STARTER

Removal and Installation

Remove the negative (-) battery cable.

Remove the starter wiring by disconnecting the harness from terminal 30 by removing the nut. Remove the connector from terminal 50.

Remove the starter from the engine.

Reverse procedures to install starter.

Overhaul

FIG. 10C-02: Remove the starter.

Remove the lead from terminal C.

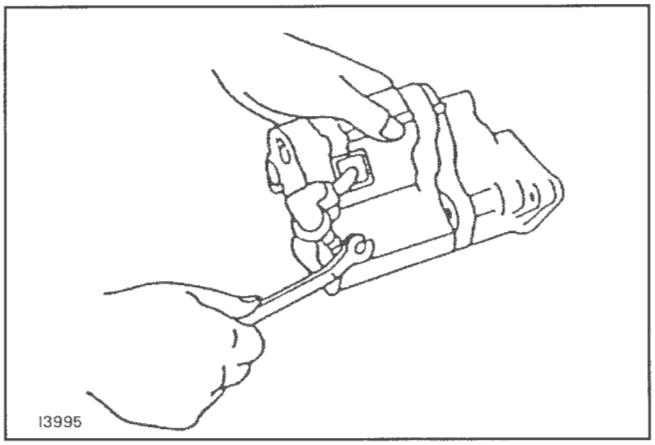

FIG. 10C-02

FIG. 10C-03: Remove the starter yoke/armature assembly and O-ring by removing the two through bolts.

Remove the commutator end frame and an O-ring.

Disconnect the motor (yoke) housing from the magnetic switch.

Remove the drive gear from the armature.

Remove the idle gear and retainer with roller.

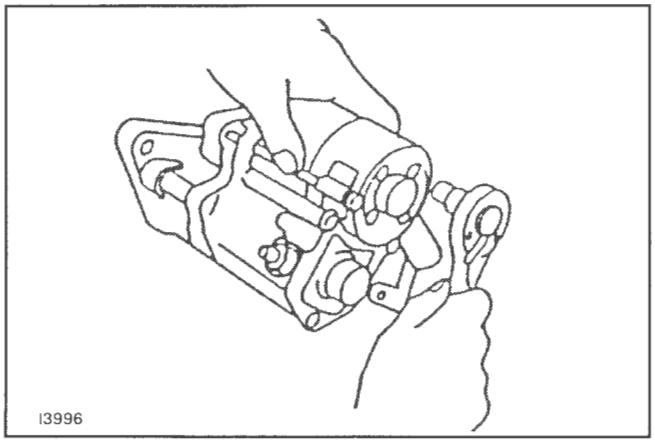

FIG. 10C-03

FIG. 10C-04: Remove the clutch assembly from the magnet switch.

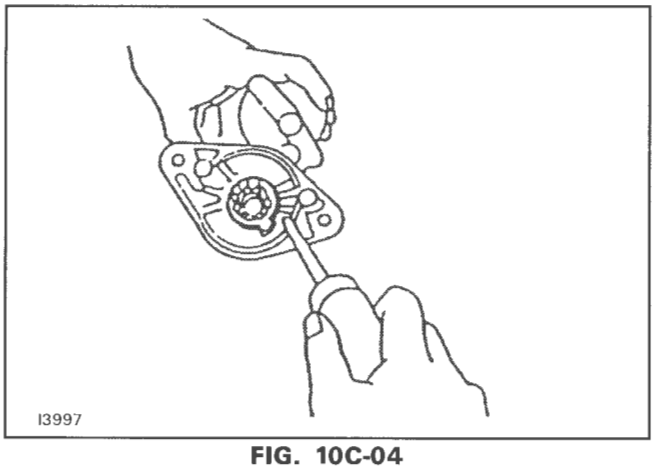

FIG. 10C-04

FIG. 10C-05: Remove the steel ball and spring assemblies from the clutch.

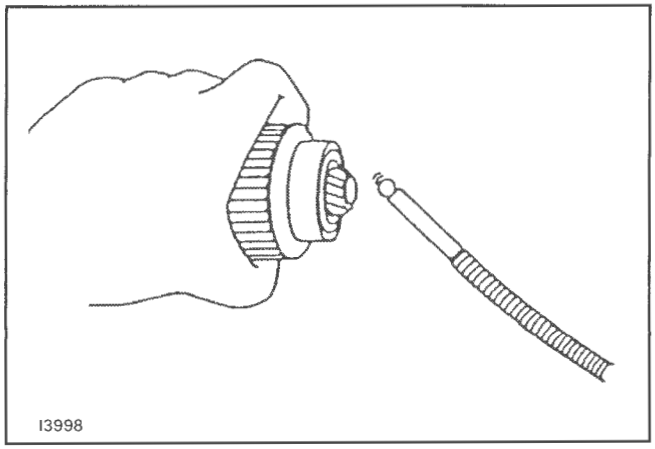

FIG. 10C-05

FIG. 10C-06: Lift up the brush springs and take out the brushes.

