COOLING SYSTEM

CONTENTS

Description

In order to provide satisfactory protection for the wide variety of corporation models the cooling system of each must be tailored to specific needs. To do this effectively the Corporation offers three basic systems:

1. Standard
2. Air Conditioning
3. High Capacity

The standard system consists of a tube and spacer type radiator, 14 psi radiator pressure cap, centrifugal water pump, 180°F. thermostat, and a four, six or seven blade fan (Fig. 1). See specifications for application.

The cooling system for air conditioned cars generally requires a greater capacity radiator along with a fan shroud, 16 psi radiator pressure cap, special centrifugal water pump, larger fan, and thermostatically controlled fan drive (in some installations). See specifications for applications.

The high capacity system, available as optional equipment to the standard car, is a combination of the standard and air conditioning systems as necessary to provide protection against overheating for unusually severe operation requirements.

For internal cooling system protection each cooling system is factory equipped with sufficient permanent type anti-freeze for —20°F. protection. It is recommended that the coolant be changed annually to insure adequate anti-freeze and corrosion protection. In areas where anti-freeze is not required, MOPAR rust inhibitor must be added to the water coolant for normal corrosion protection. Air conditioned cars require year round protection with permanent type anti-freeze with a minimum of +15°F. protection for summer operation and additional anti-freeze in the winter according to the prevailing temperatures.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
EXTERNAL LEAKAGE	(a) Loose hose clamp.	(a) Replace the hose clamp.
	(b) Hose leaking.	(b) Replace the hose.
	(c) Leaking radiator.	(c) Repair or replace the radiator as necessary.
	(d) Worn or damaged water pump seal.	(d) Replace the water pump seal.
	(e) Loose core hole plug.	(e) Install new core hole plug.
	(f) Damaged gasket, or dry gasket, if engine has been stored.	(f) Replace gaskets as necessary.
	(g) Cylinder head bolts loose, or tightened unevenly.	(g) Replace the cylinder head gasket and torque head in correct sequence.
	(h) Leak at heater connection.	(h) Clean the heater connections and replace the hoses and clamps if necessary.
	(i) Leak at water temperature sending unit.	(i) Tighten the water temperature sending unit.
	(j) Leak at water pump attaching bolt.	(j) Tighten the water pump attaching bolts 30 foot-pounds torque.
	(k) Leak as exhaust manifold stud.	(k) Seal and re-drive the stud.
	(l) Cracked thermostat housing.	(l) Replace the thermostat housing.
	(m) Dented radiator inlet or outlet tube.	(m) Straighten the radiator inlet or outlet tube as necessary.
	(n) Leaking heater core.	(n) Repair or replace the heater core.
	(o) Cracked or porous water pump housing.	(o) Replace the water pump assembly.

