

STARTING SYSTEM

ALL MODELS

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DESCRIPTION AND OPERATION

require no additional lubrication between overhaul periods.

STARTING SYSTEM DESCRIPTION

The new Delco Remy starter for 1973 is a brush-type series wound electric motor equipped with an overrunning clutch and operated by a solenoid. The field frame is enclosed by the commutator end frame and the drive housing and carries the pole shoes and the field coils. The armature has a spline on the drive end which carries the over-running clutch and pinion assembly. The armature shaft is supported in sintered bronze bushings in the commutator end frame and the drive end housing. These bushings are packed with lubricant during initial assembly and

As the starter is operated by turning the ignition switch on the instrument panel, the shift lever is moved against spring tension. By means of the guide ring, the shift lever moves the pinion into mesh with the flywheel ring gear.

After the pinion meshes with the flywheel ring gear teeth, the solenoid contact disc closes the circuit and the engine is cranked. When the engine starts, the speed of the rotating flywheel causes the pinion to over-run the clutch and armature. The pinion continues to be engaged as long as the shift lever is kept in the cranking position.

TROUBLE DIAGNOSIS

STARTING SYSTEM DIAGNOSIS

In case of cranking motor breakdown, it should be kept in mind that the relevant cause(s) for the trouble may not only lie in the cranking motor itself

but also in the condition of related units, such as battery, switches, electrical wiring and wiring connections.

Condition	Possible Cause	Correction
When ignition switch is on, cranking motor locks up or drags .	1. Battery discharged.	1. Charge battery.
	2. Battery defective. Battery terminals loose, corroded or improperly grounded.	1. Test and replace as required. Retighten terminals, clean battery posts and terminals and coat them with acid-proof grease.
	3. Cranking motor or brush terminals grounded.	1. Eliminate grounds.
	4. Cranking motor brushes do not rest on commutator, or arc jammed in their guides, worn out, oily or clogged.	1. Check brushes • clean or replace as required. Clean guides on brush holders.
	5. Ignition switch damaged (loose parts preventing switch from closing or burnt parts).	1. Replace ignition switch.
	6. Solenoid switch damaged.	1. Repair or replace as required.
	7. Excessive voltage drop in wiring switches damaged, connections loose.	1. Check wiring and connections. Repair or replace switches.
The armature revolves but the drive pinion does not come into mesh.	1. Drive pinion clogged.	1. Clean drive pinion.
	2. Drive pinion or ring gear teeth flattened or burred.	1. Replace ring gear and overrunning clutch.
	3. Poor condition of shaft splines .	1. Replace armature and overrunning clutch.
	4. Voltage drop.	1. Replace shift lever.
When ignition switch is on, armature revolves until drive pinion engages and then stops .	1. Battery discharged.	1. Charge battery.
	2. Brush spring tension too weak.	1. Check brushes • clean or replace as required.
	3. Cranking motor solenoid or switch defective.	1. Replace or repair solenoid or switch.

Condition	Possible Cause	Correction
	4. Voltage drop.	1. Check wiring and wiring connections.
	5. Overrun&g clutch slips.	1. Replace overrunning clutch.
The cranking motor keeps on rotating after ignition switch is off.	1. Ignition switch does not cut off or solenoid switch sticks.	1. Immediately disconnect cranking motor cable from battery. Inspect and/or replace or repair ignition and solenoid switches as required.
The drive pinion does not demesh after engine has been cranked.	1. Drive pinion or ring gear teeth clogged or flattened. Return spring slack or broken.	1. Clean components as specified. Replace as required.

MAINTENANCE AND ADJUSTMENT

STARTING SYSTEM CHECKS

Voltage Loss Checks

When the starter cranks too slowly, check the battery state of charge and all electrical connections between the battery **and starter**.

1. Turn on headlights and **operate** starter. If headlights dim considerably when starter is engaged, the battery may be discharged or be defective. Check the battery.

2. If the headlights stay bright but the starter **does** not turn over, the starter cables may be faulty or the starter defective.

(a) Test battery voltage while cranking engine (.9 volts minimum).