Disconnect the brush holder from the starter yoke.

Remove the armature from the starter yoke.

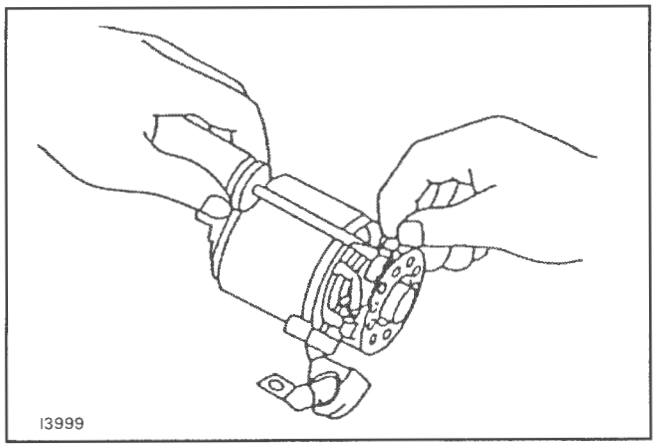

FIG. 10C-06

Inspecting and Servicing

FIG. 10C-07: Check continuity across the commutator and armature coil core. If there is no continuity, the armature coil is normal.

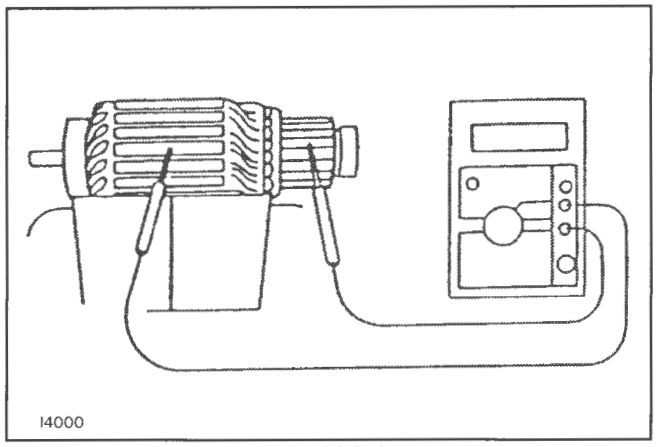

FIG. 10C-07

FIG. 10C-08: Turn the armature coil on a armature coil tester while holding a metal strip closely above the armature. If the iron piece does not vibrate and is not attracted to the armature, the armature is normal.

NOTE: The armature coil surfaces should be cleaned prior to testing.

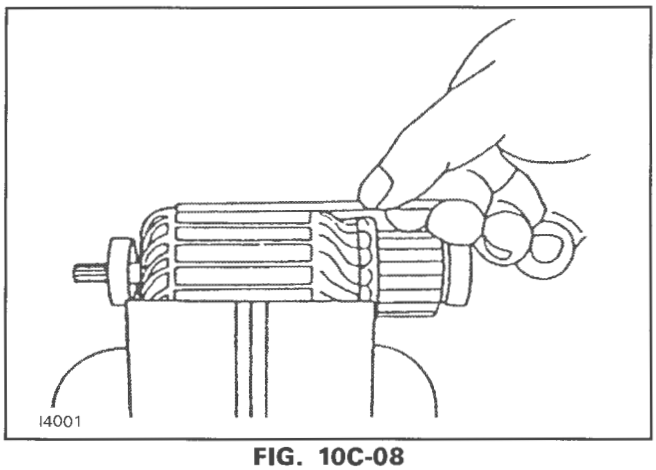

FIG. 10C-08

FIG. 10C-09: Inspect the commutator surfaces for dirt, burning, damage, etc. Minor damage can be corrected with #400 sandpaper (or finer).

Inspect the commutator for run-out with a dial gauge on a V-block.

