COOLING SYSTEM

GENERAL

The cooling system regulates the engine operating temperature by allowing the engine to reach normal operating temperature as quickly as possible, maintaining normal operating temperature, and preventing overheating (fig. 2-1 and 2-2). The cooling system also provides a means to heat the passenger compartment and to cool the automatic transmission fluid.

The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the engine and heater core.

The **coolant** is a mixture of low mineral content water and ethylene glycol based antifreeze. The antifreeze lowers the freezing point of the solution to prevent engine damage from freezing. The antifreeze also raises the boiling point to increase efficiency of coolant flow, reduce coolant loss from high heat, and minimize the possibility of cavitation damage.

Cavitation is the formation of a partial vacuum in a liquid caused by a swiftly moving solid body (impeller). The vacuum reduces the boiling point of the liquid and allows vapor bubbles to form, which burst when contacting a hard surface. If enough bubbles do this in a localized area, metal can be eroded and leakage can occur.

A centrifugal **water pump** driven by a V-type drive belt circulates the coolant through the water jackets, passages, and hoses of the system. The drive belt is

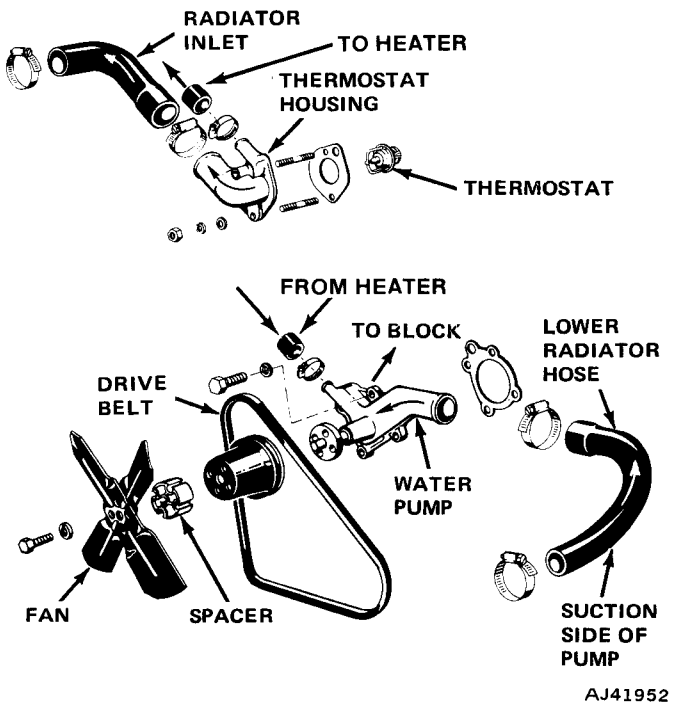


Fig. 2-1 Six-Cylinder Cooling System

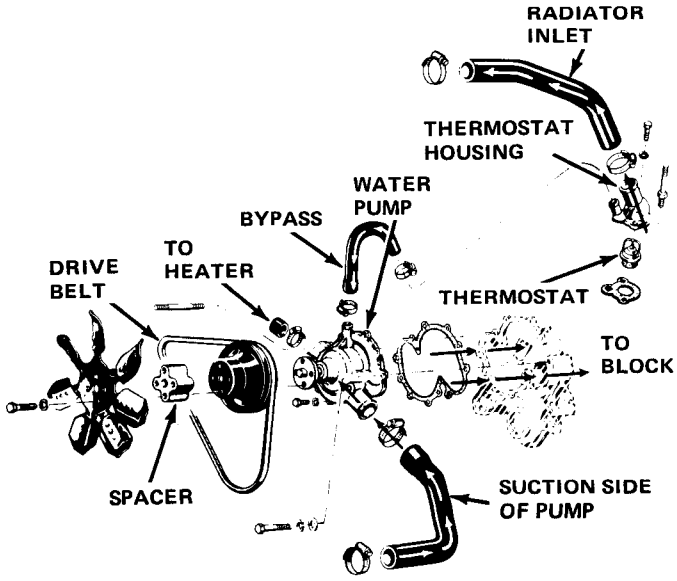


Fig. 2-2 V-8 Cooling System

driven by the vibration damper pulley, as are the belts for the other engine driven accessories (refer to Drive Belt Arrangement diagrams at the end of this section). The steel water pump impeller is pressed on the rear of the shaft which rides in a bushing pressed into the cast iron housing. The housing has a small hole to allow escape of any seepage that may occur. The water pump seals are lubricated by antifreeze; the bearings are sealed and no additional lubrication is necessary.

Rubber **hoses** route coolant to the heater core and radiator. On vehicles with V-8 engines, the heater core return hose is routed through a bracket attached to the carburetor choke housing.

The lower radiator hose on all models is spring reinforced to prevent collapsing caused by suction at the water pump inlet.

NOTE: *Coolant Temperature Override (CTO) switches are installed in the cooling system to control vacuum for emission control equipment. (Refer to Section 4A—Emission Control for description and operation.)*

A pellet-type **thermostat** controls operating temperature of the coolant by controlling coolant flow to the radiator. The temperature-sensitive pellet keeps the water control valve closed below 195°F, causing coolant to be recirculated within the engine, or open above 195°F to allow coolant flow to the radiator. This provides quick warmup and overall temperature control. Stamped on the thermostat are the words UP and TO RAD to indicate the proper installed position. The same thermostat is used winter and summer. Engines should not be operated without a thermostat (except for servicing or testing). Operating without a thermostat causes longer engine warmup time, poor warmup performance, and slower heater warmup.

With the thermostat open, coolant flows into a fin and tube type **radiator**. The radiator is composed of a top and bottom tank soldered to the cooling tubes. On the upper tank is the filler neck which has an overflow tube that routes overboil to the road. The bottom tank contains an **oil cooler** on vehicles equipped with automatic transmissions. The radiator has a drain cock in the lower tank to permit draining of the radiator.

Some radiators have a plastic **shroud** attached to funnel air more directly through the radiator for improved cooling.

Fitted to the radiator filler neck is a **radiator pressure cap** consisting of a pressure valve and a vacuum valve. The cap performs several functions:

- Prevents coolant loss when vehicle is in motion.
- Keeps impurities and air out of the system to minimize corrosion.
- Allows atmospheric pressure to enter the system and equalize. during cool down when a cooling system vacuum occurs.
- Seals the cooling system up to 15 psi pressure, which raises the coolant boiling point approximately 2-1/2°F per pound of pressure.

The **Tempatrol** fan drive is a torque and temperature-sensitive clutch unit which automatically increases or decreases fan speed to provide adequate cooling (fig. 2-3). It is used with heavy-duty or air conditioning cooling systems.

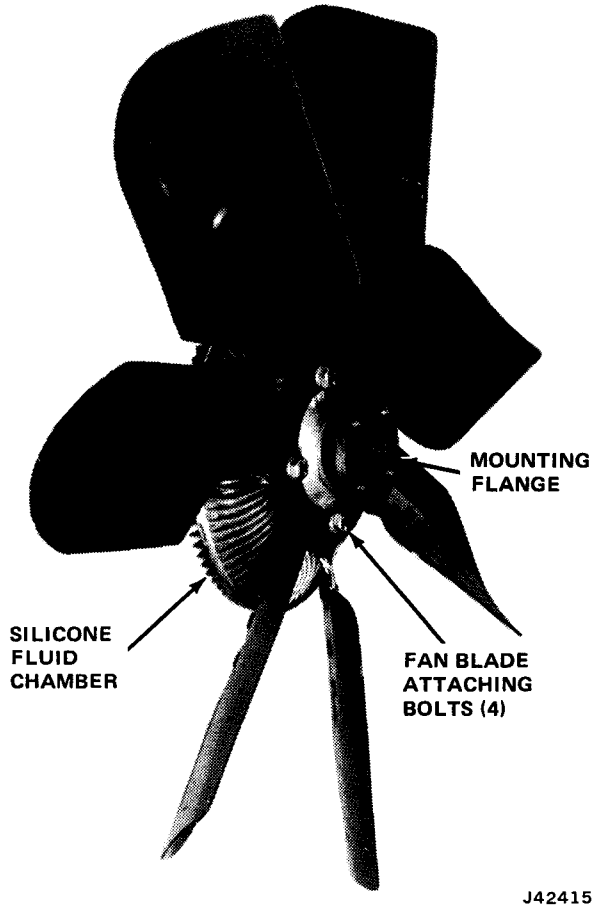


Fig. 2-3 Tempatrol Viscous Fan

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.

