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MECHANOTECHNOLOGY N3

MALUTI TVET COLLEGE

LECTURER : MT MPHAGO



ITEMOHELENG CAMPUS



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MODULE 11

LUBRICATION AND COOLING

LO : Understand and describe the need for lubrication, need and purpose of oil filtering, cooling system and its advantages and disadvantages.





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INTRODUCTION

- Lubrication is used to obtain maximum life and endurance from a machine by reducing the friction between the moving parts and other parts.
- It helps the working parts to move more freely with smoother action and less wear damage.
- It creates protective layer of anti-friction material between the surfaces.



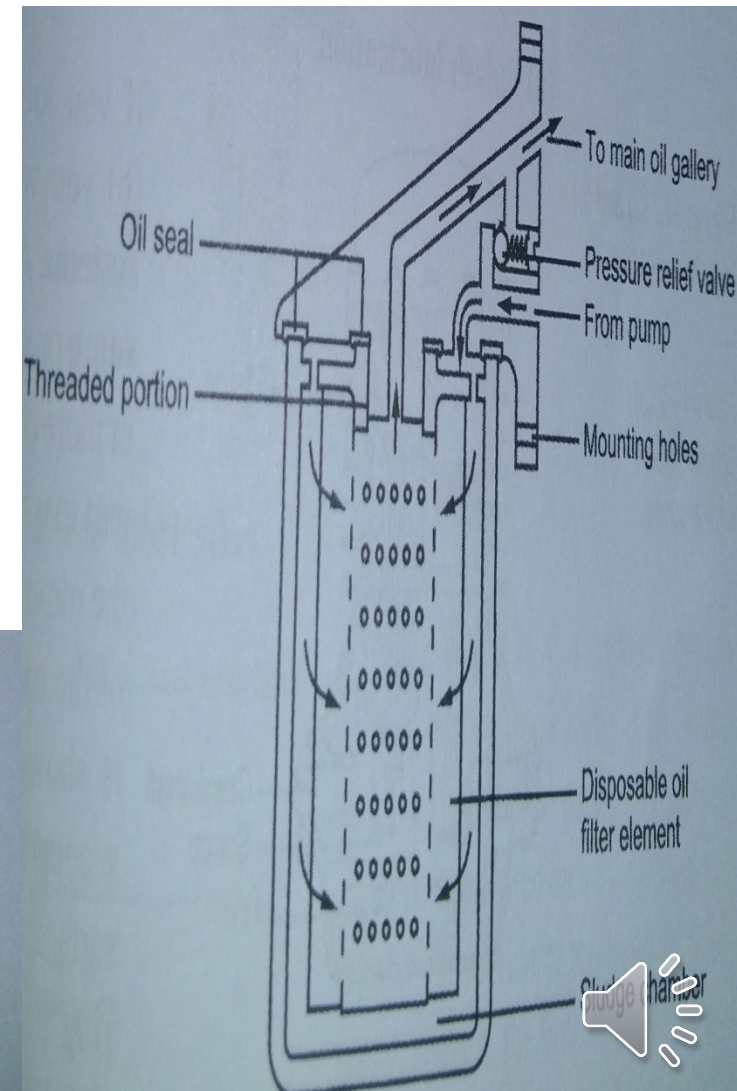
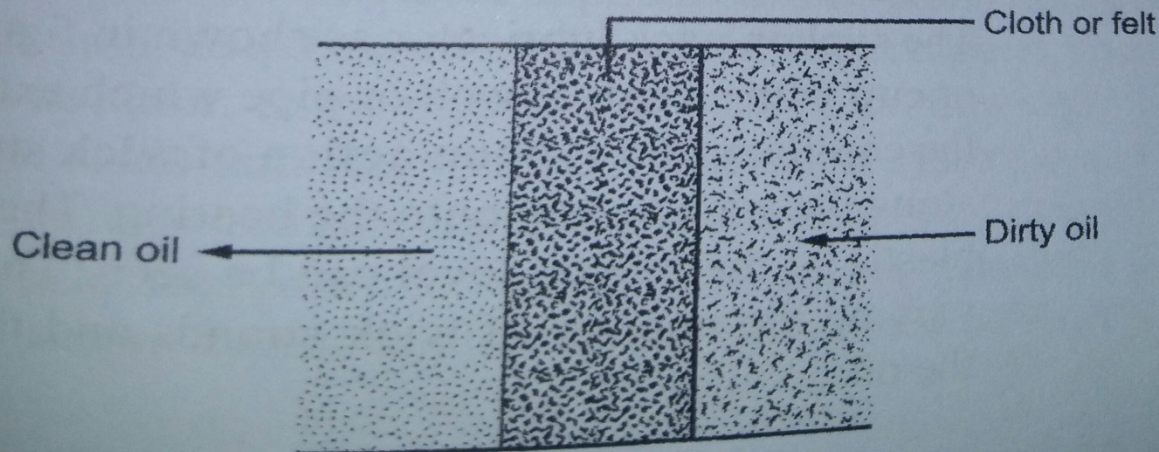
LUBRICATION OF BEARING, GEAR BOXES, COMPRESSORS AND COMBUSTION ENGINES

