I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

15E

NOVEMBER 1987
ENGLISH EDITION

1988 GRAND WAGONEER AND TRUCK MODELS

R 0000

GENERAL

Attention: Workshop, Parts Department

UPDATE AND REVISIONS TO WORKSHOP MANUAL

This I.S. Note contains service information unique to 1988 GRAND WAGONEER AND TRUCK models. Only those items that apply to 1988 Grand Wagoneer and Truck models are outlined in this I.S. Note. All other service information in the M.R. 253 remains unchanged. Service information in the M.R. 253 affected by these updates/revisions include:

- General
- Engines
- Electrical

FILING INSTRUCTIONS

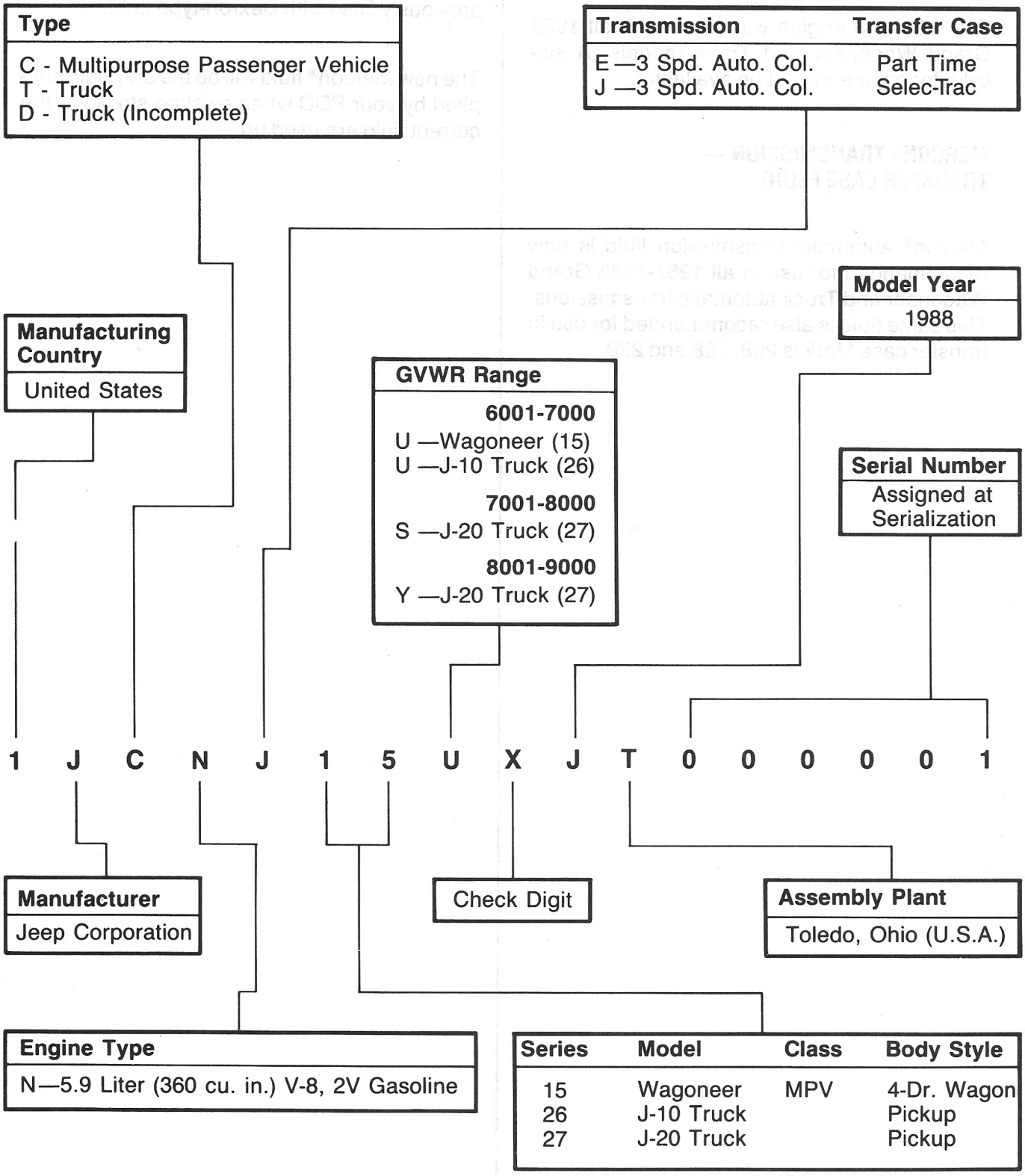
File this I.S. Note in the M.R. 253 manual.

Copyright © 1987 American Motors Corporation and Jeep Corporation. All rights reserved. Litho in U.S.A.

8980 001 438

CONTENTS

VEHICLE IDENTIFICATION NUMBER (VIN)



2617

ENGINE APPLICATION

The 5.9L, V-8 engine will be used in all 1988 Grand Wagoneer and Truck models. A six-cylinder engine will not be available.

MERCON® TRANSMISSION — TRANSFER CASE FLUID

Mercon® automatic transmission fluid is now recommended for use in all 1987-1988 Grand Wagoneer and Truck automatic transmissions. This same fluid is also recommended for use in transfer case Models 208, 228 and 229.

Mercon® is compatible with Dexron® II and can be used to top off a transmission/transfer case previously filled with Dexron-type fluid.

The new Mercon® fluid will be the only fluid supplied by your PDC when existing stocks of the current fluid are used up.

