ENGINE COOLING

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GENERAL DESCRIPTION

The cooling system on all 1954 Cadillac engines is a low capacity type, made possible by the small cylinder head area exposed to flame and by high mechanical and combustion efficiencies, which decrease the amount of heat transferred to the coolant. This allows a large amount of heat energy to be converted into useful power to increase engine efficiency.

The radiator cores are of the tube and center construction. Water passages are wide and straight with smooth interiors to permit maximum coolant flow and also effective cleaning of the radiator.

Pressure in the cooling system is controlled by a pressure operated vent type radiator cap which prevents the coolant from reaching the overflow pipe. As a pressure of 12 to 15 pounds is required to open this valve, the boiling point of the solution is raised and there is less likelihood of loss of coolant, particularly volatile anti-freezes.

The water pump is centrally mounted at the front of the cylinder block to assure even distribution of the coolant to both banks. The pump is driven by a belt, which also drives the generator. The coolant is drawn from the bottom of the radiator and delivered to both cylinder blocks simultaneously. The coolant circulates around the cylinders and up through drilled holes to the cylinder heads. After circulating through the heads, the coolant flows through the thermostat housing which is located at the top of the water pump. Fig. 13-1.

A thermostat is used on all 1954 series cars to control water temperature by restricting the flow of coolant from the cylinder heads to the radiator when the engine is cold.

When the thermostat is closed, the coolant from the cylinder heads is drawn through a by-pass in the pump body and recirculated through the cylinder blocks. When the engine is sufficiently warm, the thermostat will open and coolant will flow back to the upper radiator tank where it is cooled as it is drawn through the radiator core, to the bottom, to repeat the cycle. Air is drawn through the radiator core by a four blade fan on 1954-62 and 60S series cars and a five blade fan on 75 and 86 commercial cars.

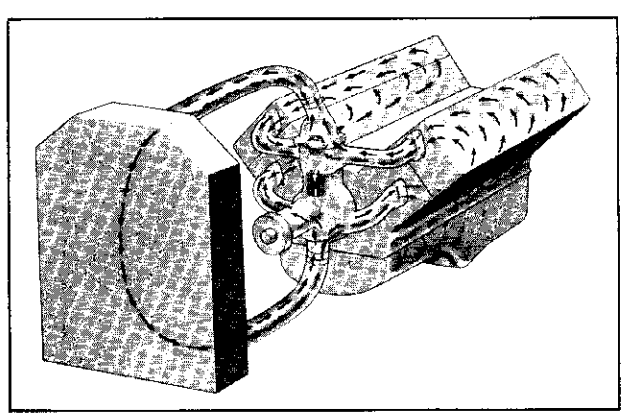

Fig. 13-1 Flow of Coolant

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SERVICE INFORMATION

(1) Removal of Radiator Filler Cap

The radiator cap on all 1954 series cars is of the bayonet type with a safety catch. To remove the cap, it is first rotated toward the left until the stop is reached. In this position the cooling system is vented to the atmosphere through the overflow pipe. The cap should be left in this safety position until all pressure or steam has been relieved. If the coolant boils when the cap is placed in the safety position and steam continues to escape, cool the radiator by flowing cold water over outside of radiator while the engine is idling. The cap may then be removed by further rotation to the left.

(2) Draining and Refilling the Cooling System

There are three drain plugs in the cooling systems of all 1954-Series cars. One is located at the side of each cylinder block and third is mounted at the bottom of the radiator on the right side.

In order to assure a complete drainage of the cooling system, be sure to open all three drain plugs, and to have the engine hot when draining. Also, the dash and underseat heater hoses should be disconnected and heater cores emptied, using compressed air regulated to 15 lbs. pressure.

(3) Radiator Preventive Maintenance

Cadillac Cooling System Inhibitor should be added to every car when the cooling system is drained, flushed, and refilled each spring and fall.

The importance of adding an inhibitor, when installing fresh liquid in the spring, is generally recognized. It is equally important to add a charge of Cadillac Cooling System Inhibitor in the fall, regardless of the type of anti-freeze that is used.

(4) Preparation of Cooling System for Anti-Freeze

Before installing an anti-freeze solution, the cooling system should be inspected and serviced for winter operation. The system should be thoroughly cleaned and all loose scale and iron rust removed, as explained in Note 15.

