COOLING

DESCRIPTION

The cooling system, sometimes referred to as the engine temperature control system, allows the engine to reach normal operating temperature as quickly as possible and maintains operating temperatures to prevent engine overheating. These functions are required to prevent engine damage and to provide temperature control for desired cylinder combustion. The cooling system also provides a means to heat the passenger compartment.

The cooling system is a pressure type using a centrifugal water pump to circulate coolant throughout the system. It consists of the following components:

Coolant: Absorbs heat from engine.
Water Passages, Water Jackets, and Hoses: Surround hot areas and provide passageways for coolant.
Radiator: Removes heat from coolant.
Water Pump: Circulates coolant.
Drive Belt: Operates water pump and fan.
Fan: Increases airflow through radiator.
Thermostat: Regulates operating temperature of coolant.
Radiator Pressure Cap: Pressurizes system and prevents coolant loss from spillage.
Temperature Indicating System: Informs driver of operating temperature.
Shroud (see Cooling System Component Chart): Funnels air more directly through radiator.

OPERATION

As the engine turns, the belt-driven fan and water pump also turn. The pump vanes receive coolant from the pump inlet and force coolant to circulate into the block and throughout the cooling system.

Six-Cylinder Engine

Coolant flows through the cylinder block back through the cylinder head to the thermostat housing. Below 205 degrees F the thermostat is closed, so coolant flows through a bypass port to recirculate within the engine. Above 205 degrees F the thermostat opens and allows coolant flow through the upper radiator hose to the radiator (fig. 2-1).

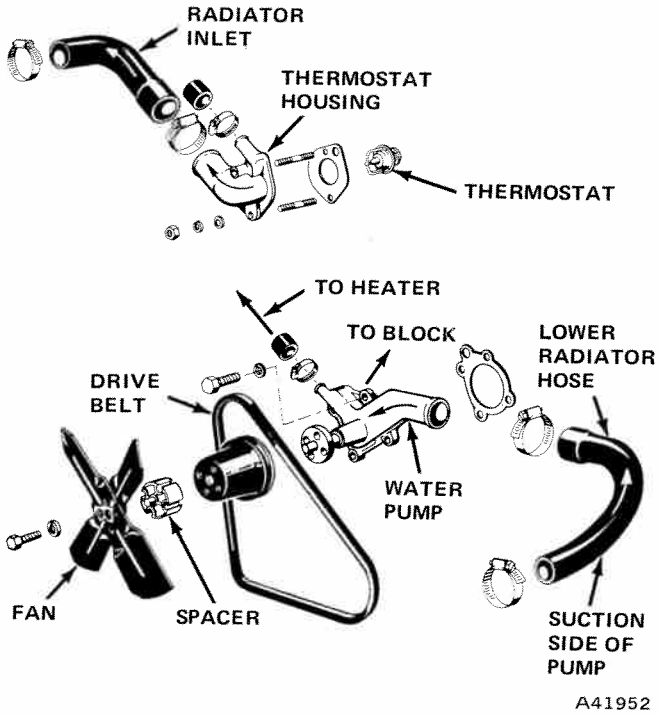


Fig. 2-1 Six-Cylinder Pump Components

V-8 Engine

The pump impeller housing is cast integrally with the water distribution manifold and the engine front cover (fig. 2-2). The water pump discharges coolant into the distribution manifold where dual outlets supply a balanced flow of coolant into both cylinder banks. The coolant flows through the block and back through the cylinder heads to the intake manifold.

Below 195 degrees F the thermostat is closed and coolant flows out a bypass port to the pump inlet for recirculation. Above 195 degrees F the thermostat is open and allows coolant flow through the upper radiator hose to the radiator.

Running warm coolant through the intake manifold aids in quick warmup, better fuel vaporization when

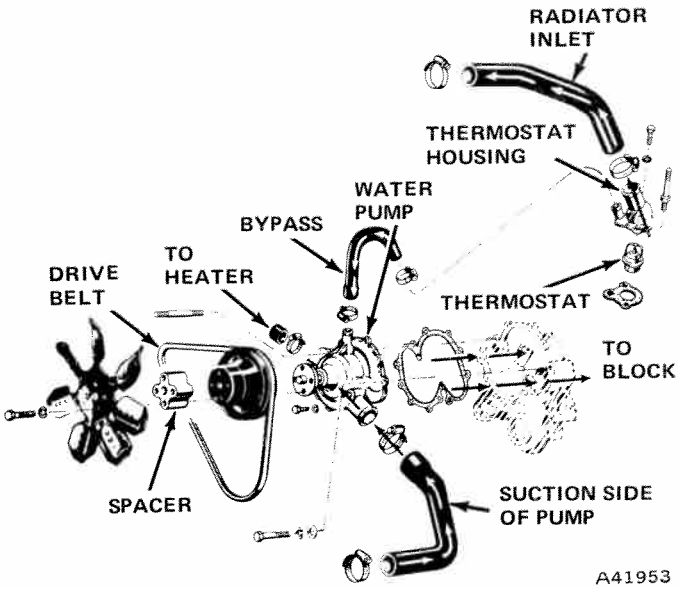


Fig. 2-2 V-8 Pump Components

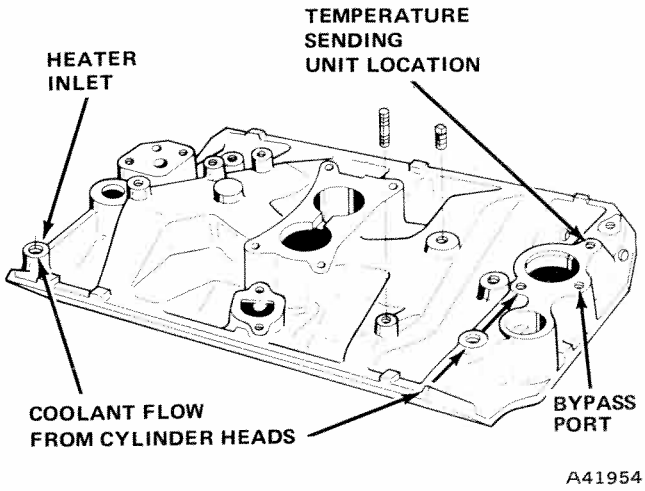


Fig. 2-3 Intake Manifold V-8 Engine

cold, and a more even engine temperature when warm (fig. 2-3).

All

Hot coolant enters the radiator top tank and flows down through tubes to the bottom tank. As it flows, the fan-pulled air flows across the tubes and fins, thus carrying heat away from the coolant. With the pump turning, coolant flows out the lower radiator hose at a cooler temperature, and flows into the pump to restart the cooling cycle.

COOLANT

All-Season Coolant is factory-installed to offer protection against freezing, overheating, and corrosion. All vehicles are protected from freezing to -34 degrees F (36.7 degrees C) by a mixture of 50 percent antifreeze and 50 percent water.

There are important limits to protection levels. A minimum of 44 percent antifreeze (-20 degrees F freezing protection) is desirable for adequate and lasting corrosion protection. A maximum of 68 percent antifreeze affords the lowest possible freezing temperature (-90 degrees F). Freeze protection should be within these limits for maximum year-round protection. A higher percentage will actually raise the freezing temperature. A 100 percent solution of ethylene glycol will freeze at -8 degrees F.

The purpose of using antifreeze in the summer time (especially on cars equipped with air conditioning) is to raise the boiling point for a better heat transfer. Antifreeze does not transfer heat as well as plain water; however, the boiling point of water is raised with the addition of antifreeze and improves overall ability of the cooling system to dissipate heat. Antifreeze solution also provides better circulation than pure water at higher temperatures and during severe operating conditions. The lack of antifreeze allows internal boiling of coolant at low pressure areas throughout the cooling system. This results in reduced flow and cavitation, which is harmful to engine parts.

If coolant level is low, add a mixture of antifreeze and water sufficient to meet local temperature requirements. Plain water may be used in an emergency, but the coolant should be checked as soon as possible for the proper freeze protection. Any time water is used, it should be of low mineral content to resist corrosion and deposits.

The cooling system should be drained, flushed, and the coolant changed at 25,000 miles or 25 months, and then at the start of every winter season. At the same time, the system should be inspected and pressure tested for leaks.

A dark, oily, rust inhibitor is also installed in the coolant. If too much inhibitor is installed, it collects in the radiator upper tank. If overheating does not occur, siphon excess out of the radiator and replenish the level with the correct coolant solution. If overheating occurs, be certain all other units are functioning properly, then drain the cooling system and refill with the proper mixture of coolant.

All-Season Coolant contains lubricant for the water pump seals and corrosion preventive inhibitors. Plain water, methanol, or alcohol-type antifreeze should not be used in the cooling system except in emergencies.

CAUTION: *Coolant additives which are claimed to improve engine cooling are not recommended and should not be used. Some of these additives are not compatible with the foam depressant and other additives already in All-Season Coolant and may actually lower the efficiency of the cooling system.*

Coolant Level

Radiator coolant level should be checked when the engine is cold (before running). When cold, maintain coolant level 1-1/2 inches to 2 inches below the rear of the filler-neck surface (1/2 inch to 1 inch when hot). Maintain level with mixture of AMC All-Season Coolant and water.

If the radiator cap must be removed when the engine is hot, let the engine cool down by letting it idle for a few moments before removing the cap. Then turn the cap slowly to the first notch to let any pressure escape before removing the cap. When doing so, use a heavy rag or towel wrapped over the cap.

