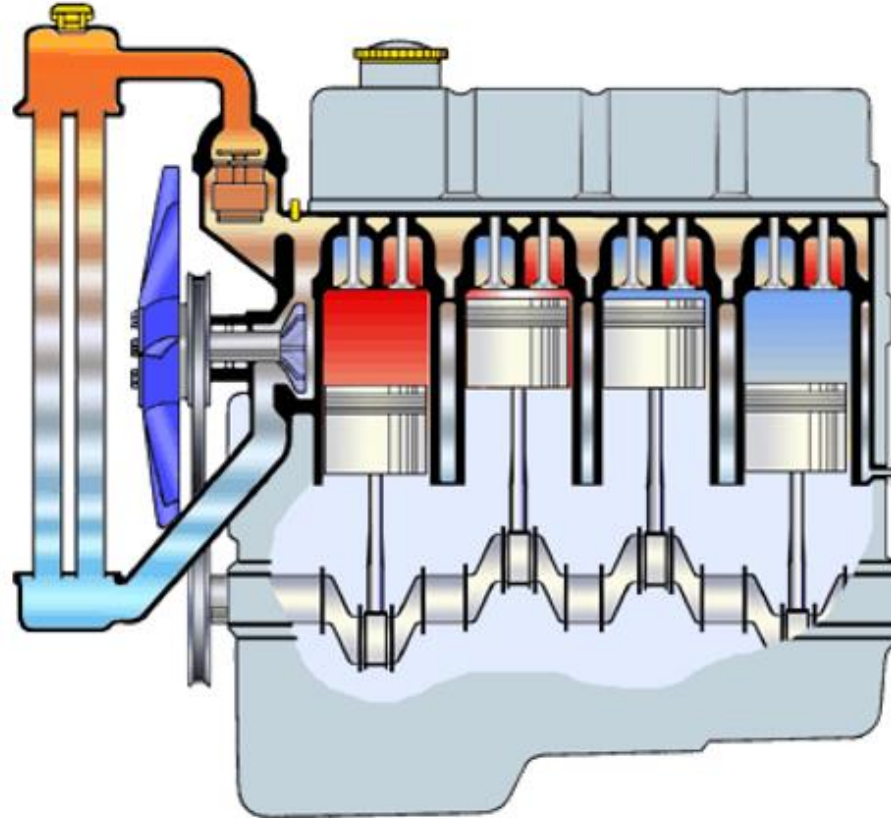


# ENGINE COOLING SYSTEM

# PURPOSE

- Get the engine up to optimum operating Temperature as quickly as possible and maintains it at that temperature.
- Controls the heat produced in combustion chamber, so that the engine parts are not damaged & the oil does not break down.



# TYPES

- AIR COOLED ( FOR SMALL ENGINES )

- A. NATURAL FLOW:**

- Have metal FINS on the outer perimeter of the engine.
    - Heat is transferred from the engine, through these fins, into the atmosphere.

- B. FORCED CONVECTION**

- Uses a fan
    - For enclosed engines

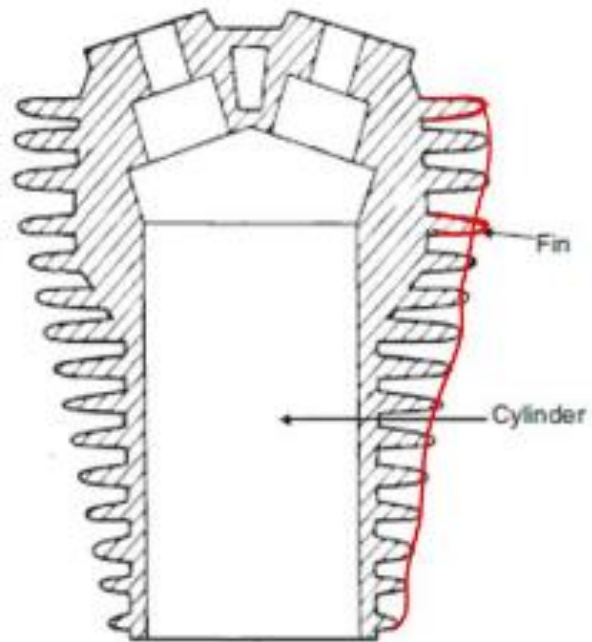
- LIQUID COOLED ( FOR LARGE ENGINES )

- A liquid (**coolant**) is circulated around the cylinders and absorb heat from the cylinder walls and cylinder head.