GENERAL INFORMATION

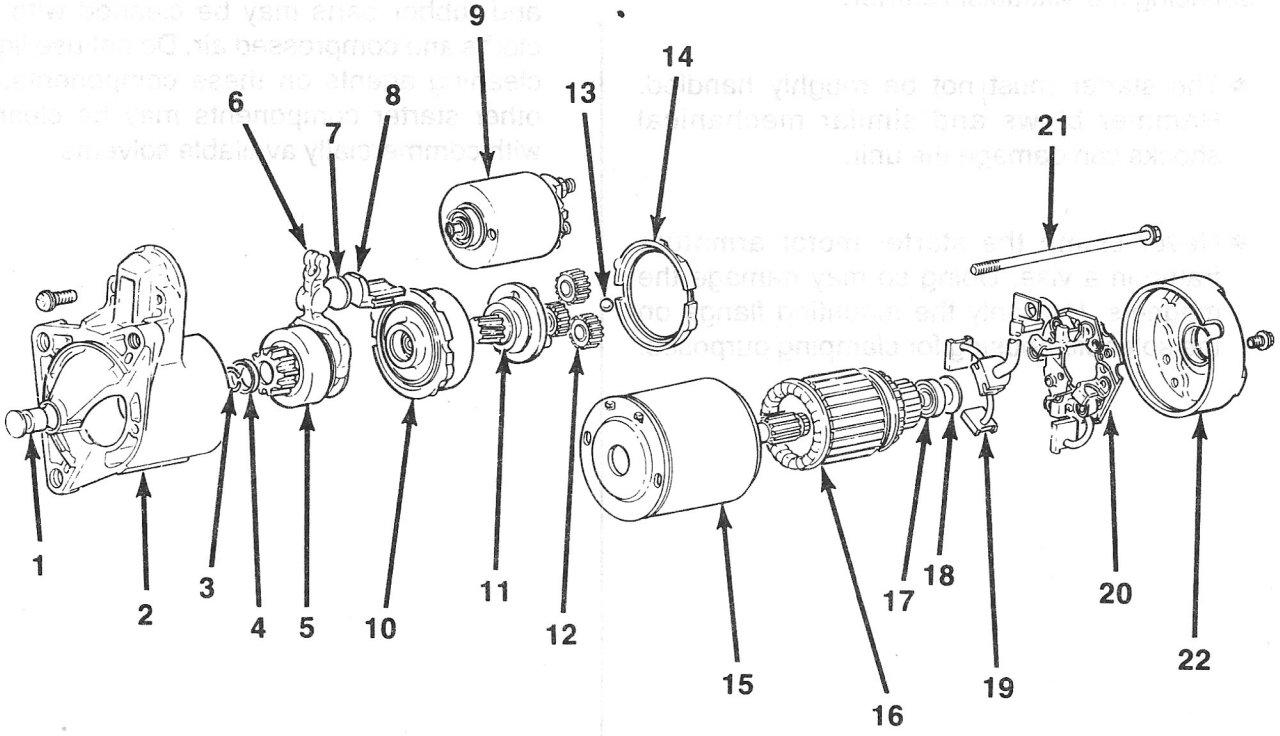
A Mitsubishi starter motor will be used on 1988 Grand Wagoneer and Truck models. This starter motor is a light-weight unit featuring a planetary gear drive and permanent magnets for current induction.

The planetary gear drive is splined to both the armature shaft and overrunning clutch. Starter torque is transmitted to the overrunning clutch pinion through the planetary gears which provide higher rotational speeds.

The starter magnetic field is produced by six permanent magnets. The magnets are mounted in the armature frame and positioned according to polarity. They are permanently attached to the frame and are not removable.

The starter motor is activated by a solenoid mounted on the overrunning clutch housing.

STARTER MOTOR



1. Bushing
2. Overrunning Clutch Housing
3. Snap Ring
4. Stop Ring
5. Overrunning Clutch
6. Clutch Yoke
7. Yoke Washer
8. Retainer
9. Solenoid
10. Planetary Annulus Gear
11. Planetary Carrier and Pinion Shaft
12. Planetary Gears
13. Armature Shaft Ball
14. Seal Ring
15. Armature Frame and Magnet Assembly
16. Armature
17. Bearing
18. Washer
19. Carbon Brushes
20. Brush Holder
21. Armature Frame Bolts (2)
22. End Cover

2635

STARTER SERVICE INFORMATION

The Mitsubishi starter motor is a serviceable component and can be disassembled for repair.

Replaceable components include the solenoid, overrunning clutch, brushes, brush holder, armature frame and magnets, overrunning clutch housing and the planetary gear drive assembly.

Certain precautions must be observed when servicing the Mitsubishi starter.

- The starter must not be roughly handled. Hammer blows and similar mechanical shocks can damage the unit.

- Never clamp the starter motor armature frame in a vise. Doing so may damage the magnets. Use only the mounting flange on the solenoid housing for clamping purposes.

- Be sure test connections are correct when checking starter performance. A wrong connection will damage the starter magnets seriously enough to require replacement.

- Ensure cleanliness during starter repair. Metal chips are attracted by the starter magnets. Be sure all chips are removed with compressed air and clean shop towels. Chips in the armature frame, planetary gears, or overrunning clutch can cause premature wear.

- The starter armature, armature frame, overrunning clutch, planetary gears, solenoid and rubber parts may be cleaned with dry cloths and compressed air. Do not use liquid cleaning agents on these components. All other starter components may be cleaned with commercially available solvents.

STARTER MOTOR AND SOLENOID SPECIFICATIONS

Component	Dimension
Carbon Brushes	Minimum Length 9mm (0.354 in)
Ring/Pinion Clearance	2-5 mm (0.078-0.196 in)
Backlash (Meshed Ring and Pinion)	0.3-0.7 mm (0.012-0.028 in)
Commutator Diameter	Min 28.4mm (1.118 in) max 29.5 mm (1.161 in)
Run Out:	
Commutator	0.03mm (0.001 in)
Armature Core	0.08mm (0.003 in)
Armature End Play	0.58mm (0.023 in)

NO LOAD TEST WITH 11.2 VOLTS		SOLENOID SPECIFICATIONS	
AMPS	RPM	HOLD-IN WINDING VOLTAGE	PULL-IN WINDING VOLTAGE
80 MAX.	2500 MIN.	3.5 MIN.	7.8 MAX.

2634

COLD CRANKING SPECIFICATIONS

Battery Test Voltage	12.5 Volts
Cold Cranking Voltage (Min.)	9.6 Volts
Cold Cranking Amps	130 Amps

100665A

STARTING SYSTEM DIAGNOSIS

Battery Test

The electrolyte level must be above the plates and separators. OK?
- NO → Add distilled water up to the mark or above the plates and charge battery.
- YES ↓

Test specific gravity of electrolyte. Minimum value 1.235. OK?
- NO → Charge battery, check regulator voltage (see Charging Systems). Refer to Battery section.
- ↓

Heavy Load
See Battery Test Section

Starter Operation

Battery must be sufficiently charged. Any unusual noise?
- YES → Unusual noise: engine ring gear damaged — repair or replace. Starter defective — remove and replace.
- NO ↓

Does engine start immediately?
- NO → If engine starts poorly or not at all, check compression, valve play, injection system, etc.

Starter Does Not Crank Engine

Is starter solenoid engaging (pinion meshes?)
- YES → Engaging noise is audible but headlights dim when cranking: starter defective (armature shorted, communutator worn, brushes worn). Remove and repair starter. Engaging noise is audible and headlights remain bright: starter communtator circuit is open . . . make necessary repairs.
- NO ↓

Engaging noise is not audible and headlights remain bright: no voltage at starter relay, check ignition switch. Open circuit to ignition switch or voltage drop at ignition switch. Eliminate open circuit or replace switch, refer to ETM. No voltage at starter solenoid terminal, check solenoid wire. Clean or replace wire if corrosion is present. Apply silicone dielectric compound to terminal.

Starter solenoid engaging (pinion does not mesh). → Damaged teeth on ring gear. Replace defective ring gear. Incorrect installation of starter: starter flange misaligned or loose. Correct installation. Damaged pinion teeth on starter overrunning clutch drive.

Starter Continues To Spin After Disengagement

Defective starter (no armature braking effect). Remove and repair overrunning clutch and planetary gear system. Check solenoid switch and fork assembly operation.

