



SNS COLLEGE OF TECHNOLOGY

**An Autonomous Institution
Coimbatore – 35**

Accredited by NBA – AICTE and Accredited by NACC – UGC with 'A++' Grade
Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai.

DEPARTMENT OF AGRICULTURAL ENGINEERING

19AGB301 – FARM TRACTORS

II – YEAR IV SEMESTER

UNIT 2 – TRACTOR ENGINE SYSTEMS

TOPIC 2 – ENGINE COOLING SYSTEM



Need of cooling system?

- Engine is the device which converts heat energy generated from the combustion of fuel into useful mechanical work.
- Around 25% of whole heat energy generated from the fuel is utilized for generating the desired output.
- The rest of heat is either released in the form of exhaust gases or is absorbed by the engine itself.
- This absorbed heat by the engine is required to be dissipated through engine cooling system otherwise engine will become overheated and result in burning of lubricant which further causes the engine seizure and damage to the engine components.





Engine efficiency!



- ❖ Keeping in view the essential requirement of maintaining optimum operating temperature of the engine a suitable cooling system is required.
- ❖ However, the cooling beyond the desired limit, results into decrease in the engine efficiency because of the following reasons.
- ❖ (i) Decrease in the thermal efficiency due to loss of heat
- ❖ (ii) Decrease in the combustion efficiency due to less vaporization of the fuel
- ❖ (iii) Decrease in mechanical efficiency due to increase in piston friction as the viscosity of lubricant increases with low temperature



Optimum temperature:



- ❖ The overheating of an engine is considered to be as serious and undesirable as over cooling.
- ❖ So, it is desired that the temperature of cooling system is to be maintained in the optimum operating temperature range (71° to 82°C for petrol engines and 88° to 90°C in diesel engines) to do the following ;
- ❖ Maintain optimum lubrication between the moving components of an engine
- ❖ Minimise the loss of power due to detonation
- ❖ Avoids burning of oil with fuel



