SECTION 6S

COOLING SYSTEM

INDEX

GENERAL DESCRIPTION

The cooling system consists of radiator, shroud, fan, fan clutch, fan belt, water pump and pulleys, hoses, thermostat and supply tank.

There are four types of radiators in use on Corvette vehicles. The six cylinder engine is equipped with a radiator and a separate expansion tank mounted along the right side of the engine valve cover. The V-8 uses a conventional copper radiator, an aluminum cross-flow radiator with an expansion tank (fig. 1) or an aluminum cross-flow radiator with a separate supply tank (fig. 2).

When an expansion tank is used with a pressure cap, the coolant may expand and pass the pressure cap into the expansion tank. When the coolant cools, a vacuum is formed in the radiator causing the coolant in the expansion tank to return past the pressure cap valve into the radiator.

In the later model aluminum cross-flow radiator the coolant follows two paths from the radiator to the water pump: (1) main flow is through the radiator outlet hose directly to the pump and (2) through the supply tank

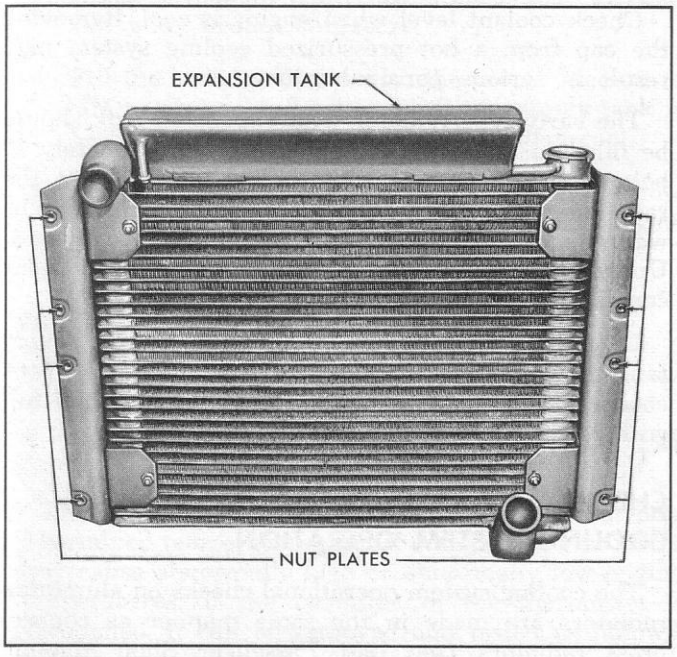

Fig. 1—Early Aluminum Radiator

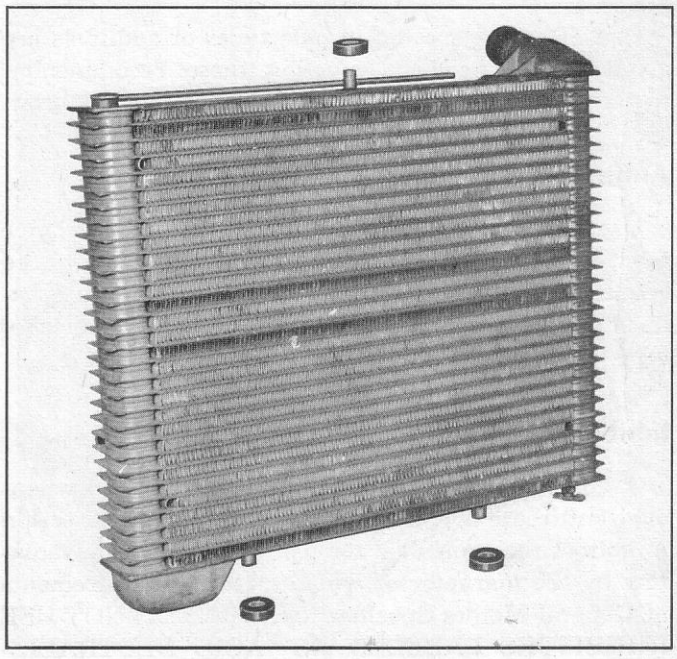

Fig. 2—Late Aluminum Radiator

from the top of the radiator, the latter acting as an air separator as well as a supply tank.

Care should be used to avoid nicking or denting the sealing surface of the top of the filler neck and the main valve gasket sealing surface.

A special filler cap is used with aluminum radiators. The use of a filler cap containing brass parts for an extended period will result in serious radiator damage which may require radiator replacement.