(b) Check voltage from starter **terminal** of solenoid to starter frame while cranking engine.

3. The difference in readings taken in Operations 2a and **2b** above represents the **voltage** drop through the cables and solenoid switch. **Voltage** drop should **not** exceed .5 volt.

4. Locate excessive resistance as follows:

(a) Turn voltmeter to scale above 12 volts and connect voltmeter leads **across** connection or switch: to be checked.

(b) With starter switch closed, turn voltmeter switch to lowest scale and take reading as quickly as possible, then turn switch back to higher scale and **stop** cranking engine.

(c) Voltmeter must not read more than .2 volt across any **connection**. If voltmeter reads more than .2 volt, the **defect** must be corrected.

Starter Current Draw • Lock Test

1. Make sure battery is fully charged and in good condition.

2. Connect a volt ampere starter tester according to manufacturer's instructions.

3. Pull parking brake on securely, shift transmission into 4th (direct) gear and actuate starter. (Starter will not **turn** engine because engine is locked through transmission.)

4. While starter is actuated, read voltage and current. Refer to Specification Chart.

(a) Voltage low • poor battery or a voltage loss in the starter circuit.

(b) Current high • short circuit in starter. Overhaul starter.

(c) Current low • commutator dirty, brushes worn, solenoid switch contacts defective or open circuit in starter. Overhaul starter.

Starter Current Draw • On Car

1. Bring engine to normal operating temperature.

2. Stop engine and disconnect coil wire from distributor.

3. Ground coil wire to prevent excessive coil voltage build up.

4. Connect test equipment and, with transmission in neutral, turn engine over until voltage stabilizes. Note readings.
5. Current draw should be between 90-130 amperes.

MAJOR REPAIR

STARTER OVERHAUL

Starter Removal

1. Disconnect starter wiring.
2. Remove starter support bracket.
3. Remove two starter bolts, one nut and lockwashers.
4. Remove starter.

Starter Disassembly

1. Hold starter in a vise, as shown in Figure 1B- 3. Mark end frame and field frame to ensure correct installation of parts on reassembly.

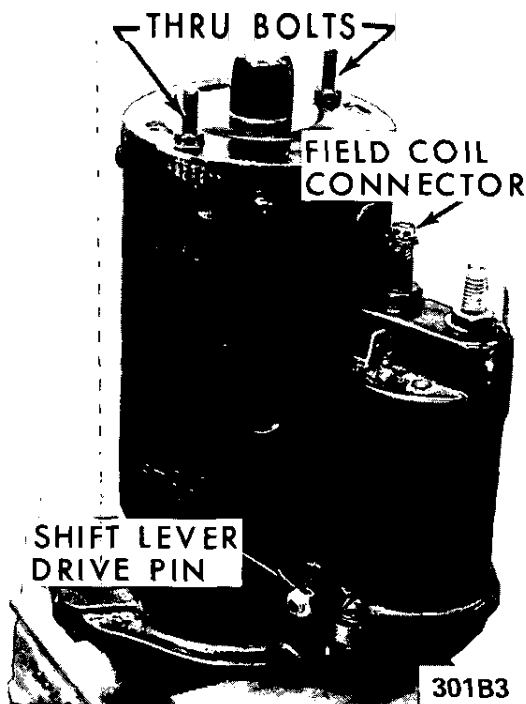


Figure 1 B-3 Cranking Motor in Vise

2. Remove both starter through bolts and field coil end from solenoid switch lower threaded bolt. See Figure 1B-3.

3. Remove end frame from field frame and pull both insulating tubes out of field frame.

4. To prevent brushes from coming out when removing the field frame, place a 29 millimeter socket over commutator while lifting up on the field frame. The brushes will be held in place by the socket. See Figure 1B-4.

