

SECTION 6B

COOLING AND RADIATOR

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

The cooling system, which consists of a radiator assembly and coolant recovery subsystem, electric engine coolant fan assembly, engine coolant thermostat assembly and water pump assembly and serpentine drive belt, works to maintain engine temperature at an efficient level during all engine operating conditions.

On the 3.4L L32 engine, coolant is drawn from the radiator assembly by the water pump assembly and circulated through coolant jackets in the engine block assembly, intake manifold assembly, and cylinder head assemblies. It is then directed back to the radiator assembly.

On the 5.7L LT1 engine, coolant is drawn from the radiator assembly by the water pump assembly and circulated through coolant jackets in the cylinder heads, then

through coolant jackets in the engine block. It is then directed back to the radiator assembly.

The system directs some engine coolant through hose assemblies to the heater core to provide defrost and passenger compartment heat. A coolant recovery reservoir assembly is connected to the radiator assembly to recover engine coolant displaced by expansion. As the engine assembly cools, the engine coolant is drawn back into the radiator assembly by vacuum.

RADIATOR ASSEMBLY

Cross-Flow Radiator Core and Outlet and Inlet Tanks

A cross-flow radiator core is used on all models. Outlet and inlet tanks are located to the right and left of the cross-flow radiator core. All radiator assemblies used with automatic transmissions have transmission oil coolers and inlet and outlet fittings for transmission fluid circulation. Vehicles with manual transmission assemblies use radiator assemblies without transmission oil coolers.

An aluminum-plastic radiator assembly can be identified by a note on the outlet tank 127 mm (5 inches) below the filler neck which reads: "Important – for repair see Harrison Service Manual." Service procedures for the aluminum-plastic radiator assembly are described in that manual and in this section.

Transmission Oil Cooler Assembly

If equipped, the transmission oil cooler assembly is located in the outlet tank on the right side of the radiator assembly. For information on servicing the transmission oil cooler and pipe assemblies, refer to SECTION 7A.

Engine Oil Cooler Assembly

The 5.7L LT1 engines equipped with a GU5 axle require an engine oil cooler assembly which is located in the left end of the radiator assembly. Engine oil cooler pipe assemblies connect the radiator assembly to the engine block assembly through an adapter assembly, located between the oil filter assembly and engine block.

Radiator Drain Cock Assembly

The radiator drain cock assembly includes the radiator drain cock and the radiator drain cock sealer; it is located on the inner right side of the radiator assembly, near the bottom.

RADIATOR FILLER CAP ASSEMBLY

Figure 1

A pressure-type radiator filler cap assembly is used with the cross-flow radiator assembly to allow a buildup of 124 kPa (18 psi) in the cooling system. This pressure raises the boiling point of engine coolant to approximately 125°C (257°F) at sea level.

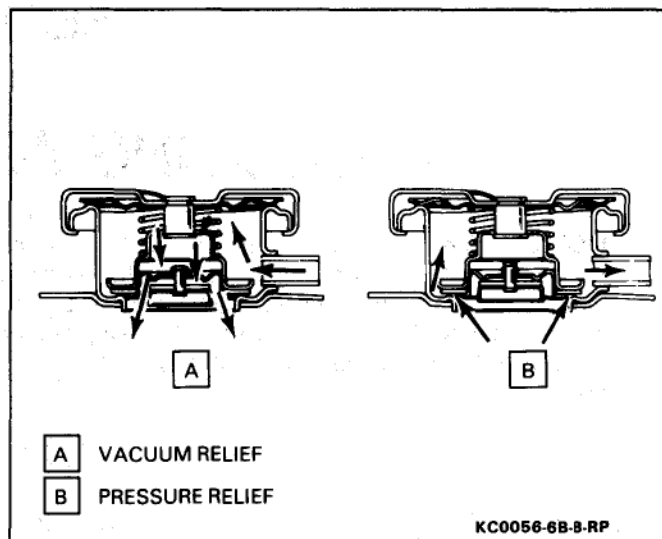


Figure 1 – Pressure-Type Radiator Filler Cap Assembly (Typical)

CAUTION: Do not remove radiator filler cap assembly to check engine coolant level; check engine coolant at the coolant recovery reservoir assembly. Engine coolant should be added only to the coolant recovery reservoir assembly, when the system cools.

CAUTION: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution. Removal of the radiator filler cap assembly while engine assembly is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine assembly, fenders and person removing cap. If the solution contains flammable anti-freeze, such as alcohol (not recommended for use at any time), there is also the possibility of causing a serious fire.

The pressure-type radiator filler cap assembly contains a blow-off (pressure) valve and a vacuum (atmospheric) valve. The pressure valve is held against its seat by a heavy spring. This spring protects the radiator assembly by relieving pressure exceeding 124 kPa (18 psi).

To prevent radiator assembly collapse caused by vacuum as the engine assembly cools, the vacuum valve prevents excessive pressure differences from occurring between the cooling system and the atmosphere.

The radiator filler cap assembly has been designed without finger grips to discourage inadvertent removal. To safely remove the radiator filler cap assembly, rotate the cap assembly slowly counter-clockwise (do not press down) to detent. Allow any pressure to be relieved. Next, press down on the cap assembly and continue to rotate cap assembly counterclockwise and lift off the cap assembly. Embossed on the cap assembly is a caution against opening it and arrows indicating the proper closed position.

ELECTRIC ENGINE COOLANT FAN ASSEMBLY

An electric engine coolant fan assembly aids air flow through the radiator assembly. There are five plastic blades on each fan blade assembly. The fan blade assembly is driven by a motor attached to the radiator support. The 5.7L LT1 engine assembly equipped with air conditioning has two engine coolant fan assemblies attached to the radiator support.

The fan motor is activated by an PCM controlled fan relay. If the vehicle is equipped with air conditioning, the fan motor also operates when the compressor assembly is operating.

CAUTION: If a fan blade assembly is bent or damaged in any way, no attempt should be made to repair or reuse the damaged part. A bent or damaged fan blade assembly should always be replaced. It is essential that fan blade assemblies remain in proper balance and proper balance cannot be assured once a fan blade assembly has been bent or damaged. A fan blade assembly that is not in proper balance could fail and fly apart during subsequent use, creating an extremely dangerous condition.

The fan blade assembly is designed to aid air flow through the radiator and air conditioning condenser.

ENGINE COOLANT TEMPERATURE GAGE SENSOR

This sensor controls a temperature gage in the instrument cluster assembly. The temperature gage indicates the operating temperature of the engine assembly. Refer to SECTION 8A for engine coolant temperature gage sensor diagnosis and location.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

This sensor sends a signal to the powertrain control module (PCM) which completes the ground for the electric engine coolant fan relay, which operates the fan assembly when the engine coolant temperature exceeds 110°C (230°F). Refer to SECTION 6E3 for engine coolant temperature (ECT) sensor diagnosis and location.

ENGINE COOLANT THERMOSTAT ASSEMBLY

A pellet-type engine coolant thermostat assembly is used in the engine coolant outlet passage to control the flow of engine coolant to provide fast engine warm-up and to regulate engine temperatures. A wax pellet element in the thermostat assembly expands when heated and contracts when cooled. The pellet element is connected through a piston to a valve. The valve remains closed while the engine coolant is cold, preventing circulation of engine coolant through the radiator assembly and allowing the circulation of engine coolant only through the engine assembly.

As the engine assembly warms, the pellet element expands and the thermostat valve opens, permitting engine coolant to flow through the radiator assembly.

COOLANT RECOVERY SYSTEM

A plastic reservoir is connected to the radiator assembly by a hose. As the vehicle is driven, the engine coolant is heated and expands. The portion of the engine coolant displaced by this expansion flows from the radiator assembly into the reservoir assembly. When the engine assembly is stopped and the engine coolant cools and contracts, the displaced engine coolant is drawn back into the radiator assembly by vacuum. Thus, the radiator assembly is kept filled with engine coolant to the desired level at all times, resulting in increased cooling efficiency.

RADIATOR AIR BAFFLE ASSEMBLIES AND DEFLECTORS

Radiator air baffle assemblies and deflectors are located at the top and bottom of the radiator assembly to increase air flow through the radiator assembly.

SERPENTINE DRIVE BELT

The serpentine drive belt drives the water pump assembly (V6 only) and engine accessories. To check the condition of the serpentine drive belt and tensioner assembly, refer to SECTION 6A2A or SECTION 6A3A.

ENGINE BLOCK COOLANT DRAIN HOLE PLUG

The engine block coolant drain hole plug is on the left side of the engine block assembly. It must be removed during a complete drain and refill of the coolant system. The knock sensor on the right side of the engine block assembly must also be removed.

MAINTENANCE RECOMMENDATIONS

Regular maintenance of the cooling system will help keep it operating properly. Use the following procedures to check the cooling system at least once a year or 25 000 km (15,000 miles).

CHECKING ENGINE COOLANT

Check the engine coolant level in the reservoir assembly by removing the reservoir cap and checking the dipstick while the engine is cold. The level should be at or above the "FULL COLD" mark on the dipstick when the engine assembly is cold. At normal operating temperatures the engine coolant level should be at or above the "FULL HOT" mark on the dipstick.

Engine coolant should be added only to the reservoir assembly to raise the level to the appropriate mark. Use a 50/50 mixture of high quality ethylene glycol and water for engine coolant additions.

Every two years or 50 000 kilometers (30,000 miles), whichever comes first, the cooling system should be drained and refilled. Refer to "Draining and Refilling the Cooling System" in this section.

ENGINE COOLANT CONCENTRATION

The percentage of ethylene glycol in the engine coolant should be checked periodically and when the engine coolant level is adjusted or the system drained and refilled.

This test is done by using a refractometer engine coolant tester. Refractometers test for the amount of glycol in a coolant mixture by measuring the speed of light as it passes through the fluid and are not affected by the specific gravity of the glycol. Refer to "Engine Coolant Testing" in this section for the test procedures.

HOSE ASSEMBLIES AND CLAMPS INSPECTION

Inspect the condition of all hose assemblies and clamps. Hose assemblies should be flexible and show no signs of bulging, cracks, cuts, kinks or area of possible leaks. Inspect the brackets, supports, ties and clamps. Adjust and tighten as necessary.

WATER PUMP ASSEMBLY COOLANT WEEPAGE

A very slight amount of weepage may occur at the water pump vent hole during vehicle operation. Tracks of residue may occur from the lower vent hole. The water pump should be replaced only if coolant is dripping from the vent hole while the engine is in operation or while the cooling system is pressurized.

Minor water pump weepage and minor engine cooling system leaks may be corrected by adding two sealant pellets to the cooling system. The pellets are available from GMSPO in packages of six under GM P/N 3634621.

Two engine coolant supplement pellets should be added to the coolant system under the following conditions:

- Vehicle encountering water pump weepage or minor coolant leak/loss that cannot be corrected through normal service procedures.
- When cooling system is drained and coolant is replaced with new coolant due to engine repair work or at recommended coolant change intervals (two years or 30,000 miles).
- Whenever engine water pump is replaced. The addition of pellets provides a mild lapping of the new water pump seal that improves conformability of the mating surfaces. Water pump seal weepage is minimized by the addition of pellets.

CAUTION: To avoid the danger of being burned, do not remove the cap while the engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure.

NOTICE: Do not add pellets into non-pressurized coolant recovery bottles.

The two pellets should be installed into the radiator. Care should be exercised to avoid contamination of the pressure/radiator cap and mating sealing surfaces with pellet debris. The use of sealant pellets may cause a film to appear around the sides of non-pressurized coolant

recovery bottles. The presence of this film is considered to be normal.

Following installation of the pellets, run the engine for approximately 15 minutes, then check for coolant leaks and proper cooling system operation.



Important

If pellets have been installed to correct an excessive water pump seal weepage condition, one to two weeks of normal vehicle operation may be required to lap in the mating seal surfaces. Some staining due to minor weepage may continue to occur. This is considered normal.

PRESSURE TESTING

Test the radiator filler cap assembly for the proper pressure holding capacity. Refer to "Pressure Test" in this section.

EXTERIOR RADIATOR ASSEMBLY CLEANING

Clearing away bugs, leaves and other debris from the small air passageways of the radiator assembly will improve the operation of the cooling system.

Use compressed air to blow through the radiator assembly from the rear towards the front of the vehicle. If compressed air is not available, water can be used by directing the water hose from the rear of the radiator assembly.

NOTICE: The radiator fins are necessary for good heat transfer and should not be brushed. Brushing may damage the fins, reducing heat transfer.

DIAGNOSIS

COOLING SYSTEM OVERHEATING

Figure 2

1. If overheating occurs due to prolonged idling in gear, instruct operator on driving techniques which would reduce possibility of engine assembly overheating:
 - Idle in "NEUTRAL" as much as possible and raise engine rpm using accelerator pedal assembly.
 - Turn air conditioning "OFF" during extended idling.
2. If above does not apply, refer to diagnosis chart.

ENGINE COOLANT THERMOSTAT ASSEMBLY TEST

Figure 2

Tools Required:

- J 24731-188 Tempil Stick
- J 24731-206 Tempil Stick



Inspect

- Thermostat assembly opening temperature (Figure 2).