An aluminum drain cock is used with aluminum radiators. In the event of loss or damage, a ⅛ NFT cast iron pipe plug may be used as a *temporary* substitute. The use of a cast iron plug or of a brass drain cock for an extended period will result in serious radiator damage which may require radiator replacement.

The water pump is the same as the passenger car pump except when system is equipped with a supply tank on which an opening on the intake side is provided for the return hose from the supply tank.

Standard equipment on 1962 Corvette engines and optional on earlier models is a thermo-modulated fan hub which limits fan speed to approximately 1500 rpm during cold weather and approximately 3500 rpm in warm weather. This feature serves to add usable horsepower and reduce fan noise.

MAINTENANCE AND ADJUSTMENTS

CONVENTIONAL RADIATORS

Refer to the 1961 Passenger Car Shop Manual (Section 8, Pages 115-117) for periodic maintenance, antifreeze use, checks and tests of cooling system failures and thermostat replacement and testing.

ALUMINUM RADIATORS

Aluminum radiators have been designed to combine heavy duty structure with high performance cooling. However, due to the physical properties of aluminum, maintenance procedures are different from those used with copper radiators.

Additives

Recommendations for specific types of additives are given below. Products meeting these recommendations are available from your General Motors Dealer.

Antifreezes

Use only antifreeze recommended by the marketer for use with aluminum radiators or which meets the requirements of the appropriate General Motors Specification. Either permanent (GM 1899M) or alcohol type (GM 1898M) antifreeze may be used.

Inhibitors

A corrosion inhibitor should always be used whenever antifreeze is not in the system. Use only corrosion inhibitors recommended for use with aluminum radiators by the marketer or which meet the requirements of General Motors Specification 1894M. DO NOT USE INHIBITORS LABELED AS "ACID NEUTRALIZERS."

Cleaners

If the cooling system is maintained as described above, a cooling system cleaner should not be required. However, if it is desired to use one, use only a radiator cleaner which is recommended by the marketer for use with aluminum radiators. If such a cleaner is not available, reverse flushing with clear water is the only recommended cleaning procedure. DO NOT USE THE COMMON "SODA" OR CAUSTIC BASE CLEANERS GENERALLY USED WITH COPPER RADIATORS UNLESS THEY ARE SPECIFICALLY RECOMMENDED FOR USE WITH ALUMINUM RADIATORS BY THEIR MARKETERS.

COOLANT LEVEL

Check coolant level when engine is cool. Removing the cap from a hot pressurized cooling system may result in serious personal injury.

The early type radiator with expansion tank should be filled to cover third plate edge (approximately 1" below filler neck.) When the cooling system is hot, the radiator will be completely full and there may be water in the expansion tank (a standard condition). Under these conditions, coolant will be lost if filler cap is removed to check level.

Late model aluminum radiators with separate supply tanks have the pressure cap on the supply tank. Proper coolant level is reached when supply tank is half full with the system cool and engine running.

CHECKS AND TESTS OF COOLING SYSTEM OPERATION

The cooling system operational checks on aluminum radiators are made in the same manner as copper-brass radiators (see 1961 Passenger Shop Manual, Section 8).

CHANGING TO ANTIFREEZE

Use only antifreeze recommended by the marketer for use with aluminum radiators or which meets the requirements of the appropriate General Motors Specification. Either permanent (GM 1899M) or alcohol type (GM 1898M) antifreeze may be used.

In determining the antifreeze solution for winter operation, the local conditions and the type of service must be considered. To be certain that the solution will not leak out and be lost entirely, the following procedure should be followed in conditioning the system:

1. Drain the entire cooling system including the cylinder block. If considerable rust, scale, oil, or grease is present in the water drained out, it is advisable to flush and clean the system.

   NOTE: For complete draining, the radiator drain cock at left side of radiator should be opened and the drain plug at each side of the V-8 block should be removed. Supply tank pressure cap should be removed to allow air to enter system.

2. Inspect the fan belt and adjust or replace if necessary (See Fan Belt Adjustment, page 38).

3. Inspect all hoses including heater hoses. If hoses are collapsed, cracked or in any way indicate a rotted condition on the inside, replacement should be made.

4. Carefully check and tighten all hose clamps.

5. Check the thermostat. Make sure it does not stick open or closed. A 170° thermostat should be used when permanent antifreeze is used, 160° thermostat with alcohol antifreeze.

6. Fill the cooling system with the proper amount of GM antifreeze and water, until the supply tank is ½ full, with engine running and system cool.

7. Warm up engine and check radiator, water pump, hoses and hose connections for leaks with engine hot.

THERMOSTAT

The thermostat consists of a restriction valve actuated by a thermostatic element. This unit is mounted in the housing at the cylinder head water outlet above the water pump.

