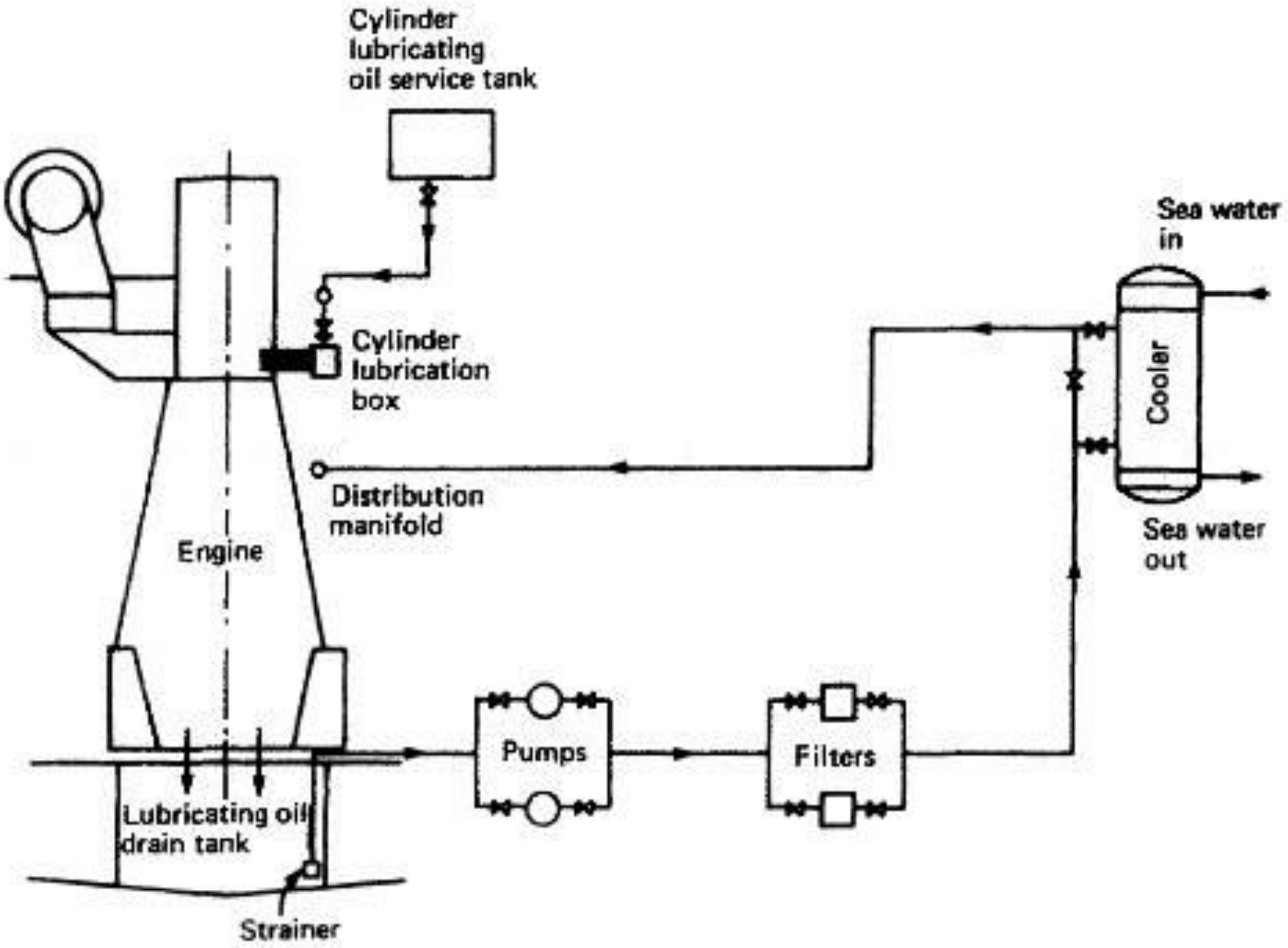
LUBRICATING OIL SYSTEM

Prediction

- The lubrication system of an engine **provides** ……
- Its **main function** is to ……
- The lubricating oil is **also used as** ……

- The lubrication system of an engine **provides** a supply of lubricating oil to the various moving parts in the engine.
- Its **main function** is to enable the formation of a film of oil between the moving parts, which reduces friction and wear.
- The lubricating oil is **also used as** a cleaner and in some engines as a coolant.

http://www.machineryspaces.com/lubrication.html



Lubricating oil system

- Lubricating oil for an engine is **stored** in the bottom of the crankcase, known as the sump, or in a drain tank located beneath the engine.
- The oil **is drawn from** this tank through a strainer, one of a pair of pumps, into one of a pair of fine filters.
- It is then **passed** through a cooler before entering the engine and being distributed to the various branch pipes.

Lubricating oil system - MCT

- Lubricating oil for an engine **is** **booked / stored / placed** in the bottom of the crankcase, known as the sump, or in a drain tank located beneath the engine.
- The oil is **run / carried/ drawn** **from** this tank through a strainer, one of a pair of pumps, into one of a pair of fine filters.
- It is then **fitted / flown/ passed** through a cooler before entering the engine and being distributed to the various branch pipes.

- The branch pipe for a particular cylinder may *feed* the main bearing, for instance. Some of this oil will *pass* along a drilled passage in the crankshaft to the bottom end bearing and then *up a drilled passage* in the connecting rod *to* the gudgeon pin or crosshead bearing.

- An **alarm** at the end of the distribution pipe ensures that adequate pressure is maintained by the pump. **Pumps and fine filters** are arranged in duplicate with one as standby. The fine filters will be arranged so that one can be cleaned while the other is operating. After use in the engine the lubricating oil *drains back* to the sump or drain tank for re-use. A **level gauge** gives a local read-out of the drain tank contents. A **centrifuge** is arranged for cleaning the lubricating oil in the system and clean oil can be provided from a storage tank.

