

SECTION 6B

ENGINE COOLING

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GENERAL DESCRIPTION

The cooling system is used to maintain the engine and automatic transmission at a proper operating temperature. In cold weather, it is also used to supply heat for the interior of the vehicle.

The cooling system consists of the following:

- o Radiator with filler cap and drain cock
- o Heater core
- o Coolant reservoir
- o Water pump
- o Fans (electric and belt driven)
- o Automatic fan clutch*
- o Temperature switches and relays*
- o Thermostat housing with thermostat
- o Thermostat housing cap*
- o Belts and hoses

*Not used on all applications

When the cooling system components are operating properly, the system is able to maintain a proper operating temperature during all driving conditions.

The radiator is used to dissipate excess engine heat. The thermostat controls the amount of coolant flow through the system and the coolant reservoir stores expanded coolant when the engine is hot. See component description for a detailed explanation of function and operation.

RADIATOR

Radiators come in different sizes depending on the engine and options being used. See the parts book if radiator replacement is required. Radiator hose attachments vary depending on application.

A cross-flow type radiator is used on all models. Tanks in this type radiator are located on both sides of the core.

All radiators have a coolant recovery hose attached to the filler cap neck area.

Radiators used with automatic transmissions have an oil cooler built into one of the radiator side tanks to aid in cooling the transmission fluid.

Some vehicles utilize an aluminum/plastic radiator that can be easily repaired. See

Aluminum/Plastic Radiator information at the end of the General Description Section, see page 6B-5.

A pressure-type filler cap is located on the upper part of the radiator and a drain cock is located on the lower part of one side tank.

Fan shrouds and air baffles are mounted around the radiator to direct the air flow through the radiator and over the engine for maximum cooling. Always make sure to install all removed shrouds and baffles into their original position.

Radiator Cap

CAUTION: Do not remove the radiator cap while the engine is warm.

The cooling system is sealed by a pressure type radiator filler cap which causes the system to operate at higher than atmospheric pressure. The higher pressure raises the boiling point of the coolant and increases the cooling efficiency of the radiator.

Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through coolant reservoir. Coolant should be added only to the reservoir.

If the reservoir is empty when hot, the coolant level of the radiator must be checked when the system has cooled down and filled if necessary.

The pressure-type radiator filler cap contains a blow off or pressure valve and a vacuum or atmospheric valve (Figure 6B-2). The pressure valve is held against its seat by a spring. The valve protects the radiator by relieving pressure exceeding that for which the cooling system is designed. The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created when the system cools.

The radiator cap must be pushed downward before it can be removed. A rubber asbestos gasket is added to the diaphragm spring at the top of the cap. Embossed on the cap is a caution against being opened and arrows indicating the proper closed position.

Every vehicle has a radiator cap. J Series vehicles with L4 engines have a thermostat housing cap. For these engines, add coolant through the thermostat housing (with the thermostat and cap removed).

6B-2 ENGINE COOLING

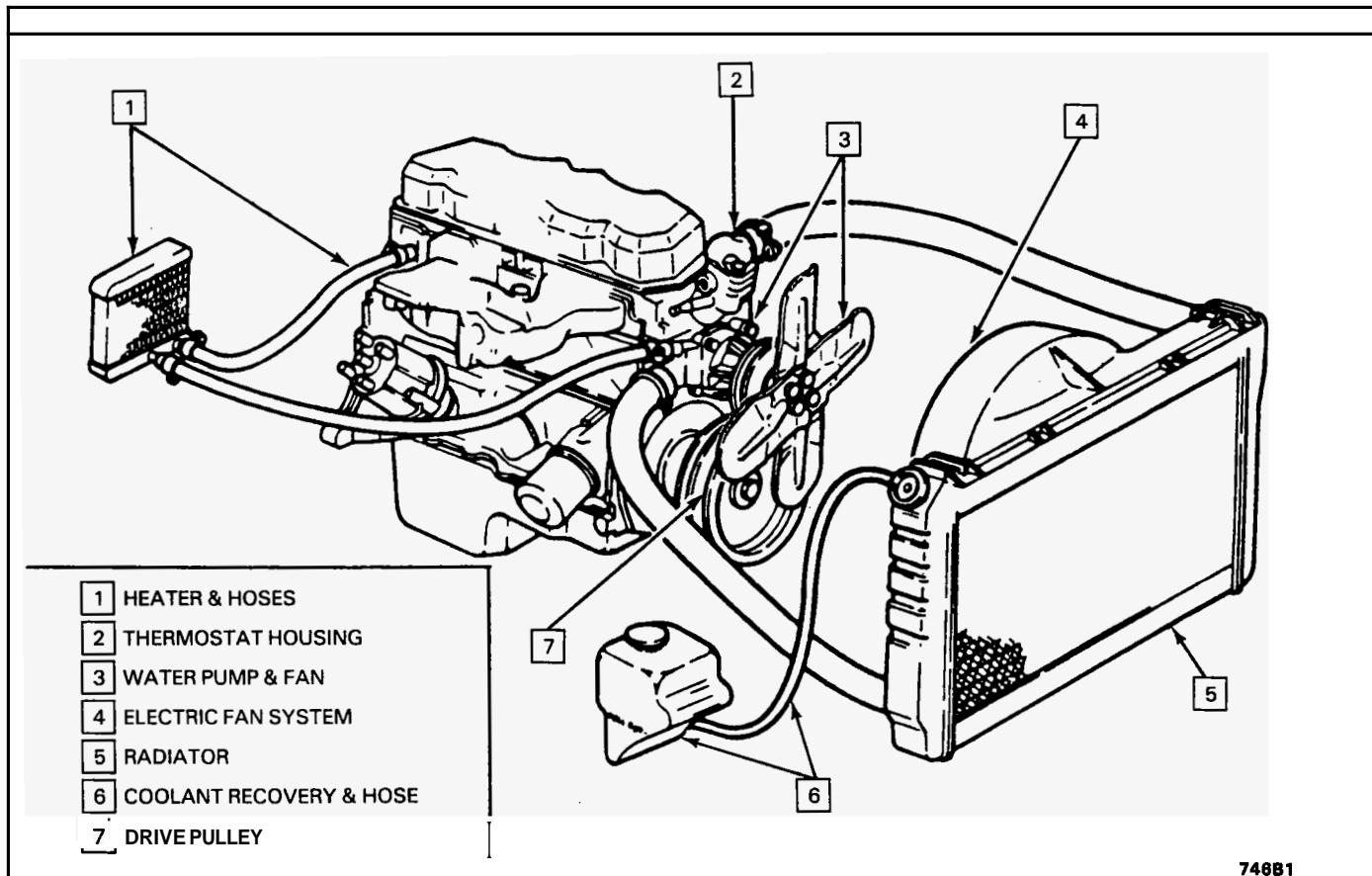
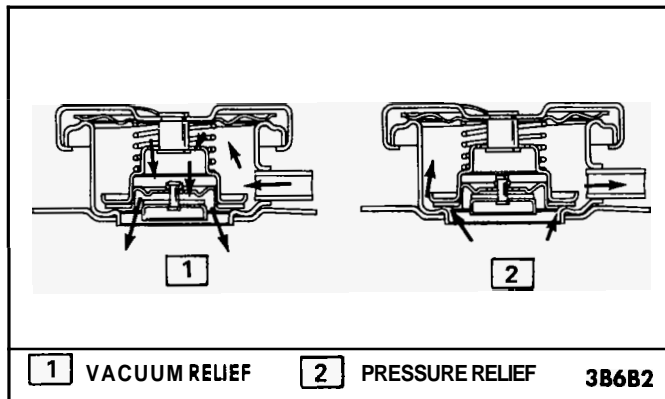


Figure 66-1 Engine Cooling System-Typical



Drain Cock

The radiator drain cock is located on the lower part of the radiator to facilitate draining of the system. To ensure that the drained coolant does not run onto other components, slip a rubber hose over the end of the drain cock and place the other end into a suitable container.

Coolant Reservoir

When the coolant in the system gets hot and starts to expand, it is forced from the system through the pressure relief valve of the radiator cap. It then passes through a small hose to the coolant reservoir.

After the engine is shut off and begins to cool, the coolant contracts and the fluid is now drawn back into the system from the reservoir through the vacuum relief valve of the radiator cap. (See Figure 6B-2.)

The cooling system has been filled at the factory with a high-quality, inhibited, year-around coolant that meets the standards of General Motors Specification 1825-M. This coolant solution provides freezing protection to at least -37°C (-34°F), and it has been formulated to be used for two full calendar years or 30,000 miles, whichever first occurs, of normal operation without replacement, provided the proper concentration of coolant is maintained.

NOTICE: It is **very important** the coolant used meets **GM** specification 1825-M. Failing to use the proper coolant can result in cooling system damage and the chance of engine overheating. Coolant level should be between "ADD" and "FULL" marks on recovery bottle. These marks are approximately two quarts apart so that a **50/50** mixture can be added (one quart of ethylene glycol anti-freeze and one quart of water).

Fans

There are two types of cooling fan systems being used, belt driven and those using an electric motor.

Belt Drive Fans

Some belt driven fans utilize an automatic fan clutch. The fan clutch is bolted between the fan blade and the front of the engine. (See Figure 6B-5.) Also see Automatic Fan Clutch for description and operation.

On applications that do not utilize the automatic fan clutch, the fan blade is bolted directly to the front of the engine. (See Figure 6B-6.)

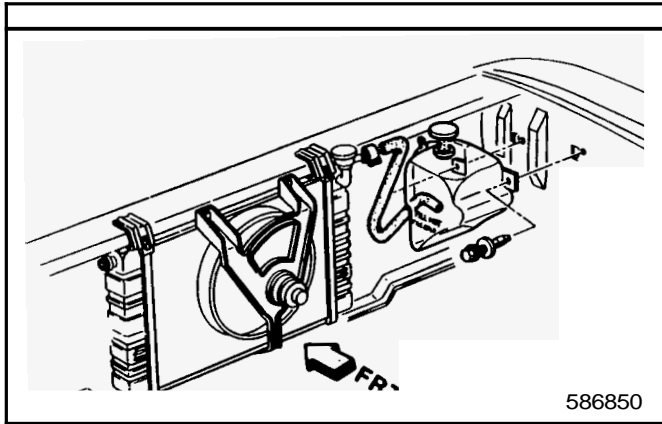


Figure 6B-3 Coolant Recovery System

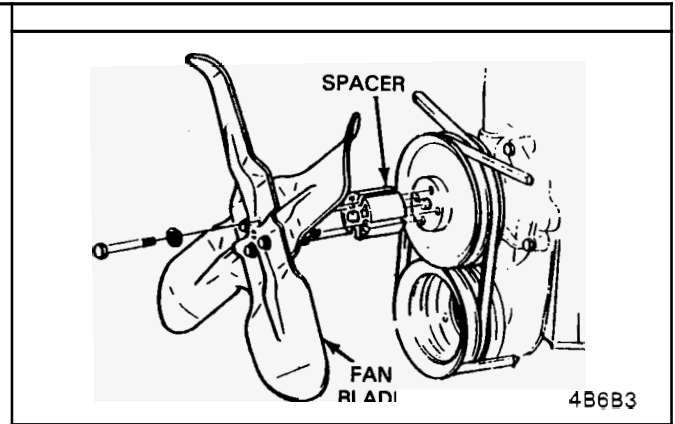


Figure 6B-6 Fan Without Automatic Fan Clutch

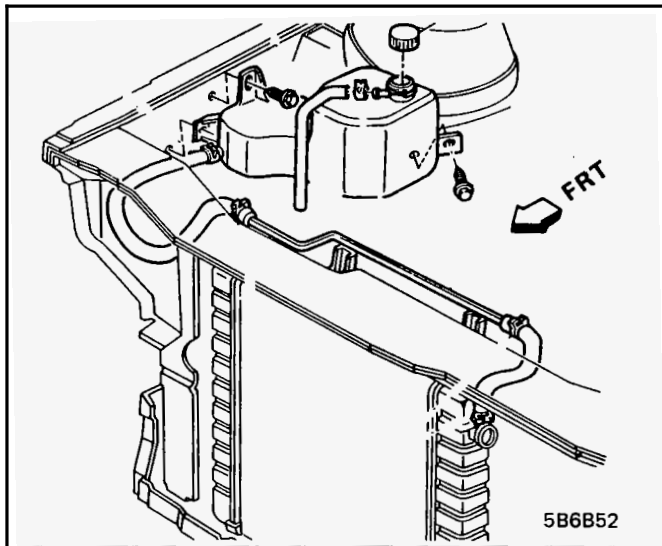


Figure 6B-4 Coolant Recovery-LT2/LT3

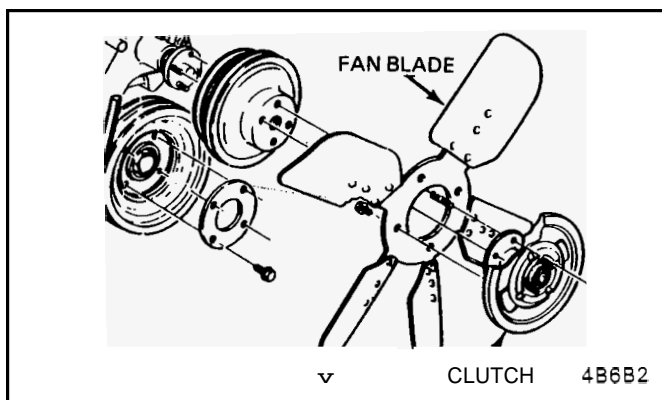


Figure 6B-5 Fan With Automatic Fan Clutch

Electric Fans

CAUTION: Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. Some electric fans can come on whether or not the engine is running. The fan can start automatically in response to a heat sensor with the ignition in the "OFF," "RUN" or "ACCESSORY" position.

Transverse engines utilize electric cooling fans, with some vehicles using two electric fans.

Fans range in sizes from 290mm (11.6 in) to 422mm (16.9 in) with 4 to 7 blades to aid air **flow** through the radiator/condenser. The fan or fans are driven by electric motors which are attached to the radiator support.

A variety of temperature switches and relays are utilized for fan motor control. (Also see Temperature Switches and Coolant Fan Relays.)

CAUTION: If a fan blade is bent or damaged in any way, no attempt should be made to repair and reuse the damaged part. A bent or damaged fan assembly should always be replaced with a new fan assembly.

The majority of non-A/C cars use a fan with four blades which are unevenly spaced and have curled tips to provide minimum noise. A fan shroud is used to guide the air through the radiator core and over the engine for maximum cooling.