Standard Value	Usable Limit
0.02 mm	0.05mm

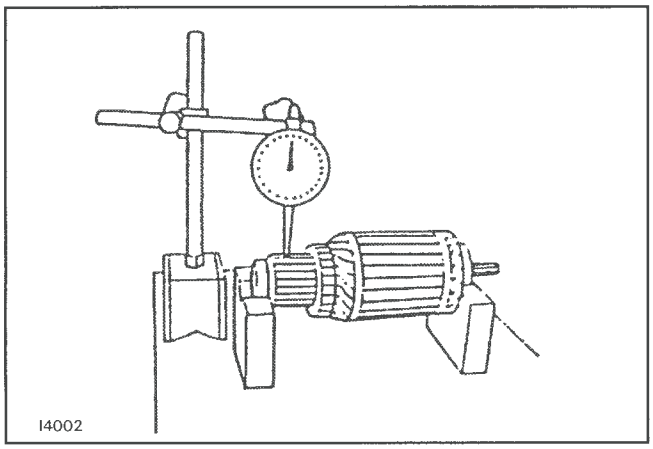

FIG. 10C-09

FIG. 10C-10: Measure the commutator diameter with vernier calipers.

Standard Value	Usable Limit
30 mm	29 mm

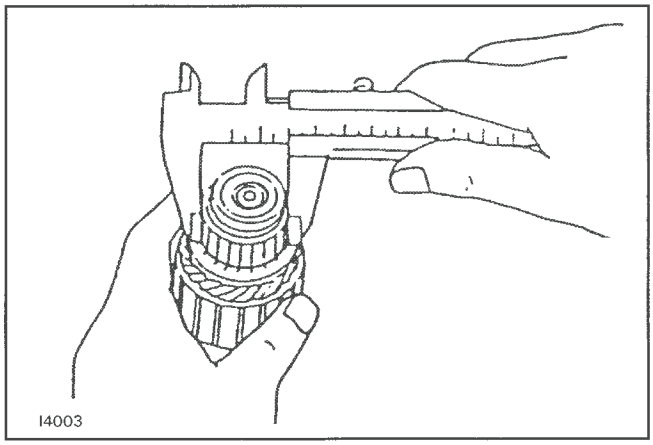

FIG. 10C-10

FIG. 10C-11: Measure mica depth against segment top.

Standard Value	Usable Limit
0.5 - 0.8 mm	0.2 mm

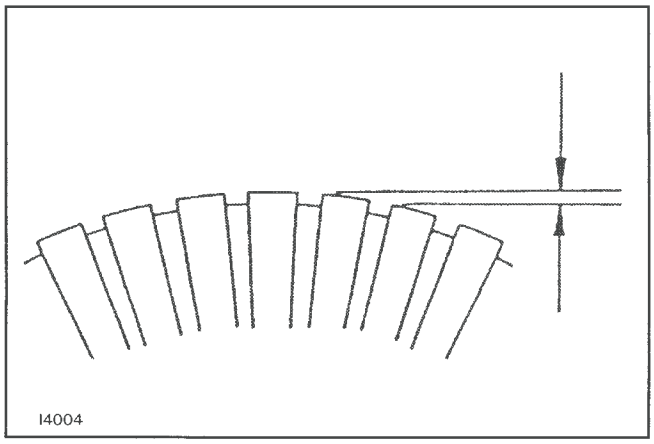

FIG. 10C-11

FIG. 10C-12: Inspect for continuity across the lead from terminal C and field coil brushes. If there is continuity, the coils are normal.

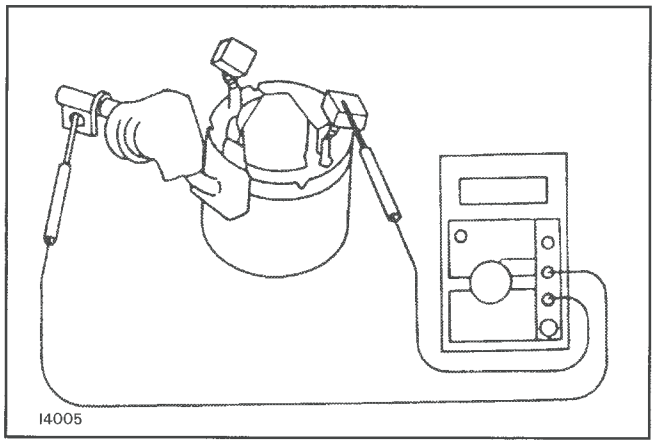

FIG. 10C-12

FIG. 10C-13: Inspect continuity across the field coil brush and field coil. If there is no continuity, the coils are normal.