Insert the phrase in the right place in the sentence

- An alarm the distribution pipe ensures that adequate pressure is maintained by the pump. (**at the end of**)
- Pumps and fine filters are arranged with one as standby. (**in duplicate**)
- The fine filters will be arranged one can be cleaned while the other is operating. (**so that**)
- After use in the engine the lubricating oil drains back to the sump or drain tank. (**for re-use**)
- A level gauge gives the drain tank contents. (**a local read-out of**)
- A centrifuge is arranged for cleaning the lubricating oil in the system and from a storage tank. (**clean oil can be provided**)

Supply the missing verb

- An alarm at the end of the distribution pipe _____ that adequate pressure is _____ by the pump. Pumps and fine filters are _____ in duplicate with one as standby. The fine filters will be arranged so that one can be _____ while the other is _____. After use in the engine the lubricating oil _____ back to the sump or drain tank for re-use. A level gauge _____ a local read-out of the drain tank contents. A centrifuge is _____ for cleaning the lubricating oil in the system and clean oil can be _____ from a storage tank.

- The **oil cooler** is circulated by sea water, which is at a lower pressure than the oil. As a result any **leak** in the cooler will mean a loss of oil and not contamination of the oil by sea water.

  Where the engine has **oil-cooled pistons** they will be supplied from the lubricating oil system, possibly at a higher pressure produced by **booster pumps**, e.g. Sulzer RTA engine. An appropriate type of lubricating oil must be used for oil-lubricated pistons in order to avoid **carbon deposits** on the hotter parts of the system.

Supply the missing term

- The _____ is circulated by sea water, which is at a lower pressure than the oil. As a result any _____ in the cooler will mean a loss of oil and not _____ of the oil by sea water.

  Where the engine has _____ they will be supplied from the lubricating oil system, possibly at a higher pressure produced by _____ , e.g. Sulzer RTA engine. An appropriate type of lubricating oil must be used for oil-lubricated pistons in order to avoid _____ on the hotter parts of the system.

Cylinder lubrication – guessing from the context

- Large slow-speed diesel engines are _____ with a **separate lubrication system** for the cylinder liners. Oil is _____ between the liner and the piston by **mechanical lub**ricators which _____ their individual cylinder. A special type of _____ is used which is not recovered. As well as lubricating, it assists in forming a **gas seal** and _____ **additives** which clean the cylinder liner.

Cylinder lubrication

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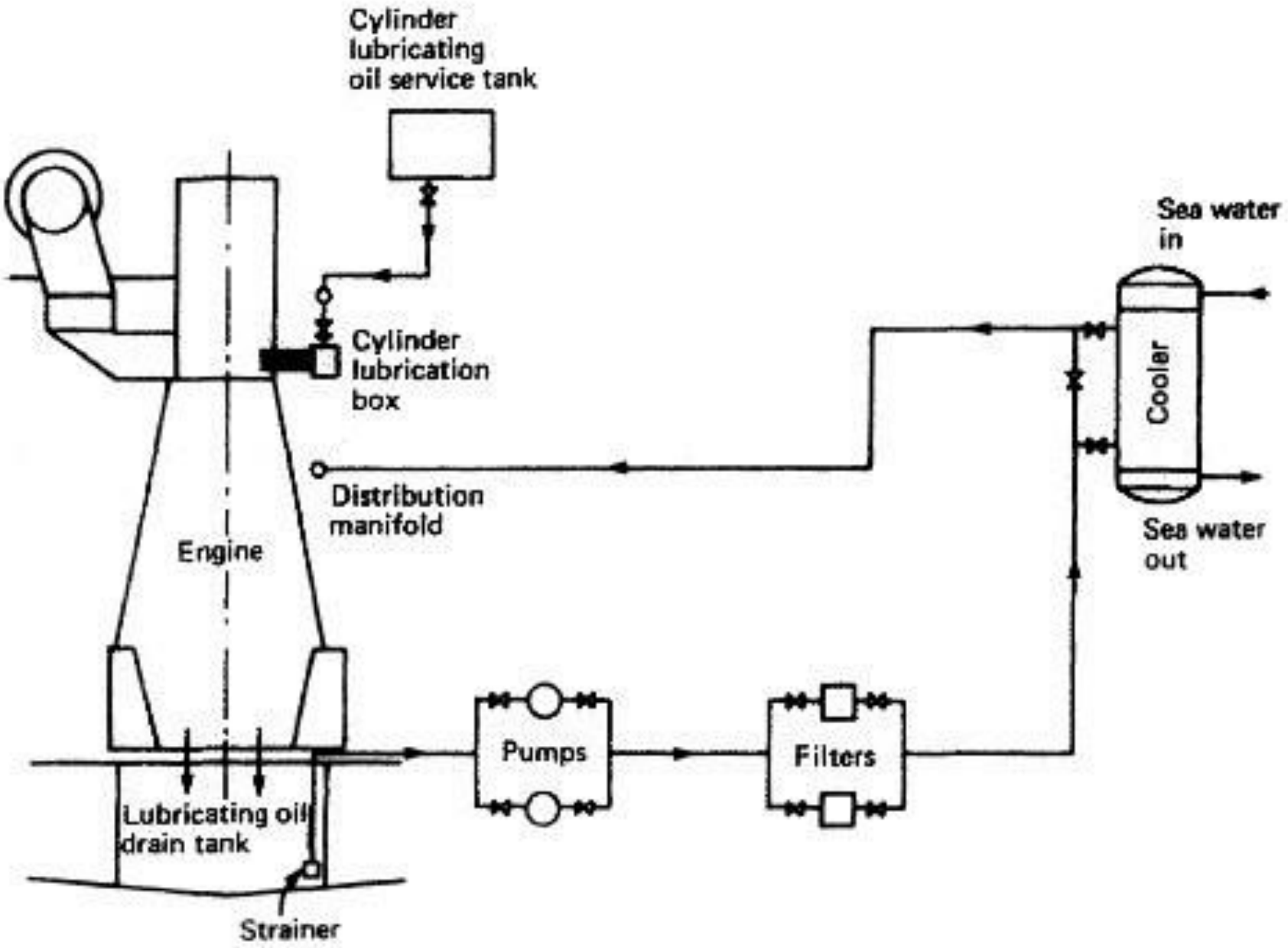
Describe the passage of lube oil



Study the verbs used in describing the flow of lube oil in the previous slides – provide their noun collocates

lubricating oil	lubricating oil
is stored in the	……
is drawn from	……
is passed through	……
…..	……
…..	……