BEARINGS	GEARBOXES	COMPRESSORS	ENGINES
Lubricating rolling and sliding contacts.	Remove heat.	Prevent wear and atmospheric contaminants to reach the bearings	Prevent welding and seizure.
Provide cooling and control the temperature.	Lubricate the moving parts.	Seal close clearances.	Reduce power loss by reducing friction.
Prevent rusting , scuffing and wear.	Absorb vibration and shock.	Protects against corrosion.	Maintain internal cleanness and assist as a sealant.
Serve as seal against moisture and dirt.	Prevent rusting and contact on metal on metal.		Absorb shock between moving parts and reduce noise.
			Resist and reduce oxidation and rust.



OIL FILTERING

- Contaminated oil lose the required properties.
- Oil can be contaminated by thing like dust and carbon from the combustion chamber.
- Oil filters removes solid contaminants from the oil but can not remove the liquid contaminants and it is for the reason that we must change oil filters and oil at regular intervals.
- The drawing on the right shows oil filter element made of pleated paper or form of cloth. The function of the element or cloth is to trap as many of the contaminants as possible. The oil seal prevents leakage of oil and dirt into the filter.
- With modern filters the oil is filtered before passing to the engine.



LUBRICATION METHODS

Dry sump lubrication

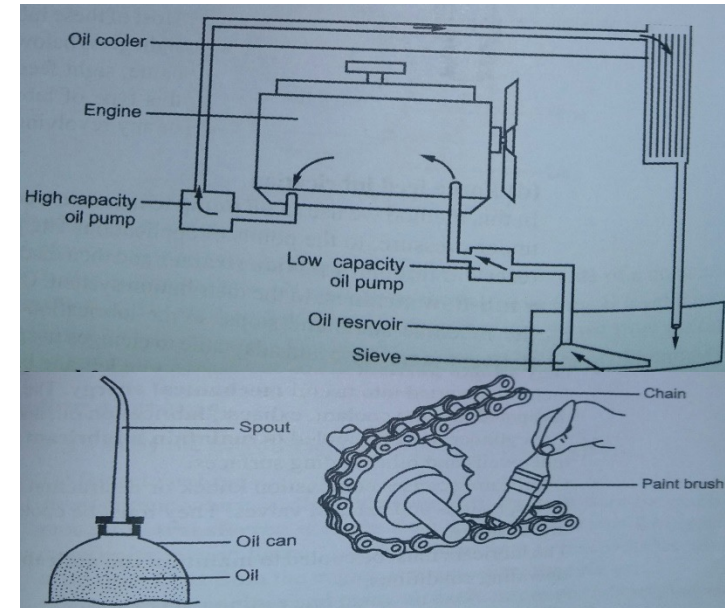
- Is mostly used for cooling oil in large engines.
- It consists of a separate oil reservoir with a sieve and low capacity oil supply pump.
- A high capacity oil pump is connected between the engine and the oil cooler which is in turn connected to the oil reservoir.
- It is an efficient lubrication system.