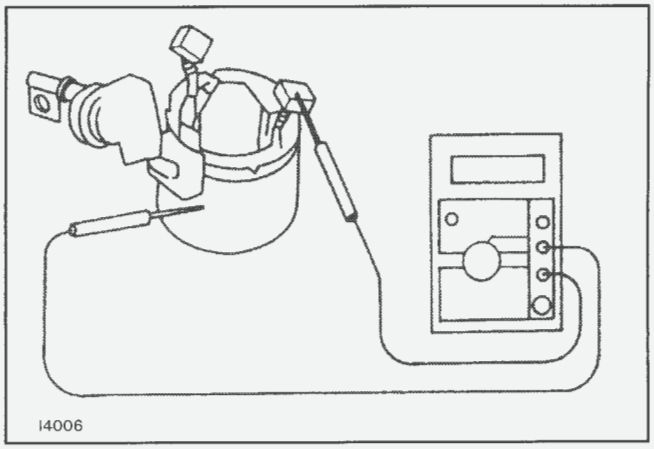

FIG. 10C-13

FIG. 10C-14: Measure brush length in the middle.

Standard Value	Usable Limit
15.0 mm	11.0 mm

Correct the contact surfaces of the brushes on the sandpaper wrapped around the commutator.

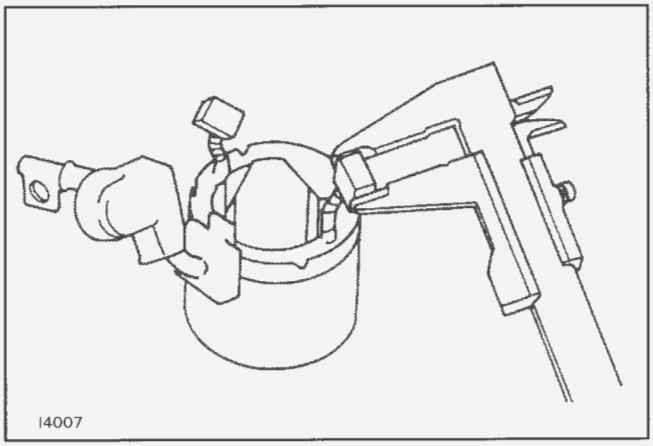

FIG. 10C-14

FIG. 10C-15: Measure spring tension with a spring scale and read the tension at the moment when the spring is about to leave the brush.

Standard Value	Usable Limit
1785 - 2415 mm	1200 mm

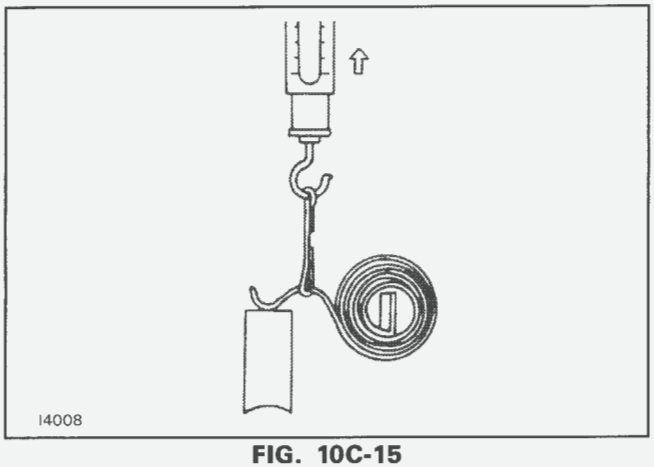

FIG. 10C-15

FIG. 10C-16: Inspect for insulation across positive (+) side and negative (-) side of the brush holder. If there is no continuity, the brush holder is normal.

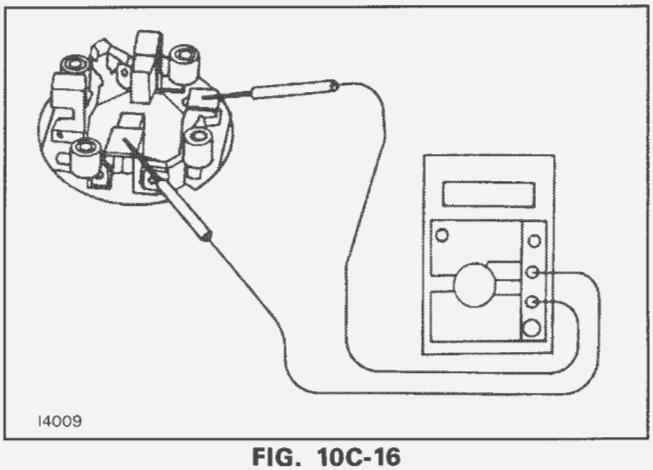

FIG. 10C-16

FIG. 10C-17: Inspect the pinion gear for wear and damage.