Condition	Possible Cause	Correction
EXTERNAL LEAKAGE Continued	(p) Warped or cracked cylinder head.	(p) Replace the cylinder head.
	(q) Cracked cylinder block.	(q) Replace the cylinder block.
	(r) Sand holes or porous condition in block or head.	(r) Replace the cylinder block or cylinder head as necessary.
	(s) Faulty pressure cap.	(s) Replace pressure cap.
	(t) Loose or stripped oil cooler fittings.	(t) Tighten or replace as necessary.
INTERNAL LEAKAGE	(a) Faulty head gasket.	(a) Install a new head gasket.
	(b) Refer to causes (f), (g), (p), (q), (r) and (t) listed under External Leakage.	(b) Refer to corrections (f), (g), (p), (q), (r) and (t) listed under External Leakage.
	(c) Crack in head into valve compartment.	(c) Pressure test cooling system, replace the cylinder head.
	(d) Cracked valve port.	(d) Pressure test cooling system, replace the cylinder head.
	(e) Crack in block into push rod compartment.	(e) Pressure test cooling system, replace the cylinder block.
	(f) Cracked cylinder wall.	(f) Pressure test cooling system, replace the cylinder block.
	(g) Leaking oil cooler.	(g) Repair or replace the oil cooler.
POOR CIRCULATION	(a) Low coolant level.	(a) Fill radiator to correct level.
	(b) Collapsed radiator hose. (A bottom hose with faulty spring may collapse only at medium or high engine speeds.)	(b) Replace the hose and spring.
	(c) Fan belt glazed, oil soaked, or loose.	(c) Tighten or replace the fan belt as necessary.
	(d) Air leak through bottom hose.	(d) Reposition hose clamps or replace the hose.
	(e) Faulty thermostat.	(e) Replace the thermostat.
	(f) Water pump impeller broken or loose on shaft.	(f) Replace the water pump impeller assembly.
	(g) Restricted radiator core water passages.	(g) Flush the radiator thoroughly.
	(h) Restricted engine water jacket.	(h) Flush the engine cooling system thoroughly.
OVERHEATING OR APPARENT OVERHEATING (refer to Causes listed under "Poor Circulation")	(a) Low coolant level.	(a) Fill radiator to proper level.
	(b) Blocked radiator air passages.	(b) Blow out the radiator air passages.
	(c) Incorrect ignition timing.	(c) Time the engine ignition system.
	(d) Low engine oil level.	(d) Add engine oil to the correct level.
	(e) Incorrect valve timing.	(e) Correct the engine valve timing.
	(f) Inaccurate temperature gauge.	(f) Replace the temperature gauge.
	(g) Restricted overflow tube.	(g) Remove restriction from the overflow tube.
	(h) Faulty radiator pressure cap or seat.	(h) Replace the radiator cap.
	(i) Frozen heat control valve.	(i) Free up the manifold heat control valve.
	(j) Dragging brakes.	(j) Adjust the brokes.
	(k) Excessive engine idling.	(k) Stop engine.
	(l) Frozen coolant.	(l) Thaw out cooling system, add antifreeze as required.
	(m) Faulty fan drive unit.	(m) Replace the fan drive unit.
	(n) Faulty temperature sending unit.	(n) Replace the sending unit.
OVERFLOW LOSS	(a) Refer to causes listed under "Poor Circulation and Overheating."	(a) Refer to corrections under "Poor Circulation and Overheating."
	(b) Overfilling.	(b) Adjust coolant to the correct level.
	(c) Coolant foaming due to insufficient corrosion inhibitor.	(c) Flush the radiator and add MoPar antifreeze or rust inhibitor as required.
	(d) Air leak at bottom radiator hose.	(d) Reposition hose clamps or replace the hose.
	(e) Blown head gasket.	(e) Replace the head gasket.

Condition	Possible Cause	Correction
CORROSION	(a) Use of water containing large concentration of lime and minerals.	(a) Use only clean soft water.
	(b) Low coolant level.	(b) Fill the cooling system to the correct level.
	(c) Insufficient corrosion inhibitor.	(c) Use MoPar antifreeze or rust inhibitor as required.
	(d) Use of antifreeze for extended length of time.	(d) Drain cooling system and replace with new antifreeze.
	(e) Failure to use corrosion inhibitor in summer.	(e) Flush radiator and refill with clean soft water and rust inhibitor.
	(f) Air leak at bottom radiator hose.	(f) Replace the hose and/or hose clamps.
TEMPERATURE TOO LOW—SLOW ENGINE WARM UP	(a) Faulty thermostat.	(a) Replace the thermostat.
	(b) Inaccurate temperature gauge.	(b) Replace the temperature gauge.
	(c) Faulty temperature sending unit.	(c) Replace the sending unit.
WATER PUMP NOISY	(a) Seal noisy.	(a) Add 202 MoPar Water Pump Lube.
	(b) Bearing corroded.	(b) Replace bearing seal and impeller.

ACCESSORY BELT DRIVES

INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	(a) Belt too loose.	(a) Adjust belt tension.
	(b) Belt excessively glazed or worn.	(b) Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	(a) Belt too loose.	(a) Adjust belt tensions.
	(b) Belt glazed.	(b) Replace belt.
BELT SQUEAK AT IDLE	(a) Belt too loose.	(a) Adjust belt tension.
	(b) Dirt and paint imbedded in belt.	(b) Replace belt.
	(c) Non-uniform belt.	(c) Replace belt.
	(d) Misaligned pulleys.	(d) Align accessories (file brackets or use spacers as required.)
	(e) Non-uniform groove or eccentric pulley.	(e) Replace pulley.
BELT ROLLED OVER IN GROOVE	(a) Broken cord in belt.	(a) Replace belt.
	(b) Belt not matched (A/C).	(b) Install matched belt.
BELT JUMPS OFF	(a) Belt too loose.	(a) Adjust belt tension.
	(b) Belts not matched (A/C).	(b) Install matched belt.
	(c) Misaligned pulleys.	(c) Align accessories.