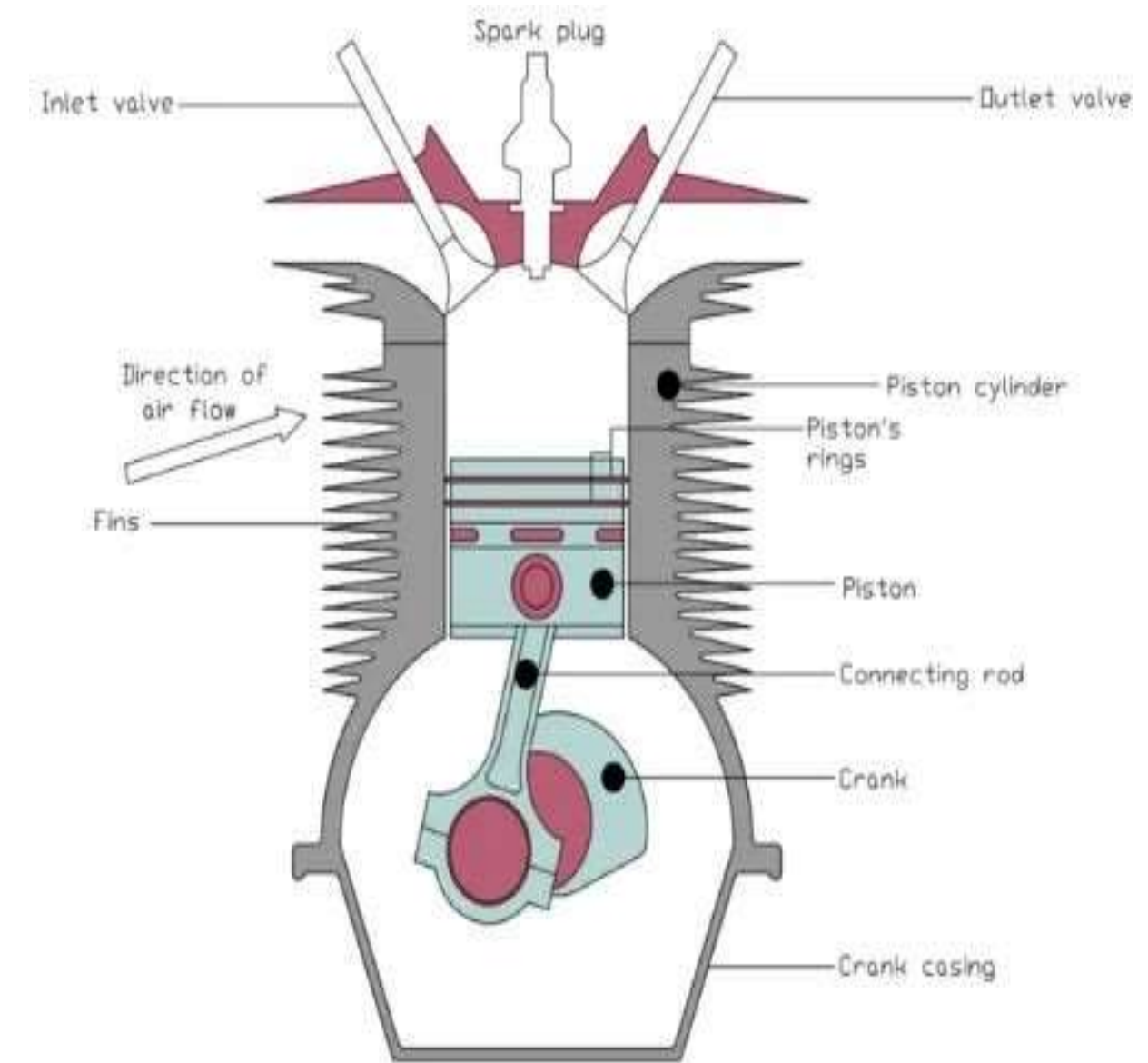
Types of cooling systems

- ❖ Generally there are two types of cooling systems used in an engine;
- ❖ Air cooling system
- ❖ Water cooling system.



Air cooling system:

- An air blower or fan is used in the tractors having air cooled engines to circulate the air for dissipating the heat from the engine surface, cylinder in particular.
- Special baffles/fins are used to direct the air to reach the desired heated component and to avoid any hot spot.
- Size and spacing of the fins depend upon the amount to be removed, temperature of air, speed of air, material of fins and spacing between the fins and cylinder size.
- Generally, large number of short fins are considered to be better than small number of large fins.



AIR COOLED ENGINE COOLING SYSTEM



Advantage and disadvantage

Advantages of Air Cooled System

Following are some advantages of using Air Cooling System:

- Light in weight
- No antifreeze is required
- This system can be used where water scarcity is there
- Simple in design
- Require less space



Disadvantages of Air Cooled System

Following are some disadvantages of using Air Cooling System:

- More noise in operation.
- The coefficient of heat transfer of air is less, hence less efficient in working.





