

ON –LINE LECTURE

Course Code : FMPE-2.4.4

Course Title : Tractor and Automotive Engines

**Topic : Engine Lubrication system
*for***

B. Tech Students of CAET Godhra

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By

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➤ **Need of Engine lubrication**

- 1. To reduce the friction between the moving parts**
- 2. To reduce the power required by moving parts to overcome the friction**
- 3. To reduce the wear of engine components**
- 4. To reduce the heat generation due to friction between moving parts**
- 5. To absorb the heat generated and helps in engine cooling**
- 6. To act as seal between piston rings and cylinder walls/liners**
- 7. To clean the engine components by removing the dust or any other foreign material entering in the engine cylinder**

➤ **Functions of Engine oil**

- 1.It minimize friction and wear.**
- 2.It removes heat from the engine parts, thus acting as a cooling agent.**
- 3.It absorbs shock between the bearings and other engine parts, thus reducing noise and extending engine life.**
- 4.It forms good seal between the piston rings and cylinder walls.**
- 5.It acts as cleaning agent and carry away dirt, particles of carbon and other foreign matter to the sump.**

➤ **Properties of lubricants**

✓ For smooth functioning of engine components, the efficient function of engine lubrication is must and for efficient functioning of lubrication system, the lubricants should also have the following properties.

- 1. Viscosity**
- 2. Viscosity Index**
- 3. Clean and stable**
- 4. Pour point**
- 5. Flashpoint**
- 6. Corrosion resistant**

1. Viscosity

- **Viscosity is the property of the oil which refers to the resistance it has to flow due which two surfaces are kept apart from each other.**
- **The viscosity of the lubricants oil should be sufficient to ensure **hydrodynamic** lubrication.**
- **Higher viscosity is also not desirable as it increases the friction and power loss.**
- **The oil viscosity decreases at higher temperature and loses its efficacy, so the lubricants should have resistance against the temperature.**
- **High viscosity lubricating oils also hampers the initial starting of the engine.**

2. Viscosity Index (VI)

- Viscosity Index (VI) is a measure of the change of viscosity of oil with temperature.
- A high viscosity index means less change of oil viscosity with temperature rise. Petroleum lubricating oils general have viscosity index from 100 to 110, which may be increased to 120 to 130 by means of additives.

➤ SAE Number

- In practice lubricating oil usually are marketed by their SAE viscosity number recommended by the Society of Automotive Engineers, USA.
- As SAE number increases, the viscosity of oil is increases means it become more thicker.

• **For example**

SAE Number	Viscosity range at 130 0 F	
	Min	Max
10	90	120
20	120	185
30	185	255

3. Clean and stable

- **The lubricating oils should be sufficiently clean and stable for the smooth and prolonged trouble free operation of the engine.**
- **Lubricating oils should be stable at lowest and highest temperature as the oil particles should not get separated at low temperature and get vaporised at high temperature.**
- **Generally, it is observed that at high temperature oils get oxidized which become sticky and damages the engine components, sometimes form carbon, which damages the piston rings causing compression loss.**
- **So the lubricating oils should be chemically stable also which do not change their properties at high temperature.**

4. Pour Point

- It is the minimum temperature at which the fluid/oil pour and the liquid/oil below this temperature will not be able to flow.
- Hence the lubricants below this temperature can not used for its desired purpose.
- Thus, the lubricating oil with pour point less than the lowest temperature encountered in the engine is selected.

5. Flash Point

- The flash point of the fluid/oil refers to the temperature at which it gets sparked and it should be sufficiently high so as to avoid flashing of oil vapours.

6. Corrosion Resistance

- **The lubricating oil used in the automobile engines should have sufficient resistance to corrosion of the engine components like pipe lines, crank case etc. which are in regular contact with each other.**

