

COOLING SYSTEM

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GENERAL DESCRIPTION

The water pump (figs. 188, 189, and 190) is a ball bearing, centrifugal vane impeller type. It requires no care other than to make certain the air vent at the top of the housing and the drain holes in the bottom do not become plugged with dirt or grease.

A water by-pass is included in the cooling system which utilizes a hole in the cylinder block on 283 cu. inch engines. On the 348 cu. inch engines a by-pass at the top of the water pump is connected to the inlet manifold utilizing cross over passages to the cylinder heads.

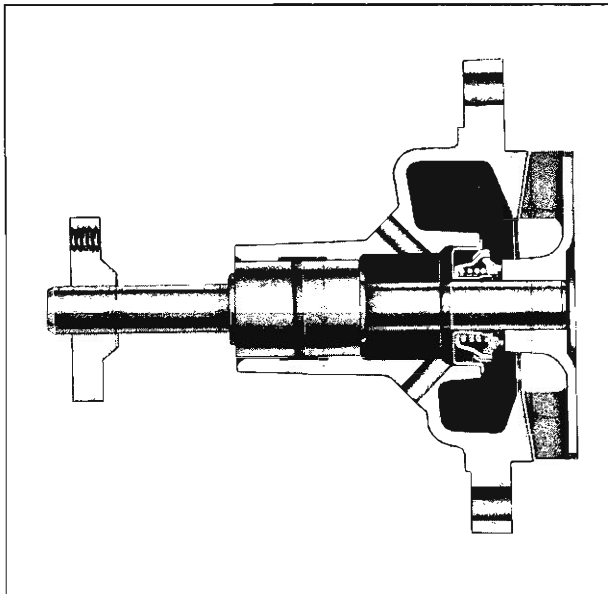


Fig. 188—Water Pump, 6 Cylinder

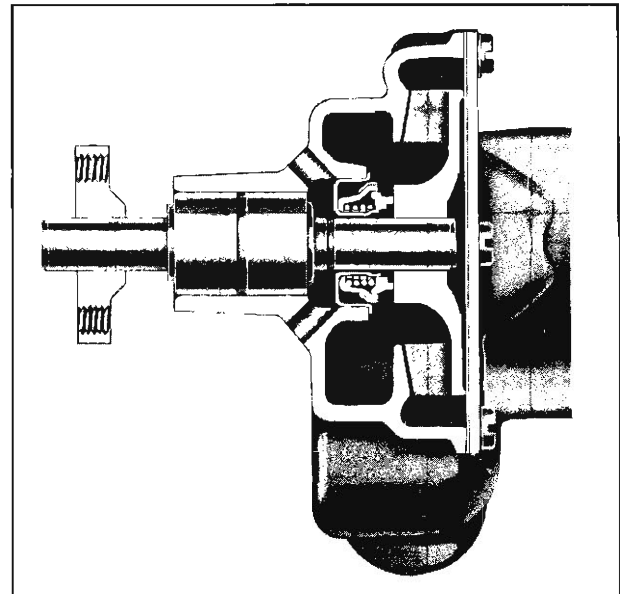


Fig. 189—Water Pump, 283 Cu. In., 8 Cylinder

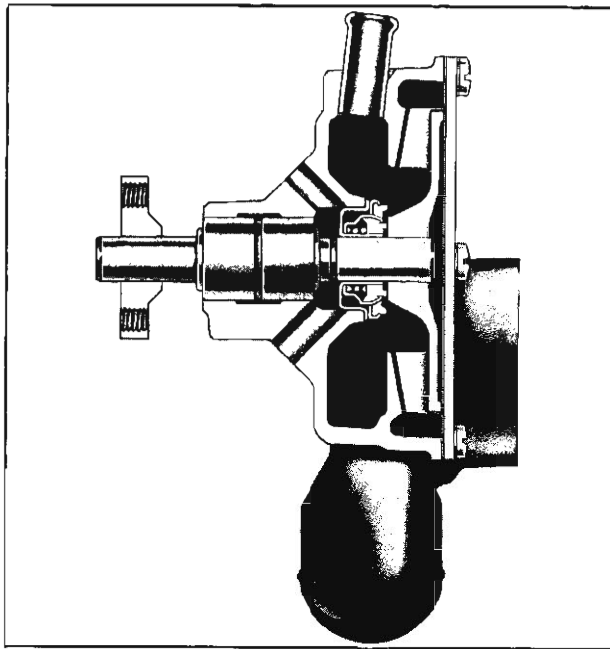


Fig. 190—Water Pump, 348 Cu. In., 8 Cylinder

A pressure cooling system is provided for on all models by a pressure type radiator cap (fig. 191). The pressure type radiator cap used is designed to hold

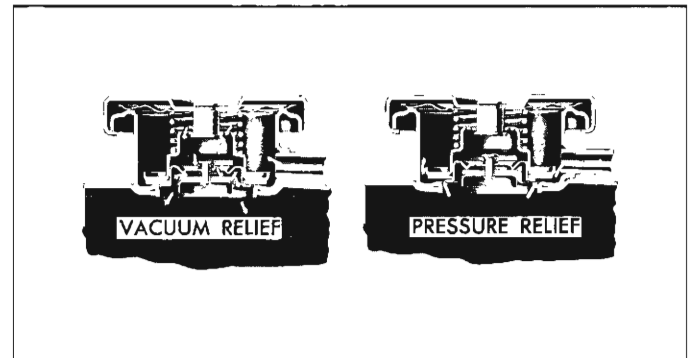


Fig. 191—Pressure Radiator Cap

a pressure up to approximately 13 pounds per square inch above atmospheric pressure in the cooling system. Above 13 pounds the pressure is relieved by a valve within the cap that opens to radiator overflow.