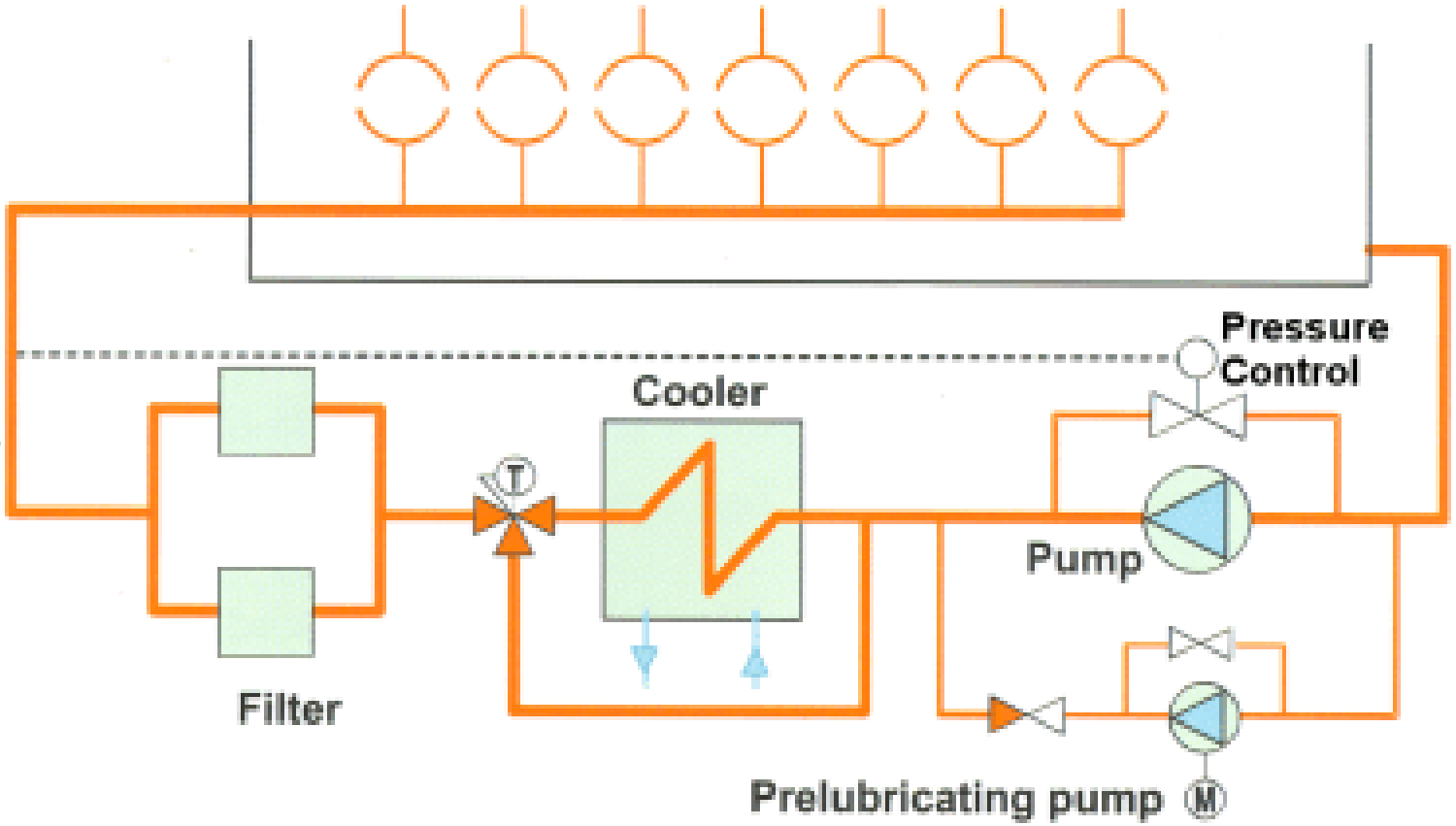
Guessing from previous knowledge:

The Basics of the Lubricating Oil System

- Lubricating oil for a marine diesel engine achieves two objectives; it must cool and _____.
- The oil is taken from the _____ tank usually underneath the engine by a screw type pump. It is cooled, _____ and supplied to the engine via the oil inlet pipe or inlet rail at a pressure of about 4 bar. On a _____ 4 stroke engine the oil is supplied to the main bearings through drillings in the engine frame to the crankshaft main bearings. Drillings in the crankshaft then take the oil to the crankpin or _____. The oil is then led up the _____ to the piston or gudgeon pin and from there to the piston cooling before returning to the _____.

The Basics of the Lubricating Oil System

- Lubricating oil for a marine diesel engine achieves two objectives; it must cool and lubricate.
- The oil is taken from the drain tank usually underneath the engine by a screw type pump. It is cooled, filtered and supplied to the engine via the oil inlet pipe or inlet rail at a pressure of about 4 bar. On a medium speed 4 stroke engine the oil is supplied to the main bearings through drillings in the engine frame to the crankshaft main bearings. Drillings in the crankshaft then take the oil to the crankpin or bottom end bearings. The oil is then led up the connecting rod to the piston or gudgeon pin and from there to the piston cooling before returning to the crankcase.



http://www.marinediesels.info/Basics/lubrication_system.htm

- Oil is also supplied to lubricate the rocker gear operating the inlet and exhaust valves, and to the camshaft and camshaft drive.
-
- The oil then drains from the crankcase into the drain tank or sump.
-
- The oil in the drain tank is being constantly circulated through a centrifugal purifier. This is to remove any water and products of combustion plus any foreign particles which may be in the oil.

MCT

- Oil is also supplied to lubricate the rocker **equipment / arrangement / gear** operating the inlet and exhaust valves, and to the camshaft and camshaft drive.
- The oil then **flows / drains / runs** from the crankcase into the drain tank or sump.
- The oil in the drain tank is being constantly circulated through a centrifugal **filter / purifier / strainer**.
- This is to remove any water and products of combustion plus any foreign **parcels / participles / particles** which may be in the oil.

Provide the caption (text) for each picture below

- The cylinder liner must be lubricated as well. This is so that there will be a film of oil between the piston rings and the liner and also so that any acid produced by combustion of the fuel is neutralised by the oil and does not cause corrosion. Some of this lubrication will be supplied by so called "splash lubrication" which is the oil splashed up into the liner by the rotating crankshaft. However larger medium speed marine diesel engines also use separate pumps to supply oil under pressure to the cylinder liner. The oil is led through drillings onto the liner surface where grooves distribute it circumferentially around the liner, and the piston rings spread it up and down the surface of the liner.
- A pre lub pump is sometimes fitted especially to engines where the main pump is engine driven. This pump is electrically driven and circulates oil around the engine prior to starting.