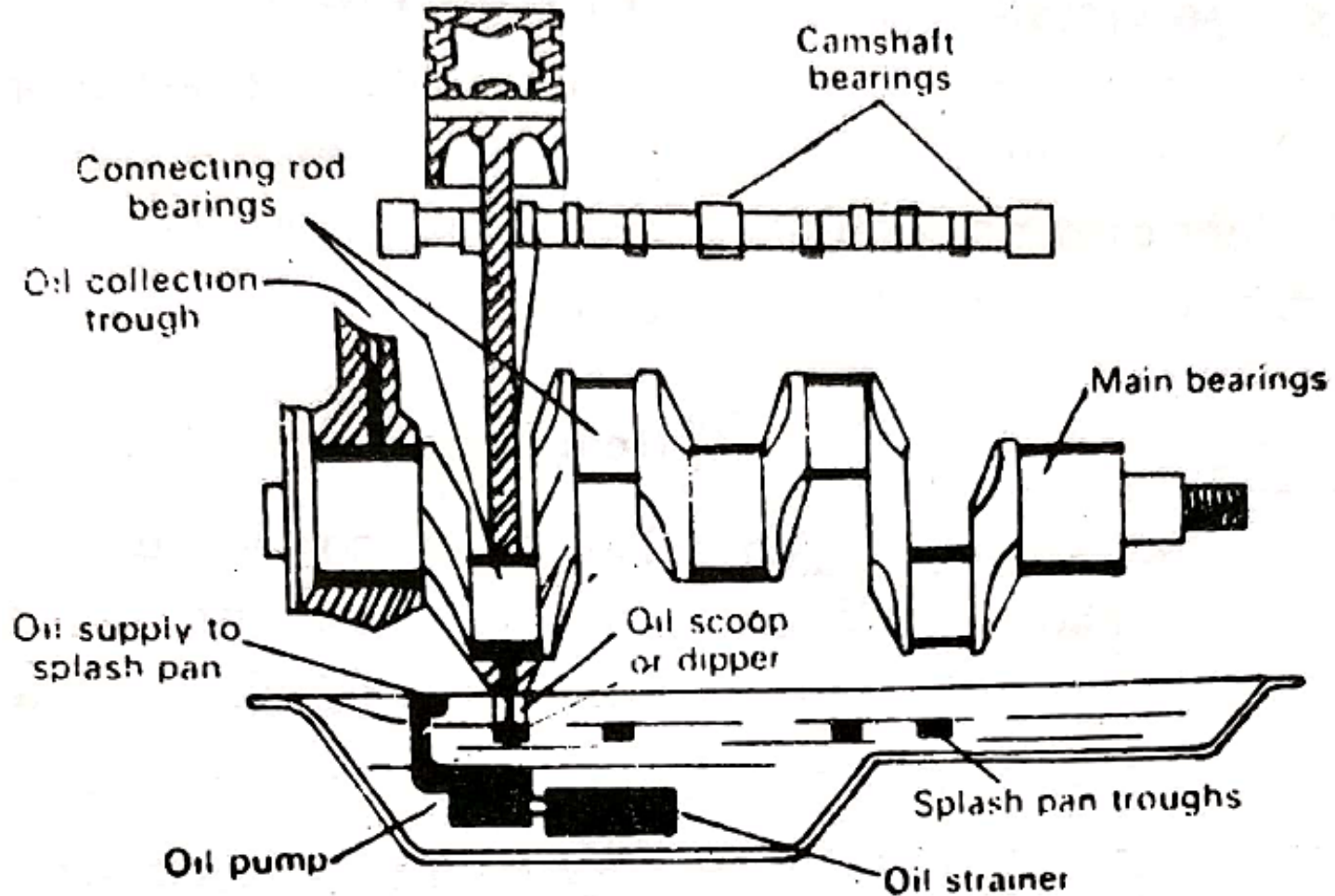
➤ **Methods of Engine lubrication**

- 1) Splash lubrication system**
- 2) Pressure /Force feed lubrication system**
- 3) Combination of splash and pressure lubrication system**

1) Splash lubrication system

- In splash lubrication system the lubrication oil is picked from the oil sump or a pan by a dipper provided at the bottom of the connecting rod.
- The connecting rod picks the oil from the bottom and moves upward to the engine components.
- Some oils is also reached to different components like bearings, connecting rod through splash as mechanical turbulence is generated in the crankcase by the moving components which further makes the oil spread in the form of mist in the crankcase.
- This mist further reaches to other engine components like piston, piston pin and cylinder walls.
- The camshaft and valve mechanism is also lubricated by the oil.
- Although the splash type lubrication system is still being used in the engines these days but its usage has been found to be limited to small or single cylinder engines as the splash only is not sufficient to make oil to reach all critical components of the engine.

