4004

STARTER AND STARTER SOLENOID

TABLE OF CONTENTS

CASE CORPORATION

Bur 8-11370

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SPECIFICATIONS

Case part number ..... A 170746

No-Load Test at 80°F (26.7°C)
Volts 11

Current draw ..... 180 amperes maximum

Starter drive speed ..... 3500 rpm (r/min) minimum

LUBRICATION

Interval ..... When the starter is disassembled or each time the engine is removed for repairs

Lubricant
Molykote-GN ..... Use on shaft at pinion end of starter drive

Case multipurpose grease ..... Use on bearings, gears, idler gear shaft and spring.

NO-LOAD TEST

General Information

1. The No-Load Test is done with the starter removed from the engine.

2. Check to see if you can pull the gear on the starter drive out of the starter drive housing.

3. Check to see if the starter drive can be turned. Pull the gear on the starter drive out of the starter drive housing. Turn the gear to turn the starter drive and the armature.

4. If the starter drive cannot be turned, disassemble the starter and make repairs as needed. Then do the No-Load Test.

Test Equipment

The No-Load Test can be done using a Sun Electric VAT-33 Tester, an equivalent tester, or separate pieces of test equipment.

A hand held tachometer is needed to measure the speed of the armature shaft.

A remote starter button is needed to actuate the starter.

A fully charged 12 volt battery is needed to supply the electricity to turn the starter.

Test Procedure

The illustrations in this procedure show the use of the Sun Electric *VAT-33* tester. Other test equipment can be used. Connect the test equipment according to this procedure and the manufacturer's instructions.

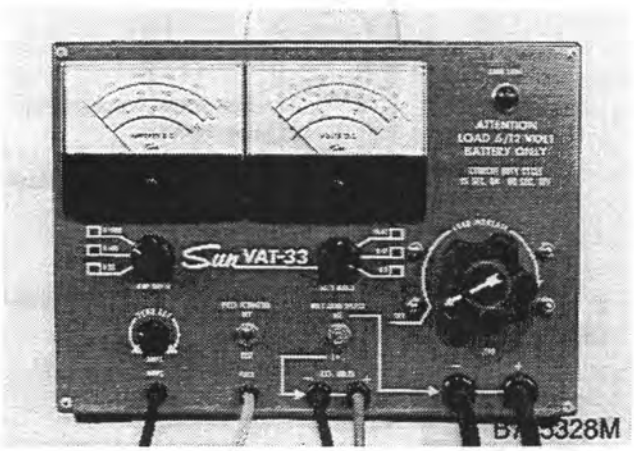
1. If the *VAT*-33 tester is being used:

   a. Select the 0 to 100 ampere range.

   b. Select the 18 to 40 volt range.

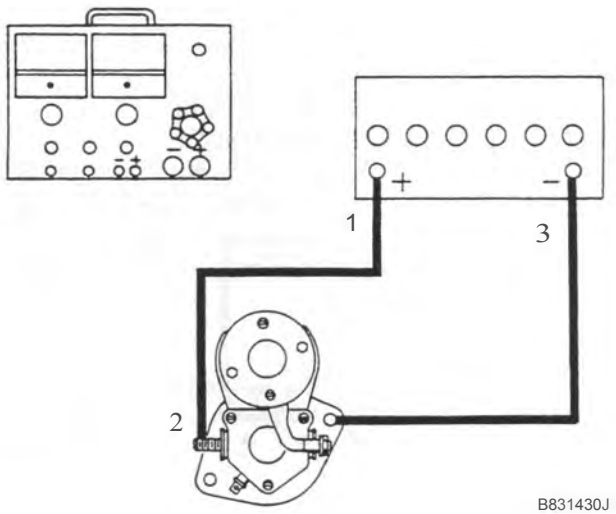
   c. Move the volt lead switch to the EXT. position.

   d. Turn the load control to the OFF position.



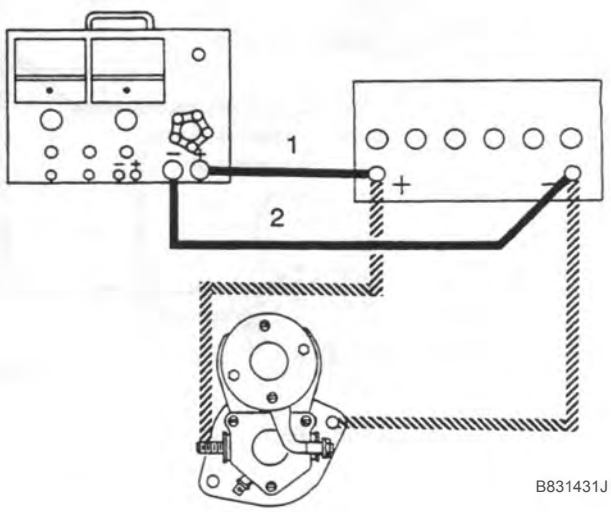
2. Fasten the starter in a vise or use another method to prevent the starter from moving. This must be done to prevent personal injury.

3. Connect the positive battery cable to the battery terminal on the starter solenoid and the negative battery cable to the mounting flange of the starter.



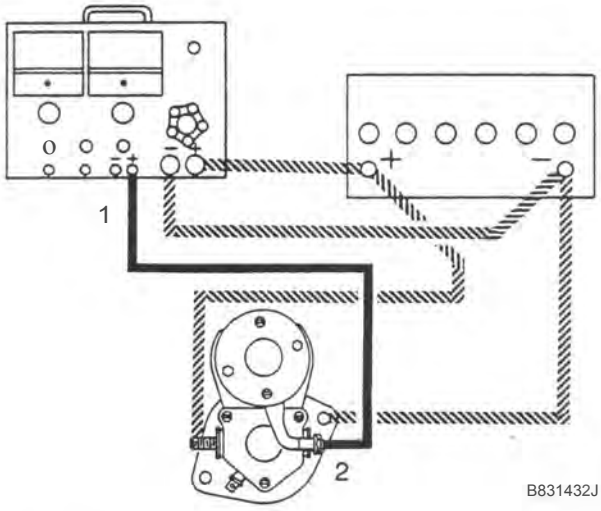
1. *Positive Battery Cable*
2. *Battery Terminal*
3. *Negative Bettery Cable*

4. Connect the positive load cable to the positive post of the battery. Connect the negative load cable to the negative post.



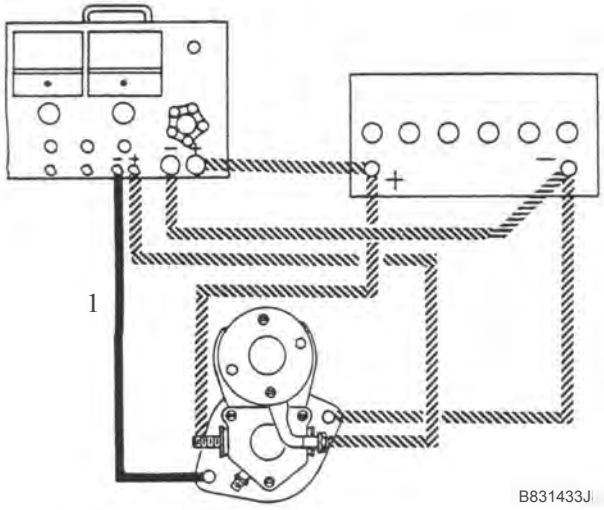
1. *Positive Load Cable*
2. *Negative Load Cable*

5. Connect the red voltmeter lead to the motor terminal on the starter solenoid.



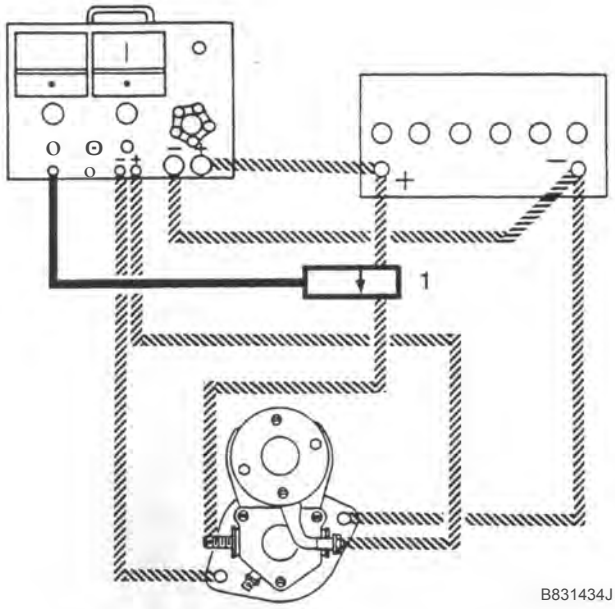
1. *Red Voltmeter Lead*
2. *Motor Terminal*