Supply the missing info

- The cylinder liner must be ……
- This is so that there will be a film of oil between …… and also so that any acid produced by combustion of the fuel is neutralised by the oil and does not cause corrosion.
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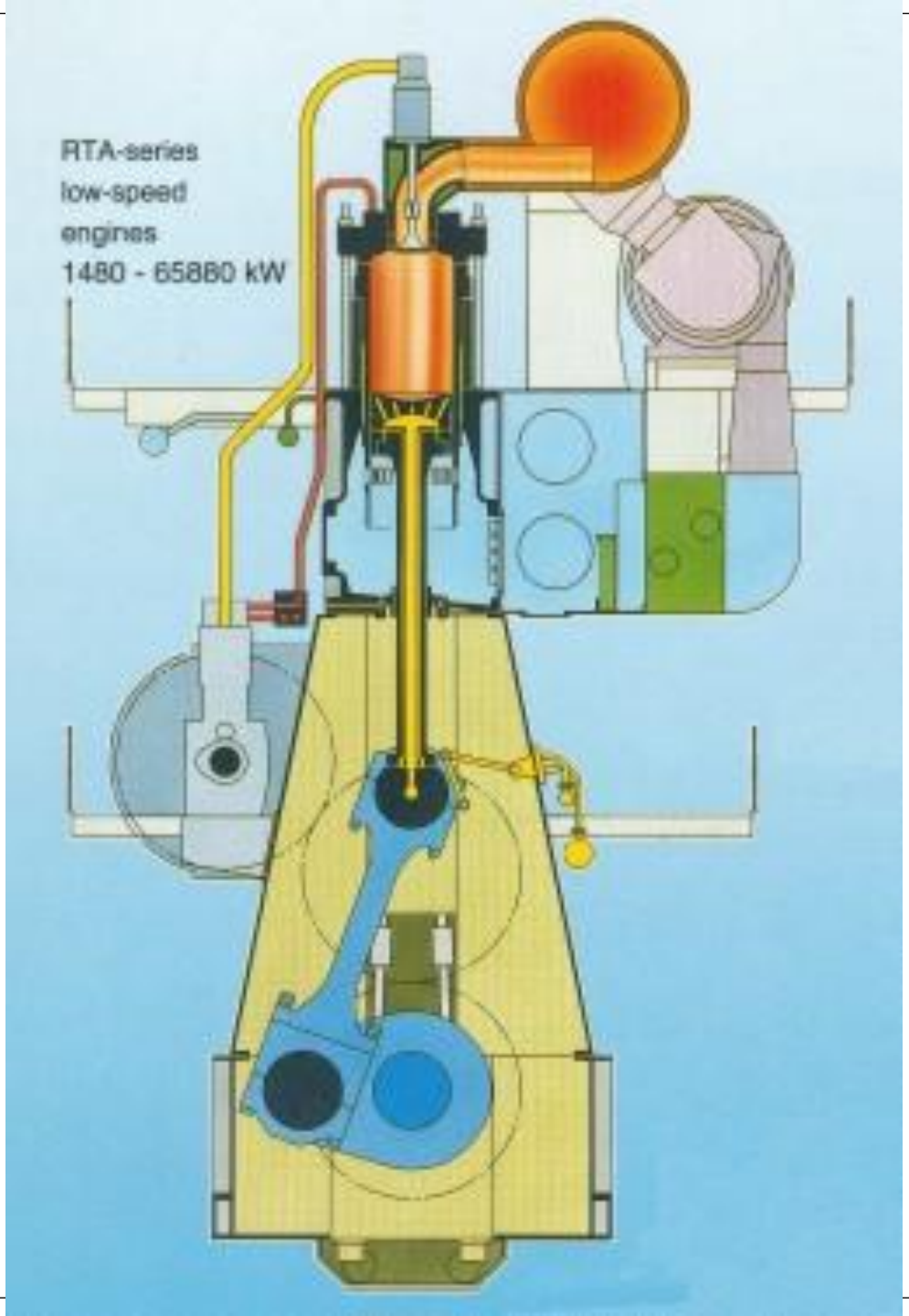
- However larger medium speed marine diesel engines also use separate pumps to supply …… to ……
- The oil is led through drillings onto the liner surface where grooves distribute it circumferentially around the liner, and the piston rings spread it …… the surface of the liner.
- A pre lub pump is …… especially to engines where the main pump is engine driven. This pump is electrically driven and circulates oil around the engine ……

- On a two stroke crosshead engine lubricating oil is supplied to the main bearings and camshaft and camshaft drive. A separate supply is led via a swinging arm or a telescopic pipe to the crosshead where some of it is diverted to cool the piston (travelling up and back through the piston rod), whilst some is used to lubricate the crosshead and guides, and the rest led down a drilling in the connecting rod to the bottom end or crankpin bearing. Oil is also used to operate the hydraulic exhaust valves.


RTA-series
low-speed
engines
1480 - 65880 kW

- On some engines, the oil supply to the crosshead bearing is boosted in pressure to about 12 bar by a second set of pumps. This oil is also used to operate the hydraulic reversing gear for the engine.
- The cylinder liners on a two stroke engine are lubricated using separate injection pumps which use a different specification of oil. The oil which is led to drillings in the liner is able to deal with the acids produced by the burning of high sulphur fuels.

Insert the phrase in the right place

- the oil supply to the crosshead bearing is boosted in pressure to about 12 bar by a second set of pumps. **on some engines,**
- This oil is also used the hydraulic reversing gear for the engine**. to operate**
- The cylinder liners are lubricated using separate injection pumps which use a different specification of oil. **on a two stroke engine**
- The to drillings in the liner is able to deal with the acids produced by the burning of high sulphur fuels. **oil which is led**

Lubricating Oil Sump Level

- The level of lubricating oil indicated in the sump when the main engine is running must be sufficient to prevent vortexing and ingress of air which can lead to bearing damage.

  The sump level is to be according to manufacturers/shipbuilders instructions . The 'Sump Quantity' is always maintained at the same safe operating level and is given in litres. It is essential that the figures are mathematically steady and correct from month-to-month, taking into account consumption, losses and refills and reported .

  The 'Sump Quantity' is calculated with the engine stopped

Pre-Lubrication Pumps – underline the key terms

They provide an essential part of the lubrication system on many types of engine in particular auxiliary engines with engine driven lubricating oil pumps.