MAINTENANCE AND ADJUSTMENTS

RADIATOR COOLANT LEVEL

The radiator coolant level should only be checked when the *engine is cool*, particularly on cars equipped with air conditioning. If the radiator cap is removed from a hot cooling system, serious personal injury may result.

The cooling system fluid level should be maintained *one inch below* the bottom of the filler neck of the radiator when a cold cooling system, or at the bottom of the filler neck when the system is warm. It is very important that the correct fluid level be maintained. The sealing ability of the radiator cap is affected when the cooling level is too high.

All passenger car cooling systems are pressurized with a 13 psi pressure cap which permits safe engine operation at cooling temperatures of up to 243° F.

When the radiator cap is removed or loosened, the system pressure drops to atmospheric, and the heat which had caused water temperature to be higher than 212° F, will be dissipated by conversion of water to steam. Inasmuch as the steam may form in the engine water passages, it will blow coolant out of the radiator upper hose and top tank, necessitating coolant replacement. Engine operating temperatures higher than the normal boiling point of water are in no way objectionable so long as the coolant level is satisfactory when the engine is cool.

Upon repeated coolant loss, the pressure radiator cap and seat should be checked for sealing ability. Also, the cooling system should be checked for loose hose connections, defective hoses, gasket leaks, etc.

CHECKS AND TESTS OF COOLING SYSTEM FAILURES

1. Test for restriction in the radiator, by warming the engine up and then turning the engine off and feeling the radiator. The radiator should be hot at the top and warm at the bottom, with an even temperature rise from bottom to top. Cold spots in the radiator indicate clogged sections.
2. Water pump operation may be checked by running the engine while squeezing the upper radiator hose. A pressure surge should be felt. Check for a plugged vent-hole in pump.
3. A defective head gasket may allow exhaust gases to leak into the cooling system. This is particularly damaging to the cooling system as the gases combine with the water to form acids which are particularly harmful to the radiator and engine. To check for exhaust leaks into the cooling system, drain the system until the water level stands just above the top of the cylinder head, then disconnect the upper radiator hose and remove the thermostat and fan belt. Start the engine and quickly accelerate several times. At the same time note any appreciable water rise or the appearance of bubble which is indicative of exhaust gases leaking into the cooling system.

PERIODIC MAINTENANCE

Periodic service must be performed to the engine cooling system to keep it in efficient operating condi-

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tion. These services should include a complete cleaning and reverse flushing as well as a reconditioning service.

In the course of engine operation, rust and scale accumulate in the radiator and engine water jacket. The accumulation of these deposits can be kept to a minimum by the use of a good rust inhibitor but it should be remembered that an inhibitor will not remove rust already present in the cooling system.

Two common causes of corrosion are: (1) air suction—Air may be drawn into the system due to low liquid level in the radiator, leaky water pump or loose hose connections; (2) exhaust gas leakage—exhaust gas may be blown into the cooling system past the cylinder head gasket or through cracks in the cylinder head and block.

Cleaning

A good cleaning solution should be used to loosen the rust and scale before reverse flushing the cooling system. There are a number of cleaning solutions available and the manufacturer's instructions with the particular cleaner being used should always be followed.

An excellent preparation to use for this purpose is G.M. Cooling System Cleaner. The following directions for cleaning the system applies only when this type cleaner is used.

1. Drain the cooling system including the cylinder block and then close both drain cocks. On eight cylinder models, replace pipe plugs on each side of block.
2. Remove thermostat and replace thermostat housing.
3. Add the liquid portion (No. 1) of the cooling system cleaner.
4. Fill the cooling system with water to a level of about 3 inches below the top of the overflow pipe.
5. Cover the radiator and run the engine at moderate speed until the heat indicator reaches 180 degrees.
6. Remove cover from radiator and continue to run the engine for 20 minutes. *Avoid boiling.*
7. While the engine is still running, add the powder portion (No. 2) or the cooling system cleaner and continue to run the engine for 10 minutes.
8. At the end of this time, stop the engine, wait a few minutes and then open the drain cocks or remove pipe plugs. Also remove lower hose connection.

CAUTION: Be careful not to scald your hands.

Reverse Flushing

Reverse flushing should always be accomplished after the system is thoroughly cleaned as outlined above. Flushing is accomplished through the system

in a direction opposite to the normal flow. This action causes the water to get behind the corrosion deposits and force them out.

Radiator

1. Remove the upper and lower radiator hoses and replace the radiator cap.
2. Attach a lead-away hose at the top of the radiator.
3. Attach a new piece of hose to the radiator outlet connection and insert the flushing gun in this hose.
4. Connect the water hose of the flushing gun to a water outlet and the air hose to an air line.
5. Turn on the water and when the radiator is full, turn on the air in short blasts, allowing the radiator to fill between blasts of air.

CAUTION: Apply air gradually as a clogged radiator will stand only a limited pressure.

6. Continue this flushing until the water from the lead-away hose runs clear.

NOTE: If Powerglide or Turboglide transmission model radiators are to be tank tested for repairs, plug oil cooler openings tightly.

Cylinder Block and Cylinder Head

1. With the thermostat removed, attach a lead-away hose to the water pump inlet and a length of new hose to the water outlet connection at the top of the engine.
- NOTE:** Disconnect the heater hose when reverse flushing engine.
2. Insert the flushing gun in the new hose.
 3. Turn on the water and when the engine water jacket is full, turn on the air in short blasts.
 4. Continue this flushing until the water from the lead-away hose runs clear.

Hot Water Heater

1. Remove water outlet hose from heater core pipe.
- NOTE:** Be sure heater control valve is open.
2. Remove inlet hose from engine connection.
 3. Insert flushing gun and flush heater core. Care must be taken when applying air pressure to prevent damage to the core.

After cooling system has been cleaned and reverse flushed, the system should be thoroughly reconditioned. Procedure for reconditioning as outlined under "Antifreeze" in this section should be followed.

Dirt and bugs may be cleaned out of the radiator air passages by blowing out with air pressure from the back of the core.