Cylinder heads should be tightened and gaskets replaced, if necessary, to avoid possibility of anti-freeze solutions leaking into engine, or combustion gases blowing into cooling system. Anti-freeze, or water, mixed with engine oil may form sludge, which will interfere with lubrication and, in some cases, may form varnish-like deposits which will cause gumming and sticking of moving parts. A cooling system sealer such as "DuPont Sealer" should be added if permanent type anti-freeze is to be used.

The water pump seal must be leak-tight, not only to avoid loss of liquid, but to prevent air from being drawn into cooling system. Aeration of cooling liquid causes foaming and promotes oxidation, which may result in serious corrosion.

After anti-freeze has been installed, the entire system, including the hose connections, cylinder head gaskets and pump, should be inspected regularly to be sure that no leaks have developed.

Anti-freeze, or water, or both, may be lost from the cooling system through leaks, evaporation, boiling, or expansion. Loss by expansion is a result of overfilling. In the 1954 Cadillac cooling system, the coolant expands approximately 4 pints, when heated from cold to the maximum temperature, and space for this expansion should be left, when adding liquid to the radiator. The correct height when filling a cold engine, is 2-1/4 inches below the top of the filler neck. At the normal operating temperature of about 170° F, the height will be 1-3/4 inches below the top of the filler neck.

(5) Anti-Freeze Recommendations

The available commercial materials which may be used for preparing anti-freeze solutions for automobile radiators are denatured alcohol, methanol, propanol, ethylene glycol, and distilled glycerine.

Kerosene or other oils, or solutions containing calcium chloride, magnesium chloride, sodium silicate or other inorganic salts, are not satisfactory for use in the cooling system.

Denatured alcohol and methanol are used extensively for anti-freeze solutions. The various types of alcohol anti-freeze afford protection against freezing and have the advantage of wide distribution and low first cost. There are, however, two important disadvantages: Alcohol may be lost, especially on warm days or during hard driving, and unless the solution in the radiator is tested periodically and sufficient alcohol added to replace the loss, the engine or radiator, or both, are likely to be damaged by overheating or subsequent freezing. The car finish is softened and

damaged by contact with alcohol solutions or vapors. Alcohol accidentally spilled on the finish should be flushed off immediately with a large quantity of cold water, without wiping or rubbing.

The use of the pressure radiator cap on Cadillac cars serves to increase the boiling point of the anti-freeze solution and reduces the possibility of loss through evaporation or boiling.

Ethylene glycol is, in initial cost, more expensive than alcohol. It has the advantage, however, that in a tight system only water is required to replace evaporation losses, although any solution lost mechanically through leakage or foaming must be replaced by additional new solution. Under ordinary conditions, ethylene glycol solutions are not injurious to the car finish.

Radiator glycerine, which is chemically treated in accordance with the formula approved by the Glycerine Producer's Association to avoid corrosion, is satisfactory for use in the cooling system.

(6) Testing Anti-Freeze Solutions

A hydrometer test will indicate whether anti-freeze, or water, or both, should be added to bring the solution to proper level and to maintain the desired freezing point.

Cars shipped by truck or delivered at the factory during winter are protected by the addition of a methanol-alcohol anti-freeze solution. Solutions of this type should be checked with an alcohol tester, having both a glass tube and a glass float. Methanol-alcohol cannot be tested with all purpose or combination testers as the alcohol will attack the plastic float or tube.

Some devices used for testing anti-freeze solutions will indicate correct freezing point only when test is made at a specific temperature. Other testers, provided with thermometers and tables, indicate freezing points corresponding to readings made at various temperatures. Disregarding the temperature of the solution, when testing, may cause an error as large as 30°F. Some testing devices are made to test only one kind of anti-freeze solution. Others have several scales and may be used for the corresponding kinds of anti-freeze.

The freezing point of a solution containing both alcohol and ethylene glycol cannot be determined accurately by means of a hydrometer. Also, the freezing point of solutions containing different types of permanent anti-freeze with an ethylene glycol base cannot be accurately determined by means of a tester.

(7) Checking Radiator Cap and Seat

The cooling system pressure should be checked whenever cases of overheating, coolant loss, or anti-freeze odors are noticed.

A cylinder block testing gauge, similar to the one shown in Fig.13-2, will prove helpful in testing the cooling system pressure according to the following procedure:

1. Check all heater and radiator hose connections for leaks.

2. Tighten all cylinder head screws to proper torque.

3. Remove left cylinder block drain plug and immediately insert testing gauge fixture.

4. Fill cooling system so that water level is 2-1/4 inches below the top of radiator filler neck.

5. Place a container filled with water so that end of radiator overflow pipe is immersed.

6. Moisten the radiator cap gasket and install cap securely.

7. Open air cock on pressure testing fixture and adjust so that pressure does not exceed 17 pounds.

8. As soon as a large number of bubbles are observed escaping from overflow pipe, record the pressure shown by gauge, shut off air valve, and record time.