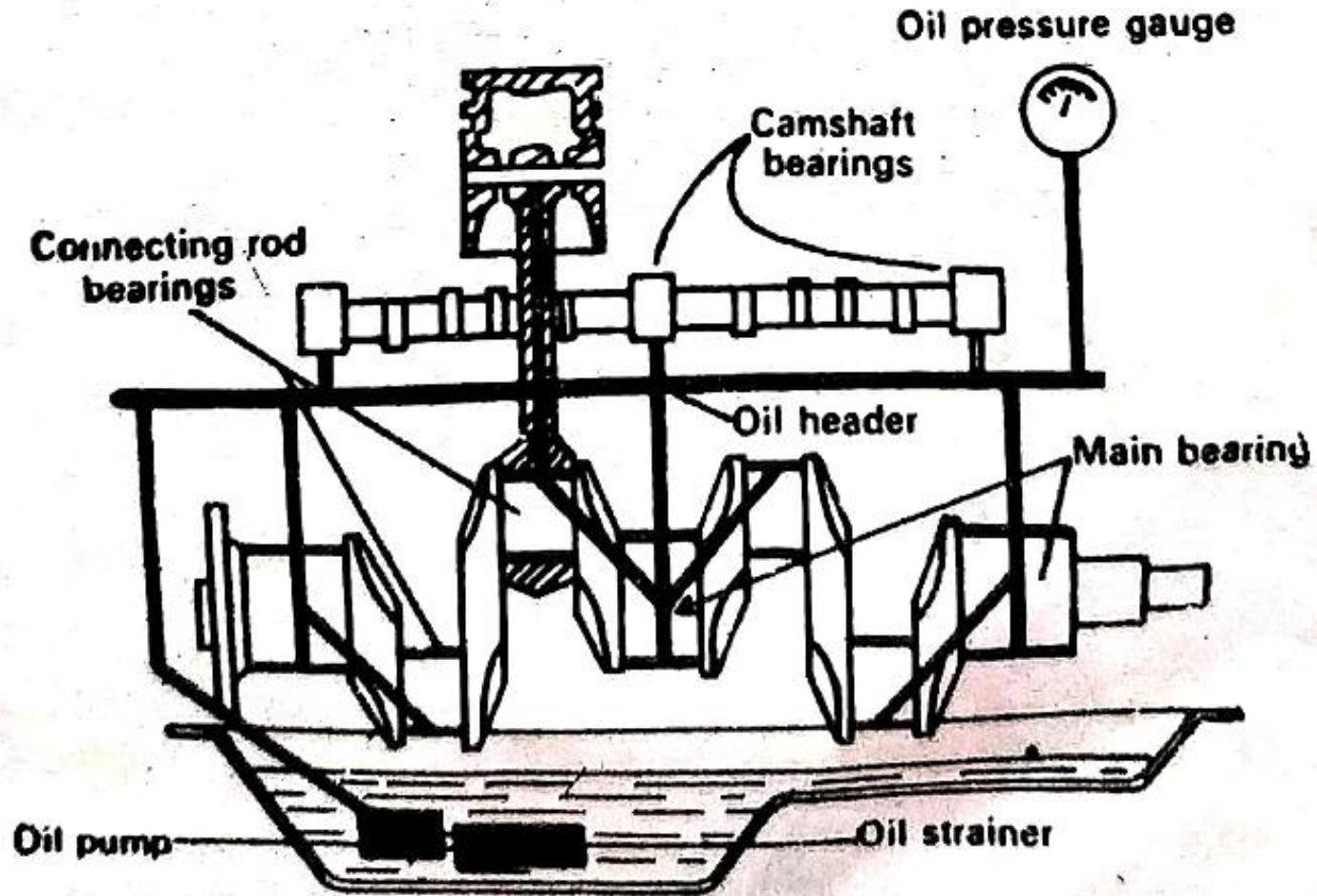
1) Splash lubrication system



2. Pressure/Force feed lubrication system

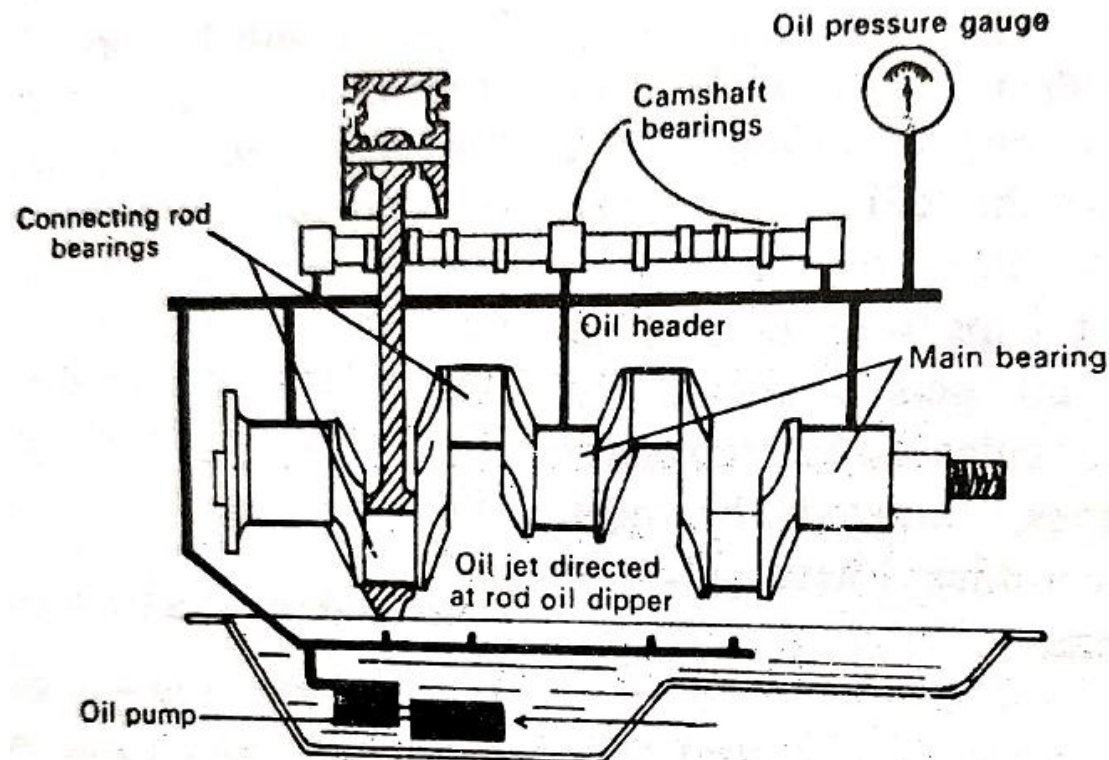
- **Force feed system is used to generate additional pressure to ensure oil reaching to all essential and desired components for lubrication purposes.**
- **Generally, a gear type pump driven by the camshaft generates the pressure in oil to move from the crankcase to crankshaft, connecting rod, bearings pistons and valves.**
- **The lubricating oil is supplied to the engine components under pressure, hence the reach of oil is enhanced to lubricate the remote and farthest points.**