6. Connect the black voltmeter lead to the mounting flange on the starter.



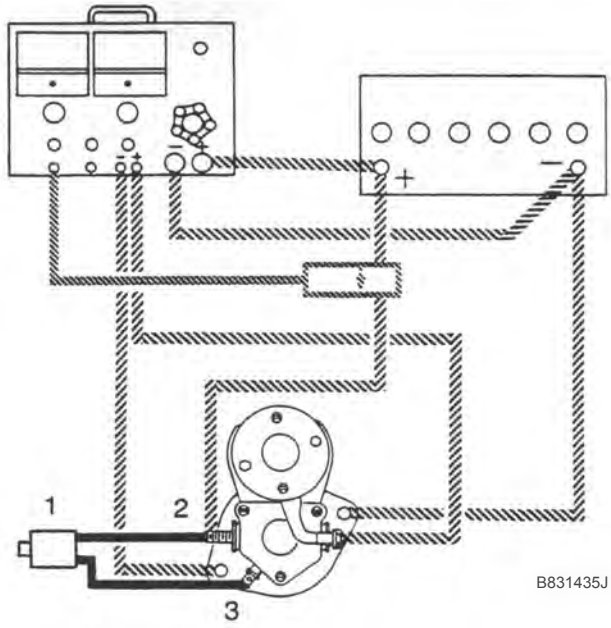
1. *Black Voltmeter Lead*

7. Fasten the ammeter clamp around the positive battery cable so that the tip of the arrow is toward the ?tarter.



1. *Ammeter Clamp*

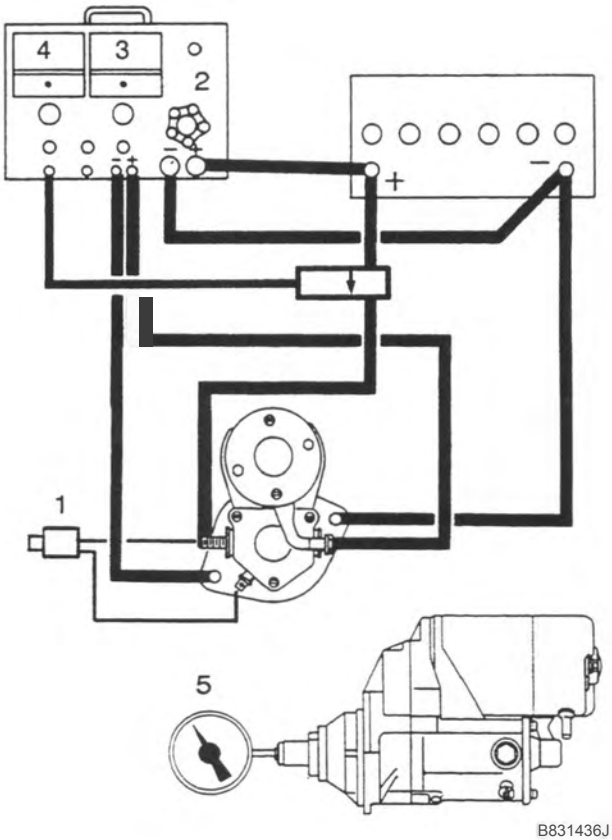
8. Connectthe leads from the remote starter button to the Battery and Switch terminals.



1. *Remote Starter Button*
2. *Battery Terminal*
3. *Switch Terminal*

IMPORTANT: *Steps 9, 10, and 11 must be done rapidly. Do not load the battery for more than 15 seconds at one time. After the battery has been loaded for 15 seconds, let the starter cool for 60 seconds.*

9. Actuate the remote starter button and turn the load control until the voltmeter indicates 11 volts.



1. *Remote Starter Button*
2. *Load Control*
3. *Voltmeter*
4. *Ammeter*
5. *Hand Held Tachometer*

10. Look at the ammeter and make a record of the ammeter indication.

11. Use the hand held tachometer and check the armature shaft speed. Make a record of armature shaft speed.

12. Release the remote starter button and turn the load control to the OFF position.

Understanding No-Load Test Results

1. If the current draw and the armature shaft speed are within the ranges under Specifications, the starter is good.

2. Low armature shaft speed and high current draw are indications of too much friction. Possible causes of too much friction are:

   a. Tight, dirty, or worn bearings.

   b. A bent armature shaft.

   c. Loose pole shoes (pole shoes make contact with the armature).

   d. A short circuit in the armature coil. Disassemble the starter. Use an armature tester to test the armature. Use the instructions included with the armature tester.

   e. Damaged field coil. Do the test on page 4004-12.

3. If the armature does not rotate and the current draw is high, possible causes are:

   a. Field terminal making contact with the field frame. Inspect the insulators for the field terminal

   b. Damaged field coil. Do the tests on page 4004-12.

   c. Damaged bearings.

4. If the armature does not rotate and the current draw is zero, possible causes are:

   a. An open field armature circuit. Disassemble the starter and inspect the field coil connections.

   b. An open armature coil. Disassemble the starter and check for burned commutator bars. Use an armature tester to test the armature. Use the instructions included with the armature tester.

   c. Brushes not making good contact with the commutator bars. Check for high insulation between the commutator bars, broken brush springs, or worn brushes.

5. Low armature shaft speed and low current draw are indications of:

   a. Dirt or corrosion on connections.

   b. Damaged wiring.

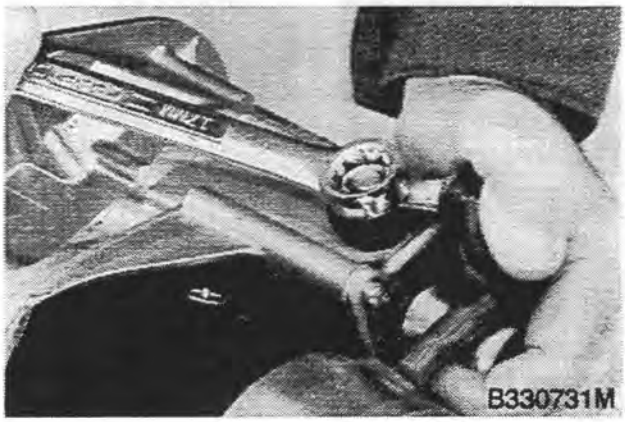
   c. Dirty commutator bars.

   d. All causes in step 4.

6. High armature shaft speed and high current draw are indications of a short circuit in the field coil. It is difficult to find a short circuit in a field coil. Install a new field coil. Do the No-Load Test again to check for improvement in the operation of the starter.

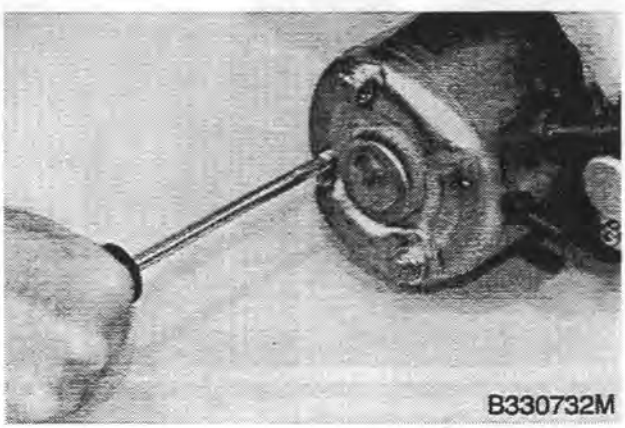
DISASSEMBLY

STEP 1



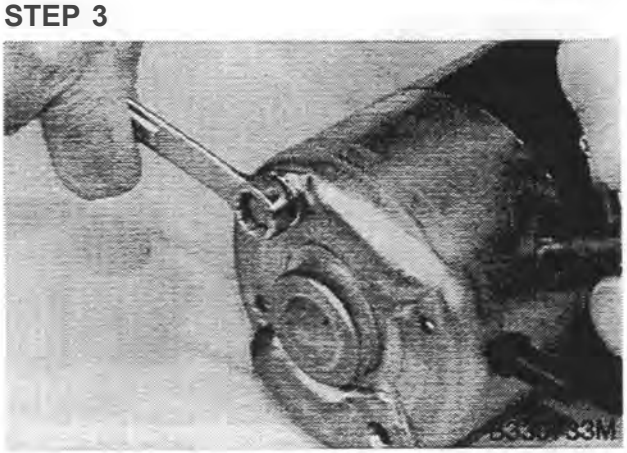
Pull back the boot on the motor terminal and loosen and remove the nut and lock washer.

STEP 2



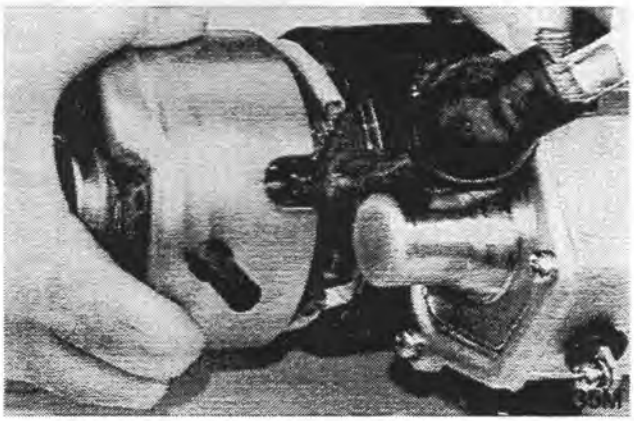
Loosen and remove the screws that hold the cover.

STEP 3



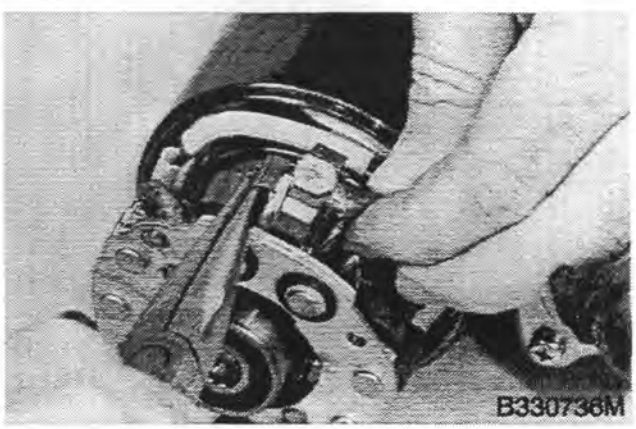
Loosen and remove the cap screws.

STEP 4



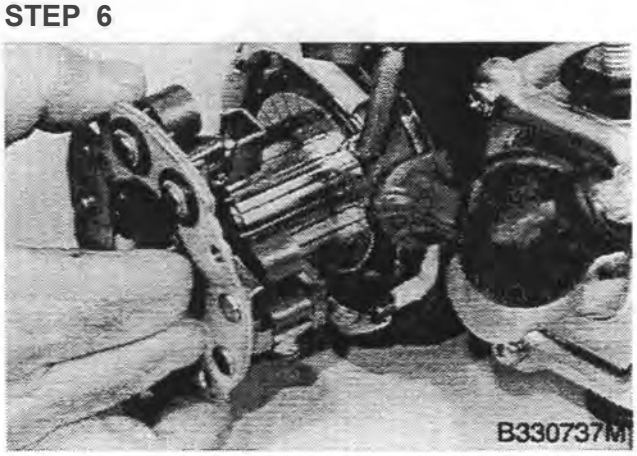
Remove the cover.