Manual feed lubrication.

- In this method the operator is responsible for quantities of lubricants to be applied by using oil cans directly on open gears, chains and wire ropes.

Lubrication by mixing oil and petrol.

- This method is used in two stroke engines.
- The working fluid consists of a mixture of air, petrol and lubricating oil. This is called “all loss” lubrication system because no oil circulating equipment is necessary.
- Too much oil will cause smoke and ring sticking.
- Too little oil will cause piston seizure, deposit on piston skirts, wear and rusting.



LUBRICATION METHODS

Splash lubrication

- Consists of a sump or reservoir through which one or more moving parts runs.
- This part/s may be a scoop that is attached to the moving part like crankshaft for lubrication.
- Same principle may be used on gearboxes.

Syphon wick lubrication.

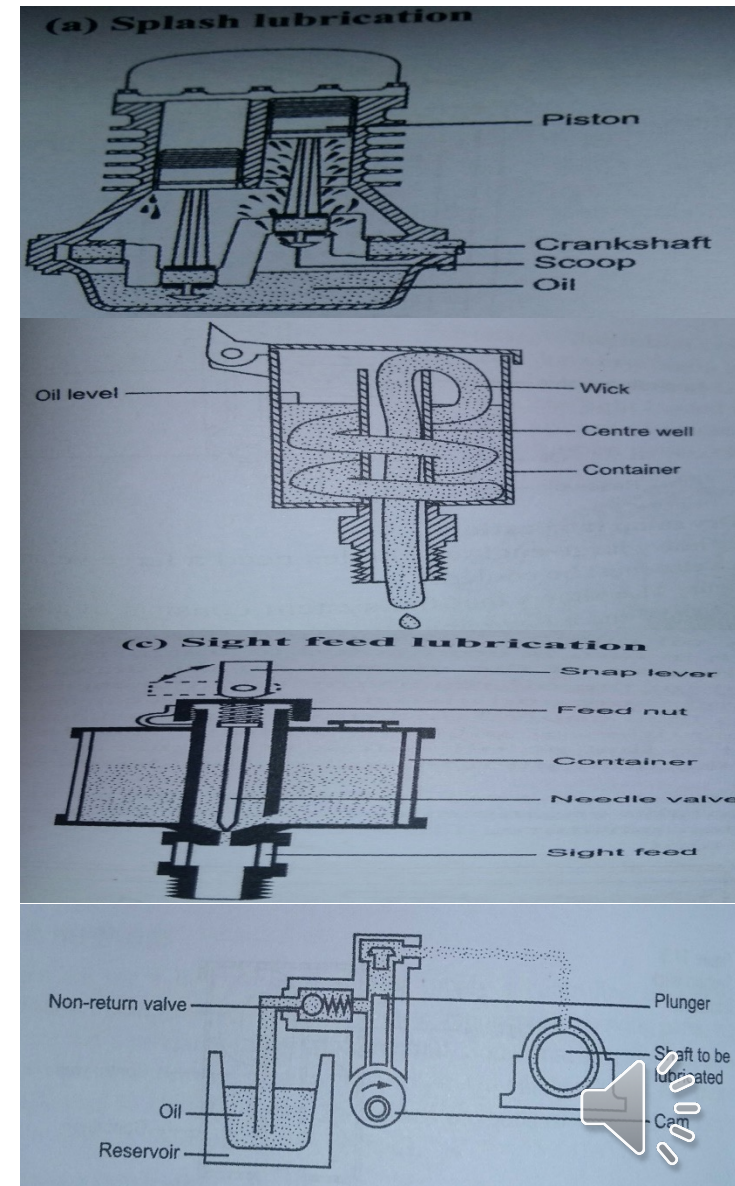
- Consists of a container or cup with a central well or pipe which extends above the oil level. It uses capillary and syphon action of wick strands to carry oil the cup along the wick to drip onto the bearings.
- The oil feed rate is controlled by varying the number of wick strands and the length of the wick immersed in the oil.

