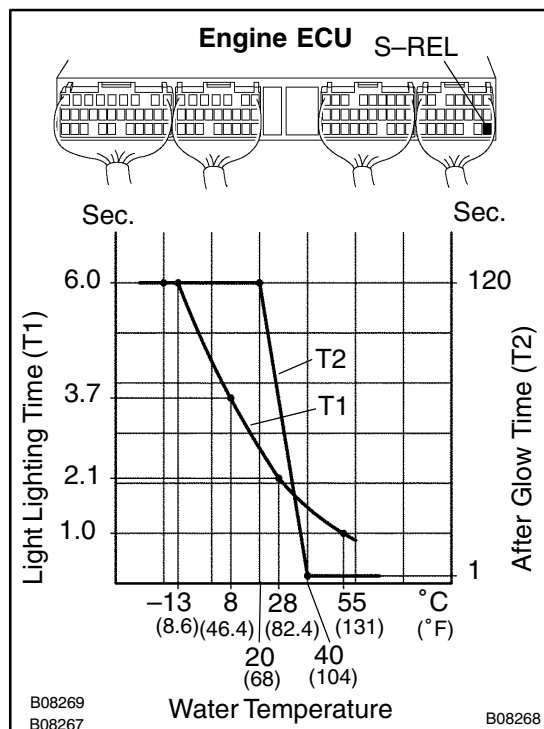

STARTING

PRE-HEATING SYSTEM	ST-1
STARTER	ST-3
STARTER RELAY	ST-14





PRE-HEATING SYSTEM INSPECTION

ST0GU-01

1. INSPECT LIGHTING TIME OF GLOW INDICATOR LIGHT

Turn the ignition switch ON, and measure the lighting time.

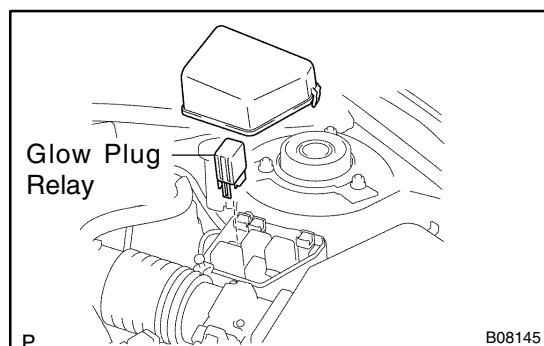
Light lighting time (T1): Refer to the chart graph

2. INSPECT AFTER GLOW TIME

Turn the ignition switch to START, after the engine starts, measure the time when the battery voltage is applied to terminal S-REL of the engine ECU.

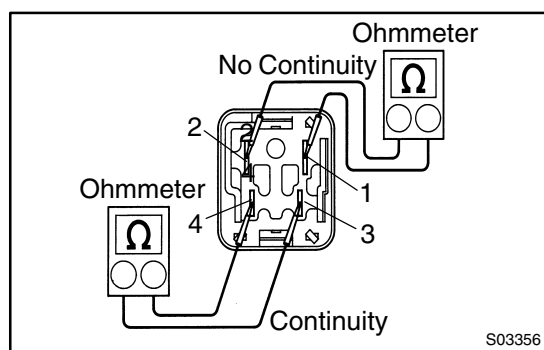
After glow time (T2): Refer to the chart graph

3. INSPECT ENGINE ECU (See page DI-118)



4. INSPECT GLOW PLUG RELAY (Making: GLOW)

- Remove the relay box cover.
- Remove the glow plug relay.



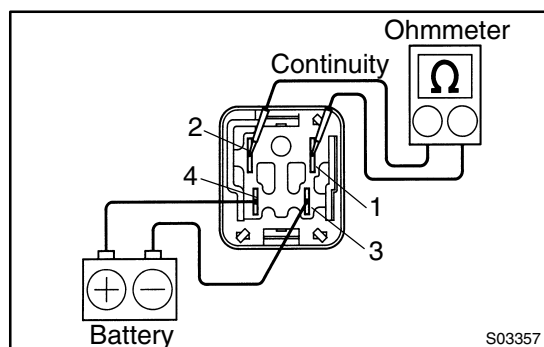
- Inspect the glow plug relay continuity.

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

If there is continuity, replace the relay.

- Check that there is continuity between terminals 3 and 4.

If there is no continuity, replace the relay.



- Inspect the glow plug relay operation.

- Apply battery voltage across terminals 3 and 4.

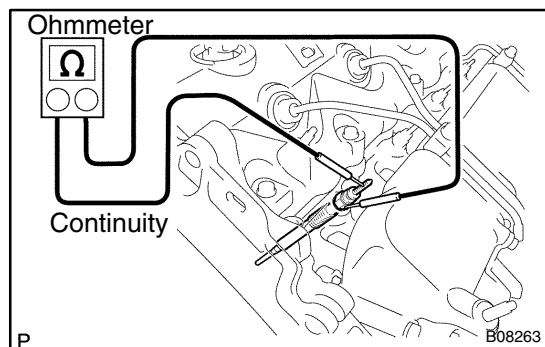
- Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

- Reinstall the glow plug relay.

- Reinstall the relay box cover.

5. INSPECT WATER TEMPERATURE SENSOR (See page ED-10)



6. INSPECT GLOW PLUGS

Using an ohmmeter, check that there is continuity between the glow plug terminal and ground.

Standard resistance: Approx. 0.72Ω at 20°C (68°F)

If there is no continuity, replace the glow plug.

