MOTORCRAFT POSITIVE ENGAGEMENT

Ford Motor Co.
Jeep (6 & 8 Cyl.)

DESCRIPTION

Unit is a four pole, four brush starter with three series coils and one shunt coil. The shunt coil is wound around a moveable pole piece which operates the integral positive engagement drive mechanism.

TESTING

STARTER CRANKING CIRCUIT TESTS

Before performing tests, remove and ground coil secondary wire (disconnect at distributor). Place transmission in neutral or park and apply parking brake. Be sure battery is fully charged. When making voltmeter connections, be sure to connect leads to battery posts or threaded terminals and not just to cable ends.

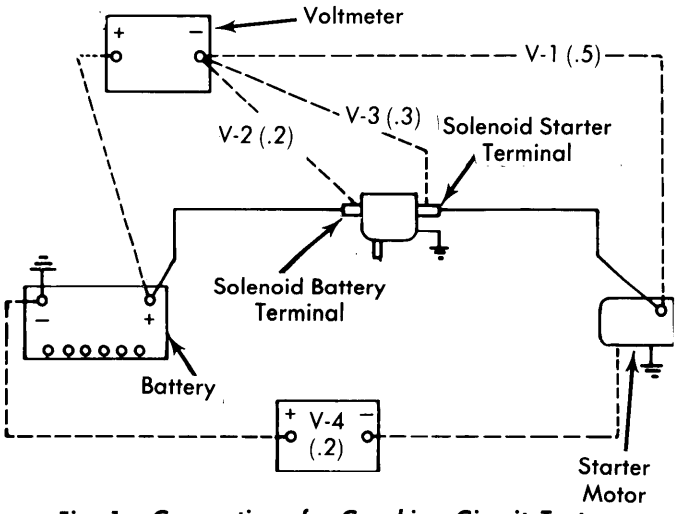

Fig. 1 Connections for Cranking Circuit Test

Battery-to-Starter Motor Voltage Drop (V-1) – Connect voltmeter positive lead to battery positive post and negative lead to starter motor terminal. While cranking engine, note voltmeter reading. Reading should be .5 volts or less at specified load test amperage. If reading is greater, move negative lead to starter cable at starter and retest. If voltage is now .5 volt or less, remove cable and clean connections, then retest at starter motor terminal. If voltage is still above specifications, test individual cables between battery and starter as follows:

Battery-to-Solenoid Voltage Drop (V-2) – Connect voltmeter positive lead to battery positive post and negative lead to battery terminal of solenoid. While cranking engine, note voltmeter reading. Reading should be .2 volt or less at specified load test amperage. If reading is greater, remove cable and clean connections, then retest. If reading is still greater, replace cable.

Solenoid Voltage Drop (V-3) – Connect voltmeter positive lead to battery positive post and negative lead to starter CABLE at solenoid. While cranking engine, note voltmeter reading. Reading should be .3 volt or less at specified load test amperage. If reading is greater, move negative lead to starter TERMINAL at solenoid and retest. If reading is now .3 volt or less, remove and clean cable connector, then retest. If still in excess of .3 volt, replace solenoid. If battery-to-starter circuit (V-1) reading is now greater than .5 volt, replace solenoid-to-starter cable.

Starter Motor Ground Voltage Drop (V-4) – Connect voltmeter negative lead to starter motor housing and positive lead to battery negative post. While cranking engine, note voltmeter reading. Reading should be .5 volt or less at specified load test amperage. If more, move positive lead to ground cable attaching bolt at engine and retest. If reading is now less than .2 volt, check starter motor for loose mounting bolts, corrosion or dirt on mounting surface. If reading is now more than .2 volt, examine ground cable for bad connections or bad cable.

STARTER LOAD TEST

Connect a tester and battery into starter circuit *(see Fig. 2)*. Crank engine with ignition coil secondary wire grounded and note voltage on tester. Stop cranking engine and turn load control knob until voltage reading is exactly the same as it was when engine was cranking. Read current draw on ammeter scale. If not within specifications, starter is defective and must be overhauled.