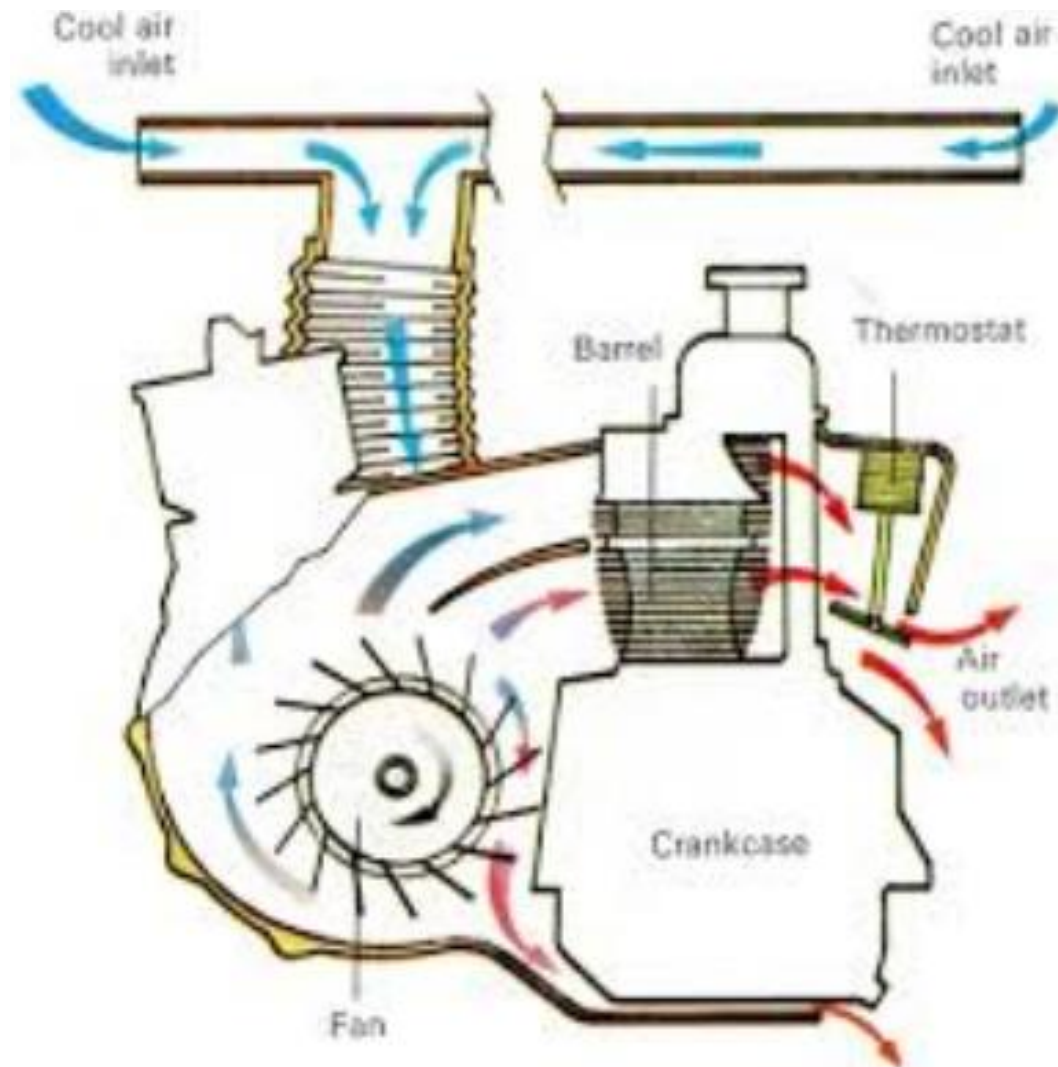
# AIR COOLED TYPE



Finned Engine Cylinder

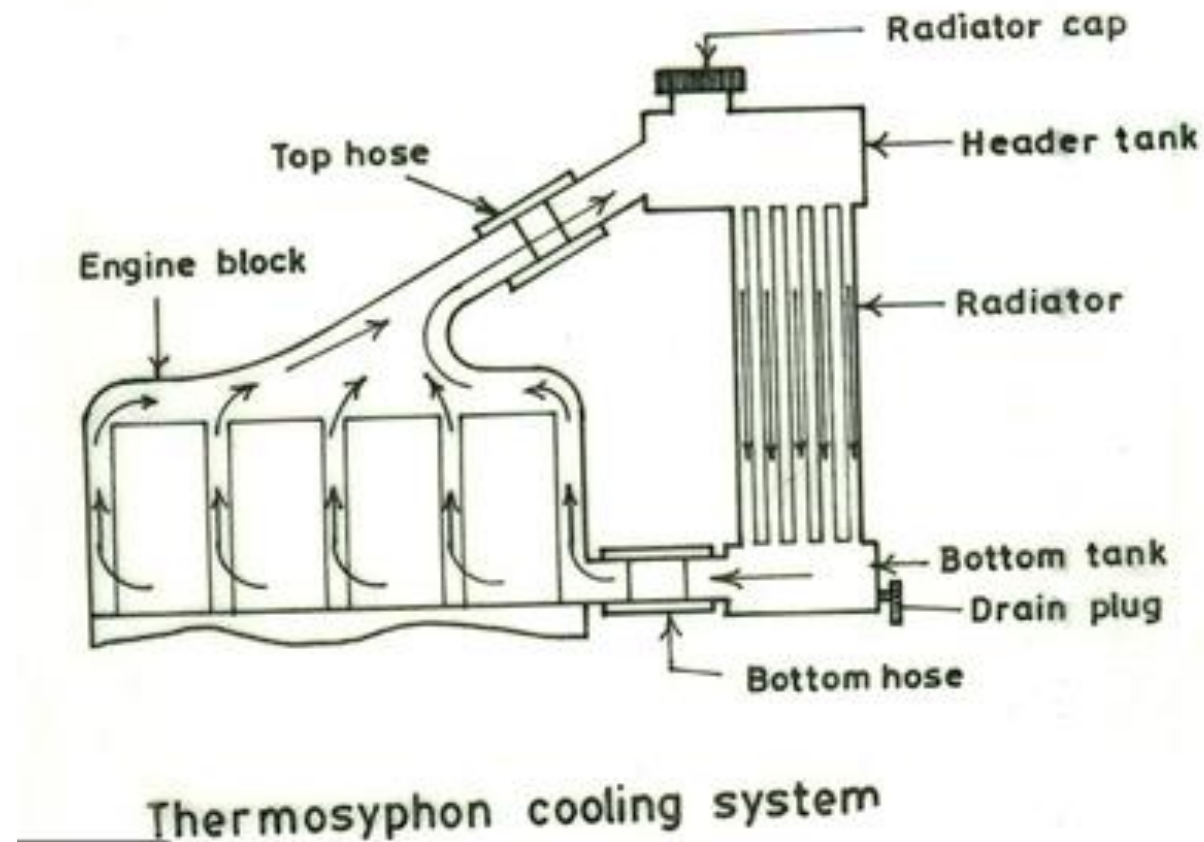


## Air Cooling: Vw Beetle Air Cooling System



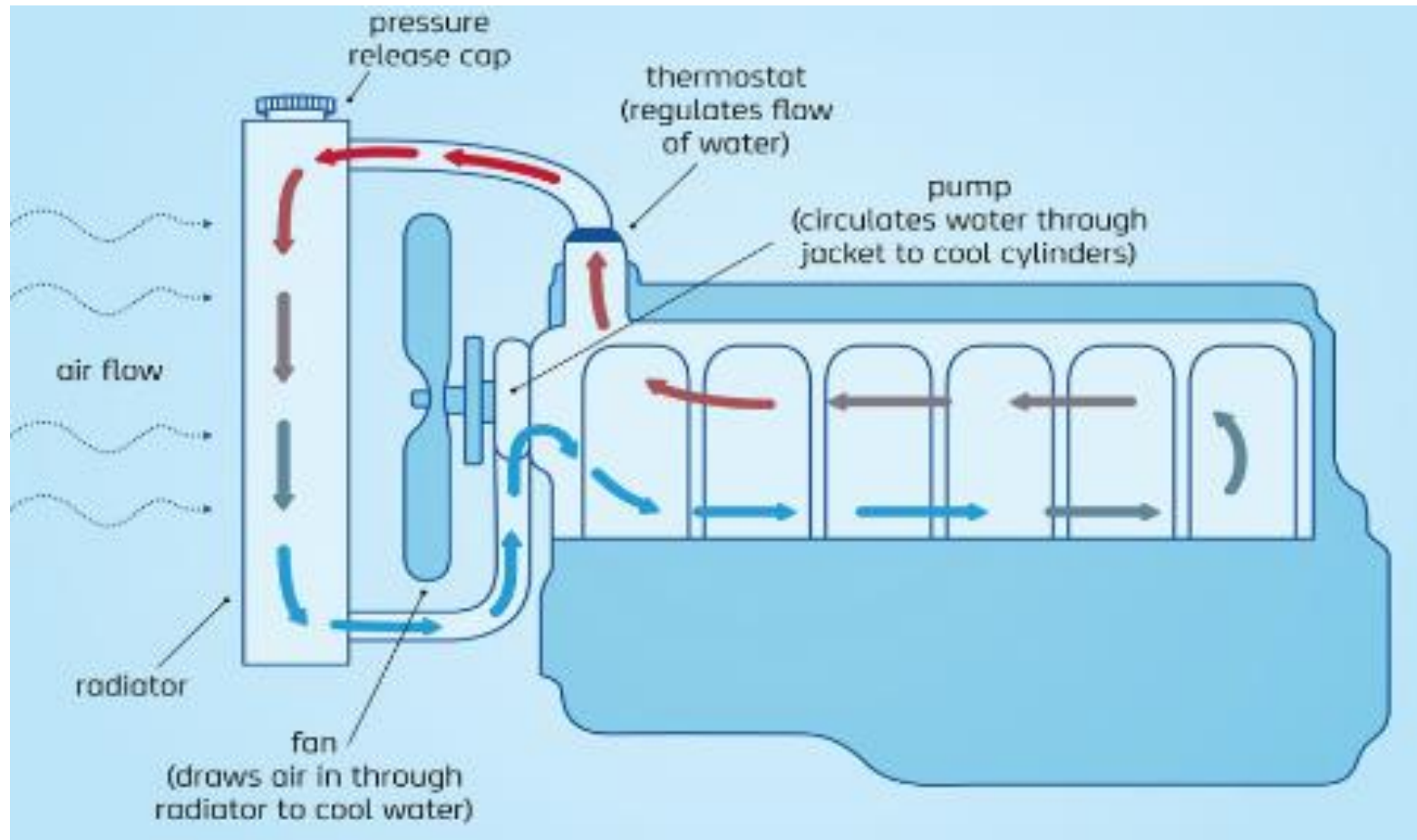
# LIQUID COOLING SYSTEM

- THERMOSYPHON SYSTEM



# LIQUID COOLING SYSTEM

Forced Circulation system





# SYSTEM COMPONENTS

**COOLANT** is a mixture of antifreeze (*Ethylene Glycol*) and