adjusting screw counter-clockwise ¼ turn.

When the adjusting screw is positioned to provide the correct number of active coils, hold the adjusting screw and turn the calibrating nut in the direction required with the A-24283 wrench until dimension "B" (Figure 15) indicated on the "Calibration Specification" sheets for the particular governor is provided. This measurement is from the center of the last spring coil to the inside of the governor housing, as indicated on Figure 15.

This will usually provide a setting within a few hundred revolutions of the maximum governed engine speed recommended for a particular model. However, further adjustment may be required after the governor is installed on the engine to obtain correct control and governed maximum speed. Perform any changes necessary, according to the instructions outlined under the subject of "Adjustments."

Lead type seals are recommended for the governor adjustment, inasmuch as it is possible to lock the lead type seals with a particular symbol which prevents tampering, as any change in the seal would be readily noticeable. While the patented type seals are easier to use, they offer but little protection, inasmuch as they can be easily purchased, enabling the operator or mechanic to change the adjustment and reseal the governor to avoid detection.

Generally, it is not economical to attempt major governor repairs in the average shop, as mechanics are seldom familiar with this type of work. Moreover, it will usually prove less expensive to replace the governor if necessary or have it reconditioned in an Authorized Handy Governor Service Station.

22. DESCRIPTION—PIERCE MECHANICAL GOVERNOR

Some engines are equipped with a mechanical type, belt-driven governor. Governor weights revolving with the mainshaft through centrifugal force cause the rocker shaft and operating lever to rotate. The operating lever is connected to the carburetor throttle. A calibrated spring attached to the operating lever opposes the effort exerted by the governor weights. The engine speed is governed by the balance of the two forces. Speed and sensitivity are set by the end product manufacturer to provide accurate control, and to correct surge. The governor may also be adjusted for governed engine speed.

23. ADJUSTING PIERCE GOVERNOR (Fig. 18)

a. Test Manifold Vacuum

Before attempting to adjust the governor, make certain no engine deficiencies exist. Run the engine until normal operating temperature is reached. The manifold vacuum must be at least 17 inches at idling speed with an allowable reduction of approximately 3½ inches at 5,000 feet above sea level.

b. Adjust Governor Drive Belt

Loosen the governor mounting cap screws and move the governor away from the engine to tighten the drive belt.

c. Adjust Carburetor to Governor Rod

The lower ball joint should be installed in the upper hole of the governor throttle lever. Screw in the low speed stop screw to hold the governor throttle lever in its open position, toward the rear of the engine. Hold the carburetor throttle lever against its wide open stop and adjust the length of the rod so that the upper ball joint will just fit into the tapped hole in the die cast throttle lever. Check the rod installation and eliminate friction or excessive free play by adjusting the ball joints.

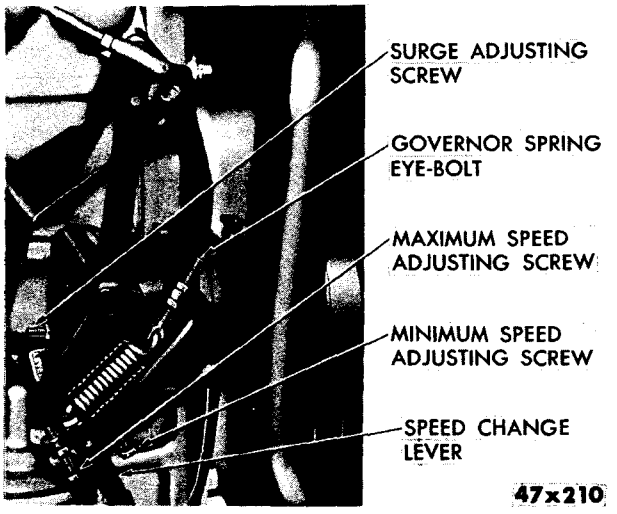


Fig. 18 — Governor Adjustments (Pierce Governor)

d. Adjust Governor to Eliminate Surge

Select an engine speed at the low point of the range at which the governor is to operate and move the speed change lever to obtain this speed. If a no-load surge is encountered at this point, turn the surge adjusting screw in ¼ turn at a time until the surge is removed. UNDER NO CIRCUMSTANCES SHOULD THIS SCREW BE TURNED IN FAR ENOUGH TO INCREASE THE NO-LOAD SPEED OF THE ENGINE MORE THAN 25 R.P.M.

e. Adjust Governor Speed of Engine

Move the speed change lever in a clockwise direction until an engine speed mid-point in the desired range is obtained. Check the regulation by loading and unloading the engine. If there is too great a variation in engine between no-load and full-load speeds, increase the tension on the governor spring by adjusting the screw eye and move the speed change lever in a counter-clockwise direction until the previously selected speed is obtained. Check results again and repeat the process until the desired regulation is obtained. Should the governor surge objectionably when the engine is under load, it will be necessary to decrease the tension on the governor spring with the screw eye and bring the engine back to the selected speed with the speed change lever. Repeat until the load surge is removed.

Move the speed change lever in a clockwise direction until the top load is reached. Set the maximum speed adjusting screw to stop the lever travel at this point. Move the speed change lever back until the lowest speed in the range is reached and set the minimum speed adjusting screw to check the lever travel at this speed. Lock all adjustments securely with the check nuts.

LIQUID PROPANE GAS

24. LIQUID PROPANE GAS OPERATION

Liquid Propane Gas is a high quality petroleum product which can be stored in liquid form under pressure, but will boil or become vapor at normal atmospheric temperatures. Although Liquid Propane gas is a liquid in the tank it can readily be converted to a vapor when entering the carburetor. The Liquid Propane gas system (Figure 19), is composed of three main units, carburetor, converter and filter.

a. **The carburetor** is of venturi principle and so designed to mix Liquid Propane gas vapor fuel and air in the correct proportions for best engine operating efficiency at all engine speeds.

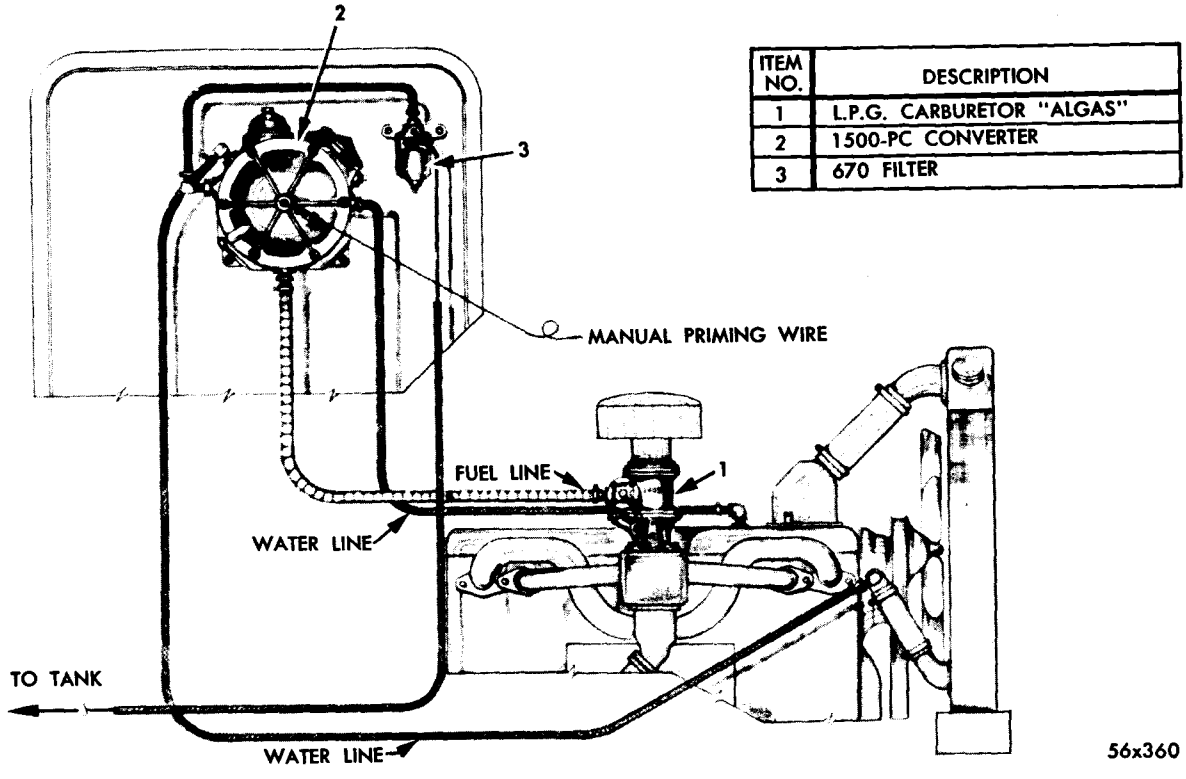
b. **The converter** is a combination heat exchanger and pressure reducing unit. The converter receives the liquid fuel under tank pressure, converts it to vapor form, reduces pressure to slightly below atmospheric, and regulates the flow of vapor in volume to meet the engine's demand.

c. **The filter's** function is to catch foreign particles of dirt that may be in the tank and fuel line.

d. **To start engine,** open throttle **all the way.** Depress plunger on the propane vaporizer for a short period of time and close the throttle to one-fourth open position. Depress magnetic safety switch and start the engine. Continue to depress safety switch button until oil pressure reaches 40 pounds. When weather is extremely cold, it may be necessary to "choke" the engine occasionally by depressing button on the vaporizer. Warm up the engine at approximately 1400 rpm before putting on the load.

25. OPERATING AND SERVICE INSTRUCTIONS

When removing or servicing converter or filter, be sure to shut off fuel at the tank and run engine until all fuel is out of the lines.



ITEM NO.	DESCRIPTION
1	L.P.G. CARBURETOR "ALGAS"
2	1500-PC CONVERTER
3	670 FILTER

Fig. 19 — Liquid Propane Gas System

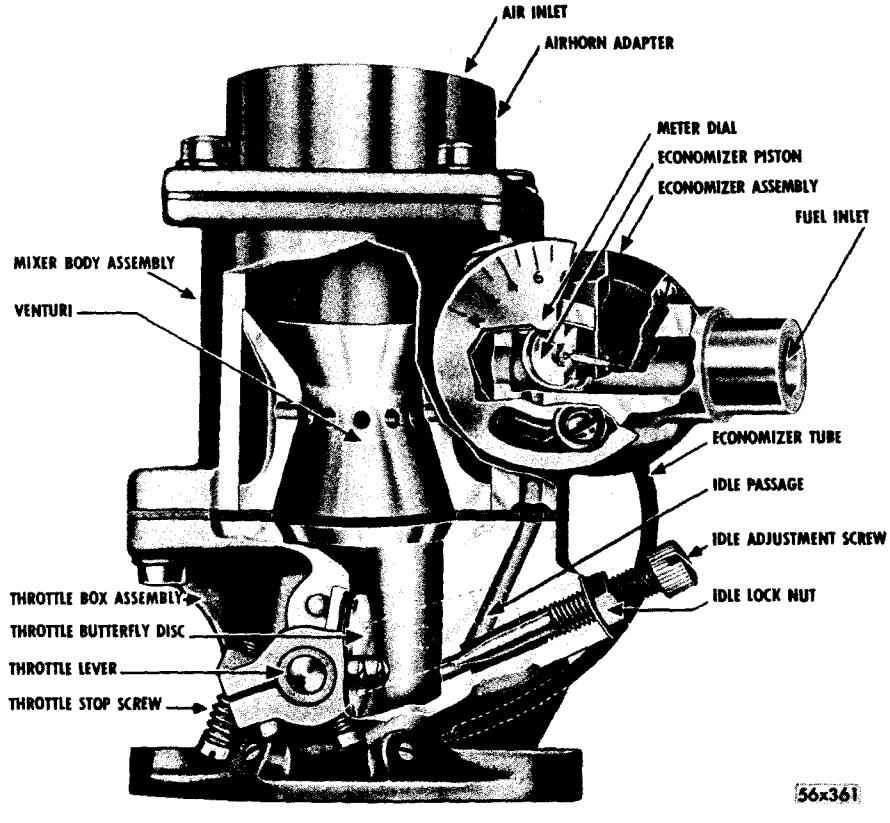


Fig. 20 — Liquid Propane Gas Carburetor

26. CARBURETOR

The Liquid Propane gas carburetor (Figure 20) replaces and serves the same function as the gasoline carburetor in that it mixes the fuel and air in proper ratio for economical operation under all load conditions. The idle, or no load, adjustment consists of a needle valve at the base of the throttle box, the setting being held by a locknut, as shown in Figure 20. The power adjustment is made by rotating the meter tube dial and is firmly set by a lockscrew. This provides the fuel setting for maximum power and rpm. The economizer varies the fuel input in proportion to engine requirements during part throttle or irregular operation at the engine, such as during cruising or deceleration periods. Adjustment is made by the economizer screw on the opposite side of the meter tube dial.

27. CONVERTER (Figure 21)

The converter is composed of three parts, as follows:

a. The heat exchanger portion is connected to the cooling system of the engine. The converter furnishes the heat for vaporizing the fuel in the transformation from liquid to vapor.

b. The primary regulator reduces the liquid fuel from existing tank pressure to a lower controllable pressure approximately 5½ to 7 pounds.

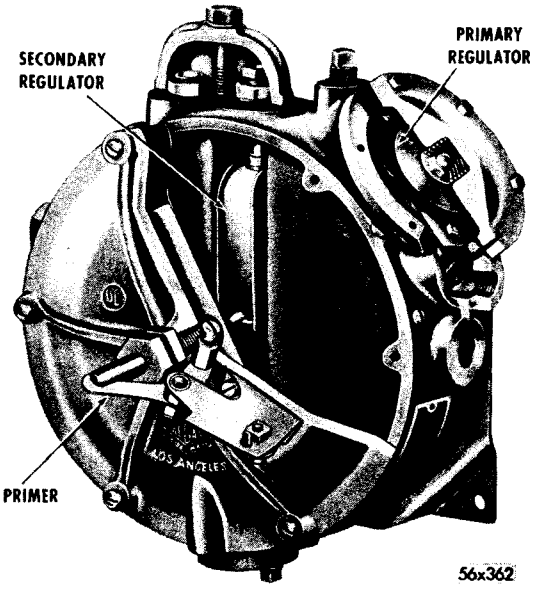


Fig. 21 — Liquid Propane Gas Converter

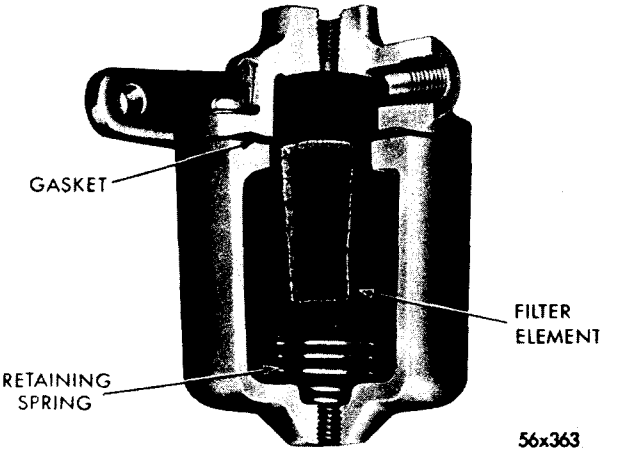


Fig. 22 — Liquid Propane Gas Filter

c. The secondary regulator is a lockoff device as well as a fuel regulation unit and controls the flow of fuel to the carburetor. It operates by engine suction when the engine is running, and locks off the fuel flow when the engine is stopped. The converter is equipped with a priming device for starting. The primer when depressed causes the secondary regulator to leak thus filling the carburetor lines and manifold with fuel sufficient to start the engine and suction takes over and operates the secondary regulator to continue the flow of fuel. Both primary and secondary regulators are controlled by spring pressure and do not require adjustment.

28. FILTER (Figure 22)

Remove the drain plug from bottom of the Filter and drain any particles trapped in filter bowl. By removing the six screws in the cover, the bowl and filtering element may be removed for cleaning or replacing.

29. ADJUSTING PROCEDURES

The following adjustments are essential to obtain the best performance of the engine operating system. Run engine to reach operating temperature before adjusting. In making adjustments, it is best to use a Tachometer and Fuel Analyzer.

30. APPROXIMATE IDLE

Screw idler adjustment (Figure 20) in (for lean) or out (for rich) until a good smooth idle is obtained. This may be checked by means

of manifold vacuum; the best idle is at the highest vacuum.

31. POWER ADJUSTMENT

Screw economizer adjustment all the way in. Set engine at 1400 rpm with throttle stop screw. After engine has stabilized at this speed, set power adjustment to read 12.5 on fuel analyzer. Tighten screw on meter tube after adjustment. If a fuel analyzer is not available proceed as follows: Set engine at 1400 rpm with throttle stop screw.

After engine has stabilized at this speed, rotate meter tube dial to the lean side until engine rpm starts to fall off, mark this point. Rotate the dial to the rich side until engine rpm again falls off and mark this point. Go halfway between marks and set 2 to 3 serations to the rich side.

32. ECONOMIZER ADJUSTMENT

With engine running at 1400 rpm after making power adjustment, turn out economizer screw gradually until engine has reached peak rpm at this throttle setting and begins to lose speed. Turn screw back in until peak rpm is reached, and tighten locknut. Fuel analyzer will read between 13.8 and 14.4 with this adjustment.

33. FINAL IDLE ADJUSTMENT

With main jet and economizer set as above, adjust idle screw for smoothest idle. The throttle stop screw is set for desired idle rpm. Making this final adjustment will not affect the correct power or economizer settings.

34. PRIMER ADJUSTMENT

Run engine at 700 rpm. Loosen locknut and turn primer out (counter-clockwise) a couple of turns. Press primer button and turn primer in (clockwise) until mixture richens to drop engine 350 to 400 rpms.

CAUTION

Under no circumstances should power settings be made too lean as this will result in poor economy and possible engine damage.

Most analyzers may reverse their reading if they have been subjected to an overly lean or rich condition. If satisfactory reading cannot be attained, check analyzer.

SERVICE DIAGNOSIS

35. POOR IDLING

Possible Causes:

a. Idle aid bleed carbonized or of incorrect size.

b. Idle discharge holes plugged or gummed.

c. Throttle body carbonized or throttle shaft worn.

d. Damaged or worn idle mixture needle.

e. Incorrect fuel level.

f. Loose main body to throttle body screws.

Remedies:

a. Disassemble carburetor. Use compressed air to clear idle air bleed after soaking in a suitable solvent.

b. Disassemble carburetor. Use compressed air to clear idle discharge holes after soaking main and throttle bodies in suitable solvent.

c. Disassemble carburetor. Check throttle valve shaft for wear. If excessive wear is apparent, replace throttle body assembly.

d. Replace worn or damaged idle needle. Adjust air mixture.

e. Check fuel level in carburetor. Adjust as necessary to obtain correct float level.

f. Tighten main body to throttle body screws securely to prevent air leaks and cracked housings.

36. CARBURETOR FLOODS OR LEAKS

Possible Causes:

a. Cracked body.

b. Defective body gaskets.

c. High float level.

d. Worn needle valve and seat.

e. Excessive fuel pump pressure.

Remedies:

a. Disassemble carburetor. Replace cracked body. Make sure main-to-throttle body screws are tight.

b. Disassemble carburetor. Replace defective gaskets and check for leakage. Tighten screws securely.

c. Check fuel level in carburetor. Make necessary adjustment to obtain correct float level.

d. Clean and inspect needle valve and seat. If found to be in a questionable condition, replace complete assembly and check fuel pump pressure.

e. Test fuel pump pressure. If pressure is in excess of recommended pressure (refer to Data and Specifications), replace fuel pump.

37. POOR ACCELERATION

Possible Causes:

a. Accelerator pump by-pass seat corroded. or bad.

b. Accelerator pump piston (or plunger) leather too hard, worn, or loose on stem.

c. Faulty accelerator pump discharge.

d. Faulty accelerator pump inlet check valve.

e. Incorrect fuel level.

f. Worn or corroded needle valve and seat.

g. Worn accelerator pump or throttle linkage.

h. Automatic choke not operating properly —if so equipped.

i. Manifold heat control valve stuck.

Remedies:

a. Disassemble carburetor. Clean and inspect accelerator pump by-pass jet. Replace by-pass jet, if it is in questionable condition.

b. Disassemble carburetor. Replace accelerator pump assembly if leather is hard, cracked or worn. Test follow-up spring for compression.

c. Disassemble carburetor. Use compressed air to clear the discharge nozzle and channels, after soaking main body in a suitable solvent. Check the pump capacity.

d. Disassemble carburetor. Check accelerator pump inlet check valve for poor seat or release. If part is faulty, replace.

e. Check fuel level in carburetor. Adjust as necessary to obtain correct float level.

f. Clean and inspect needle valve and seat.

If found to be in questionable condition, replace assembly. Check fuel pump pressure. Refer to Data and Specifications Chart for correct fuel pump pressure.

g. Disassemble carburetor. Replace worn accelerator pump and throttle linkage and check for correct position.

h. Check adjustment and operation of automatic choke. If necessary, replace the choke assembly.

38. POOR PERFORMANCE (Mixture Too Rich)

Possible Causes:

a. Restricted air cleaner.

b. Excess oil in air cleaner.

c. Leaking float.

d. High float level.

e. Excessive fuel pump pressure.

f. Worn metering jet.

Remedies:

a. Remove and clean air cleaner.

b. Remove and clean air cleaner. Refill reservoir to proper level with correct lubricant.

c. Disassemble carburetor. Replace leaking

float. Check float level and correct as necessary to obtain proper float level.

d. Adjust float level as necessary to secure proper level.

e. Check fuel pump pressure. Refer to Data and Specifications for recommended pressure. If pressure is in excess of recommended pressure, replace fuel pump assembly.

f. Disassemble carburetor. Replace worn metering jet, using a new jet of the correct size and type.

h. Remove choke heat tube; drill out sealed opening.

39. POOR PERFORMANCE (Mixture Too Lean)

Possible Causes:

a. Main metering jet damaged, worn or wrong type or size used.

b. Top shoulder seat of main discharge jet bad or tip damaged.

c. Vacuum piston worn or stuck.

d. Power jet corroded or seating badly.

e. Float level incorrect.

f. Needle valve and seat corroded or worn.

g. Defective fuel pump.

h. Intake manifold leak.