- **This helps in efficient lubrication of engine components and hence in achieving better engine performance.**

2. Pressure/Force feed lubrication system



3) Combination of splash and pressure lubrication system

- In this system some of the parts are lubricated by splash and some by pressure.



➤ **Main parts of lubrication system**

- 1. Oil sump**
- 2. Oil pump**
- 3. Oil pressure relief valve**
- 4. Oil filter**
- 5. Oil pressure guage**
- 6. Oil level dipstick**

1. Oil sump

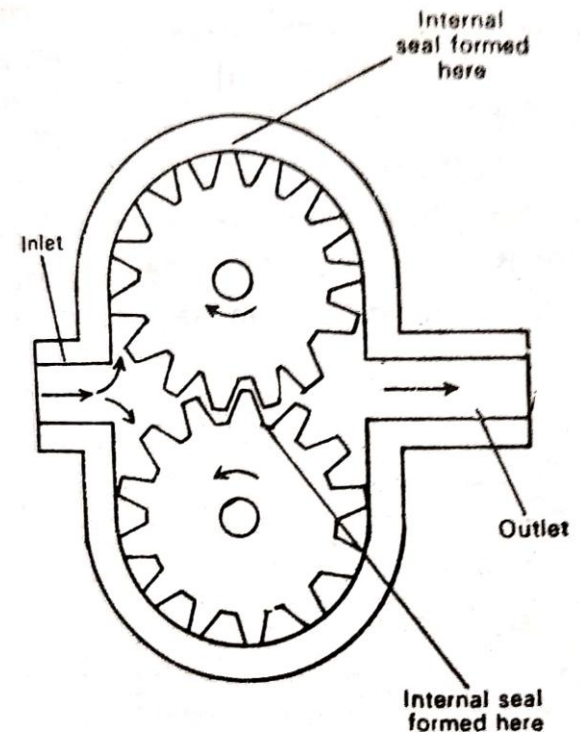
- This is the lowest part of the engine which contains lubricating oil.
- It is made of cast iron or sheet metal.