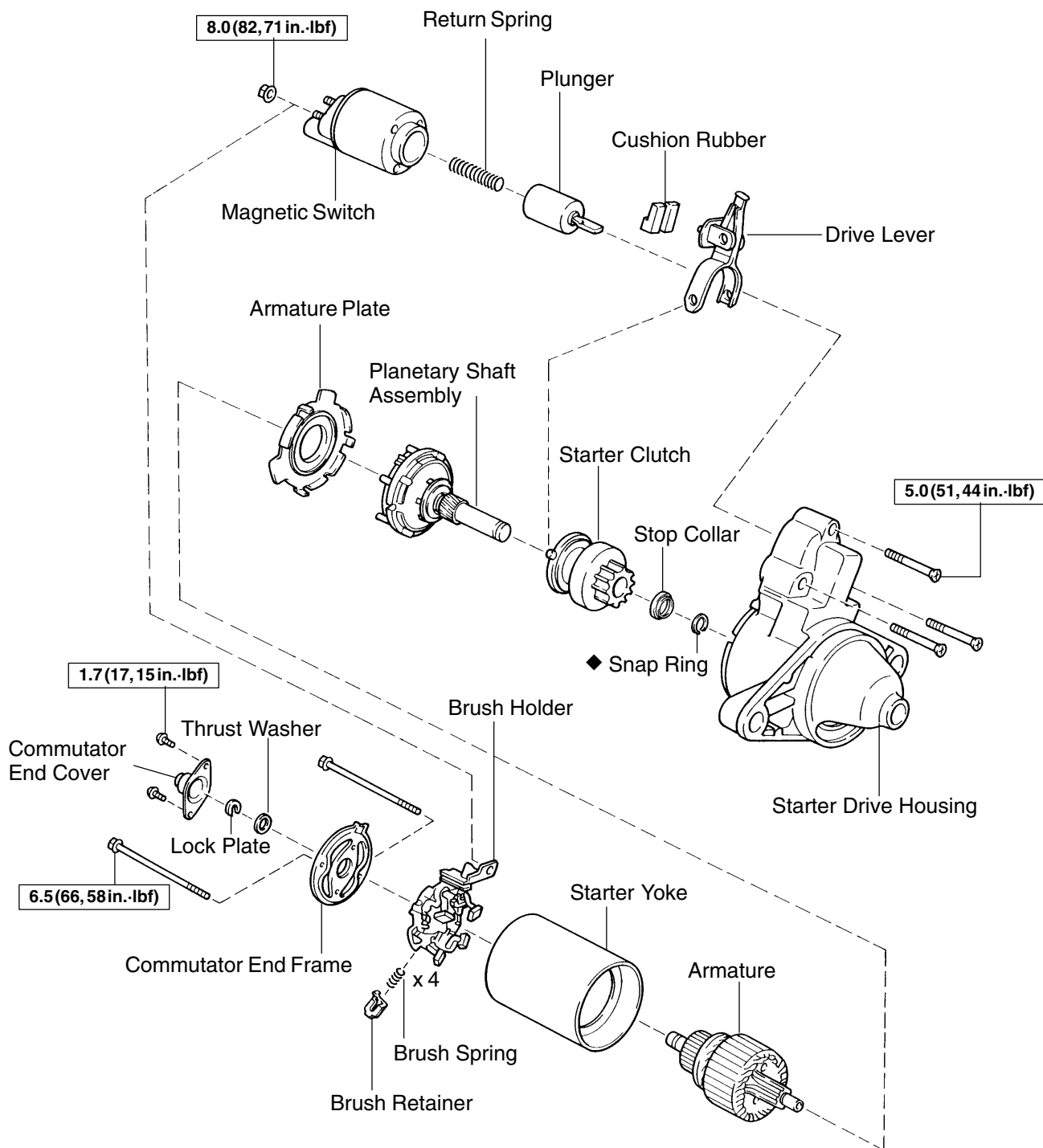
Torque: $13 \text{ N}\cdot\text{m}$ ($130 \text{ kgf}\cdot\text{cm}$, $10 \text{ ft}\cdot\text{lbf}$)

NOTICE:

- Be careful not to damage the glow plug pipes as it could cause an open circuit or shorten life of the glow plugs.
- Avoid getting oil and gasoline on the glow plug when cleaning.
- During inspection, be sure to wipe any oil of the terminal and bakelite washer with a dry cloth.
- Be careful no to apply more than 11 V to the glow plug as it could cause an open circuit.

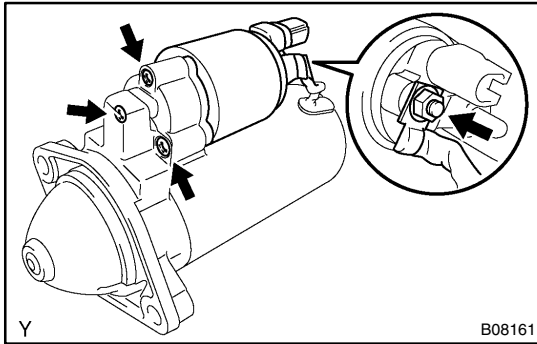
STARTER COMPONENTS

STOFJ-02



N ◆ Non-reusable part

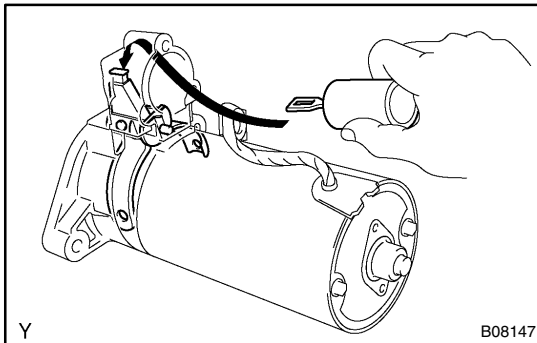
B08266



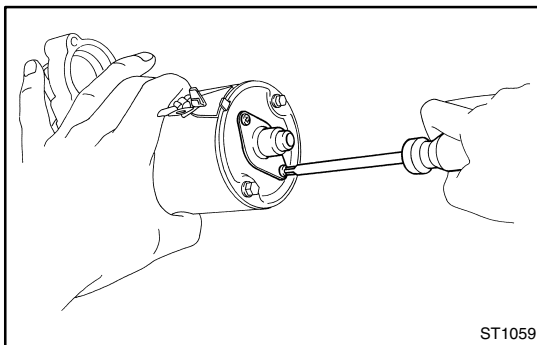
DISASSEMBLY

1. REMOVE MAGNETIC SWITCH

- (a) Remove the nut, and disconnect lead wire from the magnetic switch terminal.
- (b) Remove the 3 screws, magnetic switch and return spring.