NOTE: The original pressure should be at least 12 pounds per square inch. After two minutes, the pressure should not drop more

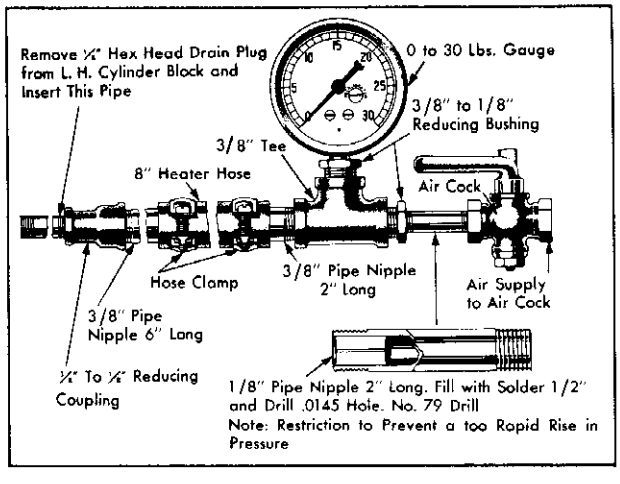

Fig. 13-2 Crankcase Air Pressure Gauge

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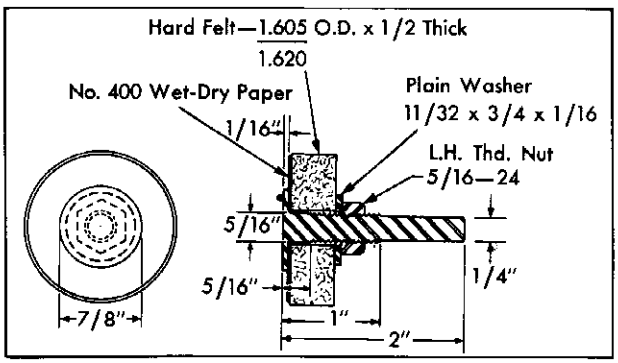

Fig. 13-3 Filler Neck Refinishing Tool

than 3 pounds per square inch below original pressure.

9. If pressure is below these specifications, inspect radiator cap gasket for obvious causes of leakage, such as cracks and cuts. Examine radiator cap gasket seat within filler neck for dents or surface imperfections. If this surface is bent or badly dented, filler neck must be replaced.

10. If filler neck seat is only scratched or pitted, it may be resurfaced with a tool made for this purpose, as shown in Fig.

CAUTION: Remove only a small amount of material from the seat. Excessive refinishing will ruin filler neck.

11. Repeat pressure test after refinishing.

(8) Removal of Thermostat

1. Drain radiator partially.

2. Remove upper radiator hose.

3. Remove four cap screws from thermostat housing at top of water pump body and remove housing and gasket.

4. Remove thermostat from top of water pump body.

(9) Radiator Thermostat Tests

A radiator thermostat may be checked by placing it, with the thermostat heat control unit down on a brick in a pan of water also containing a thermometer. Neither the thermostat nor the thermometer should rest on the bottom of the pan, because of the uneven concentration of heat at the point where the pan is heated.

To test a standard thermostat, the water in the pan should be heated and should be stirred continuously as the temperature approaches 155°F. The thermostat valve should start to open at a temperature between 163°F and 168°F. When the water reaches a temperature of 188°F, the valve should be fully open.

High temperature thermostats should start to open at 177°F to 182°F and should be fully open at 202°F.

(10) Installation of Thermostat

1. Install thermostat in opening at top of water pump with valve up.

NOTE: Be sure that the thermostatic spring strap is parallel to the centerline of the car (fore and aft). This will reduce the possibility of the right hand bank running at a higher temperature than the left hand bank.

2. Install a new thermostat gasket, coated with gasket cement, on water pump housing.

3. Install thermostat housing on water pump body and install cap screws, tightening them to 13 ft. lbs. torque.

4. Install upper radiator hose on radiator and pump housing.

5. Fill cooling system.

(11) Flushing Cooling System

1. Remove generator drive belt and water pump, See Note 18.

2. Install reverse flushing apparatus in right cylinder head outlet hole.

3. Turn on full flow of water.

4. Remove second, third, sixth, and seventh cylinder head bolts from the lower row, next to the exhaust manifolds, one at a time and insert Cylinder Block Air Gun, Tool No. J-1543, Fig. 13-4. Blow air into each hole several times.

