Cooling and lubricating system

Objectives: At the end of this lesson you shall be able to
- **state the necessity of the cooling system**
- **list out the different types of cooling systems**
- **state the advantages of the forced type of cooling system**
- **draw the water circulation path in an engine block**
- **state the function of the water pump, radiator, temperature indicator, pressure cap**
- **state the need and function of the thermostat valve, recovery system**
- **state the different types of thermostat valves.**

Combustion of fuel inside a cylinder develops a very high temperature (Appx. 2200^0C). At this temperature the engine parts will expand and tend to seize. Similarly the lubricating oil will loose its property. Therefore it is necessary to keep the engine temperature to operating limits. This is done by the cooling system. Heat is removed from the engine by cooling media (water or air) and is dissipated to the atmosphere.

Types of cooling systems

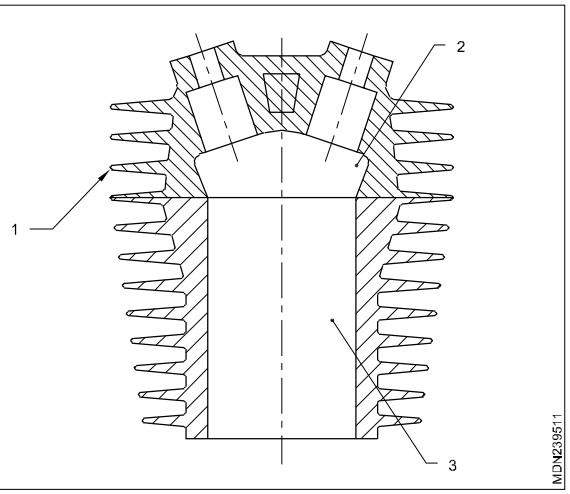
There are two types of cooling systems used in engines.

- Direct cooling - air cooling.
- Indirect cooling - water cooling.

Air-cooled engines

In air-cooled (Fig 1) engines, cylinders are semi-independent. They are not grouped in a block. Metal fins (1) are provided on the head (2) and cylinder (3), to help dissipate heat from the engine. In some engines fans are also used to improve air circulation around the cylinders and heads. This type of cooling system is employed in two-wheelers and small stationary engines. These are used in both S.I. and C.I. engines.

Fig 1

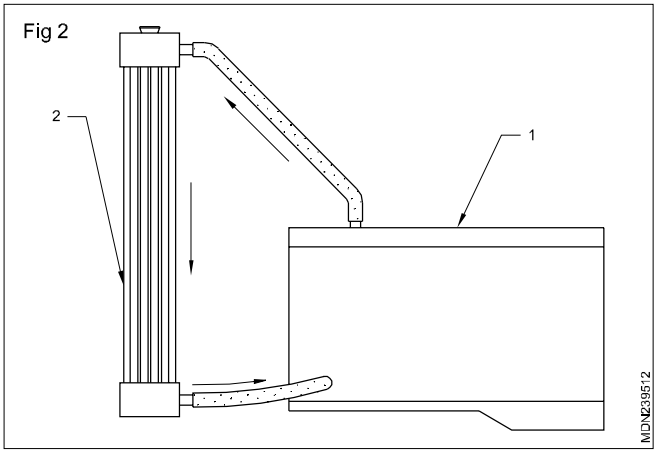


Water cooling

Two types of water cooling systems are used.

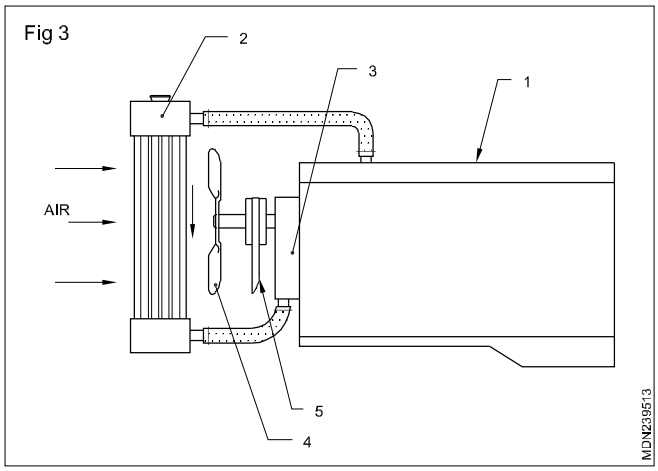
- Thermo-siphon system (Fig 2)

Fig 2



- Forced circulation system (Fig 3)

Fig 3



Thermo-siphon system

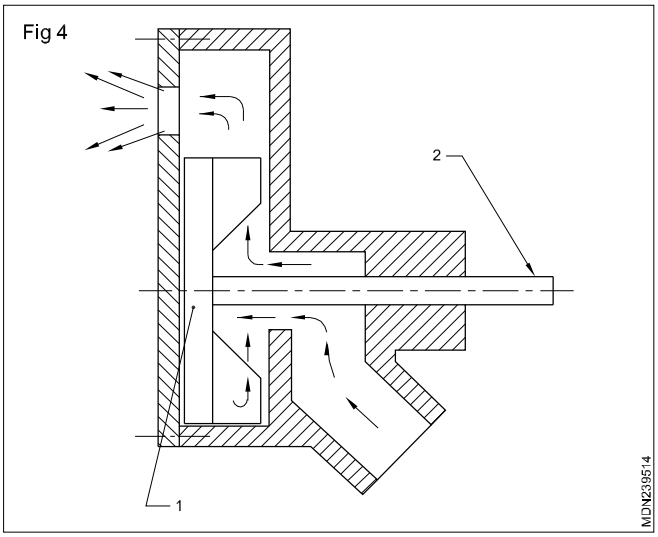
In this system no pump is used for water circulation. Water circulation is obtained due to the difference in the densities of hot and cold water. Water absorbs the heat and rises up in the block (1) and goes to the radiator's (2) top side. Water is cooled in the radiator (2). It again goes to the water jackets in the engine. To maintain a continuous flow of water the level of water is maintained at certain minimum level. If the water level falls down the circulation will discontinue. This system is simple but the rate of cooling is very slow.

Pump circulation system (Forced feed system)

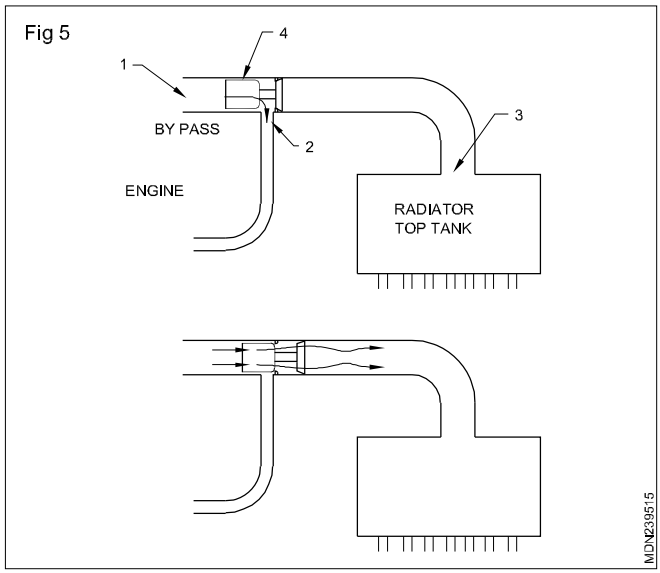
In this system water is circulated by a pump (3). The pump is driven by a belt (5) which is connected with the crank-shaft pulley. The circulation depends upon the engine speed. More water is circulated at higher engine speed.