The **temperature gauge** is an electrical instrument that indicates coolant temperature. It responds to electrical resistance changes of the sending unit, which is

installed in the intake manifold of V-8 engines, and the cylinder head of six-cylinder engines (refer to Section 3—Electrical).

A factory-installed engine cylinder **block heater** is optional. It consists of a 600W, 120V heater element fitted into a core plug hole in the block, and a power cord and nylon straps which are placed in the glove box for later installation.

OPERATION

With engine running, the belt driven water pump circulates coolant throughout the system. On six-cylinder engines coolant is forced directly into the cylinder block through the water jackets surrounding the cylinders. It travels up through passages in the head gasket and cylinder head, around the combustion chambers and valves, and forward to the front of the cylinder head. Below 195°F, the thermostat is closed and coolant flows through the bypass port in the cylinder head, down through the block and back to the water pump where it is recirculated. A bypass port in the head allows coolant flow to the heater core.

On V-8 engines coolant is forced from the center of the engine timing case cover to each side outlet into each bank of the cylinder block. It flows in the water jackets around all cylinders and up through holes in the block and head gaskets into the cylinder heads to cool the combustion chambers and valves. Coolant then flows through each head to passages at the front of the head and then into the intake manifold to the thermostat. In the right head, coolant is also forced into the intake manifold at the rear corner and out to the heater core, through the heater core, and back to the water pump where it is recirculated.

Below 195°F the thermostat is closed and coolant flows out the bypass port through the hose to the water pump, where it is recirculated.

On all engines the recirculation cycle continues until coolant temperature reaches 195°F and the thermostat begins to open. Coolant then flows to the radiator upper tank, down through the cooling tubes, and into the bottom tank. The radiator fan and vehicle motion cause air to flow past the cooling fins, removing heat from the coolant. As the coolant flows through the lower tank, it passes the automatic transmission oil cooler (if equipped) and cools the automatic transmission fluid. Coolant is then pushed through the lower radiator hose into the water pump inlet to restart the cycle.

The thermostat continues to open allowing more coolant flow to the radiator until it reaches maximum open position (219°F (±3°)).

The heat causes system pressure to rise, which raises the boiling point of the coolant. The pressure cap maintains pressure between 13.9 and 18 psi. Above 15 psi the relief valve in the cap allows pressurized coolant to vent through the filler neck overflow tube to the road (fig. 2-4).

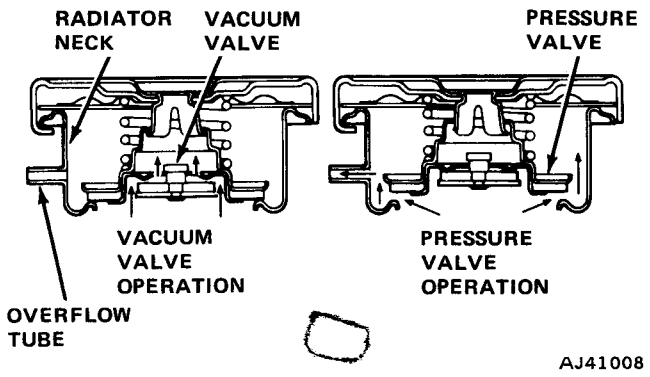


Fig. 2-4 Radiator Cap Operation

Immediately after engine shutdown, temperature rises during heat soak. In some cases, particularly after a hard run, or if coolant level is too high, some coolant may be pushed out the overflow tube. Unless overflow occurs frequently, IT IS NORMAL.

As engine temperature drops, the hot coolant contracts and forms a partial vacuum in the system. The radiator cap vacuum valve allows atmospheric pressure to enter the system where there is a 0.6 psi differential.

During operation, the coolant temperature is monitored by the temperature sending unit. The sending unit electrical resistance varies as temperature changes, which allows the temperature gauge to read accordingly (refer to Section 3—Electrical).

The sender responds to temperature changes, so under high load or on hot days, the coolant will be hotter and the gauge will indicate higher temperatures. Unless the gauge needle is past the high end of the band or coolant loss occurs, THIS IS NORMAL.

COOLING SYSTEM DIAGNOSIS

If the cooling system requires frequent addition of coolant in order to maintain the proper level, check all units and connections in the cooling system for evidence of leakage. Inspection should be made with cooling system cold. Small leaks, which may show up as dampness or dripping, can easily escape detection

when the engine is hot due to the rapid evaporation of coolant. Telltale stains of a grayish white or rusty color, or dye stains from antifreeze, at joints in the cooling system, are almost a sure sign of small leaks, even though there appears to be no damage.

Air may be drawn into the cooling system through leakage at the water pump seal. Combustion gas may be forced into the cooling system through a leak at the cylinder head gasket even though the passage is too small to allow water to enter the combustion chamber.

Cooling System 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

Cooling System Service Diagnosis (Continued)

Condition	Possible Cause	Correction
HIGH TEMPERATURE INDICATION—OVERHEATING (Continued)	(19) Excessive engine friction	(19) Repair engine
	(20) Vehicle working beyond cooling system capacity	(20) Install heavy-duty cooling or use special-duty vehicle
	(21) Antifreeze concentration over 68%	(21) Lower antifreeze content
LOW TEMPERATURE INDICATION—UNDERCOOLING	(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

Cooling System 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

COOLING SYSTEM TESTS

Water Pump

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.
(4) Bend a stiff clothes hanger or welding rod as shown in figure 2-5.
(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.

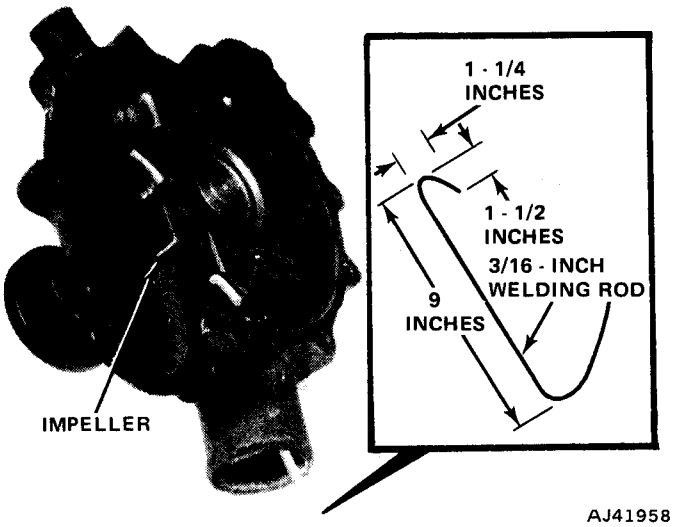


Fig. 2-5 Checking Water Pump for Loose Impeller

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

(1) Remove thermostat.

(2) Insert 0.003-inch feeler gauge, with wire or string attached, between valve and seat (fig. 2-6).

(3) Submerge thermostat in a container of antifreeze and water solution, suspended 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 be open 0.003 inch at 192°F to 199°F. It must be fully open a minimum of 0.360 inch at 219°F (±3°F).

(7) Install thermostat.

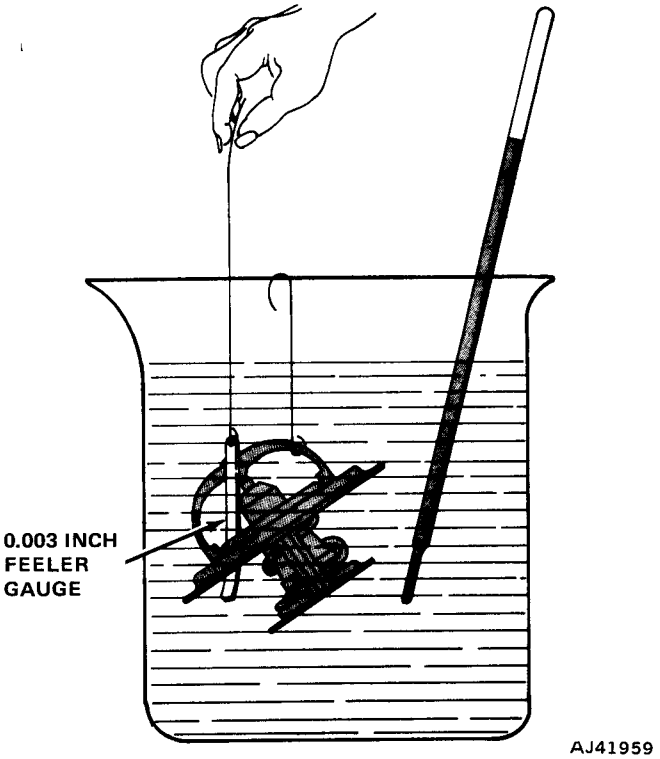


Fig. 2-6 Testing Thermostat

Radiator Cap

(1) Remove cap from radiator.