SERVICE PROCEDURES

THERMAL CONTROL FAN DRIVE

The thermal control drive (Fig. 2) is a silicone fluid filled coupling connecting the fan to the fan pulley. A thermal spring on the drive face senses the heat from the radiator and engages the drive for normal fan operation when required.

In case of engine overheating during slow vehicle speed or idle operation, increase the engine speed to approximately 1000 rpm in neutral gear. If the condition is not corrected by increasing the engine speed, replace the fan drive unit with a unit known to be operating properly and test by operating the vehicle under the same conditions. Replace the original drive unit assembly if the trouble was corrected with the test unit.

WATER PUMP

Removal (Fig. 3)

(1) Drain the cooling system. (Remove the upper half of the fan shroud on Air Conditioning Models only.)

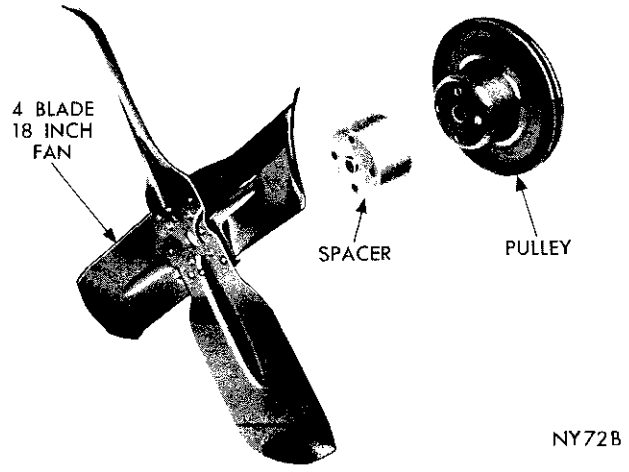


Fig. 1—Standard Fan Drive

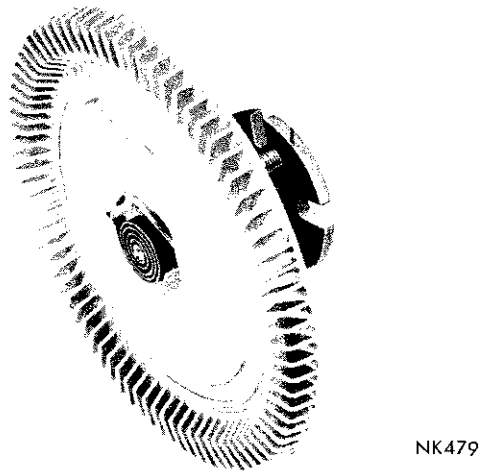


Fig. 2—Thermal Control Fan Drive

(2) Loosen the power steering pump, idler pulley and alternator. Remove all belts.

(3) Remove the fan, spacer and pulley. On Air Conditioning Models, remove the pulley from the water pump fan hub. Loosen all nuts from the fan to remove the fan drive.

(4) Remove the bolts attaching the water pump body to the housing and remove the water pump.

Installation

(1) Install the water pump body on the housing, using a new gasket.

(2) Tighten the bolts to 30 foot-pounds torque. Install the pulley, spacer and fan. (On Air Conditioning Models, assemble the fan to the fan drive and pulley, and attach the assembly to the water pump.)

(3) Tighten the nuts to 15 foot-pounds torque. Install the upper half of the fan shroud, run the engine, and test for leaks.

Disassembly (Fig. 3)

(1) Support the pump body on the hub and remove the impeller by breaking the plastic away from the metal insert, as shown in Figure 4.

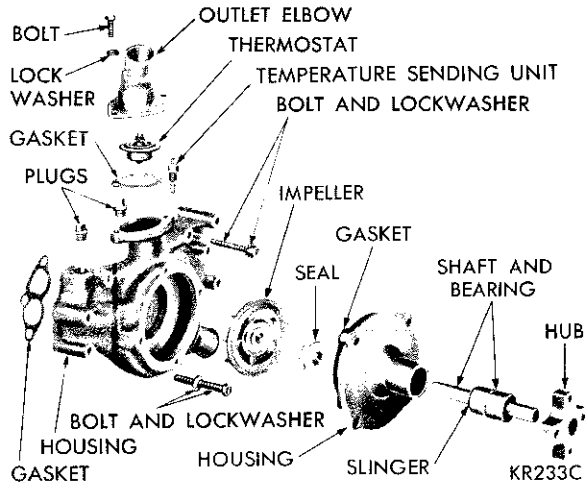


Fig. 3—383, 413 and 426 Cubic Inch Engine Water Pump

(2) Remove the impeller metal insert using a chisel and hammer.