STEP 5



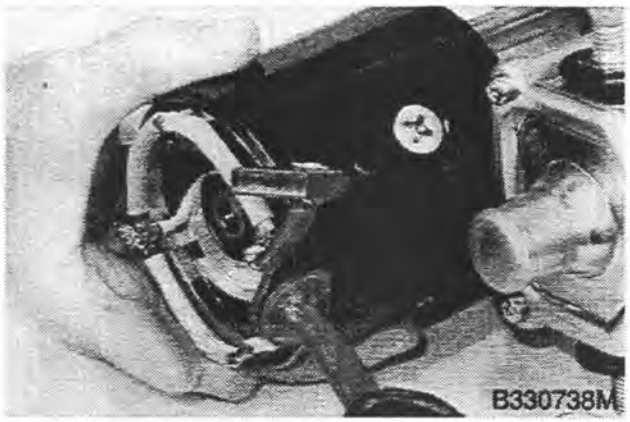
Hold the spring away from one of the brushes connected to the field coil and remove the brush from the brush holder. Repeat this step for the other brush connected to the field coil.

STEP 6



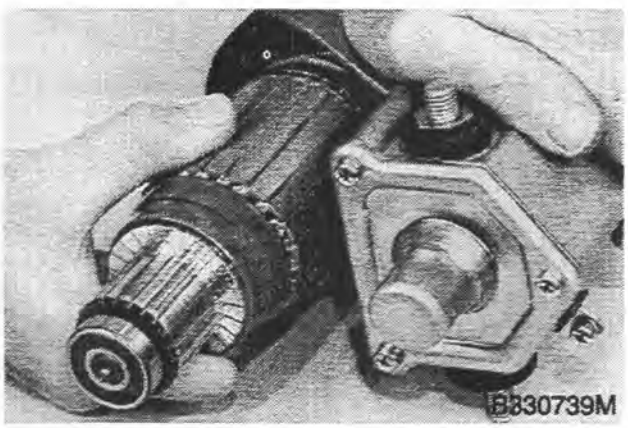
Remove the brush holder.

STEP 7



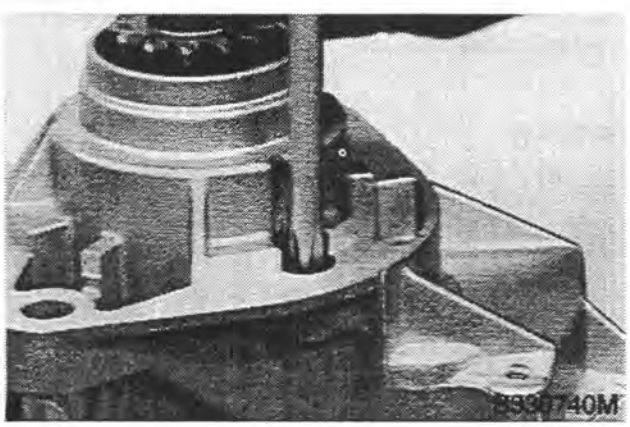
Remove the field frame assembly.

STEP 8



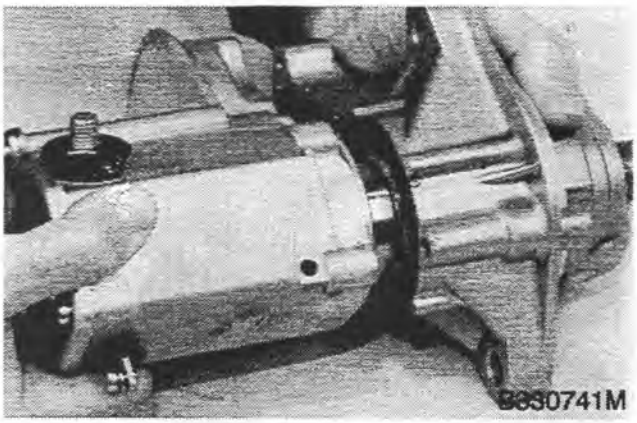
Remove the armature.

STEP 9



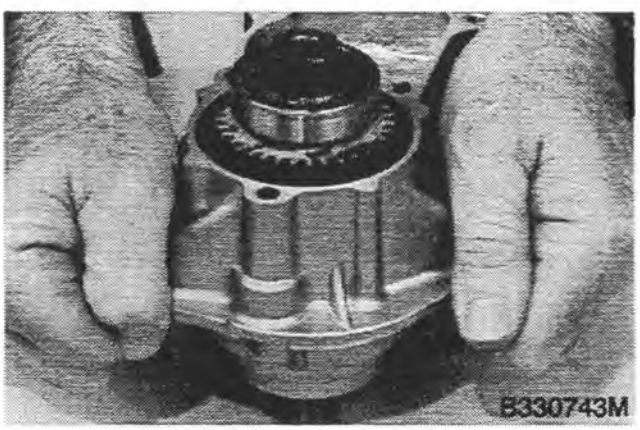
Fasten the starter solenoid in a vise and loosen and remove the screws that hold the starter drive housing.

STEP 10



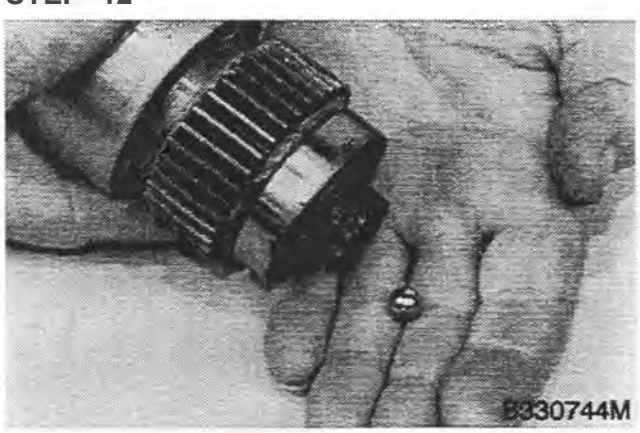
Remove the starter drive housing from the starter solenoid.

STEP 11



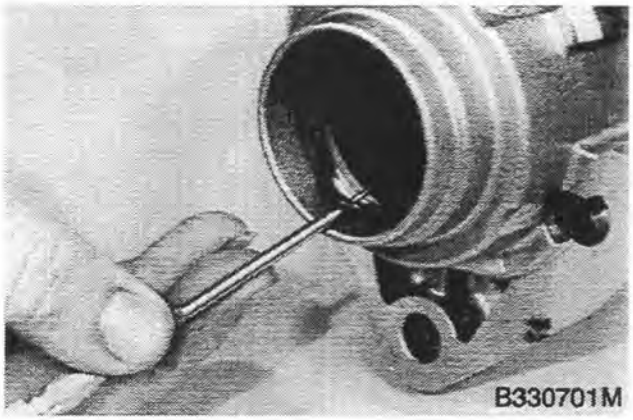
Push down the starter drive housing as shown to loosen and remove the starter drive.

STEP 12



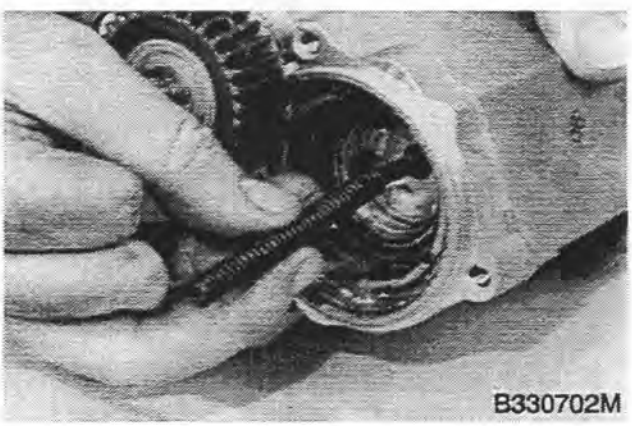
Remove the steel ball from the starter drive. If necessary, use a magnet.

STEP 13



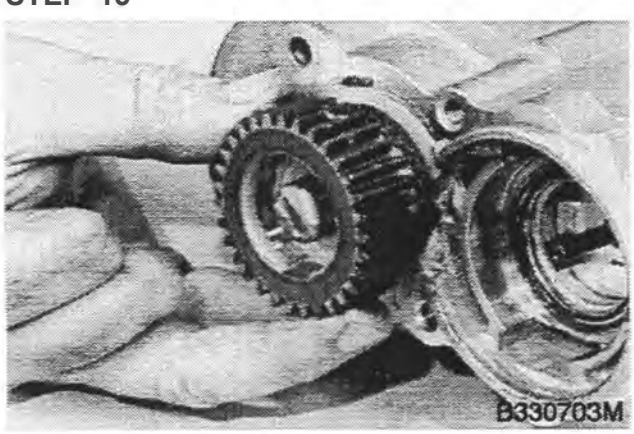
Remove the O-ring from the groove in the starter drive housing.

STEP 14



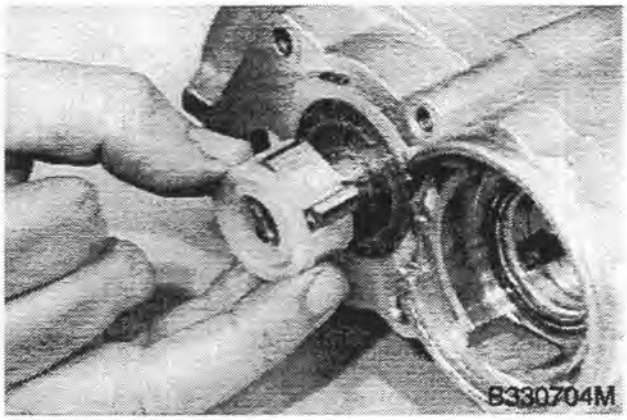
Remove the spring.