Water cooling system

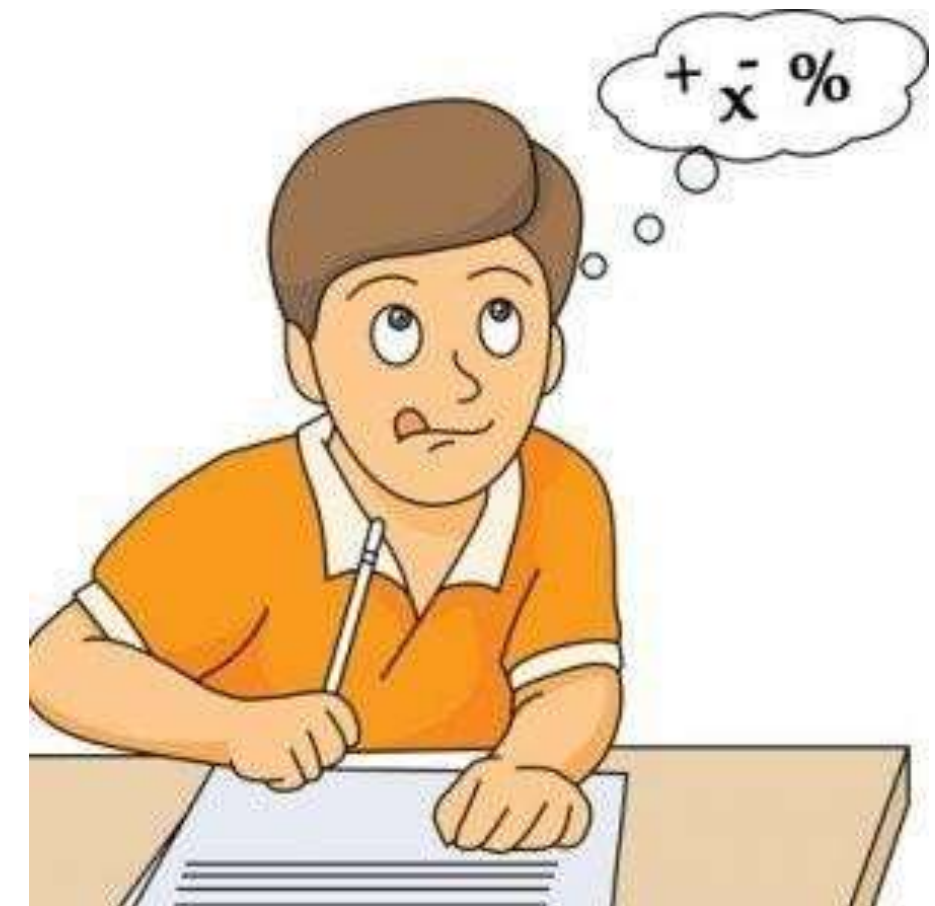
- ❖ In water cooling system, water jackets are provided around the engine cylinder or liners.
- ❖ The circulating water in these jackets absorb the heat from the cylinder surface and then heated water is cooled by the air passing in the radiator.
- ❖ The water cooling system consists of water jackets, water pump, radiator, thermostat valve, fan, belt and pulley etc