Remedies:

a. Disassemble carburetor, inspect main jet and replace if necessary.

b. Disassemble carburetor, remove main discharge jet, clean, inspect and replace if necessary.

c. Disassemble carburetor, free piston if stuck. If piston is badly worn replace air horn assembly.

d. Disassemble carburetor, clean power jet and channels and inspect. If seating is faulty replace jet.

e. Check float level in carburetor. If level is incorrect adjust vertical lip of float.

f. Clean and inspect needle valve and seat. Replace assembly if necessary, and check fuel pump pressure.

g. Repair or replace fuel pump.

h. Tighten manifold or install new gaskets, if necessary.

Section IV

COOLING SYSTEM

DATA AND SPECIFICATIONS

	MODELS *IND. 52, 53, 54, 56, 56A*
WATER PUMP	
Type	Centrifugal
Drive	Belt
Type of Bearing	Ball
Shaft End Play (Inches)	.004-.008
THERMOSTAT	
Type	Choke
Starts to Open (Degrees F.)	159-165
Fully Open (Degrees F.)	190
FAN BELT	
No. Used	Two
Type	½" Vee
Tension (Pounds)	45
RADIATOR (CHRYSLER)	
Type	Tubular
Capacity (Including Engine)	Approximately 8½ Gallons

TIGHTENING REFERENCE

Part Name	*Foot-Pounds Torque*
WATER PUMP ASSEMBLY TO BLOCK SCREW	30
WATER PUMP BY-PASS ELBOW SCREW	15
WATER OUTLET ELBOW SCREW	30

Section IV

COOLING SYSTEM

1. DESCRIPTION

The belt driven, centrifugal type water pump (Fig. 1) circulates water from the heat exchanger or radiator to the cylinder block, completely around each cylinder bore, through the cylinder heads, around the exhaust valve ports and into special passages in the intake manifold (on some industrial units) and thence to the thermostat housing for recirculation or return to the radiator or heat exchanger.

Three drain cocks are provided for draining the cooling system, one in the radiator and one at each side of the cylinder block near the exhaust manifold outlet. All three must be open to drain the system completely.

2. REMOVAL AND INSTALLATION OF WATER PUMP

a. Removal

Drain the cooling system. Remove the fan and both belts. Remove the belt pulley. Remove five water attaching cap screws and remove the water pump. On the Ind. 56 and 56A remove the water pump housing from the cylinder block and cylinder heads.

b. Installation

After completely assembling, check the shaft and impeller for free rotation and lubricate through the fitting (using only specified water pump grease) while spinning the impeller.

Using a new pump housing gasket, install the pump. Tighten cap screws to the specified torque. Install fan pulley, fan belts, and fan. Refill the cooling system.

3. DISASSEMBLY OF WATER PUMP (Removed) (Fig. 1)

Drive out fan pulley hub pin. Pull fan pulley hub with puller, Tool C-412. Remove bearing

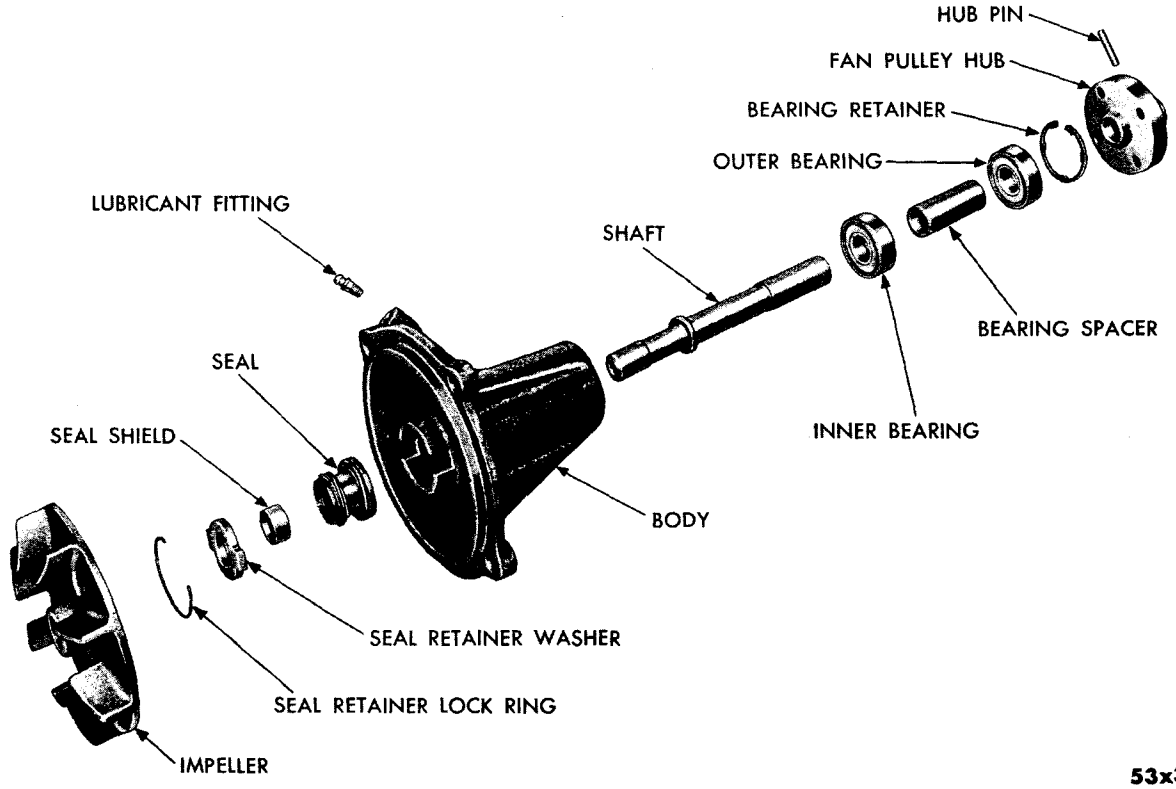


Fig. 1 — Water Pump (Typical) (Exploded View)

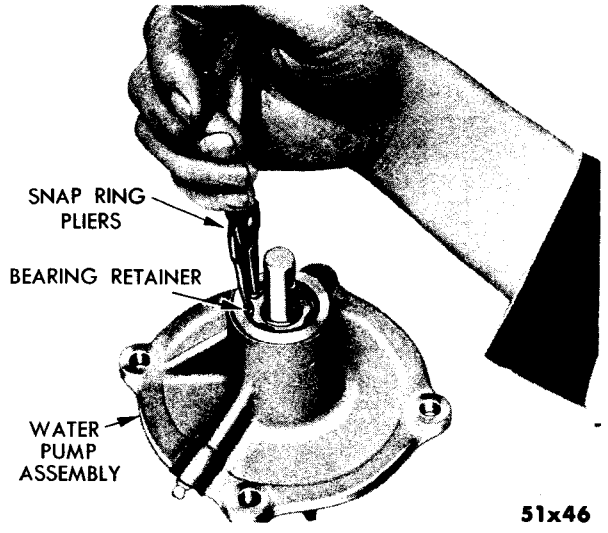


Fig. 2 — Removing or Installing Bearing Retainer (Tool C-760)

retainer with pliers, Tool C-760. (Fig. 2). Place pump assembly in a vise. Break away the plastic impeller. On some Ind. 56 and 56A Ind. engines the cast iron impeller can be removed from the water pump and used again. (Fig. 3). Then place water pump on an arbor press, front side down.

CAUTION

The pump should be placed on the arbor press so that equal pressure will be applied completely around the mounting flange. Failure to observe this precaution is likely to result in a broken water pump housing. Press water pump shaft and bearing assembly out of the water pump housing.

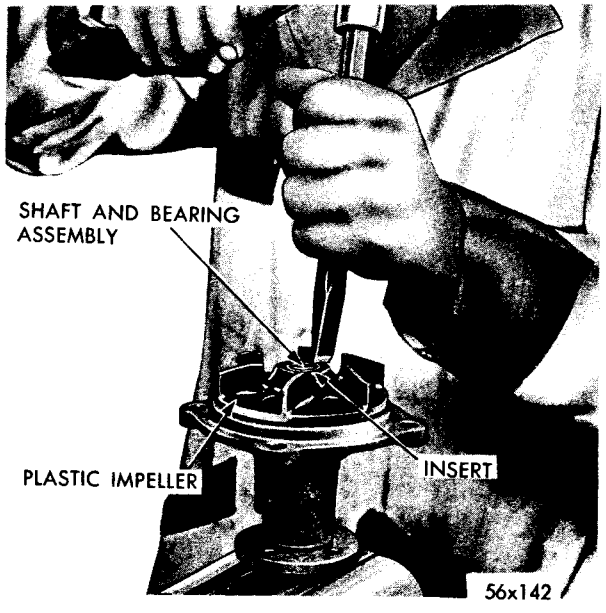


Fig. 3 — Removing Plastic Impeller

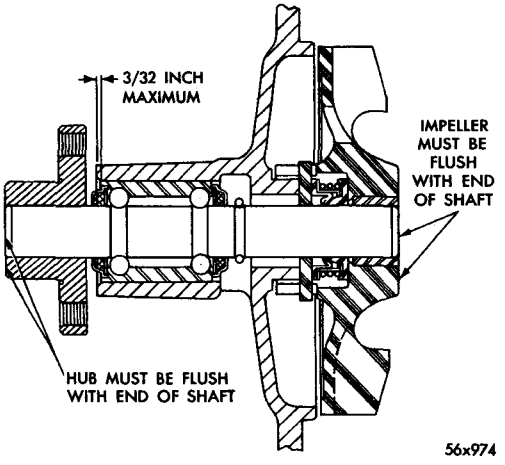


Fig. 4 — Water Pump (Sectional View)

CAUTION

The shaft and bearing assembly must be pushed out the front of the pump as a counterbore within the pump body will not allow the bearings to pass if pushed in the opposite direction. Discard shaft assembly—it will be badly damaged when pressed out of pump.

a. Cleaning and Inspection

Clean all parts thoroughly in a suitable solvent and dry with compressed air. Then inspect parts for wear or damage.

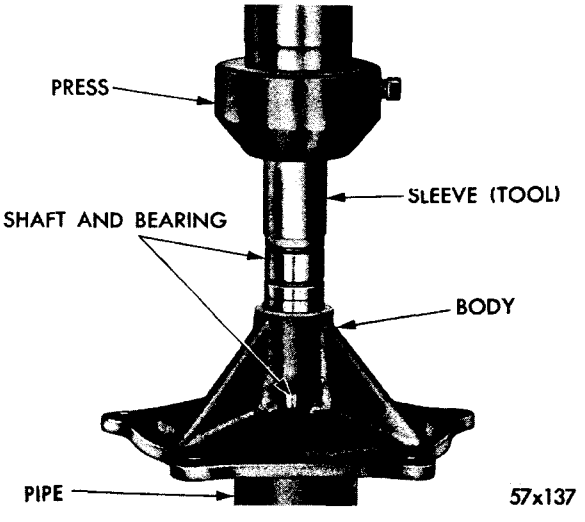


Fig. 5 — Installing Shaft and Bearings

b. Assembly

Press the new water pump shaft and bearing assembly into the water pump housing until the shoulder of bearing is $^{3}/_{32}$ inch below the machined surface of housing (Fig. 4) using Tool Sleeve C-3468, as shown in Figure 5.

Drill hole through hub and shaft, and insert new pin. If the old shaft has been used, drill a new hole at right angles to the old one.

Check end play of pump shaft. The end play of the water pump shaft should be from .004 to .008 inch. Measure with a feeler gauge between the pump body and the snap ring. Remove all traces of torn gaskets and install new ones. Install impeller cover.

Install a new water pump seal and retainer washer. *When inserting the pump impeller on the pump shaft, be certain that the flats on the impeller interlock with the lugs on the thrust washer. (Fig. 6)*

Support impeller end of pump shaft and then press water pump hub on shaft until it is flush with end of shaft.

4. INSTALLATION (On Engine)

After completing assembly, check the shaft and impeller for free rotation. Lubricate through fitting (using only specified water pump grease) while spinning the impeller.

Install pump using new pump housing gasket. On Ind. 56 and 56A install a new gasket between the cylinder block and head. Tighten

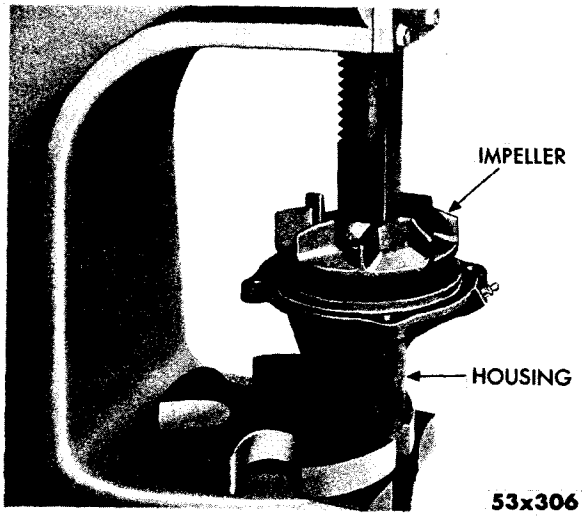


Fig. 6 — Pressing Impeller on Shaft

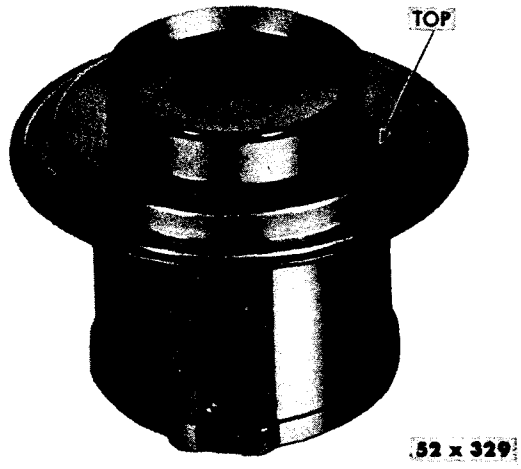


Fig. 7 — Thermostat (Choke Type)

bolts to 30 foot-pounds torque. Install fan pulley, belts and fan. Refill cooling system.

5. CHOKE TYPE THERMOSTAT (Description)

The choke type thermostat, as shown in Figure 7, is located at the top of the water pump housing. It is used to control water temperatures by restricting or permitting the flow of coolant from the cylinder heads to the radiator or heat exchanger. When the thermostat is closed, coolant from the cylinder heads is drawn through a permanent, elongated by-pass in the pump housing to the inlet side of the water pump. The coolant is then recirculated through the cylinder banks.

6. TESTING CHOKE TYPE THERMOSTAT

During the warm-up period, the thermostat will start to open at 159 to 165 degrees F. and is fully open at a temperature of about 190 degrees F.

To test the thermostat for correct opening, gently force the valve open, and insert a piece of string into the opening. Allow the valve to close. Suspend the thermostat in a pail of water with a thermometer. Heat the water. At the moment the thermostat drops off the string, the thermometer should read from 159 to 165 degrees F. Thermostat should be fully open at 190 degrees F. The temperature at which the thermostat opens, is very important and should be tested whenever the cooling system is checked. When installing the thermostat the notation "TOP" must be facing the outlet tube.

NOTE

When the engine has been exposed to extreme freezing or overheating, check the thermostat, as the excessive temperature may have caused the bellows to remain in the expanded position. In this case the thermostat must be replaced. There are no repairs or adjustments to be made on thermostats. Replace the unit if it fails to operate properly.

7. SERVICING THE RADIATOR (If So Equipped)

Only clean, soft water should be used in the radiator and the cooling system of the engine. Hard water will form a scale, not only in the radiator core, but in the engine block and heads as well. Scale or lime deposits cause hot spots within the engine and will plug the small passages of the radiator core. Dirty water will also close the tubes in the core and restrict coolant flow, and in extreme cases, will collect in the engine and cause overheating and eventual engine failure.

In some instances the engine may overheat although the fan belts, fan and coolant level in upper expansion tank are in satisfactory condition.

In this case it is usually necessary to clean and flush the entire cooling system to correct the overheating condition. In addition, all grease, oil, dirt and any other obstructions must be removed from the front of the radiator core so that the entire cooling area of the core can readily transmit the heat of the coolant to the air stream.

CAUTION

Never add cold water or anti-freeze to an overheated engine when level of cooling medium is low. The introduction of cold liquid will cause sudden contraction of overheated metal, resulting in cracks or fractures of cylinder head or block. When in doubt, allow engine to cool.

8. DRAINING AND FILLING THE COOLING SYSTEM

The cooling system has three drain cocks: one for the radiator and one on each side of the cylinder block. To completely drain the cooling system, all three drain cocks must be opened.

The capacity of the cooling system is 8½ gallons—when equipped with the Chrysler radiator.

9. CLEANING THE COOLING SYSTEM

Should the cooling system become obstructed because of internal deposits it is advisable to use a cleaner to remove the accumulations that cause a loss in cooling efficiency.

Drain cooling system and refill with clean SOFT water and the contents of one can (No. 1 top-compartment) of MOPAR Cooling System Cleaner. Run engine at a fast idle for ½ to ¾ hour. Drain cooling system and refill with clean water. Pour conditioner (No. 2 bottom-compartment) into radiator and run engine for ten minutes. Flush entire cooling system until water runs clean. Refill radiator with clean SOFT water. Use MOPAR Radiator Rust Inhibitor during the summer months.

10. WATER TEMPERATURE INDICATOR

The temperature of the water in the cylinder block is indicated by a gauge on the instrument panel.

This is operated by a gas-filled metal bulb connected to the gauge assembly by a capillary tube. The bulb is screwed into the water jacket of the cylinder head. In the event of failure to indicate or operate properly, the complete assembly (tube, gauge and bulb) should be replaced. When working on the engine, or when removing the cylinder head, work with care to avoid damaging the tube or bulb. Sharp kinks in the tube must be avoided.

The gauge will not stand a temperature in excess of 250 degrees F. If the gauge (unit on the instrument panel) is found to have a permanent set so that it does not return to 100 degrees F. when cold, it is an indication that extreme temperature has been created by low water level, frozen radiator, etc.

If the inaccuracy of the gauge is not over 30 degrees F., it is frequently possible to correct the gauge reading by bending the link which connects the operating tube to the pointer.

Immerse the metal bulb in a pail of water and heat to 140 degrees F. thermometer reading. If gauge does not indicate a similar close reading, replace complete assembly.

11. RADIATOR RUST RESISTOR

MOPAR Rust Resistor, when added to water in the cooling system, prevents formation of scale and rust. It is also a safeguard against electrolytic corrosion which takes place when dissimilar metals are used, such as in the radiator core. Scale or rust tends to obstruct flow through passages of both block and radiator, and when such formation is excessive, can cause overheating. This causes loss in lubricating efficiency and accumulation of carbon, varnish, and gums.

Follow the manufacturers' recommendations when adding MOPAR Rust Resistor to the cooling system. When the proper amount is added, no further additions are necessary except when the system is drained or flushed. Rust Resistor does not remove or dissolve rust—it is a preventive only and not a cleaner.

12. ANTI-FREEZE SOLUTION

There are several commercial liquids available which may be used to prepare anti-freeze solutions that are satisfactory for Industrial Engine cooling systems. Among these liquids are denatured alcohol, methanol (synthetic wood alcohol) and ethylene glycol. It is recommended that the cooling system be cool before adding an anti-freeze solution. To facilitate accurate testing of freeze points, it is advisable not to mix different basic types of anti-freeze.

The alcohol anti-freeze solutions are subject to evaporation, especially on heavy runs during warm weather. If these liquids are used as anti-freeze solution, the solution should be tested at least once a week, and the necessary quantity of anti-freeze added to protect the cooling system for the lowest anticipated temperature.

These liquids, if spilled on the canopy, should be washed off immediately with a generous quantity of water to prevent damage to finish.

Tighten all hose connections. If necessary, replace hose or connections to obtain tight joints. It is important that the cylinder head gasket be kept tight to prevent leakage. The use of water pump grease is further precaution against leaks at the water pump shaft.

The cooling system should be watched closely for leaks. When using water for refilling a cooling system charged with this solution, care must be taken not to overfill with water (above the proper level). This might weaken the solution and raise its freezing point.

CAUTION

Anti-freeze solutions containing sodium chloride (common salt), calcium chloride, magnesium chloride, or any inorganic salt should never be used as an anti-freeze. Water soluble organic products, such as sugar, honey or glucose or any organic crystalline compounds are not recommended. Mineral oils, such as kerosene or engine oil may damage rubber parts and therefore prove harmful.

13. TESTING ANTI-FREEZE SOLUTION

The freezing point of an anti-freeze solution may be determined by using a hydrometer made for this purpose. The solution should be tested at the temperature for which the hydrometer is calibrated. The correct hydrometer for the solution must be employed in testing. Universal hydrometers, which will test any anti-freeze solution at several temperatures, are available.

14. TORQUE CONVERTER OIL COOLER

For information concerning this unit, refer to the Clutch, Fluid Coupling and Torque Converter Section in this manual.

15. FAN

The cooling fans used in the Industrial V-8 Engines are either of the "suction" or "pusher" type. The type, size and number of blades used is dependent upon individual model application requirements.

SERVICE DIAGNOSIS

16. EXTERNAL LEAKAGE

Possible Causes:

a. Loose hose clamps.

b. Defective rubber hose.

c. Broken radiator seams.

d. Worn water pump.

e. Loose core hole plugs.

f. Damaged gaskets.

g. Warped cylinder head.

h. Cracked cylinder head.

i. Cracked cylinder block.

j. Cracked thermostat housing (water outlet elbow).

k. Leak at water temperature indicator bulb. (in head).

l. Leak at exhaust manifold center studs (long).

m. Leak at water pump attaching bolt holes.

Remedies:

a. Tighten hose clamps as required to stop leaking. Replace if necessary.

b. Replace defective hose as needed.

c. Remove radiator and solder seams. Test radiator before installation.

d. Remove and recondition water pump.

e. Remove leaking plug. Clean out hole and install new plug.

f. Check for leaks at water pump, cylinder head, thermostat housing (water outlet elbow) and by-pass tube flange. Replace gaskets as required.

g. Replace cylinder head and gasket. Tighten bolts to 70 foot-pounds torque. Tighten in sequence, as illustrated in Engine Section.

h. Replace cylinder head and tighten. (See g above.)

i. Replace cylinder block, as described in Engine Section.

j. Replace thermostat housing and gasket.

k. Tighten nut or replace adaptor.

l. Remove studs and coat with a suitable sealing compound. Reinstall and check for leaks.

m. Apply a suitable sealer to the bolts and tighten.

17. INTERNAL LEAKAGE

Possible Causes:

a. Warped cylinder head.

b. Blown cylinder head gasket.

c. Cracked cylinder wall.

d. Loose cylinder head bolts.

e. Cracked valve port.

f. Sand holes or porous condition.

g. Porous condition around distributor hole in cylinder block.

h. Cracked block in valve chamber.