5. Duplicate this operation on left cylinder block.

6. Shut off flow of water and examine water passage with a flashlight. If they are still dirty, repeat the flushing operation.

7. Reverse flush radiator with radiator cap and hoses removed.

8. Install water pump using new gaskets.

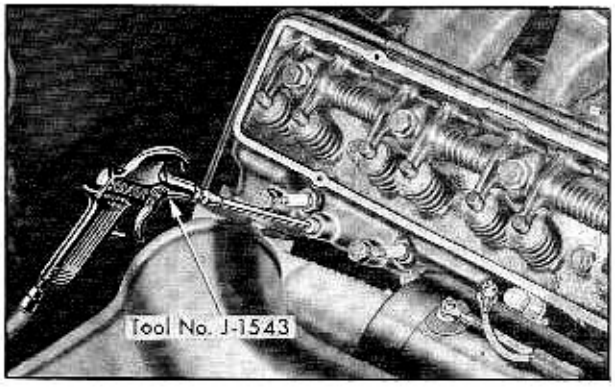

Fig. 13-4 Cleaning Cylinder Block

9. Install radiator hoses.

10. Install generator drive belt and adjust, as explained in Section 11, Note 24.

(12) Vacuum Tests for Radiator Clogging

1. Remove radiator filler cap and attach vacuum gauge or a mercury manometer to radiator drain fitting.

NOTE: It is necessary to install either a fitting with a 1/4 to 1/8 inch pipe reducing bushing or a plain tube fitting to avoid air leakage at this point.

2. Run engine until solution has been warmed to between 160°F and 180°F and make certain that thermostat valve is open.

3. Accelerate engine to a speed of about 3000 R.P.M. and take reading on vacuum gauge or mercury manometer. If vacuum exceeds 5" of mercury, this is evidence of at least partial radiator clogging or restriction.

NOTE: A quick check for a restricted radiator may be made by removing the radiator cap and warming up the engine. If the engine speed is increased from idle to 2000 R.P.M., the coolant level in the upper radiator should not rise appreciably. If the level rises or coolant overflows from the filler neck when the speed is increased, it indicates a restricted radiator.

(13) Air and Gasket Leakage Tests

The following test procedure will show the presence of combustion chamber leakage at cylinder head gaskets and air leakage at suction side of water pump.

1. Fill cooling system completely. Do not leave any air or expansion space, as in normal filling.

2. Install a radiator cap without a pressure valve, or a cap in which pressure valve has been drilled out.

3. Attach a length of 3/8 inch rubber tubing to the radiator overflow pipe and submerge the other end of hose in a jar partially filled with water.

4. Jack up car and run engine with transmission in drive range or high gear. Evidence of leakage from lower radiator hose, water pump or cylinder head gaskets will be bubbling of air through rubber hose into jar.

Cylinder head gasket leakage is most evident at speeds not over 10 MPH operating under full load or wide open throttle, a condition secured by momentarily applying the brakes.

Water pump leakage is most evident at higher speeds (around 60 M.P.H.) and with little or no load.

(14) Correction of Air and Water Leakage

Cylinder head gasket leakage can be corrected by installing new gaskets after cleaning cylinder head and block surfaces and tightening heads properly, as explained in Section 10, Note 7.

CAUTION: Be sure no foreign material falls out of cylinder head onto gasket when placing the cylinder head on the gasket.

Water pump leakage, in an otherwise normal cooling system, can usually be remedied by replacing worn pump parts. A water pump in good condition will, however, leak air at high speeds, if radiator is so badly clogged that there is a high restriction at the pump inlet or if the lower radiator hose leaks.

(15) Radiator Cleaning Procedure

NOTE: This procedure is recommended for all cars once a year, and to give maximum efficiency to average cooling systems in need of cleaning.

1. Drain solution from cooling system by opening all drains.

2. Refill system with fresh water and add one package of Cadillac Cooling System Cleaner.

3. Run engine at medium speed for one hour at a temperature as hot as possible without boiling. Cover radiator if necessary.

NOTE: Radiator cap should be installed.