(2) Make sure seating surfaces are clean.

(3) Wet rubber gasket with water and install cap on tester (fig. 2-7).

(4) Operate tester pump and observe needle at its highest point. Cap release pressure should be 13.9 to 18 pounds.

NOTE: *Cap is okay when pressure holds steady or holds within the 13.9 to 18 pound range for 30 seconds or more. If needle drops quickly, replace cap.*

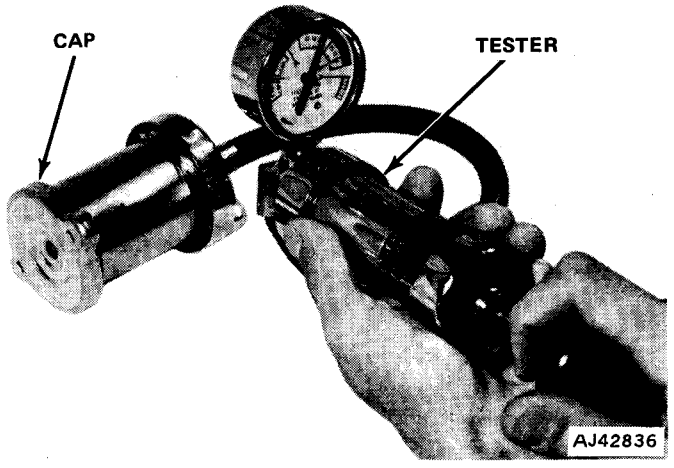


Fig. 2-7 Radiator Pressure Cap Test

Cooling System Pressure Test

NOTE: *Engine must be at normal operating temperature.*

(1) Carefully remove radiator pressure cap from filler neck and check coolant level.

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

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

(4) Inspect 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.

(5) Attach pressure tester to filler neck (fig. 2-8). DO NOT FORCE.

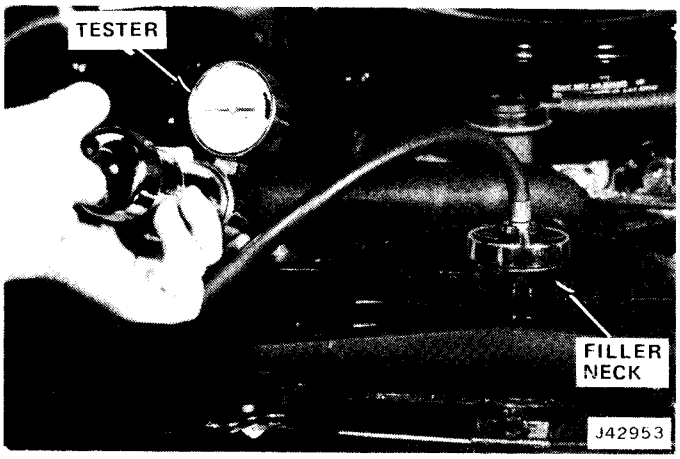


Fig. 2-8 Cooling System Pressure Test

(6) Operate tester pump to apply 15 psi pressure to system. If hoses swell excessively while testing, replace as necessary.

(7) Observe needle:

(a) **Holds Steady:** If needle holds steady for two minutes, there are no serious leaks in the system.

NOTE: *There may be an internal leak that does not show up under normal system pressure. If it is certain that coolant is being lost and no leaks can be found, check for internal leakage or proceed with Combustion Leakage Test (Without Pressure Tester).*

(b) **Drops Slowly:** Indicates presence of small leaks or seepage. Examine all points for seepage or slight leakage with a flashlight. Check radiator, hose, gaskets, and heater. Seal tiny leaks with AMC Sealer Lubricant, or equivalent. Repair leaks and recheck system.

(c) **Drops Quickly:** Indicates that serious leakage is present. Examine system for serious leaks. If none are visible, check for internal leakage.

NOTE: *Large radiator leaks should be repaired by a reputable radiator repair shop.*

Checking for Internal Leakage

(1) Remove oil pan drain plug and drain a small amount of oil (water, being heaviest, should drain first), or run engine to churn oil, then examine dipstick for water gobules.

(2) Check transmission dipstick for water globules.

(3) Check transmission oil cooler for leakage (refer to Oil Cooler Leakage).

(4) Run engine at normal operating temperature without pressure cap on radiator.

(5) Carefully attach Pressure Tester to filler neck. If pressure builds up quickly, a leak exists as a result of a faulty head gasket or crack. Repair as necessary.

CAUTION: *Do not allow pressure buildup over 18 psi. Release pressure by turning engine off and slowly removing tester. If tester does not have a safety catch, rock tester cap from side to side to release pressure.*

(6) If there is no immediate pressure increase, operate Pressure Tester until gauge reads within system range. Gauge hand vibration indicates compression or combustion leakage into cooling system.

Isolate compression leak by shorting each spark plug. Gauge hand should stop or decrease vibration when spark plug of leaking cylinder is shorted.

Combustion Leakage (Without Pressure Tester)

(1) Drain sufficient coolant to allow thermostat removal.

(2) Disconnect water pump drive belt.

(3) Six-Cylinder Engine: Disconnect upper radiator hose from thermostat housing, remove thermostat, and install thermostat housing to cylinder head.
V-8 Engine: Remove thermostat housing from intake manifold and remove thermostat.

(4) Add coolant to engine to bring level within 1/2 inch of top of thermostat housing or intake manifold.

(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.*

Oil Cooler Leakage

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

(1) Remove transmission-to-cooler lines at radiator.

(2) Plug one fitting in cooler.

(3) Remove radiator cap and fill radiator so bubbles can be seen.

(4) Apply shop line pressure (50 to 200 psi) to other fitting.

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

CAUTION: *Because of high oil pressure, conventional soldering must not be used for oil cooler repair.* **All repairs must be silvered soldered or brazed.**

Hose and Belt Inspection

Check hoses at regular intervals by squeezing. If a hose is cracked or feels brittle when squeezed, it should be replaced. If a hose swells excessively when under pressure, it should be replaced. Inspect V-belts frequently for defects such as extreme dryness, fraying, or cracking.

CAUTION: *Do not use any commercial belt dressing or oil-based lubricant on any drive belt. Do not dress the sides of any drive belt with a file or other abrasive. Each belt has 5 to 6 tensile members wrapped around it and, if these members are cut, the belt could fail.*

COOLANT

Maintain coolant level with a mixture of ethylene-glycol-based antifreeze and low mineral content water.

CAUTION: *Freeze protection should always be maintained to meet local requirements. Maximum protection is provided with a 68 percent concentration which prevents freezing to -90°F. A higher percentage will freeze at a higher point. For example, pure antifreeze freezes at -8°F. Antifreeze concentration MUST ALWAYS be at least 44 percent (-20°F freezing point), year-round and in all climates. If concentration is lower, engine parts can be eroded from a condition called cavitation.*

CAUTION: *Coolant additives which claim to improve engine cooling should not be used.*

Coolant level when cold should be 1-1/2 inches to 2 inches below the rear of the radiator filler neck sealing surface, and at normal operating temperature it should be 1/2 inch to 1 inch below this surface. If necessary to check level, idle engine for a few moments to cool it down. If engine is overheated and all coolant has not been lost, operate engine above curb idle speed for a few moments with hood up, then shut engine off and let it cool 15 minutes before removing cap.

WARNING: *Use extreme care when removing the cap from a hot radiator. If possible, wait until the engine has cooled, then wrap a thick cloth around the radiator cap and turn it slowly to the first stop. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, press down on the cap (with a cloth), turn, and remove it.*

Draining Coolant

Coolant is drained from the radiator by loosening the drain cock on the bottom tank.

Coolant is drained from the engine block by removing the drain plugs.

- Six-Cylinder—Two located on left side of block, which may be replaced by one or two CTW switches.
- V-8—Centrally located on each side of block.

WARNING: *Do not remove block drains with system under pressure or serious burns from coolant may occur.*

Refilling

Before refilling, install all drain plugs and tighten radiator drain cock. Add the proper mixture of coolant to meet local requirements for freeze protection.

