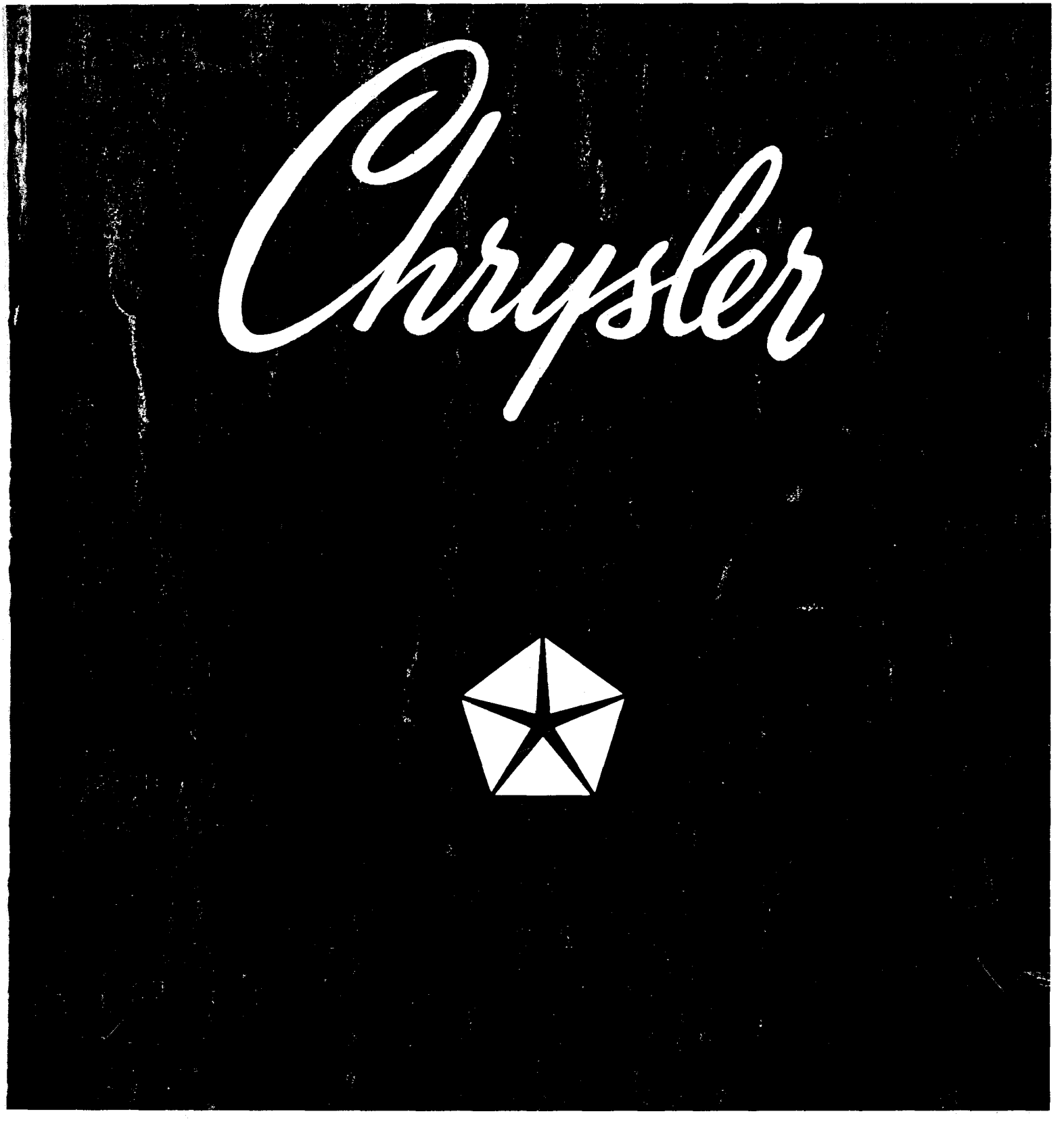


MAINTENANCE MANUAL

INDUSTRIAL PRODUCTS DIVISION CHRYSLER CORPORATION

81-670-0027

CHRYSLER MAINTENANCE MANUAL

CHRYSLER INDUSTRIAL ENGINES

MODELS IND. 225, 318-360
361-413, 400-440

GROUP INDEX

INDUSTRIAL PRODUCTS DIVISION CHRYSLER CORPORATION

GENERAL INFORMATION

UNIT APPLICATION

Chrysler Industrial Engines, are supplied in various types for powering; Delivery trucks, Sweepers, Lift Trucks, Irrigation and Stand-by Pumps, Wind Machines, Mobile Air Conditioners, Crane Carriers, Hoisting Equipment, Welding Generators, Tow Tractors, Concrete Mixers, Orchard Sprayers and many other Industrial Applications.

When an engine is modified for various adaptations, with a particular combination of accessories, it is designated by a separate model and type number. These engine models and types have been designated so that they may be readily identified in determining the service parts requirements, or when additional accessories are required for various adaptations.

SERVICE TOOLS

The service tools referred to in this Manual, or their equivalent are necessary for efficient servicing of the Chrysler Industrial Engines. All tools listed are available through the
Miller Special Tools, 32615 Park Lane,
Garden City, Michigan 48135, U.S.A.
A division of Utica Tool Company, Inc.

SERVICE BULLETINS

Bulletins will be issued from time to time and will either supplement the information contained in the manual or contain new, detailed service instructions. It is suggested that the service technician make any notes of importance thereon and file the bulletins with the corresponding section for future reference.

DATA AND SPECIFICATIONS

Recommended tolerances and specifications for the fitting or adjustment of parts or components will be found at the beginning of the section to which they pertain. It is suggested that the information contained therein, be carefully followed in order to obtain the utmost in performance from the unit.

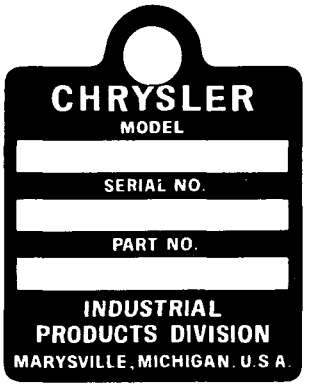
SERVICE DIAGNOSIS

"Trouble Shooting" information is provided in most of the sections as an aid to the serviceman, when diagnosing troubles. It covers many of the troubles that may be encountered, together with their possible causes.

ORDERING PARTS

Most IMPORTANT in ordering parts is the proper identification of the engine. ALWAYS mention the Model, Type and Serial Number. This information is stamped on the identification plate and should be mentioned in all parts orders or communications.

Orders for parts should be placed with the nearest authorized Chrysler Industrial Engine Distributor. Authorized Chrysler Industrial Engine Distributors are in possession of complete parts information and can, in most instances, promptly supply your parts requirements from their inventory. If you do not know your nearest Chrysler Industrial Engine Distributor, a card addressed to the Chrysler Corporation, Industrial Products Division, Box 1, Marysville, Michigan, 48040, will bring you his name and address promptly.



OPERATION

Before placing a new engine in service, make a thorough inspection for evidence of damage or loose parts. Particular attention should be given to the nuts and bolts which hold the attaching parts.

The life of an engine depends to a great extent, upon careful and frequent inspection as an assurance that all units are adequately lubricated and maintained. When the engine is in constant use, make the inspections daily. If the engine has been idle for a period of time, make the inspections before the engine is started.

OPERATING PRECAUTIONS

a. Warm-up Period

After starting a cold engine, operate at a speed slightly faster than idle (approximately 700 rpm) for a few minutes to allow the engine to reach normal operating temperature before placing under full load. This is done to allow the oil to warm up and reach the bearing surfaces. Thus reducing the possibility of scoring and premature wear of internal engine parts.

b. Oil Pressure

With the engine turning at approximately 2,000 rpm and the water temperature at 160 degrees F., the oil pressure should be from 30 to 70 pounds, providing there is no unusual escape of oil from some point in the system. As bearings wear and the increased clearance allows more than the normal amount of oil to escape there will be a drop in pressure shown on the gauge, idling speed press.: 8 psi minimum.

When the oil filter is operating properly, oil pressure on the gauge should be 30 to 70 pounds. If this pressure drops to 25 pounds, the filter element may be plugged and should be changed.

c. Water Temperature

A thermostat is used to retard the circulation of water in the cooling system until the water has reached a predetermined temperature, thereby permitting faster warm-up of the engine. When operating in hot climates, the maximum reading shown on the temperature gauge should not exceed 100 degrees F. above the prevailing atmospheric temperature.

CAUTION: Do not operate the engine with the thermostat removed, as excessive sludge formations will form in the crankcase as a result of the engine running too cool to dissipate the fumes in the crankcase.

d. Ignition System

Keep the units of the ignition system clean and properly adjusted.

e. Fuel System

Keep the fuel tank, lines and filters clean. Use a good grade of fuel at all times.

f. Cooling System

Do not fill the cooling system when the engine is overheated. Allow the engine to cool before adding water or anti-freeze to prevent cracking the cylinder block or heads. Use a good grade of anti-freeze during cold weather.

BREAKING IN A NEW OR REBUILT ENGINE

For peak performance and economical operation, the following adjustments should be made on a new or rebuilt engine after one hour of operation.

1. Adjust ignition timing—if necessary.
2. Lubricate water pump. (If equipped with grease fittings.)
3. Set mechanical governor to required engine speed. Use a tachometer.
4. Inspect for fuel, oil or water leaks.
5. Adjust idle mixture and idle speed on the carburetor.

STORING THE ENGINE

When the engine is to be stored or removed from operation, for an extended period of time, special precautions should be taken to protect the engine against rust accumulation, corrosion of the bearing and mating surfaces within the engine and a gumming condition in the fuel system. To properly store an engine, the following instructions should be followed:

1. Drain lubricating oil from engine. Add 2½ quarts of Rust Preventive Lubricant, (as manufactured by a reliable oil company) to the crankcase.
2. Drain cooling system and add MOPAR Rust Resistor. Fill with clean water.
3. Run engine at idle speed for 3 to 4 minutes. This will allow the MOPAR Rust Resistor to coat the radiator (if so equipped) and engine water jackets with a protective film and the Rust Proofing Oil to be distributed throughout the internal parts of the engine.

NOTE: If unable to run the engine under its own power, turn it over several times with the starter until Rust Proofing Oil has been thoroughly distributed.

4. Remove the top of the air cleaner. Run the engine at approximately 1,000 rpm and slowly pour ½ pint of Rust Preventive Oil through the carburetor air intake. Shut off engine as soon as the ½ pint of Rust Preventive Oil has been drawn into the combustion chamber.
5. Drain the Rust Proofing Oil from the crankcase.
6. Remove the spark plugs and pour 1 ounce of Rust Preventive Oil into each spark plug hole. Turn the engine over 4 or 5 times with the starter. Reinstall the spark plugs.
7. Drain the cooling system at the radiator and cylinder block.
8. Drain the fuel system tank, fuel pump, filter and carburetor. Operate the carburetor throttle lever several times to empty the accelerator pump system.
9. Remove the carburetor air cleaner, the oil filter cap air cleaner and the outlet ventilator pipe air cleaner. Seal the openings with masking or adhesive tape. Seal the exhaust outlet opening in the exhaust manifold or exhaust pipe.
10. Change the element in the oil filter and clean out the filter housings.
11. Replenish the water in the storage battery to ⅜ inch above the plates. Recharge, if necessary, and store in a cool dry place.
12. Protect the engine with a waterproof cover if exposed to the weather.
13. Make periodic inspections to determine condition of engine and seals.

CLUTCH

CONTENTS

GENERAL INFORMATION

Mechanical clutch actuation is used on all Models. Clutch spinning is frequently confused with clutch dragging. A clutch disc which releases perfectly will naturally spin under its own weight and momentum immediately after being released, providing transmission gears are in neutral position.

Gear clash, when shifting from neutral to first speed, or to reverse, is usually caused by clutch spinning. This can be overcome only by releasing the clutch, allowing disc to stop spinning, before shifting the gears.

Specifications data is located at the end of this section. Information listed therein is as of time of publication.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
CHATTERING OR GRABBING	(a) Improper lever adjustment.	(a) Adjust clutch.
	(b) Oil or grease on facings.	(b) Check for oil leaks.
	(c) Loose universal joint flange.	(c) Check universal joint flange and tighten as recommended.
	(d) Worn splines on transmission shaft.	(d) Replace worn transmission drive pinion.
	(e) Binding pressure plate.	(e) Check pressure plate for binding. Replace worn parts as required.
	(f) Binding release levers.	(f) Free up binding release levers, or replace.
	(g) Binding disc hub.	(g) Replace disc assembly and adjust clutch.
	(h) Glazed facings.	(h) Replace disc assembly after checking pressure plate and flywheel for possible scoring. Replace parts that are badly scored or worn.
	(i) Unequal contact of pressure plate.	(i) Check clearances of release levers, disc for thickness and pressure plate for parallel position against flywheel.
	(j) Bent clutch disc.	(j) Replace disc assembly.
	(k) Uneven spring pressures.	(k) Adjust springs for tension.
	(l) Improper alignment of transmission.	(l) Check clutch housing alignment.
	(m) Loose facings.	(m) Replace disc assembly.
	(n) Scored pressure plate.	(n) Replace plate, if pressure plate is warped more than .015 inch.
	(o) Worn pressure plate, flywheel or disc.	(o) Replace when there are signs of excessive wear, heat checking or scoring.
	(p) Clutch disc hub sticking on shaft.	(p) Check shaft for excessive wear or burrs. Check for distortion and replace if required.
	(q) Worn or binding release levers.	(q) If the levers are badly worn, replace levers and replace bearing.
	(r) Broken or weak pressure springs.	(r) Replace broken or weak springs.
	(s) Sticking clutch pedal.	(s) Check for worn or misaligned parts.
	(t) Incorrect disc facings.	(t) Replace with clutch disc assembly.
	(u) Engine loose in frame.	(u) Check engine mountings for loose bolts. Tighten if required.

Condition	Possible Cause	Correction
SLIPPING	(a) Weak or broken pressure springs.	(a) Replace springs.
	(b) Worn facings.	(b) Replace disc assembly.
	(c) Improper clutch adjustment.	(c) Make Clutch Adjustment.
	(d) Oil or grease on facings.	(d) Replace disc assembly. Replace oil seal if required and refer to Engine section in this manual.
	(e) Warped disc assembly.	(e) Replace.
	(f) Warped or scored pressure plate.	(f) A pressure plate that is badly scored, heat checked or warped more than .015 inch, must be replaced. Test springs for tension and install new disc assembly.
	(g) Binding release levers.	(g) Free release levers.
	(h) Binding clutch pedal.	(h) See Suspended Clutch and brake pedals.
DRAGGING	(a) Oil or grease on facings.	(a) Replace disc assembly.
	(b) Incorrect lever adjustment.	(b) Readjust levers after checking for possible damage.
	(c) Incorrect pedal adjustment.	(c) Readjust pedal. See Clutch adjustment.
	(d) Dust or dirt on clutch.	(d) Disassemble clutch and clean thoroughly.
	(e) Worn or broken facings.	(e) Replace disc assembly.
	(f) Bent clutch disc.	(f) Replace bent disc assembly after checking to determine cause of distortion.
	(g) Disc hub binding on pinion shaft.	(g) Check shaft for burrs or gummed splines.
	(h) Binding pilot bushing.	(h) Replace pilot bushing.
	(i) Sticking release bearing sleeve.	(i) Free up sticking sleeve and examine mating surfaces for scoring or rough spots.
	(j) Warped pressure plate.	(j) Replace pressure plate if warped more than .015 inch.
RATTLING	(a) Weak or broken release lever anti-rattle spring.	(a) Replace weak or broken anti-rattle spring.
	(b) Damaged pressure plate.	(b) Replace plate and adjust clutch.
	(c) Broken pull back spring.	(c) Replace broken pull back spring.
	(d) Worn splines on pinion shaft or disc hub.	(d) Replace pinion shaft and/or disc assembly.
	(e) Worn release bearing.	(e) Replace worn release bearing. Examine the tips of release levers for excessive wear. Replace levers if necessary.
	(f) Dry or worn pilot bushing.	(f) Replace pilot bushing and lubricate.
	(g) Unequal contact of release levers.	(g) Readjust release levers.
	(h) Pedal free play improperly adjusted.	(h) Adjust pedal free play.
	(i) Warped disc assembly.	(i) Replace disc assembly. Check pressure plate for excessive wear and replace if required.
SQUEAKING	(a) No lubrication in release sleeves.	(a) Lubricate.
	(b) Worn release sleeve.	(b) Replace sleeve.
	(c) Dry pilot bushing.	(c) Replace pilot bushing.
	(d) Pilot bushing turning in crankshaft.	(d) Replace pilot bushing.
	(e) Worn drive pinion bearing.	(e) Replace worn drive pinion bearing.
	(f) Improper alignment of transmission.	(f) Check clutch housing alignment.
	(g) Insufficient grease between fork and housing pivot.	(g) Lubricate.
	(h) Insufficient grease in torque shaft.	(h) Lubricate.
WHIRRING	(a) Insufficient pedal free play.	(a) Adjust pedal free play.
	(b) Improper alignment of transmission.	(b) Check clutch housing alignment.

Condition	Possible Cause	Correction
GRINDING	(a) Dry release bearing.	(a) Replace dry release bearing.
	(b) Worn or dry pilot bushing.	(b) Replace worn or dry pilot bushings.
	(c) Worn pinion shaft bearing.	(c) Replace worn drive pinion bearing.
HEAVY, STIFF PEDAL	(a) Dry or scored linkage parts.	(a) Lubricate all clutch linkage parts.
	(b) Sticking release bearing sleeve.	(b) Check release bearing sleeve for excessive wear, burrs or roughness on mating surfaces.
	(c) Dry or scored pedal hub.	(c) Replace bushing or bearings in pedal hub and lubricate.
	(d) Pedal interference with floorboard or mat.	(d) Check pedal for interference.
	(e) Rough or dry pivot ball, or fork pivots.	(e) Lubricate all points of movement.
SPINNING	(a) Dry or worn bushings.	(a) Replace bushings.
	(b) Misaligned clutch housing.	(b) Check clutch housing alignment.
	(c) Bent or distorted disc.	(c) Replace disc assembly.
	(d) Warped pressure plate.	(d) Replace pressure plate.
	(e) Excessive pedal free play.	(e) Readjust pedal free play.

SERVICE PROCEDURES

CLUTCH PEDAL

The mechanical linkage of the clutch pedal shaft has a lever on it which is attached to a rod. This rod passes vertically through the floor and is attached to a bellcrank on the frame.

A rod from this bellcrank travels rearward and fastens to the outer lever on the torque shaft. Fastened to the inner lever of the torque shaft is the adjustable push rod to the clutch release fork.

The only adjustment required for the clutch is pedal linkage adjustment to provide prescribed clutch pedal free play. Adjustment is necessary to restore pedal free play reduced by normal clutch wear.

To regulate pedal free play, adjust fork rod by turning self-locking adjusting nut to provide 3/16 inch free movement at end of fork. Movement will provide prescribed 1-1/2 inch free play at pedal.

CLUTCH ASSEMBLY REMOVAL

(1) Refer to Transmission Section in this manual for removal of transmission.

(2) Remove clutch housing pan if so equipped.

(3) Remove clutch fork together with clutch bearing and sleeve assembly if not removed with transmission.

(4) Mark clutch cover and flywheel, with a prick punch, to assure correct reassembly.

(5) Remove retaining cap screws and then remove clutch cover. Be sure to loosen evenly so clutch cover will not be distorted.

(6) Pull pressure plate assembly clear of flywheel and while supporting pressure plate, slide clutch disc from between flywheel and pressure plate.

PRESSURE PLATE

When the same pressure plate and clutch cover are to be reinstalled, mark these parts so that assembly may be made in same relative position.

(1) Install plain thrust washer and compression nut over center screw and compress springs with cover.

(2) Remove clutch release lever eyebolt nuts on strap drive type cover and pressure plate assemblies.

(3) Remove cap screws that hold driving straps to pressure plate, then release pressure to prevent springs from flying out. When tension is relieved, lift off cover.

(4) To remove release levers, grasp lever and eyebolt between thumb and finger so that flat side of lever and upper end of eyebolt are as close together as possible (Fig. 3).

(5) Be sure to keep eyebolt pin seated in lever socket. Strut can then be lifted over ridge on end of lever, making it possible to lift lever and eyebolt off pressure plate.

(6) Place the 14 inch single plate clutch in press to release pressure. Remove lock nuts. On 13 inch clutches, it may be necessary to hold clutch cover to fixture with 8 cap screws.

Spring Testing

(1) Place springs in Tool C-647 and install a torque wrench and check tension. Refer to Specifications to obtain minimum and maximum tension for each spring.

(2) Care should be taken to have table on Tool C-647 adjusted to specified height. Multiply the reading by two. Discard all springs that do not meet specifications (Fig. 4).

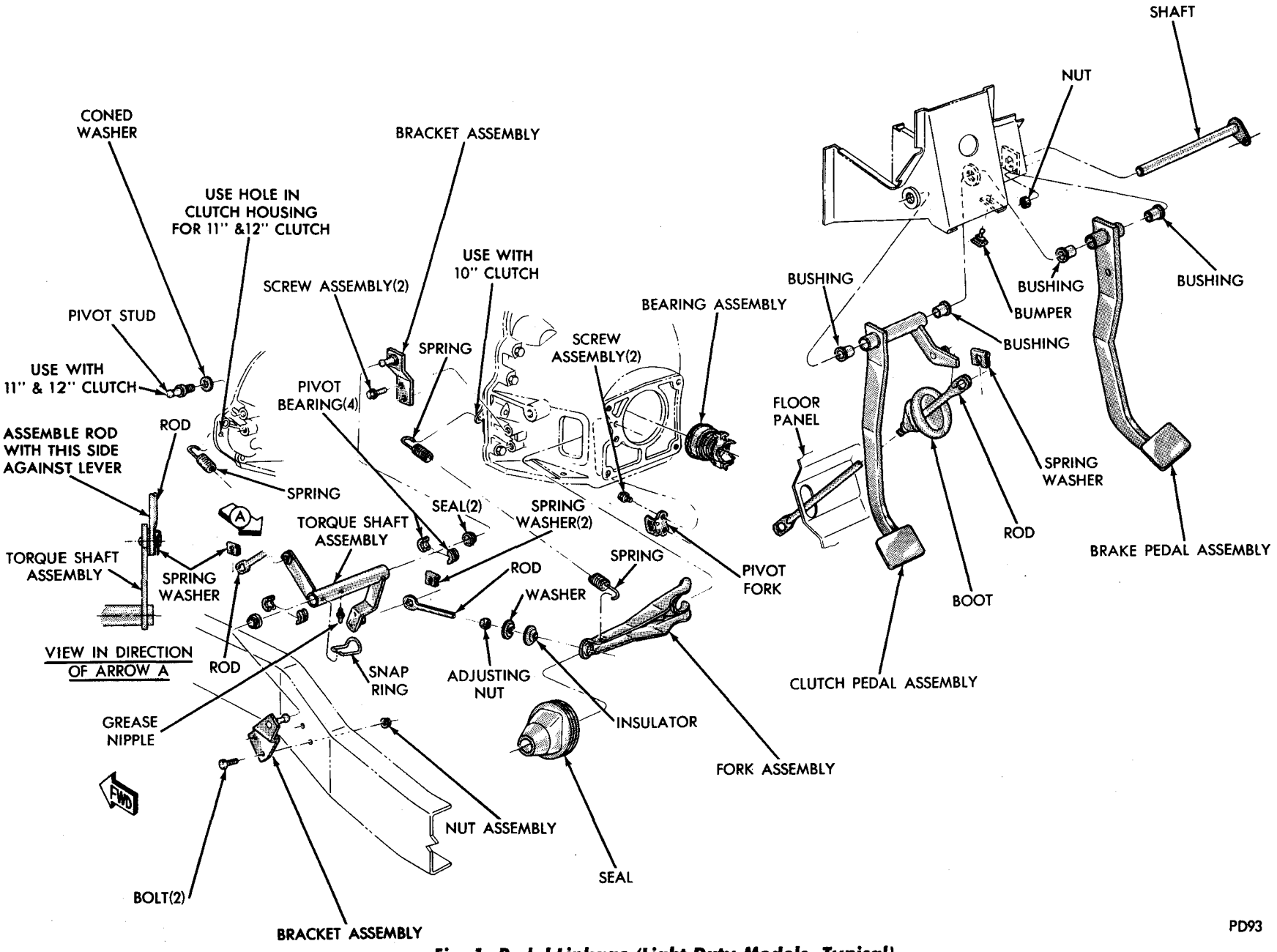


Fig. 1—Pedal Linkage (Light Duty Models—Typical)

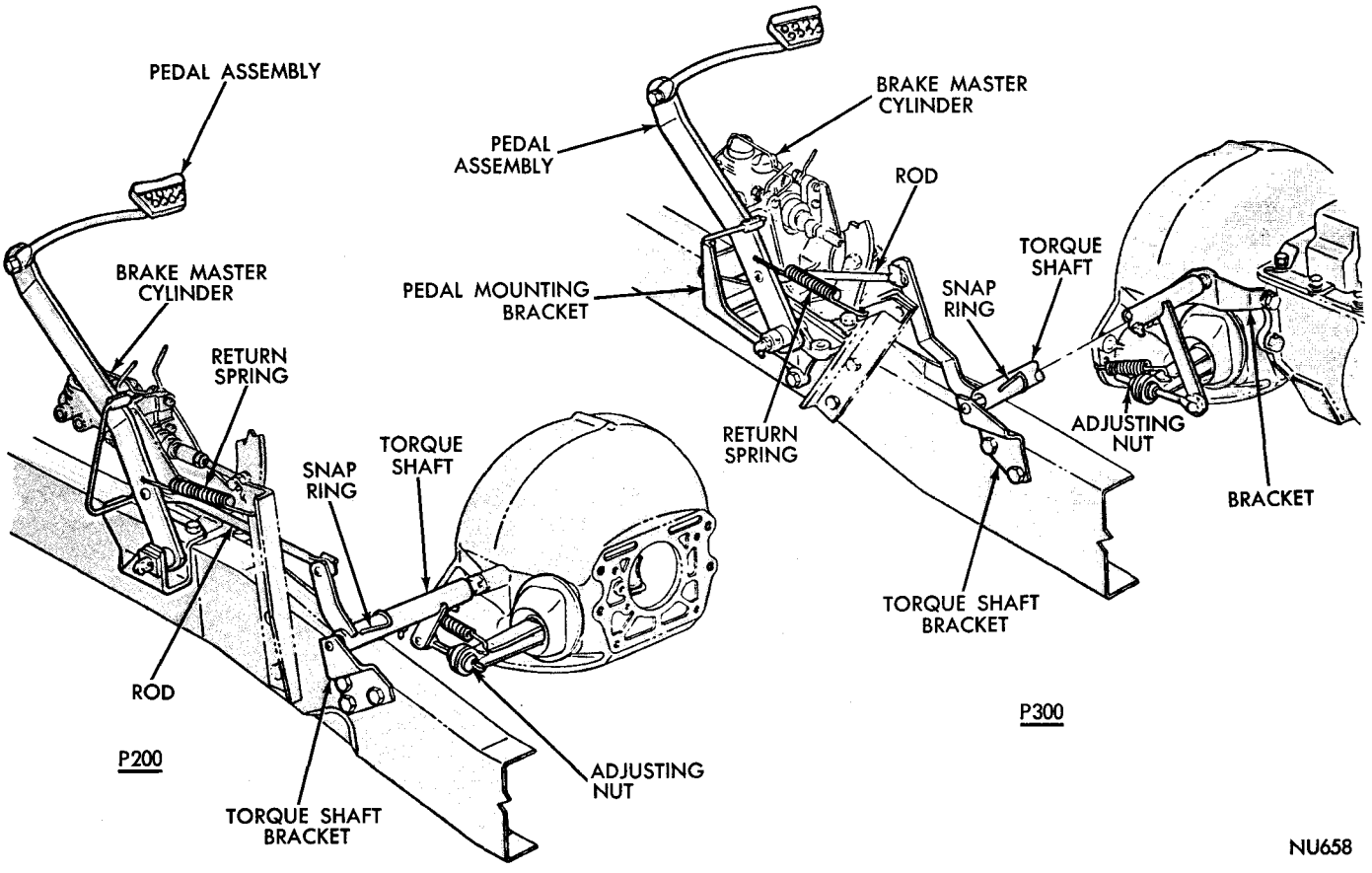


Fig. 2—Pedal Linkage (Typical)

Assembly

(1) Check release levers, struts, eyebolts, and pins for wear. Replace parts that are worn or distorted. Slight roughness or grooving on the pressure plate may be smoothed out with crocus cloth.

(2) Apply a thin film of lubricant to working edges of struts and each side of the ears on pressure plate where they extend through clutch cover before as-

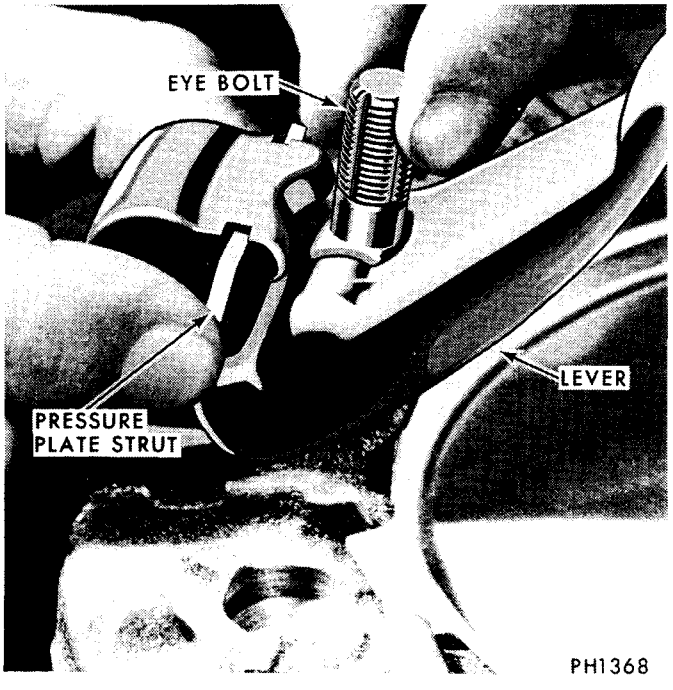


Fig. 3—Pressure Plate

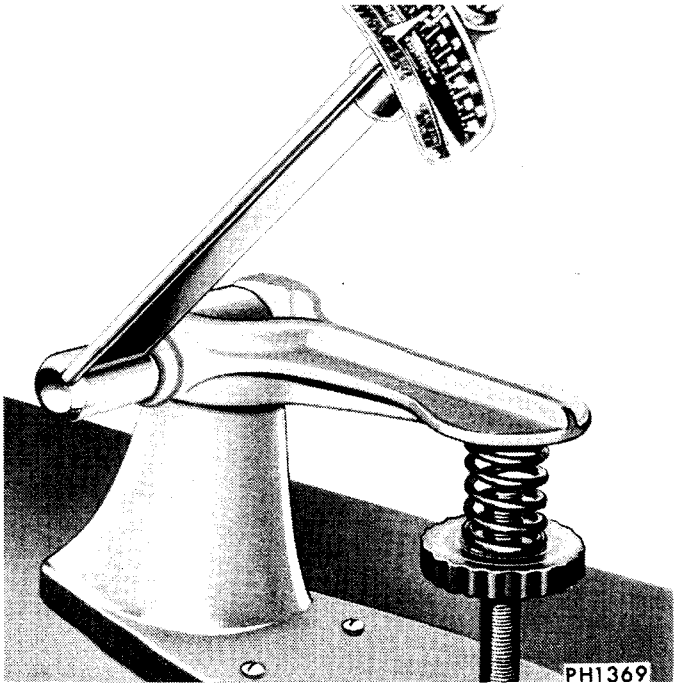


Fig. 4—Pressure Spring Test

sembling struts and release levers.

(3) Place springs on pressure plate and lever return springs in cover. Lay clutch on top of pressure plate (Fig. 5) and assembled parts.

Marks on pressure plate and cover must be matched. Lever return springs must remain in correct position and tops of pressure springs directly under embossed seats in cover.

(4) Compress cover slowly, eyebolt and pressure plate lugs must guide through proper holes in cover.

RELEASE LEVERS ADJUSTMENT (11 AND 13 INCH CLUTCHES)

(1) Mount clutch cover and pressure plate assembly on fixture. On clutches having four release levers, two of release levers should be positioned directly over two feeler gauges in base of fixture (Fig. 6).

(2) Place proper spacer on center screw of fixture. Use spacer 19 and 21 for 11 inch clutch or spacer 20 and 43 for 13 inch clutch.

(3) Install compression plate on center screw making sure that it rests directly against clutch release fingers. Plate can be reversed for proper clearance, depending on the size of clutch.

(4) Install self-aligning washer, plain thrust washer and compression nut. Tighten compression nut until compression plate comes into contact with spacers on center screw.

(5) On 11 inch clutches install clutch cover clamps over bolt holes and tighten securely.

(6) On clutches with four release levers, adjust two levers that have been centered over two of feeler gauges until both have same slight drag or feel while gauge is pushed in and out.

(7) Tighten clutch release lever eyebolt nut to decrease drag and loosen nut to increase drag. After proper drag has been obtained, clutch assembly must be rotated 1/2 turn (or two levers not adjusted, centered over two of the feeler gauges in a like manner as the first two adjusted). Adjust these levers so they have same slight drag as first two release levers. On 13 inch clutches it may be necessary to hold the clutch cover to the fixture with 8 cap screws.

(8) When removing clutch cover assembly from fixture, loosen cover clamps or cap screws first. Then remove compression nut to avoid throwing unequal strain on release lever.

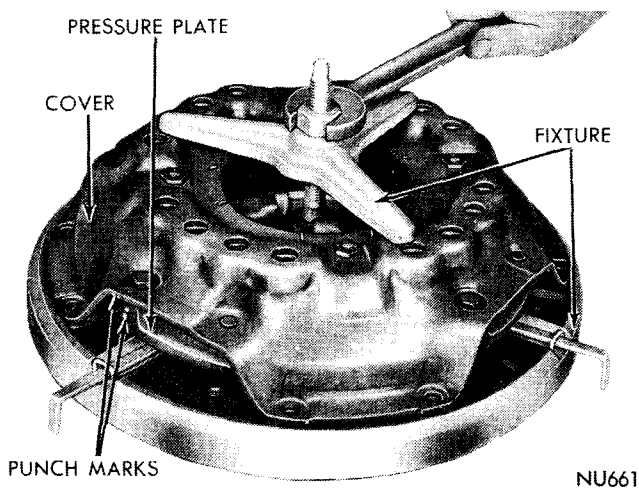


Fig. 5—Cover and Pressure Plate Fixture

MAIN DRIVE GEAR PILOT BUSHING

Normal wear on the clutch shaft pilot bushing or bearing will not require its replacement. However, it is recommended that the bushing be replaced whenever a clutch overhaul is performed.

Removal

(1) Screw tapered bolt into bushing allowing pilot to cut its own threads until a solid grip is obtained.

(2) Insert puller screw and turn, forcing bushing out of crankshaft. Remove bearing by tapping with soft hammer.

Installation

(1) Slide new bushing over the pilot bolt and drive into place with a soft hammer. Bushing will tighten up on pilot. Install cup and puller nut and tighten to remove tool from bushing. This will burnish bushing to exact size and leaves a smooth and lasting finish.

(2) Lubricate bushing with small amount of Multi-Purpose grease. Place grease in radius at back. For further information on lubricate, see "Lubrication Section" in this manual.

(3) Install bearing by tapping with soft hammer. Assure free movement of bearing.

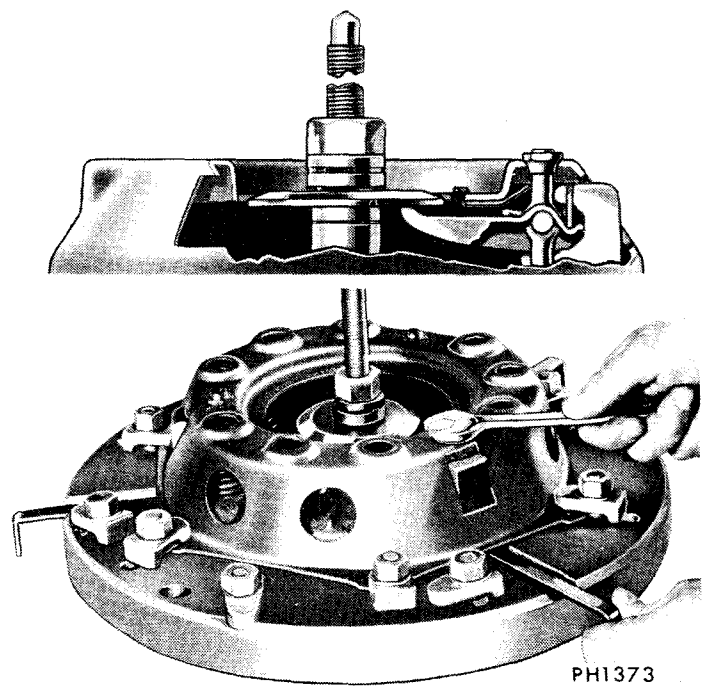


Fig. 6—Release Levers Adjustments

Inspection

(1) On vehicles equipped with a two-piece clutch housing (flywheel housing and bell housing), it will be necessary to use dial indicator set, Tool C-3339.

(2) With flywheel turning Tool C-771, crank engine while noting dial indicator needle deflection. Out-of-round of bore must not exceed .010 inch total indicator reading (Fig. 7).

Correction

When bore runout is in excess of .010 inch total indicator reading, proceed with correction as follows:

- To illustrate, assume that the total indicator reading is .016 inch, in a direction which approximates 2 o'clock in engine block.
- In this case, the housing is off crankshaft centerline .008 inch (one-half total indicator reading) which is .003 inch greater than allowable limit of .005 (one-half total indicator reading).
- In the case under consideration, use of the .007 inch offset dowels (pair) will bring the runout well within the allowable limits of .005 inch (.008 inch minus .007 inch equals .001 inch runout). Dowels must be used in pairs (same part number).

(1) To install dowel pins (pair), remove clutch housing after disconnecting and removing starting motor. Remove dowel pins from engine block.

(2) Select eccentric dowels (pair) which are available with the following amount of offset .007" (No. 1736347), .014" (No. 1736348) .021" (No. 1736353).

(3) The amount of eccentricity of the dowel will bring about a total indicator reading change of double the dowel eccentricity. Therefore, use a pair of dowels with the nearest to 1/2 of the total indicator runout of the bore. For runout (total indicator reading) of .012" through .020", use a .007" dowel (P/N 1736347), .022" through .034", use .014" dowel (P/N 1736348), and .036" through .052", use .021" dowel (P/N 1736353).

(4) Install both dowels with slots parallel and aligned in direction to correct bore runout. Slot indicates direction of maximum dowel eccentricity. Majority of corrections will be for one direction only but it is possible housing bore may be out in two directions. In the latter case, it may be necessary to use next higher step dowels. Both dowels should be inserted into engine block up to offset shoulder. Install and tighten clutch housing bolts to 50 foot-pounds.

(5) Remount dial indicator and recheck bore run out. Small corrections can be made by removing clutch housing and turning dowels with a screw driver to shift the housing to bring bore within limits. On some clutch housings, dowels can be adjusted without removing housing by making adjustment within housing.

Face Runout

(1) Rotate flywheel, using Tool C-771. If total indicator reading is greater than .006 inch, note amount of total indicator reading and location of lowest indicator reading at the point where indicator arm or follower is extended farthest (Fig. 8).

(2) Correct excessive runout by placing proper thickness of shim stock between clutch housing and engine block or between transmission and clutch housing.

(3) Recheck face runout and tighten housing bolts to 50 foot-pounds.

(4) Install transmission as outlined in appropriate Transmission section.

DISC INSTALLATION

(1) Clean faces of flywheel and pressure plate. Remove grease and dirt from surfaces.

(2) Place grease in radius at back of bushing.

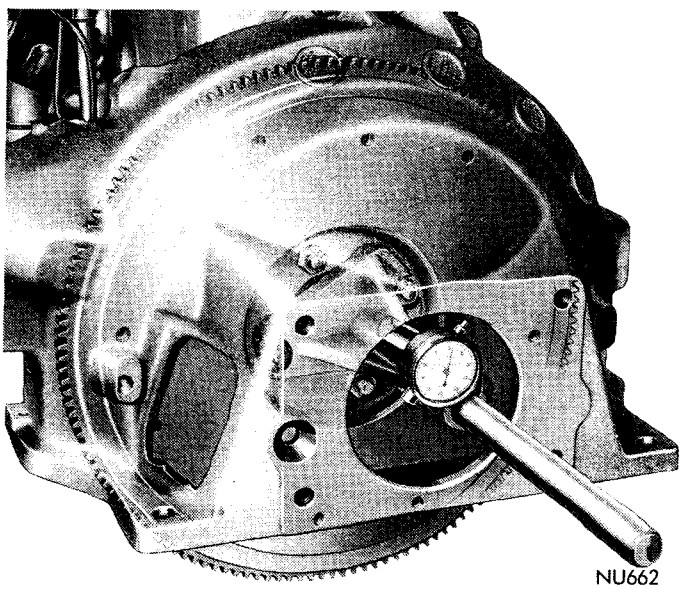


Fig. 7—Bore Runout Inspection

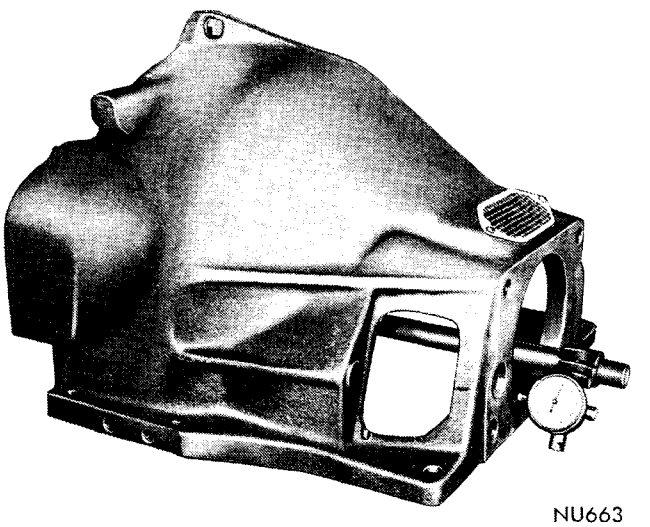


Fig. 8—Face Runout Inspection

(3) Rotate clutch cover and pressure plate assembly to position of maximum clearance between flywheel and frame crossmember.

(4) Tilt top edge of clutch cover and pressure plate assembly back and move it up into clutch housing. Support clutch cover and pressure plate assembly and slide clutch disc into position.

(5) Position clutch disc and plate against flywheel and insert a spare transmission main drive gear shaft through clutch disc hub and into main drive pilot bearing.

(6) Rotate clutch cover until prick punch marks line up on cover and flywheel.

(7) Bolt cover loosely to flywheel. Progressively tighten cover bolts a few turns at a time until snug.

(8) Tighten bolts to specifications.

(9) Install transmission and install linkage. Adjust free play.

RELEASE BEARING REPLACEMENT

Removal

(1) Remove transmission. Refer to Transmission Section in this manual.

(2) Disconnect clutch linkage from clutch fork.

(3) Unhook release bearing return spring.

(4) Remove release bearing.

Installation

(1) Position release bearing on clutch fork shaft.

(2) Connect return spring.

(3) Position and secure transmission.

(4) Place clutch linkage in position and secure.

(5) Adjust clutch pedal free travel.

SPECIFICATIONS

The 11, 12 and 13 inch clutches have released bearing free play measured at .187 inch by travel at outer end of lever and approximately 1 inch to 1-1/2 inch at pedal. The 14 inch clutch has release bearing free play measured at .069 inch by travel at clutch release shaft lever adjusting screw and approximately 1 inch to 1-1/2 inch at pedal. All clutch assemblies are single plate.