The water absorbs heat from the engine and flows to the radiator's (2) top tank. Water from the top tank of the radiator (2) flows down to the bottom tank. The fan (4) draws the air through the radiator's fins and cools the hot water. Cold water from the bottom tank is again pumped to the engine and the cycle is repeated.

Water pump



The centrifugal type water pump (Fig 4) is used in engines. It is mounted on the front side of the cylinder block or head. The water pump is driven by the crankshaft pulley through the fan belt. The impeller (1) is mounted on one end of the water pump shaft (2). The shaft (2) is fitted in the pump housing with bearings. A water seal is provided in the pump to prevent leakage of water and to prevent water entering into the bearings. When the impeller rotates it draws water from the lower tank of radiator, and pumps water to the engine block, by centrifugal force under pressure. The fan is mounted on the water pump pulley.

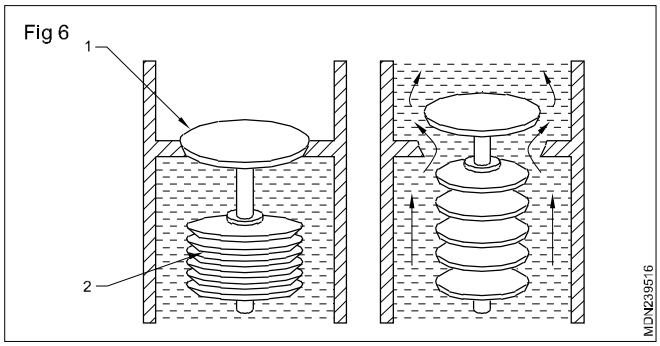


Thermostat

The thermostat (Fig 5) helps to bring the cold engine to the operating temperature quickly.

It is fitted in between the water outlet of the cylinder head (1) and the inlet (2) of the radiator in the water cooling system. When the engine is cold, the thermostat (4) is closed. It does not permit water to enter the radiator. Water recirculates in the engine through the bypass hole (2) and the engine reaches the operating temperature quickly. Once the engine has reached the operating temperature the thermostat (4) opens. It closes the bypass hole (2) and now permits water to enter the radiator tank (3). Thermostats are rated to open at different temperatures. Two types of thermostats are used.

- Bellows type (Fig 6)
- Wax type (Fig 7)



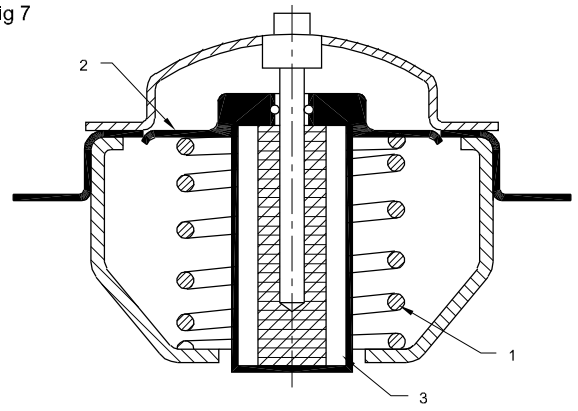
Bellows type

It has a flexible metal bag closed at both ends. The metal bag is partially filled with ethyl which has a low boiling temperature.

When the engine is cold the valve (1) closes its outlet passage and does not allow water to reach the radiator top tank from the engine, but is circulated through the bypass port to the engine.

When the water reaches the working temperature, ethyl in the closed bellow (2) expands and opens the valve (1). Now the water reaches the radiator top tank from the engine. In the valve's opened position the bypass passage is closed.

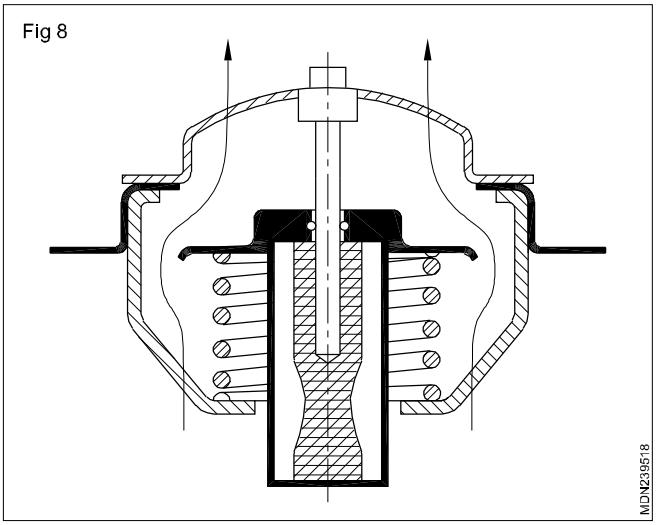
Fig 7



Wax pellet type

In this type a wax pellet (3) (Fig 8) is used as a heating element. When the circulating water's temperature is lesser than the operating temperature, the spring (1) keeps the valve (2) in the closed position and the water does not reach the radiator top tank from the engine.

Fig 8



As the water reaches the operating temperature the wax pellet expands and forces the valve (2) to open against the spring tension. Now the water reaches the radiator top tank, from the engine. At this position the bypass port is closed by the valve.

Components of water cooling system

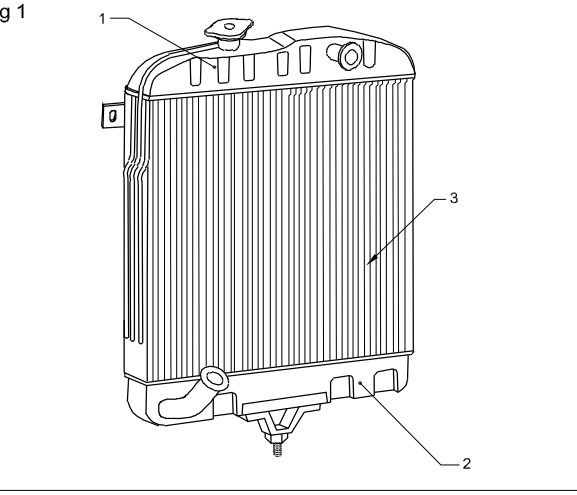
Objectives: At the end of this lesson you shall be able to
- **state the constructional features of a radiator**
- **state the need of a pressure cap**
- **explain the marine engine cooling system**
- **explain the open cooling system.**

Radiator

The purpose of a radiator in the cooling system is to cool hot water coming out of engine.

It has a large cooling surface area to allow enough of air to pass through it. Water circulated through it is cooled by the passing air.

Fig 1



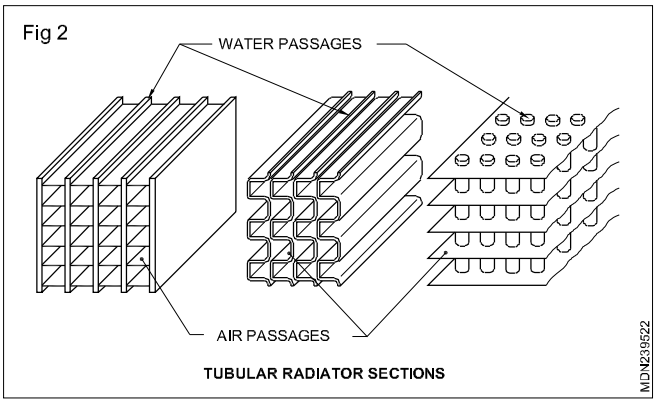
The radiator (Fig 1) consists of an upper tank (1),a lower tank (2) and in between the upper and lower tank radiator cores (3) are provided. The upper tank (1) is connected to the water outlet of the engine through a rubber hose. The lower tank (2) is connected to the water pump through rubber hoses.