4. Drain system by opening all drains.

5. Flush entire system thoroughly with clear water to remove all cleaner.

NOTE: Cooling systems containing oil should be cleaned with a solution of "Sal Soda", using the procedure outlined above for normal cleaning at radiators. When this solution is used, restrict the water flow through the heater cores, by using clamps or disconnecting the heater hoses and inserting plugs to prevent leakage while performing cleaning operation. Flush the system thoroughly with water after draining the solution, to prevent chemical action of the "Sal Soda" with the radiator core.

6. Inspect following points in cooling system.

a. Check radiator core for leaks.
b. Check radiator air passages for plugging with bugs, leaves, etc.
c. Check thermostat to see that it opens and closes properly.
d. Check condition and tension of generator drive belt.
e. Check condition of hoses and tighten clamps.
f. Refill cooling system. In summer, use water and the Cadillac Cooling System Inhibitor. In winter, use the inhibitor also, regardless of whether or not the anti-freeze also contains an inhibitor. Run engine until thoroughly warm to make sure system is full.

(16) Removal and Installation of Radiator Assembly

a. Removal

1. Drain radiator, and remove upper and lower radiator hoses.

2. On Air Conditioner equipped cars, remove fan ring.

3. Remove six screws, and six spacers on Air Conditioner cars, which hold radiator to support. The center screws behind the condenser on Air Conditioner cars, may be reached with a long end wrench.

4. Remove radiator.

b. Installation

1. Place radiator in position against support, and install six radiator to support mounting screws. On Air Conditioner equipped cars, place spacers between radiator and support before installing screws.

2. Check space between rear face of radiator core and front edge of the fan blade assembly. This should be 1/2 to 1 inch and is important for efficient fan operation.

3. On Air Conditioned equipped cars, install fan ring.

4. Install radiator hoses and clamps.

5. Fill cooling system.

(17) Disassembly and Assembly of Radiator Core

a. Disassembly

1. Loosen side straps, where they are soldered to the upper and lower radiator tanks.

2. Remove the overflow tube from side of radiator by loosening clips.

3. Melt solder at tank to header lap joints and lift off tank.

b. Assembly

1. Assemble the tanks to the core in the reverse order of disassembly, being sure all joints are clean and free from foreign material before soldering.

(18) Removal of Water Pump

1. Drain cooling system.

2. Remove generator drive belt.

3. Remove upper and lower radiator hoses and heater hoses from water pump.

4. On Air Conditioner equipped cars, the following steps must be performed before proceeding.

a. Remove compressor drive belt.

b. Remove fan ring.

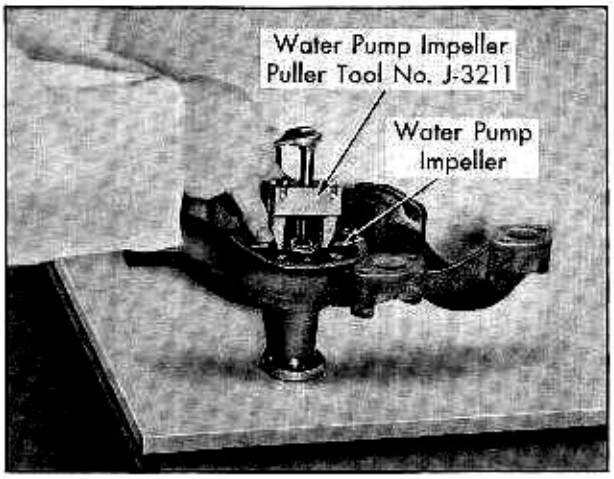

Fig. 13-5 Removing Impeller From Pump

c. Remove two screws which secure compressor mounting bracket to right upper and lower water pump outlet flanges.

d. Remove compressor support strap to thermostat housing screw, and move support out of the way.

e. Loosen compressor support to cylinder block screw.

5. Remove the power steering hydraulic pump from the cylinder head in order to remove the water pump left outlet flange screws from cylinder head.

6. Remove the four screws which hold the pump inlet flanges to the cylinder block, and remove the water pump with gaskets. On Air Conditioner cars, lift the pump out toward the left side of the engine.