11 Inch Clutch

225-1 Engine

Disc (B&B)	14017	Facing Material	Woven Asbestos
Pressure Plate (B&B)	1649	Release Bearing	Permanently Lubricated Ball
Actuation	Mechanical		
Facing—Thickness (Frt)	.140 in.	Pilot Bearing	Oilite Bushing
Inside Diameter	6.5 in.	Hub Spline Diameter (23 Splines Rolled)	1.00 in.
Outside Diameter	11.0 in.	Vibration Damping Springs	6
No. of Pressure Springs	9		
Total Pressure (Lbs.)	1848		

11 Inch Clutch

318-1 Engine

Disc (B&B)	14018	Facing Material	Woven Asbestos
Pressure Plate (B&B)	X-106-10014	Release Bearing	Permanently Lubricated Ball
Actuation	Mechanical		
Facing—Thickness (Frt)	.140 in.	Pilot Bearing	Oilite Bushing
Thickness (Rr)	6.5 in.	Hub Spline Diameter (23 Splines Rolled)	1.00 in.
Inside Diameter	11.0 in.	Vibration Damping Springs	6
No. of Pressure Springs	12		
Total Pressure (Lbs.)	2220		

11 Inch Clutch

360 Engine

Disc (B&B)	X-102-10014	Facing Material	Woven Asbestos
Pressure Plate (B&B)	X-106-1004	Release Bearing	Permanently Lubricated Ball
Actuation	Mechanical		
Facing—Thickness	.140 in.	Pilot Bearing	Oilite Bushing
Inside Diameter	6.5 in.	Hub Spline Diameter (23 Splines Rolled)	1.00 in.
Outside Diameter	11 in.	Vibration Damping Springs	6
No. of Pressure Springs	12		
Total Pressure (Lbs.)	2220		

12 Inch Clutch

400 Engine

Disc (B&B)	102-10789	Facing Material	Woven Asbestos
Pressure Plate (B&B)	106-10376	Release Bearing	Permanently Lubricated Ball
Actuation	Mechanical		
Facing—Thickness	.140 in.	Pilot Bearing	Oilite Bushing
Inside Diameter	6.75 in.	Hub Spline Diameter (23 Splines Rolled)	1.00 in.
Outside Diameter	11.87 in.	Vibration Damping Springs	6
No. of Pressure Springs	12		
Total Pressure (Lbs.)	2750		

13 Inch Clutch

318-3 Engine

Disc (Dana)	101296-1	Total Pressure (Lbs.)	2600
Pressure Plate (Dana)	101227-1	Facing Material	Woven Asbestos
Actuation	Mechanical	Release Bearing	Permanently Lubricated Ball
Facing Thickness	.175 in.		
Inside Diameter	7.00 in.	Pilot Bearing	Oilite Bushing
Outside Diameter	12.875 in.	Hub Spline Diameter (10 Splines)	1.38 in.
No. of Pressure Springs	6		

14 Inch Clutch

361 & 413 Engines

Disc (B&B)	14067	Total Pressure (Lbs.)	2550
Pressure Plate	3-10062-7(Rockford)	Facing Material	Woven Asbestos
Actuation	Hydraulic	Release Bearing	Permanently Lubricated Ball
Facing Thickness	.187 in.		
Inside Diameter	8.375 in.	Pilot Bearing	Oilite Bushing
Outside Diameter	13.875 in.	Hub Spline Diameter (10 Splines—Square)	1.50 in.
No. of Pressure Springs	15		

PRESSURE PLATE SPRING TIGHTENING REFERENCE

(As Required to Compress to Specified Spring Height)

Spring Color	1-7/16 inch	1-1/2 inch	1-11/16 inch	1-13/16 inch
Lavender	145-155			
White	239-251			
Pink			209-225	
Dark Blue			183-197	
Black		223-237		165-175
Yellow and No Color		189-201		
Green			109-115	
Purple			131-141	
Orange	170-180			

COOLING SYSTEM

CONTENTS

GENERAL INFORMATION

The cooling system used on the Dodge Truck consists of tube and spacer type radiators, centrifugal pump, fan, and choke type thermostat.

In order to provide satisfactory protection for the wide variety of corporation models the cooling system of each must be tailored to specific needs.

The standard system consists of a radiator, 16 psi radiator pressure cap, centrifugal water pump, 185 degrees F. thermostat for V8, 195 degrees F. for all 6 Cyl. and D.W100-V8 and a four, five, or seven blade fan. See Specifications for application.

The cooling system for air conditioned equipped vehicles generally requires a greater capacity radiator along with a fan shroud, air seals, special centrifugal water pump and drive ratio, larger fan, and thermostatically controlled fan drive (in some installations). See specifications for applications.

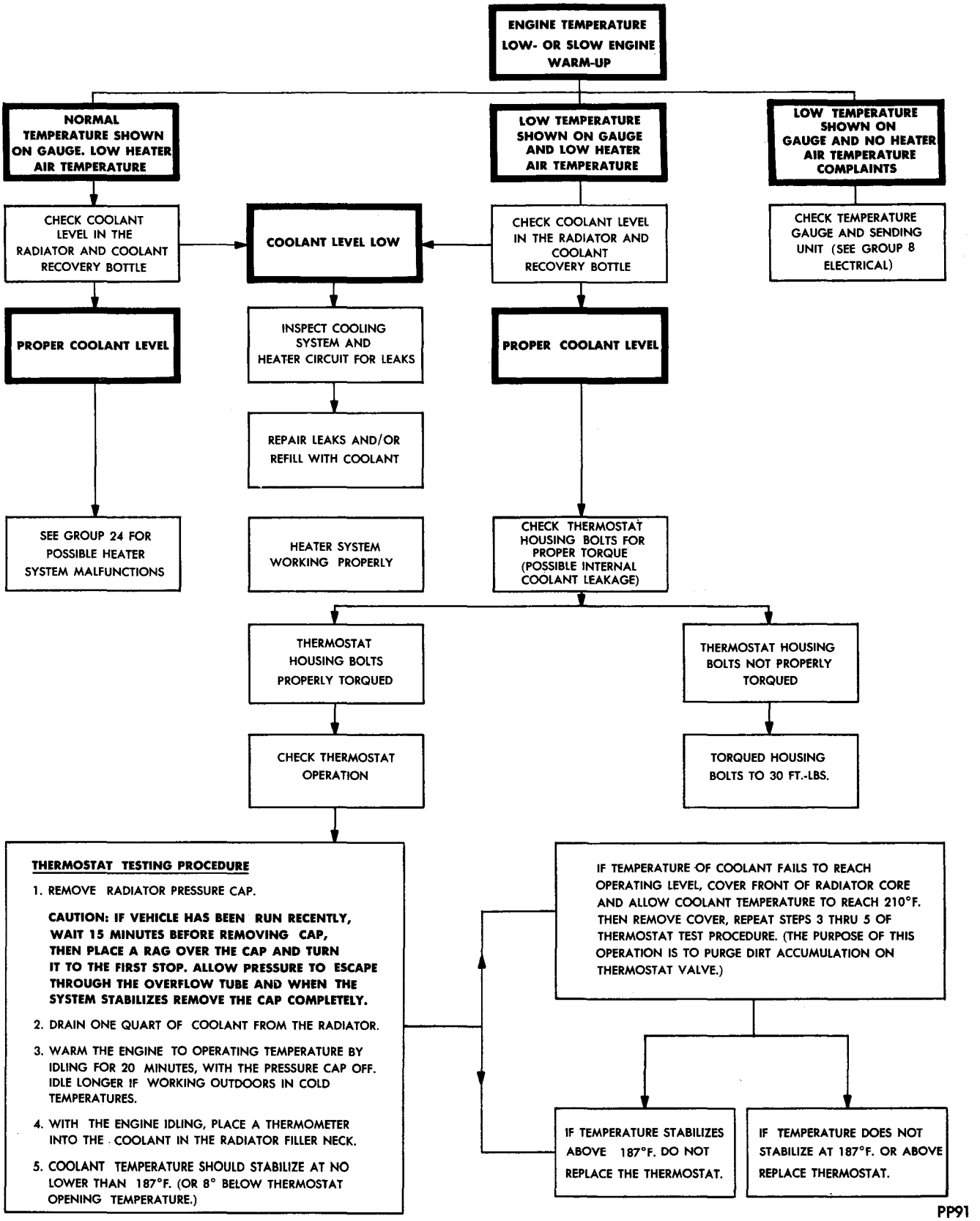
For internal cooling system protection each cooling system is factory equipped with sufficient permanent type anti-freeze for —20 degrees F. protection. It is recommended that the coolant be changed at 24 months or 30,000 miles and every 12 months or 15,000 miles thereafter, to insure adequate anti-freeze and corrosion protection. Air conditioned D, W and S models require year round protection with permanent type anti-freeze with a minimum of 15 degrees F. protection for summer operation to prevent freeze-up in the heater core and additional anti-freeze in the winter according to the prevailing temperatures. Protection to —20 degrees F. is recommended year around. Avoid mixing brands.

The use of a 160/F. thermostat or alcohol type anti-freeze is not recommended.

The specified thermostat should always be used to control both engine operating conditions and control exhaust emissions to approved levels.

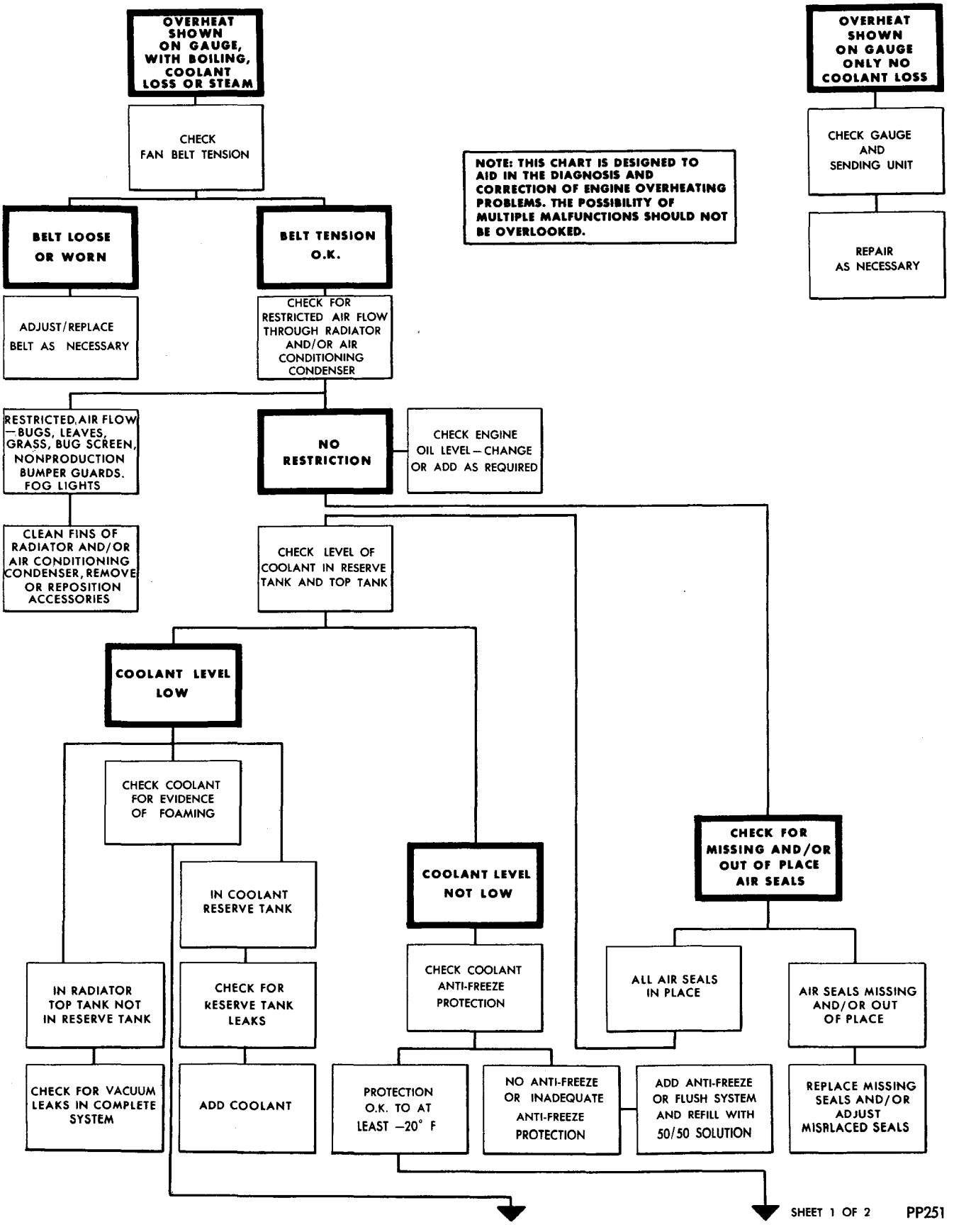
A Coolant Control Exhaust Gas Recirculation Valve (CCEGR Valve) is used on some models which is mounted in the radiator top tank. See Emission Control Systems Group 25 for service procedures.

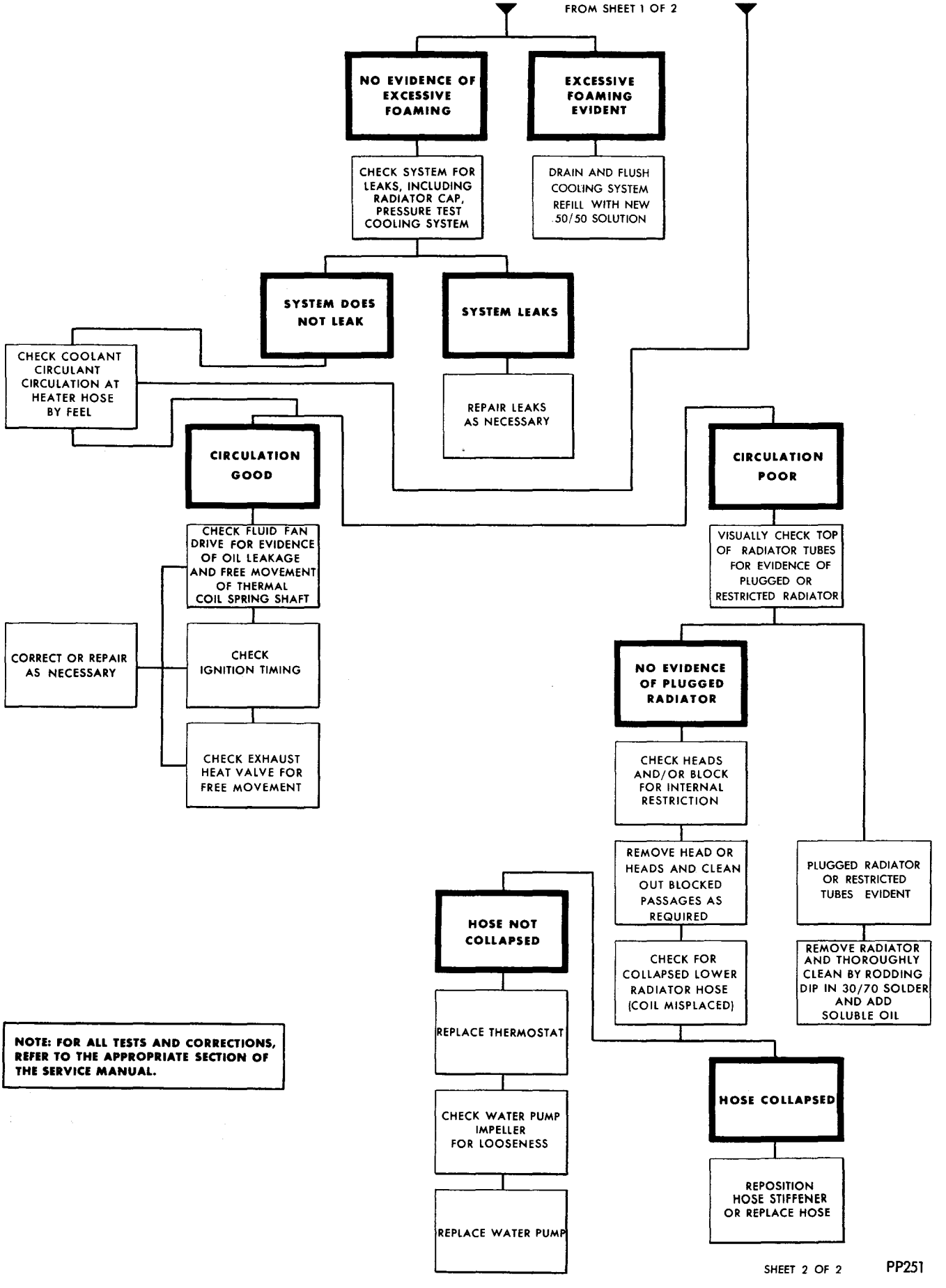
LOW ENGINE TEMPERATURE DIAGNOSIS



PP91

ENGINE OVERHEATING DIAGNOSIS




FROM SHEET 1 OF 2
NO EVIDENCE OF EXCESSIVE FOAMING
EXCESSIVE FOAMING EVIDENT
CHECK SYSTEM FOR LEAKS, INCLUDING RADIATOR CAP, PRESSURE TEST COOLING SYSTEM
DRAIN AND FLUSH COOLING SYSTEM REFILL WITH NEW 50/50 SOLUTION
SYSTEM DOES NOT LEAK
SYSTEM LEAKS
CHECK COOLANT CIRCULANT CIRCULATION AT HEATER HOSE BY FEEL
REPAIR LEAKS AS NECESSARY
CIRCULATION GOOD
CIRCULATION POOR
CHECK FLUID FAN DRIVE FOR EVIDENCE OF OIL LEAKAGE AND FREE MOVEMENT OF THERMAL COIL SPRING SHAFT
VISUALLY CHECK TOP OF RADIATOR TUBES FOR EVIDENCE OF PLUGGED OR RESTRICTED RADIATOR
CORRECT OR REPAIR AS NECESSARY
CHECK IGNITION TIMING
CHECK EXHAUST HEAT VALVE FOR FREE MOVEMENT
NO EVIDENCE OF PLUGGED RADIATOR
CHECK HEADS AND/OR BLOCK FOR INTERNAL RESTRICTION
REMOVE HEAD OR HEADS AND CLEAN OUT BLOCKED PASSAGES AS REQUIRED
PLUGGED RADIATOR OR RESTRICTED TUBES EVIDENT
CHECK FOR COLLAPSED LOWER RADIATOR HOSE (COIL MISPLACED)
REMOVE RADIATOR AND THOROUGHLY CLEAN BY RODDING DIP IN 30/70 SOLDER AND ADD SOLUBLE OIL
HOSE NOT COLLAPSED
HOSE COLLAPSED
REPLACE THERMOSTAT
CHECK WATER PUMP IMPELLER FOR LOOSENESS
REPLACE WATER PUMP
REPOSITION HOSE STIFFENER OR REPLACE HOSE
NOTE: FOR ALL TESTS AND CORRECTIONS, REFER TO THE APPROPRIATE SECTION OF THE SERVICE MANUAL.
SHEET 2 OF 2
PP251

SERVICE PROCEDURES

FAN

There are no repairs to be made to fan. If fan is bent or damaged it should be replaced. **Never bend or straighten fan.**

Removal

(1) Remove shroud attaching screws, separate shroud from radiator, position shroud rearward on engine. Fan attaching screws can now be removed.

(2) On models equipped with fluid fan drive, remove fan drive attaching screws. The fan and fluid fan drive removed as a unit.

Installation

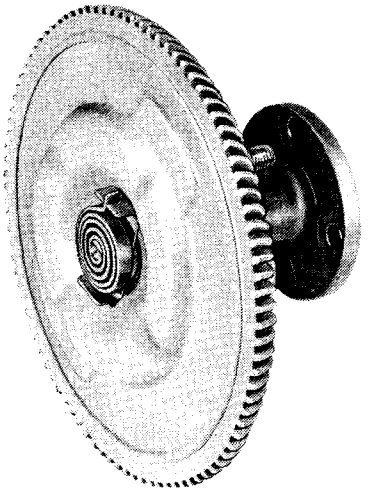
Use correct fan spacer, if required, so clearance between fan blades and radiator is 3/4 to 1-1/4 inches. No fan spacer permitted with fluid fan drive regardless of fan blades to radiator clearance. Install one piece shroud on vehicles so equipped. Tighten fan belts.

FLUID FAN DRIVE

CAUTION: To prevent silicone fluid from draining into fan drive bearing and ruining the grease, do not place drive unit with shaft pointing downward.

Thermal Control Drive (Fig. 1)

Air conditioned vehicles only, the thermal Control Drive is a silicone fluid filled coupling connecting the fan to the fan pulley. The unit allows the fan to be driven in a normal manner at lower engine speeds while limiting the top speed of the fan to a pre-determined level at higher engine speeds. On the drive face a thermostat spring senses temperature from the radiator and engages the drive for higher fan speed if temperature from the radiator rises above a certain point.



NP541

Fig. 1—Thermal Control Fan Drive

Procedure for Performance Testing—Viscous Fan Clutch

The viscous fan clutch with a multi-bladed fan is a temperature sensitive and torque limiting device. The bi-metal coil on the face of the viscous fan clutch senses the temperature of the air passing through the radiator core. Until engine cooling is called for, the fan will idle along at a reduced speed despite elevated engine speed. Only when sufficient heat is present in the radiator core to cause a reaction of the bi-metal sensing coil, will the viscous fan clutch engage and come up in speed to perform the necessary engine cooling. All viscous fan clutches are calibrated to operate to pre-set maximum speed limitations as determined by the torque generated by the fan used with it. Once that maximum fan speed has been reached the fan will not turn faster despite increased engine speed. When the necessary engine cooling has been accomplished and the level of heat passing through the radiator core has been reduced, the bi-metal coil again reacts and the fan speed reduces to the previous disengaged condition. Some fluid fan drives are also built with an idle lock-up feature which will require more effort to turn fan by hand.

Prior to going through a checking procedure on the viscous fan clutch, for an overheating complaint, the other cooling system items should be checked as directed by Service Diagnosis.

To check the function of the viscous fan clutch on a vehicle with an overheating complaint, it is necessary to follow these steps:

(1) Prepare car for test as follows:

(a) Drill a 1/8″ diameter hole in top center of shrould between leading edge of fan and radiator core face. Insert a dial thermometer (Miller Tool Number C-4347, 0-220°F 8″ stem or equivalent) through shroud. Take **Caution** that fan clearance is adequate.

(b) Install Engine Tachometer and engine ignition timing light, used as strobe light.

(c) Block Air Conditioning condenser with 36″ x 24″ plasticene sheet-insert between vertical hood lock support. On non air condition models block radiator airflow. Tape sheet at top to yoke and take care to insure good seal.

(2) Air Conditioning is to be **turned off** to prevent high compressor head pressures. Ambient temperature should be 70°F or more. With Air Conditioning on, high head pressure may blow Air Conditioning head gasket.

(3) Start engine and run test at 2400 RPM engine speed, with engine ignition timing light aimed at fan blade as strobe light.

(4) Within ten (10) minutes the air temperature measured on Dial Thermometer should reach maximum of 190°F. Satisfactory operation of drive requires that the fan drive engage before or at 190°F. Engagement is distinguishable by an **increase** in fan roar. Timing light will also show increase in speed of fan.

(5) When dial thermometer temperature reaches 190°F, remove plasticene sheet from blocking Air Conditioning condenser or radiator. Satisfactory operation of drive requires temperature to drop 20°F or more. Satisfactory operation of drive also requires that drive be heard to disengage. Timing light will show disengagement and a slowing down of the fan drive.

(6) Do not allow thermometer temperature above 200°F.

Since there is no method available to service the viscous fan drive, any unit determined to be defective must be replaced.

WATER PUMP

NOTE: The water pump is serviced only as an assembly on 225, 318, 360, 400 and 440 cubic inch engines. When replacing the water pump do not install a standard water pump on any air conditioned vehicle or vice versa. When replacing a water pump because of a bearing or shaft failure replace the engine fan at the same time. See specification for proper pump.

It is possible to replace the water pump without discharging or charging the air conditioning system.

SIX CYLINDER ENGINE

Removal

(1) Drain the cooling system. (Remove fan shroud if so equipped and set back on engine).

(2) Loosen alternator, power steering pump, air pump and remove belts if so equipped.

(3) Remove fan blade, spacer, pulley and bolts as an assembly. (Remove shroud if so equipped).

(4) Position lower hose clamp in the center of the by-pass hose. Disconnect heater hose and lower hose from water pump.

(5) Remove water pump retaining bolts and remove water pump. Discard gasket.

V8 ENGINE

Removal

(1) Drain the cooling system (partial). (Remove fan shroud if so equipped and set back on engine).

(2) Loosen alternator adjusting strap bolts and pivot bolt (power steering and air pump if so equipped). Remove drive belts.

(3) **On 318-360 Cubic Inch Engine Without Air Conditioning,** remove alternator bracket attaching bolts from water pump; swing alternator out-of-way, tighten pivot bolt.

(4) **On 318-360 Cubic Inch Engine With Air Conditioning,** remove idler pulley assembly, alternator and adjusting bracket.

(5) Remove fan blade, spacer (or fluid drive) pulley and bolts as an assembly.

CAUTION: To prevent silicone fluid from draining into fan drive bearing and ruining the grease, do not place drive unit with shaft pointing downward.

(6) **On 318-360 Cubic Inch Engine,** disconnect heater and by-pass hoses.

(7) **On 318-360 Cubic Inch Engine,** remove compressor clutch assembly.

(8) **On 318-360 Cubic Inch Engine,** remove compressor to front mounting bracket bolts.

(9) **On 318-360 Cubic Inch Engine,** remove water pump to compressor front mount bracket bolts and bracket.

(10) Remove water pump retaining bolts and remove water pump assembly. Discard gasket.

SIX and V8 ENGINE

Installation

(1) Install a new by-pass hose if necessary, with clamp positioned in the center of the hose.

(2) Install water pump using a new gasket. Tighten pump retainer bolts to 30 foot-pounds. Rotate pump by hand to be sure it rotates freely.

(3) **On 225-318-360 Cubic Inch Engine,** install heater hose and position by-pass hose clamps.

(4) **On 318-360 Cubic Inch Engine With Air Conditioning,** install compressor front bracket. Tighten compressor bolts to 50 foot-pounds and water pump bolts 30-foot-pounds.

(5) Install alternator, adjusting bracket and idler pulley assembly. Tighten bolts to 30 foot-pounds.

(6) Install compressor clutch assembly.

(7) **On 318-360 Cubic Inch Engine Without Air Conditioning,** install alternator front bracket, tighten to 30 foot-pounds.

(8) Install fan blade, spacer (or fluid drive) pulley and bolts as an assembly.

(9) Install belts and tighten as outlined in "Belt Tension Specifications".

(10) Install shroud if so equipped.

(11) Fill the cooling system to 1-1/4 inch below filler neck seat, with sufficient permanent anti-freeze for —20 degrees F. protection to insure adequate corrosion protection. After warm-up, recheck coolant level. Maintain at 1-1/4 inch below filler neck, full on coolant reserve systems. Heater valve full on.

Disassembly (361-413 Cubic Inch Engines Fig. 2)

(1) Remove fan pulley hub.

(2) Remove bearing retainer.
(3) Remove cast iron impeller and ceramic seal seat assembly.
(4) Press water pump shaft and bearings out of pump body from impeller end.
(5) Remove cartridge seal from impeller end of body.

Assembly (361-413 Cubic Inch Engines)

(1) Install inner bearing on pump shaft with shielded side of bearing against shoulder of shaft.
(2) Press shaft and inner bearing assembly into pump body using Tool C-3468.
(3) Install bearing spacer on shaft.
(4) Pack the area with the recommended grease.
(5) Support pump shaft on impeller end, then press outer bearing on shaft against the spacer, with shielded side of bearing outward (hub end) using a sleeve tool.
(6) Install bearing retainer.
(7) Press on fan pulley hub until it contacts outer bearing.
(8) Apply a thin coat of Perfect Seal Sealer Compound, Part Number 1057784 or equivalent to seal pocket in pump body.
(9) With the pump housing supported use a 1-1/4 inch (12 point) socket to apply pressure against outer lip of seal retainer and press cartridge seal assembly into body until retainer lip is against the pump body.
(10) Install ceramic seal seat assembly on shaft. Push assembly down shaft until ceramic engages wear washer of cartridge seal. **Avoid contacting the ceramic seal seat with other pump parts or with tools used for pump assembly.**
(11) Support pump on fan hub end of shaft and position new impeller on pump shaft (blade portion up). Using a tool that will press against impeller hub only, press impeller onto shaft until it is flush with end of shaft.

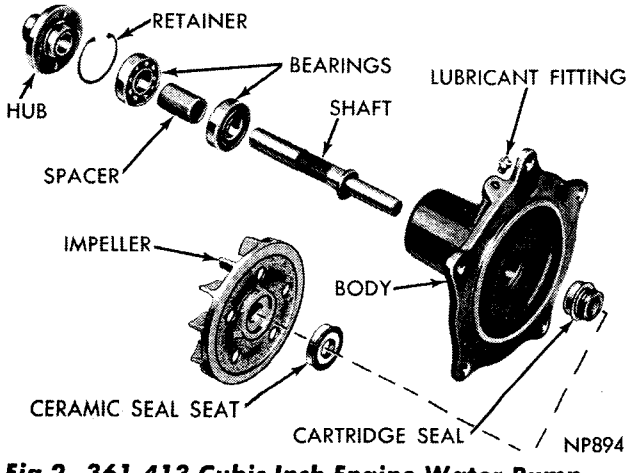


Fig 2—361-413 Cubic Inch Engine Water Pump

RADIATOR

Removal

(1) Drain cooling system.
(2) On vehicles with automatic transmission, disconnect oil cooler lines at radiator bottom tank.
(3) Remove upper and lower radiator hoses (using pliers C-3250).
(4) Remove shroud attaching screws, separate shroud from radiator, position shroud rearward on engine for maximum clearance.
(5) Remove radiator attaching screws. On some models with Air Conditioning it will be necessary to remove the condenser attaching bolts.
(6) Radiator can now be lifted free from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal. Fan damage should always be avoided.**

Installation

(1) Slide radiator down into position behind radiator support and install attaching screws.
(2) Install fan shroud (if so equipped), connect hoses, and connect transmission oil cooler lines, if so equipped.
(3) When refilling cooling system of 361 and 413 engines, open draincock on top right side of water pump housing with hydraulic brakes, when air compressor is used, draincock will be on air compressor. Draincock must be left open until coolant displaces air in the system and flows freely. Close draincock and fill radiator to proper level. Fill cooling system to 1-1/4 in. below filler neck seat with water and antifreeze, as required. After warm-up, re-check coolant level. Maintain at 1-1/4 in. below filler neck, full on coolant reserve systems. Heater valve full on.
(4) On vehicles with automatic transmission measure transmission oil level after warm up and add oil as required.

Cleaning

(1) Drain cooling system and refill with clean **soft** water and a reliable cooling system cleaner.
(2) Operate engine according to directions on Cleaner label.
(3) After cleaning operation, flush entire cooling system until water runs clean.
(4) Regardless of climate, the cooling system should be refilled with sufficient permanent type antifreeze for —20 degrees F. protection. To insure adequate corrosion protection.
(5) If vehicle is equipped with **air conditioning** the cooling system must contain anti-freeze all year round. This is necessary because in the reheat-cycle system used, cold refrigerated air passes through the heater core. Anti-freeze is necessary to prevent the heater core from freezing in hot weather when the air conditioner is being used.

Coolant Control Exhaust Gas Recirculation Valve (CCEGR Valve)

Some vehicles have Exhaust Gas Recirculation (EGR) and are equipped with a CCEGR valve mounted in the radiator top tank. During warm up when the top tank coolant temperature exceeds 75°F the valve is open so that vacuum is applied to the EGR valve allowing exhaust gas to recirculate. The 360-2bbl. CCEGR valve is located in the intake manifold and functions in the same manner except at block temperatures in excess of 130°F. Refer to Group 25 of this manual for complete description, diagnosis and service procedures.

TRANSMISSION OIL COOLER (225, 318, 360, 400 and 440 ENGINES)

The transmission oil cooler is located in the bottom radiator tank (water cooled), which is an integral part of the radiator for Loadflite Transmission (A-727).

Some models are equipped with an auxiliary oil cooler (air cooled) mounted ahead of the radiator and is connected in series with the standard transmission oil cooler (Fig. 3).

In case of a leak, engine coolant may become mixed with transmission fluid, also, transmission fluid may enter cooling system. Both cooling system and transmission should be inspected in event cooler is leaking.

Testing Oil Cooler for Leaks

(1) Disconnect both oil cooler lines at radiator.

(2) Connect a pressure gauge to one cooler connection and a shut off valve to the other. Close the valve.

(3) Connect a source of air pressure to the valve.

(4) Coat all fittings with oil.

(5) Open the test valve and apply (up to 100 psi) air pressure. Oil bubbles will identify any fitting joint leaks. Repair all joint leaks.

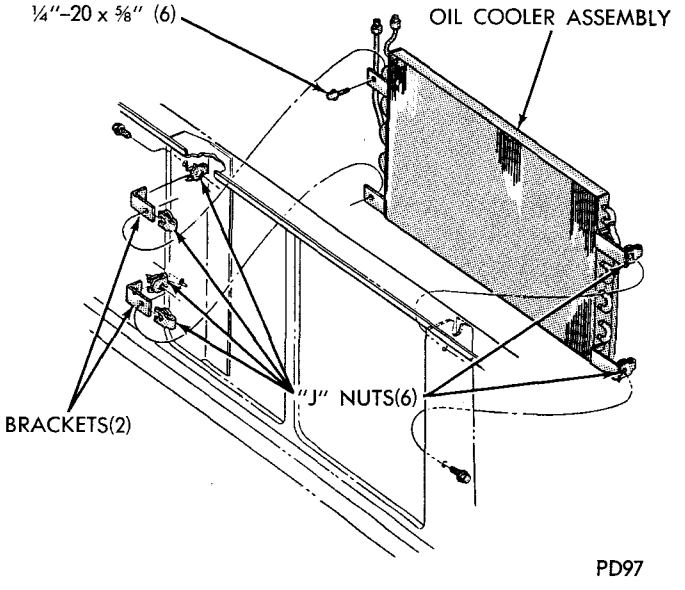


Fig. 3—Transmission Auxiliary Oil Cooler

(6) Close the valve. Gauge reading will then drop if cooler is leaking.

Repairing Oil Cooler

The transmission auxiliary oil cooler being all aluminum can be repaired by a local reliable radiator service having the equipment for alumibrazing or heliarc.

(1) Remove radiator from vehicle.

(2) Remove radiator bottom tank.

(3) Melt the soft solder holding the cooler to the tank.

(4) Remove the stamped retainer nuts holding the cooler fittings to the bottom tank and remove the cooler.

(5) Install a new cooler or repair the old cooler with **silver solder** and reinstall as follows:

(6) Position oil cooler in bottom tank and install the stamped retainer nuts on oil cooler fittings.

(7) Use soft solder to secure the cooler in the tank.

(8) Attach bottom tank to radiator using soft solder.

(9) Install radiator as described in Paragraph "Radiator".

(10) Fill cooling system and test for leaks.

(11) When refilling cooling system of 361 and 413 engines, open draincock on top right side of water pump housing with hydraulic brakes, when air compressor is used, draincock will be on air compressor. Draincock must be left open until coolant displaces air in the system and flows freely. Close draincock and fill radiator to proper level.

If the transmission operates properly after repairing the leak, drain the transmission and torque converter while hot, remove the transmission oil pan and inspect for sludge, rust, dirty or plugged inlet filter. If none of these conditions are found, reconditioning may not be necessary. Reassemble, using transmission fluid of the type labeled DEXRON.

REVERSE FLUSHING THE COOLING SYSTEM

Reverse flushing of the cooling system is the forcing of water through the cooling system, using air pressure in a direction opposite to that of the normal flow of water.

Flushing Cylinder Block

(1) Drain radiator and remove hoses at radiator.

(2) Remove thermostat and reinstall thermostat housing.

(3) Install Tool C-3514, or other suitable flushing gun to inlet hose.

(4) Connect water hose of gun to a pressure water source and air hose of gun to a pressure air source.

(5) Turn on water, and when cylinder block is filled, turn on air (up to 20 psi) in short blasts.

(6) Allow cylinder block to fill between blasts of air.

(7) Continue this procedure until water runs clean. Test thermostat and if satisfactory, reinstall: otherwise, replace using a new housing gasket.

(8) When refilling cooling system of 361 and 413 engines, open draincock on top right side of water pump housing with hydraulic brakes, when air compressor is used, draincock will be on air compressor. Draincock must be left open until coolant displaces air in the system and flows freely. Close draincock and fill radiator to proper level. Fill cooling system to 1-1/4 inches below filler neck, full on coolant reserve systems, using **soft** water and anti-freeze, depending on season or if equipped with air conditioning.

(9) Engine should be operated until temperature gauge indicates normal operating temperature, then, continue an additional five minutes to release any air trapped in system. Heater valve full on.

(10) Check for leaks and coolant level; correct as necessary. Maintain coolant level to 1-1/4 in. below bottom of filler neck, full on coolant reserve systems.

Reverse Flushing Radiator

(1) Drain cooling system and remove hoses from engine.

(2) Install Tool C-3514, or other suitable flushing gun in radiator lower outlet.

(3) Fill radiator and turn on air in short blasts.

CAUTION: Internal radiator pressure must not exceed 20 psi, on D, W, and S models as damage to radiator may result.

(4) Continue this procedure until water runs clean. **It is a good policy to reverse flush heater core any time the radiator is reverse flushed.**

(5) When refilling cooling system of 361 or 413 engines, open draincock on top right side of water pump housing with hydraulic brakes, when air compressor is used, draincock will be on air compressor. Draincock must be left open until coolant displaces air in the system and flows freely. Close draincock and fill radiator to proper level. Fill cooling system to 1-1/4 inches below filler neck, full on coolant reserve systems, using **soft** water and anti-freeze, depending on season or if equipped with air conditioning.

(6) Engine should be operated until temperature gauge indicates normal operating temperature, then, continue an additional five minutes to release any air trapped in system. Heater valve full on.

(7) Check for leaks and coolant level; correct as necessary.

THERMOSTAT

The thermostat is actuated by a pellet containing a copper-impregnated wax, as shown in (Fig. 4). As the temperature of the pellet increases, the wax expands and opens the valve. A 185 degree thermostat is standard equipment on all engines except on D100 and W100 and all six cylinder engines 195 degree F. thermostat is required. **The use of alcohol type anti-freeze is not recommended.**

If the thermostat does not close completely when cold, the engine will warm up slowly or not at all, and heater performance will also be impaired. Poor heater performance may also be due to valve opening at too low a temperature. Too high a valve opening temperature or a valve that will not open can cause overheating.

Removal

(1) Drain cooling system down to thermostat level or below.

(2) Remove upper radiator hose from thermostat housing.

(3) Remove thermostat housing bolts and remove thermostat and housing.

Testing Thermostat

(1) Visually inspect thermostat to make sure valve closes tightly. If valve does not close completely due to dirt, sand or other foreign material, carefully clean the sealing edge making sure the sealing edge is not damaged. If valve does not close tightly when clean, install a new thermostat.

(2) Immerse thermostat in a container of 50% ethylene glycol and 50% water so that pellet of thermostat is completely covered in solution. The pellet must not touch bottom or sides of container.

(3) Heat the solution and stir it continuously (to insure uniform temperature) and check solution temperature with a thermometer at the point when a .001 in. feeler gauge can be inserted into valve opening. The feeler gauge should pass freely into the valve opening at a solution temperature of 182 degrees to 189 degrees F. for the 185 degrees thermostat, and 192 to 199 degrees for the 195 degree thermostat. If outside of this range, replace thermostat.

(4) Continue heating solution to approximately 205 degrees F. for the 185 degree thermostat and 219 degrees for the 195 degree thermostat. The thermostat valve should be fully open at this temperature. If it is not, replace thermostat.

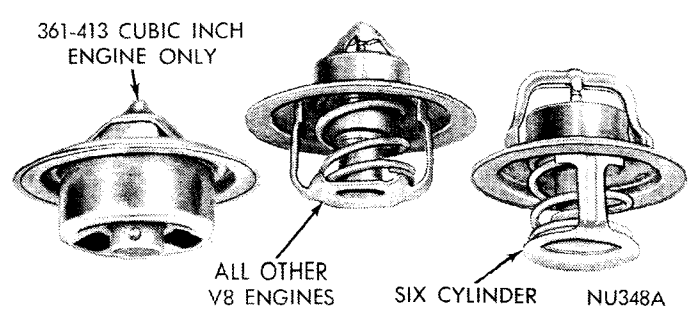


Fig. 4—Thermostat

Installation

Only a Fulton thermostat as shown on left side of figure 4 should be used on 361 and 413 cubic inch engines.

(1) Using a new gasket, position thermostat so pellet end is toward engine (six cylinder with vent hole up), attach with bolts through thermostat housing. Tighten to specifications.

(2) If removed, reinstall or replace the upper hose.

(3) Fill cooling system to 1-1/4 inches below filler neck with water and anti-freeze, full on coolant reserve system. Heater valve full on.

RADIATOR HOSES

The hoses are removed and installed using hose clamp pliers C-3250.

A hardened, cracked, swollen or restricted hose should be replaced.

The reinforcement spring inside the lower hose is necessary to prevent collapsing of the hose due to suction at medium or high engine speeds. If this spring is misplaced in hose, it should be repositioned. If this spring is deformed hose must be replaced.

RADIATOR CAPS

All vehicles are equipped with a 16 pound pressure (psi) cap and is identified with a 16 stamped on top of cap (Fig. 5 & 6).

Pressure Vent Cap

Under normal operating conditions, pressure is not built up in the system. However, if an abnormal condition develops, such as overheating, the valve at bottom of the cap closes, seating against the gasket. This action pressure the system up to approximately 16 pounds. The valve and seat rises at pressures above specifications and allows the excess pressure to escape through the overflow tube.

Fig. 5—Radiator Cap

Coolant Reserve System Radiator Cap

The Coolant Reserve System is equipped with a 16 psi vented radiator cap containing a pressure relief valve and a vent valve (Fig. 7). As the cooling system temperature increases and coolant expands in the radiator top tank, the vent valve in the center of the cap allows expanding coolant to flow into the reserve tank. When temperature of the expanding coolant approaches the boiling point, and velocity of the coolant closes the vent valve, the radiator becomes pressurized to raise the boiling point of the coolant.

However, if the pressure continues to rise and exceeds 16 psi, the pressure relief valve opens to vent excess pressure and coolant to the reserve tank. As the cooling system temperature decreases and coolant contracts, coolant held in the reserve tank is drawn back into the radiator (Fig. 7).

WARNING: The warning words "DO NOT OPEN HOT" on the radiator pressure cap is a safety precaution. When hot, pressure builds up in cooling system. To prevent scalding or injury, the radiator cap should not be removed while the system is under pressure.

There is no need to remove the radiator cap at any time **except** for the following purposes:

(1) Check anti-freeze freeze point.

(2) Add anti-freeze to lower freeze point.

(3) Refill system with new anti-freeze.

WARNING: When removing pressure cap, turn counterclockwise to stop, without downward pressure on cap, permitting built-up pressure if present to escape through over-flow tube. This will prevent hot water from spraying out of radiator filler opening. To complete removal apply downward pressure and turn counterclockwise.

CAUTION: Radiator cap must be installed fully tight to prevent loss of coolant and possible engine damage.

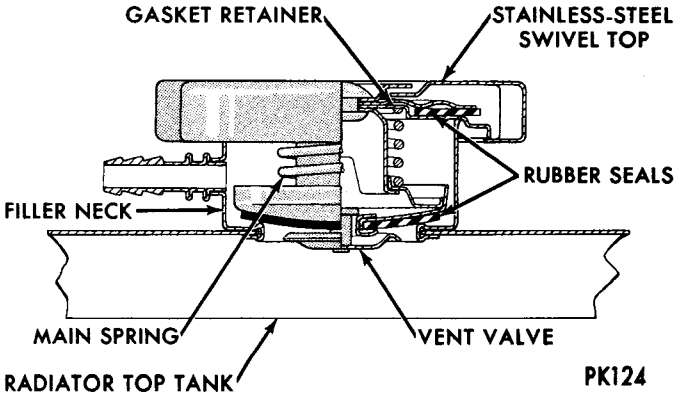


Fig. 6—Radiator Pressure Cap—Coolant Reserve System (Cutaway)

Checking Coolant Level

CAUTION: Do not open hood if steam is evident.

Coolant level is checked by observing the level in the plastic reserve tank—**Not by removing the radiator cap.** Level should be at the "1 quart" or the maintain fluid level mark on the reserve tank with engine at normal operating temperature; coolant level may be observed slightly below the "1 quart" or the maintain fluid level mark when engine is below normal operating temperature.

When required, coolant should be added to the system only at the reserve tank—**not by removing the radiator cap.** When adding coolant, use only a 50/50 mixture of permanent-type anti-freeze and water. Anti-freeze protection should be provided for and checked in both the radiator and reserve tank.

Testing Coolant Reserve System

With coolant in the reserve tank at the proper level and radiator cap installed, open the radiator drain cock. Coolant should be drawn from the reserve tank into the radiator. If test does not draw coolant from the reserve tank, check for leaks at the radiator filler neck and overflow nipple, radiator cap and reserve tank tube.

It may be necessary to pressure test the radiator cap and cooling system to locate a leak.

WARNING: When removing pressure cap, turn counterclockwise to stop, without downward pressure on cap, permitting built-up pressure to escape through over-flow tube. This will prevent hot water from spraying out of radiator filler opening. To complete removal apply downward pressure and turn counterclockwise.

When a condition exists where the cooling system continually requires that coolant be added to maintain proper level, check for internal or external leaks or the engine is operating at too high a temperature due to abnormal operating conditions.