Remedies:

a. Replace cylinder head and gasket. Tighten bolts to 70 foot-pounds torque and tighten in sequence, as illustrated in Engine Section.

b. Replace gasket and tighten bolts, as described in a.

c. Replace cylinder block, as described in Engine Section.

d. Tighten cylinder head bolts to 70 foot-pounds torque and tighten in sequence, as illustrated in Engine Section.

e. Weld crack in valve port or replace cylinder block, as described in Engine Section.

f. Weld sand holes or replace cylinder block, as outlined in Engine Section.

g. A porous condition in the cylinder block may be corrected by the use of a good sealing compound. Follow vendor's instructions for the best results.

h. Replace cylinder block, as described in Engine Section.

18. OVERFLOW LOSS

Possible Causes:

a. Refer to causes listed in Paragraph 19 of this section.

b. Boiling (overheating).

c. Leak in cylinder head gasket.

d. Overfilling.

Remedies:

a. Refer to remedies listed in Paragraph 19 of this Section.

b. Check cooling system, as listed in Paragraph 7, of this section.

c. Replace cylinder head gasket. If leak was internal, check oil for contamination. Drain, flush and refill to correct level.

d. Fill radiator to approximately 1¼ inches below filler neck.

NOTE

Excess water is forced out of the overflow tube due to expansion and may give the impression that the cooling system has developed a leak.

19. POOR CIRCULATION

Possible Causes:

a. Restricted water jacket.

b. Low coolant level.

c. Collapsed radiator hose.

d. Water pump impeller loose on shaft.

e. Loose adjustment of fan belt.

f. Scale in cylinder block.

Remedies:

a. Drain system. Disconnect radiator hoses and reverse flush cylinder block, as described in Paragraph 12 of this section.

b. Refill radiator to approximately 1¼ inches below filler neck.

c. Replace radiator hose, check clamps for fatigue and replace as required.

d. Remove and recondition water pump.

e. Tighten fan belts after checking the driving surfaces. If belts are frayed, cracked or greasy on the sides or bottom, replace and adjust for approximately ½ inch slack (when pushed from a straight line) midway between the fan and generator pulley.

f. Use MOPAR Cooling System Cleaner for correction of this condition. After correction, use MOPAR Rust Resistor to prevent reoccurrence.

20. CORROSION

Possible Causes:

a. Impurities in water.

b. Improper draining and service.

c. Air leaks in system.

d. Exhaust gas leakage.

Remedies:

a. Drain and flush radiator and cylinder block until clean. Refill system with clean water and add MOPAR Rust Resistor. The rust resistor contains a special water softener, making it effective when hard water is used in the cooling system.

b. Drain and flush radiator and cylinder block until clean. Refill system with clean water and add MOPAR Rust Resistor.

c. In all draining operations the drain cocks in the cylinder block must be opened. In severe cases, it is recommended that the drain cocks be removed in order to allow larger particles of sediment to be washed out.

d. Tighten all hose connections. Check for possible leaks in cylinder head gasket. Check water level in system, if necessary fill to required level.

21. OVERHEATING

Possible Causes:

a. All causes listed in Paragraph 19.

b. Excessive sludge in crankcase of engine.

c. Air passages of radiator core plugged.

d. Obstruction in front of radiator (if so equipped).

Remedies:

a. Refer to remedies listed in Paragraph 19.

b. Drain lubricating oil from engine. Refill to required level with light flushing oil. Operate engine at slow speed for approximately 15 to 20 minutes. Drain and refill case with proper grade of oil. In severe cases, remove oil pan and clean inside of block by hand.

c. Use air pressure on reverse side of radiator core and clean out passages thoroughly.

d. Remove any obstruction that blocks air entrance to the radiator.

22. FACTORS WHICH MAY CAUSE HIGHER THAN NORMAL ENGINE OPERATING TEMPERATURE

Possible Causes:

a. Incorrect ignition timing.

b. Incorrect valve timing.

c. Low oil level.

d. Tight engine.

e. Defective heat control valve.

f. Clogged, defective muffler or exhaust pipes.

g. Overloading.

h. Engine laboring.

i. Excessive engine idling.

Remedies:

a. Check ignition timing, as described in Electrical Section.

b. Check valve timing, as described in Engine Section.

c. Check condition of oil. If necessary, drain and refill to required level.

d. Use extreme care during "break-in" of a new or rebuilt engine. Run at moderate speeds —not too slow. Check oil and water levels often, adding oil or water as required.

e. Replace heat control valve spring and check valve stop for wear or damage. Replace stop if necessary.

f. Check exhaust system for restriction, replace parts as required.

g. Avoid excessive loads.

h. To avoid engine lugging or laboring, shift to the next lowest gear.

i. Avoid excessive idling over prolonged periods.

23. OVERCOOLING

Possible Causes:

a. Defective thermostat.

b. Inaccurate temperature gauge.

Remedies:

a. Check thermostat for operation, as outlined in Paragraph 6 of this section. Replace if necessary.

b. Check water temperature gauge.

Section V

ELECTRICAL SYSTEM

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

Section V

ELECTRICAL SYSTEM

DATA AND SPECIFICATIONS

STARTING MOTOR

	6 Volt	*12 Volt*	*24 Volt*
Make	Autolite	Autolite	Autolite
Model	MCL-6308	MCT-6301	MCZ-4107T
Chrysler Part Number	1558155	1616639	1558150
ARMATURE			
End Play (in.)	.005–.030	.005–.030	.005–.030
Runout (in.)	.003	.003	.003
BRUSHES			
Number Used	4	4	4
Spring Tension (oz.)	42–53	42–53	42–53
Field Coils	4	4	4
DRIVE			
Type	Clutch	Clutch	Clutch
Pinion to Thrust Washer Clearance (in.)	1.317–1.467		
Clearance (in.)	$\frac{3}{32}+\frac{1}{32}$ or $-\frac{1}{64}$	NA	NA
Pinion Teeth	9	9	9
FREE RUNNING TEST			
Amperage Draw (Max.) @5 Volts	65 Amps.	@10 Volts 35 Amps.	@20 Volts 12 Amps.
Minimum Speed (r.p.m.)	4900	4800	3400

STARTING MOTOR (Contd.)

	6 Volt	*12 Volt*	*24 Volt*
STALL TORQUE TEST			
Voltage	2 Volts	4 Volts	8 Aolts
Amperage Draw (Max.)	410 Amps.	175 Amps.	75 Amps.
Minimum Torque (ft. lbs.)	8	6.5	5

GENERATOR

	6 Volt	*12 Volt*	*24 Volt*
Make	Autolite	Autolite	Autolite
Model	GGW-6001Q	GJC-7012-S1	GPH-6002TS
Chrysler Part Number	1383531	1787931	1550597
Type	Shunt	Shunt	Shunt
Rotation (Drive End)	C. W.	C. W.	C. W.
Bearing (Drive End)	Ball	Ball	Ball
Bushing (Commutator End)	Oilite	Oilite	Oilite
Armature End Play (in.)	.003–.010	.003–.010	.003–.010
Ground Polarity	Positive	Positive	Positive
Number Brushes	2	2	2
Brush Spring Tension (oz.)	35–53	18–36	35–53
Field Coil Draw (Amps.)	@5 Volts 1.6–1.7 Amps.	@10 Volts 1.2–1.3 Amps.	@20 Volts 0.8–0.9 Amps.
Output—Hot			
Volts	8	15	30
Maximum Amps	45	30	10
Maximum r.p.m.	2125	2250	1800
Control	Current and Voltage Regulator		

CURRENT AND VOLTAGE REGULATOR

	6 Volt	*12 Volt*	*24 Volt*
Make	Autolite	Autolite	Autolite
Model	VBE-6201A	VRX-6201A	VBJ-6001AT
Chrysler Part Number	1343573	1642333	1486145
Armature Air Gap (in.)			
Cutout Relay	.031–.034	.031–.034	.031–.034
Voltage Regulator	.048–.052	.048–.052	.048–.052
Current Regulator	.048–.052	.048–.052	.048–.052
Contact Gaps (in.)	.015 Min.	.015 Min.	.015 Min.
Closing Voltage	6.3–6.8	13.0–13.8	26.0–27.2
Voltage Regulator Volts @ 70° F.	7.2	14.5	29.3
Current Regulator Amps. @ 70° F.	45	30	25
Ground Polarity	Positive	Negative	Negative

IGNITION DISTRIBUTOR

MODELS	*52*	*53*	*54*	*56*	*56A*
Make	Autolite	Autolite	Autolite	Autolite	Autolite
Model	IBM-4001-B	IBM-4101-A	IBM-4101-B	IBB-4105-B	IBB-4105-B
Chrysler Part Number	1664956	1792703	1793772	1634193	1634193
Rotation	C. W.	C. W.	C. W.	C. W.	C. W.
Advance Control	Governor Only	Governor Only	Governor Only	Governor Only	Governor Only
Drive	Camshaft	Camshaft	Camshaft	Camshaft	Camshaft
Bushings	Oilite	Oilite	Oilite	Oilite	Oilite
Condenser Capacity (Microfarads)	.250–.285	.250–.285	.250–.285	.250–.285	.250–.285

IGNITION DISTRIBUTOR (Contd.)

MODELS	*52*	*53*	*54*	*56*	*56A*
Breaker Arm Spring Tension (oz.)	17–20	17–20	17–20	17–20	17–20
Cam Angle (One Set Points)	26°–28°	26°–28°	26°–28°	26°–28°	26°–28°
Total Dwell	32°–36°	32°–36°	32°–36°	32°–36°	32°–36°
Point Gap (in.)	.015–.018	.015–.018	.015–.018	.015–.018	.015–.018
Timing Mark Location	4° BTDC	6° BTDC	5° BTDC	8° BTDC	8° BTDC
Firing Order	1-8-4-3-6-5-7-2				

AUTOMATIC ADVANCE CURVE

DISTRIBUTION RPM AND DEGREES

IND. 52		*IND. 53*		*IND. 54*		*IND. 56*		*IND. 56A*	
DEG	RPM	DEG	RPM	DEG	RPM	DEG	RPM	DEG	RPM
0	350	0	350	0	350	0	350–425	0	350–425
1	370	1	385	1	385	1	425	1	425
8.5	500	5	515	5	515	6	825	6	825
16	1650	8	615	8	615	11	1900	11	1900
17	1800	9	650	9	650	12	2100	12	2100

AUTOMATIC ADVANCE CURVE

DEGREES AND INCHES OF MERCURY

IND. 52	*IND. 53*	*IND. 54*	*IND. 56*	*IND. 56A*
DEG. MER.	DEG. MER.	DEG. MER.	DEG. MER.	DEG. MER.
None	None	None	None	None

SPARK PLUGS

MODEL	*52*	*53*	*54*	*56*	*56A*
Make	Autolite	Autolite	Autolite	Autolite	Autolite
Type					
Hot	None	None	None	None	None
Cold	AR-41	None	None	AGR-41	AGR-41
Standard	AR-51	AGR-51	AR-41	AR-41	AGR-51
Size	14	14	14	14	14
Length of Spark Plug	3/8" with Gasket	3/4" with Gasket	3/8" without Gasket	3/4" without Gasket	3/4" without Gasket
Gap	.035	.035	.035	.035	.035

COIL

ALL MODELS	*IND. 52, 53, 54, 56, 56A*
Make	Autolite
Model	CAM-4002—6 Volt
	CAH-4001-32-1—12 Volt
	EO-15381—24 Volt

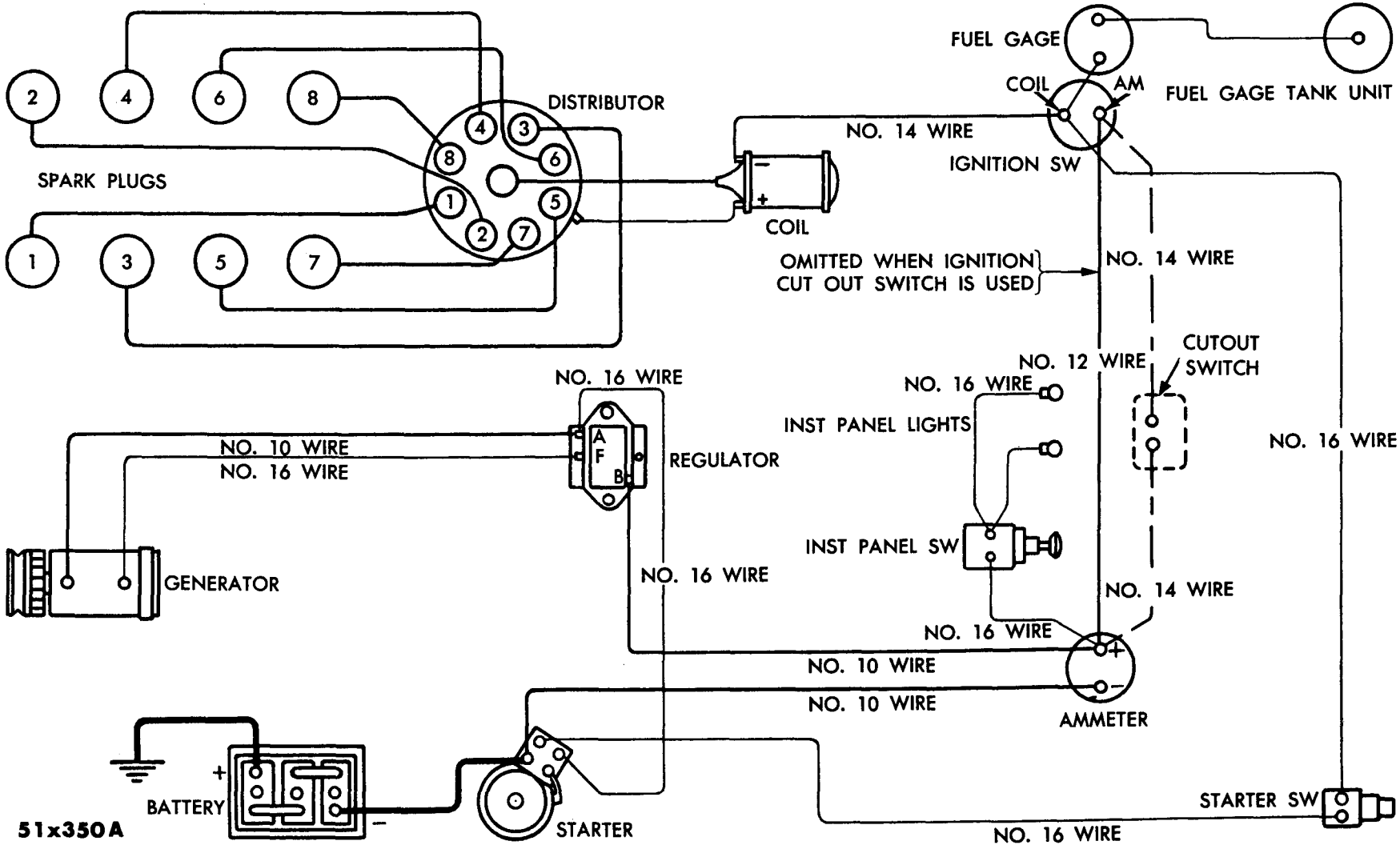


Fig. 1 — Wiring Diagram 6-12-24 Volt Positive Ground System

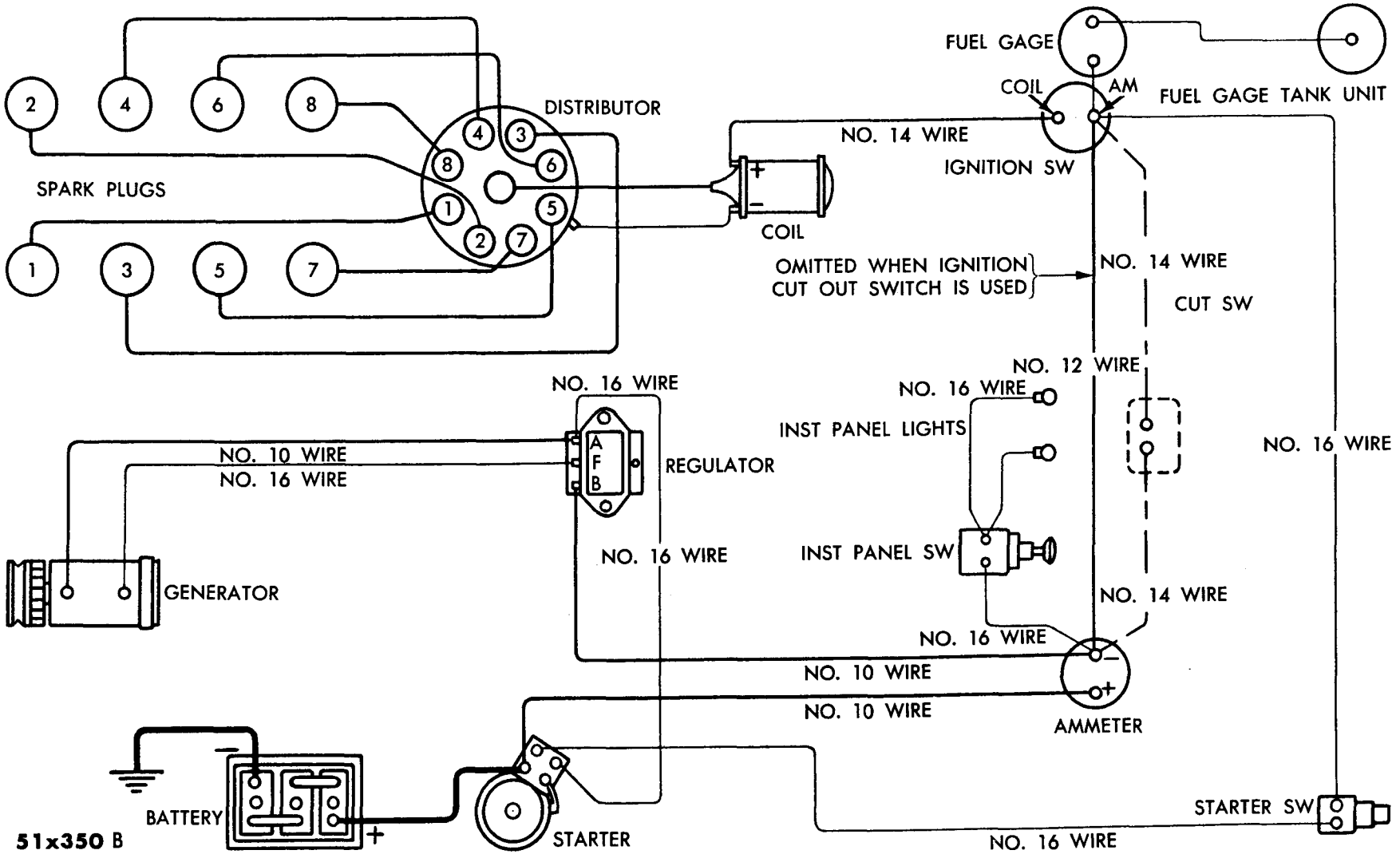


Fig. 2 — Wiring Diagram 6-12-24 Volt Negative Ground System

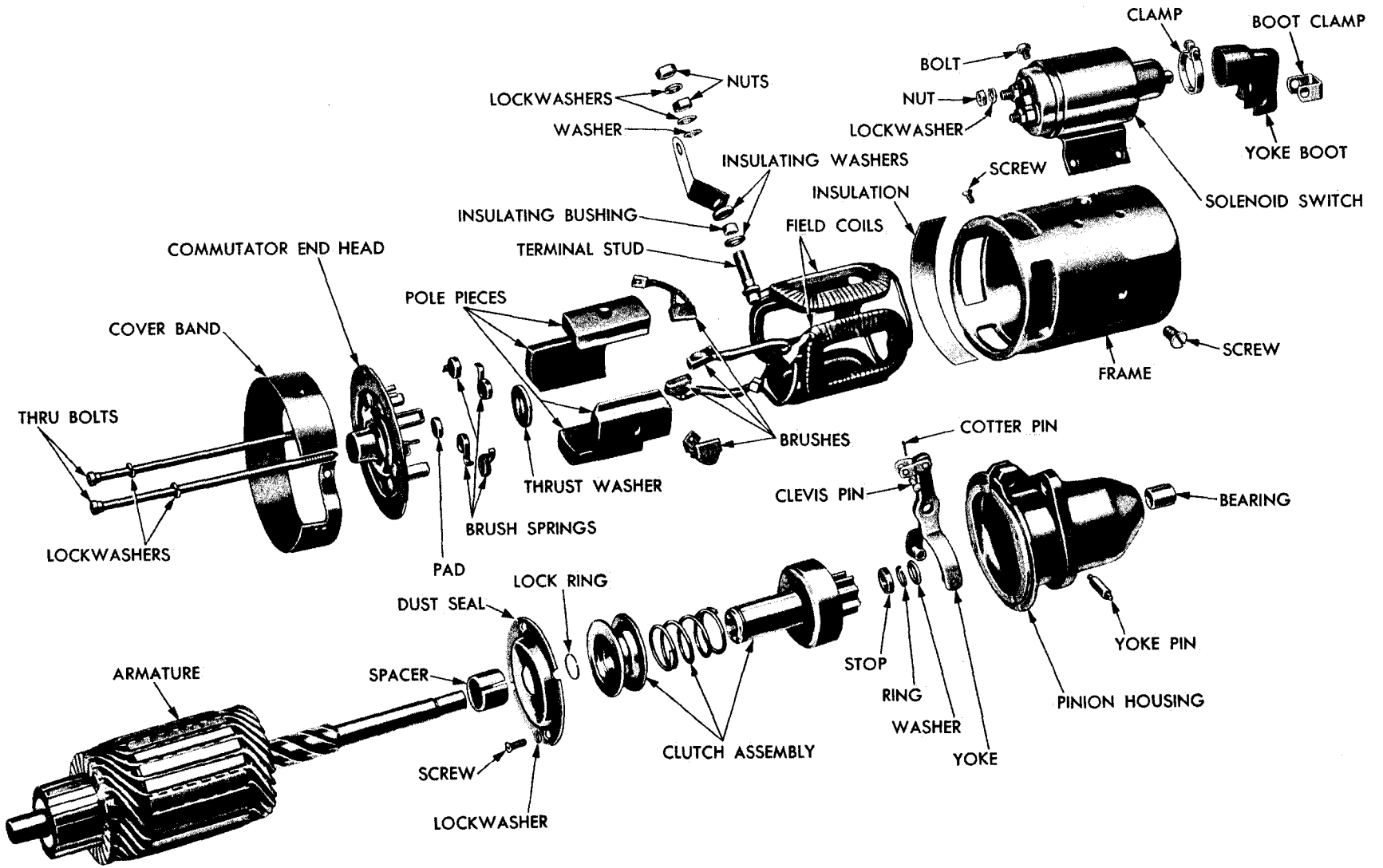


Fig. 3 — Typical Starter (Exploded View)

Section V

ELECTRICAL SYSTEM

Chrysler Industrial IND. 52, 53, 54, 56 and 56A Engines are equipped with 6-volt, 12-volt or 24-volt electrical systems, depending upon installation requirements. (See Figs. 1 and 2).