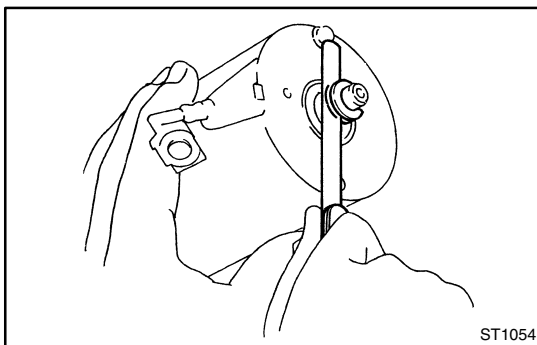


- (c) Pull the plunger, and disconnect the plunger hook from the upper side of the drive lever.



2. REMOVE COMMUTATOR END COVER

- (a) Remove the 2 screws and end cover.



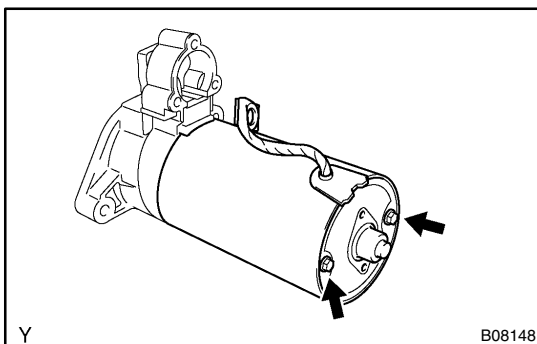
- (b) Using a feeler gauge, measure the armature thrust clearance between the lock plate and end frame.

Standard thrust clearance: 0.3 mm (0.012 in.)

Maximum thrust clearance: 0.6 mm (0.024 in.)

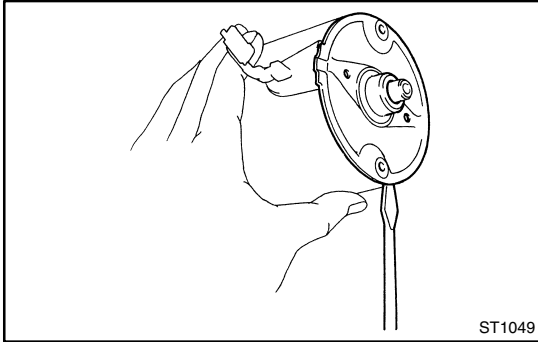
If the thrust clearance is greater than the maximum, replace the thrust washer.

- (c) Remove the lock plate and thrust washer.



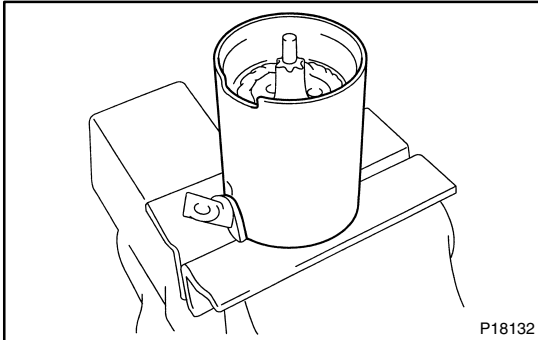
3. REMOVE STARTER YOKE AND ARMATURE

Remove the 2 through bolts, and pull out the starter yoke together with the armature.

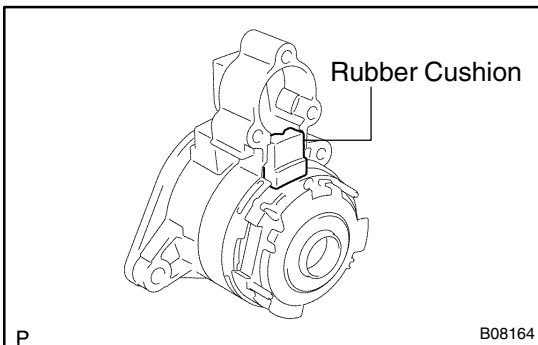


4. REMOVE COMMUTATOR END FRAME

Using a screwdriver, pry out the commutator end frame.



5. REMOVE STARTER YOKK FROM ARMATURE
6. REMOVE ARMATURE FROM BRUSH HOLDER

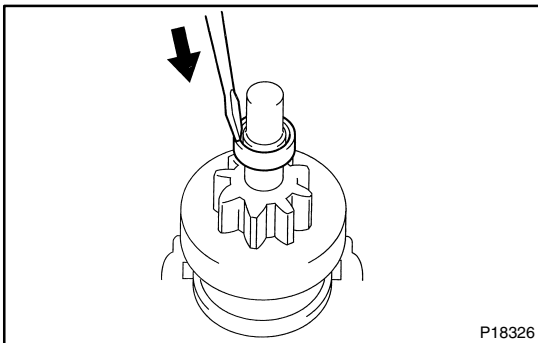


7. REMOVE ARMATURE PLATE

8. REMOVE PLANETARY SHAFT ASSEMBLY AND STARTER CLUTCH

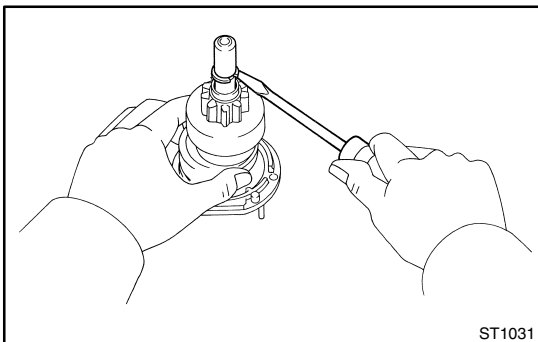
- (a) Remove the rubber cushion.
- (b) Remove the planetary shaft and starter clutch assembly.