(19) Disassembly and Inspection of Water Pump

a. Disassembly

1. Remove thermostat housing from pump by removing the four cap screws and gasket.

2. Remove thermostat from pump body.

3. Remove screws which hold fan blade assembly and pulley to hub and remove blade assembly and pulley.

4. Remove cap screws which hold cover plate to pump body and remove cover plate and gasket.

5. Remove the plastic impeller from pump shaft with Water Pump Impeller Puller Tool No. J-3211, Fig. 13-5.

6. Remove seal, dampener, and seal washer assembly from pump body.

b. Inspection

1. Inspect the impeller blades for indication of improper clearance or for excessive wear.

2. Inspect seal washer and spring loaded seal for wear or cracks and replace if necessary.

3. Check shaft bearing in pump for roughness or excessive end play. If found defective, remove the hub, shaft, slinger, and bearing assembly by pressing out through the front of the pump body.

4. Examine machined seal surface in pump for scratches or nicks and refinish with Water Pump Seal Seat Refinishing Tool, No. J-2999A, as shown in Fig. 13-6.

(20) Assembly of Water Pump

1. If bearing, shaft, and slinger assembly has been removed, replace by pressing new assembly into body, using Water Pump Shaft Installer and Hub Spacer, Tool No. J-3249, as shown in Fig. 13-7.

2. Install washer and seal assembly over the driving lugs of slinger. Washer should slide freely over lugs of slinger.

3. Press impeller on shaft, until outer face of impeller is .005 to .010 inches below back face of water pump.

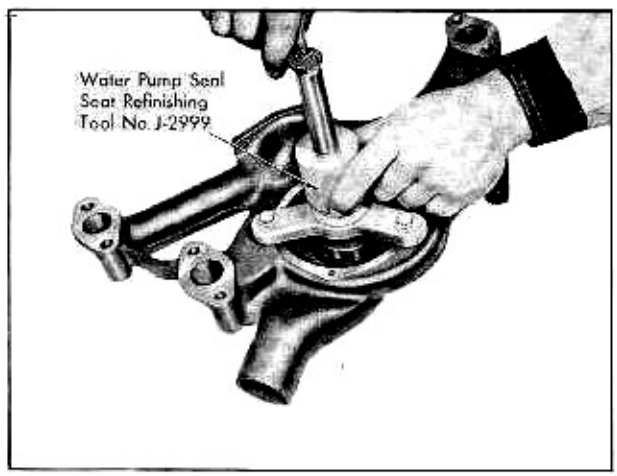

Fig. 13-6 Refinishing Water Pump Seal Seat

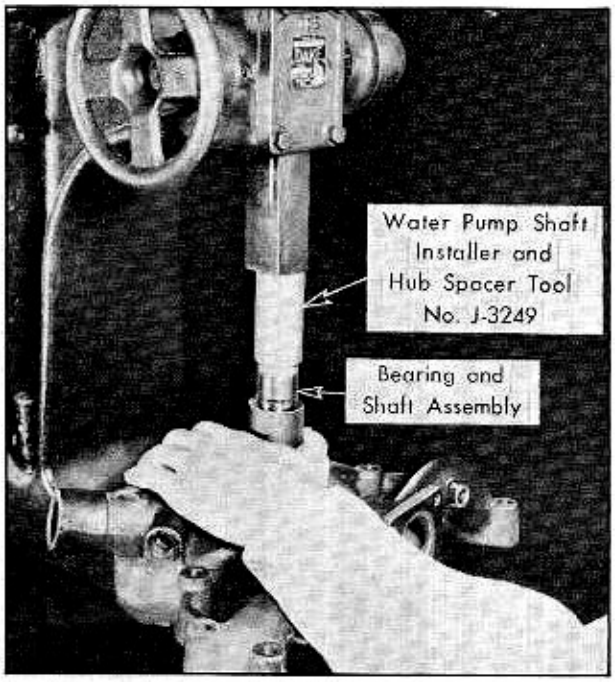

Fig. 13-7 Pressing Bearing and Shaft Into Pump Housing

4. Press new hub on shaft, using Hub Spacer, Tool No. j-3249, until tool bottoms on shaft.

5. Brush gasket cement on pump and cover. Assemble cover gasket and cover to pump. Install cap screws and washers.

6. Spin shaft in pump to be sure impeller has clearance.

7. Install pulley and fan assembly on water pump shaft hub and install cap screws and lock washers.

8. Install thermostat in pump housing, and coat thermostat housing and pump flange with gasket cement and install gasket and housing, tightening screws to 15-18 ft. lbs. torque.

(21) Installation of Water Pump

1. Brush gasket cement on water pump inlet and outlet flange surfaces and place new gaskets in position on pump, Fig. 13-8.

