



Engine Cooling Systems

Matthew Whitten
Brookhaven College



Cooling Systems Objectives

- Describe cooling system
- Describe cooling system types
- Identify components
- Theory and operation of cooling system

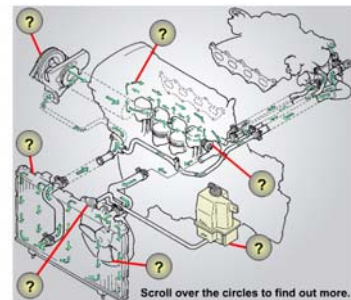


Purpose

- The cooling system is used to maintain an optimal engine temperature.
- Optimal engine temperature is high enough to help emissions and not too high to cause damage to the engine.



Components

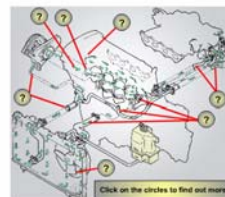


Coolant

- Engine coolant is used to raise the boiling point and lower the freezing point of the cooling system.
- Mix 50/50
- Ethylene Glycol based:
 - Green/Gold
 - 30,000 or 50,000 service interval.
- Organic Acid Technology:
 - Orange
 - Extended life coolant.
 - Only used in last body style cougars.



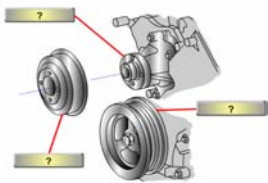
Operation



- When a cold engine is started, the coolant pump only circulates coolant through the cylinder head and engine block coolant passages. Some of the coolant may be diverted to the heating system.
- When enough heat is created to open the thermostat, the water pump circulates coolant throughout the engine and into the radiator.
- The hot coolant flows from the upper tank of the radiator to the lower radiator tank. Cool air passing over the radiator fins removes heat from the coolant.
- From the lower tank, coolant flows through the lower radiator hose to the coolant pump inlet.

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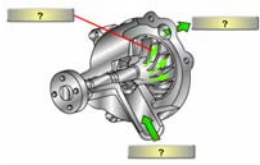
Water Pump



- Coolant is circulate throughout the cooling system to help dissipate and distribute heat.
- The coolant is circulated by the use of a coolant pump (water pump).
- Drives:
 - Crank-Serpentine Belt
 - Crank-Timing belt/chain
 - Camshaft Belt
 - Camshaft Flange
 - Electric

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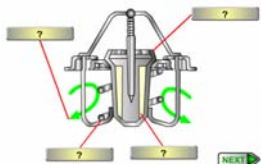
Impeller



- Water pumps use an impeller pump. This uses centrifugal force to pressurize the water.
- Impeller materials:
 - Stamped steel
 - Cast iron
 - Plastic/Phenolic material.

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Thermostat

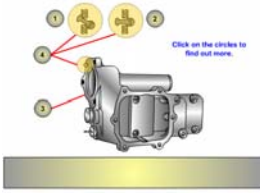


- Purpose:
 - Maintain the engine at an optimal operating temperature.
- Restricts the coolant flow when the coolant is cold.
- Once the temp increases to set point the Thermostat opens which redirects hot coolant to the radiator.
- Uses a heat sensitive wax to open and close.

NEXT

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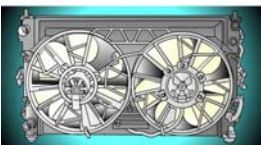
Jiggle Pin



- Trapped air in a cooling system can cause overheating or incorrectly indicate overheating.
- A Jiggle Pin is used to purge the air from the cooling system.
- If air is present the pin will drop and open the orifice.

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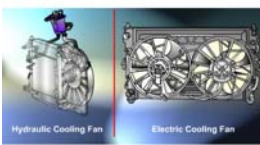
Cooling Fan



- Once the hot coolant is in the radiator the heat needs to be exchanged to the air. Increasing the amount of air over the radiator will increase the amount of heat exchanged to the air.
- When a vehicle is driving slowly the cooling fan is engaged to increase the amount of air over the fins.