9. REMOVE DRIVE LEVER FROM STARTER CLUTCH

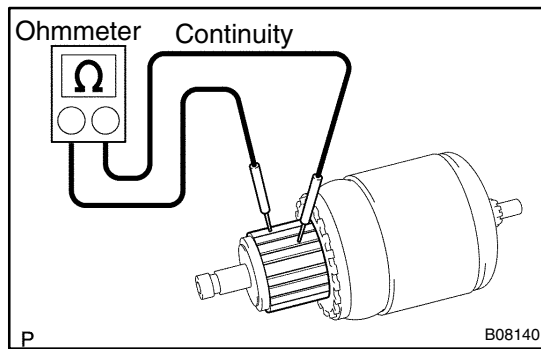


10. REMOVE STARTER CLUTCH FROM PLANETARY SHAFT

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



- (b) Using a screwdriver, pry out the snap ring.
- (c) Remove the stop collar from the shaft.



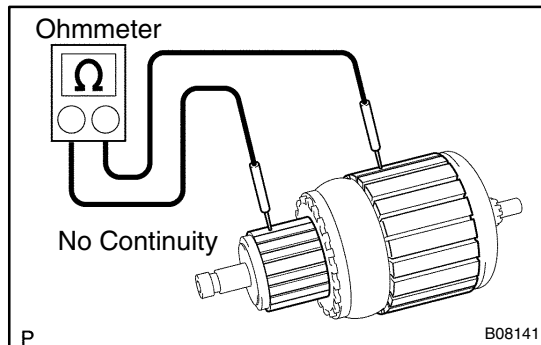
INSPECTION

1. INSPECT ARMATURE COIL

- (a) Check the 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 segments, replace the armature.



- (b) Check the commutator for ground.

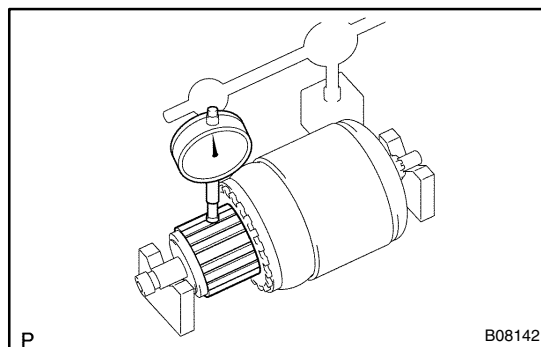
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

2. INSPECT COMMUTATOR

- (a) Check the commutator for the dirty and burnt surface.

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



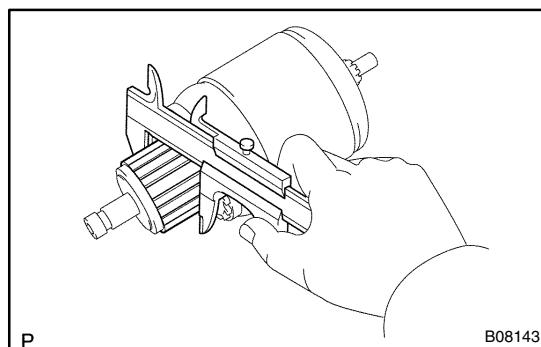
- (b) Check for the commutator circuit runout.

- (1) Place the commutator on V-blocks.

- (2) Using a dial indicator, measure the circle runout.

Maximum circle runout: 0.03 mm (0.0012 in.)

If the circle runout is greater than maximum, correct it on a lathe.

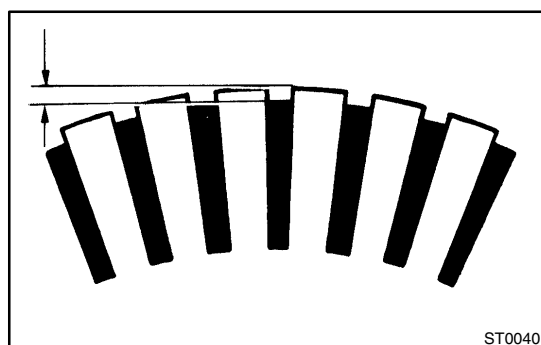


- (c) Using vernier calipers, measure the commutator diameter.

Standard diameter: 32.3 mm (1.272 in.)

Minimum diameter: 30.5 mm (1.201 in.)

If the diameter is less than minimum, replace the armature.

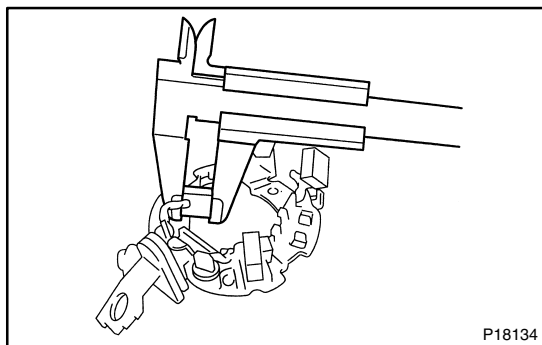


- (d) Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth: 0.9 mm (0.035 in.)

Minimum undercut depth: 0.3 mm (0.012 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.



3. INSPECT BRUSH

Using vernier calipers, measure the brush length.

Standard length: 14.5 mm (0.571 in.)

Minimum length: 9.0 mm (0.354 in.)