STEP 15



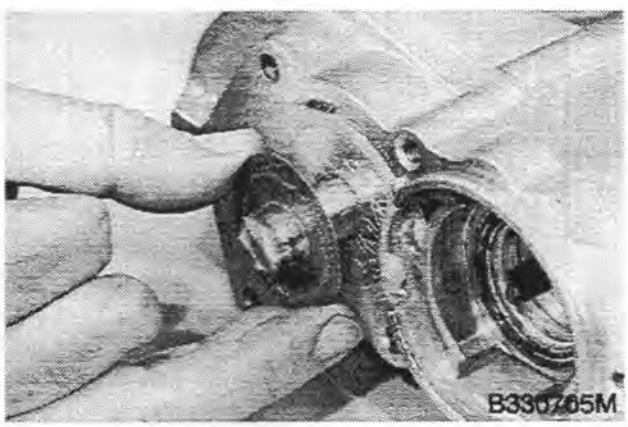
Remove the idler gear.

STEP 16



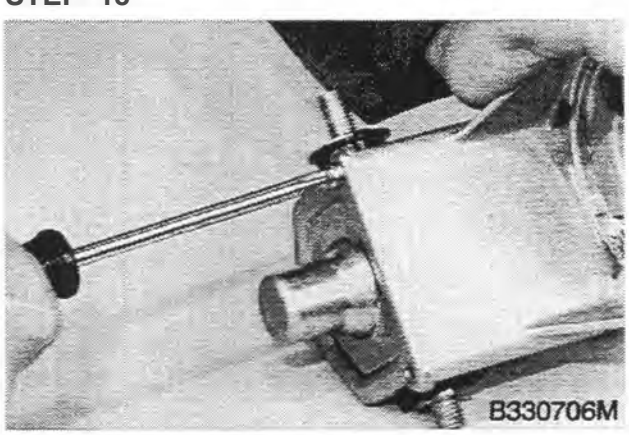
Remove the bearing cage.

STEP 17



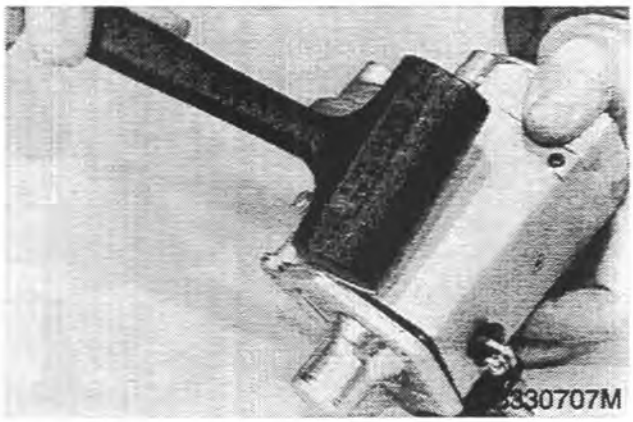
Remove the thrust washer.

STEP 18



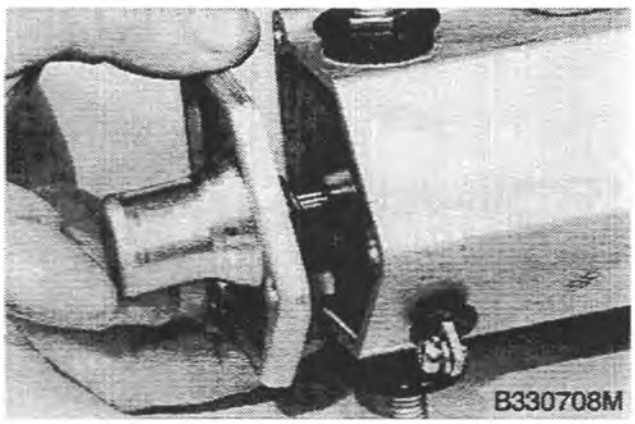
Loosen and remove the screws that hold the cover.

STEP 19



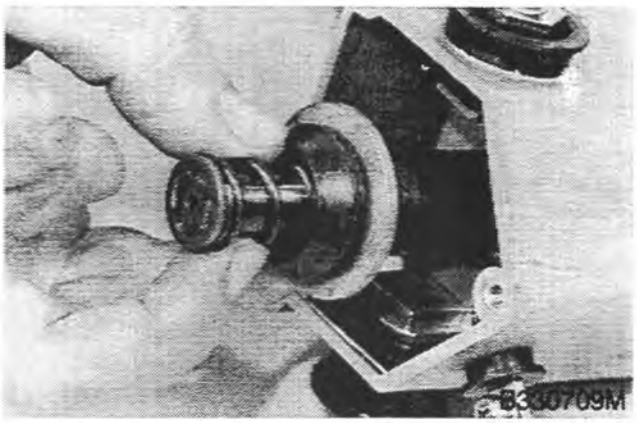
If necessary, use a hammer to loosen the cover..

STEP 20



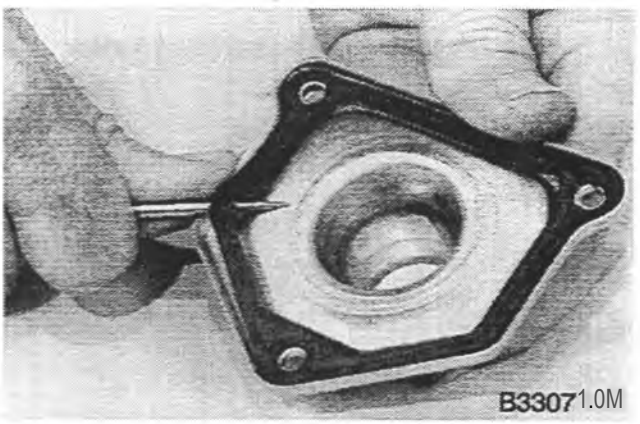
Remove the cover.

STEP 21



Remove the plunger.

STEP 22



If necessry, remove the gasket from the cover..

INSPECTION

All parts except the starter drive must be cleaned using mineral spirits and a brush or cloth. Use a clean, dry cloth to clean the starter drive.

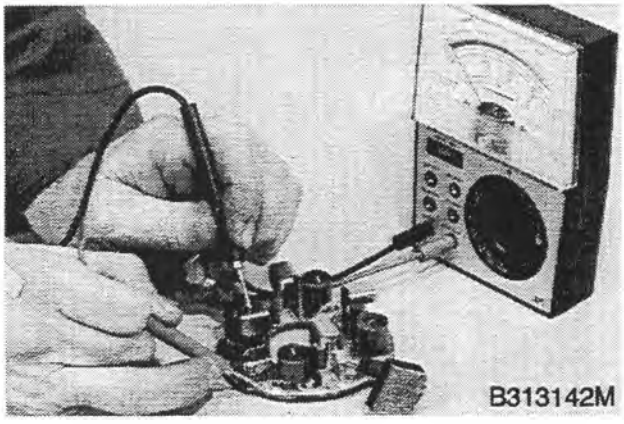
Brushes and Brush Springs

1. If the length of the brush fastened to the brush holder is less than 7/16 inch (11 mm), a new brush holder assembly must be used when the starter is assembled.

2. If the length of a brush fastened to the field coil is less than 7/16 inch (11 mm), a new field frame assembly must be used when the starter is assembled.

3. Use a spring scale to check the tension of the brush springs. Pull the brush spring up until the brush spring is just above the brush holder. The scale indication must be between 4 and 9 pounds (1.8 and 4.1 kg). If a brush spring is not as specified, use a new brush spring when the starter is assembled.

Brush Holder

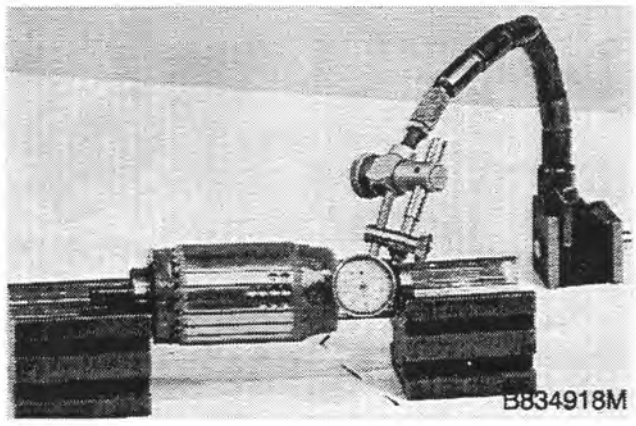


1. Hold the leads of an ohmmeter against the frame and the brush holders that have insulation between the brush holder and frame.

2. If there was an indication of a complete circuit, install a new brush holder.

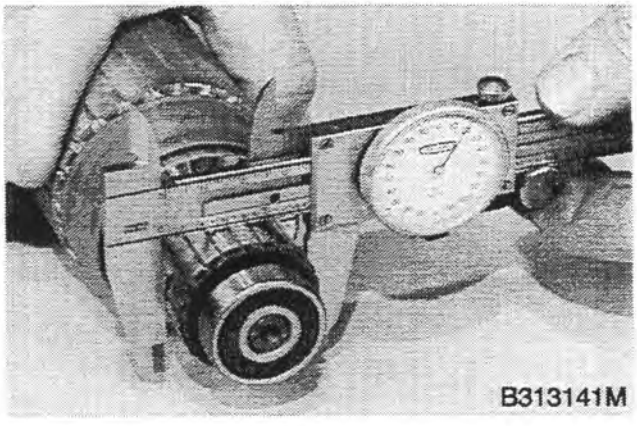
Armature

1. Test the armature on an armature tester. Use the equipment manufacturer's instructions.



2. Put the armature on vee-blocks as shown and check the runout of the armature with a dial indicator. The runout must not be more than .002 inch (0.05 mm).

3. If necessary, put the armature in a lathe and remove enough material from the commutator to make the runout less than .002 inch (0.05 mm).