2. Oil pump

- It is used to supply lubricating oil to all moving parts of engine under pressure.
- Generally pressure about 3kg/cm^2 is developed in the lubrication system of tractor.
- There are three types of pumps
 - (i) Gear type
 - (ii) Rotary type
 - (iii) Plunger type

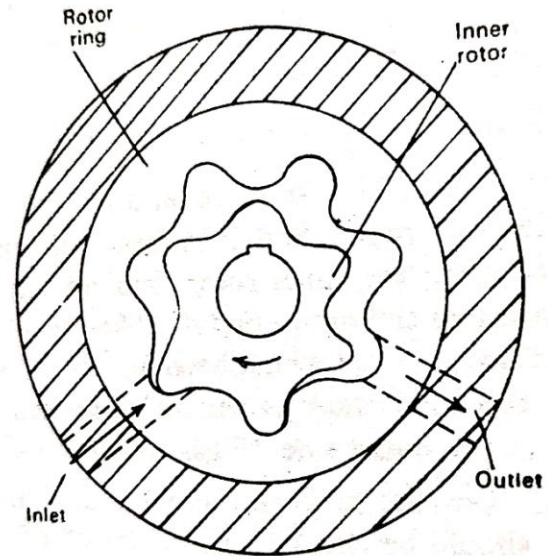
(i) Gear type

- This pump consist of a housing containing two spur gears one fitted on idle shaft and other on main shaft, which gets drive from cam shaft or crank shaft.
- The pump has operating speed is about 400-500 rpm, the gear ratio of cam shaft and pump is 1:1.5 and the peripheral speed is less than 10m/s
- In operation, the two gears revolve in opposite directions. Oil is drawn between the teeth of gears from pockets which carry oil from the inlet side of the pump to the outlet side where it is discharged.



(iii) Rotary type

- This consist of two rotors inner and outer and fits in oil pump body.
- When pump rotates, inner rotor revolves with outer rotor in pump body.
- The inner rotor has one lobe less than outer fixed rotor and at time only one lobe is in contact with outer rotor.
- The revolving rotors form pockets which filled with oil at inlet side of pump and discharged at outlet side.
- The clearance between outer and inner rotors should be checked by means of feeler gauge.
- If clearance exceeds 0.025 mm, both rotors should be replaced.



(b)
Fig. 7.9(b) Rotor pump

(iii) Plunger type

- This type of pump is used in stationary oil engines and motor cycles.
- It consist of housing containing a spring- loaded plunger, which moves up & down to pump oil & a Check valve which prevents the oil from flow back.

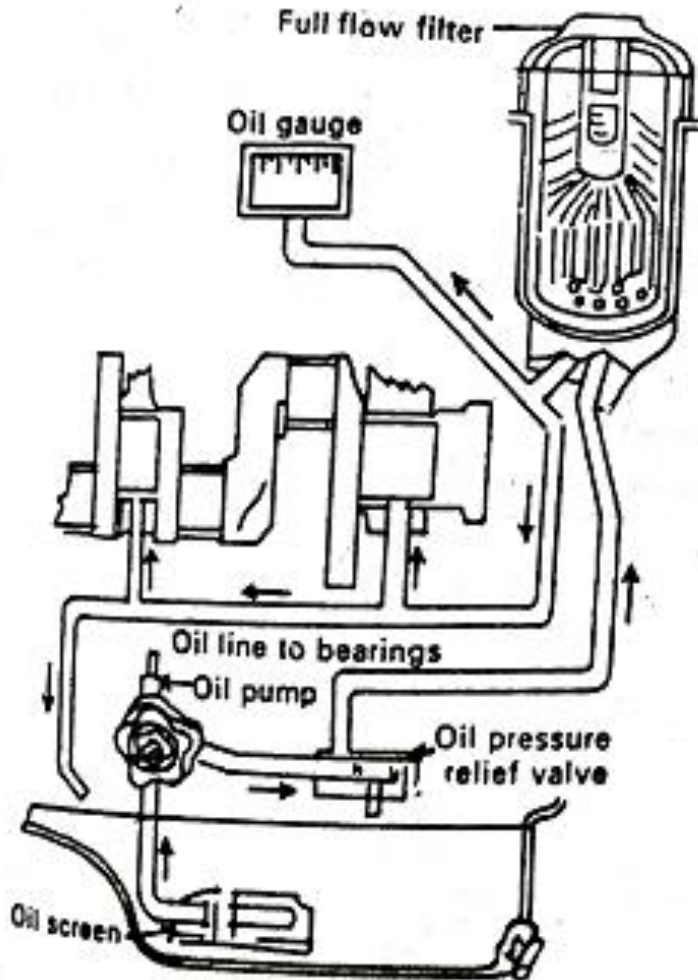
3.Oil pressure relief valve

- This is the type of non-return valve which allows the oil to pass in one direction only.
- This vaive is fitted on delivery of pump to prevent excessive oil pressure by limiting maximum value.
- As pressure increases the ball or plunger is fitted off and excessive oil passes through relief valve to crank case.
- Two types: (i) ball and spring type (ii) Disc and spring type