Make sure that the gear locks when turned in diving direction and turns smoothly in the reverse direction.

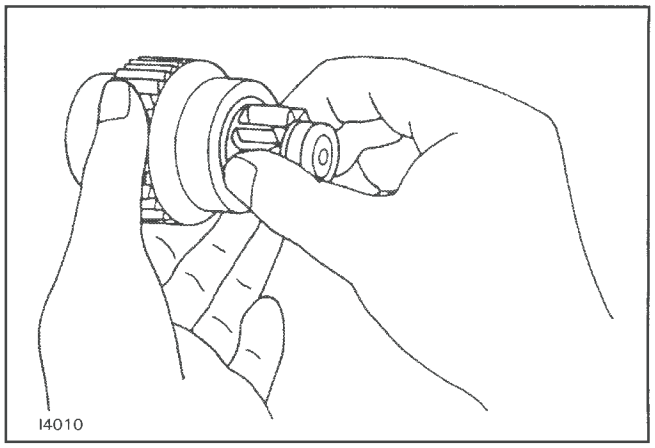

FIG. 10C-17

FIG. 10C-18: There should be no binding when the bearings are turned with fingers.

Bearings should not make abnormal noises when turned quickly.

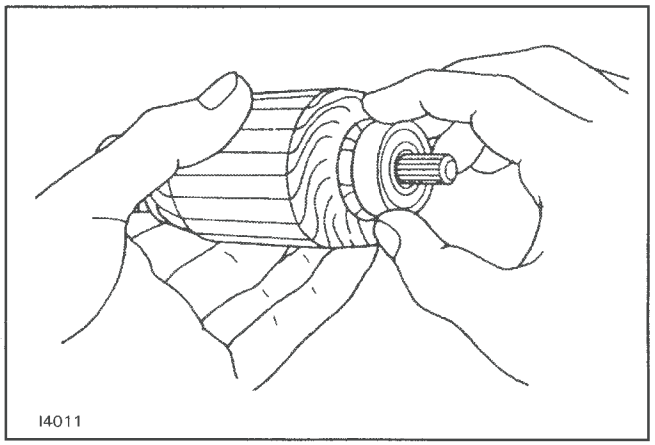

FIG. 10C-18

FIG. 10C-19: Remove the bearings(s), as required, using a puller as illustrated.

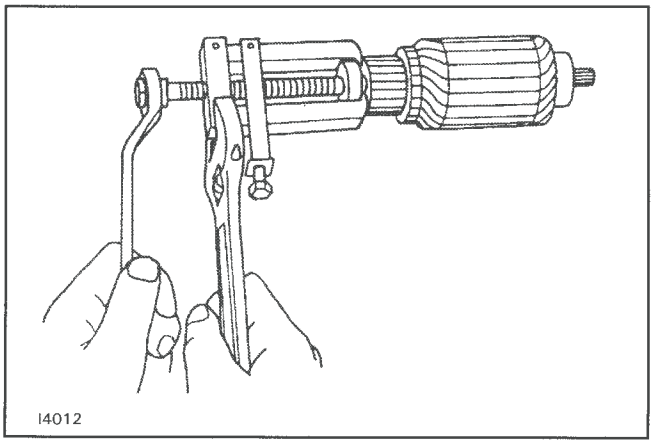

FIG. 10C-19

FIG. 10C-20: Press new bearing(s) fully into position.

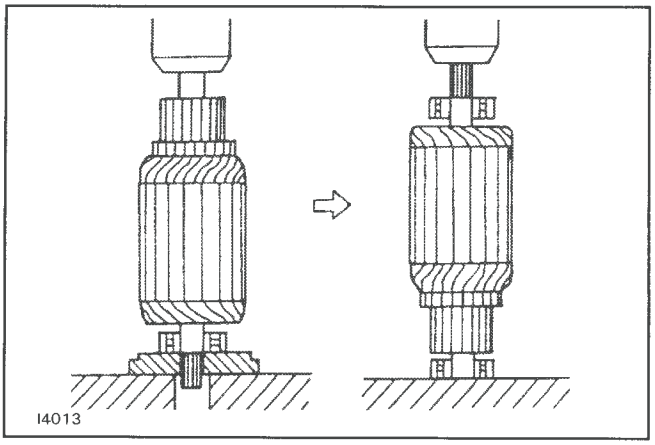

FIG. 10C-20

FIG. 10C-21: Inspect for continuity across magnetic switch terminals 50 and C. If there is continuity, the switch is normal.