4. Measure the diameter of the commutator. If the diameter is less than 1.38 inch (35 mm), install a new armature.

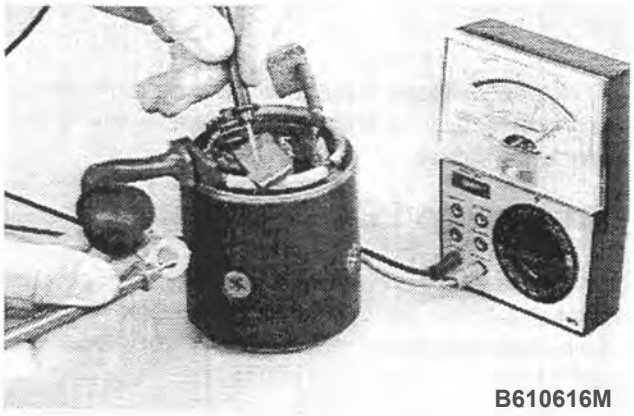
5. If the depth of the groove between the commutator bars is less than .008 inch (0.2 mm), cut the insulation between the commutator bars to a depth of 1/64 to 1/32 inch (0.5 to 0.8 mm). Use sandpaper to remove the rough edges from the commutator bars.

6. Check the bearings on the armature for free rotation, rough balls, and damage to the inner race or outer race. If a bearing is to be replaced, use a press and acceptable tools to remove and install the bearings.

Field Coil Test

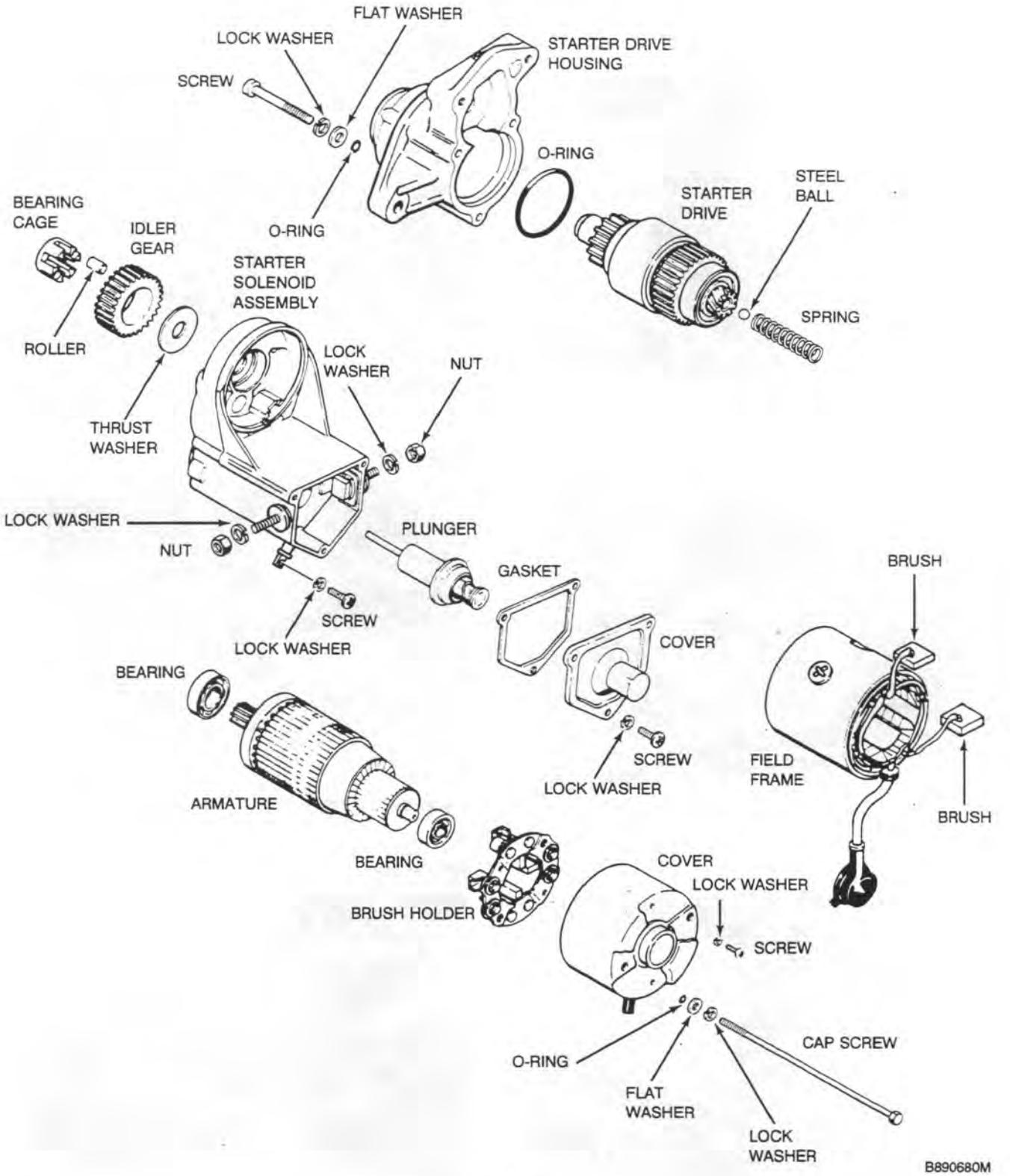
1. Hold the leads of an ohmmeter against one of the brushes and the field frame. The needle of the ohmmeter must not move.

2. If the needle of the ohmmeter moved, install a new field frame assembly.



3. Hold the leads of the ohmmeter against one of the brushes and the end of the cable. The needle of the ohmmeter must move.

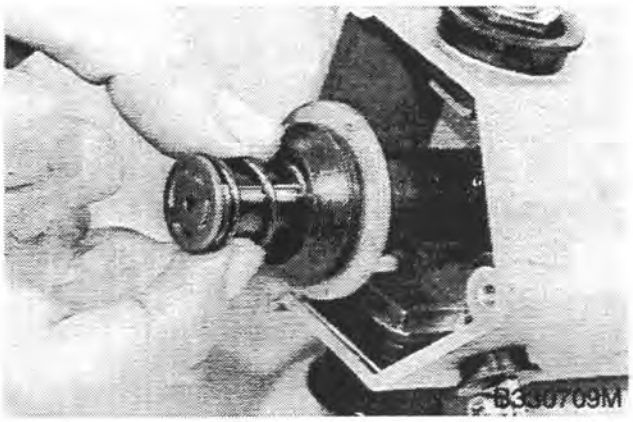
4. If the needle of the ohmmeter did not move, install a new field frame assembly.


FLAT WASHER
LOCK WASHER
STARTER DRIVE HOUSING
SCREW
O-RING
O-RING
STEEL BALL
STARTER DRIVE
BEARING CAGE
IDLER GEAR
STARTER SOLENOID ASSEMBLY
SPRING
ROLLER
LOCK WASHER
NUT
THRUST WASHER
LOCK WASHER
NUT
PLUNGER
GASKET
BRUSH
SCREW
COVER
LOCK WASHER
BEARING
SCREW
FIELD FRAME
BRUSH
ARMATURE
BEARING
COVER
LOCK WASHER
BRUSH HOLDER
SCREW
CAP SCREW
O-RING
FLAT WASHER
LOCK WASHER
B890680M

Starter

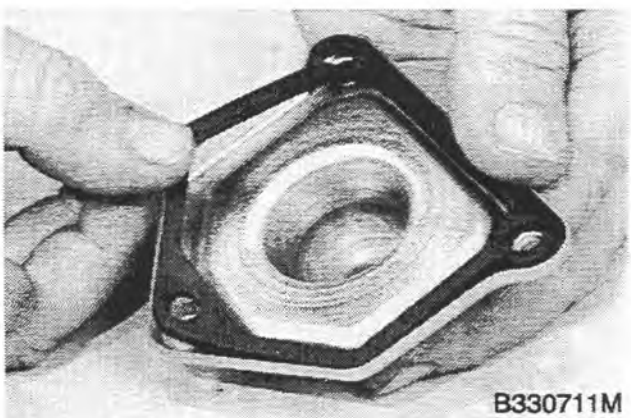
ASSEMBLY

STEP 23



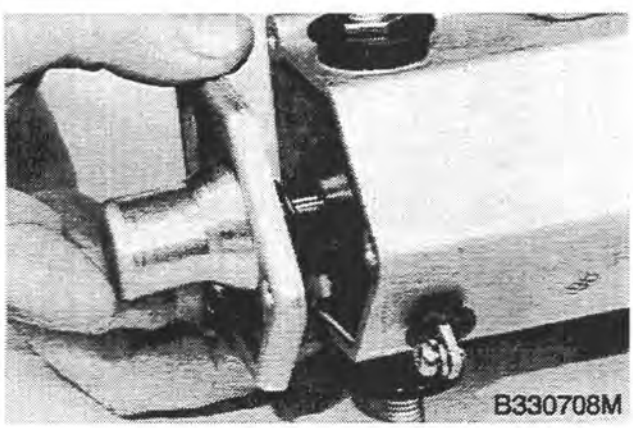
Install the plunger in the starter solenoid.

STEP 24



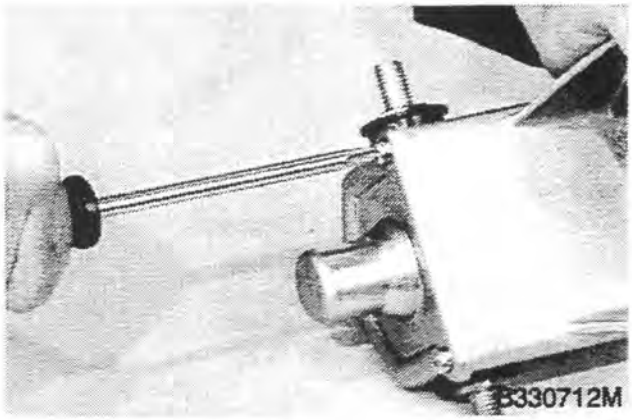
If necessary, install a new gasket in the cover.