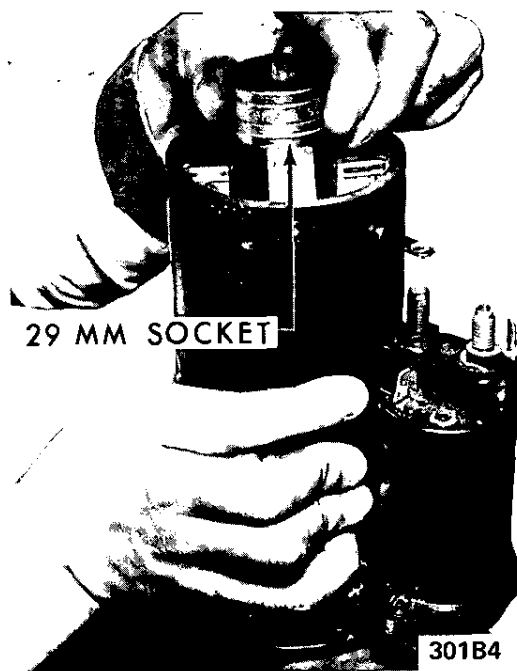


Figure 1B-4 Removing Field Frame

5. Remove the two (2) solenoid attaching screws and remove solenoid and spring.

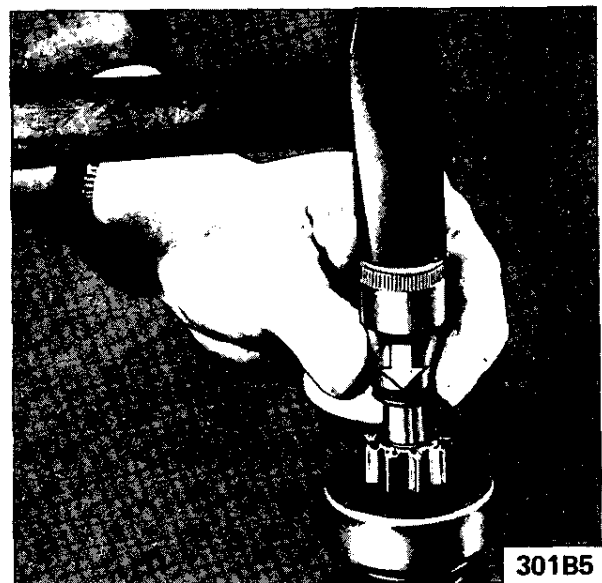
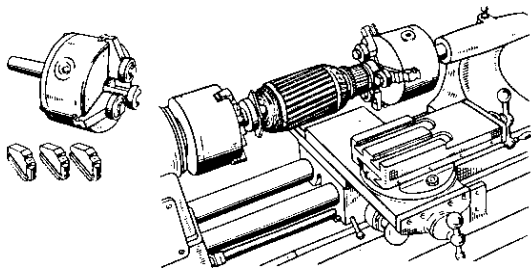


Figure 1B-5 Driving Retaining Ring Back

6. Remove shift lever shaft and lift armature and shift lever assembly.
7. Drive back retaining ring on armature shaft. See Figure 1B-5.
8. Take the lock ring, retaining ring, and overrunning clutch and pinion off armature shaft. Check groove in shaft for burrs and remove with a soft file.

Cleaning and Inspecting Parts

1. Clean and check all parts. Replace defective parts.
2. Turn down worn or burnt commutator on a good precision lathe. Use a spindle speed between 2,000 and 3,000 RPM. See Figure 1B-6. When turning down commutator, adjust cutting depth of tool so that no more pits exist after this operation. Do not remove any more material than necessary, however, because if commutator diameter is less than 1 15/32 inches, armature must be replaced.



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Figure 1B-6 Turning Down Commutator

3. Undercut mica approximately .020 below commutator surface. Finish and thoroughly clean commutator.
4. Check armature for short circuit on a growler.
5. With a test lamp, check armature for ground. Test lamp must not light up. See Figure 1B-7.