They provide a supply of oil to the bearings prior to start up and limit the length of time that boundary lubrication exists, and shorten the time when hydrodynamic lubrication commences. They must be maintained and operated in accordance with the manufacturers' instructions.

Lubrication Schedule and Orders -

- The Chief Engineer is responsible to establish a list of machinery requiring periodic lubrication onboard the vessel. The Fleet Superintendent is responsible for agreeing the specifications and grades of oil for this list of machinery with the nominated lubrication oil supplier. A copy of the lubricating oil schedule shall be made available onboard the vessel and in the office.

Lubrication Schedule and Orders – supply the missing info

- …… to establish a list of machinery requiring periodic lubrication onboard the vessel.
- The Fleet Superintendent …… for agreeing the specifications and grades of oil for this list of machinery with the nominated ……
- A copy of the lubricating oil schedule shall …… onboard the vessel and in the office.

Chief Engineer's jobs and duties

- The Chief Engineer shall ascertain the location of all the lubricating oil storage tanks and establish the safe-filling capacities of these. This information shall be made available to the office.

  Some grades of oil may be taken and stored in drums on board at safe locations agreed with the Master and lashed safely for bad weather conditions. When an order for lubricating oil supply is made, the Chief Engineer shall specify whether it is in bulk or in drums. The choice of lubricating oil for air compressors is to be discussed with the Management Office. When agreed, synthetic oil is to be used.

- Bunkering of lubricating oils shall be handled with the same care as the previous chapter due to the risk of pollution. In addition, it must be borne in mind that the auto-ignition temperature of lubricating oils is much lower than fuels therefore utmost safety precautions must be taken.

- Regular inventory of lubricating oils shall be kept under the responsibility of the Chief Engineer, separating broached and unbroached oils. These shall be recorded in a lube oil soundings book and corrected for trim/list similar to the fuel soundings book.

- The Chief Engineer is responsible for placing orders for all lubricating oils and greases for a period of time and/or the forthcoming voyage, as applicable. The calculations for the lubricating oil consumption and next voyage requirements should be done by a senior Engineer and checked by the Chief Engineer. Each requirement for lubricating oil must be done by a Requisition Form in the purchasing system, using the lubricating oil account code, specifying the grades, quantities and whether in bulk or in drums.

Writing skills: Study the four slides above and list the Chief Engineer's duties with respect to lubrication oil system

- ascertain the location of all the lubricating oil storage tanks
- ……
- ……
- ……
- ……
- ……
- ……
- **etc.**

Losses of Lubricating Oils

- All possible preventative action must be taken, to ensure that lubricating oil losses are kept to a minimum. There are to be no discrepancies between the quantity of lubricants on board, and the totals entered in the Engine Room Log Book and the regular returns made to the relevant Management Office. Accurate entries must always be recorded, and any indication of abnormal losses or consumptions advised immediately, to the relevant Management Office.
- Regular and vigilant tours of the Engine Room by watchkeepers, or duty engineers are essential to check for oil leaks. Lubricating oil coolers using sea or fresh water as the cooling medium, must also be periodically checked for oil leakage.

Losses of Lubricating Oils

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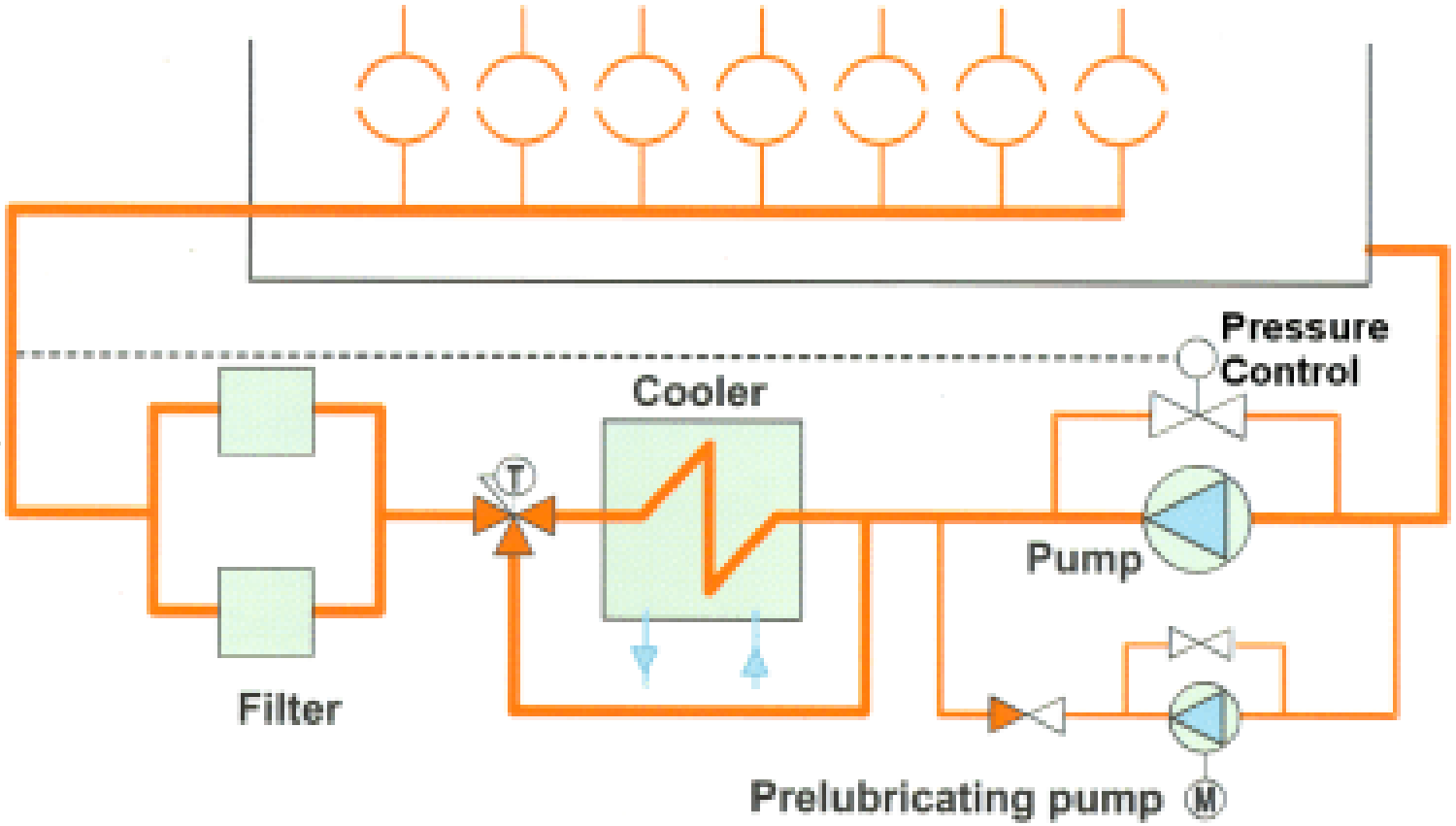
- BP – AS