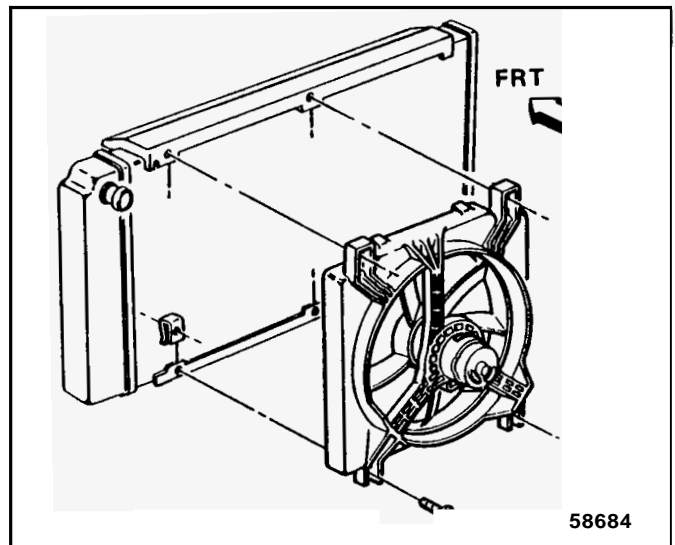


Figure 6B-7 Single Electric Fan

Fan Temperature Switches

A large variety of coolant switches are utilized. Some applications utilize one switch to turn on the low speed and a second switch is used to turn on the high speed. On some A/C applications, a separate switch is used to activate the motor, depending upon A/C compressor head pressure to the condenser. (Also see Section 8A for location and diagnosis.)

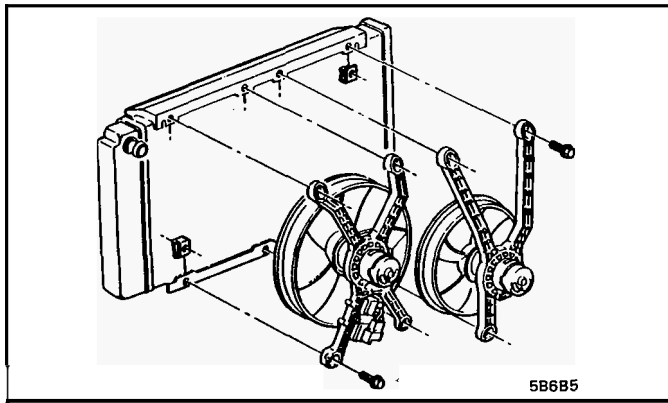


Figure 6B-8 Dual Electric Fans

ECM Input Switches

Some coolant sensors are used to relay engine temperature information to the Electronic Control Module (ECM). This allows the ECM to maintain a correct fuel control mixture during hot or cold engine operating conditions.

Temperature Light Switch

A coolant sensor mounted in the water jacket is used to turn on the instrument panel temperature "temp" light. This is to alert the driver that the engine coolant temperature is excessive.

When a temperature gage is used, rather than a light, the temperature switch is replaced with a transducer.

Coolant Fan Relay and Switches

Coolant fan relays and switches are used so that the cooling fan motor can be turned ON and OFF as required and from more than one location. In this manner, the air conditioning or transmission convertor clutch systems can affect blower operation under various conditions. See electrical section for component locations, explanations and diagnosis.

★ **NOTICE:** It is possible to reverse the connectors to the high and low speed cooling fan relays on the LT3 (VIN M) engine equipped vehicles. When diagnosing cooling fan problems, check the function of both relays.

Automatic Fan Clutch

The automatic fan clutch is mounted between the fan blade and the engine. (See Figure 6B-5.) When the engine is running the heat of the engine will determine the RPM of the fan blade. When the engine is cold, the fan clutch disengages the fan blade from the engine, so that it free wheels using little engine power. When the engine heat increases, the fan clutch begins to engage increasing the fan blade speed in order to improve cooling. Maximum air flow is achieved when the fan clutch is locked up and the fan blade speed is the same as engine speed.

Engagement and disengagement is controlled by a bi-metallic coil and silicone fluid in the fan clutch.

The fan clutch is engaged during the first few minutes after start-up until the silicone fluid is redistributed within the fan clutch. Under certain temperature conditions there is a lateral movement at the fan tip which should not be considered as a hub or bearing failure. This condition is a design feature of the

clutch assembly which allows up to approximately 1/4" lateral movement measured at the fan tip.

Testing a fan clutch by holding the small hub with one hand and rotating the aluminum housing in a clockwise/counter-clockwise motion will cause the clutch to freewheel, which is a normal condition when operated in this manner. This should not be considered a test by which replacement is determined.

Thermostat

The thermostat blocks the flow of coolant from the engine to the radiator until proper operating temperature is attained. During this time, the coolant is allowed to circulate only throughout the engine for rapid warm up.

After warm up, the thermostat varies the coolant flow to the radiator to maintain a desired engine temperature. Some engines have a thermostat housing cap. For these engines, add coolant through the thermostat housing (with the thermostat and cap removed). See Figure 6B-9.

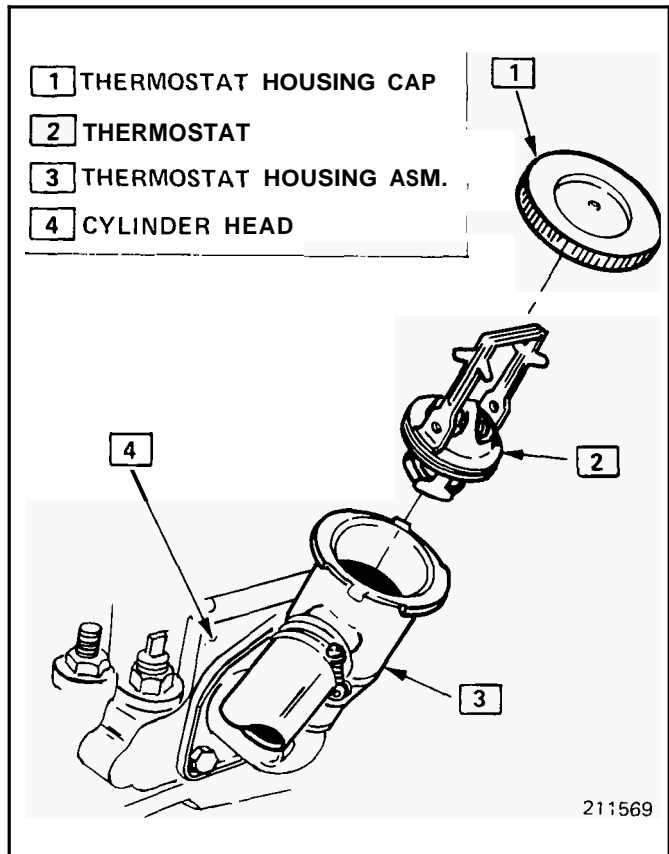


Figure 6B-9 Thermostat and Housing-LT2/LT3

Water Pump

A water pump mounted on the engine circulates the coolant through the engine and radiator and is belt driven.

Heater Core

The heater core is an important part of the cooling system, as the volume of coolant in the core and hoses is calculated for engine cooling.

Insufficient heat from the heater can be an indication of low coolant or a cylinder head gasket leak. On some models the heater core is the highest

spot of the cooling system. The air on a low coolant situation or exhaust gases leaking in from the head gasket become trapped in the heater core, and acts like a vapor lock in a fuel line. (See Cooling System Diagnosis.)

HOSES

Hoses connect the engine to the radiator and heater core. Some hoses utilize support straps and support brackets. Make sure that all straps and support brackets are reinstalled if removal is required during service. See Figure 6B-10.

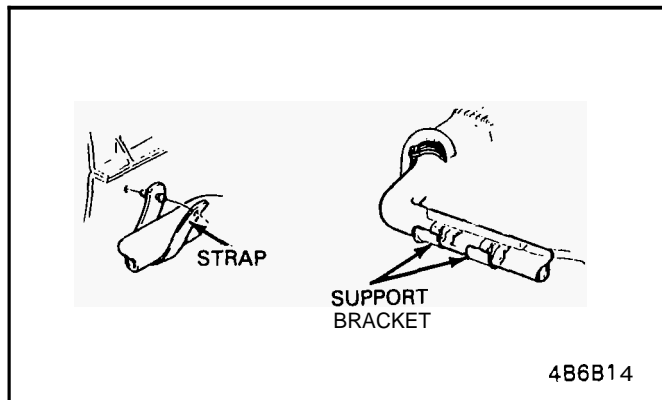


Figure 6B-10 Strap and Support Bracket

Heater Hoses MFI-SFI

All MFI and SFI systems have heater hoses attached to the mounting base to aid in quicker warm ups.

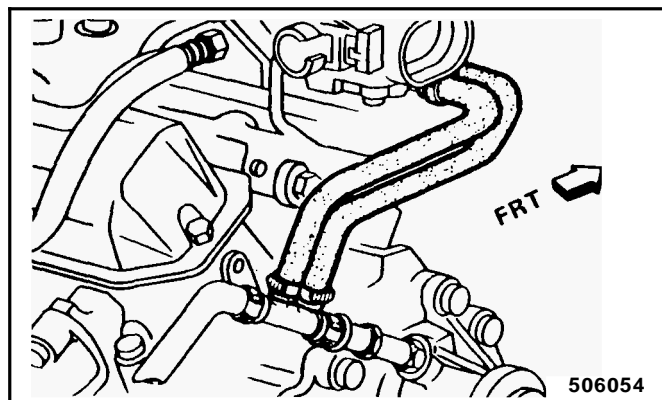


Figure 6B-11 MFI/SFI Heater Hoses

ALUMINUM/PLASTIC RADIATOR

Some vehicles utilize an aluminum/plastic radiator that is repairable.

Radiator

The radiator utilizes an aluminum core with plastic side tanks. The core and side tanks can be replaced separately and core repair is made using the hot melt adhesive method explained in Unit Repair. A transmission oil cooler is located in one of the side tanks. The oil coolers can be replaced (see Unit Repair). A radiator cap is mounted on the top of the side tank and a drain cock is located on the lower part of one of the tanks. The drain cock is also serviceable.

Core

The core is made of aluminum and is of the crossflow design. It utilizes large tubes that resist plugging, and repairs to the tubes and core are easily made using the hot melt adhesive method (see Unit Repair).

The core is attached to the tanks by clinched tabs on the core that can be bent back if tank or core replacement is required.

A high temperature rubber gasket is used to seal the mating surface between the core and the tank. (See Figure 6B-12.) The gasket must be replaced any time a tank is removed from the core.

If the damage to a tube is too severe, a tube can be blocked or plugged as explained later. No more than two tubes should ever be blocked on a core. Also replace the core if more than three tabs are broken on one side or if two adjacent tabs are broken.

Tanks

The tanks are attached to the core by the use of clinched tabs attached to the sides of the core. The clinched tabs can be bent back if the tanks need to be removed from the core. Bend the tabs back only enough to remove the tank. Overbending will weaken the tabs. (See On-Car Service.)

A high temperature rubber gasket is used to seal the mating surface between the core and the tank. (See Figure 6B-12.) The gasket must be replaced any time a tank is removed from the core.

Transmission Oil Cooler

The transmission oil cooler is located in the passenger side radiator tank. The oil cooler can be replaced by removing the tank from the core. (See Unit Repair.)

A leaking oil cooler gasket can be replaced without removing the tank from the core. (See Unit Repair.)

Engine Oil Cooler

The LC2 engine has an engine oil cooler mounted on the passenger side radiator tank. Like the transmission oil cooler, it can be replaced by removing the tank from the core and the gaskets can be replaced without removing the tank.

Drain Cock

The aluminum/plastic radiator utilizes a two piece plastic drain cock and a rubber seal. The drain cock is serviceable. (See Figure 6B-13.)

RADIATOR SERVICE

The aluminum-plastic radiator core can be repaired at the dealership. The following components are easily replaced:

- o Core
- o Tanks and gaskets
- o Oil cooler and gasket
- o Drain cock and gasket

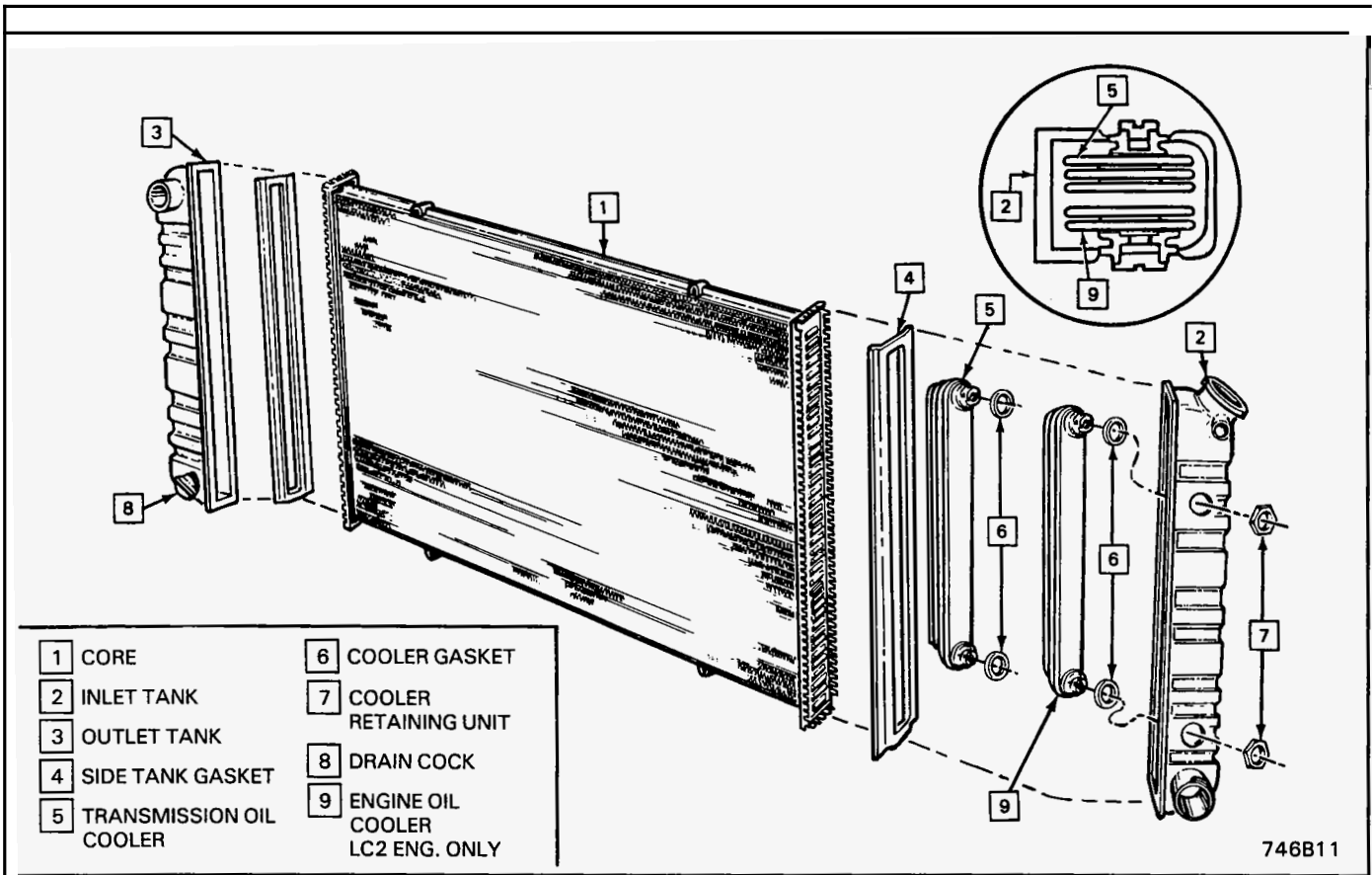


Figure 6B-12 Aluminum/Plastic Radiator-Exploded View

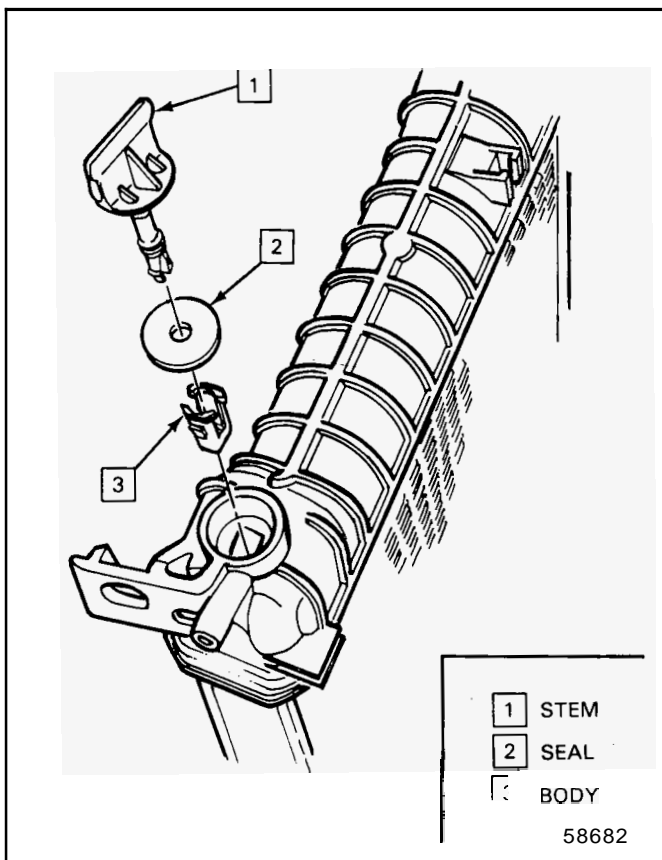


Figure 6B-13 Drain Cock

The **tanks cannot be repaired** if broken or cracked. The radiator core can be replaced and the new core used with the original tanks.