Required Testers:
Hydrometer
Volt/Ohmmeter
Test Lamp
Inductive Ammeter

Starter Cranks Too Slowly

Voltage at solenoid switch battery terminal at least 9.5V? During cranking?
- NO → Voltage drop between battery and starter solenoid battery terminal. Refer to ETM.
- YES ↓

Voltage at solenoid switch terminal 45 at least 9.5V? During cranking?
- NO → Remove and clean braided brush cable connections. Defective starter (excessive voltage drop at solenoid switch). Refer to ETM.
- YES ↓

See Starter No Load Test

Starter Does Not Disengage

Test voltage at solenoid switch ignition terminal with test lamp. After releasing ignition switch from start position there should be no voltage at solenoid terminal. OK?
- NO → Ignition switch defective, or out of adjustment.

Current Draw Test, Cold Cranking

Connect inductive ammeter on battery cable leading to starter and measure current draw while starter is cranking. → If current consumption is out of specification, starter cables or connections may be defective, or battery may be wrong capacity for application.
Battery test voltage 12.5V
Cranking voltage 9.6V (Min)
Testing current 160A (70°F)
NOTE: engine condition, oil viscosity and temperature will affect this test

101307C

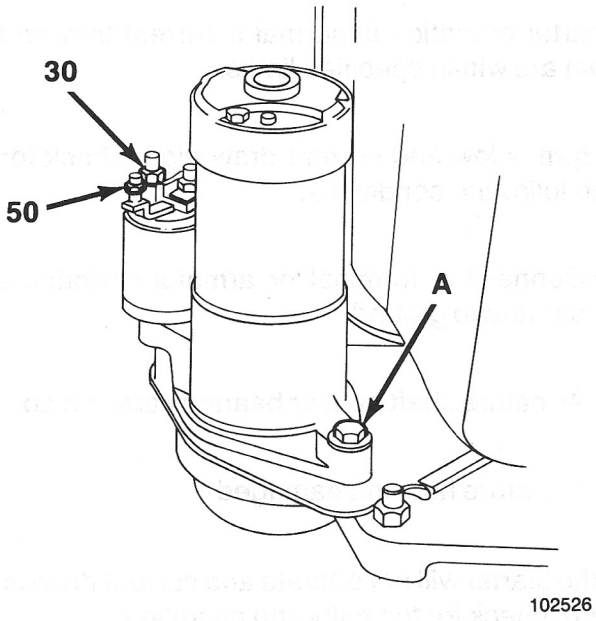
STARTER REMOVAL

Disconnect the battery negative cable.

Raise and support the vehicle.

Disconnect the wires from starter solenoid terminals 30 and 50.

Remove starter front mounting bolt (A).



Remove the starter rear mounting bolt and remove the starter.

STARTER INSTALLATION

Position the starter in the housing.

Install and tighten the starter mounting bolts to 45 N·m (33 ft-lbs) torque.

Install the starter wires on the solenoid terminals. Tighten the large terminal nut to 9 N·m (80 in-lbs) torque. Tighten the small terminal nut to 6 N·m (55 in-lbs) torque.

Lower the vehicle.

Connect the battery negative cable.

STARTER TESTING

Inspection

Remove the starter and check movement of the armature and overrunning clutch pinion. The pinion and armature should rotate freely. Engage the pinion and check armature rotation by turning the pinion with a screwdriver.

A damaged bushing or bearing, armature shaft, or armature frame will cause the armature to bind and not rotate freely.

If the armature and pinion rotate freely, perform the No-Load Test before disassembly. If the armature or pinion bind, disassemble and repair the starter as needed.

No-Load Test

CAUTION: Do not operate the starter for more than 5 seconds at a time during the no-load test. The starter can be overheated and damaged if operated for periods longer than this. Allow the starter to cool down for a minimum of two minutes between tests.

Connect a voltmeter (A) between terminal 45 and the starter frame. Connect (ground) the remaining voltmeter terminal to the starter frame or housing.

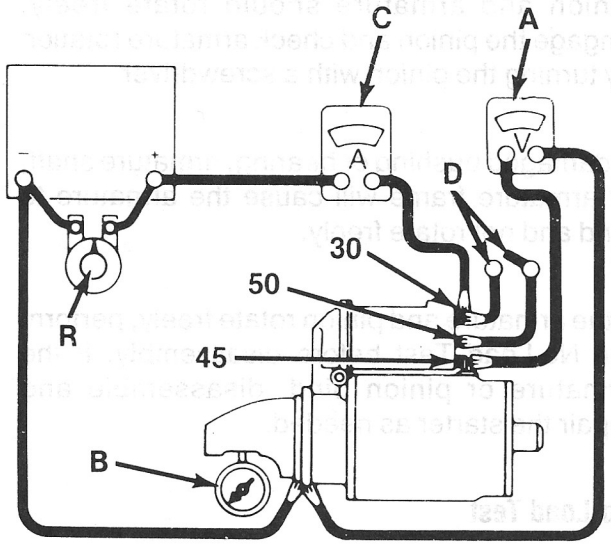
Install a mechanical tachometer (B) on the overrunning clutch pinion shaft to measure armature speed.

Connect an ammeter (C) between the battery positive post and terminal 30 of the solenoid.

Verify that the test battery is at specified test voltage. Charge the battery if necessary.

Connect the battery negative terminal to the starter frame or housing.

Connect a test switch (D) between terminals 30 and 50 of the solenoid. The switch should be in the open position.



84945B

Close the test switch (D) and operate the starter for no more than 5 seconds. Record starter rpm, current, and voltage. Then compare the readings with those listed in the test specifications charts.

NOTE: It is not necessary to obtain exact specified test voltage. If voltage is slightly higher, rpm will also be higher proportionately (current will not be affected). However, if test voltage is higher than specified and exact test voltage is desired, use a carbon pile rheostat (R) to reduce voltage. Connect the rheostat across the battery.

Open the test switch and disconnect the test equipment from the starter.

CAUTION: Do not disconnect the test equipment until the switch is open.

Refer to No-Load Test Analysis.

No-Load Test Analysis

NOTE: The specified current flow also includes solenoid current flow.

Interpret test results as follows:

Starter operation is normal if current flow and rpm are within specified limits.

If rpm is low and current draw high, check for the following conditions:

- Connecting terminal or armature windings shorted to ground
- Armature shaft bent or bearings are seized
- Armature housing damaged

If the starter will not operate and current draw is zero, check for the following conditions:

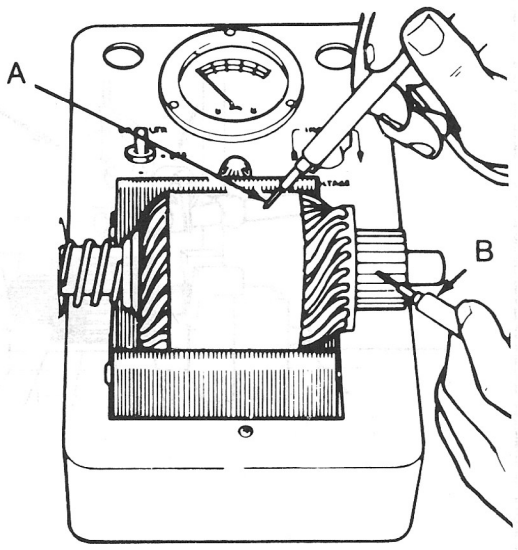
- Grease, dirt on brushes or commutator
- Open armature windings. Inspect commutator for burned spots.
- Worn brushes
- Damaged brush springs or spring holders
- Protruding insulation between commutator bars
- Solenoid terminals damaged

If tests indicate an armature problem, check the armature on the growler. Refer to the armature testing procedures in this section.