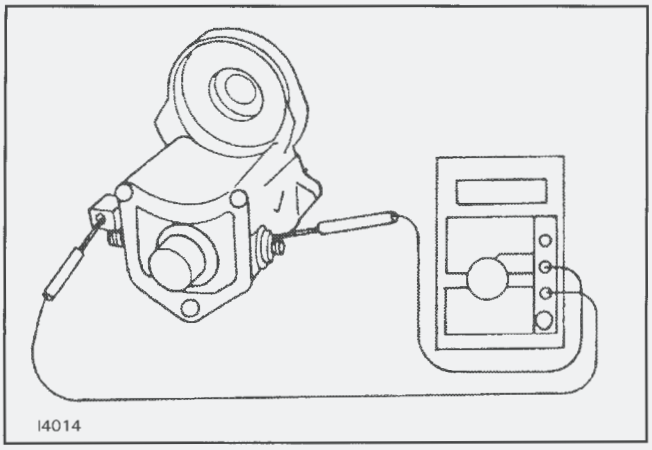

FIG. 10C-21

FIG. 10C-22: Inspect for continuity across terminal 50 and magnetic switch body. If there is continuity, the switch is normal.

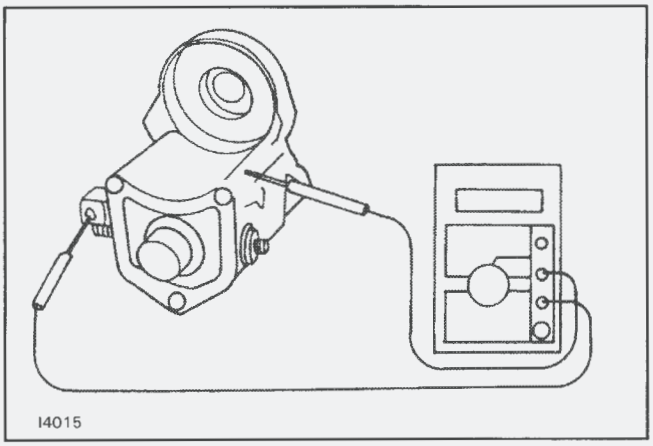

FIG. 10C-22

Reassembly

Apply grease to the armature bearings and then install the armature in the starter yoke.

FIG. 10C-23: Lift up and hold each spring and install the brush.

Install the commutator end frame using an O-ring.

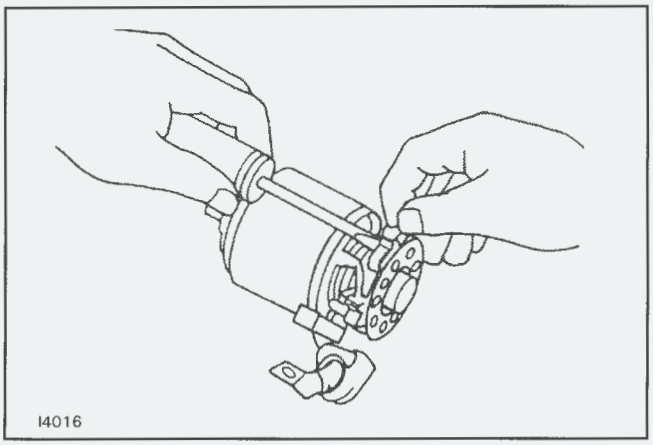

FIG. 10C-23

FIG. 10C-24: Install the starter yoke on the magnetic switch using an O-ring.

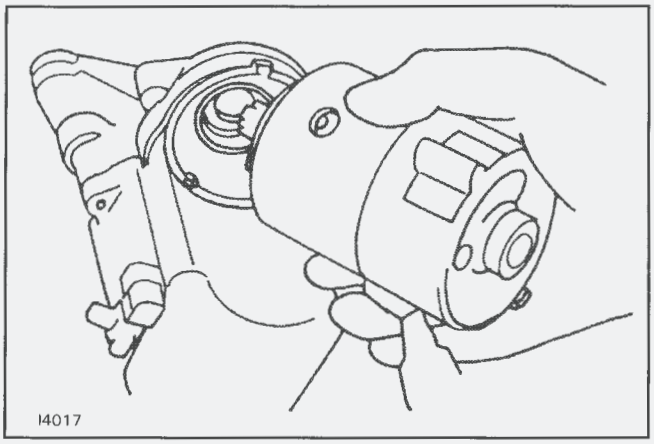

FIG. 10C-24

FIG. 10C-25: Apply grease to the balls and install the ball and spring assemblies into the clutch.