Precautions

As with all cooling system service, take measures to prevent personal injury and damage to the system.

CAUTION: Do not remove the radiator cap while the engine is still warm.

- Do not open the hood if you can see or hear steam or coolant escaping from the engine compartment.
- Do not remove the radiator cap or coolant recovery tank cap if the coolant in the recovery tank looks like it is boiling.
- Wear eye protection.
- Wear gloves to protect your hands against excessive heat or the effects of chemicals on your skin.
- Prevent dirt and water from entering the transmission oil cooler.
- Do not use boil-out tanks or vats or other tanks that have been used for copper and brass radiators. The flux, acid, and caustic cleaners remaining in these tanks will attack the aluminum and cause radiator failure. A separate test tank containing clean water is strongly recommended for servicing aluminum-plastic radiators.

NOTICE: Never use shop air to pressure test radiator that is not regulated at 20 psi (138 kPa).

Pressures over 20 psi (138 kPa) will damage the radiator.

DIAGNOSIS

Leak Testing

Some core leaks can be detected by merely adding water to the radiator. It is helpful to clean the core so that the damaged area can be more easily found.

1. Remove dirt and insects from the fins with a common water hose without a nozzle. Excessive water pressure could damage the fins.
2. Scrub the core with a soft-bristle brush using clean, hot water or hot water with a mild detergent solution.

On-Car Pressure Testing

You can pressure-test the aluminum-plastic radiator with a common pump and gage, such as BT-7002-3 or J-24460-01 with J-23699 (Figure 6B-14). With the system at a cool temperature, remove the radiator cap, connect the gage, and apply normal system operating pressure. Do not exceed 20 psi (138 kPa). Watch the gage needle for an indication of a leak, and examine the radiator and other cooling system parts for signs of escaping coolant.

Repair all hose and hose connections as required. Also check radiator cap to ensure that it will maintain the correct pressure.

If the radiator is found to be leaking during the pressure test, mark the leak area so that it is easily found once the radiator has been removed from the vehicle.

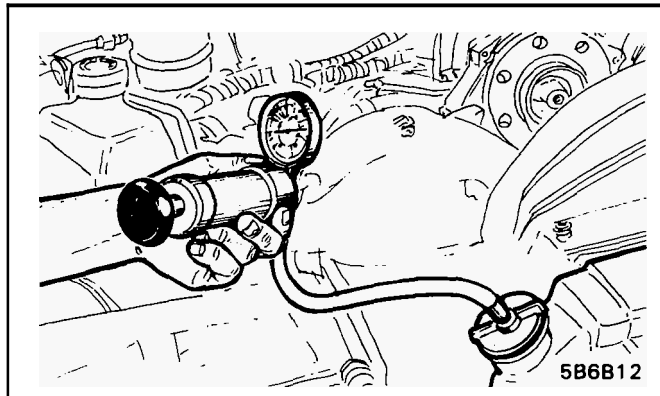


Figure 6B-14 Pressure Testing Radiator

Off-Car Leak Testing

Do not use boil-out tanks or vats or other tanks that have been used for copper and brass radiators. The flux, acid, and caustic cleaners remaining in these tanks will attack the aluminum and cause radiator failure. A separate test tank containing clean water is strongly recommended for servicing aluminum-plastic radiators.

1. Install test fittings or rubber test caps in the inlet and outlet necks and seal the oil cooler fittings with metal plugs to protect the cooler and keep the fluid from running out (Figure 6B-15).

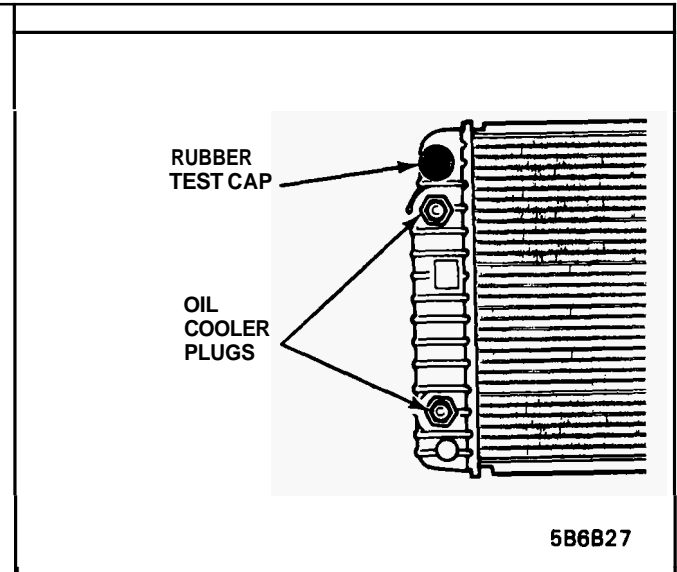


Figure 6B-15 Radiator and Oil Cooler Plugs

2. Attach pressure tester and gradually apply air pressure til 20 psi (138 kPa) is attained. Do not exceed 20 psi (138 kPa). Check pressure gage to see if there is a pressure loss. To ensure that there are no small leaks, run water over the repair area and look for bubbles. (A mild detergent is very helpful.)

If a large water tank is available, the radiator can be submerged, and a check for air bubbles can be made.

UNIT REPAIR

Repairable Leaks

There are two types of leaks that can be repaired on the aluminum-plastic radiator: core leaks and gasket leaks. Leaks in the plastic tanks cannot be repaired.

Core leaks can occur in a tube or in the joints between the tubes and headers. Gasket leaks can occur in the joints between the plastic tanks and the headers or in the joints between the oil cooler fittings and the tank. Some leaks can be repaired while the radiator is on the car; however, it is usually best to remove the radiator.

Repair Methods

There are several methods that can be used to repair the radiator core, but the hot melt adhesive method has been found to be the most simple and effective.

The kit contains adhesive sticks, cotton swabs, wire brush and primer. The adhesive stick is reusable, has an indefinite shelf life, and is waste-free. The sticks must be stored in a sealed container to keep them dry.

Special Preparation

Cooling Fin Removal

For damaged areas that are between the cooling fins, it may be necessary to remove some of the fins. Do not remove more fins than necessary. Usually 1/4" (6

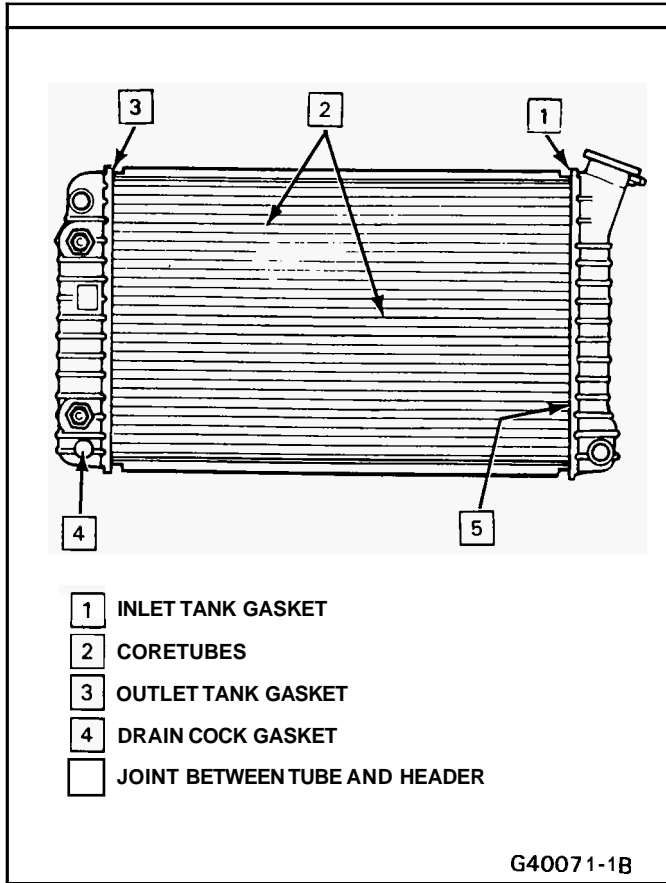


Figure 6B-16 Possible Leak Areas

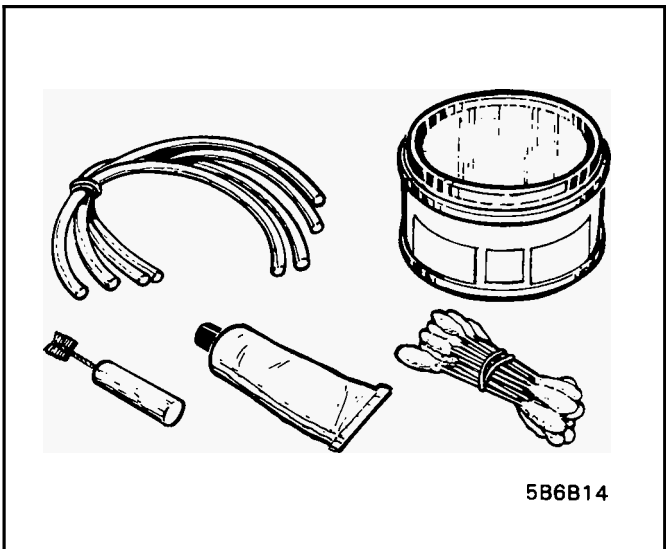


Figure 6B-17 Hot Melt Adhesive Repair Kit

mm) beyond the leak or damage area is enough to make an effective repair.

Tube Blocking

If a tube is severely damaged, it can be blocked off.

NOTICE: DO NOT BLOCK OFF MORE THAN TWO TUBES IN A RADIATOR. BLOCKING OFF MORE THAN TWO TUBES WILL REDUCE THE COOLING CAPACITY OF THE SYSTEM.

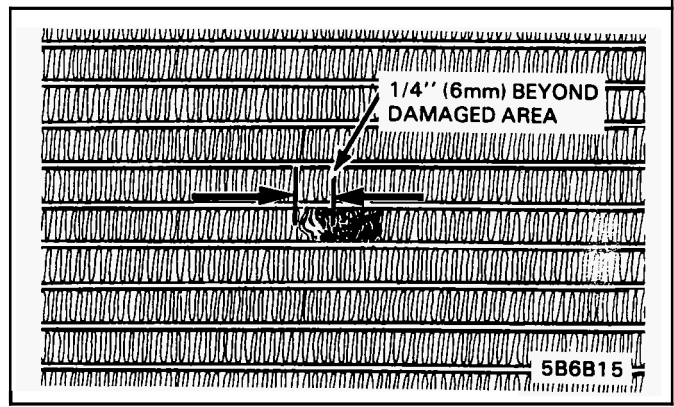


Figure 6B-18 Fins Removed from Damaged Area

The tube should be cut off 1/4" from the header and pinched shut before it is cleaned and sealed. (See General Sealing.)

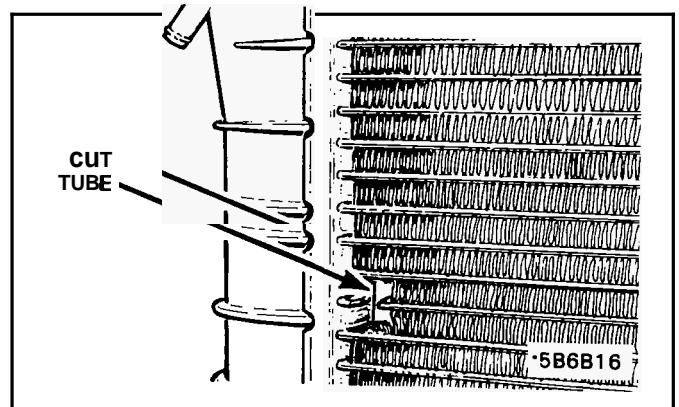


Figure 6B-19 Tube Blocking

Header Repair

If the header or a tube near the header requires a repair, the side tank does not have to be removed. A damp cloth can be placed against the side tank where the repair has to be made (Figure 6B-20). The side tank can also be submerged in a tank of water up to the header (Figure 6B-21).

NOTICE: One of these procedures have to be used when repairs are made on or near the header to prevent damage to the tank or gasket.

General Core Repair

Preparation of the surface in the repair area cannot be overemphasized. If the leak area surface is not clean, none of the repair materials will stick to the surface.

1. Position the core so the repair area is accessible.
2. Apply a wet cloth if you are working near the plastic tanks or the joints between the core tubes and header (Figure 6B-20); or submerge the tank in water (Figure 21).
3. Heat the repair area slightly with a small torch or heat gun to be sure it is dry. **Do not use a blow torch.**
4. Brush the area to be repaired with the small steel brush that is supplied in the kit and blow dust away from repair area.