Radiator cores are classified into two types.

- Tubular core (Fig 2)
- Cellular core (Fig 3)

Tubular core

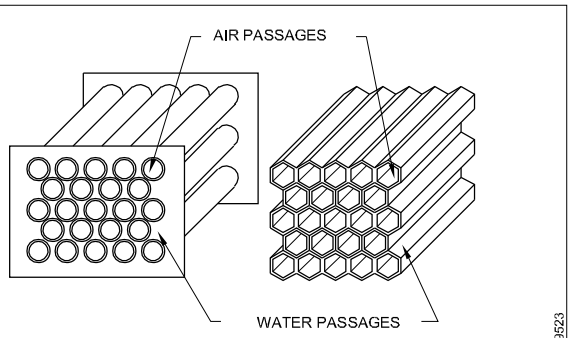
Fig 2



In a tubular type the upper and lower tanks are connected by tubes. Water passes through these tubes. Cooling fins are provided around the tubes, to absorb and radiate heat to the atmospheric air.

Cellular cores

Fig 3



CELLULAR RADIATOR SECTION

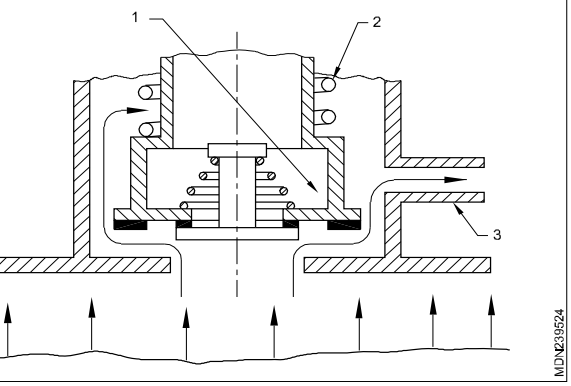
In the cellular type a large number of individual air cells are provided and surrounded by water. Because of its appearance, the cellular type is known as a 'honeycomb' radiator.

The material of the core is of copper and brass. The parts are normally connected together by soldering.

Pressure cap

In normal atmospheric conditions water boils at 100°C. In higher altitude height the atmospheric pressure is low and water boils at a temperature below 100°C. To increase the boiling temperature of water the pressure of the cooling system is increased. This is achieved by providing pressure caps to seal the system. The coolant loss, due to evaporation is also minimized, by using a pressure cap. (Fig 4)

Fig 4



It also permits the engine to operate at a higher temperature so that better efficiency of the engine is achieved.

The pressure cap is fitted in the filler neck portion on the top of the radiator tank. If pressure is increased by 15 P.S.I., the boiling temperature raises to 113°C. The pressure cap has two valves.

- Pressure valve
- Vacuum valve

Pressure valve

If the pressure in the system rises it may damage the components. To avoid this a pressure relief valve (1) is used to release the excess pressure. It is a spring- loaded valve. The spring's (2) tension depends on the system's pressure.

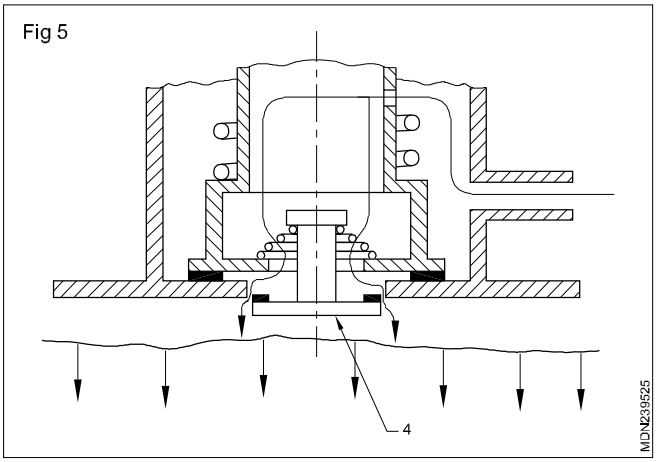
When the cooling water of the engine is heated up it expands which results in high pressure in the system. If the force due to pressure is more than the spring's (2) tension the valve opens and water vapour/steam escapes through the overflow pipe (3) until the pressure is lowered to the preset value.

Vacuum valve

When the engine cools down the pressure in the system decreases due to loss of the coolant and a vacuum is created.(This valve is also located in the cap and fitted in the filler neck of the radiator.)

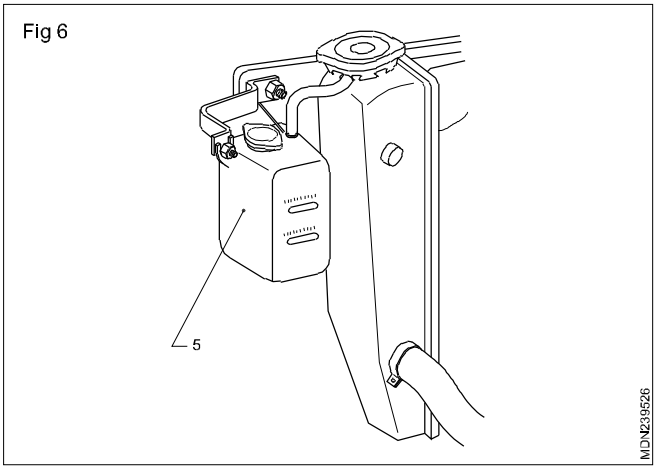
At this time the vacuum valve (4) (Fig 5) opens and air flows into the system until the vacuum is filled up in the system.

Fig 5



In some engines an overflow pipe is connected to an expansion tank (5). The expansion tank (5) (Fig 6) collects the water vapour during the pressure valve operation, and the same vapour, after condensing, goes to the radiator when the vacuum valve is in operation.

Fig 6



Marine engine cooling system

There are two types of cooling system used in marine engines.

1 Heat exchange cooling system

2 Keel cooling system

Heat exchange cooling system

Heat exchange cooling system consists of the following units.

Water cooled exhaust manifold.

Engine coolant pump.

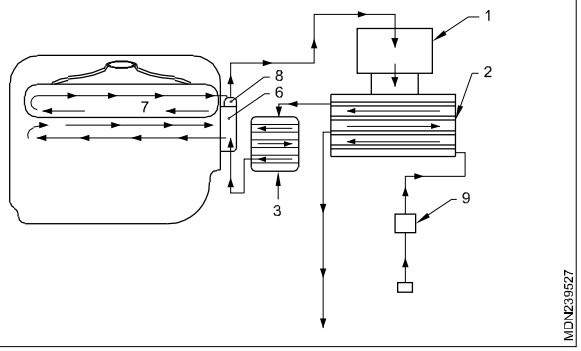
Heat exchanger.

Expansion tank.

Operation

The coolant flows (Fig 7) from the expansion tank (1) around core cells (2). These core cells contain sea water. The sea water is circulated through the core by the water pump (9). Hot engine coolant flows outside of the core (2) and it is cooled by the sea-water inside the core.

Fig 7



Coolant as fresh water is circulated through an expansion tank (1). From the expansion tank (1) it flows down around the cores (2). From the cores (2) to the oil cooler (3) and then through inlet of engine's coolant pump (6). It is then pumped to the engine and sent to the expansion tank (1) through the exhaust manifold (7) and thermostat (8).

A separate pump (9) is used to circulate sea water to cool cores (2) and back.

