(A.T.E) (Chap-2) Cooling and Lubrication

During combustion in I.C engines, a large amount of heat is produced.
Due to combustion, heat energy is converted into mechanical work.
- only about 25~30% of heat is converted into useful work.
- About 40% of heat is carried away by gases.
- About 30% of heat dissipiate to cylinder walls, cylinder, piston pins etc.

If Engine operate 250 to 300°C, so

1. At high temperature, lubricating oil decompes.
2. High temperature cause pre-ignition.
3. It reduce the piston, piston rings strength.
4. Thermal stress is produced.
5. It reduces the volumetric efficiency.
6. Power output of engine is reduced.

Cooling Process

The process of removal of heat from I.C. Engines is known as cooling Process.

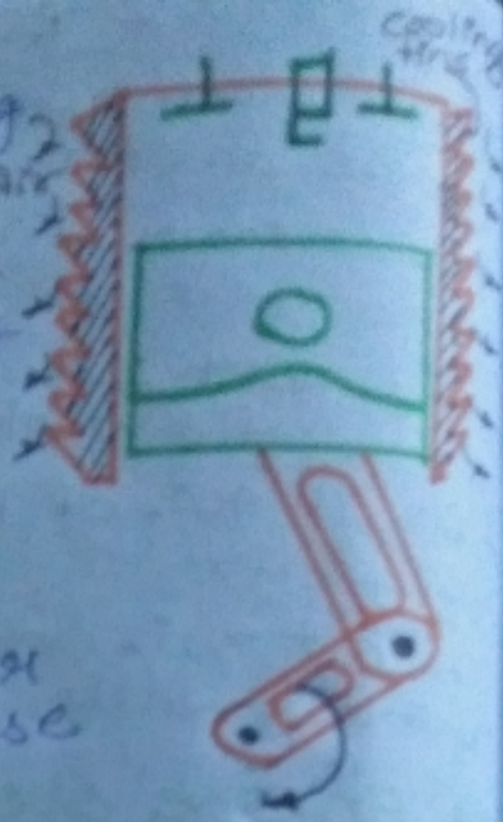
Two Types of cooling System

1. Air cooling
2. water cooling

• Air Cooling

It is called Direct cooling process.

— Transfer of heat and Air has direct contact and carried away heat outside the engine.



— Air cooling done in two stroke engines.

— For more heat transfer engine parts likes we use fins and Baffels.

• Advantages —

1. Simple mechanisms.
2. Less part Required.
3. It warm up much faster.
4. No coolant leakage.
5. It not need radiator, coolant and water pump.

• Disadvantages —

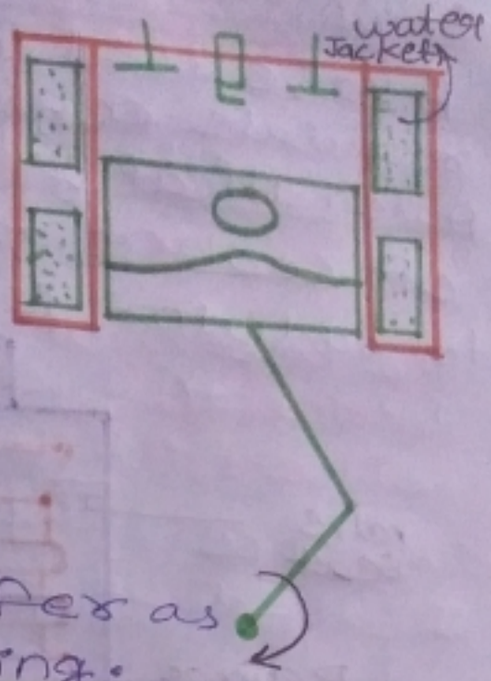
1. Lesser heat transfer compared to water cooled engine.
2. Higher possibility of overheat.
3. Noisy.
4. Less efficient as compared to water cooling.
5. More expensive to build.

• Water Cooling

This system consist of a water jacket inside the cylinder and act as a

heat exchanger and connect with radiator.

- coolant is circulated through water Jacket in engine cylinder head.
- coolant remove excess heat from engine.