4. Oil Filters

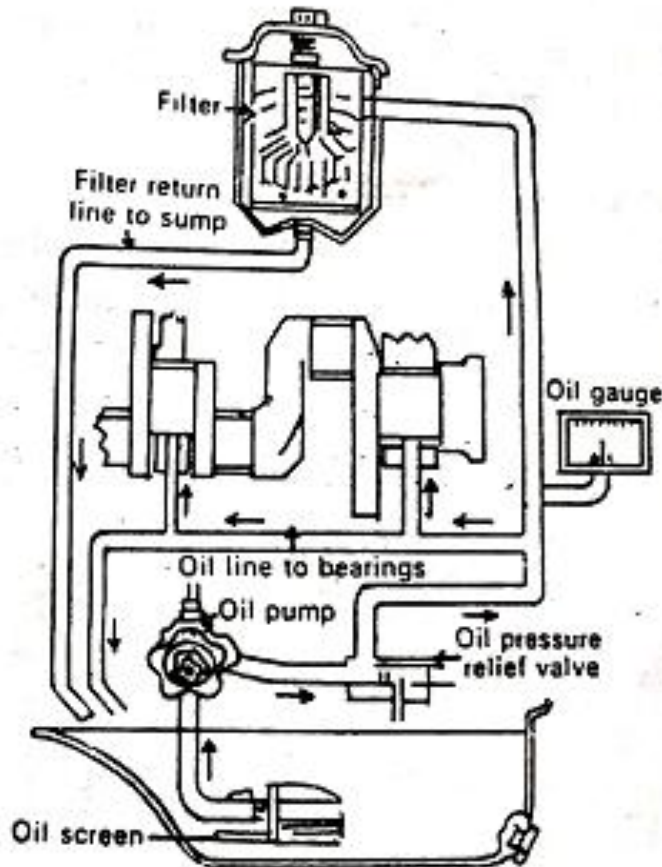
- **Carbon deposit, dust dirt and metal rubbings get mixed with crankcase oil and causes serious of defects in engine hence, oil filters are provided on all tractor engines**
- **These filters have two types of filtering elements one is replaceable type and another is cleanable type.**
- **Generally replaceable type filtering elements are used and normally they are replaced after 120 days of operation.**
- **Two types of filters are used (i) Full flow filter (ii) By-pass filter**

(i) Full flow filter



- It is designed in a way such that entire quantity of oil is forced to circulate through filter before it enters in the engine.
- A spring loaded valve is usually associated in this type of filter as a protection against oil starvation in case the filter gets clogged.

(ii) By-pass filter



- In this, the supply lines from pump are connected to permit only a part of oil through the filter, the balance oil is reaching directly to the engine parts.
- Over a period of operation, all the oil in the crank case passes through filter.
- Since only a part of oil passes through filter, clogged filter has no effect on working of engine.

5. Oil Pressure guage

- It is used to know the oil pressure, which gives a warning against low or high pressure.
- **Types:** (i) **Pressure Expansion type**- it is Bourdon tube type guage directly fitted on filter head or on main gallery.
- (ii) **Electric operated:** Bimetal Thermostat type and balancing type.

6. Oil level dipstick

- It is placed to check the oil level on the engine sump.
- It is marked to read as “full”, “half” and “danger”
- The oil level is checked by standing the tractor on level ground.

➤ **Crank case Ventilation**

- **Water vapours may be a byproduct of combustion in the cylinder that has leaked into the crankcase through the piston rings.**
- **These vapours not only contaminates the crankcase oil but also built up the pressure in the crankcase.**
- **These water vapours condensed in to water after engine is stopped and the crankcase is allowed to cool.**
- **Also diesel may enter into the sump when the injector dribbles.**
- **The fuel or oil contains sulphur, sulphuric acid which causes corrosion of the crankcase metal and also it dilute the quality of oil.**
- **Crankcase ventilation is employed to minimize this dilution.**
- **It involves the passing of a constant stream of air through the crankcase which picks up and carries away most of the fuel vapour before they can condense and dilute the oil.**

THANK YOU

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- 3. ICAR- e course material**