If the engine is overheated, exercise extreme care. Let the engine idle for a period above normal idle speed with the hood up unless all coolant has been lost. Shut off the engine and let it cool for 15 minutes before removal of the cap.

FAN

Fan blade assemblies are balanced within 0.25 in.-oz. and, therefore, should not be altered in any way. Refer to the Cooling System Components Chart for fan applications.

Power Flex Fan

Heavy-duty or air conditioning cooling packages use a fan having seven flexible blades which automatically change pitch relative to engine rpm. As rpm increases, blade pitch decreases, saving power and decreasing noise level. At slow speed, the pitch increases and the airflow rate increases to effectively cool the engine. Refer to Cooling System Components Chart for fan applications.

CAUTION: *Fans are designed to fit certain applications only. Therefore, DO NOT attempt to increase cooling capacity by installing a fan not intended for a given engine. Otherwise noise and fan damage may result.*

Tempatrol - Viscous Fan Drive

The Tempatrol fan drive is a torque and temperature-sensitive clutch unit which automatically increases or decreases fan speed to provide adequate cooling (fig. 2-4).

A bimetal thermostatic coil at the front of the clutch unit reacts to changing radiator air temperatures and regulates the flow of silicone fluid into the drive chamber. The amount of fluid flowing into the chamber provides automatic fan speed control in proportion to the cooling demands of the engine.

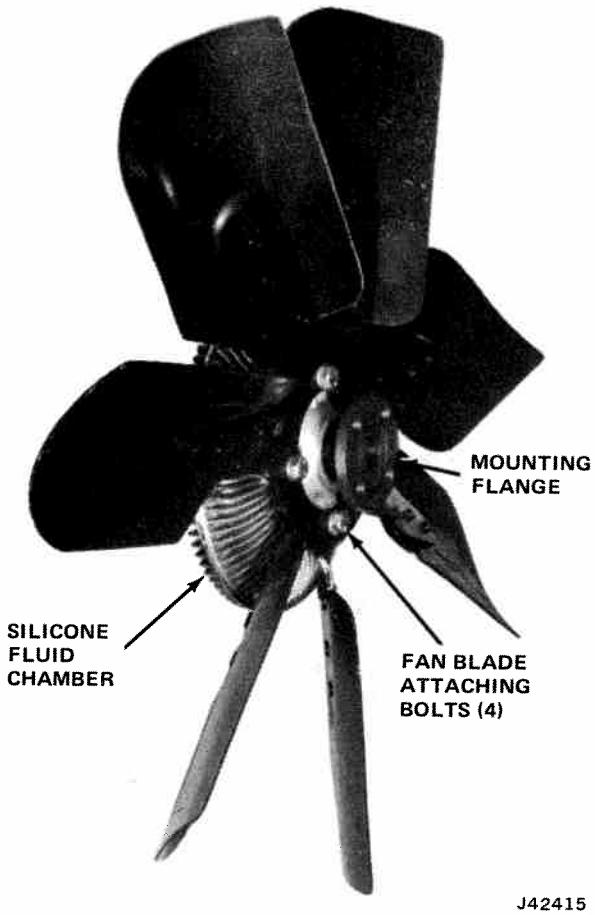


Fig. 2-4 Tempatrol - Viscous Fan

THERMOSTAT

The thermostat assists quick engine warmup by keeping coolant flow within the engine until sufficient temperature relaxes the bimetallic spring and allows coolant to flow to the radiator. This occurs at 205 degrees F (±3 degrees) on six-cylinder engines, and 195 degrees F (±3 degrees) on V-8 engines. The six-cylinder thermostat is fully open at 228 degrees F; the V-8 thermostat is fully open at 218 degrees F.

Engines should not be operated (except for servicing or testing procedures) without a thermostat installed. This causes longer engine warmup time, poor warmup performance, and slower heater warmup.

It is not necessary to change thermostats with a change in season. Use the same thermostat for winter and summer.

NOTE: *The thermostat should be checked whenever the cooling system is serviced, particularly at the time of installation of antifreeze solution.*

When installing the thermostat, the pellet, which is encircled by a coil spring, must face the engine. All thermostats are marked on the outer flange to indicate proper installed position.

The thermostat on six-cylinder engines **must be installed with the air bleed hole up** (fig. 2-5). This prev-

vents air being trapped in the block which could cause a sudden burping of the coolant when the thermostat opens.

Also during installation, observe the recess on the intake manifold (V-8) or cylinder head (six) and fit the thermostat in that groove (fig. 2-6 and 2-7). Then install the gasket and thermostat housing.

CAUTION: *Tightening the housing unevenly or with the thermostat out of its recess, will result in a cracked housing.*

RADIATOR

The radiator is a fin and tube type with a top and bottom tank soldered to a section of coolant tubes and cooling fins. The bottom tank contains the oil cooler for cars with automatic transmissions.

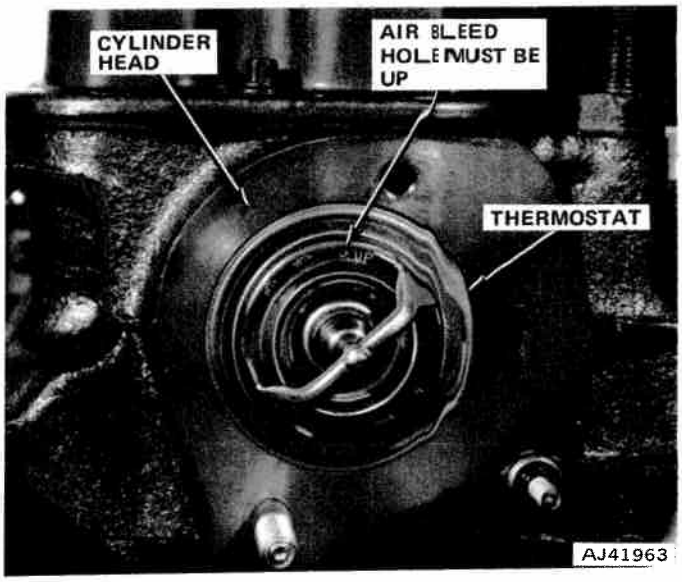


Fig. 2-5 Thermostat Installation - Six-Cylinder

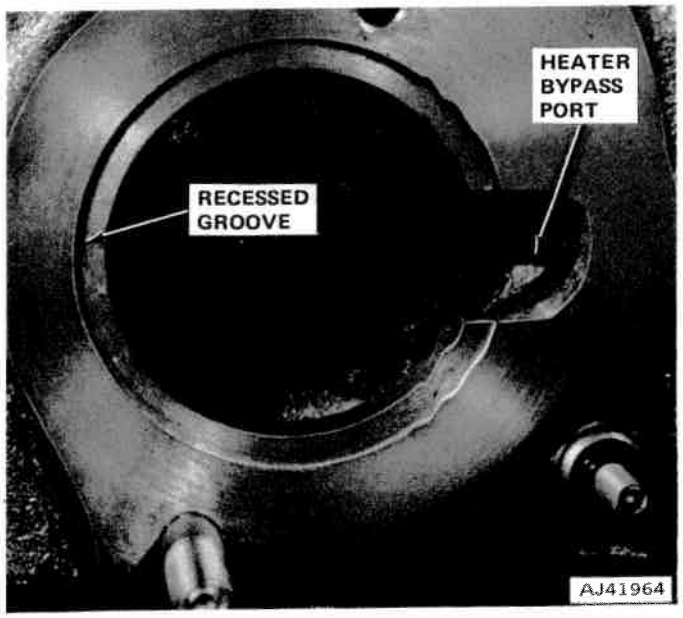


Fig. 2-6 Thermostat Recess - Six-Cylinder

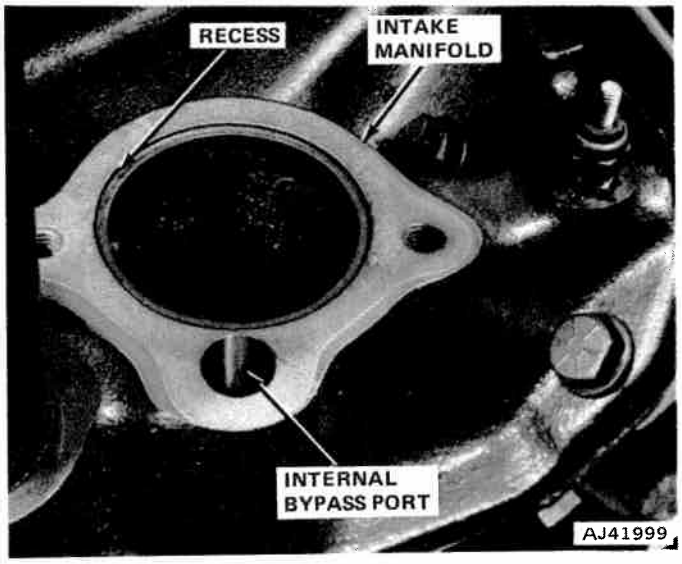


Fig. 2-7 Thermostat Recess - V-8

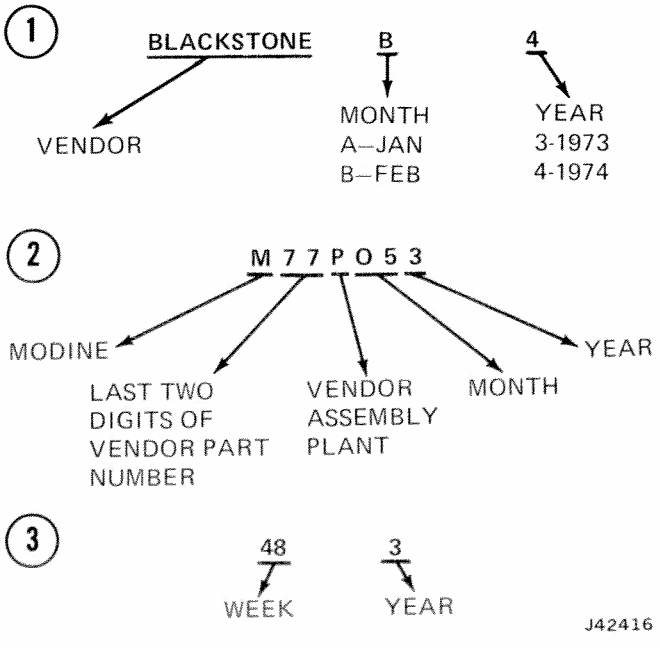
The filler neck on the top tank has an overflow tube attached to provide a passage for escaping coolant. This tube routes boilover to the road on all models.