Water (*some Aluminum radiators have special antifreeze*)

- Coolant absorbs heat as it passes through the engine and also lubricates the water pump. |
- Hot coolant enters the radiator in which the heat is transferred to air that is flowing through the radiator.
- Prevents rust and corrosion from the water jackets.
- Cooling system flush is recommended every two years in order to remove any rust or contaminants.



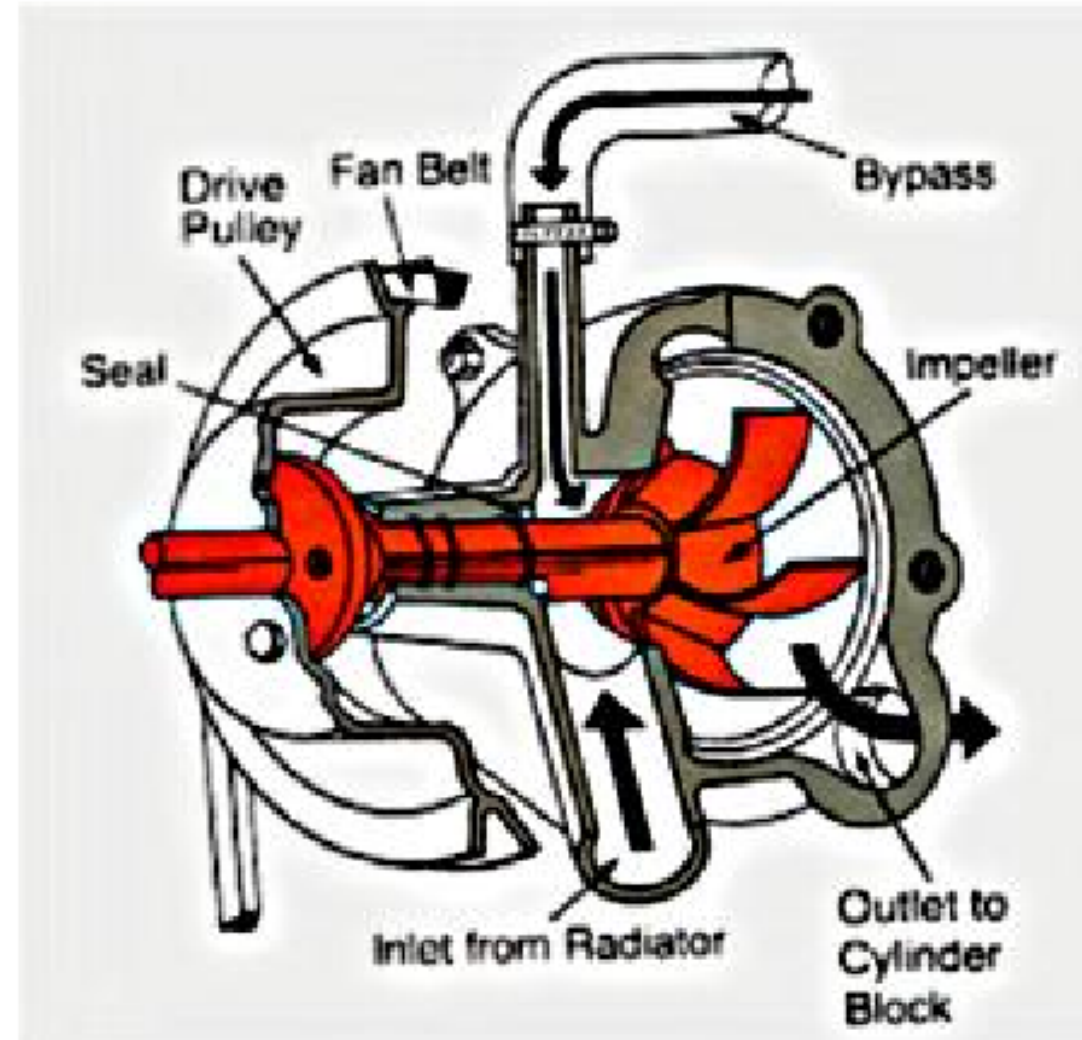
## **Water Jackets**

- Designed to keep engine block and cylinder head cool.
- Open spaces between the outside of cylinder and inside of cylinder block and head.
- When engine is running at normal operating temperature, the coolant is forced through the water jackets in the engine block, through the head gasket, into the head, and back to the radiator.