ANTIFREEZE

In selecting an antifreeze solution for winter operation, the local conditions and the type of service must be considered. In any event, it is very essential to make certain checks and do certain things to at least insure the antifreeze remaining in the cooling system. To be certain that the solution will not leak out and be lost entirely, resulting in little or no protection against freezing, or seep into the working parts of the engine, the following procedure should be followed in conditioning the system.

1. Drain the engine cooling system including the cylinder block.

NOTE: If considerable rust, scale, oil or grease is present in the water drained out, it is advisable to flush and clean the system.

2. Tighten all cylinder head bolts in sequence as shown in the Engine Mechanical Section of this manual.
3. Check the water pump for leaks, excessive end play or looseness of the shaft in the pump.

NOTE: Should the water pump leak or indicate that leakage would occur with antifreeze in the system, it should be repaired, see "Service Operations, Water Pump."

4. Inspect fan belt. Replace if badly worn. Adjust belt to proper tension.
5. Inspect all radiator and heater hoses. If hoses are collapsed, cracked or in any way indicate a rotted condition on the inside, replacement should be made. Carefully check and tighten all hose clamps.
6. Check the thermostat. Make sure it does not stick open or closed. Refer to "Thermostat," in this section.
7. Fill the cooling system with the proper quantity of antifreeze and water according to instructions of manufacturer of antifreeze.

NOTE: Be sure to allow for additional amount of antifreeze solution when vehicle is equipped with a hot water heater.

8. Warm up engine and recheck radiator, water pump and all hose connections for leaks with ENGINE HOT.

FAN BELT ADJUSTMENT

1. Loosen bolts at generator slotted bracket.
2. Pull generator away from engine until desired belt tension is obtained. Refer to Section 7 for fan belt tension specifications.
3. Tighten all generator bolts securely.

THERMOSTAT

The thermostat consists of a restriction valve actuated by a thermostatic element. This is mounted in the housing at the cylinder head water outlet above the water pump.

Thermostats are designed to open and close at predetermined temperatures and if not operating properly should be removed and tested.

1. Remove radiator to water outlet hose.
2. Remove water outlet housing bolts on V-8 engines and remove water outlet, gasket and thermostat (fig. 192). On 6 cylinder engines remove thermostat housing bolts and remove water outlet and gasket thermostat from thermostat housing.

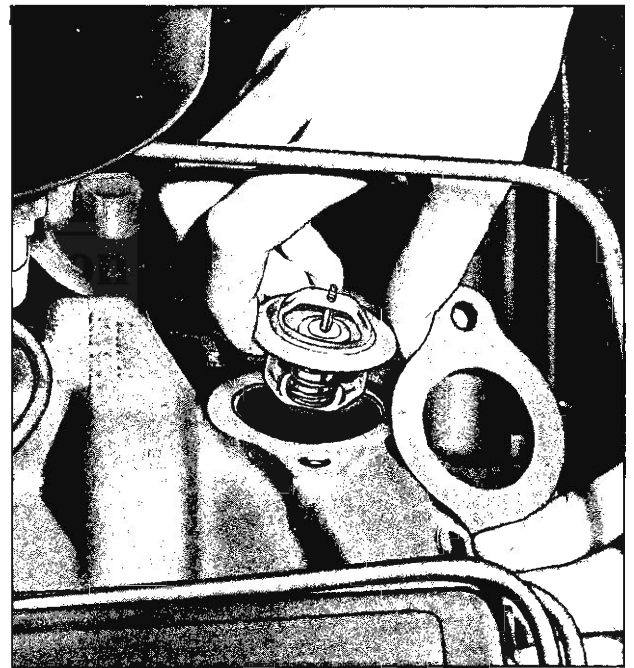


Fig. 192—Removing Thermostat, V-8 Engines

3. Inspect thermostat valve to make sure it is in good condition.
4. Place thermostat in hot water 25° above the temperature stamped on the thermostat valve.
5. Submerge the valve completely and agitate the water thoroughly. Under this condition the valve should open fully.
6. Remove the thermostat and place in water 10° below temperature indicated on the valve.
7. With valve completely submerged and water agitated thoroughly, the valve should close completely.
8. If thermostat checks satisfactorily, replace, using a new housing gasket.

SERVICE OPERATIONS

WATER PUMP

The water pumps on both 6 and 8 cylinder models are basically similar, and are both covered in the same operation description.

Removal and Disassembly

1. Drain radiator and remove water inlet hose from pump. Remove fan belt.
2. On heater equipped models, remove hose from pump housing.
3. Remove water pump to cylinder block attaching bolts and remove pump from engine.

CAUTION: On 6 cylinder models, pull pump straight out of cylinder block to avoid damage to impeller and shaft.

4. Remove fan and pulley by removing four retaining bolts.
5. On 8 cylinder models, remove back plate screws, plate and gasket.
6. Support fan hub in an arbor press and press pump shaft out of hub. A $\frac{1}{2}$ " x 2" bar will allow the shaft to be pushed through the hub. See Figure 193.
7. Support pump in an arbor press as shown in Figure 194. Press shaft and impeller assembly out of pump, applying pressure on the outer race of the shaft bearing only.

CAUTION: Shaft and bearing assembly must not be pushed out of housing by applying force on shaft, or bearings will be damaged. Use a $\frac{7}{8}$ " deep socket or piece of tubing $1\frac{1}{8}$ "

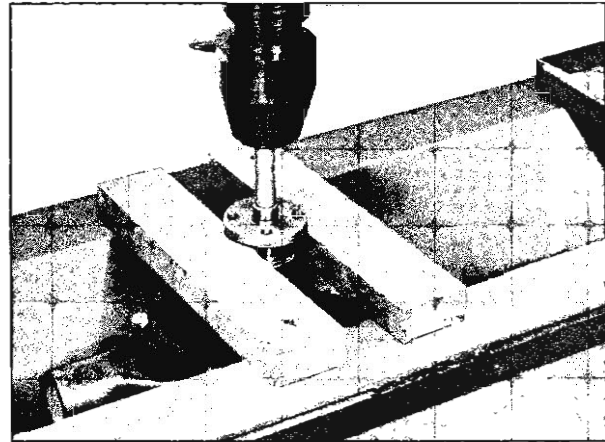


Fig. 193—Removing Fan Hub

O.D. Shaft and bearing assembly should be pressed out of rear of pump only.