http://www.marinediesels.info/Basics/lubrication_system.htm



Insert the words in the right place

- The satisfactory operation of any engine on adequate of lubricating oil to all its moving parts (***supply, depends***). A typical lubrcating oil system is shown in Fig.13.1.
- The pump the oil from the lubricating tank and it through a and filter to the engine (***draws, passes, cooler***) .
- Inside the engine it enters the main gallery on which is situated the pressure regulating valve.
- Any excess oil is by this valve into the engine sump (**divereted**).
- The remainder, at the regulated pressure, to the main bearings and to the camshaft and valve rocker gear **(passes; feeds)** .
- A part of the oil the main bearings is used to lubricate the bearings themsaelfs, whilst the remainder is via the central grooves and drillings in the crankshaft to the large end bearings. (**entering; conducted**)

- Again, some oil is used to lubricate the large end bearings whilst the remainder leaves via the groove in the centre of this bearing and up the passage in the connecting rod to the small end. Here some of it is used to lubricate the small end and the gudgeoun pin bearings in the piston, whilst the remainder is conducted through the passages in the gudgeon pin and the piston itself, to the cooling belt behind the rings and to the crown of each piston. Oil, which has been used to cool the piston, is then released and falls back into the engine sump. From the sump the oil is drained into the lubricating oil tank for re-use. In most cases this is a gravity drain to a tank in the double bottom.

Supply the missing word

- Again, some oil is used to _____ the large end bearings whilst the remainder leaves via the _____ in the centre of this bearing and up the _____ in the connecting rod to the small end. Here some of it is used to _____ the small end and the gudgeon pin bearings in the piston, whilst the remainder is _____ through the passages in the gudgeon pin and the piston itself, to the cooling belt behind the rings and to the _____ of each piston. Oil, which has been used to cool the piston, is then released and falls back into the _____ . From the sump the oil is _____ into the lubricating oil tank for re-use. In most cases this is a _____ drain to a tank in the double bottom.

Supply the missing info

- Some oil is used to lubricate … … … whilst the remainder leaves via the groove in the centre of this bearing and up the passage in … … … .
- Here some of it is used to lubricate the small end and … … … , whilst the remainder is conducted through the passages in the gudgeon pin and the piston itself, to the cooling belt behind the rings and to … … ….
- Oil, which has been used to cool the piston, is then released and … … … .
- From the sump the oil is drained into … … … for … … …
- In most cases this is a gravity drain to … … …

- The lubricating oil supply pumps may be driven directly from the engine, or they may be driven separately. If these pumps are engine driven then a separately driven pump is included with which the lubricating oil system can be fully primed before the engine is restarted after any prolonged shutdown.

Supply the missing words

- The lubricating oil supply pumps may be … _____ directly from the engine, or they may be driven _____. If these pumps are engine driven then a separately driven pump is _____ with which the lubricating oil system can be fully _____ before the engine is restarted after any prolonged _____.

- In its passage through the engine the oil picks up a certain amount of heat, and this has to be extracted from it before it next enters the engine. For this purpose it is pumped through a cooler. The cooler consists of a number of closely packed tubes leading from headers, one at each end, enclosed in a casing. The casing contains the passages for the lubricating oil whilst the cooling water is passed through the tubes from one header to another. This arrangement directs the cooling water, which is usually sea water, to the inside of the tubes which are more easily cleaned (by passing rods through them) than the outsides.

Supply the missing info

- In its passage through the engine the oil picks up … … … , and this has to be extracted from it before it … … … .
- For this purpose it … … … .
- The cooler consists of a number of … … … leading … … … , one at each end, enclosed in a casing.
- The casing contains the passages for … … … whilst the cooling water is passed through the tubes … … … .
- This arrangement … … … , which is usually sea water, to the inside of the tubes which are more easily cleaned (by … … …) than the outsides.

- **As** the oil becomes very viscous when cold, it is essential to have a temperature control **so that** it is kept at a level which is neither too hot nor too cold. A thermostatic valve is mounted on the cooler **which** senses the temperature of the lubricating oil and regulates the flow of either the lubricating oil or the cooling water accordingly.
- Pressure gauges are fitted **to show** the lubricating oil pressure before and after the filter. Any abnormally high difference in reading between the two gauges indicates **that** the element is blocked and should be changed or cleaned according to the type.

- As the oil becomes very _____ when cold, it is essential to have a temperature control so that it is kept at a _____ which is neither too hot nor too cold.
- A thermostatic valve is _____ on the cooler which _____ the temperature of the lubricating oil and _____ the flow of either the lubricating oil or the cooling water accordingly.
- Pressure _____ are fitted to show the lubricating oil pressure before and after the _____.
- Any abnormally high difference in _____ between the two gauges indicates that the element is _____ and should be changed or _____ according to the type.

- Large slow speed engines are provided with the separate lubrication system for the cylinder liners. Oil is injected between the liner and the piston by mechanical lubricators which supply their individual cylinder. A special type of oil is used which is not recovered. As well as lubricating, it assists in forming a gas seal and contains additives which claean and protect against cold and hot corrosion of the cylinder liner.

- … … … are provided with the separate lubrication system for the cylinder liners.
- … … … between the liner and the piston by mechanical lubricators which supply their individual cylinder.
- … … … is used which is not recovered.
- … … …, it assists in forming a gas seal and contains additives which … … … against cold and hot corrosion of the cylinder liner.