The following service information, though written for the 6-volt system can be adapted for the 12-volt, and 24-volt systems. The procedures listed will vary only in the general specifications of the units concerned.

When testing the 12-volt and 24-volt equipment, refer to Data and Specifications page for the information desired.

STARTER

The starter is of the conventional four pole, four brush type employing an overrunning clutch type drive (Fig. 3).

The starter solenoid, as shown in Figure 4, is controlled by a push button. As the button is pushed, current flows from the ignition and starter switch through the solenoid relay coil and generator armature to ground. This causes the relay armature to close the contact points. Current then flows from the battery connections at the solenoid through the relay points and coils of the solenoid.

The solenoid winding is made up of two coils. One coil is connected from the relay points to the starter side of the solenoid starter switch. The other coil is connected from the same side of the relay points to ground. When the relay points are first closed, current flows through both coils, which immediately pulls in the solenoid plunger and shift lever, engaging the pin-

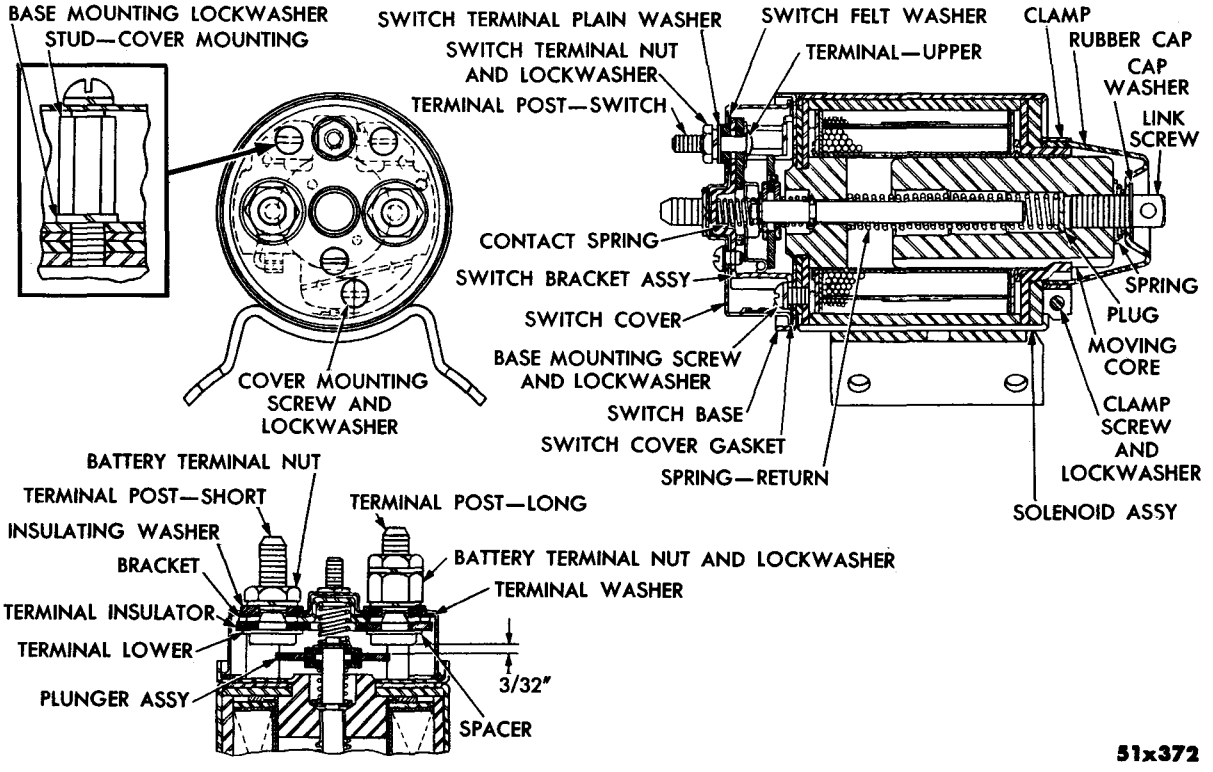


Fig. 4 — Typical Starter Solenoid

ion of the starting motor with the flywheel. At the end of travel of the plunger, the starter switch disc is closed and the starter cranks the engine.

As the starter switch disc is closed, one coil of the solenoid is shorted out (coil from battery lead post to starter side of the solenoid switch). The second coil remains in the circuit with sufficient current to hold the pinion in engagement with the flywheel while the engine is being cranked. As soon as pressure on the starter button is released, the relay contacts open, breaking the solenoid circuit and allowing the return spring on the shift lever to disengage the pinion. The solenoid circuit is also interrupted when the generator speed increases on starting of engine due to voltage build-up which opposes the flow of current from the ignition and starter switch.

SERVICE PROCEDURES

1. REMOVAL AND INSTALLATION OF STARTING MOTOR

a. Removal

(1) Disconnect the battery negative cable at the battery.

(2) Disconnect the battery cable, main lead and relay lead wires at the solenoid.

(3) Using Tool C-455, remove starting motor bolts and remove motor from engine.

b. Installation

(1) Clean drive end housing flange and flywheel housing starting motor mounting face.

(2) Position starting motor in flywheel housing and install bolts. Tighten bolts evenly to 50 foot-pounds torque.

(3) Install the relay lead wires, main lead wire and battery cable on solenoid.

NOTE

Clean the inside of the battery cable terminal post and clean the terminal post before installing the cable.

(4) Connect the battery cable to the battery terminal post and cover the terminal with petroleum jelly.

(5) Test the operation of the starting motor.

2. TESTING STARTING MOTOR (Assembled)

The starting motor should be checked to see that the free running voltage and current are within the limits shown in the Data and Specifications.

a. Testing For Free Running

Remove starting motor. Place on test bench and connect the starter to a fully-charged 6-volt battery, with a resistor in parallel. Adjust the resistor to 5.5 volts across the battery. Run the motor (if new brushes were installed) for approximately two minutes to allow the brushes to seat. Cool motor before testing.

The ammeter should show a current draw of 50-65 amps., while the starter is running free. If the amperage is too high, check the bushing alignment and end play for binding or interference.

If a test bench is not available, connect the starter to a 6-volt battery. If the armature revolves smoothly at a satisfactory speed, the motor will crank the engine.

b. Testing For Stall Torque

Connect the starter to the test bench and mount torque arm and spring scale on the starting motor. Close the test bench switch and adjust the resistor so that the specified voltage is shown on the voltmeter. At 8 foot-pounds torque, the ammeter reading should be 410 amps., and the voltmeter reading should be 4.0 volts.

If the test results are not as specified, recondition or replace the unit.

3. DISASSEMBLY OF STARTING MOTOR (Removed) (Fig. 2)

(1) Lift the brush springs and pull the brushes

up until the springs rest against the side of the brush.

(2) Remove the through bolts and tap the drive end housing from the locating pin. Lift the housing from the field frame.

(3) Remove the armature and the drive assembly from the field frame.

(4) Remove the nut from the yoke bolt and drive the bolt through the drive end housing and yoke lever. Remove the yoke lever and drive assembly from the housing.

(5) Remove the insulated brushes from the commutator end head and lift the head from the field frame.

(6) Remove the field coils from the field frame (if necessary), using Tool C-3078.

4. TESTING STARTER ARMATURE

Place armature in a growler, as shown in Figure 5, and rotate armature while holding a testing blade parallel with the core slots. A short will be indicated by the vibration of the test blade when it is over a coil in which a short exists.

Inspect the commutator grooves for the presence of metal particles that may be causing a short. Remove particles by drawing a thin-bladed undercutting tool through the grooves. Retest unit in the growler. Replace shorted armature.

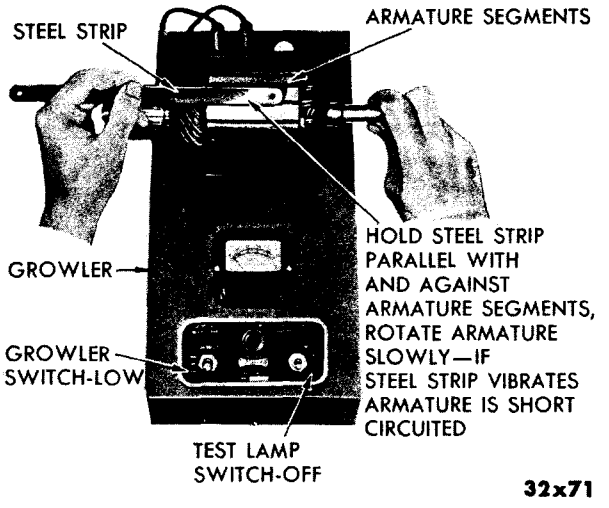


Fig. 5 — Testing Starter Armature for Short Circuit

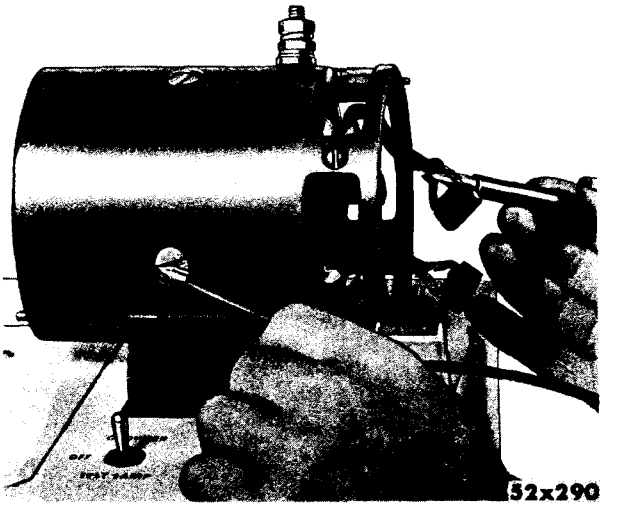


Fig. 6 — Testing Field for Ground

5. SERVICING THE COMMUTATOR

The armature commutator should be cleaned, if covered with dirt or oil film. If the mica is high, or the commutator is out of round, it should be turned down in a lathe. Remove only sufficient material to correct the difficulty.

NOTE

The undercutting tool should be .002 inch wider than the mica. Center the tool so that .001 inch of the commutator bar is removed on each side of the mica.

Undercut the mica $\frac{1}{32}$ inch and use 00 sandpaper to remove burrs and to smooth the commutator.

CAUTION

After undercutting, make certain that metal particles resulting from the operation, are cleaned out. Do not permit metal particles to remain between the commutator bars, or the armature may short out. Retest armature in a growler.

6. TESTING FIELD AND BRUSH HOLDERS FOR GROUND

a. Testing for Grounded Field (Fig. 6)

A grounded field can be located by touching test prods from a 110-volt test lamp between the contact terminal and the starter frame. If the field is grounded, the test lamp will light.

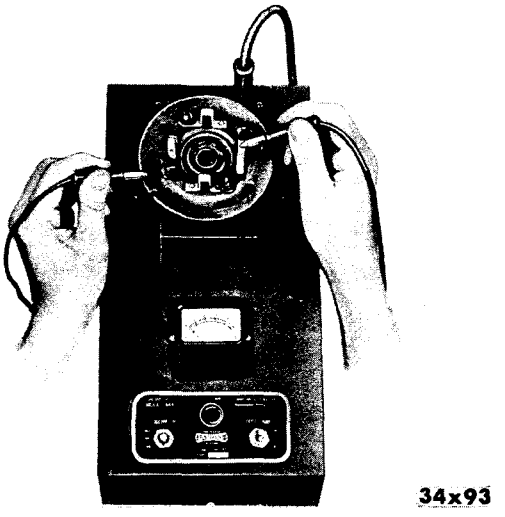


Fig. 7 — Testing Brush Holder for Ground

CAUTION

The brush leads must not touch the ground.

b. Testing Brush For Ground (Fig. 7)

Touch the test prods from a 110-volt test lamp to the insulated brush holder and the commutator end head. The test lamp should not light. If the lamp lights, replace the commutator end head.

7. SERVICING THE BRUSHES

Replace the brushes if oil soaked, or worn within one-half their original length.

To remove the brushes, unsolder and unclinch the lead from the field coil or connector. Insert the new brush lead into the clip, clinch and solder to make a low resistance connection. Do not use acid as a soldering flux. The acid will damage insulation, cause corrosion, and high resistance connections will result. Use an alcohol and resin solution or resin core solder.

a. Testing Brush Alignment

Install a spare brush in the brush holder. The brush must be parallel with the commutator segments. To align the brush, install a new commutator end head assembly.

b. Testing Brush Spring Tension

To measure spring tension, hook a spring scale under the spring (where the spring presses on the brush, with the brush in place). Hold the scale parallel with the brush. Pull up on the scale until the spring starts to move and observe the reading on the scale. If, according to the indication on the scale, the springs have less than 42 ounces tension or more than 53 ounces tension, replace the springs.

8. SERVICING THE BUSHINGS

Place the armature in a vise which has soft jaws. Do not clamp the core tight or the laminations will be damaged. Place the commutator end head in position on the armature shaft and check for play. If side play is excessive, a bushing or the shaft is worn. Make the necessary replacements. Check the drive end frame in the same manner at the drive end of the armature shaft.

9. SERVICING THE OVER-RUNNING CLUTCH

Using cleaning solvent and a brush, clean the outside of the drive.

CAUTION

Do not soak the drive because the clutch mechanism can not be lubricated.

Inspect for wear and make certain that the drive slides freely on the armature shaft. Replace the drive, if the pinion, or internal splines, are worn or damaged. Place the drive on the armature shaft and turn the pinion. The pinion should turn in one direction and lock in the opposite direction. If the clutch action slips, is sluggish or restricted, the drive assembly should be replaced.

10. ADJUSTING PINION CLEARANCE

It is important that the relationship between the over-running clutch drive (or pinion) and the solenoid switch be maintained within proper limits.

(1) Remove the strap connecting the solenoid to the starter terminal post. This will eliminate the current through the solenoid pull in coil.

(2) Connect a lead wire between the positive battery post and the starter frame.

(3) Connect a lead wire from the negative battery post to the solenoid switch terminal.

(4) Push the solenoid plunger into the solenoid, by hand, until the solenoid hold-in coil will hold the pinion in the engaged position.

(5) Measure the pinion clearance with a feeler gauge placed between the end of the pinion and the drive end thrust collar. The pinion clearance should be as shown in Data and Specifications.

(6) To adjust the proper clearance disconnect one of the jumpers from the battery.

(7) Remove the pin from the link screw and turn the screw in to decrease clearance, or turn screw out to increase clearance.

(8) Replace the pin in the link screw and the jumper. Test after each adjustment.

11. CHECKING ARMATURE SHAFT END PLAY

(1) Push the armature toward the commutator end head and measure between the shoulder on the shaft and the drive end thrust washer. The proper clearance is from .005 to .030 inch.

(2) Adjust clearance, if required, by inserting thrust washers between the leather brake washer and the commutator end head.

12. ASSEMBLY OF STARTING MOTOR (Fig. 3)

(1) Soak the bronze bearing and felts in SAE 10-W engine oil and apply a light film of oil to the shaft bearing surfaces. Remove excess oil. Do not allow oil to get on the commutator or brushes.

(2) Assemble the starting motor, checking carefully to make sure that all thrust washers and spacer washers are installed in their proper locations.

(3) When assembling the yoke, the yoke shoes must be installed with curved edge toward pinion end of drive.

(4) Install the solenoid switch and linkage, making certain that the linkage operates freely. Check the operation of the pinion.

(5) Check the armature for free rotation with no binding except that exerted by brush spring tension.

(6) Perform the free running test, as outlined in Paragraph 2, before installing the starting motor on the engine.

SERVICE DIAGNOSIS

13. STARTER FAILS TO OPERATE

Possible Causes:

a. Weak battery.

b. Loose battery cables.

c. Dead battery cell.

d. Defective solenoid or solenoid switch.

e. Defective starter windings.

f. Stop sheared off armature shaft.

g. Corrosion at battery posts.

h. Faulty relay.

i. Faulty wiring.

Remedies:

a. Test specific gravity of battery and check for dead cell. Replace or recharge battery as necessary.

b. Clean battery posts and cable clamps. For good contact, tighten securely.

c. Replace defective battery. Check voltage regulator and generator output.

d. Replace starter and ignition switch and check starting motor solenoid for operation. Check soldered connections of solenoid windings.

e. Remove and test starting motor. Replace parts, or the complete unit, as required.

f. Replace armature.

g. Remove battery cables and clean terminals and clamps. Check clamps for corrosion and replace as necessary. Coat clamps with vaseline or cup grease to retard corrosion, replace and tighten securely.

h. Inspect all wiring. Check control wiring by touching a jumper lead from relay "Bat" to "Ign" terminals.

i. Check relay by touching heavy jumper lead from relay "Bat" to "Sol" terminals.

14. STARTER TURNS SLOWLY

Possible Causes:

a. Weak battery.

b. Loose connections.

c. Dead battery cell.

d. Corroded battery terminals.

e. Internal ground in windings.

Remedies:

a. Test specific gravity of battery and check for dead cell. Replace or recharge battery as necessary.

b. Tighten loose connections as necessary. Check terminals for corrosion and clean to form good contact.

c. Replace defective battery. Check voltage regulator and generator output to determine cause of battery failure.

d. Remove battery terminals and clean terminals and clamps. Check clamps for corrosion and replace as necessary. Coat with vaseline or cup grease to retard corrosion, install and tighten securely.

e. Remove starting motor and test. Replace parts, or complete unit as required to correct condition.

15. STARTER TURNS BUT DOES NOT ENGAGE

Possible Causes:

a. Defective starter clutch (slipping).

b. Broken teeth on flywheel ring gear.

c. Defective switch on yoke linkage.

Remedies:

a. Remove starting motor and install new pinion and clutch assembly. Check shaft for excessive wear or burring and replace if necessary.

b. Replace flywheel ring gear. Check teeth on mating pinion for wear and replace as necessary.

c. Install new linkage.

16. STARTER LOCKS

Possible Causes:

a. Broken or chipped teeth on flywheel ring gear.

b. Loose starter mounting bolts.

Remedies:

a. Replace flywheel ring gear. Check teeth on mating pinion for wear and replace as necessary.

b. Remove starting motor and check for possible damage to pinion teeth. Remount starting motor and tighten bolts securely.

GENERATOR

The generator (Fig. 8) is a heavy-duty, air-cooled, shunt type, with which an automatic cut-out, current and voltage regulator is used. The output of the unit is controlled in relation to the voltage requirements to maintain the battery in a charged condition and to maintain proper voltage for normal operating conditions.

SERVICE PROCEDURES

17. TESTING THE GENERATOR (Installed)

(1) Remove the cover band and inspect the condition of the commutator and the brushes, as described in Paragraph 19.

(2) Disconnect the battery lead at the "B" terminal of the regulator. Connect a test ammeter in series with the "B" terminal and the disconnected lead.

(3) Connect a jumper wire between the generator field terminal and ground.

(4) Turn on all lights and accessories.

(5) Start the engine and increase the speed until the output is slightly higher than the rated output in amperes, and determine if the brushes are bouncing or arcing. The brushes should not bounce and practically no arcing should occur.

NOTE

Perform the above test as rapidly as possible. Do not permit generator to operate at this higher output longer than the time required to make the test. Otherwise, generator may become damaged. This test is made to determine if generator can produce more amperage than its rated capacity.

(6) If generator does not produce rated output or more, remove generator for repairs.

18. TESTING THE GENERATOR (Removed)

a. Output Test (On Test Bench)

When testing the generator on a test bench, it is necessary to connect a jumper wire from the generator "F" terminal to ground in order to complete the field circuit. The generator armature should not be driven at a speed that will cause output to exceed maximum specifications for generator being tested, or for a longer period of time than is necessary to make the output test.

b. Motoring Test

If the generator will rotate as a motor, it should generate voltage when driven as a generator.

(1) Connect the jumper wire from a 6-volt battery negative post to the generator "A" terminal.

(2) Connect a jumper wire from the generator "F" terminal post to the generator frame (ground).

Connect a jumper wire from the positive battery post to generator fram. The generator should motor freely, if it is in satisfactory condition—electrically and mechanically. The current draw should be from 5.0 to 5.5 amperes at 6 volts.

NOTE

The purpose of connecting generator "A" terminal to the negative battery post is to assure that proper residual polarity is maintained.

19. INSPECTION OF BRUSHES

Inspect the brushes at frequent intervals. Make certain that they are not excessively worn. To avoid damage to armature, commutator and windings, replace brushes that are worn within ½ of their original length, or are soaked with oil.