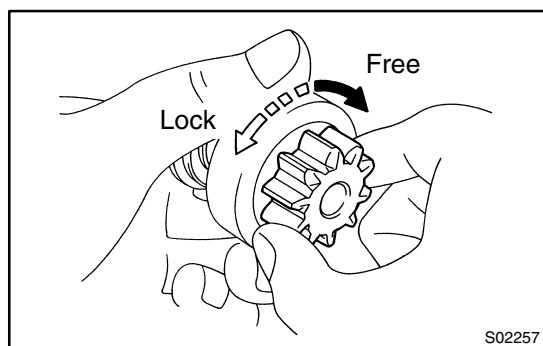
If the length is less than minimum, replace the brush holder.

4. INSPECT CLUTCH AND GEAR

- (a) Check the gear teeth on the starter clutch for wear or damage.

If the gear is damaged, replace it.

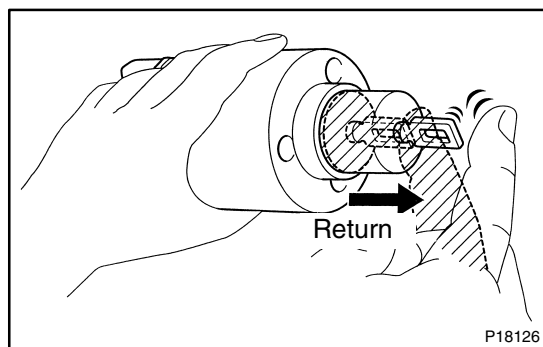
If damaged, replace the clutch assembly. If damaged, also check the drive plate ring gear for wear or damage.



- (b) Check the 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.

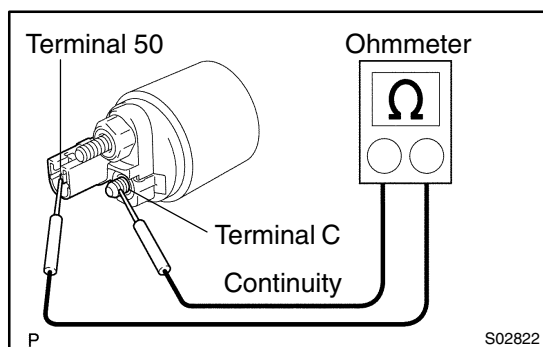


5. INSPECT MAGNETIC SWITCH

- (a) Check the plunger.

Push in the plunger and check that it returns quickly to its original position.

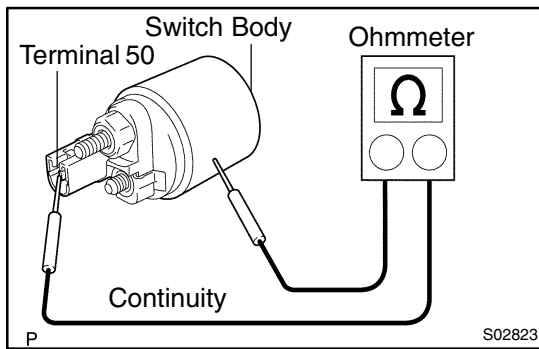
If necessary, replace the magnetic switch.



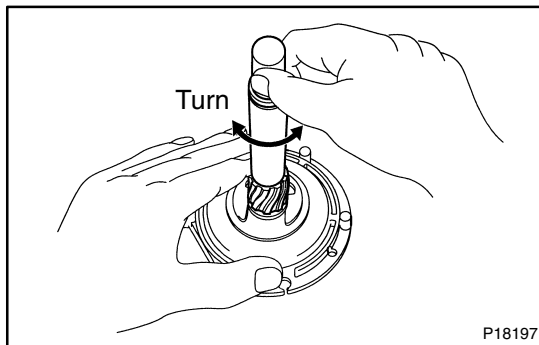
- (b) Check the pull-in coil for open circuit.

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

If there is no continuity, replace the magnetic switch.

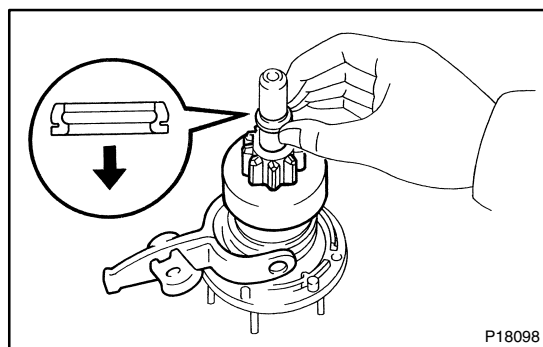


- (c) Check the hold-in coil for open circuit.
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.



6. INSPECT PLANETARY SHAFT

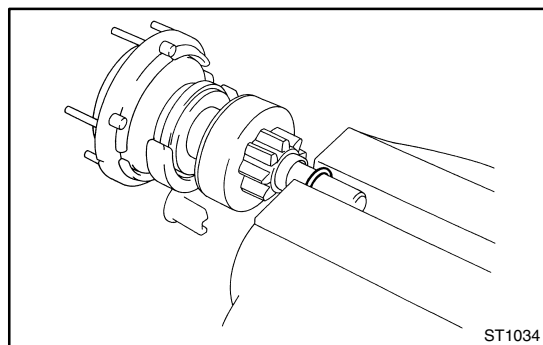
Turn the shaft, and check that it is not rough or worn.
If it feels rough or worn, replace the planetary shaft assembly.