NOTE: The shaft and bearing assembly do not have to be removed to service a leaking pump. The shaft and bearing assembly should be very carefully inspected to be sure the pump leak has not damaged the bearing.

(3) Remove the rubber portion of the shaft seal and the spring.

(4) Using Tool C-3753, remove the seal retainer from the housing.

(5) Remove the fan hub with Tool C-412.

(6) Support the body on the fan hub end and press out the shaft and bearing assembly.

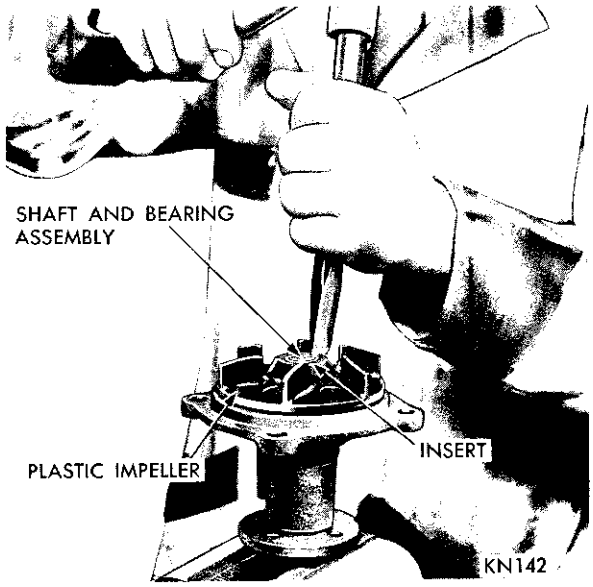


Fig. 4—Removing the Plastic Impeller & Metal Insert

CAUTION: The shaft and bearing assembly can be removed only in the direction described. If an attempt is made to remove the shaft in the opposite direction, damage to the water pump body may result.

NOTE: The bearing and hub assemblies removed from water pumps for any reason should not be used again because damage to bearings and hub usually result during removal.

(7) Clean all parts thoroughly. Remove rust from the housing with a wire brush.

Assembly (Fig. 3)

NOTE: Inspect the seal surface of the impeller hub to be sure it is free of nicks, burrs, scratches and rust. If necessary remove these blemishes using crocus cloth on a flat plate.

(1) Apply a thin coat of MoPar Perfect Seal Sealing Compound, Part Number 1057794 to the seal pocket in the pump body.

(2) With the pump housing supported at the hub end, use a 1¼ inch (12 point) socket to apply pressure against the outer lip of the seal retainer and press the seal assembly into the body until the retainer lip is against the pump body.

(3) With the slinger ring in position on the long end of the pump shaft (approximately ⅛ inch from the bearing assembly) start the shaft and bearing assembly into the fan hub end of the pump body bore.

(4) Use a 1¼ inch (12 point) socket and support the pump body at the seal end. With Tool C-3468 positioned against the outer bearing race, press the shaft and bearing into the pump body so the end of the bearing is exactly flush with the end of the pump body.

(5) While supporting the pump on the impeller end of the shaft, press the fan hub onto the shaft (flat surface out) so that shaft extends $^{11}/_{32}$ inch through the fan hub.

(6) Support the pump on the fan hub end of the shaft and position the new impeller on the pump shaft (blade portion up). Using a tool that will press against the impeller insert only, press the impeller onto the shaft until it is flush with the end of the shaft.

RADIATOR

Removal

(1) Drain the cooling system.

(2) On vehicles with automatic transmission, disconnect the oil cooler lines at the radiator bottom tank.

(3) Remove the upper and lower radiator hoses (using pliers Tool C-3250).

(4) On vehicles with a fan shroud, remove the lower half of the fan shroud.

(5) Remove the radiator attaching screws.