# Cooling System Components

## Water Pump (Non Positive displacement - Impeller Type)

- Draws the coolant from radiator, through the lower radiator hose, and then forces it through the water jackets, back into the radiator.
- Water pumps gasket is placed between the water pump and the engine block to prevent leakage (if left loose it might leak and if tightened too much it might crack).



# Cooling Fan

- Provides air flow when vehicle is stationery
- Provides increased air flow at low RPM or vehicle speeds

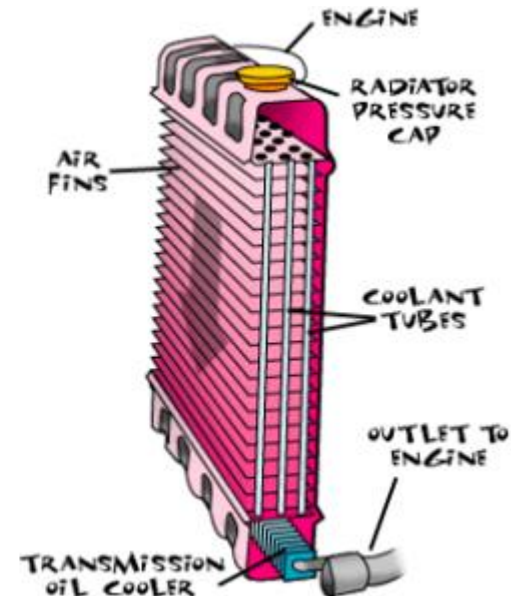
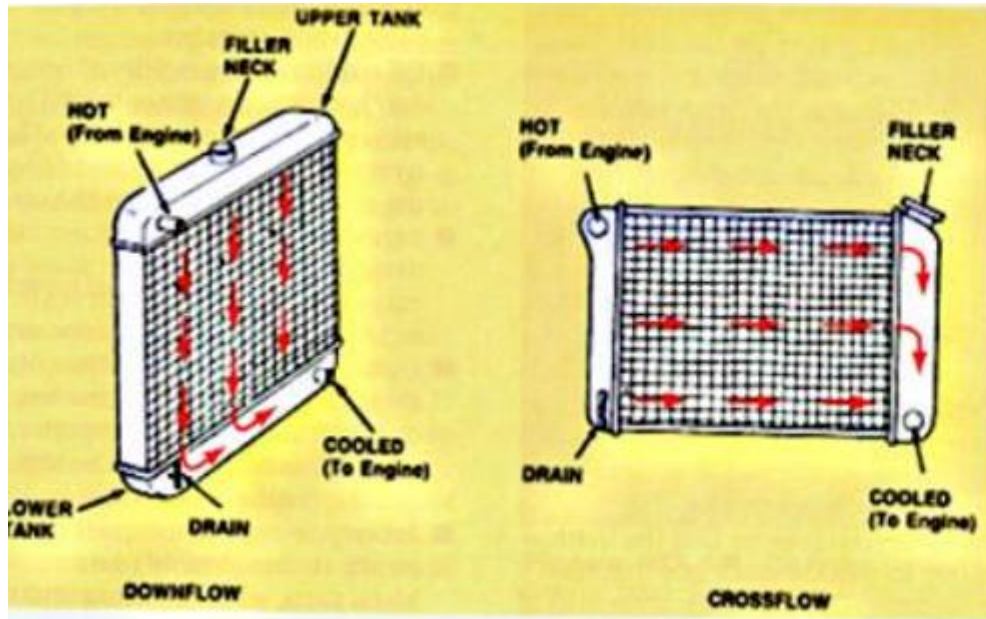


**Electric fan** is mounted on the radiator and is operated by battery power.

- Is controlled by the thermostat switch.
- Is located on Thermostat housing, Block, or Radiator.
- Some modern cars have the range between 193° to 207° F (89 to 97° C)
- On AC equipped cars, a second fan is mounted, and it runs any time AC is turned on.

# Radiator

- Heat Exchanger which transfers heat from coolant to the atmosphere
- Two types – Vertical & cross flow
- Vehicles equipped with automatic transmission have transmission cooler build into the radiator.
- Aluminum, brass, copper core; brass, copper or plastic tanks
- Air movement through radiator created by a mechanical fan or/and by vehicle movement dissipates heat