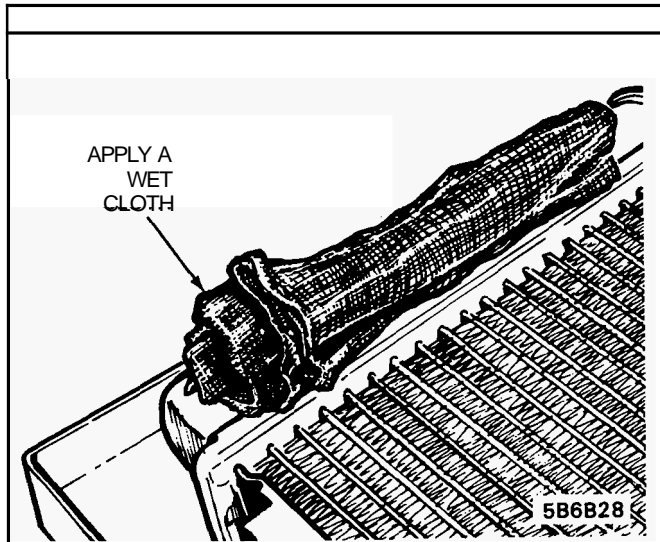


Figure 68-20 Using Wet Cloth on Side Tank

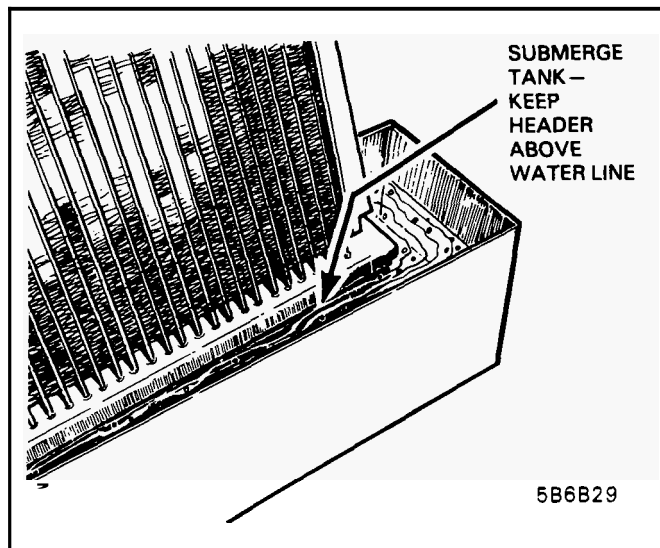


Figure 68-21 Submerging Side Tank



Figure 6B-22 Cleaning Area With Steel Brush

6. Open the tube of primer, using the spurred cap or a pin, and apply primer to the repair area only. Use of the primer produces a stronger repair. Do not heat the primer.

CAUTION: The primer contains trichlorethane.

- o It could be harmful or fatal if swallowed. If swallowed, get medical attention.
 - o Use with adequate ventilation.
 - o In case of eye contact, flush with plenty of water and get medical attention.
 - o In case of body contact, wash thoroughly with soap and water.
 - o Do not mix the primer with water.
7. Scrub the repair area with a cotton swab until a fresh swab **stays** clean. The clear, yellow-brown coating does not have to be removed.



Figure 6B-23 Scrubbing Area with Primer

8. Heat the repair area with the heat gun or by moving the torch in a circular pattern (Figure 24). Use a soft, small blue flame (like a gas stove flame).

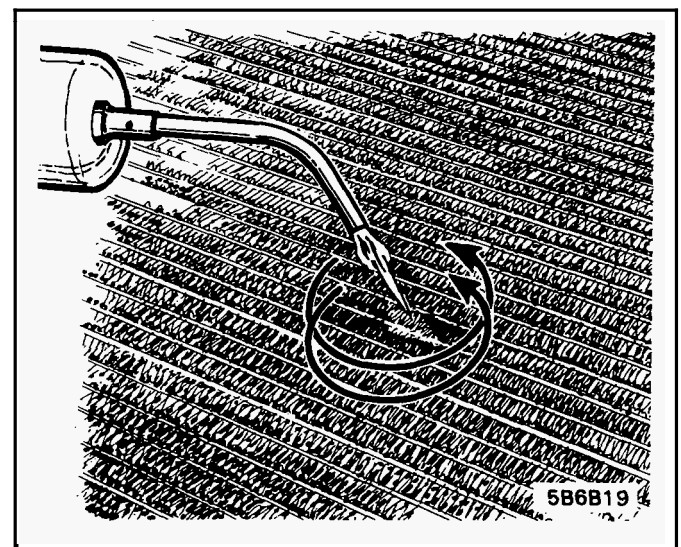


Figure 6B-24 Heating the Repair Area

9. Withdraw the torch and rub the adhesive stick on the repair area (Figure 25). The adhesive will flow at a temperature of approximately 500°F (260°C). If the stick doesn't start to melt, remove it and reapply the heat. Do not heat the stick directly with a flame. High heat will burn and char the adhesive.
10. Continue heating until the adhesive flows and wets the entire repair area and fills the joint. If a

6B-10 ENGINE COOLING

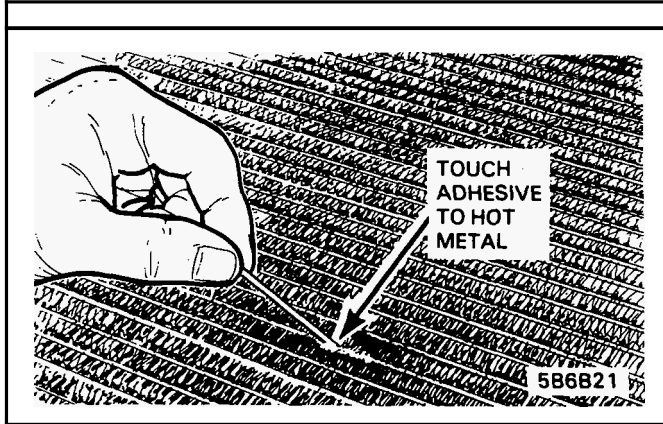


Figure 68-25 Applying Hot Melt Adhesive

hole is in the center of a tube, heat the tube and let the hot surface melt and pull in the adhesive. The force of the flame or heat gun will also tend to guide the adhesive toward the hole. For leaks between a tube and header, flow the adhesive completely around the tube and heater joint with the tank installed.

11. Heat the repair area until the adhesive is bubble-free and smooth, with a light yellow color. Curing is not required.
12. Test the radiator for leaks when cool. If the repair area still leaks, reheat it gently to dry it. Heat and reflow the adhesive or apply more as necessary to repair the leak.

Tank Gasket Leak Repair

Tank gasket leaks can easily be mistaken for tank or header leaks. If a plastic tank leaks from the header joint gasket, tighten the clinch tabs with the clinching tool or locking-type pliers (Figure 26). If this method doesn't seal the leak, remove the tank for further inspection.

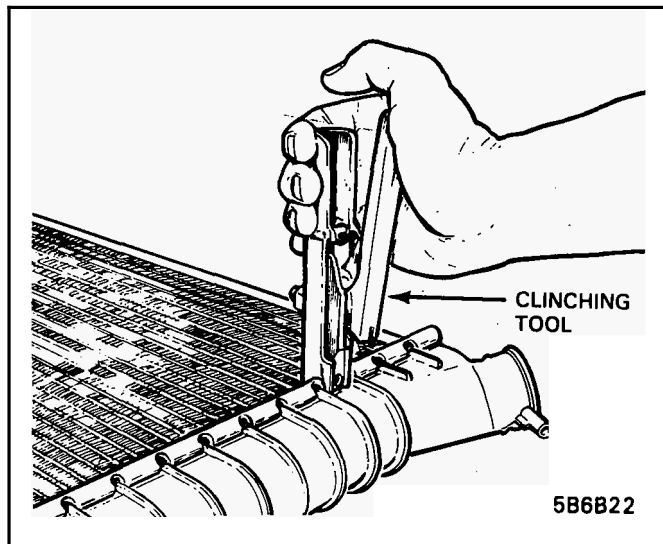


Figure 68-26 Tightening Clinch Tabs

1. Pry open the clinch tabs, except those under inlet, outlet, and filler necks, using the prying tool or a screwdriver (Figure 27). Lift the tabs only enough to allow removal.

NOTICE: Care should be taken not to overbend tabs. Overbending could result in breakage. If there are more than 3 tabs broken on one side of the header, or more than 2 adjacent tabs together, the core must be replaced.

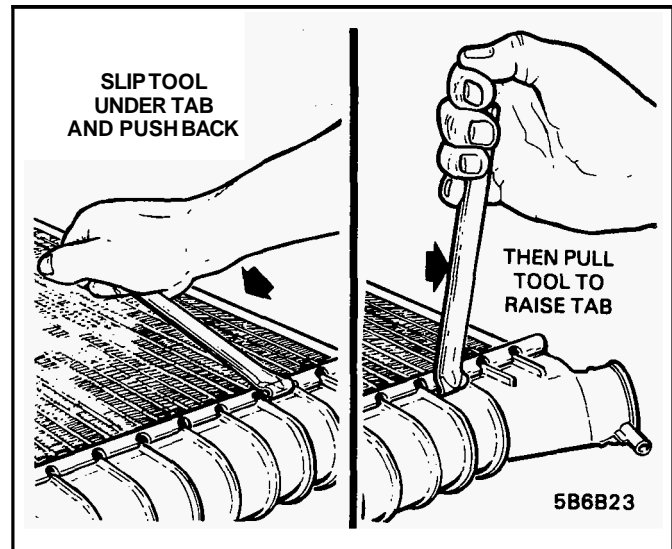


Figure 68-27 Opening Clinch Tabs

2. Lift the tank and slide it out from under the remaining clinched tab. You may have to tap the tank with your hand to dislodge the gasket. Lift the remaining tab(s) with pliers.
3. Remove and discard the gasket.
4. Clean the header and gasket groove of all dirt and old rubber.
5. Clean the sealing edge of the plastic tank.
6. Examine the header gasket surface and tank flange for evidence of leakage, and clean or repair the surface to remove dirt, burrs, and bumps.
7. Remove the oil cooler, if equipped, and install it in the new tank, if used.
8. Dip or coat the new tank gasket in engine coolant and position it on the header surface. The coolant helps hold the gasket in place.
9. Position the tank and gasket to the header, clamp it in place and secure it by bending four clinch tabs as shown in Figure 6B-28.

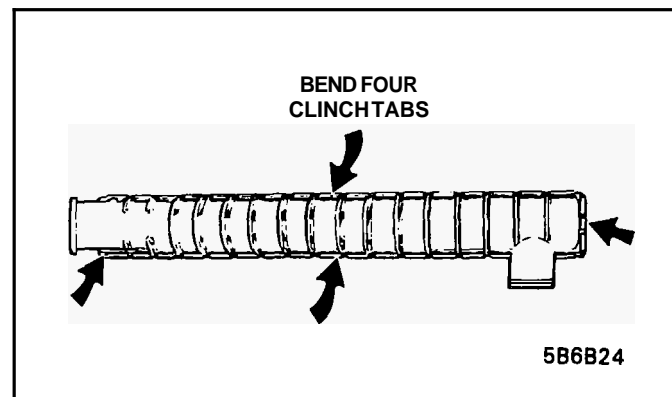


Figure 6D-28 Seating Tank to Core

10. Clamp remaining clinch tabs around the header using the clinching tool or pliers (Figure 29).
NOTE: Tighten the clinch tabs as you would cylinder head bolts, starting at the center and working out to the ends.
11. Replace the core if there are more than three tabs broken on one side or two adjacent tabs broken.

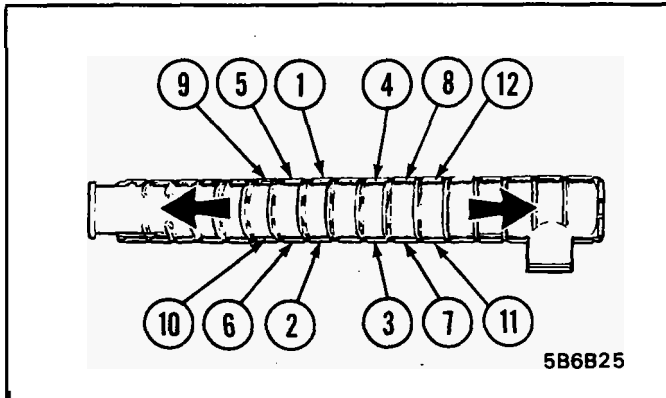


Figure 68-29 Clinching Sequence

12. Install the drain cock, if removed.
13. Test the radiator for leaks.

Oil Cooler Leak Test

If you suspect an oil leak from an oil cooler, test it before removal. Disconnect the cooler lines. Plug one fitting and attach a shop air supply hose to the other fitting. Remove the radiator cap. **Apply air pressure gradually**, increasing it up to a maximum of **150 psi**. If bubbles appear in the coolant, you'll have to remove the radiator and tank for oil cooler replacement. (You can also test the oil cooler with the radiator assembled and removed from the vehicle. Submerge it in a water test tank, apply air pressure, and look for air bubbles.)

Oil Cooler Gasket Replacement

The outlet tank must be removed to replace the oil cooler, but the oil cooler gaskets can be replaced without removing the tank.

1. Remove the radiator and lay it on a flat surface.
2. Remove the bottom oil cooler nut and loosen the top nut.
3. Press the oil cooler into the hole and remove the gasket using a small hook (Figure 30).
4. Blow-dry all surfaces on the tank and oil cooler.
5. Install a new gasket **without lubrication**. Be sure it is seated properly inside the tip of the fitting.
6. Reach into the oil cooler and push it into position against the tank.
7. Assemble the oil cooler nut loosely.
8. Replace the other gasket by following the same procedure.
9. Install the oil cooler nuts and torque to **20 N·m (15 ft. lbs.)**. Do not overtighten, as damage to the gasket could result.
10. Leak-test the radiator.

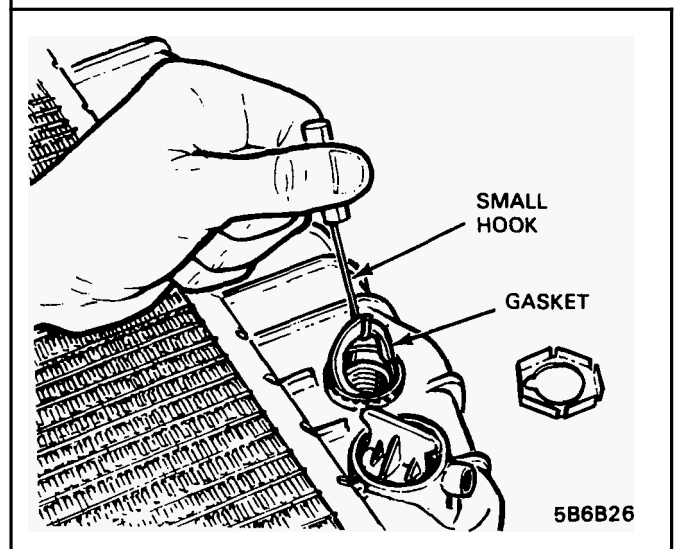


Figure 68-30 Removing Oil Cooler Gasket

Oil Cooler

Replacement

1. Remove the outlet tank as previously outlined.
2. Remove nuts from the oil cooler fittings.
3. Remove oil cooler and gaskets from tank.
4. Remove old rubber gaskets and discard. Clean and dry seal areas.
5. Place rubber gaskets on a new oil cooler and place onto outlet tank fitting holes being careful not to loosen or misalign gaskets. Gaskets must be installed dry and free of dirt and oil.
6. Install and tighten nuts snugly onto fittings.
7. Torque nuts to **20 N·m (15 ft. lbs.)**. Overtorquing could cut the rubber gaskets.
8. Replace tank as previously described.
9. Test radiator.