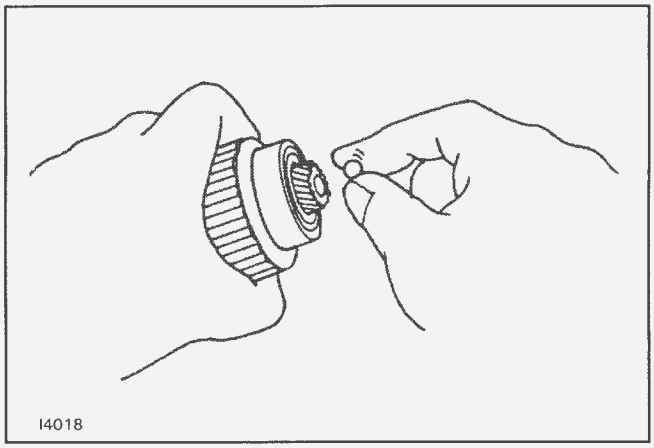

FIG. 10C-25

FIG. 10C-26: Install the clutch assembly, 1, in the starter housing.

Apply grease to the roller/retainer assembly, 2, and idlegear, 3, and then install.

Install the drive pinion on the armature shaft.

Apply grease to each gear.

Install the starter housing to the magnetic switch.

Install the two through bolts.

Connect wire lead to terminal C.

NOTE: Each step should be performed within three to five seconds to prevent damage.

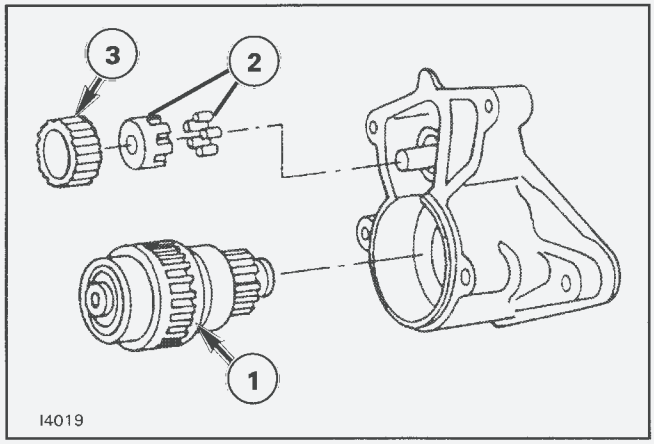

FIG. 10C-26

FIG. 10C-27: Pull-In Test-Make sure the pinion is pushed out when the starter is connected as illustrated.

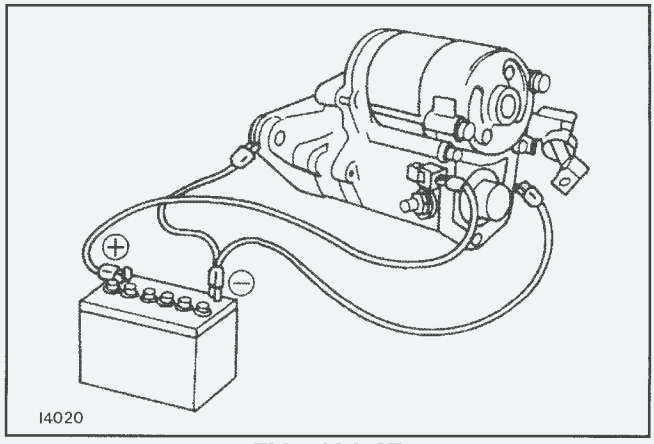

FIG. 10C-27

FIG. 10C-28: Coil Holding Test-while conducting pull-in test, the gear should remain pushed out when the lead, 1, is disconnected from terminal C.