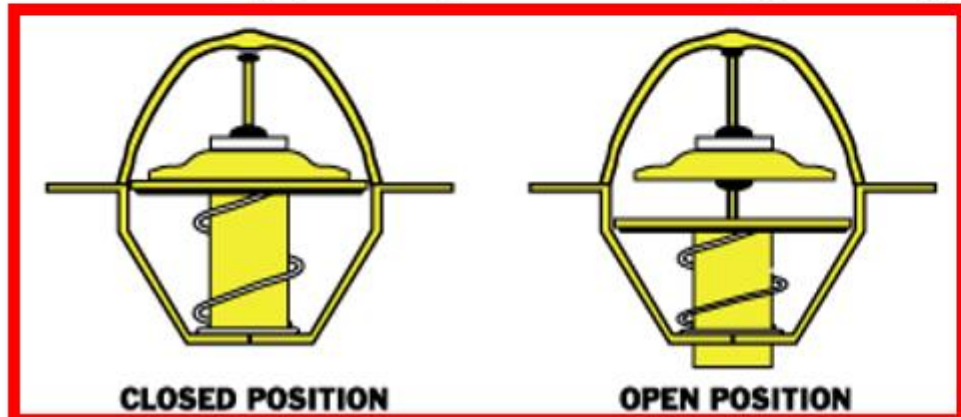
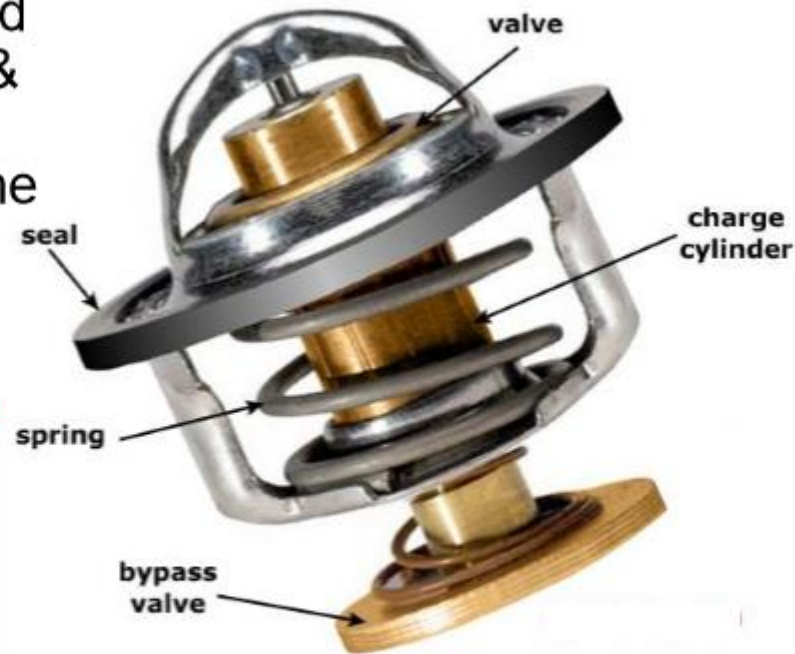