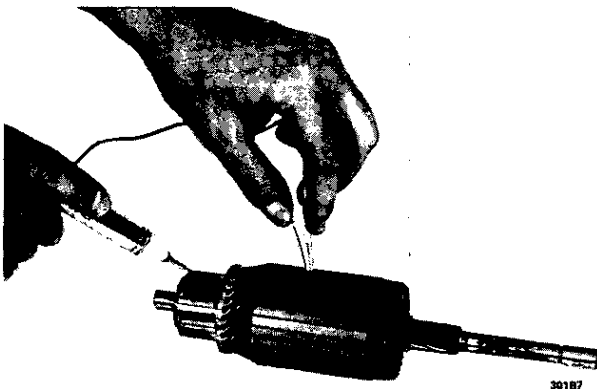


Figure 1B-7 Testing Armature for Grounds

6. Check armature for an open circuit on a growler. Considerable variation in readings between individual commutator bars would indicate an open circuit.
7. Visually check field coils. Replace burnt or scorched field coils.
8. With a test lamp, check field coils for ground. See Figure 1B-8. Test lamp must not light up. Replace grounded field coil.

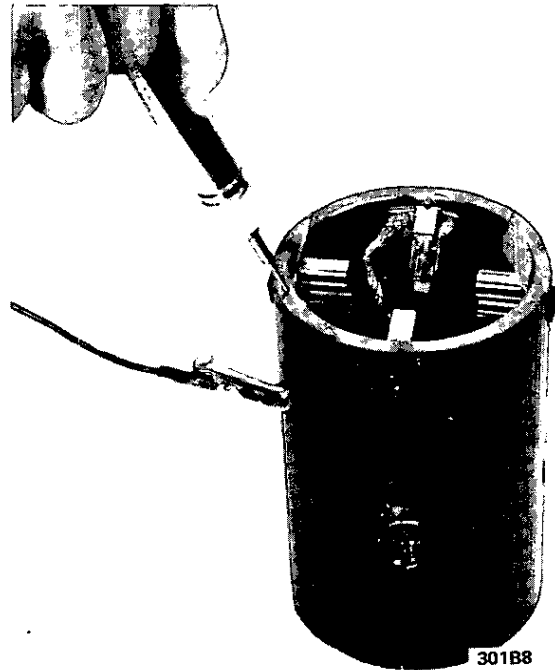


Figure 1B-8 Checking Field Coils for Ground

Replacing Field Coils

1. Mark locations of pole shoes to avoid incorrect installation.

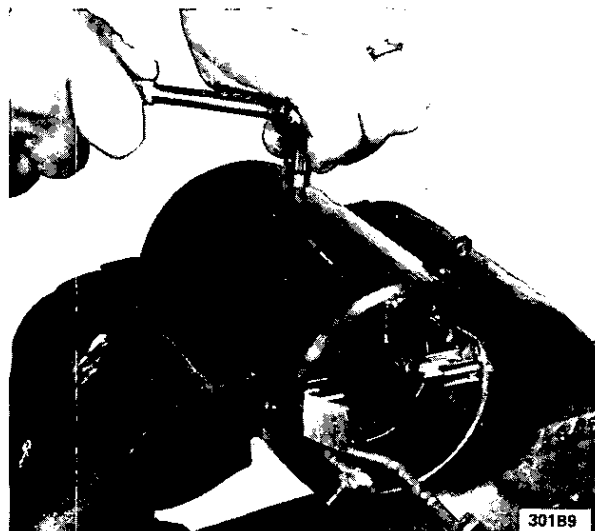


Figure 1B-9 Removing Pole Shoes

2. Unscrew the four (4) pole shoe attaching bolts and take field coils out of field frame. See Figure 1B-9.
3. To ensure proper installation of the pole shoes, align shoes exactly parallel with the armature shaft prior to tightening attaching bolts.