Advantages :-

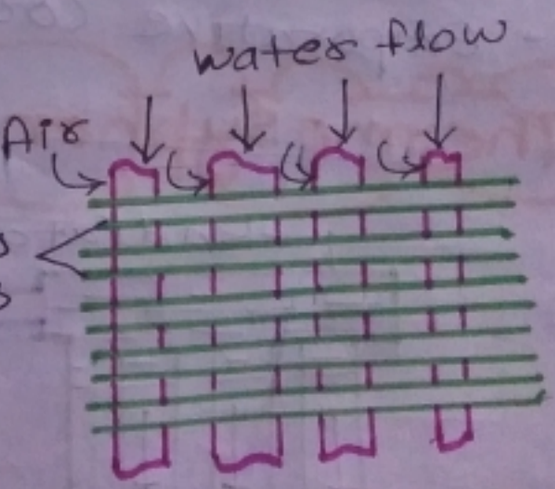
1. Higher heat transfer as compared to Air cooling.
2. Most suitable for four stroke Engine.

Disadvantages :-

1. It need parts like radiator, hoses and water pump etc.
2. Not efficient for smaller Engine.
3. Engine cylinder construction is complicated.

• Radiator

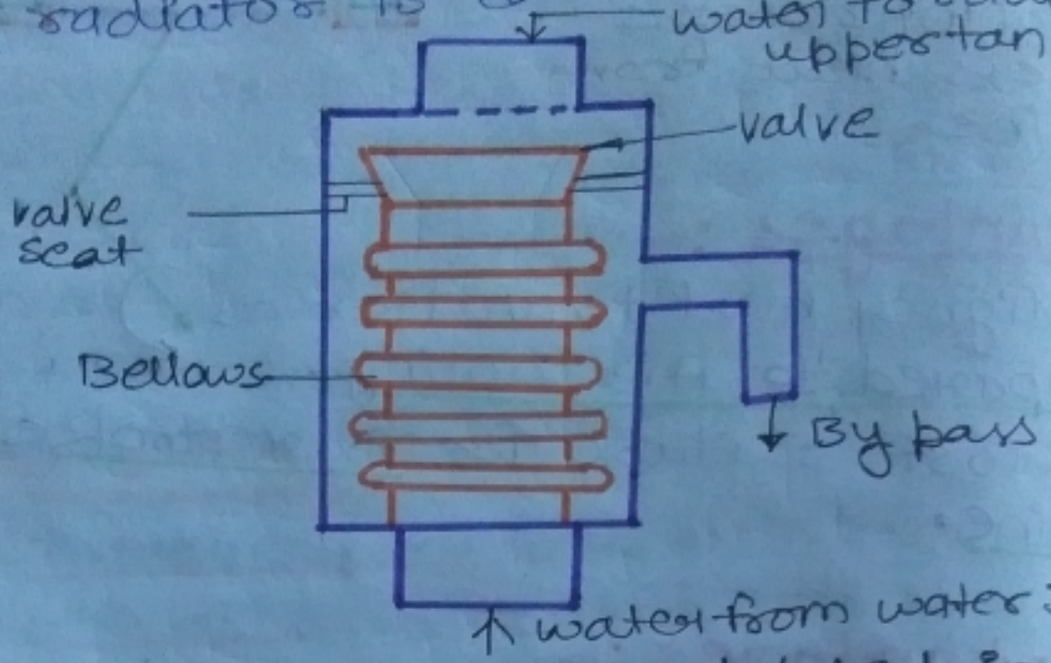
The component which remove heat from circulating water to Air is called Radiator.



The Radiator cool down the hot water coming from engine, by providing a larger cooling surface to Air stream.