The radiator is designed to operate at 12 to 15 psi. A 14-psi pressure cap, fitted to the filler neck, controls operating pressure.

NOTE: *For testing radiator for leaks or pressure loss, see Cooling System Pressure Test.*

The bottom tank is fitted with a drain cock to provide a convenient means of draining the radiator. The drain cock should be finger-tight to prevent leaks.

NOTE: *Radiators are identified by a date code stamped on the upper tank following the part number and the vendor's name or, on some J-Series vehicles, the code is on the radiator right side support. Examples:*



RADIATOR CAP

The radiator cap performs several functions:

- It prevents loss of coolant when the car is in motion and it keeps impurities and excess air out of the cooling system.
- It seals the cooling system up to 12 to 15 psi pressure. This raises the boiling point of the coolant which results in less coolant loss, more efficient engine operating temperature, and better passenger compartment heating.

NOTE: *Pressurizing the cooling system increases the boiling point approximately 2-1/2 degrees F for each pound of pressure. The 14-psi cap raises the coolant boiling point 42 degrees F.*

- It allows atmospheric pressure to enter the cooling system to equalize pressure during cool-down when a cooling system vacuum occurs.

Operation

The cap consists of a pressure release valve and a vacuum vent valve. With the system cold, the pressure valve is spring-loaded, providing a seal between the filler neck and the cap (fig. 2-8). The vacuum valve is suspended and hangs freely, so no pressure can build at this time. As coolant temperature rises, vapors begin to form and flow through the vacuum valve. When this flow reaches 0.4 to 0.7 cubic feet per minute, the vacuum valve seats and pressure begins to rise. When pressure exceeds the cap rating (14 psi nominal, 12 to 15 psi OK range), pressure overcomes the spring tension, unseats the valve, and allows pressure and coolant to flow out the overflow tube.

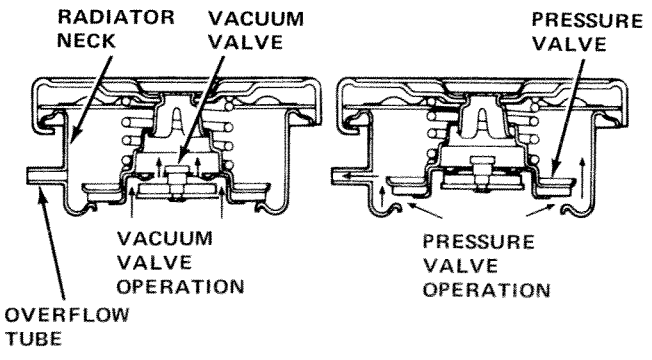


Fig. 2-8 Pressure Radiator Cap

After shutdown, the coolant temperature drops and the coolant contracts. This shrinking within the closed system creates a low pressure. Atmospheric pressure above the vacuum valve pushes the vacuum valve open, allowing pressure to equalize.

If the pressure valve did not release, pressure would eventually build to a point that would burst hoses or the radiator. If the vacuum valve did not allow pressure to equalize, the weaker parts in the cooling system (heater core, radiator, and hoses) would collapse.

TEMPERATURE GAUGE

The temperature gauge is an electrical instrument that indicates coolant temperature.

Temperature indication should be interpreted as shown in the Temperature Gauge Calibration Chart. Temperatures in the range between 171 degrees F and 242 degrees F are considered normal. During extreme cold weather operation, temperature indication will be lower. During extreme load conditions, high ambient temperature, high altitude, or in slow moving traffic, temperature indications may reach the higher end of the scale. This is normal providing there is no coolant loss.

TEMPERATURE GAUGE CALIBRATION (ALL MODELS)

C (Cold)	130 degrees F
Beginning of Band	171 degrees F
Top of Band	242 degrees F
H (Hot)	270 degrees F

COOLING SYSTEM SERVICE DIAGNOSIS

Cooling system problems generally involve engine overheating, running too cold, or the loss of coolant. Any of these problems should be serviced promptly to avoid engine damage or driver discomfort. An engine running too cold may suffer from crankcase oil dilution or excess sludge deposits. A hot engine can cause thinning of the oil, premature wear, increased oil consumption, and pre-ignition.

Cooling system trouble is often related to a gauge reading. If operating properly, the gauge only indicates what temperature actually exists. For complaints of high or low temperature indications that are not accompanied with coolant loss or poor heater performance, verify the reading by checking the coolant temperature with a thermometer. If the temperature corresponds with the gauge, test the cooling system; if not, test the gauge.

The cooling system is designed to function properly through a range of temperatures. Temperatures within the band on the temperature gauge are considered normal. The usual running temperature encountered will depend on ambient temperature, driving and load conditions, and gauge and sending unit tolerances.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
HIGH TEMPERATURE INDICATION — OVERHEATING	(1) Coolant level low	(1) Replenish coolant level
	(2) Fan belt loose	(2) Adjust fan belt
	(3) Radiator hose(s) collapsed	(3) Replace hose(s)
	(4) Radiator blocked to airflow by debris or special equipment	(4) Remove restriction
	(5) Faulty radiator cap	(5) Replace cap
	(6) Vehicle overloaded	(6) Reduce load
	(7) Defective Tempatrol fan	(7) Replace fan
	(8) Ignition timing incorrect	(8) Adjust ignition timing
	(9) Idle speed low	(9) Adjust idle speed
	(10) Air trapped in cooling system	(10) Purge air
	(11) Vehicle in heavy traffic	(11) Operate at fast idle intermittently to cool engine
	(12) Incorrect cooling system component(s) installed	(12) Install proper component
	(13) Faulty thermostat	(13) Replace thermostat
	(14) Water pump shaft broken or impeller loose	(14) Replace water pump
	(15) Radiator tubes clogged	(15) Flush radiator
	(16) Cooling system clogged	(16) Flush system
	(17) Casting flash in cooling passages.	(17) Repair or replace as necessary. Flash may be visible by removing cooling system components or removing core plugs.
	(18) Brakes dragging.	(18) Repair brakes.
	(19) Excessive engine friction.	(19) Repair engine
	(20) Vehicle working beyond cooling system capacity	(20) Install heavy-duty cooling or use special-duty vehicle

SERVICE DIAGNOSIS (Continued)

Condition	Possible Cause	Correction
HIGH TEMPERATURE INDICATION—OVERHEATING (Continued)	(21) Antifreeze concentration over 68%	(21) Lower antifreeze content
LOW TEMPERATURE INDICATION	(1) Improper fan being used	(1) Install proper fan
	(2) Improper radiator	(2) Install proper radiator
	(3) Thermostat stuck open	(3) Replace thermostat
	(4) Improper fan pulley (too small)	(4) Install proper pulley
COOLANT LOSS BOILOVER	Refer to Overheating Causes in addition to the following:	
	(1) Overfilled cooling system	(1) Reduce coolant level to proper specification.
	(2) Quick shutdown after hard (hot) run	(2) Allow engine to run at fast idle prior to shutdown.

NOTE: *Immediately after shutdown, the engine enters a period known as "heat soak." This occurs when the cooling system is inoperative and engine temperature is still high. If coolant temperature rises about the boiling point, it may push some coolant out of the radiator overflow tube. If this does not occur frequently, it is considered normal.*

	(3) Air in system resulting in occasional burping of coolant	(3) Purge system
	(4) Insufficient antifreeze allowing coolant boiling point to be too low	(4) Add antifreeze to raise boiling point
	(5) Antifreeze deteriorated because of age or contamination	(5) Replace coolant
	(6) Leaks due to loose hose clamps, loose nuts, bolts, drain plugs, faulty hoses, or defective radiator.	(6) Pressure test system to locate leak then repair as necessary.
	(7) Faulty head gasket	(7) Replace head gasket.