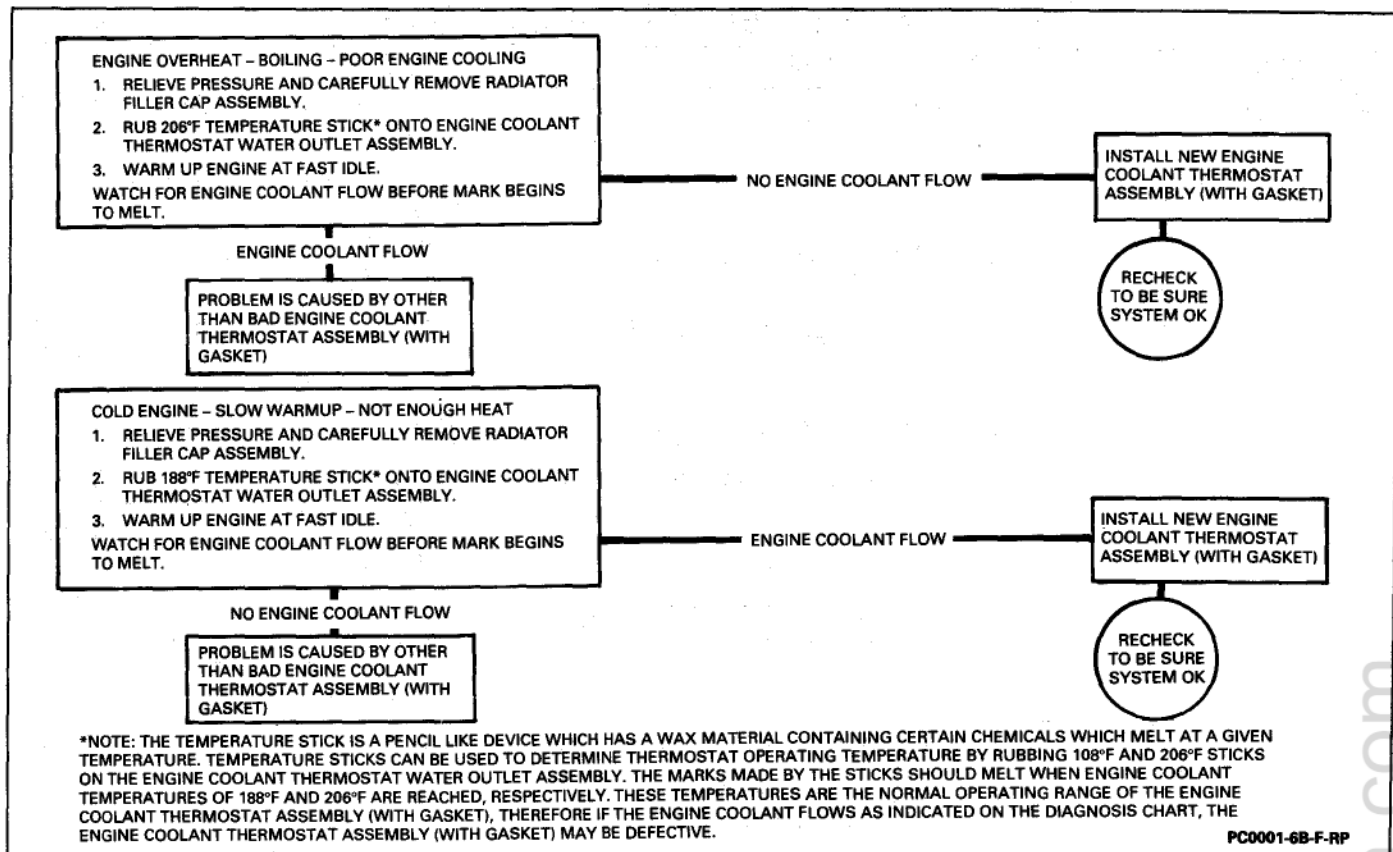


Figure 2 - Thermostat Assembly Diagnosis

RADIATOR FILLER CAP ASSEMBLY



Inspect

- Cap assembly for weak spring washer or damage to gasket. If spring washer is weak, replace cap assembly.
- Relief valve gasket in cap assembly and inner sealing surface of neck assembly for damage or debris.
- Hose fitting on neck assembly for cracks. If fitting is loose or cracked, replace radiator end tank.

Pressure Test

Tool Required:

J 24460-01 Cooling System Tester

1. Clean cap assembly.
2. Install cap assembly on J 24460-01.
3. Pump pressure tester slowly to obtain minimum holding pressure.
 - A. If cap assembly fails to hold 83 kPa (12 psi), replace cap assembly.
 - B. If installing new cap assembly, coat both gaskets with engine coolant.

SERPENTINE DRIVE BELT

Routine inspection of the serpentine drive belt may reveal cracks in the belt ribs. These cracks will not impair belt performance and are not a basis for belt replacement. For belt tensioning and replacement procedures, refer to SECTION 6A2A or SECTION 6A3A.

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine overheats.	a. Loss of engine coolant.	a. Refer to next condition – “Loss of engine coolant.”
	b. Loss of system pressure.	b. Perform radiator filler cap assembly pressure test.
	c. Weak engine coolant solution.	c. Test engine coolant for proper 50-50 mixture.
	d. Loose serpentine drive belt.	d. Check serpentine drive belt tension. Refer to SECTION 6A2A or SECTION 6A3A.
	e. Advanced/Retarded ignition timing.	e. Refer to SECTION 6E.
	f. Obstructed radiator fins.	f. Remove or relocate added-on parts that block air to radiator assembly. Clean away bugs, leaves, and other debris.
	g. Cooling system passages blocked by rust or scale.	g. Flush cooling system or flow check radiator assembly. Remove cylinder head assembly and inspect, if required.
	h. Kinked reservoir hose assembly.	h. Re-route reservoir hose assembly.
	i. Inoperative engine coolant temperature fan assembly.	i. Refer to SECTION 8A.
	j. Loose, damaged, and/or missing radiator upper and lower shrouds, air deflectors or baffle assemblies.	j. Repair or replace as required.
	k. Thermostat assembly.	k. Replace thermostat assembly stuck in closed position.
	l. Faulty water pump assembly.	l. Replace water pump assembly.
	m. Incorrect radiator assembly.	m. Determine proper radiator assembly for vehicle and replace radiator assembly if necessary.
	n. Incorrect or damaged fan blade assembly.	n. Check for correct part number. Replace fan blade assembly if required.
	o. Faulty emission system components. – PCV valve. – Catalytic converter plugged.	o. Refer to SECTION 6E or 6F.
	p. Engine oil overfill.	p. Check engine oil level.
Loss of engine coolant.	a. Leaking radiator assembly.	a. Inspect radiator assembly. Repair as necessary.
	b. Radiator filler cap assembly faulty.	b. Perform cap assembly pressure test.
	c. Distorted neck assembly.	c. If radiator neck assembly upper sealing area is distorted, use wood block and mallet to reform neck assembly to fit cap assembly.
	d. Leaking reservoir or hose assembly.	d. Replace reservoir or hose assembly.
	e. Loose or damaged radiator or heater hose assemblies or connections.	e. Reseat hose assemblies. Replace hose assemblies or clamps.

CONDITION	POSSIBLE CAUSE	CORRECTION
	f. Water pump assembly seal leaking.	f. Replace water pump assembly.
	g. Water pump gasket leaking.	g. Replace water pump gasket.
	h. Improper cylinder head assembly torque.	h. Re-tighten cylinder head bolts/screws to specifications. Replace cylinder head gasket if required.
	i. Leaking – intake manifold assembly (3.4L L32 engine). – cylinder head assembly gasket. – engine block coolant drain hole plug or knock sensor. – heater core. – heater water valve, if equipped.	i. Make repairs or replace components as necessary to correct leak.
Engine fails to reach normal operating temperature. Cool air from the heater.	a. Thermostat assembly stuck open or wrong type of thermostat assembly.	a. Install new thermostat assembly of correct type and heat range.
	b. Engine coolant is below the "FULL COLD" mark.	b. Add engine coolant.

ON-VEHICLE SERVICE

DRAINING AND REFILLING COOLING SYSTEM

CAUTION: To avoid the danger of being burned, do not remove the radiator filler cap assembly while the engine and radiator assembly are still hot. Scalding fluid and steam may be blown out under pressure.

NOTICE: See "Notice" on page 6B-1 of this section.

Important

- Dispose of used coolant in a proper fashion, i.e., in a used coolant holding tank. Never pour used coolant down the drain. Ethylene glycol antifreeze is a very toxic chemical; disposing of it into the sewer system or ground water is both illegal and ecologically unsound.

ENGINE COOLANT FLUSHING AND RECYCLING

Engine Coolant Flushing

Tool Required:

Non-Aqueous Coolant Exchanger such as Pro-Fill J 75010-KM (Available in the GM Dealer Equipment program)

If your state/local environmental enforcement group does not allow the discharge of coolant or if you do not desire to put used coolant into the environment there are various methods and equipment that can be used to flush the coolant system. If using special equipment such as back flusher, follow the manufacturer's instructions.

However, the thermostat should be removed before flushing the system.

Engine Coolant Recycling

Tool Required:

GM approved Recycling System such as Pro Clean (Available in the GM Dealer Equipment program)

As the need arises to conduct cooling system maintenance or repairs, all of the used coolant must be removed and replaced with qualified new or recycled coolant. If only the radiator is drained, up to 50 percent of the used, contaminated coolant can remain in the cooling system. Removing used coolant (from the vehicle) can be accomplished by several methods:

- Utilize waterless coolant evacuation system available in the GM Dealer Equipment program (or equivalent) which removes the used coolant and replaces it with approved new or recycled coolant.
- Utilize a GM approved coolant recycling system available in the GM Dealer Equipment program (or equivalent) which recycles the coolant on the vehicle thereby eliminating the need for evacuation.
- Recover used coolant and store in a used coolant holding tank and submit the used coolant for recycling on a regular basis.

3.4L L32 Engine

1. Park vehicle on a level surface.
2. Remove, clean and reinstall reservoir assembly. Refer to "Battery Tray and Coolant Recovery Reservoir Assembly" in this section.
3. Remove pressure cap assembly.

- A. Turn pressure cap assembly slowly counterclockwise until it reaches the "stop." Do not press down while turning pressure cap assembly.
 - B. Wait until any remaining pressure (indicated by hissing sound) is relieved.
 - C. After all hissing ceases, press down on pressure cap assembly and continue to rotate pressure cap assembly counterclockwise.
4. Open drain cock assembly.
 5. Remove drain hole plug and knock sensor, located on either side of engine block.
 6. Allow system to drain completely.
 7. Close drain cock assembly.
 8. Install drain hole plug and knock sensor.

Tighten

- Drain hole plug to 21 N•m (15 lb. ft.).
 - Knock sensor to 19 N•m (14 lb. ft.).
 - Drain cock assembly to 1.5 N•m (13 lb. in.).
9. Add enough water to fill cooling system.
 10. Run engine assembly until thermostat assembly opens.
 11. Stop engine assembly. Repeat steps 2 through 10, until drained fluid is nearly colorless.
 12. Remove, empty and reinstall reservoir assembly. Refer to "Battery Tray and Coolant Recovery Reservoir Assembly" in this section.

NOTICE: Use new ethylene glycol antifreeze, meeting GM specification 1825M, to provide the required freezing and corrosion protection – at least 50 percent solution, at temperature of -37°C (-34°F).

13. Add enough water and new ethylene glycol antifreeze (meeting GM specification 1825M) to provide a solution that is at least 50 percent antifreeze, but no more than 70 percent antifreeze.
 - A. Fill radiator assembly to below neck assembly.
 - B. Fill reservoir assembly to "FULL COLD" mark.
 - C. Add two cooling system sealer pellets.
 - D. Install reservoir assembly cap.
14. Run engine assembly, with radiator cap assembly removed, until normal operating temperature is reached (radiator inlet hose assembly becomes hot).

CAUTION: Under some conditions, ethylene glycol in engine coolant is flammable. To avoid being burned when adding engine coolant, do not spill it on the exhaust system or on hot engine parts.
15. With engine assembly idling, add engine coolant to radiator assembly until level reaches bottom of neck assembly.
16. Install cap assembly.

- Arrows on cap assembly must line up with reservoir hose assembly.

5.7L LT1 Engine

1. Park vehicle on level surface.
2. Remove coolant recovery reservoir filler cap assembly.
 - A. Slowly rotate cap counterclockwise about 1/4 turn and then stop.
 - B. Wait until any remaining pressure (indicated by hissing sound) is relieved.
 - C. After all hissing ceases, continue to rotate cap assembly counterclockwise until cap is removed.
3. Open coolant drain cock assembly.
4. Open heater air bleed vents located just above water pump assembly on the thermostat housing and heater outlet hose pipe. Air bleed vents should be open two or three turns.
 - Place a shop towel under the bleed valve to prevent coolant from splashing onto distributor assembly.
5. Remove drain hole plug and knock sensor, located on either side of engine block.
6. Allow system to drain completely.

Important

- Store used coolant in a proper fashion, i.e., in a used coolant holding tank. **NEVER POUR USED COOLANT DOWN THE DRAIN!** Ethylene Glycol antifreeze is a very toxic chemical; disposing of it into the sewer system or ground water is both illegal and ecologically unsound!
7. Close coolant drain cock valve.
 8. Install ESC knock sensors and drain hole plug.

NOTICE: Use Ethylene Glycol antifreeze meeting GM specification 2025-M to provide required freezing and corrosion protection – at least 50-percent solution, -37°C (-34°F).
 9. Fill cooling system through the radiator neck.
 10. Close air bleed vent when bubbles disappear and only coolant is visible.
 11. Fill the coolant recovery reservoir assembly to the "COLD" fill mark. This will provide the extra coolant required to replace the air left in the system upon the first couple of thermocycles.
 12. Coolant recovery reservoir assembly cap.

Important

- Block wheel assemblies, place transmission assembly in "PARK" or "NEUTRAL" and set parking brake.
13. Run engine with the coolant radiator pressure cap off until thermostat assembly opens.

Important

- With the engine running, add coolant to the radiator until the level reaches the bottom of the filler neck.
14. Open air bleed valves. When bubbles disappear and only coolant is visible, close heater air bleed valve.
 - Place a shop towel under the bleed valves to prevent coolant from splashing onto distributor assembly.

CAUTION: Under some conditions, Ethylene Glycol in engine coolant is flammable. To avoid being burned when adding engine coolant, do not spill it on the exhaust system or on hot engine parts.