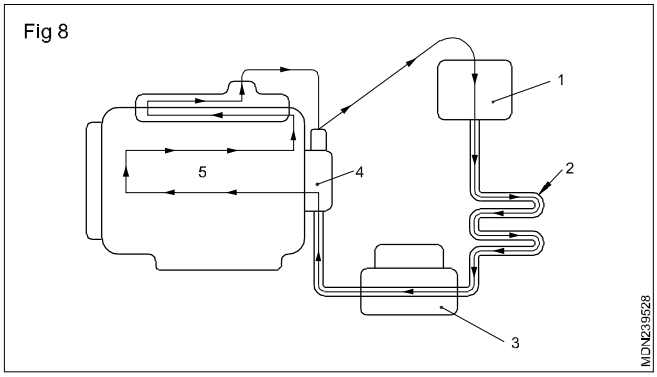
Keel cooling system

In this system coolant flows from the expansion tank (1) to the keeling coil (2) and goes to the engine (5) through an oil cooler (3). A pump (4) is used to circulate the coolant in system.

Open cooling system

In this system (Fig 8) water is stored in a reservoir and circulated in the engine by a water pump. Hot water from the engine is pumped to the reservoir where it flows from a height and gets cooled.

Fig 8



Colant hoses

Hose pipes

It is made of synthetic rubber

1 Upper hose: It is connected between the cylinder head and radiator upper tank.

2 Lower hose: It is connected between the cylinder block as radiator lower tank.

3 Bypass hose: It is connected between the cylinder head coolant/water outlet and water pump intake side.

Fan

The is mounted behind the radiator on the water pump shaft. It is driven by the belt that drives the water pump. It drawn the air through radiator to cool the pins & pipe (core).

In latest vehicles the fan is mounted an frame behind the radiator. It is operated electrically by ECM.

Fan does not start toll the coolant/water temperature reaches at normal working temperature (Ex. 90°C).

Temperature indicator

The temperature indicator is fitted on the instrument panel it indicates the temperature of the water in engine water jackets. There are two types of temperature indicator used in an automobile.

1 Mechanical type

2 Electric type

mechanical type temperature indicator consistes of a scaled bulb that fits in the cylinder head water jacket and connected by a fine tube to temperature pressure gauge on the dash board.

The electric type water temperature scalling unit is fitted in the cylinder head water jacket and it is conected through electric wire from ignition switch to temperature use sending units cold terminal through panel indicator bulb, another wire is conected from temperature sending units hot terminal to temperature warning lamo. When the engine temperature reaches normal, the green light circuit is completed by the engine unit and the dial indicates green ligjt. When the engine is over heated the engine unit complees read light circuit and the dial indicates the red light.

In latest vehicle engine coolant temperature (ECT) sensors are using.

Thermo switch

THis divice is prevents the engine from over heating by activating radiator cooling fan, measuring the coolant temperature and controlling the level gaugesand warning lights on the engine control unit. This device have upto four terminals and be installed on the radiator, the cooling system tubes or thermostate, so that the coolant flows across the sensing element (bimetela disc or thermistor).

Function of thermo switch

Theremo switch operates independent from any current supply, temperature detection is effected by means of a by metal disk switch on temperature. When this fixed switch on temperature is reached this bimetal disk well snap over, closing a contack the circuit system and there by closing the electric of device to be started. After cooling down and reaching the cut off temperature. The bimetal disk will auto mechanically return into its original position and open the contact. The electric circuit is opened again.

Coolant properties

A efficient colling system removes 30 to 35% of the heat generated in the combustion chamber.

- Coolant should be remove heat at a fast rate, when the engine is hot.
- Coolant should be remove heat at a slow rate when the engine is started until the engines reaches at its normal operating temperature.
- Coolant should not remove too much heat from the engine. Too much removal of the heat decreases thermal efficiency of the engine.
- It should circulate freely in the coding system.
- It should be prevent frequency and rust formations.
- It should be reasonbly cheap.
- It should not waste by voporization.
- It should not deposit any foreign mater in the water jackets/radiator.

Change of engine coolat interval

1 Coolant should be replace as per specified by the manufacture.
2 Coolant should be replace during major repari is an engine or radiator.
3 Coolant should be replace at dilute (oil mix with water).

Anti- Freeze mixtures

1 Wood alcohol
2 Denatured alcohol
3 Gycerine
4 Ethylene glycol
5 Propylene glycol
6 Mixture of alcohol and glycerine

Engine lubricating system

Objectives: At the end of this lesson you shall be able to
- **list out the different types of engine lubricating systems**
- **explain the function of each system**
- **draw the oil circulation path in an engine block**
- **state the function of the pressure relief valve**
- **state the types of the pressure relief valve**
- **list out the different types of crankcase ventilation**
- **explain positive crankcase ventilation.**

Types of lubricating system

The following types of lubricating systems are used in engines.

1 Petrol-oil lubrication

2 Dry sump lubrication

3 Splash lubrication

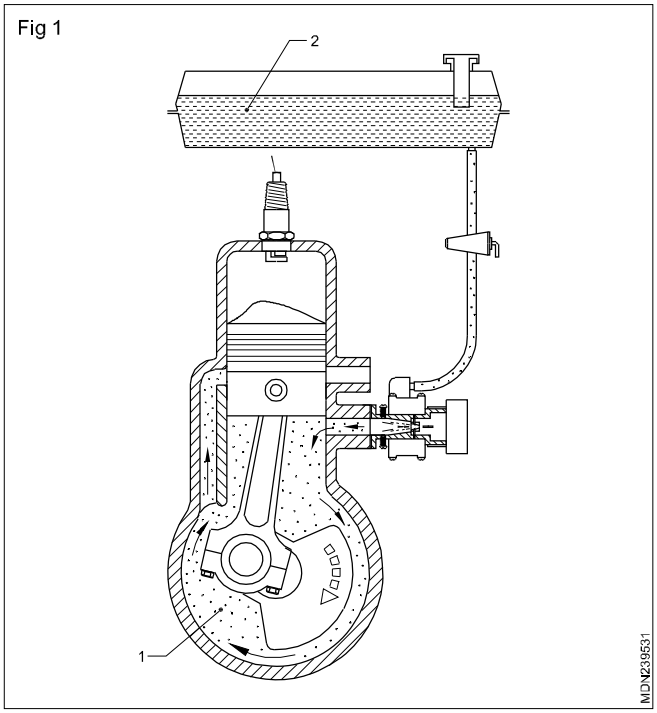
4 Pressurized lubrication

5 Combined lubrication

Petrol-oil lubricating system (Fig 1)

In this system the lubricating oil is mixed with the petrol(2). The ratio of petrol and oil is 20:1. When fuel goes in the crankcase chamber (1) and crankshaft bearings, the oil mist sticks to the moving parts and gives the lubricating effect. This system is mostly used in two-stroke engines.

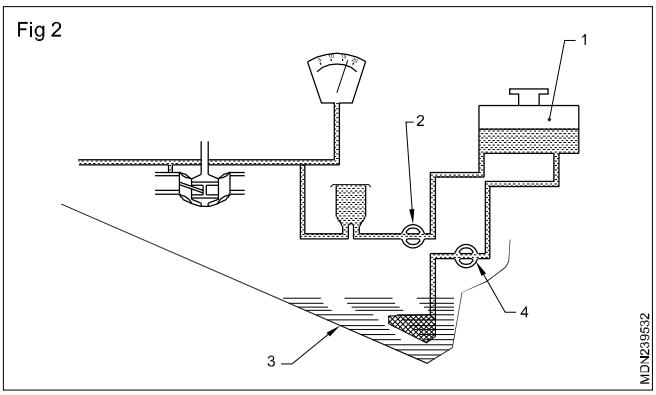
Fig 1



Dry sump lubricating system (Fig 2)

In this system the lubricating oil is delivered from a separate tank (1) to the components by an oil pump (2). The oil lubricates the moving parts and flows back to the oil sump (3). A scavenging pump (4) is provided to pump oil from the sump to the tank.