If brushes are badly worn, or if the commutator is rough or worn so that the mica is even

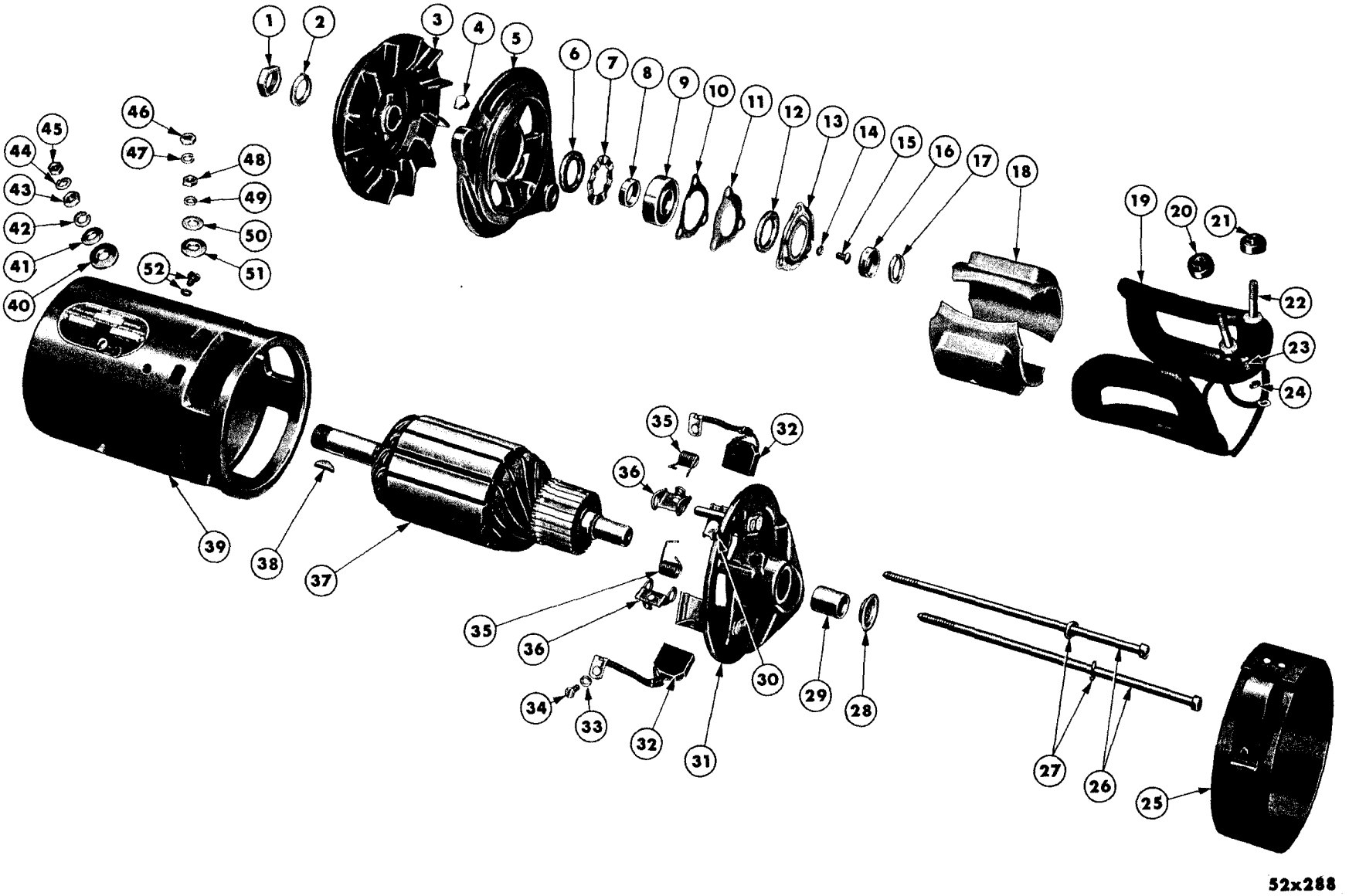


Fig. 8 — Typical Generator (Exploded View)

Fig. 8 — Typical Generator (Exploded View)

1 — Nut	14 — Lock Washer	27 — Lock Washers	40 — Insulator Washer
2 — Lock Washer	15 — Screw	28 — Plug	41 — Flat Washer
3 — Pulley	16 — Retainer	29 — Bushing	42 — Lock Washer
4 — Oiler	17 — Snap Ring	30 — Oiler	43 — Nut
5 — Drive Head	18 — Pole Shoes	31 — Commutator End Head	44 — Lock Washer
6 — Felt Washer	19 — Coil	32 — Brushes	45 — Nut
7 — Serrated Washer	20 — Terminal Post Insulator	33 — Lock Washer	46 — Nut
8 — Spacer	21 — Terminal Post Insulator	34 — Brush Lead Screw	47 — Lock Washer
9 — Bearing	22 — Terminal Post	35 — Brush Spring	48 — Nut
10 — Gasket	23 — Coil Lead Screw	36 — Brush Holder	49 — Lock Washer
11 — Plate	24 — Lock Washer	37 — Armature	50 — Flat Washer
12 — Felt Washer	25 — Cover Band	38 — Woodruff Key	51 — Insulator Washer
13 — Washer Retainer	26 — Through Bolts	39 — Generator Frame	52 — Pole Shoe Screw and Washer

with the bars, perform the following operations. Remove the generator from the engine, disassemble, inspect, and clean. Turn down the commutator and undercut the mica, assemble, and fit new brushes. Bench test the generator before installing it on the engine.

20. REMOVAL AND INSTALLATION OF GENERATOR

To remove the generator, disconnect the lead wires, remove the adjusting strap bolt and the support bracket bolts.

When installing generator, adjust belt by pulling outward on generator until belts are just snug. Tighten the generator in this position.

The belt tension should allow for a deflection of ½ inch, when measured at a point midway between the generator and the water pump drive pulleys.

21. DISASSEMBLY OF GENERATOR

a. Removal and Disassembly of Commutator End Head

(1) Remove generator cover band.

(2) Remove terminal screws, which attach brush pigtails to brush holders. Lift brush arms away from brushes and remove brushes.

(3) Remove the bearing retaining screws from the end of the commutator end head.

(4) Remove the two long frame screws and remove the commutator end head. Inspect commutator end head bushing. If it is worn or damaged, replace bushing.

If bushing is worn the armature core may rub against the pole shoes and cause damage. Remove the felt wick from the end head (generator so equipped). Press out the worn bushing and install a new bushing, using a suitable tool, or mandrel. The end of the tool, or mandrel, should be well-polished and should be .005 inch larger than the armature shaft. Never ream an oil impregnated bushing. Be sure to soak the bushing before installation. Replace the felt wick, if the generator is so equipped.

Inspect all other parts of commutator end head for wear or distortion, and replace parts as required. If brush holders are loose, replace the head. Do not try to tighten the brush holders.

b. Removal and Disassembly of Drive End Head

(1) Pull the drive end head and armature from generator frame. Remove the armature shaft nut, pulley and key.

(2) Remove the bearing cover screws and retainer. Pull the drive end head from the shaft.

(3) Inspect bearing. If it is worn or rough, replace bearing.

c. Removal of Field Coils

(1) Remove the nuts from the field and the armature terminal posts and push the posts to the inside of the generator frame.

(2) Remove the large screws, which hold the field pole shoes to the generator frame, with Tool C-3078 and remove the pole shoes and coils.

CAUTION

Do not immerse the field coils, armature, felt washer, or insulating parts, in fluid or dry them with heat. Never steam clean the generator. Wipe the field coils with a cloth moistened with solvent.

22. TESTING AND SERVICING THE ARMATURE

Inspect the core for scored or damaged laminations, improperly positioned or loose windings, or loose connections at the commutator. Inspect the commutator for roughness, excessive wear, or run-out, or improperly undercut mica. Inspect shaft and make sure it is not bent or worn.

a. Testing Armature for Ground

With a 110 volt test lamp, test armature for ground by touching the test probes to the shaft and to a commutator bar. Do not touch the face of the commutator or shaft bearing surface with test probe. (Refer to Fig. 9.) If the armature is grounded, the test lamp will light. If such is the case, replace the armature assembly.

b. Testing Armature for Short Circuit

Place the armature on the growler. Turn the armature slowly while holding a hacksaw blade, or strip of thin steel, over the core of the armature and parallel with its length (Fig. 10). If the blade of the hacksaw (or thin steel strip) vibrates, the coil is shorted. If such is the case, replace the armature.

NOTE

If it is believed that the armature should be replaced, first inspect the grooves in the commutator for the presence of metal particles which may be causing the armature to short out. To do this, draw a thin undercutting tool through the commutator grooves and then make another test. If the armature is shorted, install a new unit.

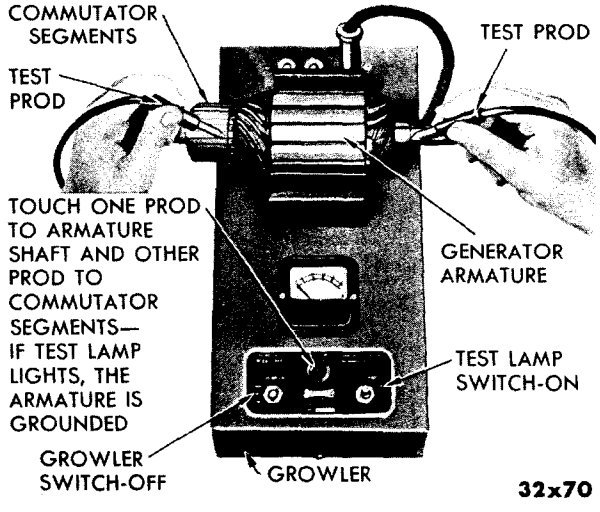


Fig. 9 — Testing Generator Armature for Ground

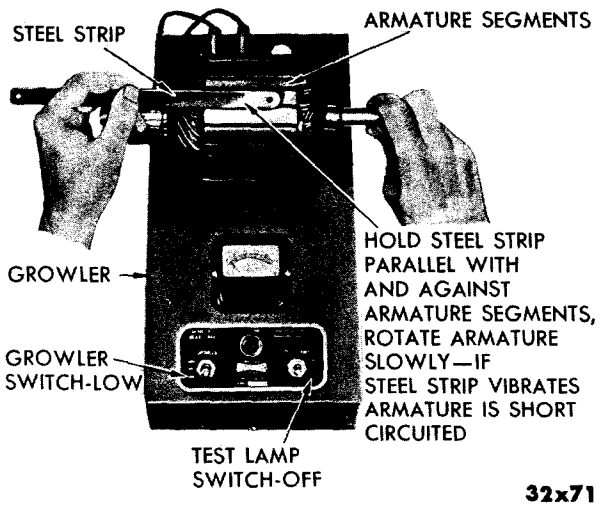


Fig. 10 — Testing Generator Armature for Short Circuit

c. Checking Commutator Run-Out

With armature shaft bearing surfaces resting in "V" blocks, place a dial indicator against commutator. Rotate armature, while taking indicator reading. If runout is more than .0005 inch, reface commutator as described below.

d. Refacing the Commutator

If the commutator is rough, out-of-round, burned, or if the mica is even with (or extends above) the surface, the commutator should be turned down, using turning and undercutting

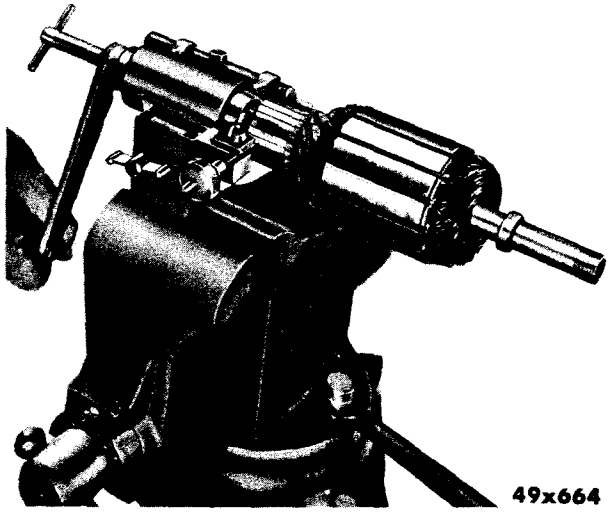


Fig. 11 — Turning Commutator

Tool C-770 (Fig. 11), or a lathe.

NOTE

Remove only sufficient metal to give a smooth clean surface.

e. Undercutting the Mica

Undercut mica segments to a depth of approximately $\frac{1}{32}$ inch, using special Tool C-770 (Fig. 12), or a fine tooth hacksaw blade. Be sure to undercut the mica square and the full width of the groove. After undercutting, polish the commutator with No. 00 sandpaper to remove burred edges. Retest armature.

23. TESTING FIELD COILS

a. Testing Field Coils for Ground (Fig. 13)

(1) Touch one test prod from a 110 volt test lamp to the "F" terminal post and the other prod to the generator frame. The test lamp will light if the field coils are grounded.

(2) If a ground is indicated, remove the "F" terminal post nuts, washers, insulators and the terminal post from the generator field frame. Inspect insulation washers for charring and proper installation. If the terminal post is not grounded, separate the field coils and test each one individually. If test lamp lights the coil is grounded. If coil is defective, replace it.

b. Testing Field Coils for Current Draw (Fig. 14)

(1) Connect a test ammeter and variable resistance in series with the negative post of a battery and the generator field "F" terminal post. Connect voltmeter, as shown in Figure 14.

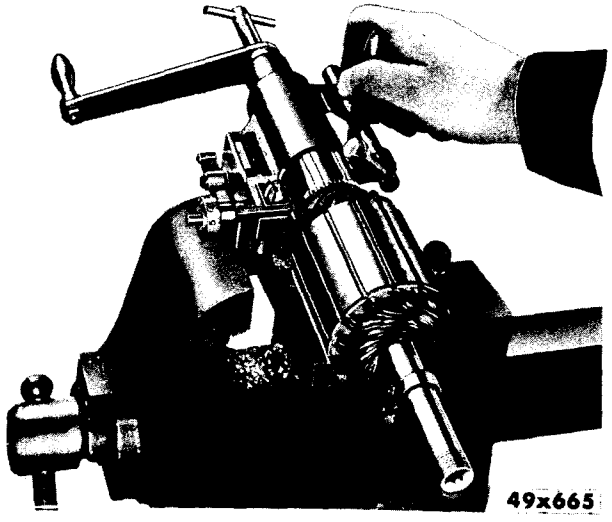


Fig. 12 — Undercutting Mica

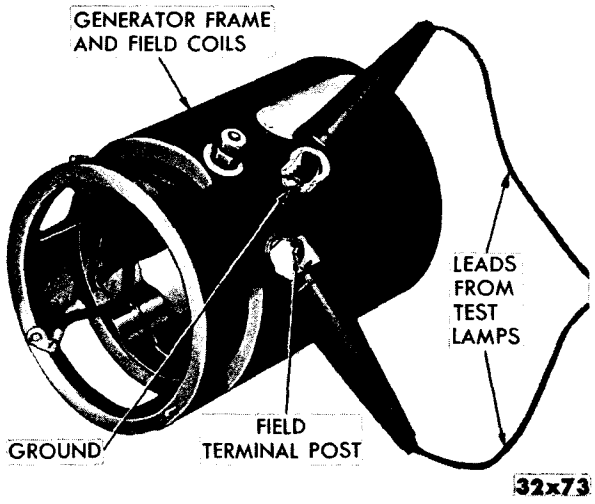


Fig. 13 — Testing Field Coils for Ground

(2) Connect a jumper wire from the positive battery post to the generator field brush lead.

(3) Adjust the battery voltage with the variable resistance to 5 volts and read the ammeter. The reading of the ammeter should conform with the current draw specifications of 1.7 to 1.8 amperes.

A reading that is too low indicates that there is high resistance in the field coils or connections. Make test connection to lead between the coils and test each coil individually. Each coil should test twice as high as both coils should test together.

A reading that is too high indicates that the field coils are short circuited between the windings. Make test connection to lead between the coils and test each one separately, noting the one which produces the highest reading. Replace the defective coil.

24. SERVICING THE COMMUTATOR END HEAD

Clean the head, brush plates and holders with a suitable solvent. Do not soak the insulation. Wipe with a clean dry rag. Check armature shaft bushing for wear and, if necessary, replace bushing and end head. Inspect all other

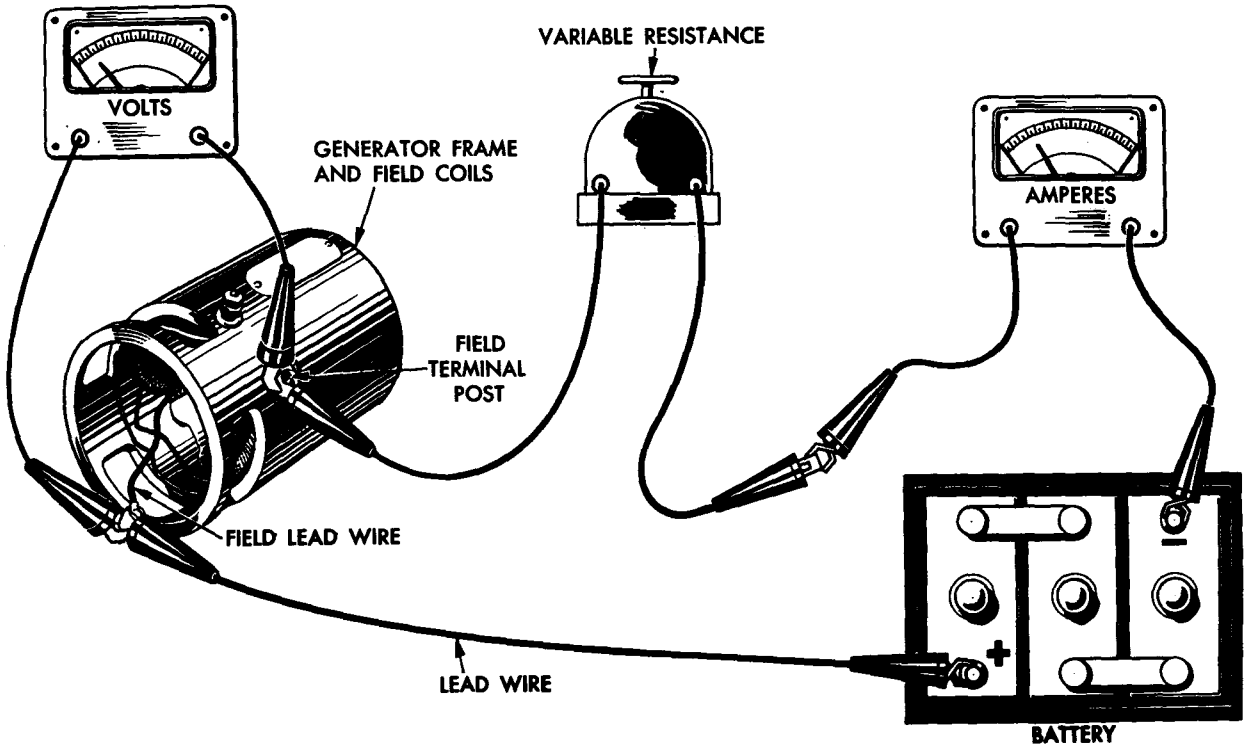


Fig. 14 — Testing Field Coils for Field Current Draw

parts for wear or distortion, replacing parts as required. If brush holders are loose, do not attempt to tighten. Instead, replace the head. Test brush springs for tension and test the holders for ground.

25. TESTING THE BRUSH HOLDER FOR GROUND (Fig. 15)

Use a 110 volt test light and test between the head and insulated brush holder, as shown in Figure 15. If the test lamp lights, the brush holders are grounded and the end head must be replaced.

26. SERVICING THE DRIVE END HEAD

The drive end head should be disassembled and cleaned thoroughly in a suitable solvent. Before cleaning, remove felts and wipe with a clean cloth.

Inspect all parts for excessive wear, cracks, or distortion, and replace as required. Be sure that the ball bearing is in good condition and fits snugly in the recess.

CAUTION

Do not spin the ball bearing with compressed air, as the bearing may become damaged.

27. TESTING BRUSH SPRING TENSION

(1) Place the armature in a vise equipped with soft jaws.

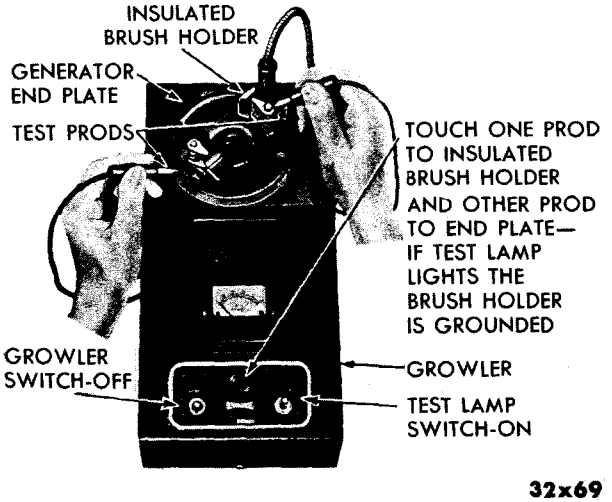


Fig. 15 — Testing Insulated Brush Holder

NOTE

Do not squeeze the core too tightly or the laminations may be damaged.

(2) Install the commutator end head on the armature and insert brushes in holders.

(3) Hook a spring scale to the spring, where the spring contacts the brush and at right angle (90 degrees) to the radius of the brush arm.

(4) Pull up on the spring scale and note the reading as the spring just starts to leave the brush. This reading will indicate the number or ounces of spring tension. Replace springs that do not conform to specifications (35 to 53 ounces, brush spring tension).

28. SEATING NEW BRUSHES (Fig. 16)

When new brushes are installed, sand them to obtain correct fit against the commutator. To seat brush against commutator, use a strip of No. 00 sandpaper, as wide as the finished surface of the commutator. Lift the brush and slide the sandpaper, grit side up, between commutator and brush. With spring pressure against the brush, hold the sandpaper to the contour of the commutator and slide the sandpaper under the brush. Each brush should have a 75 per cent fit. Repeat the operation on all brushes.

29. ASSEMBLING THE GENERATOR

a. Installation of Field Coils (If Removed)

Inspect the leads, insulating bushings, and washers. If they are cracked or damaged, replace as required.

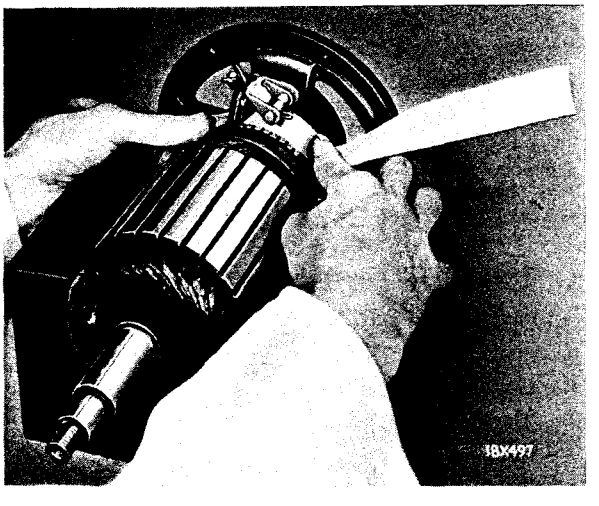


Fig. 16 — Seating New Brushes

When installing new coils or pole shoes, dip the mounting screws in boiled linseed oil before assembly. As the screws are tightened, rap the frame one or two sharp blows with a rubber hammer to help settle and align the pole shoes. Continue to assemble the unit as follows:

(1) Slide the field coils and field shoes into the generator frame, with the brush lead wire and terminal post adjacent to the armature terminal post hole.

(2) Insert the terminal posts through the frame.

(3) Install the insulating washers and binding nuts on the terminal posts. Install the screws which hold the field pieces to the frame.

NOTE

A suitable pole shoe jack and a pole shoe screw driver should be used to properly install the fields in the frame.