SERVICE DIAGNOSIS (Continued)

Condition	Possible Cause	Correction
COOLANT LOSS BOILOVER (Continued)	(8) Cracked head, manifold, or block	(8) Replace as necessary
COOLANT ENTRY INTO CRANKCASE OR CYLINDER	(1) Faulty head gasket	(1) Replace head gasket
	(2) Crack in head, manifold or block	(2) Replace as necessary
NOISE	(1) Fan contacting shroud	(1) Reposition shroud and check engine mounts
	(2) Loose water pump	(2) Replace pump
	(3) Dry fan belt	(3) Apply belt dressing or replace belt
	(4) Loose fan belt	(4) Adjust fan belt
	(5) Rough surface on drive pulley	(5) Replace pulley
	(6) Water pump bearing worn	(6) Remove belt to isolate. Replace pump
NO COOLANT FLOW THROUGH HEATER CORE	(1) Plugged return pipe in water pump	(1) Remove obstruction
	(2) Heater hose collapsed or plugged	(2) Remove obstruction or replace hose
	(3) Plugged heater core	(3) Remove obstruction or replace core
	(4) Plugged outlet in thermostat housing	(4) Remove flash or obstruction
	(5) Heater bypass hole in cylinder head plugged (six-cylinder).	(5) Remove obstruction

ADJUSTMENTS

Drive Belts

The cooling system fan, alternator, and water pump are driven by a V-type drive belt from a pulley on the vibration damper. In addition, such engine-driven accessories as the power steering pump and air conditioning compressor also employ a similar V-type drive belt.

It is important that the proper tension of the belt be maintained to ensure efficient operation of the cooling system. Overtightening will cause excessive wear on the water pump, alternator, and accessory bearings.

The belts can be checked for proper adjustment by using a belt strand tension gauge on the longest accessible span of belt between two pulleys (see Engine Drive Belt Tension chart).

When using the gauge on a notched belt, the middle finger of the gauge should be in the notched cavity of the belt.

NOTE: *New belt tension specifications apply only to service replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used belt specifications.*

Make adjustments at the mounting brackets of each unit.

NOTE: *Consult Specifications for proper tensions.*

Fan and Alternator Belt Adjustment

(1) Loosen alternator pivoting mount bolt.
(2) Loosen alternator adjusting bolt.
(3) Adjust belt using pry bar or 1/2-inch square drive bar. Snug adjusting bolt (fig. 2-9 and 2-10).

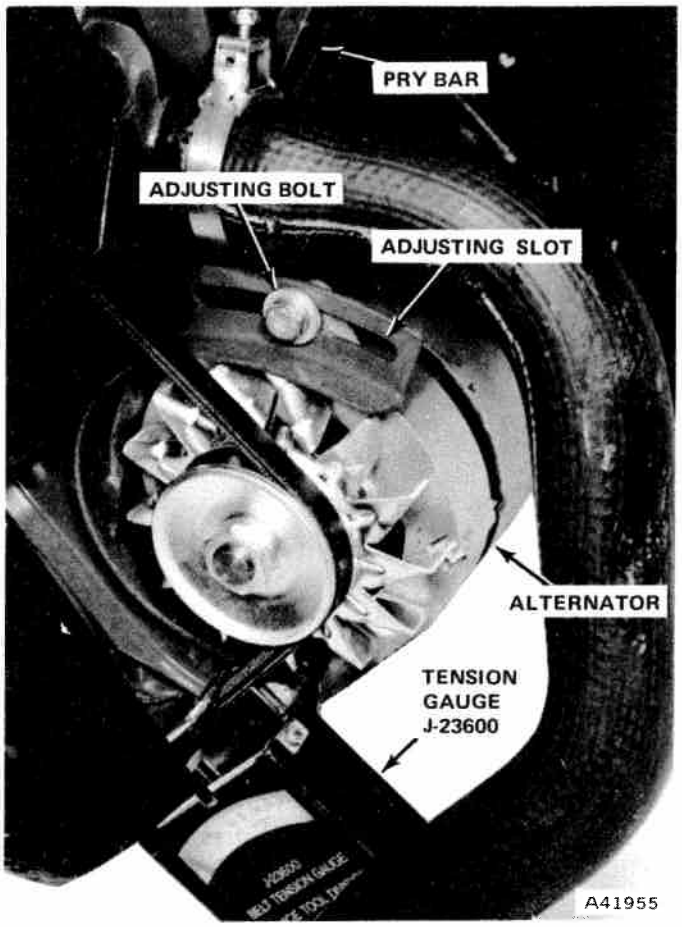


Fig. 2-9 Adjusting Fan Drive Belt - Six-Cylinder

(4) Check belt tension using Tension Gauge J-23600 (fig. 2-11).
(5) Tighten adjusting bolt to 18 foot-pounds torque and mounting bolts to 28 foot-pounds torque.

Hose Position

In places where hoses do not have specific routing clamps, make sure hoses are moved to clear exhaust pipes, fan blades, and drive belts. Otherwise hoses will be damaged resulting in coolant loss and overheating.

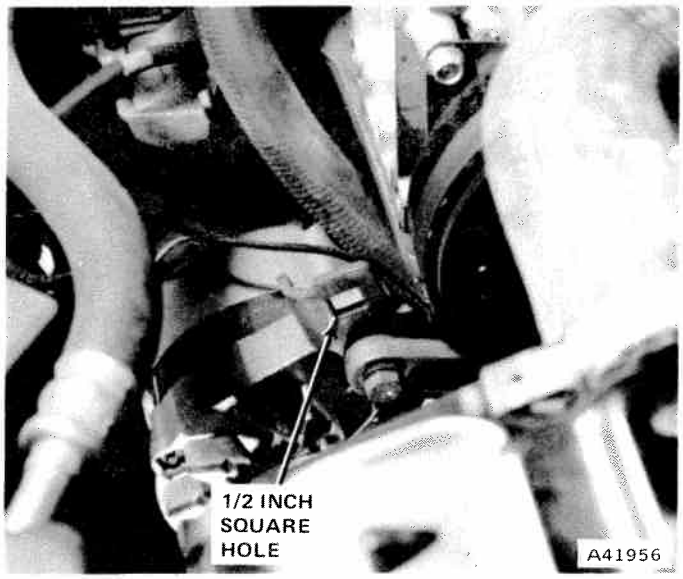


Fig. 2-10 Alternator Adjustment Bracket - V-8

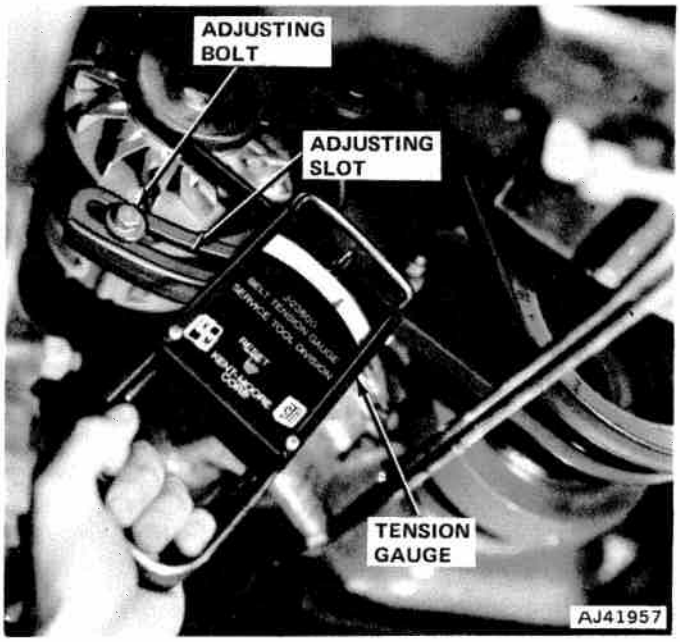


Fig. 2-11 Checking Fan Drive Belt Tension

Shroud Position

In some extreme cases, the engine fan may contact the shroud. An examination of proper engine mounting should locate the trouble. If not, examine the shroud position. To compensate for normal engine movement, loosen the shroud mounting screws and relocate shroud to prevent fan-to-shroud contact.

DIAGNOSIS TESTS

Freeze Protection

Cooling system freeze protection should be checked with an antifreeze hydrometer to determine protection level.

Water Pump Test

To test a water pump for a loose impeller, proceed as follows:

(1) Position clean bucket beneath water pump.

(2) Loosen fan belt.

(3) Disconnect lower radiator hose from water pump.

WARNING: *Engine should be cooled prior to this test to avoid burns.*

(4) Bend a stiff clothes hanger or welding rod as shown in figure 2-12.

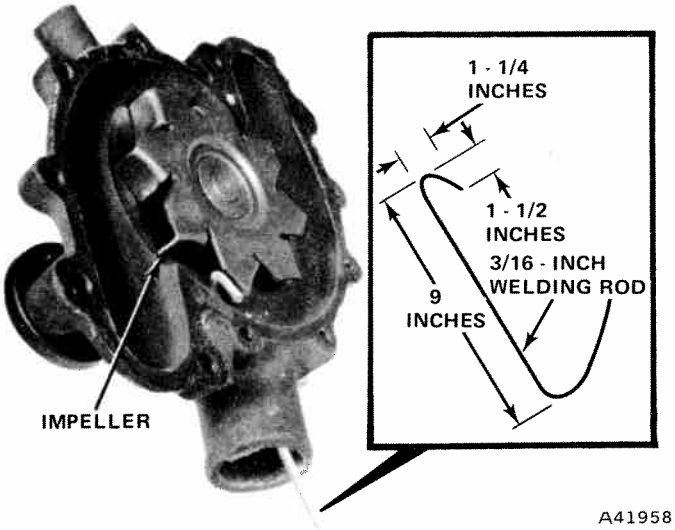


Fig. 2-12 Checking Water Pump for Loose Impeller

(5) Position rod in water pump inlet and try to turn fan. If impeller is loose and can be held with rod while fan is turning, pump is defective. If impeller turns, pump is OK.