Armature Ground Test

Place the armature in the growler jaws and turn the power switch to TEST position.

Place one test lead (A) on the armature core. Place the other lead (B) on each commutator bar and observe the test lamp. The lamp should not light. If the lamp lights when the test lead contacts one or more of the commutator bars, the armature is grounded and must be replaced.

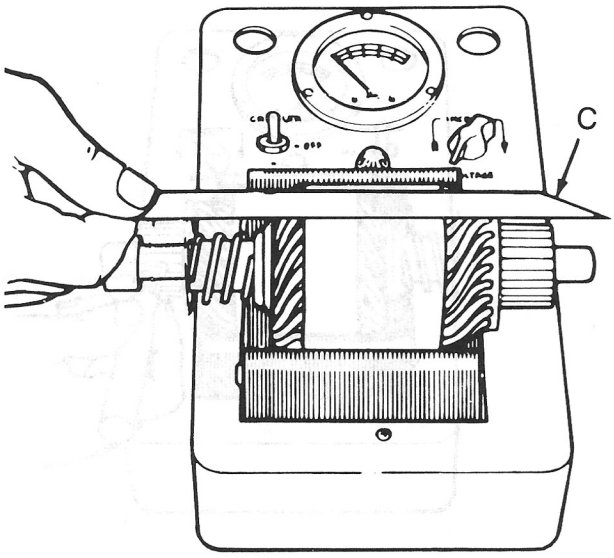


84936B

Armature Short Test

CAUTION: To avoid damaging the growler, do not operate the growler unless an armature is mounted in the growler jaws.

Place the armature in the growler jaws and turn the power switch to GROWLER position.



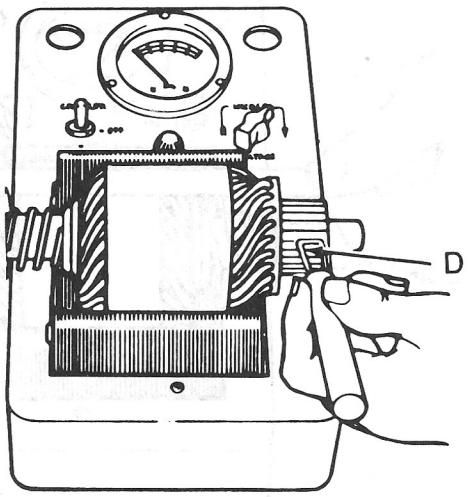
84937B

Position the growler steel blade (C) parallel to and touching the armature core. Slowly rotate the armature one or more revolutions in the growler jaws. If the steel blade vibrates at any part of the core, the windings are shorted and the armature must be replaced.

Armature Balance Test

Place the armature in the growler jaws and turn the power switch to GROWLER position.

Place the contact fingers of the meter test lead (D) across adjacent commutator bars.



84938B

Adjust the growler voltage control until the pointer indicates highest voltage on scale.

Test each commutator bar with the adjacent bar until all have been tested. Zero voltage at any commutator bar indicates a short circuit in the pair being tested. The armature must be replaced if a short is discovered.

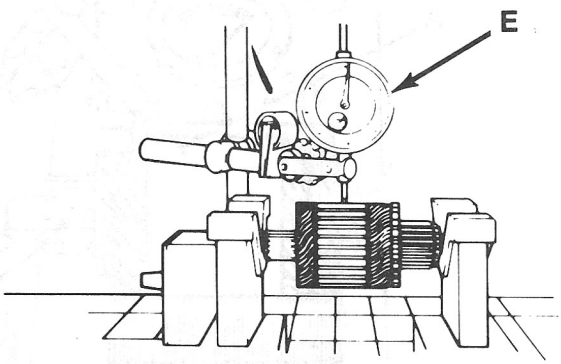
Armature Runout

Check runout of the armature core and commutator with a dial indicator (E). Mount the armature in V-blocks for accurate readings.

Runout at the core should not exceed 0.08mm (0.003 in).

Runout at the commutator should not exceed 0.03mm (0.001 in).

Replace the armature if runout exceeds specified limit at the core or commutator.



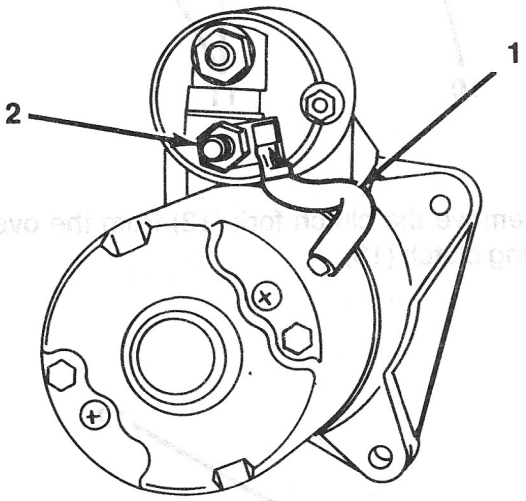
2636

STARTER OVERHAUL

Starter Disassembly

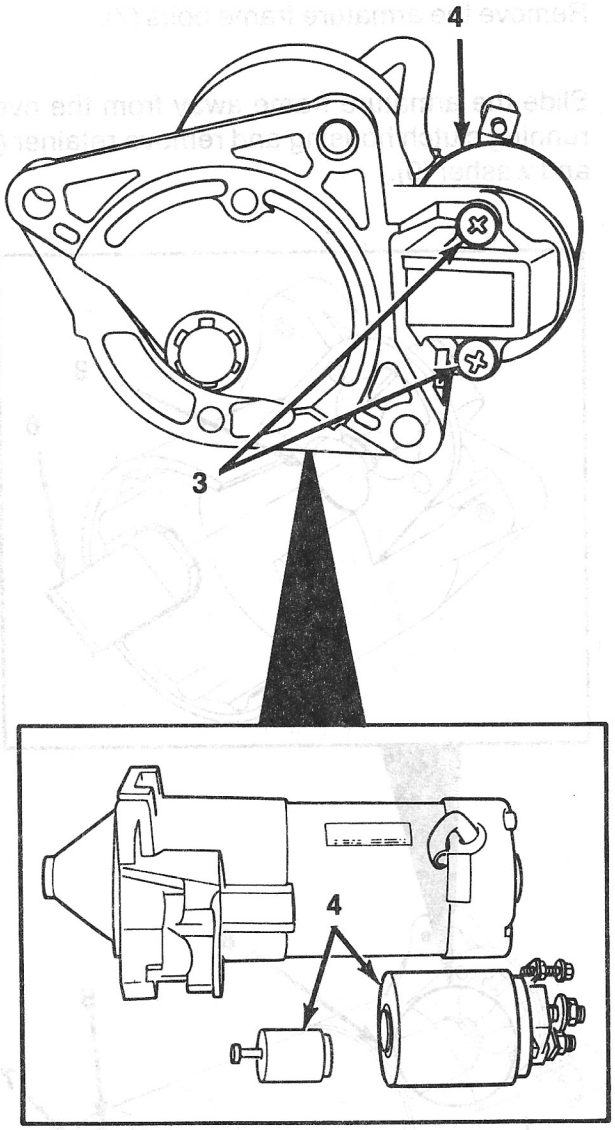
CAUTION: Do not clamp the armature frame in a vise or strike it with a hammer during repair operations. The permanent magnets attached to the frame could be broken and the frame dented or deformed if mishandled. If the starter is to be mounted in a vise during repair, use only the mounting flange on the housing for clamping purposes.