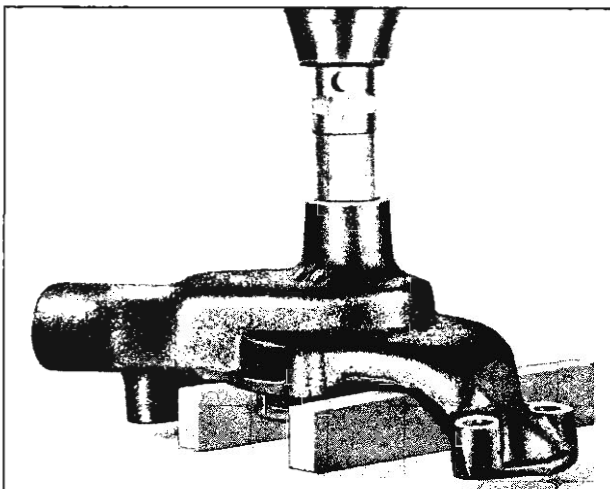
8. Support impeller on seal surface, using Tool J-5855 in an arbor press, using a $\frac{1}{2}$ " x 2" pin, press shaft out of impeller (fig. 195). Discard seal.

Inspection

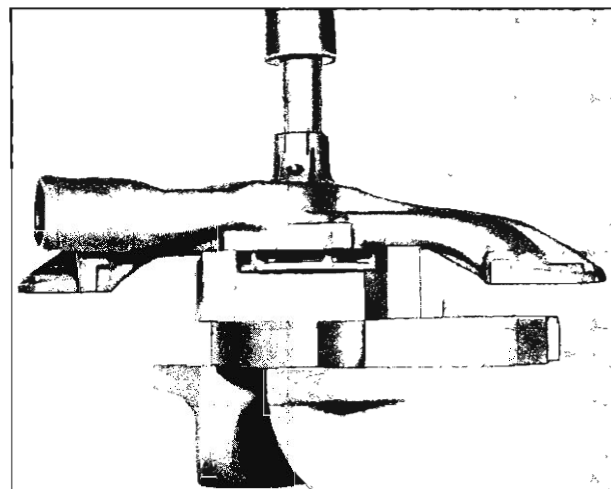
1. Wash all parts except pump shaft bearing in cleaning solvent, Figures 196, 197 and 198 show the water pumps disassembled.

NOTE: Pump shaft bearing is permanently sealed and lubricated bearing and should not be washed in cleaning solvent.

2. Inspect shaft and bearing assembly for roughness or excessive end play. Remove any rust or scale from shaft with fine emery cloth. The bearing



(235 and 283 Cu. In. Pump)



(348 Cu. In. Pump)