(4) Tighten screws securely and stake.

b. Installation of Drive End Head and Armature

Be sure that the ball bearing is in good condition and fits snugly into the recess. Before assembling, pack ball bearings about ½ full with high temperature non-fiber grease. Soak felts in clean engine oil and compress slightly to remove excess oil before installation.

NOTE

When assembling armature and drive end head, install felt washer retainer on shaft over snap ring before pressing shaft into bearing. This retainer turns with the shaft and inner race and prevents snap ring from tearing the felt washer. Be sure that the snap ring on the armature shaft is pressed firmly against the inner race of the bearing.

(1) Install parts on armature shaft in following order: snap ring, inner bearing retainer and washer retainers, shaft spacer, inner felt washer, ball bearing, outer washer retainer and felt washer. Slide drive end head on armature shaft and assemble outer washer, retainer and bearing in end

head. Properly align the inner washers, spacer and retainers to end head and install the retaining screws.

(2) Install drive key and pulley on shaft and secure with nut and lock washers.

(3) Slide armature and head assembly into place, with hole in end head over dowel pin in generator frame.

c. Installation of Commutator End Head and Brushes

(1) Place the brush arms and springs over the pins in the end head. Install end head on the frame, with hole in end head over dowel pin in the frame.

(2) Install the two, long, frame screws.

(3) Hold the brush arms cut against the spring tension. Slide the brushes into the brush holders with the angle on the brushes conforming with the contour of the commutator.

(4) Connect brush pigtails to brush holders.

(5) Connect the field lead wires to the insulated brush holder. Be certain that the terminals do not contact the generator frame.

(6) Place cover band in position and install the clamp bolt.

CAUTION

When installing the through bolts, make sure that the lower bolt is located under the loop in the field connection insulation to prevent grounding of the field coils by the bolts.

When installing commutator end head, remove the felt wick and reinstall it, after the head and armature are assembled on the generator. This will prevent the wick from being damaged when the shaft is inserted. Before installing the generator on the engine, perform the motoring test as previously explained, or test the generator on a generator test bench, if available.

SERVICE DIAGNOSIS

30. GENERATOR FAILS TO CHARGE

Possible Causes:

a. Open charging circuit.

b. Sticking brushes.

c. Dirty or burned commutator.

d. Grounded commutator. Grounded wiring.

e. Grounded field coil.

f. Open circuit in field.

g. Poor soldering on armature and field studs.

h. Faulty regulator.

Remedies:

a. Test generator for open charging circuit.

b. Free or replace generator brushes.

c. Check commutator and brushes. If brushes are badly worn, or the commutator is dirty, rough, or worn so that the mica is even with the bars, recondition armature. At reassembly, install new brushes.

d. Check armature for grounded commutator. Check wiring for a ground.

e. Check generator for grounded field coil.

f. Check generator for open circuit in field.

g. Check armature and field stud connections for poor contacts. Resolder to form good contact surface to correct this condition.

h. Check regulator.

31. LOW, UNSTEADY CHARGING RATE

Possible Causes:

a. Slipping belt.

b. Defective ammeter.

c. Improperly seating brushes.

d. Weak brush spring tension.

e. Poor bond between brush and pigtail.

f. Out-of-round commutator.

g. Resistance in charging circuit.

h. High mica between commutator bars.

i. Open armature winding.

j. High resistance at battery terminal posts.

k. Loose connections.

Remedies:

a. Check driving surfaces of belt and tighten. If the sides or bottom of belt are frayed, cracked or greasy, replace belt and adjust it for approximately ½ inch slack (when pushed from a straight line, midway between the fan and generator pulley).

b. Replace defective ammeter after checking to determine cause of failure.

c. Replace generator brushes and seat properly. Check armature commutator for roughness or high mica. Recondition commutator if necessary.

d. Check brush spring tension with tension specified in Data and Specifications. Discard springs that do not meet minimum requirements.

e. Check pigtails for discoloration which indicates a burned condition. Replace brushes as necessary. Tighten pigtails securely to form a good contact.

f. Recondition armature commutator. Install new brushes and check spring tension.

g. Check charging circuit.

h. Undercut mica.

i. Test armature for open winding. If unable to correct condition, replace armature and install new brushes.

j. Remove battery cables and clean terminals and clamps. Check clamps for corrosion and replace if necessary. Coat clamps with vaseline or grease to retard corrosion, install and tighten securely.

k. Clean and tighten connections in the charging circuits.

32. EXCESSIVE CHARGING RATE

Possible Causes:

a. Defective regulator.

b. Overheated battery.

c. Shorted field.

d. Grounded field or ground in generator to regulator wiring.

e. Shorted cell in battery.

Remedies:

a. Replace defective regulator. Check to determine cause of failure.

b. Test battery. Test regulator for high voltage setting. Adjust or replace regulator to correct this condition.

c. Test field coil for short. Replace coils as necessary to correct condition.

d. Check generator for internal ground, check generator to regulator wire for ground and repair as necessary.

e. Test specific gravity of battery. Replace battery if necessary.

33. GENERATOR NOISY

Possible Causes:

a. Misaligned belt or pulley.

b. Improperly seating brushes.

c. Worn bushing or bearing.

d. Loose generator drive pulley.

e. Loose field poles.

f. Excessive voltage output.

g. High wedges in armature slots.

h. Bent flange on pulley.

i. Generator fan blades striking.

j. Loose generator mounting.

Remedies:

a. Check belt and pulley for true running. Replace parts as necessary to correct this condition.

b. Check brushes for excessive wear and

for looseness in holders. Replace brushes if necessary.

c. Replace bearing, and/or bushing. Check armature assembly for possible damage and replace if necessary.

d. Tighten drive pulley and check for true running.

e. Tighten pole shoes and check armature for possible damage.

f. Refer to Paragraph 32 for possible causes.

g. Replace, or sand down armature slot wedges.

h. Check belt for possible damage. Replace pulley as required.

i. Test generator pulley for true running.

j. Tighten generator mounting bolts.

34. NOISE AND ARCING AT GENERATOR BRUSHES

Possible Causes:

a. High mica between commutator bars.

b. Out-of-round commutator.

c. Sprung armature shaft.

d. Dirty, glazed commutator.

e. Hard spots on brushes.

f. Weak brush springs.

g. Worn or loose brushes.

h. Loose wiring at brush pigtails.

i. Excessive voltage output.

Remedies:

a. Undercut mica. Inspect and replace brushes if necessary.

b. Recondition commutator. Check brushes and replace if necessary.

c. Replace armature assembly and install new brushes. Seat brushes properly.

d. Recondition armature. Check brushes for excessive wear and replace as required.

e. Replace brushes.

f. Check brush spring tension with tension specified in Data and Specifications. Discard springs that do not meet minimum requirements.

g. Replace brushes.

h. Refer to Paragraph 31, remedy e for correction of this condition.

i. Refer to Paragraph 32 for remedies of this condition.

35. ARMATURE FAILURE (Premature)

Possible Causes:

a. Excessive charging rate.

b. Failure of voltage regulator.

c. Improper type brushes used.

d. Worn shaft bearing (pole rub).

e. Short between armature coils.

f. Shorted battery cell.

g. Insufficient ventilation.

Remedies:

a. Check regulator setting and replace armature assembly. Check and adjust regulator as necessary.

b. Replace armature assembly. Check voltage regulator for proper adjustment. If unable to adjust, replace voltage regulator.

c. Replace armature assembly and install new brushes.

d. Replace armature assembly and install new bearing and bushing.

e. Replace armature assembly and install new brushes.

f. Replace battery and check voltage regulator for improper adjustment.

g. Inspect fan and vent holes for dirt or obstruction.

CURRENT-VOLTAGE REGULATOR

The current and voltage regulator assembly (Fig. 17) contains three units, namely: the cut out relay, the current regulator and the voltage regulator. Each unit has its own function to perform.

The cut out relay acts as an automatic switch between the generator and the battery. The cut out relay closes the charging circuit when the generator is charging and opens the circuit when the generator is not charging. This action prevents the battery discharging back through the generator.

The current regulator limits the maximum current output of the generator in amperes. When the generator output reaches a predetermined maximum, the regulator points are opened, cutting in a resistance in the generator field circuit—thus reducing the output. Immediately upon the dropping of the output, the points close (cutting out the resistance) and the output rises. These cycles occur so rapidly that the points vibrate at a high frequency, thus holding the output constant at a predetermined maximum.

The voltage regulator is used for holding the voltage of the electrical system constant within close limits. When the voltage rises to a predetermined value, the regulator contact points vibrate, thus cutting a resistance in and out of the generator field circuit.

CAUTION

Do not attempt to adjust the regulator assembly, unless its operation is thoroughly understood and accurate meters are available. Even a slight error in the setting of the unit may cause improper functioning, resulting in a rundown or overcharged battery.

SERVICE PROCEDURES

36. REGULATOR INSPECTION

Remove regulator cover, after checking to determine if seal has been broken, which may indicate previous adjustment or repair has been made. A close visual inspection should be made to determine if any of the following conditions exist:

(1) Loose or broken connections resulting from poor soldering or rough handling.

(2) Evidence of burning or abnormal high temperatures at the coils, contact points, insulation or flexible arm to which regulator contacts are mounted.

(3) Broken or altered resistors.

(4) Improperly installed armature springs, distorted spring hangers, bent armatures, yokes or hinges.

(5) Evidence of moisture or corrosion in regulator.

If any of the above conditions are apparent, or if regulator is in a general poor condition, it should be replaced.

Before testing or adjusting regulator, the following test should be made:

(1) Test and check the wiring in the charging circuit. Be sure all connections are clean, tight and in good condition.

(2) Test the specific gravity and check the ground polarity and voltage of the battery. If not fully charged and in good condition, substitute (temporarily for test purposes) a fully charged battery of the same type and capacity.

(3) Check generator for operation without the regulator in the circuit.

(4) Check the part numbers stamped on the name plates of the generator and regulator to make sure the correct regulator has been installed. Each regulator is designed for use with a generator having a specified field draw, output, internal connections and speed range and may not work

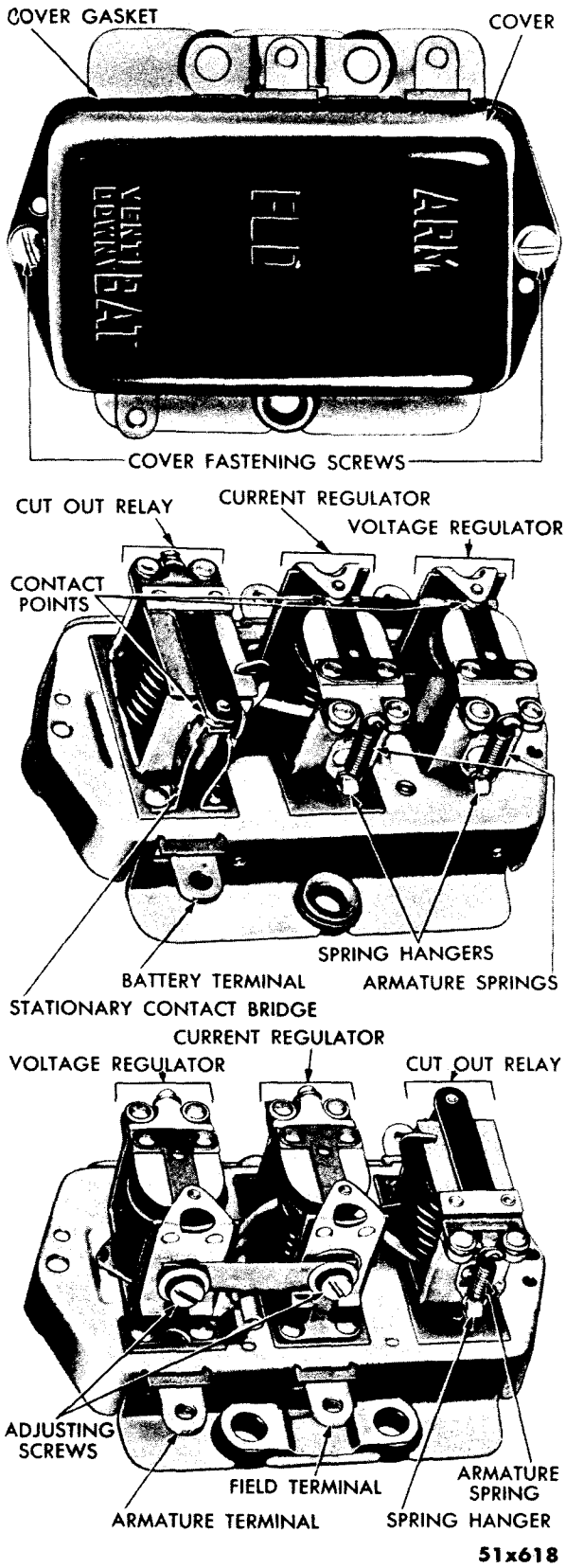


Fig. 17 — Current and Voltage Regulator

properly, if an incorrect substitution has been made.

37. TESTING CUT OUT RELAY

Disconnect wire from "B" terminal of the regulator; connect the positive (+) lead of a test ammeter to the wire removed and the negative (—) lead to the regulator "B" terminal, as shown in 10, Figure 18.

Connect the negative (—) lead of a test voltmeter to the "A" terminal of the regulator and positive (+) lead to the regulator housing ground, as shown in 9, Figure 18.

Start engine and be sure that it idles smoothly. Increase engine speed slowly to determine when the cut out relay points close. When the hand on the voltmeter kicks back slightly, it

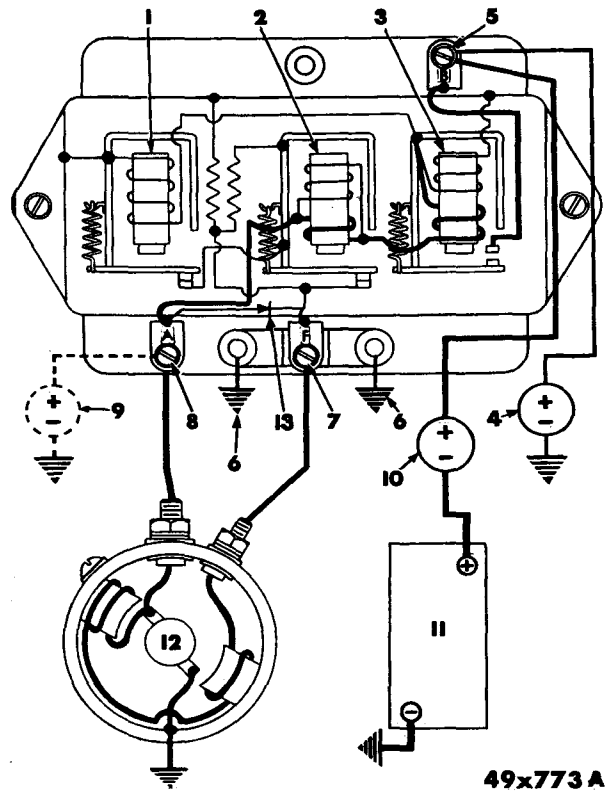


Fig. 18 — Generator Regulator Wiring Diagram and Test Connections

1 — Voltage Regulator Coil
2 — Current Regulator Coil
3 — Cut Out Relay
4 — Voltmeter Connection for Current and Voltage Regulator Tests
5 — Regulator Battery Terminal
6 — Regulator Ground Screws
7 — Regulator Field Terminal
8 — Regulator Armature Terminal
9 — Voltmeter Connection for Circuit Breaker Test
10 — Test Ammeter
11 — Battery
12 — Generator
13 — Resistor

indicates points have closed. This should occur at 6.3 to 6.8 volts.

If an adjustment is necessary, remove regulator cover and inspect the contacts of all three units. In normal use, the contacts will become grayed. If the contacts are burned, dirty or pitted, service the regulator contact points, as outlined in Paragraph 40.

Adjust closing by bending lower spring hanger on cut out relay unit.

NOTE

Any electrical measuring device used during performance of test on regulator unit must be accurately calibrated and in correct adjustment —if correct diagnosis is to be obtained.

38. TESTING VOLTAGE REGULATOR

Change voltmeter connection from armature to battery terminal of regulator, as shown in 4, Figure 18. Connect a variable resistance across the battery posts.

Run engine at a fast idle for 15 minutes and adjust load to give 10 amps. output. Cover must be on regulator during this warm-up period and when taking test readings. The voltage regulator must control the voltage from 7.1 to 7.4 volts at 70° F.

If an adjustment is necessary, remove regulator cover and service the contact points, as outlined in Paragraph 40.

Adjust regulated voltage by bending lower spring hanger. Replace cover, operate for 5 minutes then check voltage.

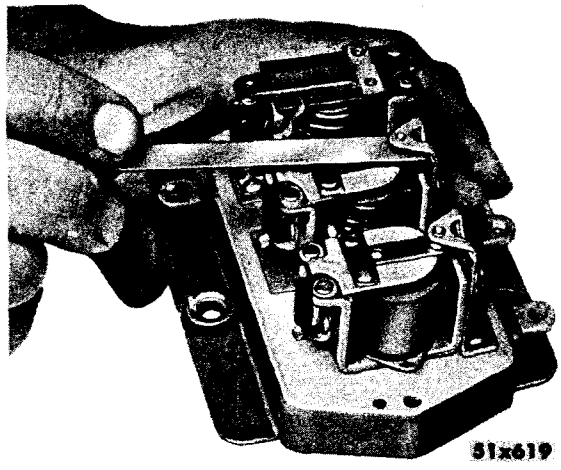


Fig. 19 — Refacing Contact Points

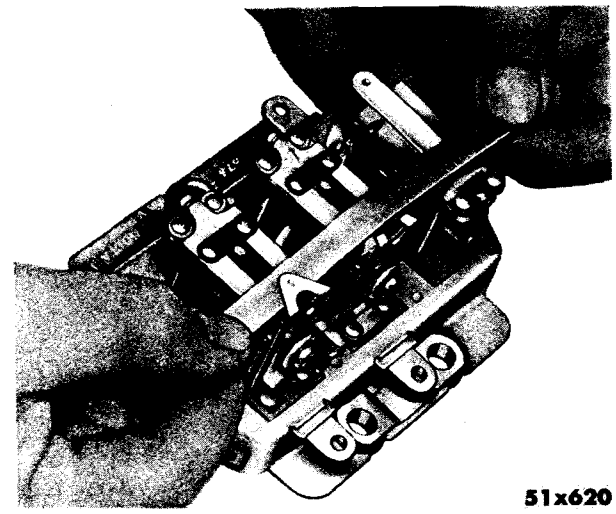


Fig. 20 — Cleaning Contact Points

39. TESTING CURRENT REGULATOR

Leave the voltmeter and ammeter connected as when testing the voltage regulator.

Run engine at a fast idle for 15 additonal minutes, applying enough resistance load across the battery to maintain the voltmeter registering between 6.9 and 7.1 volts. At 70° F., the current regulator should operate at the lower figure indicated on the regulator name plate (plus or minus 2 amps.) at the conclusion of the warm-up period.

If an adjustment is necessary, remove regulator cover and service the points, as outlined, in Paragraph 40.

Adjust by bending lower spring hanger.

NOTE

When removing or replacing the regulator cover, do not touch the relay armature. This would cause a short circuit and damage the regulator assembly.

40. SERVICING REGULATOR CONTACT POINTS

Remove regulator cover and inspect the contact points of all three units. In normal use, the contacts will become grayed. If the contact points are burned, dirty or pitted, reface with a clean fine file.

CAUTION

Never use sandpaper, emery cloth or a rough file.

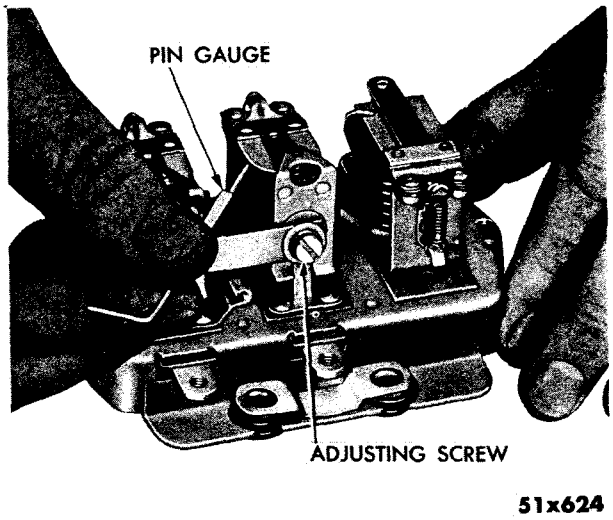


Fig. 21 — Checking Air Gaps

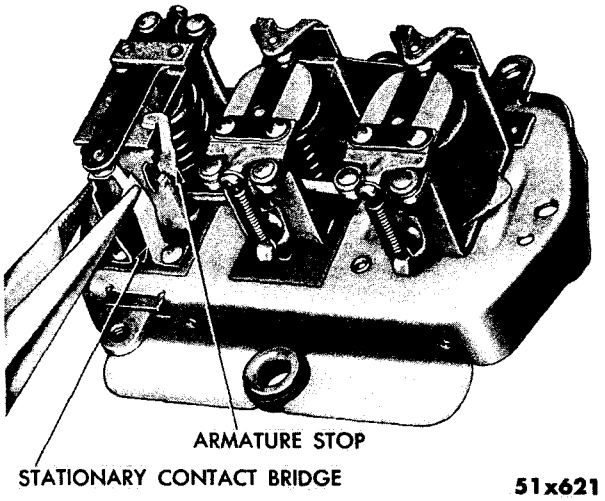


Fig. 23 — Adjusting Relay Contact Gap

To reface contact points file lengthwise and parallel to the armature, as shown in Figure 19, until the contact points present a smooth flat surface toward each other. It will not be necessary to remove all traces of pitting.

NOTE

Crossways filing may form grooves which would tend to cause sticking and erratic operation.

Clean the contact points after filing with a strip of lintless bond tape, as shown in Figure 20. Be sure that no lint remains between contacts after cleaning.

After refacing and cleaning the contact points, it will be necessary to readjust the armature air gaps in order to compensate for metal removed from contacts.

To check the current and voltage regulator air gaps, use pin type gap gauge from Kit Tool C-828. Insert gauge on the point side of the air gap and next to the armature stop pin (Fig. 21) and with the contact points just separating.

To adjust air gap, loosen the bracket screws and raise or lower the contact point brackets until the desired clearance is obtained. Be sure that these screws are tightened securely after adjustments are made. Keep contacts aligned.