15. Fill the cooling system again after these procedures are completed.

NOTICE: Use Ethylene Glycol antifreeze meeting GM specification 1825-M to provide required freezing and corrosion protection – at least 50-percent solution, -37°C (-34°F).

Important

- When refilling the engine cooling system, add two engine coolant supplemental sealant pellets GM P/N 3634621 or equivalent) and coolant antifreeze meeting GM specification 2025-M.
16. Install the radiator cap assembly.

Inspect

- For leaks, after running engine until normal operating temperature is reached.

NOTICE: “LOW COOLANT” warning/indicator lamp may come on after this procedure. After operating vehicle so engine heats up and cools down three times, if “LOW COOLANT” warning/indicator lamp does not go out, or fails to come on at ignition check and coolant is above “FULL COLD” mark in reservoir assembly, refer to SECTION 8A. If at any time the “TEMP” warning/indicator lamp comes on, immediate action is required. Turn off engine and allow vehicle to cool. Do not remove coolant recovery reservoir cap at this time.

17. Test coolant concentration. Refer to “Testing the Coolant Concentration” in this section.

ALUMINUM RADIATOR SERVICE

Figures 3 and 4

This radiator uses an aluminum core with plastic side tanks. The core and side tanks can be replaced separately. Core repair is easily made with the hot melt adhesive method. A transmission oil cooler may be located in one of the side tanks. The drain cock is located on the lower part of one of the tanks.

The following components are serviceable:

- Radiator core.

- Tanks and gaskets. (Tanks cannot be repaired if broken or cracked).
- Oil cooler and gaskets.
- Drain cock and gaskets.

Precautions

CAUTION: Failure to follow any one of these procedures could result in personal injury or components damage.

- Do not remove radiator cap while engine is at normal operating temperature. Cooling system will release scalding fluid and steam under pressure if cap is removed while engine and radiator are still hot.
- Do not use boil-out tanks or any tank that has been used for copper or brass radiators.
- Do not open hood if steam or coolant can be seen escaping from engine compartment.
- Do not remove cap on coolant recovery reservoir if an engine over temperature is suspected.

Diagnosis

Leak Testing

Some core leaks can be detected by adding water to the radiator. Clean the core so the damaged area is easier to find.

On-Vehicle Pressure Testing

Figure 5

Tool Required:

J 24460-01 Cooling System Tester

1. Ensure that radiator hose clamps and heater hose clamps are properly positioned and secured.
2. Inspect connections for leaks. Repair as required.

CAUTION: To avoid being burned, do not remove radiator cap assembly while engine assembly is at normal operating temperature. The cooling system will release scalding fluid and steam under pressure if radiator filler cap assembly is removed while engine assembly and radiator assembly are still hot.

3. Remove radiator filler cap assembly.
4. Fill cooling system to base of radiator assembly neck.
5. Attach J 24460-01 to radiator assembly neck.
 - Follow instructions supplied with J 24460-01.
6. Build up pressure to no more than 138 kPa (20 psi).
7. System should hold pressure for about two minutes.
 - A. If a measurable amount of pressure drops in less than two minutes, check for leak.
 - B. Mark leaking area and remove radiator assembly for repair. Refer to “Radiator Assembly” in this section.

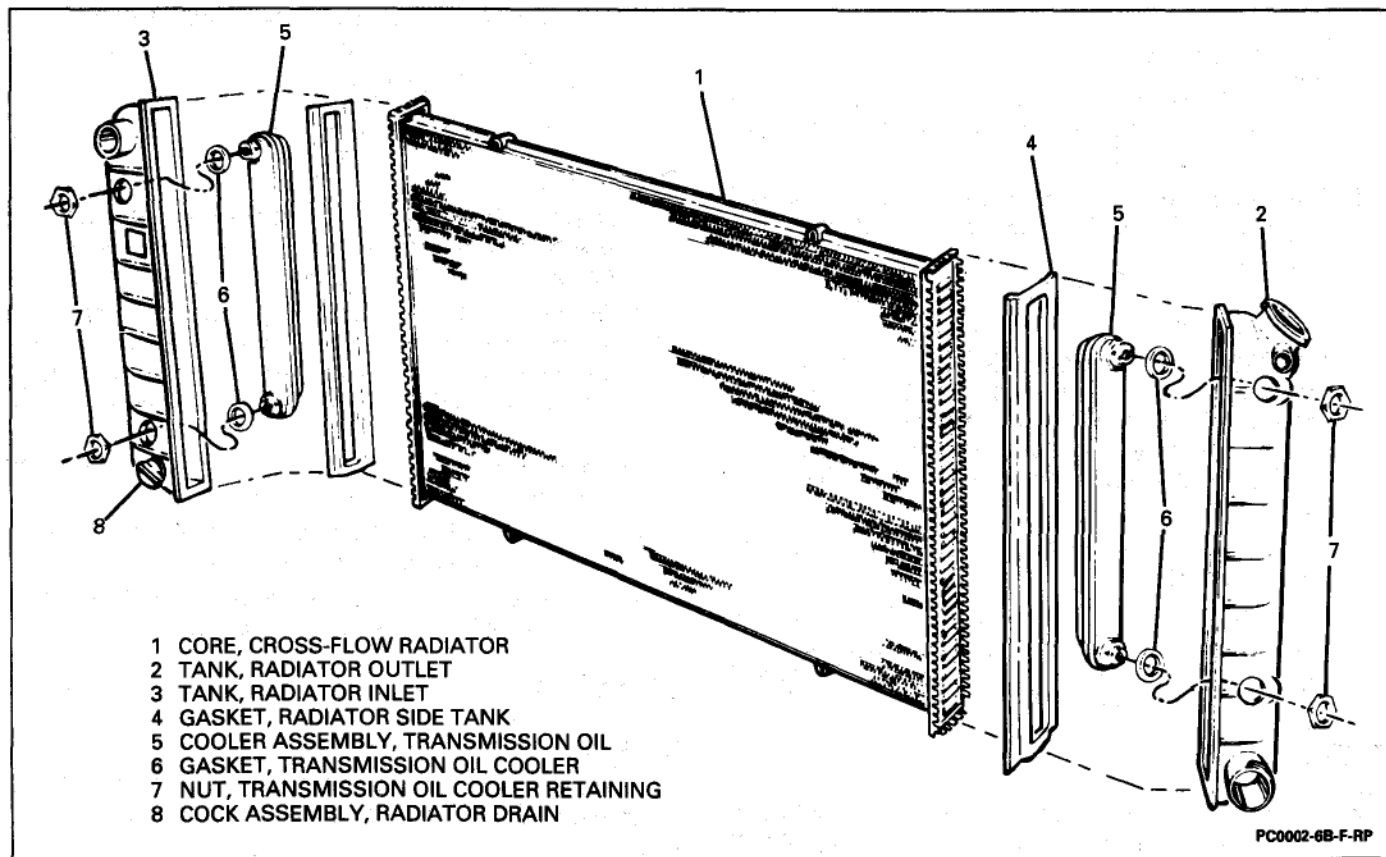


Figure 3 – Aluminum Radiator Assembly

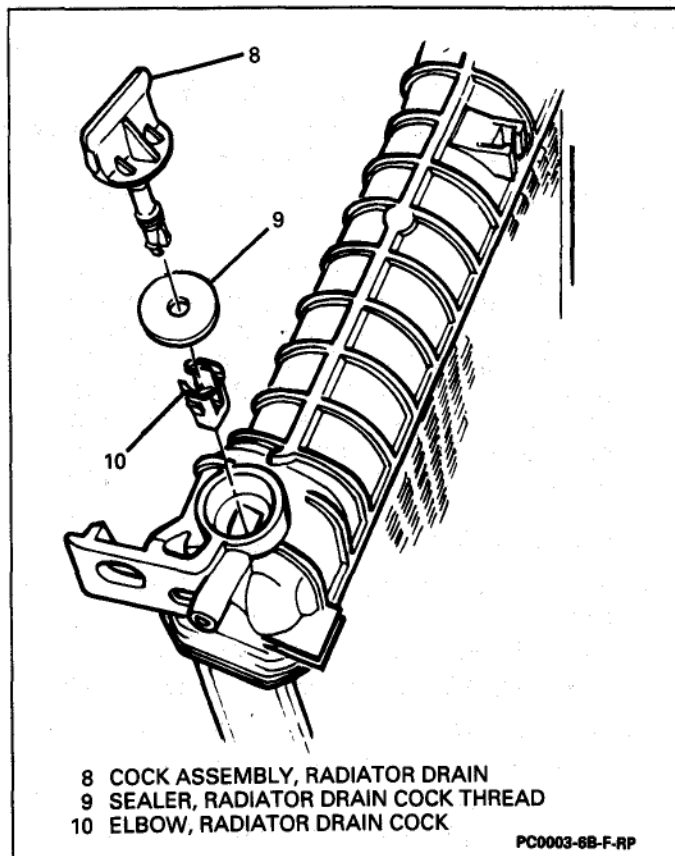


Figure 4 – Aluminum Radiator Drain Cock Assembly

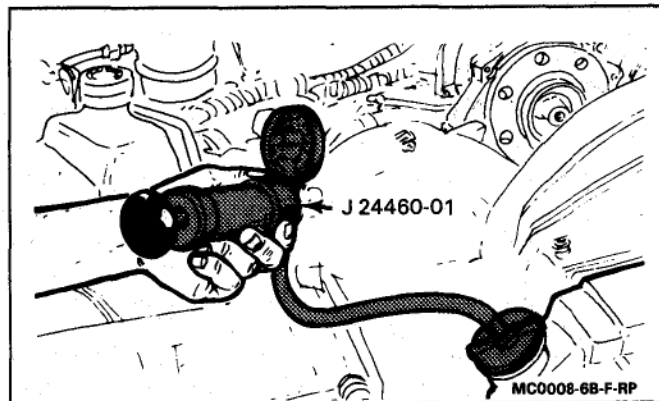


Figure 5 – Pressure Testing the Radiator Assembly

Off-Vehicle Leak Testing

NOTICE: Do not use boil-out tanks or any tank that has been used for copper or brass radiator assemblies. The remaining solutions or chemicals in these tanks could cause radiator assembly failure.

Figures 6 and 7

Tool Required:

J 24460-01 Cooling System Tester

1. Plug radiator inlet and outlet tubes. Make sure drain cock is closed.
2. Attach J 24460-01 to radiator assembly.
3. Build up pressure to 138 kPa (20 psi).
4. Observe gage for any pressure loss.

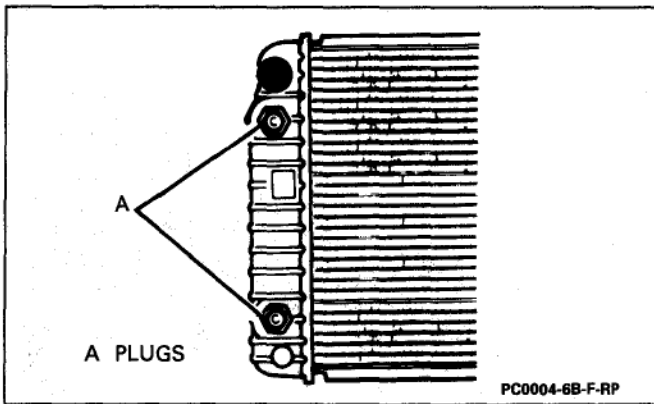


Figure 6 – Aluminum Radiator Assembly and Oil Cooler Plugs

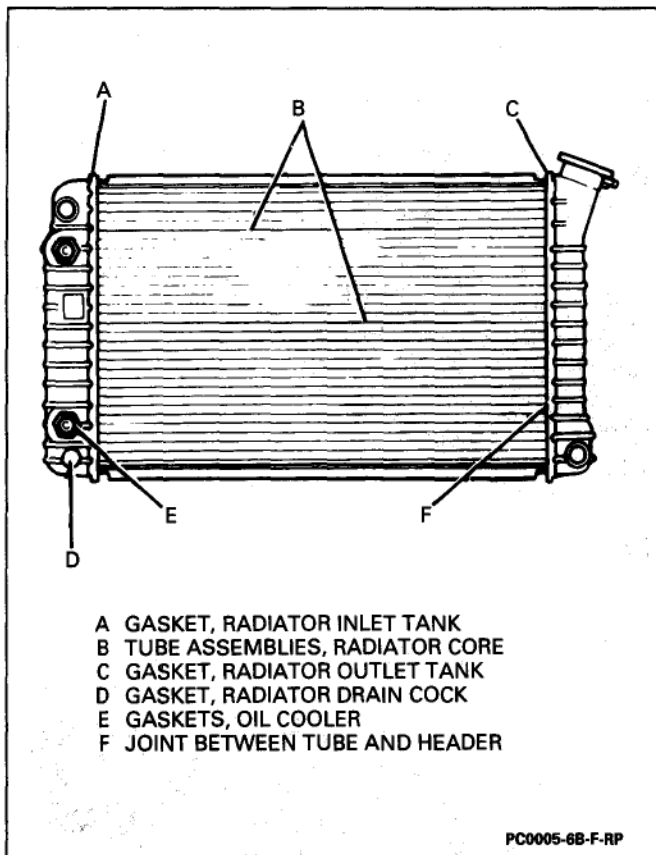


Figure 7 – Possible Leak Areas

5. Run water over repair area and look for any bubbles.
 - If a large tank is available, radiator assembly can be submerged to check for air bubbles.

Repairable Leaks

Core leaks and gasket leaks are the two types of leaks that can be repaired on the radiator assembly. Core leaks can occur in a tube or in the joints between the tubes and headers. Gasket leaks can occur between the oil cooler fittings and the tank. Some leaks can be repaired while the radiator assembly is on the vehicle; however, it is more practical to remove the radiator assembly from the vehicle.