Checking and Replacing Brushes

1. Check both positive brush holders for ground. See Figure 1B-10. Test lamp must not light up.

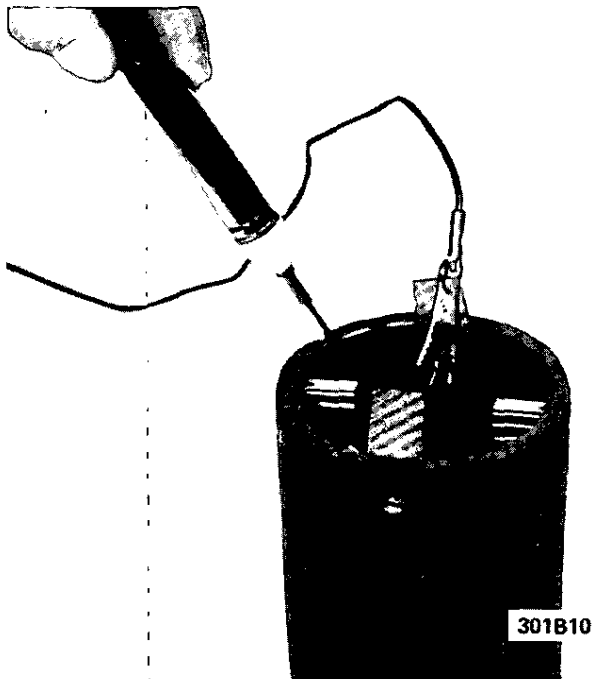


Figure 1 B-10 Checking Positive Brush Holder for Grounds

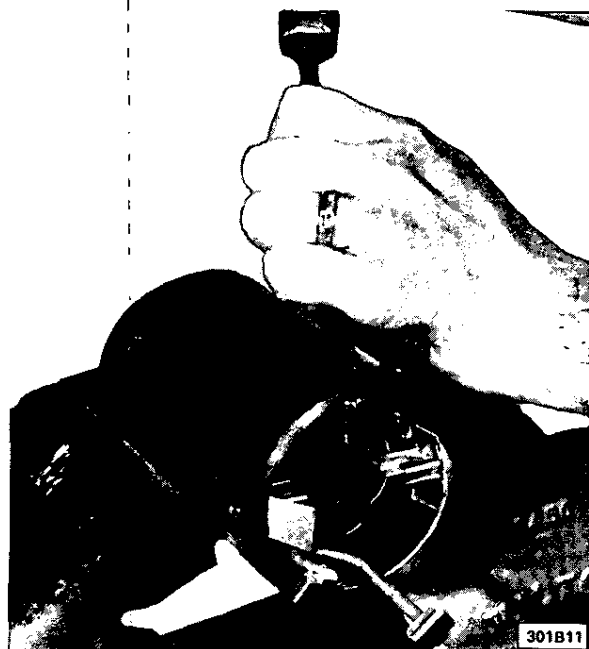


Figure 1B-11 Removing Rivet

2. Check brushes. Replace brushes, if worn down to .28 inches or less. Always replace all four (4) brushes.

3. To replace positive brushes, cut off wires at the connecting strap of the field coil. Clean soldered joint and solder stranded wire of new brushes. Hold wire with flatnose pliers so that no tin enters wire strands.

4. On replacement of the negative brushes, the complete brush holder with the welded brush has to be replaced.

5. Shear off rivet head with a chisel and drive rivet out. See Figure 1B-11.

6. A tool to replace the negative brush holder and rivet can be made up out of 1/4 inch steel. See Figure 1B-12.

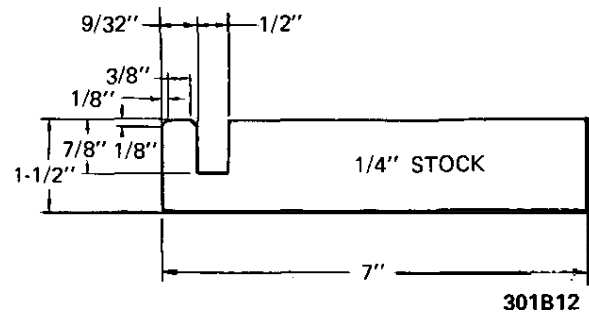


Figure 1B-12 Negative Brush Holder Installation Tool

7. Place new brush holder and new rivet on installation tool and insert rivet into bore of field frame. See Figure 1B-13.