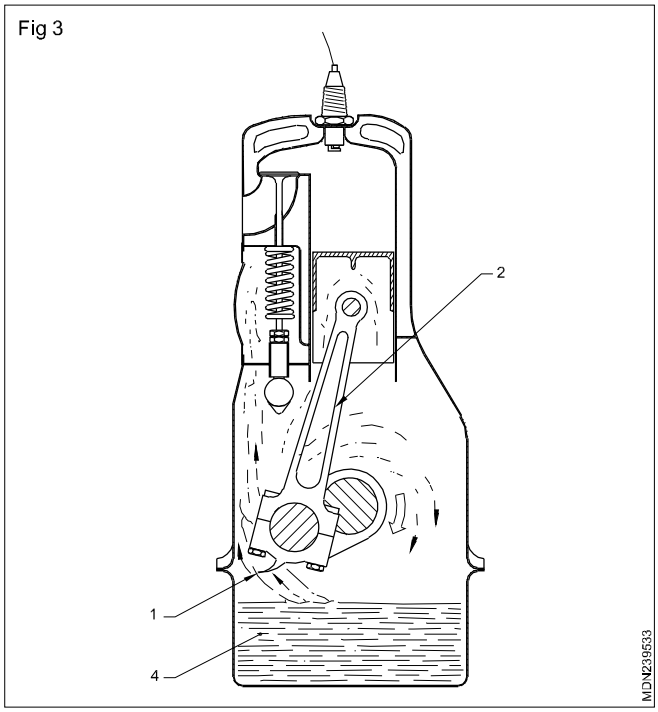
Fig 2



The lubrication effect is not affected when the vehicle is climbing up or moving down.

Splash type lubricating system (Fig 3)

Fig 3



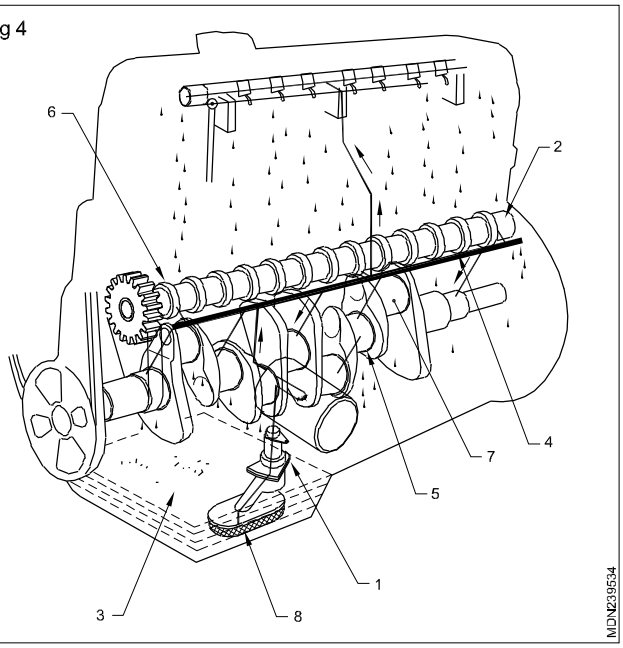
In this system the lubricating oil is stored in a sump(4). A dipper (1) is made at the lowest part of the connecting rod (2). When the crankshaft rotates the dipper (1) dips in the oil once in every revolution of the crankshaft and splashes oil on the cylinder walls.

Pressure lubricating system (Fig 4)

In the system the lubricating oil is circulated to all the moving parts of the engine under pressure, by the oil pump (1) driven by the camshaft (2).

The oil from the sump (3) is sucked by the oil pump (1) through the strainer (8) and suction pipe. The strainer filters the solid dust particles. The oil flows to the main gallery (4) from the filter's outlet. From the main oil gallery (4) the oil flows to the crankshaft main journals (5) and camshaft bushes (6).

Fig 4



From the crankshaft main journal (5) the oil flows to the crankpin (7). From the camshaft bush it flows to the cylinder head and lubricates the rocker bushes. When the crankshaft rotates the oil splashes from the connecting rod bearings and lubricates the piston rings and liner. In some engines an oil hole is drilled from the connecting rod big end to the small end to lubricate the gudgeon pin bush.

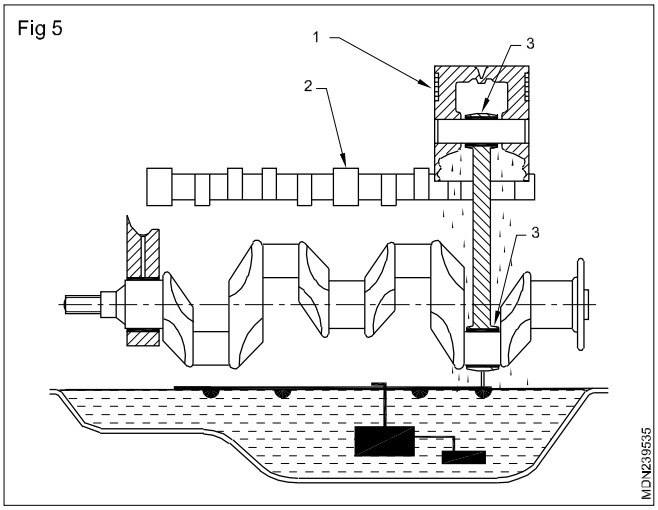
A relief valve is provided in the path between the oil pump and the filter. The relief valve limits the maximum pressure of the oil in the system. An oil pressure gauge or indicating lamp is provided to indicate the oil pressure.

After lubricating the various parts of the engine, the oil reaches the oil sump.Combined lubricating system

Combined lubricating system (Fig 5)

It is a combination of splash lubricating system and pressure lubricating system. Some parts are lubricated by the splash lubricating system - such as the cylinder wall (1), camshaft bearings (2), connecting rod bearing (3) and the remaining parts are lubricated by pressure lubricating system.

Fig 5



Pressure relief valve

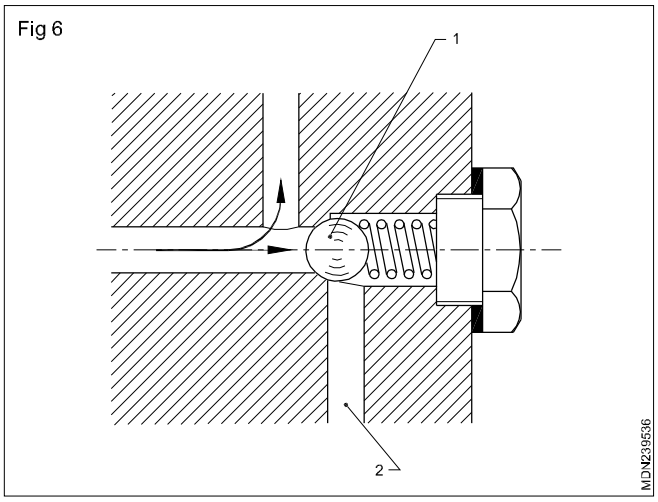
The pressure relief valve is used to limit the maximum pressure of the oil. When the oil pressure increases more than the prescribed limit, the relief valve opens and allows oil to return back to the oil sump directly.

Following types of relief valves are used.