Fig. 194—Removing Shaft and Bearing Assembly

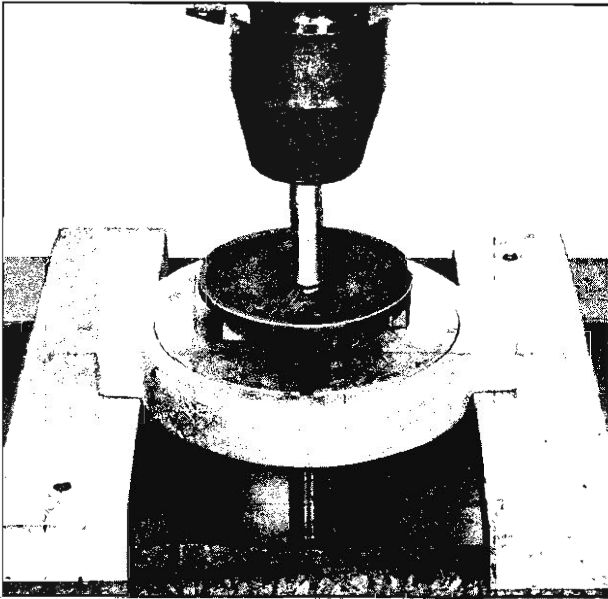


Fig. 195—Removing Seal

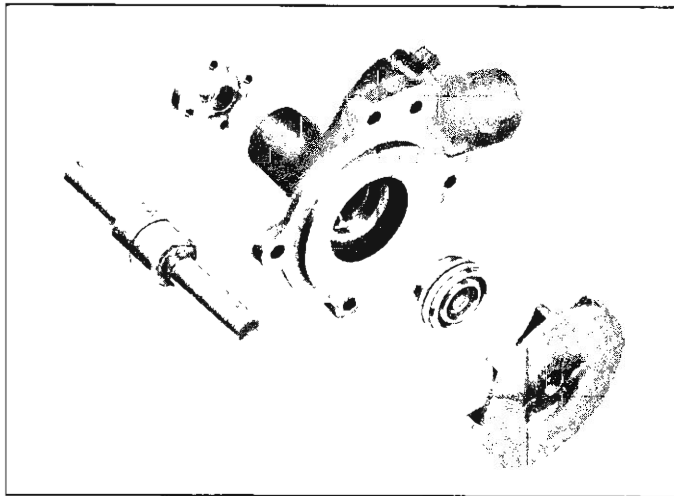


Fig. 196—6 Cylinder Pump Disassembled

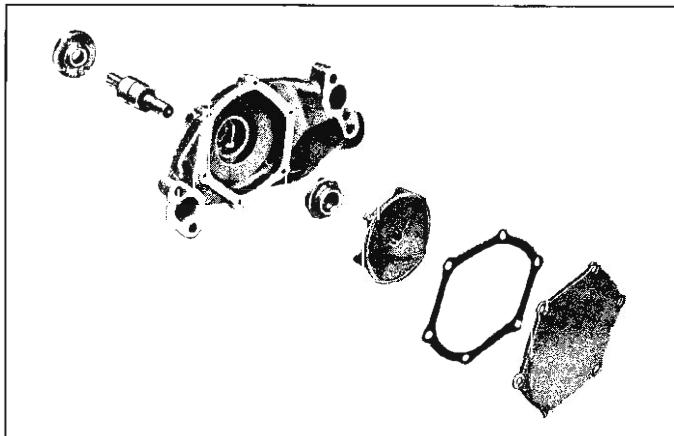


Fig. 197—Cylinder Pump Disassembled (283 Cu. In.)

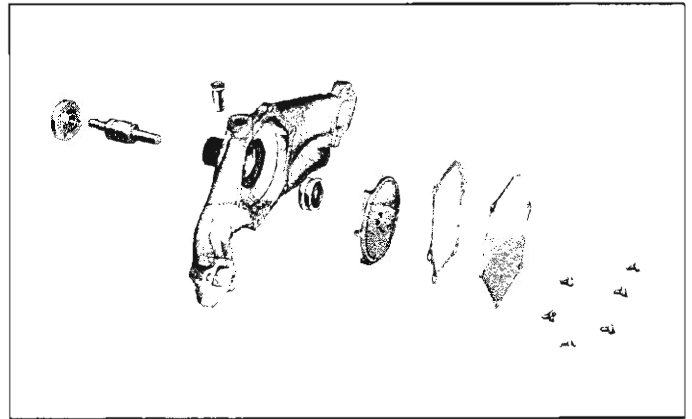


Fig. 198—8 Cylinder Pump Disassembled (348 Cu. In.)

should be wrapped in cloth while this operation is performed to prevent emery dust from entering bearing.

3. Inspect seat for thrust washer on impeller for pit marks or scoring. If seat for thrust washer is scored or pitted, the impeller should be replaced.

Assembly and Installation

1. Install pump shaft and bearing assembly into pump body bearing bore, applying pressure to outer race until it is flush with front of pump body, (fig. 199) on 235 and 283 cubic inch engine water pumps.

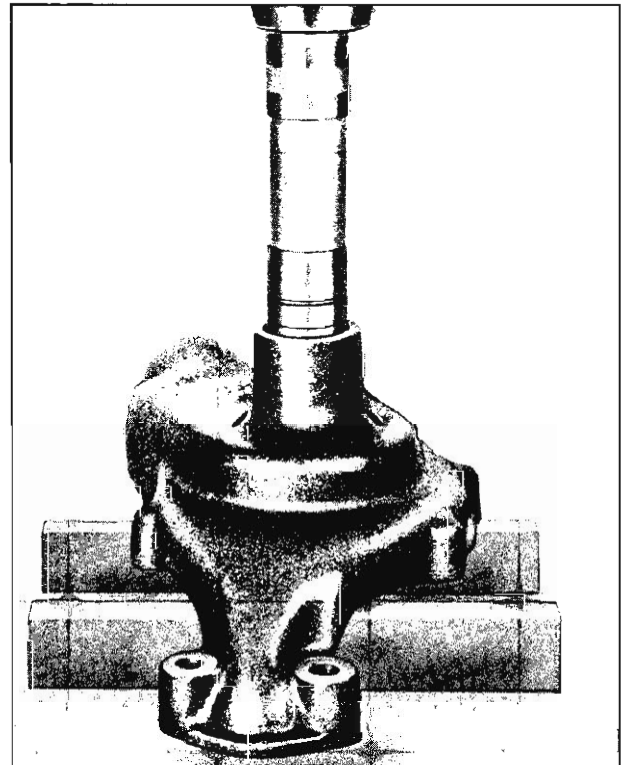


Fig. 199—Installing Shaft and Bearing Assembly (235 and 283 Cu. In. Pump)

CAUTION: Apply pressure to outer race only. On 348 cu. in. water pumps install pump shaft and bearing assembly into pump body bore as shown in Figure 200. Support pump body with a hollow tube and press in bearing assembly until it is flush with front of pump body.

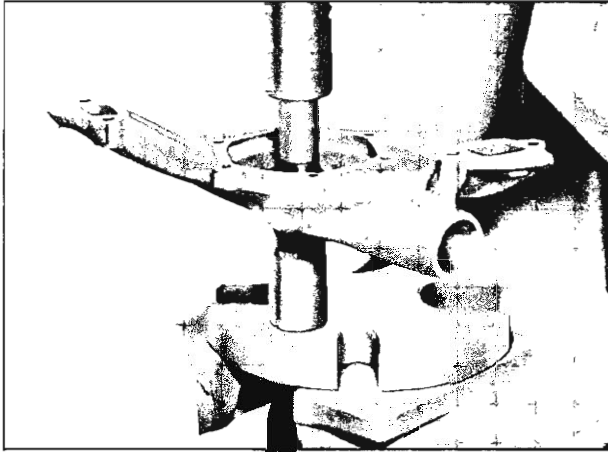


Fig. 200—Installing Shaft and Bearing Assembly (348 Cu. In. Pump)

2. Lightly coat O.D. of new seal with a sealing compound and press into place with Tool J-5590, applying pressure to the seal outer flange. The seal should bottom with the outer flange against the pump body (figs. 201 and 202).