Repair Methods

Figures 8 through 12

The hot melt adhesive is the most effective method of repairing the radiator core. The hot melt adhesive kit contains adhesive sticks, cotton swabs, wire brush and primer. The adhesive kit is reusable, has an indefinite shelf life and is waste free. The sticks must be stored in a sealed container to keep them dry.

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 removal of fins 6 mm (1/4 inch) beyond the leak or damage area is enough to make an accurate repair.

Tube Blocking

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

NOTICE: Do not block off more than two tubes in radiator assembly. Blocking off more than two tubes will reduce the cooling capability of the system.

The tube should be cut off 6 mm (1/4 inch) from the header and pinched shut before it is cleaned and sealed.

Header Repair

NOTICE: To prevent damage to the tank or gasket, the following procedures must be used when repairs are made on or near the header.

If the header or the 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. The side tank can also be submerged in a tank of water up to the header.

General Core Repair

Figures 13 through 16

If the leak area surface is not clean, the repair material will not stick to the surface.

1. Position core so repair area is accessible.
2. Apply wet cloth between core pipes and headers if working near plastic tanks or joints or submerge tank in water.
3. Heat repair area slightly with small torch or heat gun to be sure it is dry.
 - Do not use blow torch.
4. Brush area to be repaired with small steel brush that is supplied in kit and remove dust away from repair area.

CAUTION: To help avoid personal injury when using the primer (which contains trichloroethane) the following precautions and steps should be followed:

- If primer is swallowed, seek medical attention.
- If primer contacts the eyes, do not rub eyes. Splash the affected area with large quantities of cold water and seek medical attention.

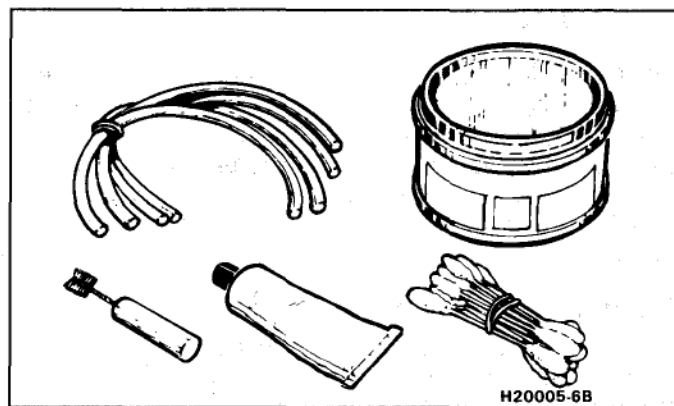


Figure 8 – Hot Melt Adhesive Repair Kit

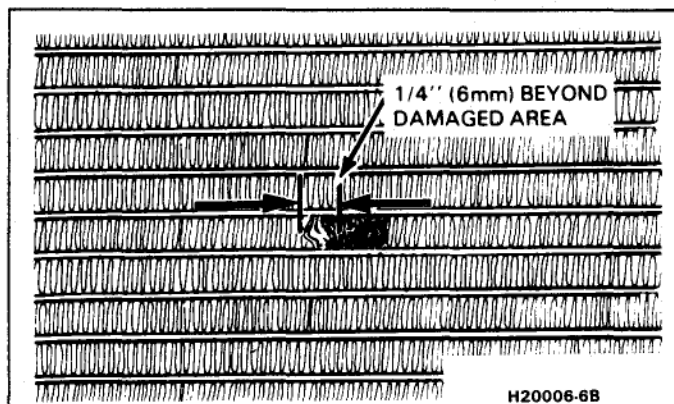


Figure 9 – Fins Removed from Damaged Area

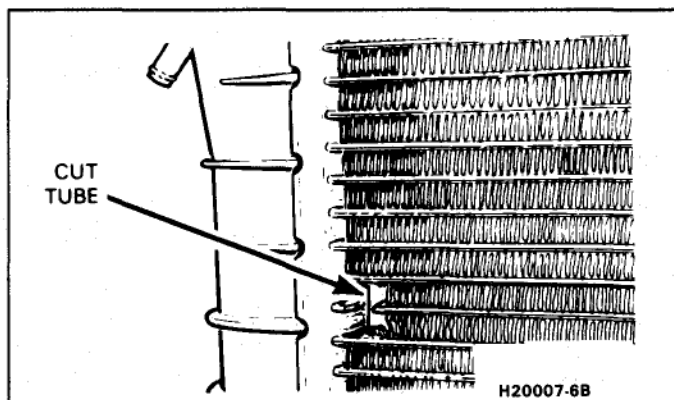


Figure 10 – Tube Blocking

- If primer contacts the body, wash thoroughly with soap and water.
 - Do not mix the primer with water.
5. Open tube of primer using spurred cap or pin and apply primer to repair area only. Use of primer produces stronger repair.
 6. Scrub repair area with cotton swab until fresh swab stays clean.
 - Clear, yellow-brown coating does not have to be removed.
 7. Heat repair area with heat gun or by moving small torch in circular pattern using soft, blue flame.
 8. Withdraw small torch or heat gun and rub adhesive stick on repair area. Adhesive will flow at temperature of approximately 260°C (500°F).

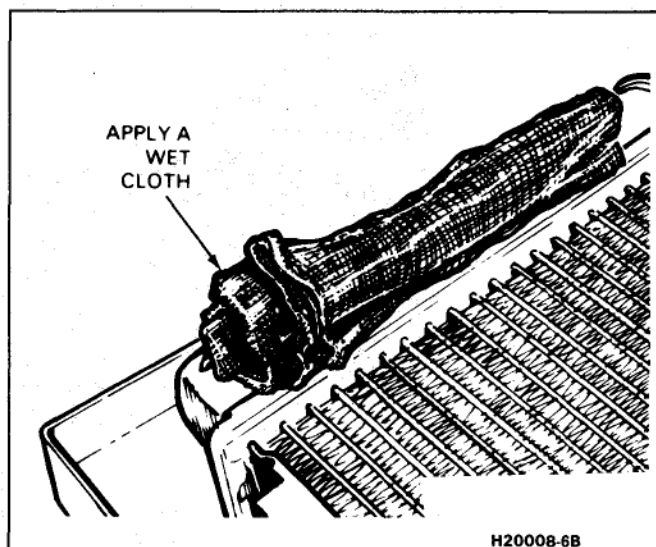


Figure 11 – Using a Wet Cloth on the Side Tank

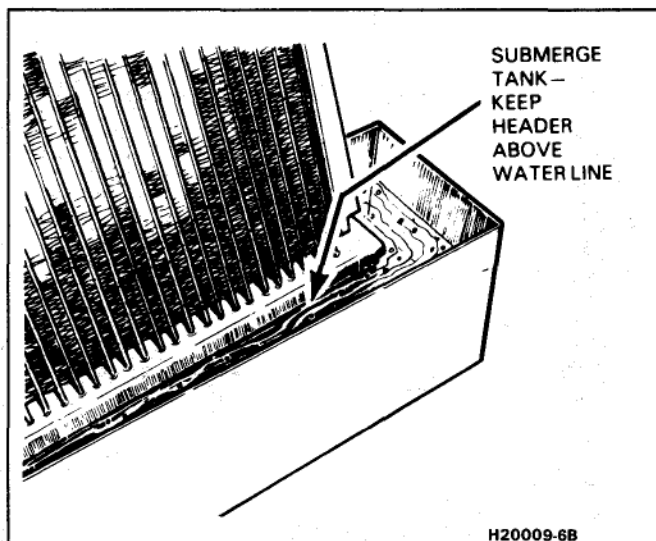


Figure 12 – Submerging the Side Tank

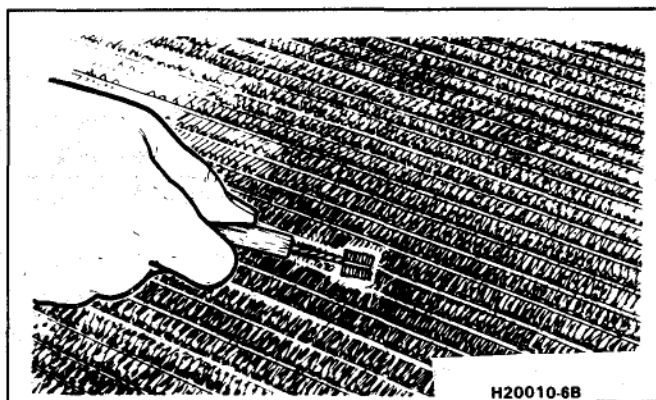


Figure 13 – Cleaning the Area with a Steel Brush

- If stick doesn't start to melt, remove it and reapply heat. Do not heat stick directly with flame. High heat will burn and char adhesive.
9. Continue heating until adhesive flows and wets entire repair area and fills joint. If a hole is in center of tube, heat tube and let hot surface melt and pull in adhesive. Force of flame or heat gun will also tend to guide adhesive toward hole. For leaks between tube

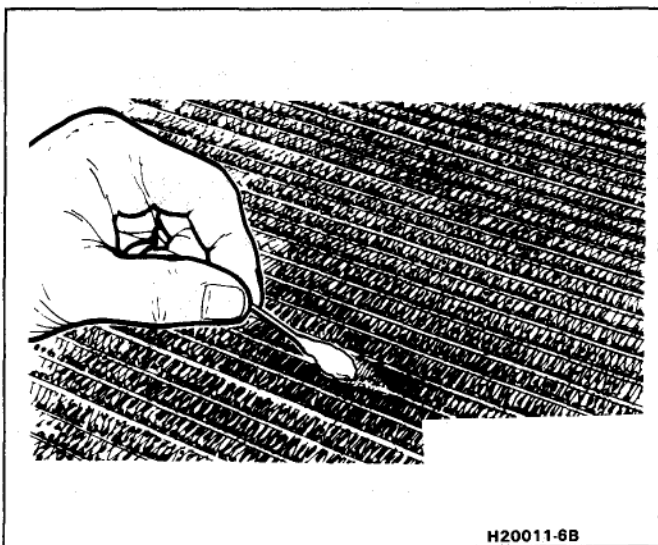


Figure 14 – Scrubbing the Area with Primer

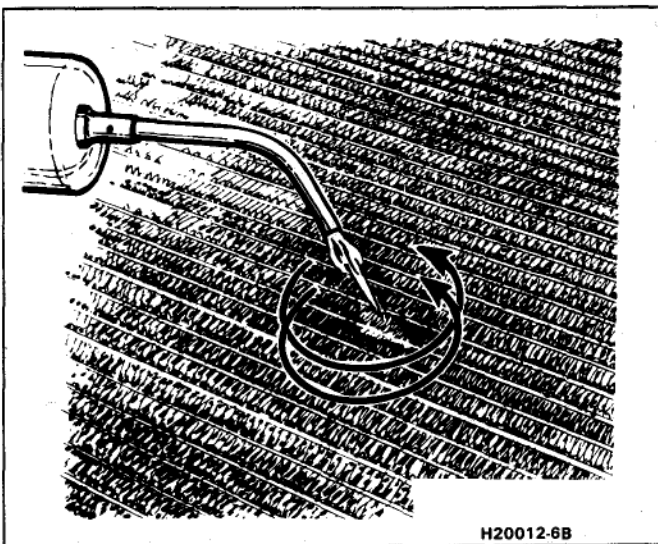


Figure 15 – Heating the Repair Area

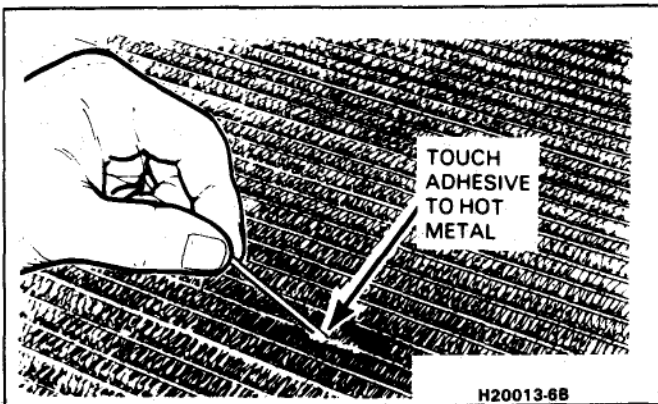


Figure 16 – Applying Hot Melt Adhesive

and header, flow adhesive completely around tube and header joint with tank installed.

10. Heat repair area until adhesive is bubble free, smooth and has light yellow color. Curing is not required.

11. Test radiator assembly for leaks when cool. Refer to "Off-Vehicle Testing" in this section. If repair area still leaks, heat it gently to dry it. Heat and flow adhesive or apply more as necessary to repair leak.

Radiator Side Tank Gasket Leak Repair

Figures 17 through 20

Tool Required:

J 33419-A Radiator Core Remover/Installer

Radiator side 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 J 33419-A or locking-type pliers. If the tank still leaks, remove and repair it.

1. Pry open clinch tabs except those under inlet, outlet and radiator assembly neck, using J 33419-A or screwdriver.

- Lift tabs only enough to allow removal.

NOTICE: Do not overbend tabs. Overbending tabs could result in breaking tab. If more than three tabs are broken on one side of header or more than two adjacent tabs are broken, the core must be replaced.

2. Lift tank and slide it out from under remaining clinched tab.

- Tapping tank with your hand may be required to dislodge gasket.

3. Lift remaining tab(s) with pliers.

4. Remove and discard gasket.



Clean

- Header gasket groove of dirt and old rubber.
- Sealing edge of plastic tank.



Inspect

- Header gasket surface and tank flange for evidence of leaks.
- Surfaces and remove dirt, burrs and bumps.

5. Remove transmission oil cooler, if equipped, and install it into new tank.

6. Dip or coat new gasket in engine coolant and position it on header surface.

7. Position tank and gasket to header. Clamp it in place and secure it by bending four clinch tabs.

8. Clamp remaining clinch tabs around header using J 33419-A or pliers.

- Start at center and work towards end.