Recore

If the radiator core is damaged beyond repair and the other parts are serviceable, install the original inlet and outlet tanks, oil cooler, radiator cap, and drain valve, along with the new core and new gaskets.

SPECIAL TOOLS

Special tools are available through normal channels for servicing the aluminum-plastic radiator. Tool number **J-33419**, the Radiator Repair Kit, consists of a pry-and-clamp tool, **533419-1**; an inlet plug, **J-33419-2**; and an outlet plug, **5-33419-3**. The universal Cooling System and Cap Pressure Tester, **J-24460-01**, can also be used with the aluminum-plastic radiator.

DIAGNOSIS

For cooling system diagnosis, see Figures **6B-31** through **6B-34**.

Little or no heat coming from the heater, especially at idle, could be an indication of a cooling system problem.

As the coolant level begins to get lower than normal, air enters the system to replace the missing

coolant. The heater core is one of the highest parts of the cooling system and therefore, the first area to lose coolant.

At first, with a small amount of coolant loss, lack of heat will be most noticeable at idle. As driving speed increase, the engine temperature increases, expanding the coolant. Some heat is now able to pass through the heater core.

If coolant level drops even lower, heater operation will become less effective, even during normal driving. Cooling and engine systems can be adversely affected if problem is not corrected.

The exhaust gases also force coolant out of the system and into the coolant reservoir.

Air bubbles in the coolant or an overflow condition of the coolant reservoir are also indicators of a cylinder head gasket leak.

FAN CLUTCH DIAGNOSIS

Noise

Fan noise is sometimes evident under the following normal conditions:

- When clutch is engaged for maximum cooling.
- During first minute after start-up until the clutch can re-distribute the silicone fluid back to its normal disengaged operating condition.

Looseness

Under various temperature conditions there is a visible lateral movement that can be observed at the tip of the fan blade. This is a normal condition due to the type of bearing used. Approximately 1/4" maximum lateral movement measured at the fan tip is allowable. This not cause for replacement.

Silicone Fluid Leak

At times, a small amount of silicone fluid will seep out around the bearing assembly area. This is a normal condition and should not be classed as a leak.

If excessive amounts of fluid leak from this area, the fan clutch should be replaced.

Engine Overheating

- Start with a cool engine to ensure complete fan clutch disengagement.
- If the fan and clutch assembly free-wheels with no drag (revolves over 5 times when spun by hand), the clutch should be replaced. If clutch performs properly with a slight drag, go to Step c.
Testing a fan clutch by holding the small hub with one hand and rotating the aluminum housing in a clockwise/counterclockwise motion will cause the clutch to freewheel, which is a normal condition when operated in this manner. This should be considered a test by which replacement is determined.
- Use dial type thermometer J-23640, or a similar type that will read to 220°F. Position thermometer so that the thermometer sensor is centered in the space between the fan blades and the radiator. This can be achieved by inserting the sensor through one of the existing holes in the fan shroud or fan guard, or by placing it between the

radiator and the shroud. On some models, it may be necessary to drill a 3/16" hole in the fan shroud to insert Tool J-23640.

NOTICE: Check for adequate clearance between fan blades and thermometer sensor before starting engine, or damage to sensor could occur.

Be sure fan clutch is disengaged at beginning of test.

- Cover radiator grille sufficiently to induce a high engine temperature. Start engine and turn on A/C if equipped. Maintain a position in front of the vehicle to observe the thermometer reading. Accelerate the engine to approximately 2000 rpm. Use tachometer if available.
 - Observe thermometer reading when clutch engages. It will take approximately 5 to 10 minutes for the temperature to become high enough to cause engagement of the fan clutch. This will be indicated by an increase or roar in fan air noise and by a drop in the thermometer reading of approximately 5-15°F (3° - 8°C). If the clutch did not engage by the specified temperature, the unit should be replaced.
To avoid engine overheating, do not continue test past the temperature specified.
- If no temperature drop was observed and the fan noise level was constant from start of test to the specified temperature, the unit should be replaced.
- As soon as the clutch engages, remove the radiator grille cover and turn off the A/C to assist in engine cooling. Reduce engine speed to 1500 rpm.
 - After several minutes the fan clutch should disengage, as indicated by a reduction in fan speed and roar.

Whenever an engine has been severely overheated, test a cooling system for a combustion gas presence due to bad head gasket caused by the extreme heat. Retightening the head bolts may solve the problem. If not, the head gaskets will have to be replaced.

The following diagnostic information covers common problems and possible causes. When the proper diagnosis is made the problem should be corrected by part replacement, adjustment, or repair as required. Refer to the appropriate section of the service manual for these procedures.

ON CAR SERVICE

Cooling System Care

The cooling system requires little care except for maintaining an adequate coolant level and periodic service as outlined below. The recovery type cooling system is standard on all cars and is designed to maintain the engine at proper operating temperatures. The cooling system has been filled at the factory with a high-quality, inhibited, year-around coolant that meets the standards of General Motors Specification

ENGINE COOLING SYSTEM COMPLAINT

TO AVOID NEEDLESS TIME AND COST IN DIAGNOSING COOLING SYSTEM COMPLAINTS, THE CUSTOMER SHOULD BE QUESTIONED ABOUT DRIVING CONDITIONS THAT PLACE ABNORMAL LOADS ON THE COOLING SYSTEM.

1. DOES OVERHEATING OCCUR WHILE PULLING A TRAILER?

IF ANSWER IS "YES" — HOW HEAVY IS TRAILER? IF TRAILER WEIGHT IS GREATER THAN 1,000 LBS. & CAR IS EQUIPPED WITH NORMAL DUTY COOLING SYSTEM, A HEAVY DUTY COOLING PACKAGE IS REQUIRED (PER MFR'S TRAILER HAULING SPECS.). FURTHER DIAGNOSTIC CHECKS SHOULD NOT BE REQUIRED.

2. IS CAR EQUIPPED WITH ADD—ON OR AFTER MARKET AIR CONDITIONING SYSTEM?

IF ANSWER IS "YES" — WAS HEAVY DUTY RADIATOR INSTALLED WITH THE SYSTEM? IF NOT, INSTALL HEAVY DUTY AIR CONDITIONING RADIATOR FOR THE CAR MODEL INVOLVED (PER MANUFACTURER'S SPECS.). FURTHER DIAGNOSTIC CHECKS SHOULD NOT BE REQUIRED.

3. IS OVERHEATING OCCURRING AFTER PROLONGED IDLE, IN GEAR, A/C SYSTEM OPERATING?

IF ANSWER IS "YES" — INSTRUCT OWNER ON DRIVING TECHNIQUES THAT WOULD AVOID OVERHEATING SUCH AS:
 a. IDLE IN NEUTRAL AS MUCH AS POSSIBLE — INCREASE ENGINE R.P.M. TO GET HIGHER AIR FLOW & WATER FLOW THROUGH RADIATOR.
 b. TURN A/C SYSTEM OFF DURING EXTENDED IDLES IF OVERHEATING IS INDICATED BY HOT LIGHT OR TEMP. GAGE. FURTHER DIAGNOSTIC CHECKS SHOULD NOT BE REQUIRED.

4. IS OVERHEATING OCCURRING AFTER PROLONGED DRIVING IN SLOW CITY TRAFFIC, TRAFFIC JAMS, GARAGES, ETC.?

IF ANSWER IS "YES" — INSTRUCT OWNER ON DRIVING TECHNIQUES THAT WOULD AVOID OVERHEATING — SAME AS FOR PROLONGED IDLES — NO. 3 FURTHER DIAGNOSTIC CHECKS SHOULD NOT BE REQUIRED.

IF NONE OF THE ABOVE APPLY, GO TO DIAGNOSTIC CHART

TO EFFECTIVELY USE THIS CHART, QUESTION THE OWNER TO DETERMINE WHICH OF THE FOLLOWING (3) CATEGORIES APPLIES TO THE COMPLAINT:

1. HOT LIGHT OR HOT INDICATION ON TEMPERATURE GAGE
2. BOILING
3. COOLANT LOSS

1. IF COMPLAINT IS HOT LIGHT OR HOT INDICATION ON TEMPERATURE GAGE —

WAS HOT LIGHT ACCOMPANIED BY BOILING? IF ANSWER IS "YES", GO TO BOILING ON CHART
 IF ANSWER IS "NO", GO TO HOT LIGHT ON CHART

2. IF COMPLAINT IS BOILING — GO TO BOILING ON CHART

IF PROBLEM REMAINS, GO TO COOLING FAN DIAGNOSIS SECTION 8 (IF SO EQUIPPED).

3. IF COMPLAINT IS COOLANT LOSS —

DETERMINE IF CUSTOMER IS OVERFILLING THE SYSTEM, THIS WOULD NORMALLY RESULT IN SMALL AMOUNTS OF COOLANT LOSS THROUGH THE OVERFLOW TUBE. IF THIS IS THE CASE, INSTRUCT THE CUSTOMER ON PROPER FILL LEVEL & NO FURTHER DIAGNOSTIC CHECKS SHOULD BE REQUIRED.

IF OVERFILLING IS NOT THE PROBLEM, GO TO COOLANT LOSS ON CHART.

NOTICE: ANYTIME COOLING SYSTEM IS OBVIOUSLY CONTAMINATED, THE SYSTEM SHOULD BE DRAINED AND FLUSHED.

CAUTION — THE COOLING SYSTEM IS DESIGNED TO OPERATE AT 15 P.S.I. PRESSURE & TEMPERATURES EXCEEDING 200°F. CAUTION SHOULD BE EXERCISED WHEN REMOVING PRESSURE CAP OR SERVICING THE SYSTEM.

BOILING/ENGINE OVERHEAT/ ENGINE COOLANT LOSS

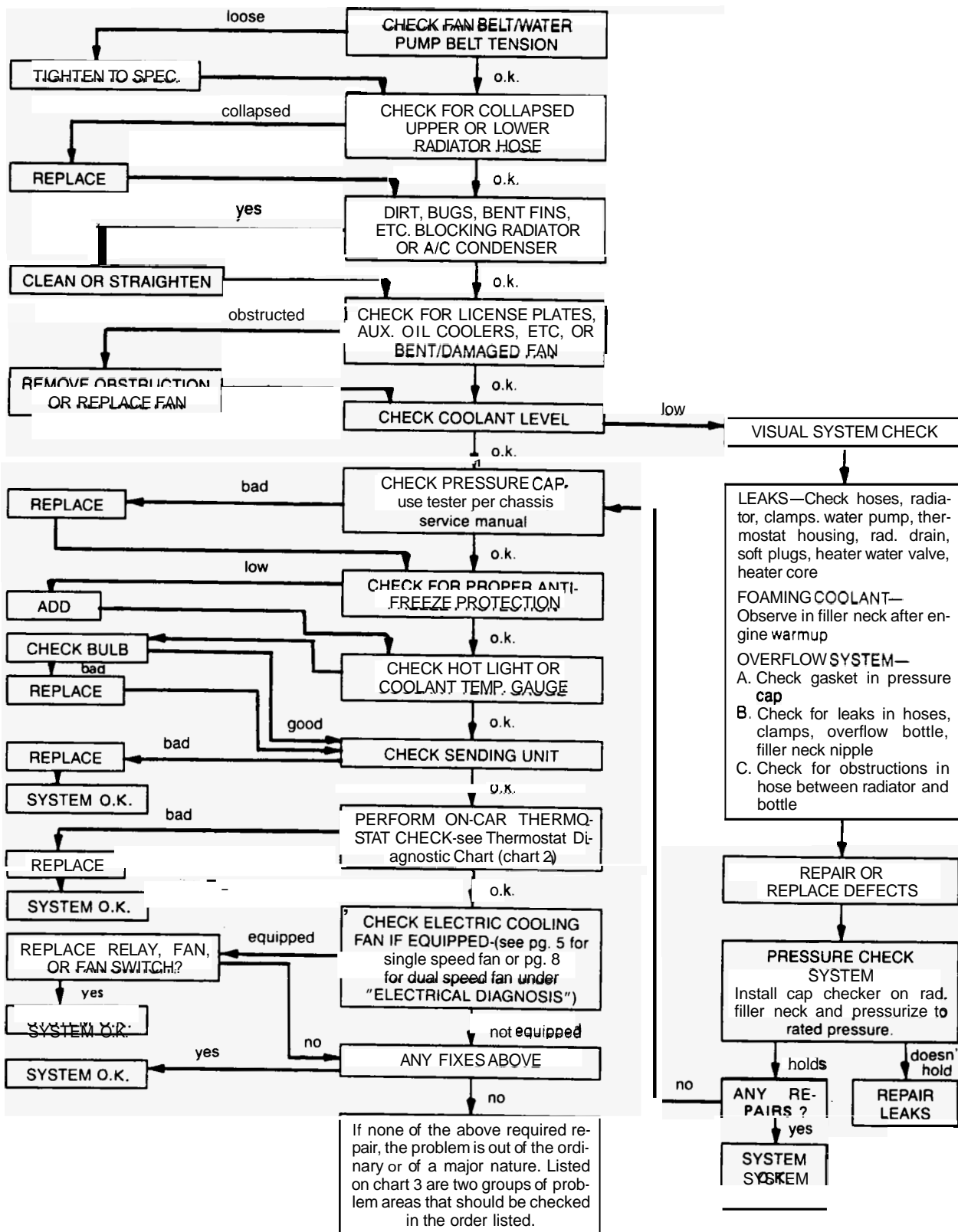
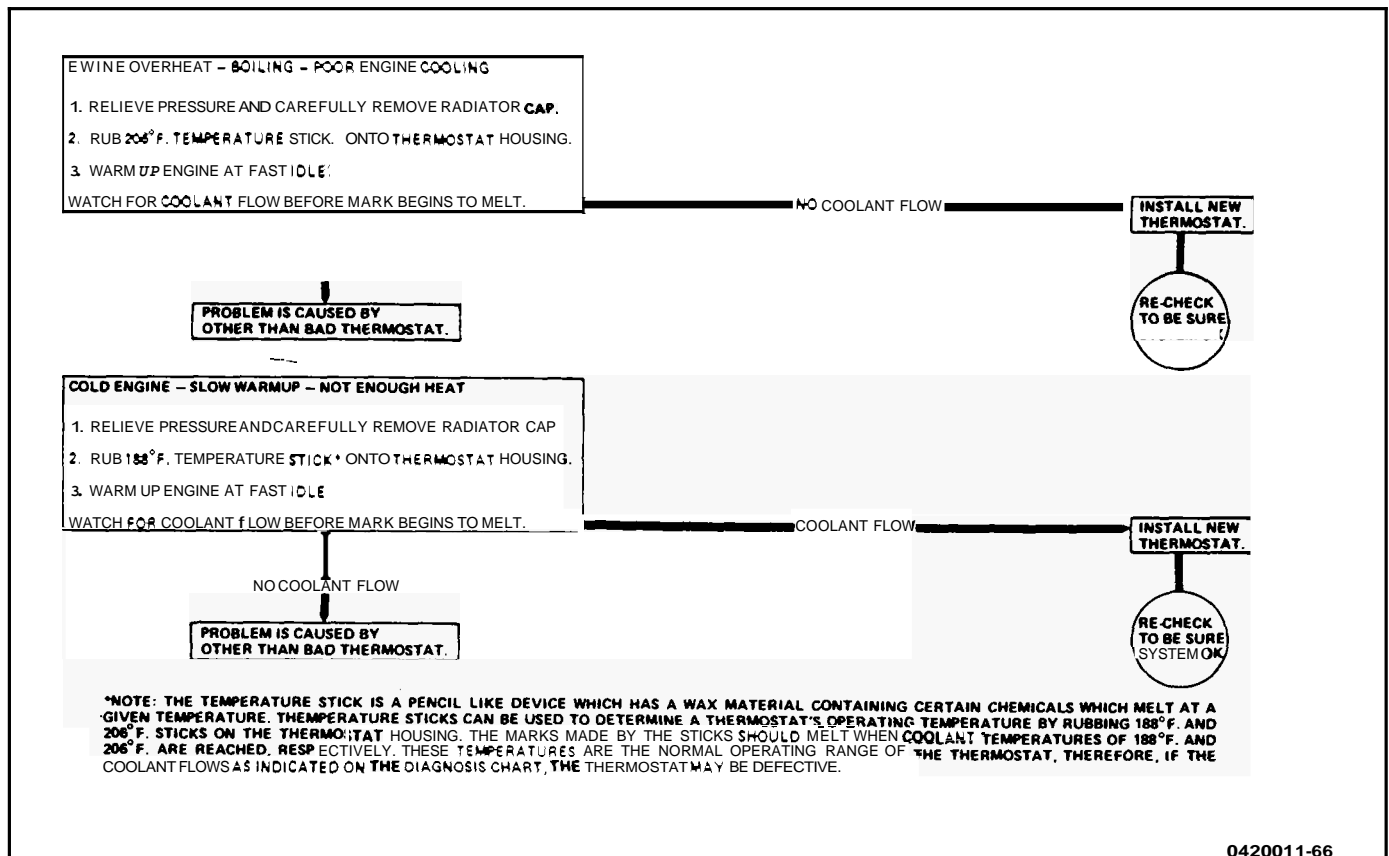