• Thermostat

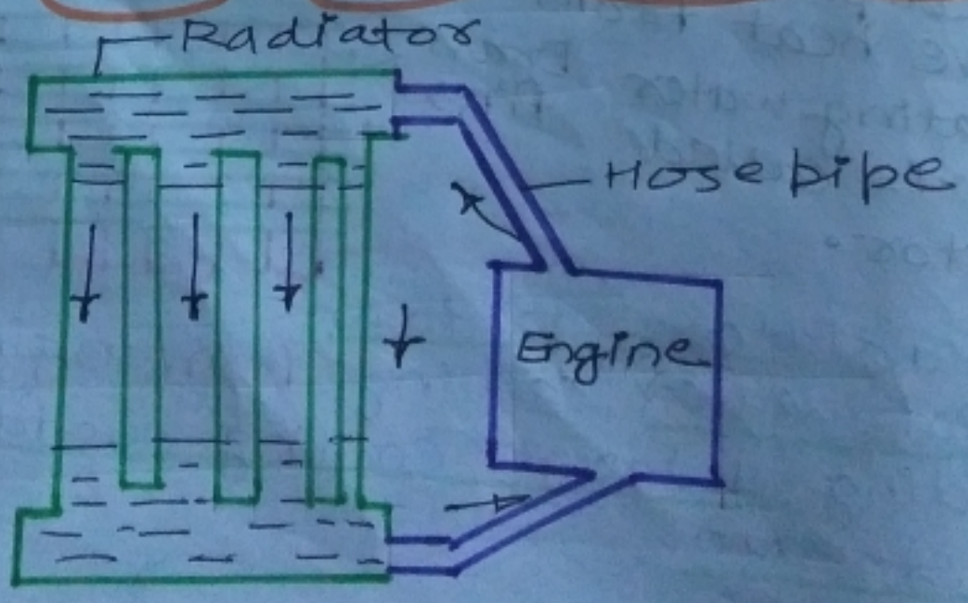
A valve used in cooling system to regulate engine temperature Automatically by control the amount of coolant flowing from water jacket to radiator is called Thermostat.



The various Method adopted in water cooling —

1. Thermosyphon Method
2. Full pump circulation Method
3. Thermostatic cooling system
4. Pressurized cooling system
5. Evaporative cooling system.

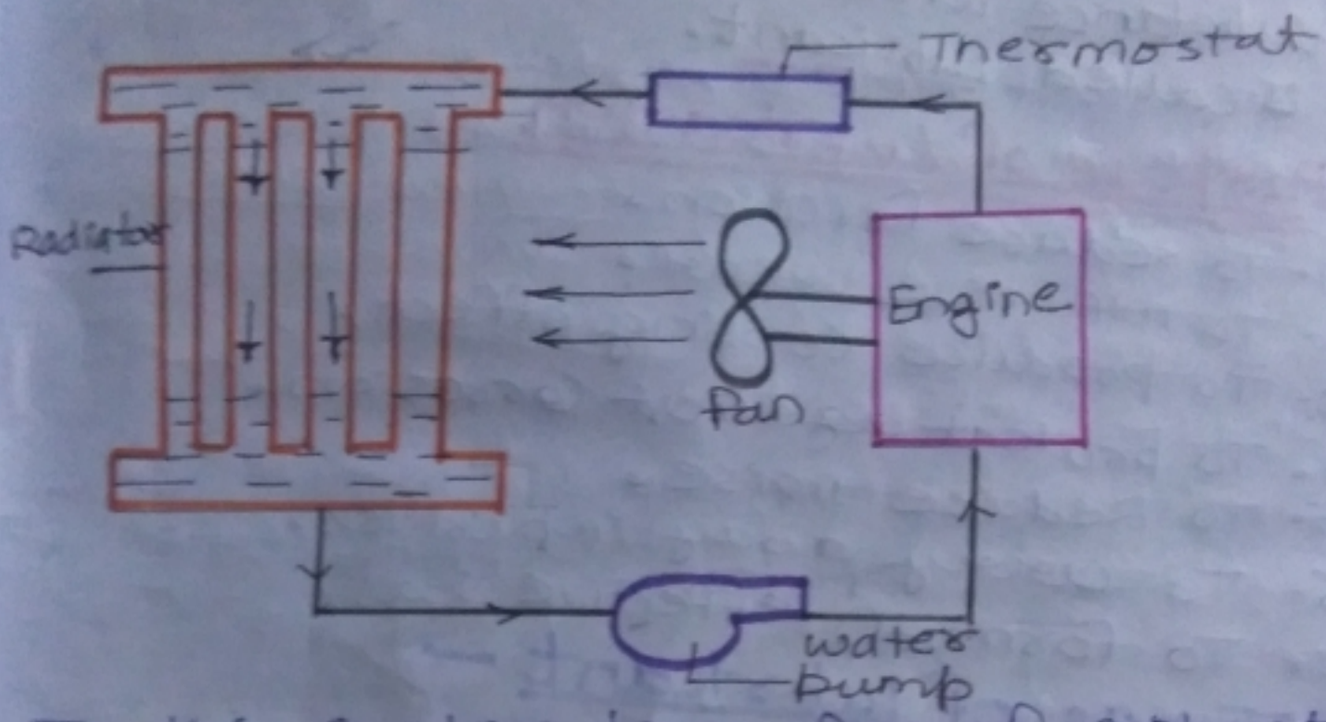
Thermosyphon Cooling System



Thermo syphon method is based upon principle that water is heated its density decreases.