Assessment



- **Why Engine cooling system is needed?**
- **What is Engine?**



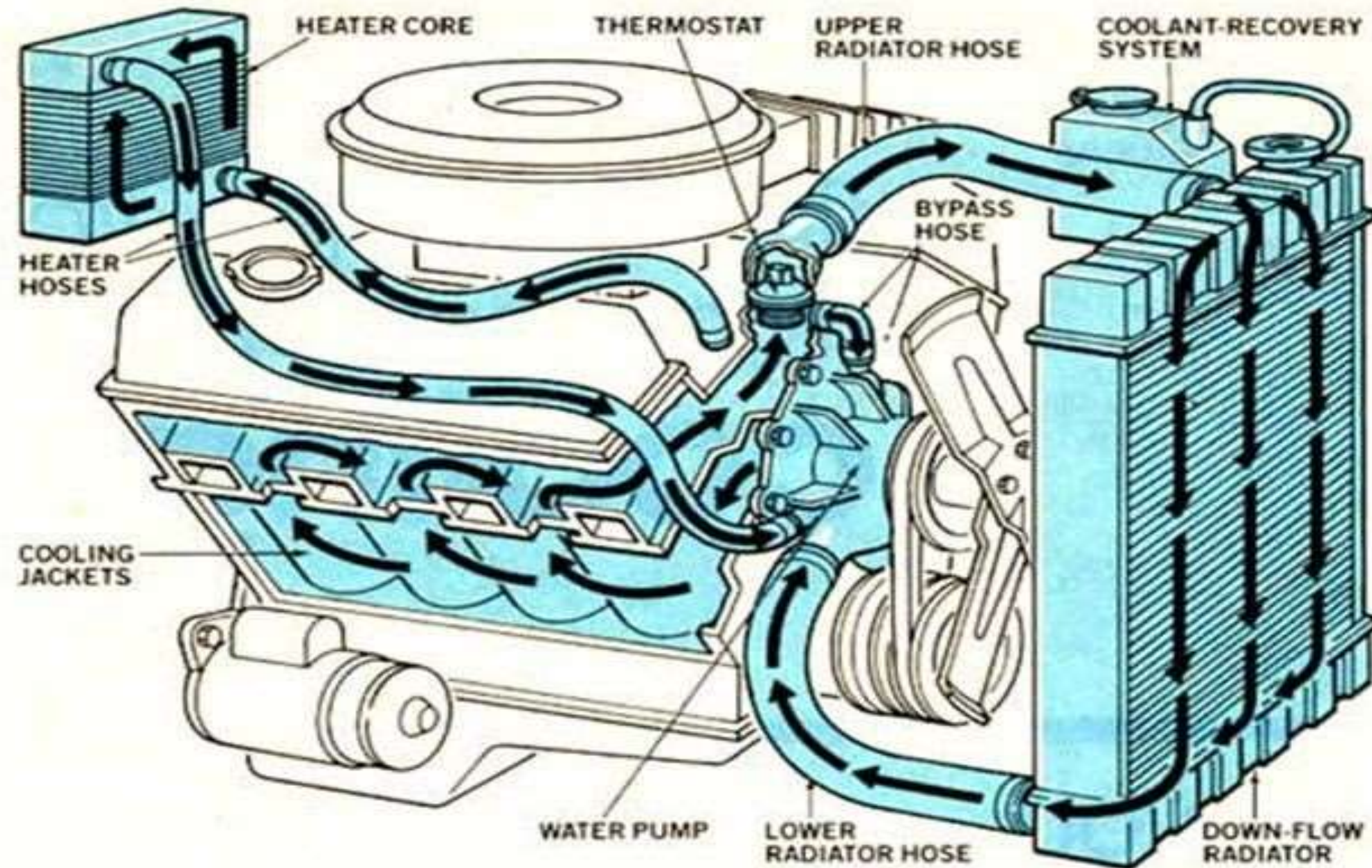


Parts of Water Cooled Engine Cooling System

- ❖ Parts of the Water Cooled Engine Cooling System
- ❖ Following are some main parts of a water cooling system:
 - ❖ Radiator
 - ❖ Water Pump
 - ❖ Fan
 - ❖ Water Jackets around the Cylinders
 - ❖ Hose Pipe
 - ❖ Thermostat Valve



Water cooling engine diagram:





Working

- ❖ The water is made to circulate in the water jackets continuously with desired pressure and speed with the help of water pump driven by belt.
- ❖ The pump inlet is connected with radiator at bottom to draw the coolant/water from the radiator.
- ❖ When the engine is cooled, the thermostat valve remains close and same water/coolant is being circulated through the water jackets.
- ❖ By the time, water/coolant gets heated, the thermostat valve is opened to make water pass through the radiator to dissipate heat by coming intact with the air passing through the radiator.
- ❖ The radiator is located in the front of tractor/vehicle and it consists of water/coolant tank, tubes and pressure cap on the tube.
- ❖ <https://www.youtube.com/watch?v=sRHDsEyEQ2M>



Advantages and disadvantages

Advantages of Water Cooled System

Following are some advantages of Water Cooling System:

This type of cooling system is used where the size or power of the engine is more.

Thermal Conductivity is more

Water is easily available

Liquid has a high enthalpy of vaporization so that the efficiency of water cooling is more.

Disadvantages of Water Cooled System

The disadvantages of Water Cooling System are mentioned below:

Some time corrosion takes place inside the radiator pipe or storage.

Due to scaling, heat transfer rate goes down after the long run, because of which it needs regular cleaning and maintenance.



s.no	Air cooling system	Water cooling system
1	In this system cooling medium used is Air	In this system cooling medium used is Water
2	The engine design is simple	The engine design is complex
3	The air cooled engine is less sensitive to climate condition.	Engine performance becomes more sensitive to climate conditions
4	Air cooling system has no maintenance	It requires maintenance. slight leakage of radiator may result in engine breakdown
6	Size of engine is small and weight is less as there is no water jacket, radiator and water pump	Size and weight of engine is increased to use of radiator and water pump
7	Air cooled engine must be installed in front side of the vehicle	Water cooled engine can be installed anywhere on the vehicle
8	Volumetric efficiency is lower due to high cylinder head temperature	Volumetric efficiency is greater than air cooled engine.
9	Examples: Bikes, Scooters etc.	Examples: Cars, Buses, Trucks etc.



ACTIVITY



- DRAW THE ENGINE COOLING SYSTEM (BOTH) IN A NEAT A4 SHEET (ONE SHEET ONE DIAGRAM)
- WITH THEIR COMPONENTS USING COLOURS (STRICTLY NO PENCIL)
- SUBMISSION- NEXT CLASS



See You at Next Class!!!!