Figure 68-32 Cooling System Diagnosis Chart (2 of 3)

- A. PROBLEMS NOT REQUIRING DISASSEMBLY OF COOLING SYSTEM -**
1. LARGE OBSTRUCTIONS BLOCKING RADIATOR OR CONDENSER
 - a. AUXILIARY OIL COOLERS
 - b. LICENSE PLATES
 - c. SPARE TIRES
 - d. ICE, MUD OR SNOW OBSTRUCTING GRILLE - REMOVE
 2. ENGINE OIL OVERFILL - CHECK ENGINE OIL DIPSTICK
 3. WRONG RADIATOR FOR APPLICATION - CHECK PART NO. AGAINST PARTS LIST
 4. LOOSE, DAMAGED OR MISSING AIR SEALS - SEE BODY SERVICE MANUAL
 5. MISSING OR DAMAGED LOWER AIR BAFFLE - SEE BODY SERVICE MANUAL
 6. WRONG IGNITION TIMING - SEE CHASSIS SERVICE MANUAL
- B. PROBLEMS REQUIRING DISASSEMBLY OF COOLING SYSTEM -**
1. INCORRECT OR DAMAGED FAN - CHECK PART NO. AGAINST PARTS LIST
 2. FAULTY EMISSION SYSTEM COMPONENTS (COULD CAUSE OVERHEATING AT IDLE)
 - a. PCV VALVE
 - b. TVS OR TCS
 3. PRESSURE CHECK COOLING SYSTEM WITH PRESSURE CAP INSTALLED - WILL SHOW IF PRESSURE CAP LEAKS BECAUSE OF RADIATOR FILLER NECK DAMAGE
 4. DEFECTIVE WATER PUMP
 - a. ERODED OR BROKEN IMPELLER VANES
 - b. FAILED BEARING OR SEAL - CHECK FOR SHAFT OR BEARING PLAY
 5. PLUGGED RADIATOR TUBES - SEND TO RADIATOR REPAIR SHOP FOR FLOW CHECK
 6. INTERNAL SYSTEM LEAKS
 - a. HEAD GASKET - SEE CHASSIS SERVICE MANUAL
 - b. CRACKED BLOCK
 - c. TIMING CHAIN COVER
 - d. INTAKE MANIFOLD GASKET
 7. PLUGGED COOLANT PASSAGES IN CYLINDER HEADS - REMOVE HEADS AND CHECK VISUALLY

G420010-6B

Figure 68-33 Cooling System Diagnosis Chart (3of 3)



0420011-66

Figure 66-34 Thermostat Diagnosis Chart

1825-M. This coolant solution provides freezing protection to at least -37°C (-34°F), and it has been formulated to be used for two full calendar years or 30,000 miles, whichever first occurs, of normal operation without replacement, provided the proper concentration of coolant is maintained.

The radiator cap should not be removed to check coolant level unless a cooling system problem has boiled out much of the coolant or a leaking condition has been encountered. Coolant is added at the coolant reservoir for normal coolant service. Check the coolant level visually in the “see through” coolant reservoir tank every time hood is up. Level should be near “ADD” mark when the system is cold. At normal operating temperature the coolant level should increase to the “FULL” mark on the recovery tank. Coolant should be added only to the reservoir to raise level to the “FULL” mark. Use a 50/50 mixture of high-quality ethylene glycol antifreeze and water for coolant additions.

NOTICE: If recommended quality antifreeze is used, supplemental inhibitors or additives claiming to provide increased cooling capability are not necessary. They may be detrimental to the efficient operation of the system, and represent an unnecessary operating expense.

Every 12 months or 15,000 miles, the cooling system should be serviced as follows:

1. Wash radiator cap and filler neck with clean water.
2. Check coolant for proper level and freeze protection.
3. Pressure test system and radiator cap for proper pressure holding capacity 103 kPa (15 psi). If replacement of cap is required, use the proper cap specified for car model.
4. Tighten hose clamps and inspect all hoses. Replace hoses whenever checked, swollen or otherwise deteriorated.
5. Clean frontal area of radiator core and air conditioning condenser.

DRAINING AND REFILLING THE COOLING SYSTEM

Replace hoses every 24 months or 30,000 miles or earlier if cracked, swollen or otherwise deteriorated. Every two years or 30,000 miles, whichever first occurs, the cooling system should be flushed and refilled using the following recommended procedure:

1. Remove radiator cap or thermostat housing cap (LT2 and LT3) when engine is cool by:
 - a. Slowly rotating cap counterclockwise to detent. (Do not press down while rotating.)
 - b. Wait until any residual pressure (indicated by a hissing sound) is relieved.
 - c. After all hissing ceases, and system has cooled, press down on cap while continuing to rotate counterclockwise.

CAUTION: To avoid the danger of being burned, do not remove radiator cap while engine and radiator are still

hot, scalding fluid and steam may be blown out under pressure.

2. Remove the thermostat by using the wire handle to lift it out of the housing (LT2 and LT3).
3. (LT2 and LT3) With the thermostat removed, install the thermostat housing cap.
4. Open radiator drain valve and block drain plugs to drain coolant.
4. Close valve, install block drain plugs, and add sufficient water to fill system.
5. Run engine, drain and refill the system, as described in steps 1, 2, and 3 a sufficient number of times until the drained liquid is nearly colorless.
6. **BLOCK DRIVE WHEELS**, place transmission in **PARK** (automatic transmission) or **NEUTRAL** (manual transmission) and set the parking brake.
7. Allow system to drain completely and then close radiator drain valve tightly, and install block drain plugs.
8. Remove recovery cap leaving hoses in place. Remove coolant recovery tank and empty of fluid. Flush tank with clean water, drain and reinstall.
9. Add sufficient ethylene glycol coolant, meeting GM specifications, 1825-M, to provide the required freezing and corrosion protection - at least 50 percent solution. Fill radiator to the base of the radiator fill neck and add sufficient coolant to the recovery tank to raise level to the “FULL” mark. Reinstall recovery tank cap.
10. Run engine, with radiator cap or thermostat housing cap removed, until normal operating temperature is reached. (Radiator upper hose becomes hot.)
11. With engine idling, add coolant until level reaches bottom of filler neck and install cap making certain arrows line up with overflow tube.

CAUTION: Under some conditions, the ethylene glycol in engine coolant is flammable. To avoid being burned when adding coolant, DO NOT spill it on the exhaust system or hot engine parts.

It is the owner’s responsibility to keep the freeze protection at a level proportionate with the temperatures which may occur in the area of vehicle operation.

- a. Maintain cooling system freeze protection at -37°C (-34°F), to ensure protection against corrosion and loss of coolant if freezing temperatures are not expected.
- b. Add ethylene glycol base coolant that meets GM Specifications 1825-M when coolant additions are required because of coolant loss or to provide additional protection against freezing at temperatures lower than -37°C (-34°F).

NOTICE: Alcohol or methanol base coolants or plain water are not recommended at any time.

NOTICE: Adding anti-freeze to maintain correct freeze protection but too much will affect the freezing point. A solution stronger than **70%** anti-freeze should never be used, as the freeze level rises rapidly after this point. Pure anti-freeze will freeze at **-22°C (-8°F)**. To assure sufficient engine cooling, the protection level should be maintained to at least **-37°C (-34°F)**.

Fill Procedures For LC2, LG3 and LN7 Engines (A-C-G-H & N Car Lines)

1. Engine must be cold (at least one hour since last run).
2. Remove radiator cap and clamp off radiator overflow bottle hose. Avoid hose damage if using vice grips.
3. Fill radiator to top with a 50/50 mixture of ethylene glycol based antifreeze which meets **GM Specification 1825-M**.
4. Place transmission selector in "Park."
5. Run engine at approximately **2000 RPM**.
6. Disconnect heater outlet hose (LN7 or LG3) from heater outlet pipe and bleed until stream is free from air (approximately **5 seconds**).
7. Reattach hose to heater outlet pipe and tighten hose clamp.
8. Add coolant with engine at idle until coolant level reaches filler neck.
9. Throttle engine between idle and approximately **3000 RPM** ten times.
10. Repeat Step 8 if necessary.
11. Let engine idle until upper radiator hose is hot to the touch.
12. Repeat Step 9.
13. Repeat Step 8 if necessary.
14. Replace radiator cap and unclamp radiator overflow hose.

Important

Whenever it becomes necessary to open up the cooling system, or the coolant is changed for any reason, three pellets of Engine Coolant Supplement, P/N **3634621** should be added to the coolant, to retain the original factory level protection.

Testing Coolant

In using a hydrometer to determine the freezing point of radiator solution, make sure correct hydrometer markings are read. Unless hydrometer is provided with means for temperature correction, test should be made at temperature at which hydrometer is calibrated, if the solution is warmer or colder, large errors may result, in some cases as much as **17°C (30°F)**.

Thermostat (All except J Series, Code LT2 and LT3)

Remove or Disconnect

1. Negative battery cable
2. Engine coolant, partially
3. Water outlet to thermostat housing attaching bolts
4. Thermostat housing
5. Thermostat

Clean

- o Thermostat housing mating surfaces
- o Water outlet mating surfaces

Install or Connect

1. A 3mm (1/8") bead of RTV sealer, to thermostat housing
2. Thermostat in water outlet
3. Thermostat housing to water outlet, while sealer is still wet
4. Attaching bolts and torque to **28 N·m (21 lb.ft.)**
5. Engine coolant
6. Negative battery cable

Inspect

- o For correct completion of repair
- o For coolant leaks

Thermostat (J Series LT2 and LT3)

See figure 60-9

Remove or Disconnect

1. Thermostat housing cap
2. Grasp the handle of thermostat and gently pull upward

Clean

- o Thermostat housing and thermostat O-ring
- Apply suitable lubricant to O-ring after cleaning for easier installation

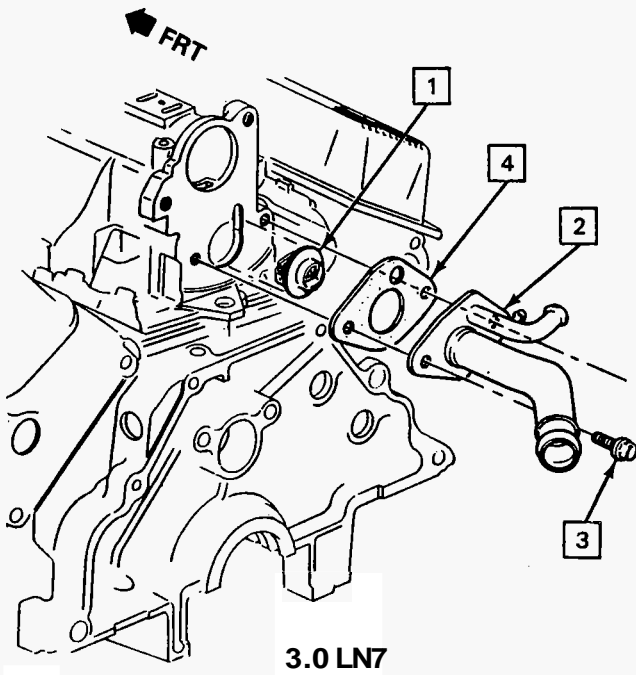
Install or Connect

1. Thermostat in housing, pushing down to insure the thermostat is properly seated
2. Thermostat housing cap

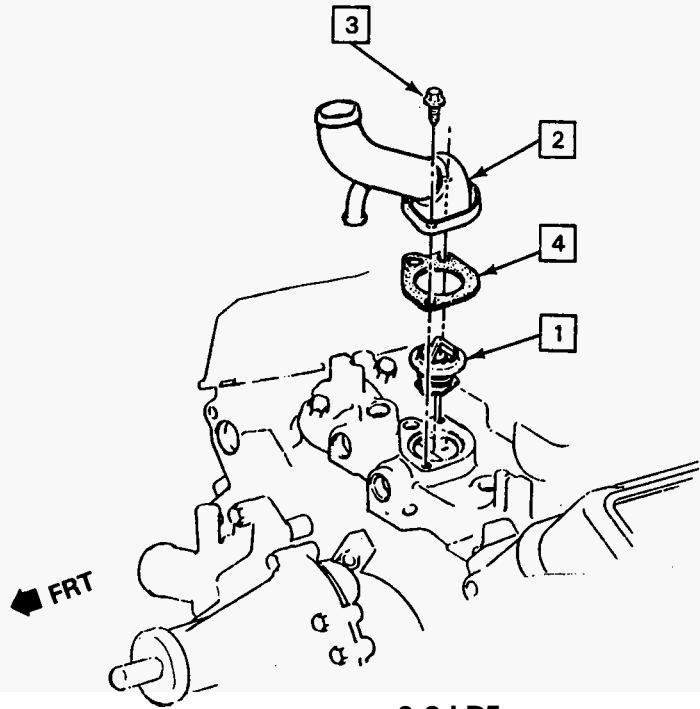
Thermostat (N Series, LN7)

Electric Cooling Fan

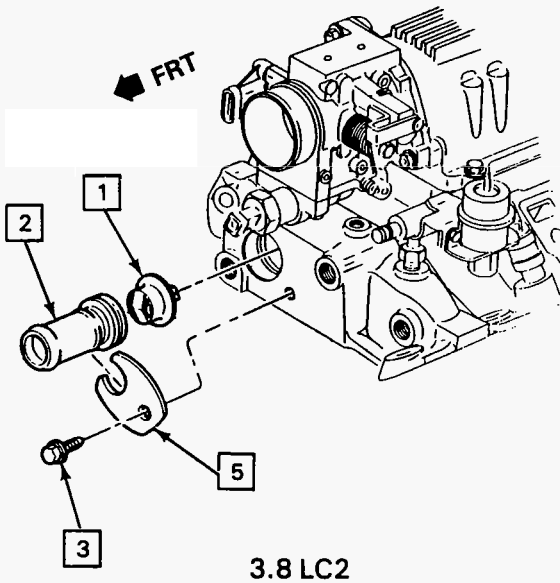
CAUTION: Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to a heat sensor with the ignition in the "OFF", "RUN" or "ACCESSORY" position.