STEP 25



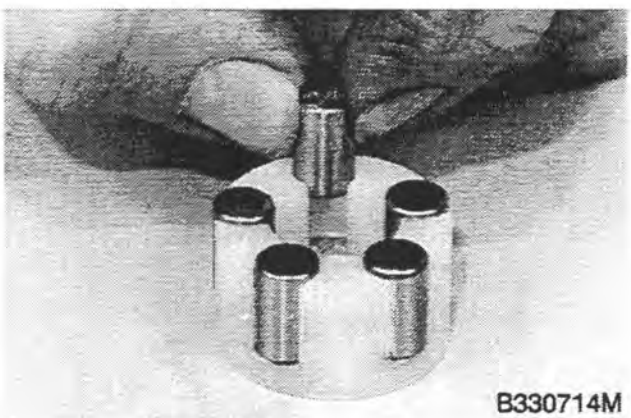
Install the cover.

STEP 26



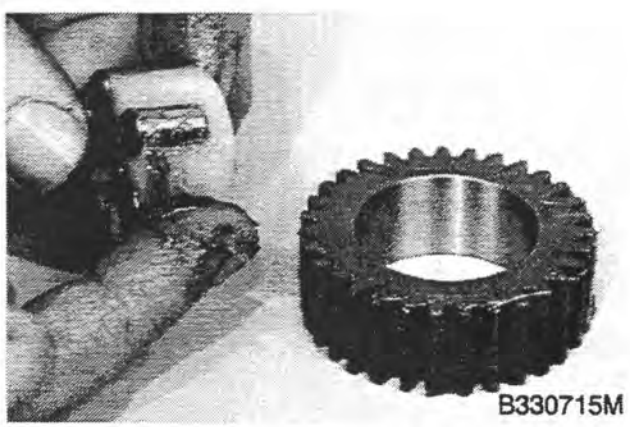
Install and tighten the screws.

STEP 27



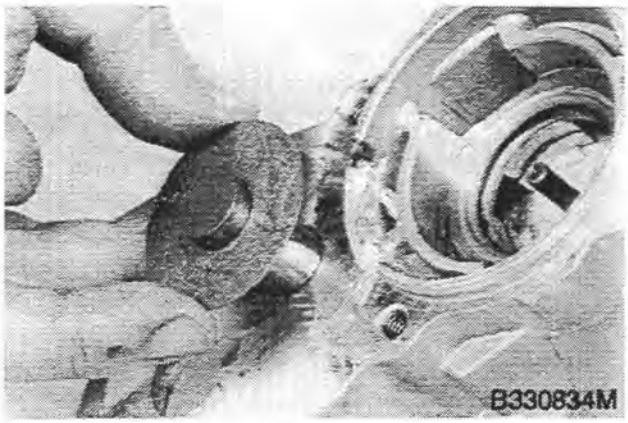
Install the bearings in the bearing cage.

STEP 28



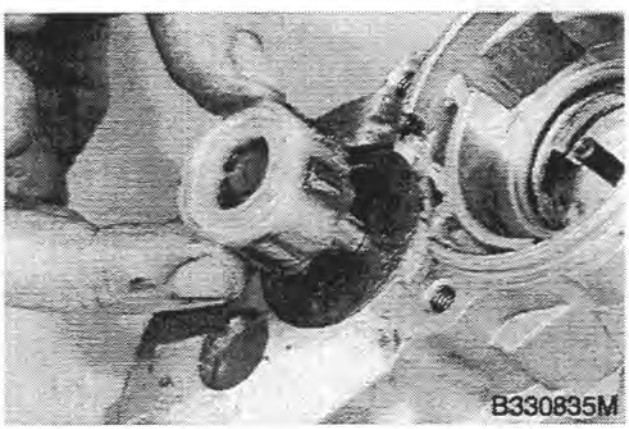
Lubricate the bearings and teeth of the idler gear with the grease specified on page 4004-2.

STEP 29



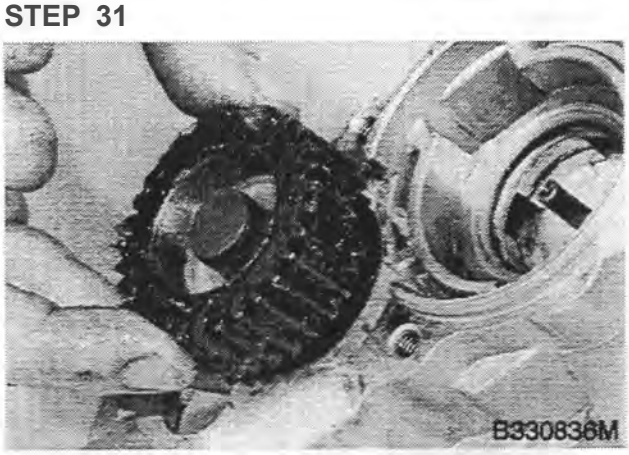
Install the thrust washer.

STEP 30



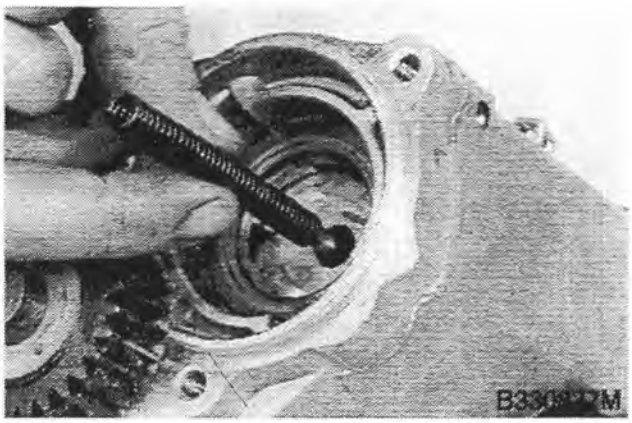
Install the bearing cage as shown.

STEP 31



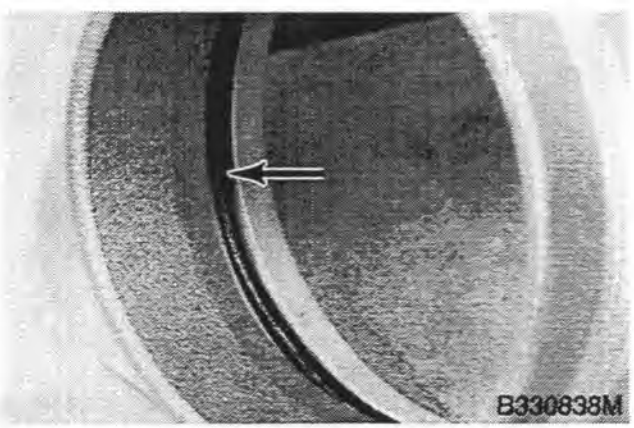
Install the idler gear.

STEP 32



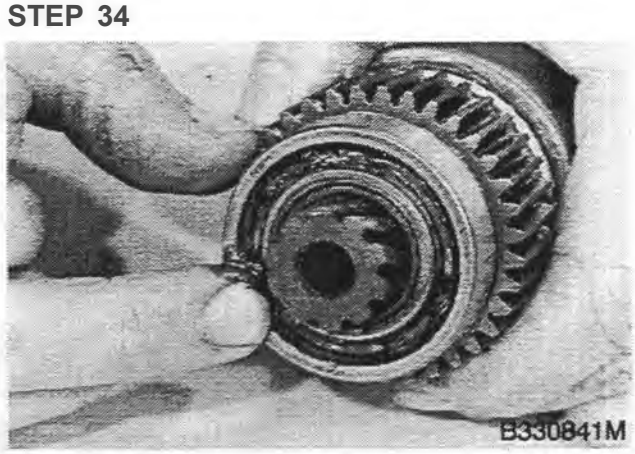
Install the spring.

STEP 33



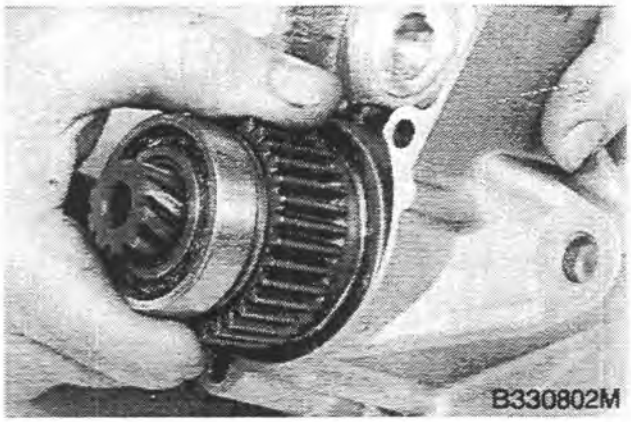
Install a new O-ring in the groove in the starter drive housing. Lubricate the O-ring.

STEP 34



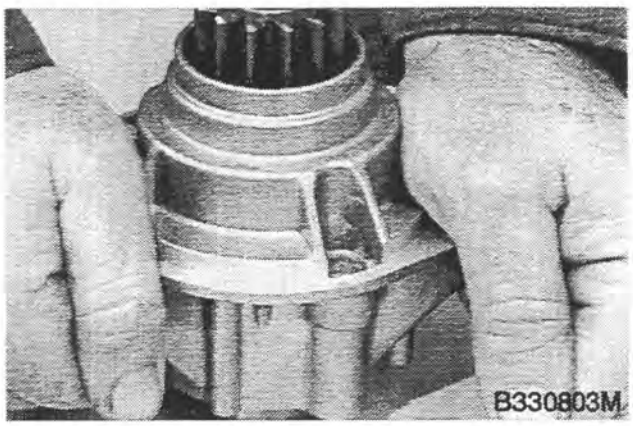
Lubricate the open bearing on the starter drive with the grease specified on page 4004-2.