- Ball type
- Plunger type

Ball type (Fig 6)

Fig 6

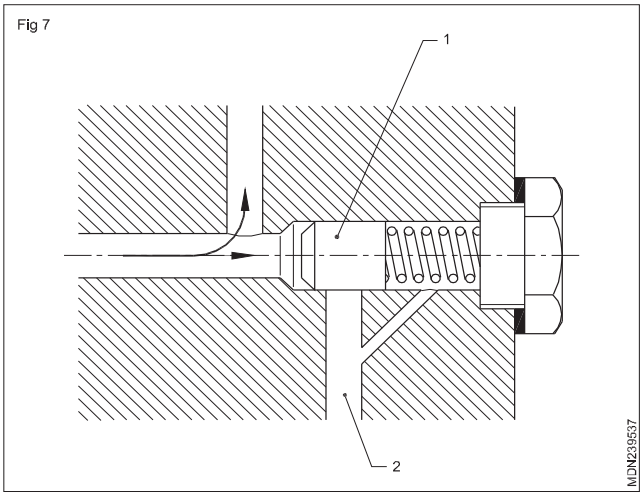


In this type of relief valve a spring-loaded ball (1) opens the connection to the return channel (2) when the oil pressure over comes the spring force. The oil flows through the return channel back to the oil sump.

Plunger type relief valve (Fig 7)

This type of relief valve is similar to that of the ball type except that a plunger (1) is used instead of a ball. A leakage oil relurn passage is provided to allow oil to return to the oil sump which has passed through the plunger (1).

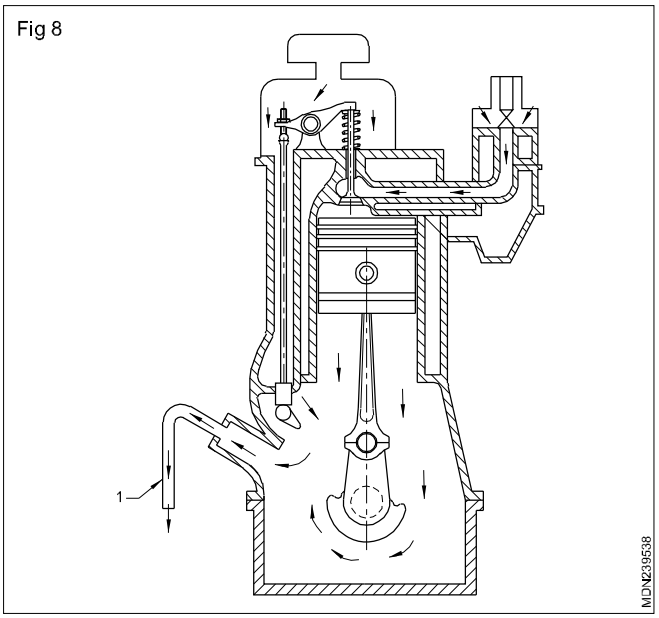
Fig 7



Crankcase ventilation (Fig 8)

In the crankcase oil gets diluted due to the mixture of blow by gases, carbon particles, metallic particles, sand, dust, dirt and the acids formed out of the exhaust gas condensation such as sulphuric acid and phosphoric acid. This affects lubrication and forms a sludge (accumulation of dirty oil). Frequent cleaning and change of oil is needed. To overcome this problem, crankcase ventilation is provided. Fresh air is allowed in the crankcase which passes out after circulation through a breather pipe (1) in the rear. This arrangement is known as OPEN TYPE CRANKCASE VENTILATION.

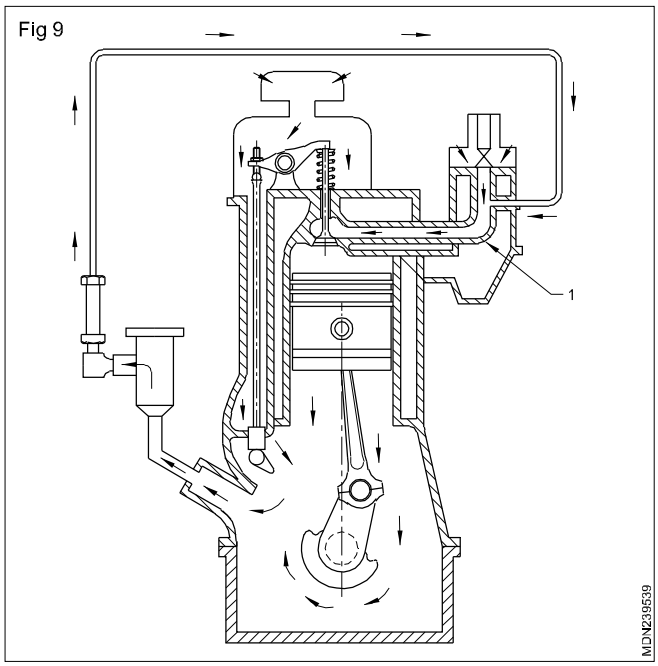
Fig 8



Positive crankcase ventilation (Fig 9)

The exhaust gases and other particles going out of the engine are toxic and injurious to public health. To overcome this positive crankcase ventilation or closed type ventilation is provided. In this arrangement all air flowing out of the engine crankcase is drawn back into the inlet manifold (1) and fed into the engine. This prevents the flow of gases outside the engine.

Fig 9



Function of sump

Oil sump is the lowest part of the crank case (Engine). It provides a covering for the crankshaft and contains oil in it. In unit sump lubricating system, the oil is taken out from the sump and after lubricating different parts oil drops in oil sump. It is made of steel pressing/aluminium/east iron. It contains drain plug at its lowest part to drawn out the oil. In dry sump lubricating system the oil is contansed in a separate oil tank.

Oil collection pan

Oil pan is the lowest part of the engine. In dry sump lubricating system oil pan is collect the oil after lubricating different parts oil drops in an engine and then oil is sent back to the oil tank by a separate delivery pump.

Oil tank

In dry sump lubrication system, two oil pumps are used one for feed the oil from tank to lubricating sysem and another pump delivery pump is sent oil from dry sump to oil tank. In this system oil is not stored in oil sump.

Pick up tube

In dry sump lubricating system pick up tube is connected between delivery pump and oil tank, to pick up the oil from sump to oil tank

Oil pump & Filter

Objectives:
- **list out the types of oil pumb**
- **list out the type of oil flow system**
- **purpose of the oil cooler**

Oil level indicator

It is a steel stick graduated at the front end for measuring the level (amount) of oil in the sump. The graduatuons are “Fukk” , “Half”, “Low” marks are provided on the bottom end of the dip stick. These marks show whether the oil is up to the required full or half level or the level is so low. The low level oil may cause danger to engine life.

For measuring oil level, remove the stick from the engine, clean and dipped into the oil sump and again taken out to see graduation oil has sticked.

Oil pressure indicator

Oil pressure gauge or oil waring light is provided on the dash board to indicate the lubrication

Oil pressure during of an engine running.

Oil pressure gauge

It is equipped with pressure lubricating system to warm the engine operator, what is the oil pressure is in the engine. The oil pressures are following types

1 Pressure expansion type

2 Electric type

  a Balancing type

  b Binmetal thermal type

Oil pressure indicating light

The light comes when the ignition switch is turned on and the oil pressure is low. The circuit uses four stage diaphragm switch, which operates a warning lamp according to the pressure required for different engine speeds. The switch is located at the oil main gallory. Its connection with the warning light is through the ignition switch. When engine.

Components of the lubrication system

Oil pumps

The oil pump is used to pump oil from the oil sump to the oil galleries at a certain pressure.