(6) Reconnect hose and replenish coolant, or proceed with further repairs.

Tempatrol Fan - Test

Start the engine and allow it to warm up to operating temperature. From under the hood, gradually increase the engine speed until a definite decrease of the audible fan airflow is heard. Maintain this engine speed until a definite increase of the audible fan airflow is heard.

The Tempatrol unit is operating satisfactorily if the time interval between decrease and increase of the audible fan airflow does not exceed three minutes.

NOTE: *The cooling system must be in good condition prior to performing the above test to ensure against excessively high radiator air temperatures.*

Thermostat Test

(1) Remove thermostat.

(2) Insert 0.003-inch feeler gauge, with wire or string attached, between valve and its seat (fig. 2-13).

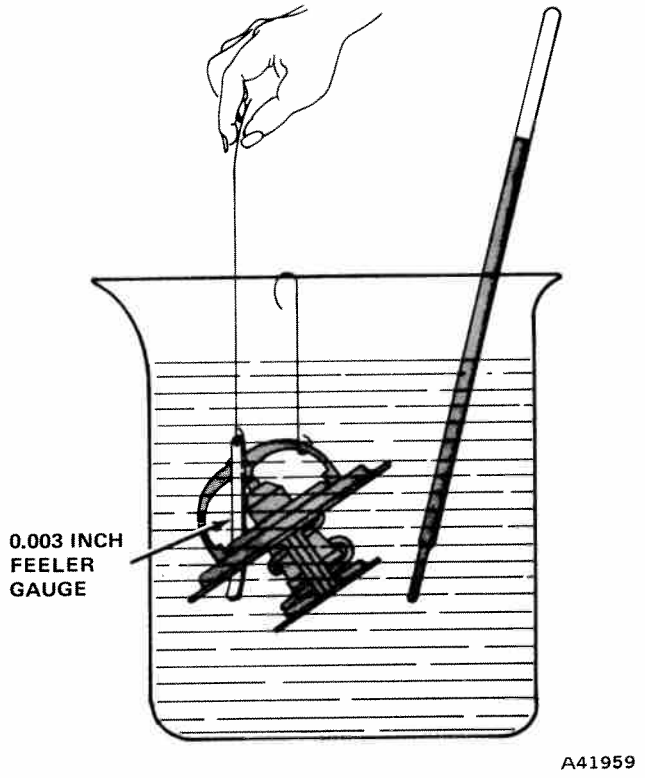


Fig. 2-13 Testing Thermostat

(3) Submerge thermostat in a container of antifreeze solution, suspend it so it does not touch sides or bottom of container.

(4) Suspend a thermometer in solution so it does not touch container.

(5) Heat solution.

(6) Apply slight tension on feeler gauge while solution is heated. The moment valve opens 0.003 inch, feeler gauge will slip free from valve. Note temperature at which this occurs. Valve must open 0.003 inch at its rated temperature (±3 degrees F). It must be fully open as follows:

	Thermostat Rating	Fully Open
V-8 Engine	195 degrees F	218 degrees F
Six-Cylinder Engine	205 degrees F	228 degrees F

(7) Install thermostat.

Cooling System Pressure Test

NOTE: *Engine should be at operating temperature.*

(1) Carefully remove the radiator pressure cap from filler neck.

(2) Check coolant level.

(3) Wipe inside of filler neck. Examine lower inside sealing seat of filler neck for nicks, dirt, and solder bumps.

(4) Inspect overflow tube for dents or internal obstruction. Run a wire through tube to be sure it is clear.

NOTE: *Pressure released by pressure cap during operation must pass through this tube. An obstructed tube may cause the radiator or some portion of cooling system to burst from excessive pressure.*

(5) Inspect the cams on outside of filler neck. If cams are bent, seating of pressure cap valve and tester seal will be affected. Bent cams can be reformed if done carefully.

(6) Attach pressure tester to filler neck with locking ears in line with entrance notches of filler neck (fig. 2-14). Press down slightly and rotate clockwise until locking ears are stopped by stop lugs on filler neck. DO NOT FORCE.

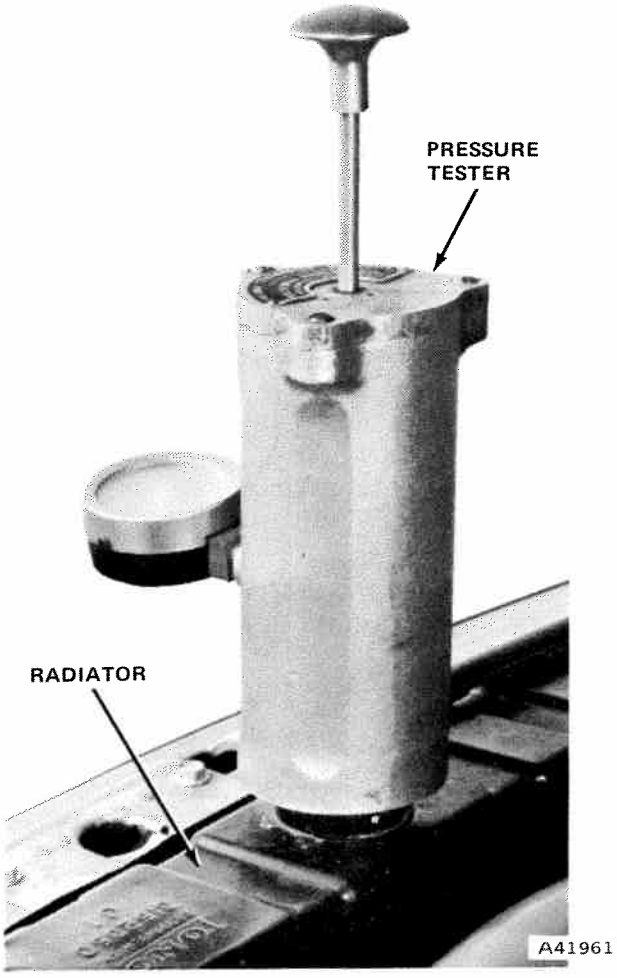


Fig. 2-14 Cooling System Pressure Test

(7) Operate tester pump to apply 15 psi pressure to system.

(8) Observe needle.

(a) **Holds Steady:** If needle holds steady for two minutes, there are no serious leaks in system. Examine all points for seepage or slight leakage with a flashlight.

(b) **Drops Slowly:** Indicates presence of small leaks or seepage. Check radiator, hose, gaskets, and heater. Seal tiny leaks in radiator core with AMC Sealer Lubricant (part number 8990040). Repair leaks and recheck system for minor leaks. If radiator hose swells excessively while testing, replace hose.

(c) **Drops Quickly:** Indicates that serious leakage is present. Large radiator leaks should be repaired by a reputable radiator repair shop.

(9) Check for interior leakage.

(a) Gauge shows pressure drop and there is no visible leakage.

1. Remove tester and replace pressure cap.
2. Run engine to churn oil, then examine dipstick for water gobules or remove crankcase drain plug and drain a small amount of oil (water, being heaviest, should drain first).
3. Check transmission dipstick for water globules.
4. Check transmission intercoolers for leakage.

(b) Compression or combustion leakage into cooling system.

1. Run engine at normal operating temperature with pressure cap on radiator.

CAUTION: *Do not allow pressure buildup over 15 psi. Release pressure by turning engine off and removing tester.*

2. Remove pressure cap carefully and apply Pressure Tester to filler neck. If pressure builds up quickly, a leak exists as a result of a blown gasket or crack. Repair as necessary.
3. Operate Pressure Tester, if there is no immediate pressure increase, until gauge reads within system range. Gauge hand vibration indicates compression or combustion leak into cooling system.
4. Isolate compression leak by shorting each spark plug. Gauge hand stops or decreases vibration when spark plug of leaking cylinder is shorted. Retest with Pressure Tester after repair.

(10) Remove tester from radiator neck.

Combustion Leakage Test (Without Pressure Tester)

(1) Drain coolant.

(2) Disconnect water pump drive belt.

(3) Disconnect thermostat housing from engine and remove thermostat.

(4) Add coolant and water mixture to engine to bring level above bottom surface.

(5) Start engine and accelerate rapidly three times while watching coolant.

CAUTION: *Do not run engine too long to avoid overheating.*

NOTE: *If any internal engine leaks to the cooling system exist, bubbles will appear in the coolant. If bubbles do not appear, there are no internal leaks.*

Hose and Belt Inspection

Check hoses at regular intervals by squeezing. If a cool hose is firm when squeezed, it is OK. If a hose is cracked or feels brittle when squeezed, it should be replaced to prevent later trouble. Inspect V-belts frequently for similar defects.

Radiator Cap Test

(1) Remove cap from radiator.
(2) Make sure seating surfaces are clean.
(3) Wet rubber gasket with water and install cap on tester (fig. 2-15).