Thermostats are designed to open and close at predetermined temperatures and if not operating properly may cause abnormally high or abnormally low engine temperatures. If the condition of the thermostat is questioned, it can be removed and tested as follows:

1. Open radiator drain cock and drain out about half the coolant to bring the coolant level below the thermostat, then close the drain cock.

2. Remove the two cap screws that attach the water outlet to the thermostat housing (fig. 44), and lift water outlet (with hose attached), gasket, and thermostat from housing.

3. Heat a container of water to a temperature 25° above the temperature stamped on the thermostat and place thermostat in the water and see if it opens fully. If it does not fully open, it should be replaced.

4. Place thermostat in water 10° below the temperature stamped on the thermostat and see if thermostat fully closes. If it does not fully close, it should be replaced.

5. Place thermostat in housing, then using a new gasket, install water outlet and cap screws. Tighten screws evenly and securely.

6. Fill cooling system and check for leaks.

FAN BELT ADJUSTMENT

1. Loosen bolt at generator slotted bracket.

2. Pull the generator away from the engine until desired belt tension is obtained using a belt tension gauge (fig. 3). Tension should be 75 ± 5 lbs. using a Strand tension gauge.

3. Tighten bolt at slotted bracket.

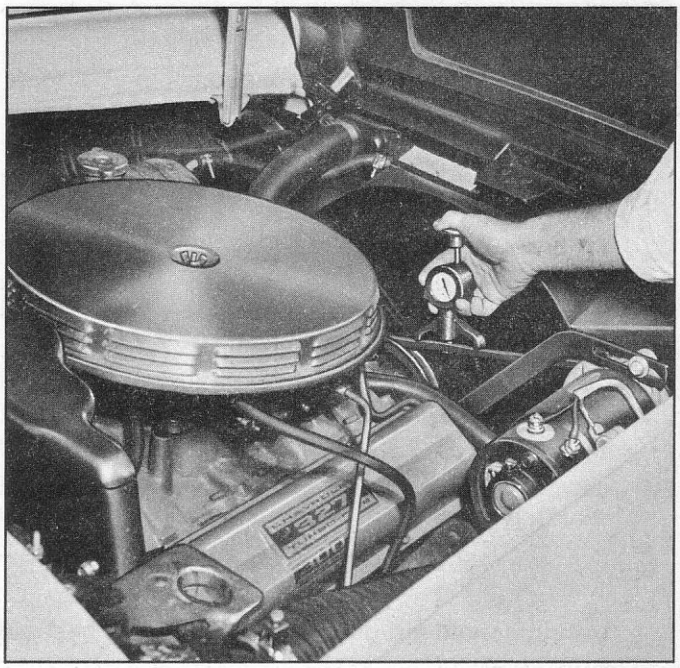

Fig. 3—Adjust Fan Belt Tension

SERVICE OPERATIONS

WATER PUMP

Removal (V-8)

1. Drain cooling system.
2. Remove fan belt.
3. Remove fan and fan pulley. (On models with thermal modulated hubs, remove fan and hub as an assembly.)
4. Disconnect heater hoses, lower radiator hose and supply tank hose at water pump.
5. Remove front engine mount bolts.
6. Raise engine enough for engine mount bracket to clear mounts (jack from below engine).
7. Remove 4 water pump bolts and remove water pump and engine mounting bracket.

Clean and Repair

1. Repair procedures for disassembly and assembly are the same as outlined in the 1961 Passenger Car Shop Manual. The hub location and impeller clearance measurements for each engine correspond to the measurement of passenger car V-8 water pump for the same year.
2. Clean the gasket surfaces on engine block, both sides of engine mount plate, and on water pump body.
3. Check motor mounts for deterioration or other damage before reuse.

Installation

1. Install one ⅜-16 stud approximately 3½″ long in the upper water pump bolt hole on each side of engine block for locating purposes.
2. Hang mount bracket-to-engine gaskets, the mount bracket, and the pump-to-bracket gasket over the studs.
3. Start water pump over the studs, then install lower bolts carefully through pump, gaskets and mount bracket and start them into engine block.
4. Remove alignment studs and install two top pump bolts. Tighten all 4 evenly and torque to 25-35 ft. lbs.
5. Lower the engine onto front mounts and install mount bolts, ground straps and nuts.
6. Connect heater, supply tank and lower radiator hoses at pump.
7. Install fan and fan pulley, then install fan belt and adjust tension.
8. Fill cooling system and check for leaks.