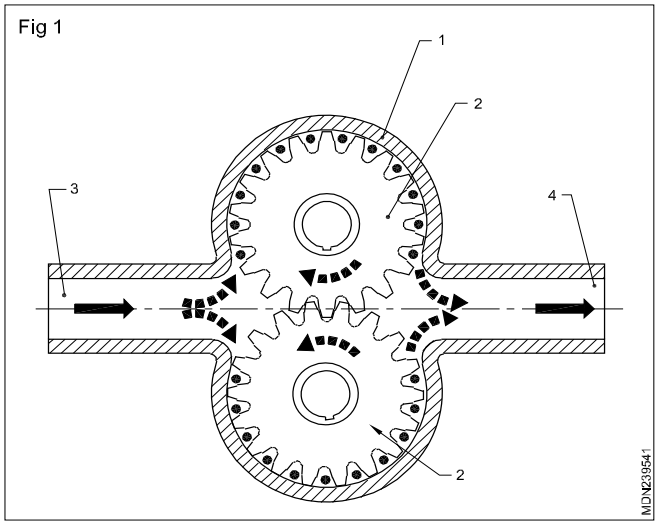
It is located in the crankcase and is driven by the camshaft. Foru types of oil pumps are used.

- Gear type oil pump
- Rotor type oil pump
- Vane type oil pump
- Plunger type oil pump

Gear type oil pump (Fig 1)

In this type two gears are fixed in the pump housing (1). The gears (2) have little clearance with the pump housing (1). When the gears rotate a vacuum is created in the casing. Oil is sucked through the inlet (3) and pumped to the oil gallery through the outlet (4).

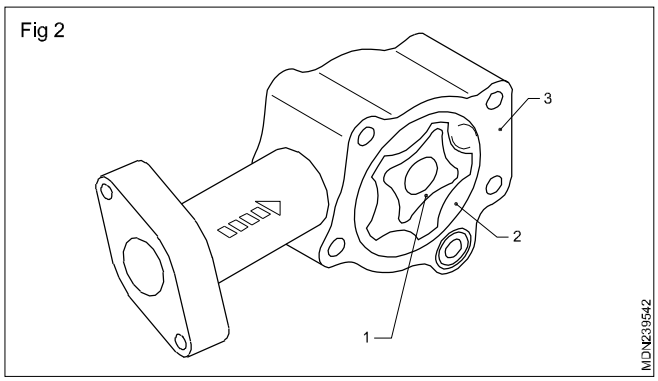
Fig 1



Rotar type oil pump (Fig 2)

The rotor type oil pump consists of an inner driving rotor (1), and an outer drive rotor (2) which rotates freely in the pump housing (3) and runs eccentrically in realation to the inner rotor.

Fig 2

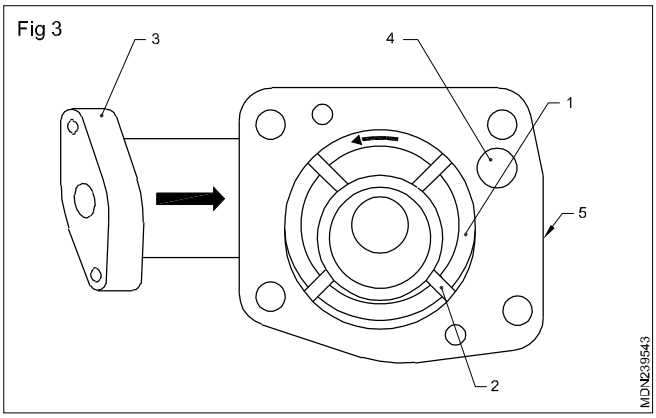


The oil is sucked into the pump in the side where the volume between the rotor teeth increases and is pumped out on the side where the volume decreases.

Vane pump (Fig 3)

In the vane tyoe pump the rotor (1) runs eccentrically in the pump housing (5). Spring- loaded vanes (2) slide against the pump housing walls. Suction us created by the vanes (2) when the rotor (1) rotates. Oil is sucked through the inlet duct (3) and discharged through the discharge duct (4).

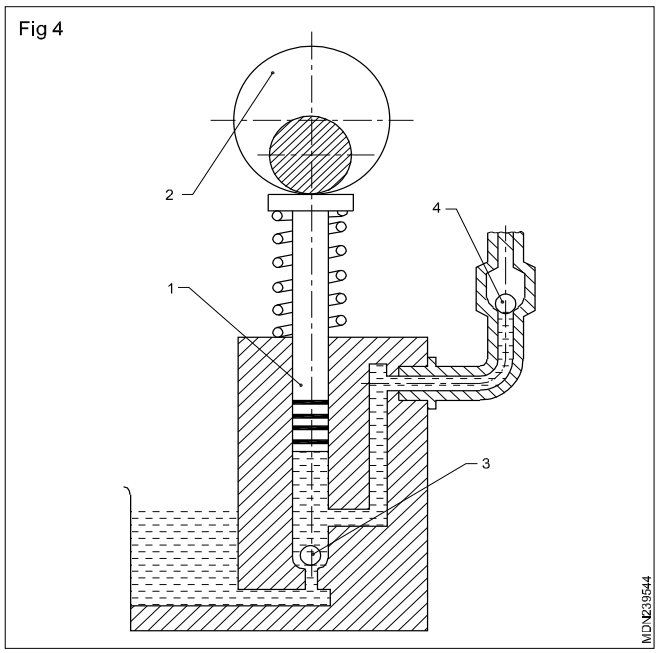
Fig 3



Plunger type oil pump (Fig 4)

In this type of plunger (1) moves uo and down in the cylinder. It is operated by a special eccentruc cam (2). THis pump has two non-return ball valves (3) & (4). These valves are spring-loaded balls. One of these is on the suction side (3).

Fig 4



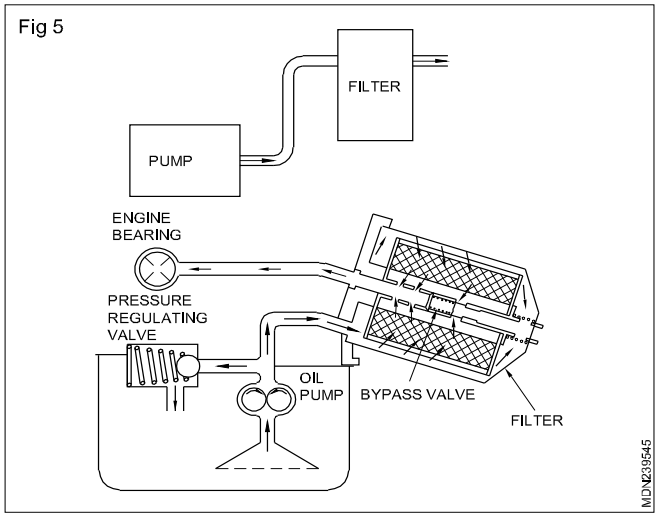
During the upward stroke the oil is sucked through the valve (3). During the downward stroke the non-return valve (3) closes. The other non-return valve (4) which is on the delivery side opens and permits the oil to flow out from the pump. This type of plunger pump is used in medium and high pressure lubricating systems.

Oil filter

Full flow oil filter system (Fig 5)

In this system all the oil passes through the filter before reaching the main oil gallery. One bypass valve is provided in the filter which allows oil to reach the main oil gallery directlu if the filter is choked.