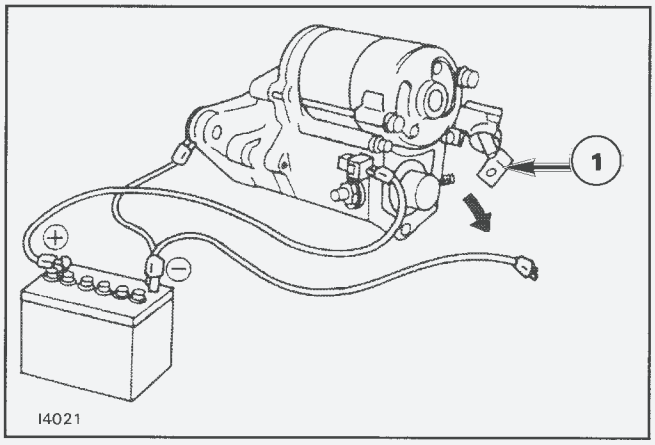

FIG. 10C-28

FIG. 10C-29: Plunger Return Test-Following the coil holding test, the pinion should retract when the connection is removed as illustrated.

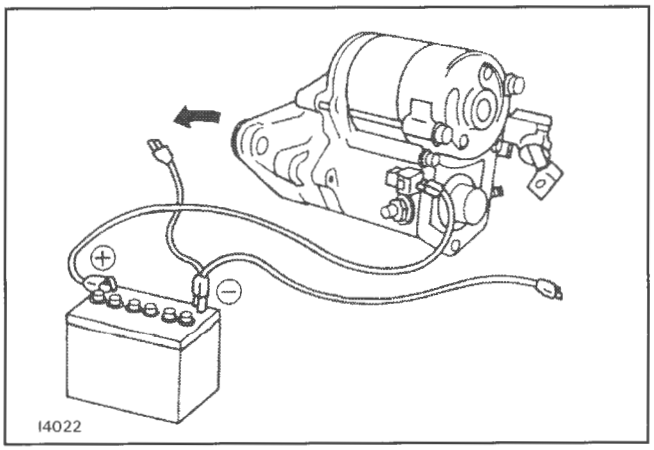

FIG. 10C-29

STARTER PERFORMANCE TESTING

Procedure

NOTE: Hold the starter securely in a vise. In unloaded test used thick wires because of high current.

FIG. 10C-30: Unloaded Test - Drive the starter independently with a specified battery without any load and check for spinning speed, voltage, and current. Values should be as shown below:

Voltage	11.5 V
Current	90A or less
Speed	3000 rpm or more

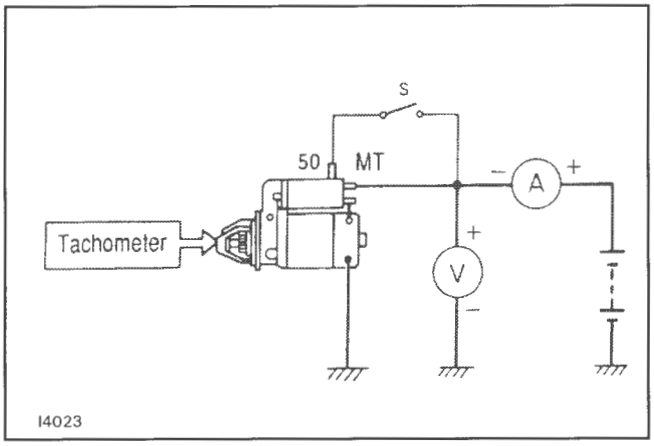

FIG. 10C-30

FIG. 10C-31: Install the starter on a test bench and apply brake. Measure each value while the starter is thus prevented from spinning. Each value should be as shown below:

Voltage	8.5 V
Current	350A or less at 1000 rpm or over
Speed	1.35 kgf-m (9.8 ft. lbs.) or over

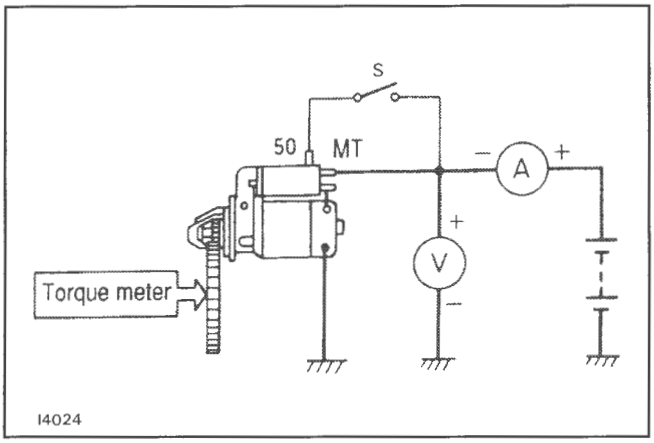

FIG. 10C-31