FAN SHROUD

Removal

1. Drain radiator.
2. Disconnect upper radiator hose at radiator (and hoses at supply tank when tank is separate from radiator).
3. Remove 1 sheet metal screw to lower shroud half and cap screw to frame rail on each side.
4. Remove shroud-to-radiator support bolts and lift overflow hose out of vehicle (on earlier vehicles these bolts thread into weld nuts on radiator flange).
5. Lift out the upper shroud half.
6. Remove fan for easier access to lower shroud.
7. Separate lower shroud half —
   a. 3 screws on 2-piece unit (Fig. 4).
   b. one side only of 3-piece unit (3 screws) (Fig. 5).
8. Remove lower shroud-to-frame bolts and remove shroud pieces.

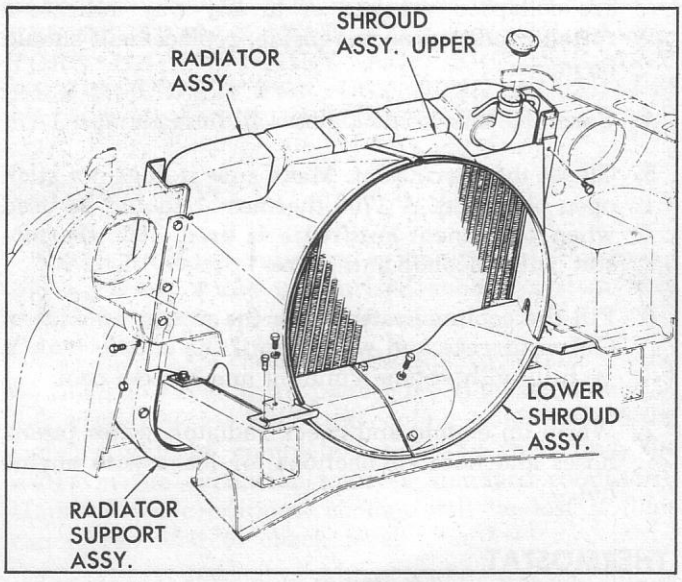

Fig. 4—Two-Piece Lower Shroud

Installation

1. Place lower shroud pieces in installed position and start shroud-to-frame bolts.
2. Install lower shroud connecting sheet metal screws, then tighten frame bolts.
3. Reverse Steps 3, 4, 5, and 6 of removal procedure to install upper shroud and overflow hose clip.

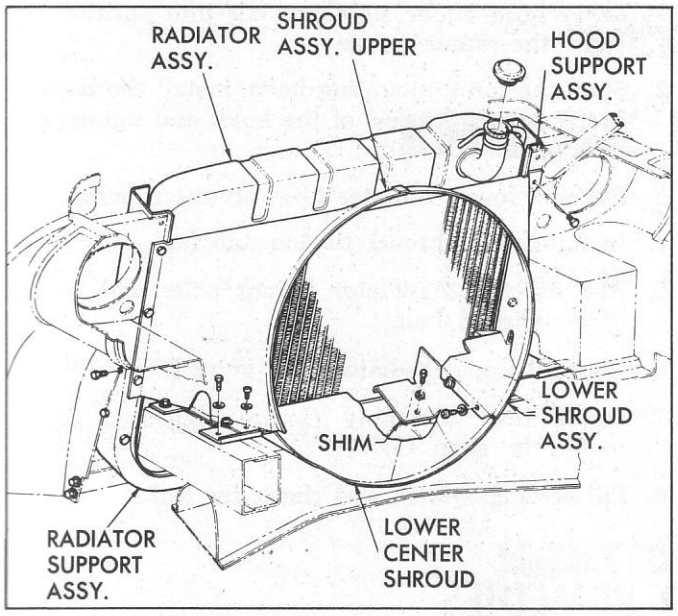

Fig. 5—3-Piece Lower Shroud

4. Connect upper radiator hose and hoses at supply tank if so equipped.
5. Fill cooling system and check for leaks.

RADIATOR (Late Model Aluminum)

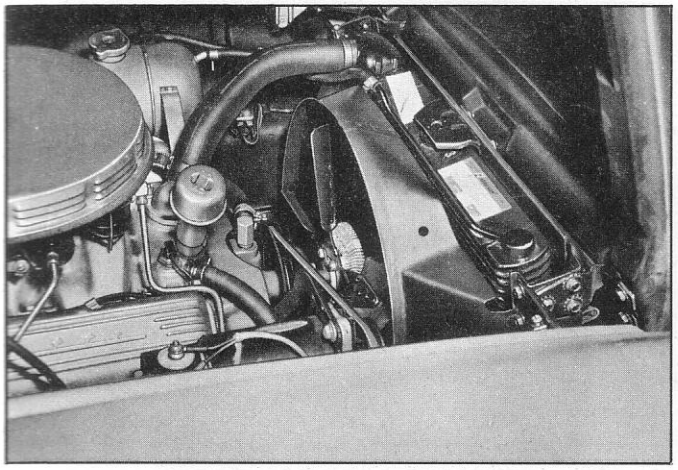

Fig. 6—Radiator Installed (Late Alluminum)

