

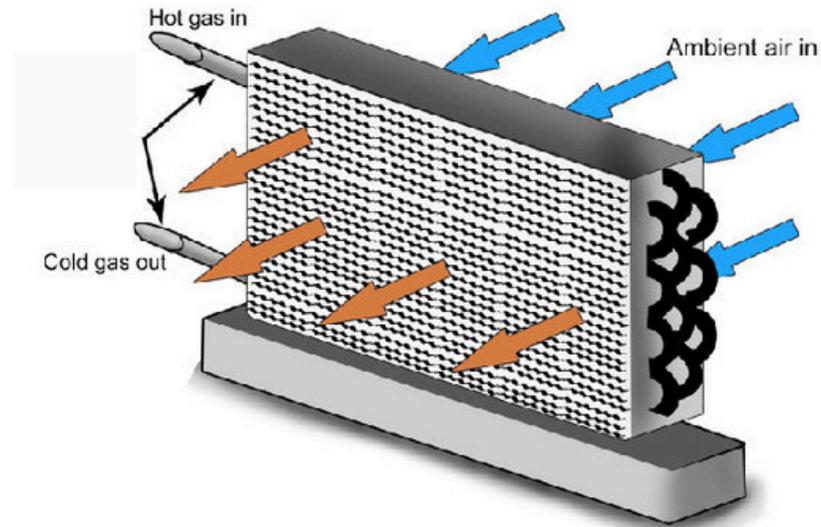
COOLING SYSTEM IN VEHICLES

- In case of Internal Combustion engines, combustion of air and fuel takes place inside the engine cylinder and hot gases are generated. The temperature of gases will be around 2300 -2500 C. This is a moving parts and may result into 150 -200 C at which the since it reduces the thermal its most efficient operating engine cylinder and hot gases are generated. The temperature of gases will be around 2300 may result into burning of oil film between the moving parts and So, this temperature must be reduced to about 150 efficiently.
- Too much cooling is also not desirable since cooling system is to keep the engine running at its engine cylinder and hot gases are generated. The temperature of gases will be around 2300 very high temperature and may result into burning of seizing or welding of the same. So, engine will work most efficiently. efficiency. So, the object of cooling temperature.

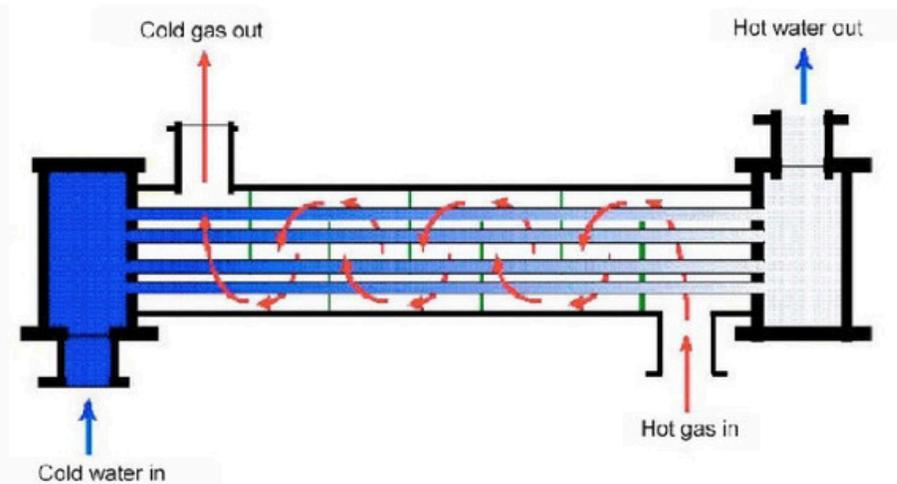
- It is to be noted that the engine is quite inefficient when it is cold and hence the cooling such a way that it prevents cooling when the engine is operating temperature, then it starts cooling system is designed in such a way that it prevents cooling when the engine is warming up and till it attains to maximum efficient starts cooling. warming up and till it attains to maximum efficient
- It is also to be noted that: About 20-25% of total power (useful work). total heat generated is used for
- Cooling system is designed to remove 30-35% of total heat.
- Remaining heat is lost in friction and carried away by exhaust gases.