QUESTIONS AND DISCUSSION

1. What does the lubricating oil system provide ?
2. Where does the lube oil pass before entering the engine ?
3. What is the role of the pressure regulating valve ?
4. What are the main lubricating points inside the engine ?
5. Describe the flow of the lubricating oil to the camshaft and valve rocker gear.
6. How is the piston cooled ?
7. What is a gravity drain ?
8. How is a supply pump driven ?
9. In which case should the lubricating oil system be primed ?
10. How is the lubricating oil cooled ?
11. What control instruments is the lubricating system supplied with ?
12. How are the cylinder liners of large slow speed engines lubricated ?

I. Say which of the following statements are TRUE and which are FALSE. If FALSE state why.

1. The function of the lubricating system is not only to provide a film of oil between the moving parts in the ngine but also to use oil as cleaner and a coolant.
2. Large marine diesel engines generally have two systems of lubrication: a total loss system feeding the cylinders and a circualting system lubricating the running gear and cooling the piston.
3. The lube oil tank is a “drain tank” situated in the structure of the vessel high above the engine.
4. A pressure regulating valve is used to increase the pressure of the oil before it enters the engine.
5. The lubricating oil supply pump can be either engine driven or separately driven.
6. The lube oil supply pump driven directly from the engine is also known as the priming pump.
7. If the lube oil supply pump is driven independently it is necessary to include also a priming pump.
8. The lube oil is cooled making it pass through a bundle of tubes surounded by sea water.
9. In the cooler sea water is circulated at a lower pressure than the oil to prevent the contamination of the lube oil in case of leakage.

II. The auxiliary equipment of the lubricating system is listed below in a descriptive form. Give appropriate single words or compounds for each of them.

1. The bottom of the crankcase where lube oil is collected _____
2. The device that forces oil through the lubricating system _____
3. Fine mesh strainers used to free oil from solid matter _____
4. The container under the engine for storing lube oil _____
5. The automatic temperature-sensitive device in the cooling system _____
6. Instruments for measuring pressures _____
7. The device for expelling air pockets from the pipe-line _____
8. The heat exchanger arranged to remove Heat from lube oil _____
9. Instruments for measuring temperatures _____
10. Rotary machine used for centrifugating contaminants from fuel or lube oil _____
11. The container where oil and water or sludge separate naturally _____
12. Mechanical device for controlling pressure _____

III. State which equipment is used to:

- control and measure the oil pressure
- control and measure the oil temperature
- keep oil clean
- provide the oil supply to the system

IV. Find in List B one-word synonyms to the two-word verbs given in List A.

A	B
go into	a. absorb
get out from	b. divert
set running	c. draw
turn away	d. enter
flow off	e. drain
take out	f. release
fall back	g. leave
let go	h. return
carry off	i. start ,

Replace the boldface words in the following sentences with their corresponding one-word alternatives:

- The heat produced by frictional resistance in the bearings is picked up by the circulating lubricating oil and this heat is carried off by sea water passing through the oil cooler.
- Used lubricating oil flows off to the crankcase and then through strainers to a tank by gravity.
- The lubricating oil is taken out from the sump or drain tank and passed through a cooler and filters before returning to the engine.
- The pressure regulating valve turns away any excessive amount of oil returning it to the engine sump.
- After the exhaust has been used to drive the turboblower, it is let go out into the atmosphere.
- Air, after getting out from the impeller, goes into the diffuser.
- Before a large diesel is set running it must be warmed through by circulating hot water through the jackets.
- Oil, which has been used to cool the piston, falls back into the engine sump.
-

VI. Fill in the blanks with the suitable prepositions:

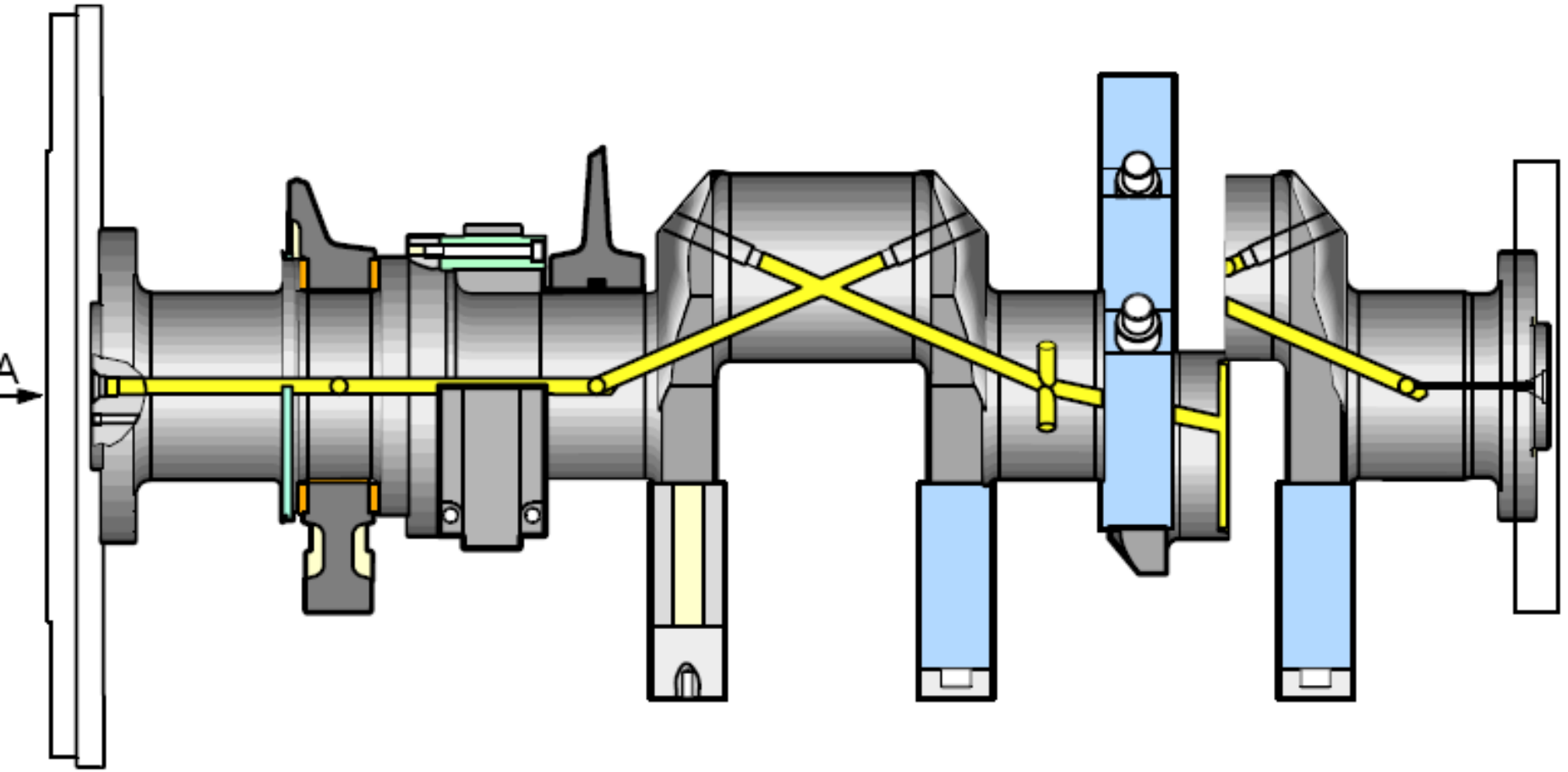
at, from, in, into, of, on, per, through, to up, with,