Sight feed lubrication/ Needle valve lubricator.

- It has a reservoir with a needle sitting in hole at the bottom of the reservoir.
- The oil supply is controlled by the position of the needle.
- They are fitted with the sight glass below the reservoir.

Force feed lubrication

- Use a pump to maintain a continuous delivery of oil under pressure.
- The pump draws oil from the reservoir through a suction strainer and discharge it through a full flow strainer to the distribution of application.



COOLING OF ENGINES, COMPRESSORS , ELECTRIC MOTORS AND WELDING MACHINES

Internal combustion engines need to be cooled because:

- High temperatures can melt components like pistons and valves.
- Small portion of total heat energy is converted into mechanical energy and the remainder is dissipated into the coolant, exhaust, lubrication oil and by radiation.
- Cylinders must be cooled to maintain a lubricant film on the cylinder walls.
- To prevent damages caused by overheating.

Compressors need to be cooled because:

- More air can be stored in the reservoir if it is cooled.
- When the temperature in the cylinder is reduced , lubrication is easier.
- There is less chance of explosion.
- It provides the correct viscosity for sealing.

Reasons why electric motors need cooling

- Viscosity is reduced at high temperatures which causes excessive heat and wear on running parts.
- It prevents the insulation material from crumbling.
- It prevent short circuiting in motors caused by overheating.

Welding Machines.

- Cooling prevents the insulation material from crumbling.
- High temperatures increases resistances and this results in poor power transmission.
- Short circuit may lead to shock.



AIR COOLING SYSTEMS

Direct cooling

- In an engine which is directly air cooled, the heat from the combustion process is transferred directly from the cylinder to the fins around the cylinder.
- Motorcycles engines and aircraft engines are directly air cooled.

Indirect cooling

- The heat is transferred from the engine to water which flows around it.
- The water is stored in a radiator where it in turn is cooled by air flow.

Advantages and disadvantages of direct cooling over indirect cooling

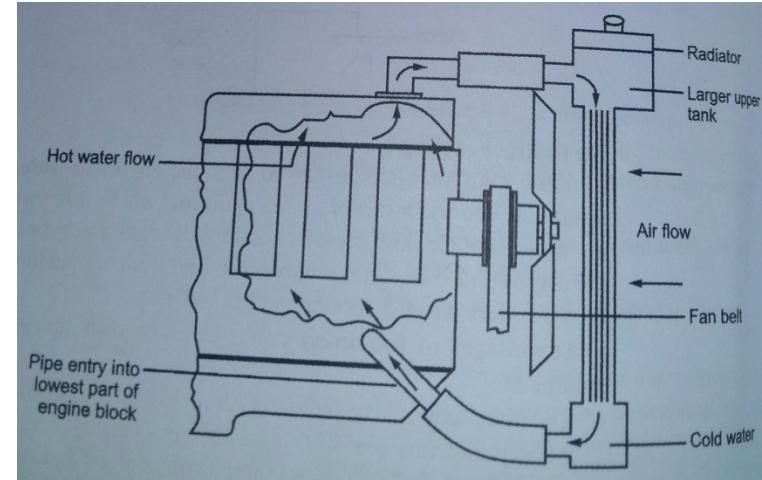
Advantages	Disadvantages
Saves on costs and mass because there is no water pump or radiator.	There is greater distortion of components because operating temperatures are higher.
There is no coolant that can boil or freeze.	Water jackets in this system absorb sound, reducing engine noise.
Engines using this system requires less servicing.	The fan fitted to blow air over the engine reduces engine power.