There are mainly two types of types of cooling systems :

- Air cooled system, and
- Water cooledsystem.



Air cooled type condenser



Water cooled type condenser

AIR COOLED SYSTEM

Air Cooled system is generally used in small engines say up to 15–20 kW and in aeriplane engines. In this systems fins or extended surfaces are provided on the cylinder walls, cylinder head, etc. Heat generated due to combustion in the engine cylinder will be conducted to the fins and when the air flows over the fins, heat will be dissipated to air.

The amount of heat dissipated to air depends upon :

- Amount of air flowing through the fins.
- Fin surface area.
- Thermal conductivity of metal used for fins.

Advantages of Air Cooled System

Following are the advantages of air cooled system :

- Radiator/pump is absent hence the system is light.
- In case of water cooling system there are leakages, but in this case there are no leakages.
- Coolant and antifreeze solutions are not required.
- This system can be used in cold climates, where if water is used it may freeze.

Disadvantages of Air Cooled System

- Comparatively it is less efficient.
- It is used in aero planes and motorcycle engines where the engines are exposed to air directly.

WATER COOLING SYSTEM

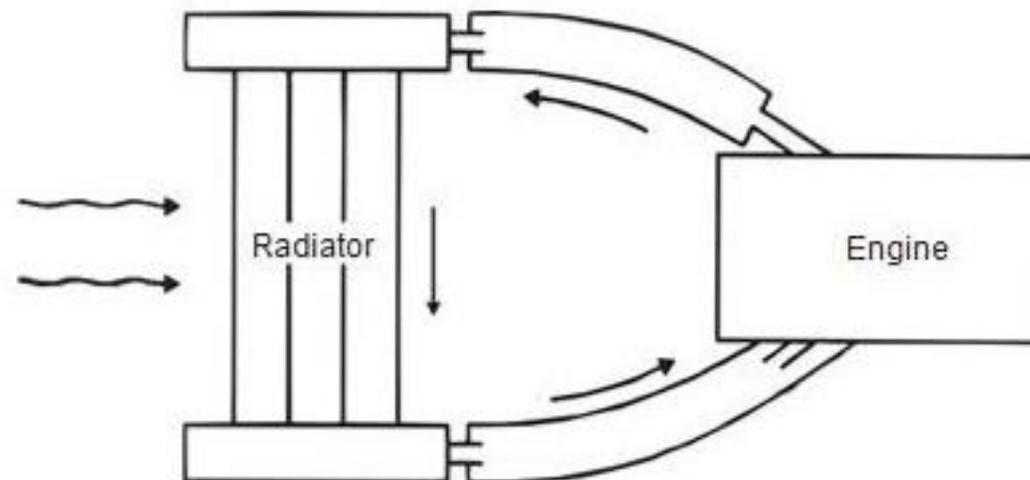
In this method, cooling water jackets are provided around the cylinder, cylinder head, valve seats etc. The water when circulated through the jackets, it absorbs heat of combustion. This hot water will then be cooling in the radiator partially by a fan and partially by the flow developed by the forward motion of the vehicle. The cooled water is again recirculated through the water jackets