2. Place pump in position against cylinder head and block and install mounting screws in inlet flanges.

3. On cars equipped with power steering, install hydraulic steering pump in position with front mounting bracket over left pump outlet flange and install two mounting screws.

4. On Air Conditioner equipped cars, proceed as follows:

a. Tighten the one compressor support to cylinder head screw.

b. Move compressor support strap into position on thermostat housing and install screw.

c. Install two screws which secure compressor support to right upper and lower water pump outlet flanges.

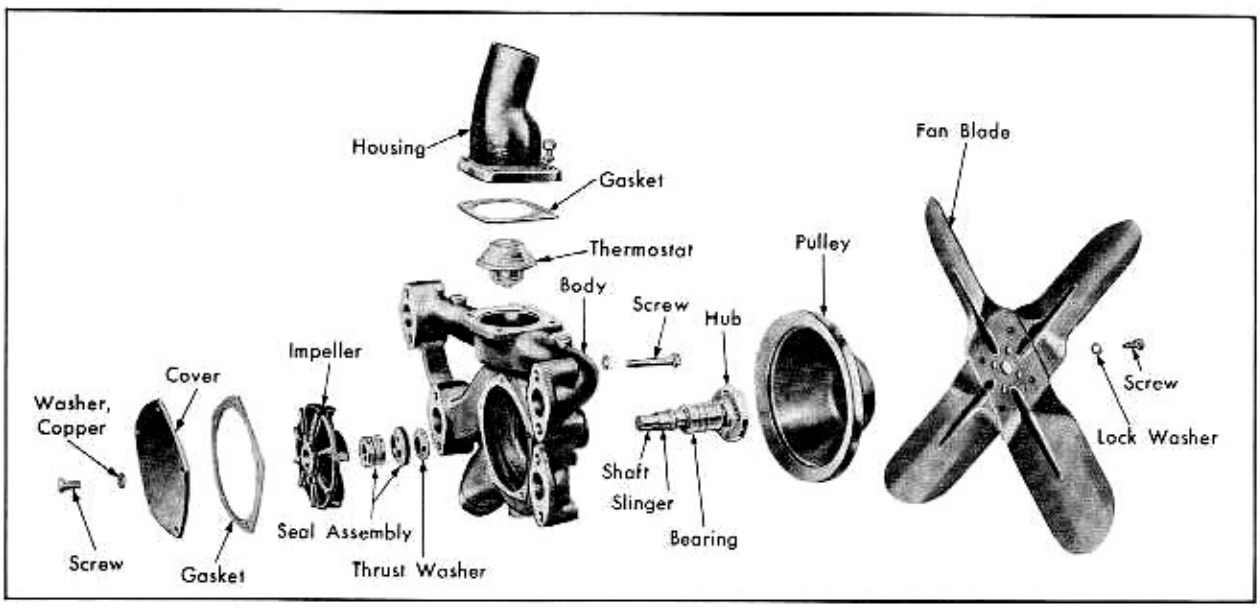

Fig. 13-8 Water Pump - Disassembled

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d. Install fan ring.

e. Install compressor drive belt.

5. Install radiator and heater hoses and install generator drive belt, adjusting tension as explained in Section 11, Note 24.