9. Replace core if there are more than three tabs broken on one side or if two adjacent tabs are broken.

10. Install radiator drain cock assembly, if removed.

11. Test radiator assembly for leaks. Refer to "Off-Vehicle Leak Testing" in this section.

TRANSMISSION OIL COOLER GASKET

Figure 21

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

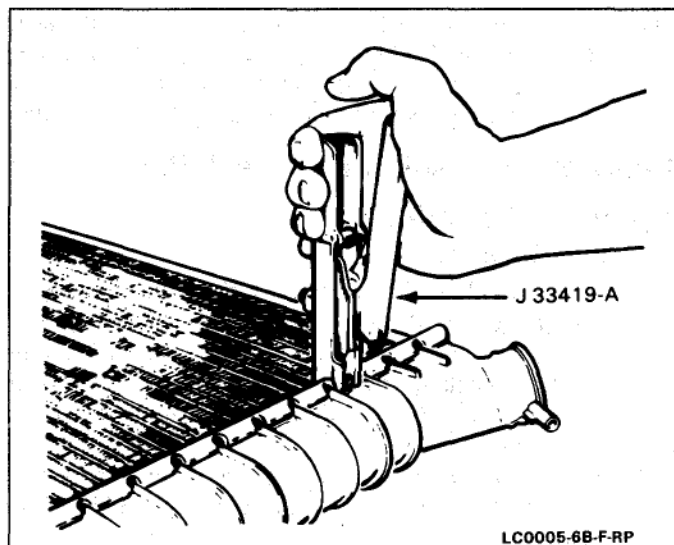


Figure 17 – Tightening the Clinch Tabs

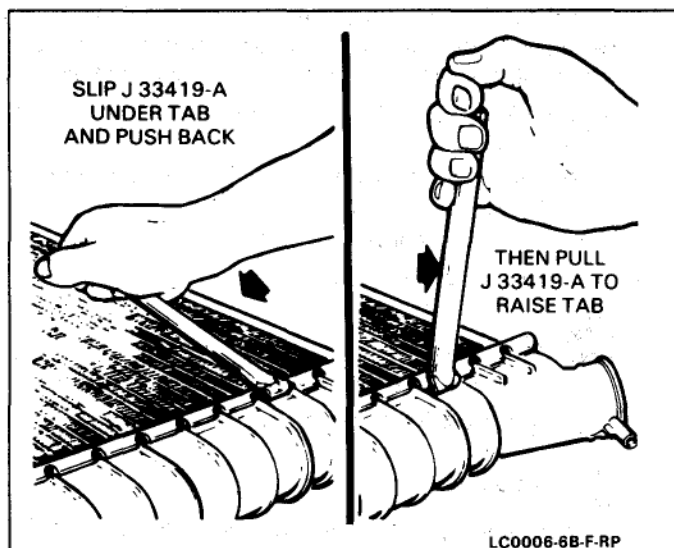


Figure 18 – Opening the Clinch Tabs

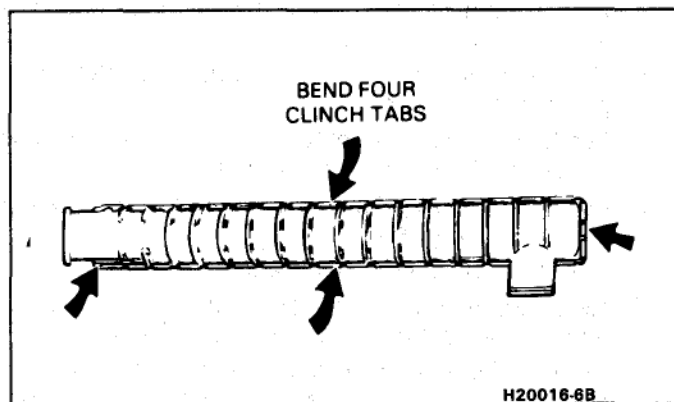


Figure 19 – Seating the Tank to the Core

1. Remove radiator assembly. Refer to "Radiator Assembly" in this section.

- Lay radiator assembly on flat surface.

2. Remove bottom transmission oil cooler pipe and loosen top pipe connection.

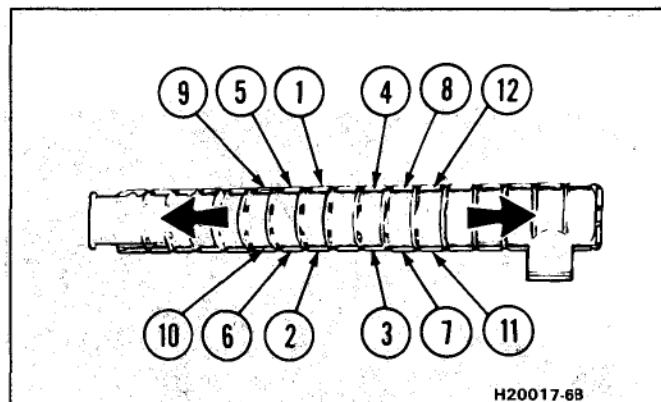


Figure 20 – Clinching Sequence

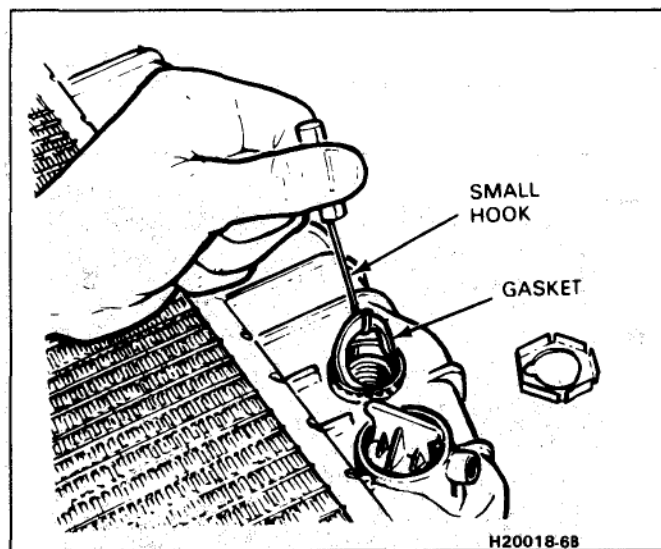


Figure 21 – Removing the Transmission Oil Cooler Gasket

3. Press transmission oil cooler into hole and remove gasket using small hook.
4. Blow dry all surfaces on outlet tank and transmission oil cooler.
5. Install new transmission oil cooler gasket without lubrication.

- Be sure gasket is properly seated inside lip of fitting.

6. Reach into inlet or outlet opening and push transmission oil cooler into position against outlet tank.

NOTICE: See "Notice" on page 6B-1 of this section.

7. Install transmission oil cooler pipe loosely.

- To replace other gasket, follow previous steps in order.

Tighten

- Transmission oil cooler pipe connections to 20 N•m (15 lb. ft.).

– Do not overtighten.

8. Leak test radiator assembly. Refer to "Off-Vehicle Leak Testing" in this section.
9. Install radiator assembly. Refer to "Radiator Assembly" in this section.

TRANSMISSION OIL COOLER

Figure 3

Remove or Disconnect

1. Radiator assembly. Refer to "Radiator Assembly" in this section.
2. Outlet tank.
3. Transmission oil cooler retaining nuts.
4. Transmission oil cooler gaskets.
5. Transmission oil cooler.

Clean

- Sealing surfaces.

Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. New transmission oil cooler gaskets without lubrication.
2. Transmission oil cooler into outlet tank.
3. Transmission oil cooler retaining nuts.
4. Outlet tank.
 - Be careful not to loosen or misalign gaskets.
5. Radiator assembly. Refer to "Radiator Assembly" in this section.

RECORE

If the radiator core is damaged beyond repair and the other parts are serviceable, install the original inlet and outlet tanks, transmission oil cooler, radiator filler cap assembly and radiator drain cock assembly onto a new core and install new gaskets.

RADIATOR DRAIN COCK ASSEMBLY

Figure 4

If the drain cock assembly does not seal when tightened snugly, remove the radiator drain cock assembly, clean the drain and replace the radiator drain cock assembly. If the body of the radiator drain cock assembly is broken, remove the body from the tank by squeezing the sides together with needle nose pliers.

ENGINE COOLANT THERMOSTAT ASSEMBLY

Figures 22 and 23

Remove or Disconnect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Open radiator drain cock assembly and drain engine coolant from radiator assembly to below level of engine coolant thermostat assembly.
2. Close radiator drain cock assembly.

Tighten

- Radiator drain cock assembly to 12 N•m (106 lb. in.).
3. Air cleaner assembly.
 4. Inlet hose assembly and clamp from engine coolant thermostat assembly.
 5. Water outlet bolt/screw (12 or 15).
 6. Water outlet assembly (11 or 14).
 7. Water outlet gasket (16), if equipped.
 8. Engine coolant thermostat assembly (13 or 17).

Clean

- Gasket surfaces of water outlet assembly and intake manifold assembly or water pump assembly.

Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Engine coolant thermostat assembly into intake manifold assembly or water pump assembly.
2. New water outlet gasket (16), if equipped.
3. Water outlet assembly (11 or 14).
4. Water outlet bolt/screw (12 or 15).

Tighten

- Water outlet bolt/screw (12 or 15) to 28 N•m (21 lb. ft.).
5. Inlet hose assembly and clamp. Refer to SECTION 1A.
 6. Air cleaner assembly.
 7. Add engine coolant. Refer to "Draining and Refilling the Cooling System" in this section.

Inspect

- For leaks, after running engine assembly to normal operating temperature.

ELECTRIC ENGINE COOLANT FAN ASSEMBLY

Figures 24 and 25

CAUTION: Keep hands, tools, and clothing away from electric engine coolant fan(s) to help prevent personal injury. This/These fan is/are electric and can come on whether or not the engine is running. The fan(s) can start automatically in response to a heat sensor with the ignition in the "ON" position.

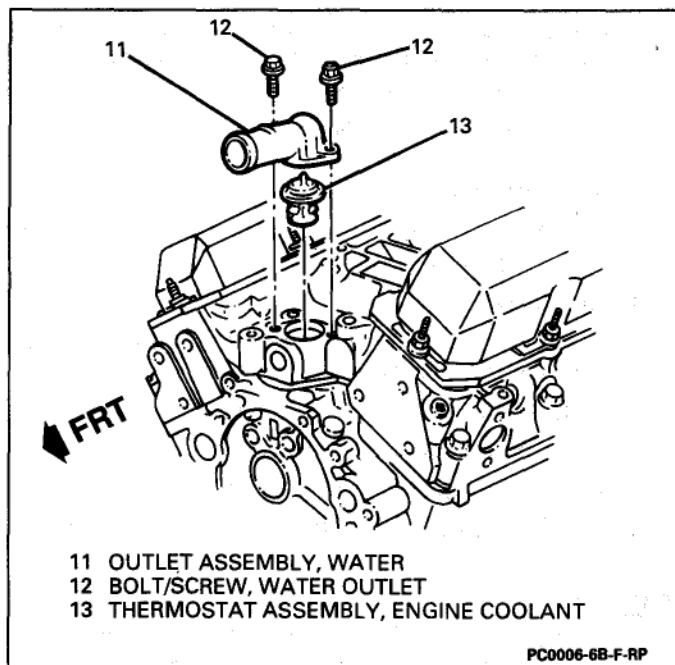


Figure 22 – Engine Coolant Thermostat Assembly
(3.4L L32 Engine)

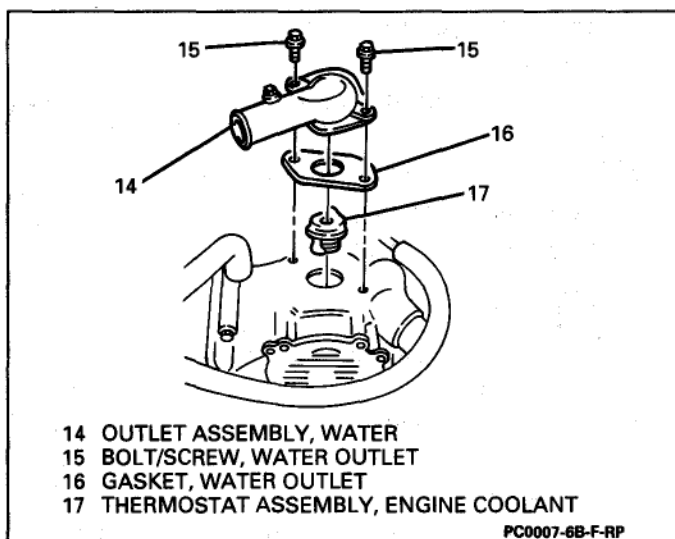


Figure 23 – Engine Coolant Thermostat Assembly
(5.7L LT1 Engine)

↔ Remove or Disconnect

1. Air cleaner assembly.
2. Electrical connector and clips.
3. Electric engine coolant fan assembly (19 or 20).
 - Electric engine coolant fan assembly (19 or 20) will slide out.
4. Fan blade nut (23 or 24).
5. Fan blade assembly (25 or 26).

🔍 Inspect

- For bent or cracked fan blades.
- Mating surfaces for smoothness. Remove burrs or other imperfections as necessary.