STEP 35



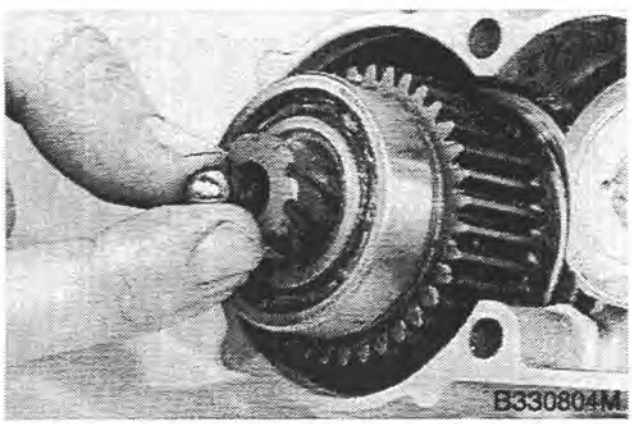
Start the starter drive into the starter drive housing.

STEP 36



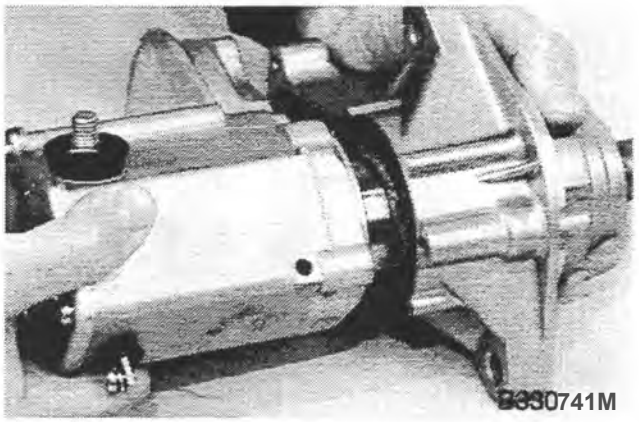
Push down the starter drive housing to push the starter drive all the way into the starter drive housing.

STEP 37



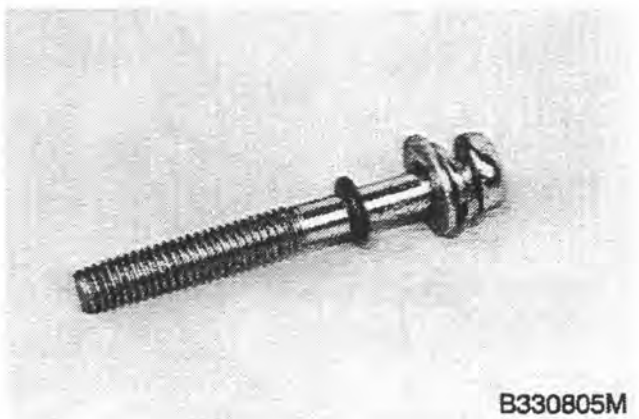
Put a small amount of grease in the hole in the starter drive and install the steel ball in the hole.

STEP 38



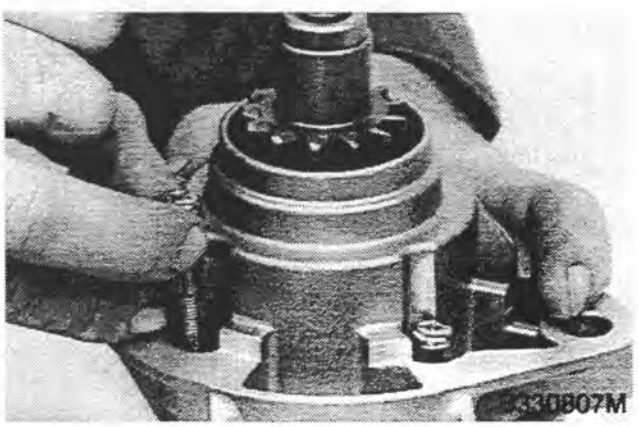
Assemble the starter drive housing and starter solenoid.

STEP 39



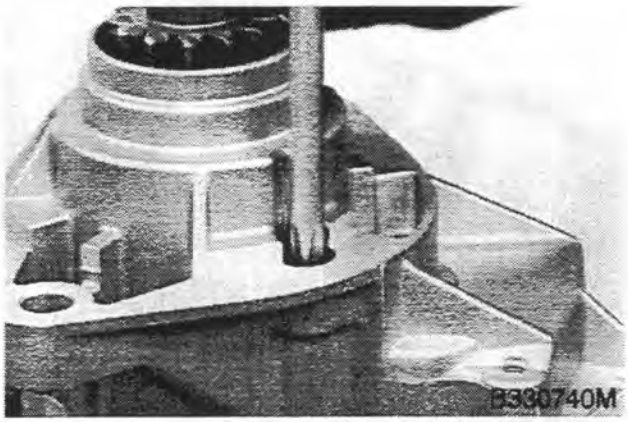
Install a lock washer, flat washer, and O-ring on the screws that hold the starter drive housing. Lubricate the O-rings.

STEP 40



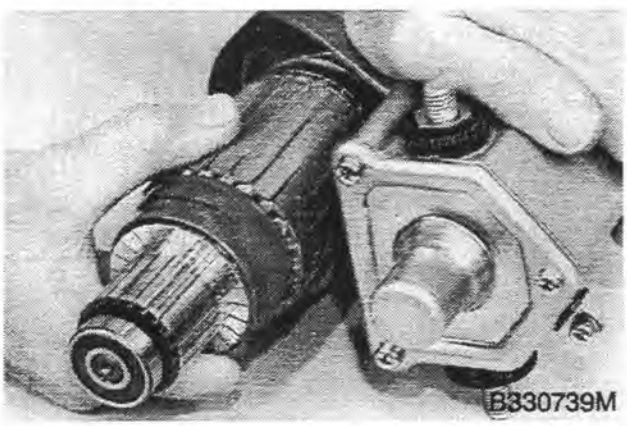
Install the screws in the starter drive housing.

STEP 41



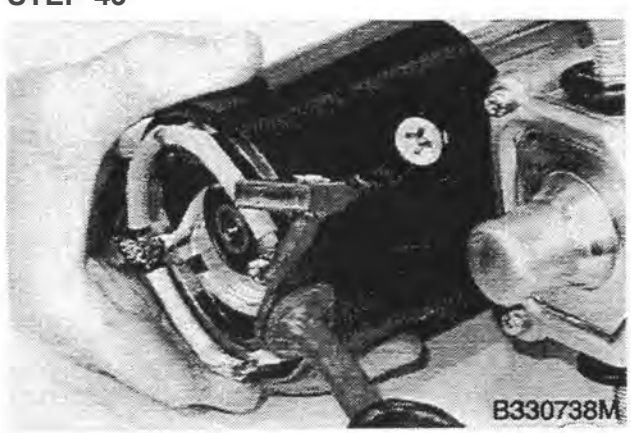
Fasten the starter solenoid in the vise and tighten the screws that hold the starter drive housing.

STEP 42



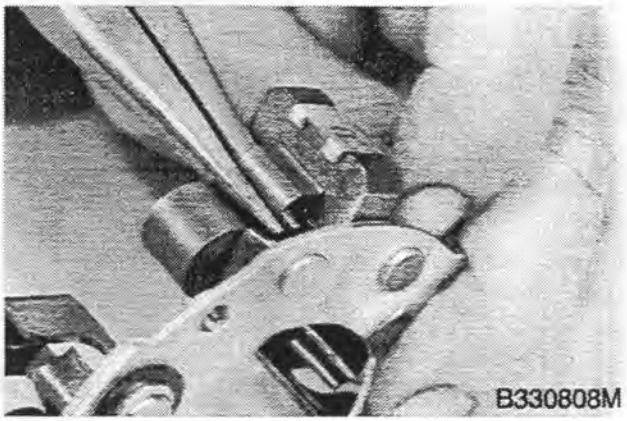
Install the armature.

STEP 43



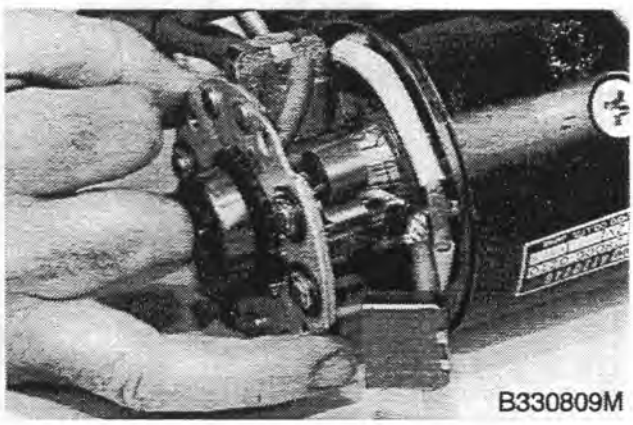
Install the field frame assembly.

STEP 44



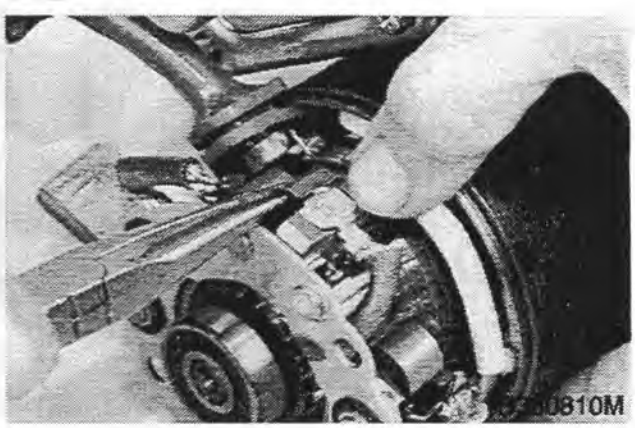
Use the springs to hold the brushes in the brush holder as shown.