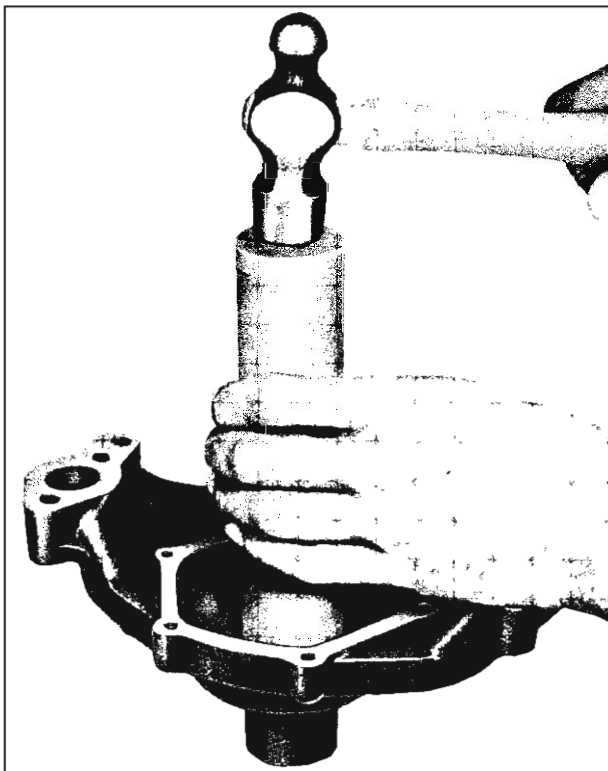


Fig. 201—Installing Seal (235 and 283 Cu. In. Water Pump)

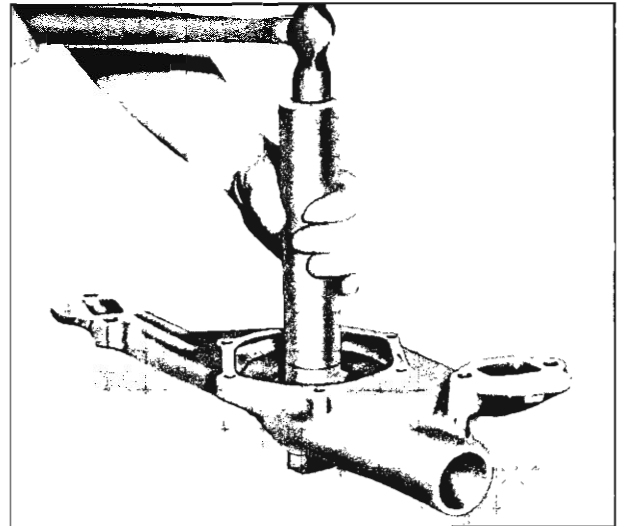


Fig. 202—Installing Seal (348 Cu. In. Water Pump)

3. Press on fan hub. Check fan hub location, as this is very critical and has a definite bearing on fan belt operation. Install Tool J-5775 used for 235 and 283 cu. in. water pumps and install Tool J-7034 in 348 cu. in. water pumps, in one of the bolt holes, from rear of pump (figs. 203 and 204). On 6 cylinder models place a straight edge on the front face of the fan hub with the head of the gauge held firmly against body, the straight edge should lightly contact short step on gauge Tool J-5775 (fig. 205). 8 cylinder 283 cu. in., use end of gauge J-5775 (fig. 203) and gauge Tool J-7034 for 348 cu. in., 8 cylinder models use short step of gauge (fig. 204).

NOTE: The factory specifications on this dimension carries a tolerance of $\pm .005''$.

4. Support pump on front or hub end of shaft and

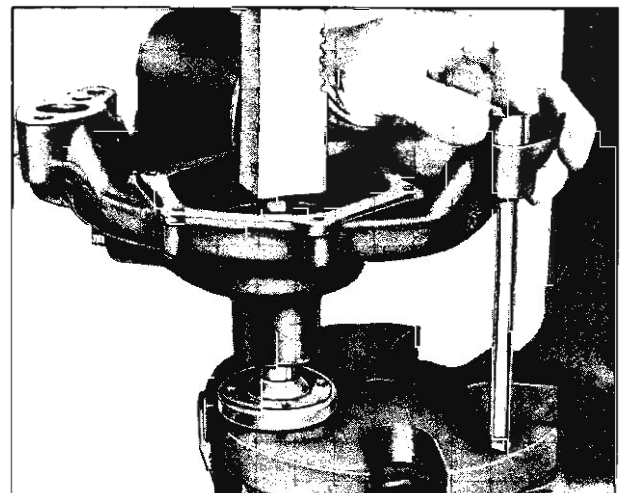


Fig. 203—Installing Fan Hub, 8 Cylinder (283 Cu. In. Engine)

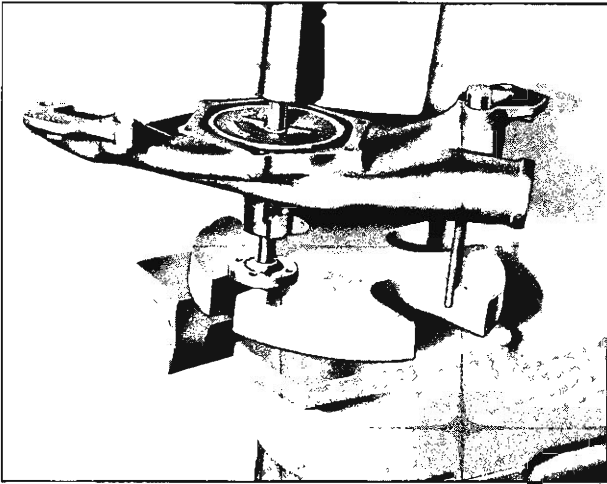
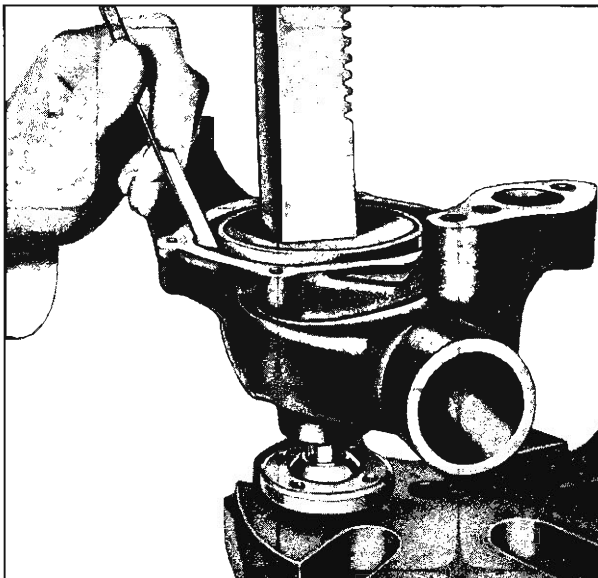