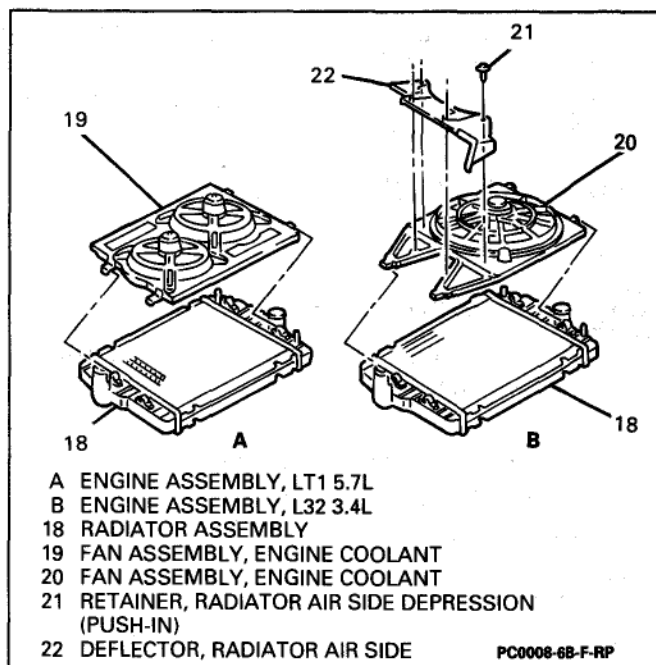


Figure 24 – Engine Coolant Fan Assembly

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

CAUTION: It is essential that the fan blade assembly remain in proper balance. Balance cannot be assured once a fan blade assembly has been bent or damaged. A fan blade assembly that is not in proper balance could fail and fly apart during subsequent use, creating an extremely dangerous condition.

↔ Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Fan blade assembly (25 or 26).
2. Fan blade nut (23 or 24)
3. Electric engine coolant fan assembly (19 or 20).
 - Electric engine coolant fan assembly (19 or 20) will slide into place.
4. Electrical connector and clips.
5. Air cleaner assembly.

WATER PUMP ASSEMBLY

Figures 26, 27 and 28

↔ Remove or Disconnect

3.4L L32 Engine

1. Drain radiator assembly. Refer to "Draining and Refilling Cooling System" in this section.
2. Air duct and electrical connector.
3. Top coil of coil pack.

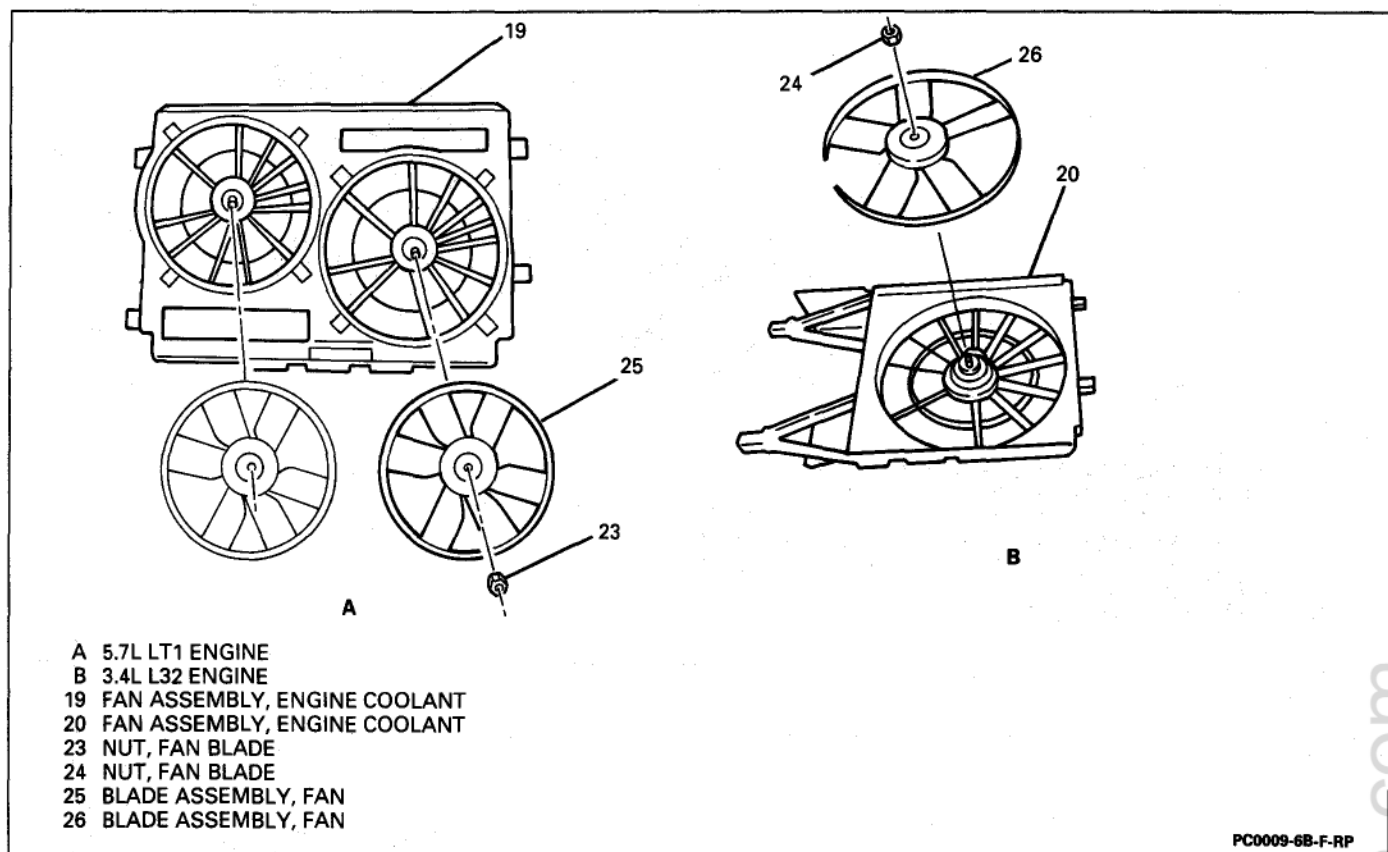


Figure 25 – Fan Blade Assembly

4. Loosen tensioner pulley bolt/screw.
5. Heater hose from pump. Refer to SECTION 1A.
6. Loosen water pump pulley bolts/screws (27).
7. Power steering bracket bolts/screws. Refer to SECTION 3B.
8. Serpentine belt. Refer to SECTION 6A2A and SECTION 6A3A.
9. Water pump pulley (28).
10. Power steering pump bracket and pump. Refer to SECTION 3B.
11. Water pump bolts/screws (29).
12. Engine front cover bolts/screws (30).
13. Water pump cover bolts/screws (31).
14. Water pump assembly (32) and water pump gasket (33).

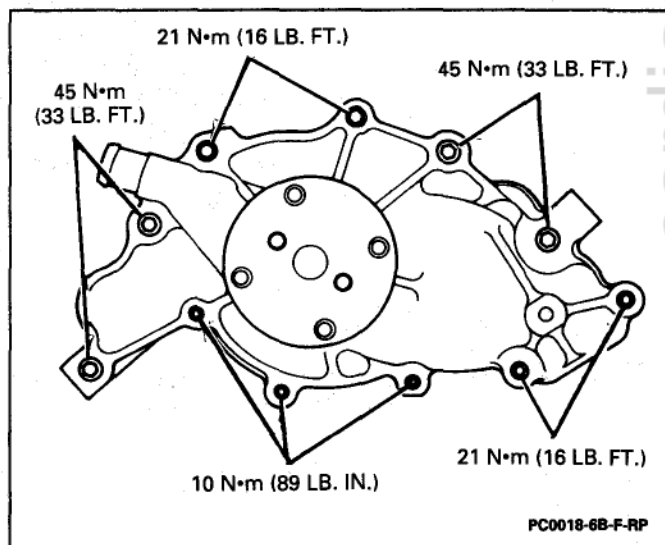
**Clean**

- All gasket surfaces.
- Water pump bolts/screws.

**Install or Connect**

NOTICE: See “Notice” on page 6B-1 of this section.

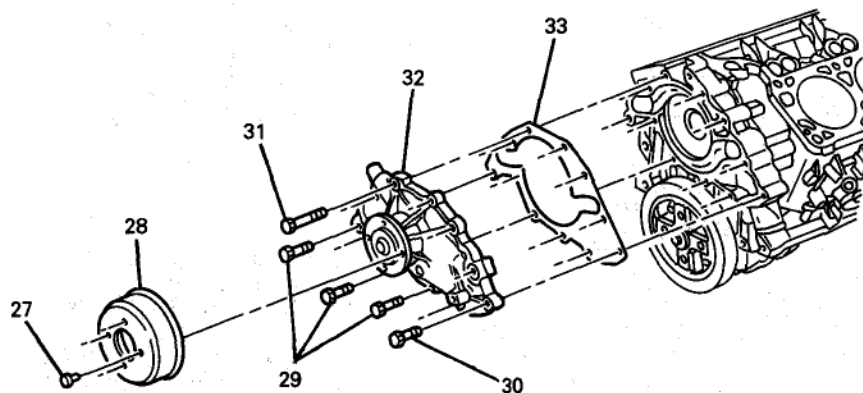
1. New water pump gasket (33).
2. Water pump assembly (32).
3. Water pump cover bolts/screws (31).

Figure 26 – Water Pump Bolt/Screw Torques
(3.4L L32 Engine)**Tighten**

- Water pump cover bolts/screws (31) to 45 N•m (33 lb. ft.).
4. Engine front cover bolts/screws (30).

**Tighten**

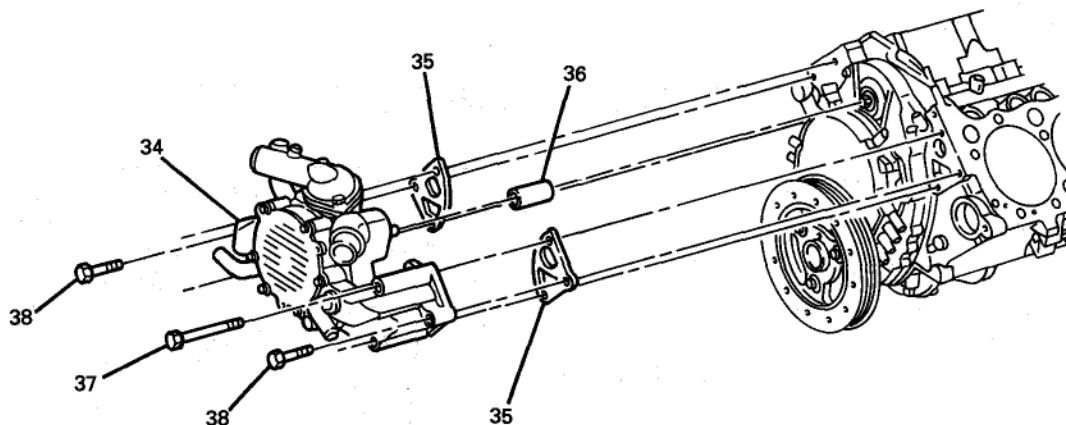
- Engine front cover bolts/screws (30) to 21 N•m (16 lb. ft.).



- 27 BOLT/SCREW, WATER PUMP PULLEY, 25 N•m (18 LB. FT.)
 28 PULLEY, WATER PUMP
 29 BOLT/SCREW, WATER PUMP, 10 N•m (89 LB. IN.)
 30 BOLT/SCREW, ENGINE FRONT COVER, 21 N•m (16 LB. FT.)
 31 BOLT/SCREW, WATER PUMP COVER, 45 N•m (33 LB. FT.)
 32 PUMP ASSEMBLY, WATER
 33 GASKET, WATER PUMP

PC0010-6B-F-RP

Figure 27 – Water Pump Assembly (3.4L L32 Engine)



- 34 PUMP ASSEMBLY, WATER
 35 GASKET, WATER PUMP
 36 COUPLING, SHAFT
 37 BOLT/SCREW, WATER PUMP COVER, 45 N•m (33 LB. FT.)
 38 BOLT/SCREW, WATER PUMP, 42 N•m (31 LB. FT.)

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Figure 28 – Water Pump Assembly (5.7L LT1 Engine)

5. Water pump bolt/screw (29).

**Tighten**

- Water pump bolts/screws (29) to 10 N•m (89 lb. in.).
6. Power steering pump and bracket. Refer to SECTION 3B.
 7. Water pump pulley (28).
 8. Serpentine belt. Refer to SECTION 6A2A or SECTION 6A3A.
 9. Power steering pump bracket bolts/screws. Refer to SECTION 3B.

**Tighten**

- Power steering bracket bolts/screws to 31 N•m (23 lb. ft.).
10. Heater hose to pump. Refer to SECTION 1A.
 11. Top coil of coil pack.
 12. Electrical connector to alternator.
 13. Air duct and electrical connector.
 14. Add engine coolant. Refer to "Draining and Refilling the Cooling System" in this section.

**Inspect**

- For leaks, after running engine to normal operating temperature.

**Remove or Disconnect****5.7L LT1 Engine**

1. Electrical connector from electric engine coolant fan assembly.
2. Right electric engine coolant fan assembly. Refer to "Electric Engine Coolant Fan Assembly" in this section.
3. Block drain plug and knock sensor.
4. Drain engine coolant. Refer to "Draining and Refilling the Cooling System" in this section.
5. Install drain plug and knock sensor.
6. Air intake duct.
7. Air cleaner assembly.
8. Upper and lower radiator hose assembly from water pump assembly.
9. Heater hose assemblies from water pump assembly and throttle body. Refer to SECTION 1A.
10. Electrical connector from coolant sensor.
11. Reposition coil and bracket.
12. Air pump and bracket. Refer to SECTION 6E3.
13. Water pump bolts/screws (38).
14. Water pump cover bolt/screw (37).
15. Water pump assembly (34).
16. Water pump gaskets (35).
17. Shaft coupling (36).

**Clean**

- Water pump gasket surfaces.
- Water pump bolts/screws (38).

**Install or Connect**

1. Shaft coupling (36).
2. Water pump gaskets (35).
3. Water pump assembly (34).
4. Water pump cover bolt/screw (37).

**Tighten**

- Water pump cover bolt/screw (37) to 45 N•m (33 lb. ft.).
5. Water pump bolts/screws (38).