WATER COOLING SYSTEMS

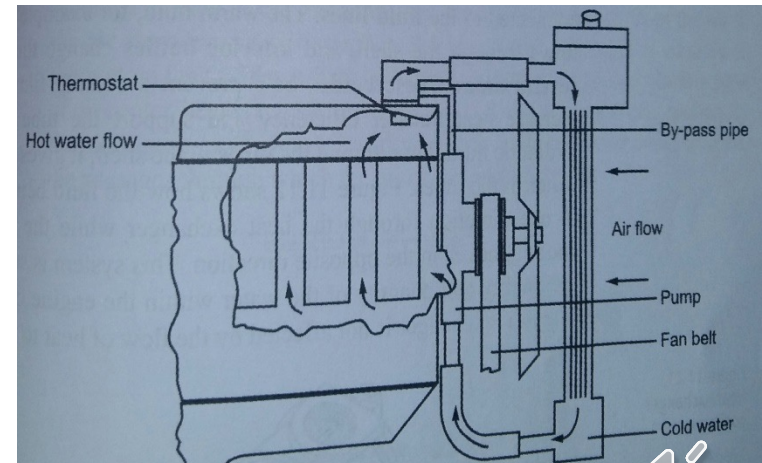
Thermosyphon cooling system

- This type of system uses the principle of convection.
- A larger radiator which extends from below the cylinder block to above the cylinder head is connected to the engine by means of flexible hoses. As the water in the engine block is heated, it becomes less dense and rises. It is replaced by cooler water from the bottom. The hot water rises to the highest point of the system which is the radiator upper tank. Circulation is established and the water cools as it flows down the tubes of the radiator.



Impeller assisted cooling system

- It is a thermosyphon system which uses a pump with an impeller which assists thermosyphon action.
- The pump circulates water and in the process accelerates the thermosyphon action. The farther the pump and the impeller the faster the thermosyphon action. When the engine is accelerated the water is drawn out of the bottom tank faster than it flows into the top tank. The water in the top tank drops to a lower level. Cooling water is actually pumped through the system.



ADVANTAGES & DISADVANTAGES OF IMPELLER ASSISTED OVER THERMOSYPHON COOLING SYSTEM

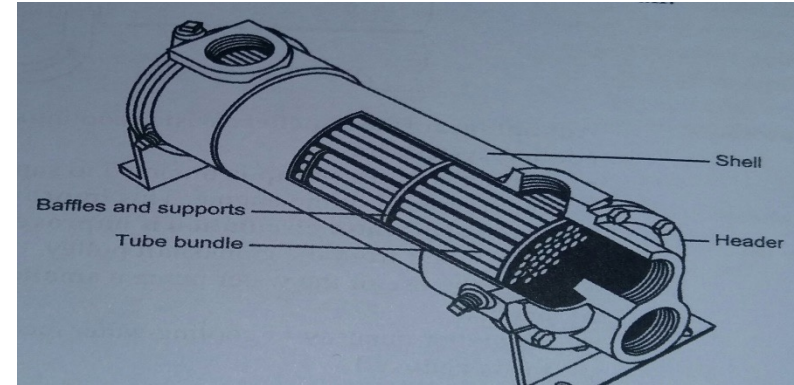
Advantages	Disadvantages
The water pump helps to improve water flow rate.	A larger volume of water is needed because of the slow circulation of water.
The impeller improves the rate of water circulation.	The radiator is very large and has to extend above the cylinder head.
With the use of the water pump a smaller volume of cooling water is needed.	The system can only function if it is completely filled with water.
A smaller quantity of cooling water means that the size of the radiator is reduced.	There is no circulation the water starts to boil in the water jackets.