- Due to decrease in density hot water move upside and cold water take place due to more density.
- Radiator is used to cool the circulating water by Air stream.

Forced or Pump cooling system



In this system transfer of coolant from [water Jacket to Radiator and Radiator to water Jacket) by use of water pump.

water pump is driven by belt and belt is driven by engine.

Thermostatic cooling system

In this system, thermostat is situated between Engine and Radiator. It contain Bellows in which low volatile fluid is filled with ether partially.

in cylinder from thermostat coolant amount flowing through water Jacket to Radiator.

• Engine Lubrication

The Process of introducing a film of lubricant between the moving parts, to Reduce friction is called Lubrication.

- Substance which is used to reduce friction is called Lubricant.

• Purpose of Lubrication

1. To reduce friction.
2. To minimise wear.
3. To produce cooling effect.
4. To protect against corrosion.
5. To Reduce noise.
6. To carry away impurities.
7. To form an effective seal.

• Types of lubricant —

1. Solid Lubricant
2. semi solid Lubricant
3. Liquid Lubricant

1. Solid Lubricants

• Graphite, Molybdenum, Mica

2. semi solid Lubricants

• Grease.

3. Liquid Lubricants

• Mineral oil, Vegetable oil and Animal oil.

Properties of Engine Lubricant

1. Viscosity
2. Flash point
3. Fire point
4. Cloud point
5. Pour point
6. Film strength
7. Specific Gravity
8. Adhesiveness
9. Oiliness
10. Emulsification

Lubrication System of I.C. Engines

The process which is used to supply and regulate the flow of lubricants to various Engine parts so, is called Lubrication system.

Classification of Lubrication

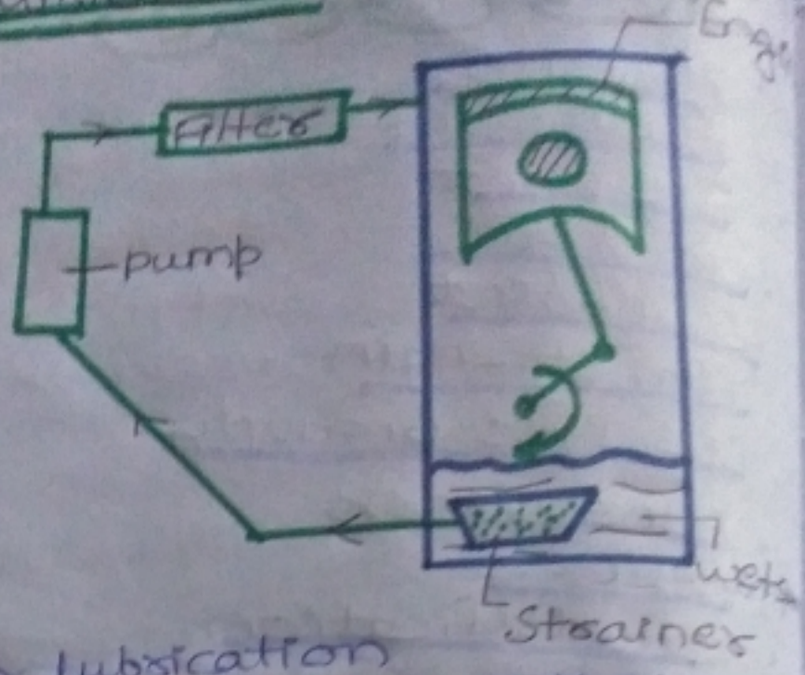
1. Mist or charge Lubrication

- The lubrication system used in two stroke petrol engine.
- In such Engines, lubricating oil is mixed with fuel with usual ratio of 3% to 6%
- Fuel is reach to the various parts of Engine, Lubricate and vapourise in form of mist goes deep into the bearing surfaces and lubricates them.