CAUTION: *Antifreeze concentration MUST ALWAYS BE at least 44 percent (-20°F freezing point), year-round and in all climates. If concentration is lower, engine parts can be eroded from cavitation.*

Fill the radiator to the proper coolant level. the radiator cap.

After refilling the system or when air pockets are suspected, the cooling system should be bled of excess air.

Bleeding Air from System

Trapped air will hamper or stop coolant flow or cause "burping" of engine coolant out of the radiator.

Bleed air by operating the engine with a properly filled cooling system with the radiator cap off until coo-

lant has completely circulated throughout the engine, or until normal operating temperature is reached. The heater control must be in the HEAT position, and the heater temperature control must be in the full WARM or HIGH position.

Replenish coolant level, if necessary, and reinstall radiator cap. After coolant has reached normal operating temperature, shut engine off and replenish coolant level as necessary.

ADJUSTMENTS

Fan and Alternator Belt Adjustment

(1) Loosen alternator pivot mount bolt and alternator adjusting bolt.

(2) Adjust belt using pry bar on six-cylinder engines and 1-inch,open-end wrench on V-8 engines.Snug adjusting bolt (fig. 2-9 and 2-10).

(3) Check belt tension using Tension Gauge J-23600 (fig. 2-11).

(4) Tighten adjusting bolt to 18 foot-pounds torque and pivot bolt to 28 foot-pounds torque.

Alternator Belt Adjustment Six-Cylinder with Air Conditioning

(1) Loosen alternator lower adjusting bolt.
(2) Loosen alternator bracket adjusting bolt.
(3) Loosen alternator upper pivot bolt.

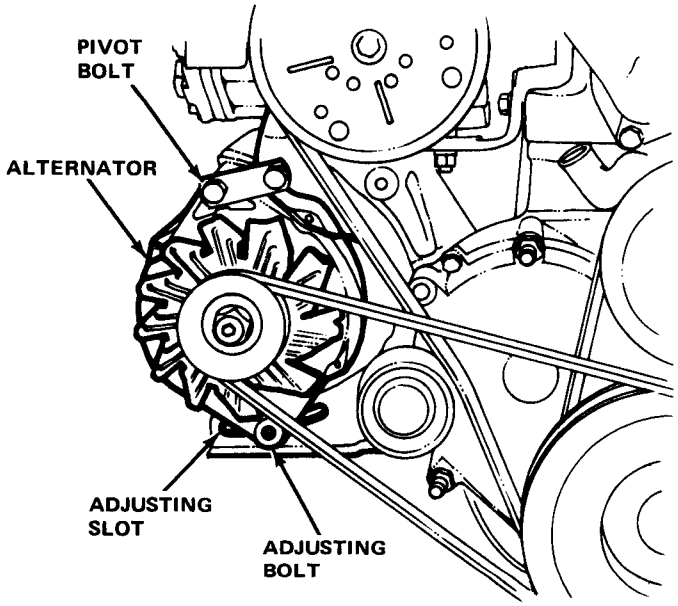


Fig. 2-9 Alternator Adjustment—Six-Cylinder

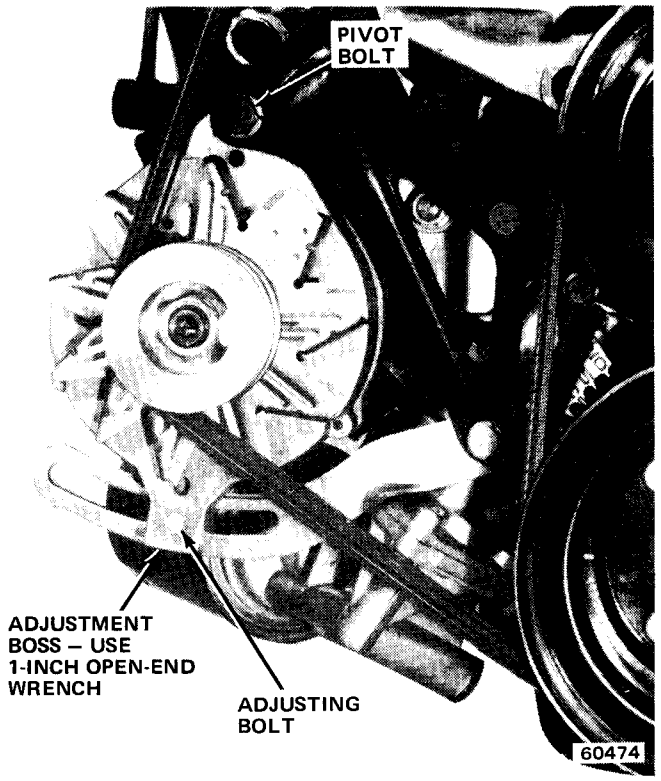


Fig. 2-10 Alternator Adjustment—V-8

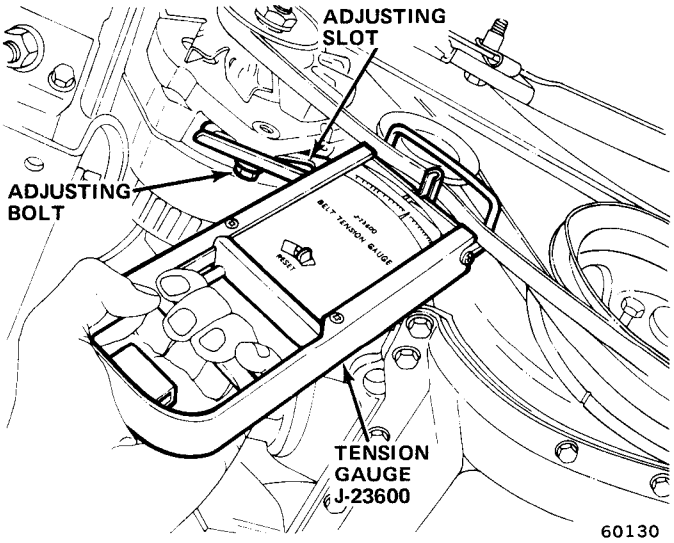


Fig. 2-11 Checking Drive Belt Tension—Typical

(4) Adjust alternator using a suitable pry bar. Snug adjust bolt (fig. 2-12).

(5) Check belt tension using Tension Gauge J-23600 (fig. 2-11). Correct if necessary.

(6) Tighten adjusting bolt to 18 foot-pounds torque, and tighten mounting bolts to 28 foot-pounds torque. If equipped with back idler, tighten to 33 foot-pounds torque.