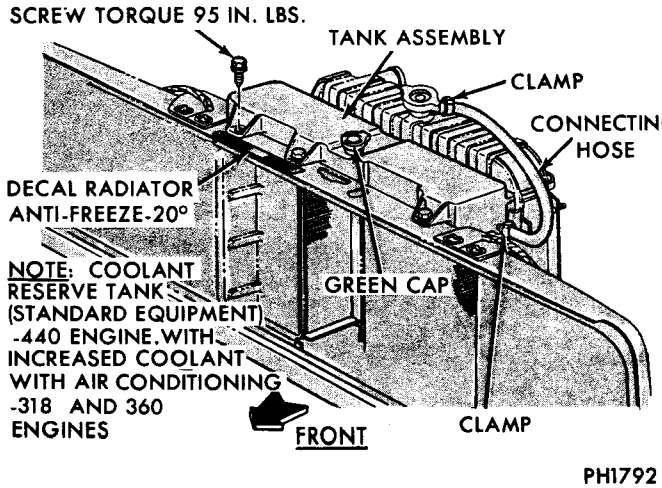


Fig. 7—Coolant Reserve Tank D & W 1, 2, 3

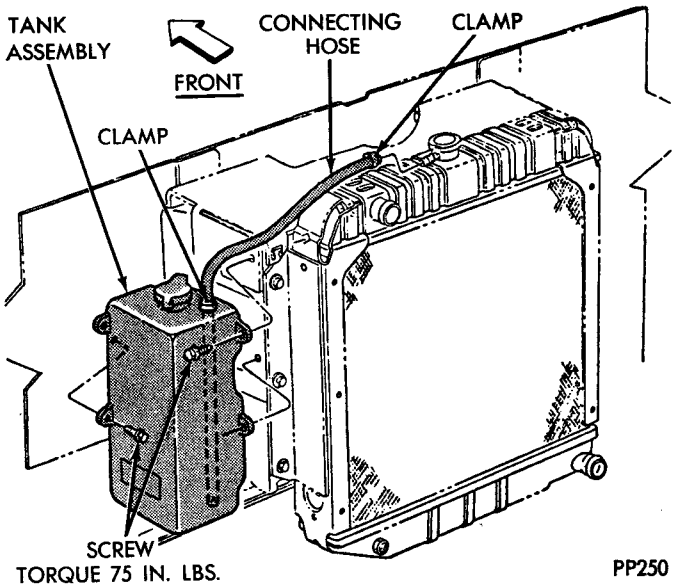


Fig. 8—Coolant Reserve Tank D5, 6, 7, 8 and S6-7 and W6 (Typical)

PRESSURE TESTING RADIATOR CAP

Select the short neoprene seal and metal adapter from the kit, Tool C-4080. Slip the seal on the tube at the bottom of the instrument. Then attach either end of the short adapter to the instrument. Dip the pressure cap in water and apply cap to end of adapter. Working the plunger, as shown in (Fig. 9) bring the pressure to the number of pounds stamped on ear of the cap. If the cap fails to hold

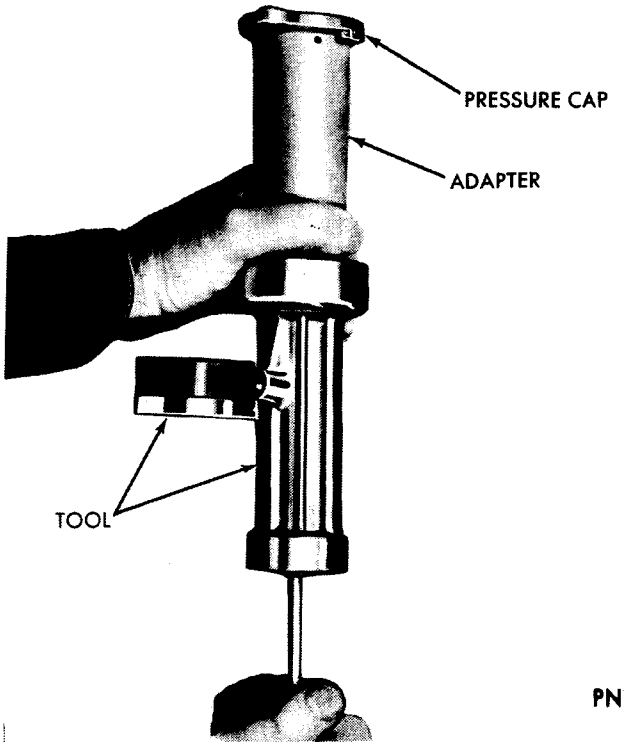


Fig. 9—Testing Pressure Cap

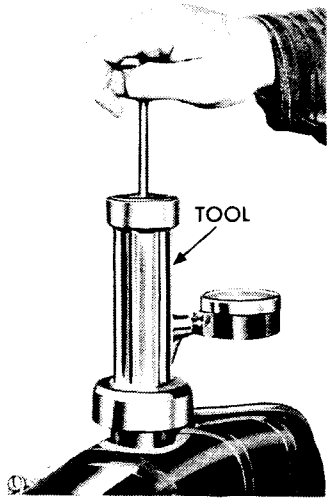


Fig. 10—Pressure Testing Cooling System

the pressure within a range of 14 to 17 pounds for the 16 pound cap, replace the cap with a new tested cap.

The brass valve, at the bottom of the cap, should hang freely on the 16 pound cap. If the rubber gasket has swollen and prevents the valve action, replace the cap.

PRESSURE TESTING COOLING SYSTEM

(1) With engine not running, wipe the radiator filler neck sealing seat clean. The water level should be 1/2 inch below neck of radiator.

(2) Attach the Tester Tool C-4080 to the radiator, as shown in (Fig. 10) and apply pressure, 15 pounds for all models.

If the pressure drops, inspect all points for external leaks.

(3) If there are no external leaks, after the gauge dial shows a drop in pressure, detach the tester, start engine and run the engine to operating temperature in order to open the thermostat and allow the coolant to expand. Reattach the tester and pump to 7 pounds pressure while the engine is running. Race the engine, and if the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket.

WARNING: Pressure builds up fast. Any excessive amount of pressure built up by continuous engine operation must be released to a safe pressure point. NEVER PERMIT PRESSURE TO EXCEED 20 POUNDS ON ALL MODELS.

(4) If the needle on the dial does not fluctuate, race the engine a few times and if an abnormal amount of water emits from the exhaust system at the tail pipe, it may indicate a leak that can be a faulty head gasket, cracked engine block, or the cylinder head near the exhaust ports.

(5) If the above pressure test of the cooling system holds without fluctuation, then there is no leak, however, there may be internal leaks which can be determined by removing the oil dip-stick and if water globules appear intermixed with the oil it will indicate a serious internal leak in the engine. If there is an internal leak, the engine must be disassembled, the leak located and necessary new parts installed.

ENGINE WATER TEMPERATURE GAUGE

For Removal, Installation and Testing procedures of the water temperature sending and receiving units, refer to "Electrical" Group 8 "Gauges".

ENGINE BLOCK HEATER

Description and Operation

On all models an engine block heater is available as an optional accessory. The heater, operated by ordi-

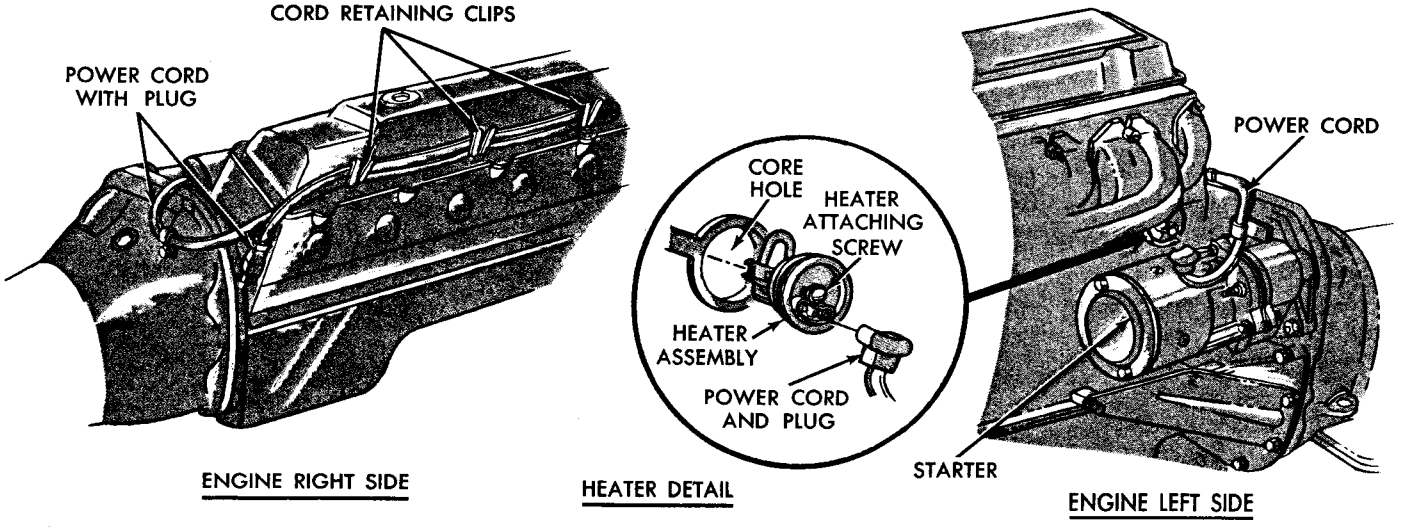


Fig. 11—Engine Block Heater—Six Cylinder Engine

nary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille, provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures. The heater is mounted in a core hole (in place of a core hole plug) in the engine block, with the heating element immersed in coolant.

On six-cylinder engines, the heater is mounted in the rear core hole on the left side of the engine, directly above the starter. (Fig. 11).

On V-8 engines, a heater is mounted on **each** side of the engine in the core holes behind the exhaust manifolds. (Fig. 12).

The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.

If unit does not operate, trouble can be in either the power cord or the heater element. Test power cord for continuity with a 110-volt voltmeter or 110-volt test light; test heater element continuity with an ohmmeter or 12-volt test light.

Removal

(1) Drain coolant from radiator and cylinder block.
(2) Detach power cord plug from heater.
(3) Loosen screw in center of heater. Remove heater assembly.

Installation

(1) Thoroughly clean core hole and heater seat.
(2) Insert heater assembly with element loop positioned **upward on six-cylinder and V8 engines** (Fig. 11 12).
(3) With heater seated, tighten center screw securely to assure a positive seal.
(4) Fill cooling system with coolant to the proper level, then inspect for leaks.

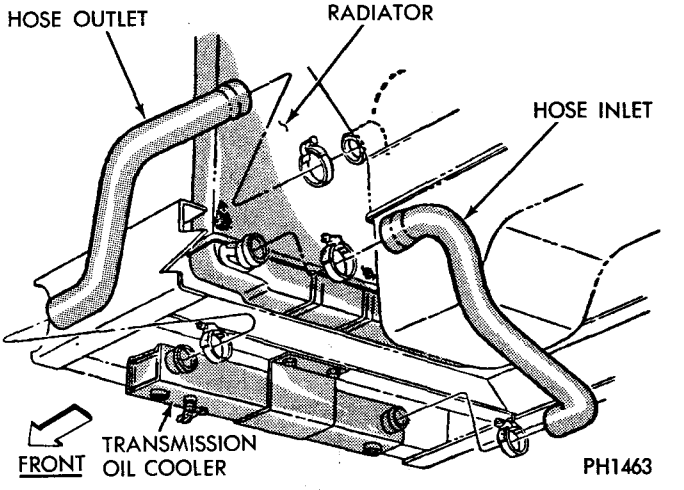


Fig. 13—Radiator Oil Cooler Hoses A-345 and Allison AT 540 Transmission (Typical)

TRANSMISSION OIL COOLER—WITH ALLISON AT-540 and CHRYSLER A345 TRANSMISSION

Transmission oil cooling is provided for the torque convertor and automatic transmission by an oil cooler located under the radiator, mounted on the bottom side of the front crossmember. Engine coolant is circulated through cooling tank; transmission oil is circulated through a core immersed in coolant. (Fig. 13, 14 and 15).

Oil Cooler Repair

An **external leak** in the oil cooler should be detected by inspection and observing transmission fluid leaking at a fitting or elbow, or coolant leaking at a hose connection or from the tank. External leaks can usually be repaired by removing the tank and carefully applying soft solder.

An **internal leak** in the oil cooler can cause engine coolant to become mixed with transmission fluid, or

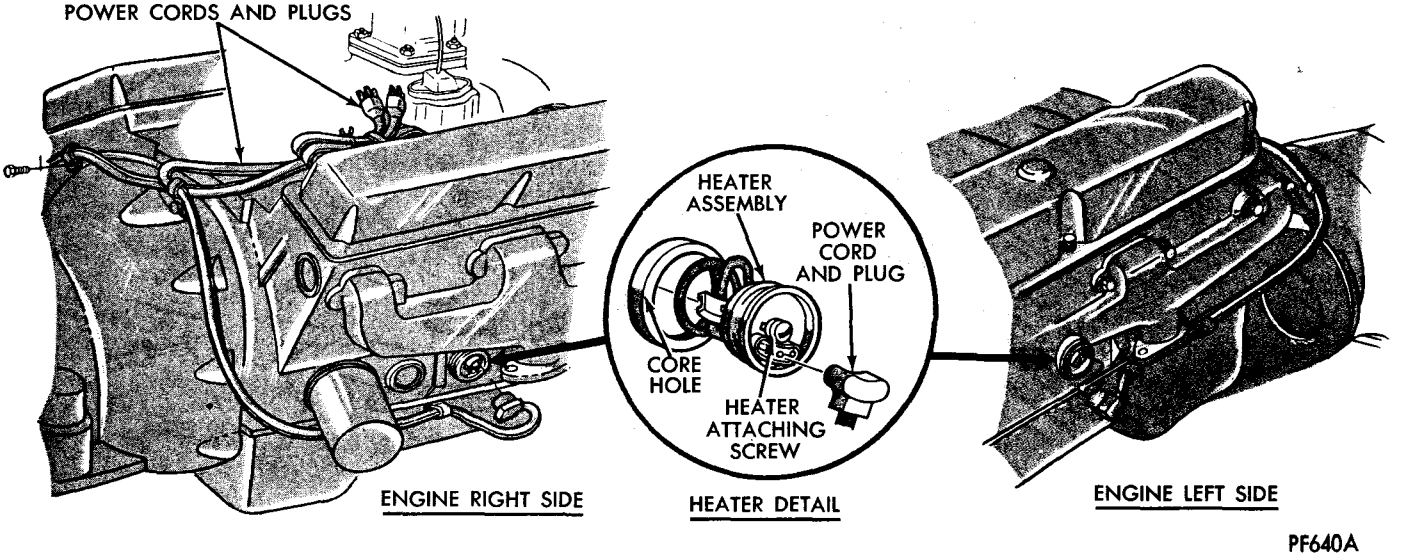


Fig. 12—Engine Block Heater (Typical) 318 and 360 Engine Shown

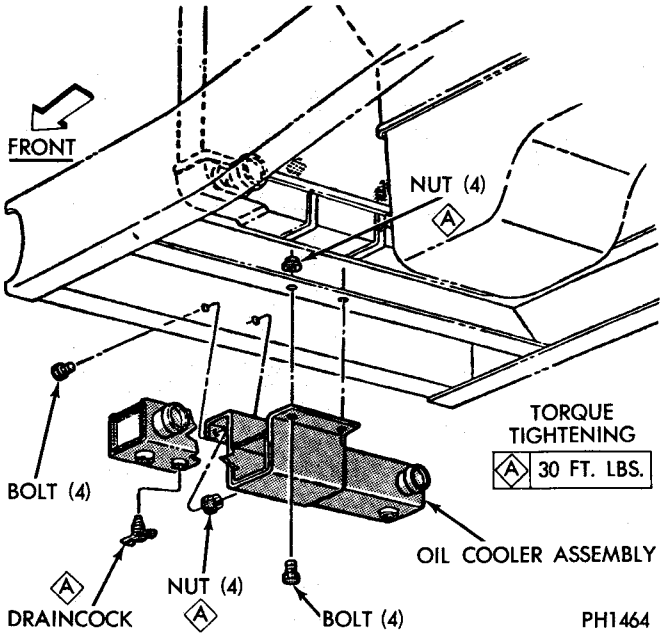


Fig. 14—Transmission Oil Cooler A-345 and Allison AT 540 Transmission (Typical)

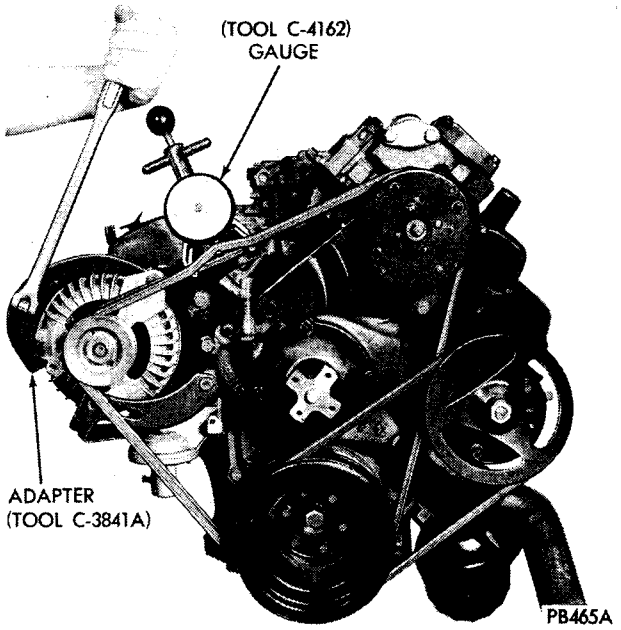


Fig. 16—Belt Tension Gauge and Alternator Adjusting Adapter

transmission fluid may enter the engine cooling system. Both cooling system and transmission (and torque converter) should be drained and inspected in the event of an internal leak. The cooling tube inside the cooler cannot be replaced separately; in the event of an internal leak, the cooler assembly must be replaced.

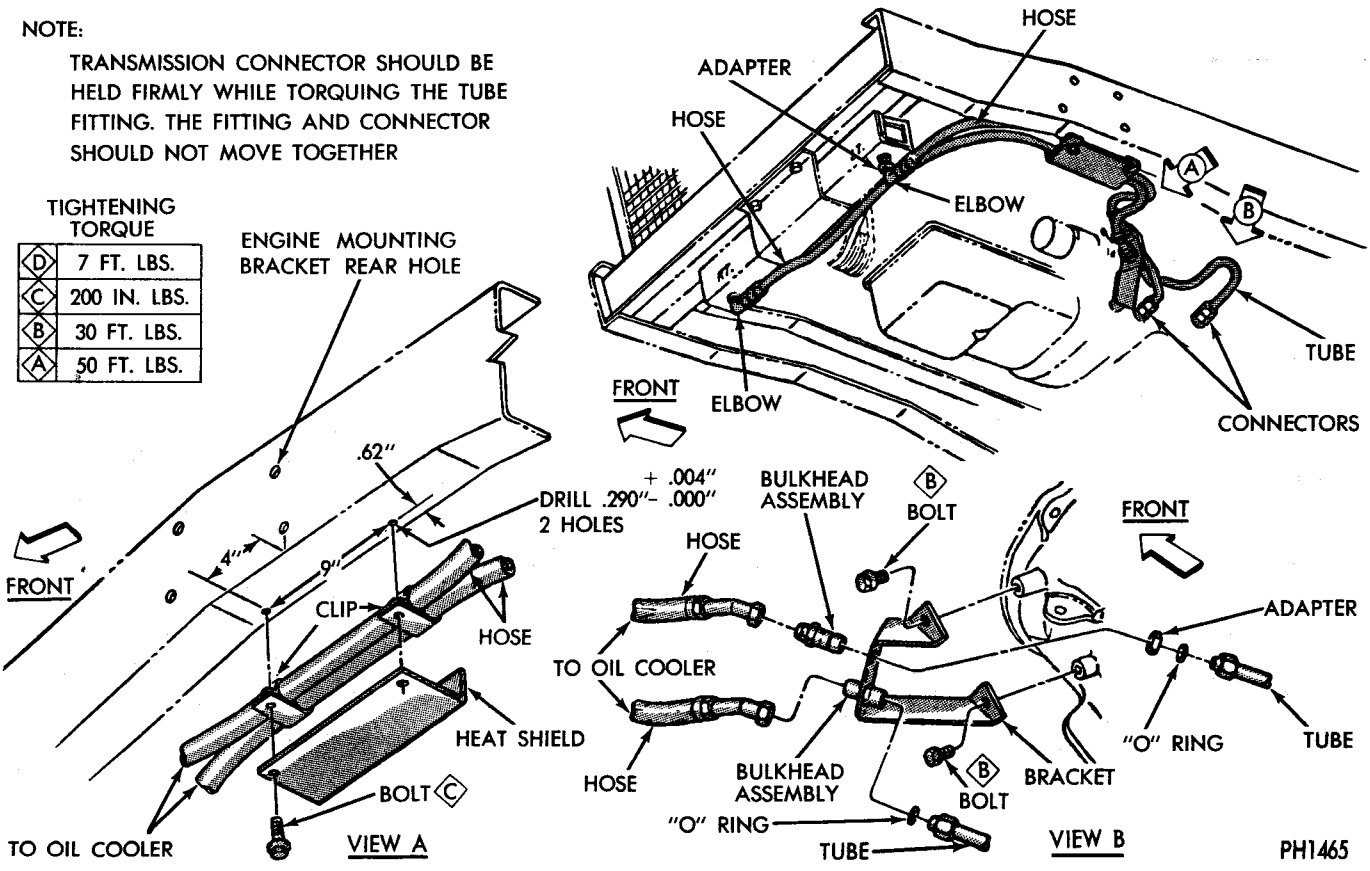


Fig. 15—Oil Cooler Lines A 345 Transmission

ACCESSORY BELT DRIVES

Proper Belt Tension

Satisfactory performance on belt-driven accessories depends on maintenance of proper belt tension. Either the "Gauge Method" or the "Torque Method" may be used as follows:

Gauge Method

This method is preferred because it gives a direct reading of belt tension.

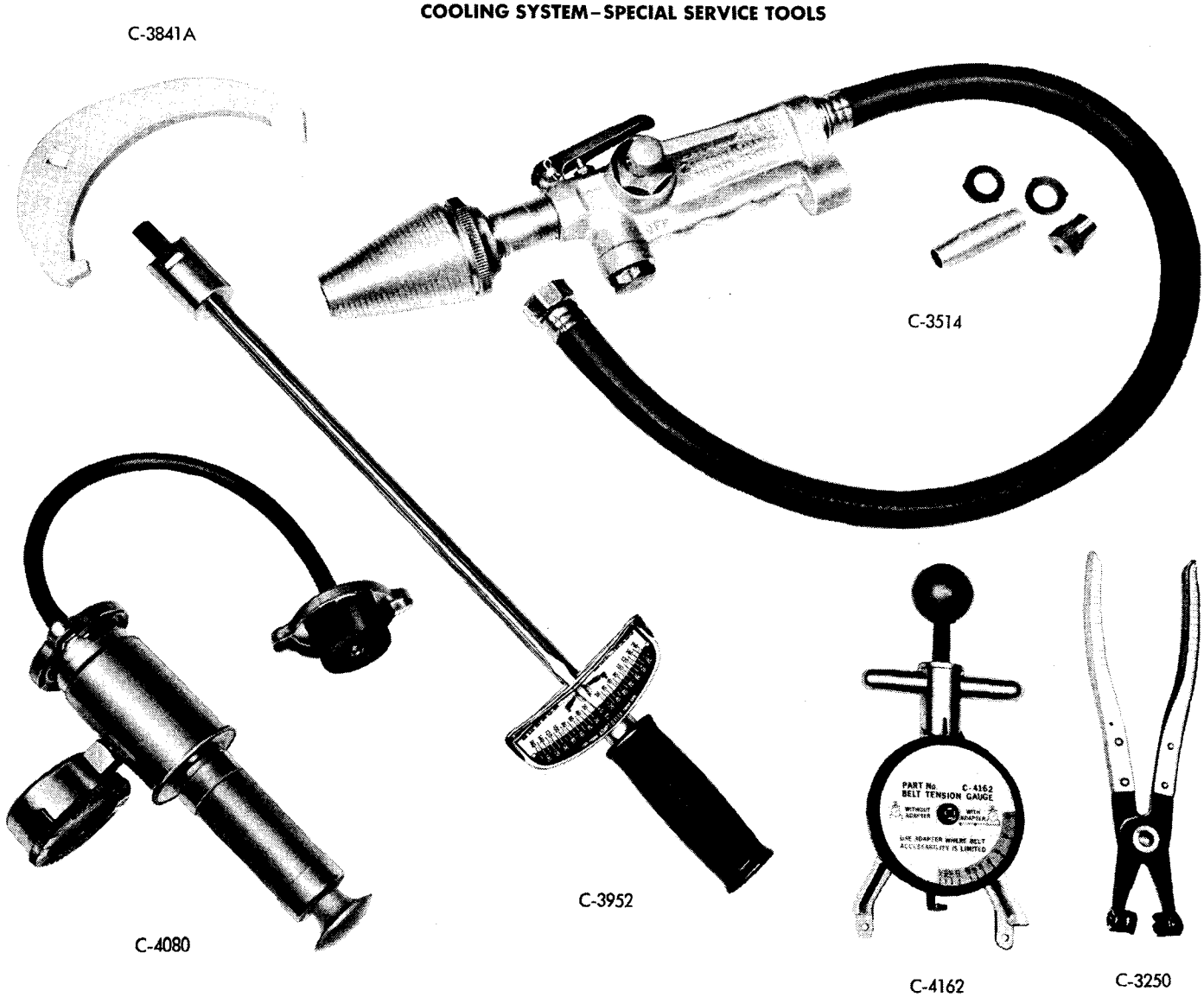
Loosen attaching bolts and attach gauge C-4162 to belt as shown in (Fig. 16) (for dual belts, attach gauge to front belt only). Apply torque using the 1/2 inch square hole in the brackets or Tool C-3841-A for the alternator (attach tool to heavily ribbed section of alternator to prevent damage). The gauge should read to "Specifications" after all bolts are tightened.

Torque Method

All belts can be adjusted to the specified tension by use of a torque wrench. The alternator belts are adjusted by using Tool C-3841-A. The tool should be hooked at the heavily ribbed section of the alternator to prevent damage. Other belts are tightened by torque wrench using the square hole in the brackets.

To tighten belts by the torque method, loosen all mounting bolts and apply specified torque to the components (See Specifications). Initial orientation of torque wrench should be approximately vertical to obtain proper tension. Tighten all mounting bolts while torque is applied to the accessory. If it is difficult to use the torque wrench because of clearance, use an extension.

COOLING SYSTEM–SPECIAL SERVICE TOOLS



PF370B

TIGHTENING REFERENCE

	Inch Pounds	Foot Pounds	Thread Size
Water Pump Bolts	—	30	3/8-16
Fan Attaching Bolts	200	—	5/16-18
Thermostat Housing Bolts	—	30	3/8-18
Shroud Mounting Screws	30	—	1/4-20
Shroud Mounting Nuts	30	—	1/4-20
Radiator Mounting Screws	—	30	3/8-18
	75	—	1/4-20
Drain Cock on Radiator Tank	150	—	1/4-NPTF
Drain Cock on Oil Cooler Tank (AT540)	—	30	—
Oil Cooler Fittings (Loadflite)			
Lines to Fittings	110	—	—
Lines to Auxiliary Cooler	85	—	—
Lines to Connectors	50	—	—
Oil Cooler Fittings (Allison AT540)			
Reducer Fittings to Tank	—	50	3/4-16
Elbows to Reducer Fittings	—	50	3/4-16
Lines to Elbows	—	50	—

BELT TENSION SPECIFICATIONS

GAUGE METHOD

NEW BELT (All)
120 Lbs. Gauge Reading

***USED BELT (All)**
70 Lbs. Gauge Reading*

TORQUE METHOD

TORQUE (FT.-LBS) TO BE APPLIED TO COMPONENTS

Engine Displacement (Cubic Inches)	NEW BELT 225	318 360	361 413	400 440	*USED BELT 225	318 360	361 413	400 440
POWER STEERING PUMP								
With Air Pump		100		100		65		65
Without Air Pump	90	50	45	45	50	35	30	30
POWER STEERING & AIR PUMP	35				20			
ALTERNATOR								
Without Air Conditioning	15	35	70	70	10	25	40	40
With Air Conditioning		100	120	120		70	80	80
FAN IDLER		35				20		
AIR PUMP								
Without Air Conditioning	40	100	55	55	25	65	35	35
With Air Conditioning		75	55	55		50	35	35

*A belt is considered "Used" after 15 minutes of running.

TRUCK MODEL DESIGNATION

	D100	W100	D200	W200	D300	W300	D500	D600	W600	S600	S700	D700	D800
Capacity (U.S. Quarts)—W/Heater													
225 CID	13(1)	13(2)	13(1)	13(2)	14(1)	14	—	—	—	—	—	—	—
318 CID	17(1)	17(1)	17(4)	17(4)	17(4)	17(4)	19(3)	19(3)	19(3)	19(3)	—	—	—
360 CID	16(1)	16(1)	16(1)	16(1)	16(1)	16(1)	—	—	—	—	26	—	—
361 CID	—	—	—	—	—	—	26(6)	23(6)	23(6)	23(6)	23(6)	23(6)	23(6)
413 CID	—	—	—	—	—	—	—	—	—	—	24(6)	24(6)	24(6)
400 & 440 CID (△)	16(4)	16(4)	16(4)	16(4)	16(4)	16(4)	—	—	—	—	—	—	—
Radiator Pressure Cap (PSI)	16	16	16	16	16	16	16	16	16	16	16	16	16
Thermostat (In Degrees F.)	195	195	185-V8 195-6 Cyl.	185-V8 195-6 Cyl.	185-V8 195-6 Cyl.	185-V8 195-6 Cyl.	185	185	185	185	185	185	185
Fan Shroud													
225 CID	No	(*)	No	(*)	(*)	(*)	—	—	—	—	—	—	—
318 CID	(**)	(**)	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	—	—	—
360 CID	Std.	Std.	Std.	Std.	Std.	Std.	Std.	—	—	—	Std.	Std.	—
361 CID	—	—	—	—	—	—	—	Std.	Std.	Std.	—	—	Std.
400 & 440 CID	Std.	Std.	Std.	Std.	Std.	Std.	—	—	—	—	—	—	—
413 CID	—	—	—	—	—	—	—	—	—	—	Std.	Std.	Std.
Fluid Fan Drive													
225 CID	No	No	No	No	No	No	—	—	—	—	—	—	—
318 CID	(#)	(#)	(#)	(#)	(#)	(#)	No	No	No	No	—	—	—
360 CID	(#)	(#)	(#)	(#)	(#)	(#)	—	—	—	—	—	—	—
361 CID	—	—	—	—	—	—	—	No	No	No	No	No	No
400 & 440 CID	Std.	Std.	Std.	Std.	Std.	Std.	—	—	—	—	—	—	—
413 CID	—	—	—	—	—	—	—	—	—	—	No	No	No
Fan Ratio													
225 CID	1.07:1	1.07:1	1.07:1	1.07:1	1.07:1	1.07:1	—	—	—	—	—	—	—
318 CID	.95:1	.95:1	.95:1	.95:1	.95:1	.95:1	.95:1	.95:1	.95:1	.95:1	—	—	—
With Air Conditioning	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	.95:1	.95:1	.95:1	.95:1	—	—	—
360 CID	.95:1	.95:1	.95:1	.95:1	.95:1	.95:1	—	—	—	—	—	—	—
With Air Conditioning	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	—	—	—	—	—	—	—
361 CID	—	—	—	—	—	—	—	1.05:1	1.05:1	1.05:1	1.05:1	1.05:1	1.05:1
400 & 440 CID	1.10:1	1.10:1	1.10:1	1.10:1	1.10:1	1.10:1	—	—	—	—	—	—	—
With Air Conditioning	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	—	—	—	—	—	—	—
413 CID	—	—	—	—	—	—	—	—	—	—	1.05:1	1.05:1	1.05:1
Fan (##)													
225 CID	18/4	18/4	18/4	18/4	18/4	18/4	—	—	—	—	—	—	—
318 CID	18/4	18/4	18/4	18/4	18/4	18/4	18/4	18/4	18/4	18/4	—	—	—
With Increased Cooling	18/4	18/4	18/4	18/4	18/4	18/4	18/7	18/7	18/7	18/7	—	—	—
With Air Conditioning	18/7	18/7	18/7	18/7	18/7	18/7	18/7	18/7	18/7	18/7	—	—	—
360 CID	18/4	18/4	18/4	18/4	18/4	18/4	—	—	—	—	—	—	—
With Increased Cooling	18/4	18/4	18/7	18/4	18/4	18/4	—	—	—	—	—	—	—
With Air Conditioning	18/7	18/7	18/7	18/7	18/7	18/7	—	—	—	—	—	—	—
361 CID	—	—	—	—	—	—	—	21/5	21/5	21/5	—	—	21/5
413 CID	—	—	—	—	—	—	—	—	—	—	21/5	21/5	21/5
400 & 440 CID	20/7	20/7	20/7	20/7	20/7	20/7	—	—	—	—	—	—	—
With Increased Cooling	—	—	20/7	20/7	20/7	20/7	—	—	—	—	—	—	—
With Air Conditioning	20/7	20/7	20/7	20/7	20/7	20/7	—	—	—	—	—	—	—

(*) With Increased Cooling Package Only.
(**) With Automatic Transmission and/or Air Conditioning and/or Increased Cooling
(#) With Air Conditioning Only.
(##) Fan Diameter-inches/Number of Blades.
(△) If equipped with Coolant Reserve System, add 1 qt. to capacity shown.

(1) Add 1 qt. with Increased Cooling Package, Auxiliary Heater or Air Conditioning.
(2) Add 1 qt. with Automatic Transmission and/or Increased Cooling.
(3) Add 6 qts. with Increased Cooling Package.
(4) Add 1-1/2 qts. with Air Conditioning or Increased Cooling.
(6) Add 2 qts. with Air Conditioning and 1 qt. for Increased Cooling.

ELECTRICAL

CONTENTS

BATTERY

INDEX

SERVICE PROCEDURES

GENERAL INFORMATION

The battery is the heart of the vehicles electrical system, so it is very important that it is capable of delivering the necessary electricity when called for and capable of accepting electricity when it is in a low state of charge.

Another important feature of the battery is that it acts as a giant capacitor (shock absorber) in the vehicles electrical system. It absorbs many abnormal and transient voltages that are created by the various electrical components of the system.

If a battery is not up to specifications it will not deliver the necessary electricity, will not accept electricity and will not act as a capacitor. Consequently, the vehicles entire electrical system will be effected when this happens.

BATTERY VISUAL INSPECTION

(1) Disconnect battery cables at battery.

(2) Remove battery hold-down clamp and remove battery from vehicle.

WARNING: Care, should be taken, in the event battery case is cracked or leaking, to protect hands from the electrolyte. A suitable pair of rubber gloves (not the household type) should be worn when removing battery by hand.

(3) Inspect battery carrier for damage caused by loss of acid from battery. If acid damage is present it will be necessary to clean area with a solution of clean warm water and baking soda. Scrub area with a stiff bristle brush and wipe off with a cloth moistened with ammonia or baking soda in water.

(4) Clean top of battery with same solutions as described in Step (3).

CAUTION: Keep cleaning solution out of battery cells for it will weaken the electrolyte.

(5) Inspect battery case and cover for cracks. If cracks are present battery must be replaced.

(6) Clean battery post with a suitable battery post cleaning tool.

(7) Clean the inside surfaces of the terminal clamps with a suitable battery terminal cleaning tool. Replace damage or frayed cables and broken terminal clamps.

(8) Connect cables to battery observing correct polarity.

(9) Tighten hold-down clamp nuts to 3 foot-pounds torque. **Do not over tighten for damage to battery case and/or cover will occur.**

(10) Connect cable clamps to battery post and tighten securely. Coat all connections with light mineral grease **after tightening.**

(11) If electrolyte level is low, fill to recommended level with distilled water.

SPECIFIC GRAVITY TEST

Hydrometer

The hydrometer is used to measure the specific gravity of the electrolyte in the battery cells. This

will give an indication of how much unused sulphuric acid remains in the solution, which determines the state of charge the battery is in. A hydrometer should be graduated to read from 1.160 to 1.320. In graduations of .005 specific gravity. Graduated markings should be accurate to within .002 specific gravity.

In reading a hydrometer, the gauge barrel must be held vertically and just right amount of fluid be drawn up into gauge barrel, with pressure bulb fully expanded, to lift float freely so it does not touch the sides, top or bottom of the barrel. Take a reading with eye on level with liquid level in the gauge barrel. **DO NOT TILT** hydrometer.

Electrolyte

Liquid level of each battery cell should be up to the bottom of each vent plug hole. Add distilled water when necessary, to obtain proper electrolyte level. Electrolyte should be thoroughly mixed with any water which may have just been added to the battery by charging the battery before taking hydrometer readings.

Specific gravity of battery electrolyte strength or density varies not only with the quantity of the acid in solution but also with temperature. As temperature increases, the density of the electrolyte decreases and specific gravity decreases. As temperature decreases the density of the electrolyte increases and the specific gravity increases.

Specific gravity variations caused by temperatures must be considered and corrected to 80°F. in the analysis of the battery, otherwise specific gravity readings will not give a true indication of state of charge.

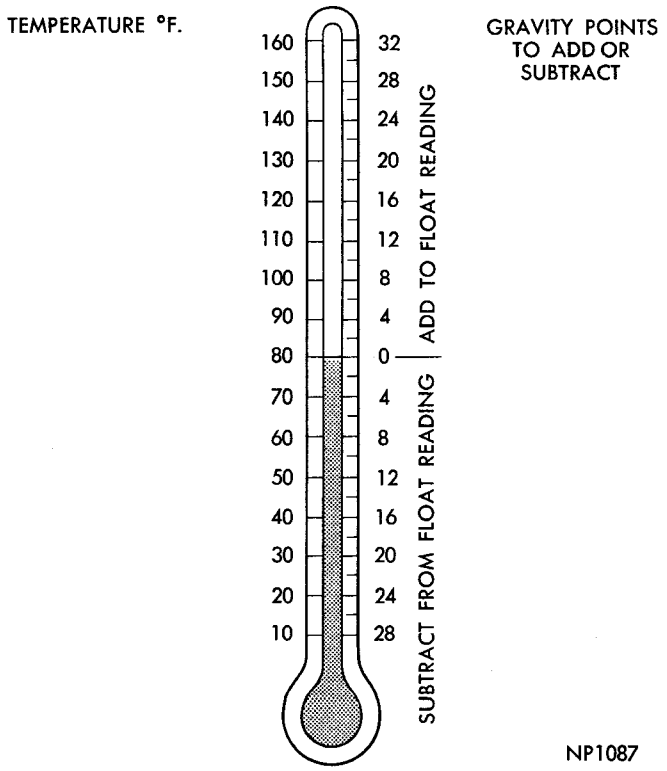


Fig. 1—Hydrometer Reading Correction Chart

Test

Draw electrolyte in and out of the hydrometer barrel several times to bring the temperature of the hydrometer float to that of the acid in the cell and then measure the electrolyte temperature in the cell.

If the hydrometer is equipped with a thermometer, electrolyte temperature may be read from it. If the hydrometer is not equipped with a thermometer, use a battery immersion type thermometer of the mercury-in-glass type, having a scale reading as high as 125°F, or if not available a suitable dairy type thermometer may be used to obtain the electrolyte temperature.

The electrolyte temperature correction in specific gravity reading at 80°Fahrenheit is zero. Add .004 specific gravity points for every 10 degrees over 80°F and subtract .004 specific gravity points for every 10 degrees under 80°F. All readings must be corrected to 80 degrees Fahrenheit. Refer to Figure 1 and examples one and two as follows:

Example 1—
Hydrometer Reading 1.260
Electrolyte Temperature ....20 degrees Fahrenheit
Subtract Specific Gravity .....−.024
Corrected Specific Gravity is 1.236

Example 2—
Hydrometer Reading 1.225
Electrolyte Temperature ...100 degrees Fahrenheit
Add Specific Gravity .....+.008
Corrected Specific Gravity is 1.233

A fully charged relatively new battery has a specific gravity reading of 1.270 plus .015 minus .005.

Test Conclusions

(a) Battery specific gravity is less than 1.220, battery should be recharged. Make a high rate discharge test for capacity. If battery cells test O.K., recharge and adjust gravity of all cells uniformly. Thoroughly test the electrical system for short circuits, loose connections and corroded terminals.

(b) **Cells show more than 25 points (.025 Specific Gravity) Variation,**—Short circuit, low cell, or loss of electrolyte by leakage or excessive overcharge; try to recharge battery. See "Charging the Battery." See "Adjustment of Acid Gravity".

(c) Battery specific gravity is above 1.220 and all cells are even. Battery state of charge may be satisfactory. Test by making "High Rate Discharge Test of Battery Capacity". Make sure all electrical connections are clean and tight.

HIGH RATE DISCHARGE TEST OF BATTERY CAPACITY

Satisfactory capacity tests can be made only when battery equals or exceeds 1.220 specific gravity tem-

perature corrected. If the reading is below 1.220, the battery should be **slow** charged until fully charged in order to obtain proper test results. If charging fails to bring the specific gravity up in any one or all of the cells, the battery is defective and must be replaced.

Test Procedure

(1) Turn control knob of Battery-Starter-Tester to OFF position.

(2) Turn Voltmeter Selector Switch to the 16 Volt position on test units so equipped.

(3) Connect test ammeter and voltmeter positive leads to battery positive terminal. Connect ammeter and voltmeter negative leads to battery negative terminal (Fig. 2). Voltmeter clips must contact battery posts or cable clamps and not ammeter lead clips.

(4) Turn control knob clockwise until ammeter reading is equal to three times ampere hour rating of battery.

(5) Maintain the load for 15 seconds and note reading of the voltmeter.

Test Results

(a) If the voltmeter reading is 9.5 volts or more and the specific gravity was 1.220 or more before testing, the battery is in good condition and can be placed back into service. However, if it was necessary to charge the battery before testing thoroughly check the electrical system for short circuits, loose connections and corroded terminals.

(b) If the voltmeter reading is less than 9.5 volts, this indicates a possible defective condition and the battery should be given the three minute charge test.

Three Minute Charge Test (Fig. 3)

This test should not be used if battery temperature is below 60 degree F. **Do not perform this test on the battery unless it has failed the capacity test.**

(1) Connect Battery Charger positive lead to battery positive terminal and negative lead to battery negative terminal. IMPORTANT: Be sure of correct polarity during this test.

(2) Turn the Battery Charger Power Switch to ON position. Turn timer switch past three minute mark then back to the three minute mark.

(3) Adjust Battery Charger Switch to highest possible rate not exceeding 40 amperes.

(4) When timer switch cuts off at the end of 3 minutes, turn timer switch back to Fast Charge.

(5) Use the 16 Volt scale of the Battery Starter Tester and measure total voltage of battery posts while battery is being fast charged, and note the voltmeter reading.

Test Results

If total voltage during charge exceeds 15.5 volts, battery is sulphated and should be cycled and slow-charged until specific gravity reaches 1.270 (See "Slow Charging"). **A slow charge is preferable to bring the battery up to a full charge.**

If specific gravity remains constant after testing battery at one hour intervals for three hours, battery is at its highest state of charge.

(6) Make another capacity test. If capacity test does not meet specifications, replace battery.

CHARGING THE BATTERY

Slow Charging Batteries

If adequate time is available, the slow charging method should be used in recharging a discharged battery.

There are many types of battery charging equipment available. **Be sure to follow the instruction of the equipment manufacturer for the necessary preparations and precautions.** However, the following items should be observed when slow charging the battery with any type of equipment:

(1) If the battery is to remain in the vehicle, disconnect the cables at the battery, to prevent damage

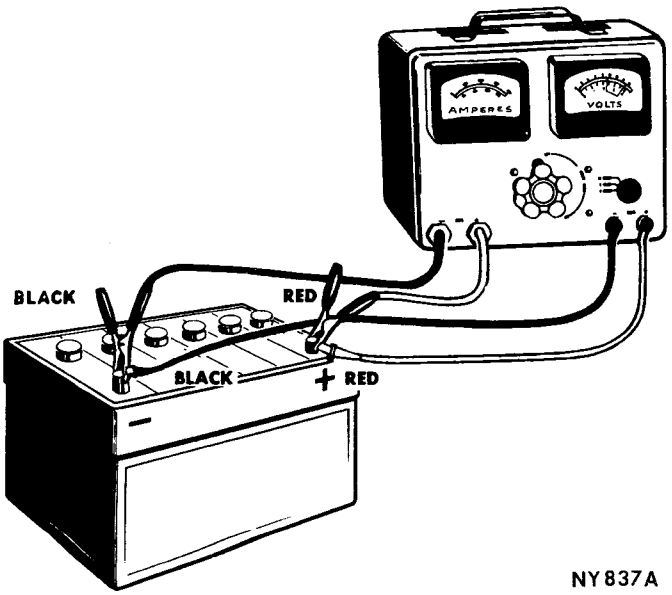


Fig. 2—High Rate Discharge Test

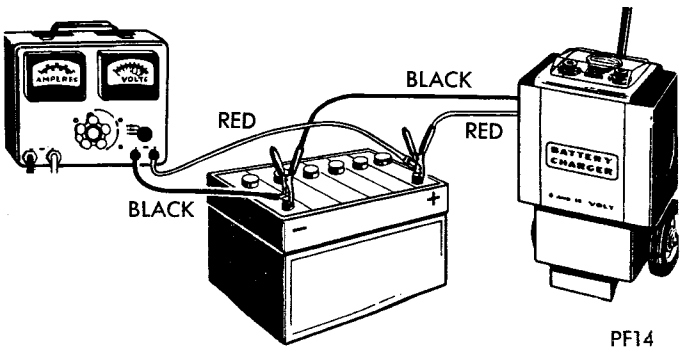


Fig. 3—Three Minute Charge Test

to the electrical system, during charging.