(6) The radiator can now be lifted free from the engine compartment. Care should be taken not to damage the radiator cooling fins or water tubes during the removal.

Installation

(1) Slide the radiator down into position behind the radiator support and install the attaching bolts.

(2) Install the fan shroud, connect the hoses, and connect the transmission oil cooler lines.

(3) Fill the cooling system to 1¼" below the filler neck seat with water and rust inhibitor or water and anti-freeze, as required. After warm-up, re-check coolant level.

(4) On vehicles with automatic transmission, measure the transmission oil level after warm-up and add oil as required.

Cleaning

(1) Drain the cooling system and refill with clean SOFT water and add the contents of one can (No. 1 top-compartment of MoPar Cooling System Cleaner).

(2) Operate the engine at a fast idle for ½ to ¾ hour.

(3) Drain the cooling system and refill with clean water.

(4) Pour the conditioner (No. 2 bottom-compartment) into the radiator and run engine for ten minutes.

(5) Flush the entire cooling system until the water runs clean.

(6) Refill the radiator with clean SOFT water.

(7) Use MoPar Radiator Rust Inhibitor during the summer months.

TRANSMISSION OIL COOLER

The transmission oil cooler is located in the bottom radiator tank, which is an integral part of the radiator.

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

Testing Oil Cooler for Leaks

(1) Disconnect both oil cooler lines at the radiator.

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

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

(4) Coat all fittings with oil.

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

(6) Close the valve. The gauge reading will then drop if the cooler is leaking inside of the lower radiator tank.

Repairing the Oil Cooler

(1) Remove the radiator from the vehicle.

(2) Remove the radiator lower tank.

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

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

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

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

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

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

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

(10) Fill the cooling system and test for leaks.

If the transmission operates properly after repairing the leak, drain the transmission and torque converter while hot, remove the transmission oil pan and inspect for sludge, rust, dirty or plugged inlet filter. If none of these conditions are found reconditioning may not be necessary. Reassemble the transmission. Fill the transmission using Transmission Fluid, AQ-ATF, Suffix "A."

REVERSE FLUSHING THE COOLING SYSTEM

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

Flushing Cylinder Block

(1) Drain the radiator and remove the hoses at the radiator.

(2) Remove the thermostat and reinstall the thermostat housing.

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

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

(5) Turn on the water, and when the cylinder block is filled, turn on the air in short blasts.

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

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

(8) Refill the cooling system and test for leaks.

Reverse Flushing the Radiator

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

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

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

CAUTION: Do not apply more than 15 psi pressure when pressure flushing a radiator, as damage to the radiator may result.

(4) Continue this procedure until the water runs clean. Refill the cooling system.

(5) Run the engine and test for leaks.

THERMOSTAT

The thermostat is actuated by a pellet containing a copper-impregnated wax (Fig. 5). As the temperature of the pellet increases, the wax expands and opens the valve. A 180° thermostat is standard equipment.

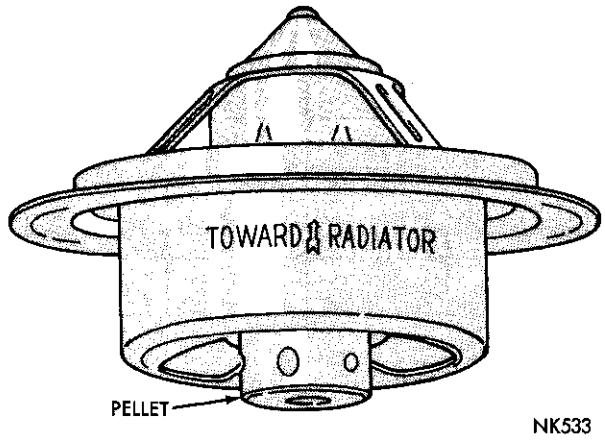


Fig. 5—Thermostat

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

Removal

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

(2) Remove the upper radiator hose from the thermostat housing using pliers Tool C-3250.

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

Testing Thermostat

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

(2) Immerse the thermostat in a container of warm water so that the pellet of the thermostat is completely covered. The pellet must not touch the bottom or sides of the container.

(3) Heat the water and stir it continuously (to insure uniform temperature) and test the water temperature with a thermometer at the point when a .003" feeler gauge can be inserted into the valve opening. The feeler gauge should pass freely into the valve opening at a water temperature of 175° to 185°F. If outside of this range, replace the thermostat.