NOTE: *It may be necessary to install cap several times to ensure tight seal.*

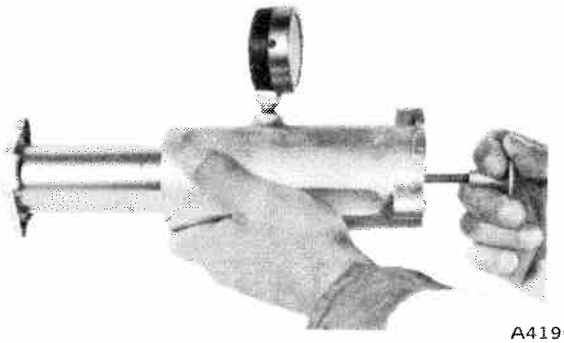


Fig. 2-15 Radiator Pressure Cap Test

(4) Operate tester pump and observe needle at its highest point. Cap release pressure should be 12 to 15 pounds.

NOTE: *Cap is OK when pressure holds steady or holds within the 12 to 15 pound range for 30 seconds or more. If needle drops quickly, replace cap.*

Temperature Gauge and Sending Unit Tests

On-vehicle tests of the sending unit are limited to temperatures up to the boiling point. Install a thermometer in radiator filler neck opening to determine coolant temperature.

Touch one prod of an ohmmeter to sending unit terminal and other prod to outer portion of sender.

CAUTION: *Do not connect ohmmeter with sender unit wire connected and key in on position. Damage to ohmmeter may result.*

Ohmmeter reading should coincide with coolant temperature (fig. 2-16). To check temperatures over boiling point, remove sending unit and put it in a pan of pure antifreeze or oil. Check using a thermometer and ohmmeter.

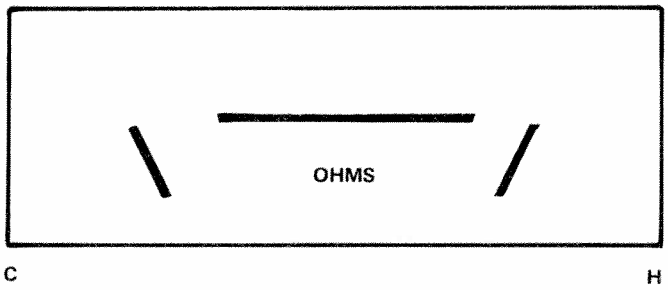


Fig. 2-16 Coolant Temperature Gauge

TEMPERATURE GAUGE CALIBRATION (ALL MODELS)

C (COLD): 130 Degrees - 73 Ohms
Beginning of Band: 171 Degrees - 36 Ohms
Top of Band: 242 Degrees - 13 Ohms
H (HOT): 270 Degrees - 9 Ohms

Use Gauge Tester J-22344-0 to test the temperature gauge.

Connect one test lead to ground and other lead to sender unit wire. Adjust tester to 9 and turn ignition on. Gauge needle should be on hot mark after several seconds of warmup time. If gauge does not register correctly through entire tester range, gauge is defective. If gauge does not register at all or registers high or low through its entire range, refer to the Electrical Section - Instrument Cluster Component Tests for further testing.

SERVICE PROCEDURES

Draining Coolant

NOTE: *DO NOT WASTE usable coolant. If solution is clean and is being drained only to service the cooling system (i.e., remove radiator), collect coolant in a clean container and re-use it.*

The coolant can be drained from the radiator by loosening the drain cock on the bottom tank.

Coolant can be drained from the engine block by removing the drain plugs.

Six-Cylinder: Two located on left side of block. May have one or two CTO switches in them.

V-8: Centrally located on each side of block.

WATER PUMP SERVICE

The water pump is the centrifugal type and is serviced only as an assembly.

Removal - Six-Cylinder Engine

(1) Disconnect battery negative cable.
(2) Drain cooling system at radiator.
(3) Disconnect radiator and heater hoses from water pump.
(4) Loosen alternator adjustment strap screw and remove drive belt.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate shroud from radiator to facilitate removal and installation of engine fan and hub assembly.*

(5) Remove fan and hub assembly.
(6) If equipped with air conditioning, disconnect compressor mount bracket from water pump housing and loosen remaining mount bracket nuts, do not remove nuts.
(7) Remove front half of alternator bracket. Support weight of alternator by inserting lower pivot bolt through rear half of alternator bracket.
(8) Remove water pump and gasket from engine.
(9) Clean all old gasket material from gasket surface of engine, and remove any foreign material which may have accumulated in impeller cavity.

Installation

(1) Install new water pump and gasket to engine.
(2) Tighten retaining bolts to specified torque.
(3) Install front half of alternator bracket.
(4) Install alternator drive belt and tighten to specified tension.
(5) If disconnected, connect compressor mount bracket to water pump housing, and tighten remaining mount bracket nuts.
(6) Tighten air conditioning drive belt to specified tension.
(7) Connect radiator and heater hoses to water pump.
(8) Reconnect battery.
(9) Fill radiator with a 50 percent Jeep All-Season Coolant and 50 percent water mixture. Start engine and open heater control valve to remove air bubbles from heater core. Operate engine long enough for thermostat to open, and recheck coolant level.

Removal - V-8 Engine

(1) Disconnect battery negative cable.
(2) Drain radiator and disconnect upper radiator hose at radiator.
(3) Loosen all drive belts.
(4) Remove fan and hub assembly.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate it from radiator to facilitate removal and installation of engine fan and hub assembly.*

(5) If equipped with a viscous fan, remove fan assembly (do not unbolt fan blades) and shroud all at the same time. There is sufficient room to move viscous fan assembly toward radiator and clear water pump.

NOTE: *Studs in water pump may back out of water pump when nuts are removed preventing fan assembly from clearing water pump. In the event this happens, install a double nut on stud(s) and remove stud(s).*

(6) If vehicle is equipped with air conditioning, install a double nut on air conditioning compressor bracket to water pump stud and remove stud (fig. 2-17).

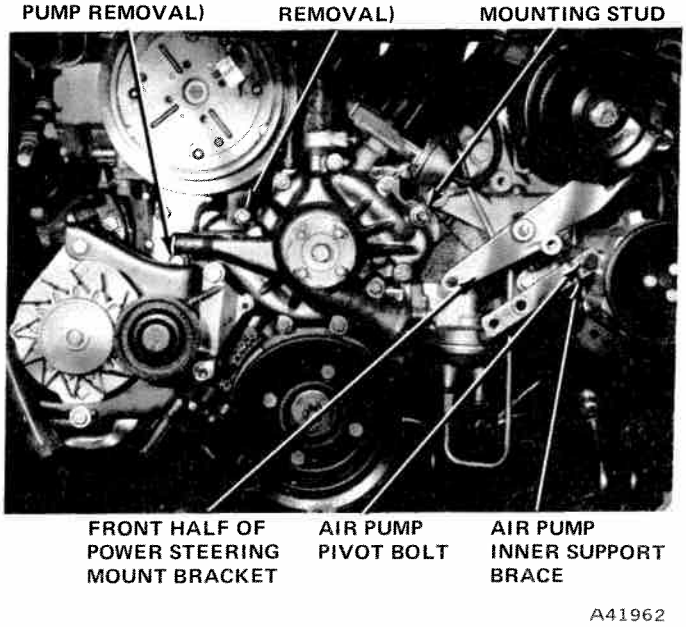


Fig. 2-17 Water Pump Mounting - V-8 Engine

NOTE: *Removal of this stud eliminates removing compressor mounting bracket.*

(7) Remove alternator and mount bracket assembly and place aside. Do not disconnect wires.
(8) If equipped with power steering, remove two nuts that attach power steering pump to rear half of pump mounting bracket.
(9) Remove two bolts that attach front half of bracket to rear half.
(10) Remove remaining upper bolt from inner air pump support brace, loosen lower bolt and drop brace away from power steering front bracket (fig. 2-17).

(11) Remove front half of power steering bracket from water pump mounting stud.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate it from radiator to facilitate removal and installation of engine fan and hub assembly.*

(12) Disconnect heater hose, bypass hose, and lower radiator hose at water pump.
(13) Remove water pump and gasket from timing chain cover.
(14) Clean all old gasket material from gasket surface of timing chain cover.

Installation

(1) Install new water pump and gasket to timing chain cover.
(2) Tighten retaining bolts to specified torque.
(3) If removed, install front section of power steering mount bracket, power steering pulley and drive belt.
(4) Tighten drive belt to specified tension, then tighten pulley retaining nut to 55 to 60 foot-pounds torque.
(5) If removed, install air pump drive belt and tighten to specified tension.
(6) Install alternator and mount bracket assembly.
(7) Connect heater hose, bypass hose, and lower radiator hose to water pump.

NOTE: *Vehicles with a shroud should have radiator removed previously as bolts that attach shroud also retain radiator.*

CAUTION: *Check to be sure the wire coil is installed in the lower radiator hose. Failure to install this coil will result in the hose collapsing during high engine rpm.*

(8) Install engine fan and hub assembly and tighten retaining bolts to specified torque.
(9) If equipped with a viscous fan, install shroud and fan assembly at same time.
(10) Install alternator drive belt and tighten to specified tension.
(11) Connect upper radiator hose to radiator.
(12) Connect battery negative cable.
(13) Fill cooling system with a 50 percent Jeep All-Season Coolant and 50 percent water mixture. Operate engine with heater control valve open until thermostat opens. Shut off engine and recheck coolant level.

Radiator Maintenance

The radiator should be free from any obstruction to airflow. This includes bugs, leaves, mud, emblems, flags, improperly mounted license plates, or collision damage.

NOTE: *Dirt may be removed by blowing shop air from the engine side of the radiator through the fins.*

Several problems may affect the ability of the radiator to perform properly:
- Bent or damaged tube.
- Corrosive deposits restricting coolant flow.
- Tubes blocked due to improper soldering.