(2) Thoroughly clean the battery. Refer to "Battery Visual Inspection".

(3) Make sure the electrolyte level is at the normal level. Refer to "Testing Specific Gravity".

(4) The battery is to be charged at a rate (amps) of 1/20 of its ampere hour capacity.

(5) The average length of time necessary to charge a battery by the slow charge method at normal rates is from 12 to 16 hours, however, when a battery continues to show an increase in specific gravity, battery charge should be continued even if it takes 24 hours or more. Watch the temperature of the electrolyte and if the temperature of the cells reaches 110°F., lower the charging rate.

Battery will be fully charged when it is gassing freely and when there is no further rise in specific gravity after three successive readings taken at hourly intervals. Make sure hydrometer readings are corrected for temperature.

Sulphated Batteries

Many sulphated batteries can be brought back to good condition by slow charging.

The rate of charge for a sulphated battery should be no more than 1/2 the normal slow charge rate and the charging time should be from 60 to 100 hours. This long charging cycle is necessary to reconvert crystalline lead sulphate into active materials.

Fast Charging Battery

If adequate time for a slow charge is not available a high rate (FAST) charge is permissible and will give a sufficient charge in one hour enabling the battery and alternator to continue to carry the electrical load. If the battery is to remain in the vehicle, disconnect the cables at the battery to prevent damage to the electrical system during charging. The manufacturers of high rate charging equipment generally outline the necessary precautions and some models have thermostatic temperature limiting and time limiting controls. **Make sure their instructions are followed.**

WARNING: When batteries are being charged an explosive gas mixture forms beneath the cover of each cell. Do not smoke near batteries on charge or which have recently been charged. Do not break live circuits at the terminals of the batteries on charge. A spark will occur where the live circuit is broken. Keep all open flames away from the battery.

CAUTION: The battery can be damaged beyond repair unless the following precautions are taken:

(1) Make sure electrolyte level is at normal level. Refer to "Testing Specific Gravity".

(2) Battery electrolyte temperature must NEVER exceed 125 degrees Fahrenheit.

If this temperature is reached, battery should be cooled by reducing charging rate or remove battery from the circuit.

(3) As battery approaches full charge electrolyte in each cell will begin to gas or bubble. Excessive gassing must not be allowed.

(4) Do not fast charge longer than one hour. If battery does not show a significant change in specific gravity after one hour of "FAST" charge, the slow charge method should be used.

Remember to use temperature correction when checking specific gravity.

ADJUSTMENT OF ACID GRAVITY

Hydrometer floats usually are not calibrated below 1.160 specific gravity and cannot indicate the condition of a battery in a very low state of charge. Therefore, it may be necessary to give the battery several hours charge before a hydrometer reading will indicate that the battery is taking a charge.

If the specific gravity of all cells are not within .015 points of specified value, corrected to 80 degrees F, at the end of a full charge, remove some of the electrolyte with a hydrometer and add a like amount of distilled water to reduce the gravity if too high, or add 1.400 Specific Gravity acid to raise specific gravity, if too low. Continue the charge so as to give the electrolyte a chance to mix and then read the gravity after another hour of charge to note the effect of the additions. Continue this adjusting procedure until gravity is brought to the desired value by charging for one hour after each adjustment.

ASSIST (JUMP) STARTING WITH A BOOSTER BATTERY

If it becomes necessary to use a booster battery, with jumper cables, to start a vehicle's engine because its battery is discharged, the following procedure should be followed:

CAUTION: TO PREVENT PERSONAL INJURY OR DAMAGE TO CLOTHING, DO NOT ALLOW BATTERY FLUID TO CONTACT EYES, SKIN OR FABRICS. DO NOT LEAN OVER BATTERY WHEN CONNECTING JUMPER CABLES OR ALLOW CABLE CLAMPS TO TOUCH EACH OTHER. KEEP OPEN FLAMES OR SPARKS AWAY FROM BATTERY FILLER HOLES. ALWAYS WEAR EYE PROTECTION WHEN WORKING WITH BATTERIES.

(1) Turn ignition switch and headlights off.

(2) Remove vent caps of both booster battery and discharged battery.

(3) Make sure electrolyte is at proper level.

CAUTION: DURING COLD WEATHER WHEN TEMPERATURES ARE BELOW FREEZING POINT, ELECTROLYTE IN A DISCHARGED BATTERY MAY FREEZE. IF ELECTROLYTE IS NOT VISIBLE IN BATTERY OR IT APPEARS FROZEN, DO NOT AT-

TEMPT JUMP STARTING BECAUSE BATTERY COULD RUPTURE OR EXPLODE. BATTERY TEMPERATURE MUST BE BROUGHT UP ABOVE FREEZING POINT AND WATER ADDED (IF NECESSARY) BEFORE ATTEMPTING JUMP STARTING.

(4) Cover vent cap openings of both batteries with a cloth.

(5) Connect one jumper cable between POSITIVE (+) POST of both batteries.

(6) Connect ONE end of other jumper cable to NEGATIVE (−) POST of booster battery. Connect OTHER end of cable to alternator mounting bracket of vehicle with discharged battery, making sure a good connection is made. **DO NOT CONNECT TO NEGATIVE POST OF DISCHARGED BATTERY.**

(7) After engine is started or if engine fails to start, cables must be disconnected in following order;

(a) negative cable at alternator bracket,

(b) negative cable at negative post on booster battery,

(c) cable between positive post of both batteries.

(8) Remove cloths from both batteries.

CAUTION: CLOTHS HAVE BEEN EXPOSED TO SULFURIC ACID FUMES AND SHOULD BE THROWN AWAY.

(9) Install vent caps on batteries.

ASSIST (JUMP) STARTING WITH PORTABLE STARTING UNIT

There are many types of these units available. Follow instructions of their manufacturer for necessary precautions and operation. However, it is very important that their operating voltage does not exceed **16** volts because damage to battery, starter motor, alternator or electrical systems may occur.

STARTER (DIRECT DRIVE)

INDEX

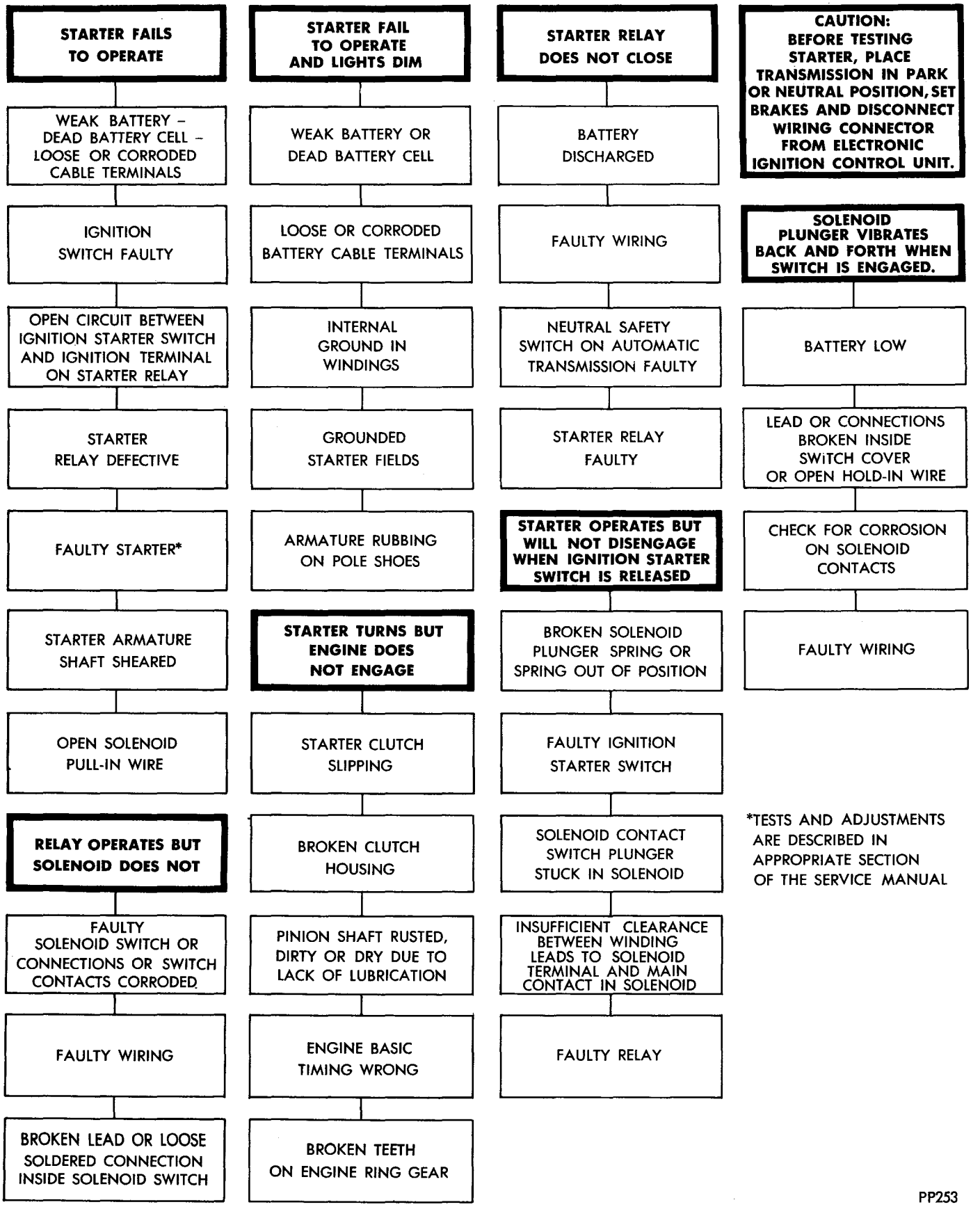
GENERAL INFORMATION

Two types of Direct Drive Starters are used on all Heavy Duty Trucks equipped with gasoline powered engines.

Both starters are identical except for their pinion housings. Service procedures and specifications are the same.

The starter drive is an overrunning clutch type, with a solenoid switch mounted on the starter motor.

DIRECT DRIVE STARTER DIAGNOSIS



PP253

SERVICE PROCEDURES

AMPERAGE DRAW TEST (with Starter Tester)

Engine should be up to operating temperatures. Extremely heavy oil or a tight engine will increase starter amperage draw.

Check battery electrolyte gravity with a reliable hydrometer. Gravity should be not less than 1.225 (temperature corrected). See that battery passes High Rate Discharge Test shown in the "Battery" section of this manual.

Turn Battery—Starter Tester **CONTROL KNOB** to "OFF" position.

Turn voltmeter Selector Switch to 16 Volt position. Connect heavy **Positive** ammeter lead **(Red)** to **Positive** battery terminal. Connect heavy **Negative** ammeter lead **(Black)** to **Negative** battery terminal.

Connect **Positive** voltmeter lead **(Red)** to **Positive** battery terminal. Connect **Negative** voltmeter lead **(Black)** to **Negative** battery terminal.

DISCONNECT coil wire from distributor cap and secure to a good ground to prevent engine from starting.

Crank engine with a remote control starter switch and observe **Exact** reading on Voltmeter. Stop cranking engine. Without cranking engine, turn tester **CONTROL KNOB** clockwise until voltmeter reads **Exactly** the same as when engine was being cranked with the remote control starter switch. Ammeter now indicates starter amperage draw. Check specifications.

STARTER RESISTANCE TEST

(1) Test battery electrolyte specific gravity. Specific gravity should be 1.225 or above.

(2) Disconnect positive battery lead from battery terminal post. Connect a 0 to 300 scale ammeter between disconnected lead and battery terminal post.

(3) Connect a test voltmeter with 10 scale division between volts between battery positive post and starter switch terminal at starter solenoid.

(4) Crank engine and observe reading on voltmeter and ammeter. The voltage should not exceed .3 volt. A reading of voltage that exceeds .3 volt indicates there is high resistance caused from loose circuit connections, a faulty cable, burned starter relay or solenoid switch contacts. A current that is high and is combined with slow cranking speed, indicates that starter should be removed and repaired.

INSULATED CIRCUIT TEST

(1) Test battery electrolyte specific gravity. Specific gravity should be 1.225 or above.

(2) Turn Voltmeter Selector Switch to 4 volt position.

(3) Disconnect ignition coil secondary cable.

(4) Connect voltmeter positive lead to battery positive post and voltmeter negative lead to solenoid connector which connects to starter field coils. **NOTE:** To reach this connection, it will be necessary to peel back rubber boot on solenoid. **The voltmeter will read off scale to the right until starter is actuated.**

(5) Connect remote control switch to the battery and solenoid terminal of starter relay.

(6) Crank engine with a remote control starter switch and observe voltmeter reading. Voltmeter reading should not exceed .3 volt. A voltmeter reading of .3 volt or less indicates voltage drop is normal in the cables, starter relay switch, solenoid switch and connections between battery and starter is normal. See "Starter Ground Circuit Test."

If voltmeter reading is more than .3 volt, it indicates high resistance in the starter insulated circuit. Make following tests to isolate point of excessive voltage loss:

(a) Remove the voltmeter lead from the solenoid connector and connect to the following points, repeating test at each connection. Starter terminal of solenoid, battery terminal of solenoid, battery cable terminal at solenoid, starter relay and cable clamp at battery.

(b) A small change will occur each time a normal portion of the circuit is removed from the test. A definite change in voltmeter reading indicates that the last part eliminated in the test is at fault.

Maximum allowable voltage loss is as follows:

Battery insulated cable	.2 volt
Solenoid switch	.1 volt
Each connection	.0 volt

Replace faulty cables. Clean and tighten all connections.

STARTER GROUND CIRCUIT TEST

(1) Connect the voltmeter positive lead to starter housing and negative voltmeter lead to battery negative post.

(2) Crank engine with a remote control starter switch and observe voltmeter reading. Voltmeter reading should not exceed .2 volt. A reading of .2 volt or less indicates voltage loss in ground cable and connections are normal. If voltmeter reading is more than .2 volt, it indicates excessive voltage loss in starter ground circuit. Make the following tests to isolate point of excessive voltage loss, repeating test at each connection.

(a) Starter drive housing.

(b) Cable terminal at engine.

(c) Cable clamp at battery.

A small change will occur each time a normal por-

tion of the circuit is removed from test. A definite change in voltmeter reading indicates the last part eliminated in the test is at fault.

Maximum allowable voltage loss is as follows:

Battery ground cable	.0 volt
Engine ground circuit	.2 volt
Each connection	.1 volt

REMOVING STARTER

(1) Disconnect ground cable at battery.
(2) Remove starter cable at starter.
(3) Disconnect solenoid lead wire from solenoid.
(4) Remove bolts attaching starter to flywheel housing and remove starter.

TESTING STARTER MOTOR (Bench Test)

Free Running Test

(1) Place starter in a vise equipped with soft jaws and connect a fully-charged, 12 volt battery to starter as follows:
(2) Connect a test ammeter (100 amperes scale) and a carbon pile rheostat in series with battery positive post and starter terminal.
(3) Connect voltmeter (15 volt scale) across starter.
(4) Rotate carbon pile to full-resistance position.
(5) Connect battery cable from battery negative post to starter frame.
(6) Adjust rheostat until battery voltage shown on voltmeter reads 11 volts.
(7) Current draw should be 78 amperes maximum at 3800 minimum rpm.

Locked Resistance Test

(1) Install starter in test bench.
(2) Follow instructions of test equipment manufacturer and test the locked-resistance of the starter as follows:

With applied battery voltage adjusted to 4 volts; current draw should be as shown in specifications.

DISASSEMBLING THE STARTER

(1) Refer to Figure 1, remove through bolts and tap commutator end head from field frame.
(2) Remove thrust washers from armature shaft.
(3) Lift brush holder springs and remove brushes from brush holders.
(4) Remove brush plate (Fig. 2).
(5) Disconnect field coil leads at solenoid connector (Fig. 3).
(6) Remove solenoid attaching screws and remove solenoid and boot assembly (Fig. 4).
(7) Drive out overrunning clutch shift fork pivot pin (Fig. 5).
(8) Remove drive end pinion housing and spacer washer. Replace the pinion housing assembly, if the rubber seal (Fig. 1) is damaged (units so equipped).
(9) Note position of shifter fork on starter drive

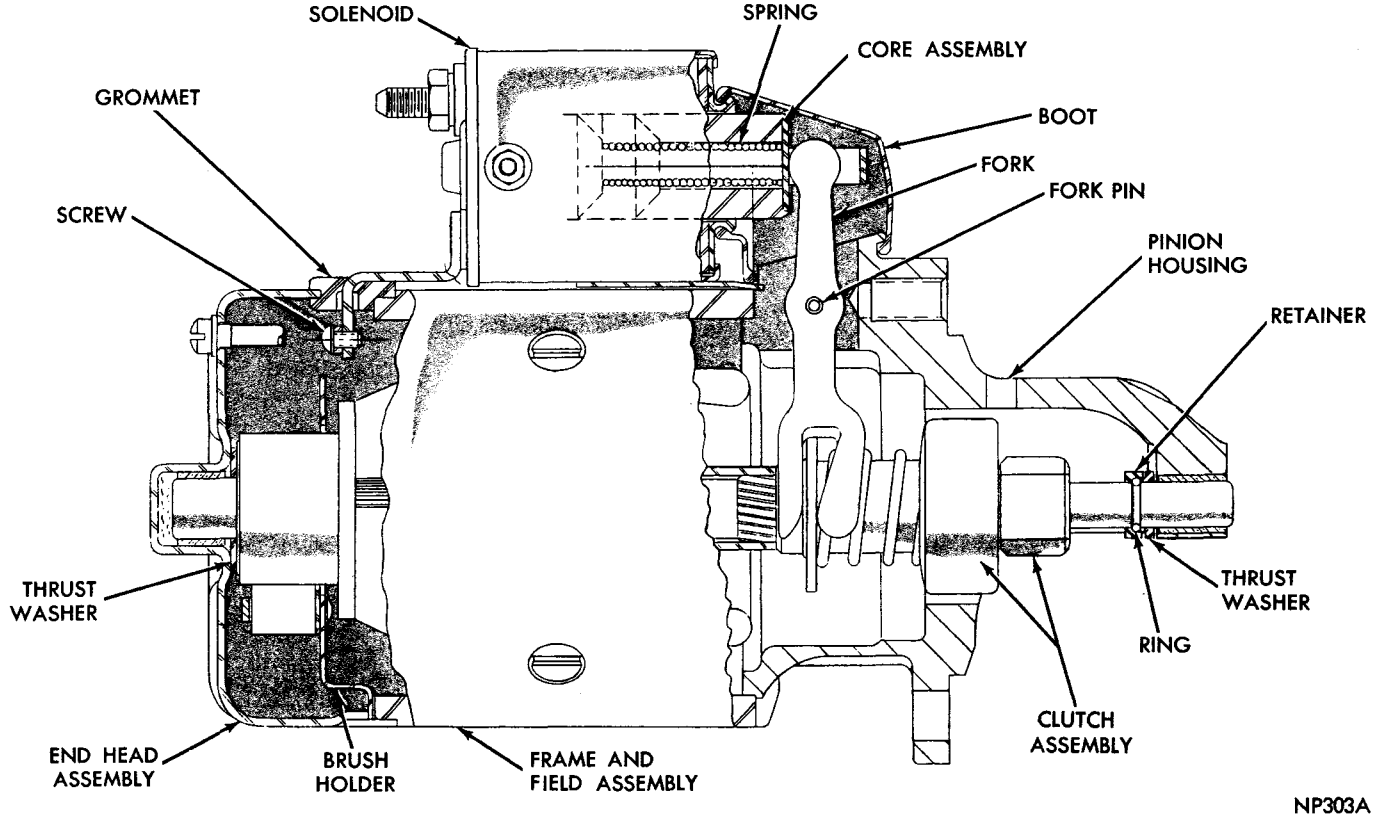


Fig. 1—Starter (Cross Section View)

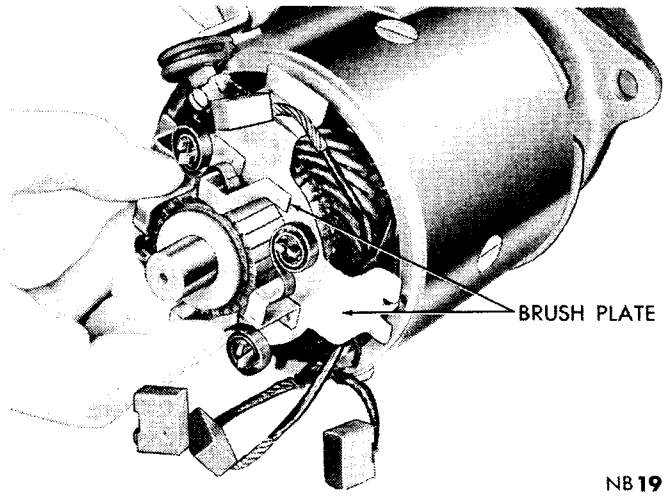


Fig. 2—Removing Brush Plate

and remove shifter fork (Fig. 6).

(10) Slide overrunning clutch pinion gear toward commutator end of armature, drive stop retainer toward clutch pinion gear to expose snap ring and remove snap ring.

(11) Slide overrunning clutch drive from armature shaft.

(12) If it is necessary to replace field coils, remove the ground brushes terminal attaching screw and raise the brushes with terminal and shunt wire up and away from field frame (Fig. 7). Remove pole shoe screws with special pole shoe impact screwdriver, Tool C-3475.

CLEANING THE STARTER PARTS

(1) Do not immerse parts in cleaning solvent. Immersing the field frame and coil assembly and/or armature will damage insulation. Wipe these parts with a cloth **only.**

(2) Do not immerse drive unit in cleaning solvent. Drive clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.

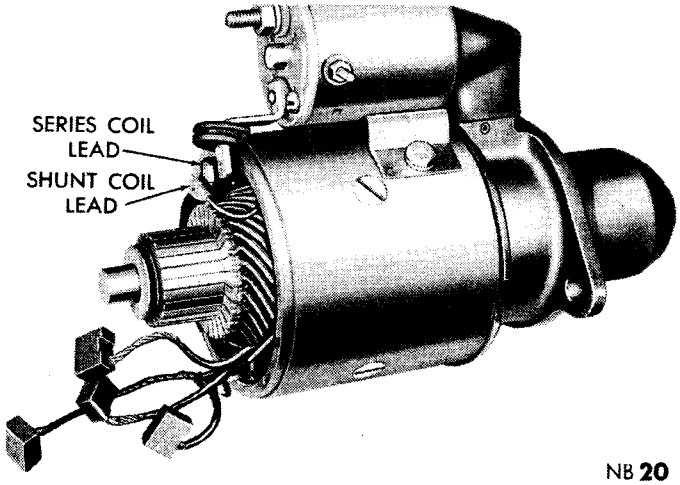


Fig. 3—Field Coil Leads Disconnected From Solenoid Connector

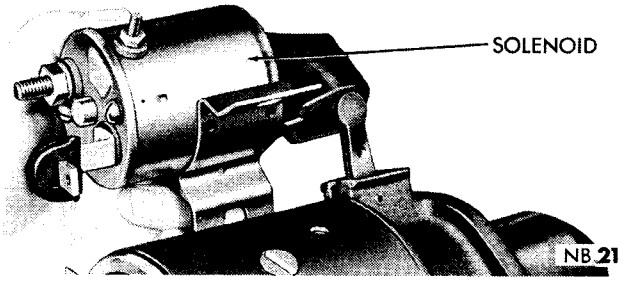


Fig. 4—Removing Starter Solenoid

(3) The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

BRUSHES AND SPRINGS—REPLACEMENT

(1) Brushes that are worn more than 1/2 the length of new brush, or are oil-soaked, should be replaced. Brushes and springs can be replaced after removing commutator end head and brush plate.

(2) Disengage brushes from brush holders and remove brush plate.

(3) Disconnect series coil and shunt field coil terminal at solenoid connector (Fig. 3).

(4) Remove ground brush terminal screw and carefully remove ground brush set to prevent breaking shunt field lead.

(5) Remove shunt field lead from old brush set to ensure as much length as possible.

(6) Remove field terminal plastic covering and remove old brushes. Use side cutters to break the weld by rolling the stranded wire off the terminal.

(7) Drill a .174 to .184 inch hole in the series coil terminal 3/16 of an inch from top of terminal to centerline of hole (Fig. 7). (Use a number 16 drill.)

CAUTION: Do not damage the field coil during the drilling operation.

(8) Attach insulated brush set to series field terminal with flat washer and number 8 self-tapping screw.

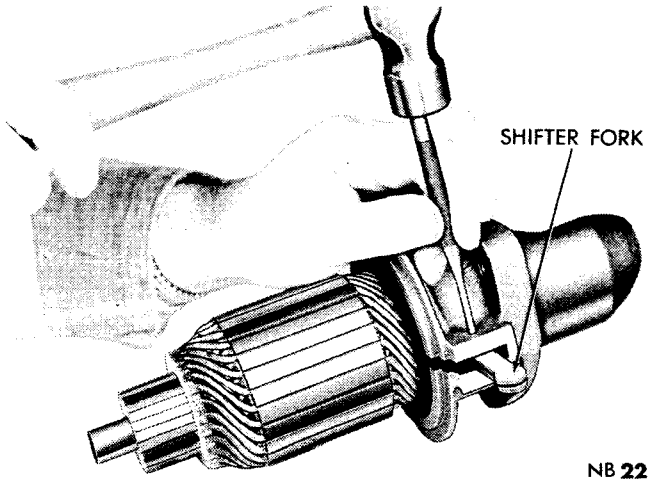


Fig. 5—Removing Shifter Fork Pivot Pin

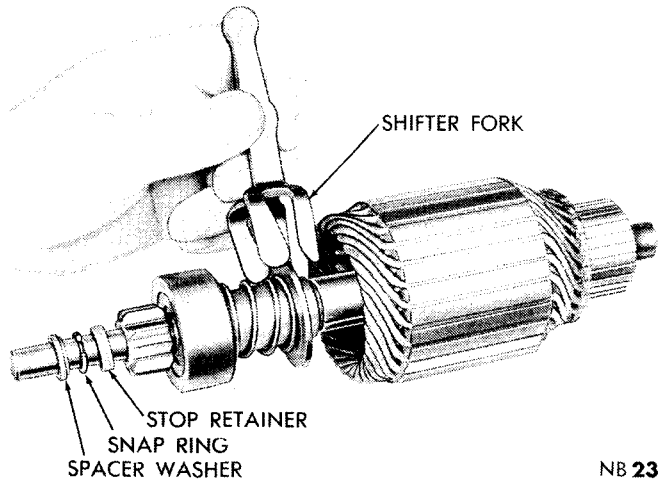


Fig. 6—Removing Shift Fork

(9) Attach shunt field lead to new ground brush set by making a loop around the terminal and soldering lead to the terminal with resin core solder.

(10) Attach ground brush terminal to field frame with attaching screw. Fold surplus shunt field lead back along the brush lead and secure with rubber insulating tape.

(11) Measure brush spring tension with a spring scale hooked under spring near brush end. Pull scale on a line parallel to edge of brush and take a reading just as spring end leaves the brush. Spring tension should be 32 to 36 ounces. Replace springs that do not meet specifications.

(12) Brush springs can be removed by spreading the retainers and disengaging the springs from retainer legs.

TESTING ARMATURE

Testing Armature for Short Circuit

Place armature in a growler (Fig. 8) and hold a thin steel blade parallel to the core and just above it, while slowly rotating armature in growler. A shorted armature will cause blade to vibrate and be attracted to the core. Replace shorted armature.

Testing Armature for Ground

Touch armature shaft and the end of each commutator bar with a pair of test lamp prods (Fig. 9). If lamp lights, it indicates a grounded armature. Replace grounded armature.

Testing Commutator Runout, Refacing

Place armature in a pair of "V" blocks and check runout with a dial indicator. Check both shaft and commutator. A bent shaft requires replacement of armature.

When commutator runout exceeds .003 inch, commutator should be refaced. Remove only a sufficient amount of metal to provide a smooth, even surface.

TESTING FIELD COILS FOR GROUND

(1) Remove through bolts and commutator end frame.

(2) Remove brushes from brush holders and remove brush plate (Fig. 2).

(3) Disconnect field lead wires at solenoid connector and separate field leads to make sure they do not touch solenoid connector (Fig. 3).

(4) Remove ground brushes attaching screw, and raise brushes with terminal and shunt wire up and away from field frame.

(5) Touch one probe of test lamp to series field coil lead and other probe to field frame (Fig. 10). Lamp should not light.

(6) Touch one probe to shunt field coil lead and other probe to field frame (Fig. 11).

If lamp lights in either test (5) or (6), field coils are grounded. If field coils are grounded, test each coil separately after unsoldering connector wires. Replace grounded field coils.

(7) Touch each of the brush holders with one test probe, while holding other test probe against brush ring. Two brush holders that are 180 degrees apart should cause test lamp to light as they are intentionally grounded. The other two brush holders (Fig. 12)

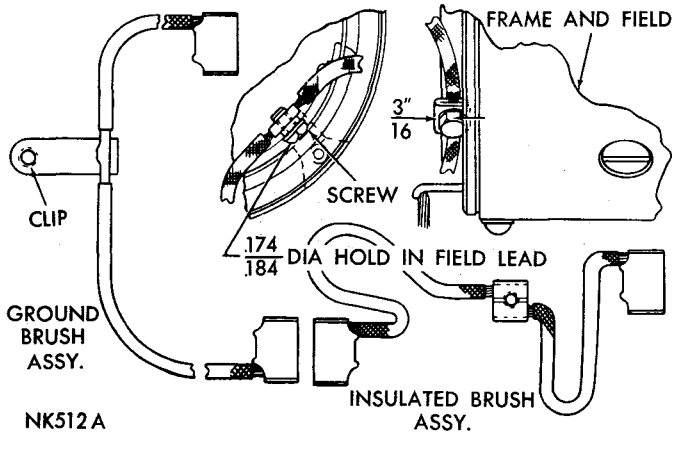


Fig. 7—Brush Replacement

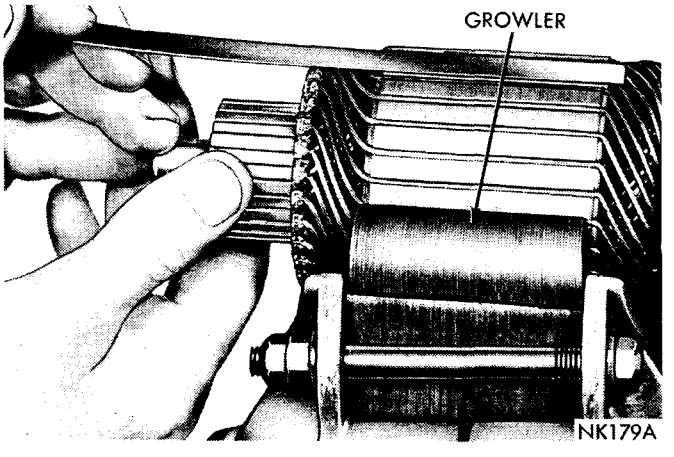


Fig. 8—Testing Armature For Short

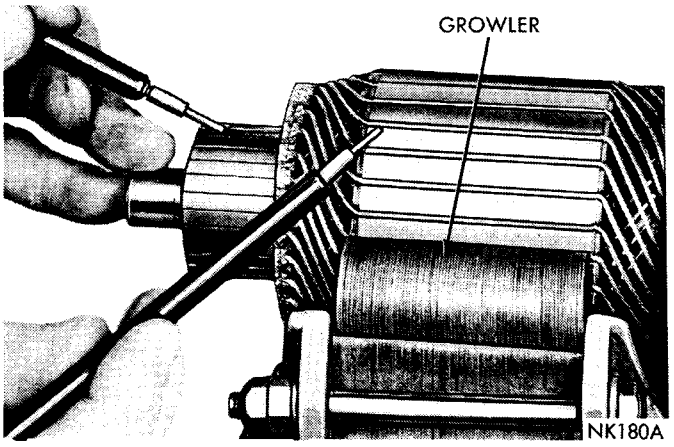


Fig. 9—Testing Armature For Ground

should not cause lamp to light when tested as they are insulated. If insulated brush holders cause lamp to light when tested, it indicates that brush holders on brush ring are grounded. Replace brush ring assembly if brush holders are grounded.

REPLACING FIELD COILS

A pole shoe impact screwdriver Tool C-3475 should be used to remove and install field coils to prevent damage to the pole shoe screws and for proper tightening.

Pole shoes that are loose and not properly seated may cause armature core to rub on pole shoes. This will decrease starter efficiency and damage armature core. **Scribe a mark in the pole shoe and field frame to ensure pole shoes are assembled in their original position.**

SERVICING BUSHINGS

Inspect armature shaft bearing surfaces and bushings for wear by placing armature core in a vise equipped with soft jaws. Do not squeeze tightly. Try the commutator end frame, drive end frame, and armature support bushings for wear by placing them on

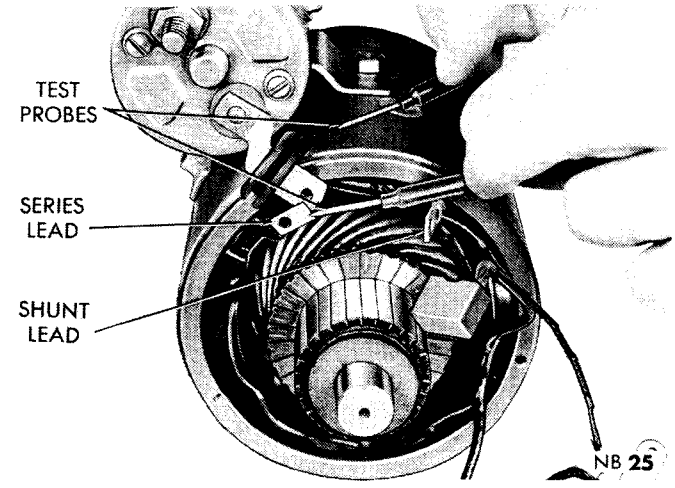


Fig. 10—Testing Series Coil For Ground

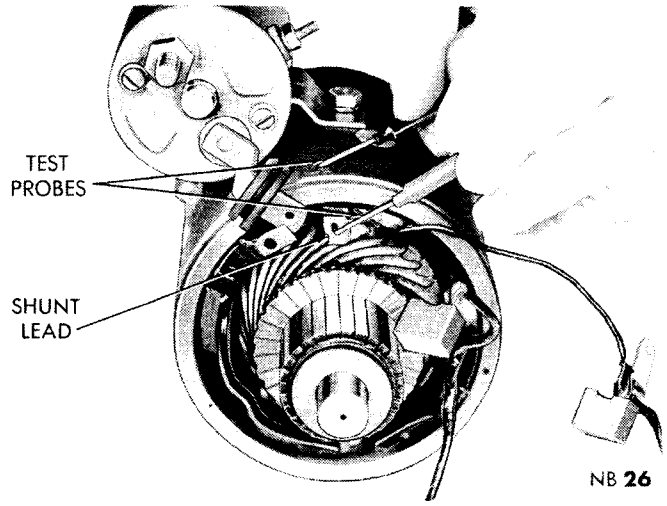


Fig. 11—Testing Shunt Coil For Ground

shafts and checking for side play. Replace commutator end frame and bushing assembly if bushing is worn. Replace drive end bushing if worn. The bushing should be well soaked in SAE 30 engine oil before it is installed. New pre-sized bushings should be pressed into the housing until bushing is flush with inner side of housing to provide proper clearance. Use Tool C-3944 to remove and install bushing.

SERVICING DRIVE UNIT

Place drive unit on armature shaft and, while holding armature, rotate the pinion. Drive pinion should rotate smoothly in one direction (not necessarily easily), but should not rotate in opposite direction. If drive unit does not function properly, or if pinion is worn or burred, replace drive unit.

ASSEMBLING THE STARTER (Refer to Figs 1 and 13)

(1) Lubricate armature shaft and splines with SAE 10-W or SAE-30 oil.

(2) Install starter drive, stop collar (retainer), lock ring and spacer washer.

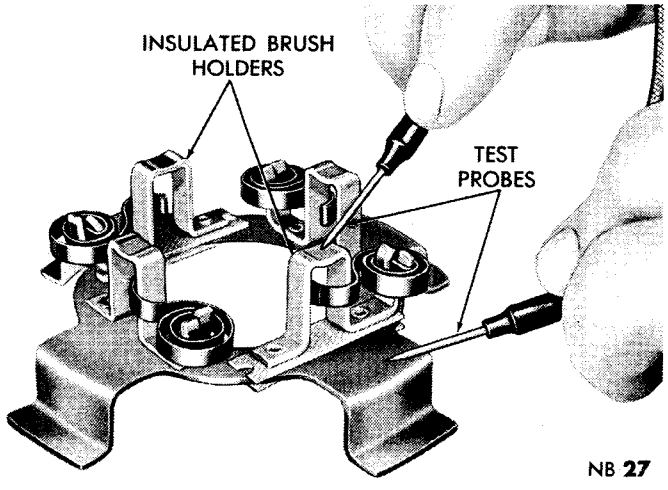


Fig. 12—Testing Insulated Brush Holder For Ground

(3) Install shifter fork over starter drive spring retainer washer with narrow leg of fork toward the commutator (Fig. 6). This is important, if the fork is not properly positioned starter gear travel will be restricted causing a lockup in the clutch mechanism.

(4) Install drive end (pinion) housing on armature shaft, indexing shifting fork with slot in drive end housing.

(5) Install shifter fork pivot pin (Fig. 5).

(6) With clutch drive, shifter fork, and pinion housing assembled to the armature, slide armature into field frame until pinion housing indexes with slot in field frame.

(7) Install solenoid and boot assembly (Fig. 4). Tighten bolts to 60-70 inch pounds.

(8) Connect field coil leads at solenoid connector (Fig. 3). **Be sure terminals do not touch field frame.**

(9) Install brush holder ring (Fig. 2) indexing tang of ring in hole of field frame.

(10) Position brushes in brush holders. Be sure field coil lead wires are properly enclosed behind brush holder plate and do not interfere with brush operation.

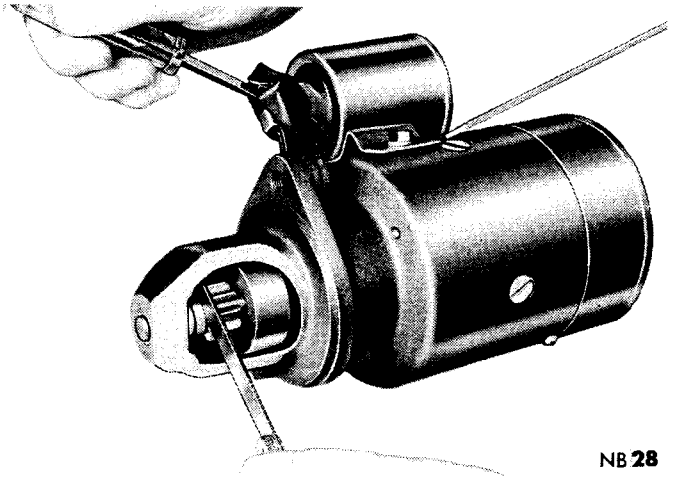
(11) Install thrust washers on commutator end of armature shaft to obtain .010 inch minimum end play.

(12) Install commutator end head.

(13) Install through bolts and tighten to 40 to 50 inch-pounds.

ADJUSTING STARTER DRIVE GEAR (PINION) CLEARANCE

(1) Place starter assembly in a vise equipped with soft jaws and tighten vise sufficiently to hold starter.



NB28

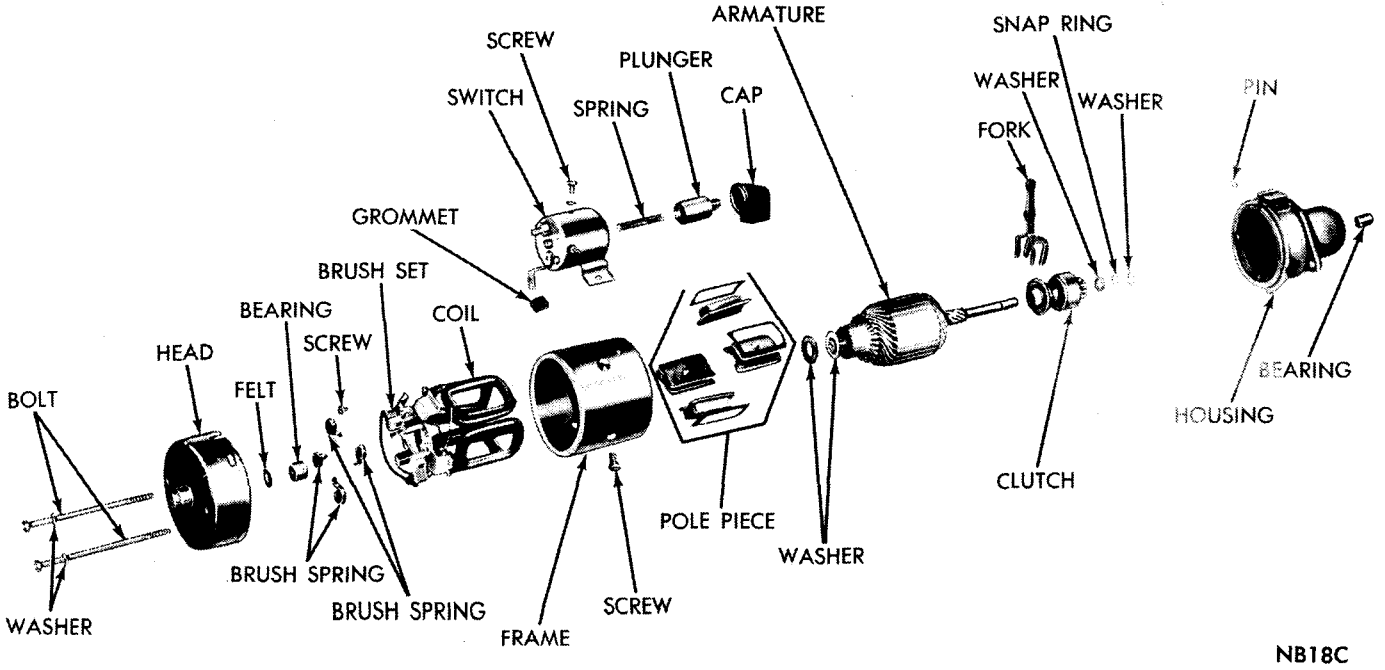
Fig. 14—Checking Starter Drive Pinion Clearance

Place a wedge or screwdriver between bottom of solenoid and starter frame to eliminate all deflection in the solenoid when making the pinion clearance test.

(2) Push in on solenoid plunger cage (Fig. 14) (NOT THE FORK LEVER) until plunger bottoms.

(3) Measure clearance between end of pinion and pin stop with plunger seated and pinion pushed toward the commutator end. Clearance should be 1/8 inch. Adjust for proper clearance by loosening solenoid attaching screws and move solenoid fore and aft as required.

(4) Test starter operation under a "Free Running Test."



NB18C

Fig. 13—Starter Exploded View

INSTALLING THE STARTER

(1) Before installing the starter, be sure starter and flywheel housing mounting surfaces are free of dirt and oil. These surfaces must be clean to make good electrical contact.

(2) Position starter to flywheel housing removable seal (if removed).

(3) Install starter from beneath the engine.

(4) Tighten attaching bolts securely.

(5) Attach the wires to solenoid switch and starter terminal.

(6) Install battery ground cable and test operation of starter for proper engine cranking.

REDUCTION GEAR STARTER MOTOR

INDEX

GENERAL INFORMATION

The starter has a 3.5 to 1 reduction gear set built into the Starter assembly which is housed in an aluminum die casting, Fig. 1. The starter utilizes a solenoid shift device, the housing of the solenoid is integral with the starter drive end housing.

The starter system consists of two separate circuits. The supply circuit which supplies heavy current to power the starter motor and the control circuit which controls the starter solenoid.