# Thermostat

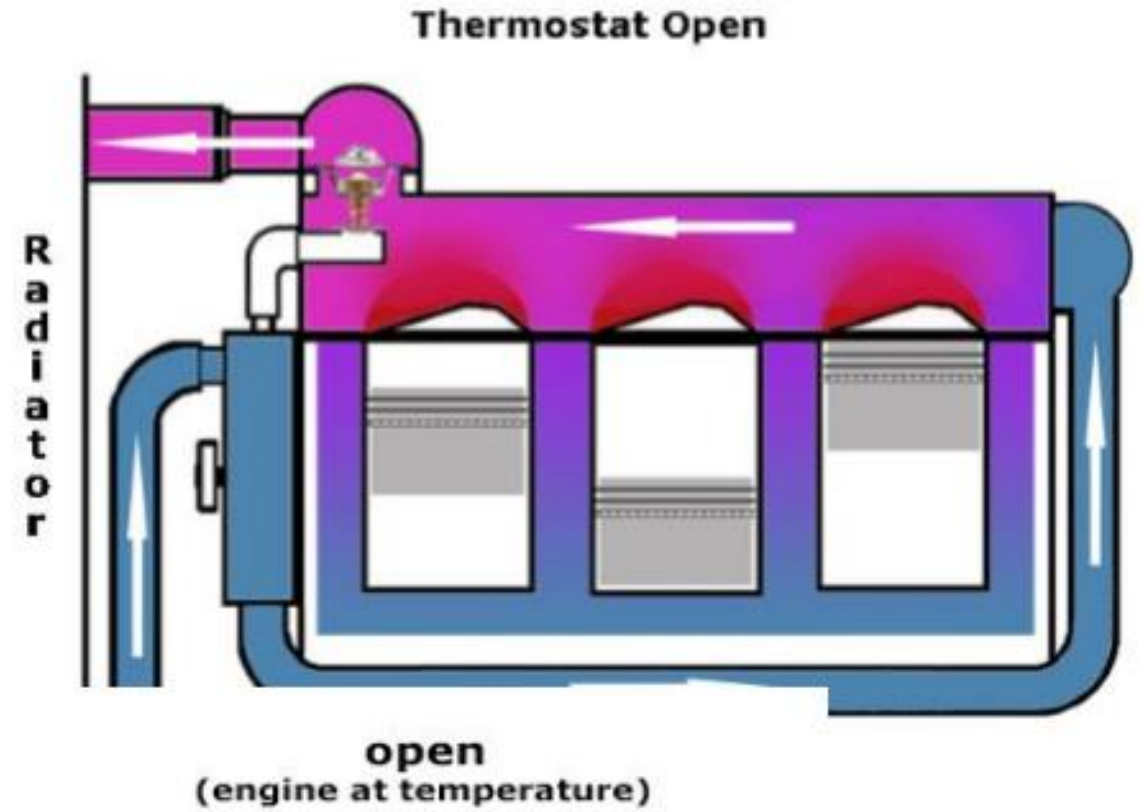
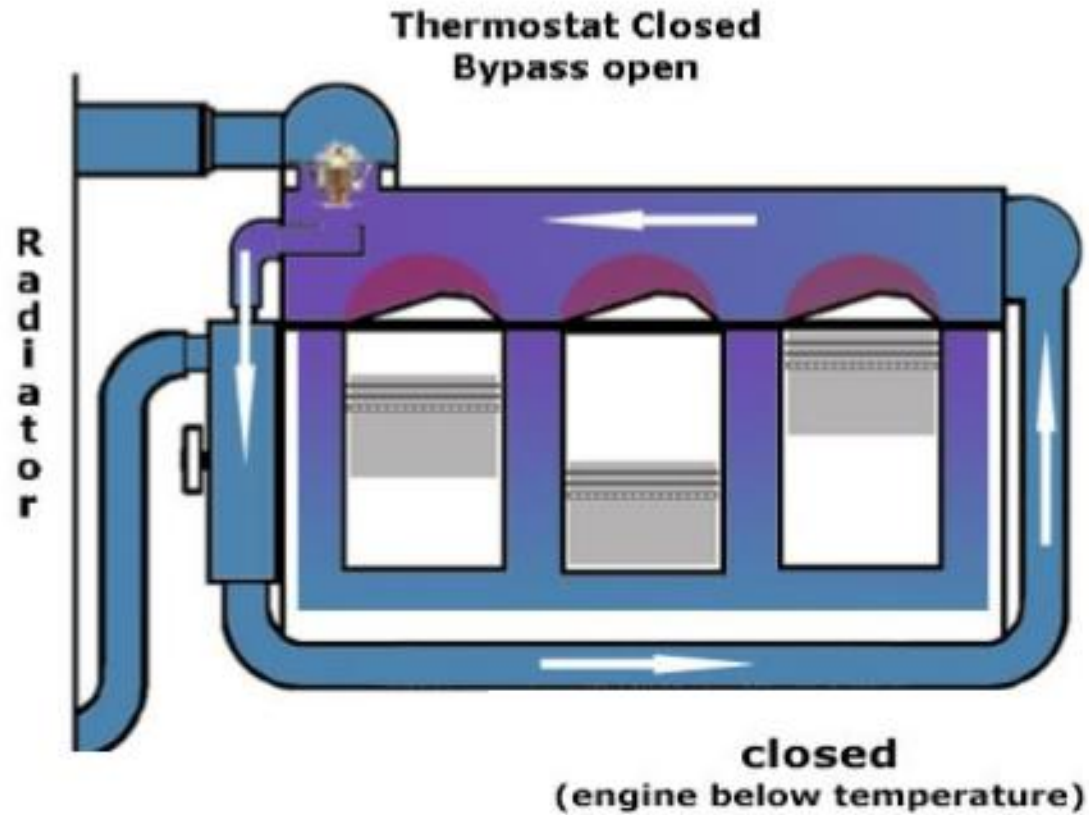
- Placed between the cylinder head and top radiator hose.
- Regulates engine coolant temperature
- The temperature that the thermostat opens is called **thermostat rating**. (85-90° C most common)
- Solid Expansion design – wax pellet expands as temp increases, valve begins opening at rating & is completely open within 10 degrees

If it fails in open position, engine runs cold resulting in poor mileage and high wear & tear.

If it fails closed, creates temperature in the engine well beyond normal limits. Many types of damage may occur. (Can be checked by placing in the boiling water)



# Working of Thermostat





## Hoses

Top Radiator hose brings the coolant back to the radiator and are molded Specifically for individual make and model.



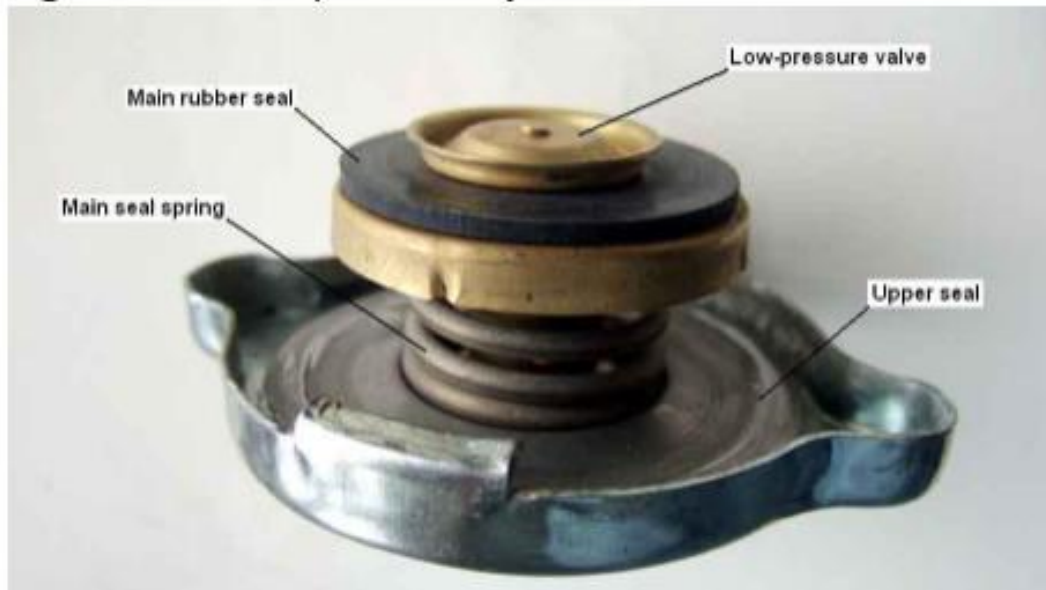
Lower radiator hose draws the coolant into the engine, from the radiator and is attached to the water pump