NOTE – *Do not take amperage draw reading until starter has obtained maximum RPM.*

Load Test Specifications

Application	Amperes
Ford	
4" Starter	150-200
4½" Starter	150-180
Jeep	
6 Cyl.	150-180
8 Cyl.	160-210

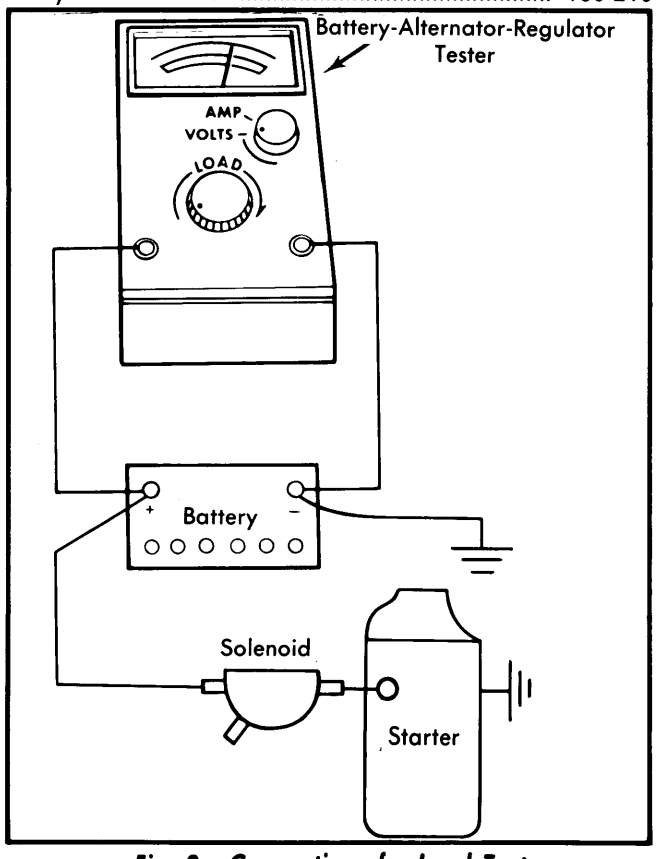

Fig. 2 Connections for Load Test

MOTORCRAFT POSITIVE ENGAGEMENT (Cont.)

STARTER NO-LOAD TEST

With a tester and battery connected to starter *(see Fig. 3)* operate starter motor and note voltage reading and tachometer reading. Disconnect starter from battery. Turn load control knob until voltage reading is same as when starter is connected. Read the amperage draw, and if amperage reading is less than specifications, starter has high electrical resistance. If starter RPM is less than specifications, worn bushings or bent armature shaft is indicated.

No-Load Specifications

Application	Specifications
Voltage	12
Amperage	70-80
RPM Range	8900-9600

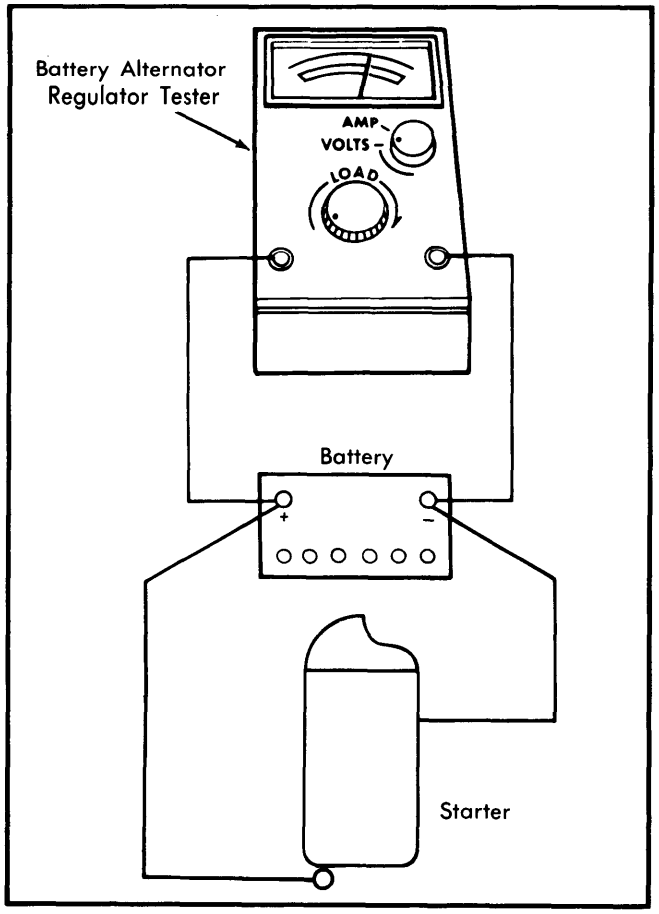

Fig. 3 Connections for No-Load Test

OVERHAUL

DISASSEMBLY

1) Remove cover screw, cover through bolts, starter drive end housing and starter drive plunger lever return spring. Remove pivot pin retaining plunger lever and remove plunger lever and armature.