6. Install hydraulic steering pump drive belt and adjust tension as explained in Section 7, Note 6.

7. Fill radiator and check for leaks.

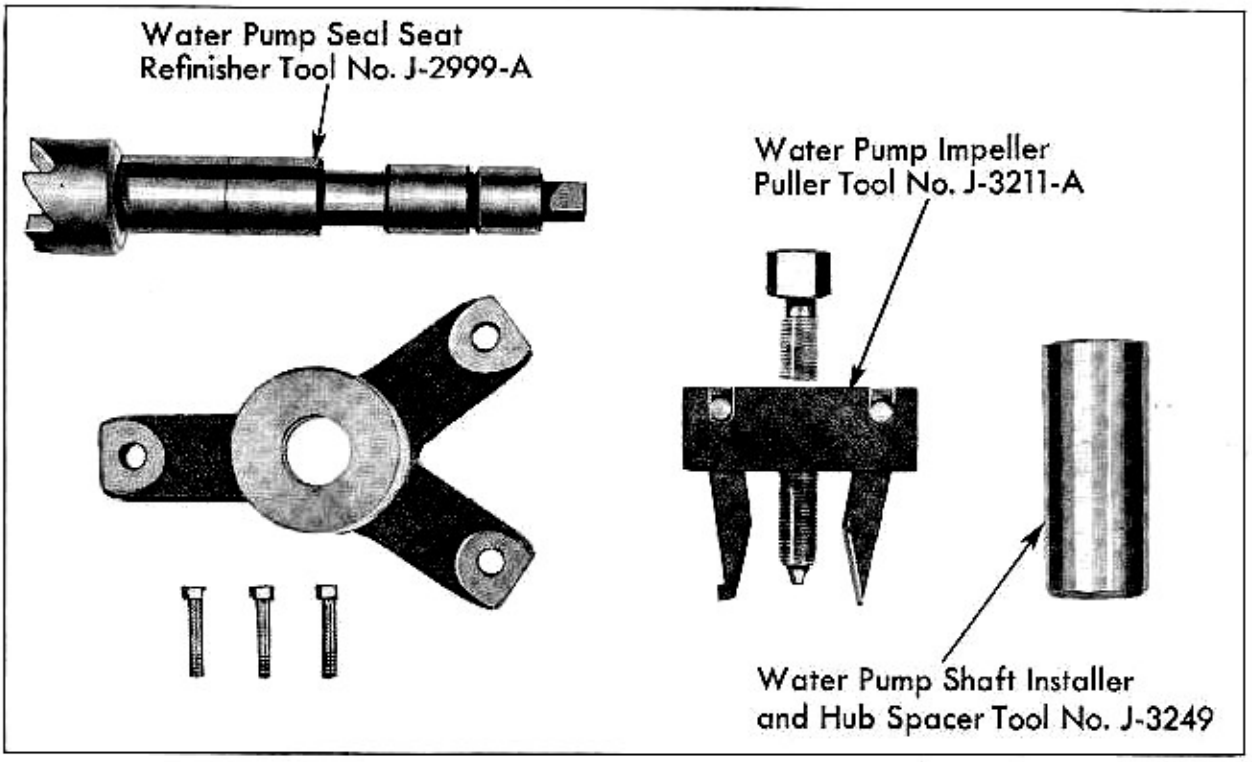

Fig. 13-9 Engine Cooling Special Tools

Tool No.	Name	Model Adaptation	
J-1543-A	Cylinder Block Air Gun	1938-54	All Models
J-3249	Water Pump Shaft Installer and Hub Spacer	1949-54	All Models
J-3211-A	Water Pump Impeller Puller	1949-54	All Models
J-2999-A	Water Pump Seal Seat Refinisher	1949-54	All Models

TORQUE TIGHTNESS

Location	Size	Ft. Lbs. Min.	Ft. Lbs. Max.
Hose clamp	Special	15	20
Radiator anchorage nut	5/8-18	70	80
Thermostat housing	5/16-18	15	18
Water pump to crankcase	3/8-16	25	29
Water pump to cylinder head	3/8-16	25	29
Water pump cover to body	1/4-20	10	12

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SPECIFICATIONS

Subject and Remarks	All Series
FAN	
Belt--	
Length-pitch circumference. . .	57"
Width	.380"
Type	Wedge
Distance from fan hub to end of fan shaft	.3255" Mean
Drive Radio--	
Standard	.95 to 1.0
Air Conditioner cars	1.1 to 1.0
Number of Blades--	
62, 60S Standard.	4
Air Conditioner cars	4
75 and 86 Com'l.	5
RADIATOR	
Area of core, in sq. in.	359.93
Capacity of system (with heater) 62, 60S, 86	22 Qts.
Capacity of system (with heater) 1%.	24-1/2 Qts.
Capacity of system (without heater)	19-3/4 Qts.
Radiator core make	Harrison
Radiator core center constant (standard)	.222"
Radiator core center constant (Air Conditioner cars)	.20"
Tube spacing	.550"

Subject and Remarks	All Series
Radiator cap pressure	12 to 15 lbs.
Hose, thermostat housing to radiator (top)--	
Diameter, inside	1-3/4"
Length--	
Standard	8-7/16"
Air Conditioner equipped cars	9-1/4"
Type	Molded
Hose, radiator to water pump--	
Diameter, inside	1-3/4"
Length--	
Standard	8-7/16"
Air Conditioner equipped cars	9-1/4"
Type	Molded
WATER PUMP	
Clearance between impeller and pump body	.005"-.010"
THERMOSTAT	
Type	Dole
Standard--	
Starts to open	163°F to 168°F
Fully open	188°F
High Opening--	
Starts to open	177°F to 182°F
Fully open	202°F

OTHER NOTES AND REFERENCES