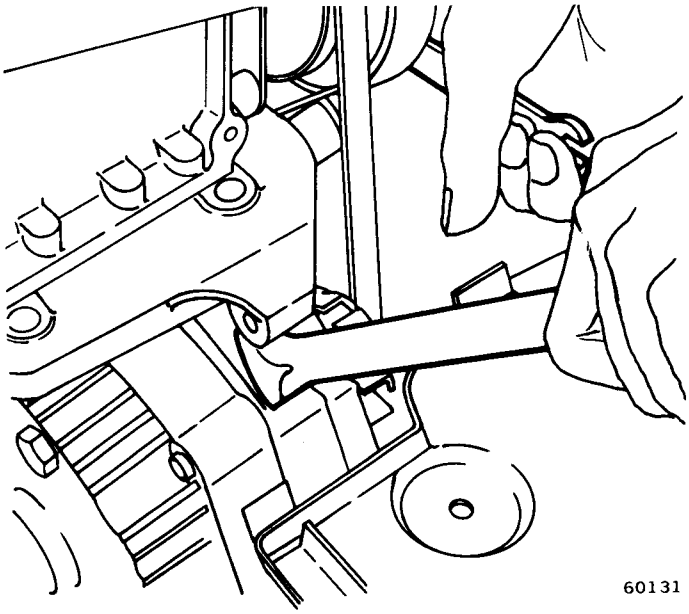


Fig. 2-12 Alternator Adjustment—Six-Cylinder with Air Conditioning

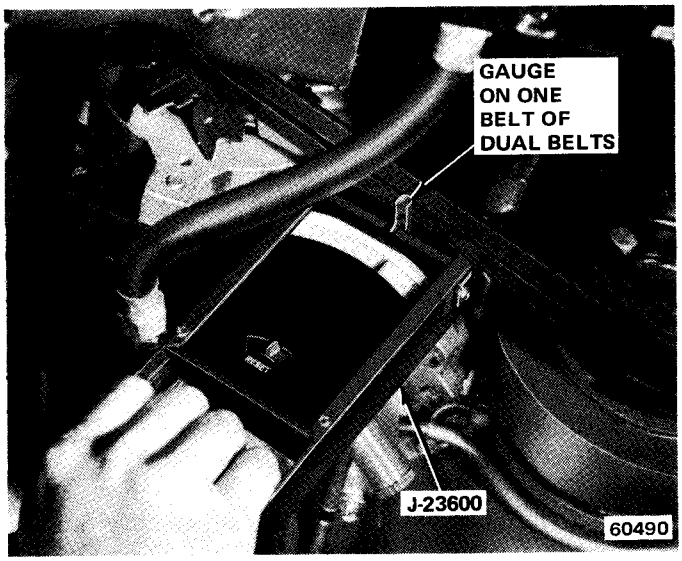


Fig. 2-13 Checking Drive Belt Tension—V-8 Engine with Air Conditioning

Belt Adjustment—V-8 Engine with Air Conditioning

V-8 engines equipped with air conditioning have a matched pair of belts to drive the alternator and AC compressor. The belts must be replaced together as a set; do not replace them individually. When checking belt tension, check one belt, not both, or incorrect indications will result (fig. 2-13).

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.

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.

WATER PUMP SERVICE

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

Removal—Six-Cylinder Engine

(1) Drain cooling system at radiator.

(2) Disconnect radiator and heater hoses from water pump.

(3) Loosen alternator adjustment strap screw, upper pivot bolt, 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.*

(4) Remove fan and hub assembly.

(5) Remove air conditioning intermediate idler pulley and mounting bracket (if equipped).

(6) Remove power steering pump front mounting bracket (if equipped).

(7) Remove water pump and gasket from engine.

(8) 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 13 foot-pounds torque.

(3) Install power steering pump front mounting bracket (if equipped).

(4) Install air conditioning intermediate idler pulley and mounting bracket (if equipped).

(5) Install alternator drive belt and tighten to specified tension.

(6) Connect radiator and heater hoses to water pump.

(7) Tighten air conditioning drive belt to specified tension.

(8) Fill radiator with a mixture of 50 percent Jeep All-Season Coolant (or equivalent) and 50 percent water. 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 allow removal 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 while removing nuts, preventing fan assembly from clearing water pump. If 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. 2-14).

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

(7) Remove alternator and mount bracket assembly and place aside. Do not disconnect wires.

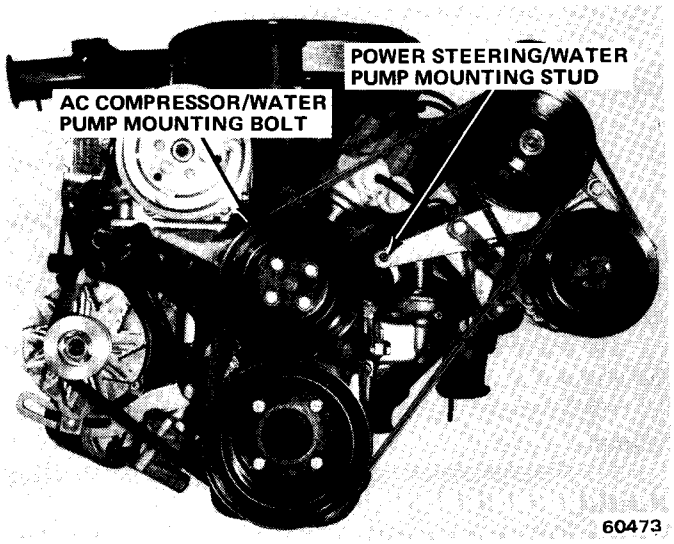


Fig. 2-14 Water Pump Mounting—V-8 Engine

(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. 2-14).
(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 case 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) Install air pump drive belt (if removed) 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 the 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 or equivalent and 50 percent water mixture. Operate engine with heater control valve open until thermostat opens. Shut off engine and recheck coolant level.

THERMOSTAT REPLACEMENT

When installing the thermostat, the pellet, which is encircled by a coil spring, should 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. 2-15). This prevents air from being trapped in the block which could cause a sudden burping over of the coolant when the thermostat opens.

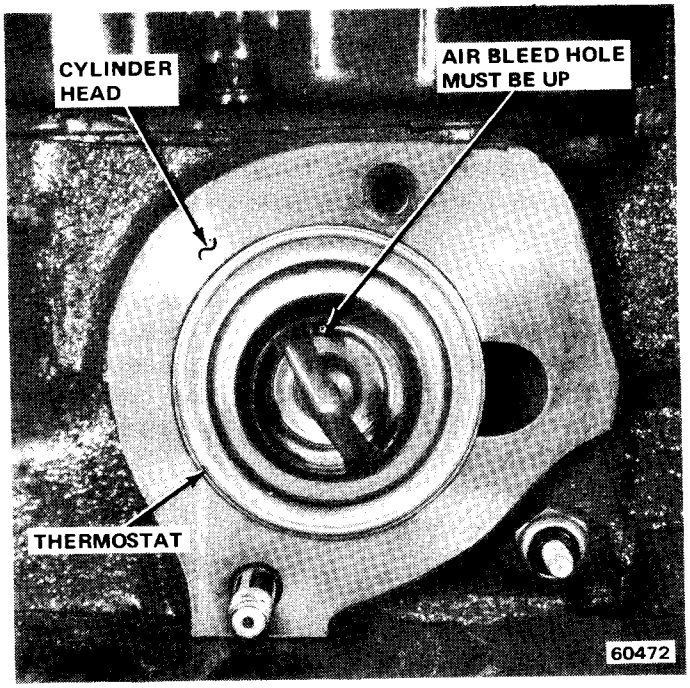


Fig. 2-15 Thermostat Installation—Six-Cylinder

Also during installation, observe the recess on the intake manifold (V-8) or cylinder head (six) and fit the thermostat in that groove (fig. 2-16 and 2-14). Then install the gasket and thermostat housing. Tightening the housing unevenly or with the thermostat out of its recess will result in a cracked housing. Tighten housing to 13 foot-pounds torque.

RADIATOR

Radiators are identified by Jeep part number and the vendor build code number embossed on the upper tank, or on some Cherokees, Wagoneers, or Trucks, the code is on the radiator right side support.