Disconnect the brush wire (1) from the solenoid terminal (2).



02637

Remove the solenoid screws (3) and remove the solenoid and solenoid plunger (4).

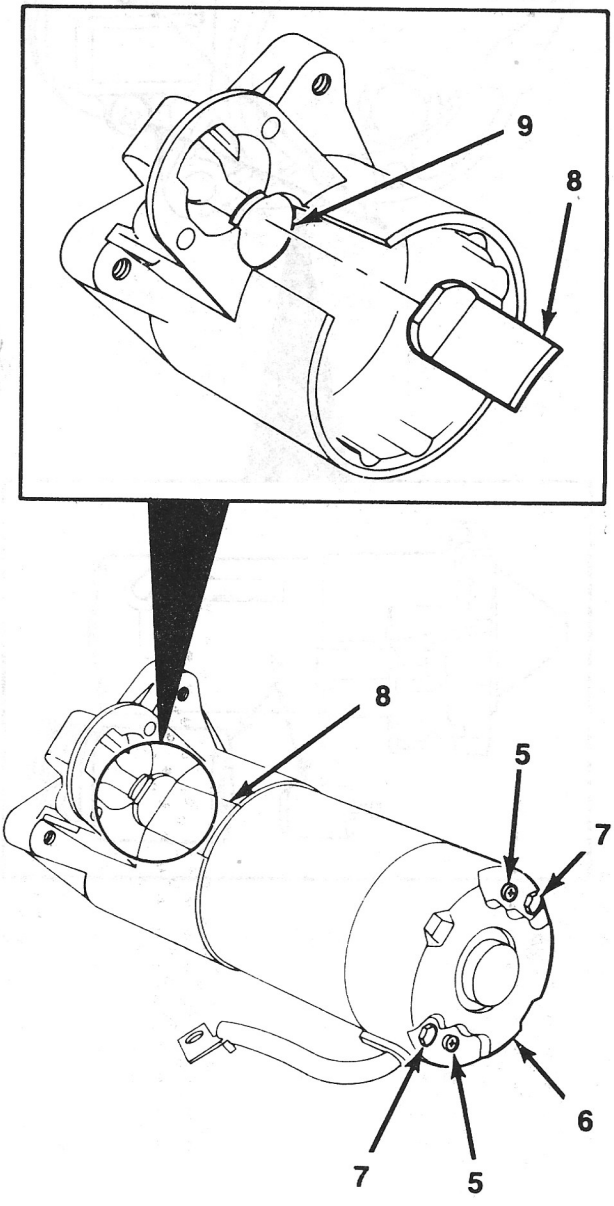


2638

Loosen but do not remove the two screws (5) that attach the commutator shield (6) to the brush holder plate.

Remove the armature frame bolts (7).

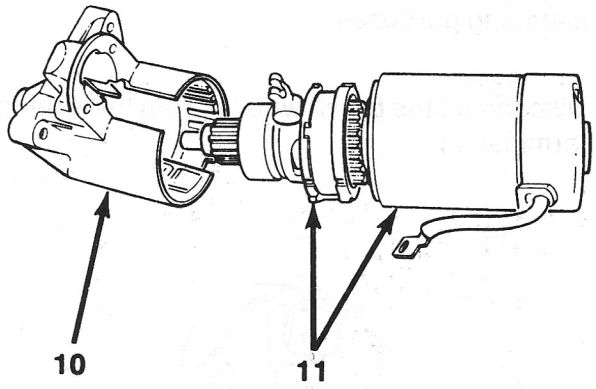
Slide the armature frame away from the overrunning clutch housing and remove retainer (8) and washer (9).



2639

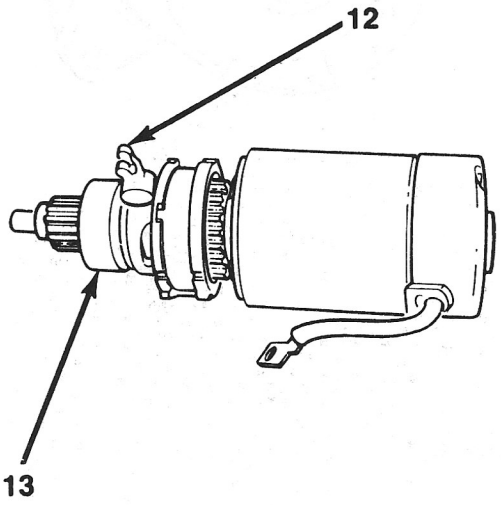
Remove the overrunning clutch housing (10) from the armature frame (11).

Remove and retain the armature shaft ball.



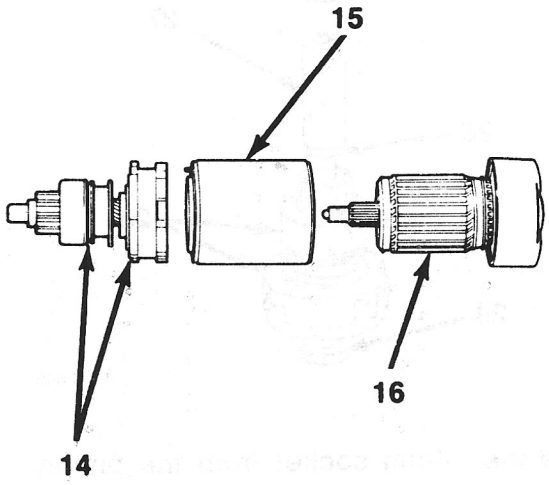
2640

Remove the clutch fork (12) from the overrunning clutch (13).