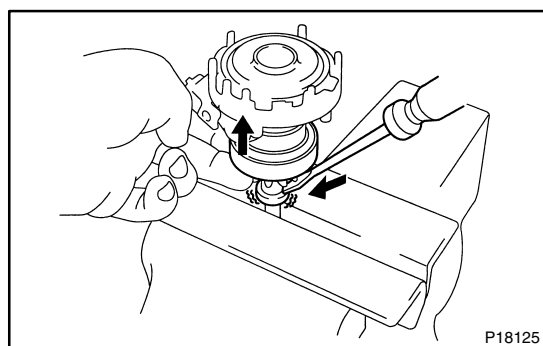
REASSEMBLY

1. **INSTALL DRIVE LEVER TO STARTER CLUTCH**
2. **INSTALL STARTER CLUTCH TO PLANETARY SHAFT**

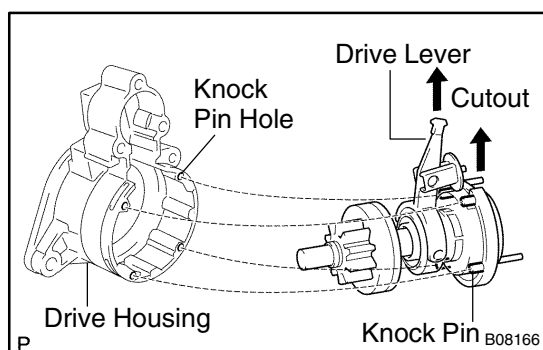
- (a) Apply grease to the bushing and spline of the starter clutch and planetary shaft.
- (b) Place the starter clutch and stop collar on the planetary shaft as shown in the illustration.



- (c) Install a new snap ring to the planetary shaft groove.
- (d) Using a vise, compress the snap ring.
- (e) Check that the snap ring fits correctly.

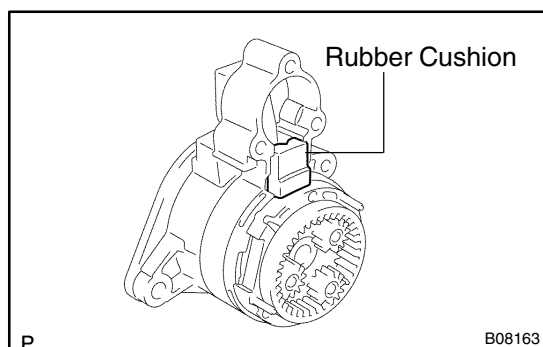


- (f) Using a screwdriver, tap the stop collar to slide it onto the snap ring.

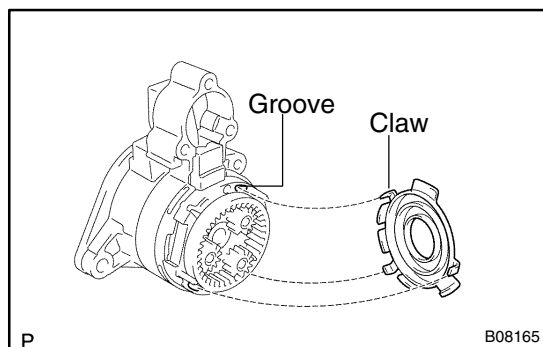


3. **INSTALL PLANETARY SHAFT ASSEMBLY AND STARTER CLUTCH**

- (a) Set the planetary shaft and drive lever in position as shown in the illustration.
- (b) Align the holes of the driver housing with the knock pins.
- (c) Install the planetary shaft and starter clutch to the drive housing.

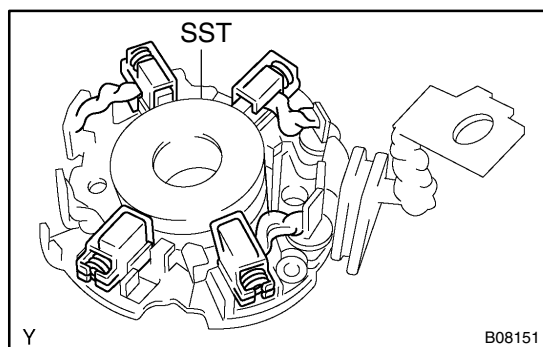


- (d) Install the rubber cushion.



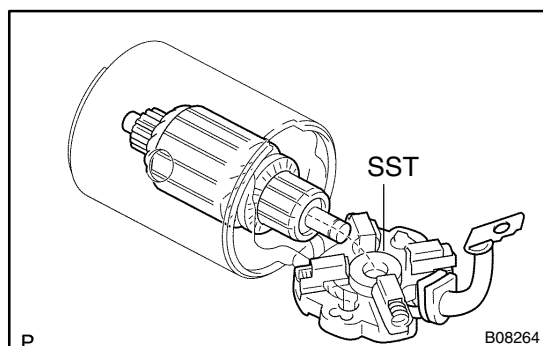
4. INSTALL ARMATURE PLATE

- Set the armature plate in position as shown in the illustration.
- Align the claw grooves of the internal gear with the claws of the armature plate.
- Install the armature plate to the internal gear.

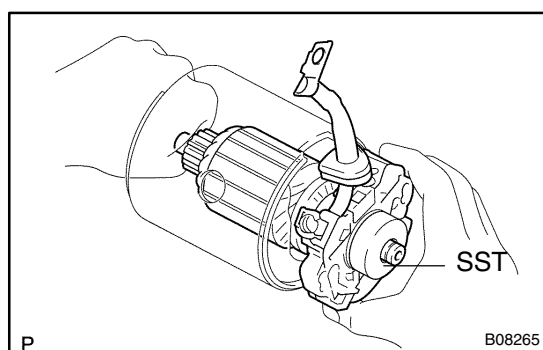


5. INSTALL BRUSH HOLDER TO ARMATURE

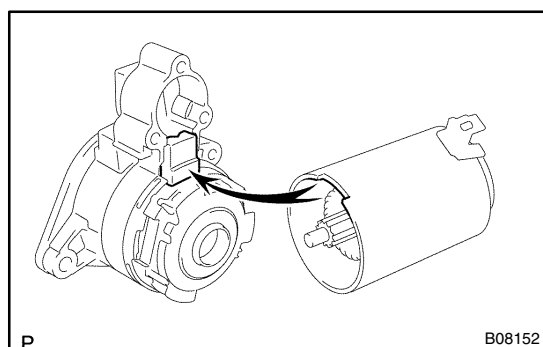
- Install the 4 brush retainers and 4 brush springs to the brush holder.
- Using SST, install the 4 brushes to the brush holder.
SST 09950-60010 (09951-00340)



- Attach the brush holder to the armature.