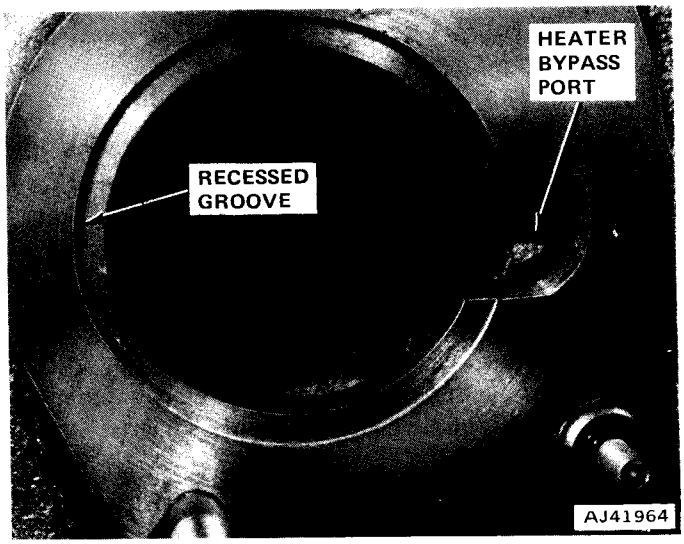


Fig. 2-16 Thermostat Recess—Six-Cylinder

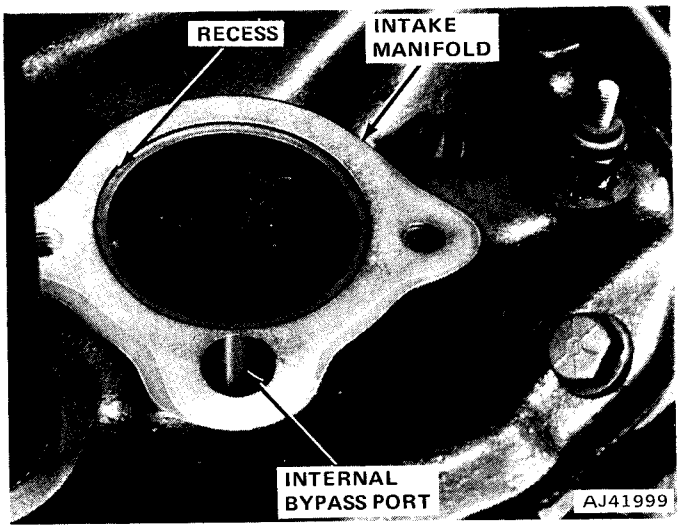
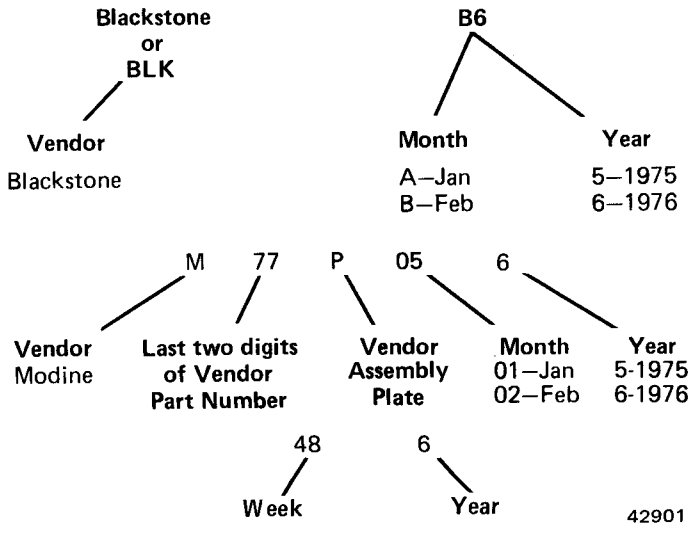


Fig. 2-17 Thermostat Recess—V-8

Radiator Identification



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

Several conditions may affect radiator operation:

- Bent or damaged tubes.
- 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 usually can be cleared by reverse flushing or by solvent cleaning.

Solvent Cleaning

Use of a radiator cleaner (AMC Radiator Kleen, or equivalent) prior to flushing will soften scale and deposits.

Reverse Flushing Radiator

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

(1) Disconnect radiator hoses.
(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 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.

Oil Cooler Repairs

Because of the high pressure in the oil cooler, conventional soldering will not repair leaks. **All repairs must be silver-soldered or brazed.**

FAN REPLACEMENT

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

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

CYLINDER BLOCK

Removing Coolant from Crankcase

Should coolant mix with engine oil, it will clog the oil lines and cause the pistons to seize. Severe damage to the engine will result. If coolant has leaked into the lubricating system, locate the cause for the coolant leak (such as a faulty head gasket or cracked block) and make the necessary repairs. After repairing the leak, use AMC Crankcase Cleaner, or equivalent, to flush engine.

Engine Flushing

(1) Remove thermostat housing and thermostat. Replace thermostat housing.
(2) Attach flushing gun to upper radiator hose at radiator end.
(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) Remove thermostat housing and install thermostat. Install thermostat housing. Tighten bolts to 13 foot-pounds torque.
(8) Connect radiator hoses.
(9) Refill cooling system.

Replacing Core Plugs

Prior to "hot tanking" or "block boiling," remove casting flash causing hot spots or coolant flow blockage. Remove core plugs with hammer, chisel, and prying tool. Apply a sealer to edges of new plug and install with hammer and suitable tool. Refer to the core plug size chart for location and size.

ENGINE BLOCK HEATER

On engines equipped with an engine block heater, the heating element plugs into any standard wall outlet. It heats the coolant which heats the engine parts to provide easier cold starting.

Installation

(1) Drain coolant from engine.
(2) Remove core plug and install block heater (fig. 2-18). Tighten six-cylinder T-bolt to 20 inch-pounds torque. Tighten V-8 compression nut to 10 foot-pounds torque.

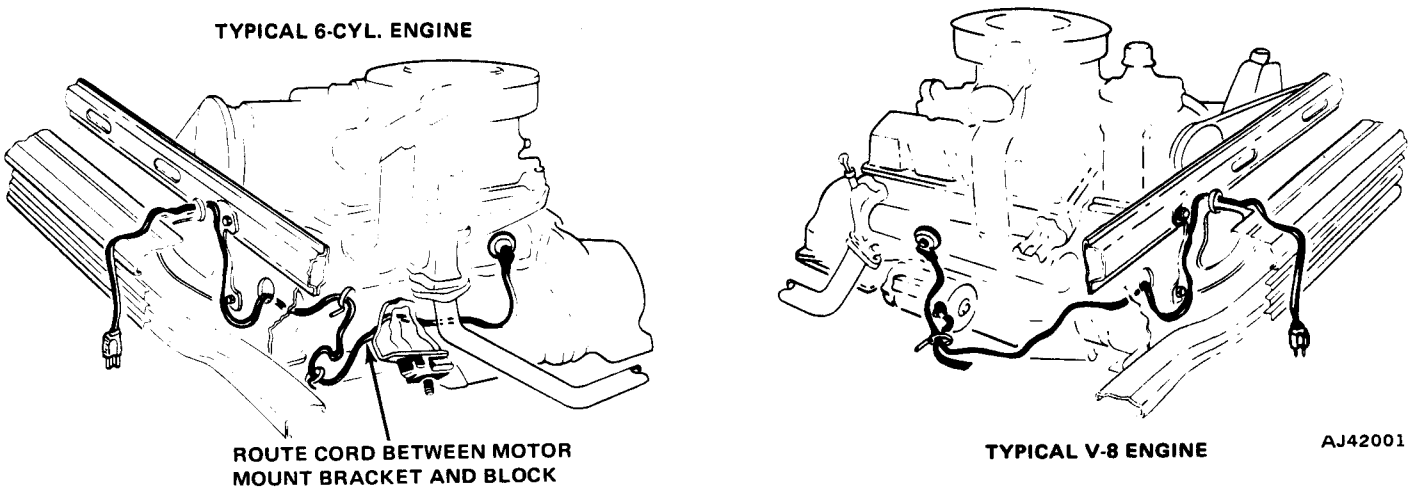


Fig. 2-18 Engine Block Heater Installation

CAUTION: *Be careful when tightening heater mounting bolt. Improper tightening may damage seal or allow heater to loosen, resulting in coolant loss and engine damage.*

(3) From front of vehicle, route heater (female) end of power cord through hole in front panel, along wire harness and connect to block heater.

(4) Using the furnished nylon straps, tie cord to wire harness and to inside of grille, and allow cord to extend outside of grille.

(5) Refill radiator with coolant.

Core Plug Sizes

Location	Diameter (inches)
Six-Cylinder Head – Left Side (3)	7/8
V8 Heads – Outer Sides (2 ea)	1
V8 Cylinder Block (3 ea side)	1 1/2
V8 Heads (1 ea end)	1 1/2
Six-Cylinder Block (3 on left side, 1 at rear)	2
Six-Cylinder Head (1 at rear)	2

60248

Torque Specifications

Service Set-To Torques should be used when assembling components.

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torques	Service In-Use Recheck Torques
Accessory Drive Pulley Screws (Six-Cylinder)	18	12-25
Air Conditioning Idler Pulley Bracket to Timing Case Cover Nut	7	4-9
Air Pump-to-Bracket Screws	20	15-22
Air Pump Bracket-to-Engine Screws	25	18-28
Air Pump Adjusting Strap to Pump	20	15-22
Alternator Adjusting Bolt	18	15-20
Alternator Mounting Bracket-to-Engine Bolt	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
Engine Block Heater Nut (V-8) Compression Type	10	8-13
Engine Block Heater Nut Six-Cylinder T-Bolt Type	20 in-lb	17-25 in-lb
Fan Blades and Pulley to Hub Screw	18	12-25
Idler Pulley Bearing Shaft to Bracket Nut	33	28-38
Idler Pulley Bracket to Front Cover Nut	7	4-9
Oil Cooler Line Flared Fitting Nuts	25	15-30

Torque Specifications (Continued)

	Service Set-To Torques	Service In-Use Recheck Torques
Oil Cooler Line Radiator Fitting	15	10-30
Power Steering Pump Adapter Screw	23	18-28
Power Steering Pump Bracket Screw	43	37-47
Power Steering Pump Mounting Screw	28	25-35
Power Steering Pump Pressure Line Nut	30	30-45
Power Steering Pump Pulley Nut	58	40-69
Thermostat Housing	13	10-18
Timing Case Cover to Block (V-8) (through Water Pump)	25	18-33
Water Pump-to-Block Screws (Six-Cylinder)	13	9-18
Water Pump to Engine Block (V-8)	25	18-33
Water Pump-to-Timing Case Cover Screws (V-8)	48 in-lb	40-55 in-lb