**Tighten**

- Water pump bolts/screws (38) to 42 N•m (31 lb. ft.).
6. Air pump and bracket. Refer to SECTION 6E3.
 7. Reposition coil and bracket.
 8. Electrical connector to coolant sensor.

9. Heater hose assemblies to water pump assembly and throttle body. Refer to SECTION 1A.
10. Upper and lower radiator hose assembly to water pump assembly.
11. Air cleaner assembly.
12. Air intake duct.
13. Refill cooling system. Refer to "Draining and Refilling the Cooling System" in this section.
14. Electrical connector to electric engine coolant fan assembly.

**Inspect**

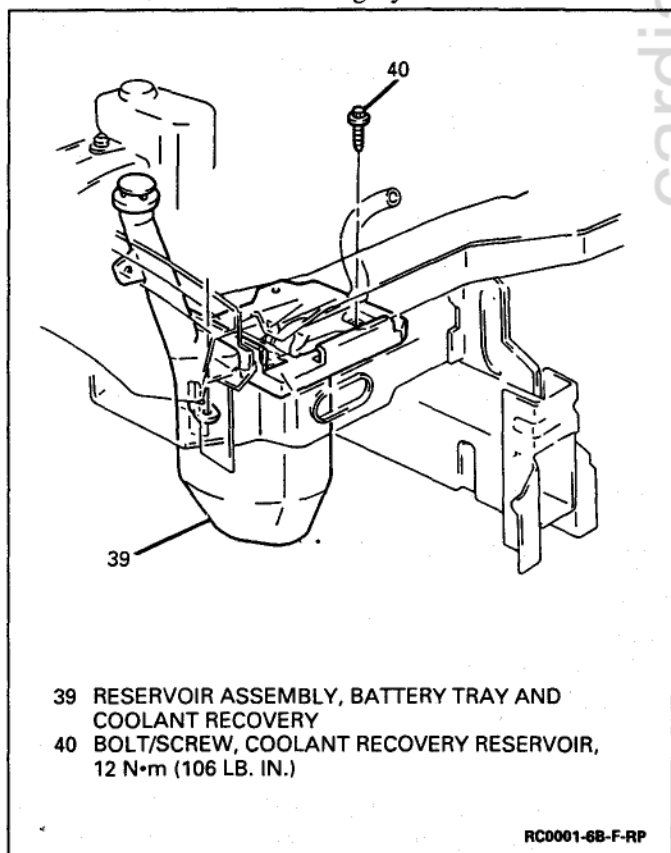
- For leaks, after running engine assembly to normal operating temperature.

BATTERY TRAY AND COOLANT RECOVERY RESERVOIR ASSEMBLY**Figure 29****Remove or Disconnect**

1. Battery. Refer to SECTION 6D1.
2. Coolant recovery hose assembly.
3. Bolt/screw (40).
4. Battery tray and reservoir assembly (39).

**Clean**

- Battery tray and reservoir assembly (39) with soap and water. Rinse thoroughly.

**Figure 29 – Battery Tray and Coolant Recovery Reservoir Assembly**

Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Battery tray and reservoir assembly (39).
2. Bolt/screw (40).

Tighten

- Bolt/screw (40) to 12 N•m (106 lb. in.).
3. Coolant recovery hose assembly.
 4. Battery. Refer to SECTION 6D1.
 5. Add engine coolant to "FULL COLD" mark on reservoir assembly.

ENGINE OIL COOLER INLET AND OUTLET HOSE ASSEMBLIES

Refer to SECTION 6A3A for service information on inlet and outlet hose assemblies.

COOLANT LEVEL SENSOR

(5.7L LT1 Engine Only)

Remove or Disconnect

1. Raise and suitably support vehicle. Refer to SECTION 0A.
2. Drain engine coolant. Refer to "Draining and Refilling the Cooling System" in this section.
3. Lower vehicle.
4. Battery. Refer to SECTION 6D1.
5. Electrical connector at sensor.
6. Sensor.

Install or Connect

1. Sensor.
2. Electrical connector to sensor.
3. Battery. Refer to SECTION 6D1.
4. Add engine coolant. Refer to "Draining and Refilling the Cooling System" in this section.

RADIATOR ASSEMBLY

Figures 30 and 31

Remove or Disconnect

1. Air intake duct.
2. Air cleaner assembly.
3. Raise and suitably support vehicle. Refer to SECTION 0A.
4. Drain engine coolant. Refer to "Draining and Refilling the Cooling System" in this section.
5. Electrical connector(s) at electric engine coolant fan assembly.

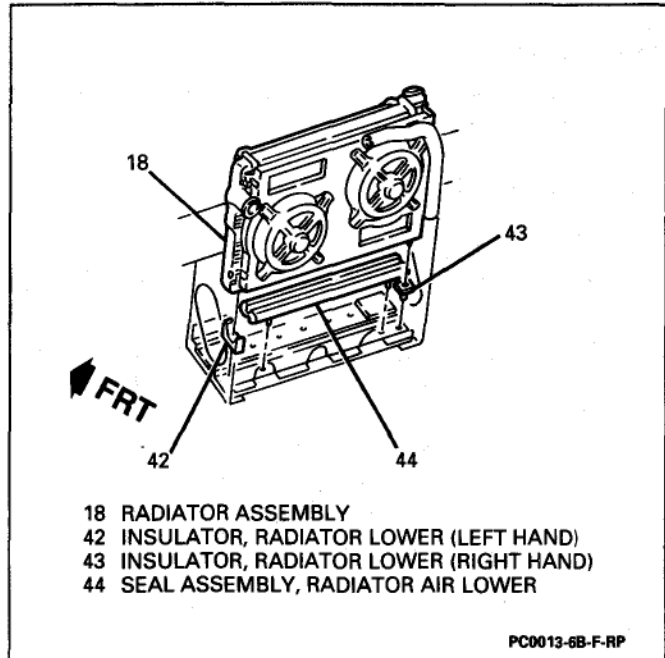


Figure 30 – Radiator Insulators and Seal Assembly

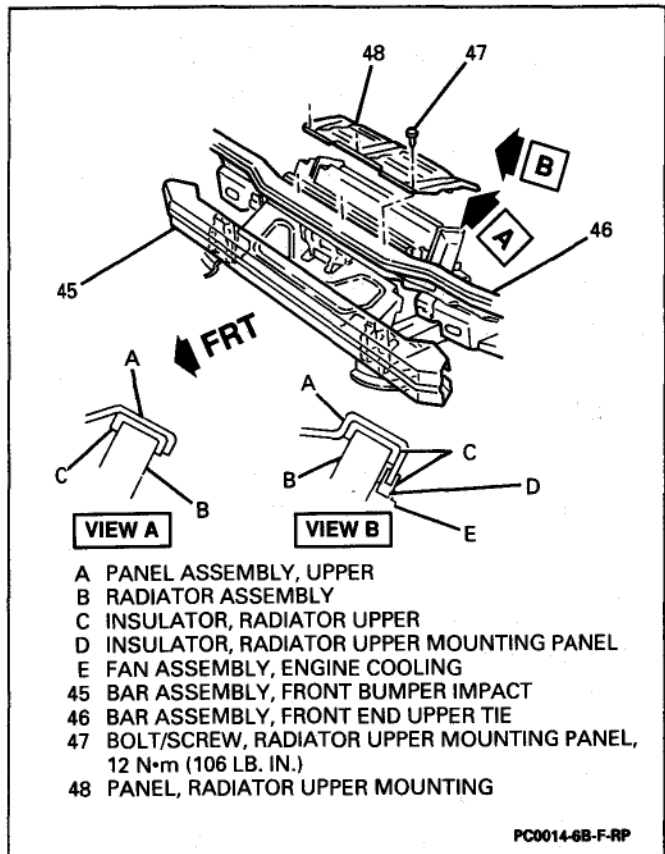


Figure 31 – Radiator Upper Mounting Panel Assembly

6. Electric engine coolant fan assembly. Refer to "Electric Engine Coolant Fan Assembly" in this section.
7. Transmission oil cooler lines. Refer to SECTION 7A.
8. Coolant level sensor, if equipped. Refer to "Coolant Level Sensor" in this section.

9. Lower vehicle.
10. Loosen receiver dehydrator bracket.
11. Lower radiator hose assembly at water pump assembly.
12. Upper radiator hose assembly.
13. Overflow tube.
14. Radiator from condenser.
15. Radiator assembly (18).

Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Radiator assembly (18).
 - Make sure radiator assembly is seated on radiator insulators (42 and 43).
2. Radiator assembly to condenser.
3. Overflow tube.
4. Upper radiator hose.
5. Lower radiator hose assembly to water pump assembly.
6. Tighten receiver dehydrator bracket.
7. Raise and suitably support vehicle. Refer to SECTION 0A.
8. Coolant level sensor, if equipped. Refer to "Coolant Level Sensor" in this section.
9. Transmission oil cooler lines. Refer to SECTION 7A.
10. Electric engine coolant fan assembly. Refer to "Electric Engine Coolant Fan Assembly" in this section.
11. Electrical connector(s) to electric engine coolant fan assembly.
12. Add engine coolant. Refer to "Draining and Refilling the Cooling System" in this section.
13. Lower vehicle.
14. Air cleaner assembly.
15. Air intake duct.

Inspect

- For leaks, after running engine assembly until normal operating temperature is reached.

RADIATOR AIR BAFFLE ASSEMBLIES AND DEFLECTORS

Radiator Upper Mounting Panel

Figure 31

Remove or Disconnect

1. Bolts/screws (47).
2. Upper mounting panel (48).

Install or Connect

1. Upper mounting panel (48).
2. Bolts/screws (47).

Tighten

- Bolts/screws (47) to 12 N•m (106 lb. in.).

Radiator Air Lower Baffle Assembly and Deflector

Figure 32

Remove or Disconnect

1. Radiator air lower deflector bolt/screw (52).
2. Radiator air lower deflector (51).
3. Radiator air lower baffle retainers (50).
4. Radiator air lower baffle assembly (49).

Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Radiator air lower baffle assembly (49).
2. Radiator air lower baffle retainers (50).
3. Radiator air lower deflector (51).
4. Radiator air lower deflector bolt/screw (52).

Tighten

- Bolt/screw (52) to 1.5 N•m (13 lb. in.).

Radiator Air Upper Baffle Assembly

Figure 33

Remove or Disconnect

1. Radiator air upper baffle retainers (54).
2. Radiator air upper baffle assembly (53).

Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Radiator air upper baffle assembly (53) to radiator assembly (18).
2. Radiator air upper baffle retainers (54).

ENGINE COOLANT HOSE ASSEMBLIES

Remove or Disconnect

1. Drain radiator assembly so level of engine coolant is below hose assembly being removed.
2. Air cleaner assembly.
3. Inlet hose assembly from radiator assembly and engine coolant thermostat assembly.