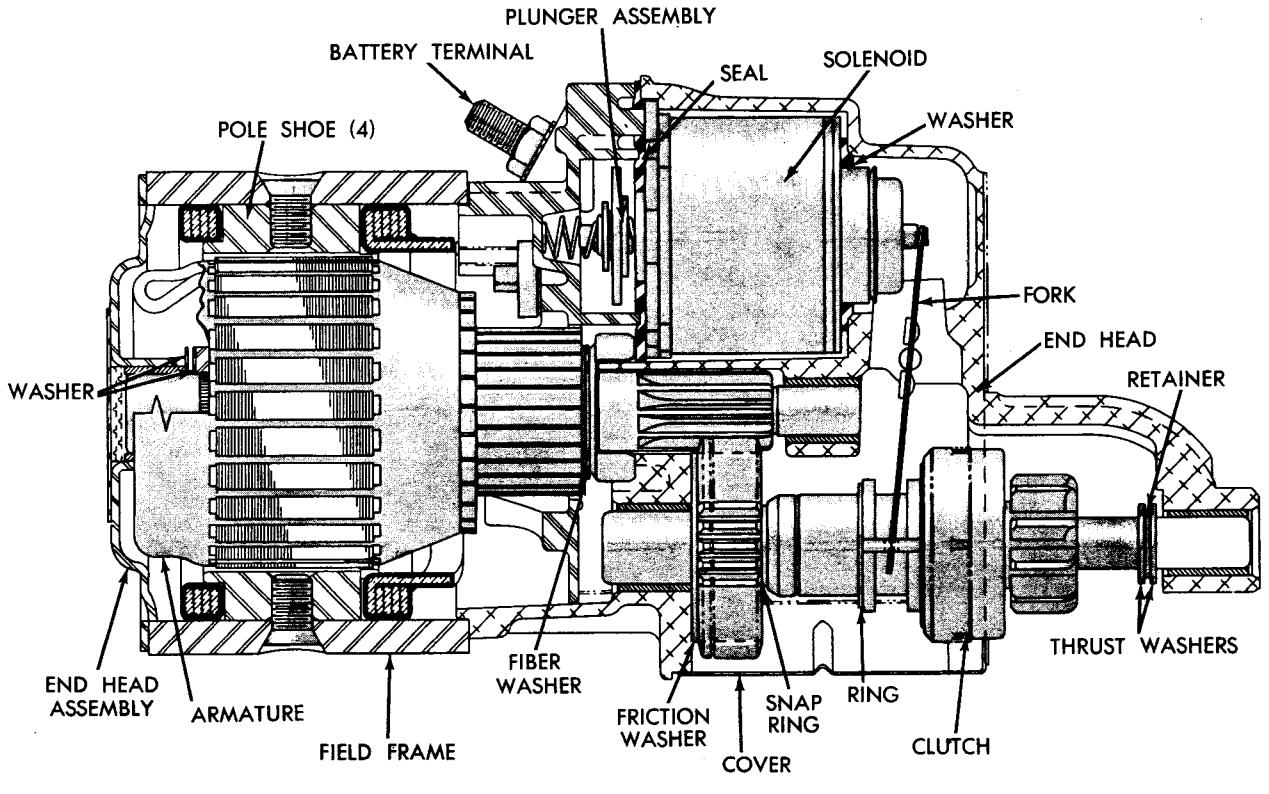
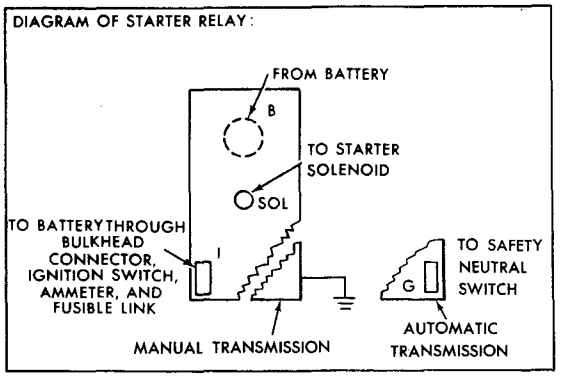


Fig. 1—Starter (Cross Section View)

REDUCTION GEAR STARTER DIAGNOSIS



CAUTION: BEFORE TESTING STARTER PLACE TRANSMISSION IN PARK OR NEUTRAL POSITION, SET BRAKES AND DISCONNECT WIRING CONNECTOR FROM ELECTRONIC IGNITION CONTROL UNIT.

TEST BATTERY. (SPECIFIC GRAVITY MUST BE AT LEAST 1.225)

CONDITION 1 STARTER FAILS TO OPERATE (NO STARTER RELAY CLICK)

TEST SOLENOID AND STARTER. CONNECT REMOTE STARTER SWITCH BETWEEN RELAY TERMINALS "B" AND "SOL" ACTUATE SWITCH (STARTER SHOULD OPERATE)

STARTER DOES NOT OPERATE

SOLENOID DOES NOT OPERATE OR "CLATTERS"

- LOOSE BULKHEAD, AMMETER, OR IGNITION SWITCH CONNECTIONS
- LOOSE OR CORRODED BATTERY TERMINALS, CABLES, OR CONNECTIONS
- LOOSE OR DISCONNECTED WIRE FROM RELAY "SOL" TERMINAL TO SOLENOID
- FAULTY SOLENOID*

SOLENOID OPERATES—STARTER MOTOR DOES NOT OPERATE

- LOOSE OR CORRODED BATTERY TERMINALS, CABLES, OR CONNECTIONS
- SOLENOID SWITCH CONTACTS BURNED
- FAULTY STARTER*

STARTER OPERATION NORMAL

TEST RELAY CIRCUIT. CONNECT REMOTE STARTER SWITCH BETWEEN RELAY TERMINALS "B" AND "I". ACTUATE SWITCH. (STARTER SHOULD OPERATE)

STARTER OPERATION NORMAL

- LOOSE BULKHEAD CONNECTOR
- OPEN WIRE FROM RELAY "B" TERMINAL TO IGNITION STARTER SWITCH "BAT" TERMINAL
- FUSIBLE LINK BURNED
- OPEN WIRE FROM IGNITION SWITCH TO RELAY "I" TERMINAL
- LOOSE CONNECTIONS AT AMMETER
- IGNITION SWITCH CONTACTS BURNED OR CORRODED

STARTER DOES NOT OPERATE

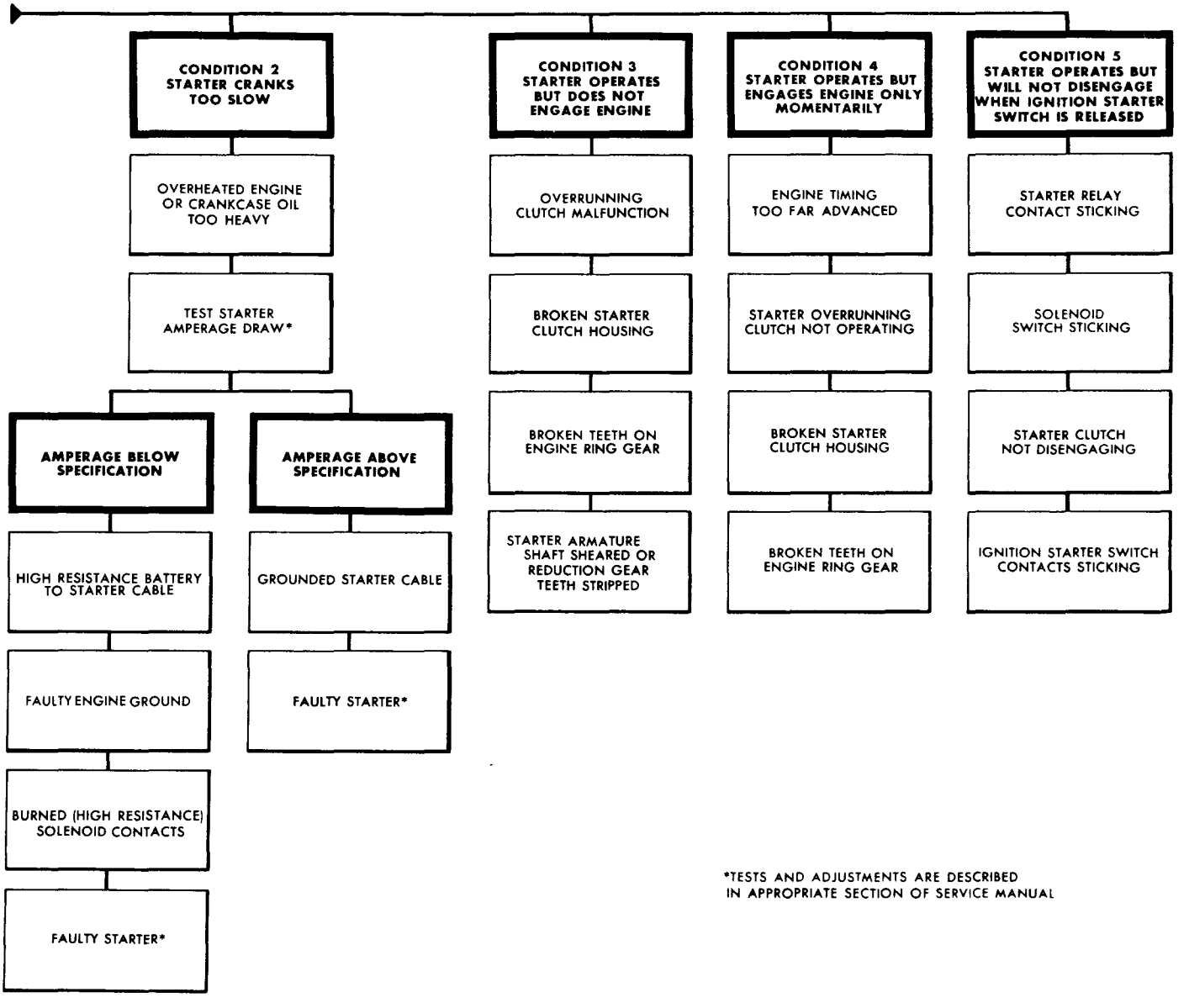
- CONNECT JUMPER WIRE BETWEEN RELAY "G" TERMINAL AND GROUND
- REPEAT RELAY CIRCUIT TEST (STARTER SHOULD OPERATE)

STARTER DOES NOT OPERATE

- FAULTY RELAY

STARTER OPERATES

- AUTOMATIC TRANSMISSION: FAULTY TRANSMISSION LINKAGE ADJUSTMENT. FAULTY NEUTRAL START SWITCH OR WIRING



*TESTS AND ADJUSTMENTS ARE DESCRIBED IN APPROPRIATE SECTION OF SERVICE MANUAL

SERVICE PROCEDURES

SUPPLY CIRCUIT

The supply circuit consists of the battery, battery cables, clamps, and connectors. In checking this circuit always begin with a visual inspection of the battery post and cable clamps.

Test the battery to make sure it is in good condition, minimum specific gravity reading of 1.225, temperature corrected and see that the battery passes the "High Rate Discharge Test" shown in the "Battery" section of this group.

If the connections and battery are good, proceed as follows in checking the supply circuit:

Starter Current Draw Test

Engine should be up to operating temperature before performing this test. Extremely heavy oil or a tight engine will increase starter amperage draw.

(1) Connect a reliable Battery-Starter Tester per instructions of its manufacturer.

(2) Turn the variable resistor control knob tester to the off or zero position.

(3) Connect a remote starter jumper per instructions of its manufacturer.

(4) Crank the engine long enough to read the cranking voltage on voltmeter and note.

CAUTION: Do not crank engine excessively or the starter may overheat and damage will occur.

(5) Without cranking the engine; turn the variable resistor control knob on the tester until the voltmeter reads the cranking voltage previously noted. When this point is reached you can read the equivalent of the starter current draw on the ammeter. Refer to "Specifications" for current draw limits.

Circuit Resistance Test

High resistance in the supply circuit wiring or connections will cause the starter motor to crank the engine at a slower rate than normal. These connections can be tested for high resistance with the use of a reliable voltmeter which will indicate tenths of a volt. **Also, all tests are made without separating or disconnecting any connection. Voltmeter leads are to be connected across each of the connections shown in the Circuit Resistance Chart. While the engine is being cranked note the reading of the voltmeter. If any of the readings are higher than the specified limits there is high resistance in that connection and it must be cleaned or repaired. After doing so repeat test at the connection.**

CONTROL CIRCUIT

The starter control circuit consists of the starter, solenoid, starter relay, ignition switch, safety neutral switch (automatic transmission), and all their wiring and connections.

Testing procedures for these components are as follows and should be followed in order as described.

CAUTION: Before performing any test disconnect coil wire from distributor cap and secure to a good ground to prevent engine from starting.

Starter Solenoid Test

Connect a heavy jumper wire on the starter relay between the battery and solenoid terminals. If the engine cranks the starter solenoid is good. Proceed to the starter relay test.

If the engine does not crank, check the wiring and connectors from the relay to the starter for loose or corroded connections, particularly at the starter terminals. Repeat test and if the engine still fails to crank the trouble is within the starter and it must be removed for repairs.

CIRCUIT RESISTANCE CHART

Connection	Voltage Lead Connection		Voltmeter Reading
	Positive	Negative	
Postive post on battery to cable clamp	To post	To clamp	0
Negative post on battery to cable clamp	To post	To clamp	0
Battery ground cable to engine block	To bolt	To cable connector	Not to exceed 0.2 volts
Battery Cable to Starter	To Battery Positive Post	To Battery Terminal on Starter	Not to exceed 0.2 volts
Starter housing to ground	To starter housing	To negative post on battery	Not to exceed 0.2 volts

Starter Relay Test (After starter solenoid test)

Automatic Transmission

Position transmission gear selector in neutral or park position. Connect a jumper wire on the starter relay between the battery and ignition terminals. If the engine cranks the starter relay is good.

If the engine does not crank connect a second jumper wire on the starter relay between the ground terminal and to a good ground. Repeat test and if engine cranks the starter relay is good, however, the transmission linkage is out of adjustment or the safety neutral switch is defective. If the engine does not crank the starter relay is defective and must be replaced.

Manual Transmission

Connect a jumper wire on the starter relay between the battery and ignition terminals. If the engine cranks the starter relay is good.

If the engine does not crank connect a second jumper wire on the starter relay to a good ground. Repeat test and if engine cranks the starter relay is good, however, there is a poor ground between relay housing and its mounting surface. If the engine does not crank the starter relay is defective and must be replaced.

Ignition Switch Test

After testing the starter solenoid and relay and they prove to be in good working order, the trouble is within the ignition switch or its wiring or connections. Check all connections for corrosion or for being loose, particularly at the bulkhead connector on firewall and at the main wiring harness multiple connector to ignition switch harness multiple connector under the instrument panel.

REMOVING STARTER

(1) Disconnect ground cable at battery.
(2) Remove cable at starter.
(3) Disconnect solenoid lead wires at solenoid terminals.
(4) Remove one stud nut and one bolt attaching starter to flywheel housing, slide automatic transmission oil cooler tube bracket off the stud (if so equipped) and remove the starter. **Do not damage flywheel housing seal.**

TESTING STARTER (Bench Test)

Free Running Test

(1) Place starter in a vise and connect a fully charged, 12 volt battery to starter as follows:
(a) Connect a test ammeter (100 amperes scale) and a carbon pile rheostat in series with battery positive post and starter terminal.
(b) Connect a voltmeter (15 volt scale) across starter.
(c) Rotate carbon pile to full-resistance position.
(d) Connect battery cable from battery negative post to starter frame.
(e) Adjust the rheostat until battery voltage shown on voltmeter reads 11 volts. Amperage draw should be as shown in specifications.

Locked-Resistance Test

(1) Install starter in a test bench.
(2) Follow instructions of test equipment manufacturers and test starter against following specifications. With applied battery voltage adjusted to 4 volts amperage draw should be as shown in specifications.

DISASSEMBLING STARTER

(1) Remove through bolts and end head assembly, (Fig. 2).
(2) Carefully remove armature from gear housing and field frame assembly, by pulling outwards, (Fig. 3).

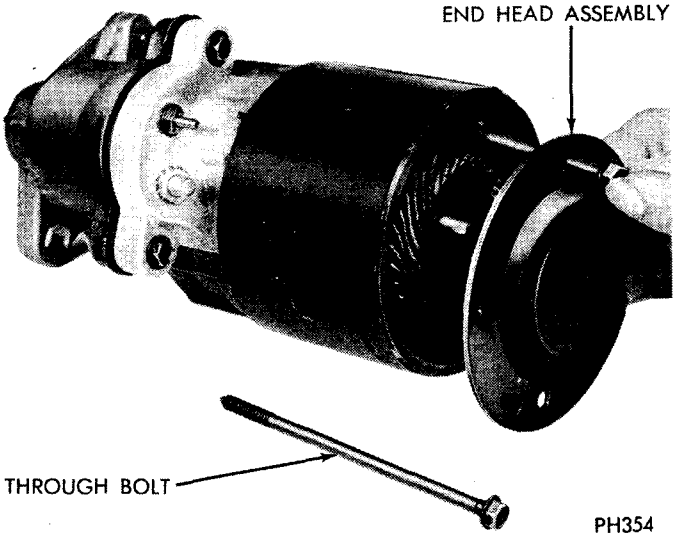


Fig. 2—Removing Through Bolts and End Head Plate

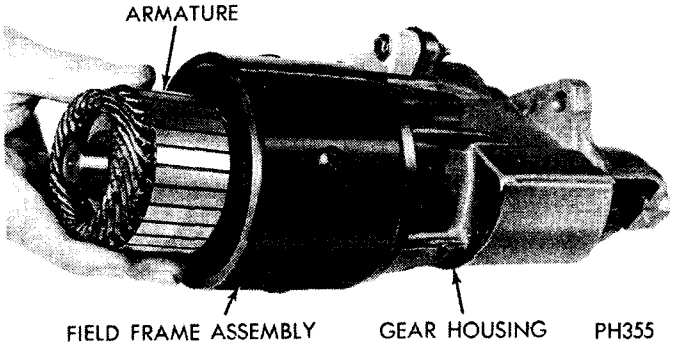


Fig. 3—Removing Armature

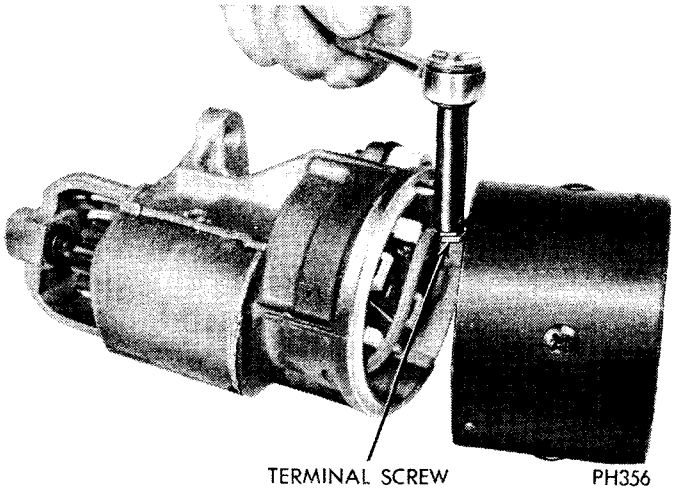


Fig. 4—Removing Terminal Screw

(3) Carefully pull field frame assembly from gear housing far enough to expose terminal screw.

(4) Remove terminal screw. It may be necessary to support terminal by placing finger behind it, (Fig. 4).

(5) Remove field frame assembly.

(6) Remove nut, steelwasher, and sealing washer from solenoid terminal, (Fig. 5).

(7) Unwind solenoid lead wire from brush terminal, (Fig. 6).

(8) Remove nuts attaching solenoid and brush holder plate assembly to gear housing, (Fig. 7).

(9) Remove solenoid and brush plate assembly from gear housing, (Fig. 8).

(10) Remove screws attaching solenoid to brush plate, (Fig. 9).

(11) Remove solenoid from brush plate. (Fig. 10).

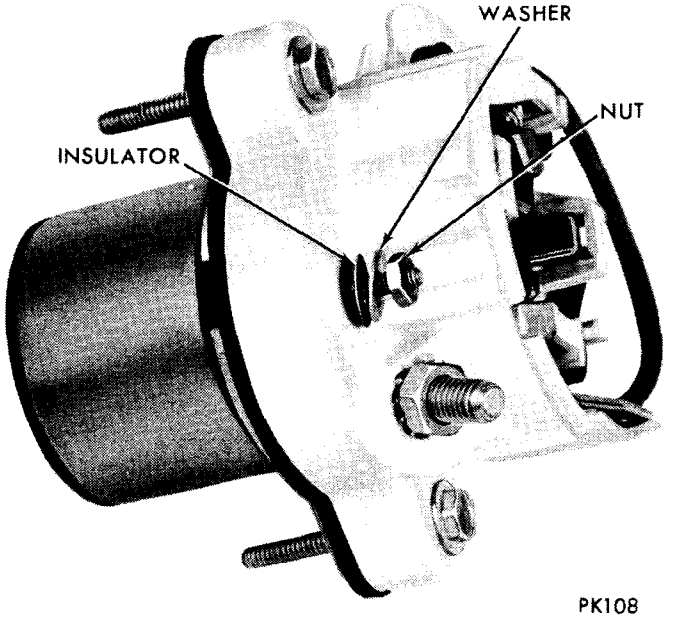


Fig. 5—Removing Nuts and Washers from Solenoid Terminal

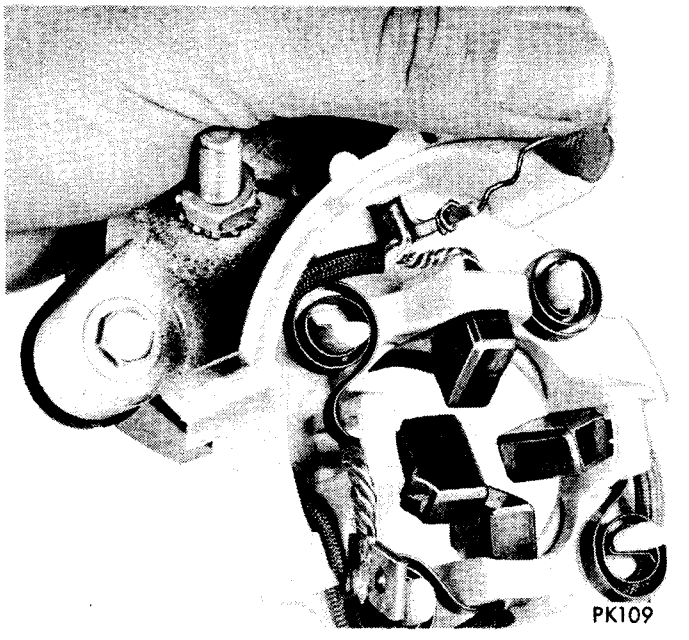


Fig. 6—Unwinding Solenoid Lead Wire

(12) On brush plate remove nut from battery terminal and remove terminal, (Fig. 11).

(13) Remove solenoid contact and plunger assembly from solenoid, (Fig. 12).

(14) Remove return spring from inside of solenoid moving core, (Fig. 13).

(15) Remove dust cover from gear housing (Fig. 14).

(16) Release retainer clip that positions driven gear on pinion shaft (Fig. 15).

CAUTION: Retainer is under tension and a cloth should be placed over the retainer to prevent it from springing away after removal.

(17) Remove pinion shaft "C" clip, (Fig. 16).

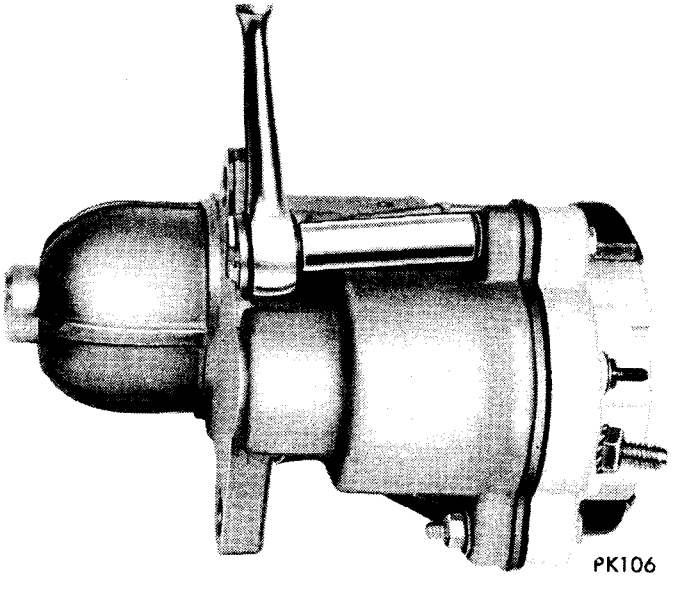


Fig. 7—Removing Solenoid and Brush Plate Assembly Attaching Nuts

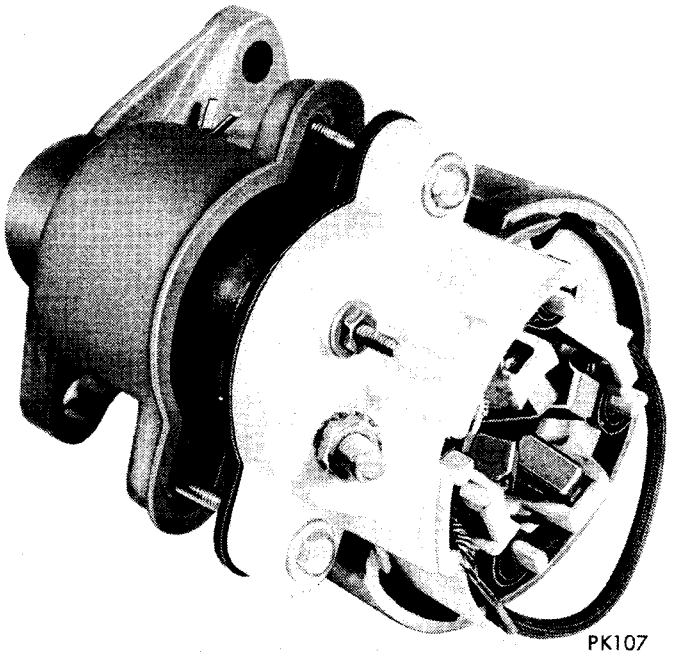


Fig. 8—Removing Solenoid and Brush Plate Assembly From Gear Housing

(18) Push pinion shaft towards rear of housing (Fig. 17) and remove retainer ring and thrust washers, clutch and pinion assembly, with the two shift fork nylon actuators as an assembly (Fig. 18).

(19) Remove driven gear and friction washer.

(20) Pull shifting fork forward and remove solenoid moving core (Fig. 19).

(21) Remove shifting fork retainer pin (Fig. 20) and remove clutch shifting fork assembly.

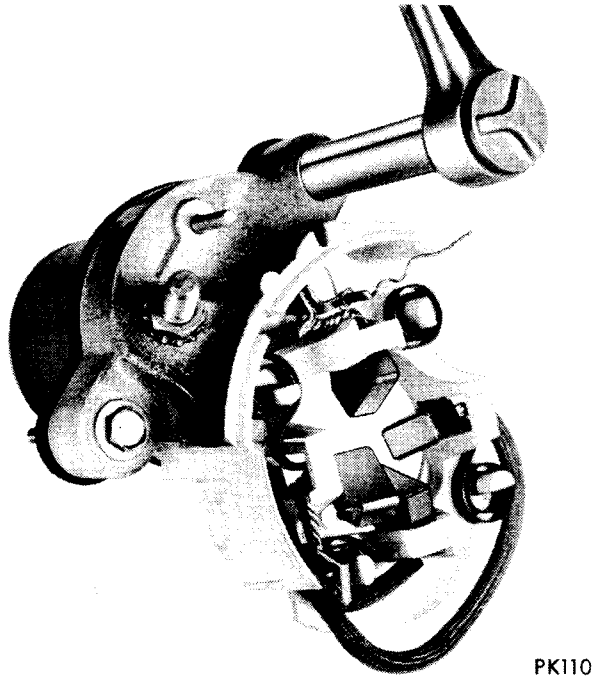


Fig. 9—Removing Solenoid Attaching Screws

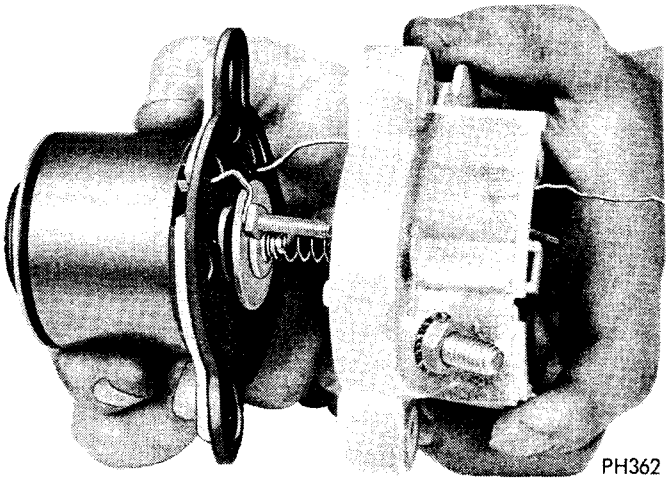


Fig. 10—Removing Solenoid

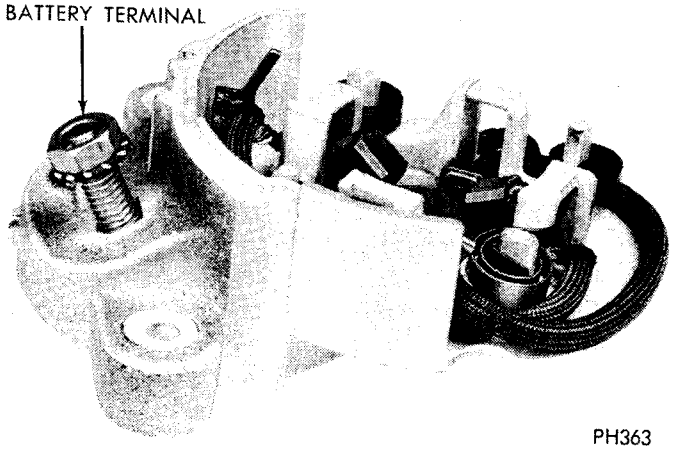


Fig. 11—Removing Battery Terminal Nut and Washer

CLEANING STARTER PARTS

(1) Do not immerse parts in cleaning solvent. Immersing field frame and coil assembly and/or armature will damage insulation. Wipe these parts with a clean cloth **only.**

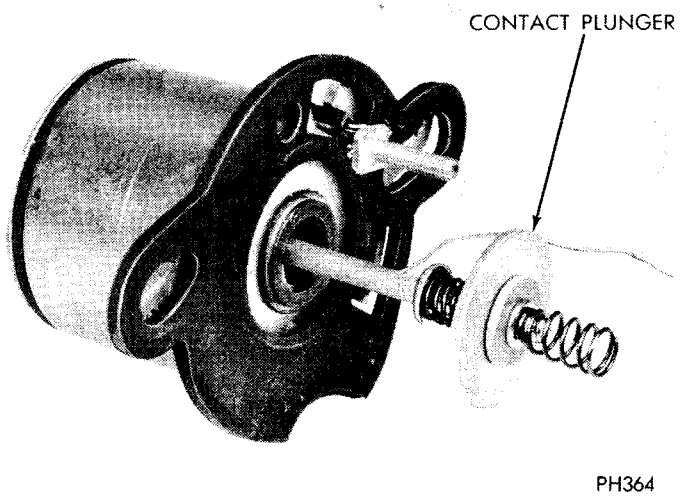


Fig. 12—Removing Contact and Plunger

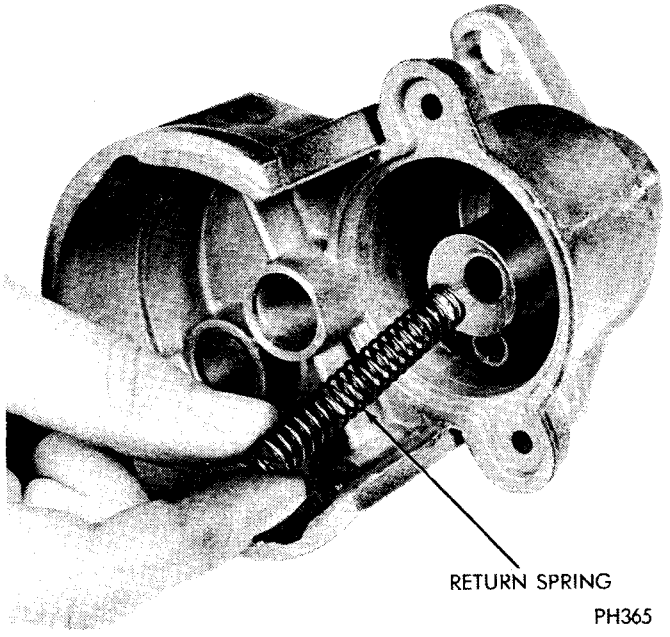


Fig. 13—Removing Return Spring

(2) Do not immerse clutch unit in cleaning solvent. The clutch is pre-lubricated at the factory and solvent will wash lubricant from the clutch.

(3) The starter-clutch outer housing and pinion gear may be cleaned with a cloth moistened with cleaning solvent and wiped dry with a clean dry cloth.

(4) Clean terminal contacts and contactor with crocus cloth.

(5) Thoroughly clean outside area of brush plate to remove all oil and dirt.

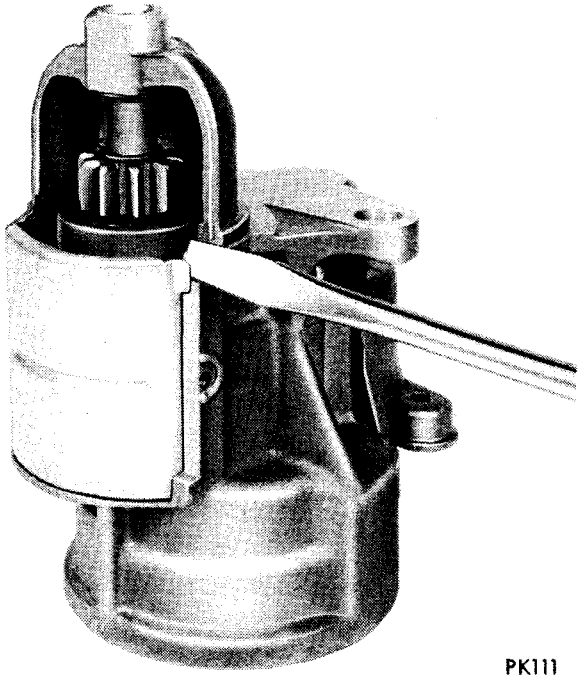


Fig. 14—Removing Dust Cover

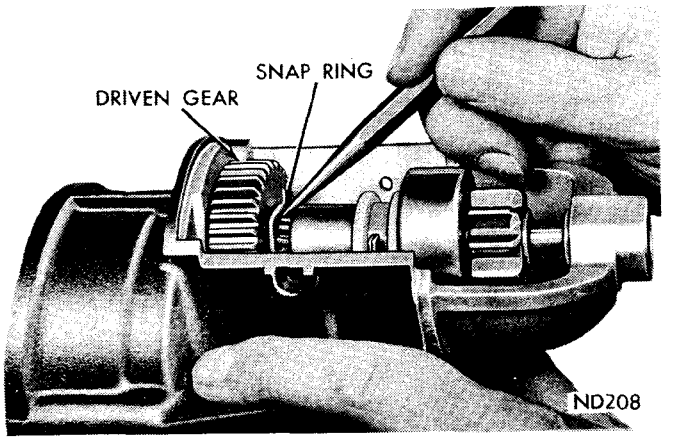


Fig. 15—Removing Driven Gear Snap Ring

REPLACEMENT OF BRUSHES AND SPRINGS

(1) Brushes that are worn more than 1/2 the length of new brushes, or are oil-soaked, should be replaced.

(2) When **soldering** the solenoid lead, make a strong low resistance connection using a high temperature solder and resin flux. **Do not use acid** or acid core solder.

(3) Measure brush spring tension with a spring scale hooked under the spring near the end. Pull

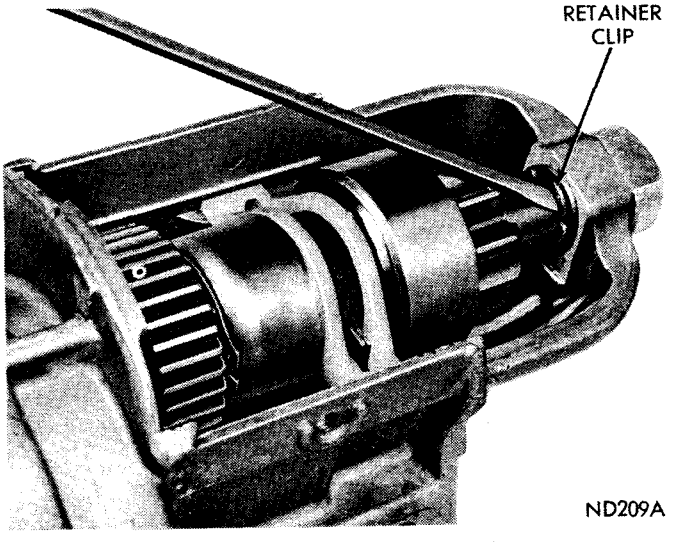


Fig. 16—Removing Pinion Shaft "C" Clip

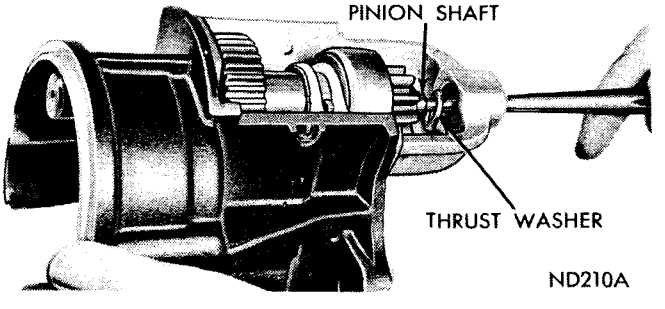


Fig. 17—Removing Pinion Shaft

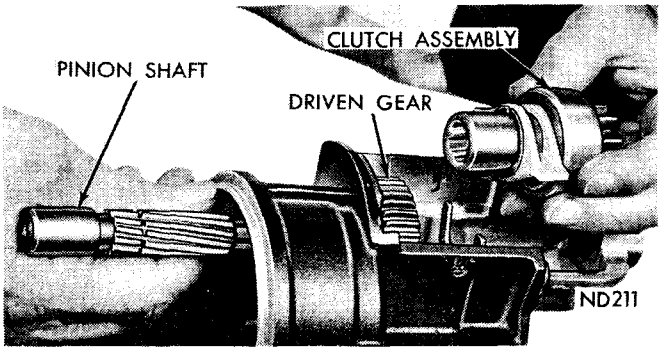


Fig. 18—Removing Clutch Assembly

scale on a line parallel to the edge of brush and take a reading just as spring leaves brush. Spring tension should be 32 to 36 ounces. Replace springs that do not meet specifications.

TESTING ARMATURE

Testing Armature for Short Circuit

Place armature in growler and hold a thin steel blade parallel to the core and just above it, while slowly rotating armature in growler. A shorted armature will cause blade to vibrate and be attracted to the core. Replace armature if shorted.

Testing Armature for Ground

Contact armature shaft and each of the commutator riser bars with a pair of test lamp test probes. If lamp lights, it indicates a grounded armature. Replace grounded armature.

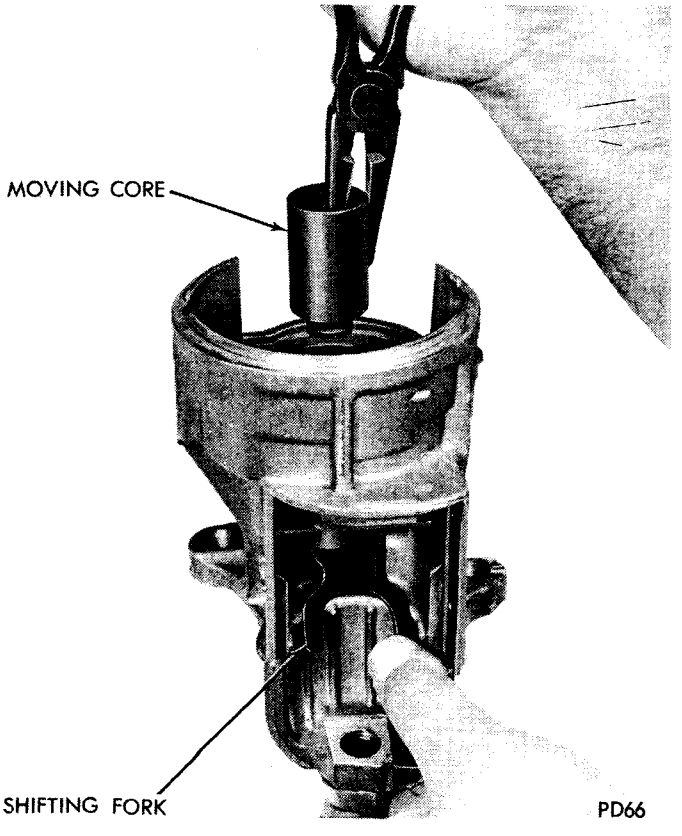


Fig. 19—Removing Solenoid Core

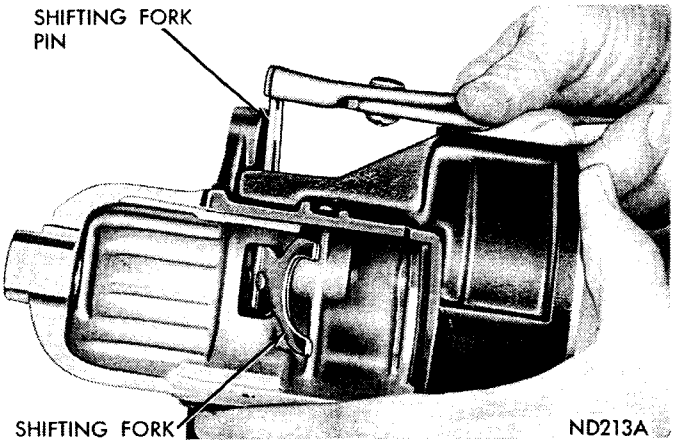


Fig. 20—Removing Shifting Fork Pin

Testing Commutator Run-Out, and Refacing

Place armature in pair of "V" blocks and measure runout with dial indicator. Measure both shaft and commutator. A bent shaft requires replacement of armature. When commutator runout exceeds .004 inch, commutator should be refaced. Remove only a sufficient amount of metal to provide a smooth, even surface.

TESTING FIELD COILS FOR GROUND

(1) Remove field frame assembly from starter.

(2) Carefully drill out the rivet attaching the field coil ground leads to field frame.

(3) Insulate field coil leads from field frame.

(4) Test for ground using a 110 volt test lamp. Touch one probe of test lamp to field coil lead and other probe to field frame. Lamp should not light.

If lamp lights, it indicates that field coils are grounded and require replacement.

REPLACING THE FIELD COILS

The field coils are not serviced as a separate item. They are serviced in the Field Frame Assembly.

SERVICING STARTER BUSHINGS

Inspect armature shaft bearing, pinion shaft surfaces and bushings for wear. Try the bushings for wear by inserting the shafts and test for side play. **Pre-sized starting motor bushings are available as service bushings. Use Tool C-3944 to remove old bushings and install the new. No burnishing or reaming is required to fit pre-sized bushings.**

The C-3944 Tool and its adaptors are designed to service all of the gear reduction motor bushings with the exception of the end head bushing. End head bushing and end head are serviced as an assembly.

Remove and install bushings (Figs. 21, 22, and 23).

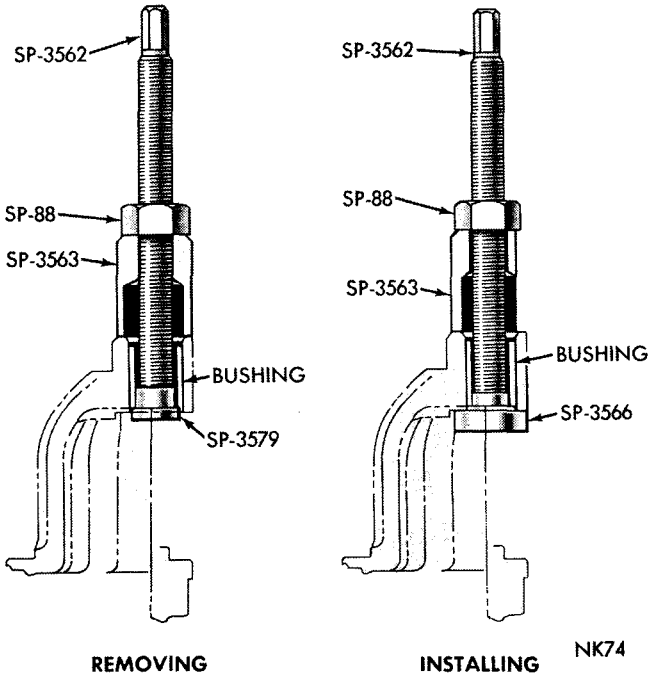


Fig. 21—Replacing Pinion Housing End Bushing

SERVICING STARTER CLUTCH UNIT

Do not immerse starter clutch unit in a cleaning solvent. Starter clutch is pre-lubricated at the factory and a solvent will wash lubricant from the clutch.