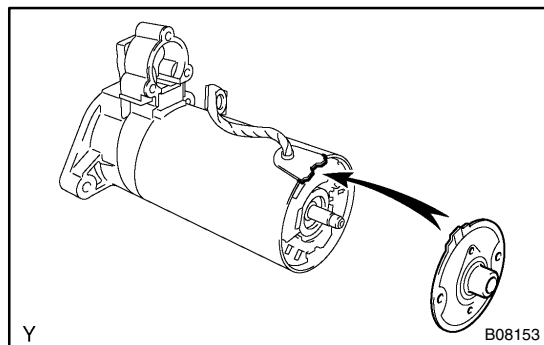


- Push the armature, and remove the SST.

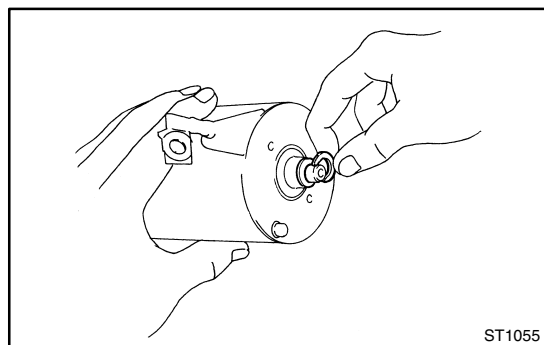


6. INSTALL STARTER YOKE AND ARMATURE ASSEMBLY

- Align the cushion rubber on the starter drive housing with the cutout of the starter yoke.
- Install the starter yoke and armature assembly.

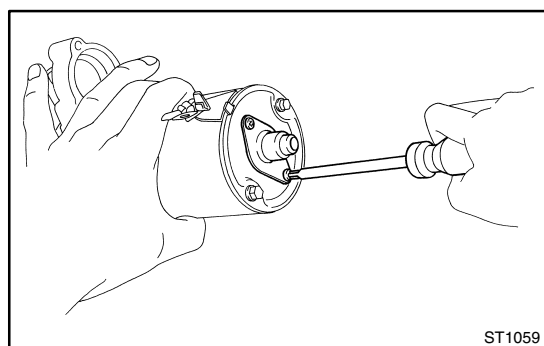


- (c) Align the commutator end frame with the brush holder rubber part as shown in the illustration.
- (d) Install the commutator end frame with the 2 through bolts.
Torque: 6.5 N·m (66 kgf·cm, 58 in.-lbf)

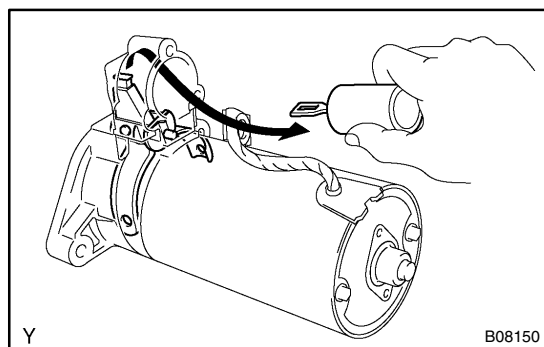


7. INSTALL COMMUTATOR END COVER

- (a) Install the thrust washer and lock plate.
- (b) Check the armature thrust clearance between the lock plate and the end frame. (See page ST-4)

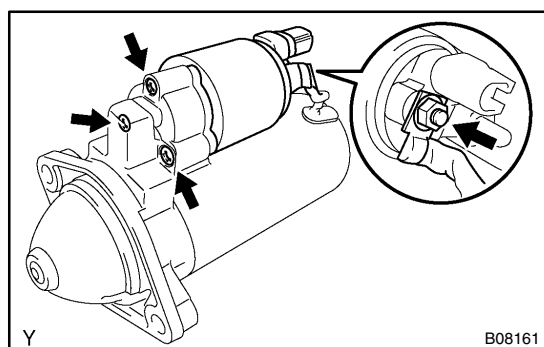


- (c) Pack grease to the commutator end cover.
- (d) Install the commutator end cover with the 2 screws.
Torque: 1.7 N·m (17 kgf·cm, 15 in.-lbf)



8. INSTALL MAGNETIC SWITCH

- (a) Hang the plunger hook to the upper side of the drive lever.
- (b) Install the return spring into the plunger.

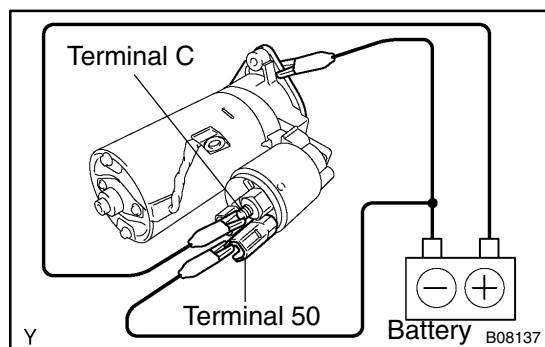


- (c) Install the return spring and magnetic switch with the 3 screws.
Torque: 5.0 N·m (51 kgf·cm, 44 in.-lbf)
- (d) Connect the lead wire to the magnetic switch terminal with the nut.
Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)

TEST

NOTICE:

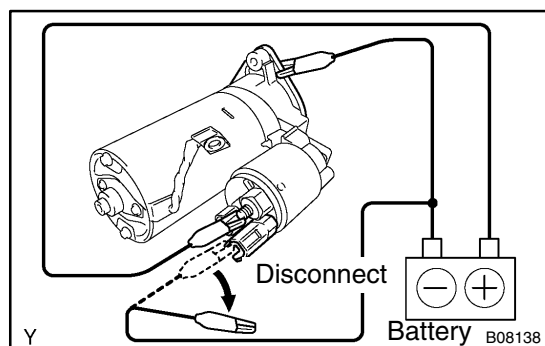
These tests must be done within 3 to 5 seconds to avoid burning out the coil.