HEAT EXCHANGERS AND OIL COOLERS

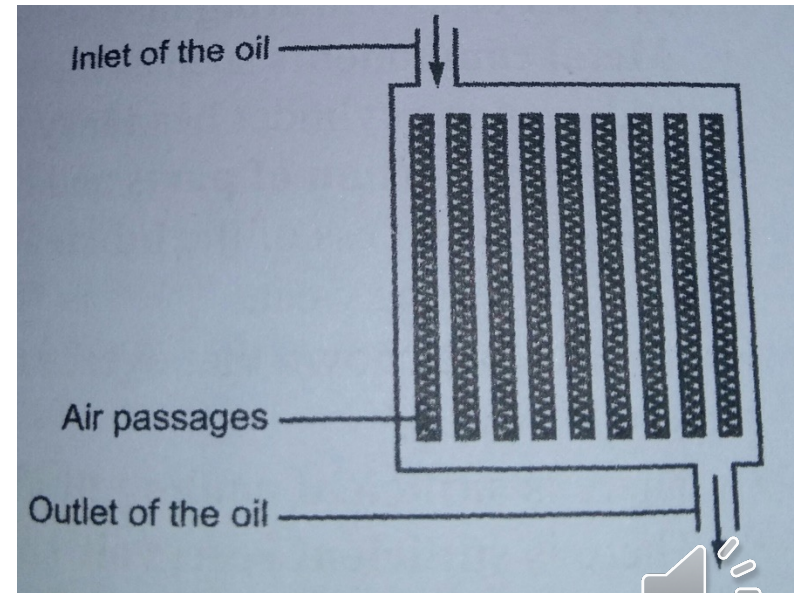
Heat exchangers

- It is the best cooling system for stationary engine installation where additional cooling is needed.
- It consists of a bundle of tubes or pipes in a closed shell.
- The cooling medium or fluid is water and is often called raw water.
- The water circulates through the tubes and the shell is connected the fluid lines.



Oil coolers

- Air cooled engines and some high performance water cooled engines use an oil cooler to prevent the lubricating oil from becoming too hot.
- The operation of oil cooling system is similar to that of a radiator of a water cooled engine.
- The difference is that it is designed to operate at much higher pressures.
- It is situated between the pump and main oil gallery or reservoir before or after the oil filter.
- Heat is transferred from the oil to the air stream passing through it.



OVERCOOLING AND OVERHEATING

Overcooling


- Results in condensation of the fuel and this washes the lubrication oil off the cylinder heads and this will cause wear.
- The condensation of fuel causes the engine not run at maximum power.
- Water enters the crankcase through the condensation of water vapour present in the air ventilating the crankcase.
- When the engine is switched off , the air cools down and any water vapour present will condense on the cool engine components and drain into the oil. This is called **dilution of oil**. It reduces the quality of oil.
- Overcooling causes excessive carbon build in the cylinder head and on the valves.

Overheating

- High temperature in engines will cause engine overheat if not controlled and excessive overheat may destroy the engine.



CAUSES AND RESULTS OF OVERHEATING, AND HOW TO PREVENT IT.

CAUSES OF OVERHEATING	RESULTS OF OVER HEATING	PRVEENTING OVERHEATING
When the fan unit is faulty.	Metal components like pistons and valves may melt down.	Make sure that there is sufficient cooling fluid in the system.
The cooling air is too hot.	Severe distortion of parts may components may occur.	There is sufficient reservoir surface area to radiate the heat properly.
In a direct air cooled system the engine may overheat when the vehicle is not moving.	The effectiveness of lubrication oil is reduced. This will increase engine wear.	The system has a free standing reservoir that permits the air circulation on all sides of the reservoir.
If there is a blockage in the passage of the cooling air or water.		There is a good baffle in the reservoir
If the engine is incorrectly tuned.		The system is located in a cooler area of the shop.
When the thermostat or thermostatic unit is inefficient or not working.		



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SUMMARY

- Introduction
- Lubrication of bearings , gearboxes, compressor and combustion engines.
- Oil filtering.
- Lubrication methods.
- Cooling of engines, compressors, electric motors and welding machines.
- Air cooling systems
- Water cooling systems
- Advantages and disadvantages of impeller assisted cooling system over thermosyphon cooling system.
- Heat exchanger and oil coolers.
- Overcooling and overheating.
- Causes and results, and how to prevent it.





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ASSESSMENT

On page 240 & 241 of the textbook supplied by the college. "Mechanotechnology N3 second edition." by *FM GOUWS*.

1, 4, 6, 9 & 10.

CONTACT ME ON WHATSUP FOR ANY QUESTIONS THAT YOU MAY HAVE.

*MY NUMBER IS **073 215 7689***

THANK YOU.