Damaged tubes which affect proper operation must be repaired. Leaks can be detected by applying 3 to 5 psi air pressure to the radiator while it is submerged in water. Tubes should be repaired with solder.

A clogged radiator can be restored by reverse flushing or by solvent cleaning.

Solvent Cleaning

In some cases, installing a radiator cleaner (AMC Radiator Kleen, part number 8990397) prior to flushing will soften scale and deposits and reinforce the flushing operation.

CAUTION: *Be sure to follow directions on container.*

Reverse Flushing Radiator

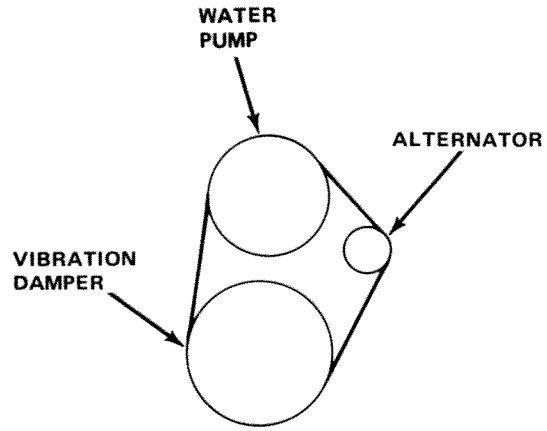
CAUTION: *The cooling system normally operates at 12 to 15 psi pressure. Exceeding this pressure may damage the radiator, heater core, or hoses.*

(1) Disconnect radiator.
(2) Attach a piece of radiator hose to radiator bottom outlet and insert flushing gun.
(3) Connect water supply hose and air supply line to flushing gun.
(4) Allow radiator to fill with water.
(5) When radiator is filled, apply air in short blasts, allowing radiator to refill between blasts.

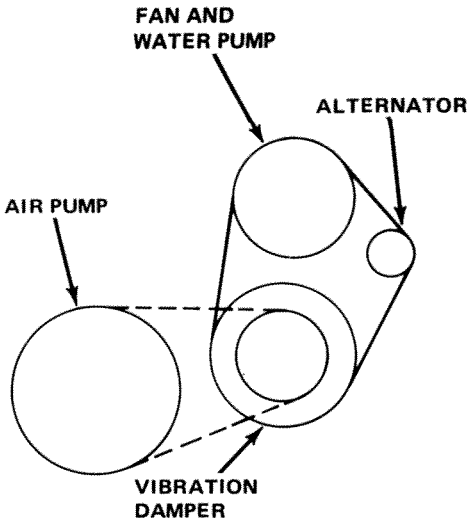
Continue this reverse flushing until clean water flows through top hose. If flushing fails to clear radiator passage, the radiator will have to be cleaned more extensively by a radiator repair shop.

Engine Flushing

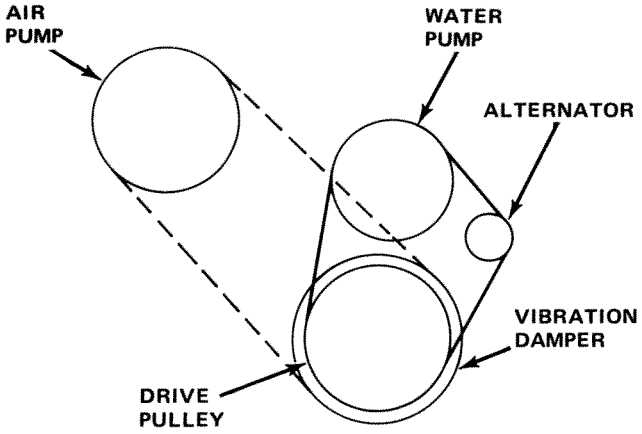
(1) Remove thermostat and reinstall thermostat housing.
(2) Attach flushing gun to upper radiator hose.
(3) Attach leadaway hose to water pump inlet.
(4) Connect water supply hose and air supply line to flushing gun.
(5) Allow engine to fill with water.
(6) When engine is filled, apply air in short blasts, allowing system to fill between air blasts. Continue until clean water flows through leadaway hose.
(7) Install thermostat.



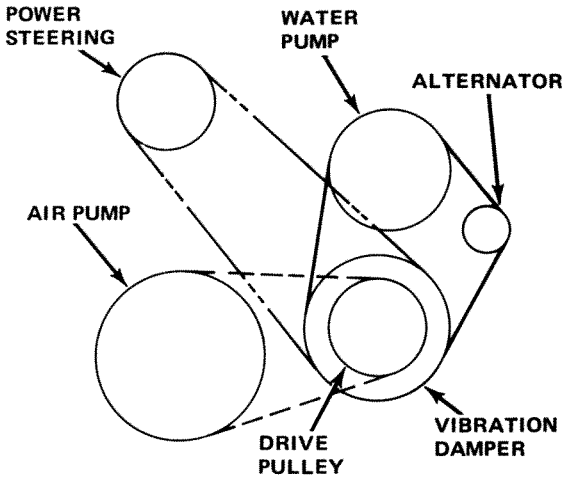
BELT ARRANGEMENT - CJ SIX-CYLINDER - WO/AGE, WO/PS, WO/AC



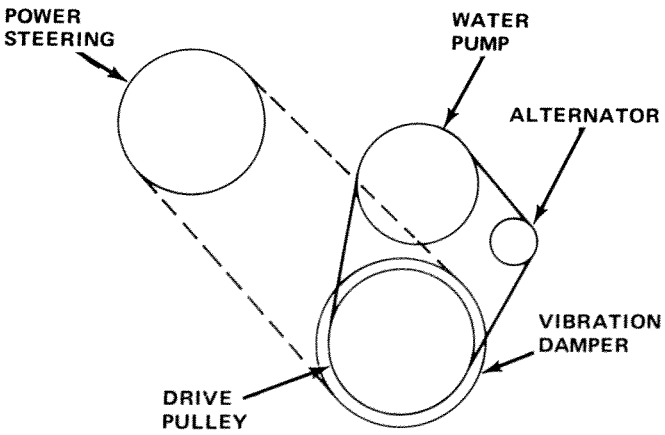
BELT ARRANGEMENT - CHEROKEE AND TRUCK SIX-CYLINDER - W/AGE (WO/PS, WO/AC)



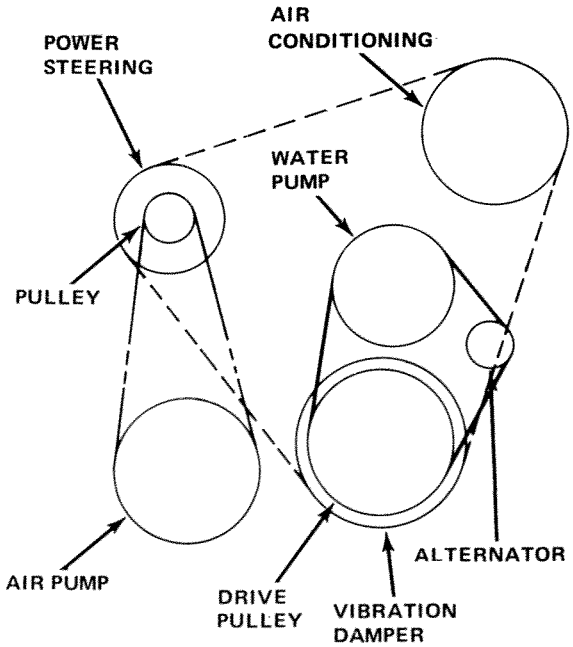
BELT ARRANGEMENT - CHEROKEE AND TRUCK SIX-CYLINDER - W/AGE (WO/PS, WO/AC)



BELT ARRANGEMENT - CHEROKEE AND TRUCK- SIX-CYLINDER - W/PS, W/AGE, (WO/AC)

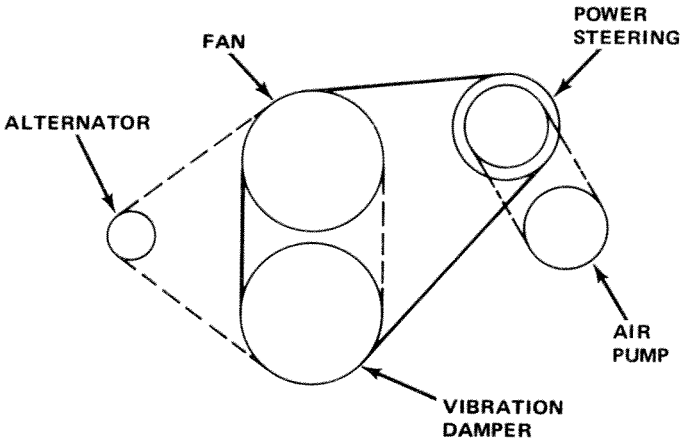


BELT ARRANGEMENT - CJ SIX-CYLINDER - W/PS, (WO/AGE, WO/AC)