Advantages

1. Lubrication system is simple.
2. It has low cost it does not require oil pump and oil filter.

2. Wet sump lubrication



In a wet sump lubrication system, the sump is attached to the bottom of crank case. The strainer, oil pump and oil are housed in sump from which the lubricating oil is pump to the various Engine components.

After lubrication, the oil back to the sump by gravity where it is picked by pump and recirculated through engine lubrication system.

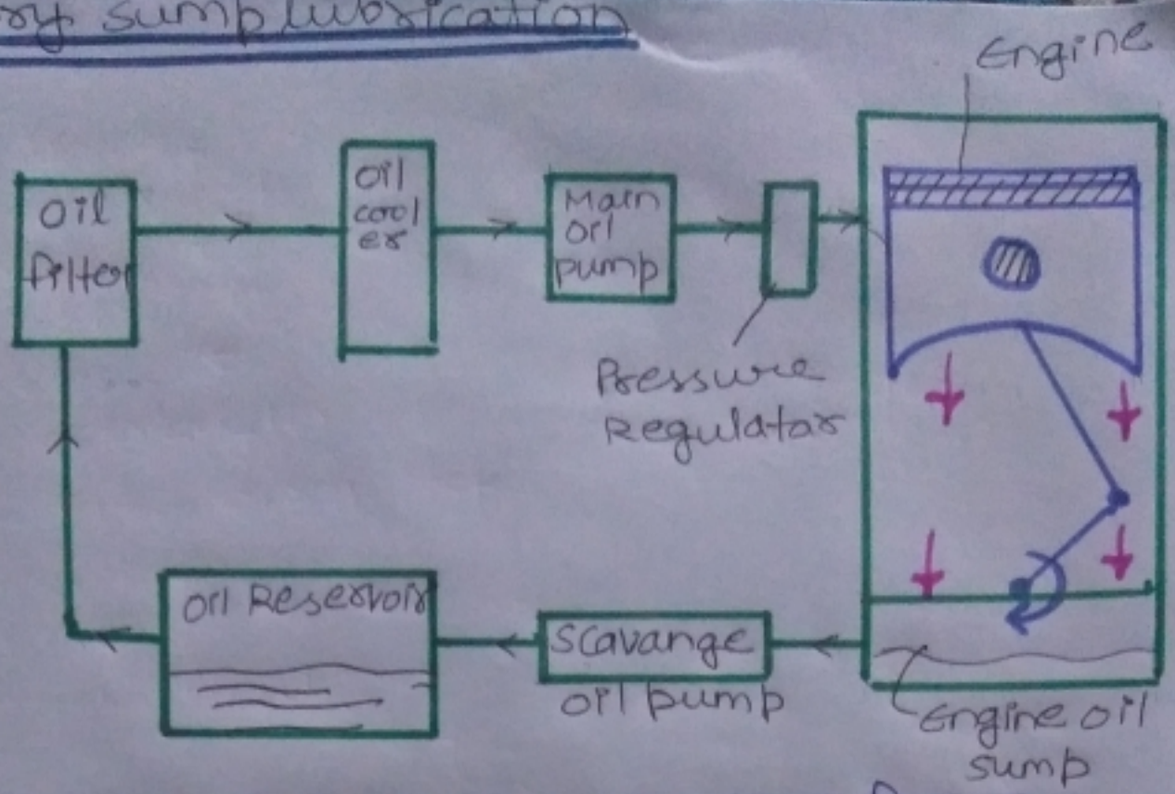
Lubrication is classified in three ways

1. Splash Lubrication system
2. Splash and pressure lubrication
3. fully pressure lubrication system.

Splash lubrication system

The system in which the lubricating oil is splashed by centrifugal force over different moving parts of Engine, called splash lubrication system.

3. Dry sump lubrication



It is best lubrication system for I.C Engines, It is used in sport Racing cars and Aircrafts.

It consist of oil sump, scavenge oil pump, oil filter, oil Reservoir, oil filter, oil cooler, Main oil pump, Pressure Regulator

- In this system, the engine oil sump will be almost dry as the scavenge oil pump will abstract oil to fill the Reservoir of oil.

Working –

Oil Reservoir → Oil filter → Oil Cooler → Main oil pump → Pressure Regulator → Engine parts (cam shaft, crankshaft) etc