STEP 45



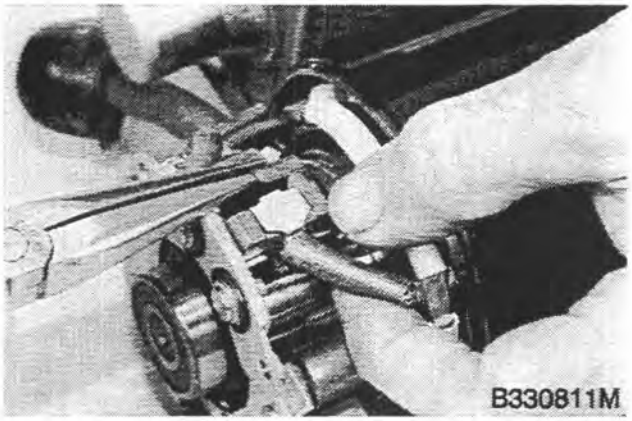
Install the brush holder..

STEP 46



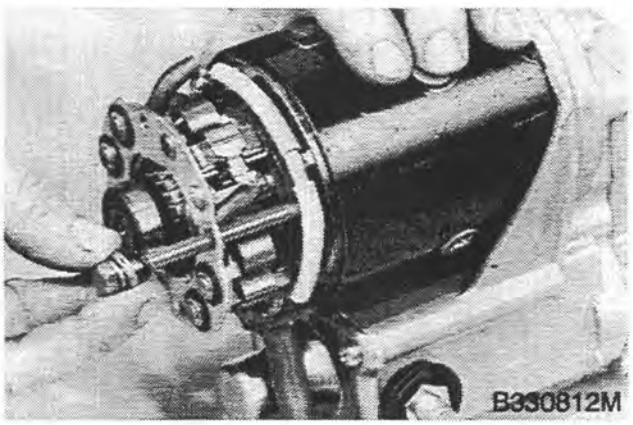
Put the springs on top of the brushes connected to the brush holder..

STEP 47



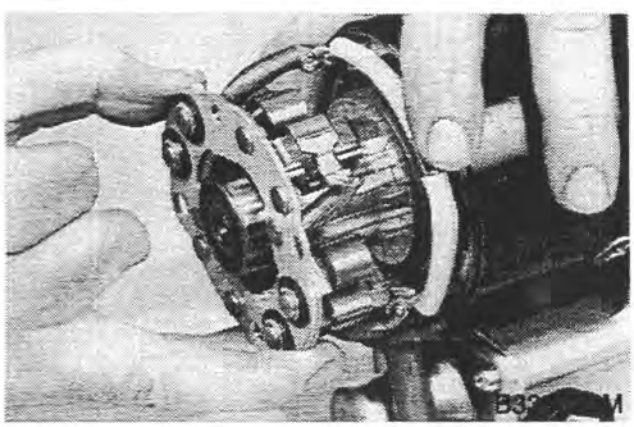
Install the brushes that are connected to the field coil.

STEP 48



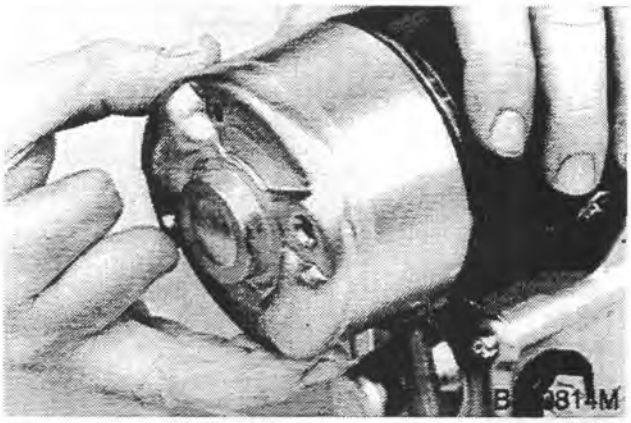
Use a cap screw to align the brush holder with the field frame assembly.

STEP 49



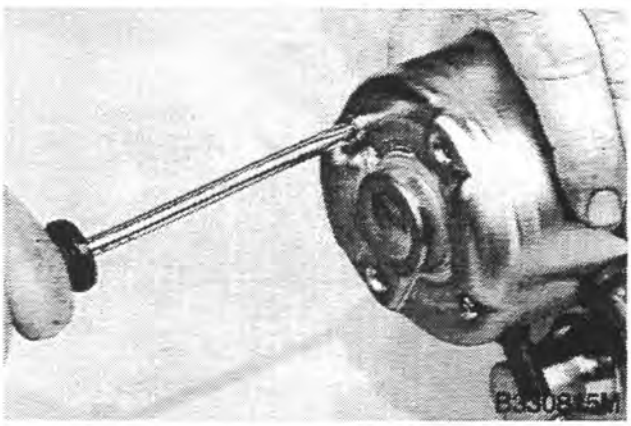
Move the brush holder so that the brush holder is even with the end of the armature.

STEP 50



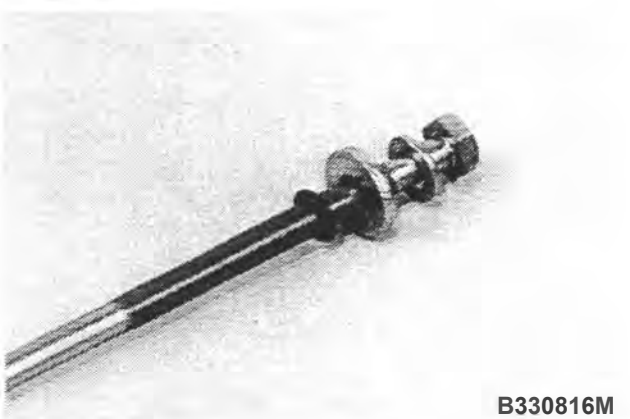
Install the cover and align the *cover* with the brush holder.

STEP 51



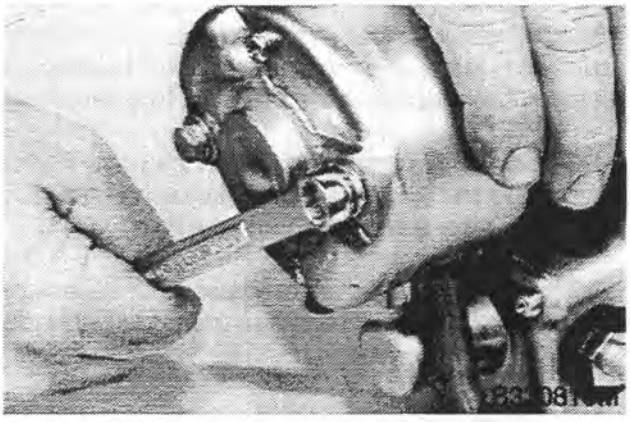
Install the tighten the screws that hold the brush holder.

STEP 52



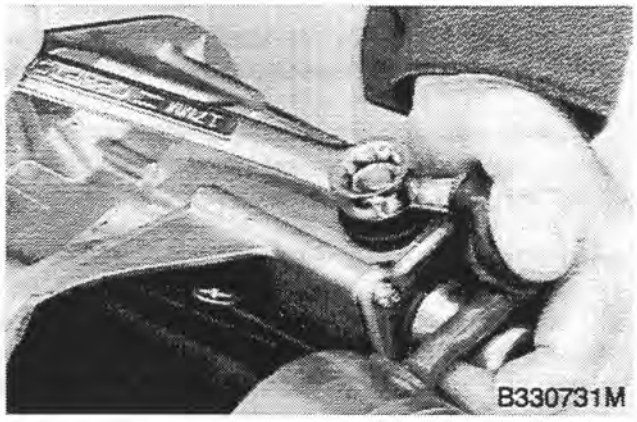
Install a lock washer, flat washer, and O-ring on the cap screws. Lubricate the O-rings.

STEP 53



Install and tighten the cap screws.

STEP 54



Install the cable, lock washer, and nut on the motor terminal, and tighten the nut.

STEP 55

Pull the boot over the motor terminal.

STARTER SOLENOID TEST

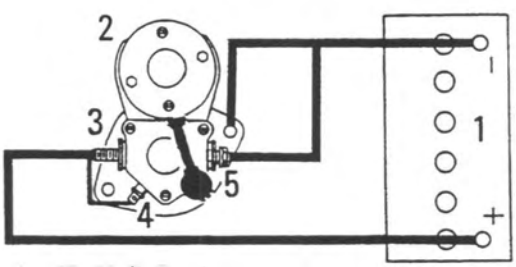
This test will check the condition of the pull-in winding and the hold-in winding in the starter solenoid.

The jumper cable connected to the starter mounting flange and the motor terminal must have a common connection at the negative battery post..

Starter Solenoid Test Procedure

1. Remove the rubber boot from the motor terminal.. Remove the nut and lock washer from the motor terminal.. Then remove the wire from the motor terminal..

2. Connect a jumper cable to the positive battery post of a fully charged 12 volt battery. Connect the other end of the jumper cable to the battery terminal in the starter solenoid housing.



B831438R

1. *12 Volt Battery*
2. *Starter*
3. *Battery Terminal*
4. *Switch Terminal*
5. *Motor Terminal*

3. Connect a jumper wire to the battery terminal and the switch terminal in the starter solenoid housing. The jumper wire must be made from No. 10 or larger wire.

4. Connect the jumper cable with the common connection to the starter mounting flange and the motor terminal in the starter solenoid housing.

NOTE: *Steps 5 and 7 must be done in a maximum of 15 seconds to prevent damage to the pull-in winding and the hold-in winding.*

5. Connect the jumper cable with the common connection to the negative battey post.. The pinion gear on the starter drive must come all the way out rapidly and with force.

6. If the pinion gear did not come out rapidly and with force, the pull-in winding is damaged. The complete starter solenoid housing assembly must be replaced.

7. Disconnect the jumper cable from the motor terminal in the starter solenoid housing. The pinion gear on the starter drive must not move toward the starter drive housing.

8. If the pinion gear started to move toward the starter drive housing, the hold-in winding is damaged. The complete starter solenoid housing assembly must be replaced.