Types of Water Cooling System

- Thermo Siphon System
- Pump Circulation System

Thermo Siphon System

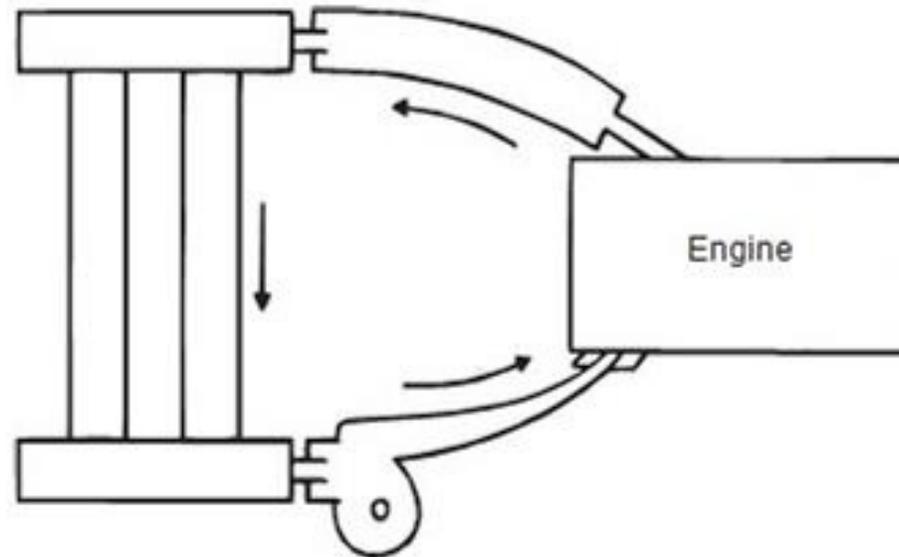
In this system the circulation of water is due to difference in temperature (i.e. difference in densities) of water. So in this system pump is not required but water is circulated because of density difference only.



Thermo Siphon System of Cooling

Pump Circulation System

In this system circulation of water is obtained by a pump. This pump is driven by means of engine output shaft through V-belts.



Pump Circulation System

Components of Water Cooling System

- Radiator,
- Thermostat valve,
- Water pump,
- Fan,
- Water Jackets
- Antifreeze mixtures.

RADIATOR

It mainly consists of an upper tank and lower tank and between them is a core. The upper tank is connected to the water outlets from the engines jackets by a hose pipe and the lower tank is connect to the jacket inlet through water pump by means of hose pipes.

There are 2-types of cores :

- Tubular
- Cellular

WATER PUMP

It is used to pump the circulating water. Impeller type pump will be mounted at the front end.

Pump consists of an impeller mounted on a shaft and enclosed in the pump casing. The pump casing has inlet and outlet openings.

The pump is driven by means of engine output shaft only through belts. When it is driven water will be pumped.

FAN

It is driven by the engine output shaft through same belt that drives the pump. It is provided behind the radiator and it blows air over the radiator for cooling purpose.

WATER JACKETS

Cooling water jackets are provided around the cylinder, cylinder head, valve seats and any hot parts which are to be cooled.

Heat generated in the engine cylinder, conducted through the cylinder walls to the jackets. The water flowing through the jackets absorbs this heat and gets hot.. This hot water will then be cooled in the the radiator.

ANTIFREEZE MIXTURE

In western countries if the water used in the radiator freezes because of cold climates, then ice formed has more volume and produces cracks in the cylinder blocks, pipes, and radiator. So, to prevent freezing antifreeze mixtures or solutions are added in the cooling water.

The ideal antifreeze solutions should have the following properties :

- It should dissolve in water easily.
- It should not evaporate.
- It should not deposit any foreign matter in cooling system.
- It should not have any harmful effect on any part of cooling system.
- It should be cheap and easily available.
- It should not corrode the system.

No single antifreeze satisfies all the requirements. Normally following are used as antifreeze solutions

