Description

The purpose of the cooling system is to control the operating temperature of the engine (and in some units, the transmission, brakes, and hydraulic system). A centrifugal water pump circulates coolant through passages in the engine block and the radiator. A thermostat is installed in the water outlet fitting on the engine. As the coolant flows through the radiator, the fan moves air through the radiator to help cool the system.

The coolant is a mixture of water and antifreeze. The antifreeze prevents the coolant from freezing in cold weather, and thereby preventing damage to the engine and radiator. The antifreeze also prevents rust and lubricates the water pump.

RADIATOR

The radiator is the heat exchanger for the cooling system. The fan causes air to flow through the radiator and reduces the temperature of the coolant. The auxiliary coolant reservoir is connected to the radiator by a hose. As the engine gets hot, the coolant expands. During expansion, coolant moves from the radiator to the reservoir. When the engine stops, the coolant becomes cool and contracts. The coolant in the reservoir flows back into the radiator. In this way, the radiator is kept filled with coolant during normal operation.

On units with a powershift transmission, an oil cooler is built into the radiator. Oil from the transmission flows through coils in the radiator tank to help control the oil temperature.

RADIATOR CAP

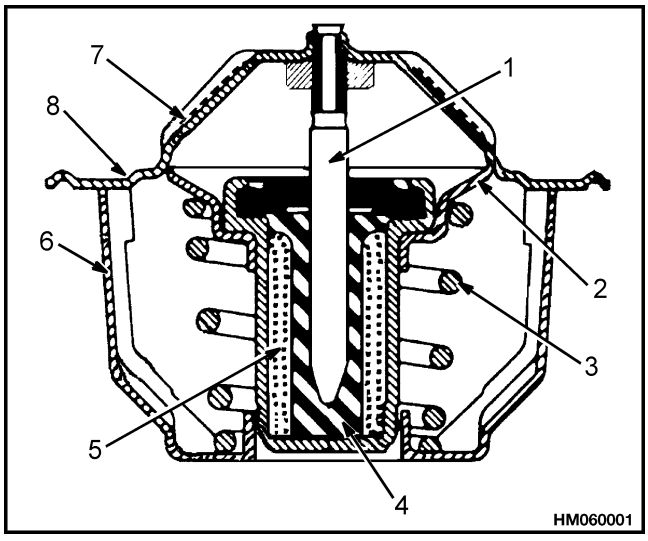
The radiator cap is a pressure-vent type that lets the pressure in the cooling system increase to 103 kPa (15 psi). The pressure in the system prevents vapor from forming in the coolant flowing to the water pump. This action maintains the efficiency of the water pump and the performance of the cooling system. The increase in pressure also raises the boiling point of the coolant mixture to approximately 125°C (257°F) at sea level.

The radiator cap has a pressure valve and a vacuum valve. The pressure valve is held against its seat by a spring. The pressure valve opens when the pressure in the cooling system exceeds 103 kPa (15 psi). The vacuum valve is held against its seat by another spring. The vacuum valve opens to relieve the vacuum created when the coolant temperature decreases. In certain conditions this vacuum can cause the radiator or top hose to collapse.

THERMOSTAT

The thermostat is a device that controls coolant flow by opening and closing to regulate coolant temperature. The thermostat uses a wax pellet to control its operation. The wax pellet expands when it is heated and contracts when it is cold. When heated, the wax pellet pushes on the piston, causing the valve in the thermostat to open. As the wax pellet cools, it contracts and lets a spring close the valve. When the engine is first started and the coolant is cold, the thermostat remains closed. During this time the coolant circulates through the engine, letting it warm quickly. As the engine becomes warm the thermostat opens, letting coolant circulate through the radiator.

The opening and closing of the thermostat helps keep the coolant within the operating limits of the system. The same thermostat is used for summer and winter seasons. Do not operate the engine without a thermostat. The engine will take longer to get warm and may run improperly. See Figure 2.



1. PISTON
2. VALVE SEAT
3. SPRING
4. DIAPHRAGM
5. WAX PELLET
6. FRAME
7. FLANGE
8. VENT HOLE

Figure 2. Typical Thermostat

WATER PUMP

The centrifugal-type water pump is installed at the front of the engine block. The inlet for the pump is connected to the bottom of the radiator by a hose. From the pump, coolant passes through the passages in the engine block to the top of the radiator. The thermostat controls the flow of coolant through the engine and radiator.

FAN AND FAN SHROUD

The fan is used to provide airflow through the radiator at all engine speeds. The fan is a pusher-type or puller-type and can be installed on the water pump or on a separate hub. The fan is driven by a drive belt from the engine crankshaft.

The fan shroud ensures the air flow from the fan goes through the core of the radiator.

Cooling System Checks

RADIATOR

WARNING

During engine operation, be careful not to touch the fan, pulleys, or drive belts. Contact with these parts can cause serious injury.

NOTE: The Repair procedures for the radiator are in the **Frame** section of the **Service Manual**.

To check for water flow restrictions in the radiator, run the engine until it is warm. Shut the engine OFF and feel the radiator. The temperature must be even across the radiator. (The radiator will be hotter near the top radiator hose.) Cold spots on the radiator indicate restrictions.

If the radiator has leaks, have it repaired by trained personnel.

THERMOSTAT

WARNING

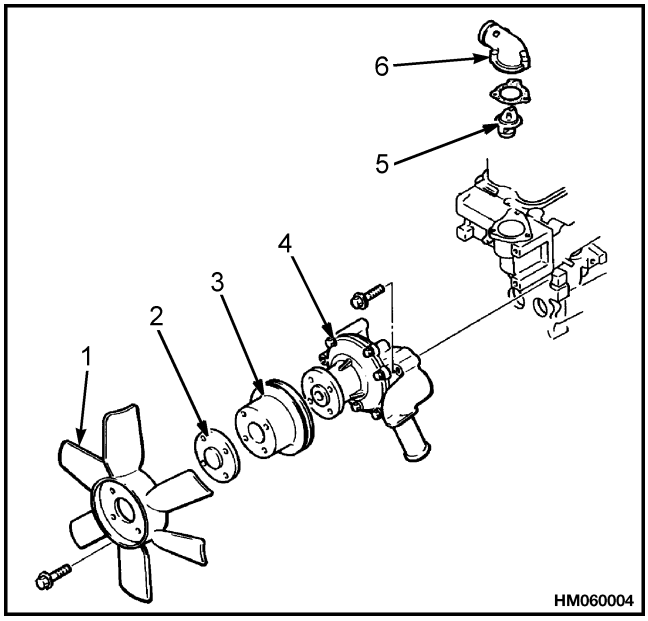
During engine operation, be careful not to touch the fan, pulleys, or drive belts. Contact with these parts can cause serious injury.

CAUTION

DO NOT operate the engine without a thermostat. The engine and cooling system can be damaged.

NOTE: Repair procedures for the thermostat are in the **Engine** section of the **Service Manual**.

1. Remove thermostat from cooling system. See Figure 3.
2. Mix solution of water with 33% antifreeze. Heat solution to 14°C (57°F) above temperature on thermostat.
3. Hold thermostat with wire and put it in solution. Stir solution. If operating correctly, thermostat will open.
4. Remove thermostat and put in same solution at –12°C (10°F) below temperature on thermostat. Valve must close completely.



1. FAN
2. SPACER
3. HUB/PULLEY
4. WATER PUMP
5. THERMOSTAT
6. THERMOSTAT HOUSING

Figure 3. Cooling System Components Typical Arrangement