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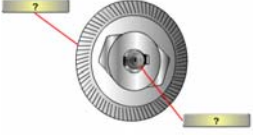
Fan Drives



- Types:
 - Viscous clutch/mechanical
 - May be thermostatically controlled or PCM controlled
 - Electrical motor driven
 - PCM or CCRM controlled
 - Hydraulic pump driven
 - PCM controlled

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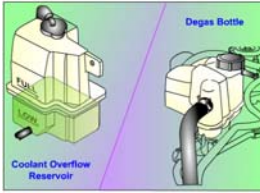
Viscous Drive



- Viscous: having high resistance to flow.
- Components:
 - Input shaft is mounted to drive pulley.
 - Clutch housing is mounted to fan.
 - Bi-metallic thermostat spring.
- Operation:
 - Hot air from the radiator heats the bi-metallic spring causing it to turn the clutch control piston.
 - The clutch control piston decreases the volume for the viscous fluid.
 - The input impeller and output wheel spin at same speed.

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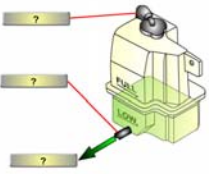
Reservoir Types



- The reservoir types dictate the type of cooling system used on a vehicle.
- Types:
 - Coolant Overflow
 - Degas Bottle

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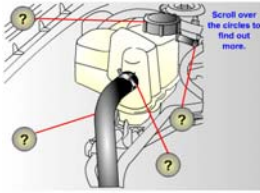
Overflow Bottle



- In the "Overflow" system the bottle is not a part of the pressurized cooling system.
- States of operation:
 - Any excess fluid/gas pressure is pushed past the pressure cap to the bottle.
 - In a system that is cooling the air pockets are contracting. This contraction is creating a vacuum. The vacuum pulls coolant back into the pressure system past the cap.
 - Under normal operation the cooling system pressures balance around the cap pressure.
- Idea: to push out vapors/air and pull in liquid coolant.
- To purge this system the cap must be installed and with multiple hot and cold cycles.

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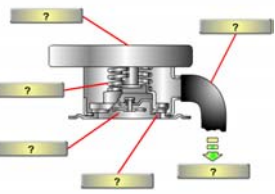
Degas Bottle



- In the "Degas" system the bottle is a part of the pressurized cooling system.
- States of operation:
 - Normal pressure and heat expansion.
 - Open area to separate liquid from vapor/gases.
- To purge system cap must be installed and coolant level must not exceed "Max" level.

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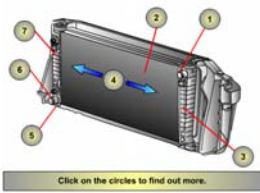
Pressure Cap



- A Pressure cap is used to maintain pressure on the cooling system.
- With higher pressure comes higher boiling points of the coolant.
- How can manufacturers increase the operating temperature of their engines without using different coolants?

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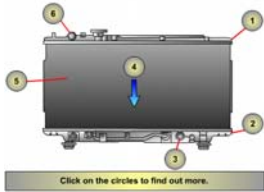
Radiator Cross-Flow



- Cross-flow radiator uses side mounted tanks. Used in low profile applications.
- Components:
 - Outlet/Inlet
 - Core (horizontal flow)
 - Tanks



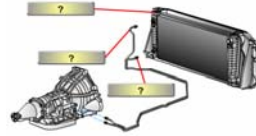
Radiator Down-Flow



- The radiator tanks are located on the top and bottom of the radiator core. Used in high/narrow applications. F series trucks
- Components:
 - Tank
 - Core
 - Flow downward
 - Inlet and outlets



Transmission Cooler



- Transmission coolers are integrated into the radiator.
- Reasons:
 - Heat transmission fluid
 - Cool transmission fluid