2) Remove stop ring retainer, stop ring from starter drive gear and starter drive gear assembly. Remove brush end plate and insulator assembly, then remove brushes from brush holder and lift out brush holder. Note location of brush holder with respect to end terminal.

3) Remove ground brushes-to-frame retaining screws. On the field coil which operates drive gear actuating lever, bend the edges on the retaining sleeve and remove sleeve and retainers.

4) Remove 3 coil retaining screws with tool 10044-A and an arbor press. Cut the field coil connection at the switch post lead and remove small diameter ground wire from upper tab riveted to frame. Remove pole shoes and coils from frame. Cut the positive brush leads from fields coils as close to the field connection point as possible.

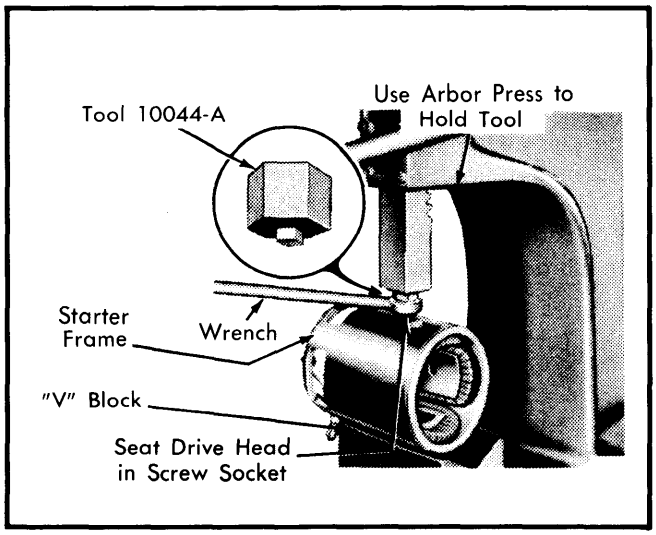

Fig. 4 Removing Pole Shoe Screw

PARTS REPLACEMENT & TESTING

Brushes & Springs – Check brush holders for broken springs and insulated brush holders for shorts to ground. Tighten any loose rivets. Replace brushes if worn to ¼" in length. Measure spring tension with spring scale hooked under spring near end, pull on line parallel to edge of brush and note the reading just as spring end leaves brush. Spring tension should be 40 ozs. on 4" starters, 80 ozs. on 4½" starters. If replacing brushes, use a 300 watt soldering iron and rosin core solder.

Armature – Check armature for shorted coils with a growler and a test light. Touch one test lead to armature core and the other to each commutator bar one at a time. If light lights, armature is shorted to ground and must be replaced. Place switch on growler in GROWLER position and hold steel blade parallel to and touching armature core. Rotate armature and if blade vibrates at any point, that area is shorted and armature must be replaced. Inspect armature shaft for excessive wear. Inspect windings for broken or burned insulation. If commutator is rough or more than .005" out of round, turn down in a lathe, removing only enough material to provide a smooth, even surface.

Field Coil Assembly – Inspect the field coils for burned or broken insulation and continuity. Check field brush connections and lead insulation. Check for grounds in the field coil windings.

MOTORCRAFT POSITIVE ENGAGEMENT (Cont.)

REASSEMBLY

1) Position 3 coils and pole pieces and install attaching screws. As pole shoe screws are tightened, strike the frame with a soft hammer to seat and align pole shoes, then stake the screws.

2) Install the remaining coil and retainer and bend the tabs to secure coil to frame. Position the new field brush lead on field coil terminal. Install clip to hold brush lead to terminal. Solder lead, clip and terminal together with a 300 watt iron and rosin core solder.

3) Ground the coil around the retaining sleeve by placing the small diameter wire from the coil under the copper tab which attaches the contact to frame. Install ground brushes to frame with screws. Lubricate armature shaft splines with lubriplate (or equivalent). Install the drive gear assembly on the armature shaft. Install new retaining stop ring and stop retainer.