Fig. 204—Installing Fan Hub, 8 Cylinder (348 Cu. In. Engine)

press on impeller. Press to obtain .010" to .035" clearance between impeller vanes and pump body. Of eight cylinder models, it will be necessary to put a bend about ½" front end of feeler gauge to enable clearance checking (fig. 206).

5. Install pump cover and gasket with a light coat of gasket sealer and install screws, then tighten all six diagonally.
6. Install pump pulley and fan on pump hub and tighten bolts securely.
7. Install pump assembly on cylinder block and tighten bolts securely. Use a new pump to block gasket.
8. Install hoses and fill cooling system.
9. Install fan belt and adjust as follows:
 - a. Loosen bolts at generator slotted bracket.



(235 and 283 Cu. In. Water Pump)

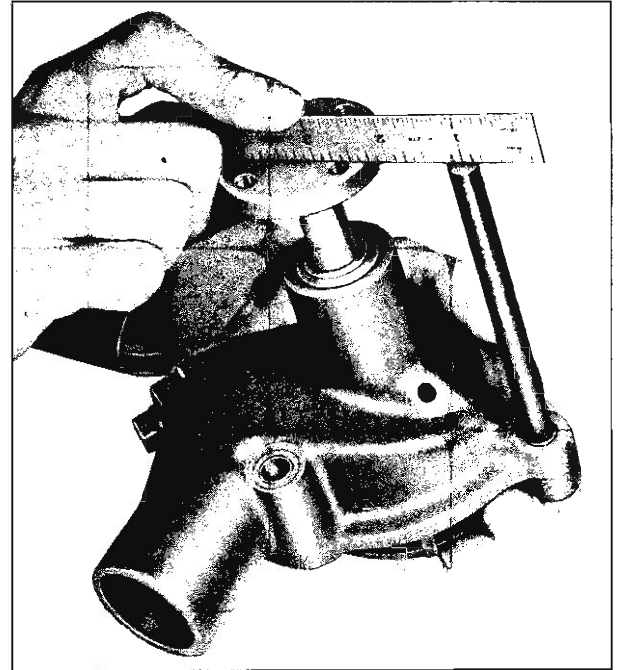
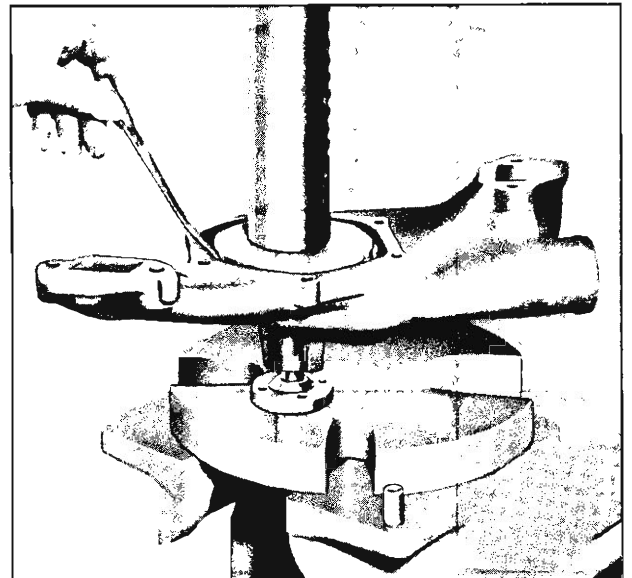


Fig. 205—Checking Fan Hub, 6 Cylinder

- b. Pull generator away from engine until desired belt tension is obtained.

NOTE: With a 15 pound push, mid-way between pulleys, the belt should deflect ⅜" on six cylinder engine models, ¼" on 283 cu. in. V-8 engine models and ⅜" on 384 cu. in. V-8 engine models.

- c. Torque all generator bolts to correct specifications.



(348 Cu. In. Water Pump)

Fig. 206—Installing Impeller

RADIATOR REPLACEMENT

Removal

1. Remove drain plug and drain radiator.
2. Remove six bottom bolts (3 on each side) holding shroud and radiator on vehicles equipped with V-8 engines.

NOTE: Leave two bolts holding radiator and shroud until radiator and shroud is ready to be removed.

NOTE: Vehicles equipped with six cylinder engines use no shroud. Fan blade to radiator core clearance should be 1/2" minimum.

3. Remove radiator inlet and outlet hoses.
4. Remove transmission oil cooler lines, if so equipped.
5. Remove remaining two bolts and move shroud back onto fan. Remove radiator.

Installation

1. Slide radiator core into position.
2. Support radiator and install attaching bolts for shroud and radiator.
3. Install radiator hoses and radiator drain plug.
4. Install oil cooler lines on automatic transmission models.
5. Fill cooling system and check for leaks.

SPECIFICATIONS

Refer to Section 16 for Engine Cooling system specifications.