2539

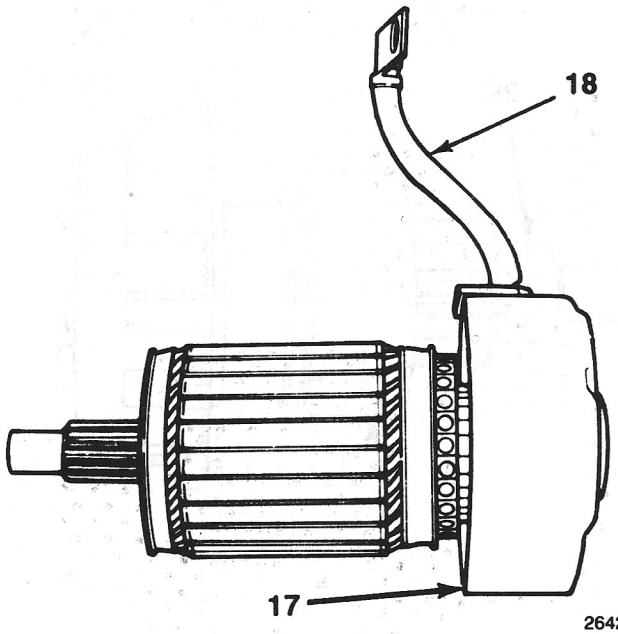
Remove the overrunning clutch (14) and frame (15) from the armature (16).



2641

Remove the screws attaching the end cover (17) to the armature. Remove the cover but do not remove the brush holder plate.

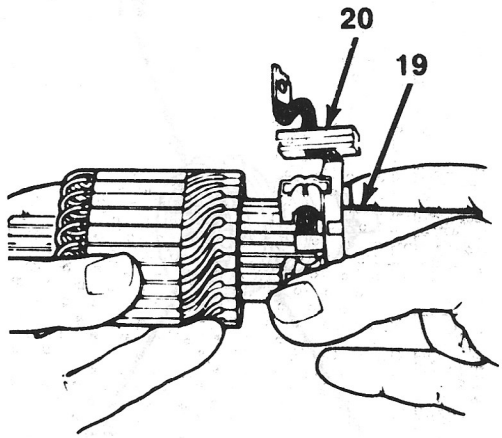
Remove the brush feed wire (18) by sliding the wire and wire connector out of the shield (17).



2642

Install a 22mm socket (19) on the armature shaft.

Slide the socket up against the armature commutator. Then slide the brush holder (20) onto the socket (19). Leave the socket in position in the brush holder for inspection and assembly.

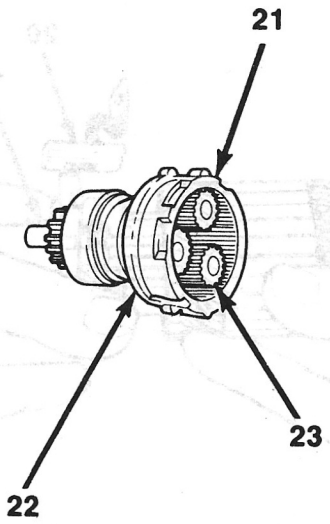


2643

Remove the seal ring (21) from the planetary gear assembly (22).

Remove the planetary gears (23).

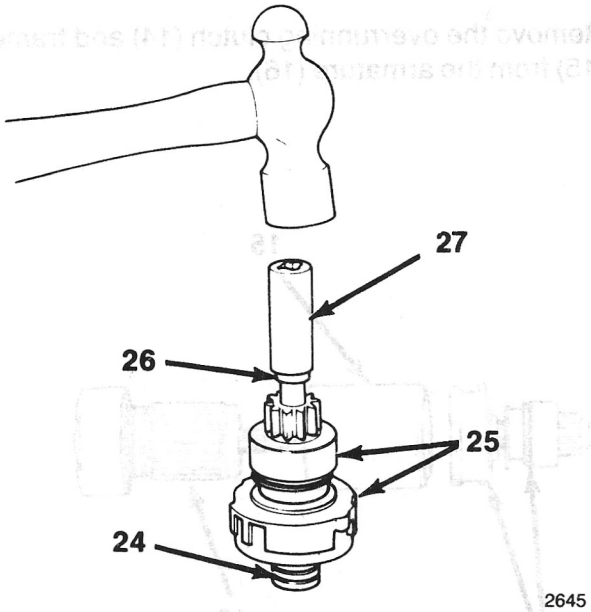
Remove the gear carrier and pinion shaft from the planetary annulus gear.



2644

Place a 17mm socket (24) on the workbench. Then position the planetary gear/overrunning clutch assembly (25) in a vertical position (on end), so the entire assembly rests on the socket.

Unseat the stop ring (26) using a 12 point 14mm socket (27). Position the socket on the pinion shaft and against the stop ring (26). Then strike the socket with a hammer to unseat the stop ring and expose the snap ring.

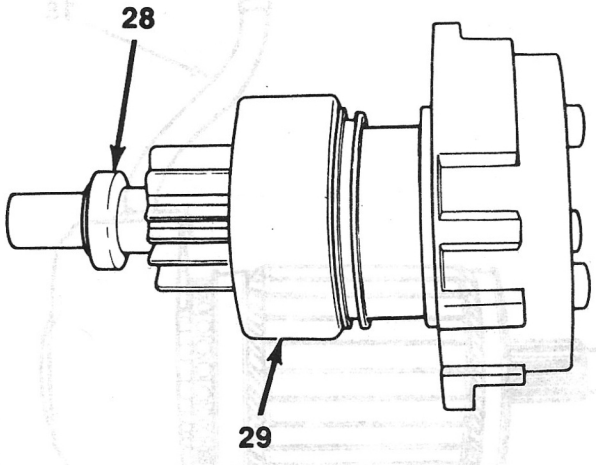


2645

Remove the 14mm socket from the pinion shaft.

Remove the snap ring and stop ring (28) from the pinion shaft.

Remove the overrunning clutch (29) from the pinion shaft.



2646

STARTER CLEANING AND INSPECTION

Cleaning

Clean the armature, armature frame, overrunning clutch, solenoid, and brush holder assembly with clean, dry cloths or compressed air only. Do not use liquid solvents to clean these components. Use mineral spirits or similar solvents to clean the remaining starter components.

Inspection

Inspect the armature frame and magnets. Do not attempt to remove the magnets. They are permanently attached. Replace the frame and magnets as an assembly if either component is damaged.

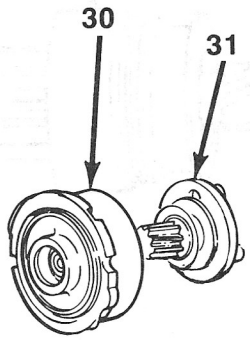
Replace the planetary gear assembly and pinion shaft if worn or damaged.

Inspect the armature shaft bushing and bearing. Replace either part if worn. However, if the bushing or bearing has worn to the point where armature-to-frame contact has occurred, replace the starter motor as an assembly.

Inspect the brushes and brush holder. Replace the brushes if damaged or worn below the minimum length of 9 mm (0.354 in.). Replace the brush holder if cracked, bent, or distorted. Do not remove the socket from the brush holder unless the holder must be replaced.

