

AUTO ENGINE-1

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- 1. Identify different parts of cooling system.*
- 2. They came to know the working of cooling system.*
- 3. Describe the working of internal combustion engine*
- 4. Determine various properties of coolant*
- 5. Explain the working of Four stroke engine .*
- 6. Explain the working of Two stroke engine.*

1. Purpose of Cooling system

- To regulate the engine internal temperature
- To remove excess heat from engine
- To provide heat to the passenger compartment
- During the combustion of air fuel mixture the temperature as high as 2500 degreeC may be reached by burning gases.

- The temperature is so high as it will break the lubrication system.
- This temperature must be reduced by some means to such a value, about 200°C to 250°C
- The purpose of cooling system is to reduce the temperature of engine

2 Types of cooling system

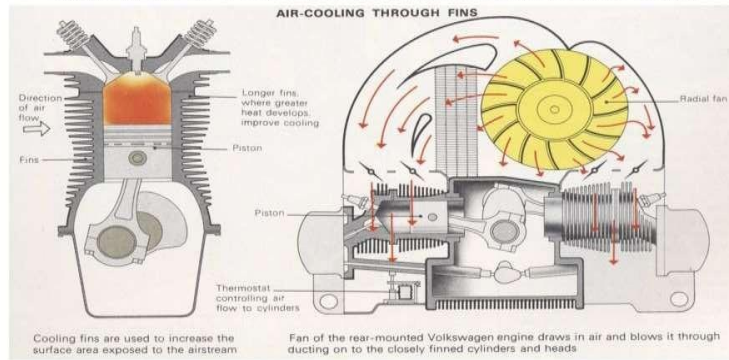
- Air cooling system
- Water cooling system

2.1 Air cooling

- Air cooling system is the simplest method of cooling engines.
- The engine being cooled will have a flow of air moving over its surface.
- Many motorcycles use air cooling for the sake of reducing weight and complexity.
- Surface area of metal in contact with air.
- Rate of air flow.
- Temperature difference between the heated surface and the air.