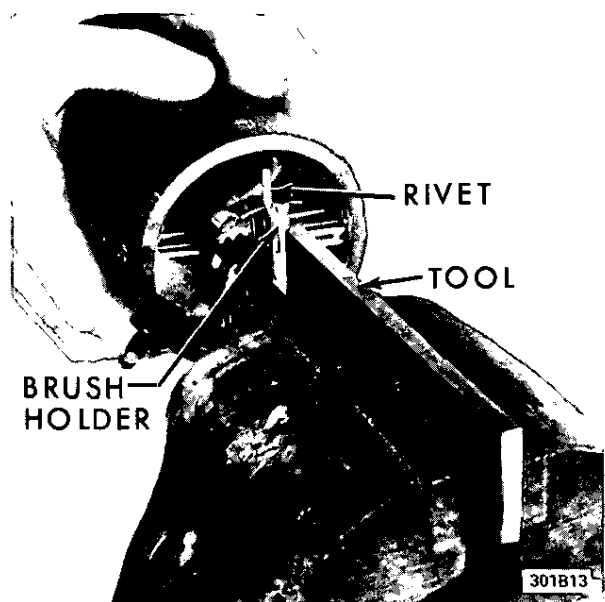


Figure 1B-13 Brush Holder and Rivet Installed on Tool

8. Making sure that brush holder is aligned at right angles to the field frame, rivet brush holder to field frame. See Figure 1B-14.

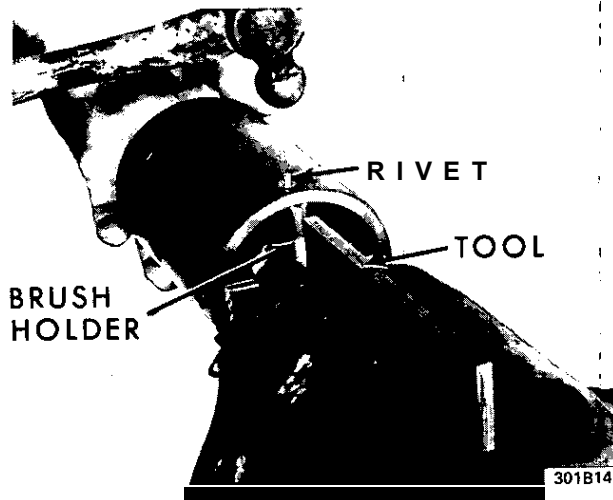


Figure 1B-14 Riveting Brush Holder to Frame

Replacing Bushings

If sintered bronze bushings in commutator end frame and drive housing are worn, they must be **replaced**. Soak new bushings in engine oil for at least half an hour prior to installation. Press out old bushings and press in new bushings. See Figure 1B-15.

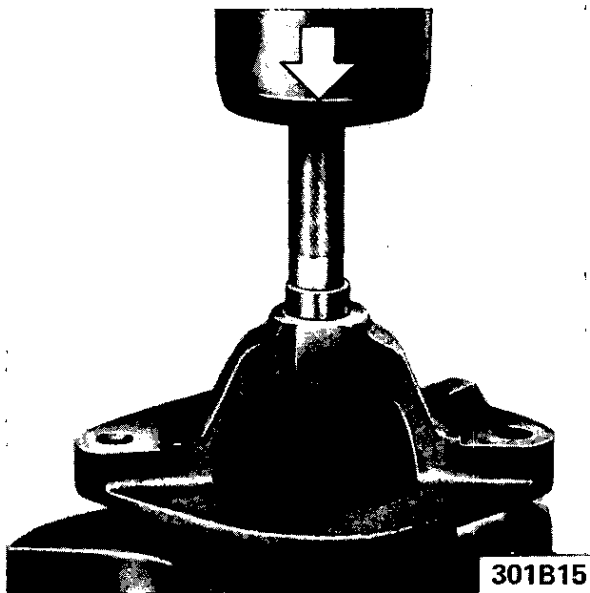


Figure 1B-15 Installing New Bushings

Starter Assembly

1. Lubricate armature shaft. Install drive assembly with pinion outward.

2. Slide pinion stop retainer down over shaft with recessed side outward.

3. Place a new snap ring on drive end of shaft and hold it in place with a hard **wood** block. Strike block with hammer to force snap ring over end of shaft, then slide the ring down into groove in shaft. See Figure 1B-16, view A.