To check the relay air gap, use flat gauge from Kit Tool C-828. Insert gauge between armature and magnet core, as shown in Figure

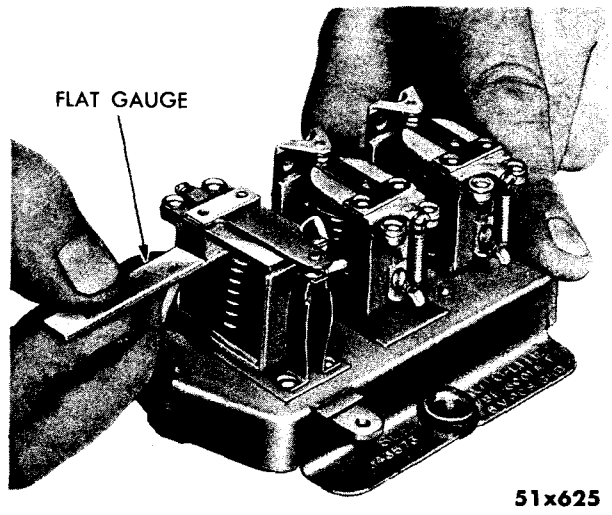


Fig. 22 — Checking Relay Air Gap

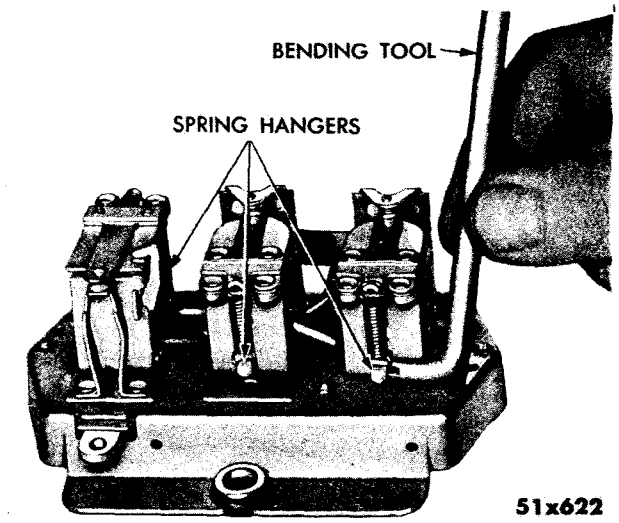


Fig. 24 — Adjusting Spring Tension

22. Be sure gauge is placed as near to the hinge as possible.

To adjust the relay air gap, bend the armature stop so the space between the core and armature is within the limits specified. Stop must not interfere with the armature movement. Adjust the contact gap by expanding or contracting the stationary contact bridge, as shown in Figure 23. Be sure to keep the contact points in alignment when adjusting contact gap.

To adjust armature for proper opening and closing voltages use bending tool from Kit C-828. With slot in the end of tool place over the lower spring hanger (Fig. 24), bend hanger to increase or decrease the spring tension until the desired opening or closing voltage is obtained.

SERVICE DIAGNOSIS

41. REGULATOR POINTS OXIDIZED

Possible Causes:

a. Poor ground connections.

b. Misaligned contact points.

c. Improper air gap setting.

d. Shorted field in generator.

Remedies:

a. File down contact points, after checking for poor connections on ground side of circuit.

b. File down contact points, align and adjust.

c. File down contact points. Set air gap to required specifications.

d. File down contact points, after checking for shorted field in generator.

42. REGULATOR POINTS PITTED

Possible Causes:

a. Long usage, normal wear.

b. High current output of generator.

c. Insufficient point spring tension.

d. Reversed polarity in generator.

Remedies:

a. File down contact points. Reset air gaps to required specifications.

b. Check regulator for burned coil windings or contact arms. If conditions exist, replace regulator. Otherwise, file down contact points, check air gap and contact point setting. Check generator for grounded or shorted field, or high resistance in ground circuit.

c. File down contact points. With special Tool from Kit C-828 placed over the lower spring hanger, bend slightly to increase tension. Increasing the spring tension raises the closing voltage.

d. File down contact points, reset air gaps and adjust contact points. Check generator polarity and correct as necessary.

43. BURNED COIL WINDINGS

Possible Causes:

a. High voltage regulator setting.

b. High current regulator setting.

c. Grounded generator field.

Remedies:

a. Replace regulator assembly.

b. Replace regulator assembly.

c. Replace regulator assembly, after checking and correcting the grounded condition in the generator field.

44. BURNED CONTACT ARM

Possible Causes:

a. Regulator connected incorrectly.

b. Accidental, momentary short between battery terminal and field terminal of regulator.

c. Wrong procedure followed in connecting generator, causing a build-up.

Remedies:

a. Check wiring diagram and replace regulator assembly.

b. Replace regulator assembly. To avoid dead shorts, be careful when working on regulator.

a. File down contact points. Polarize generator (after making all connections) by causing a momentary connection from the starting switch or the regulator battery terminal to the generator armature terminal.

45. STUCK CURRENT REGULATOR POINTS

Possible Causes:

a. Reversed polarity.

b. Long usage.

c. Foreign material present.

Remedies:

a. File down contact points Polarize generator.

b. File down contact points. If conditions still exists, replace regulator assembly.

c. Clean interior of regulator, inspect contact points, clean and align. Check cover gasket. If it does not seal properly—replace.

46. STICKING VOLTAGE REGULATOR CONTACT POINTS

Possible Causes:

a. Misaligned points.

b. Poor ground connections between generator and regulator.

c. Wrong polarity on regulator.

d. Pitted or oxidized points.

e. Defective winding in regulator.

Remedies:

a. Free up points, reset air gaps and adjust contact points.

b. Free up points, reset air gaps, clean and adjust contact points. Check connections between generator and regulator for indication of poor ground. Clean or tighten faulty connections to correct this condition.

c. Negative polarity regulators have "NEG" stamped in red on cover and should be used on negative ground systems only. Replace with proper positive ground regulator.

d. Refer to Paragraph 41 for remedies of this condition.

e. Replace regulator assembly after checking to determine cause of failure.

DISTRIBUTOR

The ignition distributor (Figure 25) is driven by a drive shaft which engages the camshaft. The distributor accurately times and distributes the ignition current. Two sets of breaker points, located in the base of the distributor, time the ignition by opening and closing the primary circuit between the battery and the ignition coil at the correct time. A rotor in the distributor cap distributes the high tension current (built up by the ignition coil) to the spark plugs as the pistons reach the top of their compression strokes.

Two devices are built into the distributor to provide automatic advance of ignition timing, according to engine speed and load. One of these, a centrifugal governor in the distributor body, regulates the spark timing according to speed. The other is a vacuum operated unit that is attached to the side of the distributor body. The vacuum for operating this unit is obtained through a drilled passage above the throttle valve in the carburetor. The vacuum unit regulates the spark timing according to load.

47. PRINCIPLES OF OPERATION

a. Distributor Points

When distributor points open, the primary current through the coil is interrupted. This causes

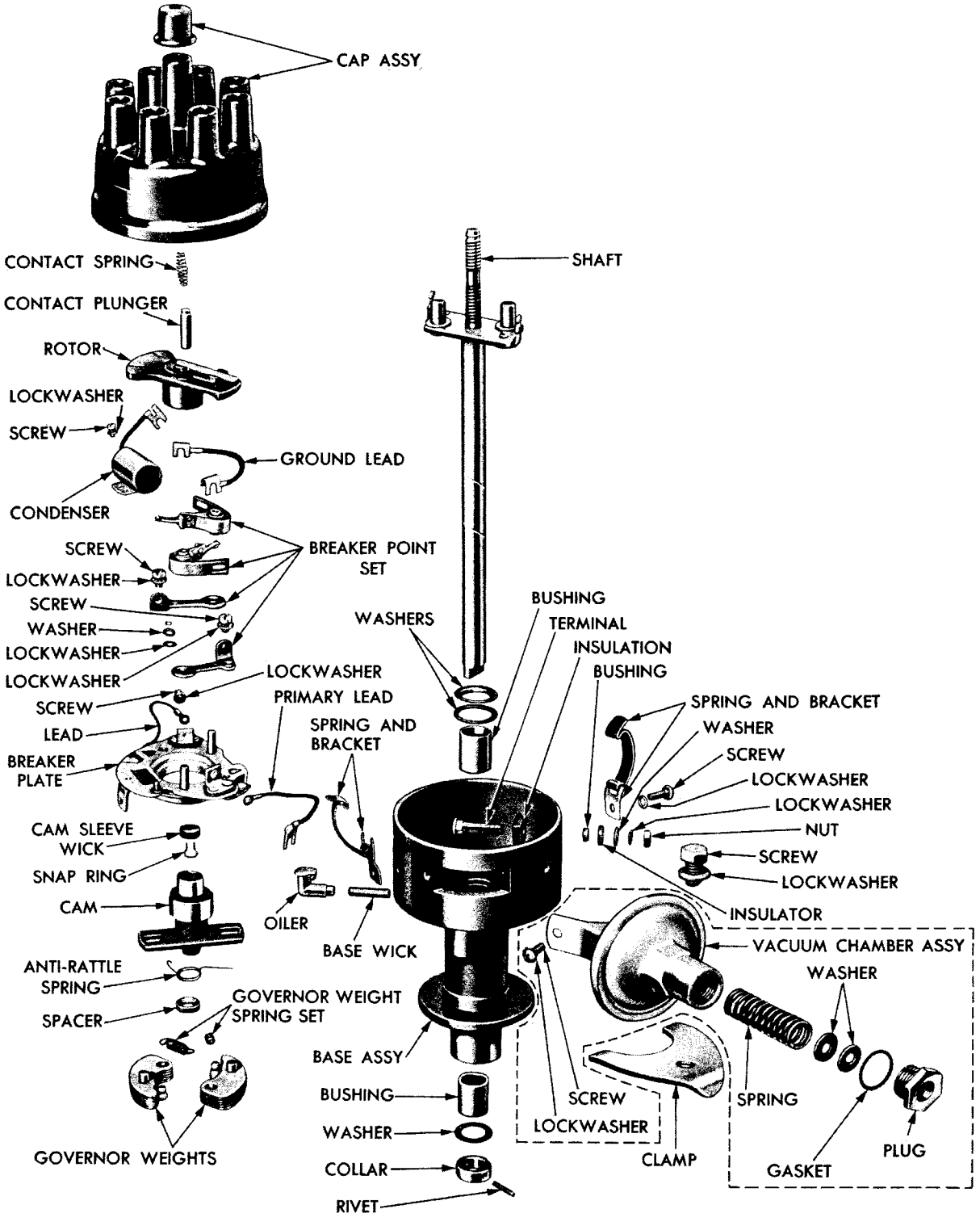


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Fig. 25 — Typical Distributor (Exploded View)

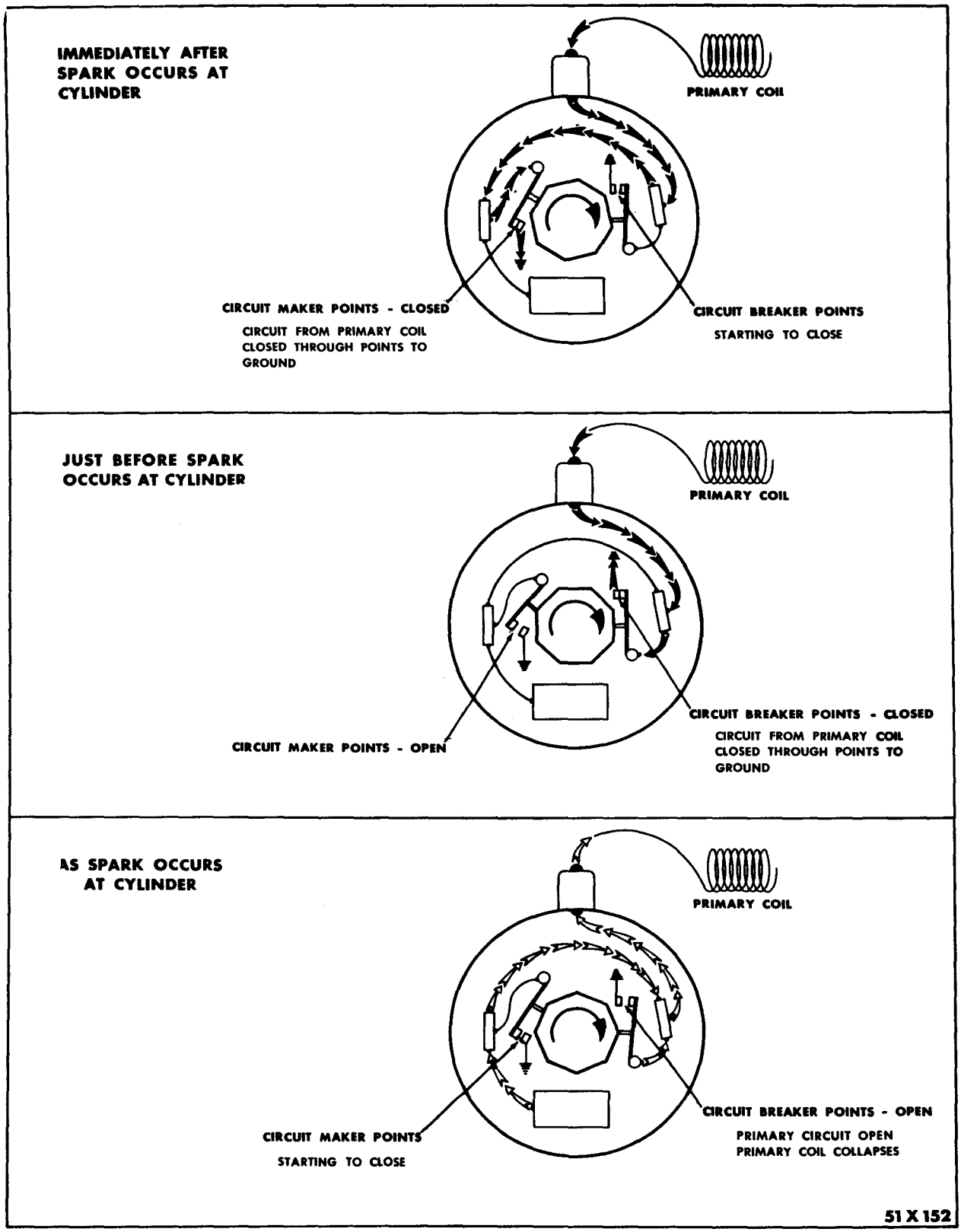

Fig. 26 — Distributor (Operational Schematic)

the magnetic field to collapse suddenly and induces a high voltage in the secondary winding. This high voltage fires the spark plug. The value of this voltage depends on how much primary current is present at the instant of point opening. This primary current starts building up as soon as the points close after firing the spark plug. The longer the points remain closed, the greater will be the primary current build up (to the point of saturation) and the higher the voltage induced when the points again open to fire the next spring plug.

On the Chrysler V-8 Engine, this build-up time for the primary current is increased by using two sets of points which are connected in parallel between coil and ground and are staggered in relation to the 8-lobe cam. The overlapped contacts result in longer coil saturation and, as they are in a parallel circuit, no ignition occurs until both contacts are open. See Figure 26. As the cam rotates in a clockwise direction (as viewed from above), the first set of points closes the primary circuit. As it rotates a little further, the second set of points closes. But, since they are connected in parallel, the circuit is not changed. Further rotation of the cam causes the first or "circuit maker" points to open. But, the circuit is not interrupted because the second or "circuit breaker" points are still closed. Later, the second set of points open and break the primary circuit, causing a spark at the plug. Thus, one set of points closes the primary circuit and the other set opens the circuit. The primary current therefore, has more time to build up for efficient high speed operation.

b. Spark Advance

When the engine is idling with throttle closed, there is no vacuum present at the vacuum unit and the spark occurs at the timed position. With wide open throttle operation, such as on acceleration, the vacuum is insufficient to operate the vacuum unit, but the spark is advanced to correct position by means of the centrifugal governor.

Under normal load or part throttle operation, the spark is advanced by the governor in proportion to speed. In addition, sufficient vacuum is created at the vacuum control unit to move the diaphragm and compress the spring in the unit. The arm of the vacuum unit is connected to the breaker point plate which rotates, causing additional spark advance for efficient fuel economy.

SERVICE PROCEDURES

48. REMOVAL AND INSTALLATION OF DISTRIBUTOR

To remove distributor, disconnect vacuum control line, low tension wire and remove cap and lock plate hold down screw.

When installing distributor assembly on engine, make sure that number one piston is at top dead center on compression stroke and that the distributor rotor is in the number one firing position.

49. SERVICING THE DISTRIBUTOR

The distributor should be tested and recalibrated at regular intervals, in order to insure efficient engine operation.

NOTE

Before attempting to calibrate the distributor, check drive shaft bushings with dial indicator, Tool C-707, and spring scale, Tool C-690, as shown in Figure 27. If play in shaft is more than .005 inch, replace and burnish bushings with Tool C-3041.

To check the mechanical advance mechanism, place the distributor on tester and connect leads to the primary connection on the distributor. Connect the vacuum control tube to vacuum chamber on distributor.

Start the tester and check the advance curve number of rpm against the degree of advance. Compare with specifications. If the degree of

advance is more than limits shown in specifications, at the same rpm, the governor weight spring is too weak, making the advance too rapid.

If the degree of advance is less than the limits shown in the specifications, at the same rpm, the spring tension is too stiff, making the advance too slow.

In most cases, the tension of the spring may be increased or decreased by bending the bracket on the weight plate to which the springs are attached, in order to make the springs conform with specifications.

It is advisable to replace old springs with new ones only after failure to make original spring come within specifications.

The vacuum chamber on the distributor compensates for load conditions of the engine. Upon sudden acceleration, or wide open throttle operation, the manifold vacuum drops, causing the spring in the chamber to retard the ignition timing. As engine load, or throttle opening, decreases, the vacuum increases and overcomes pressure spring and advances the ignition timing.

A weak or broken spring in the chamber will not retard the timing properly and detonation will result.

NOTE

Before testing, be sure the diaphragm in the vacuum chamber will hold vacuum.

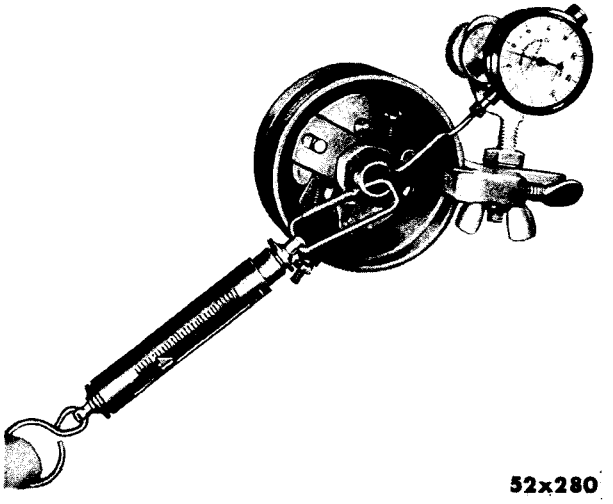

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Fig. 27 — Checking Distributor Shaft Side Play

To check the vacuum advance mechanism, slow the tester down to about 800 rpm, where gauge will show a steady reading. Check the vacuum control specifications for the inches of vacuum at which the advance starts.

Without changing distributor speed, turn the control knob on the tester to get the amount of vacuum required for full specified advance. If the advance does not fall within specifications, remove the retaining nut and take out or add washers to make the necessary adjustment. Check washer thickness and substitute a thinner washer, if the advance requires more than the vacuum specified. If too much advance is obtained, substitute a thicker washer.

When the right combination of washers is obtained to permit full advance to start, check the amount of vacuum necessary to produce 1 degree of advance. Usually, if the advance is correct at full position and at the proper vacuum, it will be correct throughout the entire range. In some cases, it may be necessary to change the spring and then readjust its tension by means of various combinations of washers.

50. TESTING BREAKER SPRING TENSION

Hook a spring scale on the arm at the point end and pull at right angles to the point surfaces. Take a reading as the points start to separate. The spring tension should be 17 to 20 ounces. If spring tension is not within these specifications, loosen the screw which holds the end of the point spring and slide the end of the spring in and out as necessary. Do not pull the conductor ribbon tight against the spring, as this will cause the ribbon to fatigue and break. Tighten the screw and check the tension. Test the tension of the remaining breaker arm spring in like manner.

51. CHECKING DISTRIBUTOR GOVERNOR

Mount the distributor assembly in a test stand and check the distributor rpm and degrees of advance as follows:

(1) Operate the distributor in the correct rotation, at low speeds. Gradually increase speed until the distributor spark advances. Reduce the speed and set the indicator at zero.

(2) Increase the distributor speed from 350 to 500 rpm. The degree reading should be zero.

(3) Again advance the speed to 600 rpm. The reading should show 1½ degrees (plus or minus 1 degree) advance. If the advance is not as specified, stop the distributor, remove the breaker plate and bend the outer spring lug on the light-weight spring to change its tension.

(4) Check this adjustment again and operate the distributor just below 1775 rpm. If this advance is not as specified in Data and Specifications, stop the distributor. Bend the outer spring lug on the heavy-weight spring to change its tension.

(5) Recheck the zero point and the above two settings and make the changes required. Check the advance at all points specified.

NOTE

When making this last check, operate the distributor both up and down the speed range. If variations exist between the readings for increasing and decreasing speeds, the governor action is sluggish and an overhaul is required.

52. CHECKING THE VACUUM ADVANCE

After checking the distributor governor action, check the vacuum advance as follows:

(1) Connect the vacuum line, being careful not to distort the vacuum chamber housing. Turn on the vacuum pump to give a reading of 10 to 20 inches of vacuum. Shut off the pump. If the gauge reading falls, it indicates leakage in the vacuum chamber, gauge, or connections. The source of the leakage should be located and the condition corrected before check is made.

(2) Remove the vacuum line from the distributor and operate at a speed above the maximum governor advance speed (see Data and Specifications) to eliminate all spark advance variation due to the governor.

(3) Set the indicator at zero and apply vacuum to give one of the advance figures specified. If the advance reading is incorrect, change the spacer washers between the vacuum chamber spring and nut.

NOTE

If the reading is below specifications, remove necessary washers to give correct reading. If the reading is above specifications, add necessary thickness washers to give a correct reading.

When changing washers, tighten the nut securely and make sure the nut gasket is in place.

When one point of the curve is adjusted, the others should be checked. If they are not correct, it indicates either incorrect spring characteristics or leakage in the vacuum chamber or tubes.

53. ADJUSTMENT OF DISTRIBUTOR BREAKER POINTS

a. Setting Points

Since the breaker points are timed to close and open at the exact instant necessary for efficient engine operation, adjustment of points is an important factor in correct distributor operation.