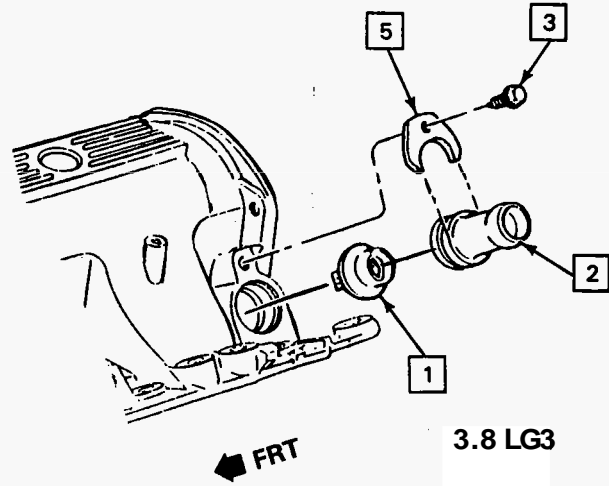
3.0 LN7



3.8 LD5



3.8 LC2



3.8 LG3

- 1 THERMOSTAT
- 2 WATER OUTLET
- 3 BOLT/SCREW
- 4 GASKET
- 5 CLAMP

Figure 68-35 V-6 Engine Thermostat Locations

 **Remove or Disconnect**

1. Negative battery cable
2. Harness from fan motor and fan frame
3. Fan frame to radiator support attaching bolts
4. Fan and frame assembly

 **Install or Connect**

1. Fan and frame assembly
2. Fan frame to radiator support attaching bolts and torque to 9.5 N·m (85 lb. in.)
3. Harness to fan frame and fan motor
4. Negative battery cable

 **Inspect**

- o For proper completion of repairs
- o For operation of fan motor

Water Pump LT2 and LT3 Engines

 **Remove or Disconnect**

1. Timing belt.
2. Timing belt rear protective covers.
3. Lower radiator hose from the water pump.
4. Water pump attaching bolts.
5. Water pump and seal ring.

 **Clean**

Water pump and engine block sealing surfaces.

 **Install or Connect**

1. A 2mm (3/32") bead of sealant on the water pump sealing surface.
2. Water pump while sealer is still wet.
3. Water pump attaching bolts finger tight.
4. Hose to the water pump.
5. Timing belt rear protective covers.
6. Timing belt and adjust to specifications.

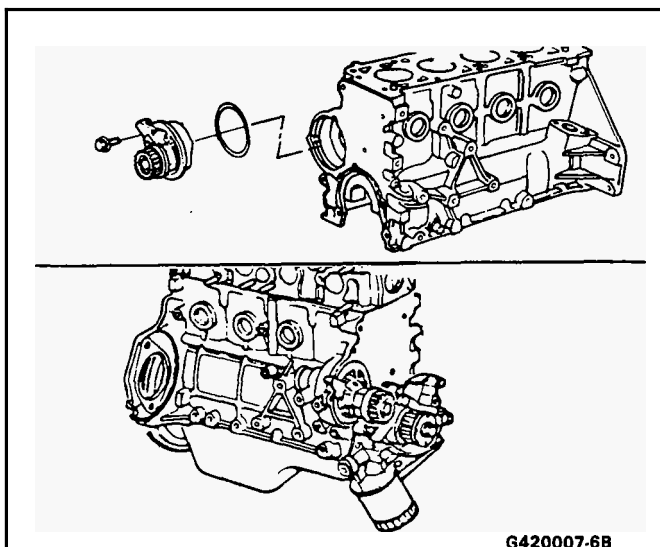


Figure 68-36 Water Pump - LC2 and LC3

 **Inspect**

- o For proper completion of repair
- o For coolant leaks.

Water Pump LL8 Engine

 **Remove or Disconnect**

1. Negative cable at battery.
2. Drain cooling system.
3. Accessory drive belts.
4. Generator.
5. Water pump pulley attaching bolts and pulley.
6. Water pump attaching bolts and pump.

 **Clean**

o Water pump and engine block sealing surfaces

 **Install or Connect**

1. A 3mm (1/8") bead of sealant.
2. Water pump while sealer is still wet. on water pump sealing surface.
3. Water pump attaching bolts and torque bolts to specification.
4. Water pump pulley and torque bolts to specifications.
5. Generator.
6. Accessory drive belts to proper tension.
7. Engine coolant.
8. Negative battery cable.

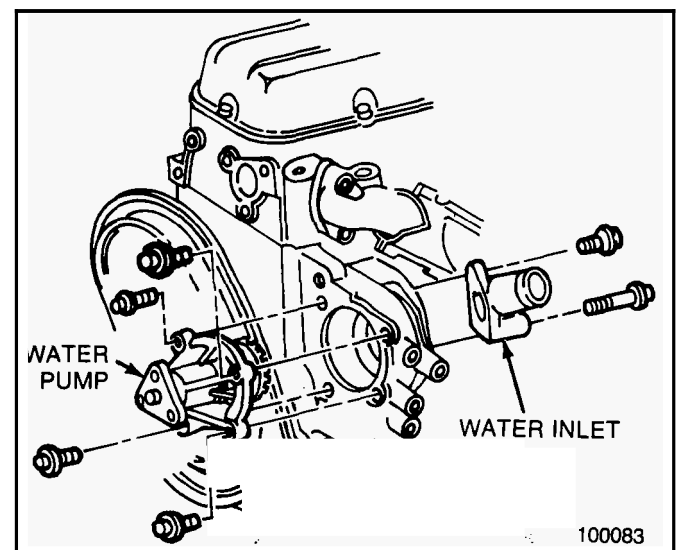


Figure 6B-37 Water Pump Mounting - LL8 Engine

Water Pump 2.5L Engine

 **Remove or Disconnect**

1. Negative battery cable.
2. Cooling system.
3. Accessory drive belts.
4. Hose from water pump.
5. Water pump attaching bolts.
6. Water pump.

66-20 ENGINE COOLING



Clean

- Water pump mating surfaces.



Install or Connect

1. A 3mm (1/8") bead of sealant on water pump sealing surface.
2. Water pump, while sealer is still wet, attaching bolts and torque to specification. Water pump bolts must also be coated with RTV sealer to avoid coolant leaks.
3. Lower radiator hose and heater hose to water pump.
4. Generator or A/C compressor.
5. New fan and pump pulley.
6. Accessory drive belts and adjust.
7. Engine coolant.
8. Negative battery cable.

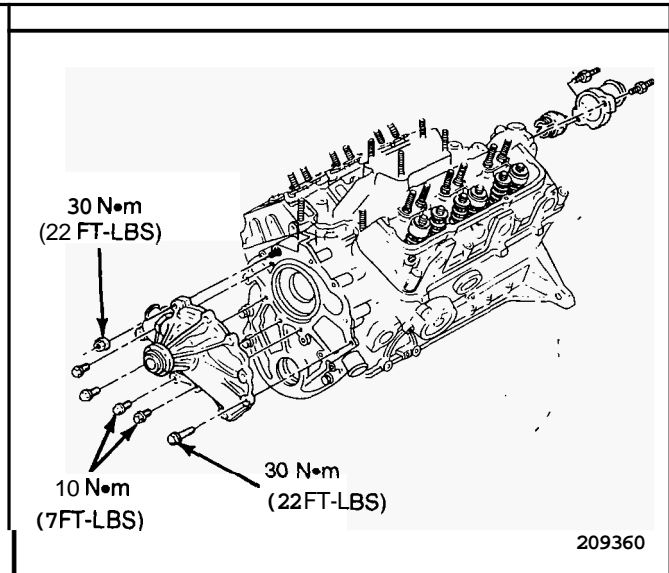


Figure 6B-39 Water Pump Mounting - 2.8L Engine

Water Pump 2.8L Engine



Remove or Disconnect

1. Negative battery.
2. Engine coolant.
3. Drive belts.
4. Radiator and heater hose.
5. Water pump attaching bolts.
6. Water pump.



Clean

- Water pump mating surfaces.



Install or Connect

1. A 2mm (3/32") bead of sealant on the water pump sealing surface.
2. Water pump attaching bolts with sealer and torque bolts to specifications.
3. Radiator and heater hose.
4. Accessory drive belts to proper tension.

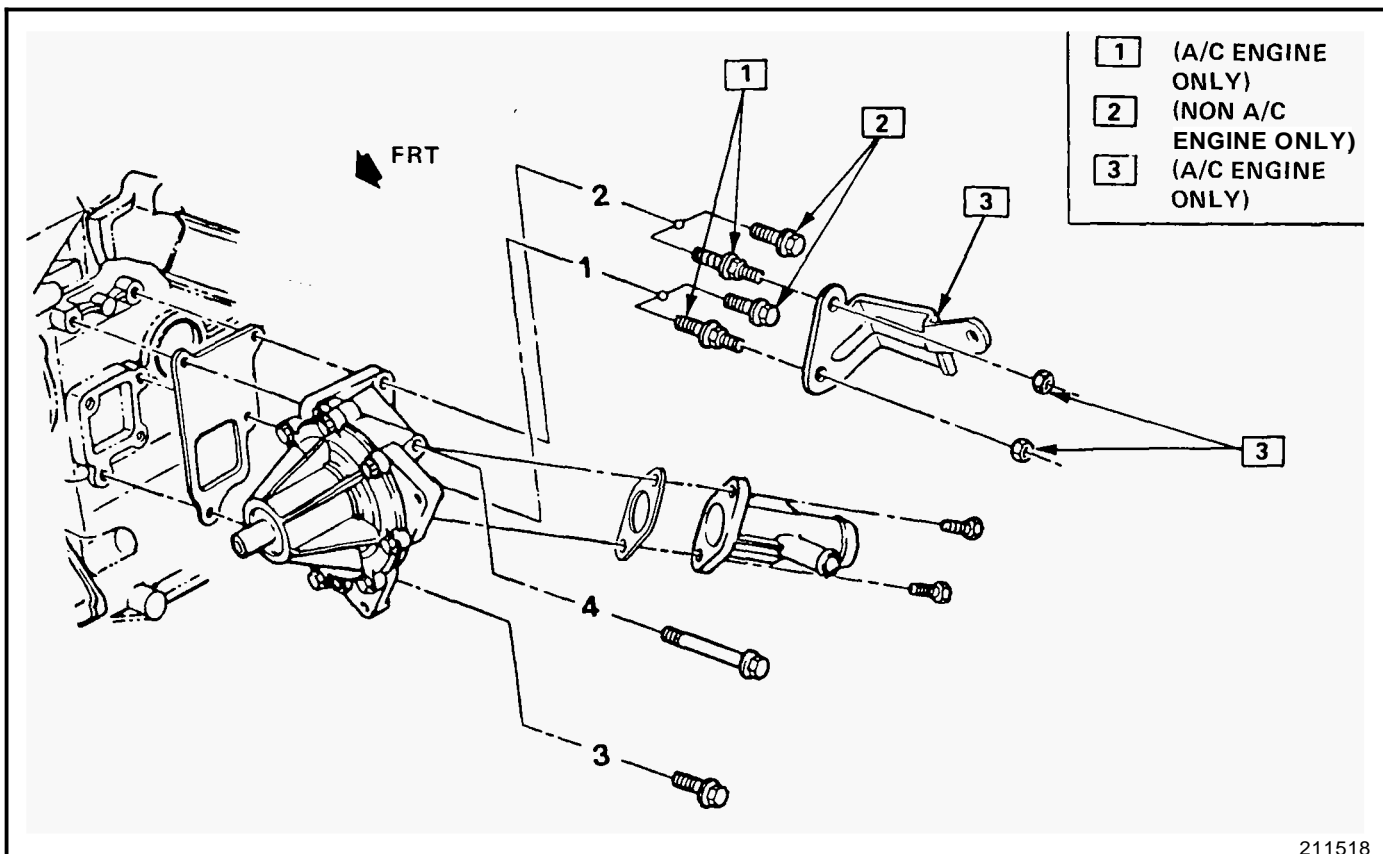


Figure 68-38 Water Pump Mounting 2.5L Engine

5. Engine coolant.
6. Negative battery cable.

3.0L Engine

Remove or Disconnect

Figure 68-40

1. Negative battery cable
2. Engine coolant
3. Accessory drive belts
4. Lower radiator hose at pump
5. Heater hose at pump
6. Water pump pulley attaching bolts (long bolt is removed through access hole provided in the body side rail).
7. Water pump pulley
8. Water pump attaching bolts
9. Water pump

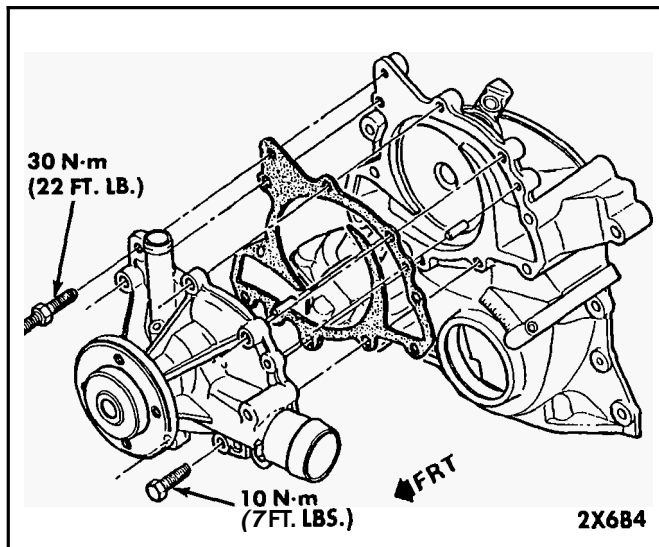


Figure 68-40 Water Pump Mounting-3.0L Engine

Clean

- o Water pump gasket mating surface
- o Timing chain cover

Install or Connect

1. Water pump on dowels
2. Water pump attaching bolts and torque to specification
3. Water pump pulley
4. Water pump pulley attaching bolts
5. Lower radiator hose at pump
6. Heater hose at pump
7. Accessory drive belts to proper tension
8. Engine coolant
9. Negative battery cable

Inspect

- o For proper completion of repairs

- o For coolant leaks

Recovery Bottle

Remove or Disconnect

1. Hose from recovery bottle.
2. Attaching screws and remove bottle.

Clean

- o Recovery bottle with suitable solution.