Removal

1. Drain radiator, then close petcock to maintain clearance through hole in support during removal.
2. Disconnect upper radiator hose at radiator and supply tank hoses at supply tank.
3. Remove upper half of radiator shroud.
4. Remove fan assembly from pulley and loosely reinstall pulley bolts through pulley.
5. Remove lower half of shroud.
6. Disconnect lower radiator hose at radiator or engine (engine end may be easier).
7. Remove 2 nuts and nut plate from upper radiator support bracket, remove bracket and lift radiator from vehicle. (Be careful of lower hose if disconnected at engine.)

Installation

1. Install rubber mounts on radiator.
2. Lower radiator into position over lower mounts.
3. Tilt radiator rearward to install upper support bracket over upper mount, then tilt forward to insert bracket studs through radiator support.
4. Install nut plate and 2 nuts.
5. Reverse Steps 2 through 6 of removal procedure to complete installation.
6. Be sure drain petcock is closed, then refill cooling system until the supply tank is ½ full with the engine running and system cool.
7. Check all connections for leaks with engine running and then with engine stopped.

RADIATOR—(Conventional and Early Aluminum)

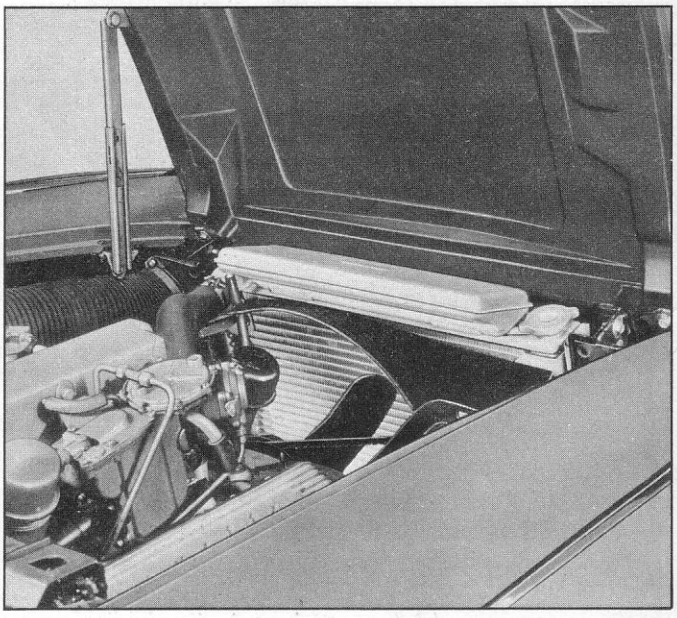

Fig. 7—Radiator Installed (Early Aluminum)

Removal

1. Scribe hood hinge at radiator mounting, then remove hood.
2. Drain radiator.
3. Disconnect upper radiator hose at radiator.

4. Remove upper half of radiator shroud.
5. Remove the fan for easier access to lower shroud.
6. Remove lower shroud.
   a. Separate 2-piece shroud to remove it (fig. 4).
   b. Separate 3-piece shroud into 2 sections at right side then remove it (fig. 5).
7. Disconnect lower radiator hose at water pump.
8. Remove the remaining radiator mounting bolt at each bottom side of radiator.
9. Guide lower hose under stabilizer bar and lift radiator out of vehicle.

Installation

1. Lower radiator into support channel and guide lower hose under stabilizer bar into position toward the water pump.
2. Start the top 2 mounting bolts, install the bottom 2, then align the rest of the holes and tighten the bottom 2 bolts.
3. Connect lower radiator hose at water pump.
4. Install lower shroud, then install fan.
5. Remove top 2 radiator mount bolts and install upper shroud half.
6. Connect upper radiator hose at radiator.
7. Install hood assembly (locate hinges at scribe marks to align hood).
8. Fill cooling system and check for leaks.

TROUBLES AND REMEDIES

Refer to 1961 Passenger Shop Manual Section 8, Page 122 for Chart.

SPECIFICATIONS

Refer to Section 14—Engine Chart for Cooling System Specifications.