The starter clutch outer housing and pinion gear may be cleaned with a cloth moistened with a cleaning solvent and wiped dry with a clean dry cloth.

Rotate the pinion. Pinion gear should rotate smoothly in one direction (not necessarily easily), but

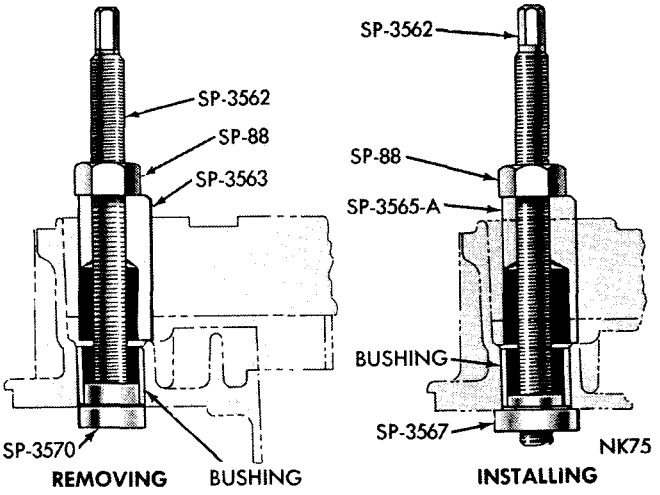


Fig. 22—Replacing Pinion Housing Drive Shaft Bushing

should not rotate in opposite direction. If starter clutch unit does not function properly, or pinion is worn, chipped or burred, replace starter clutch unit.

ASSEMBLING STARTER (Fig. 24)

The shifter fork consists of two spring steel plates assembled with two rivets. There should be approximately 1/16 inch side movement as shown in Figure 25 to insure proper pinion gear engagement. Lubricate between the plates sparingly with SAE 10 engine oil.

(1) Position shifter fork in drive housing and install shifting fork retainer pin. One tip of pin should be straight, other tip should be bent at a 15 degree angle away from the housing. The fork and retainer

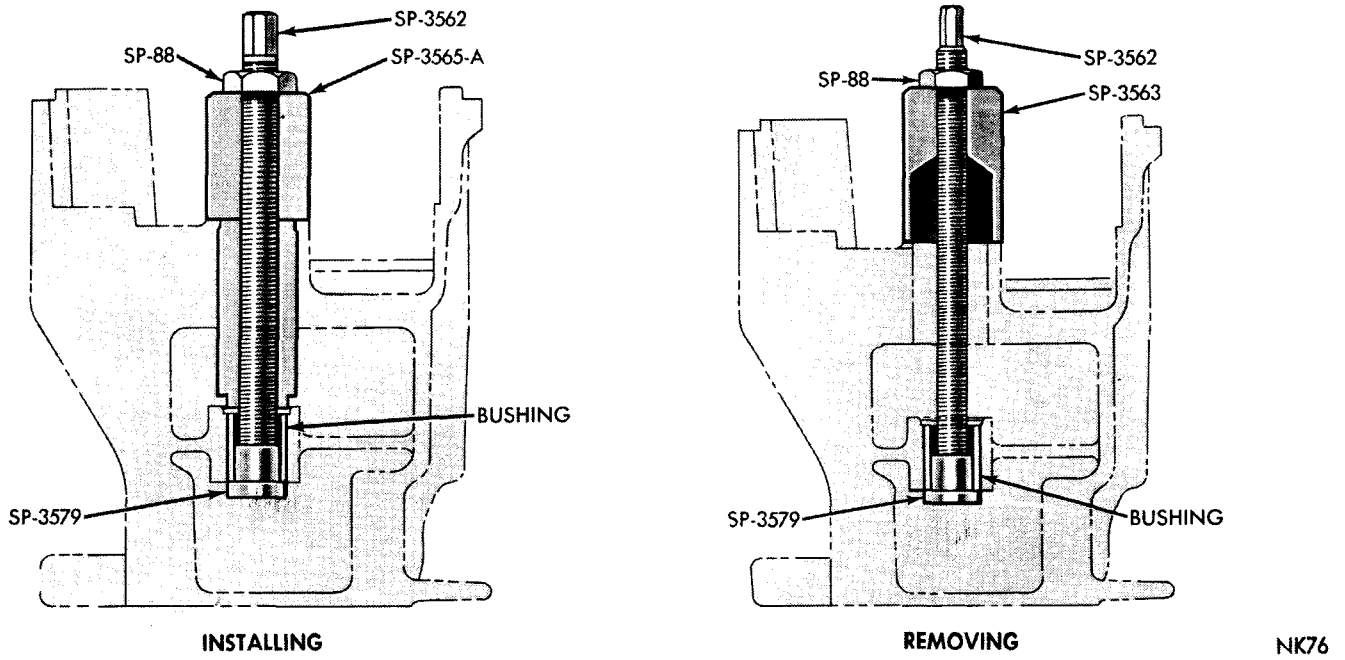


Fig. 23—Replacing Pinion Housing Armature Shaft Bushing

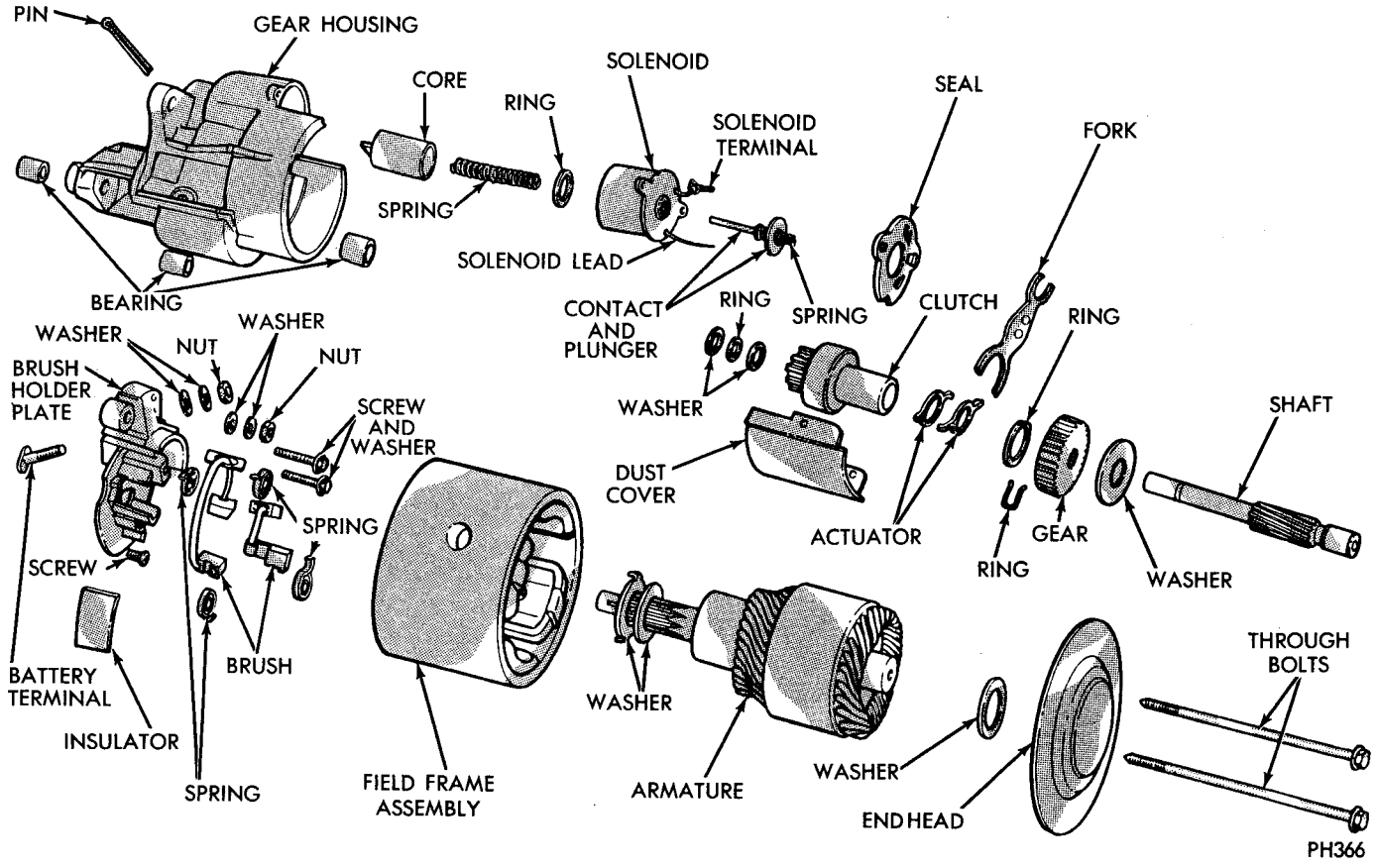


Fig. 24—Starter (Exploded View)

pin should operate freely after bending tip of pin.

(2) Install solenoid moving core and engage shifting fork (Fig. 19).

(3) Enter pinion shaft into drive housing and install friction washer and drive gear.

(4) Install clutch and pinion assembly, thrust washer, retaining and thrust washer (Fig. 18).

(5) Complete installation of pinion shaft, engaging shifting fork with clutch actuators. Figures 25 and 26 show correct relation of parts at assembly. **The friction washer must be positioned on shoulder of splines of the pinion shaft before driven gear is positioned.**

(6) Install driven gear snap ring (Fig. 15).

(7) Install pinion shaft "C" clip, (Fig. 16).

(8) Install starter solenoid return spring into bore of movable core.

Inspect condition of starter solenoid switch contacting washer, if top of washer is burned from arcing, disassemble contact switch plunger assembly and reverse the washer.

(9) Install solenoid contact plunger assembly into solenoid.

Make sure contact spring is positioned on the shaft of the solenoid contact plunger assembly.

(10) Assemble battery terminal stud in brush holder.

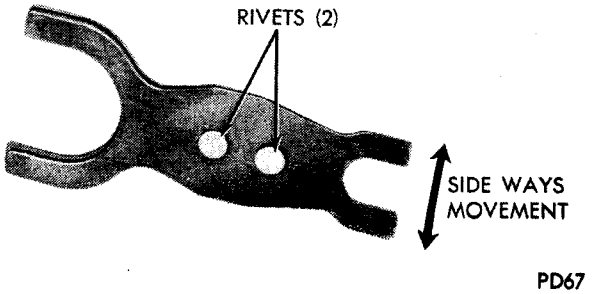


Fig. 25—Shifter Fork Assembly

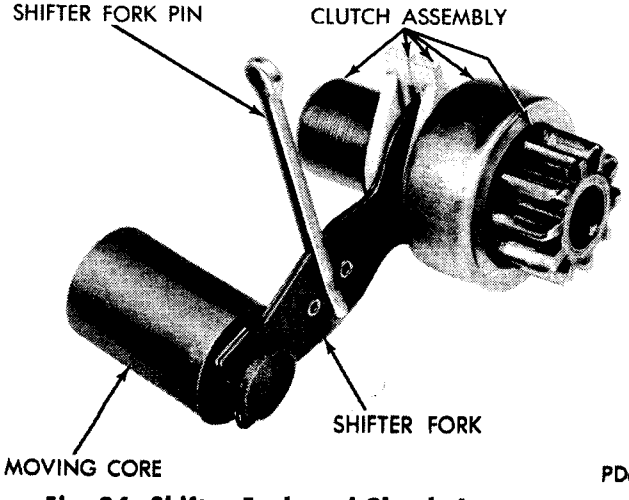


Fig. 26—Shifter Fork and Clutch Arrangement

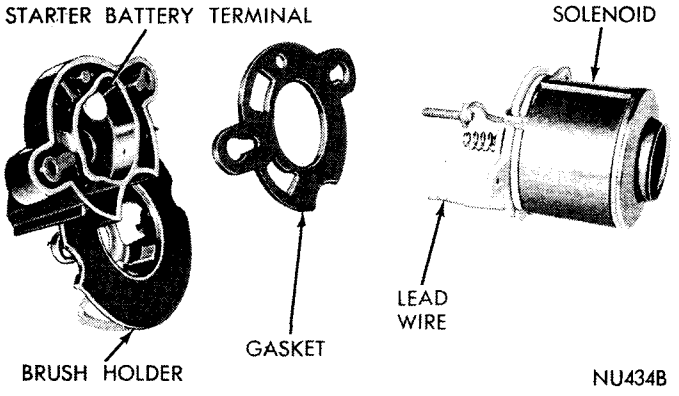


Fig. 27—Assembling Solenoid to Brush Holder Plate

Inspect condition of the contacts in brush holder plate. If contacts are badly burned, replace brush holder with brushes and contacts as an assembly.

(11) Position seal on brush holder plate.

(12) Enter solenoid lead wire through hole in brush holder (Fig. 27) and install solenoid stud, insulating washer, flat washer and nut.

(13) Wrap solenoid lead wire tightly around brush terminal post as shown in Figure 28 and solder securely with a high temperature resin core solder and resin flux.

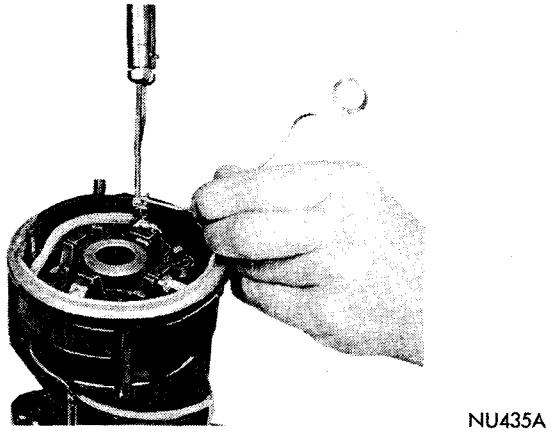


Fig. 28—Soldering Solenoid Lead to Brush Terminal

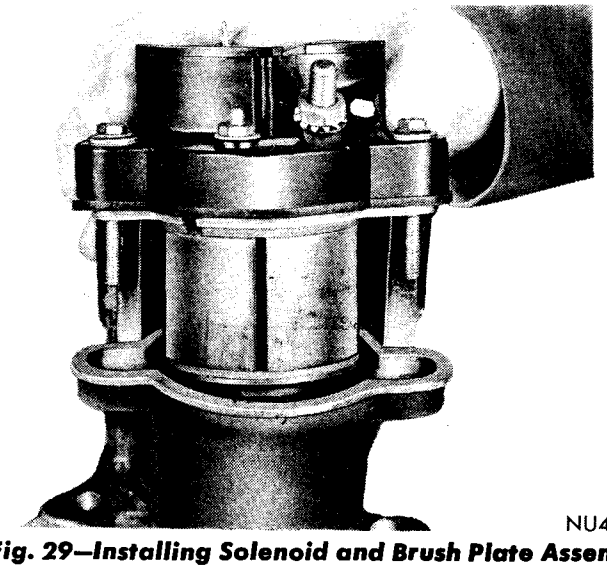


Fig. 29—Installing Solenoid and Brush Plate Assembly

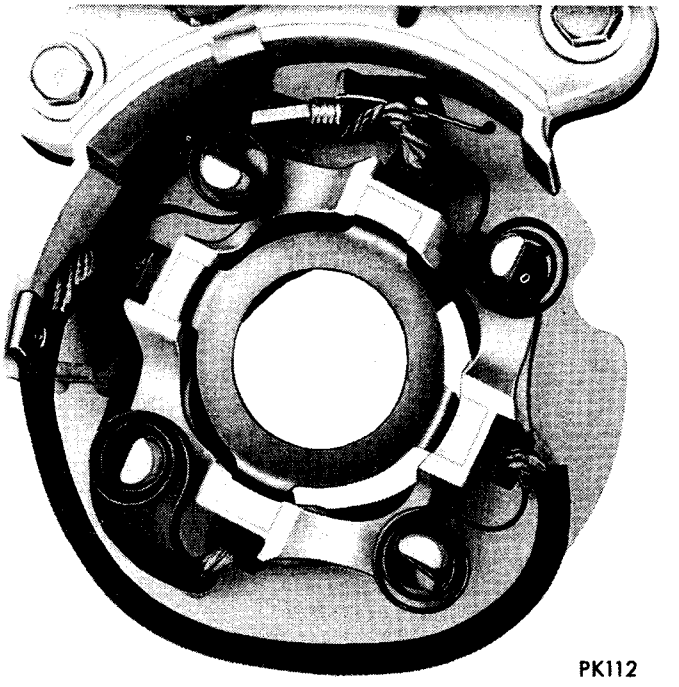


Fig. 30—Positioning Armature Thrust Washer to Brushes

(14) Install brush holder to solenoid attaching screws.

(15) Carefully enter solenoid coil and brush plate assembly into bore of gear housing and position brush plate assembly into starter gear housing (Fig. 29) and install housing attaching nuts. Tighten securely.

(16) Position brushes with armature thrust washer as shown in Figure 30. This will hold brushes out and facilitate proper installation of armature.

(17) Install brush terminal screw (Fig. 4).

(18) Position field frame to the exact position on gear housing and enter armature into field frame and starter gear housing (Fig. 31) carefully engaging splines of shaft with reduction gear by rotating armature slightly to engage the splines.

(19) Install thrust washer on armature shaft.

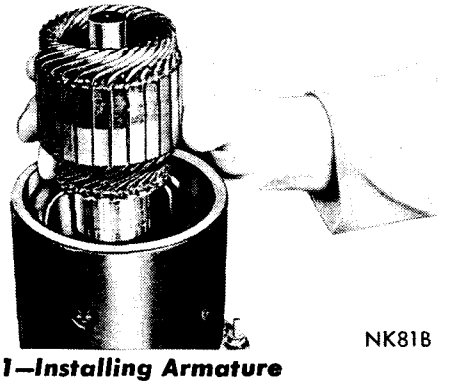


Fig. 31—Installing Armature

(20) Position starter end head assembly and install through bolts. Tighten through bolts securely.

INSTALLING STARTER

(1) Before installing the starter, make sure starter and flywheel housing mounting surfaces are free of dirt and oil, to insure a good electrical contact.

(2) Position starter to flywheel housing **removable seal** (if removed).

(3) Install the starter, washer and bolt, the automatic transmission oil cooler tube bracket (if so equipped) and washer and nut. **When tightening attaching bolt and nut be sure to hold the starter pulled away from the engine to insure proper alignment.**

(4) Attach wire at solenoid switch terminal, and cable to starter terminal.

(5) Connect battery ground cable and test operation of the starter for proper engine cranking.

ALTERNATOR AND ELECTRONIC VOLTAGE REGULATOR

INDEX

GENERAL INFORMATION

Conventional Alternator

The alternator (Figs. 1 and 2) has six (6) built-in silicon rectifiers, that convert AC current into DC current. Current at the "output" terminal is DC.

The main components of the alternator are the rotor, stator, rectifiers, the end shields and the drive pulley.

100 Amp High Capacity Alternator

This alternator (Fig. 3) has twelve (12) built in silicon rectifiers, that convert AC current into DC current. Current at the "Output" terminal is DC.

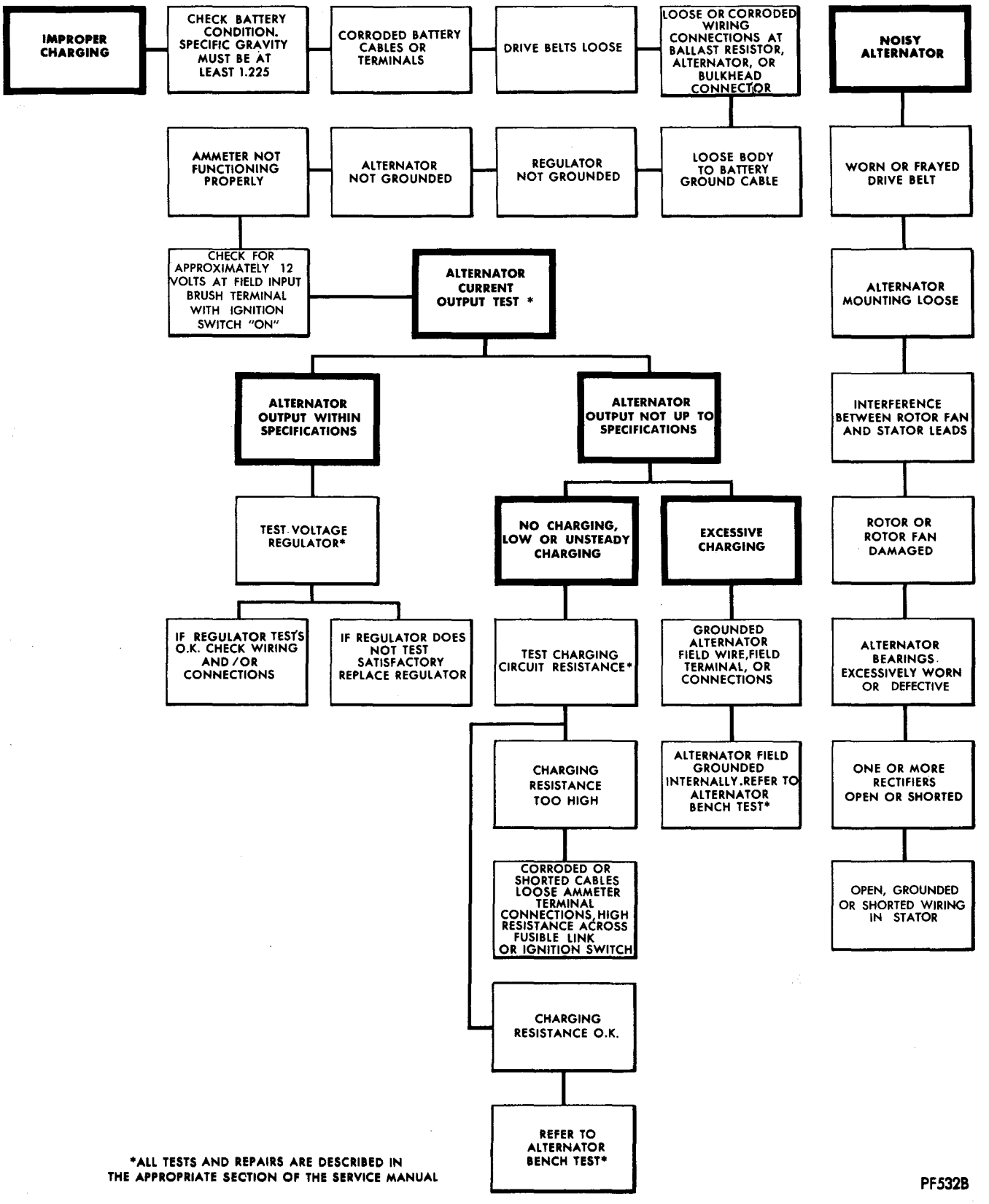
The main components are the rotor, stator, rectifiers, end shields and pulley.

The alternator is Chrysler designed and manufactured and is capable of supplying 100 amperes. The alternator is installed with three polypropylene oxide rubber isolation mounts. This type of rubber has good heat resistance and low temperature qualities combined with good sound and vibration characteristics.

REGULATOR OPERATION

The electronic voltage regulator is a device that regulates the vehicle electrical system voltage by limiting the output voltage that is generated by the alternator. This is accomplished by controlling the amount of current that is allowed to pass through the alternator field winding. The electronic voltage regulator has no moving parts and requires no adjustment after it is set internally at the factory. There are several semiconductor components, transistors and diodes, in the regulator plus some resistors and a capacitor. Basically the electronic regulator operates as a voltage sensitive switch. There is a large transistor which is placed in series with the alternator field winding and a control circuit that senses the system voltage and turns the large transistor on and off as required. As alternator speed and electrical system load conditions change, the control circuit is turning the transistor on and off many times per second most of the time that the vehicle is in operation. The only time that the transistor is not turning on and off rapidly is during low engine speed operation when high electrical loads are present and require that the alternator field be in the on state continuously. One other important feature of the electronic regulator is the ability of its control circuit to vary the regulated system voltage up or down as the temperature changes. This provides the best charging conditions for the battery throughout the seasons of the year.

ALTERNATOR AND VOLTAGE REGULATOR DIAGNOSIS



*ALL TESTS AND REPAIRS ARE DESCRIBED IN THE APPROPRIATE SECTION OF THE SERVICE MANUAL

PF532B

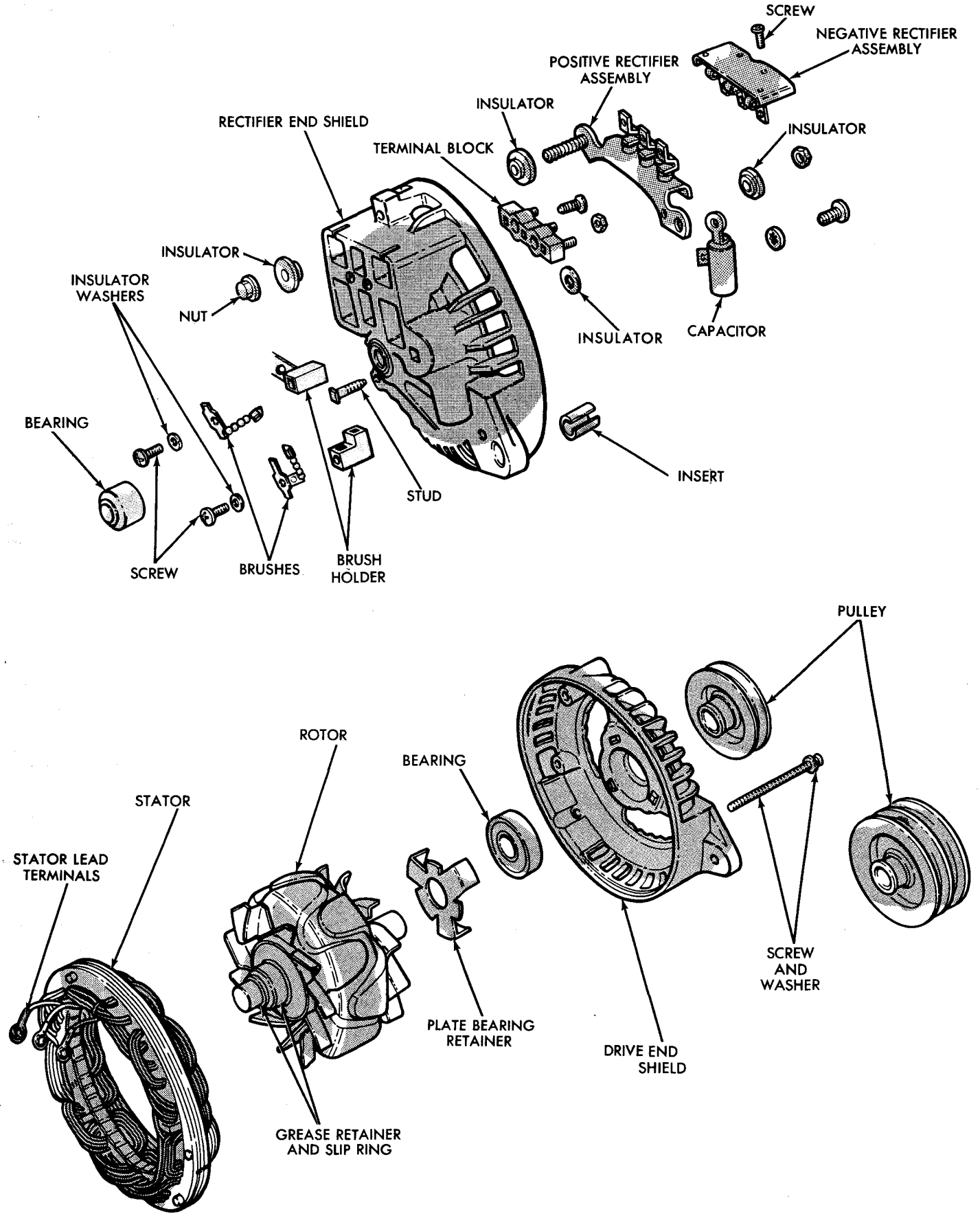


Fig. 1—Alternator (Exploded View)

SERVICE PROCEDURES

CHARGING CIRCUIT RESISTANCE TEST

The charging circuit resistance test will show the amount of "voltage drop" between the alternator output terminal wire and battery. For the charging circuit resistance test:

(1) Disconnect the battery ground cable.

(2) Disconnect the "Bat" lead at the alternator output terminal.

(3) Connect a 0-100 ampere scale DC ammeter in series between the alternator "Bat" terminal and the disconnected "Bat" lead wire (Fig. 4).

(4) Connect the positive lead of a test voltmeter to the disconnected "Bat" lead wire. Connect the negative lead of the test voltmeter to battery positive post.

(5) Disconnect the green (Regulator) field lead wire from the alternator.

(6) Connect a "jumper" lead from the alternator field terminal to ground.

(7) Connect an engine tachometer and reconnect the battery ground cable.

(8) Connect a variable carbon pile rheostat to the battery terminals. **Be sure the carbon pile is in the "OPEN" or "OFF" position before connecting the leads.**

(9) Start and operate the engine at idle. **Immediately after starting, reduce engine speed to idle.**

(10) Adjust the engine speed and carbon pile to maintain 20 amperes flowing in the circuit. Observe the voltmeter reading. The voltmeter reading should not exceed .7 volts. If a higher voltage drop is indicated, inspect, clean and tighten all connections in the charging circuit. A voltage drop test may be performed at each connection to locate the connection with excessive resistance. If the charging circuit resistance tested satisfactorily, reduce engine speed, turn off carbon pile and turn off ignition switch.

(11) Disconnect battery ground cable.

(12) Remove test ammeter, voltmeter and carbon pile.

(13) Remove "jumper wire" between alternator field terminal and ground. Connect the green field wire to the alternator field terminal.

(14) Reconnect the battery ground cable.

CURRENT OUTPUT TEST

The current output test determines whether or not the alternator is capable of delivering its rated current output.

Test Preparation (Fig. 5)

(1) Disconnect the battery ground cable.

(2) Disconnect the "batt" lead wire at the alternator output terminal.

(3) Connect an ammeter (range 0-100 amps minimum) in series between the alternator "batt" terminal and the disconnected "batt" lead wire.

(4) Connect the positive lead of a voltmeter (range 0-15 volts minimum) to the "batt" terminal of the alternator.

(5) Connect the negative lead of the voltmeter to a good ground.

(6) Disconnect the green field wire (to voltage regulator) at the alternator.

(7) Connect a "jumper wire" from the alternator field terminal to ground.

(8) Connect an engine tachometer and reconnect the battery ground cable.

(9) Connect a variable carbon pile rheostat between the battery terminals. (Be sure the carbon pile is in the "open" or "off" position before connecting leads.)

(10) Start the engine and operate at idle. **Immediately after starting reduce engine speed to idle.**

(11) Adjust carbon pile and engine speed in increments until a speed of 1250 RPM (900 RPM for 100

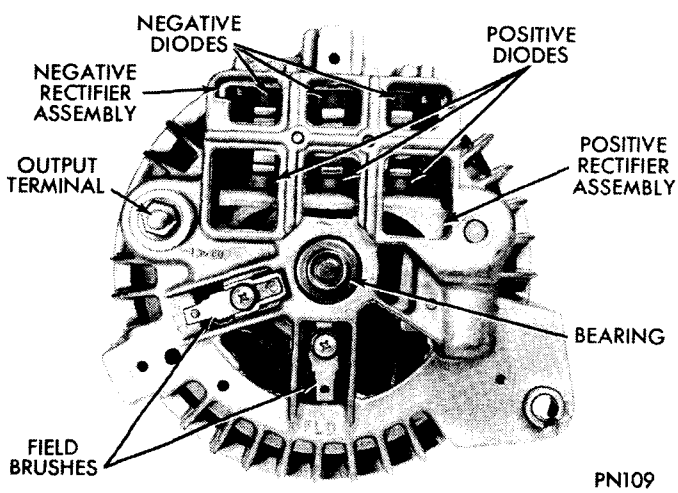


Fig. 2—Alternator Assembly

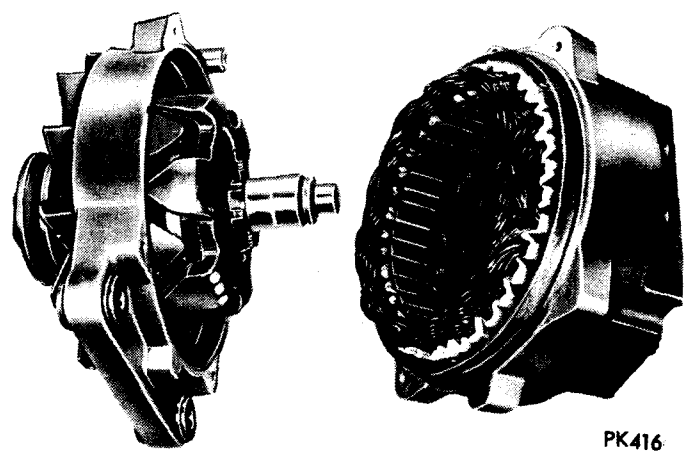


Fig. 3—Alternator Assembly 100 Amp

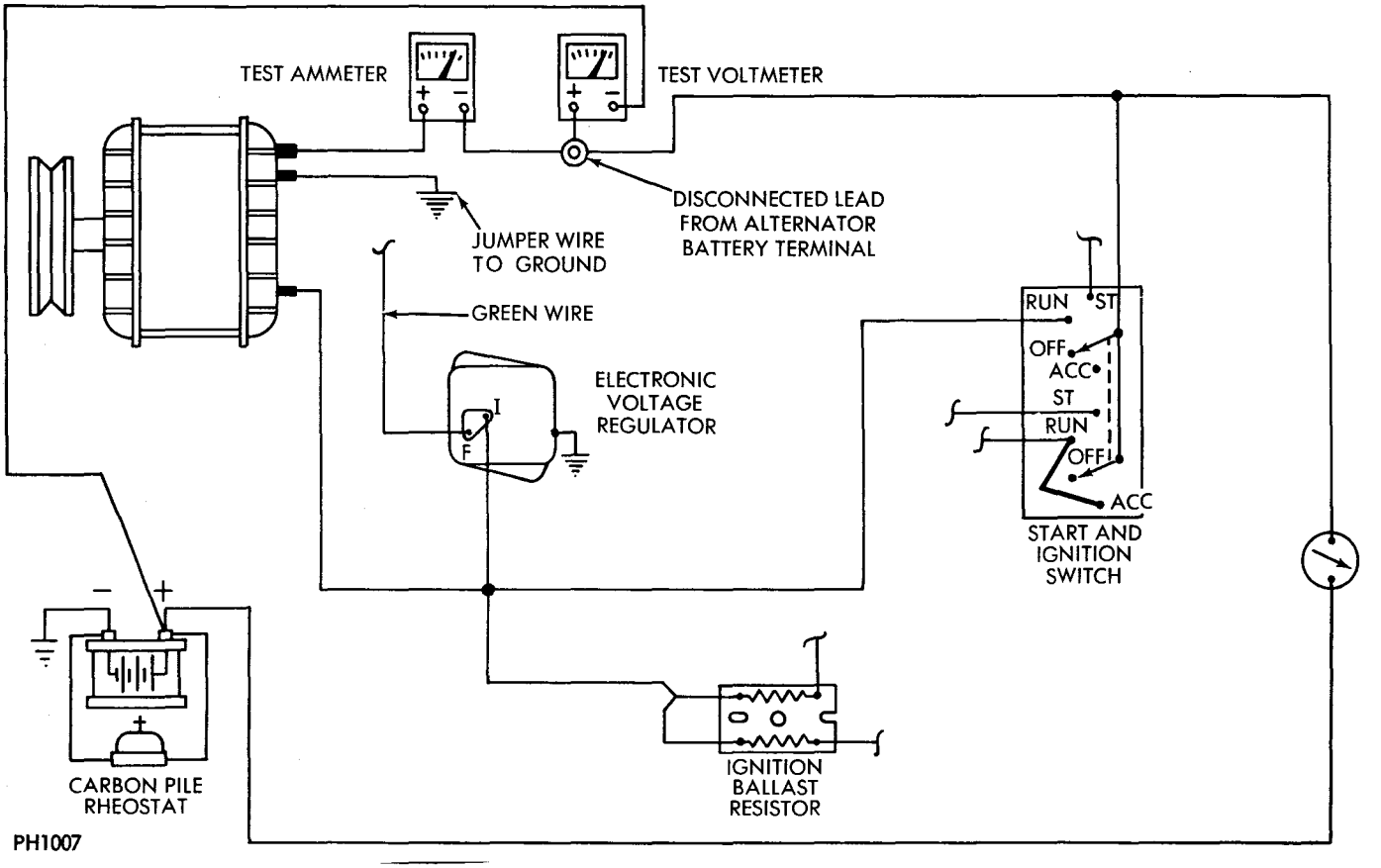


Fig. 4—Charging Circuit Resistance Test

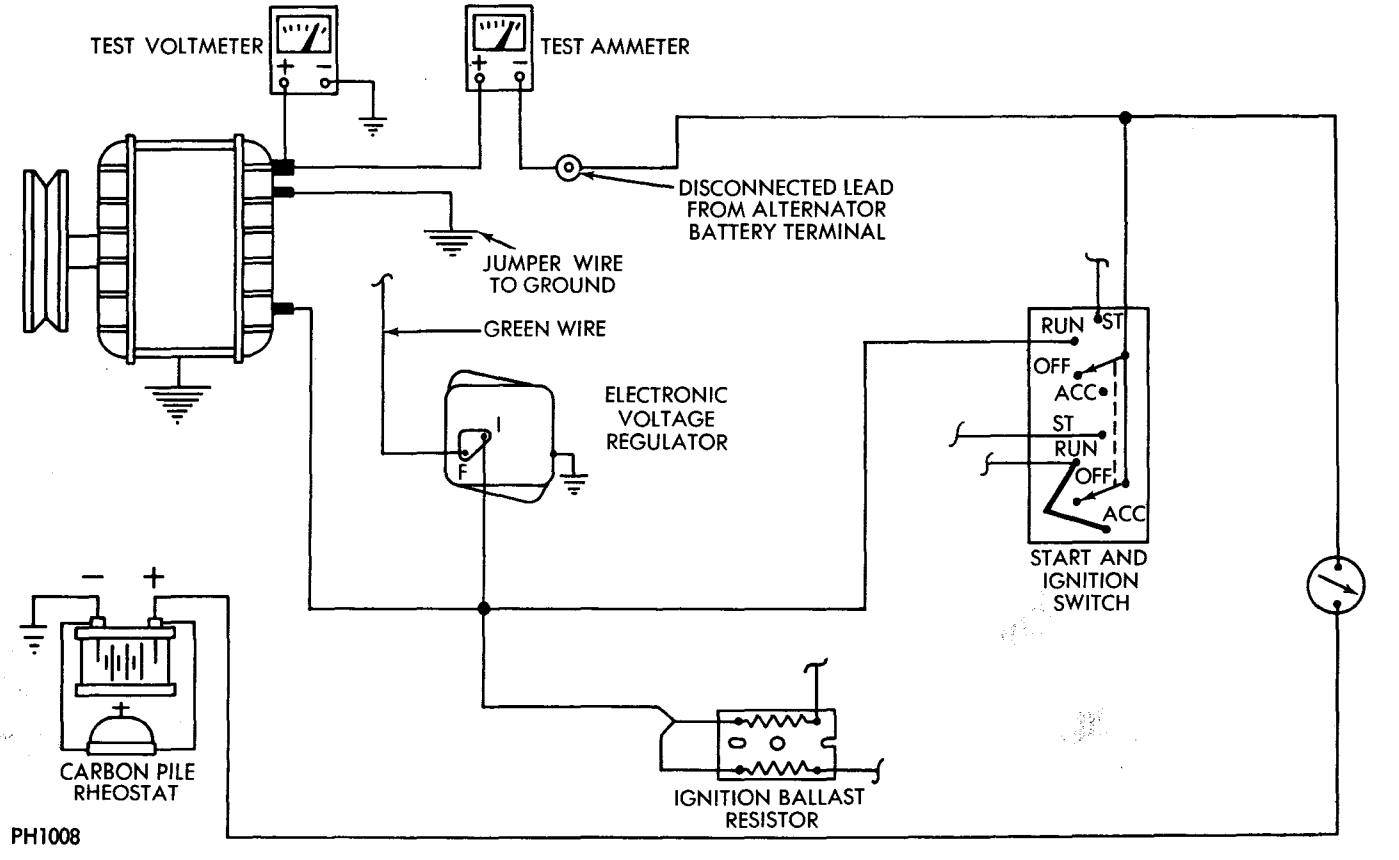


Fig. 5—Current Output Test

amp alternator) and voltmeter reading of 15 volts (13 volts 100 amp alternator) is obtained.

CAUTION: Do not allow voltage meter to read above 16 volts.

(12) The ammeter reading must be within the limits shown in the "alternator specification chart" for that size of alternator being tested.

(13) If the reading is less than specified the alternator should be removed from vehicle and "bench tested".

(14) After current output test is completed reduce engine speed, turn off carbon pile and turn off ignition switch.

(15) Disconnect battery ground cable.

(16) Remove test ammeter, voltmeter and carbon pile.

(17) Remove "jumper wire" between alternator field terminal and ground. Connect the green field wire to the alternator field terminal.

(18) Reconnect the battery ground cable.

VOLTAGE REGULATOR TEST (When Tester C-4133 is Not Available) (Fig. 6)

(1) Clean the battery terminals and check the specific gravity. It should be above 1.200 to allow a properly regulated voltage check.

If the specific gravity is below 1.200, charge or use another battery and do not leave the uncharged battery in the circuit.

(2) Connect the positive lead of the voltmeter to the terminal on the ballast resistor which has a blue wire or a blue and black wire connected to it.

Do not disconnect connector from ballast resistor terminal.

(3) Connect the negative lead from the voltmeter to a good vehicle body ground.

(4) Start and operate engine at 1250 rpm with all lights and accessories turned off. Check voltmeter, the regulator is working properly if the voltage readings are in accordance with the following chart.

AMBIENT TEMPERATURE NEAR VOLTAGE REGULATOR	VOLTAGE RANGE
-20° F	14.9 to 15.9
80° F	13.9 to 14.6
140° F	13.3 to 13.9
Above 140° F	Less than 13.6

It is normal for the ammeter to show an immediate charge and then gradually return to normal position. The duration the ammeter hand remains to the right will be dependent on the length of cranking time.

(5) If the voltage is below limits or is fluctuating, proceed as follows:

(a) Check for a good voltage regulator ground.

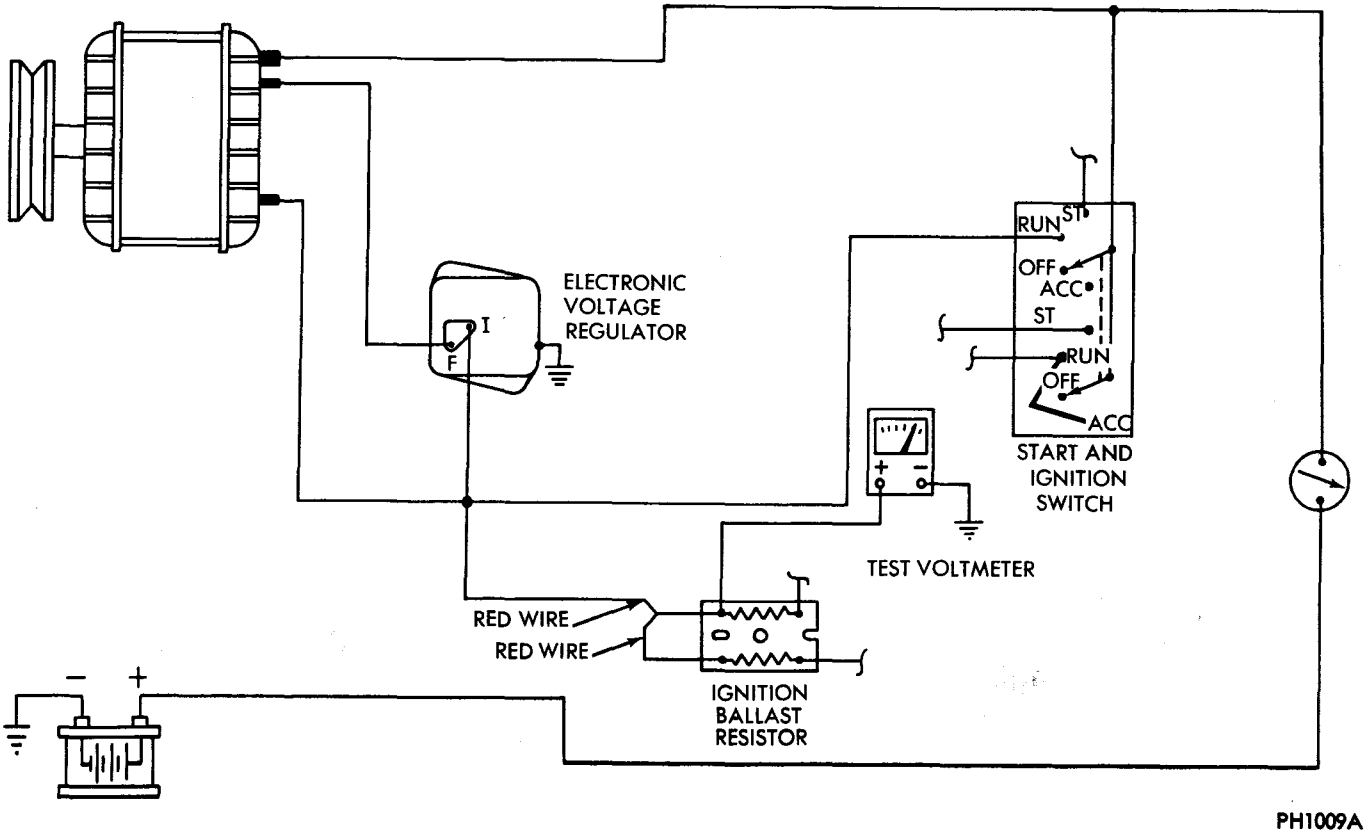


Fig. 6—Voltage Regulator Test

Voltage regulator ground is obtained through regulator case to mounting screws and to sheet metal of vehicle. This is ground circuit that is to be checked for opens.