Install or Connect

1. Place bottle in vehicle and torque attaching screws to 3 N·m (27 lb.in.).
2. Coolant hose to bottle.
3. Fill bottle to appropriate mark.

Radiator (Longitudinal Engines)

Remove or Disconnect

1. Negative battery cable.
2. Engine coolant.
3. Fan blade.
On fan clutch equipped cars, store clutch in upright position to prevent seal leakage.
4. Upper and lower radiator hoses.
5. On vehicles equipped with automatic transmission, plug transmission/engine oil (LC2) cooler lines.
6. Fan shield assembly if applicable.
7. Radiator and shroud assembly, lift straight up. The radiator assembly is held at the bottom by two cradles secured to the radiator support.

Install or Connect

1. If new radiator, transfer fittings from old radiator to new radiator.
2. Radiator in car, locating bottom of radiator in lower mounting pads.
3. Transmission/Engine oil cooler lines at radiator.
4. Coolant recovery bottle hose at radiator.
5. Coolant hoses at radiator.
6. Upper radiator support bracket.
7. Engine coolant.
8. Negative battery cable.

Inspect

- o For proper completion of repair.
- o For fluid leaks.

Radiator (Transverse Engines)

Remove or Disconnect

1. Negative battery cable.
2. Engine coolant.
3. Engine forward strut brace at radiator and swing strut rearward.

! important

To prevent shearing of rubber bushing, loosen bolt before swinging strut.

4. Forward lamp harness from fan frame and unplug fan connector.
5. Fan attaching bolts.
6. Fan and frame assembly.
7. Hood latch from radiator support. Scribe latch location before removal so it may be reinstalled in the same location.
8. Coolant hoses from radiator and coolant recovery tank hose from radiator neck.
9. Transmission oil cooler lines from radiator, if applicable.
10. Radiator to radiator support attaching bolts and clamps.
11. Radiator from car.

↔ Install or Connect

1. If new radiator, transfer fittings from old radiator to new radiator.
2. Radiator in vehicle, locating bottom of radiator in lower mounting pads.
3. Radiator to radiator support attaching clamp and bolts. Torque to 10 N·m (7 lb.in.).
4. Transmission oil cooler lines. Torque nuts to 27 N·m (6 lb.ft.). If applicable.

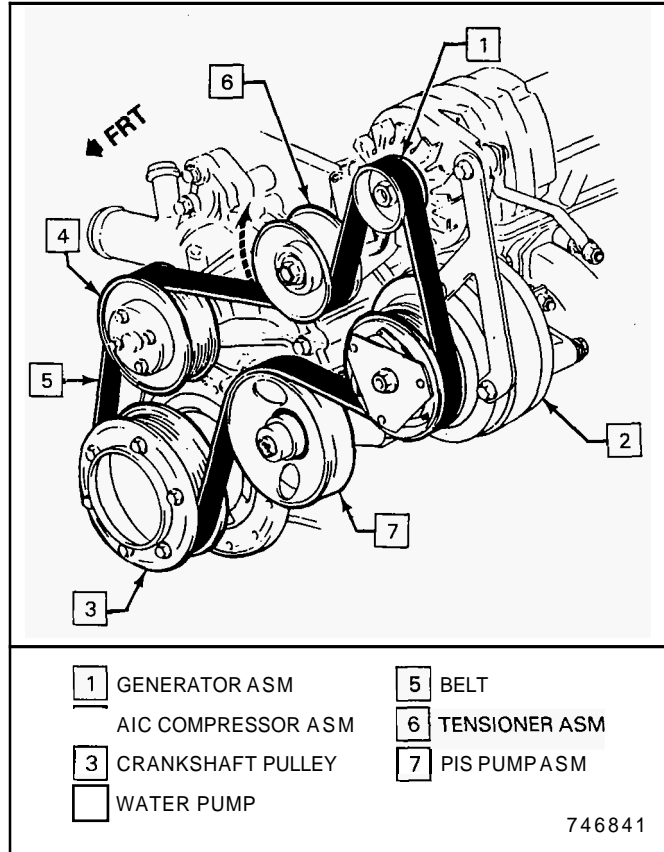


Figure 66-41 Belt Routing LC2

5. Coolant hoses to radiator. Torque clamps to 2 N·m (15 lb.in.).
6. Coolant recovery hose to radiator neck.
7. Hood latch to radiator support. Torque bolts to 25 N·m (6 lb.ft.).
8. Fan assembly making sure bottom leg of frame fits into rubber grommet at lower radiator support.
9. Fan attaching bolts; torque to 10N·m (85 lb. in.).
10. Fan connector and forward lamp harness to fan frame.
11. Swing engine forward strut and brace forward until brace contacts radiator support. Install brace to radiator support attaching bolts and torque to 50 N·m (11 lb.ft.). Be sure to connect engine ground strap to strut brace.
12. Engine coolant.
13. Negative battery cable.

□ Inspect

- o For proper completion of repair.
- o For leaks.

ACCESSORY DRIVE BELTS

Drive belt tension is important in maintaining proper operation of engine accessory drive systems and in extending the normal life of drive belts. When drive belts require replacement or adjustment, follow the drive belt specifications listed in Section OA using belt tension tools J-23600-B or BT 33-95-ACBN.

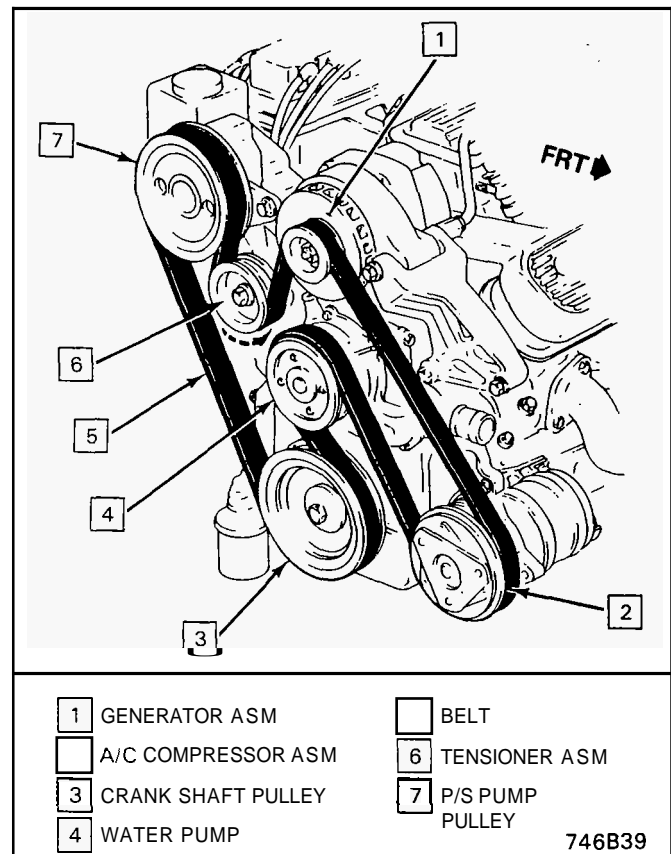


Figure 66-42 Belt Routing LG3/LN7

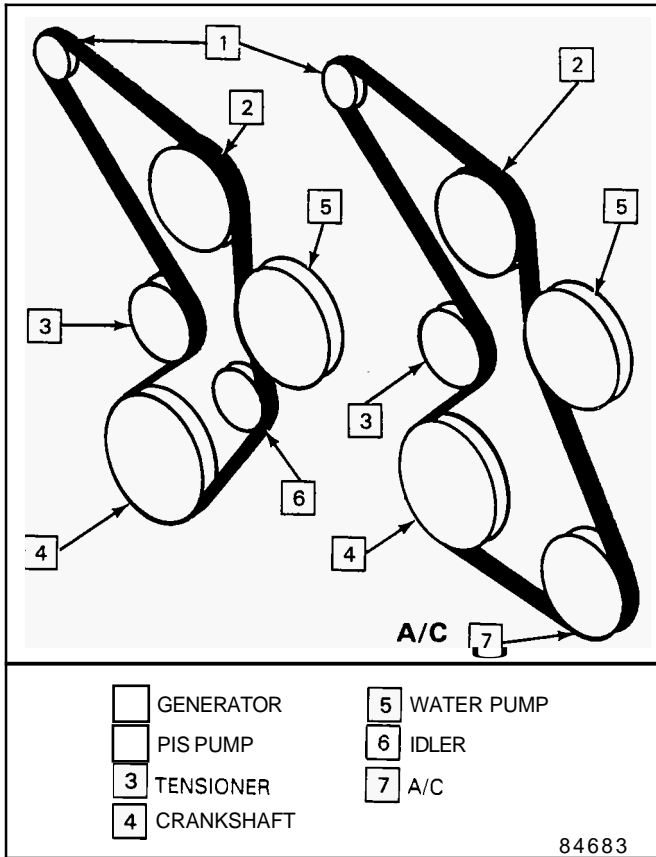


Figure 68-43 Belt Routing L66

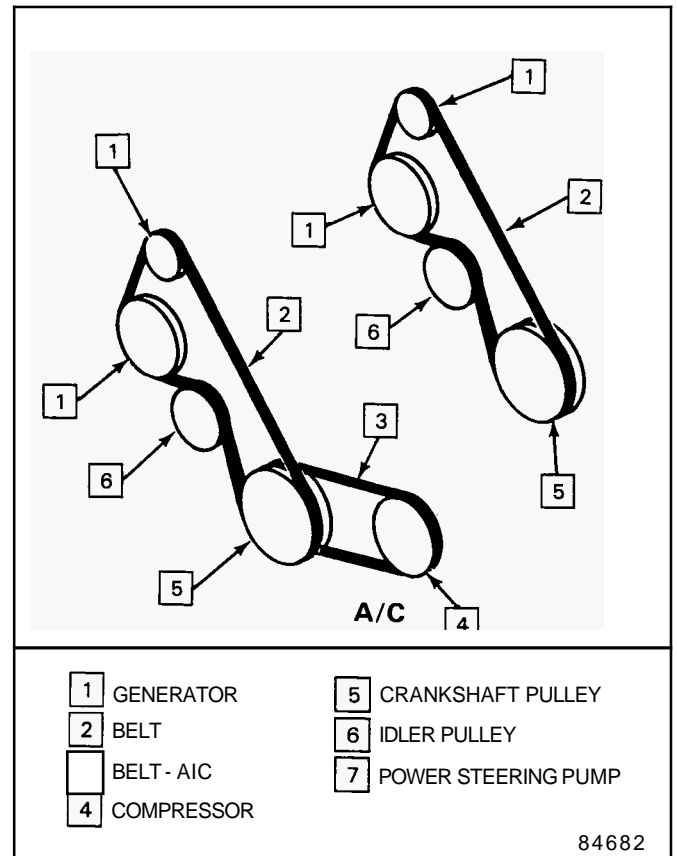


Figure 66-44 Belt Routing LT3

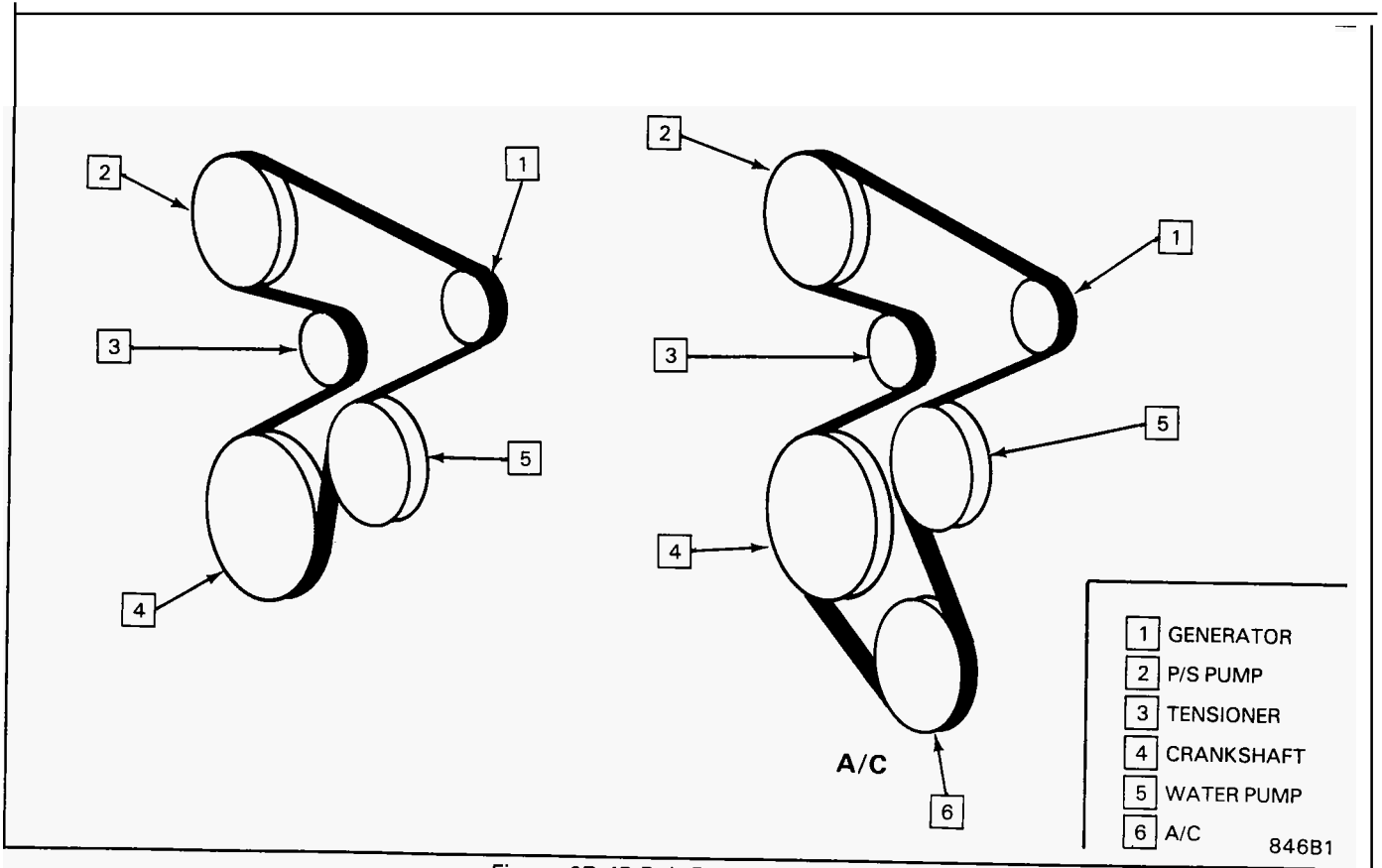


Figure 6B-45 Belt Routing LL8/LR8