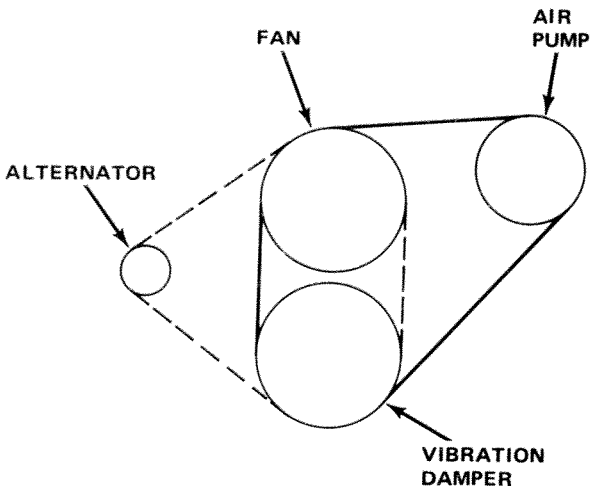


BELT ARRANGEMENT - CHEROKEE AND TRUCK SIX-CYLINDER - W/PS, W/AC, W/AGE J42418

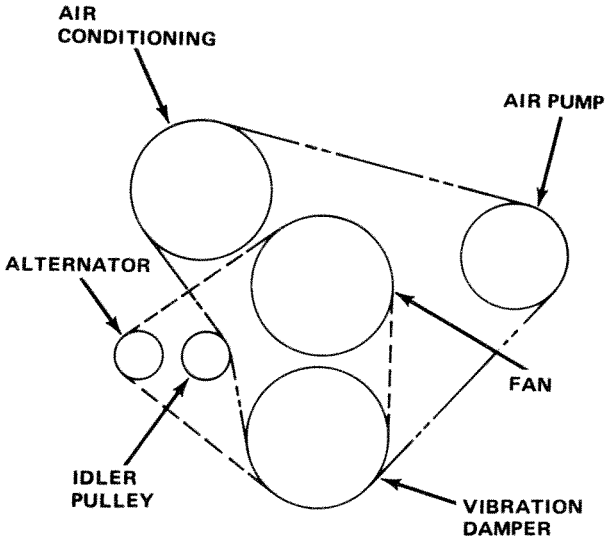
Fig. 2-18 Drive Belt Arrangement - Six-Cylinder Engines



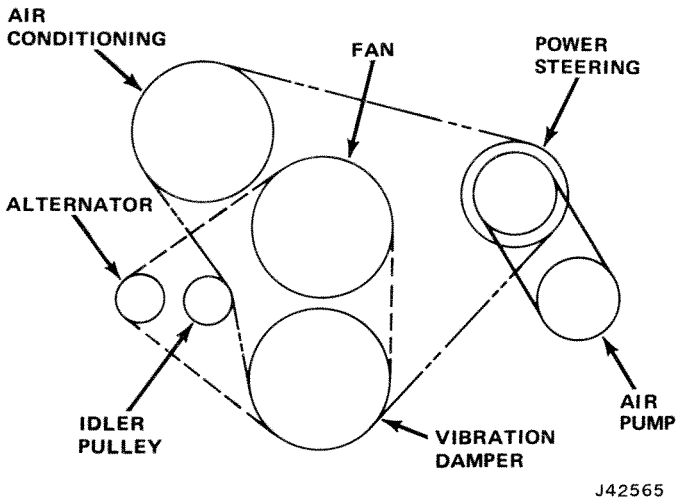
BELT ARRANGEMENT - CHEROKEE, WAGONEER, AND TRUCK V8 - WITH STD. COOLING, H.D. COOLING - W/AGE W/PS, (W)/AC)



BELT ARRANGEMENT - ALL V8 - WITH STD. COOLING AND WITH H.D. COOLING - W/AGE (WO/PS, WO/AC)



BELT ARRANGEMENT - CHEROKEE, WAGONEER, AND TRUCK V8 - WITH H.D. COOLING - W/AC, W/AGE (WO/PS)



BELT ARRANGEMENT - CHEROKEE, WAGONEER, AND TRUCK V8 - WITH H.D. COOLING W/AC, W/AGE, W/PS

Fig. 2-19 Drive Belt Arrangement - V-8 Engines

(8) Connect radiator hoses.
(9) Refill cooling system.

OIL COOLER

An oil cooler is incorporated in the lower tank of the radiator on all vehicles equipped with an automatic transmission. Hot oil from the transmission is pumped through the cooler where the heat transfers to the coolant in the radiator. Two lines connect the transmission to the lower radiator tank.

Should a leak in the oil cooler occur, it can be detected by the presence of oil in the coolant. If oil appears in the coolant, check the oil level of the automatic transmission. If the oil level is low, check the oil cooler for leaks as follows:

(1) Remove transmission-to-cooler lines at radiator.
(2) Plug one fitting.
(3) Remove radiator cap and fill radiator so bubbles can be seen.
(4) Apply shop line air pressure (50 to 200 psi) to other fitting.

Bubbles in coolant at filler neck indicate a leak in oil cooler. Should a leak in oil cooler occur, radiator must be removed and repaired.

NOTE: *Because of high pressure oil cooler may be subjected to, soldering is not allowed for oil cooler repair.* **All repairs must be silvered soldered or brazed.**

Bleeding Air from System

It may be necessary to bleed trapped air from the cooling system. Trapped air will hamper or stop coolant flow or cause burping of engine coolant out of radiator.

Bleed air by operating the engine with a properly filled cooling system with the radiator cap off until coolant has completely circulated throughout the engine, or until normal operating temperature is reached. The heater temperature control must be in the full HEAT position.

Replenish coolant level, if necessary, and reinstall radiator cap.

COOLING SYSTEM COMPONENTS APPLICATION CHART

Models									Engines						Cooling System			Radiator Specifications					Fan				Shroud
																		Core Size (Inches)			① Fins per Inch	Rows of Tubes					
14	15	16	17	25	45	46	83	84	232	258	304	360-2V	360-4V	401	Std.	H. Duty	A/C	Width	Thick-ness	Height			Vis-cous	No. of Blades	Fan Diam. (Inches)	Fan Spacer Thick-ness (Inches)	
•	•	•	•	•	•	•						•			•			26.05	1.50	15.88	13	2	No	4	19.00	1.00	No
•	•	•	•	•	•								•		•			26.05	1.50	15.88	13	2	Yes	7	19.50		No
•	•	•	•	•	•	•								•	•			26.05	1.50	15.88	13	2	Yes	7	19.50		No
•	•	•	•	•	•	•						•				•	•	26.05	2.25	15.88	15	3	Yes	7	19.50		Yes
•	•	•	•	•	•								•			•	•	26.05	2.25	15.88	15	3	Yes	7	19.50		Yes
•	•	•	•	•	•	•								•		•	•	26.05	2.25	15.88	15	3	Yes	7	19.50		Yes
		•	•	•	•					•					•			24.42	1.27	16.58	13	2	No	4	15.62	1.77	No
		•	•	•	•					•						•	•	24.34	1.95	16.33	13	3	No	7	15.62	1.13	Yes
							•	•			•				•			24.34	1.25	15.60	15	2	No	4	19.00	1.88	No
							•	•	•	•					•			24.34	1.25	15.60	9	2	No	4	15.62	1.00	No
							•	•			•					•		24.34	1.94	15.60	15	3	Yes	7	19.50		Yes
							•	•	•	•						•		24.34	1.25	15.60	9	2	No	7	15.62	1.00	No

J41010

ENGINE DRIVE BELT TENSION SPECIFICATIONS

	Initial Pounds New Belt	Reset Pounds Used Belt
Air Conditioner		
Six-Cylinder	125-155	90-115
V-8	125-155	105-130
Air Pump		
All except six-cylinder w/AC	125-155	90-115
Six-cylinder w/AC (1/4 inch belt)	40-50	35-45
Fan	125-155	90-115
Idler Pulley	125-155	90-115
Power Steering Pump	125-155	90-115

J42421

TORQUE SPECIFICATIONS

Component	Set-To	In-Use
Accessory Drive Pulley Screws (Six-Cylinder)	18	12-25
Alternator Adjusting Bolt	18	15-20
Alternator Mounting Bracket Bolt to Engine	28	23-30
Alternator Pivot Bolt or Nut	28	20-35
Alternator Pivot Mounting Bolt to Head	33	30-35
Crankshaft Pulley to Damper Screw	23	18-28
Fan Blades and Pulley to Hub Screw	18	12-25
Oil Cooler Line Flared Fitting Nuts	25	15-30
Oil Cooler Line Radiator Fitting	15	10-30
Thermostat Housing	13	10-18
Water Pump to Front Block Screws (Six-Cylinder)	13	9-18
Water Pump to Front Cover Screws (V-8)	48 in-lb.	40-55 in-lb.

J42422

COOLING SYSTEM SPECIFICATIONS

	Six-Cylinder	V-8
Radiator Cap		
Relief Pressure	15 psi	15 psi
Thermostat		
Rating	205°F	195°F
Must be open 0.003 inch	+3° of 205°F	+3° of 195°F
Fully open	228°F	218°F
Water Pump		
Type	Centrifugal	Centrifugal
Drive	V-Belt	V-Belt
Radiator		
Type	Tube & Fin	Tube & Fin
Cooling System Capacities (Includes 1 quart for heater)		
232 and 258 CID Engines	10.5 qts. U.S. 8.7 qts. Imp.	
304 CID Engine		13.0 qts. U.S. 11.6 qts. Imp.
360 and 401 CID Engines		14.0 qts. U.S. 10.8 qts. Imp.
Fan		
Number of blades	Refer to Cooling System Component Chart	
Diameter	Refer to Cooling System Component Chart	
Drive Belt		
Angle of V	38°	38°
Width — top of groove	0.391-0.453	0.391-0.453
Type (plain or cogged)	plain	plain