4) Install armature in frame. Partially fill drive end housing bearing bore with grease and position drive gear plunger lever to frame and starter drive assembly and install pivot pin. Install plunger lever return spring and drive end housing to frame. Install brush holder, brushes and springs. Install brush holder insulator.

5) Position end plate to frame and align plate locator with frame slot. Install and tighten through bolts. DO NOT pinch brush leads when installing end plate. Position drive gear plunger lever cover on starter and tighten cover screw.

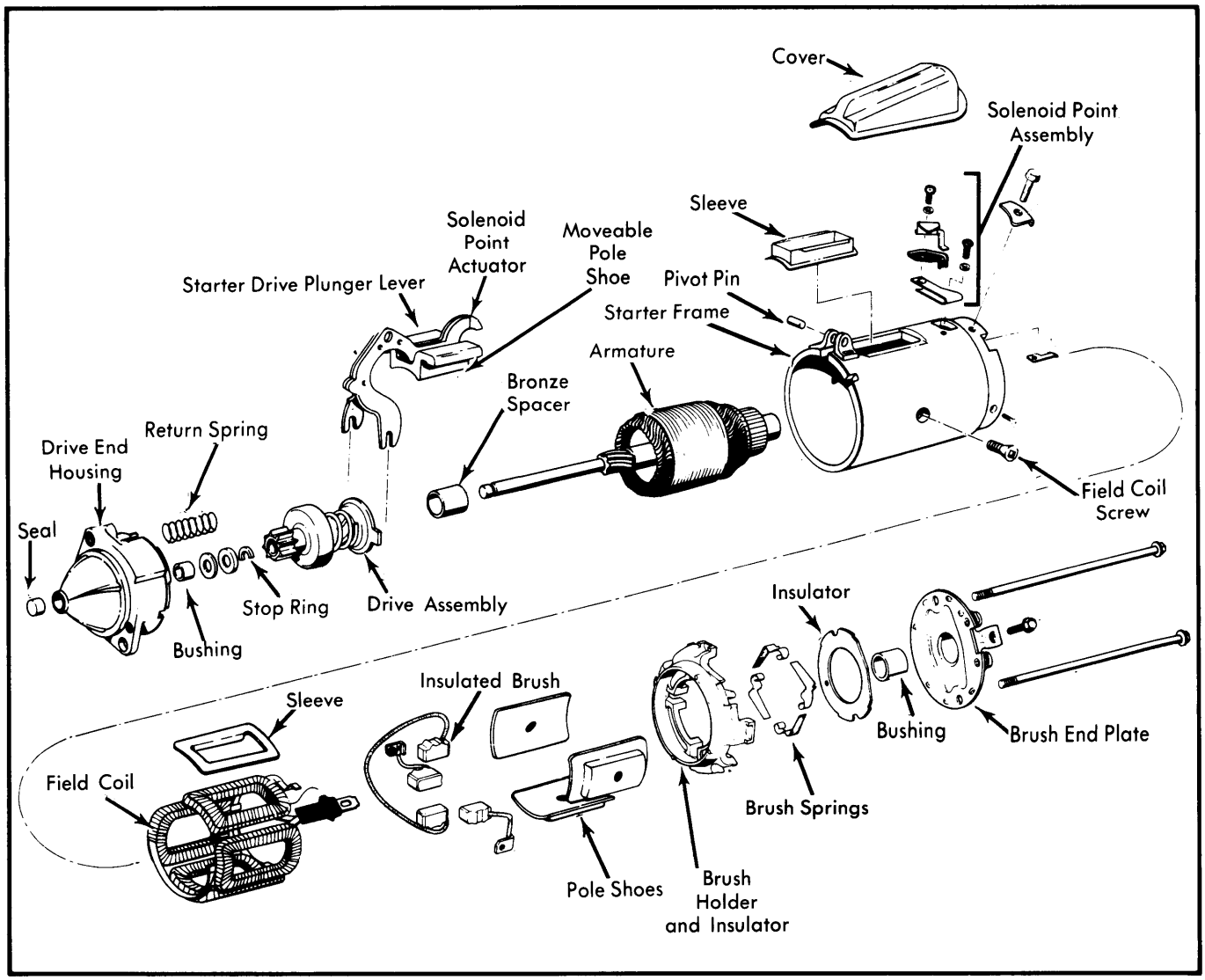

Fig. 5 Exploded View of Motorcraft Starter Motor Assembly