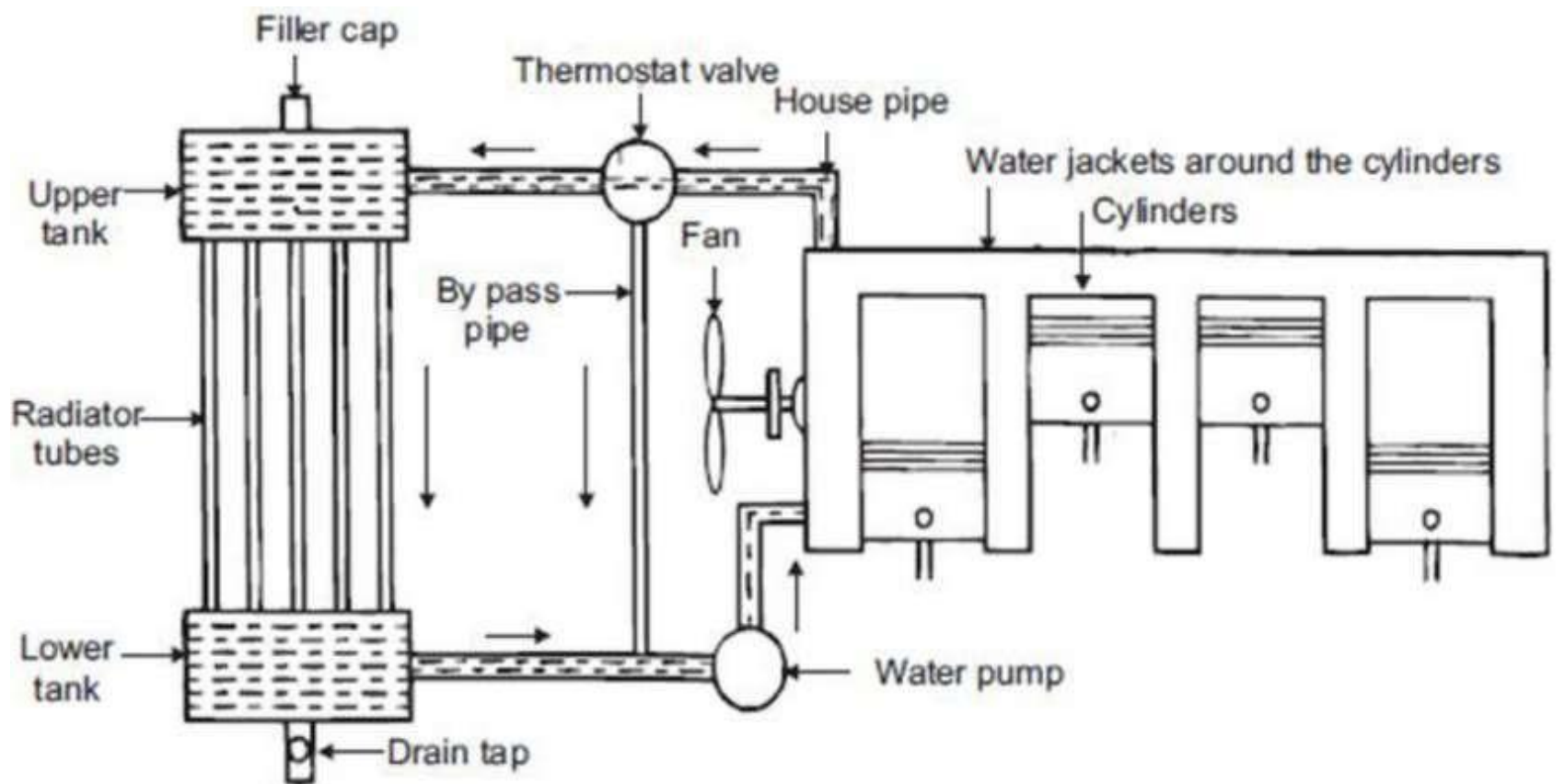
The Air Cooling System

- Advantages-system is simpler and lighter in weight (less parts), no coolant leaks, works in all climates.
- Disadvantages-Greater engine noise due to no water jackets, not suitable for in-line engines due to heat build up, cooling fan absorbs or uses a significant amount of engine power, car interior heating difficult to arrange



2.2 Water cooling system

- Water cooling is commonly used for
- .
- Water cooling is method heat removal from components.
- In this method of cooling water is circulated through water jacket around each of the combustion chamber.
- The circulating water when passes through the engine.



2.3 Major components of water

cooling system

- Radiators
- Thermostat
- Water pump
- Fan
- Pressure cap
- Water jackets
- Antifreeze solutions

2.4 Difference between air cooling

system and water cooling

Air cooling

- Air cooling is cheap in price.
- Air cooling reducesthe
- weight of vehicle.
- Air coolingg isoften with forced cooling type to cool down the engine.

Water cooling

- Water cooling system ismore expensive as compared to air cooling system
- Water cooling system is havier and increasesthe weight of vehicle
- With water cooling theliquid is pumped around the engine.

3 I.C ENGINE

An **engine** or **motor** is a machine designed to convert one form of energy into mechanical energy.^{[1][2]} Heat engines burn a fuel to create heat which is then used to do work. Internal combustion engines are heat engines that burn fuel in a combustion chamber to extract work from the pressure of expanding gases. Electric motors convert electrical energy into mechanical motion; pneumatic motors use compressed air; and clockwork motors in wind-up toys use elastic energy. In biological systems, molecular motors, like myosins in muscles, use chemical energy to create forces and eventually motion.

3. Automotive Engines are generally classified according to following different categories:

Internal combustion (IC) and External Combustion (EC)

Type of fuel: Petrol, Diesel, Gas, Bio / Alternative Fuels

Number of strokes – Two stroke Petrol, Two-Stroke Diesel, Four Stroke Petrol / Four Stroke Diesel

Type of ignition such as Spark Ignition, Compression Ignition

Number of Cylinders – From 1 to upto 18 cylinders (in a car)

Arrangement of cylinders which are Inline, V, W, Horizontal, Radial

Motion of Pistons which are Reciprocatory, Rotary

Size / Capacity

Bore-to-Stroke Ratio

Engine cooling methods such as Air-cooled, Liquid-cooled (Water based), Oil-cooled (Oil is cooled separately)

Breathing such as Naturally Aspirated, Turbocharged /

Supercharged

Applications such as Bikes, Passenger Cars, Racing cars,

Commercial Vehicles, Marine, Agricultural equipment and Earth-moving equipment etc.

3.1 FOUR STROKE ENGINE

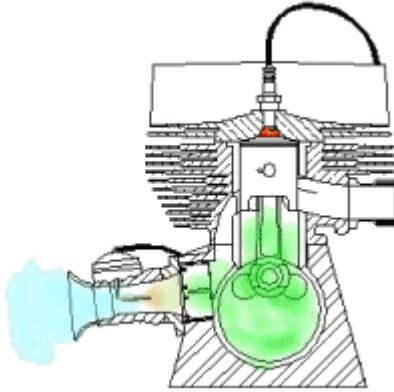
A **four-stroke** (also **four-cycle**) **engine** is an internal combustion (IC) engine in which the piston completes four separate strokes while turning the crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

Intake: Also known as induction or suction. This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion. The piston is moving down as air is being sucked in by the downward motion against the piston.

Compression: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.

Combustion: Also known as power or ignition. This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.

Exhaust: Also known as outlet. During the *exhaust* stroke, the piston, once again, returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.



3.2 TWO STROKE ENGINE

A **two-stroke** (or **two-cycle**) **engine** is a type of internal combustion engine which completes a power cycle with two strokes (up and down movements) of the piston during only one crankshaft revolution. This is in contrast to a "four-stroke engine", which requires four strokes of the piston to complete a power cycle during two crankshaft revolutions. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously, with the intake and exhaust (or scavenging) functions occurring at the same time.

Two-stroke engines often have a high power-to-weight ratio, power being available in a narrow range of rotational speeds called the "power band". Compared to four-stroke engines, two-stroke engines have a greatly reduced number of moving parts, and so can be more compact and significantly lighter.

Short Answer type Questions

1. What is the function of cooling system.
2. Write down the construction and working of water cooling system.
3. Explain thermo syphon cooling system.
4. Explain air cooling system

Long Answer type Questions

1. Explain the construction and working of Four stroke Engine
2. Explain the construction and working of Two stroke Engine.
3. Write down the properties of coolant.