(4) Continue heating the water to approximately 200°F. The thermostat valve should be fully open at this temperature. If it does not, replace the thermostat.

Installation

(1) Using a new gasket, position the thermostat so the pellet end is toward the engine and attach with bolts through the thermostat housing.

(2) If removed, reinstall or replace the upper hose using Tool C-3250.

(3) Fill the cooling system to 1¼ inches below the filler neck with water and rust resistor or water and antifreeze.

RADIATOR HOSES

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

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

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

RADIATOR PRESSURE CAP

Radiators are equipped with a 14 psi cap, as standard equipment and 16 psi with air conditioning, as shown in Figure 6. Always note the identification number on the cap when replacing.

WARNING: When removing the pressure cap, turn counter-clockwise to the stop, permitting the built-up pressure to escape through the overflow tube. This will prevent the hot water from spraying out of the radiator filler opening.

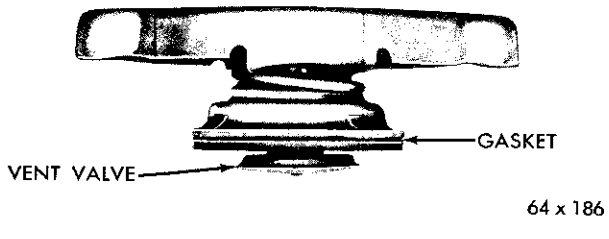


Fig. 6—Radiator Pressure Cap

TESTING THE RADIATOR CAP

Select the short neoprene seal and metal adapter from the kit, Tool C-3499. Slip the seal on the tube at the bottom of the instrument. Attach either end of the short adaptor to the instrument. Dip the pressure cap in water and apply the cap to the end of the adapter. Working the plunger, as shown in Figure 7,

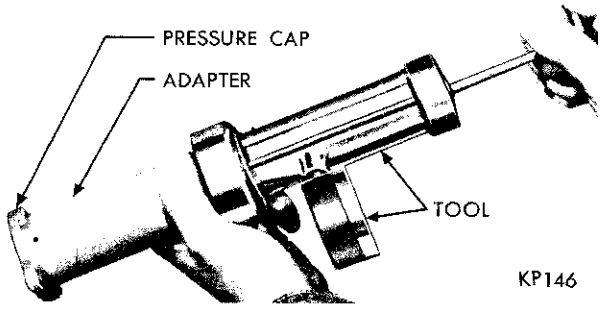


Fig. 7—Testing the Pressure Cap

bring the pressure to 14 pounds on the gauge. If the pressure cap fails to hold the pressure within a range of 12 to 15 pounds, replace the cap with a **new tested** cap. If the vehicle is equipped with air conditioning, the cap should test between 15 to 16 psi.

The brass vent valve at the bottom of the cap should hang freely. If the rubber gasket has swollen and prevents the valve from hanging loosely, replace the cap.

PRESSURE TESTING THE COOLING SYSTEM

(1) Wipe the radiator filler neck sealing seat clean. The water level should be ½ inch below the neck of the radiator.

(2) Attach the tester, Tool C-3499 to the radiator, as shown in Figure 8 and apply 15 pounds pressure.

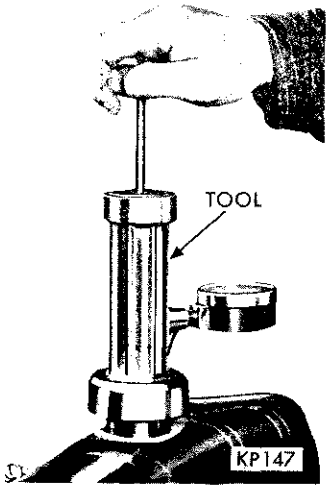


Fig. 8—Pressure Testing the Cooling System

If the pressure drops inspect all points for external leaks.

WARNING: Pressure builds up fast. Any excessive amount of pressure built up by continuous engine operation, must be released to a safe pressure point. NEVER PERMIT PRESSURE TO EXCEED 15 LBS.