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

60250

Cooling System Specifications

	Six-Cylinder	V-8
Radiator Cap		
Relief Pressure	15 psi	15 psi
Thermostat		
Rating	195°F	195°F
Must be open 0.003 inch	+3° of 195°F	+3° of 195°F
Fully open	218°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 Engines		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

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Cooling System Components

Model	Package			Engine				Fan					Shroud
	Std	HD	AC	232 258	304	360(2V)	360(4V) 401	Dia. (Inches)	No. of Blades	Flex	Tempatrol	Spacer Thickness	
CJ	•			•				15.62	4			.52	
		•		•				19.00	7			.52	
	•				•			19.00	4			1.50	
		•			•			18.75	7	•		1.50	
Cherokee-Wagoneer-Truck	•			•				15.62	4			1.77	
		•		•				15.62	7			1.00	
			•	•				15.62	7			1.00	•
	•					•		19.00	4			1.77	
	•						•	19.50	7		•		
		•				•	•	19.50	7		•		
			•			•	•	19.50	7		•		•

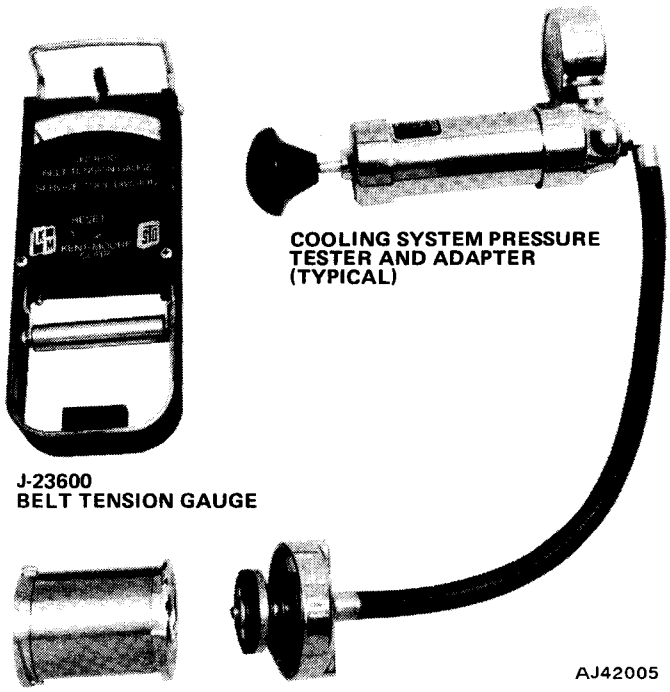
Note: All standard cooling package radiators have two rows of tubes. All other radiators have three rows of tubes. Refer to the parts catalog for application.

60571

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	90-115
Air Pump		
All except six-cylinder w/PS	125-155	90-115
Six-Cylinder w/PS (3/8-inch belt)	65-75	60-70
Fan	125-155	90-115
Power Steering Pump	125-155	90-115

60253



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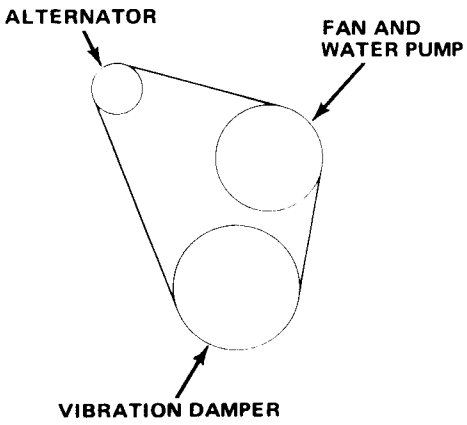
Special Tools

LEGEND

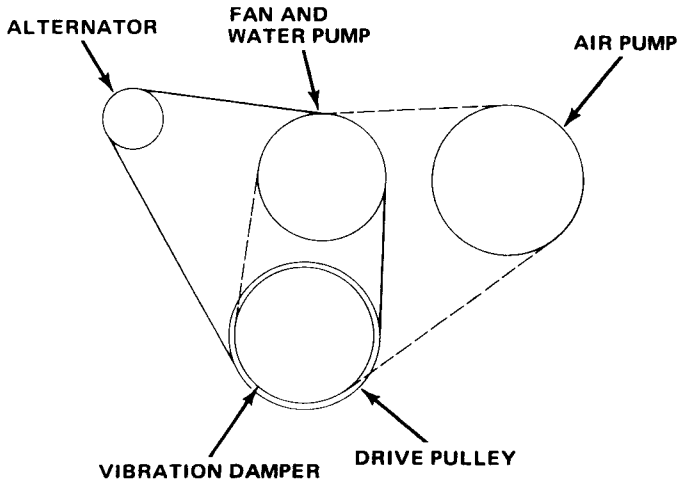
FRONT BELT _____

MIDDLE BELT _____ . _____ . _____

REAR BELT _ _ _ _ _ _ _ _ _



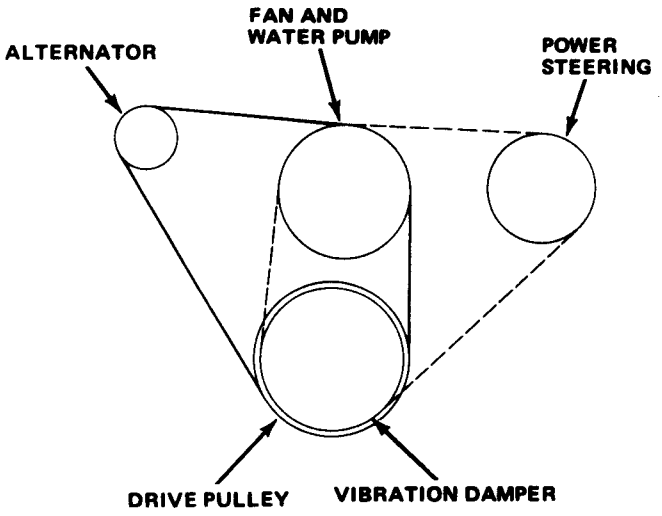
BASIC BELT ARRANGEMENT – SIX-CYLINDER ENGINE



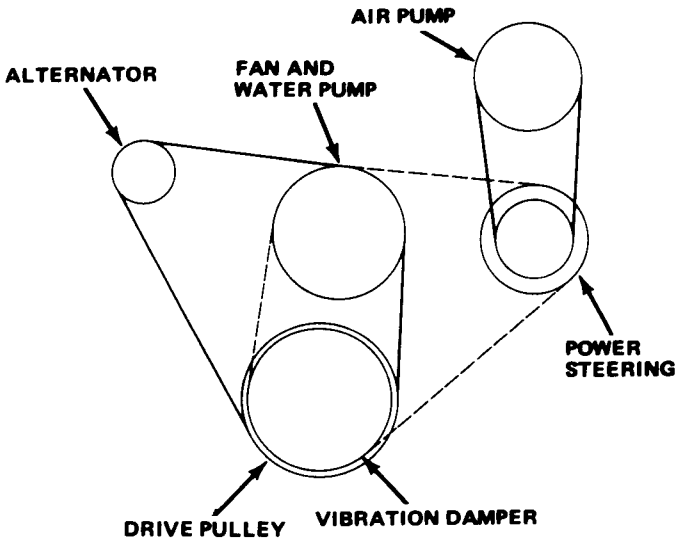
AIR GUARD – SIX-CYLINDER ENGINE

Drive Belt Arrangement (1 of 3)