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.

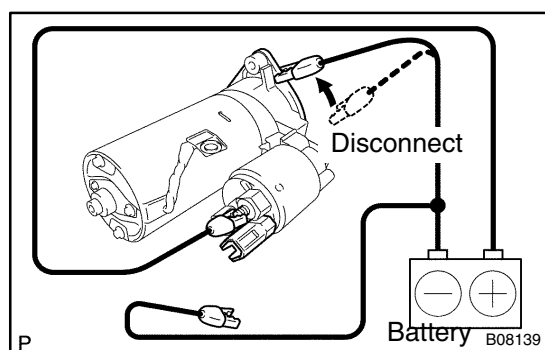
If the clutch pinion gear does not move, replace the magnetic switch.



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.

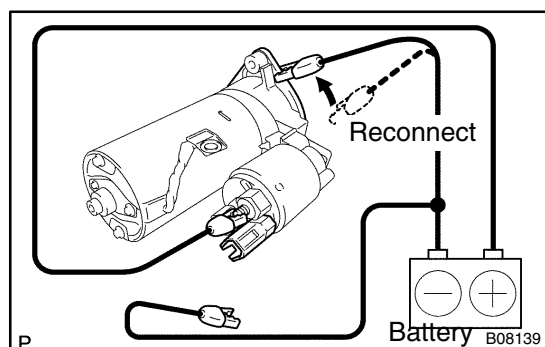
If the clutch pinion gear returns inward, replace the magnetic switch.



3. INSPECT CLUTCH PINION GEAR RETURN

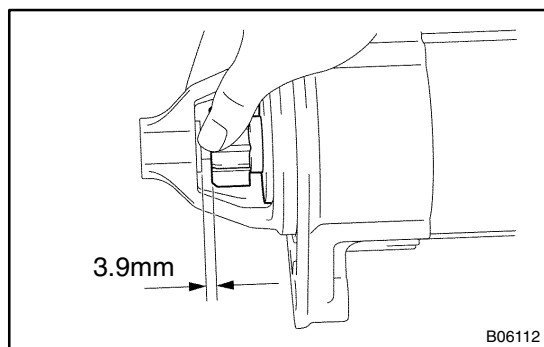
Disconnect the negative (–) lead from the starter housing. Check that the clutch pinion gear returns inward.

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



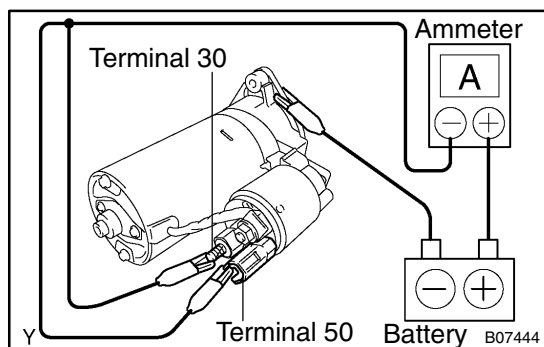
4. INSPECT CLUTCH PINION GEAR CLEARANCE

- (a) Reconnect the negative (–) lead to the starter housing.



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

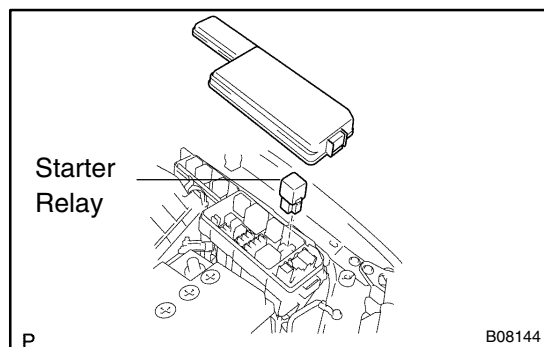
Maximum clearance: 3.9 mm (0.154 in.)



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.

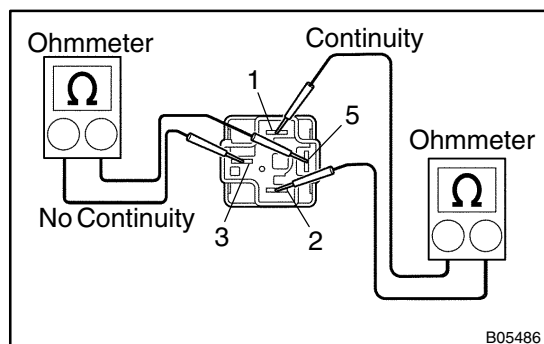
Specified current: 160 A or less at 10.5 V



STARTER RELAY INSPECTION

ST08J-05

1. REMOVE RELAY BOX COVER
2. REMOVE STARTER RELAY



3. INSPECT STARTER RELAY

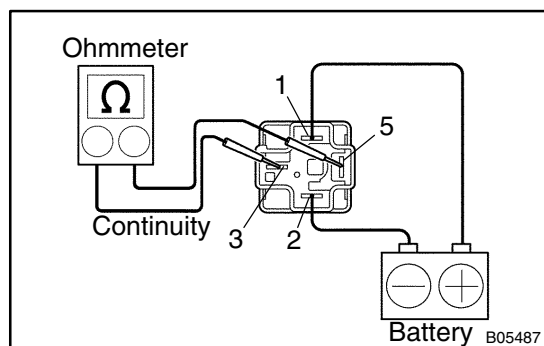
- (a) Inspect the relay continuity.

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

If there is no continuity, replace the relay.

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

If there is continuity, replace the relay.



- (b) Inspect the relay operation.

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

- (2) 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

5. REINSTALL RELAY BOX COVER