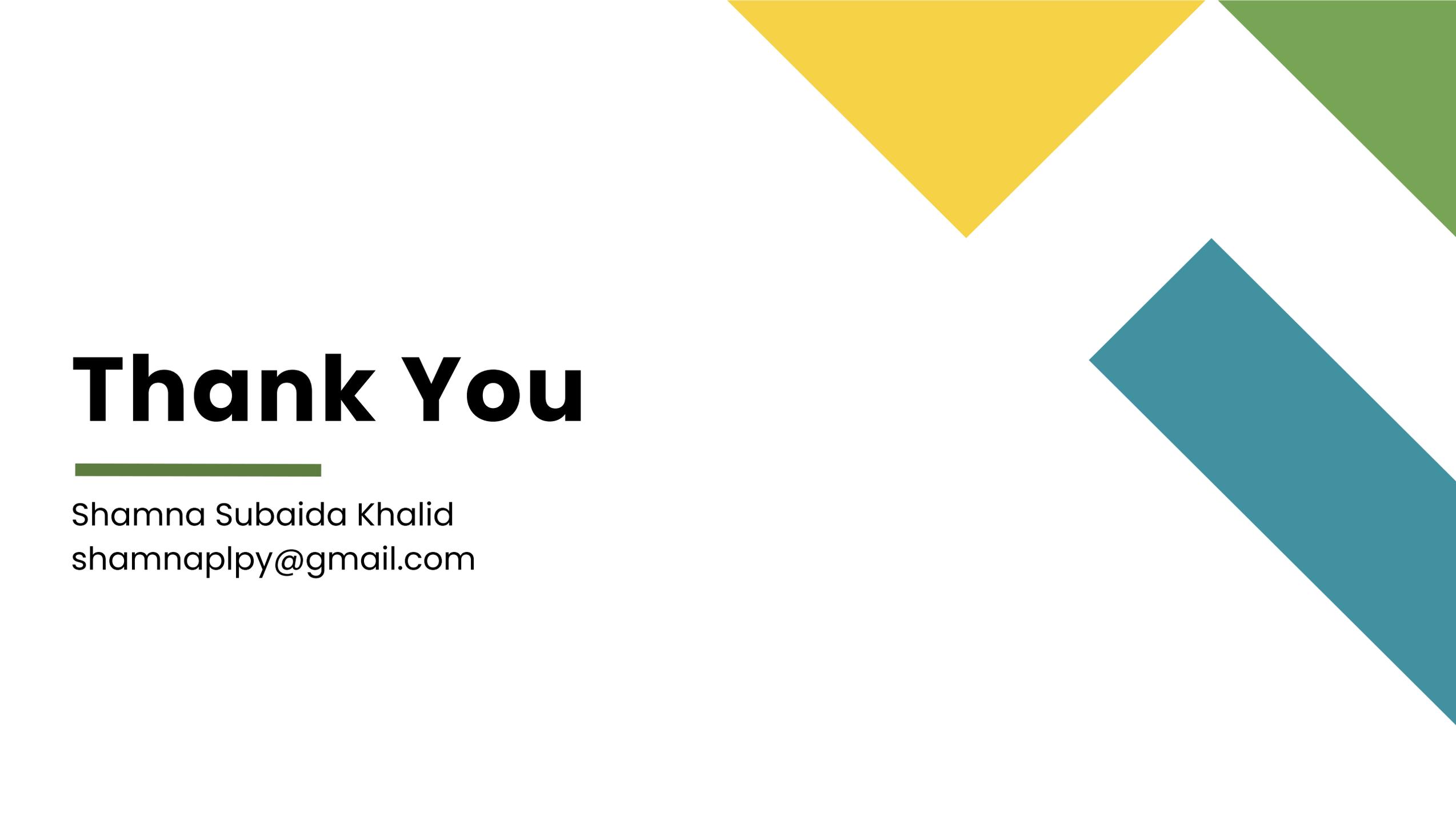
- Methyl, ethyl and isopropyl alcohols.
- A solution of alcohol and water.
- Ethylene Glycol.
- A solution of water and Ethylene Glycol.
- Glycerin along with water, etc

ADVANTAGES

- Uniform cooling of cylinder, cylinder head and valves.
- Specific fuel consumption of engine improves by using water cooling system.
- If we employ water cooling system, then engine need not be provided at the front end of moving vehicle.
- Engine is less noisy as compared with air cooled engines, as it has water for damping noise.

DISADVANTAGES

- It depends upon the supply of water.
- The water pump which circulates water absorbs considerable power.
- If the water cooling system fails then it will result in severe damage of engine.
- The water cooling system is costlier as it has more number of parts. Also it requires more maintenance and care for its parts.



Thank You

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