TROUBLES AND REMEDIES

COOLING SYSTEM

Symptom and Probable Cause	Probable Remedy
Overheating	
<ul style="list-style-type: none"> a. Lack of Coolant b. Fan belt loose c. Fan belt oil soaked d. Thermostat sticks closed e. Water pump inoperative f. Cooling system inoperative g. Incorrect ignition timing h. Brakes dragging severely 	<ul style="list-style-type: none"> a. Refill system and check for leaks b. Adjust c. Replace fan belt d. Replace thermostat e. Repair or replace water pump f. Clean system and reverse flush g. Retime engine h. Adjust brakes
Overcooling	
<ul style="list-style-type: none"> a. Thermostat remains open b. Extremely cold climate 	<ul style="list-style-type: none"> a. Replace thermostat b. Cover part of radiator area
Loss of Coolant	
<ul style="list-style-type: none"> a. Leaking radiator b. Loose or damaged hose connection c. Leaking water pump d. Loose or damaged heater hose e. Leaking heater unit f. Leak at cylinder head gasket g. Cracked cylinder head h. Cracker cylinder or block expansion plug loose i. Engine operating at too high temperature 	<ul style="list-style-type: none"> a. Replace or repair b. Tighten or replace hose connections c. Repair water pump d. Tighten or replace hose e. Replace or repair heater core f. Replace gasket and tighten bolts securely and evenly g. Replace cylinder head h. Make necessary repairs or replacements i. See overheating causes
Circulation System Noisy	
<ul style="list-style-type: none"> a. Pump bearing rough b. Fan blades loose or bent c. Fan blades noisy in pulley d. Fan belt inner plies loose e. Improper fan to shroud clearance 	<ul style="list-style-type: none"> a. Replace pump b. Tighten or replace fan blades c. Dress with belt dressing or soap and adjust d. Replace fan belt e. Adjust clearance, 5/8" to 3/4"

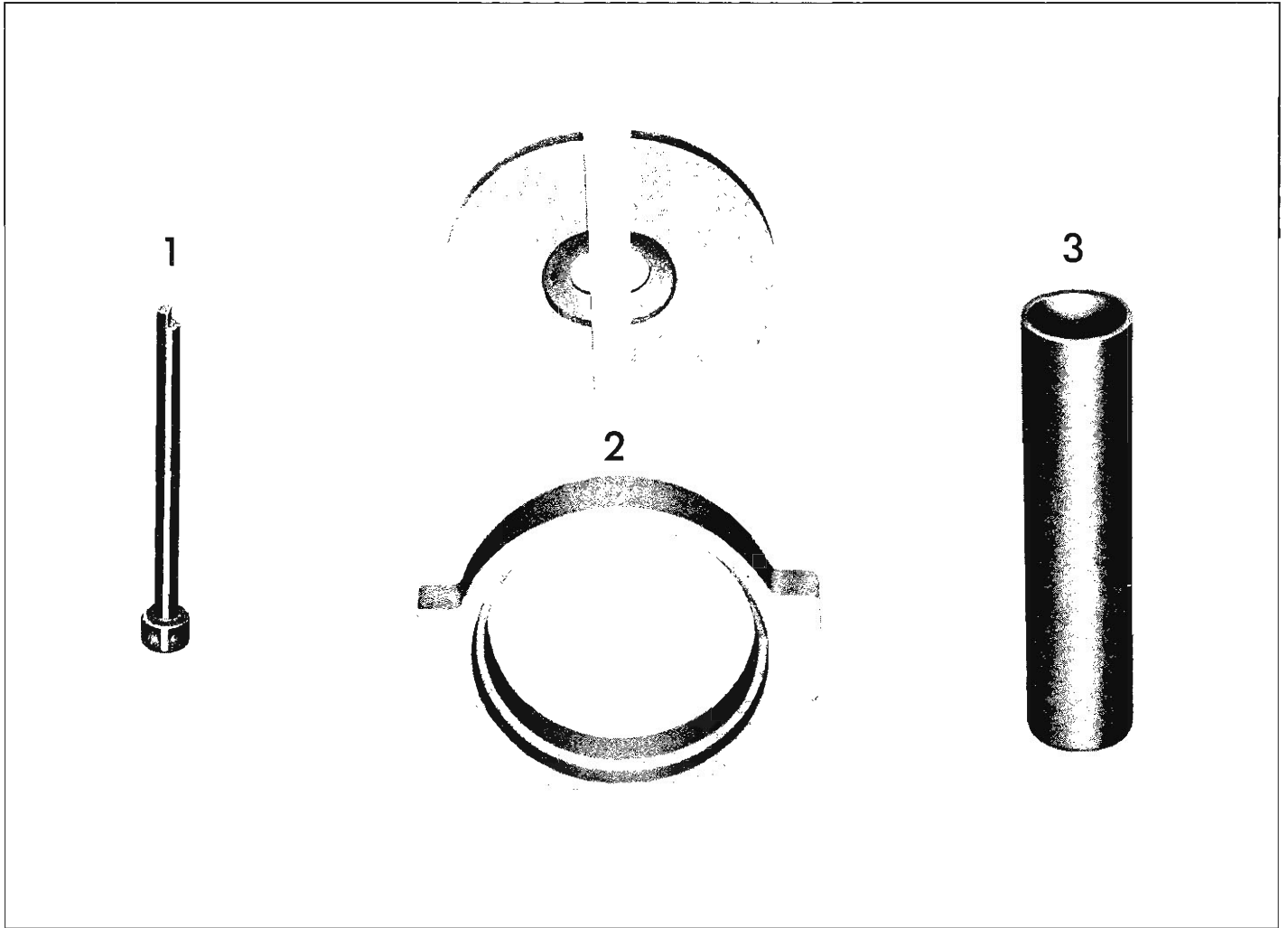


Fig. 207—Cooling System Special Tools

1. J-5775
J-7034

Fan Hub Locating Gauge—235 and 283 Pumps
Fan Hub Locating Gauge—348 Pumps

2. J-5855
3. J-5590

Generator Bearing Remover and Installer
Transmission Front Bearing Installer