New points can be adjusted with a feeler gauge. If points are used but are still clean and make flat contact with each other, a dial indicator, Tool C-707, can be used satisfactorily. If points are pitted or badly worn, they should be replaced because metal may be burned, causing a resistance that would result in poor point operation.

Rotate the distributor shaft until rubbing block of one set of points is on high spot of cam. With screwdriver blade inserted in the

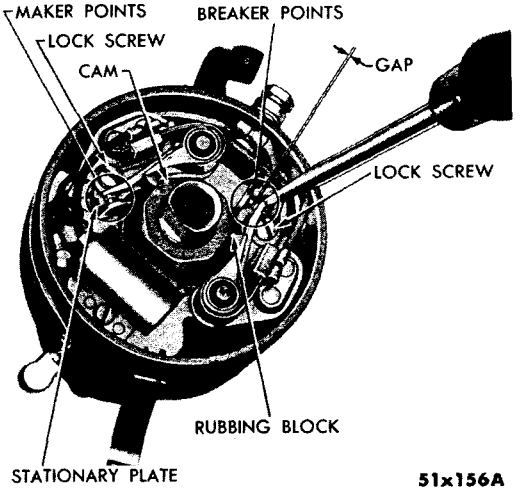

Fig. 28 — Adjusting Distributor Breaker Point Gap

triangular opening as shown in Figure 28, close or open points to a clearance of .015 to .018 inch by turning screwdriver blade against stationary point plate. Check clearance with a clean feeler gauge or dial indicator.

NOTE

The lock screw should be loosened just enough so that the stationary point plate can be moved with a slight drag. Otherwise, it will be difficult to set the points accurately.

After setting points to correct clearance, tighten lock screw. Turn distributor shaft until rubbing block of second set of points is on high spot of cam. Adjust the second set of points in the same manner.

b. Checking Condition of Distributor with Dwell Meter

When adjusting distributor contact points with a dwell meter, first set the point gap to the specified clearance with a feeler gauge, or dial indicator, as outlined in a. Find the degrees of dwell on the dwell meter and check the dwell reading with the gap of the points.

If the dwell meter shows 27 degrees for one set of points (with the specified gap of .015 inch to .018 inch), or a total dwell of 34 degrees, the distributor is in good condition. But, if the dwell angle is not within specifications with the specified point gap, or if the dwell meter needle is erratic, the distributor should be carefully checked for the following conditions:

(1) Worn rubbing block.

(2) Rubbing block bent or worn over to form a sort of shoe at the end. (This condition usually results when non-standard parts are used.)

(3) Rubbing block not square with cam.

(4) Badly worn cam (only on very old distributor).

(5) Drive shaft bushing wear.

54. ADJUSTING IGNITION TIMING

First, make sure that points have been properly adjusted and that distributor has been properly installed in engine. Timing can be most satisfactorily adjusted with the use of timing light, Tool C-693, as follows:

a. Setting to Specified Firing Position (Engine Running)

(1) Place chalk mark on vibration damper indicating specified number of degrees.

(2) Insert male end of adapter, Tool C-3066, into No. 1 distributor tower and insert No. 1 spark plug wire into female end of adapter as shown in Figure 29.

(1) Place chalk mark on vibration damper or crankshaft pulley indicating specified number of degrees.

(a) Connect blue wire to metal female end of adapter, Tool C-3066.

(b) Connect wire with black insulator to negative battery terminal.

(c) Connect wire with red insulator to positive battery terminal.

(4) Start the engine and allow to idle.

CAUTION

For accurate reading, make sure that the carburetor is not set at the fast warm-up, idle speed. Wait until it is at slow idle after warm up.

(5) The timing light flash should occur when the chalk mark on vibration damper or pulley is opposite the pointer on the engine block. If it does not, loosen the distributor clamp bolt and move the distribu-

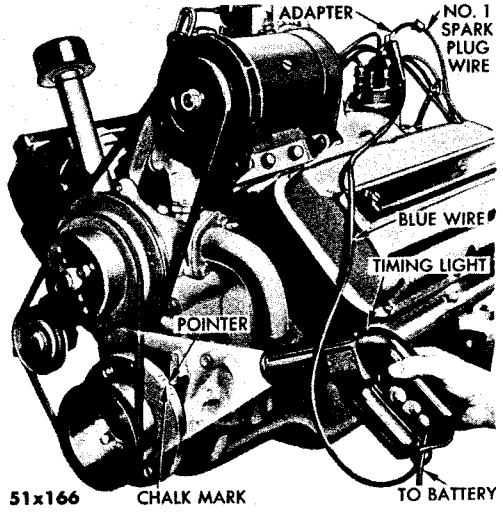

Fig. 29 — Timing Light (Typical Procedure)

tor either clockwise or counter-clockwise until the specified setting is obtained. Tighten the clamp bolt. As the engine speed is increased, the timing light should indicate a gradual spark advance.

b. Setting to Specified Firing Position (Engine Not Running)

If timing light is not available, a fairly accurate adjustment can be made as follows:

(1) Turn engine over in operation direction until specified reading in degrees or crankshaft rotation on vibration damper or camshaft pulley appears at pointer.

(2) Connect test lamp in series between distributor primary lead and negative battery post.

(3) Loosen distributor adjustment clamp bolt and back off distributor by turning it clockwise until lamp lights. If lamp lights immediately, this back-off is unnecessary.

(4) Turn distributor slowly counter-clockwise (against direction of rotor travel) until instant lamp goes out.

(5) Tighten clamp bolt.

c. Setting to Advance or Retard Position

To advance or retard the timing to conform with special conditions, leave timing light, Tool C-693, hooked up as outlined in a., and proceed according to the following instructions:

In low altitudes, the engine will give its best performance if timed according to the Data and Specifications Chart.

With this timing, there will be a trace of spark ping when accelerating with wide open throttle.

When using lower grade fuels, or after carbon has accumulated, spark ping may be excessive with the specified timing. In such cases, ignition should be retarded not to exceed 4 degrees of crankshaft rotation later than specified timing.

In high altitudes, here is less tendency for spark ping with either standard or premium fuels, and the same thing is true in low altitudes, when using premium gasolines. In such cases, improved performance may be obtained by advancing the spark not to exceed 4 degrees ahead of specified setting.

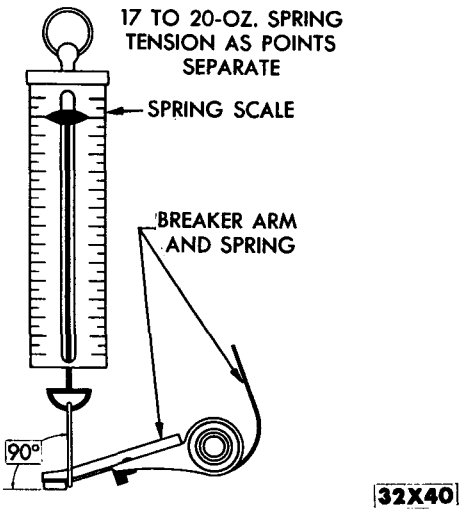

Fig. 30 — Testing Breaker Arm Spring Tension

Within the foregoing limits, namely: from 4 degrees earlier to 4 degrees later than specified timing, a good rule to follow is to advance the spark until a slight ping is audible when accelerating at wide open throttle.

The distributor should be moved clockwise to retard ignition and counter-clockwise to advance ignition.

d. Checking Distributor Advance

The operation of the advance mechanism in the distributor can be checked on a testing machine. Refer to Data and Specifications for distributor advance specifications.

55. ADJUSTING BREAKER ARM SPRING TENSION

Hook a spring scale on the arm at the point end and pull at right angles to the point surfaces, as shown in Figure 30. Take a reading as the points start to separate. The spring tension should be 17 to 20 ounces. If not, loosen the screw which holds the end of the point spring and slide the end of spring in or out as necessary. Retighten screw and recheck tension.

56. CHECKING DISTRIBUTOR SHAFT BUSHINGS

To service distributor drive shaft bushings, remove the breaker plate assembly and cam and stop plate. Check the bushing wear as follows:

Attach a dial indicator to the distributor

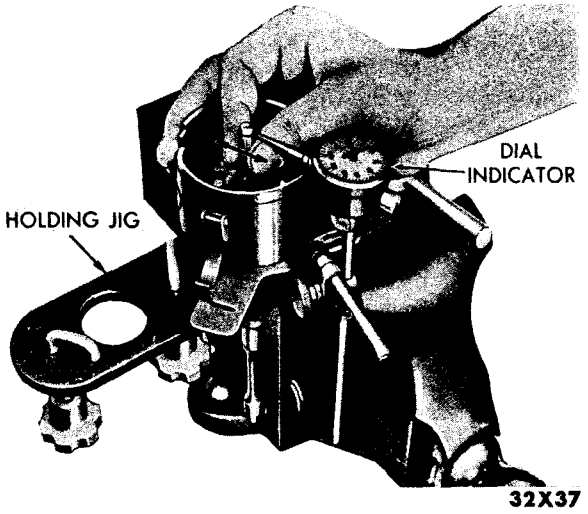

Fig. 31 — Measuring Drive Shaft Bushing Wear

base and adjust the plunger of the indicator against the top of the drive shaft. Move the shaft to and from the indicator with just enough force to indicate the clearance, as shown in Figure 31. (Too much pressure will cause the shaft to spring and show a false reading.) If the clearance is more than .008 inch, replace the bushings.

57. SERVICING DISTRIBUTOR ADVANCE

The change in advance according to increase in speed is known as the "automatic advance curve," while the change in advance according to throttle position or carburetor vacuum is known as the "vacuum advance curve." These two curves can be checked separately on a reliable bench testing device consisting of a variable speed drive to the distributor, a protractor, and a source of vacuum.

Results of the checks for any distributor should agree with the figures shown in the advance curve tables.

When checking the automatic advance, improper action between 300 and 400 rpm shows that the fine spring is faulty, while improper advance above 400 rpm indicates that the heavy spring is faulty. If the automatic advance is too rapid, it indicates that the governor springs are weak, broken, or have insufficient tension. If it is impossible to correct the condition by increasing tension, the springs should be replaced. If the advance is too slow, one of the springs is stiff, or tension is too great. If it is impossible to correct the condition by decreasing tension, the springs should be replaced.

The vacuum advance curve can be adjusted by changing washer in vacuum chamber (Fig. 25). These washers are available in three different thicknesses to control the tension on the return spring. If the vacuum advance is too fast, it indicates that the spring is weak and a combination of washers have greater thickness should be installed. If the vacuum advance is too slow, the spring pressure is too great and a combination of washers having lesser thickness is required in the chamber. It should be noted that at high altitudes, atmospheric pressures are reduced and manifold vacuum is correspondingly lower.

The distributor of an engine operated continuously in high altitude areas may be adjusted to provide a maximum advance at lower vacuum. Otherwise, adjust the distributor for lower altitude operation.

Where testing equipment is not available, the distributor can be checked on the engine using a timing light. By this means it is possible to determine whether or not the advancing devices are operating, although accurate calibration over the range of the two curves is difficult. With engine idling, marks on crankshaft pulley or damper can be compared with timing pointer. At idle speed, pointer should line up with specified mark given under "Ignition Timing." If throttle is suddenly opened wide, the mark on crankshaft pulley or damper should advance approximately 10 degrees when engine reaches a speed corresponding to about 25 miles per hour. If throttle is then closed to maintain this speed, the mark on pulley or damper should advance approximately another 10 degrees, depending on amount of vacuum created.

IGNITION COIL

The ignition coil transforms battery voltage into high voltage for the spark plugs. If there are indications that the coil is not delivering a satisfactory spark, first check all connections at ammeter, ignition switch, coil and distributor to make sure that they are clean and tight.

A quick coil check may be made by removing coil high tension wire at distributor cap and holding it near cylinder head. With ignition switch turned on and starting motor cranking the engine, a spark should jump from the end of the high tension wire to the cylinder head. If spark is more than ¼ inch long, the coil is in good condition and the trouble is elsewhere in the electrical system. Check the electrical system to determine the cause and correct as necessary.

The ignition coil has been carefully designed to give maximum power and performance. No improvements can be obtained by use of other than the original equipment type of unit. If there is a clear indication that coil is defective, it should be replaced with a unit of same make and model.

To remove coil, disconnect high and low tension wires. Remove retaining screws or nuts and dismount coil.

SPARK PLUGS

The resistor type spark plug incorporates a resistor which, with the resistor in the distributor, eliminates radio static noises.

By using a high voltage, high output coil and 10,000 ohm resistor in the distributor cap, the spark plug gap has been increased to .035 inch. This improves idle and low speed operating performance.

For best engine performance and economical operation, spark plugs should be kept clean. They should be cleaned frequently in a blast type cleaner which will remove deposit formed by use of chemically treated fuels for high compression engines. If this deposit is not removed, the engine may "miss" under heavy load or high speed.

NOTE

Maintenance of the temperature of the plugs depends largely upon the proper installation and tightening of the plugs in the cylinder head to insure the proper heat transfer from the nose of each plug through the shell and seat gasket to the engine's cooling system.

After cleaning the spark plugs, adjust the gap to .035 inch, using a round feeler gauge. Make all adjustments on the side electrode of the spark plug. If the center electrode is bent, the porcelain may crack, resulting in plug failure.

CAUTION

Do not drop spark plugs into the tubes as this may cause the gaps to close up. When installing, place a spark plug in the socket wrench (Fig. 32) and bring the tube down over the plug. Hold the plug down in the tube and insert the assembly into the cylinder head.

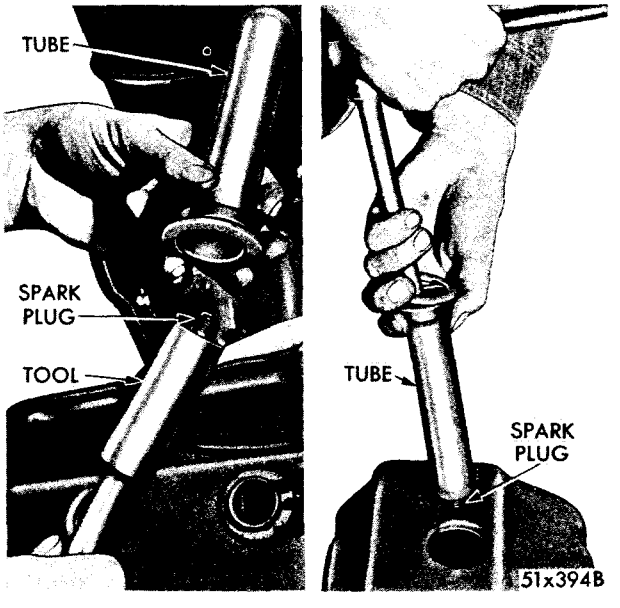

Fig. 32 — Spark Plug in Socket Wrench

SERVICE DIAGNOSIS

58. BURNED OR PITTED POINTS

Possible Causes:

a. Dirt or oil on points.

b. Improperly adjusted points.

c. Defective condenser.

d. Defective coil.

e. Worn bushings on distributor shaft.

f. Regulator setting high.

g. Extremely high voltage.

Remedies:

a. Clean breaker points and check for pitting. If the contact surfaces are badly burned, replace points and condenser.

b. Adjust points. Excessive flashing or burning may be caused by a chattering or rebound of the contact points. Test breaker arm spring tension.

c. Replace condenser and check contacts for pitting or burning. Replace parts as required.

d. Replace defective coil. Check points for burned or pitted contact surface. Replace parts as required.

e. Replace bushing on distributor drive shaft.

f. Check regulator setting. Check points for excessive burning. Replace parts as required.

g. Damage to the coil by extreme high voltages may be caused by failure of the voltage regulator to operate properly. This will be indicated by an overcharged condition of the battery. Check voltage regulator. Replace defective coil and points, if the contacts are burned or pitted.

59. IGNITION COIL FAILURE

Possible Causes:

a. Extremely high voltages.

b. Moisture formation.

c. Excessive heat from engine.

d. Open circuit at soldered connection on primary studs.

Remedies:

a. Damage to the coil by extreme high voltages may be caused by failure of the voltage regulator to operate properly. This will be indicated by an overcharged condition of the battery. Check voltage regulator. Replace defective coil and points, if the contacts are burned or pitted.

b. Replace defective coil and points, if the contact surfaces are burned or pitted. The failure of the ignition coil may be caused by the entrance of moisture through a break in the soldered joints of the can—due to rough handling.

c. Replace defective coil and points, if the contact surfaces are burned or pitted. Refer to Cooling System Section for correction of excessive engine heat.

d. Resolder connections in primary studs, allowing solder to flow into stud cavity. Be very careful not to overheat the bakelite tower. If unable to make satisfactory connection, replace coil and points if necessary.

60. CONDENSER FAILURE

Possible Causes:

a. Normal fatigue.

b. Excessive heat.

c. Moisture.

Remedies:

a. Replace condenser and check points for burning or pitting. Replace if necessary.

b. Replace condenser and check points for burning or pitting. Refer to Cooling System Section to correct excessive engine heat.

c. Replace condenser and check points for burning or pitting. Replace parts as required.

61. FOULED OR BURNED SPARK PLUGS

Possible Causes:

a. Incorrect type of spark plugs.

b. Spark plugs not sufficiently tight in head.

c. Valves seating improperly.

d. Excessive lean air-fuel mixture.

e. Ignition timing improperly adjusted.

f. Water leaking into combustion chamber.

Remedies:

a. Remove incorrect spark plugs and replace. Make sure gap is .035 inch.

b. Tighten spark plugs to 32 foot-pounds torque.

c. Refer to Engine Section for correction of this condition.

d. Refer to Fuel System Section for adjustment of the carburetor.

e. Refer to Paragraph 54, of this section, for correct ignition timing.

f. Replace cylinder head or gasket as outlined in Engine Section.

SHIELDED IGNITION UNITS

Chrysler Industrial Engines may be equipped with radio shielding devices.

For maintenance or servicing of the shielded units refer to the Service Procedures as outlined for the standard system.

62. GENERATOR SHIELDING

The purpose of the generator shielding is to provide a barrier for any electrical transmission set up by normal operation of the generator unit. A non-shielded generator would interfere with the operation of certain pieces of electrical or electronic equipment operating within the installation area of the Industrial Engine.

63. IGNITOR SHIELDING

When installing Ignitor cover care must be exercised. The cover rubber seal ring must be seated properly. To seat the Ignitor cover improperly would render the purpose of the Ignitor system ineffective.

64. REGULATOR SHIELDING

Mount the regulator within the shielding. If a condenser has been furnished for connection to the "Bat" terminal of the regulator, ground the condenser at the side of the shield using the screw provided. The lead to the ammeter is non-shielded and passes thru the assembled side adaptor.

65. IGNITOR VENTILATION SYSTEM

The Ignitor is ventilated by utilizing the vacuum of the carburetor air intake. Install the curved pilot tube within the air cleaner, flame arrestor, or carburetor intake. The small curved tube extends into the airstream pointing downstream. Copper tubing is then pressed between the pilot tube and the compression fitting on the base of the Ignitor. Trim any excessive tubing.

66. LOW TENSION IGNITOR LEAD

Connect to Ignitor using suitable terminal fittings.

67. SPARK PLUGS

The sparks plugs, as used with the Ignitor system, are self-shielded and self supported. As the spark plugs are recessed in the cylinder heads, extensions are employed as a means of attaching the leads. In removing or installing the lead wires extreme care must be observed when assembling the various retainers and adapters.

68. COIL SHIELDING

In the Ignitor system the ignition coil is placed within the Ignitor housing to form a compact distributor-coil unit.

69. CHECKING IGNITION COIL

The ignition coil transforms battery voltage into high voltage for the spark plugs. If there are indications that the coil is not delivering a satisfactory spark, first check all connections at the ammeter, ignition switch, Ignitor to see they are clean and tight.

A coil check may be made by removing a spark plug lead and holding it near the cylinder head. With the ignition switch turned on and the starting motor cranking the engine, a spark should jump from the end of the spark plug lead to the cylinder head. If the spark is less than ¼ inch long, the electrical system should be tested with accurate electrical testing equipment to determine the cause of the difficulty.

The ignition coil has been carefully designed to give maximum power and performance. No improvements can be obtained by the use of other than the original type of unit. If there is a clear indication that the coil is defective, it should be replaced with a unit of the same make and model.

70. BONDING STRAPS (Where Required)

Flexible bonding straps, where required, are provided. One end connects to the shield, while the other connects to a convenient engine stud or screw. Tooth type lockwashers should be used for this application and should be placed between strap and support.

71. FINAL INSTRUCTIONS FOR SHIELDING INSTALLATIONS

All coupling nuts, cover screws, bond strap connections (where required) and mounting screws must be tight. *This is a must, otherwise radiation will occur.*

It is recommended that tooth type lockwashers be utilized wherever possible for grounding and mounting the shields and that the washer be placed next to the grounding surface so as to dig through any corrosion protecting coating, if present.

NOTE

ALL INFORMATION COVERED UNDER "SHIELDED IGNITION UNITS" IS OF A BASIC NATURE AND SERVES ONLY TO ACQUAINT THE OPERATOR WITH A GENERAL DESCRIPTION AND SERVICE RECOMMENDATIONS.

ADDITIONAL INFORMATION CONCERNING SERVICE PROCEDURES AND MAINTENANCE OF THE IGNITOR SYSTEM MAY BE OBTAINED BY ADDRESSING REQUESTS TO:

THE ELECTRIC AUTO-LITE COMPANY
TOLEDO, OHIO, U.S.A.

Section VI

TRANSMISSIONS

DATA AND SPECIFICATIONS

	Regular	*Heavy Duty*
NO. OF FORWARD SPEEDS	4	5
RATIOS IN TRANSMISSION		
5th		1 to 1
4th	1 to 1	1.48 to 1
3rd	1.69 to 1	2.40 to 1
2nd	3.10 to 1	4.05 to 1
1st	6.68 to 1	7.41 to 1
Reverse	8.25 to 1	7.85 to 1
END PLAY		
Third Speed Gear	0 to .009	0 to .009
Fourth Speed Gear	.001 to .007	.001 to .007
POWER TAKE-OFF LOCATION	Right Side	Both Sides
TYPE	6 Stud	6 Stud
SHIFT LEVER LOCATION	On Transmission	On Transmission
LUBRICANT CAPACITY	5½ pts.	9½ pts.

TIGHTENING REFERENCE

Part Name	*Foot-pounds Torque*
Main shaft flange nut	105
Transmission case to clutch housing screws	50
Clutch housing to cylinder block screws	35
Rear cover to transmission case screws	35
Detent spring retaining screw	20