(b) Turn off ignition switch and disconnect voltage regulator connector. Be sure terminals of connector have not spread open to cause an open or intermittant connection.

(c) **Do not start engine or distort terminals with voltmeter probe:** turn on ignition switch, check for battery voltage at the wiring harness terminal. Both red and green leads should read battery voltage. Turn off ignition switch.

(d) If the previous steps, (5)(a) through (5)(c) tested satisfactory, replace the regulator and repeat step (4).

(6) If the voltage is above the limits shown on the chart, proceed as follows:

(a) Turn off the ignition switch and disconnect voltage regulator connector. Be sure terminals on the connector have not spread open.

(b) **Do not start engine or distort terminals with voltmeter probe:** turn on ignition switch, check for battery voltage at the wiring harness terminal. Both red and green leads should read battery voltage. Turn off ignition switch.

(c) If the previous steps, (6)(a) and (6)(b) tested satisfactory, replace the regulator and repeat step (4).

(7) Remove the test voltmeter.

VOLTAGE REGULATOR TEST (With Tester Tool C-4133 and Adapter C-4341)

In order to test voltage regulators, Adapter C-4341 (Fig. 7), must be installed to tester C-4133 at it's voltage regulator connector lead (Fig. 8). Once installed, it will not be necessary to remove it to test prior model year regulators.

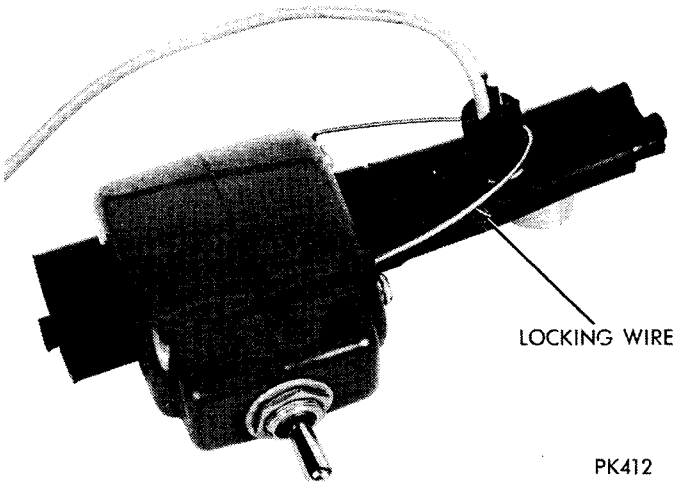


Fig. 8—Adapter Installed

This is made possible by putting a three way switch in adapter, which can be moved to select correct type of regulator being tested. To determine right position of switch, look at part number printed on face of regulator (Fig. 9) and set switch on adapter to same number. Refer to "Specifications" for more identification information.

(1) Remove connector from Electronic Voltage Regulator on vehicle.

(2) Plug in power cord of Voltage Regulator Tester to 110 Volt AC 60 cycle source.

(3) Connect ground wire from voltage regulator tester to a good body ground near regulator, (A place free of paint).

(4) Plug connector of voltage regulator tester into voltage regulator on vehicle.

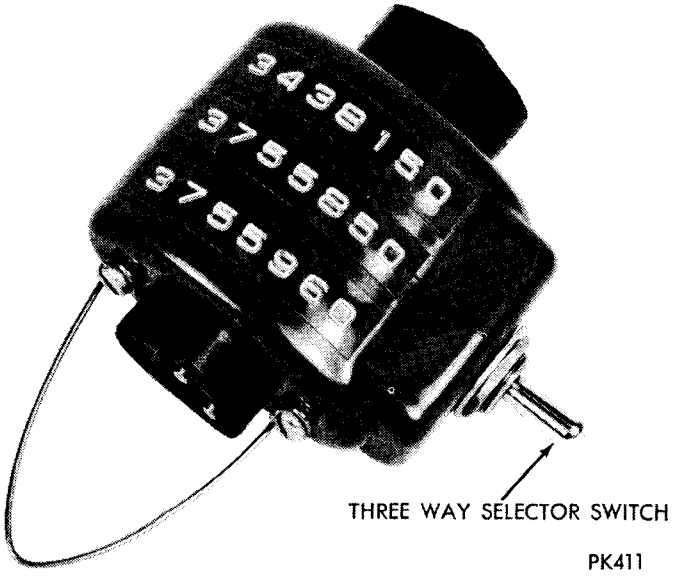


Fig. 7—Adapter C-4341

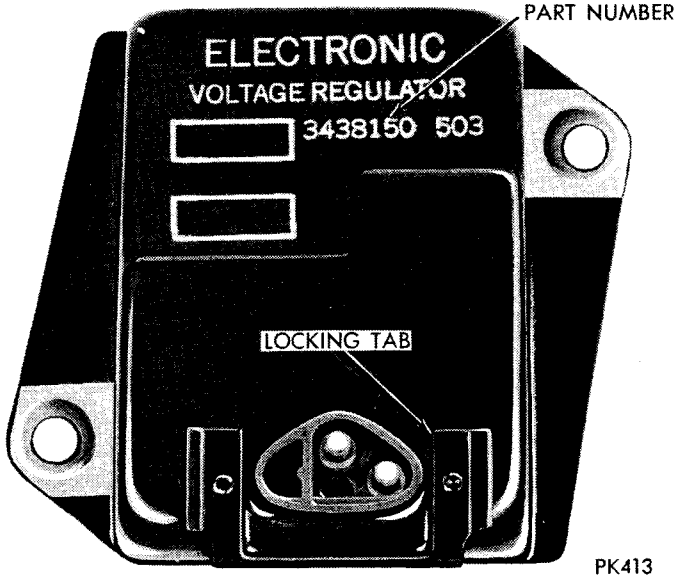


Fig. 9—Voltage Regulator Identification

(5) Place knob on the tester to the regulator test position.

(6) Press the test button on the voltage regulator tester. The voltage reading should be in accordance with the following:

(a) If the voltage regulator temperature is at room temperature (80 degrees F.) or above, the meter reading should be in the green or yellow range.

(b) If the voltage regulator is at room temperature (80 degrees F.) or below, the meter reading should be in the green or blue range.

(7) While holding the test button in, depress **Black Button** (A) (Fig. 10) the meter reading should remain within the limits of step (6).

(8) While holding the test button in, depress **Red Button** (B) (Fig. 11), the meter should read above the red line.

(9) If all tests remain within limits the voltage regulator is good.

(10) If regulator tests defective by this procedure, do not replace it until ground circuit of regulator has been checked.

This is done by moving ground lead of tester from body ground and connecting it to connector locking bracket of regulator. Scrape paint from bracket to insure good ground connection.

Repeat test procedures and if regulator now test good this indicates an open ground circuit between regulator case and mounting surface. If regulator does not test okay, replace.

Remove regulator and clean all dirt and corrosion from regulator cover, mounting screws and mounting surface including threaded holes.

The tester may be used as a DC Voltmeter by placing tester knob in either the 18 volt or 1.8 volt position. Use the red probe and black clip leads for testing.

ALTERNATOR SERVICE PROCEDURES (All Except 100 Amp. Alternator)

If alternator performance does not meet current output specifications limits, it will have to be removed and disassembled for further test and servicing.

(1) Disconnect battery ground cable at battery negative terminal.

(2) Disconnect alternator output "BAT" and field "FLD" leads and disconnect ground wire.

(3) Remove alternator mounting bolts and remove alternator.

BENCH TESTS

Rotor Field Coil Current Draw Test

If alternator field coil draw has not been tested on vehicle it may be tested on test bench as follows:

(1) Connect a jumper wire between one field terminal of the alternator and the positive terminal of a fully charged battery. Connect test ammeter positive lead to the other field terminal of the alternator and the negative lead to the battery negative terminal.

(2) Slowly rotate alternator rotor by hand. Observe ammeter reading. Field coil draw should be 4.5 amperes to 6.5 amperes at 12 volts. **A low rotor coil draw is an indication of high resistance in field coil**

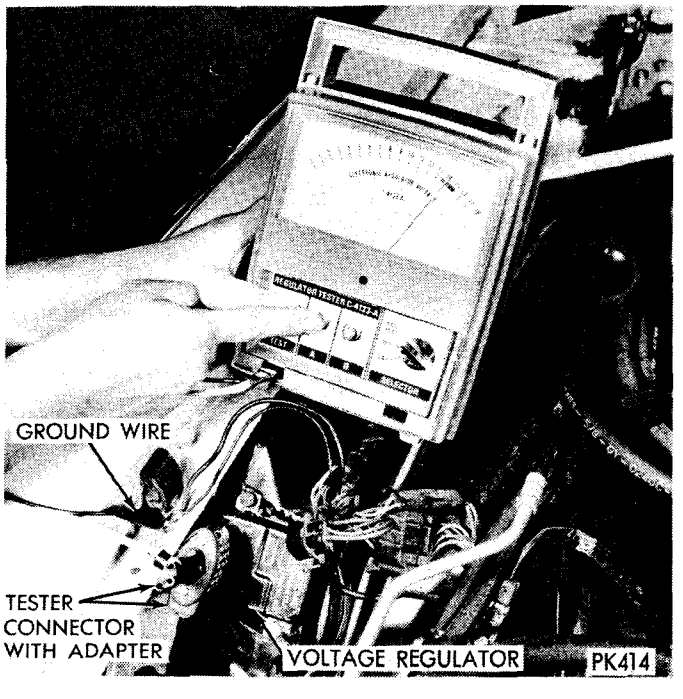


Fig. 10—Voltage Regulator Test (Depressing Test Button and Black Button "A")

Fig. 11—Voltage Regulator Test (Depressing Test Button and Red Button "B")

circuit, (brushes, slip rings, or rotor coil). A higher rotor coil draw indicates possible shorted rotor coil or grounded rotor.

No reading indicates an open rotor or defective brushes.

ALTERNATOR DISASSEMBLY AND TESTING

Separating Alternator End Shields

To prevent possible damage to brush assemblies, they should be removed before separating the end shields. The field brushes are mounted in plastic holders that position the brushes against the slip rings of the rotor.

(1) Remove the brush screws, insulating washers and lift brush assemblies from end shield (Fig. 12).

CAUTION: Stator is laminated, do not burr stator or end shield.

(2) Remove through bolts and pry between the stator and drive end shield with blade of a screwdriver (Fig. 13). Carefully separate drive end shield, pulley and rotor assembly away from stator and rectifier end shield assembly.

TESTING RECTIFIERS
With Tester Tool C-3829

The Rectifier Tester Tool C-3829 provides a quick, simple and accurate test of the alternator rectifiers without the necessity of disconnecting the stator phase leads. With alternator rectifier end shield separated from drive end housing proceed with rectifier test as follows:

Positive Rectifier Test (Fig. 14)

CAUTION: Do not break the plastic cases of the diodes. The cases are for protection against corrosion. Always touch test probe to metal strap nearest rectifier.

(1) Place rear end shield and stator assembly on an insulated surface. Connect test lead clip to the alternator (BAT) output terminal.

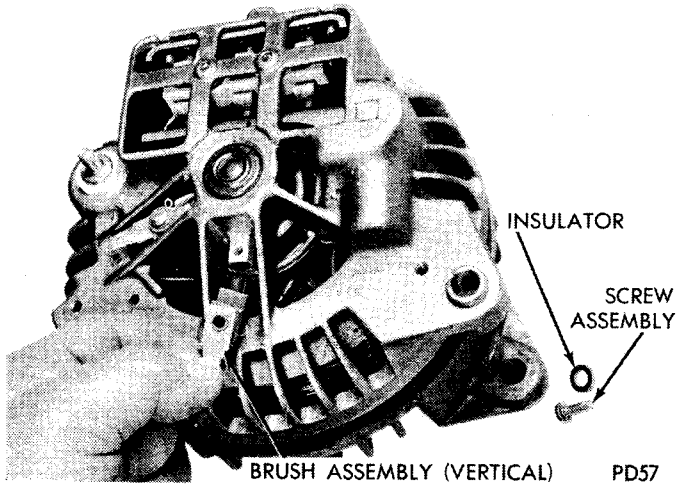


Fig. 12—Removing Field Brushes

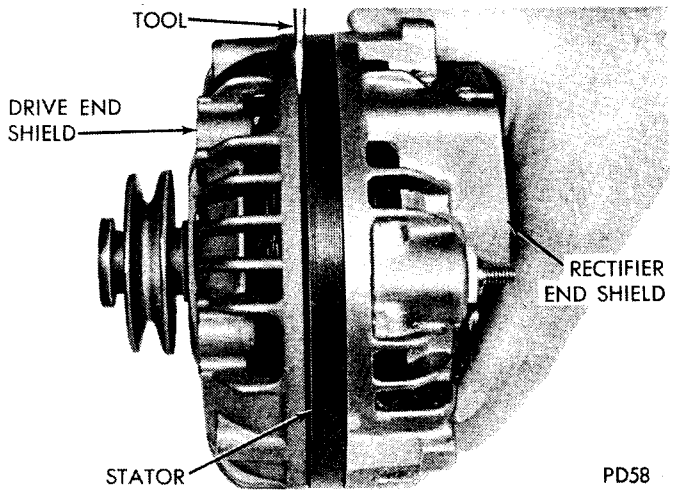


Fig. 13—Separating Drive End Shield From Stator

(2) Plug in Tool C-3829 power source lead into a 110 volt AC power supply. Touch the metal strap of each of the positive rectifiers, with test probe.

The reading for satisfactory rectifiers will be 1-3/4 amperes or more. Reading should be approximately the same and the meter needle must move in the same direction for all three rectifiers.

When two rectifiers are good and one is shorted, reading taken at the good rectifier will be low, and reading at shorted rectifier will be zero. Disconnect lead to the rectifier reading zero and retest. The reading of the good rectifiers will now be within satisfactory range.

When one rectifier is open it will read approximately one ampere, and two good rectifiers will read within satisfactory range.

Negative Rectifier Test (Fig. 15)

CAUTION: Do not break the plastic cases of the diodes. The cases are for protection against corrosion. Always touch test probe to metal strap nearest rectifier.

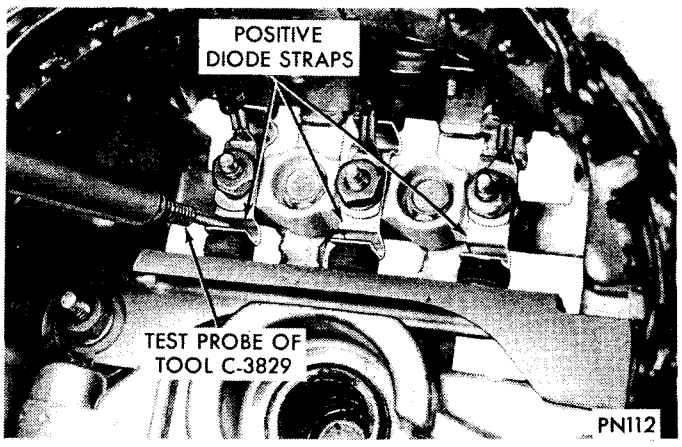


Fig. 14—Testing Positive Rectifiers

(1) Connect test lead clip to rectifier end housing.

(2) Touch the metal strap of each of the negative rectifiers with test probe.

Test specifications are the same, and test results will be approximately the same as for positive case rectifiers, except meter will read on opposite side of scale.

Note: If a negative rectifier shows shorted isolate the stator from the rectifier end shield and retest. It is possible that a stator winding could be grounded to the stator laminations or rectifier end shield which would indicate a shorted negative rectifier.

When Tool C-3829 is not available

(1) Remove nuts from studs on terminal block securing stator windings, positive, and negative rectifier straps to block, (Fig. 16).

(2) Lift off stator winding terminals and carefully pry stator assembly from end shield.

(3) Test rectifiers with a 12 volt battery and a test lamp equipped with a number 67 bulb (4 candle power) by connecting one side of test lamp to positive battery post; other side of test lamp to a test probe with other test probe connected to the negative battery post.

(4) Contact the heat sink of rectifier with one test probe and other test probe to strap on the top of rectifier (Fig. 17).

(5) Reverse the probes, moving probe from rectifier heat sink to rectifier strap and the probe from rectifier strap to rectifier heat sink (Fig. 18).

If test lamp "lights" in one direction but does "not light" in other direction, rectifier is satisfactory. If lamp lights in "both directions," **rectifier** is "shorted". If test lamp does "not light" in either direction, rectifier is "open".

(6) Repeat the above procedure for all rectifiers in both assemblies; change rectifier and heat sink assemblies which have shorted or open rectifiers. The lamp should light in the same direction for all rectifiers on each assembly.

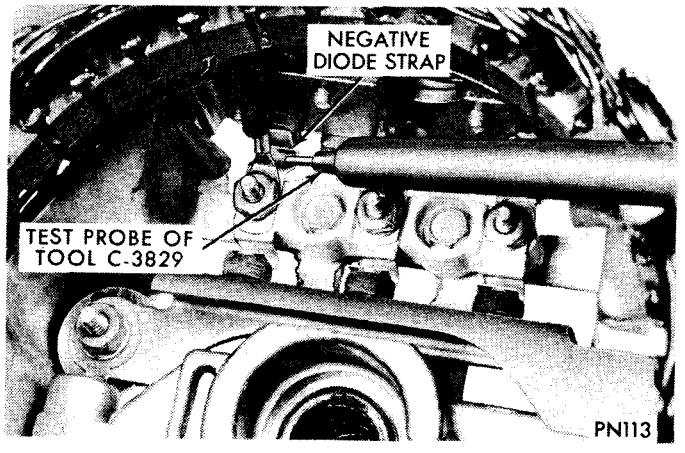


Fig. 15—Testing Negative Rectifiers

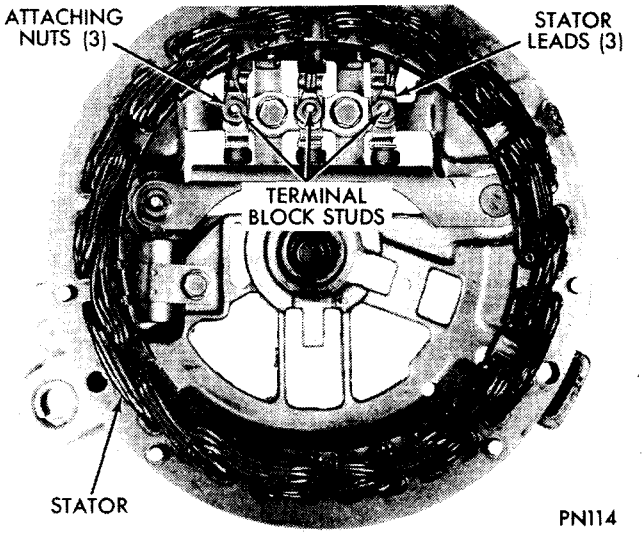


Fig. 16—Rectifier End Shield and Stator Assembly

Rectifier and Heat Sink Assembly Removal (Fig. 19)

If negative heat sink recitifier straps are under positive heat sink straps proceed to step 2, otherwise proceed as follows:

(1) Remove four hexagon-head screws, (Fig. 19) securing negative rectifier and heat sink assembly to rectifier end shield and lift heat sink assembly out of end shield.

(2) Remove nut and washer assembly, (Fig. 19) from alternator output ("BAT") terminal (located on outside of rectifier end shield. Remove round plastic insulator.

(3) Turn end shield over and remove nut and washer assembly from end shield stud (attaching capacitor). Remove screw that attaches capacitor to case, (Fig. 20).

(4) Lift out capacitor and insulated washer and heat sink assembly. Remove round plastic insulator from "BAT" terminal hole.

(5) Remove mica insulator from end shield stud. If negative heat sink diode straps were under positive heat sink diode straps perform step 1.

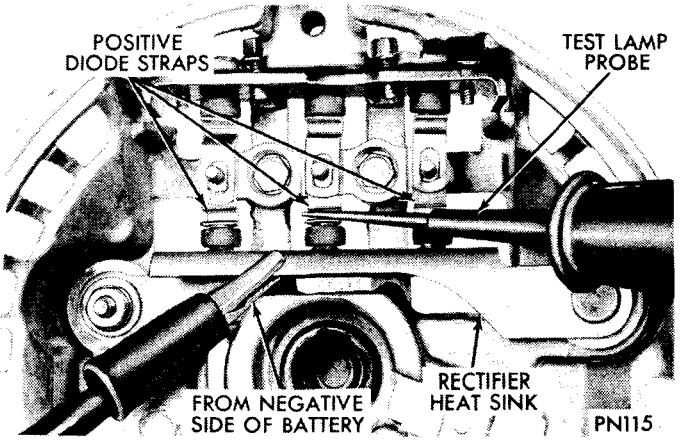


Fig. 17—Testing Positive Rectifiers with Test Lamp

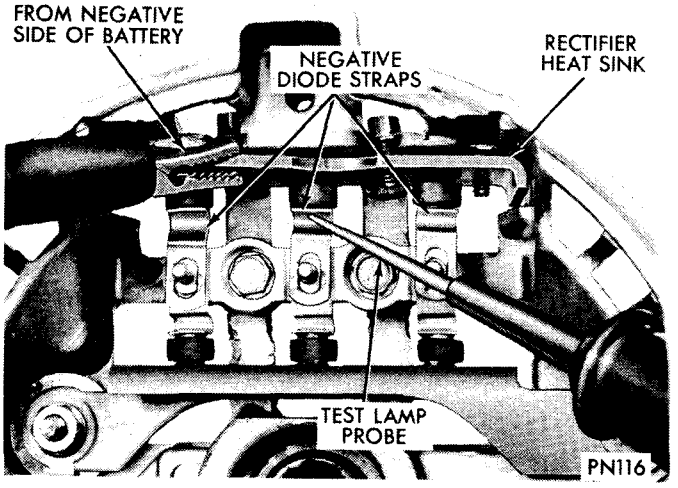


Fig. 18—Testing Negative Rectifiers with Test Lamp

Testing the Stator

(1) Press test probe firmly onto any pin on the stator frame. Be sure the varnish has been removed so that the pin is bare (Fig. 21).

(2) Press test probe firmly to each of the three phase (stator) lead terminals one at a time. If the lamp lights, the stator lead is "grounded."

(3) Press test probe firmly on one phase terminal lead and contact firmly each of the other two stator leads. Test lamp should light when prod contacts each of the terminals. If lamp does not light, stator winding is "open".

(4) Install new stator if stator tested is "grounded" or "open".

Pulley and Bearing Removal

(1) The pulley is an interference fit on rotor shaft. Remove pulley with Puller Tool C-4068 (Fig. 22).

(2) Pry drive end bearing retainer from end shield with a screwdriver (Fig. 23).

(3) Support end shield and tap rotor shaft with a plastic hammer to separate rotor from end shield.

(4) The drive end ball bearing is an interference fit

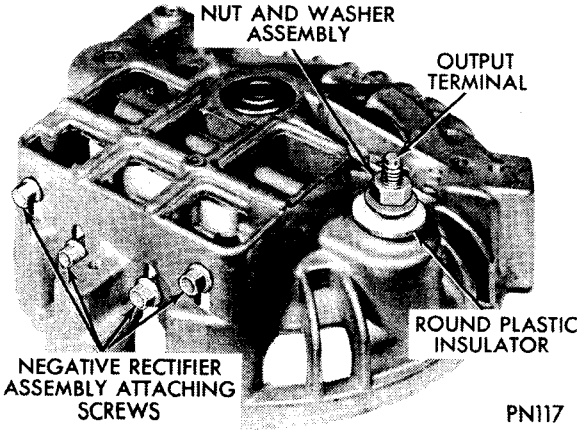


Fig. 19—Removing Negative Rectifier Assembly and Output Terminal Nut

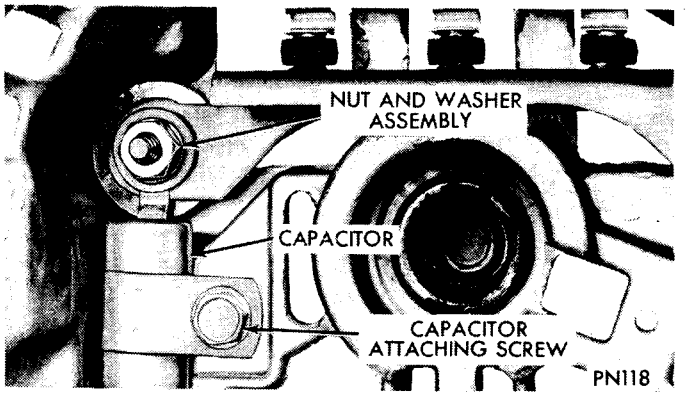


Fig. 20—Removing Capacitor

with the rotor shaft. Remove bearing with Puller Tool C-4068, (Fig. 24).

(5) The needle roller bearing in rectifier end shield is a press fit. If necessary to remove rectifier end frame needle bearing, protect end shield by supporting shield with Tool C-3925 when pressing bearing out with Tool C-3770A (Fig. 25).

ROTOR TEST

The rotor assembly may be checked electrically for grounded, open or shorted field coils.

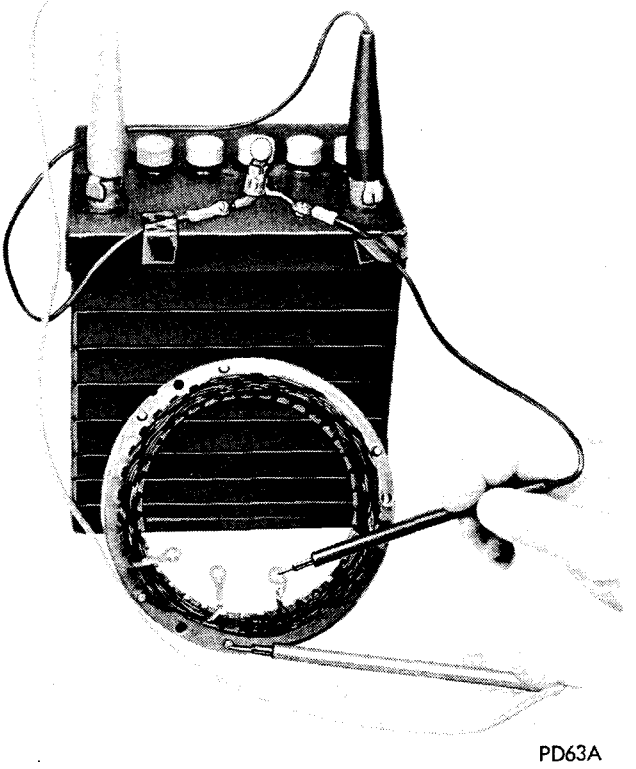


Fig. 21—Testing Stator for Ground

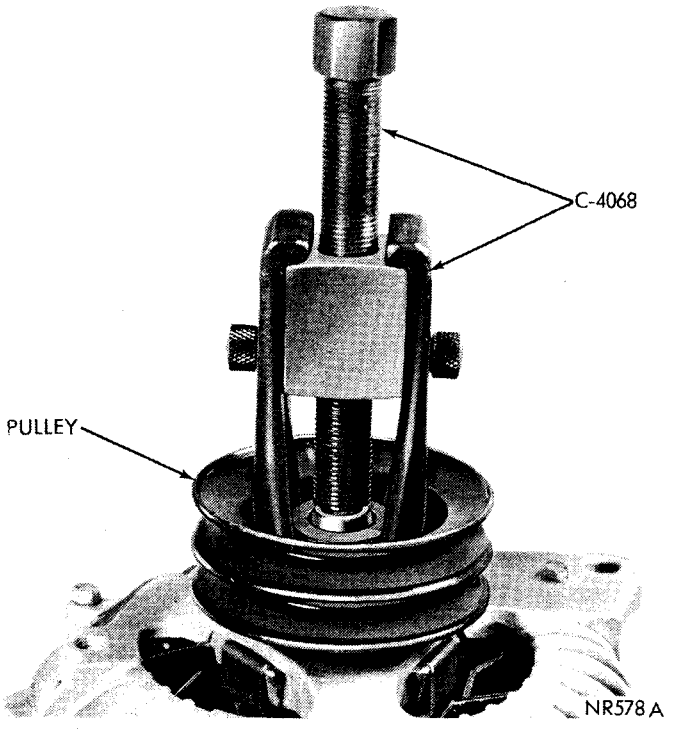


Fig. 22—Removing Pulley

To check for a "grounded" field coil; connect an ohmmeter from each slip ring to the rotor shaft (Fig. 26). **Note:** Ohmmeter should be set for "infinite" reading when probes are apart and zero when probes are shorted. The ohmmeter should read "infinite". If the reading is zero or higher, the rotor is grounded.

To check for an "open" field coil, connect an ohmmeter to the slip rings (Fig. 27). The ohmmeter reading should be between 1.5 and 2 ohms on rotor coils at room ambient conditions. Resistance between 2.5 and 3.0 ohms would result from alternator rotors that have been operated on the vehicle at higher engine compartment temperatures. Readings above 3.5 ohms would indicate high resistance rotor coils and further testing or replacement may be required.

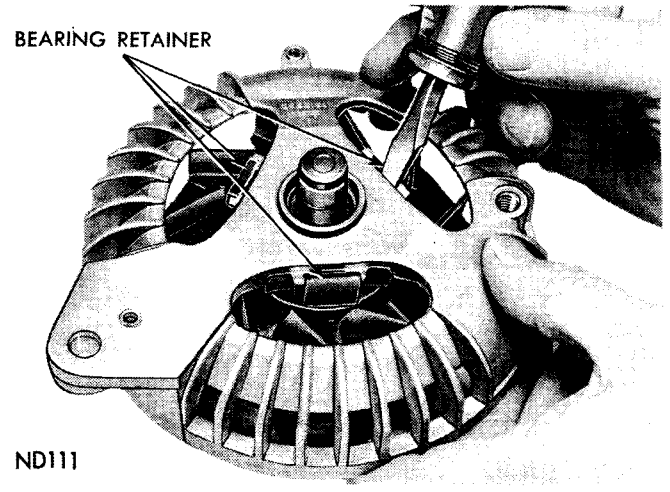


Fig. 23—Disengaging Bearing Retainer From End Shield

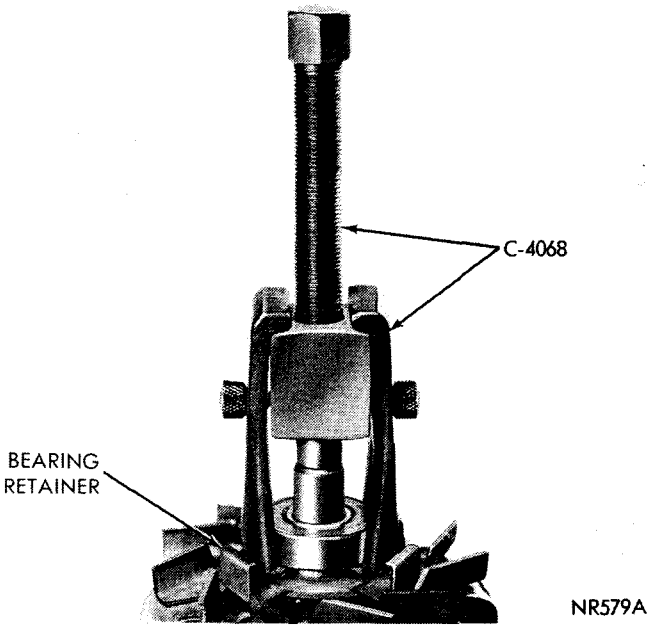


Fig. 24—Removing Bearing From Rotor Shaft

To check for a "shorted" field coil, connect an ohmmeter to the two slip rings (Fig. 27). If the reading is below 1.5 ohms, the field coil is shorted.

REPLACING SLIP RINGS

Slip rings are not serviced as a separate item. They are serviced with the rotor assembly.

ASSEMBLING THE ALTERNATOR

(1) Position grease retainer on rotor shaft and press retainer on shaft with installer Tool C-3921 (Fig. 28). The plastic retainer is properly positioned when the inner bore of the installer tool bottoms on the rotor shaft.

(2) Position rectifier end shield bearing on base of Tool C-4201. Place alternator end shield on top of

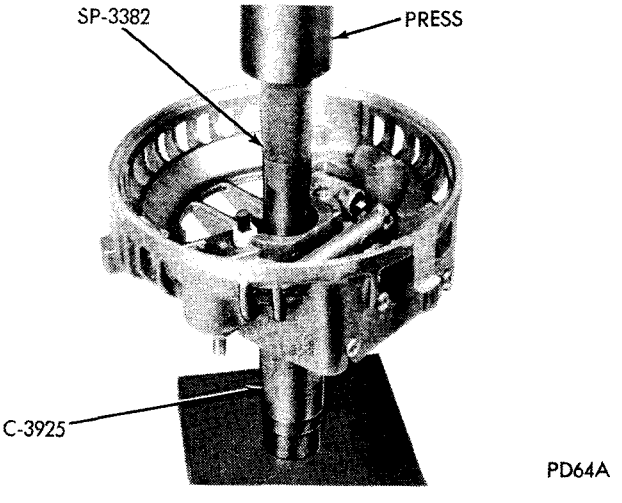


Fig. 25—Removing Rectifier End Shield Bearing

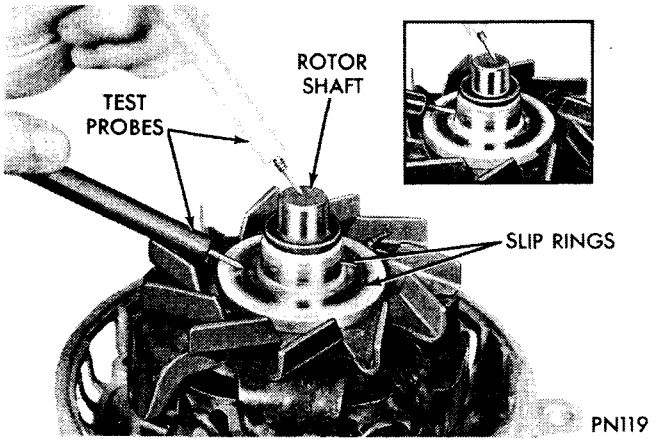


Fig. 26—Rotor Test for Ground

bearing so that it is properly aligned. With top part of Tool C-4201 placed on end shield, press into place until it bottoms against it. (Fig. 29). **New bearings are prelubricated, additional lubrication is not required.**

(3) Insert drive end bearing in drive end shield and install bearing retainer plate to hold bearing in place.

(4) Position bearing and drive end shield on rotor shaft and, while supporting base of rotor shaft, press bearing end shield into position on rotor shaft with

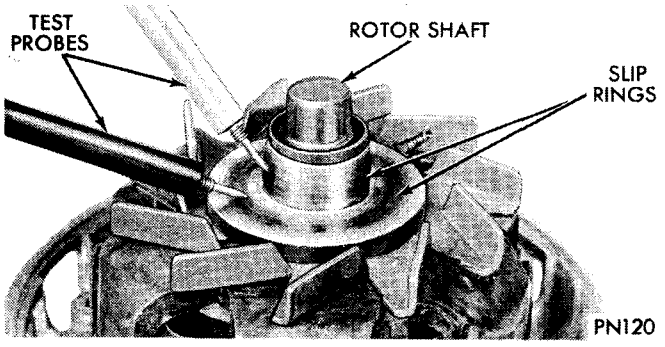


Fig. 27—Rotor Test for Opens or Shorts

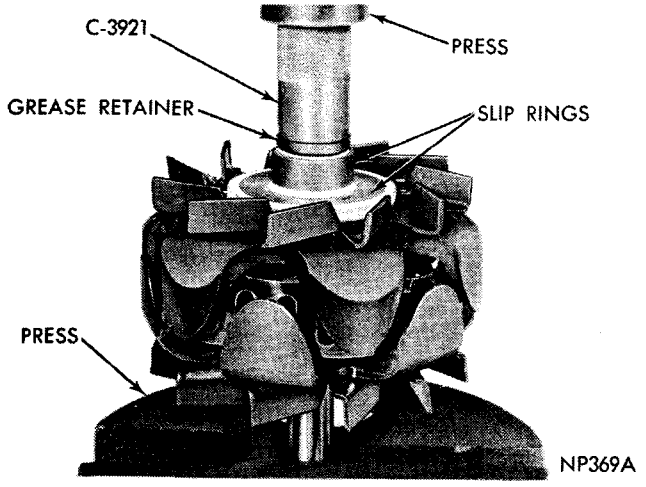


Fig. 28—Installing Grease Retainer

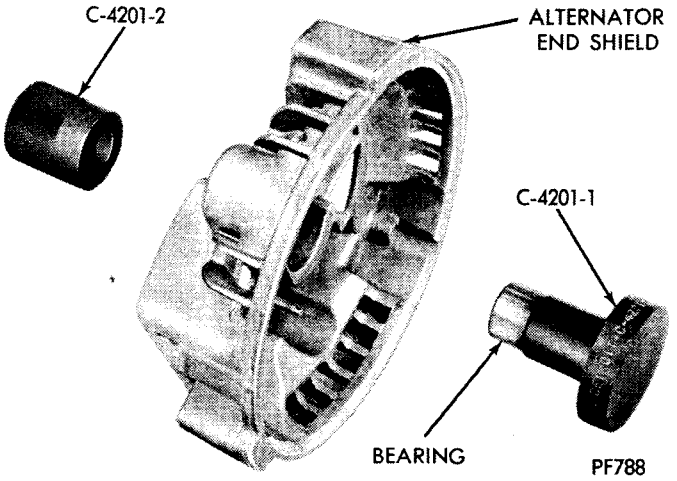


Fig. 29—Installing Rectifier End Shield Bearing

arbor press and Tool C-3858 (Fig. 30).

CAUTION: Make sure bearing is installed squarely at installation; otherwise, damage to bearing will result. Press bearing on rotor shaft until bearing contacts shoulder on rotor shaft fan hub.

(5) Install pulley on rotor shaft. Shaft of rotor must be supported in a manner so all pressing force is on pulley hub and rotor shaft (Fig. 31). **Press pulley on rotor shaft until pulley contacts inner race of drive and bearing. Do not exceed 6800 pounds pressure. Do not hammer.**

(6) Install mica insulator on heat sink mounting stud in end shield. Install round plastic insulator flat face up in battery stud hole in end shield, (Fig. 32).

(7) Install positive heat sink assembly, (Fig. 33) by placing battery terminal through round plastic insulator and capacitor end over heat sink mounting stud; guide three diode straps over studs on terminal block, (Fig. 34).

(8) Install capacitor terminal over heat sink stud, (Fig. 35). Install capacitor insulator (be sure it seats properly in capacitor terminal and heat sink hole).

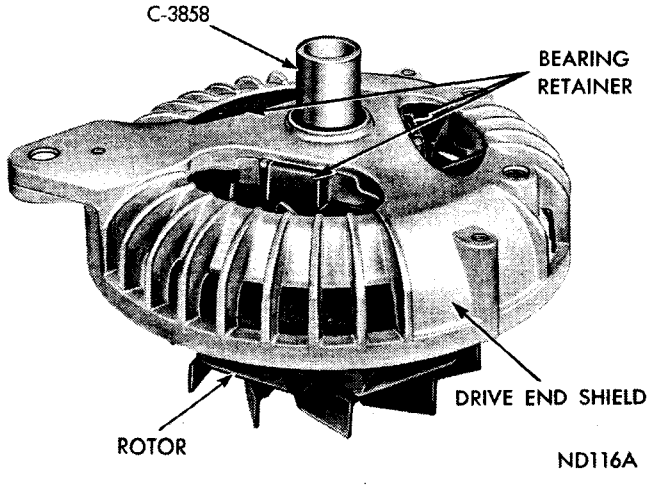


Fig. 30—Install Drive End Shield Bearing

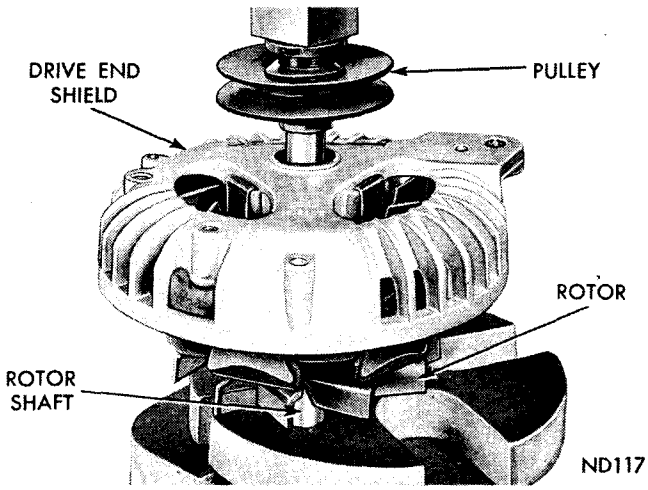


Fig. 31—Installing Pulley

Attach capacitor bracket to end shield with metal screw. Complete capacitor end assembly by installing positive heat sink nut and lock washer assembly. Tighten to 20 to 30 lbs.-in. torque.

(9) Turn end shield over and install round plastic insulator over the battery terminal (flat side up). Install nut and washer assembly and tighten to 30 to 50 lbs.-in. torque, (Fig. 36).

CAUTION: Be sure all nuts are properly torqued or failure is likely to occur.

(10) Slide negative rectifier and heat sink assembly, (Fig. 37) into place in end shield. Position three diode straps on terminal block studs. Install hexagon-head metal screws through end shield and into negative heat sink and tighten securely (19 to 29 lbs.-in. torque), (Fig. 38).

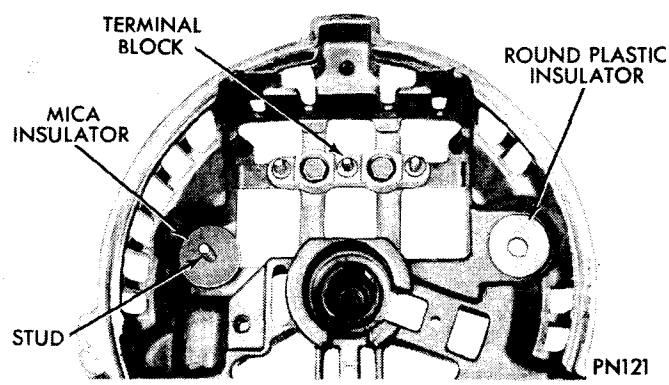


Fig. 32—Installing Insulators

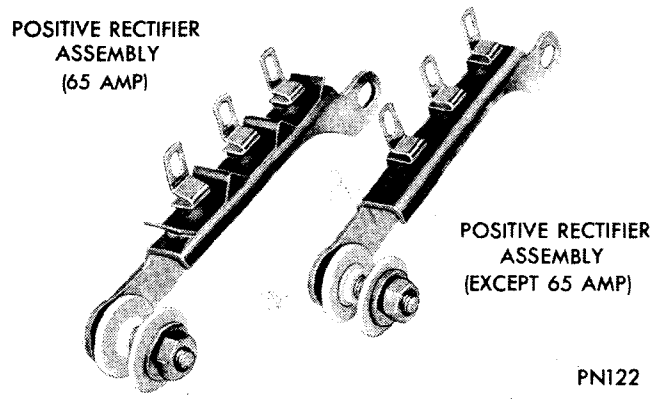


Fig. 33—Positive Rectifier Assembly

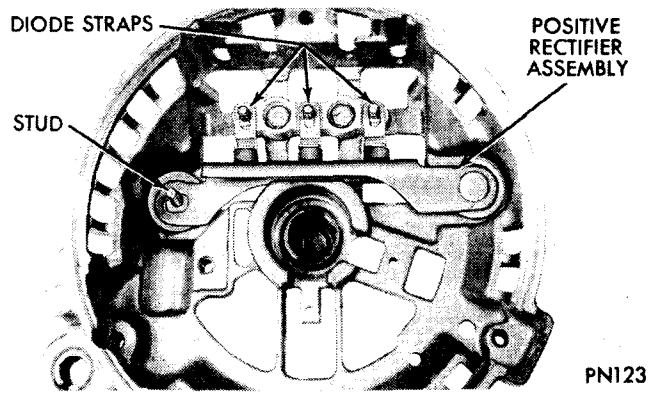


Fig. 34—Installing Positive Rectifier Assembly

(11) Position stator over rectifier end shield and install winding terminals on terminal block press stator pins into end shield and install and tighten winding terminal nuts. Route leads so that they cannot contact rotor or sharp edge of negative heat sink, (Fig. 39).

