are damage, lock or rust.

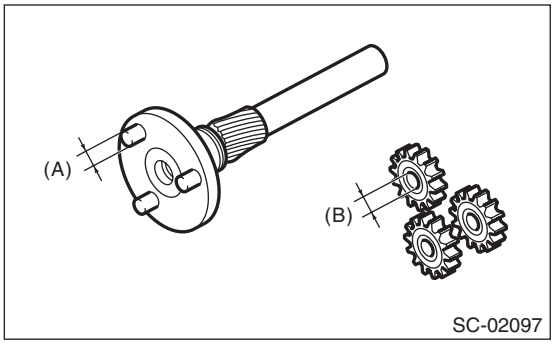


(A) Bearing
(B) End frame

8. PLANETARY GEAR BUSHING

Measure the outer diameter (A) of pin which is press-fitted into shaft. Then, measure the inner diameter (B) of planetary gear bushing, and calculate the clearance. If it exceeds the service limit, replace the planetary gear or shaft.

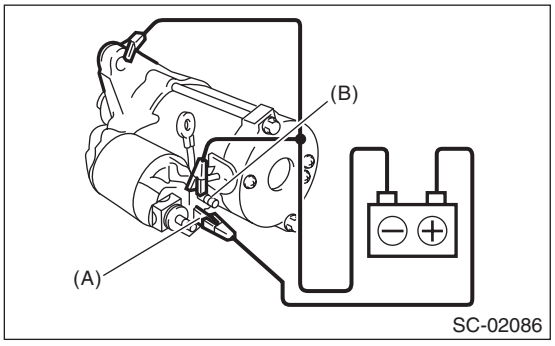
Clearance:
Standard
0.035 — 0.065 mm (0.001 — 0.0025 in)
Service limit
0.1 mm (0.003 in)



9. SWITCH ASSEMBLY OPERATION

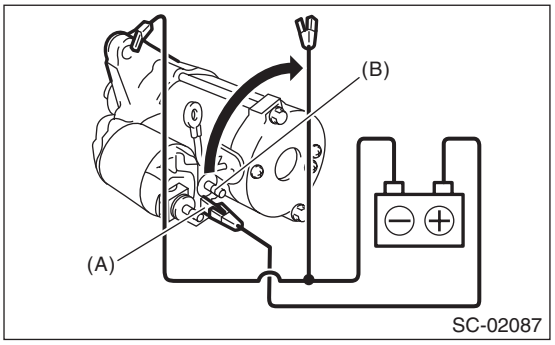
NOTE:
Test period of each test must be within short time (3 — 5 seconds).

1) Vacuum test
Disconnect the harness from terminal M and connect it as shown in the figure. Make sure the pinion gear sticks out.



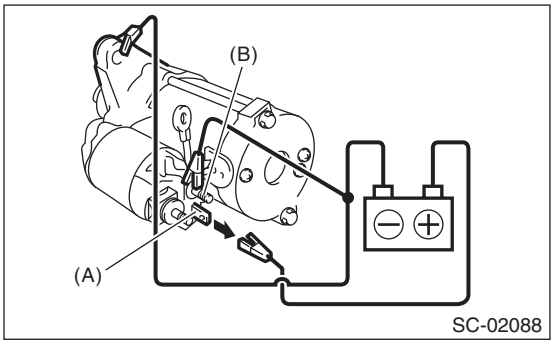
(A) Terminal S
(B) Terminal M

2) Hold test
Make sure the pinion gear remains stick out even after disconnecting terminal M in the above condition.



(A) Terminal S
(B) Terminal M

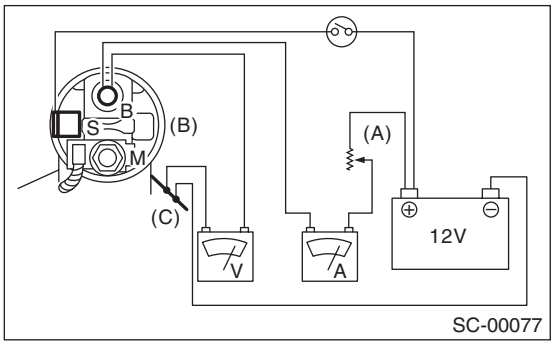
3) Return test
Connect the positive terminal to terminal S and the negative terminal to terminal M and starter body to pull the pinion gear at the main contact point. Make sure the pinion gear returns to its original position when the terminal S is disconnected.



(A) Terminal S
(B) Terminal M

10.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) Starter body
(C) Magnetic switch

1) No-load test
With switch on, adjust the variable resistance until the voltage is 11 V, read the value of ammeter to measure rotating speed. Compare these values with the standard.

No-load test (standard):

Voltage/Current
Max. 11 V/90 A or less

Rotating speed
More than 1,550 rpm

2) Load test
Apply the specified braking torque to starter. The condition is satisfactory if the current draw and rotating speed are within specifications.

Load test (standard):

Voltage/Load
8 V/12.8 N·m (1.31 kgf-m, 9.4 ft-lb)

Current/Speed
370 A/800 rpm or more

3) Lock test
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
3 V/750 A or less

Torque
19.0 N·m (1.94 kgf-m, 14.0 ft-lb)