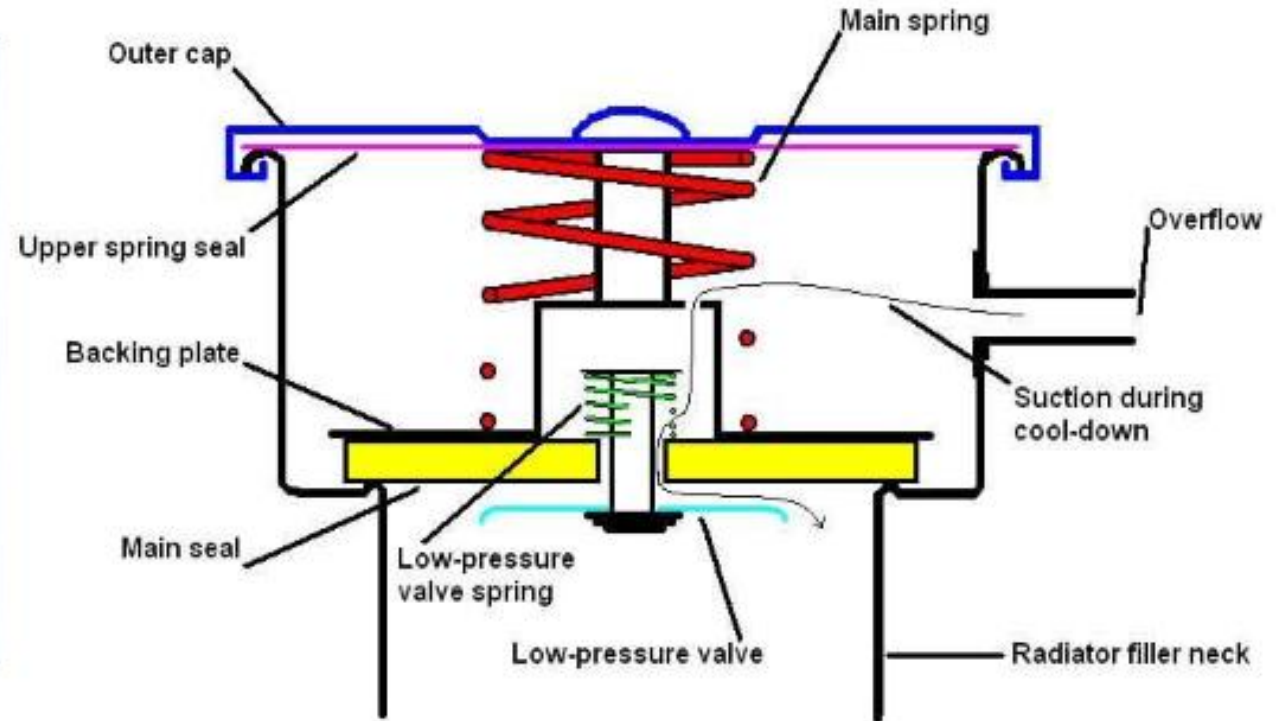
**Radiator Pressure cap** seals the cooling system and pressurizes it.

- Most caps exert 10-16 psi (0.7-1.1 kg/sqcm) of pressure
- Each psi of pressure inserted increases the boiling point of coolant by 1.8° C (3° F)
- Built in pressure relief valve prevents excessive pressure build-up by sending excess coolant to the expansion (Recovery) tank
- Vacuum vent valve allows the coolant to re-enters the system (when engine is shut off and cools)

**CAUTION:** Radiator cap should never be opened when the engine is hot (if the top radiator hose is hard)



# Working of Radiator cap valves





# Coolant Recovery Tank

- Keeps the coolant level full in the system at all times.
- Works in conjunction with the radiator cap.
- When the engine heats up the coolant expands and flows to the recovery tank.
- When the engine cools the coolant contracts and creates a vacuum and draws the fluid back into the radiator.
- Reduces air in system
- Reduces rust
- Less need to open radiator



# Cooling System Inspection

- Check coolant level.
- Check anti-freeze protection.
- Check coolant condition.
- Check coolant pH.
- Leak check system.
- Check radiator cap.
- Check belt tension.
- Check belt condition.
- Check hose condition.
- Blow out radiator fins.
- Check thermostat.
- Check radiator fan.
- Check water pump.