(12) Position rotor and drive end shield assembly over stator and rectifier end shield assembly. Align through bolt holes in stator, rectifier end shield and drive end shield.

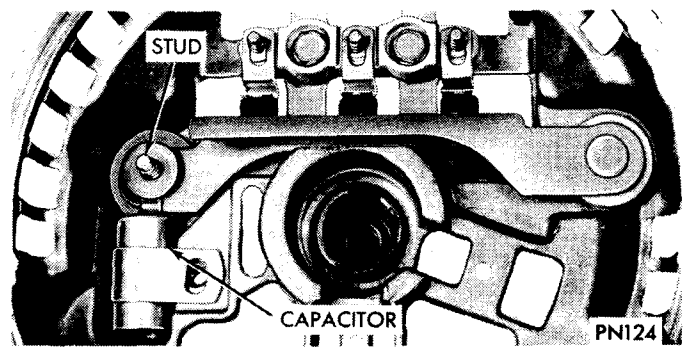


Fig. 35—Installing Capacitor

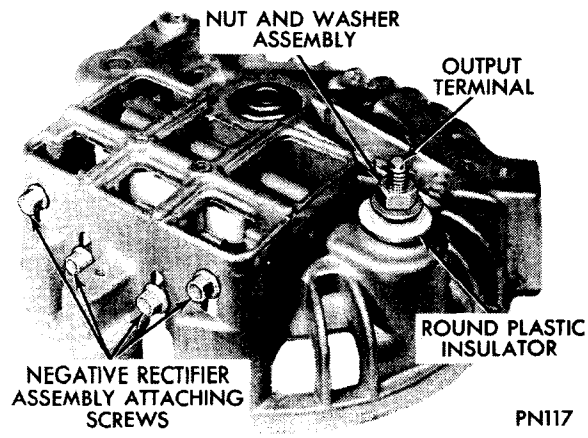


Fig. 36—Installing Battery Output Insulator and Nut

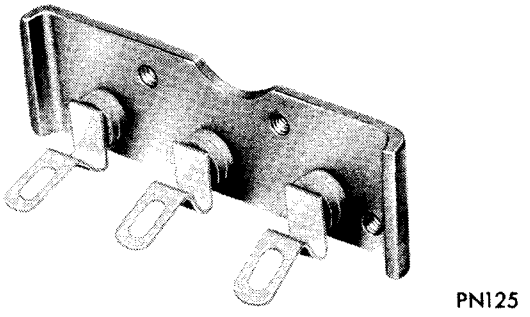


Fig. 37—Negative Rectifier Assembly

(13) Compress stator and both end shields manually and install through bolts and washers. Tighten through bolts evenly to 25-55 inch-pounds.

(14) Install field brushes in insulated holders. Position vertical and horizontal field brushes in proper location in rectifier end shield, (Fig. 40).

(15) Place insulating washer on each field brush terminal and install lockwashers and attaching screws. **Be sure that the brushes are not grounded.** Tighten attaching screws.

(16) Rotate pulley slowly by hand to be sure that rotor fan blades do not hit stator winding leads.

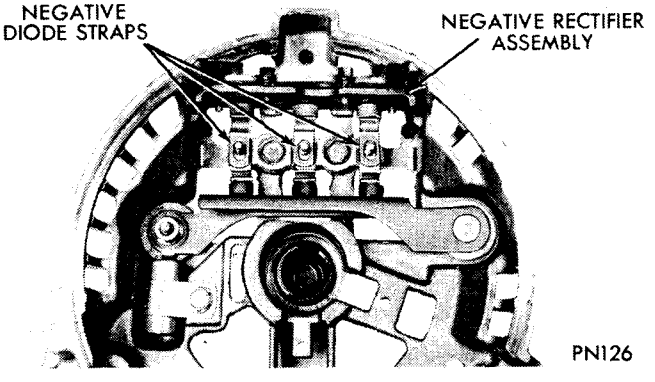


Fig. 38—Installing Negative Rectifier Assembly

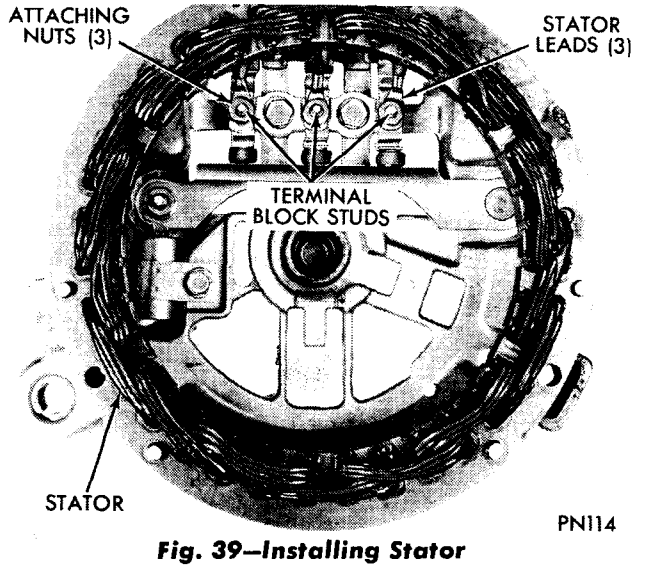


Fig. 39—Installing Stator

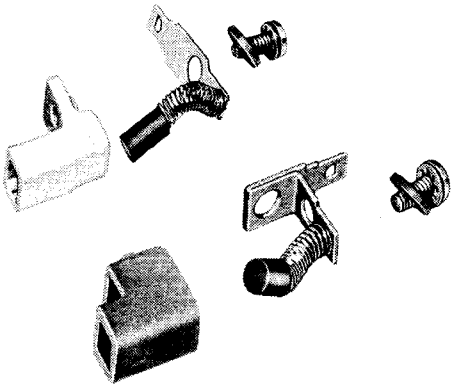


Fig. 40—Field Brushes

(17) Install alternator and adjust drive belt to specifications.

CAUTION: DO NOT ADJUST DRIVE BELTS WITH ENGINE RUNNING.

(18) Connect alternator output (BAT) and two field (FLD) leads. Connect battery ground cable.

(19) Start and operate engine. Observe alternator operation.

(20) Test current output.

ALTERNATOR SERVICE PROCEDURES (100 Amp Alternator)

If alternator performance does not meet current output specification limits, it will have to be removed and disassembled for further test and servicing.

(1) Disconnect battery ground cable at battery negative terminal.

(2) Disconnect battery "BAT", fields "FLD" and ground "GND" leads from alternator (Fig. 41).

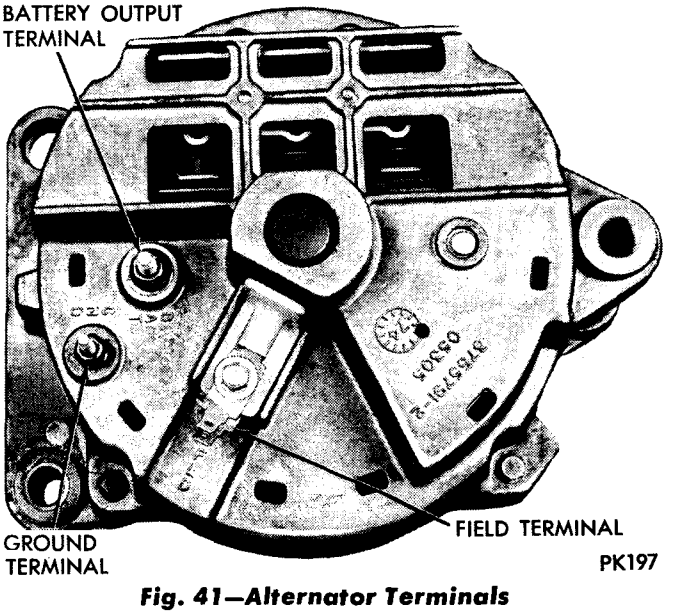


Fig. 41—Alternator Terminals

(3) Remove alternator mounting bolts and remove alternator.

BENCH TESTS

Rotor Field Coil Current Draw Test

If alternator field coil draw has not been tested on vehicle it may be tested on test bench as follows:

Preparation

Connect a jumper wire between one field terminal of alternator and positive terminal of a fully charged battery. Connect test ammeter positive lead to other field terminal of alternator and negative lead to the battery negative terminal.

Test

Slowly rotate alternator rotor by hand. Observe ammeter reading.

Results

Field coil draw should be 4.75 amperes to 6.0 amperes at 12 volts. **A low rotor coil draw is an indication of high resistance in field coil circuit. (Brushes, slip rings or rotor coil). A higher rotor coil draw indicates possible shorted rotor coil or grounded rotor.**

No reading indicates an open rotor or defective brushes.

ALTERNATOR DISASSEMBLY AND TESTING

Separating Alternator End Shields

To prevent possible damage to brush assembly it must be removed before separating end shields. Field brushes are mounted in a plastic holder that positions brushes against slip rings of rotor.

(1) Remove brush holder screw, insulating washer and lift brush assembly from end shield (Fig. 42).

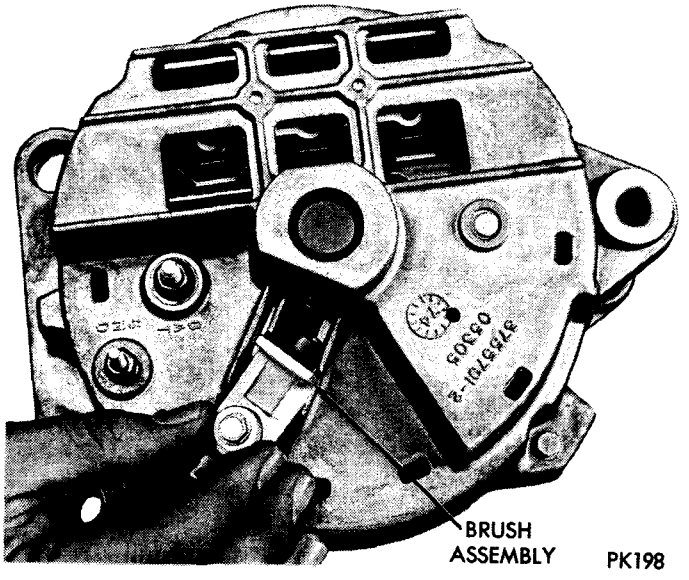


Fig. 42—Removing Brush Assembly

(2) Remove through bolts and pry between stator and drive end shield with blade of a screwdriver in slot provided (Fig. 43). Carefully separate drive end shield, pulley and rotor assembly away from stator and rectifier end shield assembly.

CAUTION: STATOR IS LAMINATED, DO NOT BURR STATOR OR END SHIELD.

Testing Rectifiers With Tester Tool C-3829

The Rectifier Tester Tool C-3829 provides a quick, simple and accurate test of the alternator rectifiers without the necessity of disconnecting the stator phase leads. With alternator rectifier end shield separated from drive end housing proceed with rectifier test as follows:

Positive Rectifier Test

CAUTION: DO NOT BREAK PLASTIC CASES OF DIODES. CASES ARE FOR PROTECTION AGAINST CORROSION. ALWAYS TOUCH TEST PROBE TO METAL STRAP NEAREST RECTIFIER.

Preparation

(1) Place rear end shield and stator assembly on an insulated surface. Connect test lead clip to alternator (BAT) output terminal.

(2) Plug in Tool C-3829 power source lead into a 110 volt AC power supply.

Test

Touch metal strap of each of positive rectifiers, with test probe and observe reading of meter (Fig. 44).

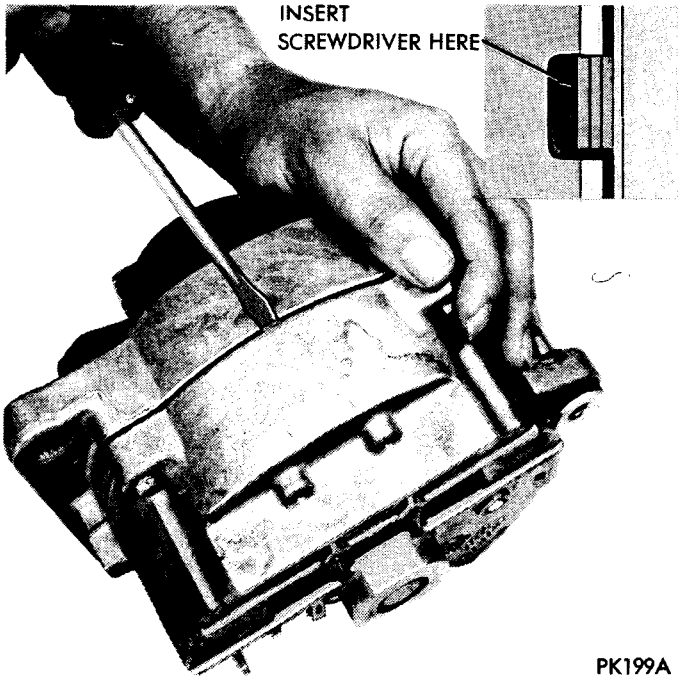


Fig. 43—Separating End Shields

Results

(1) Reading for satisfactory rectifiers will be 1-3/4 amperes or more. Reading should be approximately same and meter needle must move in the same direction for all three rectifiers.

(2) When two rectifiers are good and one is shorted, reading taken at good rectifier will be low and reading at shorted rectifier will be zero. Disconnect lead to rectifier reading zero and retest. Reading of good rectifiers will now be within satisfactory range.

Negative Rectifier Test

CAUTION: DO NOT BREAK PLASTIC CASES OF DIODES. CASES ARE FOR PROTECTION AGAINST CORROSION. ALWAYS TOUCH TEST PROBE TO METAL STRAP NEAREST RECTIFIER.

Preparation

Connect test lead clip to rectifier end housing.

Test

Touch metal strap of each of negative rectifiers with test probe (Fig. 45).

Results

Test specifications are same and test results will be approximately same as for positive case rectifiers, except meter will read on opposite side of scale.

NOTE: If a negative rectifier indicates a short, isolate the stator from the rectifier end shield and retest. It is possible that a stator winding could be grounded to the stator laminations or rectifier end shield which would indicate a shorted negative rectifier.

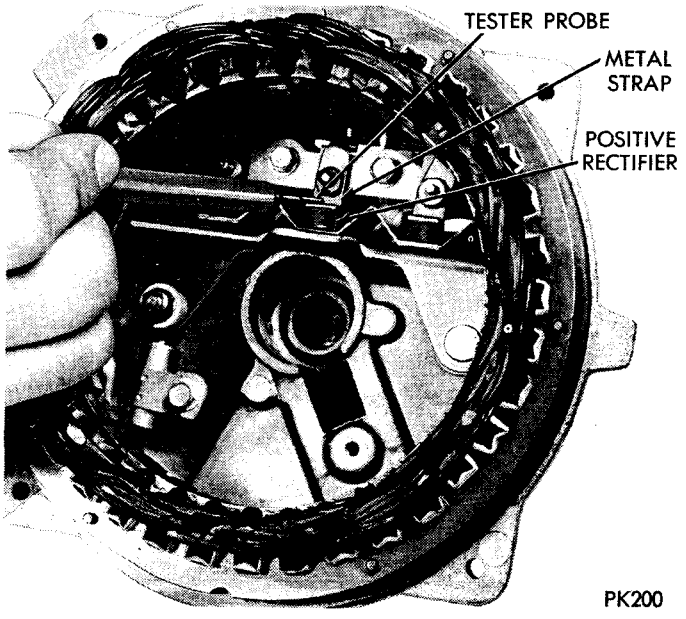


Fig. 44—Testing Positive Rectifiers

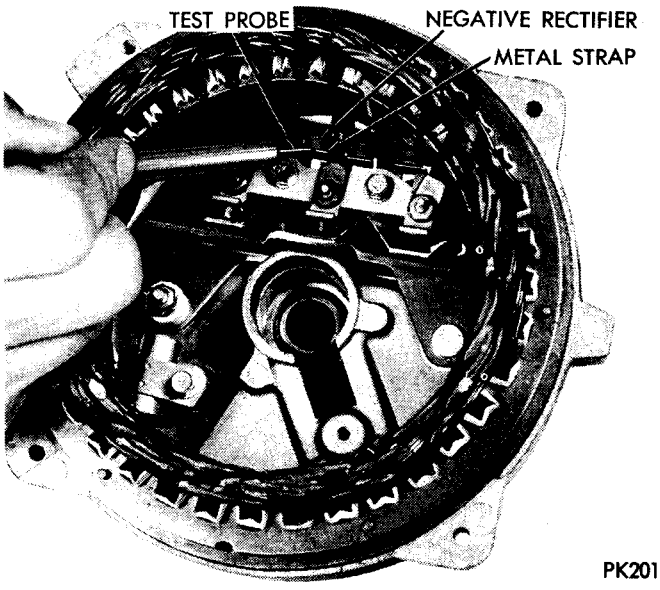


Fig. 45—Testing Negative Rectifiers

When Tool C-3829 is not available

Preparation

(1) Remove nuts from studs securing stator windings lead to terminal block (Fig. 46).

(2) Lift off stator winding terminals and **carefully** pry stator assembly from end shield.

(3) Test rectifiers with a 12 volt battery and a test lamp equipped with a number 67 bulb (4 candle power) by connecting test lamp to positive battery post and a test probe lead to battery negative post.

Test

(1) Contact heat sink of rectifier with test lamp probe and other test probe to metal strap on top of rectifier (Fig. 47).

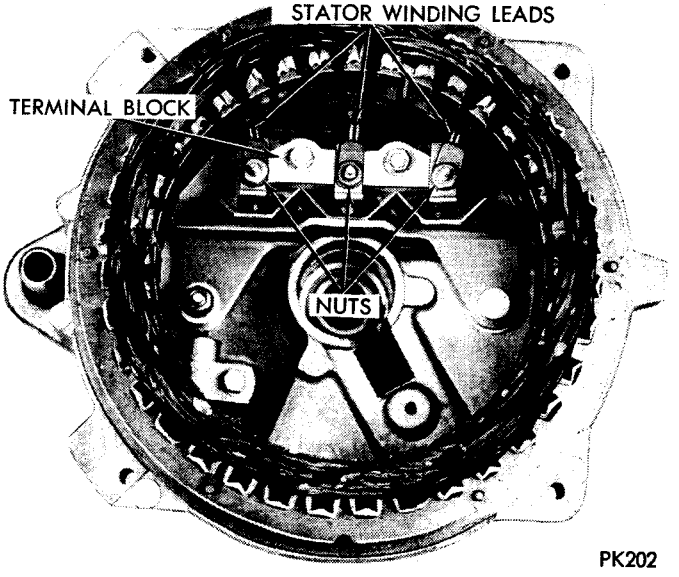


Fig. 46—Removing Stator Winding Leads

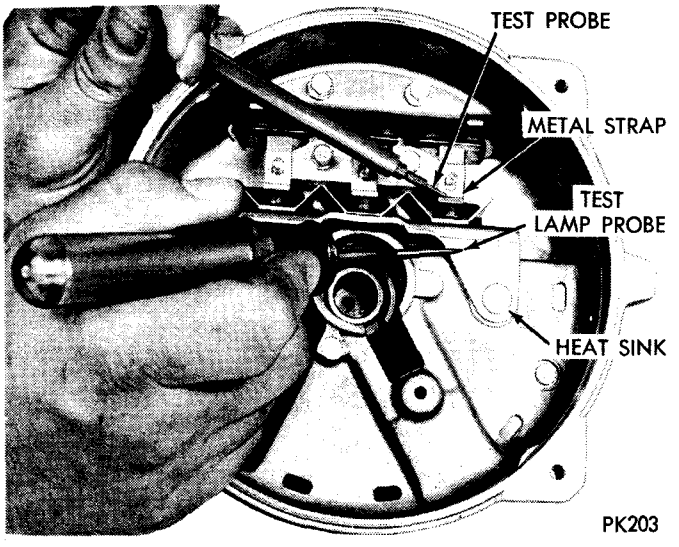


Fig. 47—Testing Rectifiers with Test Lamp

(2) Reverse probes, moving test lamp probe from rectifier heat sink to rectifier metal strap and probe from rectifier strap to rectifier heat sink.

Results

If test lamp "lights" in one direction but does "not light" in other direction, rectifier is satisfactory. If lamp lights in "both directions" **rectifier** is "shorted". If test lamp does "not light" in either direction, rectifier is "open".

Repeat above procedure for all rectifiers in both assemblies, change rectifier and heat sink assemblies which have shorted or open rectifiers. Lamp should light in same direction for all rectifiers on each assembly.

Rectifier and Heat Sink Assembly Removal (Refer to Figure 48)

(1) From inside of rectifier end shield remove nut and insulator attaching positive heat sink assembly to end shield stud.

(2) Remove screw attaching capacitor to end shield.

(3) From outside of rectifier end shield remove nut and insulator attaching positive heat sink assembly stud to end shield.

(4) Remove positive heat sink assembly and note location of all insulators (Fig. 49).

(5) Remove two screws attaching negative heat sink assembly to rectifier end shield.

(6) Remove negative heat sink assembly (Fig. 50).

(7) Remove two screws attaching terminal block to end shield.

(8) Remove terminal block.

(9) Remove capacitor and insulator.

Stator Test for Ground

(1) Press test probe firmly on outer diameter of stator frame (Fig. 51).

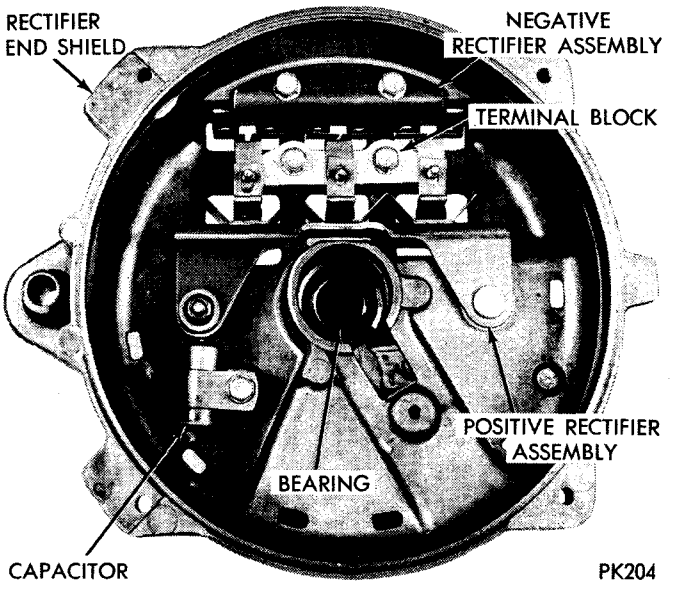


Fig. 48—Rectifier End Shield Assembly

(2) Press test probe firmly to each of three phase (stator) lead terminals, one at a time. If lamp lights, stator lead is "grounded".

(3) Install new stator if stator tested is "grounded".

The stator windings are Delta Wound. Therefore, they cannot be tested for opens or shorts with a test lamp. They can only be tested for these items with test equipment **not common** to automotive service test equipment.

If stator is not grounded, and all other electrical circuits and components of alternator test okay, it can be suspected that stator could possibly be open or shorted and must be replaced.

Pulley and Bearing Removal

(1) The pulley is an interference fit on rotor shaft. Remove pulley with Puller Tool C-4333. Position spacer block of tool in narrowest position as shown in Figure 52.

(2) Remove screws attaching bearing retainer to drive end shield (Fig. 53).

(3) Support end shield and tap rotor shaft with a

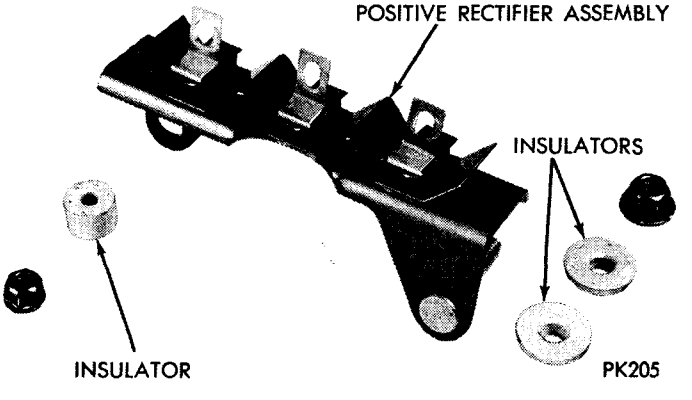


Fig. 49—Positive Rectifier Assembly and Insulators

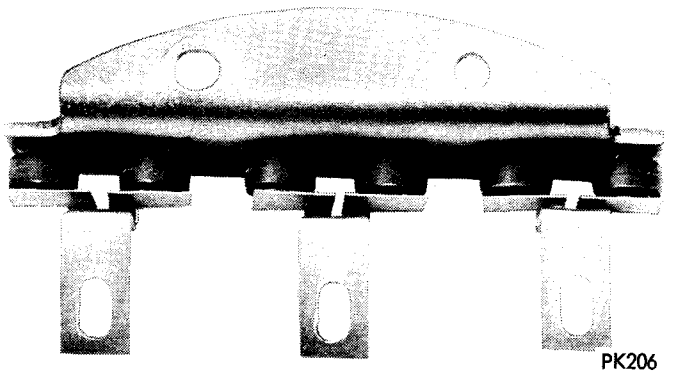


Fig. 50—Negative Rectifier Assembly Removed

plastic hammer to separate rotor from end shield.

(4) The drive end shield bearing is an interference fit with the rotor shaft. Remove bearing with Puller Tool C-4333 (Fig. 54). Position spacer block of tool in widest position.

(5) The needle roller bearing in rectifier end shield is a press fit. If necessary to remove bearing, refer to Figure 55 for correct positioning of tool C-4330.

Rotor Test

The rotor assembly may be checked electrically for grounded, open or shorted field coils and high resistance.

To check for a "grounded" field coil; connect test lamp between each slip ring to rotor shaft (Fig. 56). Test lamp should not light. If it does rotor is grounded and must be replaced.

To check for an "open" field coil, connect test lamp between slip rings (Fig. 57). Test lamp should light. If it does not rotor is open and must be replaced.

To check for high resistance connect an ohmmeter between slip rings. Reading should be 1.7 ohms to 2.1 ohms at 80°F ± 10°. Rotors that are still warm from operation on vehicle may check slightly higher. If in doubt, allow rotor to cool down and repeat test. Replace rotor if resistance is not within specified limits.

To check for a "shorted" rotor connect an ohmmeter between slip rings. If reading is below 1.7 ohms, rotor is shorted.

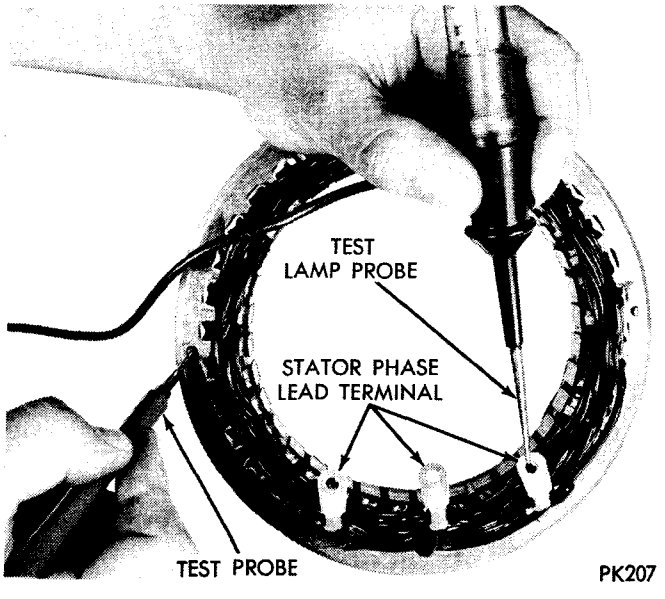


Fig. 51—Stator Test

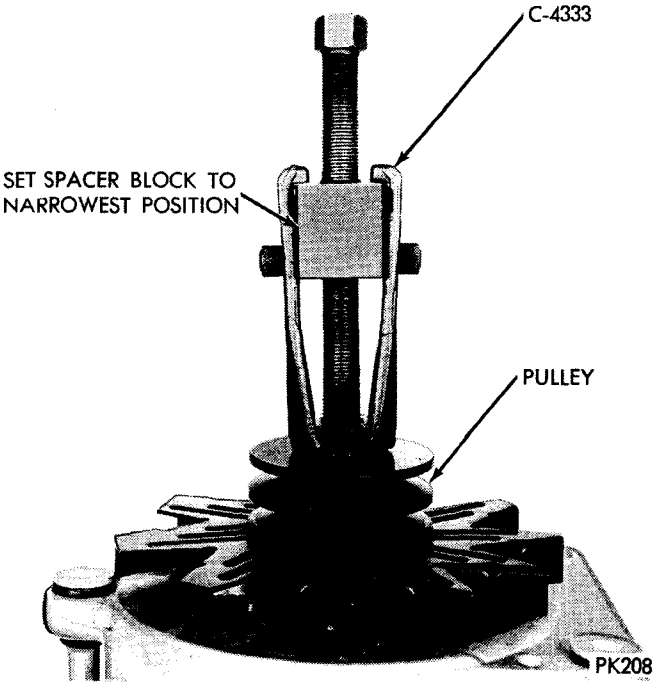


Fig. 52—Removing Pulley

Replacing Slip Rings

Slip rings are not serviced as a separate item. They are replaced with the rotor assembly.

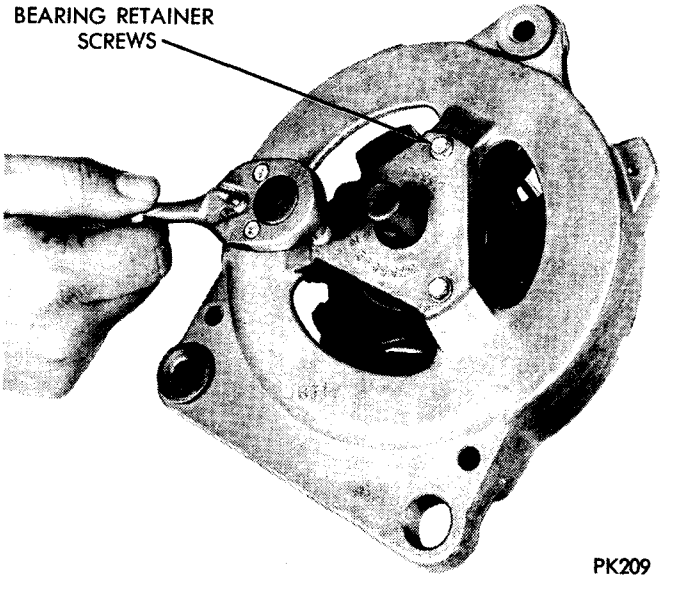


Fig. 53—Removing Bearing Retainer Screws

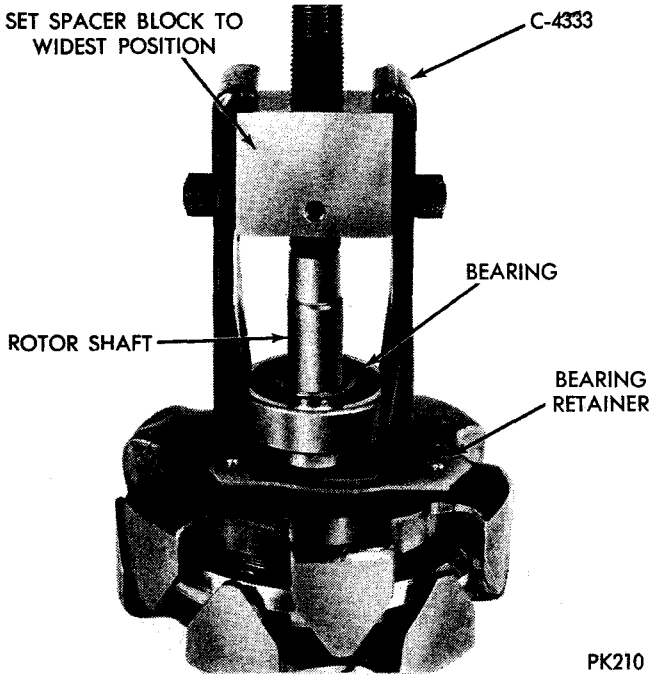


Fig. 54—Removing Drive End Shield Bearing

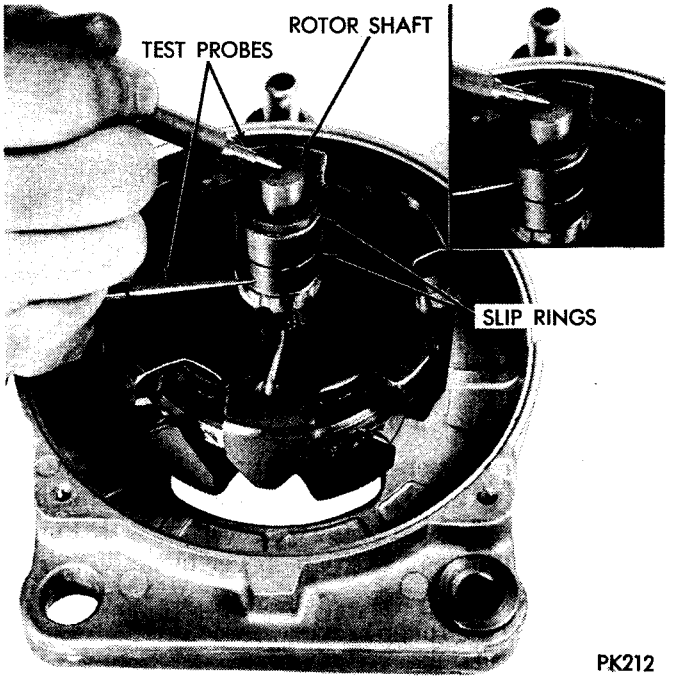


Fig. 56—Testing Rotor For Ground

ASSEMBLING THE ALTERNATOR

(1) Position grease retainer on rotor shaft and press retainer on shaft with installer Tool C-4331 (Fig. 58).

The plastic retainer is properly positioned when inner bore of installer tool bottoms on the rotor shaft.

(2) Position rectifier end shield bearing on base of Tool C-4330-1. Place alternator end shield on top of bearing so that it is properly aligned. With Tool C-4330-2 placed on end shield, press into place until end shield touches base of press (Fig. 59). **New bearings are prelubricated, additional lubrication is not required.**

(3) Insert drive end bearing in drive end shield, position retainer into place, install mounting screws and tighten securely.

(4) Position bearing and drive end shield on rotor shaft and while supporting base of rotor shaft press bearing end shield into position on rotor shaft with

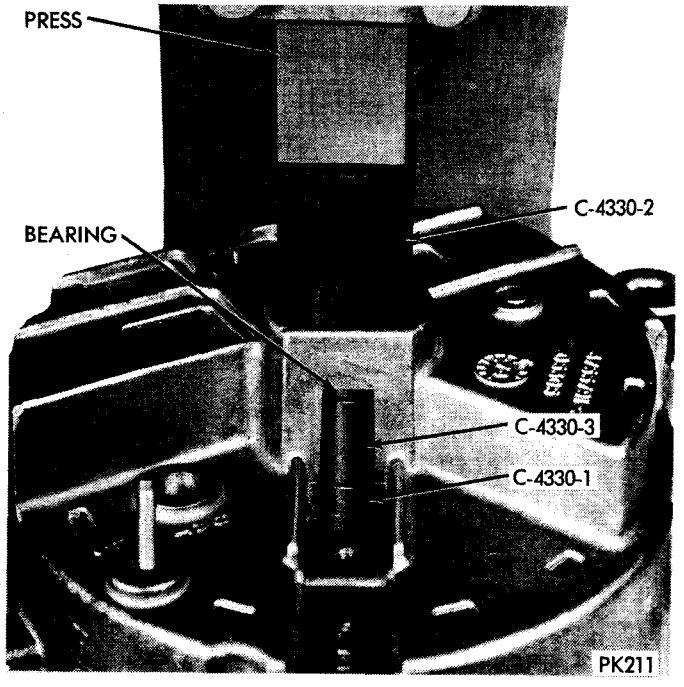


Fig. 55—Removing Rectifier End Shield Bearing

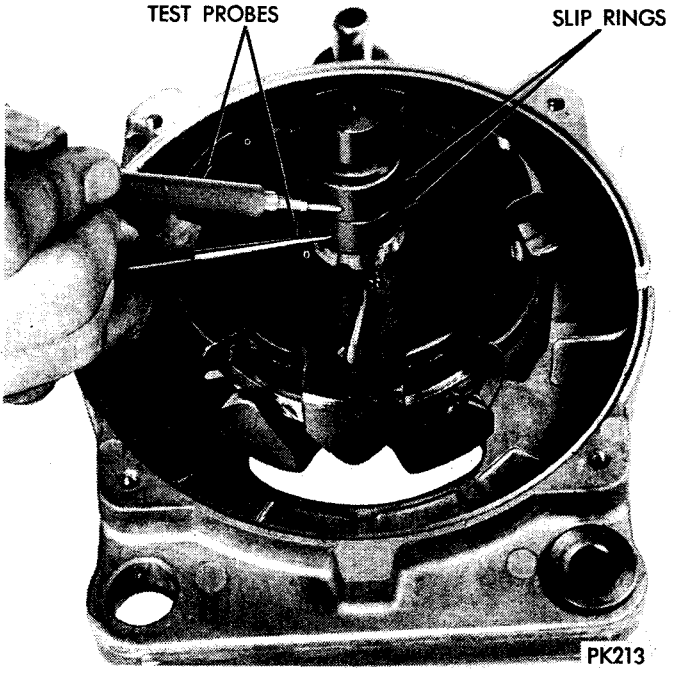


Fig. 57—Testing Rotor For Shorts or Opens

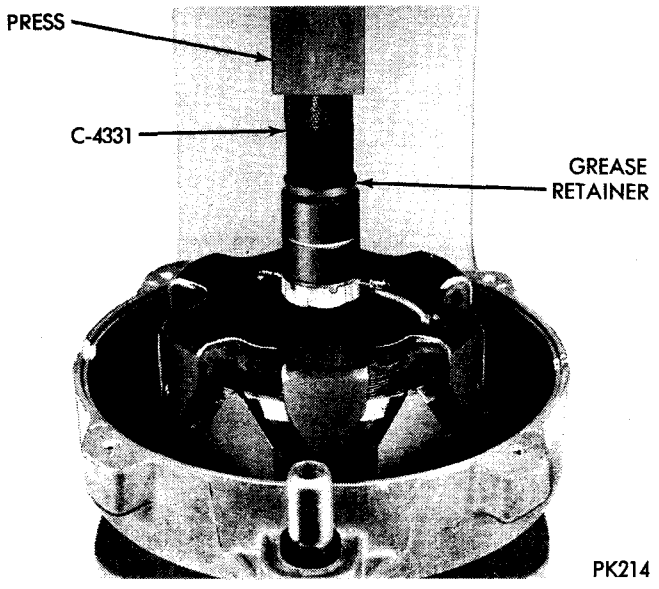


Fig. 58—Installing Grease Retainer

arbor press and Tool C-3858 (Fig. 60).

CAUTION: MAKE SURE ROTOR SPACER IS IN POSITION BEFORE PRESSING BEARING ON SHAFT.

CAUTION: MAKE SURE BEARING IS INSTALLED SQUARELY AT INSTALLATION: OTHERWISE, DAMAGE TO BEARING WILL RESULT. PRESS BEARING ON ROTOR SHAFT UNTIL BEARING CONTACTS ROTOR SPACER.

(5) Install pulley on rotor shaft. Shaft of rotor must be supported in a manner so all pressing force is on pulley hub and rotor shaft (Fig. 61). **Press pulley on rotor shaft until pulley contacts inner race of drive end bearing. Do not exceed 6800 pounds pressure. Do not hammer.**

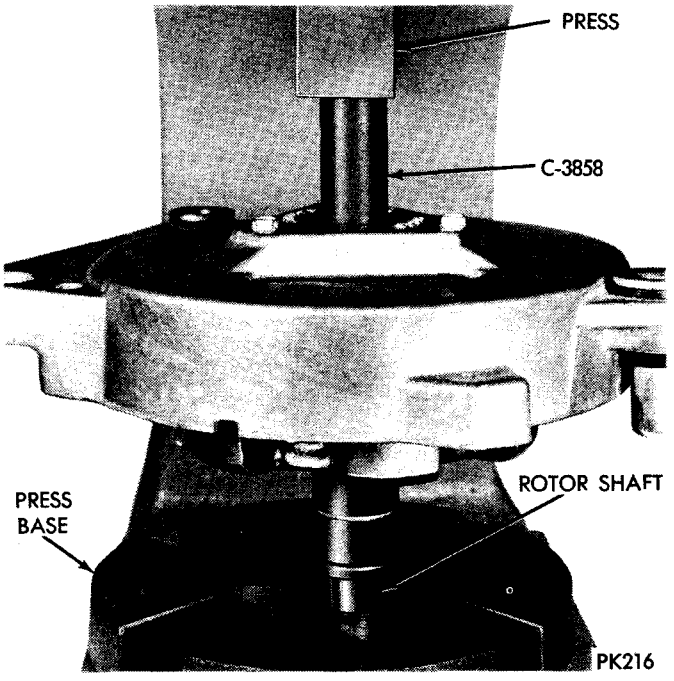


Fig. 60—Installing Drive End Shield Bearing

(6) Position insulator and then capacitor on positive heat sink mounting stud, install capacitor mounting screw and tighten securely (Fig. 62).

(7) Position terminal block into place in rectifier end shield, install mounting screws and tighten securely (Fig. 63).

(8) Position negative heat sink assembly into place in end shield making sure metal straps properly posi-

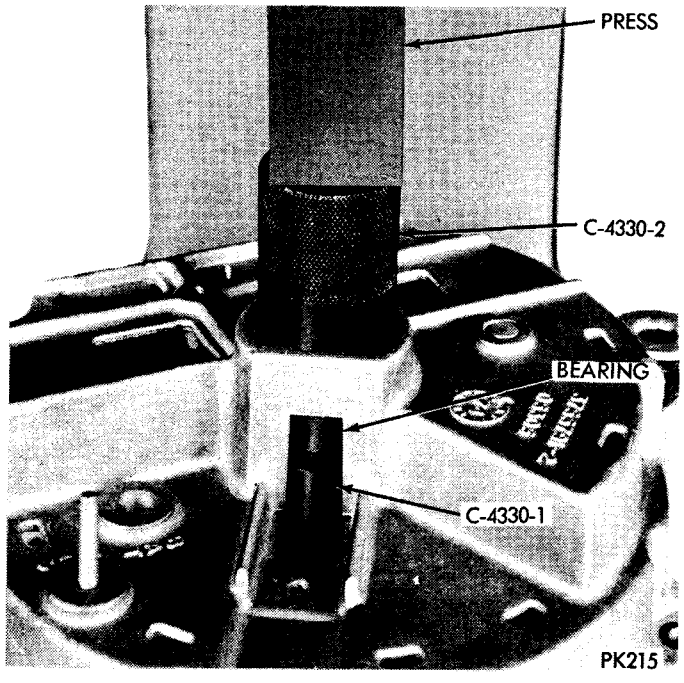


Fig. 59—Installing Rectifier End Shield Bearing

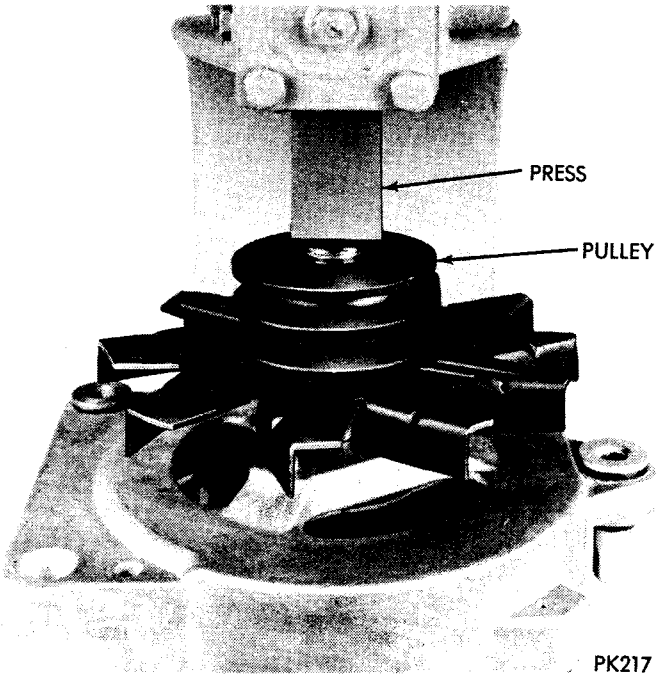


Fig. 61—Installing Drive Pulley