STARTER ASSEMBLY

Install the planetary annulus gear (30) on the gear carrier and pinion shaft (31).

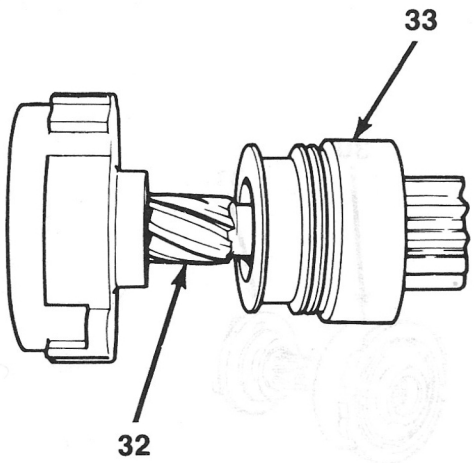


2647

Lubricate the pinion shaft (32) and the bushing in the overrunning clutch housing with SAE 20W motor oil.

Lubricate the spiral splines in the overrunning clutch bore with Lubriplate.

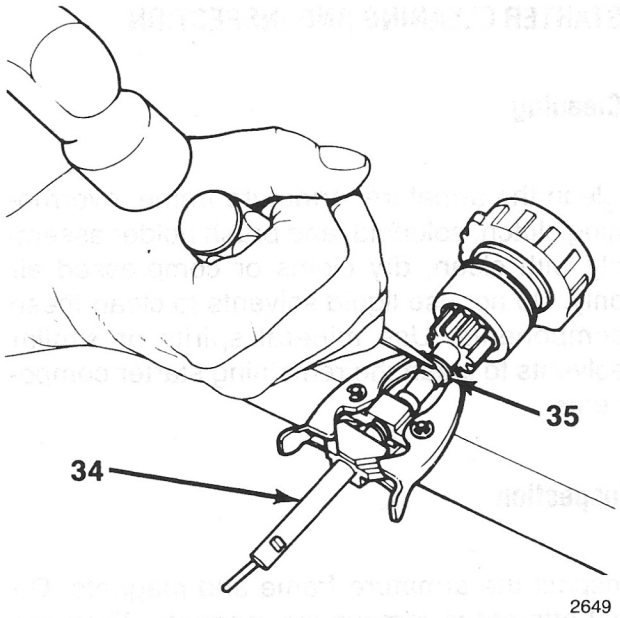
Install the overrunning clutch (33) on the pinion shaft (32).



2648

Install the stop ring and snap ring on the pinion shaft as follows:

- Install the stop ring on the pinion shaft. Slide the stop ring past the snap ring groove.
- Expand and install the snap ring on the pinion shaft. position the snap ring in the shaft groove and crimp the snap ring in place.
- Pull the stop ring against the snap ring with a battery cable puller (34).
- Check snap ring-to-stop ring alignment. If necessary, tap the snap ring with a screwdriver until aligned in the stop ring.
- Tighten the puller tool to seat the stop ring (35) on-and-over the snap ring.

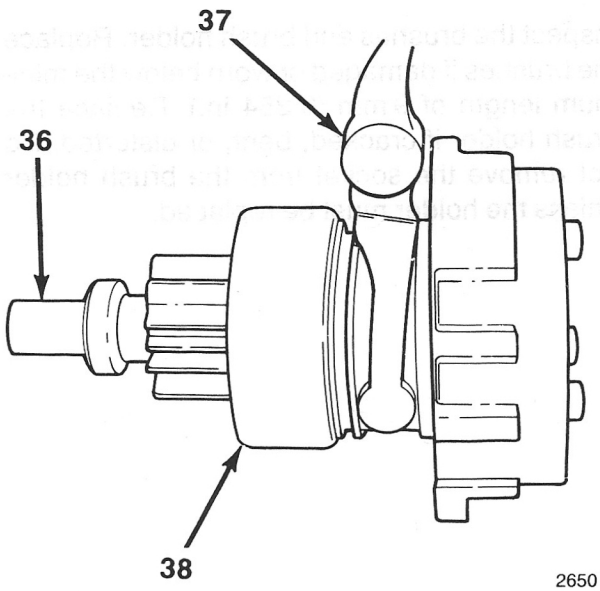


2649

Inspect the pinion shaft bushing surface (36) after installing the snap and stop rings. Remove small burrs or scratches on this surface with crocus cloth or 400-600 grit sandpaper.

Lightly lubricate the bushing in the overrunning clutch housing with SAE 20W oil.

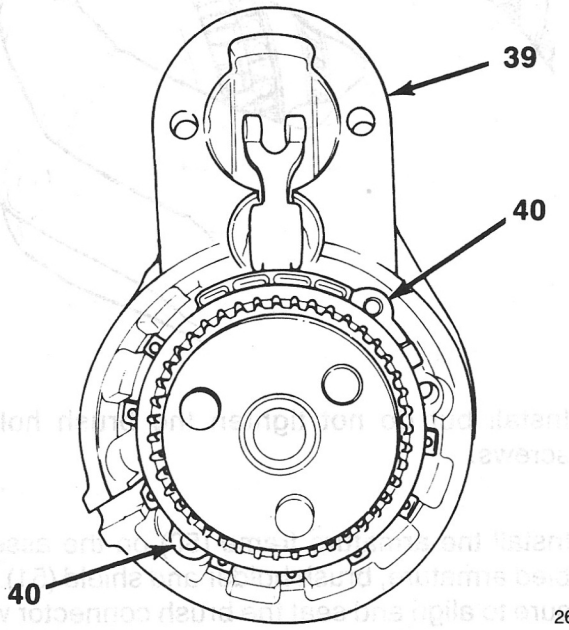
Install the clutch fork (37) on the overrunning clutch (38).



2650

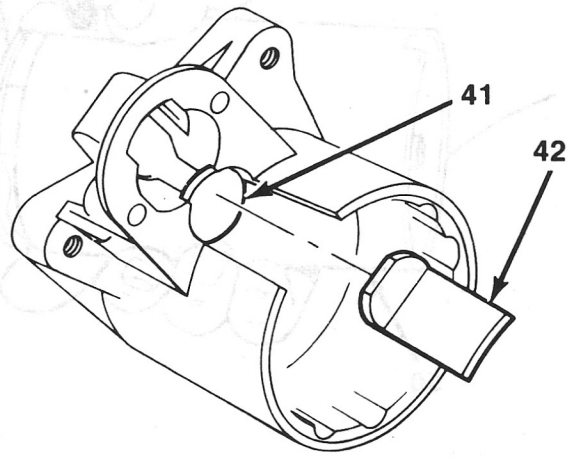
Install the planetary/overrunning clutch assembly in the overrunning clutch housing (39).

Be sure the locating lugs (40) on the planetary annulus are properly aligned and seated in the housing.



2651

Install the fork washer (41) and fork retainer (42).