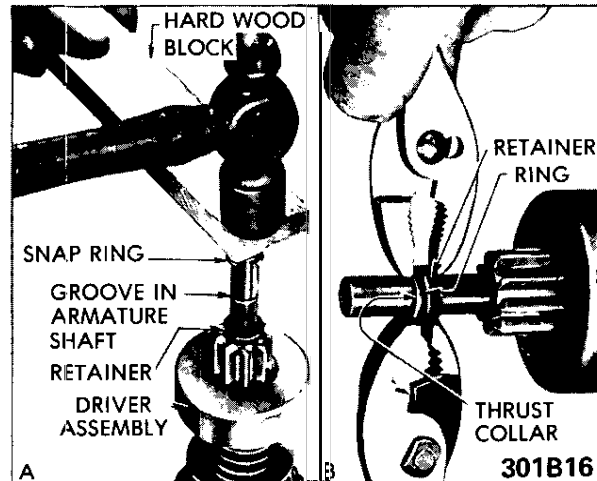


Figure 1B-16 Pinion Stop Retainer and Snap Ring Installation

4. Place thrust collar on shaft with shoulder next to snap ring and move the retainer into contact with ring. Using pliers on opposite sides of shaft, squeeze retainer and thrust collar together until snap ring is forced into the retainer. See Figure 1B-16, view B.

5. Lubricate drive housing bushing and install armature and drive assembly in housing.

6. Install solenoid thrust spring and solenoid.

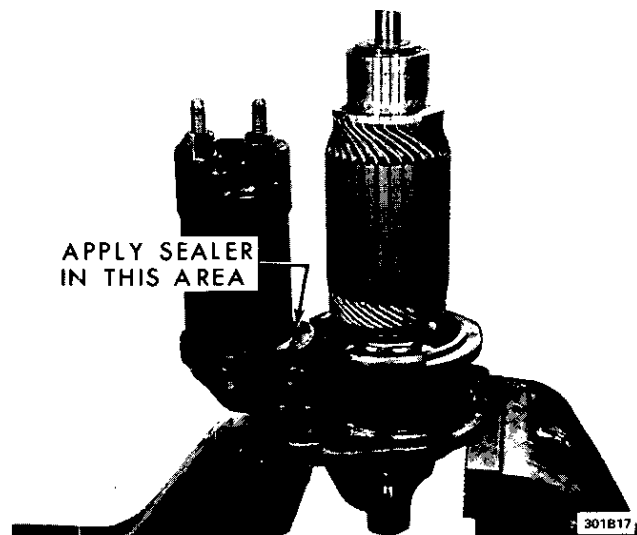


Figure 1B-17 Applying Sealer to Starter

7. Seal area between solenoid and frame. See Figure 1B-17.
8. With brushes and spring in housings held in place with a 29 millimeter socket, slide frame assembly in position.
9. Install insulating sleeves in field frame.
10. Install end frame and replace through bolts and tighten bolts.
11. Install bolt holding field frame to solenoid.

12. Check starter on bench before installing.

Starter Installation

1. Hold starter in position.
2. Install two bolts, one nut and lockwashers. Tighten securely.
3. Install support bracket. To ensure a stress-free installation, install bolt and two nuts only finger tight. First tighten the bolt at the engine, then tighten the two nuts at the starter end frame.

SPECIFICATIONS

Starter Specifications

Starter Number	EF 12V0 .8 PS
Rated Voltage	12
No Load Test:	
Volts	10.6
Amperes	30-50
RPM	7300-8500
Cranking Amperes Test (In Car-Engine at Operating Temp.)	175-205
Lock Test:	
Volts	6 Min.
Amperes	280-320
Voltage Required to Close Solenoid Contacts	7.5
Minimum Diameter of Commutator in Inches	1.46
Brush Spring Pressure in Ounces	40-46
Minimum Length of Brushes in Inches28