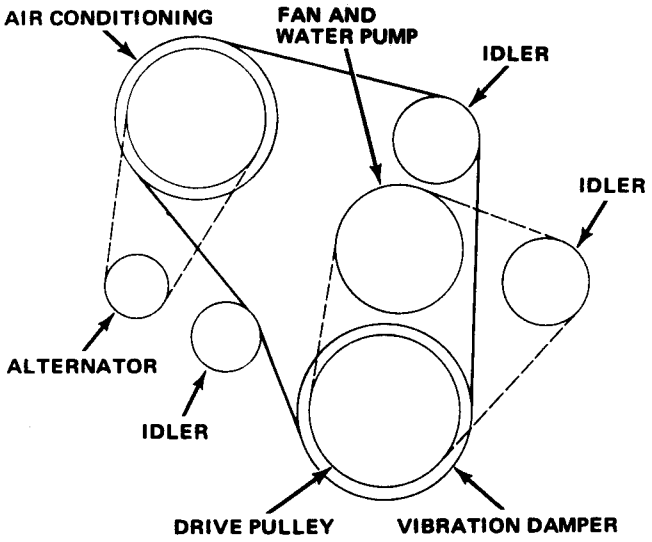
60254A



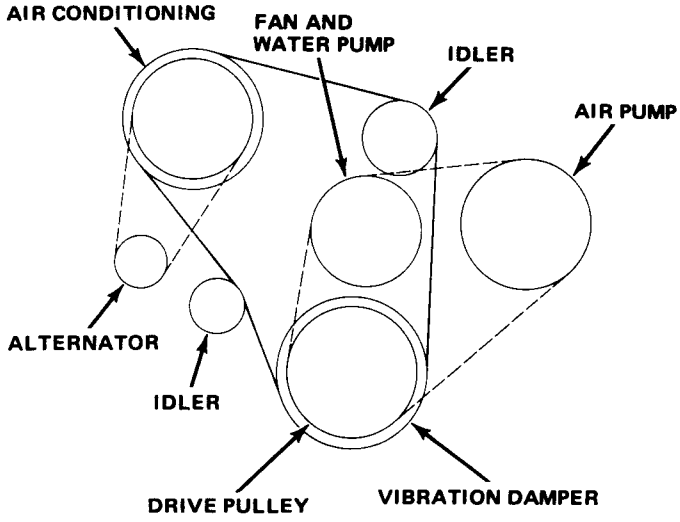
POWER STEERING – SIX-CYLINDER ENGINE



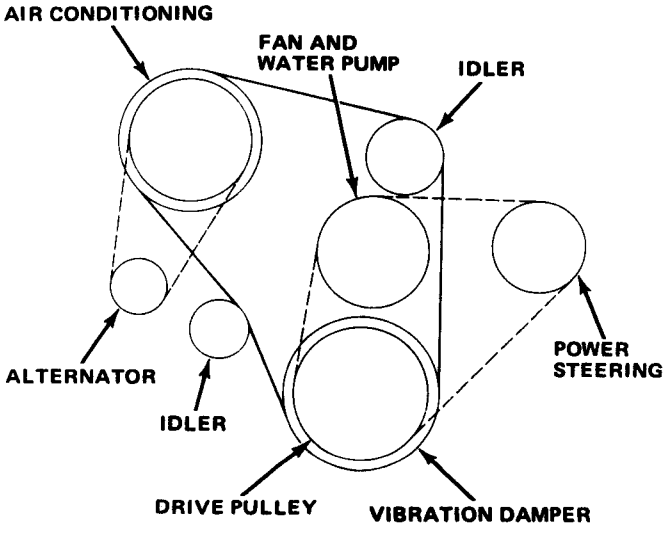
AIR GUARD AND POWER STEERING – SIX-CYLINDER ENGINE



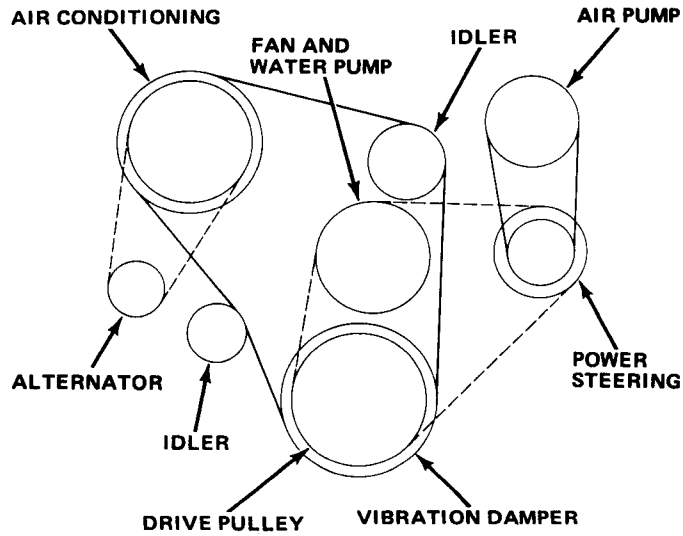
AIR CONDITIONING ONLY – SIX-CYLINDER ENGINE



AIR GUARD AND AIR CONDITIONING– SIX-CYLINDER ENGINE



POWER STEERING AND AIR CONDITIONING – SIX-CYLINDER ENGINE



AIR GUARD, POWER STEERING AND AIR CONDITIONING – SIX-CYLINDER ENGINE

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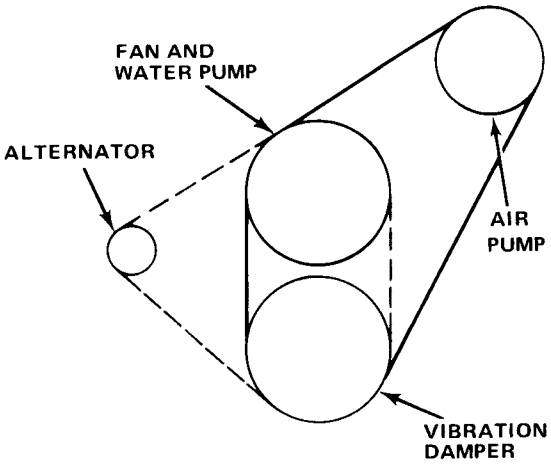
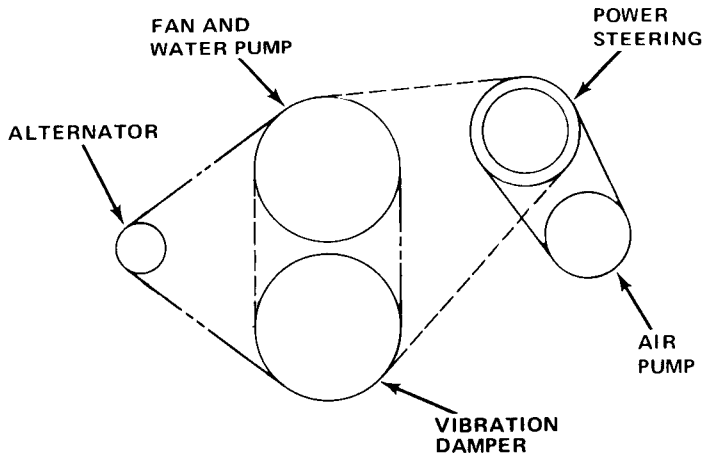
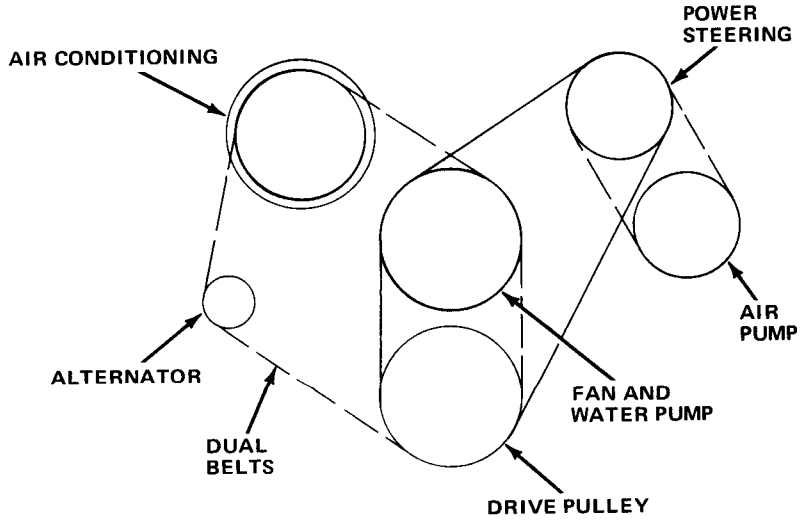
Drive Belt Arrangement (2 of 3)



BASIC BELT ARRANGEMENT WITH
AIR GUARD – V-8 ENGINE



AIR GUARD AND POWER
STEERING - V-8 ENGINE



AIR GUARD, AIR CONDITIONING, AND
POWER STEERING – V-8 ENGINE

60254C

Drive Belt Arrangement (3 of 3)

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.