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

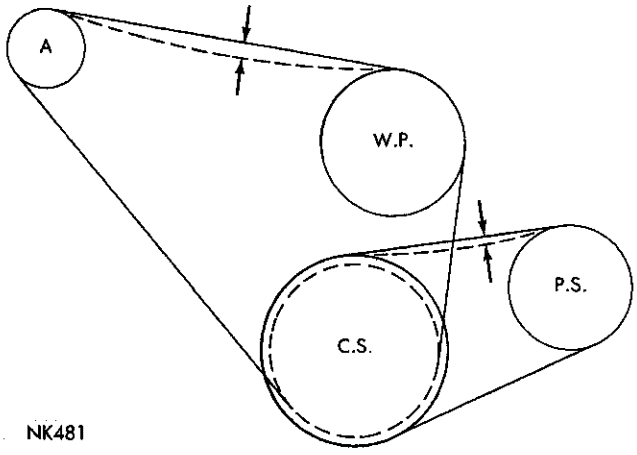
(4) Remove the wires from the spark plugs on one bank and operate the engine on the opposite bank. If the needle continues to fluctuate it indicates a leak on the bank still in operation. If the needle ceases to fluctuate, the leak is in the bank, the combustion has been released from.

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

(6) If the above pressure test of the cooling system holds the pressure as outlined above, then there is no leak, however, there may be internal leaks which can be determined by removing the oil dipstick and if water globules appear intermixed with the oil it will indicate a serious internal leak in the engine. If there is an internal leak, the engine must be disassembled, the leak located and necessary new parts installed.

ENGINE WATER TEMPERATURE GAUGE

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



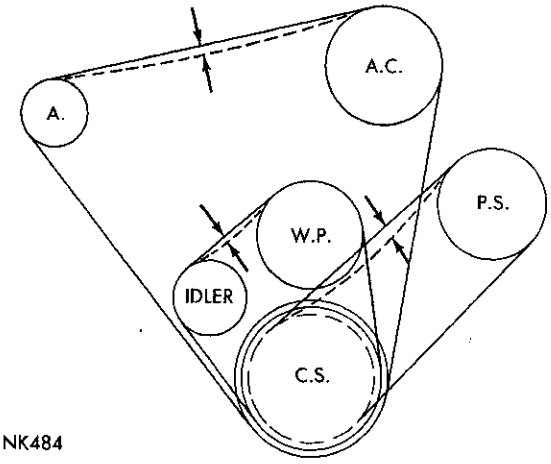


Fig. 9—Belt Deflection Locations

ACCESSORY BELT DRIVES

PROPER BELT TENSION

The satisfactory performance of the belt driven accessories (Fig. 9) depends on the maintenance of the proper belt tension. There are two methods by which belt tensions can be properly established. "The Torque Method" and "The belt Deflection Method." If the specified tensions are not maintained, belt slippage may cause engine overheating, lack of power steering assist, loss in air conditioning capacity, reduced belt life. To avoid any such adverse effects, the following service procedure should be followed:

*Adjust all belts to the specified "belt in use" tension at new vehicle preparation. The new belt tension specifications should be used on all belt replacement, and the above procedure followed thereafter.

Torque Method

All alternator and power steering pump belts can be adjusted to the specified tension by use of a torque wrench. The power steering belts are tightened by using Tool C-3832 and torque wrench Tool C-3005. The alternator belts are adjusted by using a special Tool C-3841 and torque wrench Tool C-3005.

The special tool should be hooked at the heavily-ribbed section of the alternator rectifier end shield. Other belts can also be tightened by this method if the adjusting bracket has a square hole. To tighten

belts by the torque method, loosen all mounting bolts and apply the specified torque to the accessory or idler. Tighten all mounting bolts while the torque is applied to the accessory. If it is not possible to use the torque wrench because of clearance, use an extension.

Belt Deflection Method

All belts can also be adjusted by measuring the deflection of the belt at the mid-point between two pulleys under a five-pound push or pull. A small spring scale can be used to establish the five-pound load. See Figure 9 for correct location at which to measure deflection.

This method should be used only when it is not possible to use the torque method. To adjust the belts by the deflection method, loosen all mounting bolts and use a bar to apply tensions to the belts being careful not to damage the accessory. A ½ inch square drive hinge handle can be used if the accessory has a square hole. Tighten the mounting bolts and test the deflection. (See Specifications.) It may be necessary to repeat this procedure several times to establish the correct tension.

*Any belt that has operated for a minimum of a half-hour is considered a "belt in use."