Each preposition is used only once.

- Modern diesel engines are built _____ pressure lubricating systems. The crankcase is oiltight and all the rubbing or sliding surfaces have a continuous flow _____ clean, cool lube oil pumped _____ them. The lube oil which drips off the running gear is usually collected _____ the bottom of the crankcase _____ which it flows _____ sump tank. A lubricating oil pump picks _____ the oil from the tank and is passed _____ a strainer and cooler before entering _____ the engine. The pump discharges 1 to 2 gallons of oil _____ hour _____ a pressure of 2.3 to 3.6 kp/cm, depending _____ the builder's design.

VII. Translate into English:

- Ulje za podmazivanje ne služi samo da smanji mehaničko trenje već I da hladi ležajeve tako da održava temperaturu u dopuštenim granicama.
- Temperatura ulja kod sporohodnih motora iznosi od 50^0 do 60^0 C, a kod brzohodnih od 70^0 do 85^0 C; temperaturna razlika ulazno-izlaznog ulja iznosi od 10^0 do 15^0 C.
- Sisaljka za podmazivanje siše ulje iz kartera preko usisnog ventila I tlači ga kroz dvostruki čistilac i hladnjak u sabirnu cijev, odatle u ležajeve, a iz ležaja curi u karter.
- Kod motora manjih snaga ulje se dovodi u jedan temeljni ležaj, a odalte se kanalima koljenastog vratila provodi u sve leteće i ostale temeljne ležaje.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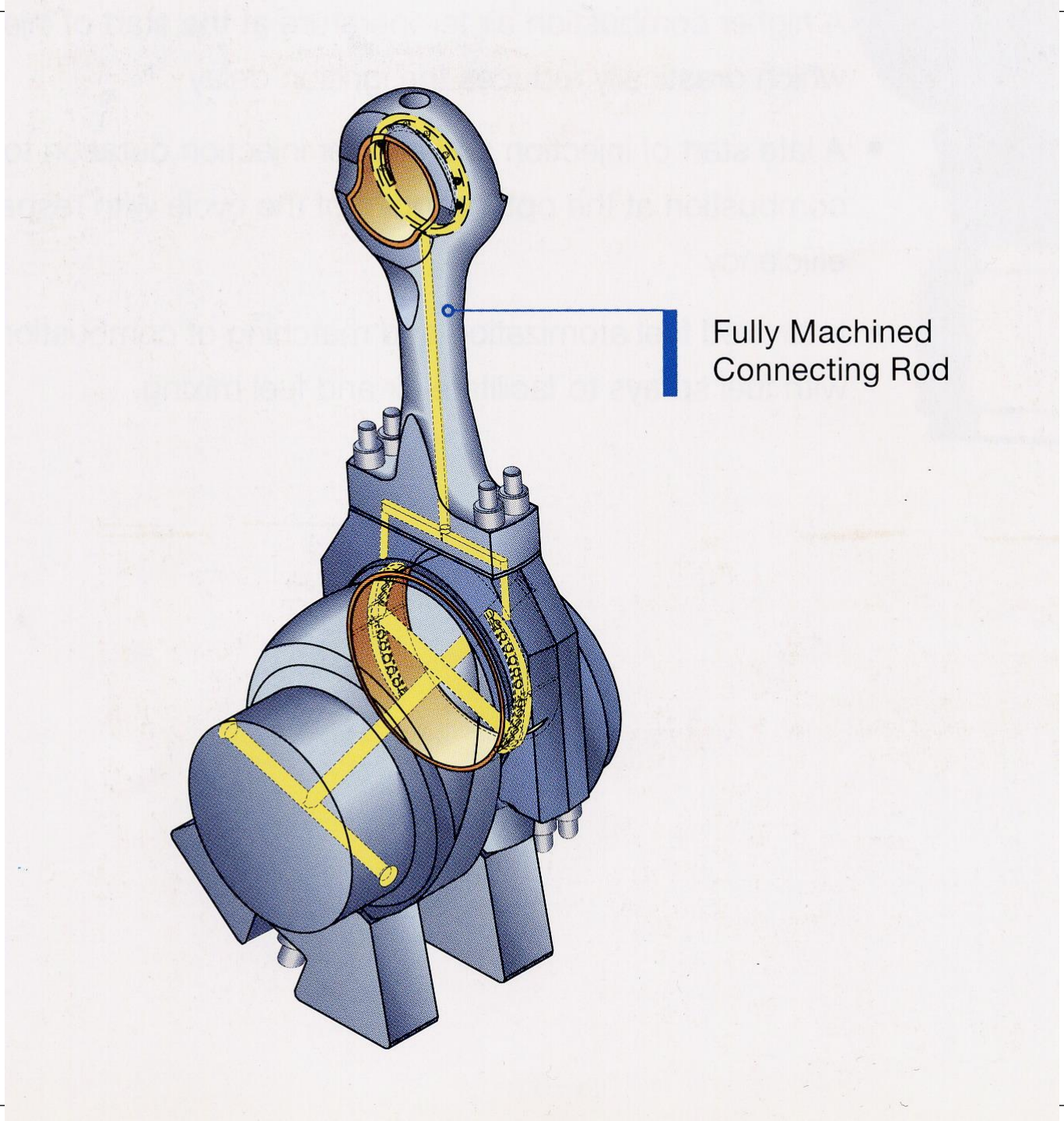
Fully Machined
Connecting Rod