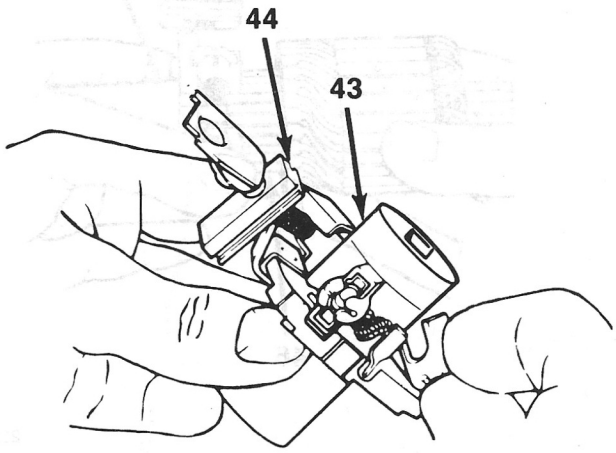


2652

Lubricate the planetary gears with chassis grease and install the three gears on the planetary carrier shafts.

Install the seal ring on the overrunning clutch housing. Position the largest lug on the seal ring at the top.

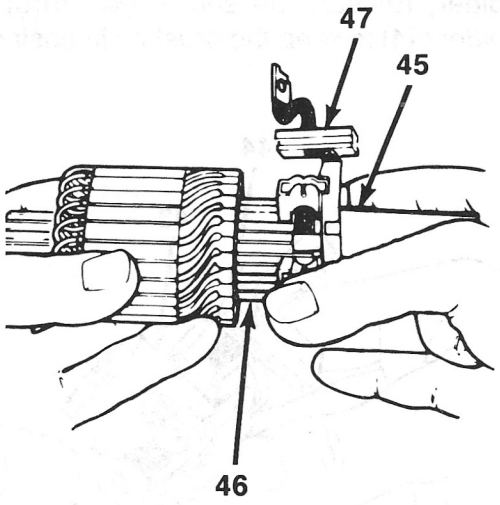
If replacement brushes were installed in the holder, reinsert the socket (43) through the holder (44) to keep the brushes in position.



2653

Position the socket (45) against the armature commutator (46). Then slide the brush holder and brushes (47) onto the commutator and remove the socket.

Verify that the brushes and brush retainers are seated in the holder.

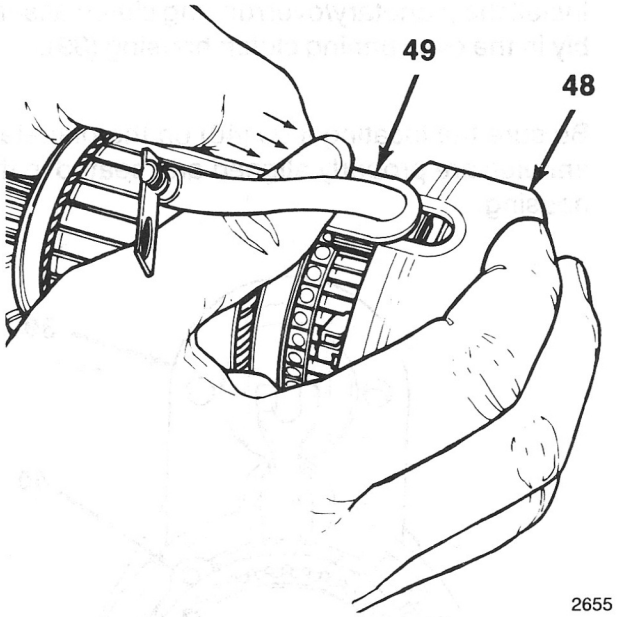


2654

Install the bearing and washer on the armature shaft if not previously installed.

Position the end cover (48) on the brush holder.

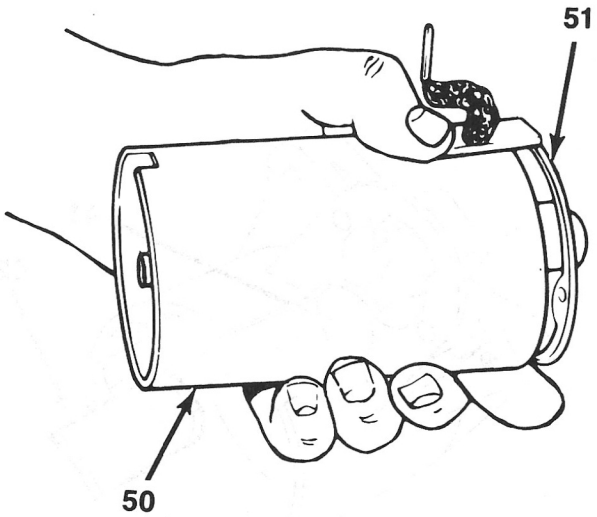
Align the brush connector wire and grommet (49) in the end cover and push the cover into place.



2655

Install but do not tighten the brush holder screws.

Install the armature frame (50) on the assembled armature, brush holder and shield (51). Be sure to align and seat the brush connector wire grommet in the frame during installation.

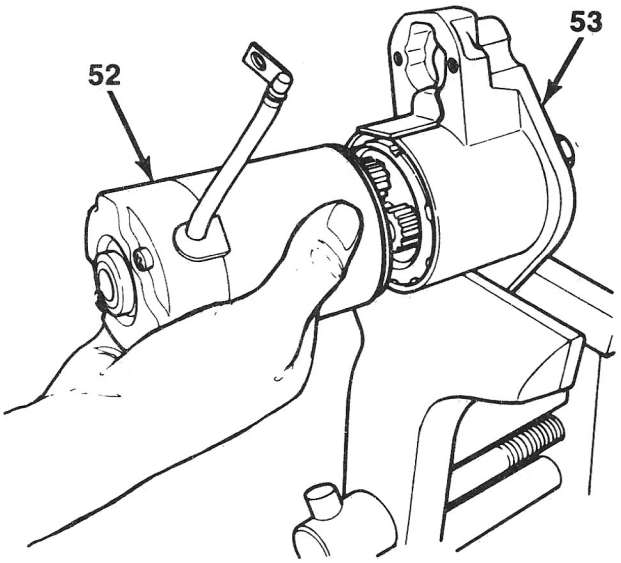


2656

Install the ball in the splined end of the armature shaft. Use chassis grease to hold the ball in place if necessary.

Install the armature and frame (52) on the clutch housing (53). Rotate the armature frame until the alignment tabs on the frame seat in the clutch housing slots.

NOTE: Be sure the armature shaft splines are seated in the planetary gears and the armature shaft is seated in the planetary bushing bore.



2657

Install the bolts that attach the armature frame to the overrunning clutch housing. Tighten the bolts to 3 N·m (28 in-lbs) torque.

Tighten the brush holder attaching screws to 2 N·m (18 in-lbs) torque.

Install the solenoid on the housing as follows:

- Engage the solenoid plunger in the clutch fork.
- Install the plunger return spring, spacer washer and the solenoid housing.
- Install and tighten the solenoid attaching screws.
- Attach the brush connecting wire to terminal 45 of the solenoid.