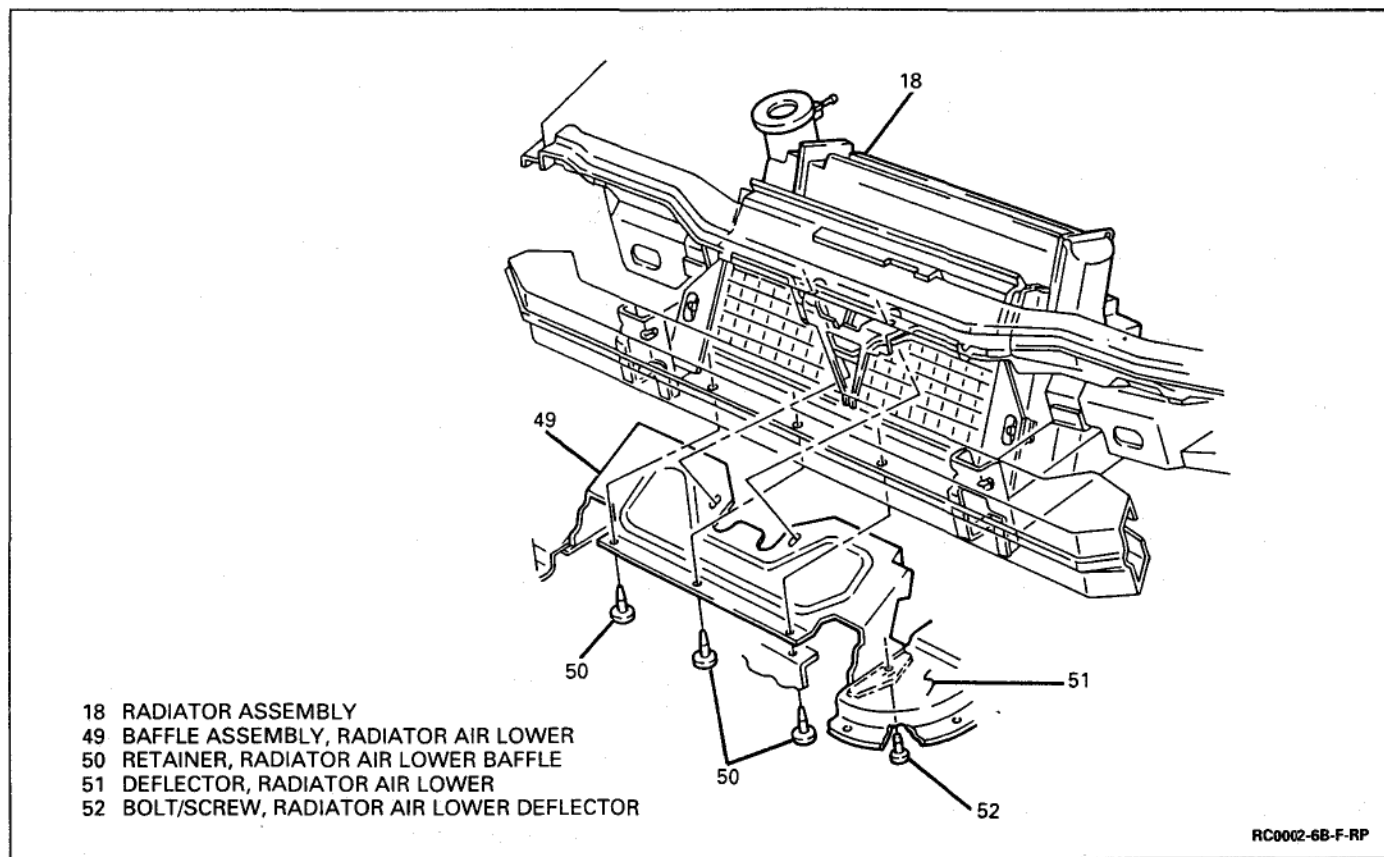


Figure 32 – Radiator Air Lower Baffle Assembly

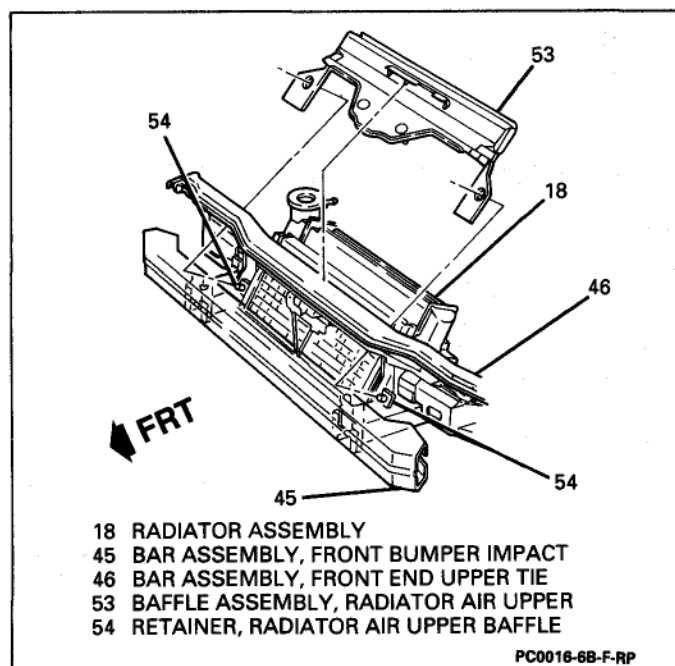


Figure 33 – Radiator Air Upper Baffle Assembly

1. Outlet hose assembly and clamps to radiator assembly and water pump assembly.
2. Inlet hose assembly to radiator assembly and engine coolant thermostat assembly.
3. Add engine coolant. Refer to "Draining and Refilling Cooling System" in this section.
4. Air cleaner assembly.

COOLANT AIR BLEED PIPE ASSEMBLY

↔ Remove or Disconnect

1. Drain coolant. Refer to "Draining and Refilling Cooling System" in this section.
2. Transmission. Refer to SECTION 7A or SECTION 7B.
3. Left and right bleed pipe mounting (banjo) bolts.
 - Use a backup wrench.
4. Lower vehicle.
5. Upper alternator bracket. Refer to SECTION 6D3.
6. Electrical connectors and vacuum hoses, as necessary, to gain access to bleed pipe.
7. Air bleed pipe mounting nut at intake manifold.
8. Coolant hose at air bleed pipe.
9. Coolant air bleed pipe assembly.

↔ Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

↔ Install or Connect

NOTICE: See "Notice" on page 6B-1 of this section.

1. Coolant air bleed pipe assembly.
2. Coolant hose at air bleed pipe.
3. Air bleed pipe mounting nut at intake manifold.

Tighten

- Mounting nut to 21 N•m (15 lb. ft.).
4. Electrical connectors and vacuum hoses, as necessary.
 5. Upper alternator bracket. Refer to SECTION 6D3.
 6. Raise and suitably support vehicle. Refer to SECTION 0A.
 7. Left and right bleed pipe mounting (banjo) bolts.
 - Use a backup wrench.

Tighten

- Mounting bolts to 42 N•m (31 lb. ft.).
8. Transmission. Refer to SECTION 7A or SECTION 7B.
 9. Refill cooling system. Refer to "Draining and Refilling Cooling System" in this section.

TESTING THE COOLANT CONCENTRATION

Figures 34 through 36

Tools Required:

J 23688-A or J 26568-A Coolant Tester

Important

- Both J 23688-A and J 26568-A automatically compensate for temperature.
 - Make sure eyepiece of J 23688-A or J 26568-A is totally free of solution before looking through it. Refer to Figure 34.
 - Before each use, swing plastic cover at slanted end of J 26568-A or J 23688-A exposing measuring window and bottom of plastic cover.
 - Wipe dry both prism and bottom of sample cover with tissue or clean soft cloth. Refer to Figure 35.
 - Close plastic cover.
1. Release tip of pump from J 23688-A or J 26568-A housing.
 - Do not remove clear plastic pump from J 23688-A or J 26568-A.

CAUTION: To avoid being burned, DO NOT remove coolant recovery reservoir cap while engine is at normal operating temperature. The cooling system will release scalding fluid and steam under pressure if cap is removed while engine and radiator are still hot. This could result in a large coolant loss and possible personal injury.

2. Remove coolant recovery reservoir cap.
3. Insert tube into coolant recovery reservoir assembly.
 - Make sure tube is below level of coolant.
4. Press and release bulb to get sample of coolant.

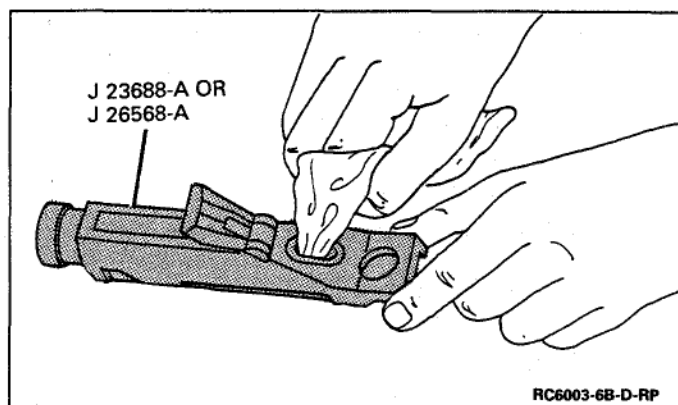


Figure 34 – Cleaning the Coolant Tester

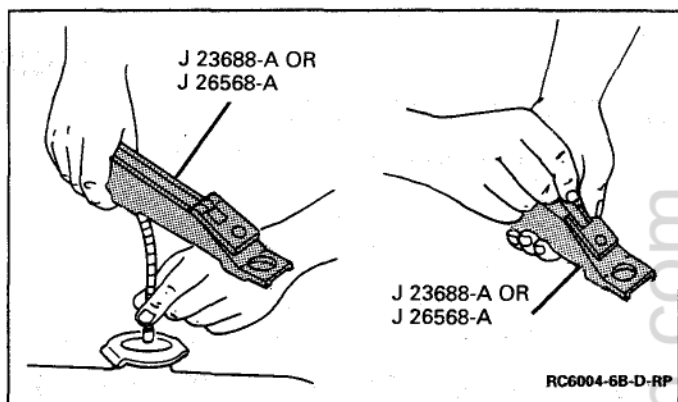


Figure 35 – Collecting the Coolant

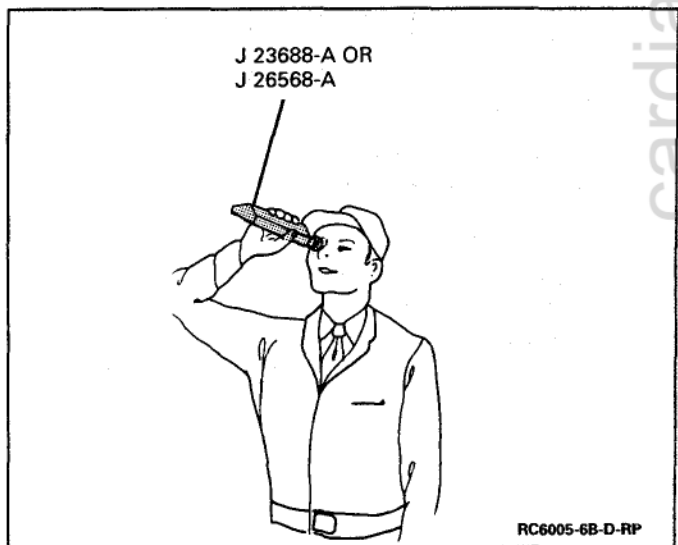


Figure 36 – Reading the Coolant Tester

5. Bend tube around J 23688-A or J 23568-A so that tip can be inserted in cover plate opening.
6. Press bulb and allow a few drops to fall onto measuring surface.
 - Do not open plastic cover when taking readings because water evaporation can change readings.
7. Point J 23688-A or J 26568-A toward any light source and look into eyepiece.

- Coolant protection reading is at point where dividing line between light and dark crosses scale on right.
- Temperature scale is reversed from a standard thermometer scale. Below zero readings are on upper half of scale.
- If readings are not clear, the measuring prism was not cleaned and dried or there was not enough fluid on measuring prism.

Calibrating Testers

J 23688-A and J 26568-A are factory calibrated and sealed and should not require adjustment. If adjustment is required, follow instructions below.

1. Make sure J 23688-A and J 26568-A is between 21 and 29°C (70 and 85°F).
2. Using distilled water, take a reading. If reading departs from a 0°C (32°F) reading on scale, a correction can be made by adjusting screw on bottom of J 23688-A and J 26568-A.
3. Remove sealant covering screw.


Important

 - Do not remove screw from J 23688-A and J 26568-A.
4. Turn screw in direction necessary to adjust reading to 0°C (32°F) line.
5. Reseal the screw using a silicone sealant.

SPECIFICATIONS

GENERAL SPECIFICATIONS

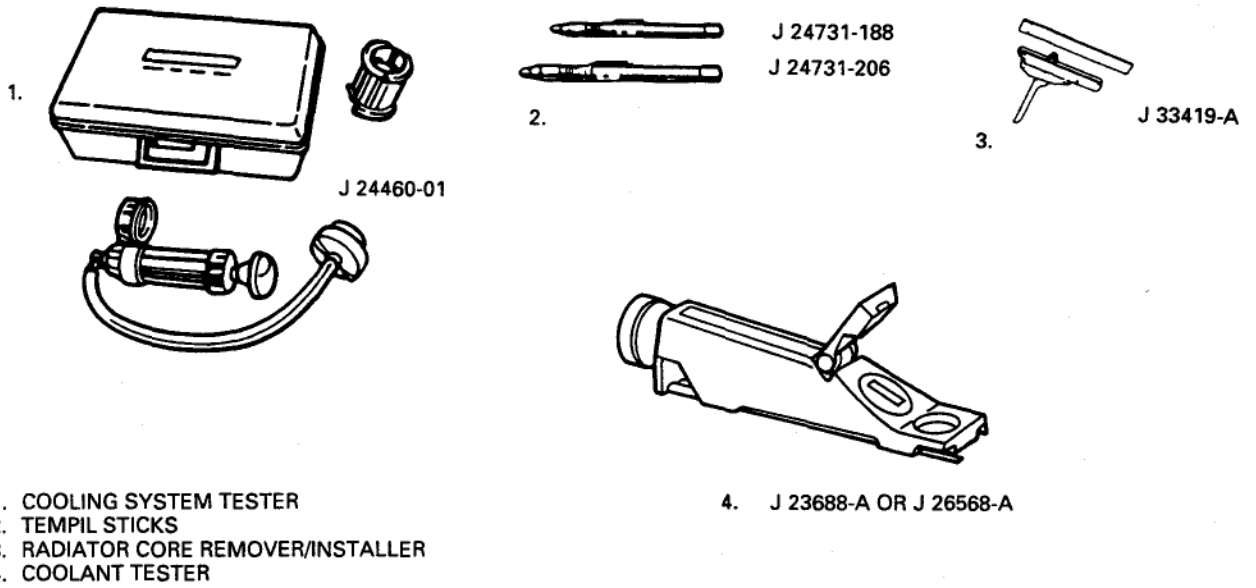
Cooling System Approximate Fluid Capacities	
3.4L L32 Engine	
With Manual Transmission	11.8 liters (12.5 qt.)
With Automatic Transmission	11.6 liters (12.3 qt.)
5.7L LT1 Engine	
With Manual Transmission	14.5 liters (15.3 qt.)
With Automatic Transmission	14.3 liters (15.1 qt.)

FASTENER TIGHTENING SPECIFICATIONS

Air Bleed Pipe Mounting Bolts/Screws	42 N•m (31 lb. ft.)
Air Bleed Pipe Mounting Nut	21 N•m (15 lb. ft.)
Battery Tray and Coolant Recovery Reservoir Bolt/Screw	12 N•m (106 lb. in.)
Engine Block Coolant Drain Hole Plug	21 N•m (15 lb. ft.)
Engine Front Cover Bolt/Screw	21 N•m (16 lb. ft.)
Knock Sensor	19 N•m (14 lb. ft.)
Oil Cooler Pipe Connections	20 N•m (15 lb. ft.)
Power Steering Bracket Bolt/Screw	31 N•m (23 lb. ft.)
Radiator Air Lower Deflector Bolt/Screw	1.5 N•m (13 lb. in.)
Radiator Drain Cock Assembly	1.5 N•m (13 lb. in.)
Radiator Upper Mounting Panel Bolt/Screw	12 N•m (106 lb. in.)
Water Outlet Bolt/Screw	28 N•m (21 lb. ft.)
Water Pump Bolt/Screw (3.4L L32 Engine)	10 N•m (89 lb. in.)
Water Pump Bolt/Screw (5.7L LT1 Engine)	42 N•m (31 lb. ft.)
Water Pump Cover Bolt/Screw	45 N•m (33 lb. ft.)

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SPECIAL TOOLS



RC0003-6B-F-RP