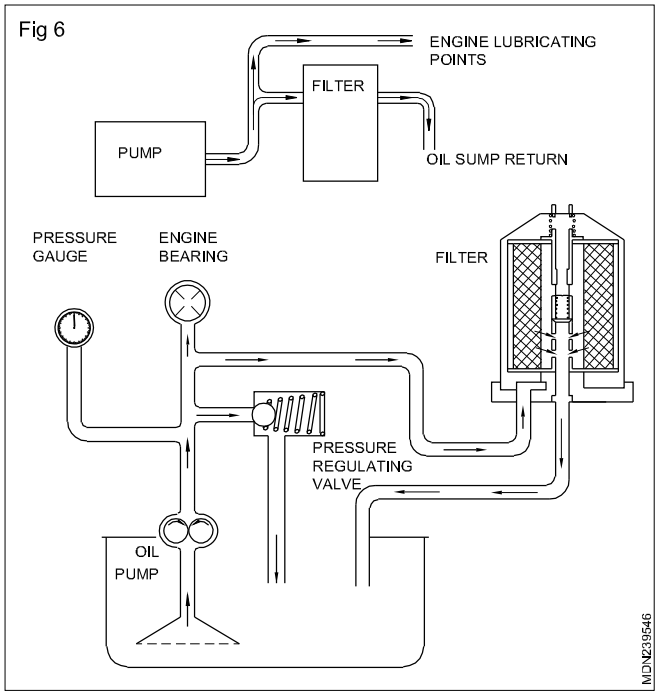
Fig 5



Bypass oil filter system (Fig 6)

In this system only a part of the engine oil enters the filter. After filtering, the oil goes to the oil sump. The remaning oil goes directly to the main oil gallery.

Fig 6



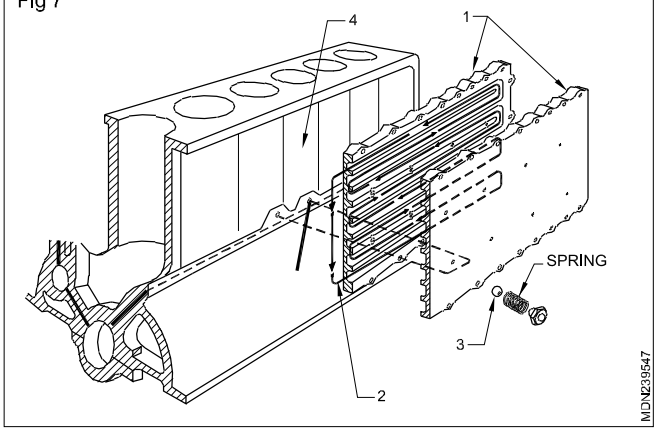
Filter element

Filter elements are made of felt, cotton waste, cloth and paper. Oil filters are replaced after certain kilometres of running of the engine as specified by the manufacturer.

Oil coolers (Fig 7)

OIl cooler consists of two halves (1). Passages (2) are provided in between the cooler's halves for oil circulation. A ball valve (3) is provided to maintain the required oil pressure. THis is made of cast iron. The purpose of the oil cooler is to tansfer the heat from engine oil to cooling water and cool the engine oil.

Fig 7



The inner wall of the oil cooler is in contact with cooling water. The engine oil which is made to circulate through the passages provided in the oil cooler, transfers its heat to the cooling water circulating in engine block (4), and the inner wall of oil cooler. This maintains the temperature of the engine.

Note: Oil cooler shift to next page oil cooler heading is working and there is sifficient oil pressure in the pressure system, the indicating light switching light switch is open due to oil pressure effect on it and no current blows to the light, during this occassion warng light is off. When the pressure system fails due to any breakdown in the system or stoppage the engine, the warning light switch is closed and light starts to glowing.

Oil cooler purpose (Fig 8)

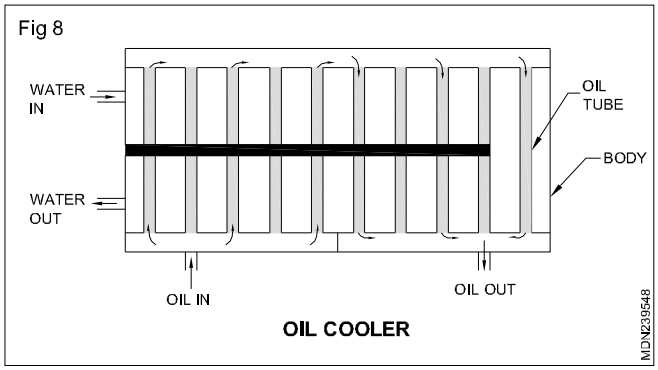
The purpose of an oil cooler us to cool the lubricating oil in heavy duty engines where the oil temperature become quite high the oil must be kept cold in the lubricating system.

An oil cooler is just like a simple heat exhanger. The oil may be cooled in it either by cold

water from the radiator. At the time of starting when the water is hotter that the oil, the oil is heated to provide complete circulation in the system. At higher temperatures, when the oil becomes hotter than water, the water cools the oil.

A water type oil cooler, simply consists of tubes in which oil circulates. The water circulates outside the tubes in the casing of the cooler. The heat of the oil is carries away by the circulating water.

Fig 8



Spurt holes and maingallory

The engine parts are lubircated under pressure feed. The oil pump takes the oil through oil strainer and delivers it at pressure of 2.4 kg/cm2 to maingallory. Further thr pressurised oil goes through different size of spurt holdes to main bearing camshaft bearing cranks pin, rocker arm and valves, main gallory is get as hub for oil distribution to engine moveable working parts.

Definition

Lubrication

The most effective method of reducting friction 15 minimum and save the metals from wear and tear is called lubrication.

Lubricant

The substance is used for the purpose of lubrication is called lubricant.

Lubrcicant

Objectives: At the end of this lesson you shall be able to
- **state the need of lubricating an engine**
- **list out the properties of lubricating oils**

Functions of a lubricant

The main function of a lubricant is to minimise the friction between two moving surfaces which are in contact with each other.

It also helps to:

- absorb heat form the moving parts due to friction.
- Minimise wear and tear of the components.
- Provide a cushioning effect between the moving parts.
- Clean the parts by carrying away metal chips with it.
- Protect parts from corrosion.
- Prevent blow-by of gases by provinding an oil film between the rings and the liner/bore.

Properties of a lubricant

- It should have viscosity to suit the operating condions.
- The viscosity should remain the same in both hot and cold conditions.
- Its boiling temperature should be high.
- It should be corrosion-resistant.
- It should not develop foam.
- It should withstand critical operating pressure.

Viscosity

It is most important properties of lubricating oils for it determines their ability to flow. An oil with excessively high viscosity is very thick, and it is difficult for it to penetrate the clearance between the rubbing engine parts, while an oil with too low viscosity flows easily and does not stay in the clearances. So that the engine oil should be used as particular engine specifications and the seanson (plain area or high attitude area).

Oil additives

Any mineral oil by it self does not posses all the properties. The oil companies add a number of additives into the oil during the manufacturing process the main additives.

- Pour point depressents
- Oxidation inhibitors
- Corrosion and rust inhibitors
- Foaming resistance
- Detergents disperssents
- Extreme pressure resistance

Synthetic oil

- Synthetic oils manufactured oils made from substances other than crude oil
- They can be made from vegetable oils

Types

1 Polyalkylene glycols and their derived

2 Silicon which are manufactured from coal and saud

Application

a This oil can provide longer service life, less friction and improved fuel economy than convention oil.

b It costs more than regular motor oil.

When expected atmospheric temperature are-	Single viscosity graded oil	Multi viscosity graded oil
Below minus 10° F	SAE5W	SAEFW-20
Above minus 10° F	SAE10W	SAE10W-20, or SAE10W-30
Above plus 10° F	SAE20W	SAE 20W-30 or SAE10W-30
Above 32° F	SAE20 or 20 W SAE 30 Some manufacturers	SAE 20W-30 or SAE10W-30
Above 90° F	SAE 30 SAE 30 Some manufacturers	SAE 20W-30 or SAE 10W -30